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THE
ENCYCLOPÆDIA BRITANNICA

A DICTIONARY OF ARTS, SCIENCES, LITERATURE & GENERAL INFORMATION

THIRTEENTH EDITION

Being Volumes One to Twenty-eight of the Latest Standard Edition with the Three New Volumes covering Recent Years and the Index Volume

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VOLUME I

A *to* ANDROPHAGI

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TO

THE TWO HEADS OF THE ENGLISH-SPEAKING PEOPLES

HIS MAJESTY GEORGE THE FIFTH
KING OF GREAT BRITAIN AND IRELAND
AND OF THE BRITISH DOMINIONS BEYOND THE SEAS
EMPEROR OF INDIA

AND

CALVIN COOLIDGE
PRESIDENT OF THE UNITED STATES OF AMERICA

PREFATORY NOTE

BORN in the Edinburgh of the eighteenth century when that capital was at the height of a famous intellectual activity, *The Encyclopædia Britannica* has pursued an uninterrupted existence. The Thirteenth Edition now appears nearly one hundred and sixty years after the beginning of the First. In 1768 that notable undertaking started publication in sixpenny numbers appearing weekly in the name of "a Society of Gentlemen in Scotland." Completed in 1771, the work made three quarto volumes. The proprietors were Colin MacFarquhar, an Edinburgh printer, and Andrew Bell, the principal Scottish engraver of that day; but MacFarquhar, a man of wide knowledge and excellent judgment, seems to have been the real originator, though want of capital prevented his sole ownership. The undertaking was edited and in large part written by William Smellie, another Edinburgh printer, and one bold enough to make "fifteen capital sciences" his own share. The numerous plates were engraved by Bell so admirably that some of them have been reproduced in every subsequent edition.

The work differed from all preceding "dictionaries of arts and sciences," as encyclopaedias then were called, by combining, in alphabetical order, the full treatment of important subjects with numerous shorter articles for ready reference. Though the infant *Encyclopædia Britannica* omitted the whole field of history and biography as beneath the dignity of the sciences, it speedily won sufficient popularity to justify a new edition on a much larger scale. A decision to include history and biography caused the secession of Smellie; but MacFarquhar himself then edited the work, and for the first time produced an encyclopaedia embracing all human knowledge. This Second Edition, issued in numbers between June 1777 and Sept. 1784, was afterwards bound up in ten quarto volumes containing 8,595 pages and 340 plates—over three times more material than in the First Edition.

Next, the Third Edition adopted that new plan of enlisting specialist learning which has since given *The Encyclopædia Britannica* its high repute. This edition, begun in 1778, was completed in 18 volumes in 1797, and edited by MacFarquhar until his death in 1793, when he was succeeded by George Gleig—afterwards Bishop of Brechin. It was he who first engaged as contributors the most eminent men of science then living in Scotland. The labours of these scientists gave *The Encyclopædia Britannica* pre-eminent standing among works of reference and prepared it to become, as a later editor claimed, not merely a register but an instrument of research, since thereafter leading specialists in all departments often contributed their unpublished results to its pages.

In the Fourth Edition, published by Andrew Bell in 20 volumes between 1801 and 1810, the principle of specialist contributions was much extended, but only later was that method brought as nearly to perfection as then attainable by Archibald Constable, Scott's renowned publisher. That "Great Napoleon of the realms of print" purchased the copyright of *The Encyclopædia Britannica* after Bell's death in 1809. The Fifth Edition, following in 1815, was a virtual reprint of the Fourth Edition (so was the Sixth), but with the addition of the famous Supplement which Constable commissioned MacVey Napier to edit. With the appearance of this Supplement *The Encyclopædia Britannica* ceased to be a purely Scottish undertaking. It blossomed out into that cosmopolitan enterprise it has since remained. The most eminent writers, scholars and men of science in England and on the continent of Europe, as well as in Scotland itself, were enlisted in the work: Sir Walter Scott; Jeffrey; scientists like Leslie, Playfair, Sir Humphry Davy and Thomas Young; philosophers like Dugald Stewart—who received the then unprecedented fee of £1,000 for a single contribution; economists like Ricardo and Malthus, with foreign savants like Arago and Biot. From this time onward, a list of the contributors to successive editions of *The Encyclopædia Britannica* was a list of the most eminent writers and thinkers of each generation; the work had now become the product of organized co-operation by acknowledged leaders of the world's thought in every department of human knowledge. For this advance, chief credit is due to Constable.

Adam Black bought the copyright on Constable's failure. By the new publisher the Seventh Edition, also edited by Napier, was brought out. This was issued between 1830 and 1842 and comprised 21 volumes, including a general index of the whole work. The Eighth Edition, under the editorship of T. Stewart

Traill, was issued by the firm of A. & C. Black between 1853 and 1860 in 21 volumes besides a separate index volume.

The Ninth Edition, undertaken by the same firm, was by far the greatest up to then—replanned on a scale which Adam Black considered so hazardous that he refused to have any part in the enterprise, and advertised his retirement from the firm. This work began to appear in 1875 under the editorship of Thomas Spencer Baynes; when completed in 1889 under William Robertson Smith, it consisted of 24 volumes containing 21,500 pages and 300 plates with an additional index volume.

Adam Black's prophecies of failure were signally falsified, for nearly 500,000 sets—including American pirated and mutilated editions—were ultimately demanded. The full possibilities of popularity for *The Encyclopædia Britannica* in Great Britain were only realised when, in 1898, *The Times* (London) undertook to sell this Ninth Edition at about half the price originally asked for it by the publishers. The success of this stroke led in 1902 to the publication by *The Times* of an elaborate supplement in eleven New Volumes, constituting, with the previous 24 volumes, the Tenth Edition.

The Eleventh Edition, written by some 1,500 eminent specialists drawn from nearly every country of the civilised world, under the editorship of Mr. Hugh Chisholm,[1] was published in 1910–1 by the University of Cambridge in 28 volumes of text containing 30,000 pages and 450 full-page plates, and a separate index volume of 950 pages. In one very important respect the Eleventh Edition differed from its predecessors and, indeed, from all previous encyclopaedias. Instead of appearing volume by volume spread over a considerable number of years—in the case of the Ninth Edition, more than fourteen years—it was prepared as a whole and published in its entirety at one time. This added largely to expense, but much more to usefulness.

Hardly had the Eleventh Edition appeared before the World War of 1914–8 broke the whole intellectual structure of the world. To meet the urgent needs thus created, the publishers (now *The Encyclopædia Britannica* Company, Ltd.) commissioned Mr. Chisholm in 1920 to prepare new volumes covering the years from 1910 to the date of publication, and dealing exhaustively with the long years of the World War. These volumes, three in number, appeared in 1922, and, in accordance with the tradition of *The Encyclopædia Britannica* since 1815, they formed, in combination with the volumes of the Eleventh Edition, the Twelfth Edition. They maintained tradition also in the number and distinction of the contributors.

These volumes written in 1920 and 1921 are animated by the spirit and temper of that time. They are a valuable historical document—one of the most suggestive in existence as reflecting the circumstances and psychology of the War years and just after. But as the War years recede into the background, so must the volumes especially devoted to them. Further, the years from 1921 to 1926 may challenge comparison with any previous period in all history as regards the progress of science, the achievements of industry and invention, the agitation of the world's thought and the significance of the world's changes.

Accordingly, the publishers commissioned Mr. J. L. Garvin, successor to Mr. Hugh Chisholm as editor-in-chief, to prepare in Three Volumes the necessary new Supplement to *The Encyclopædia Britannica*. It was to cover the years from 1910 to 1926 and supersede the three volumes of half a decade ago. Again in accordance with the tradition of *The Encyclopædia Britannica*, since Constable and MacVey Napier, these three volumes with the 28 volumes of the latest standard edition, the Eleventh, and the Index Volume, now form the Thirteenth Edition.

In the Preface to these latest volumes (see Volume 29) the Editor sets forth his aims and method. We need only add here, in connection with this sketch of the history of *The Encylopædia Britannica*, that these volumes are fortunate enough to surpass any of their predecessors in one respect—in the number and especially the fame of their contributors, as may be seen from the lists prefixed.

In conclusion, the publishers ask to be pardoned for referring to one feature of *The Encyclopædia Britannica* which has characterised every edition for over 100 years—the co-operation of scholars, experts and men of affairs from all the civilised countries of the world. Knowledge knows no nationality, and is vain unless it rises above partisanship and the narrowing spirit; its increase and diffusion serve the cause of civilisation everywhere. In this respect, *The Encyclopædia Britannica* for over a century has had a world-wide influence which its publishers hope may be amply continued for generations to come.

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[1] Mr. Chisholm's biography will be found in these pages, and to his memory an exceptional tribute is due. To him and his collaborators all who consult *The Encyclopædia Britannica* are under a deep obligation. His full editorial preface upon the making and makers of the Eleventh Edition is part of the history of *The Encyclopædia*. It appeared in preceding issues from 1910 onwards, and further reference may be made to it.

INITIALS USED IN VOLUME I TO IDENTIFY INDIVIDUAL CONTRIBUTORS,[1] WITH THE HEADINGS OF THE ARTICLES IN THIS VOLUME SO SIGNED.

A. A. R.*	Arthur Alcock Rambaut, M.A., D.Sc., F.R.S. Radcliffe Observer, Oxford. Professor of Astronomy in the University of Dublin and Royal Astronomer of Ireland, 1892–1897.	**Airy.**
A. C. L.	Sir Alfred Comyn Lyall, K.C.B. See the biographical article: Lyall, Sir A. C.	**Abdur Rahman;** **Afghanistan:** *History.*
A. D.	Austin Dobson, LL.D. See the biographical article: Dobson, Henry Austin.	**Addison** (*in part*).
A. E. S.	Arthur Everett Shipley, M.A., D.Sc., F.R.S. Fellow and Tutor of Christ's College, Cambridge. Reader in Zoology in Cambridge University. Joint-editor of the *Cambridge Natural History.*	**Acanthocephala.**
A. F. B.	Aldred Farrer Barker, M.Sc. Professor of Textile Industries at Bradford Technical College.	**Alpaca.**
A. F. P.	Albert Frederick Pollard, M.A., F.R.Hist.Soc. Fellow of All Souls' College, Oxford; Professor of English History in the University of London. Assistant-editor of the *Dictionary of National Biography*, 1893–1901.	**Aconcio.**
A. GIR.	Arthur Girault. Professor of Political Economy at the University of Poitiers. Member of the International Colonial Institute. Author of *Principes de colonisation* (1907–1908).	**Algeria:** *History.*
A. G. H.	A. G. Hadcock (late R.A.) Manager of the Gun Department, Elswick Works, Newcastle-on-Tyne.	**Ammunition** (*in part*).
A. H. J. G.	Abel Hendy Jones Greenidge, M.A., D.Litt. (Oxon.) (d. 1905). Formerly Fellow and Lecturer of Hertford College, Oxford, and of St John's College, Oxford. Author of *Infamia in Roman Law*; &c.	**Agrarian Laws** (*in part*).
A. J. B.	Alfred Joshua Butler, M.A., D.Litt. Fellow and Bursar of Brasenose College, Oxford. Fellow of Eton College.	**Abyssinian Church.**
A. J. G.	Rev. Alexander J. Grieve, M.A., B.D. Professor of New Testament and Church History, Yorkshire United Independent College, Bradford.	**Adoptianism; Alford;** **Alsop, V.; Ambrose, St.**
A. Mw.	Allen Mawer, M.A. Professor of English Language and Literature, Armstrong College, Newcastle-on-Tyne; formerly Fellow of Gonville and Caius College, Cambridge.	**Æthelflaed; Æthelred I.;** **Æthelstan; Æthelweard.**
A. M. C.	Agnes Mary Clerke. See the biographical article: Clerke, A. M.	**Algol.**
A. M. Cl.	Agnes Muriel Clay (Mrs Edward Wilde). Late Resident Tutor of Lady Margaret Hall, Oxford. Joint-editor of *Sources of Roman History, 133–70* B.C.	**Agrarian Laws** (*in part*).
A. R. W.	Alfred Russel Wallace, LL.D., D.C.L., F.R.S. See the biographical article: Wallace, A. R.	**Acclimatization.**
A. Si.	Arthur Sidgwick, M.A., LL.D. (Glasgow). Fellow of Corpus Christi College, Oxford; formerly Reader in Greek, Oxford University.	**Aeschylus.**
A. W.*	Arthur Willey, D.Sc., F.R.S. Director of Colombo Museum, Ceylon.	**Amphioxus.**
A. W. H.*	Arthur William Holland. Formerly Scholar of St John's College, Oxford. Bacon Scholar of Gray's Inn, 1900.	**Aberdeen, 4th Earl of.**
B. M.*	Budgett Meakin (d. 1906). Author of *The Moors*; *The Land of the Moors*; *The Moorish Empire*; &c.	**Almohades** (*in part*); **Almoravides** (*in part*).
C. B.*	Charles Bémont, D. ès L., Litt.D. (Oxon.). See the biographical article: Bémont, C.	**Agenais.**
C. E.*	Charles Everitt, M.A., F.C.S., F.G.S., F.R.A.S. Magdalen College, Oxford.	**Algebra:** *History.*
C. F. A.	Charles Francis Atkinson. Formerly Scholar of Queen's College, Oxford. Captain, 1st City of London (Royal Fusiliers). Author of *The Wilderness and Cold Harbour.*	**Alexandria:** *Battle.* **American Civil War;** **Ammunition** (*in part*).

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[1] A complete list, showing all individual contributors, appears in the final volume.

C. F. R.	Charles F. Richardson, Ph.D. Professor of English, Dartmouth College, U.S.A.	**Alcott, A. B.;** **Alcott, L. M.**
C. L.	H. Caldwell Lipsett. Formerly Editor of the *Civil and Military Gazette*, Lahore, India.	**Afridi; Agra.**
C. Mi.	Chedomille Mijatovich. Senator of the Kingdom of Servia. Envoy Extraordinary and Minister Plenipotentiary of the King of Servia to the Court of St James's, 1895–1900, and 1902–1903.	**Alexander of Servia.**
C. Pf.	Christian Pfister, D. ès L. Professor at the Sorbonne, Paris. Chevalier of the Legion of Honour. Author of *Études sur le règne de Robert le Pieux.*	**Alcuin.**
C. Pl.	Rev. Charles Plummer, M.A. Fellow of Corpus Christi College, Oxford. Author of *Life and Times of Alfred the Great*; &c. Ford's Lecturer, 1901.	**Alfred the Great.**
C. R. B.	Charles Raymond Beazley, M.A., D.Litt. Professor of Modern History in the University of Birmingham. Formerly Fellow of Merton College, Oxford, and University Lecturer in the History of Geography. Author of *Henry the Navigator*; *The Dawn of Modern Geography*; &c.	**Andrew of Longjumeau.**
C. S. P.*	Rev. Charles Stanley Phillips. King's College, Cambridge. Gladstone Memorial Prize, 1904.	**Æthelred II.**
C. We.	Cecil Weatherly. Formerly Scholar of Queen's College, Oxford. Barrister-at-Law.	**Advertisement** (*in part*).
D. B. Ma.	Duncan Black Macdonald, M.A., D.D. Professor of Semitic Languages, Hartford Theological Seminary, U.S.A.	**Abu Hanifa;** **Ahmad Ibn Hanbal.**
D. G. H.	David George Hogarth, M.A. Keeper of the Ashmolean Museum, Oxford. Fellow of Magdalen College, Oxford. Fellow of the British Academy. Excavated at Paphos, 1888; Naukratis, 1899 and 1903; Ephesus, 1904–1905; Assiut, 1906–1907; Director, British School at Athens, 1897–1900; Director, Cretan Exploration Fund, 1899.	**Adalia; Adana; Aegean Civilization; Aintab; Aleppo;** **Alexandria; Alexandretta;** **Alexandria Troas;** **Amasia; Anazarbus.**
D. H.	David Hannay. Formerly British Vice-Consul at Barcelona. Author of *Short History of Royal Navy, 1217–1688*; *Life of Emilio Castelar*; &c.	**Abbadides; Abd-Ar-Rahman;** **Admiral; Agreda;** **Almogavares; Almohades;** **Almoravides; Alphonso;** **America:** *History*; **American War of Independence:** *Naval Operations*; **American War of 1812.**
D. M.	Rev. D. Meiklejohn.	**Adams, John Couch.**
D. Mn.	Rev. Dugald Macfadyen, M.A. Minister of South Grove Congregational Church, Highgate.	**Alexander, W. L.; Allon, H.**
D. M. W.	Sir Donald Mackenzie Wallace, K.C.I.E., K.C.V.O. Extra Groom of the Bedchamber to H.M. King George V. Director of the Foreign Department of *The Times*, 1891–1899. Author of *Russia*.	**Alexander II., of Russia;** **Alexander III., of Russia.**
E. B.*	Ernest C. F. Babelon. Professor at the Collège de France. Keeper of the Dept. of Medals and Antiquities at the Bibliothèque Nationale. Chevalier of the Legion of Honour.	**Africa, Roman.**
E. Br.	Ernest Barker, M.A. Fellow and Lecturer in Modern History, St John's College, Oxford. Formerly Fellow and Tutor of Merton College.	**Amalric.**
E. Ch.	Edward Channing, Ph.D. Professor of History, Harvard University.	**Adams, John;** **Adams, John Quincy;** **Adams, Samuel.**
E. C. B.	Right Rev. Edward Cuthbert Butler, O.S.B., D.Litt. Abbot of Downside Abbey, Bath.	**Acoemeti.**
E. G.	Edmund Gosse, LL.D. See the biographical article: Gosse, Edmund.	**Aasen; Almqvist;** **Anacreontics;** **Andersen, Hans Christian.**
E. Gr.	Ernest Arthur Gardner, M.A. See the biographical article: Gardner, Percy.	**Abae; Acarnania;** **Aegina.**
E. He.	Edward Heawood, M.A. Librarian to Royal Geographical Society, London. Author of *Geography of Africa*; &c.	**Africa:** *Geography, Economics, Bibliography.*
E. H. M.	Ellis Hovell Minns, M.A. Lecturer and Assistant Librarian, and formerly Fellow, Pembroke College, Cambridge. University Lecturer in Palaeography.	**Alani.**
E. J. R.	Emanuel Joseph Ristori, Ph.D., Assoc.M.Inst.C.E. Member of Council, Institute of Metals.	**Aluminium.**
E. M. W.	Rev. Edward Mewburn Walker, M.A. Fellow, Senior Tutor and Librarian of Queen's College, Oxford.	**Aegina:** *History.*
E. O.*	Edmund Owen, M.B., F.R.C.S., LL.D., D.Sc. Consulting Surgeon to St Mary's Hospital, London, and to the Children's Hospital, Great Ormond Street. Late Examiner in Surgery at the Universities of Cambridge, Durham and London. Author of *A Manual of Anatomy for Senior Students.*	**Abdomen;** **Abscess; Adenoids.**

E. Pr.	Edgar Prestage. Special Lecturer in Portuguese Literature in the University of Manchester; Examiner in Portuguese in the Universities of London, Manchester, &c. Commendador, Portuguese Order of S. Thiago.	**Alcoforado.**
E. R. B.	Edwyn Robert Bevan, M.A. New College, Oxford. Author of *The House of Seleucus.*	**Alexander the Great.**
E. Tn.	Rev. Ethelred Leonard Taunton (d. 1907). Author of *The English Black Monks of St Benedict*; *History of the Jesuits in England.*	**Acolyte;** **Allen, William.**
E. V.	Rev. Edmund Venables, M.A., D.D. (1819–1895). Canon and Precentor of Lincoln. Author of *Episcopal Palaces of England.*	**Abbey;** **Abbot.**
E. W.*	Edgar Whitaker (d. 1905). Formerly *Times* correspondent at Constantinople.	**Ahmed Vefik.**
F. A. E.	Fred. A. Eaton. Secretary to the Royal Academy.	**Academy, Royal.**
F. C. C.	Frederick Cornwallis Conybeare, M.A., D.Th. (Giessen). Formerly Fellow of University College, Oxford. Fellow of the British Academy. Author of *The Ancient Armenian Texts of Aristotle*; *Myth, Magic and Morals*; &c.	**Ablution; Agapē;** **Anabaptists;** **Ancestor-Worship.**
F. Fn.	Frank Finn, F.Z.S. Late Assistant Director of the Indian Museum, Calcutta.	**Acclimatization.**
F. G. M. B.	Frederick George Meeson Beck, M.A. Fellow and Lecturer of Clare College, Cambridge.	**Æthelbald; Æthelberht;** **Æthelfrith; Æthelred;** **Æthelwulf; Alamanni.**
F. G. P.	Frederick Gymer Parsons, F.R.C.S., F.Z.S., F.R.Anthrop.Inst. Vice-President, Anatomical Society of Great Britain and Ireland. Lecturer on Anatomy at St Thomas's Hospital and the London School of Medicine for Women. Formerly Hunterian Professor at the Royal College of Surgeons.	**Alimentary Canal;** **Anatomy.**
F. H. Ne.	Francis Henry Neville, M.A., F.R.S. Fellow of Sidney Sussex College, Cambridge, and Lecturer on Physics and Chemistry.	**Alloys** (*in part*).
F. Ll. G.	Francis Llewellyn Griffith, M.A., Ph.D., F.S.A. Reader in Egyptology, Oxford. Editor of the Archaeological Survey and Archaeological Reports of the Egypt Exploration Fund.	**Abu Simbel;** **Akhmim; Amasis; Ammon.**
F. R. C.	Frank R. Cana. Author of *South Africa from the Great Trek to the Union.*	**Abyssinia:** *Geography*; **Africa:** *Geography*, *History* (*in part*); **Albert Edward Nyanza** (*in part*); **Albert Nyanza** (*in part*); **Alexandria** (*in part*); **Algeria:** *Geography.*
F. S.	Francis Storr. Editor of the *Journal of Education* (London). Officier d'Académie (Paris).	**Academies.**
F. T. M.	Sir Frank Thomas Marzials. Accountant-General of the Army, 1898–1904. Editor of "Great Writers" Series.	**About.**
F. W. R.*	Frederick William Rudler, I.S.O., F.G.S. Curator and Librarian of the Museum of Practical Geology, London, 1879–1902. President of the Geologists' Association, 1887–1889.	**Agate; Alabaster;** **Alexandrite;** **Amber; Amethyst.**
G.*	Count Albert Edward Wilfred Gleichen, K.C.V.O., C.B., C.M.G., D.S.O., A.D.M.O., War Office; Colonel, Grenadier Guards. Mission to Abyssinia, 1897.	**Abyssinia:** *History.*
G. A. B.	George A. Boulenger, D.Sc., F.R.S. In charge of the Collections of Reptiles and Fishes, Department of Zoology, British Museum. Vice-President of the Zoological Society of London.	**Alytes.**
G. A. Gr.	George Abraham Grierson, C.I.E., Ph.D., D.Litt. Member of the Indian Civil Service, 1873–1903. In charge of Linguistic Survey of India, 1898–1902. Gold Medallist, Asiatic Society, 1909.	**Ahom.**
G. Br.	Rev. George Bryce, D.D., LL.D. Head of Faculty of Science, and Lecturer in Biology and Geology in Manitoba University, 1891–1904. Vice-President of Royal Society, Canada, 1908.	**Alberta.**
G. B. M.	George Ballard Mathews, M.A., F.R.S. Formerly Professor of Mathematics, University College of N. Wales. Sometime Fellow of St John's College, Cambridge.	**Algebra:** *Special.*
G. C. R.	George Croom Robertson. See the biographical article: Robertson, G. C.	**Abelard** (*in part*).
G. E. C.	Colonel George Earl Church. See the biographical article: Church, G. E.	**Amazon.**
G. E. W.	George Edward Woodberry, Litt.D., LL.D. Professor of Comparative Literature at Columbia University, 1891–1904. Author of *Edgar Allan Poe*; *Makers of Literature*; *America in Literature*; &c.	**American Literature.**
G. F. B.	G. F. Barwick. Assistant-Keeper of Printed Books and Superintendent of Reading-room, British Museum.	**Alfred, Duke of Saxe-Coburg;** **Alice, Grand-Duchess of Hesse**
G. L.	Georg Lunge, Ph.D. (Breslau), Hon. Dr.Ing. (Karlsruhe). See the biographical article: Lunge, G.	**Alkali Manufacture.**

G. P. M.	George Percival Mudge, A.R.C.S., F.Z.S. Lecturer on Biology, London Hospital Medical College, and London School of Medicine for Women.	**Albino.**
G. W. B.	George Willis Botsford, A.M., Ph.D. Professor of History of Greece and Rome in Columbia University, New York. Author of *The Roman Assemblies*; &c.	**Amphictyony.**
G. W. T.	Rev. Griffithes Wheeler Thatcher, M.A., B.D. Warden of Camden College, Sydney, N.S.W. Formerly Tutor in Hebrew and Old Testament History at Mansfield College, Oxford.	**Abu-l-ʽala; Abu-l-ʽAtahiya; Abulfaraj; Abulfeda; Abu-l-Qasim; Abu Nuwas; Abu Tammam; Abu Ubaida; Akhtal; Alqama Ibn ʽAbada; Amru'-ul-Qais.**
H. B. Wo.	Horace Bolingbroke Woodward, F.R.S., F.G.S. Formerly Assistant Director of the Geological Survey of England and Wales. President Geologists' Association, 1893–1894. Wollaston Medallist, 1908.	**Agassiz, J. L. R.**
H. Ch.	Hugh Chisholm, M.A. Formerly Scholar of Corpus Christi College, Oxford. Editor of the 11th edition of the *Encyclopaedia Britannica*; co-editor of the 10th edition.	**Acton, Lord; Agnosticism; Albert, Prince Consort.**
H. C. C.	Herbert Challice Crouch, M.R.C.S., L.R.C.P. Anaesthetist and Teacher of Anaesthetics at St Thomas's, Samaritan and French Hospitals, London.	**Anaesthesia.**
H. M. R.	Hugh Munro Ross. Formerly Exhibitioner of Lincoln College, Oxford. Editor of the *Times Engineering Supplement*. Author of *British Railways*.	**Alchemy.**
H. M. V.	Herbert M. Vaughan, F.S.A. Keble College, Oxford. Author of *The Last of the Royal Stuarts*; &c.	**Albany, Countess of.**
H. P. J.*	Henry Phelps Johnston. Author of *Loyalist History of the Revolution*; *The Yorktown Campaign*; &c.	**American War of Independence:** ***Land Operations.***
H. R. H.*	H. R. Haxton.	**Advertisement.**
H. S.-K.	Sir Henry Seton-Karr, C.M.G. Member for St. Helen's, 1885–1906. Author of *The Call to Arms.*	**Ammunition:** ***Small Arms.***
H. S. J.	Henry Stuart Jones, M.A. Formerly Fellow of Trinity College, Oxford. Director of the British School at Rome, 1903–1905. Author of *The Roman Empire.*	**Amphitheatre.**
H. V. K.	Captain Howard V. Knox, M.A. Exeter College, Oxford.	**Alps:** ***Flora and Fauna.***
H. W. C. D.	Henry William Carless Davis, M.A. Fellow and Tutor of Balliol College, Oxford. Fellow of All Souls', Oxford, 1895–1902.	**Ælred; Alredus; Ambrose.**
H. W. H.	Hope W. Hogg, M.A. Professor of Semitic Languages and Literatures in the University of Manchester.	**Anah.**
H. W. S.	H. Wickham Steed. Correspondent of *The Times* at Rome (1897–1902) and Vienna.	**Amedeo, Ferdinando, of Savoy.**
H. Y.	Sir Henry Yule, K.C.S.I. See the biographical article: Yule, Sir H.	**Afghanistan:** ***History.***
J. A. Ba.	J. Arthur Barrett, LL.B. New York Bar, 1880. U.S. Supreme Court Bar, 1901.	**Admiralty Jurisdiction:** ***United States.***
J. A. E.	James Alfred Ewing, C.B., LL.D., F.R.S., M.Inst.C.E. Director of (British) Naval Education, 1903. Hon. Fellow of King's College, Cambridge. Professor of Mechanism and Applied Mechanics in the University of Cambridge, 1890–1903.	**Air-Engine.**
J. A. F.	John Ambrose Fleming, M.A., D.Sc., F.R.S. Pender Professor of Electrical Engineering in the University of London. Fellow of University College, London. Formerly Fellow of St John's College, Cambridge, and University Lecturer on Applied Mechanics. Author of *Magnets and Electric Currents.*	**Amperemeter.**
J. A. H.	John Allen Howe, B.Sc. Curator and Librarian at the Museum of Practical Geology, London.	**Albian.**
J. B. B.	John Bagnell Bury, Litt.D., LL.D. See the biographical article: Bury, J. B.	**Alexius I. to III.**
J. D. B.	James David Bourchier, M.A., F.R.G.S. Correspondent of *The Times* in South-Eastern Europe. Officer of the Order of St Alexander of Bulgaria.	**Albania; Alexander of Bulgaria.**
J. D. Pr.	John Dyneley Prince, Ph.D. Professor of Semitic Languages at Columbia University, N.Y. Took part in the Expedition to Southern Babylonia, 1888–89.	**Akkad.**
J. F.-K.	James Fitzmaurice-Kelly, Litt.D., F.R.Hist.S. Fellow of the British Academy. Gilmour Professor of Spanish Language and Literature in the University of Liverpool. Norman MacColl Lecturer in the University of Cambridge. Knight Commander of the Order of Alphonso XII. Author of *A History of Spanish Literature.*	**Acosta, J. de; Alarcon, J. R. de; Alarcon, P. A. de; Aleman; Amadis de Gaula.**
J. F. R.	James Ford Rhodes, LL.D. See the biographical article: Rhodes, J. Ford.	**Adams, C. F.**
J. G. C. A.	John George Clark Anderson, M.A. Student, Censor and Tutor of Christ Church, Oxford. Craven Fellow, 1896. Formerly Fellow of Lincoln College, Oxford.	**Ancyra.**

J. G. Gr.	John G. Griffiths. Fellow and late President, Institute of Chartered Accountants.	**Accountants.**
J. G. Sc.	Sir James George Scott, K.C I.E. Superintendent and Political Officer, Southern Shan States. Author of *Burma*; &c.	**Akyab.**
J. H. P.	John Henry Poynting, M.A., D.Sc., F.R.S. Mason Professor of Physics and Dean of the Faculty of Science, Birmingham University. Sometime Fellow of Trinity College, Cambridge.	**Acoustics.**
J. H. R.	John Horace Round, M.A., LL.D. (Edin.). Author of *Feudal England*; *Peerage and Pedigree*; &c.	**Abeyance; Aids.**
J. I.	Jules Isaac. Professor of History at the Lycée of Lyons, France.	**Amboise, G. d'.**
J. L.*	Sir Joseph Larmor, M.A., D.Sc., LL.D., D.C.L., F.R.A.S. Fellow of St John's College, Cambridge. Lucasian Professor of Mathematics in Cambridge University. Secretary of the Royal Society. Author of *Aether and Matter*; &c.	**Aether.**
J. L. M.	John Linton Myres, M.A., F.S.A., F.R.G.S. Wykeham Professor of Ancient History in the University of Oxford. Formerly Gladstone Professor of Greek and Lecturer in Ancient Geography, University of Liverpool. Lecturer in Classical Archaeology in University of Oxford.	**Amathus.**
J. M. M.	John Malcolm Mitchell. Formerly Scholar of Queen's College, Oxford. Lecturer in Classics, East London College (University of London). Joint-editor of Grote's *History of Greece*.	**Anaxagoras** (*in part*).
J. P.-B.	James George Joseph Penderel-Brodhurst. Editor of the *Guardian* (London).	**Adam, Robert.**
J. P. Pe.	John Punnett Peters, Ph.D., D.D. Canon Residentiary, Cathedral of New York. Formerly Professor of Hebrew in the University of Pennsylvania. In charge of the University Expedition to Babylonia, 1888–1895. Author of *Nippur, or Explorations and Adventures on the Euphrates*.	**Anbar.**
J. R. C.	Joseph Rogerson Cotter, M.A. Assistant to the Professor of Physics, Trinity College, Dublin. Editor of 2nd edition of Preston's *Theory of Heat*.	**Absorption of Light.**
J. R. D.	Colonel John Richard Dodd, M.D., F.R.C.S., R.A.M.C. Administrative Medical Officer of Cork Military District.	**Ambulance.**
J. S.	James Sully, LL.D. See the biographical article: Sully, J.	**Aesthetics.**
J. S. F.	John Smith Flett, D.Sc., F.G.S. Petrographer to the Geological Survey. Formerly Lecturer on Petrology in Edinburgh University.	**Agglomerate; Amphibolite; Andesite.**
J. S. K.	John Scott Keltie, LL.D., F.S.S., F.S.A. (Scot.). Sec. Royal Geog. Soc. Hon. Memb. Geographical Societies of Paris, Berlin, Rome, &c. Editor of *Statesman's Year-book*. Editor of the *Geographical Journal*.	**Abbadie; Africa:** *History*.
J. T. Be.	John T. Bealby. Joint-author of *Stanford's Europe*. Formerly editor of the *Scottish Geographical Magazine*. Translator of Sven Hedin's *Through Asia, Central Asia and Tibet*; &c.	**Altai.**
J. T. C.	Joseph Thomas Cunningham, M.A., F.Z.S. Lecturer on Zoology at South-Western Polytechnic, London. Formerly Fellow of University College, Oxford. Assistant Professor of Natural History in the University of Edinburgh. Naturalist to the Marine Biological Association.	**Anchovy.**
J. T. S.*	James Thomson Shotwell, Ph.D. Professor of History in Columbia University, New York City.	**Abelard** (*in part*).
J. V. B.	J. Vernon Bartlet, M.A., D.D. Professor of Church History, Mansfield College, Oxford.	**Acts of the Apostles.**
Jno. W.	John Westlake, K.C., LL.D., D.C.L. Professor of International Law, Cambridge, 1888–1908. One of the Members for United Kingdom of International Court of Arbitration under the Hague Convention, 1900–1906. Author of *A Treatise on Private International Law, or the Conflict of Laws: Chapters on the Principles of International Law*, part i. "Peace," part ii. "War."	**Alien; Allegiance.**
J. W. D.	Captain J. Whitly Dixon, R.N. Nautical Assessor to the Court of Appeal.	**Anchor.**
K. S.	Kathleen Schlesinger. Author of *The Instruments of the Orchestra*; &c.	**Accordion; Aeolian Harp; Alpenhorn.**
L. D.*	Louis Marie Olivier Duchesne. See the biographical article: Duchesne, L. M. O.	**Adrian I., II., III.; Alexander I., II.** (popes).
L. J. S.	Leonard James Spencer. Department of Mineralogy, British Museum. Formerly Scholar of Sidney Sussex College, Cambridge, and Harkness Scholar. Editor of the *Mineralogical Magazine*.	**Albite; Alunite; Amblygonite; Ampibole; Analcite; Anatase; Andalusite.**
L. V.*	Luigi Villari. Italian Foreign Office (Emigration Dept.). Formerly Newspaper Correspondent in east of Europe; Italian Vice-Consul in New Orleans, 1906, Philadelphia, 1907, and Boston, U.S.A., 1907–1910. Author of *Italian Life in Town and Country*; &c.	**Accoramboni; Alexander VI.** (pope); **Amari.**

M. Br.	Margaret Bryant.	**Alexander the Great:** *Legends.*
M. G.	Moses Gaster, Ph.D. (Leipzig). Chief Rabbi of the Sephardic communities of England. Vice-President, Zionist Congress, 1898, 1899, 1900. Ilchester Lecturer at Oxford on Slavonic and Byzantine Literature, 1886 and 1891. President, Folklore Society of England. Vice-President, Anglo-Jewish Association. Author of *History of Rumanian Popular Literature*; *The Hebrew Version of the Secretum Secretorum of Aristotle.*	**Alecsandri.**
M. G. D.	Rt. Hon. Sir Mountstuart Elphinstone Grant-Duff, G.C.S.I., F.R.S. (1829–1906). M.P. for the Elgin Burghs, 1857–1881. Under-Secretary of State for India, 1868–1874. Under-Secretary of State for the Colonies, 1880–1881. Governor of Madras, 1881–1886. President of the Royal Geographical Society, 1889–1893. President of the Royal Historical Society, 1892–1899. Author of *Studies in European Politics*; *Notes from a Diary*; &c.	**Ampthill, Baron.**
M. Ha.	Marcus Hartog, M.A., D.Sc. (Lond.), F.L.S. Professor of Zoology in University College, Cork. Formerly Professor of Natural History in Queen's College, Cork, and Fellow of the Royal University of Ireland.	**Amoeba.**
M. H. C.	Montague Hughes Crackanthorpe, M.A., K.C., D.C.L. President of the Eugenics Education Society. Formerly Member of the General Council of the Bar and Council of Legal Education. Late Chairman, Incorporated Council of Law Reporting. Chairman of Quarter Sessions, Westmorland. Honorary Fellow, St John's College, Oxford.	**"Alabama" Arbitration.**
M. Ja.	Morris Jastrow, Jr., Ph.D. Professor of Semitic Languages, University of Pennsylvania, U.S.A. Author of *Religion of the Babylonians and Assyrians*; &c.	**Adad.**
M. M. Bh.	Sir Mancherjee Merwanjee Bhownaggree, K.C.I.E. Fellow of Bombay University. M.P. (C.) Bethnal Green, North-East, 1895–1906. Author of *Small History of the East India Company.*	**Aga Khan.**
M. N. T.	Marcus Niebuhr Tod, M.A. Fellow and Lecturer of Oriel College, Oxford. University Lecturer in Greek Epigraphy. Corresponding Member of the German Imperial Archaeological Institute. Joint-author of *Catalogue of the Sparta Museum.*	**Agesilaus;** **Agis.**
M. O. B. C.	Max Otto Bismarck Caspari, M.A. Reader in Ancient History at London University. Lecturer in Greek at Birmingham University, 1905–1908.	**Acarnania; Achaean League; Actium; Aetolia; Ambracia.**
M. P.*	Léon Jacques Maxime Prinet. Formerly Archivist to the French National Archives. Auxiliary of the Institute of France (Academy of Moral and Political Sciences).	**Albret;** **Alençon, Counts of.**
N. V.	Joseph Marie Noel Valois. Member of Académie des Inscriptions et Belles-lettres, Paris. Honorary Archivist at the Archives Nationales. Formerly President of the Société de l'Histoire de France, and of the Société de l'École de Chartes.	**Ailly;** **Alexander V. (pope).**
O. E.	S. Otto Eppenstein, Ph.D. Member of Scientific Staff at Zeiss's optical works, Jena. Editor of 2nd ed. of *Grundzüge der Theorie der optischen Instrumente nach Abbe.*	**Aberration.**
O. H.*	Otto Hehner, Ph.D. Formerly President of the Society of Analytical Chemists.	**Adulteration.**
O. T. M.	Otis Tufton Mason (d. 1908). Curator, Department of Anthropology, National Museum, Washington, 1884–1908. Author of *Woman's Share in Primitive Culture*; *Primitive Travel and Transportation*; &c.	**America:** *Ethnology and Archaeology.*
P. A.	Paul Daniel Alphandéry. Professor of the History of Dogma, École Pratique des Hautes Études, Sorbonne, Paris. Author of *Les Idées morales chez les hétérodoxes latines au début du XIII^e siècle.*	**Alain de Lille;** **Albigenses.**
P. A. A.	Philip A. Ashworth, M.A., D.Juris. New College, Oxford. Barrister-at-Law.	**Alsace-Lorraine.**
P. A. G.	P. Anderson Graham. Editor of *Country Life.* Author of *The Rural Exodus: the Problem of the Village and the Town.*	**Allotments.**
P. A. K.	Prince Peter Alexeivitch Kropotkin. See the biographical article: Kropotkin, P. A.	**Altai; Amur:** *District*; **Anarchism.**
P. A. M.	Percy Alexander MacMahon, D.Sc., F.R.S., late Major R.A. Deputy Warden of the Standards, Board of Trade. Joint General Secretary, British Association. Formerly Professor of Physics, Ordnance College. President of London Mathematical Society, 1894–1896.	**Algebraic Forms.**
P. C. M.	Peter Chalmers Mitchell, F.R.S., D.Sc., LL.D. Secretary to the Zoological Society of London from 1903. University Demonstrator in Comparative Anatomy and Assistant to Linacre Professor at Oxford, 1888–1891. Lecturer on Biology at Charing Cross Hospital, 1892–1894; at London Hospital, 1894. Examiner in Biology to the Royal College of Physicians, 1892–1896, 1901–1903. Examiner in Zoology to the University of London, 1903.	**Abiogenesis; Actinozoa;** **Alimentary Canal;** **Amphibia** (*in part*).
P. C. Y.	Philip Chesney Yorke, M.A. Magdalen College, Oxford.	**Aberdeen, 1st Earl of;** **Allestree, R.**
P. Gi.	Peter Giles, M.A., LL.D. Fellow and Classical Lecturer of Emmanuel College, Cambridge, and University Reader in Comparative Philology.	**A; Accent;** **Alphabet.**

P. La.	PHILIP LAKE, M.A., F.G.S. Lecturer on Physical and Regional Geography in Cambridge University. Formerly of the Geological Survey of India. Author of *Monograph of British Cambrian Trilobites.* Translator and editor of Kayser's *Comparative Geology.*	Alps: *Geology.*
R. A. S. M.	ROBERT ALEXANDER STEWART MACALISTER, M.A., F.S.A. Director of Excavations for the Palestine Exploration Fund.	Acre; Ai; Altar.
R. K. D.	SIR ROBERT KENNAWAY DOUGLAS. Formerly Keeper of Oriental Printed Books and MSS. at the British Museum; Professor of Chinese, King's College, London. Author of *The Language and Literature of China*; &c.	Alcock, Sir R.
R. L.*	RICHARD LYDEKKER, F.R.S., Author of *Catalogues of Fossil Mammals, Reptiles and Birds in British Museum*; *The Deer of all Lands*; *The Game Animals of Africa*; &c.	Amblypoda; Ancylopoda.
R. N. B.	ROBERT NISBET BAIN (d. 1909). Assistant Librarian, British Museum, 1883–1909. Author of *Scandinavia: the Political History of Denmark, Norway and Sweden, 1513–1900*; *The First Romanovs, 1613 to 1725*; *Slavonic Europe: the Political History of Poland and Russia from 1469 to 1796*, &c.	Aagesen; Absalon; Adolphus Frederick; Alexander Nevsky; Alexius Mikhailovich; Alexius Petrovich; Alin; Andrassy, Count; Andrew II. of Hungary.
R. P. S.	R. PHENÉ SPIERS, F.S.A., F.R.I.B.A. Past President of Architectural Association. Associate and Fellow of King's College, London. Editor of *Fergusson's History of Architecture.* Author of *Architecture: East and West*; &c.	Aisle.
R. S. C.	ROBERT SEYMOUR CONWAY, M.A., LITT.D. Professor of Latin, Victoria University of Manchester; formerly Professor of Latin in University College, Cardiff.	Aequi.
R. Tr.	ROLAND TRUSLOVE, M.A. Dean, Fellow and Lecturer, Worcester College, Oxford. Formerly Scholar of Christ Church, Oxford.	Agriculture (*in part*).
R. V. H.	ADMIRAL SIR RICHARD VESEY HAMILTON, G.C.B. Senior Naval Lord of Admiralty, 1889–1891. President, Royal Naval College, Greenwich, 1891–1894.	Admiralty Administration (*British*).
R. W. P.	REGINALD W. PHILLIPS, D.Sc., F.L.S. Professor of Botany in the University College of North Wales. Author of *Morphology of the Algae*, &c.	Algae.
S. A. C.	STANLEY ARTHUR COOK, M.A. Lecturer in Hebrew and Syriac, and formerly Fellow, Gonville and Caius College, Cambridge. Examiner in Hebrew and Aramaic, London University, 1904–1908. Council of Royal Asiatic Society, 1904–1905. Editor for Palestine Exploration Fund. Author of *Critical Notes on Old Testament History*; *Religion of Ancient Palestine*; &c.	Aaron; Abimelech; Abraham; Ahab; Amalekites; Ammonites.
S. E. B.	SIMEON EBEN BALDWIN, M.A., LL.D. Professor of Constitutional and Private International Law in Yale University. Chief Justice of the Supreme Court of Errors, Connecticut. President of the International Law Association. President of the American Historical Association.	American Law.
T. As.	THOMAS ASHBY, M.A., D.LITT. (Oxon.), F.S.A. Formerly Scholar of Christ Church, Oxford. Director of British School of Archaeology at Rome.	Adria; Aemilia Via; Agrigentum; Alba Fucens; Alba Longa; Aletrium; Anagnia; Ancona.
T. A. I.	THOMAS ALLAN INGRAM, M.A., LL.D. Trinity College, Dublin.	Affiliation.
T. A. J.	T. ATHOL JOYCE, M.A. Assistant in Department of Ethnography, British Museum. Hon. Sec. Anthropological Society.	Ababda; Africa: *Ethnology.*
T. H.	THOMAS HODGKIN, LL.D., D.LITT. See the biographical article: HODGKIN, T.	Alaric.
T. H. H.	THOMAS HENRY HUXLEY, F.R.S. See the biographical article: HUXLEY, THOMAS H.	Amphibia (*in part*).
T. H. H.*	COLONEL SIR THOMAS HUNGERFORD HOLDICH, K.C.M.G., K.C.I.E., HON. D.Sc. Superintendent, Frontier Surveys, India, 1892–1898. Author of *The Indian Borderland*; *The Countries of the King's Award*; *India*; *Tibet*; &c.	Afghanistan: *Geography*; Afghan Turkestan.
T. K. C.	REV. THOMAS KELLY CHEYNE, D.LITT., D.D. See the biographical article: CHEYNE, T. K.	Adam; Amos.
T. W. R. D.	T. W. RHYS DAVIDS, LL.D., PH.D. Professor of Comparative Religion in Manchester University. President of the Pali Text Society. Fellow of the British Academy. Secretary and Librarian of Royal Asiatic Society, 1885–1902. Author of *Buddhism*; &c.	Abhidhamma; Ajanta; Ananda.
V. B. L.	VIVIAN BYAM LEWES, F.I.C., F.C.S. Professor of Chemistry, Royal Naval College. Chief Superintendent Gas Examiner to the Corporation of the City of London.	Acetylene.
W.	SIR JOSEPH WALTON (d. 1910). Formerly Judge of the King's Bench Div. Chairman of the General Council of the Bar, 1899.	Affreightment.

W. A. B. C.	Rev William Augustus Brevoort Coolidge, M.A , F.R.G.S., D.Ph. (Bern). Fellow of Magdalen College, Oxford Professor of English History, St David's College, Lampeter, 1880-1881. Author of *Guide du Haut Dauphiné*; *The Range of the Tödi*; *Guide to Grindelwald*; *Guide to Switzerland*; *The Alps in Nature and in History*; &c. Editor of the *Alpine Journal*, 1880-1889, &c.	**Aar; Aarau; Aargau; Adda; Adige; Albula Pass; Alp; Alpes Maritimes; Alps; Altdorf.**
W. A. P.	Walter Alison Phillips, M.A. Formerly Exhibitioner of Merton College and Senior Scholar of St John's College, Oxford. Author of *Modern Europe*, &c.	**Abbot; Aix-la-Chapelle:** *Congresses*; **Alexander I. of Russia; Ali, of Iannina; Alliance; Ambassador.**
W. Ba.	William Bacher, Ph.D. Professor at the Rabbinical Seminary, Buda-Pest.	**Abenezra.**
W. C. R.-A.	Sir William Chandler Roberts-Austen, K.C.B., D.C.L., F.R.S. See the biographical article: Roberts-Austen, Sir W. C.	**Alloys** (*in part*).
W. E. G.	Sir William Edmund Garstin, G.C.M.G. Governing Director, Suez Canal Co. Formerly Inspector-General of Irrigation, Egypt. Under-Secretary of State for Public Works. Adviser to the Ministry of Public Works in Egypt, 1904-1908.	**Albert Edward Nyanza; Albert Nyanza** (*in part*).
W. Fr.	William Fream, LL.D., F.G.S., F.L.S., F.S.S. (d. 1907). Author of *Handbook of Agriculture*.	**Agriculture** (*in part*)
W. F. Sh.	William Fleetwood Sheppard, M.A. Senior Examiner in the Board of Education. Formerly Fellow of Trinity College, Cambridge. Senior Wrangler, 1884.	**Algebra.**
W. G.*	Walcot Gibson, D.Sc., F.G.S. H.M. Geological Survey. Author of *The Gold-Bearing Rocks of the S. Transvaal*; *Mineral Wealth of Africa*; *The Geology of Coal and Coalmining*; &c.	**Africa:** *Geology*; **Algeria:** *Geology*.
W. G. F. P.	Sir Walter George Frank Phillimore, Bart., D.C.L., LL.D. Judge of the King's Bench Div. President of International Law Association, 1905. Author of *Book of Church Law*. Edited 2nd ed. of *Phillimore's Ecclesiastical Law*, and 3rd ed. of vol. iv. of *Phillimore's International Law*.	**Admiralty, High Court of; Admiralty Jurisdiction.**
W. Ht.	Walter Hibbert, A.M.I.C.E., F.I.C., F.C.S. Lecturer on Physics and Electro-Technology, Polytechnic, Regent Street, London.	**Accumulator.**
W. M. D.	William Morris Davis, D.Sc., Ph.D. Professor of Geology in Harvard University. Formerly Professor of Physical Geography. Author of *Physical Geography*; &c.	**America:** *Physical Geography*
W. M. F. P.	William M. Flinders Petrie, D.C.L., Litt.D., LL.D., Ph.D. See the biographical article: Petrie, W. M. F.	**Abydos.**
W. M. R.	William Michael Rossetti. See the biographical article: Rossetti, Dante Gabriel.	**Andrea del Sarto.**
W. O. B.	Ven. Winfrid Oldfield Burrows, M.A. Archdeacon of Birmingham. Formerly Tutor of Christ Church, Oxford, 1884-1891, and Principal of Leeds Clergy School, 1891-1900.	**Absolution.**
W. Ri.	William Ridgeway, M.A., D.Sc., Litt.D. Disney Professor of Archaeology, Cambridge University, and Brereton Reader in Classics. Fellow of Caius College, Cambridge. Fellow of the British Academy. President of Royal Anthropological Institute, 1908. Author of *The Early Age of Greece*, &c.	**Achaeans.**
W. S.	William Spalding. See the biographical article: Spalding, W.	**Addison** (*in part*).
W. T. S.	Rear-Admiral W. T. Sampson, LL.D. See the biographical article: Sampson, W. T.	**Admiralty Administration** (*United States*).
W. W.	William Wallace. See the biographical article: Wallace, William (1844-1897).	**Anaxagoras** (*in part*).
W. W. F.*	William Warde Fowler, M.A. Fellow of Lincoln College, Oxford. Sub-Rector, 1881-1904. Gifford Lecturer, Edinburgh University, 1908. Author of *The City-State of the Greeks and Romans*.	**Ambarvalia.**
W. W. R.*	William Walker Rockwell, Lic.Theol. Assistant Professor of Church History, Union Theological Seminary, New York.	**Adrian IV., V., VI.; Alexander III., IV., VII., VIII.; Ancyra, Synod of.**

PRINCIPAL UNSIGNED ARTICLES

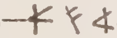
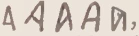
Abbreviation.
Acid.
Aconite.
Addison's Disease.
Adoption.
Advocate.
Advowson.
Aeronautics.
Aerotherapeutics.
Agapemonites.
Age.
Alabama.
Alaska.
Alb.
Albumin.
Alcohol.
Alcohols.
Aldehydes.
Alexandrian School.
Alhambra.
Alimony.
Alismaceae.
Almanac.
Aloe.
Alum.
Amazons.
Ambo.
Ammonia.
Amsterdam.
Ana.
Andaman Islands.
Andes.

THE
ENCYCLOPÆDIA BRITANNICA

VOLUME I

A TO ANDROPHAGI

A This letter of ours corresponds to the first symbol in the Phoenician alphabet and in almost all its descendants. In Phoenician, *a*, like the symbols for *e* and for *o*, did not represent a vowel, but a breathing; the vowels originally were not represented by any symbol. When the alphabet was adopted by the Greeks it was not very well fitted to represent the sounds of their language. The breathings which were not required in Greek were accordingly employed to represent some of the vowel sounds, other vowels, like *i* and *u*, being represented by an adaptation of the symbols for the semi-vowels *y* and *w*. The Phoenician name, which must have corresponded closely to the Hebrew *Aleph*, was taken over by the Greeks in the form *Alpha* (ἄλφα). The earliest authority for this, as for the names of the other Greek letters, is the grammatical drama (γραμματικὴ θεωρία) of Callias, an earlier contemporary of Euripides, from whose works four trimeters, containing the names of all the Greek letters, are preserved in Athenaeus x. 453 d.

The form of the letter has varied considerably. In the earliest of the Phoenician, Aramaic and Greek inscriptions (the oldest Phoenician dating about 1000 B.C., the oldest Aramaic from the 8th, and the oldest Greek from the 8th or 7th century B.C.) A rests upon its side thus—. In the Greek alphabet of later times it generally resembles the modern capital letter, but many local varieties can be distinguished by the shortening of one leg, or by the angle at which the cross line is set—, &c. From the Greeks of the west the alphabet was borrowed by the Romans and from them has passed to the other nations of western Europe. In the earliest Latin inscriptions, such as the inscription found in the excavation of the Roman Forum in 1899, or that on a golden *fibula* found at Praeneste in 1886 (see ALPHABET), the letters are still identical in form with those of the western Greeks. Latin develops early various forms, which are comparatively rare in Greek, as , or unknown, as . Except possibly Faliscan, the other dialects of Italy did not borrow their alphabet directly from the western Greeks as the Romans did, but received it at second hand through the Etruscans. In Oscan, where the writing of early inscriptions is no less careful than in Latin, the A takes the form , to which the nearest parallels are found in north Greece (Boeotia, Locris and Thessaly, and there only sporadically).

In Greek the symbol was used for both the long and the short sound, as in English *father* (ā) and German *Ratte* (ă); English, except in dialects, has no sound corresponding precisely to the Greek short α, which, so far as can be ascertained, was a mid-back-wide sound, according to the terminology of H. Sweet (*Primer of Phonetics*, p. 107). Throughout the history of Greek the short sound remained practically unchanged. On the other hand, the long sound of α in the Attic and Ionic dialects passed into an open ē-sound, which in the Ionic alphabet was represented by the same symbol as the original ē-sound (see ALPHABET : *Greek*). The vowel sounds vary from language to language, and the *a* symbol has, in consequence, to represent in many cases sounds which are not identical with the Greek α whether long or short, and also to represent several different vowel sounds in the same language. Thus the *New English Dictionary* distinguishes about twelve separate vowel sounds, which are represented by *a* in English. In general it may be said that the chief changes which affect the *a*-sound in different languages arise from (1) rounding, (2) fronting, *i.e.* changing from a sound produced far back in the mouth to a sound produced farther forward. The rounding is often produced by combination with rounded consonants (as in English *was*, *wall*, &c.), the rounding of the preceding consonant being continued into the formation of the vowel sound. Rounding has also been produced by a following *l*-sound, as in the English *fall*, *small*, *bald*, &c. (see Sweet's *History of English Sounds*, 2nd ed., §§ 906, 784). The effect of fronting is seen in the Ionic and Attic dialects of Greek, where the original name of the Medes, *Mādoi*, with *ā* in the first syllable (which survives in Cyprian Greek as Μᾶδοι), is changed into *Mēdoi* (Μῆδοι), with an open *ē*-sound instead of the earlier *ā*. In the later history of Greek this sound is steadily narrowed till it becomes identical with *ī* (as in English *seed*). The first part of the process has been almost repeated by literary English, *ā* (*ah*) passing into *ē* (*eh*), though in present-day pronunciation the sound has developed further into a diphthongal *ei* except before *r*, as in *hare* (Sweet, *op. cit.* § 783).

In English *a* represents unaccented forms of several words, e.g. *ān* (one), *of*, *have*, *he*, and of various prefixes the history of which is given in detail in the *New English Dictionary* (Oxford, 1888), vol. i. p. 4. (P. Gi.)

As a symbol the letter is used in various connexions and for various technical purposes, *e.g.* for a note in music, for the first of the seven dominical letters (this use is derived from its being the first of the *litterae nundinales* at Rome), and generally as a sign of priority.

In Logic, the letter A is used as a symbol for the universal affirmative proposition in the general form "all x is y." The letters I, E and O are used respectively for the particular affirmative "some x is y," the universal negative "no x is y," and the particular negative "some x is not y." The use of these letters is generally derived from the vowels of the two Latin verbs *AffIrmo* (or *AIo*), "I assert," and *nEgO*, "I deny." The use of the symbols dates from the 13th century, though some authorities trace their origin to the Greek logicians. A is also used largely in abbreviations (*q.v.*).

In Shipping, A1 is a symbol used to denote quality of construction and material. In the various shipping registers ships are classed and given a rating after an official examination, and assigned a classification mark, which appears in addition to other particulars in those registers after the name of the ship. See Shipbuilding. It is popularly used to indicate the highest degree of excellence.

AA, the name of a large number of small European rivers. The word is derived from the Old German *aha*, cognate to the Latin *aqua*, water (cf. Ger. *-ach*; Scand. *å*, *aa*, pronounced *ō*). The following are the more important streams of this name:—Two rivers in the west of Russia, both falling into the Gulf of Riga, near Riga, which is situated between them; a river in the north of France, falling into the sea below Gravelines, and navigable as far as St Omer; and a river of Switzerland, in the cantons of Lucerne and Aargau, which carries the waters of Lakes Baldegger and Hallwiler into the Aar. In Germany there are the Westphalian Aa, rising in the Teutoburger Wald, and joining the Werre at Herford, the Münster Aa, a tributary of the Ems, and others.

AAGESEN, ANDREW (1826–1879), Danish jurist, was educated for the law at Kristianshavn and Copenhagen, and interrupted his studies in 1848 to take part in the first Schleswig war, in which he served as the leader of a reserve battalion. In 1855 he became professor of jurisprudence at the university of Copenhagen. In 1870 he was appointed a member of the commission for drawing up a maritime and commercial code, and the navigation law of 1882 is mainly his work. In 1879 he was elected a member of the Landsthing; but it is as a teacher at the university that he won his reputation. Among his numerous juridical works may be mentioned: *Bidrag til Laeren om Overdragelse af Ejendomsret, Bemaerkinger om Rettigheder over Ting* (Copenhagen, 1866, 1871–1872); *Fortegnelse over Retssamlinger, Retslitteratur i Danmark, Norge, Sverige* (Copenhagen, 1876). Aagesen was Hall's successor as lecturer on Roman law at the university, and in this department his researches were epoch-making. All his pupils were profoundly impressed by his exhaustive examination of the sources, his energetic demonstration of his subject and his stringent search after truth. His noble, imposing, and yet most amiable personality won for him, moreover, universal affection and respect.

See C. F. Bricka, *Dansk. Biog. Lex.* vol. i. (Copenhagen, 1887); *Samlade Skrifter*, edited by F. C. Bornemann (Copenhagen, 1863). (R. N. B.)

AAL, also known as A'l, Ach, or Aich, the Hindustani names for the *Morinda tinctoria* and *Morinda citrifolia*, plants extensively cultivated in India on account of the reddish dye-stuff which their roots contain. The name is also applied to the dye, but the common trade name is *Suranji*. Its properties are due to the presence of a glucoside known as *Morindin*, which is compounded from glucose and probably a trioxy-methyl-anthraquinone.

AALBORG, a city and seaport of Denmark, the seat of a bishop, and chief town of the *amt* (county) of its name, on the south bank of the Limfjord, which connects the North Sea and the Cattegat. Pop. (1901) 31,457. The situation is typical of the north of Jutland. To the west the Limfjord broadens into an irregular lake, with low, marshy shores and many islands. North-west is the Store Vildmose, a swamp where the mirage is seen in summer. South-east lies the similar Lille Vildmose. A railway connects Aalborg with Hjörring, Frederikshavn and Skagen to the north, and with Aarhus and the lines from Germany to the south. The harbour is good and safe, though difficult of access. Aalborg is a growing industrial and commercial centre, exporting grain and fish. An old castle and some picturesque houses of the 17th century remain. The Budolphi church dates mostly from the middle of the 18th century, while the Frue church was partially burnt in 1894, but the foundation of both is of the 14th century or earlier. There are also an ancient hospital and a museum of art and antiquities. On the north side of the fjord is Nörre Sundby, connected with Aalborg by a pontoon and also by an iron railway bridge, one of the finest engineering works in the kingdom. Aalborg received town-privileges in 1342, and the bishopric dates from 1554.

AALEN, a town of Germany, in the kingdom of Württemberg, pleasantly situated on the Kocher, at the foot of the Swabian Alps, about 50 m. E. of Stuttgart, and with direct railway communication with Ulm and Cannstatt. Pop. 10,000. Woollen and linen goods are manufactured, and there are ribbon looms and tanneries in the town, and large iron works in the neighbourhood. There are several schools and churches, and a statue of the poet Christian Schubart. Aalen was a free imperial city from 1360 to 1802, when it was annexed to Württemberg.

AALESUND, a seaport of Norway, in Romsdal *amt* (county), 145 m. N. by E. from Bergen. Pop. (1900) 11,672. It occupies two of the outer islands of the west coast, Aspö and Nörvö, which enclose the picturesque harbour. Founded in 1824, it is the principal shipping-place of Söndmöre district, and one of the chief stations of the herring fishery. Aalesund is adjacent to the Jörund and Geiranger fjords, frequented by tourists. From Öje at the head of Jörund a driving-route strikes south to the Nordfjord, and from Merok on Geiranger another strikes inland to Otta, on the railway to Lillehammer and Christiania. Aalesund is a port of call for steamers between Bergen, Hull, Newcastle and Hamburg, and Trondhjem. A little to the south of the town are the ruins of the reputed castle of Rollo, the founder, in the 9th century, of the dynasty of the dukes of Normandy. On the 23rd of January 1904, Aalesund was the scene of one of the most terrible of the many conflagrations to which Norwegian towns, built largely of wood, have been subject. Practically the whole town was destroyed, a gale aiding the flames, and the population had to leave the place in the night at the notice of a few minutes. Hardly any lives were lost, but the sufferings of the people were so terrible that assistance was sent from all parts of the kingdom, and by the German government, while the British government also offered it.

AALI, MEHEMET, Pasha (1815–1871), Turkish statesman, was born at Constantinople in 1815, the son of a government official. Entering the diplomatic service of his country soon after reaching manhood, he became successively secretary of the Embassy in Vienna, minister in London, and foreign minister under Reshid Pasha. In 1852 he was promoted to the post of grand vizier, but after a short time retired into private life. During the Crimean War he was recalled in order to take the portfolio of foreign affairs for a second time under Reshid Pasha, and in this capacity took part in 1855 in the conference of Vienna. Again becoming in that year grand vizier, an office he filled no less than five times, he represented Turkey at the congress of Paris in 1856. In 1867 he was appointed regent of Turkey during the sultan's visit to the Paris Exhibition. Aali Pasha was one of the most zealous advocates of the introduction of Western reforms under the sultans Abdul Mejid and Abdul Aziz. A scholar and a linguist, he was a match for the diplomats of the Christian powers, against whom he successfully defended the interests of his country. He died at Erenkeni in Asia Minor on the 6th of September 1871.

AAR, or Aare, the most considerable river which both rises and ends entirely within Switzerland. Its total length (including all bends) from its source to its junction with the Rhine is about 181 m., during which distance it descends 5135 ft., while its drainage area is 6804 sq. m. It rises in the great Aar glaciers, in the canton of Bern, and W. of the Grimsel Pass. It runs E. to the Grimsel Hospice, and then N.W. through the Hasli valley, forming on the way the magnificent waterfall of the Handegg (151 ft.), past Guttannen, and pierces the limestone barrier of the Kirchet by a grand gorge, before reaching Meiringen, situated in a plain. A little beyond, near Brienz, the river expands into the lake of Brienz, where it becomes navigable. Near the west end of that lake it receives its first important affluent, the Lütschine (left), and then runs across the swampy plain of the Bödeli, between Interlaken (left) and Unterseen (right), before again expanding in order to form the Lake of Thun. Near the west end of that lake it receives on the left the Kander, which has just before been joined by the Simme; on flowing out of the lake it passes Thun, and then circles the lofty bluff on which the town of Bern is built. It soon changes its north-westerly for a due westerly direction, but after receiving the Saane or Sarine (left) turns N. till near Aarberg its stream is diverted W. by the Hagneck Canal into the Lake of Bienne, from the upper end of which it issues through the Nidau Canal and then runs E. to Büren. Henceforth its course is N.E. for a long distance, past Soleure (below which the Grosse Emme flows in on the right), Aarburg (where it is joined by the Wigger, right), Olten, Aarau, near which is the junction with the Suhr on the right, and Wildegg, where the Hallwiler Aa falls in on the right. A short way beyond, below Brugg, it receives first the Reuss (right), and very shortly afterwards the Limmat or Linth (right). It now turns due N., and soon becomes itself an affluent of the Rhine (left), which it surpasses in volume when they unite at Coblenz, opposite Waldshut. (W. A. B. C.)

AARAU, the capital of the Swiss canton of Aargau. In 1900 it had 7831 inhabitants, mostly German-speaking, and mainly Protestants. It is situated in the valley of the Aar, on the right bank of that river, and at the southern foot of the range of the Jura. It is about 50 m. by rail N.E. of Bern, and 31 m. N.W. of Zürich. It is a well-built modern town, with no remarkable features about it. In the Industrial Museum there is (besides collections of various kinds) some good painted glass of the 16th century, taken from the neighbouring Benedictine monastery of Muri (founded 1027, suppressed 1841—the monks are now quartered at Gries, near Botzen, in Tirol). The cantonal library contains many works relating to Swiss history and many MSS. coming from the suppressed Argovian monasteries. There are many industries in the town, especially silk-ribbon weaving, foundries, and factories for the manufacture of cutlery and scientific instruments. The popular novelist and historian, Heinrich Zschokke (1771–1848), spent most of his life here, and a bronze statue has been erected to his memory. Aarau is an important military centre. The slopes of the Jura are covered with vineyards. Aarau, an ancient fortress, was taken by the Bernese in 1415, and in 1798 became for a time the capital of the Helvetic republic. Eight miles by rail N.E. are the famous sulphur baths of Schinznach, just above which is the ruined castle of Habsburg, the original home of that great historical house. (W. A. B. C.)

AARD-VARK (meaning "earth-pig"), the Dutch name for the mammals of genus *Orycteropus*, confined to Africa (see EDENTATA). Several species have been named. Among them is the typical form, *O. capensis*, or Cape ant-bear from South Africa, and the northern aard-vark (*O. aethiopicus*) of north-eastern Africa, extending into Egypt. In form these animals are somewhat pig-like; the body is stout, with arched back; the limbs are short and stout, armed with strong, blunt claws; the ears disproportionately long; and the tail very thick at the base and tapering gradually. The greatly elongated head is set on a short thick neck, and at the extremity of the snout is a disk in which the nostrils open. The mouth is small and tubular, furnished with a long extensile tongue. The measurements of a female, taken in the flesh, were head and body 4 ft., tail 17½ in.; but a large individual measured 6 ft. 8 in. over all. In colour the Cape aard-vark is pale sandy or yellow, the hair being scanty and allowing the skin to show; the northern aard-vark has a still thinner coat, and is further distinguished by the shorter tail and longer head and ears. These animals are of nocturnal and burrowing habits, and generally to be found near ant-hills. The strong claws make a hole in the side of the ant-hill, and the insects are collected on the extensile tongue. Aard-varks are hunted for their skins; but the flesh is valued for food, and often salted and smoked.

AARD-WOLF (earth-wolf), a South and East African carnivorous mammal (*Proteles cristatus*), in general appearance like a small striped hyena, but with a more pointed muzzle, sharper ears, and a long erectile mane down the middle line of the neck and back. It is of nocturnal and burrowing habits, and feeds on decomposed animal substances, larvae and termites.

AARGAU (Fr. *Argovie*), one of the more northerly Swiss cantons, comprising the lower course of the river Aar (*q.v.*), whence its name. Its total area is 541·9 sq. m., of which 517·9 sq. m. are classed as "productive" (forests covering 172 sq. m. and vineyards 8·2 sq. m.). It is one of the least mountainous Swiss cantons, forming part of a great table-land, to the north of the Alps and the east of the Jura, above which rise low hills. The surface of the country is beautifully diversified, undulating tracts and well-wooded hills alternating with fertile valleys watered mainly by the Aar and its tributaries. It contains the famous hot sulphur springs of Baden (*q.v.*) and Schinznach, while at Rheinfelden there are very extensive saline springs. Just below Brugg the Reuss and the Limmat join the Aar, while around Brugg are the ruined castle of Habsburg, the old convent of Königsfelden (with fine painted medieval glass) and the remains of the Roman settlement of Vindonissa [Windisch]. The total population in 1900 was 206,498, almost exclusively German-speaking, but numbering 114,176 Protestants to 91,039 Romanists and 990 Jews. The capital of the canton is Aarau (*q.v.*), while other important towns are Baden (*q.v.*), Zofingen (4591 inhabitants), Reinach (3668 inhabitants), Rheinfelden (3349 inhabitants), Wohlen (3274 inhabitants), and Lenzburg (2588 inhabitants). Aargau is an industrious and prosperous canton, straw-plaiting, tobacco-growing, silk-ribbon weaving, and salmon-fishing in the Rhine being among the chief industries. As this region was, up to 1415, the centre of the Habsburg power, we find here many historical old castles (*e.g.* Habsburg, Lenzburg, Wildegg), and former monasteries (*e.g.* Wettingen, Muri), founded by that family, but suppressed in 1841, this act of violence being one of the main causes of the civil war called the "Sonderbund War," in 1847 in Switzerland. The cantonal constitution dates mainly from 1885, but since 1904 the election of the executive council of five members is made by a direct vote of the people. The legislature consists of members elected in the proportion of one to every 1100 inhabitants. The "obligatory referendum" exists in the case of all laws, while 5000 citizens have the right of "initiative" in proposing bills or alterations in the cantonal constitution. The canton sends 10 members to the federal *Nationalrat*, being one for every 20,000, while the two *Ständeräte* are (since 1904) elected by a direct vote of the people. The canton is divided into eleven administrative districts, and contains 241 communes.

In 1415 the Aargau region was taken from the Habsburgs by the Swiss Confederates. Bern kept the south-west portion (Zofingen, Aarburg, Aarau, Lenzburg, and Brugg), but some districts, named the *Freie Ämter* or "free bailiwicks" (Mellingen, Muri, Villmergen, and Bremgarten), with the county of Baden, were ruled as "subject lands" by all or certain of the Confederates. In 1798 the Bernese bit became the canton of Aargau of the Helvetic Republic, the remainder forming the canton of Baden. In 1803, the two halves (plus the Frick glen, ceded in 1802 by Austria to the Helvetic Republic) were united under the name of Kanton Aargau, which was then admitted a full member of the reconstituted Confederation.

See also *Argovia* (published by the Cantonal Historical Society), Aarau, from 1860; F. X. Bronner, *Der Kanton Aargau*, 2 vols., St Gall and Bern, 1844; H. Lehmann, *Die argauische Strohindustrie*, Aarau, 1896; W. Merz, *Die mittelalt. Burganlagen und Wehrbauten d. Kant. Argau* (fine illustrated work on castles), Aarau, 2 vols., 1904–1906; W. Merz and F. E. Welti, *Die Rechtsquellen d. Kant. Argau*, 3 vols., Aarau, 1898–1905; J. Müller, *Der Aargau*, 2 vols., Zürich, 1870; E. L. Rochholz, *Aargauer Weisthümer*, Aarau, 1877; E. Zschokke, *Geschichte des Aargaus*, Aarau, 1903. (W. A. B. C.)

AARHUS, a seaport and bishop's see of Denmark, on the east coast of Jutland, of which it is the principal port; the second largest town in the kingdom, and capital of the *amt* (county) of Aarhus. Pop. (1901) 51,814. The district is low-lying, fertile and well wooded. The town is the junction of railways from all parts of the country. The harbour is good and safe, and agricultural produce is exported, while coal and iron are among the chief imports. The cathedral of the 13th century (extensively restored) is the largest church in Denmark. There is a museum of art and antiquities. To the south-west (13 m. by rail), a picturesque region extends west from the railway junction of Skanderborg, including several lakes, through which flows the Gudenaa, the largest river in Jutland, and rising ground exceeding 500 ft. in the Himmelbjerg. The railway traverses this pleasant district of moorland and wood to Silkeborg, a modern town having one of the most attractive situations in the kingdom. The bishopric of Aarhus dates at least from 951.

AARON, the traditional founder and head of the Jewish priesthood, who, in company with Moses, led the Israelites out of Egypt (see EXODUS; MOSES). The greater part of his life-history is preserved in late Biblical narratives, which carry back existing conditions and beliefs to the time of the Exodus, and find a precedent for contemporary hierarchical institutions in the events of that period. Although Aaron was said to have been sent by Yahweh (Jehovah) to meet Moses at the "mount of God" (Horeb, Ex. iv. 27), he plays only a secondary part in the incidents at Pharaoh's court. After the "exodus" from Egypt a striking account is given of the vision of the God of Israel vouchsafed to him and to his sons Nadab and Abihu on the same holy mount (Ex. xxiv. 1 seq. 9-11), and together with Hur he was at the side of Moses when the latter, by means of his wonder-working rod, enabled Joshua to defeat the Amalekites (xvii. 8-16). Hur and Aaron were left in charge of the Israelites when Moses and Joshua ascended the mount to receive the Tables of the Law (xxiv. 12-15), and when the people, in dismay at the prolonged absence of their leader, demanded a god, it was at the instigation of Aaron that the golden calf was made (see CALF, GOLDEN). This was regarded as an act of apostasy which, according to one tradition, led to the consecration of the Levites, and almost cost Aaron his life (cp. Deut. ix. 20). The incident paves the way for the account of the preparation of the new tables of stone which contain a series of laws quite distinct from the Decalogue (*q.v.*) (Ex. xxxiii. seq.). Kadesh, and not Sinai or Horeb, appears to have been originally the scene of these incidents (Deut. xxxiii. 8 seq. compared with Ex. xxxii. 26 sqq.), and it was for some obscure offence at this place that both Aaron and Moses were prohibited from entering the Promised Land (Num. xx.). In what way they had not "sanctified" (an allusion in the Hebrew to *Kādēsh* "holy") Yahweh is quite uncertain, and it would appear that it was for a similar offence that the sons of Aaron mentioned above also met their death (Lev. x. 3; cp. Num. xx. 12, Deut. xxxii. 51). Aaron is said to have died at Moserah (Deut. x. 6), or at Mt. Hor; the latter is an unidentified site on the border of Edom (Num. xx. 23, xxxiii. 37; for Moserah see *ib.* 30-31), and consequently not in the neighbourhood of Petra, which has been the traditional scene from the time of Josephus (*Ant.* iv. 4. 7).

Several difficulties in the present Biblical text appear to have arisen from the attempt of later tradition to find a place for Aaron in certain incidents. In the account of the contention between Moses and his sister Miriam (Num. xii.), Aaron occupies only a secondary position, and it is very doubtful whether he was originally mentioned in the older surviving narratives. It is at least remarkable that he is only thrice mentioned in Deuteronomy (ix. 20, x. 6, xxxii. 50). The post-exilic narratives give him a greater share in the plagues of Egypt, represent him as high-priest, and confirm his position by the miraculous budding of his rod alone of all the rods of the other tribes (Num. xvii.; for parallels see Gray, *comm. ad loc.*, p. 217). The latter story illustrates the growth of the older exodus-tradition along with the development of priestly ritual: the old account of Korah's revolt against the authority of Moses has been expanded, and now describes (*a*) the divine prerogatives of the Levites in general, and (*b*) the confirmation of the superior privileges of the Aaronites against the rest of the Levites, a development which can scarcely be earlier than the time of Ezekiel (xliv. 15 seq.).

Aaron's son Eleazar was buried in an Ephraimite locality known after the grandson as the "hill of Phinehas" (Josh. xxiv. 33). Little historical information has been preserved of either. The name Phinehas (apparently of Egyptian origin) is better known as that of a son of Eli, a member of the priesthood of Shiloh, and Eleazar is only another form of Eliezer the son of Moses, to whose kin Eli is said to have belonged. The close relation between Aaronite and Levitical names and those of clans related to Moses is very noteworthy, and it is a curious coincidence that the name of Aaron's sister Miriam appears in a genealogy of Caleb (1 Chron. iv. 17) with Jether (cp. JETHRO) and Heber (cp. KENITES). In view of the confusion of the traditions and the difficulty of interpreting the details sketched above, the recovery of the *historical* Aaron is a work of peculiar intricacy. He may well have been the traditional head of the priesthood, and R. H. Kennett has argued in favour of the view that he was the founder of the cult at Bethel (*Journ. of Theol. Stud.*, 1905, pp. 161 sqq.), corresponding to the Mosaite founder of Dan (*q.v.*). This throws no light upon the *name*, which still remains quite obscure; and unless Aaron (*Aharon*) is based upon *Ārōn*, "ark" (Redslob, R. P. A. Dozy, J. P. N. Land), it must be placed in a line with the other un-Hebraic and difficult names associated with Moses and Aaron, which are, apparently, of South Palestinian (or North-Arabian) origin.

For the literature and a general account of the Jewish priesthood, see the articles LEVITES and PRIEST. (S. A. C.)

AARON'S ROD, the popular name given to various tall flowering plants ("hag taper," "golden rod," &c.). In architecture the term is given to an ornamental rod with sprouting leaves, or sometimes with a serpent entwined round it (from the Biblical references in Exodus vii. 10 and Numbers xvii. 8).

AARSSENS, or AARSSEN, **FRANCIS VAN** (1572–1641), a celebrated diplomatist and statesman of the United Provinces. His talents commended him to the notice of Advocate Johan van Oldenbarneveldt, who sent him, at the age of 26 years, as a diplomatic agent of the states-general to the court of France. He took a considerable part in the negotiations of the twelve years' truce in 1606. His conduct of affairs having displeased the French king, he was recalled from his post by Oldenbarneveldt in 1616. Such was the hatred he henceforth conceived against his former benefactor, that he did his very utmost to effect his ruin. He was one of the packed court of judges who in 1619 condemned the aged statesman to death. For his share in this judicial murder a deep stain rests on the memory of Aarssens. He afterwards became the confidential counsellor of Maurice, prince of Orange, and afterwards of Frederick Henry, prince of Orange, in their conduct of the foreign affairs of the republic. He was sent on special embassies to Venice, Germany and England, and displayed so much diplomatic skill and finesse that Richelieu ranked him among the three greatest politicians of his time.

AASEN, IVAR (1813–1896), Norwegian philologist and lexicographer, was born at Aasen i Örsten, in Söndmöre, Norway, on the 5th of August 1813. His father, a small peasant-farmer named Ivar Jonssön, died in 1826. He was brought up to farm-work, but he assiduously cultivated all his leisure in reading, and when he was eighteen he opened an elementary school in his native parish. In 1833 he entered the household of H. C. Thoresen, the husband of the eminent writer Magdalene Thoresen, in Herö, and here he picked up the elements of Latin. Gradually, and by dint of infinite patience and concentration, the young peasant became master of many languages, and began the scientific study of their structure. About 1841 he had freed himself from all the burden of manual labour, and could occupy his thoughts with the dialect of his native district, the Söndmöre; his first publication was a small collection of folk-songs in the Söndmöre language (1843). His remarkable abilities now attracted general attention, and he was helped to continue his studies undisturbed. His *Grammar of the Norwegian Dialects* (1848) was the result of much labour, and of journeys taken to every part of the country. Aasen's famous *Dictionary of the Norwegian Dialects* appeared in its original form in 1850, and from this publication dates all the wide cultivation of the popular language in Norwegian, since Aasen really did no less than construct, out of the different materials at his disposal, a popular language or definite *folke-maal* for Norway. With certain modifications, the most important of which were introduced later by Aasen himself, this artificial language is that which has been adopted ever since by those who write in dialect, and which later enthusiasts have once more endeavoured to foist upon Norway as her official language in the place of Dano-Norwegian. Aasen composed poems and plays in the composite dialect to show how it should be used; one of these dramas, *The Heir* (1855), was frequently acted, and may be considered as the pioneer of all the abundant dialect-literature of the last half-century, from Vinje down to Garborg. Aasen continued to enlarge and improve his grammars and his dictionary. He lived very quietly in lodgings in Christiania, surrounded by his books and shrinking from publicity, but his name grew into wide political favour as his ideas about the language of the peasants became more and more the watchword of the popular party. Quite early in his career, 1842, he had begun to receive a stipend to enable him to give his entire attention to his philological investigations; and the Storthing—conscious of the national importance of his work—treated him in this respect with more and more generosity as he advanced in years. He continued his investigations to the last, but it may be said that, after the 1873 edition of his *Dictionary*, he added but little to his stores. Ivar Aasen holds perhaps an isolated place in literary history as the one man who has invented, or at least selected and constructed, a language which has pleased so many thousands of his countrymen that they have accepted it for their schools, their sermons and their songs. He died in Christiania on the 23rd of September 1896, and was buried with public honours. (E. G.)

AB, the fifth month of the ecclesiastical and the eleventh of the civil year of the Jews. It approximately corresponds to the period of the 15th of July to the 15th of August. The word is of Babylonian origin, adopted by the Jews with other calendar names after the Babylonian exile. Tradition ascribes the death of Aaron to the first day of Ab. On the ninth is kept the Fast of Ab, or the Black Fast, to bewail the destruction of the first temple by Nebuchadrezzar (586 B.C.) and of the second by Titus (A.D. 70).

ABA. (1) A form of altazimuth instrument, invented by, and called after, Antoine d'Abbadie; (2) a rough homespun manufactured in Bulgaria; (3) a long coarse shirt worn by the Bedouin Arabs.

ABĀBDA (the Gebadei of Pliny, probably the Troglodytes of classical writers), a nomad tribe of African "Arabs" of Hamitic origin. They extend from the Nile at Assuan to the Red Sea, and reach northward to the Kena-Kosseir road, thus occupying the southern border of Egypt east of the Nile. They call themselves "sons of the Jinns." With some of the clans of the Bisharin (*q.v.*) and possibly the Hadendoa (*q.v.*) they represent the Blemmyes of classic geographers, and their location to-day is almost identical with that assigned them in Roman times. They were constantly at war with the Romans, who at last subsidized them. In the middle ages they were known as Beja (*q.v.*), and convoyed pilgrims from the Nile valley to Aidhab, the port of embarkation for Jedda. From time immemorial they have acted as guides to caravans through the Nubian desert and up the Nile valley as far as Sennar. To-day many of them are employed in the telegraph service across the Arabian desert. They intermarried with the Nuba, and settled in small colonies at Shendi and elsewhere long before the Egyptian invasion (A.D. 1820–1822). They are still great trade carriers, and visit very distant districts. The Abābda of Egypt, numbering some 30,000, are governed by an hereditary "chief." Although nominally a vassal of the Khedive he pays no tribute. Indeed he is paid a subsidy, a portion of the road-dues, in return for his safeguarding travellers from Bedouin robbers. The sub-sheikhs are directly responsible to him. The Abābda of Nubia, reported by Joseph von Russegger, who visited the country in 1836, to number some 40,000, have since diminished, having probably amalgamated with the Bisharin, their hereditary enemies when they were themselves a powerful nation. The Abābda generally speak Arabic (mingled with Barabra [Nubian] words), the result of their long-continued contact with Egypt; but the southern and south-eastern portion of the tribe in many cases still retain their Beja dialect, To-Bedawiet. Those of Kosseir will not speak this before strangers, as they believe that to reveal the mysterious dialect would bring ruin on them. Those nearest the Nile have much fellah blood in them. As a tribe they claim an Arab origin, apparently through their sheikhs. They have adopted the dress and habits of the fellahin, unlike their kinsmen the Bisharin and Hadendoa, who go practically naked. They are neither so fierce nor of so fine a physique as these latter. They are lithe and well built, but small: the average height is little more than 5 ft., except in the sheikh clan, who are obviously of Arab origin. Their complexion is more red than black, their features angular, noses straight and hair luxuriant. They bear the character of being treacherous and faithless, being bound by no oath, but they appear to be honest in money matters and hospitable, and, however poor, never beg. Formerly very poor, the Abābda became wealthy after the British occupation of Egypt. Their chief settlements are in Nubia, where they live in villages and employ themselves in agriculture. Others of them fish in the Red Sea and then hawk the salt fish in the interior. Others are pedlars, while charcoal-burning, wood-gathering and trading in gums and drugs, especially in senna leaves, occupy many. Unlike the true Arab, the Abābda do not live in tents, but build huts with hurdles and mats, or live in natural caves, as did their ancestors in classic times. They have few horses, using the camel as beast of burden or their "mount" in war. They live chiefly on milk and durra, the latter eaten either raw or roasted. They are very superstitious, believing, for example, that evil would overtake a family if a girl member should, after her marriage, ever set eyes on her mother: hence the Abābda husband has to make his home far from his wife's village. In the Mahdist troubles (1882–1898) many "friendlies" were recruited from the tribe.

For their earlier history see BEJA; see also BISHARIN, HADENDOA, KABBABISH; and the following authorities:—Sir F. R. Wingate, *Mahdism and the Egyptian Sudan* (Lond. 1891); Giuseppe Sergi, *Africa: Antropologia della Stirpe Camitica* (Turin, 1897); A. H. Keane, *Ethnology of Egyptian Sudan* (Lond. 1884); *Anglo-Egyptian Sudan*, edited by Count Gleichen (Lond. 1905); Joseph von Russegger, *Die Reisen in Afrika* (Stuttgart, 1841–1850). (T. A. J.)

ABACA, or ABAKA, a native name for the plant *Musa textilis*, which produces the fibre called Manila Hemp (*q.v.*).

ABACUS (Gr. ἄβαξ, a slab; Fr. *abaque, tailloir*), in architecture, the upper member of the capital of a column. Its chief function is to provide a larger supporting surface for the architrave or arch it has to carry. In the Greek Doric order the abacus is a plain square slab. In the Roman and Renaissance Doric orders it is crowned by a moulding. In the Archaic-Greek Ionic order, owing to the greater width of the capital, the abacus is rectangular in plan, and consists of a carved ovolo moulding. In later examples the abacus is square, except where there are angle volutes, when it is slightly curved over the same. In the Roman and Renaissance Ionic capital, the abacus is square with a fillet on the top of an ogee moulding, but curved over angle volutes. In the Greek Corinthian order the abacus is moulded, its sides are concave and its angles canted (except in one or two exceptional Greek capitals, where it is brought to a sharp angle); and the same shape is adopted in the Roman and Renaissance Corinthian and Composite capitals, in some cases with the ovolo moulding carved. In Romanesque architecture the abacus is square with the lower edge splayed off and moulded or carved, and the same was retained in France during the medieval period; but in England, in Early English work, a circular deeply moulded abacus was introduced, which in the 14th and 15th centuries was transformed into an octagonal one. The diminutive of Abacus, ABACISCUS, is applied in architecture to the chequers or squares of a tessellated pavement. "Abacus" is also the name of an instrument employed by the ancients for arithmetical calculations; pebbles, bits of bone or coins being used as counters. Fig. 1 shows a Roman abacus taken

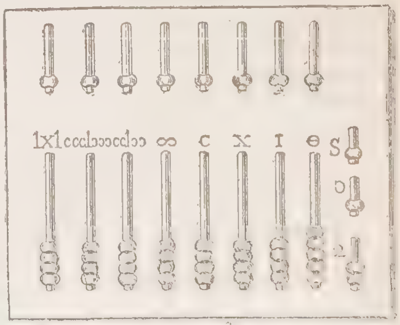


FIG. 1.—Roman Abacus.

from an ancient monument. It contains seven long and seven shorter rods or bars, the former having four perforated beads running on them and the latter one. The bar marked I indicates units, X tens, and so on up to millions. The beads on the shorter bars denote fives,—five units, five tens, &c. The rod Θ and corresponding short rod are for marking ounces; and the short quarter rods for fractions of an ounce.

The *Swan-Pan* of the Chinese (fig. 2) closely resembles the Roman abacus in its construction and use. Computations are made with it by means of balls of bone or ivory running on slender bamboo rods, similar to the simpler board, fitted up with beads strung on wires, which is employed in teaching the rudiments of arithmetic in English schools.

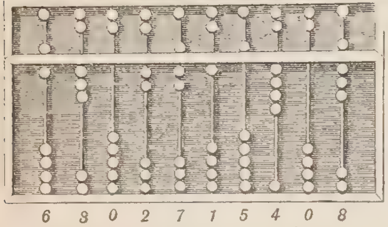


Fig. 2.—Chinese Swan-Pan.

The name of "abacus" is also given, in logic, to an instrument, often called the "logical machine," analogous to the mathematical abacus. It is constructed to show all the possible combinations of a set of logical terms with their negatives, and, further, the way in which these combinations are affected by the addition of attributes or other limiting words, *i.e.* to simplify mechanically the solution of logical problems. These instruments are all more or less elaborate developments of the "logical slate," on which were written in vertical columns all the combinations of symbols or letters which could be made logically out of a definite number of terms. These were compared with any given premises, and those which were incompatible were crossed off. In the abacus the combinations are inscribed each on a single slip of wood or similar substance, which is moved by a key; incompatible combinations can thus be mechanically removed at will, in accordance with any given series of premises. The principal examples of such machines are those of W. S. Jevons (*Element. Lessons in Logic*, c. xxiii.), John Venn (see his *Symbolic Logic*, 2nd ed., 1894, p. 135), and Allan Marquand (see *American Academy of Arts and Sciences*, 1885, pp. 303–7, and *Johns Hopkins University Studies in Logic*, 1883).

ABADDON, a Hebrew word meaning "destruction." In poetry it comes to mean "place of destruction," and so the underworld or Sheol (cf. Job xxvi. 6; Prov. xv. 11). In Rev. ix. 11 Abaddon ('Αβαδδὼν) is used of hell personified, the prince of the underworld. The term is here explained as Apollyon (*q.v.*), the "destroyer." W. Baudissin (Herzog-Hauck, *Realencyklopädie*) notes that Hades and Abaddon in Rabbinic writings are employed as personal names, just as *shemayya* in Dan. iv. 23, *shāmayim* ("heaven"), and *mākōm* ("place") among the Rabbins, are used of God.

ABADEH, a small walled town of Persia, in the province of Fars, situated at an elevation of 6200 ft. in a fertile plain on the high road between Isfahan and Shiraz, 140 m. from the former and 170 m. from the latter place. Pop. 4000. It is the chief place of the Abadeh-Iklid district, which has 30 villages; it has telegraph and post offices, and is famed for its carved wood-work, small boxes, trays, sherbet spoons, &c., made of the wood of pear and box trees.

ABAE ("Αβαι), a town in the N.E. corner of Phocis, in Greece, famous in early times for its oracle of Apollo, one of those consulted by Croesus (Herod. i. 46). It was rich in treasures (Herod. viii. 33), but was sacked by the Persians, and the temple remained in a ruined state. The oracle was, however, still consulted, *e.g.* by the Thebans before Leuctra (Paus. iv. 32. 5). The temple seems to have been burnt again during the Sacred War, and was in a very dilapidated state when seen by Pausanias (x. 35), though some restoration, as well as the building of a new temple, was undertaken by Hadrian. The sanctity of the shrine ensured certain privileges to the people of Abae (*Bull. Corresp. Hell.* vi. 171), and these were confirmed by the Romans. The polygonal walls of the acropolis may still be seen in a fair state of preservation on a circular hill standing about 500 ft. above the little plain of Exarcho; one gateway remains, and there are also traces of town walls below. The temple site was on a low spur of the hill, below the town. An early terrace wall supports a precinct in which are a stoa and some remains of temples; these were excavated by the British School at Athens in 1894, but very little was found.

See also W. M. Leake, *Travels in Northern Greece*, ii. p. 163; *Journal of Hellenic Studies*, xvi. pp. 291-312 (V. W. Yorke). (E. Gr.)

ABAKANSK, a fortified town of Siberia, in the Russian government of Yeniseisk, on the river Yenisei, 144 m. S.S.W. of Krasnoyarsk, in lat. 54°20′ N., long. 91°40′ E. This is considered the mildest and most salubrious place in Siberia, and is remarkable for certain tumuli (of the Li Kitai) and statues of men from seven to nine feet high, covered with hieroglyphics. Peter the Great had a fort built here in 1707. Pop. 2000.

ABALONE, the Spanish name used in California for various species of the shell-fish of the Haliotidae family, with a richly coloured shell yielding mother-of-pearl. This sort of Haliotis is also commonly called "ear-shell," and in Guernsey "ormer" (Fr. *ormier*, for *oreille de mer*). The abalone shell is found especially at Santa Barbara and other places on the southern Californian coast, and when polished makes a beautiful ornament. The mollusc itself is often eaten, and dried for consumption in China and Japan.

ABANA (or Amanah, classical *Chrysorrhoas*) and **PHARPAR,** the "rivers of Damascus" (2 Kings v. 12), now generally identified with the Barada (*i.e.* "cold") and the A'waj (*i.e.* "crooked") respectively, though if the reference to Damascus be limited to the city, as in the Arabic version of the Old Testament, Pharpar would be the modern Taura. Both streams run from west to east across the plain of Damascus, which owes to them much of its fertility, and lose themselves in marshes, or lakes, as they are called, on the borders of the great Arabian desert. John M'Gregor, who gives an interesting description of them in his *Rob Roy on the Jordan*, affirmed that as a work of hydraulic engineering, the system and construction of the canals, by which the Abana and Pharpar were used for irrigation, might be considered as one of the most complete and extensive in the world. As the Barada escapes from the mountains through a narrow gorge, its waters spread out fan-like, in canals or "rivers," the name of one of which, Nahr Banias, retains a trace of Abana.

ABANCOURT, CHARLES XAVIER JOSEPH DE FRANQUEVILLE D' (1758–1792), French statesman, and nephew of Calonne. He was Louis XVI.'s last minister of war (July 1792), and organized the defence of the Tuileries for the 10th of August. Commanded by the Legislative Assembly to send away the Swiss guards, he refused, and was arrested for treason to the nation and sent to Orleans to be tried. At the end of August the Assembly ordered Abancourt and the other prisoners at Orleans to be transferred to Paris with an escort commanded by Claude Fournier, "the American." At Versailles they learned of the massacres at Paris, and Abancourt and his fellow-prisoners were murdered in cold blood on the 8th of September 1792. Fournier was unjustly charged with complicity in the crime.

ABANDONMENT (Fr. *abandonnement*, from *abandonner*, to abandon, relinquish; *abandonner* was originally equivalent to *mettre à bandon*, to leave to the jurisdiction, *i.e.* of another, *bandon* being from Low Latin *bandum*, *bannum*, order, decree, "ban"), in law, the relinquishment of an interest, claim, privilege or possession. Its signification varies according to the branch of the law in which it is employed, but the more important uses of the word are summarized below.

Abandonment of an Action is the discontinuance of proceedings commenced in the High Court of Justice either because the plaintiff is convinced that he will not succeed in his action or for other reasons. Previous to the Judicature Act of 1875, considerable latitude was allowed as to the time when a suitor might abandon his action, and yet preserve his right to bring another action on the same suit (see Nonsuit); but since 1875 this right has been considerably curtailed, and a plaintiff who has delivered his reply (see Pleading), and afterwards wishes to abandon his action, can generally obtain leave so to do only on condition of bringing no further proceedings in the matter.

Abandonment in marine insurance is the surrender of the ship or goods insured to the insurers, in the case of a constructive total loss of the thing insured. For the requisites and effects of abandonment in this sense see Insurance, Marine.

Abandonment of wife and children is dealt with under Desertion, and the *abandonment or exposure* of a young child under the age of two, which is an indictable misdemeanour, is dealt with under Children, Cruelty to.

Abandonment of domicile is the ceasing to reside permanently in a former domicile coupled with the intention of choosing a new domicile. The presumptions which will guide the court in deciding whether a former domicile has been abandoned or not must be inferred from the facts of each individual case. See Domicile.

Abandonment of an easement is the relinquishment of some accommodation or right in another's land, such as right of way, free access of light and air, &c. See Easement.

Abandonment of railways has a legal signification in England recognized by statute, by authority of which the Board of Trade may, under certain circumstances, grant a warrant to a railway authorizing the abandonment of its line or part of it.

ABANO, PIETRO D' (1250–1316), known also as Petrus de Apono or Aponensis, Italian physician and philosopher, was born at the Italian town from which he takes his name in 1250, or, according to others, in 1246. After studying medicine and philosophy at Paris he settled at Padua, where he speedily gained a great reputation as a physician, and availed himself of it to gratify his avarice by refusing to visit patients except for an exorbitant fee. Perhaps this, as well as his meddling with astrology, caused him to be charged with practising magic, the particular accusations being that he brought back into his purse, by the aid of the devil, all the money he paid away, and that he possessed the philosopher's stone. He was twice brought to trial by the Inquisition; on the first occasion he was acquitted, and he died (1316) before the second trial was completed. He was found guilty, however, and his body was ordered to be exhumed and burned; but a friend had secretly removed it, and the Inquisition had, therefore, to content itself with the public proclamation of its sentence and the burning of Abano in effigy. In his writings he expounds and advocates the medical and philosophical systems of Averroes and other Arabian writers. His best known works are the *Conciliator differentiarum quae inter philosophos et medicos versantur* (Mantua, 1472; Venice, 1476), and *De venenis eorumque remediis* (1472), of which a French translation was published at Lyons in 1593.

ABANO BAGNI, a town of Venetia, Italy, in the province of Padua, on the E. slope of the Monti Euganei; it is 6 m. S.W. by rail from Padua. Pop. (1901) 4556. Its hot springs and mud baths are much resorted to, and were known to the Romans as *Aponi fons* or *Aquae Patavinae*. Some remains of the ancient baths have been discovered (S. Mandruzzato, *Trattato dei Bagni d' Abano*, Padua, 1789). An oracle of Geryon lay near, and the so-called *sortes Praenestinae* (*C.I.L.* i., Berlin, 1863; 1438–1454), small bronze cylinders inscribed, and used as oracles, were perhaps found here in the 16th century.

ABARIS, a Scythian or Hyperborean, priest and prophet of Apollo, who is said to have visited Greece about 770 B.C., or two or three centuries later. According to the legend, he travelled throughout the country, living without food and riding on a golden arrow, the gift of the god; he healed the sick, foretold the future, worked miracles, and delivered Sparta from a plague (Herod. iv. 36; Iamblichus, *De Vit. Pythag.* xix. 28). Suidas credits him with several works: Scythian oracles, the visit of Apollo to the Hyperboreans, expiatory formulas and a prose theogony.

ABATED, an ancient technical term applied in masonry and metal work to those portions which are sunk beneath the surface, as in inscriptions where the ground is sunk round the letters so as to leave the letters or ornament in relief.

ABATEMENT (derived through the French *abattre*, from the Late Latin *battere*, to beat), a beating down or diminishing or doing away with; a term used especially in various legal phrases.

Abatement of a nuisance is the remedy allowed by law to a person or public authority injured by a public nuisance of destroying or removing it, provided no breach of the peace is committed in doing so. In the case of private nuisances abatement is also allowed provided there be no breach of the peace, and no damage be occasioned beyond what the removal of the nuisance requires. (See Nuisance.)

Abatement of freehold takes place where, after the death of the person last seised, a stranger enters upon lands before the entry of the heir or devisee, and keeps the latter out of possession. It differs from intrusion, which is a similar entry by a stranger on the death of a tenant for life, to the prejudice of the reversioner, or remainder man; and from disseisin, which is the forcible or fraudulent expulsion of a person seised of the freehold. (See Freehold.)

Abatement of debts and legacies. When the equitable assets (see Assets) of a deceased person are not sufficient to satisfy fully all the creditors, their debts must abate proportionately, and they must accept a dividend. Also, in the case of legacies when the funds or assets out of which they are payable are not sufficient to pay them in full, the legacies abate in proportion, unless there is a priority given specially to any particular legacy (see Legacy). Annuities are also subject to the same rule as general legacies.

Abatement in pleading, or plea in abatement, was the defeating or quashing of a particular action by some matter of fact, such as a defect in form or the personal incompetency of the parties suing, pleaded by the defendant. It did not involve the merits of the cause, but left the right of action subsisting. In criminal proceedings a plea in abatement was at one time a common practice in answer to an indictment, and was set up for the purpose of defeating the indictment as framed, by alleging misnomer or other misdescription of the defendant. Its effect for this purpose was nullified by the Criminal Law Act 1826, which required the court to amend according to the truth, and the Criminal Procedure Act 1851, which rendered description of the defendant unnecessary. All pleas in abatement are now abolished (R.S.C. Order 21, r. 20). See Pleading.

Abatement in litigation. In civil proceedings, no action abates by reason of the marriage, death or bankruptcy of any of the parties, if the cause of action survives or continues, and does not become defective by the assignment, creation or devolution of any estate or title *pendente lite* (R.S.C. Order 17, r. 1). Criminal proceedings do not abate on the death of the prosecutor, being in theory instituted by the crown, but the crown itself may bring about their termination without any decision on the merits and without the assent of the prosecutor.

Abatement of false lights. By the Merchant Shipping Act 1854, the general lighthouse authority (see Lighthouse) has power to order the extinguishment or screening of any light which may be mistaken for a light proceeding from a lighthouse.

Abatement in commerce is a deduction sometimes made at a custom-house from the fixed duties on certain kinds of goods, on account of damage or loss sustained in warehouses. The rate and conditions of such deductions are regulated, in England, by the Customs Consolidation Act 1853. (See also Drawback; Rebate.)

Abatement in heraldry is a badge in coat-armour, indicating some kind of degradation or dishonour. It is called also *rebatement*.

ABATI, or Dell' Abbato, **NICCOLO** (1512–1571), a celebrated fresco-painter of Modena, whose best works are there and at Bologna. He accompanied Primaticcio to France, and assisted in decorating the palace at Fontainebleau (1552–1571). His pictures exhibit a combination of skill in drawing, grace and natural colouring. Some of his easel pieces in oil are in different collections; one of the finest, in the Dresden Gallery, represents the martyrdom of St Peter and St Paul.

ABATIS, Abattis or Abbattis (a French word meaning a heap of material thrown), a term in field fortification for an obstacle formed of the branches of trees laid in a row, with the tops directed towards the enemy and interlaced or tied with wire. The abatis is used alone or in combination with wire-entanglements and other obstacles.

ABATTOIR (from *abattre*, to strike down), a French word often employed in English as an equivalent of "slaughter-house" (*q.v.*), the place where animals intended for food are killed.

ABAUZIT, FIRMIN (1679–1767), a learned Frenchman, was born of Protestant parents at Uzès, in Languedoc. His father died when he was but two years of age; and when, on the revocation of the edict of Nantes in 1685, the authorities took steps to have him educated in the Roman Catholic faith, his mother contrived his escape. For two years his brother and he lived as fugitives in the mountains of the Cevennes, but they at last reached Geneva, where their mother afterwards joined them on escaping from the imprisonment in which she was held from the time of their flight. Abauzit at an early age acquired great proficiency in languages, physics and theology. In 1698 he went to Holland, and there became acquainted with Pierre Bayle, P. Jurieu and J. Basnage. Proceeding to England, he was introduced to Sir Isaac Newton, who found in him one of the earliest defenders of his discoveries. Sir Isaac corrected in the second edition of his *Principia* an error pointed out by Abauzit, and, when sending him the *Commercium Epistolicum*, said, "You are well worthy to judge between Leibnitz and me." The reputation of Abauzit induced William III. to request him to settle in England, but he did not accept the king's offer, preferring to return to Geneva. There from 1715 he rendered valuable assistance to a society that had been formed for translating the New Testament into French. He declined the offer of the chair of philosophy in the university in 1723, but accepted, in 1727, the sinecure office of librarian to the city of his adoption. Here he died at a good old age, in 1767. Abauzit was a man of great learning and of wonderful versatility. Whatever chanced to be discussed, it used to be said of Abauzit, as of Professor W. Whewell of more modern times, that he seemed to have made it a subject of particular study. Rousseau, who was jealously sparing of his praises, addressed to him, in his *Nouvelle Héloïse*, a fine panegyric; and when a stranger flatteringly told Voltaire he had come to see a great man, the philosopher asked him if he had seen Abauzit. Little remains of the labours of this intellectual giant, his heirs having, it is said, destroyed the papers that came into their possession, because their own religious opinions were different. A few theological, archaeological and astronomical articles from his pen appeared in the *Journal Helvétique* and elsewhere, and he contributed several papers to Rousseau's *Dictionnaire de musique* (1767). He wrote a work throwing doubt on the canonical authority of the Apocalypse, which called forth a reply from Dr Leonard Twells. He also edited and made valuable additions to J. Spon's *Histoire de la république de Genève*. A collection of his writings was published at Geneva in 1770 (*Œuvres de feu M. Abauzit*), and another at London in 1773 (*Œuvres diverses de M. Abauzit*). Some of them were translated into English by Dr Edward Harwood (1774).

Information regarding Abauzit will be found in J. Senebier's *Histoire Littéraire de Genève*, Harwood's *Miscellanies*, and W. Orme's *Bibliotheca Biblica* (1824).

'ABAYE, the name of a Babylonian *'amora* (*q.v.*), born in the middle of the 3rd century. He died in 339.

'ABBA 'ARIKA, the name of the Babylonian *'amora* (*q.v.*) of the 3rd century, who established at Sura the systematic study of the Rabbinic traditions which, using the Mishnah as text, led to the compilation of the Talmud. He is commonly known as Rab.

ABBADIDES, a Mahommedan dynasty which arose in Spain on the downfall of the western caliphate. It lasted from about 1023 till 1091, but during the short period of its existence was singularly active and typical of its time. The founder of the house was Abd-ul-Qāsim Mahommed, the cadi of Seville in 1023. He was the chief of an Arab family settled in the city from the first days of the conquest. The Beni-abbad were not of ancient descent, though the poets, whom they paid largely, made an illustrious pedigree for them when they had become powerful. They were, however, very rich. Abd-ul-Qāsim gained the confidence of the townsmen by organizing a successful resistance to the Berber soldiers of fortune who were grasping at the fragments of the caliphate. At first he professed to rule only with the advice of a council formed of the nobles, but when his power became established he dispensed with this show of republican government, and then gave himself the appearance of a legitimate title by protecting an impostor who professed to be the caliph Hisham II. When Abd-ul-Qāsim died in 1042 he had created a state which, though weak in itself, was strong as compared to the little powers about it. He had made his family the recognized leaders of the Mahommedans of Arab and native Spanish descent against the Berber element, whose chief was the king of Granada. Abbad, surnamed El Motaḍḍid, his son and successor, is one of the most remarkable figures in Spanish Mahommedan history. He had a striking resemblance to the Italian princes of the later middle ages and the early renaissance, of the stamp of Filipo Maria Visconti. El Motaḍḍid was a poet and a lover of letters, who was also a poisoner, a drinker of wine, a sceptic and treacherous to the utmost degree. Though he waged war all through his reign he very rarely appeared in the field, but directed the generals, whom he never trusted, from his "lair" in the fortified palace, the Alcazar of Seville. He killed with his own hand one of his sons who had rebelled against him. On one occasion he trapped a number of his enemies, the Berber chiefs of the Ronda, into visiting him, and got rid of them by smothering them in the hot room of a bath. It was his taste to preserve the skulls of the enemies he had killed—those of the meaner men to be used as flower-pots, while those of the princes were kept in special chests. His reign until his death on the 28th of February 1069 was mainly spent in extending his power at the expense of his smaller neighbours, and in conflicts with his chief rival the king of Granada. These incessant wars weakened the Mahommedans, to the great advantage of the rising power of the Christian kings of Leon and Castile, but they gave the kingdom of Seville a certain superiority over the other little states. After 1063 he was assailed by Fernando El Magno of Castile and Leon, who marched to the gates of Seville, and forced him to pay tribute. His son, Mahommed Abd-ul-Qāsim Abenebet—who reigned by the title of El Motamid—was the third and last of the Abbadides. He was a no less remarkable person than his father and much more amiable. Like him he was a poet, and a favourer of poets. El Motamid went, however, considerably further in patronage of literature than his father, for he chose as his favourite and prime minister the poet Ibn Ammar. In the end the vanity and featherheadedness of Ibn Ammar drove his master to kill him. El Motamid was even more influenced by his favourite wife, Romaica, than by his vizir. He had met her paddling in the Guadalquivir, purchased her from her master, and made her his wife. The caprices of Romaica, and the lavish extravagance of Motamid in his efforts to please her, form the subject of many stories. In politics he carried on the feuds of his family with the Berbers, and in his efforts to extend his dominions could be as faithless as his father. His wars and his extravagance exhausted his treasury, and he oppressed his subjects by taxes. In 1080 he brought down upon himself the vengeance of Alphonso VI. of Castile by a typical piece of flighty oriental barbarity. He had endeavoured to pay part of his tribute to the Christian king with false money. The fraud was detected by a Jew, who was one of the envoys of Alphonso. El Motamid, in a moment of folly and rage, crucified the Jew and imprisoned the Christian members of the mission. Alphonso retaliated by a destructive raid. When Alphonso took Toledo in 1085, El Motamid called in Yusef ibn Tashfin, the Almoravide (see SPAIN, *History*, and ALMORAVIDES). During the six years which preceded his deposition in 1091, El Motamid behaved with valour on the field, but with much meanness and political folly. He endeavoured to curry favour with Yusef by betraying the other Mahommedan princes to him, and intrigued to secure the alliance of Alphonso against the Almoravide. It was probably during this period that he surrendered his beautiful daughter Zaida to the Christian king, who made her his concubine, and is said by some authorities to have married her after she bore him a son, Sancho. The vacillations and submissions of El Motamid did not save him from the fate which overtook his fellow-princes. Their scepticism and extortion had tired their subjects, and the mullahs gave Yusef a "fetva" authorizing him to remove them in the interest of religion. In 1091 the Almoravides stormed Seville. El Motamid, who had fought bravely, was weak enough to order his sons to surrender the fortresses they still held, in order to save his own life. He died in prison in Africa in 1095.

Authorities.—Dozy, *Histoire des Musulmans d'Espagne*, Leiden, 1861; and *Historia Abbadidarum* (Scriptorum Arabum loci de Abbadidio), Leiden, 1846. (D. H.)

ABBADIE, ANTOINE THOMSON D' (1810–1897), and **ARNAUD MICHEL D'** (1815–1893), two brothers notable for their travels in Abyssinia during the first half of the 19th century. They were both born in Dublin, of a French father and an Irish mother, Antoine in 1810 and Arnaud in 1815. The parents removed to France in 1818, and there the brothers received a careful scientific education. In 1835 the French Academy sent Antoine on a scientific mission to Brazil, the results being published at a later date (1873) under the title of *Observations relatives à la physique du globe faites au Brésil et en Éthiopie*. The younger Abbadie spent some time in Algeria before, in 1837, the two brothers started for Abyssinia, landing at Massawa in February 1838. They visited various parts of Abyssinia, including the then little-known districts of Ennarea and Kaffa, sometimes together and sometimes separately. They met with many difficulties and many adventures, and became involved in political intrigues, Antoine especially exercising such influence as he possessed in favour of France and the Roman Catholic missionaries. After collecting much valuable information concerning the geography, geology, archaeology and natural history of Abyssinia, the brothers returned to France in 1848 and began to prepare their materials for publication. The younger brother, Arnaud, paid another visit to Abyssinia in 1853. The more distinguished brother, Antoine, became involved in various controversies relating both to his geographical results and his political intrigues. He was especially attacked by C. T. Beke, who impugned his veracity, especially with reference to the journey to Kaffa. But time and the investigations of subsequent explorers have shown that Abbadie was quite trustworthy as to his facts, though wrong in his contention—hotly contested by Beke—that the Blue Nile was the main stream. The topographical results of his explorations were published in Paris in 1860–1873 in *Géodésie d'Éthiopie*, full of the most valuable information and illustrated by ten maps. Of the *Géographie de l'Éthiopie* (Paris, 1890) only one volume has been published. In *Un Catalogue raisonné de manuscrits éthiopiens* (Paris, 1859) is a description of 234 Ethiopian manuscripts collected by Antoine. He also compiled various vocabularies, including a *Dictionnaire de la langue amarinna* (Paris, 1881), and prepared an edition of the *Shepherd of Hermas*, with the Latin version, in 1860. He published numerous papers dealing with the geography of Abyssinia, Ethiopian coins and ancient inscriptions. Under the title of *Reconnaissances magnétiques* he published in 1890 an account of the magnetic observations made by him in the course of several journeys to the Red Sea and the Levant. The general account of the travels of the two brothers was published by Arnaud in 1868 under the title of *Douze ans dans la Haute-Éthiopie*. Both brothers received the grand medal of the Paris Geographical Society in 1850. Antoine was a knight of the Legion of Honour and a member of the Academy of Sciences. He died in 1897, and bequeathed an estate in the Pyrenees, yielding 40,000 francs a year, to the Academy of Sciences, on condition of its producing within fifty years a catalogue of half-a-million stars. His brother Arnaud died in 1893. (J. S. K.)

ABBADIE, JAKOB (1654?–1727), Swiss Protestant divine, was born at Nay in Bern. He studied at Sedan, Saumur and Puylaurens, with such success that he received the degree of doctor in theology at the age of seventeen. After spending some years in Berlin as minister of a French Protestant church, where he had great success as a preacher, he accompanied Marshal Schomberg, in 1688, to England, and next year became minister of the French church in the Savoy, London. His strong attachment to the cause of King William appears in his elaborate defence of the Revolution (*Défense de la nation britannique*, 1692) as well as in his history of the conspiracy of 1696 (*Histoire de la grande conspiration d'Angleterre*). The king promoted him to the deanery of Killaloe in Ireland. He died in London in 1727. Abbadie was a man of great ability and an eloquent preacher, but is best known by his religious treatises, several of which were translated from the original French into other languages and had a wide circulation throughout Europe. The most important of these are *Traité de la vérité de la religion chrétienne* (1684); its continuation, *Traité de la divinité de Jésus-Christ* (1689); and *L'Art de se connaître soi-même* (1692).

'ABBAHU, the name of a Palestinian *'amora* (*q.v.*) who flourished *c.* 279–320. 'Abbahu encouraged the study of Greek by Jews. He was famous as a collector of traditional lore, and is very often cited in the Talmud.

ABBA MARI (in full, Abba Mari ben Moses ben Joseph), French rabbi, was born at Lunel, near Montpellier, towards the end of the 13th century. He is also known as Yarhi from his birthplace (Heb. Yerah, *i.e.* moon, *lune*), and he further took the name Astruc, Don Astruc or En Astruc of Lunel. The descendant of men learned in rabbinic lore, Abba Mari devoted himself to the study of theology and philosophy, and made himself acquainted with the writing of Moses Maimonides and Nachmanides as well as with the Talmud. In Montpellier, where he lived from 1303 to 1306, he was much distressed by the prevalence of Aristotelian rationalism, which, through the medium of the works of Maimonides, threatened the authority of the Old Testament, obedience to the law, and the belief in miracles and revelation. He, therefore, in a series of letters (afterwards collected under the title *Minhat Kenaot*, *i.e.* "Jealousy Offering") called upon the famous rabbi Solomon ben Adret of Barcelona to come to the aid of orthodoxy. Ben Adret, with the approval of other prominent Spanish rabbis, sent a letter to the community at Montpellier proposing to forbid the study of philosophy to those who were less than thirty years of age, and, in spite of keen opposition from the liberal section, a decree in this sense was issued by ben Adret in 1305. The result was a great schism among the Jews of Spain and southern France, and a new impulse was given to the study of philosophy by the unauthorized interference of the Spanish rabbis. On the expulsion of the Jews from France by Philip IV. in 1306, Abba Mari settled at Perpignan, where he published the letters connected with the controversy. His subsequent history is unknown. Beside the letters, he was the author of liturgical poetry and works on civil law.

Authorities.—Edition of the *Minhat Kenaot* by M. L. Bislichis (Pressburg, 1838); E. Renan, *Les rabbins français*, pp. 647 foll.; Perles, *Salomo ben Abraham ben Adereth*, pp. 15-54; *Jewish Encyclopaedia*, *s.v.* "Abba Mari."

ABBAS I. (1813–1854), pasha of Egypt, was a son of Tusun Pasha and grandson of Mehemet Ali, founder of the reigning dynasty. As a young man he fought in Syria under Ibrahim Pasha (*q.v.*), his real or supposed uncle. The death of Ibrahim in November 1848 made Abbas regent of Egypt, and in August following, on the death of Mehemet Ali—who had been deposed in July 1848 on account of mental weakness,—Abbas succeeded to the pashalik. He has been generally described as a mere voluptuary, but Nubar Pasha spoke of him as a true Turkish gentleman of the old school. He was without question a reactionary, morose and taciturn, and spent nearly all his time shut up in his palace. He undid, as far as lay in his power, the works of his grandfather, good and bad. Among other things he abolished trade monopolies, closed factories and schools, and reduced the strength of the army to 9000 men. He was inaccessible to adventurers bent on plundering Egypt, but at the instance of the British government allowed the construction of a railway from Alexandria to Cairo. In July 1854 he was murdered in Benha Palace by two of his slaves, and was succeeded by his uncle, Said Pasha.

ABBAS II. (1874–), khedive of Egypt. Abbas Hilmi Pasha, great-great-grandson of Mehemet Ali, born on the 14th of July 1874, succeeded his father, Tewfik Pasha, as khedive of Egypt on the 8th of January 1892. When a boy he visited England, and he had an English tutor for some time in Cairo. He then went to school in Lausanne, and from there passed on to the Theresianum in Vienna. In addition to Turkish, his mother tongue, he acquired fluency in Arabic, and a good conversational knowledge of English, French and German. He was still at college in Vienna when the sudden death of his father raised him to the Khedivate; and he was barely of age according to Turkish law, which fixes majority at eighteen in cases of succession to the throne. For some time he did not co-operate very cordially with Great Britain. He was young and eager to exercise his new power. His throne and life had not been saved for him by the British, as was the case with his father. He was surrounded by intriguers who were playing a game of their own, and for some time he appeared almost disposed to be as reactionary as his great-uncle Abbas I. But in process of time he learnt to understand the importance of British counsels. He paid a second visit to England in 1900, during which he frankly acknowledged the great good the British had done in Egypt, and declared himself ready to follow their advice and to co-operate with the British officials administering Egyptian affairs. The establishment of a sound system of native justice, the great remission of taxation, the reconquest of the Sudan, the inauguration of the stupendous irrigation works at Assuan, the increase of cheap, sound education, each received his approval and all the assistance he could give. He displayed more interest in agriculture than in statecraft, and his farm of cattle and horses at Koubah, near Cairo, would have done credit to any agricultural show in England; at Montaza, near Alexandria, he created a similar establishment. He married the Princess Ikbal Hanem and had several children. Mahommed Abdul Mouneim, the heir-apparent, was born on the 20th of February 1899.

ABBAS I. (*c.* 1557–1628 or 1629), shah of Persia, called the Great, was the son of shah Mahommed (d. 1586). In the midst of general anarchy in Persia, he was proclaimed ruler of Khorasan, and obtained possession of the Persian throne in 1586. Determined to raise the fallen fortunes of his country, he first directed his efforts against the predatory Uzbegs, who occupied and harassed Khorasan. After a long and severe struggle, he regained Meshed, defeated them in a great battle near Herat in 1597, and drove them out of his dominions. In the wars he carried on with the Turks during nearly the whole of his reign, his successes were numerous, and he acquired, or regained, a large extent of territory. By the victory he gained at Bassora in 1605 he extended his empire beyond the Euphrates; sultan Ahmed I. was forced to cede Shirvan and Kurdistan in 1611; the united armies of the Turks and Tatars were completely defeated near Sultanieh in 1618, and Abbas made peace on very favourable terms; and on the Turks renewing the war, Bagdad fell into his hands after a year's siege in 1623. In 1622 he took the island of Ormuz from the Portuguese, by the assistance of the British, and much of its trade was diverted to the town of Bander-Abbāsi, which was named after the shah. When he died, his dominions reached from the Tigris to the Indus. Abbas distinguished himself, not only by his successes in arms, and by the magnificence of his court and of the buildings which he erected, but also by his reforms in the administration of his kingdom. He encouraged commerce, and, by constructing highways and building bridges, did much to facilitate it. To foreigners, especially Christians, he showed a spirit of tolerance; two Englishmen, Sir Anthony and Sir Robert Shirley, or Sherley, were admitted to his confidence. His fame is tarnished, however, by numerous deeds of tyranny and cruelty. His own family, especially, suffered from his fits of jealousy; his eldest son was slain, and the eyes of his other children were put out, by his orders.

See *The Three Brothers, or Travels of Sir Anthony, Sir Robert Sherley, &c.* (London, 1825); Sir C. R. Markham, *General Sketch of the History of Persia* (London, 1874).

ABBASIDS, the name generally given to the caliphs of Bagdad, the second of the two great dynasties of the Mahommedan empire. The Abbasid caliphs officially based their claim to the throne on their descent from Abbas (A.D. 566–652), the eldest uncle of Mahomet, in virtue of which descent they regarded themselves as the rightful heirs of the Prophet as opposed to the Omayyads, the descendants of Omayya. Throughout the second period of the Omayyads, representatives of this family were among their most dangerous opponents, partly by the skill with which they undermined the reputation of the reigning princes by accusations against their orthodoxy, their moral character and their administration in general, and partly by their cunning manipulation of internecine jealousies among the Arabic and non-Arabic subjects of the empire. In the reign of Merwan II. this opposition culminated in the rebellion of Ibrahīm the Imam, the fourth in descent from Abbas, who, supported by the province of Khorasan, achieved considerable successes, but was captured (A.D. 747) and died in prison (as some hold, assassinated). The quarrel was taken up by his brother Abdallah, known by the name of Abu'l-Abbas as-Saffāh, who after a decisive victory on the Greater Zab (750) finally crushed the Omayyads and was proclaimed caliph.

The history of the new dynasty is marked by perpetual strife and the development of luxury and the liberal arts, in place of the old-fashioned austerity of thought and manners. Mansur, the second of the house, who transferred the seat of government to Bagdad, fought successfully against the peoples of Asia Minor, and the reigns of Harun al-Rashid (786–809) and Mamun (813–833) were periods of extraordinary splendour. But the empire as a whole stagnated and then decayed rapidly. Independent monarchs established themselves in Africa and Khorasan (Spain had remained Omayyad throughout), and in the north-west the Greeks successfully encroached. The ruin of the dynasty came, however, from those Turkish slaves who were constituted as a royal bodyguard by Moqtasim (833–842). Their power steadily grew until Radi (934–941) was constrained to hand over most of the royal functions to Mahommed b. Raik. Province after province renounced the authority of the caliphs, who were merely lay figures, and finally Hulagu, the Mongol chief, burned Bagdad (Feb. 28th, 1258). The Abbasids still maintained a feeble show of authority, confined to religious matters, in Egypt under the Mamelukes, but the dynasty finally disappeared with Motawakkil III., who was carried away as a prisoner to Constantinople by Selim I.

See CALIPHATE (Sections B, 14 and C), where a detailed account of the dynasty will be found.

ABBAS MIRZA (*c.* 1783–1833), prince of Persia, was a younger son of the shah, Feth Ali, but on account of his mother's royal birth was destined by his father to succeed him. Entrusted with the government of a part of Persia, he sought to rule it in European fashion, and employed officers to reorganize his army. He was soon at war with Russia, and his aid was eagerly solicited by both England and Napoleon, anxious to checkmate one another in the East. Preferring the friendship of France, Abbas continued the war against Russia, but his new ally could give him very little assistance, and in 1814 Persia was compelled to make a disadvantageous peace. He gained some successes during a war between Turkey and Persia which broke out in 1821, but cholera attacked his army, and a treaty was signed in 1823. His second war with Russia, which began in 1825, was attended with the same want of success as the former one, and Persia was forced to cede some territory. When peace was made in 1828 Abbas then sought to restore order in the province of Khorasan, which was nominally under Persian supremacy, and while engaged in the task died at Meshed in 1833. In 1834 his eldest son, Mahommed Mirza, succeeded Feth Ali as shah. Abbas was an intelligent prince, possessed some literary taste, and is noteworthy on account of the comparative simplicity of his life.

ABBAS-TUMAN, a spa in Russian Transcaucasia, government of Tiflis, 50 m. S.W. of the Borzhom railway station and 65 m. E. of Batum, very picturesquely situated in a cauldron-shaped valley. It has hot sulphur baths ($93\frac{1}{2}^{\circ}$–$118\frac{1}{2}^{\circ}$ Fahr.) and an astronomical observatory (4240 ft.).

ABBAZIA, a popular summer and winter resort of Austria, in

Istria, 56 m. S.E. of Trieste by rail. Pop. (1900) 2343. It is situated on the Gulf of Quarnero in a sheltered position at the foot of the Monte Maggiore (4580 ft.), and is surrounded by beautiful woods of laurel. The average temperature is 50° Fahr. in winter, and 77° Fahr. in summer. The old abbey, San Giacomo della Priluca, from which the place derives its name, has been converted into a villa. Abbazia is frequented annually by about 16,000 visitors. The whole sea-coast to the north and south of Abbazia is rocky and picturesque, and contains several smaller winter-resorts. The largest of them is Lovrana (pop. 513), situated 5 m. to the south.

ABBESS (Lat. *abbatissa*, fem. form of *abbas*, abbot), the female superior of an abbey or convent of nuns. The mode of election, position, rights and authority of an abbess correspond generally with those of an abbot (*q.v.*). The office is elective, the choice being by the secret votes of the sisters from their own body. The abbess is solemnly admitted to her office by episcopal benediction, together with the conferring of a staff and pectoral cross, and holds for life, though liable to be deprived for misconduct. The council of Trent fixed the qualifying age at forty, with eight years of profession. Abbesses have a right to demand absolute obedience of their nuns, over whom they exercise discipline, extending even to the power of expulsion, subject, however, to the bishop. As a female an abbess is incapable of performing the spiritual functions of the priesthood belonging to an abbot. She cannot ordain, confer the veil, nor excommunicate. In England abbesses attended ecclesiastical councils, *e.g.* that of Becanfield in 694, where they signed before the presbyters.

By Celtic usage abbesses presided over joint-houses of monks and nuns. This custom accompanied Celtic monastic missions to France and Spain, and even to Rome itself. At a later period, A.D. 1115, Robert, the founder of Fontevraud, committed the government of the whole order, men as well as women, to a female superior.

In the German Evangelical church the title of abbess (*Aebtissin*) has in some cases—*e.g.* Itzehoe—survived to designate the heads of abbeys which since the Reformation have continued as *Stifte*, *i.e.* collegiate foundations, which provide a home and an income for unmarried ladies, generally of noble birth, called canonesses (*Kanonissinen*) or more usually *Stiftsdamen*. This office of abbess is of considerable social dignity, and is sometimes filled by princesses of the reigning houses.

ABBEVILLE, a town of northern France, capital of an arrondissement in the department of Somme, on the Somme, 12 m. from its mouth in the English Channel, and 28 m. N.W. of Amiens on the Northern railway. Pop. (1901) 18,519; (1906) 18,971. It lies in a pleasant and fertile valley, and is built partly on an island and partly on both sides of the river, which is canalized from this point to the estuary. The streets are narrow, and the houses are mostly picturesque old structures, built of wood, with many quaint gables and dark archways. The most remarkable building is the church of St Vulfran, erected in the 15th, 16th and 17th centuries. The original design was not completed. The nave has only two bays and the choir is insignificant. The façade is a magnificent specimen of the flamboyant Gothic style, flanked by two Gothic towers. Abbeville has several other old churches and an hôtel-de-ville, with a belfry of the 13th century. Among the numerous old houses, that known as the Maison de François I^{er}, which is the most remarkable, dates from the 16th century. There is a statue of Admiral Courbet (d. 1885) in the chief square. The public institutions include tribunals of first instance and of commerce, a board of trade-arbitrators, and a communal college. Abbeville is an important industrial centre; in addition to its old-established manufacture of cloth, hemp-spinning, sugar-making, ship-building and locksmiths' work are carried on; there is active commerce in grain, but the port has little trade.

Abbeville, the chief town of the district of Ponthieu, first appears in history during the 9th century. At that time belonging to the abbey of St Riquier, it was afterwards governed by the counts of Ponthieu. Together with that county, it came into the possession of the Alençon and other French families, and afterwards into that of the house of Castille, from whom by marriage it fell in 1272 to Edward I., king of England. French and English were its masters by turns till 1435 when, by the treaty of Arras, it was ceded to the duke of Burgundy. In 1477 it was annexed by Louis XI., king of France, and was held by two illegitimate branches of the royal family in the 16th and 17th centuries, being in 1696 reunited to the crown.

ABBEY, EDWIN AUSTIN (1852–), American painter, was born at Philadelphia, Pennsylvania, on the 1st of April 1852. He left the schools of the Pennsylvania Academy of Fine Arts at the age of nineteen to enter the art department of the publishing house of Harper & Brothers in New York, where, in company with such men as Howard Pyle, Charles Stanley Reinhart, Joseph Pennell and Alfred Parsons, he became very successful as an illustrator. In 1878 he was sent by the Harpers to England to gather material for illustrations of the poems of Robert Herrick. These, published in 1882, attracted much attention, and were followed by illustrations for Goldsmith's *She Stoops to Conquer* (1887), for a volume of *Old Songs* (1889), and for the comedies (and a few of the tragedies) of Shakespeare. His water-colours and pastels were no less successful than the earlier illustrations in pen and ink. Abbey now became closely identified with the art life of England, and was elected to the Royal Institute of Painters in Water-Colours in 1883. Among his water-colours are "The Evil Eye" (1877); "The Rose in October" (1879); "An Old Song" (1886); "The Visitors" (1890), and "The Jongleur" (1892). Possibly his best known pastels are "Beatrice," "Phyllis," and "Two Noble Kinsmen." In 1890 he made his first appearance with an oil painting, "A May Day Morn," at the Royal Academy in London. He exhibited "Richard duke of Gloucester and the Lady Anne" at the Royal Academy in 1896, and in that year was elected A.R.A., becoming a full R.A. in 1898. Apart from his other paintings, special mention must be made of the large frescoes entitled "The Quest of the Holy Grail," in the Boston Public Library, on which he was occupied for some years; and in 1901 he was commissioned by King Edward VII. to paint a picture of the coronation, containing many portraits elaborately grouped. The dramatic subjects, and the brilliant colouring of his oil pictures, gave them pronounced individuality among the works of contemporary painters. Abbey became a member not only of the Royal Academy, but also of the National Academy of Design of New York, and honorary member of the Royal Bavarian Society, the Société Nationale des Beaux Arts (Paris), the American Water-Colour Society, etc. He received first class gold medals at the International Art Exhibition of Vienna in 1898, at Philadelphia in 1898, at the Paris Exhibitions of 1889 and 1900, and at Berlin in 1903; and was made a chevalier of the French Legion of Honour.

ABBEY (Lat. *abbatia*; from Syr. *abba*, father), a monastery, or conventual establishment, under the government of an ABBOT or an ABBESS. A *priory* only differed from an abbey in that the superior bore the name of *prior* instead of *abbot*. This was the case in all the English conventual cathedrals, *e.g.* Canterbury, Ely, Norwich, &c., where the archbishop or bishop occupied the abbot's place, the superior of the monastery being termed prior. Other priories were originally offshoots from the larger abbeys, to the abbots of which they continued subordinate; but in later times the actual distinction between abbeys and priories was lost.

The earliest Christian monastic communities (see MONASTICISM) with which we are acquainted consisted of groups of cells or huts collected about a common centre, which was usually the abode of some anchorite celebrated for superior holiness or singular asceticism, but without any attempt at orderly arrangement. The formation of such communities in the East does not date from the introduction of Christianity. The example had been already set by the Essenes in Judea and the Therapeutae in Egypt.

In the earliest age of Christian monasticism the ascetics were accustomed to live singly, independent of one another, at no great distance from some village, supporting themselves by the labour of their own hands, and distributing the surplus after the supply of their own scanty wants to the poor. Increasing religious fervour, aided by persecution, drove them farther and farther away from the abodes of men into mountain solitudes or lonely deserts. The deserts of Egypt swarmed with the "cells" or huts of these anchorites. Anthony, who had retired to the Egyptian Thebaid during the persecution of Maximin, A.D. 312, was the most celebrated among them for his austerities, his sanctity, and his power as an exorcist. His fame collected round him a host of followers, emulous of his sanctity. The deeper he withdrew into the wilderness, the more numerous his disciples became. They refused to be separated from him, and built their cells round that of their spiritual father. Thus arose the first monastic community, consisting of anchorites living each in his own little dwelling, united together under one superior. Anthony, as Neander remarks (*Church History*, vol. iii. p. 316, Clark's trans.), "without any conscious design of his own, had become the founder of a new mode of living in common, Coenobitism." By degrees order was introduced in the groups of huts. They were arranged in lines like the tents in an encampment, or the houses in a street. From this arrangement these lines of single cells came to be known as *Laurae*, Λαῦραι, "streets" or "lanes."

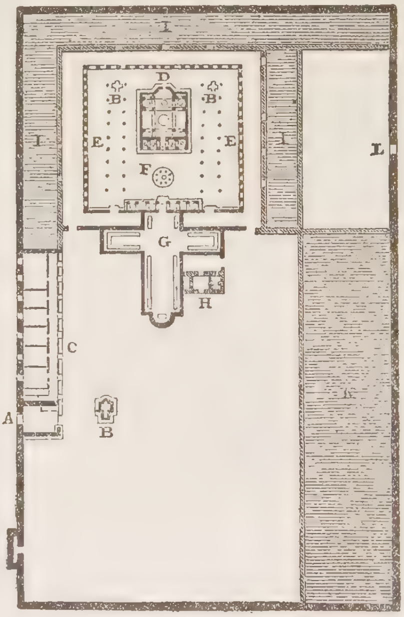
The real founder of coenobian (κοινός, common, and βίος, life) monasteries in the modern sense was Pachomius, an Egyptian of the beginning of the 4th century. The first community established by him was at Tabennae, an island of the Nile in Upper Egypt. Eight others were founded in his lifetime, numbering 3000 monks. Within fifty years from his death his societies could reckon 50,000 members. These coenobia resembled villages, peopled by a hard-working religious community, all of one sex. The buildings were detached, small and of the humblest character. Each cell or hut, according to Sozomen (*H.E.* iii. 14), contained three monks. They took their chief meal in a common refectory at 3 P.M., up to which hour they usually fasted. They ate in silence, with hoods so drawn over their faces that they could see nothing but what was on the table before them. The monks spent all the time, not devoted to religious services or study, in manual labour. Palladius, who visited the Egyptian monasteries about the close of the 4th century, found among the 300 members of the coenobium of Panopolis, under the Pachomian rule, 15 tailors, 7 smiths, 4 carpenters, 12 camel-drivers and 15 tanners. Each separate community had its own *oeconomus* or steward, who was subject to a chief *oeconomus* stationed at the head establishment. All the produce of the monks' labour was committed to him, and by him shipped to Alexandria. The money raised by the sale was expended in the purchase of stores for the support of the communities, and what was over was devoted to charity. Twice in the year the superiors of the several *coenobia* met at the chief monastery, under the presidency of an archimandrite ("the chief of the fold," from μάνδρα, a fold), and at the last meeting gave in reports of their administration for the year. The *coenobia* of Syria belonged to the Pachomian institution. We learn many details concerning those in the vicinity of Antioch from Chrysostom's writings. The monks lived in separate huts, καλύβια, forming a religious hamlet on the mountain side. They were subject to an abbot, and observed a common rule. (They had no refectory, but ate their common meal, of bread and water only, when the day's labour was over, reclining on strewn grass, sometimes out of doors.) Four times in the day they joined in prayers and psalms.

Santa Laura, Mount Athos.

The necessity for defence from hostile attacks, economy of space and convenience of access from one part of the community to another, by degrees dictated a more compact and orderly arrangement of the buildings of a monastic coenobium. Large piles of building were erected, with strong outside walls, capable of resisting the assaults of an enemy, within which all the necessary edifices were ranged round one or more open courts, usually surrounded with cloisters. The usual Eastern arrangement is exemplified in the plan of the convent of Santa Laura, Mount Athos (*Laura*, the designation of a monastery generally, being converted into a female saint).

This monastery, like the oriental monasteries generally, is surrounded by a strong and lofty blank stone wall, enclosing an area of between 3 and 4 acres. The longer side extends to a length of about 500 feet. There is only one main entrance, on the north side (A), defended by three separate iron doors. Near the entrance is a large tower (M), a constant feature in the monasteries of the Levant. There is a small postern gate at L. The *enceinte* comprises two large open courts, surrounded with buildings connected with cloister galleries of wood or stone. The outer court, which is much the larger, contains the granaries and storehouses (K), and the kitchen (H) and other offices connected with the refectory (G). Immediately adjacent to the gateway is a two-storied guest-house, opening from a cloister (C). The inner court is surrounded by a cloister (EE), from which open the monks' cells (II). In the centre of this court stands the catholicon or conventual church, a square building with an apse of the cruciform domical Byzantine type, approached by a domed narthex. In front of the church stands a marble fountain (F), covered by a dome supported on columns. Opening from the western side of the cloister, but actually standing in the outer court, is the refectory (G), a large cruciform building, about 100 feet each way, decorated within with frescoes of saints. At the upper end is a semicircular recess, recalling the triclinium of the Lateran Palace at Rome, in which is placed the seat of the *hegumenos* or abbot. This apartment is chiefly used as a hall of meeting, the oriental monks usually taking their meals in their separate cells. St Laura is exceeded in magnitude by the convent of Vatopede, also on Mount Athos. This enormous establishment covers at least 4 acres of ground, and contains so many separate buildings within its massive walls that it resembles a fortified town. It lodges above 300 monks, and the establishment of the hegumenos is described as resembling the court of a petty sovereign prince. The immense refectory, of the same cruciform shape as that of St Laura, will accommodate 500 guests at its 24 marble tables.

Vatopede.



A. Gateway.
B. Chapels.
C. Guest-house.
D. Church.
E. Cloister.
F. Fountain.
G. Refectory.
H. Kitchen.
I. Cells.
K. Storehouses.
L. Postern gate.
M. Tower.

FIG. 1.—Monastery of Santa Laura, Mount Athos (Lenoir).

The annexed plan of a Coptic monastery, from Lenoir, shows a church of three aisles, with cellular apses, and two ranges of cells on either side of an oblong gallery.

Monasticism in the West owes its extension and development to Benedict of Nursia (born A.D. 480). His rule was diffused with miraculous rapidity from the parent foundation on Monte Cassino through the whole of western Europe, and every country witnessed the erection of monasteries far exceeding anything that had yet been seen in spaciousness and splendour. Few great towns in Italy were without their Benedictine convent, and they quickly rose in all the great centres of population in England, France and Spain. The number of these monasteries founded between A.D. 520 and 700 is

Benedictine.

amazing. Before the Council of Constance, A.D. 1415, no fewer than 15,070 abbeys had been established of this order alone. The buildings of a Benedictine abbey were uniformly arranged after one plan, modified where necessary (as at Durham and Worcester, where the monasteries stand close to the steep bank of a river) to accommodate the arrangement to local circumstances. We have no existing examples of the earlier monasteries of the Benedictine order. They have all yielded to the ravages of time and the violence of man. But we have fortunately preserved to

St Gall.

us an elaborate plan of the great Swiss monastery of St Gall, erected about A.D. 820, which puts us in possession of the whole arrangements of a monastery of the first class towards the early part of the 9th century. This curious and interesting plan has been made the subject of a memoir both by Keller (Zürich, 1844) and by Professor Robert Willis (*Arch. Journal*, 1848, vol. v. pp. 86-117. To the latter we are indebted for the substance of the following description, as well as for the plan, reduced from his elucidated transcript of the original preserved in the archives of the convent. The general appearance of the convent is that of a town of isolated houses with streets running between them. It is evidently planned in compliance with the Benedictine rule, which enjoined that, if possible, the monastery should contain within itself every necessary of life, as well as the buildings more intimately connected with the religious and social life of its inmates. It should comprise a mill, a bakehouse, stables and cow-houses, together with accommodation for carrying on all necessary mechanical arts within the walls, so as to obviate the necessity of the monks going outside its limits.

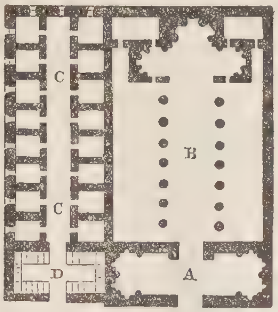


FIG. 2.—Plan of Coptic Monastery.
A. Narthex. B. Church.
C. Corridor, with cells on each side.
D. Staircase.

The general distribution of the buildings may be thus described:—The church, with its cloister to the south, occupies the centre of a quadrangular area, about 430 feet square. The buildings, as in all great monasteries, are distributed into groups. The church forms the nucleus, as the centre of the religious life of the community. In closest connexion with the church is the group of buildings appropriated to the monastic life and its daily requirements—the refectory for eating, the dormitory for sleeping, the common room for social intercourse, the chapter-house for religious and disciplinary conference. These essential elements of monastic life are ranged about a cloister court, surrounded by a covered arcade, affording communication sheltered from the elements between the various buildings. The infirmary for sick monks, with the physician's house and physic garden, lies to the east. In the same group with the infirmary is the school for the novices. The outer school, with its head-master's house against the opposite wall of the church, stands outside the convent enclosure, in close proximity to the abbot's house, that he might have a constant eye over them. The buildings devoted to hospitality are divided into three groups,—one for the reception of distinguished guests, another for monks visiting the monastery, a third for poor travellers and pilgrims. The first and third are placed to the right and left of the common entrance of the monastery,—the hospitium for distinguished guests being placed on the north side of the church, not far from the abbot's house; that for the poor on the south side next to the farm buildings. The monks are lodged in a guest-house built against the north wall of the church. The group of buildings connected with the material wants of the establishment is placed to the south and west of the church, and is distinctly separated from the monastic buildings. The kitchen, buttery and offices are reached by a passage from the west end of the refectory, and are connected with the bakehouse and brewhouse, which are placed still farther away. The whole of the southern and western sides is devoted to workshops, stables and farm-buildings. The buildings, with some exceptions, seem to have been of one story only, and all but the church were probably erected of wood. The whole includes thirty-three separate blocks. The church (D) is cruciform, with a nave of nine bays, and a semicircular apse at either extremity. That to the west is surrounded by a semicircular colonnade, leaving an open "paradise" (E) between it and the wall of the church. The whole area is divided by screens into various chapels. The high altar (A) stands immediately to the east of the transept, or ritual choir; the altar of St Paul (B) in the eastern, and that of St Peter (C) in the western apse. A cylindrical campanile stands detached from the church on either side of the western apse (FF).

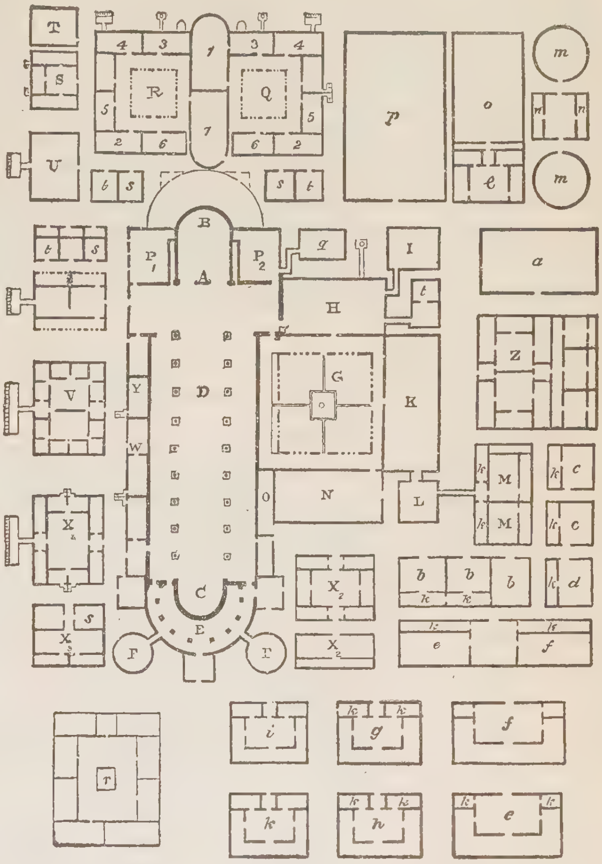


FIG. 3.—Ground-plan of St Gall.

CHURCH.

A.	High altar.
B.	Altar of St Paul.
C.	Altar of St Peter.
D.	Nave.
E.	Paradise.
FF.	Towers.

MONASTIC BUILDINGS.

G.	Cloister.
H.	Calefactory, with dormitory over.
I.	Necessary.
J.	Abbot's house.
K.	Refectory.
L.	Kitchen.
M.	Bakehouse and brewhouse.
N.	Cellar.
O.	Parlour.
P_1.	Scriptorium with library over.
P_2.	Sacristy and vestry.
Q.	House of Novices—1. chapel; 2. refectory; 3. calefactory; 4. dormitory; 5. master's room; 6. chambers.
R.	Infirmary—1-6 as above in the house of novices.
S.	Doctor's house.
T.	Physic garden.
U.	House for blood-letting.
V.	School.
W.	Schoolmaster's lodgings.
X_1X_1.	Guest-house for those of superior rank.
X_2X_2.	Guest-house for the poor.
Y.	Guest-chamber for strange monks.

MENIAL DEPARTMENT.

Z.	Factory.
a.	Threshing-floor.
b.	Workshops.
c, c.	Mills.
d.	Kiln.
e.	Stables.
f.	Cow-sheds.
g.	Goat-sheds.
h.	Pig-sties.
i.	Sheep-folds.
k, k, k.	Servants' and workmen's sleeping-chambers.
l.	Gardener's house.
m, m.	Hen and duck house.
n.	Poultry-keeper's house.
o.	Garden.
p.	Cemetery.
q.	Bakehouse for sacramental bread.
r.	Unnamed in plan.
s, s, s.	Kitchens.
t, t, t.	Baths.

The "cloister court" (G) on the south side of the nave of the church has on its east side the "pisalis" or "calefactory" (H), the common sitting-room of the brethren, warmed by flues beneath the floor. On this side in later monasteries we invariably find the chapter-house, the absence of which in this plan is somewhat surprising. It appears, however, from the inscriptions on the plan itself, that the north walk of the cloisters served for the purposes of a chapter-house, and was fitted up with benches on the long sides. Above the calefactory is the "dormitory" opening into the south transept of the church, to enable the monks to attend the nocturnal services with readiness. A passage at the other end leads to the "necessarium" (I), a portion of the monastic buildings always planned with extreme care. The southern side is occupied by the "refectory" (K), from the west end of which by a vestibule the kitchen (L) is reached. This is separated from the main buildings of the monastery, and is connected by a long passage with a building containing the bakehouse and brewhouse (M), and the sleeping-rooms of the servants. The upper story of the refectory is the "vestiarium," where the ordinary clothes of the brethren were kept. On the western side of the cloister is another two-story building (N). The cellar is below, and the larder and store-room above. Between this building and the church, opening by one door into the cloisters, and by another to the outer part of the monastery area, is the "parlour" for interviews with visitors from the external world (O). On the eastern side of the north transept is the "scriptorium" or writing-room (P_1), with the library above.

To the east of the church stands a group of buildings comprising two miniature conventual establishments, each complete in itself. Each has a covered cloister surrounded by the usual buildings, *i.e.* refectory, dormitory, &c., and a church or chapel on one side, placed back to back. A detached building belonging to each contains a bath and a kitchen. One of these diminutive convents is appropriated to the "oblati" or novices (Q), the other to the sick monks as an "infirmary" (R).

The "residence of the physicians" (S) stands contiguous to the infirmary, and the physic garden (T) at the north-east corner of the monastery. Besides other rooms, it contains a drug store, and a chamber for those who are dangerously ill. The "house for blood-letting and purging" adjoins it on the west (U).

The "outer school," to the north of the convent area, contains a large schoolroom divided across the middle by a screen or partition, and surrounded by fourteen little rooms, termed the dwellings of the scholars. The head-master's house (W) is opposite, built against the side wall of the church. The two "hospitia" or "guest-houses" for the entertainment of strangers of different degrees (X_1 X_2) comprise a large common chamber or refectory in the centre, surrounded by sleeping-apartments. Each is provided with its own brewhouse and bakehouse, and that for travellers of a superior order has a kitchen and storeroom, with bedrooms for their servants and stables for their horses. There is also an "hospitium" for strange monks, abutting on the north wall of the church (Y).

Beyond the cloister, at the extreme verge of the convent area to the south, stands the "factory" (Z), containing workshops for shoemakers, saddlers (or shoemakers, *sellarii*), cutlers and grinders, trencher-makers, tanners, curriers, fullers, smiths and goldsmiths, with their dwellings in the rear. On this side we also find the farm-buildings, the large granary and threshing-floor (*a*), mills (*c*), malthouse (*d*). Facing the west are the stables (*e*), ox-sheds (*f*), goat-stables (*g*), piggeries (*h*), sheep-folds (*i*), together with the servants' and labourers' quarters (*k*). At the south-east corner we find the hen and duck house, and poultry-yard (*m*), and the dwelling of the keeper (*n*). Hard by is the kitchen garden (*o*), the beds bearing the names of the vegetables growing in them, onions, garlic, celery, lettuces, poppy, carrots, cabbages, &c., eighteen in all. In the same way the physic garden presents the names of the medicinal herbs, and the cemetery (*p*) those of the trees, apple, pear, plum, quince, &c., planted there.

Canterbury Cathedral.

A curious bird's-eye view of Canterbury Cathedral and its annexed conventual buildings, taken about 1165, is preserved in the Great Psalter in the library of Trinity College, Cambridge. As elucidated by Professor Willis,[1] it exhibits the plan of a great Benedictine monastery in the 12th century, and enables us to compare it with that of the 9th as seen at St Gall. We see in both the same general principles of arrangement, which indeed belong to all Benedictine monasteries, enabling us to determine with precision the disposition of the various buildings, when little more than fragments of the walls exist. From some local reasons, however, the cloister and monastic buildings are placed on the north, instead, as is far more commonly the case, on the south of the church. There is also a separate chapter-house, which is wanting at St Gall.

The buildings at Canterbury, as at St Gall, form separate groups. The church forms the nucleus. In immediate contact with this, on the north side, lie the cloister and the group of buildings devoted to the monastic life. Outside of these, to the west and east, are the "halls and chambers devoted to the exercise of hospitality, with which every monastery was provided, for the purpose of receiving as guests persons who visited it, whether clergy or laity, travellers, pilgrims or paupers." To the north a large open court divides the monastic from the menial buildings, intentionally placed as remote as possible from the conventual buildings proper, the stables, granaries, barn, bakehouse, brewhouse, laundries, &c., inhabited by the lay servants of the establishment. At the greatest possible distance from the church, beyond the precinct of the convent, is the eleemosynary department. The *almonry* for the relief of the poor, with a great hall annexed, forms the paupers' hospitium.

The most important group of buildings is naturally that devoted to monastic life. This includes two cloisters, the great cloister surrounded by the buildings essentially connected with the daily life of the monks,—the church to the south, the refectory or frater-house here as always on the side opposite to the church, and farthest removed from it, that no sound or smell of eating might penetrate its sacred precincts, to the east the dormitory, raised on a vaulted undercroft, and the chapter-house adjacent, and the lodgings of the cellarer to the west. To this officer was committed the provision of the monks' daily food, as well as that of the guests. He was, therefore, appropriately lodged in the immediate vicinity of the refectory and kitchen, and close to the guest-hall. A passage under the dormitory leads eastwards to the smaller or infirmary cloister, appropriated to the sick and infirm monks. Eastward of this cloister extend the hall and chapel of the infirmary, resembling in form and arrangement the nave and chancel of an aisled church. Beneath the dormitory, looking out into the green court or herbarium, lies the "pisalis" or "calefactory," the common room of the monks. At its north-east corner access was given from the dormitory to the *necessarium*, a portentous edifice in the form of a Norman hall, 145 ft. long by 25 broad, containing fifty-five seats. It was, in common with all such offices in ancient monasteries, constructed with the most careful regard to cleanliness and health, a stream of water running through it from end to end. A second smaller dormitory runs from east to west for the accommodation of the conventual officers, who were bound to sleep in the dormitory. Close to the refectory, but outside the cloisters, are the domestic offices connected with it: to the north, the kitchen, 47 ft. square, surmounted by a lofty pyramidal roof, and the kitchen court; to the west, the butteries, pantries, &c. The infirmary had a small kitchen of its own. Opposite the refectory door in the cloister are two lavatories, an invariable adjunct to a monastic dining-hall, at which the monks washed before and after taking food.

The buildings devoted to hospitality were divided into three groups. The prior's group "entered at the south-east angle of the green court, placed near the most sacred part of the cathedral, as befitting the distinguished ecclesiastics or nobility who were assigned to him." The cellarer's buildings were near the west end of the nave, in which ordinary visitors of the middle class were hospitably entertained. The inferior pilgrims and paupers were relegated to the north hall or almonry, just within the gate, as far as possible from the other two.

Westminster Abbey.

Westminster Abbey is another example of a great Benedictine abbey, identical in its general arrangements, so far as they can be traced, with those described above. The cloister and monastic buildings lie to the south side of the church. Parallel to the nave, on the south side of the cloister, was the refectory, with its lavatory at the door. On the eastern side we find the remains of the dormitory, raised on a vaulted substructure and communicating with the south transept. The chapter-house opens out of the same alley of the cloister. The small cloister lies to the south-east of the larger cloister, and still farther to the east we have the remains of the infirmary with the *table hall*, the refectory of those who were able to leave their chambers. The abbot's house formed a small courtyard at the west entrance, close to the inner gateway. Considerable portions of this remain, including the abbot's parlour, celebrated as "the Jerusalem Chamber," his hall, now used for the Westminster King's Scholars, and the kitchen and butteries beyond.

York.

St Mary's Abbey, York, of which the ground-plan is annexed, exhibits the usual Benedictine arrangements. The precincts are surrounded by a strong fortified wall on three sides, the river Ouse being sufficient protection on the fourth side. The entrance was by a strong gateway (U) to the north. Close to the entrance was a chapel, where is now the church of St Olaf (W), in which the new-comers paid their devotions immediately on their arrival. Near the gate to the south was the guest-hall or hospitium (T). The buildings are completely ruined, but enough remains to enable us to identify the grand cruciform church (A), the cloister-court with the chapter-house (B), the refectory (I), the kitchen-court with its offices (K, O, O) and the other principal apartments. The infirmary has perished completely.

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[1] *The Architectural History of the Conventual Buildings of the Monastery of Christ Church in Canterbury.* By the Rev. Robert Willis. Printed for the Kent Archaeological Society, 1869.

Some Benedictine houses display exceptional arrangements, dependent upon local circumstances, *e.g.* the dormitory of Worcester runs from east to west, from the west walk of the cloister, and that of Durham is built over the west, instead of as usual, over the east walk; but, as a general rule, the arrangements deduced from the examples described may be regarded as invariable.

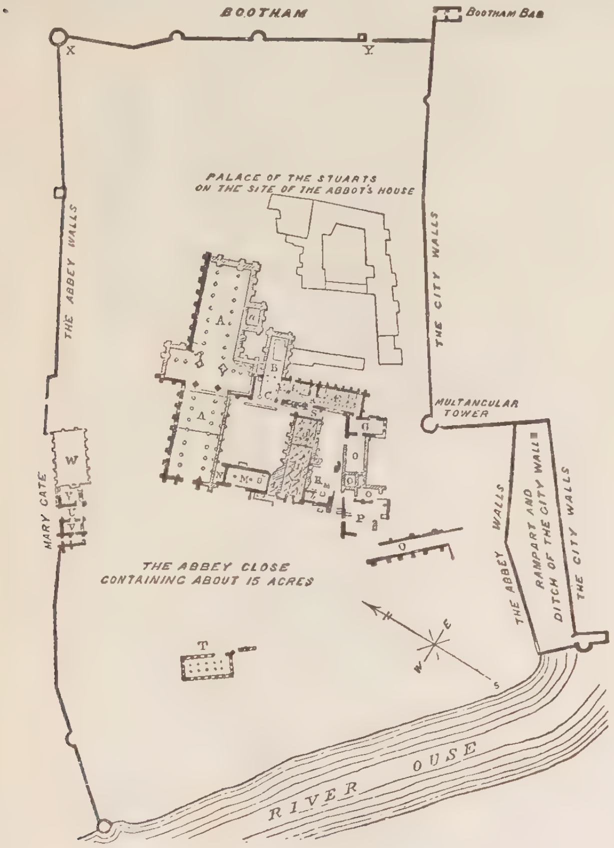

BOOTHAM
BOOTHAM BAR
X
Y
PALACE OF THE STUARTS ON THE SITE OF THE ABBOT'S HOUSE
THE ABBEY WALLS
THE CITY WALLS
MULTANGULAR TOWER
MARY GATE
W
THE ABBEY CLOSE CONTAINING ABOUT 15 ACRES
THE ABBEY WALLS
RAMPART AND DITCH OF THE CITY WALLS
THE CITY WALLS
T
N
E
S
W
RIVER OUSE

FIG. 4.

St Mary's Abbey, York (Benedictine).—Churton's *Monastic Ruins.*

A. Church.
B. Chapter-house.
C. Vestibule to ditto.
E. Library or scriptorium.
F. Calefactory.
G. Necessary.
H. Parlour.
I. Refectory.
K. Great kitchen and court.
L. Cellarer's office.
M. Cellars.
N. Passage to cloister.
O. Offices.
P. Cellars.
Q. Uncertain.
R. Passage to abbot's house.
S. Passage to common house.
T. Hospitium.
U. Great gate.
V. Porter's lodge.
W. Church of St Olaf.
X. Tower.
Y. Entrance from Bootham.

The history of monasticism is one of alternate periods of decay and revival. With growth in popular esteem came increase in material wealth, leading to luxury and worldliness. The first religious ardour cooled, the strictness of the rule was relaxed, until by the 10th century the decay of discipline was so complete in France that the monks are said to have been frequently unacquainted with the rule of St Benedict, and even ignorant that they were bound by any rule at all. The reformation of abuses generally took the form of the establishment of new monastic orders, with new and more stringent rules, requiring a modification of the architectural arrangements. One of the earliest of these reformed orders was the *Cluniac*. This order took its name from the little village of Cluny, 12 miles N.W. of Mâcon, near which, about A.D. 909, a reformed Benedictine abbey was founded by William, duke of Aquitaine and count of Auvergne, under Berno, abbot of Beaume. He was succeeded by Odo, who is often regarded as the founder of the order. The fame of Cluny spread far and wide. Its rigid rule was adopted by a vast number of the old Benedictine abbeys, who placed themselves in affiliation to the mother society, while new foundations sprang up in large numbers, all owing allegiance to the "archabbot," established at Cluny. By the end of the 12th century the number of monasteries affiliated to Cluny in the various countries of western Europe amounted to 2000. The monastic establishment of Cluny was one of the most extensive and magnificent in France. We may form some idea of its enormous dimensions from the fact recorded, that when, A.D. 1245, Pope Innocent IV., accompanied by twelve cardinals, a patriarch, three archbishops, the two generals of the Carthusians and Cistercians, the king (St Louis), and three of his sons, the queen mother, Baldwin, count of Flanders and emperor of Constantinople, the duke of Burgundy, and six lords, visited the abbey, the whole party, with their attendants, were lodged within the monastery without disarranging the monks, 400 in number. Nearly the whole of the abbey buildings, including the magnificent church, were swept away at the close of the 18th century. When the annexed ground-plan was taken, shortly before its destruction, nearly all the monastery, with the exception of the church, had been rebuilt.

Cluny.

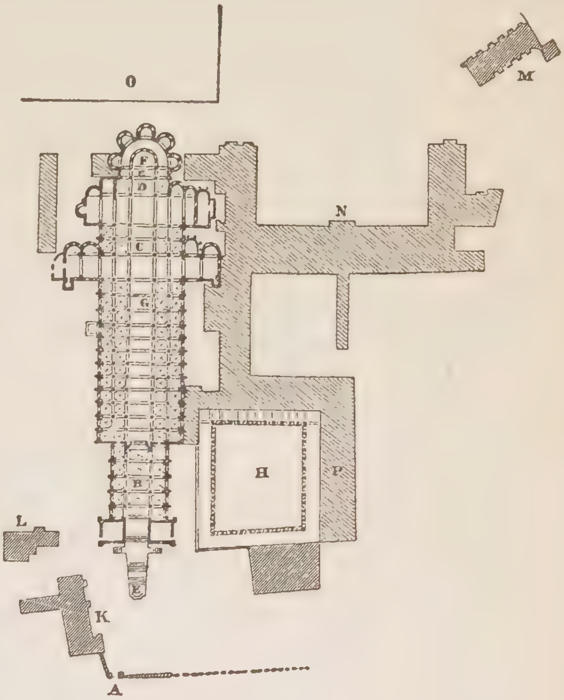


FIG. 5.—Abbey of Cluny, from Viollet-le-Duc.

A. Gateway.
B. Narthex.
C. Choir.
D. High-altar.
E. Retro-altar.
F. Tomb of St Hugh.
G. Nave.
H. Cloister.
K. Abbot's house.
L. Guest-house.
M. Bakehouse.
N. Abbey buildings.
O. Garden.
P. Refectory.

The church, the ground-plan of which bears a remarkable resemblance to that of Lincoln Cathedral, was of vast dimensions. It was 656 ft. by 130 ft. wide. The nave was 102 ft. and the aisles 60 ft. high. The nave (G) had double vaulted aisles on either side. Like Lincoln, it had an eastern as well as a western transept, each furnished with apsidal chapels to the east. The western transept was 213 ft. long, and the eastern 123 ft. The choir terminated in a semicircular apse (F), surrounded by five chapels, also semicircular. The western entrance was approached by an ante-church, or *narthex* (B), itself an aisled church of no mean dimensions, flanked by two towers, rising from a stately flight of steps bearing a large stone cross. To the south of the church lay the cloister-court (H), of immense size, placed much farther to the west than is usually the case. On the south side of the cloister stood the refectory (P), an immense building, 100 ft. long and 60 ft. wide, accommodating six longitudinal and three transverse rows of tables. It was adorned with the portraits of the chief benefactors of the abbey, and with Scriptural subjects. The end wall displayed the Last Judgment. We are unhappily unable to identify any other of the principal buildings (N). The abbot's residence (K), still partly standing, adjoined the entrance-gate. The guest-house (L) was close by. The bakehouse (M), also remaining, is a detached building of immense size.

English Cluniac.

The first English house of the Cluniac order was that of Lewes, founded by the earl of Warren, *c.* A.D. 1077. Of this only a few fragments of the domestic buildings exist. The best preserved Cluniac houses in England are Castle Acre, Norfolk, and Wenlock, Shropshire. Ground-plans of both are given in Britton's *Architectural Antiquities*. They show several departures from the Benedictine arrangement. In each the prior's house is remarkably perfect. All Cluniac houses in England were French colonies, governed by priors of that nation. They did not secure their independence nor become "abbeys" till the reign of Henry VI. The Cluniac revival, with all its brilliancy, was but short-lived. The celebrity of this, as of other orders, worked its moral ruin. With their growth in wealth and dignity the Cluniac foundations became as worldly in life and as relaxed in discipline as their predecessors, and a fresh reform was needed.

Cistercian.

The next great monastic revival, the Cistercian, arising in the last years of the 11th century, had a wider diffusion, and a longer and more honourable existence. Owing its real origin, as a distinct foundation of reformed Benedictines, in the year 1098, to Stephen Harding (a native of Dorsetshire, educated in the monastery of Sherborne), and deriving its name from Cîteaux (*Cistercium*), a desolate and almost inaccessible forest solitude, on the borders of Champagne and Burgundy, the rapid growth and wide celebrity of the order are undoubtedly to be attributed to the enthusiastic piety of St Bernard, abbot of the first of the monastic colonies, subsequently sent forth in such quick succession by the first Cistercian houses, the far-famed abbey of Clairvaux (de Clara Valle), A.D. 1116. The rigid self-abnegation, which was the ruling principle of this reformed congregation of the Benedictine order, extended itself to the churches and other buildings erected by them. The characteristic of the Cistercian abbeys was the extremest simplicity and a studied plainness. Only one tower—a central one—was permitted, and that was to be very low. Unnecessary pinnacles and turrets were prohibited. The triforium was omitted. The windows were to be plain and undivided, and it was forbidden to decorate them with stained glass. All needless ornament was proscribed. The crosses must be of wood; the candlesticks of iron. The renunciation of the world was to be evidenced in all that met the eye. The same spirit manifested itself in the choice of the sites of their monasteries. The more dismal, the more savage, the more hopeless a spot appeared, the more did it please their rigid mood. But they came not merely as ascetics, but as improvers. The Cistercian monasteries are, as a rule, found placed in deep well-watered valleys. They always stand on the border of a stream; not rarely, as at Fountains, the buildings extend over it. These valleys, now so rich and productive, wore a very different aspect when the brethren first chose them as the place of their retirement. Wide swamps, deep morasses, tangled thickets, wild impassable forests, were their prevailing features. The "bright valley," *Clara Vallis* of St Bernard, was known as the "valley of Wormwood," infamous as a den of robbers. "It was a savage dreary solitude, so utterly barren that at first Bernard and his companions were reduced to live on beech leaves."—(Milman's *Lat. Christ.* vol. iii. p. 335.)

Clairvaux.

All Cistercian monasteries, unless the circumstances of the locality forbade it, were arranged according to one plan. The general arrangement and distribution of the various buildings, which went to make up one of these vast establishments, may be gathered from that of St Bernard's own abbey of Clairvaux, which is here given. It will be observed that the abbey precincts are surrounded by a strong wall, furnished at intervals with watch-towers and other defensive works. The wall is nearly encircled by a stream of water, artificially diverted from the small rivulets which flow through the precincts, furnishing the establishment with an abundant supply in every part, for the irrigation of the gardens and orchards, the sanitary requirements of the brotherhood and for the use of the offices and workshops.

The precincts are divided across the centre by a wall, running from N. to S., into an outer and inner ward,—the former containing the menial, the latter the monastic buildings. The precincts are entered by a gateway (P), at the extreme western extremity, giving admission to the lower ward. Here the barns, granaries, stables, shambles, workshops and workmen's lodgings were placed, without any regard to symmetry, convenience being the only consideration. Advancing eastwards, we have before us the wall separating the outer and inner ward, and the gatehouse (D) affording communication between the two. On passing through the gateway, the outer court of the inner ward was entered, with the western façade of the monastic church in front. Immediately on the right of entrance was the abbot's house (G), in close proximity to the guest-house (F). On the other side of the court were the stables, for the accommodation of the horses of the guests and their attendants (H). The church occupied a central position. To the south was the great cloister (A), surrounded by the chief monastic buildings, and farther to the east the smaller cloister, opening out of which were the infirmary, novices' lodgings and quarters for the aged monks. Still farther to the east, divided from the monastic buildings by a wall, were the vegetable gardens and orchards, and tank for fish. The large fish-ponds, an indispensable adjunct to any ecclesiastical foundation, on the formation of which the monks lavished extreme care and pains, and which often remain as almost the only visible traces of these vast establishments, were placed outside the abbey walls.

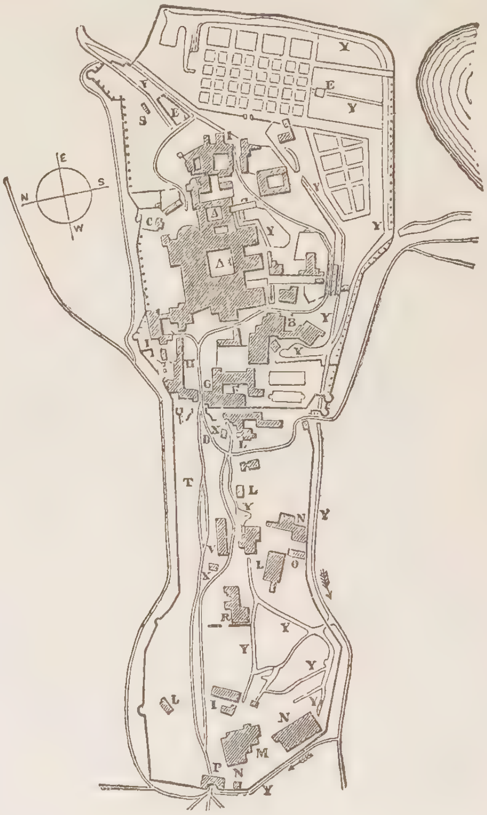


FIG. 6.—Clairvaux, No. 1 (Cistercian), General Plan.

A. Cloisters.
B. Ovens, and corn and oil mills.
C. St Bernard's cell.
D. Chief entrance.
E. Tanks for fish.
F. Guest-house.
G. Abbot's house.
H. Stables.
I. Wine-press and hay-chamber.
K. Parlour.
L. Workshops and workmen's lodgings.
M. Slaughter-house.
N. Barns and stables.
O. Public presse.
P. Gateway.
R. Remains of old monastery.
S. Oratory.
V. Tile-works.
X. Tile-kiln.
Y. Water-courses.

Plan No. 2 furnishes the ichnography of the distinctly monastic buildings on a larger scale. The usually unvarying arrangement of the Cistercian houses allows us to accept this as a type of the monasteries of this order. The church (A) is the chief feature. It consists

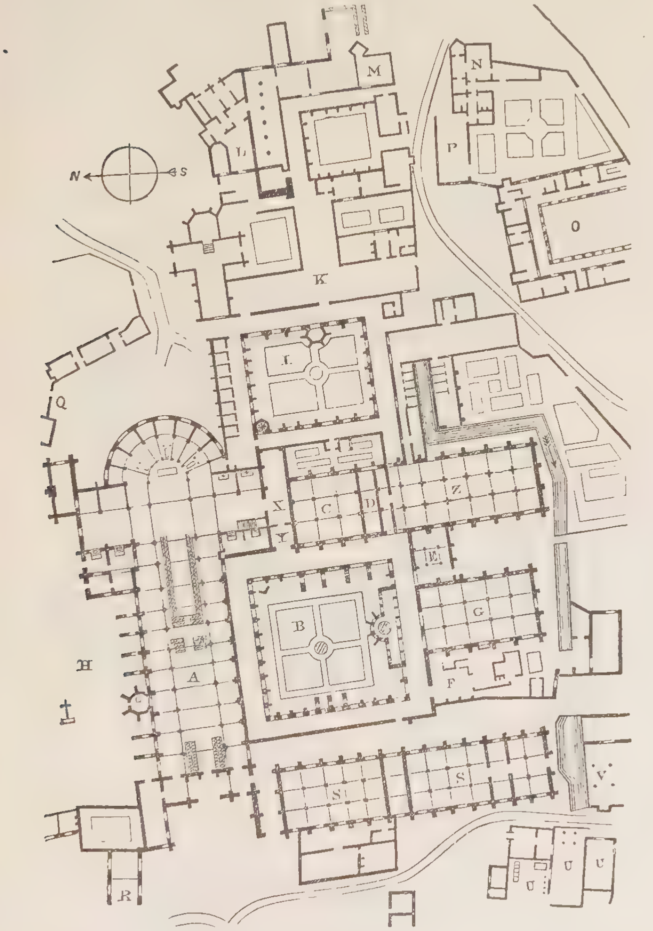


FIG. 7.—Clairvaux, No. 2 (Cistercian), Monastic Buildings.

A. Church.
B. Cloister.
C. Chapter-house.
D. Monks' parlour.
E. Calefactory.
F. Kitchen and court.
G. Refectory.
H. Cemetery.
I. Little cloister.
K. Infirmary.
L. Lodgings of novices.
M. Old guest-house.
N. Old abbot's lodgings.
O. Cloister of supernumerary monks.
P. Abbot's hall.
Q. Cell of St Bernard.
R. Stables.
S. Cellars and storehouses.
T. Water-course.
U. Saw-mill and oil-mill.
V. Currier's workshop.
X. Sacristy.
Y. Little library.
Z. Undercroft of dormitory.

of a vast nave of eleven bays, entered by a narthex, with a transept and short apsidal choir. (It may be remarked that the eastern limb in all unaltered Cistercian churches is remarkably short, and usually square.) To the east of each limb of the transept are two square chapels, divided according to Cistercian rule by solid walls. Nine radiating chapels, similarly divided, surround the apse. The stalls of the monks, forming the ritual choir, occupy the four eastern bays of the nave. There was a second range of stalls in the extreme western bays of the nave for the *fratres conversi*, or lay brothers. To the south of the church, so as to secure as much sun as possible, the cloister was invariably placed, except when local reasons forbade it. Round the cloister (B) were ranged the buildings connected with the monks' daily life. The chapter-house (C) always opened out of the east walk of the cloister in a line with the south transept. In Cistercian houses this was quadrangular, and was divided by pillars and arches into two or three aisles. Between it and the transept we find the sacristy (X), and a small book-room (Y), *armariolum*, where the brothers deposited the volumes borrowed from the library. On the other side of the chapter-house, to the south, is a passage (D) communicating with the courts and buildings beyond. This was sometimes known as the *parlour*, *colloquii locus*, the monks having the privilege of conversation here. Here also, when discipline became relaxed, traders, who had the liberty of admission, were allowed to display their goods. Beyond this we often find the *calefactorium* or *day-room*—an apartment warmed by flues beneath the pavement, where the brethren, half frozen during the night offices, betook themselves after the conclusion of lauds, to gain a little warmth, grease their sandals and get themselves ready for the work of the day. In the plan before us this apartment (E) opens from the south cloister walk, adjoining the refectory. The place usually assigned to it is occupied by the vaulted substructure of the *dormitory* (Z). The *dormitory*, as a rule, was placed on the east side of the cloister, running over the *calefactory* and *chapter-house*, and joined the south transept, where a flight of steps admitted the brethren into the church for nocturnal services. Opening out of the dormitory was always the *necessarium*, planned with the greatest regard to health and cleanliness, a water-course invariably running from end to end. The refectory opens out of the south cloister at G. The position of the refectory is usually a marked point of difference between Benedictine and Cistercian abbeys. In the former, as at Canterbury, the refectory ran east and west parallel to the nave of the church, on the side of the cloister farthest removed from it. In the Cistercian monasteries, to keep the noise and smell of dinner still farther away from the sacred building, the refectory was built north and south, at right angles to the axis of the church. It was often divided, sometimes into two, sometimes, as here, into three aisles. Outside the refectory door, in the cloister, was the *lavatory*, where the monks washed their hands at dinner-time. The buildings belonging to the material life of the monks lay near the refectory, as far as possible from the church, to the S.W. With a distinct entrance from the outer court was the kitchen court (F), with its buttery, scullery and larder, and the important adjunct of a stream of running water. Farther to the west, projecting beyond the line of the west front of the church, were vast vaulted apartments (SS), serving as cellars and storehouses, above which was the dormitory of the *conversi*. Detached from these, and separated entirely from the monastic buildings, were various workshops, which convenience required to be banished to the outer precincts, a saw-mill and oil-mill (UU) turned by water, and a currier's shop (V), where the sandals and leathern girdles of the monks were made and repaired.

Returning to the cloister, a vaulted passage admitted to the small cloister (I), opening from the north side of which were eight small cells, assigned to the scribes employed in copying works for the library, which was placed in the upper story, accessible by a turret staircase. To the south of the small cloister a long hall will be noticed. This was a *lecture-hall*, or rather a hall for the religious disputations customary among the Cistercians. From this cloister opened the *infirmary* (K), with its hall, chapel, cells, blood-letting house and other dependencies. At the eastern verge of the vast group of buildings we find the *novices' lodgings* (L), with a third cloister near the novices' quarters and the original guest-house (M). Detached from the great mass of the monastic edifices was the original abbot's house (N), with its dining-hall (P). Closely adjoining to this, so that the eye of the father of the whole establishment should be constantly over those who stood the most in need of his watchful care,—those who were training for the monastic life, and those who had worn themselves out in its duties,—was a fourth cloister (O), with annexed buildings, devoted to the aged and infirm members of the establishment. The cemetery, the last resting-place of the brethren, lay to the north side of the nave of the church (H).

It will be seen from the above account that the arrangement of a Cistercian monastery was in accordance with a clearly defined system, and admirably adapted to its purpose. The base court nearest to the outer wall contained the buildings belonging to the functions of the body as agriculturists and employers of labour. Advancing into the inner court, the buildings devoted to hospitality are found close to the entrance; while those connected with the supply of the material wants of the brethren,—the kitchen, cellars, &c.,—form a court of themselves outside the cloister and quite detached from the church. The church refectory, dormitory and other buildings belonging to the professional life of the brethren surround the great cloister. The small cloister beyond, with its scribes' cells, library, hall for disputations, &c., is the centre of the literary life of the community. The requirements of sickness and old age are carefully provided for in the infirmary cloister and that for the aged and infirm members of the establishment. The same group contains the quarters of the novices.

This stereotyped arrangement is further shown by the illustration of the mother establishmet of Cîteaux.

Cîteaux.

A cross (A), planted on the high road, directs travellers to the gate of the monastery, reached by an avenue of trees. On one side of the gate-house (B) is a long building (C), probably the almonry, with a dormitory above for the lower class of guests. On the other side is a chapel (D). As soon as the porter heard a stranger knock at the gate, he rose, saying, *Deo gratias*, the opportunity for the exercise of hospitality being regarded as a cause for thankfulness. On opening the door he welcomed the new arrival with a blessing—*Benedicite*. He fell on his knees before him, and then went to inform the abbot. However important the abbot's occupations might be, he at once hastened to receive him whom heaven had sent. He also threw himself at his guest's feet, and conducted him to the chapel (D) purposely built close to the gate. After a short prayer, the abbot committed the guest to the care of the brother hospitaller, whose duty it was to provide for his wants and conduct the beast on which h might be riding to the stable (F), built adjacent to the inner gate-house (E). This inner gate conducted into the base court (T), round which were placed the barns, stables, cow-sheds, &c. On the eastern side stood the dormitory of the lay brothers, *fratres conversi* (G), detached from the cloister, with cellars and storehouses below. At H, also outside the monastic buildings proper, was the abbot's house, and annexed to it the guest-house. For these buildings there was a separate door of entrance into the church (S). The large cloister, with its surrounding arcades, is seen at V. On the south end projects the refectory (K), with its kitchen at I, accessible from the base court. The long gabled building on the east side of the cloister contained on the ground floor the chapter-house and calefactory, with the monks' dormitory above (M), communicating with the south transept of the church. At L was the staircase to the dormitory. The small cloister is at W, where were the *carols* or cells of the scribes, with the library (P) over, reached by a turret staircase. At R we see a portion of the infirmary. The whole precinct is surrounded by a strong buttressed wall (XXX), pierced with arches, through which streams of water are introduced. It will be noticed that the choir of the church is short, and has a square end instead of the usual apse. The tower, in accordance with the Cistercian rule, is very low. The windows throughout accord with the studied simplicity of the order.

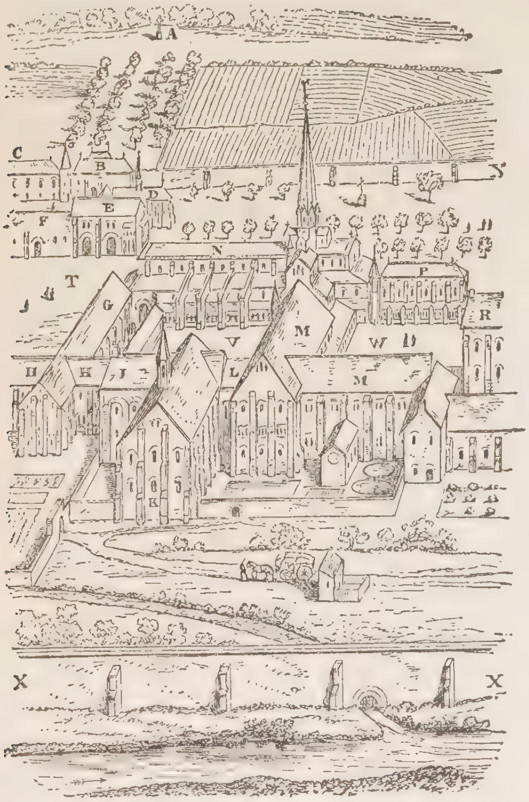


FIG. 8.—Bird's-eye view of Cîteaux.

A. Cross.
B. Gate-house.
C. Almonry.
D. Chapel.
E. Inner gate-house.
F. Stable.
G. Dormitory of lay brethren.
H. Abbot's house.
I. Kitchen.
K. Refectory.
L. Staircase to dormitory.
M. Dormitory.
N. Church.
P. Library.
R. Infirmary.
S. Door to the church for the lay brothers.
T. Base court.
V. Great cloister.
W. Small cloister.
X. Boundary wall.

Kirkstall Abbey.

The English Cistercian houses, of which there are such extensive and beautiful remains at Fountains, Rievaulx, Kirkstall, Tintern, Netley, &c., were mainly arranged after the same plan, with slight local variations. As an example, we give the ground-plan of Kirkstall Abbey, which is one of the best preserved. The church here is of the Cistercian type, with a short chancel of two squares, and transepts with three eastward chapels to each, divided by solid walls (2 2 2). The whole is of the most studied plainness. The windows are unornamented, and the nave has no triforium. The cloister to the south (4) occupies the whole length of the nave. On the east side stands the two-aisled chapter-house (5), between which and the south transept is a small sacristy (3), and on the other side two small apartments, one of which was probably the parlour (6). Beyond this stretches southward the calefactory or day-room of the monks (14). Above this whole range of building runs the monks' dormitory, opening by stairs into the south transept of the church. At the other end were the necessaries. On the south side of the cloister we have the remains of the old refectory (11), running, as in Benedictine houses, from east to west, and the new refectory (12), which, with the increase of the inmates of the house, superseded it, stretching, as is usual in Cistercian houses, from north to south. Adjacent to this apartment are the remains of the kitchen, pantry and buttery. The arches of the lavatory are to be seen near the refectory entrance. The western side of the cloister is, as usual, occupied by vaulted cellars, supporting on the upper story the dormitory of the lay brothers (8). Extending from the south-east angle of the main group of buildings are the walls and foundations of a secondary group of considerable extent. These have been identified either with the hospitium or with the abbot's house, but they occupy the position in which the infirmary is more usually found. The hall was a very spacious apartment, measuring 83 ft. in length by 48 ft. 9 in. in breadth, and was divided by two rows of columns. The fish-ponds lay between the monastery and the river to the south. The abbey mill was situated about 80 yards to the north-west. The mill-pool may be distinctly traced, together with the gowt or mill stream.

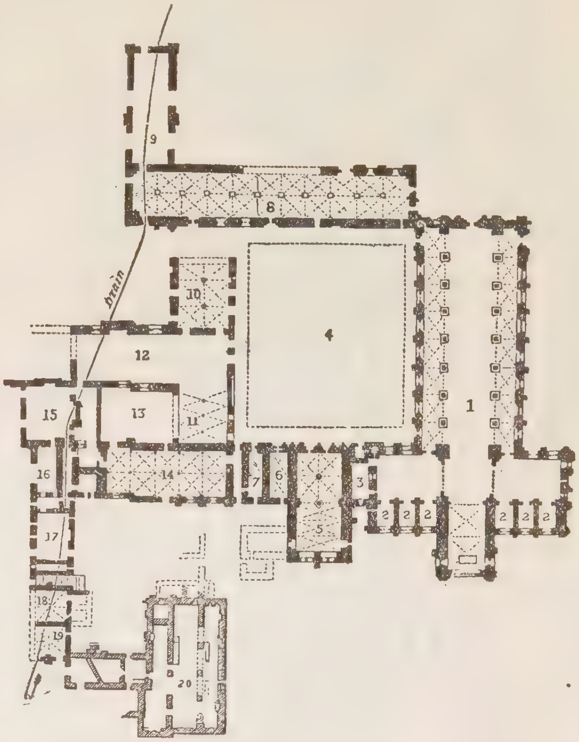


FIG. 9.—Kirkstall Abbey, Yorkshire (Cistercian).

1. Church.
2. Chapels.
3. Sacristy.
4. Cloister.
5. Chapter-house.
6. Parlour.
7. Punishment cell (?).
8. Cellars, with dormitories for *conversi* over.
9. Guest-house.
10. Common room.
11. Old refectory.
12. New refectory.
13. Kitchen court.
14. Calefactory or day-room.
15. Kitchen and offices.
16-19. Uncertain; perhaps offices connected with the infirmary.
20. Infirmary or abbot's house.

Fountains Abbey.

Fountains Abbey, first founded A.D. 1132, is one of the largest and best preserved Cistercian houses in England. But the earlier buildings received considerable additions and alterations in the later period of the order, causing deviations from the strict Cistercian type. The church stands a short distance to the north of the river Skell, the buildings of the abbey stretching down to and even across the stream. We have the cloister (H) to the south, with the three-aisled chapter-house (I) and calefactory (L) opening from its eastern walk, and the refectory (S), with the kitchen (Q) and buttery (T) attached, at right angles to its southern walk.

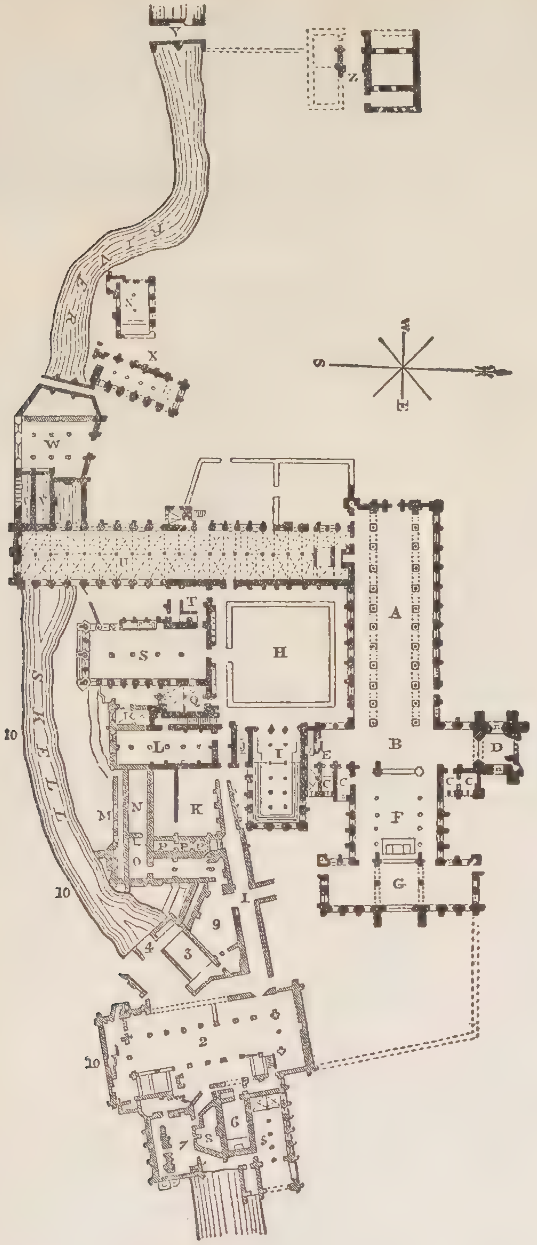


FIG. 10.—Ground-plan of Fountains Abbey, Yorkshire.

A. Nave of the church.
B. Transept.
C. Chapels.
D. Tower.
E. Sacristy.
F. Choir.
G. Chapel of nine altars.
H. Cloister.
I. Chapter-house.
K. Base court.
L. Calefactory.
M. Water-course.
N. Cellar.
O. Brewhouse.
P. Prisons.
Q. Kitchen.
R. Offices.
S. Refectory.
T. Buttery.
U. Cellars and store-houses.
V. Necessary.
W. Infirmary (?).
X. Guest-houses.
Y. Mill bridge.
Z. Gate-house.

ABBOT'S HOUSE.

1. Passage.
2. Great hall.
3. Refectory.
4. Buttery.
5. Storehouse.
6. Chapel.
7. Kitchen.
8. Ashpit.
9. Yard.
10. Kitchen tank.

Parallel with the western walk is an immense vaulted substructure (U), incorrectly styled the cloisters, serving as cellars and store-rooms, and supporting the dormitory of the *conversi* above. This building extended across the river. At its S.W. corner were the necessaries (V), also built, as usual, above the swiftly flowing stream. The monks' dormitory was in its usual position above the chapter-house, to the south of the transept As peculiarities of arrangement may be noticed the position of the kitchen (Q), between the refectory and calefactory, and of the infirmary (W) (unless there is some error in its designation) above the river to the west, adjoining the guest-houses (XX). We may also call attention to the greatly lengthened choir, commenced by Abbot John of York, 1203–1211, and carried on by his successor, terminating, like Durham Cathedral, in an eastern transept, the work of Abbot John of Kent, 1220–1247, and to the tower (D), added not long before the dissolution by Abbot Huby, 1494–1526, in a very unusual position at the northern end of the north transept. The abbot's house, the largest and most remarkable example of this class of buildings in the kingdom, stands south to the east of the church and cloister, from which it is divided by the kitchen court (K), surrounded by the ordinary domestic offices. A considerable portion of this house was erected on arches over the Skell. The size and character of this house, probably, at the time of its erection, the most spacious house of a subject in the kingdom, not a castle, bespeaks the wide departure of the Cistercian order from the stern simplicity of the original foundation. The hall (2) was one of the most spacious and magnificent apartments in medieval times, measuring 170 ft. by 70 ft. Like the hall in the castle at Winchester, and Westminster Hall, as originally built, it was divided by 18 pillars and arches, with 3 aisles. Among other apartments, for the designation of which we must refer to the ground-plan, was a domestic oratory or chapel, 46½ ft. by 23 ft. and a kitchen (7), 50 ft. by 38 ft. The whole arrangements and character of the building bespeak the rich and powerful feudal lord, not the humble father of a body of hard-working brethren, bound by vows to a life of poverty and self-denying toil. In the words of Dean Milman, "the superior, once a man bowed to the earth with humility, care-worn, pale, emaciated, with a coarse habit bound with a cord, with naked feet, had become an abbot on his curvetting palfrey, in rich attire, with his silver cross before him, travelling to take his place amid the lordliest of the realm."—(*Lat. Christ.* vol. iii. p. 330.)

Austin Canons.

The buildings of the *Austin canons* or *Black canons* (so called from the colour of their habit) present few distinctive peculiarities. This order had its first seat in England at Colchester, where a house for Austin canons was founded about A.D. 1105, and it very soon spread widely. As an order of regular clergy, holding a middle position between monks and secular canons, almost resembling a community of parish priests living under rule, they adopted naves of great length to accommodate large congregations. The choir is usually long, and is sometimes, as at Llanthony and Christ Church (Twynham), shut off from the aisles, or, as at Bolton, Kirkham, &c., is destitute of aisles altogether. The nave in the northern houses, not unfrequently, had only a north aisle, as at Bolton, Brinkburn and Lanercost. The arrangement of the monastic buildings followed the ordinary type. The prior's lodge was almost invariably attached to the S.W. angle of the nave. The annexed plan of the Abbey of St Augustine's at Bristol, now the cathedral church of that city, shows the arrangement of the buildings, which departs very little from the ordinary Benedictine type. The Austin canons' house at Thornton, in Lincolnshire, is remarkable for the size and magnificence of its gate-house, the upper floors of which formed the guest-house of the establishment, and for possessing an octagonal chapter-house of Decorated date.

Bristol Cathedral.

Premonstratensians.

The *Premonstratensian* regular canons, or White canons, had as many as 35 houses in England, of which the most perfect remaining are those of Easby, Yorkshire, and Bayham, Kent. The head house of the order in England was Welbeck. This order was a reformed branch of the Austin canons, founded, A.D. 1119, by Norbert (born at Xanten, on the Lower Rhine, *c.* 1080) at Prémontré, a secluded marshy valley in the forest of Coucy in the diocese of Laon. The order spread widely. Even in the founder's lifetime it possessed houses in Syria and Palestine. It long maintained its rigid austerity, till in the course of years wealth impaired its discipline, and its members sank into indolence and luxury. The Premonstratensians were brought to England shortly after A.D. 1140, and were first settled at Newhouse, in Lincolnshire, near the Humber. The ground-plan of Easby Abbey, owing to its situation on the edge of the steeply sloping banks of a river, is singularly irregular. The cloister is duly placed on the south side of the church, and the chief buildings occupy their usual positions round it. But the cloister garth, as at Chichester, is not rectangular, and all the surrounding buildings are thus made to sprawl in a very awkward fashion. The church follows the plan adopted by the Austin canons in their northern abbeys, and has only one aisle to the nave—that to the north; while the choir is long, narrow and aisleless. Each transept has an aisle to the east, forming three chapels.

The church at Bayham was destitute of aisles either to nave or choir. The latter terminated in a three-sided apse. This church is remarkable for its exceeding narrowness in proportion to its length. Extending in longitudinal dimensions 257 ft., it is not more than 25 ft. broad. Stern Premonstratensian canons wanted no congregations, and cared for no possessions; therefore they built their church like a long room.

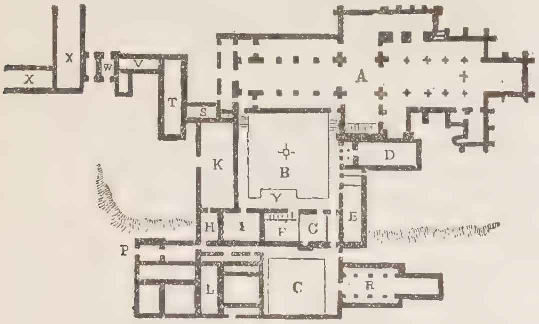


Fig. 11.—St Augustine's Abbey, Bristol (Bristol Cathedral).

A. Church.
B. Great cloister.
C. Little cloister.
D. Chapter-house.
E. Calefactory.
F. Refectory.
G. Parlour.
H. Kitchen.
I. Kitchen court.
K. Cellars.
L. Abbot's hall.
P. Abbot's gateway.
R. Infirmary.
S. Friars' lodging.
T. King's hall.
V. Guest-house.
W. Abbey gateway.
X. Barns, stables, &c.
Y. Lavatory.

Carthusians.

The *Carthusian* order, on its establishment by St Bruno, about A.D. 1084, developed a greatly modified form and arrangement of a monastic institution. The principle of this order, which combined the coenobitic with the solitary life, demanded the erection of buildings on a novel plan. This plan, which was first adopted by St Bruno and his twelve companions at the original institution at Chartreux, near Grenoble, was maintained in all the Carthusian establishments throughout Europe, even after the ascetic severity of the order had been to some extent relaxed, and the primitive simplicity of their buildings had been exchanged for the magnificence of decoration which characterizes such foundations as the *Certosas* of Pavia and Florence. According to the rule of St Bruno, all the members of a Carthusian brotherhood lived in the most absolute solitude and silence. Each occupied a small detached cottage, standing by itself in a small garden surrounded by high walls and connected by a common corridor or cloister. In these cottages or cells a Carthusian monk passed his time in the strictest asceticism, only leaving his solitary dwelling to attend the services of the Church, except on certain days when the brotherhood assembled in the refectory. The peculiarity of the arrangements of a Carthusian monastery, or *charter-house*, as it was called in England, from a corruption of the French *chartreux*, is exhibited in the plan of that of Clermont, from Viollet-le-Duc.

Clermont.

The whole establishment is surrounded by a wall, furnished at intervals with watch towers (R). The enclosure is divided into two courts, of which the eastern court, surrounded by a cloister, from which the cottages of the monks (I) open, is much the larger. The two courts are divided by the main buildings of the monastery, including the church, the sanctuary (A), divided from B, the monks' choir, by a screen with two altars, the smaller cloister to the south (S) surrounded by the chapter-house (E), the refectory (X)—these buildings occupying their normal position—and the chapel of Pontgibaud (K). The kitchen with its offices (V) lies behind the refectory, accessible from the outer court without entering the cloister. To the north of the church, beyond the sacristy (L), and the side chapels (M), we find the cell of the sub-prior (*a*), with its garden. The lodgings of the prior (G) occupy the centre of the outer court, immediately in front of the west door of the church, and face the gateway of the convent (O). A small raised court with a fountain (C) is before it. This outer court also contains the guest-chambers (P), the stables and lodgings of the lay brothers (N), the barns and granaries (Q), the dovecot (H) and the bakehouse (T). At Z is the prison. (In this outer court, in all the earlier foundations, as at Witham, there was a smaller church in addition to the larger church of the monks.) The outer and inner courts are connected by a long passage (F), wide enough to admit a cart laden with wood to supply the cells of the brethren with fuel. The number of cells surrounding the great cloister is 18. They are all arranged on a uniform plan. Each little dwelling contains three rooms: a sitting-room (C), warmed by a stove in winter; a sleeping-room (D), furnished with a bed, a table, a bench, and a bookcase; and a closet (E). Between the cell and the cloister gallery (A) is a passage or corridor (B), cutting off the inmate of the cell from all sound or movement which might interrupt his meditations. The superior had free access to this corridor, and through open niches was able to inspect the garden without being seen. At I is the hatch or turn-table, in which the daily allowance of food was deposited by a brother appointed for that purpose, affording no view either inwards or outwards. H is the garden, cultivated by the occupant of the cell. At K is the wood-house. F is a covered walk, with the necessary at the end.

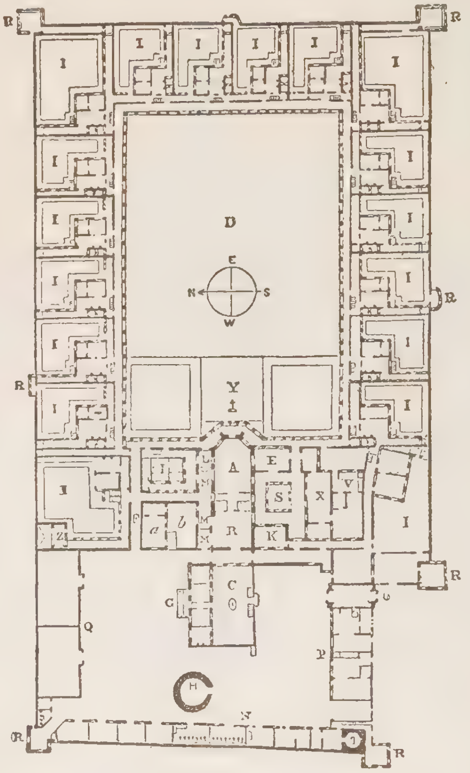
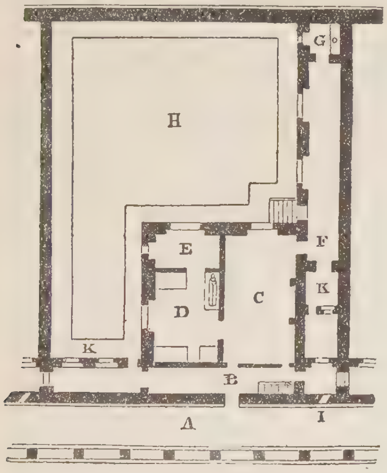


Fig. 12.—Carthusian monastery of Clermont.

A. Church.
B. Monks' choir.
C. Prior's garden.
D. Great cloister.
E. Chapter-house.
F. Passage.
G. Prior's lodgings.
H. Dovecot.
I. Cells.
K. Chapel of Pontgibaud.
L. Sacristy.
M. Chapel.
N. Stables.
O. Gateway.
P. Guest-chambers.
Q. Barns and granaries.
R. Watch-tower.
S. Little cloister.
T. Bakehouse.
V. Kitchen.
X. Refectory.
Y. Cemetery.
Z. Prison.
a. Cell of sub-prior.
b. Garden of do.

The above arrangements are found with scarcely any variation in all the charter-houses of western Europe. The Yorkshire Charter-house of Mount Grace, founded by Thomas Holland, the young duke of Surrey, nephew of Richard II. and marshal of England, during the revival of the popularity of the order, about A.D. 1397, is the most perfect and best preserved English example. It is characterized by all the simplicity of the order. The church is a modest building, long, narrow and aisleless. Within the wall of enclosure are two courts. The smaller of the two, the south, presents the usual arrangement of church, refectory, &c., opening out of a cloister. The buildings are plain and solid. The northern court contains the cells, 14 in number. It is surrounded by a double stone wall, the two walls being about 30 ft. or 40 ft. apart. Between these, each in its own garden, stand the cells; low-built two-storied cottages, of two or three rooms on the ground-floor, lighted by a larger and a smaller window to the side, and provided with a doorway to the court, and one at the back, opposite to one in the outer wall, through which the monk may have conveyed the sweepings of his cell and the refuse of his garden to the "eremus" beyond. By the side of the door to the court is a little hatch through which the daily pittance of food was supplied, so contrived by turning at an angle in the wall that no one could either look in or look out. A very perfect example of this hatch—an arrangement belonging to all Carthusian houses—exists at Miraflores, near Burgos, which remains nearly as it was completed in 1480.



A. Cloister gallery.
B. Corridor.
C. Living-room.
D. Sleeping-room.
E. Closets.
F. Covered walk.
G. Necessary.
H. Garden.
I. Hatch.
K. Wood-house.

FIG. 13.—Carthusian cell, Clermont.

There were only nine Carthusian houses in England. The earliest was that at Witham in Somersetshire, founded by Henry II., by whom the order was first brought into England. The wealthiest and most magnificent was that of Sheen or Richmond in Surrey, founded by Henry V. about A.D. 1414. The dimensions of the buildings at Sheen are stated to have been remarkably large. The great court measured 300 ft. by 250 ft.; the cloisters were a square of 500 ft.; the hall was 110 ft. in length by 60 ft. in breadth. The most celebrated historically is the Charter-house of London, founded by Sir Walter Manny A.D. 1371, the name of which is preserved by the famous public school established on the site by Thomas Sutton A.D. 1611, now removed to Godalming.

Mendicant Friars.

Norwich. Gloucester.

Hulne.

An article on monastic arrangements would be incomplete without some account of the convents of the Mendicant or Preaching Friars, including the Black Friars or Dominicans, the Grey or Franciscans, the White or Carmelites, the Eremite or Austin Friars. These orders arose at the beginning of the 13th century, when the Benedictines, together with their various reformed branches, had terminated their active mission, and Christian Europe was ready for a new religious revival. Planting themselves, as a rule, in large towns, and by preference in the poorest and most densely populated districts, the Preaching Friars were obliged to adapt their buildings to the requirements of the site. Regularity of arrangement, therefore, was not possible, even if they had studied it. Their churches, built for the reception of large congregations of hearers rather than worshippers, form a class by themselves, totally unlike those of the elder orders in ground-plan and character. They were usually long parallelograms unbroken by transepts. The nave very usually consisted of two equal bodies, one containing the stalls of the brotherhood, the other left entirely free for the congregation. The constructional choir is often wanting, the whole church forming one uninterrupted structure, with a continuous range of windows. The east end was usually square, but the Friars Church at Winchelsea had a polygonal apse. We not unfrequently find a single transept, sometimes of great size, rivalling or exceeding the nave. This arrangement is frequent in Ireland, where the numerous small friaries afford admirable exemplifications of these peculiarities of ground-plan. The friars' churches were at first destitute of towers; but in the 14th and 15th centuries, tall, slender towers were commonly inserted between the nave and the choir. The Grey Friars at Lynn, where the tower is hexagonal, is a good example. The arrangement of the monastic buildings is equally peculiar and characteristic. We miss entirely the regularity of the buildings of the earlier orders. At the Jacobins at Paris, a cloister lay to the north of the long narrow church of two parallel aisles, while the refectory—a room of immense length, quite detached from the cloister—stretched across the area before the west front of the church. At Toulouse the nave also has two parallel aisles, but the choir is apsidal, with radiating chapel. The refectory stretches northwards at right angles to the cloister, which lies to the north of the church, having the chapter-house and sacristy on the east. As examples of English friaries, the Dominican house at Norwich, and those of the Dominicans and Franciscans at Gloucester, may be mentioned. The church of the Black Friars of Norwich departs from the original type in the nave (now St Andrew's Hall), in having regular aisles. In this it resembles the earlier examples of the Grey Friars at Reading. The choir is long and aisleless; an hexagonal tower between the two, like that existing at Lynn, has perished. The cloister and monastic buildings remain tolerably perfect to the north. The Dominican convent at Gloucester still exhibits the cloister-court, on the north side of which is the desecrated church. The refectory is on the west side and on the south the dormitory of the 13th century. This is a remarkably good example. There were 18 cells or cubicles on each side, divided by partitions, the bases of which remain. On the east side was the prior's house, a building of later date. At the Grey or Franciscan Friars, the church followed the ordinary type in having two equal bodies, each gabled, with a continuous range of windows. There was a slender tower between the nave and the choir. Of the convents of the Carmelite or White Friars we have a good example in the Abbey of Hulne, near Alnwick, the first of the order in England, founded A.D. 1240. The church is a narrow oblong, destitute of aisles, 123 ft. long by only 26 ft. wide. The cloisters are to the south, with the chapter-house, &c., to the east, with the dormitory over. The prior's lodge is placed to the west of the cloister. The guest-houses adjoin the entrance gateway, to which a chapel was annexed on the south side of the conventual area. The nave of the church of the Austin Friars or Eremites in London is still standing. It is of Decorated date, and has wide centre and side aisles, divided by a very light and graceful arcade. Some fragments of the south walk of the cloister of the Grey Friars remained among the buildings of Christ's Hospital (the Blue-Coat School), while they were still standing. Of the Black Friars all has perished but the name. Taken as a whole, the remains of the establishments of the friars afford little warrant for the bitter invective of the Benedictine of St Alban's, Matthew Paris:—"The friars who have been founded hardly 40 years have built residences as the palaces of kings. These are they who, enlarging day by day their sumptuous edifices, encircling them with lofty walls, lay up in them their incalculable treasures, imprudently transgressing the bounds of poverty and violating the very fundamental rules of their profession." Allowance must here be made for jealousy of a rival order just rising in popularity.

Cells.

Every large monastery had depending upon it one or more smaller establishments known as *cells*. These cells were monastic colonies, sent forth by the parent house, and planted on some outlying estate. As an example, we may refer to the small religious house of St Mary Magdalene's, a cell of the great Benedictine house of St Mary's, York, in the valley of the Witham, to the south-east of the city of Lincoln. This consists of one long narrow range of building, of which the eastern part formed the chapel and the western contained the apartments of the handful of monks of which it was the home. To the east may be traced the site of the abbey mill, with its dam and mill-lead. These cells, when belonging to a Cluniac house, were called *Obedientiae*. The plan given by

Viollet-le-Duc of the Priory of *St Jean des Bons Hommes*, a Cluniac cell, situated between the town of Avallon and the village of Savigny, shows that these diminutive establishments comprised every essential feature of a monastery,—chapel, cloister, chapter-room, refectory, dormitory, all grouped according to the recognized arrangement. These Cluniac *obedientiae* differed from the ordinary Benedictine cells in being also places of punishment, to which monks who had been guilty of any grave infringement of the rules were relegated as to a kind of penitentiary. Here they were placed under the authority of a prior, and were condemned to severe manual labour, fulfilling the duties usually executed by the lay brothers, who acted as farm-servants. The outlying farming establishments belonging to the monastic foundations were known as *villae* or *granges*. They gave employment to a body of *conversi* and labourers under the management of a monk, who bore the title of *Brother Hospitaller*—the granges, like their parent institutions, affording shelter and hospitality to belated travellers.

AUTHORITIES.—Dugdale, *Monasticon*; Lenoir, *Architecture monastique* (1852–1856); Viollet-le-Duc, *Dictionnaire raisonnée de l'architecture française*; Springer, *Klosterleben und Klosterkunst* (1886); Kraus, *Geschichte der christlichen Kunst* (1896). (E. V.)

ABBON OF FLEURY, or ABBO FLORIACENSIS (*c.* 945–1004), a learned Frenchman, born near Orleans about 945. He distinguished himself in the schools of Paris and Reims, and was especially proficient in science as known in his time. He spent two years in England, assisting Archbishop Oswald of York in restoring the monastic system, and was abbot of Romsey. After his return to France he was made abbot of Fleury on the Loire (988). He was twice sent to Rome by King Robert the Pious (986, 996), and on each occasion succeeded in warding off a threatened papal interdict. He was killed at La Réole in 1004, in endeavouring to quell a monkish revolt. He wrote an *Epitome de vitis Romanorum pontificum*, besides controversial treatises, letters, &c. (see Migne, *Patrologia Latina*, vol. 139). His life, written by his disciple Aimoin of Fleury, in which much of Abbon's correspondence was reproduced, is of great importance as a source for the reign of Robert II., especially with reference to the papacy (cf. Migne, *op. cit.* vol. 139).

See Ch. Pfister, *Études sur le règne de Robert le Pieux* (1885); Cuissard-Gaucheron, "L'École de Fleury-sur-Loire à la fin du 10^{e} siècle," in *Mémoires de la société archéol. de l'Orléanais*, xiv. (Orleans, 1875); A. Molinier, *Sources de l'histoire de France*.

ABBOT, EZRA (1819–1884), American biblical scholar, was born at Jackson, Waldo county, Maine, on the 28th of April 1819. He graduated at Bowdoin College in 1840; and in 1847, at the request of Prof. Andrews Norton, went to Cambridge, where he was principal of a public school until 1856. He was assistant librarian of Harvard University from 1856 to 1872, and planned and perfected an alphabetical card catalogue, combining many of the advantages of the ordinary dictionary catalogues with the grouping of the minor topics under more general heads, which is characteristic of a systematic catalogue. From 1872 until his death he was Bussey Professor of New Testament Criticism and Interpretation in the Harvard Divinity School. His studies were chiefly in Oriental languages and the textual criticism of the New Testament, though his work as a bibliographer showed such results as the exhaustive list of writings (5300 in all) on the doctrine of the future life, appended to W. R. Alger's *History of the Doctrine of a Future Life, as it has prevailed in all Nations and Ages* (1862), and published separately in 1864. His publications, though always of the most thorough and scholarly character, were to a large extent dispersed in the pages of reviews, dictionaries, concordances, texts edited by others, Unitarian controversial treatises, &c.; but he took a more conspicuous and more personal part in the preparation (with the Baptist scholar, Horatio B. Hackett) of the enlarged American edition of Dr (afterwards Sir) William Smith's *Dictionary of the Bible* (1867–1870), to which he contributed more than 400 articles besides greatly improving the bibliographical completeness of the work; was an efficient member of the American revision committee employed in connexion with the Revised Version (1881–1885) of the King James Bible; and aided in the preparation of Caspar René Gregory's *Prolegomena* to the revised Greek New Testament of Tischendorf. His principal single production, representing his scholarly method and conservative conclusions, was *The Authorship of the Fourth Gospel: External Evidences* (1880; second edition, by J. H. Thayer, with other essays, 1889), originally a lecture, and in spite of the compression due to its form, up to that time probably the ablest defence, based on external evidence, of the Johannine authorship, and certainly the completest treatment of the relation of Justin Martyr to this gospel. Abbot, though a layman, received the degree of S. T. D. from Harvard in 1872, and that of D.D. from Edinburgh in 1884. He died in Cambridge, Massachusetts, on the 21st of March 1884.

See S. J. Barrows, *Ezra Abbot* (Cambridge, Mass., 1884).

ABBOT, GEORGE (1562–1633), English divine, archbishop of Canterbury, was born on the 19th of October 1562, at Guildford in Surrey, where his father was a cloth-worker. He studied, and then taught, at Balliol College, Oxford, was chosen master of University College in 1597, and appointed dean of Winchester in 1600. He was three times vice-chancellor of the university, and took a leading part in preparing the authorized version of the New Testament. In 1608 he went to Scotland with the earl of Dunbar to arrange for a union between the churches of England and Scotland. He so pleased the king (James I.) in this affair that he was made bishop of Lichfield and Coventry in 1609, was translated to the see of London a month afterwards, and in less than a year was raised to that of Canterbury. His puritan instincts frequently led him not only into harsh treatment of Roman Catholics, but also into courageous resistance to the royal will, *e.g.* when he opposed the scandalous divorce suit of the Lady Frances Howard against the earl of Essex, and again in 1618 when, at Croydon, he forbade the reading of the declaration permitting Sunday sports. He was naturally, therefore, a promoter of the match between the elector palatine and the Princess Elizabeth, and a firm opponent of the projected marriage of the prince of Wales with the infanta of Spain. This policy brought upon him the hatred of Laud (with whom he had previously come into collision at Oxford) and the court, though the king himself never forsook him. In 1622, while hunting in Lord Zouch's park at Bramshill, Hampshire, a bolt from his cross-bow aimed at a deer happened to strike one of the keepers, who died within an hour, and Abbot was so greatly distressed by the event that he fell into a state of settled melancholy. His enemies maintained that the fatal issue of this accident disqualified him for his office, and argued that, though the homicide was involuntary, the sport of hunting which had led to it was one in which no clerical person could lawfully indulge. The king had to refer the matter to a commission of ten, though he said that "an angel might have miscarried after this sort." The commission was equally divided, and the king gave a casting vote in the archbishop's favour, though signing also a formal pardon or dispensation. After this the archbishop seldom appeared at the council, chiefly on account of his infirmities. He attended the king constantly, however, in his last illness, and performed the ceremony of the coronation of Charles I. His refusal to license the assize sermon preached by Dr Robert Sibthorp at Northampton on the 22nd of February 1626–1627, in which cheerful obedience was urged to the king's demand for a general loan, and the duty proclaimed of absolute non-resistance even to the most arbitrary royal commands, led Charles to deprive him of his functions as primate, putting them in commission. The need of summoning parliament, however, soon brought about a nominal restoration of the archbishop's powers. His presence being unwelcome at court, he lived from that time in retirement, leaving Laud and his party in undisputed ascendancy. He died at Croydon on the 5th of August 1633, and was buried at Guildford, his native place, where he had endowed a hospital with lands to the value of £300 a year. Abbot was a conscientious prelate, though narrow in view and often harsh towards both separatists and Romanists. He wrote a large number of works, the most interesting being his discursive *Exposition on the Prophet Jonah* (1600), which was reprinted in 1845. His *Geography, or a Brief Description of the Whole World* (1599), passed through numerous editions.

The best account of him is in S. R. Gardiner's *History of England*.

ABBOT, GEORGE (1603–1648), English writer, known as "The Puritan," has been oddly and persistently mistaken for others. He has been described as a clergyman, which he never was, and as son of Sir Morris (or Maurice) Abbot, and his writings accordingly entered in the bibliographical authorities as by the nephew of the archbishop of Canterbury. One of the sons of Sir Morris Abbot was, indeed, named George, and he was a man of mark, but the more famous George Abbot was of a different family altogether. He was son or grandson (it is not clear which) of Sir Thomas Abbot, knight of Easington, East Yorkshire, having been born there in 1603–1604, his mother (or grandmother) being of the ancient house of Pickering. Of his early life and training nothing is known. He married a daughter of Colonel Purefoy of Caldecote, Warwickshire, and as his monument, which may still be seen in the church there, tells, he bravely held the manor house against Princes Rupert and Maurice during the civil war. As a layman, and nevertheless a theologian and scholar of rare ripeness and critical ability, he holds an almost unique place in the literature of the period. The terseness of his *Whole Booke of Job Paraphrased, or made easy for any to understand* (1640, 4to), contrasts favourably with the usual prolixity of the Puritan expositors and commentators. His *Vindiciae Sabbathi* (1641, 8vo) had a profound and lasting influence in the long Sabbatarian controversy. His *Brief Notes upon the Whole Book of Psalms* (1651, 4to), as its date shows, was posthumous. He died on the 2nd of February 1648.

AUTHORITIES.—MS. collections at Abbeyville for history of all of the name of Abbot, by J. T. Abbot, Esq., F.S.A., Darlington; Dugdale's *Antiquities of Warwickshire*, 1730, p. 1099; Wood's *Athenae* (Bliss), ii. 141, 594; Cox's *Literature of the Sabbath*.

ABBOT, ROBERT (1588?–1662?), English Puritan divine. Noted as this worthy was in his own time, and representative in various ways, he has often since been confounded with others, *e.g.* Robert Abbot, bishop of Salisbury. He is also wrongly described as a relative of Archbishop Abbot, from whom he acknowledges very gratefully, in the first of his epistles dedicatory of *A Hand of Fellowship to Helpe Keepe out Sinne and Antichrist* (1623, 4to), that he had "received all" his "worldly maintenance," as well as "best earthly countenance" and "fatherly incouragements." The worldly maintenance was the presentation in 1616 to the vicarage of Cranbrook in Kent. He had received his education at Cambridge, where he proceeded M.A., and was afterwards incorporated at Oxford. In 1639, in the epistle to the reader of his most noticeable book historically, his *Triall of our Church-Forsakers*, he tells us, "I have lived now, by God's gratious dispensation, above fifty years, and in the place of my allotment two and twenty full." The former date carries us back to 1588–1589, or perhaps 1587–1588 —the "Armada" year—as his birth-time; the latter to 1616–1617 (*ut supra*). In his *Bee Thankfull London and her Sisters* (1626), he describes himself as formerly "assistant to a reverend divine . . . now with God," and the name on the margin is "Master Haiward of Wool Church (Dorset)." This was doubtless previous to his going to Cranbrook. Very remarkable and effective was Abbot's ministry at Cranbrook, where his parishioners were as his own "sons and daughters" to him. Yet, Puritan though he was, he was extremely and often unfairly antagonistic to Nonconformists. He remained at Cranbrook until 1643, when, Parliament deciding against pluralities of ecclesiastical offices, he chose the very inferior living of Southwick, Hants, as between the one and the other. He afterwards succeeded the "extruded" Udall of St Austin's, London, where according to the *Warning-piece* he was still pastor in 1657. He disappears silently between 1657–1658 and 1662. Robert Abbot's books are conspicuous amongst the productions of his time by their terseness and variety. In addition to those mentioned above he wrote *Milk for Babes, or a Mother's Catechism for her Children* (1646), and *A Christian Family builded by God, or Directions for Governors of Families* (1653).

AUTHORITIES.—Brook's *Puritans*, iii. 182, 3; Walker's *Sufferings*, ii. 183; Wood's *Athenae* (Bliss), i. 323; Palmer's *Nonconf. Mem.* ii. 218, which confuses him most oddly of all with one of the ejected ministers of 1662.

ABBOT, WILLIAM (1798–1843), English actor, was born in Chelsea, and made his first appearance on the stage at Bath in 1806, and his first London appearance in 1808. At Covent Garden in 1813, in light comedy and melodrama, he made his first decided success. He was Pylades to Macready's Orestes in Ambrose Philips's *Distressed Mother* when Macready made his first appearance at that theatre (1816). He created the parts of Appius Claudius in Sheridan Knowles's *Virginius* (1820) and of Modus in his *Hunchback* (1832). In 1827 he organized the company, including Macready and Miss Smithson, which acted Shakespeare in Paris. On his return to London he played Romeo to Fanny Kemble's Juliet (1830). Two of Abbot's melodramas, *The Youthful Days of Frederick the Great* (1817) and *Swedish Patriotism* (1819), were produced at Covent Garden. He died in poverty at Baltimore, Maryland.

ABBOT (from the Hebrew *ab*, a father, through the Syriac *abba*, Lat. *abbas*, gen. *abbatis*, O.E. *abbad*, fr. late Lat. form *abbad-em* changed in 13th century under influence of the Lat. form to *abbat*, used alternatively till the end of the 17th century; Ger. *Abt*; Fr. *abbé*), the head and chief governor of a community of monks, called also in the East hegumenos or archimandrite. The title had its origin in the monasteries of Syria, whence it spread through the East, and soon became accepted generally in all languages as the designation of the head of a monastery. At first it was employed as a respectful title for any monk, as we learn from St Jerome, who denounced the custom on the ground that Christ had said, "Call no man father on earth" (in *Epist. ad Gal.* iv. 6, in Matt. xxiii. 9), but it was soon restricted to the superior. The name "abbot," though general in the West, was never universal. Among the Dominicans, Carmelites, Augustinians, &c., the superior was called *Praepositus*, "provost," and *Prior*; among the Franciscans, *Custos*, "guardian"; and by the monks of Camaldoli, *Major*.

In Egypt, the first home of monasticism, the jurisdiction of the abbot, or archimandrite, was but loosely defined. Sometimes he ruled over only one community, sometimes over several, each of which had its own abbot as well. Cassian speaks of an abbot of the Thebaid who had 500 monks under him, a number exceeded in other cases. By the rule of St Benedict, which, until the reform of Cluny, was the norm in the West, the abbot has jurisdiction over only one community. The rule, as was inevitable, was subject to frequent violations; but it was not until the foundation of the Cluniac Order that the idea of a supreme abbot, exercising jurisdiction over all the houses of an order, was definitely recognized. New styles were devised to express this new relation; thus the abbot of Monte Cassino was called *abbas abbatum*, while the chiefs of other orders had the titles *abbas generalis*, or *magister* or *minister generalis*.

Monks, as a rule, were laymen, nor at the outset was the abbot any exception. All orders of clergy, therefore, even the "doorkeeper," took precedence of him. For the reception of the sacraments, and for other religious offices, the abbot and his monks were commanded to attend the nearest church (*Novellae*, 133, c. ii.). This rule naturally proved inconvenient when a monastery was situated in a desert or at a distance from a city, and necessity compelled the ordination of abbots. This innovation was not introduced without a struggle, ecclesiastical dignity being regarded as inconsistent with the higher spiritual life, but, before the close of the 5th century, at least in the East, abbots seem almost universally to have become deacons, if not presbyters. The change spread more slowly in the West, where the office of abbot was commonly filled by laymen till the end of the 7th century, and partially so up to the 11th. Ecclesiastical councils were, however, attended by abbots. Thus at that held at Constantinople, A.D. 448, for the condemnation of Eutyches, 23 archimandrites or abbots sign, with 30 bishops, and, *c.* A.D 690, Archbishop Theodore promulgated a canon, inhibiting bishops from compelling abbots to attend councils. Examples are not uncommon in Spain and in England in Saxon times. Abbots were permitted by the second council of Nicaea, A.D. 787, to ordain their monks to the inferior orders. This rule was adopted in the West, and the strong prejudice against clerical monks having gradually broken down, eventually monks, almost without exception, took holy orders.

Abbots were originally subject to episcopal jurisdiction, and continued generally so, in fact, in the West till the 11th century. The Code of Justinian (lib. i. tit. iii. de Ep. leg. xl.) expressly subordinates the abbot to episcopal oversight. The first case recorded of the partial exemption of an abbot from episcopal control is that of Faustus, abbot of Lerins, at the council of Arles, A.D. 456; but the exorbitant claims and exactions of bishops, to which this repugnance to episcopal control is to be traced, far more than to the arrogance of abbots, rendered it increasingly frequent, and, in the 6th century, the practice of exempting religious houses partly or altogether from episcopal control, and making them responsible to the pope alone, received an impulse from Gregory the Great. These exceptions, introduced with a good object, had grown into a widespread evil by the 12th century, virtually creating an *imperium in imperio*, and depriving the bishop of all authority over the chief centres of influence in his diocese. In the 12th century the abbots of Fulda claimed precedence of the archbishop of Cologne. Abbots more and more assumed almost episcopal state, and in defiance of the prohibition of early councils and the protests of St Bernard and others, adopted the episcopal insignia of mitre, ring, gloves and sandals. It has been maintained that the right to wear mitres was sometimes granted by the popes to abbots before the 11th century, but the documents on which this claim is based are not genuine (J. Braun, *Liturgische Gewandung*, p. 453). The first undoubted instance is the bull by which Alexander II. in 1063 granted the use of the mitre to Egelsinus, abbot of the monastery of St Augustine at Canterbury (see MITRE). The mitred abbots in England were those of Abingdon, St Alban's, Bardney, Battle, Bury St Edmund's, St Augustine's Canterbury, Colchester, Croyland, Evesham, Glastonbury, Gloucester, St Benet's Hulme, Hyde, Malmesbury, Peterborough, Ramsey, Reading, Selby, Shrewsbury, Tavistock, Thorney, Westminster, Winchcombe, St Mary's York. Of these the precedence was originally yielded to the abbot of Glastonbury, until in A.D. 1154 Adrian IV. (Nicholas Breakspear) granted it to the abbot of St Alban's, in which monastery he had been brought up. Next after the abbot of St Alban's ranked the abbot of Westminster. To distinguish abbots from bishops, it was ordained that their mitre should be made of less costly materials, and should not be ornamented with gold, a rule which was soon entirely disregarded, and that the crook of their pastoral staff should turn inwards instead of outwards, indicating that their jurisdiction was limited to their own house.

The adoption of episcopal insignia by abbots was followed by an encroachment on episcopal functions, which had to be specially but ineffectually guarded against by the Lateran council, A.D. 1123. In the East, abbots, if in priests' orders, with the consent of the bishop, were, as we have seen, permitted by the second Nicene council, A.D. 787, to confer the tonsure and admit to the order of reader; but gradually abbots, in the West also, advanced higher claims, until we find them in A.D. 1489 permitted by Innocent IV. to confer both the subdiaconate and diaconate. Of course, they always and everywhere had the power of admitting their own monks and vesting them with the religious habit.

When a vacancy occurred, the bishop of the diocese chose the abbot out of the monks of the convent, but the right of election was transferred by jurisdiction to the monks themselves, reserving to the bishop the confirmation of the election and the benediction of the new abbot. In abbeys exempt from episcopal jurisdiction, the confirmation and benediction had to be conferred by the pope in person, the house being taxed with the expenses of the new abbot's journey to Rome. By the rule of St Benedict, the consent of the laity was in some undefined way required; but this seems never to have been practically enforced. It was necessary that an abbot should be at least 25 years of age, of legitimate birth, a monk of the house, unless it furnished no suitable candidate, when a liberty was allowed of electing from another convent, well instructed himself, and able to instruct others, one also who had learned how to command by having practised obedience. In some exceptional cases an abbot was allowed to name his own successor. Cassian speaks of an abbot in Egypt doing this; and in later times we have another example in the case of St Bruno. Popes and sovereigns gradually encroached on the rights of the monks, until in Italy the pope had usurped the nomination of all abbots, and the king in France, with the exception of Cluny, Prémontré and other houses, chiefs of their order. The election was for life, unless the abbot was canonically deprived by the chiefs of his order, or when he was directly subject to them, by the pope or the bishop.

The ceremony of the formal admission of a Benedictine abbot in medieval times is thus prescribed by the consuetudinary of Abingdon. The newly elected abbot was to put off his shoes at the door of the church, and proceed barefoot to meet the members of the house advancing in a procession. After proceeding up the nave, he was to kneel and pray at the topmost step of the entrance of the choir, into which he was to be introduced by the bishop or his commissary, and placed in his stall. The monks, then kneeling, gave him the kiss of peace on the hand, and rising, on the mouth, the abbot holding his staff of office. He then put on his shoes in the vestry, and a chapter was held, and the bishop or his commissary preached a suitable sermon.

The power of the abbot was paternal but absolute, limited, however, by the canons of the church, and, until the general establishment of exemptions, by episcopal control. As a rule, however, implicit obedience was enforced; to act without his orders was culpable; while it was a sacred duty to execute his orders, however unreasonable, until they were withdrawn. Examples among the Egyptian monks of this blind submission to the commands of the superiors, exalted into a virtue by those who regarded the entire crushing of the individual will as the highest excellence, are detailed by Cassian and others,—*e.g.* a monk watering a dry stick, day after day, for months, or endeavouring to remove a huge rock immensely exceeding his powers. St Jerome, indeed, lays down, as the principle of the compact between the abbot and his monks, that they should obey their superiors in all things, and perform whatever they commanded (Ep. 2, *ad Eustoch. de custod. virgin.*). So despotic did the tyranny become in the West, that in the time of Charlemagne it was necessary to restrain abbots by legal enactments from mutilating their monks and putting out their eyes; while the rule of St Columban ordained 100 lashes as the punishment for very slight offences. An abbot also had the power of excommunicating refractory nuns, which he might use if desired by their abbess.

The abbot was treated with the utmost submission and reverence by the brethren of his house. When he appeared either in church or chapter all present rose and bowed. His letters were received kneeling, like those of the pope and the king. If he gave a command, the monk receiving it was also to kneel. No monk might sit in his presence, or leave it without his permission. The highest place was naturally assigned to him, both in church and at table. In the East he was commanded to eat with the other monks. In the West the rule of St Benedict appointed him a separate table, at which he might entertain guests and strangers. This permission opening the door to luxurious living, the council of Aix, A.D. 817, decreed that the abbot should dine in the refectory, and be content with the ordinary fare of the monks, unless he had to entertain a guest. These ordinances proved, however, generally ineffectual to secure strictness of diet, and contemporaneous literature abounds with satirical remarks and complaints concerning the inordinate extravagance of the tables of the abbots. When the abbot condescended to dine in the refectory, his chaplains waited upon him with the dishes, a servant, if necessary, assisting them. At St Alban's the abbot took the lord's seat, in the centre of the high table, and was served on silver plate, and sumptuously entertained noblemen, ambassadors and strangers of quality. When abbots dined in their own private hall, the rule of St Benedict charged them to invite their monks to their table, provided there was room, on which occasions the guests were to abstain from quarrels, slanderous talk and idle gossiping.

The ordinary attire of the abbot was according to rule to be the same as that of the monks. But by the 10th century the rule was commonly set aside, and we find frequent complaints of abbots dressing in silk, and adopting sumptuous attire. They sometimes even laid aside the monastic habit altogether, and assumed a secular dress.[1] This was a necessary consequence of their following the chase, which was quite usual, and indeed at that time only natural. With the increase of wealth and power, abbots had lost much of their special religious character, and become great lords, chiefly distinguished from lay lords by celibacy. Thus we hear of abbots going out to sport, with their men carrying bows and arrows; keeping horses, dogs and huntsmen; and special mention is made of an abbot of Leicester, *c.* 1360, who was the most skilled of all the nobility in hare-hunting. In magnificence of equipage and retinue the abbots vied with the first nobles of the realm. They rode on mules with gilded bridles, rich saddles and housings, carrying hawks on their wrist, followed by an immense train of attendants. The bells of the churches were rung as they passed. They associated on equal terms with laymen of the highest distinction, and shared all their pleasures and pursuits. This rank and power was, however, often used most beneficially. For instance, we read of Whiting, the last abbot of Glastonbury, judicially murdered by Henry VIII., that his house was a kind of well-ordered court, where as many as 300 sons of noblemen and gentlemen, who had been sent to him for virtuous education, had been brought up, besides others of a meaner rank, whom he fitted for the universities. His table, attendance and officers were an honour to the nation. He would entertain as many as 500 persons of rank at one time, besides relieving the poor of the vicinity twice a week. He had his country houses and fisheries, and when he travelled to attend parliament his retinue amounted to upwards of 100 persons. The abbots of Cluny and Vendôme were, by virtue of their office, cardinals of the Roman church.

In process of time the title abbot was improperly transferred to clerics who had no connexion with the monastic system, as to the principal of a body of parochial clergy; and under the Carolingians to the chief chaplain of the king, *Abbas Curiae*, or military chaplain of the emperor, *Abbas Castrensis*. It even came to be adopted by purely secular officials. Thus the chief magistrate of the republic at Genoa was called *Abbas Populi*. Du Cange, in his glossary, also gives us *Abbas Campanilis, Clocherii, Palatii, Scholaris*, &c.

Lay abbots (M. Lat. *defensores*, *abbacomites*, *abbates laici*, *abbates milites*, *abbates saeculares* or *irreligiosi*, *abbatiarii*, or sometimes simply *abbates*) were the outcome of the growth of the feudal system from the 8th century onwards. The practice of *commendation*, by which—to meet a contemporary emergency—the revenues of the community were handed over to a lay lord, in return for his protection, early suggested to the emperors and kings the expedient of rewarding their warriors with rich abbeys held *in commendam*. During the Carolingian epoch the custom grew up of granting these as regular heritable fiefs or benefices, and by the 10th century, before the great Cluniac reform, the system was firmly established. Even the abbey of St Denis was held *in commendam* by Hugh Capet. The example of the kings was followed by the feudal nobles, sometimes by making a temporary concession permanent, sometimes without any form of commendation whatever. In England the abuse was rife in the 8th century, as may be gathered from the acts of the council of Cloveshoe. These lay abbacies were not merely a question of overlordship, but implied the concentration in lay hands of all the rights, immunities and jurisdiction of the foundations, *i.e.* the more or less complete secularization of spiritual institutions. The lay abbot took his recognized rank in the feudal hierarchy, and was free to dispose of his fief as in the case of any other. The enfeoffment of abbeys differed in form and degree. Sometimes the monks were directly subject to the lay abbot; sometimes he appointed a substitute to perform the spiritual functions, known usually as dean (*decanus*), but also as abbot (*abbas legitimus, monasticus, regularis*). When the great reform of the 11th century had put an end to the direct jurisdiction of the lay abbots, the honorary title of abbot continued to be held by certain of the great feudal families, as late as the 13th century and later, the actual head of the community retaining that of dean. The connexion of the lesser lay abbots with the abbeys, especially in the south of France, lasted longer; and certain feudal families retained the title of *abbés chevaliers* (abbates milites) for centuries, together with certain rights over the abbey lands or revenues. The abuse was not confined to the West. John, patriarch of Antioch, at the beginning of the 12th century, informs us that in his time most monasteries had been handed over to laymen, *beneficiarii*, for life, or for part of their lives, by the emperors.

In conventual cathedrals, where the bishop occupied the place of the abbot, the functions usually devolving on the superior of the monastery were performed by a prior.

The title *abbé* (Ital. *abbate*), as commonly used in the Catholic church on the European continent, is the equivalent of the English "Father," being loosely applied to all who have received the tonsure. This use of the title is said to have originated in the right conceded to the king of France, by the concordat between Pope Leo X. and Francis I. (1516), to appoint *abbés commendataires* to most of the abbeys in France. The expectation of obtaining these sinecures drew young men towards the church in considerable numbers, and the class of abbés so formed—*abbés de cour* they were sometimes called, and sometimes (ironically) *abbés de sainte espérance*, abbés of St Hope—came to hold a recognized position. The connexion many of them had with the church was of the slenderest kind, consisting mainly in adopting the name of *abbé*, after a remarkably moderate course of theological study, practising celibacy and wearing a distinctive dress—a short dark-violet coat with narrow collar. Being men of presumed learning and undoubted leisure, many of the class found admission to the houses of the French nobility as tutors or advisers. Nearly every great family had its abbé. The class did not survive the Revolution; but the courtesy title of abbé, having long lost all connexion in people's minds with any special ecclesiastical function, remained as a convenient general term applicable to any clergyman.

In the German Evangelical church the title of abbot (*Abt*) is sometimes bestowed, like *abbé*, as an honorary distinction, and sometimes survives to designate the heads of monasteries converted at the Reformation into collegiate foundations. Of these the most noteworthy is the abbey of Lokkum in Hanover, founded as a Cistercian house in 1163 by Count Wilbrand of Hallermund, and reformed in 1593. The abbot of Lokkum, who still carries a pastoral staff, takes precedence of all the clergy of Hanover, and is *ex officio* a member of the consistory of the kingdom. The governing body of the abbey consists of abbot, prior and the "convent" of canons (*Stiftsherren*).

See Joseph Bingham, *Origines ecclesiasticae* (1840); Du Cange, *Glossarium med. et inf. Lat.* (ed. 1883); J. Craigie Robertson, *Hist. of the Christian Church* (1858–1873); Edmond Martène, *De antiquis ecclesiae ritibus* (Venice, 1783); C. F. R. de Montalembert, *Les moines d'occident depuis S. Benoît jusqu'à S. Bernard* (1860–1877); Achille Luchaire, *Manuel des institutions françaises* (Par. 1892).

(E. V.; W. A. P.)

ABBOTSFORD, formerly the residence of Sir Walter Scott, situated on the S. bank of the Tweed, about 3 m. W. of Melrose, Roxburghshire, Scotland, and nearly 1 m. from Abbotsford Ferry station on the North British railway, connecting Selkirk and Galashiels. The nucleus of the estate was a small farm of 100 acres, called Cartleyhole, nicknamed Clarty (*i.e.* muddy) Hole, and bought by Scott on the lapse of his lease (1811) of the neighbouring house of Ashestiel. It was added to from time to time, the last and principal acquisition being that of Toftfield

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[1] Walworth, the fourth abbot of St Alban's, *c.* 930, is charged by Matthew Paris with adopting the attire of a sportsman.

(afterwards named Huntlyburn), purchased in 1817. The new house was then begun and completed in 1824. The general ground-plan is a parallelogram, with irregular outlines, one side overlooking the Tweed; and the style is mainly the Scottish Baronial. Into various parts of the fabric were built relics and curiosities from historical structures, such as the doorway of the old Tolbooth in Edinburgh. Scott had only enjoyed his residence one year when (1825) he met with that reverse of fortune which involved the estate in debt. In 1830 the library and museum were presented to him as a free gift by the creditors. The property was wholly disencumbered in 1847 by Robert Cadell, the publisher, who cancelled the bond upon it in exchange for the family's share in the copyright of Sir Walter's works. Scott's only son Walter did not live to enjoy the property, having died on his way from India in 1847. Among subsequent possessors were Scott's son-in-law, J. G. Lockhart, J. R. Hope Scott, Q.C., and his daughter (Scott's great-granddaughter), the Hon. Mrs Maxwell Scott. Abbotsford gave its name to the "Abbotsford Club," a successor of the Bannatyne and Maitland clubs, founded by W. B. D. D. Turnbull in 1834 in Scott's honour, for printing and publishing historical works connected with his writings. Its publications extended from 1835 to 1864.

See Lockhart, *Life of Scott*; Washington Irving, *Abbotsford and Newstead Abbey*; W. S. Crockett, *The Scott Country*.

ABBOTT, EDWIN ABBOTT (1838–), English schoolmaster and theologian, was born on the 20th of December 1838. He was educated at the City of London school and at St John's College, Cambridge, where he took the highest honours in the classical, mathematical and theological triposes, and became fellow of his college. In 1862 he took orders. After holding masterships at King Edward's School, Birmingham, and at Clifton College, he succeeded G. F. Mortimer as headmaster of the City of London school in 1865 at the early age of twenty-six. He was Hulsean lecturer in 1876. He retired in 1889, and devoted himself to literary and theological pursuits. Dr Abbott's liberal inclinations in theology were prominent both in his educational views and in his books. His *Shakespearian Grammar* (1870) is a permanent contribution to English philology. In 1885 he published a life of Francis Bacon. His theological writings include three anonymously published religious romances—*Philochristus* (1878), *Onesimus* (1882), *Silanus* (1906). More weighty contributions are the anonymous theological discussion *The Kernel and the Husk* (1886), *Philomythus* (1891), his book on *Cardinal Newman as an Anglican* (1892), and his article "The Gospels" in the ninth edition of the *Encyclopaedia Britannica*, embodying a critical view which caused considerable stir in the English theological world; he also wrote *St Thomas of Canterbury, his Death and Miracles* (1898), *Johannine Vocabulary* (1905), *Johannine Grammar* (1906).

His brother, Evelyn Abbott (1843–1901), was a well-known tutor of Balliol, Oxford, and author of a scholarly *History of Greece.*

ABBOTT, EMMA (1849–1891), American singer, was born at Chicago and studied in Milan and Paris. She had a fine soprano voice, and appeared first in opera in London under Colonel Mapleson's direction at Covent Garden, also singing at important concerts. She organized an opera company known by her name, and toured extensively in the United States, where she had a great reputation. In 1873 she married E. J. Wetherell. She died at Salt Lake City on the 5th of January 1891.

ABBOTT, JACOB (1803–1879), American writer of books for the young, was born at Hallowell, Maine, on the 14th of November 1803. He graduated at Bowdoin College in 1820; studied at Andover Theological Seminary in 1821, 1822, and 1824; was tutor in 1824–1825, and from 1825 to 1829 was professor of mathematics and natural philosophy in Amherst College; was licensed to preach by the Hampshire Association in 1826; founded the Mount Vernon School for young ladies in Boston in 1829, and was principal of it in 1829–1833; was pastor of Eliot Congregational Church (which he founded), at Roxbury, Mass., in 1834–1835; and was, with his brothers, a founder, and in 1843–1851 a principal of Abbott's Institute, and in 1845–1848 of the Mount Vernon School for boys, in New York City. He was a prolific author, writing juvenile stories, brief histories and biographies, and religious books for the general reader, and a few works in popular science. He died on the 31st of October 1879 at Farmington, Maine, where he had spent part of his time since 1839, and where his brother Samuel Phillips Abbott founded in 1844 the Abbott School, popularly called "Little Blue." Jacob Abbott's "Rollo Books"—*Rollo at Work*, *Rollo at Play*, *Rollo in Europe*, &c. (28 vols.)—are the best known of his writings, having as their chief characters a representative boy and his associates. In them Abbott did for one or two generations of young American readers a service not unlike that performed earlier, in England and America, by the authors of *Evenings at Home*, *Sandford and Merton*, and the *Parent's Assistant*. Of his other writings (he produced more than two hundred volumes in all), the best are the *Franconia Stories* (10 vols.), twenty-two volumes of biographical histories in a series of thirty-two volumes (with his brother John S. C. Abbott), and the *Young Christian*,—all of which had enormous circulations.

His sons, Benjamin Vaughan Abbott (1830–1890), Austin Abbott (1831–1896), both eminent lawyers, Lyman Abbott (*q.v.*), and Edward Abbott (1841–1908), a clergyman, were also well-known authors.

See his *Young Christian, Memorial Edition, with a Sketch of the Author by one of his sons, i.e.* Edward Abbott (New York, 1882), with a bibliography of his works.

ABBOTT, JOHN STEVENS CABOT (1805–1877), American writer, was born in Brunswick, Maine, on the 18th of September 1805. He was a brother of Jacob Abbott, and was associated with him in the management of Abbott's Institute, New York City, and in the preparation of his series of brief historical biographies. He is best known, however, as the author of a partisan and unscholarly, but widely popular and very readable *History of Napoleon Bonaparte* (1855), in which the various elements and episodes in Napoleon's career are treated with some skill in arrangement, but with unfailing adulation. Dr Abbott graduated at Bowdoin College in 1825, prepared for the ministry at Andover Theological Seminary, and between 1830 and 1844, when he retired from the ministry, preached successively at Worcester, Roxbury and Nantucket, Massachusetts. He died at Fair Haven, Connecticut, on the 17th of June 1877. He was a voluminous writer of books on Christian ethics, and of histories, which now seem unscholarly and untrustworthy, but were valuable in their time in cultivating a popular interest in history. In general, except that he did not write juvenile fiction, his work in subject and style closely resembles that of his brother, Jacob Abbott.

ABBOTT, LYMAN (1835–), American divine and author, was born at Roxbury, Massachusetts, on the 18th of December 1835, the son of Jacob Abbott. He graduated at the University of New York in 1853, studied law, and was admitted to the bar in 1856; but soon abandoned the legal profession, and, after studying theology with his uncle, J. S. C. Abbott, was ordained a minister of the Congregational Church in 1860. He was pastor of a church in Terre Haute, Indiana, in 1860–1865, and of the New England Church in New York City in 1865–1869. From 1865 to 1868 he was secretary of the American Union (Freedman's) Commission. In 1869 he resigned his pastorate to devote himself to literature. He was an associate editor of *Harper's Magazine*, was editor of the *Illustrated Christian Weekly*, and was co-editor (1876–1881) of *The Christian Union* with Henry Ward Beecher, whom he succeeded in 1888 as pastor of Plymouth Church, Brooklyn. From this pastorate he resigned ten years later. From 1881 he was editor-in-chief of *The Christian Union*, renamed *The Outlook* in 1893; this periodical reflected his efforts toward social reform, and, in theology, a liberality, humanitarian and nearly unitarian. The latter characteristics marked his published works also.

His works include *Jesus of Nazareth* (1869); *Illustrated Commentary on the New Testament* (4 vols., 1875); *A Study in Human Nature* (1885); *Life of Christ* (1894); *Evolution of Christianity* (Lowell Lectures, 1896); *The Theology of an Evolutionist* (1897); *Christianity and Social Problems* (1897); *Life and Letters of Paul* (1898);

The Life that Really is (1899); *Problems of Life* (1900); *The Rights of Man* (1901); *Henry Ward Beecher* (1903); *The Christian Ministry* (1905); *The Personality of God* (1905); *Industrial Problems* (1905); and *Christ's Secret of Happiness* (1907). He edited *Sermons of Henry Ward Beecher* (2 vols., 1868).

ABBOTTABAD, a town of British India, 4120 ft. above sea-level, 63 m. from Rawalpindi, the headquarters of the Hazara district in the N.W. Frontier Province, called after its founder, Sir James Abbott, who settled this wild district after the annexation of the Punjab. It is an important military cantonment and sanatorium, being the headquarters of a brigade in the second division of the northern army corps. In 1901 the population of the town and cantonment was 7764.

ABBREVIATION (Lat. *brevis*, short), strictly a shortening; more particularly, an "abbreviation" is a letter or group of letters, taken from a word or words, and employed to represent them for the sake of brevity. Abbreviations, both of single words and of phrases, having a meaning more or less fixed and recognized, are common in ancient writings and inscriptions (see PALAEOGRAPHY and DIPLOMATIC), and very many are in use at the present time. A distinction is to be observed between abbreviations and the contractions that are frequently to be met with in old manuscripts, and even in early printed books, whereby letters are dropped out here and there, or particular collocations of letters represented by somewhat arbitrary symbols. The commonest form of abbreviation is the substitution for a word of its initial letter; but, with a view to prevent ambiguity, one or more of the other letters are frequently added. Letters are often doubled to indicate a plural or a superlative.

I. CLASSICAL ABBREVIATIONS.—The following list contains a selection from the abbreviations that occur in the writings and inscriptions of the Romans:—

A.

A.	Absolvo, Aedilis, Aes, Ager, Ago, Aio, Amicus, Annus, Antiquo, Auctor, Auditor, Augustus, Aulus, Aurum, Aut.
A.A.	Aes alienum, Ante audita, Apud agrum, Aurum argentum.
AA.	Augusti. AAA. Augusti tres.
A.A.A.F.F.	Auro argento aere flando feriundo.[1]
A.A.V.	Alter ambove.
A.C.	Acta causa, Alius civis.
A.D.	Ante diem; *e.g.* A.D.V. Ante diem quintum.
A.D.A.	Ad dandos agros.
AED.	Aedes, Aedilis, Aedilitas.
AEM. *and* AIM.	Aemilius, Aemilia.
AER.	Aerarium. AER.P. Aere publico.
A.F.	Actum fide, Auli filius.
AG.	Ager, Ago, Agrippa.
A.G.	Animo grato, Aulus Gellius.
A.L.AE. *and* A.L.E.	Arbitrium litis aestimandae.
A.M. *and* A.MILL.	Ad milliarium.
AN.	Aniensis, Annus, Ante.
ANN.	Annales, Anni, Annona.
ANT.	Ante, Antonius.
A.O.	Alii omnes, Amico optimo.
AP.	Appius, Apud.
A.P.	Ad pedes, Aedilitia potestate.
A.P.F.	Auro (*or* argento) publico feriundo.
A.P.M.	Amico posuit monumentum, Annorum plus minus.
A.P.R.C.	Anno post Romam conditam.
ARG.	Argentum.
AR.V.V.D.D.	Aram votam volens dedicavit, Arma votiva dono dedit.
A T.	A tergo. *Also* A TE. *and* A TER.
A.T.M.D.O.	Aio te mihi dare oportere.
AV.	Augur, Augustus, Aurelius.
A.V.	Annos vixit.
A.V.C.	Ab urbe condita.
AVG.	Augur, Augustus.
AVGG.	Augusti (*generally of two*). AVGGG. Augusti tres.
AVT.PR.R.	Auctoritas provinciae Romanorum.

B.

B.	Balbius, Balbus, Beatus, Bene, Beneficiarius, Beneficium, Bonus, Brutus, Bustum.
B. *for* V.	Berna Bivus, Bixit.
B.A.	Bixit anos, Bonis auguriis, Bonus amabilis.
BB. *or* B.B.	Bene bene, *i.e.* optime, Optimus.
B.D.	Bonae deae, Bonum datum.
B.DD.	Bonis deabus.
B.D.S.M.	Bene de se merenti.
B.F.	Bona femina, Bona fides, Bona fortuna, Bonum factum.
B.F.	Bona femina, Bona filia.
B.H.	Bona hereditaria, Bonorum heres.
B.I.	Bonum judicium. B.I.I. Boni judicis judicium.
B.M.	Beatae memoriae, Bene merenti.
B.N.	Bona nostra, Bonum nomen.
BN.H.I.	Bona hic invenies.
B.P.	Bona paterna, Bonorum potestas, Bonum publicum.
B.Q.	Bene quiescat, Bona quaesita.
B.RP.N.	Bono reipublicae natus.
BRT.	Britannicus.
B.T.	Bonorum tutor, Brevi tempore.
B.V.	Bene vale, Bene vixit, Bonus vir.
B.V.V.	Balnea vina Venus.
BX.	Bixit, *for* vixit.

C.

C.	Caesar, Caius, Caput, Causa, Censor, Civis, Cohors, Colonia, Comitialis (dies), Condemno, Consul, Cum, Curo, Custos.
Ↄ.	Caia, Centuria, Cum, *the prefix* Con.
C.B.	Civis bonus, Commune bonum, Conjugi benemerenti, Cui bono.
C.C.	Calumniae causa, Causa cognita, Conjugi carissimae, Consilium cepit, Curiae consulto.
C.C.C.	Calumniae cavendae causa.
C.C.F.	Caesar (*or* Caius) curavit faciendum, Caius Caii filius.
CC.VV.	Clarissimi viri.
C.D.	Caesaris decreto, Caius Decius, Comitialibus diebus.
CES.	Censor, Censores. CESS. Censores.
C.F.	Causa fiduciae, Conjugi fecit, Curavit faciendum.
C.H.	Custos heredum, Custos hortorum.
C.I.	Caius Julius, Consul jussit, Curavit judex.
CL.	Clarissimus, Claudius, Clodius, Colonia.
CL.V.	Clarissimus vir, Clypeum vovit.
C.M.	Caius Marius, Causa mortis.
CN.	Cnaeus.
COH.	Coheres, Cohors.
COL.	Collega, Collegium, Colonia, Columna.
COLL.	Collega, Coloni, Coloniae.
COM.	Comes, Comitium, Comparatum.
CON.	Conjux, Consensus, Consiliarius, Consul, Consularis.
COR.	Cornelia (tribus), Cornelius, Corona, Corpus.
COS.	Consiliarius, Consul, Consulares. COSS. Consules.
C.P.	Carissimus *or* Clarissimus puer, Civis publicus, Curavit ponendum.
C.R.	Caius Rufus, Civis Romanus, Curavit reficiendum.
CS.	Caesar, Communis, Consul.
C.V.	Clarissimus *or* Consularis vir.
CVR.	Cura, Curator, Curavit, Curia.

D.

D.	Dat, Dedit, &c., De, Decimus, Decius, Decretum, Decurio, Deus, Dicit, &c., Dies, Divus, Dominus, Domus, Donum.
D.C.	Decurio coloniae, Diebus comitialibus, Divus Caesar.
D.D.	Dea Dia, Decurionum decreto, Dedicavit, Deo dedit, Dono dedit.
D.D.D.	Datum decreto decurionum, Dono dedit dedicavit.
D.E.R.	De ea re.
DES.	Designatus.
D.I.	Dedit imperator, Diis immortalibus, Diis inferis.
D.I.M.	Deo invicto Mithrae, Diis inferis Manibus.
D.M.	Deo Magno, Dignus memoria, Diis Manibus, Dolo malo.
D.O.M.	Deo Optimo Maximo.
D.P.S.	Dedit proprio sumptu, Deo perpetuo sacrum, De pecunia sua.

E.

E.	Ejus, Eques, Erexit, Ergo, Est, Et, Etiam, Ex.
EG.	Aeger, Egit, Egregius.
E.M.	Egregiae memoriae, Ejusmodi, Erexit monumentum.
EQ.M.	Equitum magister.
E.R.A.	Ea res agitur.

F.

F.	Fabius, Facere, Fecit, &c., Familia, Fastus (dies), Felix, Femina, Fides, Filius, Flamen, Fortuna, Frater, Fuit, Functus.
F.C.	Faciendum curavit, Fidei commissum, Fiduciae causa.
F.D.	Fidem dedit, Flamen Dialis, Fraude donavit.
F.F.F.	Ferro flamma fame, Fortior fortuna fato.
FL.	Filius, Flamen, Flaminius, Flavius.
F.L.	Favete linguis, Fecit libens, Felix liber.
FR.	Forum, Fronte, Frumentarius.
F.R.	Forum Romanum.

G.

G.	Gaius (=Caius), Gallia, Gaudium, Gellius, Gemina, Gens, Gesta, Gratia.
G.F.	Gemina fidelis (*applied to a legion*). *So* G.P.F. Gemina pia fidelis.

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[1] Describing the function of the *triumviri monetales*.

GL.	Gloria.
GN.	Genius, Gens, Genus, Gnaeus (=Cnaeus).
G.P.R.	Genio populi Romani.

H.

H.	Habet, Heres, Hic, Homo, Honor, Hora.
HER.	Heres, Herennius. HER. *and* HERC. Hercules.
H.L.	Hac lege, Hoc loco, Honesto loco.
H.M.	Hoc monumentum, Honesta mulier, Hora mala.
H.S.E.	Hic sepultus est, Hic situs est.
H.V.	Haec urbs, Hic vivit, Honeste vixit, Honestus vir.

I.

I.	Immortalis, Imperator, In, Infra, Inter, Invictus, Ipse, Isis, Judex, Julius, Junius, Jupiter, Justus.
IA.	Jam, Intra.
I.C.	Julius Caesar, Juris Consultum, Jus civile.
ID.	Idem, Idus, Interdum.
I.D.	Inferis diis, Jovi dedicatum, Jus dicendum, Jussu Dei.
I.D.M.	Jovi deo magno.
I.F.	In foro, In fronte.
I.H.	Jacet hic, In honestatem, Justus homo.
IM.	Imago, Immortalis, Immunis, Impensa.
IMP.	Imperator, Imperium.
I.O.M.	Jovi optimo maximo.
I.P.	In publico, Intra provinciam, Justa persona.
I.S.V.P.	Impensa sua vivus posuit.

K.

K.	Kaeso, Caia, Calumnia, Caput, Carus, Castra.
K., KAL. *and* KL.	Kalendae.

L.

L.	Laelius, Legio, Lex, Libens, Liber, Libra, Locus, Lollius, Lucius, Ludus.
LB.	Libens, Liberi, Libertus.
L.D.D.D.	Locus datus decreto decurionum.
LEG.	Legatus, Legio.
LIB.	Liber, Liberalitas, Libertas, Libertus, Librarius.
LL.	Leges, Libentissime, Liberti.
L.M.	Libens merito, Locus monumenti.
L.S.	Laribus sacrum, Libens solvit, Locus sacer.
LVD.	Ludus.
LV.P.F.	Ludos publicos fecit.

M.

M.	Magister, Magistratus, Magnus, Manes, Marcus, Marius, Marti, Mater, Memoria, Mensis, Miles, Monumentum, Mortuus, Mucius, Mulier.
M'.	Manius.
M.D.	Magno Deo, Manibus diis, Matri deum, Merenti dedit.
MES.	Mensis. MESS. Menses.
M.F.	Mala fides, Marci filius, Monumentum fecit.
M.I.	Matri Idaeae, Matri Isidi, Maximo Jovi.
MNT. *and* MON.	Moneta.
M.P.	Male positus, Monumentum posuit.
M.S.	Manibus sacrum, Memoriae sacrum, Manu scriptum.
MVN.	Municeps, *or* municipium; *so also* MN., MV. *and* MVNIC.
M.V.S.	Marti ultori sacrum, Merito votum solvit.

N.

N.	Natio, Natus, Nefastus (dies), Nepos, Neptunus, Nero, Nomen, Non, Nonae, Noster, Novus, Numen, Numerius, Numerus, Nummus.
NEP.	Nepos, Neptunus.
N.F.C.	Nostrae fidei commissum.
N.L.	Non licet, Non liquet, Non longe.
N.M.V.	Nobilis memoriae vir.
NN.	Nostri. NN., NNO. *and* NNR. Nostrorum.
NOB.	Nobilis. NOB., NOBR. *and* NOV. Novembris.
N.P.	Nefastus primo (*i.e.* priore parte diei), Non potest.

O.

O.	Ob, Officium, Omnis, Oportet, Optimus, Opus, Ossa.
OB.	Obiit, Obiter, Orbis.
O.C.S.	Ob cives servatos.
O.H.F.	Omnibus honoribus functus.
O.H.S.S.	Ossa hic sita sunt.
OR.	Hora, Ordo, Ornamentum.
O.T.B.Q.	Ossa tua bene quiescant.

P.

P.	Pars, Passus, Pater, Patronus, Pax, Perpetuus, Pes, Pius, Plebs, Pondo, Populus, Post, Posuit, Praeses, Praetor, Primus, Pro, Provincia, Publicus, Publius, Puer.
P.C.	Pactum conventum, Patres conscripti, Pecunia constituta, Ponendum curavit, Post consulatum, Potestate censoria.
P.F.	Pia fidelis, Pius felix, Promissa fides, Publii filius.
P.M.	Piae memoriae, Plus minus, Pontifex maximus.
P.P.	Pater patratus, Pater patriae, Pecunia publica, Praepositus, Primipilus, Propraetor.
PR.	Praeses, Praetor, Pridie, Princeps.
P.R.	Permissu reipublicae, Populus Romanus.
P.R.C.	Post Romam conditam.
PR.PR.	Praefectus praetorii, Propraetor.
P.S.	Pecunia sua, Plebiscitum, Proprio sumptu, Publicae saluti.
P.V.	Pia victrix, Praefectus urbi, Praestantissimus vir.

Q.

Q.	Quaestor, Quando, Quantus, Que, Qui, Quinquennalis, Quintus, Quirites.
Q.D.R.	Qua de re.
Q.I.S.S.	Quae infra scripta sunt; *so* Q.S.S.S. Quae supra, &c.
QQ.	Quaecunque, Quinquennalis, Quoque.
Q.R.	Quaestor reipublicae.

R.

R.	Recte, Res, Respublica, Retro, Rex, Ripa, Roma, Romanus, Rufus, Rursus.
R.C.	Romana civitas, Romanus civis.
RESP. *and* RP.	Respublica.
RET.P. *and* RP.	Retro pedes.

S.

S.	Sacrum, Scriptus, Semis, Senatus, Sepultus, Servius, Servus, Sextus, Sibi, Sine, Situs, Solus, Solvit, Sub, Suus.
SAC.	Sacerdos, Sacrificium, Sacrum.
S.C.	Senatus consultum.
S.D.	Sacrum diis, Salutem dicit, Senatus decreto, Sententiam dedit.
S.D.M.	Sacrum diis Manibus, Sine dolo malo.
SER.	Servius, Servus.
S.E.T.L.	Sit ei terra levis.
SN.	Senatus, Sententia, Sine.
S.P.	Sacerdos perpetua, Sine pecunia, Sua pecunia.
S.P.Q.R.	Senatus populusque Romanus.
S.S.	Sanctissimus senatus, Supra scriptum.
S.V.B.E.E.Q.V.	Si vales bene est, ego quidem valeo.

T.

T.	Terminus, Testamentum, Titus, Tribunus, Tu, Turma, Tutor.
TB., TI. *and* TIB.	Tiberius.
TB., TR. *and* TRB.	Tribunus.
T.F.	Testamentum fecit, Titi filius, Titulum fecit, Titus Flavius.
TM.	Terminus, Testamentum, Thermae.
T.P.	Terminum posuit, Tribunicia potestate, Tribunus plebis.
TVL.	Tullius, Tullus.

V.

V.	Urbs, Usus, Uxor, Vale, Verba, Vestalis, Vester, Vir, Vivus, Vixit, Volo, Votum.
V.A.	Veterano assignatus, Vixit annos.
V.C.	Vale conjux, Vir clarissimus, Vir consularis.
V.E.	Verum etiam, Vir egregius, Visum est.
V.F.	Usus fructus, Verba fecit, Vivus fecit.
V.P.	Urbis praefectus, Vir perfectissimus, Vivus posuit.
V.R.	Urbs Roma, Uti rogas, Votum reddidit.

II. MEDIEVAL ABBREVIATIONS.—Of the different kinds of abbreviations in use in the middle ages, the following are examples:—

A.M.	Ave Maria.
B.P.	Beatus Paulus, Beatus Petrus.
CC.	Carissimus (*also plur.* Carissimi), Clarissimus, Circum.
D.	Deus, Dominicus, Dux.
D.N.PP.	Dominus noster Papa.
FF.	Felicissimus, Fratres, Pandectae (*prob. for Gr.* II).
I.C. *or* I.X.	Jesus Christus.
I.D.N.	In Dei nomine.
KK.	Karissimus (*or* -mi).
MM.	Magistri, Martyres, Matrimonium, Meritissimus.
O.S.B.	Ordinis Sancti Benedicti.
PP.	Papa, Patres, Piissimus.
R.F.	Rex Francorum.
R.P.D.	Reverendissimus Pater Dominus.
S.C.M.	Sacra Caesarea Majestas.
S.M.E.	Sancta Mater Ecclesia.
S.M.M.	Sancta Mater Maria.
S.R.I.	Sanctum Romanum Imperium.
S.V.	Sanctitas Vestra, Sancta Virgo.
V.	Venerabilis, Venerandus.
V.R.P.	Vestra Reverendissima Paternitas.

III. ABBREVIATIONS NOW IN USE.—The import of these will often be readily understood from the connexion in which they occur. There is no occasion to explain here the common abbreviations used for Christian names, books of Scripture, months of the year, points of the compass, grammatical and mathematical terms, or familiar titles, like "Mr," &c.

The ordinary abbreviations, now or recently in use, may be conveniently classified under the following headings:—

1. ABBREVIATED TITLES AND DESIGNATIONS.

A.A.	Associate of Arts.
A.B.	Able-bodied seaman; (in America) Bachelor of Arts.
A.D.C.	Aide-de-Camp.
A.M.	(*Artium Magister*), Master of Arts.
A.R.A.	Associate of the Royal Academy.
A.R.I.B.A.	Associate of the Royal Institution of British Architects.
A.R.S.A.	Associate of the Royal Scottish Academy.
B.A.	Bachelor of Arts.
Bart.	Baronet.
B.C.L.	Bachelor of Civil Law.
B.D.	Bachelor of Divinity.
B.LL.	Bachelor of Laws.
B.Sc.	Bachelor of Science.
C.	Chairman.
C.A.	Chartered Accountant.
C.B.	Companion of the Bath.
C.E.	Civil Engineer.
C.I.E.	Companion of the Order of the Indian Empire.
C.M.	(*Chirurgiae Magister*), Master in Surgery.
C.M.G.	Companion of St Michael and St George.
C.S.I.	Companion of the Star of India.
D.C.L.	Doctor of Civil Law.
D.D.	Doctor of Divinity.
D.Lit. *or* Litt. D.	Doctor of Literature.
D.M.	Doctor of Medicine (Oxford).
D.Sc.	Doctor of Science.
D.S.O.	Distinguished Service Order.
Ebor.	(*Eboracensis*) of York.[1]
F.C.S.	Fellow of the Chemical Society.
F.D.	(*Fidei Defensor*), Defender of the Faith.
F.F.P.S.	Fellow of the Faculty of Physicians and Surgeons (Glasgow).
F.G.S.	Fellow of the Geological Society.
F.K.Q.C.P.I.	Fellow of King and Queen's College of Physicians in Ireland.
F.L.S.	Fellow of the Linnaean Society.
F.M.	Field Marshal.
F.P.S.	Fellow of the Philological Society.
F.R.A.S.	Fellow of the Royal Astronomical Society.
F.R C.P.	Fellow of the Royal College of Physicians.
F.R.C.P.E.	Fellow of the Royal College of Physicians of Edinburgh.
F.R.C.S.	Fellow of the Royal College of Surgeons.
F.R.G.S.	Fellow of the Royal Geographical Society.
F.R.H.S.	Fellow of the Royal Horticultural Society.
F.R.Hist.Soc.	Fellow of the Royal Historical Society.
F.R.I.B.A.	Fellow of the Royal Institution of British Architects.
F.R.S.	Fellow of the Royal Society.
F.R.S.E.	Fellow of the Royal Society of Edinburgh.
F.R.S.L.	Fellow of the Royal Society of Literature.
F.S.A.	Fellow of the Society of Antiquaries.
F.S.S.	Fellow of the Statistical Society.
F.Z.S.	Fellow of the Zoological Society.
G.C.B.	Knight Grand Cross of the Bath.
G.C.H.	Knight Grand Cross of Hanover.
G.C.I.E.	Knight Grand Commander of the Order of the Indian Empire.
G.C.M.G.	Knight Grand Cross of St Michael and St George.
G.C.S.I.	Knight Grand Commander of the Star of India.
G.C.V.O.	Knight Grand Commander of the Victorian Order.
H.H.	His or Her Highness.
H.I.H.	His or Her Imperial Highness.
H.I.M.	His or Her Imperial Majesty.
H.M.	His or Her Majesty.
H.R.H.	His or Her Royal Highness.
H.S.H.	His or Her Serene Highness.
J.	Judge.
J.C.D.	(*Juris Canonici Doctor*, or *Juris Civilis Doctor*), Doctor of Canon or Civil Law.
J.U.D.	(*Juris utriusque Doctor*), Doctor of Civil and Canon Law.
J.P.	Justice of the Peace.
K.C.	King's Counsel.
K.C.B.	Knight Commander of the Bath.
K.C.I.E.	Knight Commander of the Order of the Indian Empire.
K.C.M.G.	Knight Commander of St Michael and St George.
K.C.S.I.	Knight Commander of the Star of India.
K.C.V.O.	Knight Commander of the Victorian Order.
K.G.	Knight of the Garter.
K.P.	Knight of St Patrick.
K.T.	Knight of the Thistle.
L.A.H.	Licentiate of the Apothecaries' Hall.
L.C.C.	London County Council, or Councillor.
L.C.J.	Lord Chief Justice.
L.J.	Lord Justice.
L.L.A.	Lady Literate in Arts.
LL.B.	(*Legum Baccalaureus*), Bachelor of Laws.
LL.D.	(*Legum Doctor*), Doctor of Laws.
LL.M.	(*Legum Magister*), Master of Laws.
L.R.C.P.	Licentiate of the Royal College of Physicians.
L.R.C.S.	Licentiate of the Royal College of Surgeons.
L.S.A.	Licentiate of the Apothecaries' Society.
M.A.	Master of Arts.
M.B.	(*Medicinae Baccalaureus*), Bachelor of Medicine
M.C.	Member of Congress.
M.D.	(*Medicinae Doctor*), Doctor of Medicine.
M.Inst.C.E.	Member of the Institute of Civil Engineers.
M.P.	Member of Parliament.
M.R.	Master of the Rolls.
M.R.C.P.	Member of the Royal College of Physicians.
M.R.C.S.	Member of the Royal College of Surgeons.
M.R.I.A.	Member of the Royal Irish Academy.
Mus.B.	Bachelor of Music.
Mus.D.	Doctor of Music.
M.V.O.	Member of the Victorian Order.
N.P.	Notary Public.
O.M.	Order of Merit.
P.C.	Privy Councillor.
Ph.D.	(*Philosophiae Doctor*), Doctor of Philosophy.
P.P.	Parish Priest.
P.R.A.	President of the Royal Academy.
R.	(*Rex, Regina*), King, Queen.
R. & I.	*Rex et Imperator*.
R.A.	Royal Academician, Royal Artillery.
R.A.M.	Royal Academy of Music.
R.E.	Royal Engineers.
Reg. Prof.	Regius Professor.
R.M.	Royal Marines, Resident Magistrate.
R.N.	Royal Navy.
S. *or* St.	Saint.
S.S.C.	Solicitor before the Supreme Courts [of Scotland].
S.T.P.	(*Sacrosanctae Theologiae Professor*), Professor of Sacred Theology.
V.C.	Vice-Chancellor, Victoria Cross.
V.G.	Vicar-General.
V.S.	Veterinary Surgeon.
W.S.	Writer to the Signet [in Scotland]. *Equivalent to Attorney*

2. ABBREVIATIONS DENOTING MONIES, WEIGHTS, AND MEASURES.[2]

ac.	acre.	℔. *or* lb.	(*libra*), pound (weight).
bar.	barrel.	m. *or* mi.	mile, minute.
bus.	bushel.	♏.	minim.
c.	cent.	mo.	month.
c. (*or* cub.) ft. &c.	cubic foot, &c.	na.	nail.
cwt.	hundredweight.	oz.	ounce.
d.	(*denarius*), penny.	pk.	peck.
deg.	degree.	po.	pole.
dr.	drachm *or* dram.	pt.	pint.
dwt.	pennyweight.	q.	(*quadrans*), farthing.
f.	franc.	qr.	quarter.
fl.	florin.	qt.	quart.
ft.	foot.	ro.	rood.
fur.	furlong.	Rs.[3]	rupees.
gal.	gallon.	s. *or* /	(*solidus*), shilling.
gr.	grain.	s. *or* sec.	second.
h. *or* hr.	hour.	sc. *or* scr.	scruple.
hhd.	hogshead.	sq. ft. &c.	square foot, &c.
in.	inch.	st.	stone.
kilo.	kilometre.	yd.	yard.
L.,[2]	£,[2] or *l.* (*libra*), pound (money).		

3. MISCELLANEOUS ABBREVIATIONS.

A.	Accepted.
A.C.	(*Ante Christum*), Before Christ.
acc., a/c. *or* acct.	Account.
A.D.	(*Anno Domini*), In the year of our Lord.
A.E.I.O.U.	*Austriae est imperare orbi universo*[4] *or* Alles Erdreich Ist Oesterreich Unterthan.
Aet. *or* Aetat.	(*Aetatis*, [*anno*]), In the year of his age.
A.H.	(*Anno Hegirae*), In the year of the Hegira (the Mohammedan era).

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[1] An archbishop or bishop, in writing his signature, substitutes for his surname the name of his see; thus the prelates of Canterbury, York, Oxford, London, &c., subscribe themselves with their initials (Christian names only), followed by Cantuar., Ebor., Oxon., Londin. (sometimes London.), &c.

[2] Characters, not properly abbreviations, are used in the same way; *e.g.* ° ′ ″ for "degrees, minutes, seconds" (circular measure); ℥, ʒ, ℈ for "ounces, drachms, scruples." ℥ is probably to be traced to the written form of the z in "*oz.*"

[3] These forms (as well as $, the symbol for the American dollar) are placed before their amounts.

[4] *It is given to Austria to rule the whole earth.* The device of Austria, first adopted by Frederick III.

A.M.	(*Anno Mundi*), In the year of the world.
A.M.	(*Ante meridiem*), Forenoon.
Anon.	Anonymous.
A.U.C.	(*Anno urbis conditae*), In the year from the building of the city (*i.e.* Rome).
A.V.	Authorized version of the Bible.
b.	born.
B.V.M.	The Blessed Virgin Mary.
B.C.	Before Christ.
c.	*circa*, about.
C. *or* Cap.	(*Caput*), Chapter.
C.	Centigrade (*or* Celsius's) Thermometer.
cent.[1]	(*Centum*), A hundred, *frequently* £100.
Cf. *or* cp.	(*Confer*), Compare.
Ch. *or* Chap.	Chapter.
C.M.S.	Church Missionary Society.
Co.	Company, County.
C.O.D.	Cash on Delivery.
Cr.	Creditor.
curt.	Current, the present month.
d.	died.
D.G.	(*Dei gratia*), By the grace of God.
Do.	Ditto, the same.
D.O.M.	(*Deo Optimo Maximo*), To God the Best and Greatest.
Dr.	Debtor.
D.V.	(*Deo volente*), God willing.
E.& O.E.	Errors and omissions excepted.
e.g.	(*Exempli gratia*), For example.
etc. *or* &c.	(*Et caetera*), And the rest; and so forth.
Ex.	Example.
F. *or* Fahr.	Fahrenheit's Thermometer.
Fec.	(*Fecit*), He made (*or* did) it.
fl.	Flourished.
Fo. *or* Fol.	Folio.
f.o.b.	Free on board.
G.P.O.	General Post Office.
H.M.S.	His Majesty's Ship, or Service.
Ib. *or* Ibid.	(*Ibidem*), In the same place.
Id.	(*Idem*), The same.
i.e.	(*Id est*), That is.
I.H.S.	A symbol for "Jesus," derived from the first three letters of the Greek (I H Σ); the correct origin was lost sight of, and the Romanized letters were then interpreted erroneously as standing for *Jesus, Hominum Salvator*, the Latin "h" and Greek long "e" being confused.
I.M.D.G.	(*In majorem Dei gloriam*), To the greater glory of God.
Inf.	(*Infra*), Below.
Inst.	Instant, the present month.
I.O.U.	I owe you.
i.q.	(*Idem quod*), The same as.
κ.τ.λ.	(*καὶ τὰ λοιπά*), *Et caetera*, and the rest.
L. *or* Lib.	(*Liber*), Book.
Lat.	Latitude.
l.c.	(*Loco citato*), In the place cited.
Lon. *or* Long.	Longitude.
L.S.	(*Locus sigilli*), The place of the seal.
Mem.	(*Memento*), Remember, Memorandum.
MS.	Manuscript. MSS. Manuscripts.
N.B.	(*Nota bene*), Mark well; take notice.
N.B.	North Britain (*i.e.* Scotland).
N.D.	No date.
nem. con.	(*Nemine contradicente*), No one contradicting.
No.	(*Numero*), Number.
N.S.	New Style.
N.T.	New Testament.
ob.	(*Obiit*), Died.
Obs.	Obsolete.
O.H.M.S.	On His Majesty's Service.
O.S.	Old Style.
O.S.B.	*Ordo Sancti Benedicti* (Benedictines).
O.T.	Old Testament.
P.	Page. Pp. Pages.
ꝑ	(*Per*), For; *e.g.* ꝑ ℔., For one pound.
Pinx.	(*Pinxit*), He painted it.
P.M.	(*Post Meridiem*), Afternoon.
P.O.	Post Office, Postal Order.
P.O.O.	Post Office Order.
P.P.C.	(*Pour prendre congé*), To take leave.
P.R.	Prize-ring.
prox.	(*Proximo* [*mense*]), Next month.
P.S.	Postscript.
Pt.	Part.
p.t. *or* pro tem.	(*Pro tempore*), For the time.
P.T.O.	Please turn over.
Q., Qu., *or* Qy.	Query; Question.
q.d.	(*Quasi dicat*), As if he should say; as much as to say.
Q.E.D.	(*Quod erat demonstrandum*), Which was to be demonstrated.
Q.E.F.	(*Quod erat faciendum*), Which was to be done.
q.s. *or* quant. suff.	(*Quantum sufficit*), As much as is sufficient.
q.v.	(*Quod vide*), Which see.
R. *or* ℞.	(*Recipe*), Take.
√	(=*r.* for *radix*), The sign of the square root.
R.I.P.	(*Requiescat in pace!*), May he rest in peace!
R.S.V.P.	(*Réspondez s'il vous plait*), Please reply.
sc.	(*Scilicet*), Namely; that is to say.
Sc. *or* Sculp.	(*Sculpsit*), He engraved it.
S.D.U.K.	Society for the Diffusion of Useful Knowledge.
seq. *or* sq., seqq. *or* sqq.	(*Sequens, sequentia*), The following.
S.J.	Society of Jesus.
s.p.	(*Sine prole*), Without offspring.
S.P.C.K.	Society for the Promotion of Christian Knowledge.
S.P.G.	Society for the Propagation of the Gospel.
S.T.D. S.T.B. S.T.L.	Doctor, Bachelor, Licentiate of Theology.
Sup.	(*Supra*), Above.
s.v.	(*Sub voce*), Under the word (*or* heading).
T.C.D.	Trinity College, Dublin.
ult.	(*Ultimo* [*mense*]), Last month.
U.S.	United States.
U.S.A.	United States of America.
v.	(*Versus*), Against.
v. *or* vid.	(*Vide*), See.
viz.	(*Videlicet*), Namely.
Xmas.	Christmas. This X is a Greek letter, corresponding to Ch.

See also Graevius's *Thesaurus Antiquitatum* (1694, sqq.); Nicolai's *Tractatus de Siglis Veterum*; Mommsen's *Corpus Inscriptionum Latinarum* (1863, sqq.); Natalis de Wailly's *Paléographie* (Paris, 1838); Alph. Chassant's *Paléographie* (1854), and *Dictionnaire des Abréviations* (3rd ed. 1866); Campelli, *Dizionario di Abbreviature* (1899).

ABBREVIATORS, a body of writers in the papal chancery, whose business was to sketch out and prepare in due form the pope's bulls, briefs and consistorial decrees before these are written out *in extenso* by the *scriptores*. They are first mentioned in *Extravagantes* of John XXII. and of Benedict XII. Their number was fixed at seventy-two by Sixtus IV. From the time of Benedict XII. (1334–1342) they were classed as *de Parco majori* or *Praesidentiae majoris*, and *de Parco minori*. The name was derived from a space in the chancery, surrounded by a grating, in which the officials sat, which is called higher or lower (major or minor) according to the proximity of the seats to that of the vice-chancellor. After the protonotaries left the sketching of the minutes to the abbreviators, those *de Parco majori*, who ranked as prelates, were the most important officers of the apostolic chancery. By Martin V. their signature was made essential to the validity of the acts of the chancery; and they obtained in course of time many important privileges. They were suppressed in 1908 by Pius X. and their duties were transferred to the *protonotarii apostolici participantes*. (See Curia Romana.)

ABDALLATIF, or Abd-ul-Latif (1162–1231), a celebrated physician and traveller, and one of the most voluminous writers of the East, was born at Bagdad in 1162. An interesting memoir of Abdallatif, written by himself, has been preserved with additions by Ibn-Abu-Osaiba (Ibn abī Usaibia), a contemporary. From that work we learn that the higher education of the youth of Bagdad consisted principally in a minute and careful study of the rules and principles of grammar, and in their committing to memory the whole of the Koran, a treatise or two on philology and jurisprudence, and the choicest Arabian poetry. After attaining to great proficiency in that kind of learning, Abdallatif applied himself to natural philosophy and medicine. To enjoy the society of the learned, he went first to Mosul (1189), and afterwards to Damascus. With letters of recommendation from Saladin's vizier, he visited Egypt, where the wish he had long cherished to converse with Maimonides, "the Eagle of the Doctors," was gratified. He afterwards formed one of the circle of learned men whom Saladin gathered around him at Jerusalem. He taught medicine and philosophy at Cairo and at Damascus for a number of years, and afterwards, for a shorter period, at Aleppo. His love of travel led him in his old age to visit different parts of Armenia and Asia Minor, and he was setting out on a pilgrimage to Mecca when he died at Bagdad in 1231. Abdallatif was undoubtedly a man of great knowledge and of an inquisitive and penetrating mind. Of the numerous works—mostly on medicine—which Osaiba ascribes to him, one only, his graphic and detailed *Account of Egypt* (in two parts), appears to be known in Europe. The manuscript, discovered by Edward Pococke the Orientalist, and preserved in the Bodleian Library, contains a vivid description of a famine caused, during the author's residence in Egypt, by the Nile failing to overflow its banks. It was translated into Latin by Professor White of Oxford in 1800, and into French, with valuable notes, by De Sacy in 1810.

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[1] "Per cent." is often signified by %, a form traceable to "100."

ABD-AR-RAHMAN, the name borne by five princes of the Omayyad dynasty, amirs and caliphs of Cordova, two of them being rulers of great capacity.

Abd-ar-Rahman I. (756–788) was the founder of the branch of the family which ruled for nearly three centuries in Mahommedan Spain. When the Omayyads were overthrown in the East by the Abbasids he was a young man of about twenty years of age. Together with his brother Yahya, he took refuge with Bedouin tribes in the desert. The Abbasids hunted their enemies down without mercy. Their soldiers overtook the brothers; Yahya was slain, and Abd-ar-rahman saved himself by fleeing first to Syria and thence to northern Africa, the common refuge of all who endeavoured to get beyond the reach of the Abbasids. In the general confusion of the caliphate produced by the change of dynasty, Africa had fallen into the hands of local rulers, formerly amirs or lieutenants of the Omayyad caliphs, but now aiming at independence. After a time Abd-ar-rahman found that his life was threatened, and he fled farther west, taking refuge among the Berber tribes of Mauritania. In the midst of all his perils, which read like stories from the *Arabian Nights*, Abd-ar-rahman had been encouraged by reliance on a prophecy of his great-uncle Maslama that he would restore the fortune of the family. He was followed in all his wanderings by a few faithful clients of the Omayyads. In 755 he was in hiding near Ceuta, and thence he sent an agent over to Spain to ask for the support of other clients of the family, descendants of the conquerors of Spain, who were numerous in the province of Elvira, the modern Granada. The country was in a state of confusion under the weak rule of the amir Yusef, a mere puppet in the hands of a faction, and was torn by tribal dissensions among the Arabs and by race conflicts between the Arabs and Berbers. It offered Abd-ar-rahman the opportunity he had failed to find in Africa. On the invitation of his partisans he landed at Almuñecar, to the east of Malaga, in September 755. For a time he was compelled to submit to be guided by his supporters, who were aware of the risks of their venture. Yusef opened negotiations, and offered to give Abd-ar-rahman one of his daughters in marriage and a grant of land. This was far less than the prince meant to obtain, but he would probably have been forced to accept the offer for want of a better if the insolence of one of Yusef's messengers, a Spanish renegade, had not outraged a chief partisan of the Omayyad cause. He taunted this gentleman, Obeidullah by name, with being unable to write good Arabic. Under this provocation Obeidullah drew the sword. In the course of 756 a campaign was fought in the valley of the Guadalquivir, which ended, on the 16th of May, in the defeat of Yusef outside Cordova. Abd-ar-rahman's army was so ill provided that he mounted almost the only good war-horse in it; he had no banner, and one was improvised by unwinding a green turban and binding it round the head of a spear. The turban and the spear became the banner of the Spanish Omayyads. The long reign of Abd-ar-rahman I. was spent in a struggle to reduce his anarchical Arab and Berber subjects to order. They had never meant to give themselves a master, and they chafed under his hand, which grew continually heavier. The details of these conflicts belong to the general history of Spain. It is, however, part of the personal history of Abd-ar-rahman that when in 763 he was compelled to fight at the very gate of his capital with rebels acting on behalf of the Abbasids, and had won a signal victory, he cut off the heads of the leaders, filled them with salt and camphor and sent them as a defiance to the eastern caliph. His last years were spent amid a succession of palace conspiracies, repressed with cruelty. Abd-ar-rahman grew embittered and ferocious. He was a fine example of an oriental founder of a dynasty, and did his work so well that the Omayyads lasted in Spain for two centuries and a half.

Abd-ar-Rahman II. (822–852) was one of the weaker of the Spanish Omayyads. He was a prince with a taste for music and literature, whose reign was a time of confusion. It is chiefly memorable for having included the story of the "Martyrs of Cordova," one of the most remarkable passages in the religious history of the middle ages.

Abd-ar-Rahman III. (912–961) was the greatest and the most successful of the princes of his dynasty in Spain (for the general history of his reign see Spain, *History*). He ascended the throne when he was barely twenty-two and reigned for half a century. His life was so completely identified with the government of the state that he offers less material for biography than his ancestor Abd-ar-rahman I. Yet it supplies some passages which show the real character of an oriental dynasty even at its best. Abd-ar-rahman III. was the grandson of his predecessor, Abdallah, one of the weakest and worst of the Spanish Omayyads. His father, Mahommed, was murdered by a brother Motarrif by order of Abdallah. The old sultan was so far influenced by humanity and remorse that he treated his grandson kindly. Abd-ar-rahman III. came to the throne when the country was exhausted by more than a generation of tribal conflict among the Arabs, and of strife between them and the Mahommedans of native Spanish descent. Spaniards who were openly or secretly Christians had acted with the renegades. These elements, which formed the bulk of the population, were not averse from supporting a strong ruler who would protect them against the Arab aristocracy. These restless nobles were the most serious of Abd-ar-rahman's enemies. Next to them came the Fatimites of Egypt and northern Africa, who claimed the caliphate, and who aimed at extending their rule over the Mahommedan world, at least in the west. Abd-ar-rahman subdued the nobles by means of a mercenary army, which included Christians. He repelled the Fatimites, partly by supporting their enemies in Africa, and partly by claiming the caliphate for himself. His ancestors in Spain had been content with the title of sultan. The caliphate was thought only to belong to the prince who ruled over the sacred cities of Mecca and Medina. But the force of this tradition had been so far weakened that Abd-ar-rahman could proclaim himself caliph on the 16th of January 929, and the assumption of the title gave him increased prestige with his subjects, both in Spain and Africa. His worst enemies were always his fellow Mahommedans. After he was defeated by the Christians at Alhandega in 939 through the treason of the Arab nobles in his army (see Spain, *History*) he never again took the field. He is accused of having sunk in his later years into the self-indulgent habits of the harem. When the undoubted prosperity of his dominions is quoted as an example of successful Mahommedan rule, it is well to remember that he administered well not by means of but in spite of Mahommedans. The high praise given to his administration may even excite some doubts as to its real excellence. We are told that a third of his revenue sufficed for the ordinary expenses of government, a third was hoarded and a third spent on buildings. A very large proportion of the surplus must have been wasted on the palace-town of Zahra, built three miles to the north of Cordova, and named after a favourite concubine. Ten thousand workmen are said to have been employed for twenty-five years on this wonder, of which no trace now remains. The great monument of early Arabic architecture in Spain, the mosque of Cordova, was built by his predecessors, not by him. It is said that his harem included six thousand women. Abd-ar-rahman was tolerant, but it is highly probable that he was very indifferent in religion, and it is certain that he was a thorough despot. One of the most authentic sayings attributed to him is his criticism of Otto I. of Germany, recorded by Otto's ambassador, Johann, abbot of Gorze, who has left in his *Vita* an incomplete account of his embassy (in Pertz, *Mon. Germ. Scriptores*, iv. 355-377). He blamed the king of Germany for trusting his nobles, which he said could only increase their pride and leaning to rebellion. His confession that he had known only twenty happy days in his long reign is perhaps a moral tale, to be classed with the "*omnia fui, et nil expedit*" of Septimius Severus.

In the agony of the Omayyad dynasty in Spain, two princes of the house were proclaimed caliphs for a very short time, Abd-ar-rahman IV. Mortaḍa (1017), and Abd-ar-rahman V. Mostadir (1023–1024). Both were the mere puppets of factions, who deserted them at once. Abd-ar-rahman IV. was murdered in the year in which he was proclaimed, at Guadiz, when fleeing from a battle in which he had been deserted by his supporters. Abd-ar-rahman V. was proclaimed caliph in December 1023 at Cordova, and murdered in January 1024 by a mob of unemployed workmen, headed by one of his own cousins.

The history of the Omayyads in Spain is the subject of the *Histoire des Musulmans d'Espagne*, by R. Dozy (Leiden, 1861). (D. H.)

ABD-EL-AZIZ IV. (1880–), sultan of Morocco, son of Sultan Mulai el Hasan III. by a Circassian wife. He was fourteen years of age on his father's death in 1894. By the wise action of Si Ahmad bin Musa, the chamberlain of El Hasan, Abd-el-Aziz's accession to the sultanate was ensured with but little fighting. Si Ahmad became regent and for six years showed himself a capable ruler. On his death in 1900 the regency ended, and Abd-el-Aziz took the reins of government into his own hands, with an Arab from the south, El Menebhi, for his chief adviser. Urged by his Circassian mother, the sultan sought advice and counsel from Europe and endeavoured to act up to it. But disinterested advice was difficult to obtain, and in spite of the unquestionable desire of the young ruler to do the best for the country, wild extravagance both in action and expenditure resulted, leaving the sultan with depleted exchequer and the confidence of his people impaired. His intimacy with foreigners and his imitation of their ways were sufficient to rouse fanaticism and create dissatisfaction. His attempt to reorganize the finances by the systematic levy of taxes was hailed with delight, but the government was not strong enough to carry the measures through, and the money which should have been used to pay the taxes was employed to purchase firearms. Thus the benign intentions of Mulai Abd-el-Aziz were interpreted as weakness, and Europeans were accused of having spoiled the sultan and of being desirous of spoiling the country. When British engineers were employed to survey the route for a railway between Mequinez and Fez, this was reported as indicating an absolute sale of the country. The fanaticism of the people was aroused, and a revolt broke out near the Algerian frontier. Such was the condition of things when the news of the Anglo-French Agreement of 1904 came as a blow to Abd-el-Aziz, who had relied on England for support and protection against the inroads of France. On the advice of Germany he proposed the assembly of an international conference at Algeciras in 1906 to consult upon methods of reform, the sultan's desire being to ensure a condition of affairs which would leave foreigners with no excuse for interference in the control of the country, and would promote its welfare, which Abd-el-Aziz had earnestly desired from his accession to power. The sultan gave his adherence to the Act of the Algeciras Conference, but the state of anarachy into which Morocco fell during the latter half of 1906 and the beginning of 1907 showed that the young ruler lacked strength sufficient to make his will respected by his turbulent subjects. In May 1907 the southern tribes invited Mulai Hafid, an elder brother of Abd-el-Aziz, and viceroy at Marrakesh, to become sultan, and in the following August Hafid was proclaimed sovereign there with all the usual formalities. In the meantime the murder of Europeans at Casablanca had led to the occupation of that port by France. In September Abd-el-Aziz arrived at Rabat from Fez and endeavoured to secure the support of the European powers against his brother. From France he accepted the grand cordon of the Legion of Honour, and was later enabled to negotiate a loan. His leaning to Christians aroused further opposition to his rule, and in January 1908 he was declared deposed by the ulema of Fez, who offered the throne to Hafid. After months of inactivity Abd-el-Aziz made an effort to restore his authority, and quitting Rabat in July he marched on Marrakesh. His force, largely owing to treachery, was completely overthrown (August 19th) when near that city, and Abd-el-Aziz fled to Settat within the French lines round Casablanca. In November he came to terms with his brother, and thereafter took up his residence in Tangier as a pensioner of the new sultan. He declared himself more than reconciled to the loss of the throne, and as looking forward to a quiet, peaceful life. (See MOROCCO, *History*.)

ABD-EL-KADER (*c.* 1807–1883), amir of Mascara, the great opponent of the conquest of Algeria by France, was born near Mascara in 1807 or 1808. His family were *sherifs* or descendants of Mahomet, and his father, Mahi-ed-Din, was celebrated throughout North Africa for his piety and charity. Abd-el-Kader received the best education attainable by a Mussulman of princely rank, especially in theology and philosophy, in horsemanship and in other manly exercises. While still a youth he was taken by his father on the pilgrimage to Mecca and Medina and to the tomb of Sidi Abd-el-Kader El Jalili at Bagdad—events which stimulated his natural tendency to religious enthusiasm. While in Egypt in 1827, Abd-el-Kader is stated to have been impressed, by the reforms then being carried out by Mehemet Ali, with the value of European civilization, and the knowledge he then gained affected his career. Mahi-ed-Din and his son returned to Mascara shortly before the French occupation of Algiers (July 1830) destroyed the government of the Dey. Coming forward as the champion of Islam against the infidels, Abd-el-Kader was proclaimed amir at Mascara in 1832. He prosecuted the war against France vigorously and in a short time had rallied to his standard all the tribes of western Algeria. The story of his fifteen years' struggle against the French is given under ALGERIA. To the beginning of 1842 the contest went in favour of the amir; thereafter he found in Marshal Bugeaud an opponent who proved, in the end, his master. Throughout this period Abd-el-Kader showed himself a born leader of men, a great soldier, a capable administrator, a persuasive orator, a chivalrous opponent. His fervent faith in the doctrines of Islam was unquestioned, and his ultimate failure was due in considerable measure to the refusal of the Kabyles, Berber mountain tribes whose Mahommedanism is somewhat loosely held, to make common cause with the Arabs against the French. On the 21st of December 1847, the amir gave himself up to General Lamoricière at Sidi Brahim. On the 23rd, his submission was formally made to the duc d'Aumale, then governor of Algeria. In violation of the promise that he would be allowed to go to Alexandria or St Jean d'Acre, on the faith of which he surrendered, Abd-el-Kader and his family were detained in France, first at Toulon, then at Pau, being in November 1848 transferred to the château of Amboise. There Abd-el-Kader remained until October 1852, when he was released by Napoleon III. on taking an oath never again to disturb Algeria. The amir then took up his residence in Brusa, removing in 1855 to Damascus. In July 1860, when the Moslems of that city, taking advantage of disturbances among the Druses of Lebanon, attacked the Christian quarter and killed over 3000 persons, Abd-el-Kader helped to repress the outbreak and saved large numbers of Christians. For this action the French government, which granted the amir a pension of £4000, bestowed on him the grand cross of the Legion of Honour. In 1865, he visited Paris and London, and was again in Paris at the exposition of 1867. In 1871, when the Algerians again rose in revolt, Abd-el-Kader wrote to them counselling submission to France. After his surrender in 1847 he devoted himself anew to theology and philosophy, and composed a philosophica treatise, of which a French translation was published in 1858 under the title of *Rappel à l'intelligent. Avis à l'indifférent*. He also wrote a book on the Arab horse. He died at Damascu on the 26th of May 1883.

See Commdt. J. Pichon, *Abd el Kader*, 1807–1883 (Paris [1899]); Alex. Bellemare, *Abd-el-Kader: sa vie politique et militaire* (Paris 1863); Col. C. H. Churchill, *The Life of Abdel Kader* (London, 1867).

ABDERA, an ancient seaport town on the south coast of Spain, between Malaca and New Carthage, in the district inhabited by the Bastuli. It was founded by the Carthaginians as a trading station, and after a period of decline became under the Romans one of the more important towns in the province of Hispania Baetica. It was situated on a hill above the modern Adra (*q.v.*). Of its coins the most ancient bear the Phoenician inscription *abdrt* with the head of Heracles (Melkarth) and a tunny-fish; those of Tiberius (who seems to have made the place a colony) show the chief temple of the town with two tunny-fish erect in the form of columns. For inscriptions relating to the Roman municipality see *C.I.L.* ii. 267.

ABDERA, a town on the coast of Thrace near the mouth of the Nestos, and almost opposite Thasos. Its mythical foundation was attributed to Heracles, its historical to a colony from Clazomenae in the 7th century B.C. But its prosperity dates from 544 B.C., when the majority of the people of Teos migrated to Abdera after the Ionian revolt to escape the Persian yoke (Herod. i. 168); the chief coin type, a gryphon, is identical with that of Teos; the coinage is noted for the beauty and variety of its reverse types. The town seems to have declined in importance after the middle of the 4th century. The air of Abdera was proverbial as causing stupidity; but among its citizens was the philosopher Democritus. The ruins of the town may still be seen on Cape Balastra; they cover seven small hills, and extend from an eastern to a western harbour; on the S.W. hills are the remains of the medieval settlement of Polystylon.

Mittheil. d. deutsch. Inst. Athens, xii. (1887), p. 161 (Regel); *Mém. de l'Acad. des Inscriptions*, xxxix. 211; K. F. Hermann, *Ges. Abh.* 90-111, 370 ff.

ABDICATION (Lat. *abdicatio*, disowning, renouncing, from *ab*, from, and *dicare*, to declare, to proclaim as not belonging to one), the act whereby a person in office renounces and gives up the same before the expiry of the time for which it is held. In Roman law, the term is especially applied to the disowning of a member of a family, as the disinheriting of a son, but the word is seldom used except in the sense of surrendering the supreme power in a state. Despotic sovereigns are at liberty to divest themselves of their powers at any time, but it is otherwise with a limited monarchy. The throne of Great Britain cannot be lawfully abdicated unless with the consent of the two Houses of Parliament. When James II., after throwing the great seal into the Thames, fled to France in 1688, he did not formally resign the crown, and the question was discussed in parliament whether he had forfeited the throne or had abdicated. The latter designation was agreed on, for in a full assembly of the Lords and Commons, met in convention, it was resolved, in spite of James's protest, "that King James II. having endeavoured to subvert the constitution of the kingdom, by breaking the original contract between king and people, and, by the advice of Jesuits and other wicked persons, having violated the fundamental laws, and having withdrawn himself out of this kingdom, has abdicated the government, and that the throne is thereby vacant." The Scottish parliament pronounced a decree of forfeiture and deposition. Among the most memorable abdications of antiquity may be mentioned that of Sulla the dictator, 79 B.C., and that of the Emperor Diocletian, A.D. 305. The following is a list of the more important abdications of later times:—

	A.D.
Benedict IX., pope	1048
Stephen II. of Hungary	1131
Albert (the Bear) of Brandenburg	1169
Ladislaus III. of Poland	1206
Celestine V., pope	Dec. 13, 1294
John Baliol of Scotland	1296
John Cantacuzene, emperor of the East	1355
Richard II. of England	Sept. 29, 1399
John XXIII., pope	1415
Eric VII. of Denmark and XIII. of Sweden	1439
Murad II., Ottoman Sultan	1444 and 1445
Charles V., emperor	1556
Christina of Sweden	1654
John Casimir of Poland	1668
James II. of England	1688
Frederick Augustus of Poland	1704
Philip V. of Spain	1724
Victor Amadeus II. of Sardinia	1730
Ahmed III., Sultan of Turkey	1730
Charles of Naples (on accession to throne of Spain)	1759
Stanislaus II. of Poland	1795
Charles Emanuel IV. of Sardinia	June 4, 1802
Charles IV. of Spain	Mar. 19, 1808
Joseph Bonaparte of Naples	June 6, 1808
Gustavus IV. of Sweden	Mar. 29, 1809
Louis Bonaparte of Holland	July 2, 1810
Napoleon I., French Emperor	April 4, 1814, and June 22, 1815
Victor Emanuel of Sardinia	Mar. 13, 1821
Charles X. of France	Aug. 2, 1830
Pedro of Brazil[1]	April 7, 1831
Miguel of Portgual	May 26, 1834
William I. of Holland	Oct. 7, 1840
Louis Philippe, king of the French	Feb. 24, 1848
Louis Charles of Bavaria	Mar. 21, 1848
Ferdinand of Austria	Dec. 2, 1848
Charles Albert of Sardinia	Mar. 23, 1849
Leopold II. of Tuscany	July 21, 1859
Isabella II. of Spain	June 25, 1870
Amadeus I. of Spain	Feb. 11, 1873
Alexander of Bulgaria	Sept. 7, 1886
Milan of Servia	Mar. 6, 1889

ABDOMEN (a Latin word, either from *abdere*, to hide, or from a form *adipomen*, from *adeps*, fat), the belly, the region of the body containing most of the digestive organs. (See for anatomical details the articles ALIMENTARY CANAL, and ANATOMY, *Superficial and Artistic.*)

ABDOMINAL SURGERY.—The diseases affecting this region are dealt with generally in the article DIGESTIVE ORGANS, and under their own names (*e.g.* APPENDICITIS). The term "abdominal surgery" covers generally the operations which involve opening the abdominal cavity, and in modern times this field of work has been greatly extended. In this Encyclopaedia the surgery of each abdominal organ is dealt with, for the most part, in connexion with the anatomical description of that organ (see STOMACH, KIDNEY, LIVER, &c.); but here the general principles of abdominal surgery may be discussed.

Exploratory Laparotomy.—In many cases of serious intra-abdominal disease it is impossible for the surgeon to say exactly what is wrong without making an incision and introducing his finger, or, if need be, his hand among the intestines. With due care this is not a perilous or serious procedure, and the great advantage appertaining to it is daily being more fully recognized. It was Dr Oliver Wendell Holmes, the American physiologist and poet, who remarked that one cannot say of what wood a table is made without lifting up the cloth; so also it is often impossible to say what is wrong inside the abdomen without making an opening into it. When an opening is made in such circumstances—provided only it is done soon enough—the successful treatment of the case often becomes a simple matter. An exploratory operation, therefore, should be promptly resorted to as a means of diagnosis, and not left as a last resource till the outlook is well-nigh hopeless.

It is probable that if the question were put to any experienced hospital surgeon if he had often had cause to regret having advised recourse to an exploratory operation on the abdomen, his answer would be in the negative, but that, on the other hand, he had not infrequently had cause to regret that he had not resorted to it, *post-mortem* examination having shown that if only he had insisted on an exploration being made, some band, some adhesion, some tumour, some abscess might have been satisfactorily dealt with, which, left unsuspected in the dark cavity, was accountable for the death. A physician by himself is helpless in these cases.

Much of the rapid advance which has of late been made in the results of abdominal surgery is due to the improved relationship which exists between the public and the surgical profession. In former days it was not infrequently said, "If a surgeon is called in he is sure to operate." Not only have the public said this, but even physicians have been known to suggest it, and have indeed used the equivocal expression, the "apotheosis of surgery," in connexion with the operative treatment of a serious abdominal lesion. But fortunately the public have found out that the surgeon, being an honest man, does not advise operation unless he believes that it is necessary or, at any rate, highly advisable. And this happy discovery has led to much more confidence being placed in his decision. It has truly been said that a surgeon is a physician who can operate, and the public have begun to realize the fact that it is useless to try to relieve an acute abdominal lesion by diet or drugs. Not many years ago cases of acute, obscure or chronic affections of the abdomen which were admitted into hospital were sent as a matter of course into the medical wards, and after the effect of drugs had been tried with expectancy and failure, the services of a surgeon were called in. In acute cases this delay spoilt all surgical chances, and the idea was more widely spread that surgery, after all, was a poor handmaid to medicine. But now things are different. Acute or obscure abdominal cases are promptly relegated to the surgical wards; the surgeon is at once sent for, and if operation is thought desirable it is performed without any delay. The public have found that the surgeon is not a reckless operator, but a man who can take a broad view of a case in all its bearings. And so it has come about that the results of operations upon the interior of the abdomen have been improving day by day. And doubtless they will continue to improve.

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[1] Pedro had succeeded to the throne of Portugal in 1826, but abdicated it at once in favour of his daughter.

A great impetus was given to the surgery of wounded, mortified or diseased pieces of intestine by the introduction from Chicago of an ingenious contrivance named, after the inventor, *Murphy's button.* This consists of a short nickel-plated tube in two pieces, which are rapidly secured in the divided ends of the bowel, and in such a manner that when the pieces are subsequently "married" the adjusted ends of the bowel are securely fixed together and the canal rendered practicable. In the course of time the button loosens itself into the interior of the bowel and comes away with the alvine evacuation. In many other cases the use of the button has proved convenient and successful, as in the establishment of a permanent communication between the stomach and the small intestine when the ordinary gateway between these parts of the alimentary canal is obstructed by an irremovable malignant growth; between two parts of the small intestine so that some obstruction may be passed; between small and large intestine. The operative procedure goes by the name of *short-circuiting;* it enables the contents of the bowel to get beyond an obstruction. In this way also a permanent working communication can be set up between the gall-bladder, or a dilated bile-duct, and the neighbouring small intestine—the last-named operation bears the precise but very clumsy name of *choledocoduodenostomy.* By the use of Murphy's ingenious apparatus the communication of two parts can be secured in the shortest possible space of time, and this, in many of the cases in which it is resorted to, is of the greatest importance. But there is this against the method—that sometimes ulceration occurs around the rim of the metal button, whilst at others the loosened metal causes annoyance in its passage along the alimentary canal. Some surgeons therefore prefer to use a bobbin of decalcified bone or similar soft material, while others rely upon direct suturing of the parts. The last-named method is gradually increasing in popularity, and of course, when time and circumstances permit, it is the ideal method of treatment. The cause of death in the case of intestinal obstruction is usually due to the blood being poisoned by the absorption of the products of decomposition of the fluid contents of the bowel above the obstruction. It is now the custom, therefore, for the surgeon to complete his operation for the relief of obstruction by drawing out a loop of the distended bowel, incising and evacuating it, and then carefully suturing and returning it. The surgeon who first recognized the lethal effect of the absorption of this stagnant fluid—or, at any rate, who first suggested the proper method of treating it—was Lawson Tait of Birmingham, who on the occurrence of grave symptoms after operating on the abdomen gave small, repeated doses of Epsom salts to wash away the harmful liquids of the bowel and to enable it at the same time to empty itself of the gas, which, by distending the intestines, was interfering with respiration and circulation.

Amongst still more recent improvements in abdominal surgery may be mentioned the placing of the patient in the sitting position as soon as practicable after the operation, and the slow administration of a hot saline solution into the lower bowel, or, in the more desperate cases, of injecting pints of this "normal saline" fluid into the loose tissue of the armpit. Hot water thus administered or injected is quickly taken into the blood, increasing its volume, diluting its impurities and quenching the great thirst which is so marked a symptom in this condition.

Gunshot Wounds of the Abdomen.—If a revolver bullet passes through the abdomen, the coils of intestine are likely to be traversed by it in several places. If the bullet be small and, by chance, surgically clean, it is possible that the openings may tightly close up behind it so that no leakage takes place into the general peritoneal cavity. If increasing collapse suggests that serious bleeding is occurring within the abdomen, the cavity is opened forthwith and a thorough exploration made. When it is uncertain if the bowel has been traversed or not, it is well to wait before opening the abdomen, due preparation being made for performing that operation on the first appearance of symptoms indicative of perforation having occurred. Small perforating wounds of the bowel are treated by such suturing as the circumstances may suggest, the interior of the abdominal cavity being rendered as free from septic micro-organisms as possible. It is by the malign influence of such germs that a fatal issue is determined in the case of an abdominal wound, whether inflicted by firearms or by a pointed weapon. If aseptic procedure can be promptly resorted to and thoroughly carried out, abdominal wounds do well, but these essentials cannot be obtained upon the field of battle. When after an action wounded men come pouring into the field-hospital, the many cannot be kept waiting whilst preparations are being made for the thorough carrying out of a prolonged aseptic abdominal operation upon a solitary case. Experience in the South African war of 1899–1902 showed that Mauser bullets could pierce coils of intestine and leave the soldiers in such a condition that, if treated by mere "expectancy," more than 50 % recovered, whereas if operations were resorted to, fatal septic peritonitis was likely to ensue. In the close proximity of the fight, where time, assistants, pure water, towels, lotions and other necessaries for carrying out a thoroughly aseptic operation cannot be forthcoming, gunshot wounds of the abdomen had best not be interfered with.

Stabs of the abdomen are serious if they have penetrated the abdominal wall, as, at the time of injury, septic germs may have been introduced, or the bowel may have been wounded. In either case a fatal inflammation of the peritoneum may be set up. It is inadvisable to probe a wound in order to find out if the belly-cavity has been penetrated, as the probe itself might carry inwards septic germs. In case of doubt it is better to enlarge the wound in order to determine its depth, and to disinfect and close it if it be non-penetrating. If, however, the belly-cavity has been opened, the neighbouring pieces of bowel should be examined, cleansed and, if need be, sutured. Should there have been an escape of the contents of the bowel the "toilet of the peritoneum" would be duly made, and a drainage-tube would be left in. If the stab had injured a large blood-vessel either of the abdominal cavity, or of the liver or of some other organ, the bleeding would be arrested by ligature or suture, and the extravasated blood sponged out. Before the days of antiseptic surgery, and of exploratory abdominal operations, these cases were generally allowed to drift to almost certain death, unrecognized and almost untreated: at the present time a large number of them are saved.

Intussusception.—This is a terribly fatal disease of infants and children, in which a piece of bowel slips into, and is gripped by, the piece next below it. Formerly it was generally the custom to endeavour to reduce the invagination by passing air or water up the rectum under pressure—a speculative method of treatment which sometimes ended in a fatal rupture of the distended bowel, and often—one might almost say *generally*—failed to do what was expected of it. The teaching of modern surgery is that a small incision into the abdomen and a prompt withdrawal of the invaginated piece of bowel can be trusted to do all that, and more than, injection can effect, without blindly risking a rupture of the bowel. It is certain that when the surgeon is unable to unravel the bowel with his fingers gently applied to the parts themselves, no speculative distension of the bowel could have been effective. But the outlook in these distressing cases, even when the operation is promptly resorted to, is extremely grave, because of the intensity of the shock which the intussusception and resulting strangulation entail. Still, every operation gives them by far the best chance.

Cancer of the Intestine.—With the introduction of aseptic methods of operating, it has been found that the surgeon can reach the bowel through the peritoneum easily and safely. With the peritoneum opened, moreover, he can explore the diseased bowel and deal with it as circumstances suggest. If the cancerous mass is fairly movable the affected piece of bowel is excised and the cut ends are spliced together, and the continuity of the alimentary canal is permanently re-established. Thus in the case of cancer of the large intestine which is not too far advanced, the surgeon expects to be able not only to relieve the obstruction of the bowel, but actually to cure the patient of his disease. When the lowest part of the bowel was found to be occupied by a cancerous obstruction, the surgeon used formerly to secure an easy escape for the contents of the bowel by making an opening into the colon in the left loin. But in recent years this operation of *lumbar colotomy* has been almost entirely replaced by opening the colon in the left groin. This operation of *inguinal colotomy* is usually divided into two stages: a loop of the large intestine is first drawn out through the abdominal wound and secured by stitches, and a few days afterwards, when it is firmly glued in place by adhesive inflammation, it is cut across, so that subsequently the motions can no longer find their way into the bowel below the artificial anus. If at the first stage of the operation symptoms of obstruction are urgent, one of the ingenious glass tubes with a rubber conduit, which Mr F. T. Paul has invented, may be forthwith introduced into the distended bowel, so that the contents may be allowed to escape without fear of soiling the peritoneum or even the surface-wound. (E. O.*)

ABDUCTION (Lat. *abductio*, *abducere*, to lead away), a law term denoting the forcible or fraudulent removal of a person, limited by custom to the case where a woman is the victim. In the case of men or children, it has been usual to substitute the term kidnapping (*q.v.*). The old English laws against abduction, generally contemplating its object as the possession of an heiress and her fortune, have been repealed by the Offences against the Person Act 1861, which makes it felony for any one from motives of lucre to take away or detain against her will, with intent to marry or carnally know her, &c., any woman of any age who has any interest in any real or personal estate, or is an heiress presumptive, or co-heiress, or presumptive next of kin to any one having such an interest; or for any one to cause such a woman to be married or carnally known by any other person; or for any one with such intent to allure, take away, or detain any such woman under the age of twenty-one, out of the possession and against the will of her parents or guardians. By s. 54, forcible taking away or detention against her will of any woman of any age with like intent is felony. The same act makes abduction without even any such intent a misdemeanour, where an unmarried girl under the age of sixteen is unlawfully taken out of the possession and against the will of her parents or guardians. In such a case the girl's consent is immaterial, nor is it a defence that the person charged reasonably believed that the girl was sixteen or over. The Criminal Law Amendment Act 1885 made still more stringent provisions with reference to abduction by making the procuration or attempted procuration of any virtuous female under the age of *twenty-one years* a misdemeanour, as well as the abduction of any girl under *eighteen years* of age with the intent that she shall be carnally known, or the detaining of *any female* against her will on any premises, with intent to have, or that another person may have, carnal knowledge of her. In Scotland, where there is no statutory adjustment, abduction is similarly dealt with by practice.

ABD-UL-AZIZ (1830–1876), sultan of Turkey, son of Sultan Mahmud II., was born on the 9th of February 1830, and succeeded his brother Abd-ul-Mejid in 1861. His personal interference in government affairs was not very marked, and extended to little more than taking astute advantage of the constant issue of State loans during his reign to acquire wealth, which was squandered in building useless palaces and in other futile ways: he is even said to have profited, by means of "bear" sales, from the default on the Turkish debt in 1875 and the consequent fall in prices. Another source of revenue was afforded by Ismail Pasha, the khedive of Egypt, who paid heavily in *bakshish* for the firman of 1866, by which the succession to the khedivate was made hereditary from father to son in direct line and in order of primogeniture, as well as for the subsequent firmans of 1867, 1869 and 1872 extending the khedive's prerogatives. It is, however, only fair to add that the sultan was doubtless influenced by the desire to bring about a similar change in the succession to the Ottoman throne and to ensure the succession after him of his eldest son, Yussuf Izz-ed-din. Abd-ul-Aziz visited Europe in 1867, being the first Ottoman sultan to do so, and was made a Knight of the Garter by Queen Victoria. In 1869 he received the visits of the emperor of Austria, the Empress Eugenie and other foreign princes, on their way to the opening of the Suez Canal, and King Edward VII., while prince of Wales, twice visited Constantinople during his reign. The mis-government and financial straits of the country brought on the outbreak of Mussulman discontent and fanaticism which eventually culminated in the murder of two consuls at Salonica and in the "Bulgarian atrocities," and cost Abd-ul-Aziz his throne. His deposition on the 30th of May 1876 was hailed with joy throughout Turkey; a fortnight later he was found dead in the palace where he was confined, and trustworthy medical evidence attributed his death to suicide. Six children survived him: Prince Yussuf Izz-ed-din, born 1857; Princess Saliha, wife of Kurd Ismail Pasha; Princess Nazimé, wife of Khalid Pasha; Prince Abd-ul-Mejid, born 1869; Prince Seif-ed-din, born 1876; Princess Emine, wife of Mahommed Bey; Prince Shefket, born 1872, died 1899.

ABD-UL-HAMID I. (1725–1789), sultan of Turkey, son of Ahmed III., succeeded his brother Mustafa III. in 1773. Long confinement in the palace aloof from state affairs had left him pious, God-fearing and pacific in disposition. At his accession the financial straits of the treasury were such that the usual donative could not be given to the janissaries. War was, however, forced on him, and less than a year after his accession the complete defeat of the Turks at Kozluja led to the treaty of Kuchuk Kainarji (21st July 1774), the most disastrous, especially in its after effects, that Turkey has ever been obliged to conclude. (See TURKEY.) Slight successes in Syria and the Morea against rebellious outbreaks there could not compensate for the loss of the Crimea, which Russia soon showed that she meant to absorb entirely. In 1787 war was again declared against Russia, joined in the following year by Austria, Joseph II. being entirely won over to Catherine, whom he accompanied in her triumphal progress in the Crimea. Turkey held her own against the Austrians, but in 1788 Ochakov fell to the Russians. Four months later, on the 7th of April 1789, the sultan died, aged sixty-four.

ABD-UL-HAMID II. (1842–), sultan of Turkey, son of Sultan Abd-ul-Mejid, was born on the 21st of September 1842, and succeeded to the throne on the deposition of his brother Murad V., on the 31st of August 1876. He accompanied his uncle Sultan Abd-ul-Aziz on his visit to England and France in 1867. At his accession spectators were struck by the listless manner in which he rode, practically unattended, on his way to be girt with the sword of Eyub. He was supposed to be of liberal principles, and the more conservative of his subjects were for some years after his accession inclined to regard him with suspicion as a too ardent reformer. But the circumstances of the country at his accession were ill adapted for liberal developments. Default in the public funds and an empty treasury, the insurrection in Bosnia and the Herzegovina, the war with Servia and Montenegro, the feeling aroused throughout Europe by the methods adopted in stamping out the Bulgarian rebellion, all combined to prove to the new sultan that he could expect little aid from the Powers. But, still clinging to the groundless belief, for which British statesmen had, of late at least, afforded Turkey no justification, that Great Britain at all events would support him, he obstinately refused to give ear to the pressing requests of the Powers that the necessary reforms should be instituted. The international Conference which met at Constantinople towards the end of 1876 was, indeed, startled by the salvo of guns heralding the promulgation of a constitution, but the demands of the Conference were rejected, in spite of the solemn warnings addressed to the sultan by the Powers; Midhat Pasha, the author of the constitution, was exiled; and soon afterwards his work was suspended, though figuring to this day on the Statute-Book. Early in 1877 the disastrous war with Russia followed. The hard terms, embodied in the treaty of San Stefano, to which Abd-ul-Hamid was forced to consent, were to some extent amended at Berlin, thanks in the main to British diplomacy (see EUROPE, *History*); but by this time the sultan had lost all confidence in England, and thought that he discerned in Germany, whose supremacy was evidenced in his eyes by her capital being selected as the meeting-place of the Congress, the future friend of Turkey. He hastened to employ Germans for the reorganization of his finances and his army, and set to work in the determination to maintain his empire in spite of the difficulties surrounding him, to resist the encroachments of foreigners, and to take gradually the reins of absolute power into his own hands, being animated by a profound distrust, not unmerited, of his ministers. Financial embarrassments forced him to consent to a foreign control over the Debt, and the decree of December 1881, whereby many of the revenues of the empire were handed over to the Public Debt Administration for the benefit of the bondholders, was a sacrifice of principle to which he could only have consented with the greatest reluctance. Trouble in Egypt, where a discredited khedive had to be deposed, trouble on the Greek frontier and in Montenegro, where the Powers were determined that the decisions of the Berlin Congress should be carried into effect, were more or less satisfactorily got over. In his attitude towards Arabi, the would-be saviour of Egypt, Abd-ul-Hamid showed less than his usual astuteness, and the resulting consolidation of England's hold over the country contributed still further to his estrangement from Turkey's old ally. The union in 1885 of Bulgaria with Eastern Rumelia, the severance of which had been the great triumph of the Berlin Congress, was another blow. Few people south of the Balkans dreamed that Bulgaria could be anything but a Russian province, and apprehension was entertained of the results of the union until it was seen that Russia really and entirely disapproved of it. Then the best was made of it, and for some years the sultan preserved towards Bulgaria an attitude skilfully [illegible] so as to avoid [illegible] Russia [illegible] Germany (whose friendship was not entirely [illegible] and had to be fostered [illegible] concession from time to time, until in [illegible] the Bagdad railway, was con[illegible] docile instruments, the sultan had [illegible] secretaries, and [illegible] administration of the country [illegible] dissension was not [illegible] in turmoil; the Greeks were [illegible] the Armenians began a violent agitation with a view to obtaining the reforms promised them at Berlin. Minor troubles had occurred in 1892 and 1893 at Marsovan and Yozgad. In 1894 a more serious outbreak in the mountainous region of Sasun was ruthlessly stamped out; the Powers insistently demanded reforms, the eventual grant of which in the autumn of 1895 was the signal for a series of massacres, brought on in part by the injudicious and provocative methods of the agitators, and extending over many months and throughout Asia Minor as well as in the capital itself. The reforms became more or less a dead letter. Crete indeed profited by the grant of extended privileges, but these did not satisfy its turbulent population, and early in 1897 a Greek expedition sailed to unite the island to Greece. War followed, in which Turkey was easily successful and gained a small rectification of frontier; then a few months later Crete was taken over "*en dépôt*" by the Four Powers—Germany and Austria not participating,—and Prince George of Greece was appointed their mandatory. In the next year the sultan received the visit of the German emperor and empress.

Abd-ul-Hamid had always resisted the pressure of the European Powers to the last moment, in order to seem to yield only to overwhelming force, while posing as the champion of Islam against aggressive Christendom. The Panislamic propaganda was encouraged; the privileges of foreigners in the Ottoman Empire—often an obstacle to good government—were curtailed; the new railway to the Holy Places was pushed on, and emissaries were sent to distant countries preaching Islam and the caliph's supremacy. This appeal to Moslem sentiment was, however, powerless against the disaffection due to perennial misgovernment. In Mesopotamia and Yemen disturbance was endemic; nearer home, a semblance of loyalty was maintained in the army and among the Mussulman population by a system of delation and espionage, and by wholesale arrests; while, obsessed by terror of assassination, the sultan withdrew himself into fortified seclusion in the palace of Yildiz.

The national humiliation of the situation in Macedonia (*q.v.*), together with the resentment in the army against the palace spies and informers, at last brought matters to a crisis. The remarkable revolution associated with the names of Niazi Bey and Enver Bey, the young Turk leaders, and the Committee of Union and Progress is described elsewhere (see TURKEY: *History*); here it must suffice to say that Abd-ul-Hamid, on learning of the threat of the Salonica troops to march on Constantinople (July 23), at once capitulated. On the 24th an *iradé* announced the restoration of the suspended constitution of 1876; next day, further *iradés* abolished espionage and the censorship, and ordered the release of political prisoners. On the 17th of December the sultan opened the Turkish parliament with a speech from the throne in which he said that the first parliament had been "temporarily dissolved until the education of the people had been brought to a sufficiently high level by the extension of instruction throughout the empire."

The correct attitude of the sultan did not save him from the suspicion of intriguing with the powerful reactionary elements in the state, a suspicion confirmed by his attitude towards the counter-revolution of the 13th of April, when an insurrection of the soldiers and the Moslem populace of the capital overthrew the committee and the ministry. The committee, restored by the Salonica troops, now decided on Abd-ul-Hamid's deposition, and on the 27th of April his brother Reshid Effendi was proclaimed sultan as Mahommed V. The ex-sultan was conveyed into dignified captivity at Salonica.

ABD-UL-MEJID (1823–1861), sultan of Turkey, was born on the 23rd of April 1823, and succeeded his father Mahmud II. on the 2nd of July 1839. Mahmud appears to have been unable to effect the reforms he desired in the mode of educating his children, so that his son received no better education than that given, according to use and wont, to Turkish princes in the harem. When Abd-ul-Mejid succeeded to the throne, the affairs of Turkey were in an extremely critical state. At the very time his father died, the news was on its way to Constantinople that the Turkish army had been signally defeated at Nezib by that of the rebel Egyptian viceroy, Mehemet Ali, and the Turkish fleet was at the same time on its way to Alexandria, where it was handed over by its commander, Ahmed Pasha, to the same enemy, on the pretext that the young sultan's advisers were sold to Russia. But through the intervention of the European Powers Mehemet Ali was obliged to come to terms, and the Ottoman empire was saved. (See MEHEMET ALI.) In compliance with his father's express instructions, Abd-ul-Mejid set at once about carrying out the reforms to which Mahmud had devoted himself. In November 1839 was proclaimed an edict, known as the Hatt-i-sherif of Gulhané, consolidating and enforcing these reforms, which was supplemented at the close of the Crimean war by a similar statute issued in February 1856. By these enactments it was provided that all classes of the sultan's subjects should have security for their lives and property; that taxes should be fairly imposed and justice impartially administered; and that all should have full religious liberty and equal civil rights. The scheme met with keen opposition from the Mussulman governing classes and the *ulema*, or privileged religious teachers, and was but partially put in force, especially in the remoter parts of the empire; and more than one conspiracy was formed against the sultan's life on account of it. Of the other measures of reform promoted by Abd-ul-Mejid the more important were—the reorganization of the army (1843–1844), the institution of a council of public instruction (1846), the abolition of an odious and unfairly imposed capitation tax, the repression of slave trading, and various provisions for the better administration of the public service and for the advancement of commerce. For the public history of his times—the disturbances and insurrections in different parts of his dominions throughout his reign, and the great war successfully carried on against Russia by Turkey, and by England, France and Sardinia, in the interest of Turkey (1853–1856)—see TURKEY, and CRIMEAN WAR. When Kossuth and others sought refuge in Turkey, after the failure of the Hungarian rising in 1849, the sultan was called on by Austria and Russia to surrender them, but boldly and determinedly refused. It is to his credit, too, that he would not allow the conspirators against his own life to be put to death. He bore the character of being a kind and honourable man, if somewhat weak and easily led. Against this, however, must be set down his excessive extravagance, especially towards the end of his life. He died on the 25th of June 1861, and was succeeded by his brother, Abd-ul-Aziz, as the oldest survivor of the family of Osman. He left several sons, of whom two, Murad V. and Abd-ul-Hamid II., eventually succeeded to the throne. In his reign was begun the reckless system of foreign loans, carried to excess in the ensuing reign, and culminating in default, which led to the alienation of European sympathy from Turkey and, indirectly, to the dethronement and death of Abd-ul-Aziz.

ABDUR RAHMAN KHAN, amir of Afghanistan (*c.* 1844–1901), was the son of Afzul Khan, who was the eldest son of Dost Mahomed Khan, the famous amir, by whose success in war the Barakzai family established their dynasty in the rulership of Afghanistan. Before his death at Herat, 9th June 1863, Dost Mahomed had nominated as his successor Shere Ali, his third son, passing over the two elder brothers, Afzul Khan and Azim Khan; and at first the new amir was quietly recognized. But after a few months Afzul Khan raised an insurrection in the northern province, between the Hindu Kush mountains and the Oxus, where he had been governing when his father died; and then began a fierce contest for power among the sons of Dost Mahomed, which lasted for nearly five years. In this war, which resembles in character, and in its striking vicissitudes, the English War of the Roses at the end of the 15th century, Abdur Rahman soon became distinguished for ability and daring energy. Although his father, Afzul Khan, who had none of these qualities, came to terms with the Amir Shere Ali, the son's behaviour in the northern province soon excited the amir's suspicion, and Abdur Rahman, when he was summoned to Kabul, fled across the Oxus into Bokhara. Shere Ali threw Afzul Khan into prison, and a serious revolt followed in south Afghanistan; but the amir had scarcely suppressed it by winning a desperate battle, when Abdur Rahman's reappearance in the north was a signal for a mutiny of the troops stationed in those parts and a gathering of armed bands to his standard. After some delay and desultory fighting, he and his uncle, Azim Khan, occupied Kabul (March 1866). The amir Shere Ali marched up against them from Kandahar; but in the battle that ensued at Sheikhabad on 10th May he was deserted by a large body of his troops, and after his signal defeat Abdur Rahman released his father, Afzul Khan, from prison in Ghazni, and installed him upon the throne as amir of Afghanistan. Notwithstanding the new amir's incapacity, and some jealousy between the real leaders, Abdur Rahman and his uncle, they again routed Shere Ali's forces, and occupied Kandahar in 1867; and when at the end of that year Afzul Khan died, Azim Khan succeeded to the rulership, with Abdur Rahman as his governor in the northern province. But towards the end of 1868 Shere Ali's return, and a general rising in his favour, resulting in their defeat at Tinah Khan on the 3rd of January 1869, forced them both to seek refuge in Persia, whence Abdur Rahman proceeded afterwards to place himself under Russian protection at Samarkand. Azim died in Persia in October 1869.

This brief account of the conspicuous part taken by Abdur Rahman in an eventful war, at the beginning of which he was not more than twenty years old, has been given to show the rough school that brought out his qualities of resource and fortitude, and the political capacity needed for rulership in Afghanistan. He lived in exile for eleven years, until on the death, in 1879, of Shere Ali, who had retired from Kabul when the British armies entered Afghanistan, the Russian governor-general at Tashkent sent for Abdur Rahman, and pressed him to try his fortunes once more across the Oxus. In March 1880 a report reached India that he was in northern Afghanistan; and the governor-general, Lord Lytton, opened communications with him to the effect that the British government were prepared to withdraw their troops, and to recognize Abdur Rahman as amir of Afghanistan, with the exception of Kandahar and some districts adjacent. After some negotiations, an interview took place between him and Mr (afterwards Sir) Lepel Griffin, the diplomatic representative at Kabul of the Indian government, who described Abdur Rahman as a man of middle height, with an exceedingly intelligent face and frank and courteous manners, shrewd and able in conversation on the business in hand. At the durbar on the 22nd of July 1880, Abdur Rahman was officially recognized as amir, granted assistance in arms and money, and promised, in case of unprovoked foreign aggression, such further aid as might be necessary to repel it, provided that he followed British advice in regard to his external relations. The evacuation of Afghanistan was settled on the terms proposed, and in 1881 the British troops also made over Kandahar to the new amir; but Ayub Khan, one of Shere Ali's sons, marched upon that city from Herat, defeated Abdur Rahman's troops, and occupied the place in July. This serious reverse roused the amir, who had not at first displayed much activity. He led a force from Kabul, met Ayub's army close to Kandahar, and the complete victory which he there won forced Ayub Khan to fly into Persia. From that time Abdur Rahman was fairly seated on the throne at Kabul, and in the course of the next few years he consolidated his dominion over all Afghanistan, suppressing insurrections by a sharp and relentless use of his despotic authority. Against the severity of his measures the powerful Ghilzai tribe revolted, and were crushed by the end of 1887. In that year Ayub Khan made a fruitless inroad from Persia; and in 1888 the amir's cousin, Ishak Khan, rebelled against him in the north; but these two enterprises came to nothing.

In 1885, at the moment when (see AFGHANISTAN) the amir was in conference with the British viceroy, Lord Dufferin, in India, the news came of a collision between Russian and Afghan troops at Panjdeh, over a disputed point in the demarcation of the north-western frontier of Afghanistan. Abdur Rahman's attitude at this critical juncture is a good example of his political sagacity. To one who had been a man of war from his youth up, who had won and lost many fights, the rout of a detachment and the forcible seizure of some debateable frontier lands was an untoward incident; but it was no sufficent reason for calling upon the British, although they had guaranteed his territory's integrity, to vindicate his rights by hostilities which would certainly bring upon him a Russian invasion from the north, and would compel his British allies to throw an army into Afghanistan from the south-east. His interest lay in keeping powerful neighbours, whether friends or foes, outside his kingdom. He knew this to be the only policy that would be supported by the Afghan nation; and although for some time a rupture with Russia seemed imminent, while the Indian government made ready for that contingency, the amir's reserved and circumspect tone in the consultations with him helped to turn the balance between peace and war, and substantially conduced towards a pacific solution. Abdur Rahman left on those who met him in India the impression of a clear-headed man of action, with great self-reliance and hardihood, not without indications of the implacable severity that too often marked his administration. His investment with the insignia of the highest grade of the Order of the Star of India appeared to give him much pleasure.

From the end of 1888 the amir passed eighteen months in his northern provinces bordering upon the Oxus, where he was engaged in pacifying the country that had been disturbed by revolts, and in punishing with a heavy hand all who were known or suspected to have taken any part in rebellion. Shortly afterwards (1892) he succeeded in finally beating down the resistance of the Hazara tribe, who vainly attempted to defend their immemorial independence, within their highlands, of the central authority at Kabul.

In 1893 Sir Henry Durand was deputed to Kabul by the government of India for the purpose of settling an exchange of territory required by the demarcation of the boundary between north-eastern Afghanistan and the Russian possessions, and in order to discuss with the amir other pending questions. The amir showed his usual ability in diplomatic argument, his tenacity where his own views or claims were in debate, with a sure underlying insight into the real situation. The territorial exchanges were amicably agreed upon; the relations between the Indian and Afghan governments, as previously arranged, were confirmed; and an understanding was reached upon the important and difficult subject of the border line of Afghanistan on the east, towards India. In 1895 the amir found himself unable, by reason of ill-health, to accept an invitation from Queen Victoria to visit England; but his second son Nasrullah Khan went in his stead.

Abdur Rahman died on the 1st of October 1901, being succeeded by his son Habibullah. He had defeated all enterprises by rivals against his throne; he had broken down the power of local chiefs, and tamed the refractory tribes; so that his orders were irresistible throughout the whole dominion. His government was a military despotism resting upon a well-appointed army; it was administered through officials absolutely subservient to an inflexible will and controlled by a widespread system of espionage; while the exercise of his personal authority was too often stained by acts of unnecessary cruelty. He held open courts for the receipt of petitioners and the dispensation of justice; and in the disposal of business he was indefatigable. He succeeded in imposing an organized government upon the fiercest and most unruly population in Asia; he availed himself of European inventions for strengthening his armament, while he sternly set his face against all innovations which, like railways and telegraphs, might give Europeans a foothold within his country. His adventurous life, his forcible character, the position of his state as a barrier between the Indian and the Russian empires, and the skill with which he held the balance in dealing with them, combined to make him a prominent figure in contemporary Asiatic politics and will mark his reign as an epoch in the history of Afghanistan.

The amir received an annual subsidy from the British government of 18½ lakhs of rupees. He was allowed to import munitions of war. In 1896 he adopted the title of Zia-ul-Millat-ud-Din (Light of the nation and religion); and his zeal for the cause of Islam induced him to publish treatises on Jehad. His eldest son Habibullah Khan, with his brother Nasrullah Khan, was born at Samarkand. His youngest son, Mahomed Omar Jan, was born in 1889 of an Afghan mother, connected by descent with the Barakzai family.

See also S. Wheeler, F.R.G.S., *The Amir Abdur Rahman* (London, 1895); *The Life of Abdur Rahman, Amir of Afghanistan, G.C.B., G.C.S.I.*, edited by Mir Munshi, Sultan Mahommed Khan (2 vols., London, 1900); *At the Court of the Amir*, by J. A. Grey (1895). (A. C. L.)

ABECEDARIANS, a nickname given to certain extreme Anabaptists (*q.v.*), who regarded the teaching of the Holy Spirit as all that was necessary, and so despised all human learning and even the power of reading the written word.

À BECKETT, GILBERT ABBOTT (1811–1856), English writer, was born in north London on the 9th of January 1811. He belonged to a family claiming descent from the father of St Thomas Becket. His elder brother, Sir William à Beckett (1806–1869), became chief justice of Victoria (Australia). Gilbert Abbott à Beckett was educated at Westminster school, and was called to the bar at Gray's Inn in 1841. He edited *Figaro in London*, and was one of the original staff of *Punch* and a contributor all his life. He was an active journalist on *The Times* and *The Morning Herald*, contributed a series of light articles to *The Illustrated London News*, conducted in 1846 *The Almanack of the Month* and found time to produce some fifty or sixty plays, among them dramatized versions of Dickens's shorter stories in collaboration with Mark Lemon. As poor-law commissioner he presented a valuable report to the home secretary regarding scandals in connexion with the Andover Union, and in 1849 he became a metropolitan police magistrate. He died at Boulogne on the 30th of August 1856 of typhus fever.

His eldest son GILBERT ARTHUR À BECKETT (1837–1891) was born at Hammersmith on the 7th of April 1837. He went up to Christ Church, Oxford, as a Westminster scholar in 1855, graduating in 1860. He was entered at Lincoln's Inn, but gave his attention chiefly to the drama, producing *Diamonds and Hearts* at the Haymarket in 1867, which was followed by other light comedies. His pieces include numerous burlesques and pantomimes, the libretti of *Savonarola* (Hamburg, 1884) and of *The Canterbury Pilgrims* (Drury Lane, 1884) for the music of Dr (afterwards Sir) C. V. Stanford. *The Happy Land* (Court Theatre, 1873), a political burlesque of W. S. Gilbert's *Wicked World*, was written in collaboration with F. L. Tomline. For the last ten years of his life he was on the regular staff of *Punch*. His health was seriously affected in 1889 by the death of his only son, and he died on the 15th of October 1891.

A younger son, ARTHUR WILLIAM À BECKETT (1844–1909), a well-known journalist and man of letters, was also on the staff of *Punch* from 1874 to 1902, and gave an account of his father and his own reminiscences in *The À Becketts of Punch* (1903). He died in London on the 14th of January 1909.

See also M. H. Spielmann, *The History of Punch* (1895).

ABEDNEGO, the name given in Babylon to Azariah, one of the companions of Daniel (Dan. i. 7, &c.). It is probably a corruption, perhaps deliberate, of Abednebo, "servant of Nebo," though G. Hoffmann thinks that the original form was Abednergo, for Abednergal, "servant of the god Nergal." C. H. Toy compares Barnebo, "son of Nebo," of which he regards Barnabas as a slightly disguised form (*Jewish Encyclopaedia*).

ABEKEN, HEINRICH (1809–1872), German theologian and Prussian official, was born at Berlin on the 8th of August 1809. He studied theology at Berlin and in 1834 became chaplain to the Prussian embassy in Rome. In 1841 he visited England, being commissioned by King Frederick William IV. to make arrangements for the establishment of the Protestant bishopric of Jerusalem. In 1848 he received an appointment in the Prussian ministry for foreign affairs, and in 1853 was promoted to be privy councillor of legation (Geheimer Legationsrath). He was much employed by Bismarck in the writing of official despatches, and stood high in the favour of King William, whom he often accompanied on his journeys as representative of the foreign office. He was present with the king during the campaigns of 1866 and 1870–71. In 1851 he published anonymously *Babylon und Jerusalem*, a slashing criticism of the views of the Countess von Hahn-Hahn (*q.v.*).

See *Heinrich Abeken, ein schlichtes Leben in bewegter Zeit* (Berlin, 1898), by his widow. This is valuable by reason of the letters written from the Prussian headquarters.

ABEL (Hebrew for *breath*), the second son of Adam, slain by Cain, his elder brother (Gen. iv. 1-16). The narrative in Genesis which tells us that "the Lord had respect unto Abel and to his offering, but unto Cain and to his offering he had not respect," is supplemented by the statement of the New Testament, that "by faith Abel offered unto God a more excellent sacrifice than Cain" (Heb. xi. 4), and that Cain slew Abel "because his own works were evil and his brother's righteous" (1 John iii. 12). See further under Cain. The name has been identified with the Assyrian *ablu*, "son," but this is far from certain. It more probably means "herdsman" (cf. the name Jabal), and a distinction is drawn between the pastoral Abel and the agriculturist Cain. If Cain is the eponym of the Kenites it is quite possible that Abel was originally a South Judaean demigod or hero; on this, see Winckler, *Gesch. Israels*, ii. p. 189; E. Meyer, *Israeliten*, p. 395. A sect of *Abelitae*, who seem to have lived in North Africa, is mentioned by Augustine (*De Haeresibus*, lxxxvi.).

ABEL, SIR FREDERICK AUGUSTUS, Bart. (1827–1902), English chemist, was born in London on the 17th of July 1827. After studying chemistry for six years under A. W. von Hofmann at the Royal College of Chemistry (established in London in 1845), he became professor of chemistry at the Royal Military Academy in 1851, and three years later was appointed chemist to the War Department and chemical referee to the government. During his tenure of this office, which lasted until 1888, he carried out a large amount of work in connexion with the chemistry of explosives. One of the most important of his investigations had to do with the manufacture of gun-cotton, and he developed a process, consisting essentially of reducing the nitrated cotton to fine pulp, which enabled it to be prepared with practically no danger and at the same time yielded the product in a form that increased its usefulness. This work to an important extent prepared the way for the "smokeless powders" which came into general use towards the end of the 19th century; cordite, the particular form adopted by the British government in 1891, was invented jointly by him and Professor James Dewar. Our knowledge of the explosion of ordinary black powder was also greatly added to by him, and in conjunction with Sir Andrew Noble he carried out one of the most complete inquiries on record into its behaviour when fired. The invention of the apparatus, legalized in 1879, for the determination of the flash-point of petroleum, was another piece of work which fell to him by virtue of his official position. His first instrument, the open-test apparatus, was prescribed by the act of 1868, but, being found to possess certain defects, it was superseded in 1879 by the Abel close-test instrument (see Petroleum). In electricity Abel studied the construction of electrical fuses and other applications of electricity to warlike purposes, and his work on problems of steel manufacture won him in 1897 the Bessemer medal of the Iron and Steel Institute, of which from 1891 to 1893 he was president. He was president of the Institution of Electrical Engineers (then the Society of Telegraph Engineers) in 1877. He became a member of the Royal Society in 1860, and received a royal medal in 1887. He took an important part in the work of the Inventions Exhibition (London) in 1885, and in 1887 became organizing secretary and first director of the Imperial Institute, a position he held till his death, which occurred in London on the 6th of September 1902. He was knighted in 1891, and created a baronet in 1893.

Among his books were—*Handbook of Chemistry* (with C. L. Bloxam), *Modern History of Gunpowder* (1866), *Gun-cotton* (1866), *On Explosive Agents* (1872), *Researches in Explosives* (1875), and *Electricity applied to Explosive Purposes* (1884). He also wrote several important articles in the ninth edition of the *Encyclopaedia Britannica.*

ABEL, KARL FRIEDRICH (1725–1787), German musician, was born in Köthen in 1725, and died on the 20th of June 1787 in London. He was a great player on the viola da gamba, and composed much music of importance in its day for that instrument. He studied under Johann Sebastian Bach at the Leipzig Thomasschule; played for ten years (1748–1758) under A. Hasse in the band formed at Dresden by the elector of Saxony; and then, going to England, became (in 1759) chamber-musician to Queen Charlotte. He gave a concert of his own compositions in London, performing on various instruments, one of which, the pentachord, was newly invented. In 1762 Johann Christian Bach, the eleventh son of Sebastian, came to London, and the friendship between him and Abel led, in 1764 or 1765, to the establishment of the famous concerts subsequently known as the Bach and Abel concerts. For ten years these were organized by Mrs Cornelys, whose enterprises were then the height of fashion. In 1775 the concerts became independent of her, and were continued by Abel unsuccessfully for a year after Bach's death in 1782. At them the works of Haydn were first produced in England. After the failure of his concert undertakings Abel still remained in great request as a player on various instruments new and old, but he took to drink and thereby hastened his death. He was a man of striking presence, of whom several fine portraits, including two by Gainsborough, exist.

ABEL, NIELS HENRIK (1802–1829), Norwegian mathematician, was born at Findöe on the 25th of August 1802. In 1815 he entered the cathedral school at Christiania, and three years later he gave proof of his mathematical genius by his brilliant solutions of the original problems proposed by B. Holmboë. About this time, his father, a poor Protestant minister, died, and the family was left in straitened circumstances; but a small pension from the state allowed Abel to enter Christiania University in 1821. His first notable work was a proof of the impossibility of solving the quintic equation by radicals. This investigation was first published in 1824 and in abstruse and difficult form, and afterwards (1826) more elaborately in the first volume of *Crelle's Journal.* Further state aid enabled him to visit Germany and France in 1825, and having visited the astronomer Heinrich Schumacher (1780–1850) at Hamburg, he spent six months in Berlin, where he became intimate with August Leopold Crelle, who was then about to publish his mathematical journal. This project was warmly encouraged by Abel, who contributed much to the success of the venture. From Berlin he passed to Freiberg, and here he made his brilliant researches in the theory of functions, elliptic, hyperelliptic and a new class known as Abelians being particularly studied. In 1826 he moved to Paris, and during a ten months' stay he met the leading mathematicians of France; but he was little appreciated, for his work was scarcely known, and his modesty restrained him from proclaiming his researches. Pecuniary embarrassments, from which he had never been free, finally compelled him to abandon his tour, and on his return to Norway he taught for some time at Christiania. In 1829 Crelle obtained a post for him at Berlin, but the offer did not reach Norway until after his death near Arendal on the 6th of April.

The early death of this talented mathematician, of whom Legendre said "*quelle tête celle du jeune Norvegien!*", cut short a career of extraordinary brilliance and promise. Under Abel's guidance, the prevailing obscurities of analysis began to be cleared, new fields were entered upon and the study of functions so advanced as to provide mathematicians with numerous ramifications along which progress could be made. His works, the greater part of which originally appeared in *Crelle's Journal*, were edited by Holmboë and published in 1839 by the Swedish government, and a more complete edition by L. Sylow and S. Lie was published in 1881.

For further details of his mathematical investigations see the articles Groups, Theory of, and Functions of Complex Variables.

See C. A. Bjerknes, *Niels Henrik Abel: Tableau de sa vie et son action scientifique* (Paris, 1885); Lucas de Peslouän, *Niels Henrik Abel* (Paris, 1906).

ABEL (better Abell), **THOMAS** (d. 1540), an English priest who was martyred during the reign of Henry VIII. The place and date of his birth are unknown. He was educated at Oxford and entered the service of Queen Catherine some time before 1528, when he was sent by her to the emperor Charles V. on a mission relating to the proposed divorce. On his return he was presented by Catherine to the living of Bradwell, in Essex, and remained to the last a staunch supporter of the unfortunate queen. In 1533, he published his *Invicta Veritas* (with the fictitious pressmark of Luneberge, to avoid suspicion), which contained an answer to the numerous tracts supporting Henry's ecclesiastical claims. After an imprisonment of more than six years, Abel was sentenced to death for denying the royal supremacy in the church, and was executed at Smithfield on the 30th of July 1540. There is still to be seen on the wall of his prison in the Tower the symbol of a bell with an A upon it and the name Thomas above, which he carved during his confinement. He was beatified by Pope Leo XIII.

See J. Gillow's *Bibl. Dictionary of Eng. Catholics*, vol. i.; *Calendar of State Papers of Henry VIII.*, vols. iv.-vii. *passim.*

ABELARD, PETER (1079–1142), scholastic philosopher, was born at Pallet (Palais), not far from Nantes, in 1079. He was the eldest son of a noble Breton house. The name *Abaelardus* (also written *Abailardus*, *Abaielardus*, and in many other ways) is said to be a corruption of *Habelardus*, substituted by himself for a nickname *Bajolardus* given to him when a student. As a boy, he showed an extraordinary quickness of apprehension, and, choosing a learned life instead of the knightly career natural to a youth of his birth, early became an adept in the art of dialectic, under which name philosophy, meaning at that time chiefly the logic of Aristotle transmitted through Latin channels, was the great subject of liberal study in the episcopal schools. Roscellinus, the famous canon of Compiègne, is mentioned by himself as his teacher; but whether he heard this champion of extreme Nominalism in early youth, when he wandered about from school to school for instruction and exercise, or some years later, after he had already begun to teach for himself, remains uncertain. His wanderings finally brought him to Paris, still under the age of twenty. There, in the great cathedral school of Notre-Dame, he sat for a while under the teaching of William of Champeaux, the disciple of St Anselm and most advanced of Realists, but, presently stepping forward, he overcame the master in discussion, and thus began a long duel that issued in the downfall of the philosophic theory of Realism, till then dominant in the early Middle Age. First, in the teeth of opposition from the metropolitan teacher, while yet only twenty-two, he proceeded to set up a school of his own at Melun, whence, for more direct competition, he removed to Corbeil, nearer Paris. The success of his teaching was signal, though for a time he had to quit the field, the strain proving too great for his physical strength. On his return, after 1108, he found William lecturing no longer at Notre-Dame, but in a monastic retreat outside the city, and there battle was again joined between them. Forcing upon the Realist a material change of doctrine, he was once more victorious, and thenceforth he stood supreme. His discomfited rival still had power to keep him from lecturing in Paris, but soon failed in this last effort also. From Melun, where he had resumed teaching, Abelard passed to the capital, and set up his school on the heights of St Geneviève, looking over Notre-Dame. From his success in dialectic, he next turned to theology and attended the lectures of Anselm at Laon. His triumph over the theologian was complete; the pupil was able to give lectures, without previous training or special study, which were acknowledged superior to those of the master. Abelard was now at the height of his fame. He stepped into the chair at Notre-Dame, being also nominated canon, about the year 1115.

Few teachers ever held such sway as Abelard now did for a time. Distinguished in figure and manners, he was seen surrounded by crowds—it is said thousands—of students, drawn from all countries by the fame of his teaching, in which acuteness of thought was relieved by simplicity and grace of exposition. Enriched by the offerings of his pupils, and feasted with universal admiration, he came, as he says, to think himself the only philosopher standing in the world. But a change in his fortunes was at hand. In his devotion to science, he had hitherto lived a very regular life, varied only by the excitement of conflict: now, at the height of his fame, other passions began to stir within him. There lived at that time, within the precincts of Notre-Dame, under the care of her uncle, the canon Fulbert, a young girl named Heloise, of noble extraction, and born about 1101. Fair, but still more remarkable for her knowledge, which extended beyond Latin, it is said, to Greek and Hebrew, she awoke a feeling of love in the breast of Abelard; and with intent to win her, he sought and gained a footing in Fulbert's house as a regular inmate. Becoming also tutor to the maiden, he used the unlimited power which he thus obtained over her for the purpose of seduction, though not without cherishing a real affection which she returned in unparalleled devotion. Their relation interfering with his public work, and being, moreover, ostentatiously sung by himself, soon became known to all the world except the too-confiding Fulbert; and, when at last it could not escape even his vision, they were separated only to meet in secret. Thereupon Heloise found herself pregnant, and was carried off by her lover to Brittany, where she gave birth to a son. To appease her furious uncle, Abelard now proposed a marriage, under the condition that it should be kept secret, in order not to mar his prospects of advancement in the church; but of marriage, whether public or secret, Heloise would hear nothing. She appealed to him not to sacrifice for her the independence of his life, nor did she finally yield to the arrangement without the darkest forebodings, only too soon to be realized. The secret of the marriage was not kept by Fulbert; and when Heloise, true to her singular purpose, boldly denied it, life was made so unsupportable to her that she sought refuge in the convent of Argenteuil. Immediately Fulbert, believing that her husband, who aided in the flight, designed to be rid of her, conceived a dire revenge. He and some others broke into Abelard's chamber by night, and perpetrated on him the most brutal mutilation. Thus cast down from his pinnacle of greatness into an abyss of shame and misery, there was left to the brilliant master only the life of a monk. The priesthood and ecclesiastical office were canonically closed to him. Heloise, not yet twenty, consummated her work of self-sacrifice at the call of his jealous love, and took the veil.

It was in the abbey of St Denis that Abelard, now aged forty, sought to bury himself with his woes out of sight. Finding, however, in the cloister neither calm nor solitude, and having gradually turned again to study, he yielded after a year to urgent entreaties from without and within, and went forth to reopen his school at the priory of Maisoncelle (1120). His lectures, now framed in a devotional spirit, were heard again by crowds of students, and all his old influence seemed to have returned; but old enmities were revived also, against which he was no longer able as before to make head. No sooner had he put in writing his theological lectures (apparently the *Introductio ad Theologiam* that has come down to us), than his adversaries fell foul of his rationalistic interpretation of the Trinitarian dogma. Charging him with the heresy of Sabellius in a provincial synod held at Soissons in 1121, they procured by irregular practices a condemnation of his teaching, whereby he was made to throw his book into the flames and then was shut up in the convent of St Médard at Soissons. After the other, it was the bitterest possible experience that could befall him, nor, in the state of mental desolation into which it plunged him, could he find any comfort from being soon again set free. The life in his own monastery proved no more congenial than formerly. For this Abelard himself was partly responsible. He took a sort of malicious pleasure in irritating the monks. *Quasi jocando*, he cited Bede to prove that Dionysius the Areopagite had been bishop of Corinth, while they relied upon the statement of the abbot Hilduin that he had been bishop of Athens. When this historical heresy led to the inevitable persecution, Abelard wrote a letter to the abbot Adam in which he preferred to the authority of Bede that of Eusebius' *Historia Ecclesiastica* and St Jerome, according to whom Dionysius, bishop of Corinth, was distinct from Dionysius the Areopagite, bishop of Athens and founder of the abbey, though, in deference to Bede, he suggested that the Areopagite might also have been bishop of Corinth. Life in the monastery was intolerable for such a troublesome spirit, and Abelard, who had once attempted to escape the persecution he had called forth by flight to a monastery at Provins, was finally allowed to withdraw. In a desert place near Nogent-sur-Seine, he built himself a cabin of stubble and reeds, and turned hermit. But there fortune came back to him with a new surprise. His retreat becoming known, students flocked from Paris, and covered the wilderness around him with their tents and huts. When he began to teach again he found consolation, and in gratitude he consecrated the new oratory they built for him by the name of the Paraclete.

Upon the return of new dangers, or at least of fears, Abelard left the Paraclete to make trial of another refuge, accepting an invitation to preside over the abbey of St Gildas-de-Rhuys, on the far-off shore of Lower Brittany. It proved a wretched exchange. The region was inhospitable, the domain a prey to lawless exaction, the house itself savage and disorderly. Yet for nearly ten years he continued to struggle with fate before he fled from his charge, yielding in the end only under peril of violent death. The misery of those years was not, however, unrelieved; for he had been able, on the breaking up of Heloise's convent at Argenteuil, to establish her as head of a new religious house at the deserted Paraclete, and in the capacity of spiritual director he often was called to revisit the spot thus made doubly dear to him. All this time Heloise had lived amid universal esteem for her knowledge and character, uttering no word under the doom that had fallen upon her youth; but now, at last, the occasion came for expressing all the pent-up emotions of her soul. Living on for some time apart (we do not know exactly where), after his flight from St Gildas, Abelard wrote, among other things, his famous *Historia Calamitatum*, and thus moved her to pen her first *Letter*, which remains an unsurpassed utterance of human passion and womanly devotion; the first being followed by the two other *Letters*, in which she finally accepted the part of resignation which, now as a brother to a sister, Abelard commended to her. He not long after was seen once more upon the field of his early triumphs lecturing on Mount St Geneviève in 1136 (when he was heard by John of Salisbury), but it was only for a brief space: no new triumph, but a last great trial, awaited him in the few years to come of his chequered life. As far back as the Paraclete days, he had counted as chief among his foes Bernard of Clairvaux, in whom was incarnated the principle of fervent and unhesitating faith, from which rational inquiry like his was sheer revolt, and now this uncompromising spirit was moving, at the instance of others, to crush the growing evil in the person of the boldest offender. After preliminary negotiations, in which Bernard was roused by Abelard's steadfastness to put forth all his strength, a council met at Sens (1141), before which Abelard, formally arraigned upon a number of heretical charges, was prepared to plead his cause. When, however, Bernard, not without foregone terror in the prospect of meeting the redoubtable dialectician, had opened the case, suddenly Abelard appealed to Rome. The stroke availed him nothing; for Bernard, who had power, notwithstanding, to get a condemnation passed at the council, did not rest a moment till a second condemnation was procured at Rome in the following year. Meanwhile, on his way thither to urge his plea in person, Abelard had broken down at the abbey of Cluny, and there, an utterly fallen man, with spirit of the humblest, and only not bereft of his intellectual force, he lingered but a few months before the approach of death. Removed by friendly hands, for the relief of his sufferings, to the priory of St Marcel, near Chalon-sur-Saone, he died on the 21st of April 1142. First buried at St Marcel, his remains soon after were carried off in secrecy to the Paraclete, and given over to the loving care of Heloise, who in time came herself to rest beside them (1164). The bones of the pair were shifted more than once afterwards, but they were marvellously preserved even through the vicissitudes of the French Revolution, and now they lie united in the well-known tomb in the cemetery of Père-la-Chaise at Paris.

Great as was the influence exerted by Abelard on the minds of his contemporaries and the course of medieval thought, he has been little known in modern times but for his connexion with Heloise. Indeed, it was not till the 19th century, when Cousin in 1836 issued the collection entitled *Ouvrages inédits d'Abélard*, that his philosophical performance could be judged at first hand; of his strictly philosophical works only one, the ethical treatise *Scito te ipsum*, having been published earlier, namely, in 1721. Cousin's collection, besides giving extracts from the theological work *Sic et Non* (an assemblage of opposite opinions on doctrinal points, culled from the Fathers as a basis for discussion, the main interest in which lies in the fact that there is no attempt to reconcile the different opinions), includes the *Dialectica*, commentaries on logical works of Aristotle, Porphyry and Boëthius, and a fragment, *De Generibus et Speciebus*. The last-named work, and also the psychological treatise *De Intellectibus*, published apart by Cousin (in *Fragmens Philosophiques*, vol. ii.), are now considered upon internal evidence not to be by Abelard himself, but only to have sprung out of his school. A genuine work, the *Glossulae super Porphyrium*, from which Charles de Rémusat, in his classical monograph *Abélard* (1845), has given extracts, remains in manuscript.

The general importance of Abelard lies in his having fixed more decisively than any one before him the scholastic manner of philosophizing, with its object of giving a formally rational expression to the received ecclesiastical doctrine. However his own particular interpretations may have been condemned, they were conceived in essentially the same spirit as the general scheme of thought afterwards elaborated in the 13th century with approval from the heads of the church. Through him was prepared in the Middle Age the ascendancy of the philosophical authority of Aristotle, which became firmly established in the half-century after his death, when first the completed *Organon*, and gradually all the other works of the Greek thinker, came to be known in the schools: before his time it was rather upon the authority of Plato that the prevailing Realism sought to lean. As regards his so-called Conceptualism and his attitude to the question of Universals, see SCHOLASTICISM. Outside of his dialectic, it was in ethics that Abelard showed greatest activity of philosophical thought; laying very particular stress upon the subjective intention as determining, if not the moral character, at least the moral value, of human action. His thought in this direction, wherein he anticipated something of modern speculation, is the more remarkable because his scholastic successors accomplished least in the field of morals, hardly venturing to bring the principles and rules of conduct under pure philosophical discussion, even after the great ethical inquiries of Aristotle became fully known to them.

BIBLIOGRAPHY.—Abelard's own works remain the best sources for his life, especially his *Historia Calamitatum*, an autobiography, and the correspondence with Heloise. The literature on Abelard is extensive, but consists principally of monographs on different aspects of his philosophy. Charles de Rémusat's *Abélard* (2 vols., 1845) remains an authority; it must be distinguished from his drama *Abélard* (1877), which is an attempt to give a picture of medieval life. McCabe's life of Abelard is written closely from the sources. See also the valuable analysis by Nitsch in the article "Abälard" in Hauck's *Realencyklopädie f. prot. Theol. u. Kirche*, 3rd ed., 1896. There is a comprehensive bibliography in U. Chevalier, *Répertoire des sources hist. du moyen âge*, s. "Abailard." (G. C. R.; J. T. S.*)

ABELIN, JOHANN PHILIPP, an early 16th-century German chronicler, was born, probably, at Strasburg, and died there between the years 1634 and 1637. He wrote numerous histories over the pseudonyms of Philipp Arlanibäus, Abeleus and Johann Ludwig Gottfried or Gotofredus, his earliest works of importance being his history of the German wars of Gustavus Adolphus, entitled *Arma Suecica* (pub. 1631–1634, in 12 parts), and the *Inventarium Sueciae* (1632)—both compilations from existing records. His best known work is the *Theatrum Europaeum*, a series of chronicles of the chief events in the history of the world down to 1619. He was himself responsible for the first two volumes. It was continued by various writers and grew to twenty-one volumes (Frankf. 1633–1738). The chief interest of the work is, however, its illustration by the beautiful copperplate engravings of Matthäus Merian (1593–1650). Abelin also wrote a history of the antipodes, *Historia Antipodum* (posthumously pub. Frankf. 1655), and a history of India.

See G. Droysen, *Arlanibaeus, Godofredus, Abelinus* (Berlin, 1864); and notice in *Allgemeine Deutsche Biographie.*

ABENCERRAGES, a family or faction that is said to have held a prominent position in the Moorish kingdom of Granada in the 15th century. The name appears to have been derived from the Yussuf ben-Serragh, the head of the tribe in the time of Mahommed VII., who did that sovereign good service in his struggles to retain the crown of which he was three times deprived. Nothing is known of the family with certainty; but the name is familiar from the interesting romance of Gines Perez de Hita, *Guerras civiles de Granada*, which celebrates the feuds of the Abencerrages and the rival family of the Zegris, and the cruel treatment to which the former were subjected. J. P. de Florian's *Gonsalve de Cordoue* and Chateaubriand's *Le dernier des Abencerrages* are imitations of Perez de Hita's work. The hall of the Abencerrages in the Alhambra takes its name from being the reputed scene of the massacre of the family.

ABENDANA, the name of two Jewish theologians. (1) Jacob (1630–1695), rabbi (Hakham) of the Spanish Jews in London from 1680. Like his brother Isaac, Jacob Abendana had a circle of Christian friends, and his reputation led to the appreciation of Jewish scholarship by modern Christian theologians. (2) Isaac (*c.* 1650–1710), his brother, taught Hebrew at Cambridge and afterwards at Oxford. He compiled a Jewish Calendar and wrote *Discourses on the Ecclesiastical and Civil Polity of the Jews* (1706).

ABENEZRA (Ibn Ezra), or, to give him his full name, Abraham ben Meir Ibn Ezra (1092 or 1093–1167), one of the most distinguished Jewish men of letters and writers of the Middle Ages. He was born at Toledo, left his native land of Spain before 1140 and led until his death a life of restless wandering, which took him to North Africa, Egypt, Italy (Rome, Lucca, Mantua, Verona), Southern France (Narbonne, Beziers), Northern France (Dreux), England (London), and back again to the South of France. At several of the above-named places he remained for some time and developed a rich literary activity. In his native land he had already gained the reputation of a distinguished poet and thinker; but, apart from his poems, his works, which were all in the Hebrew language, were written in the second period of his life. With these works, which cover in the first instance the field of Hebrew philology and Biblical exegesis, he fulfilled the great mission of making accessible to the Jews of Christian Europe the treasures of knowledge enshrined in the works written in Arabic which he had brought with him from Spain. His grammatical writings, among which *Moznayim* ("the Scales," written in 1140) and *Zahot* ("Correctness," written in 1141) are the most valuable, were the first expositions of Hebrew grammar in the Hebrew language, in which the system of Hayyūj and his school prevailed. He also translated into Hebrew the two writings of Hayyūj in which the foundations of the system were laid down Of greater original value than the grammatical works of Ibn Ezra are his commentaries on most of the books of the Bible, of which, however, a part has been lost. His reputation as an intelligent and acute expounder of the Bible was founded on his commentary on the Pentateuch, of which the great popularity is evidenced by the numerous commentaries which were written upon it. In the editions of this commentary (ed. princ. Naples 1488) the commentary on the book of Exodus is replaced by a second, more complete commentary of Ibn Ezra, while the first and shorter commentary on Exodus was not printed until 1840. The great editions of the Hebrew Bible with rabbinical commentaries contained also commentaries of Ibn Ezra's on the following books of the Bible: Isaiah, Minor Prophets, Psalms, Job, Pentateuch, Daniel; the commentaries on Proverbs, Ezra and Nehemiah which bear his name are really those of Moses Kimhi. Ibn Ezra wrote a second commentary on Genesis as he had done on Exodus, but this was never finished. There are second commentaries also by him on the Song of Songs, Esther and Daniel. The importance of the exegesis of Ibn Ezra consists in the fact that it aims at arriving at the simple sense of the text, the so-called "Pesohat," on solid grammatical principles. It is in this that, although he takes a great part of his exegetical material from his predecessors, the originality of his mind is everywhere apparent, an originality which displays itself also in the witty and lively language of his commentaries. To judge by certain signs, of which Spinoza in his *Tractatus Theologico Politicus* makes use, Ibn Ezra belongs to the earliest pioneers of the criticism of the Pentateuch. His commentaries, and especially some of the longer excursuses, contain numerous contributions to the philosophy of religion. One writing in particular, which belongs to this province (Yōsōd Mēra), on the division and the reasons for the Biblical commandments, he wrote in 1158 for a London friend, Joseph b. Jacob. In his philosophical thought neo-platonic ideas prevail; and astrology also had a place in his view of the world. He also wrote various works on mathematical and astronomical subjects. Ibn Ezra died on the 28th of January 1167, the place of his death being unknown.

Among the literature on Ibn Ezra may be especially mentioned: M. Friedländer, *Essays on the Writings of Ibn Ezra* (London, 1877); W. Bacher, *Abraham Ibn Ezra als Grammatiker* (Strasburg, 1882); M. Steinschneider, *Abraham Ibn Ezra*, in the *Zeitschrift für Mathematik und Physik*, Band xxv., Supplement: D. Rosin, *Die Religionsphilosophie Abraham Ibn Ezra's* in vols. xlii. and xliii. of the *Monatschrift für Geschichte und Wissenschaft des Judenthums;* his *Diwan* was edited by T. Egers (Berlin, 1886); a collection of his poems, *Reime und Gedichte*, with translation and commentary, were published by D. Rosin in several annual reports of the Jewish theological Seminary at Breslau (1885–1894). (W. Ba.)

ABENSBERG, a town of Germany, in the kingdom of Bavaria, on the Abens, a tributary of the Danube, 18 m. S.W. of Regensburg, with which it is connected by rail. Pop. 2202. It has a small spa, and its sulphur baths are resorted to for the cure of rheumatism and gout. The town is the Castra Abusina of the Romans, and Roman remains exist in the neighbourhood. Here, on the 20th of April 1809, Napoleon gained a signal victory over the Austrians under the Archduke Louis and General Hiller.

ABEOKUTA, a town of British West Africa in the Egba division of the Yoruba country, S. Nigeria Protectorate. It is situated in 7° 8′ N., 3° 25′ E., on the Ogun river, 64 m. N. of Lagos by railway, or 81 m. by water. Population, approximately 60,000. Abeokuta lies in a beautiful and fertile country, the surface of which is broken by masses of grey granite. It is spread over an extensive area, being surrounded by mud walls 18 miles in extent. Abeokuta, under the reforming zeal of its native rulers, was largely transformed during the early years of the 20th century. Law courts, government offices, prisons and a substantial bridge were built, good roads made, and a large staff of sanitary inspectors appointed. The streets are generally narrow and the houses built of mud. There are numerous markets in which a considerable trade is done in native products and articles of European manufacture. Palm-oil, timber, rubber, yams and shea-butter are the chief articles of trade. An official newspaper is published in the Yoruba and English languages. Abeokuta is the headquarters of the Yoruba branch of the Church Missionary Society, and British and American missionaries have met with some success in their civilizing work. In their schools about 2000 children are educated. The completion in 1899 of a railway from Lagos helped not only to develop trade but to strengthen generally the influence of the white man.

Abeokuta (a word meaning "under the rocks"), dating from 1825, owes its origin to the incessant inroads of the slave-hunters from Dahomey and Ibadan, which compelled the village populations scattered over the open country to take refuge in this rocky stronghold against the common enemy. Here they constituted themselves a free confederacy of many distinct tribal groups, each preserving the traditional customs, religious rites and even the very names of their original villages. Yet this apparently incoherent aggregate held its ground successfully against the powerful armies often sent against the place both by the king of Dahomey from the west, and by the people of Ibadan from the north-east.

The district of Egba, of which Abeokuta is the capital, has an estimated area of 3000 sq. m. and a population of some 350,000. It is officially known as the Abeokuta province of the Southern Nigeria protectorate. It contains luxuriant forests of palm-trees, which constitute the chief wealth of the people. Cotton is indigenous and is grown for export. The Egbas are enthusiastic farmers and have largely adopted European methods of cultivation. They are very tenacious of their independence, but accepted without opposition the establishment of a British protectorate, which, while putting a stop to inter-tribal warfare, slave-raiding and human sacrifices, and exercising control over the working of the laws, left to the people executive and fiscal autonomy. The administration is in the hands of a council of chiefs which exercises legislative, executive and, to some extent, judicial functions. The president of this council, or ruling chief—chosen from among the members of the two recognized reigning families—is called the *alake*, a word meaning "Lord of Ake," Ake being the name of the principal quarter of Abeokuta, after the ancient capital of the Egbas. The alake exercises little authority apart from his council, the form of government being largely democratic. Revenue is chiefly derived from tolls or import duties. A visit of the alake to England in 1904 evoked considerable public interest. The chief was a man of great intelligence, eager to study western civilization, and an ardent agriculturist.

See the publications of the Church Missionary Society dealing with the Yoruba Mission; Col. A. B. Ellis's *The Yoruba-speaking Peoples* (London, 1894); and an article on Abeokuta by Sir Wm. Macgregor, sometime governor of Lagos, in the African Society's *Journal*, No. xii. (London, July 1904).

ABERAVON, a contributory parliamentary and municipal borough of Glamorganshire, Wales, on the right bank of the Avon, near its mouth in Swansea Bay, 11 m. E.S.E. of Swansea and 170 m. from London by rail. Pop. (1901) 7553. It has a station on the Rhondda and Swansea Bay railway and is also on the main South Wales line of the Great Western, whose station, however, is at Port Talbot, half a mile distant, on the eastern side of the Avon. The valley of the Avon, which is only some three miles long, has been from about 1840 a place of much metallurgical activity. There are tinplate and engineering works within the borough. At Cwmavon, 1½ m. to the north-east, are large copper-smelting works established in 1838, acquired two years later by the governor and Company of the Copper Miners of England, but now worked by the Rio Tinto Copper Company. There are also iron, steel and tinplate works both at Cwmavon and at Port Talbot, which, when it consisted only of docks, was appropriately known as Aberavon Port.

The town derives its name from the river Avon (corrupted from Avan), which also gave its name to a medieval lordship. On the Norman conquest at Glamorgan, Caradoc, the eldest son of the defeated prince, Lestyn ab Gwrgan, continued to hold this lordship, and for the defence of the passage of the river built here a castle whose foundations are still traceable in a field near the churchyard. His descendants (who from the 13th century onwards styled themselves De Avan or D'Avene) established, under the protection of the castle, a chartered town, which in 1372 received a further charter from Edward Le Despenser, into whose family the lordship had come on an exchange of lands. In modern times these charters were not acted upon, the town being deemed a borough by prescription, but in 1861 it was incorporated under the Municipal Corporations Act. Since 1832 it has belonged to the Swansea parliamentary district of boroughs, uniting with Kenfig, Loughor, Neath and Swansea to return one member; but in 1885 the older portion of Swansea was given a separate member.

ABERCARN, an urban district in the southern parliamentary division of Monmouthshire, England, 10 m. N.W. of Newport by the Great Western railway. Pop. (1901) 12,607. There are collieries, ironworks and tinplate works in the district; the town, which lies in the middle portion of the Ebbw valley, being situated on the south-eastern flank of the great mining region of Glamorganshire and Monmouthshire.

ABERCORN, JAMES HAMILTON 1st Earl of (*c.* 1575–1618), was the eldest son of Claud Hamilton, Lord Paisley (4th son of James, 2nd earl of Arran, and duke of Chatelherault), and of Margaret, daughter of George, 6th Lord Seton. He was made sheriff of Linlithgow in 1600, received large grants of lands in Scotland and Ireland, was created in 1603 baron of Abercorn, and on the 10th of July 1606 was rewarded for his services in the matter of the union by being made earl of Abercorn, and Baron Hamilton, Mount Castle and Kilpatrick. He married Marion, daughter of Thomas, 5th Lord Boyd, and left five sons, of whom the eldest, baron of Strabane, succeeded him as 2nd earl of Abercorn. He died on the 23rd of March 1618. The title of Abercorn, held by the head of the Hamilton family, became a marquessate in 1790, and a dukedom in 1868, the 2nd duke of Abercorn (b. 1838) being a prominent Unionist politician and chairman of the British South Africa Company.

ABERCROMBIE, JOHN (1780–1844), Scottish physician, was the son of the Rev. George Abercrombie of Aberdeen, where he was born on the 10th of October 1780. He was educated at the university of Edinburgh, and after graduating as M.D. in 1803 he settled down to practise in that city, where he soon attained a leading position. From 1816 he published various papers in the *Edinburgh Medical and Surgical Journal*, which formed the basis of his *Pathological and Practical Researches on Diseases of the Brain and Spinal Cord*, and of his *Researches on the Diseases of the Intestinal Canal, Liver and other Viscera of the Abdomen*, both published in 1828. He also found time for philosophical speculations, and in 1830 he published his *Inquiries concerning the Intellectual Powers of Man and the Investigation of Truth*, which was followed in 1833 by a sequel, *The Philosophy of the Moral Feelings*. Both works, though showing little originality of thought, achieved wide popularity. He died at Edinburgh on the 14th of November 1844.

ABERCROMBY, DAVID, a 17th-century Scottish physician who was sufficiently noteworthy a generation after the probable date of his death to have his *Nova Medicinae Praxis* reprinted at Paris in 1740. During his lifetime his *Tuta ac efficax luis venereae saepe absque mercurio ac semper absque salivatione mercuriali curando methodus* (1684) was translated into French, Dutch and German. Two other works by him were *De Pulsus Variatione* (London, 1685), and *Ars explorandi medicas facultates plantarum ex solo sapore* (London, 1685–1688). His *Opuscula* were collected in 1687. These professional writings gave him a place and memorial in A. von Haller's *Bibliotheca Medicinae Pract.* (4 vols. 8vo, 1779, tom. iii. p. 619); but he claims notice rather by his remarkable controversial books in theology and philosophy than by his medical writings. Bred up at Douai as a Jesuit, he abjured popery, and published *Protestancy proved Safer than Popery* (London, 1686). But the most noticeable of his productions is *A Discourse of Wit* (London, 1685), which contains some of the most characteristic and most definitely-put metaphysical opinions of the Scottish philosophy of common sense. It was followed by *Academia Scientiarum* (1687), and by *A Moral Treatise of the Power of Interest* (1690), dedicated to Robert Boyle. *A Short Account of Scots Divines*, by him, was printed at Edinburgh in 1833, edited by James Maidment. The exact date of his death is unknown, but according to Haller he was alive early in the 18th century.

ABERCROMBY, PATRICK (1656–*c.* 1716), Scottish physician and antiquarian, was the third son of Alexander Abercromby of Fetterneir in Aberdeenshire, and brother of Francis Abercromby, who was created Lord Glasford by James II. He was born at Forfar in 1656 apparently of a Roman Catholic family. Intending to become a doctor of medicine he entered the university of St Andrews, where he took his degree of M.D. in 1685, but apparently he spent most of his youthful years abroad. It has been stated that he attended the university of Paris. The *Discourse of Wit* (1685), sometimes assigned to him, belongs to Dr David Abercromby (*q.v.*). On his return to Scotland, he is found practising as a physician in Edinburgh, where, besides his professional duties, he gave himself with characteristic zeal to the study of antiquities. He was appointed physician to James II. in 1685, but the revolution deprived him of the post. Living during the agitations for the union of England and Scotland, he took part in the war of pamphlets inaugurated and sustained by prominent men on both sides of the Border, and he crossed swords with no less redoubtable a foe than Daniel Defoe in his *Advantages of the Act of Security compared with those of the intended Union* (Edinburgh, 1707), and *A Vindication of the Same against Mr De Foe* (*ibid.*). A minor literary work of Abercromby's was a translation of Jean de Beaugué's *Histoire de la guerre d'Écosse* (1556) which appeared in 1707. But the work with which his name is permanently associated is his *Martial Atchievements of the Scots Nation*, issued in two large folios, vol. i. 1711, vol. ii. 1716. In the title-page and preface to vol. i. he disclaims the ambition of being an historian, but in vol. ii., in title-page and preface alike, he is no longer a simple biographer, but an historian. Even though, read in the light of later researches, much of the first volume must necessarily be relegated to the region of the mythical, none the less was the historian a laborious and accomplished reader and investigator of all available authorities, as well manuscript as printed; while the roll of names of those who aided him includes every man of note in Scotland at the time, from Sir Thomas Craig and Sir George Mackenzie to Alexander Nisbet and Thomas Ruddiman. The date of Abercromby's death is uncertain. It has been variously assigned to 1715, 1716, 1720, and 1726, and it is usually added that he left a widow in great poverty. The *Memoirs of the Abercrombys*, commonly attributed to him, do not appear to have been published.

See Robert Chambers, *Eminent Scotsmen*, *s.v.*; William Anderson, *Scottish Nation*, *s.v.*; Alexander Chalmers, *Biog. Dict.*, *s.v.*; George Chalmers, *Life of Ruddiman*; William Lee, *Defoe.*

ABERCROMBY, SIR RALPH (1734–1801), British lieutenant-general, was the eldest son of George Abercromby of Tullibody, Clackmannanshire, and was born in October 1734. Educated at Rugby and Edinburgh University, in 1754 he was sent to Leipzig to study civil law, with a view to his proceeding to the Scotch bar. On returning from the continent he expressed a strong preference for the military profession, and a cornet's commission was accordingly obtained for him (March 1756) in the 3rd Dragoon Guards. He served with his regiment in the Seven Years' war, and the opportunity thus afforded him of studying the methods of the great Frederick moulded his military character and formed his tactical ideas. He rose through the intermediate grades to the rank of lieutenant-colonel of the regiment (1773) and brevet colonel in 1780, and in 1781 he became colonel of the King's Irish infantry. When that regiment was disbanded in 1783 he retired upon half-pay. That up to this time he had scarcely been engaged in active service was owing mainly to his disapproval of the policy of the government, and especially to his sympathies with the American colonists in their struggles for independence; and his retirement is no doubt to be ascribed to similar feelings. On leaving the army he for a time took up political life as member of Parliament for Clackmannanshire. This, however, proved uncongenial, and, retiring in favour of his brother, he settled at Edinburgh and devoted himself to the education of his children. But on France declaring war against England in 1793, he hastened to resume his professional duties; and, being esteemed one of the ablest and most intrepid officers in the whole British forces, he was appointed to the command of a brigade under the duke of York, for service in Holland. He commanded the advanced guard in the action at Le Cateau, and was wounded at Nijmwegen. The duty fell to him of protecting the British army in its disastrous retreat out of Holland, in the winter of 1794–1795. In 1795 he received the honour of a knighthood of the Bath, in acknowledgment of his services. The same year he was appointed to succeed Sir Charles Grey, as commander-in-chief of the British forces in the West Indies. In 1796 Grenada was suddenly attacked and taken by a detachment of the army under his orders. He afterwards obtained possession of the settlements of Demerara and Essequibo, in South America, and of the islands of St Lucia, St Vincent and Trinidad. He returned in 1797 to Europe, and, in reward for his important services, was appointed colonel of the regiment of Scots Greys, entrusted with the governments of the Isle of Wight, Fort-George and Fort-Augustus, and raised to the rank of lieutenant-general. He held, in 1797–1798, the chief command of the forces in Ireland. There he laboured to maintain the discipline of the army, to suppress the rising rebellion, and to protect the people from military oppression, with a care worthy alike of a great general and an enlightened and beneficent statesman. When he was appointed to the command in Ireland, an invasion of that country by the French was confidently anticipated by the English government. He used his utmost efforts to restore the discipline of an army that was utterly disorganized; and, as a first step, he anxiously endeavoured to protect the people by re-establishing the supremacy of the civil power, and not allowing the military to be called out, except when it was indispensably necessary for the enforcement of the law and the maintenance of order. Finding that he received no adequate support from the head of the Irish government, and that all his efforts were opposed and thwarted by those who presided in the councils of Ireland, he resigned the command. His departure from Ireland was deeply lamented by the reflecting portion of the people, and was speedily followed by those disastrous results which he had anticipated, and which he so ardently desired and had so wisely endeavoured to prevent. After holding for a short period the office of commander-in-chief in Scotland, Sir Ralph, when the enterprise against Holland was resolved upon in 1799, was again called to command under the duke of York. The campaign of 1799 ended in disaster, but friend and foe alike confessed that the most decisive victory could not have more conspicuously proved the talents of this distinguished officer. His country applauded the choice when, in 1801, he was sent with an army to dispossess the French of Egypt. His experience in Holland and the West Indies particularly fitted him for this new command, as was proved by his carrying his army in health, in spirits and with the requisite supplies, in spite of very great difficulties, to the destined scene of action. The debarkation of the troops at Aboukir, in the face of strenuous opposition, is justly ranked among the most daring and brilliant exploits of the English army. A battle in the neighbourhood of Alexandria (March 21, 1801) was the sequel of this successful landing, and it was Abercromby's fate to fall in the moment of victory. He was struck by a spent ball, which could not be extracted, and died seven days after the battle. His old friend and commander the duke of York paid a just tribute to the great soldier's memory in general orders: "His steady observance of discipline, his ever-watchful attention to the health and wants of his troops, the persevering and unconquerable spirit which marked his military career, the splendour of his actions in the field and the heroism of his death, are worthy the imitation of all who desire, like him, a life of heroism and a death of glory." By a vote of the House of Commons, a monument was erected in his honour in St Paul's cathedral. His widow was created Baroness Abercromby of Tullibody and Aboukir Bay, and a pension of £2000 a year was settled on her and her two successors in the title.

A memoir of the later years of his life (1793–1801) by his third son, James (who was Speaker of the House of Commons, 1835–1839, and became Lord Dunfermline), was published in 1861. For a shorter account of Sir Ralph Abercromby see Wilkinson, *Twelve British Soldiers* (London, 1899).

ABERDARE, HENRY AUSTIN BRUCE, 1st Baron (1815–

1895), English statesman, was born at Duffryn, Aberdare, Glamorganshire, on the 16th of April 1815, the son of John Bruce, a Glamorganshire landowner. John Bruce's original family name was Knight, but on coming of age in 1805 he assumed the name of Bruce, his mother, through whom he inherited the Duffryn estate, having been the daughter of William Bruce, high sheriff of Glamorganshire. Henry Austin Bruce was educated at Swansea grammar school, and in 1837 was called to the bar. Shortly after he had begun to practise, the discovery of coal beneath the Duffryn and other Aberdare Valley estates brought the family great wealth. From 1847 to 1852 he was stipendiary magistrate for Merthyr Tydvil and Aberdare, resigning the position in the latter year, when he entered parliament as Liberal member for Merthyr Tydvil. In 1862 he became under-secretary for the home department, and in 1869, after losing his seat at Merthyr Tydvil, but being re-elected for Renfrewshire, he was made home secretary by W. E. Gladstone. His tenure of this office was conspicuous for a reform of the licensing laws, and he was responsible for the Licensing Act of 1872, which constituted the magistrates the licensing authority, increased the penalties for misconduct in public-houses and shortened the number of hours for the sale of drink. In 1873 he relinquished the home secretaryship, at Gladstone's request, to become lord president of the council, and was almost simultaneously raised to the peerage as Baron Aberdare. The defeat of the Liberal government in the following year terminated Lord Aberdare's official political life, and he subsequently devoted himself to social, educational and economic questions. In 1876 he was elected F.R.S.; from 1878 to 1892 he was president of the Royal Historical Society; and in 1881 he became president of the Royal Geographical Society. In 1882 he began a connexion with West Africa which lasted the rest of his life, by accepting the chairmanship of the National African Company, formed by Sir George Taubman Goldie, which in 1886 received a charter under the title of the Royal Niger Company and in 1899 was taken over by the British government, its territories being constituted the protectorate of Nigeria. West African affairs, however, by no means exhausted Lord Aberdare's energies, and it was principally through his efforts that a charter was in 1894 obtained for the university of Wales at Cardiff. Lord Aberdare, who in 1885 was made a G.C.B., presided over several Royal Commissions at different times. He died in London on the 25th of February 1895. His second wife was the daughter of Sir William Napier, the historian of the Peninsular war, whose *Life* he edited.

ABERDARE, a market town of Glamorganshire, Wales, situated (as the name implies) at the confluence of the Dâr and Cynon, the latter being a tributary of the Taff. Pop. of urban district (1901), 43,365. It is 4 m. S.W. of Merthyr Tydvil, 24 from Cardiff and 160 from London by rail. It has a station on the Pontypool and Swansea section of the Great Western railway, and is also served by the Llwydcoed and Abernant stations which are on a branch line to Merthyr. The Taff Vale line (opened 1846) has a terminus in the town. The Glamorgan canal has also a branch (made in 1811) running from Abercynon to Aberdare. From being, at the beginning of the 19th century, a mere village in an agricultural district, the place grew rapidly in population owing to the abundance of its coal and iron ore, and the population of the whole parish (which was only 1486 in 1801) increased tenfold during the first half of the century. Ironworks were established at Llwydcoed and Abernant in 1799 and 1800 respectively, followed by others at Gadlys and Aberaman in 1827 and 1847. These have not been worked since about 1875, and the only metal industries remaining in the town are an iron foundry or two and a small tinplate works at Gadlys (established in 1868). Previous to 1836, most of the coal worked in the parish was consumed locally, chiefly in the ironworks, but in that year the working of steam coal for export was begun, pits were sunk in rapid succession, and the coal trade, which at least since 1875 has been the chief support of the town, soon reached huge dimensions. There are also several brickworks and breweries. During the latter half of the 19th century, considerable public improvements were effected in the town, making it, despite its neighbouring collieries, an agreeable place of residence. Its institutions included a post-graduate theological college (opened in connexion with the Church of England in 1892, until 1907, when it was removed to Llandaff). There is a public park of fifty acres with two small lakes. Aberdare, with the ecclesiastical parishes of St Fagan's (Trecynon) and Aberaman carved out of the ancient parish, has some twelve Anglican churches, one Roman Catholic church (built in 1866 in Monk Street near the site of a cell attached to Penrhys Abbey) and over fifty Nonconformist chapels. The services in the majority of the chapels are in Welsh. The whole parish falls within the parliamentary borough of Merthyr Tydvil. The urban district includes what were once the separate villages of Aberaman, Abernant, Cwmbach, Cwmaman, Cwmdare, Llwydcoed and Trecynon. There are several cairns and the remains of a circular British encampment on the mountain between Aberdare and Merthyr. Hirwaun moor, 4 m. to the N.W. of Aberdare, was according to tradition the scene of a battle at which Rhys ap Jewdwr, prince of Dyfed, was defeated by the allied forces of the Norman Robert Fitzhamon and Iestyn ab Gwrgan, the last prince of Glamorgan.

ABERDEEN, GEORGE GORDON, 1st Earl of (1637–1720), lord chancellor of Scotland, son of Sir John Gordon, 1st baronet of Haddo, Aberdeenshire, executed by the Presbyterians in 1644, was born on the 3rd of October 1637. He graduated M.A., and was chosen professor at King's College, Aberdeen, in 1658. Subsequently he travelled and studied civil law abroad. At the Restoration the sequestration of his father's lands was annulled, and in 1665 he succeeded by the death of his elder brother to the baronetcy and estates. He returned home in 1667, was admitted advocate in 1668 and gained a high legal reputation. He represented Aberdeenshire in the Scottish parliament of 1669 and in the following assemblies, during his first session strongly opposing the projected union of the two legislatures. In November 1678 he was made a privy councillor for Scotland, and in 1680 was raised to the bench as Lord Haddo. He was a leading member of the duke of York's administration, was created a lord of session in June and in November 1681 president of the court. The same year he is reported as moving in the council for the torture of witnesses.[1] In 1682 he was made lord chancellor of Scotland, and was created, on the 13th of November, earl of Aberdeen, Viscount Formartine, and Lord Haddo, Methlick, Tarves and Kellie, in the Scottish peerage, being appointed also sheriff principal of Aberdeenshire and Midlothian. Burnet reflects unfavourably upon him, calls him "a proud and covetous man," and declares "the new chancellor exceeded all that had gone before him."[2] He executed the laws enforcing religious conformity with severity, and filled the parish churches, but resisted the excessive measures of tyranny prescribed by the English government; and in consequence of an intrigue of the duke of Queensberry and Lord Perth, who gained the duchess of Portsmouth with a present of £27,000, he was dismissed in 1684. After his fall he was subjected to various petty prosecutions by his victorious rivals with the view of discovering some act of maladministration on which to found a charge against him, but the investigations only served to strengthen his credit. He took an active part in parliament in 1685 and 1686, but remained a non-juror during the whole of William's reign, being frequently fined for his non-attendance, and took the oaths for the first time after Anne's accession, on the 11th of May 1703. In the great affair of the Union in 1707, while protesting against the completion of the treaty till the act declaring the Scots aliens should be repealed, he refused to support the opposition to the measure itself and refrained from attending parliament when the treaty was settled. He died on the 20th of April 1720, after having amassed a large fortune. He is described by John Mackay as "very knowing in the laws and constitution of his country and is believed to be the solidest statesman in Scotland, a fine orator, speaks slow but sure."

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[1] Sir J. Lauder's *Hist. Notices* (Bannatyne Club, 1848), p. 297.

[2] *Hist. of his own Times*, i. 523.

His person was said to be deformed, and his "want of mine or deportment" was alleged as a disqualification for the office of lord chancellor. He married Anne, daughter and sole heiress of George Lockhart of Torbrecks, by whom he had six children, his only surviving son, William, succeeding him as 2nd earl of Aberdeen.

See *Letters to George, earl of Aberdeen* (with memoir: Spalding Club, 1851); *Hist. Account of the Senators of the College of Justice*, by G. Brunton and D. Haig (1832), p. 408; G. Crawfurd's *Lives of the Officers of State* (1726), p. 226; *Memoirs of Affairs in Scotland*, by Sir G. Mackenzie (1821), p. 148; Sir J. Lauder's (Lord Fountainhall) *Journals* (Scottish Hist. Society, vol. xxxvi., 1900); J. Mackay's *Memoirs* (1733), p. 215; A. Lang's *Hist. of Scotland*, iii. 369, 376.

(P. C. Y.)

ABERDEEN, GEORGE HAMILTON GORDON, 4TH EARL OF (1784–1860), English statesman, was the eldest son of George Gordon, Lord Haddo, by his wife Charlotte, daughter of William Baird of Newbyth, Haddingtonshire, and grandson of George, 3rd earl of Aberdeen. Born in Edinburgh on the 28th of January 1784, he lost his father in 1791 and his mother in 1795; and as his grandfather regarded him with indifference, he went to reside with Henry Dundas, afterwards Viscount Melville. At the age of fourteen he was permitted by Scotch law to name his own *curators*, or guardians, and selecting William Pitt and Dundas for this office he spent much of his time at their houses, thus meeting many of the leading politicians of the day. He was educated at Harrow, and St John's College, Cambridge, where he graduated as a nobleman in 1804. Before this time, however, he had become earl of Aberdeen on his grandfather's death in 1801, and had travelled over a large part of the continent of Europe, meeting on his journeys Napoleon Bonaparte and other persons of distinction. He also spent some time in Greece, and on his return to England founded the Athenian Society, membership of which was confined to those who had travelled in that country. Moreover, he wrote an article in the *Edinburgh Review* of July 1805 criticizing Sir William Gill's *Topography of Troy*, and these circumstances led Lord Byron to refer to him in *English Bards and Scotch Reviewers* as "the travell'd thane, Athenian Aberdeen." Having attained his majority in 1805, he married on the 28th of July Catherine Elizabeth Hamilton, daughter of John James, 1st marquess of Abercorn. In December 1806 he was elected a representative peer for Scotland, and took his seat as a Tory in the House of Lords, but for some years he took only a slight part in public business. However, by his birth, his abilities and his connexions alike he was marked out for a high position, and after the death of his wife in February 1812 he was appointed ambassador extraordinary and minister plenipotentiary at Vienna, where he signed the treaty of Töplitz between Great Britain and Austria in October 1813; and accompanying the emperor Francis I. through the subsequent campaign against France, he was present at the battle of Leipzig. He was one of the British representatives at the congress of Châtillon in February 1814, and in the same capacity was present during the negotiations which led to the treaty of Paris in the following May. Returning home he was created a peer of the United Kingdom as Viscount Gordon of Aberdeen (1814), and made a member of the privy council. On the 15th of July 1815 he married Harriet, daughter of the Hon. John Douglas, and widow of James, Viscount Hamilton, and thus became doubly connected with the family of the marquess of Abercorn. During the ensuing thirteen years Aberdeen took a less prominent part in public affairs, although he succeeded in passing the Entail (Scotland) Act of 1825. He kept in touch, however, with foreign politics, and having refused to join the ministry of George Canning in 1827, became a member of the cabinet of the duke of Wellington as chancellor of the duchy of Lancaster in January 1828. In the following June he was transferred to the office of secretary of state for foreign affairs, and having acquitted himself with credit with regard to the war between Russia and Turkey, and to affairs in Greece, Portugal and France, he resigned with Wellington in November 1830, and shared his leader's attitude towards the Reform Bill of 1832. As a Scotsman, Aberdeen was interested in the ecclesiastical controversy which culminated in the disruption of 1843. In 1840 he introduced a bill to settle the vexed question of patronage; but disliked by a majority in the general assembly of the Scotch church, and unsupported by the government, it failed to become law, and some opprobrium was cast upon its author. In 1843 he brought forward a similar measure "to remove doubts respecting the admission of ministers to benefices." This Admission to Benefices Act, as it was called, passed into law, but did not reconcile the opposing parties.

During the short administration of Sir Robert Peel in 1834 and 1835, Aberdeen had filled the office of secretary for the colonies, and in September 1841 he took office again under Peel, on this occasion as foreign secretary; the five years during which he held this position were the most fruitful and successful of his public life. He owed his success to the confidence placed in him by Queen Victoria, to his wide knowledge of European politics, to his intimate friendship with Guizot, and not least to his own conciliatory disposition. Largely owing to his efforts, causes of quarrel between Great Britain and France in Tahiti, over the marriage of Isabella II. of Spain, and in other directions, were removed. More important still were his services in settling the question of the boundary between the United States and British North America at a time when a single injudicious word would probably have provoked a war. In 1845 he supported Peel when in a divided cabinet he proposed to suspend the duty on foreign corn, and left office with that minister in July 1846. After Peel's death in 1850 he became the recognized leader of the Peelites, although since his resignation his share in public business had been confined to a few speeches on foreign affairs. His dislike of the Ecclesiastical Titles Assumption Bill, the rejection of which he failed to secure in 1851, prevented him from joining the government of Lord John Russell, or from forming an administration himself in this year. In December 1852, however, be became first lord of the treasury and head of a coalition ministry of Whigs and Peelites. Although united on free trade and in general on questions of domestic reform, a cabinet which contained Lord Palmerston and Lord John Russell, in addition to Aberdeen, was certain to differ on questions of foreign policy. The strong and masterful character of these and other colleagues made the task of the prime minister one of unusual difficulty, a fact which was recognized by contemporaries. Charles Greville in his *Memoirs* says, "In the present cabinet are five or six first-rate men of equal, or nearly equal, pretensions, none of them likely to acknowledge the superiority or defer to the opinions of any other, and every one of these five or six considering himself abler and more important than their premier"; and Sir James Graham wrote, "It is a powerful team, but it will require good driving." The first year of office passed off successfully, and it was owing to the steady support of the prime minister that Gladstone's great budget of 1853 was accepted by the cabinet. This was followed by the outbreak of the dispute between France and Turkey over the guardianship of the holy places at Jerusalem, which, after the original cause of quarrel had been forgotten, developed into the Crimean war. The tortuous negotiations which preceded the struggle need not be discussed here, but in defence of Aberdeen it may be said that he hoped and strove for peace to the last. Rightly or wrongly, however, he held that Russell was indispensable to the cabinet, and that a resignation would precipitate war. His outlook, usually so clear, was blurred by these considerations, and he lacked the strength to force the suggestions which he made in the autumn of 1853 upon his imperious colleagues. Palmerston, supported by Russell and well served by Lord Stratford de Redcliffe, British ambassador at Constantinople, favoured a more aggressive policy, and Aberdeen, unable to control Palmerston, and unwilling to let Russell go, cannot be exonerated from blame. When the war began he wished to prosecute it vigorously; but the stories of misery and mismanagement from the seat of war deprived the ministry of public favour. Russell resigned; and on the 29th of January 1855 a motion by J. A. Roebuck, for the appointment of a select committee to enquire into the conduct of the war, was carried in the House of Commons by a large majority. Treating this as a vote of want of confidence Aberdeen at once resigned office, and the queen bestowed upon him the order of the Garter. He smoothed the way for Palmerston to succeed him, and while the earl of Clarendon remained at the foreign office he aided him with advice and was consulted on matters of moment. He died in London on the 14th of December 1860, and was buried in the family vault at Stanmore. By his first wife he had one son and three daughters, all of whom predeceased their father. By his second wife, who died in August 1833, he left four sons and one daughter. His eldest son, George John James, succeeded as 5th earl; his second son was General Sir Alexander Hamilton-Gordon, K.C.B.; his third son was the Reverend Douglas Hamilton-Gordon; and his youngest son Arthur Hamilton, after holding various high offices under the crown, was created Baron Stanmore in 1893. Among the public offices held by the earl were those of lord-lieutenant of Aberdeenshire, president of the society of Antiquaries from 1812 to 1846 and fellow of the Royal Society.

Aberdeen was a distinguished scholar with a retentive memory and a wide knowledge of literature and art. His private life was exemplary, and he impressed his contemporaries with the loftiness of his character. His manner was reserved, and as a speaker he was weighty rather than eloquent. In public life he was remarkable for his generosity to his political opponents, and for his sense of justice and honesty. He did not, however, possess the qualities which impress the populace, and he lacked the strength which is one of the essential gifts of a statesman. His character is perhaps best described by a writer who says "his strength was not equal to his goodness." His foreign policy was essentially one of peace and non-intervention, and in pursuing it he was accused of favouring the despotisms of Europe. Aberdeen was a model landlord. By draining the land, by planting millions of trees and by erecting numerous buildings, he greatly improved the condition of his Aberdeenshire estates, and studied continually the welfare of his dependants. A bust of him by Matthew Noble is in Westminster Abbey, and his portrait was painted by Sir Thomas Lawrence. He wrote *An Inquiry into the Principles of Beauty in Grecian Architecture* (London, 1822), and the *Correspondence of the Earl of Aberdeen* has been printed privately under the direction of his son, Lord Stanmore.

The 6th earl, George (1841–1870), son of the 5th earl, was drowned at sea, and was succeeded by his brother John Campbell Gordon, 7th earl of Aberdeen (b. 1847), a prominent Liberal politician, who was lord-lieutenant of Ireland in 1886, governor-general of Canada 1893–1898, and again the lord-lieutenant of Ireland when Sir Henry Campbell-Bannerman formed his ministry at the close of 1905.

See Lord Stanmore, *The Earl of Aberdeen* (London, 1893); C. C. F. Greville, *Memoirs*, edited by H. Reeve (London, 1888); Spencer Walpole, *History of England* (London, 1878–1886), and *Life of Lord John Russell* (London, 1889); A. W. Kinglake, *Invasion of the Crimea* (London, 1877–1888); Sir T. Martin, *Life of the Prince Consort* (London, 1875–1880); J. Morley, *Life of Gladstone* (London, 1903). (A. W. H.*)

ABERDEEN, a royal burgh, city and county of a city, capital of Aberdeenshire, and chief seaport in the north of Scotland. It is the fourth Scottish town in population, industry and wealth, and stands on a bay of the North Sea, between the mouths of the Don and Dee, 130½ m. N.E. of Edinburgh by the North British railway. Though Old Aberdeen, extending from the city suburbs to the southern banks of the Don, has a separate charter, privileges and history, the distinction between it and New Aberdeen can no longer be said to exist; and for parliamentary, municipal and other purposes, the two towns now form practically one community. Aberdeen's popular name of the "Granite City" is justified by the fact that the bulk of the town is built of granite, but to appreciate its more poetical designation of the "Silver City by the Sea," it should be seen after a heavy rainfall when its stately structures and countless houses gleam pure and white under the brilliant sunshine. The area of the city extends to 6602 acres, the burghs of Old Aberdeen and Woodside, and the district of Torry (for parliamentary purposes in the constituency of Kincardineshire) to the south of the Dee, having been incorporated in 1891. The city comprises eleven wards and eighteen ecclesiastical parishes, and is under the jurisdiction of a council with lord provost, bailies, treasurer and dean of guild. The corporation owns the water (derived from the Dee at a spot 21 m. W.S.W. of the city) and gas supplies, electric lighting and tramways. Since 1885 the city has returned two members to Parliament. Aberdeen is served by the Caledonian, Great North of Scotland and North British railways (occupying a commodious joint railway station), and there is regular communication by sea with London and the chief ports on the eastern coast of Great Britain and the northern shores of the Continent. The mean temperature of the city for the year is 45·8° F., for summer 56° F., and for winter 37·3° F. The average yearly rainfall is 30·57 inches. The city is one of the healthiest in Scotland.

Streets and Buildings.—Roughly, the extended city runs north and south. From the new bridge of Don to the "auld brig" of Dee there is tramway communication *via* King Street, Union Street and Holburn Road—a distance of over five miles. Union Street is one of the most imposing thoroughfares in the British Isles. From Castle Street it runs W. S. W. for nearly a mile, is 70 ft. wide, and contains the principal shops and most of the modern public buildings, all of granite. Part of the street crosses the Denburn ravine (utilized for the line of the Great North of Scotland railway) by a fine granite arch of 132 ft. span, portions of the older town still fringing the gorge, fifty feet below the level of Union Street. Amongst the more conspicuous secular buildings in the street may be mentioned the Town and County Bank, the Music Hall, with sitting accommodation for 2000 persons, the Trinity Hall of the incorporated trades (originating in various years between 1398 and 1527, and having charitable funds for poor members, widows and orphans), containing some portraits by George Jamesone, a noteworthy set of carved oak chairs, dating from 1574, and the shields of the crafts with quaint inscriptions; the office of the *Aberdeen Free Press*, one of the most influential papers in the north of Scotland; the Palace Hotel; the office of the Northern Assurance Company, and the National Bank of Scotland. In Castle Street, a continuation eastwards of Union Street, are situated the Municipal and County Buildings, one of the most splendid granite edifices in Scotland, in the Franco-Scottish Gothic style, built in 1867–1878. They are of four stories and contain the great hall with an open timber ceiling and oak-panelled walls; the Sheriff Court House; the Town Hall, with excellent portraits of Prince Albert (Prince Consort), the 4th earl of Aberdeen, the various lord provosts and other distinguished citizens. In the vestibule of the entrance corridor stands a suit of black armour believed to have been worn by Provost Sir Robert Davidson, who fell in the battle of Harlaw, near Inverurie, in 1411. From the south-western corner a grand tower rises to a height of 210 ft., commanding a fine view of the city and surrounding country. Adjoining the municipal buildings is the North of Scotland Bank, of Greek design, with a portico of Corinthian columns, the capitals of which are exquisitely carved. On the opposite side of the street is the fine building of the Union Bank. At the upper end of Castle Street stands the Salvation Army Citadel, an effective castellated mansion, the most imposing "barracks" possessed anywhere by this organization. In front of it is the Market Cross, a beautiful, open-arched, hexagonal structure, 21 ft. in diameter and 18 ft. high. The original was designed in 1682 by John Montgomery, a native architect, but in 1842 it was removed hither from its old site and rebuilt in a better style. On the entablature surmounting the Ionic columns are panels containing medallions of Scots sovereigns from James I. to James VII. From the centre rises a shaft, 12½ ft. high, with a Corinthian capital on which is the royal unicorn rampant. On an eminence east of Castle Street are the military barracks. In Market Street are the Mechanics' Institution, founded in 1824, with a good library; the Post and Telegraph offices; and the Market, where provisions of all kinds and general wares are sold. The Fish Market, on the Albert Basin, is a busy scene in the early morning.

The Art Gallery and Museum at Schoolhill, built in the Italian Renaissance style of red and brown granite, contains an excellent collection of pictures, the Macdonald Hall of portraits of contemporary artists by themselves being of altogether exceptional interest and unique of its kind in Great Britain. The public library, magnificently housed, contains more than 60,000 volumes. The theatre in Guild Street is the chief seat of dramatic, as the Palace Theatre in Bridge Place is of variety entertainment. The new buildings of Marischal College fronting Broad Street, opened by King Edward VII. in 1906, form one of the most splendid examples of modern architecture in Great Britain; the architect, Alexander Marshall Mackenzie, a native of Aberdeen, having adapted his material, white granite, to the design of a noble building with the originality of genius.

Churches.—Like most Scottish towns, Aberdeen is well equipped with churches, most of them of good design, but few of special interest. The East and West churches of St Nicholas, their kirkyard separated from Union Street by an Ionic façade, 147½ ft. long, built in 1830, form one continuous building, 220 ft. in length, including the Drum Aisle (the ancient burial-place of the Irvines of Drum) and the Collison Aisle, which divide them and which formed the transept of the 12th-century church of St Nicholas. The West Church was built in 1775, in the Italian style, the East originally in 1834 in the Gothic. In 1874 a fire destroyed the East Church and the old central tower with its fine peal of nine bells, one of which, Laurence or "Lowrie," was 4 ft. in diameter at the mouth, 3½ ft. high and very thick. The church was rebuilt and a massive granite tower erected over the intervening aisles at the cost of the municipality, a new peal of 36 bells, cast in Holland, being installed to commemorate the Victorian jubilee of 1887. The Roman Catholic Cathedral in Huntly Street, a Gothic building, was erected in 1859. The see of Aberdeen was first founded at Mortlach in Banffshire by Malcolm II. in 1004 to celebrate his victory there over the Danes, but in 1137 David I. transferred the bishopric to Old Aberdeen, and twenty years later the cathedral of St Machar, situated a few hundred yards from the Don, was begun. Save during the episcopate of William Elphinstone (1484–1511), the building progressed slowly. Gavin Dunbar, who followed him in 1518, was enabled to complete the structure by adding the two western spires and the southern transept. The church suffered severely at the Reformation, but is still used as the parish church. It now consists of the nave and side aisles. It is chiefly built of outlayer granite, and, though the plainest cathedral in Scotland, its stately simplicity and severe symmetry lend it unique distinction. On the flat panelled ceiling of the nave are the heraldic shields of the princes, noblemen and bishops who shared in its erection, and the great west window contains modern painted glass of excellent colour and design. The cemeteries are St Peter's in Old Aberdeen, Trinity near the links, Nellfield at the junction of Great Western and Holburn Roads, and Allenvale, very tastefully laid out, adjoining Duthie Park.

Education.—Aberdeen University consists of King's College in Old Aberdeen, founded by Bishop Elphinstone in 1494, and Marischal College, in Broad Street, founded in 1593 by George Keith, 5th earl Marischal, which were incorporated in 1860. Arts and divinity are taught at King's, law, medicine and science at Marischal. The number of students exceeds 800 yearly. The buildings of both colleges are the glories of Aberdeen. King's forms a quadrangle with interior court, two sides of which have been rebuilt, and a library wing has been added. The Crown Tower and the Chapel, the oldest parts, date from 1500. The former is surmounted by a structure about 40 ft. high, consisting of a six-sided lantern and royal crown, both sculptured, and resting on the intersections of two arched ornamental slips rising from the four corners of the top of the tower. The choir of the chapel still contains the original oak canopied stalls, miserere seats and lofty open screens in the French flamboyant style, and of unique beauty of design and execution. Their preservation was due to the enlightened energy of the principal at the time of the Reformation, who armed his folk to save the building from the barons of the Mearns after they had robbed St Machar's of its bells and lead. Marischal College is a stately modern building, having been rebuilt in 1836–1841, and greatly extended several years later at a cost of £100,000. The additions to the buildings opened by King Edward VII. in 1906 have been already mentioned. The beautiful Mitchell Tower is so named from the benefactor (Dr Charles Mitchell) who provided the splendid graduation hall. The opening of this tower in 1895 signalized the commemoration of the four hundredth anniversary of the foundation of the university. The University Library comprises nearly 100,000 books. A Botanic Garden was presented to the university in 1899. Aberdeen and Glasgow Universities combine to return one member to Parliament. The United Free Church Divinity Hall in Alford Place, in the Tudor Gothic style, dates from 1850. The Grammar School, founded in 1263, was removed in 1861–1863 from its old quarters in Schoolhill to a large new building, in the Scots Baronial style, off Skene Street. Robert Gordon's College in Schoolhill was founded in 1729 by Robert Gordon of Straloch and further endowed in 1816 by Alexander Simpson of Collyhill. Originally devoted (as Gordon's Hospital) to the instruction and maintenance of the sons of poor burgesses of guild and trade in the city, it was reorganized in 1881 as a day and night school for secondary and technical education, and has since been unusually successful. Besides a High School for Girls and numerous board schools, there are many private higher-class schools. Under the Endowments Act 1882 an educational trust was constituted which possesses a capital of £155,000. At Blairs, in Kincardineshire, five miles S.W. of Aberdeen, is St Mary's Roman Catholic College for the training of young men intended for the priesthood.

Charities.—The Royal Infirmary, in Woolmanhill, established in 1740, rebuilt in the Grecian style in 1833–1840, and largely extended after 1887 as a memorial of Queen Victoria's jubilee; the Royal Asylum, opened in 1800; the Female Orphan Asylum, in Albyn Place, founded in 1840; the Blind Asylum, in Huntly Street, established in 1843; the Royal Hospital for Sick Children; the Maternity Hospital, founded in 1823; the City Hospital for Infectious Diseases; the Deaf and Dumb Institution; Mitchell's Hospital in Old Aberdeen; the East and West Poorhouses, with lunatic wards; and hospitals devoted to specialized diseases, are amongst the most notable of the charitable institutions. There are, besides, industrial schools for boys and girls and for Roman Catholic children, a Female School of Industry, the Seabank Rescue Home, Nazareth House and Orphanage, St Martha's Home for Girls, St Margaret's Convalescent Home and Sisterhood, House of Bethany, the Convent of the Sacred Heart and the Educational Trust School.

Parks and Open Spaces.—Duthie Park, of 50 acres, the gift of Miss Elizabeth Crombie Duthie of Ruthrieston, occupies an excellent site on the north bank of the Dee. Victoria Park (13 acres) and its extension Westburn Park (13 acres) are situated in the north-western area; farther north lies Stewart Park (11 acres), called after Sir D. Stewart, lord provost in 1893. The capacious links bordering the sea between the mouths of the two rivers are largely resorted to for open-air recreation; there is here a rifle range where a "wapinschaw," or shooting tournament, is held annually. Part is laid out as an 18-hole golf course; a section is reserved for cricket and football; a portion has been railed off for a race-course, and a bathing-station has been erected. Union Terrace Gardens are a popular rendezvous in the heart of the city.

Statues.—In Union Terrace Gardens stands a colossal statue in bronze of Sir William Wallace, by W. G. Stevenson, R.S.A. (1888). In the same gardens are a bronze statue of Burns and Baron Marochetti's seated figure of Prince Albert. In front of Gordon's College is the bronze statue, by T. S. Burnett, A.R.S.A. of General Gordon (1888). At the east end of Union Street is the bronze statue of Queen Victoria, erected in 1893 by the royal tradesmen of the city. Near the Cross stands the granite statue of the 5th duke of Gordon (d. 1836). Here may also be mentioned the obelisk of Peterhead granite, 70 ft. high, erected in the square of Marischal College to the memory of Sir James of George (1816–1898), the military surgeon and director-general of the Army Medical Department, who was thrice elected lord rector of the College.

Bridges.—The Dee is crossed by four bridges,—the old bridge, the Wellington suspension bridge, the railway bridge, and Victoria Bridge, opposite Market Street. The first, till 1832 the only access to the city from the south, consists of seven semicircular ribbed arches, is about 30 ft. high, and was built early in the 16th century by Bishops Elphinstone and Dunbar. It was nearly all rebuilt in 1718–1723, and in 1842 was widened from 14½ to 26 ft. The bridge of Don has five granite arches, each 75 ft. in span, and was built in 1827–1832. A little to the west is the Auld Brig o' Balgownie, a picturesque single arch spanning the deep black stream, said to have been built by King Robert I. and celebrated by Byron in the tenth canto of *Don Juan*.

Harbour.—A defective harbour, with a shallow sand and gravel bar at its entrance, long retarded the trade of Aberdeen, but under various acts since 1773 it was greatly deepened. The north pier, built partly by Smeaton in 1775–1781, and partly by Telford in 1810–1815, extends nearly 3000 ft. into the North Sea. It increases the depth of water on the bar from a few feet to 22 or 24 ft. at spring tides and to 17 or 18 ft. at neap. A wet dock of 29 acres, and with 6000 ft. of quay, was completed in 1848 and called Victoria Dock in honour of the queen's visit to the city in that year. Adjoining it is the Upper Dock. By the Harbour Act of 1868, the Dee near the harbour was diverted from the south at a cost of £80,000, and 90 acres of new ground (in addition to 25 acres formerly made up) were provided on the north side of the river for the Albert Basin (with a graving dock), quays and warehouses. A breakwater of concrete (1050 ft. long) was constructed on the south side of the stream as a protection against south-easterly gales. On Girdleness, the southern point of the bay, a lighthouse was built in 1833. Near the harbour mouth are three batteries mounting nineteen guns.

Industry.—Owing to the variety and importance of its chief industries Aberdeen is one of the most prosperous cities in Scotland. Grey, bluish grey granite has been quarried near Aberdeen for more than 300 years, and blocks and dressed paving "setts," kerb and building stones, and monumental and other ornamental work of granite have long been exported from the district to all parts of the world. This, though once the predominant industry, has been surpassed by the deep-sea fisheries, which derived a great impetus from steam-trawling, introduced in 1882, and steam line fishing in 1889, and threaten to rival if not to eclipse those of Grimsby. Fish trains are despatched to London daily. Textile manufacturing industry dates from the 18th century, amongst them woollens (1703), linen (1749) and cotton (1779). These give employment to several thousands of operatives. The paper-making industry is one of the most famous and oldest in the city, paper having been first made in Aberdeen in 1694. Flax-spinning and jute and comb-making factories are also very flourishing, and there are successful foundries and engineering works. There are large distilleries and breweries, and chemical works employing many hands. In the days of wooden ships ship-building was a flourishing industry, the town being noted for its fast clippers, many of which established records in the "tea races." The introduction of trawling revived this to some extent, and despite the distance of the city from the iron fields there is a fair yearly output of iron vessels. Of later origin are the jam, pickle and potted meat factories, hundreds of acres having been laid down in strawberries and other fruits within a few miles of the city.

History.—Aberdeen was an important place as far back as the 12th century. William the Lion had a residence in the city, to which he gave a charter in 1179 confirming the corporate rights granted by David I. The city received other royal charters later. It was burned by the English king, Edward III., in 1336, but it was soon rebuilt and extended, and called New Aberdeen. The burgh records are the oldest in Scotland. They begin in 1398 and with one brief break are complete to the present day. For many centuries the city was subject to attacks by the neighbouring barons, and was strongly fortified, but the gates were all removed by 1770. In 1497 a blockhouse was built at the harbour mouth as a protection against the English. During the struggles between the Royalists and Covenanters the city was impartially plundered by both sides. In 1715 the Earl Marischal proclaimed the Old Pretender at Aberdeen, and in 1745 the duke of Cumberland resided for a short time in the city before attacking the Young Pretender. The motto on the city arms is "Bon Accord," which formed the watchword of the Aberdonians while aiding Robert Bruce in his battles with the English.

Population.—In 1396 the population was about 3000. By 1801 it had become 26,992; in 1841 it was 63,262; (1891) 121,623; (1901) 153,503.

Authorities.—The charters of the burgh; extracts from the council register down to 1625, and selections from the letters, guildry and treasurer's accounts, forming 3 vols. of the Spalding Club; Cosmo Innes, *Registrum Episcopatus Aberdonensis*, Spalding Club; Walter Thom, *The History of Aberdeen* (1811); Robert Wilson, *Historical Account and Delineation of Aberdeen* (1822); William Kennedy, *The Annals of Aberdeen* (1818); Orem, *Description of the Chanonry, Cathedral and King's College of Old Aberdeen, 1724–1725* (1830); Sir Andrew Leith Hay of Rannes, *The Castellated Architecture of Aberdeen*; Giles, *Specimens of Old Castellated Houses of Aberdeen* (1838); James Bryce, *Lives of Eminent Men of Aberdeen* (1841); J. Gordon, *Description of Both Towns of Aberdeen* (Spalding Club, 1842); Joseph Robertson, *The Book of Bon-Accord* (Aberdeen, 1839); W. Robbie, *Aberdeen: its Traditions and History* (Aberdeen, 1893); C. G. Burr and A. M. Munro, *Old Landmarks of Aberdeen* (Aberdeen, 1886); A. M. Munro, *Memorials of the Aldermen, Provosts and Lord Provosts of Aberdeen* (Aberdeen, 1897); P. J. Anderson, *Charters, &c., illustrating the History of the Royal Burgh of Aberdeen* (Aberdeen, 1890); *Selections from the Records of Marischal College* (New Spalding Club, 1889, 1898–1899); J. Cooper, *Chartulary of the Church of St Nicholas* (New Spalding Club, 1888–1892); J. Cadenhead, *Sketch of the Territorial History of the Burgh of Aberdeen* (Aberdeen, 1876); W. Cadenhead, *Guide to the City of Aberdeen* (Aberdeen, 1897); A. Smith, *History and Antiquities of New and Old Aberdeen* (Aberdeen, 1882).

ABERDEEN, a city and the county-seat of Brown county, South Dakota, U.S.A., about 125 m. N.E. of Pierre. Pop. (1890) 3182; (1900) 4087, of whom 889 were foreign born; (1905) 5841; (1910) 10,753. Aberdeen is served by the Chicago, Milwaukee and St Paul, the Great Northern, the Minneapolis and St Louis, and the Chicago and North Western railways. It is the financial and trade centre for the northern part of the state, a fine agricultural region, and in 1908 had five banks and a number of wholesale houses. The city is the seat of the Northern Normal and Industrial School, a state institution, and has a Carnegie library; the principal buildings are the court house and the government buildings. Artesian wells furnish good water-power, and artesian-well supplies, grain pitchers, brooms, chemicals and flour are manufactured. The municipality owns and operates the water-works. Aberdeen was settled in 1880, and was chartered as a city in 1883.

ABERDEENSHIRE, a north-eastern county of Scotland, bounded N. and E. by the North Sea, S. by Kincardine, Forfar and Perth, and W. by Inverness and Banff. It has a coast-line of 65 m., and is the sixth Scottish county in area, occupying 1,261,887 acres or 1971 sq. m. The county is generally hilly, and from the south-west, near the centre of Scotland, the Grampians send out various branches, mostly to the north-east. The shire is popularly divided into five districts. Of these the first is Mar, mostly between the Dee and Don, which nearly covers the southern half of the county and contains the city of Aberdeen. It is mountainous, especially Braemar (*q.v.*), which contains the greatest mass of elevated land in the British Isles. The soil on the Dee is sandy, and on the Don loamy. The second district, Formartine, between the lower Don and Ythan, has a sandy coast, which is succeeded inland by a clayey, fertile, tilled tract, and then by low hills, moors, mosses and tilled land. Buchan, the third district, lies north of the Ythan, and, comprising the north-east of the county, is next in size to Mar, parts of the coast being bold and rocky, the interior bare, low, flat, undulating and in places peaty. On the coast, 6 m. S. of Peterhead, are the Bullers of Buchan—a basin in which the sea, entering by a natural arch, boils up violently in stormy weather. Buchan Ness is the most easterly point of Scotland. The fourth district, Garioch, in the centre of the shire, is a beautiful, undulating, loamy, fertile valley. formerly called the granary of Aberdeen. Strathbogie, the fifth district, occupying a considerable area south of the Deveron, mostly consists of hills, moors and mosses. The mountains are the most striking of the physical features of the county. Ben Macdhui (4296 ft.), a magnificent mass, the second highest mountain in Great Britain, Braeriach (4248), Cairntoul (4241), Ben-na-bhuaird (3924), Ben Avon (3843), "dark" Lochnagar (3786), the subject of a well-known song by Byron, Cairn Eas (3556), Sgarsoch (3402), Culardoch (2953), are the principal heights in the division of Mar. Farther north rise the Buck of Cabrach (2368) on the Banffshire border, Tap o' Noth (1830), Bennachie (1698), a beautiful peak which from its central position is a landmark visible from many different parts of the county, and which is celebrated in John Imlah's song, "O gin I were where Gadie rins," and Foudland (1529). The chief rivers are the Dee, 90 m. long; the Don, 82 m. ; the Ythan, 37 m., with mussel-beds at its mouth; the Ugie, 20 m., and the Deveron, 62 m., partly on the boundary of Banffshire. The rivers abound with salmon and trout, and the pearl mussel occurs in the Ythan and Don. A valuable pearl in the Scottish crown is said to be from the Ythan. Loch Muick, the largest of the few lakes in the county, 1310 ft. above the sea, 2⅔ m. long and ⅓ to ½ m. broad, lies some 8½ m. S.W. of Ballater, and has Altnagiuthasach, a royal shooting-box, near its south-western end. Loch Strathbeg, 6 m. S.E. of Fraserburgh, is only separated from the sea by a narrow strip of land. There are noted chalybeate springs at Peterhead, Fraserburgh, and Pannanich near Ballater.

Geology.—The greater part of the county is composed of crystalline schists belonging to the metamorphic rocks of the Eastern Highlands. In the upper parts of the valleys of the Dee and the Don they form well-marked groups, of which the most characteristic are (1) the black schists and phyllites, with calc-flintas, and a thin band of tremolite limestone, (2) the main or Blair Atholl limestone, (3) the quartzite. These divisions are folded on highly inclined or vertical axes trending north-east and south-west, and hence the same zones are repeated over a considerable area. The quartzite is generally regarded as the highest member of the series. Excellent sections showing the component strata occur in Glen Clunie and its tributary valleys above Braemar. Eastwards down the Dee and the Don and northwards across the plain of Buchan towards Rattray Head and Fraserburgh there is a development of biotite gneiss, partly of sedimentary and perhaps partly of igneous origin. A belt of slate which has been quarried for roofing purposes runs along the west border of the county from Turriff by Auchterless and the Foudland Hills towards the Tap o' Noth near Gartly. The metamorphic rocks have been invaded by igneous materials, some before, and by far the larger series after the folding of the strata. The basic types of the former are represented by the sills of epidiorite and hornblende gneiss in Glen Muick and Glen Callater, which have been permeated by granite and pegmatite in veins and lenticles, often foliated. The later granites subsequent to the plication of the schists have a wide distribution on the Ben Macdhui and Ben Avon range, and on Lochnagar; they stretch eastwards from Ballater by Tarland to Aberdeen and north to Bennachie. Isolated masses appear at Peterhead and at Strichen. Though consisting mainly of biotite granite, these later intrusions pass by intermediate stages into diorite, as in the area between Balmoral and the head-waters of the Gairn. The granites have been extensively quarried at Rubislaw, Peterhead and Kemnay. Serpentine and troctolite, the precise age of which is uncertain, occur at the Black Dog rock north of Aberdeen, at Belhelvie and near Old Meldrum. Where the schists of sedimentary origin have been pierced by these igneous intrusions, they are charged with contact minerals such as sillimanite, cordierite, kyanite and andalusite. Cordierite-bearing rocks occur near Ellon, at the foot of Bennachie, and on the top of the Buck of Cabrach. A banded and mottled calc-silicate hornfels occurring with the limestone at Derry Falls, W.N.W. of Braemar, has yielded malacolite, wollastonite, brown idocrase, garnet, sphene and hornblende. A larger list of minerals has been obtained from an exposure of limestone and associated beds in Glen Gairn, about four miles above the point where that river joins the Dee. Narrow belts of Old Red Sandstone, resting unconformably on the old platform of slates and schists, have been traced from the north coast at Peterhead by Turriff to Fyvie, and also from Huntly by Gartly to Kildrummy Castle. The strata consist mainly of conglomerates and sandstones, which, at Gartly and at Rhynie, are associated with lenticular bands of andesite indicating contemporaneous volcanic action. Small outliers of conglomerate and sandstone of this age have recently been found in the course of excavations in Aberdeen. The glacial deposits, especially in the belt bordering the coast between Aberdeen and Peterhead, furnish important evidence. The ice moved eastwards off the high ground at the head of the Dee and the Don, while the mass spreading outwards from the Moray Firth invaded the low plateau of Buchan; but at a certain stage there was a marked deflection northwards parallel with the coast, as proved by the deposit of red clay north of Aberdeen. At a later date the local glaciers laid down materials on top of the red clay. The committee appointed by the British Association (*Report* for 1897, p. 333) proved that the Greensand, which has yielded a large suite of Cretaceous fossils at Moreseat, in the parish of Cruden, occurs in glacial drift, resting probably on granite. The strata from which the Moreseat fossils were derived are not now found in place in that part of Scotland, but Mr Jukes Brown considers that the horizon of the fossils is that of the lower Greensand of the Isle of Wight or the Aptien stage of France. Chalk flints are widely distributed in the drift between Fyvie and the east coast of Buchan. At Plaidy a patch of clay with Liassic fossils occurs. At several localities between Logie Coldstone and Dinnet a deposit of diatomite (Kieselguhr) occurs beneath the peat.

Flora and Fauna.—The tops of the highest mountains have an arctic flora. At the royal lodge on Loch Muick, 1350 ft. above the sea, grow larches, vegetables, currants, laurels, roses, &c. Some ash-trees, four or five feet in girth, are growing at 1300 ft. above the sea. Trees, especially Scotch fir and larch, grow well, and Braemar is rich in natural timber, said to surpass any in the north of Europe. Stumps of Scotch fir and oak found in peat are sometimes far larger than any now growing. The mole is found at 1800 ft. above the sea, and the squirrel at 1400. Grouse, partridges and hares are plentiful, and rabbits are often too numerous. Red deer abound in Braemar, the deer forest being the most extensive in Scotland.

Climate and Agriculture.—The climate, except in the mountainous districts, is comparatively mild, owing to the proximity of much of the shire to the sea. The mean annual temperature at Braemar is 43·6° F., and at Aberdeen 45·8°. The mean yearly rainfall varies from about 30 to 37 in. The summer climate of the upper Dee and Don valleys is the driest and most bracing in the British Isles, and grain is cultivated up to 1000 ft. above the sea, or 400 to 500 ft. higher than elsewhere in North Britain. Poor, gravelly, clayey and peaty soils prevail, but tile-draining, bones and guano, and the best methods of modern tillage, have greatly increased the produce. Indeed, in no part of Scotland has a more productive soil been made out of such unpromising material. Farm-houses and steadings have much improved, and the best agricultural implements and machines are in general use. About two-thirds of the population depend entirely on agriculture. Farms are small compared with those in the south-eastern counties. Oats are the predominant crop, wheat has practically gone out of cultivation, but barley has largely increased. The most distinctive industry is cattle-feeding. A great number of the home-bred crosses are fattened for the London and local markets, and Irish animals are imported on an extensive scale for the same purposes, while an exceedingly heavy business in dead meat for London and the south is done all over the county. Sheep, horses and pigs are also raised in large numbers.

Fisheries.—A large fishing population in villages along the coast engage in the white and herring fishery, which is the next most important industry to agriculture, its development having been due almost exclusively to the introduction of steam trawlers. The total value of the annual catch, of which between a half and a third consists of herrings, amounts to £1,000,000. Haddocks are salted and rock-dried (speldings) or smoked (finnans). The ports and creeks are divided into the fishery districts of Peterhead, Fraserburgh and Aberdeen, the last of which includes also three Kincardineshire ports. The herring season for Aberdeen, Peterhead and Fraserburgh is from June to September, at which time the ports are crowded with boats from other Scottish districts. There are valuable salmon-fishings—rod, net and stake-net—on the Dee, Don, Ythan and Ugie. The average annual despatch of salmon from Aberdeenshire is about 400 tons.

Other Industries.—Manufactures are mainly prosecuted in or near the city of Aberdeen, but throughout the rural districts there is much milling of corn, brick and tile making, smith-work, brewing and distilling, cart and farm-implement making, casting and drying of peat, and timber-felling, especially on Deeside and Donside, for pit-props, railway sleepers, laths and barrel-staves. There are a number of paper-making establishments, most of them on the Don near Aberdeen.

The chief source of mineral wealth is the noted durable granite, which is quarried at Aberdeen, Kemnay, Peterhead and elsewhere. An acre of land on being reclaimed has yielded £40 to £50 worth of causewaying stones. Sandstone and other rocks are also quarried at different parts. The imports are mostly coal, lime, timber, iron, slate, raw materials for the textile manufactures, wheat, cattle-feeding stuffs, bones, guano, sugar, alcoholic liquors, fruits. The exports are granite (rough-dressed and polished), flax, woollen and cotton goods, paper, combs, preserved provisions, oats, barley, live and dead cattle.

Communications.—From the south Aberdeen city is approached by the Caledonian (*via* Perth, Forfar and Stonehaven), and the North British (*via* Dundee, Montrose and Stonehaven) railways, and the shire is also served by the Great North of Scotland railway, whose main line runs *via* Kintore and Huntly to Keith and Elgin. There are branch lines from various points opening up the more populous districts, as from Aberdeen to Ballater by Deeside, from Aberdeen to Fraserburgh (with a branch at Maud for Peterhead and at Ellon for Cruden Bay and Boddam), from Kintore to Alford, and from Inverurie to Old Meldrum and also to Macduff. By sea there is regular communication with London, Leith, Inverness, Wick, the Orkneys and Shetlands, Iceland and the continent. The highest of the macadamized roads crossing the eastern Grampians rises to a point 2200 ft. above sea-level.

Population and Government.—In 1891 the population numbered 284,036 and in 1901 it was 304,439 (of whom 159,603 were females), or 154 persons to the sq. m. In 1901 there were 8 persons who spoke Gaelic only, and 1333 who spoke Gaelic and English. The chief towns are Aberdeen (pop. in 1901, 153,503), Bucksburn (2231), Fraserburgh (9105), Huntly (4136), Inverurie (3624), Peterhead (11,794), Turriff (2273). The Supreme Court of Justiciary sits in Aberdeen to try cases from the counties of Aberdeen, Banff and Kincardine. The three counties are under a sheriff, and there are two sheriffs-substitute resident in Aberdeen, who sit also at Fraserburgh, Huntly, Peterhead and Turriff. The sheriff courts are held in Aberdeen and Peterhead. The county sends two members to parliament—one for East Aberdeenshire and the other for West Aberdeenshire. The county town, Aberdeen (*q.v.*), returns two members. Peterhead, Inverurie and Kintore belong to the Elgin group of parliamentary burghs, the other constituents being Banff, Cullen and Elgin. The county is under school-board jurisdiction, and there are also several voluntary schools. There are higher-class schools in Aberdeen, and secondary schools at Huntly, Peterhead and Fraserburgh, and many of the other schools in the county earn grants for secondary education. The County Secondary Education Committee dispense a large sum, partly granted by the education department and partly contributed by local authorities from the "residue" grant, and support, besides the schools mentioned, local classes and lectures in agriculture, fishery and other technical subjects, in addition to subsidizing the agricultural department of the university of Aberdeen. The higher branches of education have always been thoroughly taught in the schools throughout the shire, and pupils have long been in the habit of going directly from the schools to the university.

The native Scots are long-headed, shrewd, careful, canny, active, persistent, but reserved and blunt, and without demonstrative enthusiasm. They have a physiognomy distinct from the rest of the Scottish people, and have a quick, sharp, rather angry accent. The local Scots dialect is broad, and rich in diminutives, and is noted for the use of *e* for *o* or *u*, *f* for *wh*, *d* for *th*, &c. So recently as 1830 Gaelic was the fireside language of almost every family in Braemar, but now it is little used.

History.—The country now forming the shires of Aberdeen and Banff was originally peopled by northern Picts, whom Ptolemy called Taixali, the territory being named Taixalon. Their town of Devana, once supposed to be the modern Aberdeen, has been identified by Prof. John Stuart with a site in the parish of Peterculter, where there are remains of an ancient camp at Normandykes, and by Dr W. F. Skene with a station on Loch Davan, west of Aboyne. So-called Roman camps have also been discovered on the upper Ythan and Deveron, but evidence of effective Roman occupation is still to seek. Traces of the native inhabitants, however, are much less equivocal. Weems or earth-houses are fairly common in the west. Relics of crannogs or lake-dwellings exist at Loch Ceander, or Kinnord, 5 m. north-east of Ballater, at Loch Goul in the parish of New Machar and elsewhere. Duns or forts occur on hills at Dunecht, where the dun encloses an area of two acres, Barra near Old Meldrum, Tap o' Noth, Dunnideer near Insch and other places. Monoliths, standing stones and "Druidical" circles of the pagan period abound, and there are many examples of the sculptured stones of the early Christian epoch. . Efforts to convert the Picts were begun by Ternan in the 5th century, and continued by Columba (who founded a monastery at Old Deer), Drostan, Maluog and Machar, but it was long before they showed lasting results. Indeed, dissensions within the Columban church and the expulsion of the clergy from Pictland by the Pictish king Nectan in the 8th century undid most of the progress that had been made. The Vikings and Danes periodically raided the coast, but when (1040) Macbeth ascended the throne of Scotland the Northmen, under the guidance of Thorfinn, refrained from further trouble in the north-east. Macbeth was afterwards slain at Lumphanan (1057), a cairn on Perkhill marking the spot. The influence of the Norman conquest of England was felt even in Aberdeenshire. Along with numerous Anglo-Saxon exiles, there also settled in the country Flemings who introduced various industries, Saxons who brought farming, and Scandinavians who taught nautical skill. The Celts revolted more than once, but Malcolm Canmore and his successors crushed them and confiscated their lands. In the reign of Alexander I. (d. 1124) mention is first made of Aberdeen (originally called Aberdôn and, in the Norse sagas, Apardion), which received its charter from William the Lion in 1179, by which date its burgesses had already combined with those of Banff, Elgin, Inverness and other trans-Grampian communities to form a free Hanse, under which they enjoyed exceptional trading privileges. By this time, too, the Church had been organized, the bishopric of Aberdeen having been established in 1150. In the 12th and 13th centuries some of the great Aberdeenshire families arose, including the earl of Mar (*c.* 1122), the Leslies, Freskins (ancestors of the dukes of Sutherland), Durwards, Bysets, Comyns and Cheynes, and it is significant that in most cases their founders were immigrants. The Celtic thanes and their retainers slowly fused with the settlers. They declined to take advantage of the disturbed condition of the country during the wars of the Scots independence, and made common cause with the bulk of the nation. Though John Comyn (d. 1300?), one of the competitors for the throne, had considerable interests in the shire, his claim received locally little support. In 1296 Edward I. made a triumphal march to the north to terrorize the more turbulent nobles. Next year William Wallace surprised the English garrison in Aberdeen, but failed to capture the castle. In 1303 Edward again visited the county, halting at the castle of Kildrummy, then in the possession of Robert Bruce, who shortly afterwards became the acknowledged leader of the Scots and made Aberdeen his headquarters for several months. Despite the seizure of Kildrummy Castle by the English in 1306, Bruce's prospects brightened from 1308, when he defeated John Comyn, earl of Buchan (d. 1313?), at Inverurie. For a hundred years after Robert Bruce's death (1329) there was intermittent anarchy in the shire. Aberdeen itself was burned by the English in 1336, and the re-settlement of the districts of Buchan and Strathbogie occasioned constant quarrels on the part of the dispossessed. Moreover, the crown had embroiled itself with some of the Highland chieftains, whose independence it sought to abolish. This policy culminated in the invasion of Aberdeenshire by Donald, lord of the Isles, who was, however, defeated at Harlaw, near Inverurie, by the earl of Mar in 1411. In the 15th century two other leading county families appeared, Sir Alexander Forbes being created Lord Forbes about 1442, and Sir Alexander Seton Lord Gordon in 1437 and earl of Huntly in 1445. Bitter feuds raged between these families for a long period, but the Gordons reached the height of their power in the first half of the 16th century, when their domains, already vast, were enhanced by the acquisition, through marriage, of the earldom of Sutherland (1514). Meanwhile commerce with the Low Countries, Poland and the Baltic had grown apace, Campvere, near Flushing in Holland, becoming the emporium of the Scottish traders, while education was fostered by the foundation of King's College at Aberdeen in 1497 (Marischal College followed a century later). At the Reformation so little intuition had the clergy of the drift of opinion that at the very time that religious structures were being despoiled in the south, the building and decoration of churches went on in the shire. The change was acquiesced in without much tumult, though rioting took place in Aberdeen and St Machar's cathedral in the city suffered damage. The 4th earl of Huntly offered some resistance, on behalf of the Catholics, to the influence of Lord James Stuart, afterwards the Regent Murray, but was defeated and killed at Corrichie on the hill of Fare in 1562. As years passed it was apparent that Presbyterianism was less generally acceptable than Episcopacy, of which system Aberdeenshire remained for generations the stronghold in Scotland. Another crisis in ecclesiastical affairs arose in 1638, when the National Covenant was ordered to be subscribed, a demand so grudgingly responded to that the marquis of Montrose visited the shire in the following year to enforce acceptance. The Cavaliers, not being disposed to yield, dispersed an armed gathering of Covenanters in the affair called the Trot of Turriff (1639), in which the first blood of the civil war was shed. The Covenanters obtained the upper hand in a few weeks, when Montrose appeared at the bridge of Dee and compelled the surrender of Aberdeen, which had no choice but to cast in its lot with the victors. Montrose, however, soon changed sides, and after defeating the Covenanters under Lord Balfour of Burleigh (1644), delivered the city to rapine. He worsted the Covenanters again after a stiff fight on the 2nd of July 1645, at Alford, a village in the beautiful Howe of Alford. Peace was temporarily restored on the "engagement" of the Scots commissioners to assist Charles I. On his return from Holland in 1650 Charles II. was welcomed in Aberdeen, but in little more than a year General Monk entered the city at the head of the Cromwellian regiments. The English garrison remained till 1659, and next year the Restoration was effusively hailed, and prelacy was once more in the ascendant. Most of the Presbyterians conformed, but the Quakers, more numerous in the shire and the adjoining county of Kincardine than anywhere else in Scotland, were systematically persecuted. After the Revolution (1688) episcopacy passed under a cloud, but the clergy, yielding to *force majeure*, gradually accepted the inevitable, hoping, as long as Queen Anne lived, that prelacy might yet be recognized as the national form of Church government. Her death dissipated these dreams, and as George I., her successor, was antipathetic to the clergy, it happened that Jacobitism and episcopalianism came to be regarded in the shire as identical, though in point of fact the non-jurors as a body never countenanced rebellion. The earl of Mar raised the standard of revolt in Braemar (6th of September 1715); a fortnight later James was proclaimed at Aberdeen cross; the Pretender landed at Peterhead on the 22nd of December, and in February 1716 he was back again in France. The collapse of the first rising ruined many of the lairds, and when the second rebellion occurred thirty years afterwards the county in the main was apathetic, though the insurgents held Aberdeen for five months, and Lord Lewis Gordon won a trifling victory for Prince Charles Edward at Inverurie (23rd of December 1745). The duke of Cumberland relieved Aberdeen at the end of February 1746, and in April the Young Pretender was a fugitive. Thereafter the people devoted themselves to agriculture, industry and commerce, which developed by leaps and bounds, and, along with equally remarkable progress in education, transformed the aspect of the shire and made the community as a whole one of the most prosperous in Scotland.

See W. Watt, *History of Aberdeen and Banff* (Edinburgh, 1900); *Collections for a History of the Shires of Aberdeen and Banff* (edited by Dr Joseph Robertson, Spalding Club); Sir A. Leith-Hay, *Castles of Aberdeenshire* (Aberdeen, 1887); J. Davidson, *Inverurie and the Earldom of the Garioch* (Edinburgh, 1878); Pratt, *Buchan* (rev. by R. Anderson), (Aberdeen, 1900); A. I. M'Connochie, *Deeside* (Aberdeen, 1895).

ABERDOUR, a village of Fifeshire, Scotland. Pleasantly situated on the shore of the Firth of Forth, 17½ m. N.W. of Edinburgh by the North British railway and 7 m. N.W. of Leith by steamer, it is much resorted to for its excellent sea-bathing. There are ruins of a castle and an old decayed church, which contains some fine Norman work. About 3 m. S.W. is Donibristle House, the seat of the earl of Murray (Moray), and the scene of the murder (Feb. 7, 1592) of James, 2nd (Stuart) earl of Murray. The island of Inchcolm, or Island of Columba, ¾ m. from the shore, is in the parish of Aberdour. As its name implies, its associations date back to the time of Columba. The primitive stone-roofed oratory is supposed to have been a hermit's cell. The Augustinian monastery was founded in 1123 by Alexander I. The buildings are well preserved, consisting of a low square tower, church, cloisters, refectory and small chapter-house. The island of Columba was occasionally plundered by English and other rovers, but in the 16th century it became the property of Sir James Stuart, whose grandson became 2nd earl of Murray by virtue of his marriage to the elder daughter of the 1st earl. From it comes the earl's title of Lord St Colme (1611).

ABERDOVEY (*Aberdyfi*: the Dyfi is the county frontier), a seaside village of Merionethshire, North Wales, on the Cambrian railway. Pop. (1901) 1466. It lies in the midst of beautiful scenery, 4 m. from Towyn, on the N. bank of the Dyfi estuary, commanding views of Snowdon, Cader Idris, Arran Mawddy and Plynlimmon. The Dyfi, here a mile broad, is crossed by a ferry to Borth sands, whence a road leads to Aberystwyth. The submerged "bells of Aberdovey" (since Seithennin "the drunkard" caused the formation of Cardigan Bay) are famous in a Welsh song. Aberdovey is a health and bathing resort.

ABERFOYLE, a village and parish of Perthshire, Scotland, 34¼ m. N. by W. of Glasgow by the North British railway. Pop. of parish (1901) 1052. The village is situated at the base of Craigmore (1271 ft. high) and on the Laggan, a head-water of the Forth. Since 1885, when the duke of Montrose constructed a road over the eastern shoulder of Craigmore to join the older road at the entrance of the Trossachs pass, Aberfoyle has become the alternative route to the Trossachs and Loch Katrine. Loch Ard, about 2 m. W. of Aberfoyle, lies 105 ft. above the sea. It is 3 m. long (including the narrows at the east end) and 1 m. broad. Towards the west end is Eilean Gorm (the green isle), and near the north-western shore are the falls of Ledard. Two m. N.W. is Loch Chon, 200 ft. above the sea, 1¾ m. long, and about ½ m. broad. It drains by the Avon Dhu to Loch Ard, which is drained in turn by the Laggan. The slate quarries on Craigmore are the only industry in Aberfoyle.

ABERGAVENNY, a market town and municipal borough in the northern parliamentary division of Monmouthshire, England, 14 m. W. of Monmouth on the Great Western and the London and North-Western railways. Pop. (1901) 7795. It is situated at the junction of a small stream called the Gavenny with the river Usk; and the site, almost surrounded by lofty hills, is very beautiful. The town was formerly walled, and has the remains of a castle built soon after the conquest, frequently the scene of border strife. The church of St Mary belonged originally to a Benedictine monastery founded early in the 12th century. The existing building, however, is Decorated and Perpendicular, and contains a fine series of memorials of dates from the 13th to the 17th century. There is a free grammar school, which till 1857 had a fellowship at Jesus College, Oxford. Breweries, ironworks, quarries, brick fields and collieries in the neighbourhood are among the principal industrial establishments. Abergavenny was incorporated in 1899, and is governed by a mayor, 4 aldermen and 12 councillors. Area, 825 acres.

This was the Roman *Gobannium*, a small fort guarding the road along the valley of the Usk and ensuring quiet among the hill tribes. There is practically no trace of this fort. Abergavenny (Bergavenny) grew up under the protection of the lords of Abergavenny, whose title dated from William I. Owing to its situation, the town was frequently embroiled in the border warfare of the 12th and 13th centuries, and Giraldus Cambrensis relates how in 1175 the castle was seized by the Welsh. Hamelyn de Baalun, first lord of Abergavenny, founded the Benedictine priory, which was subsequently endowed by William de Braose with a tenth of the profits of the castle and town. At the dissolution of the priory part of this endowment went towards the foundation of a free grammar school, the site itself passing to the Gunter family. During the Civil War prior to the siege of Raglan Castle in 1645, Charles I. visited Abergavenny, and presided in person over the trial of Sir Trevor Williams and other parliamentarians. In 1639 Abergavenny received a charter of incorporation under the title of bailiff and burgesses. A charter with extended privileges was drafted in 1657, but appears never to have been enrolled or to have come into effect. Owing to the refusal of the chief officers of the corporation to take the oath of allegiance to William III. in 1688, the charter was annulled, and the town subsequently declined in prosperity. The act of 27 Henry VIII., which provided that Monmouth, as county town, should return one burgess to parliament, further stated that other ancient Monmouthshire boroughs were to contribute towards the payment of the member. In consequence of this clause Abergavenny on various occasions shared in the election, the last instance being in 1685. Reference to a market at Abergavenny is found in a charter granted to the prior by William de Braose (d. 1211). The right to hold two weekly markets and three yearly fairs, as hitherto held, was confirmed in 1657. Abergavenny was celebrated for the production of Welsh flannel, and also for the manufacture, whilst the fashion prevailed, of periwigs of goats' hair.

The title of Baron Abergavenny, in the Neville family, dates from Edward Neville (d. 1476), who was the youngest son of the 1st earl of Westmoreland by Joan Beaufort, daughter of John of Gaunt. He married the heiress of Richard, earl of Worcester, whose father had inherited the castle and estate of Abergavenny, and was summoned in 1392 to parliament as Lord Bergavenny. Edward Neville was summoned to parliament with this title in 1450. His direct male descendants ended in 1587 in Henry Neville, but a cousin, Edward Neville (d. 1622), was confirmed in the barony in 1604. From him it has descended continuously, the title being increased to an earldom in 1784; and in 1876 William Nevill (*sic*), 5th earl (b. 1826), an indefatigable and powerful supporter of the Conservative party, was created 1st marquess of Abergavenny. (See NEVILLE.)

ABERIGH-MACKAY, GEORGE ROBERT (1848–1881), Anglo-Indian writer, son of a Bengal chaplain, was born on the 25th of July 1848, and was educated at Magdalen College School and Cambridge University. Entering the Indian education department in 1870, he became professor of English literature in Delhi College in 1873, tutor to the raja of Rutlam 1876, and principal of the Rajkumar College at Indore in 1877. He is best known for his book *Twenty-one Days in India* (1878–1879), a satire upon Anglo-Indian society and modes of thought. This book gave promise of a successful literary career; but the author died at the age of thirty-three.

ABERNETHY, JOHN (1680–1740), Irish Presbyterian divine, was born at Coleraine, county Londonderry, where his father was Nonconformist minister, on the 19th of October 1680. In his thirteenth year he entered the university of Glasgow, and on concluding his course there went on to Edinburgh, where his intellectual and social attainments gained him a ready entrance into the most cultured circles. Returning home he received licence to preach from his Presbytery before he was twenty-one. In 1701 he was urgently invited to accept charge of an important congregation in Antrim; and after an interval of two years, mostly spent in further study in Dublin, he was ordained there on the 8th of August 1703. Here he did notable work, both as a debater in the synods and assemblies of his church and as an evangelist. In 1712 he lost his wife (Susannah Jordan), and the loss desolated his life for many years. In 1717 he was invited to the congregation of Usher's Quay, Dublin, and contemporaneously to what was called the Old Congregation of Belfast. The synod assigned him to Dublin. After careful consideration he declined to accede, and remained at Antrim. This refusal was regarded then as ecclesiastical high-treason; and a controversy of the most intense and disproportionate character followed, Abernethy standing firm for religious freedom and repudiating the sacerdotal assumptions of all ecclesiastical courts. The controversy and quarrel bears the name of the two camps in the conflict, the "Subscribers" and the "Non-subscribers." Out-and-out evangelical as John Abernethy was, there can be no question that he and his associates sowed the seeds of that after-struggle (1821–1840) in which, under the leadership of Dr Henry Cooke, the Arian and Socinian elements of the Irish Presbyterian Church were thrown out. Much of what he contended for, and which the "Subscribers" opposed bitterly, has been silently granted in the lapse of time. In 1726 the "Non-subscribers," spite of an almost wofully pathetic pleading against separation by Abernethy, were cut off, with due ban and solemnity, from the Irish Presbyterian Church. In 1730, although a "Non-subscriber," he was invited to Wood Street, Dublin, whither he removed. In 1731 came on the greatest controversy in which Abernethy engaged, viz. in relation to the Test Act nominally, but practically on the entire question of tests and disabilities. His stand was "against all laws that, upon account of mere differences of religious opinions and forms of worship, excluded men of integrity and ability from serving their country." He was nearly a century in advance of his age. He had to reason with those who denied that a Roman Catholic or Dissenter could be a "man of integrity and ability." His *Tracts*—afterwards collected—did fresh service, generations later, and his name is honoured by all who love freedom of conscience and opinion. He died in December 1740.

See Dr Duchal's *Life*, prefixed to *Sermons* (1762); *Diary* in MS., 6 vols. 4to; Reid's *Presbyterian Church in Ireland*, iii. 234.

ABERNETHY, JOHN (1764–1831), English surgeon, grandson of John Abernethy (see above), was born in London on the 3rd of April 1764. His father was a London merchant. Educated at Wolverhampton grammar school, he was apprenticed in 1779 to Sir Charles Blicke (1745–1815), surgeon to St Bartholomew's Hospital, London. He attended the anatomical lectures of Sir William Blizard (1743–1835) at the London Hospital, and was early employed to assist as "demonstrator"; he also attended Percival Pott's surgical lectures at St Bartholomew's Hospital, as well as the lectures of John Hunter. On Pott's resignation of the office of surgeon of St Bartholomew's, Sir Charles Blicke, who was assistant-surgeon, succeeded him, and Abernethy was elected assistant-surgeon in 1787. In this capacity he began to give lectures at his house in Bartholomew Close, which were so well attended that the governors of the hospital built a regular theatre (1790–1791), and Abernethy thus became the founder of the distinguished school of St Bartholomew's. He held the office of assistant-surgeon of the hospital for the long period of twenty-eight years, till, in 1815, he was elected principal surgeon. He had before that time been appointed lecturer in anatomy to the Royal College of Surgeons (1814). Abernethy was not a great operator, though his name is associated with the treatment of aneurism by ligature of the external iliac artery. His *Surgical Observations on the Constitutional Origin and Treatment of Local Diseases* (1809)—known as "My Book," from the great frequency with which he referred his patients to it, and to page 72 of it in particular, under that name—was one of the earliest popular works on medical science.

He taught that local diseases were frequently the results of disordered states of the digestive organs, and were to be treated by purging and attention to diet. As a lecturer he was exceedingly attractive, and his success in teaching was largely attributable to the persuasiveness with which he enunciated his views. It has been said, however, that the influence he exerted on those who attended his lectures was not beneficial in this respect, that his opinions were delivered so dogmatically, and all who differed from him were disparaged and denounced so contemptuously, as to repress instead of stimulating inquiry. The celebrity he attained in his practice was due not only to his great professional skill, but also in part to the singularity of his manners. He used great plainness of speech in his intercourse with his patients, treating them often brusquely and sometimes even rudely. In the circle of his family and friends he was courteous and affectionate; and in all his dealings he was strictly just and honourable. He resigned his position at St Bartholomew's Hospital in 1827, and died at his residence at Enfield on the 20th of April 1831.

A collected edition of his works was published in 1830. A biography, *Memoirs of John Abernethy*, by George Macilwain, appeared in 1853.

ABERRATION (Lat. *ab*, from or away, *errare*, to wander), a deviation or wandering, especially used in the figurative sense: as in ethics, a deviation from the truth; in pathology, a mental derangement; in zoology and botany, abnormal development or structure. In optics, the word has two special applications: (1) Aberration of Light, and (2) Aberration in Optical Systems. These subjects receive treatment below.

I. ABERRATION OF LIGHT

This astronomical phenomenon may be defined as an apparent motion of the heavenly bodies; the stars describing annually orbits more or less elliptical, according to the latitude of the star; consequently at any moment the star appears to be displaced from its true position. This apparent motion is due to the finite velocity of light, and the progressive motion of the observer with the earth, as it performs its yearly course about the sun. It may be familiarized by the following illustrations. Alexis Claude Clairaut gave this figure: Imagine rain to be falling vertically, and a person carrying a thin perpendicular tube to be standing on the ground. If the bearer be stationary, rain-drops will traverse the tube without touching its sides; if, however, the person be walking, the tube must be inclined at an angle varying as his velocity in order that the rain may traverse the tube centrally. J. J. L. de Lalande gave the illustration of a roofed carriage with an open front: if the carriage be stationary, no rain enters; if, however, it be moving, rain enters at the front. The "umbrella" analogy is possibly the best known figure. When stationary, the most efficient position in which to hold an umbrella is obviously vertical; when walking, the umbrella must be held more and more inclined from the vertical as the walker quickens his pace. Another familiar figure, pointed out by P. L. M. de Maupertuis, is that a sportsman, when aiming at a bird on the wing, sights his gun some distance ahead of the bird, the distance being proportional to the velocity of the bird. The mechanical idea, named the parallelogram of velocities, permits a ready and easy graphical representation of these facts. Reverting to the analogy of Clairaut, let AB (fig. 1) represent the velocity of the rain, and AC the relative velocity of the person bearing the tube. The diagonal AD of the parallelogram, of which AB and AC are adjacent sides, will represent, both in direction and magnitude, the motion of the rain as apparent to the observer. Hence for the rain to centrally traverse the tube, this must be inclined at an angle BAD to the vertical; this angle is conveniently termed the *aberration* due to these two motions. The umbrella analogy is similarly explained; the most efficient position being when the stick points along the resultant AD.

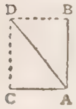

FIG. 1.

The discovery of the aberration of light in 1725, due to James Bradley, is one of the most important in the whole domain of astronomy. That it was unexpected there can be no doubt; and it was only by extraordinary perseverance and perspicuity that Bradley was able to explain it in 1727. Its origin is seated in attempts made to free from doubt the prevailing discordances as to whether the stars possessed appreciable parallaxes. The Copernican theory of the solar system—that the earth revolved annually about the sun—had received confirmation by the observations of Galileo and Tycho Brahe, and the mathematical investigations of Kepler and Newton. As early as 1573, Thomas Digges had suggested that this theory should necessitate a parallactic shifting of the stars, and, consequently, if such stellar parallaxes existed, then the Copernican theory would receive additional confirmation. Many observers claimed to have determined such parallaxes, but Tycho Brahe and G. B. Riccioli concluded that they existed only in the minds of the observers, and were due to instrumental and personal errors. In 1680 Jean Picard, in his *Voyage d'Uranibourg*, stated, as a result of ten years' observations, that *Polaris*, or the Pole Star, exhibited variations in its position amounting to 40″ annually; some astronomers endeavoured to explain this by parallax, but these attempts were futile, for the motion was at variance with that which parallax would occasion. J. Flamsteed, from measurements made in 1689 and succeeding years with his mural quadrant, similarly concluded that the declination of the Pole Star was 40″ less in July than in September. R. Hooke, in 1674, published his observations of γ *Draconis*, a star of the second magnitude which passes practically overhead in the latitude of London, and whose observations are therefore singularly free from the complex corrections due to astronomical refraction, and concluded that this star was 23″ more northerly in July than in October.

When James Bradley and Samuel Molyneux entered this sphere of astronomical research in 1725, there consequently prevailed much uncertainty as to whether stellar parallaxes had been observed or not; and it was with the intention of definitely answering this question that these astronomers erected a large telescope at the house of the latter at Kew. They determined to reinvestigate the motion of γ *Draconis*: the telescope, constructed by George Graham (1675–1751), a celebrated instrument-maker, was affixed to a vertical chimney-stack, in such manner as to permit a small oscillation of the eyepiece, the amount of which, *i.e.* the deviation from the vertical, was regulated and measured by the introduction of a screw and a plumb-line. The instrument was set up in November 1725, and observations on γ *Draconis* were made on the 3rd, 5th, 11th, and 12th of December. There was apparently no shifting of the star, which was therefore thought to be at its most southerly point. On the 17th of December, however, Bradley observed that the star was moving southwards, a motion further shown by observations on the 20th. These results were unexpected, and, in fact, inexplicable by existing theories; and an examination of the telescope showed that the observed anomalies were not due to instrumental errors. The observations were continued, and the star was seen to continue its southerly course until March, when it took up a position some 20″ more southerly than its December position. After March it began to pass northwards, a motion quite apparent by the middle of April; in June it passed at the same distance from the zenith as it did in December; and in September it passed through its most northerly position, the extreme range from north to south, *i.e.* the angle between the March and September positions, being 40″.

This motion is evidently not due to parallax, for, in this case, the maximum range should be between the June and December positions; neither was it due to observational errors. Bradley and Molyneux discussed several hypotheses in the hope of fixing the solution. One hypothesis was: while γ *Draconis* was stationary, the plumb-line, from which the angular measurements were made, varied; this would follow if the axis of the earth varied. The oscillation of the earth's axis may arise in two distinct ways; distinguished as "nutation of the axis" and "variation of latitude." Nutation, the only form of oscillation imagined by Bradley, postulates that while the earth's axis is fixed with respect to the earth, *i.e.* the north and south poles occupy permanent geographical positions, yet the axis is not directed towards a fixed point in the heavens; variation of latitude, however, is associated with the shifting of the axis within the earth, *i.e.* the geographical position of the north pole varies.

Nutation of the axis would determine a similar apparent motion for all stars: thus, all stars having the same polar distance as γ *Draconis* should exhibit the same apparent motion after or before this star by a constant interval. Many stars satisfy the condition of equality of polar distance with that of γ *Draconis*, but few were bright enough to be observed in Molyneux's telescope. One such star, however, with a right ascension nearly equal to that of γ *Draconis*, but in the opposite sense, was selected and kept under observation. This star was seen to possess an apparent motion similar to that which would be a consequence of the nutation of the earth's axis; but since its declination varied only one half as much as in the case of γ *Draconis*, it was obvious that nutation did not supply the requisite solution. The question as to whether the motion was due to an irregular distribution of the earth's atmosphere, thus involving abnormal variations in the refractive index, was also investigated; here, again, negative results were obtained.

Bradley had already perceived, in the case of the two stars previously scrutinized, that the apparent difference of declination from the maximum positions was nearly proportional to the sun's distance from the equinoctial points; and he realized the necessity for more observations before any generalization could be attempted. For this purpose he repaired to the Rectory, Wanstead, then the residence of Mrs Pound, the widow of his uncle James Pound, with whom he had made many observations of the heavenly bodies. Here he had set up, on the 19th of August 1727, a more convenient telescope than that at Kew, its range extending over 6¼° on each side of the zenith, thus covering a far larger area of the sky. Two hundred stars in the *British Catalogue* of Flamsteed traversed its field of view; and, of these, about fifty were kept under close observation. His conclusions may be thus summarized: (1) only stars near the solstitial colure had their maximum north and south positions when the sun was near the equinoxes, (2) each star was at its maximum positions when it passed the zenith at six o'clock morning and evening (this he afterwards showed to be inaccurate, and found the greatest change in declination to be proportional to the latitude of the star), (3) the apparent motions of all stars at about the same time was in the same direction.

A re-examination of his previously considered hypotheses as to the cause of these phenomena was fruitless; the true theory was ultimately discovered by a pure accident, comparable in simplicity and importance with the association of a falling apple with the discovery of the principle of universal gravitation. Sailing on the river Thames, Bradley repeatedly observed the shifting of a vane on the mast as the boat altered its course; and, having been assured that the motion of the vane meant that the boat, and not the wind, had altered its direction, he realized that the position taken up by the vane was determined by the motion of the boat and the direction of the wind. The application of this observation to the phenomenon which had so long perplexed him was not difficult, and, in 1727, he published his theory of the aberration of light—a corner-stone of the edifice of astronomical science. Let S (fig. 2) be a star and the observer be carried along the line AB; let SB be perpendicular to AB. If the observer be stationary at B, the star will appear in the direction BS; if, however, he traverses the distance BA in the same time as light passes from the star to his eye, the star will appear in the direction AS. Since, however, the observer is not conscious of his own translatory motion with the earth in its orbit, the star appears to have a displacement which is at all times parallel to the motion of the observer. To generalize this, let S (fig. 3) be the sun, ABCD the earth's orbit, and *s* the true position of a star. When the earth is at A, in consequence of aberration, the star is displaced to a point *a*, its displacement *sa* being parallel to the earth's motion at A; when the earth is at B, the star appears at *b*; and so on throughout an orbital revolution of the earth. Every star, therefore, describes an apparent orbit, which, if the line joining the sun and the star be perpendicular to the plane ABCD, will be exactly similar to that of the earth, *i.e.* almost a circle. As the star decreases in latitude, this circle will be viewed more and more obliquely, becoming a flatter and flatter ellipse until, with zero latitude, it degenerates into a straight line (fig. 4).

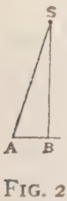

FIG. 2.

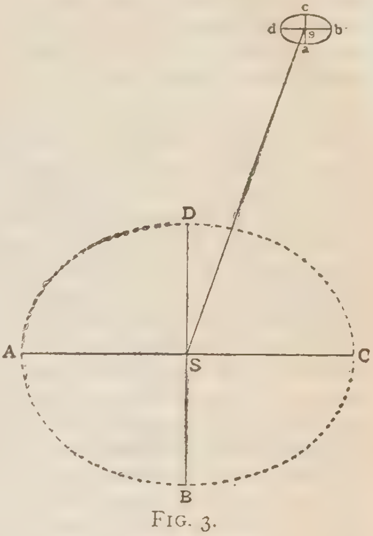

FIG. 3.

The major axis of any such aberrational ellipse is always parallel to AC, *i.e.* the ecliptic, and since it is equal to the ratio of the velocity of light to the velocity of the earth, it is necessarily constant. This constant length subtends an angle of about 40″ at the earth; the "constant of aberration" is half this angle. The generally accepted value is 20·445″, due to Struve; the last two figures are uncertain, and all that can be definitely affirmed is that the value lies between 20·43″ and 20·48″. The minor axis, on the other hand, is not constant, but, as we have already seen, depends on the latitude, being the product of the major axis into the sine of the latitude.

Assured that his explanation was true, Bradley corrected his observations for aberration, but he found that there still remained a residuum which was evidently not a parallax, for it did not exhibit an annual cycle. He reverted to his early idea of a nutation of the earth's axis, and was rewarded by the discovery that the earth did possess such an oscillation (see ASTRONOMY). Bradley recognized the fact that the experimental determination of the aberration constant gave the ratio of the velocities of light and of the earth; hence, if the velocity of the earth be known, the velocity of light is determined. In recent years much attention has been given to the nature of the propagation of light from the heavenly bodies to the earth, the argument generally being centred about the relative effect of the motion of the aether on the velocity of light. This subject is discussed in the articles AETHER and LIGHT.

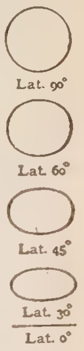

FIG. 4.

REFERENCES.—A detailed account of Bradley's work is given in S. Rigaud, *Memoirs of Bradley* (1832), and in Charles Hutton, *Mathematical and Philosophical Dictionary* (1795); a particularly clear and lucid account is given in H. H. Turner, *Astronomical Discovery* (1904). The subject receives treatment in all astronomical works.

II. ABERRATION IN OPTICAL SYSTEMS

Aberration in optical systems, *i.e.* in lenses or mirrors or a series of them, may be defined as the non-concurrence of rays from the points of an object after transmission through the system; it happens generally that an image formed by such a system is irregular, and consequently the correction of optical systems for aberration is of fundamental importance to the instrument-maker. Reference should be made to the articles REFLEXION, REFRACTION, and CAUSTIC for the general characters of reflected and refracted rays (the article LENS considers in detail the properties of this instrument, and should also be consulted); in this article will be discussed the nature, varieties and modes of aberrations mainly from the practical point of view, *i.e.* that of the optical-instrument maker.

Aberrations may be divided in two classes: chromatic (Gr. χρῶμα, colour) aberrations, caused by the composite nature of the light generally applied (*e.g.* white light), which is dispersed by refraction, and *monochromatic* (Gr. *μόνος*, one) aberrations produced without dispersion. Consequently the monochromatic class includes the aberrations at reflecting surfaces of any coloured light, and at refracting surfaces of monochromatic or light of single wave length.

(*a*) *Monochromatic Aberration.*

The elementary theory of optical systems leads to the theorem: Rays of light proceeding from any "object point" unite in an "image point"; and therefore an "object space" is reproduced in an "image space." The introduction of simple auxiliary terms, due to C. F. Gauss (*Dioptrische Untersuchungen*, Göttingen, 1841), named the focal lengths and focal planes, permits the determination of the image of any object for any system (see LENS). The Gaussian theory, however, is only true so long as the angles made by all rays with the *optical axis* (the symmetrical axis of the system) are infinitely small, *i.e.* with infinitesimal objects, images and lenses; in practice these conditions are not realized, and the images projected by uncorrected systems are, in general, ill defined and often completely blurred, if the aperture or field of view exceeds certain limits. The investigations of James Clerk Maxwell (*Phil.Mag.*, 1856; *Quart. Journ. Math.*, 1858, and Ernst Abbe[1]) showed that the properties of these reproductions, *i.e.* the relative position and magnitude of the images, are not special properties of optical systems, but necessary consequences of the supposition (in Abbe) of the reproduction of all points of a space in image points (Maxwell assumes a less general hypothesis), and are independent of the manner in which the reproduction is effected. These authors proved, however, that no optical system can justify these suppositions, since they are contradictory to the fundamental laws of reflexion and refraction. Consequently the Gaussian theory only supplies a convenient method of approximating to reality; and no constructor would attempt to realize this unattainable ideal. All that at present can be attempted is, to reproduce a single plane in another plane; but even this has not been altogether satisfactorily accomplished, aberrations always occur, and it is improbable that these will ever be entirely corrected.

This, and related general questions, have been treated—besides the above-mentioned authors—by M. Thiesen (*Berlin. Akad. Sitzber.*, 1890, xxxv. 799; *Berlin.Phys.Ges. Verh.*, 1892) and H. Bruns (*Leipzig. Math. Phys. Ber.*, 1895, xxi. 325) by means of Sir W. R. Hamilton's "characteristic function" (*Irish Acad. Trans.*, "Theory of Systems of Rays," 1828, et seq.). Reference may also be made to the treatise of Czapski-Eppenstein, pp. 155-161.

A review of the simplest cases of aberration will now be given. (1) *Aberration of axial points* (Spherical aberration in the restricted sense). If S (fig. 5) be any optical system, rays proceeding from an axis point O under an angle u_1 will unite in the axis point O'_1; and those under an angle u_2 in the axis point O'_2. If there be refraction at a collective spherical surface, or through a thin positive lens, O'_2 will lie in front of O'_1 so long as the angle u_2 is greater than u_1 ("under correction"); and conversely with a dispersive surface or lenses ("over correction"). The caustic, in the first case, resembles the sign > (greater than); in the second < (less than). If the angle u_1 be very small, O'_1 is the Gaussian image; and O'_1 O'_2 is termed the "longitudinal aberration," and O'_1R the "lateral aberration" of the pencils with aperture u_2. If the pencil with the angle u_2 be that of the maximum aberration of all the pencils transmitted, then in a plane perpendicular to the axis at O'_1 there is a circular "disk of confusion" of radius O'_1R, and in a parallel plane at O'_2 another one of radius O'_2R_2; between these two is situated the "disk of least confusion."

The largest opening of the pencils, which take part in the reproduction of O, *i.e.* the angle *u*, is generally determined by the margin of one of the lenses or by a hole in a thin plate placed between, before, or behind the lenses of the system. This hole is termed the "stop" or "diaphragm"; Abbe used the term "aperture stop" for both the hole and the limiting margin of the lens. The component S_1 of the system, situated between the aperture stop and the object O, projects an image of the diaphragm, termed by Abbe the "entrance pupil"; the "exit pupil" is the image formed by the component S_2, which is placed behind the aperture stop. All rays which issue from O and pass through the aperture stop also pass through the entrance and exit pupils, since these are images of the aperture stop. Since the maximum aperture of the pencils issuing from O is the angle *u* subtended by the entrance pupil at this point, the magnitude of the aberration will be determined by the position and diameter of the entrance pupil. If the system be entirely behind the aperture stop, then this is itself the entrance pupil ("front stop"); if entirely in front, it is the exit pupil ("back stop").

If the object point be infinitely distant, all rays received by the first member of the system are parallel, and their intersections, after traversing the system, vary according to their "perpendicular height of incidence," *i.e.* their distance from the axis. This distance replaces the angle *u* in the preceding considerations; and the aperture, *i.e.* the radius of the entrance pupil, is its maximum value.

(2) *Aberration of elements*, i.e. *smallest objects at right angles to the axis.*—If rays issuing from O (fig. 5) be concurrent, it does not follow that points in a portion of a plane perpendicular at O to the axis will be also concurrent, even if the part of the plane be very small. With a considerable aperture, the neighbouring point N will be reproduced, but attended by aberrations comparable in magnitude to ON. These aberrations are avoided if, according to Abbe, the "sine condition," $\sin u'_1/\sin u_1 = \sin u'_2/\sin u_2$, holds for all rays reproducing the point O. If the object point O be infinitely distant, u_1 and u_2 are to be replaced by h_1 and h_2, the perpendicular heights of incidence; the "sine condition" then becomes $\sin u'_1/h_1 = \sin u'_2/h_2$. A system fulfilling this condition and free from spherical aberration is called "aplanatic" (Greek α-, privative, πλάνη, a wandering). This word was first used by Robert Blair (d. 1828), professor of practical astronomy at Edinburgh University, to characterize a superior achromatism, and, subsequently, by many writers to denote freedom from spherical aberration. Both the aberration of axis points, and the deviation from the sine condition, rapidly increase in most (uncorrected) systems with the aperture.

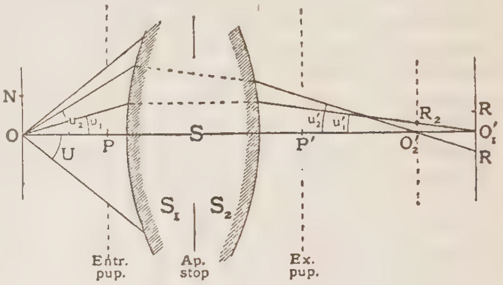

FIG. 5.

(3) *Aberration of lateral object points* (*points beyond the axis*) *with narrow pencils. Astigmatism.*—A point O (fig. 6) at a finite distance from the axis (or with an infinitely distant object, a point which subtends a finite angle at the system) is, in general, even then not sharply reproduced, if the pencil of rays issuing from it and traversing the system is made infinitely narrow by reducing the aperture stop; such a pencil consists of the rays which can pass from the object point through the now infinitely small entrance pupil. It is seen (ignoring exceptional cases) that the pencil does not meet the refracting or reflecting surface at right angles; therefore it is astigmatic (Gr. α-, privative, στίγμα, a point). Naming the central ray passing through the entrance pupil the "axis of the pencil" or "principal ray," we can say: the rays of the pencil intersect, not in one point, but in two focal lines, which we can assume to be at right angles to the principal ray; of these, one lies in the plane containing the principal ray and

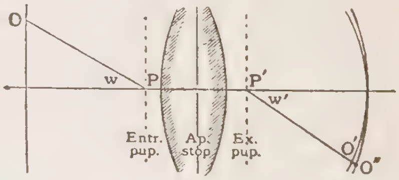

FIG. 6.

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[1] The investigations of E. Abbe on geometrical optics, originally published only in his university lectures, were first compiled by S. Czapski in 1893. See below, AUTHORITIES.

the axis of the system, *i.e.* in the "first principal section" or "meridional section," and the other at right angles to it, *i.e.* in the second principal section or sagittal section. We receive, therefore, in no single intercepting plane behind the system, as, for example, a focussing screen, an image of the object point; on the other hand, in each of two planes lines O' and O'' are separately formed (in neighbouring planes ellipses are formed), and in a plane between O' and O'' a circle of least confusion. The interval $O'O''$, termed the astigmatic difference, increases, in general, with the angle W made by the principal ray OP with the axis of the system, *i.e.* with the field of view. Two "astigmatic image surfaces" correspond to one object plane; and these are in contact at the axis point; on the one lie the focal lines of the first kind, on the other those of the second. Systems in which the two astigmatic surfaces coincide are termed anastigmatic or stigmatic.

Sir Isaac Newton was probably the discoverer of astigmation; the position of the astigmatic image lines was determined by Thomas Young (*A Course of Lectures on Natural Philosophy*, 1807); and the theory has been recently developed by A. Gullstrand (*Skand. Arch. f. physiol.*, 1890, 2, p. 269; *Allgemeine Theorie der monochromat. Aberrationen*, etc., Upsala, 1900; *Arch. f. Ophth.*, 1901, 53, pp. 2, 185). A bibliography by P. Culmann is given in M. von Rohr's *Die Bilderzeugung in optischen Instrumenten* (Berlin, 1904).

(4) *Aberration of lateral object points with broad pencils. Coma.*—By opening the stop wider, similar deviations arise for lateral points as have been already discussed for axial points; but in this case they are much more complicated. The course of the rays in the meridional section is no longer symmetrical to the principal ray of the pencil; and on an intercepting plane there appears, instead of a luminous point, a patch of light, not symmetrical about a point, and often exhibiting a resemblance to a comet having its tail directed towards or away from the axis. From this appearance it takes its name. The unsymmetrical form of the meridional pencil—formerly the only one considered—is coma in the narrower sense only; other errors of coma have been treated by A. König and M. von Rohr (*op. cit.*), and more recently by A. Gullstrand (*op. cit.*; *Ann. d. Phys.*, 1905, 18, p. 941).

(5) *Curvature of the field of the image.*—If the above errors be eliminated, the two astigmatic surfaces united, and a sharp image obtained with a wide aperture—there remains the necessity to correct the curvature of the image surface, especially when the image is to be received upon a plane surface, *e.g.* in photography. In most cases the surface is concave towards the system.

(6) *Distortion of the image.*—If now the image be sufficiently sharp, inasmuch as the rays proceeding from every object point meet in an image point of satisfactory exactitude, it may happen that the image is distorted, *i.e.* not sufficiently like the object. This error consists in the different parts of the object being reproduced with different magnifications; for instance, the inner parts may differ in greater magnification than the outer ("barrel-shaped distortion"), or conversely ("cushion-shaped distortion") (see fig. 7). Systems free of this aberration are called "orthoscopic" (ὀρθός, right, σκοπεῖν, to look). This aberration is quite distinct from that of the sharpness of reproduction; in unsharp reproduction, the question of distortion arises if only parts of the object can be recognized in the figure. If, in an unsharp image, a patch of light corresponds to an object point, the "centre of gravity" of the patch may be regarded as the image point, this being the point where the plane receiving the image, *e.g.* a focussing screen, intersects the ray passing through the middle of the stop. This assumption is justified if a poor image on the focussing screen remains stationary when the aperture is diminished; in practice, this generally occurs. This ray, named by Abbe a "principal ray" (not to be confused with the "principal rays" of the Gaussian theory), passes through the centre of the entrance pupil before the first refraction, and the centre of the exit pupil after the last refraction. From this it follows that correctness of drawing depends solely upon the principal rays; and is independent of the sharpness or curvature of the image field. Referring to fig. 8, we have $O'Q'/OQ = a' \tan w'/a \tan w = 1/N$, where N is the "scale" or magnification of the image. For N to be constant for all values of w, $a' \tan w'/a \tan w$ must also be constant. If the ratio a'/a be sufficiently constant, as is often the case, the above relation reduces to the "condition of Airy," *i.e.* $\tan w'/\tan w = \text{a constant}$. This simple relation (see *Camb. Phil. Trans.*, 1830, 3, p. 1) is fulfilled in all systems which are symmetrical with respect to their diaphragm (briefly named "symmetrical or holosymmetrical objectives"), or which consist of two like, but different-sized, components, placed from the diaphragm in the ratio of their size, and presenting the same curvature to it (hemisymmetrical objectives); in these systems $\tan w'/\tan w = 1$. The constancy of a'/a necessary for this relation to hold was pointed out by R. H. Bow (*Brit. Journ. Photog.*, 1861), and Thomas Sutton (*Photographic Notes*, 1862); it has been treated by O. Lummer and by M. von Rohr (*Zeit. f. Instrumentenk.*, 1897, 17, and 1898, 18, p. 4). It requires the middle of the aperture stop to be reproduced in the centres of the entrance and exit pupils without spherical aberration. M. von Rohr showed that for systems fulfilling neither the Airy nor the Bow-Sutton condition, the ratio $a' \tan w'/a \tan w$ will be constant for one distance of the object. This combined condition is exactly fulfilled by holosymmetrical objectives reproducing with the scale 1, and by hemisymmetrical, if the scale of reproduction be equal to the ratio of the sizes of the two components.

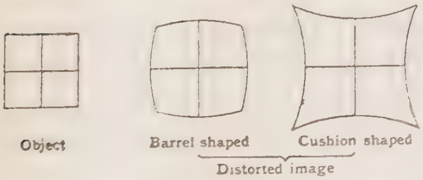

FIG. 7.

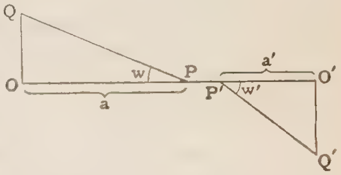

FIG. 8.

Analytic Treatment of Aberrations.—The preceding review of the several errors of reproduction belongs to the "Abbe theory of aberrations," in which definite aberrations are discussed separately; it is well suited to practical needs, for in the construction of an optical instrument certain errors are sought to be eliminated, the selection of which is justified by experience. In the mathematical sense, however, this selection is arbitrary; the reproduction of a finite object with a finite aperture entails, in all probability, an infinite number of aberrations. This number is only finite if the object and aperture are assumed to be "infinitely small of a certain order"; and with each order of infinite smallness, *i.e.* with each degree of approximation to reality (to finite objects and apertures), a certain number of aberrations is associated. This connexion is only supplied by theories which treat aberrations generally and analytically by means of indefinite series.

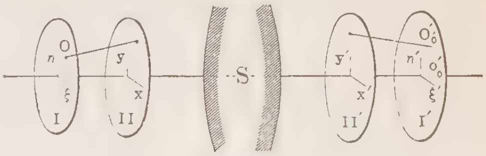

FIG. 9.

A ray proceeding from an object point O (fig. 9) can be defined by the co-ordinates (ξ, η) of this point O in an object plane I, at right angles to the axis, and two other co-ordinates (x, y), the point in which the ray intersects the entrance pupil, *i.e.* the plane II. Similarly the corresponding image ray may be defined by the points (ξ', η'), and (x', y'), in the planes I′ and II′. The origins of these four plane co-ordinate systems may be collinear with the axis of the optical system; and the corresponding axes may be parallel. Each of the four co-ordinates ξ', η', x', y' are functions of ξ, η, x, y; and if it be assumed that the field of view and the aperture be infinitely small, then ξ, η, x, y are of the same order of infinitesimals; consequently by expanding ξ', η', x', y' in ascending powers of ξ, η, x, y, series are obtained in which it is only necessary to consider the lowest powers. It is readily seen that if the optical system be symmetrical, the origins of the co-ordinate systems collinear with the optical axis and the corresponding axes parallel, then by changing the signs of ξ, η, x, y, the values ξ', η, x', y' must likewise change their sign, but retain their arithmetical values; this means that the series are restricted to *odd* powers of the unmarked variables.

The nature of the reproduction consists in the rays proceeding from a point O being united in another point O′; in general, this will not be the case, for ξ', η' vary if ξ, η be constant, but x, y variable. It may be assumed that the planes I′ and II′ are drawn where the images of the planes I and II are formed by rays near the axis by the ordinary Gaussian rules; and by an extension of these rules, not, however, corresponding to reality, the Gauss image point O'_0, with co-ordinates ξ'_0, η'_0, of the point O at some distance from the axis could be constructed. Writing $\Delta\xi' = \xi' - \xi'_0$ and $\Delta\eta' = \eta' - \eta'_0$, then $\Delta\xi'$ and $\Delta\eta'$ are the aberrations belonging to ξ, η and x, y, and are functions of these magnitudes which, when expanded in series, contain only odd powers, for the same reasons as given above. On account of the aberrations of all rays which pass through O, a patch of light, depending in size on the lowest powers of ξ, η, x, y which the aberrations contain, will be formed in the plane I′. These degrees, named by J. Petzval (*Bericht über die Ergebnisse einiger dioptrischer Untersuchungen*, Buda Pesth, 1843; *Akad. Sitzber.*, Wien, 1857, vols. xxiv. xxvi.) "the numerical orders of the image," are consequently only odd powers; the condition for the formation of an image of the mth order is that in the series for $\Delta\xi'$ and $\Delta\eta'$ the coefficients of the powers of the 3rd, 5th . . . $(m-2)$th degrees must vanish. The images of the Gauss theory being of the third order, the next problem is to obtain an image of 5th order, or to make the coefficients of the powers of 3rd degree zero. This necessitates the satisfying of five equations; in other words, there are five alterations of the 3rd order, the vanishing of which produces an image of the 5th order.

The expression for these coefficients in terms of the constants of the optical system, *i.e.* the radii, thicknesses, refractive indices and distances between the lenses, was solved by L. Seidel (*Astr. Nach.*, 1856, p. 289); in 1840, J. Petzval constructed his portrait objective, unexcelled even at the present day, from similar calculations, which have never been published (see M. von Rohr, *Theorie und Geschichte des photographischen Objectivs*, Berlin, 1899, p. 248). The theory was elaborated by S. Finterswalder (*München. Akad. Abhandl.*, 1891, 17, p. 519), who also published a posthumous paper of Seidel containing a short view of his work (*München. Akad. Sitzber.*, 1898, 28, p. 395); a simpler form was given by A. Kerber (*Beiträge zur Dioptrik*, Leipzig, 1895–6–7–8–9). A. König and M. von Rohr (see M. von Rohr, *Die Bilderzeugung in optischen Instrumenten*, pp. 317-323) have represented Kerber's method, and have deduced the Seidel formulae from geometrical considerations based on the Abbe method, and have interpreted the analytical results geometrically (pp. 212-316).

The aberrations can also be expressed by means of the "characteristic function" of the system and its differential coefficients, instead of by the radii, &c., of the lenses; these formulae are not immediately applicable, but give, however, the relation between the number of aberrations and the order. Sir William Rowan Hamilton (*British Assoc. Report*, 1833, p. 360) thus derived the aberrations of the third order; and in later times the method was pursued by Clerk Maxwell (*Proc. London Math. Soc.*, 1874–1875; see also the treatises of R. S. Heath and L. A. Herman), M. Thiesen (*Berlin. Akad. Sitzber.*, 1890, 35, p. 804), H. Bruns (*Leipzig. Math. Phys. Ber.*, 1895, 21, p. 410), and particularly successfully by K. Schwartzschild (*Göttingen. Akad. Abhandl.*, 1905, 4, No. 1), who thus discovered the aberrations of the 5th order (of which there are nine), and possibly the shortest proof of the practical (Seidel) formulae. A. Gullstrand (*vide supra*, and *Ann. d. Phys.*, 1905, 18, p. 941) founded his theory of aberrations on the differential geometry of surfaces.

Aberrations of the third order.

The aberrations of the third order are: (1) aberration of the axis point; (2) aberration of points whose distance from the axis is very small, less than of the third order—the deviation from the sine condition and coma here fall together in one class; (3) astigmatism; (4) curvature of the field; (5) distortion.

(1) Aberration of the third order of axis points is dealt with in all text-books on optics. It is important for telescope objectives, since their apertures are so small as to permit higher orders to be neglected. For a single lens of very small thickness and given power, the aberration depends upon the ratio of the radii $r:r'$, and is a minimum (but never zero) for a certain value of this ratio; it varies inversely with the refractive index (the power of the lens remaining constant). The total aberration of two or more very thin lenses in contact, being the sum of the individual aberrations, can be zero. This is also possible if the lenses have the same algebraic sign. Of thin positive lenses with $n=1\cdot5$, four are necessary to correct spherical aberration of the third order. These systems, however, are not of great practical importance. In most cases, two thin lenses are combined, one of which has just so strong a positive aberration ("under-correction," *vide supra*) as the other a negative; the first must be a positive lens and the second a negative lens; the powers, however, may differ, so that the desired effect of the lens is maintained. It is generally an advantage to secure a great refractive effect by several weaker than by one high-power lens. By one, and likewise by several, and even by an infinite number of thin lenses in contact, no more than two axis points can be reproduced without aberration of the third order. Freedom from aberration for two axis points, one of which is infinitely distant, is known as "Herschel's condition." All these rules are valid, inasmuch as the thicknesses and distances of the lenses are not to be taken into account.

(2) The condition for freedom from coma in the third order is also of importance for telescope objectives; it is known as "Fraunhofer's condition." (4) After eliminating the aberration on the axis, coma and astigmatism, the relation for the flatness of the field in the third order is expressed by the "Petzval equation," $\Sigma 1/r(n'-n) = 0$, where r is the radius of a refracting surface, n and n' the refractive indices of the neighbouring media, and Σ the sign of summation for all refracting surfaces.

Practical Elimination of Aberrations.—The existence of an optical system, which reproduces absolutely a finite plane on another with pencils of finite aperture, is doubtful; but practical systems solve this problem with an accuracy which mostly suffices for the special purpose of each species of instrument. The problem of finding a system which reproduces a given object upon a given plane with given magnification (in so far as aberrations must be taken into account) could be dealt with by means of the approximation theory; in most cases, however, the analytical difficulties are too great. Solutions, however, have been obtained in special cases (see A. König in M. von Rohr's *Die Bilderzeugung*, p. 373; K. Schwarzschild, *Göttingen. Akad. Abhandl.*, 1905, 4, Nos. 2 and 3). At the present time constructors almost always employ the inverse method: they compose a system from certain, often quite personal experiences, and test, by the trigonometrical calculation of the paths of several rays, whether the system gives the desired reproduction (examples are given in A. Gleichen, *Lehrbuch der geometrischen Optik*, Leipzig and Berlin, 1902). The radii, thicknesses and distances are continually altered until the errors of the image become sufficiently small. By this method only certain errors of reproduction are investigated, especially individual members, or all, of those named above. The analytical approximation theory is often employed provisionally, since its accuracy does not generally suffice.

In order to render spherical aberration and the deviation from the sine condition small throughout the whole aperture, there is given to a ray with a finite angle of aperture u^* (with infinitely distant objects: with a finite height of incidence h^*) the same distance of intersection, and the same sine ratio as to one neighbouring the axis (u^* or h^* may not be much smaller than the largest aperture U or H to be used in the system). The rays with an angle of aperture smaller than u^* would not have the same distance of intersection and the same sine ratio; these deviations are called "zones," and the constructor endeavours to reduce these to a minimum. The same holds for the errors depending upon the angle of the field of view w: astigmatism, curvature of field and distortion are eliminated for a definite value, w^*; "zones of astigmatism, curvature of field and distortion" attend smaller values of w. The practical optician names such systems "corrected for the angle of aperture u^* (the height of incidence h^*) or the angle of field of view w^*." Spherical aberration and changes of the sine ratios are often represented graphically as functions of the aperture.

in the same way as the deviations of two astigmatic image surfaces of the image plane of the axis point are represented as functions of the angles of the field of view.

The best form of a practical system consequently rests on compromise; enlargement of the aperture results in a diminution of the available field of view, and *vice versa*. The following may be regarded as typical:—(1) Largest aperture; necessary corrections are—for the axis point, and sine condition; errors of the field of view are almost disregarded; example—high-power microscope objectives. (2) Largest field of view; necessary corrections are—for astigmatism, curvature of field and distortion; errors of the aperture only slightly regarded; examples—photographic widest angle objectives and oculars. Between these extreme examples stands the ordinary photographic objective: the portrait objective is corrected more with regard to aperture; objectives for groups more with regard to the field of view. (3) Telescope objectives have usually not very large apertures, and small fields of view; they should, however, possess zones as small as possible, and be built in the simplest manner. They are the best for analytical computation.

(*b*) *Chromatic or Colour Aberration.*

In optical systems composed of lenses, the position, magnitude and errors of the image depend upon the refractive indices of the glass employed (see LENS, and above, "Monochromatic Aberration"). Since the index of refraction varies with the colour or wave length of the light (see DISPERSION), it follows that a system of lenses (uncorrected) projects images of different colours in somewhat different places and sizes and with different aberrations; *i.e.* there are "chromatic differences" of the distances of intersection, of magnifications, and of monochromatic aberrations. If mixed light be employed (*e.g.* white light), all these images are formed; and since they are all ultimately intercepted by a plane (the retina of the eye, a focussing screen of a camera, &c.), they cause a confusion, named *chromatic aberration*; for instance, instead of a white margin on a dark background, there is perceived a coloured margin, or narrow spectrum. The absence of this error is termed *achromatism*, and an optical system so corrected is termed achromatic. A system is said to be "chromatically under-corrected" when it shows the same kind of chromatic error as a thin positive lens, otherwise it is said to be "over-corrected."

If, in the first place, monochromatic aberrations be neglected—in other words, the Gaussian theory be accepted—then every reproduction is determined by the positions of the focal planes, and the magnitude of the focal lengths, or if the focal lengths, as ordinarily happens, be equal, by three constants of reproduction. These constants are determined by the data of the system (radii, thicknesses, distances, indices, &c., of the lenses); therefore their dependence on the refractive index, and consequently on the colour, are calculable (the formulae are given in Czapski-Eppenstein, *Grundzüge der Theorie der optischen Instrumente* (1903, p. 166)). The refractive indices for different wave lengths must be known for each kind of glass made use of. In this manner the conditions are maintained that any one constant of reproduction is equal for two different colours, *i.e.* this constant is achromatized. For example, it is possible, with one thick lens in air, to achromatize the position of a focal plane of the magnitude of the focal length. If all three constants of reproduction be achromatized, then the Gaussian image for all distances of objects is the same for the two colours, and the system is said to be in "stable achromatism."

In practice it is more advantageous (after Abbe) to determine the chromatic aberration (for instance, that of the distance of intersection) for a fixed position of the object, and express it by a sum in which each component contains the amount due to each refracting surface (see Czapski-Eppenstein, *op. cit.* p. 170; A. König in M. v. Rohr's collection, *Die Bilderzeugung*, p. 340). In a plane containing the image point of one colour, another colour produces a disk of confusion; this is similar to the confusion caused by two "*zones*" in spherical aberration. For infinitely distant objects the radius of the chromatic disk of confusion is proportional to the linear aperture, and independent of the focal length (*vide supra*, "Monochromatic Aberration of the Axis Point"); and since this disk becomes the less harmful with an increasing image of a given object, or with increasing focal length, it follows that the deterioration of the image is proportional to the ratio of the aperture to the focal length, *i.e.* the "relative aperture." (This explains the gigantic focal lengths in vogue before the discovery of achromatism.)

Examples.—(*a*) In a very thin lens, in air, only one constant of reproduction is to be observed, since the focal length and the distance of the focal point are equal. If the refractive index for one colour be n, and for another $n+dn$, and the powers, or reciprocals of the focal lengths, be ϕ and $\phi+d\phi$, then (1) $d\phi/\phi = dn/(n-1) = 1/\nu$; dn is called the dispersion, and ν the dispersive power of the glass.

(*b*) Two thin lenses in contact: let ϕ_1 and ϕ_2 be the powers corresponding to the lenses of refractive indices n_1 and n_2 and radii r'_1, r''_1, and r'_2, r''_2 respectively; let ϕ denote the total power, and $d\phi$, dn_1, dn_2 the changes of ϕ, n_1, and n_2 with the colour. Then the following relations hold:—

(2) $\phi = \phi_1 + \phi_2 = (n_1 - 1)(1/r'_1 - 1/r''_1) + (n_2 - 1)(1/r'_2 - 1/r''_2) = (n_1 - 1)k_1 + (n_2 - 1)k_2$; and

(3) $d\phi = k_1 dn_1 + k_2 dn_2$. For achromatism $d\phi = 0$, hence, from (3),

(4) $k_1/k_2 = -dn_2/dn_1$, or $\phi_1/\phi_2 = -\nu_1/\nu_2$. Therefore ϕ_1 and ϕ_2 must have different algebraic signs, or the system must be composed of a collective and a dispersive lens. Consequently the powers of the two must be different (in order that ϕ be not zero (equation 2)), and the dispersive powers must also be different (according to 4).

Newton failed to perceive the existence of media of different dispersive powers required by achromatism; consequently he constructed large reflectors instead of refractors. James Gregory and Leonhard Euler arrived at the correct view from a false conception of the achromatism of the eye; this was determined by Chester More Hall in 1728, Klingenstierna in 1754 and by Dollond in 1757, who constructed the celebrated achromatic telescopes. (See TELESCOPE.)

Glass with weaker dispersive power (greater ν) is named "crown glass"; that with greater dispersive power, "flint glass." For the construction of an achromatic collective lens (ϕ positive) it follows, by means of equation (4), that a collective lens I. of crown glass and a dispersive lens II. of flint glass must be chosen; the latter, although the weaker, corrects the other chromatically by its greater dispersive power. For an achromatic dispersive lens the converse must be adopted. This is, at the present day, the ordinary type, *e.g.*, of telescope objective (fig. 10); the values of the four radii must satisfy the equations (2) and (4). Two other conditions may also be postulated; one is always the elimination of the aberration on the axis; the second either the "Herschel" or "Fraunhofer condition," the latter being the best (*vide supra*, "Monochromatic Aberration"). In practice, however, it is often more useful to avoid the second condition by making the lenses have contact, *i.e.* equal radii. According to P. Rudolph (*Eder's Jahrb. f. Photog.*, 1891, 5, p. 225; 1893, 7, p. 221), cemented objectives of thin lenses permit the elimination of spherical aberration on the axis, if, as above, the collective lens has a smaller refractive index; on the other hand, they permit the elimination of astigmatism and curvature of the field, if the collective lens has a greater refractive index (this follows from the Petzval equation; see L. Seidel, *Astr. Nachr.*, 1856, p. 289). Should the cemented system be positive, then the more powerful lens must be positive; and, according to (4), to the greater power belongs the weaker dispersive power (greater ν), that is to say, crown glass; consequently the crown glass must have the greater refractive index for astigmatic and plane images. In all earlier kinds of glass, however, the dispersive power increased with the refractive index; that is, ν decreased as n increased; but some of the Jena glasses by E. Abbe and O. Schott were crown

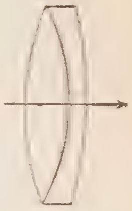

FIG. 10.

glasses of high refractive index, and achromatic systems from such crown glasses, with flint glasses of lower refractive index, are called the "new achromats," and were employed by P. Rudolph in the first "anastigmats" (photographic objectives).

Instead of making $d\phi$ vanish, a certain value can be assigned to it which will produce, by the addition of the two lenses, any desired chromatic deviation, *e.g.* sufficient to eliminate one present in other parts of the system. If the lenses I. and II. be cemented and have the same refractive index for one colour, then its effect for that one colour is that of a lens of one piece; by such decomposition of a lens it can be made chromatic or achromatic at will, without altering its spherical effect. If its chromatic effect $(d\phi/\phi)$ be greater than that of the same lens, this being made of the more dispersive of the two glasses employed, it is termed "hyper-chromatic."

For two thin lenses separated by a distance D the condition for achromatism is $D=(v_1f_1+v_2f_2)\ (v_1+v_2)$; if $v_1=v_2$ (*e.g.* if the lenses be made of the same glass), this reduces to $D=\frac{1}{2}(f_1+f_2)$, known as the "condition for oculars."

If a constant of reproduction, for instance the focal length, be made equal for two colours, then it is not the same for other colours, if two different glasses are employed. For example, the condition for achromatism (4) for two thin lenses in contact is fulfilled in only one part of the spectrum, since dn_2/dn_1 varies within the spectrum. This fact was first ascertained by J. Fraunhofer, who defined the colours by means of the dark lines in the solar spectrum; and showed that the ratio of the dispersion of two glasses varied about 20% from the red to the violet (the variation for glass and water is about 50%). If, therefore, for two colours, a and b, $f_a=f_b=f$, then for a third colour, c, the focal length is different, viz. if c lie between a and b, then $f_c<f$, and *vice versa*; these algebraic results follow from the fact that towards the red the dispersion of the positive crown glass preponderates, towards the violet that of the negative flint. These chromatic errors of systems, which are achromatic for two colours, are called the "secondary spectrum," and depend upon the aperture and focal length in the same manner as the primary chromatic errors do.

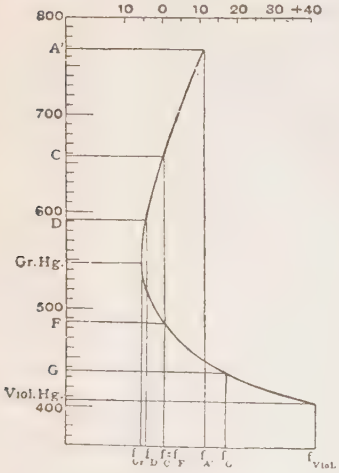

Fig. 11.—Secondary Spectrum of the combination O. 1726, O. 108. Optical correction $f_C=f_F=$ 100 mm. The ordinates give the wave-lengths in μμ. The abscissae give $f\lambda - f_C$ in 0·01 mm., commencing at $f_C\,f_F$.

(From M. v. Rohr, *op. cit.*)

In fig. 11, taken from M. von Rohr's *Theorie und Geschichte des photographischen Objectivs*, the abscissae are focal lengths, and the ordinates wave-lengths; of the latter the Fraunhofer lines used are—

A′	C	D	Green Hg.	F	G′	Violet Hg.
767·7	656·3	589·3	546·1	486·2	434·1	405·1 μμ,

and the focal lengths are made equal for the lines C and F. In the neighbourhood of 550 μμ the tangent to the curve is parallel to the axis of wave-lengths; and the focal length varies least over a fairly large range of colour, therefore in this neighbourhood the colour union is at its best. Moreover, this region of the spectrum is that which appears brightest to the human eye, and consequently this curve of the secondary spectrum, obtained by making $f_C=f_F$, is, according to the experiments of Sir G. G. Stokes (*Proc. Roy Soc.*, 1878), the most suitable for visual instruments ("optical achromatism"). In a similar manner, for systems used in photography, the vertex of the colour curve must be placed in the position of the maximum sensibility of the plates; this is generally supposed to be at G′; and to accomplish this the F and violet mercury lines are united. This artifice is specially adopted in objectives for astronomical photography ("pure actinic achromatism"). For ordinary photography, however, there is this disadvantage: the image on the focussing-screen and the correct adjustment of the photographic sensitive plate are not in register; in astronomical photography this difference is constant, but in other kinds it depends on the distance of the objects. On this account the lines D and G′ are united for ordinary photographic objectives; the optical as well as the actinic image is chromatically inferior, but both lie in the same place; and consequently the best correction lies in F (this is known as the "actinic correction" or "freedom from chemical focus").

Should there be in two lenses in contact the same focal lengths for three colours a, b, and c, *i.e.* $f_a=f_b=f_c=f$, then the relative partial dispersion $(n_c-n_b)\ (n_a-n_b)$ must be equal for the two kinds of glass employed. This follows by considering equation (4) for the two pairs of colours ac and bc. Until recently no glasses were known with a proportional degree of absorption; but R. Blair (*Trans. Edin. Soc.*, 1791, 3, p. 3), P. Barlow, and F. S. Archer overcame the difficulty by constructing fluid lenses between glass walls. Fraunhofer prepared glasses which reduced the secondary spectrum; but permanent success was only assured on the introduction of the Jena glasses by E. Abbe and O. Schott. In using glasses not having proportional dispersion, the deviation of a third colour can be eliminated by two lenses, if an interval be allowed between them; or by three lenses in contact, which may not all consist of the old glasses. In uniting three colours an "achromatism of a higher order" is derived; there is yet a residual "tertiary spectrum," but it can always be neglected.

The Gaussian theory is only an approximation; monochromatic or spherical aberrations still occur, which will be different for different colours; and should they be compensated for one colour, the image of another colour would prove disturbing. The most important is the chromatic difference of aberration of the axis point, which is still present to disturb the image, after par-axial rays of different colours are united by an appropriate combination of glasses. If a collective system be corrected for the axis point for a definite wave-length, then, on account of the greater dispersion in the negative components—the flint glasses,—over-correction will arise for the shorter wave-lengths (this being the error of the negative components), and under-correction for the longer wave-lengths (the error of crown glass lenses preponderating in the red). This error was treated by Jean le Rond d'Alembert, and, in special detail, by C. F. Gauss. It increases rapidly with the aperture, and is more important with medium apertures than the secondary spectrum of par-axial rays; consequently, spherical aberration must be eliminated for two colours, and if this be impossible, then it must be eliminated for those particular wave-lengths which are most effectual for the instrument in question (a graphical representation of this error is given in M. von Rohr, *Theorie und Geschichte des photographischen Objectivs*).

The condition for the reproduction of a surface element in the place of a sharply reproduced point—the constant of the sine relation—must also be fulfilled with large apertures for several colours. E. Abbe succeeded in computing microscope objectives free from error of the axis point and satisfying the sine condition for several colours, which therefore, according to his definition, were "aplanatic for several colours"; such systems he termed "apochromatic." While, however, the magnification of the individual zones is the same, it is not the same for red as for blue; and there is a chromatic difference of magnification. This is produced in the same amount, but in the opposite sense, by the oculars, which are used with these objectives ("compensating oculars"), so that it is eliminated in the image of the whole microscope. The best telescope objectives, and photographic objectives intended for three-colour work, are also apochromatic, even if they do not possess quite the same quality of correction as microscope objectives do. The chromatic differences of other errors of reproduction have seldom practical importances.

AUTHORITIES.—The standard treatise in English is H. D. Taylor, *A System of Applied Optics* (1906); reference may also be made to R. S. Heath, *A Treatise on Geometrical Optics* (2nd ed., 1895); and L. A. Herman, *A Treatise on Geometrical Optics* (1900). The ideas of Abbe were first dealt with in S. Czapski, *Theorie der optischen Instrumente nach Abbe*, published separately at Breslau in 1893, and as vol. ii. of Winkelmann's *Handbuch der Physik* in 1894; a second edition, by Czapski and O. Eppenstein, was published at Leipzig in 1903 with the title, *Grundzüge der Theorie der optischen Instrumente nach Abbe*, and in vol. ii. of the 2nd ed. of Winkelmann's *Handbuch der Physik*. The collection of the scientific staff of Carl Zeiss at Jena, edited by M. von Rohr, *Die Bilderzeugung in optischen Instrumenten vom Standpunkte der geometrischen Optik* (Berlin, 1904), contains articles by A. König and M. von Rohr specially dealing with aberrations. (O. E.)

ABERSYCHAN, an urban district in the northern parliamentary division of Monmouthshire, England, 11 m. N. by W. of Newport, on the Great Western, London and North-Western, and Rhymney railways. Pop. (1901) 17,768. It lies in the narrow upper valley of the Afon Lwyd on the eastern edge of the great coal and iron mining district of Glamorganshire and Monmouthshire, and its large industrial population is occupied in the mines and ironworks. The neighbourhood is wild and mountainous.

ABERTILLERY, an urban district in the western parliamentary division of Monmouthshire, England, 16 m. N.W. of Newport, on the Great Western railway. Pop. (1891) 10,846; (1901) 21,945. It lies in the mountainous mining district of Monmouthshire and Glamorganshire, in the valley of the Ebbw Fach, and the large industrial population is mainly employed in the numerous coal-mines, ironworks and tinplate works. Farther up the valley are the mining townships of NANTYGLO and BLAINA, forming an urban district with a population (1901) of 13,489.

ABERYSTWYTH, a municipal borough, market-town and seaport of Cardiganshire, Wales, near the confluence of the rivers Ystwyth and Rheidol, about the middle of Cardigan Bay. Pop. (1901) 8013. It is the terminal station of the Cambrian railway, and also of the Manchester and Milford line. It is the most popular watering-place on the west coast of Wales, and possesses a pier, and a fine sea-front which stretches from Constitution Hill at the north end of the Marine Terrace to the mouth of the harbour. The town is of modern appearance, and contains many public buildings, of which the most remarkable is the imposing but fantastic structure of the University College of Wales near the Castle Hill. Much of the finest scenery in mid-Wales lies within easy reach of Aberystwyth.

The history of Aberystwyth may be said to date from the time of Gilbert Strongbow, who in 1109 erected a fortress on the present Castle Hill. Edward I. rebuilt Strongbow's castle in 1277, after its destruction by the Welsh. Between the years 1404 and 1408 Aberystwyth Castle was in the hands of Owen Glendower, but finally surrendered to Prince Harry of Monmouth, and shortly after this the town was incorporated under the title of Ville de Lampadarn, the ancient name of the place being Llanbadarn Gaerog, or the fortified Llanbadarn, to distinguish it from Llanbadarn Fawr, the village one mile inland. It is thus styled in a charter granted by Henry VIII., but by Elizabeth's time the town was invariably termed Aberystwyth in all documents. In 1647 the parliamentarian troops razed the castle to the ground, so that its remains are now inconsiderable, though portions of three towers still exist. Aberystwyth was a contributory parliamentary borough until 1885, when its representation was merged in that of the county. In modern times Aberystwyth has become a Welsh educational centre, owing to the erection here of one of the three colleges of the university of Wales (1872), and of a hostel for women in connexion with it. In 1905 it was decided to fix here the site of the proposed Welsh National Library.

ABETTOR (from "to abet," O. Fr. *abeter*, *à* and *beter*, to bait, urge dogs upon any one; this word is probably of Scandinavian origin, meaning to cause to bite), a law term implying one who instigates, encourages or assists another to commit an offence. An abettor differs from an accessory (*q.v.*) in that he must be present at the commission of the crime; all abettors (with certain exceptions) are principals, and, in the absence of specific statutory provision to the contrary, are punishable to the same extent as the actual perpetrator of the offence. A person may in certain cases be convicted as an abettor in the commission of an offence in which he or she could not be a principal, *e.g.* a woman or boy under fourteen years of age in aiding rape, or a solvent person in aiding and abetting a bankrupt to commit offences against the bankruptcy laws.

ABEYANCE (O. Fr. *abeance*, "gaping"), a state of expectancy in respect of property, titles or office, when the right to them is not vested in any one person, but awaits the appearance or determination of the true owner. In law, the term abeyance can only be applied to such future estates as have not yet vested or possibly may not vest. For example, an estate is granted to A for life, with remainder to the heir of B, the latter being alive; the remainder is then said to be in abeyance, for until the death of B it is uncertain who his heir is. Similarly the freehold of a benefice, on the death of the incumbent, is said to be in abeyance until the next incumbent takes possession. The most common use of the term is in the case of peerage dignities. If a peerage which passes to heirs-general, like the ancient baronies by writ, is held by a man whose heir-at-law is neither a male, nor a woman who is an only child, it goes into abeyance on his death between two or more sisters or their heirs, and is held by no one till the abeyance is terminated; if eventually only one person represents the claims of all the sisters, he or she can claim the termination of the abeyance as a matter of right. The crown can also call the peerage out of abeyance at any moment, on petition, in favour of any one of the sisters or their heirs between whom it is in abeyance. The question whether ancient earldoms created in favour of a man and his "heirs" go into abeyance like baronies by writ has been raised by the claim to the earldom of Norfolk created in 1312, discussed before the Committee for Privileges in 1906. It is common, but incorrect, to speak of peerage dignities which are dormant (*i.e.* unclaimed) as being in abeyance. (J. H. R.)

ABGAR, a name or title borne by a line of kings or toparchs, apparently twenty-nine in number, who reigned in Osrhoene and had their capital at Edessa about the time of the Christian era. According to an old tradition, one of these princes, perhaps Abgar V. (Ukkāmā or Uchomo, "the black"), being afflicted with leprosy, sent a letter to Jesus, acknowledging his divinity, craving his help and offering him an asylum in his own residence, but Jesus wrote a letter declining to go, promising, however, that after his ascension he would send one of his disciples. These letters are given by Eusebius (*Eccl. Hist.* i. 13), who declares that the Syriac document from which he translates them had been preserved in the archives at Edessa from the time of Abgar. Eusebius also states that in due course Judas, son of Thaddaeus, was sent (in 340 = A.D. 29). In another form of the story, derived from Moses of Chorene, it is said further that Jesus sent his portrait to Abgar, and that this existed in Edessa (*Hist. Armen.*, ed. W. Whiston, ii. 29-32). Yet another version is found in the Syriac *Doctrina Addaei* (Addaeus = Thaddaeus), edited by G. Phillips (1876). Here it is said that the reply of Jesus was given not in writing, but verbally, and that the event took place in 343 (A.D. 32). Greek forms of the legend are found in the *Acta Thaddaei* (C. Tischendorf, *Acta apostolorum apocr.* 261 ff.).

These stories have given rise to much discussion. The testimony of Augustine and Jerome is to the effect that Jesus wrote nothing. The correspondence was rejected as apocryphal by Pope Gelasius and a Roman Synod (*c.* 495), though, it is true, this view has not been shared universally by the Roman church (Tillemont, *Mémoires*, i. 3, pp. 990 ff.). Amongst Evangelicals the spuriousness of the letters is almost generally admitted. Lipsius (*Die Edessenische Abgarsage*, 1880) has pointed out anachronisms which seem to indicate that the story is quite unhistorical. The first king of Edessa of whom we have any trustworthy information is Abgar VIII., bar Ma'nu (A.D. 176–213). It is suggested that the legend arose from a desire to trace the christianizing of his kingdom to an apostolic source.

Eusebius gives the legend in its oldest form; it was worked up in the *Doctrina Addaei* in the second half of the 4th century; and Moses of Chorene was dependent upon both these sources.

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ABHIDHAMMA, the name of one of the three *Pitakas*, or baskets of tradition, into which the Buddhist scriptures (see BUDDHISM) are divided. It consists of seven works: 1. *Dhamma Sanganī* (enumeration of qualities). 2. *Vibhanga* (exposition). 3. *Kathā Vatthu* (bases of opinion). 4. *Puggala Paññatti* (on individuals). 5. *Dhatu Kathā* (on relations of moral dispositions). 6. *Yamaka* (the pairs, that is, of ethical states). 7. *Patthāna* (evolution of ethical states). These have now been published by the Pali Text Society. The first has been translated into English, and an abstract of the third has been published. The approximate date of these works is probably from about 400 B.C. to about 250 B.C., the first being the oldest and the third the latest of the seven. Before the publication of the texts, when they were known only by hearsay, the term *Abhidhamma* was usually rendered "Metaphysics." This is now seen to be quite erroneous. *Dhamma* means the doctrine, and *Abhidhamma* has a relation to *Dhamma* similar to that of by-law to law. It expands, classifies, tabulates, draws corollaries from the ethical doctrines laid down in the more popular treatises. There is no metaphysics in it at all, only psychological ethics of a peculiarly dry and scholastic kind. And there is no originality in it; only endless permutations and combinations of doctrines already known and accepted. As in the course of centuries the doctrine itself, in certain schools, varied, it was felt necessary to rewrite these secondary works. This was first done, so far as is at present known, by the Sarvāstivādins (Realists), who in the century before and after Christ produced a fresh set of seven *Abhidhamma* books. These are lost in India, but still exist in Chinese translations. The translations have been analysed in a masterly way by Professor Takakusu in the article mentioned below. They deal only with psychological ethics. In the course of further centuries these books in turn were superseded by new treatises; and in one school at least, that of the Mahā-yāna (great vehicle) there was eventually developed a system of metaphysics. But the word *Abhidhamma* then fell out of use in that school, though it is still used in the schools that continue to follow the original seven books.

See *Buddhist Psychology* by Caroline Rhys Davids (London, 1900), a translation of the *Dhamma Sanganî*, with valuable introduction; "Schools of Buddhist Belief," by T. W. Rhys Davids, in *Journal of the Royal Asiatic Society*, 1892, contains an abstract of the *Kathā Vatthu*; "On the *Abhidhamma* books of the Sarvāstivādins," by Prof. Takakusu, in *Journal of the Pali Text Society*, 1905.

(T. W. R. D.)

ABHORRERS, the name given in 1679 to the persons who expressed their *abhorrence* at the action of those who had signed petitions urging King Charles II. to assemble parliament. Feeling against Roman Catholics, and especially against James, duke of York, was running strongly; the Exclusion Bill had been passed by the House of Commons, and the popularity of James, duke of Monmouth, was very great. To prevent this bill from passing into law, Charles had dissolved parliament in July 1679, and in the following October had prorogued its successor without allowing it to meet. He was then deluged with petitions urging him to call it together, and this agitation was opposed by Sir George Jeffreys (*q.v.*) and Francis Wythens, who presented addresses expressing "abhorrence" of the "Petitioners," and thus initiated the movement of the *abhorrers*, who supported the action of the king. "The frolic went all over England," says Roger North; and the addresses of the Abhorrers which reached the king from all parts of the country formed a counterblast to those of the Petitioners. It is said that the terms Whig and Tory were first applied to English political parties in consequence of this dispute.

ABIATHAR (Heb. *Ebyāthar*, "the [divine] father is preeminent"), in the Bible, son of Ahimelech or Ahijah, priest at Nob. The only one of the priests to escape from Saul's massacre, he fled to David at Keilah, taking with him the ephod (1 Sam. xxii. 20 f., xxiii. 6, 9). He was of great service to David, especially at the time of the rebellion of Absalom (2 Sam. xv. 24, 29, 35, xx. 25). In 1 Kings iv. 4 Zadok and Abiathar are found acting together as priests under Solomon. In 1 Kings i. 7, 19, 25, however, Abiathar appears as a supporter of Adonijah, and in ii. 22 and 26 it is said that he was deposed by Solomon and banished to Anathoth. In 2 Sam. viii. 17 "Abiathar, the son of Ahimelech" should be read, with the Syriac, for "Ahimelech, the son of Abiathar." For a similar confusion see Mark ii. 2

ABICH, OTTO WILHELM HERMANN VON (1806–1886) German mineralogist and geologist, was born at Berlin on the 11th of December 1806, and educated at the university in that city. His earliest scientific work related to spinels and other minerals, and later he made special studies of fumaroles, of the mineral deposits around volcanic vents and of the structure of volcanoes. In 1842 he was appointed professor of mineralogy in the university of Dorpat, and henceforth gave attention to the geology and mineralogy of Russia. Residing for some time at Tiflis he investigated the geology of the Caucasus. Ultimately he retired to Vienna, where he died on the 1st of July 1886. The mineral Abichite was named after him.

PUBLICATIONS.—*Vues illustratives de quelques phénomènes géologiques, prises sur le Vésuve et l'Etna, pendant les années* 1833 *et* 1834 (Berlin, 1836); *Ueber die Natur und den Zusammenhang der vulcanischen Bildungen* (Brunswick, 1841); *Geologische Forschungen in den Kaukasischen Ländern* (3 vols., Vienna, 1878, 1882, and 1887).

ABIGAIL (Heb. *Abigayil*, perhaps "father is joy"), or ABIGAL (2 Sam. iii. 3), in the Bible, the wife of Nabal the Carmelite, on whose death she became the wife of David (1 Sam. xxv.). By her David had a son, whose name appears in the Hebrew of 2 Sam. iii. 3 as Chileab, in the Septuagint as Daluyah, and in 1 Chron. iii. 1 as Daniel. The name Abigail was also borne by a sister of David (2 Sam. xvii. 25; 1 Chron. ii. 16 f.). From the former (self-styled "handmaid" 1 Sam. xxv. 25 f.) is derived the colloquial use of the term for a waiting-woman (cf. Abigail, the "waiting gentlewoman," in Beaumont and Fletcher's *Scornful Lady*).

ABIJAH (Heb. *Abiyyah* and *Abiyyahu*, "Yah is father"), a name borne by nine different persons mentioned in the Old Testament, of whom the most noteworthy are the following. (1) The son and successor of Rehoboam, king of Judah (2 Chron. xii. 16–xiii.), reigned about two years (918–915 B.C.). The accounts of him in the books of Kings and Chronicles are very conflicting (compare 1 Kings xv. 2 and 2 Chron. xi.20 with 2 Chron. xiii.2). The Chronicler tells us that he has drawn his facts from the Midrash (commentary) of the prophet Iddo. This is perhaps sufficient to explain the character of the narrative. (2) The second son of Samuel (1 Sam. viii. 2; 1 Chron. vi. 28 [13]). He and his brother Joel judged at Beersheba. Their misconduct was made by the elders of Israel a pretext for demanding a king (1 Sam. viii. 4). (3) A son of Jeroboam I., king of Israel; he died young (1 Kings xiv. 1 ff., 17). (4) Head of the eighth order of priests (1 Chron. xxiv. 10), the order to which Zacharias, the father of John the Baptist, belonged (Luke i. 5).

The alternative form *Abijam* is probably a mistake, though it is upheld by M. Jastrow.

ABILA, (1) a city of ancient Syria, the capital of the tetrarchy of Abilene, a territory whose extent it is impossible to define. It is generally called Abila of Lysanias, to distinguish it from (2) below. Abila was an important town on the imperial highway from Damascus to Heliopolis (Baalbek). The site is indicated by ruins of a temple, aqueducts, &c., and inscriptions on the banks of the river Barada at Sūk Wādi Baradā, a village called by early Arab geographers Ābil-es-Sūk, between Baalbek and Damascus. Though the names Abel and Abila differ in derivation and in meaning, their similarity has given rise to the tradition that this was the place of Abel's burial. According to Josephus, Abilene was a separate Iturean kingdom till A.D. 37, when it was granted by Caligula to Agrippa I.; in 52 Claudius granted it to Agrippa II. (See also LYSANIAS.) (2) A city in Perea, now Ābil-ez-Zeit.

ABILDGAARD, NIKOLAJ ABRAHAM (1744–1809), called "the Father of Danish Painting," was born at Copenhagen, the son of Sören Abildgaard, an antiquarian draughtsman of repute. He formed his style on that of Claude and of Nicolas Poussin, and was a cold theorist, inspired not by nature but by art. As a technical painter he attained remarkable success, his tone being very harmonious and even, but the effect, to a foreigner's eye, is rarely interesting. His works are scarcely known out of Copenhagen, where he won an immense fame in his own generation. He was the founder of the Danish school of painting, and the master of Thorwaldsen and Eckersberg.

ABIMELECH (Hebrew for "father of [*or* is] the king"). (1) A king of Gerar in South Palestine with whom Isaac, in the Bible, had relations. The patriarch, during his sojourn there, alleged that his wife Rebekah was his sister, but the king doubting this remonstrated with him and pointed out how easily adultery might have been unintentionally committed (Gen. xxvi.). Abimelech is called "king of the Philistines," but the title is clearly an anachronism. A very similar story is told of Abraham and Sarah (ch. xx.), but here Abimelech takes Sarah to wife, although he is warned by a divine vision before the crime is actually committed. The incident is fuller and shows a great advance in ideas of morality. Of a more primitive character, however, is another parallel story of Abraham at the court of Pharaoh, king of Egypt (xii. 10-20), where Sarah his wife is taken into the royal household, and the plagues sent by Yahweh lead to the discovery of the truth. Further incidents in Isaac's life at Gerar are narrated in Gen. xxvi. (cp. xxi. 22-34, time of Abraham), notably a covenant with Abimelech at Beer-sheba (whence the name is explained "well of the oath"); (see ABRAHAM). By a pure error, or perhaps through a confusion in the traditions, Achish the Philistine (of Gath, 1 Sam. xxi., xxvii.), to whom David fled, is called Abimelech in the superscription to Psalm xxxiv.

(2) A son of Jerubbaal or Gideon (*q.v.*), by his Shechemite concubine (Judges viii. 31, ix.). On the death of Gideon, Abimelech set himself to assert the authority which his father had earned, and through the influence of his mother's clan won over the citizens of Shechem. Furnished with money from the treasury of the temple of Baal-berith, he hired a band of followers and slew seventy (cp. 2 Kings x. 7) of his brethren at Ophrah, his father's home. This is one of the earliest recorded instances of a practice common enough on the accession of Oriental despots. Abimelech thus became king, and extended his authority over central Palestine. But his success was short-lived, and the subsequent discord between Abimelech and the Shechemites was regarded as a just reward for his atrocious massacre. Jotham, the only one who is said to have escaped, boldly appeared on Mount Gerizim and denounced the ingratitude of the townsmen towards the legitimate sons of the man who had saved them from Midian. "Jotham's fable" of the trees who desired a king may be foreign to the context; it is a piece of popular lore, and cannot be pressed too far: the nobler trees have no wish to rule over others, only the bramble is self-confident. The "fable" appears to be antagonistic to ideas of monarchy. The origin of the conflicts which subsequently arose is not clear. Gaal, a new-comer, took the opportunity at the time of the vintage, when there was a festival in the temple, to head a revolt and seized Shechem. Abimelech, warned by his deputy Zebul, left his residence at Arumah and approached the city. In a fine bit of realism we are told how Gaal observed the approaching foe and was told by Zebul, "You see the shadow of the hills as men," and as they drew nearer Zebul's ironical remark became a taunt, "Where is now thy mouth? is not this the people thou didst despise? go now and fight them!" This revolt, which Abimelech successfully quelled, appears to be only an isolated episode. Another account tells of marauding bands of Shechemites which disturbed the district. The king disposed his men (the whole chapter is specially interesting for the full details it gives of the nature of ancient military operations), and after totally destroying Shechem, proceeded against Thebez, which had also revolted. Here, while storming the citadel, he was struck on the head by a fragment of a millstone thrown from the wall by a woman. To avoid the disgrace of perishing by a woman's hand, he begged his armour-bearer to run him through the body, but his memory was not saved from the ignominy he dreaded (2 Sam. xi. 21). It is usual to regard Abimelech's reign as the first attempt to establish a monarchy in Israel, but the story is mainly that of the rivalries of a half-developed petty state, and of the ingratitude of a community towards the descendants of its deliverer. (See, further, JEWS, JUDGES.) (S. A. C.)

ABINGDON, a market town and municipal borough in the Abingdon parliamentary division of Berkshire, England, 6 m. S. of Oxford, the terminus of a branch of the Great Western railway from Radley. Pop. (1901) 6480. It lies in the flat valley of the Thames, on the west (right) bank, where the small river Ock flows in from the Vale of White Horse. The church of St Helen stands near the river, and its fine Early English tower with Perpendicular spire is the principal object in the pleasant views of the town from the river. The body of the church, which has five aisles, is principally Perpendicular. The smaller church of St Nicholas is Perpendicular in appearance, though parts of the fabric are older. Of a Benedictine abbey there remain a beautiful Perpendicular gateway, and ruins of buildings called the prior's house, mainly Early English, and the guest house, with other fragments. The picturesque narrow-arched bridge over the Thames near St Helen's church dates originally from 1416. There may be mentioned further the old buildings of the grammar school, founded in 1563, and of the charity called Christ's Hospital (1583); while the town-hall in the market-place, dating from 1677, is attributed to Inigo Jones. The grammar school now occupies modern buildings, and ranks among the lesser public schools of England, having scholarships at Pembroke College, Oxford. St Peter's College, Radley, 2 m. from Abingdon, is one of the principal modern public schools. It was opened in 1847. The buildings lie close to the Thames, and the school is famous for rowing, sending an eight to the regatta at Henley each year. Abingdon has manufactures of clothing and carpets and a large agricultural trade. The borough is under a mayor, four aldermen and twelve councillors. Area, 730 acres.

Abingdon (Abbedun, Abendun) was famous for its abbey, which was of great wealth and importance, and is believed to have been founded in A.D. 675 by Cissa, one of the *subreguli* of Centwin. Abundant charters from early Saxon monarchs are extant confirming various laws and privileges to the abbey, and the earliest of these, from King Ceadwalla, was granted before A.D. 688. In the reign of Alfred the abbey was destroyed by the Danes, but it was restored by Edred, and an imposing list of possessions in the Domesday survey evidences recovered prosperity. William the Conqueror in 1084 celebrated Easter at Abingdon, and left his son, afterwards Henry I., to be educated at the abbey. After the dissolution in 1538 the town sank into decay, and in 1555, on a representation of its pitiable condition, Queen Mary granted a charter establishing it as a free borough corporate with a common council consisting of a mayor, two bailiffs, twelve chief burgesses, and sixteen secondary burgesses, the mayor to be clerk of the market, coroner and a justice of the peace. The council was empowered to elect one burgess to parliament, and this right continued until the Redistribution of Seats Act of 1885. A town clerk and other officers were also appointed, and the town boundaries described in great detail. Later charters from Elizabeth, James I., James II., George II. and George III. made no considerable change. James II. changed the style of the corporation to that of a mayor, twelve aldermen and twelve burgesses. The abbot seems to have held a market from very early times, and charters for the holding of markets and fairs were granted by various sovereigns from Edward I. to George II. In the 13th and 14th centuries Abingdon was a flourishing agricultural centre with an extensive trade in wool, and a famous weaving and clothing manufacture. The latter industry declined before the reign of Queen Mary, but has since been revived.

The present Christ's Hospital originally belonged to the Gild of the Holy Cross, on the dissolution of which Edward VI. founded the hospital under its present name.

See *Victoria County History, Berkshire*; Joseph Stevenson, *Chronicon Monasterii de Abingdon*, A.D. 201–1189 (Rolls Series, 2 vols., London, 1858).

ABINGER, JAMES SCARLETT, 1ST BARON (1769–1844), English judge, was born on the 13th of December 1769 in Jamaica, where his father, Robert Scarlett, had property. In the summer of 1785 he was sent to England to complete his education, and went to Trinity College, Cambridge, taking his B.A. degree in 1789. Having entered the Inner Temple he was called to the bar in 1791, and joined the northern circuit and the Lancashire sessions. Though he had no professional connexions, by steady application he gradually obtained a large practice, ultimately confining himself to the Court of King's Bench and the northern circuit. He took silk in 1816, and from this time till the close of 1834 he was the most successful lawyer at the bar; he was particularly effective before a jury, and his income reached the high-water mark of £18,500, a large sum for that period. He began life as a Whig, and first entered parliament in 1819 as member for Peterborough, representing that constituency with a short break (1822–1823) till 1830, when he was elected for the borough of Malton. He became attorney-general, and was knighted when Canning formed his ministry in 1827; and though he resigned when the duke of Wellington came into power in 1828, he resumed office in 1829 and went out with the duke of Wellington in 1830. His opposition to the Reform Bill caused his severance from the Whig leaders, and having joined the Tories he was elected, first for Colchester and then in 1832 for Norwich, for which borough he sat until the dissolution of parliament. He was appointed lord chief baron of the exchequer in 1834, and presided in that court for more than nine years. While attending the Norfolk circuit on the 2nd of April he was suddenly seized with apoplexy, and died in his lodgings at Bury on the 7th of April 1844. He had been raised to the peerage as Baron Abinger in 1835, taking his title from the Surrey estate he had bought in 1813. The qualities which brought him success at the bar were not equally in place on the bench; he was partial, dictatorial and vain; and complaint was made of his domineering attitude towards juries. But his acuteness of mind and clearness of expression remained to the end. Lord Abinger was twice married (the second time only six months before his death), and by his first wife (d. 1829) had three sons and two daughters, the title passing to his eldest son Robert (1794–1861). His second son, General Sir James Yorke Scarlett (1799–1871), leader of the heavy cavalry charge at Balaclava, is dealt with in a separate article; and his elder daughter, Mary, married John, Baron Campbell, and was herself created Baroness Stratheden (Lady Stratheden and Campbell) (d. 1860). Sir Philip Anglin Scarlett (d. 1831), Lord Abinger's younger brother, was chief justice of Jamaica.

See P. C. Scarlett, *Memoir of James, 1st Lord Abinger* (1877); Foss's *Lives of the Judges*; E. Manson, *Builders of our Law* (1904).

ABINGTON, FRANCES (1737–1815), English actress, was the daughter of a private soldier named Barton, and was, at first, a flower girl and a street singer. She then became servant to a French milliner, obtaining a taste in dress and a knowledge of French which afterwards stood her in good stead. Her first appearance on the stage was at the Haymarket in 1755 as Miranda in Mrs Centlivre's *Busybody*. In 1756, on the recommendation of Samuel Foote, she became a member of the Drury Lane company, where she was overshadowed by Mrs Pritchard and Kitty Clive. In 1759, after an unhappy marriage with her music-master, one of the royal trumpeters, she is mentioned in the bills as Mrs Abington. Her first success was in Ireland as Lady Townley, and it was only after five years, on the pressing invitation of Garrick, that she returned to Drury Lane. There she remained for eighteen years, being the original of more than thirty important characters, notably Lady Teazle (1777). Her Beatrice, Portia, Desdemona and Ophelia were no less liked than her Miss Hoyden, Biddy Tipkin, Lucy Lockit and Miss Prue. It was in the last character in *Love for Love* that Reynolds painted his best portrait of her. In 1782 she left Drury Lane for Covent Garden. After an absence from the stage from 1790 until 1797, she reappeared, quitting it finally in 1799. Her ambition, personal wit and cleverness won her a distinguished position in society, in spite of her humble origin. Women of fashion copied her frocks, and a head-dress she wore was widely adopted and known as the "Abington cap." She died on the 4th of March 1815.

ABIOGENESIS, in biology, the term, equivalent to the older terms "spontaneous generation," *Generatio aequivoca*, *Generatio primaria*, and of more recent terms such as archegenesis and archebiosis, for the theory according to which fully formed living organisms sometimes arise from not-living matter. Aristotle explicitly taught abiogenesis, and laid it down as an observed fact that some animals spring from putrid matter, that plant-lice arise from the dew which falls on plants, that fleas are developed from putrid matter, and so forth. T. J. Parker (*Elementary Biology*) cites a passage from Alexander Ross, who, commenting on Sir Thomas Browne's doubt as to "whether mice may be bred by putrefaction," gives a clear statement of the common opinion on abiogenesis held until about two centuries ago. Ross wrote: "So may he (Sir Thomas Browne) doubt whether in cheese and timber worms are generated; or if beetles and wasps in cows' dung; or if butterflies, locusts, grasshoppers, shell-fish, snails, eels, and such like, be procreated of putrefied matter, which is apt to receive the form of that creature to which it is by formative power disposed. To question this is to question reason, sense and experience. If he doubts of this let him go to Egypt, and there he will find the fields swarming with mice, begot of the mud of Nylus, to the great calamity of the inhabitants."

The first step in the scientific refutation of the theory of abiogenesis was taken by the Italian Redi, who, in 1668, proved that no maggots were "bred" in meat on which flies were prevented by wire screens from laying their eggs. From the 17th century onwards it was gradually shown that, at least in the case of all the higher and readily visible organisms, abiogenesis did not occur, but that *omne vivum e vivo*, every living thing came from a pre-existing living thing.

The discovery of the microscope carried the refutation further. In 1683 A. van Leeuwenhoek discovered bacteria, and it was soon found that however carefully organic matter might be protected by screens, or by being placed in stoppered receptacles, putrefaction set in, and was invariably accompanied by the appearance of myriads of bacteria and other low organisms. As knowledge of microscopic forms of life increased, so the apparent possibilities of abiogenesis increased, and it became a tempting hypothesis that whilst the higher forms of life arose only by generation from their kind, there was a perpetual abiogenetic fount by which the first steps in the evolution of living organisms continued to arise, under suitable conditions, from inorganic matter. It was due chiefly to L. Pasteur that the occurrence of abiogenesis in the microscopic world was disproved as much as its occurrence in the macroscopic world. If organic matter were first sterilized and then prevented from contamination from without, putrefaction did not occur, and the matter remained free from microbes. The nature of sterilization, and the difficulties in securing it, as well as the extreme delicacy of the manipulations necessary, made it possible for a very long time to be doubtful as to the application of the phrase *omne vivum e vivo* to the microscopic world, and there still remain a few belated supporters of abiogenesis. Subjection to the temperature of boiling water for, say, half an hour seemed an efficient mode of sterilization, until it was discovered that the spores of bacteria are so involved in heat-resisting membranes, that only prolonged exposure to dry, baking heat can be recognized as an efficient process of sterilization. Moreover, the presence of bacteria, or their spores, is so universal that only extreme precautions guard against a re-infection of the sterilized material. It may now be stated definitely that all known living organisms arise only from pre-existing living organisms.

So far the theory of abiogenesis may be taken as disproved. It must be noted, however, that this disproof relates only to known existing organisms. All these are composed of a definite substance, known as protoplasm (*q.v.*), and the modern refutation of abiogenesis applies only to the organic forms in which protoplasm now exists. It may be that in the progress of science it may yet become possible to construct living protoplasm from non-living material. The refutation of abiogenesis has no further bearing on this possibility than to make it probable that if protoplasm ultimately be formed in the laboratory, it will be by a series of stages, the earlier steps being the formation of some substance, or substances, now unknown, which are not protoplasm. Such intermediate stages may have existed in the past, and the modern refutation of abiogenesis has no application to the possibility of these having been formed from inorganic matter at some past time. Perhaps the words archebiosis, or archegenesis, should be reserved for the theory that protoplasm in the remote past has been developed from not-living matter by a series of steps, and many of those, notably T. H. Huxley, who took a large share in the process of refuting contemporary abiogenesis, have stated their belief in a primordial archebiosis. (See BIOGENESIS and LIFE.) (P. C. M.)

ABIPONES, a tribe of South American Indians of Guaycuran stock recently inhabiting the territory lying between Santa Fé and St Iago. They originally occupied the Chaco district of Paraguay, but were driven thence by the hostility of the Spaniards. According to Martin Dobrizhoffer, a Jesuit missionary, who, towards the end of the 18th century, lived among them for a period of seven years, they then numbered not more than 5000. They were a well-formed, handsome people, with black eyes and aquiline noses, thick black hair, but no beards. The hair from the forehead to the crown of the head was pulled out, this constituting a tribal mark. The faces, breasts and arms of the women were covered with black figures of various designs made with thorns, the tattooing paint being a mixture of ashes and blood. The lips and ears of both sexes were pierced. The men were brave fighters, their chief weapons being the bow and spear. No child was without bow and arrows; the bow-strings were made of foxes' entrails. In battle the Abipones wore an armour of tapir's hide over which a jaguar's skin was sewn. They were excellent swimmers and good horsemen. For five months in the year when the floods were out they lived on islands or even in shelters built in the trees. They seldom married before the age of thirty, and were singularly chaste. "With the Abipones," says Darwin, "when a man chooses a wife, he bargains with the parents about the price. But it frequently happens that the girl rescinds what has been agreed upon between the parents and bridegroom, obstinately rejecting the very mention of marriage. She often runs away and hides herself, and thus eludes the bridegroom." Infanticide was systematic, never more than two children being reared in one family, a custom doubtless originating in the difficulty of subsistence. The young were suckled for two years. The Abipones are now believed to be extinct as a tribe.

Martin Dobrizhoffer's Latin *Historia de Abiponibus* (Vienna, 1784) was translated into English by Sara Coleridge, at the suggestion of Southey, in 1822, under the title of *An Account of the Abipones* (3 vols.).

ABITIBBI, a lake and river of Ontario, Canada. The lake, in 49° N., 80° W., is 60 m. long and studded with islands. It is shallow, and the shores in its vicinity are covered with small timber. It was formerly employed by the Hudson's Bay Company as part of a canoe route to the fur lands of the north. The construction of the Grand Trunk Pacific railway through this district has made it of some importance. Its outlet is Abitibbi river, a rapid stream, which after a course of 200 m. joins the Moose river, flowing into James Bay.

ABJURATION (from Lat. *abjurare*, to forswear), a solemn repudiation or renunciation on oath. At common law, it signified the oath of a person who had taken sanctuary to leave the realm for ever; this was abolished in the reign of James I. The *Oath of Abjuration*, in English history, was a solemn disclaimer, taken by members of parliament, clergy and laymen against the right of the Stuarts to the crown, imposed by laws of William III., George I. and George III.; but its place has since been taken by the oath of allegiance.

ABKHASIA, or ABHASIA, a tract of Russian Caucasia, government of Kutais. The Caucasus mountains on the N. and N.E. divide it from Circassia; on the S.E. it is bounded by Mingrelia; and on the S.W. by the Black Sea. Though the country is generally mountainous, with dense forests of oak and walnut, there are some deep, well-watered valleys, and the climate is mild. The soil is fertile, producing wheat, maize, grapes, figs, pomegranates and wine. Cattle and horses are bred. Honey is produced; and excellent arms are made. This country was subdued (*c.* 550) by the Emperor Justinian, who introduced Christianity. Native dynasties ruled from 735 to the 15th century, when the region was conquered by the Turks and became Mahommedan. The Russians acquired possession of it piecemeal between 1829 and 1842, but their power was not firmly established until after 1864. Area, 2800 sq. m. The principal town is Sukhum-kaleh. Pop. 43,000, of whom two-thirds are Mingrelians and one-third Abkhasians, a Cherkess or Circassian race. The total number of Abkhasians in the two governments of Kutais and Kuban was 72,103 in 1897; large numbers emigrated to the Turkish empire in 1864 and 1878.

ABLATION (from Lat. *ablatus*, carried away), the process of removing anything; a term used technically in geology of the wearing away of a rock or glacier, and in surgery for operative removal.

ABLATITIOUS (from Lat. *ablatus*, taken away), reducing or withdrawing; in astronomy a force which interferes between the moon and the earth to lessen the strength of gravitation is called "ablatitious," just as it is called "addititious" when it increases that strength.

ABLATIVE (Lat. *ablativus*, sc. *casus*, from *ablatum*, taken away), in grammar, a case of the noun, the fundamental sense of which is direction from; in Latin, the principal language in which the case exists, this has been extended, with or without a preposition, to the instrument or agent of an act, and the place or time at, and manner in, which a thing is done. The case is also found in Sanskrit, Zend, Oscan and Umbrian, and traces remain in other languages. The "Ablative Absolute," a grammatical construction in Latin, consists of a noun in the ablative case, with a participle, attribute or qualifying word agreeing with it, not depending on any other part of the sentence, to express the time, occasion or circumstance of a fact.

ABLUTION (Lat. *ablutio*, from *abluere*, "to wash off"), a washing, in its religious use, destined to secure that ceremonial or ritualistic purity which must not be confused with the physical or hygienic cleanliness of persons and things obtained by the use of soap and water.[1] Indeed the two states may contradict each other, as in the case of the 4th-century Christian pilgrim to Jerusalem who boasted that she had not washed her face for eighteen years for fear of removing therefrom the holy chrism of baptism. The purport, then, of ablutions is to remove, not dust and dirt, but the—to us imaginary—stains contracted by contact with the dead, with childbirth, with menstruous women, with murder whether wilful or involuntary, with almost any form of bloodshed, with persons of inferior caste, with dead animal refuse, *e.g.* leather or excrement, with leprosy, madness and any form of disease. Among all races in a certain grade of development such associations are vaguely felt to be dangerous and to impair vitality. In a later stage the taint is regarded as alive, as a demon or evil spirit alighting on and passing into the things and persons exposed to contamination. In general, water, cows' urine and blood of swine are the materials used in ablutions. Of these water is the commonest, and its efficacy is enhanced if it be running, and still more if a magical or sacramental virtue has been imparted to it by ritual blessing or consecration. Some concrete examples will best illustrate the nature of such ablutions. In the *Atharva-Veda*, vii. 116, we have this allopathic remedy for fever. The patient's skin burns, that of a frog is cold to the touch; therefore tie to the foot of the bed a frog, bound with red and black thread, and wash down the sick man so that the water of ablution falls on the frog. Let the medicine man or magician pray that the fever may pass into the frog, and the frog be forthwith released, and the cure will be effected. In the old Athenian Anthesteria the blood of victims was poured over the unclean. A bath of bulls' blood was much in vogue as a baptism in the mysteries of Attis. The water must in ritual washings run off in order to carry away the miasma or unseen demon of disease; and accordingly in baptism the early Christians used living or running water. Nor was it enough that the person baptized should himself enter the water; the baptizer must pour it over his head, so that it run down his person. Similarly the Brahman takes care, after ablution of a person, to wipe the cathartic water off from head to feet downwards, that the malign influence may pass out through the feet. The same care is shown in ritual ablutions in the Bukovina and elsewhere.

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[1] In its technical ecclesiastical sense the *ablution* is the ritual washing of the chalice and of the priest's fingers after the celebration of Holy Communion in the Catholic Church. The wine and water used for this purpose are themselves sometimes called "the ablution."

Water and fire, spices and sulphur, are used in ritual cleansings, says Iamblichus in his book on mysteries (v. 23), as being specially full of the divine nature. Nevertheless in all religions, and especially in the Brahmanic and Christian, the cathartic virtue of water is enhanced by the introduction into it by means of suitable prayers and incantations of a divine or magical power. Ablutions both of persons and things are usually cathartic, that is, intended to purge away evil influences (καθαίρειν, to make καθαρός, pure). But, as Robertson Smith observes, "holiness is contagious, just as uncleanness is"; and common things and persons may become taboo, that is, so holy as to be dangerous and useless for daily life through the mere infection of holiness. Thus in Syria one who touched a dove became taboo for one whole day, and if a drop of blood of the Hebrew sin-offering fell on a garment it had to be ritually washed off. It was as necessary in the Hebrew religion for the priest to wash his hands *after* handling the sacred volume as before. Christians might not enter a church to say their prayers without first washing their hands. So Chrysostom says: "Although our hands may be already pure, yet unless we have washed them thoroughly, we do not spread them upwards in prayer." Tertullian (*c.* 200) had long before condemned this as a heathen custom; none the less, it was insisted on in later ages, and is a survival of the pagan lustrations or περιρραντήρια. Sozomen (vi. 6) tells how a priest sprinkled Julian and Valentinian with water according to the heathen custom as they entered his temple. The same custom prevails among Mahommedans. Porphyry (*de Abst.* ii. 44) relates that one who touched a sacrifice meant to avert divine anger must bathe and wash his clothes in running water before returning to his city and home, and similar scruples in regard to holy objects and persons have been observed among the natives of Polynesia, New Zealand and ancient Egypt. The rites, met within all lands, of pouring out water or bathing in order to produce rain from heaven, differ in their significance from ablutions with water and belong to the realm of sympathetic magic.

There are certain forms of purification which one does not know whether to describe as ablutions or anointings. Thus Demosthenes in his speech "On the crown" accused Aeschines of having "purified the initiated and wiped them clean *with* (not *from*) mud and pitch." Smearing with gypsum (τίτανος, *titanos*) had a similar purifying effect, and it has been suggested[1] that the Titans were no more than old-world votaries who had so disguised themselves. Perhaps the use of ashes in mourning had the same origin. In the rite of death-bed penance given in the old Mozarabic Christian ritual of Spain, ashes were poured over the sick man.

AUTHORITIES.—W. R. Smith, *Religion of the Semites*; Jul. Wellhausen, *Reste arabischen Heidentums* (=*Skizzen und Vorarbeiten*, iii. 2nd ed., Berlin, 1897); John Spencer, *De legibus Hebraeorum ritualibus* (Tubingae, 1732); Art. "Clean and Unclean" in Hastings' *Bible Dictionary* and in *Jewish Encyclopedia*, vol. iv.; J. G. Frazer, *Adonis, Attis, Osiris* (London, 1906); Joseph Bingham, *Antiquities of the Christian Church*, bk. viii.; Hermann Oldenberg, *Die Religion des Veda's*, Berlin, 1894. (F. C. C.)

ABNAKI ("the whitening sky at daybreak," *i.e.* Easterners), a confederacy of North American Indians of Algonquian stock, called Terrateens by the New England tribes and colonial writers. It included the Passamaquoddy, Penobscot, Norridgewock, Malecite and other tribes. It formerly occupied what is now Maine and southern New Brunswick. All the tribes were loyal to the French during the early years of the 18th century, but after the British success in Canada most of them withdrew to St Francis, Canada, subsequently entering into an agreement with the British authorities. The Abnaki now number some 1600.

For details see *Handbook of American Indians*, edited by F. W. Hodge (Washington, 1907).

ABNER (Hebrew for "father of [*or* is a] light"), in the Bible, first cousin of Saul and commander-in-chief of his army (1 Sam. xiv. 50, xx. 25). He is only referred to incidentally in Saul's history (1 Sam. xvii. 55, xxvi. 5), and is not mentioned in the account of the disastrous battle of Gilboa when Saul's power was crushed. Seizing the only surviving son, Ishbaal, he set him up as king over Israel at Mahanaim, east of the Jordan. David, who was accepted as king by Judah alone, was meanwhile reigning at Hebron, and for some time war was carried on between the two parties. The only engagement between the rival factions which is told at length is noteworthy, inasmuch as it was preceded by an encounter at Gibeon between twelve chosen men from each side, in which the whole twenty-four seem to have perished (2 Sam. ii. 12).[1] In the general engagement which followed, Abner was defeated and put to flight. He was closely pursued by Asahel, brother of Joab, who is said to have been "light of foot as a wild roe." As Asahel would not desist from the pursuit, though warned, Abner was compelled to slay him in self-defence. This originated a deadly feud between the leaders of the opposite parties, for Joab, as next of kin to Asahel, was by the law and custom of the country the avenger of his blood. For some time afterwards the war was carried on, the advantage being invariably on the side of David. At length Ishbaal lost the main prop of his tottering cause by remonstrating with Abner for marrying Rizpah, one of Saul's concubines, an alliance which, according to Oriental notions, implied pretensions to the throne (cp. 2 Sam. xvi. 21 sqq.; 1 Kings ii. 21 sqq.). Abner was indignant at the deserved rebuke, and immediately opened negotiatons with David, who welcomed him on the condition that his wife Michal should be restored to him. This was done, and the proceedings were ratified by a feast. Almost immediately after, however, Joab, who had been sent away, perhaps intentionally returned and slew Abner at the gate of Hebron. The ostensible motive for the assassination was a desire to avenge Asahel, and this would be a sufficient justification for the deed according to the moral standard of the time. The conduct of David after the event was such as to show that he had no complicity in the act, though he could not venture to punish its perpetrators (2 Sam. iii. 31-39; cp. 1 Kings ii. 31 seq.). (See DAVID.)

ÅBO (Finnish *Turku*), a city and seaport, the capital of the province of Åbo-Björneborg, in the grand duchy of Finland, on the Aura-joki, about 3 m. from where it falls into the gulf of Bothnia. Pop. (1810) 10,224; (1870) 19,617; (1904) 42,639. It is 381 m. by rail from St Petersburg *via* Tavastehus, and is in regular steamer communication with St Petersburg, Vasa, Stockholm, Copenhagen and Hull. It was already a place of importance when Finland formed part of the kingdom of Sweden. When the Estates of Finland seceded from Sweden and accepted the Emperor Alexander of Russia as their grand duke at the Diet of Borgå in 1809, Åbo became the capital of the new state, and so remained till 1819 when the seat of government was transferred to Helsingfors. In November 1827 nearly the whole city was burnt down, the university and its valuable library being entirely destroyed. Before this calamity Åbo contained 1110 houses and 13,000 inhabitants; and its university had 40 professors, more than 500 students, and a library of upwards of 30,000 volumes, together with a botanical garden, an observatory and a chemical laboratory. The university has since been removed to Helsingfors. Åbo remains the ecclesiastical capital of Finland, is the seat of the Lutheran archbishop and contains a fine cathedral dating from 1258 and restored after the fire of 1827. The cathedral is dedicated to St Henry, the patron saint of Finland, an English missionary who introduced Christianity into the country in the 12th century. Åbo is the seat of the first of the three courts of appeal of Finland. It has two high schools, a school of commerce and a school of navigation. The city is second only to Helsingfors for its trade; sail-cloth, cotton and tobacco are manufactured, and there are extensive saw-mills. There is also a large trade in timber and a considerable butter export. Ship-building has considerably developed, torpedo-boats being built here for the Russian navy. Vessels drawing 9 or 10 feet come up to the town, but ships of greater draught are laden and discharged at its harbour (Bornholm, on Hyrvinsala Island), which is entered yearly by from 700 to 800 ships, of about 200,000 tons.

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[1] By J. E. Harrison, *Prolegomena to Greek Religion*, p. 493.

[1] The object of the story of the encounter is to explain the name Helkath-hazzurim, the meaning of which is doubtful (*Ency. Bib.* col. 2006; Batten in *Zeit. f. alt-test. Wissens.* 1906, pp. 90 sqq.).

ÅBO-BJÖRNEBORG, a province occupying the S.W. corner of Finland and including the Åland islands. It has a total area of 24,171 square kilometres and a population (1900) of 447,098, of whom 379,622 spoke Finnish and 67,260 Swedish; 446,900 were of the Lutheran religion. The province occupies a prominent position in Finland for its manufacture of cottons, sugar refinery, wooden goods, metals, machinery, paper, &c. Its chief towns are: Åbo (pop. 42,639), Björneborg (16,053), Raumo (5501), Nystad (4165), Mariehamn (1171), Nådendal (917).

ABODE (from "abide," to dwell, properly "to wait for," to bide), generally, a dwelling. In English law this term has a more restricted meaning than domicile, being used to indicate the place of a man's residence or business, whether that be either temporary or permanent. The law may regard for certain purposes, as a man's abode, the place where he carries on business, though he may reside elsewhere; so that the term has come to have a looser significance than *residence*, which has been defined as "where a man lives with his family and sleeps at night" (*R.* v. *Hammond*, 1852, 17 Q.B. 772). In serving a notice of action, a solicitor's place of business may be given as his abode (*Roberts* v. *Williams*, 1835, 5 L.J.M.C. 23), and in more recent decisions it has been similarly held that where a notice was required to be served under the Public Health Act 1875, either personally or to some inmate of the owner's or occupier's "place of abode," a place of business was sufficient.

ABOMASUM (*caillette*), the fourth or rennet stomach of Ruminantia. From the *omasum* the food is finally deposited in the abomasum, a cavity considerably larger than either the second or third stomach, although less than the first. The base of the abomasum is turned to the *omasum*. It is of an irregular conical form. It is that part of the digestive apparatus which is analogous to the single stomach of other Mammalia, as the food there undergoes the process of chymification, after being macerated and ground down in the three first stomachs.

ABOMEY, capital of the ancient kingdom of Dahomey, West Africa, now included in the French colony of the same name. It is 70 m. N. by rail of the seaport of Kotonu, and has a population of about 15,000. Abomey is built on a rolling plain, 800 ft. above sea-level, terminating in short bluffs to the N.W., where it is bounded by a long depression. The town was surrounded by a mud wall, pierced by six gates, and was further protected by a ditch 5 ft. deep, filled with a dense growth of prickly acacia, the usual defence of West African strongholds. Within the walls, which had a circumference of six miles, were villages separated by fields, several royal palaces, a market-place and a large square containing the barracks. In November 1892, Behanzin, the king of Dahomey, being defeated by the French, set fire to Abomey and fled northward. Under French administration the town has been rebuilt, placed (1905) in railway communication with the coast, and given an ample water supply by the sinking of artesian wells.

ABOMINATION (from Lat. *ab*, from, and *ominare*, to forebode), anything contrary to omen, and therefore regarded with aversion; a word used often in the Bible to denote evil doctrines or ceremonial practices which were impure. An incorrect derivation was *ab homine* (*i.e.* inhuman), and the spelling of the adjective "abominable" in the first Shakespeare folio is always "abhominable." Colloquially "abomination" and "abominable" are used to mean simply excessive in a disagreeable sense.

ABOR HILLS, a tract of country on the north-east frontier of India, occupied by an independent tribe called the Abors. It lies north of Lakhimpur district, in the province of eastern Bengal and Assam, and is bounded on the east by the Mishmi Hills and on the west by the Miri Hills, the villages of the tribe extending to the Dibong river. The term Abor is an Assamese word, signifying "barbarous" or "independent," and is applied in a general sense by the Assamese to many frontier tribes; but in its restricted sense it is specially given to the above tract. The Abors, together with the cognate tribes of Miris, Daphlas and Akas, are supposed to be descended from a Tibetan stock. They are a quarrelsome and sulky race, violently divided in their political relations. In former times they committed frequent raids upon the plains of Assam, and have been the object of more than one retaliatory expedition by the British government. In 1893–94 occurred the first Bor Abor expedition. Some military police sepoys were murdered in British territory, and a force of 600 troops was sent, who traversed the Abor country, and destroyed the villages concerned in the murder and all other villages that opposed the expedition. A second expedition became necessary later on, two small patrols having been treacherously murdered; and a force of 100 British troops traversed the border of the Abor country and punished the tribes, while a blockade was continued against them from 1894 to 1900.

See Colonel Dalton's *Ethnology of Bengal*, 1872.

ABORIGINES, a mythical people of central Italy, connected in legendary history with Aeneas, Latinus and Evander. They were supposed to have descended from their mountain home near Reate (an ancient Sabine town) upon Latium, whence they expelled the Siceli and subsequently settled down as Latini under a King Latinus (Dion Halic. i. 9. 60). The most generally accepted etymology of the name (*ab origine*), according to which they were the original inhabitants (= Gk. αὐτόχθονες) of the country, is inconsistent with the fact that the oldest authorities (*e.g.* Cato in his *Origines*) regarded them as Hellenic immigrants, not as a native Italian people. Other explanations suggested are *arborigines*, "tree-born," and *aberrigines*, "nomads." Historical and ethnographical discussions have led to no result; the most that can be said is that, if not a general term, "aborigines" may be the name of an Italian stock, about whom the ancients knew no more than ourselves.

In modern times the term "Aborigines" has been extended in signification, and is used to indicate the inhabitants found in a country at its first discovery, in contradistinction to colonies or new races, the time of whose introduction into the country is known.

The Aborigines' Protection Society was founded in 1838 in England as the result of a royal commission appointed at the instance of Sir T. Fowell Buxton to inquire into the treatment of the indigenous populations of the various British colonies. The inquiry revealed the gross cruelty and injustice with which the natives had been often treated. Since its foundation the society has done much to make English colonization a synonym for humane and generous treatment of savage races.

ABORTION (from Lat. *aboriri*, to fail to be born, or perish), in obstetrics, the premature separation and expulsion of the contents of the pregnant uterus. It is a common terminology to call premature labour of an accidental type a "miscarriage," in order to distinguish "abortion" as a deliberately induced act, whether as a medical necessity by the accoucheur, or as a criminal proceeding (see Medical Jurisprudence); otherwise the term "abortion" would ordinarily be used when occurring before the eighth month of gestation, and "premature labour" subsequently. As an accident of pregnancy, it is far from uncommon, although its relative frequency, as compared with that of completed gestation, has been very differently estimated by accoucheurs. It is more liable to occur in the earlier than in the later months of pregnancy, and it would also appear to occur more readily at the periods corresponding to those of the menstrual discharge. It may be induced by numerous causes, both of a local and general nature. Malformations of the pelvis, accidental injuries and the diseases and displacements to which the uterus is liable, on the one hand; and, on the other, various morbid conditions of the ovum or placenta leading to the death of the foetus, are among the direct local causes. The general causes embrace certain states of the system which are apt to exercise a more or less direct influence upon the progress of utero-gestation. The tendency to recurrence in persons who have previously miscarried is well known, and should ever be borne in mind with the view of avoiding any cause likely to lead to a repetition of the accident. Abortion resembles ordinary labour in its general phenomena, excepting that in the former hemorrhage often to a large extent forms one of the leading symptoms. The treatment embraces the means to be used by rest, astringents and sedatives, to prevent the occurrence when it merely threatens; or when, on the contrary, it is inevitable, to accomplish as speedily as possible the complete removal of the entire contents of the uterus.

Among primitive savage races abortion is practised to a far less extent than infanticide (*q.v.*), which offers a simpler way of getting rid of inconvenient progeny. But it is common among the American Indians, as well as in China, Cambodia and India, although throughout Asia it is generally contrary both to law and religion. How far it was considered a crime among the civilized nations of antiquity has long been debated. Those who maintain the impunity of the practice rely for their authority upon certain passages in the classical authors, which, while bitterly lamenting the frequency of this enormity, yet never allude to any laws by which it might be suppressed. For example, in one of Plato's dialogues (*Theaet.*), Socrates is made to speak of artificial abortion as a practice, not only common but allowable; and Plato himself authorizes it in his *Republic* (lib. v.). Aristotle (*Polit.* lib. vii. c. 17) gives it as his opinion that no child ought to be suffered to come into the world, the mother being above forty or the father above fifty-five years of age. Lysias maintained, in one of his pleadings quoted by Harpocration, that forced abortion could not be considered homicide, because a child *in utero* was not an animal, and had no separate existence. Among the Romans, Ovid (*Amor.* lib. ii.), Juvenal (*Sat.* vi. 594) and Seneca (*Consol. ad Hel.* 16) mention the frequency of the offence, but maintain silence as to any laws for punishing it. On the other hand, it is argued that the authority of Galen and Cicero (*pro Cluentio*) place it beyond a doubt that, so far from being allowed to pass with impunity, the offence in question was sometimes punished by death; that the authority of Lysias is of doubtful authenticity; and that the speculative reasonings of Plato and Aristotle, in matters of legislation, ought not to be confounded with the actual state of the laws. Moreover, Stobaeus (*Serm.* 73) has preserved a passage from Musonius, in which that philosopher expressly states that the ancient law-givers inflicted punishments on females who caused themselves to abort. After the spread of Christianity among the Romans, however, foeticide became equally criminal with the murder of an adult, and the barbarian hordes which afterwards overran the empire also treated the offence as a crime punishable with death. This severe penalty remained in force in all the countries of Europe until the Middle Ages. With the gradual disuse of the old barbarous punishments so universal in medieval times came also a reversal of opinion as to the magnitude of the crime involved in killing a child not yet born. But the exact period of transition is not clearly marked.

In England the Anglo-Saxons seem to have regarded abortion only as an ecclesiastical offence. Sir Matthew Hale (1609–1676) tells us that if anything is done to "a woman quick or great with child, to make an abortion, or whereby the child within her is killed, it is not murder or manslaughter by the law of England, because it is not yet *in rerum natura*." But the common law appears, nevertheless, to have treated as a misdemeanour any attempt to effect the destruction of such an infant, though unsuccessful. Blackstone (1723–1780), to be sure, a hundred years later, says that, "if a woman is quick with child, and by poison or otherwise killeth it in her womb, or if any one beat her, whereby the child dieth in her body, and she is delivered of a dead child, this, though not murder, was, by the ancient law, homicide or manslaughter." Whatever may have been the exact view taken by the common law, the offence was made statutory by an act of 1803, making the attempt to cause the miscarriage of a woman, not being, or not being proved, to be quick with child, a felony, punishable with fine, imprisonment, whipping or transportation for any term not exceeding fourteen years. Should the woman have proved to have quickened, the attempt was punishable with death. The provisions of this statute were re-enacted in 1828. The English law on the subject is now governed by the Offences against the Person Act 1861, which makes the attempting to cause miscarriage by administering poison or other noxious thing, or unlawfully using any instrument equally a felony, whether the woman be, or be not, with child. No distinction is now made as to whether the foetus is or is not alive, legislation appearing to make the offence statutory with the object of prohibiting any risk to the life of the mother. If a woman administers to herself any poison or other noxious thing, or unlawfully uses any instrument or other means to procure her own miscarriage, she is guilty of felony. The punishment for the offence is penal servitude for life or not less than three years, or imprisonment for not more than two years. If a child is born alive, but in consequence of its premature birth, or of the means employed, afterwards dies, the offence is murder; the general law as to accessories applies to the offence.

In all the countries of Europe the causing of abortion is now punishable with more or less lengthy terms of imprisonment. Indeed, the tendency in continental Europe is to regard the abortion as a crime against the unborn child, and several codes (notably that of the German Empire) expressly recognize the life of the foetus, while others make the penalty more severe if abortion has been caused in the later stages of pregnancy, or if the woman is married. According to the weight of authority in the United States abortion was not regarded as a punishable offence at common law, if the abortion was produced with the consent of the mother prior to the time when she became quick with child; but the Supreme Courts of Pennsylvania and North Carolina held it a crime at common law, which might be committed as soon as gestation had begun (*Mills* v. *Com.* 13 Pa. St. 630; *State* v. *Slagle*, 83 N.C. 630). The attempt is a punishable offence in several states, but not in Ohio. Nor was it ever murder at common law to take the life of the child at any period of gestation, even in the very act of delivery (*Mitchell* v. *Com.* 78 Ky. 204). If the death of the woman results it is murder at common law (*Com.* v. *Parker*, 9 Met. [Mass.] 263). It is now a statutory offence in all states of the Union, but the woman must be actually pregnant. In most states not only is the person who causes the abortion punishable, but also any one who supplies any drug or instrument for the purpose. The woman, however, is not an accomplice (except by statute as in Ohio, *State* v. *M'Coy*, 39 N.E. 316), nor is she guilty of any crime unless by statute as in New York (Penal Code, § 295) and California (Penal Code, § 275) and Connecticut (Gen. Stats. 1902, § 1156). She may be a witness, and her testimony does not need corroboration. The attempt is also a crime in New York (1905, *People* v. *Conrad*, 102 App. D. 566).

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ABOUKIR, a village on the Mediterranean coast of Egypt, 14½ m. N.E. of Alexandria by rail, containing a castle used as a state prison by Mehemet Ali. Near the village are many remains of ancient buildings, Egyptian, Greek and Roman. About 2 m. S.E. of the village are ruins supposed to mark the site of Canopus. A little farther east the Canopic branch of the Nile (now dry) entered the Mediterranean.

Stretching eastward as far as the Rosetta mouth of the Nile is the spacious bay of Aboukir, where on the 1st of August 1798 Nelson fought the battle of the Nile, often referred to as the battle of Aboukir. The latter title is applied more properly to an engagement between the French expeditionary army and the Turks fought on the 25th of July 1799. Near Aboukir, on the 8th of March 1801, the British army commanded by Sir R. Abercromby landed from its transports in the face of a strenuous opposition from a French force entrenched on the beach. (See French Revolutionary Wars.)

ABOUT, EDMOND FRANÇOIS VALENTIN (1828–1885), French novelist, publicist and journalist, was born on the 14th of February 1828, at Dieuze, in Lorraine. The boy's school career was brilliant. In 1848 he entered the École Normale, taking the second place in the annual competition for admission, Taine being first. Among his college contemporaries were Taine, Francisque, Sarcey, Challemel-Lacour and the ill-starred Prévost-Paradol. Of them all About was, according to Sarcey, the most highly vitalized, exuberant, brilliant and "undisciplined." At the end of his college career he joined the French school in Athens, but if we may believe his own account, it had never been his intention to follow the professorial career, for which the École Normale was a preparation, and in 1853 he returned to France and frankly gave himself to literature and journalism. A book on Greece, *La Grèce contemporaine* (1855), which did not spare Greek susceptibilities, had an immediate success. In *Tolla* (1855) About was charged with drawing too freely on an earlier Italian novel, *Vittoria Savelli* (Paris, 1841). This caused a strong prejudice against him, and he was the object of numerous attacks, to which he was ready enough to retaliate. The *Lettres d'un bon jeune homme*, written to the *Figaro* under the signature of Valentin de Quévilly, provoked more animosities. During the next few years, with indefatigable energy, and generally with full public recognition, he wrote novels, stories, a play—which failed,—a book-pamphlet on the Roman question, many pamphlets on other subjects of the day, newspaper articles innumerable, some art criticisms, rejoinders to the attacks of his enemies, and popular manuals of political economy, *L'A B C du travailleur* (1868), *Le progrès* (1864). About's attitude towards the empire was that of a candid friend. He believed in its improvability, greeted the liberal ministry of Émile Ollivier at the beginning of 1870 with delight and welcomed the Franco-German War. That day of enthusiasm had a terrible morrow. For his own personal part he lost the loved home near Saverne in Alsace, which he had purchased in 1858 out of the fruits of his earlier literary successes. With the fall of the empire he became a republican, and, always an inveterate anti-clerical, he threw himself with ardour into the battle against the conservative reaction which made head during the first years of the republic. From 1872 onwards for some five or six years his paper, the *XIX^e Siècle*, of which he was the heart and soul, became a power in the land. But the republicans never quite forgave the tardiness of his conversion, and no place rewarded his later zeal. On the 23rd January 1884 he was elected a member of the French Academy, but died on the 16th of January 1885, before taking his seat. His journalism—of which specimens in his earlier and later manners will be found in the two series of *Lettres d'un bon jeune homme à sa cousine Madeleine* (1861 and 1863), and the posthumous collection, *Le dix-neuvième siècle* (1892)—was of its nature ephemeral. So were the pamphlets, great and small. His political economy was that of an orthodox popularizer, and in no sense epoch-making. His dramas are negligible. His more serious novels, *Madelon* (1863), *L'infâme* (1867), the three that form the trilogy of the *Vieille Roche* (1866), and *Le roman d'un brave homme* (1880)—a kind of counterblast to the view of the French workman presented in Zola's *Assommoir*—contain striking and amusing scenes, no doubt, but scenes which are often suggestive of the stage, while description, dissertation, explanation too frequently take the place of life. His best work after all is to be found in the books that are almost wholly farcical, *Le nez d'un notaire* (1862); *Le roi des montagnes* (1856); *L'homme à l'oreille cassée* (1862); *Trente et quarante* (1858); *Le cas de M. Guérin* (1862). Here his most genuine wit, his sprightliness, his vivacity, the fancy that was in him, have free play. "You will never be more than a little Voltaire," said one of his masters when he was a lad at school. It was a true prophecy. (F. T. M.)

ABRABANEL, ISAAC, called also Abravanel, Abarbanel (1437–1508), Jewish statesman, philosopher, theologian and commentator, was born at Lisbon of an ancient family which claimed descent from the royal house of David. Like many of the Spanish Jews he united scholarly tastes with political ability. He held a high place in the favour of King Alphonso V., who entrusted him with the management of important state affairs. On the death of Alphonso in 1481, his counsellors and favourites were harshly treated by his successor John, and Abrabanel was compelled to flee to Spain, where he held for eight years (1484–1492) the post of a minister of state under Ferdinand and Isabella. When the Jews were banished from Spain in 1492, no exception was made in Abrabanel's favour. He afterwards resided at Naples, Corfu and Monopoli, and in 1503 removed to Venice, where he held office as a minister of state till his death in 1508. His repute as a commentator on the Scriptures is still high; in the 17th and 18th centuries he was much read by Christians such as Buxtorf. Abrabanel often quotes Christian authorities, though he opposed Christian exegesis of Messianic passages. He was one of the first to see that for Biblical exegesis it was necessary to reconstruct the social environment of olden times, and he skilfully applied his practical knowledge of statecraft to the elucidation of the books of Samuel and Kings.

ABRACADABRA, a word analogous to Abraxas (*q.v.*), used as a magical formula by the Gnostics of the sect of Basilides in invoking the aid of beneficent spirits against disease and misfortune. It is found on Abraxas stones which were worn as amulets. Subsequently its use spread beyond the Gnostics, and in modern times it is applied contemptuously (*e g.* by the early opponents of the evolution theory) to a conception or hypothesis which purports to be a simple solution of apparently insoluble phenomena. The Gnostic physician Serenus Sammonicus gave precise instructions as to its mystical use in averting or curing agues and fevers generally. The paper on which the word was written had to be folded in the form of a cross, suspended from the neck by a strip of linen so as to rest on the pit of the stomach, worn in this way for nine days, and then, before sunrise, cast behind the wearer into a stream running to the east. The letters were usually arranged as a triangle in one of the following ways:—

ABRACADABRA
ABRACADABR
ABRACADAB
ABRACADA
ABRACAD
ABRACA
ABRAC
ABRA
ABR
AB
A

ABRACADABRA
BRACADABR
RACADAB
ACADA
CAD
A

ABRAHAM, or Abram (Hebrew for "father is high"), the ancestor of the Israelites, the first of the great Biblical patriarchs. His life as narrated in the book of Genesis reflects the traditions of different ages. It is the latest writer (P) who mentions Abram (the original form of the name), Nahor and Ḥaran, sons of Terah, at the close of a genealogy of the sons of Shem, which includes among its members Eber the eponym of the Hebrews. Terah is said to have come from Ur of the Chaldees, usually identified with Mukayyar in south Babylonia. He migrated to Haran[1] in Mesopotamia, apparently the classical Carrhae, on a branch of the Ḥabor. Thence, after a short stay, Abram with his wife Sarai, and Lot the son of Ḥaran, and all their followers, departed for Canaan. The oldest tradition does not know of this twofold move, and seems to locate Abram's birthplace and the homes of his kindred at Ḥaran (Gen. xxiv. 4, 7, xxvii. 43). At the divine command, and encouraged by the promise that Yahweh would make of him, although hitherto childless, a great nation, he journeyed down to Shechem, and at the sacred tree (cf. xxxv. 4, Josh. xxiv. 26, Judg. ix. 6) received a new promise that the land would be given unto his seed. Having built an altar to commemorate the theophany, he removed to a spot between Bethel and Ai, where he built another altar and called upon (*i.e.* invoked) the name of Yahweh (Gen. xii. 1-9). Here he dwelt for some time, until strife arose between his herdsmen and those of Lot. Abram thereupon proposed to Lot that they should separate, and allowed his nephew the first choice. Lot preferred the fertile land lying east of the Jordan, whilst Abram, after receiving another promise from Yahweh, moved down to the oaks of Mamre in Hebron and built an altar. In the subsequent history of Lot and the destruction of Sodom and Gomorrah, Abram appears prominently in a fine passage where he intercedes with Yahweh on behalf of Sodom, and is promised that if ten righteous men can be found therein the city shall be preserved (xviii. 16-33).

A peculiar passage, more valuable for the light it throws upon primitive ideas than for its contribution to the history of Abram, narrates the patriarch's visit to Egypt. Driven by a famine to take refuge in Egypt (cf. xxvi. 1, xli. 57, xlii. 1), he feared lest his wife's beauty should arouse the evil designs of the Egyptians and thus endanger his own safety, and alleged that Sarai was his sister. This did not save her from the Pharaoh, who took her into the royal harem and enriched Abram with herds and servants. But when Yahweh "plagued Pharaoh and his house with great plagues" suspicion was aroused, and the Pharaoh rebuked the patriarch for his deceit and sent him away under an escort (xii. 10–xiii. 1). This story of Abram and his increased wealth (xiii. 2) receives no comment at the hands of the narrator, and in its present position would make Sarai over sixty years of age (xii. 4, xvii. 1, 17). A similar experience is said to have happened to Abraham and Sarah at Gerar with the Philistine king Abimelech (xx. E), but the tone of the narrative is noticeably more advanced, and the presents which the patriarch receives are compensation for the king's offence. Here, however, Sarah has reached her ninetieth year (xvii. 17). (The dates are due to the post-exilic framework in which the stories are inserted.) Still another episode of the same nature is recorded of Isaac and Rebekah at Gerar, also with Abimelech. Ethically it is the loftiest, and Isaac obtains his wealth simply through his successful farming. Arising out of the incident is an account of a covenant between Abimelech and Isaac (xxvi. 16-33, J), a duplicate of which is placed in the time of Abraham (xxi. 22-34, J and E). Beersheba, which figures in both, is celebrated by the planting of a sacred tree and (like Bethel) by the invocation of the name of Yahweh. This district is the scene of the birth of Ishmael and Isaac. As Sarai was barren (cf. xi. 30)[2] the promise that his seed should possess the land seemed incapable of fulfilment. According to one rather obscure narrative, Abram's sole heir was the servant, who was over his household, apparently a certain Eliezer of Damascus[3] (xv. 2, the text is corrupt). He is now promised as heir one of his own flesh, and a remarkable and solemn passage records how the promise was ratified by a covenant. The description is particularly noteworthy for the sudden appearance of birds of prey, which attempted to carry off the victims of the sacrificial covenant. The interpretation of the evil omen is explained by an allusion to the bondage of the Israelites in Egypt and their return in the fourth generation (xv. 16; contrast *v.* 13, after four hundred years; the chapter is extremely intricate and has the appearance of being of secondary origin). The main narrative now relates how Sarai, in accordance with custom, gave to Abram her Egyptian handmaid Hagar, who, when she found she was with child, presumed upon her position to the extent that Sarai, unable to endure the reproach of barrenness (cf. the story of Hannah, 1 Sam. i. 6), dealt harshly with her and forced her to flee (xvi. 1-14, J; on the details see ISHMAEL). Another tradition places the expulsion of Hagar after the birth of Isaac. It was thirteen years after the birth of Ishmael, according to the latest narratives, that God appeared unto Abram with a renewed promise that his posterity should inhabit the land. To mark the solemnity of the occasion, the patriarch's name was changed to Abraham, and that of his wife to Sarah.[4] A covenant was concluded with him for all time, and as a sign thereof the rite of circumcision was instituted (xvii. P). The promise of a son to Sarah made Abraham "laugh", a punning allusion to the name Isaac (*q.v.*) which appears again in other forms. Thus, it is Sarah herself who "laughs" at the idea, when Yahweh appears to Abraham at Mamre (xviii. 1-15, J), or who, when the child is born cries "God hath made me laugh; every one that heareth will laugh at me" (xxi. 6, E). Finally, there is yet another story which attributes the flight of Hagar and Ishmael to Sarah's jealousy at the sight of Ishmael's "mocking" (rather dancing or playing, the intensive form of the verb "to laugh") on the feast day when Isaac was weaned (xxi. 8 sqq.). But this last story is clearly out of place, since a child who was then fourteen years old (cf. xvii. 24, xxi. 5) could scarcely be described as a weak babe who had to be carried (xxi. 14; see the commentaries).

Abraham was now commanded by God to offer up Isaac in the land of Moriah. Proceeding to obey, he was prevented by an angel as he was about to sacrifice his son, and slew a ram which he found on the spot. As a reward for his obedience he received another promise of a numerous seed and abundant prosperity (xxii. E). Thence he returned to Beersheba. The story is one of the few told by E, and significantly teaches that human sacrifice was not required by the Almighty (cf. Mic. vi. 7 seq.). The interest of the narrative now extends to Isaac alone. To his "only son" (cp. xxii. 2, 12) Abraham gave all he had, and dismissed the sons of his concubines to the lands outside Palestine; they were thus regarded as less intimately related to Isaac and his descendants (xxv. 1-4, 6). The measures taken by the patriarch for the marriage of Isaac are circumstantially described. His head-servant was sent to his master's country and kindred to find a suitable bride, and the necessary preparation for the story is contained in the description of Nahor's family (xxii. 20-24). The picturesque account of the meeting with Rebekah throws interesting light on oriental custom. Marriage with one's own folk (cf. Gen. xxvii. 46, xxix. 19; Judg. xiv. 3), and especially with a cousin, is recommended now even as in the past. For its charm the story is comparable with the account of Jacob's experiences in the same land (xxix.). For the completion of the history of Abraham the compiler of Genesis has used P's narrative. Sarah is said to have died at a good old age, and was buried in the cave of Machpelah near Hebron, which the patriarch had purchased, with the adjoining field, from Ephron the Hittite (xxiii.); and here he himself was buried. Centuries later the tomb became a place of pilgrimage and the traditional site is marked by a fine mosque.[5]

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[1] The name is not spelt with the same guttural as Ḥaran the son of Terah.

[2] Barrenness is a *motif* which recurs in the stories of Rebekah, Rachel, the mother of Samson, and Hannah (Gen. xxv. 21, xxix. 31; Judg. xiii. 2; 1 Sam. i. 5).

[3] Abram's connexion with Damascus is supplemented in the traditions of Nicolaus of Damascus as cited by Josephus (*Antiq.* i. 7. 2).

[4] Abram (or Abiram) is a familiar and old-attested name meaning "(my) father is exalted"; the meaning of Abraham is obscure and the explanation Gen. xvii. 5 is mere word-play. It is possible that *rāhām* was originally only a dialectical form of *rām*.

[5] See Sir Charles Warren's description, Hasting's *Dict. Bible*, vol. iii. pp. 200 seq. The so-called Babylonian colouring of Gen.

The story of Abraham is of greater value for the study of Old Testament theology than for the history of Israel. He became to the Hebrews the embodiment of their ideals, and stood at their head as the founder of the nation, the one to whom Yahweh had manifested his love by frequent promises and covenants. From the time when he was bidden to leave his country to enter the unknown land, Yahweh was ever present to encourage him to trust in the future when his posterity should possess the land, and so, in its bitterest hours, Israel could turn for consolation to the promises of the past which enshrined in Abraham its hopes for the future. Not only is Abraham the founder of religion, but he, of all the patriarchal figures, stands out most prominently as the recipient of the promises (xii. 2 seq. 7, xiii. 14-17, xv., xvii., xviii. 17-19, xxii. 17 seq.; cf. xxiv. 7), and these the apostle Paul associates with the coming of Christ, and, adopting a characteristic and artificial style of interpretation prevalent in his time, endeavours to force a Messianic interpretation out of them.[1]

For the history of the Hebrews the life of Abraham is of the same value as other stories of traditional ancestors. The narratives, viewed dispassionately, represent him as an idealized sheikh (with one important exception, Gen. xiv., see below), about whose person a number of stories have gathered. As the father of Isaac and Ishmael, he is ultimately the common ancestor of the Israelites and their nomadic fierce neighbours, men roving unrestrainedly like the wild ass, troubled by and troubling every one (xvi. 12). As the father of Midian, Sheba and other Arabian tribes (xxv. 1-4), it is evident that some degree of kinship was felt by the Hebrews with the dwellers of the more distant south, and it is characteristic of the genealogies that the mothers (Sarah, Hagar and Keturah) are in the descending scale as regards purity of blood. This great ancestral figure came, it was said, from Ur in Babylonia and Ḥaran and thence to Canaan. Late tradition supposed that the migration was to escape Babylonian idolatry (Judith v., Jubilees xii.; cf. Josh. xxiv. 2), and knew of Abraham's miraculous escape from death (an obscure reference to some act of deliverance in Is. xxix. 22). The route along the banks of the Euphrates from south to north was so frequently taken by migrating tribes that the tradition has nothing improbable in itself, but the prominence given in the older narratives to the view that Ḥaran was the home gives this the preference. It was thence that Jacob, the father of the tribes of Israel, came and the route to Shechem and Bethel is precisely the same in both. A twofold migration is doubtful, and, from what is known of the situation in Palestine in the 15th century B.C., is extremely improbable. Further, there is yet another parallel in the story of the conquest by Joshua (*q.v.*), partly implied and partly actually detailed (cf. also Josh. viii. 9 with Gen. xii. 8, xiii. 3), whence it would appear that too much importance must not be laid upon any ethnological interpretation which fails to account for the three versions. That similar traditional elements have influenced them is not unlikely; but to recover the true historical foundation is difficult. The invasion or immigration of certain tribes from the east of the Jordan; the presence of Aramaean blood among the Israelites (see JACOB); the origin of the sanctity of venerable sites,—these and other consideratons may readily be found to account for the traditions. Noteworthy coincidences in the lives of Abraham and Isaac, noticed above, point to the fluctuating state of traditions in the oral stage, or suggest that Abraham's life has been built up by borrowing from the common stock of popular lore.[2] More original is the parting of Lot and Abraham at Bethel. The district was the scene of contests between Moab and the Hebrews (cf. perhaps Judg. iii.), and if this explains part of the story, the physical configuration of the Dead Sea may have led to the legend of the destruction of inhospitable and vicious cities (see SODOM AND GOMORRAH).

Different writers have regarded the life of Abraham differently. He has been viewed as a chieftain of the Amorites (*q.v.*), as the head of a great Semitic migration from Mesopotamia; or, since Ur and Ḥaran were seats of Moon-worship, he has been identified with a moon-god. From the character of the literary evidence and the *locale* of the stories it has been held that Abraham was originally associated with Hebron. The double name Abram-Abraham has even suggested that two personages have been combined in the Biblical narrative; although this does not explain the change from Sarai to Sarah.[3] But it is important to remember that the narratives are not contemporary, and that the interesting discovery of the name Abi-ramu (Abram) on Babylonian contracts of about 2000 B.C. does not prove the Abram of the Old Testament to be an historical person, even as the fact that there were "Amorites" in Babylonia at the same period does not make it certain that the patriarch was one of their number. One remarkable chapter associates Abraham with kings of Elam and the east (Gen. xiv.). No longer a peaceful sheikh but a warrior with a small army of 318 followers,[4] he overthrows a combination of powerful monarchs who have ravaged the land. The genuineness of the narrative has been strenuously maintained, although upon insufficient grounds.

> "It is generally recognized that this chapter holds quite an isolated place in the Pentateuchal history; it is the only passage which presents Abraham in the character of a warrior, and connects him with historical names and political movements, and there are no clear marks by which it can be assigned to any one of the documents of which Genesis is made up. Thus, while one school of interpreters finds in the chapter the earliest fragment of the political history of western Asia, some even holding with Ewald that the narrative is probably based on old Canaanite records, other critics, as Nöldeke, regard the whole as unhistorical and comparatively late in origin. On the latter view, which finds its main support in the intrinsic difficulties of the narrative, it is scarcely possible to avoid the conclusion that the chapter is one of the latest additions to the Pentateuch (Wellhausen and many others)."[5]

On the assumption that a recollection of some invasion in remote days may have been current, considerable interest is attached to the names. Of these, Amraphel, king of Shinar (*i.e.* Babylonia, Gen. x. 10), has been identified with Khammurabi, one of the greatest of the Babylonian kings (*c.* 2000 B.C.), and since he claims to have ruled as far west as the Mediterranean Sea, the equation has found considerable favour. Apart from chronological difficulties, the identification of the king and his country is far from certain, and at the most can only be regarded as possible. Arioch, king of Ellasar, has been connected with Eriaku of Larsa—the reading has been questioned—a contemporary with Khammurabi. Chedorlaomer, king of Elam, bears what is doubtless a genuine Elamite name. Finally, the name of Tidʿal, king of Goiim, may be identical with a certain Tudḫulu the son of Gazza, a warrior, but apparently not a king, who is mentioned in a Babylonian inscription, and Goiim may stand for Gutim, the Guti being a people who lived to the east of Kurdistan. Nevertheless, there is as yet no monumental evidence in favour of the genuineness of the story, and at the most it can only be said that the author (of whatever date) has derived his names from a trustworthy source, and in representing an invasion of Palestine by Babylonian overlords has given expression to a possible situation.[6] The improbabilities and internal difficulties of the narrative remain

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xxiii. has been much exaggerated; see S. R. Driver, *Genesis*, ad loc.; S. A. Cook, *Laws of Moses*, p. 208.

[1] See H. St. J. Thackeray, *Relation of St Paul to Contemporary Jewish Thought*, p. 69 seq. (1900).

[2] On the other hand, the coincidences in xx. xxi. are due to E, who is also the author of xxii. Apart from these the narratives of Abraham are from J and P.

[3] According to Breasted (*Amer. Journ. of Sem. Lit.*, 1904, p. 36), the "field of Abram" occurs among the places mentioned in the list of the Egyptian king Shishak (No. 71-2) in the 10th century. See also his *History of Egypt*, p. 530.

[4] The number is precisely that of the total numerical value of the consonants of the name "Eliezer" (Gen. xv. 2); an astral signification has also been found.

[5] W. R. Smith, *Ency. Brit.* (9th ed., 1883), art. "Melchizedek."

[6] That the names may be those of historical personages is no proof of historical accuracy: "We cannot therefore conclude that the whole account is accurate history, any more than we can argue that Sir Walter Scott's *Anne of Geierstein* is throughout a correct account of actual events because we know that Charles the Bold and Margaret of Anjou were real people" (W. H. Bennett, *Century Bible: Genesis*, p. 186).

untouched, only the bare outlines may very well be historical. If, as most critics agree, it is a historical romance (cf., *e.g.*, the book of Judith), it is possible that a writer, preferably one who lived in the post-exilic age and was acquainted with Babylonian history, desired to enhance the greatness of Abraham by exhibiting his military success against the monarchs of the Tigris and Euphrates, the high esteem he enjoyed in Palestine and his lofty character as displayed in his interview with Melchizedek.

See further, Pinches, *Old Test. in Light of Hist. Records*, pp. 208-236; Driver, *Genesis*, p. xlix., and notes on ch. xiv.; Addis, *Documents of the Hexateuch*, ii. pp. 208-213; Carpenter and Harford-Battersby, *The Hexateuch*, i. pp. 157-159, 168; Bezold, *Bab.-Assyr. Keilinschriften*, pp. 24 sqq., 54 sqq.; A. Jeremias, *Altes Test. im Lichte d. Alten Orients*$^{(2)}$, pp. 343 seq.; also the literature to the art. GENESIS. Many fanciful legends about Abraham founded on Biblical accounts or spun out of the fancy are to be found in Josephus, and in post-Biblical and Mahommedan literature; for these, reference may be made to Beer, *Leben Abrahams* (1859); Grünbaum, *Neue Beiträge z. semit. Sagenkunde*, pp. 89 seq. (1893); the apocryphal "Testament of Abraham" (M. R. James in *Texts and Studies*, 1892); W. Tisdall, *Original Sources of the Quran*, *passim* (1905). (S. A. C.)

ABRAHAM A SANCTA CLARA (1644–1709), Austrian divine, was born at Kreenheinstetten, near Messkirch, in July 1644. His real name was Ulrich Megerle. In 1662 he joined the order of Barefooted Augustinians, and assumed the name by which he is known. In this order he rose step by step until he became *prior provincialis* and *definitor* of his province. Having early gained a great reputation for pulpit eloquence, he was appointed court preacher at Vienna in 1669. The people flocked to hear him, attracted by the force and homeliness of his language, the grotesqueness of his humour, and the impartial severity with which he lashed the follies of all classes of society and of the court in particular. In general he spoke as a man of the people, the predominating quality of his style being an overflowing and often coarse wit. There are, however, many passages in his sermons in which he rises to loftier thought and uses more dignified language. He died at Vienna on the 1st of December 1709. In his published writings he displayed much the same qualities as in the pulpit. Perhaps the most favourable specimen of his style is his didactic novel entitled *Judas der Erzschelm* (4 vols., Salzburg, 1686–1695).

His works have been several times reproduced in whole or in part, though with many spurious interpolations. The best edition is that published in 21 vols. at Passau and Lindau (1835–1854). See Th. G. von Karajan, *Abraham a Sancta Clara* (Vienna, 1867); Blanckenburg, *Studien über die Sprache Abrahams a S. C.* (Halle, 1897); Sexto, *Abraham a S. C.* (Sigmaringen, 1896); Schnell, *Pater A. a S. C.* (Munich, 1895); H. Mareta, *Über Judas d. Erzschelm* (Vienna, 1875).

ABRAHAM IBN DAUD (*c.* 1110–1180), Jewish historiographer and philosopher of Toledo. His historical work was the *Book of Tradition* (*Sepher Haqabala*), a chronicle down to the year 1161. This was a defence of the traditional record, and also contains valuable information for the medieval period. It was translated into Latin by Génébrad (1519). His philosophy was expounded in an Arabic work better known under its Hebrew title *'Emunah Ramah* (*Sublime Faith*). This was translated into German by Weil (1882). Ibn Daud was one of the first Jewish scholastics to adopt the Aristotelian system; his predecessors were mostly neo-Platonists. Maimonides owed a good deal to him.

ABRAHAMITES, a sect of deists in Bohemia in the 18th century, who professed to be followers of the pre-circumcised Abraham. Believing in one God, they contented themselves with the Decalogue and the Paternoster. Declining to be classed either as Christians or Jews, they were excluded from the edict of toleration promulgated by the emperor Joseph II. in 1781, and deported to various parts of the country, the men being drafted into frontier regiments. Some became Roman Catholics, and those who retained their "Abrahamite" views were not able to hand them on to the next generation.

ABRAHAM-MEN, the nickname for vagrants who infested England in Tudor times. The phrase is certainly as old as 1561, and was due to these beggars pretending that they were patients discharged from the Abraham ward at Bedlam. The genuine Bedlamite was allowed to roam the country on his discharge, soliciting alms, provided he wore a badge. This humane privilege was grossly abused, and thus gave rise to the slang phrase "to sham Abraham."

ABRANTES, a town of central Portugal, in the district of Santarem, formerly included in the province of Estremadura; on the right bank of the river Tagus, at the junction of the Madrid–Badajoz–Lisbon railway with the Guarda–Abrantes line. Pop. (1900) 7255. Abrantes, which occupies the crest of a hill covered with olive woods, gardens and vines, is a fortified town, with a thriving trade in fruit, olive oil and grain. As it commands the highway down the Tagus valley to Lisbon, it has usually been regarded as an important military position. Originally an Iberian settlement, founded about 300 B.C., it received the name Aurantes from the Romans; perhaps owing to the alluvial gold (*aurum*) found along the Tagus. Roman mosaics, coins, the remains of an aqueduct, and other antiquities have been discovered in the neighbourhood. Abrantes was captured on the 24th of November 1807 by the French under General Junot, who for this achievement was created duke of Abrantes. By the Convention of Cintra (22nd of August 1808) the town was restored to the British and Portuguese.

ABRASION (from Lat. *ab*, off, and *radere*, to scrape), the process of rubbing off or wearing down, as of rock by moving ice, or of coins by wear and tear; also used of the results of such a process as an abrasion or excoriation of the skin. In machinery, abrasion between moving surfaces has to be prevented as much as possible by the use of suitable materials, good fitting and lubrication. Engineers and other craftsmen make extensive use of abrasion, effected by the aid of such abrasives as emery and carborundum, in shaping, finishing and polishing their work.

ABRAUM SALTS (from the German *Abraum-salze*, salts to be removed), the name given to a mixed deposit of salts, including halite, carnallite, kieserite, &c., found in association with rock-salt at Stassfurt in Prussia.

ABRAXAS, or ABRASAX, a word engraved on certain antique stones, called on that account *Abraxas stones*, which were used as amulets or charms. The Basilidians, a Gnostic sect, attached importance to the word, if, indeed, they did not bring it into use. The letters of ἀβραξάς, in the Greek notation, make up the number 365, and the Basilidians gave the name to the 365 orders of spirits which, as they conceived, emanated in succession from the Supreme Being. These orders were supposed to occupy 365 heavens, each fashioned like, but inferior to that above it; and the lowest of the heavens was thought to be the abode of the spirits who formed the earth and its inhabitants, and to whom was committed the administration of its affairs. Abraxas stones are of very little value. In addition to the word Abraxas and other mystical characters, they have often cabalistic figures engraved on them. The commonest of these have the head of a fowl, and the arms and bust of a man, and terminate in the body and tail of a serpent.

ABROGATION (Lat. *abrogare*, to repeal or annul a law; *rogare*, literally "to ask," to propose a law), the annulling or repealing of a law by legislative action. Abrogation, which is the total annulling of a law, is to be distinguished from the term *derogation*, which is used where a law is only partially abrogated. Abrogation may be either express or implied. It is express either when the new law pronounces the annulment in general terms, as when in a concluding section it announces that all laws contrary to the provisions of the new one are repealed, or when in particular terms it announces specifically the preceding laws which it repeals. It is implied when the new law contains provisions which are positively contrary to the former laws without expressly abrogating those laws, or when the condition of things for which the law had provided has changed and consequently the need for the law no longer exists. The abrogation of any statute revives the provisions of the common law which had been abrogated by that statute. See STATUTE; REPEAL.

ABRUZZI E MOLISE, a group of provinces (*compartimento*) of Southern Italy, bounded N. by the province of Ascoli, N.W. and

W. by Perugia, S.W. by Rome and Caserta, S. by Benevento, E. by Foggia and N.E. by the Adriatic Sea. It comprises the provinces of Teramo (population in 1901, 307,444), Aquila (396,629), Chieti (370,907) and Campobasso (366,571), which, under the kingdom of Naples, respectively bore the names Abruzzo Ulteriore I., Abruzzo Ulteriore II., Abruzzo Citeriore (the reference being to their distance from the capital) and Molise. The total area is 6567 sq. m. and the population (1901) 1,441,551. The district is mainly mountainous in the interior, including as it does the central portion of the whole system of the Apennines and their culminating point, the *Gran Sasso d'Italia*. Towards the sea the elevation is less considerable, the hills consisting mainly of somewhat unstable clay and sand, but the zone of level ground along the coast is quite inconsiderable. The coast line itself, though over 100 miles in length, has not a single harbour of importance. The climate varies considerably with the altitude, the highest peaks being covered with snow for the greater part of the year, while the valleys running N.E. towards the sea are fertile and well watered by several small rivers, the chief of which are the Tronto, Vomano, Pescara, Sangro, Trigno and Biferno. These are fed by less important streams, such as the Aterno and Gizio, which water the valleys between the main chains of the Apennines. They are liable to be suddenly swollen by rains, and floods and landslips often cause considerable damage. This danger has been increased, as elsewhere in Italy, by indiscriminate timber-felling on the higher mountains without provision for re-afforestation, though considerable oak, beech, elm and pine forests still exist and are the home of wolves, wild boars and even bears. They also afford feeding-ground for large herds of swine, and the hams and sausages of the Abruzzi enjoy a high reputation. The rearing of cattle and sheep was at one time the chief occupation of the inhabitants, and many of them still drive their flocks down to the Campagna di Roma for the winter months and back again in the summer, but more attention is now devoted to cultivation. This flourishes especially in the valleys and in the now drained bed of the Lago Fucino. The industries are various, but none of them is of great importance. Arms and cutlery are produced at Campobasso and Agnone. At the exhibition of Abruzzese art, held at Chieti in 1905, fine specimens of goldsmiths' work of the 15th and 16th centuries, of majolica of the 17th and 18th centuries, and of tapestries and laces were brought together; and the reproduction of some of these is still carried on, the small town of Castelli being the centre of the manufacture. The river Pescara and its tributary the Tirino form an important source of power for generating electricity. The chief towns are (1) Teramo, Atri, Campli, Penne, Castellammare Adriatico; (2) Aquila, Avezzano, Celano, Tagliacozzo, Sulmona; (3) Chieti, Lanciano, Ortona, Vasto; (4) Campobasso, Agnone, Isernia. Owing to the nature of the country, communications are not easy. Railways are (1) the coast railway (a part of the Bologna–Gallipoli line), with branches from Giulianova to Teramo and from Termoli to Campobasso; (2) a line diverging S.E. from this at Pescara and running *via* Sulmona (whence there are branches *via* Aquila and Rieti to Terni, and *via* Carpinone to (*a*) Isernia and Caianello, on the line from Rome to Naples, and (*b*) Campobasso and Benevento), and Avezzano (whence there is a branch to Roccasecca) to Rome.

The name Abruzzi is conjectured to be a medieval corruption of Praetuttii. The district was, in Lombard times, part of the duchy of Spoleto, and, under the Normans, a part of that of Apulia; it was first formed into a single province in 1240 by Frederick II., who placed the *Justiciarius Aprutii* at Solmona and founded the city of Aquila. After the Hohenstauffen lost their Italian dominions, the Abruzzi became a province of the Angevin kingdom of Naples, to which it was of great strategic importance. The division into three parts was not made until the 17th century. The Molise, on the other hand, formed part of the Lombard duchy of Benevento, and was placed under the *Justiciarius* of Terra di Lavoro by Frederick II.: after various changes it became part of the Capitanata, and was only formed into an independent province in 1811. The people are remarkably conservative in beliefs, superstitions and traditions.

See V. Bindi, *Monumenti storici ed artistici degli Abruzzi* (Naples, 1889); A. de Nino, *Usi e costumi Abruzzesi* (Florence, 1879–1883).

ABSALOM (Hebrew for "father of [*or* is] peace"), in the Bible, the third son of David, king of Israel. He was deemed the handsomest man in the kingdom. His sister Tamar having been violated by David's eldest son Amnon, Absalom, after waiting two years, caused his servants to murder Amnon at a feast to which he had invited all the king's sons (2 Sam. xiii.). After this deed he fled to Talmai, "king" of Geshur (see Josh. xii. 5 or xiii. 2), his maternal grandfather, and it was not until five years later that he was fully reinstated in his father's favour (see JOAB). Four years after this he raised a revolt at Hebron, the former capital. Absalom was now the eldest surviving son of David, and the present position of the narratives (xv.-xx.)—after the birth of Solomon and before the struggle between Solomon and Adonijah—may represent the view that the suspicion that he was not the destined heir of his father's throne excited the impulsive youth to rebellion. All Israel and Judah flocked to his side, and David, attended only by the Cherethites and Pelethites and some recent recruits from Gath, found it expedient to flee. The priests remained behind in Jerusalem, and their sons Jonathan and Ahimaaz served as his spies. Absalom reached the capital and took counsel with the renowned Ahithophel. The pursuit was continued and David took refuge beyond the Jordan. A battle was fought in the "wood of Ephraim" (the name suggests a locality *west* of the Jordan) and Absalom's army was completely routed. He himself was caught in the boughs of an oak-tree, and as David had strictly charged his men to deal gently with the young man, Joab was informed. What a common soldier refused to do even for a thousand shekels of silver, the king's general at once undertook. Joab thrust three spears through the heart of Absalom as he struggled in the branches, and as though this were not enough, his ten armour-bearers came around and slew him. The king's overwhelming grief is well known. A great heap of stones was erected where he fell, whilst another monument near Jerusalem (not the modern "Absalom's Tomb," which is of later origin) he himself had erected in his lifetime to perpetuate his name (2 Sam. xviii. 17 seq.). But the latter notice does not seem to agree with xiv. 27 (cf. 1 Kings xv. 2). On the narratives in 2 Sam. xiii.-xix., see further DAVID; SAMUEL, BOOKS OF.

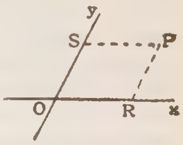
ABSALON (*c.* 1128–1201), Danish archbishop and statesman, was born about 1128, the son of Asser Rig of Fjenneslev, at whose castle he and his brother Esbjörn were brought up along with the young prince Valdemar, afterwards Valdemar I. The Rigs were as pious and enlightened as they were rich. They founded the monastery of Sorö as a civilizing centre, and after giving Absalon the rudiments of a sound education at home, which included not only book-lore but every manly and martial exercise, they sent him to the university of Paris. Absalon first appears in Saxo's Chronicle as a fellow-guest at Roskilde, at the banquet given, in 1157, by King Sweyn to his rivals Canute and Valdemar. Both Absalon and Valdemar narrowly escaped assassination at the hands of their treacherous host on this occasion, but at length escaped to Jutland, whither Sweyn followed them, but was defeated and slain at the battle of Grathe Heath. The same year (1158) which saw Valdemar ascend the Danish throne saw Absalon elected bishop of Roskilde. Henceforth Absalon was the chief counsellor of Valdemar, and the promoter of that imperial policy which, for three generations, was to give Denmark the dominion of the Baltic. Briefly, it was Absalon's intention to clear the northern sea of the Wendish pirates, who inhabited that portion of the Baltic littoral which we now call Pomerania, and ravaged the Danish coasts so unmercifully that at the accession of Valdemar one-third of the realm of Denmark lay wasted and depopulated. The very existence of Denmark demanded the suppression and conversion of these stiff-necked pagan freebooters, and to this double task Absalon devoted the best part of his life. The first expedition against the Wends, conducted by Absalon in person, set out in 1160, but it was not till 1168 that the chief Wendish fortress, at Arkona in Rügen, containing the sanctuary of their god Svantevit, was surrendered, the Wends agreeing to accept Danish suzerainty and the Christian religion at the same time. From Arkona Absalon proceeded by sea to Garz, in south Rügen, the political capital of the Wends, and an all but impregnable stronghold. But the unexpected fall of Arkona had terrified the garrison, which surrendered unconditionally at the first appearance of the Danish ships. Absalon, with only Sweyn, bishop of Aarhus, and twelve "house-carls," thereupon disembarked, passed between a double row of Wendish warriors, 6000 strong, along the narrow path winding among the morasses, to the gates of the fortress, and, proceeding to the temple of the seven-headed god Rügievit, caused the idol to be hewn down, dragged forth and burnt. The whole population of Garz was then baptized, and Absalon laid the foundations of twelve churches in the isle of Rügen. The destruction of this chief sally-port of the Wendish pirates enabled Absalon considerably to reduce the Danish fleet. But he continued to keep a watchful eye over the Baltic, and in 1170 destroyed another pirate stronghold, farther eastward, at Dievenow on the isle of Wollin. Absalon's last military exploit was the annihilation, off Strela (Stralsund), on Whit-Sunday 1184, of a Pomeranian fleet which had attacked Denmark's vassal, Jaromir of Rügen. He was now but fifty-seven, but his strenuous life had aged him, and he was content to resign the command of fleets and armies to younger men, like Duke Valdemar, afterwards Valdemar II., and to confine himself to the administration of the empire which his genius had created. In this sphere Absalon proved himself equally great. The aim of his policy was to free Denmark from the German yoke. It was contrary to his advice and warnings that Valdemar I. rendered fealty to the emperor Frederick Barbarossa at Dôle in 1162; and when, on the accession of Canute V. in 1182, an imperial ambassador arrived at Roskilde to receive the homage of the new king, Absalon resolutely withstood him. "Return to the emperor," cried he, "and tell him that the king of Denmark will in no wise show him obedience or do him homage." As the archpastor of Denmark Absalon also rendered his country inestimable services, building churches and monasteries, introducing the religious orders, founding schools and doing his utmost to promote civilization and enlightenment. It was he who held the first Danish Synod at Lund in 1167. In 1178 he became archbishop of Lund, but very unwillingly, only the threat of excommunication from the holy see finally inducing him to accept the pallium. Absalon died on the 21st of March 1201, at the family monastery of Sorö, which he himself had richly embellished and endowed.

Absalon remains one of the most striking and picturesque figures of the Middle Ages, and was equally great as churchman, statesman and warrior. That he enjoyed warfare there can be no doubt; and his splendid physique and early training had well fitted him for martial exercises. He was the best rider in the army and the best swimmer in the fleet. Yet he was not like the ordinary fighting bishops of the Middle Ages, whose sole concession to their sacred calling was to avoid the "shedding of blood" by using a mace in battle instead of a sword. Absalon never neglected his ecclesiastical duties, and even his wars were of the nature of crusades. Moreover, all his martial energy notwithstanding, his personality must have been singularly winning; for it is said of him that he left behind not a single enemy, all his opponents having long since been converted by him into friends.

See Saxo, *Gesta Danorum*, ed. Holder (Strassburg, 1886), books x.-xvi.; Steinstrup, *Danmark's Riges Historie. Oldtiden og den ældre Middelalder*, pp. 570-735 (Copenhagen, 1897–1905). (R. N. B.)

ABSCESS (from Lat. *abscedere*, to separate), in pathology, a collection of pus among the tissues of the body, the result of bacterial inflammation. Without the presence of septic organisms abscess does not occur. At any rate, every acute abscess contains septic germs, and these may have reached the inflamed area by direct infection, or may have been carried thither by the blood-stream. Previous to the formation of abscess something has occurred to lower the vitality of the affected tissue—some gross injury, perchance, or it may be that the power of resistance against bacillary invasion was lowered by reason of constitutional weakness. As the result, then, of lowered vitality, a certain area becomes congested and effusion takes place into the tissues. This effusion coagulates and a hard, brawny mass is formed which softens towards the centre. If nothing is done the softened area increases in size, the skin over it becomes thinned, loses its vitality (mortifies) and a small "slough" is formed. When the slough gives way the pus escapes and, tension being relieved, pain ceases. A local necrosis or death of tissue takes place at that part of the inflammatory swelling farthest from the healthy circulation. When the attack of septic inflammation is very acute, death of the tissue occurs *en masse*, as in the core of a boil or carbuncle. Sometimes, however, no such mass of dead tissue is to be observed, and all that escapes when the skin is lanced or gives way is the creamy pus. In the latter case the tissue has broken down in a molecular form. After the escape of the core or slough along with a certain amount of pus, a space, the *abscess-cavity*, is left, the walls of which are lined with new vascular tissue which has itself escaped destruction. This lowly organized material is called *granulation tissue*, and exactly resembles the growth which covers the floor of an ulcer. These granulations eventually fill the contracting cavity and obliterate it by forming interstitial scar-tissue. This is called *healing by second intention*. Pus may accumulate in a normal cavity, such as a joint or bursa, or in the cranial, thoracic or abdominal cavity. In all these situations, if the diagnosis is clear, the principle of treatment is evacuation and drainage. When evacuating an abscess it is often advisable to scrape away the lining of unhealthy granulations and to wash out the cavity with an antiseptic lotion. If the after-drainage of the cavity is thorough the formation of pus ceases and the watery discharge from the abscess wall subsides. As the cavity contracts the discharge becomes less, until at last the drainage tube can be removed and the external wound allowed to heal. The large collections of pus which form in connexion with disease of the spinal column in the cervical, dorsal and lumbar regions are now treated by free evacuation of the tuberculous pus, with careful antiseptic measures. The opening should be in as dependent a position as possible in order that the drainage may be thorough. If tension recurs after opening has been made, as by the blocking of the tube, or by its imperfect position, or by its being too short, there is likely to be a fresh formation of pus, and without delay the whole procedure must be gone through again. (E. O.*)

ABSCISSA (from the Lat. *abscissus*, cut off), in the Cartesian system of co-ordinates, the distance of a point from the axis of y measured parallel to the horizontal axis (axis of x). Thus PS (or OR) is the abscissa of P. The word appears for the first time in a Latin work written by Stefano degli Angeli (1623–1697), a professor of mathematics in Rome. (See Geometry, § *Analytical*.)



ABSCISSION (from Lat. *abscindere*), a tearing away, or cutting off; a term used sometimes in prosody for the elision of a vowel before another, and in surgery especially for abscission of the cornea, or the removal of that portion of the eyeball situated in front of the attachments of the recti muscles; in botany, the separation of spores by elimination of the connexion.

ABSCOND (Lat. *abscondere*, to hide, put away), to depart in a secret manner; in law, to remove from the jurisdiction of the courts or so to conceal oneself as to avoid their jurisdiction. A person may "abscond" either for the purpose of avoiding arrest for a crime (see Arrest), or for a fraudulent purpose, such as the defrauding of his creditors (see Bankruptcy).

ABSENCE (Lat. *absentia*), the fact of being "away," either in body or mind; "absence of mind" being a condition in which the mind is withdrawn from what is passing. The special occasion roll-call at Eton College is called "Absence," which the boys attend in their tall hats. A soldier must get permission or "leave of absence" before he can be away from his regiment. Seven years' absence with no sign of life either by letter or message is held presumptive evidence of death in the law courts.

ABSENTEEISM, a term used primarily of landed proprietors who absent themselves from their estates, and live and spend their incomes elsewhere; in its more extended meaning it includes all those (in addition to landlords) who live out of a country or locality but derive their income from some source within it. Absenteeism is a question which has been much debated, and from both the economic and moral point of view there is little doubt that it has a prejudicial effect. To it has been attributed in a great measure the unprosperous condition of the rural districts of France before the Revolution, when it was unusual for the great nobles to live on their estates unless compelled to do so by a sentence involving their "exile" from Paris. It has also been an especial evil in Ireland, and many attempts were made to combat it. As early as 1727 a tax of four shillings in the pound was imposed on all persons holding offices and employments in Ireland and residing in England. This tax was discontinued in 1753, but was re-imposed in 1769. In 1774 the tax was reduced to two shillings in the pound, but was dropped after some years. It was revived by the Independent Parliament in 1782 and for some ten years brought in a substantial amount to the revenue, yielding in 1790 as much as £63,089.

AUTHORITIES.—For a discussion of absenteeism from the economic point of view see N. W. Senior, *Lectures on the Rate of Wages*, *Political Economy*; J. S. Mill, *Political Economy*; J. R. McCulloch, *Treatises and Essays on Money, &c.*, article "Absenteeism"; A. T. Hadley, *Economics*; on absenteeism in Ireland see A. Young, *Tour in Ireland* (1780); T. Prior, *List of Absentees* (1729); E. Wakefield, *Account of Ireland* (1812); W. E. H. Lecky, *Ireland in the 18th Century* (1892); A. E. Murray, *History of the Commercial and Financial Relations between England and Ireland* (1903); *Parliamentary Papers, Ireland*, 1830, vii., ditto, 1845, xix.-xxii.; in France, A. de Monchrétien, *Traicté de l'œkonomie politique* (1615); A. de Tocqueville, *L'Ancien Régime* (1857); H. Taine, *Les Origines de la France contemporaine, l'ancien Régime* (1876).

ABSINTHE, a liqueur or aromatized spirit, the characteristic flavouring matter of which is derived from various species of wormwood (*Artemisia absinthium*). Among the other substances generally employed in its manufacture are angelica root, sweet flag, dittany leaves, star-anise fruit, fennel and hyssop. A colourless "alcoholate" (see LIQUEURS) is first prepared, and to this the well-known green colour of the beverage is imparted by maceration with green leaves of wormwood, hyssop and mint. Inferior varieties are made by means of essences, the distillation process being omitted. There are two varieties of absinthe, the French and the Swiss, the latter of which is of a higher alcoholic strength than the former. The best absinthe contains 70 to 80% of alcohol. It is said to improve very materially by storage. There is a popular belief to the effect that absinthe is frequently adulterated with copper, indigo or other dye-stuffs (to impart the green colour), but, in fact, this is now very rarely the case. There is some reason to believe that excessive absinthe-drinking leads to effects which are specifically worse than those associated with over-indulgence in other forms of alcohol.

ABSOLUTE (Lat. *absolvere*, to loose, set free), a term having the general signification of independent, self-existent, unconditioned. Thus we speak of "absolute" as opposed to "limited" or "constitutional" monarchy, or, in common parlance, of an "absolute failure," *i.e.* unrelieved by any satisfactory circumstances. In philosophy the word has several technical uses. (1) In Logic, it has been applied to non-connotative terms which do not imply attributes (see CONNOTATION), but more commonly, in opposition to *Relative*, to terms which do not imply the existence of some other (correlative) term; *e.g.* "father" implies "son," "tutor" "pupil," and therefore each of these terms is relative. In fact, however, the distinction is formal, and, though convenient in the terminology of elementary logic, cannot be strictly maintained. The term "man," for example, which, as compared with "father," "son," "tutor," seems to be absolute, is obviously relative in other connexions; in various contexts it implies its various possible opposites, *e.g.* "woman," "boy," "master," "brute." In other words, every term which is susceptible of definition is *ipso facto* relative, for definition is precisely the segregation of the thing defined from all other things which it is not, *i.e.* implies a relation. Every term which has a meaning is, therefore, relative, if only to its contradictory.

(2) The term is used in the phrase "absolute knowledge" to imply knowledge *per se*. It has been held, however, that, since all knowledge implies a knowing subject and a known object, absolute knowledge is a contradiction in terms (see RELATIVITY). So also Herbert Spencer spoke of "absolute ethics," as opposed to systems of conduct based on particular local or temporary laws and conventions (see ETHICS).

(3) By far the most important use of the word is in the phrase "the Absolute" (see METAPHYSICS). It is sufficient here to indicate the problems involved in their most elementary form. The process of knowledge in the sphere of intellect as in that of natural science is one of generalization, *i.e.* the co-ordination of particular facts under general statements, or in other words, the explanation of one fact by another, and that other by a third, and so on. In this way the particular facts or existences are left behind in the search for higher, more inclusive conceptions; as twigs are traced to one branch, and branches to one trunk, so, it is held, all the plurality of sense-given data is absorbed in a unity which is all-inclusive and self-existent, and has no "beyond." By a metaphor this process has been described as the ὁδὸς ἄνω (as of tracing a river to its source). Other phrases from different points of view have been used to describe the idea, *e.g.* First Cause, Vital Principle (in connexion with the origin of life), God (as the author and sum of all being), Unity, Truth (*i.e.* the sum and culmination of all knowledge), *Causa Causans*, &c. The idea in different senses appears both in idealistic and realistic systems of thought.

The theories of the Absolute may be summarized briefly as follows. (1) The Absolute does not exist, and is not even in any real sense thinkable. This view is held by the empiricists, who hold that nothing is knowable save phenomena. The Absolute could not be conceived, for all knowledge is susceptible of definition and, therefore, relative. The Absolute includes the idea of necessity, which the mind cannot cognize. (2) The Absolute exists for thought only. In this theory the absolute is the unknown x which the human mind is logically compelled to postulate *a priori* as the only coherent explanation and justification of its thought. (3) The Absolute exists but is unthinkable, because it is an aid to thought which comes into operation, as it were, as a final explanation beyond which thought cannot go. Its existence is shown by the fact that without it all demonstration would be a mere *circulus in probando* or verbal exercise, because the existence of separate things implies some one thing which includes and explains them. (4) The Absolute both exists and is conceivable. It is argued that we do in fact conceive it in as much as we do conceive Unity, Being, Truth. The conception is so clear that its inexplicability (admitted) is of no account. Further, since the unity of our thought implies the absolute, and since the existence of things is known only to thought, it appears absurd that the absolute itself should be regarded as non-existent. The Absolute is substance in itself, the ultimate basis and matter of existence. All things are merely manifestations of it, exist in virtue of it, but are not identical with it. (5) Metaphysical idealists pursue this line of argument in a different way. For them nothing exists save thought; the only existence that can be predicated of any thing and, therefore, of the Absolute, is that it is thought. Thought creates God, things, the Absolute. (6) Finally, it has been held that we can conceive the Absolute, though our conception is only partial, just as our conception of all things is limited by the imperfect powers of human intellect. Thus the Absolute exists for us only in our thought of it (4 above). But thought itself comes from the Absolute which, being itself the pure thought of thoughts, separates from itself individual minds. It is, therefore, perfectly natural that human thought, being essentially homogeneous with the Absolute, should be able by the consideration of the universe to arrive at some imperfect conception of the source from which all is derived.

The whole controversy is obscured by inevitable difficulties in terminology. The fundamental problem is whether a thing which is by hypothesis infinite can in any sense be defined, and if it is not defined, whether it can be said to be cognized or thought. It would appear to be almost an axiom that anything which by hypothesis transcends the intellect (*i.e.* by including subject and object, knowing and known) is *ipso facto* beyond the limits of the knower. Only an Absolute can cognize an absolute.

ABSOLUTION (Lat. *absolutio* from *absolvo*, loosen, acquit), a term used in civil and ecclesiastical law, denoting the act of setting free or acquitting. In a criminal process it signifies the acquittal of an accused person on the ground that the evidence has either disproved or failed to prove the charge brought against him. In this sense it is now little used, except in Scottish law in the forms *assoilzie* and *absolvitor*. The ecclesiastical use of the word is essentially different from the civil. It refers not to an accusation, but to sin actually committed (after baptism); and it denotes the setting of the sinner free from the guilt of the sin, or from its ecclesiastical penalty (excommunication), or from both. The authority of the church or minister to pronounce absolution is based on John xx. 23; Matt. xviii. 18; James v. 16, &c. In primitive times, when confession of sins was made before the congregation, the absolution was deferred till the penance was completed; and there is no record of the use of any special formula. Men were also encouraged, *e.g.* by Chrysostom, to confess their secret sins secretly to God. In course of time changes grew up. (1) From the 3rd century onwards, secret (auricular) confession before a bishop or priest was practised. For various reasons it became more and more common, until the fourth Lateran council (1215) ordered all Christians of the Roman obedience to make a confession once a year at least. In the Greek church also private confession has become obligatory. (2) In primitive times the penitent was reconciled by imposition of hands by the bishop with or without the clergy: gradually the office was left to be discharged by priests, and the outward action more and more disused. (3) It became the custom to give the absolution to penitents immediately after their confession and before the penance was performed. (4) Until the Middle Ages the form of absolution after private confession was of the nature of a prayer, such as "May the Lord absolve thee"; and this is still the practice of the Greek church. But about the 13th century the Roman formula was altered, and the council of Trent (1551) declared that the "form" and power of the sacrament of penance lay in the words *Ego te absolvo*, &c., and that the accompanying prayers are not essential to it. Of the three forms of absolution in the Anglican Prayer Book, that in the Visitation of the Sick (disused in the church of Ireland by decision of the Synods of 1871 and 1877) runs "I absolve thee," tracing the authority so to act through the church up to Christ: the form in the Communion Service is precative, while that in Morning and Evening Prayer is indicative indeed, but so general as not to imply anything like a judicial decree of absolution. In the Lutheran church also the practice of private confession survived the Reformation, together with both the exhibitive (I forgive, &c.) and declaratory (I declare and pronounce) forms of absolution. In granting absolution, even after general confession, it is in some places still the custom for the minister, where the numbers permit of it, to lay his hands on the head of each penitent. (W. O. B.)

ABSOLUTISM, in aesthetics, a term applied to the theory that beauty is an objective attribute of things, not merely a subjective feeling of pleasure in him who perceives. It follows that there is an absolute standard of the beautiful by which all objects can be judged. The fact that, in practice, the judgments even of connoisseurs are perpetually at variance, and that the so-called criteria of one place or period are more or less opposed to those of all others, is explained away by the hypothesis that individuals are differently gifted in respect of the capacity to appreciate. (See AESTHETICS.)

In political philosophy absolutism, as opposed to constitutional government, is the despotic rule of a sovereign unrestrained by laws and based directly upon force. In the strict sense such governments are rare, but it is customary to apply the term to a state at a relatively backward stage of constitutional development.

ABSORPTION OF LIGHT. The term "absorption" (from Lat. *absorbere*) means literally "sucking up" or "swallowing," and thus a total incorporation in something, literally or figuratively; it is technically used in animal physiology for the function of certain vessels which suck up fluids; and in light and optics *absorption spectrum* and *absorption band* are terms used in the discussion of the transformation of rays in various media.

If a luminous body is surrounded by empty space, the light which it emits suffers no loss of energy as it travels outwards. The intensity of the light diminishes merely because the total energy, though unaltered, is distributed over a wider and wider surface as the rays diverge from the source. To prove this, it will be sufficient to mention that an exceedingly small deficiency in the transparency of the free aether would be sufficient to prevent the light of the fixed stars from reaching the earth, since their distances are so immense. But when light is transmitted through a material medium, it always suffers some loss, the light energy being *absorbed* by the medium, that is, converted partially or wholly into other forms of energy such as heat, a portion of which transformed energy may be re-emitted as radiant energy of a lower frequency. Even the most transparent bodies known absorb an appreciable portion of the light transmitted through them. Thus the atmosphere absorbs a part of the sun's rays, and the greater the distance which the rays have to traverse the greater is the proportion which is absorbed, so that on this account the sun appears less bright towards sunset. On the other hand, light can penetrate some distance into all substances, even the most opaque, the absorption being, however, extremely rapid in the latter case.

The nature of the surface of a body has considerable influence on its power of absorbing light. Platinum black, for instance, in which the metal is in a state of fine division, absorbs nearly all the light incident on it, while polished platinum reflects the greater part. In the former case the light penetrating between the particles is unable to escape by reflexion, and is finally absorbed.

The question of absorption may be considered from either of two points of view. We may treat it as a *superficial* effect, especially in the case of bodies which are opaque enough or thick enough to prevent all transmission of light, and we may investigate how much is reflected at the surface and how much is absorbed; or, on the other hand, we may confine our attention to the light which enters the body and inquire into the relation between the decay of intensity and the depth of penetration. We shall take these two cases separately.

Absorptive Power.—When none of the radiations which fall on a body penetrates through its substance, then the ratio of the amount of radiation of a given wave-length which is absorbed to the total amount received is called the "absorptive power" of the body for that wave-length. Thus if the body absorbed half the incident radiation its absorptive power would be $\frac{1}{2}$, and if it absorbed all the incident radiation its absorptive power would be 1. A body which absorbs all radiations of all wave-lengths would be called a "perfectly black body." No such body actually exists, but such substances as lamp-black and platinum-black approximately fulfil the condition. The fraction of the incident radiation which is not absorbed by a body gives a measure of its *reflecting power*, with which we are not here concerned. Most bodies exhibit a selective action on light, that is to say, they readily absorb light of particular wave-lengths, light of other wave-lengths not being largely absorbed. All bodies when heated emit the same kind of radiations which they absorb—an important principle known as the principle of the equality of radiating and absorbing powers. Thus black substances such as charcoal are very luminous when heated. A tile of white porcelain with a black pattern on it will, if heated red-hot, show the pattern bright on a darker ground. On the other hand, those substances which either are good reflectors or good transmitters, are not so luminous at the same temperature; for instance, melted silver, which reflects well, is not so luminous as carbon at the same temperature, and common salt, which is very transparent for most kinds of radiation, when poured in a fused condition out of a bright red-hot crucible, looks almost like water, showing only a faint red glow for a moment or two. But all such bodies appear to lose their distinctive properties when heated in a vessel which nearly encloses them, for in that case those radiations which they do not emit are either transmitted through them from the walls of the vessel behind, or else reflected from their surface. This fact may be expressed by saying that the radiation within a heated enclosure is the same as that of a perfectly black body.

Coefficient of Absorption, and Law of Absorption.—The law which governs the rate of decay of light intensity in passing through any medium may be readily obtained. If I_0 represents the intensity of the light which enters the surface, I_1 the intensity after passing through 1 centimetre, I_2 the intensity after passing through 2 centimetres, and so on; then we should expect that whatever fraction of I_0 is absorbed in the first centimetre, the same fraction of I_1 will be absorbed in the second. That is, if an amount jI_0 is absorbed in the first centimetre, jI_1 is absorbed in the second, and so on. We have then

$$I_1 = I_0(1-j)$$
$$I_2 = I_1(1-j) = I_0(1-j)^2$$
$$I_3 = I_2(1-j) = I_0(1-j)^3$$

and so on, so that if I is the intensity after passing through a thickness t in centimetres

$$I = I_0(1-j)^t \qquad (1).$$

We might call j, which is the proportion absorbed in one centimetre, the "coefficient of absorption" of the medium. It would, however, not then apply to the case of a body for which the whole light is absorbed in less than one centimetre. It is better then to define the coefficient of absorption as a quantity k such that k/n of the light is absorbed in $1/n$th part of a centimetre, where n may be taken to be a very large number. The formula (1) then becomes

$$I = I_0 e^{-kt} \qquad (2)$$

where e is the base of Napierian logarithms, and k is a constant which is practically the same as j for bodies which do not absorb very rapidly.

There is another coefficient of absorption (κ) which occurs in Helmholtz's theory of dispersion (see DISPERSION). It is closely related to the coefficient k which we have just defined, the equation connecting the two being $k = 4\pi\kappa/\lambda$, λ being the wave-length of the incident light.

The law of absorption expressed by the formula (2) has been verified by experiments for various solids, liquids and gases. The method consists in comparing the intensity after transmission through a layer of known thickness of the absorbent with the intensity of light from the same source which has not passed through the medium, k being thus obtained for various thicknesses and found to be constant. In the case of solutions, if the absorption of the solvent is negligible, the effect of increasing the concentration of the absorbing solute is the same as that of increasing the thickness in the same ratio. In a similar way the absorption of light in the coloured gas chlorine is found to be unaltered if the thickness is reduced by compression, because the density is increased in the same ratio that the thickness is reduced. This is not strictly the case, however, for such gases and vapours as exhibit well-defined bands of absorption in the spectrum, as these bands are altered in character by compression.

If white light is allowed to fall on some coloured solutions, the transmitted light is of one colour when the thickness of the solution is small, and of quite another colour if the thickness is great. This curious phenomenon is known as *dichromatism* (from δι-, two, and χρῶμα, colour). Thus, when a strong light is viewed through a solution of chlorophyll, the light seen is a brilliant green if the thickness is small, but a deep blood-red for thicker layers. This effect can be explained as follows. The solution is moderately transparent for a large number of rays in the neighbourhood of the green part of the spectrum; it is, on the whole, much more opaque for red rays, but is readily penetrated by certain red rays belonging to a narrow region of the spectrum. The small amount of red transmitted is at first quite overpowered by the green, but having a smaller coefficient of absorption, it becomes finally predominant. The effect is complicated, in the case of chlorophyll and many other bodies, by selective reflexion and fluorescence.

For the molecular theory of absorption, see SPECTROSCOPY.

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ABSTEMII (a Latin word, from *abs*, away from, *temetum*, intoxicating liquor, from which is derived the English "abstemious" or temperate), a name formerly given to such persons as could not partake of the cup of the Eucharist on account of their natural aversion to wine. Calvinists allowed these to communicate in the species of bread only, touching the cup with their lip; a course which was deemed a profanation by the Lutherans. Among several Protestant sects, both in Great Britain and America, *abstemii* on a somewhat different principle have appeared in modern times. These are total abstainers, who maintain that the use of stimulants is essentially sinful, and allege that the wine used by Christ and his disciples at the supper was unfermented. They accordingly communicate in the unfermented "juice of the grape."

ABSTINENCE (from Lat. *abstinere*, to abstain), the fact or habit of refraining from anything, but usually from the indulgence of the appetite and especially from strong drink. "Total abstinence" and "total abstainer" are associated with taking the pledge to abstain from alcoholic liquor (see TEMPERANCE). In the discipline of the Christian Church abstinence is the term for a less severe form of Fasting (*q.v.*).

ABSTRACTION (Lat. *abs* and *trahere*), the process or result of drawing away; that which is drawn away, separated or derived. Thus the noun is used for a summary, compendium or epitome of a larger work, the gist of which is given in a concentrated form. Similarly an absent-minded man is said to be "abstracted," as paying no attention to the matter in hand. In philosophy the word has several closely related technical senses. (1) In formal logic it is applied to those terms which denote qualities, attributes, circumstances, as opposed to concrete terms, the names of things; thus "friend" is concrete, "friendship" abstract. The term which expresses the connotation of a word is therefore an abstract term, though it is probably not itself connotative; adjectives are concrete, not abstract, *e.g.* "equal" is concrete, "equality" abstract (cf. Aristotle's *aphaeresis* and *prosthesis*). (2) The process of abstraction takes an important place both in psychological and metaphysical speculation. The psychologist finds among the earliest of his problems the question as to the process from the perception of things seen and heard to mental conceptions, which are ultimately distinct from immediate perception (see PSYCHOLOGY). When the mind, beginning with isolated individuals, groups them together in virtue of perceived resemblances and arrives at a unity in plurality, the process by which attention is diverted from individuals and concentrated on a single inclusive concept (*i.e.* classification) is one of abstraction. All orderly thought and all increase of knowledge depend partly on establishing a clear and accurate connexion between particular things and general ideas, rules and principles. The nature of the resultant concepts belongs to the great controversy between Nominalism, Realism and Conceptualism. Metaphysics, again, is concerned with the ultimate problems of matter and spirit; it endeavours to go behind the phenomena of sense and focus its attention on the fundamental truths which are the only logical bases of natural science. This, again, is a process of abstraction, the attainment of abstract ideas which, apart from the concrete individuals, are conceived as having a substantive existence. The final step in the process is the conception of the Absolute (*q.v.*), which is abstract in the most complete sense.

Abstraction differs from Analysis, inasmuch as its object is to select a particular quality for consideration in itself as it is found in all the objects to which it belongs, whereas analysis considers all the qualities which belong to a single object.

ABSTRACT OF TITLE, in English law, an epitome of the various instruments and events under and in consequence of which the vendor of an estate derives his title thereto. Such an abstract is, upon the sale or mortgage of an estate, prepared by some competent person for the purchaser or mortgagee, and verified by his solicitor by a comparison with the original deeds. (See Conveyancing.)

ABT, FRANZ (1819–1885), German composer, was born on the 22nd of December 1819 at Eilenburg, Saxony, and died at Wiesbaden on the 31st of March 1885. The best of his popular songs have become part of the recognized art-folk-music of Germany; his vocal works, solos, part-songs, &c., enjoyed an extraordinary vogue all over Europe in the middle of the 19th century, but in spite of their facile tunefulness have few qualities of lasting beauty. Abt was kapellmeister at Bernburg in 1841, at Zurich in the same year and at Brunswick from 1852 to 1882, when he retired to Wiesbaden.

ABU, a mountain of Central India, situated in 24° 36′ N. lat. and 72° 43′ E. long., within the Rajputana state of Sirohi. It is an isolated spur of the Aravalli range, being completely detached from that chain by a narrow valley 7 miles across, in which flows the western Banas. It rises from the surrounding plains of Marwar like a precipitous granite island, its various peaks ranging from 4000 to 5653 feet. The elevations and platforms of the mountain are covered with elaborately sculptured shrines, temples and tombs. On the top of the hill is a small round platform containing a cavern, with a block of granite, bearing the impression of the feet of Data-Bhrigu, an incarnation of Vishnu. This is the chief place of pilgrimage for the Jains, Shrawaks and Banians. The two principal temples are situated at Deulwara, about the middle of the mountain, and five miles south-west of Guru Sikra, the highest summit. They are built of white marble, and are pre-eminent alike for their beauty and as typical specimens of Jain architecture in India. The more modern of the two was built by two brothers, rich merchants, between the years 1197 and 1247, and for delicacy of carving and minute beauty of detail stands almost unrivalled, even in this land of patient and lavish labour. The other was built by another merchant prince, Vimala Shah, apparently about A.D. 1032, and, although simpler and bolder in style, is as elaborate as good taste would allow in a purely architectural object. It is one of the oldest as well as one of the most complete examples of Jain architecture known. The principal object within the temple is a cell lighted only from the door, containing a cross-legged seated figure of the god Parswanath. The portico is composed of forty-eight pillars, the whole enclosed in an oblong courtyard about 140 feet by 90 feet, surrounded by a double colonnade of smaller pillars, forming porticos to a range of fifty-five cells, which enclose it on all sides, exactly as they do in a Buddhist monastery (*vihāra*). In this temple, however, each cell, instead of being the residence of a monk, is occupied by an image of Parswanath, and over the door, or on the jambs of each, are sculptured scenes from the life of the deity. The whole interior is magnificently ornamented.

Abu is now the summer residence of the governor-general's agent for Rajputana, and a place of resort for Europeans in the hot weather. It is 16 miles from the Abu road station of the Rajputana railway. The annual mean temperature is about 70°, rising to 90° in April; but the heat is never oppressive. The annual rainfall is about 68 inches. The hills are laid out with driving-roads and bridle-paths, and there is a beautiful little lake. The chief buildings are a church, club, hospital and a Lawrence asylum school for the children of British soldiers.

ABU-BEKR (573–634), the name ("Father of the virgin") of the first of the Mahommedan caliphs (see Caliph). He was originally called Abd-el-Ka'ba ("servant of the temple"), and received the name by which he is known historically in consequence of the marriage of his virgin daughter Ayesha to Mahomet. He was born at Mecca in the year A.D. 573, a Koreishite of the tribe of Beni-Taim. Possessed of immense wealth, which he had himself acquired in commerce, and held in high esteem as a judge, an interpreter of dreams and a depositary of the traditions of his race, his early accession to Islamism was a fact of great importance. On his conversion he assumed the name of Abd-Alla (*servant of God*). His own belief in Mahomet and his doctrines was so thorough as to procure for him the title El Siddik (*the faithful*), and his success in gaining converts was correspondingly great. In his personal relationship to the prophet he showed the deepest veneration and most unswerving devotion. When Mahomet fled from Mecca, Abu-Bekr was his sole companion, and shared both his hardships and his triumphs, remaining constantly with him until the day of his death. During his last illness the prophet indicated Abu-Bekr as his successor by desiring him to offer up prayer for the people. The choice was ratified by the chiefs of the army, and ultimately confirmed, though Ali, Mahomet's son-in-law, disputed it, asserting his own title to the dignity. After a time Ali submitted, but the difference of opinion as to his claims gave rise to the controversy which still divides the followers of the prophet into the rival factions of Sunnites and Shiites. Abu-Bekr had scarcely assumed his new position (632), under the title Califet-Resul-Allah (*successor of the prophet of God*), when he was called to suppress the revolt of the tribes Hejaz and Nejd, of which the former rejected Islamism and the latter refused to pay tribute. He encountered formidable opposition from different quarters, but in every case he was successful, the severest struggle being that with the impostor Mosailima, who was finally defeated by Khalid at the battle of Akraba. Abu-Bekr's zeal for the spread of the new faith was as conspicuous as that of its founder had been. When the internal disorders had been repressed and Arabia completely subdued, he directed his generals to foreign conquest. The Irak of Persia was overcome by Khalid in a single campaign, and there was also a successful expedition into Syria. After the hard-won victory over Mosailima, Omar, fearing that the sayings of the prophet would be entirely forgotten when those who had listened to them had all been removed by death, induced Abu-Bekr to see to their preservation in a written form. The record, when completed, was deposited with Hafsa, daughter of Omar, and one of the wives of Mahomet. It was held in great reverence by all Moslems, though it did not possess canonical authority, and furnished most of the materials out of which the Koran, as it now exists, was prepared. When the authoritative version was completed all copies of Hafsa's record were destroyed, in order to prevent possible disputes and divisions. Abu-Bekr died on the 23rd of August 634. Shortly before his death, which one tradition ascribes to poison, another to natural causes, he indicated Omar as his successor, after the manner Mahomet had observed in his own case.

ABU HAMED, a town of the Anglo-Egyptian Sudan on the right bank of the Nile, 345 m. by rail N. of Khartum. It stands at the centre of the great S-shaped bend of the Nile, and from it the railway to Wadi Halfa strikes straight across the Nubian desert, a little west of the old caravan route to Korosko. A branch railway, 138 m. long, from Abu Hamed goes down the right bank of the Nile to Kareima in the Dongola mudiria. The town is named after a celebrated sheikh buried here, by whose tomb travellers crossing the desert used formerly to deposit all superfluous goods, the sanctity of the saint's tomb ensuring their safety.

ABŪ ḤANĪFA AN-NUʿMĀN IBN THĀBIT, Mahommedan canon lawyer, was born at Kufa in A.H. 80 (A.D. 699) of non-Arab and probably Persian parentage. Few events of his life are known to us with any certainty. He was a silk-dealer and a man of considerable means, so that he was able to give his time to legal studies. He lectured at Kufa upon canon law (*fiqh*) and was a consulting lawyer (*muftī*), but refused steadily to take any public post. When al-Manṣūr, however, was building Bagdad (145–149) Abū Ḥanīfa was one of the four overseers whom he appointed over the craftsmen (G. Le Strange, *Baghdad during the Abbasid Caliphate*, p. 17). In A.H. 150 (A.D. 767) he died there under circumstances which are very differently reported. A persistent but apparently later tradition asserts that he died in prison after severe beating, because he refused to obey al-Manṣūr's command to act as a judge (cadi, *qādī*). This was to avoid a responsibility for which he felt unfit—a frequent attitude of more pious Moslems. Others say that al-Mahdī, son of al-Manṣūr, actually constrained him to be a judge and that he died a few days after. It seems certain that he did suffer imprisonment and beating for this reason, at the hands of an earlier governor of Kūfa under the Omayyads (Ibn Qutaiba, *Ma'ārif*, p. 248). Also that al-Manṣūr desired to make him judge, but compromised upon his inspectorship of buildings (so in Tabarī). A late story is that the judgeship was only a pretext with al-Manṣūr, who considered him a partisan of the 'Alids and a helper with his wealth of Ibrāhīm ibn 'Abd Allāh in his insurrection at Kufa in 145 (Weil, *Geschichte*, ii. 53 ff.).

For many personal anecdotes see de Slane's transl. of Ibn Khallikan iii. 555 ff., iv. 272 ff. For his place as a speculative jurist in the history of canon law, see MAHOMMEDAN LAW. He was buried in eastern Bagdad, where his tomb still exists, one of the few surviving sites from the time of al-Manṣūr, the founder. (Le Strange 191 ff.)

See C. Brockelmann, *Geschichte*, i. 169 ff.; Nawawi's *Biogr. Dict.* pp. 698-770; Ibn Hajar al-Haitami's *Biography*, publ. Cairo, A.H. 1304; legal bibliography under MAHOMMEDAN LAW. (D. B. MA.)

ABU KLEA, a halting-place for caravans in the Bayuda Desert, Anglo-Egyptian Sudan. It is on the road from Merawi to Metemma and 20 m. N. of the Nile at the last-mentioned place. Near this spot, on the 17th of January 1885, a British force marching to the relief of General Gordon at Khartum was attacked by the Mahdists, who were repulsed. On the 19th, when the British force was nearer Metemma, the Mahdists renewed the attack, again unsuccessfully. Sir Herbert Stewart, the commander of the British force, was mortally wounded on the 19th, and among the killed on the 17th was Col. F. G. Burnaby (see EGYPT, *Military Operations*).

ABŪ-L-'ALĀ UL-MA'ARRĪ [Abū-l-'Alā Aḥmad ibn 'Abdallāh ibn Sulaimān] (973–1057), Arabian poet and letter-writer, belonged to the South Arabian tribe Tanukh, a part of which had migrated to Syria before the time of Islam. He was born in 973 at Ma'arrat un-Nu'mān, a Syrian town nineteen hours' journey south of Aleppo, to the governor of which it was subject at that time. He lost his father while he was still an infant, and at the age of four lost his eyesight owing to smallpox. This, however, did not prevent him from attending the lectures of the best teachers at Aleppo, Antioch and Tripoli. These teachers were men of the first rank, who had been attracted to the court of Saif-ud-Daula, and their teaching was well stored in the remarkable memory of the pupil. At the age of twenty-one Abū-l-'Alā returned to Ma'arra, where he received a pension of thirty dinars yearly. In 1007 he visited Bagdad, where he was admitted to the literary circles, recited in the salons, academies and mosques, and made the acquaintance of men to whom he addressed some of his letters later. In 1009 he returned to Ma'arra, where he spent the rest of his life in teaching and writing. During this period of scholarly quiet he developed his characteristic advanced views on vegetarianism, cremation of the dead and the desire for extinction after death.

Of his works the chief are two collections of his poetry and two of his letters. The earlier poems up to 1029 are of the kind usual at the time. Under the title of *Saqt uz-Zand* they have been published in Bulaq (1869), Beirūt (1884) and Cairo (1886). The poems of the second collection, known as the *Luzūm ma lam yalzam*, or the *Luzūmiyyāt*, are written with the difficult rhyme in two consonants instead of one, and contain the more original, mature and somewhat pessimistic thoughts of the author on mutability, virtue, death, &c. They have been published in Bombay (1886) and Cairo (1889). The letters on various literary and social subjects were published with commentary by Shain Effendi in Beirut (1894), and with English translation, &c., by Prof. D. S. Margoliouth in Oxford (1898). A second collection of letters, known as the *Risālat ul-Ghufrān*, was summarized and partially translated by R. A. Nicholson in the *Journal of the Royal Asiatic Society* (1900, pp. 637 ff.; 1902, pp. 75 ff., 337 ff., 813 ff.).

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ABŪ-L-'ATĀHIYA [Abū Isḥāq Ismā'īl ibn Qāsim al-'Anazī] (748–828), Arabian poet, was born at 'Ain ut-Tamar in the Hijāz near Medina. His ancestors were of the tribe of 'Anaza. His youth was spent in Kufa, where he was engaged for some time in selling pottery. Removing to Bagdad, he continued his business there, but became famous for his verses, especially for those addressed to 'Utba, a slave of the caliph al-Mahdī. His affection was unrequited, although al-Mahdī, and after him Harūn al-Rashīd, interceded for him. Having offended the caliph, he was in prison for a short time. The latter part of his life was more ascetic. He died in 828 in the reign of al-Ma'mūn. The poetry of Abū-l-'Atāhiya is notable for its avoidance of the artificiality almost universal in his days. The older poetry of the desert had been constantly imitated up to this time, although it was not natural to town life. Abū-l-'Atāhiya was one of the first to drop the old *qasīda* (elegy) form. He was very fluent and used many metres. He is also regarded as one of the earliest philosophic poets of the Arabs. Much of his poetry is concerned with the observation of common life and morality, and at times is pessimistic. Naturally, under the circumstances, he was strongly suspected of heresy.

His poems (*Diwān*) with life from Arabian sources have been published at the Jesuit Press in Beirūt (1887, 2nd ed. 1888). On his position in Arabic literature see W. Ahlwardt, *Diwān des Abu Nowas* (Greifswald, 1861), pp. 21 ff.; A. von Kremer, *Culturgeschichte des Orients* (Wien, 1877), vol. ii. pp. 372 ff. (G. W. T.)

ABULFARAJ [Abū-l-Faraj 'Alī ibn ul-Ḥuṣain ul-Isbahānī] (897–967), Arabian scholar, was a member of the tribe of the Quraish (Koreish) and a direct descendant of Marwān, the last of the Omayyad caliphs. He was thus connected with the Omayyad rulers in Spain, and seems to have kept up a correspondence with them and to have sent them some of his works. He was born in Ispahān, but spent his youth and made his early studies in Bagdad. He became famous for his knowledge of early Arabian antiquities. His later life was spent in various parts of the Moslem world, in Aleppo with Saif-ud-Daula (to whom he dedicated the *Book of Songs*), in Rai with the Buyid vizier Ibn 'Abbād and elsewhere. In his last years he lost his reason. In religion he was a Shiite. Although he wrote poetry, also an anthology of verses on the monasteries of Mesopotamia and Egypt, and a genealogical work, his fame rests upon his *Book of Songs* (*Kitāb ul-Aghānī*), which gives an account of the chief Arabian songs, ancient and modern, with the stories of the composers and singers. It contains a mass of information as to the life and customs of the early Arabs, and is the most valuable authority we have for their pre-Islamic and early Moslem days. A part of it was published by J. G. L. Kosegarten with Latin translation (Greifswald, 1840). The text was published in 20 vols. at Bulaq in 1868. Vol. xxi. was edited by R. E. Brünnow (Leyden, 1888). A volume of elaborate indices was edited by I. Guidi (Leyden, 1900), and a missing fragment of the text was published by J. Wellhausen in the *Zeitschrift der deutschen morgenländischen Gesellschaft*, vol. 50, pp. 146 ff.

For his life see M'G. de Slane's translation of Ibn Khallikan's *Biographical Dictionary*, vol. ii. pp. 249 ff. (G. W. T.)

ABUL FAZL, wazir and historiographer of the great Mogul emperor, Akbar, was born in the year A.D. 1551. His career as a minister of state, brilliant though it was, would probably have been by this time forgotten but for the record he himself has left of it in his celebrated history. The *Akbar Nameh*, or *Book of Akbar*, as Abul Fazl's chief literary work, written in Persian, is called, consists of two parts—the first being a complete history of Akbar's reign and the second, entitled *Ain-i-Akbari*, or *Institutes of Akbar*, being an account of the religious and political constitution and administration of the empire. The style is singularly elegant, and the contents of the second part possess a unique and lasting interest. An excellent translation of the *Ain* by Francis Gladwin was published in Calcutta, 1783–1786. It was reprinted in London very inaccurately, and copies of the original edition are now exceedingly rare and correspondingly valuable. It was also translated by Professor Blockmann in 1848. Abul Fazl died by the hand of an assassin, while returning from a mission to the Deccan in 1602. The murderer was instigated by Prince Selim, afterwards Jahangir, who had become jealous of the minister's influence.

ABULFEDA [Abū-l-Fidā' Ismā'īl ibn 'Alī 'Imād-ud-Dnī] (1273–1331), Arabian historian and geographer, was born at Damascus, whither his father Malik ul-Afdal, brother of the prince of Hamah, had fled from the Mongols. He was a descendant of Ayyūb, the father of Saladin. In his boyhood he devoted himself to the study of the Koran and the sciences, but from his twelfth year was almost constantly engaged in military expeditions, chiefly against the crusaders. In 1285 he was present at the assault of a stronghold of the knights of St John, and he took part in the sieges of Tripoli, Acre and Qal'at ar-Rūm. In 1298 he entered the service of the Mameluke Sultan Malik al-Nāṣir and after twelve years was invested by him with the governorship of Hamah. In 1312 he became prince with the title Malik us-Sālih, and in 1320 received the hereditary rank of sultan with the title Malik ul-Mu'ayyad. For more than twenty years altogether he reigned in tranquillity and splendour, devoting himself to the duties of government and to the composition of the works to which he is chiefly indebted for his fame. He was a munificent patron of men of letters, who came in large numbers to his court. He died in 1331. His chief historical work in *An Abridgment of the History of the Human Race*, in the form of annals extending from the creation of the world to the year 1329 (Constantinople, 2 vols. 1869). Various translations of parts of it exist, the earliest being a Latin rendering of the section relating to the Arabian conquests in Sicily, by Dobelius, Arabic professor at Palermo, in 1610 (preserved in Muratori's *Rerum Italicarum Scriptores*, vol. i.). The section dealing with the pre-Islamitic period was edited with Latin translation by H. O. Fleischer under the title *Abulfedae Historia Ante-Islamica* (Leipzig, 1831). The part dealing with the Mahommedan period was edited, also with Latin translation, by J. J. Reiske as *Annales Muslemici* (5 vols., Copenhagen, 1789–1794). His *Geography* is, like much of the history, founded on the works of his predecessors, and so ultimately on the work of Ptolemy. A long introduction on various geographical matters is followed by twenty-eight sections dealing in tabular form with the chief towns of the world. After each name are given the longitude, latitude, "climate," spelling, and then observations generally taken from earlier authors. Parts of the work were published and translated as early as 1650 (cf. Carl Brockelmann's *Geschichte der Arabischen Litteratur*, Berlin, 1902, vol. ii. pp. 44-46). The text of the whole was published by M'G. de Slane and M. Reinaud (Paris, 1840), and a French translation with introduction by M. Reinaud and Stanislas Guyard (Paris, 1848–1883). (G. W. T.)

ABŪ-L-QĀSIM [Khalaf ibn 'Abbās uz-Zahrāwi], Arabian physician and surgeon, generally known in Europe as ABULCASIS, flourished in the tenth century at Cordova as physician to the caliph 'Abdur-Rahmān III. (912–961). No details of his life are known. A part of his compendium of medicine was published in Latin in the 16th century as *Liber theoricae nec non practicae Alsaharavii* (Augsburg, 1519). His manual of surgery was published at Venice in 1497, at Basel in 1541, and at Oxford *Abulcasis de Chirurgia arabice et latine cura Johannis Channing* (2 vols. 1778).

For his other works see Carl Brockelmann, *Geschichte der arabischen Litteratur* (Weimar, 1898), vol. i. pp. 239-240. (G. W. T.)

ABUNDANTIA ("Abundance"), a Roman goddess, the personification of prosperity and good fortune. Modelled after the Greek Demeter, she is practically identical with Copia, Annona and similar goddesses. On the coins of the later Roman emperors she is frequently represented holding a cornucopia, from which she shakes her gifts, thereby at the same time indicating the liberality of the emperor or empress. She may be compared with Domina Abundia (Old Fr. *Dame Habonde*, *Notre Dame d'Abondance*), whose name often occurs in poems of the Middle Ages, a beneficent fairy, who brought plenty to those whom she visited (Grimm, *Teutonic Mythology*, tr. 1880, i. 286-287).

ABŪ NUWĀS [Abū 'Alī Hal-asan ibn Hāni'al-Ḥakamī] (*c.* 756–810), known as Abū Nuwās, Arabian poet, was born in al-Ahwāz, probably about 756. His mother was a Persian, his father a soldier, a native of Damascus. His studies were made in Baṣra under Abū Zaid and Abū 'Ubaida (*q.v.*), and in Kufa under Khalaf al-Aḥmar. He is also said to have spent a year with the Arabs in the desert to gain purity of language. Settling in Bagdad he enjoyed the favour of Harūn al-Rashīd and al-Amīn, and died there probably about 810. The greater part of his life was characterized by great licentiousness and disregard of religion, but in his later days he became ascetic. Abū Nuwās is recognized as the greatest poet of his time. His mastery of language has led to extensive quotation of his verses by Arabian scholars. Genial, cynical, immoral, he drew on all the varied life of his time for the material of his poems. In his wine-songs especially the manners of the upper classes of Bagdad are revealed. He was one of the first to ridicule the set form of the *qasīda* (elegy) as unnatural, and has satirized this form in several poems. See I. Goldziher, *Abhandlungen zur Arabischen Philologie* (Leyden, 1896), i. pp. 145 ff. His poems were collected by several Arabian editors. One such collection (the MS. of which is now in Vienna) contains nearly 5000 verses grouped under the ten headings: wine, hunting, praise, satire, love of youths, love of women, obscenities, blame, elegies, renunciation of the world. His collected poems (*Diwān*) have been published in Cairo (1860) and in Beirūt (1884). The wine-songs were edited by W. Ahlwardt under the title *Diwān des Abu Nowas. 1. Die Weinlieder* (Greifswald, 1861). (G. W. T.)

ABU SIMBEL, or IPSAMBUL, the name of a group of temples of Rameses II. (*c.* 1250 B.C.) in Nubia, on the left bank of the Nile, 56 m. by river S. of Korosko. They are hewn in the cliffs at the riverside, at a point where the sandstone hills on the west reach the Nile and form the southern boundary of a wider portion of the generally barren valley. The temples are three in number. The principal temple, probably the greatest and most imposing of all rock-hewn monuments, was discovered by Burckhardt in 1812 and opened by Belzoni in 1817. (The front has been cleared several times, most recently in 1892, but the sand is always pressing forward from the north end.) The hillside was recessed to form the façade, backed against which four immense seated colossi of the king, in pairs on either side of the entrance, rise from a platform or forecourt reached from the river by a flight of steps. The colossi are no less than 65 ft. in height, of nobly placid design, and are accompanied by smaller figures of Rameses' queen and their sons and daughters; behind and over them is the cornice, with the dedication below in a line of huge hieroglyphs, and a long row of apes, standing in adoration of the rising sun above. The temple is dedicated primarily to the solar gods Amenrē of Thebes and Raharakht of Heliopolis, the true sun god; it is oriented to the east so that the rays of the sun in the early morning penetrate the whole length of two great halls to the innermost sanctuary and fall upon the central figures of Amenrē and Rameses, which are there enthroned with Ptah of Memphis and Raharakht on either side. The interior of the temple is decorated with coloured sculpture of fine workmanship and in good preservation; the scenes are more than usually interesting; some are of religious import (amongst them Rameses as king making offerings to himself as god), others illustrate war in Syria, Libya and Ethiopia: another series depicts the events of the famous battle with the Hittites and their allies at Kadesh, in which Rameses saved the Egyptian camp and army by his personal valour. Historical stelae of the same reign are engraved inside and outside the temple; the most interesting is that recording the marriage with a Hittite princess in the 34th year. Not the least important feature of the temple belongs to a later age, when some Greek, Carian and Phoenician soldiers of one of the kings named Psammetichus (apparently Psammetichus II., 594–589 B.C.) inscribed their names upon the two southern colossi, doubtless the only ones then clear of sand. These graffiti are of the highest value for the early history of the alphabet, and as proving the presence of Greek mercenaries in the Egyptian armies of the period. The upper part of the second colossus (from the south) has fallen; the third was repaired by Sethos II. not many years after the completion of the temple. This great temple was wholly rock-cut, and is now threatened by gradual ruin by sliding on the planes of stratification. A small temple, immediately to the south of the first, is believed to have had a built antechamber: it is the earliest known example of a "birth chapel," such as was usually attached to Ptolemaic temples for the accommodation of the divine mother-consort and her son. The third and northernmost temple, separated from the others by a ravine, is on a large scale; the colossi of the façade are six in number and 33 ft. high, representing Rameses and his queen Nefrēre, who dedicated the temple to the goddess Hathōr. The whole group forms a singular monument of Rameses' unbounded pride and self-glorification.

See EGYPT; J. H. Breasted, *Ancient Records, Egypt*, vol. iii. pp. 124 et seq., esp. 212; "The Temples of Lower Nubia," in the *American Journal of Semitic Languages and Literatures*, October 1906. (F. LL. G.)

ABŪ TAMMĀM [Ḥabīb ibn Aus] (807–846), Arabian poet, was, like Buḥturī, of the tribe of Ṭāi (though some say he was the son of a Christian apothecary named Thaddeus, and that his genealogy was forged). He was born in Jāsim (Josem), a place to the north-east of the Sea of Tiberias or near Manbij (Hierapolis). He seems to have spent his youth in Homs, though, according to one story, he was employed during his boyhood in selling water in a mosque in Cairo. His first appearance as a poet was in Egypt, but as he failed to make a living there he went to Damascus and thence to Mosul. From this place he made a visit to the governor of Armenia, who awarded him richly. After 833 he lived mostly in Bagdad, at the court of the caliph Moʻtasim. From Bagdad he visited Khorassan, where he enjoyed the favour of ʻAbdallah ibn Ṭāhir. About 845 he was in Maʻarrat un-Nuʻmān, where he met Buḥturī. He died in Mosul. Abu Tammām is best known in literature as the compiler of the collection of early poems known as the *Hamāsa* (*q.v.*). Two other collections of a similar nature are ascribed to him. His own poems have been somewhat neglected owing to the success of his compilations, but they enjoyed great repute in his lifetime, and were distinguished for the purity of their style, the merit of the verse and the excellent manner of treating subjects. His poems (*Diwān*) were published in Cairo (A.D. 1875).

See Life in Ibn Khallikan's *Biographical Dictionary*, trans. by M'G. de Slane (Paris and London, 1842), vol. i. pp. 348 ff.; and in the *Kitāb ul-Aghāni* (Book of Songs) of Abulfaraj (Bulaq, 1869), vol. xv. pp. 100-108. (G. W. T.)

ABUTILON (from the Arabic *aubūtīlūn*, a name given by Avicenna to this or an allied genus), in botany, a genus of plants, natural order Malvaceae (Mallows), containing about eighty species, and widely distributed in the tropics. They are free-growing shrubs with showy bell-shaped flowers, and are favourite greenhouse plants. They may be grown outside in England during the summer months, but a few degrees of frost is fatal to them. They are readily propagated from cuttings taken in the spring or at the end of the summer. A large number of horticultural varieties have been developed by hybridization, some of which have a variegated foliage.

ABUTMENT, a construction in stone or brickwork designed to receive and resist the lateral pressure of an arch, vault or strut. When built outside a wall it is termed a buttress.

ABŪ UBAIDA [Maʻmar ibn ul-Muthanna] (728–825), Arabian scholar, was born a slave of Jewish Persian parents in Baṣra, and in his youth was a pupil of Abūʻ Amr ibn ul-ʻAlā. In 803 he was called to Bagdad by Harūn al-Rashīd. He died in Baṣra. He was one of the most learned and authoritative scholars of his time in all matters pertaining to the Arabic language, antiquities and stories, and is constantly cited by later authors and compilers. Jāhiz held him to be the most learned scholar in all branches of human knowledge, and Ibn Hishām accepted his interpretation even of passages in the Koran. The titles of 105 of his works are mentioned in the *Fihrist*, and his *Book of Days* is the basis of parts of the history of Ibn al-Athīr and of the *Book of Songs* (see ABULFARAJ), but nothing of his (except a song) seems to exist now in an independent form. He is often described as a Kharijite. This, however, is true only in so far as he denied the privileged position of the Arab people before God. He was, however, a strong supporter of the Shuʻūbite movement, *i.e.* the movement which protested against the idea of the superiority of the Arab race over all others. This is especially seen in his satires on Arabs (which made him so hated that no man followed his bier when he died). He delighted in showing that words, fables, customs, &c., which the Arabs believed to be peculiarly their own, were derived from the Persians. In these matters he was the great rival of Asmaʻī (*q.v.*).

See *Life* in Ibn Khallikān's *Biographical Dictionary*, trans. by M'G. de Slane (Paris and London, 1842), vol. iii. pp. 388-398; also I. Goldziher's *Muhammedanische Studien* (Halle, 1888), vol. i. pp. 194-206. (G. W. T.)

ABYDOS, an ancient city of Mysia, in Asia Minor, situated at Nagara Point on the Hellespont, which is here scarcely a mile broad. It probably was originally a Thracian town, but was afterwards colonized by Milesians. Here Xerxes crossed the strait on his bridge of boats when he invaded Greece. Abydos is celebrated for the vigorous resistance it made against Philip V. of Macedon (200 B.C.), and is famed in story for the loves of Hero and Leander. The town remained till late Byzantine times the toll station of the Hellespont, its importance being transferred to the Dardanelles (*q.v.*), after the building of the "Old Castles" by Sultan Mahommed II. (*c.* 1456).

See Choiseul-Gouffier, *Voyage dans l'empire ottoman* (Paris, 1842).

ABYDOS, one of the most ancient cities of Upper Egypt, about 7 m. W. of the Nile in lat. 26° 10′ N. The Egyptian name was *Abdu*, "the hill of the symbol or reliquary," in which the sacred head of Osiris was preserved. Thence the Greeks named it Abydos, like the city on the Hellespont; the modern Arabic name is *Arabet el Madfuneh*. The history of the city begins in the late prehistoric age, it having been founded by the pre-Menite kings (Petrie, *Abydos*, ii. 64), whose town, temple and tombs have been found there. The kings of the Ist dynasty, and some of the IInd dynasty, were also buried here, and the temple was renewed and enlarged by them. Great forts were built on the desert behind the town by three kings of the IInd dynasty. The temple and town continued to be rebuilt at intervals down to the times of the XXXth dynasty, and the cemetery was used continuously. In the XIIth dynasty a gigantic tomb was cut in the rock by Senwosri (or Senusert) III. Seti I. in the XIXth dynasty founded a great new temple to the south of the town in honour of the ancestral kings of the early dynasties; this was finished by Rameses (or Ramessu) II., who also built a lesser temple of his own. Mineptah (Merenptah) added a great Hypogeum of Osiris to the temple of Seti. The latest building was a new temple of Nekhtnebf in the XXXth dynasty. From the Ptolemaic times the place continued to decay and no later works are known (Petrie, *Abydos*, i. and ii.).

The worship here was of the jackal god Upuaut (Ophoïs, Wepwoi), who "opened the way" to the realm of the dead, increasing from the Ist dynasty to the time of the XIIth dynasty and then disappearing after the XVIIIth. Anher appears in the XIth dynasty; and Khentamenti, the god of the western Hades, rises to importance in the middle kingdom and then vanishes in the XVIIIth. The worship here of Osiris in his various forms begins in the XIIth dynasty and becomes more important in later times, so that at last the whole place was considered as sacred to him (*Abydos*, ii. 47).

The temples successively built here on one site were nine or ten in number, from the Ist dynasty, 5500 B.C. to the XXVIth dynasty, 500 B.C. The first was an enclosure, about 30 × 50 ft., surrounded by a thin wall of unbaked bricks. Covering one wall of this came the second temple of about 40 ft. square in a wall about 10 ft. thick. An outer *temenos* (enclosure) wall surrounded the ground. This outer wall was thickened about the IInd or

IIIrd dynasty. The old temple entirely vanished in the IVth dynasty, and a smaller building was erected behind it, enclosing a wide hearth of black ashes. Pottery models of offerings are found in the ashes, and these were probably the substitutes for sacrifices decreed by Cheops (Khufu) in his temple reforms. A great clearance of temple offerings was made now, or earlier, and a chamber full of them has yielded the fine ivory carvings and the glazed figures and tiles which show the splendid work of the Ist dynasty. A vase of Menes with purple inlaid hieroglyphs in green glaze and the tiles with relief figures are the most important pieces. The noble statuette of Cheops in ivory, found in the stone chamber of the temple, gives the only portrait of this greatest ruler. The temple was rebuilt entirely on a larger scale by Pepi I. in the VIth dynasty. He placed a great stone gateway to the temenos, an outer temenos wall and gateway, with a colonnade between the gates. His temple was about 40×50 ft. inside, with stone gateways front and back, showing that it was of the processional type. In the XIth dynasty Menthotp (Mentuhotep) III. added a colonnade and altars. Soon after, Sankhkerē entirely rebuilt the temple, laying a stone pavement over the area, about 45 ft. square, besides subsidiary chambers. Soon after Senwosri (Senusert) I. in the XIIth dynasty laid massive foundations of stone over the pavement of his predecessor. A great temenos was laid out enclosing a much larger area, and the temple itself was about three times the earlier size.

The XVIIIth dynasty began with a large chapel of Amasis (Ahmosi, Aahmes) I., and then Tethmosis (Thothmes, Tahutmes) III. built a far larger temple, about 130×200 ft. He made also a processional way past the side of the temple to the cemetery beyond, with a great gateway of granite. Rameses III. added a large building; and Amasis II. in the XXVIth dynasty rebuilt the temple again, and placed in it a large monolith shrine of red granite, finely wrought. The foundations of the successive temples were comprised within about 18 ft. depth of ruins; these needed the closest examination to discriminate the various buildings, and were recorded by over 4000 measurements and 1000 levellings (Petrie, *Abydos*, ii.).

The temple of Seti I. was built on entirely new ground half a mile to the south of the long series of temples just described. This is the building best known as the Great Temple of Abydos, being nearly complete and an impressive sight. A principal object of it was the adoration of the early kings, whose cemetery, to which it forms a great funerary chapel, lies behind it. The long list of the kings of the principal dynasties carved on a wall is known as the "Table of Abydos." There were also seven chapels for the worship of the king and principal gods. At the back were large chambers connected with the Osiris worship (Caulfield, *Temple of the Kings*); and probably from these led out the great Hypogeum for the celebration of the Osiris mysteries, built by Mineptah (Murray, *Osireion*). The temple was originally 550 ft. long, but the forecourts are scarcely recognizable, and the part in good state is about 250 ft. long and 350 ft. wide, including the wing at the side. Excepting the list of kings and a panegyric on Rameses II., the subjects are not historical but mythological. The work is celebrated for its delicacy and refinement, but lacks the life and character of that in earlier ages. The sculptures have been mostly published in hand copy, not facsimile, by Mariette in his *Abydos*, i. The adjacent temple of Rameses II. was much smaller and simpler in plan; but it had a fine historical series of scenes around the outside, of which the lower parts remain. A list of kings, similar to that of Seti, formerly stood here, but the fragments were removed by the French consul and sold to the British Museum.

The Royal Tombs of the earliest dynasties were placed about a mile back on the great desert plain. The earliest is about 20×10 ft. inside, a pit lined with brick walls, and originally roofed with timber and matting. Others also before Menes are 15×25 ft. The tomb probably of Menes is of the latter size. After this the tombs increase in size and complexity. The tomb-pit is surrounded by chambers to hold the offerings, the actual sepulchre being a great wooden chamber in the midst of the brick-lined pit. Rows of small tomb-pits for the servants of the king surround the royal chamber, many dozens of such burials being usual. By the end of the IInd dynasty the type changed to a long passage bordered with chambers on either hand, the royal burial being in the middle of the length. The greatest of these tombs with its dependencies covered a space of over 3000 square yards. The contents of the tombs have been nearly destroyed by successive plunderers; enough remained to show that rich jewellery was placed on the mummies, a profusion of vases of hard and valuable stones from the royal table service stood about the body, the store-rooms were filled with great jars of wine, perfumed ointment and other supplies, and tablets of ivory and of ebony were engraved with a record of the yearly annals of the reigns. The sealings of the various officials, of which over 200 varieties have been found, give an insight into the public arrangements (Petrie, *Royal Tombs*, i. and ii.).

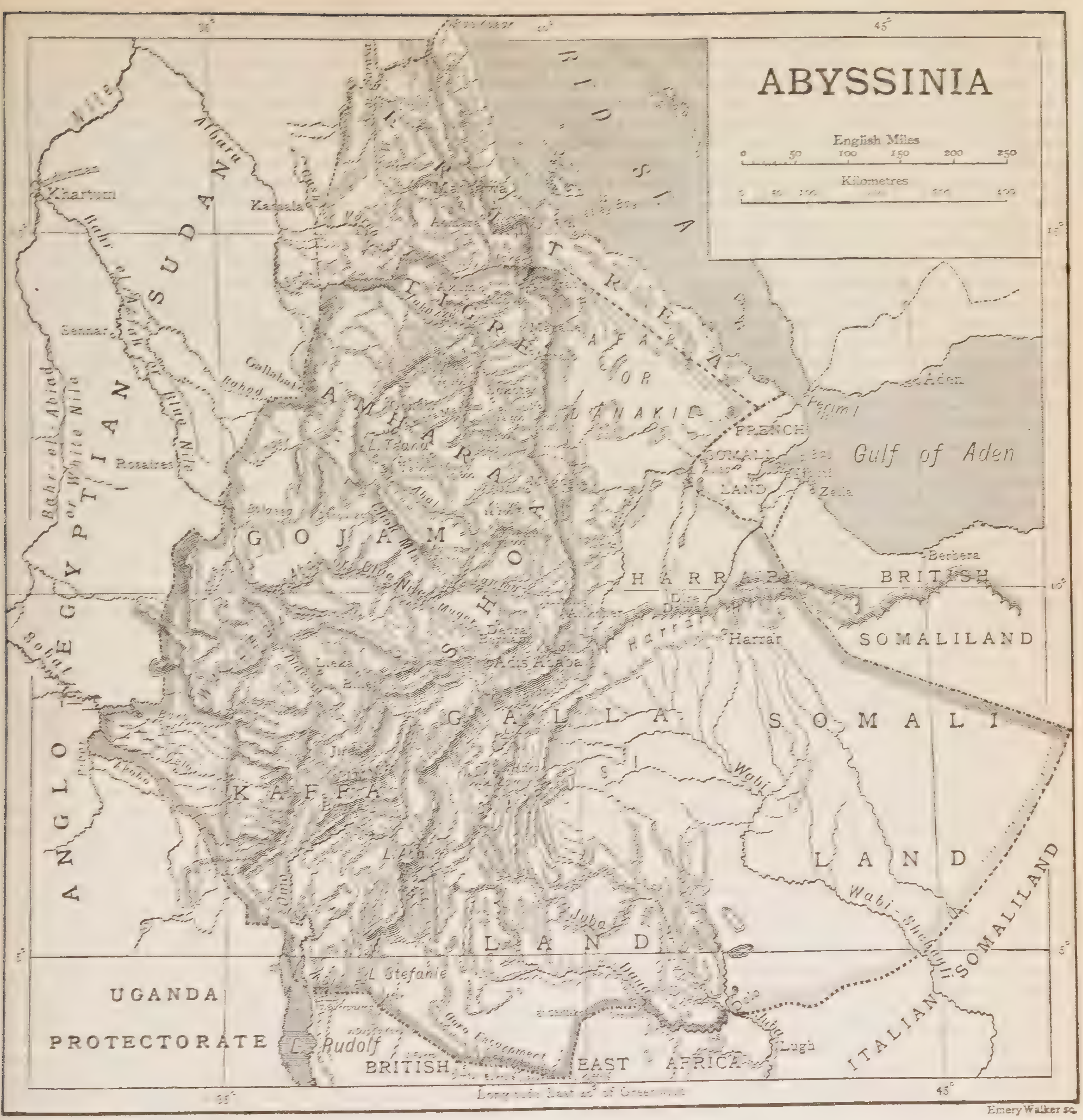
The cemetery of private persons begins in the Ist dynasty with some pit tombs in the town. It was extensive in the XIIth and XIIIth dynasties and contained many rich tombs. In the XVIIIth-XXth dynasties a large number of fine tombs were made, and later ages continued to bury here till Roman times. Many hundred funeral steles were removed by Mariette's workmen, without any record of the burials (Mariette, *Abydos*, ii. and iii.). Later excavations have been recorded by Ayrton, *Abydos*, iii.; MacIver, *El Amrah and Abydos*; and Garstang, *El Arabah*.

The forts lay behind the town. That known as Shunet ez Zebib is about 450×250 ft. over all, and still stands 30 ft. high. It was built by Khasekhemui, the last king of the IInd dynasty. Another fort nearly as large adjoined it, and is probably rather older. A third fort of a squarer form is now occupied by the Coptic convent; its age cannot be ascertained (Ayrton, *Abydos*, iii.). (W. M. F. P.)

ABYSS (Gr. ἀ-, privative, βυσσός, bottom), a bottomless depth; hence any deep place. From the late popular *abyssimus* (superlative of Low Latin *abyssus*) through the French *abisme* (i.e. *abîme*) is derived the poetic form *abysm*, pronounced as late as 1616 to rhyme with *time*. The adjective "abyssal" or "abysmal" has been used by zoologists to describe deep regions of the sea; hence *abysmal* zone, *abysmal* flora and fauna, *abysmal* accumulations, the deposit on the abysmal bed of the ocean. In heraldry, the abyss is the middle of an escutcheon. In the Greek version of the Old Testament the word represents (1) the original chaos (Gen. i. 2), (2) the Hebrew *tehōm* ("a surging water-deep"), which is used also in apocalyptic and kabbalistic literature and in the New Testament for hell, the place of punishment (cf. Eurip. *Phoen.* for the "yawning chasm of Tartarus"); in the Revised (not the Authorized) version *abyss* is generally used for this idea. Primarily in the Septuagint cosmography the word is applied (*a*) to the waters under the earth which originally covered it, and from which the springs and rivers are supplied, (*b*) to the waters of the firmament which were regarded as closely connected with those below. Derivatively, from the general idea of depth, it acquired the meaning of the place of the dead, though apparently never quite the same as Sheol. In *Revelation* it is the prison of evil spirits whence they may occasionally be let loose, and where Satan is doomed to spend 1000 years. Beneath the altar in the temple of Jerusalem there was believed to be a passage which led down to the abyss of the world, where the foundation-stone of the earth was laid. In rabbinical cosmography the abyss is a region of Gehenna situated below the ocean bed and divided into three or seven parts imposed one above the other. In the Kabbalah the abyss as the opening into the lower world is the abode of evil spirits, and corresponds to the opening of the abyss to the world above. In general the abyss is regarded vaguely as a place of indefinite extent, the abode of mystery and sorrow.

See G. Schiaparelli, *Astronomy in the Old Testament* (Eng. trans., Oxford, 1905).

ABYSSINIA (officially ETHIOPIA), an inland country and empire of N.E. Africa lying, chiefly, between 5° and 15° N. and 35° and 42° E. It is bounded N. by Eritrea (Italian), W.


ABYSSINIA
English Miles
0 50 100 150 200 250
Kilometres
Khartum
Kassala
Sennar
Rosaires
ANGLO EGYPTIAN SUDAN
RED SEA
ERITREA
TIGRE
AMHARA
GOJAM
SHOA
AFAR OR DANAKIL
FRENCH SOMALI LAND
Gulf of Aden
Aden
Perim I.
Zaila
Berbera
BRITISH SOMALILAND
HARRAR
Harrar
Dire Dawa
Adis Ababa
GALLA
SOMALI LAND
GALLA LAND
KAFFA
Blue Nile
Bahr el Abiad or White Nile
Atbara
Sobat
L. Tsana
L. Stefanie
L. Rudolf
Wabi
Wabi-Shebeli
Juba
Daua
Lugh
UGANDA PROTECTORATE
BRITISH EAST AFRICA
ITALIAN SOMALILAND
Goro Escarpment
Longitude East 40° of Greenwich
35°
45°
15°
10°
5°

Emery Walker sc.

by the Anglo-Egyptian Sudan, S. by British East Africa, S.E. and E. by the British, Italian and French possessions in Somaliland and on the Red Sea. The coast lands held by European powers, which cut off Abyssinia from access to the sea, vary in width from 40 to 250 miles. The country approaches nearest to the ocean on its N.E. border, where the frontier is drawn about 40 m. from the coast of the Red Sea. Abyssinia is narrowest in the north, being here 230 m. across from east to west. It broadens out southward to a width of 900 m. along the line of 9° N., and resembles in shape a triangle with its apex to the north. It is divided into Abyssinia proper (*i.e.* Tigré, Amhara, Gojam, &c.), Shoa, Kaffa and Galla land—all these form a geographical unit—and central Somaliland with Harrar. To the S.W. Abyssinia also includes part of the low country of the Sobat tributary of the Nile. The area of the whole state is about 350,000 sq. m., of which Abyssinian Somaliland covers fully a third.

(1) *Physical Features.*— Between the valley of the Upper Nile and the low lands which skirt the south-western shores of the Red Sea and the Gulf of Aden is a region of elevated plateaus from which rise various mountain ranges. These tablelands and mountains constitute Abyssinia, Shoa, Kaffa and Galla land. On nearly every side the walls of the plateaus rise with considerable abruptness from the plains, constituting outer mountain chains. The Abyssinian highlands are thus a clearly marked orographic division. From Ras Kasar (18° N.) to Annesley Bay (15° N.) the eastern wall of the plateau runs parallel to the Red Sea. It then turns due S. and follows closely the line of 40° E. for some 400 m. About 9° N. there is a break in the wall, through which the river Hawash flows eastward. The main range at this point trends S.W., while south of the Hawash valley, which is some 3000 ft. below the level of the mountains, another massif rises in a direct line south. This

second range sends a chain (the Harrar hills) eastward to the Gulf of Aden. The two chief eastern ranges maintain a parallel course S. by W., with a broad upland valley between—in which valley are a series of lakes—to about 3° N., the outer (eastern) spurs of the plateau still keeping along the line of 40° E. The southern escarpment of the plateau is highly irregular, but has a general direction N.W. and S.E. from 6° N. to 3° N. It overlooks the depression in which is Lake Rudolf and—east of that lake—southern Somaliland. The western wall of the plateau from 6° N. to 11° N. is well marked and precipitous. North of 11° N. the hills turn more to the east and fall more gradually to the plains at their base. On its northern face also the plateau falls in terraces to the level of the eastern Sudan. The eastern escarpment is the best defined of these outer ranges. It has a mean height of from 7000 to 8000 ft., and in many places rises almost perpendicularly from the plain. Narrow and deep clefts, through which descend mountain torrents to lose themselves in the sandy soil of the coast land, afford means of reaching the plateau, or the easier route through the Hawash valley may be chosen. On surmounting this rocky barrier the traveller finds that the encircling rampart rises little above the normal level of the plateau.

(2) The aspect of the highlands is most impressive. The northern portion, lying mainly between 10° and 15° N., consists of a huge mass of Archaean rocks with a mean height of from 7000 to 7500 ft. above the sea, and is flooded in a deep central depression by the waters of Lake Tsana. Above the plateau rise several irregular and generally ill-defined mountain ranges which attain altitudes of from 12,000 to over 15,000 ft. Many of the mountains are of weird and fantastic shape. Characteristic of the country are the enormous fissures which divide it, formed in the course of ages by the erosive action of water. They are in fact the valleys of the rivers which, rising on the uplands or mountain sides, have cut their way to the surrounding lowlands. Some of the valleys are of considerable width; in other cases the opposite walls of the gorges are but two or three hundred yards apart, and fall almost vertically thousands of feet, representing an erosion of hard rock of many millions of cubic feet. One result of the action of the water has been the formation of numerous isolated flat-topped hills or small plateaus, known as *ambas*, with nearly perpendicular sides. The highest peaks are found in the Simen (or Semien) and Gojam ranges. The Simen Mountains lie N.E. of Lake Tsana and culminate in the snow-covered peak of Daschan (Dajan), which has an altitude of 15,160 ft. A few miles east and north respectively of Dajan are Mounts Biuat and Abba Jared, whose summits are a few feet only below that of Dajan. In the Chok Mountains in Gojam Agsias Fatra attains a height of 13,600 ft.

Parallel with the eastern escarpment are the heights of Baila (12,500 ft.), Abuna Josef (13,780 ft.), and Kollo (14,100 ft.), the last-named being S.W. of Magdala. The valley between these hills and the eastern escarpment is one of the longest and most profound chasms in Abyssinia. Between Lake Tsana and the eastern hills are Mounts Guna (13,800 ft.) and Uara Sahia (13,000 ft.). The figures given are, however, approximate only. The southern portion of the highlands—the 10° N. roughly marks the division between north and south—has more open tableland than the northern portion and fewer lofty peaks. Though there are a few heights between 10,000 and 12,000 ft., the majority do not exceed 8000 ft. But the general character of the southern regions is the same as in the north—a much-broken hilly plateau.

Most of the Abyssinian uplands have a decided slope to the north-west, so that nearly all the large rivers find their way in that direction to the Nile. Such are the Takazzé in the north, the Abai in the centre, and the Sobat in the south, and through these three arteries is discharged about four-fifths of the entire drainage. The rest is carried off, almost due north by the Khor Baraka, which occasionally reaches the Red Sea south of Suakin; by the Hawash, which runs out in the saline lacustrine district near the head of Tajura Bay; by the Webi Shebeli (Wabi-Shebeyli) and Juba, which flow S.E. through Somaliland, though the Shebeli fails to reach the Indian Ocean; and by the Omo, the main feeder of the closed basin of Lake Rudolf.

The Takazzé, which is the true upper course of the Atbara, has its head-waters in the central tableland; and falls from about 7000 to 2500 ft. in the tremendous crevasse through which it sweeps round west, north and west again down to the western terraces, where it passes from Abyssinian to Sudan territory. During the rains the Takazzé (*i.e.* the "Terrible") rises some 18 ft. above its normal level, and at this time forms an impassable barrier between the northern and central provinces. In its lower course the river is known by the Arab name Setit. The Setit is joined (14° 10′ N., 36° E.) by the Atbara, a river formed by several streams which rise in the mountains W. and N.W. of Lake Tsana. The Gash or Mareb is the most northerly of the Abyssinian rivers which flow towards the Nile valley. Its head-waters rise on the landward side of the eastern escarpment within 50 miles of Annesley Bay on the Red Sea. It reaches the Sudan plains near Kassala, beyond which place its waters are dissipated in the sandy soil. The Mareb is dry for a great part of the year, but like the Takazzé is subject to sudden freshets during the rains. Only the left bank of the upper course of the river is in Abyssinian territory, the Mareb here forming the boundary between Eritrea and Abyssinia.

(3) The Abai—that is, the upper course of the Blue Nile—has its source near Mount Denguiza in the Gojam highlands (about 11° N. and 37° E.), and first flows for 70 m. nearly due north to the south side of Lake Tsana. Tsana (*q.v.*), which stands from 2500 to 3000 ft. below the normal level of the plateau, has somewhat the aspect of a flooded crater. It has an area of about 1100 sq. m., and a depth in some parts of 250 ft. At the south-east corner the rim of the crater is, as it were, breached by a deep crevasse through which the Abai escapes, and here develops a great semicircular bend like that of the Takazzé, but in the reverse direction—east, south and north-west—down to the plains of Sennar, where it takes the name of Bahr-el-Azrak or Blue Nile. The Abai has many tributaries. Of these the Bashilo rises near Magdala and drains eastern Amhara; the Jamma rises near Ankober and drains northern Shoa; the Muger rises near Adis Ababa and drains south-western Shoa; the Didessa, the largest of the Abai's affluents, rises in the Kaffa hills and has a generally S. to N. course; the Yabus runs near the western edge of the plateau escarpment. All these are perennial rivers. The right-hand tributaries, rising mostly on the western sides of the plateau, have steep slopes and are generally torrential in character. The Bolassa, however, is perennial, and the Rahad and Dinder are important rivers in flood-time.

In the mountains and plateaus of Kaffa and Galla in the south-west of Abyssinia rise the Baro, Gelo, Akobo and other of the chief affluents of the Sobat tributary of the Nile. The Akobo, in about 7° 50′ N. and 33° E., joins the Pibor, which in about 8½° N. and 33° 20′ E. unites with the Baro, the river below the confluence taking the name of Sobat. These rivers descend from the mountains in great falls, and like the other Abyssinian streams are unnavigable in their upper courses. The Baro on reaching the plain becomes, however, a navigable stream affording an open waterway to the Nile. The Baro, Pibor and Akobo form for 250 m. the W. and S.W. frontiers of Abyssinia (see NILE, SOBAT and SUDAN).

The chief river of Abyssinia flowing east is the Hawash (Awash, Awasi), which rises in the Shoan uplands and makes a semicircular bend first S.E. and then N.E. It reaches the Afar (Danakil) lowlands through a broad breach in the eastern escarpment of the plateau, beyond which it is joined on its left bank by its chief affluent, the Germama (Kasam), and then trends round in the direction of Tajura Bay. Here the Hawash is a copious stream nearly 200 ft. wide and 4 ft. deep, even in the dry season, and during the floods rising 50 or 60 ft. above low-water mark, thus inundating the plains for many miles along both its banks. Yet it fails to reach the coast, and after a winding course of about 500 m. passes (in its lower reaches) through a series of *badds* (lagoons) to Lake Aussa, some 60 or 70 m. from the head of Tajura Bay. In this lake the river is lost. This remarkable phenomenon is explained by the position of Aussa in the centre of a saline lacustrine depression several hundred feet below sea-level. While most of the other lagoons are highly saline, with thick incrustations of salt round their margins, Aussa remains fresh throughout the year, owing to the great body of water discharged into it by the Hawash.

Another lacustrine region extends from the Shoa heights south-west to the Samburu (Lake Rudolf) depression. In this chain of lovely upland lakes, some fresh, some brackish, some completely closed, others connected by short channels, the chief links in their order from north to south are:—Zwai, communicating southwards with Hara and Lamina, all in the Arusi Galla territory; then Abai with an outlet to a smaller tarn in the romantic Baroda and Gamo districts, skirted on the west sides by grassy slopes and wooded ranges from 6000 to nearly 9000 ft. high; lastly, in the Asille country, Lake Stefanie, the Chuwaha of the natives, completely closed and falling to a level of about 1800 ft. above the sea. To the same system obviously belongs the neighbouring Lake Rudolf (*q.v.*), which is larger than all the rest put together. This lake receives at its northern end the waters of the Omo, which rises in the Shoa highlands and is a perennial river with many affluents. In its course of some 370 m. it has a total fall of about 6000 ft. (from 7600 at its source to 1600 at lake-level), and is consequently a very rapid stream, being broken by the Kokobi and other falls, and navigable only for a short distance above its mouth. The chief rivers of Somaliland (*q.v.*), the Webi Shebeli and the Juba (*q.v.*), have their rise on the south-eastern slopes of the Abyssinian escarpment, and the greater part of their course is through territory belonging to Abyssinia. There are numerous hot springs in Abyssinia, and earthquakes, though of no great severity, are not uncommon.

(4) *Geology.*—The East African tableland is continued into Abyssinia. Since the visit of W. T. Blanford in 1870 the geology has received little attention from travellers. The following formations are represented:—

Sedimentary and Metamorphic.	
Recent.	Coral, alluvium, sand.
Tertiary.	(?) Limestones of Harrar.
Jurassic.	Antalo Limestones.
Triassic (?).	Adigrat Sandstones.
Archaean.	Gneisses, schists, slaty rocks.
Igneous.	
Recent.	Aden Volcanic Series.
Tertiary, Cretaceous (?).	Magdala group.
Jurassic.	Ashangi group.

Archaean.—The metamorphic rocks compose the main mass of the tableland, and are exposed in every deep valley in Tigré and along the valley of the Blue Nile. Mica schists form the prevalent rocks. Hornblende schists also occur and a compact felspathic rock in the Suris defile. The foliae of the schists strike north and south.

Triassic (?).—In the region of Adigrat the metamorphic rocks are invariably overlain by white and brown sandstones, unfossiliferous, and attaining a maximum thickness of 1000 feet. They are overlain by the fossiliferous limestones of the Antalo group. Around Chelga and Adigrat coal-bearing beds occur, which Blanford suggests may be of the same age as the coal-bearing strata of India. The Adigrat Sandstone possibly represents some portion of the Karroo formation of South Africa.

Jurassic.—The fossiliferous limestones of Antalo are generally horizontal, but are in places much disturbed when interstratified with trap rocks. The fossils are all characteristic Oolite forms and include species of *Hemicidaris*, *Pholadomya*, *Ceromya*, *Trigonia* and *Alaria*.

Igneous Rocks.—Above a height of 8000 ft. the country consists of bedded traps belonging to two distinct and unconformable groups. The lower (Ashangi group) consists of basalts and dolerites often amygdaloidal. Their relation to the Antalo limestones is uncertain, but Blanford considers them to be not later in age than the Oolite. The upper (Magdala group) contains much trachytic rock of considerable thickness, lying perfectly horizontally, and giving rise to a series of terraced ridges characteristic of central Abyssinia. They are interbedded with unfossiliferous sandstones and shales. Of more recent date (probably Tertiary) are some igneous rocks, rich in alkalis, occurring in certain localities in southern Abyssinia. Of still more recent date are the basalts and ashes west of Massawa and around Annesley Bay and known as the Aden Volcanic Series. With regard to the older igneous rocks, the enormous amount they have suffered from denudation is a prominent feature. They have been worn into deep and narrow ravines, sometimes to a depth of 3000 to 4000 ft.

(5) *Climate.*—The climate of Abyssinia and its dependent territories varies greatly. Somaliland and the Danakil lowlands have a hot, dry climate producing semi-desert conditions; the country in the lower basin of the Sobat is hot, swampy and malarious. But over the greater part of Abyssinia as well as the Galla highlands the climate is very healthy and temperate. The country lies wholly within the tropics, but its nearness to the equator is counterbalanced by the elevation of the land. In the deep valleys of the Takazzé and Abai, and generally in places below 4000 ft., the conditions are tropical and fevers are prevalent. On the uplands, however, the air is cool and bracing in summer, and in winter very bleak. The mean range of temperature is between 60° and 80° F. On the higher mountains the climate is Alpine in character. The atmosphere on the plateaus is exceedingly clear, so that objects are easily recognizable at great distances. In addition to the variation in climate dependent on elevation, the year may be divided into three seasons. Winter, or the cold season, lasts from October to February, and is followed by a dry hot period, which about the middle of June gives place to the rainy season. The rain is heaviest in the Takazzé basin in July and August. In the more southern districts of Gojam and Wallega heavy rains continue till the middle of September, and occasionally October is a wet month. There are also spring and winter rains; indeed rain often falls in every month of the year. But the rainy season proper, caused by the south-west monsoon, lasts from June to mid-September, and commencing in the north moves southward. In the region of the Sobat sources the rains begin earlier and last longer. The rainfall varies from about 30 in. a year in Tigré and Amhara to over 40 in. in parts of Galla land. The rainy season is of great importance not only to Abyssinia but to the countries of the Nile valley, as the prosperity of the eastern Sudan and Egypt is largely dependent upon the rainfall. A season of light rain may be sufficient for the needs of Abyssinia, but there is little surplus water to find its way to the Nile; and a shortness of rain means a low Nile, as practically all the flood water of that river is derived from the Abyssinian tributaries (see NILE).

(6) *Flora and Fauna.*—As in a day's journey the traveller may pass from tropical to almost Alpine conditions of climate, so great also is the range of the flora and fauna. In the valleys and lowlands the vegetation is dense, but the general appearance of the plateaus is of a comparatively bare country with trees and bushes thinly scattered over it. The glens and ravines on the hillside are often thickly wooded, and offer a delightful contrast to the open downs. These conditions are particularly characteristic of the northern regions; in the south the vegetation on the uplands is more luxuriant. Among the many varieties of trees and plants found are the date palm, mimosa, wild olive, giant sycamores, junipers and laurels, the myrrh and other gum trees (gnarled and stunted, these flourish most on the eastern foothills), a magnificent pine (the Natal yellow pine, which resists the attacks of the white ant), the fig, orange, lime, pomegranate, peach, apricot, banana and other fruit trees; the grape vine (rare), blackberry and raspberry; the cotton and indigo plants, and occasionally the sugar cane. There are in the south large forests of valuable timber trees; and the coffee plant is indigenous in the Kaffa country, whence it takes

its name. Many kinds of grasses and flowers abound. Large areas are covered by the kussa, a hardy member of the rose family, which grows from 8 to 10 ft. high and has abundant pendent red blossoms. The flowers and the leaves of this plant are highly prized for medicinal purposes. The fruit of the kurarina, a tree found almost exclusively in Shoa, yields a black grain highly esteemed as a spice. On the tableland a great variety of grains and vegetables are cultivated. A fibrous plant, known as the sanseviera, grows in a wild state in the semi-desert regions of the north and south-east.

In addition to the domestic animals enumerated below (§ 8) the fauna is very varied. Elephant and rhinoceros are numerous in certain low-lying districts, especially in the Sobat valley. The Abyssinian rhinoceros has two horns and its skin has no folds. The hippopotamus and crocodile inhabit the larger rivers flowing west, but are not found in the Hawash, in which, however, otters of large size are plentiful. Lions abound in the low countries and in Somaliland. In central Abyssinia the lion is no longer found except occasionally in the river valleys. Leopards, both spotted and black, are numerous and often of great size; hyaenas are found everywhere and are hardy and fierce; the lynx, wolf, wild dog and jackal are also common. Boars and badgers are more rarely seen. The giraffe is found in the western districts, the zebra and wild ass frequent the lower plateaus and the rocky hills of the north. There are large herds of buffalo and antelope, and gazelles of many varieties and in great numbers are met with in most parts of the country. Among the varieties are the greater and lesser kudu (both rather rare); the duiker, gemsbuck, hartebeest, gerenuk (the most common—it has long thin legs and a camel-like neck); klipspringer, found on the high plateaus as well as in the lower districts; and the dik-dik, the smallest of the antelopes, its weight rarely exceeding 10 ℔, common in the low countries and the foothills. The civet is found in many parts of Abyssinia, but chiefly in the Galla regions. Squirrels and hares are numerous, as are several kinds of monkeys, notably the guereza, gelada, guenon and dog-faced baboon. They range from the tropical lowlands to heights of 10,000 ft.

Birds are very numerous, and many of them remarkable for the beauty of their plumage. Great numbers of eagles, vultures, hawks, bustards and other birds of prey are met with; and partridges, duck, teal, guinea-fowl, sand-grouse, curlews, woodcock, snipe, pigeons, thrushes and swallows are very plentiful. A fine variety of ostrich is commonly found. Among the birds prized for their plumage are the marabout, crane, heron, blackbird, parrot, jay and humming-birds of extraordinary brilliance. Among insects the most numerous and useful is the bee, honey everywhere constituting an important part of the food of the inhabitants. Of an opposite class is the locust. Serpents are not numerous, but several species are poisonous. There are thousands of varieties of butterflies and other insects.

(7) *Provinces and Towns.*—Politically, Abyssinia is divided into provinces or kingdoms and dependent territories. The chief provinces are Tigré, which occupies the N.E. of the country; Amhara or Gondar, in the centre; Gojam, the district enclosed by the great semicircular sweep of the Abai; and Shoa (*q.v.*), which lies east of the Abai and south of Amhara. Besides these ancient provinces and several others of smaller size, the empire includes the Wallega region, lying S.W. of Gojam; the Harrar province in the east; Kaffa (*q.v.*) and Galla land, S.W. and S. of Shoa; and the central part of Somaliland.

With the exception of Harrar (*q.v.*), a city of Arab foundation, there are no large towns in Abyssinia. Harrar is some 30 m. S.E. of Dire Dawa, whence there is a railway (188 m. long) to Jibuti on the Gulf of Aden. The absence of large towns in Abyssinia proper is due to the provinces into which the country is divided having been for centuries in a state of almost continual warfare, and to the frequent change of the royal residences on the exhaustion of fuel supplies. The earliest capital appears to have been Axum (*q.v.*) in Tigré, where there are extensive ruins. In the middle ages Gondar in Amhara became the capital of the country and was so regarded up to the middle of the 19th century. Since 1892 the capital has been Adis Ababa in the kingdom of Shoa.

The other towns of Abyssinia worthy of mention may be grouped according to their geographical position. None of them has a permanent population exceeding 6000, but at several large markets are held periodically. In Tigré there are Adowa or Adua (17 m. E. by N. of Axum), Adigrat, Macalle and Antalo. The three last-named places are on the high plateau near its eastern escarpment and on the direct road south from Massawa to Shoa. West of Adigrat is the monastery of Debra-Domo, one of the most celebrated sanctuaries in Abyssinia.

In Amhara there are:—Magdala (*q.v.*), formerly the residence of King Theodore, and the place of imprisonment of the British captives in 1866. Debra-Tabor ("Mount Tabor"), the chief royal residence during the reign of King John, occupies a strong strategic position overlooking the fertile plains east of Lake Tsana, at a height of about 8,620 ft. above the sea; it has a population of 3000, including the neighbouring station of Samara, headquarters of the Protestant missionaries in the time of King Theodore. Ambra-Mariam, a fortified station midway between Gondar and Debra-Tabor near the north-east side of Lake Tsana, with a population of 3000; here is the famous shrine and church dedicated to St Mary, whence the name of the place, "Fort St Mary." Mahdera-Mariam ("Mary's Rest"), for some time a royal residence, and an important market and great place of pilgrimage, a few miles south-west of Debra-Tabor; its two churches of the "Mother" and the "Son" are held in great veneration by all Abyssinians; it has a permanent population estimated at over 4000, Gallas and Amharas, the former mostly Mahommedan. Sokota, one of the great central markets, and capital of the province of Waag in Amhara, at the converging point of several main trade routes; the market is numerously attended, especially by dealers in the salt blocks which come from Lake Alalbed. The following towns are in Shoa:—Ankober, formerly the capital of the kingdom; Aliu-Amba, east of Ankober on the trade route to the Gulf of Aden; Debra-Berhan (Debra-Bernam) ("Mountain of Light"), once a royal residence; Liché (Litché), one of the largest market towns in southern Abyssinia. Liekà, the largest market in Galla land, has direct communications with Gojam, Shoa and other parts of the empire. Bonga, the commercial centre of Kaffa, and Jiren, capital of the neighbouring province of Jimma, are frequented by traders from all the surrounding provinces, and also by foreign merchants from the seaports on the Gulf of Aden. Apart from these market-places there are no settlements of any size in southern Abyssinia.

Communications.—The Jibuti-Dire Dawa railway has been mentioned above. The continuation of this railway to the capital was begun in 1906 from the Adis Ababa end. There are few roads in Abyssinia suitable for wheeled traffic. Transport is usually carried on by mules, donkeys, pack-horses and (in the lower regions) camels. From Dire Dawa to Harrar there is a well-made carriage road, and from Harrar to Adis Ababa the caravan track is kept in good order, the river Hawash being spanned by an iron bridge. There is also a direct trade route from Dire Dawa to the capital. Telegraph lines connect Adis Ababa and several important towns in northern Abyssinia with Massawa, Harrar and Jibuti. There is also a telephonic service, the longest line being from Harrar to the capital.

(8) *Agriculture.*—The soil is exceedingly fertile, as is evident from the fact that Egypt owes practically all its fertility to the sediment carried into the Nile by its Abyssinian tributaries. Agriculture is extensively followed, chiefly by the Gallas, the indolence of the Abyssinians preventing them from being good farmers. In the lower regions a wide variety of crops are grown—among them maize, durra, wheat, barley, rye, *teff*, pease, cotton and sugar-cane—and many kinds of fruit trees are cultivated. *Teff* is a kind of millet with grains about the size of an ordinary pin-head, of which is made the bread commonly eaten. The low grounds also produce a grain, *tocussa*, from which black bread is made. Besides these, certain oleaginous plants, the *suf*, *nuc* and *selite* (there are no European equivalents for the

native names), and the ground-nut are largely grown. The castor bean grows wild, the green castor in the low, damp regions, the red castor at medium altitudes. The kat plant, a medicinal herb which has a tonic quality, is largely grown in the Harrar province. On the higher plateaus the hardier cereals only are cultivated. Here the chief crops are wheat, barley, teff, peppers, vegetables of all kinds and coffee. Above 10,000 ft. the crops are confined practically to barley, oats, beans and occasionally wheat.

Coffee is one of the most important products of the country, and its original home is believed to be the Kaffa highlands. It is cultivated in the S., S.E. and S.W. provinces, and to a less extent in the central districts. Two qualities of coffee are cultivated, one known as Abyssinian, the other as Harrar-Mocha. The "Abyssinian" coffee is grown very extensively throughout the southern highlands. Little attention is paid to the crop, the berries being frequently gathered from the ground, and consequently the coffee is of comparatively low grade. "Harrar-Mocha" is of first-class quality. It is grown in the highlands of Harrar, and cultivated with extreme care. The raising of cotton received a considerable impetus in the early years of the 20th century. The soil of the Hawash valley proved particularly suitable for raising this crop. In the high plateaus the planting of seeds begins in May, in the lower plateaus and the plains in June, but in certain parts where the summer is long and rain abundant sowing and reaping are going on at the same time. Most regions yield two, many three crops a year. The methods of culture are primitive, the plough commonly used being a long pole with two vertical iron teeth and a smaller pole at right angles to which oxen are attached. This implement costs about four shillings. The ploughing is done by the men, but women and girls do the reaping. The grain is usually trodden out by cattle and is often stored in clay-lined pits. Land comparatively poor yields crops eight to tenfold the quantity sown; the major part of the land yields twenty to thirtyfold. In the northern parts of the empire very little land is left uncultivated. The hillsides are laid out in terraces and carefully irrigated in the dry season, the channels being often two miles or more long. Of all the cereals barley is the most widely grown. The average rate of pay to an agricultural labourer is about threepence a day in addition to food, which may cost another penny a day.

The Abyssinians keep a large number of domestic animals. Among cattle the Sanga or Galla ox is the most common. The bulls are usually kept for ploughing, the cow being preferred for meat. Most of the cattle are of the zebu or hump-backed variety, but there are also two breeds—one large, the other resembling the Jersey cattle—which are straight-backed. The horns of the zebu variety are sometimes four feet long. Sheep, of which there are very large flocks, belong to the short and fat-tailed variety. The majority are not wool-bearing, but in one district a very small black sheep is raised for wool. The small mountain breed of sheep weigh no more than 20 to 30 ℔ apiece. Goats are of both the long and short-haired varieties. The horns of the large goats are often thirty inches in length and stand up straight from the head. The goats from the Arusi Galla country have fine silky hair which is sometimes sixteen inches long. The meat of both sheep and goats is excellent; that of the latter is preferred by the natives. In 1904 the estimated number of sheep and goats in the country was 20,000,000. Large quantities of butter, generally rancid, are made from the milk of cows, goats and sheep. In the Leka province small black pigs are bred in considerable numbers. The horses (very numerous) are small but strong; they are generally about 14 hands in height. The best breeds come from the Shoa uplands. The ass is also small and strong; and the mule, bred in large numbers, is of excellent quality, and both as a transport animal and as a mount is preferred to the horse. The mule thrives in every condition of climate, is fever-proof, travels over the most difficult mountain passes with absolute security, and can carry with ease a load of 200 ℔. The average height of a mule is 12½ hands. The country is admirably adapted for stock-raising.

(9) *Minerals.*—In the south and south-west provinces placer gold mines by the banks of watercourses are worked by Gallas as an industry subsidiary to tending their flocks and fields. In the Wallega district are veins of gold-bearing quartz, mined to a certain extent. There are also gold mines in southern Shoa. The annual output of gold is worth not less than £500,000. Only a small proportion is exported. Besides gold, silver, iron, coal and other minerals are found. Rock-salt is obtained from the province of Tigré.

Trade and Currency.—Abyssinia being without seaports, the external trade is through Massawa (Italian) in the north, Jibuti (French), Zaila and Berbera (British) in the south, and for all these ports Aden is a distributing centre. For Tigré and Amhara products Massawa is the best port, for the rest of the empire, Jibuti. For southern Abyssinia, Kaffa and Galla lands, Harrar is the great entrepot, goods being forwarded thence to Jibuti and the other Somaliland ports. There is also a considerable trade with the Anglo-Egyptian Sudan through the frontier towns of Rosaires and Gallabat. At the French and British ports there is freedom of trade, but on goods for Abyssinia entering Massawa a discriminating tax is levied if they are not imported from Italy.

The chief articles of export are coffee, skins, ivory, civet, ostrich feathers, gum, pepper, kat plant (used by Moslems for its stimulating properties), gold (in small quantities) and live stock. The trade in skins is mainly with the United States through Aden; America also takes a large proportion of the coffee exported. For live stock there is a good trade with Madagascar. The chief imports are cotton goods, the yearly value of this trade being fully £250,000; the sheetings are largely American; the remainder English and Indian. No other article of import approaches cotton in importance, but a considerable trade is done in arms and ammunition, rice, sugar, flour and other foods, and a still larger trade in candles and matches (from Sweden), oil, carpets (oriental and European), hats and umbrellas. Commerce long remained in a backward condition; but under the Emperor Menelek II. efforts were made to develop the resources of the country, and in 1905 the total volume of trade exceeded £1,000,000.

Until the end of the 19th century the usual currency was the Maria Theresa dollar, bars of rock-salt and cartridges. In 1894 a new coinage was introduced, with the Menelek dollar or *talari*, worth about two shillings, as the standard. This new coinage gradually superseded the older currency. In 1905 the Bank of Abyssinia, the first banking house in the country, was founded, with its headquarters at Adis Ababa. The bank, which was granted a monopoly of banking business in the empire for fifty years, has a capital of £500,000, has the power to issue notes, to mint the Abyssinian coinage, and to engage in commercial operations. It was founded under Egyptian law by the National Bank of Egypt, which institution had previously obtained a concession from the emperor Menelek.

(10) *Government.*—The political institutions are of a feudal character. Within their provinces the *rases* (princes) exercise large powers. The emperor, styled *negūs negusti* (king of kings), is occasionally assisted by a council of rases. In October 1907 an imperial decree announced the constitution of a cabinet on European lines, ministers being appointed to the portfolios of foreign affairs, war, commerce, justice and finance. The legal system is said to be based on the Justinian code. From the decisions of the judges there is a right of appeal to the emperor. The chief judicial official is known as the *afa-negūs* (breath of the king). The Abyssinian church (*q.v.*) is presided over by an *abuna*, or archbishop. The land is not held in fee simple, but is subject to the control of the emperor or the church. Revenue is derived from an *ad valorem* tax on all imports; the purchase and sale of animals; from royalties on trading concessions, and in other ways, including fees for the administration of justice. Education, of a rudimentary character, is given by the clergy. In 1907 a system of compulsory education "of all male children over the age of 12" was decreed. The education was to be state

provided, Coptic teachers were brought from Egypt and school buildings were erected.

The Abyssinian calendar is as follows:—The Abyssinian year of 365 days (366 in leap-year) begins on the 1st of Maskarram, which corresponds to about the 10th of September. The months have thirty days each, and are thus named: Maskarram, Tekemt, Hadar, Tahsas, Tarr, Yekatit, Magawit, Miaziah, Genbot, Sanni, Hamle, Nas'hi. The remaining five days in the year, termed Pagmen or Quaggimi (six in leap-year, the extra day being named Kadis Yohannis), are put in at the end and treated as holidays. Abyssinian reckoning is about seven years eight months behind the Gregorian. Festivals, such as Easter, fall a week later than in western Europe.

Army.—A small standing army is maintained in each province of Abyssinia proper. Every able-bodied Abyssinian is expected to join the army in case of need, and a force, well armed with modern weapons, approaching 250,000 can be placed in the field. The cavalry is chiefly composed of Galla horsemen. (F. R. C.)

ETHNOLOGY

(11) The population of the empire is estimated at from 3,500,000 to 5,000,000. The inhabitants consist mainly of the Abyssinians, the Galla and the Somali (the two last-named peoples are separately noticed). Of non-African races the most numerous are Armenians, Indians, Jews and Greeks. There is a small colony of British, French, Italians and Russians. The following remarks apply solely to Abyssinia proper and its inhabitants. It should be remembered that the term "Abyssinian" is purely geographical, and has little or no ethnical significance; it is derived from the Arabic *Habesh*, "mixed," and was a derisive name applied by the Arabs to the heterogeneous inhabitants of the Abyssinian plateau.

Abyssinia appears to have been originally peopled by the eastern branch of the Hamitic family, which has occupied this region from the remotest times, and still constitutes the great bulk of its inhabitants, though the higher classes are now strongly Semitized. The prevailing colour in the central provinces (Amhara, Gojam) is a deep brown, northwards (Tigré, Lasta) it is a pale olive, and here even fair complexions are seen. Southwards (Shoa, Kobbo, Amuru) a decided chocolate and almost sooty black is the rule. Many of the people are distinctly negroid, with big lips, small nose, broad at the base, and frizzly or curly black hair. The negroid element in the population is due chiefly to the number of negro women who have been imported into the harems of the Abyssinians. The majority, however, may be described as a mixed Hamito-Semitic people, who are in general well formed and handsome, with straight and regular features, lively eyes, hair long and straight or somewhat curled and in colour dark olive, approaching to black. The Galla, who came originally from the south, are not found in many parts of the country, but predominate in the Wollo district, between Shoa and Amhara. It is from the Galla that the Abyssinian army is largely recruited, and, indeed, there are few of the chiefs who have not an admixture of Galla blood in their veins.

As regards language, several of the indigenous groups, such as the Khamtas of Lasta, the Agau or Agaos of Agaumeder ("Agao land") and the Falashas (*q.v.*), the so-called "Jews" of Abyssinia, still speak rude dialects of the old Hamitic tongue. But the official language and that of all the upper classes is of Semitic origin, derived from the ancient Himyaritic, which is the most archaic member of the Semitic linguistic family. Geez, as it is called, was introduced with the first immigrants from Yemen, and although no longer spoken is still studied as the liturgical language of the Abyssinian Christians. Its literature consists of numerous translations of Jewish, Greek and Arabic works, besides a valuable version of the Bible. (See ETHIOPIA.) The best modern representative of Geez is the Tigrina of Tigré and Lasta, which is much purer but less cultivated than the Amharic dialect, which is used in state documents, is current in the central and southern provinces and is much affected by Hamitic elements. All are written in a peculiar syllabic script which, unlike all other Semitic forms, runs from left to right, and is derived from that of the Sabaeans and Minaeans, still extant in the very old rock-inscriptions of south Arabia.

The hybridism of the Abyssinians is reflected in their political and social institutions, and especially in their religious beliefs and practices. On a seething mass of African heathendom, already in early times affected by primitive Semitic ideas, was suddenly imposed a form of Christianity which became the state religion. While the various ethnical elements have been merged in the composite Abyssinian nation, the primitive and more advanced religious ideas have nowhere been fused in a uniform Christian system. Foreigners are often surprised at the strange mixture of savagery and lofty notions in a Christian community which, for instance, accounts accidental manslaughter as wilful murder. Recourse is still had to dreams as a means of detecting crime. A priest is summoned, and, if his prayers and curses fail, a small boy is drugged, and "whatever person he dreams of is fixed on as the criminal. . . . If the boy does not dream of the person whom the priest has determined on as the criminal, he is kept under drugs until he does what is required of him" (Count Gleichen, *With the Mission to Menelik*, chap. xvi., 1898).

The Abyssinian character reflects the country's history. Murders and executions are frequent, yet cruelty is not a marked feature of their character; and in war they seldom kill their prisoners. When a man is convicted of murder, he is handed over to the relatives of the deceased, who may either put him to death or accept a ransom. When the murdered person has no relatives, the priests take upon themselves the office of avengers. The natural indolence of the people has been fostered by the constant wars, which have discouraged peaceful occupations. The soldiers live by plunder, the monks by alms. The haughtiest Abyssinian is not above begging, excusing himself with the remark, "God has given us speech for the purpose of begging." The Abyssinians are vain and selfish, irritable but easily appeased; and are an intelligent bright people, fond of gaiety. On every festive occasion, as a saint's day, birth, marriage, &c., it is customary for a rich man to collect his friends and neighbours, and kill a cow and one or two sheep. The principal parts of the cow are eaten raw while yet warm and quivering, the remainder being cut into small pieces and cooked with the favourite sauce of butter and red pepper paste. The raw meat eaten in this way is considered to be very superior in taste and much more tender than when cold. The statement by James Bruce respecting the cutting of steaks from a live cow has frequently been called in question, but there can be no doubt that Bruce actually saw what he narrates. Mutton and goat's flesh are the meats most eaten: pork is avoided on religious grounds, and the hare is never touched, possibly, as in other countries, from superstition. Many forms of game are forbidden; for example, all water-fowl. The principal drinks are *mēse*, a kind of mead, and *bousa*, a sort of beer made from fermented cakes. The Abyssinians are heavy eaters and drinkers, and any occasion is seized as an excuse for a carouse. Old and young, of both sexes, pass days and nights in these *symposia*, at which special customs and rules prevail. Little bread is eaten, the Abyssinian preferring a thin cake of durra meal or *teff*, kneaded with water and exposed to the sun till the dough begins to rise, when it is baked. Salt is a luxury; "he eats salt" being said of a spendthrift. Bars of rock-salt, after serving as coins, are, when broken up, used as food. There is a general looseness of morals: marriage is a very slight tie, which can be dissolved at any time by either husband or wife. Polygamy is by no means uncommon. Hence there is little family affection, and what exists is only between children of the same father and mother. Children of the same father, but of different mothers, are said to be "always enemies to each other." (Samuel Gobat's *Journal of a Three Years' Residence in Abyssinia*, 1834.)

The dress of the Abyssinians is much like that of the Arabs. It consists of close-fitting drawers reaching below the knees, with a sash to hold them, and a large white robe. The Abyssinian, however, is beginning to adopt European clothes on the upper part of the body, and European hats are becoming common.

The Christian Abyssinians usually go barehead and barefoot, in contrast to the Mahommedans, who wear turbans and leather sandals. The women's dress is a smock with sleeves loose to the wrist, where they fit tightly. The priests wear a white jacket with loose sleeves, a head-cloth like a turban and a special type of shoe with turned-up toes and soles projecting at the heel. In the Woldeba district hermits dress in ochre-yellow cloths, while the priests of some sects wear hides dyed red. Clothes are made of cotton, though the nobles and great people wear silk robes presented by the emperor as a mark of honour. The possessor of one of these is allowed to appear in the royal presence wearing it instead of having one shoulder bared, as is the usual Abyssinian method of showing respect. A high-born man covers himself to the mouth in the presence of inferiors. The men either cut their hair short or plait it; married women plait their hair and wind round the head a black or parti-coloured silk handkerchief; girls wear their hair short. In the hot season no Abyssinian goes without a flag-shaped fan of plaited rushes. The Christian Abyssinians, men and women, wear a blue silk cord round the neck, to which is often attached a crucifix. For ornament women wear silver ankle-rings with bells, silver necklaces and silver or gold rosettes in the ears. Silver rings on fingers and also on toes are common. The women are very fond of strong scents, which are generally oils imported from India and Ceylon. The men scarcely ever appear without a long curved knife, generally they carry shield and spear as well. Although the army has been equipped with modern rifles, the common weapon of the people is the matchlock, and slings are still in use. The original arms were a sickle-shaped sword, spear and shield. The Abyssinians are great hunters and are also clever at taming wild beasts. The nobles hunt antelopes with leopards, and giraffes and ostriches with horse and greyhound. In elephant-hunting iron bullets weighing a quarter of a pound are used; throwing-clubs are employed for small game, and lions are hunted with the spear. Lion skins belong to the emperor, but the slayer keeps a strip to decorate his shield.

Stone and mortar are used in building, but the Abyssinian houses are of the roughest kind, being usually circular huts, ill made and thatched with grass. These huts are sometimes made simply of straw and are surrounded by high thorn hedges, but, in the north, square houses, built in stories, flat-roofed, the roof sometimes laid at the same slope as the hillside, and some with pitched thatched roofs, are common. The inside walls are plastered with cow-dung, clay and finely chopped straw. None of the houses have chimneys, and smoke soon colours the interior a dark brown. Generally the houses are filthy and ill ventilated and swarm with vermin. Drainage and sanitary arrangements do not exist. The caves of the highlands are often used as dwellings. The most remarkable buildings in Abyssinia are certain churches hewn out of the solid rock. The chief native industries are leather-work, embroidery and filigree metal-work; and the weaving of straw mats and baskets is extensively practised. The baskets are particularly well made, and are frequently used to contain milk.

Abyssinian art is crude and is mainly reserved for rough frescoes in the churches. These frescoes, however, often exhibit considerable skill, and are indicative of the lively imagination of their painters. They are in the Byzantine style and the colouring is gaudy. Saints and good people are always depicted full face, the devil and all bad folk are shown in profile. Among the finest frescoes are those in the church of the Holy Trinity at Adowa and those in the church at Kwarata, on the shores of Lake Tsana. The churches are usually circular in form, the walls of stone, the roof thatched.

The chief musical instruments are rough types of trumpets and flutes, drums, tambourines and cymbals, and quadrangular harps.

HISTORY

(12) Abyssinia, or at least the northern portion of it, was included in the tract of country known to the ancients as Ethiopia, the northern limits of which reached at one time to about Syene. The connexion between Egypt and Ethiopia was in early times very intimate, and occasionally the two countries were under the same ruler, so that the arts and civilization of the one naturally found their way into the other. In early times, too, the Hebrews had commercial intercourse with the Ethiopians; and according to Abyssinian tradition the queen of Sheba who visited Solomon was a monarch of their country, and from their son Menelek the kings of Abyssinia claim descent. During the Captivity many of the Jews settled here and brought with them a knowledge of the Jewish religion. Under the Ptolemies, the arts as well as the enterprise of the Greeks entered Ethiopia, and led to the establishment of Greek colonies. A Greek inscription at Adulis, no longer extant, but copied by Cosmas of Alexandria, and preserved in his *Topographia Christiana*, records that Ptolemy Euergetes, the third of the Greek dynasty in Egypt, invaded the countries on both sides of the Red Sea, and having reduced most of the provinces of Tigré to subjection, returned to the port of Adulis, and there offered sacrifices to Jupiter, Mars and Neptune. Another inscription, not so ancient, found at Axum, states that Aizanas, king of the Axumites, the Homerites, &c., conquered the nation of the Bogos, and returned thanks to his father, the god Mars, for his victory. Out of these Greek colonies appears to have arisen the kingdom of Auxume which flourished from the 1st to the 7th century A.D. and was at one time nearly coextensive with Abyssinia proper. The capital Auxume and the seaport Adulis were then the chief centres of the trade with the interior of Africa in gold dust, ivory, leather, aromatics, &c. At Axum, the site of the ancient capital, many vestiges of its former greatness still exist; and the ruins of Adulis, which was once a seaport on the bay of Annesley, are now about 4 m. from the shore (see ETHIOPIA, *The Axumite Kingdom*).

Introduction of Christianity.

(13) Christianity was introduced into the country by Frumentius (*q.v.*), who was consecrated first bishop of Ethiopia by St Athanasius of Alexandria about A.D. 330. From the scanty evidence available it would appear that the new religion at first made little progress, and the Axumite kings seem to have been among the latest converts. Towards the close of the 5th century a great company of monks are believed to have established themselves in the country. Since that time monachism has been a power among the people and not without its influence on the course of events. In the early part of the 6th century the king of the Homerites, on the opposite coast of the Red Sea, having persecuted the Christians, the emperor Justinian I. requested the king of Auxume, Caleb or El-Esbaha, to avenge their cause. He accordingly collected an army, crossed over into Arabia, and conquered Yemen (*c.* 525), which remained subject to Ethiopia for about fifty years. This was the most flourishing period in the annals of the country. The Ethiopians possessed the richest part of Arabia, carried on a large trade, which extended as far as India and Ceylon, and were in constant communication with the Greek empire. Their expulsion from Arabia, followed by the conquest of Egypt by the Mahommedans in the middle of the 7th century, changed this state of affairs, and the continued advances of the followers of the Prophet at length cut them off from almost every means of communication with the civilized world; so that, as Gibbon says, "encompassed by the enemies of their religion, the Ethiopians slept for near a thousand years, forgetful of the world by whom they were forgotten." About A.D. 1000, a Jewish princess, Judith, conceived the design of murdering all the members of the royal family, and of establishing herself in their stead. During the execution of this project, the infant king was carried off by some faithful adherents, and conveyed to Shoa, where his authority was acknowledged, while Judith reigned for forty years over the rest of the kingdom, and transmitted the crown to her descendants. In 1268 the kingdom was restored to the royal house in the person of Yekūnō Amlāk.

(14) Towards the close of the 15th century the Portuguese missions into Abyssinia began. A belief had long prevailed in Europe of the existence of a Christian kingdom in the far east, whose monarch was known as Prester John, and various

Portuguese influence.

expeditions had been sent in quest of it. Among others who had engaged in this search was Pedro de Covilham, who arrived in Abyssinia in 1490, and, believing that he had at length reached the far-famed kingdom, presented to the negūs, or emperor of the country, a letter from his master the king of Portugal, addressed to Prester John. Covilham remained in the country, but in 1507 an Armenian named Matthew was sent by the negūs to the king of Portugal to request his aid against the Mahommedans. In 1520 a Portuguese fleet, with Matthew on board, entered the Red Sea in compliance with this request, and an embassy from the fleet visited the negūs, Lebna Dengel Dawit (David) II., and remained in Abyssinia for about six years. One of this embassy was Father Francisco Alvarez, from whom we have the earliest and not the least interesting account of the country. Between 1528 and 1540 armies of Mahommedans, under the renowned general Mahommed Gran (or Granyé, probably a Somali or a Galla), entered Abyssinia from the low country to the south-east, and overran the kingdom, obliging the emperor to take refuge in the mountain fastnesses. In this extremity recourse was again had to the Portuguese. John Bermudez, a subordinate member of the mission of 1520, who had remained in the country after the departure of the embassy, was, according to his own statement (which is untrustworthy), ordained successor to the *abuna* (archbishop), and sent to Lisbon. Bermudez certainly came to Europe, but with what credentials is not known. Be that as it may, a Portuguese fleet, under the command of Stephen da Gama, was sent from India and arrived at Massawa in February 1541. Here he received an ambassador from the negūs beseeching him to send help against the Moslems, and in the July following a force of 450 musqueteers, under the command of Christopher da Gama, younger brother of the admiral, marched into the interior, and being joined by native troops were at first successful against the enemy; but they were subsequently defeated, and their commander taken prisoner and put to death (August 1542). On the 21st of February 1543, however, Mahommed Granyé was shot in an engagement and his forces totally routed. After this, quarrels arose between the negūs and Bermudez, who had returned to Abyssinia with Christopher da Gama and who now wished the emperor publicly to profess himself a convert to Rome. This the negūs refused to do, and at length Bermudez was obliged to make his way out of the country. The Jesuits who had accompanied or followed the da Gama expedition into Abyssinia, and fixed their headquarters at Fremona (near Adowa), were oppressed and neglected, but not actually expelled. In the beginning of the 17th century Father Pedro Paez arrived at Fremona, a man of great tact and judgment, who soon rose into high favour at court, and gained over the emperor to his faith. He directed the erection of churches, palaces and bridges in different parts of the country, and carried out many useful works. His successor Mendez was a man of much less conciliatory manners, and the feelings of the people became strongly excited against the intruders, till at length, on the death of the negūs Sysenius, Socinius or Seged I., and the accession of his son Fasilidas in 1633, they were all sent out of the country, after having had a footing there for nearly a century and a half. The French physician C. J. Poncet, who went there in 1698, *via* Sennar and the Blue Nile, was the only European that afterwards visited the country before Bruce in 1769. James Bruce's main object was to discover the sources of the Nile, which he was convinced lay in Abyssinia. Accordingly, leaving Massawa in September 1769, he travelled *via* Axum to Gondar, where he was well received by King Tekla Haimanot II. He accompanied the king on a warlike expedition round Lake Tsana, moving S. round the eastern shore, crossing the genuine Blue Nile (Abai) close to its point of issue from the lake and returning *via* the western shore. On a second expedition of his own he proved to his own satisfaction that the river originated some 40 miles S.W. of the lake at a place called Geesh (4th of November 1770). He showed that this river flowed into the lake, and left it by its now well-known outlet. Bruce subsequently returned to Egypt (end of 1772) *via* Gondar, the upper Atbara, Sennar, the Nile and the Korosko desert (see Bruce, James).

Visits of Poncet and Bruce.

Position of the negūs negusti.

(15) In order to attain a clear view of native Abyssinian history, as distinct from the visits and influence of Europeans, it must be borne in mind that during the last three hundred years, and indeed for a longer period, for the old chroniclers may be trusted to have given a somewhat distorted view of the importance of the particular chieftains with whom they came in contact, the country has been merely a conglomeration of provinces and districts, ill defined, loosely connected and generally at war with each other. Of these the chief provinces have been Tigré (northern), Amhara (central) and Shoa (southern). The seat of government, or rather of overlordship, has usually been in Amhara, the ruler of which, calling himself negūs negusti (king of kings, or emperor), has exacted tribute, when he could, from the other provinces. The title of negūs negusti has been to a considerable extent based on the blood in the veins of the claimant. All the emperors have based their claims on their direct descent from Solomon and the queen of Sheba; but it is needless to say that in many, if not in most, cases their success has been due more to the force of their arms than to the purity of their lineage. Some of the rulers of the larger provinces have at times been given, or have given themselves, the title of negūs or king, so that on occasion as many as three, or even more, negūses have been reigning at the same time; and this must be borne in mind by the student of Abyssinian history in order to avoid confusion of rulers. The whole history of the country is in fact one gloomy record of internecine wars, barbaric deeds and unstable governments, of adventurers usurping thrones, only to be themselves unseated, and of raids, rapine and pillage. Into this chaos enter from time to time broad rays of sunshine, the efforts of a few enlightened monarchs to evolve order from disorder, and to supply to their people the blessings of peace and civilization. Bearing these matters in mind, we find that during the 18th century the most prominent and beneficent rulers were the emperor Yesu of Gondar, who died about 1720, Sebastié, negūs of Shoa (1703–1718), Amada Yesus of Shoa, who extended his kingdom and founded Ankober (1743–1774), Tekla Giorgis of Amhara (1770–1798?) and Asfa Nassen of Shoa (1774–1807), the latter being especially renowned as a wise and benevolent monarch. The first years of the 19th century were disturbed by fierce campaigns between Guxa, ras of Gondar, and Wolda Selassié, ras of Tigré, who were both striving for the crown of Guxa's master, the emperor Eguala Izeion. Wolda Selassié was eventually the victor, and practically ruled the whole country till his death in 1816 at the age of eighty.

British mission and missionary enterprise.

(16) Mention must here be made of the first British mission, under Lord Valentia and Mr Henry Salt, which was sent in 1805 to conclude an alliance with Abyssinia, and obtain a port on the Red Sea in case France secured Egypt by dividing up the Turkish empire with Russia. This mission was succeeded by many travellers, missionaries and merchants of all countries, and the stream of Europeans continued until well into Theodore's reign. For convenience' sake we insert at this point a partial list of missionaries and others who visited the country during the second third of the 19th century—merely calling attention to the fact that their visits were distributed over widely different parts of the country, ruled by distinct lines of monarchs or governors. In 1830 Protestant missionary enterprise was begun by Samuel Gobat and Christian Kugler, who were sent out by the Church Missionary Society, and were well received by the ras of Tigré. Mr Kugler died soon after his arrival, and his place was subsequently supplied by Mr C. W. Isenberg, who was followed by Dr Ludwig Krapf, the discoverer of Mount Kenya, and others. Mr (afterwards Bishop) Gobat proceeded to Gondar, where he also met with a favourable reception. In 1833 he returned to Europe, and published a journal of his residence in Abyssinia. In 1834 Gobat went back to Tigré, but in 1836 ill health compelled him to leave. In 1838 other missionaries were obliged to leave the country, owing to the opposition of the native

priests. Messrs Isenberg and Krapf went south, and established themselves at Shoa. The former soon after returned to England, but Mr Krapf remained in Shoa till March 1842, when he removed to Mombasa. Dr E. Rüppell, the German naturalist, visited the country in 1831, and remained nearly two years. M. E. Combes and M. Tamisier arrived at Massawa in 1835, and visited districts which had not been traversed by Europeans since the time of the Portuguese. One who did much at the time to extend our geographical knowledge of the country was Dr C. T. Beke (*q.v.*), who was there from 1840 to 1843. Mr Mansfield Parkyns was there from 1843 to 1846, and wrote the most interesting book on the country since the time of Bruce. Bishop Gobat having conceived the idea of sending lay missionaries into the country, who would engage in secular occupations as well as carry on missionary work, Dr Krapf returned to Abyssinia in 1855 with Mr Flad as pioneers of that mission; Krapf, however, was not permitted to remain in the country. Six lay workers came out at first, and they were subsequently joined by others. Their secular work, however, appears to have been more valuable to Theodore than their preaching, so that he employed them as workmen to himself, and established them at Gaffat, near his capital. Mr Stern arrived in Abyssinia in 1860, and after a visit to Europe returned in 1863, accompanied by Mr and Mrs Rosenthal.[1]

Rivalry of British and French factions.

(17) Wolda Selassié of Tigré was succeeded in 1817, through force of arms, by Sabagadis of Agamé, and the latter, as ras of Tigré, introduced various Englishmen, whom he much admired, into the country. He increased the prosperity of his land considerably, but by so doing roused the jealousy of Ras Marié of Amhara—to whom he had refused tribute—and Ubié, son of Hailo Mariam, a governor of Simen. In an ensuing battle (in January 1831), both Sabagadis and Marié were killed, and Ubié retired to watch events from his own province. Marié was shortly succeeded in the ras-ship of Amhara by Ali, a nephew of Guxa and a Mahommedan. But Ubié, who was aiming at the crown, soon attacked Ras Ali, and after several indecisive campaigns proclaimed himself negūs of Tigré. To him came many French missionaries and travellers, chief of whom were Lieut. Lefebvre, charged (1839) with political and geographical missions, and Captains Galinier and Ferret, who completed for him a useful triangulation and survey of Tigré and Simen (1840–1842). The brothers Antoine and Arnaud d'Abbadie (*q.v.*) spent ten years (1838–1848) in the country, making scientific investigations of great value, and also involving themselves in the stormy politics of the country. Northern Abyssinia was now divided into two camps, the one, Amhara and Ras Ali, under Protestant British, and the other, Tigré and Ubié, under Roman Catholic French, influence. The latent hostility between the two factions threatened at one time to develop into a religious war, but no serious campaigns took place until Kassa (later Theodore) appeared on the scene.

Rise of the emperor Theodore.

(18) Lij (=Mr) Kassa was born in Kwara, a small district of Western Amhara, in 1818. His father was a small local chief, and his uncle was governor of the districts of Dembea, Kwara and Chelga between Lake Tsana and the undefined N.W. frontier. He was educated in a monastery, but preferred a more active life, and by his talents and energy came rapidly to the front. On the death of his uncle he was made chief of Kwara, but in consequence of the arrest of his brother Bilawa by Ras Ali, he raised the standard of revolt against the latter, and, collecting a large force, repeatedly beat the troops that were sent against him by the ras (1841–1847). On one occasion peace was restored by his receiving Tavavich, daughter of Ras Ali, in marriage; and this lady is said to have been a good and wise counsellor during her lifetime. He next turned his arms against the Turks, in the direction of Massawa, but was defeated; and the mother of Ras Ali having insulted him in his fallen condition, he proclaimed his independence. As his power was increasing, to the detriment of both Ras Ali and Ubié, these two princes combined against him, but were heavily defeated by him at Gorgora (on the southern shore of Lake Tsana) in 1853. Ubié retreated to Tigré, and Ras Ali fled to Begemeder, where he eventually died. Kassa now ruled in Amhara, but his ambition was to attain to supreme power, and he turned his attention to conquering the remaining chief divisions of the country, Gojam, Tigré and Shoa, which still remained unsubdued. Berro, ras of Gojam, in order to save himself, attempted to combine with Tigré, but his army was intercepted by Kassa and totally destroyed, himself being taken prisoner and executed (May 1854). Shortly afterwards Kassa moved against Tigré, defeated Ubié's forces at Deragié, in Simen (February 1855), took their chief prisoner and proclaimed himself negūs negusti of Ethiopia under the name of Theodore III. He now turned his attention to Shoa.

Growing power of Shoa.

(19) Retracing our steps for a moment in that direction, we find that in 1813 Sahela (or Sella) Selassié, younger son of the preceding ras, Wassen Seged, had proclaimed himself negūs or king. His reign was long and beneficent. He restored the towns of Debra-Berhan and Angolala, and founded Entotto, the strong stone-built town whose ruins overlook the modern capital, Adis Ababa. In the terrible "famine of St Luke" in 1835, Selassié still further won the hearts of his subjects by his wise measures and personal generosity; and by extending his hospitality to Europeans, he brought his country within the closer ken of civilized European powers. During his reign he received the missions of Major W. Cornwallis Harris, sent by the governor-general of India (1841), and M. Rochet d'Héricourt, sent by Louis Philippe (1843), with both of whom he concluded friendly treaties on behalf of their respective governments. He also wrote to Pope Pius IX., asking that a Roman Catholic bishop should be sent to him. This request was acceded to, and the pope despatched Monsignor Massaja to Shoa. But before the prelate could reach the country, Selassié was dead (1847), leaving his eldest son, Haeli Melicoth, to succeed him. Melicoth at once proclaimed himself negūs, and by sending for Massaja, who had arrived at Gondar, gave rise to the suspicion that he wished to have himself crowned as emperor. By increasing his dominions at the expense of the Gallas, he still further roused the jealousy of the northerners, and a treaty which he concluded with Ras Ali against Kassa in 1850 determined the latter to crush him at the earliest opportunity.

Thus it was that in 1855 Kassa, under the name of the emperor Theodore, advanced against Shoa with a large army. Dissensions broke out among the Shoans, and after a desperate and futile attack on Theodore at Debra-Berhan, Haeli Melicoth died of exhaustion and fever, nominating with his last breath his eleven-year-old son Menelek[2] as successor (November 1855). Dargé, Haeli's brother, took charge of the young prince, but after a hard fight with Angeda, one of Theodore's rases, was obliged to capitulate. Menelek was handed over to the negūs, taken to Gondar, and there trained in Theodore's service.

(20) Theodore was now in the zenith of his career. He is described as being generous to excess, free from cupidity, merciful to his vanquished enemies, and strictly continent, but subject to violent bursts of anger and possessed of unyielding pride and fanatical religious zeal. He was also a man of education and intelligence, superior to those among whom he lived, with natural talents for governing and gaining the esteem of others. He had, further, a noble bearing and majestic walk, a frame capable of enduring any amount of fatigue, and is said to have been "the best shot, the best spearman, the best runner, and the best horseman in Abyssinia." Had he contented himself with the sovereignty of Amhara and Tigré, he might have maintained his position; but he was led to exhaust his strength against the Wollo Gallas, which was probably one of the chief causes of his ruin. He obtained several victories over that people, ravaged their country, took possession of Magdala, which he afterwards made his principal stronghold, and enlisted many of the chiefs and their followers in his own ranks. As has been shown, he also reduced the kingdom of Shoa, and took Ankober, the capital;

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[1] Since Theodore's time Protestant missionary work, except by natives, has been stopped.

[2] Menelek means "a second self."

but in the meantime his own people were groaning under his heavy exactions, rebellions were breaking out in various parts of his provinces, and his good queen Tavavich was now dead.

Theodore's quarrel with Great Britain.

The British consul, Walter C. Plowden, who was strongly attached to Theodore, having been ordered by his government in 1860 to return to Massawa, was attacked on his way by a rebel named Garred, mortally wounded, and taken prisoner. Theodore attacked the rebels, and in the action the murderer of Mr Plowden was slain by his friend and companion Mr J. T. Bell, an engineer, but the latter lost his life in preserving that of Theodore. The deaths of the two Englishmen were terribly avenged by the slaughter or mutilation of nearly 2000 rebels. Theodore soon after married his second wife Terunish, the proud daughter of the late governor of Tigré, who felt neither affection nor respect for the upstart who had dethroned her father, and the union was by no means a happy one. In 1862 he made a second expedition against the Gallas, which was stained with atrocious cruelties. Theodore had now given himself up to intoxication and lust. When the news of Mr Plowden's death reached England, Captain C. D. Cameron was appointed to succeed him as consul, and arrived at Massawa in February 1862. He proceeded to the camp of the king, to whom he presented a rifle, a pair of pistols and a letter in the queen's name. In October Captain Cameron was sent home by Theodore, with a letter to the queen of England, which reached the Foreign Office on the 12th of February 1863. This letter was put aside and no answer returned, and to this in no small degree are to be attributed the difficulties that subsequently arose with that country. In November despatches were received from England, but no answer to the emperor's letter, and this, together with a visit paid by Captain Cameron to the Egyptian frontier town of Kassala, greatly offended him; accordingly in January 1864 Captain Cameron and his suite, with Messrs Stern and Rosenthal, were cast into prison. When the news of this reached England, the government resolved, when too late, to send an answer to the emperor's letter, and selected Mr Hormuzd Rassam to be its bearer. He arrived at Massawa in July 1864, and immediately despatched a messenger requesting permission to present himself before the emperor. Neither to this nor a subsequent application was any answer returned till August 1865, when a curt note was received, stating that Consul Cameron had been released, and if Mr Rassam still desired to visit the king, he was to proceed by the route of Gallabat. Later in the year Theodore became more civil, and the British party on arrival at the king's camp in Damot, on the 25th of January 1866, were received with all honour, and were afterwards sent to Kwarata, on Lake Tsana, there to await the arrival of the captives. The latter reached Kwarata on the 12th of March, and everything appeared to proceed favourably. A month later they started for the coast, but had not proceeded far when they were all brought back and put into confinement. Theodore then wrote a letter to the queen, requesting European workmen and machinery to be sent to him, and despatched it by Mr Flad. The Europeans, although detained as prisoners, were not at first unkindly treated; but in the end of June they were sent to Magdala, where they were soon afterwards put in chains. They suffered hunger, cold and misery, and were in constant fear of death, till the spring of 1868 when they were relieved by the British troops.

Sir Robert Napier's expedition.

(21) In the meantime the power of Theodore in the country was rapidly waning. Shoa had already shaken off his yoke; Gojam was virtually independent; Walkeit and Simen were under a rebel chief; and Lasta, Waag and the country about Lake Ashangi had submitted to Wagshum Gobassié, who had also overrun Tigré and appointed Dejaj Kassai his governor. The latter, however, in 1867 rebelled against his master and assumed the supreme power of that province. This was the state of matters when the English troops made their appearance in the country. With a view if possible to effect the release of the prisoners by conciliatory measures, Mr Flad was sent back, with some artisans and machinery, and a letter from the queen, stating that these would be handed over to his majesty on the release of the prisoners and their return to Massawa. This, however, failed to influence the emperor, and the English government at length saw that they must have recourse to arms. In July 1867, therefore, it was resolved to send an army into Abyssinia to enforce the release of the captives, under Sir Robert Napier (1st Baron Napier of Magdala). The landing-place selected was Mulkutto (Zula), on Annesley Bay, the point of the coast nearest to the site of the ancient Adulis, and we are told that "the pioneers of the English expedition followed to some extent in the footsteps of the adventurous soldiers of Ptolemy, and met with a few faint traces of this old-world enterprise" (C. R. Markham). The force amounted to upwards of 16,000 men, besides 12,640 belonging to the transport service, and followers, making in all upwards of 32,000 men. The task to be accomplished was to march over 400 miles of a mountainous and little-known country, inhabited by savage tribes, to the camp or fortress of Theodore, and compel him to deliver up his captives. The commander-in-chief landed on the 7th of January 1868, and soon after the troops began to move forward through the pass of Senafé, and southward through the districts of Agamé, Tera, Endarta, Wojerat, Lasta and Wadela. In the meantime Theodore had been reduced to great straits. His army, which at one time numbered over 100,000 men, was rapidly deserting him, and he could hardly obtain food for his followers. He resolved to quit his captial Debra-Tabor, which he burned, and set out with the remains of his army for Magdala. During this march he displayed an amount of engineering skill in the construction of roads, of military talent and fertility of resource, that excited the admiration and astonishment of his enemies. On the afternoon of the 10th of April a force of about 3000 men suddenly poured down upon the English in the plain of Arogié, a few miles from Magdala. They advanced again and again to the charge, but were each time driven back, and finally retired in good order. Early next morning Theodore sent Lieut. Prideaux, one of the captives, and Mr Flad, accompanied by a native chief, to the English camp to sue for peace. Answer was returned, that if he would deliver up all the Europeans in his hands, and submit to the queen of England, he would receive honourable treatment. The captives were liberated and sent away, and accompanying a letter to the English general was a present of 1000 cows and 500 sheep, the acceptance of which would, according to Eastern custom, imply that peace was granted. Through some misunderstanding, word was sent to Theodore that the present would be accepted, and he felt that he was now safe; but in the evening he learned that it had not been received, and despair again seized him. Early next morning he attempted to escape with a few of his followers, but subsequently returned. The same day (13th April) Magdala was stormed and taken, practically without loss, and within they found the dead body of the emperor, who had fallen by his own hand. The inhabitants and troops were subsequently sent away, the fortifications destroyed and the town burned. The queen Terunish having expressed her wish to go back to her own country, accompanied the British army, but died during the march, and her son Alamayahu, the only legitimate son of the emperor, was brought to England, as this was the desire of his father.[1] The success of the expedition was in no small degree owing to the aid afforded by the several native chiefs through whose country it passed, and no one did more in this way than Dejaj Kassa or Kassai of Tigré. In acknowledgment of this, several pieces of ordnance, small arms and ammunition, with much of the surplus stores, were handed over to him, and the English troops left the country in May 1868.

Menelek II., king of Shoa.

(22) It is now time to return to the story of the young prince Menelek, who, as we have seen, had been nominated by his late father as ruler of Shoa, but was in Theodore's power in Tigré. The following table shows his descent since the beginning of the 19th century:—

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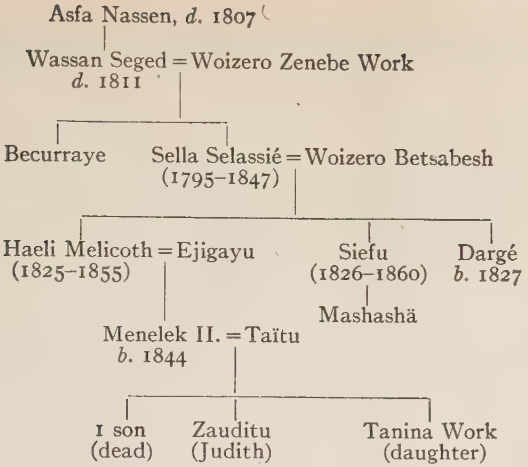
[1] He was subsequently sent to school at Rugby, but died in his nineteenth year, on the 14th of November 1879. He was buried at St George's Chapel, Windsor.



King John attains supreme power.

On the retirement of Theodore's forces from Shoa in 1855, Siefu, brother of Haeli Melicoth, proclaimed himself negūs of Shoa at Ankober, and beat the local representatives of the northern government. The emperor returned, however, in 1858, and after several repulses succeeded in entering Ankober, where he behaved with great cruelty, murdering or mutilating all the inhabitants. Siefu kept up a gallant defence for two more years, but was then killed by Kebret, one of his own chiefs. Thus chaos again reigned supreme in Shoa. In 1865, Menelek, now a *dejazmach*[1] of Tigré, took advantage of Theodore's difficulties with the British government and escaped to Workitu, queen of the Wollo Galla country. The emperor, who held as hostage a son of Workitu, threatened to kill the boy unless Menelek were given up; but the gallant queen refused, and lost both her son and her throne. The fugitive meanwhile arrived safely in Shoa, and was there acclaimed as negūs. For the next three years Menelek devoted himself to strengthening and disciplining his army, to legislation, to building towns, such as Liché (near Debra-Berhan), Worra Hailu (Wollo Galla country), &c., and to repelling the incursions of the Gallas. On the death of Theodore (13th April 1868) many Shoans, including Ras Dargé, were released, and Menelek began to feel himself strong enough, after a few preliminary minor campaigns, to undertake offensive operations against the northern princes. But these projects were of little avail, for Kassai of Tigré, as above mentioned, had by this time (1872) risen to supreme power in the north. With the help of the rifles and guns presented to him by the British, he had beaten Ras Bareya of Tigré, Wagshum Gobassié of Amhara and Tekla Giorgis of Condar, and after proclaiming himself negūs negusti under the name of Johannes or John, was now preparing to march on Shoa. Here, however, Menelek was saved from probable destruction through the action of Egypt. This power had, by the advice of Werner Munzinger (*q.v.*), their Swiss governor of Massawa, seized and occupied in 1872 the northern province of Bogos; and, later on, insisted on occupying Hamasen also, for fear Bogos should be attacked. John, after futile protests, collected an army, and with the assistance of Ras Walad Michael, hereditary chief of Bogos, advanced against the Egyptian forces, who were under the command of one Arendrup, a Dane. Meeting near the Mareb, the Egyptians were beaten in detail, and almost annihilated at Gundet (13th November 1875). An avenging expedition was prepared in the spring of the following year, and, numbering 14,000 men under Ratib Pasha, Loring (American), and Prince Hassan, advanced to Gura and fortified a position in the neighbourhood. Although reinforced by Walad Michael, who had now quarrelled with John, the Egyptians were a second time (25th March 1876) heavily beaten by the Abyssinians, and retired, losing an enormous quantity of both men and rifles. Colonel C. G. Gordon, governor-general of the Sudan, was now ordered to go and make peace with John, but the king had moved south with his army, intending to punish Menelek for having raided Gondar whilst he, John, was engaged with the Egyptians.

(23) Menelek's kingdom was meanwhile torn in twain by serious dissensions, which had been instigated by his concubine Bafana. This lady, to whom he was much attached, had been endeavouring to secure the succession of one of her own sons to the throne of Shoa, and had almost succeeded in getting rid of Mashashä, son of Siefu and cousin of Menelek, who was the apparent heir. On the approach of John, the Shoans united for a time against their common enemy. But after a few skirmishes they melted away, and Menelek was obliged to submit and do obeisance to John. The latter behaved with much generosity, but at the same time imposed terms which effectually deprived Shoa of her independence (March 1878). In 1879 Gordon was sent on a fresh mission to John on behalf of Egypt; but he was treated with scant courtesy, and was obliged to leave the country without achieving anything permanent.

Beginning of Italian influence.

The Italians now come on the scene. Assab, a port near the southern entrance of the Red Sea, had been bought from the local sultan in March 1870 by an Italian company, which, after acquiring more land in 1879 and 1880, was bought out by the Italian government in 1882. In this year Count Pietro Antonelli was despatched to Shoa in order to improve the prospects of the colony by treaties with Menelek and the sultan of Aussa. Several missions followed upon this one, with more or less successful results; but both John and Menelek became uneasy when Beilul, a port to the north of Assab Bay, was occupied by the Italians in January 1885, and Massawa taken over by them from Egypt in the following month. This latter act was greatly resented by the Abyssinians, for by a treaty concluded with a British and Egyptian mission under Admiral Hewett and Mason Pasha[2] in the previous year, free transit of goods was to be allowed through this port. Matters came to a head in January 1887, when the Abyssinians, in consequence of a refusal from General Gené to withdraw his troops, surrounded and attacked a detachment of 500 Italian troops at Dogali, killing more than 400 of them. Reinforcements were sent from Italy, whilst in the autumn the British government stepped in and tried to mediate by means of a mission under Mr (afterwards Sir Gerald) Portal. His mission, however proved abortive, and after many difficulties and dangers he returned to Egypt at the end of the year. In April 1888 the Italian forces, numbering over 20,000 men, came into touch with the Abyssinian army; but negotiations took the place of fighting, with the result that both forces retired, the Italians only leaving some 5000 troops in Eritrea, as their colony was now called. Meanwhile John had not been idle with regard to the dervishes, who had in the meantime become masters of the Egyptian Sudan. Although he had set his troops in motion too late to relieve Kassala, Ras Alula, his chief general, had succeeded in inflicting a handsome defeat on Osman Digna at Kufit in September 1885. Fighting between the dervishes and the Abyssinians continued, and in August 1887 the dervishes entered and sacked Gondar. After some delay, King John took the field in force against the enemy, who were still harassing the north-west of his territory. A great battle ensued at Gallabat, in which the dervishes, under Zeki Tumal, were beaten. But a stray bullet struck the king, and the Abyssinians decided to retire. The king died during the night, and his body fell into the hands of the enemy (9th March 1889).

Menelek emperor.

(24) Immediately the news of John's death reached Menelek, he proclaimed himself emperor, and received the submission of Gondar, Gojam and several other provinces. In common with other northern princes, Mangasha, reputed son and heir of King John, with the yellow-eyed Ras Alula,[3] refused to acknowledge the sovereignty of Menelek; but, on the latter marching against them in the following January with a large army, they submitted. As it happened, Count Antonelli was with Menelek when he claimed

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[1] A title variously translated. A *dejazmach* (*dejaj*) is a high official, ranking immediately below a *ras*.

[2] The main object of this mission was to seek John's assistance in evacuating the Egyptian garrisons in the Sudan, which were threatened by the dervishes.

[3] Ras Alula died February 1897, aged about 52. He had raised himself by his military talents from being a groom and private soldier to the position of generalissimo of the army.

the throne, and promptly concluded (2nd of May 1889) with him on behalf of Italy a friendly treaty, to be known hereafter as the famous Uccialli treaty. In consequence of this the Italians occupied Asmara, made friends with Mangasha and received Ras Makonnen,[1] Menelek's nephew, as his plenipotentiary in Italy. Thus it seemed as though hostilities between the two countries had come to a definite end, and that peace was assured in the land. For the next three years the land was fairly quiet, the chief political events being the convention (6th February 1891) between Italy and Abyssinia, protocols between Italy and Great Britain (24th March and 15th April 1891) and a proclamation by Menelek (10th April 1891), all on the subject of boundaries. As, however, the Italians became more and more friendly with Mangasha and Tigré the apprehensions of Menelek increased, till at last, in February 1893, he wrote denouncing the Uccialli treaty, which differed in the Italian and Amharic versions. According to the former, the negūs was bound to make use of Italy as a channel for communicating with other powers, whereas the Amharic version left it optional. Meanwhile the dervishes were threatening Eritrea. A fine action by Colonel Arimondi gained Agordat for Italy (21st December 1893), and a brilliant march by Colonel Baratieri resulted in the acquisition of Kassala (17th July 1894).

On his return Baratieri found that Mangasha was intriguing with the dervishes, and had actually crossed the frontier with a large army. At Koatit and Senafé (13th to 15th January 1895) Mangasha was met and heavily defeated by Baratieri, who occupied Adrigat in March. But as the year wore on the Italian commander pushed his forces unsupported too far to the south. Menelek was advancing with a large army in national support of Mangasha, and the subsequent reverses at Amba Alagi (7th December 1895) and Macalle (23rd January 1896) forced the Italians to fall back.

Battle of Adowa.

Reinforcements of many thousands were meanwhile arriving at Massawa, and in February Baratieri took the field at the head of over 13,000 men. Menelek's army, amounting to about 90,000, had during this time advanced, and was occupying a strong position at Abba Garima, near Adua (or Adowa). Here Baratieri attacked him on the 1st of March, but the difficulties of the country were great, and one of the four Italian brigades had pushed too far forward. This brigade was attacked by overwhelming numbers, and on the remaining brigades advancing in support, they were successively cut to pieces by the encircling masses of the enemy. The Italians lost over 4500 white and 2000 native troops killed and wounded, and over 2500 prisoners, of which 1600 were white, whilst the Abyssinians owned to a loss of over 3000. General Baldissera advanced with a large body of reinforcements to avenge this defeat, but the Abyssinians, desperately short of supplies, had already retired, and beyond the peaceful relief of Adrigat no further operations took place. It may here be remarked that the white prisoners taken by Menelek were exceedingly well treated by him, and that he behaved throughout the struggle with Italy with the greatest humanity and dignity. On the 26th of October following a provisional treaty of peace was concluded at Adis Ababa, annulling the treaty of Uccialli and recognizing the absolute independence of Abyssinia. This treaty was ratified, and followed by other treaties and agreements defining the Eritrean-Abyssinian and the Abyssinian-Italian Somaliland frontiers (see ITALY, *History*, and SOMALILAND, *Italian*).

Menelek as independent monarch.

(25) The war, so disastrous to Italy, attracted the attention of all Europe to Abyssinia and its monarch, and numerous missions, two Russian, three French and one British, were despatched to the country, and hospitably received by Menelek. The British one, under Mr (afterwards Sir) Rennell Rodd, concluded a friendly treaty with Abyssinia (15th of May 1897), but did not, except in the direction of Somaliland, touch on frontier questions, which for several years continued a subject of discussion. During the same year (1897) a small French expedition under Messrs Clochette and de Bonchamps endeavoured to reach the Nile, but, after surmounting many difficulties, stuck in the marshes of the Upper Sobat, and was obliged to return. Another expedition of Abyssinians, under Dejaj Tasamma and accompanied by three Europeans—Faivre (French), Potter (Swiss) and Artomonov (Russian)—started early in 1898, and reached the Nile at the Sobat mouth in June, a few days only before Major Marchand and his gallant companions arrived on the scene. But no contact was made, and the expedition returned to Abyssinia.

In the same year Menelek proceeded northwards with a large army for the purpose of chastising Mangasha, who was again rebelling against his authority. After some trifling fighting Mangasha submitted, and Ras Makonnen despatched a force to subdue Beni Shangul, the chief of which gold country, Wad Tur el Guri, was showing signs of disaffection. This effected, the Abyssinians almost came into contact with the Egyptian troops sent up the Blue Nile (after the occupation of Khartum) to Famaka and towards Gallabat; but as both sides were anxious to avoid a collision over this latter town, no hostile results ensued. An excellent understanding was, in fact, established between these two contiguous countries, in spite of occasional disturbances by bandits on the frontier. On this frontier question, a treaty was concluded on the 15th of May 1902 between England and Abyssinia for the delimitation of the Sudan-Abyssinian frontier. Menelek, in addition, agreed not to obstruct the waters of Lake Tsana, the Blue Nile or the Sobat, so as not to interfere with the Nile irrigation question, and he also agreed to give a concession, if such should be required, for the construction of a British railway through his dominions, to connect the Sudan with Uganda. A combined British-Abyssinian expedition (Mr A. E. Butter's) was despatched in 1901 to propose and survey a boundary between Abyssinia on the one side and British East Africa and Uganda on the other; and the report of the expedition was made public by the British government in November 1904. It was followed in 1908 by an agreement defining the frontiers concerned.

Co-operation with Britain against the Somali mullah.

(26) In 1899 the rebellion of the so-called "mad" mullah (Hajji Mahommed Abdullah) began on the borders of British Somaliland. An Abyssinian expedition was, at Great Britain's request, sent against the mullah, but without much effect. In the spring and summer of 1901 a fresh expedition from Harrar was undertaken against the mullah, who was laying waste the Ogaden country. Two British officers accompanied this force, which was to co-operate with British troops advancing from Somaliland; but little was achieved by the Abyssinians, and after undergoing considerable privations and losses, and harassing the country generally, including that of some friendly tribes, it returned to Harrar. During the 1902–3 campaign of General (Sir) W. H. Manning, Menelek provided a force of 5000 to co-operate with the British and to occupy the Webi Shebeli and south-western parts of the Haud. This time the Abyssinians were more successful, and beat the rebels in a pitched fight; but the difficulties of the country again precluded effective co-operation. During General Egerton's campaign (1903–4) yet another force of 5000 Abyssinians was despatched towards Somaliland. Accompanied by a few British officers, it worked its way southward, but did not contribute much towards the final solution. In any case, however, it is significant that the Abyssinians have repeatedly been willing to co-operate with the British away from their own country.

Growth of European influence.

Regarding the question of railways, the first concession for a railway from the coast at Jibuti (French Somaliland) to the interior was granted by Menelek to a French company in 1894. The company having met with numberless difficulties and financial troubles, the French government, on the extinction of the company's funds, came to the rescue and provided money for the construction. (In the alternative British capitalists interested in the company would have obtained control of the line.) The French government's help enabled the railway to be completed to Dire Dawa, 28 m. from Harrar, by the last day of 1902. Difficulties arose over the continuation of the railway to Adis Ababa and beyond, and the proposed internationalization of the line. These difficulties, which hindered the work of construction for years, were composed (so far as the European Powers interested were concerned) in 1906. By the terms of an Anglo-French-Italian agreement, signed in London on the 13th of December of that year, it was decided that the French company should build the railway as far as Adis Ababa, while railway construction west of that place should be under British auspices, with the stipulation that any railway connecting Italy's possessions on the Red Sea with its Somaliland protectorate should be built under Italian auspices. A British, an Italian and an Abyssinian representative were to be appointed to the board of the French company, and a French director to the board of any British or Italian company formed. Absolute equality of treatment on the railway and at Jibuti was guaranteed to the commerce of all the Powers.

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[1] Ras of Harrar, which province had been conquered and occupied by Menelek in January 1887.

Meanwhile the country slowly developed in parts and opened out cautiously to European influences. Most of the Powers appointed representatives at Menelek's capital—the British minister-plenipotentiary and consul-general, Lieut.-Colonel Sir J. L. Harrington, having been appointed shortly after the British mission in 1897. In December 1903 an American mission visited Adis Ababa, and a commercial treaty between the United States and Abyssinia was signed. A German mission visited the country early in 1905 and also concluded a treaty of commerce with the negūs. Later in the year a German minister was appointed to the court of the emperor.

After 1897 British influence in Abyssinia, owing largely no doubt to the conquest of the Sudan, the destruction of the dervish power and the result of the Fashoda incident, was sensibly on the increase. Of the remaining powers France occupied the most important position in the country. Ras Makonnen, the most capable and civilized of Menelek's probable successors, died in March 1906, and Mangasha died later in the same year; the question of the succession therefore opened up the possibility that, in spite of recent civilizing influences, Abyssinia might still relapse in the future into its old state of conflict. The Anglo-French-Italian agreement of December 1906 contained provisions in view of this contingency. The preamble of the document declared that it was the common interest of the three Powers "to maintain intact the integrity of Ethiopia," and Article I. provided for their co-operation in maintaining "the political and territorial *status quo* in Ethiopia." Should, however, the *status quo* be disturbed, the powers were to concert to safeguard their special interests. The terms of the agreement were settled in July 1906, and its text forthwith communicated to the negūs. After considerable hesitation Menelek sent, early in December, a note to the powers, in which, after thanking them for their intentions, he stipulated that the agreement should not in any way limit his own sovereign rights. In June 1908, by the nomination of his grandson, Lij Yasu (b. 1896), as his heir, the emperor endeavoured to end the rivalry between various princes claiming the succession to the throne. (See MENELEK.) A convention with Italy, concluded in the same year, settled the frontier questions outstanding with that country. (G.*)

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ABYSSINIAN CHURCH. As the chronicle of Axum relates, Christianity was adopted in Abyssinia in the 4th century. About A.D. 330 Frumentius was made first bishop of Ethiopia by Athanasius, patriarch of Alexandria. Cedrenus and Nicephorus err in dating Abyssinian Christianity from Justinian, *c.* 542. From Frumentius to the present day, with one break, the Metropolitan (*Abuna*) has always been appointed from Egypt, and, oddly enough, he is always a foreigner. Little is known of church history down to the period of Jesuit rule, which broke the connexion with Egypt from about 1500 to 1633. But the Abyssinians rejected the council of Chalcedon, and still remain monophysites. Union with the Coptic Church (*q.v.*) continued after the Arab conquest in Egypt. Abū Sālih records (12th century) that the patriarch used always to send letters twice a year to the kings of Abyssinia and Nubia, till Al Hākim stopped the practice. Cyril, 67th patriarch, sent Severus as bishop, with orders to put down polygamy and to enforce observance of canonical consecration for all churches. These examples show the close relations of the two churches in the Middle Ages. But early in the 16th century the church was brought under the influence of a Portuguese mission. In 1439, in the reign of Zara Yakub, a religious discussion between an Abyssinian, Abba Giorgis, and a Frank had led to the despatch of an embassy from Abyssinia to the Vatican; but the initiative in the Roman Catholic missions to Abyssinia was taken, not by Rome, but by Portugal, as an incident in the struggle with the Mussulmans for the command of the trade route to India by the

Red Sea. In 1507 Matthew, or Matheus, an Armenian, had been sent as Abyssinian envoy to Portugal to ask aid against the Mussulmans, and in 1520 an embassy under Dom Rodrigo de Lima landed in Abyssinia. An interesting account of this mission, which remained for several years, was written by Francisco Alvarez, the chaplain. Later, Ignatius Loyola wished to essay the task of conversion, but was forbidden. Instead, the pope sent out João Nunez Barreto as patriarch of the East Indies, with André de Oviedo as bishop; and from Goa envoys went to Abyssinia, followed by Oviedo himself, to secure the king's adherence to Rome. After repeated failures some measure of success was achieved, but not till 1604 did the king make formal submission to the pope. Then the people rebelled and the king was slain. Fresh Jesuit victories were followed sooner or later by fresh revolt, and Roman rule hardly triumphed when once for all it was overthrown. In 1633 the Jesuits were expelled and allegiance to Alexandria resumed.

There are many early rock-cut churches in Abyssinia, closely resembling the Coptic. After these, two main types of architecture are found—one basilican, the other native. The cathedral at Axum is basilican, though the early basilicas are nearly all in ruins—*e.g.* that at Adulis and that of Martula Mariam in Gojam, rebuilt in the 16th century on the ancient foundations. These examples show the influence of those architects who, in the 6th century, built the splendid basilicas at Sanaa and elsewhere in Arabia. Of native churches there are two forms—one square or oblong, found in Tigré; the other circular, found in Amhara and Shoa. In both, the sanctuary is square and stands clear in the centre. An outer court, circular or rectangular, surrounds the body of the church. The square type may be due to basilican influence, the circular is a mere adaptation of the native hut: in both, the arrangements are obviously based on Jewish tradition. Church and outer court are usually thatched, with wattled or mud-built walls adorned with rude frescoes. The altar is a board on four wooden pillars having upon it a small slab (tabūt) of alabaster, marble, or shittim wood, which forms its essential part. At Martula Mariam, the wooden altar overlaid with gold had two slabs of solid gold, one 500, the other 800 ounces in weight. The ark kept at Axum is described as 2 feet high, covered with gold and gems. The liturgy was celebrated on it in the king's palace at Christmas, Epiphany, Easter and Feast of the Cross.

Generally the Abyssinians agree with the Copts in ritual and practice. The LXX. version was translated into Geez, the literary language, which is used for all services, though hardly understood. Saints and angels are highly revered, if not adored, but graven images are forbidden. Fasts are long and rigid. Confession and absolution, strictly enforced, give great power to the priesthood. The clergy must marry, but once only. Pilgrimage to Jerusalem is a religious duty and covers many sins.

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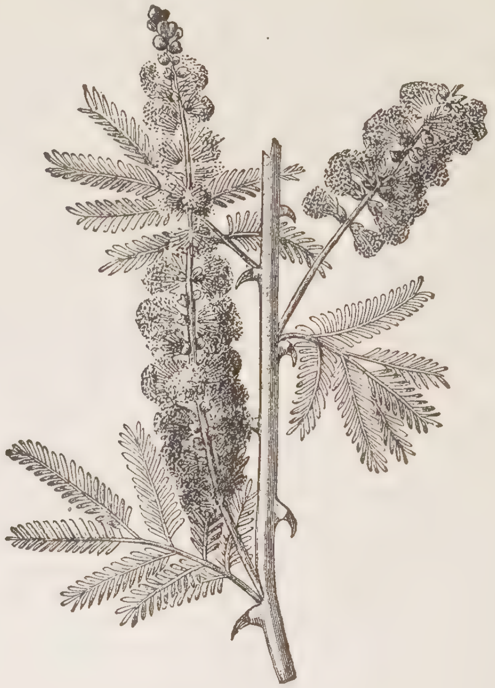
(A. J. B.)

ACACIA, a genus of shrubs and trees belonging to the family Leguminosae and the sub-family Mimoseae. The small flowers are arranged in rounded or elongated clusters. The leaves are compound pinnate in general (see fig.). In some instances, however, more especially in the Australian species, the leaflets are suppressed and the leaf-stalks become vertically flattened, and serve the purpose of leaves. The vertical position protects the structure from the intense sunlight, as with their edges towards the sky and earth they do not intercept light so fully as ordinary horizontally placed leaves. There are about 450 species of acacia widely scattered over the warmer regions of the globe. They abound in Australia and Africa. Various species yield gum. True gum-arabic is the product of *Acacia Senegal*, abundant in both east and west tropical Africa. *Acacia arabica* is the gum-arabic tree of India, but yields a gum inferior to the true gum-arabic. An astringent medicine, called catechu (*q.v.*) or cutch, is procured from several species, but more especially from *Acacia catechu*, by boiling down the wood and evaporating the solution so as to get an extract. The bark of *Acacia arabica*, under the name of *babul* or *babool*, is used in Scinde for tanning. The bark of various Australian species, known as wattles, is also very rich in tannin and forms an important article of export. Such are *Acacia pycnantha*, golden wattle, *A. decurrens*, tan wattle, and *A. dealbata*, silver wattle. The pods of *Acacia nilotica*, under the name of neb-neb, and of other African species are also rich in tannin and used by tanners. The seeds of *Acacia niopo* are roasted and used as snuff in South America. Some species afford valuable timber; such are *Acacia melanoxylon*, black wood of Australia, which attains a great size; its wood is used for furniture, and takes a high polish; and *Acacia homalophylla* (also Australian), myall wood, which yields a fragrant timber, used for ornamental purposes. *Acacia formosa* supplies the valuable Cuba timber called sabicu. *Acacia seyal* is supposed to be the shittah tree of the Bible, which supplied shittim-wood. *Acacia heterophylla*, from Mauritius and Bourbon, and *Acacia koa* from the Sandwich Islands are also good timber trees. The plants often bear spines, especially those growing in arid districts in Australia or tropical and South Africa. These sometimes represent branches which have become short, hard and pungent, or sometimes leaf-stipules. *Acacia armata* is the kangaroo-thorn of Australia, *A. giraffae*, the African camel-thorn. In the Central American *Acacia sphaerocephala* (bull-thorn acacia) and *A. spadicigera*, the large thorn-like stipules are hollow and afford shelter for ants, which feed on a secretion of honey on the leaf-stalk and curious food-bodies at the tips of the leaflets; in return they protect the plant against leaf-cutting insects. In common language the term Acacia is often applied to species of the genus Robinia (*q.v.*) which belongs also to the



Acacia Senegal, flowering branch, natural size (after A. Meyer and Schumann).

From Strasburger's *Lehrbuch der Botanik*.

Leguminous family, but is placed in a different section. *Robinia Pseud-acacia*, or false acacia, is cultivated in the milder parts of Britain, and forms a large tree, with beautiful pea-like blossoms. The tree is sometimes called the locust tree.

ACADEMIES. The word "academy" is derived from "the olive grove of Academe, Plato's retirement," the birthplace of the Academic school of philosophy (see under ACADEMY, GREEK). The schools of Athens after the model of the Academy continued to flourish almost without a break for nine centuries till they were abolished by a decree of Justinian. It was not without significance in tracing the history of the word that Cicero gave the name to his villa near Puteoli. It was there that he entertained his cultured friends and held the symposia which he afterwards elaborated in *Academic Questions* and other philosophic and moral dialogues.

"Academy," in its modern acceptation, may be defined as a society or corporate body having for its object the cultivation and promotion of literature, of science and of art, either severally or in combination, undertaken for the pure love of these pursuits, with no interested motive. Modern academies, moreover, have, almost without exception, some form of public recognition; they are either founded or endowed, or subsidized, or at least patronized, by the sovereign of the state. The term "academy" is very loosely used in modern times; and, in essentials, other bodies with the title of "society" or "college," or even "school," often embody the same idea; we are only concerned here, however, with those which, bearing the title of academy, are of historical importance in their various spheres.

Early History.—The first academy, as thus defined, though it might with equal justice claim to be the first of universities, was the museum of Alexandria founded at the beginning of the 3rd century B.C. by the first of the Ptolemies. There all the sciences then known were pursued, and the most learned men of Greece and of the East gathered beneath its spacious porticos. Here, too, was the nucleus of the famous library of Alexandria.

Passing over the state institute for the promotion of science founded at Constantinople by Caesar Bardas in the 9th century, and the various academies established by the Moors at Granada, at Corduba and as far east as Samarkand, we come to the academy over which Alcuin presided, a branch of the School of the Palace established by Charlemagne in 782. This academy was the prototype of the learned coteries of Paris which Molière afterwards satirized. It took all knowledge for its province; it included the learned priest and the prince who could not write his own name, and it sought to solve all problems by witty definitions.

The David of Alcuin's academy (such was the name that the emperor assumed) found no successors or imitators, and the tradition of an Oxford academy of Alfred the Great has been proved to rest on a forgery. The academy of arts founded at Florence in 1270 by Brunetto Latini was short-lived and has left no memories, and modern literary academies may be said to trace their lineage in direct descent from the troubadours of the early 14th century. The first Floral Games were held at Toulouse in May 1324, at the summons of a gild of troubadours, who invited "honourable lords, friends and companions who possess the science whence spring joy, pleasure, good sense, merit and politeness" to assemble in their garden of the "gay science" and recite their works. The prize, a golden violet, was awarded to Vidal de Castelnaudary for a poem to the glory of the Virgin. In spite of the English invasion and other adversities the Floral Games survived till, about the year 1500, their permanence was secured by the munificent bequest of Clémence Isaure, a rich lady of Toulouse. In 1694 the *Académie des Jeux Floraux* was constituted an academy by letters patent of Louis XIV.; its statutes were reformed and the number of members raised to 36. Suppressed during the Revolution it was revived in 1806, and still continues to award amaranths of gold and silver lilies, for which there is keen competition.

Provence led the way, but Italy of the Renaissance is the soil in which academies most grew and flourished. The *Accademia Pontaniana*, to give it its subsequent title, was founded at Florence in 1433 by Antonio Beccadelli of Palermo and fostered by Laurentius Valla. Far more famous was the *Accademia Platonica*, founded *c.* 1442 by Cosimo de' Medici, which numbered among its members Marsilio Ficino, Pico della Mirandola, Machiavelli and Angelo Poliziano. It was, as the name implies, chiefly occupied with Plato, but it added to its objects the study of Dante and the purification of the Italian language, and though it lived for barely half a century, yet its influence as a model for similar learned societies was great and lasting.

Modern Academies.—Academies have played an important part in the revival of learning and in the birth of scientific inquiry. They mark an age of aristocracies when letters were the distinction of the few and when science had not been differentiated into distinct branches, each with its own specialists. Their interest is mainly historical, and it cannot be maintained that at the present day they have much direct influence on the advancement of learning either by way of research or of publication. For example, the standard dictionaries of France, Germany and England are the work, not of academies, but of individual scholars, of Littré, Grimm and Murray. Matthew Arnold's plea for an English academy of letters to save his countrymen from the note of vulgarity and provinciality has met with no response. Academies have been supplanted, socially by the modern club, and intellectually by societies devoted to special branches of science. Those that survive from the past serve, like the Heralds' College, to set an official stamp on literary and scientific merit. The principal academies of Europe, past and present, may be dealt with in various classes, according to the subjects to which they are devoted.

I. SCIENTIFIC ACADEMIES

Austria.—The *Kaiserliche Akademie der Wissenschaften* at Vienna, originally projected by Leibnitz, was founded by the emperor Ferdinand I. in 1846, and has two classes—mathematics and natural science, and history and philology.

Belgium and the Netherlands.—A literary society was founded at Brussels in 1769 by Count Cobenzl, the prime minister of Maria Theresa, which after various changes of name and constitution became in 1816 the *Académie impériale et royale des sciences et belles-lettres*, under the patronage of William I. of the Netherlands. It has devoted itself principally to natural history and antiquities. The Royal Institute of the Low Countries was founded in 1808 by King Louis Bonaparte. It was replaced in 1851 by the Royal Academy of Sciences at Amsterdam, to which in 1856 a literary section was added.

Denmark.—The *Kongelige danske videnskabernes selskab* (Royal Academy of Sciences) at Copenhagen owes its origin to Christian VI., who in 1742 invited six Danish numismatists to arrange his cabinet of medals. Historians and antiquaries were called in to assist at the sittings, and the commission developed into a sort of learned club. The king took it under his protection, enlarged its scope by the addition of natural history, physics and mathematics, and in 1743 constituted it a royal academy with an endowment fund.

France.—The old *Académie des sciences* had the same origin as the more celebrated *Académie française*. A number of men of science had for some thirty years met together, first at the house of P. Marsenne, then at that of Montmort, a member of the Council of State, afterwards at that of Melchisédec Thévenot, the learned traveller. It included Descartes, Gassendi, Blaise and Etienne Pascal. Hobbes, the author of *Leviathan*, was presented to it during his visit to Paris in 1640. Colbert conceived the idea of giving an official status to this learned club. A number of chemists, physicians, anatomists and eminent mathematicians, among whom were Christian Huyghens and Bernard Frenicle de Bessy (1605–1675), the author of a famous treatise on magic squares, were chosen to form the nucleus of the new society. Pensions were granted by Louis XIV. to each of the members, and a fund for instruments and experiment was placed at their disposal. They began their session on the 22nd of December 1666 in the Royal Library, meeting twice a week—the mathematicians on Wednesdays, the physicists on Saturdays. Duhamel was appointed permanent secretary, a post he owed more to his polished Latinity than to his scientific attainments, all the proceedings of the society being recorded in Latin, and C. A. Couplet was made treasurer. At first the academy was rather a laboratory and observatory than an academy proper. Experiments were undertaken in common and results discussed. Several foreign *savants*, in particular the Danish astronomer Roemer, joined the society, attracted by the liberality of the Grand Monarque; and the German physician and geometer Tschirnhausen and Sir Isaac Newton were made foreign associates. The death of Colbert, who was succeeded by Louvois, exercised a disastrous effect on the fortunes of the academy. The labours of the academicians were diverted from the pursuit of pure science to such works as the construction of fountains and cascades at Versailles, and the mathematicians were employed to calculate the odds of the games of lansquenet and basset. In 1699 the academy was reconstituted by Louis Phelypeaux, comte de Pontchartrain, under whose department as secretary of state the academies came. By its new constitution it consisted of twenty-five members, ten honorary, men of high rank interested in science, and fifteen pensionaries, who were the working members. Of these three were geometricians, three astronomers, three mechanicians, three anatomists, and three chemists. Each of these three had two associates, and, besides, each pensionary had the privilege of naming a pupil. There were eight foreign and four free associates. The officers were, a president and a vice-president, named by the king from among the honorary members, and a secretary and treasurer chosen from the pensionaries, who held office for life. Fontenelle, a man of wit, and rather a popularizer of science than an original investigator, succeeded Duhamel as secretary. The constitution was purely aristocratical, differing in that respect from that of the French Academy, in which the principle of equality among the members was never violated. Science was not yet strong enough to dispense with the patronage of the great. The two leading spirits of the academy at this period were Clairault and Réaumur. To trace the subsequent fortunes of this academy would be to write the history of the rise and progress of science in France. It has reckoned among its members Laplace, Buffon, Lagrange, D'Alembert, Lavoisier, and Jussieu, the father of modern botany. On the 21st of December 1792 it met for the last time, and it was suppressed with its sister academies by the act of the Convention on the 8th of April 1793. Some of its members were guillotined, some were imprisoned, more were reduced to poverty. The aristocracy of talent was almost as much detested and persecuted by the Revolution as that of rank.

In 1795 the Convention decided on founding an *Institut National* which was to replace all the academies, and its first class corresponded closely to the old academy of sciences. In 1816 the *Académie des sciences* was reconstituted as a branch of the Institute. The new academy has reckoned among its members, besides many other brilliant men, Carnot the engineer, the physicists Fresnel, Ampère, Arago, Biot, the chemists Gay-Lussac and Thénard, the zoologists G. Cuvier and the two Geoffroy Saint-Hilaires. In France there were also considerable academies in most of the large towns. Montpellier, for example, had a royal academy of sciences, founded in 1706 by Louis XIV., on nearly the same footing as that of Paris, of which, indeed, it was in some measure the counterpart. It was reconstituted in 1847, and organized under three sections—medicine, science and letters. Toulouse also has an academy, founded in 1640, under the name of *Société de lanternistes*; and there were analogous institutions at Nîmes, Arles, Lyons, Dijon, Bordeaux and elsewhere.

Germany.—The *Collegium Curiosum* was a scientific society, founded by J. C. Sturm, professor of mathematics and natural philosophy in the university of Altorf, in Franconia, in 1672, on the plan of the *Accademia del Cimento*. It originally consisted of twenty members, and continued to flourish long after the death of its founder. The early labours of the society were devoted to the repetition (under varied conditions) of the most notable experiments of the day, or to the discussion of the results. Two volumes (1676–1685) of proceedings were published by Sturm. The former, *Collegium Experimentale sive Curiosum*, begins with an account of the diving-bell, "a new invention"; next follow chapters on the camera obscura, the Torricellian experiment, the air-pump, microscope, telescope, &c.

The *Akademie der Wissenschaften zu Berlin*, if judged by the work it has produced, holds the first place in Germany. Its origin was the *Societas Regia Scientiarum*, constituted in 1700 by Frederick I. on the comprehensive plan of Leibnitz, who was its first president. Hampered and restricted under Frederick William I., it was reorganized under Frederick II. on the French model furnished by Maupertuis, and received its present constitution in 1812. It is divided into two classes and four sections—physical and mathematical, philosophical and historical. Each section has a permanent secretary with a salary of 1200 marks, and each of the 50 regular members is paid 600 marks a year. Among the contributors to its transactions (first volume published in 1710), to name only the dead, we find Immanuel Bekker, Böckling, Bernoulli, F. Bopp, P. Buttmann, Encke (of comet fame), L. Euler, the brothers Grimm, the two Humboldts, Lachmann, Lagrange, Leibnitz, T. Mommsen, J. Müller, G. Niebuhr, C. Ritter (the geographer), Savigny and Zumpt. Frederick II. presented in 1768 *A Dissertation on Ennui*. To the *Berlin Academy* we owe the *Corpus Inscriptionum Graecarum*, the *Corpus Inscriptionum Latinarum*, and the *Monumenta Germaniae Historica*.

The *Akademie der Wissenschaften zu Mannheim* was founded by the elector Palatine in 1755. Since 1780 it has devoted itself specially to meteorology, and has published valuable observations under the title of *Ephemerides Societatis Meteorologicae Theodoro-Palatinae*.

The Bavarian *Akademie der Wissenschaften zu München* was founded in 1759. It is distinguished from other academies by the part it has played in national education. Maximilian Joseph, the enlightened elector (afterwards king) of Bavaria, induced the government to hand over to it the organization and superintendence of public instruction, and this work was carried out by Privy-councillor Jacobi, the president of the academy. In recent years the academy has specially occupied itself with natural history.

The *Königliche Akademie der Wissenschaften*, at Erfurt, which dates from 1754 and devotes itself to applied science, and the Hessian academy of sciences at Giessen, which publishes medical transactions, also deserve mention.

Great Britain and Ireland.— In 1616 a scheme for founding a royal academy was started by Edmund Bolton, an eminent scholar and antiquary, who in his petition to King James I., which was supported by George Villiers, marquis of Buckingham, proposed that the title of the academy should be "King James, his Academe or College of honour." A list of the proposed original members is still extant, and includes the names of George Chapman, Michael Drayton, Ben Jonson, John Selden, Sir Kenelm Digby and Sir Henry Wotton. The constitution is of interest as reflecting the mind of the learned king. The academy was to consist of three classes,—tutelaries, who were to be Knights of the Garter, auxiliaries, all noblemen or ministers of state, and the essentials, "called from out of the most famous lay gentlemen of England, and either living in the light of things, or without any title of profession or art of life for lucre." Among other duties to be assigned to this academy was the licensing of all books other than theological. The death of King James put an end to the undertaking. In 1635 a second attempt to found an academy was made under the patronage of Charles I., with the title of "Minerva's Museum," for the instruction of young noblemen in the liberal arts and sciences, but the project was soon dropped. (For the "British Academy" see III. below.) About 1645 the more ardent followers of Bacon used to meet, some in London, some at Oxford, for the discussion of subjects connected with experimental science. This was the original of the Royal Society (*q.v.*), which received its charter in 1662.

A society was formed in Dublin, similar to the Royal Society in London, as early as 1683; but the distracted state of the country proved unpropitious to the cultivation of philosophy and literature. The Royal Irish Academy grew from a society established in Dublin about 1782 by a number of gentlemen, most of whom belonged to the university. They held weekly meetings, and read, in turn, essays on various subjects. They professed to unite the advancement of science with the history of mankind and polite literature. The first volume of transactions appeared in 1788.

Hungary.—The *Magyar Tudományos Akadêmia* (Hungarian Academy of Sciences) was founded in 1825 by Count Stephen Széchenyi for the encouragement of the study of the Hungarian language and the various sciences. It has about 300 members and a fine building in Budapest containing a picture gallery and housing various national collections.

Italy.—The *Academia Secretorum Naturae* was founded at Naples in 1560 by Giambattista della Porta. It arose like the French Academy from a little club of friends who met at della Porta's house and called themselves the *Otiosi*. The condition of membership was to have made some discovery in natural science. Della Porta was suspected of practising the black arts and summoned to Rome to justify himself before the papal court. He was acquitted by Paul V., but commanded to close his academy.

The *Accademia dei Lincei*, to which della Porta was admitted when at Rome, and of which he became the chief ornament, had been founded in 1603 by Federigo Cesi, the marchese di Monticelli. Galileo and Colonna were among its earliest members. Its device was a lynx with upturned eyes, tearing a Cerberus with its claws. As a monument the Lincei have left the magnificent edition of Fernandez de Oviedo's *Natural History of Mexico* (Rome, 1651, fol.), printed at the expense of the founder and elaborately annotated by the members. This academy was resuscitated in 1870 under the title of *Reale Accademia dei Lincei*, with a literary as well as a scientific side, endowed in 1878 by King Humbert; and in 1883 it received official recognition from the Italian government, being lodged in the Corsini palace, whose owner made over to it his library and collections.

The *Accademia del Cimento* was founded at Florence in 1657 by Leopold de' Medici, brother of the grand duke Ferdinand II., at the instigation of Vincenzo Viviani, the geometrician. It was an academy of experiment, a deliberate protest against the deductive science of the quadrivium. Its founder left it when he was made a cardinal, and it lasted only ten years, but the grand folio published in Italian (afterwards translated into Latin) in 1667 is a landmark in the history of science. It contains experiments on the pressure of the air (Torricelli and Borelli were among its members), on the incompressibility of water and on universal gravity.

Science in Italy is now represented by the *Reale Accademia delle Scienze* (Royal Academy of Sciences), founded in 1757 as a private society, and incorporated under its present name by royal warrant in 1783. It consists of 40 full members, who must be residents of Turin, 20 non-resident, and 20 foreign members. It publishes a yearly volume of proceedings and awards prizes to learned works. There are, besides, royal academies of science at Naples, Lucca and Palermo.

Portugal.—The *Academia Real das Sciencias* (Royal Academy of Sciences) at Lisbon dates from 1779. It was reorganized in 1851 and since then has been chiefly occupied in the publication of *Portugaliae Monumenta Historica*.

Russia.—The *Académie Impériale des sciences de Saint-Petersbourg, Imperatorskaya Akademiya naük*, was projected by Peter the Great. The advice of Wolff and Leibnitz was sought, and several learned foreigners were invited to become members. Peter himself drew the plan, and signed it on the 10th of February 1724; but his sudden death delayed its fulfilment. On the first of December 1725, however, Catherine I. established it according to his plan, and on the 27th the society met for the first time. On the 1st of August 1726, Catherine honoured the meeting with her presence, when Professor G. B. Bilfinger, a German scientist, delivered an oration upon the determination of magnetic variations and longitude. Shortly afterwards the empress settled a fund of £4982 per annum for the support of the academy; and 15 eminent members were admitted and pensioned, under the title of professors in the various branches of science and literature. The most distinguished of these were Nicholas and Daniel Bernouilli, the two Delisles, Bilfinger, and Wolff.

During the short reign of Peter II. the salaries of members were discontinued, and the academy neglected by the Court; but it was again patronized by the empress Anne, who added a seminary under the superintendence of the professors. Both institutions flourished for some time under the direction of Baron Johann Albrecht Korff (1697–1766). At the accession of Elizabeth the original plan was enlarged and improved; learned foreigners were drawn to St Petersburg; and, what was considered a good omen for the literature of Russia, two natives, Lomonosov and Rumovsky, men of genius who had prosecuted their studies in foreign universities, were enrolled among its members. The annual income was increased to £10,659, and sundry other advantages were conferred upon the institution. Catherine II. utilized the academy for the advancement of national culture. She altered the court of directors greatly to the advantage of the whole body, corrected many of its abuses, added to its means, and infused a new vigour and spirit into its researches. By her recommendation the most intelligent professors visited all the provinces of her vast dominions, with most minute and ample instructions to investigate the natural resources, conditions and requirements, and report on the real state of the empire. The result was that no country at that time could boast, within so few years, such a number of excellent official publications on its internal state, its natural productions, its topography, geography and history, and on the manners, customs and languages of the different tribes that inhabited it, as came from the press of this academy. In its researches in Asiatic languages, oriental customs and religions, it proved itself the worthy rival of the Royal Asiatic Society in England. The first transactions, *Commentarii Academiae Scientiarum Imperialis Petropolitanae ad annum* 1726, with a dedication to Peter II., were published in 1728. This was continued until 1747, when the transactions were called *Novi Commentarii Academiae*, &c.; and in 1777, *Acta Academiae Scientiarum Imperialis Petropolitanae*, with some alteration in the arrangements and plan of the work. The papers, hitherto in Latin only, were now written indifferently in Latin or in French, and a preface added, *Partie Historique*, which contains an account of the society's meetings. Of the *Commentaries*, fourteen volumes were published: of the *New Commentaries* (1750–1776) twenty. Of the *Acta Academiae* two volumes are printed every year. In 1872 there was published at St Petersburg in 2 vols., *Tableau général des matières contenues dans les publications de l'Académie Impériale des Sciences de St Petersbourg.* The academy is composed, as at first, of fifteen professors, besides the president and director. Each of the professors has a house and an annual stipend of from £200 to £600. Besides the professors, there are four pensioned adjuncts, who are present at the meetings of the society, and succeed to the first vacancies. The buildings and apparatus of this academy are on a vast scale. There is a fine library, of 36,000 books and manuscripts; and an extensive museum, considerably augmented by the collections made by Pallas, Gmelin, Guldenstädt and other professors, during their expeditions through the Russian empire. The motto of the society is *Paulatim.*

Spain.—The *Real Academia Española* at Madrid (see below) had a predecessor in the *Academia Naturae curiosorum* (dating from 1657) modelled on that of Naples. It was reconstituted in 1847 after the model of the French academy.

Sweden.—The *Kongliga Svenska Vetenskaps Akademien* owes its institution to six persons of distinguished learning, among whom was Linnaeus. They met on the 2nd of June 1739, and formed a private society, the *Collegium Curiosorum;* and at the end of the year their first publication made its appearance.

As the meetings continued and the members increased the society attracted the notice of the king; and on the 31st of March 1741 it was incorporated as the Royal Swedish Academy. Though under royal patronage and largely endowed, it is, like the Royal Society in England, entirely self-governed. Each of the members resident at Stockholm becomes in turn president, and continues in office for three months. The dissertations read at each meeting are published in the Swedish language, quarterly, and make an annual volume. The first forty volumes, octavo, completed in 1779, are called the *Old Transactions.*

United States of America.—The oldest scientific association in the United States is the American Philosophical Society Held at Philadelphia for Promoting Useful Knowledge. It owed its origin to Benjamin Franklin, who in 1743 published "A Proposal for Promoting Useful Knowledge among the British Plantations in America," which was so favourably received that in the same year the society was organized, with Thomas Hopkinson (1709–1751) as president and Franklin as secretary. In 1769 it united with another scientific society founded by Franklin, called the American Society Held at Philadelphia for Promoting Useful Knowledge, and adopted its present name, adding the descriptive phrase from the title of the American Society, and elected Franklin president, an office which he held until his death (1790). The American Philosophical Society is national in scope and is exclusively scientific; its Transactions date from 1771, and its Proceedings from 1838. It has a hall in Philadelphia, with meeting-rooms and a valuable library and collection of interesting portraits and relics. David Rittenhouse was its second and Thomas Jefferson was its third president. In 1786 John Hyacinth de Magellan, of London, presented a fund, the income of which was to supply a gold medal for the author of the most important discovery "relating to navigation, astronomy or natural philosophy (mere natural history excepted)." An annual general meeting is held.

The American Academy of Arts and Sciences (Boston), the second oldest scientific organization in the United States, was chartered in Massachusetts in 1780 by some of the most prominent men of that time. James Bowdoin was its first president, John Adams its second. The Academy published Memoirs beginning in 1785, and Proceedings from 1846. The Rumford Premium awarded through it for the most "important discovery or useful improvement on Heat, or on Light" is the income of $5000 given to the Academy by Count Rumford.

The National Academy of Sciences (1863) was incorporated by Congress with the object that it "shall, whenever called upon by any department of the Government, investigate, examine, experiment and report upon any subject of science or art." Its membership was first limited to 50; after the amendment of the act of incorporation in 1870 the limit was placed at 100; and in 1907 it was prescribed that the resident membership should not exceed 150 in number, that not more than 10 members be elected in any one year, and that the number of foreign associates be restricted to 50. The Academy is divided into six committees: mathematics and astronomy; physics and engineering; chemistry; geology and palaeontology; biology; and anthropology. It gives several gold medals for meritorious researches and discoveries. It publishes scientific monographs (at the expense of the Federal Government). Its presidents have been Alexander D. Bache, Joseph Henry, Wm. B. Rogers, Othniel C. Marsh, Wolcott Gibbs, Alexander Agassiz and Ira Remsen.

The Academy of Natural Sciences of Philadelphia was organized in 1812. It has a large library, very rich in natural history, and its museum, with nearly half a million specimens, is particularly strong in conchology and ornithology. The society has published Journals since 1817, and Proceedings since 1841; it also has published the *American Journal of Conchology.* The American Entomological Society (in 1859–1867 the Entomological Society of Philadelphia, and since 1876 part of this academy) has published *Proceedings* since 1861, and the *Entomological News* (a monthly).

There are also other scientific organizations like the American Association for the Advancement of Science (chartered in 1874, as a continuation of the American Association of Geologists, founded in 1840 and becoming in 1842 the American Association of Geologists and Naturalists), which publishes its Proceedings annually; the American Geographical Society (1852), with headquarters in New York; the National Geographic Society (1888), with headquarters in Washington, D.C.; the Geological Society of America (1888), the American Ornithologists' Union (1883), the American Society of Naturalists (1883), the Botanical Society of America (1893), the American Academy of Medicine (1876); and local academies of science, or of special sciences, in many of the larger cities. The Smithsonian Institution at Washington is treated in a separate article.

II. Academies of Belles Lettres

Belgium.—Belgium has always been famous for its literary societies. The little town of Diest boasts that it possessed a society of poets in 1302, and the Catherinists of Alost date from 1107. It is at least certain that numerous Chambers of Rhetoric (so academies were then called) existed in the first years of the rule of the house of Burgundy.

France.—The French Academy (*l'Acadêmie française*) was established by order of the king in the year 1635, but in its original form existed four or five years earlier. About the year 1629 certain literary friends in Paris agreed to meet informally each week at the house of Valentin Courart, the king's secretary. The conversation turned mostly on literary topics; and when one of the number had finished some literary work, he read it to the rest, and they gave their opinions upon it. The fame of these meetings, though the members were bound to secrecy, reached the ears of Cardinal Richelieu, who promised his protection and offered to incorporate the society by letters patent. Nearly all the members would have preferred the charms of privacy, but, considering the risk they would run in incurring the cardinal's displeasure, and that by the letter of the law all meetings of any sort were prohibited, they expressed their gratitude for the high honour the cardinal thought fit to confer on them, proceeded at once to organize their body, settle their laws and constitution, appoint officers and choose a name. Letters patent were granted by the king on the 29th of January 1635. The officers consisted of a director and a chancellor, chosen by lot, and a permanent secretary, chosen by vote. They elected also a publisher, not a member of the body. The director presided at the meetings, being considered as *primus inter pares.* The chancellor kept the seals and sealed all the official documents of the academy. The cardinal was *ex officio* protector. The meetings were held weekly as before.

The object for which the academy was founded, as set forth in its statutes, was the purification of the French language. "The principal function of the academy shall be to labour with all care and diligence to give certain rules to our language, and to render it pure, eloquent and capable of treating the arts and sciences" (Art. 24). They proposed "to cleanse the language from the impurities it has contracted in the mouths of the common people, from the jargon of the lawyers, from the misusages of ignorant courtiers, and the abuses of the pulpit" (*Letter of Academy to Cardinal Richelieu*).

The number of members was fixed at forty. The original members formed a nucleus of eight, and it was not till 1639 that the full number was completed. Their first undertaking consisted of essays written by the members in rotation. To judge by the titles and specimens which have come down to us, these possessed no special originality or merit, but resembled the ἐπιδείξεις of the Greek rhetoricians. Next, at the instance of Cardinal Richelieu, they undertook a criticism of Corneille's *Cid*, the most popular work of the day. It was a rule of the academy that no work could be criticized except at the author's request, and fear of incurring the cardinal's displeasure wrung from Corneille an unwilling consent. The critique of the academy was re-written several times before it met with the cardinal's approbation. After six months of elaboration, it was published under the title, *Sentiments de l'académie française sur le Cid.* This judgment did not satisfy Corneille, as a saying attributed to him on the occasion shows. "*Horatius*," he said, referring to his last play, "was condemned by the Duumviri, but he was absolved by the people." But the crowning labour of the academy, begun in 1639, was a dictionary of the French language. By the twenty-sixth article of their statutes, they were pledged to compose a dictionary, a grammar, a treatise on rhetoric and one on poetry. Jean Chapelain, one of the original members and leading spirits of the academy, pointed out that the dictionary would naturally be the first of these works to be undertaken, and drew up a plan of the work, which was to a great extent carried out. A catalogue was to be made of all the most approved authors, prose and verse: these were to be distributed among the members, and all approved words and phrases were to be marked for incorporation in the dictionary. For this they resolved themselves into two committees, which sat on other than the regular days. C. F. de Vaugelas was appointed editor in chief. To remunerate him for his labours, he received from the cardinal a pension of 2000 francs. The first edition of this dictionary appeared in 1694, the sixth and last in 1835, since when *compléments* have been added.

This old *Académie française* perished with the other prerevolutionary academies in 1793, and it has little but the name in common with the present academy, a section of the Institute. That Jean Baptiste Suard, the first perpetual secretary of the new, had been a member of the old academy, is the one connecting link.

The chronicles of the Institute down to the end of 1895 have been given in full by the count de Franqueville in *Le premier siècle de l'Institut de France*, and from it we extract a few leading facts and dates. Before the Revolution there were in existence the following institutions:—(1) the *Académie de poésie et de musique*, founded by Charles IX. in 1570 at the instigation of Baïf, which counted among its members Ronsard and most of the Pléiade; (2) the *Académie des inscriptions et medailles*, founded in 1701; (3) the *Académie des inscriptions et belles-lettres*; (4) the old *Académie des sciences*; (5) the *Académie de peinture et de sculpture*, a school as well as an academy; (6) the *Académie d'architecture*.

The object of the Convention in 1795 was to rebuild all the institutions that the Revolution had shattered and to combine them in an organic whole; in the words of the preamble:—"*Il y a pour toute la République un Institut national chargé de recueiller les découvertes, de perfectionner les arts et les sciences.*" As Renan has remarked, the Institute embodied two ideas, one disputable, the other of undisputed truth:—That science and art are a state concern, and that there is a solidarity between all branches of knowledge and human activities. The Institute was at first composed of 184 members resident in Paris and an equal number living in other parts of France, with 24 foreign members, divided into three classes, (1) physical and mathematical science, (2) moral and political science, (3) literature and the fine arts. It held its first sitting on the 4th of April 1796. Napoleon as first consul suppressed the second class, as subversive of government, and reconstituted the other classes as follows: (1) as before, (2) French language and literature, (3) ancient history and literature, (4) fine arts. The class of moral and political science was restored on the proposal of M. Guizot in 1832, and the present Institute consists of the five classes named above. Each class or academy has its own special jurisdiction and work, with special funds; but there is a general fund and a common library, which, with other common affairs, are managed by a committee of the Institute—two chosen from each academy, with the secretaries. Each member of the Institute receives an annual allowance of 1200 francs, and the secretaries of the different academies have a salary of 6000 francs.

The class of the Institute which deals with the language and literature takes precedence, and is known as the *Académie française.* There was at first no perpetual secretary, each secretary of sections presiding in turn. Shortly afterwards J. B. Suard was elected to the post, and ever since the history of the academy has been determined by the reigns of its successive perpetual secretaries. The secretary, to borrow an epigram of Sainte-Beuve, both reigns and governs. There have been in order: Suard (13 years), François Juste Raynouard (9 years), Louis Simon Auger, François Andrieux, Arnault, Villemain (34 years), Henri Joseph Patin, Charles Camille Doucet (19 years), Gaston Boissier. Under Raynouard the academy ran a tilt against the abbé Delille and his followers. Under Auger it did battle with romanticism, "a new literary schism." Auger did not live to see the election of Lamartine in 1829, and it needed ten more years for Victor Hugo after many vain assaults to enter by the breach. The academy is professedly non-political. It accepted and even welcomed in succession the empire, the restoration and the reign of Louis Philippe, and it tolerated the republic of 1848; but to the second empire it offered a passive resistance, and no politician of the second empire, whatever his gifts as an orator or a writer, obtained an armchair. The one seeming exception, Emile Ollivier, confirms the rule. He was elected on the eve of the Franco-German war, but his *discours de réception*, a eulogy of the emperor, was deferred and never delivered. The Institute appears in the annual budget for a grant of about 700,000 fr. It has also large vested funds in property, including the magnificent estate and library of Chantilly bequeathed to it by the duc d'Aumale. It awards various prizes, of which the most considerable are the Montyon prizes, each of 20,000 fr., one for the poor Frenchman who has performed the most virtuous action during the year, and one for the French author who has published the book of most service to morality. The conditions are liberally interpreted; the first prize is divided among a number of the deserving poor, and the second has been assigned for lexicons to Molière, Corneille and Madame de Sévigné.

One alteration in the methods of the French Academy has to be chronicled: in 1869 it became the custom to discuss the claims of the candidates at a preliminary meeting of the members. In 1880, on the instance of the philosopher Caro, supported by A. Dumas *fils*, and by the aged Désiré Nisard, it was decided to abandon this method.

A point of considerable interest is the degree in which, since its foundation, the French Academy has or has not represented the best literary life of France. It appears from an examination of the lists of members that a surprising number of authors of the highest excellence have, from one cause or another, escaped the honour of academic "immortality." When the academy was founded in 1634, the moment was not a very brilliant one in French letters. Among the forty original members we find only ten who are remembered in literary history; of these four may reasonably be considered famous still—Balzac, Chapelain, Racan and Voiture. In that generation Scarron was never one of the forty, nor do the names of Descartes, Malebranche or Pascal occur; Descartes lived in Holland, Scarron was paralytic, Pascal was best known as a mathematician—(his *Lettres provinciales* was published anonymously)—and when his fame was rising he retired to Port Royal, where he lived the life of a recluse. The duc de la Rochefoucauld declined the honour from a proud modesty, and Rotrou died too soon to be elected. The one astounding omission of the 17th century, however, is the name of Molière, who was excluded by his profession as an actor.[1] On the other hand, the French Academy was never more thoroughly representative of letters than when Boileau, Corneille, La Fontaine, Racine, and Quinault were all members. Of the great theologians of that and the subsequent age, the Academy contained Bossuet, Fléchier, Fénelon, and Massillon, but not Bourdaloue. La Bruyère and Fontenelle were among the forty, but not Saint-Simon, whose claims as a man of letters were unknown to his contemporaries. Early in the 18th century almost every literary personage of eminence found his place naturally in the Academy. The only exceptions of importance were Vauvenargues, who died too early for the honour, and two men of genius but of dubious social position, Le Sage and the abbé Prévost d'Exiles. The approach of the Revolution affected gravely the *personnel* of the Academy. Montesquieu and Voltaire belonged to it, but not Rousseau or Beaumarchais. Of the Encyclopaedists, the French Academy opened its doors to D'Alembert, Condorcet, Volney, Marmontel and La Harpe, but not to Diderot, Rollin, Condillac, Helvétius or the Baron d'Holbach. Apparently the claims of Turgot and of Quesnay did not appear to the Academy sufficient, since neither was elected. In the transitional period, when the social life of Paris was distracted and the French Academy provisionally closed, neither André Chénier nor Benjamin Constant nor Joseph de Maistre became a member. In the early years of the 19th century considerations of various kinds excluded from the ranks of the forty the dissimilar names of Lamennais, Prudhon, Comte and Béranger. Critics of the French Academy are fond of pointing out that neither Stendhal, nor Balzac, nor Théophile Gautier, nor Flaubert, nor Zola penetrated into the Mazarine Palace. It is not so often remembered that writers so academic as Thierry and Michelet and Quinet suffered the same exclusion. In later times neither Alphonse Daudet nor Edmond de Goncourt, neither Guy de Maupassant nor Ferdinand Fabre, has been among the forty immortals. The non-election, after a long life of distinction, of the scholar Fustel de Coulanges is less easy to account for. Verlaine, although a poet of genius, was of the kind that no academy can ever be expected to recognize.

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[1] The Academy has made the *amende honorable* by placing in the *Salle des séances* a bust of Molière, with the inscription "*Rienne manque à sa gloire, il manquait à la notre.*"

Concerning the influence of the French Academy on the language and literature, the most opposite opinions have been advanced. On the one hand, it has been asserted that it has corrected the judgment, purified the taste and formed the language of French writers, and that to it we owe the most striking characteristics of French literature, its purity, delicacy and flexibility. Thus Matthew Arnold, in his *Essay on the Literary Influence of Academies*, has pronounced a glowing panegyric on the French Academy as a high court of letters, and a rallying-point for educated opinion, as asserting the authority of a master in matters of tone and taste. To it he attributes in a great measure that thoroughness, that openness of mind, that absence of vulgarity which he finds everywhere in French literature; and to the want of a similar institution in England he traces that eccentricity, that provincial spirit, that coarseness which, as he thinks, are barely compensated by English genius. Thus, too, Renan, one of its most distinguished members, says that it is owing to the academy "*qu'on peut tout dire sans appareil scholastique avec la langue des gens du monde.*" "*Ah ne dites,*" he exclaims, "*qu'ils n'ont rien fait, ces obscures beaux esprits dont la vie se passe à instruire le procès des mots, à peser les syllables. Ils ont fait un chef-d'œuvre—la langue française.*" On the other hand, its inherent defects have been well summed up by P. Lanfrey in his *Histoire de Napoléon*: "This institution had never shown itself the enemy of despotism. Founded by the monarchy and for the monarchy, eminently favourable to the spirit of intrigue and favouritism, incapable of any sustained or combined labour, a stranger to those great works pursued in common which legitimize and glorify the existence of scientific bodies, occupied exclusively with learned trifles, fatal to emulation, which it pretends to stimulate, by the compromises and calculations to which it subjects it, directed in everything by petty considerations, and wasting all its energy in childish tournaments, in which the flatteries that it showers on others are only a foretaste of the compliments it expects in return for itself, the French Academy seems to have received from its founders the special mission to transform genius into *bel esprit*, and it would be hard to produce a man of talent whom it has not demoralized. Drawn in spite of itself towards politics, it alternately pursues and avoids them; but it is specially attracted by the gossip of politics, and whenever it has so far emancipated itself as to go into opposition, it does so as the champion of ancient prejudices. If we examine its influence on the national genius, we shall see that it has given it a flexibility, a brilliance, a polish, which it never possessed before; but it has done so at the expense of its masculine qualities, its originality, its spontaneity, its vigour, its natural grace. It has disciplined it, but it has emasculated, impoverished and rigidified it. It sees in taste, not a sense of the beautiful, but a certain type of correctness, an elegant form of mediocrity. It has substituted pomp for grandeur, school routine for individual inspiration, elaborateness for simplicity, *fadeur* and the monotony of literary orthodoxy for variety, the source and spring of intellectual life; and in the works produced under its auspices we discover the rhetorician and the writer, never the man. By all its traditions the academy was made to be the natural ornament of a monarchical society. Richelieu conceived and created it as a sort of superior centralization applied to intellect, as a high literary court to maintain intellectual unity and protest against innovation. Bonaparte, aware of all this, had thought of re-establishing its ancient privileges; but it had in his eyes one fatal defect—*esprit*. Kings of France could condone a witticism even against themselves, a *parvenu* could not."

On the whole the influence of the French Academy has been conservative rather than creative. It has done much by its example for style, but its attempts to impose its laws on language have, from the nature of the case, failed. For, however perfectly a dictionary or a grammar may represent the existing language of a nation, an original genius is certain to arise—a Victor Hugo or an Alfred de Musset—who will set at defiance all dictionaries and academic rules.

Germany.—Of the German literary academies the most celebrated was *Die Fruchtbringende Gesellschaft* (the Fruitful Society), established at Weimar in 1617. Five princes were among the original members. The object was to purify the mother tongue. The German academies copied those of Italy in their quaint titles and petty ceremonials, and exercised little permanent influence on the language or literature of the country.

Italy.—Italy in the 16th century was remarkable for the number of its literary academies. Tiraboschi, in his *History of Italian Literature*, has given a list of 171; and Jarkius, in his *Specimen Historiae Academiarum Conditarum*, enumerates nearly 700. Many of these, with a sort of Socratic irony, gave themselves ludicrous names, or names expressive of ignorance. Such were the *Lunatici* of Naples, the *Estravaganti*, the *Fulminales*, the *Trapessati*, the *Drowsy*, the *Sleepers*, the *Anxious*, the *Confused*, the *Unstable*, the *Fantastic*, the *Transformed*, the *Ethereal*. "The first academies of Italy chiefly directed their attention to classical literature; they compared manuscripts; they suggested new readings or new interpretations; they deciphered inscriptions or coins, they sat in judgment on a Latin ode or debated the propriety of a phrase. Their own poetry had, perhaps, never been neglected; but it was not till the writings of Bembo furnished a new code of criticism in the Italian language that they began to study it with the same minuteness as modern Latin." "They were encouragers of a numismatic and lapidary erudition, elegant in itself, and throwing for ever little specks of light on the still ocean of the past, but not very favourable to comprehensive observation, and tending to bestow on an unprofitable pedantry the honours of real learning."[1] The Italian nobility, excluded as they mostly were from politics, and living in cities, found in literature a consolation and a career. Such academies were oligarchical in their constitution; they encouraged culture, but tended to hamper genius and extinguish originality. Far the most celebrated was the *Accademia della Crusca* or *Furfuratorum*; that is, of bran, or of the sifted, founded in 1582. The title was borrowed from a previous society at Perugia, the *Accademia degli Scossi*, of the well-shaken. Its device was a sieve; its motto, "Il più bel fior ne coglie" (it collects the finest flower); its principal object the purification of the language. Its great work was the *Vocabulario della Crusca*, printed at Venice in 1612. It was composed avowedly on Tuscan principles, and regarded the 14th century as the Augustan period of the language. Paul Beni assailed it in his *Anti-Crusca*, and this exclusive Tuscan purism has disappeared in subsequent editions. The *Accademia della Crusca* is now incorporated with two older societies—the *Accademia degli Apatici* (the Impartials) and the *Accademia Florentina.*

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[1] Hallam's *Int. to Lit. of Europe*, vol. i. p. 654, and vol. ii. p. 502.

Among the numerous other literary academies of Italy we may mention the academy of Naples, founded about 1440 by Alphonso, the king; the Academy of Florence, founded 1540, to illustrate and perfect the Tuscan tongue, especially by the close study of Petrarch; the *Intronati* of Siena, 1525; the *Infiammati* of Padua, 1534; the *Rozzi* of Siena, suppressed by Cosimo, 1568.

The Academy of Humorists arose from a casual meeting of witty noblemen at the marriage of Lorenzo Marcini, a Roman gentleman. It was carnival time, and to give the ladies some diversion they recited verses, sonnets and speeches, first impromptus and afterwards set compositions. This gave them the name, Belli Humori, which, after they resolved to form an academy of belles lettres, they changed to *Humoristi.*

In 1690 the *Accademia degli Arcadi* was founded at Rome, for the purpose of reviving the study of poetry, by Crescimbeni, the author of a history of Italian poetry. Among its members were princes, cardinals and other ecclesiastics; and, to avoid disputes about pre-eminence, all came to its meetings masked and dressed like Arcadian shepherds. Within ten years from its establishment the number of academicians was 600.

The Royal Academy of Savoy dates from 1719, and was made a royal academy by Charles Albert in 1848. Its emblem is a gold orange tree full of flowers and fruit; its motto "Flores fructusque perennes," the same as that of the famous Florimentane Academy, founded at Annecy by St Francis de Sales. It has published valuable memoirs on the history and antiquities of Savoy.

Spain.—The *Real Academia Española* at Madrid held its first meeting in July 1713, in the palace of its founder, the duke d'Escalona. It consisted at first of 8 academicians, including the duke; to which number 14 others were afterwards added, the founder being chosen president or director. In 1714 the king granted them the royal confirmation and protection. Their device is a crucible in the middle of the fire, with this motto, *Limpia, fixa, y da esplendor*—"It purifies, fixes, and gives brightness." The number of its members was limited to 24; the duke d'Escalona was chosen director for life, but his successors were elected yearly, and the secretary for life. Their object, as marked out by the royal declaration, was to cultivate and improve the national language. They were to begin with choosing carefully such words and phrases as have been used by the best Spanish writers; noting the low, barbarous or obsolete ones; and composing a dictionary wherein these might be distinguished from the former.

Sweden.—The *Svenska Akademien* was founded in 1786, for the purpose of purifying and perfecting the Swedish language. A medal is struck by its direction every year in honour of some illustrious Swede. This academy does not publish its transactions.

III. ACADEMIES OF ARCHAEOLOGY AND HISTORY

France.—The old *Académie des inscriptions et belles-lettres* (or "*Petite Académie,*" founded in 1663) was an offshoot of the French Academy, which then at least contained the *élite* of French learning. Louis XIV. was of all French kings the one most occupied with his own aggrandisement. Literature, and even science, he only encouraged so far as they redounded to his own glory. Nor were literary men inclined to assert their independence. Boileau well represented the spirit of the age when, in dedicating his tragedy *Berenice* to Colbert, he wrote: "The least things become important if in any degree they can serve the glory and pleasure of the king." Thus it was that the Academy of Inscriptions arose. At the suggestion of Colbert a company (a committee we should now call it) had been appointed by the king, chosen from the French Academy, charged with the office of furnishing inscriptions, devices and legends for medals. It consisted of four academicians: Chapelain, then considered the poet laureate of France, one of the authors of the critique on the *Cid;* the abbé Amable de Bourzeis (1606–1671); François Charpentier (1620–1702), an antiquary of high repute among his contemporaries; and the abbé Jacques de Cassagnes (1636–1679), who owed his appointment more to the fulsome flattery of his odes than to his really learned translations of Cicero and Sallust. This company used to meet in Colbert's library in the winter, at his country-house at Sceaux in the summer, generally on Wednesdays, to serve the convenience of the minister, who was always present. Their meetings were principally occupied with discussing the inscriptions, statues and pictures intended for the decoration of Versailles; but Colbert, a really learned man and an enthusiastic collector of manuscripts, was often pleased to converse with them on matters of art, history and antiquities. Their first published work was a collection of engravings, accompanied by descriptions, designed for some of the tapestries at Versailles. Louvois, who succeeded Colbert as a superintendent of buildings, revived the company, which had begun to relax its labours. Félibien, the learned architect, and the two great poets Racine and Boileau, were added to their number. A series of medals was commenced, entitled *Médailles de la Grande Histoire*, or, in other words, the history of the Grand Monarque.

But it was to M. de Pontchartrain, comptroller-general of finance and secretary of state, that the academy owed its institution. He added to the company Renaudot and Jacques Tourreil, both men of vast learning, the latter tutor to his son, and put at its head his nephew, the abbé Jean Paul Bignon, librarian to the king. By a new regulation, dated the 16th of July 1701, the *Académie royale des inscriptions et médailles* was instituted, being composed of ten honorary members, ten pensioners, ten associates, and ten pupils. Its constitution was an almost exact copy of that of the Academy of Sciences. Among the regulations we find the following, which indicates clearly the transition from a staff of learned officials to a learned body: "The academy shall concern itself with all that can contribute to the perfection of inscriptions and legends, of designs for such monuments and decorations as may be submitted to its judgment; also with the description of all artistic works, present and future, and the historical explanation of the subject of such works; and as the knowledge of Greek and Latin antiquities, and of these two languages, is the best guarantee for success in labours of this class, the academicians shall apply themselves to all that this division of learning includes, as one of the most worthy objects of their pursuit."

Among the first honorary members we find the indefatigable Mabillon (excluded from the pensioners by reason of his orders), Père La Chaise, the king's confessor, and Cardinal Rohan; among the associates Fontenelle and Rollin, whose *Ancient History* was submitted to the academy for revision. In 1711 they completed *L'Histoire métallique du roi*, of which Saint-Simon was asked to write the preface. In 1716 the regent changed its title to that of the *Académie des inscriptions et belles-lettres*, a title which better suited its new character.

In the great battle between the Ancients and the Moderns which divided the learned world in the first half of the 18th century, the Academy of Inscriptions naturally espoused the cause of the Ancients, as the Academy of Sciences did that of the Moderns. During the earlier years of the French Revolution the academy continued its labours uninterruptedly; and on the 22nd of January 1793, the day after the death of Louis XVI., we find in the *Proceedings* that M. Bréquigny read a paper on the projects of marriage between Queen Elizabeth and the dukes of Anjou and Alençon. In the same year were published the 45th and 46th vols. of the *Mémoires de l'académie.* On the 2nd of August of the same year the last *séance* of the old academy was held. More fortunate than its sister Academy of Sciences, it lost only three of its members by the guillotine. One of these was the astronomer Sylvain Bailly. Three others sat as members of the Convention; but for the honour of the academy, it should be added that all three were distinguished by their moderation.

In the first draft of the new Institute, October 25, 1795, no class corresponded exactly to the old Academy of Inscriptions; but most of the members who survived found themselves re-elected either in the class of moral and political science, under which history and geography were included as sections, or more generally under the class of literature and fine arts, which embraced ancient languages, antiquities and monuments.

In 1816 the academy received again its old name. The *Proceedings* of the society embrace a vast field, and are of very various merits. Perhaps the subjects on which it has shown most originality are comparative mythology, the history of science among the ancients, and the geography and antiquities of France. The old academy has reckoned among its members De Sacy the orientalist, Dansse de Villoison (1750–1805) the philologist, Anquetil du Perron the traveller, Guillaume J. de C. L. Sainte-Croix and du Theil the antiquaries, and Le Beau, who has been named the last of the Romans. The new academy has inscribed on its lists the names of Champollion, A. Rémusat, Raynouard, Burnouf and Augustin Thierry.

In consequence of the attention of several literary men in Paris having been directed to Celtic antiquities, a *Celtic Academy* was established in that city in 1805. Its objects were, first, the elucidation of the history, customs, antiquities, manners and monuments of the Celts, particularly in France; secondly, the etymology of all the European languages, by the aid of the Celto-British, Welsh and Erse; and, thirdly, researches relating to Druidism. The attention of the members was also particularly called to the history and settlements of the Galatae in Asia. Lenoir, the keeper of the museum of French monuments, was appointed president. The academy still exists as *La société nationale des antiquaires de France.*

Great Britain.—The British Academy was the outcome of a meeting of the principal European and American academies, held at Wiesbaden in October 1899. A scheme was drawn up for an international association of the academies of the world under the two sections of natural science and literary science, but while the Royal Society adequately represented England in science there was then no existing institution that could claim to represent England in literature, and at the first meeting of the federated academies this chair was vacant. A plan was proposed by Professor H. Sidgwick to add a new section to the Royal Society, but after long deliberation this was rejected by the president and council. The promoters of the plan thereupon determined to form a separate society, and invited certain persons to become the first members of a new body, to be called "The British Academy for the promotion of historical, philosophical and philological studies." The unincorporated body thus formed petitioned for a charter, and on the 8th of August 1902 the royal charter was granted and the by-laws were allowed by order in council. The objects of the academy are therein defined—"the promotion of the study of the moral and political sciences, including history, philosophy, law, politics and economics, archaeology and philology." The number of ordinary fellows (so all members are entitled) is restricted to one hundred, and the academy is governed by a president (the first being Lord Reay) and a council of fifteen elected annually by the fellows.

Italy.—Under this class the *Accademia Ercolanese* (*Academy of Herculaneum*) properly ranks. It was established at Naples about 1755, at which period a museum was formed of the antiquities found at Herculaneum, Pompeii and other places, by the marquis Tanucci, who was then minister of state. Its object was to explain the paintings, &c., discovered at those places. For this purpose the members met every fortnight, and at each meeting three paintings were submitted to three academicians, who made their report at their next sitting. The first volume of their labours appeared in 1775, and they have been continued under the title of *Antichità di Ercolano.* They contain engravings of the principal paintings, statues, bronzes, marble figures, medals, utensils, &c., with explanations. In the year 1807 an academy of history and antiquities, on a new plan, was established at Naples by Joseph Bonaparte. The number of members was limited to forty, twenty of whom were to be appointed by the king; and these twenty were to present to him, for his choice, three names for each of those needed to complete the full number. Eight thousand ducats were to be annually allotted for the current expenses, and two thousand for prizes to the authors of four works which should be deemed by the academy most deserving of such a reward. A grand meeting was to be held every year, when the prizes were to be distributed and analyses of the works read. The first meeting took place on the 25th of April 1807; but the subsequent changes in the political state of Naples prevented the full and permanent establishment of this institution. In the same year an academy was established at Florence for the illustration of Tuscan antiquities, which published some volumes of memoirs.

IV. ACADEMIES OF MEDICINE AND SURGERY

Austria.—The defunct Academy of Surgery at Vienna was instituted in 1784 by the emperor Joseph II. under the direction of the distinguished surgeon, Giovanni Alessandro Brambilla (1728–1800). For many years it did important work, and though closed in 1848 was reconstituted by the emperor Francis Joseph in 1854. In 1874 it ceased to exist; its functions had become mainly military, and were transferred to newer schools.

France.—*Académie de Médecine.* Medicine is a science which has always engaged the attention of the kings of France. Charlemagne established a school of medicine in the Louvre, and various societies have been founded, and privileges granted to the faculty by his successors. The *Académie de médecine* succeeded to the old *Académie royale de chirurgie et société royale de médecine.* It was erected by a royal ordinance, dated December 20, 1820. It was divided into three sections—medicine, surgery and pharmacy. In its constitution it closely resembled the *Académie des sciences.* Its function was to preserve or propagate vaccine matter, and answer inquiries addressed to it by the government on the subject of epidemics, sanitary reform and public health generally. It has maintained an enormous correspondence in all quarters of the globe and published extensive minutes.

Germany.—The *Academia Naturae Curiosi*, afterwards called the *Academia Caesaraea Leopoldina*, was founded in 1662 by J. L. Bausch, a physician of Leipzig, who published a general invitation to medical men to communicate all extraordinary cases that occurred in the course of their practice. The works of the *Naturae Curiosi* were at first published separately; but in 1770 a new arrangement was planned for publishing a volume of observations annually. From some cause, however, the first volume did not make its appearance until 1784, when it was published under the title of *Ephemerides.* In 1687 the emperor Leopold took the society under his protection, and its name was changed in his honour. This academy has no fixed abode, but follows the home of its president. Its library remains at Dresden. By its constitution the Leopoldine Academy consists of a president, two adjuncts or secretaries and unlimited colleagues or members. At their admission the last come under a twofold obligation—first, to choose some subject for discussion out of the animal, vegetable or mineral kingdoms, not previously treated by any colleague of the academy; and, secondly, to apply themselves to furnish materials for the annual *Ephemerides.*

V. ACADEMIES OF THE FINE ARTS

France.—The *Académie royale de peinture et de sculpture* at Paris was founded by Louis XIV. in 1648, under the title of *Académie royale des beaux arts*, to which was afterwards united the *Académie d'architecture*, founded 1671. It is composed of painters, sculptors, architects, engravers and musical composers. From among the members of the society who are painters, is chosen the director of the French *Académie des beaux arts* at Berne, also instituted by Louis XIV. in 1677. The director's province is to superintend the studies of the painters, sculptors, &c., who, chosen by competition, are sent to Italy at the expense of the government, to complete their studies in that country. Most of the celebrated French painters have begun their career in this way.

The *Académie nationale de musique* is the official and administrative name given in France to the grand opera. In 1570 the poet Baïf established in his house a school of music, at which ballets and masquerades were given. In 1645 Mazarin brought from Italy a troupe of actors, and established them in the rue du Petit Bourbon, where they gave Jules Strozzi's *Achille in Sciro*, the first opera performed in France. After Molière's death in 1673, his theatre in the Palais Royal was given to Sulli, and there were performed all Gluck's great operas; there Vestris danced, and there was produced Jean Jacques Rousseau's *Devin du Village*.

Great Britain.—The Royal Academy of Arts in London, founded in 1768, is described in a separate article. (See Academy, Royal.)

The Academy of Ancient Music was established in London in 1710, with the view of promoting the study and practice of vocal and instrumental harmony. This institution had a fine musical library, and was aided by the performances of the gentlemen of the Chapel Royal and the choir of St Paul's, with the boys belonging to each, and continued to flourish for many years. About 1734 the academy became a seminary for the instruction of youth in the principles of music and the laws of harmony. The Royal Academy of Music was formed for the performance of operas, composed by Handel, and conducted by him at the theatre in the Haymarket. The subscription amounted to £50,000, and the king, besides subscribing £1000, allowed the society to assume the title Royal. It consisted of a governor, deputy-governor and twenty directors. A contest between Handel and Senesino, one of the performers, in which the directors took the part of the latter, occasioned the dissolution of the academy after it had existed with honour for more than nine years. The present Royal Academy of Music dates from 1822, and was incorporated in 1830. It instructs pupils of both sexes in music. (See also the article Conservatoire for colleges of music.)

Italy.—In 1778 an academy of painting and sculpture was established at Turin. The meetings were held in the palace of the king, who distributed prizes among the most successful members. In Milan an academy of architecture was established so early as 1380, by Gian Galeazzo Visconti. About the middle of the 18th century an academy of the arts was established there, after the example of those at Paris and Rome. The pupils were furnished with originals and models, and prizes were distributed by competent judges annually. The prize for painting was a gold medal. Before the effects of the French Revolution reached Italy this was one of the best establishments of the kind in that kingdom. In the hall of the academy were some admirable examples of Correggio, as well as several statues of great merit, particularly a small bust of Vitellius, and a torso of Agrippina, of most exquisite beauty. The academy of the arts, which had been long established at Florence, fell into decay, but was restored in the end of the 18th century. In it there are halls for nude and plaster figures, for the use of the sculptor and the painter, with models of all the finest statues in Italy. But the treasures of this and the other institutions for the fine arts were greatly diminished during the occupancy of Italy by the French. The academy of the arts at Modena, after being plundered by the French, dwindled into a petty school for drawing from living models. There is also an academy of the fine arts in Mantua, and another at Venice.

Russia.—The academy of St Petersburg was established in 1757 by the empress Elizabeth, at the suggestion of Count Shuvalov, and annexed to the academy of sciences. The fund for its support was £4000 per annum, and the foundation admitted forty scholars. Catherine II. formed it into a separate institution, augumented the annual revenue to £12,000, and increased the number of scholars to three hundred; she built for it a large circular building, which fronts the Neva. The scholars are admitted at the age of six, and continue until they have attained that of eighteen. They are clothed, fed and lodged at the expense of the crown; and are instructed in reading, writing, arithmetic, French, German and drawing. At the age of fourteen they are at liberty to choose any of the following arts; first, painting in all its branches, architecture, mosaic, enamelling, &c.; second, engraving on copper-plates, seal-cutting, &c.; third, carving on wood, ivory and amber; fourth, watch-making, turning, instrument-making, casting statues in bronze and other metals, imitating gems and medals in paste and other compositions, gilding and varnishing. Prizes are annually distributed, and from those who have obtained four prizes, twelve are selected, who are sent abroad at the charge of the crown. A certain sum is paid to defray their travelling expenses; and when they are settled in any town, they receive during four years an annual salary of £60. The academy has a small gallery of paintings for the use of the scholars; and those who have made great progress are permitted to copy the pictures in the imperial collection. For the purpose of design, there are full-size models of the best antique statues in Italy.

South America.—There are several small academies in the various towns of South America, the only one of note being that of Rio de Janeiro, founded by John VI. of Portugal in 1816 and now known as the *Escola Nacional de Bellas Artes*.

Spain.—In Madrid an academy for painting, sculpture and architecture, the *Academia de Bellas Artes de San Fernando*, was founded by Philip V. The minister for foreign affairs is president. Prizes are distributed every three years. In Cadiz a few students are supplied by government with the means of drawing and modelling from figures; and such as are not able to purchase the requisite instruments are provided with them.

Sweden.—An academy of the fine arts was founded at Stockholm in the year 1733 by Count Tessin. In its hall are the ancient figures of plaster presented by Louis XIV. to Charles XI. The works of the students are publicly exhibited, and prizes are distributed annually. Such of them as display distinguished ability obtain pensions from government, to enable them to reside in Italy for some years, for the purposes of investigation and improvement. In this academy there are nine professors and generally about four hundred students.

Austria.—In the year 1705 an academy of painting, sculpture and architecture was established at Vienna, with the view of encouraging and promoting the fine arts.

United States of America.—In America the institution similar to the Royal Academy of Arts in London is the National Academy of Design (1826), which in 1906 absorbed the Society of American Artists; the members of the society becoming members of the academy.

The volume of excerpts from the general catalogue of books in the British Museum, "Academies," 5 parts and index, furnishes a complete bibliography. (F. S.)

ACADEMY, GREEK or Academe (Gr. ἀκαδήμεια or ἐκαδημία), the name given to the philosophic successors of Plato. The name is derived from a pleasure-garden or gymnasium situated in the suburb of the Ceramicus on the river Cephissus about a mile to the north-west of Athens from the gate called Dipylum. It was said to have belonged to the ancient Attic hero Academus, who, when the Dioscuri invaded Attica to recover their sister Helen, carried off by Theseus, revealed the place where she was hidden. Out of gratitude the Lacedaemonians, who reverenced the Dioscuri, always spared the Academy during their invasions of the country. It was walled in by Hipparchus and was adorned with walks, groves and fountains by Cimon (Plut. *Cim.* 13), who bequeathed it as a public pleasure-ground to his fellow-citizens. Subsequently the garden became the resort of Plato (*q.v.*), who had a small estate in the neighbourhood. Here he taught for nearly fifty years till his death in 348 B.C., and his followers continued to make it their headquarters. It was closed for teaching by Justinian in A.D. 529 along with the other pagan schools. Cicero borrowed the name for his villa near Puteoli, where he composed his dialogue *The Academic Questions*.

The Platonic Academy (proper) lasted from the days of Plato to those of Cicero, and during its whole course there is traceable a distinct continuity of thought which justifies its examination as a real intellectual unit. On the other hand, this continuity of thought is by no means an identity. The Platonic doctrine was so far modified in the hands of successive scholarchs that the Academy has been divided into either two, three or five main sections (Sext. Empir. *Pyrrh. Hyp.* i. 220). Finally, in the days of Philo, Antiochus and Cicero, the metaphysical dogmatism of Plato had been changed into an ethical syncretism which combined elements from the Scepticism of Carneades and the doctrines of the Stoics; it was a change from a dogmatism which men found impossible to defend, to a probabilism which afforded a retreat from Scepticism and intellectual anarchy. Cicero represents at once the doctrine of the later Academy and the general attitude of Roman society when he says, "My words do not proclaim the truth, like a Pythian priestess; but I conjecture what is probable, like a plain man; and where, I ask, am I to search for anything more than verisimilitude?" And again: "The characteristic of the Academy is never to interpose one's judgment, to approve what seems most probable, to compare together different opinions, to see what may be advanced on either side and to leave one's listeners free to judge without pretending to dogmatize."

The passage from Sextus Empiricus, cited above, gives the general view that there were three academies: the first, or Old, academy under Speusippus and Xenocrates; the second, or Middle, academy under Arcesilaus and Polemon; the third, or New, academy under Carneades and Clitomachus. Sextus notices also the theory that there was a fourth, that of Philo of Larissa and Charmidas, and a fifth, that of Antiochus. Diogenes Laertius says that Lacydes was the founder of the New Academy (i. 19, iv. 59). Cicero (*de Orat.* iii. 18, &c.) and Varro insist that there were only two academies, the Old and the New. Those who maintain that there is no justification for the five-fold division hold that the agnosticism of Carneades was really latent in Plato, and became prominent owing to the necessity of refuting the Stoic *criterion*.

The general tendency of the Academic thinkers was towards practical simplicity, a tendency due in large measure to the inferior intellectual capacity of Plato's immediate successors. Cicero (*de Fin.* v. 3) says generally of the Old Academy: "Their writings and method contain all liberal learning, all history, all polite discourse; and besides they embrace such a variety of arts, that no one can undertake any noble career without their aid. . . . In a word the Academy is, as it were, the workshop of every artist." It is true that these men turned to scientific investigation, but in so doing they escaped from the high altitudes in which Plato thought, and tended to lay emphasis on the mundane side of philosophy. Of Plato's originality and speculative power, of his poetry and enthusiasm they inherited nothing, "nor amid all the learning which has been profusely lavished upon investigating their tenets is there a single deduction calculated to elucidate distinctly the character of their progress or regression" (Archer Butler, *Lect. on Anc. Phil.* ii. 315).

The modification of Academic doctrine from Plato to Cicero may be indicated briefly under four heads.

(1) Plato's own theory of Ideas was not accepted even by Speusippus and Xenocrates. They argued that the Good cannot be the origin of things, inasmuch as Goodness is only found as an attribute of things. Therefore, the idea of Good must be secondary to some other more fundamental principle of existence. This unit Speusippus attempted to find in the Pythagorean number-theory. From it he deduced three principles, one for numbers, one for magnitude, one for the soul. The Deity he conceived as that living force which rules all and resides everywhere. Xenocrates, though like Speusippus infected with Pythagoreanism, was the most faithful of Plato's successors. He distinguished three spheres, the sensible, the intelligible, and a third compounded of the two, to which correspond respectively, sense, intellect and opinion (δόξα). Cicero notes, however, that both Speusippus and Xenocrates abandon the Socratic principle of hesitancy.

(2) Up to Arcesilaus, the Academy accepted the principle of finding a general unity in all things, by the aid of which a principle of certainty might be found. Arcesilaus, however, broke new ground by attacking the very possibility of certainty. Socrates had said, "This alone I know, that I know nothing." But Arcesilaus went farther and denied the possibility of even the Socratic minimum of certainty: "I cannot know even whether I know or not." Thus from the dogmatism of the master the Academy plunged into the extremes of agnostic criticism.

(3) The next stage in the Academic succession was the moderate scepticism of Carneades, which owed its existence to his opposition to Chrysippus, the Stoic. To the Stoical theory of perception, the φαντασία καταληπτική, by which they expressed a conviction of certainty arising from impressions so strong as to amount to science, he opposed the doctrine of acatalepsia, which denied any necessary correspondence between perceptions and the objects perceived. He saved himself, however, from absolute scepticism by the doctrine of probability or verisimilitude, which may serve as a practical guide in life. Thus his criterion of imagination (φαντασία) is that it must be credible, irrefutable and attested by comparison with other impressions; it may be wrong, but for the person concerned it is valid. In ethics he was an avowed sceptic. During his official visit to Rome, he gave public lectures, in which he successively proved and disproved with equal ease the existence of justice.

(4) In the last period we find a tendency not only to reconcile the internal divergences of the Academy itself, but also to connect it with parallel growths of thought. Philo of Larissa endeavours to show that Carneades was not opposed to Plato, and further that the apparent antagonism between Plato and Zeno was due to the fact that they were arguing from different points of view. From this syncretism emerged the prudent non-committal eclecticism of Cicero, the last product of Academic development.

For detailed accounts of the Academicians see SPEUSIPPUS, XENOCRATES, &c.; also STOICS and NEOPLATONISM. Consult histories of philosophy by Zeller and Windelband, and Th. Gomperz, *Greek Thinkers*, ii. 270 (Eng. tr., London, 1905).

ACADEMY, ROYAL. The Royal Academy of Arts in London, to give it the original title in full, was founded in 1768, "for the purpose of cultivating and improving the arts of painting, sculpture and architecture." Many attempts had previously been made in England to form a society which should have for its object the advancement of the fine arts. Sir James Thornhill, his son-in-law Hogarth, the Dilettanti Society, made efforts in this direction, but their schemes were wrecked by want of means. Accident solved the problem. The crowds that attended an exhibition of pictures held in 1758 at the Foundling Hospital for the benefit of charity, suggested a way of making money hitherto unsuspected. Two societies were quickly formed, one calling itself the "Society of Artists" and the other the "Free Society of Artists." The latter ceased to exist in 1774. The former flourished, and in 1765 was granted a royal charter under the title of the "Incorporated Society of Artists of Great Britain." But though prosperous it was not united. A number of the members, including the most eminent artists of the day, resigned in 1768, and headed by William Chambers the architect, and Benjamin West, presented on 28th November in that year to George III., who had already shown his interest in the fine arts, a memorial soliciting his "gracious assistance, patronage and protection," in "establishing a society for promoting the arts of design." The memorialists stated that the two principal objects they had in view were the establishing of "a well-regulated school or academy of design for the use of students in the arts, and an annual exhibition open to all artists of distinguished merit; the profit arising from the last of these institutions" would, they thought, "fully answer all the expenses of the first," and, indeed, leave something over to be distributed "in useful charities." The king expressed his agreement with the proposal, but asked for further particulars. These were furnished to him on the 7th of December and approved, and on the 10th of December they were submitted in form, and the document embodying them received his signature, with the words, "I approve of this plan; let it be put into execution." This document, known as the "Instrument," defined under twenty-seven heads the constitution and government of the Royal Academy, and contained the names of the thirty-six original members nominated by the king. Changes and modifications in the laws and regulations laid down in it have of course been made, but none of them without the sanction of the sovereign, and the "Instrument" remains to this day in all essential particulars the Magna Charta of the society. Four days after the signing of this document—on the 14th of December—twenty-eight of the first nominated members met and drew up the Form of Obligation which is still signed by every academician on receiving his diploma, and also elected a president, keeper, secretary, council and visitors in the schools; the professors being chosen at a further meeting held on the 17th. No time was lost in establishing the schools, and on the 2nd of January 1769 they were opened at some rooms in Pall Mall, a little eastward of the site now occupied by the Junior United Service Club, the president, Sir Joshua Reynolds, delivering on that occasion the first of his famous "discourses." The opening of the first exhibition at the same place followed on the 26th of April.

The king when founding the Academy undertook to supply out of his own privy purse any deficiencies between the receipts derived from the exhibitions and the expenditure incurred on the schools, charitable donations for artists, &c. For twelve years he was called upon to do so, and contributed in all something over £5000, but in 1781 there was a surplus, and no further call has ever been made on the royal purse. George III. also gave the Academy rooms in what was then his own palace of Somerset House, and the schools and offices were removed there in 1771, but the exhibition continued to be held in Pall Mall, till the completion in 1780 of the new Somerset House, when the Academy took possession of the apartments in it which the king, on giving up the palace for government offices, had expressly stipulated should be provided. Here it remained till 1837, when the government, requiring the use of these rooms, offered in exchange a portion of the National Gallery, then just erected in Trafalgar Square. The offer, which contained no conditions, was accepted. But it was not long before the necessity for a further removal became imminent. Already in 1850 notice was given by the government that the rooms occupied by the Academy would be required for the purposes of the National Gallery, and that they proposed to give the Academy £40,000 to provide themselves with a building elsewhere. The matter slumbered, however, till 1858, when the question was raised in the House of Commons as to whether it would not be justifiable to turn the Academy out of the National Gallery without making any provision for it elsewhere. Much discussion followed, and a royal commission was appointed in 1863 "to inquire into the present position of the Royal Academy in relation to the fine arts, and into the circumstances and conditions under which it occupies a portion of the National Gallery, &c." In their report, which contained a large number of proposals and suggestions, some of them since carried out, the commissioners stated that they had "come to the clear conclusion that the Royal Academy have no legal, but that they have a moral claim to apartments at the public expense." Negotiations had been already going on between the government and the Academy for the appropriation to the latter of a portion of the site occupied by the recently purchased Burlington House, on which the Academy offered to erect suitable buildings at its own expense. The negotiations were renewed in 1866, and in March in the following year a lease of old Burlington House, and a portion of the garden behind it, was granted to the Academy for 999 years at a peppercorn rent, subject to the condition that "the premises shall be at all times exclusively devoted to the purpose of the cultivation of the fine arts." The Academy immediately proceeded to erect, on the garden portion of the site thus acquired, exhibition galleries and schools, which were opened in 1869, further additions being made in 1884. An upper storey was also added to old Burlington House, in which to place the diploma works, the Gibson statuary and other works of art. Altogether the Academy, out of its accumulated savings, has spent on these buildings more than £160,000. They are its own property, and are maintained entirely at its expense.

The government of the Academy was by the "Instrument" vested in "a president and eight other persons, who shall form a council." Four of these were to retire every year, and the seats were to go by rotation to every academician. The number was increased in 1870 to twelve, and reduced to ten in 1875. The rules as to retirement and rotation are still in force. Newly elected academicians begin their two years' service as soon as they have received their diploma. The council has, to quote the "Instrument," "the entire direction and management of the business" of the Academy in all its branches; and also the framing of new laws and regulations, but the latter, before coming into force, must be sanctioned by the general assembly and approved by the sovereign. The general assembly consists of the whole body of academicians, and meets on certain fixed dates and at such other times as the business may require; also at the request to the president of any five members. The principal executive officers of the Academy are the president, the keeper, the treasurer, the librarian and the secretary, all now elected by the general assembly, subject to the approval of the sovereign. The president is elected annually on the foundation day, 10th December, but the appointment is virtually for life. No change has ever been made in the conditions attached to this office, with the exception of its being now a salaried instead of an unsalaried post. The treasurership and librarianship, both offices originally held not by election but by direct appointment from the sovereign, are now elective, the holders being subject to re-election every five years, and the keepership is also held upon the same terms; while the secretaryship, which up to 1873 had always been filled like the other offices by an academician, has since then been held by a layman. Other officers elected by the general assembly are the auditors (three academicians, one of whom retires every year), the visitors in the schools (academicians and associates), and the professors of painting, sculpture and architecture—who must be members—and of anatomy and chemistry. There are also a registrar, and curators and teachers in the schools, who are appointed by the council.

The thirty-six original academicians were named by George III. Their successors have been elected, up to 1867, by academicians only—since that date by academicians and associates together. The original number was fixed in the "Instrument" at forty, and has so remained. Each academician on his election has to present an approved specimen of his work—called his diploma work—before his diploma is submitted to the sovereign for signature. On receiving his diploma he signs the Roll of Institution as an academician, and takes his seat in the general assembly. The class of associates, out of whom alone the academicians can be elected, was founded in 1769—they were "to be elected from amongst the exhibitors, and be entitled to every advantage enjoyed by the royal academicians, excepting that of having a voice in the deliberations or any share in the government of the Academy." Those exhibitors who wished to become candidates had to give in their names at the close of the exhibition. This condition no longer exists, candidates having since 1867 merely to be proposed and seconded by members of the Academy. On election, they attend at a council meeting to sign the Roll of Institution as an associate, and receive a diploma signed by the president and secretary. In 1867 also associates were admitted to vote at all elections of members; in 1868 they were made eligible to serve as visitors in the schools, and in 1886 to become candidates for the professorships of painting, sculpture and architecture. At first the number of associates was limited to twenty; in 1866 the number was made indefinite with a minimum of twenty, and in 1876 the minimum was raised to thirty. Vacancies in the lists of academicians and associates caused by death or resignation can be filled up at any time within five weeks of the event, except in the months of August, September and October, but a vacancy in the associate list caused by election only dates from the day on which the new academician receives his diploma. The mode of election is the same in both cases, first by marked lists and afterwards by ballot. All who at the first marking have four or more votes are marked for again, and the two highest then go to the ballot. Engravers have always constituted a separate class, and up to 1855 they were admitted to the associateship only, the number, six, being in addition to the other associates; now the maximum is four, of whom not more than two may be academicians. A class of honorary retired academicians was established in 1862, and of honorary retired associates in 1884. The first honorary foreign academicians were elected in 1869. The honorary members consist of a chaplain, an antiquary, a secretary for foreign correspondence, and professors of ancient history and ancient literature. These posts, which date from the foundation of the Academy, have always been held by distinguished men.

Academy Schools.—One of the most important functions of the Royal Academy, and one which for nearly a century it discharged alone, was the instruction of students in art. The first act, as has been shown, of the newly founded Academy was to establish schools —"an Antique Academy," and a "School for the Living Model" for painters, sculptors and architects. In the first year, 1769, no fewer than seventy-seven students entered. A school of painting was added in 1815, and special schools of sculpture and architecture in 1871. It would occupy too much space to follow the various changes that have been made in the schools since their establishment. In one important respect, however, they remain the same, viz. in the instruction being gratuitous—no fees have ever been charged. Up to the removal of the Academy to its present quarters the schools could not be kept permanently open, as the rooms occupied by them were wanted for the exhibition. They are now open all the year round with the exception of a fortnight at Christmas, and the months of August and September. They consist of an antique school, upper and lower schools of painting, a school of drawing from the life, a school of modelling from the life and an architectural school. Admission is gained by submitting certain specimens of drawing or modelling, and the successful candidates, called probationers, have then to undergo a further test in the schools, on passing which they are admitted as students for three years. At the end of that time they are again examined, and if qualified admitted for a further term of two years. These examinations are held twice a year, in January and July. Female students were first admitted in 1860. There are many scholarships, money prizes and medals to be gained by the various classes of students during the time of studentship, including travelling studentships of the value of £200 for one year, gold and silver medals, and prizes varying from £50 to £10. There are permanent curators and teachers in all the schools, but the principal teaching is done by the visitors, academicians and associates, elected to serve in each school. The average cost of maintaining these schools, including salaries, fees, cost of models, prizes, books, maintenance of building, &c., is from £5000 to £6000 a year, apart from certain scholarships and prizes derived from moneys given or bequeathed for this purpose, such as the Landseer scholarships, the Creswick prize, the Armitage prizes and the Turner scholarship and gold medal.

Charities.—Another of the principal objects to which the profits of the Royal Academy have been devoted has been the relief of distressed artists and their families. From the commencement of the institution a fund was set apart for this purpose, and subsequently a further sum was allotted to provide pensions for necessitous members of the Academy and their widows. Both these funds were afterwards merged in the general fund, and various changes have from time to time been made in the conditions under which pensions and donations have been granted and in their amount. At the present time pensions not exceeding a certain fixed amount may be given to academicians and associates, sixty years of age, who have retired and whose circumstances show them to be in need, provided the sum given does not make their total annual income exceed a certain limit, and the same amounts can be given to their widows subject to the same conditions. No pensions are granted without very strict inquiry into the circumstances of the applicant, who is obliged to make a yearly declaration as to his or her income. The average annual amount of these pensions has been latterly about £2000. Pensions are also given according to the civil service scale to certain officers on retirement. It may be stated here that with the exception of these pensions and of salaries and fees for official services, no member of the Academy derives any pecuniary benefit from the funds of the institution. Donations to distressed artists who are or have been exhibitors at the Royal Academy, their widows and children under twenty-one years of age, are made twice a year in February and August. The maximum amount that can be granted to any one applicant in one donation is £100, and no one can receive a grant more than once a year. The average yearly amount thus expended is from £1200 to £1500. In addition to these charities from its general funds, the Academy administers for the benefit of artists, not members of the Academy, certain other funds which have been bequeathed to it for charitable purposes, viz. the Turner fund, the Cousins fund, the Cooke fund, the Newton bequest and the Edwards fund (see below).

Exhibitions.—The source from which have been derived the funds for carrying on the varied work of the Royal Academy, its schools, its charities and general cost of administration, and which has enabled it to spend large sums on building, and provided it with the means of maintaining the buildings, has been the annual exhibitions. With the exception of the money left by John Gibson, R.A., some of which was spent in building the gallery containing the statues and bas-reliefs bequeathed by him, these exhibitions have provided the sole source of revenue, all other moneys that have come to the Academy having been either left in trust, or been constituted trusts, for certain specific purposes. The first exhibition in 1769 contained 136 works, of which more than one-half were contributed by members, and brought in £699: 17: 6. In 1780, the first year in which the receipts exceeded the expenditure, the number of works was 489, of which nearly one-third were by members, and the sum received was £3069: 1s. This increase continued gradually with fluctuations, and in 1836, the last year at Somerset House, the number of works was 1154, and the receipts were £5179: 19s. No great addition to the number of works exhibited took place at Trafalgar Square, but the receipts steadily grew, and their careful management enabled the Academy, when the time came for moving, to erect its own buildings and become no longer dependent on the government for a home. The greater space afforded by the galleries at Burlington House rendered it possible to increase the number of works exhibited, which of late years has reached a total of over 2000, while the receipts have also been such as to provide the means for further building, and for a largely increased expenditure of all kinds. It may be noted that the number of works sent for exhibition soon began to exceed the space available. In 1868, the last year at Trafalgar Square, the number sent was 3011. This went on increasing, with occasional fluctuations, at Burlington House, and in the year 1900 it reached the number of 13,462. The annual winter exhibition of works by old masters and deceased British artists was begun in 1870. It was never intended to be a source of revenue, but appreciation by the public has so far prevented it from being a cause of loss. The summer exhibition of works by living artists opens on the first Monday in May, and closes on the first Monday in August. The winter exhibition of works by deceased artists opens on the first Monday in January, and closes on the second Saturday in March. The galleries containing the diploma works, the Gibson statuary and other works of art are open daily, free.

Presidents of the Royal Academy.—Sir Joshua Reynolds, 1768–1792; Benjamin West (resigned), 1792–1805; James Wyatt (president-elect), 1805; Benjamin West (re-elected), 1806–1820; Sir Thomas Lawrence, 1820–1830; Sir Martin Archer Shee, 1830–1850; Sir Charles Lock Eastlake, 1850–1865; Sir Francis Grant, 1866–1878; Frederick, Lord Leighton of Stretton, 1878–1896; Sir John Everett Millais, 1896; Sir Edward John Poynter, 1896.

The library contains about 7000 volumes, dealing with the history, the theory and the practice of the various branches of the fine arts, some of them of great rarity and value. It is open daily to the students and members, and to other persons on a proper introduction.

The trust funds administered by the Royal Academy are:—

The *Turner fund* (J. M. W. Turner, R.A.), which provides sixteen annuities of £50 each, for artists of repute not members of the Academy, also a biennial scholarship of £50 and a gold medal for a landscape painting.

The *Chantrey fund* (Sir Francis Chantrey, R.A.), the income of which, paid over by the Chantrey trustees, is spent on pictures and sculpture. (See CHANTREY.)

The *Creswick fund* (Thomas Creswick, R.A.), which provides an annual prize of £30 for a landscape painting in oil.

The *Cooke fund* (E. W. Cooke, R.A.), which provides two annuities of £35 each for painters not members of the Academy, over sixty years of age and in need.

The *Landseer fund* (Charles Landseer, R.A.), which provides four scholarships of £40 each, two in painting and two in sculpture, tenable for two years, open to students at the end of the first two years of studentship, and given for the best work done during the second year.

The *Armitage fund* (E. Armitage, R.A.), which provides two annual prizes of £30 and £10, for a design in monochrome for a figure picture.

The *Cousins fund* (S. Cousins, R.A.), which provides seven annuities of £80 each for deserving artists, not members of the Academy, in need of assistance.

The *Newton bequest* (H. C. Newton), which provides an annual sum of £60 for the indigent widow of a painter.

The *Bizo fund* (John Bizo), to be used in the scientific investigation into the nature of pigments and varnishes, &c.

The *Edwards fund* (W. J. Edwards), producing £40 a year for the benefit of poor artists or artistic engravers.

The *Leighton bequest* (Lord Leighton, P.R.A.), received from Mrs Orr and Mrs Matthews in memory of their brother, the income from which, about £300, is expended on the decoration of public places and buildings.

The literature concerning the Royal Academy consists chiefly of pamphlets and articles of more or less ephemeral value. More serious works are: William Sandby, *The History of the Royal Academy of Arts* (London, 1862) (withdrawn from circulation on a question of copyright); *Report from the Select Committee on Arts and their Connexion with Manufactures, with the Minutes of Evidence and Appendix* (London, 1836); *Report of the Royal Commission on the Royal Academy, with Minutes of Evidence and Appendix* (London, 1863); Martin

Archer Shee, *The Life of Sir M. A. Shee, P.R.A.* (London, 1860); C. R. Leslie, R.A., and Tom Taylor, *Life and Times of Sir Joshua Reynolds, P.R.A.* (London, 1865); J. E. Hodgson, R.A. (the late), and Fred. A. Eaton, Sec. R.A., "The Royal Academy in the Last Century," *Art Journal*, 1889–1891. But the chief sources of information on the subject are the minute-books of the council and of the general assembly, and the annual reports, which, however, only date from 1859. (F. A. E.)

ACADIAN, in geology, the name given by Sir J. W. Dawson in 1867 to a series of black, red and green shales and slates, with dark grey limestones, which are well developed at St John, New Brunswick; Avalon in E. Newfoundland, and Braintree in E. Massachusetts. These rocks are of Middle Cambrian age and possess a *Paradoxides* fauna. They have been correlated with limestone beds in Tennessee, Alabama, Central Nevada and British Columbia (St Stephen).

See CAMBRIAN SYSTEM; also C. D. Walcott, *Bull. U.S. Geol. Survey*, No. 81, 1891; and Sir J. W. Dawson, *Acadian Geology*, 1st ed. 1855, 3rd ed. 1878.

ACADIE, or ACADIA, a name given by the French in 1603 to that part of the mainland of North America lying between the latitudes 40° and 46°. In the treaty of Utrecht (1713) the words used in transferring the French possessions to Britain were "Nova Scotia or Acadia." See NOVA SCOTIA for the limits included at that date under the term.

ACANTHOCEPHALA, a compact group of cylindrical, parasitic worms, with no near allies in the animal kingdom. Its members are quite devoid of any mouth or alimentary canal, but have a well-developed body cavity into which the eggs are dehisced and which communicates with the exterior by means of an oviduct. The size of the animals varies greatly, from forms a few millimetres in length to *Gigantorhynchus gigas*, which measures from 10 to 65 cms. The adults live in great numbers in the alimentary canal of some vertebrate, usually fish, the larvae are as a rule encysted in the body cavity of some invertebrate, most often an insect or crustacean, more rarely a small fish. The body is divisible into a proboscis and a trunk with sometimes an intervening neck region. The proboscis bears rings of recurved hooks arranged in horizontal rows, and it is by means of these hooks that the animal attaches itself to the tissues of its host. The hooks may be of two or three shapes. Like the body, the proboscis is hollow, and its cavity is separated from the body cavity by a septum or proboscis sheath. Traversing the cavity of the proboscis are muscle-strands inserted into the tip of the proboscis at one end and into the septum at the other. Their contraction causes the proboscis to be invaginated into its cavity (fig. 2). But the whole proboscis apparatus can also be, at least partially, withdrawn into the body cavity, and this is effected by two retractor muscles which run from the posterior aspect of the septum to the body wall (fig. 3).

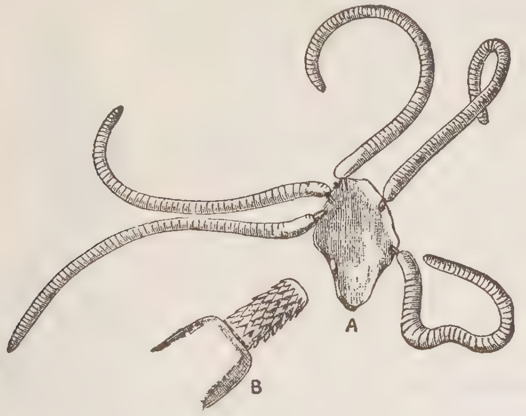

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FIG. 1.

A, Five specimens of *Echinorhynchus acus*, Rud., attached to a piece of intestinal wall,

B, The proboscis of one still more highly magnified.

The skin is peculiar. Externally is a thin cuticle; this covers the epidermis, which consists of a syncytium with no cell limits. The syncytium is traversed by a series of branching tubules containing fluid and is controlled by a few wandering, amoeboid nuclei (fig. 2). Inside the syncytium is a not very regular layer of circular muscle fibres, and within this again some rather scattered longitudinal fibres; there is no endothelium. In their minute structure the muscular fibres resemble those of Nematodes. Except for the absence of the longitudinal fibres the skin of the proboscis resembles that of the body, but the fluid-containing tubules of the latter are shut off from those of the body. The canals of the proboscis open ultimately into a circular vessel which runs round its base. From the circular canal two sac-like diverticula called the "lemnisci" depend into the cavity of the body (fig. 2). Each consists of a prolongation of the syncytial material of the proboscis skin, penetrated by canals and sheathed with a scanty muscular coat. They seem to act as reservoirs into which the fluid of the tense, extended proboscis can withdraw when it is retracted, and from which the fluid can be driven out when it is wished to expand the proboscis.

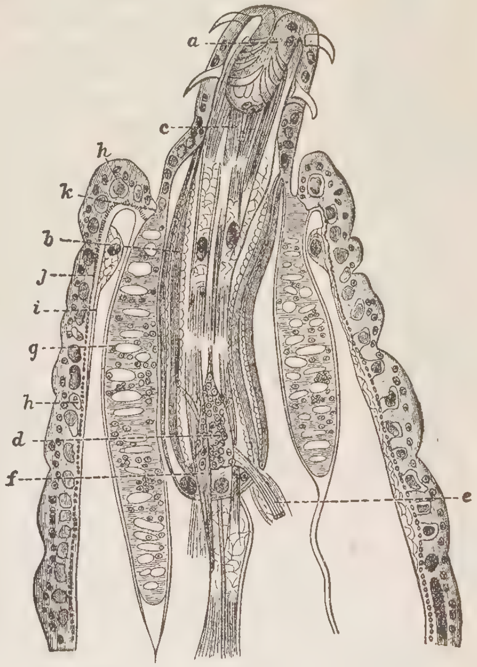

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FIG. 2.—A longitudinal section through the anterior end of *Echinorhynchus haeruca*, Rud. (from Hamann).

a, The proboscis not fully expanded.
b, Proboscis-sheath.
c, Retractor muscles of the proboscis.
d, Cerebral ganglion.
e, Retinaculum enclosing a nerve.
f, One of the retractors of the sheath.
g, A lemniscus.
h, One of the spaces in the sub-cuticular tissue.
i, Longitudinal muscular layer.
j, Circular muscular layer.
k, Line of division between the sub-cuticular tissue of the trunk and that of the proboscis with the lemnisci.

There are no alimentary canal or specialized organs for circulation or for respiration. Food is imbibed through the skin from the digestive juices of the host in which the Acanthocephala live.

J. Kaiser has described as kidneys two organs something like minute shrubs situated dorsally to the generative ducts into which they open. At the end of each twig is a membrane pierced by pores, and a number of cilia depend into the lumen of the tube; these cilia maintain a constant motion.

The central ganglion of the nervous system lies in the proboscis-sheath or -septum. It supplies the proboscis with nerves and gives off behind two stout trunks which supply the body (fig. 2). Each of these trunks is surrounded by muscles, and the complex retains the old name of "retinaculum." In the male at least there is also a genital ganglion. Some scattered papillae may possibly be sense-organs.

The Acanthocephala are dioecious. There is a "stay" called the "ligament" which runs from the hinder end of the proboscis-sheath to the posterior end of the body. In this the two testes lie (fig. 3). Each opens in a vas deferens which bears three diverticula or vesiculae seminales, and three pairs of cement glands also are found which pour their secretions through a duct into the vasa deferentia. The latter unite and end in a penis which opens posteriorly.

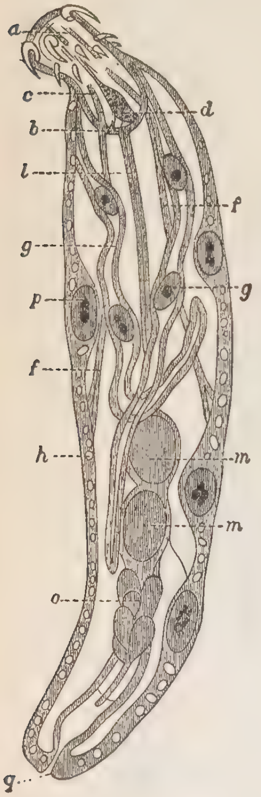

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FIG. 3.—An optical section through a male *Neorhynchus clavaeceps*, Zed. (from Hamann).

a, Proboscis.
b, Proboscis sheath.
c, Retractor of the proboscis.
d, Cerebral ganglion.
f, *f*, Retractors of the proboscis sheath.
g, *g*, Lemnisci, each with two giant nuclei.
h, Space in sub-cuticular layer of the skin.
l, Ligament.
m, *m*, Testes.
o, Glands on vas deferens.
p, Giant nucleus in skin.
q, Opening of vas deferens.

The ovaries arise like the testes as rounded bodies in the ligament. From these masses of ova dehisce into the body cavity and float in its fluid. Here the eggs are fertilized and here they segment so that the young embryos are formed within their mother's body. The embryos escape into the uterus through the "bell," a funnel-like opening continuous with the uterus. Just at the junction of the "bell" and the uterus there is a second small opening situated dorsally. The "bell" swallows the matured embryos and passes them on into the uterus, and thus out of the body via the oviduct, which opens at one end into the uterus and at the other on to the exterior at the posterior end of the body. But should the "bell" swallow any of the ova, or even one of the younger embryos, these are passed back into the body cavity through the second and dorsal opening.

The embryo thus passes from the body of the female into the alimentary canal of the host and leaves this with the faeces. It is then, if lucky, eaten by some crustacean, or insect, more rarely by a fish. In the stomach it casts its membranes and becomes mobile, bores through the stomach walls and encysts usually in the body-cavity of its first and invertebrate host. By this time the embryo has all the organs of the adult perfected save only the reproductive; these develop only when the first host is swallowed by the second or final host, in which case the parasite attaches itself to the wall of the alimentary canal and becomes adult.

A curious feature shared by both larva and adult is the large size of many of the cells, *e.g.* the nerve cells and the bell.

O. Hamann has divided the group into three families, to which a fourth must be added.

(i.) Fam. *Echinorhynchidae.* This is by far the largest family and contains the commonest species; the larva of *Echinorhynchus proteus* lives in *Gammarus pulex* and in small fish, the adult is common in many fresh-water fish: *E. polymorphus*, larval host the crayfish, adult host the duck: *E. angustatus* occurs as a larva in *Asellus aquaticus*, as an adult in the perch, pike and barbel: *E. moniliformis* has for its larval host the larvae of the beetle *Blaps mucronata*, for its final host certain mice, if introduced into man it lives well: *E. acus* is common in whiting: *E. porrigeus* in the fin-whale, and *E. strumosus* in the seal. A species named *E. hominis* has been described from a boy.

(ii.) Fam. *Gigantorhynchidae.* A small family of large forms with a ringed and flattened body. *Gigantorhynchus gigas* lives normally in the pig, but is not uncommon in man in South Russia, its larval host is the grub of *Melolontha vulgaris*, *Cetonis auratus*, and in America probably of *Lachnosterna arcuata*: *G. echinodiscus* lives in the intestine of ant-eaters: *G. spira* in that of the king vulture, *Sarcorhampus papa*, and *G. taeniodes* in *Dicholopus cristatus*, a cariama.

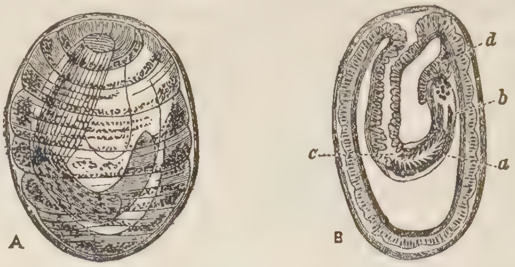

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FIG. 4.

A, The larva of *Echinorhynchus proteus* from the body cavity of *Phoxinus laevis*, with the proboscis retracted and the whole still enclosed in a capsule.

B, A section through the same; *a*, the invaginated proboscis; *b*, proboscis sheath; *c*, beginning of the neck; *d*, lemniscus. Highly magnified (both from Hamann).

(iii.) Fam. *Neorhynchidae.* Sexually mature whilst still in the larval stage. *Neorhynchus clavaeceps* in *Cyprinus carpio* has its larval form in the larva of *Sialis lutaria* and in the leech *Nephelis octocula*: *N. agilis* is found in *Mugil auratus* and *M. cephalus*.

(iv.) *Apororhynchidae.* With no proboscis. This family contains the single species *Apororhynchus hemignathi*, found near the anus of *Hemignathus procerus*, a Sandwich Island bird.

AUTHORITIES.—O. Hamann, *O. Jen. Zeitschr.* xxv., 1891, p. 113; *Zool. Anz.* xv., 1892, 195; J. Kaiser, *Bibl. Zool.* ii., 1893; A. E. Shipley, *Quart. Journ. Micr. Sci.* xxxix., 1896; *ibid.* xlii., 1899, p. 361; Villot, *Zool. Anz.* viii., 1885, p. 19.

(A. E. S.)

ACANTHUS (the Greek and Latin name for the plant, connected with ἀκή, a sharp point), a genus of plants belonging to the natural order Acanthaceae. The species are natives of the southern parts of Europe and the warmer parts of Asia and Africa. The best-known is *Acanthus mollis* (brank-ursine, or bears' breech), a common species throughout the Mediterranean region, having large, deeply cut, hairy, shining leaves. Another species, *Acanthus spinosus*, is so called from its spiny leaves. They are bold, handsome plants, with stately spikes, 2 to 3 ft. high, of flowers with spiny bracts. *A. mollis*, *A. latifolius* and *A. longifolius* are broad-leaved species; *A. spinosus* and *A. spinosissimus* have narrower, spiny toothed leaves. In decoration, the acanthus was first reproduced in metal, and subsequently carved in stone by the Greeks. It was afterwards, with various changes, adopted in all succeeding styles of architecture as a basis of ornamental decoration. There are two types, that found in the *Acanthus spinosus*, which was followed by the Greeks, and that in the *Acanthus mollis*, which seems to have been preferred by the Romans.

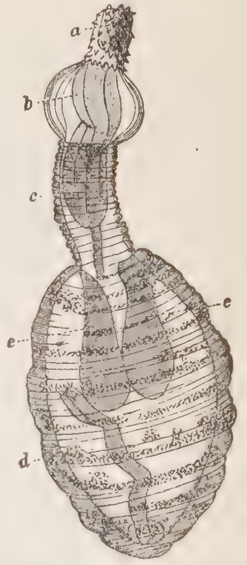

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FIG. 5.—Fully formed larva of *Echinorhynchus proteus* from the body cavity of *Phoxinus laevis* (from Hamann). Highly magnified. *a*, Proboscis; *b*, bulla; *c*, neck; *d*, trunk; *e*, *e*, lemnisci.

ACAPULCO, a city and port of the state of Guerrero on the Pacific coast of Mexico, 190 m. S.S.W. of the city of Mexico, Pop. (1900) 4932. It is located on a deep, semicircular bay, almost land-locked, easy of access, and with so secure an anchorage that vessels can safely lie alongside the rocks that fringe the shore. It is the best harbour on the Pacific coast of Mexico, and it is a port of call for steamship lines running between Panama and San Francisco. The town is built on a narrow strip of low land, scarcely half a mile wide, between the shore line and the lofty mountains that encircle the bay. There is great natural beauty in the surroundings, but the mountains render the town difficult of access from the interior, and give it an exceptionally hot and unhealthy climate. The effort to admit the cooling sea breezes by cutting through the mountains a passage called the Abra de San Nicolas had some beneficial effect. Acapulco was long the most important Mexican port on the Pacific, and the only depot for the Spanish fleets plying between Mexico and Spain's East Indian colonies from 1778 until the independence of Mexico, when this trade was lost. The town has been chosen as the terminus for two railway lines seeking a Pacific port—the Interoceanic and the Mexican Central. The town suffered considerably from earthquakes in July and August 1909. There are exports of hides, cedar and fruit, and the adjacent district of Tabares produces cotton, tobacco, cacao, sugar cane, Indian corn, beans and coffee.

ACARNANIA, a district of ancient Greece, bounded on the W. by the Ionian Sea, on the N. by the Ambracian Gulf, on the E. and S. by Mt. Thyamus and the Achelous. The Echinades islands, off the S.W. coast, are gradually being joined up to the mainland. Its most populous region was the plain of the Achelous, commanded by the principal town Stratus; communication with the coast was impeded by mountain ridges and lagoons. Its people long continued in semi-barbarism, having little intercourse with the rest of Greece. In the 5th century B.C. with the aid of Athens they subdued the Corinthian factories on their coast. In 391 they submitted to the Spartan king Agesilaus; in 371 they passed under Theban control. In the Hellenistic age the Acarnanians were constantly assailed by their Aetolian neighbours. On the advice of Cassander they made effective their ancient cantonal league, apparently after the pattern of Aetolia. In the 3rd century they obtained assistance from the Illyrians, and formed a close alliance with Philip V. of Macedonia, whom they supported in his Roman wars, their new federal capital, Leucas, standing a siege in his interest. For their sympathy with his successor Perseus they were deprived of Leucas and required to send hostages to Rome (167). The country was finally desolated by Augustus, who drafted its inhabitants into Nicopolis and Patrae. Acarnania took a prominent part in the national uprising of 1821; it is now joined with Aetolia as a nome. The sites of several ancient towns in Acarnania are marked by well-preserved walls, especially those of Stratus, Oeniadae and Limnaea.

AUTHORITIES.—Strabo vii. 7, x. 2; Thucydides; Polybius iv. 40; Livy xxxiii. 16-17; *Corpus Inscr. Graecarum*, no. 1739; E. Oberhummer, *Akarnanien im Altertum* (Munich, 1887); Heuzey, *Mt. Olympe et l'Acarnanie* (Paris, 1860). (M. O. B. C.; E. GR.)

ACARUS (from Gr. ἄκαρι, a mite), a genus of Arachnids, represented by the cheese mite and other forms.

ACASTUS, in Greek legend, the son of Pelias, king of Iolcus in Thessaly (Ovid, *Metam.* viii. 306; Apollonius Rhodius i. 224; Pindar, *Nemea*, iv. 54, v. 26). He was a great friend of Jason, and took part in the Calydonian boar-hunt and the Argonautic expedition. After his father's death he instituted splendid funeral games in his honour, which were celebrated by artists and poets, such as Stesichorus. His wife Astydameia (called Hippolytē in Horace, *Odes*, iii. 7. 17) fell in love with Peleus (*q.v.*), who had taken refuge at Iolcus, but when her advances were rejected accused him falsely to her husband. Acastus, to avenge his fancied wrongs, left Peleus asleep on Mount Pelion, having first hidden his famous sword. On awaking, Peleus was attacked by the Centaurs, but saved by Cheiron. Having recovered his sword he returned to Iolcus and slew Acastus and Astydameia. Acastus was represented with his famous horses in the painting of the Argonautic expedition by Micon in the temple of the Dioscuri at Athens.

ACATALEPSY (Gr. ἀ-, privative, and καταλαμβάνειν, to seize), a term used in Scepticism to denote incomprehensibility.

ACAULESCENT (Lat. *acaulescens*, becoming stemless, from *a*, not, and *caulis*, a stem), a term used of a plant apparently stemless, as dandelion, the stem being almost suppressed.

ACCA LARENTIA (not Laurentia), in Roman legend, the wife of the shepherd Faustulus, who saved the lives of the twins Romulus and Remus after they had been thrown into the Tiber. She had twelve sons, and on the death of one of them Romulus took his place, and with the remaining eleven founded the college of the Arval brothers (Fratres Arvales). The tradition that Romulus and Remus were suckled by a wolf has been explained by the suggestion that Larentia was called *lupa* ("courtesan," literally "she-wolf") on account of her immoral character (Livy i. 4; Ovid, *Fasti*, iii. 55). According to another account, Larentia was a beautiful girl, whom Hercules won in a game of dice (Macrobius i. 10; Plutarch, *Romulus*, 4, 5, *Quaest. Rom.* 35; Aulus Gellius vi. 7). The god advised her to marry the first man she met in the street, who proved to be a wealthy Etruscan named Tarutius. She inherited all his property and bequeathed it to the Roman people, who out of gratitude instituted in her honour a yearly festival called Larentalia (Dec. 23). According to some, Acca Larentia was the mother of the Lares, and, like Ceres, Tellus, Flora and others, symbolized the fertility of the earth—in particular the city lands and their crops.

See Mommsen, "Die echte und die falsche Larentia," in *Römische Forschungen*, ii. 1879; E. Pais, *Ancient Legends of Roman History* (Eng. trans. 1906), whose views on the subject are criticized by W. W. Fowler in W. H. D. Rouse's *The Year's Work in Classical Studies* (1907); C. Pascal, *Studii di antichità e Mitologia* (1896).

ACCELERATION (from Lat. *accelerare*, to hasten, *celer*, quick), hastening or quickening; in mechanics, a term employed to denote the rate at which the velocity of a body, whose motion is not uniform, either increases or decreases. (See MECHANICS and HODOGRAPH.)

ACCENT. The word "accent" has its origin in the Lat. *accentus*, which in its turn is a literal translation of the Gr. προσῳδία. The early Greek grammarians used this term for the musical accent which characterized their own language, but later the term became specialized for quantity in metre, whence comes the Eng. *prosody*. Besides various later developments of usage it is important to observe that "accent" is used in two different and often contrasted senses in connexion with language. In all languages there are two kinds of accent: (1) musical chromatic or pitch accent; (2) emphatic or stress accent. The former indicates differences in musical pitch between one sound and another in speech, the latter the difference between one syllable and another which is occasioned by emitting the breath in the production of one syllable with greater energy than is employed for the other syllables of the same word. These two senses, it is to be noticed, are different from the common usage of the word in the statement that some one talks with a foreign or with a vulgar accent. In these cases, no doubt, both differences of intonation and differences of stress may be included in the statement, but other elements are frequently no less marked, *e.g.* the pronunciation of *t* and *d* as real dentals, whereas the English sounds so described are really produced not against the teeth but against their sockets, the inability to produce the interdental *th* whether breathed as in *thin* or voiced as in *this* and its representation by *d* or *z*, the production of *o* as a uniform sound instead of one ending as in English in a slight *u* sound, or such dialect changes as *lydy* (*laidy*) for *lady*, or *toime* for *time* (*taime*).

In different languages the relations between pitch and stress differ very greatly. In some the pitch or musical accent predominates. In such languages if signs are employed to mark the position of the chief accent in the word it will be the pitch and not the stress accent which will be thus indicated. Amongst the languages of ancient times Sanskrit and Greek both indicate by signs the position of the chief pitch accent in the word, and the same method has been employed in modern times for languages in which pitch accent is well marked, as it is, for example, in Lithuanian, the language still spoken by some two millions of people on the frontier between Prussia and Russia in the neighbourhood of Königsberg and Vilna. Swedish also has a well-marked musical accent. Modern Greek has changed from pitch to stress, the stress being generally laid upon the same syllable in modern as bore the pitch accent in ancient Greek.

In the majority of European languages, however, stress is more conspicuous than pitch, and there is plenty of evidence to show that the original language from which Greek, Latin, Celtic, Teutonic, Slavonic and other languages of Europe are descended, possessed stress accent also in a marked degree. To the existence of this accent must be attributed a large part of the phenomena known as Ablaut or Gradation (see INDO-EUROPEAN LANGUAGES). In modern languages we can see the same principle at work making *Acton* out of the O. Eng. (Anglo-Saxon) *āc-tūn* (oak-town), and in more recent times producing the contrast between *New Town* and *Newton.* In French, stress is less marked than it is in English, but here also there is evidence to show that in the development from Latin to French a very strong stress accent must have existed. The natural result of producing one syllable of a word with greater energy than the others is that the other syllables have a less proportion of breath assigned to them and therefore tend to become indistinct or altogether inaudible. Thus the strong stress accent existing in the transition period between Latin and French led to the curtailing of long Latin words like *latrocínium* or *hospitále* into the words which we have borrowed from French into English as *larceny* and *hotel.* It will be observed that the first syllable and that which bears the accent are the two which best withstand change, though the strong tendency in English to stress heavily the first syllable bids fair ultimately to oust the *e* in the pronunciation of *larceny.* No such changes arise when a strong pitch accent is accompanied by a weaker stress accent, and hence languages like ancient Sanskrit and ancient Greek, where such conditions existed, preserve fuller forms than their sister languages or than even their own descendants, when stress takes the place of pitch as the more important element in accent.

In both pitch and stress accent different gradations may be observed. In pitch, the accent may be uniform, rising or falling. Or there may be combinations of rising and falling or of falling and rising accents upon the same syllable. In ancient Greek, as is well known, three accents are distinguished—(1) the acute (´), a rising accent; (2) the grave (`), apparently merely the indication that in particular positions in the sentence the acute accent is not used where it would occur in the isolated word; and (3) the circumflex, which, as its form (^) shows, and as the ancient grammarians inform us, is a combination of the rising and the falling accent upon the same syllable, this syllable being always long. Different Greek dialects, however, varied the syllables of the word on which the accent occurred, Aeolic Greek, for example, never putting the acute on the last syllable of a word, while Attic Greek had many words so accented.

The pitch accent of the Indo-European languages was originally free, *i.e.* might occur on any syllable of a word, and this condition of things is still found in the earliest Sanskrit literature. But in Greek before historical times the accent had become limited to the last three syllables of a word, so that a long word like the Homeric genitive φερομένοιο could in no circumstances be accented on either of its first two syllables, while if the final syllable was long, as in the accusative plural φερομένους, the accent could go back only to the second syllable from the end. As every vowel has its own natural pitch, and a frequent interchange between *e* (a high vowel) and *o* (a low vowel) occurs in the Indo-European languages, it has been suggested that *e* originally went with the highest pitch accent, while *o* appeared in syllables of a lower pitch. But if there is any foundation for the theory, which is by no means certain, its effects have been distorted and modified by all manner of analogical processes. Thus ποιμήν with acute accent and δαίμων with the acute accent on the preceding syllable would correspond to the rule, so would ἀληθές and ἔπος, but there are many exceptions like ὁδός where the acute accent accompanies an *o* vowel. Somewhat similar distinctions characterize syllables which are stressed. The strength of the expiration may be greatest either at the beginning, the end or the middle of the syllable, and, according as it is so, the accent is a falling, a rising, or a rising and falling one. Syllables in which the stress is produced continuously whether increasing or decreasing are called single-pointed syllables, those in which a variation in the stress occurs without being strong enough to break the syllable into two are called double-pointed syllables. These last occur in some English dialects, but are commonest in languages like Swedish and Lithuanian, which have a "sing-song" pronunciation. It is often not easy to decide whether a syllable is double-pointed or whether what we hear is really two-single-pointed syllables. There is no separate notation for stress accent, but the acute (´) is used for the increasing, the grave (`) for the decreasing stress, and the circumflex (˜) for the rising and falling (increasing and decreasing) and (ˇ) for the opposite. A separate notation is much to be desired, as the nature of the two accents is so different, and could easily be devised by using S for the falling, (´) for the rising stress, and ∞ for the combination of the two in one syllable. This would be clearer than the upright stroke ( ) preceding the stressed syllable, which is used in some phonetic works.

The relation between the two accents in the same language at the same time is a subject which requires further investigation. It is generally assumed that the chief stress and the chief pitch in a word coincide, but this is by no means certain for all cases, though the incidence of the chief stress accent in modern Greek upon the same syllable as had the chief pitch accent in ancient times suggests that the two did frequently fall upon the same syllable. On the other hand, in words like the Sanskrit *saptá*, the Gr. ἑπτά, the pitch accent which those languages indicate is upon a syllable which certainly, in the earliest times at least, did not possess the principal stress. For forms in other languages, like the Lat. *septem* or the Gothic *sibun*, show that the *a* of the final syllables in Sanskrit and Greek is the representative of a reduced syllable in which, even in the earliest times, the nasal alone existed (see under N for the history of these so-called sonant nasals). It is possible that sporadic changes of accent, as in the Gr. μήτηρ compared with the Sanskrit *mātā́*, is owing to the shifting of the pitch accent to the same syllable as the stress occupied.

There is no lack of evidence to show that the stress accent also may shift its position in the history of a language from one syllable to another. In prehistoric times the stress in Latin must have rested upon the first syllable in all cases. Only on this hypothesis can be explained forms like *peperci* (perfect of *parco*) and *collīdo* (a compound of *laedo*). In historical times, when the stress in Latin was on the second syllable from the end of the word if that syllable was long, or on the third syllable from the end if the second from the end was short, we should have expected to find **peparci* and **collaedo*, for throughout the historical period the stress rested in these words upon the second syllable from the end. The causes for the change of position are not always easy to ascertain. In words of four syllables with a long penult and words of five syllables with a short penult there probably developed a secondary accent which in course of time replaced the earlier accent upon the first syllable. But the number of such long words in Latin is comparatively small. It is no less possible that relations between the stress and pitch accents were concerned. For unless we are to regard the testimony of the ancient Latin grammarians as altogether untrustworthy there was at least in classical Latin a well-marked pitch as well as a stress accent. This question, which had long slumbered, has been revived by Dr J. Vendryes in his treatise entitled *Recherches sur l'histoire et les effets de l'intensité initiale en latin* (Paris, 1902).

In English there is a tendency to throw the stress on to the first syllable, which leads in time to the modification of borrowed words. Thus throughout the 18th century there was a struggle going on over the word *balcony*, which earlier was pronounced *balcóny*. Swift is the first author quoted for the pronunciation *bálcony*, and Cowper's *balcóny* in "John Gilpin" is among the latest instances of the old pronunciation. Disregarding the Latin quantity of *orātor* and *senător*, English by throwing the stress on the first syllable has converted them into *órător* and *sénător*, while Scots lawyers speak also of a *cúrător*. How far French influence plays a part here is not easy to say.

Besides the accent of the syllable and of the word, which have been already discussed, there remains the accent of the sentence. Here the problem is much more complicated. The accent of a word, whether pitch or stress, may be considerably modified in the sentence. From earliest times some words have become parasitic or enclitic upon other words. Pronouns more than most words are modified from this cause, but conjunctions like the Gr. τε ("and"), the Lat. *que*, have throughout their whole history been enclitic upon the preceding word. A very important word may be enclitic, as in English *don't, shan't*. It is to be remembered that the unit of language is rather the sentence than the word, and that the form which is given to the word in the dictionary is very often not the form which it takes in actual speech. The divisions of words in speech are quite different from the divisions on the printed page. Sanskrit alone amongst languages has consistently recognized this, and preserves in writing the exact combinations that are spoken.

Accent, whether pitch or stress, can be utilized in the sentence to express a great variety of meanings. Thus in English a sentence like *You rode to Newmarket yesterday*, which contains five words, may be made to express five different statements by putting the stress upon each of the words in turn. By putting the stress on *you* the person addressed is marked out as distinct from certain others, by putting it upon *rode* other means of locomotion to Newmarket are excluded, and so on. With the same order of words five interrogative sentences may also be expressed, and a third series of exclamatory sentences expressing anger, incredulity, &c., may be obtained from the same words. It is to be noticed that for these two series a different intonation, a different musical (pitch) accent appears from that which is found in the same words when employed to make a matter-of-fact statement.

In languages like Chinese, which have neither compound words nor inflection, accent plays a very important part. As the words are all monosyllabic, stress could obviously not be so important as pitch as a help to distinguish different senses attached to the same vocable, and in no other language is variety of pitch so well developed as in Chinese. In languages which, like English, show comparatively little pitch accent it is to be noticed that the sentence tends to develop a more musical character under the influence of emotion. The voice is raised and at the same time greater stress is generally employed when the speaker is carried away by emotion, though the connexion is not essential and strong emotion may be expressed by a lowering as well as by a raising of the voice. In either case, however, the stress will be greater than the normal.

Bibliography.—H. Sweet, *Primer of Phonetics* (1890, now in 3rd edition), § 96 ff., *History of English Sounds* (1888), § 110 ff., and other works; E. Sievers, *Grundzüge der Phonetik* (1893), § 532 ff.; O. Jespersen, *Lehrbuch der Phonetik* (1904), an abbreviated German translation of the author's larger work in Danish, § 216 ff. The books of Sievers and Jespersen give (especially Sievers) full references to the literature of the subject. For the accent system of the Indo-European languages see "Betonung" in Brugmann's *Grundriss der vergleichenden Grammatik der indogermanischen Sprachen*, vol. i. (1897), or, with considerable modifications, his *Kurze vergleichende Grammatik der idg. Sprachen* (1902), §§ 32-65 and 343-350. (P. Gi.)

ACCEPTANCE (Lat. *acceptare*, frequentative form of *accipere*, to receive), generally, a receiving or acknowledgment of receipt; in law, the act by which a person binds himself to comply with the request contained in a *bill of exchange* (*q.v.*), addressed to him by the drawer. In all cases it is understood to be a promise to pay the bill in money, the law not recognizing an acceptance in which the promise is to pay in some other way, *e.g.* partly in money and partly by another bill. Acceptance may be either general or qualified. A *general* acceptance is an engagement to pay the bill strictly according to its tenor, and is made by the drawee subscribing his name, with or without the word "accepted," at the bottom of the bill, or across the face of it. *Qualified* acceptance may be a promise to pay on a contingency occurring, *e.g.* on the sale of certain goods consigned by the drawer to the acceptor. No contingency is allowed to be mentioned in the body of the bill, but a qualified acceptance is quite legal, and equally binding with a general acceptance upon the acceptor when the contingency has occurred. It is also qualified acceptance where the promise is to pay only part of the sum mentioned in the bill, or to pay at a different time or place from those specified. As a qualified acceptance is so far a disregard of the drawer's order, the holder is not obliged to take it; and if he chooses to take it he must give notice to antecedent parties, acting at his own risk if they dissent. In all cases acceptance involves the signature of the acceptor either by himself or by some person duly authorized on his behalf. A bill can be accepted in the first instance only by the person or persons to whom it is addressed; but if he or they fail to do so, it may, after being protested for non-acceptance, be accepted by some one else "*supra* protest," for the sake of the honour of one or more of the parties concerned in it, and he thereupon acquires a claim against the drawer and all those to whom he could have resorted.

ACCEPTILATION (from Lat. *acceptilatio*), in Roman and Scots law, a verbal release of a verbal obligation. This formal mode of extinguishing an obligation contracted verbally received its name from the book-keeping term *acceptilatio*, entering a receipt, *i.e.* carrying it to credit. The words conveying the release had to correspond to, or strictly cover, the expressed obligation. Figuratively, in theology, the word acceptilation means free remission or forgiveness of sins.

ACCESS (Lat. *accessus*), approach, or the means of approaching. In law, the word is used in various connexions. The presumption of a child's legitimacy is negatived if it be proved that a husband has not had access to his wife within such a period of time as would admit of his being the father. (See Legitimacy.) In the law of easements, every person who has land adjoining a public road or a public navigable river has a right of access to it from his land. So, also, every person has a right of access to air and light from an ancient window. For the right of access of parents to children under the guardianship of the court, see Infant.

ACCESSION (from Lat. *accedere*, to go to, to approach), in law, a method of acquiring property adopted from Roman law, by which, in things that have a close connexion with or dependence on one another, the property of the principal draws after it the property of the accessory, according to the principle, *accessio cedet principali*. Accession may take place either in a natural way, such as the growth of fruit or the pregnancy of animals, or in an artificial way. The various methods may be classified as (1) land to land by accretion or alluvion; (2) moveables to land (see Fixtures); (3) moveables to moveables; (4) moveables added to by the art or industry of man; this may be by specification, as when wine is made out of grapes, or by confusion, or commixture, which is the mixing together of liquids or solids, respectively. In the case of industrial accession ownership is determined according as the natural or manufactured substance is of the more importance, and, in general, compensation is payable to the person who has been dispossessed of his property.

In a historical or constitutional sense, the term "accession" is applied to the coming to the throne of a dynasty or line of sovereigns or of a single sovereign.

"Accession" sometimes likewise signifies consent or acquiescence. Thus, in the bankruptcy law of Scotland, where there is a settlement by a trust-deed, it is accepted on the part of each creditor by a "deed of accession."

ACCESSORY, a person guilty of a felonious offence, not as principal, but by participation; as by advice, command, aid or concealment. In certain crimes, there can be no accessories; all concerned being principals, whether present or absent at the time of their commission. These are treason, and all offences below the degree of felony, as specified in the Offences against the Person Act 1861.

There are two kinds of accessories—*before* the fact, and *after* it. The first is he who commands or procures another to commit felony, and is not present himself; for if he be present, he is a principal. The second is he who receives, harbours, assists, or comforts any man that has done murder or felony, whereof he has knowledge. An accessory before the fact is liable to the same punishment as the principal; and there is now indeed no practical difference between such an accessory and a principal in regard either to indictment, trial or punishment. Accessories after the fact are in general punishable with imprisonment (with or without hard labour) for a period not exceeding two years, but in the case of murder punishable by penal servitude for life, or not less than three years, or by imprisonment (with or without hard labour) to the extent of two years.

The law of Scotland makes no distinction between the accessory to any crime and the principal (see ART AND PART). Except in the case of treason, accession after the fact is not noticed by the law of Scotland, unless as an element of evidence to prove previous accession.

ACCIAJUOLI, DONATO (1428–1478), Italian scholar, was born at Florence in 1428. He was famous for his learning, especially in Greek and mathematics, and for his services to his native state. Having previously been entrusted with several important embassies, he became Gonfalonier of Florence in 1473. He died at Milan in 1478, when on his way to Paris to ask the aid of Louis XI. on behalf of the Florentines against Pope Sixtus IV. His body was taken back to Florence, and buried in the church of the Carthusians at the public expense, and his daughters were portioned by his fellow-citizens, the fortune he left being, owing to his probity and disinterestedness, very small. He wrote a Latin translation of some of Plutarch's *Lives* (Florence, 1478); Commentaries on Aristotle's *Ethics* and *Politics*; and the lives of Hannibal, Scipio and Charlemagne. In the work on Aristotle he had the co-operation of his master Argyropulus.

ACCIDENCE (a mis-spelling of "accidents," from the Latin neuter plural *accidentia*, casual events), the term for the grammatical changes to which words are subject in their inflections as to gender, number, tense and case. It is also used to denote a book containing the first principles of grammar, and so of the rudiments of any subject or art.

ACCIDENT (from Lat. *accidere*, to happen), a word of widely variant meanings, usually something fortuitous and unexpected; a happening out of the ordinary course of things. In the law of tort, it is defined as "an occurrence which is due neither to design nor to negligence"; in equity, as "such an unforeseen event, misfortune, loss, act or omission, as is not the result of any negligence or misconduct." So, in criminal law, "an effect is said to be accidental when the act by which it is caused is not done with the intention of causing it, and when its occurrence as a consequence of such act is not so probable that a person of ordinary prudence ought, under the circumstances, to take reasonable precaution against it" (Stephen, *Digest of Criminal Law*, art. 210). The word may also have in law the more extended meaning of an unexpected occurrence, whether caused by any one's negligence or not, as in the Fatal Accidents Act 1846, Notice of Accidents Act 1894. See also CONTRACT, CRIMINAL LAW, EMPLOYERS' LIABILITY, INSURANCE, TORT, &c.

In logic an "accident" is a quality which belongs to a subject but not as part of its essence (in Aristotelian language κατὰ συμβεβηκός, the scholastic *per accidens*). Essential attributes are necessarily, or causally, connected with the subject, *e.g.* the sum of the angles of a triangle; accidents are not deducible from the nature, or are not part of the necessary connotation, of the subject, *e.g.* the area of a triangle. It follows that increased knowledge, *e.g.* in chemistry, may show that what was thought to be an accident is really an essential attribute, or vice versa. It is very generally held that, in reality, there is no such thing as an accident, inasmuch as complete knowledge would establish a causal connexion for all attributes. An accident is thus merely an unexplained attribute. Accidents have been classed as (1) "inseparable," *i.e.* universally present, though no causal connexion is established, and (2) "separable," where the connexion is neither causally explained nor universal. Propositions expressing a relation between a subject and an accident are classed as "accidental," "real" or "ampliative," as opposed to "verbal" or "analytical," which merely express a known connexion, *e.g.* between a subject and its connotation (*q.v.*).

ACCIDENTALISM, a term used (1) in philosophy for any system of thought which denies the causal nexus and maintains that events succeed one another haphazard or by chance (not in the mathematical but in the popular sense). In metaphysics, accidentalism denies the doctrine that everything occurs or results from a definite cause. In this connexion it is synonymous with Tychism (τύχη, chance), a term used by C. S. Peirce for the theories which make chance an objective factor in the process of the Universe. Opponents of this accidentalism maintain that what seems to be the result of chance is in reality due to a cause or causes which, owing to the lack of imagination, knowledge or scientific instruments, we are unable to detect. In ethics the term is used, like indeterminism, to denote the theory that mental change cannot always be ascribed to previously ascertained psychological states, and that volition is not causally related to the motives involved. An example of this theory is the doctrine of the *liberum arbitrium indifferentiae* ("liberty of indifference"), according to which the choice of two or more alternative possibilities is affected neither by contemporaneous data of an ethical or prudential kind nor by crystallized habit (character). (2) In painting, the term is used for the effect produced by accidental lights (Ruskin, *Modern Painters*, I. 11. 4, iii. § 4, 287). (3) In medicine, it stands for the hypothesis that disease is only an accidental modification of the healthy condition, and can, therefore, be avoided by modifying external conditions.

ACCIUS, a Latin poet of the 16th century, to whom is attributed a paraphrase of Aesop's Fables, of which Julius Scaliger speaks with great praise.

ACCIUS, LUCIUS, Roman tragic poet, the son of a freedman, was born at Pisaurum in Umbria, in 170 B.C. The year of his death is unknown, but he must have lived to a great age, since Cicero (*Brutus*, 28) speaks of having conversed with him on literary matters. He was a prolific writer and enjoyed a very high reputation (Horace, *Epistles*, ii. 1, 56; Cicero, *Pro Plancio*, 24). The titles and considerable fragments (about 700 lines) of some fifty plays have been preserved. Most of these were free translations from the Greek, his favourite subjects being the legends of the Trojan war and the house of Pelops. The national history, however, furnished the theme of the *Brutus* and *Decius*,—the expulsion of the Tarquins and the self-sacrifice of Publius Decius Mus the younger. The fragments are written in vigorous language and show a lively power of description.

Accius wrote other works of a literary character: *Didascalicōn* and *Pragmaticōn libri*, treatises in verse on the history of Greek and Roman poetry, and dramatic art in particular; *Parerga* and *Praxidica* (perhaps identical) on agriculture; and an *Annales*. He also introduced innovations in orthography and grammar.

See Boissier, *Le Poète Accius*, 1856; L. Müller, *De Accii fabulis Disputatio* (1890); Ribbeck, *Geschichte der römischen Dichtung* (1892); editions of the tragic fragments by Ribbeck (1897), of the others by Bährens (1886); Plessis, *Poésie latine* (1909).

ACCLAMATION (Lat. *acclamatio*, a shouting at), in deliberative or electoral assemblies, a spontaneous shout of approval or praise. Acclamation is thus the adoption of a resolution or the passing of a vote of confidence or choice unanimously, in direct distinction from a formal ballot or division. In the Roman senate opinions were expressed and votes passed by acclamation in such forms as *Omnes, omnes, Aequum est, Justum est*, &c.; and the praises of the emperor were celebrated in certain pre-arranged sentences, which seem to have been chanted by the whole body of senators. In ecclesiastical councils vote by acclamation is very common, the question being usually put in the form, *placet* or *non placet*. The Sacred College has sometimes elected popes by acclamation, when the cardinals simultaneously and without any previous consultation "acclaimed" one of their number as pontiff. A further ecclesiastical use of the word is in its application to set forms of praise or thanksgiving in church services, the stereotyped responses of the congregation. In modern parliamentary usage a motion is carried by acclamation when, no amendment being proposed, approval is expressed by shouting such words as *Aye* or *Agreed*.

ACCLIMATIZATION, the process of adaptation by which animals and plants are gradually rendered capable of surviving and flourishing in countries remote from their original habitats, or under meteorological conditions different from those which they have usually to endure, and at first injurious to them.

The subject of acclimatization is very little understood, and some writers have even denied that it can ever take place. It is often confounded with *domestication* or with *naturalization*; but these are both very different phenomena. A *domesticated* animal or a cultivated plant need not necessarily be *acclimatized*; that is, it need not be capable of enduring the severity of the seasons without protection. The canary bird is *domesticated* but not *acclimatized*, and many of our most extensively cultivated plants are in the same category. A *naturalized* animal or plant, on the other hand, must be able to withstand all the vicissitudes of the seasons in its new home, and it may therefore be thought that it must have become acclimatized. But in many, perhaps most cases of *naturalization* (see Appendix below) there is no evidence of a gradual adaptation to new conditions which were at first injurious, and this is essential to the idea of *acclimatization.* On the contrary, many species, in a new country and under somewhat different climatic conditions, seem to find a more congenial abode than in their native land, and at once flourish and increase in it to such an extent as often to exterminate the indigenous inhabitants. Thus L. Agassiz (in his work on Lake Superior) tells us that the roadside weeds of the north-eastern United States, to the number of 130 species, are all European, the native weeds having disappeared westwards; while in New Zealand there are, according to T. Kirk (*Transactions of the New Zealand Institute*, vol. ii. p. 131), no less than 250 species of naturalized plants, more than 100 of which spread widely over the country and often displace the native vegetation. Among animals, the European rat, goat and pig are naturalized in New Zealand, where they multiply to such an extent as to injure and probably exterminate many native productions. In none of these cases is there any indication that *acclimatization* was necessary or ever took place.

On the other hand, the fact that an animal or plant cannot be *naturalized* is no proof that it is not *acclimatized.* It has been shown by C. Darwin that, in the case of most animals and plants in a state of nature, the competition of other organisms is a far more efficient agency in limiting their distribution than the mere influence of climate. We have a proof of this in the fact that so few, comparatively, of our perfectly hardy garden plants ever run wild; and even the most persevering attempts to naturalize them usually fail. Alphonse de Candolle (*Géographie botanique*, p. 798) informs us that several botanists of Paris, Geneva, and especially of Montpellier, have sown the seeds of many hundreds of species of exotic hardy plants, in what appeared to be the most favourable situations, but that in hardly a single case has any one of them become naturalized. Attempts have also been made to naturalize continental insects in Britain, in places where the proper food-plants abound and the conditions seem generally favourable, but in no case do they seem to have succeeded. Even a plant like the potato, so largely cultivated and so perfectly hardy, has not established itself in a wild state in any part of Europe.

Different Degrees of Climatal Adaptation in Animals and Plants.—Plants differ greatly from animals in the closeness of their adaptation to meteorological conditions. Not only will most tropical plants refuse to live in a temperate climate, but many species are seriously injured by removal a few degrees of latitude beyond their natural limits. This is probably due to the fact, established by the experiments of A. C. Becquerel, that plants possess no proper temperature, but are wholly dependent on that of the surrounding medium.

Animals, especially the higher forms, are much less sensitive to change of temperature, as shown by the extensive range from north to south of many species. Thus, the tiger ranges from the equator to northern Asia as far as the river Amur, and to the isothermal of 32° Fahr. The mountain sparrow (*Passer montana*) is abundant in Java and Singapore in a uniform equatorial climate, and also inhabits Britain and a considerable portion of northern Europe. It is true that most terrestrial animals are restricted to countries not possessing a great range of temperature or very diversified climates, but there is reason to believe that this is due to quite a different set of causes, such as the presence of enemies or deficiency of appropriate food. When supplied with food and partially protected from enemies, they often show a wonderful capacity of enduring climates very different from that in which they originally flourished. Thus, the horse and the domestic fowl, both natives of very warm countries, flourish without special protection in almost every inhabited portion of the globe. The parrot tribe form one of the most pre-eminently tropical groups of birds, only a few species extending into the warmer temperate regions; yet even the most exclusively tropical genera are by no means delicate birds as regards climate. In the *Annals and Magazine of Natural History* for 1868 (p. 381) is a most interesting account, by Charles Buxton, of the naturalization of parrots at Northreps Hall, Norfolk. A considerable number of African and Amazonian parrots, Bengal parroquets, four species of white and rose crested cockatoos, and two species of crimson lories, remained at large for many years. Several of these birds bred, and they almost all lived in the woods the whole year through, refusing to take shelter in a house constructed for their use. Even when the thermometer fell 6° below zero, all appeared in good spirits and vigorous health. Some of these birds have lived thus exposed for many years, enduring the English cold easterly winds, rain, hail and snow, all through the winter—a marvellous contrast to the equable equatorial temperature (hardly ever less than 70°) to which many of them had been accustomed for the first year or years of their existence. Similarly the recent experience of zoological gardens, particularly in the case of parrots and monkeys, shows that, excluding draughts, exposure to changes of temperature without artificial heat is markedly beneficial as compared with the older method of strict protection from cold.

Hardly any group of Mammalia is more exclusively tropical than the Quadrumana, yet, if other conditions are favourable, some of them can withstand a considerable degree of cold. *Semnopithecus schistaceus* was found by Captain Hutton at an elevation of 11,000 feet in the Himalayas, leaping actively among fir-trees whose branches were laden with snow-wreaths. In Abyssinia a troop of dog-faced baboons was observed by W. T. Blanford at 9000 feet above the sea. We may therefore conclude that the restriction of the monkey tribe to warm latitudes is probably determined by other causes than temperature alone.

Similar indications are given by the fact of closely allied species inhabiting very extreme climates. The recently extinct Siberian mammoth and woolly rhinoceros were closely allied to species now inhabiting tropical regions exclusively. Wolves and foxes are found alike in the coldest and hottest parts of the earth, as are closely allied species of falcons, owls, sparrows and numerous genera of waders and aquatic birds.

A consideration of these and many analogous facts might induce us to suppose that, among the higher animals at least, there is little constitutional adaptation to climate, and that in their case acclimatization is not required. But there are numerous examples of domestic animals which show that such adaptation does exist in other cases. The yak of Thibet cannot long survive in the plains of India, or even on the hills below a certain altitude; and that this is due to climate, and not to the increased density of the atmosphere, is shown by the fact that the same animal appears to thrive well in Europe, and even breeds there readily. The Newfoundland dog will not live in India, and the Spanish breed of fowls in this country suffer more from frost than most others. When we get lower in the scale the adaptation is often more marked. Snakes, which are so abundant in warm countries, diminish rapidly as we go north, and wholly cease at lat. 62°. Most insects are also very susceptible to cold, and seem to be adapted to very narrow limits of temperature.

From the foregoing facts and observations we may conclude, firstly, that some plants and many animals are not constitutionally adapted to the climate of their native country only, but are capable of enduring and flourishing under a more or less extensive range of temperature and other climatic conditions; and, secondly, that most plants and some animals are, more or less closely, adapted to climates similar to those of their native habitats. In order to domesticate or naturalize the former class in countries not extremely differing from that from which the species was brought, it will not be necessary to *acclimatize*, in the strict sense of the word. In the case of the latter class, however, acclimatization is a necessary preliminary to naturalization, and in many cases to useful domestication, and we have therefore to inquire whether it is possible.

Acclimatization by Individual Adaptation.—It is evident that acclimatization may occur (if it occurs at all) in two ways, either by modifying the constitution of the individual submitted to the new conditions, or by the production of offspring which may be better adapted to those conditions than their parents. The alteration of the constitution of individuals in this direction is not easy to detect, and its possibility has been denied by many writers. C. Darwin believed, however, that there were indications that it occasionally occurred in plants, where it can be best observed, owing to the circumstance that so many plants are propagated by cuttings or buds, which really continue the existence of the same individual almost indefinitely. He adduced the example of vines taken to the West Indies from Madeira, which have been found to succeed better than those taken directly from France. But in most cases habit, however prolonged, appears to have little effect on the constitution of the individual, and the fact has no doubt led to the opinion that acclimatization is impossible. There is indeed little or no evidence to show that any animal to which a new climate is at first prejudicial can be so acclimatized by habit that, after subjection to it for a few or many seasons, it may live as healthily and with as little care as in its native country; yet we may, on general principles, believe that under proper conditions such an acclimatization would take place.

Acclimatization by Variation.—A mass of evidence exists showing that variations of every conceivable kind occur among the offspring of all plants and animals, and that, in particular, constitutional variations are by no means uncommon. Among cultivated plants, for example, hardier and more tender varieties often arise. The following cases are given by C. Darwin:—Among the numerous fruit-trees raised in North America some are well adapted to the climate of the northern States and Canada, while others only succeed well in the southern States. Adaptation of this kind is sometimes very close, so that, for example, few English varieties of wheat will thrive in Scotland. Seed-wheat from India produced a miserable crop when planted by the Rev. M. J. Berkeley on land which would have produced a good crop of English wheat. Conversely, French wheat taken to the West Indies produced only barren spikes, while native wheat by its side yielded an enormous harvest. Tobacco in Sweden, raised from home-grown seed, ripens its seeds a month earlier than plants grown from foreign seed. In Italy, as long as orange trees were propagated by grafts, they were tender; but after many of the trees were destroyed by the severe frosts of 1709 and 1763, plants were raised from seed, and these were found to be hardier and more productive than the former kinds. Where plants are raised from seed in large quantities, varieties always occur differing in constitution, as well as others differing in form or colour; but the former cannot be perceived by us unless marked out by their behaviour under exceptional conditions, as in the following cases. After the severe winter of 1860–1861 it was observed that in a large bed of araucarias some plants stood quite unhurt among numbers killed around them. In C. Darwin's garden two rows of scarlet runners were entirely killed by frost, except three plants, which had not even the tips of their leaves browned. A very excellent example is to be found in Chinese history, according to E. R. Huc, who, in his *L' Empire chinois* (tom. ii. p. 359), gives the following extract from the *Memoirs of the Emperor Khang*:—"On the 1st day of the 6th moon I was walking in some fields where rice had been sown to be ready for the harvest in the 9th moon. I observed by chance a stalk of rice which was already in ear. It was higher than all the rest, and was ripe enough to be gathered. I ordered it to be brought to me. The grain was very fine and well grown, which gave me the idea to keep it for a trial, and see if the following year it would preserve its precocity. It did so. All the stalks which came from it showed ear before the usual time, and were ripe in the 6th moon. Each year has multiplied the produce of the preceding, and for thirty years it is this rice which has been served at my table. The grain is elongate and of a reddish colour, but it has a sweet smell and very pleasant taste. It is called *Yu-mi*, Imperial rice, because it was first cultivated in my gardens. It is the only sort which can ripen north of the great wall, where the winter ends late and begins very early; but in the southern provinces, where the climate is milder and the land more fertile, two harvests a year may be easily obtained, and it is for me a sweet reflection to have procured this advantage for my people." Huc adds his testimony that this kind of rice flourishes in Manchuria, where no other will grow. We have here, therefore, a perfect example of acclimatization by means of a spontaneous constitutional variation.

That this kind of adaptation may be carried on step by step to more and more extreme climates is illustrated by the following examples. Sweet-peas raised in Calcutta from seed imported from England rarely blossom, and never yield seed; plants from French seed flower better, but are still sterile; but those raised from Darjeeling seed (originally imported from England) both flower and seed profusely. The peach is believed to have been tender, and to have ripened its fruit with difficulty, when first introduced into Greece; so that (as Darwin observes) in travelling northward during two thousand years it must have become much hardier. Sir J. Hooker ascertained the average vertical range of flowering plants in the Himalayas to be 4000 ft., while in some cases it extended to 8000 ft. The same species can thus endure a great difference of temperature; but the important fact is, that the individuals have become acclimatized to the altitude at which they grow, so that seeds gathered near the upper limit of the range of a species will be more hardy than those gathered near the lower limit. This was proved by Hooker to be the case with Himalayan conifers and rhododendrons, raised in Britain from seed gathered at different altitudes.

Among animals exactly analogous facts occur. When geese were first introduced into Bogota they laid few eggs at long intervals, and few of the young survived. By degrees the fecundity improved, and in about twenty years became equal to what it is in Europe. The same author tells us that, according to Garcilaso, when fowls were first introduced into Peru they were not fertile, whereas now they are as much so as in Europe. C. Darwin adduced the following examples. Merino sheep bred at the Cape of Good Hope have been found far better adapted for India than those imported from England; and while the Chinese variety of the Ailanthus silk-moth is quite hardy, the variety found in Bengal will only flourish in warm latitudes. C. Darwin also called attention to the circumstance that writers of agricultural works generally recommend that animals should be removed from one district to another as little as possible. This advice occurs even in classical and Chinese agricultural books as well as in those of our own day, and proves that the close adaptation of each variety or breed to the country in which it originated has always been recognized.

Constitutional Adaptation often accompanied by External Modification.—Although in some cases no perceptible alteration of form or structure occurs when constitutional adaptation to climate has taken place, in others it is very marked. C. Darwin collected a large number of cases in his *Animals and Plants under Domestication*.

In his *Contributions to the Theory of Natural Selection* (p. 167), A. R. Wallace has recorded cases of simultaneous variation among insects, apparently due to climate or other strictly local causes. He found that the butterflies of the family *Papilionidae*, and some others, became similarly modified in different islands and groups of islands. Thus, the species inhabiting Sumatra, Java and Borneo are almost always much smaller than the closely allied species of Celebes and the Moluccas; the species or varieties of the small island of Amboyna are larger than the same species or closely allied forms inhabiting the surrounding islands; the species found in Celebes possess a peculiar form of wing, quite distinct from that of the same or closely allied species of adjacent islands; and, lastly, numerous species which have tailed wings in India and the western islands of the Archipelago, gradually lose the tail as we proceed eastward to New Guinea and the Pacific.

Many of these curious modifications may, it is true, be due to other causes than climate only, but they serve to show how powerfully and mysteriously local conditions affect the form and structure of both plants and animals; and they render it probable that changes of constitution are also continually produced, although we have, in the majority of cases, no means of detecting them. It is also impossible to determine how far the effects described are produced by spontaneous favourable variations or by the direct action of local conditions; but it is probable that in every case both causes are concerned, although in constantly varying proportions.

Selection and Survival of the Fittest as Agents in Naturalization.—We may now take it as an established fact that varieties of animals and plants occur, both in domesticity and in a state of nature, which are better or worse adapted to special climates. There is no positive evidence that the influence of new climatal conditions on the parents has any tendency to produce variations in the offspring better adapted to such conditions. Neither does it appear that this class of variations are very frequent. It is, however, certain that whenever any animal or plant is largely propagated constitutional variations will arise, and some of these will be better adapted than others to the climatal and other conditions of the locality. In a state of nature, every recurring severe winter or otherwise unfavourable season weeds out those individuals of tender constitution or imperfect structure which may have got on very well during favourable years, and it is thus that the adaptation of the species to the climate in which it has to exist is kept up. Under domestication the same thing occurs by what C. Darwin has termed "unconscious selection." Each cultivator seeks out the kinds of plants best suited to his soil and climate and rejects those which are tender or otherwise unsuitable. The farmer breeds from such of his stock as he finds to thrive best with him, and gets rid of those which suffer from cold, damp or disease. A more or less close adaptation to local conditions is thus brought about, and breeds or races are produced which are sometimes liable to deterioration on removal even to a short distance in the same country, as in numerous cases quoted by C. Darwin (*Animals and Plants under Domestication*).

The Method of Acclimatization.—Taking into consideration the foregoing facts and illustrations, it may be considered as proved—*1st*, That habit has little (though it appears to have some) definite effect in adapting the constitution of animals to a new climate; but that it has a decided, though still slight, influence in plants when, by the process of propagation by buds, shoots or grafts, the individual can be kept under its influence for long periods; *2nd*, That great and sudden changes of climate often check reproduction even when the health of the individuals does not appear to suffer. In order, therefore, to have the best chance of acclimatizing any animal or plant in a climate very dissimilar from that of its native country, and in which it has been proved that the species in question cannot live and maintain itself without acclimatization, we must adopt some such plan as the following:—

1. We must transport as large a number as possible of adult healthy individuals to some intermediate station, and increase them as much as possible for some years. Favourable variations of constitution will soon show themselves, and these should be carefully selected to breed from, the tender and unhealthy individuals being rigidly eliminated.

2. As soon as the stock has been kept a sufficient time to pass through all the ordinary extremes of climate, a number of the hardiest may be removed to the more remote station, and the same process gone through, giving protection if necessary while the stock is being increased, but as soon as a large number of healthy individuals are produced, subjecting them to all the vicissitudes of the climate.

It can hardly be doubted that in most cases this plan would succeed. It has been recommended by C. Darwin, and at one of the early meetings of the *Société Zoologique d' Acclimatation*, at Paris, Isodore Geoffroy St Hilaire insisted that it was the only method by which acclimatization was possible. But in looking through the long series of volumes of Reports published by this society, there is no sign that any systematic attempt at acclimatization has even once been made. A number of foreign animals have been introduced, and more or less domesticated, and some useful exotics have been cultivated for the purpose of testing their applicability to French agriculture or horticulture; but neither in the case of animals nor of plants has there been any systematic effort to modify the constitution of the species, *by breeding largely and selecting the favourable variations that appeared.*

Take the case of the *Eucalyptus globulus* as an example. This is a Tasmanian gum-tree of very rapid growth and great beauty, which will thrive in the extreme south of France. In the *Bulletin* of the society a large number of attempts to introduce this tree into general cultivation in other parts of France are recorded in detail, with the failure of almost all of them. But no precautions such as those above indicated appear to have been taken in any of these experiments; and we have no intimation that either the society or any of its members are making systematic efforts to acclimatize the tree. The first step would be, to obtain seed from healthy trees growing in the coldest climate and at the greatest altitude in its native country, sowing these very largely, and in a variety of soils and situations, in a part of France where the climate is somewhat but not much more extreme. It is almost a certainty that a number of trees would be found to be quite hardy. As soon as these produced seed, it should be sown in the same district and farther north in a climate a little more severe. After an exceptionally cold season, seed should be collected from the trees that suffered least, and should be sown in various districts all over France. By such a process there can be hardly any doubt that the tree would be thoroughly acclimatized in any part of France, and in many other countries of central Europe; and more good would be effected by one well-directed effort of this kind than by hundreds of experiments with individual animals and plants, which only serve to show us which are the species that *do not require to be acclimatized.*

Acclimatization of Man.—On this subject we have, unfortunately, very little direct or accurate information. The general laws of heredity and variation have been proved to apply to man as well as to animals and plants; and numerous facts in the distribution of races show that man must, in remote ages at least, have been capable of constitutional adaptation to climate. If the human race constitutes a single species, then the mere fact that man now inhabits every region, and is in each case constitutionally adapted to the climate, proves that acclimatization has occurred. But we have the same phenomenon in single varieties of man, such as the American, which inhabits alike the frozen wastes of Hudson's Bay and Tierra del Fuego, and the hottest regions of the tropics,—the low equatorial valleys and the lofty plateaux of the Andes. No doubt a sudden transference to an extreme climate is often prejudicial to man, as it is to most animals and plants; but there is every reason to believe that, if the migration occurs step by step, man can be acclimatized to almost any part of the earth's surface in comparatively few generations. Some eminent writers have denied this. Sir Ranald Martin, from a consideration of the effects of the climate of India on Europeans and their offspring, believed that there is no such thing as acclimatization. Dr Hunt, in a report to the British Association in 1861, argued that "time is no agent," and—"if there is no sign of acclimatization in one generation, there is no such process." But he entirely ignored the effect of favourable variations, as well as the direct influence of climate acting on the organization from infancy.

Professor Theodor Waitz, in his *Introduction to Anthropology*, adduced many examples of the comparatively rapid constitutional adaptation of man to new climatic conditions. Negroes, for example, who have been for three or four generations acclimatized in North America, on returning to Africa become subject to the same local diseases as other unacclimatized individuals. He well remarked that the debility and sickening of Europeans in many tropical countries are wrongly ascribed to the climate, but are rather the consequences of indolence, sensual gratification and an irregular mode of life. Thus the English, who cannot give up animal food and spirituous liquors, are less able to sustain the heat of the tropics than the more sober Spaniards and Portuguese. The excessive mortality of European troops in India, and the delicacy of the children of European parents, do not affect the real question of acclimatization under proper conditions. They only show that acclimatization is in most cases necessary, not that it cannot take place. The best examples of partial or complete acclimatization are to be found where European races have permanently settled in the tropics, and have maintained themselves for several generations. There are, however, two sources of inaccuracy to be guarded against, and these are made the most of by the writers above referred to, and are supposed altogether to invalidate results which are otherwise opposed to their views. In the first place, we have the possibility of a mixture of native blood having occurred; in the second, there have almost always been a succession of immigrants from the parent country, who continually intermingle with the families of the early settlers. It is maintained that one or other of these mixtures is absolutely necessary to enable Europeans to continue long to flourish in the tropics.

There are, however, certain cases in which the sources of error above mentioned are reduced to a minimum, and cannot seriously affect the results; such as those of the Jews, the Dutch at the Cape of Good Hope and in the Moluccas, and the Spaniards in South America.

The Jews are a good example of acclimatization, because they have been established for many centuries in climates very different from that of their native land; they keep themselves almost wholly free from intermixture with the people around them; and they are often so populous in a country that the intermixture with Jewish immigrants from other lands cannot seriously affect the local purity of the race. They have, for instance, attained a population of millions in such severe climates as Poland and Russia; in the towns of Algeria they have succeeded so conspicuously as to bring about an outburst of anti-semitism; and in Cochin-China and Aden they succeed in rearing children and forming permanent communities.

In some of the hottest parts of South America Europeans are perfectly acclimatized, and where the race is kept pure it seems to be even improved. Some very valuable notes on this subject were furnished to the present writer by the well-known botanist, Richard Spruce, who resided many years in South America, but who was prevented by ill-health from publishing his researches (see A. R. Wallace, *Notes of a Botanist*, 1908). As a careful, judicious and accurate observer, both of man and nature, he had few superiors. He says:

> The white inhabitants of Guayaquil (lat. 2° 13′ S.) are kept pure by careful selection. The slightest tincture of red or black blood bars entry into any of the old families who are descendants of Spaniards from the Provincias Vascongadas or those bordering the Bay of Biscay, where the morals are perhaps the purest (as regards the intercourse of the sexes) of any in Europe, and where for a girl, even of the poorest class, to have a child before marriage is the rarest thing possible. The consequence of this careful breeding is, that the women of Guayaquil are considered (and justly) the finest along the whole Pacific coast. They are often tall, sometimes very handsome, decidedly healthy, although pale, and assuredly prolific enough. Their sons are big, stout men, but when they lead inactive lives are apt to become fat and sluggish. Those of them, however, who have farms in the savannahs and are accustomed to take long rides in all weathers, and those whose trade obliges them to take frequent journeys in the mountainous interior, or even to Europe and North America, are often as active and as little burdened with superfluous flesh as a Scotch farmer.
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> The oldest Christian town in Peru is Piura (lat. 5° S.), which was founded by Pizarro himself. The climate is very hot, especially in the three or four months following the southern solstice. In March 1843 the temperature only once fell as low as 83° during the whole month, the usual lowest night temperature being 85°. Yet people of all colours find it very healthy, and the whites are very prolific. I resided in the town itself nine months, and in the neighbourhood seven months more. The population (in 1863–1864) was about 10,000, of which not only a considerable proportion was white, but was mostly descended from the first emigrants after the conquest. Purity of descent was not, however, quite so strictly maintained as at Guayaquil. The military adventurers, who have often risen to high or even supreme rank in Peru, have not seldom been of mixed race, and fear or favour has often availed to procure them an alliance with the oldest and purest-blooded families.

These instances, so well stated by Spruce, seem to demonstrate the complete acclimatization of Spaniards in some of the hottest parts of South America. Although we have here nothing to do with mixed races, yet the want of fertility in these has been often taken to be a fact inherent in the mongrel race, and has been also sometimes held to prove that neither the European nor his half-bred offspring can maintain themselves in the tropics. The following observation is therefore of interest:—

> At Guayaquil for a lady of good family—married or unmarried—to be of loose morals is so uncommon, that when it does happen it is felt as a calamity by the whole community. But here, and perhaps in most other towns in South America, a poor girl of mixed race—especially if good-looking—rarely thinks of marrying one of her own class until she has—as the Brazilians say—"approveitada de sua mocidade" (made the most of her youth) in *receiving presents from gentlemen*. If she thus bring a good dowry to her husband, he does not care to inquire, or is not sensitive, about the mode in which it was acquired. The consequence of this indiscriminate sexual intercourse, especially if much prolonged, is to diminish, in some cases to paralyse, the fertility of the female. And as among people of mixed race it is almost universal, the population of these must fall off both in numbers and quality.

The following example of divergent acclimatization of the same race to hot and cold zones is very interesting, and will conclude our extracts from Spruce's valuable notes:—

> One of the most singular cases connected with this subject that have fallen under my own observation, is the difficulty, or apparent impossibility, of acclimatizing the Red Indian in a certain zone of the Andes. Any person who has compared the physical characters of the native races of South America must be convinced that these have all originated in a common stirps. Many local differences exist, but none capable of invalidating this conclusion. The warmth yet shade-loving Indian of the Amazon; the Indian of the hot, dry and treeless coasts of Peru and Guayaquil, who exposes his bare head to the sun with as much zest as an African negro; the Indian of the Andes, for whom no cold seems too great, who goes constantly bare-legged and often bare-headed, through whose rude straw hut the piercing wind of the paramos sweeps and chills the white man to the very bones;—all these, in the colour and texture of the skin, the hair and other important features, are plainly of one and the same race.
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> Now there is a zone of the equatorial Andes, ranging between about 4000 and 6000 feet altitude, where the very best flavoured coffee is grown, where cane is less luxuriant but more saccharine than in the plains, and which is therefore very desirable to cultivate, but where the red man sickens and dies. Indians taken down from the sierra get ague and dysentery. Those of the plains find the temperature chilly, and are stricken down with influenza and pains in the limbs. I have seen the difficulty experienced in getting farms cultivated in this zone, on both sides of the Cordillera. The permanent residents are generally limited to the major-domo and his family; and in the dry season labourers are hired, of any colour that can be obtained—some from the low country, others from the highlands—for three, four, or five months, who gather in and grind the cane, and plant for the harvest of the following year; but the staff of resident Indian labourers, such as exists in the farms of the sierra, cannot be kept up in the *Yungas*, as these half-warm valleys are called. White men, who take proper precautions, and are not chronically soaked with cane-spirit, stand the climate perfectly, but the creole whites are still too much *caballeros* to devote themselves to agricultural work.
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> In what is now the republic of Ecuador, the only peopled portions are the central valley, between the two ridges of the Andes—height 7000 to 12,000 feet—and the hot plain at their western base; nor do the wooded slopes appear to have been inhabited, except by scattered savage hordes, even in the time of the Incas. The Indians of the highlands are the descendants of others who have inhabited that region exclusively for untold ages; and a similar affirmation may be made of the Indians of the plain. Now, there is little doubt that the progenitors of both these sections came from a temperate region (in North America); so that here we have one moiety acclimatized to endure extreme heat, and the other extreme cold; and at this day exposure of either to the opposite extreme (or even, as we have seen, to the climate of an intermediate zone) is always pernicious and often fatal. But if this great difference has been brought about in the red man, might not the same have happened to the white man? Plainly it might, time being given; for one cannot doubt that the inherent adaptability is the same in both, or (if not) that the white man possesses it in a higher degree.

The observations of Spruce are of themselves almost conclusive as to the possibility of Europeans becoming acclimatized in the tropics; and if it is objected that this evidence applies only to the dark-haired southern races, we are fortunately able to point to facts, almost equally well authenticated and conclusive, in the case of one of the typical Germanic races. In South Africa the Dutch have been settled and nearly isolated for over 200 years, and have kept themselves almost or quite free from native intermixture. They are still preponderatingly fair in complexion, while physically they are tall and strong. They marry young and have large families. The population, according to a census taken in 1798, was under 22,000. In 1865 it was near 182,000, the majority being of "Dutch, German or French origin, mostly descendants of original settlers." In more recent times, the conditions have been so greatly changed by immigration, that the later statistics cease to have a definite meaning with regard to acclimatization. We have here a population which doubled itself every twenty-two years; and the greater part of this rapid increase must certainly be due to the old European immigrants. In the Moluccas, where the Dutch have had settlements for 250 years, some of the inhabitants trace their descent to early immigrants; and these, as well as most of the people of Dutch descent in the east, are quite as fair as their European ancestors, enjoy excellent health, and are very prolific. But the Dutch accommodate themselves admirably to a tropical climate, doing much of their work early in the morning, dressing very lightly, and living a quiet, temperate and cheerful life. They also pay great attention to drainage and general cleanliness. In addition to these examples, it is obvious that the rapid increase of English-speaking populations in the United States and in Australia is far greater than can be explained by immigration, and shows two conspicuous examples of acclimatization.

On the whole, we seem justified in concluding that, under favourable conditions, and with a proper adaptation of means to the end in view, man may become acclimatized with at least as much certainty and rapidity (counting by generations rather than by years) as any of the lower animals. The greatest difficulty in his way is not temperature, but the presence of parasitic diseases to resist which his body has not been prepared, and modern knowledge is rapidly defining these dangers and the modes of avoiding them. (A. R. W.)

APPENDIX

The task of collecting information as to animals which have become permanently naturalized away from their native haunts is anything but easy, as few regular records have been kept by acclimatizers. Moreover, recorders of local fauna have been almost unanimous in ignoring the introduced forms, except when they have had occasion to comment on the effects, real or supposed, of these immigrants on aboriginal faunas.

Mammals.—It is unnecessary here to dwell upon the world-wide distribution of the two rats *Mus rattus* and *M. decumanus*, and of the house-mouse *M. musculus*; their introduction has always been involuntary. Similarly nearly all our domestic mammals except the sheep have become feral somewhere or other, whether by intentional liberation or by escape; but the smaller ones more than the larger, such as pigs, goats, dogs and cats. This has been especially the case in Hawaii and New Zealand; in America, Australia and Hawaii, horses and cattle are also feral. Feral pigs are numerous in New Zealand.

The domestic Indian buffalo (*Bos bubalus*) exists as a wild animal in North Australia; it is very liable to revert to a wild state, being little altered from its still-existing wild ancestor. A more curious case is that of the one-humped camel (*Camelus dromedarius*), a beast only known in domestication, and that in arid countries; yet a number of these have become feral in the Spanish marshes, where they wade about like quadrupedal flamingoes.

The red deer (*Cervus elaphus*) is now widely distributed as a wild animal over New Zealand, where also the fallow-deer (*C. dama*) and the Indian sambar (*C. aristotelis* or *unicolor*) have been introduced locally. The sambar, or one or other of its subspecies, has also been naturalized in Mauritius, and in the Marianne Islands in the open Pacific.

The wide introduction of the rabbit, as a wild animal, is well known. Amounting to a serious pest in Australasian colonies, it is also established in the Falklands and Kerguelen; its presence in much of Europe is attributed to early acclimatization, as it seems anciently to have been confined to the Iberian peninsula.

The hare has been established in New Zealand and Barbadoes.

Few other rodents have been designedly naturalized, but the North American grey squirrel (*Sciurus cinereus*) appears to be established as a wild animal in Woburn Park, Bedfordshire, England, and may probably spread thence.

To check the increase of the rabbit, stoats, weasels and pole-cats (the last in the form of the domesticated ferret) were introduced into New Zealand on a very large scale in the last quarter of the 19th century. They have spread widely, and have not confined their depredations to the rabbits, so that the indigenous flightless birds have suffered largely.

Another carnivore of very similar habits, the Indian mongoose (*Herpestus griseus* or *H. mungo*), has been naturalized in Jamaica, whence it has been carried to other West Indian Islands, and in the Hawaiian group. It has also been tried, but unsuccessfully, in Australia. The first introduction into Jamaica took place in 1872, and ten years later the animal was credited with saving many thousands of pounds annually by its destruction of rats. But before an equal space of time had further elapsed, it had itself become a pest; the most recent information, however, is to the effect that its numbers are now on the decline, and that the disturbed faunal equilibrium is being readjusted.

The civets, being celebrated for their odoriferous secretion, are likely animals to have been naturalized. W. T. Blanford (*Fauna of British India*, "Mammals") thinks that the presence of the Indian form, *Viverricula malaccensis*, in Socotra, the Comoro Islands and Madagascar is due to the assistance of man.

The common fox of Europe has been introduced into Australia, where it is destructive to the native fauna and to lambs.

Among primates, a Ceylonese monkey (*Macacus pileatus*) has been naturalized in Mauritius for centuries, the circumstances of introduction being unknown.

The common Australian "opossum" or phalanger (*Trichosurus vulpecula*) has been naturalized in New Zealand, although very destructive to fruit trees; the value of its fur being probably the motive. It is said that the pelage of the New Zealand specimens is superior, as might be expected from the colder climate.

Birds.—The introduction of mammals has been largely influenced by economic conditions, when, indeed, it was not absolutely accidental and unavoidable; but in the case of birds it has been more gratuitous, so to speak, in many cases, and hence is looked upon with especial dislike by naturalists. The domestic birds have comparatively seldom become feral, doubtless, as C. Darwin points out, from the reduction of their powers of flight in many cases. The guinea-fowl, however, has long been in this condition in Jamaica and St Helena, and the fowl in Hawaii and other Polynesian islands. The pheasant has been naturalized in the United States, New Zealand, Hawaii and St Helena. Its naturalization in western Europe is very ancient, but the race supposed to have been introduced by the Romans (*Phasianus colchicus*) has been much modified within the last century or two by the introduction of the ring-necked Chinese form (*P. torquatus*), which produces fertile hybrids with the old breed. Thus those acclimatized were usually, no doubt, of mixed blood, and further introductions of pure Chinese stock have tended to make the latter the dominant form, at any rate in the United States (where it is erroneously called Mongolian[1]) and in New Zealand. In Hawaii and St Helena the ring-neck appears to have been the only pheasant introduced pure, but in the former the Japanese race (*P. versicolor*) is also naturalized.

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[1] The true Mongolian pheasant (*P. mongolicus*), a very different bird, has recently been introduced into England.

The golden pheasant (*Chrysolophus pictus*) is locally established in the United States, as appear to be other pheasants of less common species. The Reeves' pheasant (*P. reevesi*) is at large on some English estates. Of the partridges, the continental red-leg (*Caccabis rufa*) is established in England, and its ally, the Asiatic chukore (*C. chukar*), in St Helena, as is the Californian quail (*Lophortyx californica*) in New Zealand and Hawaii. The latter, however, though thriving as an aviary bird, has failed at large in England, as did the bob-white (*Ortyx virginianus*) both there and in New Zealand.

The desirable character of the grouse as game-birds has led to many attempts at their acclimatization, but usually these have been unsuccessful; the red grouse (*Lagopus scoticus*), however, the only endemic British bird, is naturalized in some parts of Europe.

Of waterfowl, the Canada goose (*Branta canadensis*) is naturalized to a small extent in Britain, and also, to a less degree, the Egyptian goose (*Chenalopex aegyptiacus*); the latter bird also occurs wild in New Zealand. The modern presence of the black swan of Australia (*Chenopis atrata*) in New Zealand appears to be due to a natural irruption of the species about half a century ago as much as to acclimatization by man, if not more so.

Birds of prey are, unjustly enough, regarded with so little favour that few attempts have been made to naturalize them; the continental little owl (*Athene noctua*), however, has for some time been well established in England, where it has hardly, if ever, appeared naturally.

Pigeons have been very little naturalized; the tame bird has become feral locally in various countries, and the Chinese turtle-dove (*Turtur chinensis*) is established in Hawaii, as is the small East Indian zebra dove (*Geopelia striata*) in the Seychelles, and the allied Australian (*G. tranquilla*) in St Helena. There has also been very little naturalization of parrots, but the rosella parrakeet of Australia (*Platycercus eximius*) is being propagated by escaped captives in the north island of New Zealand, and its ally the mealy rosella (*P. pallidiceps*) is locally wild in Hawaii, the stock in this case having descended from a single pair intentionally liberated. Attempts to naturalize that well-known Australian grass-parrakeet the budgerigar (*Melopsittacus undulatus*) in England have so far proved abortive, and none of the species experimented with in Norfolk and Bedfordshire effected a settlement. The greyheaded love-bird (*Agapornis cana*) of Madagascar is established in the Seychelles. Some of the passerine birds have been the most widely distributed, especially the house-sparrow (*Passer domesticus*), which is now an integral, and very troublesome, part of the fauna in the Australasian States and in North America. It is, in fact, as notorious an example of over-successful acclimatization as the rabbit, but in Hutton and Drummond's recent work on the New Zealand animals (London, 1905) it is not regarded in this light, considering that some very common exotic birds were needed to keep down the insects, which it certainly did. Even in the United States also, it has been found a useful destroyer of weed-seeds. The house-sparrow is also feral in Argentina, some of the West Indian islands, Hawaii and the Andamans.

The allied tree-sparrow (*P. montanus*) has been locally naturalized in the United States; it is a more desirable bird, being less prolific and pugnacious, but it is expelled from towns by the house-sparrow.

The so-called Java sparrow (*Munia oryzivora*), although a destructive bird to rice, has been widely distributed by accident or design, and is now found in several East Indian islands besides Java, in south China, St Helena, India, Zanzibar and the east African coast. An allied but much smaller weaver-finch, a form of the spice-bird (*Munia nisoria punctata*), is introduced and well distributed over the Hawaiian islands. The little rooibek of South Africa (*Estrilda astrild*) has been so long and well established in St Helena that it is known in the bird trade as the St Helena waxbill, and the brilliant scarlet weaver of Madagascar (*Foudia madagascariensis*) inhabits as an imported bird Mauritius, the Seychelles and even the remote Chagos Islands.

Returning to the true finches, the only one which can compete with the house-sparrow in the extent of its distribution by man is the goldfinch (*Carduelis carduelis*), now established all over New Zealand, as well as in Australia, the United States and Jamaica. It bears a good character, and is one of the marked successes of naturalization. The redpoll (*Acanthis linaria*), chaffinch (*Fringilla coelebs*) and greenfinch (*Chloris chloris*) are established in New Zealand, the last named being a pest there, as is also the cirl-bunting (*Emberiza cirlus*)—the yellow-hammer (*E. citrinella*) being perhaps confused with this also.

Among starlings, the Indian mynah (generally the house mynah, *Acridotheres tristis*, but some other species seem to have been confused with this) has been naturalized in the Andamans, Seychelles, Réunion, Australia, Hawaii and parts of New Zealand. Its alleged destructiveness to the Hawaiian avifauna seems open to doubt.

The European starling (*Sturnus vulgaris*) is naturalized in New Zealand, Australia and to some extent in the United States. Thrushes have not been widely introduced, but the song-thrush and blackbird (*Turdus musicus* and *Merula merula*) are common in New Zealand; attempts were made, but unsuccessfully, to establish the latter in the United States. The so-called hedge-sparrow (*Accentor modularis*), really a member of this group, is one of the successful introductions into New Zealand. The robin (*Erithacus rubecula*) failed there.

Rooks (*Corvus frugilegus*) and the Australian "magpie" or piping crow (*Gymnorhina*) are to be found in New Zealand, but only locally, especially the former.

Reptiles and Amphibians.—Very little naturalization has been effected, or indeed apparently attempted, in regard to these groups, but the occurrence of the edible frog of the continent of Europe (*Rana esculenta*) as an introduced animal in certain British localities is well known. An Australian tree-frog (*Hyla peronii*) is naturalized in many parts of the north island of New Zealand.

Fish.—The instances of naturalization in this class are few, but important. The common carp (*Cyprinus carpio*), originally a Chinese fish, has for centuries been acclimatized in Europe, where indeed it is in places a true domestic creature, with definite variations. It is, however, quite feral also, and has been introduced into North America.

The Prussian carp (*Carassius vulgaris*) is established in New Zealand, and the nearly-allied goldfish, a domestic form (*C. auratus*) of Chinese origin, has been widely distributed as a pet, and is feral in some places.

The gourami (*Osphromenus olfax*) of the East Indies has been established in Mauritius and Cayenne, being a valuable food-fish.

The most important case of naturalization of fish is, however, the establishment of some *Salmonidae* in Tasmania and New Zealand. These are the common trout and sea-trout (*Salmo fario* and *S. trutta*); they attain a great size. So far, attempts to establish the true salmon in alien localities have been unsuccessful, but the American rainbow trout (*S. irideus*) has thriven in New Zealand, and the brook char of the same continent (*S. fontinalis*) inhabits at least one stream there to the exclusion of the common trout.

Invertebrates.—Many insects and other invertebrates, mostly noxious, have been accidentally naturalized, and some have been deliberately introduced, like the honey-bee, now feral in Australasia and North America, and the humble-bee, imported into New Zealand to effect the fertilization of red clover.

The spread of the European house-fly has been deliberately encouraged in New Zealand, as wherever it penetrates the native flesh-fly, a more objectionable pest, disappears.

The wide distribution of three common cockroaches (*Periplaneta americana*, *Blatta orientalis* and *Ectobia germanica*) is well known, but these are chiefly house-insects.

The common small white butterfly of Europe (*Pontia* or *Pieris rapae*) is now established in North America; and the march of the jigger, or foot-infesting flea (*Sarcopsylla penetrans*) of tropical America, across Africa, has taken place in quite recent years.

The Romans are credited with having purposely introduced the edible snail (*Helix pomatia*) into England, and the common garden snail and slugs (*Helix aspersa*, *Limax agrestis* and *Arion hortensis*) have been unwittingly established in New Zealand. In that country, also, the earthworms of Europe are noticed to replace native forms as the ground is broken.

General Remarks.—A great deal has been said about the upsetting of the balance of nature by naturalization, and as to the ill-doing of exotic forms. But certain considerations should be borne in mind in this connexion. In the first place, naturalization experiments fail at least as often as they succeed, and often quite inexplicably. Thus, the linnet and partridge have failed to establish themselves in New Zealand. This may ultimately throw some light on the disappearance of native forms; for these have at times declined without any assignable cause.

Secondly, native forms often disappear with the clearing off of the original forest or other vegetation, in which case their recession is to a certain extent unavoidable, and the fauna which has established itself in the presence of cultivation is needed to replace them.

Thirdly, the ill effect of introduced forms on existing ones may often be due rather to the spread of disease and parasites than to actual attack; thus, in Hawaii the native birds have been found suffering from a disease which attacks poultry. And the recession of the New Zealand earthworms and flies before exotic forms probably falls under this category. As man cannot easily avoid introducing parasites, and must keep domestic animals and till the land, a certain disturbance in aboriginal faunas is absolutely unavoidable. Under certain circumstances, however, the native animals may recover, for in some cases they even profit by man's advent, and at times themselves become pests, like the Kea parrot (*Nestor notabilis*), which attacks sheep in New Zealand, and the bobolink or rice-bird (*Dolichonyx oryzivorus*) in North America. Finally, it should never be forgotten that the worst enemies of declining forms have been collectors who have not given these species the chance of recovering themselves. (F. Fn.)

ACCOLADE (from Ital. *accolata*, derived from Lat. *collum*, the neck), a ceremony anciently used in conferring knighthood; but whether it was an actual embrace (according to the use of the modern French word *accolade*), or a slight blow on the neck or cheek, is not agreed. Both these customs appear to be of great antiquity. Gregory of Tours writes that the early kings of France, in conferring the gilt shoulder-belt, kissed the knights on the left cheek; and William the Conqueror is said to have made use of the blow in conferring the honour of knighthood on his son Henry. At first it was given with the naked fist, a veritable box on the ear, but for this was substituted a gentle stroke with the flat of the sword on the side of the neck, or on either shoulder as well. In Great Britain the sovereign, in conferring knighthood, still employs this latter form of accolade.

"Accolade" is also a technical term in music-printing for a sort of brace joining separate staves; and in architecture it denotes a form of decoration on doors and windows.

ACCOLTI, BENEDETTO (1415–1466), Italian jurist and historian, was born at Arezzo, in Tuscany, of a noble family, several members of which were distinguished like himself for their attainments in law. He was for some time professor of jurisprudence in the university of Florence, and on the death of the celebrated Poggio, in 1459, became chancellor of the Florentine republic. He died at Florence. In conjunction with his brother Leonardo, he wrote in Latin a history of the first crusade, entitled *De Bello a Christianis contra Barbaros gesto pro Christi Sepulchro et Judaea recuperandis libri tres* (Venice, 1432, translated into Italian, 1543, and into French, 1620), which, though itself of little interest, is said to have furnished Tasso with the historic basis for his *Jerusalem Delivered*. Another work of Accolti's—*De Praestantia Virorum sui Aevi*—was published at Parma in 1689. His brother Francesco (1418–1483) was also a distinguished jurist, and was the author of *Consilia seu responsa* (Pisa, 1481); *Commentaria super lib. ii. decretalium* (Bologna, 1481); *Commentaria* (Pavia, 1493); *de Balneis Puteolanis* (1475).

ACCOLTI, BERNARDO (1465–1536), Italian poet, born at Arezzo, was the son of Benedetto Accolti. Known in his own day as *l' Unico Aretino*, he acquired great fame as a reciter of impromptu verse. He was listened to by large crowds, composed of the most learned men and the most distinguished prelates of the age. Among others, Cardinal Bembo has left on record a testimony to his extraordinary talent. His high reputation with his contemporaries seems scarcely justified by the poems he published, though they give evidence of brilliant fancy. It is probable that he succeeded better in his extemporary productions than in those which were the fruit of deliberation. His works, under the title *Virginia, Comedia, Capitoli e Strambotti di Messer Bernardo Accolti Aretino*, were published at Florence in 1513, and have been several times reprinted.

ACCOLTI, PIETRO (1455–1532), brother of the preceding, known as the cardinal of Ancona, was born in Florence on the 15th of March 1455, and died at Rome on the 12th of December 1532 (Ciaconi, *Vitae Pontificum*, 1677, iii. 295). He was made bishop of Ancona, 1505, and cardinal on the 17th of March 1511, by Julius II. He was abbreviator under Leo X., and in that capacity drew up in 1520 the bull against Luther (L. Cardella, *Memorie Storiche de' Cardinali*, 1793, iii. 450). He held successively the suburban sees of Albano and Sabina, also the sees of Cadiz, Maillezais, Arras and Cremona, and was made archbishop of Ravenna, 1524, by Clement VII.

F. Cristofori (*Storia dei Cardinali*, 1888) and others have confused him with his nephew Benedetto (1497–1549), son of Michaele; who followed him in several of his preferments, was made cardinal, 1527, by Clement VII., and is known as a writer in behalf of papal claims and as a Latin poet.

ACCOMMODATION (Lat. *accommodare*, to make fit, from *ad*, to, *cum*, with, and *modus*, measure), the process of fitting, adapting, adjusting or supplying with what is needed (*e.g.* housing).

In theology the term "accommodation" is used rather loosely to describe the employment of a word, phrase, sentence or idea, in a context other than that in which it originally occurred; the actual wording of the quotation may be modified to a greater or lesser extent. Such accommodation, though sometimes purely literary or stylistic, generally has the definite purpose of instruction, and is frequently used both in the New Testament and in pulpit utterances in all periods as a means of producing a reasonably accurate impression of a complicated idea in the minds of those who are for various reasons unlikely to comprehend it otherwise. There are roughly three main kinds. (1) A later Biblical passage quotes from an earlier, partly as a literary device, but also with a view to demonstration. Sometimes it is plain that the writer deliberately "accommodates" a quotation (cf. John xviii. 8, 9 with xvii. 12). But New Testament quotations of Old Testament predictions are often for us accommodations—striking or forced as the case may be—while the New Testament writer, "following the exegetical methods current among the Jews of his time, Matthew ii. 15, 18, xxvi. 31, xxvii. 9" (S. R. Driver in *Zechariah* in *Century Bible*, pp. 259, 271), puts them forward as arguments. To say that he is merely "describing a New Testament fact in Old Testament phraseology" may be true of the result rather than of his design. (2) Much besides in the Bible—parable, metaphor, &c.—has been called an "accommodation," or divine condescension to human weakness. (3) German 18th-century rationalism (see Apologetics) held that the Biblical writers made great use of conscious accommodation—intending moral commonplaces when they seemed to be enunciating Christian dogmas. Another expression for this, used, *e.g.*, by J. S. Semler, is "economy," which also occurs in the kindred sense of "reserve" (or of *Disciplina Arcani*—a modern term for the supposed early Catholic habit of reserving esoteric truths). Isaac Williams on *Reserve in Religious Teaching*, No. 80 of *Tracts for the Times*, made a great sensation; see R. W. Church's comments in *The Oxford Movement*. Strictly, accommodation (2) or (3) modifies, in form or in substance, the content of religious belief; reserve, from prudence or cunning, withholds part. "Economy" is used in both senses.

ACCOMMODATION BILL. An accommodation bill, as its name implies, is a *bill of exchange* accepted and sometimes endorsed without any receipt of value in order to afford temporary pecuniary aid to the person accommodated. (See Bill of Exchange.)

ACCOMPANIMENT (*i.e.* that which "accompanies"), a musical term for that part of a vocal or instrumental composition added to support and heighten the principal vocal or instrumental part; either by means of other vocal parts, single instruments or the orchestra. The accompaniment may be *obbligato* or *ad libitum*, according as it forms an essential part of the composition or not. The term *obbligato* or *obbligato accompaniment* is also used for an independent instrumental solo accompanying a vocal piece. Owing to the early custom of only writing the accompaniment in outline, by means of a "figured bass," to be filled in by the performer, and to the changes in the number, quality and types of the instruments of the orchestra, "additional" accompaniments have been written for the works of the older masters; such are Mozart's "additional" accompaniments to Handel's *Messiah* or those to many of the elder Bach's works by Robert Franz. In common parlance any support given, *e.g.* by the piano, to a voice or instrument is loosely called an accompaniment, which may be merely "vamped" by the introduction of a few chords, or may rise to the dignity of an artistic composition. In the history of song the evolution of the art side of an accompaniment is important, and in the higher forms the vocal and instrumental parts practically constitute a duet, in which the instrumental part may be at least as important as that of the voice.

ACCOMPLICE (from Fr. *complice*, conspirator, Lat. *complex*, a sharer, associate, *complicare*, to fold together; the *ac-* is possibly due to confusion with "accomplish," to complete, Lat. *complere*, to fill up), in law, one who is associated with another or others in the commission of a crime, whether as principal or accessory. The term is chiefly important where one of those charged with a crime turns king's evidence in the expectation of obtaining a pardon for himself. Accordingly, as his evidence is tainted with self-interest, it is a rule of practice to direct a jury to acquit, where the evidence of an accomplice is not corroborated by independent evidence both as to the circumstances of the offence and the participation of the accused in it. An accomplice who has turned king's evidence usually receives a pardon, but has no legal right to exemption from punishment till he has actually received it.

ACCORAMBONI, VITTORIA (1557–1585), an Italian lady famous for her great beauty and accomplishments and for her tragic history. She was born in Rome of a family belonging to the minor *noblesse* of Gubbio, which migrated to Rome with a view to bettering their fortunes. After refusing several offers of marriage for Vittoria, her father betrothed her to Francesco Peretti (1573), a man of no position, but a nephew of Cardinal Montalto, who was regarded as likely to become pope. Vittoria was admired and worshipped by all the cleverest and most brilliant men in Rome, and being luxurious and extravagant although poor, she and her husband were soon plunged in debt. Among her most fervent admirers was P. G. Orsini, duke of Bracciano, one of the most powerful men in Rome, and her brother Marcello, wishing to see her the duke's wife, had Peretti murdered (1581). The duke himself was suspected of complicity, inasmuch as he was believed to have murdered his first wife, Isabella de' Medici. Now that Vittoria was free he made her an offer of marriage, which she willingly accepted, and they were married shortly after. But her good fortune aroused much jealousy, and attempts were made to annul the marriage; she was even imprisoned, and only liberated through the interference of Cardinal Carlo Borromeo. On the death of Gregory XIII., Cardinal Montalto, her first husband's uncle, was elected in his place as Sixtus V. (1585); he vowed vengeance on the duke of Bracciano and Vittoria, who, warned in time, fled first to Venice and thence to Salò in Venetian territory. Here the duke died in November 1585, bequeathing all his personal property (the duchy of Bracciano he left to his son by his first wife) to his widow. Vittoria, overwhelmed with grief, went to live in retirement at Padua, where she was followed by Lodovico Orsini, a relation of her late husband and a servant of the Venetian republic, to arrange amicably for the division of the property. But a quarrel having arisen in this connexion Lodovico hired a band of bravos and had Vittoria assassinated (22nd of December 1585). He himself and nearly all his accomplices were afterwards put to death by order of the republic.

About Vittoria Accoramboni much has been written, and she has been greatly maligned by some biographers. Her story formed the basis of Webster's drama, *The Tragedy of Paolo Giordano Ursini* (1612), and of Ludwig Tieck's novel, *Vittoria Accoramboni* (1840); it is told more accurately in D. Gnoli's volume, *Vittoria Accoramboni* (Florence, 1870), and an excellent sketch of her life is given in Countess E. Martinengo-Cesaresco's *Lombard Studies* (London, 1902). (L. V.*)

ACCORD (from Fr. *accorder*, to agree), in law, an agreement between two parties, one of whom has a right of action against the other, to give and accept in substitution for such right any good legal consideration. Such an agreement when executed discharges the cause of action and is called *Accord and Satisfaction.*

ACCORDION (Fr. *accordéon;* Ger. *Handharmonica*, *Ziehharmonica*), a small portable reed wind instrument with keyboard, the smallest representative of the organ family, invented in 1829 by Damian, in Vienna.

The accordion consists of a bellows of many folds, to which is attached a keyboard with from 5 to 50 keys. The keys on being depressed, while the bellows are being worked, open valves admitting the wind to free reeds, consisting of narrow tongues of metal riveted some to the upper, some to the lower board of the bellows, having their free ends bent, some inwards, some outwards. Each key produces two notes, one from the inwardly bent reed when the bellows are compressed, the other from the outwardly bent reed by suction (as in the American organ; see Harmonium) when the bellows are expanded. The pitch of the note is determined by the length and thickness of the reeds, reduction of the length tending to sharpen the note, while reduction of the thickness lowers it. The right hand plays the melody on the keyboard, while the left works the bellows and manipulates the two or three bass harmony keys, which sound the simple chords of the tonic and dominant. The archetype of the accordion is the cheng (*q.v.*), or Chinese organ, between which and the harmonium it forms a connecting link structurally, although not invented for some thirty years after the harmonium. The timbre of the accordion is coarse and devoid of beauty, but in the hands of a skilful performer the best instruments are not entirely without artistic merit. Improvements in the construction of the accordion produced the concertina (*q.v.*), melodion and melophone.

See Adolf Mueller, *Accordion-Schule oder vollständige Anleitung, das Accordion in kurzer Zeit richtig spielen zu erlernen* (Wien, 1834). See also Free Reed Vibrator. (K. S.)

ACCORSO (Accursius), **MARIANGELO** (*c.* 1490–1544), Italian critic, was born at Aquila, in the kingdom of Naples. He was a great favourite with Charles V., at whose court he resided for thirty-three years, and by whom he was employed on various foreign missions. To a perfect knowledge of Greek and Latin he added an intimate acquaintance with several modern languages. In discovering and collating ancient manuscripts, for which his travels abroad gave him special opportunities, he displayed uncommon diligence. His work entitled *Diatribae in Ausonium, Solinum et Ovidium* (1524) is a monument of erudition and critical skill. He was the first editor of the *Letters of Cassiodorus*, with his *Treatise on the Soul* (1538); and his edition of *Ammianus Marcellinus* (1533) contains five books more than any former one. The affected use of antiquated terms, introduced by some of the Latin writers of that age, is humorously ridiculed by him, in a dialogue in which an Oscan, a Volscian and a Roman are introduced as interlocutors (1531). Accorso was accused of plagiarism in his notes on Ausonius, a charge which he most solemnly and energetically repudiated.

ACCOUNT (through O. Fr. *acont*, Late Lat. *comptum*, *computare*, to calculate), counting, reckoning, especially of moneys paid and received, hence a statement made as to the receipt and payment of moneys; also any statement as to acts or conduct, or quite simply any narrative report of events, &c. A further sense-development is that of esteem, consideration.

As a stock-exchange term "account" is used in several senses. (1) The periodical settlements occurring, in London, monthly for British government and a few other first-class securities, and fortnightly for all others. The settlement extends over four days in mining shares and three days in other securities. The first day is the carry-over, "contango," or making-up, day, on which speculative commitments are carried over, or continued: that is, the bulls, who have bought stock for the rise, arrange the rate of interest that they have to give on their stock to a moneylender, or bear, who will pay for it or take it in for them; and the bears, who have sold for the fall, arrange the rate that they receive from the bulls or, if the stock is scarce and oversold, the backwardation or rate that they have to pay to holders of the stock who will lend it them to enable them to complete their bargains. On the second day, called ticket-day or name day, a ticket giving the name and address of the ultimate buyer and the firm which will pay for the stock is passed through the various intermediaries to the ultimate seller, so that the actual transfer of the stock can be made directly. In the mining market the passing of names takes two days. On the last day, account day, pay day or settling day, cheques are paid to meet speculative differences, or against the delivering of stock. (2) The period between two settlements. A nineteen-day account is one in which nineteen days elapse between one pay-day and another. (3) The volume or condition of commitments. A speculator is said to have a large account open when he has dealt heavily either for the rise or fall. A bull account exists in a stock or group of stocks when it or they have been bought for the rise by a large number of operators; in the contrary case, when there have been heavy sales for the fall, a bear account is developed.

ACCOUNTANT-GENERAL, formerly an officer in the English Court of Chancery, who received all moneys lodged in court, and by whom they were deposited in bank and disbursed. The office was abolished by the Chancery Funds Act 1872, and the duties transferred to the paymaster-general (*q.v.*).

ACCOUNTANTS. The term "accountant" is one to which, of late years, its original meaning has been more generally attributed—that of an expert in the science of book-keeping. It is sometimes adopted by book-keepers, but this is an erroneous application of the term; it properly describes those competent to design and control the systems of accounts required for the record of the multifarious and rapid transactions of trade and finance. It assumes the possession of a wide knowledge of the principles upon which accountancy is based, which may be shortly described as constituting a science by means of which all mercantile and financial transactions, whether in money or in money's worth, including operations completed and engagements undertaken to be fulfilled at once or in a future, however remote, may be recorded; and this science comprises a knowledge of the methods of preparing statistics, whether relating to finance or to any transactions or circumstances which can be stated by numeration, and of ascertaining or estimating on correct bases the cost of any operation whether in money, in commodities, in time, in life or in any wasting property. Generally, accountancy may be described as being the science by means of which all operations, as far as they are capable of being shown in figures, are accurately recorded and their results ascertained and stated.

History.

The origin of the profession of accountancy in Great Britain is difficult to trace; auditors of accounts were naturally of very early existence, being mentioned as officers of importance in the statutes of Westminster in the reign of Edward I. The art of accountancy on a scientific principle must certainly have been understood in Italy before 1495, when Friar Luca dal Borgo published at Venice his treatise on book-keeping; but the first known English book on the science was published in London by John Gouge or Gough in 1543. It is described as *A Profitable Treatyce called the Instrument or Boke to learn to knowe the good order of the kepyng of the famouse reconynge, called in Latin, Dare and Habere, and, in Englyshe, Debitor and Creditor.* A short book of instruction was also published in 1588 by John Mellis of Southwark, in which he says, "I am but the renuer and reviver of an auncient old copie printed here in London the 14 of August 1543: collected, published, made, and set forth by one Hugh Oldcastle, Scholemaster, who, as appeareth by his treatise, then taught Arithmetike, and this booke in Saint Ollaves parish in Marke Lane." John Mellis refers to the fact that the principle of accounts he explains (which is a simple system of double entry) is "after the forme of Venice." The very interesting and able book described as *The Merchants Mirrour, or directions for the perfect ordering and keeping of his accounts; framed by way of Debitor and Creditor, after the* (*so tearmed*) *Italian manner*, by Richard Dafforne, accountant, published in 1635, contains many references to early books on the science of accountancy. In a chapter in this book, headed "Opinion of Book-keeping's Antiquity," the author states, on the authority of another writer, that the form of book-keeping referred to had then been in use in Italy about two hundred years, "but that the same, or one in many parts very like this, was used in the time of Julius Caesar, and in Rome long before." He gives quotations of Latin book-keeping terms in use in ancient times, and refers to "ex Oratione Ciceronis pro Roscio Comaedo"; and he adds: "That the one side of their booke was used for Debitor, the other for Creditor, is manifest in a certaine place, Naturalis Historiae Plinii, lib. 2, cap. 7, where hee, speaking of Fortune, saith thus:

> Huic Omnia Expensa.
> Huic Omnia Feruntur accepta et in tota Ratione mortalium sola Utramque Paginam facit."

An early Dutch writer appears to have suggested that double-entry book-keeping was even in existence among the Greeks, pointing to scientific accountancy having been invented in remote times.

There were several editions of Richard Dafforne's book printed—the second edition having been published in 1636, the third in 1656, and another was issued in 1684. The book is a very complete treatise on scientific accountancy, it was beautifully prepared and contains elaborate explanations; the numerous editions tend to prove that the science was highly appreciated in the 17th century. From this time there has been a continuous supply of literature on the subject, many of the authors styling themselves accountants and teachers of the art, and thus proving that the professional accountant was then known and employed. Very early in the 18th century the services of an accountant practising in the city of London were made use of in the course of an investigation into the transactions of a director of the South Sea Company, who had been dealing in the company's stock. During this investigation the accountant appears to have examined the books of at least two firms of merchants. His report is described *Observations made upon examining the books of Sawbridge and Company*, by Charles Snell, Writing Master and Accountant in Foster Lane, London.

In 1799, when Holden's *Triennial Directory of London, Westminster and Southwark* was first published, 11 individuals and firms were therein described as accountants; in the same directory, for the period 1809–1811, the number had risen to 24; and in that for 1822–1824, there were 73 firms of practising accountants recorded.

Modern development.

The earliest English books dealing with scientific book-keeping were written at a time when the English and Dutch were very actively engaged in foreign trade, in succession to the Italian merchants of the 14th, 15th and 16th centuries; but it was not until the beginning of the 19th century that, in consequence of the adoption of improved methods of manufacture and transit, resulting from the application of water and steam power to manufactures and methods of conveyance which largely increased the trade of Great Britain, the profession of an accountant became one which men of scientific knowledge and capacity adopted for their business career. Corporations and companies were formed to carry out large operations previously either left to the state or not undertaken, and for the development of trades and manufactures which were becoming less profitable when carried on by hand labour and with limited capital; and, for these, the services of public accountants were necessarily required to devise systems of accounts and methods of control, and to enable the results of the various transactions carried on to be ascertained with the least waste of power or chance of loss by negligence or fraud. The large number of companies formed in 1843 and 1844, when a great amount of capital was invested in railways and extensive speculation resulted, also added to the demand for the services of professional accountants. The Companies' Clauses Consolidation Act 1845 made provision for the audit of the accounts of companies regulated by act of parliament, and gave some extensive powers to the auditors, who are now, to a very large extent, selected from among professional accountants. The Companies Act of 1862 led to a large extension of the business of accountants, both as auditors and liquidators of companies; and the acts relating to bankruptcy passed between the years 1831 and 1883 added to the work devolving on professional accountants. The Companies Act 1879, which affected banking companies, made provision for the audit of their accounts, and it has been found desirable, in most cases, to appoint professional accountants to this duty. The experience and professional knowledge of trained accountants have, in fact, been utilized by their appointment as auditors in the majority of joint-stock companies, whether manufacturing, banking, trading or created for any other purpose. Until the Companies Act 1900 was passed there was no general obligation upon limited companies to have auditors; this act not only requires that auditors shall be appointed in all cases, but provides for their remuneration, and to a limited extent defines their rights and duties. The legislature evidently did not find it easy to formulate at all clearly the duties of auditors, and it seems reasonable to suppose that any general definition will prove an impossibility, as the work which auditors undertake must vary very widely, and depends largely upon the scope of the operations the accounts of which are to be examined.

Duties.

Auditors.

The duties of practising accountants cover a very wide area: they act as trustees, liquidators, receivers and managers of businesses, the owners of which are in default or their affairs in liquidation, both under the direction of the courts and by appointment of creditors and others; they are largely engaged as arbitrators, umpires and referees in differences relating to matters of account or finance; they prepare the accounts of executors and trustees, and the necessary statements of affairs in cases of bankruptcy, both of firms and companies; they prepare accounts for prosecutions in cases of fraud and misconduct; and they are constantly called upon to unravel and properly state the accounts of complicated transactions. Their services are commonly required to certify the profits of businesses intended to be sold, either privately or to companies by means of a published prospectus; and, in cases of compulsory purchases of businesses by railway companies and public bodies, the statements of the profits of the businesses to be acquired are generally made by them. In a very large number of financial operations they are called upon to give advice and prepare accounts, and in few business matters requiring arithmetical calculations or involving the investigation of figures, and particularly where a considerable acquaintanceship with the principles of law is needed, are their services not utilized. One of the most important duties undertaken by accountants is the audit of accounts, and this duty has, of late years, been widely extended. Originally, auditors were appointed to examine and vouch statements of receipts and payments; but the provisions made in acts of parliament in relation to audit, and the requirements of most articles of association of limited companies, put much graver responsibilities on auditors, who are now generally required to certify to the accuracy of balance sheets and of revenue and other accounts, the performance of which duties involves far more knowledge of accounts than was once required. The efficiency, in most cases, of audits conducted by skilled accountants has led the public to attach exceptional value to their audit certificates, and to demand extensive knowledge and ability in the conduct of the audit of the accounts of public companies. One other requirement which is generally regarded as indispensable, is that the work of audit should be very expeditiously performed; for it is easy to understand that, were the presentation of the accounts of a company and the distribution of dividends materially delayed in consequence of the audit, much inconvenience would result, while the value of the criticism of the accounts of business operations would be much deteriorated if it could not be made very shortly after the accounts were closed. In these circumstances, in the cases of large concerns with wide ramifications and numerous transactions, it is necessary that auditors should have the help of trained assistants, and thus the personal examination of details by the auditor himself is, to a large extent, rendered unnecessary and the cost of audit materially reduced. This delegation of duty by auditors is generally well understood, and is in accordance with the requirements of those concerned; but there has been a tendency of late years to enlarge the responsibilities of auditors to an extent which, if persisted in, might render it dangerous for men of reputation and means to accept the duties.

Organization.

While the number of practising accountants has of late years been steadily increasing and their services are correspondingly appreciated, the necessity for controlling those exercising the profession and for improving its status has naturally become apparent. The first important steps in this direction were taken by the accountants in Scotland—the Society of Accountants in Edinburgh being incorporated by royal charter in 1854; similar societies in Glasgow and Aberdeen being also incorporated by charter in 1855 and 1867. The Institute of Accountants was formed in London in 1870, but did not receive a royal charter until the 11th May 1880, when all the then existing accountants' societies and institutes in England were incorporated as the Institute of Chartered Accountants in England and Wales, and means were provided by which all the then practising accountants in these countries could claim membership thereof. In the year 1885 the Society of Accountants and Auditors was incorporated, but has obtained no charter; this body, while numbering among its members a considerable number of practising accountants in the United Kingdom, also includes treasurers and accountants to cities and boroughs in England, as well as clerks to chartered and other accountants. A large proportion of its members also consists of accountants practising abroad. In 1888 an Institute of Chartered Accountants was formed in Ireland, and a great many institutes and societies have been formed in the British colonies and in the United States, some of which have local charters. It is curious to note, however, that, outside the United Kingdom, it was only in the British colonies that associations of practising accountants existed, until, in 1895, an Institute of Accountants (*Nederlands Instituut van Accountants*) was founded in Utrecht for Dutch accountants; when, although the principles of accountancy have been well understood and practised in Holland since the 16th century, and probably earlier, it was found necessary to borrow the words "accountant" and "accountancy" from the English language to convey to the Dutch an idea of the meaning of the terms. Three others have since been formed, the *Nederlandsche Academie van Accountants* (1902); the *Nationale Organisatie van Accountants* (1903); and the *Nederlandsche Bond van Accountants* (1902). Sweden has a society, *Svenska Revisorsamfundet*, formed in 1899; Belgium, the *Chambre Syndicate des Experts Comptables*, founded in 1903. In South America, accountants have acquired a certain status in Argentina, Uruguay and Peru.

In the United States the organization of professional accountants is of quite recent growth. The first society formed in America was "The New York State Society of Certified Public Accountants," and shortly afterwards (in 1896) the New York state legislature passed an act authorizing the State university to confer the degree of certified public accountant (C.P.A.) on the members of the society, while requiring all subsequent entrants to pass an examination. This degree, however, can be obtained, like other university degrees, without being a member of the society. Other states, notably Pennsylvania, Maryland, California, Illinois, Washington and New Jersey, have followed the example of New York. In 1903 the various state societies formed themselves into a federation. There is also an independent society of practising accountants, the American Association of Public Accountants, with objects similar to those of the federation, but steps have been taken to bring about an amalgamation between the two in order to form one central society to look after their common interests, without, however, interfering with the individual organization of the various state societies.

See R. Brown, *History of Accounting and Accountants* (Edinburgh), 1905, the most comprehensive book upon the subject; also G. W. Haskins, *Accountancy, its Past and Present* (U.S.A., 1900); S. S. Dawson, *Accountant's Compendium*; G. Lisle, *Accounting in Theory and Practice* (1899); F. W. Pixley, *Auditors and their Liabilities* (1901). The professional periodicals, *The Accountant* (vol. i., 1877); *Accountant's Journal* (vol. i., 1883–1884); *The Accountants' Magazine* (vol. i., 1897); *Incorporated Accountants' Journal* (vol. i., 1889–1890); *Accountics* (U.S.A., vol. i., 1897) may also be consulted, and also the Year-books of the Society of Accountants and Auditors, and of the Institute of Chartered Accountants. (J. G. Gr.)

ACCOUTREMENT (a French word, probably derived from *à* and *coustre* or *coutre*, an old word meaning one who has charge of the vestments in a church), clothing, apparel; a term used especially, in the plural, of the military equipment of a soldier other than his arms and clothing.

ACCRA, a port on the Gulf of Guinea in 5° 31′ N., 0° 12′ W., since 1876 capital of the British Gold Coast colony. Population about 20,000, including some 150 Europeans. Accra is about 80 m. E. of Cape Coast (*q.v.*), the former capital of the colony. The name is derived from the Fanti word *Nkran* (an ant), by which designation the tribe inhabiting the surrounding district was formerly known. The town grew up around three forts established in close proximity—St James (British), Crèvecœur (Dutch) and Christiansborg (Danish). The last named was ceded to Britain in 1850, Crèvecœur not till 1871. Fort St James is now used as a signal station, lighthouse and prison. Accra preserves the distinctions of James Town, Ussher Town and Christiansborg, indicative of its tripartite origin. Ussher Town represents Crèvecœur, the fort being renamed after H. T. Ussher, administrator of the Gold Coast (1867–1872). The sea frontage extends about three miles; there is, however, no harbour, and steamers have to lie about a mile out, goods and passengers being landed in surf boats. The streets formerly consisted largely of mud hovels, but since a great fire in 1894, which destroyed large parts of James Town and Ussher Town, more substantial buildings have been erected. Christiansborg, the finest of the three forts, is the official residence of the governor of the colony. Westwards of the landing-place, where is the customs house, lies James Town. Beyond the fort are various public buildings leading to Otoo Street, the main thoroughfare, which runs two miles in a straight line to Christiansborg. This street contains a fine stone church built in 1895 for the use of the Anglican community, a branch of the Bank of British West Africa, telegraph offices and the establishments of the principal trading firms. In Victoriaborg, a suburb of Ussher Town, are the residences of the principal officials, and here a racecourse has been laid out. (Accra is almost the only point along the Gold Coast where horses thrive.) Behind the town is rolling grass land, which gives place to the highlands of Aquapim and Akim. At Aburi in the Aquapim hills, 26 m. N. by E. of Accra, are the government sanatorium and botanical gardens.

Accra, the first town in the Gold Coast colony to be raised (July 1, 1896) to the rank of a municipality, is governed by a town council with power to raise and spend money. The council consists in equal proportions of nominated and elected members, no racial distinctions being made. Accra is connected by cable with Europe and South Africa, and is the sea terminus of a railway serving the districts N.E., where are flourishing cocoa plantations.

ACCRETION (from Lat. *ad*, to, and *crescere*, to grow), an addition to that which already exists; increase in any substance by the addition of particles from the outside. In law, the term is used for the increase of property caused by gradual natural additions, as on a river bank or seashore.

ACCRINGTON, a market town and municipal borough in the Accrington parliamentary division of Lancashire, England, 208 m. N.W. by N. from London, and 23 m. N. by W. from Manchester, on the Lancashire and Yorkshire railway. Pop. (1891) 38,603; (1901) 43,122. It lies in a deep valley on the Hindburn, a feeder of the Calder. Cotton spinning and printing works, cotton-mill machinery works, dye-works and chemical manufactures, and neighbouring collieries maintain the industrial population. The church of St James dates from 1763, and the other numerous places of worship and public buildings are all modern. The borough is under a mayor, 8 aldermen and 24 councillors. Area 3427 acres.

Accrington (Akerenton, Alkerington, Akerington) was granted by Henry de Lacy to Hugh son of Leofwine in Henry II.'s reign, but came again into the hands of the Lacys, and was given by them about 1200 to the monks of Kirkstall, who converted it into a grange. It again returned, however, to the Lacys in 1287, was granted in parcels, and like their other lands became merged in the duchy of Lancaster. In 1553 the commissioners of chantries sold the chapel to the inhabitants to be continued as a place of divine service. In 1836 Old and New Accrington were merely straggling villages with about 5000 inhabitants. By 1861 the population had grown to 17,688, chiefly owing to its position as an important railway junction. A charter of incorporation was granted in 1878. The date of the original chapel is unknown, but it was probably an oratory which was an offshoot of Kirkstall Abbey. Ecclesiastically the place was dependent on Altham till after the middle of the 19th century.

ACCUMULATION (from Lat. *accumulare*, to heap up), strictly a piling-up of anything; technically, in law, the continuous adding of the interest of a fund to the principal, for the benefit of some person or persons in the future. Previous to 1800, this accumulation of property was not forbidden by English law, provided the period during which it was to accumulate did not exceed that forbidden by the law against perpetuities, viz. the period of a life or lives in being, and twenty-one years afterwards. In 1800, however, the law was amended in consequence of the eccentric will of Peter Thellusson (1737–1797), an English merchant, who directed the income of his property, consisting of real estate of the annual value of about £5000 and personal estate amounting to over £600,000, to be accumulated during the lives of his children, grandchildren and great-grandchildren, living at the time of his death, and the survivor of them. The property so accumulated, which, it is estimated, would have amounted to over £14,000,000, was to be divided among such descendants as might be alive on the death of the survivor of those lives during which the accumulation was to continue. The bequest was held valid (*Thellusson v. Woodford*, 1798, 4 Vesey, 237). In 1856 there was a protracted lawsuit as to who were the actual heirs. It was decided by the House of Lords (June 9, 1859) in favour of Lord Rendlesham and Charles Sabine Augustus Thellusson. Owing, however, to the heavy expenses, the amount inherited was not much larger than that originally bequeathed.

To prevent such a disposition of property in the future, the Accumulations Act 1800 (known also as the "Thellusson Act") was passed, by which it was enacted that no property should be accumulated for any longer term than either (1) the life of the settlor; or (2) the term of twenty-one years from his death; or (3) during the minority of any person living or *en ventre sa mère* at the time of the death of the grantor; or (4) during the minority of any person who, if of full age, would be entitled to the income directed to be accumulated. The act, however, did not extend to any provision for payment of the debts of the grantor or of any other person, nor to any provision for raising portions for the children of the settlor, or any person interested under the settlement, nor to any direction touching the produce of timber or wood upon any lands or tenements. The act was extended to heritable property in Scotland by the Entail Amendment Act 1848, but does not apply to property in Ireland. The act was further amended by the Accumulations Act 1892, which forbids accumulations for the purpose of the purchase of land for any longer period than during the minority of any person or persons who, if of full age, would be entitled to receive the income. (See also TRUST and PERPETUITY.)

ACCUMULATOR, the term applied to a number of devices whose function is to store energy in one form or another, as, for example, the hydraulic accumulator of Lord Armstrong (see HYDRAULICS, § 179). In the present article the term is restricted to its use in electro-technology, in which it describes a special type of battery. The ordinary voltaic cell is made by bringing together certain chemicals, whose reaction maintains the electric currents taken from the cell. When exhausted, such cells can be restored by replacing the spent materials, by a fresh "charge" of the original substances. But in some cases it is not necessary to get rid of the spent materials, because they can be brought back to their original state by forcing a reverse current through the cell. The reverse current reverses the chemical action and re-establishes the original conditions, thus enabling the cell to repeat its electrical work. Cells which can thus be "re-charged" by the action of a reverse current are called accumulators because they "accumulate" the chemical work of an electric current. An accumulator is also known as a "reversible battery," "storage battery" or "secondary battery." The last name dates from the early days of electrolysis. When a liquid like sulphuric acid was electrolysed for a moment with the aid of platinum electrodes, it was found that the electrodes could themselves produce a current when detached from the primary battery. Such a current was attributed to an "electric polarization" of the electrodes, and was regarded as having a secondary nature, the implication being that the phenomenon was almost equivalent to a *storage of electricity*. It is now known that the platinum electrodes stored, not electricity, but the products of electro-chemical decomposition. Hence if the two names, secondary and storage cells, are used, they are liable to be misunderstood unless the interpretation now put on them be kept in mind. "Reversible battery" is an excellent name for accumulators.

Sir W. R. Grove first used "polarization" effects in his gas battery, but R. L. G. Planté (1834–1889) laid the foundation of modern methods. That he was clear as to the function of an accumulator is obvious from his declaration that the lead-sulphuric acid cell could retain its charge for a long time, and had the power *d'emmagasiner ainsi le travail chimique de la pile voltaique*: a phrase whose accuracy could not be excelled. Planté began his work on electrolytic polarization in 1859, his object being to investigate the conditions under which its maximum effects can be produced. He found that the greatest storage and the most useful electric effects were obtained by using lead plates in dilute sulphuric acid. After some "forming" operations described below, he obtained a cell having a high electromotive force, a low resistance, a large capacity and almost perfect freedom from polarization.

The practical value of the lead-peroxide-sulphuric-acid cell arises largely from the fact that not only are the active materials (lead and lead peroxide, PbO_2) insoluble in the dilute acid, but that the sulphate of lead formed from them in the course of discharge is also insoluble. Consequently, it remains fixed in the place where it is formed; and on the passage of the charging current, the original PbO_2 and lead are reproduced in the places they originally occupied. Thus there is no material change in the distribution of masses of active material. Lastly, the active materials are in a porous, spongy condition, so that the acid is within reach of all parts of them.

Planté's cell.

Planté carefully studied the changes which occur in the formation, charge and discharge of the cell. In forming, he placed two sheets of lead in sulphuric acid, separating them by narrow strips of caoutchouc (fig. 1). When a charging current is sent through the cell, the hydrogen liberated at one plate escapes, a small quantity possibly being spent in reducing the surface film of oxide generally found on lead. Some of the oxygen is always fixed on the other (positive) plate, forming a surface film of peroxide. After a few minutes the current is reversed so that the first plate is peroxidized, and the peroxide previously formed on the second plate is reduced to metallic lead in a spongy state. By repeated reversals, the surface of each plate is alternately peroxidized and reduced to metallic lead. In successive oxidations, the action penetrates farther into the plate, furnishing each time a larger quantity of spongy PbO_2 on one plate and of spongy lead on the other. It follows that the duration of the successive charging currents also increases. At the beginning, a few minutes suffice; at the end, many hours are required. After the first six or eight cycles, Planté allowed a period of repose before reversing. He claimed that the PbO_2 formed by reversal after repose was more strongly adherent, and also more crystalline than if no repose were allowed. The following figures show the relative amounts of oxygen absorbed by a given plate in successive charges (between one charge and the next the plate stood in repose for the time stated, then was reduced, and again charged as anode):—

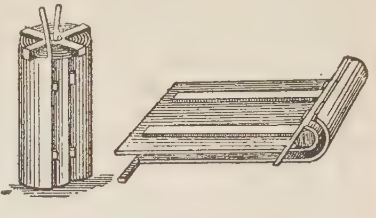

FIG. 1.

Separate Periods of Repose.	Charge.	Relative Amount of Peroxide formed.
. .	First	1·0
18 hours	Second	1·57
2 days	Third	1·71
4 "	Fourth	2·14
2 "	Fifth	2·43

and so on for many days (Gladstone and Tribe, *Chemistry of Secondary Batteries*). Seeing that each plate is in turn oxidized and then reduced, it is evident that the spongy lead will increase at the same rate on the other plate of the cell. The process of "forming" thus briefly described was not continued indefinitely, but only till a fair proportion of the thickness of the plates was converted into the spongy material, PbO_2 and Pb respectively. After this, reversal was not permitted, the cell being put into use and always charged in a given direction. If the process of forming by reversal be continued, the positive plate is ultimately all converted into PbO_2 and falls to pieces.

Planté made excellent cells by this method, yet three objections were urged against them. They required too much time to "form"; the spongy masses (PbO_2 more especially) fell off for want of mechanical support, and the separating strips of caoutchouc were not likely to have a long life. The first advance was made by C. A. Faure (1881), who greatly shortened the time required for "forming" by giving the plates a preliminary coating of red lead, whereby the slow process of biting into the metal was avoided. At the first charging, the red lead on the + electrode is changed to PbO_2, while that on the − electrode is reduced to spongy lead. Thus one continuous operation, lasting perhaps sixty hours, takes the place of many reversals, which, with periods of repose, last as much as three months. Faure used felt as a separating membrane, but its use was soon abolished by methods of construction due to É. Volckmar, J. S. Sellon, J. W. Swan and others. These inventors put the paste not on to plates of lead, but into the holes of a grid, which, when carefully designed, affords good mechanical support to the spongy masses, and does away with the necessity for felt, &c. They are more satisfactory, however, as supporters of spongy lead than of the peroxide, since at the point of contact in the latter case the acid gives rise to a local action, which slowly destroys the grid. Disintegration follows sooner or later, though the best makers are able to defer the failure for a fairly long time. Efforts have been made by A. Tribe, D. G. Fitzgerald and others to dispense with a supporting grid for the positive plate, but these attempts have not yet been successful enough to enable them to compete with the other forms.

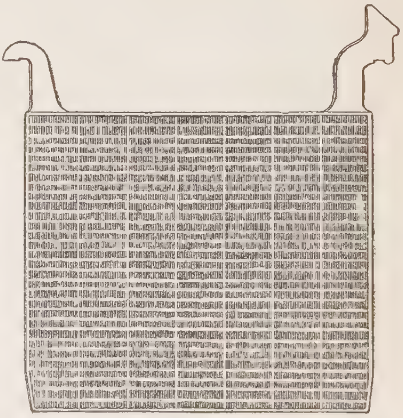

FIG. 2.—Tudor positive plate.

For many years the battle between the "Planté" type and the Faure or "pasted" type has been one in which the issue was doubtful, but the general tendency is towards a mixed type at the present time. There are many good cells, the value of all resting on the care exercised during the manufacture and also in the choice of pure materials. Increasing emphasis is laid on the purity of the water used to replace that lost by evaporation, distilled water generally being specified. The following descriptions will give a good idea of modern practice.

Chloride cell.

The "chloride cell" has a Planté positive with a pasted negative. For the positive a lead casting is made, about 0·4 inch thick pierced by a number of circular holes about half an inch in diameter. Into each of these holes is thrust a roll or rosette of lead ribbon, which has been cut to the right breadth (equal to the thickness of the plate), then ribbed or gimped, and finally coiled into a rosette. The rosettes have sufficient spring to fix themselves in the holes of the lead plate, but are keyed in position by a hydraulic press. The plates are then "formed" by passing a current for a long time. In a later pattern a kind of discontinuous longitudinal rib is put in the ribbon, and increases the capacity and life by strengthening the mass without interfering with the diffusion of acid.

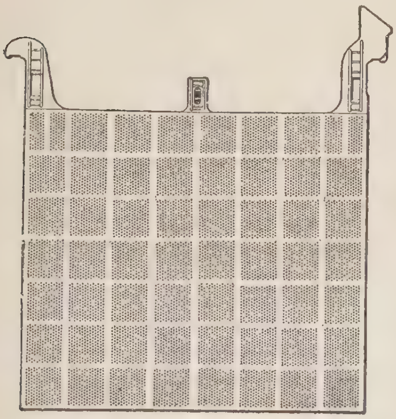

FIG. 3.—Tudor negative plate.

The negative plate was formerly obtained by reducing pastilles of lead chloride, but by a later mode of construction it is made by casting a grid with thin vertical ribs, connected horizontally by small bars of triangular section. The bars on the two faces are "staggered," that is, those on one face are not opposite those on the other. The grid is pasted with a lead oxide paste and afterwards reduced; this is known as the "exide" negative.

The larger sizes of negative plate are of a "box" type, formed by riveting together two grids and filling the intervening space with paste. A feature of the "chloride" cells is the use of separators made of thin sheets of specially prepared wood. These prevent short circuits arising from scales of active material or from the formation of "trees" of lead which sometimes grow across in certain forms of battery.

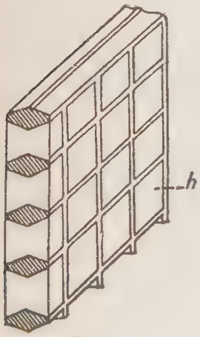

FIG. 4.

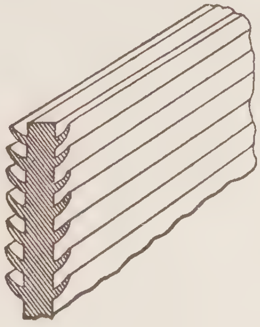

FIG. 5.

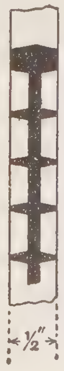

FIG. 6.

Tudor cell.

The Tudor cell has positives formed of lead plates cast in one piece with a large surface of thin vertical ribs, intersected at intervals by horizontal ribs to give the plates strength to withstand buckling in both directions (fig. 2). The thickness of the plates is about 0·4 inch, and the developed surface is about eight times that of a smooth plate of the same size. A thoroughly adherent and homogeneous coating of peroxide of lead is formed on this large surface by an improved Planté process. The negative plate (fig. 3) is composed of two grids riveted together to form a shallow box; the outer surfaces are smooth sheets pierced with many small holes. The space between them is intersected by ribs and pasted (before riveting).

E.P.S. cell.

Many of the E.P.S. cells, made by the Electrical Power Storage Company, are of the Faure or pasted type, but the Planté formation is used for the positives of two kinds of cell. The paste for the positive plates is a mixture of red lead with sulphuric acid; for the negative plates, litharge is substituted for red lead. Figs. 4 and 5 roughly represent the grids employed for the negative and positive plates respectively of a type used for lighting. Fig. 6 is the cross section of the casting used for the Planté positive of the larger cells for rapid discharge. Finer indentations on the side expose a large surface. Fig. 7 shows a complete cell.

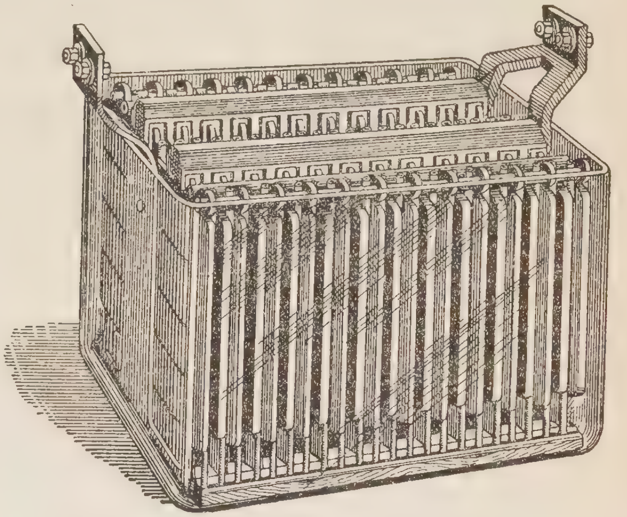

FIG. 7.

Hart cell.

The Hart cell, as used for lighting, is a combination of the Planté and Faure (pasted) types. The plates hang by side lugs on glass slats, and are separated by three rows of glass tubes $\frac{3}{8}$ inch diameter (fig. 8). The tubes rest in grooved teak wood blocks placed at the bottom of the glass boxes. The blocks also serve as base for a skeleton framework of the same material which surrounds and supports the section. Of course the wood has to be specially treated to withstand the acid. A special non-corrosive terminal is used. A coned bolt draws the lug ends of adjacent cells together, fitting in a corresponding tapered hole in the lugs, and thus increasing the contact area. The positive and negative tapers being different, a cell cannot be connected up in the wrong way.

Gould cell.

In America, in addition to some of the cells already described, there are types which are not found in England. Two may be described. The Gould cell is of the Planté type. A special effort is made to reduce local and other deleterious action by starting with perfectly homogeneous plates. They are formed from sheet lead blanks by suitable machines, which gradually raise the surface into a series of ribs and grooves. The sides and middle of the blank are left untouched and amply suffice to distribute the current over the surface of the plate. The grooves are very fine, and when the active material is formed in them by electro-chemical action, they hold it very securely.

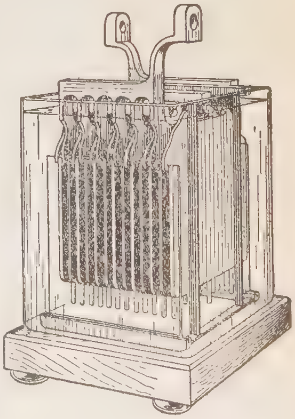

FIG. 8.—Hart Accumulator.

The Hatch cell has its positive enclosed in an envelope. A very shallow porous tray (made of kaolin and silica) is filled with

Hatch cell.

red lead paste, an electrode of rolled sheet lead is placed on its surface, and over this again is placed a second porous tray filled with paste. The whole then looks like a thin earthenware box with the lug of the electrode projecting from one end. The negatives consist of sheet lead covered by active material. On assembling the plates, each negative is held between two positive " boxes," the outsides of which have projecting vertical ribs. These press against the active material on the negative plates, and help to keep it in position. At the same time, the clearance between the ribs allows room for acid to circulate freely between the negative plate and the outer face of the positive envelope. Diffusion of the acid through this envelope is easy, as it is very porous and not more than $\frac{1}{32}$ inch thick.

Traction Cells.—Attempts to run tramcars by accumulators have practically all failed, but traction cells are employed for electric broughams and light vehicles for use in towns. There are no large deviations in manufacture except those imposed by limited space, weight and vibration. The plates are generally thinner and placed closer together. The Planté positive is not used so much as in lighting types. The acid is generally a little stronger in order to get a higher electromotive force (E.M.F.). To prevent the active material from being shaken out of the grids, corrugated and perforated ebonite separators are placed between the plates. The " chloride " traction cell uses a special variety of wood separator: the " exide " type of plate is used for both positive and negative. Cells are now made to run 3000 or more miles before becoming useless. The specific output can be made as high as 10 or 11 watt-hours per pound of cell, but this involves a chance of shorter life. The average working requirement for heavy vehicles is about 50 watt-hours per 1000 ℔ per mile.

Ignition Cells for motor cars are made on the same lines as traction cells, though of smaller capacity. As a rule two cells are put up in ebonite or celluloid boxes and joined in series so as to give a 4-volt battery, the pressure for which sparking coils are generally designed. The capacity ranges from 20 to 100 ampere-hours, and the current for a single cylinder engine will average one to one and a half amperes during the running intervals.

General Features.—The tendency in stationary cells is to allow plenty of space below the plates, so that any active material which falls from the plates may collect there without risk of short-circuit, &c. More space is allowed between the plates, which means that (*a*) there is more acid within reach, and (*b*) a slight buckling is not so dangerous, and indeed is not so likely to occur. The plates are now generally made thicker than formerly, so as to secure greater mechanical rigidity. At the same time, the manufacturers aim at getting the active materials in as porous a state as possible.

The figures with regard to specific output are difficult to classify. It would be most interesting to give the data in the form of watt-hours per pound of active material, and then to compare them with the theoretical values, but such figures are impossible in the nature of the case except in very special instances. For many purposes, long life and trustworthiness are more important than specific output. Except in the case of traction cells, therefore, the makers have not striven to reduce weight to its lowest values. Table I. shows roughly the weight of given types of cells for a given output in ampere hours.

TABLE I.

Type of Cell.	Capacity in ampere-hours if discharged in				Weight of Cell.
	9 hrs.	6 hrs.	3 hrs.	1 hr.	
Ordinary lighting	200	182	153	101	100 pounds.
" "	420	380	300	210	200 "
" "	1200	1080	880	600	670 "
Central station and High Rate	3500	3100	2500	1700	2000 "
" "	6000	5400	4400	3000	3200 "
Traction . . .	220	185	155	125	40 "
" . . .	. .	440	. .	. .	90 "

Influence of Temperature on Capacity.—These figures are true only at ordinary temperatures. In winter the capacity is diminished, in summer it is increased. The differences are due partly to change of liquid resistance but more especially to the difference in the rate at which acid can diffuse into or out of the pores: obviously this is greater at higher temperatures. The increase in capacity on warming is appreciable, and may amount to as much as 3% per degree centigrade (Gladstone and Hibbert, *Journ. Inst. Elec. Eng.* xxi. 441; Heim, *Electrician*, Nov. 1901, p. 55; Liagre, *L'Éclairage électrique*, 1901, xxix. 150). Notwithstanding these results, it is not advisable to warm accumulators appreciably. At higher temperatures, local action is greatly increased and deterioration becomes more rapid. It is well, however, to avoid low winter temperatures.

Working of Accumulators.—Whatever the type of cell may be, it is important to attend to the following working requirements:—(1) The cells must be fully equal to the maximum demand, both in discharge rate and capacity. (2) All the cells in one series ought to be equal in discharge rate and capacity. This involves similarity of treatment. (3) The cells are erected on strong wooden stands. Where floor space is too expensive, they can be erected in tiers; but, if possible, this should be avoided. They ought to lie in rows, so arranged that it is easy to get to one side (at least) of every cell, for examination and testing, and if need be to detach and remove it or its plates. Where a second tier is placed over the first, sufficient clearance space must be allowed for the plates to be lifted out of the lower boxes. The cells are insulated by supporting them on glass or mushroom-shaped oil insulators. If the containing vessels are made of glass, it is desirable to put them in wooden trays which distribute the weight between the vessel and insulators. To prevent acid spray from filling the air of the room, a glass plate is arranged over each cell. The positive and negative sections are fixed in position with insulating forks or tubes, and the positive terminal of one cell is joined to the negative of the next by burning or bolting. If the latter method is adopted, the surfaces ought to be very clean and well pressed home. The joint ought to be covered by vaseline or varnish. When this has been done, examination ought to be made of each cell to see that the plates are evenly spaced, that the separators (glass tubes or ebonite forks between the plates) are in position and vertical, and that there are no scales or other adventitious matter connecting the plates. The floor of the cell ought to be quite clear; if anything lies there it must be removed. (4) To mix the solution a *gentle stream* of sulphuric acid must be poured into the water (not the other way, lest too great heating cause an accident). It is necessary to stir the whole as the mixing proceeds and to arrange that the density is about 1190, or according to the recommendation of the maker. About five volumes of water ought to be taken to one volume of acid. After mixing, allow to cool for two or three hours. The strong acid ought to be free from arsenic, copper and other similar impurities. The water ought to be as pure as can be obtained, distilled water being best; rain water is also good. If potable water be employed, it will generally be improved by boiling, which removes some of the lime held in solution. The impurity in ordinary drinking water is very slight; but as all cells lose by evaporation and require additions of water from time to time, there is a tendency for it to increase. The acid must not be put into the cells till everything is ready for charging. (5) A shunt-wound or separately-excited dynamo being ready and running so as to give at will 2·6 or 2·7 volts per cell, the acid is run into the cells. As soon as this is done, the dynamo must be switched on and charging commenced. The positive terminal of the dynamo must be joined to the positive terminal of the battery. If necessary, the + end of the machine must be found by a trial cell made of two plain lead sheets in dilute acid. It is important also to maintain this first charging operation for a long time without a break. Twelve hours is a minimum time, twenty-four not too much. The charging is not even then complete, though a short interval is not so injurious as in the earlier stage. The full charge required varies with the cells, but in all types a full and practically continuous first charge is imperatively necessary. During the early part of this charge the density of the acid may fall; but after a time ought to increase, and finally reach the value desired for permanent working. Towards the end of the "formation" vigilant observation must be exercised. It is important to notice whether any cells are appreciably behind the others in voltage, density or gassing. Such cells may be faulty, and in any case they must be charged and tended till their condition is like that of the others. They ought not to go on the discharge circuit till this is assured. The examination of the cells before passing them as ready for discharge includes:—(*a*) Density of acid as shown by the hydrometer. (*b*) Voltage. This may be taken when charging or when idle. In the first case it ought to be from 2·4 to 2·6 volts, according to conditions. In the second case it ought to be just over 2 volts, provided that the observation is not taken too soon after switching off the charging current. For about half an hour after that is done, the E.M.F. has a transient high value, so that, if it be desired to get the proper E.M.F. of the cell, the observation must be taken thirty minutes after the charging ceases.

(*c*) Eye observations of the plates and the acid between them. The positive plates ought to show a rich dark brown colour, the negatives a dull slate-blue, and the space between ought to be quite clear and free from anything like solid matter. All the positives ought to be alike, and similarly all the negatives. If the cells show similarity in these respects they will probably be in good working order.

As to management, it is important to keep to certain simple rules, of which these are the chief:—(1) Never discharge below a potential difference of 1·85 (or in rapid discharge, 1·8) volt. (2) Never leave the cells discharged, if it be avoidable. (3) Give the cells a special full charging once a month. (4) Make a periodic examination of each cell, determining its E.M.F., density of acid, the condition of its plates and freedom from growth. Any incipient growth, however small, must be carefully watched. (5) If any cell shows signs of weakness, keep it off discharge till it has been brought back to full condition. See that it is free from any connexion between the plates which would cause short-circuiting; the frame or support which carries the plates sometimes gets covered by a conducting layer. To restore the cell, two methods can be adopted. In private installations it may be disconnected and charged by one or two cells reserved for the purpose; or, as is preferable, it may be left in circuit, and a cell in good order put in parallel with it. This acts as a "milking" cell, not only preventing the faulty one from discharging, but keeping it supplied with a charging current till its potential difference (P.D.) is normal. Every battery attendant should be provided with a hydrometer and a voltmeter. The former enables him to determine from time to time the density of the acid in the cells; instruments specially constructed for the purpose are now easily procurable, and it is desirable that one be provided for every 20 or 25 cells. The voltmeter should read up to about 3 volts and be fitted with a suitable connector to enable contacts to be made quickly with any desired cell. A portable glow lamp should also be available, so that a full light can be thrown into any cell; a frosted bulb is rather better than a clear one for this purpose. He must also have some form of wooden scraper to remove any growth from the plates. The scraping must be done gently, with as little other disturbance as possible. By the ordinary operations which go on in the cell, small portions of the plates become detached. It is important that these should fall below the plates, lest they short-circuit the cell, and therefore sufficient space ought to be left between the bottom of the plates and the floor of the cell for these "scalings" to accumulate without touching the plates. It is desirable that they be disturbed as little as possible till their increase seriously encroaches on the free space. It sometimes happens that brass nuts or bolts, &c., are dropped into a cell; these should be removed at once, as their partial solution would greatly endanger the negative plates. The level of the liquid must be kept above the top of the plates. Experience shows the advisability of using distilled water for this purpose. It may sometimes be necessary to replenish the solution with some dilute acid, but strong acid must never be added.

The chief faults are buckling, growth, sulphating and disintegration. Buckling of the plates generally follows excessive discharge, caused by abnormal load or by accidental short-circuiting. At such times asymmetry in the cell is apt to make some part of the plate take much more than its share of the current. That part then expands unduly, as explained later, and curvature is produced. The only remedy is to remove the plate, and press it back into shape as gently as possible. Growth arises generally from scales from one part falling on some other—say, on the negative. In the next charging the scale is reduced to a projecting bit of lead, which grows still further because other particles rest on it. The remedy is, gently to scrape off any incipient growth. Sulphating, the formation of a white hard surface on the active material, is due to neglect or excessive discharge. It often yields if a small quantity of sulphate of soda be added to the liquid in the cell. Disintegration is due to local action, and there is no ultimate remedy. The end can be deferred by care in working, and by avoiding strains and excessive discharge as much as possible.

Accumulators in Repose.—Accumulators contain only three active substances—spongy lead on the negative plate, spongy lead peroxide on the positive, and dilute sulphuric acid between them. Sulphate of lead is formed on both plates during discharge and brought back to lead and lead peroxide again during charge, and there is a consequent change in the strength of acid during every cycle. The chief properties of these substances are shown in Table II.

TABLE II.

Substance.	Colour.	Density.	Specific Resistance.
Lead	slate blue	11·3	0·0000195 ohm
Peroxide of lead	dark brown	9·28	5·6 to 6·8 ,,
Sulphuric acid after charge .	clear liquid	1·210	1·37 ,,
Sulphuric acid after discharge	,, ,,	1·170	1·28 ,,
Sulphuric acid in pores . . .	,, ,,	below 1·03	8·0 ,,
Sulphate of lead	white	6·3	non-conductor.

The curve in fig. 9 shows the relative conductivity (reciprocal of resistance) of all the strengths of sulphuric acid solutions, and by its aid and the figures in the preceding table, the specific resistance of any given strength can be determined.

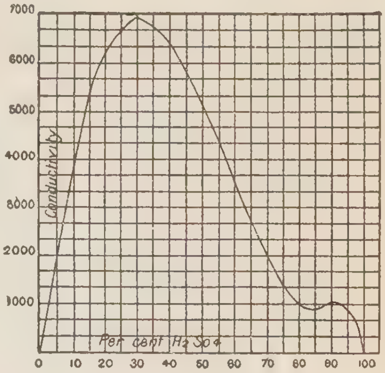

FIG. 9.

The lead accumulator is subject to three kinds of local action. First and chiefly, local action on the positive plate, because of the contact between lead peroxide and the lead grid which supports it. In carelessly made or roughly handled cells this may be a very serious matter. It would be so in all circumstances if the lead sulphate formed on the exposed lead grid did not act as a covering for it. It explains why Planté found "repose" a useful help in "forming," and also why positive plates slowly disintegrate; the lead support is gradually eaten through. Secondly, local action on the negative plate when a more electro-negative metal settles on the lead. This often arises when the original paste or acid contains metallic impurities. Similar impurity is also introduced by scraping copper wire, &c., near a battery. Thirdly, local action due to the acid varying in strength in different parts of a plate. This may arise on either plate and is set up because two specimens of either the same lead or the same peroxide give an E.M.F. when placed in acids of different strengths. J. H. Gladstone and W. Hibbert found that the E.M.F. depends on the difference of strength. With two lead plates, a maximum of about quarter volt was obtained, the lead in the *weaker* acid being positive. With two peroxide plates the maximum voltage was about 0·64, the plate in *stronger* acid being positive to that in weaker. The electromotive force of a cell depends chiefly on the strength of the acid, as may be seen from fig. 10 taken from Gladstone and Hibbert's paper (*Journ. Inst. Elec. Eng.*, 1892). The observations with very strong acid were difficult to obtain, though even that with 98% acid marked X is believed to be trustworthy. C. Heim (*Elek. Zeit*, 1889), F. Streintz (*Ann. Phys. Chem.* xlvi. p. 449) and F. Dolezalek (*Theory of Lead Accumulators*, p. 55) have also given tables.

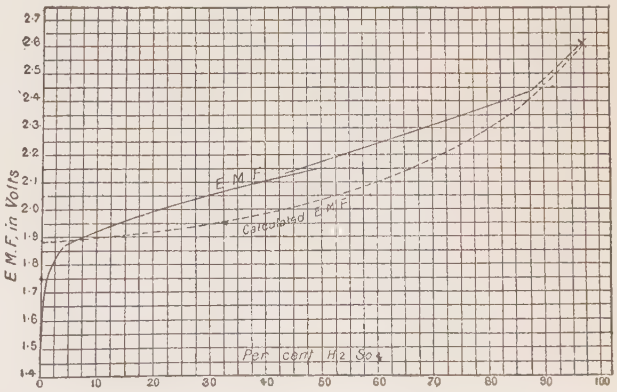

FIG. 10.

It is only necessary to add to these results the facts illustrated by the following diffusion curves, in order to get a complete clue to the behaviour of an accumulator in active work. Fig 11 shows the rate of diffusion from plates soaked in 1·175 acid and then placed in distilled water. It is from a paper by L. Duncan and H. Wiegand (*Elec. World*, N.Y., 1889), who were the first to show the importance of diffusion. About one half the acid diffused out in 30 minutes, a good illustration of the slowness of this process. The rate of diffusion is much the same for both positive and negative plates; but slower for discharged plates than for charged ones. Discharge affects the rate of diffusion on the lead plate more than on the peroxide plate. This is in accordance with the density values given in Table I. For while lead sulphate is formed in the pores of both plates, the consequent expansions (and obstructions) are different; 100 volumes of lead form 290 volumes of sulphate (a threefold expansion), and 100 volumes of peroxide form 186 volumes of sulphate (a twofold expansion). The influence of diffusion on the electromotive force is illustrated by fig. 12. A cell was prepared with 20% acid. It also held a porous pot containing stronger acid, and into this the positive plate was suddenly transferred from the general body of liquid. The E.M.F. rose by diffusion of stronger acid into the pores. Curve I. in fig. 12 shows the rate of rise when the porous pot contained 34% acid; curve II. was obtained with the stronger (58%) acid (Gladstone and Hibbert, *Phil. Mag.*, 1890). Of these two curves the first is more useful, because its conditions are nearer those which occur in practice.

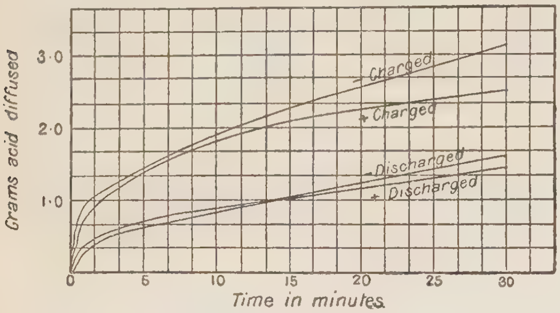

FIG. 11.

At the end of a discharge it is a common thing for the plates to be standing in 25% acid, while inside the pores the acid may not exceed 8% or 10%. If the discharge be stopped, we have conditions somewhat like fig. 12, and the E.M.F. begins to rise. In one minute it has gone up by about 0·08 volt, &c.

Charge and Discharge.—The most important practical questions concerning an accumulator are:—its maximum rate of working; its capacity at various discharge rates; its efficiency; and its length of life. Apart from mechanical injury all these depend primarily on the way the cell is made, and then on the method of charging and discharging. For each type and size of cell there is a normal maximum discharging current. Up to this limit any current may be taken; beyond it, the cell may suffer if discharge be continued for any appreciable time. The most important point to attend to is the voltage at which discharge shall cease. The potential difference at terminals must not fall below 1·80 volt during discharge at ordinary rates (10 hours) or 1·75 to 1·70 volt for 1 or 2 hour rate. The reason underlying the figures is simple. These voltages indicate that the acid in the pores is not being renewed fast enough, and that if the discharge continue the chemical action will change: sulphate will not be formed *in situ* for want of acid. Any such change in action is fatal to reversibility and therefore to life and constancy in capacity. To illustrate: when at slow discharge rates the voltage is 1·80 volt, the acid in the pores has weakened to a mean value of about 2·5% (see fig. 11), which is quite consistent with some part of the interior being practically pure water. With high discharge rates, something like 0·1 volt may be lost in the cells, by ordinary ohmic fall, so that a voltage reading of 1·75 means an E.M.F. of a little over 1·8 volt, and a very weak density of the acid inside the pores. Guided by these figures, an engineer can determine what ought to be the permissible drop in terminal volts for any given working conditions. Messrs W. E. Ayrton, C. G. Lamb, E. W. Smith and M. W. Woods were the first to trace the working of a cell through varied conditions (*Journ. Inst. Elec. Eng.*, 1890), and a brief *résumé* of their results is given below.

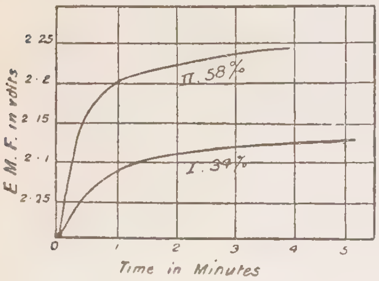

FIG. 12.

They began by charging and discharging between the limits of 2·4 and 1·6 volts.

Fig. 13 shows a typical discharge curve. Noteworthy points are:—(1) At the beginning and at the end there is a rapid fall in P.D., with an intermediate period of fairly uniform value. (2) When the P.D. reaches 1·6 volt the fall is so rapid that there is no advantage in continuing the action. When the P.D. had fallen to 1·6 volt the cell was automatically switched into a charging circuit, and with a current of 9 amperes yielded the curve in fig. 14. Here again there is a rapid variation in P.D. (in these cases a rise) at the beginning and end of the operation. The cells were now carried through the same cycle several times, giving almost identical values for each cycle. After some days, however, they became more and more difficult to charge, and the return on discharge was proportionately less. It became impossible to charge up to a P.D. of 2·4 volts, and finally the capacity fell away to half its first value. Examination showed that the plates were badly scaled, and that some of the scales had partially connected the plates. These scales were cleared away and the experiments resumed, limiting the fall of P.D. to 1·8 volt. The difficulties then disappeared, showing that discharge to 1·6 volt caused injury that did not arise at a limit of 1·8. Before describing the new results it will be useful to examine these two cases in the light of the theory of E.M.F. already given.

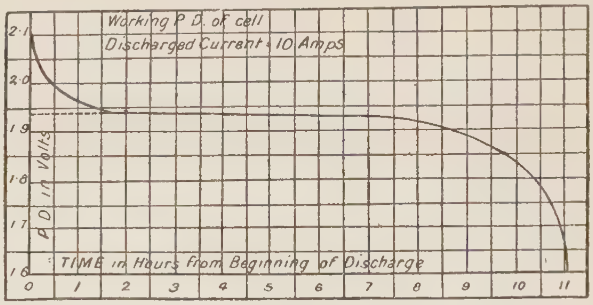

FIG. 13.

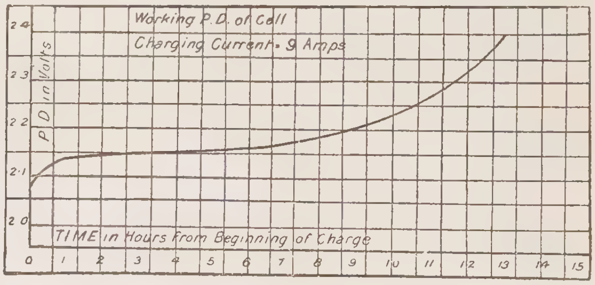

FIG. 14.

(*a*) *Fall in* E.M.F. *at beginning of discharge.*—At the moment when previous charging ceases the pores of the positive plate contain strong acid, brought there by the charging current. There is consequently a high E.M.F. But the strong acid begins to diffuse away at once and the E.M.F. falls rapidly. Even if the cell were not discharged this fall would occur, and if it were allowed to rest for thirty minutes or so the discharge would have begun with the dotted line (fig. 13). (*b*) *Final rapid fall.*—The pores being clogged by sulphate the plugs cannot get acid by diffusion, and when 5% is reached the fall in E.M.F. is disproportionately large (see fig. 10). If discharge be stopped, there is an almost instantaneous diffusion inwards and a rapid rise in E.M.F. (*c*) *The rise in* E.M.F. *at beginning and end of the charging* is due to acid in the pores being strengthened, partly by diffusion, partly by formation of sulphuric acid from sulphate, and partly by electrolytic carrying of strong acid to the positive plate. The injurious results at 1·6 volt arise because then the pores contain water. The chemical reaction is altered, oxide or hydrate is formed, which will partially dissolve, to be changed to sulphate when the sulphuric acid subsequently diffuses in. But formed in this way it will not appear mixed with the active masses in the electrolytic paths, but more or less alone in the pores. In this position it will more or less block the passage and isolate some of the peroxide.

Further, when forming in the narrow passage its disruptive action will tend to force off the outer layers. It is evident that limitation of P.D. to 1·8 volt ought to prevent these injuries, because it prevents exhaustion of acid in the plugs.

Fig. 15 shows the results obtained by study of successive periods of rest, the observations being taken between the limits of 2·4 and 1·8 volts. Curves A and B show the state and capacity at the beginning. After a 10 days' rest the capacity was smaller, but repeated cycles of work brought it back to C and D. A second rest (10 days), followed by many cycles, then gave E and F. After a third rest (16 days) and many cycles, G and H were obtained. After a fourth rest (16 days) the first discharge gave I and the first charge J. Repeated cycles brought the cells back to K and L. Curves M and N show first cycle after a fifth rest (16 days); O and P show the final restoration brought about by repeated cycles of work. The numbers given by the integration of some of these curves are stated in Table III.

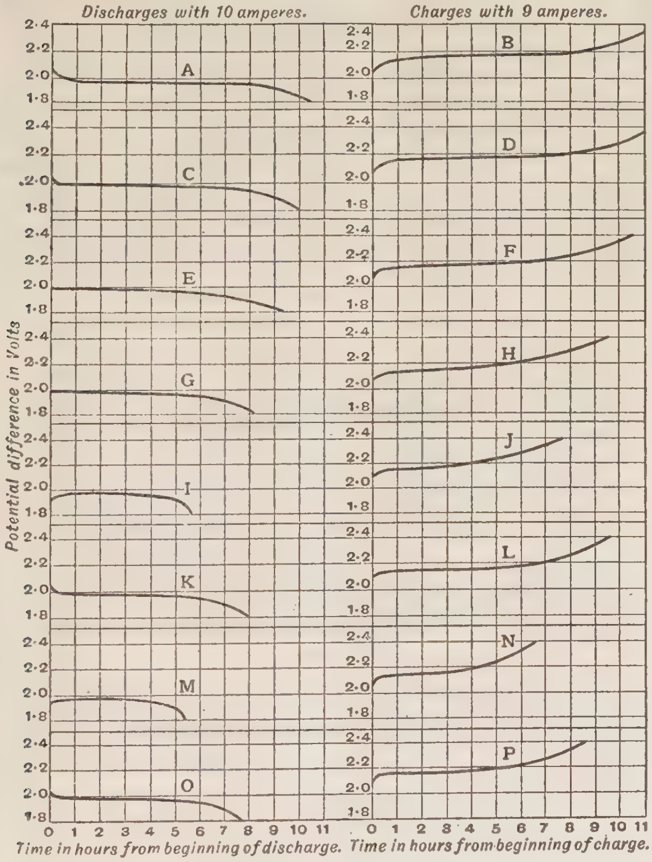

FIG. 15.

TABLE III.

	Capacity and Efficiency under Various Conditions of Working.					
	Discharge.		Charge.		Efficiency.	
Experiment.	Ampere Hours.	Watt Hours.	Ampere Hours.	Watt Hours.	Quantity.	Energy.
Normal cycle.	102	201·7	104·5	230·7	97·2	87·4
Restoration after 1st rest	100	179	103·8	228·2	96·8	85·8
Ditto, after 2nd rest . .	91	176·7	96·8	213·2	94·1	82·8
Ditto, after 3rd rest . .	82·6	161·3	86·2	190·5	95·8	84·7
Discharge immediately after rest	56·5	110·5	86·2	190·5	65·5	58[1]
	56·5	110·5	71·1	158·3	79·6	69·6
Restoration after 8 cycles	80	156·9	83·8	184·6	95·5	85

The table shows that the efficiency in a normal cycle may be as high as 87·4%; that during a rest of sixteen days the charged accumulator is so affected that about 30% of its charge is not available, and in subsequent cycles it shows a diminished capacity and efficiency; and that by repeated charges and discharges the capacity may be partially restored and the efficiency more completely so. These changes might be due to—(*a*) leakage or short-circuit, (*b*) some of the active material having fallen to the bottom of the cell or (*c*) some change in the active materials. (*a*) is excluded by the fact that the subsequent charge is smaller, and (*b*) by the continued increase of capacity during the cycles that follow the rest. Hence the third hypothesis is the one which must be relied upon. The change in the active materials has already been given. The formation of lead sulphate by local action on the peroxide plate and by direct action of acid on spongy metal on the lead plate explains the loss of energy shown in curve M, fig. 15, while the fact that it is probably formed, not in the path of the regular currents, but on the wall of the grid (remote from the ordinary action), gives a probable explanation of the subsequent slow recovery. The action of the acid on the lead during rest must not be overlooked.

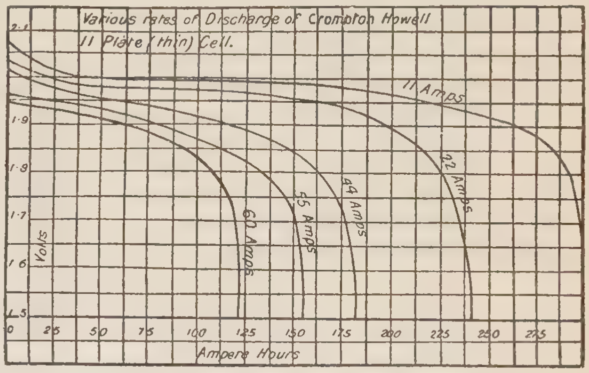

FIG. 16.

We have seen that capacity diminishes as the discharge rate increases; that is, the available output increases as the current diminishes. R. E. B. Crompton's diagram illustrating this fact is given in fig. 16. At the higher rates the consumption of acid is too rapid, diffusion cannot maintain its strength in the pores, and the fall comes so much earlier.

The resistance varies with the condition of the cell, as shown by the curves in fig. 17. It may be unduly increased by long or narrow lugs, and especially by dirty joints between the lugs. It is interesting to note that it increases at the end of both charge and discharge, and much more for the first than the second. Now the composition of the active materials near the end of charge is almost exactly the same as at the beginning of discharge, and at first sight there seems nothing to account for the great fall in resistance from 0·0115 to 0·004 ohm; that is, to about one-third the value. There is, however, one difference between charging and discharging—namely, that due to the strong acid near the positive, with a corresponding weaker acid near the negative electrode. The curve of conductivity for sulphuric acid shows that both strong and weak acid have much higher resistances than the liquid usually employed in accumulators, and it is therefore reasonable to suppose that local variations in strength of acid cause the changes in resistance. That these are not due to the constitution of the plugs is shown by the fact that, while the plugs

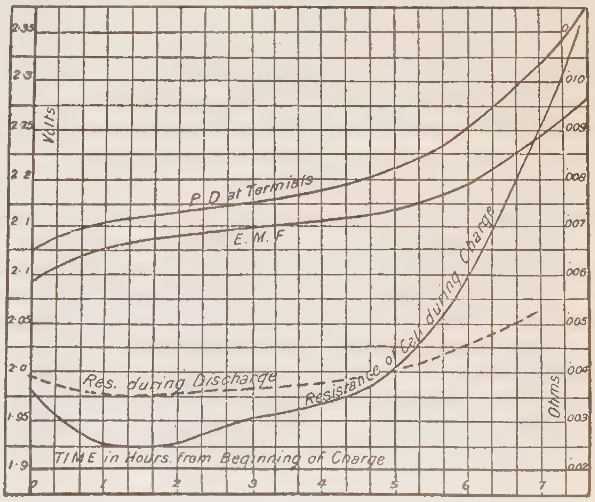

FIG. 17.

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[1] This discharge is here compared with the charge that preceded the rest; in the next line the same discharge is compared with the charge following the rest.

are almost identical at end of discharge and beginning of charge, the resistance falls from 0·0055 to 0·0033 ohm.

While a current flows through a cell, heat is produced at the rate of $C^2R \times 0{\cdot}24$ calories (water-gram-degree) per second. As a consequence the temperature tends to rise. But the change of temperature actually observed is much greater during charge, and much less during discharge, than the foregoing expression would suggest; and it is evident that, besides the heat produced according to Joule's law, there are other actions which warm the cell during charge and cool it during discharge. Duncan and Wiegand (*loc. cit.*), who first observed the thermal changes, ascribe the chief influence to the electrochemical addition of H_2SO_4 to the liquid during charge and its removal during discharge. Fig. 18 gives some results obtained by Ayrton, Lamb, &c. This elevation of temperature (due to electrolytic strengthening of acid and local action) is a measure of the energy lost in a cycle, and ought to be minimized as much as possible.

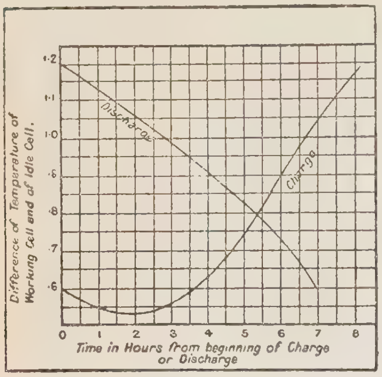

FIG. 18.

Chemistry.—The chemical theory adopted in the foregoing pages is very simple. It declares that sulphate of lead is formed on *both* plates during discharge, the chemical action being reversed in charging. The following equations express the experimental results.

Condition before discharge:—

$$\begin{array}{ccccc} +\text{plate} & & \text{Liquid} & & -\text{plate} \\ x.\ PbO_2 & + & \begin{bmatrix} y.\ H_2SO_4 \\ n.\ H_2O \end{bmatrix} & + & z.\ \ Pb \end{array}$$

After discharge:—

$$\begin{array}{ccccc} +\text{plate} & & \text{Liquid} & & -\text{plate} \\ \begin{bmatrix} (x-p).\ PbO_2 \\ p.\ PbSO_4 \end{bmatrix} & + & \begin{bmatrix} (y-2p).\ H_2SO_4 \\ (n+2p).\ H_2O \end{bmatrix} & + & \begin{bmatrix} (z-p)\ \ Pb \\ p.\ PbSO_4 \end{bmatrix} \end{array}$$

During charge, the substances are restored to their original condition: the equation is therefore reversed. An equation of this general nature was published by Gladstone and Tribe in 1882, when they first suggested the "sulphate" theory, which was based on very numerous analyses. Confirmation was given by E. Frankland in 1883, É. Reynier 1884, A. P. P. Crova and P. Garbe 1885, C. Heim and W. F. Kohlrausch 1889, W. E. Ayrton, &c., with G. H Robertson 1890, C. H. J. B. Liebenow 1897, F. Dolezalek 1897, and M. Mugdan 1899. Yet there has been, as Dolezalek says, an incomprehensible unwillingness to accept the theory, though no suggested alternative could offer good verifiable experimental foundation. Those who seek a full discussion will find it in Dolezalek's *Theory of the Lead Accumulator*. We shall take it that the sulphate theory is proved, and apply it to the conditions of charge and discharge.

From the chemical theory it will be obvious that the acid in the pores of both plates will be stronger during charge than that outside. During discharge the reverse will be the case. Fig. 19 shows a curve of potential difference during charge, with others showing the concurrent changes in the percentage of PbO_2 and the density of acid. These increase almost in proportion to the duration of the current, and indicate the decomposition of sulphate and liberation of sulphuric acid. There are breaks in the P.D. curve at A, B, C, D where the current was stopped to extract samples for analysis, &c. The fall in E.M.F. in this short interval is noteworthy; it arises from the diffusion of stronger acid out of the pores. The final rise of pressure is due to increase in resistance and the effect of stronger acid in the pores, this last arising partly from reduced sulphate and partly from the electrolytic convection of SO_4 (see also Dolezalek, *Theory*, p. 113). Fig. 20 gives the data for discharge. The percentage of PbO_2 and the density here fall almost in proportion to the duration of the current. The special feature is the rapid fall of voltage at the end.

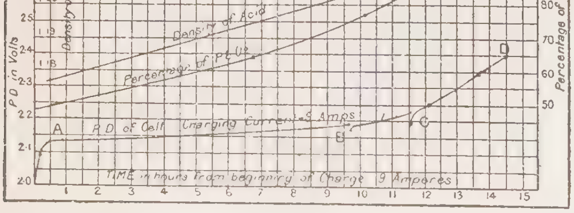

FIG. 19.

Several suggestions have been made about this phenomenon. The writer holds that it is due to the exhaustion of the acid in the pores. Planté, and afterwards Gladstone and Tribe, found a possible cause in the formation of a film of peroxide on the spongy lead. E. J. Wade has suggested a sudden readjustment of the spongy mass into a complex sulphate. To rebut these hypotheses it is only necessary to say that the fall can be deferred for a long time by pressing fresh acid into the pores hydrostatically (see Liebenow, *Zeits. für Elektrochem.*, 1897, iv. 61), or by working at a higher temperature. This increases the diffusion inwards of strong acid, and like the increase due to hydrostatic pressure maintains the E.M.F. The other suggested causes of the fall therefore fail. Fig. 20 also shows that when the discharge current was stopped at points A, B, C, D to extract samples, the voltage immediately rose, owing to inward diffusion of stronger acid. The inward diffusion of fresh acid also accounts for the recuperation found after a rest which follows either a complete discharge or a partial discharge at a very rapid rate. If the discharge be complete the recuperation refers only to the electromotive force; the pressure falls at once on closed circuit. If discharge has been rapid, a rest will enable the cell to resume work because it brings fresh acid into the active regions.

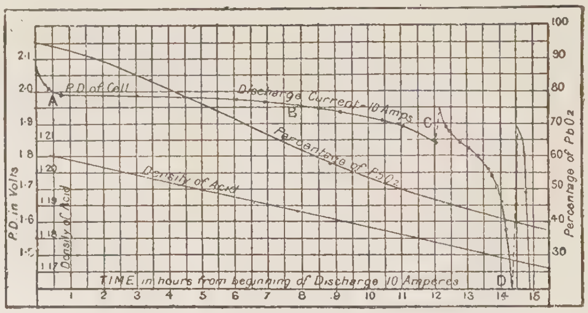

FIG. 20.

As to the effect of repose on a charged cell, Gladstone and Tribe's experiments showed that peroxide of lead lying on its lead support suffers from a local action, which reduces one molecule of PbO_2 to sulphate at the same time that an atom of the grid below it is also changed to sulphate. There is thus not only a loss of the available peroxide, but a corrosion of the grid or plate. It is through this action that the supports gradually give way. On the negative plate an action arises between the finely divided lead and the sulphuric acid, with the result that hydrogen is set free:—

$$Pb + H_2SO_4 = PbSO_4 + H_2.$$

This involves a diminution of available spongy lead, or loss of capacity occasionally with serious consequences. The capacity of the lead plate is reduced absolutely, of course, but its relative value is more seriously affected In the discharge it gets sulphated too much because the better positive keeps up the E.M.F. too long. In the succeeding charge, the positive is fully charged before the negative, and the differences between them tend to increase in each cycle.

Kelvin and Helmholtz have shown that the E.M.F. of a voltaic cell can be calculated from the energy developed by the chemical action. For a dyad gram equivalent (=2 grams of hydrogen, 207 grams of lead, &c.), the equation connecting them is

$$E = \frac{H}{46000} + T\frac{dE}{dT}$$

where E is the E.M.F. in volts, H is the heat developed by a dyad equivalent of the reacting substances, T is the absolute temperature, and dE/dT is the temperature coefficient of the E.M.F. If the E.M.F. does not change with temperature, the second term is zero. The thermal values for the various substances formed and decomposed are:—For PbO_2, 62400; for $PbSO_4$, 216210; for H_2SO_4, 192920; and for H_2O, 68400 calories. Writing the equation in its simplest form for strong acid, and ignoring the temperature coefficient term,

$$\begin{array}{c} PbO_2 + 2H_2SO_4 + Pb = 2PbSO_4 + 2H_2O \\ -62440 - 385840 \qquad +432420 + 136720 \end{array}$$

leaving a balance of 120860 calories. Dividing by 46000 gives 2·627 volts. The experimental value in strong acid, according to Gladstone and Hibbert, is 2·607 volts, a very close approximation. For other strengths of acid, the energy will be less by the quantity of heat evolved by dilution of the acid, because the chemical action must take the H_2SO_4 from the diluted liquid. The dotted curve in fig. 10 indicates the calculated E.M.F. at various points when this is taken into account. The difference between it and the continuous curve must, if the chemical theory be correct, depend on the second term in the equation. The figure shows that the observed E.M.F. is above the theoretical for all strengths from 100 down to 5%. Below 5 the position is reversed. The question remains, Can the temperature coefficient be obtained? This is difficult, because the value is so small, and it is not easy to secure a good cycle of observations. Streintz has given the following values:—

E	1·9223	1·9828	2·0031	2·0084	2·0105	2·078	2·2070
$\frac{dE}{dT}\cdot 10^6$	140	228	335	285	255	130	73

Unpublished experiments by the writer give $\frac{dE}{dT}\cdot 10^6=350$ for acid of density 1·156. With stronger acid, a true cycle could not be obtained. Taking Streintz's value, 335 for 25% acid, the second term of the equation is $T\frac{dE}{dT}=290\times\cdot000335=0\cdot0971$ volt. The first term gives 88800 calories = 1·9304 volt. Adding the second term, $1\cdot9304+0\cdot0971=2\cdot2075$ volts. The observed value is 2·030 volts (see fig. 10), a remarkably good agreement. This calculation and the general relation shown in fig. 10 render it highly probable that, if the temperature coefficient were known for all strengths of acid, the result would be equally good. It is worth observing that the reversal of relationship between the observed and calculated curves, which takes place at 5% or 6%, suggests that the chemistry must be on the point of altering as the acid gets weak, a conclusion which has been already arrived at on purely chemical grounds. The thermodynamical relations are thus seen to confirm very strongly the chemical and physical analyses.[1]

Accumulators in Central Stations.—As the efficiency of accumulators is not generally higher than 75%, and machines must be used to charge them, it is not directly economical to use cells alone for public supply. Yet they play an important and an increasing part in public work, because they help to maintain a constant voltage on the mains, and can be used to distribute the load on the running machinery over a much greater fraction of the day. Used in parallel with the dynamo, they quickly yield current when the load increases, and immediately begin to charge when the load diminishes, thus largely reducing the fluctuating stress on dynamo and engine for sudden variations in load. Their use is advantageous if they can be charged and discharged at a time when the steam plant would otherwise be working at an uneconomical load.

Regulation of the potential difference is managed in various ways. More cells may be thrown in as the discharge proceeds, and taken out during charge; but this method often leads to trouble, as some cells get unduly discharged, and the unity of the battery is disturbed. Sometimes the number of cells is kept fixed for supply, but the P.D. they put on the mains is reduced during charge by employing regulating cells in opposition. Both these plans have proved unsatisfactory, and the battery is now preferably joined across the mains in parallel with the dynamo. The cells take the peaks of the load and thus relieve the dynamo and engine of sudden changes, as shown in fig. 21. Here the line current (shown by the erratic curve) varied spasmodically from 0 to 375 amperes, yet the dynamo current varied from 100 to 150 amperes only (see line A). At the same time the line voltage (535 volts normal) was kept nearly constant. In the late evening the cells became exhausted and the dynamo charged them. Extra voltage was required at the end of a "charge" and was provided by a "booster." Originally a booster was an auxiliary dynamo worked in series with the chief machine, and driven in any convenient way. It has developed into a machine with two or more exciting coils, and having its armature in series with the cells (see fig. 22). The exciting coils act in opposition; the one carrying the main current sets up an E.M.F. in the same direction as that of the cells, and helps the cells to discharge as the load rises. When the load is small, the voltage on the mains is highest and the shunt exciting current greatest. The booster E.M.F. now acts with the dynamo and against the cells, and causes them to take a full charge. Even this arrangement did not suffice to keep the line voltage as constant as seemed desirable in some cases, as where lighting and traction work were put on the same plant. Fig. 23 is a diagram of a complex booster which gives very good regulation. The booster B has its armature in series with the accumulators A, and is kept running in a given direction at a constant speed by means of a shunt-wound motor (not shown), so that the E.M.F. induced in the armature depends on the excitation. This is made to vary in value and in direction by means of four independent exciting coils, C_1, C_2, C_3, C_4. The last is not essential, as it merely compensates for the small voltage drop in the armature. It is obvious that the excitation C_3 will be proportionate to the difference in voltage between the battery and the mains, and it is arranged that battery volts and booster volts shall equal the volts on the mains. Under this excitation there is no tendency for the battery to charge or discharge. But any additional excitation leads to strong currents one way or the other. Excitation C_1 rises with the load on the line, and gives an E.M.F. helping the battery to discharge most when the load is greatest. C_2 is dependent on the bus-bar voltage, and is greatest when the generator load is small: it opposes C_1 and therefore excites the booster to charge the battery. The exact generator load at which the booster shall reverse its E.M.F. from a charging to a discharging value is adjusted by the resistance R_2 in series with C_2. A similar resistance R_3 allows the excitation of C_3 to be adjusted. Very remarkable regulation can be obtained by reversible boosters of this type. In traction and lighting stations it is quite possible to keep the variation of bus-bar pressure within 2% of the normal value, although the load may momentarily vary from a few amperes up to 200 or 300.

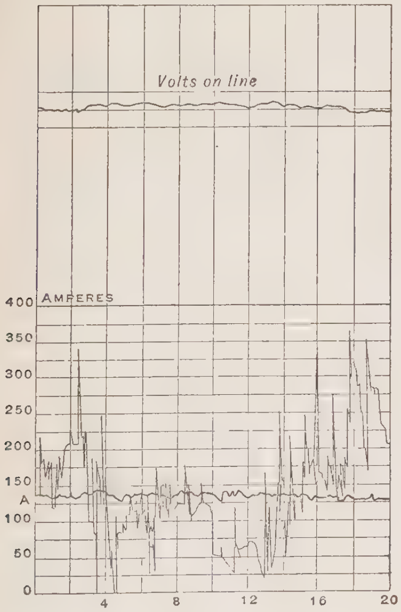

FIG. 21.

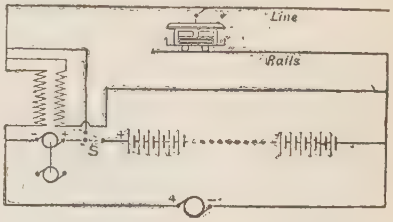

FIG. 22.

J. B. Entz has introduced an auxiliary device which enables him to use a much more simple booster. The Entz booster has no series coil and only one shunt coil, the direction and value of excitation due to this being controlled by a carbon regulator, having two arms, the resistance of each of which can be varied by pressure due to the magnetizing action of a solenoid. The main current from the generator passes through the solenoid and causes one or other of the two carbon arms to have the less resistance. This change in resistance determines the direction of the exciter field current, and therefore the direction of the boost. A photograph of the switchboard at Greenock where this booster is in use shows the voltmeter needle as if it had been held rigid, although the exposure lasted 90 minutes. On the same photograph the ammeter needle does not appear, its incessant and large movements preventing any picture from being formed.

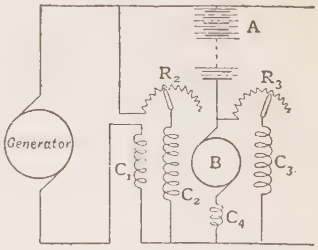

FIG. 23.

Alkaline Accumulators.—Owing to the high electro-chemical equivalent of lead, a great saving in weight would be secured by using almost any other metal. Unfortunately no other metal and its compounds can resist the acid. Hence inventors have been incited to try alkaline liquids as electrolytes. Many attempts have been made to construct accumulators in this way, though with only moderate success. The Lalande-Chaperon, Desmazures, Waddell-Entz and Edison are the chief cells. T. A. Edison's cell has been most developed, and is intended for traction work. He made the plates of very thin sheets of nickel-plated steel, in each of which 24 rectangular holes were stamped, leaving a mere framework of the metal. Shallow rectangular pockets of perforated nickel-steel were fitted in the holes and then burred over the framework by high pressures. The pockets contained the active material. On the positive plate this consisted of nickel peroxide mixed with flake graphite, and on the negative plate of finely divided iron mixed with graphite. Both kinds of active material were prepared in a special way. The graphite gives greater conductivity. The liquid was a 20% solution of caustic potash. During discharge the iron was oxidized, and the nickel reduced to a lower state of oxidation. This change was reversed during charge. Fig. 24 shows the general features.

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[1] For the discussion of later electrolytic theories as applied to accumulators, see Dolezalek, *Theory of the Lead Accumulator.*

The chief results obtained by European experts showed that the E.M.F. was 1·33 volt, with a transient higher value following charge. A cell weighing 17·8 ℔ had a resistance of 0·0013 ohm, and an output at 60 amperes of 210 watt-hours, or at 120 amperes of 177 watt-hours. Another and improved cell weighing 12·7 ℔ gave 14·6 watt-hours per pound of cell at a 20-ampere rate, and 13·5 watt-hours per pound at a 60-ampere rate. The cell could be charged and discharged at almost any rate. A full charge could be given in 1 hour, and it would stand a discharge rate of 200 amperes (*Journ. Inst. Elec. Eng.*, 1904, pp. 1-36).

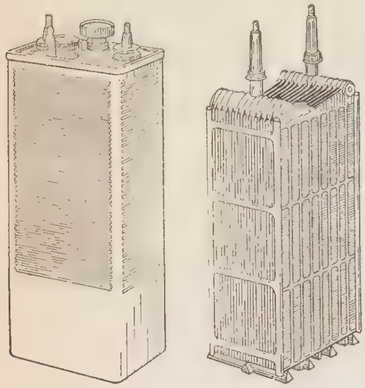

Fig. 24.—Edison Accumulator.

Subsequently Edison found some degree of falling-off in capacity, due to an enlargement of the positive pockets by pressure of gas. Most of the faults have been overcome by altering the form of the pocket and replacing the graphite by a metallic conductor in the form of flakes.

References.—G. Planté, *Recherches sur l'électricité* (Paris, 1879); Gladstone and Tribe, *Chemistry of Secondary Batteries* (London, 1884); Reynier, *L'Accumulateur voltaïque* (Paris, 1888); Heim, *Die Akkumulatoren* (Berlin, 1889); Hoppe, *Die Akk. für Elektricität* (Berlin, 1892); Schoop, *Handbuch für Akk.* (Stuttgart, 1898); Sir E. Frankland, "Chemistry of Storage Batteries," *Proc. Roy. Soc.*, 1883; Reynier, *Jour. Soc. Franç. de Phys.*, 1884; Heim, "Ü. d. Einfluss der Säuredichte auf die Kapazität der Akk.," *Elek. Zeits.*, 1889; Kohlrausch and Heim, "Ergebnisse von Versuchen an Akk. für Stationsbetrieb," *Elek. Zeits.*, 1889; Darrieus, *Bull. Soc. Intern. des Élect.*, 1892; F. Dolezalek, *The Theory of the Lead Accumulator* (London, 1906); Sir D. Salomons, *Management of Accumulators* (London, 1906); E. J. Wade, *Secondary Batteries* (London, 1901); L. Jumau, *Les Accumulateurs électriques* (Paris, 1904). (W. Ht.)

ACCURSIUS (*Ital.* Accorso), **FRANCISCUS** (1182–1260), Italian jurist, was born at Florence about 1182. A pupil of Azo, he first practised law in his native city, and was afterwards appointed professor at Bologna, where he had great success as a teacher. He undertook the great work of arranging into one body the almost innumerable comments and remarks upon the Code, the Institutes and Digests, the confused dispersion of which among the works of different writers caused much obscurity and contradiction. This compilation, bearing the title *Glossa ordinaria* or *magistralis*, but usually known as the Great Gloss, though written in barbarous Latin, has more method than that of any preceding writer on the subject. The best edition of it is that of Denis Godefroi (1549–1621), published at Lyons in 1589, in 6 vols. folio. When Accursius was employed in this work, it is said that, hearing of a similar one proposed and begun by Odofred, another lawyer of Bologna, he feigned indisposition, interrupted his public lectures, and shut himself up, till with the utmost expedition he had accomplished his design. Accursius was greatly extolled by the lawyers of his own and the immediately succeeding age, and he was even called the idol of jurisconsults, but those of later times formed a much lower estimate of his merits. There can be no doubt that he disentangled the sense of many laws with much skill, but it is equally undeniable that his ignorance of history and antiquities often led him into absurdities, and was the cause of many defects in his explanations and commentaries. He died at Bologna in 1260. His eldest son Franciscus (1225–1293), who also filled the chair of law at Bologna, was invited to Oxford by King Edward I., and in 1275 or 1276 read lectures on law in the university.

ACCUSATION (Lat. *accusatio*, *accusare*, to challenge to a *causa*, a suit or trial at law), a legal term signifying the charging of another with wrong-doing, criminal or otherwise. An accusation which is made in a court of justice during legal proceedings is privileged (see Privilege), though, should the accused have been maliciously prosecuted, he will have a right to bring an action for malicious prosecution. An accusation made outside a court of justice would, if the accusation were false, render the accuser liable to an action for defamation of character, while, if the accusation be committed to writing, the writer of it is liable to indictment, whether the accusation be made only to the party accused or to a third person. A threat or conspiracy to accuse another of a crime or of misconduct which does not amount to a crime for the purpose of extortion is in itself indictable.

ACCUSATIVE (Lat. *accusativus*, sc. *casus*, a translation of the Gr. *αἰτιατικὴ πτῶσις*, the case concerned with cause and effect, from *αἰτία*, a cause), in grammar, a case of the noun, denoting primarily the object of verbal action or the destination of motion.

ACE (derived through the Lat. *as*, from the Tarentine form of the Gr. *εἷς*), the number one at dice, or the single point on a die or card; also a point in the score of racquets, lawn-tennis, tennis and other court games.

ACELDAMA (according to Acts i. 19, "the field of blood"), the name given to the field purchased by Judas Iscariot with the money he received for the betrayal of Jesus Christ. A different version is given in Matthew xxvii. 8, where Judas is said to have cast down the money in the Temple, and the priests who had paid it to have recovered the pieces, with which they bought "the potter's field, to bury strangers in." The MS. evidence is greatly in favour of a form Aceldamach. This would seem to mean "the field of thy blood," which is unsuitable. Since, however, we find elsewhere one name appearing as both Sirach and Sira (ch = א), Aceldamach may be another form of an original Aceldama (חֲקַל דְּמָא), the "field of blood." A. Klostermann, however, takes the *ch* to be part of the Aramaic root *demach*, "to sleep"; the word would then mean "field of sleep" or cemetery (*Probleme im Aposteltexte*, 1-8, 1883), an explanation which fits in well with the account in Matthew xxvii. The traditional site (now Hak el-Dum), S. of Jerusalem on the N.E. slope of the "Hill of Evil Counsel" (Jebel Deir Abu Tor), was used as a burial-place for Christian pilgrims from the 6th century A.D. till as late, apparently, as 1697, and especially in the time of the Crusades. Near it there is a very ancient charnel-house, partly rock-cut, partly of masonry, said to be the work of Crusaders.

ACENAPHTHENE, $C_{12}H_{10}$, a hydrocarbon isolated from the fraction of coal-tar boiling at 260°–270° by M. P. E. Berthelot, who, in conjunction with Bardy, afterwards synthesized it from α-ethyl naphthalene (*Ann. Chem. Phys.*, 1873, vol. xxix.). It forms white needles (from alcohol), melts at 95° and boils at 278°. Oxidation gives naphthalic acid (1·8 naphthalene dicarboxylic acid).

Acenaphthalene, $C_{12}H_8$, a hydrocarbon crystallizing in yellow tables and obtained by passing the vapour of acenaphthene over heated litharge. Sodium amalgam reduces it to acenaphthene; chromic acid oxidizes it to naphthalic acid.

ACEPHALI (from ἀ-, privative, and κεφαλή, head), a term applied to several sects as having no head or leader; and in particular to a strict monophysite sect that separated itself, in the end of the 5th century, from the rule of the patriarch of Alexandria (Peter Mongus), and remained "without king or bishop" till they were reconciled by Mark I. (799–819).[1] The term is also used to denote *clerici vagrantes*, *i.e.* clergy without title or benefice, picking up a living anyhow (cf. Hinschius i. p. 64). Certain persons in England during the reign of King Henry I. were called *Acephali* because they had no lands by virtue of which they could acknowledge a superior lord. The name is also given to certain legendary races described by ancient naturalists and geographers as having no heads, their mouths and eyes being in their breasts, generally identified with Pliny's Blemmyae.

ACEPHALOUS, headless, whether literally or metaphorically, leaderless. The word is used literally in biology; and metaphorically in prosody or grammar for a verse or sentence with a beginning wanting. In zoology, the mollusca are divided into cephalous and acephalous (Acephala), according as they have or have not an organized part of their anatomy as the seat of the brain and special senses. The Acephala, or *Lamellibranchiata* (*q.v.*), are commonly known as bivalve shell-fish. In botany the word is used for ovaries not terminating in a stigma. Acephalocyst is the name given by R. T. H. Laennec to the hydatid, immature or larval tapeworm.

ACERENZA (anc. *Aceruntia*), a town of the province of Potenza, Italy, the seat of an archbishop, 15½ m. N.E. of the station of Pietragalla, which is 9 m. N.W. of Potenza by rail, 2730 ft. above sea-level. Pop. (1901) 4499. Its situation is one of great strength, and it has only one entrance, on the south. It was occupied as a colony at latest by the end of the Republic, and its importance as a fortress was specially appreciated by the Goths and Lombards in the 6th and 7th centuries. It has a fine Norman cathedral, upon the gable of which is one of the best extant busts of Julian the Apostate.

ACEROSE (from Lat. *acus*, needle, or *acer*, sharp), needle-shaped, a term used in botany (since Linnaeus) as descriptive of the leaves, *e.g.*, of pines. From Lat. *acus*, chaff, comes also the distinct meaning of "mixed with chaff."

ACERRA, a town and episcopal see of Campania, Italy, in the province of Caserta, 9 m. N.E. from Naples by rail. Pop. (1901) 16,443. The town lies on the right bank of the Agno, which divides the province of Naples from that of Caserta, 90 ft. above the sea, in a fertile but somewhat marshy district, which in the middle ages was very malarious. The ancient name (*Acerrae*) was also borne by a town in Umbria and another in Gallia Transpadana (the latter now Pizzighettone on the Adda, 13 m. W.N.W. of Cremona). It became a city with Latin rights in 332 B.C. and later a *municipium*. It was destroyed by Hannibal in 216 B.C., but restored in 210; in 90 B.C. it served as the Roman headquarters in the Social war, and was successfully held against the insurgents. It received a colony under Augustus, but appears to have suffered much from floods of the river Clanis. Under the Empire we hear no more of it, and no traces of antiquity, beyond inscriptions, remain.

ACERRA, in Roman antiquity, a small box or pot for holding incense, as distinct from the turibulum (thurible) or censer in which incense was burned. The name was also given by the Romans to a little altar placed near the dead, on which incense was offered every day till the burial. In ecclesiastical Latin the term acerra is still applied to the incense boats used in the Roman ritual.

ACETABULUM, the Latin word for a vinegar cup, an ancient Roman vessel, used as a liquid measure (equal to about half a gill); it is also a word used technically in zoology, by analogy for certain cup-shaped parts, *e.g.* the suckers of a mollusc, the socket of the thigh-bone, &c.; and in botany for the receptacle of Fungi.

ACETIC ACID (*acidum aceticum*), $CH_3 \cdot CO_2H$, one of the most important organic acids. It occurs naturally in the juice of many plants, and as the esters of n-hexyl and n-octyl alcohols in the seeds of *Heracleum giganteum*, and in the fruit of *Heracleum sphondylium*, but is generally obtained, on the large scale, from the oxidation of spoiled wines, or from the destructive distillation of wood. In the former process it is obtained in the form of a dilute aqueous solution, in which also the colouring matters of the wine, salts, &c., are dissolved; and this impure acetic acid is what we ordinarily term vinegar (*q.v.*). Acetic acid (in the form of vinegar) was known to the ancients, who obtained it by the oxidation of alcoholic liquors. Wood-vinegar was discovered in the middle ages. Towards the close of the 18th century, A. L. Lavoisier showed that air was necessary to the formation of vinegar from alcohol. In 1830 J. B. A. Dumas converted acetic acid into trichloracetic acid, and in 1842 L. H. F. Melsens reconverted this derivative into the original acetic acid by reduction with sodium amalgam. The synthesis of trichloracetic acid from its elements was accomplished in 1843 by H. Kolbe; this taken in conjunction with Melsens's observation provided the first synthesis of acetic acid. Anhydrous acetic acid—glacial acetic acid—is a leafy crystalline mass melting at 16·7° C., and possessing an exceedingly pungent smell. It boils at 118°, giving a vapour of abnormal specific gravity. It dissolves in water in all proportions with at first a contraction and afterwards an increase in volume. It is detected by heating with ordinary alcohol and sulphuric acid, which gives rise to acetic ester or ethyl acetate, recognized by its fragrant odour; or by heating with arsenious oxide, which forms the pungent and poisonous cacodyl oxide. It is a monobasic acid, forming one normal and two acid potassium salts, and basic salts with iron, aluminium, lead and copper. Ferrous and ferric acetates are used as mordants; normal lead acetate is known in commerce as sugar of lead (*q.v.*); basic copper acetates are known as verdigris (*q.v.*).

Pharmacology and Therapeutics.—Glacial acetic acid is occasionally used as a caustic for corns. The dilute acid, or vinegar, may be used to bathe the skin in fever, acting as a pleasant refrigerant. Acetic acid has no valuable properties for internal administration. Vinegar, however, which contains about 5% acetic acid, is frequently taken as a cure for obesity, but there is no warrant for this application. Its continued employment may, indeed, so injure the mucous membrane of the stomach as to interfere with digestion and so cause a morbid and dangerous reduction in weight.

The acetates constitute a valuable group of medicinal agents, the potassium salt being most frequently employed. After absorption into the blood, the acetates are oxidized to carbonates, and therefore are *remote alkalies*, and are administered whenever it is desired to increase the alkalinity of the blood or to reduce the acidity of the urine, without exerting the disturbing influence of alkalies upon the digestive tract. The citrates act in precisely similar fashion, and may be substituted. They are somewhat more pleasant but more expensive.

ACETO-ACETIC ESTER, $C_6H_{10}O_3$ or $CH_3 \cdot CO \cdot CH_2 \cdot COOC_2H_5$, a chemical substance discovered in 1863 by A. Geuther, who showed that the chief product of the action of sodium on ethyl acetate was a sodium compound of composition $C_6H_9O_3Na$, which on treatment with acids gave a colourless, somewhat oily liquid of composition $C_6H_{10}O_3$. E. Frankland and B. F. Duppa in 1865 examined the reaction and concluded that Geuther's sodium salt was a derivative of the ethyl ester of acetone carboxylic acid and possessed the constitution $CH_3CO \cdot CHNa \cdot COOC_2H_5$. This view was not accepted by Geuther, who looked upon his compound $C_6H_{10}O_3$ as being an acid. J. Wislicenus also investigated the reaction very thoroughly and accepted the Frankland-Duppa formula (*Annalen*, 1877, 186, p. 163; 1877, 190, p. 257).

The substance is best prepared by drying ethyl acetate over calcium chloride and treating it with sodium wire, which is best introduced in one operation; the liquid boils and is then heated on a water bath for some hours, until the sodium all dissolves. After the reaction is completed, the liquid is acidified with dilute sulphuric acid (1:5) and then shaken with salt solution, separated from the salt solution, washed, dried and fractionated. The portion boiling between 175° and 185°C. is redistilled. The yield amounts to about 30% of that required by theory.

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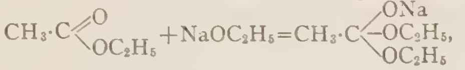
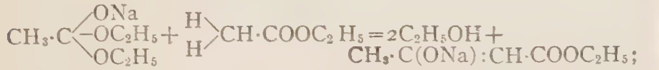
[1] See Gibbon, ch. xlvii. (vol. v. p. 129 in Bury's ed.).

A. Ladenburg and J. A. Wanklyn have shown that pure ethyl acetate free from alcohol will not react with sodium to produce aceto-acetic ester. L. Claisen, whose views are now accepted, studied the reactions of sodium ethylate and showed that if sodium ethylate be used in place of sodium in the above reaction the same result is obtained. He explains the reactions thus:



$$CH_3\cdot C\left\langle\begin{matrix}O\\OC_2H_5\end{matrix}\right.+NaOC_2H_5=CH_3\cdot C\left\langle\begin{matrix}ONa\\OC_2H_5,\\OC_2H_5\end{matrix}\right.$$

this reaction being followed by



$$CH_3\cdot C\left\langle\begin{matrix}ONa\\OC_2H_5\\OC_2H_5\end{matrix}\right.+\left.\begin{matrix}H\\H\end{matrix}\right\rangle CH\cdot COOC_2H_5=2C_2H_5OH+CH_3\cdot C(ONa):CH\cdot COOC_2H_5;$$

and on acidification this last substance gives aceto-acetic ester. Aceto-acetic ester is a colourless liquid boiling at 181°C.; it is slightly soluble in water, and when distilled undergoes some decomposition forming dehydracetic acid $C_8H_8O_4$. It undoubtedly contains a keto-group, for it reacts with hydrocyanic acid, hydroxylamine, phenylhydrazine and ammonia; sodium bisulphite also combines with it to form a crystalline compound, hence it contains the grouping $CH_3\cdot CO-$. J. Wislicenus found that only one hydrogen atom in the $-CH_2-$ group is directly replaceable by sodium, and that if the sodium be then replaced by an alkyl group, the second hydrogen atom in the group can be replaced in the same manner. These alkyl substitution products are important, for they lead to the synthesis of many organic compounds, on account of the fact that they can be hydrolysed in two different ways, barium hydroxide or dilute sodium hydroxide solution giving the so-called ketone hydrolysis, whilst concentrated sodium hydroxide gives the acid hydrolysis.

Ketone hydrolysis;—

$$CH_3\cdot CO\cdot C(XY)\cdot CO_2C_2H_5\rightarrow CH_3\cdot CO\cdot CH(XY)+C_2H_5OH+CO_2;$$

Acid hydrolysis:—

$$CH_3\cdot CO\cdot C(XY)\cdot CO_2C_2H_5\rightarrow CH_3\cdot CO_2H+C_2H_5OH+CH(XY)\cdot COOH;$$

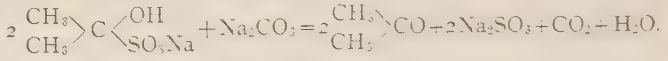
(where X and Y =alkyl groups).

Both reactions occur to some extent simultaneously. Aceto-acetic ester is a most important synthetic reagent, having been used in the production of pyridines (*q.v.*), quinolines (*q.v.*), pyrazolones, furfurane (*q.v.*), pyrrols (*q.v.*), uric acid (*q.v.*), and many complex acids and ketones.

For a discussion as to the composition, and whether it is to be regarded as possessing the " keto " form $CH_3\cdot CO\cdot CH_2\cdot COOC_2H_5$ or the "enol" form $CH_3\cdot C(OH):CH\cdot COOC_2H_5$, see ISOMERISM, and also papers by J. Wislicenus (*Ann.*, 1877, 186, p. 163; 1877, 190, p. 257), A. Michael (*Journ. Prak. Chem.*, 1887, [2] 37, p. 473), L. Knorr (*Ann.*, 1886, 238, p. 147), W. H. Perkin, senr. (*Journ. of Chem. Soc.*, 1892, 61, p. 800) and J. U. Nef (*Ann.*, 1891, 266, p. 70; 1892, 270, pp. 289, 333; 1893, 276, p. 212).

ACETONE, or DIMETHYL KETONE, $CH_3\cdot CO\cdot CH_3$, in chemistry, the simplest representative of the aliphatic ketones. It is present in very small quantity in normal urine, in the blood, and in larger quantities in diabetic patients. It is found among the products formed in the destructive distillation of wood, sugar, cellulose, &c., and for this reason it is always present in crude wood spirit, from which the greater portion of it may be recovered by fractional distillation. On the large scale it is prepared by the dry distillation of calcium acetate $(CH_3CO_2)_2Ca=CaCO_3+CH_3COCH_3$. E. R. Squibb (*Journ. Amer. Chem. Soc.*, 1895, 17, p. 187) manufactures it by passing the vapour of acetic acid through a rotating iron cylinder containing a mixture of pumice and precipitated barium carbonate, and kept at a temperature of from 500° C. to 600° C. The mixed vapours of acetone, acetic acid and water are then led through a condensing apparatus so that the acetic acid and water are first condensed, and then the acetone is condensed in a second vessel. The barium carbonate used in the process acts as a contact substance, since the temperature at which the operation is carried out is always above the decomposition point of barium acetate.

Crude acetone may be purified by converting it into the crystalline sodium bisulphite compound, which is separated by filtration and then distilled with sodium carbonate.



$$2\left.\begin{matrix}CH_3\\CH_3\end{matrix}\right\rangle C\left\langle\begin{matrix}OH\\SO_3Na\end{matrix}\right.+Na_2CO_3=2\left.\begin{matrix}CH_3\\CH_3\end{matrix}\right\rangle CO+2Na_2SO_3+CO_2+H_2O.$$

It is then dehydrated and redistilled.

Acetone is largely used in the manufacture of cordite (*q.v.*). For this purpose the crude distillate is redistilled over sulphuric acid and then fractionated.

Acetone is a colourless mobile liquid of pleasant smell, boiling at 56·53°C., and has a specific gravity 0·819(0°/4°C.). It is readily soluble in water, alcohol, ether, &c. In addition to its application in the cordite industry, it is used in the manufacture of chloroform (*q.v.*) and sulphonal, and as a solvent. It forms a hydrazone with phenyl hydrazine, and an oxime with hydroxylamine. Reduction by sodium amalgam converts it into isopropyl alcohol; oxidation by chromic acid gives carbon dioxide and acetic acid. With ammonia it reacts to form di- and triacetoneamines. It also unites directly with hydrocyanic acid to form the nitrile of α-oxyisobutyric acid.

By the action of various reagents such as lime, caustic potash, hydrochloric acid, &c., acetone is converted into condensation products, mesityl oxide $C_6H_{10}O$, phorone $C_9H_{14}O$, &c., being formed. On distillation with sulphuric acid, it is converted into mesitylene C_9H_{12}(symmetrical trimethyl benzene). Acetone has also been used in the artificial production of indigo. In the presence of iodine and an alkali it gives iodoform. Acetone has been employed medicinally in cases of dyspnoea. With potassium iodide, glycerin and water, it forms the preparation spirone, which has been used as a spray inhalation in paroxysmal sneezing and asthma.

ACETOPHENONE, or PHENYL-METHYL KETONE, C_8H_8O or $C_6H_5CO\cdot CH_3$, in chemistry, the simplest representative of the class of mixed aliphatic-aromatic ketones. It can be prepared by distilling a mixture of dry calcium benzoate and acetate, $Ca(O_2CC_6H_5)_2+(CH_3CO_2)_2Ca=2CaCO_3+2C_6H_5CO\cdot CH_3$, or by condensing benzene with acetyl chloride in the presence of anhydrous aluminium chloride (C. Friedel and J. M. Crafts), $C_6H_6+CH_3COCl=HCl+C_6H_5COCH_3$. It crystallizes in colourless plates melting at 20°C. and boiling at 202°C.; it is insoluble in water, but readily dissolves in the ordinary organic solvents. It is reduced by nascent hydrogen to the secondary alcohol $C_6H_5\cdot CH\cdot OH\cdot CH_3$ phenyl-methyl-carbinol, and on oxidation forms benzoic acid. On the addition of phenylhydrazine it gives a phenylhydrazone, and with hydroxylamine furnishes an oxime $\left.\begin{matrix}C_6H_5\\CH_3\end{matrix}\right\rangle C=N\cdot OH$ melting at 59°C. This oxime undergoes a peculiar rearrangement when it is dissolved in ether and phosphorus pentachloride is added to the ethereal solution, the excess of ether distilled off and water added to the residue being converted into the isomeric substance acetanilide, $C_6H_5NHCOCH_3$, a behaviour shown by many ketoximes and known as the Beckmann change (see *Berichte*, 1886, 19, p. 988). With sodium ethylate in ethyl acetate solution it forms the sodium derivative of benzoyl acetone, from which benzoyl acetone, $C_6H_5\cdot CO\cdot CH_2\cdot CO\cdot CH_3$, can be obtained by acidification with acetic acid. When heated with the halogens, acetophenone is substituted in the aliphatic portion of the nucleus; thus bromine gives phenacyl bromide, $C_6H_5CO\cdot CH_2Br$. Numerous derivatives of acetophenone have been prepared, one of the most important being orthoaminoacetophenone, $NH_2\cdot C_6H_4\cdot CO\cdot CH_3$, which is obtained by boiling orthoaminophenylpropiolic acid with water. It is a thick yellowish oil boiling between 242° C. and 250° C. It condenses with acetone in the presence of caustic soda to a quinoline. *Acetonyl-acetophenone*, $C_6H_5\cdot CO\cdot CH_2\cdot CH_2\cdot CO\cdot CH_3$, is produced by condensing phenacyl bromide with sodium aceto-acetate with subsequent elimination of carbon dioxide, and on dehydration gives αα-phenyl-methyl-furfurane. Oxazoles (*q.v.*) are produced on condensing phenacyl bromide with acid-amides (M. Lewy, *Berichte*, 1887, 20, p. 2578). K. L. Paal has also obtained pyrrol derivatives by condensing acetophenone-aceto-acetic-ester with substances of the type NH_2R.

Physical properties.

ACETYLENE, klumene or ethine, a gaseous compound of carbon and hydrogen, represented by the formula C_2H_2. It is a colourless gas, having a density of 0·92. When prepared by the action of water upon calcium carbide, it has a very strong and penetrating odour, but when it is thoroughly purified from sulphuretted and phosphuretted hydrogen, which are invariably present with it in minute traces, this extremely pungent odour disappears, and the pure gas has a not unpleasant ethereal smell. It can be condensed into the liquid state by cold or by pressure, and experiments by G. Ansdell show that if the gas be subjected to a pressure of 21·53 atmospheres at a temperature of 0° C., it is converted into the liquid state, the pressure needed increasing with the rise of temperature, and decreasing with the lowering of the temperature, until at $-82°$ C. it becomes liquid under ordinary atmospheric pressure. The critical point of the gas is 37° C., at which temperature a pressure of 68 atmospheres is required for liquefaction. The properties of liquid and solid acetylene have been investigated by D. McIntosh (*Jour. Chem. Soc., Abs.*, 1907, i. 458). A great future was expected from its use in the liquid state, since a cylinder fitted with the necessary reducing valves would supply the gas to light a house for a considerable period, the liquid occupying about $\frac{1}{400}$ the volume of the gas, but in the United States and on the continent of Europe, where liquefied acetylene was made on the large scale, several fatal accidents occurred owing to its explosion under not easily explained conditions. As a result of these accidents M. P. E. Berthelot and L. J. G. Vieille made a series of valuable researches upon the explosion of acetylene under various conditions. They found that if liquid acetylene in a steel bottle be heated at one point by a platinum wire raised to a red heat, the whole mass decomposes and gives rise to such tremendous pressures that no cylinder would be able to withstand them. These pressures varied from 71,000 to 100,000 ℔. per square inch. They, moreover, tried the effect of shock upon the liquid, and found that the repeated dropping of the cylinder from a height of nearly 20 feet upon a large steel anvil gave no explosion, but that when the cylinder was crushed under a heavy blow the impact was followed, after a short interval of time, by an explosion which was manifestly due to the fracture of the cylinder and the ignition of the escaping gas, mixed with air, from sparks caused by the breaking of the metal. A similar explosion will frequently follow the breaking in the same way of a cylinder charged with hydrogen at a high pressure. Continuing these experiments, they found that in acetylene gas under ordinary pressures the decomposition brought about in one portion of the gas, either by heat or the firing in it of a small détonator, did not spread far beyond the point at which the decomposition started, while if the acetylene was compressed to a pressure of more than 30 ℔ on the square inch, the decomposition travelled throughout the mass and became in reality detonation. These results showed clearly that liquefied acetylene was far too dangerous for general introduction for domestic purposes, since, although the occasions would be rare in which the requisite temperature to bring about detonation would be reached, still, if this point were attained, the results would be of a most disastrous character. The fact that several accidents had already happened accentuated the risk, and in Great Britain the storage and use of liquefied acetylene are prohibited.

When liquefied acetylene is allowed to escape from the cylinder in which it is contained into ordinary atmospheric pressure, some of the liquid assumes the gaseous condition with such rapidity as to cool the remainder below the temperature of $-90°$ C., and convert it into a solid snow-like mass.

Solubility of acetylene.

Acetylene is readily soluble in water, which at normal temperature and pressure takes up a little more than its own volume of the gas, and yields a solution giving a purple-red precipitate with ammoniacal cuprous chloride and a white precipitate with silver nitrate, these precipitates consisting of acetylides of the metals. The solubility of the gas in various liquids, as given by different observers, is—

100 Volumes of		Volumes of Acetylene.
Brine	absorb	5
Water	,,	110
Alcohol	,,	600
Paraffin	,,	150
Carbon disulphide	,,	100
Fusel oil	,,	100
Benzene	,,	400
Chloroform	,,	400
Acetic acid	,,	600
Acetone	,,	2500

It will be seen from this table that where it is desired to collect and keep acetylene over a liquid, brine, *i.e.* water saturated with salt, is the best for the purpose, but in practice it is found that, unless water is agitated with acetylene, or the gas bubbled through, the top layer soon gets saturated, and the gas then dissolves but slowly. The great solubility of acetylene in acetone was pointed out by G. Claude and A. Hess, who showed that acetone will absorb twenty-five times its own volume of acetylene at a temperature of 15° C. under atmospheric pressure, and that, providing the temperature is kept constant, the liquid acetone will go on absorbing acetylene at the rate of twenty-five times its own volume for every atmosphere of pressure to which the gas is subjected.

At first it seemed as if this discovery would do away with all the troubles connected with the storage of acetylene under pressure, but it was soon found that there were serious difficulties still to be overcome. The chief trouble was that acetone expands a small percentage of its own volume while it is absorbing acetylene; therefore it is impossible to fill a cylinder with acetone and then force in acetylene, and still more impracticable only partly to fill the cylinder with acetone, as in that case the space above the liquid would be filled with acetylene under high pressure, and would have all the disadvantages of a cylinder containing compressed acetylene only. This difficulty was overcome by first filling the cylinder with porous briquettes and then soaking them with a fixed percentage of acetone, so that after allowing for the space taken up by the bricks the quantity of acetone soaked into the brick will absorb ten times the normal volume of the cylinder in acetylene for every atmosphere of pressure to which the gas is subjected, whilst all danger of explosion is eliminated.

This fact having been fully demonstrated, acetylene dissolved in this way was exempted from the Explosives Act, and consequently upon this exemption a large business has grown up in the preparation and use of dissolved acetylene for lighting motor omnibuses, motor cars, railway carriages, lighthouses, buoys, yachts, &c., for which it is particularly adapted.

Poisonous properties.

Acetylene was at one time supposed to be a highly poisonous gas, the researches of A. Bistrow and O. Liebreich having apparently shown that it acts upon the blood in the same way as carbon monoxide to form a stable compound. Very extensive experiments, however, made by Drs N. Grehant, A. L. Brociner, L. Crismer, and others, all conclusively show that acetylene is much less toxic than carbon monoxide, and indeed than coal gas.

Chemical properties.

When acetylene was first introduced on a commercial scale grave fears were entertained as to its safety, it being represented that it had the power of combining with certain metals, more especially copper and silver, to form acetylides of a highly explosive character, and that even with coal gas, which contains less than 1%, such copper compounds had been known to be formed in cases where the gas-distributing mains were composed of copper, and that accidents had happened from this cause. It was therefore predicted that the introduction of acetylene on a large scale would be followed by numerous accidents unless copper and its alloys were rigidly excluded from contact with the gas. These fears have, however, fortunately proved to be unfounded, and ordinary gas fittings can be used with perfect safety with this gas.

Acetylene has the property of inflaming spontaneously when brought in contact with chlorine. If a few pieces of carbide be dropped into saturated chlorine water the bubbles of gas take fire as they reach the surface, and if a jet of acetylene be passed up into a bottle of chlorine it takes fire and burns with a heavy red flame, depositing its carbon in the form of soot. If chlorine be bubbled up into a jar of acetylene standing over water, a violent explosion, attended with a flash of intense light and the deposition of carbon, at once takes place. When the gas is kept in a small glass holder exposed to direct sunlight, the surface of the glass soon becomes dimmed, and W. A. Bone has shown that when exposed for some time to the sun's rays it undergoes certain polymerization changes which lead to the deposition of a film of heavy hydrocarbons on the surface of the tube. It has also been observed by L. Cailletet and later by P. Villard that when allowed to stand in the presence of water at a low temperature a solid hydrate is formed. Acetylene is readily decomposed by heat, polymerizing under its influence to form an enormous number of organic compounds; indeed the gas, which can itself be directly prepared from its constituents, carbon and hydrogen, under the influence of the electric arc, can be made the starting-point for the construction of an enormous number of different organic compounds of a complex character. In contact with nascent hydrogen it builds up ethylene; ethylene acted upon by sulphuric acid yields ethyl sulphuric acid; this can again be decomposed in the presence of water to yield alcohol, and it has also been proposed to manufacture sugar from this body. Picric acid can also be obtained from it by first treating acetylene with sulphuric acid, converting the product into phenol by solution in potash and then treating the phenol with fuming nitric acid.

The polymerization of acetylene.

Endothermic nature of acetylene.

Acetylene is one of those bodies the formation of which is attended with the disappearance of heat, and it is for this reason termed an "endothermic" compound, in contradistinction to those bodies which evolve heat in their formation, and which are called "exothermic." Such endothermic bodies are nearly always found to show considerable violence in their decomposition, as the heat of formation stored up within them is then liberated as sensible heat, and it is undoubtedly this property of acetylene gas which leads to its easy detonation by either heat or a shock from an explosion of fulminating mercury when in contact with it under pressure. The observation that acetylene can be resolved into its constituents by detonation is due to Berthelot, who started an explosive wave in it by firing a charge of 0·1 gram of mercury fulminate. It has since been shown, however, that unless the gas is at a pressure of more than two atmospheres this wave soon dies out, and the decomposition is only propagated a few inches from the detonator. Heated in contact with air to a temperature of 480° C., acetylene ignites and burns with a flame, the appearance of which varies with the way in which it is brought in contact with the air. With the gas in excess a heavy lurid flame emitting dense volumes of smoke results, whilst if it be driven out in a sufficiently thin sheet, it burns with a flame of intense brilliancy and almost perfect whiteness, by the light of which colours can be judged as well as they can by daylight. Having its ignition point below that of ordinary gas, it can be ignited by any red-hot carbonaceous matter, such as the brightly glowing end of a cigar. For its complete combustion a volume of acetylene needs approximately twelve volumes of air, forming as products of combustion carbon dioxide and water vapour. When, however, the air is present in much smaller ratio the combustion is incomplete, and carbon, carbon monoxide, carbon dioxide, hydrogen and water vapour are produced. This is well shown by taking a cylinder one-half full of acetylene and one-half of air; on applying a light to the mixture a lurid flame runs down the cylinder and a cloud of soot is thrown up, the cylinder also being thickly coated with it, and often containing a ball of carbon. If now, after a few moments' interval to allow some air to diffuse into the cylinder, a taper again be applied, an explosion takes place, due to a mixture of carbon monoxide and air. It is probable that when a flame is smoking badly, distinct traces of carbon monoxide are being produced, but when an acetylene flame burns properly the products are as harmless as those of coal gas, and, light for light, less in amount. Mixed with air, like every other combustible gas, acetylene forms an explosive mixture. F. Clowes has shown that it has a wider range of explosive proportions when mixed with air than any of the other combustible gases, the limiting percentages being as follows:—

Acetylene	3 to 82
Hydrogen	5 to 72
Carbon monoxide	13 to 75
Ethylene	4 to 22
Methane	5 to 13

Methods of production.

The methods which can be and have been employed from time to time for the formation of acetylene in small quantities are exceedingly numerous. Before the commercial production of calcium carbide made it one of the most easily obtainable gases, the processes which were most largely adopted for its preparation in laboratories were:—first, the decomposition of ethylene bromide by dropping it slowly into a boiling solution of alcoholic potash, and purifying the evolved gas from the volatile bromethylene by washing it through a second flask containing a boiling solution of alcoholic potash, or by passing it over moderately heated soda lime; and, second, the more ordinarily adopted process of passing the products of incomplete combustion from a Bunsen burner, the flame of which had struck back, through an ammoniacal solution of cuprous chloride, when the red copper acetylide was produced. This on being washed and decomposed with hydrochloric acid yielded a stream of acetylene gas. This second method of production has the great drawback that, unless proper precautions are taken to purify the gas obtained from the copper acetylide, it is always contaminated with certain chlorine derivatives of acetylene. Edmund Davy first made acetylene in 1836 from a compound produced during the manufacture of potassium from potassium tartrate and charcoal, which under certain conditions yielded a black compound decomposed by water with considerable violence and the evolution of acetylene. This compound was afterwards fully investigated by J. J. Berzelius, who showed it to be potassium carbide. He also made the corresponding sodium compound and showed that it evolved the same gas, whilst in 1862 F. Wöhler first made calcium carbide, and found that water decomposed it into lime and acetylene. It was not, however, until 1892 that the almost simultaneous discovery was made by T. L. Willson in America and H. Moissan in France that if lime and carbon be fused together at the temperature of the electric furnace, the lime is reduced to calcium, which unites with the excess of carbon present to form calcium carbide. The cheap production of this material and the easy liberation by its aid of acetylene at once gave the gas a position of commercial importance. In the manufacture of calcium carbide in the electric furnace, lime and anthracite of the highest possible degree of purity are employed. A good working mixture of these materials may be taken as being 100 parts by weight of lime with 68 parts by weight of carbonaceous material. About 1·8 lb of this is used up for each pound of carbide produced. The two principal processes utilized in making calcium carbide by electrical power are the ingot process and the tapping process. In the former, the anthracite and lime are ground and carefully mixed in the right proportions to suit the chemical actions involved. The arc is struck in a crucible into which the mixture is allowed to flow, partially filling it. An ingot gradually builds up from the bottom of the crucible, the carbon electrode being raised from time to time automatically or by hand to suit the diminution of resistance due to the shortening of the arc by the rising ingot. The crucible is of metal and considerably larger than the ingot, the latter being surrounded by a mass of unreduced material which protects the crucible from the intense heat. When the ingot has been made and the crucible is full, the latter is withdrawn and another substituted. The process is not continuous, but a change of crucibles only takes two or three minutes under the best conditions, and only occurs every ten or fifteen hours. The essence of this process is that the coke and lime are only heated to the point of combination, and are not

Manufacture of calcium carbide.

"boiled" after being formed. It is found that the ingot of calcium carbide formed in the furnace, although itself consisting of pure crystalline calcium carbide, is nearly always surrounded by a crust which contains a certain proportion of imperfectly converted constituents, and therefore gives a lower yield of acetylene than the carbide itself. In breaking up and sending out the carbide for commercial work, packed in air-tight drums, the crust is removed by a sand blast. A statement of the amount made per kilowatt hour may be misleading, since a certain amount of loss is of necessity entailed during this process. For instance, in practical working it has been found that a furnace return of 0·504 ℔ per kilowatt hour is brought down to 0·406 ℔ per kilowatt hour when the material has been broken up, sorted and packed in air-tight drums. In the tapping process a fixed crucible is used, lined with carbon, the electrode is nearly as big as the crucible and a much higher current density is used. The carbide is heated to complete liquefaction and tapped at short intervals. There is no unreduced material, and the process is considerably simplified, while less expensive plant is required. The run carbide, however, is never so rich as the ingot carbide, since an excess of lime is nearly always used in the mixture to act as a flux, and this remaining in the carbide lowers its gas-yielding power. Many attempts have been made to produce the substance without electricity, but have met with no commercial success.

Properties of calcium carbide.

Calcium carbide, as formed in the electric furnace, is a beautiful crystalline semi-metallic solid, having a density of 2·22, and showing a fracture which is often shot with iridescent colours. It can be kept unaltered in dry air, but the smallest trace of moisture in the atmosphere leads to the evolution of minute quantities of acetylene and gives it a distinctive odour. It is infusible at temperatures up to 2000° C., but can be fused in the electric arc. When heated to a temperature of 245° C. in a stream of chlorine gas it becomes incandescent, forming calcium chloride and liberating carbon, and it can also be made to burn in oxygen at a dull red heat, leaving behind a residue of calcium carbonate. Under the same conditions it becomes incandescent in the vapour of sulphur, yielding calcium sulphide and carbon disulphide; the vapour of phosphorus will also unite with it at a red heat. Acted upon by water it is at once decomposed, yielding acetylene and calcium hydrate. Pure crystalline calcium carbide yields 5·8 cubic feet of acetylene per pound at ordinary temperatures, but the carbide as sold commercially, being a mixture of the pure crystalline material with the crust which in the electric furnace surrounds the ingot, yields at the best 5 cubic feet of gas per pound under proper conditions of generation. The volume of gas obtained, however, depends very largely upon the form of apparatus used, and while some will give the full volume, other apparatus will only yield, with the same carbide, 3¾ feet. The purity of the carbide entirely depends on the purity of the material used in its manufacture, and before this fact had been fully grasped by manufacturers, and only the purest material obtainable employed, it contained notable quantities of compounds which during its decomposition by water yielded a somewhat high proportion of impurities in the acetylene generated from it. Although at the present time a marvellous improvement has taken place all round in the quality of the carbide produced, the acetylene nearly always contains minute traces of hydrogen, ammonia, sulphuretted hydrogen, phosphuretted hydrogen, silicon hydride, nitrogen and oxygen, and sometimes minute traces of carbon monoxide and dioxide. The formation of hydrogen is caused by small traces of metallic calcium occasionally found free in the carbide, and cases have been known where this was present in such quantities that the evolved gas contained nearly 20 % of hydrogen. This takes place when in the manufacture of the carbide the material is kept too long in contact with the arc, since this overheating causes the dissociation of some of the calcium carbide and the solution of metallic calcium in the remainder. The presence of free hydrogen is nearly always accompanied by silicon hydride formed by the combination of the nascent hydrogen with the silicon in the carbide. The ammonia found in the acetylene is probably partly due to the presence of magnesium nitride in the carbide.

Impurities.

On decomposition by water, ammonia is produced by the action of steam or of nascent hydrogen on the nitride, the quantity formed depending very largely upon the temperature at which the carbide is decomposed. The formation of nitrides and cyanamides by actions of this kind and their easy conversion into ammonia is a useful method for fixing the nitrogen of the atmosphere and rendering it available for manurial purposes. Sulphuretted hydrogen, which is invariably present in commercial acetylene, is formed by the decomposition of aluminium sulphide. A. Mourlot has shown that aluminium sulphide, zinc sulphide and cadmium sulphide are the only sulphur compounds which can resist the heat of the electric furnace without decomposition or volatilization, and of these aluminium sulphide is the only one which is decomposed by water with the evolution of sulphuretted hydrogen. In the early samples of carbide this compound used to be present in considerable quantity, but now rarely more than $\frac{1}{10}$ % is to be found. Phosphuretted hydrogen, one of the most important impurities, which has been blamed for the haze formed by the combustion of acetylene under certain conditions, is produced by the action of water upon traces of calcium phosphide found in carbide. Although at first it was no uncommon thing to find ½ % of phosphuretted hydrogen present in the acetylene, this has now been so reduced by the use of pure materials that the quantity is rarely above 0·15 %, and it is often not one-fifth of that amount.

Generation of acetylene from carbide.

In the generation of acetylene from calcium carbide and water, all that has to be done is to bring these two compounds into contact, when they mutually react upon each other with the formation of lime and acetylene, while, if there be sufficient water present, the lime combines with it to form calcium hydrate.

$$\begin{array}{ccccccc} \text{Calcium carbide.} & & \text{Water.} & & \text{Acetylene.} & & \text{Lime.} \\ CaC_2 & + & H_2O & = & C_2H_2 & + & CaO \end{array}$$

$$\begin{array}{ccccc} \text{Lime.} & & \text{Water.} & & \text{Calcium hydrate.} \\ CaO & + & H_2O & = & Ca(HO)_2 \end{array}$$

The decomposition of the carbide by water may be brought about either by bringing the water slowly into contact with an excess of carbide, or by dropping the carbide into an excess of water, and these two main operations again may be varied by innumerable ingenious devices by which the rapidity of the contact may be modified or even eventually stopped. The result is that although the forms of apparatus utilized for this purpose are all based on the one fundamental principle of bringing about the contact of the carbide with the water which is to enter into double decomposition with it, they have been multiplied in number to a very large extent by the methods employed in order to ensure control in working, and to get away from the dangers and inconveniences which are inseparable from a too rapid generation.

Generators.

In attempting to classify acetylene generators some authorities have divided them into as many as six different classes, but this is hardly necessary, as they may be divided into two main classes—first, those in which water is brought in contact with the carbide, the carbide being in excess during the first portion of the operation; and, second, those in which the carbide is thrown into water, the amount of water present being always in excess. The first class may again be subdivided into generators in which the water rises in contact with the carbide, in which it drips upon the carbide, and in which a vessel full of carbide is lowered into water and again withdrawn as generation becomes excessive. Some of these generators are constructed to make the gas only as fast as it is consumed at the burner, with the object of saving the expense and room which would be involved by a storage-holder. Generators with devices for regulating and stopping at will the action going on are generally termed "automatic." Another set merely aims at developing the gas from the carbide and putting it into a storage-holder with as little loss as possible, and these are termed "non-automatic." The points to be attained in a good generator are:—

1. Low temperature of generation.
2. Complete decomposition of the carbide.
3. Maximum evolution of the gas.
4. Low pressure in every part of the apparatus.
5. Ease in charging and removal of residues.
6. Removal of all air from the apparatus before generation of the gas.

When carbide is acted upon by water considerable heat is evolved; indeed, the action develops about one-twentieth of the heat evolved by the combustion of carbon. As, however, the temperature developed is a function of the time needed to complete the action, the degree of heat attained varies with every form of generator, and while the water in one form may never reach the boiling-point, the carbide in another may become red-hot and give a temperature of over 800° C. Heating in a generator is not only a source of danger, but also lessens the yield of gas and deteriorates its quality. The best forms of generator are either those in which water rises slowly in contact with the carbide, or the second main division in which the carbide falls into excess of water.

Purification.

It is clear that acetylene, if it is to be used on a large scale as a domestic illuminant, must undergo such processes of purification as will render it harmless and innocuous to health and property, and the sooner it is recognized as absolutely essential to purify acetylene before consuming it the sooner will the gas acquire the popularity it deserves. The only one of the impurities which offers any difficulty in removal is the phosphuretted hydrogen. There are three substances which can be relied on more or less to remove this compound, and the gas to be purified may be passed either through acid copper salts, through bleaching powder or through chromic acid. In experiments with these various bodies it is found that they are all of them effective in also ridding the acetylene of the ammonia and sulphuretted hydrogen, provided only that the surface area presented to the gas is sufficiently large. The method of washing the gas with acid solutions of copper has been patented by A. Frank of Charlottenburg, who finds that a concentrated solution of cuprous chloride in an acid, the liquid being made into a paste with kieselgühr, is the most effective. Where the production of acetylene is going on on a small scale this method of purification is undoubtedly the most convenient one, as the acid present absorbs the ammonia, and the copper salt converts the phosphuretted and sulphuretted hydrogen into phosphates and sulphides. The vessel, however, which contains this mixture has to be of earthenware, porcelain or enamelled iron on account of the free acid present; the gas must be washed after purification to remove traces of hydrochloric acid, and care must be taken to prevent the complete neutralization of the acid by the ammonia present in the gas. The second process is one patented by Fritz Ullmann of Geneva, who utilizes chromic acid to oxidize the phosphuretted and sulphuretted hydrogen and absorb the ammonia, and this method of purification has proved the most successful in practice, the chromic acid being absorbed by kieselgühr and the material sold under the name of "Heratol."

The third process owes its inception to G. Lunge, who recommends the use of bleaching powder. Dr P. Wolff has found that when this is used on the large scale there is a risk of the ammonia present in the acetylene forming traces of chloride of nitrogen in the purifying-boxes, and as this is a compound which detonates with considerable local force, it occasionally gives rise to explosions in the purifying apparatus. If, however, the gas be first passed through a scrubber so as to wash out the ammonia this danger is avoided. Dr Wolff employs purifiers in which the gas is washed with water containing calcium chloride, and then passed through bleaching-powder solution or other oxidizing material.

Burners.

When acetylene is burnt from a 000 union jet burner, at all ordinary pressures a smoky flame is obtained, but on the pressure being increased to 4 inches a magnificent flame results, free from smoke, and developing an illuminating value of 240 candles per 5 cubic feet of gas consumed. Slightly higher values have been obtained, but 240 may be taken as the average value under these conditions. When acetylene was first introduced as a commercial illuminant in England, very small union jet nipples were utilized for its consumption, but after burning for a short time these nipples began to carbonize, the flame being distorted, and then smoking occurred with the formation of a heavy deposit of soot. While these troubles were being experienced in England, attempts had been made in America to use acetylene diluted with a certain proportion of air which permitted it to be burnt in ordinary flat flame nipples; but the danger of such admixture being recognized, nipples of the same class as those used in England were employed, and the same troubles ensued. In France, single jets made of glass were first employed, and then P. Résener, H. Luchaire, G. Ragot and others made burners in which two jets of acetylene, coming from two tubes placed some little distance apart, impinged and splayed each other out into a butterfly flame. Soon afterwards, J. S. Billwiller introduced the idea of sucking air into the flame at or just below the burner tip, and at this juncture the Naphey or Dolan burner was introduced in America, the principle employed being to use two small and widely separated jets instead of the two openings of the union jet burner, and to make each a minute bunsen, the acetylene dragging in from the base of the nipple enough air to surround and protect it while burning from contact with the steatite. This class of burner forms a basis on which all the later constructions of burner have been founded, but had the drawback that if the flame was turned low, insufficient air to prevent carbonization of the burner tips was drawn in, owing to the reduced flow of gas. This fault has now been reduced by a cage of steatite round the burner tip, which draws in sufficient air to prevent deposition.

Oxy-acetylene blowpipe.

When acetylene was first introduced on a commercial scale attempts were made to utilize its great heat of combustion by using it in conjunction with oxygen in the oxy-hydrogen blowpipe. It was found, however, that when using acetylene under low pressures, the burner tip became so heated as to cause the decomposition of some of the gas before combustion, the jet being choked up by the carbon which deposited in a very dense form; and as the use of acetylene under pressures greater than one hundred inches of water was prohibited, no advance was made in this direction. The introduction of acetylene dissolved under pressure in acetone contained in cylinders filled with porous material drew attention again to this use of the gas, and by using a special construction of blowpipe an oxy-acetylene flame is produced, which is far hotter than the oxy-hydrogen flame, and at the same time is so reducing in its character that it can be used for the direct autogenous welding of steel and many minor metallurgical processes.

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ACHAEA, a district on the northern coast of the Peloponnese, stretching from the mountain ranges of Erymanthus and Cyllene on the S. to a narrow strip of fertile land on the N., bordering the Corinthian Gulf, into which the mountain Panachaicus projects. Achaea is bounded on the W. by the territory of Elis, on the E. by that of Sicyon, which, however, was sometimes included in it. The origin of the name has given rise to much speculation; the current theory is that the Achaeans (*q.v.*) were driven back into this region by the Dorian invaders of the Peloponnese. Another Achaea, in the south of Thessaly, called sometimes Achaea Phthiotis, has been supposed to be the cradle of the race. In Roman times the name of the province of Achaea was given to the whole of Greece, except Thessaly, Epirus, and Acarnania. Herodotus (i. 145) mentions the twelve cities of Achaea; these met as a religious confederacy in the temple of Poseidon Heliconius at Helice; for their later history see ACHAEAN LEAGUE. During the middle ages, after the Latin conquest of the Eastern Empire, Achaea was a Latin principality, the first prince being William de Champlitte (d. 1209). It survived, with various dismemberments, until 1430, when the last prince, Centurione Zaccaria, ceded the remnant of it to his son-in-law, Theodorus II., despot of Mistra. In 1460 it was conquered, with the rest of the Morea, by the Turks. In modern times the coast of Achaea is mainly given up to the currant industry; the currants are shipped from Patras, the second town of Greece, and from Aegion (Vostitza).

ACHAEAN LEAGUE, a confederation of the ancient towns of Achaea. Standing isolated on their narrow strips of plain, these towns were always exposed to the raids of pirates issuing from the recesses of the north coast of the Corinthian Gulf. It was no doubt as a protection against such dangers that the earliest league of twelve Achaean cities arose, though we are nowhere explicitly informed of its functions other than the common worship of Zeus Amarius at Aegium and an occasional arbitration between Greek belligerents. Its importance grew in the 4th century, when we find it fighting in the Theban wars (368–362 B.C.), against Philip (338) and Antipater (330). About 288 Antigonus Gonatas dissolved the league, which had furnished a useful base for pretenders against Cassander's regency; but by 280 four towns combined again, and before long the ten surviving cities of Achaea had renewed their federation. Antigonus' preoccupation during the Celtic invasions, Sparta's prostration after the Chremonidean campaigns, the wealth amassed by Achaean adventurers abroad and the subsidies of Egypt, the standing foe of Macedonia, all enhanced the league's importance. Most of all did it profit by the statesmanship of Aratus (*q.v.*), who initiated its expansive policy, until in 228 it comprised Arcadia, Argolis, Corinth and Aegina.

Aratus probably also organized the new federal constitution, the character of which, owing to the scanty and somewhat perplexing nature of our evidence, we can only approximately determine. The league embraced an indefinite number of city-states which maintained their internal independence practically undiminished, and through their several magistrates, assemblies and law-courts exercised all traditional powers of self-government. Only in matters of foreign politics and war was their competence restricted.

The central government, like that of the constituent cities, was of a democratic cast. The chief legislative powers resided in a popular assembly in which every member of the league over thirty years of age could speak and vote. This body met for three days in spring and autumn at Aegium to discuss the league's policy and elect the federal magistrates. Whatever the number of its attendant burgesses, each city counted but one on a division. Extraordinary assemblies could be convoked at any time or place on special emergencies. A council of 120 unpaid delegates, selected from the local councils, served partly as a committee for preparing the assembly's programme, partly as an administrative board which received embassies, arbitrated between contending cities and exercised penal jurisdiction over offenders against the constitution. But perhaps some of these duties concerned the dicastae and gerousia, whose functions are nowhere described. The chief magistracy was the *strategia* (tenable every second year), which combined with an unrestricted command in the field a large measure of civil authority. Besides being authorized to veto motions, the strategus (general) had practically the sole power of introducing measures before the assembly. The ten elective *demiurgi*, who presided over this body, formed a kind of cabinet, and perhaps acted as departmental chiefs. We also hear of an under-strategus, a secretary, a cavalry commander and an admiral. All these higher officers were unpaid. Philopoemen (*q.v.*) transferred the seat of assembly from town to town by rotation, and placed dependent communities on an equal footing with their former suzerains.

The league prescribed uniform laws, standards and coinage; it summoned contingents, imposed taxes and fined or coerced refractory members.

The first federal wars were directed against Macedonia; in 266–263 the league fought in the Chremonidean league, in 243–241 against Antigonus Gonatas and Aetolia, between 239 and 229 with Aetolia against Demetrius. A greater danger arose (227–223) from the attacks of Cleomenes III. (*q.v.*). Owing to Aratus's irresolute generalship, the indolence of the rich burghers and the inadequate provision for levying troops and paying mercenaries, the league lost several battles and much of its territory; but rather than compromise with the Spartan Gracchus the assembly negotiated with Antigonus Doson, who recovered the lost districts but retained Corinth for himself (223–221). Similarly the Achaeans could not check the incursions of Aetolian adventurers in 220–218, and when Philip V. came to the rescue he made them tributary and annexed much of the Peloponnese. Under Philopoemen the league with a reorganized army routed the Aetolians (210) and Spartans (207, 201). After their benevolent neutrality during the Macedonian war the Roman general, T. Quinctius Flamininus, restored all their lost possessions and sanctioned the incorporation of Sparta and Messene (191), thus bringing the entire Peloponnese under Achaean control. The league even sent troops to Pergamum against Antiochus (190). The annexation of Aetolia and Zacynthus was forbidden by Rome. Moreover, Sparta and Messene always remained unwilling members. After Philopoemen's death the aristocrats initiated a strongly philo-Roman policy, declared war against King Perseus and denounced all sympathizers with Macedonia. This agitation induced the Romans to deport 1000 prominent Achaeans, and, failing proof of treason against Rome, to detain them seventeen years. These hostages, when restored in 150, swelled the ranks of the proletariate opposition, whose leaders, to cover their maladministration at home, precipitated a war by attacking Sparta in defiance of Rome. The federal troops were routed in central Greece by Q. Caecilius Metellus Macedonicus, and again near Corinth by L. Mummius Achaicus (146). The Romans now dissolved the league (in effect, if not in name), and took measures to isolate the communities (see POLYBIUS). Augustus instituted an Achaean synod comprising the dependent cities of Peloponnese and central Greece; this body sat at Argos and acted as guardian of Hellenic sentiment.

The chief defect of the league lay in its lack of proper provision for securing efficient armies and regular payment of imposts, and for dealing with disaffected members. Moreover, owing to difficulties of travel, the assembly and magistracies were practically monopolized by the rich, who shaped the federal policy in their own interest. But their rule was mostly judicious, and when at last they lost control the ensuing mob-rule soon ruined the country. On the other hand, it is the glory of the Achaean league to have combined city autonomy with an organized central administration, and in this way to have postponed the entire destruction of Greek liberty for over a century.

CHIEF SOURCES.—Polybius (esp. bks. ii., iv., v., xxiii., xxviii.),who is followed by Livy (bks. xxxii.-xxxv., xxxviii., &c.); Pausanias vii. 9-24; Strabo viii. 384; E. Freeman, *Federal Government*, i. (ed. 1893, London), chs. v.-ix.; M. Dubois, *Les ligues Étolienne et Achéenne* (Paris, 1885); A. Holm, *Greek History*, iv.; G. Hertzberg, *Geschichte Griechenlands unter den Römern*, i. (Leipzig, 1866); L. Warren, *Greek Federal Coinage* (London, 1863); E. Hicks, *Greek Historical Inscriptions* (Oxford, 1892), 169, 187, 198, 201; W. Dittenberger, *Sylloge Inscriptionum Graecarum* (Leipzig, 1898–1901), 236, 282, 316; H. Francotte in *Musée Belge* (1906), pp. 4-20. See also art. ROME, *History*, ii. "The Republic," sect. B(b).

(M. O. B. C.)

ACHAEANS ('Αχαιοί, Lat. *Achivi*), one of the four chief divisions of the ancient Greek peoples, descended, according to legend, from Achaeus, son of Xuthus, son of Hellen. This Hesiodic genealogy connects the Achaeans closely with the Ionians, but historically they approach nearer to the Aeolians. Some even hold that Aeolus is only a form of Achaeus. In the Homeric poems (1000 B.C.) the Achaeans are the master race in Greece; they are represented both in Homer and in all later traditions as having come into Greece about three generations before the Trojan war (1184 B.C.), *i.e.* about 1300 B.C. They found the land occupied by a people known by the ancients as Pelasgians, who continued down to classical times the main element in the population even in the states under Achaean and later under Dorian rule. In some cases it formed a serf class, *e.g.* the Penestae in Thessaly, the Helots in Laconia and the Gymnesii at Argos, whilst it practically composed the whole population of Arcadia and Attica, which never came under either Achaean or Dorian rule. This people had dwelt in the Aegean from the Stone Age, and, though still in the Bronze Age at the Achaean conquest, had made great advances in the useful and ornamental arts. They were of short stature, with dark hair and eyes, and generally dolichocephalic. Their chief centres were at Cnossus (Crete), in Argolis, Laconia and Attica, in each being ruled by ancient lines of kings. In Argolis Proetus built Tiryns, but later, under Perseus, Mycenae took the lead until the Achaean conquest. All the ancient dynasties traced their descent from Poseidon, who at the time of the Achaean conquest was the chief male divinity of Greece and the islands. The Pelasgians probably spoke an Indo-European language adopted by their conquerors with slight modifications. (See further Pelasgians for a discussion of other views.)

The Achaeans, on the other hand, were tall, fair-haired and grey-eyed, and their chiefs traced their descent from Zeus, who with the Hyperborean Apollo was their chief male divinity. They first appear at Dodona, whence they crossed Pindus into Phthiotis. The leaders of the Achaean invasion were Pelops, who took possession of Elis, and Aeacus, who became master of Aegina and was said to have introduced there the worship of Zeus Panhellenius, whose cult was also set up at Olympia. They brought with them iron, which they used for their long swords and for their cutting implements; the costume of both sexes was distinct from that of the Pelasgians; they used round shields with a central boss instead of the 8-shaped or rectangular shields of the latter; they fastened their garments with brooches, and burned their dead instead of burying them as did the Pelasgians. They introduced a special style of ornament (“geometric”) instead of that of the Bronze Age, characterized by spirals and marine animals and plants. The Achaeans, or Hellenes, as they were later termed, were on this hypothesis one of the fair-haired tribes of upper Europe known to the ancients as *Keltoi* (Celts), who from time to time have pressed down over the Alps into the southern lands, successively as Achaeans, Gauls, Goths and Franks, and after the conquest of the indigenous small dark race in no long time died out under climatic conditions fatal to their physique and morale. The culture of the Homeric Achaeans corresponds to a large extent with that of the early Iron Age of the upper Danube (*Hallstatt*) and to the early Iron Age of upper Italy (*Villanova*).

See W. Ridgeway, *The Early Age of Greece* (1901), for a detailed discussion of the evidence; articles by Ridgeway and J. L. Myres in the *Classical Review*, vol. xvi., 1902, pp. 68-93, 135. See also J. B. Bury's *History of Greece* (1902), and art. in *Journal of Hellenic Studies*, xv., 1895, pp. 217 foll.; G. G. A. Murray, *Rise of the Greek Epic* (1907), chap. ii.; Andrew Lang, *Homer and his Age* (1906); G. Busolt, *Griech. Gesch.* ed. 2, vol. i. p. 190 (1893); D. B. Monro's ed. of the *Iliad* (1901), pp. 484-488. (W. Ri.)

ACHAEMENES (Hakhāmani), the eponymous ancestor of the royal house of Persia, the Achaemenidae, “a clan *φρήτρη* of the Pasargadae” (Herod. i. 125), the leading Persian tribe. According to Darius in the Behistun inscription and Herod. iii. 75, vii. 11, he was the father of Teïspes, the great-grandfather of Cyrus. Cyrus himself, in his proclamation to the Babylonians after the conquest of Babylon, does not mention his name. Whether he really was a historical personage, or merely the mythical ancestor of the family, cannot be decided. According to Aelian (*Hist. anim.* xii. 21), he was bred by an eagle. We learn from Cyrus's proclamation that Teïspes and his successors had become kings of Anshan, *i.e.* a part of Elam (Susiana), where they ruled as vassals of the Median kings, until Cyrus the Great in 550 B.C. founded the Persian empire. After the death of Cambyses, the younger line of the Achaemenidae came to the throne with Darius, the son of Hystaspes, who was, like Cyrus, the great-grandson of Teïspes. Cyrus, Darius and all the later kings of Persia call themselves Achaemenides (*Hakhāmanishiya*). With Darius III. *Codomannus* the dynasty became extinct and the Persian empire came to an end (330). The adjective *Achaemenius* is used by the Latin poets as the equivalent of “Persian” (Horace, *Odes*, ii. 12, 21). See Persia.

The name Achaemenes is borne by a son of Darius I., brother of Xerxes. After the first rebellion of Egypt, he became satrap of Egypt (484 B.C.); he commanded the Persian fleet at Salamis, and was (460 B.C.) defeated and slain by Inarus, the leader of the second rebellion of Egypt.

ACHARD, FRANZ CARL (1753–1821), Prussian chemist, was born at Berlin on the 28th of April 1753, and died at Kunern, in Silesia, on the 20th of April 1821. He was a pioneer in turning to practical account A. S. Marggraf's discovery of the presence of sugar in beetroot, and by the end of the 18th century he was producing considerable quantities of beet-sugar, though by a very imperfect process, at Kunern, on an estate which was granted him about 1800 by the king of Prussia. There too he carried on a school of instruction in sugar-manufacture, which had an international reputation. For a time he was director of the physics class of the Berlin Academy of Sciences, and he published several volumes of chemical and physical researches, discovering among other things a method of working platinum.

ACHARIUS, ERIK (1757–1819), Swedish botanist, was born on the 10th of October 1757, and in 1773 entered Upsala University, where he was a pupil of Linnaeus. He graduated M.D. at Lund in 1782, and in 1801 was appointed professor of botany at Wadstena Academy. He devoted himself to the study of lichens, and all his publications were connected with that class of plants, his *Lichenographia Universalis* (Göttingen, 1804) being the most important. He died at Wadstena on the 13th of August 1819.

ACHATES, the companion of Aeneas in Virgil's *Aeneid*. The expression “fidus Achates” has become proverbial for a loyal and devoted companion.

ACHELOUS (mod. *Aspropotamo*, “white river”), the largest river in Greece (130 m.). It rises in Mt. Pindus, and, dividing Aetolia from Acarnania, falls into the Ionian Sea. In the lower part of its course the river winds through fertile, marshy plains. Its water is charged with fine mud, which is deposited along its banks and at its mouth, where a number of small islands (Echinades) have been formed. It was formerly called Thoas, from its impetuosity; and its upper portion was called by some Inachus, the name Achelous being restricted to the shorter eastern branch. Achelous is coupled with Ocean by Homer (*Il.* xxi. 193) as chief of rivers, and the name is given to several other rivers in Greece. The name appears in cult and in mythology as that of the typical river-god; a familiar legend is that of his contest with Heracles for Deianira.

ACHENBACH, ANDREAS (1815–   ), German landscape painter, was born at Cassel in 1815. He began his art education in 1827 in Düsseldorf under W. Schadow and at the academy. In his early work he followed the pseudo-idealism of the German romantic school, but on removing to Munich in 1835, the stronger influence of L. Gurlitt turned his talent into new channels, and he became the founder of the German realistic school. Although his landscapes evince too much of his aim at picture-making and lack personal temperament, he is a master of technique, and is historically important as a reformer. A number of his finest works are to be found at the Berlin National Gallery, the New Pinakothek in Munich, and the galleries at Dresden, Darmstadt, Cologne, Düsseldorf, Leipzig and Hamburg.

His brother, Oswald Achenbach (1827–1905), was born at Düsseldorf and received his art education from Andreas. His landscapes generally dwell on the rich and glowing effects of colour which drew him to the Bay of Naples and the neighbourhood of Rome. He is represented at most of the important German galleries of modern art.

ACHENWALL, GOTTFRIED (1719–1772), German statistician, was born at Elbing, in East Prussia, in October 1719. He studied at Jena, Halle and Leipzig, and took a degree at the last-named university. He removed to Marburg in 1746, where for two years he read lectures on history and on the law of nature and of nations. Here, too, he commenced those inquiries in statistics by which his name became known. In 1748 he was given a professorship at Göttingen, where he resided till his death in 1772. His chief works were connected with statistics. The *Staatsverfassung der heutigen vornehmsten europäischen Reiche* appeared first in 1749, and revised editions were published in 1762 and 1768.

ACHERON, in Greek mythology, the son of Gaea or Demeter. As a punishment for supplying the Titans with water in their contest with Zeus, he was turned into a river of Hades, over which departed souls were ferried by Charon. The name (meaning the river of "woe") was eventually used to designate the whole of the lower world (Stobaeus, *Ecl. Phys.* i. 41, §§ 50, 54).

ACHIACHARUS, a name occurring in the book of Tobit (i. 21 f.) as that of a nephew of Tobit and an official at the court of Esarhaddon at Nineveh. There are references in Rumanian, Slavonic, Armenian, Arabic and Syriac literature to a legend, of which the hero is Aḥiḳar (for Armenian, Arabic and Syriac, see *The Story of Aḥiḳar*, F. C. Conybeare, Rendel Harris and Agnes Lewis, Camb. 1898), and it was pointed out by George Hoffmann in 1880 that this Aḥiḳar and the Achiacharus of Tobit are identical. It has been contended that there are traces of the legend even in the New Testament, and there is a striking similarity between it and the *Life of Aesop* by Maximus Planudes (ch. xxiii.-xxxii.). An eastern sage Achaïcarus is mentioned by Strabo. It would seem, therefore, that the legend was undoubtedly oriental in origin, though the relationship of the various versions can scarcely be recovered.

See the *Jewish Encyclopaedia* and the *Encyclopaedia Biblica*; also M. R. James in *The Guardian*, Feb. 2, 1898, p. 163 f.

ACHILL ("Eagle"), the largest island off Ireland, separated from the Curraun peninsula of the west coast by the narrow Achill Sound. Pop. (1901) 4929. It is included in the county Mayo, in the western parliamentary division. Its shape is triangular, and its extent is 15 m. from E. to W. and 12 from N. to S. The area is 57 sq. m. The island is mountainous, the highest points being Slieve Croaghaun (2192 ft.) in the west, and Slievemore (2204 ft.) in the north; the extreme western point is the bold and rugged promontory of Achill Head, and the north-western and south-western coasts consist of ranges of magnificent cliffs, reaching a height of 800 ft. in the cliffs of Minaun, near the village of Keel on the south. The seaward slope of Croaghaun is abrupt and in parts precipitous, and its jagged flanks, together with the serrated ridge of the Head and the view over the broken coast-line and islands of the counties Mayo and Galway, attract many visitors to the island during summer. Desolate bogs, incapable of cultivation, alternate with the mountains; and the inhabitants earn a scanty subsistence by fishing and tillage, or by seeking employment in England and Scotland during the harvesting. The Congested Districts Board, however, have made efforts to improve the condition of the people, and a branch of the Midland Great Western railway to Achill Sound, together with a swivel bridge across the sound, improved communications and make for prosperity. Dugort, the principal village, contains several hotels. Here is a Protestant colony, known as "the Settlement" and founded in 1834. There are antiquarian remains (cromlechs, stone circles and the like) at Slievemore and elsewhere.

ACHILLES (Gr. 'Αχιλλεύς), one of the most famous of the legendary heroes of ancient Greece and the central figure of Homer's *Iliad*. He was said to have been the son of Peleus, king of the Myrmidones of Phthia in Thessaly, by Thetis, one of the Nereïds. His grandfather Aeacus was, according to the legend, the son of Zeus himself. The story of the childhood of Achilles in Homer differs from that given by later writers. According to Homer, he was brought up by his mother at Phthia with his cousin and intimate friend Patroclus, and learned the arts of war and eloquence from Phoenix, while the Centaur Chiron taught him music and medicine. When summoned to the war against Troy, he set sail at once with his Myrmidones in fifty ships.

Post-Homeric sources add to the legend certain picturesque details which bear all the evidence of their primitive origin, and which in some cases belong to the common stock of Indo-Germanic myths. According to one of these stories Thetis used to lay the infant Achilles every night under live coals, anointing him by day with ambrosia, in order to make him immortal. Peleus, having surprised her in the act, in alarm snatched the boy from the flames; whereupon Thetis fled back to the sea in anger (Apollodorus iii. 13; Apollonius Rhodius iv. 869). According to another story Thetis dipped the child in the waters of the river Styx, by which his whole body became invulnerable, except that part of his heel by which she held him; whence the proverbial "heel of Achilles" (Statius, *Achilleis*, i. 269). With this may be compared the similar story told of the northern hero Sigurd. The boy was afterwards entrusted to the care of Chiron, who, to give him the strength necessary for war, fed him with the entrails of lions and the marrow of bears and wild boars. To prevent his going to the siege of Troy, Thetis disguised him in female apparel, and hid him among the maidens at the court of King Lycomedes in Scyros; but Odysseus, coming to the island in the disguise of a pedlar, spread his wares, including a spear and shield, before the king's daughters, among whom was Achilles. Then he caused an alarm to be sounded; whereupon the girls fled, but Achilles seized the arms, and so revealed himself, and was easily persuaded to follow the Greeks (Hyginus, *Fab.* 96; Statius, *Ach.* i.; Apollodorus, *l.c.*). This story may be compared with the Celtic legend of the boyhood of Peredur or Perceval.

During the first nine years of the war as described in the *Iliad*, Achilles ravaged the country round Troy, and took twelve cities. In the tenth year occurred the quarrel with Agamemnon. In order to appease the wrath of Apollo, who had visited the camp with a pestilence, Agamemnon had restored Chryseis, his prize of war, to her father, a priest of the god, but as a compensation deprived Achilles, who had openly demanded this restoration, of his favourite slave Briseis. Achilles withdrew in wrath to his tent, where he consoled himself with music and singing, and refused to take any further part in the war. During his absence the Greeks were hard pressed, and at last he so far relaxed his anger as to allow his friend Patroclus to personate him, lending him his chariot and armour. The slaying of Patroclus by the Trojan hero Hector roused Achilles from his indifference; eager to avenge his beloved comrade, he sallied forth, equipped with new armour fashioned by Hephaestus, slew Hector, and, after dragging his body round the walls of Troy, restored it to the aged King Priam at his earnest entreaty. The *Iliad* concludes with the funeral rites of Hector. It makes no mention of the death of Achilles, but hints at its taking place "before the Scaean gates." In the *Odyssey* (xxiv. 36. 72) his ashes are said to have been buried in a golden urn, together with those of Patroclus, at a place on the Hellespont, where a tomb was erected to his memory; his soul dwells in the lower world, where it is seen by Odysseus. The contest between Ajax and Odysseus for his arms is also mentioned. The *Aethiopis* of Arctinus of Miletus took up the story of the *Iliad*. It told how Achilles, having slain the Amazon Penthesileia and Memnon, king of the Aethiopians, who had come to the assistance of the Trojans, was himself slain by Paris (Alexander), whose arrow was guided by Apollo to his vulnerable heel (Virgil, *Aen.* vi. 57; Ovid, *Met.* xii. 600). Again, it is said that Achilles, enamoured of Polyxena, the daughter of Priam, offered to join the Trojans on condition that he received her hand in marriage. This was agreed to; Achilles went unarmed to the temple of Apollo Thymbraeus, and was slain by Paris (Dictys iv. 11). According to some, he was slain by Apollo himself (Quint. Smyrn. iii. 61; Horace, *Odes*, iv. 6, 3). Hyginus (*Fab.* 107) makes Apollo assume the form of Paris.

Later stories say that Thetis snatched his body from the pyre and conveyed it to the island of Leuke, at the mouth of the Danube, where he ruled with Iphigeneia as his wife; or that he was carried to the Elysian fields, where his wife was Medea or Helen. He was worshipped in many places: at Leuke, where he was honoured with offerings and games; in Sparta, Elis, and especially Sigeum on the Hellespont, where his famous tumulus was erected.

Achilles is a typical Greek hero; handsome, brave, celebrated for his fleetness of foot, prone to excess of wrath and grief, at the same time he is compassionate, hospitable, full of affection for his mother and respect for the gods. In works of art he is represented, like Ares, as a young man of splendid physical proportions, with bristling hair like a horse's mane and a slender neck. Although the figure of the hero frequently occurs in groups—such as the work of Scopas showing his removal to the island of Leuke by Poseidon and Thetis, escorted by Nereïds and Tritons, and the combat over his dead body in the Aeginetan sculptures—no isolated statue or bust can with certainty be identified with him; the statue in the Louvre (from the Villa Borghese), which was thought to have the best claim, is generally taken for Ares or possibly Alexander. There are many vase and wall paintings and bas-reliefs illustrative of incidents in his life. Various etymologies of the name have been suggested: "without a lip" (ἀ, χεῖλος), Achilles being regarded as a river-god, a stream which overflows its banks, or, referring to the story that, when Thetis laid him in the fire, one of his lips, which he had licked, was consumed (Tzetzes on Lycophron, 178); "restrainer of the people" (ἐχέ-λαος); "healer of sorrow" (ἀχε-λώιος); "the obscure" (connected with ἀχλύς, "mist"); "snake-born" (ἔχις), the snake being one of the chief forms taken by Thetis. The most generally received view makes him a god of light, especially of the sun or of the lightning.

See E. H. Meyer, *Indogermanische Mythen, ii., Achilleïs*, 1887; F. G. Welcker, *Der epische Cyclus*, 1865–1882; articles in Pauly-Wissowa, *Real-Encyclopädie der classischen Altertumswissenschaft*, Daremberg and Saglio's *Dictionnaire des Antiquités* and Roscher's *Lexikon der Mythologie*; see also T. W. Allen in *Classical Review*, May 1906; A. E. Crawley, J. G. Frazer, A. Lang, *Ibid.*, June, July 1893, on Achilles in Scyros. In the article Greek Art, fig. 12 represents the conflict over the dead body of Achilles.

ACHILLES TATIUS, of Alexandria, Greek rhetorician, author of the erotic romance, the *Adventures of Leucippe and Cleitophon*, flourished about A.D. 450, perhaps later. Suidas, who alone calls him Statius, says that he became a Christian and eventually a bishop—like Heliodorus, whom he imitated—but there is no evidence of this. Photius, while severely criticizing his lapses into indecency, highly praises the conciseness and clearness of his style, which, however, is artificial and laboured. Many of the incidents of the romance are highly improbable, and the characters, except the heroine, fail to enlist sympathy. The descriptive passages and digressions, although tedious and introduced without adequate reasons, are the best part of the work. The large number of existing MSS. attests its popularity. (*Editio princeps*, 1601; first important critical edition by Jacobs, 1821; later editions by Hirschig, 1856; Hercher, 1858. There are translations in many languages; in English by Anthony H[odges], 1638, and R. Smith, 1855. See also Romance.)

Suidas also ascribes to this author an *Etymology*, a *Miscellaneous History of Famous Men*, and a treatise *On the Sphere*. Part of the last is extant under the title of *An Introduction to the Phaenomena of Aratus*. But if the writer is the *prudentissimus Achilles* referred to by Firmicus Maternus (about 336) in his *Matheseos libri*, iv. 10, 17 (ed. Kroll), he must have lived long before the author of *Leucippe*. The fragment was first published in 1567, then in the *Uranologion* of Petavius, with a Latin translation, 1630. Nothing definite is known as to the authorship of the other works, which are lost.

ACHILLINI, ALESSANDRO (1463–1512), Italian philosopher, born on the 29th of October 1463 at Bologna, was celebrated as a lecturer both in medicine and in philosophy at Bologna and Padua, and was styled the second Aristotle. His philosophical works were printed in one volume folio, at Venice, in 1508, and reprinted with considerable additions in 1545, 1551 and 1568. He was also distinguished as an anatomist (see Anatomy), among his writings being *Corporis humani Anatomia* (Venice, 1516–1524), and *Anatomicae Annotationes* (Bologna, 1520). He died at Bologna on the 2nd of August 1512.

His brother, Giovanni Filoteo Achillini (1466–1533), was the author of *Il Viridario* and other writings, verse and prose, and his grand-nephew, Claudio Achillini (1574–1640), was a lawyer who achieved some notoriety as a versifier of the school of the Secentisti.

ACHIMENES (perhaps from the Gr. ἀχαιμενίς, an Indian plant used in magic), a genus of plants, natural order *Gesneraceae* (to which belong also Gloxinia and Streptocarpus), natives of tropical America, and well known in cultivation as stove or warm greenhouse plants. They are herbaceous perennials, generally with hairy serrated leaves and handsome flowers. The corolla is tubular with a spreading limb, and varies widely in colour, being white, yellow, orange, crimson, scarlet, blue or purple. A large number of hybrids exist in cultivation. The plants are grown in the stove till the flowering period, when they may be removed to the greenhouse. They are propagated by cuttings, or from the leaves, which are cut off and pricked in well-drained pots of sandy soil, or by the scales from the underground tubes, which are rubbed off and sown like seeds, or by the seeds, which are very small.

ACHIN (Dutch *Atjeh*), a Dutch government forming the northern extremity of the island of Sumatra, having an estimated area of 20,544 sq. m. The government is divided into three assistant-residencies—the east coast, the west coast and Great Achin. The physical geography (see Sumatra) is imperfectly understood. Ranges of mountains, roughly parallel to the long axis of the island, and characteristic of the whole of it, appear to occupy the interior, and reach an extreme height of about 12,000 ft. in the south-west of the government. The coasts are low and the rivers insignificant, rising in the coast ranges and flowing through the coast states (the chief of which are Pedir, Gighen and Samalanga on the N.; Edi, Perlak and Langsar on the E.; Kluwah, Rigas and Melabuh on the W.). The chief ports are Olehleh, the port of Kotaraja or Achin (formerly Kraton, now the seat of the Dutch government), Segli on the N., Edi on the E., and Analabu or Melabuh on the W. Kotaraja lies near the northern extremity of the island, and consists of detached houses of timber and thatch, clustered in enclosed groups called *kampongs*, and buried in a forest of fruit-trees. It is situated nearly 3 m. from the sea, in the valley of the Achin river, which in its upper part, near Selimun, is 3 m. broad, the river having a breadth of 99 ft. and a depth of $1\frac{1}{2}$ ft.; but in its lower course, north of its junction with the Krung Daru, the valley broadens to $12\frac{1}{2}$ m. The marshy soil is covered by rice-fields, and on higher ground by *kampongs* full of trees. The river at its mouth is 327 ft. broad and 20–33 ft. deep, but before it lies a sandbank covered at low water by a depth of only 4 ft. The Dutch garrison in Kotaraja occupies the old Achinese citadel. The town is connected by rail with Olehleh, and the line also extends up the valley. The construction of another railway has been undertaken along the east coast. The following industries are of some importance—gold-working, weapon-making, silk-weaving, the making of pottery, fishing and coasting trade. The annual value of the exports (chiefly pepper) is about £58,000; of the imports, from £165,000 to £250,000. The population of Achin in 1898 was estimated at 535,432, of whom 328 were Europeans, 3933 Chinese, 30 Arabs, and 372 other foreign Asiatics.

The Achinese, a people of Malayan stock but darker, somewhat taller and not so pleasant-featured as the true Malays, regard themselves as distinct from the other Sumatrans. Their nobles claim Arab descent. They were at one time Hinduized as is evident from their traditions, the many Sanskrit words in their language, and their general appearance, which suggests Hindu as well as Arab blood. They are Mahommedans, and although Arab influence has declined, their nobles still wear the Moslem flowing robe and turban (though the women go unveiled), and they use Arabic script. The chief characteristic is their love of fighting; every man is a soldier and every village has its army. They are industrious and skilful agriculturists, metal-workers and weavers. They build excellent ships. Their chief amusements are gambling and opium-smoking. Their social organization is communal. They live in *kampongs*, which combine to form *mukims*, districts or hundreds (to use the nearest English term), which again combine to form *sagis*, of which there are three. Achin literature, unlike the language, is entirely Malay; it includes poetry, a good deal of theology and several chronicles. Northern Sumatra was visited by several European travellers in the middle ages, such as Marco Polo, Friar Odorico and Nicolo Conti. Some of these as well as Asiatic writers mention Lambri, a state which must have nearly occupied the position of Achin. But the first voyager to visit Achin, by that name, was Alvaro Tellez, a captain of Tristan d'Acunha's fleet, in 1506. It was then a mere dependency of the adjoining state of Pedir; and the latter, with Pasei, formed the only states on the coast whose chiefs claimed the title of sultan. Yet before twenty years had passed Achin had not only gained independence, but had swallowed up all other states of northern Sumatra. It attained its climax of power in the time of Sultan Iskandar Muda (1607–1636), under whom the subject coast extended from Aru opposite Malacca round by the north to Benkulen on the west coast, a sea-board of not less than 1100 miles; and besides this, the king's supremacy was owned by the large island of Nias, and by the continental Malay states of Johor, Pahang, Kedah and Perak.

The chief attraction of Achin to traders in the 17th century must have been gold. No place in the East, unless Japan, was so abundantly supplied with gold. The great repute of Achin as a place of trade is shown by the fact that to this port the first Dutch (1599) and first English (1602) commercial ventures to the Indies were directed. Sir James Lancaster, the English commodore, carried letters from Queen Elizabeth to the king of Achin, and was well received by the prince then reigning, Alauddin Shah. Another exchange of letters took place between King James I. and Iskandar Muda in 1613. But native caprice and jealousy of the growing force of the European nations in these seas, and the rivalries between those nations themselves, were destructive of sound trade; and the English factory, though several times set up, was never long maintained. The French made one great effort (1621) to establish relations with Achin, but nothing came of it. Still the foreign trade of Achin, though subject to interruptions, was important. William Dampier (*c.* 1688) and others speak of the number of foreign merchants settled there—English, Dutch, Danes, Portuguese, Chinese, &c. Dampier says the anchorage was rarely without ten or fifteen sail of different nations, bringing vast quantities of rice, as well as silks, chintzes, muslins and opium. Besides the Chinese merchants settled at Achin, others used to come annually with the junks, ten or twelve in number, which arrived in June. A regular fair was then established, which lasted two months, and was known as the China camp, a great resort of foreigners.

Hostilities with the Portuguese began from the time of the first independent king of Achin; and they had little remission till the power of Portugal fell with the loss of Malacca (1641). Not less than ten times before that event were armaments despatched from Achin to reduce Malacca, and more than once its garrison was hard pressed. One of these armadas, equipped by Iskandar Muda in 1615, gives an idea of the king's resources. It consisted of 500 sail, of which 250 were galleys, and among these a hundred were greater than any then used in Europe. Sixty thousand men were embarked.

On the death of Iskandar's successor in 1641, the widow was placed on the throne; and as a female reign favoured the oligarchical tendencies of the Malay chiefs, three more queens were allowed to reign successively. In 1699 the Arab or fanatical party suppressed female government, and put a chief of Arab blood on the throne. The remaining history of Achin was one of rapid decay.

After the restoration of Java to the Netherlands in 1816, a good deal of weight was attached by the neighbouring British colonies to the maintenance of influence in Achin; and in 1819 a treaty of friendship was concluded with the Calcutta government which excluded other European nationalities from fixed residence in Achin. When the British government, in 1824, made a treaty with the Netherlands, surrendering the remaining British settlements in Sumatra in exchange for certain possessions on the continent of Asia, no reference was made in the articles to the Indian treaty of 1819; but an understanding was exchanged that it should be modified, while no proceedings hostile to Achin should be attempted by the Dutch.

This reservation was formally abandoned by the British government in a convention signed at the Hague on the 2nd of November 1871; and in March 1873 the government of Batavia declared war upon Achin. Doubtless there was provocation, for the sultan of Achin had not kept to the understanding that he was to guarantee immunity from piracy to foreign traders; but the necessity for war was greatly doubted, even in Holland. A Dutch force landed at Achin in April 1873, and attacked the palace. It was defeated with considerable loss, including that of the general (Köhler). The approach of the south-west monsoon precluded the immediate renewal of the attempt; but hostilities were resumed, and Achin fell in January 1874. The natives, however, maintained themselves in the interior, inaccessible to the Dutch troops, and carried on a guerilla warfare. General van der Heyden appeared to have subdued them in 1878–81, but they broke out again in 1896 under the traitor Taku Umar, who had been in alliance with the Dutch. He died shortly afterwards, but the trouble was not ended. General van Hentsz carried on a successful campaign in 1898 seq., but in 1901, the principal Achinese chiefs on the north coast having surrendered, the pretender-sultan fled to the Gajoes, a neighbouring inland people. Several expeditions involving heavy fighting were necessary against these in 1901–4, and a certain amount of success was achieved, but the pretender escaped, revolt still smouldered and hostilities were continued.

See P. J. Veth, *Atchin en zijne betrekkingen tot Nederland* (Leyden, 1873); J. A. Kruijt, *Atjeh en de Atjehers* (Leyden, 1877); Kielstra, *Beschrijving van den Atjeh-oorlog* (The Hague, 1885); Van Langen, *Atjeh's Wesskust, Tijdschrift Aardrijko, Genotktsch.* (Amsterdam, 1888), p. 226; Renaud, *Jaarboek van het Mynwezen* (1882); J. Jacobs, *Het famille-en Kampongleven op Groot Atjeh* (Leyden, 1894); C. Snouck Hurgronje, *De Atjehers* (Batavia, 1894).

ACHOLI, a negro people of the upper Nile valley, dwelling on the east bank of the Bahr-el-Jebel, about a hundred miles north of Albert Nyanza. They are akin to the Shilluks of the White Nile. They frequently decorate the temples or cheeks with wavy or zigzag scars, and also the thighs with scrolls; some pierce the ears. Their dwelling-places are circular huts with a high peak, furnished with a mud sleeping-platform, jars of grain and a sunk fireplace. The interior walls are daubed with mud and decorated with geometrical or conventional designs in red, white or grey. The Acholi are good hunters, using nets and spears, and keep goats, sheep and cattle. In war they use spears and long, narrow shields of giraffe or ox hide. Their dialect is closely allied to those of the Alur, Lango and Ja-Luo tribes, all four being practically pure Nilotic. Their religion is a vague fetishism. By early explorers the Acholi were called Shuli, a name now obsolete.

ACHROMATISM (Gr. α-, privative, χρῶμα, colour), in optics, the property of transmitting white light, without decomposing it into the colours of the spectrum; "achromatic lenses" are lenses which possess this property. (See LENS, ABERRATION and PHOTOGRAPHY.)

ACID (from the Lat. root *ac-*, sharp; *acere*, to be sour), the name loosely applied to any sour substance; in chemistry it has a more precise meaning, denoting a substance containing hydrogen which may be replaced by metals with the formation of salts. An acid may therefore be regarded as a salt of hydrogen. Of the general characters of acids we may here notice that they dissolve alkaline substances, certain metals, &c., neutralize alkalies and redden many blue and violet vegetable colouring matters.

The ancients probably possessed little knowledge indeed of acids. Vinegar (or impure acetic acid), which is produced when wine is allowed to stand, was known to both the Greeks and Romans, who considered it to be typical of acid substances; this is philologically illustrated by the words ὀξύς, *acidus*, sour, and ὄξος, *acetus*, vinegar. Other acids became known during the alchemistic period; and the first attempt at a generalized conception of these substances was made by Paracelsus, who supposed them to contain a principle which conferred the properties of sourness and solubility. Somewhat similar views were promoted by Becher, who named the principle *acidum primogenium*, and held that it was composed of the Paracelsian elements "earth" and "water." At about the same time Boyle investigated several acids; he established their general reddening of litmus, their solvent power of metals and basic substances, and the production of neutral bodies, or salts, with alkalies. Theoretical conceptions were revived by Stahl, who held that acids were the fundamentals of all salts, and the erroneous idea that sulphuric acid was the principle of all acids.

The phlogistic theory of the processes of calcination and combustion necessitated the view that many acids, such as those produced by combustion, *e.g.* sulphurous, phosphoric, carbonic, &c., should be regarded as elementary substances. This principle more or less prevailed until it was overthrown by Lavoisier's doctrine that oxygen was the acid-producing element; Lavoisier being led to this conclusion by the almost general observation that acids were produced when non-metallic elements were burnt. The existence of acids not containing oxygen was, in itself, sufficient to overthrow this idea, but, although Berthollet had shown, in 1789, that sulphuretted hydrogen (or hydrosulphuric acid) contained no oxygen, Lavoisier's theory held its own until the researches of Davy, Gay-Lussac and Thénard on hydrochloric acid and chlorine, and of Gay-Lussac on hydrocyanic acid, established beyond all cavil that oxygen was not essential to acidic properties.

In the Lavoisierian nomenclature acids were regarded as binary oxygenated compounds, the associated water being relegated to the position of a mere solvent. Somewhat similar views were held by Berzelius, when developing his dualistic conception of the composition of substances. In later years Berzelius renounced the "oxygen acid" theory, but not before Davy, and, almost simultaneously, Dulong, had submitted that hydrogen and not oxygen was the acidifying principle. Opposition to the "hydrogen-acid" theory centred mainly about the hypothetical radicals which it postulated; moreover, the electrochemical theory of Berzelius exerted a stultifying influence on the correct views of Davy and Dulong. In Berzelius' system potassium sulphate is to be regarded as $\overset{+}{K_2O}.\overset{-}{SO_3}$; electrolysis should simply effect the disruption of the positive and negative components, potash passing with the current, and sulphuric acid against the current. Experiment showed, however, that instead of only potash appearing at the negative electrode, hydrogen is also liberated; this is inexplicable by Berzelius's theory, but readily explained by the "hydrogen-acid" theory. By this theory potassium is liberated at the negative electrode and combines immediately with water to form potash and hydrogen.

Further and stronger support was given when J. Liebig promoted his doctrine of polybasic acids. Dalton's idea that elements preferentially combined in equiatomic proportions had as an immediate inference that metallic oxides contained one atom of the metal to one atom of oxygen, and a simple expansion of this conception was that one atom of oxide combined with one atom of acid to form one atom of a neutral salt. This view, which was specially supported by Gay-Lussac and Leopold Gmelin and accepted by Berzelius, necessitated that all acids were monobasic. The untenability of this theory was proved by Thomas Graham's investigation of the phosphoric acids; for he then showed that the ortho- (ordinary), pyro- and metaphosphoric acids contained respectively 3, 2 and 1 molecules of "basic water" (which were replaceable by metallic oxides) and one molecule of phosphoric oxide, P_2O_5. Graham's work was developed by Liebig, who called into service many organic acids—citric, tartaric, cyanuric, comenic and meconic—and showed that these resembled phosphoric acid; and he established as the criterion of polybasicity the existence of compound salts with different metallic oxides. In formulating these facts Liebig at first retained the dualistic conception of the structure of acids; but he shortly afterwards perceived that this view lacked generality since the halogen acids, which contained no oxygen but yet formed salts exactly similar in properties to those containing oxygen, could not be so regarded. This and other reasons led to his rejection of the dualistic hypothesis and the adoption, on the ground of probability, and much more from convenience, of the tenet that "acids are particular compounds of hydrogen, in which the latter can be replaced by metals"; while, on the constitution of salts, he held that "neutral salts are those compounds of the same class in which the hydrogen is replaced by its equivalent in metal. The substances which we at present term anhydrous acids (acid oxides) only become, for the most part, capable of forming salts with metallic oxides after the addition of water, or they are compounds which decompose these oxides at somewhat high temperatures."

The hydrogen theory and the doctrine of polybasicity as enunciated by Liebig is the fundamental characteristic of the modern theory. A polybasic acid contains more than one atom of hydrogen which is replaceable by metals; moreover, in such an acid the replacement may be entire with the formation of normal salts, partial with the formation of acid salts, or by two or more different metals with the formation of compound salts (see SALTS). These facts may be illustrated with the aid of orthophosphoric acid, which is tribasic:—

Acid.	Normal salt.	Acid salts.
H_3PO_4.	Ag_3PO_4.	Na_2HPO_4; NaH_2PO_4.
Phosphoric acid.	Silver phosphate.	Acid sodium phosphates.

Compound salts.	
$Mg(NH_4)PO_4$;	$Na(NH_4)HPO_4$.
Magnesium ammonium phosphate;	Microcosmic salt.

Reference should be made to the articles CHEMICAL ACTION, THERMOCHEMISTRY and SOLUTIONS, for the theory of the strength or avidity of acids.

Organic Acids.—Organic acids are characterized by the presence of the monovalent group $-CO·OH$, termed the carboxyl group, in which the hydrogen atom is replaceable by metals with the formation of salts, and by alkyl radicals with the formation of esters. The basicity of an organic acid, as above defined, is determined by the number of carboxyl groups present. Oxy-acids are carboxylic acids which also contain a hydroxyl group; similarly we may have aldehyde-acids, ketone-acids, &c. Since the more important acids are treated under their own headings, or under substances closely allied to them, we shall here confine ourselves to general relations.

Classification.—It is convenient to distinguish between aliphatic and aromatic acids; the first named being derived from open-chain hydrocarbons, the second from ringed hydrocarbon nuclei. Aliphatic monobasic acids are further divided according to the nature of the parent hydrocarbon. Methane and its homologues give origin to the "paraffin" or "fatty series" of the general formula $C_nH_{2n+1}COOH$, ethylene gives origin to the acrylic acid series, $C_nH_{2n-1}COOH$, and so on. Dibasic acids of the paraffin series of hydrocarbons have the general formula $C_nH_2(COOH)_2^n$; malonic and succinic acids are important members. The isomerism which occurs as soon as the molecule contains a few carbon atoms renders any classification based on empirical molecular formulae somewhat ineffective; on the other hand, a scheme based on molecular structure would involve more detail than it is here possible to give. For further information, the reader is referred to any standard work on organic chemistry. A list of the acids present in fats and oils is given in the article OILS.

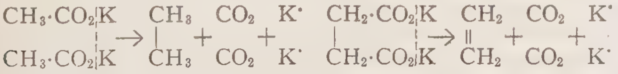
Syntheses of Organic Acids.—The simplest syntheses are undoubtedly those in which a carboxyl group is obtained directly from the oxides of carbon, carbon dioxide and carbon monoxide. The simplest of all include: (*1*) the synthesis of sodium oxalate by passing carbon dioxide over metallic sodium heated to 350°—360°; (2) the synthesis of potassium formate from moist carbon dioxide and potassium, potassium carbonate being obtained simultaneously; (3) the synthesis of potassium acetate and propionate from carbon dioxide and sodium methide and sodium ethide; (4) the synthesis of aromatic acids by the interaction of carbon dioxide, sodium and a bromine substitution derivative; and (5) the synthesis of aromatic oxy-acids by the interaction of carbon dioxide and sodium phenolates (see Salicylic Acid). Carbon monoxide takes part in the syntheses of sodium formate from sodium hydrate, or soda lime (at 200°–220°), and of sodium acetate and propionate from sodium methylate and sodium ethylate at 160°–200°. Other reactions which introduce carboxyl groups into aromatic groups are: the action of carbonyl chloride on aromatic hydrocarbons in the presence of aluminium chloride, acid-chlorides being formed which are readily decomposed by water to give the acid; the action of urea chloride $Cl\cdot CO\cdot NH_2$, cyanuric acid $(CONH)_3$, nascent cyanic acid, or carbanile on hydrocarbons in the presence of aluminium chloride, acid-amides being obtained which are readily decomposed to give the acid. An important nucleus-synthetic reaction is the saponification of nitriles, which may be obtained by the interaction of potassium cyanide with a halogen substitution derivative or a sulphonic acid.

Acids frequently result as oxidation products, being almost invariably formed in all cases of energetic oxidation. There are certain reactions, however, in which oxidation can be successfully applied to the synthesis of acids. Thus primary alcohols and aldehydes, both of the aliphatic and aromatic series, readily yield on oxidation acids containing the same number of carbon atoms. These reactions may be shown thus:—

$$R\cdot CH_2OH \rightarrow R\cdot CHO \rightarrow R\cdot CO\cdot OH.$$

In the case of aromatic aldehydes, acids are also obtained by means of "Cannizzaro's reaction" (see Benzaldehyde). An important oxidation synthesis of aromatic acids is from hydrocarbons with aliphatic side chains; thus toluene, or methyl-benzene, yields benzoic acid, the xylenes, or dimethyl-benzene, yield methyl-benzoic acids and phthalic acids. Ketones, secondary alcohols and tertiary alcohols yield a mixture of acids on oxidation. We may also notice the disruption of unsaturated acids at the double linkage into a mixture of two acids, when fused with potash.

In the preceding instances the carboxyl group has been synthesized or introduced into a molecule; we have now to consider syntheses from substances already containing carboxyl groups. Of foremost importance are the reactions termed the malonic acid and the aceto-acetic ester syntheses; these are discussed under their own headings. The electrosyntheses call for mention here. It is apparent that metallic salts of organic acids would, in aqueous solution, be ionized, the positive ion being the metal, and the negative ion the acid residue. Esters, however, are not ionized. It is therefore apparent that a mixed salt and ester, for example $KO_2C\cdot CH_2\cdot CH_2\cdot CO_2C_2H_5$, would give only two ions, viz. potassium and the rest of the molecule. If a solution of potassium acetate be electrolysed the products are ethane, carbon dioxide, potash and hydrogen; in a similar manner, normal potassium succinate gives ethylene, carbon dioxide, potash and hydrogen; these reactions may be represented:—



$$\begin{array}{lccccccclccccccc} CH_3\cdot CO_2 \vdots K & & CH_3 & & CO_2 & & K^{\cdot} & & CH_2\cdot CO_2 \vdots K & & CH_2 & & CO_2 & & K^{\cdot} \\ & \rightarrow & | & + & & + & & & | & \rightarrow & \| & + & & + & \\ CH_3\cdot CO_2 \vdots K & & CH_3 & & CO_2 & & K^{\cdot} & & CH_2\cdot CO_2 \vdots K & & CH_2 & & CO_2 & & K^{\cdot} \end{array}$$

By electrolysing a solution of potassium ethyl succinate, $KO_2C\cdot (CH_2)_2CO_2C_2H_5$, the $KO_2C\cdot$ groups are split off and the two residues $\cdot(CH_2)_2CO_2C_2H_5$ combine to form the ester $(CH_2)_4(CO_2C_2H_5)_2$. In the same way, by electrolysing a mixture of a metallic salt and an ester, other nuclei may be condensed; thus potassium acetate and potassium ethyl succinate yield $CH_3\cdot CH_2\cdot CH_2\cdot CO_2C_2H_5$.

Reactions.—Organic acids yield metallic salts with bases, and ethereal salts or esters (*q.v.*), $R\cdot CO\cdot OR'$, with alcohols. Phosphorus chlorides give acid chlorides, $R\cdot CO\cdot Cl$, the hydroxyl group being replaced by chlorine, and acid anhydrides, $(R\cdot CO)_2O$, a molecule of water being split off between two carboxyl groups. The ammonium salts when heated lose one molecule of water and are converted into acid-amides, $R\cdot CO\cdot NH_2$, which by further dehydration yield nitriles, $R\cdot CN$. The calcium salts distilled with calcium formate yield aldehydes (*q.v.*); distilled with soda-lime, ketones (*q.v.*) result.

ACIDALIUS, VALENS (1567–1595), German scholar and critic, was born at Wittstock in Brandenburg. After studying at Rostock, Greifswald and Helmstedt, and residing about three years in Italy, he settled at Breslau, where he is said to have embraced the Roman Catholic religion. Early in 1595 he accepted an invitation to Neisse, about fifty miles from Breslau, where he died of brain fever on the 25th of May, at the age of twenty-eight. His excessive application to study, and the attacks made upon him in connexion with a pamphlet of which he was reputed the author, doubtless hastened his premature end. Acidalius wrote notes on Velleius Paterculus (1590), Curtius (1594), the panegyrists, Tacitus and Plautus, published after his death.

See Leuschner, *Commentatio de A. V. Vita, Moribus, et Scriptis* (1757); F. Adam, "Der Neisser Rektor," in *Bericht der Philomathie in Neisse* (1872).

ACID-AMIDES, chemical compounds which may be considered as derived from ammonia by replacement of its hydrogen with acidyl residues, the substances produced being known as primary, secondary or tertiary amides, according to the number of hydrogen atoms replaced. Of these compounds, the primary amides of the type $R\cdot CO\cdot NH_2$ are the most important. They may be prepared by the dry distillation of the ammonium salts of the acids (A. W. Hofmann, *Ber.*, 1882, 15, p. 977), by the partial hydrolysis of the nitriles, by the action of ammonia or ammonium carbonate on acid chlorides or anhydrides, or by heating the esters (*q.v.*) with ammonia. They are solid crystalline compounds (formamide excepted) which are at first soluble in water, the solubility, however, decreasing as the carbon content of the molecule increases. They are easily hydrolysed, breaking up into their components when boiled with acids or alkalies. They form compounds with hydrochloric acid when this gas is passed into their ethereal solution; these compounds, however, are very unstable, being readily decomposed by water. On the other hand, they show faintly acid properties since the hydrogen of the amido group can be replaced by metals to give such compounds as mercury acetamide $(CH_3CONH)_2Hg$. Nitrous acid decomposes them, with elimination of nitrogen and the formation of the corresponding acid,

$$RCO\cdot NH_2+ONOH=R\cdot COOH+N_2+H_2O.$$

When distilled with phosphoric anhydride they yield nitriles. By the action of bromine and alcoholic potash on the amides, they are converted into amines containing one carbon atom less than the original amide, a reaction which possesses great theoretical importance (A. W. Hofmann),

$$R\cdot CONH_2 \rightarrow R\cdot CONHBr \rightarrow R\cdot NH_2+K_2CO_3+KBr+H_2O.$$

Formamide, $H\cdot CONH_2$, is a liquid readily soluble in water, boiling at about 195° C. with partial decomposition. Acetamide, $CH_3\cdot CONH_2$, is a white deliquescent crystalline solid, which melts at 82–83° C. and boils at 222° C. It is usually prepared by distilling ammonium acetate. It is readily soluble in water and alcohol, but insoluble in ether. Benzamide, $C_6H_5\cdot CONH_2$, crystallizes in leaflets which melt at 130° C. It is prepared by the action of ammonium carbonate on benzoyl chloride. It yields a silver salt which with ethyl iodide forms benzimido-ethyl ether, $C_6H_5C:(NH)\cdot OC_2H_5$, a behaviour which points to the silver salt as being derived from the tautomeric imido-benzoic acid, $C_6H_5C:(NH)\cdot OH$ (J. Tafel, *Ber.*, 1890, 23, p. 104). On the preparation of the substituted amides from the corresponding sodamides see A. W. Titherley (*Journ. Chem. Soc.*, 1901, 59, p. 391). The secondary and tertiary amides of the types $(RCO)_2NH$ and $(RCO)_3N$ may be prepared by heating the primary amides or the nitriles with acids or acid anhydrides to 200° C. Thiamides of the type $R\cdot CSNH_2$ are known, and result by the addition of sulphuretted hydrogen to the nitriles, or by the action of phosphorus pentasulphide on the acid-amides. They readily decompose on heating, and are easily hydrolysed by alkalies; they possess a somewhat more acid character than the acid-amides.

ACINACES (from the Greek), an ancient Persian sword, short and straight, and worn, contrary to the Roman fashion, on the right side, or sometimes in front of the body, as shown in the bas-reliefs found at Persepolis. Among the Persian nobility it was frequently made of gold, being worn as a badge of distinction. The acinaces was an object of religious worship with the Scythians and others (Herod. iv. 62).

ACINETA (so named by C. G. Ehrenberg), a genus of suctorial Infusoria characterized by the possession of a stalk and cup-shaped sheath or theca for the body, and endogenous budding. O. Bütschli has separated off the genus *Metacineta* (for *A. mystacina*), which reproduces by direct bud-fission.

ACINUS (Lat. for a berry), a term in botany applied to such fruits as the blackberry or raspberry, composed of small seed-like berries, and also to those berries themselves, or to grape-stones. By analogy, *acinus* is applied in anatomy to similar granules or glands, or lobules of a gland.

ACIREALE, a town and episcopal see of the province of Catania, Sicily; from the town of the same name it is distant 9 m. N. by E. Pop. (1901) 35,418. It has some importance as a thermal station, and the springs were used by the Romans. It takes its name from the river Acis, into which, according to the legend, Acis, the lover of Galatea, was changed after he had been slain by Polyphemus. The rocks which Polyphemus hurled at Ulysses are identified with the seven *Scogli de' Ciclopi*, or *Faraglioni*, a little to the south of Acireale.

ACIS, in Greek mythology, the son of Pan (Faunus) and the nymph Symaethis, a beautiful shepherd of Sicily, was the lover of the Nereïd Galatea. His rival the Cyclops Polyphemus surprised them together, and crushed him to pieces with a rock. His blood, gushing forth from beneath, was metamorphosed by Galatea into the river bearing his name (now Fiume di Jaci), which was celebrated for the coldness of its waters (Ovid, *Met.* xiii. 750; Silius Italicus, *Punica*, xiv. 221).

ACKERMAN, FRANCIS (*c.* 1335–1387), Flemish soldier and diplomatist, was born at Ghent, and about 1380 became prominent during the struggle between the burghers of that town and Louis II. (de Mâle), count of Flanders. He was partly responsible for inducing Philip van Artevelde to become first captain of the city of Ghent in 1382, and at the head of some troops scoured the surrounding country for provisions and thus saved Ghent from being starved into submission. By his diplomatic abilities he secured the assistance of the citizens of Brussels, Louvain and Liège, and, having been made admiral of the Flemish fleet, visited England and obtained a promise of help from King Richard II. After Artevelde's death in November 1382, he acted as leader of the Flemings, gained several victories and increased his fame by skilfully conducting a retreat from Damme to Ghent in August 1385. He took part in the conclusion of the treaty of peace between Ghent and Philip the Bold, duke of Burgundy, the successor of Count Louis, in December 1385. Trusting in Philip, and ignoring the warnings of his friends, Ackerman remained in Flanders, and was murdered at Ghent on the 22nd of July 1387, leaving a memory of chivalry and generosity.

See Jean Froissart, *Chroniques*, edited by S. Luce and G. Raynaud (Paris, 1869–1897); Johannes Brandon, *Chronodromon*, edited by K. de Lettenhove in the *Chroniques relatives à l'histoire de la Belgique sous la domination des ducs de Bourgogne* (Brussels, 1870).

ACKERMANN, JOHANN CHRISTIAN GOTTLIEB (1756–1801), German physician, was born at Zeulenroda, in Upper Saxony, on the 17th of February 1756, and died at Altdorf on the 9th of March 1801. At the age of fifteen he became a student of medicine at Jena under E. G. Baldinger, whom he followed to Göttingen in 1773, and afterwards he studied for two years at Halle. A few years' practice at Stendal (1778–1799), where there were numerous factories, enabled him to add many valuable original observations to his translation (1780–1783) of Bernardino Ramazzini's (1633–1714) treatise on diseases of artificers. In 1786 he became professor of medicine at the university of Altdorf, in Franconia, occupying first the chair of chemistry, and then, from 1794 till his death in 1801, that of pathology and therapeutics. He wrote *Institutiones Historiae Medicinae* (Nuremberg, 1792) and *Institutiones Therapiae Generalis* (Nuremberg and Altdorf, 1784–1795), besides various handbooks and translations.

ACKERMANN, LOUISE VICTORINE CHOQUET (1813–1890), French poet, was born in Paris on the 30th of November 1813. Educated by her father in the philosophy of the Encyclopaedists, Victorine Choquet went to Berlin in 1838 to study German, and there married in 1843 Paul Ackermann, an Alsatian philologist. After little more than two years of happy married life her husband died, and Madame Ackermann went to live at Nice with a favourite sister. In 1855 she published *Contes en vers*, and in 1862 *Contes et poésies*. Very different from these simple and charming *contes* is the work on which Madame Ackermann's real reputation rests. She published in 1874 *Poésies, premières poésies, poésies philosophiques*, a volume of sombre and powerful verse, expressing her revolt against human suffering. The volume was enthusiastically reviewed in the *Revue des deux mondes* for May 1871 by E. Caro, who, though he deprecated the *impiété désespérée* of the verses, did full justice to their vigour and the excellence of their form. Soon after the publication of this volume Madame Ackermann removed to Paris, where she gathered round her a circle of friends, but published nothing further except a prose volume, the *Pensées d'un solitaire* (1883), to which she prefixed a short autobiography. She died at Nice on the 2nd of August 1890.

See also Anatole France, *La vie littéraire*, 4th series (1892); the comte d'Haussonville, *Mme. Ackermann* (1882); M. Citoleux, *La poésie philosophique au XIXe. siècle* (vol. i., *Mme. Ackermann d'après de nombreux documents inédits*, Paris, 1906).

ACKERMANN, RUDOLPH (1764–1834), Anglo-German inventor and publisher, was born on the 20th of April 1764 at Schneeberg, in Saxony. He had been a saddler and coach-builder in different German cities, Paris and London for ten years before, in 1795, he established a print-shop and drawing-school in the Strand. Ackermann set up a lithographic press, and applied it in 1817 to the illustration of his *Repository of Arts, Literature, Fashions, &c.* (monthly until 1828 when forty volumes had appeared). Rowlandson and other distinguished artists were regular contributors. He also introduced the fashion of the once popular English Annuals, beginning in 1825 with *Forget-me-not*; and he published many illustrated volumes of topography and travel, *The Microcosm of London* (3 vols., 1808–1811), *Westminster Abbey* (2 vols., 1812), *The Rhine* (1820), *The World in Miniature* (43 vols., 1821–1826), &c. Ackermann was an enterprising man; he patented (1801) a method for rendering paper and cloth waterproof, erected a factory at Chelsea for the purpose and was one of the first to illuminate his own premises with gas. Indeed the introduction of lighting by gas owed much to him. After the battle of Leipzig Ackermann collected nearly a quarter of a million sterling for the German sufferers. He died at Finchley, near London, on the 30th of March 1834.

ACKNOWLEDGMENT (from the old *acknow*, a compound of *on-* and *know*, to know by the senses, which passed through the forms *oknow*, *aknow* and *acknow*; *acknowledge* is formed on analogy of "knowledge"), an admission that something has been given or done, a term used in law in various connexions. The acknowledgment of a debt, if in writing signed by the debtor or his agent, is sufficient to take it out of the Statutes of Limitations. The signature to a will by a testator, if not made in the presence of two witnesses, may be afterwards acknowledged in their presence. The acknowledgment by a woman married before 1882 of deeds for the conveyance of real property not her separate property, requires to be made by her before a judge of the High Court or of a county court or before a perpetual or special commissioner. Before such an acknowledgment can be received, the judge or commissioner is required to examine her apart from her husband, touching her knowledge of the deed, and to ascertain whether she freely and voluntarily consents to it. An acknowledgment to the right of the production of deeds of conveyance is an obligation on the vendor, when he retains any portion of the property to which the deeds relate, and is entitled to retain the deeds, to produce them from time to time at the request of the person to whom the acknowledgment is given, to allow copies to be made, and to undertake for their safe custody (Conveyancing Act 1881, s. 9). The term "acknowledgment" is, in the United States, applied to the certificate of a public officer that an instrument was acknowledged before him to be the deed or act of the person who executed it.

"Acknowledgment money" is the sum paid in some parts of England by copyhold tenants on the death of the lord of the manor.

ACLAND, CHRISTIAN HENRIETTA CAROLINE (1750–1815), usually called Lady Harriet Acland, was born on the 3rd of January 1750, the daughter of the first earl of Ilchester. In 1770 she married John Dyke Acland, who as a member of parliament became a vigorous supporter of Lord North's policy towards the American colonies, and, entering the British army in 1774, served with Burgoyne's expedition as major in the 20th regiment of foot. Lady Harriet accompanied her husband, and, when he was wounded at Ticonderoga, nursed him in his tent at the front. In the second battle of Saratoga Major Acland was again badly wounded and subsequently taken prisoner. Lady Harriet was determined to be with him, and underwent great hardships to accomplish her object, proving herself a courageous and devoted wife. A story has been told that being provided with a letter from General Burgoyne to the American general Gates, she went up the Hudson river in an open boat to the enemy's lines, arriving late in the evening. The American outposts threatened to fire into the boat if its occupants stirred, and Lady Harriet had to wait eight "dark and cold hours" until the sun rose, when she at last received permission to join her husband. Major Acland died in 1778 and Lady Harriet on the 21st of July 1815.

ACLAND, SIR HENRY WENTWORTH, Bart. (1815–1900), English physician and man of learning, was born near Exeter on the 23rd of August 1815, and was the fourth son of Sir Thomas Dyke Acland (1787–1871). Educated at Harrow and at Christ Church, Oxford, he was elected fellow of All Souls in 1840, and then studied medicine in London and Edinburgh. Returning to Oxford, he was appointed Lee's reader in anatomy at Christ Church in 1845, and in 1851 Radcliffe librarian and physician to the Radcliffe Infirmary. Seven years later he became regius professor of medicine, a post which he retained till 1894. He was also a curator of the university galleries and of the Bodleian library, and from 1858 to 1887 he represented his university on the General Medical Council, of which he served as president from 1874 to 1887. He was created a baronet in 1890, and ten years later, on the 16th of October 1900, he died at his house in Broad Street, Oxford. Acland took a leading part in the revival of the Oxford medical school and in introducing the study of natural science into the university. As Lee's reader he began to form a collection of anatomical and physiological preparations on the plan of John Hunter, and the establishment of the Oxford University museum, opened in 1861, as a centre for the encouragement of the study of science, especially in relation to medicine, was largely due to his efforts. "In Henry Acland," said his lifelong friend, John Ruskin, "physiology was an expressed gospel of which he was the solitary preacher to the heathen," but on the other hand his thorough classical training prevented science at Oxford from too abrupt a severance from the humanities. In conjunction with Dean Liddell he revolutionized the study of art and archaeology, so that the cultivation of those subjects for which, as Ruskin declared, no one at Oxford cared before that time, began to flourish in the university. Acland was also interested in questions of public health. He served on the royal commission on sanitary laws in England and Wales in 1869, and published a study of the outbreak of cholera at Oxford in 1854, together with various pamphlets on sanitary matters. His memoir on the topography of the Troad, with panoramic plan (1839), was among the fruits of a cruise which he made in the Mediterranean for the sake of his health.

ACME (Gr. ἀκμή, point), the highest point attainable; first used as an English word by Ben Jonson.

ACMITE, or Aegirite, a mineral of the pyroxene (q.v.) group, which may be described as a soda-pyroxene, being essentially a sodium and ferric metasilicate, $NaFe(SiO_3)_2$. In its crystallographic characters it is close to ordinary pyroxene (augite and diopside), being monoclinic and having nearly the same angle between the prismatic cleavages. There are, however, important differences in the optical characters: the birefringence of acmite is negative, the pleochroism is strong and the extinction angle on the plane of symmetry measured to the vertical axis is small (3°–5°). The hardness is 6–6½, and the specific gravity 3·55. Crystals are elongated in the direction of the vertical axis, and are blackish green (aegirite) or dark brown (acmite) in colour. Being isomorphous with augite, crystals intermediate in composition between augite or diopside and aegirite are not uncommon, and these are known as aegirine-augite or aegirine-diopside.

Acmite is a characteristic constituent of igneous rocks rich in soda, such as nepheline-syenites, phonolites, &c. It was first discovered as slender crystals, sometimes a foot in length, in the pegmatite veins of the granite of Rundemyr, near Kongsberg in Norway, and was named by F. Stromeyer in 1821 from the Gr. ἀκμή, a point, in allusion to the pointed terminations of the crystals. Aegirite (named from Aegir, the Scandinavian sea-god) was described in 1835 from the elaeolite-syenite of southern Norway. Although exhibiting certain varietal differences, the essential identity of acmite and aegirite has long been established, but the latter and more recent name is perhaps in more general use, especially among petrologists.

ACNE, a skin eruption produced by inflammation of the sebaceous glands and hair follicles, the essential point in the disease being the plugging of the mouths of the sebaceous follicles by a "comedo," familiarly known as "blackhead." It is now generally acknowledged that the cause of this disease is the organism known as bacillus acnes. It shows itself in the form of red pimples or papules, which may become pustular and be attended with considerable surrounding irritation of the skin. This affection is likewise most common in early adult life, and occurs on the chest and back as well as on the face, where it may, when of much extent, produce considerable disfigurement. It is apt to persist for months or even years, but usually in time disappears entirely, although slight traces may remain in the form of scars or stains upon the skin. Eruptions of this kind are sometimes produced by the continued internal use of certain drugs, such as the iodide or bromide of potassium. In treating this condition the face should first of all be held over steaming water for several minutes, and then thoroughly bathed. The blackheads should next be removed, not with the finger-nail, but with an inexpensive little instrument known as the "comedo expressor." When the more noticeable of the blackheads have been expressed, the face should be firmly rubbed for three or four minutes with a lather made from a special soap composed of sulphur, camphor and balsam of Peru. Any lather remaining on the face at the end of this time should be wiped off with a soft handkerchief. As this treatment might give rise to some irritation of the skin, it should be replaced every fourth night by a simple application of cold cream. Of drugs used internally sulphide of calcium, in pill, ¼ grain three times a day, is a very useful adjunct to the preceding. The patient should take plenty of exercise in the fresh air, a very simple but nourishing diet, and if present, constipation and anaemia must be suitably treated.

Rosacea, popularly known as *acne rosacea*, is a more severe and troublesome disorder, a true dermatitis with no relation to the foregoing, and in most cases secondary to seborrhea of the scalp. It is characterized by great redness of the nose and cheeks, accompanied by pustular enlargements on the surface of the skin, which produce marked disfigurement. Although often seen in persons who live too freely, it is by no means confined to such, but may arise in connexion with disturbances of the general health, especially of the function of digestion, and in females with menstrual disorders. It is apt to be exceedingly intractable to treatment, which is here too, as in the preceding form, partly local and partly constitutional. Of internal remedies preparations of iodine and of arsenic are sometimes found of service.

ACOEMETI (Gr. *ἀκοίμητος*, sleepless), an order of Eastern monks who celebrated the divine service without intermission day or night. This was done by dividing the communities into choirs, which relieved each other by turn in the church. Their first monastery was established on the Euphrates, in the beginning of the 5th century, and soon afterwards one was founded in Constantinople. Here also, *c.* 460, was founded by the consular Studius the famous monastery of the Studium, which was put in the hands of the Acoemeti and became their chief house, so that they were sometimes called Studites. At Agaunum (St Maurice in the Valais) a monastery was founded by the Burgundian king Sigismund, in 515, in which the perpetual office was kept up; but it is doubtful whether this had any connexion with the Eastern Acoemeti.

The Constantinopolitan Acoemeti took a prominent part in the Christological controversies of the 5th and 6th centuries, at first strenuously opposing Acacius, patriarch of Constantinople, in his attempted compromise with the monophysites; but afterwards, in Justinian's reign, falling under ecclesiastical censure for Nestorian tendencies.

See the article in *Dictionary of Christian Antiquities*; Wetzer und Welte, *Kirchenlexicon* (2nd ed.); and Herzog-Hauck, *Realencyklopädie* (3rd ed.); also the general histories of the time. (E. C. B.)

ACOLYTE (Gr. *ἀκόλουθος*, follower), the last of the four minor orders in the Roman Church. As an office it appears to be of local origin, and is entirely unknown in the Eastern Church, with the exception of the Armenians who borrowed it from the West. Before the council of Nicaea (325) it was only to be found at Rome and Carthage. When in 251 Pope Cornelius, in a letter to Fabius of Antioch, mentions among the Roman clergy forty-two acolytes, placing them after the subdeacons and before the other minor officials (see Eusebius, *Hist. Ecc.* lib. v. cap. 43), he gives no hint that the office was a new one, but speaks of them as holding an already established position. Their institution has therefore to be sought for at an earlier date than his pontificate. It is possible that the *Liber Pontificalis* refers to the office under the Latin synonym, when it says of Pope Victor (186–197) that he made *sequentes cleros*, a term—*sequens*—which Pope Gaius (283–293) uses in the sense of acolyte. While the office was well known in Rome, there is nothing to prove that it was also an order through which, as to-day, every candidate to the priesthood must pass. The contrary is a fact proved by many monumental inscriptions and authentic statements. Though the office is found at Carthage, and St Cyprian (200?–258) makes many references to acolytes, whom he used to carry his letters, this seems to be the only place in Africa where they were known. Tertullian, while speaking of readers and exorcists, says nothing about acolytes; neither does St Augustine. The Irish Church did not know them; and in Spain the council of Toledo (400) makes no mention either of the office or of the order. The *Statuta Ecclesiae Antiqua* (falsely called the Canons of the Fourth Council of Carthage in 397), a Gallican collection, originating in the province of Arles at the beginning of the 6th century, mentions the acolyte, but does not give, as in the case of the other orders, any form for the ordination. The Roman books are silent, and there is no mention of it in the collection known as the *Leonine Sacramentary*; while in the so-called *Gelasian Mass-book*, which, as we have it, is full of Gallican additions made to St Gregory's reform, there is the same silence, though in one MS. of the 10th century given by Muratori we find a form for the ordination of an acolyte. While there is frequent mention of the acolyte's office in the *Ordines Romani*, it is only in the *Ordo* VIII. (which is not earlier than the 7th century) that we find the very simple form for admitting an acolyte to his office. At the end of the mass the cleric, clad in chasuble and stole and bearing a linen bag on one arm, comes before the pope or bishop and receives a blessing. There is no collation of power or order but a simple admission to an office. The evidence available, therefore, points to the fact that the acolyte was only a local office and was not a necessary step or order for every candidate. In England, though the ecclesiastical organization came from Rome and was directed by Romans, we find no trace of such an office or order until the time of Ecgbert of York (767), the friend of Alcuin and therefore subject to Gallican influence. The Pontifical known as Ecgbert's shows that it was then in use both as an office and as an order, and Aelfric (1006) in both his pastoral epistle and canons mentions the acolyte. The conclusion, then, which seems warranted by the evidence, is that the acolyte was an office only at Rome, and, becoming an order in the Gallican Church, found its way as such into the Roman books at some period before the fusion of the two rites under Charlemagne.

The duties of the acolyte, as given in the Roman Pontifical, are identical with those mentioned in the *Statuta Ecclesiae Antiqua* of Arles: "It is the duty of acolytes to carry the candlesticks, to light the lamps of the church, to administer wine and water for the Eucharist." It might seem, from the number forty-two mentioned by Pope Cornelius, that at Rome the acolytes were divided among the seven ecclesiastical regions of the city; but we have no proof that, at that date, there were six acolytes attached to each region. From the ancient division of the Roman acolytes into *Palatini*, or those in attendance on the pope at the Lateran palace, *Stationarii*, or those who served at the churches where there was a "station," and *Regionarii*, or those attached directly to the regions, it would seem that the number forty-two was only the actual number then existing and not an official number. We get a glimpse of their duties from the *Ordines Romani*. When the pope rode in procession to the station an acolyte, on foot, preceded him, bearing the holy chrism; and at the church seven regionary acolytes with candles went before him in the procession to the altar, while two others, bearing the vessel that contained a pre-consecrated Host, presented it for his adoration. During the mass an acolyte bore the thurible (*Ordo* VI.) and three assisted at the washing of the hands. At the moment of communion the acolytes received in linen bags the consecrated Hosts to carry to the assisting priests. This office of bearing the sacrament is an ancient one, and is mentioned in the legend of Tarcisius, the Roman acolyte, who was martyred on the Appian Way while carrying the Hosts from the catacombs. The official dress of the acolyte, according to *Ordo* V., was a close-fitting linen garment (*camisia*) girt about him, a napkin hanging from the left side, a white tunic, a stole (*orarium*) and a chasuble (*planeta*) which he took off when he sang on the steps of the *ambone*.

At the present day, despite the earnest wish of the council of Trent (*Sess.* xxiii. cap. 17 *d.r.*), the acolyte, while remaining an order, has ceased to be essentially a clerical office, since the duties are now performed, almost everywhere, by laymen. The office has been revived, though unofficially, in the Church of England, as a result of the Tractarian movement.

See Morin, *Commentarius in sacris Ecclesiae ordinationibus* (Antwerp, 1685), ii. p. 209, iii. p. 152; Martène, *De Antiquis Ecclesiae ritibus* (Antwerp, 1739), ii. pp. 47 and 86; Mabillon, *Musaeum Italicum II.* for the *Ordines Romani*; Muratori, *Liturgia Romana Vetus*; Cabrol, *Dictionnaire d'archéologie chrétienne et de liturgie*, vol. i. col. 348-536. (E. Tn.)

ACOMINATUS (Akominatos), **MICHAEL** (*c.* 1140–1220), Byzantine writer and ecclesiastic, was born at Chonae (the ancient Colossae). At an early age he studied at Constantinople, and about 1175 was appointed archbishop of Athens. After the capture of Constantinople by the Franks and the establishment of the Latin empire (1204), he retired to the island of Ceos, where he died. He was a versatile writer, and composed homilies, speeches and poems, which, with his correspondence, throw considerable light upon the miserable condition of Attica and Athens at the time. His memorial to Alexis III. Angelus on the abuses of Byzantine administration, the poetical lament over the degeneracy of Athens and the monodes on his brother Nicetas and Eustathius, archbishop of Thessalonica, deserve special mention.

Edition of his works by S. Lambros (1879–1880); Migne, *Patrologia Graeca*, cxl.; see also A. Ellissen, *Michael Akominatos* (1846), containing several pieces with German translation; F. Gregorovius, *Geschichte der Stadt Athen im Mittelalter*, i. (1889); G. Finlay, *History of Greece*, iv. pp. 133-134 (1877).

His younger brother NICETAS (Niketas), sometimes called CHONIATES, who accompanied him to Constantinople, took up politics as a career. He held several appointments under the Angelus emperors (amongst them that of "great logothete" or chancellor) and was governor of the "theme" of Philippopolis at a critical period. After the fall of Constantinople he fled to Nicaea, where he settled at the court of the emperor Theodorus Lascaris, and devoted himself to literature. He died between 1210 and 1220. His chief work is his *History*, in 21 books, of the period from 1180 to 1206. In spite of its florid and bombastic style, it is of considerable value as a record (on the whole impartial) of events of which he was either an eye-witness or had heard at first hand. Its most interesting portion is the description of the capture of Constantinople, which should be read with Villehardouin's and Paolo Rannusio's works on the same subject. The little treatise *On the Statues* destroyed by the Latins (perhaps, as we have it, altered by a later writer) is of special interest to the archaeologist. His dogmatic work (*Θησαυρὸς Ὀρθοδοξίας*, *Thesaurus Orthodoxae Fidei*), although it is extant in a complete form in MS., has only been published in part. It is one of the chief authorities for the heresies and heretical writers of the 12th century.

Editions: *History*, editio princeps, H. Wolf (1557); and in the Bonn *Corpus Scriptorum Hist. Byz.*, 1st ed., Bekker (1835); Rhetorical Pieces in C. Sathas, Μεσαιωνικη Βιβλιοθήκη, i. (1872); *Thesaurus* in Migne, *Patrologia Graeca*, cxxxix., cxl.; see also C. A. Sainte-Beuve, "Geoffroy de Villehardouin" in *Causeries du Lundi*, ix.; S. Reinach, "La fin de l'empire grec" in *Esquisses Archéologiques* (1888); C. Neumann, *Griechische Geschichtsschreiber im 12. Jahrhundert* (1888); Gibbon, *Decline und Fall*, ch. lx.; and (for both Michael and Nicetas) C. Krumbacher, *Geschichte der byzantinischen Litteratur* (1897).

ACONCAGUA, a small northern province of central Chile, bounded N. by Coquimbo, E. by Argentina, S. by Santiago and Valparaiso and W. by the Pacific. Its area is officially computed at 5487 sq. m. Pop. (1895) 113,165; (1902, official estimate based on civil registry returns) 131,255. The province is very mountainous, and is traversed from east to west by the broad valley of the Aconcagua river. The climate is hot and dry, the rainfall being too small to influence climatic conditions. The valleys are highly fertile, and where irrigation is employed large crops are easily raised. Beyond the limits of irrigation the country is semi-barren. Alfalfa and grapes are the principal products, and considerable attention is given to the cultivation of other fruits, such as figs, peaches and melons. The "Vale of Quillota," through which the railway passes between Valparaiso and Santiago, is celebrated for its gardens. The Aconcagua river rises on the southern slope of the volcano Aconcagua, flows eastward through a broad valley, or bay in the mountains, and enters the Pacific 12 m. north of Valparaiso. The river has a course of about 200 m., and its waters irrigate the best and most populous part of the province. Two other rivers—the Ligua and Choapa—traverse the province, the latter forming the northern boundary line. The capital is San Felipe, on the Aconcagua river; it had a population of 11,313 in 1895, and an estimated population of 11,660 in 1902. The other chief town is Santa Rosa de los Andes (est. pop. 6854), which is a principal station on the Transandine branch of the state railway. The only port in the province is Los Vilos, in lat. 32° S., from which a railway 40 m. long runs north-east to the valley of the Choapa. Another short line connects Cabildo, in the valley of the Ligua, with the state railway.

ACONCIO, GIACOMO (1492–1566?), pioneer of religious toleration, was born at Trent, it is said, on the 7th of September 1492. He was one of the Italians like Peter Martyr and Bernardino Ochino who repudiated papal doctrine and ultimately found refuge in England. Like them, his revolt against Romanism took an extremer form than Lutheranism, and after a temporary residence in Switzerland and at Strassburg, he arrived in England soon after Elizabeth's accession. He had studied law and theology, but his profession was that of an engineer, and in this capacity he found employment with the English government. He was granted an annuity of £60 on the 27th of February 1560, and letters of naturalization on the 8th of October 1561 (*Cal. State Papers*, Dom. Ser., Addenda, 1547–1566, p. 495), and was for some time occupied with draining Plumstead marshes, for which object various acts of parliament were passed at this time (*Lords' Journals*, vol. i., and *Commons' Journals*, vol. i., *passim*). In 1564 he was sent to report on the fortifications of Berwick (*Cal. St. Pap.* For. Ser. 1564–1565, *passim*; *Acts P.C.*, 1558–1570, p. 146); his report is now in the Record Office (*C.S.P.* For., 1564–1565, No. 512).

But his real importance depends upon his contribution to the history of religious toleration. Before reaching England he had published a treatise on the methods of investigation, *De Methodo, hoc est, de recte investigandarum tradendarumque Scientiarum ratione* (Basel, 1558, 8vo); and his critical spirit placed him outside all the recognized religious societies of his time. On his arrival in London he had joined the Dutch Reformed Church in Austin Friars, but he was "infected with Anabaptistical and Arian opinions" and was excluded from the sacrament by Grindal, bishop of London. The real nature of his heterodoxy is revealed in his *Stratagemata Satanae*, published in 1565 and translated into various languages. The "stratagems of Satan" are the dogmatic creeds which rent the Christian church. Aconcio sought to find the common denominator of the various creeds; this was essential doctrine, the rest was immaterial. To arrive at this common basis, he had to reduce dogma to a low level, and his result was generally repudiated. Even Selden applied to Aconcio the remark *ubi bene, nil melius; ubi male, nemo pejus*. The dedication of such a work to Queen Elizabeth illustrates the tolerance or religious laxity during the early years of her reign. Aconcio found another patron in the earl of Leicester, and died about 1566.

AUTHORITIES.—Gough's *Index to Parker Soc. Publ.*; Strype's *Grindal*, pp. 62, 66; Bayle's *Dictionnaire*; G. Tiraboschi, *Storia della lett. italiana* (Florence, 1805–1813); *Österreichisches Biogr. Lexikon*; *Nouvelle biogr. générale*; *Dict. Nat. Biogr.* (A. F. P.)

ACONITE (*Aconitum*), a genus of plants belonging to the natural order Ranunculaceae, the buttercup family, commonly known as aconite, monkshood or wolfsbane, and embracing about 60 species, chiefly natives of the mountainous parts of the northern hemisphere. They are distinguished by having one of the five blue or yellow coloured sepals (the posterior one) in the form of a helmet; hence the English name monkshood. Two of the petals placed under the hood of the calyx are supported on long stalks, and have a hollow spur at their apex, containing honey. They are handsome plants, the tall stem being crowned by racemes of showy flowers. *Aconitum Napellus*, common monkshood, is a doubtful native of Britain, and is of therapeutic and toxicological importance. Its roots have occasionally been mistaken for horse-radish. The aconite has a short underground stem, from which dark-coloured tapering roots descend. The crown or upper portion of the root gives rise to new plants. When put to the lip, the juice of the aconite root produces a feeling of numbness and tingling. The horse-radish root, which belongs to the natural order Cruciferae, is much longer than that of the aconite, and it is not tapering; its colour is yellowish, and the top of the root has the remains of the leaves on it.

Many species of aconite are cultivated in gardens, some having blue and others yellow flowers. *Aconitum lycoctonum*, wolfsbane, is a yellow-flowered species common on the Alps of Switzerland. The roots of *Aconitum ferox* supply the famous Indian (Nepal) poison called bikh, bish or nabee. It contains considerable quantities of the alkaloid pseudaconitine, which is the most deadly poison known. *Aconitum palmatum* yields another of the celebrated bikh poisons. The root of *Aconitum luridum*, of the Himalayas, is said to be as virulent as that of *A. ferox* or *A. Napellus*. As garden plants the aconites are very ornamental, hardy perennials. They thrive well in any ordinary garden soil, and will grow beneath the shade of trees. They are easily propagated by divisions of the root or by seeds; great care should be taken not to leave pieces of the root about owing to its very poisonous character.

Chemistry.—The active principle of *Aconitum Napellus* is the alkaloid aconitine, first examined by P. L. Geiger and Hesse (*Ann.*, 1834, 7, p. 267). Alder Wright and A. P. Luff obtained apoaconitine, aconine and benzoic acid by hydrolysis; while, in 1892, C. Ehrenberg and A. Purfürst (*Journ. Prat. Chem.*, 1892, 45, p. 604) observed acetic acid as a hydrolytic product. This, and allied alkaloids, have formed the subject of many investigations by Wyndham Dunstan and his pupils in England, and by Martin Freund and Paul Beck in Berlin. But their constitution is not yet solved, there even being some divergence of opinion as to their empirical formulae. Aconitine ($C_{33}H_{45}NO_{13}$, according to Dunstan; $C_{34}H_{47}NO_{11}$, according to Freund) is a crystalline base, soluble in alcohol, but very sparingly in water; its alcoholic solution is dextrorotatory, but its salts are laevorotatory. When heated it loses water and forms pyraconitine. Hydrolysis gives acetic acid and benzaconine, the chief constituent of the alkaloids picraconitine and napelline; further hydrolysis gives aconine. Pseudaconitine, obtained from *Aconitum ferox*, gives on hydrolysis acetic acid and veratrylpseudaconine, the latter of which suffers further hydrolysis to veratric acid and pseudaconine. Japaconitine, obtained from the Japanese aconites, known locally as "kuza-uzu," hydrolyses to japbenzaconine, which further breaks down to benzoic acid and japaconine. Other related alkaloids are lycaconitine and myoctonine which occur in wolfsbane, *Aconitum lycoctonum*. The usual test for solutions of aconitine consists in slight acidulation with acetic acid and addition of potassium permanganate, which causes the formation of a red crystalline precipitate. In 1905, Dunstan and his collaborators discovered two new aconite alkaloids, indaconitine in "mohri" (*Aconitum chasmanthum*, Stapf), and bikhaconitine in "bikh" (*Aconitum spicatum*); he also proposes to classify these alkaloids according to whether they yield benzoic or veratric acid on hydrolysis (*Jour. Chem. Soc.*, 1905, 87, pp. 1620, 1650).

From the root of *Aconitum Napellus* are prepared a liniment and a tincture. The dose of the latter (Brit. Pharmacop.) is of importance as being exceptionally small, for it is not advisable to give more than at most five drops at a time. The official preparation is an ointment which contains one part of the alkaloid in fifty. It must be used with extreme care, and in small quantities, and it must not be used at all where cuts or cracks are present in the skin.

Pharmacology of Aconite and Aconitine.—Aconite first stimulates and later paralyses the nerves of pain, touch and temperature, if applied to the skin, broken or unbroken, or to a mucous membrane; the initial tingling therefore gives place to a long-continued anaesthetic action. Taken internally aconite acts very notably on the circulation, the respiration and the nervous system. The pulse is slowed, the number of beats per minute being actually reduced, under considerable doses, to forty, or even thirty, per minute. The blood-pressure synchronously falls, and the heart is arrested in diastole. Immediately before arrest the heart may beat much faster than normally, though with extreme irregularity, and in the lower animals the auricles may be observed occasionally to miss a beat, as in poisoning by veratrine and colchicum. The action of aconitine on the circulation is due to an initial stimulation of the cardio-inhibitory centre in the medulla oblongata (at the root of the vagus nerves), and later to a directly toxic influence on the nerve-ganglia and muscular fibres of the heart itself. The fall in blood-pressure is not due to any direct influence on the vessels. The respiration becomes slower owing to a paralytic action on the respiratory centre and, in warm-blooded animals, death is due to this action, the respiration being arrested before the action of the heart. Aconite further depresses the activity of all nerve-terminals, the sensory being affected before the motor. In small doses it therefore tends to relieve pain, if this be present. The activity of the spinal cord is similarly depressed. The pupil is at first contracted, and afterwards dilated. The cerebrum is totally unaffected by aconite, consciousness and the intelligence remaining normal to the last. The antipyretic action which considerable doses of aconite display is not specific, but is the result of its influence on the circulation and respiration and of its slight diaphoretic action.

Therapeutics.—The indications for its employment are limited, but definite. It is of undoubted value as a local anodyne in sciatica and neuralgia, especially in ordinary facial or trigeminal neuralgia. The best method of application is by rubbing in a small quantity of the aconitine ointment until numbness is felt, but the costliness of this preparation causes the use of the aconite liniment to be commonly resorted to. This should be painted on the affected part with a camel's hair brush dipped in chloroform, which facilitates the absorption of the alkaloid. Aconite is indicated for internal administration whenever it is desirable to depress the action of the heart in the course of a fever. Formerly used in every fever, and even in the septic states that constantly followed surgical operations in the pre-Listerian epoch, aconite is now employed only in the earliest stage of the less serious fevers, such as acute tonsilitis, bronchitis and, notably, laryngitis. The extreme pain and rapid swelling of the vocal cords—with threatened obstruction to the respiration—that characterize acute laryngitis may often be relieved by the sedative action of this drug upon the circulation. In order to reduce the pulse to its normal rate in these cases, without at the same time lessening the power of the heart, the drug must be given in doses of about two minims of the tincture every half-hour and then every hour until the pulse falls to the normal rate. Thereafter the drug must be discontinued. It is probably never right to give aconite in doses much larger than that named. There is one condition of the heart itself in which aconite is sometimes useful. Whilst absolutely contra-indicated in all cases of valvular disease, it is of value in cases of cardiac hypertrophy with over-action. But the practitioner must be assured that neither valvular lesion nor degeneration of the myocardium is present.

Toxicology.—In a few minutes after the introduction of a poisonous dose of aconite, marked symptoms supervene. The initial signs of poisoning are referable to the alimentary canal. There is a sensation of burning, tingling and numbness in the mouth, and of burning in the abdomen. Death usually supervenes before a numbing effect on the intestine can be observed. After about an hour there is severe vomiting. Much motor weakness and cutaneous sensations similar to those above described soon follow. The pulse and respiration steadily fail, death occurring from asphyxia. As in strychnine poisoning, the patient is conscious and clear-minded to the last. The only *post-mortem* signs are those of asphyxia. The treatment is to empty the stomach by tube or by a *non-depressant* emetic. The physiological antidotes are atropine and digitalin or strophanthin, which should be injected subcutaneously in maximal doses. Alcohol, strychnine and warmth must also be employed.

ACONTIUS (Gr. *Akontios*), in Greek legend, a beautiful youth of the island of Ceos, the hero of a love-story told by Callimachus in a poem now lost, which forms the subject of two of Ovid's *Heroides* (xx., xxi.). During the festival of Artemis at Delos, Acontius saw Cydippe, a well-born Athenian maiden of whom he was enamoured, sitting in the temple of the goddess. He wrote on an apple the words, "I swear by the sacred shrine of the goddess that I will marry you," and threw it at her feet. She picked it up, and mechanically read the words aloud, which amounted to a solemn undertaking to carry them out. Unaware of this, she treated Acontius with contempt; but, although she was betrothed more than once, she always fell ill before the wedding took place. The Delphic oracle at last declared the cause of her illnesses to be the wrath of the offended goddess; whereupon her father consented to her marriage with Acontius (Aristaenetus, *Epistolae*, i. 10; Antoninus Liberalis, *Metamorphoses*, i., tells the story with different names).

ACORN, the fruit of the oak-tree; a word also used, by analogy with the shape, in nautical language, for a piece of wood keeping the vane on the mast-head. The etymology of the word (earlier *akerne*, and *acharn*) is well discussed in the *New English Dictionary*. It is derived from a word (Goth. *akran*) which meant "fruit," originally "of the unenclosed land," and so of the most important forest produce, the oak. Chaucer speaks of "achornes of okes." By degrees, popular etymology connected the word both with “ corn ” and “ oak-horn,” and the spelling changed accordingly.

ACORUS CALAMUS, sweet-sedge or sweet-flag, a plant of the natural order Araceae, which shares with the Cuckoo Pint (*Arum*) the representation in Britain of that order of Monocotyledons. The name is derived from *acorus*, Gr. ἄκορος, the classical name for the plant. It was the *Calamus aromaticus* of the medieval druggists and perhaps of the ancients, though the latter has been referred by some to the Citron grass, *Andropogon Nardus*. The spice “ Calamus ” or “ Sweet-cane ” of the Scriptures, one of the ingredients of the holy anointing oil of the Jews, was perhaps one of the fragrant species of *Andropogon*. The plant is a herbaceous perennial with a long, branched root-stock creeping through the mud, about ¾ inch thick, with short joints and large brownish leaf-scars. At the ends of the branches are tufts of flat, sword-like, sweet-scented leaves 3 or 4 ft. long and about an inch wide, closely arranged in two rows as in the true Flag (*Iris*); the tall, flowering stems (scapes), which very much resemble the leaves, bear an apparently lateral, blunt, tapering spike of densely packed, very small flowers. A long leaf (spathe) borne immediately below the spike forms an apparent continuation of the scape, though really a lateral outgrowth from it, the spike of flowers being terminal. The plant has a wide distribution, growing in wet situations in the Himalayas, North America, Siberia and various parts of Europe, including England, and has been naturalized in Scotland and Ireland. Though regarded as a native in most counties of England at the present day, where it is now found thoroughly wild on sides of ditches, ponds and rivers, and very abundantly in some districts, it is probably not indigenous. It seems to have been spread in western and central Europe from about the end of the 16th century by means of botanic gardens. The botanist Clusius (Charles de l’Escluse or Lécluse, 1526–1609) first cultivated it at Vienna from a root received from Asia Minor in 1574, and distributed it to other botanists in central and western Europe, and it was probably introduced into England about 1596 by the herbalist Gerard. It is very readily propagated by means of its branching root-stock. It has an agreeable odour, and has been used medicinally. The starchy matter contained in its rhizome is associated with a fragrant oil, and it is used as hair-powder. Sir J. E. Smith (*Eng. Flora*, ii. 158, 2nd ed., 1828) mentions it as a popular remedy in Norfolk for ague. In India it is used as an insectifuge, and is administered in infantile diarrhoea. It is an ingredient in *pot-pourri*, is employed for flavouring beer and is chewed to clear the voice; and its volatile oil is employed by makers of snuff and aromatic vinegar. The rhizome of *Acorus Calamus* is sometimes adulterated with that of *Iris Pseudacorus*, which, however, is distinguishable by its lack of odour, a stringent taste and dark colour.

ACOSTA, JOSÉ DE (1539?–1600), Spanish author, was born at Medina del Campo about the year 1539. He joined the Jesuits in 1551, and in 1571 was sent as a missionary to Peru; he acted as provincial of his order from 1576 to 1581, was appointed theological adviser to the council of Lima in 1582, and in 1583 published a catechism in Quichua and Aymara—the first book printed in Peru. Returning to Spain in 1587, and placing himself at the head of the opposition to Acquaviva, Acosta was imprisoned in 1592–1593; on his submission in 1594 he became superior of the Jesuits at Valladolid, and in 1598 rector of the Jesuit college at Salamanca, where he died on the 15th of February 1600. His treatise *De natura novi orbis libri duo* (Salamanca, 1588–1589) may be regarded as the preliminary draft of his celebrated *Historia natural y moral de las Indias* (Seville, 1590) which was speedily translated into Italian (1596), French (1597), Dutch (1598), German (1601), Latin (1602) and English (1604). The *Historia* is in three sections: books I. and II. deal with generalities; books III. and IV. with the physical geography and natural history of Mexico and Peru; books V., VI. and VII. with the religious and political institutions of the aborigines. Apart from his sophistical defence of Spanish colonial policy, Acosta deserves high praise as an acute and diligent observer whose numerous new and valuable data are set forth in a vivid style. Among his other publications are *De procuranda salute Indorum libri sex* (Salamanca, 1588), *De Christo revelato libri novem* (Rome, 1590), *De temporibus novissimis libri quatuor* (Rome, 1590), and three volumes of sermons issued respectively in 1596, 1597 and 1599.

Authorities.—José R. Carricido, *El P. José de Acosta y su importancia en la literatura científica española* (Madrid, 1899); C. Sommervogel, *Bibliothèque de la Compagnie de Jésus, Première Partie* (Brussels and Paris, 1890), vol. i., col. 31–42; and Edward Grimston’s translation of the *Historia* reprinted (1880) for the Hakluyt Society with introduction and notes by Sir Clements R. Markham. (J. F.-K.)

ACOSTA, URIEL (d. 1647), a Portuguese Jew of noble family, was born at Oporto towards the close of the 16th century. His father being a convert to Christianity, Uriel was brought up in the Roman Catholic faith, and strictly observed the rites of the church till the course of his inquiries led him, after much painful doubt, to abandon the religion of his youth for Judaism. Passing over to Amsterdam, he was received into the synagogue, having his name changed from Gabriel to Uriel. His wayward disposition found, however, no satisfaction in the Jewish fold. He came into conflict with the authorities of the synagogue and was excommunicated. Unlike Spinoza (who was about fifteen at the time of Acosta’s death), Acosta was not strong enough to stand alone. Wearied by his melancholy isolation, he was driven to seek a return to the Jewish communion. Having recanted his heresies, he was readmitted after an excommunication of fifteen years, but was soon excommunicated a second time. After seven years of exclusion, he once more sought admission, and, on passing through a humiliating penance. was again received. His vacillating autobiography, *Exemplar Humanae Vitae*, was published with a “ refutation ” by Limborch in 1687, and republished in 1847. In this brief work Acosta declares his opposition both to Christianity and Judaism, though he speaks with the more bitterness of the latter religion. The only authority which he admits is the *lex naturae*. Acosta was not an original thinker, but he stands in the direct line of the rational Deists. His history forms the subject of a tale and of a tragedy by Gutzkow. Acosta committed suicide in 1647. The significance of his career has been much exaggerated.

ACOTYLEDONES, the name given by Antoine Laurent de Jussieu in 1789 to the lowest class in his Natural System of Botany, embracing flowerless plants, such as ferns, lycopods, horse-tails, mosses, liverworts, sea-weeds, lichens and fungi. The name is derived from the absence of a seed-leaf or cotyledon. Flowering plants bear a seed containing an embryo, with usually one or two cotyledons, or seed-leaves; while in flowerless plants there is no seed and therefore no true cotyledon. The term is synonymous with Cryptogams, by which it was replaced in later systems of classification.

ACOUSTICS (from the Gr. ἀκούειν to hear), a title frequently given to the science of sound, that is, to the description and theory of the phenomena which give rise to the sensation of sound (*q.v.*). The term “ acoustics ” might, however, with advantage be reserved for the aspect of the subject more immediately connected with hearing. Thus we may speak appropriately of the acoustic quality of a room or hall, describing it as good or bad acoustically, according as speaking is heard in it easily or with difficulty. When a room has bad acoustic quality we can almost always assign the fault to large smooth surfaces on the walls, floor or ceiling, which reflect or echo the voice of the speaker so that the direct waves sent out by him at any instant are received by a hearer with the waves sent out previously and reflected at these smooth surfaces. The syllables overlap, and the hearing is confused. The acoustic quality of a room may be improved by breaking up the smooth surfaces by curtains or by arrangement of furniture. The echo is then broken up into small waves, none of which may be sufficiently distinct to interfere with the direct voice. Sometimes a sounding-board over the head of a speaker improves the hearing probably by preventing echo from a smooth wall behind him. A large bare floor is undoubtedly bad for acoustics, for when a room is filled by an audience the hearing is much improved

Wires are frequently stretched across a room overhead, probably with the idea that they will prevent the voice from reaching the roof and being reflected there, but there is no reason to suppose that they are efficient. The only cure appears to consist in breaking up the reflecting surfaces so that the reflexion shall be much less regular and distinct. Probably drapery assists by absorbing the sound to some extent, and thus it lessens the echo besides breaking it up. (J. H. P.)

ACQUI, a city and episcopal see of Piedmont, Italy, in the province of Alessandria; from the town of that name it is 21 m. S.S.W. by rail. Pop. (1901) 13,786. Its warm sulphur springs are still resorted to; under the name of Aquae Statiellae they were famous in Roman times, and Paulus Diaconus and Liutprand speak of the ancient bath establishment. In the neighbourhood of the town are remains of the aqueduct which supplied it. The place was connected by road with Alba Pompeia and Augusta Taurinorum. The tribe of the Statielli, to whom the district belonged, had joined the Romans at an early period, but was attacked in 173 and in part transferred to the north of the Po. The town possesses a fine Gothic cathedral.

ACRÉ, or Aquiry, a river of Brazil and principal tributary of the Purús, rising on the Bolivian frontier and flowing easterly and northerly to a junction with the Purús at 8° 45′ S. lat. The name is also applied to a district situated on the same river and on the former (1867) boundary line between Bolivia and Brazil. The region, which abounds in valuable rubber forests, was settled by Bolivians between 1870 and 1878, but was invaded by Brazilian rubber collectors during the next decade and became tributary to the rubber markets of Manáos and Pará. In 1899 the Bolivian government established a custom-house at Puerto Alonso, on the Acré river, for the collection of export duties on rubber, which precipitated a conflict with the Brazilian settlers and finally brought about a boundary dispute between the two republics. In July 1899 the Acreanos declared their independence and set up a republic of their own, but in the following March they were reduced to submission by Brazil. Various disorders followed until Brazil decided to occupy Puerto Alonso with a military force. The boundary dispute was finally settled at Petropolis on the 17th of November 1903 through the purchase by Brazil of the rubber-producing territory south to about the 11th parallel, estimated at more than 60,000 sq. m.

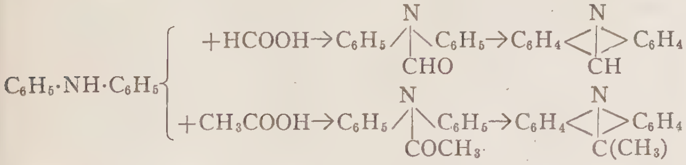
ACRE, *ʽAkka*, or St Jean d'Acre, the chief town of a governmental district of Palestine which includes Haifa, Nazareth and Tiberias. It stands on a low promontory at the northern extremity of the Bay of Acre, 80 m. N.N.W. from Jerusalem, and 25 m. S. of Tyre. The population is about 11,000; 8000 being Moslems, the remainder Christians, Jews, &c. It was long regarded as the "Key of Palestine," on account of its commanding position on the shore of the broad plain that joins the inland plain of Esdraelon, and so affords the easiest entrance to the interior of the country. But trade is now passing over to Haifa, at the south side of the bay, as its harbour offers a safer roadstead, and is a regular calling-place for steamers. Business, rapidly declining, is still carried on in wheat, maize, oil, sesame, &c., in the town market. There are few buildings of interest, owing to the frequent destructions the town has undergone. The wall, which is now ruinous and has but one gate, dates from the crusaders: the mosque was built by Jezzar Pasha (d. 1804) from materials taken from Caesarea Palaestina: his tomb is within. Acre is the seat of the head of the Babist religion.

History.—Few towns have had a more chequered or calamitous history. Of great antiquity, it is probably to be identified with the *ʼAāk* of the tribute-lists of Tethmosis (Thothmes) III. (*c.* 1500 B.C.), and it is certainly the *Akka* of the Tell el-Amarna correspondence. To the Hebrews it was known as *Acco* (Revised Version spelling), but it is mentioned only once in the Old Testament, namely Judges i. 31, as one of the places from which the Israelites did not drive out the Canaanite inhabitants. Theoretically it was in the territory of the tribe of Asher, and Josephus assigns it by name to the district of one of Solomon's provincial governors. Throughout the period of Hebrew domination, however, its political connexions were always with Syria rather than with Palestine proper: thus, about 725 B.C. it joined Sidon and Tyre in a revolt against Shalmaneser IV. It had a stormy experience during the three centuries preceding the Christian era. The Greek historians name it *Ake* (Josephus calls it also *Akre*); but the name was changed to *Ptolemaïs*, probably by Ptolemy Soter, after the partition of the kingdom of Alexander. Strabo refers to the city as once a rendezvous for the Persians in their expeditions against Egypt. About 165 B.C. Simon Maccabaeus defeated the Syrians in many battles in Galilee, and drove them into Ptolemais. About 153 B.C. Alexander Balas, son of Antiochus Epiphanes, contesting the Syrian crown with Demetrius, seized the city, which opened its gates to him. Demetrius offered many bribes to the Maccabees to obtain Jewish support against his rival, including the revenues of Ptolemais for the benefit of the Temple, but in vain. Jonathan threw in his lot with Alexander, and in 150 B.C. he was received by him with great honour in Ptolemais. Some years later, however, Tryphon, an officer of the Syrians, who had grown suspicious of the Maccabees, enticed Jonathan into Ptolemais and there treacherously took him prisoner. The city was also assaulted and captured by Alexander Jannaeus, by Cleopatra and by Tigranes. Here Herod built a gymnasium, and here the Jews met Petronius, sent to set up statues of the emperor in the Temple, and persuaded him to turn back. St Paul spent a day in Ptolemais. The Arabs captured the city in A.D. 638, and lost it to the crusaders in 1110. The latter made the town their chief port in Palestine. It was re-taken by Saladin in 1187, besieged by Guy de Lusignan in 1189 (see below), and again captured by Richard Cœur de Lion in 1191. In 1229 it was placed under the control of the knights of St John (whence one of its alternative names), but finally lost by the Franks in 1291. The Turks under Sultan Selim I. captured the city in 1517, after which it fell into almost total decay. Maundrell in 1697 found it a complete ruin, save for a khan occupied by some French merchants, a mosque and a few poor cottages. Towards the end of the 18th century it seems to have revived under the comparatively beneficent rule of Dhahar el-Amīr, the local sheikh: his successor, Jezzar Pasha, governor of Damascus, improved and fortified it, but by heavy imposts secured for himself all the benefits derived from his improvements. About 1780 Jezzar peremptorily banished the French trading colony, in spite of protests from the French government, and refused to receive a consul. In 1799 Napoleon, in pursuance of his scheme for raising a Syrian rebellion against Turkish domination, appeared before Acre, but after a siege of two months (March–May) was repulsed by the Turks, aided by Sir W. Sidney Smith and a force of British sailors. Jezzar was succeeded on his death by his son Suleiman, under whose milder rule the town advanced in prosperity till 1831, when Ibrahim Pasha besieged and reduced the town and destroyed its buildings. On the 4th of November 1840 it was bombarded by the allied British, Austrian and French squadrons, and in the following year restored to Turkish rule.

Battle of Acre.—The battle of 1189, fought on the ground to the **east** of Acre, affords a good example of battles of the Crusades. The crusading army under Guy of Lusignan, king of Jerusalem, which was besieging Acre, gave battle on the 4th of October 1189 to the relieving army which Saladin had collected. The Christian army consisted of the feudatories of the kingdom of Jerusalem, numerous small contingents of European crusaders and the military orders, and contingents from Egypt, Turkestan, Syria and Mesopotamia fought under Saladin. The Saracens lay in a semicircle **east** of the town facing inwards towards Acre. The Christians opposed them with crossbowmen in first line and the heavy cavalry in second. At Arsuf the Christians fought coherently; here the battle began with a disjointed combat between the Templars and Saladin's right wing. The crusaders were so far successful that the enemy had to send up reinforcements from other parts of the field. Thus the steady advance of the Christian centre against Saladin's own corps, in which the crossbows prepared the way for the charge of the men-at-arms, met with no great resistance. But the victors scattered to plunder. Saladin rallied his men, and, when the Christians began to retire with their booty, let loose his light horse upon them. No connected resistance was offered, and the Turks slaughtered the fugitives until checked by the fresh troops of the Christian right wing. Into this fight Guy's reserve, charged with holding back the Saracens in Acre, was also drawn, and, thus freed, 5000 men sallied out from the town to the northward; uniting with the Saracen right wing, they fell upon the Templars, who suffered severely in their retreat. In the end the crusaders repulsed the relieving army, but only at the cost of 7000 men. (R. A. S. M.)

ACRE, a land measure used by English-speaking races. Derived from the Old Eng. *acer* and cognate with the Lat. *ager*, Gr. ἀγρός, Sans. *ajras*, it has retained its original meaning "open country," in such phrases as "God's acre," or a churchyard, "broad acres," &c. As a measure of land, it was first defined as the amount a yoke of oxen could plough in a day; statutory values were enacted in England by acts of Edward I., Edward III., Henry VIII. and George IV., and the Weights and Measures Act 1878 now defines it as containing 4840 sq. yds. In addition to this "statute" or "imperial acre," other "acres" are still, though rarely, used in Scotland, Ireland, Wales and certain English counties. The Scottish acre contains 6150·4 sq. yds.; the Irish acre 7840 sq. yds.; in Wales, the land measures *erw* (4320 sq. yds.), *stang* (3240 sq. yds.) and *paladr* are called "acres"; the Leicestershire acre (2308¾ sq. yds.), Westmoreland acre (6760 sq. yds.) and Cheshire acre (10,240 sq. yds.) are examples of local values.

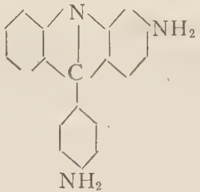
ACRIDINE, $C_{13}H_9N$, in chemistry, a heterocyclic ring compound found in crude coal-tar anthracene. It may be separated by shaking out with dilute sulphuric acid, and then precipitating the sulphuric acid solution with potassium bichromate, the resulting acridine bichromate being decomposed by ammonia. It was first isolated in 1890 by C. Graebe and H. Caro (*Ann.*, 1871, 158, p. 265). Many synthetic processes are known for the production of acridine and its derivatives. A. Bernthsen (*Ann.*, 1884, 224, p. 1) condensed diphenylamine with fatty acids, in the presence of zinc chloride. Formic acid yields acridine, and the higher homologues give derivatives substituted at the *meso* carbon atom,



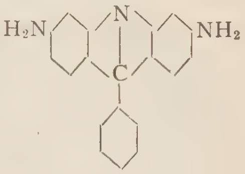
$$C_6H_5\cdot NH\cdot C_6H_5\left\{\begin{array}{l} +HCOOH\rightarrow C_6H_5\diagup\underset{CHO}{\overset{N}{|}}\diagdown C_6H_5\rightarrow C_6H_4<\underset{CH}{\overset{N}{|}}>C_6H_4 \\ +CH_3COOH\rightarrow C_6H_5\diagup\underset{COCH_3}{\overset{N}{|}}\diagdown C_6H_5\rightarrow C_6H_4<\underset{C(CH_3)}{\overset{N}{|}}>C_6H_4 \end{array}\right.$$

Acridine may also be obtained by passing the vapour of phenyl-ortho-toluidine through a red-hot tube (C. Graebe, *Ber.*, 1884, 17, p. 1370); by condensing diphenylamine with chloroform, in presence of aluminium chloride (O. Fischer, *Ber.*, 1884, 17, p. 102); by passing the vapours of orthoaminodiphenylmethane over heated litharge (O. Fischer); by heating salicylic aldehyde with aniline and zinc chloride to 260° C. (R. Mohlau, *Ber.*, 1886, 19, p. 2452); and by distilling acridone over zinc dust (C. Graebe, *Ber.*, 1892, 25, p. 1735).

Acridine and its homologues are very stable compounds of feebly basic character. They combine readily with the alkyl iodides to form alkyl acridinium iodides, which are readily transformed by the action of alkaline potassium ferricyanide to N-alkyl acridones. Acridine crystallizes in needles which melt at 110° C. It is characterized by its irritating action on the skin, and by the blue fluorescence shown by solutions of its salts. On oxidation with potassium permanganate it yields acridinic acid (quinoline -α-β-dicarboxylic acid) $C_9H_5N(COOH)_2$. Numerous derivatives of acridine are known and may be prepared by methods analogous to those used for the formation of the parent base. For the preparation of the naphthacridines, see F. Ullmann, German Patents 117472, 118439, 127586, 128754, and also *Ber.*, 1902, 35, pp. 316, 2670. Phenyl-acridine is the parent base of chrysaniline, which is the chief constituent of the dyestuff phosphine (a bye-product in the manufacture of rosaniline). Chrysaniline (diamino-phenylacridine) forms red-coloured salts, which dye silk and wool a fine yellow; and the solutions of the salts are characterized by their fine yellowish-green fluorescence. It was synthesized by O. Fischer and G. Koerner (*Ber.*, 1884, 17, p. 203) by condensing ortho-nitrobenzaldehyde with aniline, the resulting ortho-nitro-para-diamino-triphenylmethane being reduced to the corresponding orthoamino compound, which on oxidation yields chrysaniline. Benzoflavin, an isomer of chrysaniline, is also a dye-stuff, and has been prepared by K. Oehler (English Patent 9614) from meta-phenylenediamine and benzaldehyde. These substances condense to form tetra-aminotriphenylmethane, which, on heating with acids, loses ammonia and yields diaminodihydrophenylacridine, from which benzoflavin is obtained by oxidation. It is a yellow powder, soluble in hot water. The formulae of these substances are:—



Chrysaniline.



Benzoflavin.

ACRO (or ACRON), **HELENIUS,** Roman grammarian and commentator, probably flourished at the end of the 2nd century A.D. He wrote commentaries on Terence and perhaps Persius. A collection of scholia on Horace, originally anonymous in the earlier MSS., and on the whole not of great value, was wrongly attributed to him at a much later date, probably during the 15th century. It has been published by Pauly (1861) and Hauthal (1866), together with the other Horace scholia.

See *Pseudoacronis Scholia in Horatium Vetustiora*, ed. O. Keller (1902–1904).

ACROBAT (Gr. ἀκροβατεῖν, to walk on tiptoe), originally a rope-dancer; the word is now used generally to cover professional performers on the trapeze, &c., contortionists, balancers and tumblers. Evidence exists that there were very skilful performers on the tight-rope (*funambuli*) among the ancient Romans. Modern rope-walkers (*e.g.* Blondin) or wire-dancers generally use a pole, loaded at the ends, or some such assistance in balancing, and by shifting this are enabled to maintain, or readily to recover, their equilibrium.

ACROGENAE ("growing at the apex"), an obsolete botanical term, originally applied to the higher Cryptogams (mosses and ferns), which were erroneously distinguished from the lower (Algae and Fungi) by apical growth of the stem. The lower Cryptogams were contrasted as Amphigenae ("growing all over"), a misnomer, as apical growth is common among them.

ACROLITHS (Gr. ἀκρόλιθοι, *i.e.* ending in stone), statues of a transition period in the history of plastic art, in which the trunk of the figure was of wood, and the head, hands and feet of marble. The wood was concealed either by gilding or, more commonly, by drapery, and the marble parts alone were exposed. Acroliths are frequently mentioned by Pausanias, the best known specimen being the Athene Areia of the Plataeans.

ACROMEGALY, the name given to a disease characterized by a true hypertrophy (an overgrowth involving both bony and soft parts) of the terminal parts of the body, especially of the face and extremities (Gr. ἄκρον, point, and μέγας, large). It is more frequent in the female sex, between the ages of 25 and 40. Its causation is generally associated with disturbances in the pituitary gland, and an extract of this body has been tried in the treatment, as one of the recent developments in organotherapeutics; thyroid extract has also been used, but without marked success, on the apparent analogy of acromegaly with myxoedema.

ACRON, a Greek physician, born at Agrigentum in Sicily, was contemporary with Empedocles, and must therefore have lived in the 5th century before Christ. The successful measure of lighting large fires, and purifying the air with perfumes, to put a stop to the plague in Athens (430 B.C.), is said to have originated with him; but this has been questioned on chronological grounds. Suidas gives the titles of several medical works written by him in the Doric dialect.

ACROPOLIS (Gr. ἄκρος, top, πόλις, city), literally the upper part of a town. For purposes of defence early settlers naturally chose elevated ground, frequently a hill with precipitous sides, and these early citadels became in many parts of the world the nuclei of large cities which grew up on the surrounding lower ground. The word Acropolis, though Greek in origin and associated primarily with Greek towns (Athens, Argos, Thebes, Corinth), may be applied generically to all such citadels (Rome, Jerusalem, many in Asia Minor, or even Castle Hill at Edinburgh). The most famous is that of Athens, which, by reason of its historical associations and the famous buildings erected upon it, is generally known without qualification as *the* Acropolis (see ATHENS).

ACROPOLĪTA (AKROPOLĪTĒS), **GEORGE** (1217–1282), Byzantine historian and statesman, was born at Constantinople. At an early age he was sent by his father to the court of John Ducas Batatzes (Vatatzes), emperor of Nicaea, by whom and by his successors (Theodorus II. Lascaris and Michael VIII. Palaeologus) he was entrusted with important state missions. The office of "great logothete" or chancellor was bestowed upon him in 1244. As commander in the field in 1257 against Michael Angelus, despot of Epirus, he showed little military capacity. He was captured and kept for two years in prison, from which he was released by Michael Palaeologus. Acropolita's most important political task was that of effecting a reconciliation between the Greek and Latin Churches, to which he had been formerly opposed. In 1273 he was sent to Pope Gregory X., and in the following year, at the council of Lyons, in the emperor's name he recognized the spiritual supremacy of Rome. In 1282 he was sent on an embassy to John II., emperor of Trebizond, and died in the same year soon after his return. His historical work (Χρονικὴ Συγγραφή, *Annales*) embraces the period from the capture of Constantinople by the Latins (1204) to its recovery by Michael Palaeologus (1261), thus forming a continuation of the work of Nicetas Acominatus. It is valuable as written by a contemporary, whose official position as great logothete, military commander and confidential ambassador afforded him frequent opportunities of observing the course of events. Acropolita is considered a trustworthy authority as far as the statement of facts is concerned, and he is easy to understand, although he exhibits special carelessness in the construction of his sentences. He was also the author of several shorter works, amongst them being a funeral oration on John Batatzes, an epitaph on his wife Eirene and a panegyric of Theodorus II. Lascaris of Nicaea. While a prisoner at Epirus he wrote two treatises on the procession of the Holy Ghost (Ἐκπόρευσις, *Processio Spiritus Sancti*).

Editio princeps by Leo Allatius (1651), with the editor's famous treatise *De Georgiis eorumque Scriptis*; editions in the Bonn *Corpus Scriptorum Hist. Byz.*, by I. Bekker (1836), and Migne, *Patrologia Graeca*, cxl.; in the Teubner series by A. Heisenberg (1903), the second volume of which contains a full life, with bibliography; see also C. Krumbacher, *Geschichte der byzantinischen Litteratur* (1897).

ACROSTIC (Gr. ἄκρος, at the end, and στίχος, line or verse), a short verse composition, so constructed that the initial letters of the lines, taken consecutively, form words. The fancy for writing acrostics is of great antiquity, having been common among the Greeks of the Alexandrine period, as well as with the Latin writers since Ennius and Plautus, many of the arguments of whose plays were written with acrostics on their respective titles. One of the most remarkable acrostics was contained in the verses cited by Lactantius and Eusebius in the 4th century, and attributed to the Erythraean sibyl, the initial letters of which form the words Ἰησοῦς Χριστὸς Θεοῦ υἱὸς σωτήρ: "Jesus Christ, the Son of God, the Saviour." The initials of the shorter form of this again make up the word ἰχθύς (fish), to which a mystical meaning has been attached (Augustine, *De Civitate Dei*, 18, 23), thus constituting another kind of acrostic.

The monks of the middle ages, who wrote in Latin, were fond of acrostics, as well as the poets of the Middle High German period, notably Gottfried of Strassburg and Rudolph of Ems. The great poets of the Italian renaissance, among them Boccaccio, indulged in them, as did also the early Slavic writers. Sir John Davies (1569–1626) wrote twenty-six elegant *Hymns to Astraea*, each an acrostic on "Elisabetha Regina"; and Mistress Mary Fage, in *Fame's Roule*, 1637, commemorated 420 celebrities of her time in acrostic verses. The same trick of composition is often to be met with in the writings of more recent versifiers. Sometimes the lines are so combined that the final letters as well as the initials are significant. Edgar Allan Poe worked two names—one of them that of Frances Sargent Osgood—into verses in such a way that the letters of the names corresponded to the first letter of the first line, the second letter of the second, the third letter of the third, and so on.

Acrostic verse has always been held in slight estimation from a literary standpoint. Dr Samuel Butler says, in his "Character of a Small Poet," "He uses to lay the outsides of his verses even, like a bricklayer, by a line of rhyme and acrostic, and fill the middle with rubbish." Addison (*Spectator*, No. 60) found it impossible to decide whether the inventor of the anagram or the acrostic were the greater blockhead; and, in describing the latter, says, "I have seen some of them where the verses have not only been edged by a name at each extremity, but have had the same name running down like a seam through the middle of the poem." And Dryden, in *Mac Flecknoe*, scornfully assigned Shadwell the rule of

Some peaceful province in acrostic land.

The name acrostic is also applied to alphabetical or "abecedarian" verses. Of these we have instances in the Hebrew psalms (*e.g.* Ps. xxv. and xxxiv.), where successive verses begin with the letters of the alphabet in their order. The structure of Ps. cxix. is still more elaborate, each of the verses of each of the twenty-two parts commencing with the letter which stands at the head of the part in our English translation.

At one period much religious verse was written in a form imitative of this alphabetical method, possibly as an aid to the memory. The term acrostic is also applied to the formation of words from the initial letters of other words. Ἰχθύς, referred to above, is an illustration of this. So also is the word "Cabal," which, though it was in use before, with a similar meaning, has, from the time of Charles II., been associated with a particular ministry, from the accident of its being composed of Clifford, Ashley, Buckingham, Arlington and Lauderdale. Akin to this are the names by which the Jews designated their Rabbis; thus Rabbi Moses ben Maimon (better known as Maimonides) was styled "Rambam," from the initials R.M.B.M.; Rabbi David Kimchi (R.D.K.), "Radak," &c.

Double acrostics are such as are so constructed, that not only initial letters of the lines, but also the middle or last letters, form words. For example:—1. By Apollo was my first made. 2. A shoemaker's tool. 3. An Italian patriot. 4. A tropical fruit. The initials and finals, read downwards, give the name of a writer and his *nom de plume*. Answer: *Lamb, Elia.*

1. L yr E
2. A w L
3. M azzin I
4. B anan A

ACROTERIUM (Gr. ἀκρωτήριον, the summit or vertex), in architecture, a statue or ornament of any kind placed on the apex of a pediment. The term is often restricted to the plinth, which forms the podium merely for the acroterium.

ACT (Lat. *actus*, *actum*), something done, primarily a voluntary deed or performance, though any accomplished fact is often included. The signification of the word varies according to the sense in which it is employed. It is often synonymous with "statute" (see ACT OF PARLIAMENT). It may also refer to the result of the vote or deliberation of any legislature, the decision of a court of justice or magistrate, in which sense records, decrees, sentences, reports, certificates, &c., are called acts.

In law it means any instrument in writing, for declaring or justifying the truth of a bargain or transaction, as: "I deliver this as my act and deed." The origin of the legal use of the word "act" is in the *acta* of the Roman magistrates or people, of their courts of law, or of the senate, meaning (1) what was done before the magistrates, the people or the senate; (2) the records of such public proceedings.

In connexion with other words "act" is employed in many phrases, e.g. *act of God*, any event, such as the sudden, violent or overwhelming occurrence of natural forces, which cannot be foreseen or provided against. This is a good defence to a suit for non-performance of a contract. *Act of honour* denotes the acceptance by a third party of a protested bill of exchange for the honour of any party thereto. *Act of grace* denotes the granting of some special privilege.

In universities, the presenting and publicly maintaining a thesis by a candidate for a degree, to show his proficiency, is an act. "*The* Act" at Oxford, up to 1856 when it was abolished, was the ceremony held early in July for this purpose, and the expressions "Act Sunday," "Act Term" still survive.

In dramatic literature, *act* signifies one of those parts into which a play is divided to mark the change of time or place, and to give a respite to the actors and to the audience. In Greek plays there are no separate acts, the unities being strictly observed, and the action being continuous from beginning to end. If the principal actors left the stage the chorus took up the argument, and contributed an integral part of the play, though chiefly in the form of comment upon the action. When necessary, another *drama*, which is etymologically the same as an *act*, carried on the history to a later time or in a different place, and thus we have the Greek trilogies or groups of three dramas, in which the same characters reappear. The Roman poets first adopted the division into acts, and suspended the stage business in the intervals between them. Their number was usually five, and the rule was at last laid down by Horace in the *Ars Poetica*—

> Neve minor, neu sit quinto productior actu
> Fabula, quae posci vult, et spectata reponi.
> "If you would have your play deserve success,
> Give it five acts complete, nor more nor less." (*Francis.*)

On the revival of letters this rule was almost universally observed by dramatists, and that there is an inherent convenience and fitness in the number five is evident from the fact that Shakespeare, who refused to be trammelled by merely arbitrary rules, adopts it in all his plays. Some critics have laid down rules as to the part each act should sustain in the development of the plot, but these are not essential, and are by no means universally recognized. In comedy the rule as to the number of acts has not been so strictly adhered to as in tragedy, a division into two acts or three acts being quite usual since the time of Molière, who first introduced it. It may be well to mention here Milton's *Samson Agonistes* as a specimen in English literature of a dramatic work founded on a purely Greek model, in which, consequently, there is no division into acts.

For "acting," as the art and theory of dramatic representation (or *histrionics*, from Lat. *histrio*, an actor), see the article DRAMA.

ACTA DIURNA (Lat. *acta*, public acts or records; *diurnus*, daily, from *dies*), called also *Acta Populi*, *Acta Publica* and simply *Acta* or *Diurna*, in ancient Rome a sort of daily gazette, containing an officially authorized narrative of noteworthy events at Rome. Its contents were partly official (court news, decrees of the emperor, senate and magistrates), partly private (notices of births, marriages and deaths). Thus to some extent it filled the place of the modern newspaper (*q.v.*). The origin of the *Acta* is attributed to Julius Caesar, who first ordered the keeping and publishing of the acts of the people by public officers (59 B.C.; Suetonius, *Caesar*, 20). The *Acta* were drawn up from day to day, and exposed in a public place on a whitened board (see ALBUM). After remaining there for a reasonable time they were taken down and preserved with other public documents, so that they might be available for purposes of research. The *Acta* differed from the Annals (which were discontinued in 133 B.C.) in that only the greater and more important matters were given in the latter, while in the former things of less note were recorded. Their publication continued till the transference of the seat of the empire to Constantinople. There are no genuine fragments extant.

Leclerc, *Des journaux chez les Romains* (1838); Renssen, *De Diurnis aliisque Romanorum Actis* (1857); Hübner, *De Senatus Populique Romani Actis* (1860); Gaston Boissier, *Tacitus and other Roman Studies* (Eng. trans., W. G. Hutchison, 1906), pp. 197-229.

ACTAEON, son of Aristaeus and Autonoë, a famous Theban hero and hunter, trained by the centaur Cheiron. According to the story told by Ovid (*Metam.* iii. 131; see also Apollod iii. 4), having accidentally seen Artemis (Diana) on Mount Cithaeron while she was bathing, he was changed by her into a stag, and pursued and killed by his fifty hounds. His statue was often set up on rocks and mountains as a protection against excessive heat. The myth itself probably represents the destruction of vegetation during the fifty dog-days. Aeschylus and other tragic poets made use of the story, which was a favourite subject in ancient works of art. There is a well-known small marble group in the British Museum illustrative of the story.

ACTA SENATUS, or COMMENTARII SENATUS, minutes of the discussions and decisions of the Roman senate. Before the first consulship of Julius Caesar (59 B.C.), minutes of the proceedings of the senate were written and occasionally published, but unofficially; Caesar, desiring to tear away the veil of mystery which gave an unreal importance to the senate's deliberations, first ordered them to be recorded and issued authoritatively. The keeping of them was continued by Augustus, but their publication was forbidden (Suetonius, *Augustus*, 36). A young senator (*ab actis senatus*) was chosen to draw up these Acta, which were kept in the imperial archives and public libraries (Tacitus, *Ann.* v. 4). Special permission from the city praefect was necessary in order to examine them. For authorities see ACTA DIURNA.

ACTINOMETER (Gr. *ἀκτίς*, ray, *μέτρον*, measure), an instrument for measuring the heating and chemical effects of light. The name was first given by Sir John Herschel to an apparatus for measuring the heating effect of solar rays (*Edin. Journ. Science*, 1825); Herschel's instrument has since been discarded in favour of the pyrheliometer (Gr. πῦρ, fire, ἥλιος, sun). (See RADIATION.) The word actinometer is now usually applied to instruments for measuring the *actinic* or chemical effect of luminous rays; their action generally depends upon photochemical changes (see PHOTO-CHEMISTRY). Certain practical forms are described in the article PHOTOGRAPHY.

ACTINOMYCOSIS (STREPTOTRICHOSIS), a chronic infective disease occurring in both cattle and man. In both these groups it presents the same clinical course, being characterized by chronic inflammation with the formation of granulomatous tumours, which tend to undergo suppuration, fibrosis or calcification. It used to be believed that this disease was caused by a single vegetable parasite, the Ray-Fungus, but there is now an overwhelming mass of observations to show that the clinical features may be produced by a number of different species of parasites, for which the generic name Streptothrix has been generally adopted. In 1899 the committee of the Pathological Society of London recommended that the term Streptotrichosis should be used as the appropriate clinical epithet of the large class of Streptothrix infections. And since that year the name Actinomycosis has been falling into disuse, and in any case is only used synonymously with Streptotrichosis. For a further account of these parasites see the articles on BACTERIOLOGY and on PARASITIC DISEASES.

Pathological Anatomy.—The naked-eye appearance of the different organs affected by Streptothrix infection varies according to the duration and acuteness of the disease. In some tissues the appearance is that of simple inflammation, whereas in others it may be characteristic. The liver when affected shows scattered foci of suppuration, which may become aggregated into spheroidal masses, surrounded by a zone of inflammation. In the lungs the changes may be any that are produced by the following conditions. (1) An acute bronchitis. (2) A phthisical lung, grey nodules being scattered here and there almost exactly simulating tuberculous nodules. (3) An acute broncho-pneumonia with some interstitial fibrosis and a tendency to abscess formation. The most characteristic lesions are in the skin. These appear as nodules, sarcomatous-looking, soft and pulpy. Their colour is mottled, yellow and purplish red. The skin over them is thinned out, and broken down in places to form one or two crateriform ulcers from which a clear sticky fluid exudes. The size varies from that of a pea to a small orange. The pus is characteristic, varying in consistency though usually viscid, and containing numerous minute specks.

The disease is more common in males than in females, and more prevalent in Germany and Russia than in England. The infection is probably spread by grain (corn or barley), on which the fungus may often be found. In a great number of recorded cases the patient has been following agricultural pursuits. The disease can only be transmitted from one individual to another with considerable difficulty, and no case of direct transmission from animal to man has yet been noted.

Clinical History.—The course of actinomycosis is usually a chronic one, but occasionally the fungus gets into the blood, when the course is that of an acute infective disease or even pyaemia. The symptoms are entirely dependent on the organ attacked, and are in no way specially characteristic. During life a diagnosis of phthisis is continually made, and only a microscopic examination after death renders the true nature of the disease apparent. The nature of the skin lesion is the most evident, and here the parasite can be detected early in the illness. The only drug which appears to have any beneficial influence on the course of the disease is potassium iodide, and this has occasionally been used with great benefit. Surgical interference is usually needed, either excision of the part affected, or, where possible, a thorough scraping of the lesion and free application of antiseptics.

ACTINOZOA, a term in systematic zoology, first used by H. M. D. de Blainville about 1834, to designate animals the organs of which were disposed radially about a centre. De Blainville included in his group many unicellular forms such as *Noctiluca* (see PROTOZOA), sea-anemones, corals, jelly-fish and hydroid polyps, echinoderms, polyzoa and rotifera. T. H. Huxley afterwards restricted the term. He showed that in de Blainville's group there were associated with a number of heterogeneous forms a group of animals characterized by being composed of two layers of cells comparable with the first two layers in the development of vertebrate animals. Such forms he distinguished as Coelentera, and showed that they had no special affinity with echinoderms, polyzoa, &c. He divided the Coelentera into a group Hydrozoa, in which the sexually produced embryos were usually set free from the surface of the body, and a group Actinozoa, in which the embryos are detached from the interior of the body and escape generally by the oral aperture. Huxley's Actinozoa comprised the sea-anemones, corals and sea-pens, on the one hand, and the Ctenophora on the other. Later investigations, whilst confirming the general validity of Huxley's conclusions, have slightly altered the limits and definitions of his groups. (See ANTHOZOA, COELENTERA, CTENOPHORA and HYDROZOA.) (P. C. M.)

ACTION, in law, a term used by jurists in three different senses: (1) a right to institute proceedings in a court of justice to obtain redress for a wrong (*actio nihil aliud est quam jus prosequendi in judicio quod alicui debetur*, Bracton, *de Legibus Angliae*, bk. iii. ch. i., f. 98 *b*); (2) the proceeding itself (*action n'est auter chose que loyall demande de son droit*, Co. Litt. 285 (a)); (3) the particular form of the proceeding. The term is derived from the Roman law (*actio*), in which it is used in all three senses. In the history of Roman law, actions passed through three stages. The first period (terminated about 170 B.C. by the *Lex Aebutia*) is known as the system of *legis actiones*, and was based on the precepts of the XII. tables and used before the *praetor urbanus*. These *actiones* were five in number—*sacramenti*, *per judicis postulationem*, *per condictionem*, *per manus injectionem*, *per pignoris captionem*. The first was the primitive and characteristic action of the Roman law, and the others were little more than modes of applying it to cases not contemplated in the original form, or of carrying the result of it into execution when the action had been decided. The *legis actiones* were superseded by the *formulae*, originated by the *praetor peregrinus* for the determination of controversies between foreigners, but found more flexible than the earlier system and made available for citizens by the *Lex Aebutia*. Under both these systems the *praetor* referred the matter in dispute to an arbiter (*judex*), but in the later he settled the *formula* (*i.e.* the issues to be referred and the appropriate form of relief) before making the order of reference. In the third stage, the formulary stage fell into disuse, and after A.D. 342 the magistrate himself or his deputy decided the controversy after the defending party had been duly summoned by a *libellus*.

The classifications of *actiones* in Roman law were very numerous. The division which is still most universally recognized is that of actions *in rem* and actions *in personam* (Sohm, *Roman Law*, tr. by Ledlie, 2nd ed. 277). An action *in rem* asserts a right to a particular thing against all the world. An action *in personam* asserts a right only against a particular person. Perhaps the best modern example of the distinction is that made in maritime cases between an action against a ship after a collision at sea, and an action against the owners of the ship.

In English law the term "action" at a very early date became associated with civil proceedings in the Court of Common Pleas, which were distinguished from pleas of the crown, such as indictments or informations and for suits in the Court of Chancery or in the Admiralty or ecclesiastical courts. The English action was a proceeding commenced by writ original at the common law. The remedy was of right and not of grace. The history of actions is the history of civil procedure in the courts of common law. As a result of the reform of civil procedure by the Judicature Acts the term "action" in English law now means at the High Court of Justice "a civil proceeding commenced by writ of summons or in such other manner as may be prescribed by rules of court" (*e.g.* by *originating summons*). The proceeding thus commenced ends by judgment and execution. This definition includes proceedings under the Chancery, Admiralty and Probate jurisdiction of the High Court, but excludes proceedings commenced by petition, such as divorce suits and bankruptcy and winding-up matters, as well as criminal proceedings in the High Court or applications for the issue of the writs of *mandamus*, *prohibition*, *habeas corpus* or *certiorari*. The Judicature Acts and Rules have had the effect of abolishing all the forms of "action" used at the common law and of creating one common form of legal proceeding for all ordinary controversies between subjects in whatever division of the High Court. The stages in an English action are the *writ*, by which the persons against whom relief is claimed are summoned before the court; the *pleadings* and interlocutory steps, by which the issues between the parties are adjusted; the *trial*, at which the issues of fact and law involved are brought before the tribunal; the *judgment*, by which the relief sought is granted or refused; and *execution*, by which the law gives to the successful party the fruits of the judgment.

The procedure varies according as the action is in the High Court, a county court or one of the other local courts of record which still survive; but there is no substantial difference in the incidents of trial, judgment and execution in any of these courts. The initial difference between actions in the High Court and the county court is that the latter are commenced by plaint lodged in the court, on which a summons is prepared by the court and served by its bailiff, whereas in the High Court the party prepares the writ and lodges it in court for sealing, and when it is sealed, himself effects the service.

An action is said to "lie" when the law provides a remedy for some particular act or omission by a subject which infringes the legal rights of another subject. An act of such a character is said to give a "cause of action." In the action the person who alleges himself aggrieved claims a judgment of the court in his favour giving an adequate and appropriate remedy for the injury or damage which he has sustained by the infraction of his rights. As to the time within which an action must be brought, see LIMITATION, STATUTES OF. When the rights of a subject are infringed by the illegal action of the state, an action lies in England against the officers who have done the wrong, unless the claim be one arising out of breach of a contract with the state, or out of an "Act of State." For a breach by the state of a contract made between the state and a subject the remedy of the subject is, as a general rule, not by action against the agents of the state who acted for the state with reference to the making or breach of the contract, but against the Crown itself by the proceeding called Petition of Right (see PETITION).

While as a generic term "action" in its proper legal sense includes suits by the Crown and "criminal actions" (see Co. Litt. 284b; Bracton, *de Legibus Angliae*, bk. iii. ch. v. f. 1046; *Bradlaugh* v. *Clarke*, 1883, 8 App. Cas. 354, 361, 374), in popular language it is taken to mean a proceeding by a subject and is now rarely applied in England even by lawyers to criminal proceedings. What are now known as "penal actions," *i.e.* proceedings in which an individual who has not suffered personally by a breach of the law sues as a common informer for the statutory penalty either on his own benefit or on behalf also of the Crown (*qui tam pro rege quam pro se ipso*), bear some analogy to the *actio popularis* of Roman law, from which they are derived (see the statute 4 Hen. VII. 1488); but they are now treated for most purposes as civil and not as criminal proceedings. The law of Scotland follows the lines of the civil law, and the expression "criminal action" is in use to distinguish proceedings to punish offences against the public as distinguished from civil action, brought to enforce a private right.

In the United States, and the British colonies in which English law runs by settlement, charter, proclamation or statute, the nature of an action is substantially the same as in England. The differences between one state of the Union and another, and one colony and another, depend mainly on the extent to which the old procedure of the common law has been abolished, simplified or reformed by local legislation.

AUTHORITIES.—Roman Law: Sohm, *Institutes of Roman Law*, W. G. Ledlie (2nd ed., 1901). English Law: Pollock and Maitland, *English Law*; Holmes, *The Common Law*; Bullen and Leake, *Prec. Pleadings* (3rd ed.; 6th ed. 1905).

ACTIUM (mod. *Punta*), the ancient name of a promontory in the north of Acarnania (Greece) at the mouth of the Sinus Ambracius (Gulf of Arta) opposite Nicopolis, built by Augustus on the north side of the strait. On the promontory was an ancient temple of Apollo Actius, which was enlarged by Augustus, who also, in memory of the battle, instituted or renewed the quinquennial games called *Actia* or *Ludi Actiaci*. *Actiaca Aera* was a computation of time from the battle of Actium. There was on the promontory a small town, or rather village, also called *Actium*.

History.—Actium belonged originally to the Corinthian colonists of Anactorium, who probably founded the worship of Apollo Actius and the *Actia* games; in the 3rd century it fell to the Acarnanians, who subsequently held their synods there. Actium is chiefly famous as the site of Octavian's decisive victory over Mark Antony (2nd of September 31 B.C.). This battle ended a long series of ineffectual operations. The final conflict was provoked by Antony, who is said to have been persuaded by Cleopatra to retire to Egypt and give battle to mask his retreat; but lack of provisions and the growing demoralization of his army would sufficiently account for his decision. The fleets met outside the gulf, each over 200 strong (the totals given by ancient authorities are very conflicting). Antony's heavy battleships endeavoured to close and crush the enemy with their artillery; Octavian's light and mobile craft made skilful use of skirmishing tactics. During the engagement Cleopatra suddenly withdrew her squadron and Antony slipped away behind her. His flight escaped notice, and the conflict remained undecided, until Antony's fleet was set on fire and thus annihilated.

AUTHORITIES.—Dio Cassius, 50.12-51.3; Plutarch, *Antonius*, 62-68; Velleius Paterculus, ii. 84-85. C. Merivale, *History of the Romans under the Empire*, iii. pp. 313-325 (London, 1851); V. Gardthausen, *Augustus und seine Zeit*, i. pp. 369-386, ii. pp. 189-201 (Leipzig, 1891); G. Ferrero in the *Revue de Paris*, Mar. 15, 1906, pp. 225-243; J. Kromayer, in *Hermes*, xxxiv. (1899), pp. 1-54. (M. O. B. C.)

ACT OF PARLIAMENT. An act of parliament may be regarded as a declaration of the legislature, enforcing certain rules of conduct, or defining rights and conferring them upon or withholding them from certain persons or classes of persons. The collective body of such declarations constitutes the statutes of the realm or written law of the British nation, in the widest sense, from Anglo-Saxon times to the present day. It is not, however, till the earlier half of the 13th century that, in a more limited constitutional sense, the statute-book is generally held to open, and the parliamentary records only begin to assume distinct outlines late in the reign of Edward I. It gradually became a fixed constitutional principle that an act of parliament, to be valid, must express concurrently the will of the entire legislature. It was not, however, till the reign of Henry VI. that it became customary, as now, to introduce bills into parliament in the form of finished acts; and the enacting clause, regarded by constitutionalists as the first perfect assertion, in words, of popular right, came into general use as late as the reign of Charles II. It is thus expressed in the case of all acts other than those granting money to the crown:—"Be it enacted by the King's most excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal and Commons in this present Parliament assembled, and by the authority of the same." Where the act is a money grant the enacting clause is prefaced by the words, "Most gracious Sovereign, we, Your Majesty's most dutiful and loyal subjects, the Commons of the United Kingdom of Great Britain and Ireland, in Parliament assembled, towards making good the supply[1] which we have cheerfully granted to Your Majesty in this session of Parliament, have resolved to grant unto Your Majesty the sums hereinafter mentioned; and do therefore most humbly beseech Your Majesty that it may be enacted, &c." The use of the preamble with which acts are usually prefaced is thus quaintly set forth by Lord Coke: "The rehearsal or preamble of the statute is a good meane to find out the meaning of the statute, and, as it were, a key to open the understanding thereof" (Co. Litt. 79a). Originally the collective acts of each session formed but one statute, to which a general title was attached, and for this reason an act of parliament was up to 1892 generally cited as the chapter of a particular statute, *e.g.* 24 and 25 Vict. c. 101. Titles were, however, prefixed to individual acts as early as 1488. Now, by the Short Titles Act 1892, it is optional to cite most important acts up to that date by their short titles, either individually or collectively. Most modern acts have borne short titles independently of the act of 1892. (See PARLIAMENT; STATUTE.)

ACTON (JOHN EMERICH EDWARD DALBERG ACTON), 1ST BARON (1834–1902), English historian, only son of Sir Richard Acton, 7th baronet, and grandson of the Neapolitan admiral, Sir J. F. E. Acton, 6th baronet (*q.v.*), was born at Naples on the 10th of January 1834. His grandfather, who had succeeded in 1791 to the baronetcy and family estates in Shropshire, previously held by the English branch of the Acton family, represented a younger branch which had transferred itself first to France and then to Italy, but by the extinction of the elder branch the admiral became head of the family; his eldest son, Richard, had married Marie Louise Pelline, the daughter and heiress of Emerich Joseph, duc de Dalberg (*q.v.*), a naturalized French noble of ancient German lineage who had entered the French service under Napoleon and represented Louis XVIII. at the congress of Vienna in 1814, and after Sir Richard Acton's death in 1837 she became (1840) the wife of the 2nd Earl Granville. Coming of a Roman Catholic family, young Acton was educated at Oscott till 1848 under Dr (afterwards Cardinal) Wiseman, and then at Edinburgh, and at Munich under Döllinger, whose lifelong friend he became. He had wished to go to Cambridge, but for a Roman Catholic this was then impossible. By Döllinger he was inspired with a deep love of historical research and a profound conception of its functions as a critical instrument. He was a master of the chief foreign languages, and began at an early age to collect a magnificent historical library, with the object, never in fact realized, of writing a great History of Liberty. In politics he was always an ardent Liberal.

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[1] Where the grant is not of supply, the preamble varies a little, *e.g.* in the Prince of Wales's Children Act 1889.

Without being a notable traveller, he spent much time in the chief intellectual centres of Europe, and in the United States, and numbered among his friends such men as Montalembert, De Tocqueville, Fustel de Coulanges, Bluntschli, von Sybel and Ranke. He was attached to Lord Granville's mission to Moscow, as British representative at the coronation of Alexander II. in 1856. In 1859 Sir John Acton settled in England, at his country house, Aldenham, in Shropshire. He was returned to the House of Commons in that year for the Irish borough of Carlow, and became a devoted admirer and adherent of Mr Gladstone; but he was practically a silent member, and his parliamentary career came to an end after the general election of 1865, when, having headed the poll for Bridgnorth, he was unseated on a scrutiny; he contested Bridgnorth again in 1868, but without success. Meanwhile he had become editor of the Roman Catholic monthly paper, the *Rambler*, in 1859, on J. H. Newman's retirement from the editorship; and in 1862 he merged this periodical in the *Home and Foreign Review*. His contributions at once gave evidence of his remarkable wealth of historical knowledge. But though a sincere Roman Catholic, his whole spirit as a historian was hostile to ultramontane pretensions, and his independence of thought and liberalism of view speedily brought him into conflict with the Roman Catholic hierarchy. As early as August 1862, Cardinal Wiseman publicly censured the *Review*; and when in 1864, after Döllinger's appeal at the Munich Congress for a less hostile attitude towards historical criticism, the pope issued a declaration that the opinions of Catholic writers were subject to the authority of the Roman congregations, Acton felt that there was only one way of reconciling his literary conscience with his ecclesiastical loyalty, and he stopped the publication of his monthly periodical. He continued, however, to contribute articles to the *North British Review*, which, previously a Scottish Free Church organ, had been acquired by friends in sympathy with him, and which for some years (until 1872, when it ceased to appear) actively promoted the interests of a high-class Liberalism in both temporal and ecclesiastical matters; he also did a good deal of lecturing on historical subjects. In 1865 he married the Countess Marie, daughter of the Bavarian Count Arco-Valley, by whom he had one son and three daughters. In 1869 he was raised to the peerage by Gladstone as Baron Acton; he was an intimate friend and constant correspondent of the Liberal leader, and the two men had the very highest regard for one another. Matthew Arnold used to say that "Gladstone influences all round him but Acton; it is Acton who influences Gladstone."

In 1870 came the great crisis in the Roman Catholic world over the promulgation by Pius IX. of the dogma of papal infallibility. Lord Acton, who was in complete sympathy on this subject with Döllinger (*q.v.*), went to Rome in order to throw all his influence against it, but the step he so much dreaded was not to be averted. The Old Catholic separation followed, but Acton did not personally join the seceders, and the authorities prudently refrained from forcing the hands of so competent and influential an English layman. In 1874, when Gladstone published his pamphlet on *The Vatican Decrees*, Lord Acton wrote during November and December a series of remarkable letters to *The Times*, illustrating Gladstone's main theme by numerous historical examples of papal inconsistency, in a way which must have been bitter enough to the ultramontane party, but demurring nevertheless to Gladstone's conclusion and insisting that the Church itself was better than its premisses implied. Acton's letters led to another storm in the English Roman Catholic world, but once more it was considered prudent by the Vatican to leave him alone. In spite of his reservations, he regarded "communion with Rome as dearer than life." Thenceforth he steered clear of theological polemics. He devoted himself to persistent reading and study, combined with congenial society. With all his capacity for study he was a man of the world, and a man of affairs, not a bookworm. Little indeed came from his pen, his only notable publications being a masterly essay in the *Quarterly Review* of January 1878 on "Democracy in Europe"; two lectures delivered at Bridgnorth in 1877 on "The History of Freedom in Antiquity" and "The History of Freedom in Christianity"—these last the only tangible portions put together by him of his long-projected "History of Liberty"; and an essay on modern German historians in the first number of the *English Historical Review*, which he helped to found (1886). After 1879 he divided his time between London, Cannes and Tegernsee in Bavaria, enjoying and reciprocating the society of his friends. In 1872 he had been given the honorary degree of doctor of philosophy by Munich University; in 1888 Cambridge gave him the honorary degree of LL.D., and in 1889 Oxford the D.C.L.; and in 1890 he was made a fellow of All Souls. His reputation for learning had gradually been spread abroad, largely through Gladstone's influence. The latter found him a valuable political adviser, and in 1892, when the Liberal government came in, Lord Acton was made a lord-in-waiting. Finally, in 1895, on the death of Sir John Seeley, Lord Rosebery appointed him to the Regius Professorship of Modern History at Cambridge. The choice was an excellent one. His inaugural lecture on "The Study of History," afterwards published with notes displaying a vast erudition, made a great impression in the university, and the new professor's influence on historical study was felt in many important directions. He delivered two valuable courses of lectures, on the French Revolution and on Modern History, but it was in private that the effects of his teaching were most marked. The great *Cambridge Modern History*, though he did not live to see it, was planned under his editorship, and all who came in contact with him testified to his stimulating powers and his extraordinary range of knowledge. He was taken ill, however, in 1901, and died on the 19th of June 1902, being succeeded in the title by his son, Richard Maximilian Dalberg Acton, 2nd Baron Acton (b. 1870). Lord Acton has left too little completed original work to rank among the great historians; his very learning seems to have stood in his way; he knew too much and his literary conscience was too acute for him to write easily, and his copiousness of information overloads his literary style. But he was one of the most deeply learned men of his time, and he will certainly be remembered for his influence on others. His extensive library, formed for use and not for display, and composed largely of books full of his own annotations, was bought immediately after his death by Mr Andrew Carnegie, and presented to Mr John Morley, by whom it was forthwith given to the university of Cambridge.

See Mr Herbert Paul's excellent Introductory Memoir to the interesting volume of *Lord Acton's Letters to Mrs Drew* (1904), and the authorities cited there; also Dom Gasquet's *Lord Acton and his Circle* (1906). A *Bibliography of the Works of Lord Acton*, by W. A. Shaw, was published by the Royal Historical Society in 1903. The *Edinburgh Review* of April 1903 contains a luminous essay; and Mr Bryce has a chapter on Acton in his *Studies of Contemporary Biography* (1903). Lord Acton's *Lectures on Modern History*, edited by J. N. Figgis and R. V. Laurence, appeared in 1906; and his *History of Freedom and other Essays* and *Historical Essays and Studies* (by the same editors) in 1907. (H. Ch.)

ACTON, SIR JOHN FRANCIS EDWARD, Bart. (1736–1811), prime minister of Naples under Ferdinand IV., was the son of Edward Acton, a physician at Besançon, and was born there in 1736, succeeding to the title and estates in 1791, on the death of his cousin in the third degree, Sir Richard Acton of Aldenham Hall, Shropshire. He served in the navy of Tuscany, and in 1775 commanded a frigate in the joint expedition of Spain and Tuscany against Algiers, in which he displayed such courage and resource that he was promoted to high command. In 1779 Queen Maria Carolina of Naples persuaded her brother the Grand-Duke Leopold of Tuscany to allow Acton, who had been recommended to her by Prince Caramenico, to undertake the reorganization of the Neapolitan navy. The ability displayed by him in this led to his rapid advancement. He became commander-in-chief of both services, minister of finance, and finally prime minister. His policy was devised in concert with the English ambassador, Sir William Hamilton, and aimed at substituting the influence of Austria and Great Britain for that of Spain, at Naples, and consequently involved open opposition to France and the French party in Italy. The financial and administrative measures which were the outcome of a policy which necessitated a great increase of armament made him intensely unpopular, and in December 1798 he shared the flight of the king and queen. For the reign of terror which followed the downfall of the Parthenopean Republic, five months later, Acton has been held responsible. In 1804 he was for a short time deprived of the reins of government at the demand of France; but he was speedily restored to his former position, which he held till, in February 1806, on the entry of the French into Naples, he had to flee with the royal family into Sicily. He died at Palermo on the 12th of August 1811.

He had married, by papal dispensation, the eldest daughter of his brother, General Joseph Edward Acton (b. 1737), who was in the Neapolitan service, and left three children, the elder son, Sir Richard, being the father of the first Lord Acton. The second son, Charles Januarius Edward (1803–1847), after being educated in England and taking his degree at Magdalene College, Cambridge, in 1823, entered the Academia Ecclesiastica at Rome. He left this with the rank of prelate, in 1828 was secretary to the nuncio at Paris and was made vice-legate of Bologna shortly afterwards. He became secretary of the congregation of the Disciplina Regolare, and auditor of the Apostolic Chamber under Gregory XVI., by whom he was made a cardinal in 1842. Cardinal Acton was protector of the English College at Rome, and had been mainly instrumental in the increase, in 1840, of the English vicariates-general to eight, which paved the way for the restoration of the hierarchy by Pius IX. in 1850. He died on the 23rd of June 1847.

ACTON, an urban district in the Ealing parliamentary division of Middlesex, England, suburban to London, 9 m. W. of St. Paul's Cathedral. Pop. (1861) 3151; (1901) 37,744. Its appearance is now wholly that of a modern residential suburb. The derivation offered for its name is from Oak-town, in reference to the extensive forest which formerly covered the locality. The land belonged from early times to the see of London, a grant being recorded in 1220. Henry III. had a residence here. At the time of the Commonwealth Acton was a centre of Puritanism. Philip Nye (d. 1672) was rector; Richard Baxter, Sir Matthew Hale (Lord Chief-Justice), Henry Fielding the novelist and John Lindley the botanist (d. 1865) are famous names among residents here. Acton Wells, of saline waters, had considerable reputation in the 18th century.

ACT ON PETITION, the term for a part of the procedure in the Probate, Divorce and Admiralty Division, now of infrequent occurrence. It was more freely used in the old Admiralty and Divorce courts before the Judicature Acts. (See PLEADING.)

ACTS OF THE APOSTLES. This book of the Bible, which now stands fifth in the New Testament, was read at first as the companion and sequel of the Gospel of Luke. Its separation was due to growing consciousness of the Gospels as a unit of sacred records, to which *Acts* stood as a sort of appendix. Historically it is of unique interest and value: it has no fellow within the New Testament or without it. The so-called Apocryphal Acts of certain apostles, while witnessing to the impression produced by our *Acts* as a type of edifying literature, only emphasize this fact. It is the one really primitive Church history, primitive in spirit as in substance; apart from it a connected picture of the Apostolic Age would be impossible. With it, the Pauline Epistles are of priceless historical value; without it, they would remain bafflingly fragmentary and incomplete, often even misleading.

1. *Plan and Aim.*—All agree that the *Acts of the Apostles* is the work of an author of no mean skill, and that he has exercised careful selection in the use of his materials, in keeping with a definite purpose and plan. It is of moment, then, to discover from his emphasis, whether by iteration or by fulness of scale, what objects he had in mind in writing. Here it is not needful to go farther back than F. C. Baur and the Tübingen school, with its theory of sharp antitheses between Judaic and Gentile Christianity, of which they took the original apostles and Paul respectively as typical. Gradually their statement of this position underwent serious modifications, as it became realized that neither Jewish nor Gentile Christianity was a uniform genus, but included several species, and that the apostolic leaders from the first stood for mutual understanding and unity. Hence the Tübingen school did its chief work in putting the needful question, not in returning the correct answer. Their answer could not be correct, because, as Ritschl showed (in his *Altkath. Kirche*, 2nd ed., 1857), their premisses were inadequate. Still the attitude created by the Tübingen theory largely persists as a biassing element in much that is written about *Acts*. On the whole, however, there is a disposition to look at the book more objectively and to follow up the hints as to its aim given by the author in his opening verses. Thus (1) his second narrative is the natural sequel to his first. As the earlier one set forth in orderly sequence (καθεξῆς) the providential stages by which Jesus was led, "in the power of the Spirit," to begin the establishment of the consummated Kingdom of God, so the later work aims at setting forth on similar principles its extension by means of His chosen representatives or apostles. This involves emphasis on the identity of the power, Divine and not merely human, expressed in the great series of facts from first to last. Thus (2) the Holy Spirit appears as directing and energizing throughout the whole struggle with the powers of evil to be overcome in either ministry, of Master or disciples. But (3) the continuity is more than similarity of activity resting on the same Divine energy. The working of the energy in the disciples is conditioned by the continued life and volition of their Master at His Father's right hand in heaven. The Holy Spirit, "the Spirit of Jesus," is the living link between Master and disciples. Hence the pains taken to exhibit (i. 2, 4 f. 8, ii. 1 ff., cf. Luke xxiv. 49) the fact of such spiritual solidarity, whereby their activity means His continued action in the world. And (4) the scope of this action is nothing less than humanity (ii. 5 ff.), especially within the Roman empire. It was foreordained that Messiah's witnesses should be borne by Divine power through all obstacles and to ever-widening circles, until they reached and occupied Rome itself for the God of Israel—now manifest (as foretold by Israel's own prophets) as the one God of the one race of mankind. (5) Finally, as we gather from the parallel account in Luke xxiv. 46-48, the divinely appointed method of victory is through suffering (Acts xiv. 22). This explains the large space devoted to the tribulations of the witnesses, and their constancy amid them, after the type of their Lord Himself. It forms one side of the virtual *apologia* for the absence of that earthly prosperity in which the pagan mind was apt to see the token of Divine approval. Another side is the recurring exhibition of the fact that these witnesses were persecuted only by those whose action should create no bias against the persecuted. Their foes were chiefly Jews, whose opposition was due partly to a stiff-necked disinclination to bow to the wider reading of their own religion—to which the Holy Spirit had from of old been pointing (cf. the prominence given to this idea in Stephen's long speech)—and partly to jealousy of those who, by preaching the wider Messianic Evangel, were winning over the Gentiles, and particularly proselytes, in such great numbers.

Such, then, seem to be the author's main *motifs*. They make up an account fairly adequate to the manifoldness of the book; yet they may be summed up in three ideas, together constituting the moral which this history of the expansion of Christianity aims at bringing home to its readers. These are the *universality of the Gospel*, the *jealousy of national Judaism*, and the *Divine initiative* manifest in the gradual stages by which men of Jewish birth were led to recognize the Divine will in the setting aside of national restrictions, alien to the universal destiny of the Church. The practical moral is the Divine character of the Christian religion, as evinced by the manner of its extension in the empire, no less than by its original embodiment in the Founder's life and death. Thus both parts of the author's work alike tend to produce assured conviction of Christianity as of Divine origin (Luke i. 1, 4; Acts i. 1 f.).

This view has the merit of giving the book a practical religious aim—a *sine qua non* to any theory of an early Christian writing. Though meant for men of pagan birth in the first instance, it is to them as inquirers or even converts, such as "Theophilus," that the argument is addressed. In spite of all difficulties, this religion is worthy of personal belief, even though it mean opposition and suffering. Among the features of the occasion which suggested the need of such an appeal was doubtless the existence of persecution by the Roman authorities, perhaps largely at the instigation of local Judaism. To meet this special perplexity, the author holds up the picture of early days, when the great protagonist of the Gospel constantly enjoyed protection at the hands of Roman justice. It is implied that the present distress is but a passing phase, resting on some misunderstanding; meantime, the example of apostolic constancy should yield strong reassurance. The *Acts of the Apostles* is in fact an Apology for the Church as distinct from Judaism, the breach with which is accordingly traced with great fulness and care.

From this standpoint *Acts* no longer seems to end abruptly. Whether as exhibiting the Divine leading and aid, or as recording the impartial and even kindly attitude of the Roman State towards the Christians, the writer has reached a climax. "He wished," as Harnack well remarks, "to point out the might of the Holy Spirit in the apostles, Christ's witnesses; and to show how this might carried the Gospel from Jerusalem to Rome and gained for it entrance into the pagan world, whilst the Jews in growing degree incurred rejection. In keeping with this, verses 26-28 of chapter xxviii. are the solemn closing verses of the work. But verses 30, 31 are an appended observation."

Yet the writer is, in fact, ending up most fitly on one of his keynotes, in that he leaves Paul preaching in Rome itself, "unmolested." "Paulus Romae, apex Evangelii."

The full force of this is missed by those who, while rejecting the idea that the author had in reserve enough Pauline history to furnish another work, yet hold that Paul was freed from the imprisonment amid which *Acts* leaves him (see PAUL). But for those, on the other hand, who see in the writer's own words in xx. 38, uncontradicted by anything in the sequel, a broad hint that Paul never saw his Ephesian friends again, the natural view is open that the sequel to the two years' preaching was too well known to call for explicit record. Nor would such silence touching Paul's speedy martyrdom be disingenuous, any more than on the theory that martyrdom overtook him several years later. The writer views Paul's death (like the horrors of Nero's Vatican Gardens in 64) as a mere exception to the rule of Roman policy heretofore illustrated. Not even by the Roman authorities were some of Nero's acts regarded as precedents.

2. *Authorship.*—External evidence, which is relatively early and widespread (*e.g.* Muratorian Canon, Irenaeus, Tertullian, Clement and Origen), all points to Luke, the companion and fellow-worker of Paul (Philem. 24), who probably accompanied him as physician also (Col. iv. 14). It must be noted too that evidence for his authorship of the third Gospel counts also for *Acts*. This carries us back at least to the second quarter of the 2nd century (Justin, *Dial.* 103, and most probably Marcion), when Λουκᾶν no doubt stood at the head of the Gospel, especially where it was used side by side with the others. We have every reason to trust the Church's tradition at this time, particularly as Luke was not prominent enough as an associate of Paul to suggest the theory as a guess. Nor does Eusebius, who knew the ante-Nicene literature intimately, seem to know of any other view ever having been held. If, then, the traditional Lucan authorship is to be doubted, it must be on internal evidence only. The form of the book, however, in all respects favours Luke, who was of non-Jewish birth (see Col. iv. 12-14 compared with 10 f.), and as a physician presumably a man of culture. The medical cast of much of its language, which is often of a highly technical nature, points strongly the same way;[1] while the early tradition that Luke was born in the Syrian Antioch admirably suits the fulness with which the origin of the Antiochene Church and its place in the further extension of the Gospel are described (see LUKE). Again, the attitude of *Acts* towards the Roman Empire is just what would be expected from a close comrade of Paul (cf. Sir W. M. Ramsay, *St Paul the Traveller and Roman Citizen*, 1895), but was hardly likely to be shared by one of the next generation, reared in an atmosphere of resentment, first at Nero's conduct and then at the persecuting policy of the Flavian Caesars (see REVELATION). Finally, the book itself seems to claim to be written by a companion of Paul. In chap. xvi. 10 the writer, without any previous warning, passes from the third person to the first. Paul had reached Troas. There he saw a vision inviting him to go to Macedonia. "But when he saw the vision, straightway *we* sought to go forth into Macedonia." Thenceforth "we" re-emerges at certain points in the narrative until Rome is reached. Irenaeus (iii. 14. 1) quotes these passages as proof that Luke, the author, was a companion of the apostle. The minute character of the narrative, the accurate description of the various journeyings, the unimportance of some of the details, especially some of the incidents of the shipwreck, are strong reasons for believing that the narrative is that of an eye-witness. If so, we can scarcely help coming to the conclusion that this eye-witness was the author of the work; for the style of this eye-witness is exactly the style of the writer who composed the previous portions (see Harnack, *op. cit.*, reinforcing the argument as already worked out by B. Weiss, 1893, and especially by Sir J. C. Hawkins in *Horae Synopticae*, 1899, pp. 143-147). Most scholars admit that the "we" narrative is that of a personal companion of Paul, who was probably none other than Luke, in view of his traditional authorship of *Acts*. But many suppose that the tradition arose from confused remembrance of the use by a later author of Luke's "we" document or travel-diary. This supposition would compel us to believe either that the skilful writer of *Acts* was so careless as to incorporate a document without altering its form, or that "we" is introduced intentionally. In the latter case we must suppose either that the writer was an eye-witness, or that he wished to be thought an eye-witness. E. Zeller, a follower of Baur, adopted this latter alternative, and P. W. Schmiedel adheres to it. Indeed it is hard to see how it can be avoided on the theory that the author of *Acts* used a travel-document by another hand (see below, *Sources*). On the whole, then, the most tenable theory is that the writer of the "we" sections was also the author of *Acts*; and that he was Luke, Paul's companion during most of his later ministry, and also his "counterpart," "as a Hellene, who yet had personal sympathy with Jewish primitive Christianity" (Harnack, *op. cit.* p. 103; see also LUKE).

3. *Sources.*—So far from the recognition of a plan in *Acts* being inimical to a quest after the materials used in its composition, one may say that it points the way thereto, while it keeps the literary analysis within scientific limits. The more one realizes the standpoint of the mind pervading the book as a whole, the more one feels that the speeches in the first part of Acts (*e.g.* that of Stephen)—and indeed elsewhere, too—are not "free compositions" of our author, the mere outcome of dramatic idealization such as ancient historians like Thucydides or Polybius allowed themselves. The Christology, for instance of the early Petrine speeches is such as a Gentile Christian writing *c.* 80 A.D. simply could not have imagined. Thus we are forced to assume the use of a certain amount of early Judaeo-Christian material, akin to that implied also in the special parts of the Third Gospel. Paul Feine (*Eine vorkanonische Ueberlieferung des Lukas*, 1891) suggested that a single document explains this material in both works, as far as Acts xii. Others maintain that at any rate two sources underlie Acts i.-xii., or even i.-xv. (see A. Harnack, *Die Apostelgeschichte*, p. 131 ff.). In particular we can recognize a source embodying the traditions of the largely Hellenistic Church of Antioch, a secondary gloss from which may survive in the Bezan addition to xi. 27, "when *we* were assembled." Further, if our author was a careful inquirer (Luke i. 3), especially if he was in the habit of taking down in writing what he heard from different witnesses, this may explain

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[1] This argument, first worked out by Dr W. K. Hobart, *The Medical Language of St Luke* (Dublin, 1882), but hitherto neglected by many Continental scholars, has been urged afresh by Harnack, *Lukas der Arzt* (Leipzig, 1906; Eng. trans., London, 1907), to which reference may be made for all matters connected with Lucan authorship; comp. also R. J. Knowling in *The Expositor's Greek Testament*.

some of the phenomena. Such a man as Luke would have rare facilities for collecting Palestinian materials, varying no doubt in accuracy, but all relatively primitive, whether in Antioch or in Caesarea, where he probably resided for some two years in contact with men like Philip the Evangelist (xxi. 8). There and elsewhere he might also learn a good deal from John Mark, Peter's friend (1 Pet. v. 13; Acts xii. 12). In any case the study of sources (*Quellenkritik*) is a comparatively new one, and the resources of analysis, linguistic in particular, are by no means exhausted. One important analogy exists for the way in which our author would handle any written sources he may have had by him, namely, the manner in which he uses Mark's Gospel narrative in compiling his own Gospel. Guided by this objective criterion, and safeguarded by growing insight into the author's plastic aim, we need not despair of reaching large agreement as to the nature of the sources lying behind the first half of *Acts*.

In the second or strictly Pauline half we are confronted by the so-called "we" passages. Of these two main theories are possible: (1) that which sees in them traces of an earlier document—whether entries in a travel-diary, or a more or less consecutive narrative written later; and (2) that which would regard the "we" as due to the author's breaking instinctively into the first person plural at certain points where he felt himself specially identified with the history. On the former hypothesis, it is still in debate whether the "we" document does or does not lie behind more of the narrative than is definitely indicated by the formula in question (*e.g.* cc. xiii.-xv., xxi. 19-xxvi.). On the latter, it may well be questioned whether the presence or absence of "we" be not due to psychological causes, rather than to the writer's mere presence or absence.[1] That is, he may be writing sometimes as a member of Paul's mission at the critical stages of onward advance, sometimes rather as a witness absorbed in his hero's words and deeds (so "we" ceases between xx. 15 and xxi. 1). Naturally he would fall into the former attitude mostly when recording the definitive transition of Paul and his party from one sphere of work to another (xvi. 10 ff., xx. 5 ff., xxvii. 1 ff.). At such times the whole "mission" was as one man in its movements.

4. *Historical Value.*—The question of authorship is largely bound up with that as to the quality of the contents as history. *Acts* is divided into two distinct parts. The first (i.-xii.) deals with the church in Jerusalem and Judaea, and with Peter as central figure—at any rate in cc. i.-v. "Yet in cc. vi.-xii.," as Harnack[2] observes, "the author pursues several lines at once. (1) He has still in view the history of the Jerusalem community and the original apostles (especially of Peter and his missionary labours); (2) he inserts in vi. 1 ff. a history of the Hellenistic Christians in Jerusalem and of the Seven Men, which from the first tends towards the Gentile Mission and the founding of the Antiochene community; (3) he pursues the activity of Philip in Samaria and on the coast . . . ; (4) lastly, he relates the history of Paul up to his entrance on the service of the young Antiochene church. In the small space of seven chapters he pursues all these lines and tries also to connect them together, at the same time preparing and sketching the great transition of the Gospel from Judaism to the Greek world. As historian, he has here set himself the greatest task." No doubt gaps abound in these seven chapters. "But the inquiry as to whether what is narrated does not even in these parts still contain the main facts, and is not substantially trustworthy, is not yet concluded." The difficulty is that we have but few external means of testing this portion of the narrative (see below, *Date*). Some of it may well have suffered partial transformation in oral tradition before reaching our author; *e.g.* the nature of the Tongues at Pentecost does not accord with what we know of the gift of "tongues" generally. The second part pursues the history of the apostle Paul; and here we can compare the statements made in the *Acts* with the Epistles. The result is a general harmony, without any trace of direct use of these letters; and there are many minute coincidences. But attention has been drawn to two remarkable exceptions. These are, the account given by Paul of his visits to Jerusalem in *Galatians* as compared with *Acts*; and the character and mission of the apostle Paul, as they appear in his letters and in *Acts*.

In regard to the first point, the differences as to Paul's movements until he returns to his native province of Syria-Cilicia (see PAUL) do not really amount to more than can be explained by the different interests of Paul and our author respectively. But it is otherwise as regards the visits of Gal. ii. 1-10 and Acts xv. If they are meant to refer to the same occasion, as is usually assumed,[3] it is hard to see why Paul should omit reference to the public occasion of the visit, as also to the public vindication of his policy. But in fact the issues of the two visits, as given in Gal. ii. 9 f. and Acts xv. 20 f., are not at all the same.[4] Nay more, if Gal. ii. 1-10=Acts xv., the historicity of the "Relief visit" of Acts xi. 30, xii. 25, seems definitely excluded by Paul's narrative of events before the visit of Gal. ii. 1 ff. Accordingly, Sir W. M. Ramsay and others argue that the latter visit itself coincided with the Relief visit, and even see in Gal. ii. 10 witness thereto.

But why, then, does not Paul refer to the public charitable object of his visit? It seems easier therefore to admit that the visit of Gal. ii. 1 ff. is one altogether unrecorded in *Acts*, owing to its private nature as preparing the way for public developments—with which *Acts* is mainly concerned. In that case it would fall shortly before the Relief visit, to which there may be tacit explanatory allusion, in Gal. ii. 10 (see further PAUL); and it will be shown below that such a conference of leaders in Gal. ii. 1 ff. leads up excellently both to the First Mission Journey and to Acts xv.

We pass next to the Paul of *Acts*. Paul insists that he was appointed the apostle to the Gentiles, as Peter was to the Circumcision; and that circumcision and the observance of the Jewish law were of no importance to the Christian as such. His words on these points in all his letters are strong and decided. But in *Acts* it is Peter who first opens up the way for the Gentiles. It is Peter who uses the strongest language in regard to the intolerable burden of the Law as a means of salvation (xv. 10 f., cf. 1). Not a word is said of any difference of opinion between Peter and Paul at Antioch (Gal. ii. 11 ff.). The brethren in Antioch send Paul and Barnabas up to Jerusalem to ask the opinion of the apostles and elders: they state their case, and carry back the decision to Antioch. Throughout the whole of *Acts* Paul never stands forth as the unbending champion of the Gentiles. He seems continually anxious to reconcile the Jewish Christians to himself by personally observing the law of Moses. He circumcises the semi-Jew, Timothy; and he performs his vows in the temple. He is particularly careful in his speeches to show how deep is his respect for the law of Moses. In all this the letters of Paul are very different from *Acts*. In *Galatians* he claims perfect freedom in principle, for himself as for the Gentiles, from the obligatory observance of the law; and neither in it nor in *Corinthians* does he take any notice of a decision to which the apostles had come in their meeting at Jerusalem. The narrative of *Acts*, too, itself implies something other than what it sets in relief; for why should the Jews hate Paul so much, if he was not in some sense disloyal to their Law?

There is, nevertheless, no essential contradiction here, only such a difference of emphasis as belongs to the standpoints and aims of the two writers amid their respective historical conditions. Peter's function in relation to the Gentiles belongs to the early Palestinian conditions, before Paul's distinctive mission had taken shape. Once Paul's apostolate—a personal one, parallel with the more collective apostolate of "the Twelve"—has proved itself by tokens of Divine approval, Peter and his colleagues frankly recognize the distinction of the two missions, and are anxious only to arrange that the two shall not fall apart by religiously and morally incompatible usages (Acts xv.). Paul, on his side, clearly implies that Peter felt with him that the Law could not justify (Gal. ii. 15 ff.), and argues that it could not now be made obligatory in principle (cf. "a yoke," Acts xv. 10); yet for Jews it might continue for the time (pending the Parousia) to be seemly and expedient, especially for the sake of non-believing Judaism. To this he conformed his own conduct as a Jew, so far as his Gentile apostolate was not involved (1 Cor. ix. 19 ff.). There is no reason to doubt that Peter largely agreed with him, since he acted in this spirit in Gal. ii. 11 f., until coerced by Jerusalem sentiment to draw back for expediency's sake. This incident it simply did not fall within the scope of *Acts* (see below) to narrate, since it had no abiding effect on the Church's extension. As to Paul's submission of the issue in Acts xv. to the Jerusalem conference, *Acts* does not imply that Paul would have accepted a decision in favour of the Judaizers, though he saw the value of getting a decision for his own policy in the quarter to which they were most likely to defer. If the view that he already had an understanding with the "Pillar" Apostles, as recorded in Gal. ii. 1-10 (see further Paul), be correct, it gives the best of reasons why he was ready to enter the later public Conference of Acts xv. Paul's own "free" attitude to the Law, when on Gentile soil, is just what is implied by the hostile rumours as to his conduct in Acts xxi. 21, which he would be glad to disprove as at least exaggerated (*ib.* 24 and 26). What is clear is that such lack of formal accord as here exists between *Acts* and the Epistles, tells against its author's dependence on the latter, and so favours his having been a comrade of Paul himself.

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[1] This view has received Harnack's support, *op. cit.* 89 f.

[2] *Apostelgeschichte* (1908), p. 46. Harnack finds that our sense of the trustworthiness of the book "is enhanced by a thorough study of the chronological procedure of its author, both where he speaks and where he keeps silence." In this aspect the book "as a whole is according to the aims of the author and in reality a historical work" (p. 41; cf. pp. 1-20, 222 ff.).

[3] Though this view had the support of J. B. Lightfoot, it should be remembered that this was before the "South Galatian" theory as to the date of Paul's work among the Galatians came to prevail.

[4] Harnack, indeed, argues (*op. cit.* pp. 188 ff.) that the Abstinences defined for Gentiles were in the original text of Acts xv. 20 purely moral, and had no reference to Jewish scruples as to eating blood. He regards "what is strangled" (πνικτόν) as originally a mistaken gloss, which crept into the text. External evidence is against this, nor does it seem demanded by the context; in fact xv. 21 rather goes against it.

Speeches.

The speeches in *Acts* deserve special notice. Did its author follow the plan adopted by all historians of his age, or is he an exception? Ancient historians (like many of modern times) used the liberty of working up in their own language the speeches recorded by them. They did not dream of verbal fidelity; even when they had more exact reports before them, they preferred to mould a speaker's thoughts to their own methods of presentation. Besides this, some did not hesitate to give to the characters of their history speeches which were never uttered. The method of direct speech, so useful in producing a vivid idea of what is supposed to have passed through the mind of the speaker, was used to give force to the narrative. Now how far has the author of *Acts* followed the practice of his contemporaries? Some of his speeches are evidently but summaries of thoughts which occurred to individuals or multitudes. Others claim to be reports of speeches really delivered. But all these speeches have to a large extent the same style, the style also of the narrative. They have been passed though one editorial mind, and some mutual assimilation in phraseology and idea may well have resulted. They are, moreover, all of them, the merest abstracts. The speech of Paul at Athens, as given by Luke, would not occupy more than a minute or two in delivery. But these circumstances, while inconsistent with verbal accuracy, do not destroy authenticity; and in most of the speeches (*e.g.* xiv. 15-17) there is a varied appropriateness as well as an allusiveness, pointing to good information (see under *Sources*). There is no evidence that any speech in *Acts* is the free composition of its author, without either written or oral basis; and in general he seems more conscientious than most ancient historians touching the essentials of historical accuracy, even as now understood.

Miracles.

Objections to the trustworthiness of *Acts* on the ground of its miracles require to be stated more discriminately than has sometimes been the case. Particularly is this so as regards the question of authorship. As Harnack observes (*Lukas der Arzt*, p. 24), the "miraculous" or supernormal element is hardly, if at all, less marked in the "we" sections, which are substantially the witness of a companion of Paul (and where efforts to dissect out the miracles are fruitless), than in the rest of the work. The scientific method, then, is to consider each "miracle" on its own merits, according as we find reason to suppose that it has reached our author more or less directly. But the record of miracle as such cannot prejudice the question of authorship. Even the form in which the gift of Tongues at Pentecost is conceived does not tell against a companion of Paul, since it may have stood in his source, and the first outpouring of the Messianic Spirit may soon have come to be thought of as unique in some respects, parallel in fact to the Rabbinic tradition as to the inauguration of the Old Covenant at Sinai (cf. Philo, *De decem oraculis*, 9, 11, and the Midrash on Ps. lxviii. 11).

Finally as to such historical difficulties in *Acts* as still perplex the student of the Apostolic age, one must remember the possibilities of mistake intervening between the facts and the accounts reaching its author, at second or even third hand. Yet it must be strongly emphasized, that recent historical research at the hands of experts in classical antiquity has tended steadily to verify such parts of the narrative as it can test, especially those connected with Paul's missions in the Roman Empire. That is no new result; but it has come to light in greater degree of recent years, notably through Sir W. M. Ramsay's researches. The proofs of trustworthiness extend also to the theological sphere. What was said above of the Christology of the Petrine speeches applies to the whole conception of Messianic salvation, the eschatology, the idea of Jesus as equipped by the Holy Spirit for His Messianic work, found in these speeches, as also to titles like "Jesus the Nazarene" and "the Righteous One" both in and beyond the Petrine speeches. These and other cases in which we are led to discern very primitive witness behind *Acts*, do not indeed give to such witness the value of shorthand notes or even of abstracts based thereon. But they do support the theory that our author meant to give an unvarnished account of such words and deeds as had come to his knowledge. The perspective of the whole is no doubt his own; and as his witnesses probably furnished but few hints for a continuous narrative, this perspective, especially in things chronological, may sometimes be faulty. Yet when one remembers that by 70–80 A.D. it must have been a matter of small interest by what tentative stages the Messianic salvation first extended to the Gentiles, it is surely surprising that *Acts* enters into such detail on the subject, and is not content with a summary account of the matter such as the mere logic of the subject would naturally suggest. In any case, the very difference of the perspective of *Acts* and of *Galatians*, in recording the same epochs in Paul's history, argues such an independence in the former as is compatible only with an early date.

Quellenkritik, then, a distinctive feature of recent research upon *Acts*, solves many difficulties in the way of treating it as an honest narrative by a companion of Paul. In addition, we may also count among recent gains a juster method of judging such a book. For among the results of the Tübingen criticism was what Dr W. Sanday calls "an unreal and artificial standard, the standard of the 19th century rather than the 1st, of Germany rather than Palestine, of the lamp and the study rather than of active life." This has a bearing, for instance, on the differences between the three accounts of Paul's conversion in *Acts*. In the recovery of a more real standard, we owe much to men like Mommsen, Ramsay, Blass and Harnack, trained amid other methods and traditions than those which had brought the constructive study of *Acts* almost to a deadlock.

5. *Date.*—External evidence now points to the existence of *Acts* at least as early as the opening years of the 2nd century. As evidence for the Third Gospel holds equally for *Acts*, its existence in Marcion's day (120–140) is now assured. Further, the traces of it in Polycarp[1] and Ignatius,[2] when taken together, are highly probable; and it is even widely admitted that the resemblance of Acts xiii. 22, and 1 Clem. xviii. 1, in features not

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[1] Polyc. *ad Philipp.* i. 2, Acts ii. 24; ii. 1, Acts x. 42; ii. 3, Acts xx. 35; vi. 3, Acts vii. 52.

[2] Ign. *ad Magn.* v. 1, Acts i. 25; *ad Smyrn.* iii. 3, Acts x. 41.

found in the Psalm (lxxxix. 20) quoted by each, can hardly be accidental. That is, *Acts* was probably current in Antioch and Smyrna not later than *c.* A.D. 115, and perhaps in Rome as early as *c.* A.D. 96.

With this view internal evidence agrees. In spite of some advocacy of a date prior to A.D. 70, the bulk of critical opinion is decidedly against it. The prologue to Luke's Gospel itself implies the dying out of the generation of eye-witnesses as a class. A strong consensus of opinion supports a date about A.D. 80; some prefer 75 to 80; while a date between 70 and 75 seems no less possible. Of the reasons for a date in one of the earlier decades of the 2nd century, as argued by the Tübingen school and its heirs, several are now untenable. Among these are the supposed traces of 2nd-century Gnosticism and "hierarchical" ideas of organization; but especially the argument from the relation of the Roman state to the Christians, which Ramsay has reversed and turned into proof of an origin prior to Pliny's correspondence with Trajan on the subject. Another fact, now generally admitted, renders a 2nd-century date yet more incredible; and that is the failure of a writer devoted to Paul's memory to make palpable use of his Epistles. Instead of this he writes in a fashion that seems to traverse certain things recorded in them. If, indeed, it were proved that *Acts* uses the later works of Josephus, we should have to place the book about A.D. 100. But this is far from being the case.

Three points of contact with Josephus in particular are cited. (1) The circumstances attending the death of Herod Agrippa I. in A.D. 44. Here Acts xii. 21-23 is largely parallel to Jos. *Antt.* xix. 8. 2; but the latter adds an omen of coming doom, while *Acts* alone gives a circumstantial account of the occasion of Herod's public appearance. Hence the parallel, when analysed, tells against dependence on Josephus. So also with (2) the cause of the Egyptian pseudo-prophet in Acts xxi. 37 f., Jos. *Jewish War*, ii. 13. 5, *Antt.* xx. 8. 6; for the numbers of his followers do not agree with either of Josephus's rather divergent accounts, while *Acts* alone calls them *Sicarii*. With these instances in mind, it is natural to regard (3) the curious resemblance as to the (non-historical) order in which Theudas and Judas of Galilee are referred to in both as accidental, the more so that again there is difference as to numbers. Further, to make out a case for dependence at all, one must assume the mistaken order (as it may be) in Gamaliel's speech as due to gross carelessness in the author of *Acts*—an hypothesis unlikely in itself. Such a mistake was far more likely to arise in oral transmission of the speech, before it reached Luke at all.

6. *Place.*—The place of composition is still an open question. For some time Rome and Antioch have been in favour; and Blass combined both views in his theory of two editions (see below, *Text*). But internal evidence points strongly to the Roman province of Asia, particularly the neighbourhood of Ephesus. Note the confident local allusion in xix. 9 to "the school of Tyrannus"—not "a certain Tyrannus," as in the inferior text—and in xix. 33 to "Alexander"; also the very minute topography in xx. 13-15. At any rate affairs in that region, including the future of the church of Ephesus (xx. 28-30), are treated as though they would specially interest "Theophilus" and his circle; also an early tradition makes Luke die in the adjacent Bithynia. Finally it was in this region that there arose certain early glosses (*e.g.* on xix. 9, xx. 15), probably the earliest of those referred to below. How fully in correspondence with such an environment the work would be, as *apologia* for the Church against the Synagogue's attempts to influence Roman policy to its harm, must be clear to all familiar with the strength of Judaism in "Asia" (cf. Rev. ii. 9, iii. 9, and see Sir W. M. Ramsay, *The Letters to the Seven Churches*, ch. xii.).

7. *Text.*—The *apparatus criticus* of *Acts* has grown considerably of recent years; yet mainly in one direction, that of the so-called "Western text." This term, which our growing knowledge, especially of the Syriac and other Eastern versions, is rendering more and more unsatisfactory, stands for a text which used to be connected almost exclusively with the "eccentric" *Codex Bezae*, and is comparable to a Targum on an Old Testament book. But it is now recognized to have been very widespread, in both east and west, for some 200 years or more from as early as the middle of the 2nd century. The process, however, of sifting out the readings of all our present witnesses—MSS., versions, Fathers—has not yet gone far enough to yield any sure or final result as to the history of this text, so as to show what in its extant forms is primary, secondary, and so on. Beginnings have been made towards grouping our authorities; but the work must go on much further before a solid basis for the reconstruction of its primitive form can be said to exist. The attempts made at such a reconstruction, as by Blass (1895, 1897) and Hilgenfeld (1899), are quite arbitrary. The like must be said even of the contribution to the problem made by August Pott,[1] though he has helped to define one condition of success—the classification of the strata in "Western" texts—and has taken some steps in the right direction, in connexion with the complex phenomena of one witness, the Harklean Syriac.

Assuming, however, that the original form of the "Western" text had been reached, the question of its historical value, *i.e.* its relation to the original text of *Acts*, would yet remain. On this point the highest claims have been made by Blass. Ever since 1894 he held that both the "Western" text of *Acts* (which he styles the β text) and its rival, the text of the great uncials (which he styles the α text), are due to the author's own hand. Further, that the former (Roman) is the more original of the two, being related to the latter (Antiochene) as fuller first draft to severely pruned copy. But even in its later form, that "β stands nearer the *Grundschrift* than α, but yet is, like α, a copy from it," the theory is really untenable. In sober contrast of Blass's sweeping theory stand the views of Sir W. M. Ramsay. Already in *The Church in the Roman Empire* (1893) he held that the *Codex Bezae* rested on a recension made in Asia Minor (somewhere between Ephesus and S. Galatia), not later than about the middle of the 2nd century. Though "some at least of the alterations in *Codex Bezae* arose through a gradual process, and not through the action of an individual reviser," the revision in question was the work of a single reviser, who in his changes and additions expressed the local interpretation put upon *Acts* in his own time. His aim, in suiting the text to the views of his day, was partly to make it more intelligible to the public, and partly to make it more complete. To this end he "added some touches where surviving tradition seemed to contain trustworthy additional particulars," such as the statement that Paul taught in the lecture-room of Tyrannus "from the fifth to the tenth hour." In his later work, on *St Paul the Traveller and the Roman Citizen* (1895), Ramsay's views gain both in precision and in breadth. The gain lies chiefly in seeing beyond the Bezan text to the "Western" text as a whole.

Generally speaking, then, the text of *Acts* as printed by Westcott and Hort, on the basis of the earliest MSS. (אB), seems as near the autograph as that of any other part of the New Testament; whereas the "Western" text, even in its earliest traceable forms, is secondary. This does not mean that it has no historical value of its own. It may well contain some true supplements to the original text, derived from local tradition or happy inference—a few perhaps from a written source used by Luke. Certain of these may even date from the end of the 1st century, and the larger part of them are probably not later than the middle of the 2nd. But its value lies mainly in the light cast on ecclesiastical thought in certain quarters during the epoch in question. The nature of the readings themselves, and the distribution of the witness for them, alike point to a process involving several stages and several originating centres of diffusion. The classification of groups of "Western" witnesses has already begun. When completed, it will cast light, not only on the origin and growth of this type of text, but also on the exact value of the remaining witnesses to the original text of *Acts*—and further on the early handling of New Testament writings generally. *Acts*, from its very scope, was least likely to be viewed as sacrosanct as regards its text. Indeed there are signs that its undogmatic nature caused it to be comparatively neglected at certain times and places, as, *e.g.*, Chrysostom explicitly witnesses.

LITERATURE.—An account of the extensive and varied literature that has gathered round *Acts* may be found in two representative commentaries, viz., H. H. Wendt's edition of Meyer (1899), and that by R. J. Knowling in *The Expositor's Greek Testament*, vol. ii. (1900), supplemented by his *Testimony of St Paul to Christ* (1905). See also J. Moffatt, *The Historical New Testament* (1901). 412 ff., 655 ff.; C. Clemen, *Die Apostelgesch. im Lichte der neueren Forschungen* (Giessen, 1905); and A. Harnack, *Die Apostelgeschichte* (1908). (J. V. B.)

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[1] *Der abendländische Text der Apostelgeschichte u. die Wir-quelle* (Leipzig, 1900). See a review in the *Journal of Theol. Studies*, ii. 439 ff.

ACTUARY. The name of *actuarius*, sc. *scriba*, in ancient Rome, was given to the clerks who recorded the *Acta Publica* of the senate, and also to the officers who kept the military accounts and enforced the due fulfilment of contracts for military supplies. In its English form the word has undergone a gradual limitation of meaning. At first it seems to have denoted any clerk or registrar; then more particularly the secretary and adviser of any joint-stock company, but especially of an insurance company; and it is now applied specifically to one who makes those calculations as to the probabilities of human life, on which the practice of life assurance and the valuation of reversionary interests, deferred annuities, &c., are based. The first mention of the word in law is in the Friendly Societies Act of 1819, where it is used in the vague sense, "actuaries, or persons skilled in calculation," but it has received still further recognition in the Friendly Societies Act of 1875 and the Life Assurance Companies Act of 1870. The word has been used with precision since the establishment of the "Institute of Actuaries of Great Britain and Ireland" in 1848. The *Quarterly Journal, Charter of Incorporation*, and by-laws of this society may be usefully consulted for particulars as to the requirements for membership (see also ANNUITY). The registrar in the Lower House of Convocation is also called the actuary.

ACUMINATE (from Lat. *acumen*, point), sharpened or pointed, a word used principally in botany and ornithology, to denote the narrowing or lance-shaping of a leaf or of a bird's feather into a point, generally at the tip, though sometimes (with regard to a leaf) at the base. The poet William Cowper used the word to denote sharp and keen despair, but other authors, Sir T. Browne, Bacon, Bulwer, &c., use it to explain a material pointed shape.

ACUÑA, CHRISTOVAL DE (1597–*c.* 1676), Spanish missionary and explorer, was born at Burgos in 1597. He was admitted a Jesuit in 1612, and afterwards sent on mission work to Chile and Peru, where he became rector of the college of Cuenca. In 1639 he accompanied Pedro Texiera in his second exploration of the Amazon, in order to take scientific observations, and draw up a report for the Spanish government. The journey lasted ten months; and on the explorer's arrival in Peru, Acuña prepared his narrative, while awaiting a ship for Europe. The king of Spain, Philip IV., received the author coldly, and it is said even tried to suppress his book, fearing that the Portuguese, who had just revolted from Spain (1640), would profit by its information. After occupying the positions of procurator of the Jesuits at Rome and censor (*calificador*) of the Inquisition at Madrid, Acuña returned to South America, where he died, probably soon after 1675. His *Nuevo Descubrimiento del Gran Rio de las Amazonas* was published at Madrid in 1641; French and English translations (the latter from the French, appeared in 1682 and 1698.

ACUPRESSURE (from Lat. *acus*, a needle, and *premere*, to press), the name given to a method of restraining haemorrhage, introduced by Sir J. Y. Simpson, the direct pressure of a metallic needle, either alone or assisted by a loop of wire, being used to close the vessel near the bleeding point.

ACUPUNCTURE (from Lat. *acus*, a needle, and *pungere*, to prick), a form of surgical operation, performed by pricking the part affected with a needle. It has long been used by the Chinese in cases of headaches, lethargies, convulsions, colics, &c. (See SURGERY.)

ADABAZÁR, an important commercial town in the Khoja Ili sanjak of Asia Minor, situated on the old military road from Constantinople to the east, and connected by a branch line with the Anatolian railway. Pop. 18,000 (Moslems, 10,000; Christians, 8000). It was founded in 1540 and enlarged in 1608 by the settlement in it of an Armenian colony. There are silk and linen industries, and an export of tobacco, walnut-wood, cocoons and vegetables for the Constantinople market. Imports are valued at £80,000 and exports at £480,000.

See V. Cuinet, *Turquie d'Asie* (Paris, 1890–1900).

ADAD, the name of the storm-god in the Babylonian-Assyrian pantheon, who is also known as Ramman ("the thunderer"). The problem involved in this double name has not yet been definitely solved. Evidence seems to favour the view that Ramman was the name current in Babylonia, whereas Adad was more common in Assyria. To judge from analogous instances of a double nomenclature, the two names revert to two different centres for the cult of a storm-god, though it must be confessed that up to the present it has been impossible to determine where these centres were. A god Hadad who was a prominent deity in ancient Syria is identical with Adad, and in view of this it is plausible to assume—for which there is also other evidence—that the name Adad represents an importation into Assyria from Aramaic districts. Whether the same is the case with Ramman, identical with Rimmon, known to us from the Old Testament as the chief deity of Damascus, is not certain though probable. On the other hand the cult of a specific storm-god in ancient Babylonia is vouched for by the occurrence of the sign Im—the "Sumerian" or ideographic writing for Adad-Ramman—as an element in proper names of the old Babylonian period. However this name may have originally been pronounced, so much is certain,—that through Aramaic influences in Babylonia and Assyria he was identified with the storm-god of the western Semites, and a trace of this influence is to be seen in the designation Amurru, also given to this god in the religious literature of Babylonia, which as an early name for Palestine and Syria describes the god as belonging to the Amorite district.

The Babylonian storm-god presents two aspects in the hymns, incantations and votive inscriptions. On the one hand he is the god who, through bringing on the rain in due season, causes the land to become fertile, and, on the other hand, the storms that he sends out bring havoc and destruction. He is pictured on monuments and seal cylinders with the lightning and the thunderbolt, and in the hymns the sombre aspects of the god on the whole predominate. His association with the sun-god, Shamash, due to the natural combination of the two deities who alternate in the control of nature, leads to imbuing him with some of the traits belonging to a solar deity. In Syria Hadad is hardly to be distinguished from a solar deity. The process of assimilation did not proceed so far in Babylonia and Assyria, but Shamash and Adad became in combination the gods of oracles and of divination in general. Whether the will of the gods is determined through the inspection of the liver of the sacrificial animal, through observing the action of oil bubbles in a basin of water or through the observation of the movements of the heavenly bodies, it is Shamash and Adad who, in the ritual connected with divination, are invariably invoked. Similarly in the annals and votive inscriptions of the kings, when oracles are referred to, Shamash and Adad are always named as the gods addressed, and their ordinary designation in such instances is *bēlē biri*, "lords of divination." The consort of Adad-Ramman is Shala, while as Amurru his consort is called Aschratum. (See BABYLONIAN AND ASSYRIAN RELIGION.) (M. JA.)

ADAGIO (Ital. *ad agio*, at ease), a term in music to indicate slow time; also a slow movement in a symphony, sonata, &c., or an independent piece, such as Mozart's pianoforte "Adagio in B minor."

ADAIR, JOHN (d. 1722), Scottish surveyor and map-maker of the 17th century. Nothing is known of his parentage, birthplace or early life. His name first came before the public in 1683, when a prospectus was published in Edinburgh entitled *An Account of the Scottish Atlas*, stating that "the Privy Council of Scotland has appointed John Adair, mathematician and skilfull mechanick, to survey the shires." In 1686 an act of tonnage was passed in Adair's favour. He was then employed on a survey of the Scottish coast and two years later was made a fellow of the Royal Society. Two other acts of tonnage were passed for

Adair, one in 1695 and the other in 1705. In 1703 he published the first part of his *Description of the Sea Coasts and Islands of Scotland*, for the use of seamen. The second part never appeared. He is thought to have died in London about the end of 1722. He must have lost a considerable amount of money in the execution of his work, and in 1723 some remuneration was made to his widow by the government. Some of his work is preserved in the Advocates' Library at Edinburgh and in the King's Library of the British Museum, London.

ADALBERON, or Ascelin (d. 1030 or 1031), French bishop and poet, studied at Reims and became bishop of Laon in 977. When Laon was taken by Charles, duke of Lorraine, in 988, he was put into prison, whence he escaped and sought the protection of Hugh Capet, king of France. Winning the confidence of Charles of Lorraine and of Arnulf, archbishop of Reims, he was restored to his see; but he soon took the opportunity to betray Laon, together with Charles and Arnulf, into the hands of Hugh Capet. Subsequently he took an active part in ecclesiastical affairs, and died on the 19th of July 1030 or 1031. Adalberon wrote a satirical poem in the form of a dialogue dedicated to Robert, king of France, in which he showed his dislike of Odilo, abbot of Cluny, and his followers, and his objection to persons of humble birth being made bishops. The poem was first published by H. Valois in the *Carmen panegyricum in laudem Berengarii* (Paris, 1663), and in modern times by J. P. Migne in the *Patrologia Latina*, tome cxli. (Paris, 1844). Adalberon must not be confounded with his namesake, Adalberon, archbishop of Reims (d. 988 or 989).

See Richer, *Historiarum libri III. et IV.*, which appears in the *Monumenta Germaniae historica. Scriptores.* Band iii. (Hanover and Berlin, 1826–1892); A. Olleris, *Œuvres de Gerbert pape sous le nom de Sylvestre II.* (Paris, 1867); *Histoire littéraire de la France*, tome vii. (Paris, 1865–1869).

ADALBERT, or Adelbert (*c.* 1000–1072), German archbishop, the most famous ecclesiastic of the 11th century, was the son of Frederick, count of Goseck, a member of a noble Saxon family. He was educated for the church, and began his clerical career at Halberstadt, where he attained to the dignity of provost. Having attracted the notice of the German king, Henry III., Adalbert probably served as chancellor of the kingdom of Italy, and in 1045 was appointed archbishop of Hamburg-Bremen, his province including the Scandinavian countries, as well as a larger part of North Germany. In 1046 he accompanied Henry to Rome, where he is said to have refused the papal chair; and in 1052 he was made legate by Pope Leo IX., and given the right to nominate bishops in his province. He sought to increase the influence of his archbishopric, sent missionaries to Finland, Greenland and the Orkney Islands, and aimed at making Bremen a patriarchal see for northern Europe, with twelve suffragan bishoprics. He consolidated and increased the estates of the church, exercised the powers of a count, denounced simony and initiated financial reforms. The presence of this powerful and active personality, who was moreover a close friend of the emperor, was greatly resented by the Saxon duke, Bernard II., who regarded him as a spy sent by Henry into Saxony. Adalbert, who wished to free his lands entirely from the authority of the duke, aroused further hostility by an attack on the privileges of the great abbeys, and after the emperor's death in 1056 his lands were ravaged by Bernard. He took a leading part in the government of Germany during the minority of King Henry IV., and was styled *patronus* of the young king, over whom he appears to have exercised considerable influence. Having accompanied Henry on a campaign into Hungary in 1063, he received large gifts of crown estates, and obtained the office of count palatine in Saxony. His power aroused so much opposition that in 1066 the king was compelled to assent to his removal from court. In 1069 he was recalled by Henry, when he made a further attempt to establish a northern patriarchate, which failed owing to the hostility of the papacy and the condition of affairs in the Scandinavian kingdoms. He died at Goslar on the 16th or 17th of March 1072, and was buried in the cathedral which he had built at Bremen. Adalbert was a man of proud and haughty bearing, with large ideas and a strong, energetic character. He made Bremen a city of importance, and it was called by his biographer, Adam of Bremen, the *New Rome.*

See Adam of Bremen, *Gesta Hammenburgensis ecclesiae pontificum*, edited by J. M. Lappenberg, in the *Monumenta Germaniae historica. Scriptores.* Band vii. (Hanover and Berlin, 1826–1892); C. Grünhagen, *Adalbert Erzbischof von Hamburg und die Idee eines Nordischen Patriarchats* (Leipzig, 1854).

ADALBERT (originally Voytech), (*c.* 950–997), known as the apostle of the Prussians, the son of a Bohemian prince, was born at Libice (Lobnik, Lubik), the ancestral seat near the junction of the Cidlina and the Elbe. He was educated at the monastery of Magdeburg; and in 983 was chosen bishop of Prague. The extreme severity of his rule repelled the Bohemians, whom he vainly strove to wean from their national customs and pagan rites. Discouraged by the ill-success of his ministry, he withdrew to Rome until 993, when, in obedience to the command of the pope, he returned to his own people. Finding little amendment, however, in their course of living, he soon afterwards went again to Rome, and obtained permission from the pope to devote himself to missionary labours, which he carried on chiefly in North Germany and Poland. While preaching in Pomerania (997) he was assassinated by a heathen priest.

See U. Chevalier, *Répertoire des sources historiques du moyen âge*, Bio.-Bibl. (1905); Bolland, *Acta Sanctorum*, April 23; H. G. Voigt, *Adalbert von Prag* (1898), a thoroughly exhaustive monograph.

ADALIA (med. *Antaliyah*; the crusaders' *Satalia*), the ancient *Attalia* (*q.v.*), the largest seaport on the south coast of Asia Minor, though in point of trade it is now second to Mersina. The unsuitability of the harbour for modern steamers, the bad anchorage outside and the extension of railways from Smyrna have greatly lessened its former importance as an emporium for west central Anatolia. It is not connected by a *chaussée* with any point outside its immediate province, but it has considerable importance as the administrative capital of a rich and isolated *sanjak*. Adalia played a considerable part in the medieval history of the Levant. Kilij Arslan had a palace there. The army of Louis VII. sailed thence for Syria in 1148, and the fleet of Richard of England rallied there before the conquest of Cyprus. Conquered by the Seljuks of Konia, and made the capital of the province of Tekké, it passed after their fall through many hands, including those of the Venetians and Genoese, before its final occupation by the Ottoman Turks under Murad II. (1432). In the 18th century, in common with most of Anatolia, its actual lord was a Dere Bey. The family of Tekké Oglu, domiciled near Perga, though reduced to submission in 1812 by Mahmud II., continued to be a rival power to the Ottoman governor till within the present generation, surviving by many years the fall of the other great Beys of Anatolia. The records of the Levant (Turkey) Company, which maintained an important agency here till 1825, contain curious information as to the local Dere Beys. The present population of Adalia, which includes many Christians and Jews, still living, as in the middle ages, in separate quarters, the former round the walled mina or port, is about 25,000. The port is served by coasting steamers of the local companies only. Adalia is an extremely picturesque, but ill-built and backward place. The chief thing to see is the city wall, outside which runs a good and clean promenade. The government offices and the houses of the better class are all outside the walls.

See C. Lanckoronski, *Villes de la Pamphylie et de la Pisidie*, i. (1890). (D. G. H.)

ADAM, the conventional name of the first created man according to the Bible.

1. *The Name.*—The use of “Adam” (אָדָם) as a proper name is an early error. Properly the word *ādām* designated man as a species; with the article prefixed (Gen. ii. 7, 8, 16, iv. 1; and doubtless ii. 20, iii. 17) it means the first man. Only in Gen. iv. 25 and v. 3-5 is *ādām* a quasi-proper name, though LXX. and Vulgate use “Adam” (Αδαμ) in this way freely. Gen. ii. 7 suggests a popular Hebrew derivation from *ădāmah*, “the ground.” Into the question whether the original story did not give a proper name which was afterwards modified into “Adam”—important as this question is—we cannot here enter.

2. *Creation of Adam.*—For convenience, we shall take “Adam”

as a symbol for "the first man," and inquire first, what does tradition say of his creation? In Gen. ii. 4*b*-8 we read thus:—"At the time when Yahweh-Elohim[1] made earth and heaven,—earth was as yet without bushes, no herbage was as yet sprouting, because Yahweh-Elohim had not caused it to rain upon the earth, and no men were there to till the ground, but a stream[2] used to go up from the earth, and water all the face of the ground,—then Yahweh-Elohim formed the man of dust of the ground,[3] and blew into his nostrils breath of life,[4] and the man became a living being. And Yahweh-Elohim planted a garden[5] in Eden, eastward; and there he put the man whom he had formed." (See Eve.)

How greatly this simple and fragmentary tale of Creation differs from that in Gen. i. 1–ii. 4*a* (see Cosmogony) need hardly be mentioned. Certainly the priestly writer who produced the latter could not have said that God modelled the first man out of moistened clay, or have adopted the singular account of the formation of Eve in ii. 21-23. The latter story in particular (see Eve) shows us how childlike was the mind of the early men, whose God is not "wonderful in counsel" (Isa. xxviii. 29), and fails in his first attempt to relieve the loneliness of his favourite. For no beast however mighty, no bird however graceful, was a fit companion for God's masterpiece, and, apart from the serpent, the animals had no faculty of speech. All therefore that Adam could do, as they passed before him, was to name them, as a lord names his vassals. But here arises a difficulty. How came Adam by the requisite insight and power of observation? For as yet he had not snatched the perilous boon of wisdom. Clearly the Paradise story is not homogeneous.

3. *How the Animals were named.*—Some moderns, *e.g.* von Bohlen, Ewald, Driver (in *Genesis*, p. 55, but cp. p. 42), have found in ii. 19, 20 an early explanation of the origin of language. This is hardly right. The narrator assumes that Adam and Eve had an innate faculty of speech.[6] They spoke just as the birds sing, and their language was that of the race or people which descended from them. Most probably the object of the story is, not to answer any curious question (such as, how did human speech arise, or how came the animals by their names?), but to dehort its readers or hearers from the abominable vice referred to in Lev. xviii. 23.[7] There may have been stories in circulation like that of Ea-bani (§ 8), and even such as those of the Skidi Pawnee, in which "people" marry animals, or become animals. Against these it is said (ver. 20*b*) that "for Adam he found no helper (qualified) to match him."

4. *Three Riddles.*—Manifold are the problems suggested by the Eden-story (see Eden; Paradise). For instance, did the original story mention two trees, or only one, of which the fruit was taboo? In iii. 3 (cp. vv. 6, 11) only "the tree in the midst of the garden" is spoken of, but in ii. 9 and iii. 22 two trees are referred to, the fruit of both of which would appear to be taboo. To this we must add that in ii. 17 "the tree of the knowledge of good and evil" appears to have the qualities of a "tree of life," except indeed to Adam. This passage seems to give us the key to the mystery. There was only one tree whose fruit was forbidden; it might be called either "the tree of life" or "the tree of knowledge," but certainly not "the tree of knowledge of good and evil."[8] The words "life" and "knowledge" (="wisdom") are practically equivalent; perfect knowledge (so primitive man believed) would enable any being to escape death (an idea spiritualized in Prov. iii. 18).

Next, which of the trees is the "tree of life"? Various sacred trees were known to the Semitic peoples, such as the fig-tree (cp. iii. 7), which sometimes appears, conventionalized, as a sacred tree.[9] But clearly the tree referred to was more than a "sacred tree"; it was a tree from whose fruit or juice, as culture advanced, some intoxicating drink was produced. The Gaokerena of the Iranians[10] is exactly parallel. At the resurrection, those who drink of the life-giving juice of this plant will obtain "perfect welfare," including deathlessness. It is not, however, either from Iran or from India that the Hebrew tree of life is derived, but from Arabia and Babylonia, where date-wine (cp. Enoch xxiv. 4) is the earliest intoxicant. Of this drink it may well have been said in primitive times (cp. *Rig Veda*, ix. 90. 5, of Soma) that it "cheers the heart of gods" (in the speech of the vine, Judg. ix. 13). Later writers spoke of a "tree of mercy," distilling the "oil of life,"[11] *i.e.* the oil that heals, but 4 Esdr. ii. 12 (cp. viii. 53) speaks of the "tree of life," and Rev. xxii. 2 (virtually) of "trees of life," whose leaves have a healing virtue (cp. Ezek. xlvii. 12). The oil-tree should doubtless be grouped with the river of oil in later writings (see Paradise). Originally it was enough that there should be one tree of life, *i.e.* that heightened and preserved vitality.

A third enigma—why no "*fountain* of life"? The references to such a fountain in Proverbs (xiii. 14, &c.) prove that the idea was familiar,[12] and in Rev. xxii. 1 we are told that the river of Paradise was a "river of water of life" (see Paradise). The serpent, too, in mythology is a regular symbol of water. Possibly the narrator, or redactor, desired to tone down the traces of mythology. Just as the Gâthas (the ancient Zoroastrian hymns) omit Gaokerena, and the Hebrew prophets on the whole avoid mythological phrases, so this old Hebrew thinker prunes the primitive exuberance of the traditional myth.

5. *The Serpent.*—The keen-witted, fluently speaking serpent gives rise to fresh riddles. How comes it that Adam's ruin is effected by one of those very "beasts of the field" which he had but lately named (ii. 19), that in speech he is Adam's equal and in wisdom his superior? Is he a pale form of the Babylonian chaos-dragon, or of the serpent of Iranian mythology who sprang from heaven to earth to blight the "good creation"? It is true that the serpent of Eden has mythological affinities. In iii. 14, 15, indeed, he is degraded into a mere typical snake, but iii. 1-5 shows that he was not so originally. He is perhaps best regarded, in the light of Arabian folk-lore, as the manifestation of a demon residing in the tree with the magic fruit.[13] He may have been a prince among the demons, as the magic tree was a prince among the plants. Hence perhaps his strange boldness. For some unknown reason he was ill disposed towards Yahweh-Elohim (see iii. 3*b*), which has suggested to some that he may be akin to the great enemy of Creation. To Adam and Eve, however, he is not unkind. He bids them raise themselves in the scale of being by eating the forbidden fruit, which he declares to be not fatal to life but an opener of the eyes, and capable of equalizing men with gods (iii. 4, 5). To the phrase "ye shall be as gods" a later writer may have added "knowing good and evil," but "to be as gods" originally meant "to live the life of gods—wise, powerful, happy." The serpent was in the main right, but there is one point which he did not mention, viz. that for any being to retain this intensified vitality the eating of the

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[1] The English Bible gives "the Lord God." This, however, does not adequately represent the Hebrew.

[2] See commentaries of Gunkel and Cheyne. As in v. 10, the ocean-stream is meant. (See Eden.)

[3] A widely spread mythic representation. (Cp. Cosmogony.)

[4] See an illustration from Naville's *Book of the Dead* (Egyptian) in *Jewish Cyclopaedia*, i. 174a.

[5] Or park. (See Paradise.)

[6] The later Jews, however, supposed that before the Fall the animals could speak, and that they had all one language (*Jubilees*, iii. 28; Jos. *Antiquities*, i. 1, 4).

[7] Cheyne, *Genesis and Exodus*, referring to Dorsey, *Traditions of the Skidi Pawnee*, pp. 2, 80 ff.

[8] "Good and evil" may be a late marginal gloss. See further *Ency. Bib.* col. 3578, and the commentaries (Driver leaves the phrase); also Jastrow, *Relig. of Bab. and Ass.* p. 553; Sayce, *Hibbert Lectures*, p. 242.

[9] See illustration in Toy's *Ezekiel* (*Sacred Books of the Old Testament*), p. 182.

[10] Gaokerena is the mythic white haoma plant (*Zendavesta*, *Vendidad*, xx. 4; *Bundahish*, xxvii. 4). It is an idealization of the yellow haoma of the mountains which was used in sacrifices (*Yasna*, x. 6-10). It corresponds to the soma plant (*Asclepias acida*) of the ancient Aryans of India. On the illustrative value of Gaokerena see Cheyne, *Origin of the Psalter*, pp. 400-439.

[11] See *Life of Adam and Eve* (apocryphal), §§ 36, 40; *Apocal. Mos.* § 9; *Secrets of Enoch*, viii. 7, xxii. 8, 9. "Oil of life," in a Bab. hymn, *Die Keilinschriften und das Alte Testament*, ed. 3, p. 526.

[12] Cp. the Bab. myths of Adapa and of the Descent of Ishtar.

[13] W. R. Smith, *Relig. of Semites*, pp. 133, 442; *Ency. Bib.*, "Serpent," §§ 3, 4.

fruit would have to be constantly renewed. Only thus could even the gods escape death.[1]

6. *The Divine Command broken.*—The serpent has gone the right way to work; he comprehends woman's nature better than Adam comprehends that of the serpent. By her curiosity Eve is undone. She looks at the fruit; then she takes and eats; her husband does the same (iii. 6). The consequence (ver. 7) may *seem* to us rather slight: "they knew (became sensible) that they were naked, and sewed fig-leaves together, and made themselves girdles (aprons)." But the real meaning is not slight; the sexual distinction has been discovered, and a new sense of shame sends the human pair into the thickest shades, when Yahweh-Elohim walks abroad. The God of these primitive men is surprised: "Where art thou?" By degrees, he obtains a full confession—not from the serpent, whose speech might not have been edifying, but from Adam and Eve. The sentences which he passes are decisive, not only for the human pair and the serpent, but for their respective races. Painful toil shall be the lot of man; subjection and pangs that of woman.[2] The serpent too (whose unique form preoccupied the early men) shall be humiliated, as a perpetual warning to man—who is henceforth his enemy—of the danger of reasoning on and disobeying the will of God.

7. *Versions of the Adam-story.*—Theologians in all ages have allegorized this strange narrative.[3] The serpent becomes the inner voice of temptation, and the saying in iii. 15 becomes an anticipation of the final victory of good over evil—a view which probably arose in Jewish circles directly or indirectly affected by the Zoroastrian eschatology. But allegory was far from the thoughts of the original narrators. Another version of the Adam-story is given by Ezekiel (xxviii. 11-19), for underneath the king of Tyre (or perhaps Miṣṣor)[4] we can trace the majestic figure of the first man. *This* Adam, indeed, is not like the first man of Gen. ii.-iii., but more like the "bright angel" who is the first man in the Christian *Book of Adam* (i. 10; Malan, p. 12). He dwells on a glorious forest-mountain (cp. Ezekiel xxxi. 8, 18), and is led away by pride to equalize himself with Elohim (cp. xxviii. 2, 2 Thess. ii. 4), and punished. And with this passage let us group Job xv. 7, 8, where Job is ironically described as vying with the first man, who was "brought forth before the hills" (cp. Prov. viii. 25) and "drew wisdom to himself" by "hearkening in the council of Elohim." No reference is made in Job to this hero's fall. The omission, however, is repaired, not only in Ezek. xxviii. 16, but also in Isa. xiv. 12-15, where the king, whose name is given in the English Bible as "Lucifer" (or margin, "day-star"), "son of the morning," and who, like the other king in Ezekiel, is threatened with death, is a copy of the mythical Adam.

The two conceptions of the first man are widely different. The passages last referred to harmonize with the account given in Gen. i. 26, for "in our image" certainly suggests a being equal in brightness and in capacities to the angels—a view which, as we know, became the favourite one in apocryphal and Haggadic descriptions of the Adam before the Fall. And though the priestly writer, to whom the first Creation-story in its present form is due, says nothing about a sacred mountain as the dwelling-place of the first-created man, yet this mountain belongs to the type of tradition which the passage, Gen. i. 26-28, imperfectly but truly represents. The glorious first man of Ezekiel, and the god-like first men of the cosmogony (cp. Ps. viii. 5) who held the regency of the earth,[5] require a dwelling-place as far above the common level of the earth as they are themselves above the child-like Adam of the second creation-narrative (Gen. ii.). On this sacred mountain, see COSMOGONY.

8. *Origin of the Adam-story.*—That the Hebrew story of the first man in both its forms is no mere recast of a Babylonian myth, is generally admitted. The holy mountain is no doubt Babylonian, and the plantations of sacred trees, one of which at least has magic virtue, can be paralleled from the monuments (see EDEN). But there is no complete parallel to the description of Paradise in Gen. ii., or to the story of the rib, or to that of the serpent. The first part of the latter has definite Arabian affinities; the second is as definitely Hebrew. We may now add that the insertion of iii. 7 (from "were opened") to 19—a passage which has probably supplanted a more archaic and definitely mythological passage—may well have been the consequence of the change in the conception of the first man referred to above. Still there are four Babylonian stories which may serve as partial illustrations of the Hebrew Adam-story.

The first is contained in a fragment of a cosmogony in Berossus, now confirmed in the main by the sixth tablet of the Creation-epic. It represents the creation of man as due to one of the inferior gods who (at Bel's command) mingled with clay the blood which flowed from the severed head of Bel (see COSMOGONY). The three others are the myths of Adapa,[6] Ea-bani and Etana. As to Adapa, it may be mentioned here that Fossey has shown reason for holding that the true reading of the name is Adamu. It thus becomes plausible to hold that "Adam" in Gen. ii.-iii. was originally a proper name, and that it was derived from Babylonia. More probably, however, this is but an accidental coincidence; both *adam* and *adamu* may come from the same Semitic root meaning "to make." Certainly Adamu (if it is not more convenient to write "Adapa") was not regarded as the progenitor of the human race, like the Hebrew Adam. He was, however, certainly a man—one of those men who were not, of course, rival first-men, but were specially created and endowed. Adamu or Adapa, we are told, received from his divine father the gift of wisdom,[7] but not that of everlasting life. He had a chance, however, of obtaining the gift, or at least of eating the food and drinking the water which makes the gods ageless and immortal. But through a deceit practised upon him by his divine father Ea, he supposed the food and drink offered to him on a certain occasion by the gods to be "food of death," "water of death," just as Adam and Eve at first believed that the fruit of the magic tree would produce death (Gen. iii. 4, 5).

The second story is that of Ea-bani,[8] who was formed by the goddess Arusu (=the mother-goddess Ishtar) of a lump of clay (cp. Gen. ii. 7). This human creature, long-haired and sensual, was drawn away from a savage mode of life by a harlot, and Jastrow, followed by G. A. Barton, Worcester and Tennant, considers this to be parallel to the story which may underlie the account of the failure of the beasts, and the success of the woman Eve, as a "help-meet" for Adam. This, however, is most uncertain.

The third is that of Etana.[9] Here the main points are that Etana is induced by an eagle to mount up to heaven, that he may win a boon from the kindly goddess Ishtar. Borne by the eagle, he soared high up into the ether, but became afraid. Downward the eagle and his burden fell, and in the epic of Gilgamesh we find Etana in the nether world. According to Jastrow, this attempted ascension was an offence against the gods, and his fall was his punishment. We are not told, however, that Etana had the impious desire of Ezekiel's first man, and if he fell, it was through his own timidity (contrast Ezek. xxviii. 16). But certainly the myth does help us to imagine a story in which, for some sin against the gods, some favoured hero was hurled down from the divine abode, and such a story may some day be discovered.

To these illustrations it is unsafe to add the scene on a cylinder preserved in the British Museum, representing two figures, a man (with horns) and *perhaps* a woman, both clothed, on either side of a fruit-tree, towards which they stretch out their hands.[1] For the meaning of this is extremely problematical. Some better monumental illustration may some day be found, for it is clear that the Babylonian sacred literature had much to tell of offences against the gods in the primeval age.

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[1] Note the food and drink of the gods in the Babylonian Adapa (or Adamu?) myth.

[2] The mortality of man forms no part of the curse (cp. iii. 19, "dust thou art").

[3] See H. Schultz, *Alttest. Theologie*, ed. 4, pp. 679 ff., 720; Driver, *Genesis*, p. 44.

[4] See Cheyne, *Genesis and Exodus*.

[5] Cp. the "fair shepherd" Yima of the Avesta (*Vend.* ii.), the first man and the founder of civilization to the Iranians, though not like the Yama of the Vedas.

[6] See Jastrow, *Rel. of Bab. and Ass.* pp. 548-554; R. J. Harper, in *Academy*, May 30, 1891; Jensen, *Keilinschr. Bibliothek*, vi. 93 ff.

[7] The wisdom was probably to qualify him as a ruler. It is too much to say with Hommel that "Adapa is the archetype of the Johannine Logos."

[8] Jastrow, *op. cit.* p. 474 ff.; Jensen, *Keil. Bibl.* vi. 120 ff.

[9] Jastrow, p. 522 f.; Jensen, vi. 112 ff.

The student may naturally ask, Whence did the Israelites (a comparatively young people) obtain the original myth? It is most probable that they obtained it through the mediation either of the Canaanites or of the North Arabians. Babylonian influence, as is now well known, was strongly felt for many centuries in Canaan, and even the cuneiform script was in common use among the high officials of the country. When the Israelites entered Canaan, they would learn myths partly of Babylonian origin. North Arabian influence must also have been strong among the Israelites, at least while they sojourned in North Arabia. From the Kenites, at any rate, they may have received, not only a strong religious impulse, but a store of tales of the primitive age, and these stories too may have been partly influenced by Babylonian traditions. We must allow for stages of development both among the Israelites and among their tutors.

9. *Biblical References to the Adam-story.*—It is remarkable how little influence the Adam-story has had on the earlier parts of the Old Testament. The garden of Eden is referred to in Isa. li. 3, Ezek. xxxvi. 35, Joel ii. 5; cp. Ezek. xxviii. 13, xxxi. 8, 9, 16, 18, all of which are later. And it is mostly in the "humanistic" book of Proverbs that we find allusions to the "tree of life" (Prov. iii. 18, xi. 30, xiii. 12, xv. 4), and to the "fountain of life"—perhaps (see § 4) an omitted portion of the old Paradise-story (Prov. x. 11, xiii. 14, xiv. 27, xvi. 22),—the only other Biblical reference (apart from Rev. xxi. 6) being in that exquisite passage, Ps. xxxvi. 9. One can hardly be surprised at this. The Adam-story is plainly of foreign origin, and could not please the greater pre-exilic prophets. In late post-exilic times, however, foreign tales, even if of mythical origin, naturally came into favour, especially as religious symbols. If even now philosophers and theologians cannot resist the temptation to allegorize, how inevitable was it that this course should be pursued by early Jewish theologians!

10. *Incipient Reflexion on the Story.*—Let us give some instances of this. In Enoch lxix. 6 we find the story of Eve's temptation read in the light of that of the fallen angels (Gen. vi. 1, 2, 4) who conveyed an evil knowledge to men, and so subjected mankind to mortality. Evidently the writer fears culture. Elsewhere eating the fruit of the "tree of wisdom" is given as the cause of the expulsion of the human pair. In the Wisdom of Solomon (x. 1, 2) we find another view. Here, as in Ezekiel, the first man is pre-eminently wise and strong; though he transgressed, wisdom rescued him, *i.e.* taught him repentance (cp. *Life of Adam and Eve*, §§ 1-8). Elsewhere (ii. 24; cp. Jos. *Ant.* i. 1, 4) death is traced to the envy of the devil, still implying an exalted view of Adam. It is held that, but for his sin, Adam would have been immortal. Clearly the Jewish mind is exposed to some fresh foreign influences. As in the Talmud and the Jerusalem Targum, the serpent has even become the devil, *i.e.* Satan. The period of syncretism has fully come, and Zoroastrianism in particular, more indirectly than directly, is exercising an attractive power upon the Jews. For all that, the theological thinking is characteristically Jewish, and such guidance as Jewish thinkers required was mainly given by Greek culture. On this subject see further Eve, § 5.

11. *Growth of a Theology.*—Let us now turn to the Apocalypses of Baruch and of Ezra (both about 70 A.D.). Different views are here expressed. According to one (xvii. 3, xix. 8, xxiii. 4) the sin of Adam was the cause of physical death; according to another (liv. 15, lvi. 6), only of premature physical death, while according to a third (xlviii. 42, 43) it is spiritual death which is to be laid to his account. Of these three views, it is only the second which harmonizes with Gen. ii.-iii. In one of the two passages which express it we are also told that each member of the human race is "the Adam of his own soul." Adam, like Satan in Ecclus. xxi. 27, has become a psychological symbol. Truly, a worthy development of the seed-thoughts of the original narrator, and (must we not add?) entirely opposed to any doctrine of Original Sin.

In 4 Ezra, too, we find no real endorsement of such a doctrine. It is true, not only physical death (iii. 7), but spiritual, is traced to the act of Adam (iii. 21, 22, iv. 30, 31, vii. 118-121). But two modifying facts should be noticed. One is that Adam is said to have had from the first a wicked heart, owing to which he fell, and his posterity likewise, into sin and guilt. All men have the same seed of evil in them that Adam had; they sin and die, like him. The other is that, according to iii. 7-12, there are at least two ages of the world. The first ended with the Flood, so that any consequences of Adam's sin were, strictly speaking, of limited duration. The second began with righteous Noah and his household, "of whom came all righteous men." It was the descendants of these who "began again to do ungodliness more than the former ones." Doubtless the problem of evil is most imperfectly treated, even from the writer's point of view. But it would be cruel to pick holes in a writer whose thinking, like that of St Paul, is coloured by emotion.

At this point we might well make more than a passing reference to St Paul (Rom. v. 14; 1 Cor. xv. 22, 45, 47), whose doctrine of sin is evidently of mixed origin. But we cannot find space for this here. In compensation let it be mentioned that in Rev. xii. 9 (cp. xx. 2) the "great dragon," who persecuted the woman "clothed with the sun," is identified with "the old serpent, that is called the Devil and Satan." The identification is incorrect. But it may be noticed here that the phrase "the old serpent" sheds some light on the Pauline phrases "the first man Adam" and "the last Adam" (1 Cor. xv. 45, 47). The underlying idea is that the new age (that of the new heaven and earth) will be opened by events parallel to those which opened the first age. As the old serpent deceived man of old, so shall it be again. And as at the head of the first age stands the first Adam, whose doings affected all his descendants to their harm, so at the head of the second shall stand the second Adam, whose actions shall be potent for good. There is reason to suspect that the expression "the second Adam" is the coinage either of St Paul or of some one closely connected with him (as Prof. G. F. Moore has shown), for there is no proof that such terms as "the last," or "the second Adam," were generally current among the Jews.

12. *Jewish Legends.*—The parallelism between the first and second Adam in 1 Cor. xv. 45 is a parallelism of contrast. Jewish legends, however, suggest another sort of parallelism. The Haggadah gives the most extravagant descriptions of the glory of Adam before his fall. The most prominent idea is that being in the image of God—the God whose essence is light—he must have had a luminous body (like the angels). "I made thee of the light," says God in the *Book of Adam and Eve* (Malan, p. 16), "and I willed to bring children of light from thee." Similarly in *Baba batra*, 58*a*, we read, "he was of extraordinary beauty and sun-like brightness." So glorious was he that even the angels were commanded through Michael to pay homage to Adam. Satan, disobeying, was cast out of heaven; hence his ill-will towards Adam (*Life of Adam and Eve*, §§ 13-17; cp. *Koran*, xvii. 63, xx. 115, xxxviii. 74).

It only remains to give due honour to one of the most beautiful of legends, that of the deliverance of Adam's spirit from the nether world by the Christ, the earliest form of which is a Christian interpolation in *Apoc. Moses*, § 42 (cp. Malan, *Adam and Eve*, iv. 15, end). We may compare a partly parallel passage in § 37, where the agent is Michael, and notice that such legendary developments were equally popular among Jews and Christians.

Authorities.—On the apocryphal Books of Adam, see Hort, *Dict. of Chr. Biography*, i. 37 ff. In English we have Malan's translation of the Ethiopic *Book of Adam* (1882), and Issaverden's translation of another Book of Adam from the Armenian (Venice, 1901). In German, see Fuchs's translations in Kautzsch's *Die Apokryphen*, ii. 506 ff. For full bibliography see Schürer, *Gesch.*

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[1] See Smith and Sayce, *Chaldaean Genesis*, p. 88; Delitzsch, *Wo lag das Paradies?* p. 90; *Babel and Bible*, Eng. trans., p. 56, with note on pp. 114-118; Zimmern, *Die Keilinschr. und das A.T.*, ed. 3, p. 529; Jeremias, *Das Alte Test. im Lichte d. Alten Orient.* pp. 104-106.

des jüd. Volkes, ed. 3, iii. 288 f. On Jewish and Mahommedan legends, see *Jewish Cyclopaedia*, "Adam." On the belief in the Fall, see Tennant, *The Sources of the Doctrine of the Fall and Original Sin* (1903). (T. K. C.)

ADAM OF BREMEN, historian and geographer, was probably born in Upper Saxony (at Meissen, according to one tradition) before 1045. He came to Bremen about 1067–1068, most likely on the invitation of Archbishop Adalbert, and in the 24th year of the latter's episcopate (1043?–1072); in 1069 he appears as a canon of this cathedral and master of the cathedral school. Not long after this he visited the king of Denmark, Sweyn Estrithson, in Zealand; on the death of Adalbert, in 1072, he began the *Historia Hammaburgensis Ecclesiae*, which he finished about 1075. He died on the 12th of October of a year unknown, perhaps 1076. Adam's *Historia*—known also as *Gesta Hammaburgensis Ecclesiae Pontificum*, *Bremensium praesulum Historia*, and *Historia ecclesiastica*—is a primary authority, not only for the great diocese of Hamburg-and-Bremen, but for all North German and Baltic lands (down to 1072), and for the Scandinavian colonies as far as America. Here occurs the earliest mention of Vinland, and here are also references of great interest to Russia and Kiev, to the heathen Prussians, the Wends and other Slav races of the South Baltic coast, and to Finland, Thule or Iceland, Greenland and the Polar seas which Harald Hardrada and the nobles of Frisia had attempted to explore in Adam's own day (before 1066). Adam's account of North European trade at this time, and especially of the great markets of Jumne at the mouth of the Oder, of Birka in Sweden and of Ostrogard (Old Novgorod?) in Russia, is also of much value. His work, which places him among the first and best of German annalists, consists of four books or parts, and is compiled partly from written records and partly from oral information, the latter mainly gathered from experience or at the courts of Adalbert and Sweyn Estrithson. Of his minor informants he names several, such as Adelward, dean of Bremen, and William the Englishman, "bishop of Zealand," formerly chancellor of Canute the Great, and an intimate of Sweyn Estrithson. The fourth (perhaps the most important) book of Adam's *History*, variously entitled *Libellus de Situ Daniae et reliquarum quae trans Daniam sunt regionum*, *Descriptio Insularum Aquilonis*, &c., has often been considered, but wrongly, as a separate work.

Ten MSS. exist, of which the chief are (1-2) Copenhagen, Royal Library, Old Royal Collection, No. 2296, of 12th to 13th cents.; No. 718, of 15th cent.; (3) Leyden University, Voss. Lat. 123, of 11th cent.; (4) Rome, Vatican Library, 2010; (5) Vienna, Hof- u. Staatsbibliothek, 413, of 13th cent.; (6) Wolfenbüttel, Ducal Library, Gud. 83, of 15th cent.

There are 15 editions of the *Historia*, in whole or part; the first published at Copenhagen, 1579 (the first of the *Libellus* or *Descriptio Ins. Aquil.* appeared at Stockholm in 1615), the best at Hanover, 1846 (by Lappenberg, in *Scriptores Rerum Germanicarum*; reissued by L. Weiland, 1876), and at Paris, 1884 (in Migne's *Patrologia Latina*, cxlvi.). There are also three German versions, and one Danish; the best is by J. C. M. Laurent (and W. Wattenbach) in *Geschichtsschreiber d. deutsch. Vorzeit*, part vii. (1850 and 1888). See also J. Asmussen, *De fontibus Adami Bremensis*, 1834; Lappenberg in Pertz, *Archiv*, vi, 770; Aug. Bernard, *De Adamo Bremensi* (Paris, 1895); Beazley, *Dawn of Modern Geography*, ii. 514-548 (1901).

ADAM (or ADAN) **DE LE HALE** (died *c.* 1288), French trouvère, was born at Arras. His patronymic is generally modernized to La Halle, and he was commonly known to his contemporaries as Adam d'Arras or Adam le Bossu, sometimes simply as Le Bossu d'Arras. His father, Henri de le Hale, was a well-known citizen of Arras, and Adam studied grammar, theology and music at the Cistercian abbey of Vaucelles, near Cambrai. Father and son had their share in the civil discords in Arras, and for a short time took refuge in Douai. Adam had been destined for the church, but renounced this intention, and married a certain Marie, who figures in many of his songs, rondeaux, motets and *jeux-partis*. Afterwards he joined the household of Robert II., count of Artois; and then was attached to Charles of Anjou, brother of Charles IX., whose fortunes he followed in Egypt, Syria, Palestine and Italy. At the court of Charles, after he became king of Naples, he wrote his *Jeu de Robin et Marion*, the most famous of his works. He died between 1285 and 1288. Adam's shorter pieces are accompanied by music, of which a transcript in modern notation, with the original score, is given in Coussemaker's edition. His *Jeu de Robin et Marion* is cited as the earliest French play with music on a secular subject. The pastoral, which tells how Marion resisted the knight, and remained faithful to Robert the shepherd, is based on an old *chanson*, *Robin m'aime, Robin m'a*. It consists of dialogue varied by refrains already current in popular song. The melodies to which these are set have the character of folk-music, and are more spontaneous and melodious than the more elaborate music of his songs and motets. A modern adaptation, by Julien Tiersot, was played at Arras by a company from the Paris Opéra Comique on the occasion of a festival in 1896 in honour of Adam de le Hale. His other play, *Le jeu Adan* or *Le jeu de la Feuillée* (*c.* 1262), is a satirical drama in which he introduces himself, his father and the citizens of Arras with their peculiarities. His works include a *Congé*, or satirical farewell to the city of Arras, and an unfinished *chanson de geste* in honour of Charles of Anjou, *Le roi de Sicile*, begun in 1282; another short piece, *Le jeu du pèlerin*, is sometimes attributed to him.

The only MS. which contains the whole of Adam's work is the La Vallière MS. (No. 25,566) in the Bibliothèque Nationale, Paris, dating from the latter half of the 13th century. Many of his pieces are also contained in Douce MS. 308, in the Bodleian Library, Oxford. His *Œuvres complètes* (1872) were edited by E. de Coussemaker. See also an article by Paulin Paris in the *Histoire littéraire de la France* (vol. xx. pp. 638-675); G. Raynaud, *Recueil des motets français des XII*^{e} *et XIII*^{e} *siècles* (1882); *Canchons et Partures des . . . Adan delle Hale* (Halle, 1900), a critical edition by Rudolf Berger; an edition of Adam's two *jeux* in Monmerqué and Michel's *Théâtre français au moyen âge* (1842); E. Langlois, *Le jeu de Robin et Marion* (1896), with a translation in modern French; A. Guesnon, *La Satire à Arras au XIII*^{e} *siècle* (1900); and a full bibliography of works on the subject in No. 6 of the *Bibliothèque de bibliographies critiques*, by Henri Guy.

ADAM, ALEXANDER (1741–1809), Scottish writer on Roman antiquities, was born on the 24th of June 1741, near Forres, in Morayshire. From his earliest years he showed uncommon diligence and perseverance in classical studies, notwithstanding many difficulties and privations. In 1757 he went to Edinburgh, where he studied at the university. His reputation as a classical scholar secured him a post as assistant at Watson's Hospital and the headmastership in 1761. In 1764 he became private tutor to Mr Kincaid, afterwards Lord Provost of Edinburgh, by whose influence he was appointed (in 1768) to the rectorship of the High School on the retirement of Mr Matheson, whose substitute he had been for some time before. From this period he devoted himself entirely to the duties of his office and to the preparation of his numerous works on classical literature. His popularity and success as a teacher are strikingly illustrated by the great increase in the number of his pupils, many of whom subsequently became distinguished men, among them being Sir Walter Scott, Lord Brougham and Jeffrey. He succeeded in introducing the study of Greek into the curriculum of the school, notwithstanding the opposition of the university headed by Principal Robertson. In 1780 the university of Edinburgh conferred upon him the honorary degree of Doctor of Laws. He died on the 18th of December 1809, after an illness of five days, during which he occasionally imagined himself still at work, his last words being, "It grows dark, boys, you may go." Dr Adam's first publication was his *Principles of Latin and English Grammar* (1772), which, being written in English instead of Latin, brought down a storm of abuse upon him. This was followed by his *Roman Antiquities* (1791), *A Summary of Geography and History* (1794) and a *Compendious Dictionary of the Latin Tongue* (1805). The MS. of a projected larger Latin dictionary, which he did not live to complete, lies in the library of the High School. His best work was his *Roman Antiquities*, which has passed through a large number of editions and received the unusual compliment of a German translation.

See *An Account of the Life and Character of A. A.*, by A. Henderson (1810).

ADAM, SIR FREDERICK (1781–1853), British general, was the son of the Rt. Hon. W. Adam of Blair-Adam, lord-lieutenant of Kinross-shire. He was gazetted an ensign at the age of fourteen and was subsequently educated at Woolwich. He became captain in 1799, and served with the Coldstream Guards in Egypt (1801). In 1805, having purchased the intermediate steps of promotion, he obtained command of the 21st Foot, with which regiment he served in the Mediterranean from 1805 to 1813, taking part in the battle of Maida in 1806. In 1813 he accompanied the British corps sent to Catalonia, in which he commanded a brigade. He fought a gallant action at Biar (April 12, 1813), and on the following day won further distinction at Castalla. In the action of Ordal, on the 12th of September, Adam received two severe wounds. He returned to England to recover, and was made a major-general in 1814. At Waterloo, Adam's brigade, of which the 52nd under Colborne (see Seaton, Lord) formed part, shared with the Guards the honour of repulsing the Old Guard. For his services he was made a K.C.B., and received also Austrian and Russian orders. During the long peace which followed, Sir Frederick Adam was successively employed at Malta, in the Ionian Islands as lord high commissioner (1824–1831) and from 1832 to 1837 as governor of Madras. He became K.C.M.G. in 1820, G.C.M.G. four years later, lieutenant-general in 1830, a privy councillor in 1831, G.C.B. in 1840, and full general in 1846. He died suddenly on the 17th of August 1853.

ADAM, JULIETTE (1836–), French writer, known also by her maiden name of Juliette Lamber, was born at Verberie (Oise) on the 4th of October 1836. She has given an account of her childhood, rendered unhappy by the dissensions of her parents, in *Le roman de mon enfance et de ma jeunesse* (Eng. trans., London and New York, 1902). In 1852 she married a doctor named La Messine, and published in 1858 her *Idées antiproudhoniennes sur l'amour, la femme et le mariage*, in defence of Daniel Stern (Mme. d'Agoult) and George Sand. On her husband's death she married in 1868 Antoine Edmond Adam (1816–1877), prefect of police in 1870, and subsequently life-senator; and she established a salon which was frequented by Gambetta and the other republican leaders against the conservative reaction of the 'seventies. In the same interest she founded in 1879 the *Nouvelle Revue*, which she edited for the first eight years, and in the administration of which she retained a preponderating influence until 1899. She wrote the notes on foreign politics, and was unremitting in her attacks on Bismarck and in her advocacy of a policy of *revanche*. Mme. Adam was also generally credited with the authorship of papers on various European capitals signed "Paul Vasili," which were in reality the work of various writers. The most famous of her numerous novels is *Païenne* (1883). Her reminiscences, *Mes premières armes littéraires et politiques* (1904) and *Mes sentiments et nos idées avant* 1870 (1905), contain much interesting gossip about her distinguished contemporaries.

ADAM, LAMBERT SIGISBERT (1700–1759), French sculptor, known as Adam *l'aîné*, was born in Nancy, son of Jacob Sigisbert Adam, a sculptor of little repute. Adam was thirty-seven when, on his election to the Academy, he exhibited at the Salon the model of the group of "Neptune and Amphitrite" for the centre of the fountain at Versailles, and thereafter found much employment in the decoration of the royal residences. Among his more important works are "Nymphs and Tritons," "The Triumph of Neptune stilling the Waves," "Hunter with Lion in his Net," a relief for the chapel of St Adelaide, "The Seine and the Marne" in stone for St Cloud, "Hunting" and "Fishing," marble groups for Berlin, "Mars embraced by Love" and "The enthusiasm of Poetry." Adam restored with much ability the twelve statues (Lycomedes) found in the so-called Villa of Marius at Rome, and was elected a member of the Academy of St Luke. Several of his most important works were executed for Frederick the Great in Prussia.

His brother, also a sculptor, Nicolas Sébastien Adam (1705–1778), known as Adam *le jeune*, born in Nancy, worked under equal encouragement. His first work of importance was his "Prometheus chained, devoured by a Vulture," executed in plaster in 1738, and carved in marble in 1763 as his "reception piece" when he was elected into the Academy. He produced the reliefs of the "Birth" and "Agony of Christ" for the Oratory in Paris, but his chief works are the "Mausoleum of Cardinal de Fleury" and, in particular, the tomb of Catherine Opalinska, queen of Poland (wife of King Stanislaus), at Nancy.

A third brother, François Gaspard Balthasar Adam (1710–1761), born in Nancy, became the first sculptor of Frederick the Great and the head of the atelier of sculpture founded by that monarch, and passed the greater part of his life in Berlin. His chief works adorn the gardens and palaces of Sans Souci and Potsdam.

The work of the brothers Adam was too ornate in style to win the approval of the school that immediately followed them, and found its principal opponents in Bouchardon and Pigalle.

See Dussieux, *Artistes français à l'étranger* (Paris, 1855, 8vo); *Archives de l'art français, documents*, vol. i. pp. 117-180, chiefly for works executed for the king of Prussia; Mariette, *Abecedario*; Emile de la Chavignerie and Auvray, *Dictionnaire général des artistes de l'école française* (Paris, 1882), mainly for works executed; Lady Dilke, *French Architects and Sculptors of the 18th century* (London, 4to, 1900).

ADAM, MELCHIOR (d. 1622), German divine and biographer, was born at Grotkau in Silesia after 1550, and educated in the college of Brieg, where he became a Protestant. In 1598 he went to Heidelberg, where he held various scholastic appointments. He wrote the biographies of a number of German scholars of the 16th century, mostly theologians, which were published in Heidelberg and Frankfort (5 vols., 1615–1620). He dealt with only twenty divines of other countries. All his divines are Protestants. His industry as a biographer is commended by P. Bayle, who acknowledges his obligations to Adam's labours; and his biographies, though they have faults, are still useful.

ADAM, PAUL (1862–), French novelist, was born in Paris on the 7th of December 1862. He was prosecuted for his first novel, *Chair molle* (1885), but was acquitted. He collaborated with Jean Moréas in *Le thé chez Miranda* (1886), and with Moréas and Gustave Kahn he founded the *Symboliste*, coming forward as one of the earliest defenders of symbolism. Among his numerous novels should be noted *Le mystère des foules* (2 vols., 1895), a study in Boulangism, *Lettres de Malaisie* (1897), a fantastic romance of imaginary future politics. In 1899 he began a novel-sequence, giving the history of the Napoleonic campaigns, the restoration and the government of Louis Philippe, comprising *La force* (1899), *L'enfant d'Austerlitz* (1901), *La ruse* (1902), and *Au soleil de Juillet* (1903). In 1900 he wrote a Byzantine romance, *Basile et Sophia*.

ADAM, ROBERT (1728–1792), British architect, the second son of William Adam of Maryburgh, in Fife, and the most celebrated of four brothers, John, Robert, James and William Adam, was born at Kirkcaldy in 1728. For few famous men have we so little biographical material, and contemporary references to him are sparse. He certainly studied at the university of Edinburgh, and probably received his first instruction in architecture from his father, who gave proofs of his own skill and taste in the Edinburgh Royal Infirmary (now demolished). His mother was the aunt of Dr W. Robertson, the first English historian of Charles V., and in 1750 we find Robert Adam living with her in Edinburgh, and making one of the brilliant literary coterie which adorned it at that period. Somewhere between 1750 and 1754 he visited Italy, where he spent three years studying the remains of Roman architecture. There he was struck with the circumstance that practically nothing had survived of the Greek and Roman masterpieces except public buildings, and that the private palaces, which Vitruvius and Pliny esteemed so highly, had practically vanished. One example of such work, however, was extant in the ruins of Diocletian's palace at Spalato, in Dalmatia, and this he visited in July 1757, taking with him the famous French architect and antiquary, C. L. Clérisseau, and two experienced draughtsmen, with whose assistance, after being arrested as a spy, he managed in five weeks to accumulate a sufficient number of measurements and careful plans and surveys to produce a restoration of the entire building in a fine work which he published in 1764, *The Ruins of the Palace of Dioclętian, &c.* Considering the shortness of the time occupied and the obstacles placed in his way by the Venetian governor and the population of the place, the result was amazing. The influence of these studies was apparent directly and indirectly in much of his subsequent work, which, indeed, was in great measure founded upon them.

After his return to England he seems to have come rapidly to the front, and in 1762 he was appointed sole architect to the king and the Board of Works. Six years later he resigned this office, in which he was succeeded by his brother James,—who however, held the office jointly with another,—and entered parliament as member for the county of Kinross. In 1768 he and his three brothers leased the ground fronting the Thames, upon which the Adelphi now stands, for £1200 on a ninety-nine years' lease, and having obtained, with the assistance of Lord Bute, the needful act of parliament, proceeded, in the teeth of public opposition, to erect the ambitious block of buildings which is imperishably associated with their name, indicating its joint origin by the title Adelphi, from the Greek ἀδελφοί, the Brothers. The site presented attractive possibilities. A steep hill led down Buckingham Street to the river-side, and the plan was to raise against it, upon a terrace formed of massive arches and vaults and facing the river, a dignified quarter of fine streets and stately buildings, suggestive of the Spalato ruins. In spite of many difficulties, pecuniary and otherwise (the undertaking was completed from the proceeds of a lottery), money was raised and the work pushed on; in five years the Adelphi terrace stood complete, and the fine houses were eagerly sought after by artists and men of letters. Splendid, however, as the terrace and its houses are, both in conception and execution, the underground work which upholds them is perhaps more remarkable still. The vast series of arched vaults has been described by a modern writer as a very town, which, during the years that they were open, formed subterranean streets leading to the river and its wharves. In many places the arches stand in double tiers. In time these " streets " obtained a bad name as the haunt of suspicious characters, and they have long been enclosed and let as cellars. Between 1773 and 1778 the brothers issued a fine series of folio engravings and descriptions of the designs for many of their most important works, which included several great public buildings and numberless large private houses; a fine volume was published in 1822. For the remaining years of Robert's life the practice of the firm was the most extensive in the country; his position was unquestioned, and when he died in 1792 he was laid to rest in Westminster Abbey almost as a matter of course.

The art of Robert Adam was extraordinarily many-sided and prolific, and it is difficult to give a condensed appreciation of it. As an architect he was strongly under Roman and Italian influences, and his style and aims were exotic rather than native. But this does not detract from their merit, nor need it diminish our estimate of his genius. It was, indeed, the most signal triumph of that genius that he was able so to mould and adapt classical models as to create a new manner of the highest charm and distinction. Out of simple curvilinear forms, of which he principally preferred the oval, he evolved combinations of extraordinary grace and variety, and these entered into every detail of his work. In his view the architect was intimately concerned with the furniture and the decorations of a building, as well as with its form and construction, and this view he carried rigorously into practice, and with astonishing success. Nothing was too small and unimportant for him—summer-houses and dog-kennels came as readily to him as the vast façades of a terrace in town or a great country house. But he never permitted minute details to obscure the main lines of a noble design. Whatever care he might have expended upon the flowing curves of a moulding or a decoration, it was strictly kept in its place; it contributed its share and no more to the total effect. He made a distinct step forward in giving shape to the idea of imparting the unity of a single imposing structure to a number of private houses grouped in a block which is so characteristic a feature of modern town building, and though at times he failed in the breadth of grasp needful to carry out such an idea on a large scale, he has left us some fine examples of what can be accomplished in this direction. A delightful but theoretically undesirable characteristic of his work is the use of stucco. Upon it he moulded delicate forms in subtle and beautiful proportions. His " compo " was used so successfully that the patent was infringed: many of his moulds still exist and are in constant use. That most difficult feature, the column, he handled with enthusiasm and perfect mastery; he studied and wrote of it with minute pains, while his practice showed his grasp of the subject by all avoidance of bare imitation of the classic masters who first brought it to perfection. His work might be classic in form, but it was independently developed by himself. It would be impossible here to give a list of the innumerable works which he executed. In London, of course, the Adelphi stands pre-eminent; the screen and gate of the Admiralty and part of Fitzroy Square are by him, Portland Place, and much of the older portion of Finsbury Circus, besides whole streets of houses in the west end. There are the famous country houses of Lord Mansfield at Caen Wood, Highgate and Luton Hoo, and decorations and additions to many more.

Robert Adam—with, there is reason to suspect, some help from his brother James—has left as deep and enduring a mark upon English furniture as upon English architecture. Down to his time carving was the dominant characteristic of the mobiliary art, but thenceforward the wood-worker declined in importance. French influence disposed Robert Adam to the development of painted furniture with inlays of beautiful exotic woods, and many of his designs, especially for sideboards, are extremely attractive, mainly by reason of their austere simplicity. Robert Adam was no doubt at first led to turn his thoughts towards furniture by his desire to see his light, delicate, graceful interiors, with their large sense of atmosphere and their refined and finished detail, filled with plenishings which fitted naturally into his scheme. His own taste developed as he went on, but he was usually extremely successful, and cabinetmakers are still reproducing his most effective designs. In his furniture he made lavish use of his favourite decorative motives—wreaths and paterae, the honeysuckle, and that fan ornament which he used so constantly. Thus an Adam house is a unique product of English art. From façade to fire-irons, from the chimneys to the carpets, everything originated in the same order of ideas, and to this day an Adam drawing-room is to English what a Louis Seize room is to French art. In nothing were the Adams more successful than in mantelpieces and doors. The former, by reason of their simplicity and the readiness with which the " compo " ornaments can be applied and painted, are still made in cheap forms in great number. The latter were most commonly executed in a rich mahogany and are now greatly sought after. The extent to which the brothers worked together is by no means clear—indeed, there is an astonishing dearth of information regarding this remarkable family, and it is a reproach to English art literature that no biography of Robert Adam has ever been published. John Adam succeeded to his father's practice as an architect in Edinburgh. James Adam studied in Rome, and eventually was closely associated with Robert; William is variously said to have been a banker and an architect. (J. P.-B.)

ADAM, WILLIAM (1751–1839), British lawyer and politician, eldest son of John Adam of Blair-Adam, Kinross-shire, and nephew of the architect noticed above, was born on the 2nd of August 1751, studied at the universities of Edinburgh and Glasgow, and passed at the Scottish bar in 1773. Soon afterwards he removed to England, where he entered parliament in 1774, and in 1782 was called to the common law bar. He withdrew from parliament in 1795, entered it again in 1806 as representative of the united counties of Clackmannan and Kinross, and continued a member, with some interruptions, till 1811. He was a Whig and a supporter of the policy of Fox. At the English bar he obtained a very considerable practice. He was successively attorney and solicitor-general to the prince of Wales, one of the managers of the impeachment of Warren Hastings, and one of the counsel who defended the first Lord Melville when impeached. During his party's brief tenure of office in 1806 he was chancellor of the duchy of Cornwall, and was afterwards a privy councillor and lord-lieutenant of Kinross-shire. In 1814 he became a baron of Exchequer in Scotland, and was chief commissioner of the newly established jury-court for the trial of civil causes, from 1815 to 1830, when it was merged in the permanent supreme tribunal. He died at Edinburgh on the 17th of February 1839.

ADAMANT (from Gr. ἀδάμας, untameable), the modern *diamond* (*q.v.*), but also a name given to any very hard substance. The Greek word is used by Homer as a personal epithet, and by Hesiod for the hard metal in armour, while Theophrastus applies it to the hardest crystal. By an etymological confusion with the Lat. *adamare*, to have an attraction for, it also came to be associated with the loadstone; but since the term was displaced by "diamond" it has had only a figurative and poetical use.

ADAMAWA, a country of West Africa, which lies roughly between 6° and 11° N., and 11° and 15° E., about midway between the Bight of Biafra and Lake Chad. It is now divided between the British protectorate of Nigeria (which includes the chief town Yola, *q.v.*) and the German colony of Cameroon. This region is watered by the Benue, the chief affluent of the Niger, and its tributary the Faro. Another stream, the Yedseram, flows north-east to Lake Chad. The most fertile parts of the country are the plains near the Benue, about 800 ft. above the sea. South and east of the river the land rises to an elevation of 1600 ft., and is diversified by numerous hills and groups of mountains. These ranges contain remarkable rock formations, towers, battlements and pinnacles crowning the hills. Chief of these formations is a gigantic pillar some 450 ft. high and 150 ft. thick at the base. It stands on the summit of a high conical hill. Mount Alantika, about 25 miles south-south-east of Yola, rises from the plain, an isolated granite mass, to the height of 6000 ft. The country, which is very fertile and is covered with luxuriant herbage, has many villages and a considerable population. Durra, ground-nuts, yams and cotton are the principal products, and the palm and banana abound. Elephants are numerous and ivory is exported. In the eastern part of the country the rhinoceros is met with, and the rivers swarm with crocodiles and with a curious mammal called the *ayu*, bearing some resemblance to the seal.

Adamawa is named after a Fula Emir Adama, who in the early years of the 19th century conquered the country. To the Hausa and Bornuese it was previously known as Fumbina (or Southland). The inhabitants are mainly pure negroes such as the Durra, Batta and Dekka, speaking different languages, and all fetish-worshippers. They are often of a very low type, and some of the tribes are cannibals. Slave-trading was still active among them in the early years of the 20th century. The Fula (*q.v.*), who first came into the country about the 15th century as nomad herdsmen, are found chiefly in the valleys, the pagan tribes holding the mountainous districts. There are also in the country numbers of Hausa, who are chiefly traders, as well as Arabs and Kanuri from Bornu. The emir of Yola, in the period of Fula lordship, claimed rights of suzerainty over the whole of Adamawa, but the country, since the subjection of the Fula (*c.* 1900), has consisted of a number of small states under the control of the British and Germans. Garua on the upper Benue, 65 m. east of Yola, is the headquarters of the German administration for the region and the chief trade centre in the north of Adamawa. Yoko is one of the principal towns in the south of the country, and in the centre is the important town of Ngaundere. After Heinrich Barth, who explored the country in 1851, the first traveller to penetrate Adamawa was the German, E. R. Flegel (1882). It has since been traversed by many expeditions, notably that of Baron von Uechtritz and Dr Siegfried Passarge (1893–1894).

An interesting account of Adamawa, its peoples and history, is given by Heinrich Barth in his *Travels in North and Central Africa* (new edition, London, 1890), and later information is contained in S. Passarge's *Adamawa* (Berlin, 1895). (See also Cameroon and Nigeria, and the bibliographies there given.)

ADAMITES, or Adamians, a sect of heretics that flourished in North Africa in the 2nd and 3rd centuries. Basing itself probably on a union of certain gnostic and ascetic doctrines, this sect pretended that its members were re-established in Adam's state of original innocency. They accordingly rejected the form of marriage, which, they said, would never have existed but for sin, and lived in absolute lawlessness, holding that, whatever they did, their actions could be neither good nor bad. During the middle ages the doctrines of this obscure sect, which did not itself exist long, were revived in Europe by the Brethren and Sisters of the Free Spirit.

ADAMNAN, or Adomnan (*c.* 624–704), Irish saint and historian, was born at Raphoe, Donegal, Ireland, about the year 624. In 679 he was elected abbot of Hy or Iona, being ninth in succession from the founder, St Columba. While on a mission to the court of King Aldfrith of Northumberland in 686, he was led to adopt the Roman rules with regard to the time for celebrating Easter and the tonsure, and on his return to Iona he tried without success to enforce the change upon the monks. He died on the 23rd of September 704. Adamnan wrote a *Life of St Columba*, which, though abounding in fabulous matter, is of great interest and value. The best editions are those published by W. Reeves (1857, new edit. Edinburgh, 1874) and by J. T. Fowler (Oxford, 1894). Adamnan's other well-known work, *De Locis Sanctis* (edited by P. Geyer, *Itinera Hierosolymitana saeculi*, iii.-viii., &c., 1898; vol. 39 of Bienna *Corpus Script. Ecc. Latin*) was based, according to Bede, on information received from Arculf, a French bishop, who, on his return from the Holy Land, was wrecked on the west coast of Britain, and was entertained for a time at Iona. This was first published at Ingolstadt in 1619 by J. Gretser, who also defended Baronius' acceptance of Arculf's narrative against Casaubon. An English translation by G. J. R. Macpherson, *Arculfus' Pilgrimage in the Holy Land*, was published by the Pilgrim's Text Society (London, 1889).

For full bibliography see U. Chevalier, *Répert. des sources historiques* (1903), p. 40.

ADAMS, ANDREW LEITH (1827–1882), Scottish naturalist and palaeontologist, the second son of Francis Adams of Banchory, Aberdeen, was born on the 21st of March 1827, and was educated to the medical profession. As surgeon in the Army Medical Department from 1848 to 1873, he utilized his opportunities for the study of natural history in India and Kashmir, in Egypt, Malta, Gibraltar and Canada. His observations on the fossil vertebrata of the Maltese Islands led him eventually to give special study to fossil elephants, on which he became an acknowledged authority. In 1872 he was elected F.R.S. In 1873 he was chosen professor of zoology in the Royal College of Science, Dublin, and in 1878 professor of natural history in Queen's College, Cork, a post which he held until the close of his life. He died at Queenstown on the 29th of July 1882.

Publications.—*Notes of a Naturalist in the Nile Valley and Malta* (London, 1870); other works of travel; *Monograph on the British Fossil Elephants* (Palaeontographical Soc.), (London, 1877-1881).

ADAMS, CHARLES FRANCIS (1807–1886), American diplomatist, son of John Quincy Adams, and grandson of John Adams, was born in Boston on the 18th of August 1807. His father, having been appointed minister to Russia, took him in 1809 to St Petersburg, where he acquired a perfect familiarity with French, learning it as his native tongue. After eight years spent in Russia and England, he attended the Boston Latin School for four years, and in 1825 graduated at Harvard. He lived two years in the executive mansion, Washington, during his father's presidential term, studying law and moving in a society where he met Webster, Clay, Jackson and Randolph. Returning to Boston, he devoted ten years to business and study, and wrote for the *North American Review*. He also undertook the management of his father's pecuniary affairs, and actively supported him in his contest in the House of Representatives for the right of petition and the anti-slavery cause. In 1835 he wrote an effective and widely read political pamphlet, entitled, after Edmund Burke's more famous work, *An Appeal from the New to the Old Whigs*. He was a member of the Massachusetts general court from 1840 to 1845, sitting for three years in the House of Representatives and for two years in the Senate; and in 1846–1848 he edited a party journal, the *Boston Whig*. In 1848 he was prominent in politics as a "Conscience Whig," presiding over the Buffalo Convention which formed the Free Soil party and nominated Martin Van Buren for president and himself for vice-president. He was a Republican member of the Thirty-Sixth Congress, which assembled on the 5th of December 1859, and during the second session, from the 3rd of December 1860 to the 4th of March 1861, he represented Massachusetts in the Congressional Committee of Thirty-three at the time of the secession of seven of the Southern states. His selection by the chairman of this committee, Thomas Corwin, to present to the full committee certain propositions agreed upon by two-thirds of the Republican members, and his calm and able speech of the 31st of January 1861 in the House, served to make him conspicuous before congress and the country. Together with William H. Seward, he stood for the Republican policy of concession; and, while he was criticized severely and charged with inconsistency in view of his record as a "Conscience Whig," he was of the same mind as President Lincoln, willing to concede non-essentials, but holding rigidly to the principle, properly understood, that there must be no extension of slavery. He believed that as the Republicans were the victors they ought to show a spirit of conciliation, and that the policy of righteousness was likewise one of expediency, since it would have for its result the holding of the border slave states with the North until the 4th of March, when the Republicans could take possession of the government at Washington. With the incoming of the new administration Secretary Seward secured for Adams the appointment of minister to Great Britain. So much sympathy was shown in England for the South that his path was beset with difficulties; but his mission was to prevent the interference of Great Britain in the struggle; and while the work of Lincoln, Seward and Sumner, and the cause of emancipation, tended to this end, the American minister was insistent and unyielding, and knew how to present his case forcibly and with dignity. He laboured with energy and discretion to prevent the sailing of the "Alabama"; and, when unsuccessful in this, he persistently urged upon the British government its responsibility for the destruction of American merchant vessels by the privateer. In his own diary he shows that underneath his calm exterior were serious trouble and keen anxiety; and, in fact, the strain which he underwent during the Civil War made itself felt in later years. Adams was instrumental in getting Lord John Russell to stop the "Alexandra," and it was his industry and pertinacity in argument and remonstrance that induced Russell to order the detention in September 1863 of the two ironclad rams intended for the Confederate States. Adams remained in England until May 1868. His last important work was as a member, in 1871–1872, of the tribunal of arbitration at Geneva which disposed of the "Alabama" claims. His knowledge of the subject and his fairness of mind enabled him to render his country and the cause of international arbitration valuable service. He died at Boston on the 21st of November 1886.

He edited the works of *John Adams* (10 vols., 1850–1856), and the *Memoirs of John Quincy Adams* (12 vols., 1874–1877). See the excellent biography (Boston, 1900), in the "American Statesmen Series," by his son, Charles Francis Adams, Jr. (J. F. R.)

ADAMS, HENRY (1838–), American historian, son of Charles Francis Adams and grandson of John Quincy Adams, was born in Boston, Massachusetts, on the 16th of February 1838. He graduated at Harvard in 1858, and from 1861 to 1868 was private secretary to his father. From 1870 to 1877 he was assistant professor of history at Harvard and from 1870 to 1876 was editor of the *North American Review.* He is considered to have been the first (in 1874–1876) to conduct historical seminary work in the United States. His great work is his *History of the United States* (1801 to 1817) (9 vols., 1889–1891), which is incomparably the best work yet published dealing with the administrations of Presidents Jefferson and Madison. It is particularly notable for its account of the diplomatic relations of the United States during this period, and for its essential impartiality. Adams also published: *Life of Albert Gallatin* (1879), *John Randolph* (1882) in the "American Statesmen Series," and *Historical Essays* (1891); besides editing *Documents Relating to New England Federalism* (1877), and the *Writings of Albert Gallatin* (3 volumes, 1879). In collaboration with his elder brother Charles Francis Adams, Jr., he published *Chapters of Erie and Other Essays* (1871), and, with H. C. Lodge, Ernest Young and J. L. Laughlin, *Essays in Anglo-Saxon Law* (1876).

His elder brother, John Quincy Adams (1833–1894), a graduate of Harvard (1853), practised law, and was a Democratic member for several terms of the Massachusetts general court. In 1872 he was nominated for vice-president by the Democratic faction that refused to support Horace Greeley.

Another brother, Charles Francis Adams, Jr. (1835–), born in Boston on the 27th of May 1835, graduated at Harvard in 1856, and served on the Union side in the Civil War, receiving in 1865 the brevet of brigadier-general in the regular army. He was president of the Union Pacific railroad from 1884 to 1890, having previously become widely known as an authority on the management of railways. In 1900–1901 he was president of the American Historical Association. Among his writings are: *Railroads, Their Origin and Problems* (1878); *Three Episodes of Massachusetts History* (1892); a biography of his father, *Charles Francis Adams* (1900); *Lee at Appomattox and Other Papers* (1902); *Theodore Lyman and Robert Charles Winthrop, Jr., Two Memoirs* (1906); and *Three Phi Beta Kappa Addresses* (1907).

Another brother, Brooks Adams (1848–), born in Quincy, Massachusetts, on the 24th of June 1848, graduated at Harvard in 1870, and until 1881 practised law. His writings include: *The Emancipation of Massachusetts* (1887); *The Law of Civilization and Decay* (1895); *America's Economic Supremacy* (1900); and *The New Empire* (1902).

ADAMS, HENRY CARTER (1852–), American economist, was born at Davenport, Iowa, on the 31st of December 1852. He was educated at Iowa College and Johns Hopkins University, of which latter he was fellow and lecturer (1880–1882). He was afterwards a lecturer in Cornell University, and in 1887 became professor of political economy and finance in the university of Michigan. He also became statistician to the Interstate Commerce Committee and was in charge of the transportation department in the 1900 census. His principal works are *The State in Relation to Industrial Action* (1887); *Taxation in the United States, 1787 to 1816* (1884); *Public Debts* (1887); *The Science of Finance* (1888); *Economics and Jurisprudence* (1897).

ADAMS, HERBERT (1858–), American sculptor, was born at West Concord, Vermont, on the 28th of January 1858. He was educated at the Worcester (Massachusetts) Institute of Technology, and at the Massachusetts Normal Art School, and in 1885–1890 he was a pupil of Antonin Mercié in Paris. In 1890–1898 he was an instructor in the art school of Pratt Institute, Brooklyn, New York. In 1906 he was elected vice-president of the National Academy of Design, New York. He experimented successfully with some polychrome busts and tinted marbles, notably in the "Rabbi's Daughter" and a portrait of Miss Julia Marlowe, the actress; and he is at his best in his portrait busts of women, the best example being the study, completed in 1887, of Miss A. V. Pond, whom he afterwards married. Among his other productions are a fountain for Fitchburg, Massachusetts (1888); a number of works for the Congressional Library, Washington, including the bronze doors ("Writing") begun by Olin Warner, and the statue of Professor Joseph Henry; memorial tablets for the Boston State House; a memorial to Jonathan Edwards, at Northampton, Mass.; statues of Richard Smith, the type-founder, in Philadelphia, and of William Ellery Channing, in Boston (1902); and the Vanderbilt memorial bronze doors for St Bartholomew's Church, New York.

ADAMS, HERBERT BAXTER (1850–1901), American historian and educationalist, was born at Shutesbury (near Amherst), Massachusetts, on the 16th of April 1850. He graduated at Amherst, at the head of his class, in 1872; and between 1873 and 1876 he studied political science, history and economics at Göttingen, Berlin and Heidelberg, Germany, receiving the degree of Ph.D. at Heidelberg in 1876, with the highest honours (*summa cum laude*). From 1876 almost until his death he was connected with the Johns Hopkins University, Baltimore, Maryland, being in turn a fellow, an associate in history (1878–1883), an associate professor (1883–1891) and after 1891 professor of American and institutional history. In addition he was lecturer on history in Smith College, Northampton, Massachusetts, in 1878–1881, and for many years took an active part in Chautauqua work. In 1884, also, he was one of the founders of the American Historical Association, of which he was secretary until 1900. In 1882 he founded the " Johns Hopkins University Studies in Historical and Political Science," and at the time of his death some forty volumes had been issued under his editorship. After 1887 he also edited for the United States Bureau of Education the series of monographs entitled " Contributions to American Educational History," he himself preparing the *College of William and Mary* (1887), and *Thomas Jefferson and the University of Virginia* (1888). It was as a teacher, however, that Adams rendered his most valuable services, and many American historical scholars owe their training and to a considerable extent their enthusiasm to him. He died at Amherst, Massachusetts, on the 30th of July 1901.

In addition to the monographs mentioned above, he published: *Maryland's Influence in Founding a National Commonwealth* (1877); *Methods of Historical Study* (1884); *Maryland's Influence upon Land Cessions to the United States* (1885); and the *Life and Writings of Jared Sparks* (2 vols., Boston, 1893), his most important work.

See *Herbert B. Adams: Tributes of Friends* (Baltimore, 1902), extra volume (xxiii.) of "Studies in Historical and Political Science."

ADAMS, JOHN (1735–1826), second president of the United States of America, was born on the 30th of October 1735 in what is now the town of Quincy, Massachusetts. His father, a farmer, also named John, was of the fourth generation in descent from Henry Adams, who emigrated from Devonshire, England, to Massachusetts about 1636; his mother was Susanna Boylston Adams. Young Adams graduated from Harvard College in 1755, and for a time taught school at Worcester and studied law in the office of Rufus Putnam. In 1758 he was admitted to the bar. From an early age he developed the habit of writing descriptions of events and impressions of men. The earliest of these is his report of the argument of James Otis in the superior court of Massachusetts as to the constitutionality of writs of assistance. This was in 1761, and the argument inspired him with zeal for the cause of the American colonies. Years afterwards, when an old man, Adams undertook to write out at length his recollections of this scene; it is instructive to compare the two accounts. John Adams had none of the qualities of popular leadership which were so marked a characteristic of his second cousin, Samuel Adams; it was rather as a constitutional lawyer that he influenced the course of events. He was impetuous, intense and often vehement, unflinchingly courageous, devoted with his whole soul to the cause he had espoused; but his vanity, his pride of opinion and his inborn contentiousness were serious handicaps to him in his political career. These qualities were particularly manifested at a later period—as, for example, during his term as president. He first made his influence widely felt and became conspicuous as a leader of the Massachusetts Whigs during the discussions with regard to the Stamp Act of 1765. In that year he drafted the instructions which were sent by the town of Braintree to its representatives in the Massachusetts legislature, and which served as a model for other towns in drawing up instructions to their representatives; in August 1765 he contributed anonymously four notable articles to the *Boston Gazette* (republished separately in London in 1768 as *A Dissertation on the Canon and Feudal Law*), in which he argued that the opposition of the colonies to the Stamp Act was a part of the never-ending struggle between individualism and corporate authority; and in December 1765 he delivered a speech before the governor and council in which he pronounced the Stamp Act invalid on the ground that Massachusetts being without representation in parliament, had not assented to it. In 1768 he removed to Boston. Two years later, with that degree of moral courage which was one of his distinguishing characteristics, as it has been of his descendants, he, aided by Josiah Quincy, Jr., defended the British soldiers who were arrested after the "Boston Massacre," charged with causing the death of four persons, inhabitants of the colony. The trial resulted in an acquittal of the officer who commanded the detachment, and most of the soldiers; but two soldiers were found guilty of manslaughter. These claimed benefit of clergy and were branded in the hand and released. Adams's upright and patriotic conduct in taking the unpopular side in this case met with its just reward in the following year, in the shape of his election to the Massachusetts House of Representatives by a vote of 418 to 118.

John Adams was a member of the Continental Congress from 1774 to 1778. In June 1775, with a view to promoting the union of the colonies, he seconded the nomination of Washington as commander-in-chief of the army. His influence in congress was great, and almost from the beginning he was impatient for a separation of the colonies from Great Britain. On the 7th of June 1776 he seconded the famous resolution introduced by Richard Henry Lee (*q.v.*) that " these colonies are, and of a right ought to be, free and independent states," and no man championed these resolutions (adopted on the 2nd of July) so eloquently and effectively before the congress. On the 8th of June he was appointed on a committee with Jefferson, Franklin, Livingston and Sherman to draft a Declaration of Independence; and although that document was by the request of the committee written by Thomas Jefferson, it was John Adams who occupied the foremost place in the debate on its adoption. Before this question had been disposed of, Adams was placed at the head of the Board of War and Ordnance, and he also served on many other important committees.

In 1778 John Adams sailed for France to supersede Silas Deane in the American commission there. But just as he embarked that commission concluded the desired treaty of alliance, and soon after his arrival he advised that the number of commissioners be reduced to one. His advice was followed and he returned home in time to be elected a member of the convention which framed the Massachusetts constitution of 1780, still the organic law of that commonwealth. With James Bowdoin and Samuel Adams, he formed a sub-committee which drew up the first draft of that instrument, and most of it probably came from John Adams's pen. Before this work had been completed he was again sent to Europe, having been chosen on the 27th of September 1779 as minister plenipotentiary for negotiating a treaty of peace and a treaty of commerce with Great Britain. Conditions were not then favourable for peace, however; the French government, moreover, did not approve of the choice, inasmuch as Adams was not sufficiently pliant and tractable and was from the first suspicious of Vergennes; and subsequently Benjamin Franklin, Thomas Jefferson, John Jay and Henry Laurens were appointed to co-operate with Adams. Jefferson, however, did not cross the Atlantic, and Laurens took little part in the negotiations. This left the management of the business to the other three. Jay and Adams distrusted the good faith of the French government. Outvoting Franklin, they decided to break their instructions, which required them to " make the most candid confidential communications on all subjects to the ministers of our generous ally, the king of France; to undertake nothing in the negotiations for peace or truce without their knowledge or concurrence; and ultimately to govern yourself by their advice and opinion"; and, instead, they dealt directly with the British commissioners, without consulting the French ministers. Throughout the negotiations Adams was especially determined that the right of the United States to the fisheries along the British-American coast should be recognized. Political conditions in Great Britain, at the moment, made the conclusion of peace almost a necessity with the British ministry, and eventually the American negotiators were able to secure a peculiarly favourable treaty. This preliminary treaty was signed on the 30th of November 1782. Before these negotiations began, Adams had spent some time in the Netherlands. In July 1780 he had been authorized to execute the duties previously assigned to Henry Laurens, and at the Hague was eminently successful, securing there recognition of the United States as an independent government (April 19, 1782), and negotiating both a loan and, in October 1782, a treaty of amity and commerce, the first of such treaties between the United States and foreign powers after that of February 1778 with France.

In 1785 John Adams was appointed the first of a long line of able and distinguished American ministers to the court of St James's. When he was presented to his former sovereign, George III. intimated that he was aware of Mr Adams's lack of confidence in the French government. Replying, Mr Adams admitted it, closing with the outspoken sentiment: "I must avow to your Majesty that I have no attachment but to my own country"—a phrase which must have jarred upon the monarch's sensibilities. While in London Adams published a work entitled *A Defence of the Constitution of Government of the United States* (1787). In this work he ably combated the views of Turgot and other European writers as to the viciousness of the framework of the state governments. Unfortunately, in so doing, he used phrases savouring of aristocracy which offended many of his countrymen,—as in the sentence in which he suggested that "the rich, the well-born and the able" should be set apart from other men in a senate. Partly for this reason, while Washington had the vote of every elector in the first presidential election of 1789, Adams received only thirty-four out of sixty-nine. As this was the second largest number he was declared vice-president, but he began his eight years in that office (1789–1797) with a sense of grievance and of suspicion of many of the leading men. Differences of opinion with regard to the policies to be pursued by the new government gradually led to the formation of two well-defined political groups—the Federalists and the Democratic-Republicans—and Adams became recognized as one of the leaders, second only to Alexander Hamilton, of the former.

In 1796, on the refusal of Washington to accept another election, Adams was chosen president, defeating Thomas Jefferson; though Alexander Hamilton and other Federalists had asked that an equal vote should be cast for Adams and Thomas Pinckney, the other Federalist in the contest, partly in order that Jefferson, who was elected vice-president, might be excluded altogether, and partly, it seems, in the hope that Pinckney should in fact receive more votes than Adams, and thus, in accordance with the system then obtaining, be elected president, though he was intended for the second place on the Federalist ticket. Adams's four years as chief magistrate (1797–1801) were marked by a succession of intrigues which embittered all his later life; they were marked, also, by events, such as the passage of the Alien and Sedition Acts, which brought discredit on the Federalist party. Moreover, factional strife broke out within the party itself; Adams and Hamilton became alienated, and members of Adams's own cabinet virtually looked to Hamilton rather than to the president as their political chief. The United States was, at this time, drawn into the vortex of European complications, and Adams, instead of taking advantage of the militant spirit which was aroused, patriotically devoted himself to securing peace with France, much against the wishes of Hamilton and of Hamilton's adherents in the cabinet. In 1800, Adams was again the Federalist candidate for the presidency, but the distrust of him in his own party, the popular disapproval of the Alien and Sedition Acts and the popularity of his opponent, Thomas Jefferson, combined to cause his defeat. He then retired into private life. On the 4th of July 1826, on the fiftieth anniversary of the adoption of the Declaration of Independence, he died at Quincy. Jefferson died on the same day. In 1764 Adams had married Miss Abigail Smith (1744–1818), the daughter of a Congregational minister at Weymouth, Massachusetts. She was a woman of much ability, and her letters, written in an excellent English style, are of great value to students of the period in which she lived. President John Quincy Adams was their eldest son.

Authorities.—C. F. Adams, *The Works of John Adams, with Life* (10 vols., Boston, 1850–1856); John and Abigail Adams, *Familiar Letters during the Revolution* (Boston, 1875); J. T. Morse, *John Adams* (Boston, 1885: later edition, 1899), in the "American Statesmen Series"; and Mellen Chamberlain, *John Adams, the Statesman of the Revolution; with other Essays and Addresses* (Boston, 1898). (E. Ch.)

ADAMS, JOHN COUCH (1819–1892), British astronomer, was born at Lidcot farmhouse, Laneast, Cornwall, on the 5th of June 1819. His father, Thomas Adams, was a tenant farmer; his mother, Tabitha Knill Grylls, inherited a small estate at Badharlick. From the village school at Laneast he went, at the age of twelve, to Devonport, where his mother's cousin, the Rev. John Couch Grylls, kept a private school. His promise as a mathematician induced his parents to send him to the university of Cambridge, and in October 1839 he entered as a sizar at St John's College. He graduated B.A. in 1843 as the senior wrangler and first Smith's prizeman of his year. While still an undergraduate he happened to read of certain unexplained irregularities in the motion of the planet Uranus, and determined to investigate them as soon as possible, with a view to ascertaining whether they might not be due to the action of a remote undiscovered planet. Elected fellow of his college in 1843, he at once proceeded to attack the novel problem. It was this: from the observed perturbations of a known planet to deduce by calculation, assuming only Newton's law of gravitation, the mass and orbit of an unknown disturbing body. By September 1845 he obtained his first solution, and handed to Professor Challis, the director of the Cambridge Observatory, a paper giving the elements of what he described as "the new planet."

On the 21st of October 1845 he left at Greenwich Observatory, for the information of Sir George Airy, the astronomer-royal, a similar document, still preserved among the archives. A fortnight afterwards Airy wrote asking for information about a point in the solution. Adams, who thought the query unessential, did not reply, and Airy for some months took no steps to verify by telescopic search the results of the young mathematician's investigation. Meanwhile, Leverrier, on the 10th of November 1845, presented to the French Academy a memoir on Uranus, showing that the existing theory failed to account for its motion. Unaware of Adams's work, he attempted a like inquiry, and on the 1st of June 1846, in a second memoir, gave the position, but not the mass or orbit, of the disturbing body whose existence was presumed. The longitude he assigned differed by only 1° from that predicted by Adams in the document which Airy possessed. The latter was struck by the coincidence, and mentioned it to the Board of Visitors of the Observatory, James Challis and Sir John Herschel being present. Herschel, at the ensuing meeting of the British Association early in September, ventured accordingly to predict that a new planet would shortly be discovered. Meanwhile Airy had in July suggested to Challis that the planet should be sought for with the Cambridge equatorial. The search was begun by a laborious method at the end of the month. On the 4th and 12th of August, as afterwards appeared, the planet was actually observed; but owing to the want of a proper star-map it was not then recognized as planetary. Leverrier, still ignorant of these occurrences, presented on the 31st of August 1846 a third memoir, giving for the first time the mass and orbit of the new body. He communicated his results by letter to Dr Galle, of the Berlin Observatory, who at once examined the suggested region of the heavens. On the 23rd of September he detected near the predicted place a small star unrecorded in the map, and next evening found that it had a proper motion. No doubt remained that "Leverrier's planet" had been discovered. On the announcement of the fact, Herschel and Challis made known that Adams had already calculated the planet's elements and position. Airy then at length published an account of the circumstances, and Adams's memoir was printed as an appendix to the *Nautical Almanac*. A keen controversy arose in France and England as to the merits of the two astronomers. In the latter country much surprise was expressed at the apathy of Airy; in France the claims made for an unknown Englishman were resented as detracting from the credit due to Leverrier's achievement. As the indisputable facts became known, the world recognized that the two astronomers had independently solved the problem of Uranus, and ascribed to each equal glory. The new planet, at first called *Leverrier* by F. Arago, received by general consent the neutral name of *Neptune*. Its mathematical prediction was not only an unsurpassed intellectual feat; it showed also that Newton's law of gravitation, which Airy had almost called in question, prevailed even to the utmost bounds of the solar system.

The honour of knighthood was offered to Adams when Queen Victoria visited Cambridge in 1847; but then, as on a subsequent occasion, his modesty led him to decline it. The Royal Society awarded him its Copley medal in 1848. In the same year the members of St John's College commemorated his success by founding in the university an Adams prize, to be given biennially for the best treatise on a mathematical subject. In 1851 he became president of the Royal Astronomical Society. His lay fellowship at St John's College came to an end in 1852, and the existing statutes did not permit of his re-election. But Pembroke College, which possessed greater freedom, elected him in the following year to a lay fellowship, and this he held for the rest of his life. In 1858 he became professor of mathematics at St Andrews, but lectured only for a session, when he vacated the chair for the Lowndean professorship of astronomy and geometry at Cambridge. Two years later he succeeded Challis as director of the Observatory, where he resided until his death.

Although Adams's researches on Neptune were those which attracted widest notice, the work he subsequently performed in relation to gravitational astronomy and terrestrial magnetism was not less remarkable. Several of his most striking contributions to knowledge originated in the discovery of errors or fallacies in the work of his great predecessors in astronomy. Thus in 1852 he published new and accurate tables of the moon's parallax, which superseded J. K. Burckhardt's, and supplied corrections to the theories of M. C. T. Damoiseau, G. A. A. Plana and P. G. D. de Pontécoulant. In the following year his memoir on the secular acceleration of the moon's mean motion partially invalidated Laplace's famous explanation, which had held its place unchallenged for sixty years. At first, Leverrier, Plana and other foreign astronomers controverted Adams's result; but its soundness was ultimately established, and its fundamental importance to this branch of celestial theory has only developed further with time. For these researches the Royal Astronomical Society awarded him its gold medal in 1866. The great meteor shower of 1866 turned his attention to the Leonids, whose probable path and period had already been discussed by Professor H. A. Newton. Using a powerful and elaborate analysis, Adams ascertained that this cluster of meteors, which belongs to the solar system, traverses an elongated ellipse in $33\frac{1}{4}$ years, and is subject to definite perturbations from the larger planets, Jupiter, Saturn and Uranus. These results were published in 1867. Ten years later, when Mr. G. W. Hill of Washington expounded a new and beautiful method for dealing with the problem of the lunar motions, Adams briefly announced his own unpublished work in the same field, which, following a parallel course had confirmed and supplemented Hill's. In 1874–1876 he was president of the Royal Astronomical Society for the second time, when it fell to him to present the gold medal of the year to Leverrier. The determination of the constants in Gauss's theory of terrestrial magnetism occupied him at intervals for over forty years. The calculations involved great labour, and were not published during his lifetime. They were edited by his brother, Professor W. Grylls Adams, and appear in the second volume of the collected *Scientific Papers*. Numerical computation of this kind might almost be described as his pastime. The value of the constant known as Euler's, and the Bernoullian numbers up to the 62nd, he worked out to an unimagined degree of accuracy. For Newton and his writings he had a boundless admiration; many of his papers, indeed, bear the cast of Newton's thought. He laboured for many years at the task of arranging and cataloguing the great collection of Newton's unpublished mathematical writings, presented in 1872 to the university by Lord Portsmouth, and wrote the account of them issued in a volume by the University Press in 1888. The post of astronomer-royal was offered him in 1881, but he preferred to pursue his peaceful course of teaching and research in Cambridge. He was British delegate to the International Prime Meridian Conference at Washington in 1884, when he also attended the meetings of the British Association at Montreal and of the American Association at Philadelphia. Five years later his health gave way, and after a long illness he died at the Cambridge Observatory on the 21st of January 1892, and was buried in St Giles's cemetery, near his home. He married in 1863 Miss Eliza Bruce, of Dublin, who survived him. An international committee was formed for the purpose of erecting a monument to his memory in Westminster Abbey; and there, in May 1895, a portrait medallion, by Albert Bruce Joy, was placed near the grave of Newton, and adjoining the memorials of Darwin and of Joule. His bust, by the same sculptor, stands opposite that of Sir John Herschel in the hall of St John's College, Cambridge. Herkomer's portrait is in Pembroke College; and Mogford's, painted in 1851, is in the combination room of St John's. Another bust, taken in his youth, belongs to the Royal Astronomical Society. A memorial tablet, with an inscription by Archbishop Benson, is placed in the Cathedral at Truro; and Mr Passmore Edwards erected a public institute in his honour at Launceston, near his birthplace.

The Scientific Papers of John Couch Adams, 4to, vol. i. (1896), and vol. ii. (1900), edited by William Grylls Adams and Ralph Allen Sampson, with a memoir by Dr J. W. L. Glaisher, were published by the Cambridge University Press. The first volume contains his previously published writings; the second those left in manuscript, including the substance of his lectures on the Lunar Theory. A collection, virtually complete, of Adams's papers regarding the discovery of Neptune was presented by Mrs Adams to the library of St John's College. A description of them by Professor Sampson was inserted in the *Memoirs* of the Royal Astronomical Society (vol. liv. p. 143). Consult: *Month. Notices Roy. Astr. Soc.*, liii. 184; *Observatory*, xv. 174; *Nature*, xxxiv. 565, xlv. 301; *Astr. Journal*, No. 254; R. Grant, *Hist. of Physical Astronomy*, p. 168; *Edinburgh Review*, No. 381, p. 72.

ADAMS, JOHN QUINCY (1767–1848), eldest son of President John Adams, sixth president of the United States, was born on the 11th of July 1767, in that part of Braintree that is now Quincy, Massachusetts, and was named after John Quincy (1689–1767), his mother's grandfather, who was for many years a prominent member of the Massachusetts legislature. In 1778, and again in 1780, young Adams accompanied his father to Europe; studying in Paris in 1778–1779 and at the university of Leiden in 1780. In 1780, also, he began to keep that diary which forms so conspicuous a record of the doings of himself and his contemporaries. In 1781, at the age of fourteen, he accompanied Francis Dana (1743–1811), American envoy to Russia, as his private secretary; but Dana was not received by the Russian government, and in 1782 Adams joined his father at Paris, where he acted as "additional secretary" to the American commissioners in the negotiation of the treaty of peace which concluded the War of American Independence. Instead of accompanying his father to London, he, of his own choice, returned to Massachusetts, graduated at Harvard College in 1787, three years later was admitted to practise at the bar and at once opened an office in Boston. A series of papers written by him in which he controverted some of Thomas Paine's doctrines in the *Rights of Man*, and later another series in which he ably supported the neutral policy of the administration toward France and England, led to his appointment by Washington as minister to the Netherlands in May 1794. There was little for him to do at the Hague, but in the absence of a minister at London, he transacted certain public business with the English foreign secretary. In 1796 Washington appointed him minister to Portugal, but before his departure thither his father John Adams became president and changed his destination to Berlin (1797). While there, he negotiated (1799) a treaty of amity and commerce with Prussia. On Thomas Jefferson's election to the presidency in 1800, the elder Adams recalled his son, who returned home in 1801. The next year, he was elected to the Massachusetts senate, and in 1803 was sent to Washington as a member of the Senate of the United States.

Up to this time, John Quincy Adams was regarded as belonging to the Federalist party, but he now found its general policy displeasing to him, was frowned upon, as the son of his father, by the followers of Alexander Hamilton, and found himself nearly powerless as an unpopular member of an unpopular minority. He was not now, and indeed never was, a strict party man. On the first important question that came before him in the Senate, the acquisition of Louisiana, he voted with the Republicans, regardless of the opposition of his own section. In December 1807 he warmly seconded Jefferson's suggestion of an embargo and vigorously urged instant action, saying: "The president has recommended the measure on his high responsibility. I would not consider, I would not deliberate; I would act!" Within five hours the Senate had passed the Embargo Bill and sent it to the House. The support of a measure so unpopular in New England caused him to be hated by the Federalists there and cost him his seat in the Senate; his successor was chosen on the 3rd of June 1808, several months before the usual time of filling the vacancy, and five days later Adams resigned. In the same year he attended the Republican congressional caucus which nominated Madison for the presidency, and thus definitely joined the Republicans. From 1806 to 1809 Adams was professor of rhetoric and oratory at Harvard.

In 1809 President Madison sent Adams to Russia to represent the United States. He arrived at St Petersburg at the psychological moment when the tsar had made up his mind to break with Napoleon. Adams therefore met with a favourable reception and a disposition to further the interests of American commerce in every possible way. On the outbreak of the war between the United States and England in 1812, he was still at St Petersburg. In September of that year, the Russian government suggested that the tsar was willing to act as mediator between the two belligerents. Madison precipitately accepted this proposition and sent Albert Gallatin and James Bayard to act as commissioners with Mr Adams; but England would have nothing to do with it. In August 1814, however, these gentlemen, with Henry Clay and Jonathan Russell, began negotiations with English commissioners which resulted in the signature of the treaty of Ghent on the 24th of December of that year. After this Adams visited Paris, where he witnessed the return of Napoleon from Elba, and then went to London, where, with Henry Clay and Albert Gallatin, he negotiated (1815) a "Convention to Regulate Commerce and Navigation." Soon afterwards he became U.S. minister to Great Britain, as his father had been before him, and as his son, Charles Francis Adams, was after him. After accomplishing little in London, he returned to the United States in the summer of 1817 to become secretary of state in the cabinet of President Monroe.

As secretary of state, Adams played the leading part in two most important episodes,—the acquisition of Florida and the promulgation of the Monroe Doctrine. Ever since the acquisition of Louisiana successive administrations had sought to include a part at least of Florida in that purchase. In 1819, after long negotiations, Adams succeeded in bringing the Spanish minister to the point of signing a treaty in which the Spaniards abandoned all claims to territory east of the Mississippi, and the United States relinquished all claim to what is now known as Texas. Before the Spanish government ratified the treaty in 1820, Mexico, including Texas, had thrown off allegiance to the mother country, and the United States had occupied Florida by force of arms. The Monroe Doctrine (*q.v.*) rightly bears the name of the president who in 1823 assumed the responsibility for its promulgation; but it was primarily the work of John Quincy Adams. The eight years of Monroe's presidency (1817–1825) are known as the "Era of Good Feeling." As his second term drew to a close, there was a great lack of good feeling among his official advisers, three of whom—Adams, secretary of state, Calhoun, secretary of war, and Crawford, secretary of the treasury—aspired to succeed him in his high office. In addition, Henry Clay and Andrew Jackson were also candidates. Calhoun was nominated for the vice-presidency. Of the other four, Jackson received 99 electoral votes, Adams 84, Crawford 41, and Clay 37; as no one had a majority, the decision was made by the House of Representatives, which was confined in its choice to the three candidates who had received the largest number of votes. Clay, who was speaker of the House of Representatives, and had for years assumed a censorious attitude toward Jackson, cast his influence for Adams and thereby secured his election on the first ballot. A few days later Adams offered Clay the secretaryship of state, which was accepted. The wholly unjust and baseless charge of "bargain and corruption" followed, and the feud thus created between Adams and Jackson greatly influenced the history of the United States.

Up to this point Adams's career had been almost uniformly successful, but his presidency (1825–1829) was in most respects a failure, owing to the virulent opposition of the Jacksonians; in 1828 Jackson was elected president over Adams. It was during his administration that irreconcilable differences developed between the followers of Adams and the followers of Jackson, the former becoming known as the National Republicans, who with the Anti-Masons were the precursors of the Whigs. In 1829 Adams retired to private life in the town of Quincy; but only for a brief period, for in 1830, largely by Anti-Masonic votes, he was elected a member of the national House of Representatives. On its being suggested to him that his acceptance of this position would degrade an ex-president, Adams replied that no person could be degraded by serving the people as a representative in congress or, he added, as a selectman of his town. His service in congress from 1831 until his death is, in some respects, the most noteworthy part of his career. Throughout he was conspicuous as an opponent of the extension of slavery, though he was never technically an abolitionist, and in particular he was the champion in the House of Representatives of the right of petition at a time when, through the influence of the Southern members, this right was, in practice, denied by that body. His prolonged fight for the repeal of the so-called "Gag Laws" is one of the most dramatic contests in the history of congress. The agitation for the abolition of slavery, which really began in earnest with the establishment of the *Liberator* by William Lloyd Garrison in 1831, soon led to the sending of innumerable petitions to congress for the abolition of slavery in the District of Columbia, over which the Federal government had jurisdiction, and for other action by congress with respect to that institution. These petitions were generally sent to Adams for presentation. They aroused the anger of the pro-slavery members of congress, who, in 1836, brought about the passage of the first "Gag Rule," the Pinckney Resolution, presented by Henry L. Pinckney, of South Carolina. It provided that all petitions relating to slavery should be laid on the table without being referred to committee or printed; and, in substance, this resolution was re-adopted at the beginning of each of the immediately succeeding sessions of congress, the Patton Resolution being adopted in 1837, the Atherton Resolution, or "Atherton Gag," in 1838, and the Twenty-first Rule in 1840 and subsequently until repealed. Adams contended that these "Gag Rules" were a direct violation of the First Amendment to the Federal Constitution, and refused to be silenced on the question, fighting for repeal with indomitable courage, in spite of the bitter denunciation of his opponents. Each year the number of anti-slavery petitions received and presented by him increased; perhaps the climax was in 1837, when Adams presented a petition from twenty-two slaves, and, when threatened by his opponents with censure, defended himself with remarkable keenness and ability. At each session, also, the majority against him decreased until in 1844 his motion to repeal the Twenty-first Rule was carried by a vote of 108 to 80 and his battle was won. On the 21st of February 1848, after having suffered a previous stroke of apoplexy, he fell insensible on the floor of the Representatives' chamber, and two days later died. Few men in American public life have possessed more intrinsic worth, more independence, more public spirit and more ability than Adams, but throughout his political career he was handicapped by a certain reserve, a certain austerity and coolness of manner, and by his consequent inability to appeal to the imaginations and affections of the people as a whole. He had, indeed, few intimate political or personal friends, and few men in American history have, during their lifetime, been regarded with so much hostility and attacked with so much rancour by their political opponents.

Authorities.—J. T. Morse, *John Quincy Adams* (Boston, 1883; new edition, 1899); Josiah Quincy, *Memoir of the Life of John Quincy Adams* (Boston, 1858); C. F. Adams (ed.), *Memoirs of John Quincy Adams*, comprising portions of his diary from 1795 to 1848 (12 vols., Philadelphia, 1874–1877). (E. Ch.)

ADAMS, SAMUEL (1722–1803), American statesman, was born at Boston, Massachusetts, on the 27th of September 1722. He was a second cousin to the elder John Adams. His father, whose Christian name was also Samuel, was a wealthy and prominent citizen of Boston, who took an active part in the politics of the town, and was a member of the Caucus (or Caulker's) Club, with which the political term "caucus" is said to have originated; his mother was Mary Fifield. Young Adams graduated from Harvard College in 1740, and three years later, on attaining the degree of A.M., chose for his thesis, "Whether it be Lawful to resist the Supreme Magistrate, if the Commonwealth cannot otherwise be preserved." Which side he took, and how the argument proceeded, is not known, but the subject was one which well forecasted his career. He began the study of law in response to his father's advice; he discontinued it in response to his mother's disapproval. He repeatedly failed in business, notably as manager of a malt-house, largely because of his incessant attention to politics; but in the Boston town-meeting he became a conspicuous example of the efficiency of that institution for training in statecraft. He has, indeed, been called the "Man of the Town Meeting." About 1748 he began to take an important part in the affairs of the town, and became a leader in the debates of a political club which he was largely instrumental in organizing, and to whose weekly publication, the *Public Advertiser*, he contributed numerous articles. From 1756 to 1764 he was one of the town's tax-collectors, but in this office he was unsuccessful, his easy business methods resulting in heavy arrears.

Samuel Adams first came into wider prominence at the beginning of the Stamp Act episode, in 1764, when as author of Boston's instructions to its representatives in the general court of Massachusetts he urged strenuous opposition to taxation by act of parliament. The next year he was for the first time elected to the lower house of the general court, in which he served until 1774, after 1766 as clerk. As James Otis's vigour and influence declined, Adams took a more and more prominent place in the revolutionary councils; and, contrary to the opinion of Otis and Benjamin Franklin, he declared that colonial representation in parliament was out of the question and advised against any form of compromise. Many of the Massachusetts revolutionary documents, including the famous "Massachusetts Resolves" and the circular letter to the legislatures of the other colonies, are from his pen; but owing to the fact that he usually acted as clerk to the House of Representatives and to the several committees of which he was a member, documents were written by him which expressed the ideas of the committee as a whole. There can be no question, however, that Samuel Adams was one of the first, if not the first, of American political leaders to deny the legislative power of parliament and to desire and advocate separation from the mother country.

To promote the ends he had in view he suggested non-importation, instituted the Boston committees of correspondence, urged that a Continental Congress be called, sought out and introduced into public service such allies as John Hancock, Joseph Warren and Josiah Quincy, and wrote a vast number of articles for the newspapers, especially the *Boston Gazette*, over a multitude of signatures. He was, in fact, one of the most voluminous and influential political writers of his time. His style is clear, vigorous and epigrammatic; his arguments are characterized by strength of logic, and, like those of other patriots, are, as the dispute advances, based less on precedent and documentary authorities and more on "natural right." Although he lacked oratorical fluency, his short speeches, like his writings, were forceful; his plain dress and unassuming ways helped to make him extremely popular with the common people, in whom he had much greater faith than his cousin John had; and, above all, he was an eminently successful manager of men. Shrewd, wily, adroit, unfailingly tactful, an adept in all the arts of the politician, he is considered to have done more than any other one man, in the years immediately preceding the War of Independence, to mould and direct public opinion in his community.

The intense excitement which followed the "Boston Massacre" Adams skilfully used to secure the removal of the soldiers from the town to a fort in the harbour. He it was, also, who managed the proceedings of the "Boston Tea Party," and later he was moderator of the convention of Massachusetts towns called to protest against the Boston Port Bill. One of the objects of the expedition sent by Governor Thomas Gage to Lexington (*q.v.*) and Concord on April 18-19, 1775, was the capture of Adams and John Hancock, temporarily staying in Lexington, and when Gage issued his proclamation of pardon on June 12 he excepted these two, whose offences, he said, were "of too flagitious a Nature to admit of any other Consideration than that of condign Punishment."

As a delegate to the Continental Congress, from 1774 to 1781, Samuel Adams continued vigorously to oppose any concession to the British government; strove for harmony among the several colonies in the common cause; served on numerous committees, among them that to prepare a plan of confederation; and signed the Declaration of Independence. But he was rather a destructive than a constructive statesman, and his most important service was in organizing the forces of revolution before 1775. In 1779 he was a member of the convention which framed the constitution of Massachusetts that was adopted in 1780, and is still, with some amendments, the organic law of the commonwealth and one of the oldest fundamental laws in existence. He was one of the three members of the sub-committee which actually drafted that instrument; and although John Adams is generally credited with having performed the principal part of that task, Samuel Adams was probably the author of most of the bill of rights. In 1788, Samuel Adams was a member of the Massachusetts convention to ratify the Constitution of the United States. When he first read that instrument he was very much opposed to the consolidated government which it provided, but was induced to befriend it by resolutions which were passed at a mass meeting of Boston mechanics or "tradesmen"—his own firmest supporters—and by the suggestion that its ratification should be accompanied by a recommendation of amendments designed chiefly to supply the omission of a bill of rights. Without his aid it is probable that the constitution would not have been ratified by Massachusetts. From 1789 to 1794 Adams was lieutenant-governor of his state, and from 1794 to 1797 was governor. After the formation of parties he became allied with the Democratic-Republicans rather than with the Federalists. He died on the 2nd of October 1803, at Boston.

Authorities.—*Life and Public Services of Samuel Adams* (3 vols., Boston, 1865), by W. V. Wells, Adams's great-grandson—a valuable biography, containing a mass of information, but noticeably biassed; J. K. Hosmer's *Samuel Adams* (Boston, 1885), an excellent short biography in the "American Statesmen Series"; M. C. Tyler's *Literary History of the American Revolution* (2 vols., New York, 1897); and H. A. Cushing (ed.), *The Writings of Samuel Adams* (4 vols., New York, 1904–1908). (E. Ch.)

ADAMS, THOMAS (d. *c.* 1655), English divine, was, in 1612, "a preacher of the gospel at Willington," in Bedfordshire, where he is found until 1614, and whence issued his *Heaven and Earth Reconciled*, *The Devil's Banquet* and other works. In 1614–1615 he was at Wingrave, in Buckinghamshire, probably as vicar, and published a number of works in quick succession; in 1618 he held the preachership at St Gregory's, under St Paul's Cathedral, and was "observant chaplain" to Sir Henry Montague, the lord chief justice of England. These bare facts we gather from epistles-dedicatory and epistles to the reader, and title-pages.

These epistles show him to have been on the most friendly terms with some of the foremost men in state and church, though his ardent protestantism offended Laud and hindered his preferment. His "occasionally" printed sermons, when collected in 1629, placed him beyond all comparison in the van of the preachers of England, and had something to do with shaping John Bunyan. He equals Jeremy Taylor in brilliance of fancies, and Thomas Fuller in wit. Robert Southey calls him "the prose Shakespeare of Puritan theologians." His numerous works display great learning, classical and patristic, and are unique in their abundance of stories, anecdotes, aphorisms and puns.

His works were edited in J. P. Nichol's *Puritan Divines*, by J. Angus and T. Smith (3 vols. 8vo, 1862).

ADAMS, WILLIAM (d. 1620), English navigator, was born at Gillingham, near Chatham, England. When twelve years old he was apprenticed to the seafaring life, afterwards entering the British navy, and later serving the company of Barbary merchants for a number of years as master and pilot. Attracted by the Dutch trade with India, he shipped as pilot major with a little fleet of five ships despatched from the Texel in 1598 by a company of Rotterdam merchants. The vessels, boats ranging from 75 to 250 tons and crowded with men, were driven to the coast of Guinea, where the adventurers attacked the island of Annabon for supplies, and finally reached the straits of Magellan. Scattered by stress of weather the following spring the "Charity," with Adams on board, and the "Hope," met at length off the coast of Chile, where the captains of both vessels lost their lives in an encounter with the Indians. In fear of the Spaniards, the remaining crews determined to sail across the Pacific. On this voyage the "Hope" was lost, but in April 1600 the "Charity," with a crew of sick and dying men, was brought to anchor off the island of Kiushiu, Japan. Adams was summoned to Osaka and there examined by Iyeyasu, the guardian of the young son of Taiko Sama, the ruler, who had just died. His knowledge of ships and shipbuilding, and his nautical smattering of mathematics, raised him in the estimation of the shogun, and he was subsequently presented with an estate at Hémi near Yokosuka; but was refused permission to return to England. In 1611 news came to him of an English settlement in Bantam, and he wrote asking for help. In 1613 Captain John Saris arrived at Hirado in the ship "Clove" with the object of establishing a trading factory for the East India Company, and after obtaining the necessary concessions from the shogun, Adams postponed his voyage home (permission for which had now been given him) in order to take a leading part, under Richard Cocks, in the organization of this new English settlement. He had already married a Japanese woman, by whom he had a family, and the latter part of his life was spent in the service of the English trading company, for whom he undertook a number of voyages to Siam in 1616, and Cochin China in 1617 and 1618. He died on the 16th of May 1620, some three years before the dissolution of the English factory. His Japanese title was Anjin Sama, and his memory was preserved in the naming of a street in Yedo, Anjin Cho (Pilot Street), and by an annual celebration on June 15 in his honour.

See *England's Earliest Intercourse with Japan*, by C. W. Hillary (1905); *Letters written by the English Residents in Japan*, ed. by N. Murakami (1900, containing Adams's Letters reprinted from *Memorials of the Empire of Japan*, ed. by T. Rundall, Hakluyt Society, 1850); *Diary of Richard Cocks*, with preface by N. Murakami (1899, reprinted from the Hakluyt Society ed. 1883); R. Hildreth's *Japan* (1855); J. Harris's *Navigantium atque Itinerantium Bibliotheca* (1764), i. 856; *Voyage of John Saris*, ed. by Sir E. M. Satow (Hakluyt Society, 1900); *Asiatic Society of Japan Transactions*, xxvi. (sec. 1898) pp. 1 and 194, where four more hitherto unpublished letters of Adams are given; *Collection of State Papers; East Indies, China and Japan*. The MS. of his logs written during his voyages to Siam and China is in the Bodleian Library at Oxford.

ADAMS, a township in the extreme N. of Berkshire county, N.W. Massachusetts, U.S.A., having an area of 23 sq. m. Pop. (1880) 5591; (1890) 9213; (1900) 11,134, of whom 4376 were foreign-born; (1910, census) 13,026. It includes a portion of the valley of the Hoosac river, extending to the Hoosac Range on the E., and on the W. to Mt. Williams (3040 ft.), and Greylock Mountain (3535 ft.), partly in Williamstown, and the highest point in the state. The valley portion is level and contains several settlement centres, the largest of which, a busy industrial village (manufactures of cotton and paper), bears the same name as the township, and is on a branch of the Boston and Albany railroad. The village is the nearest station to Greylock, which can be easily ascended, and affords fine views of the Hoosac and Housatonic valleys, the Berkshire Hills and the Green Mountains; the mountain has been a state timber reservation since 1898. The township's principal industry is the manufacture of cotton goods, the value of which in 1905 ($4,621,261) was 84·1% of the value of the township's total factory products; in 1905 no other place in the United States showed so high a degree of specialization in this industry. The township (originally "East Hoosuck") was surveyed and defined in 1749. Fort Massachusetts, at one time within its bounds, was destroyed in 1746 by the French. An old Indian trail between the Hudson and Connecticut valley ran through the township, and was once a leading outlet of the Berkshire country. Adams was incorporated in 1778, and was named in honour of Samuel Adams, the revolutionary leader. Part of Adams was included in the new township of Cheshire in 1793, and North Adams was set off as a separate township in 1878.

ADAM'S APPLE, the movable projection, more prominent in males than females, formed in the front part of the throat by the thyroid cartilage of the larynx. The name was given from a legend that a piece of the forbidden fruit lodged in Adam's throat. The "Adam's apple" is one of the particular points of attack in the Japanese system of self-defence known as jiu-jitsu.

ADAM'S BRIDGE, or RAMA'S BRIDGE, a chain of sandbanks extending from the island of Manaar, near the N.W. coast of Ceylon to the island of Rameswaram, off the Indian coast, and lying between the Gulf of Manaar on the S.W. and Palk Strait on the N.E. It is more than 30 m. long and offers a serious impediment to navigation. Some of the sandbanks are dry; and no part of the shoal has a greater depth than 3 or 4 ft. at high water, except three tortuous and intricate channels which have recently been dredged to a sufficient depth to admit the passage of vessels, so as to obviate the long journey round the island of Ceylon which was previously necessary. Geological evidence shows that this gap was once bridged by a continuous isthmus which according to the temple records was breached by a violent storm in 1480. Operations for removing the obstacles in the channel and for deepening and widening it were begun as long ago as 1838. A service of the British India Steam Navigation Company's steamers has been established between Negapatam and Colombo through Palk Strait and this narrow passage.

ADAM SCOTUS (fl. 1180), theological writer, sometimes called Adam Anglicus or Anglo-Scotus, was born in the south of Scotland in the first half of the 12th century. About 1150 he was a Premonstratensian canon at St Andrews, and some twenty years later abbot and bishop of Candida Casa (Whithorn) in Galloway. He gained a European reputation for his writings, which are of mystico-ascetic type, and include an account of the Premonstratensian order, a collection of festival sermons, and a *Soliloquia de instructione discipuli*, formerly attributed to his contemporary, Adam of St Victor.

ADAMSON, PATRICK (1537–1592), Scottish divine, archbishop of St Andrews, was born at Perth. He studied philosophy, and took the degree of M.A. at St Andrews. After being minister of Ceres in Fife for three years, in 1566 he set out for Paris as tutor to the eldest son of Sir James Macgill, the clerk-general. In June of the same year he wrote a Latin poem on the birth of the young prince James, whom he described as *serenissimus princeps* of France and England. The French court was offended, and he was confined for six months. He was released only through the intercession of Queen Mary of Scotland and some of the principal nobility, and retired with his pupil to Bourges. He was in this city at the time of the massacre of St Bartholomew at Paris, and lived concealed for seven months in a public-house, the aged master of which, in reward for his charity to a heretic, was thrown from the roof. While in this

“Sepulchre,” he wrote his Latin poetical version of the book of Job, and his tragedy of Herod in the same language. In 1572 or 1573 he returned to Scotland, and became minister of Paisley. In 1575 he was appointed by the General Assembly one of the commissioners to settle the jurisdiction and policy of the church; and the following year he was named, with David Lindsay, to report their proceedings to the earl of Morton, then regent. In 1576 his appointment as archbishop of St Andrews gave rise to a protracted conflict with the Presbyterian party in the Assembly. He had previously published a catechism in Latin verse dedicated to the king, a work highly approved even by his opponents, and also a Latin translation of the Scottish Confession of Faith. In 1578 he submitted himself to the General Assembly, which procured him peace for a little time, but next year fresh accusations were brought against him. He took refuge in St Andrews Castle, where “a wise woman,” Alison Pearson, who was ultimately burned for witchcraft, cured him of a serious illness. In 1583 he went as James’s ambassador to the court of Elizabeth, and is said to have behaved rather badly. On his return he took strong parliamentary measures against Presbyterians, and consequently, at a provincial synod held at St Andrews in April 1586, he was accused of heresy and excommunicated, but at the next General Assembly the sentence was remitted as illegal. In 1587 and 1588, however, fresh accusations were brought against him, and he was again excommunicated, though afterwards on the inducement of his old opponent, Andrew Melville, the sentence was again remitted. Meanwhile he had published the Lamentations of Jeremiah, and the book of Revelation in Latin verse, which he dedicated to the king, complaining of his hard usage. But James was unmoved by his application, and granted the revenue of his see to the duke of Lennox. For the rest of his life Adamson was supported by charity; he died in 1592. His recantation of Episcopacy (1590) is probably spurious. Adamson was a man of many gifts, learned and eloquent, but with grave defects of character. His collected works, prefaced by a fulsome panegyric, in the course of which it is said that “he was a miracle of nature, and rather seemed to be the immediate production of God Almighty than born of a woman,” were produced by his son-in-law, Thomas Wilson, in 1619.

ADAMSON, ROBERT (1852–1902), Scottish philosopher, was born in Edinburgh on the 19th of January 1852. His father was a solicitor, and his mother was the daughter of Matthew Buist, factor to Lord Haddington. In 1855 Mrs Adamson was left a widow with small means, and devoted herself entirely to the education of her six children. Of these, Robert was successful from the first. At the end of his school career he entered the university of Edinburgh at the age of fourteen, and four years later graduated with first-class honours in mental philosophy, with prizes in every department of the faculty of Arts. He completed his university successes by winning the Tyndall-Bruce scholarship, the Hamilton fellowship (1872), the Ferguson scholarship (1872) and the Shaw fellowship (1873). After a short residence at Heidelberg (1871), where he began his study of German philosophy, he returned to Edinburgh as assistant first to Henry Calderwood and later to A. Campbell Fraser; he joined the staff of the *Encyclopaedia Britannica* (9th ed.) (1874) and studied widely in the Advocates’ Library. In 1876 he came to England as successor to W. S. Jevons in the chair of logic and philosophy, at Owens College, Manchester. In 1883 he received the honorary degree of LL.D. In 1893 he went to Aberdeen, and finally in 1895 to the chair of logic at Glasgow, which he held till his death on the 5th of February 1902. His wife, Margaret Duncan, the daughter of a Manchester merchant, was a woman of kindred tastes, and their union was entirely happy.

It is matter for regret to the student that Adamson’s active labours in the lecture room precluded him from systematic production. His writings consisted of short articles, of which many appeared in the *Encyclopaedia Britannica* (9th ed.) and in *Mind*, a volume on Kant and another on Fichte. At the time of his death he was writing a *History of Psychology*, and had promised a work on *Kant and the Modern Naturalists*. Both in his life and in his writings he was remarkable for impartiality. It was his peculiar virtue that he could quote his opponents without warping their meaning. From this point of view he would have been perhaps the first historian of philosophy of his time, had his professional labours been less exacting. Except during the first few years at Manchester, he delivered his lectures without manuscripts. In 1903, under the title *The Development of Modern Philosophy and Other Essays*, his more important lectures were published with a short biographical introduction by Prof. W. R. Sorley of Cambridge University (see *Mind*, xiii. 1904, p. 73 foll.). Most of the matter is taken verbatim from the note-book of one of his students. Under the same editorship there appeared, three years later, his *Development of Greek Philosophy*. In addition to his professional work, he did much administrative work for Victoria University and the university of Glasgow. In the organization of Victoria University he took a foremost part, and, as chairman of the Board of Studies at Owens College, he presided over the general academical board of the Victoria University. At Glasgow he was soon elected one of the representatives on the court, and to him were due in large measure the extension of the academical session and the improved equipment of the university.

Throughout his lectures, Adamson pursued the critical and historical method without formulating a constructive theory of his own. He felt that any philosophical advance must be based on the Kantian methods. It was his habit to make straight for the ultimate issue, disregarding half-truths and declining compromise. He left a hypothesis to be worked out by others; this done, he would criticize with all the rigour of logic, and with a profound distrust of imagination, metaphor and the attitude known as the will-to-believe. As he grew older his metaphysical optimism waned. He felt that the increase of knowledge must come in the domains of physical science. But this empirical tendency as regards science never modified his metaphysical outlook. He has been called Kantian and Neo-Kantian, Realist and Idealist (by himself, for he held that appearance and reality are co-extensive and coincident). At the same time, in his criticism of other views he was almost typical of Hegelian idealism. All processes of reasoning or judgment (*i.e.* all units of thought) are (1) analysable only by abstraction, and (2) are compound of deduction and induction, *i.e.* rational and empirical. An illustration of his empirical tendency is found in his attitude to the Absolute and the Self. The “Absolute” doctrines he regarded as a mere disguise of failure, a dishonest attempt to clothe ignorance in the pretentious garb of mystery. The Self as a primary, determining entity, he would not therefore admit. He represented an empiricism which, so far from refuting, was actually based on, idealism, and yet was alert to expose the fallacies of a particular idealist construction (see his essay in *Ethical Democracy*, edited by Dr Stanton Coit).

ADAM’S PEAK, a mountain in Ceylon, about 45 miles E. from Colombo, in N. lat. 6° 55′, E. long. 80° 30′. It rises steeply to a height of 7352 feet, and commands a magnificent prospect. Its conical summit terminates in an oblong platform, 74 ft. by 24, on which there is a hollow, resembling the form of a human foot, 5 ft. 4 in. by 2 ft. 6 in.; and this has been consecrated as the footprint of Buddha. The margin of this supposed footprint is ornamented with gems, and a wooden canopy protects it from the weather. It is held in high veneration by the Sinhalese, and numerous pilgrims ascend to the sacred spot, where a priest resides to receive their offerings and bless them on their departure. By the Mahommedans the impression is regarded as that of the foot of Adam, who here, according to their tradition, fulfilled a penance of one thousand years; while the Hindus claim it as that of their god Siva.

ADANA. (1) A vilayet in the S.E. of Asia Minor, which includes the ancient Cilicia. The mountain districts are rich in unexploited mineral wealth, and the fertile coast-plain, which produces cotton, rice, cereals, sugar and much fruit, and affords abundant pasturage, is well watered by the rivers that descend from the Taurus range. Imports and exports pass through Mersina (*q.v.*). (2) The chief town of the vilayet, situated in the alluvial plain about 30 m. from the sea in N. lat. 37° 1′, E. long. 35° 18′, on the right bank of the Seihan (Sihun, anc. Sarus), which is navigable by small craft as far as the town. Adana is connected with Tersus and Mersina by a railway built in 1887, and has a magnificent stone bridge, which carries the road to Missis and the east, and dates in parts from the time of Justinian, but was restored first in 743 A.D. and called Jisr al-Walid after the Omayyad caliph of that name, and again in 840 by the Caliph Mutasim. There are, also, a ruined castle founded by Harun al-Rashid in 782, fine fountains, good buildings, river-side quays, cotton mills and an American mission with church and schools. Adana, which retains its ancient name, rose to importance as a station on the Roman military road to the East, and was at one time a rival of Tarsus. The town was largely rebuilt by Mansur in 758, and during subsequent centuries it often changed hands and suffered many vicissitudes. Its position, commanding the passage of the mountains to the north of Syria, rendered it important as a military station in the contest between the Egyptians and the Turks in 1832. After the defeat of the Turkish army at Konia it was granted to Ibrahim Pasha, and though the firman announcing his appointment named him only *muhassil*, or collector of the crown revenue, it continued to be held by the Egyptians till the treaty of July 1840 restored it to the Porte. The chief productions of the province are cotton, corn, sesame and wool, which are largely exported. The population of the town is greatly mixed, and, having a large element of nomads in it, varies much from time to time. At its maximum it reaches nearly 50,000. (D. G. H.)

ADANSON, MICHEL (1727–1806), French naturalist, of Scottish descent, was born on the 7th of April 1727, at Aix, in Provençe. After leaving the Collège Sainte Barbe in Paris, he was employed in the cabinets of R. A. F. Réaumur and Bernard de Jussieu, as well as in the Jardin des Plantes. At the end of 1748 he left France on an exploring expedition to Senegal, which from the unhealthiness of its climate was a *terra incognita* to naturalists. His ardour remained unabated during the five years of his residence in Africa. He collected and described, in greater or less detail, an immense number of animals and plants; collected specimens of every object of commerce; delineated maps of the country; made systematic meteorological and astronomical observations; and prepared grammars and dictionaries of the languages spoken on the banks of the Senegal. After his return to Paris in 1754 he made use of a small portion of the materials he had collected in his *Histoire naturelle du Sénégal* (Paris, 1757). This work has a special interest from the essay on shells, printed at the end of it, where Adanson proposed his *universal method*, a system of classification distinct from those of Buffon and Linnaeus. He founded his classification of all organized beings on the consideration of each individual organ. As each organ gave birth to new relations, so he established a corresponding number of arbitrary arrangements. Those beings possessing the greatest number of similar organs were referred to one great division, and the relationship was considered more remote in proportion to the dissimilarity of organs. In 1763 he published his *Familles naturelles des plantes*. In this work he developed the principle of arrangement above mentioned, which, in its adherence to natural botanical relations, was based on the system of J. P. Tournefort, and had been anticipated to some extent nearly a century before by John Ray. The success of this work was hindered by its innovations in the use of terms, which were ridiculed by the defenders of the popular sexual system of Linnaeus; but it did much to open the way for the establishment, by means principally of A. L. de Jussieu's *Genera Plantarum* (1789), of the natural method of the classification of plants. In 1774 Adanson submitted to the consideration of the Academy of Sciences an immense work, extending to all known beings and substances. It consisted of 27 large volumes of manuscript, employed in displaying the general relations of all these matters, and their distribution; 150 volumes more, occupied with the alphabetical arrangement of 40,000 species; a vocabulary, containing 200,000 words, with their explanations; and a number of detached memoirs, 40,000 figures and 30,000 specimens of the three kingdoms of nature. The committee to which the inspection of this enormous mass was entrusted strongly recommended Adanson to separate and publish all that was peculiarly his own, leaving out what was merely compilation. He obstinately rejected this advice; and the huge work, at which he continued to labour, was never published. He had been elected a member of the Academy of Sciences in 1759, and he latterly subsisted on a small pension it had conferred on him. Of this he was deprived in the dissolution of the Academy by the Constituent Assembly, and was consequently reduced to such a depth of poverty as to be unable to appear before the French Institute when it invited him to take his place among its members. Afterwards he was granted a pension sufficient to relieve his simple wants. He died at Paris after months of severe suffering, on the 3rd of August 1806, requesting, as the only decoration of his grave, a garland of flowers gathered from the fifty-eight families he had differentiated—"a touching though transitory image," says Cuvier, "of the more durable monument which he has erected to himself in his works." Besides the books already mentioned he published papers on the ship-worm, the baobab tree, the *Adansonia digitata* of Linnaeus, the origin of the varieties of cultivated plants, and gum-producing trees.

ADAPTATION (from Lat. *adaptare*, to fit to), a process of fitting, or modifying, a thing to other uses, and so altering its form or original purpose. In literature there may be, *e.g.*, an adaptation of a novel for a drama, or in music an arrangement of a piece for two hands into one for four, &c. In biology, according to the doctrine of evolution, adaptation plays a prominent part as the process by which an organism or species of organisms becomes modified to suit the conditions of its life. Every change in a living organism involves adaptation; for in all cases life consists in a continuous adjustment of internal to external relations. Every living organism reacts to its environment; if the reaction is unfavourable, disability leading to ultimate extinction is the result. If the reaction is favourable, its result is called an adaptation. How far such adaptations are produced afresh in each generation, whether or no their effects are transmitted to descendants and so directly modify the stock, to what extent adaptations characteristic of a species or variety have come about by selection of individuals capable, in each generation, of responding favourably, or how far by the selection of individuals fortuitously suitable to the environment, or, how far, possibly by the inheritance of the responses to the environment, are problems of biology not yet definitely solved.

ADDA (anc. *Addua*), a river of North Italy. Its true source is in some small lakes near the head of the Fraële glen, but its volume is increased by the union with several smaller streams, near the town of Bormio, at the Raetian Alps. Thence it flows first S.W., then due W., through the fertile Valtellina (*q.v.*), passing Tirano, where the Poschiavino falls in on the right, and Sondrio, where is the junction with the Malero, right. It falls into the Lake of Como, at its northern end, and mainly forms that lake. On issuing from its south-eastern or Lecco arm, it crosses the plain of Lombardy, and finally, after a course of about 150 m., joins the Po, 8 m. above Cremona. The lower course of the Adda was formerly the boundary between the territories of Venice and of Milan; and on its banks several important battles have been fought, notably that of Lodi, where Napoleon defeated the Austrians in 1796. (W. A. B. C.)

ADDAMS, JANE (1860–), American sociologist, was born at Cedarville, Illinois, on the 6th of September 1860. After graduating at Rockford (Illinois) Female Seminary (now Rockford College) in 1881, she spent several years in the study of economic and sociological questions in both Europe and America, and in 1889 with Miss Ellen Gates Starr established in Chicago, Illinois, the social settlement known as Hull House, of which she became the head-worker. The success of this settlement, which became a great factor for good in the city, was principally due to Miss Addams's rare executive skill and practical common-sense methods. Her personal participation in the life of the community is exemplified in her acceptance of the office of inspector of streets and alleys under the municipal government. She became widely known as a lecturer and writer on social problems and published *Democracy and Social Ethics* (1902), *Newer Ideals of Peace* (1907), and *The Spirit of Youth and the City Streets* (1909).

ADDAX, a genus of antelopes, with one species (*A. nasomaculatus*) from North Africa and Arabia. It is a little over 3 ft. high, yellowish white in colour, with a brown mane and a fringe of the same hue on the throat. Both sexes carry horns, which are ringed and form an open spiral. The addax is a desert antelope, and in habits probably resembles the gemsbuck. It is hunted by the Arabs for its flesh and to test the speed of their horses and greyhounds; it is during these hunting parties that the young are captured for menagerie purposes.

ADDER, a name for the common viper (*Vipera cevus*), ranging from Wales to Saghalien island, and from Caithness to the north of Spain. The puff-adder (*Bitis s. Echidna arietans*) of nearly the whole of Africa, and the death-adder (*Acanthophis antarcticus*) from Australia to the Moluccas, are both very poisonous (see VIPER). The word was in Old Eng. *nædre*, later *nadder* or *naddre*; in the 14th century "a nadder" was, like "a napron," wrongly divided into "an adder." It appears with the generic meaning of "serpent" in the older forms of many Teutonic languages, cf. Old High Ger. *natra*; Goth. *nadrs*. It is thus used in the Old Eng. version of the Scriptures for the devil, the "serpent" of Genesis.

ADDISON, JOSEPH (1672–1719), English essayist, poet and man of letters, eldest son of Lancelot Addison, later dean of Lichfield, was born at his father's rectory of Milston in Wiltshire, on the 1st of May 1672. After having passed through several schools, the last of which was the Charterhouse, he went to Oxford when he was about fifteen years old. He was first entered a commoner of Queen's College, but after two years was elected to a demyship of Magdalen College, having been recommended by his skill in Latin versification. He took his master's degree in 1693, and subsequently obtained a fellowship which he held until 1711. His first literary efforts were poetical, and, after the fashion of his day, in Latin. Many of these are preserved in the *Musae Anglicanae* (1691–1699), and obtained academic commendation from academic sources. But it was a poem in the third volume of Dryden's *Miscellanies*, followed in the next series by a translation of the fourth *Georgic*, which brought about his introduction to Tonson the bookseller, and (probably through Tonson) to Lord Somers and Charles Montagu. To both of these distinguished persons he contrived to commend himself by *An Account of the Greatest English Poets* (1694), *An Address to King William* (1695), after Namur, and a Latin poem entitled *Pax Gulielmi* (1697), on the peace of Ryswick, with the result that in 1699 he obtained a pension of £300 a year, to enable him (as he afterwards said in a memorial addressed to the crown) "to travel and qualify himself to serve his Majesty." In the summer of 1699 he crossed into France, where, chiefly for the purpose of learning the language, he remained till the end of 1700; and after this he spent a year in Italy. In Switzerland, on his way home, he was stopped by receiving notice that he was to attend the army under Prince Eugene, then engaged in the war in Italy, as secretary from the king. But his Whig friends were already tottering in their places; and in March 1702 the death of King William at once drove them from power and put an end to the pension. Indeed Addison asserted that he never received but one year's payment of it, and that all the other expenses of his travels were defrayed by himself. He was able, however, to visit a great part of Germany, and did not reach Holland till the spring of 1703. His prospects were now sufficiently gloomy: he entered into treaty, oftener than once, for an engagement as a travelling tutor; and the correspondence in one of these negotiations has been preserved. Tonson had recommended him as the best person to attend in this character Lord Hertford, the son of the duke of Somerset, commonly called "The Proud." The duke, a profuse man in matters of pomp, was economical in questions of education. He wished Addison to name the salary he expected; this being declined, he announced, with great dignity, that in addition to travelling expenses he would give a hundred guineas a year; Addison accepted the munificent offer, saying, however, that he could not find his account in it otherwise than by relying on his Grace's future patronage; and his Grace immediately intimated that he would look out for some one else. In the autumn of 1703 Addison returned to England.

The works which belong to his residence on the continent were the earliest that showed him to have attained maturity of skill and genius. There is good reason for believing that his tragedy of *Cato*, whatever changes it may afterwards have suffered, was in great part written while he lived in France, that is, when he was about twenty-eight years of age. In the winter of 1701, amidst the stoppages and discomforts of a journey across Mt. Cenis, he composed, wholly or partly, his rhymed *Letter from Italy* to Charles Montagu. This contains some fine touches of description, and is animated by a noble tone of classical enthusiasm. While in Germany he wrote his *Dialogues on Medals*, which, however, were not published till after his death. These have much liveliness of style and something of the gay humour which the author was afterwards to exhibit more strongly; but they show little either of antiquarian learning or of critical ingenuity. In tracing out parallels between passages of the Roman poets and figures or scenes which appear in ancient sculptures, Addison opened the easy course of inquiry which was afterwards prosecuted by Spence; and this, with the apparatus of spirited metrical translations from the classics, gave the work a likeness to his account of his travels. This account, entitled *Remarks on Several Parts of Italy, &c.* (1705), he sent home for publication before his own return. It wants altogether the interest of personal narrative: the author hardly ever appears. The task in which he chiefly busies himself is that of exhibiting the illustrations which the writings of the Latin poets, and the antiquities and scenery of Italy, mutually give and receive. Christian antiquities and the monuments of later Italian history had no interest for him.

With the year 1704 begins a second era in Addison's life, which extends to the summer of 1710, when his age was thirty-eight. This was the first term of his official career; and though very barren of literary performance, it not only raised him from indigence, but settled definitely his position as a public man. His correspondence shows that, while on the continent, he had been admitted to confidential intimacy by diplomatists and men of rank; immediately on his return he was enrolled in the Kit-Cat Club, and brought thus and otherwise into communication with the gentry of the Whig party. Although all accounts agree in representing him as a shy man, he was at least saved from all risk of making himself disagreeable in society, by his unassuming manners, his extreme caution and that sedulous desire to oblige, which his satirist Pope exaggerated into a positive fault. His knowledge and ability were esteemed so highly as to confirm the expectations formerly entertained of his usefulness in public business; and the literary fame he had already acquired soon furnished an occasion for recommending him to public employment. Though the Whigs were out of office, the administration which succeeded them was, in all its earlier changes, of a complexion so mixed and uncertain that the influence of their leaders was not entirely lost. Not long after Marlborough's great victory at Blenheim, it is said that Godolphin, the lord treasurer, expressed to Lord Halifax a desire to have the great duke's fame extended by a poetical tribute. Halifax seized the opportunity of recommending Addison as the fittest man for the duty; stipulating, we are told, that the service should not be unrewarded, and doubtless satisfying the minister that his protégé possessed other qualifications for office besides dexterity in framing heroic verse. *The Campaign* (December 1704), the poem thus written to order, was received with extraordinary applause; and it is probably as good as any that ever was prompted by no more worthy inspiration. It has, indeed, neither the fiery spirit which Dryden threw into occasional pieces of the sort, nor the exquisite polish that would have been given by Pope, if he had stooped to make such uses of his genius; but many of the details are pleasing; and in the famous passage of the Angel, as well as in several others, there is even something of force and imagination.

The consideration covenanted for by the poet's friends was faithfully paid. A vacancy occurred by the death of another celebrated man, John Locke; and Addison was appointed one of the five commissioners of appeal in Excise. The duties of the place must have been as light for him as they had been for his predecessor, for he continued to hold it with all the appointments he subsequently received from the same ministry. But there is no reason for believing that he was more careless than other public servants in his time; and the charge of incompetency as a man of business, which has been brought so positively against him, cannot easily be true as to this first period of his official career. Indeed, the specific allegations refer exclusively to the last years of his life; and, if he had not really shown practical ability in the period now in question, it is not easy to see how he, a man destitute alike of wealth, of social or fashionable liveliness and of family interest, could have been promoted, for several years, from office to office, as he was, till the fall of the administration to which he was attached. In 1706 he became one of the under-secretaries of state, serving first under Sir Charles Hedges, who belonged to the Tory section of the government, and afterwards under Lord Sunderland, Marlborough's son-in-law, and a zealous follower of Addison's early patron, Somers. The work of this office, however, like that of the commissionership, must often have admitted of performance by deputy; for in 1707, the Whigs having become stronger, Lord Halifax was sent on a mission to the elector of Hanover; and, besides taking Vanbrugh the dramatist with him as king-at-arms, he selected Addison as his secretary. In 1708 Addison entered parliament, sitting at first for Lostwithiel, but afterwards for Malmesbury, which he represented from 1710 till his death. Here unquestionably he did fail. What part he may have taken in the details of business we are not informed; but he was always a silent member, unless it be true that he once attempted to speak and sat down in confusion. In 1708 Lord Wharton, the father of the notorious duke, having been named lord-lieutenant of Ireland, Addison became his secretary, receiving also an appointment as keeper of records. This event happened only about a year and a half before the dismissal of the ministry.

But there are letters showing that Addison made himself acceptable to some of the best and most distinguished persons in Dublin; and he escaped without having any quarrel with Swift, his acquaintance with whom had begun some time before.

In his literary history those years of official service are almost a blank, till we approach their close. Besides furnishing a prologue to Steele's comedy of *The Tender Husband* (1705), he admittedly gave him some assistance in its composition; he defended the government in an anonymous pamphlet on *The Present State of the War* (1707); he united compliments to the all-powerful Marlborough with indifferent attempts at lyrical poetry in his opera of *Rosamond*; and during the last few months of his tenure of office he contributed largely to the *Tatler*. His entrance on this new field nearly coincides with the beginning of a new period in his life. Even the coalition-ministry of Godolphin was too Whiggish for the taste of Queen Anne; and the Tories, the favourites of the court, gained, both in parliamentary power and in popularity out of doors, by a combination of lucky accidents, dexterous management and divisions and double-dealing among their adversaries. The real failure of the prosecution of Addison's old friend Sacheverell completed the ruin of the Whigs; and in August 1710 an entire revolution in the ministry had been completed. The Tory administration which succeeded kept its place till the queen's death in 1714, and Addison was thus left to devote four of the best years of his life, from his thirty-ninth year to his forty-third, to occupations less lucrative than those in which his time had recently been frittered away, but much more conducive to the extension of his own fame and to the benefit of English literature. Although our information as to his pecuniary affairs is very scanty, we are entitled to believe that he was now independent of literary labour. He speaks, in an extant paper, of having had (but lost) property in the West Indies; and he is understood to have inherited something from a younger brother, who had been governor of Madras. In 1711 he purchased, for £10,000, the estate of Bilton, near Rugby—the place which afterwards became the residence of Mr Apperley, better known by his assumed name of "Nimrod."

During those four years he produced a few political writings. Soon after the fall of the ministry, he started the *Whig Examiner* in opposition to the Tory *Examiner*, then conducted by Prior, and afterwards the vehicle of Swift's most vehement invectives against the party he had once belonged to. These are certainly the most ill-natured of Addison's writings, but they are neither lively nor vigorous, and the paper died after five numbers (14th September to 12th October 1710). There is more spirit in his allegorical pamphlet, *The Trial and Conviction of Count Tariff*.

But from the autumn of 1710 till the end of 1714 his principal employment was the composition of his celebrated periodical essays. The honour of inventing the plan of such compositions, as well as that of first carrying the idea into execution, belongs to Richard Steele, who had been a schoolfellow of Addison at the Charterhouse, continued to be on intimate terms with him afterwards and attached himself with his characteristic ardour to the same political party. When, in April 1709, Steele published the first number of the *Tatler*, Addison was in Dublin, and knew nothing of the design. He is said to have detected his friend's authorship only by recognizing, in the sixth number, a critical remark which he remembered having himself communicated to Steele. Shortly afterwards he began to furnish hints and suggestions, assisted occasionally and finally wrote regularly. According to Mr Aitken (*Life of Steele*, i. 248), he contributed 42 out of the total of 271 numbers, and was part-author of 36 more. The *Tatler* exhibited, in more ways than one, symptoms of being an experiment. For some time the projector, imitating the news-sheets in form, thought it prudent to give, in each number, news in addition to the essay; and there was a want, both of unity and of correct finishing, in the putting together of the literary materials. Addison's contributions, in particular, are in many places as lively as anything he ever wrote; and his style, in its more familiar moods at least, had been fully formed before he returned from the continent. But, as compared with his later pieces, these are only what the painter's loose studies and sketches are to the landscapes which he afterwards constructs out of them. In his invention of incidents and characters, one thought after another is hastily used and hastily dismissed, as if he were putting his own powers to the test or trying the effect of various kinds of objects on his readers; his most ambitious flights, in the shape of allegories and the like, are stiff and inanimate; and his favourite field of literary criticism is touched so slightly, as to show that he still wanted confidence in the taste and knowledge of the public.

The *Tatler* was dropped in January 1711, but only to be followed by the *Spectator*, which was begun on the 1st day of March, and appeared every week-day till the 6th day of December 1712. It had then completed the 555 numbers usually collected in its first seven volumes, and of these Addison wrote 274 to Steele's 236. He co-operated with Steele constantly from the very opening of the series; and they devoted their whole space to the essays. They relied, with a confidence which the extraordinary popularity of the work fully justified, on their power of exciting the interest of a wide audience by pictures and reflexions drawn from a field which embraced the whole compass of ordinary life and ordinary knowledge, no kind of practical themes being positively excluded except such as were political, and all literary topics being held admissible, for which it seemed possible to command attention from persons of average taste and information. A seeming unity was given to the undertaking, and curiosity and interest awakened on behalf of the conductors, by the happy invention of the Spectator's Club, for which Steele made the first sketch. The figure of Sir Roger de Coverley, however, the best even in the opening group, is the only one that was afterwards elaborately depicted; and Addison was the author of most of the papers in which his oddities and amiabilities are so admirably delineated. Six essays are by Steele, who gives Sir Roger's love-story, and one paper by Budgell describes a hunting party.

To Addison the *Spectator* owed the most natural and elegant, if not the most original, of its humorous sketches of human character and social eccentricities, its good-humoured satires on ridiculous features in manners and on corrupt symptoms in public taste; these topics, however, making up a department in which Steele was fairly on a level with his more famous coadjutor. But Steele had neither learning, nor taste, nor critical acuteness sufficient to qualify him for enriching the series with such literary disquisitions as those which Addison insinuated so often into the lighter matter of his essays, and of which he gave an elaborate specimen in his criticism on *Paradise Lost.* Still farther beyond the powers of Steele were those speculations on the theory of literature and of the processes of thought analogous to it, which, in the essays "On the Pleasures of the Imagination," Addison prosecuted, not, indeed, with much of philosophical depth, but with a sagacity and comprehensiveness which we shall undervalue much unless we remember how little of philosophy was to be found in any critical views previously propounded in England. To Addison, further, belong those essays which (most frequently introduced in regular alternation in the papers of Saturday) rise into the region of moral and religious meditation, and tread the elevated ground with a step so graceful as to allure the reader irresistibly to follow; sometimes, as in the "Walk through Westminster Abbey," enlivening solemn thought by gentle sportiveness; sometimes flowing on with an uninterrupted sedateness of didactic eloquence, and sometimes shrouding sacred truths in the veil of ingenious allegory, as in the "Vision of Mirza." While, in short, the *Spectator*, if Addison had not taken part in it, would probably have been as lively and humorous as it was, and not less popular in its own day, it would have wanted some of its strongest claims on the respect of posterity, by being at once lower in its moral tone, far less abundant in literary knowledge and much less vigorous and expanded in thinking. In point of style, again, the two friends resemble each other so closely as to be hardly distinguishable, when both are dealing with familiar objects, and writing in a key not rising above that of conversation. But in the higher tones of thought and composition Addison showed a mastery of language raising him very decisively, not above Steele only, but above all his contemporaries. Indeed, it may safely be said, that no one, in any age of English literature, has united, so strikingly as he did, the colloquial grace and ease which mark the style of an accomplished gentleman, with the power of soaring into a strain of expression nobly and eloquently dignified.

On the cessation of the *Spectator*, Steele set on foot the *Guardian*, which, started in March 1713, came to an end in October, with its 175th number. To this series Addison gave 53 papers, being a very frequent writer during the latter half of its progress. None of his essays here aim so high as the best of those in the *Spectator*; but he often exhibits both his cheerful and well-balanced humour and his earnest desire to inculcate sound principles of literary judgment. In the last six months of the year 1714, the *Spectator* received its eighth and last volume; for which Steele appears not to have written at all, and Addison to have contributed 24 of the 80 papers. Most of these form, in the unbroken seriousness both of their topics and of their manner, a contrast to the majority of his essays in the earlier volumes; but several of them, both in this vein and in one less lofty, are among the best known, if not the finest, of all his essays. Such are the "Mountain of Miseries"; the antediluvian novel of "Shalum and Hilpa"; the "Reflections by Moonlight on the Divine Perfections."

In April 1713 Addison brought on the stage, very reluctantly, as we are assured, and can easily believe, his tragedy of *Cato.* Its success was dazzling; but this issue was mainly owing to the concern which the politicians took in the exhibition. The Whigs hailed it as a brilliant manifesto in favour of constitutional freedom. The Tories echoed the applause, to show themselves enemies of despotism, and professed to find in Julius Caesar a parallel to the formidable Marlborough. Even with such extrinsic aids, and the advantage derived from the established fame of the author, *Cato* could never have been esteemed a good dramatic work, unless in an age in which dramatic power and insight were almost extinct. It is poor even in its poetical elements, and is redeemed only by the finely solemn tone of its moral reflexions and the singular refinement and equable smoothness of its diction. That it obtained the applause of Voltaire must be ascribed to the fact that it was written in accordance with the rules of French classical drama.

The literary career of Addison might almost be held as closed soon after the death of Queen Anne, which occurred in August 1714, when he had lately completed his 42nd year. His own life extended only five years longer; and in this closing portion of it we are reminded of his more vigorous days by nothing but a few happy inventions interspersed in political pamphlets, and the gay fancy of a trifling poem on Kneller's portrait of George I.

The lord justices who, previously chosen secretly by the elector of Hanover, assumed the government on the queen's demise, were, as a matter of course, the leading Whigs. They appointed Addison to act as their secretary. He next held, for a very short time, his former office under the Irish lord-lieutenant; and, late in 1716, he was made one of the lords of trade. In the course of the previous year had occurred the first of the only two quarrels with friends, into which the prudent, good-tempered and modest Addison is said to have ever been betrayed. His adversary on this occasion was Pope, who, a few years before, had received, with an appearance of humble thankfulness, Addison's friendly remarks on his *Essay on Criticism* (*Spectator*, No. 253); but who, though still very young, was already very famous, and beginning to show incessantly his literary jealousies and his personal and party hatreds. Several little misunderstandings had paved the way for a breach, when, at the same time with the first volume of Pope's *Iliad*, there appeared a translation of the first book of the poem bearing the name of Thomas Tickell. Tickell, in his preface, disclaimed all rivalry with Pope, and declared that he wished only to bespeak favourable attention for his contemplated version of the *Odyssey*. But the simultaneous publication was awkward; and Tickell, though not so good a versifier as Pope, was a dangerous rival, as being a good Greek scholar. Further, he was Addison's under-secretary and confidential friend; and Addison, cautious though he was, does appear to have said (quite truly) that Tickell's translation was more faithful than the other. Pope's anger could not be restrained. He wrote those famous lines in which he describes Addison under the name of Atticus, and although it seems doubtful whether he really sent a copy to Addison himself, he afterwards went so far as to profess a belief that the rival translation was really Addison's own. Addison, it is pleasant to observe, was at the pains, in his *Freeholder*, to express hearty approbation of the *Iliad* of Pope, who, on the contrary, after Addison's death, deliberately printed his matchlessly malignant verses in the "Epistle to Dr Arbuthnot." In 1716 there was acted, with little success, Addison's comedy of *The Drummer, or the Haunted House.* It contributes very little to his fame. From September 1715 to June 1716 he defended the Hanoverian succession, and the proceedings of the government in regard to the rebellion, in a paper called the *Freeholder*, which he wrote entirely himself, dropping it with the 55th number. It is much better tempered, not less spirited and much more able in thinking than his *Examiner.* The finical man of taste does indeed show himself to be sometimes weary of discussing constitutional questions; but he aims many enlivening thrusts at weak points of social life and manners; and the character of the Fox-hunting Squire, who is introduced as the representative of the Jacobites, is drawn with so much humour and force that we regret not being allowed to see more of him.

In August 1716, when he had completed his 44th year, Addison married Charlotte, countess-dowager of Warwick, a widow of fifteen years' standing. She seems to have forfeited her jointure by the marriage, and to have brought her husband nothing but the occupancy of Holland House at Kensington. The assertion that the courtship was a long one is probably as erroneous as the contemporary rumour that the marriage was unhappy. Such positive evidence as exists tends rather to the contrary. What seems clear is, that, from obscure causes,—among which it is alleged a growing habit of intemperance was one,—Addison's health was shattered before he took the last, and certainly the most unwise, step in his ascent to political power.

For a considerable time dissensions had existed in the ministry; and these came to a crisis in April 1717, when those who had been the real chiefs passed into the ranks of the opposition. Townshend was dismissed, and Walpole anticipated dismissal by resignation. There was now formed, under the leadership of General Stanhope and Lord Sunderland, an administration which, as resting on court-influence, was nicknamed the "German ministry." Sunderland, Addison's former superior, became one of the two principal secretaries of state; and Addison himself was appointed as the other. His elevation to such a post had been contemplated on the accession of George I., and prevented, we are told, by his own refusal; and it is asserted, on the authority of Pope, that his acceptance now was owing only to the influence of his wife. Even if there is no ground, as there probably is not, for the allegation of Addison's inefficiency in the details of business, his unfitness for such an office in such circumstances was undeniable and glaring. It was impossible that a government, whose secretary of state could not open his lips in debate, should long face an opposition headed by Robert Walpole. The decay of Addison's health, too, was going on rapidly, being, we may readily conjecture, precipitated by anxiety, if no worse causes were at work. Ill-health was the reason assigned for retirement, in the letter of resignation which he laid before the king in March 1718, eleven months after his appointment. He received a pension of £1500 a year.

Not long afterwards the divisions in the Whig party alienated him from his oldest friend. The Peerage Bill, introduced in February 1719, was attacked, on behalf of the opposition, in a weekly paper called the *Plebeian*, written by Steele. Addison answered the attack in the *Old Whig*, and this *bellum plusquam civile*—as Johnson calls it—was continued, with increased acrimony, through two or three numbers. How Addison, who was dying, felt after this painful controversy we are not told directly; but the *Old Whig* was excluded from that posthumous collection of his works (1721–1726) for which his executor Tickell had received from him authority and directions. It is said that the quarrel in politics rested on an estrangement which had been growing for some years. According to a rather nebulous story, for which Johnson is the popular authority, Addison, or Addison's lawyer, put an execution for £100 in Steele's house by way of reading his friend a lesson on his extravagance. This well-meant interference seems to have been pardoned by Steele, but his letters show that he resented the favour shown to Tickell by Addison and his own neglect by the Whigs.

The disease under which Addison laboured appears to have been asthma. It became more violent after his retirement from office, and was now accompanied by dropsy. His deathbed was placid and resigned, and comforted by those religious hopes which he had so often suggested to others, and the value of which he is said, in an anecdote of doubtful authority, to have now inculcated in a parting interview with his step-son. He died at Holland House on the 17th of June 1719, six weeks after having completed his 47th year. His body, after lying in state, was interred in the Poets' Corner of Westminster Abbey.

Addison's life was written in 1843 by Lucy Aikin. This was reviewed by Macaulay in July of the same year. A more modern study is that in the "Men of Letters" series by W. J. Courthope (1884). There is a convenient one-volume edition of the *Spectator*, by Henry Morley (Routledge, 1868), and another in 8 vols. (1897–1898) by G. Gregory Smith. Of the *Tatler* there is an edition by G. A. Aitken in 8 vols. (1898). A complete edition of Addison's works (based upon Hurd) is included in Bohn's *British Classics*. (W. S.; A. D.)

ADDISON'S DISEASE, a constitutional affection manifesting itself in an exaggeration of the normal pigment of the skin, asthenia, irritability of the gastro-intestinal tract, and weakness and irregularity of the heart's action: these symptoms being due to loss of function of the suprarenal glands. It is important to note, however, that Addison's Disease may occur without pigmentation, and pigmentation without Addison's Disease. The condition was first recognized by Dr Thomas Addison of Guy's Hospital, who in 1855 published an important work on *The Constitutional and Local Effects of Diseases of the Suprarenal Capsules*. Sir Samuel Wilks worked zealously in obtaining recognition for these observations in England, and Brown-Séquard in France was stimulated by this paper to investigate the physiology of these glands. Dr Trousseau, many years later, first called the condition by Addison's name. Dr Headlam Greenhow worked at the subject for many years and embodied his observations in the Croonian Lectures of 1875. But from this time on no further work was undertaken until the discovery of the treatment of myxoedema by thyroid extract, and the consequent researches into the physiology of the ductless glands. This stimulated renewed interest in the subject, and work was carried on in many countries. But it remained for Schäfer and Oliver of University College, London, to demonstrate the internal secretion of the suprarenals, and its importance in normal metabolism, thereby confirming Addison's original view that the disease was due to loss of function of these glands. They demonstrated that these glands contain a very powerful extract which produces toxic effects when administered to animals, and that an active principle "adrenalin" can be separated, which excites contraction of the small blood vessels and thus raises blood pressure. The latest views of this disease thus stand: (1) that it is entirely dependent on suprarenal disease, being the result of a diminution or absence of their internal secretion, or else of a perversion of their secretion; or (2) that it is of nervous origin, being the result of changes in or irritation of the large sympathetic plexuses in the abdomen; or else (3) that it is a combination of glandular inadequacy and sympathetic irritation.

The morbid anatomy shows (1) that in over 80% of the cases the changes in the suprarenals are those due to tuberculosis, usually beginning in the medulla and resulting in more or less caseation; and that this lesion is bilateral and usually secondary to tuberculous disease elsewhere, especially of the spinal column. In the remaining cases (2) simple atrophy has been noted, or (3) chronic interstitial inflammation which would lead to atrophy; and finally (4) an apparently normal condition of the glands, but the neighbouring sympathetic ganglia diseased or involved in a mass of fibrous tissue. Other morbid conditions of the suprarenals do not give rise to the symptoms of Addison's Disease.

The onset of the disease is extremely insidious, a slow but increasing condition of weakness being complained of by the patient. There is a feeble and irregular action of the heart resulting in attacks of syncope which may prove fatal. Blood pressure is extremely low. From time to time there may be severe attacks of nausea, vomiting or diarrhoea. The best known symptom, but one which only occurs after the disease has made considerable progress, is a gradually increasing pigmentation of the skin, ranging from a bronzy yellow to brown or even occasionally black. This pigmentation shows itself (1) over exposed parts, as face and hands; (2) wherever pigment appears normally, as in the axillae and round the nipples; (3) wherever pressure is applied, as round the waist; and (4) occasionally on mucous membranes, as in the mouth.

The patient's temperature is usually somewhat subnormal. The disease is found in males far more commonly than in females, and among the lower classes more than the upper. But this latter fact is probably due to poor nourishment and bad hygienic conditions rendering the poorer classes more susceptible to tuberculosis.

The diagnosis, certainly in the early stages of the disease, and often in the later, is by no means easy. Pigmentation of the skin occurs in many conditions—as in normal pregnancy, uterine fibroids, abdominal growths, certain cases of heart disease, exophthalmic goitre, &c., and after the prolonged use of certain drugs—as arsenic and silver. But the presence of a low blood pressure with weakness and irritability of the heart and some of the preceding symptoms render the diagnosis fairly certain. The latest researches on the subject tend to indicate a more certain diagnosis in the effect on the blood pressure of administering suprarenal extract, the blood pressure of the normal subject being unaffected thereby, that of the man suffering from suprarenal inadequacy being markedly raised. The disease is treated by promoting the general health in every possible way;

by diet; by tonics, especially arsenic and strychnine; by attention to the hygienic conditions; and always by the administration of one of the many preparations of the suprarenal gland extract.

"ADDRESS, THE," an English parliamentary term for the reply of the Houses of Parliament (and particularly of the House of Commons) to the speech of the sovereign at the opening of a new parliament or session. There are certain formalities which distinguish this stage of parliamentary proceedings. The "king's speech" itself is divided into three sections: the first, addressed to "My Lords and Gentlemen," touches on foreign affairs; the second, to the "Gentlemen of the House of Commons," has reference to the estimates; the third, to "My Lords and Gentlemen," outlines the proposed legislation for the session. Should the sovereign in person open parliament, he does so in the House of Lords in full state, and the speaker and members of the House of Commons are summoned there into the royal presence. The sovereign then reads his speech. If the sovereign is not present in person, the speech is read by commission. The Commons then return to their House, and an address in answer is moved in both Houses. The government of the day selects two of its supporters in each House to move and second the address, and when carrying out this honourable task they appear in levee dress. Previous to the session of 1890–1891, the royal speech was answered paragraph by paragraph, but "the address" is now moved in the form of a single resolution, thanking the sovereign for his most gracious speech. The debate on the address is used as a means of ranging over the whole government policy, amendments being introduced by the opposition. A defeat on an amendment to the address is generally regarded by the government as a vote of no-confidence. After the address is agreed to it is ordered to be presented to the sovereign. The thanks of the sovereign for the address are then conveyed to the Lords by the lord steward of the household and to the Commons by the comptroller of the household.

ADELAER, or Adeler (Norwegian for "eagle"), the surname of honour given on his ennoblement to Kurt Sivertsen (1622–1675), the famous Norwegian-Danish naval commander. He was born at Brevig in Norway, and at the age of fifteen became a cadet in the Dutch fleet under van Tromp, after a few years entering the service of the Venetian Republic, which was engaged at the time in a war with Turkey. In 1645 he had risen to the rank of captain; and after sharing in various victories as commander of a squadron, he achieved his most brilliant success at the Dardanelles, on the 13th of May 1654, when, with his own vessel alone, he broke through the line of Turkish galleys, sank fifteen of them, and burned others, causing a loss to the enemy of 5000 men. The following day he entered Tenedos, and compelled the complete surrender of the Turks. On returning to Venice he was crowned with honours, and became admiral-lieutenant in 1660. Numerous tempting offers were made to him by other naval powers, and in 1661 he left Venice to return to the Netherlands. Next year he was induced, by the offer of a title and an enormous salary, to accept the command of the Danish fleet from Frederick III. Under Christian V. he took the command of the combined Danish fleets against Sweden, but died suddenly on the 5th of November 1675 at Copenhagen, before the expedition set out. When in the Venetian service, Adelaer was known by the name of Curzio Suffrido Adelborst (*i.e.* Dutch for "naval cadet").

ADELAIDE (Ger. *Adelheid*) (931–999), queen of Italy and empress, was the daughter of Rudolph II. of Burgundy and of Bertha, daughter of Duke Burchard of Swabia. On the death of Rudolph in 937, his widow married Hugh, king of Italy, to whose son Lothair Adelaide was at the same time betrothed. She was married to him in 947; but after an unhappy union of three years Lothair died (November 22, 950). The young widow, remarkable for her character and beauty, was seized by Lothair's successor, Berengar II., margrave of Ivrea, who, angered probably at her refusal to marry his son Adalbert and thus secure his title to the Italian kingdom, kept her in close confinement at Como. After four months (August 951), she escaped, and took refuge at Canossa with Atto, count of Modena-Reggio (d. 981). Meanwhile Otto I., the German king, whose English wife Edgitha had died in 946, had formed the design of marrying her and claiming the Italian kingdom in her right, as a step towards the revival of the empire of Charlemagne. In September 951, accordingly, he appeared in Italy, Adelaide willingly accepted his invitation to meet him at Pavia and at the close of the year the fateful union was celebrated. From the first her part in German affairs was important. To her are ascribed the influences which led in 953 to the revolt of Ludolf, Otto's son by his first marriage, the crushing of which in the following year established Adelaide's power. On the 2nd of February 962 she was crowned empress at Rome by Pope John XII. immediately after her husband, and she accompanied Otto in 966 on his third expedition to Italy, where she remained with him for six years. After Otto I.'s death (May 7, 973), Adelaide exercised for some years a controlling influence over her son, the new emperor, Otto II. The causes of their subsequent estrangement are obscure, but it was possibly due to the empress's lavish expenditure in charity and church building, which endeared her to ecclesiastics but was a serious drain on the imperial finances. In 978 she left the court and lived partly in Italy, partly with her brother Conrad, king of Burgundy, by whose mediation she was ultimately reconciled to her son. In 983, shortly before his death, she was appointed his viceroy in Italy; and was successful, in concert with the empress Theophano, widow of Otto II., and Archbishop Willigis of Mainz, in defending the right of her infant grandson, Otto III., to the German crown against the pretensions of Henry the Quarrelsome, duke of Bavaria. In June 984 the infant king was handed over by Henry to the care of the two empresses; but the masterful will of Theophano soon obtained the upper hand, and until the death of the Greek empress, on the 15th of June 991, Adelaide had no voice in German affairs. She now assumed the regency, in concert with Bishop Willigis and a council of princes of the Empire, and held it until in 995 Otto was declared of age. In 996 the young king went to Italy to receive the imperial crown; and from this date Adelaide ceased to concern herself with worldly affairs, but devoted herself to pious exercises, to intimate correspondence with the abbots Majolus and Odilo of Cluny, and the foundation of churches and religious houses. She died on the 17th of December 999, and was buried in the convent of SS. Peter and Paul, her favourite foundation, at Salz in Alsace. She was proclaimed a saint by the grateful German clergy; but her name has never found a place in the Roman calendar. Like her daughter-in-law Theophano and other exalted ladies of this period, Adelaide possessed considerable literary attainments (*literatissima erat*), and her knowledge of Latin was of use to Otto I., who only learned the language late in life and remained to the end a poor scholar.

By the emperor Otto I. she had four children: Otto II. (d. 983), Mathilda, abbess of Quedlinburg (d. 999), Adelheid (Adelaide), abbess of Essen (d. 974), and Liutgard, who married Conrad II., duke of Franconia, and died in 955.

Adelaide's life (*Vita* or *Epitaphium Adalheidae imperatricis*) was written by St Odilo of Cluny. It is valuable only for the latter years of the empress, after she had retired from any active share in the world's affairs. The rest of her life is merely outlined, though her adventures in escaping from Berengar are treated in more detail. The best edition is in Duchesne, *Bibliotheca Cluniacensis*, pp. 353-362. See Giov. Batt. Semeria, *Vita politico-religiosa di s. Adeleida, &c.* (Turin, 1842); Jul. Bentzinger, *Das Leben der Kaiserin Adelheid . . . während der Regierung Ottos III.*, Inaug. Dissertation (Breslau, 1883); J. J. Dey, *Hist. de s. Adelaide, &c.* (Geneva, 1862); F. P. Wimmer, *Kaiserin Adelheid, Gemahlin Ottos I. des Grossen* (Regensb. 1889); Wattenbach, *Deutschlands Geschichtsquellen* (Stuttgart and Berlin, 1904). Further references in Chevalier, *Répertoire des sources historiques* (Paris, 1903).

ADELAIDE, the capital of South Australia. It is situated in the county to which it gives name, on the banks of the river Torrens, 7 m. from its mouth. Its site is a level plain, near the foot of the Mount Lofty range, in which Mount Lofty itself reaches 2334 ft. The broad streets of the city intersect at right angles. It is divided into North Adelaide, the residential, and South Adelaide, the business quarter. A broad strip of park lands lies between them, through which runs the river Torrens, crossed by five bridges and greatly improved by a dam on the west of the city. The banks are beautifully laid out. Broad belts of park lands surround both North and South Adelaide, and as the greater portion of these lands is planted with fine shady trees, this feature renders Adelaide one of the most attractive cities in Australasia. South Adelaide is bounded by four broad terraces facing north, south, east and west. The main thoroughfare, King William Street, runs north and south, passing through Victoria Square, a small park in the centre of the city. Handsome public buildings are numerous. Government House stands in grounds on the north side of North Terrace, with several other official buildings in the vicinity; but the majority are in King William Street. Here are the town hall, with the lofty Albert Tower, and the general post office, with the Victoria Tower—which, with the old and new Government offices, the Roman Catholic cathedral of St Francis Xavier and the court houses, surround Victoria Square. On North Terrace are the houses of parliament, and the institute, containing a public library and museum. Here is also Adelaide University, established by an act of 1874, and opened in 1876. The existing buildings were opened in 1882. Munificent gifts have from time to time assisted in the extension of its scope, as for example that of Sir Thomas Elder (d. 1897), who took a leading part in the foundation of the university. This gift, among other provisions, enabled the Elder Conservatorium of Music to be established, the building for which was opened in 1900. In 1903 a building for the schools of engineering and science was opened. The total number of students in the university approaches 1000. To the east of the university is the building in which the exhibition was held in commemoration of the jubilee of the colony in 1887. This building is occupied by the Royal Agricultural and Horticultural Society, a technical museum, &c. The school of mines and industries (1903) stands east of this again. The buildings of the numerous important commercial, social and charitable institutions add to the dignity of the city. The Anglican cathedral of St Peter (1878) is in North Adelaide. The Botanical Park, which has an area of 84 acres, lies on the south bank of the Torrens, on the east of the city. It includes the Zoological Garden, is beautifully laid out and forms one of the most attractive features of Adelaide. The city has a number of good statues, chief among which are copies of the Farnese Hercules (Victoria Square) and of Canova's Venus (North Terrace), statues of Queen Victoria and Robert Burns, Sir Thomas Elder's statue at the university, and a memorial (1905) over the grave of Colonel Light, founder of the colony, in Light Square. Adelaide is governed by a mayor and six aldermen elected by the whole body of the ratepayers, and is the only Australian city in which the mayor is so elected. The chief industries are the manufacture of woollen, earthenware and iron goods, brewing, starch-making, flour-milling and soap-boiling. Adelaide is also the central share market of Australia, for West Australian goldmines, for the silver-mines at Broken Hill, and for the copper-mines at Wallaroo, Burra Burra and Moonta; while Port Adelaide, on the neighbouring shore of St Vincent Gulf, ranks as the third in the Commonwealth. Adelaide is the terminus of an extensive railway system, the main line of which runs through Melbourne, Sydney and Brisbane to Rockhampton. In summer the climate is often oppressively hot under the influence of winds blowing from the interior, but the proximity of the sea on the one side and of the mountains on the other allows the inhabitants to avoid the excessive heat; at other seasons, however, the climate is mild and pleasant; with a mean annual rainfall of 20·4 ins. The vice-regal summer residence is at Marble Hill, on the Mount Lofty range. Adelaide was founded in 1836 and incorporated in 1843. It received its name at the desire of King William IV., in honour of Queen Adelaide. Round the city are many pleasant suburbs, connected with it by rail and tramways; the chief of these are Burnside, Beaumont, Unley, Mitcham, Goodwood, Plymton, Hindmarsh, Prospect, St Peters, Norwood and Kensington. Glenelg is a favourite watering-place. The population of the city proper was 39,240 in 1901; of the city and suburbs within a 10-miles radius, 162,261.

ADELARD (or AETHELARD) of Bath (12th century), English scholastic philosopher, and one of the greatest savants of medieval England. He studied in France at Laon and Tours, and travelled, it is said, through Spain, Italy, North Africa and Asia Minor, during a period of seven years. At a time when Western Europe was rich in men of wide knowledge and intellectual eminence, he gained so high a reputation that he was described by Vincent de Beauvais as *Philosophus Anglorum.* He lived for a time in the Norman kingdom of Sicily and returned to England in the reign of Henry I. From the Pipe Roll (31 Henry I. 1130) it appears that he was awarded an annual grant of money from the revenues of Wiltshire. The great interest of Adelard in the history of philosophy lies in the fact that he made a special study of Arabian philosophy during his travels, and, on his return to England, brought his knowledge to bear on the current scholasticism of the time. He has been credited with a knowledge of Greek, and it is said that his translation of Euclid's Elements was made from the original Greek. It is probable, however, from the nature of the text, that his authority was an Arabic version. This important work was published first at Venice in 1482 under the name of Campanus of Novara, but the work is always attributed to Adelard. Campanus may be responsible for some of the notes. It became at once the text-book of the chief mathematical schools of Europe, though its critical notes were of little value. His Arabic studies he collected under the title *Perdifficiles Quaestiones Naturales*, printed after 1472. It is in the form of a dialogue between himself and his favourite nephew, and was dedicated to Richard, bishop of Bayeux from 1113 to 1133. He wrote also treatises on the astrolabe (a copy of this is in the British Museum), on the abacus (three copies exist in the Vatican library, the library of Leiden University and the Bibliothèque Nationale in Paris), translations of the Kharismian Tables and an Arabic *Introduction to Astronomy.* His great contribution to philosophy proper was the *De Eodem et Diverso* (*On Identity and Difference*), which is in the form of letters addressed to his nephew. In this work philosophy and the world are personified as Philosophia and Philocosmia in conflict for the soul of man. Philosophia is accompanied by the liberal arts, represented as Seven Wise Virgins; the world by Power, Pleasure, Dignity, Fame and Fortune. The work deals with the current difficulties between nominalism and realism, the relation between the individual and the genus or species. Adelard regarded the individual as the really existent, and yet, from different points of view, as being himself the genus and the species. He was either the founder or the formulator of the doctrine of indifference, according to which genus and species retain their identity in the individual apart altogether from particular idiosyncrasies. For the relative importance of this doctrine see article SCHOLASTICISM.

See Jourdain, *Recherches sur les traductions d'Aristote* (2nd ed., 1843); Hauréau, *Philosophie scolastique* (2nd ed., 1872), and works appended to art. SCHOLASTICISM.

ADELSBERG (Slovene *Postojina*), a market-town in Carniola, Austria, 30 m. S.S.W. of Laibach by rail. Pop. (1900) 3636, mostly Slovene. About a mile from the town is the entrance to the famous stalactite cavern of Adelsberg, the largest and most magnificent in Europe. The cavern is divided into four grottoes, with two lateral ramifications which reach to the distance of about a mile and a half from the entrance. The river Poik enters the cavern 60 ft. below its mouth, and is heard murmuring in its recesses. In the Kaiser-Ferdinand grotto, the third of the chain, a great ball is annually held on Whit-Monday, when the chamber is brilliantly illuminated. The Franz-Joseph-Elisabeth grotto, the largest of the four, and the farthest from the entrance, is 665 ft. in length, 640 ft. in breadth and more than 100 ft. high. Besides the imposing proportions of its chambers, the cavern is remarkable for the variegated beauty of its stalactite formations, some resembling transparent drapery, others waterfalls, trees, animals or human beings, the more grotesque being called by various fanciful appellations. These subterranean wonders were known as far back as 1213, but the cavern remained undiscovered in modern times until 1816, and it is only in still more recent times that its vast extent has been fully ascertained and explored. The total length of the passages is now estimated at over 5½ m. The connexion with the Ottokar grotto was established in 1890. The Magdalene grotto, about an hour's walk to the north, is celebrated for the extraordinary subterranean amphibian, the *proteus anguinus*, first discovered there. It is about a foot in length, lives on snails and worms and is provided with both lungs and gills.

ADELUNG, JOHANN CHRISTOPH (1732–1806), German grammarian and philologist, was born at Spantekow, in Pomerania, on the 8th of August 1732, and educated at the public schools of Anklam and Klosterbergen, and the university of Halle. In 1759 he was appointed professor at the gymnasium of Erfurt, but relinquished this situation two years later and went to reside in a private capacity at Leipzig, where he devoted himself to philological researches. In 1787 he received the appointment of principal librarian to the elector of Saxony at Dresden, where he continued to reside until his death on the 10th of September 1806.

The writings of Adelung are very voluminous, and there is not one of them, perhaps, which does not exhibit some proofs of the genius, industry and erudition of the author. By means of his excellent grammars, dictionary and various works on German style, he contributed greatly towards rectifying the orthography, refining the idiom and fixing the standard of his native tongue. His German dictionary—*Grammatisch-kritisches Wörterbuch der hochdeutschen Mundart* (1774–1786)—bears witness to the patient spirit of investigation which Adelung possessed in so remarkable a degree, and to his intimate knowledge of the history of the different dialects on which modern German is based. No man before Jakob Grimm (*q.v.*) did so much for the language of Germany. Shortly before his death he issued *Mithridates, oder allgemeine Sprachenkunde* (1806). The hint of this work appears to have been taken from a publication, with a similar title, published by Konrad von Gesner (1516–1565) in 1555; but the plan of Adelung is much more extensive. Unfortunately he did not live to finish what he had undertaken. The first volume, which contains the Asiatic languages, was published immediately after his death; the other two were issued under the superintendence of Johann Severin Vater (1771–1826). Of the very numerous works by Adelung the following may be noted: *Directorium diplomaticum* (Meissen, 1802); *Deutsche Sprachlehre für Schulen* (Berlin, 1781), and the periodical, *Magazin für die deutsche Sprache* (Leipzig, 1782–1784).

ADEMPTION (Lat. *ademptio*, from *adimere*, a taking away), in law, a revocation of a grant or bequest (see Legacy).

ADEN, a seaport and territory in Arabia, politically part of British India, under the governor of Bombay. The seaport is situated in 12° 45′ N. lat., and 45° 4′ E. long., on a peninsula near the entrance to the Red Sea, 100 m. E. of the strait of Bab-el-Mandeb. The peninsula of Aden consists chiefly of a mass of barren and desolate volcanic rocks, extending five miles from east to west, and three from its northern shore to Ras Sanailah or Cape Aden, its most southerly point; it is connected with the mainland by a neck of flat sandy ground only a few feet high; and its greatest elevation is Jebel Shamshan, 1776 ft. above the level of the sea. The town is built on the eastern coast, in what is probably the crater of an extinct volcano, and is surrounded by precipitous rocks that form an admirable natural defence. There are two harbours, an outer, facing the town, protected by the island of Sirah, but now partially choked with mud; and an inner, called Aden Back-bay, or, by the Arabs, Bandar Tawayih, on the western side of the peninsula, which at all periods of the year admits vessels drawing less than 20 ft. On the whole, Aden is a healthy place, although it suffers considerably from the want of good water, and the heat is often very intense. From time to time additional land on the mainland has been acquired by cession or purchase, and the adjoining island of Perim, lying in the actual mouth of the strait, was permanently occupied in 1857. Farther inland, and along the coast, most of the Arab chiefs are under the political control of the British government, which pays them regular allowances. The area of the peninsula is only 15 sq. m., but the total area of British territory is returned at 80 sq. m., including Perim (5 sq. m.), and that of the Aden Protectorate is about 9000 sq. m. The seaport of Aden is strongly fortified. Modern science has converted "Steamer Point" into a seemingly impregnable position, the peninsula which the "Point" forms to the whole crater being cut off by a fortified line which runs from north to south, just to the east of the coal wharfs. The administration is conducted by a political resident, who is also the military commandant. All food requires to be imported, and the water-supply is largely derived from condensation. A little water is obtained from wells, and some from an aqueduct 7 m. long, constructed in 1867 at a cost of £30,000, besides an irregular supply from the old reservoirs.

From its admirable commercial and military position, Aden early became the chief entrepôt of the trade between Europe and Asia. It is the Ἀραβία εὐδαίμων of the Periplus. It was known to the Romans as *Arabia Felix* and *Attanae*, and was captured by them, probably in the year 24 B.C. In 1513 it was unsuccessfully attacked by the Portuguese under Albuquerque, but subsequently it fell into the hands of the Turks in 1538. In the following century the Turks themselves relinquished their conquests in Yemen, and the sultan of Sana established a supremacy over Aden, which was maintained until the year 1735, when the sheikh of Lahej, throwing off his allegiance, founded a line of independent sultans. In 1837 a ship under British colours was wrecked near Aden, and the crew and passengers grievously maltreated by the Arabs. An explanation of the outrage being demanded by the Bombay government, the sultan undertook to make compensation for the plunder of the vessel, and also agreed to sell his town and port to the English. Captain Haines of the Indian navy was sent to complete these arrangements, but the sultan's son refused to fulfil the promises that his father had made. A combined naval and miltary force was thereupon despatched, and the place was captured and annexed to British India on the 16th of January 1839. The withdrawal of the trade between Europe and the East, caused by the discovery of the passage round the Cape of Good Hope, and the misgovernment of the native rulers, had gradually reduced Aden to a state of comparative insignificance; but about the time of its capture by the British the Red Sea route to India was reopened, and commerce soon began to flow in its former channel. Aden was made a free port, and was chosen as one of the coaling stations of the Peninsular and Oriental Steamship Company. Its importance as a port of call for steamers and a coaling station has grown immensely since the opening of the Suez Canal. It also conducts a considerable trade with the interior of Arabia, and with the Somali coast of Africa on the opposite side of the Red Sea. The submarine cables of the Eastern Telegraph Company here diverge—on the one hand to India, the Far East and Australia, and on the other hand to Zanzibar and the Cape.

In 1839 the population was less than 1000, but in 1901 it had grown to 43,974. The gross revenue (1901–1902) was Rs. 37,25,915. There are three printing-presses, of which one is in the gaol and the other two belong to a European and a Parsee firm of merchants. The port is visited yearly by some 1300 steamers with a tonnage of 2½ million tons. The principal articles of import are coffee, cotton-piece goods, &c., grain, hides, coal, opium, cotton-twist and yarn. The exports are, in the main, a repetition of the imports. Of the total imports nearly one-third come from the east coast of Africa, and another third from Arabia. Of the total exports, nearly one-third again go to the east coast of Africa. The Aden brigade belongs to the western army corps of India.

ADENÈS (Adenez or Adans), surnamed **LE ROI**, French trouvère, was born in Brabant about 1240. He owed his education to the kindness of Henry III., duke of Brabant, and he remained in favour at court for some time after the death (1261) of his patron. In 1269 he entered the service of Guy de Dampierre, afterwards count of Flanders, probably as *roi des ménestrels*, and followed him in the next year on the abortive crusade in Tunis in which Louis IX. lost his life. The expedition returned by way of Sicily and Italy, and Adenès has left in his poems some very exact descriptions of the places through which he passed. The purity of his French and the absence of provincialisms point to a long residence in France, and it has been suggested that Adenès may have followed Mary of Brabant thither on her marriage with Philip the Bold. He seems, however, to have remained in the service of Count Guy, although he made frequent visits to Paris to consult the annals preserved in the abbey of St Denis. The poems written by Adenès are four: the *Enfances Ogier*, an enfeebled version of the *Chevalerie Ogier de Danemarche* written by Raimbert de Paris at the beginning of the century; *Berte aus granspiés*, the history of the mother of Charlemagne, founded on well-known traditions which are also preserved in the anonymous *Chronique de France*, and in the *Chronique rimée* of Philippe Mousket; *Bueves de Comarchis*, belonging to the cycle of romance gathered round the history of Aimeri de Narbonne; and a long *roman d'aventures*, *Cléomadès*, borrowed from Spanish and Moorish traditions brought into France by Blanche, daughter of Louis IX., who after the death of her Spanish husband returned to the French court. Adenès probably died before the end of the 13th century.

The romances of Adenès were edited for the Académie Impériale et Royale of Brussels by A. Scheler and A. van Hasselt in 1874; *Berte* was rendered into modern French by G. Hecq (1897) and by R. Périé (1900); *Cléomadès*, by Le Chevalier de Chatelain (1859). See also the edition of *Berte* by Paulin Paris (1832); an article by the same writer in the *Hist. litt. de la France*, vol. xx. pp. 679-718; Léon Gautier, *Les épopées françaises*, vol. iii., &c.

ADENINE, or 6-AMINO-PURIN, $C_5H_5N_5$, in chemistry, a basic substance which has been obtained as a decomposition product of nuclein, and also from the pancreatic glands of oxen. It has been synthesized by E. Fischer (*Berichte*, 1897, 30, p. 2238) by heating 2.6.8-trichlorpurin with 10 times its weight of ammonia for six hours at 100° C.; by this means 6-amino-2.8-dichlorpurin is obtained, which on reduction by means of hydriodic acid and phosphonium iodide is converted into adenine. In 1898 E. Fischer also obtained it from 8-oxy-2.6-dichlorpurin *Berichte*, 1898, 31, p. 104). It crystallizes in long needles; forms salts $C_5H_5N_5 \cdot 2HI$ and $(C_5H_5N_5)_2 \cdot H_2SO_4 \cdot 2H_2O$, and is converted by nitrous acid into hypoxanthine or 6-oxypurin. On heating with hydrochloric acid at 180–200° C. it is decomposed; the products of the reaction being glycocoll, ammonia, formic acid and carbon dioxide. Various methyl derivatives of adenine have been described by E. Fischer (*Berichte*, 1898, 31, p. 104) and by M. Kruger (*Zeit. für physiol. Chemie*, 1894, 18, p. 434). For the constitution of adenine see PURIN.

ADENOIDS, or ADENOID GROWTHS (from Gr. ἀδενοειδής, glandular), masses of soft, spongy tissue between the back of the nose and throat, occurring mostly in young children; blocking the air-way, they prevent the due inflation of the lungs and the proper development of the chest. The growths are apt to keep up a constant catarrh near the orifice of the ventilating tubes which pass from the throat to the ear, and so render the child dull of hearing or even deaf. They also give rise to asthma, and like enlarged tonsils—with which they are often associated—they impart to the child a vacant, stupid expression, and hinder his physical and intellectual development. They cause his voice to be "stuffy," thick, and unmusical. Though, except in the case of a cleft palate, they cannot be seen with the naked eye, they are often accompanied by a visible and suggestive granular condition of the wall at the back of the throat. Their presence may easily be determined by the medical attendant gently hooking the end of the index-finger round the back of the soft palate. If the tonsils are enlarged it is kinder to postpone this digital examination of the throat until the child is under the influence of an anaesthetic for operation upon the tonsils, and if adenoids are present they can be removed at the same time that the tonsils are dealt with. Though the disease is a comparatively recent discovery, the pioneer in its treatment being Meyer of Copenhagen, it has probably existed as long as tuberculosis itself, with which affection it is somewhat distantly connected. In the unenlightened days many children must have got well of adenoids without operation, and even at the present time it by no means follows that because a child has these postnasal vegetations he must forthwith be operated on. The condition is very similar to that of enlarged tonsils, where with time, patience and attention to general measures, operation is often rendered unnecessary. But if the child continues to breathe with his mouth open and to snore at night, if he remains deaf and dull, and is troubled with a chronic "cold in his head," the question of thorough exploration of the naso-pharynx and of a surgical operation should most certainly be considered. In recent years the comparatively simple operation for their removal has been very frequently performed, and, as a rule, with marked benefit, but this treatment should always be followed by a course of instruction in respiratory exercises; the child must be taught regularly to fill his lungs and make the tidal air pass through the nostrils. These respiratory exercises may be resorted to before operation is proposed, and in some cases they may render operative treatment unnecessary. Operations should not be performed in cold weather or in piercing east winds, and it is advisable to keep the child indoors for a day or two subsequent to its performance. To expose a child just after operating on his throat to the risks of a journey by train or omnibus is highly inadvisable. Although the operation is not a very painful one, it ought not to be performed upon a child except under the influence of chloroform or some other general anaesthetic. (E. O.*)

ADEPT (if used as a substantive pronounced *ad*ept, if as an adjective ad*ept*; from Lat. *adeptus*, one who has attained), completely and fully acquainted with one's subject, an expert. The word implies more than acquired proficiency, a natural inborn aptitude. In olden times an adept was one who was versed in magic, an alchemist, one who had attained the great secrets of the unknown.

ADERNÒ, a town of the province of Catania, Sicily, 22 m. N.W. of the town of that name. Pop. (1901) 25,859. It occupies the site of the ancient Adranon, which took its name from Adranos, a god probably of Phoenician origin, in Roman times identified with Vulcan, whose chief temple was situated here, and was guarded by a thousand huge gods; there are perhaps some substructures of this building still extant outside the town. The latter was founded about 400 B.C. by Dionysius I.; very fine remains of its walls are preserved. For a time it was the headquarters of Timoleon, and it was the first town taken by the Romans in the First Punic War (263 B.C.). In the centre of the modern town rises the castle, built by Roger I.; in the chapel are frescoes representing his granddaughter, Adelasia, who founded the convent of St Lucia in 1157, taking the veil. The columns in the principal church are of black lava.

See P. Russo, *Illustrazione storica di Adernò* (Adernò, 1897).

ADEVISM, a term introduced by Max Müller to imply the denial of gods (Sans. *deva*), on the analogy of Atheism, the denial of God. Max Müller used it particularly in connexion with the Vedanta philosophy for the correlative of ignorance or nescience (Gifford lectures, 1892, c. ix.).

ADHÉMAR DE CHABANNES (*c.* 988–*c.* 1030), medieval historian, was born about 988 at Chabannes, a village in the French department of Haute-Vienne. Educated at the monastery of St Martial at Limoges, he passed his life as a monk, either at this place or at the monastery of St Cybard at Angoulême. He died about 1030, most probably at Jerusalem, whither he had gone on a pilgrimage. Adhémar's life was mainly spent in writing and transcribing chronicles, and his principal work is a history entitled *Chronicon Aquitanicum et Francicum* or *Historia Francorum*. This is in three books and deals with Frankish history from the fabulous reign of Pharamond, king of the Franks, to A.D. 1028. The two earlier books are scarcely more than a copy of the *Gesta regum Francorum*, but the third book, which deals with the period from 814 to 1028, is of considerable historical importance. This is published in the *Monumenta Germaniae historica. Scriptores.* Band iv. (Hanover and Berlin, 1826–1892). He also wrote *Commemoratio abbatum Lemovicensium* *basilicae S. Martialis apostoli* (848–1029) and *Epistola ad Jordanum Lemovicensem episcopum et alios de apostolatu S. Martialis*, both of which are published by J. P. Migne in the *Patrologia Latina*, tome cxli. (Paris, 1844–1855).

See F. Arbellot, *Étude historique et littéraire sur Adémar de Chabannes* (Limoges, 1873); J. F. E. Castaigne, *Dissertation sur le lieu de naissance et sur la famille du chroniqueur Adémar, moine de l'abbaye de St Cybard d'Angoulême* (Angoulême, 1850).

ADHÉMAR (ADÉMAR, AIMAR, AELARZ) **DE MONTEIL** (d. 1098), one of the principal personages of the first crusade, was bishop of Puy en Velay from before 1087. At the council of Clermont in 1095 he showed great zeal for the crusade, and having been named apostolic legate by the pope, he accompanied Raymond IV., count of Toulouse, to the east. He negotiated with Alexis Comnenus at Constantinople, re-established at Nicaea some discipline among the crusaders, caused the siege of Antioch to be raised and died in that city of the plague on the 1st of August 1098.

See the article by C. Kohler in *La Grande Encyclopédie; Bibliographie du Velay* (1902), 640-650.

ADHESION (from Lat. *adhaerere*, to adhere), the process of adhering or clinging to anything. In a figurative sense, adhesion (like "adherent") is used of any attachment to a party or movement; but the word is also employed technically in psychology, pathology and botany. In psychology Bain and others use it of association of ideas and action; in pathology an adhesion is an abnormal union of surfaces; and in botany "adhesion" is used of dissimilar parts, *e.g.* in floral whorls, in opposition to "cohesion," which applies to similar parts, *e.g.* of the same whorl.

ADIAPHORISTS (Gr. ἀδιάφορος, indifferent). The Adiaphorist controversy among Lutherans was an issue of the provisional scheme of compromise between religious parties, pending a general council, drawn up by Charles V., sanctioned at the diet of Augsburg, 15th of May 1548, and known as the Augsburg Interim. It satisfied neither Catholics nor Protestants. As head of the Protestant party the young elector Maurice of Saxony negotiated with Melanchthon and others, and at Leipzig, on the 22nd of December 1548, secured their acceptance of the Interim as regards *adiaphora* (things indifferent), points neither enjoined nor forbidden in Scripture. This sanctioned jurisdiction of Catholic bishops, and observance of certain rites, while all were to accept justification by faith (relegating *sola* to the *adiaphora*). This modification was known as the Leipzig Interim; its advocates were stigmatized as Adiaphorists. Passionate opposition was led by Melanchthon's colleague, Matth. Flacius, on the grounds that the imperial power was not the judge of *adiaphora*, and that the measure was a trick to bring back popery. From Wittenberg he fled, April 1549, to Magdeburg, making it the headquarters of rigid Lutheranism. Practically the controversy was concluded by the religious peace ratified at Augsburg (Sept. 25, 1555), which left princes a free choice between the rival confessions, with the right to impose either on their subjects; but much bitter internal strife was kept up by Protestants on the theoretical question of *adiaphora*; to appease this was one object of the Formula Concordiae, 1577. Another *Adiaphorist* controversy between Pietists and their opponents, respecting the lawfulness of amusements, arose in 1681, when Anton Reiser (1628–1686) denounced the opera as antichristian.

See arts. by J. Gottschick in A. Hauck's *Realencyklopädie* (1896); by Fritz in I. Goschler's *Dict. Encyclop. de la Théol. Cath.* (1858); other authorities in J. C. L. Gieseler, *Ch. Hist.* (N. York ed., 1868, vol. iv.); monograph by Erh. Schmid, *Adiaphora, wissenschaftlich und historisch untersucht* (1809), from the rigorist point of view.

ADIGE (Ger. *Etsch*, anc. *Athesis*), a considerable river in North Italy. The true source of the Adige is in some small lakes on the summit of the Reschen Scheideck Pass (4902 ft.), and it is swollen by several other streams, near Glurns, where the roads over the Ofen and the Stelvio Passes fall in. It thence flows east to Meran, and then south-east to Botzen, where it receives the Eisak (6 ft.), and becomes navigable. It then turns south-west, and, after receiving the Noce (right) and the Avisio (left), leaves Tirol, and enters Lombardy, 13 m. south of Rovereto. After traversing North Italy, in a direction first southerly and then easterly, it falls into the Adriatic at Porto Fossone, a few miles north of the mouth of the Po. The most considerable towns on its banks (south of Botzen) are Trent and Rovereto, in Tirol, and Verona and Legnago, in Italy. It is a very rapid river, and subject to sudden swellings and overflowings, which cause great damage to the surrounding country. It is navigable from the heart of Tirol to the sea. In Lombardy it has a breadth of 200 yds., and a depth of 10 to 16 ft., but the strength of the current renders its navigation very difficult, and lessens its value as a means of transit between Germany and Italy. The Adige has a course of about 220 m., and, after the Po, is the most important river in Italy. In Roman times it flowed, in its lower course, much farther north than at present, along the base of the Euganean hills, and entered the sea at Brondolo. In A.D. 587 the river broke its banks, and the main stream took its present course, but new streams opened repeatedly to the south, until now the Adige and the Po form conjointly one delta. (W. A. B. C.)

ADIPOCERE (from the Lat. *adeps*, fat, and *cera*, wax), a substance into which animal matter is sometimes converted, and so named by A. F. Fourcroy, from its resemblance to both fat and wax. When the Cimetière des Innocens at Paris was removed in 1786–1787, great masses of this substance were found where the coffins containing the dead bodies had been placed very closely together. The whole body had been converted into this fatty matter, except the bones, which remained, but were extremely brittle. Chemically, adipocere consists principally of a mixture of fatty acids, glycerine being absent. Saponification with potash liberates a little ammonia (about 1%), and gives a mixture of the potassium salts of palmitic, margaric and oxymargaric acids. The insoluble residue consists of lime, &c., derived from the tissues. The artificial formation of adipocere has been studied; it appears that it is not formed from albuminous matter, but from the various fats in the body collecting together and undergoing decomposition.

ADIRONDACKS, a group of mountains in north-eastern New York, U.S.A., in Clinton, Essex, Franklin and Hamilton counties, often included by geographers in the Appalachian system, but pertaining geologically to the Laurentian highlands of Canada. They are bordered on the E. by Lake Champlain, which separates them from the Green Mountains. Unlike the Appalachians, the Adirondacks do not form a connected range, but consist of many summits, isolated or in groups, arranged with little appearance of system. There are about one hundred peaks, ranging from 1200 to 5000 ft. in height; the highest peak, Mt. Marcy (called by the Indians Tahawus or "cloud-splitter"), is near the eastern part of the group and attains an elevation of 5344 ft. Other noted peaks are M'Intyre (5210 ft.), Haystack (4918), Dix (4916) and Whiteface (4871). These mountains, consisting of various sorts of gneiss, intrusive granite and gabbro, have been formed partly by faulting but mainly by erosion, the lines of which have been determined by the presence of faults or the presence of relatively soft rocks. Lower Palaeozoic strata lap up on to the crystalline rocks on all sides of the mountain group. The region is rich in magnetic iron ores, which though mined for many years are not yet fully developed. Other mineral products are graphite, garnet used as an abrasive, pyrite and zinc ore. The mountains form the water-parting between the Hudson and the St Lawrence rivers. On the south and south-west the waters flow either directly into the Hudson, which rises in the centre of the group, or else reach it through the Mohawk. On the north and east the waters reach the St Lawrence by way of Lakes George and Champlain, and on the west they flow directly into that stream or reach it through Lake Ontario. The most important streams within the area are the Hudson, Black, Oswegatchie, Grass, Raquette, Saranac and Ausable rivers. The region was once covered, with the exception of the higher summits, by the Laurentian glacier, whose erosion, while perhaps having little effect on the larger features of the country, has greatly modified it in detail, producing lakes and ponds, whose number is said to exceed 1300, and causing many falls and rapids in the streams. Among the larger lakes are the Upper and Lower

Saranac, Big and Little Tupper, Schroon, Placid, Long, Raquette and Blue Mountain. The region known as the Adirondack Wilderness, or the Great North Woods, embraces between 5000 and 6000 sq. m. of mountain, lake, plateau and forest, which for scenic grandeur is almost unequalled in any other part of the United States. The mountain peaks are usually rounded and easily scaled, and as roads have been constructed over their slopes and in every direction through the forests, all points of interest may be easily reached by stage. Railways penetrate the heart of the region, and small steamboats ply upon the larger lakes. The surface of most of the lakes lies at an elevation of over 1500 ft. above the sea; their shores are usually rocky and irregular, and the wild scenery within their vicinity has made them very attractive to the tourist. The mountains are easily reached from Plattsburgh, Port Kent, Herkimer, Malone and Saratoga Springs. Every year thousands spend the summer months in the wilderness, where cabins, hunting lodges, villas and hotels are numerous. The resorts most frequented are in the vicinity of the Saranac and St Regis lakes and Lake Placid. In the Adirondacks are some of the best hunting and fishing grounds in the eastern United States. Owing to the restricted period allowed for hunting, deer and small game are abundant, and the brooks, rivers, ponds and lakes are well stocked with trout and black bass. At the head of Lake Placid stands Whiteface Mountain, from whose summit one of the finest views of the Adirondacks may be obtained. Two miles south-east of this lake, at North Elba, is the old farm of the abolitionist John Brown, which contains his grave and is much frequented by visitors. Lake Placid is the principal source of the Ausable river, which for a part of its course flows through a rocky chasm from 100 to 175 ft. deep and rarely over 30 ft. wide. At the head of the Ausable Chasm are the Rainbow Falls, where the stream makes a vertical leap of 70 ft. Another impressive feature of the Adirondacks is Indian Pass, a gorge about eleven miles long, between Mt. M'Intyre and Wallface Mountain. The latter is a majestic cliff rising vertically from the pass to a height of 1300 ft. Keene Valley, in the centre of Essex county, is another picturesque region, presenting a pleasing combination of peaceful valley and rugged hills. Though the climate during the winter months is very severe—the temperature sometimes falling as low as −42° F.—it is beneficial to persons suffering from pulmonary troubles, and a number of sanitariums have been established. The region is heavily forested with spruce, pine and broad-leaved trees. Lumbering is an important industry, but it has been much restricted by the creation of a state forest preserve, containing in 1907, 1,401,482 acres, and by the purchase of large tracts for game preserves and recreation grounds by private clubs. The so-called Adirondack Park, containing over 3,000,000 acres, includes most of the state preserve and large areas held in private ownership.

For a description of the Adirondacks, see S. R. Stoddard, *The Adirondacks Illustrated* (24th ed., Glen Falls, 1894); and E. R. Wallace, *Descriptive Guide to the Adirondacks* (Syracuse, 1894). For geology and mineral resources consult the *Reports of the New York State Geologist* and the *Bulletins of the New York State Museum.*

ADIS ABABA ("the new flower"), the capital of Abyssinia and of the kingdom of Shoa, in 9° 1′ N., 38° 56′ E., 220 m. W. by S. of Harrar, and about 450 m. S.W. of Jibuti on the Gulf of Aden. Adis Ababa stands on the southern slopes of the Entotto range, at an altitude of over 8000 ft., on bare, grassy undulations, watered by small streams flowing S.S.E. to the Hawash. It is a large straggling encampment rather than a town, with few buildings of any architectural merit. The Gebi or royal enclosure completely covers a small hill overlooking the whole neighbourhood, while around it are the enclosures of the abuna and principal nobles, and the residences of the foreign ministers. The principal traders are Armenians and Hindus. About a mile north-east of the palace is the military camp. On the hills some five miles to the north, 1500 ft. above the camp, are the ruins of an old fortress, and the churches of St Raguel and St Mariam. The town is in telegraphic communication with Massawa, Harrar and Jibuti. It was founded by Menelek II. in 1892 as the capital of his kingdom in succession to Entotto, a deserted settlement some ten or twelve miles north of Adis Ababa.

ADJECTIVE (from the Lat. *adjectivus*, added), a word used chiefly in its grammatical sense of limiting or defining the noun to which it refers. Formerly grammarians used not to separate a noun from its adjective, or attribute, but spoke of them together as a noun-adjective. In the art of dyeing, certain colours are known as adjective colours, as they require mixing with some basis to render them permanent. "Adjective law" is that which relates to the forms of procedure, as opposed to "substantive law," the rules of right administered by a court.

ADJOURNMENT (through the French from the Late Lat. *adjurnare*, to put off until or summon for another day), the act of postponing a meeting of any private or public body, particularly of parliament, or any business, until another time, or indefinitely (in which case it is an adjournment *sine die*). The word applies also to the period during which the meeting or business stands adjourned.

ADJUDICATION (Lat. *adjudicatio; adjudicare*, to award), generally, a trying or determining of a case by the exercise of judicial power; a judgment. In a more technical sense, in English and American law, an adjudication is an order of the bankruptcy courts by which a debtor is adjudged bankrupt and his property vested in a trustee. It usually proceeds from a resolution of the creditors or where no composition or scheme of arrangement has been proposed by the debtor. It may be said to consummate bankruptcy, for not till then does a debtor's property actually vest in a trustee for division among the creditors, though from the first act of bankruptcy till adjudication it is protected by a *receiving order*. As to the effect which adjudication has on the bankrupt, see under BANKRUPTCY. The same process in Scots law is called sequestration. In Scots law the term "adjudication" has quite a different meaning, being the name of that action by which a creditor attaches the heritable, *i.e.* the real, estate of his debtor, or his debtor's heir, in order to appropriate it to himself either in payment or security of his debt. The term is also applied to a proceeding of the same nature by which the holder of a heritable right, labouring under any defect in point of form, gets that defect supplied by decree of a court.

ADJUNCT (from Lat. *ad*, to, and *jungere*, to join), that which is joined on to another, not an essential part, and inferior to it in mind or function, but which nevertheless amplifies or modifies it. Adverbs and adjectives are adjuncts to the words they qualify. Learning, says Shakespeare, is an "adjunct to ourself" (*Love's Labour's Lost*, IV. iii. 314). Twelve members of the Royal Academy of Sciences in Paris are called "adjuncts."

ADJUSTMENT (from late Lat. *ad-juxtare*, derived from *juxta*, near, but early confounded with a supposed derivation from *justus*, right), regulating, adapting or settling; in commercial law, the settlement of a loss incurred at sea on insured goods. The calculation of the amounts to be made good to and paid by the several interests is a complicated matter. It involves much detail and arithmetic, and requires a full and accurate knowledge of the principles of the subject. Such adjustments are made by men called adjusters, who make the subject their profession. In Great Britain they are for the most part members of the Average Adjusters' Association (1870), a body which has done much careful work with a view to making and keeping the practice uniform and in accord with right principles. This association has gradually formulated, at their annual meetings, a body of practical rules which the individual members undertake to observe. (See AVERAGE and INSURANCE, *Marine.*)

ADJUTAGE (from Fr. *ajutage*, from *ajouter*, to join on; an older English form was "adjustage"), a mouthpiece or nozzle, so formed as to facilitate the outflow of liquids from a vessel or pipe. (See HYDRAULICS.)

ADJUTANT (from Lat. *adjutare*, to aid), a helper or junior in command, one who assists his superior, especially an officer who acts as an assistant to the officer commanding a corps of troops. In the British army the appointment of adjutant is held by a captain or lieutenant. The adjutant acts as staff officer to the commanding officer, issues his orders, superintends the work of the orderly room and the general administration of the corps, and is responsible for musketry duties and the training of recruits. Regular officers are appointed as adjutants to all units of the auxiliary forces. On the European continent the word is not restricted to the lower units of organization; for example, in Germany the *Adjutantur* includes all "routine" as distinct from "general" staff officers in the higher units, and the aides-de-camp of royal persons and of the higher commanders are also styled adjutant-generals, flügel-adjutanten, &c. For the so-called adjutant bird see Jabiru.

ADJUTANT-GENERAL, an army official, originally (as indicated by the word) the chief assistant (Lat. *adjuvare*) staff-officer to a general in command, but now a distinct high functionary at the head of a special office in the British and American war departments. In England the second military member of the Army Council is styled adjutant-general to the forces. He is a general officer and at the head of his department of the War Office, which is charged with all duties relative to personnel. The adjutant-general of the United States army is one of the principal officers in the war department, the head of the bureau for army correspondence, with the charge of the records, recruiting, issue of commissions, &c. Individual American states also have their own adjutant-general, with cognate duties regarding the state militia. In many countries, such as Germany and Russia, the term has retained its original meaning of an officer on the personal staff, and is the designation of personal *aides-de-camp* to the sovereign.

By a looseness of translation, the superintendents of provinces, in the order of Jesuits, who act as officials under the superintendence of and auxiliary to the general, are sometimes called *adjutants-general.*

ADLER, FELIX (1851–   ), American educationalist, was born at Alzey, Germany, on the 13th of August 1851. His father, a Jewish rabbi, emigrated to the United States in 1857, and the son graduated at Columbia College in 1870. After completing his studies at Berlin and Heidelberg, he became, in 1874, professor of Hebrew and Oriental Literature at Cornell University. In 1876 he established in New York City the Society for Ethical Culture, to the development and extension of which he devoted a great deal of time and energy, and before which he delivered a regular Sunday lecture. In 1902 he became professor of political and social ethics at Columbia University. He also acted as one of the editors of the *International Journal of Ethics.* Under his direction the Society for Ethical Culture became an important factor in educational reform in New York City, exercising through its technical training school and kindergarten (established in January 1878) a wide influence. Dr Adler also took a prominent part in philanthropic and social reform movements, such as the establishment of a system of district nursing, the erection of model tenement houses, and tenement house reform. He published *Creed and Deed* (1877), *The Moral Instruction of Children* (1892), *Life and Destiny* (1903), *Marriage and Divorce* (1905), and *The Religion of Duty* (1905).

ADMETUS, in Greek legend, son of Pheres, king of Pherae in Thessaly. By the aid of Apollo, who served him as a slave—either as a punishment for having slain the Cyclopes, or out of affection for his mortal master—he won the hand of Alcestis, the most beautiful of the daughters of Pelias, king of Iolcus. When Admetus was attacked by an illness that threatened to lead to his premature death, Apollo persuaded the Moerae (Fates) to prolong his life, provided any one could be found to die in his place. His parents refused, but Alcestis consented. She is said to have been rescued from the hands of Death by Heracles, who arrived upon the scene at an opportune moment; a later story represents her as cured of a dangerous illness by his skill.

Homer, *Iliad,* ii. 715; Apollodorus, i. 9; Euripides, *Alcestis*; Plutarch, *Amatorius,* 17; Dissel, *Der Mythus von Admetos und Alkestis,* progr. Brandenburg, 1882.

ADMINISTRATION (Lat. *administrare,* to serve), the performance or management of affairs, a term specifically used in law for the administration or disposal of the estate of a deceased person (see Will or Testament). It is also used generally for "government," and specifically for "the government" or the executive ministry, and in such connexions as the administration (administering or tendering) of the sacraments, justice, oaths, medicines, &c.

Letters of Administration.—Upon the death of a person intestate or leaving a will to which no executors are appointed, or when the executors appointed by the will cannot or will not act, the Probate Division of the High Court is obliged to appoint an administrator who performs the duties of an executor. This is done by the court granting letters of administration to the person entitled. Grants of administration may be either general or limited. A general grant is made where the deceased has died intestate. The order in which general grants of letters will be made by the court is as follows: (1) The husband, or widow, as the case may be; (2) the next of kin; (3) the crown; (4) a creditor; (5) a stranger. Since the Land Transfer Act 1897, the administrator is the real as well as the personal representative of the deceased, and consequently when the estate to be administered consists wholly or mainly of reality the court will grant administration to the heir to the exclusion of the next of kin. In the absence of any heir or next of kin the crown is entitled to the personality as *bona vacantia,* and to the reality by escheat. If a creditor claims and obtains a grant he is compelled by the court to enter into a bond with two sureties that he will not prefer his own debt to those of other creditors. The more important cases of grants of special letters of administration are the following:—

Administration *cum testamento annexo,* where the deceased has left a will but has appointed no executor to it, or the executor appointed has died or refuses to act. In this case the court will make the grant to the person (usually the residuary legatee) with the largest beneficial interest in the estate.

Administration *de bonis non administratis*: this occurs in two cases—(*a*) where the executor dies intestate after probate without having completely administered the estate; (*b*) where an administrator dies. In the first case the principle of administration *cum testamento* is followed, in the second that of general grants in the selection of the person to whom letters are granted.

Administration *durante minore aetate,* when the executor or the person entitled to the general grant is under age.

Administration *durante absentia,* when the executor or administrator is out of the jurisdiction for more than a year.

Administration *pendente lite,* where there is a dispute as to the person entitled to probate or a general grant of letters the court appoints an administrator till the question has been decided.

ADMINISTRATOR, in English law, the person to whom the Probate Division of the High Court of Justice (formerly the ordinary or judge of the ecclesiastical court) acting in the sovereign's name, commits the administration (*q.v.*) of the goods of a person deceased, in default of an executor. The origin of administrators is derived from the civil law. Their establishment in England is owing to a statute made in the 31st year of Edward I. (1303). Till then no office of this kind was known besides that of executor; in default of whom, the ordinary had the disposal of goods of persons intestate, &c. (See also Executors, and, for intestate estates, Intestacy.)

Administrator, in *Scots law,* is a person legally empowered to act for another whom the law presumes incapable of acting for himself, as a father for a pupil child.

ADMIRAL, the title of the general officer who commands a fleet, or subdivision of a fleet. The origin of the word is undoubtedly Arabic. In the 12th century the Mediterranean states which had close relations with the Moslem powers on the shores or in the islands of that sea, found the title amir or emir in combination with other words used to describe men in authority; the amir-al-mumenin—prince of the faithful—or amir-al-bahr—commander of the sea. They took the substantive "amir" and the article "al" to form one word, "amiral" or "ammiral" or "almirante." The Spaniards made miramamolin, out of amiral-mumenin, in the same way. "Amiral," as the name of an eastern ruler, became familiar to the northern nations during the crusades. Layamon, writing in the early years of the 13th century, speaks of the "ammiral of Babilon," and the word was for long employed in this sense. As a naval title it was first taken by the French from the Genoese during the crusade of 1249. By the end of the 13th century it had come to be used in England as the name of the officer who commanded the Cinque Port ships. The English form "admiral" arose from popular confusion with the Latin *admirabilis.* Such errors were naturally produced by the fantastic etymology of the middle ages. In Spain, Alphonso the Wise of Castile, in his code of laws, the *Siete Partidas* (Seven Divisions), accounts for the Spanish form "almirante" by its supposed derivation from the Latin *admirari,* since the admiral is "to be admired" for the difficulties and dangers he overcomes, and because he is the chief of those who see the wonders of the Lord in the deep—*mirabilia ejus (sc. Domini) in profundo.* Both in Spanish and in Elizabethan English the word has been applied to the flagship of an officer commanding a fleet or part of one. The Spanish *almiranta* is the ship of the second in command, and the *capitana* of the first. In this sense it is not uncommonly found in the narratives of Elizabethan voyages or campaigns, and it is so used by Milton in *Paradise Lost*—"the mast of some tall ammiral."

As the title of an office it was borne by the great military, judicial and administrative officer known in France as *grand amiral*; in England as lord high admiral; in Spain as *almirante mayor.* His functions, which were wide, have been generally absorbed by the crown, or the state, and have been divided among judicial and administrative officials (see NAVY, *History*; ADMIRALTY ADMINISTRATION; and ADMIRALTY JURISDICTION). The title of admiral is still borne as an hereditary honour by the descendants of Columbus, the dukes of Veraqua, in Spain. It is a purely honorific distinction representing the admiralship of the islands and Ocean Sea, conferred on the discoverer by the Catholic sovereigns, Ferdinand and Isabella.

In the staff of a modern navy the admirals correspond to the general officers in the army. Where, as in Russia, the grand admiralship is annexed to the crown, the highest rank is that of lieutenant admiral general. In Great Britain there is the rank of admiral of the fleet, corresponding to field-marshal. It is, however, little more than an honorary distinction. The three active ranks are those of admiral, vice-admiral and rear-admiral, corresponding to general, lieutenant-general and major-general in the army. They are found in all navies under very slightly varied forms. The only difference which is not one of mere spelling is in the equivalent for rear-admiral, which is *contre amiral* in French, and in other navies of the continent of Europe involves some slight variation of the word "contre" (first used at the time of the French Revolution). The vice- and rear-admiral of Great Britain are again honorary titles, without the active functions, conferred in compliment on senior naval officers. "Admiral" is also the name given to the chief of fishery fleets. On the banks of Newfoundland it was given to officials who had powers conferred by the state. In the case of an ordinary fishing-fleet in European waters, it is of private origin, and is of merely customary use.

AUTHORITIES.—Sir N. Harris Nicolas, *History of the Royal Navy*; La Roncière, *Histoire de la marine française*; Yonge, *Geschiedenis van het Nederlandsche Zeewezen*; C. Fernandez Duro, *Historia de la Armada de Castilea.* (D. H.)

ADMIRALTY ADMINISTRATION. 1. *The Administrative System.*—That the navy (*q.v.*) is the only real defence of the British islands has been recognized by English people ever since the days of King Offa, who died in 796, leaving to his successors the admirable lesson that "he who would be secure on land must be supreme at sea." The truth of the lesson thus learnt is sanctioned by all the experience of English history, and parliament has repeatedly enforced the fact. The navy is the only force that can safeguard the British islands from hostile descents; it is the only force that can protect their vast sea-borne commerce and food supplies; by giving safety to the home country it sets British troops free for operations abroad, and makes their passage secure; and thus, as also by giving command of the sea, the fleet is the means by which the empire is guarded and has become a true imperial bond. It is natural for British admiralty administration to be taken here as the type of an efficient system.

British Empire.

The Board of Admiralty.

British naval administration is conducted by the Board of Admiralty, and the function of that board is the maintenance and expansion of the fleet in accordance with the policy of the government, and the supplying of it with trained officers and men; its distribution throughout the world; and its preservation in readiness and efficiency in all material and personal respects. The character of the Admiralty Board is peculiar to the British constitution, and it possesses certain features which distinguish it from other departments of the state. The business it conducts is very great and complex, and the machinery by which its work is done has grown with the expansion of that business. The whole system of naval administration has been developed historically, and is not the product of the organizing skill of one or a few individuals, but an organic growth possessing marked and special characteristics. The Admiralty Board derives its character from the fact that it represents the lord high admiral, and that its powers and operation depend much more upon usage than upon those instruments which actually give it authority, and which, it may be remarked, are not in harmony among themselves. The executive operations are conducted by a series of civil departments which have undergone many changes before reaching their present constitution and relation to the Board. The salient characteristic of the admiralty is a certain flexibility and elasticity with which it works. Its members are not, in a rigid sense, heads of departments. Subject to the necessary and constitutional supremacy of the cabinet minister at their head, they are jointly and co-equally "commissioners for executing the office of high admiral of the United Kingdom, and of the territories thereunto belonging, and of high admiral of the colonies and other dominions." The members of the Board are in direct and constant communication with the first lord and with one another, as also with the civil departments which work under their control. It was enjoined by James I. that the principal officers and commissioners of the navy should be in constant communication among themselves, consulting and advising "by common council and argument of most voices," and should live as near together as could conveniently be, and should meet at the navy office at least twice a week. This system of intercommunication still exists in a manner which no system of minutes could give; and it may be remarked, as illustrative of the flexibility of the system, that a Board may be formed on any emergency by two lords and a secretary, and a decision arrived at then and there. Such an emergency board was actually constituted some years ago on board the admiralty yacht in order to deal on the instant with an event which had just occurred in the fleet. At the same time it must be remarked that, in practice, the first lord being personally responsible under the orders in council, the operations of the Board are dependent upon his direction.

History.

The present system of administering the navy dates from the time of Henry VIII. The naval business of the country had so greatly expanded in his reign that we find the Admiralty and Navy Board reorganized or established; and it is worthy of remark that there existed at the time an ordnance branch, the navy not yet being dependent in that matter upon the War Department.[1] The Navy Board administered the civil departments under the admiralty, the directive and executive duties of the lord high admiral remaining with the admiralty office. A little later the civil administration was vested in a board of principal officers subordinate to the lord high admiral, and we can henceforth trace the work of civil administration being conducted under the navy and victualling boards apart from, but yet subject to, the admiralty itself. This was a system which continued during the time of all the great wars, and was not abolished until 1832, when Sir James Graham, by his reforms, put an end to what appeared a divided control. Whatever may have been the demerits of that system, it sufficed to maintain the navy in the time of its greatest achievements, and through all the wars which were waged with the Spaniards, the Dutch and the French. The original authority for the present constitution of the Admiralty Board is found in a declaratory act (Admiralty Act 1690), in which it is enacted that "all and singular authorities, jurisdictions and powers which, by act of parliament or otherwise, had been lawfully vested" in the lord high admiral of England had always appertained, and did and should appertain, to the commissioners for executing the office for the time being "to all intents and purposes as if the said commissioners were lord high admiral of England." The admiralty commission was dissolved in 1701, and reconstituted on the death of Prince George of Denmark, lord high admiral in 1709. From that time forward, save for a short period in 1827–1828, when the duke of Clarence was lord high admiral, the office has remained in commission.

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[1] The Board of Ordnance was originally instituted for the navy, but eventually fell into military hands, to the detriment of the navy—the only navy of any nation that has not full authority over its own ordnance. In 1653, according to Oppenheim, it was, owing to its inefficiency, placed under the admiralty. In 1632 it appears to have been independent, but "still retained that evil pre-eminence in sloth and incapacity it had already earned and has never since lost."

A number of changes have been made since the amalgamation of the admiralty and the Navy Board by Sir James Graham in 1832 (see NAVY, *History*), but the general principle remains the same, and the constitution of the Admiralty Board and civil departments is described below. The Board consists of the first lord and four naval lords with a civil lord, who in theory are jointly responsible, and are accustomed to meet sometimes daily, but at all times frequently; and the system developed provides for the subdivision of labour, and yet for the co-ordinated exertion of effort. The system has worked well in practice, and has certainly won the approval and the admiration of many statesmen. Lord George Hamilton said, before the Royal Commission on Civil Establishments, 1887, that "It has this advantage, that you have all departments represented round a table, and that if it is necessary to take quick action, you can do in a few minutes that which it would take hours under another system to do"; and the report of the Royal Commission of 1889 remarked that "The constitution of the Board of Admiralty appears to us well designed, and to be placed under present regulations on a satisfactory footing."

Powers.

The special characteristics of the Admiralty Board which have been described are accompanied by a very peculiar and noteworthy feature, which is not without relation to the untrammelled and undefined operations of the admiralty. This feature arises from the discrepancy between the admiralty patent and the orders in council, for the admiralty is not administered according to the terms of the patent which invests it with authority, and its operations raise a singular point in constitutional law.

The legal origin of the powers exercised by the first lord and the Board itself is indeed curiously obscure. Under the patent the full power and authority are conferred upon "any two or more" of the commissioners, though, in the patent of Queen Anne, the grant was to "any three or more of you." It was under the Admiralty Act 1832 that two lords received the necessary authority to legalize any action of the Board; but already, under an act of 1822, two lords had been empowered to sign so long as the Board consisted of six members. We therefore find that the legal authority of the Board under the patent is vested in the Board; but in the order in council of the 14th of January 1869 the sole responsibility of the first lord was officially laid down, and in the order in council of the 19th of March 1872 the first lord was made "responsible to your Majesty and to parliament for all the business of the admiralty." As a matter of fact, the authority of the first lord, independent of his colleagues, had existed in an undefined manner from ancient times. Before a select committee of the House of Commons in 1861 the duke of Somerset stated that he considered the first lord responsible, that he had always "acted under that impression," and that he believed "all former first lords were of this opinion"; while Sir James Graham said that "the Board of Admiralty could never work, whatever the patent might be, unless the first lord were supreme, and did exercise constantly supreme and controlling authority." It is not, therefore, surprising to find that there has been undoubtedly direct government without a Board. Thus, in the operations conducted against the French channel ports in 1803–1804, Lord Melville, then first lord, took steps of great importance without the knowledge of his colleagues, though he afterwards bowed to their views, which did not coincide with his own. Again, when Lord Gambier was sent to Copenhagen in 1807, he was instructed to obey all orders from the king, through the principal secretary of state for war, and in this way received orders to attack Copenhagen, which were unknown to all but the first lord. In a similar way the secretary of the admiralty was despatched to Paris in 1815 with instructions to issue orders as if from the Board of Admiralty when directed to do so by the foreign secretary who accompanied him, and these orders resulted in Napoleon's capture. These instances were cited, except the first of them, by Sir James Graham before the select committee of the House of Commons in 1861, in order to illustrate the elastic powers under the patent which enabled the first lord to take immediate action in matters that concerned the public safety. It is not surprising that this peculiar feature of admiralty administration should have attracted adverse criticism, and have led some minds to regard the Board as "a fiction not worth keeping up."

Between 1860 and 1870 the sittings of the Board ceased to have the effective character they had once possessed. During the administration of Mr Childers,[1] first lord from 1868 to 1871 in Mr Gladstone's cabinet, a new system was introduced by which the free intercommunication of the members of the Board was hampered, and its sittings were quite discontinued. The case of the "Captain" led, however, to a return to the older practice. The "Captain" was a low freeboard masted turret ship, designed by Captain Cowper Phipps Coles, R.N. Competent critics believed that she would be unsafe, and said so before she was built; but the admiralty of Lord Derby's cabinet of 1866 gave their consent to her construction. She was commissioned early in 1870, and capsized in the Bay of Biscay on the 7th of September of that year. Mr Childers, who was nominally responsible for allowing her to be commissioned, distributed blame right and left, largely upon men who had not approved of the ship at all, and had been exonerated from all share of responsibility for allowing her to be built. The disaster was justly held to show that a civilian first lord cannot dispense with the advantage of constant communication with his professional advisers. When Mr Childers retired from the admiralty in March 1871, his successor, Mr Goschen (Viscount Goschen), reverted to the original system. It cannot be said, however, that the question of ultimate responsibility is well defined. The duke of Somerset, Sir James Graham and Sir Charles Wood, afterwards Lord Halifax, held the view that the first lord was singly and personally responsible for the sufficiency of the fleet. Sir Arthur Hood expressed before the House of Commons committee in 1888 the view that the Board collectively were responsible; whilst Sir Anthony Hoskins assigned the responsibility to the first lord alone with certain qualifications, which is a just and reasonable view.

2. *Admiralty Organization.*—Under the organization which now exists, the Board of Admiralty consists of the first lord, the first and second naval lords, the additional naval lord and controller, the junior naval lord and the civil lord, who are commissioners for executing the office of lord high admiral, and with them are the parliamentary and financial secretary and the permanent secretary. As has been explained, the first lord is responsible under the orders in council to the crown and to parliament for all admiralty business. In the hands of the

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[1] Admiral Sir Cooper Key, when director of naval ordnance during Mr Childers' administration, observed to the writer that no first lord of the admiralty knew so little of the working of the admiralty as Mr Childers, because, owing to the discontinuance of board meetings, he lost the great advantage of hearing the discussion. (R. V. H.)

other lords and secretaries rest duties very carefully defined, and they direct the civil departments which are the machinery of naval administration. The first naval lord, the second naval lord and the junior naval lord are responsible to the first lord in relation to so much of the business concerning the personnel of the navy and the movements and condition of the fleet as is confided to them, and the additional naval lord or controller is responsible in the same way for the material of the navy; while the parliamentary secretary has charge of finance and some other business, and the civil lord of all shore works—*i.e.* docks, buildings, &c.—and the permanent secretary of special duties. The first lord of the admiralty is the cabinet minister through whom the navy receives its political direction in accordance with imperial policy. He is the representative of the navy in parliament, which looks to him for everything concerned with naval affairs. The members of the Board are his advisers; but if their advice is not accepted, they have no remedy except protest or resignation. It cannot be denied that the responsibility of the members of the Board, if their advice should be disregarded, must cease, and it is sufficiently obvious that the remedy of resignation will not always commend itself to those whose position and advancement depend upon the favour of the government. Something will be said a little later concerning the working of the system and the relation of the first lord to the Board in regard to the navy estimates. In addition to general direction and supervision, the first lord has special charge of promotions and removals from the service, and of matters relating to honours and rewards, as well as the appointments of flag officers, captains and other officers of the higher ranks. With him rests also the nomination for the major part to naval cadetships and assistant clerkships.

Apart from the first lord, the first naval lord is the most important officer of the Board of Admiralty. It seems to be unquestionable that Sir James Graham was right in describing the senior naval lord as his " first naval adviser." Theoretically, the first naval lord is responsible for the personnel of the fleet; but in practice he is necessarily concerned with the material also as soon as it is put into commission, and with the actual commissioning of it. It is correct to say that he is chiefly concerned with the employment of the fleet, though his advice has weight in regard to its character and sufficiency, and is always sought in relation to the shipbuilding programme. Broadly speaking, the first naval lord's duties and authority cover the fighting efficiency and employment of the fleet, and upon him and upon the controller the naval business of the country largely falls. He directs the operations of the admiral superintendent of naval reserves in regard to ships, the hydrographer, the director of naval ordnance, so far as the gunnery and torpedo training establishments are concerned, and the naval intelligence department, and he has charge of all matters relating to discipline. The mobilization of the fleet, both in regard to personnel and material, also falls to him, and among a mass of other business in his department are necessary preparations for the protection of trade and the fisheries. It will thus be seen that the first naval lord is the chief officer of the Board of Admiralty, and that the operations of the other members of the Board all have relation to his work, which is no other than preparation for war. It may here be remarked that it appears most necessary to change the naval lords frequently, so that there may always be in the Board some one who possesses recent touch with the service afloat.

The second naval lord may be regarded as the coadjutor of the first naval lord, with whose operations his duties are very closely related, though, like every other member of the Board, he is subordinate only to the first lord. The duties of the second naval lord are wholly concerned with the personnel of the fleet, the manning of the navy and mobilization. In his hands rests the direction of naval education, training and the affairs of the royal marine forces. The training establishments and colleges are in his hands. He appoints navigating officers and lieutenants to ships (unless they be to command), sub-lieutenants, midshipmen and cadets, engineer officers, gunners and boatswains, and supervises the management of the reserve. In his province is the mobilization of the personnel, including the coastguard and the royal naval reserve. Necessarily, the first and second naval lords work together, and upon occasion can replace each other.[1]

Most important are the duties that fall to the additional naval lord and controller. He has charge of everything that concerns the material of the fleet, and his operations are the complement of the work of the first naval lord. A great number of civil departments are directed by the controller, and his survey and supervision extend to the dockyards and building establishments of the fleet. He submits plans to the Board for new ships, and is responsible for carrying into effect its decisions in regard to all matters of construction and equipment. The building operations both in the dockyards and in private yards are therefore under his supervision. In regard to all these matters the director of naval construction and the engineer-in-chief are the heads of the civil departments that carry on the work. Again, the controller is responsible in regard to armament—both gunnery and torpedo—and it is the work of his department to see to all gunnery and torpedo fittings, and to magazines, shell-rooms and electric apparatus. The officer in immediate charge of this branch of the controller's work, under his direction, is the director of naval ordnance. In regard to work at the dockyards (*q.v.*) the controller is aided by the director of dockyards. He supervises this officer in preparing the programme of work done in the dockyards, the provision of the material required and its appropriation to particular work in accordance with the programme. Other officers who conduct great operations under the authority and responsibility of the controller are the director of stores, who maintains all necessary supplies of coal and stores at home and abroad, and examines the store accounts of ships, and the inspector of dockyard expense accounts, who has charge of the accounts of dockyard expenditure and seeing that outlay is charged as directed. In regard to the navy estimates, the controller, through his subordinates, is responsible for the preparation and administration of the votes for shipbuilding and naval armaments, except in regard to some sub-headings of the former, and thus in recent years for the expenditure of something like £15,000,000 or over.

The junior naval lord has in his hands the very important duties that are concerned with the transport, medical and victualling services, as well as the regulation of hospitals, the charge of coaling arrangements for the fleet and other duties that conduce to the practical efficiency of the navy. He also appoints chaplains, naval instructors, medical officers (except in special cases) and officers of the accountant branch. A vast business in regard to the internal economy of ships greatly occupies the junior lord. He has charge, for example, of uniforms, prize-money, bounties, naval savings banks, and pensions to seamen and marines and the widows of naval and marine officers. The work of the junior naval lord places under his direction the director of transports, the director-general of the medical department, the director of victualling, and, in regard to particular matters, the director of stores, the accountant-general, the chaplain of the fleet, and the Intelligence Department, so far as the junior lord's department is concerned.

The civil lord supervises, through the director of works, the Department of Works, dealing with admiralty buildings and works, construction and labour, contracts and purchases of building stores and land. He is also responsible for the civil staff of the naval establishments, except in regard to certain officials, and for duties connected with Greenwich Hospital, compassionate allowances, charitable funds, and business of like character. The accountant-general, in regard to these matters, is directed by him, and the director of Greenwich Hospital is under his authority.

The parliamentary and financial secretary is responsible for the finance of the department, the navy estimates and matters of expenditure generally, and is consulted in regard to all matters involving reference to the treasury. His position in regard to estimates and expenditure is very important, and the accountant-general is his officer, while he has financial control over the director of contracts. The financial secretary also examines proposals for new expenditure.

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[1] The drawback is, that a naval lord can only go on leave by throwing all his work on a colleague already overweighted with work

A most important official of the Board is the permanent secretary, whose office has been described as the "nerve-centre" of the admiralty, since it is the channel through which papers for the lords of the admiralty pass for the intercommunication of departments and for the correspondence of the Board. The tradition of admiralty procedure largely rests with the permanent secretary, and it is most important that he should be chosen from one of the branches, and should have served in as many of them as possible, in order that he may possess a thorough knowledge of the theory and practice of the admiralty system. In addition to the secretarial duties of the permanent secretary's department, the permanent secretary has charge of the military, naval and legal branches, each under a principal clerk, the civil branch and the record office. The various branches deal with matters concerning the commissioning of ships and the distribution of the fleet, and the manning and discipline of the navy, with other associated matters, being the channels for the operations of the naval lords. It is a highly important function of the department of the permanent secretary to preserve the inter-related working of the various departments, and to keep unbroken the thread of administration when a new Board is constituted.

3. *Business and Responsibility.*—The manner in which the Admiralty Board conducts the great operations under its charge has been indicated. It would be impossible here to describe it in detail, though something concerning the civil departments, which are the machinery of naval administration, will be found below. It will, however, indicate the character of admiralty administration if we explain to some extent the conditions which surround the preparation of the estimates and the shipbuilding programme, the more so because this matter has been the battle-ground of critics and supporters of the admiralty. It has already been pointed out that the naval lords, if they dissent from the estimates that are presented, have no remedy but that of protest or resignation. Into the controversies that have arisen as to the responsibility of the several lords it is unnecessary to enter here. The Admiralty Board possesses, in fact, the character of a council, and its members can only be held responsible for their advice. It has even been contended that, in the circumstances, it should not be incumbent upon them to sign the navy estimates, and there have been instances in which the estimates have been presented to parliament without the signature of certain naval lords. It is in any case obvious, as has been explained above, that the ultimate responsibility must always rest with the first lord and the cabinet, by whom the policy of the country is shaped and directed. In the report of the Hartington Commission in 1890 (the chairman of which became 8th duke of Devonshire) to inquire into the civil and professional administration of the Naval and Military Departments, and the relation of these departments to each other and to the treasury, the following recommendation occurs: "On the first lord alone should rest the responsibility of deciding on the provision to be made for the naval requirements of the empire, and the existence of a council should be held in no degree to diminish that responsibility."

Two conditions primarily rule the determination as to the strength of the navy. They are, the foreign policy of the cabinet, and, on the ground of practical expediency, the amount of money available. "The estimates and strength of the navy," said Rear-Admiral Hotham before the select committee on the navy estimates, 1888, "are matters for the cabinet to determine." "Expense," said Sir Anthony Hoskins, "governs everything." The needs of the empire and financial considerations, as it is scarcely necessary to remark, may prove to be antithetical conditions governing the same problem, and in practice it follows that the Admiralty Board directs its operations in accordance with the views of the government, but limited by the public funds which are known to be available. Such considerations suggest a practical limitation of responsibility, so far as the several lords of the admiralty are concerned, but it may be presumed to be their duty individually or collectively to place their views before the first lord; and Lord George Hamilton told the select committee of 1888 that, if his colleagues should represent to him that a certain expenditure was indispensable for the efficiency of the service, he would recognize that all financial considerations should be put on one side. The commissioners reported that this was the only common-sense view of the matter, and that it was difficult to see on what other footing the control of navy expenditure, consistently with responsibility to parliament, could be placed.

Two practical considerations are bound up with the shipbuilding programme—the carrying forward of the work in hand and the new construction to be begun, since it is absolutely necessary that proper provision should be made for the employment and distribution of labour in the dockyards, and for the purchase of necessary materials. Through the director of naval construction and the director of dockyards, the controller is kept informed as to the progress of work and the amount of labour required, as also in regard to the building facilities of the yards. These matters, in a general way, must form a subject of discussion between the first naval lord and the controller, who will report on the subject to the first lord. The accountant-general, as the financial officer of the Board, will be called upon to place the proposed estimates upon a financial basis, and when the views of the cabinet are known as to the amount of money available, the several departments charged with the duty of preparing the various votes will proceed with that work. The financial basis alluded to is, of course, found in the estimates of the previous year, modified by the new conditions that arise. There has been in past times a haphazard character in our shipbuilding programmes, but with the introduction of the Naval Defence Act of 1889, which looked ahead and was not content with hand-to-mouth provision, a better state of things has grown up, and, with a larger sense of responsibility, a policy characterized by something of continuity has been developed. Certainly the largest factor in the better state of things has been the growth of a strong body of public opinion as to the supreme value of the navy for national and imperial welfare.

Another important and related matter that comes before the Board of Admiralty is the character and design of ships. The naval members of the Board indicate the classes and qualities desired, and it is the practice that the sketch-design, presented in accordance with the instructions, is fully discussed by the first naval lord and the controller, and afterwards by the Board. The design then takes further shape, and when it has received the final sanction of the Board it cannot be altered without the sanction of the same authority. A similar procedure is found in the other business of the Admiralty Board, such as shore-works, docks and the preparation of offensive and defensive plans of warfare—the last being a very important matter that falls into the operations of the Naval Intelligence Department, which has been described, though not with perfect accuracy, and certainly in no large sense, as "the brain of the navy." That department is under the direction of the first naval lord.

The shipbuilding programme may be described as the corner-stone of the executive business of the admiralty, because upon it depends very largely the preparation of all the other votes relating to numbers, stores, victualling, clothing, &c. But if the Admiralty Board is responsible through the first lord for the preparation of the estimates, it is also charged with the business of supervising expenditure. In this matter the financial secretary plays a large part, and is directed to assist the spending department of the admiralty in their duty of watching the progress of their liabilities and disbursements. Some notes on admiralty finance will be found below (section 4). The shipbuilding votes set the larger machinery of the admiralty in motion. The executive departments, except in regard to the hulls and machinery of ships and the special requirements of the director of works, do not make purchases of stores, that work resting with the director of navy contracts. Most of the important executive and spending branches are in the department of the controller, and it will be well, while we are dealing with the material side of the navy, to describe briefly their character and duties. The civil branches of the navy tributary to the controller are those of the director of naval construction, the engineer-in-chief, the directors of naval ordnance, of dockyards and of stores, and the inspector of dockyard expense accounts. The first duty of the controller is, as has been explained, in relation to the design and construction of ships and their machinery, and the executive officials who have charge of that work are the director of naval construction and the engineer-in-chief, whose operations are closely interrelated. A vast administrative stride has been made in this particular branch of the admiralty. The work of design and construction now go forward together, and the admiralty designers are in close touch with the work in hand at the dockyards. This has been largely brought about by the institution, in 1883, of the royal corps of naval constructors, whose members interchange their duties between the designing of ships at the admiralty and practical work at the dockyards. It is through the director of naval construction that many of the spending departments are set in motion, since he is responsible both for the design of ships and for their construction. It deserves to be noticed, however, that a certain obscurity exists in regard to the relative duties of the director of naval construction and the director of dockyards touching constructive works in the yards. The former officer has also charge of all the work given out to contract, though it is the business of the dockyard officials to certify that the conditions of the contract have been fulfilled. In all this work the director of naval construction collaborates with the engineer-in-chief, who is an independent officer and not a subordinate, and whose procedure in regard to machinery closely resembles that adopted in the matter of contract-built ships.

The director of naval ordnance is another officer of the Controller's Department whose operations are very closely related to the duties of the director of naval construction, and the relation is both intimate and sustained, for in the Ordnance Department everything that relates to guns, gun-mountings, magazines, torpedo apparatus, electrical fittings for guns, and other electrical fittings is centred. A singular feature of this branch of administration is that the navy long since lost direct control of ordnance matters, through the duties connected with naval gunnery, formerly in the hands of the master-general of the ordnance, and those of the Board of Ordnance—a department common to the sea and land services—being vested in 1855 in the secretary of state for war. A more satisfactory state of things has grown up through the appointment of the director of naval ordnance, taking the place of the naval officer who formerly advised the director of artillery at the War Office. Expenditure on ordnance has also been transferred from the army to the navy estimates, and a Naval Ordnance Store Department has been created. It cannot be said that the condition is yet satisfactory, nor can it be until the navy has control of and responsibility for its own ordnance. The assistant-director of torpedoes is an officer instituted at the admiralty within recent years, and his duty is to assist the director of naval ordnance in all torpedo matters.

The director of dockyards replaced the surveyor of dockyards in 1885, at about which time the inspector of dockyard expense accounts was instituted. It is upon the director of dockyards (*q.v.*) that the responsibility of the controller devolves in regard to the management of dockyards and naval establishments at home and abroad, and to the performance of work in these establishments, ship and boat building, maintenance, repairs and refits. In this department the programme for work in the dockyards is prepared, as well as certain sections of the navy estimates.

We now come to the Stores Department, with the director of stores as its chief. This officer, about the year 1869, took over the storekeeping duties previously vested in the storekeeper-general. The Naval Store Department is charged with the custody and issue of naval, as distinguished from victualling and ordnance stores, to be used in naval dockyards and establishments for the building, fitting and repairing of warships. It has, however, no concern with stores that belong to the Department of Works. The business of the director of stores is also to receive and issue the stores for ships of all classes in commission and reserve, and he deals with a vast array of objects and materials necessary for the fleet, and with coals and coaling. He frames the estimates for his department, but his purchases are made through the director of navy contracts. In practice the main business of the Stores Department is to see to the provision of stores for the navy, and to the proper supply of these at all the establishments, and for this purpose its officials direct the movements of storeships, and arrange for the despatch of colliers, the director being charged to be "careful to provide for His Majesty's ships on foreign stations, and for the necessary supplies to foreign yards." Another important business of the director of stores is the examination of the store accounts of ships as well as some other accounts. Although the director of stores is really in the department of the controller, he is supervised in regard to the coaling of the fleet by the junior naval lord. The inspector of dockyard expense accounts has been alluded to. He is the officer charged with keeping a record of expenditure at the dockyards and of supervising expense accounts.

Expenditure.

It may be useful to add a note concerning the spending of the money. Within the controller's department, as has been explained, are centred the more important spending branches of the admiralty. While the work of designing ships and preparing plans is in progress, the director of stores, the director of dockyards and other officials of that department concerned are making preparation for the work. The necessary stores, comprising almost every imaginable class of materials, are brought together, and the director of stores is specially charged to obtain accurate information in regard to requirements. He is not, however, a purchasing officer, that work being undertaken by the director of navy contracts, who is concerned with the whole business of supply, except in regard to hulls and machinery of ships built by contract, and the special requirements of the director of works. At the same time, the civil departments of the admiralty being held responsible for the administration of the votes they compile, it is their duty to watch the outlay of money, and to see that it is well expended, the accountant-general being directed to assist them in this work. The system is closely jointed and well administered, but it possesses a very centralized character, which interferes to some extent with flexible working, and with the progress of necessary repairs, especially in foreign yards. In so far as ships given out to contract are concerned (and the same is the case in regard to propelling machinery built by contract), the director of navy contracts plays no part, the professional business being conducted through the controller of the navy, who is advised thereon by the director of naval construction and the engineer-in-chief. The work conducted in private establishments is closely watched by the admiralty officials, and is thoroughly tested, but, *mutatis mutandis*, the system in regard to contract-built ships is practically the same as that which prevails in the dockyards.

4. *Naval Finance: The Accountant-General's Department.*—The subject of naval finance is one of great complexity and of vast importance. The large sums of money with which the admiralty deals in the way of both estimates and expenditure, amounting recently to about £30,000,000 annually, implies the existence of the great organization which is found in the department of the accountant-general of the navy. Under the authority of the first lord, the parliamentary and financial secretary is responsible for the finance of the admiralty in general, and for the estimates and the expenditure, the accounts and the purchases, and for all matters which concern the relations of the admiralty to the treasury and to other departments of the government; and in all the practical and advisory work the accountant-general is his officer, acting as his assistant with the director of naval contracts who, under the several lords, is concerned with the business of purchase.

The organization of the accountant-general's department has undergone many changes, and the resulting condition is the outcome of various modifications which have had for their purpose to give to this officer a measure of financial control. There have been various views as to what the duties of the accountant-general should be. After the reorganization of the admiralty by Sir James Graham in 1832, the accountant-general was regarded as a recording and accounting officer, wholly concerned with receipt and expenditure. His duties were limited to the auditing of accounts, payments and expenditure generally. Owing to changes effected in 1869, which made the parliamentary secretary, assisted by the civil lord, responsible for finance at the admiralty, bringing the naval and victualling store departments into his charge, the accountant-general was invested with the power of criticizing these accounts financially, though he did not as yet possess any financial control, and the position was little changed by fresh rules made in 1876. It was not until 1880 that the powers of the accountant-general were enlarged in this direction. It was then ordered that he should be consulted before any expenditure which the estimates had not provided for was incurred, and before any money voted was applied to other purposes than those for which it was provided. The effect of this order was not happy, for the accountant-general could not undertake these duties without setting up friction with the departments whose accounts he criticized. It was contemplated by the admiralty in 1885 to make the accountant-general the assistant of the financial secretary, and to raise him to the position of a permanent officer of finance instead of being an officer of account invested with imperfect authority in the direction of control. A select committee of the House of Commons reported that the accountant-general possessed no financial control over the departments, and that there was an urgent need for establishing such a control. At the time the position of that officer did not enable him to exercise any sufficient general supervision over expenditure, and there was no permanent high official expressly charged with finance. Accordingly, after being submitted to a departmental committee, a fresh arrangement was made in November 1885, whereby the accountant-general, under the authority of the financial secretary, was given a direct share in the preparation of the estimates. His written concurrence was required before the final approval of the votes, and each vote was referred to him for his approval or observations, and he was to exercise a financial review of expenditure and to see that it was properly accounted for. He became, in fact, "the officer to be consulted on all matters involving an expenditure of naval funds." It was believed that economical administration would result; but much opposition was raised to the principle that was involved of submitting the proposals of responsible departments to the inexpert criticism of a financial authority. Mr Main, assistant accountant-general, stated before the Royal Commission on Civil Establishments, 1887, that the effect had been to develop a tendency to withhold information or to afford only partial information, as well as to cause friction when questions were raised affecting expenditure, accompanied by protests, even in those cases in which these questions were manifestly of a legitimate character. The result was discouraging, and in the opinion of Mr Main had done much to weaken financial control and to defeat the purpose of the order. It is unnecessary to detail the various changes that have been made by the institution of dockyard expense accounts in the department of the controller, and by various other alterations introduced. The treasury instituted an independent audit of store accounts which greatly affected the position of the accountant-general, and the Royal Commission on Civil Establishments reported that the Board of Admiralty were of opinion that they could dispense with the accountant-general's review altogether. The commission was, however, of opinion that the accountant-general should be the permanent assistant and adviser, on all matters involving the outlay of public money, of the financial secretary.

The operations of the accountant-general are now conducted in accordance with the order in council of the 18th of November 1885, and of an office memorandum issued shortly afterwards. He thus acts as deputy and assistant of the parliamentary and financial secretary, and works with a finance committee within the admiralty, of which the financial secretary is president and the accountant-general himself vice-president. The duties of the department are precisely defined as consisting in the criticism of the annual estimates as to their sufficiency before they are passed, and in advising the financial and parliamentary secretary as to their satisfying the ordinary conditions of economy. The accountant-general also reviews the progress of liabilities and expenditure, and in relation to dockyard expenditure he considers the proposed programme of construction as it affects labour, material and machinery. He further reviews current expenditure, or the employment of labour and material, as distinguished from cash payments of the yard, as well as proposals for the spending of money on new work or repairs of any kind for which estimates are currently proposed. The accountant-general's department has three principal divisions: the estimates division, the navy pay division, and the invoices and claims division. In the first of these is the ledger branch, occupied with the work of accounts under the several votes and sub-heads of votes, and with preparing the navy appropriation account, as well as the estimates and liabilities branch, in which the navy estimates are largely prepared after having been proposed and worked out in the executive departments of the admiralty. There are also ships' establishments and salaries branches. The navy pay division includes the full and half-pay branch and a registry section. There is also the seamen's pay branch, which audits ships' ledgers and wages, and has charge of all matters concerning the wages of seamen. The victualling audit is also in this branch, and is concerned with payments for savings in lieu of victualling and some other matters. Further, the navy pay division examines ships' ledgers, and is concerned with the service, characters, ages, &c., of men as well as with allotments and pensions. The third division of the accountant-general's department, known as that of invoices and claims, conducts a vast amount of clerical work through many branches, and is concerned with the management of naval savings banks and matters touching prize-money and bounties.

The importance of this great department of the admiralty cannot be overrated. It is, in the first place, of supreme importance that the navy estimates should be placed upon a sound financial basis; and in practice the Board requires the concurrence of the accountant-general to the votes before they are approved, and thus in greater or less degree this officer is concerned in the preparation of every one of the votes. He does not concern himself with matters of larger policy outside the domain of finance, and it must be confessed that there appears to be something anomalous in his "review" of naval expenditure. It is, however, a mark of the flexibility or elasticity of the admiralty system that in practice the operations of the accountant-general's department work easily, and that admiralty finance is recognized as having been placed upon a sound and efficient basis. There are important financial officers outside the accountant-general's department concerned with assisting the controller. The inspector of dockyard expense accounts, who is entirely in the controller's department, enables him to exercise careful supervision over expenditure and the distribution of funds to special purposes. This work, however, though highly important, is merely one part of the system of financial control. Within recent years the bonds have been considerably tightened, and the work is untainted by corruption. It is true that in exercising rigid supervision over expenditure the work has become more centralized than is desirable, and it is a mark of change within recent years that local officers have been in larger measure deprived of independent powers. This, indeed, is a necessary condition of financial control, or at least a condition which it is not easy to change where rigid control is necessary.

5. *Mobilization of the Fleet.*—By the mobilization of the fleet is meant the placing of naval resources upon a war footing, in readiness in all material and personal respects for hostile operations. A complete mobilization for purposes of practice in peace time would dislocate seafaring life in a manner which would be justifiable only by actual war. Thus no country in peace manœuvres calls out all its naval reserves, or makes use of the auxiliary cruisers—merchant ships for which a subvention is

paid, and which are constructed with a view to use in warfare. Experience has shown that when vessels are commissioned they are liable to numerous small breakdowns of their machinery if they are manned by crews who have no familiarity with them. Many accidents of this kind had occurred in the British navy at manœuvres, though it could not be shown that the vessel was defective, or that the crew was either untrained or negligent. These experiments led the admiralty to adopt a new system in 1904, designed to obviate the risk that vessels would be crippled at a critical moment by want of acquaintance on the part of the crew with their machinery. Under this system all vessels which are considered to be available for war are divided into two classes:—first, those in full commission which constitute the different squadrons maintained at all times; and secondly, those which form the reserve and are kept in partial commission—or rather partially manned though in commission. These are kept at the home ports—Chatham, Portsmouth, Plymouth—in reserve squadrons under a flag-officer who will command them in war. Each vessel has a captain, a second in command, and a proportion of other officers including engineer, navigating and torpedo officers. Two-fifths of her full complement of crew are always on board, and they include the most skilled men needed for the proper management of the machinery of all kinds—more especially that of the torpedoes and guns. These vessels go to sea for periodical practice. When therefore the fleet must be mobilized for war it will only be necessary to fill up the number of trained men by the less skilled hands from the naval barracks occupied by the sailors not belonging to any particular ship, or from the naval reserve. All ranks of the navy are placed on a roster by which they successively serve in ships in full commission, are quartered in the naval barracks and drafted from them to the ships of the reserve, from which they return to the sea-going ships. It is calculated that there are always men enough in the barracks to complete the crews of a small squadron for emergency service without disturbing the regular routine of the peace establishment. The British admiralty may claim that though the machinery at its command in the past was not perfect it has commonly been able to send a squadron to sea more rapidly than any other power in Europe. Much depends on the arrangement of the stores as well as the disposition of the men. The introduction at the end of the 18th century of the businesslike practice of keeping the fittings of each ship together by themselves, did much to facilitate the rapid mobilization of a portion of the British fleet in 1790 which impressed all Europe. The prompt manning of a special service squadron in 1895 in consequence of the troubles then arising in connexion with the former South African Republic, showed that even before its plans for mobilization were completed the admiralty had its resources well in hand. (R .V. H.)

Other countries.

As regards the navies of countries other than Great Britain, their government is in the hands of ministers or departments variously constituted. The Russian admiralty is a highly organized bureau, divided into departments, and under the supreme control of a high admiral, usually a grand duke of the Imperial House. The German admiralty was, till 1872, a branch of the War Office, though governed by a vice-admiral under a naval prince of the reigning family. In 1872 it was severed from the War Office, though remaining an appanage thereof, and a general of the army was placed at its head. The French minister of marine, assisted by a permanent staff, controls the navy of France on a highly centralized system of administration; but the departments are well organized, and work well. The Italian fleet is governed on principles analogous to the French, but with a large admixture of the English representative element. The American system is worth describing in more detail.

United States Navy Department.

The president of the United States is commander-in-chief of the navy—a constitutional prerogative which he seldom asserts. The Navy Department is administered by a civilian secretary of the navy—a cabinet officer appointed by the president—who exercises general supervision. Next in authority is the assistant-secretary, also a civilian nominee, who acts as an assistant, and has, besides, certain specific duties, including general supervision of the marine corps, naval militia and naval stations beyond the continental limits of the United States. The details of administration are supervised by the chiefs of bureaus, of which there are eight. They are appointed by the president from the navy list for a period of four years, and have the rank of rear-admiral while serving in this capacity. They have direct control of the business and correspondence pertaining to their respective bureaus; and orders emanating from them have the same force as though issued by the secretary.

The bureau of navigation is the executive, or military, bureau and as such promulgates and enforces the orders and regulation prescribed by the secretary; it has general direction of the procurement, education, assignment and discipline of the personnel. It also controls the movements of ships, including the authorization of manœuvres and drills, such as target practice. The bureau of equipment has charge of all electrical appliances, compasses, charts and fuel, and generally all that relates to the equipment of vessels, exclusive of those articles that come naturally under the cognizance of other bureaus. It has charge of the naval observatory, where the *Ephemeris* is prepared annually, and of the hydrographic office, where charts, sailing directions, notices to mariners, &c., are issued. The bureau of ordnance has charge of the gun factory, proving ground, and torpedo station, and all naval magazines; all the details that pertain to the manufacture, tests, installation or storage of all offensive and defensive apparatus, including armour, ammunition hoists, ammunition rooms, &c., though much of the actual installation is performed by the bureau of construction after consultation with the bureau of ordnance. The bureau of construction and repair has charge of the designing, building and repairing of hulls of ships, including turrets, spars and many other accessories. It builds all boats, has charge of the docking of vessels and the care of ships in reserve. The chief of this bureau is usually a naval constructor. The bureau of steam engineering has charge of all that relates to the designing, building and repairing of steam machinery, and of all the steam connexions on board ship. The bureau of supplies and accounts procures and distributes provisions, clothing and supplies of the pay department afloat, and acts as the purchasing agent for all materials used at naval stations, except for the medical department and marine corps. It also has charge of the disbursement of money and keeping of accounts. The chief of this bureau is a pay officer. The bureau of medicine and surgery has charge of all naval hospitals, dispensaries and laboratories, and of all that pertains to the care of sick afloat and ashore. The chief of this bureau is a medical officer. The bureau of yards and docks has charge of construction and maintenance of wet and dry docks, buildings, railways, cranes, and generally all permanent constructions at naval stations. The chief of this bureau is often a civil engineer.

Under the cognizance of the secretary's office is the office of the judge-advocate-general, an officer selected by the president from the navy list for a term of four years, with the rank of captain while so serving. He is legal adviser to the department, and reviews the records of all courts and statutory boards. Under the cognizance of the assistant-secretary's office is the office of naval intelligence, which collates information on naval matters obtainable at home and abroad. The staff is composed of naval officers on shore duty, the senior in charge being usually a captain, and known as chief intelligence officer. Several boards are employed under the various bureaus, or directly as advisers to the secretary. Some are permanent in character, while others are composed of officers employed on other duty, and are convoked periodically or when required. The naval policy board is composed of officers of high rank, and meets once a month; its duties conform to those of the general staff in armies. The board of construction consists of the chiefs of bureaus of ordnance, equipment, construction and repair, steam engineering, and the chief intelligence officer. Its duty is to advise the secretary in all matters relating to the construction policy in detail. The general construction policy is suggested by the naval policy board. The board of inspection and survey is composed of representatives of all bureaus, who inspect vessels soon after commission and on return from a cruise, and report on the condition of the ship and efficiency of its personnel; it also conducts the official trials of new vessels. The boards for the examination of officers for promotion are composed of officers of the corps to which the candidate belongs and of medical officers. Every officer is examined professionally, morally and physically at each promotion. The Navy Department is located at Washington, D.C., and occupies a building together with the State and War Departments (the latter being charged solely with army affairs).

The personnel (see also under NAVY) is limited in number by law. The engineer corps was abolished in 1899, the then engineer-officers becoming line officers in their respective relative grades. Line officers are the military and executive branch, and are required besides to perform engineer duties. They are graduates of the Naval Academy. Vacancies occurring in the construction corps are filled from the graduates of the Naval Academy having the highest standing in scholarship, who are given a two years' graduate course, generally abroad, on being graduated from the Academy, and are then appointed assistant naval constructors. All other staff officers are appointed directly from civil life by the president, from candidates passing prescribed examinations. Each representative and delegate in Congress has authority to nominate a candidate for naval cadet whenever his congressional district has no representative in the Naval Academy. The candidate must be a resident of the district which the congressman represents, between fifteen and twenty years old, and must pass prescribed mental and physical examinations. The president is allowed ten representatives at the Academy at all times, appointed "at large," and one appointed from the District of Columbia.

The course of instruction at the Academy is four years, each comprising eight months' study, three months' practice cruise, and one month's furlough. At the expiration of four years, cadets are sent to cruising ships for two years' further instruction, and are then commissioned ensigns. After three years' further sea service, ensigns are promoted to lieutenants (junior grade). After this, promotion is dependent upon seniority alone, the senior officer in any grade being promoted to the lowest number in the next higher grade when a vacancy occurs in the higher grade, and not before. All officers are retired on three-fourths sea pay at the age of sixty-two, or whenever a board of medical officers certifies that an officer is not physically qualified to perform all duties of his grade. A few officers are allowed to retire voluntarily in certain circumstances, to stimulate promotion. Any officer on the retired list may be ordered by the secretary to such duty as he may be able to perform: this is a legal provision to provide for emergencies. Promotion in the staff corps is dependent upon seniority, though relative rank in the lower grades in some corps somewhat depends upon promotion of line officers of the same length of service, and accounts for the existence of staff officers in the same grade having different ranks. All sea-going officers, after commission, are required to spend three years at sea, and are then usually employed on shore-duty for a time, according to the needs of the service—short terms of shore-duty thereafter alternating with three-year cruises. This rule is adhered to as strictly as circumstances will permit. Shore-duty includes executive or distinctly professional duties in the Navy Department, under its bureaus, and at navy yards and stations; inspection of ordnance, machinery, dynamos, &c., under construction by private firms; duty on numerous temporary or permanent boards; instructors at the Naval Academy; recruiting duty; charge of branch hydrographic offices; inspection duty in the lighthouse establishment; at state nautical schools; as attachés with United States legations; and many others. Naval constructors (usually), civil engineers and professors of mathematics are continuously employed on shore-duty connected with their professions, the Naval Observatory, Nautical Almanac and the Naval Academy employing most of the last.

Warrant officers (boatswains, gunners, carpenters, sailmakers, warrant machinists and pharmacists) are appointed by the secretary, preference being given to enlisted men in the navy who have shown marked ability for the positions. They must be between twenty-one and thirty-five years of age, and pass an examination. After serving satisfactorily for one year under an acting appointment, they receive warrants that secure the permanency of their office. Ten years after appointment, boatswains, gunners, carpenters and sailmakers are eligible for examination for a commission as chief-boatswain, &c., and as such they rank with, but next after, ensigns. Mates are rated by the secretary from seamen or ordinary seamen. They have no relative rank, but take precedence of all petty officers. Their duties approximate to those of boatswains, though they seldom serve on large cruising vessels. Clerks to pay officers are appointed by the secretary on the nominations of the pay officers. They have no rank and are not promoted or retired. Their appointments are revoked when their services are no longer needed.

Boys between fifteen and seventeen years old of good character, who can read and write and pass the physical examination, may enlist for the term of their minority. They enlist as third-class apprentices, and are given six months' instruction at a training station, and thence go to sea in apprentice training vessels. When proficient they are transferred to regular cruising vessels as second class, and when further qualified are rated first class. All other enlistments are for four years. Recruits must speak English. Landsmen are usually sent to sea on special training-ships until proficient, and are then sent into general service. Raw recruits may enlist as landsmen, or coal-passers or mess attendants. Ordinary seamen must have served two years, and seamen four years before the mast, prior to first enlistment as such; and before enlistment in any other rating allowed on first enlistment, applicants must prove their ability to hold such rating. Landsmen, coal-passers, &c., as soon as they become proficient, are advanced to higher grades, and, if American citizens, may eventually become petty officers (ranking with army non-commissioned officers), with acting appointments. In twelve months, or as soon thereafter as proficiency is established, the acting appointment is made permanent, and an acting appointment for the next higher grade is issued, &c. Permanent appointments are not revokable except by sentence of court-martial, and a man re-enlists in that rating for which he held a permanent appointment in his previous enlistment. All persons re-enlisting within four months after expiration of previous enlistment are entitled to a bounty equal to four months' pay, and in addition receive a "continuous service certificate," which entitles them to higher pay and to other special considerations. The same is true for each re-enlistment. When an enlisted man completes thirty years' service and is over fifty years of age he may retire on three-fourths pay.

The Marine corps (see MARINES) is a wholly separate military body, but it is under the control of the Navy Department.

United States naval vessels are, as a rule, built at private yards under contracts awarded after competition. The government is not committed to any fixed policy or building programme. Each year the secretary recommends certain new construction. The final action rests with Congress, which must appropriate money for the new ships before the construction can be commenced. Repairing and reconstruction are usually done at government navy yards.

Ships in commission are distributed among five stations: (1) the North Atlantic, *i.e.* the Atlantic coast of the United States, Central America, and South America as far as the Amazon, also the West Indies; (2) the South Atlantic, *i.e.* the remainder of the Atlantic coast of South America and both coasts of South Africa; (3) the European, comprising the coast of Europe, including the inland seas, and the North Atlantic coast of Africa; (4) the Asiatic station, comprising the coast of Asia, including the islands north of the equator, also the east coast of North Africa; (5) the Pacific station, comprising the Pacific coast of North and South America, and Australia and the adjacent islands lying south of the equator. Each station is commanded by a flag officer, and the number of ships under the command varies according to circumstances. Ships in commission on special service, such as training, gunnery, surveying ships, &c., are not attached to stations. The shore stations of the navy are enumerated in the article on DOCKYARDS. (W. T. S.)

ADMIRALTY, HIGH COURT OF. The High Court of Admiralty of England was the court of the deputy or lieutenant of the admiral. It is supposed in the *Black Book of the Admiralty* to have been founded in the reign of Edward I.; but it would appear, from the learned discussion of R. G. Marsden, that it was established as a civil court by Edward III. in the year 1360; the power of the admiral to determine matters of discipline in the fleet, and possibly questions of piracy and prize, being somewhat earlier. Even then the court as such took no formal shape; but the various admirals began to receive in their patents express grants of jurisdiction with powers to appoint lieutenants or deputies. At first there were separate admirals or rear-admirals of the north, south and west, each with deputies and courts. A list of them was collected by Sir H. Spelman. These were merged in or absorbed by one high court early in the 15th century. Sir Thomas Beaufort, afterwards earl of Dorset and duke of Exeter (appointed admiral of the fleet 1407, and admiral of England, Ireland and Aquitaine 1412, which latter office he held till his death in 1426), certainly had a court, with a marshal and other officers, and forms of legal process—mandates, warrants, citations, compulsories, proxies, &c. Complaints of encroachment of jurisdiction by the Admiralty Courts led to the restraining acts, 13 Ric. II. c. 5 (1389), 15 Ric. II. c. 3 (1391) and 2 Hen. IV. c. 11 (1400).

Jurisdiction.

The original object of the institution of the courts or court seems to have been to prevent or punish piracy and other crimes upon the narrow seas and to deal with questions of prize; but civil jurisdiction soon followed. The jurisdiction in criminal matters was transferred by the Offences at Sea Act 1536 to the admiral or his deputy and three or four other substantial persons appointed by the lord chancellor, who were to proceed according to the course of the common law. By the Central Criminal Court Act 1834, cognizance of crimes committed within the jurisdiction of the admiralty was given to the central criminal court. By an act of 1844 it has been also given to the justices of assize; and crimes done within the jurisdiction of the admiralty are now tried as crimes committed within the body of a county. See also the Criminal Law Consolidation Acts of 1861.

From the time of Henry IV. the only legislation affecting the civil jurisdiction of the High Court of Admiralty till the time of Queen Victoria is to be found in an act of 1540, enabling the admiral or his lieutenant to decide on certain complaints of freighters against shipmasters for delay in sailing, and one of 1562, giving the lord high admiral of England, the lord warden of the Cinque Ports, their lieutenants and judges, co-ordinate power with other judges to enforce forfeitures under that act—a very curious and miscellaneous statute called "An Act for the Maintenance of the Navy."

In an act of 1534, with regard to ecclesiastical appeals from the courts of the archbishops to the crown, it is provided that the appeal shall be to the king in Chancery, "and that upon every such appeal a commission shall be directed under the great seal to such persons as shall be named by the king's highness, his heirs or successors, like as in cases of appeal from the Admiralty Court." The appeal to these "persons," called delegates, continued until it was transferred first to the privy council and then to the judicial committee of the privy council by acts of 1832 and 1833.

The early jurisdiction of the court appears to have been exercised very much under the same procedure as that used by the courts of common law. Juries are mentioned, sometimes of the county and sometimes of the county and merchants. But the connexion with foreign parts led to the gradual introduction of a procedure resembling that coming into use on the continent and based on the Roman civil law. The Offences at Sea Act 1536 states the objection to this application of the civil law to the trial of criminal cases with much force: "After the course of the civil laws, the nature whereof is that before any judgment of death can be given against the offenders, either they must plainly confess their offences (which they will never do without torture or pain), or else their offences be so plainly and directly proved by witness indifferent such as saw their offences committed, which cannot be gotten but by chance at few times."

Restraining Acts.

The material enactments of the restraining statutes were as follows:—An act of 1389 (13 Ric. II. c. 5) provided that "the admirals and their deputies shall not meddle from henceforth of anything done within the realm, but only of a thing done upon the sea, as it hath been used in the time of the noble prince king Edward, grandfather of our lord the king that now is." The act of 1391 (15 Ric. II. c. 3) provided that "of all manner of contracts, pleas and quarrels, and other things rising within the bodies of the counties as well by land as by water, and also of wreck of the sea, the admiral's court shall have no manner of cognizance, power, nor jurisdiction; but all such manner of contracts, pleas and quarrels, and all other things rising within the bodies of counties, as well by land as by water, as afore, and also wreck of the sea, shall be tried, determined, discussed and remedied by the laws of the land, and not before nor by the admiral, nor his lieutenant in any wise. Nevertheless, of the death of a man, and of a maihem done in great ships, being and hovering in the main stream of great rivers, only beneath the [bridges] of the same rivers [nigh] to the sea, and in none other places of the same rivers, the admiral shall have cognizance, and also to arrest ships in the great flotes for the great voyages of the king and of the realm; saving always to the king all manner of forfeitures and profits thereof coming; and he shall have also jurisdiction upon the said flotes, during the said voyages only; saving always to the lords, cities, and boroughs, their liberties and franchises." The act of 1400 (2 Hen. IV. c. 11) adds nothing by way of definition or restriction, but merely gives additional remedies against encroachments, providing heavy fines for those who improperly sue in the court, and those officials of the court who improperly assert jurisdiction. It was repealed by the Admiralty Court Act 1861. The statutes of Richard, except the enabling part of the second, were repealed by the Civil Procedure Acts Repeal Act 1879. The formation of a High Court of Justice rendered them obsolete.

In the reign of James I. the chronic controversies between the courts of common law and the Admiralty Court as to the limits of their respective jurisdictions reached an acute stage. We find the records of it in the second volume of Marsden's *Select Pleas in the Court of Admiralty*, and in Lord Coke's writings: *Reports*, part xiii. 51; *Institutes*, part iv. chap. 22. In this latter passage Lord Coke records how, notwithstanding an agreement asserted to have been made in 1575 between the justices of the King's Bench and the judge of the admiralty, the judges of the common law courts successfully maintained their right to prohibit suits in admiralty upon contracts made on shore, or within havens, or creeks, or tidal rivers, if the waters were within the body of any county, wheresoever such contracts were broken, for torts committed within the body of a county, whether on land or water, and for contracts made in parts beyond the seas. It is due to the memory of the judges of Lord Coke's time to say that, at any rate as regards contracts made *in partibus transmarinis*, the same rule appears to have been applied at least as early as 1544, the judges then holding that "for actions transitory abroad action may lie at common law."

Judge's patent.

All the while, however, the patents of the admiralty judge purported to confer on him a far ampler jurisdiction than the jealousy of the other courts would concede to him. The patent of the last judge of the court, Sir Robert Joseph Phillimore, dated the 23rd of August 1867, styles him "Lieut. Off^{l}. Princ^{l}. and Commissary Gen^{l}. and Special in our High Court of Admiralty of Eng. and President and Judge of the same," and gives to him power to take cognizance of "all causes, civil and maritime, also all contracts, complaints, offences or suspected offences, crimes, pleas, debts, exchanges, accounts, policies of assurance, loading of ships, and all other matters and contracts which relate to freight due for the use of ships, transportation, money or bottomry; also all suits civil and maritime between merchants or between proprietors of ships and other vessels for matters in, upon, or by the sea, or public streams, or fresh-water ports, rivers, nooks and places overflown whatsoever within the ebbing and flowing of the sea and high-water mark, or upon any of the shores or banks adjacent from any of the first bridges towards the sea through England and Ireland and the dominions thereof, or elsewhere beyond the seas." Power is also given to hear appeals from vice-admirals; also "to arrest . . . according to the civil laws and ancient customs of our high court . . . all ships, persons, things, goods, wares and merchandise"; also "to enquire by the oaths of honest and lawful men . . . of all . . . things which . . . ought to be enquired after, and to mulct, arrest, punish, chastise and reform"; also "to preserve the public streams of our admiralty as well for the preservation of our royal navy, and of the fleets and vessels of our kingdom . . . as of whatsoever fishes increasing in the rivers"; also "to reform nets too straight and other unlawful engines and instruments whatsoever for the catching of fishes"; also to take cognizance "of the wreck of the sea . . . and of the death, drowning and view of dead bodies," and the conservation of the statutes concerning wreck of the sea and the office of coroner [1276], and concerning pillages [1353], and "the cognizance of mayhem" within the ebb and flow of the tide; all in as ample manner and form as they were enjoyed by Dr David Lewis [judge from 1558 to 1584], Sir Julius Caesar, and the other judges in order (22 in all) before Sir Robert Phillimore. This form of patent differs in but few respects from the earlier Latin patents—*tempore* Henry VIII.—except that they have a clause *non obstantibus statutis*.

Modern progress.

As has been said, however, the contention of the common law judges prevailed, and the Admiralty Court (except for a temporary revival under Cromwell) sank into comparative insignificance during the 17th century. The great maritime wars of the 18th century gave scope to the exercise of its prize jurisdiction; and its international importance as a prize court in the latter half of the 18th and the first part of the 19th centuries is a matter of common historical knowledge. There were upwards of 1000 prize causes each year between 1803 and 1811, in some years upwards of 2000.

There were other great judges; but Sir William Scott, afterwards Lord Stowell, is the most famous. Before his time there were no reports of admiralty cases, except Hay and Marriott's prize decisions. But from his time onwards there has been a continuous stream of admiralty reports, and we begin to find important cases decided on the instance as well as on the prize side.

In the reign of Queen Victoria, two enabling statutes, 1840 and 1861, were passed and greatly enlarged the jurisdiction of the court. The manner in which these statutes were administered by Dr Stephen Lushington and Sir R. J. Phillimore, whose tenure of office covered the whole period of the queen's reign till the creation of the High Court of Justice, the valuable assistance rendered by the nautical assessors from the Trinity House, the great increase of shipping, especially of steam shipping, and the number and gravity of cases of collision, salvage and damage to cargo, restored the activity of the court and made it one of the most important tribunals of the country. In 1875, by the operation of the Judicature Acts of 1873 and 1875, the High Court of Admiralty was with the other great courts of England formed into the High Court of Justice. The principal officers of the court in subordination to the judge were the registrar (an office which always points to a connexion with canon or civil law), and the marshal, who acted as the maritime sheriff, having for his baton of office a silver oar. The assistance of the Trinity Masters, which has been already mentioned, was provided for in the charter of incorporation of the Trinity House. These officers and their assistance have been preserved in the High Court of Justice.

Till the year 1859 the practitioners in the High Court of Admiralty were the same as those in the ecclesiastical courts and distinct from those who practised in the ordinary courts. Advocates took the place of barristers, and proctors of solicitors. The place of the attorney-general was taken by the king's or queen's advocate-general, and that of the treasury solicitor by the king's or queen's procurator or proctor. There were also an admiralty advocate and an admiralty proctor. The king's advocate also represented the crown in the ecclesiastical courts, and was its standing adviser in matters of international and foreign law. The king's advocate led the bar of his courts, and before the privy council took precedence of the attorney-general. The admiralty advocate or advocate to his majesty in his office of admiralty represented specially the lords of the admiralty. In the Admiralty Court he ranked next after the king's advocate.

Practitioners in the court.

In an act of 1859 the practice was thrown open to barristers and to attorneys and solicitors.

Upon the next vacancy after the courts were thrown open, the crown altered the precedence and placed the queen's advocate after the attorney- and solicitor-general. There were two holders of the office under these conditions, Sir R. J. Phillimore and Sir Travers Twiss. The office was not filled up after the resignation of the latter. The admiralty had, when the courts were thrown open, a standing counsel for the ordinary courts and a solicitor. Questions soon arose as to the respective claims of the admiralty advocate and the counsel to the admiralty, and their acuteness was increased when the courts were fused into one High Court of Justice. Upon the resignation of Sir James Parker Deane the office of admiralty advocate was not filled up. In like manner the proctor to the admiralty has disappeared. The office of king's or queen's proctor has been kept alive but amalgamated with that of the solicitor for the treasury. That officer uses the title of king's proctor when he appears in certain matrimonial causes.

The last holder of the office of standing counsel to the admiralty was Alexander Staveley Hill, K.C., M.P. Since his death the office, like those of the king's or queen's advocate and the admiralty advocate, has not been filled up; and the ordinary law officers of the crown with the assistance of a junior counsel to the admiralty (a barrister appointed by the attorney-general) perform the duties of all these offices.

Judge Advocate of the Fleet.

The judge advocate of the fleet is a practising barrister whose function it is to advise the admiralty on all matters connected with courts-martial. Though section 61 of the Naval Discipline Act 1866 recognizes the possibility of his presence at a court-martial, he does not nowadays attend, but is represented by his deputy or by an officiating deputy judge advocate appointed *ad hoc* by the admiralty, the commander-in-chief of the fleet or squadron who convenes the court-martial, or, if no such appointment is made, by the president of the court-martial. But though the judge advocate of the fleet does not actually attend the courts-martial very responsible duties are imposed upon him. By a minute of the Board passed in 1884 (which is still in force) all proceedings of courts-martial on officers and men of the royal navy, excepting those where the prisoner pleads guilty and no evidence is taken, are to be referred to him, with a view to the consideration of (*a*) the charge, (*b*) the evidence on which the finding is based, and (*c*) the legality of the sentence, and he writes a minute on each case for the information of the lords commissioners of the admiralty with regard to these points. He has no power to modify a sentence, a power which is reserved to the admiralty by § 53 (1) of the Naval Discipline Act 1866, except in the case of a death sentence, which can only be remitted by the crown. All cases where the prisoner has pleaded guilty are examined in the admiralty, and if in any case there is any reason to think that there has been any informality or that the prisoner has not understood the effect of his plea, such case is submitted to the judge advocate of the fleet for his opinion. The judge advocate of the fleet receives no fees but is remunerated by a salary of £500 per annum.

The existence of a deputy judge of the fleet appointed by the admiralty has been recognized by the king's regulations, but no such officer had been appointed up to 1908.

In accordance with the provisions of § 61 of the Naval Discipline Act 1866, in the absence of the judge advocate of the fleet and his deputy, an officiating judge advocate is appointed for each court-martial. His duties are described in detail by the king's regulations, but may be summed up as consisting of seeing that the charges are in order, pointing out any informalities or defects in the charges or in the constitution of the court, seeing that any witness required by prosecutor or prisoner is summoned, keeping the minutes of the proceedings, advising on matters of law which arise at any time after the warrant for the court-martial is issued, drawing up the findings and sentence, and forwarding the minutes when completed to the admiralty. The officiating judge advocate is usually the secretary of the flag-officer convening the court-martial or some other officer of the accountancy branch. He is remunerated for his services by a fixed fee for each day the court sits.

Ireland.—The High Court of Admiralty of Ireland, being formed on the same pattern as the High Court in England, sat in the Four Courts, Dublin, having a judge, a registrar, a marshal and a king's or queen's advocate. In peace time and war time alike it exercised only an instance jurisdiction, though in 1793 it claimed to exercise prize jurisdiction (see ADMIRALTY JURISDICTION). No prize commission ever issued to it. By the Irish Judicature Act of 1877 it was directed that it should be amalgamated with the Irish High Court of Justice upon the next vacancy in the office of judge, and this subsequently took place. There was no separate lord high admiral for Ireland.

Scotland.—At the Union, while the national functions of the lord high admiral were merged in the English office it was provided by the Act of Union that the Court of Admiralty in Scotland should be continued "for determination of all maritime cases relating to private rights in Scotland competent to the jurisdiction of the Admiralty Court." This court continued till 1831, when its civil jurisdiction was given to the Court of Session and the Sheriffs' Courts (see ADMIRALTY JURISDICTION).

See Sir Travers Twiss, *Black Book of the Admiralty*, Rolls series; R. G. Marsden, *Select Pleas in the Court of Admiralty*, published by the Selden Society; Godolphin, *View of the Admiral Jurisdiction.* (W. G. F. P.)

ADMIRALTY ISLANDS, a group of about forty islands lying north of New Guinea, between 1° and 3° S., and 146° and 148° E., within the Bismarck Archipelago, belonging to Germany. The largest, Manus, is about 60 m. in length, and its highest point is about 3000 ft. above the sea; the others are very small, and rise little above sea-level. Most are of coral formation, but the hills of Manus are believed to be extinct volcanoes. The islands were discovered by the Dutch in 1616, and visited in 1767 by Philip Carteret; but no landing seems to have been effected, owing to the surrounding reefs, until the arrival of the "Challenger" in 1875. The natives are of the Papuan type, but show signs of mixed origin. They are cannibals, and many murders of whites have taken place.

ADMIRALTY JURISDICTION. The courts by which, as far as we know, admiralty jurisdiction in civil matters was first exercised were the following. In and throughout England the courts of the several admirals soon combined into one High Court of Admiralty (see ADMIRALTY, HIGH COURT OF). Within the territories of the Cinque Ports the Court of Admiralty of the Cinque Ports exercised a co-ordinate jurisdiction. In certain towns and places there were local courts of vice-admiralty. In Scotland there existed the Scottish High Court of Admiralty, in Ireland the Irish High Court of Admiralty. Of these courts that of the Cinque Ports alone remains untouched. The Scottish court was abolished, and its civil jurisdiction given to the Court of Session and to the courts of the sheriffs by the Court of Session Act 1830—not, however, till a decision given by it and the appeal therefrom to the House of Lords had established a remarkable rule of admiralty law in cases of collision (*Hay* v. *le Neve*, 1824, 2 Shaw, Sc. App. Cas. 395). The act states that the Court of Justiciary held cumulative jurisdiction with the Court of Admiralty in criminal matters. The local vice-admiralty courts in England had ceased to do much work when they were abolished by the Municipal Corporations Act 1835; the High Court became, with the other superior courts, a component part of the High Court of Justice by virtue of the Judicature Acts 1873 and 1875. And the Irish court has in like manner become a part of the High Court of Justice in Ireland by virtue of the Judicature Act passed in 1877.

Vice-Admiralty Courts.

As England first, and Great Britain afterwards, acquired colonies and possessions beyond seas, vice-admiralty courts were established. The earliest known was that in Jamaica, established in the year 1662. Some vice-admiralty courts which were created for prize purposes in the last century were suffered to expire after 1815. In the year 1863, when the act regulating the vice-admiralty courts was passed, there were vice-admiralty courts at Antigua, Bahamas, Barbadoes, Bermuda, British Columbia, British Guiana, British Honduras, Cape of Good Hope, Ceylon, Dominica, Falkland Islands, Gambia River, Gibraltar, Gold Coast, Grenada, Hong Kong, Jamaica, Labuan, Lagos, Lower Canada (otherwise Quebec), Malta, Mauritius, Montserrat, Natal, Nevis, New Brunswick, Newfoundland, New South Wales, New Zealand, Nova Scotia (otherwise Halifax), Prince Edward Island, Queensland, St Christopher, St Helena, St Lucia, St Vincent, Sierra Leone, South Australia, Tasmania, Tobago, Trinidad, Vancouver's Island, Victoria, Virgin Islands (otherwise Tortola), and Western Australia, and (for matters of the slave trade only) Aden. By the act of 1867 one for the Straits Settlements was added. These courts have been regulated from time to time by the following statutes: 2 and 3 Will. IV. c. 51, 26 and 27 Vict. c. 24 (Vice-Admiralty Courts Act 1863), already cited, and 30 and 31 Vict. c. 45 (Vice-Admiralty Courts Act Amendment Act 1867); and by the slave trade acts, of which the last and consolidating act was that of 1873.

In 1890 the Colonial Courts of Admiralty Act provided that, except in the colonies of New South Wales, Victoria, St Helena and British Honduras, vice-admiralty courts should be abolished, and a substitution made of colonial courts of admiralty. There is power, however, reserved to the crown to erect through the admiralty in any British possession any vice-admiralty court, except in India or any British possession having a representative legislature. No vice-admiralty court so established can exercise any jurisdiction except for some purpose relating to prize, the royal navy, the slave trade, foreign enlistment, Pacific Islanders' protection, and questions relating to treaties or conventions on international law. Vice-admiralty courts exercised all usual admiralty jurisdiction, and in addition a certain revenue jurisdiction, and jurisdiction over matters of slave trade and prize and under the Pacific Islanders' Protection Act. The appeal from vice-admiralty courts used to lie to the High Court of Admiralty of England, but has been transferred to the king in council.

Colonial Courts of Admiralty.

By the Colonial Courts of Admiralty Act 1890, already referred to, every court of law in a British possession which is declared by its legislature to be such, or if there be no such declaration, which has original unlimited civil jurisdiction, shall be a court of admiralty.

India.

There used at one time to be vice-admiralty courts for Calcutta, Madras and Bombay; but by the India High Courts Act 1861, § 9, the admiralty jurisdiction is given to the High Courts of these places.

Consular Courts.

Consular courts established in Turkey, China and Japan have had admiralty jurisdiction given to them, and by § 12 of the Colonial Admiralty Courts Act any court established by H.M. for the exercise of jurisdiction in any place outside H.M.'s dominion may have admiralty jurisdiction granted to it.

Australia.

By the Commonwealth of Australia Constitution Act 1900 a federal supreme court, to be called the High Court of Australia, is created, and the parliament of the Commonwealth may make laws conferring original jurisdiction on the High Court in matters of admiralty and maritime jurisdiction.

Isle of Man.

There is a court of admiralty in the Isle of Man of which the water-bailiff is judge. He is also styled admiral. It is said to have jurisdiction in salvage and over other maritime matters occurring within 3 leagues from the shore.

County Local Courts.

Modern statutes have given admiralty jurisdiction to the City of London Court, the Court of Passage and to the county courts in the following matters: Salvage, where the value of the salved property does not exceed £1000, or the claim for reward £300; towage, necessaries and wages, where the claim does not exceed £150; claims for damage to cargo, or by collision, up to £300 (and for sums above these prescribed limits by agreement between the parties); and claims arising out of breaches of charter parties and other contracts for carriage of goods in foreign ships, or torts in respect thereof, up to £300. This jurisdiction is restricted to subjects over which jurisdiction was possessed by the High Court of Admiralty at the time when the first of these acts was passed, except as regards the last branch of it (the "*Aline*," 1880, 5 Ex. Div. 227; *R.* v. *Judge of City of London Court*, 1892, 1 Q.B. 272). In analogy with the county court admiralty jurisdiction created in England, a limited admiralty jurisdiction has been given in Ireland to the recorders of certain boroughs and the chairmen of certain quarter sessions; and in salvage cases, where a county court in England would have jurisdiction, magistrates, recorders and chairmen of quarter sessions may have jurisdiction as official arbitrators (Merchant Shipping Act 1894, § 547). In Scotland, admiralty suits in cases not exceeding the value of £25 are exclusively tried in the sheriff's court; while over that limit the sheriff's court and the Court of Session have concurrent jurisdiction. The sheriff has also criminal admiralty jurisdiction, but only as to crimes which he would be competent to try if committed on land (The Court of Session Act 1830, §§ 21 and 22).

By an act of 1821 an arbitral jurisdiction in cases of salvage was given to certain commissioners of the Cinque Ports.

Appeals.

The appeal from county courts and commissioners is to the High Court of Justice, and is exercised by a divisional court of the Probate, Divorce and Admiralty Division. In cases arising within the Cinque Ports there is an optional appeal to the Admiralty Court of the Cinque Ports. The appeal from the High Court of Justice is in ordinary admiralty matters, as in others, to the Court of Appeal, and from thence to the House of Lords. But it is specially provided by the Judicature Act 1891, as it was by the Prize Act 1864, that the appeal in prize cases shall be to the sovereign in council.

Civil jurisdiction.

The unfortunate provisions of the legislature, giving to the jurisdiction of county courts different money limits in admiralty equity and common law cases, make the distinction between cases coming under the admiralty jurisdiction and other civil cases of practical moment in those courts. Arguments full of learning and research have been addressed to the courts, and weighty decisions have been given, upon questions which would never have arisen if the county courts had not a larger money area of jurisdiction in admiralty cases than they have in other matters (*R.* v. *Judge of City of London Court*, 1892, 1 Q.B. 273; the "*Zeta*," 1893, App. Cas. 468). But as regards the high courts, whether in England, Scotland or Ireland, it is not now necessary to distinguish their civil admiralty jurisdiction from their ordinary civil jurisdiction, except for the purpose of seeing whether there can or cannot be process *in rem*. Not that every admiralty action can of right be brought *in rem*, but that no process *in rem* lies at the suit of a subject unless it be for a matter of admiralty jurisdiction—one, for instance, that could in England have been tried in the High Court of Admiralty. Now these matters of admiralty jurisdiction with process *in rem* range themselves under four primary and four supplementary heads. The four primary are damage, salvage, bottomry, wages; and the four supplementary are extensions due to one or other of the statutes of 1840 (Admiralty Court) and 1861 (Admiralty Court Act). They are damage to cargo carried in a ship, necessaries supplied to a ship, mortgage of ship, and master's claim for wages and disbursements on account of a ship. In all these cases, primary and secondary, the process of which a plaintiff can avail himself for redress, may be either *in personam* as in other civil suits, or by arrest of the ship, and, in cases of salvage and bottomry, the cargo. Whenever, also, the ship can be arrested, any freight due can also be attached, by arrest of the cargo to the extent only of the freight which it has to pay. For the purpose of ascertaining whether or not process *in rem* would lie, there have been distinctions as nice, and the line of admiralty jurisdiction has been drawn as carefully, as in the cases of the admiralty jurisdiction of the county courts (the "*Theta*," 1894, Prob. 280; the "*Gas Float Whitton*," 1897, App. Cas. 337). There have been similar questions raised in the United States, from *De Lovio* v. *Boit* (1815, 2 Gallison, 398), and *Ramsay* v. *Allegre* (1827, 12 Wheaton, 611), down to the quite modern cases which will be found quoted in the arguments and judgments in the "*Gas Float Whitton*."

Disciplinary.

The disciplinary jurisdiction at one time exercised by the Admiralty Court, over both the royal navy and merchant vessels, may be said to be obsolete in time of peace, the last remnant of it being suits against merchantmen for flying flags appropriate to men-of-war (the "*Minerva*," 1800, 3 C. Rob. 34), a matter now more effectively provided against by the Merchant Shipping Act 1894. In time of war, however, it was exercised in some instances as long as the Admiralty Court lasted, and is now in consequence exercisable by the High Court of Justice (see *Prize* below). It was, perhaps, in consequence of its ancient disciplinary jurisdiction that the Admiralty Court was made the court to enforce certain portions of the Foreign Enlistment Act 1870.

Finally, appeals from decisions of courts of inquiry, under the Merchant Shipping Act, cancelling or suspending the certificates of officers in the merchant service, may be made to the Probate, Divorce and Admiralty Division of the High Court of Justice.

Criminal cases.

The admiralty jurisdiction in criminal matters extends over all crimes committed on board British ships at sea or in tidal waters, even though such tidal waters be well within foreign territory (*R.* v. *Anderson*, 1868, L.R. 1 C.C.R. 161), but not over crimes committed on board foreign vessels upon the high seas (*R.* v. *Serva*, 1845, 1 Denison C.C. 104). Whether it extended over crimes committed on foreign ships within territorial waters of the United Kingdom, and whether a zone of three miles round the shores of the United Kingdom was for such purpose territorial water, were the great questions raised in *R.* v. *Keyn* (the "*Franconia*," L.R. 2 Ex. Div. 126), and decided in the negative by the majority of the judges, rightly, as the writer of this article respectfully thinks. Since then, however, the legislature has brought these waters within the jurisdiction of the admiralty by the Territorial Waters Jurisdiction Act 1878. Section 2 runs as follows: "An offence committed by a person, whether he is or is not a British subject, on the open sea within the territorial waters of British dominions, is an offence within the jurisdiction of the admiral, although it may have been committed on board or by means of a foreign ship, and the person who committed such offence may be arrested, tried and punished accordingly." By § 7 the "jurisdiction of the admiral" is defined as "including the jurisdiction of the admiralty of England or Ireland, or either of such jurisdictions as used in any act of parliament; and for the purpose of arresting any person charged with an offence declared by this act to be within the jurisdiction of the admiral, the territorial waters adjacent to the United Kingdom, or any other part of her majesty's dominions, shall be deemed to be within the jurisdiction of any judge, magistrate or officer." And "territorial waters of her majesty's dominions" are defined as "in reference to the sea, meaning such part of the sea adjacent to the coast of the United Kingdom, or the coast of some other part of her majesty's dominions, as is deemed by international law to be within the territorial sovereignty of her majesty; and for the purpose of any offence declared by this act to be within the jurisdiction of the admiral, any part of the open sea within one marine league of the coast, measured from low-water mark, shall be deemed to be open sea within the territorial waters of her majesty's dominions." As to those portions of the sea and tidal waters which, by reason of their partially land-locked positions, are deemed to be in the body of a county, there is not admiralty jurisdiction, but crimes are tried as if they were committed on land within the same county.

Pirates, whatever flag they pretended to fly, were, from 1360 onwards, wherever their crimes were committed, subject to the admiralty jurisdiction. The criminal jurisdiction of the admiralty was first exercised by the High Court of Admiralty; and then, by virtue of the Offences at Sea Act 1536, transferred to commissioners appointed under the great seal, among whom were to be the admiral or admirals, his or their deputies. Admiralty sessions were held for this purpose till 1834. Admiralty criminal jurisdiction is now, by virtue of the series of statutes, the Offences at Sea Act 1799, the Central Criminal Court Act 1834, Offences at Sea Act 1844, and the criminal law consolidation acts passed in 1861, exercised by the Central Criminal Court and by the ordinary courts of assize. Special provision for trial in the colonies of offences committed at sea has been made by an act of William III. (1698–1699), the Offences at Sea Act 1806, and the Admiralty Offences (Colonial) Act 1849.

Prize.

The Admiralty Court had jurisdiction in matters of prize from very early times; and although since the middle of the 17th century the *instance*, or ordinary civil jurisdiction of the court, has been kept distinct from the *prize* jurisdiction, they were originally both administered and regarded as being within the ordinary jurisdiction of the lord high admiral. The early records of the admiralty show that the origin of the prize jurisdiction is to be traced to the power given to the court of the admiral to try cases of piracy and "spoil," *i.e.* captures of foreign ships by English ships. The earliest recorded case of spoil tried before the admiral is in 1357, when the goods of a Portuguese subject, taken at sea by Englishmen from a French ship which had previously spoiled a Portuguese, were awarded by the admiral as good prize to the English captors; and Edward III. in a letter to the king of Portugal answering a complaint on the subject gives the admiral's decision as a reason for refusing their restoration. During the 16th century a very large part of the business of the Admiralty Court related to spoil and piracy, and the privy council often directed the judge of the court how to deal with the spoil cases, with regard to which foreigners who had suffered from attacks by English ships made petition for redress to the admiral or the council. The spoil suit at this time (*causa spolii*) was a civil proceeding resulting in a decree *absolutoria*, dismissing the defendant, or *condemnatoria*, ordering restoration to be made by him. In 1585 the patent of Howard, the lord high admiral, authorized him to issue letters of reprisal against Spain; and an order in council regulating the conduct of those to whom such letters were issued provided by an additional article (1859) that all prizes were to be brought in without breaking of bulk for adjudication by the Admiralty Court. The court was also resorted to at this time by captors, sailing under commissions granted by the allies of England, such as the king of France and the Dutch. About the middle of the 17th century separate sittings of the court for instance and prize business began, perhaps because of the conflicting claims to *droits* of Charles II. and the duke of York as lord high admiral; and privateering under royal commission took the place of the former irregular "spoiling." The account which Lord Mansfield gave of the records of the Admiralty Court, that there were no prize act books earlier than 1641, or prize sentences earlier than 1648, and that before 1690 the records were in confusion, must be qualified by the correction that there are in existence prize sentences (on paper, not parchment) as early as 1589.

Although the courts of common law hardly ever seem to have nterfered with or disputed the admiralty prize jurisdiction, its exclusive nature was not finally admitted till 1782; but long previously royal ordinances (1512, 1602) and statutes (1661, giving an alternative of commissioners, 1670, 1706) had given he Admiralty Court the only express jurisdiction over prize. The same statute of Anne and acts of 1739 and 1744 give prize jurisdiction to any court of admiralty, and the courts of admiralty for the colonies and plantations in North America.

It has been a disputed question whether the prize jurisdiction of the court was inherent, *i.e.* coming within the powers given by the general patent of the judge, in which no express mention of it is made, or whether it required a special commission. Upon this subject the judgment of Lord Mansfield in *Lindo* v. *Rodney* (1782, Dougl. 612), the judgment of Mr Justice Story in *De Lovio* v. *Boit* (1815, 2 Gallison, 398), and Marsden's *Select Pleas of the Court of Admiralty* (introduction), may be consulted. But the settled practice now and for a long time past has been for a special commission and warrant to be issued for this purpose. In connexion with this it is observable that in 1793 the Admiralty Court of Ireland claimed to exercise prize jurisdiction under its general patent; and it is said to have been the opinion of Sir W. Wynne that the Admiralty Court of Scotland had a similar right (Brown, *Civil Law of Admiralty*, vol. ii. 211, 212). Any jurisdiction of the Scottish court over prize of war was transferred to the English court by the Court of Session Act 1825, § 57. As to the Irish court, by the Act of Union it was provided that there should remain in Ireland an instance court of admiralty for the determination of causes civil and maritime only.

In 1864 the constitution and procedure of prize courts, which had until then been prescribed by occasional acts passed for each war as it arose, were for the first time made permanent by the Naval Prize Act, by which the High Court of Admiralty and every admiralty or vice-admiralty court, or any other court exercising admiralty jurisdiction in British dominions, if for the time being authorized to exercise prize jurisdiction, were made prize courts. The High Court of Admiralty was given jurisdiction throughout British dominions as a prize court, and, as such, power to enforce any order of a vice-admiralty prize court and the judicial committee of the privy council in prize appeals—this power *mutatis mutandis* being also given to vice-admiralty prize courts. An appeal was given from any prize court to the sovereign in council. Prize courts were given jurisdiction in cases of captures made in a land expedition or an expedition made conjointly with allied forces, and power to give prize salvage on recaptured ships and prize bounty; and a form of procedure was prescribed. The High Court was also given exclusive jurisdiction as a prize court over questions of ransom and petitions of right in prize cases, and power to punish masters of ships under convoy disobeying orders or deserting convoy. By the Naval Discipline Act 1866, power to award damages to convoyed ships exposed to danger by the fault of the officer in charge of the convoy was also given to the High Court. Under other statutes it had power to try questions of booty of war when referred to it by the crown, in the same way as prize causes, and claims of king's ships for salvage on recaptures from pirates, which could be condemned as *droits* of admiralty, subject to the owner's right to receive them on paying one-eighth of the value, and also power to seize and restore prizes captured by belligerents in violation of British neutrality, or by a ship equipped in British ports contrary to British obligations of neutrality.

All jurisdiction of the High Court of Admiralty has since passed to the High Court of Justice, which is made a prize court under the Naval Prize Act, with all the powers of the Admiralty Court in that respect; and all prize causes and matters within the jurisdiction of that court as a prize court are assigned to the Probate, Divorce and Admiralty Division; and an appeal from it as a prize court lies only to the king in council (Judicature Acts 1873 and 1891).

By an act of 1894 further provision is made for the constitution of prize courts in British possessions. A commission, warrant or instruction from the crown or the admiralty may be issued at any time, even in peace; and upon such issue, subject to instructions from the crown, the vice-admiral of the possessions on being satisfied by information from a secretary of state that war has broken out between Great Britain and a foreign state, may make proclamation to that effect, and the commission or warrant comes into effect. The commission or warrant may authorize a vice-admiralty court or colonial court of admiralty to act as a prize court, or establish a vice-admiralty court for that purpose, and may be revoked or altered at any time. The court is authorized to act as a prize court during the war, and shall after its conclusion continue to act as such, and finally dispose of all matters and things arising during the war, including all penalties and forfeitures incurred therein. Rules of court may also be made by order in council for regulating, subject to the Naval Prize Act, the procedure and practice of prize courts under that act, the duties and conduct of their officers and practitioners, and the fees and costs therein (Prize Courts Act 1894, §§2, 3). This latter power has been exercised; and prize rules for the High Court of Justice and the vice-admiralty prize courts were framed in 1898 (Statutory Rules and Orders, 1898).

Authorities.—Marsden, *Select Pleas of the Court of Admiralty*, Selden Society, London, 1892 and 1897; Zouch, *Jurisdiction of the Admiralty of England asserted*; Robinson, *Collectanea Maritima*; Brown, *Admiralty*; Edwardes, *Admiralty*; Phillimore, *International Law*, vol. i., vol. iii. part xi.; Pritchard, *Admiralty Digest*, tit. Jurisdiction. (W. G. F. P.)

United States

The source of admiralty jurisdiction in the United States is Article 3, § 2 of the United States Constitution:—"The judicial power shall extend to all cases of admiralty and maritime jurisdiction." The United States Supreme Court has declared that by virtue of these words the admiralty jurisdiction extends not only to the high seas but to the great lakes and the rivers connecting them, and to all public navigable waters in the United States (the "*Genesee Chief*" v. *Fitz-Hugh*, 12 Howards U.S. Rep. 443), including even interstate canals (*Ex. p. Boyer*, 109 U.S. Rep. 629, the "*Robert W. Parsons*," [1903] 191 U.S. 17), and is not confined to tide waters. The American colonies had vice-admiralty courts with an admiralty jurisdiction equal to the largest claimed by the English admiralty courts even under Edward III. When they became states they delegated to the federal government their several "admiralty and maritime jurisdiction," using these words in the sense understood in every country in Europe, England excepted, and in the sense in which they had then been used in the colonies for a long time, and without reference to the very narrow jurisdiction of the English admiralty courts then existing (*Waring* v. *Clark*, 5 Howards U.S. Rep. 441).

It is settled as to the United States admiralty jurisdiction not that it is "co-equal with that of the original English, or that of continental European admiralty, but is rather that defined by the statutes of Richard II., under the construction given to them by contemporary or immediately subsequent courts of admiralty" (2 Parsons *Adm.* 176), and that it embraced all maritime contracts, torts, injuries or offences (*De Lovio* v. *Boit*, 2 Gallisons Rep. 398; *Waring* v. *Clark*, 5 Howards U.S. Rep. 441), and that it has never been restricted by the action of the common law courts as in England under Lord Coke (2 Parsons *Adm.* 166 n.; *Waring* v. *Clark*; *De Lovio* v. *Boit*).

Original admiralty jurisdiction was by the Judiciary Act of 1789 (U.S. Rev. Stats. § 563) granted to the United States district courts exclusively, except that concurrent original jurisdiction was given to United States circuit courts over seizures for slave trading, and condemnations of property used by persons in insurrection (§ 629; § 5309), and in the coolie trade (§ 2159), and by the act of the 3rd of March 1901; the supreme court of the District of Columbia is given the same jurisdiction as the district and circuit courts. The Supreme Court of the United States has no original jurisdiction in admiralty. All suits are brought in the first instance in the district court. Appeals lie, both on the law and on the facts, from a final decree of that court to the circuit court of appeals only, except in cases involving the jurisdiction of the court, the constitutionality of a law of any state or of the United States, or the validity or construction of any treaty of the United States, and except cases of prize and capital or infamous crime, in which cases of appeal lies directly to the supreme court. In cases of gravity and importance the Supreme Court may by certiorari review the judgment of the circuit court of appeals, but such cases are rare (re *Lau Ow Bew*, 141 U.S. Rep. 587; Benedict's *The American Admiralty*, § 607). Formerly the Judiciary Act authorized an appeal from the district court to the circuit court, and thence to the Supreme Court. But the act of the 3rd of March 1891 (Ch. 517) abolished this and created the circuit court of appeals, making it the final appellate court in admiralty, except as above stated. In any case where the district judge is unable to perform his duties or is disqualified by reason of interest or of relationship, or has acted as counsel for one of the parties to the action, it may be removed to the circuit court in that district (U.S. Rev. Stats. §§ 587, 589 and 601). These are now the only cases in which admiralty suits can come before the circuit court (Benedict's *Adm.* § 321).

The subject matter in cases of contract determines the jurisdiction (the "*General Smith*," 4 Wheaton U.S. Rep. 438), and not the presence or absence of tide, salt water, current, nor that the water be an inland basin or land-locked, or a river, nor by its being a harbour, or a port within the body of the county, nor that a remedy exists at common law. The admiralty courts have jurisdiction over all matters that concern owners and proprietors of ships as such; possessory actions and petitory actions to try title of a ship; cases of mariners' wages, wharfage, dockage, lighterage, stevedores, contracts of affreightment, charter parties, rights of passengers as such (the "*Moses Taylor*," 71 U.S. Rep. 411), pilotage, towage, maritime liens and loans, bottomry, respondentia and hypothecation of ship and cargo, marine insurance, average, jettison, demurrage, collisions, consortship, bounties, survey and sale of vessel, salvage, seizures under the laws of impost navigation or trade, cases of prize, ransom, condemnation, restitution and damages; assaults, batteries, damages and trespasses on the high seas and navigable waters of the United States; but not suits *in rem* for duties (Benedict's *Adm.* § 303a).

The U.S. Supreme Court has held in *Peoples Ferry Co.* v. *Beers*, 20 Howards U.S. Rep. 393, and in a series of subsequent cases that a contract to build a vessel is not a maritime contract (the "*Robert W. Parsons*"). Contracts to furnish cargo for ships and to furnish ships to carry the cargoes are maritime contracts (*Graham* v. *Oregon R. & N. Co.*, [1905] 135 Fed. Rep. 608).

Whenever there is a maritime lien, even though created by state statute as to a ship in her home port, it may be enforced by suit *in rem* in admiralty in the federal courts (the "*General Smith*"; the "*Lottawanna*," 21 Wallace Rep. 558, Benedict's *Adm.* § 270). In all suits by material men for supplies and repairs or other necessaries for a foreign ship, the libellant may proceed against the ship and freight *in rem* or against the master or owner *in personam* (12th Admiralty Rule; Benedict's *Adm.* § 268; the "*General Smith*"). Actions *in rem* and *in personam* may be joined in the same libel (*Newell* v. *Norton*, 3 Wallace 257; the "*Normandie*," 40 Fed. Rep. 590). But a contract to furnish fishermen with clothing, tobacco and other personal effects for use on a voyage is not a maritime contract, and a court of admiralty has no jurisdiction to enforce it *in rem* (the "*May F. Chisholm*," 1904; 129 Fed. Rep. 814). The state courts have no jurisdiction *in rem* over any maritime contract or tort (the "*Lottawanna*," the "*Belfast*," 7 Wallace Rep. 624). Admiralty jurisdiction in tort depends on locality; it must have occurred on the high seas or other navigable waters within admiralty cognizance (2 Parsons *Adm.* 347; the "*Plymouth*," 3 Wallace Rep. 20; the "*Genesee Chief*" v. *Fitz-Hugh*, the "*Blackheath*," [1903] 122 Fed. Rep. 112).

The U.S. Supreme Court in the "*Harrisburg*" (119 U.S. 199) and the "*Alaska*" (130 U.S. 207), after some conflict of opinion, held that the admiralty courts have no jurisdiction under the general admiralty law to try an action for damages for negligence on the high seas, causing death of a human being, while there was no act of Congress and no statute of the state to which the vessel belonged giving such right of action (Benedict's *Adm.* §§ 275-309a), nor where such statute is that of a foreign country (*Rundell* v. *Compagnie Générale*, [1899] 94 Fed. Rep. 366).

Admiralty has jurisdiction in cases of spoliation and piracy, collision and proceedings by owners to limit their liability under U.S. Rev. Stats. §§ 4281-9.

The United States admiralty courts have always had jurisdiction in matters of prize (*The Prize Cases*, 2 Black U.S. Rep. 635). The district courts have exclusive original jurisdiction (except that circuit courts also have jurisdiction when prize is taken from persons in insurrection), and the supreme court of the District of Columbia now has concurrent jurisdiction (*U.S.* v. *Sampson*, 1902, 187 U.S. 436) and appeals are direct to the Supreme Court. Special commissioners are appointed on the breaking out of hostilities to act under the orders of the district courts (U.S. Rev. Stats. § 4621, Prize Rule 9; Benedict's *Adm.* §509; 680 *Pieces Merchandise*, 2 Sprague 233). These commissioners take the depositions of witnesses and report to the court the evidence upon which it adjudicates. Proceedings in prize cases must be in conformity with admiralty proceedings, where the seizure is on land (*Union Insurance Co.* v. *U.S.*, 6 Wallace 759; 2 Parsons *Adm.* 174). The district courts have all the powers of a court of admiralty whether as instance or prize courts (*Glass* v. *sloop* "*Betsy*," 3 Dallas 6). To adjudicate in matters of prize is one of the ordinary functions of that court (Benedict's *Adm.* § 509).

The admiralty courts have jurisdiction over crimes and offences committed upon vessels belonging to citizens of the United States on the high seas or any arm of the sea or any waters within the admiralty and maritime jurisdiction of the United States (U.S. Rev. Stats. § 5339). High seas include the great lakes (*U.S.* v. *Rogers*, 150 U.S. 249). (J. A. Ba.)

Other Countries

France, and countries following France.

In France, and in Belgium, Spain, Portugal, Italy and Greece —countries which have adopted codes based on the Code Napoléon—the civil, or, as it would have been formerly called in England, the "instance," jurisdiction of the admiralty is exercised by the ordinary tribunals, and there are no separate courts of admiralty for this purpose. France and some other countries ave special commercial tribunals, which deal with shipping atters, but also with ordinary commercial cases. France as also *tribunaux maritimes commerciaux* (*Code disciplinaire et énal de la marine marchande du 24 mars 1852, loi du 11 mars* 891) to deal with maritime offences. Austria adopts the rench law in commercial matters. Italy had tribunals of comerce, but has given them up. She has, however, by Art. 14 f her Merchant Shipping Code, given jurisdiction to captains f ports to decide collision cases when the sum in dispute does ot exceed 200 lire.

ermany.

In Germany there are no special tribunals for admiralty atters. *Kammern für Handelssachen*, commercial courts, have been established in Berlin and some of the principal seaports. These deal with shipping matters, but also ith all other commercial suits.

candi- avian ations.

In Denmark, Sweden and Norway there is a maritime code hich came into force in Sweden in 1891, in Denmark in 1892, and in Norway in 1893. This was intended to be one code for the three countries; but each country as it finally adopted the code made some modifications of its own. Under this code there are in Norway permanent ritime courts for each town presided over by the judge the inferior local civil court (*civile underdömmer*), or if there more than one such judge then by the president, with two essors chosen out of a list. Temporary local courts, consting of the same judge with two other members of nautical ill and knowledge, can be constituted in districts where there no permanent courts. Appeals lie to the supreme court *öiesteret*). In Denmark maritime cases are brought before local courts constituted for maritime and commercial causes *ö-og-Handelsret*). In Sweden maritime cases are brought fore local courts of first instance consisting of a judge and sessors. There is an intermediate appeal to courts of second stance, and then to the supreme court, which finally decides on all causes civil and commercial.

Maritime cases in Holland are tried by the ordinary civil tribunals, with the same right of appeal.

Prize jurisdiction.

"By the maritime law of nations universally and immemorially received there is an established method of determination whether the capture be or be not lawful prize. Before the ship or goods can be disposed of by the captor there must be a regular judicial proceeding wherein both parties may be heard and condemnation thereupon as prize in a court of admiralty judging by the law of nations and treaties. . . . If the sentence of the court of admiralty is thought to be erroneous, there is in every maritime country a superior court of review. . . ." (duke of Newcastle's letter to M. Michell, secretary to the embassy of the king of Prussia, 1753). "So far as belligerent states do not make a practice of giving up the taking of booty at sea . . . they are required by international law to establish prize tribunals and thus give to their proceedings in the matter of prize a judicial character" (v. Holtzendorff, *Rechtslexikon*, tit. "Prisengerichte").

In France till the death of the duke of Montmorency in 1632 prize matters were adjudicated upon by the admiral. The duke had sold the office of admiral some years before his death to Cardinal Richelieu; but about the period of the duke's death the office of admiral appears to have been abolished, and one of grand master of navigation established in lieu. This new office was first held by Cardinal Richelieu and continued till 1695. The grand master took the admiral's place in matters of prize; but in 1659 a commission of councillors of state and masters of requests was appointed to assist the grand master and form a *Conseil des Prises*. From this conseil there was an appeal to the *Conseil d'État*. When the office of admiral was restored in 1695 he exercised his jurisdiction in prize matters with the assistance of the *Conseil des Prises*. The appeal was then given to the *Conseil Royal des Finances*. The *Ordonnance sur la marine* of August 1681 regulated the procedure. This system continued till the Revolution. The last *Conseil des Prises* was appointed in 1778. A law of the 14th of February 1793 abolished the *Conseil des Prises* and gave cognizance of prize matters "provisionally" to the tribunals of commerce. On the 8th of November 1793 (18 Brumaire, an II.) this jurisdiction was taken from the tribunals of commerce and given to the *Conseil Exécutif*. Later it was given to the *Comité de Salut Public*. On the 25th of October 1795 (3 Brumaire, an IV.) the jurisdiction was restored to the tribunals of commerce. This was again altered on the 27th of March 1800 (6 Germinal, an VIII.), when a *Conseil des Prises* was established, consisting of nine councillors of state, a commissary of the government and a secretary, all nominated by the First Consul.

On the 11th of June 1806 an appeal was given to the *Conseil d'État*. It was disputed among French jurists whether the *Conseil des Prises* was to be considered as a body actuated only by political considerations or one exercising what the French term an "administrative jurisdiction"; which is, as nearly as a parallel to it can be found in England, administration of justice between individuals and the state.

As most of the cases arising out of the great wars had been dealt with, an ordinance of the 9th of January 1815 suppressed the *Conseil des Prises* and directed the *Comité du contentieux* of the *Conseil d'État* to prepare the remaining prize matters for decision by the *Conseil d'État*. Such prize matters (probably including captures for trading in slaves) as required to be dealt with till 1854, appear to have been dealt with by this body; an ordinance of the 9th of September 1831 directing that the proceedings before the *Conseil d'État* should be private, was held to show that the jurisdiction was not political but administrative.

An Imperial decree, however, of the 18th of July 1854 restored the *Conseil des Prises*, with appeal to the *Conseil d'État*. This was for the war with Russia. A similar decree was published on the 9th of May 1859 for the war with Austria in Italy.

On the 28th of November 1861 a further decree ordered that the *Conseil* instituted in 1859 should so long as it was kept in being decide all prize matters; and this *Conseil* has decided on prizes taken in the wars with Mexico and Germany and in Cochin

China. It consists of seven judges and a commissary of the government. An appeal to the government in the *Conseil d'État* can be brought within three months. It is then decided by *l'Assemblée du Conseil d'État.*

Under the First Empire there were *commissions des ports*, *commissions colonials* and *commissions consulaires*, established mainly to collect materials for the *Conseil des Prises*, but sometimes, when the ship and cargo were clearly those of the enemy, proceeding to actual condemnation.

In Prussia Regulations of the 20th of June 1864 established a prize council consisting of a president and six associates with a law officer. An appeal was given to an upper prize council (v. Holtzendorff, *Rechtslexikon*, tit. "Prisengerichte").

By a law of the German empire of the 3rd of May 1884 the legality of prizes made during war has to be decided by prize courts, and the imperial government is authorized to determine the particulars as to the seat of such courts, their members and their proceedings (*Reichsgesetzblatt* of 1884, p. 49). Prize courts were established under this law on the occasion of the East African blockade in 1889 (*Reichsgesetzblatt* of 1889, pp. 5 sqq.).

In Italy Art. 14 of the Merchant Shipping Code provides that prize matters shall be tried by a special commission established by royal decree. On the occasion of the war with Austria such a special commission was established by royal decree of the 20th of June 1866. For the war with Abyssinia a fresh commission was established by royal decree of the 16th of August 1896. The composition of this commission, which was slightly different in character from that established in 1866, was as follows: (*a*) a first president of a court of appeal or a retired one, or a president of a section of the council of state or of cassation; (*b*) two general officers of the navy; (*c*) a member of the "contentious part" of the diplomatic service; (*d*) two councillors of a court of appeal; (*e*) a captain of a port, with a commissary of the government and a secretary; five to be a quorum. There was no appeal; but the ordinary right to have recourse to the Court of Cassation at Rome, if the prize commission proceeded without jurisdiction or in excess of jurisdiction, was preserved.

By an ordinance of the 27th of March 1895 regulating the whole matter of prize in Russia, two sorts of prize tribunals of first instance were contemplated—port tribunals and fleet tribunals. The latter are for captures made by ships of the fleet, and are to be composed of some of the principal officers of the fleet. The former are to have presidents named by the emperor from among those "*qui font partie de l'administration maritime judiciaire*"; the other members are to be appointed by the ministers of the navy, justice and foreign affairs. The court of appeal is formed by the council of the admiralty with the addition of two members of the senate and a nominee of the minister of foreign affairs (Clunet, 1904, p. 271).

On the occasion of the Russo-Japanese war, port tribunals were established under the authority of this ordinance by the lord high admiral, the Grand Duke Alexis, on the 13th of March 1904, at Sebastopol—Port Alexander III., Port Arthur and Vladivostock (Clunet, 1904, p. 479; *London Gazette*, 22nd March 1904). Many cases were heard before these tribunals and on appeal.

The procedure in prize cases under the old law of Spain is described in Abreu (Felix Joseph de Abreu y Bertodano), *Tratado juridico Politico sobre Presas de Mar* (Cadiz, 1746). On the occasion of the war with the United States the Spanish government published a proclamation stating the circumstances in which captures were to be made and prizes taken; but information is lacking as to the particular constitution of the prize court or courts.

In Greece prize questions are apparently left to be tried by the ordinary tribunals. See decision of Civil Tribunal of Athens, 1898, No. 3385 (reported Clunet, 1900, p. 826).

Turkey during her war of 1877 with Russia established a prize court and a court of appeal. The ordinance establishing these courts is set out in the *London Gazette* of the 6th of July 1877.

Japan established, in the war (1904–5) with Russia, prize courts at Sasébo and Yokosco with a court of appeal at Tokyo. Advocates were heard before these courts, and the procedure seems generally to have been modelled upon European patterns.

Authorities.—Clunet, *Journal du droit international privé*, cited shortly as Clunet; v. Holzendorff, *Rechtslexikon*, Leipzig, 1881; De Pistoye et Duverdy, *Traité des prises maritimes*, Paris, 1855, vol. ii., tit. viii.; Phillimore, *International Law*, vol. i., vol. iii. part xi.; Autran, *Code international de l'abordage, de l'assistance, et du sauvetage maritimes*, Paris, 1902; Raikes, *The Maritime Codes of Spain and Portugal* (1896), *of Holland and Belgium* (1898), *of Italy* (1900), London. (W. G. F. P.)

ADMISSION, in law, a statement made out of the witness-box by a party to legal proceedings, whether civil or criminal, or by some person whose statements are binding on that party against the interest of that party. (See Evidence.)

ADO (d. 874), archbishop of Vienne in Lotharingia, belonged to a famous Frankish house, and spent much of his middle life in Italy. He held his archiepiscopal see from 859 till his death on the 16th of December 874. Several of his letters are extant and reveal their writer as an energetic man of wide sympathies and considerable influence. Ado's principal works are a *Martyrologium* (printed *inter al.* in Migne, *Patrolog. lat.* cxxiii. pp. 181-420; append. pp. 419-436), and chronicle, *Chronicon sive Breviarium chronicorum de sex mundi aetatibus de Adamo usque ad ann.* 869 (in Migne, cxxiii. pp. 20-138, and Pertz, *Monumenta Germ.* ii. pp. 315-323, &c.). Ado's chronicle is based on that of Bede, with which he combines extracts from the ordinary sources, forming the whole into a consecutive narrative founded on the conception of the unity of the Roman empire, which he traces in the succession of the emperors, Charlemagne and his heirs following immediately after Constantine and Irene. "It is," says Wattenbach, "history from the point of view of authority and preconceived opinion, which exclude any independent judgment of events." Ado wrote also a book on the miracles (*Miracula*) of St Bernard, archbishop of Vienne (9th century), published in the Bollandist *Acta Sanctorum*; a life or *Martyrium* of St Desiderius, bishop of Vienne (d. 608), written about 870 and published in Migne, cxxiii. pp. 435-442; and a life of St Theudericus, abbot of Vienne (563), published in Mabillon, *Acta Sanct.* i. pp. 678-681, Migne, cxxiii. pp. 443-450, and revised in Bollandist *Acta Sanct.* 29th Oct. xii. pp. 840-843.

See W. Wattenbach, *Deutschlands Geschichtsquellen*, vol. i. (Stuttgart and Berlin, 1904).

ADOBE (pronounced *a-dó-be*; also corrupted to *dobie*; from the Span. *adobar*, to plaster, traceable through Arabic to an Egyptian hieroglyph meaning "brick"), a Spanish-American word for the sun-dried clay used by the Indians for building in some of the south-western states of the American Union, this method having been imported in the 16th century by Spaniards from Mexico, Peru, &c. A distinction is made between the smaller "adobes," which are about the size of ordinary baked bricks, and the larger "adobines," some of which are as much as from one to two yards long.

ADOLESCENCE (Lat. *adolescentia*, from *adolescere*, to grow up, past part. *adultus*, grown up, Eng. "adult"), the term now commonly adopted for the period between childhood and maturity, during which the characteristics—mental, physical and moral—that are to make or mar the individual disclose themselves, and then mature, in some cases by leaps and bounds, in others by more gradual evolution. The annual rate of growth, in height, weight and strength, increases to a marked extent and may even be doubled. The development in the man takes place in the direction of a greater strength, in the woman towards a fitter form for maternity. The sex sense develops, the love of nature and religion, and an overmastering curiosity both individual and general. This period of life, so fraught with its power for good and ill, is accordingly the most important and by far the most difficult for parents and educationists to deal with efficiently. The chief points for attention may be briefly indicated. Health depends mainly on two factors, heredity, or the sum total of physical and mental leanings of the individual, and environment. In an ideal system of training these two factors will be so fitted in and adapted to one another, that what is weak or unprovided for in the first will be amply compensated for in the second.

In an ideal condition children should be brought up in the country as much as possible rather than in the town. Though adults may live where they like within very wide limits and take no harm, children, even of healthy stock, living in towns, are continually subject to many minor ills, such as chronic catarrh, tonsilitis, bronchitis, and even the far graver pneumonia. Removed to healthier conditions in the country their ailments tend to disappear, and normal physical development supervenes. The residence should be on a well-drained soil, preferably near the sea in the case of a delicate child, on higher ground for those of more robust constitution. The child should be lightly clad in woollen garments all the year round, their thickness being slightly greater in winter than in summer. An abundance of simple well-cooked food in sufficient variety, ample time at table, where an atmosphere of light gaiety should be cultivated, and a period free from restraint both before and after meals, should be considered fundamental essentials. As regards the most suitable kinds of food—milk and fruit should be given in abundance, fresh meat once a day, and fish or eggs once a day. Bread had better be three days old, and baked in the form of small rolls to increase the ratio of crust to crumb. Both butter and sugar are good foods, and should be freely allowed in many forms.

The exercise of the body must be duly attended to. Nowadays this is provided for in the shape of games, some being optional, others prescribed, and such sports as boating, swimming, fencing, &c. But severe exercise should only be allowed under adequate medical control, and should be increased very gradually. In the case of girls, let them run, leap and climb with their brothers for the first twelve years or so of life. But as puberty approaches, with all the change, stress and strain dependent thereon, their lives should be appropriately modified. Rest should be enforced during the menstrual periods of these earlier years, and milder, more graduated exercise taken at other times. In the same way all mental strain should be diminished. Instead of pressure being put on a girl's intellectual education at about this time, as is too often the case, the time devoted to school and books should be diminished. Education should be on broader, more fundamental lines, and much time should be passed in the open air. With regard to the mental training of both sexes two points must be borne in mind. First, that an ample number of hours should be set on one side for sleep, up to ten years of age not less than eleven, and up to twenty years not less than nine. Secondly, that the time devoted to "bookwork" should be broken up into a number of short periods, very carefully graduated to the individual child.

In every case where there is a family tendency towards any certain disease or weakness, that tendency must determine the whole circumstances of the child's life. That diathesis which is most serious and usually least regarded, the nervous excitable one, is by far the most important and the most difficult to deal with. Every effort should be made to avoid the conditions in which the hereditary predisposition would be aroused into mischievous action, and to encourage development on simple unexciting lines. The child should be confined to the schoolroom but little and receive most of his training in wood and field. Other diatheses—the tuberculous, rheumatic, &c.—must be dealt with in appropriate ways.

The adolescent is prone to special weaknesses and moral perversions. The emotions are extremely unstable, and any stress put on them may lead to undesirable results. Warm climates, tight-fitting clothes, corsets, rich foods, soft mattresses, or indulgences of any kind, and also mental over-stimulation, are especially to be guarded against. The day should be filled with interests of an objective—in contradistinction to subjective—kind, and the child should retire to bed at night healthily fatigued in mind and body. Let there be confidence between mother and daughter, father and son, and, as the years bring the bodily changes, those in whom the children trust can choose the fitting moments for explaining their meaning and effect, and warning against abuses of the natural functions.

For bibliography see CHILD.

ADOLPH OF NASSAU (*c.* 1255–1298), German king, son of Walram, count of Nassau. He appears to have received a good education, and inherited his father's lands around Wiesbaden in 1276. He won considerable fame as a mercenary in many of the feuds of the time, and on the 5th of May 1292 was chosen German king, in succession to Rudolph I., an election due rather to the political conditions of the time than to his personal qualities. He made large promises to his supporters, and was crowned on the 1st of July at Aix-la-Chapelle. Princes and towns did homage to him, but his position was unstable, and the allegiance of many of the princes, among them Albert I., duke of Austria, son of the late king Rudolph, was merely nominal. Seeking at once to strengthen the royal position, he claimed Meissen as a vacant fief of the Empire, and in 1294 allied himself with Edward I., king of England, against France. Edward granted him a subsidy, but owing to a variety of reasons Adolph did not take the field against France, but turned his arms against Thuringia, which he had purchased from the landgrave Albert II. This bargain was resisted by the sons of Albert, and from 1294 to 1296 Adolph was campaigning in Meissen and Thuringia. Meissen was conquered, but he was not equally successful in Thuringia, and his relations with Albert of Austria were becoming more strained. He had been unable to fulfil the promises made at his election, and the princes began to look with suspicion upon his designs. Wenceslaus II., king of Bohemia, fell away from his allegiance, and his deposition was decided on, and was carried out at Mainz, on the 23rd of May 1298, when Albert of Austria was elected his successor. The forces of the rival kings met at Göllheim on the 2nd of July 1298, where Adolph was killed, it is said by the hand of Albert. He was buried at Rosenthal, and in 1309 his remains were removed to Spires.

See F. W. E. Roth, *Geschichte des Römischen Königs Adolf I. von Nassau* (Wiesbaden, 1879); V. Domeier, *Die Absetzung Adolfs von Nassau* (Berlin, 1889); L. Ennen, *Die Wahl des Königs Adolf von Nassau* (Cologne, 1866); L. Schmid, *Die Wahl des Grafen Adolf von Nassau zum Römischen König*; B. Gebhardt, *Handbuch der deutschen Geschichte*, Band i. (Berlin, 1901).

ADOLPHUS, JOHN LEYCESTER (1795–1862), English lawyer and author, was the son of John Adolphus (1768–1845), a well-known London barrister who wrote a *History of England to 1783* (1802); a *History of France from 1790* (1803) and other works. He was educated at Merchant Taylors' School and at St. John's College, Oxford. In 1821 he published *Letters to Richard Heber, Esq.*, in which he discussed the authorship of the then anonymous Waverley novels, and fixed it upon Sir Walter Scott. This conclusion was based on the resemblance of the novels in general style and method to the poems acknowledged by Scott. Scott thought at first that the letters were written by Reginald Heber, afterwards bishop of Calcutta, and the discovery of J. L. Adolphus's identity led to a warm friendship. Adolphus was called to the bar in 1822, and his *Circuiteers, an Eclogue*, is a parody of the style of two of his colleagues on the northern circuit. He became judge of the Marylebone County Court in 1852, and was a bencher of the Inner Temple. He was the author of *Letters from Spain in 1856 and 1857* (1858), and was completing his father's *History of England* at the time of his death on the 24th of December 1862.

ADOLPHUS FREDERICK (1710–1771), king of Sweden, was born at Gottorp on the 14th of May 1710. His father was Christian Augustus (1673–1726), duke of Schleswig-Holstein-Gottorp, bishop of Lübeck, and administrator, during the war of 1700–1721, of the duchies of Holstein-Gottorp for his nephew Charles Frederick; his mother was Albertina Frederica of Baden-Durlach. From 1727 to 1750 he was bishop of Lübeck, and administrator of Holstein-Kiel during the minority of Duke Charles Peter Ulrich, afterwards Peter III. of Russia. In 1743 he was elected heir to the throne of Sweden by the "Hat" faction in order that they might obtain better conditions of peace from the empress Elizabeth, whose fondness for the house of Holstein was notorious (see SWEDEN, *History*). During his whole reign (1751–1771) Adolphus Frederick was little more than a state decoration, the real power being lodged in the hands of an omnipotent *riksdag*, distracted by fierce party strife. Twice he endeavoured to free himself from the intolerable tutelage of the estates. The first occasion was in 1755 when, stimulated by his imperious consort Louisa Ulrica, sister of Frederick the Great, he tried to regain a portion of the attenuated prerogative, and nearly lost his throne in consequence. On the second occasion, under the guidance of his eldest son, the crown prince Gustavus, afterwards Gustavus III., he succeeded in overthrowing the tyrannous "Cap" senate, but was unable to make any use of his victory. He died of surfeit at Stockholm on the 12th of February 1771.

See R. Nisbet Bain, *Gustavus III. and his Contemporaries*, vol. i. (London, 1895). (R. N. B.)

ADONI, a town of British India, in the Bellary district of Madras, 307 m. from Madras by rail. It has manufactures of carpets, silk and cotton goods, and several factories for ginning and pressing cotton. The hill-fort above, now in ruins, was an important seat of government in Mahommedan times and is frequently mentioned in the wars of the 18th century. Pop. (1901) 30,416.

ADONIJAH (Heb. *Adoniyyah* or *Adoniyyahu*, "Yah is Lord"), a name borne by several persons in the Old Testament, the most noteworthy of whom was the fourth son of David. He was born to Haggith at Hebron (2 Sam. iii. 4; 1 Ch. iii. 2). The natural heir to the throne, on the death of Absalom, he sought with the help of Joab and Abiathar to seize his birthright, and made arrangements for his coronation (1 Kings i. 5 ff.). Hearing, however, that Solomon, with the help of Nathan the prophet and Bathsheba, and apparently with the consent of David, had ascended the throne, he fled for safety to the horns of the altar. Solomon spared him on this occasion (1 Kings i. 50 ff.), but later commanded Benaiah to slay him (ii. 13 ff.), because with the approval of Bathsheba he wished to marry Abishag, formerly David's concubine, and thus seemed to have designs on the throne.

ADONIS, in classical mythology, a youth of remarkable beauty, the favourite of Aphrodite. According to the story in Apollodorus (iii. 14. 4), he was the son of the Syrian king Theias by his daughter Smyrna (Myrrha), who had been inspired by Aphrodite with unnatural love. When Theias discovered the truth he would have slain his daughter, but the gods in pity changed her into a tree of the same name. After ten months the tree burst asunder and from it came forth Adonis. Aphrodite, charmed by his beauty, hid the infant in a box and handed him over to the care of Persephone, who afterwards refused to give him up. On an appeal being made to Zeus, he decided that Adonis should spend a third of the year with Persephone and a third with Aphrodite, the remaining third being at his own disposal. Adonis was afterwards killed by a boar sent by Artemis. There are many variations in the later forms of the story (notably in Ovid, *Metam.* x. 298). The name is generally supposed to be of Phoenician origin (from *adon*—"lord"), Adonis himself being identified with Tammuz (but see F. Dümmler in Pauly-Wissowa's *Real-encyklopädie*, who does not admit a Semitic origin for either name or cult). The name Abobas, by which he was known at Perga in Pamphylia, certainly seems connected with *abub* (a Semitic word for "flute"; cf. "ambubaiarum collegia" in Horace, *Satires*, i. 2. 1). (See also Attis.)

Annual festivals, called Adonia, were held in his honour at Byblus, Alexandria, Athens and other places. Although there were variations in the ceremony itself and in its date, the central idea was the death and resurrection of Adonis. A vivid description of the festival at Alexandria (for which Bion probably wrote his *Dirge of Adonis*) is given by Theocritus in his fifteenth idyll, the *Adoniazusae*. On the first day, which celebrated the union of Adonis and Aphrodite, their images were placed side by side on a silver couch, around them all the fruits of the season, "Adonis gardens" in silver baskets, golden boxes of myrrh, cakes of meal, honey and oil, made in the likeness of things that creep and things that fly. On the day following the image of Adonis was carried down to the shore and cast into the sea by women with dishevelled hair and bared breasts. At the same time a song was sung, in which the god was entreated to be propitious in the coming year. This festival, like that at Athens, was held late in summer; at Byblus, where the mourning ceremony preceded, it took place in spring.

It is now generally agreed that Adonis is a vegetation spirit, whose death and return to life represent the decay of nature in winter and its revival in spring. He is born from the myrrh-tree, the oil of which is used at his festival; he is connected with Aphrodite in her character of vegetation-goddess. A special feature of the Athenian festival was the "Adonis gardens," small pots of flowers forced to grow artificially, which rapidly faded (hence the expression was used to denote any transitory pleasure). The dispute between Aphrodite and Persephone for the possession of Adonis, settled by the agreement that he is to spend a third (or half) of the year in the lower world (the seed at first underground and then reappearing above it), finds a parallel in the story of Tammuz and Ishtar (see Aphrodite). The ceremony of the Adonia was intended as a charm to promote the growth of vegetation, the throwing of the gardens and images into the water being supposed to procure a supply of rain (for European parallels see Mannhardt). It is suggested (Frazer) that Adonis is not a god of vegetation generally, but specially a corn-spirit, and that the lamentation is not for the decay of vegetation in winter, but for the cruel treatment of the corn by the reaper and miller (cf. Robert Burns's *John Barleycorn*).

An important element in the story is the connexion of Adonis with the boar, which (according to one version) brings him into the world by splitting with his tusk the bark of the tree into which Smyrna was changed, and finally kills him. It is probable that Adonis himself was looked upon as incarnate in the swine, so that the sacrifice to him by way of expiation on special occasions of an animal which otherwise was specially sacred, and its consumption by its worshippers, was a sacramental act. Other instances of a god being sacrificed to himself as his own enemy are the sacrifice of the goat and bull to Dionysus and of the bear to Artemis. The swine would be sacrificed as having caused the death of Adonis, which explains the dislike of Aphrodite for that animal. It has been observed that whenever swine-sacrifices occur in the ritual of Aphrodite there is reference to Adonis. In any case, the conception of Adonis as a swine-god does not contradict the idea of him as a vegetation or corn spirit, which in many parts of Europe appears in the form of a boar or sow.

Authorities.—H. Brugsch, *Die Adonisklage und das Linoslied* (Berlin, 1852); Greve, *De Adonide* (Leipzig, 1877); W. H. Engel, *Kypros*, ii. (1841), still valuable; W. Mannhardt, *Wald- und Feldkulte*, ii. (1905); M. P. Nilsson, *Griechische Feste* (Leipzig, 1906); articles in Roscher's *Lexikon* and Pauly-Wissowa's *Encyklopädie;* J. G. Frazer, *The Golden Bough*, ii. (2nd ed.), p. 115, and *Adonis, Attis and Osiris* (1906); L. R. Farnell, *Cults of the Greek States*, ii. p. 646; W. Robertson Smith (*Religion of the Semites*, new ed., 1894, pp. 191, 290, 411), who, regarding Adonis as the swine-god, characterizes the Adonia as an annual piacular sacrifice (of swine), "in which the sacrifice has come to be overshadowed by its popular and dramatic accompaniments, to which the Greek celebration, not forming part of the state religion, was limited."

ADONIS, a genus of plants belonging to the natural order *Ranunculaceae*, known commonly by the names of pheasant's eye and *Flos Adonis*. They are annual or perennial herbs with much divided leaves and yellow or red flowers. *Adonis autumnalis* has become naturalized in some parts of England; the petals are scarlet with a dark spot at the base. An early flowering species, *Adonis vernalis*, with large bright yellow flowers, is well worthy of cultivation. It prefers a deep light soil. The name is also given to the butterfly, Mazarine or Clifton Blue (*Polyommatus Adonis*).

ADOPTIANISM. As the theological doctrine of the Logos which bulks so largely in the writings of the apologists of the 2nd century came to the front, the trinitarian problem became acute. The necessity of a constant protest against polytheism led to a tenacious insistence on the divine unity, and the task was to reconcile this unity with the deity of Jesus Christ. Some thinkers fell back on the "modalistic" solution which regards "Father" and "Son" as two aspects of the same subject:

but a simpler and more popular method was the "adoptianist" or humanitarian. Basing their views on the synoptic Gospels, and tracing descent from the obscure sect of the Alogi, the Adoptianists under Theodotus of Byzantium tried to found a school at Rome *c.* 185, asserting that Jesus was a man, filled with the Holy Spirit's inspiration from his baptism, and so attaining such a perfection of holiness that he was adopted by God and exalted to divine dignity. Theodotus was excommunicated by the bishop of Rome, Victor, *c.* 195, but his followers lived on under a younger teacher of the same name and under Artemon, while in the East similar views were expounded by Beryllus of Bostra and Paul of Samosata, who undoubtedly influenced Lucian of Antioch and his school, including Arius and, later, Nestorius.

There is thus a traceable historical connexion between the early adoptian controversy and the struggle in Spain at the end of the 8th century, to which that name is usually given. It was indeed only a renewal, under new conditions, of the conflict between two types of thought, the rational and the mystical, the school of Antioch and that of Alexandria. The writings of Theodore of Mopsuestia had become well known in the West, especially since the strife over the "three chapters" (544–553), and the opposition of Islam also partly determined the form of men's views on the doctrine of Christ's person. We must further remember the dyophysitism which had been sanctioned at the council of Chalcedon. About 780 Elipandus (b. 718), archbishop of Toledo, revived and vehemently defended the expression *Christus Filius Dei adoptivus*, and was aided by his much more gifted friend Felix, bishop of Urgella. They held that the duality of natures implied a distinction between two modes of sonship in Christ—the natural or proper, and the adoptive. In support of their views they appealed to scripture and to the Western Fathers, who had used the term "adoption" as synonymous with "assumption" in the orthodox sense; and especially to Christ's fraternal relation to Christians—the brother of God's adopted sons. Christ, the firstborn among many brethren, had a natural birth at Bethlehem and also a spiritual birth begun at his baptism and consummated at his resurrection. Thus they did not teach a dual *personality*, nor the old Antiochene view that Christ's divine exaltation was due to his sinless virtue; they were less concerned with old disputes than with the problem as the Chalcedon decision had left it—the relation of Christ's one personality to his two natures.

Felix introduced adoptian views into that part of Spain which belonged to the Franks, and Charlemagne thought it necessary to assemble a synod at Regensburg (Ratisbon), in 792, before which the bishop was summoned to explain and justify the new doctrine. Instead of this he renounced it, and confirmed his renunciation by a solemn oath to Pope Adrian, to whom the synod sent him. The recantation was probably insincere, for on returning to his diocese he taught adoptianism as before. Another synod was held at Frankfort in 794, by which the new doctrine was again formally condemned, though neither Felix nor any of his followers appeared.

In this synod Alcuin of York took part. A friendly letter from Alcuin, and a controversial pamphlet, to which Felix replied, were followed by the sending of several commissions of clergy to Spain to endeavour to put down the heresy. Archbishop Leidrad (d. 816) of Lyons, being on one of these commissions, persuaded Felix to appear before a synod at Aix-la-Chapelle in 799. There, after six days' disputing with Alcuin, he again recanted his heresy. The rest of his life was spent under the supervision of the archbishop at Lyons, where he died in 816. Elipandus, secure in his see at Toledo, never swerved from the adoptian views, which, however, were almost universally abandoned after the two leaders died.

In the scholastic discussions of the 12th century the question came to the front again, for the doctrine as framed by Alcuin was not universally accepted. Thus both Abelard and Peter Lombard, in the interest of the immutability of the divine substance (holding that God could not "become" anything), gravitated towards a Nestorian position. The great opponent of their Christology, which was known as Nihilianism, was the German scholar Gerhoch, who, for his bold assertion of the perfect interpenetration of deity and humanity in Christ, was accused of Eutychianism. The proposition *Deus non factus est aliquid secundum quod est homo* was condemned by a synod of Tours in 1163 and again by the Lateran synod of 1179, but Adoptianism continued all through the middle ages to be a source of theological dispute.

See A. Harnack, *Hist. of Dogma*, esp. vol. v. pp. 279-292; R. Ottley, *The Doctrine of the Incarnation*, vol. i. p. 228 ff., vol. ii. pp. 151-161; Herzog-Hauck, *Realencyk.*, art. "Adoptianismus." (A. J. G.)

ADOPTION (Lat. *adoptio*, for *adoptatio*, from *adoptare*, to choose for oneself), the act by which the relations of paternity and filiation are recognized as legally existing between persons not so related by nature. Cases of adoption were very frequent among the Greeks and Romans, and the custom was accordingly very strictly regulated in their laws. In Athens the power of adoption was allowed to all citizens who were of sound mind, and who possessed no male offspring of their own, and it could be exercised either during lifetime or by testament. The person adopted, who required to be himself a citizen, was enrolled in the family and *demus* of the adoptive father, whose name, however, he did not necessarily assume. In the interest of the next of kin, whose rights were affected by a case of adoption, it was provided that the registration should be attended with certain formalities, and that it should take place at a fixed time—the festival of the *Thargelia*. The rights and duties of adopted children were almost identical with those of natural offspring, and could not be renounced except in the case of one who had begotten children to take his place in the family of his adoptive father. Adopted into another family, children ceased to have any claim of kindred or inheritance through their natural father, though any rights they might have through their mother were not similarly affected. Among the Romans the existence of the *patria potestas* gave a peculiar significance to the custom of adoption. The motive to the act was not so generally childlessness, or the gratification of affection, as the desire to acquire those civil and agnate rights which were founded on the *patria potestas*. It was necessary, however, that the adopter should have no children of his own, and that he should be of such an age as to preclude reasonable expectation of any being born to him. Another limitation as to age was imposed by the maxim *adoptio imitatur naturam*, which required the adoptive father to be at least eighteen years older than the adopted children. According to the same maxim eunuchs were not permitted to adopt, as being impotent to beget children for themselves. Adoption was of two kinds according to the state of the person adopted, who might be either still under the *patria potestas* (*alieni juris*), or his own master (*sui juris*). In the former case the act was one of *adoption proper*, in the latter case it was styled *adrogation*, though the term adoption was also used in a general sense to describe both species. In adoption proper the natural father publicly sold his child to the adoptive father, and the sale being thrice repeated, the maxim of the Twelve Tables took effect, *Si pater filium ter venunduit, filius a patre liber esto*. The process was ratified and completed by a fictitious action of recovery brought by the adoptive father against the natural parent, which the latter did not defend, and which was therefore known as the *cessio in jure*. *Adrogation* could be accomplished originally only by the authority of the people assembled in the *Comitia*, but from the time of Diocletian it was effected by an imperial rescript. Females could not be adrogated, and, as they did not possess the *patria potestas*, they could not exercise the right of adoption in either kind. The whole Roman law on the subject of adoption will be found in Justinian's *Institutes*, lib. i. tit. II.

In Hindu law, as in nearly every ancient system, wills were formerly unknown, and adoptions took their place. (See INDIAN LAW.) Adoption is not recognized in the laws of England, Scotland or the Netherlands, though there are legal means by which one may be enabled to assume the name and arms and to inherit the property of a stranger. (See NAME.)

In France and Germany, countries which may be said to have embodied the Roman law in their jurisprudence, adoption is regulated according to the principles of Justinian, though with several more or less important modifications, rendered necessary by the usages of these countries respectively. Under French law the rights of adoption can be exercised only by those who are over fifty years of age, and who, at the time of adoption, have neither children nor legitimate descendants. They must also be fifteen years older than the person adopted. In German law the person adopting must either be fifty years of age, or at least eighteen years older than the adopted, unless a special dispensation is obtained. If the person adopted is a legitimate child the consent of his parents must be obtained; if illegitimate, the consent of the mother. Both in Germany and France the adopted child remains a member of his original family, and acquires no rights in the family of the adopter other than that of succession to the person adopting.

In the United States adoption is regulated by the statutes of the several states. Adoption of minors is permitted by statute in many of the states. These statutes generally require some public notice to be given of the intention to adopt, and an order of approval after a hearing before some public authority. The consequence commonly is that the person adopted becomes, in the eyes of the law, the child of the person adopting, for all purposes. Such an adoption, if consummated according to the law of the domicile, is equally effectual in any other state into which the parties may remove. The relative status thus newly acquired is ubiquitous. (See Whitmore, *Laws of Adoption; Ross* v. *Ross*, 129 Massachusetts Reports, 243.)

The part played by the legal fiction of adoption in the constitution of primitive society and the civilization of the race is so important, that Sir Henry S. Maine, in his *Ancient Law*, expresses the opinion that, had it never existed, the primitive groups of mankind could not have coalesced except on terms of absolute superiority on the one side and absolute subjection on the other. With the institution of adoption, however, one people might *feign itself* as descended from the same stock as the people to whose *sacra gentilicia* it was admitted; and amicable relations were thus established between stocks which, but for this expedient, must have submitted to the arbitrament of the sword with all its consequences.

ADORATION (Lat. *ad*, to, and *os*, mouth; *i.e.* "carrying to one's mouth"), primarily an act of homage or worship, which, among the Romans, was performed by raising the hand to the mouth, kissing it and then waving it in the direction of the adored object. The devotee had his head covered, and after the act turned himself round from left to right. Sometimes he kissed the feet or knees of the images of the gods themselves, and Saturn and Hercules were adored with the head bare. By a natural transition the homage, at first paid to divine beings alone, came to be paid to monarchs. Thus the Greek and Roman emperors were adored by bowing or kneeling, laying hold of the imperial robe, and presently withdrawing the hand and pressing it to the lips, or by putting the royal robe itself to the lips. In Eastern countries adoration has ever been performed in an attitude still more lowly. The Persian method, introduced by Cyrus, was to bend the knee and fall on the face at the prince's feet, striking the earth with the forehead and kissing the ground. This striking of the earth with the forehead, usually a fixed number of times, is the form of adoration usually paid to Eastern potentates to-day. The Jews kissed in homage. Thus in 1 Kings xix. 18, God is made to say, "Yet I have left me seven thousand in Israel, all the knees which have not bowed unto Baal, and every mouth which hath not kissed him." And in Psalms ii. 12, "Kiss the Son, lest he be angry, and ye perish from the way." (See also Hosea xiii. 2.) In England the ceremony of kissing the sovereign's hand, and some other acts which are performed kneeling, may be described as forms of adoration. Adoration is applied in the Roman Church to the ceremony of kissing the pope's foot, a custom which is said to have been introduced by the popes following the example of the emperor Diocletian. The toe of the famous statue of the apostle in St Peter's, Rome, shows marked wear caused by the kisses of pilgrims. In the Roman Church a distinction is made between *Latria*, a worship due to God alone, and *Dulia* or *Hyperdulia*, the adoration paid to the Virgin, saints, martyrs, crucifixes, &c. (See further HOMAGE.)

ADORF, a town of Germany, in the kingdom of Saxony, 3 m. from the Bohemian frontier, at an elevation of 1400 ft. above the sea, on the Plauen–Eger and Aue–Adorf lines of railway. Pop. 5000. It has lace, dyeing and tanning industries, and manufactures of toys and musical instruments; and there is a convalescent home for the poor of the city of Leipzig.

ADOUR (anc. *Aturrus* or *Adurus*, from Celtic *dour*, water), a river of south-west France, rising in the department of Hautes Pyrénées, and flowing in a wide curve to the Bay of Biscay. It is formed of several streams having their origin in the *massifs* of the Pic d'Arbizon and the Pic du Midi de Bigorre, but during the first half of its course remains an inconsiderable river. In traversing the beautiful valley of Campan it is artificially augmented in summer by the waters of the Lac Bleu, which are drawn off by means of a siphon, and flow down the valley of Lesponne. After passing Bagnères de Bigorre the Adour enters the plain of Tarbes, and for the remainder of its course in the department of Hautes Pyrénées is of much less importance as a waterway than as a means of feeding the numerous irrigation canals which cover the plains on each side. Of these the oldest and most important is the Canal d'Alaric, which follows the right bank for 36 m. Entering the department of Gers, the Adour receives the Arros on the right bank and begins to describe the large westward curve which takes it through the department of Landes to the sea. In the last-named department it soon becomes navigable, namely, at St Sever, after passing which it is joined on the left by the Larcis, Gabas, Louts and Luy, and on the right by the Midouze, which is formed by the union of the Douze and the Midour, and is navigable for 27 m.; now taking a south-westerly course it receives on the left the Gave de Pau, which is a more voluminous river than the Adour itself, and flowing past Bayonne enters the sea through a dangerous estuary, in which sandbars are formed, after a total course of 208 m., of which 82 are navigable. The mouth of the Adour has repeatedly shifted, its old bed being represented by the series of *étangs* and lagoons extending northward as far as the village of Vieux Boucau, 22½ m. north of Bayonne, where it found a new entrance into the sea at the end of the 14th century. Its previous mouth had been 10 m. south of Vieux Boucau. The present channel was constructed by the engineer Louis de Foix in 1579. There is a depth over the bar at the entrance of 10½ to 16 ft. at high tide. The area of the basin of the Adour is 6565 sq. m.

ADOWA (properly ADUA), the capital of Tigré, northern Abyssinia, 145 m. N.E. of Gondar and 17 m. E. by N. of Axum, the ancient capital of Abyssinia. Adowa is built on the slope of a hill at an elevation of 6500 ft., in the midst of a rich agricultural district. Being on the high road from Massawa to central Abyssinia, it is a meeting-place of merchants from Arabia and the Sudan for the exchange of foreign merchandise with the products of the country. During the wars between the Italians and Abyssinia (1887–96) Adowa was on three or four occasions looted and burnt; but the churches escaped destruction. The church of the Holy Trinity, one of the largest in Abyssinia, contains numerous wall-paintings of native art. On a hill about 2½ m. north-west of Adowa are the ruins of Fremona, the headquarters of the Portuguese Jesuits who lived in Abyssinia during the 16th and 17th centuries. On the 1st of March 1896, in the hills north of the town, was fought the battle of Adowa, in which the Abyssinians inflicted a crushing defeat on the Italian forces (see ITALY, *History*, and ABYSSINIA, *History*).

ADRA (anc. *Abdera*), a seaport of southern Spain, in the province of Almeria; at the mouth of the Rio Grande de Adra, and on the Mediterranean Sea. Pop. (1900) 11,188. Adra is the port of shipment for the lead obtained near Berja, 10 m. north-east; but its commercial development is retarded by the lack of a railway. Besides lead, the exports include grapes, sugar and esparto. Fuel is imported, chiefly from the United Kingdom.

ADRAR (Berber for "uplands"), the name of various districts of the Saharan desert, Northern Africa. Adrar Suttuf is a hilly region forming the southern part of the Spanish protectorate of the Rio de Oro (*q.v.*). Adrar or Adrar el Jebli, otherwise Adghagh, is a plateau north-east of Timbuktu. It is the headquarters of the Awellimiden Tuareg (see Tuareg and Sahara). Adrar n'Ahnet and Adrar Adhafar are smaller regions in the Ahnet country south of Insalah. Adrar Temur, the country usually referred to when Adrar is spoken of, is in the western Sahara, 300 m. north of the Senegal and separated on the north-west from Adrar Suttuf by wide valleys and sand dunes. Adrar is within the French sphere of influence. In general barren, the country contains several oases, with a total population of about 10,000. In 1900 the oasis of Atar, on the western borders of the territory, was reached by Paul Blanchet, previously known for his researches on ancient Berber remains in Algeria. (Blanchet died in Senegal on the 6th of October 1900, a few days after his return from Adrar.) Atar is inhabited by Arab and Berber tribes, and is described as a wretched spot. The other centres of population are Shingeti, Wadan and Ujeft, Shingeti being the chief commercial centre, whence caravans take to St Louis gold-dust, ostrich feathers and dates. A considerable trade is also done in salt from the sebkha of Ijil, in the north-west. Adrar occupies the most elevated part of a plateau which ends westwards in a steep escarpment and falls to the east in a succession of steps.

Adrar or Adgar is also the name sometimes given to the chief settlement in the oasis of Tuat in the Algerian Sahara.

ADRASTUS, in Greek legend, was the son of Talaus, king of Argos, and Lysianassa, daughter of Polybus, king of Sicyon. Having been driven from Argos by Amphiaraus, Adrastus fled to Sicyon, where he became king on the death of Polybus. After a time he became reconciled to Amphiaraus, gave him his sister Eriphyle in marriage, and returned to Argos and occupied the throne. In consequence of an oracle which had commanded him to marry his daughters to a lion and a boar, he wedded them to Polyneices and Tydeus, two fugitives, clad in the skins of these animals or carrying shields with their figures on them, who claimed his hospitality. He was the instigator of the famous war against Thebes for the restoration of his son-in-law Polyneices, who had been deprived of his rights by his brother Eteocles. Adrastus, followed by Polyneices and Tydeus, his two sons-in-law, Amphiaraus, his brother-in-law, Capaneus, Hippomedon and Parthenopaeus, marched against the city of Thebes, and on his way is said to have founded the Nemean games. This is the expedition of the "Seven against Thebes," which the poets have made nearly as famous as the siege of Troy. As Amphiaraus had foretold, they all lost their lives in this war except Adrastus, who was saved by the speed of his horse Arion (*Iliad*, xxiii. 346). Ten years later, at the instigation of Adrastus, the war was renewed by the sons of the chiefs who had fallen. This expedition was called the war of the "Epigoni" or descendants, and ended in the taking and destruction of Thebes. None of the followers of Adrastus perished except his son Aegialeus, and this affected him so greatly that he died of grief at Megara, as he was leading back his victorious army.

Apollodorus iii. 6, 7; Aeschylus, *Septem contra Thebas*; Euripides, *Phoenissae, Supplices*; Statius, *Thebais*; Herodotus v. 67.

ADRIA (anc. *Atria*; the form Adria or Hadria is less correct: Hatria was a town in Picenum, the modern Atri), a town and episcopal see of Venetia, Italy, in the province of Rovigo, 15 m. E. by rail from the town of Rovigo. It is situated between the mouths of the Adige and the Po, about 13½ m. from the sea and but 13 ft. above it. Pop. (1901) 15,678. The town occupies the site of the ancient Atria, which gave its name to the Adriatic. Its origin is variously ascribed by ancient writers, but it was probably a Venetian, *i.e.* Illyrian, not an Etruscan, foundation—still less a foundation of Dionysius I. of Syracuse. Imported vases of the second half of the 5th century B.C. prove the existence of trade with Greece at that period; and the town was famous in Aristotle's day for a special breed of fowls. Even at that period, however, the silt brought down by the rivers rendered access to the harbour difficult, and the historian Philistus excavated a canal to give free access to the sea. This was still open in the imperial period, and the town, which was a *municipium*, possessed its own gild of sailors; but its importance gradually decreased. Its remains lie from 10 to 20 ft. below the modern level. The Museo Civico and the Bocchi collection contain antiquities.

See R. Schöne, *Le antichitá del Museo Bocchi di Adria* (Rome, 1878). (T. As.)

ADRIAN, or Hadrian (Lat. *Hadrianus*), the name of six popes.

Adrian I., pope from 772 to 795, was the son of Theodore, a Roman nobleman. Soon after his accession the territory that had been bestowed on the popes by Pippin was invaded by Desiderius, king of the Lombards, and Adrian found it necessary to invoke the aid of Charlemagne, who entered Italy with a large army, besieged Desiderius in his capital of Pavia, took that town, banished the Lombard king to Corbie in France and united the Lombard kingdom with the other Frankish possessions. The pope, whose expectations had been aroused, had to content himself with some additions to the duchy of Rome, and to the Exarchate, and the Pentapolis. In his contest with the Greek empire and the Lombard princes of Benevento, Adrian remained faithful to the Frankish alliance, and the friendly relations between pope and emperor were not disturbed by the difference which arose between them on the question of the worship of images, to which Charlemagne and the Gallican Church were strongly opposed, while Adrian favoured the views of the Eastern Church, and approved the decree of the council of Nicaea (787), confirming the practice and excommunicating the iconoclasts. It was in connexion with this controversy that Charlemagne wrote the so-called *Libri Carolini*, to which Adrian replied by letter, anathematizing all who refused to worship the images of Christ, or the Virgin, or saints. Notwithstanding this, a synod, held at Frankfort in 794, anew condemned the practice, and the dispute remained unsettled at Adrian's death. An epitaph written by Charlemagne in verse, in which he styles Adrian "father," is still to be seen at the door of the Vatican basilica. Adrian restored the ancient aqueducts of Rome, and governed his little state with a firm and skilful hand.

Adrian II., pope from 867 to 872, was a member of a noble Roman family, and became pope in 867, at an advanced age. He maintained, but with less energy, the attitude of his predecessor. Rid of the affair of Lothair, king of Lorraine, by the death of that prince (869), he endeavoured in vain to mediate between the Frankish princes with a view to assuring to the emperor, Louis II., the heritage of the king of Lorraine. Photius, shortly after the council in which he had pronounced sentence of deposition against Pope Nicholas, was driven from the patriarchate by a new emperor, Basil the Macedonian, who favoured his rival Ignatius. An oecumenical council (called by the Latins the 8th) was convoked at Constantinople to decide this matter. At this council Adrian was represented by legates, who presided at the condemnation of Photius, but did not succeed in coming to an understanding with Ignatius on the subject of the jurisdiction over the Bulgarian converts. Like his predecessor Nicholas, Adrian II. was forced to submit, at least in temporal affairs, to the tutelage of the emperor, Louis II., who placed him under the surveillance of Arsenius, bishop of Orta, his confidential adviser, and Arsenius's son Anastasius, the librarian. Adrian had married in his youth, and his wife and daughter were still living. They were carried off and assassinated by Anastasius's brother, Eleutherius, whose reputation, however, suffered but a momentary eclipse. Adrian died in 872.

Adrian III., pope, was born at Rome. He succeeded Martin II. in 884, and died in 885, on a journey to Worms. (L. D.*)

Adrian IV. (Nicholas Breakspear), pope from 1154 to 1159, the only Englishman who has occupied the papal chair, was born before A.D. 1100 at Langley near St Albans in Hertfordshire. His father was Robert, a priest of the diocese of Bath, who entered a monastery and left the boy to his own resources. Nicholas went to Paris and finally became a monk of the cloister of St Rufus near Arles. He rose to be prior and in 1137 was unanimously elected abbot. His reforming zeal led to the lodging of complaints against him at Rome; but these merely attracted to him the favourable attention of Eugenius III., who created him cardinal bishop of Albano. From 1152 to 1154 Nicholas was in Scandinavia as legate, organizing the affairs of the new Norwegian archbishopric of Trondhjem, and making arrangements which resulted in the recognition of Upsala as seat of the Swedish metropolitan in 1164. As a compensation for territory thus withdrawn the Danish archbishop of Lund was made legate and perpetual vicar and given the title of primate of Denmark and Sweden. On his return Nicholas was received with great honour by Anastasius IV., and on the death of the latter was elected pope on the 4th of December 1154. He at once endeavoured to compass the overthrow of Arnold of Brescia, the leader of anti-papal sentiment in Rome. Disorders ending with the murder of a cardinal led Adrian shortly before Palm Sunday 1155 to take the previously-unheard-of step of putting Rome under the interdict. The senate thereupon exiled Arnold, and the pope, with the impolitic co-operation of Frederick I. Barbarossa, was instrumental in procuring his execution. Adrian crowned the emperor at St Peter's on the 18th of June 1155, a ceremony which so incensed the Romans that the pope had to leave the city promptly, not returning till November 1156. With the aid of dissatisfied barons, Adrian brought William I. of Sicily into dire straits; but a change in the fortunes of war led to a settlement (June 1156) not advantageous to the papacy and displeasing to the emperor. At the diet of Besançon in October 1157, the legates presented to Barbarossa a letter from Adrian which alluded to the *beneficia* conferred upon the emperor, and the German chancellor translated this *beneficia* in the feudal sense. In the storm which ensued the legates were glad to escape with their lives, and the incident at length closed with a letter from the pope, declaring that by *beneficium* he meant merely *bonum factum*. The breach subsequently became wider, and Adrian was about to excommunicate the emperor when he died at Anagnia on the 1st of September 1159.

A controversy exists concerning an embassy sent by Henry II. of England to Adrian in 1155. According to the elaborate investigation of Thatcher, the facts seem to be as follows. Henry asked for permission to invade and subjugate Ireland, in order to gain absolute ownership of that isle. Unwilling to grant a request counter to the papal claim (based on the forged Donation of Constantine) to dominion over the islands of the sea, Adrian made Henry a conciliatory proposal, namely, that the king should become hereditary feudal possessor of Ireland while recognizing the pope as overlord. This compromise did not satisfy Henry, so the matter dropped; Henry's subsequent title to Ireland rested on conquest, not on papal concession, and was therefore absolute. The much-discussed bull *Laudabiliter* is, however, not genuine.

See Herzog-Hauck, *Realencyklopädie*, 3rd ed. (excellent bibliography), and Wetzer and Welte, *Kirchenlexikon*, 2nd ed., under "Hadrian IV."; also Oliver J. Thatcher, *Studies concerning Adrian IV.* (The University of Chicago: Decennial Publications, 1st series, vol. iv., Chicago, 1903); R. Raby, *Pope Adrian IV.: An Historical Sketch* (London, 1849); and A. H. Tarleton, *Life of Nicholas Breakspear* (London, 1896).

Adrian V. (Ottobuono de' Fieschi), pope in 1276, was a Genoese who was created cardinal deacon by his uncle Innocent IV. In 1264 he was sent to England to mediate between Henry III. and his barons. He was elected pope to succeed Innocent V. on the 11th of July 1276, but died at Viterbo on the 18th of August, without having been ordained even to the priesthood.

Adrian VI. (Adrian Dedel, not Boyens, probably not Rodenburgh, 1459–1523), pope from 1522 to 1523, was born at Utrecht in March 1459, and studied under the Brethren of the Common Life either at Zwolle or Deventer. At Louvain he pursued philosophy, theology and canon law, becoming a doctor of theology (1491), dean of St Peter's and vice-chancellor of the university. In 1507 he was appointed tutor to the seven-year-old Charles V. He was sent to Spain in 1515 on a very important diplomatic errand; Charles secured his succession to the see of Tortosa, and on the 14th of November 1516 commissioned him inquisitor-general of Aragon. During the minority of Charles, Adrian was associated with Cardinal Jimenes in governing Spain. After the death of the latter Adrian was appointed, on the 14th of March 1518, general of the reunited inquisitions of Castile and Aragon, in which capacity he acted till his departure from Tarragona for Rome on the 4th of August 1522: he was, however, too weak and confiding to cope with abuses which Jimenes had been able in some degree to check. When Charles left for the Netherlands in 1520 he made Adrian regent of Spain: as such he had to cope with a very serious revolt. In 1517 Leo X. had created him cardinal priest *SS. Ioannis et Pauli*; on the 9th of January 1522 he was almost unanimously elected pope. Crowned in St Peter's on the 31st of August at the age of sixty-three, he entered upon the lonely path of the reformer. His programme was to attack notorious abuses one by one; but in his attempt to improve the system of granting indulgences he was hampered by his cardinals; and reducing the number of matrimonial dispensations was impossible, for the income had been farmed out for years in advance by Leo X. The Italians saw in him a pedantic foreign professor, blind to the beauty of classical antiquity, penuriously docking the stipends of great artists. As a peacemaker among Christian princes, whom he hoped to unite in a protective war against the Turk, he was a failure: in August 1523 he was forced openly to ally himself with the Empire, England, Venice, &c., against France; meanwhile in 1522 the sultan Suleiman I. had conquered Rhodes. In dealing with the early stages of the Protestant revolt in Germany Adrian did not fully recognize the gravity of the situation. At the diet which opened in December 1522 at Nuremberg he was represented by Chieregati, whose instructions contain the frank admission that the whole disorder of the church had perchance proceeded from the Curia itself, and that there the reform should begin. However, the former professor and inquisitor-general was stoutly opposed to doctrinal changes, and demanded that Luther be punished for heresy. The statement in one of his works that the pope could err in matters of faith ("*haeresim per suam determinationem aut Decretalem asserendo*") has attracted attention; but as it is a private opinion, not an *ex cathedra* pronouncement, it is held not to prejudice the dogma of papal infallibility. On the 14th of September 1523 he died, after a pontificate too short to be effective.

Most of Adrian VI.'s official papers disappeared soon after his death. He published *Quaestiones in quartum sententiarum praesertim circa sacramenta* (Paris, 1512, 1516, 1518, 1537; Rome, 1522), and *Quaestiones quodlibeticae XII.* (1st ed., Louvain, 1515). See L. Pastor, in *Geschichte der Päpste*, vol. iv. pt. ii.; *Adrian VI. und Klemens VII.* (Freiburg, 1907); also Wetzer and Welte, *Kirchenlexikon*, 2nd ed., and Herzog-Hauck, *Realencyklopädie*, 3rd ed., under "Hadrian VI."; H. Hurter, *Nomenclator literarius recentioris theologiae catholicae*, tom. iv. (Innsbruck, 1899), 1027; *The Cambridge Modern History*, vol. ii. (1904), 19-21; H. C. Lea, *A History of the Inquisition of Spain*, vol. i. (1906); Janus, *The Pope and the Council*, 2nd ed. (London, 1869), 376. Biographies:—A. Lepitre, *Adrien VI.* (Paris, 1880); C. A. C. von Höfler, *Papst Adrian VI.* (Vienna, 1880); L. Casartelli, "The Dutch Pope," in *Miscellaneous Essays* (London, 1906). (W. W. R.*)

ADRIAN, SAINT, one of the praetorian guards of the emperor Galerius Maximian, who, becoming a convert to Christianity, was martyred at Nicomedia on the 4th of March 303. It is said that while presiding over the torture of a band of Christians he was so amazed at their courage that he publicly confessed his faith. He was imprisoned, and the next day his limbs were struck off on an anvil, and he was then beheaded, dying in his wife's, St Natalia's, arms. St Adrian's festival, with that of his wife, is kept on the 8th of September. He is specially a patron of soldiers, and is much reverenced in Flanders, Germany and the north of France. He is usually represented armed, with an anvil in his hands or at his feet.

ADRIAN, a city and the county-seat of Lenawee county, Michigan, U.S.A., on the S. branch of Raisin river, near the S.E. corner of the state. Pop. (1890) 8756; (1900) 9654, of whom

1136 were foreign-born: (1910 census) 10,763. It is served by five branches of the Lake Shore railway system, and by the Wabash, the Toledo and Western, and the Toledo, Detroit and Ironton railways. Adrian is the seat of Adrian College (1859; co-educational), controlled by the Wesleyan Methodist Church in 1859–1867 and since 1867 by the Methodist Protestant Church, and having departments of literature, theology, music, fine arts, commerce and pedagogy, and a preparatory school; and of St Joseph's Academy (Roman Catholic) for girls; and 1 m. north of the city is the State Industrial Home for Girls (1879), for the reformation of juvenile offenders between the ages of ten and seventeen. Adrian has a public library. The city is situated in a rich farming region; is an important shipping point for livestock, grain and other farm products; and is especially known as a centre for the manufacture of wire-fences. Among the other manufactories are flouring and grist mills, planing mills, foundries, and factories for making agricultural implements, United States mail boxes, furniture, pianos, organs, automobiles, toys and electrical supplies. The value of the city's factory products increased from $2,124,923 in 1900 to $4,897,426 in 1904, or 130·5%; of the total value in 1904, $2,849,648 was the value of wire-work. The place was laid out as a town in 1828, and according to tradition was named in honour of the Roman emperor Hadrian. It was incorporated as a village in 1836, was made the county-seat in 1838 and was chartered as a city in 1853.

ADRIANI, GIOVANNI BATTISTA (1513–1579), Italian historian, was born of a patrician family of Florence, and was secretary to the republic of Florence. He was among the defenders of the city during the siege of 1530, but subsequently joined the Medici party and was appointed professor of rhetoric at the university. At the instance of Cosimo I. he wrote a history of his own times, from 1536 to 1574, in Italian, which is generally, but according to Brunet erroneously, considered a continuation of Guicciardini. De Thou acknowledges himself greatly indebted to this history, praising it especially for its accuracy. Adriani composed funeral orations in Latin on the emperor Charles V. and other noble personages, and was the author of a long letter on ancient painters and sculptors prefixed to the third volume of Vasari. His *Istoria dei suoi tempi* was published in Florence in 1583; a new edition appeared also in Florence in 1872.

See G. M. Mazzucchelli, *Gli Scrittori d' Italia*, i. p. 151 (Brescia, 1753).

ADRIANOPLE, a vilayet of European Turkey, corresponding with part of the ancient Thrace, and bounded on the N. by Bulgaria (Eastern Rumelia), E. by the Black Sea and the vilayet of Constantinople, S. by the Sea of Marmora and the Aegean Sea and W. by Macedonia. Pop. (1905) about 1,000,000; area, 15,000 sq. m. The surface of the vilayet is generally mountainous, except in the central valley of the Maritza, and along the banks of its tributaries, the Tunja, Arda, Ergene, &c. On the west, the great Rhodope range and its outlying ridges extend as far as the Maritza, and attain an altitude of more than 7000 ft. in the summits of the Kushlar Dagh, Karluk Dagh and Kara-Balkan. Towards the Black Sea, the less elevated Istranja Dagh stretches from north-west to south-east; and the entire south coast, which includes the promontory of Gallipoli and the western shore of the Dardanelles, is everywhere hilly or mountainous, except near the estuaries of the Maritza, and of the Mesta, a western frontier stream. The climate is mild and the soil fertile; but political disturbances and the conservative character of the people tend to thwart the progress of agriculture and other industries. The vilayet suffered severely during the Russian occupation of 1878, when, apart from the natural dislocation of commerce, many of the Moslem cultivators emigrated to Asia Minor, to be free from their alien rulers. Through the resultant scarcity of labour, much land fell out of cultivation. This was partially remedied after the Bulgarian annexation of Eastern Rumelia, in 1885, had driven the Moslems of that country to emigrate in like manner to Adrianople; but the advantage was counterbalanced by the establishment of hostile Bulgarian tariffs. The important silk industry, however, began to revive about 1890, and dairy farming is prosperous; but the condition of the vilayet is far less unsettled than that of Macedonia, owing partly to the preponderance of Moslems among the peasantry, and partly to the nearness of Constantinople, with its Western influences. The main railway from Belgrade to Constantinople skirts the Maritza and Ergene valleys, and there is an important branch line down the Maritza valley to Dédéagatch, and thence coastwise to Salonica. After the city of Adrianople (pop. 1905, about 80,000), which is the capital, the principal towns are Rodosto (35,000), Gallipoli (25,000), Kirk-Kilisseh (16,000), Xanthi (14,000), Chorlu (11,500), Demotica (10,000), Enos (8000), Gumuljina (8000) and Dédéagatch (3000).

ADRIANOPLE (anc. *Hadrianopolis*; Turk. *Edirne*, or *Edreneh*; Slav. *Odrin*), the capital of the vilayet of Adrianople, Turkey in Europe; 137 m. by rail W.N.W. of Constantinople. Pop. (1905) about 80,000, of whom half are Turks, and half Jews, Greeks, Bulgars, Armenians, &c. Adrianople ranks, after Constantinople and Salonica, third in size and importance among the cities of European Turkey. It is the see of a Greek archbishop, and of one Armenian and two Bulgarian bishops. It is the chief fortress near the Bulgarian frontier, being defended by a ring of powerful modern forts. It occupies both banks of the river Tunja, at its confluence with the Maritza, which is navigable to this point in spring and winter. The nearest seaport by rail is Dédéagatch, west of the Maritza; Enos, at the river-mouth, is the nearest by water. Adrianople is on the railway from Belgrade and Sofia to Constantinople and Salonica. In appearance it is thoroughly Oriental—a mass of mean, irregular wooden buildings, threaded by narrow tortuous streets, with a few better buildings. Of these the most important are the Idadieh school, the school of arts and crafts, the Jewish communal school; the Greek college, Zappeion; the Imperial Ottoman Bank and Tobacco Regie; a fire-tower; a theatre; palaces for the prefect of the city, the administrative staff of the second army corps and the defence works commission; a handsome row of barracks; a military hospital; and a French hospital. Of earlier buildings, the most distinguished are the Eski Serai, an ancient and half-ruined palace of the sultans; the bazaar of Ali Pasha; and the 16th-century mosque of the sultan Selim II., a magnificent specimen of Turkish architecture.

Adrianople has five suburbs, of which Kiretchhané and Yilderim are on the left bank of the Maritza, and Kirjik stands on a hill overlooking the city. The two last named are exclusively Greek, but a large proportion of the inhabitants of Kiretchhané are Bulgarian. These three suburbs —as well as the little hamlet of Demirtash, containing about 300 houses all occupied by Bulgars—are all built in the native fashion; but the fifth suburb, Karagatch, which is on the right bank of the Maritza, and occupies the region between the railway station and the city, is Western in its design, consisting of detached residences in gardens, many of them handsome villas, and all of modern European type. In all the communities schools have multiplied, but the new seminaries are of the old non-progressive type. The only exception is the Hamidieh school for boys—a government institution which takes both boarders and day-scholars. Like the Lyceum of Galata Serai in Constantinople, it has two sets of professors, Turkish and French, and a full course of education in each language, the pupils following both courses. The several communities have each their own charitable institutions, the Jews being specially well endowed in this respect. The Greeks have a literary society, and there is a well-organized club to which members of all the native communities, as well as many foreigners, belong.

The economic condition of Adrianople was much impaired by the war of 1877–78, and was just showing signs of recovery when, in 1885, the severance from it of Eastern Rumelia by a Customs cordon rendered the situation worse than ever. Adrianople had previously been the commercial headquarters of all Thrace, and of a large portion of the region between the Balkans and the Danube, now Bulgaria. But the separation of Eastern Rumelia isolated Adrianople, and transferred to Philippopolis at least two-thirds of its foreign trade which, as regards sea-borne merchandise, is carried on through the port of Burgas (*q.v.*). The city manufactures silk, leather, tapestry, woollens, linen and cotton, and has an active general trade. Besides fruits and agricultural produce, its exports include raw silk, cotton, opium, rose-water, attar of roses, wax and the dye known as Turkey red. The surrounding country is extremely fertile, and its wines are the best produced in Turkey. The city is supplied with fresh water by means of an aqueduct carried by arches over an extensive valley. There is also a fine stone bridge over the Tunja.

Adrianople was originally known as Uskadama, Uskudama or Uskodama, but was renamed and enlarged by the Roman emperor Hadrian (117–138). In 378 the Romans were here defeated by the Goths. Adrianople was the residence of the Turkish sultans from 1361, when it was captured by Murad I., until 1453, when Constantinople fell. It was occupied by the Russians in 1829 and 1878 (see Russo-Turkish Wars).

ADRIATIC SEA (ancient *Adria* or *Hadria*), an arm of the Mediterranean Sea separating Italy from the Austro-Hungarian, Montenegrin and Albanian littorals, and the system of the Apennine mountains from that of the Dinaric Alps and adjacent ranges. The name, derived from the town of Adria, belonged originally only to the upper portion of the sea (Herodotus vi. 127, vii. 20, ix. 92; Euripides, *Hippolytus*, 736), but was gradually extended as the Syracusan colonies gained in importance. But even then the Adriatic in the narrower sense only extended as far as the Mons Garganus, the outer portion being called the Ionian Sea: the name was sometimes, however, inaccurately used to include the Gulf of Tarentum, the Sea of Sicily, the Gulf of Corinth and even the sea between Crete and Malta (Acts xxvii. 27). The Adriatic extends N.W. from 40° to 45° 45′ N., with an extreme length of nearly 500 m., and a mean breadth of about 110 m., but the Strait of Otranto, through which it connects at the south with the Ionian Sea, is only 45 m. wide. Moreover, the chain of islands which fringes the northern part of the eastern shore reduces the extreme breadth of open sea in this part to 90 m. The Italian shore is generally low, merging, in the north-west, into the marshes and lagoons on either hand of the protruding delta of the river Po, the sediment of which has pushed forward the coast-line for several miles within historic times. On islands within one of the lagoons opening from the Gulf of Venice, the city of that name has its unique situation. The east coast is generally bold and rocky. South of the Istrian peninsula, which separates the Gulfs of Venice and Trieste from the Strait of Quarnero, the island-fringe of the east coast extends as far south as Ragusa. The islands, which are long and narrow (the long axis lying parallel with the coast of the mainland), rise rather abruptly to elevations of a few hundred feet, while on the mainland, notably in the magnificent inlet of the Bocche di Cattaro, lofty mountains often fall directly to the sea. This coast, though beautiful, is somewhat sombre, the prevalent colour of the rocks, a light, dead grey, contrasting harshly with the dark vegetation, which on some of the islands is luxuriant. The north part of the sea is very shallow, and between the southern promontory of Istria and Rimini the depth rarely exceeds 25 fathoms. Between Sebenico and Ortona a well-marked depression occurs, a considerable area of which exceeds 100 fathoms in depth. From a point between Curzola and the north shore of the spur of Monte Gargano there is a ridge giving shallower water, and a broken chain of a few islets extends across the sea. The deepest part of the sea lies east of Monte Gargano, south of Ragusa, and west of Durazzo, where a large basin gives depths of 500 fathoms and upwards, and a small area in the south of this basin falls below 800. The mean depth of the sea is estimated at 133 fathoms. The *bora* (north-east wind), and the prevalence of sudden squalls from this quarter or the south-east, are dangers to navigation in winter. Tidal movement is slight. (See also Mediterranean.)

For the "Marriage of the Adriatic," or more properly "of the sea," a ceremony formerly performed by the doges of Venice, see the article Bucentaur.

ADSCRIPT (from Lat. *ad*, on or to, and *scribere*, to write), something written *after*, as opposed to "subscript," which means written *under*. A labourer was called an "adscript of the soil" (*adscriptus glebae*) when he could be sold or transferred with it, as in feudal days, and as in Russia until 1861. Carlyle speaks of the Java blacks as a kind of adscripts.

ADULLAM, a Canaanitish town in the territory of the tribe of Judah, perhaps the modern ʽAīd-el-Mā, 7 m. N.E. of Beit-Jibrīn. It was in the stronghold ("cave" is a scribal error) of this town that David took refuge on two occasions (1 Sam. xxii. 1; 2 Sam. v. 17). The tradition that Adullam is in the great cave of Khareiṭūn (St Chariton) is probably due to the crusaders. From the description of Adullam as the resort of "every one that was in distress," or "in debt," or "discontented," it has often been humorously alluded to, notably by Sir Walter Scott, who puts the expression into the mouth of the Baron of Bradwardine in *Waverley*, chap. lvii., and also of Balfour of Burley in *Old Mortality*. In modern political history the expression "cave of Adullam" (hence "Adullamites") came into common use (being first employed in a speech by John Bright on the 13th of March 1866) with regard to the independent attitude of Robert Lowe (Lord Sherbrooke), Edward Horsman and their Liberal supporters in opposition to the Reform Bill of 1866. But others had previously used it in a similar connexion, *e.g.* President Lincoln in his second electoral campaign (1864), and the Tories in allusion to the Whig remnant who joined C. J. Fox in his temporary secession. From the same usage is derived the shorter political term "cave" for any body of men who secede from their party on some special subject.

ADULTERATION (from Lat. *adulterare*, to defile or falsify), the act of debasing a commercial commodity with the object of passing it off as or under the name of a pure or genuine commodity for illegitimate profit, or the substitution of an inferior article for a superior one, to the detriment of the purchaser. Although the term is mainly used in connexion with the falsification of articles of food, drink or drugs, and is so dealt with in this article, the practice of adulteration extends to almost all manufactured products and even to unmanufactured natural substances, and (as was once suggested by John Bright) is an almost inseparable—though none the less reprehensible—phase of keen trade competition. In its crudest forms as old as commerce itself, it has progressed with the growth of knowledge and of science, and is, in its most modern developments, almost a branch—and that not the least vigorous one—of applied science. From the mere concealment of a piece of metal or a stone in a loaf of bread or in a lump of butter, a bullet in a musk bag or in a piece of opium, it has developed into the use of aniline dyes, of antiseptic chemicals, of synthetic sweetening agents in foods, the manufacture of butter from cocoa-nuts, of lard from cotton-seed and of pepper from olive stones. Its growth and development has necessitated the employment of multitudes of scientific officers charged with its detection and the passing of numerous laws for its repression and punishment. While for all common forms of fraud the common law is in most cases considered strong enough, special laws against the adulteration of food have been found necessary in all civilized countries. A vigorous branch of chemical literature deals with it; there exist scientific societies specially devoted to its study; laboratories are maintained by governments with staffs of highly trained chemists for its detection; and yet it not only develops and flourishes, but becomes more general, if less virulent and dangerous to health.

There are numerous references to adulteration in the classics. The detection of the base metal by Archimedes in Hiero's crown, by the light specific gravity of the latter, is a well-known instance. Vitruvius speaks of the adulteration of minium with lime, Dioscorides of that of opium with other plant juices and with gum, Pliny of that of flour with white clay. Both in Rome and in Athens wine was often adulterated with colours and flavouring agents, and inspectors were charged with looking after it.

In England, so far back as the reign of John (1203), a proclamation was made throughout the kingdom, enforcing the legal obligations of assize as regards bread; and in the following reign the statute (51 Hen. III. Stat. 6) entitled "the pillory and tumbrel" was framed for the express purpose of protecting the public from the dishonest dealings of bakers, vintners, brewers, butchers and others. This statute is the first in which the adulteration of human food is specially noticed and prohibited; it seems to have been enforced with more or less rigour until the time of Anne, when it was repealed (1709). According to the *Liber Albus* it was strictly observed in the days of Edward I., for it states that: "If any default shall be found in the bread of a baker in the city, the first time, let him be drawn upon a hurdle from the Guildhall to his own house through the great street where there be most people assembled, and through the great streets which are most dirty, with the faulty loaf hanging from his neck; if a second time he shall be found committing the same offence, let him be drawn from the Guildhall through the great street of Cheepe in the manner aforesaid to the pillory, and let him be put upon the pillory, and remain there at least one hour in the day; and the third time that such default shall be found, he shall be drawn, and the oven shall be pulled down, and the baker made to foreswear the trade in the city for ever." The assize of 1634 provides that "if there be any manner of person or persons, which shall by any false wayes or meanes, sell any meale under the kinge's subjects, either by mixing it deceitfully or sell any musty or corrupted meal, which may be to the hurte and infection of man's body, or use any false weight, or any deceitful wayes or meanes, and so deceive the subject, for the first offence he shall be grievously punished, the second he shall loose his meale, for the third offence he shall suffer the judgment of the pillory and the fourth time he shall foreswere the town wherein he dwelleth." Vintners, spicers, grocers, butchers, regrators and others were subject to the like punishment for dishonesty in their commercial dealings—it being thought that the pillory, by appealing to the sense of shame, was far more deterrent of such crimes than fine or imprisonment. In the reign of Edward the Confessor a knavish brewer of the city of Chester was taken round the town in the cart in which the refuse of the privies had been collected. Ale-tasters had to look after the ale and test it by spilling some on to a wooden seat, sitting on the wet place in their leathern breeches, the stickiness of the "residue obtained by evaporation" affording the evidence of purity or otherwise. If sugar had been added the taster adhered to the bench; pure malt beer was not considered to yield an adhesive extract. In 1553, the lord mayor of London ordered a jury of five or six vintners to rack and draw off the suspected wine of another vintner, and to ascertain what drugs or ingredients they found in the said wine or cask to sophisticate the same. At another time eight pipes of wine were ordered to be destroyed because, on racking off, bundles of weeds, pieces of sulphur match, and "a kind of gravel mixture sticking to the casks" had been found.

Similar records have come down from the continental European countries. In 1390 an Augsburg wine-seller was sentenced to be led out of the city with his hands bound and a rope round his neck; in 1400 two others were branded and otherwise severely punished; in 1435 "were the taverner Christian Corper and his wife put in a cask in which he sold false wine, and then exposed in the pillory. The punishment was adjudged because they had roasted pears and put them into new sour wine, in order to sweeten the wine. Some pears were hung round their necks like unto a Paternoster." In Biebrich on the Rhine, in 1482, a wine-falsifier was condemned to drink six quarts of his own wine; from this he died. In Frankfurt, casks in which false wine had been found were placed with a red flag on the knacker's cart, "the jailer marched before, the rabble after, and when they came to the river they broke the casks and tumbled the stuff into the stream." In France successive *ordonnances* from 1330 to 1672 forbade the mixing of two wines together under the penalty of a fine and the confiscation of the wine.

Modern British Legislation.—In modern times the English parliament has dealt frequently with the subject of food adulteration. In 1725 it was provided that "no dealer in tea or manufacturer or dyer thereof, or pretending so to be, shall counterfeit or adulterate tea, or cause or procure the same to be counterfeited or adulterated, or shall alter, fabricate or manufacture tea with terra-japonica, or with any drug or drugs whatsoever; nor shall mix or cause or procure to be mixed with tea any leaves other than the leaves of tea or other ingredients whatsoever, on pain of forfeiting and losing the tea so counterfeited, adulterated, altered, fabricated, manufactured or mixed, and any other thing or things whatsoever added thereto, or mixed or used therewith, and also the sum of £100." Six years afterwards, in 1730–1731, a further act was passed prescribing a penalty for "sophisticating" tea; it recites that several ill-disposed persons do frequently dye, fabricate or manufacture very great quantities of sloe leaves, liquorice leaves, and the leaves of tea that have been before used, or the leaves of other trees, shrubs or plants in imitation of tea, and do likewise mix, colour, stain and dye such leaves and likewise tea with terra-japonica, sugar, molasses, clay, logwood, and with other ingredients, and do sell and vend the same as true and real tea, to the prejudice of the health of his majesty's subjects, the diminution of the revenue and to the ruin of the fair trader. This act provides that for every pound of adulterated tea found in possession of any person, a sum of £10 shall be forfeited. It was followed by one passed in 1766–1767, which increased the penalty to imprisonment for not less than six nor more than twelve months. As regards coffee, an act of 1718 recited that "divers evil-disposed persons have at the time or soon after the roasting of coffee made use of water, grease, butter or such-like materials, whereby the same is rendered unwholesome and greatly increased in weight," and a penalty of £20 is enacted. In 1803 an act refers to the addition of burnt, scorched or roasted peas, beans or other grains or vegetable substances prepared in imitation of coffee or cocoa, to coffee or cocoa, and fixes the penalty for the offence at £100, but subsequently permission was given to coffee or cocoa dealers also to deal in scorched or roasted corn, peas, beans or parsnips whole and not ground, crushed or powdered, under certain excise restrictions. An act passed in 1816 relating to beer and porter provides that no brewer of or dealer in or retailer of beer "shall receive or have in his possession, or make or mix with any worts or beer, any liquor, extract or other preparation for the purpose of darkening the colour of worts or beer, other than brown malt, ground or unground, or shall have in his possession or use, or mix with any worts or beer any molasses, honey, liquorice, vitriol, quassia, coculus-indiae, grains of paradise, guinea-pepper or opium, or any extracts of these, or any articles or preparation whatsoever for or as a substitute for malt or hops." Any person contravening was liable to a penalty of £200, and any druggist selling to any brewer or retail dealer any colouring or malt substitute was to be fined £500. It was only in 1847 that brewers were allowed to make for their own use, from sugar, a liquor for darkening the colour of worts or beer and to use it in brewing.

All the laws hitherto referred to were mainly passed in the interest of the inland revenue, and their execution was left entirely in the hands of the revenue officers. It was but natural that they should look primarily after the dutiable articles and not after those that brought no revenue to the state. About the middle of the 19th century many articles, however, paid import duty; butter, for instance, paid 5s. per hundredweight; cheese from 1s. 6d. to 2s. 6d.; flour or meal of all kinds, 4½d.; ginger, 10s.; isinglass, 5s.; and so on. Sensational and doubtless largely exaggerated statements were from time to time published concerning the food supply of the nation. F. C. Accum (1769–1838) by his *Treatise on Adulterations of Food and Culinary Poisons* (1820), and particularly an anonymous writer of a book entitled *Deadly Adulteration and Slow Poisoning unmasked, or Disease and Death in the Pot and the Bottle, in which the blood-empoisoning and life-destroying adulterations of wines, spirits, beer, bread, flour, tea, sugar, spices, cheesemongery, pastry, confectionery, medicines, &c. &c., are laid open to the public* (1830), roused the public attention. In 1850 a physician, Dr. Arthur H. Hassall, had the happy idea of looking at ground coffee through the microscope. Eminent chemists had previously found great difficulty in establishing any satisfactory chemical distinction between coffee, chicory and other adulterants of coffee; the microscope immediately showed the structural difference of the particles, however small. The results of Hassall's examinations were embodied in a paper which was read before the Botanical Society of London and was reported in *The Times*, 1850. A paper on the microscopic examination of sugar, showing the presence in that article of innumerable living mites, followed and attracted much attention. Hassall was in consequence commissioned by Thomas Wakley (1795–1862), the owner of the *Lancet*, to extend his examination to other articles of food, and for a period of nearly four years reports of the *Lancet Analytical Sanitary Commission* were regularly published, the names and addresses of hundreds of manufacturers and tradesmen selling adulterated articles being fearlessly given. The responsibility incurred was immense, but the assertions of the journal were so well founded upon fact that they were universally accepted as accurately representing the appalling state of the food supply. As instances may be cited, that of thirty-four samples of coffee only three were pure, chicory being present in thirty-one, roasted corn in twelve, beans and potato-flour each in one; of thirty-four samples of chicory, fourteen were adulterated with corn, beans or acorns; of forty-nine samples of bread, every one contained alum; of fifty-six samples of cocoa, only eight were pure; of twenty-six milks, fourteen were adulterated; of twenty-eight cayenne peppers, only four were genuine, thirteen containing red-lead and one vermilion; of upwards of one hundred samples of coloured sugar-confectionery, fifty-nine contained chromate of lead, eleven gamboge, twelve red-lead, six vermilion, nine arsenite of copper and four white-lead.

Act of 1860.

1872.

In consequence of the *Lancet's* disclosures a parliamentary committee was appointed in 1855, the labours of which resulted in 1860 in the Adulteration of Food and Drink Act, the first act that dealt generally with the adulteration of food. The first section of this enacted "that every person who shall sell any article of food or drink with which, to the knowledge of such person, any ingredient or material injurious to the health of persons eating or drinking such article has been mixed, and every person who shall sell as pure or unadulterated any article of food or drink which is adulterated and not pure, shall for every such offence, on summary conviction, pay a penalty not exceeding £5 with costs." In the case of a second offence the name, place of abode and offence might be published in the newspapers at the offender's expense. As the act, however, left it optional to the district authorities to appoint analysts or not, and did not provide for the appointment of any officer upon whom should rest the duty of obtaining samples or of prosecuting offenders, it virtually remained a dead letter till 1872, when the Adulteration of Food and Drugs Act came into force, prescribing a penalty not exceeding £50 for the sale of injurious food and, for a second offence, imprisonment for six months with hard labour. Inspectors were empowered to make purchases of samples to be submitted for analysis, but appointment of analysts was still left optional. The definition of an adulterated article given in that act was essentially that still accepted at the present time, namely, "any article of food or drink or any drug mixed with any other substances, with intent fraudulently to increase its weight or bulk, without declaration of such admixture to any purchaser thereof before delivering the same." The adoption of the act was sporadic, and, outside London and a few large towns, the number of proceedings against offenders remained exceedingly small. Nevertheless complaints soon arose that it inflicted considerable injury and imposed heavy and undeserved penalties upon some respectable tradesmen, mainly owing to the "want of a clear understanding of what does and does not constitute adulteration," and in some cases to conflicting decisions and the inexperience of analysts.

1875.

Again a parliamentary committee was appointed which took a mass of evidence, the outcome of its inquiries being the Sale of Food and Drugs Act 1875, which is in force at the present day, subject to amendments and additions made at later dates. This act avoided the term "adulteration" altogether and endeavoured to give a clearer description of punishable offences:—

Section 6. "No person shall sell to the purchaser any article of food or any drug which is not of the nature, substance and quality of the article demanded by the purchaser under a penalty not exceeding £20; provided that an offence shall not be deemed to be committed under this section in the following cases: (1) where any matter or ingredient not injurious to health has been added to the food or drug because the same is required for the production or preparation thereof as an article of commerce, in a state fit for carriage or consumption, and not fraudulently to increase the bulk, weight or measure of the food or drug, or conceal the inferior quality thereof; (2) where the food or drug is a proprietary medicine, or is the subject of a patent in force and is supplied in the state required by the specification of the patent; (3) where the food or drug is compounded as in the act mentioned; (4) where the food or drug is unavoidably mixed with some extraneous matter in the process of collection or preparation."

Section 8. "No person shall be guilty of any such offence as aforesaid in respect to the sale of an article of food or a drug mixed with any matter or ingredient not injurious to health, and not intended fraudulently to increase its bulk, weight or measure, or conceal its inferior quality, if at the time of delivering such article or drug he shall supply to the person receiving the same a notice, by a label distinctly and legibly written or printed on or with the article or drug, to the effect that the same is mixed."

The act made the appointment of analysts compulsory upon the city of London, the vestries, county quarter sessions and town councils or boroughs having a separate police establishment. For the protection of the vendor, samples that had been purchased by the inspectors for analysis were to be offered to be divided into three parts, one to be submitted to the analyst, the second to be given to the vendor to be dealt with by him as he might deem fit, and the third to be retained by the inspector, and, at the discretion of the magistrate hearing any summons, to be submitted, in case of dispute, to the commissioners of inland revenue for analysis by the chemical laboratory at Somerset House. The public analyst had to give a certificate, couched in a prescribed form, to the person submitting any sample for analysis, which certificate was to be taken as evidence of the facts therein stated, in order to render the proceedings as inexpensive as practicable. If the defendant in any prosecution could prove to the satisfaction of the court that he had purchased the article under a warranty of genuineness, and that he sold it in the same state as when he purchased it, he was to be discharged from the prosecution, but no provision was made that in that event the giver of the warranty should be proceeded against.

1879.

Section 6, quoted above, gave rise to an immense amount of litigation, and already in 1879 it was found necessary to pass an amending act, making it clear that if a purchase was effected by an inspector with the intent to get the purchased article analysed, he was as much "prejudiced" if obtaining a sophisticated article as a private purchaser who purchased for his own use and consumption. The amending act also dealt in some small measure with a difficulty which immediately after passing the act was found to arise in ascertaining whether any article was "of the nature, substance and quality demanded by the purchaser" — "in determining whether an offence has been committed under section 6 by selling spirits not adulterated otherwise than by the admixture of water, it shall be a good defence to prove that such admixture has not reduced the spirit more than twenty-five degrees under proof for brandy, whisky or rum, or thirty-five under proof for gin." Almost insuperable difficulties as to the meaning of "nature, substance and quality" subsequently arose as regards every conceivable food material. As it was obviously impossible for parliament to define every article, to lay down limits of composition within which it might vary, to specify the substances or ingredients that might enter into it, to limit the proportions of the unavoidable impurities that might be contained in it, the duty to do all this was left to the individual analysts. An enormous number of substances had to be analysed until sufficient evidence had been accumulated for the giving of correct opinions or certificates. Endless disputes unavoidably arose, friction with manufacturers and traders, unfortunately also with the referees at the inland revenue, who for many years were altogether out of touch with the analysts. Conflicting decisions come to by various benches of magistrates upon similar cases, allowing of the legal sale of an article in one district which in another had been declared illegal, rendered the position of merchants often unsatisfactory. It was not recognized by parliament until almost a quarter of a century had elapsed that it was not enough to compel local authorities to get samples analysed, but that it was also the duty of parliament to lay down specific and clear instructions that might enable the officers to do their work. This has only been very partially done even at the present time.

Difficulties of administration.

A curious condition of things arose out of the definition of "food" given in the act of 1875: "The term food shall include every article used for food or drink by man, other than drugs or water." It had been the practice of bakers to add alum to the flour from which bread was manufactured, in order to whiten the bread, and to permit the use of damaged and discoloured flour. This practice had been strongly condemned by chemists and physicians, because it rendered the bread indigestible and injurious to health. Shortly after the passing of the Food Act this objectionable practice was stamped out by numerous prosecutions, and alumed bread now no longer occurs. A large trade, however, continued to be carried on in baking powders consisting of alum and sodium bicarbonate. It was naturally thought that, as baking powder is sold with the obvious intention that it may enter into food, the vendors could also be proceeded against. The high court, however, held that, baking powder in itself not being an article of food, its sale could not be an offence under the Food Act. This anomaly was removed by a later act.

Under section 6 of the act of 1875 a defendant could be convicted, even if he had no guilty knowledge of the fact that the article he had sold was adulterated. In the repealed Adulteration Act of 1872 the words "to the knowledge of" were inserted, and they were found fatal to obtaining convictions. The general rule of the law is that the master is not criminally responsible for the acts of his servants if they are done without his knowledge or authority, but under the Food Act it was held (*Brown* v. *Foot*, 1892, 66 L.T. 649) that a master was liable for the watering of milk by one of his servants, although he had published a warning to them that they would be dismissed if found doing so. Milk might be adulterated during transit on the railway without the knowledge of the owner or receiver, and yet the vendor was liable to conviction.

When it is brought to the knowledge of a purchaser that the article sold to him is not of the nature, substance or quality he demanded, the sale is not to the prejudice of the purchaser. The notice may be given verbally or by a label supplied with the article. A common law notice may also be given. In *Sandys* v. *Small*, 1878, 3 Q.B.D. 449, a publican had displayed a placard within the inn to the effect that the spirits sold in his establishment were watered. This was held, as it were, to contract him out of the Food Act. Similarly, in the case of butters that had been adulterated with milk, the vendors, by giving a general notice in the shop, evaded punishment under the act. A notice, is, however, of no avail if given under section 8 of the act, if the admixture has been made for fraudulent purposes. In *Liddiart* v. *Reece*, 44 J.P. 233, 1880, an inspector asked for coffee and received a packet with a label describing it as a mixture of coffee and chicory. It was sold at the price of coffee. It turned out to be a mixture containing 40% of chicory. The high court held that this was an excessive quantity, and was added for the purpose of fraudulently increasing the bulk or weight. In another case, however (*Otter* v. *Edgley*, 1893, 57 J.P. 457), where an inspector had asked for French coffee and had been supplied with a mixture containing 60% of chicory, the article being labelled as a mixture, the high court held that there was no evidence of fraud, and, in the case of cocoa, a mixture containing as little as 30% of cocoa and 70% of starch and sugar, the label stating it to be a mixture, was held to have been legally sold (*Jones* v. *Jones*, 1894, 58 J.P. 653). In this case the label notifying the admixture was hidden by a sheet of opaque white paper, nor had the purchaser's attention been called to it, but the price of the article was much lower than that of pure cocoa.

It is seen from these few instances, taken at random out of scores, that this clause of the act was far from clear and was very variously interpreted at the courts. The warranty clause (clause 25) also gave rise to an immense amount of litigation. In the earlier high court decisions a very narrow interpretation was given to the term "written warranty," but in later years a wider view prevailed. A general contract to supply a pure article is not a sufficient warranty unless with every delivery there is something to identify the delivery as part of the contract. An invoice containing merely a description of an article as "lard" or "pepper" is not a warranty; but if there be added the words "guaranteed pure" it is a sufficient warranty. A label upon an article is not in itself a warranty, but a label bearing the words "pure" or "unadulterated," coupled with an invoice which could be identified with the label, together were held to form an effective warranty.

As many thousands of samples were annually submitted by inspectors under the act to the analysts who had been appointed in 237 boroughs and districts, a very large number of cases led to disputes of law or fact, about seventy high court cases being decided within eighteen years of the passing of the act. While these cases related to a variety of different articles and conditions, dairy produce, namely milk and butter, led to the greatest amount of litigation. It may seem to be a simple matter to ascertain whether a vendor of milk supplies his customer with milk of the "nature, substance and quality demanded," but milk is subject to great variations in composition owing to a large number of circumstances which will be considered below.

Margarine Act.

Not many years after the passing of the Food Act of 1875 the sale of butter substitutes assumed very large proportions, and so seriously prejudiced dairy-farmers that, as regards these, an act was passed which was not exactly an amendment of the Sale of Food and Drugs Act, although it embodied a good many provisions of that act. It was called the Margarine Act 1887. It provided that every package of articles made in imitation of butter should be labelled "margarine" in letters 1½ inches square. The vendor, however, was protected if he could show a warranty or invoice, whereas in the Sale of Food and Drugs Act he was not protected by invoice merely. Inspectors might take samples of "any butter or substitute purporting to be butter" without going through the form of purchase. The maximum penalty was raised from £20 as provided by the Food Act, to £50 in the case of a first and to £100 in the case of repeated conviction. The Margarine Act is the first statute that makes reference to and sanctions the use of preservatives, concerning which a good deal will have to be said farther on.

Select committee, 1894.

In the course of twenty years of administration of the Food Acts so many difficulties had arisen in reference to the various points referred to, that in 1894 a select committee was appointed to inquire into the working of the various acts and to report whether any, and if so what, amendments were desirable. During three sessions the committee sat and took voluminous evidence. They reported that where the acts had been well administered they had been most beneficial in diminishing adulteration offences. Forms of adulteration which were common prior to the passing of the 1875 act, such as the introduction of alum into bread and the colouring of confectionery with poisonous material, had almost entirely disappeared. A close connexion had been shown to exist between the extent of adulteration and the number of articles submitted for analysis under the acts, the proportion of adulterated samples being found to diminish as the number of samples taken relatively to the population increased. Thus, in 1890, in Somersetshire one sample had been analysed for every 379 persons, the percentage of adulterated samples in those taken for analysis being as low as 3·6; in Gloucestershire one to 770 persons with 6·2 of adulteration; in Bedfordshire one to 821 with 7·1; in Derbyshire one to 3164 with 17·1 %, and in Oxford one sample to 14,963 inhabitants with no less than 41·7 % of adulterated samples. The number of samples of articles annually submitted to analysis, according to the returns obtained by the Local Government Board, steadily increased from the commencement onward. Whereas in 1877, 14,706 samples, and in 1883, 19,648 samples were analysed, in 1904–1905 the number was no less than 84,678, or an average of one sample to 384 inhabitants for the whole country. In the five years 1877–1881 the proportion found adulterated was 16·2 %; in the following five years ending with 1886, the percentage was 13·9; in the five years ending 1891, the percentage was 11·7; and in the year 1904 the percentage was only 8·5. The select committee found that wide local differences in the administration of the acts existed, and that in many parts of the country the local authorities had failed to exercise their powers. In one metropolitan district, eight members of the local authority had been convicted of offences under the acts, upon evidence obtained by their own inspector. The result was that the duties of the inspector of the acts were afterwards controlled by a committee of that local authority, who decided the cases in which prosecutions should be undertaken, and the administration of the acts was "little better than a farce." No power existed to compel local authorities to carry out the acts. The committee came to the conclusion that in many cases the responsibility for the adulteration of articles of food did not rest with the retailer but with the wholesale dealer or manufacturer; that the law punished petty offences and left great ones untouched; that it fined a small retailer and left the wholesale offender scot free. As regards warranty, they thought that the precedent created by the Margarine Act should be followed generally, and that invoices and equivalent documents should have the force of warranties. They found that a considerable proportion of the food imports were adulterated, out of 890 samples of butter taken by the customs in 1895 no less than 106 being impure, and they recommended that in addition to tea, which by section 30 of the act of 1875 was to be systematically analysed by the customs, prior to being passed for distribution, samples of all food imports should be taken and examined by the customs. The committee further found that the penalties imposed under the acts had for the most part been trifling and quite insufficient to serve as deterrents, the profits derived from the sale of adulterated articles being out of proportion great to the insignificant fines imposed, and they recommended that for the second offence the penalty of £5 should be the minimum one, and that in respect to third or subsequent offences imprisonment without the option of a fine might be inflicted. The important question of food standards was considered at great length. The absence of legal standards or definitions of articles of food had occasioned great difficulty in numerous cases, but as no authority was provided by the existing acts that might fix such standards, they recommended the formation of a scientific authority or court of reference composed of representatives of the laboratory of the Inland Revenue, of the Local Government Board, the Board of Agriculture, the General Medical Council, the Institute of Chemistry, the Pharmaceutical Society, of other scientific men and of the trading and manufacturing community, who should have the duty of fixing standards of quality and purity of food to be confirmed by a secretary of state.

Act of 1899.

The committee's deliberations and recommendations resulted in the Sale of Food and Drugs Act 1899. This unfortunately was not a comprehensive act superseding the previous acts, but was an additional and amending one, so that at the present time four food acts run parallel and are together in force, rendering the subject from a legal point of view one of extreme complexity. In this act the growing influence of the Board of Agriculture and the desire to assist farmers and dairymen more decisively than previously are clearly apparent. Section 1 empowers the customs to take samples of consignments of imported articles of food and enjoins them to communicate to the Board of Agriculture the names of the importers of adulterated goods, any article of food to be considered adulterated or impoverished if it has been mixed with any other substance (other than preservative or colouring matter, of such a nature and such a quantity as not to render the article injurious to health), or if any part of it has been abstracted to the detriment of the article. Margarine or cheese containing margarine has to be conspicuously marked as such; condensed, separated or skim milk has to be clearly labelled "machine-skimmed milk" or "skimmed milk," as the case may be. The next sections give to the Local Government Board and the Board of Agriculture a roving commission to see that the acts are properly enforced throughout the kingdom so as to apply the acts more equally throughout the country than heretofore, and in default of local authorities carrying out their duties empower the government departments mentioned to execute and enforce the acts at the expense of the local authorities. The importance of a regular and conscientious control of the public food supply by the local authorities was thus for the first time, after forty years of experimental legislation, fully acknowledged. In recognition of the great difficulties experienced for many years by analysts in their endeavour to fix minimum percentages for the fat and other milk constituents, and their inability to do so without statutory powers, the Board of Agriculture is authorized by section 4 to make regulations "for determining what deficiency in any of the normal constituents of genuine milk, cream, butter or cheese, or what addition of extraneous matter or proportion of water" in any of these materials shall raise a presumption, until the contrary is proved, that these articles are not genuine. In pursuance of these powers the Board of Agriculture did in 1901 issue their milk regulations, adopting officially the minima agreed upon by public analysts, and in 1902 the sale of butter regulations, which fixed 16 % as the maximum of water that might be contained in butter. It is important to note that the fact of a sample of milk falling short of the standard is not conclusive evidence of adulteration, but it justifies the institution of proceedings and casts the onus of proving that the sample is genuine upon the defendant. The Margarine Act of 1887 was extended to margarine cheese, the obligatory labelling of margarine packages was more precisely regulated, margarine manufacturers and dealers in that article were compelled to keep a register open to inspection by the Board of Agriculture, showing the quantity and designation of each consignment, and power was given to officers of the board to enter at all reasonable times manufactories of margarine and margarine cheese. The amount of butter-fat that might be present in margarine was limited to 10 %, while under the Margarine Act of 1887 an unlimited admixture might have been made, provided that the mixture, no matter how large the percentage of butter, was sold as margarine. As is further explained below, the difficulty of distinguishing without chemical aid between pure butter and margarine containing a considerable percentage of butter is very great, and fraudulent sales continued to be common after the passing of the Margarine Act. The labelling section of the Food Act 1875 (§ 8), which had been systematically circumvented, was modified, a label being no longer recognized as distinctly and legibly written or printed, unless it is so written or printed that the notice of mixture given by the label is not obscured by other matter on the label, though labels that had been continuously in use for at least seven years before the commencement of the act were not interfered with. In consequence of the admitted unfairness of asking for a portion of the contents of a properly labelled tin or package and then instituting proceedings because no declaration of admixture had been made, it was enacted that no person shall be required to sell any article exposed for sale in an unopened tin or packet, except in the unopened tin or packet in which it is contained. This removed a grievance which had long been felt both by retailers and manufacturers, and is a provision of growing importance with the continually increasing sale of articles put up in factories. The warranty provisions, which, as before stated, had given rise to much litigation, were more clearly defined. A notice that a defendant would rely for his defence upon a warranty had to be given within seven days of the service of the summons or the defence would not be available, and the warrantor was empowered to appear at the hearing and to give evidence so that no man's name could, as sometimes previously happened, be dragged into a case without due notice to him. A warranty or invoice given by a person resident outside the United Kingdom was no longer recognized as a defence, unless the defendant could prove that he had taken reasonable steps to ascertain and did in fact believe in the accuracy of the statement contained in the warranty. This prevented collusion between a foreign shipper and an importer; and, lastly, the definition of "food" was widened (in view of the baking-powder decision) so that the term food "shall include every article used for food or drink by man, other than drugs or water, and any article which ordinarily enters into or is used in the composition or preparation of human food, and shall also include flavoring matters and condiments."

The act of 1899 embodies, with one exception, the most important recommendations of the Food Products Committee, the exception being the omission of instituting a board of reference that might deal with difficulties as they arose, guide analysts and public authorities in fixing limits for articles other than milk and butter, and take up the important questions of preservatives and colouring matters and such like. An occurrence which almost immediately followed the passing of the act showed in the strongest manner the necessity of such guiding board—namely, the outbreak of arsenical poisoning in the Midlands in the latter part of 1900.

Arsenic in foods.

In the month of June 1900 there occurred, mainly in the Midlands but also in other parts of England and Wales, an outbreak of an illness variously described as "alcoholism," "peripheral neuritis" or "multiple neuritis." This affected about 6000 persons and resulted in about 70 deaths. It was soon ascertained that the sufferers were all beer drinkers, and several of them were employees of a local brewery, the majority of whom had suffered for some months past. Although suspicion fell early upon beer, some considerable time elapsed before Dr E. S. Reynolds of Manchester discovered arsenic in dangerous proportions in the beer. Steps were immediately taken by brewers and sanitary authorities to ensure that this arsenical beer was withdrawn from sale, and, as a result, the epidemic came speedily to an end. In all instances where this epidemic of sickness had been traced to particular breweries, the latter had been users of brewing sugars—glucose and invert sugar—supplied by a single firm. The quantity of arsenic detected in specimens of these brewing sugars was in some cases very large, amounting to upward of four grains per pound. The implicated brewing sugars were found to have become contaminated by arsenic in course of their manufacture through the use of sulphuric acid, some specimens of which contained as much as 2·6% of arsenic. The acid had been made from highly arsenical iron pyrites, and as the manufacturers of the glucose had not specifically contracted with the acid makers for pure acid, the latter, not knowing for what purpose the acid was to be used, had felt themselves justified in supplying impure acid. A royal commission was appointed in February 1901, with Lord Kelvin as chairman, to inquire into the matter, and an enormous amount of attention was naturally given to it by chemists and medical men. It was soon found that arsenic was very widely disseminated in two classes of food materials, namely, such as had been dried or roasted in gases resulting from the combustion of coal, and such as had been more or less chemically manufactured. All coal contains iron pyrites, and this mineral again is contaminated with arsenic. When the coal is burned the fumes are arsenical and part of the arsenic condenses and deposits. Malt dried in English malt kilns was found to be almost invariably arsenical, and there cannot be a doubt that English beers had for many years past been thus contaminated. At the present time coal virtually free from arsenic is selected for malting, or Newlands' process, consisting of the admixture with coal of lime which renders the arsenic non-volatile, is adopted, and malt free from all but the merest traces of arsenic is manufactured. Part of the arsenic remains in the coal-ashes and wherever these deposit arsenic can be traced. Sir Edward Frankland had, many years previously, detected arsenic in the London atmosphere. Chicory roasted with coal, steaks and chops grilled over an open fire, thus obtain a minute arsenical dosing. In sugar refineries carbonic acid gas is, at one stage of the process, passed through the liquor for the purpose of precipitating lime or strontia. When this carbonic acid is derived from coal the sugar often shows traces of arsenic. When arsenical malt or sugar infusion is fermented, as in brewing, the yeast precipitates upon itself a considerable proportion of the impurity, thus partly cleaning the beer, but all preparations made from yeast—yeast-extracts resemble to some extent meat extracts, with which they are sometimes fraudulently mixed—are thus exposed to arsenical contamination. On the continent of Europe malt is not dried in kilns with direct access of combustion gases but on floors heated from beneath, and continental beers therefore have not been found arsenical. The second class of causes of contamination consists of chemicals. The most important chemical product is sulphuric acid. This used to be made from brimstone or native volcanic sulphur, which is virtually free from arsenic. But since about 1860 sulphuric acid has been more largely made from iron or copper pyrites. Pyrites-acid is always arsenical, but can, by suitable treatment, be easily freed from that impurity. For many purposes acid that has not been purified is employed. In the Leblanc process of manufacture the first step is the conversion of salt into sodium sulphate by sulphuric acid. The hydrochloric acid which is formed carries with it most of the arsenic of the sulphuric acid. Wherever such hydrochloric acid is used it introduces arsenic; thus, in the separation of glycerin from soap lyes, the alkali of the latter is neutralized with hydrochloric acid and glycerin is in consequence frequently highly arsenical. So is the soda produced in the Leblanc process, and every one of the numerous soda salts made from soda is liable to receive its share. All acids liberated from their salts by sulphuric acid, such as phosphoric, tartaric, citric, boracic, may be, and sometimes are, thus contaminated. All superphosphates, made by the action of crude sulphuric acid upon bones or other phosphatic materials, and sulphate of ammonia, made from gas-liquor and acid, that is to say, two of the most important manurial materials, are arsenical, and the poison is thus spread far and wide over meadows and fields, and can be traced in the soil wherever artificial manures have been applied. The crops sometimes take up arsenic to a slight extent, but happily the plant is more selective than man, and no serious amount of poison absorption appears to be possible. The risk of contamination is, of course, much greater with substances which, like glucose, are not further purified by crystallization, but retain whatever impurity is introduced into them. Glucose is not only used in beer, in which by legal enactments it is permitted to be used, but is also substituted for sugar in a number of food products, and is liable to carry into them its contamination. Sugar confectionery, jams and marmalade, honey, and such like, are often admixed with glucose. It is difficult to say in the present state of the law whether such admixture amounts to adulteration. It was clearly made originally for fraudulent purposes, but usage and high court decisions have gradually given the practice an air of respectability. Vinegar of sorts is also made from a glucose liquor produced by the action of sulphuric acid upon maize or other starchy material, and is, in its turn, exposed to arsenic contamination. There is hardly a chemical substance which has directly or indirectly come into contact with sulphuric acid that is not at times arsenical. Thus, while artificial colours, now so much used for the dyeing of food products, are no longer prepared—as was rosaniline (the parent substance of so many aniline dyes) at an early stage of its manufacture—with arsenic acid, yet they are often contaminated indirectly from sulphuric acid. Furthermore, hardly any metal that results from the smelting of any ore with coal is free from arsenic, iron in particular, as employed for pots and pans and implements, being highly arsenical. From the iron the many chemical preparations which contain or are made with the aid of iron salts may be arsenicated. The general presence of arsenic from some of these causes has been known for many years; outbreaks of arsenical poisoning have been due to it at various times, but neglect, forgetfulness and human shortsightedness let the matter go into oblivion, and it is safe to predict, in spite of all attention which has been given to the subject, of the panic which was created by the beer-poisoning outbreak, of the shock and injury caused to manufacturers of many kinds, and of the watchfulness aroused in officers of health and analysts, that as long as the production of food materials or substances that go into food materials is not left to the care of nature, and as long as man adds the products of his ingenuity to our food and drink, so long will "accidents," like the Manchester poisoning, from time to time recur. We now search for arsenic; some other time it is lead, or antimony, or selenium, that will do the mischief. Man does what he can according to his light, but he sees but a little patch of the sky of knowledge, while the plant or the animal building up its body from the plant has learned by inheritance to avoid the assimilation of matters noxious to it. Strictly speaking, arsenical poisoning does not belong to the subject of adulteration. It is not due to wilfulness but to stupidity, but it affords a lesson which cannot be taken too much to heart, that mankind, by relying too much upon "science" in feeding, is on a path that is fraught with considerable danger.

To safeguard consumers, as far as practicable, the royal commission made important recommendations concerning amendments of the Food Acts; these, as at present interpreted and administered, were reported to be unsatisfactory for the purpose of protecting the consumer against arsenic and other deleterious substances in food. "As a rule public analysts receive samples in order that they may pronounce upon their genuineness or otherwise, knowing nothing of the local circumstances which led to their being taken, of their origin or the reasons for sending them. The term 'genuine' in this sense means that the analyst has not detected such objectionable substances as he has considered it necessary to look for in the sample submitted to him. Obviously, the value of the statement that the sample is 'genuine' depends upon the extent to which the analyst has means of knowing what are the objectionable substances which it is liable to contain. In present circumstances he has not sufficient information on this point." It was also pointed out that the application of the Food Acts to prevention of contamination of foods by deleterious substances was materially hindered by want of an official authority with the duty of dealing with the various medical, chemical and technical questions involved, and that the absence of official standards militated against the efficiency of the existing acts. The commission advised that a special officer be appointed by the Local Government Board to obtain by inquiries from various sources, such information as would enable the board to direct the work of local authorities in securing greater purity of food; and they further recommended that the board or court of reference, which had been advised by the Committee on Food Products Adulteration, should be established. Pending the establishment of official standards in respect of arsenic under the Food Acts, they were of opinion that penalties should be imposed upon any vendor of beer or any other liquid food, or of any liquor entering into the composition of food, if that liquid be shown by adequate test to contain one-hundredth of a grain or more of arsenic in the gallon, and with regard to solid food, no matter whether it be consumed habitually in large or small quantities, or whether it be taken by itself (like golden syrup), or mixed with water or other substances (like chicory or yeast extract)—if the substance contain one-hundredth of a grain of arsenic or more to the pound. The board of reference, most urgently needed for the protection of the public and for the guidance of manufacturers and officers, has yet to be created.

Preservatives in food.

While from time immemorial certain articles of food have been preserved by salting, smoking, drying, or by the addition of sugar and in some cases of saltpetre, during the last quarter of the 19th century the use of chemicals acting more powerfully as antiseptics or preservatives extended enormously, particularly in England. A very large fraction of the British food supply being obtained from abroad, a proportionately great difficulty exists in obtaining the food in an entirely fresh and untainted condition. While refrigeration and cold-storage has been the chief factor in enabling the meat and other highly perishable foods to be imported, other steps, ensuring preservation of goods that are collected from farmers and brought together at shipping ports, are necessary to prevent decomposition prior to such goods coming into cold store. Thus it is well-nigh impossible to collect butter from farms in Australia or New Zealand far distant from the coast without the addition of some chemical preservative. Heavily salted goods no longer appeal to the modern palate, and, with the progress of specialized labour, the inhabitants, especially of great towns, have become accustomed to resort to manufactured provisions instead of the home-made and home-cooked food. Manufacturers of many articles of preserved food gradually adopted the use of chemical preservatives, and at the present time the practice has become so general that it may be said that practically every person in the United Kingdom who has passed the suckling stage consumes daily more or less food containing chemical preservatives. The Food Act allows of the addition of any ingredient, not injurious to health, if it be required for the production or preparation of the food, or as an article of commerce, in a state fit for carriage. The legality or otherwise of the use of chemical preservatives, therefore, hinges upon their innocuousness. Upon theoretical considerations it is clear that a substance which is capable of acting as an antiseptic must act injuriously upon bacteria, fungi or yeasts, and as the human body is, generally speaking, less resistant to poisons than the low organisms in question, it would seem to follow that antiseptics are bound to affect it injuriously. It is, of course, a question of dose and proportion. It has further been said that all antiseptics possess some sort of medicinal action, and however valuable they may be in disease when administered under the control of a competent physician, they have no business to be given indiscriminately to sick and healthy alike by purveyors of food. The result of a general desire on the part of importers and manufacturers of food materials, of the officers under the Food Act, of the medical profession and of the public, resulted after many years of agitation and complaint and after numerous conflicting magisterial decisions, in the appointment in 1899, by the president of the Local Government Board, of a departmental committee to inquire into the use of preservatives and colouring matters in food, with the reference to report: first, whether the use of such materials or any of them, in certain quantities, is injurious to health, and, if so, in what proportion does their use become injurious, and, second, to what extent and in what amounts are they used at the present time. After the examination of a great number of witnesses a report was issued in 1901. Perhaps the most important conclusion was that the instances of actual harm which were alleged to have occurred from the consumption of articles of food and drink chemically preserved were few in number, and were not at all supported by conclusive evidence. During the period which has elapsed since chemically preserved food has been used, the mortality as a whole has declined, and while this naturally cannot be put to the credit of the preservatives but is largely due to better feeding in consequence of the introduction of cheaper foods, which are rendered possible to some extent by the use of preservatives, it conclusively establishes the fact that no obvious harm has been done to the health of the community. The committee made certain recommendations which are the most authoritative pronouncements upon the subject. They are as follows:—That the use of formaldehyde or formalin, or preparations thereof, in food or drinks, be absolutely prohibited, and that salicylic acid be not used in a greater proportion than one grain per pint in liquid food and one grain per pound in solid food, its presence in all cases to be declared. That the use of any preservatives or colouring matter whatever in milk offered for sale in the United Kingdom be constituted an offence under the Sale of Food and Drugs Act. That the only preservative which it shall be lawful to use in cream be boric acid, or mixtures of boric acid and borax, and in amount not exceeding 0·25 % expressed as boric acid, the amount of such preservative to be notified by a label upon the vessel. That the only preservative permitted to be used in butter and margarine be boric acid, or mixtures of boric acid and borax, to be used in proportions not exceeding 0·5 % expressed as boric acid. That in the case of all dietetic preparations intended for the use of invalids or infants, chemical preservatives of all kinds be prohibited.

Borax.

As the most commonly used chemical preservative is boric acid, free or in the form of borax, which is extensively employed in butter, cream, ham, sausages, potted meats, cured fish, and sometimes in jams and preserved fruit, the arguments for and against its employment deserve more detailed attention. It cannot be looked upon in the light of common adulteration because, in any case, the quantity used is but an inconsiderable fraction, and the cost of it is generally greater than that of the food itself. It is not used to hide any traces of decomposition that may have taken place or to efface its effects. On the other hand, it cannot be said to be "required for the production or preparation" of the articles with which it is mixed, since a fraction at least of similar articles are made without preservative. It enables food to be kept from decomposition, but it also lessens the need for cleanliness and encourages neglect and slovenliness in factories. It has no taste, or only a very slight one, hence does not manifest itself to the consumer in the same way as does common salt, and cannot therefore be avoided by him should he desire to do so. Its preservative action, that is, its potency, is very slight in comparison with most other preservatives; its potential injuriousness to man must be proportionately small. It is practically without interference upon salivary, peptic or tryptic digestion, unless given in large quantities. Experiments made by F. W. Tunnicliffe and R. Rosenheim upon children showed that neither boric acid nor borax, administered in doses of from 15 to 23 grains per diem, exerted any influence upon proteid metabolism or upon the assimilation of phosphatized materials. The fat assimilation was, if anything, improved, and the body weight increased, and the general health and well-being was in no way affected. On the other hand, evidence was adduced that in some cases digestive disturbances, after continuous administration of from 15 to 40 grains, were observable, nausea and vomiting in some, and skin irritation, in one case resulting in complete baldness, in others.

Although it is in most cases very difficult to trace any gastric disturbance to any particular article of food or one of its ingredients, so as to exclude all other possible causes of disturbance, a fairly good case has been made out by a number of medical practitioners against boracic acid, taken in an ordinary diet and not for experimental purposes. The most exhaustive investigation which has as yet been made was carried out by Dr H. W. Wiley, chief chemist to the United States department of agriculture. A large number of young men who had offered themselves as subjects for the investigations, were boarded as a special "hygienic table," but otherwise continued their usual vocations during the whole period of the experiment. They were placed upon their honour to observe the rules and regulations prepared by the department and to use no other food or drink than that provided, water excepted, and any water consumed away from the hygienic table was to be measured and reported. They were to continue their regular habits and not to indulge in any excessive amount of labour or exercise. Weight, temperature and pulse rate were continuously recorded. The periods during which the subjects of the experiment were kept under observation varied from thirty to seventy days, periods of rest being given during which they were permitted to eat moderately at tables other than the experimental one. There was a good and ample diet. The observations were divided into three periods: the fore period, the preservative period and the after period, during the whole of which time the rations of each member were weighed or measured and the excreta collected. Before the "fore" period was commenced a note was made of the quantities of food voluntarily consumed by each of the candidates, and from these the proper amount necessary in each case to maintain a comparatively constant body weight was calculated. When a suitable result was thus arrived at, the same quantity of food was given daily during the "preservative" and "after" periods. The preservative was given in the forms of borax and of boric acid, at first mixed with butter, but subsequently in gelatine capsules. This was found to be necessary from the fact that when the preservative was mixed with the food and concealed in it some of the members of the table evinced dislike of the food with which it was supposed to be incorporated; those who thought that the preservative was in the butter were disposed to find the butter unpalatable, and the same was true with those who thought it might be in the milk or coffee, while, when the preservative was given openly, much less disturbance was created. The preservative was given at first in small doses such as might be consumed in commercial food that had been preserved with borax; gradually the quantities were increased in order to reach the limit of toleration for each individual. All food was weighed, measured and analysed, the same being the case with the excreta. The blood was examined periodically as regards colouring matter and number of corpuscles. Everything was done to keep up the general health of the members and to do away with all unfavourable mental influences due to the circumstances. During the time of the experiment analyses were made of 2550 food samples and 1175 samples each of urine and faeces. The general results were as follows: there was no tendency to excite diarrhoea, and the nitrogen-metabolism was but very little influenced, if anything being slightly decreased. As regards phosphorus the combined results of all observations indicated that the preservative increased the excretion of phosphorus to a small extent, from 97·3 % in the "fore" period, to 103·1 in the "preservative" period. The metabolism of fat was uninfluenced; there was an increase of the solid matters in the faeces and a decrease of those in the urine, from which Dr Wiley concluded that the preservatives interfered with the process of digestion and absorption. No influence was exerted on the corpuscles and the haemoglobin of the blood. The effect of boracic acid and borax on the general health varied with the amount administered, quantities not exceeding half a gramme ($7\frac{1}{2}$ grains) of boracic acid, or its equivalent of borax, producing no immediate effects, but the long-continued administration of such small doses seemed to produce the same results as the use of large doses over a shorter period. There was a tendency to diminish the appetite and to produce a feeling of fulness and uneasiness in the stomach and sometimes actual nausea, also one of fulness in the head manifested as a dull headache which disappeared when the preservative was dropped. The continued administration of large doses, 60 to 75 grains per day, resulted in most cases in loss of appetite, inability to perform work of any kind and general unfitness. In most cases 45 grains per day could be taken for some time, but gradually injurious effects were observed. In some cases 30 and even 15 grains per day appeared to cause illness, but it is acknowledged that these persons may have been suffering from influenza. The administration of 7·5 grains was declared by Dr Wiley to be too much for the normal man to receive regularly, although for a limited period there might be no danger to health. Dr Wiley concludes his report: "It appears, therefore, that both boric acid and borax, when continuously administered in small doses for a long period or when given in large quantities for a short period, create disturbance of appetite, of digestion and of health."

Dr Wiley's conclusions were adversely criticized by Dr O. Liebreich, who carefully studied on the spot all the conditions of the experiment and the documents relating to the investigation. He pointed out that the results were so indefinite and the number of persons under control so small that " one case of self-deception or of forgetfulness only would throw into absolute uncertainty the solution of the whole question "; that no lasting injury to health was found in spite of transient disturbances attributed by Dr Liebreich to other causes, and that all persons declared themselves to be in better physical condition after seven months than they had been before. On the whole the balance of evidence seems to be that while no acute injury is likely to result from boron compounds in food, they are liable to produce slighter digestive interferences.

Formaldehyde.

Other chemical substances that are in use for the purpose of preserving food materials may be treated more shortly. Formaldehyde, coming into commerce in the form of a 40 % solution under the name of formalin, was for a time largely used in milk. It certainly has very great antiseptic properties, as little as 1 part in 50,000 parts checking the growth of organisms in milk for some hours, but as the substance combines with albuminous matters and hardens them to an extraordinary degree, rendering, for instance, gelatine perfectly insoluble in water, it exerts an inhibitory effect on the digestive ferments. It injures salivary, peptic and pancreatic digestion. A set of five kittens fed with milk containing 1 part in 50,000 of formaldehyde for seven weeks were strongly retarded in growth, three ultimately dying, while four control kittens fed on pure milk flourished. In even moderate doses formalin produces severe pains in the abdomen and has caused death. It is now generally recognized as a substance that is admirably adapted for disinfecting a sick-room, but quite improper and unsuitable for food preservation.

Salicylic acid.

Salicylic acid or orthohydroxybenzoic acid is either obtained from oil of winter-green or is made synthetically by Kolbe's process from phenol and carbonic acid. Artificial salicylic acid generally contains impurities (creasotic acids) which act very injuriously upon health. When pure, salicylic acid employed as a food preservative has never produced decided injurious effects, although administered by itself in fairly strong solution it acts as an irritant to the stomach and kidneys, and sometimes causes skin eruptions. It is a powerful drug in larger doses and requires careful administration, especially as about 60 % of the persons to whom it is administered show symptoms known as " salicylism," namely, deafness, headache, delirium, vomiting, sometimes haemorrhage or heart-failure. It is doubtful whether pure salicylic acid produces these symptoms. When present in proportion of 1 to 1000 it inhibits the growth of moulds and yeasts. In jams 2 grains per pound and in beverages 7 grains to a gallon are considered by manufacturers to be sufficient for preservative purposes. It is used mainly in articles of food or drink containing sugar, that is to say, in jams and preserved fruit, lime and lemon juices, syrups, cider, British wines and imported lager. Its use in butter, potted meat, milk or cream, in which it was not infrequently met with formerly, is now quite exceptional. It has already been stated that the preservative committee recommended its permissive use in small proportions. To some extent benzoic acid and benzoates have taken the place of salicylic acid and salicylates, partly because salicylic acid can readily be detected analytically, while benzoic acid is not quite easily discoverable. Its antiseptic potency is about equal to that of salicylic acid, and the arguments for or against its use are similar to those relating to the latter.

For the preservation of meat and beer, lime juice and dried fruit, sulphur dioxide (sulphurous acid) and some of the sulphites have long been employed. Sulphuring of hops and disinfection of barrels by burning brimstone matches is an exceedingly old practice. Burning sulphur is well known as a gaseous disinfectant of rooms, bacteria being killed in air containing 1 % of the gas. As the taste and smell of sulphurous acid and of sulphites are very pronounced it follows that but small quantities can be added to food or drink. About 1 part in 4000 or 5000 of beer is the usual amount. While, in larger quantities, the sulphites have decided physiological activity and are apt to produce nephritis, there is not any evidence that they have ever caused injurious effects in alcoholic liquors. The excise authorities have tacitly sanctioned their employment in breweries, although the Customs and Inland Revenue Act 1885 declares that a brewer of beer shall not add any matter or thing thereto except finings or other matter or thing sanctioned by the commissioners of Inland Revenue, and although sulphites are used in all breweries, the Board of Inland Revenue do neither sanction nor interfere. An antiseptic with a pronounced taste is obviously a safer one in the hands of a non-medical person than one virtually devoid of taste, like boric, salicylic or benzoic acids or their salts.

Other preservatives.

Sodium fluoride, a salt possessing powerfully antiseptic properties, but also at the same time clearly injurious to health and interfering with salivary and peptic digestion, has been found in butter, imported mainly from Brittany, in quantities quite inadmissible in food under any circumstances. A few other chemical preservatives are occasionally used. Hydrogen peroxide has been found effective in milk sterilization, and if the substance is pure, no serious objection can be raised against it. Saccharine, and other artificial sweetening agents, having antiseptic properties, are taking the place of sugar in beverages like ginger-beer and lemonade, but the substitution of a trace of a substance that provides sweetness without at the same time giving the substance and food value of sugar is strongly to be deprecated.

The employment of chemical preservative matters in articles intended for human consumption threatens to become a grave danger to health or well-being. Each dealer in food contributes but a little; each one claims that his particular article of food cannot be brought into commerce without preservative, and each condemns the use of these substances by others. There is doubtless something to be said for the practice, but infinitely more against it. It cheapens food by allowing its collection in districts far away, but the chief gainer is not the public as a whole but the manufacturer and the wholesale merchant. Our body has by inheritance acquired habits and needs that are quite foreign to chemical interference. Some day, artificially prepared foods, containing liberal quantities of matters that are not now food ingredients, may conceivably compare with natural food products, but that day is not yet, and meantime it ought to be clearly the duty of the state to see that the evil is checked. The intention which has introduced this form of adulteration may be more or less beneficent, but in practice it is almost wholly evil.

Colouring matter in food.

A similar criticism applies to the continually extending use of colouring matter in food. Civilized man requires his food not only to be healthy and tasty, but also attractive in appearance. It is the art of the cook to prepare dishes that please the eye. This is a difficult art, for the various colouring matters which are naturally present in meat and fish, in fruit, legumes and green vegetables are of a delicate and changeable nature and easily affected or destroyed by cooking. Many years ago some artful, if stupid, cook found that green vegetables like peas or spinach, when cooked in a copper pan, by preference a dirty one, showed a far more brilliant colour than the same vegetables cooked in earthenware or iron. The manufacturer who puts up substances like peas in pots or tins for sale produces the same effect which the cook in her ignorance innocently obtained, by the wilful addition of a substance known to be injurious to health, namely, sulphate of copper. The copper combines with the chlorophyll, forming copper phyllocyanate, which, by reason of its insolubility in the gastric juice, is comparatively innocuous. Preserved peas and beans have been for so many years " coppered " in this manner that it is difficult to induce the public to accept these vegetables when possessed of their natural colour only. Several countries endeavoured to abolish the objectionable practice, but the public pressure has been too great, and to-day the practice is almost universal. In England the amount of copper corresponds to from one to two grains per pound of the vegetable calculated as crystallized copper sulphate. The opinion of the departmental committee was clearly expressed that the practice should be prohibited. No effect has been given to the recommendation.

Milk is naturally almost white with a tint of cream colour. When adulterated with water this tint changes to a bluish one. To hide this tell-tale of a fraud, a yellow colouring matter used to be added by London milkmen. Very gradually this practice, which had its origin in fraud, has extended to all milk sold in London. The consumer, mis-educated into believing milk to be yellow, now requires it to be so. Large dairy companies have endeavoured to wean the public of its error, without success. From milk the practice extended to butter; natural butter is sometimes yellowish, mostly a faint fawn, and sometimes almost white. In agricultural districts this is well known and taken as a matter of course. In big towns, where the connexion of butter and the cow is not well known, the consumer requires butter to be of that colour which he imagines to be butter-colour. Anatto, turmeric, carrot-juice used formerly to be employed for colouring milk, butter and cheese, but of late certain aniline dyes, mostly quite as harmless physiologically as the vegetable dyes just mentioned, are largely being used. The same aniline dyes are also employed in the manufacture of an imitation Demerara sugar from white beet sugar crystals. Aniline dyes are very frequently used by jam-makers; the natural colour of the fruit is apt to suffer in the boiling-pan, and unripe, discoloured or unsound fruit can be made brilliant and enticing by dye. The brilliant colours of cheap sugar confectionery are almost invariably produced by artificial tar-colours. Most members of this class of colouring matters are quite harmless, especially in the small quantities that are required for colouring, but there are a few exceptions, picric acid, dinitrocresol, Martius-yellow, Bismarck brown and one of the tropaeolins being distinctly poisonous. On the whole, the employment of powerful aniline dyes is an advance as compared with the use of the vicious and often highly poisonous mineral colours which Hassall met with so frequently in the middle of the 19th century. Mineral colours, with very few exceptions, are no longer used in food. Oxide of iron or ochre is still very often found in potted meats, fish sauces and chocolates; dioxide of manganese is admixed with cheap chocolates. All lump sugar of commerce is dyed. Naturally it has a yellow tint. Ultramarine is added to it and counteracts the yellowness. In the same way our linen is naturally yellow and only made to look white by the use of the blue-bag.

The same idea underlies both practices, and indeed the use of all colouring matters in manufactured articles, namely, to make them look better than they would otherwise. Within bounds, this is a reasonable and laudable desire, but it also covers many sins—poor materials, bad workmanship, faulty manufacturing and often fraud. Like sugar, flour and rice are sometimes blued to make them look white. All vinegar, most beers, all stout, are artificially coloured with burnt sugar or caramel. The line dividing the legitimate and laudable from the fraudulent and punishable is so thin and difficult to draw that neither the law nor its officers have ventured to draw it, and yet it is a matter which urgently requires regulation at the hands of the state. Practices which, when new, admit of regulation are almost ineradicable when they have become old and possessed of "vested rights." Recognizing this, the departmental committee, like the royal commission on arsenical poisons, recommended that "means be provided, either by the establishment of a separate court of reference, or by the imposition of more direct obligation on the Local Government Board, to exercise supervision over the use of preservatives and colouring matters in foods and to prepare schedules of such as may be considered inimical to the public health."

Metallic impurities.

In close connexion with this subject is the occasional occurrence of injurious metallic impurities in food-materials. Tin chloride is used in the West Indies to produce the yellow colour of Demerara sugar. The old processes of sugar-boiling left some of the brown syrup attached to the crystals, giving them both their colour and their delicious aroma; with the introduction of modern processes affording a much greater yield of highly refined sugar, white sugar only was the result. The consumer, accustomed to yellow sugar, had the colour artificially supplied by the action of the tin compound upon the sugar. At the present time all Demerara sugar, with the exception of that portion that is dyed with aniline dye, has had its colour artificially given it and consequently contains strong traces of tin. Soda-water, lemonade and other artificial aerated liquors are liable to tin or lead contamination, the former proceeding from the tin pipes and vessels, the latter from citric and tartaric acids and cream of tartar used as ingredients, these being crystallized by their manufacturers in leaden pans. Almost all "canned" goods contain more or less tin as a contamination from the tin-plate. While animal foods do not attack the tin to any great extent, their acidity being small, almost all vegetable materials, especially fruits and tomatoes, powerfully corrode the tin covering of the plate, dissolving it and becoming impregnated with tin compounds. It is quite easy to obtain tin-reactions in abundance from every grain of tinned peaches, apples or tomatoes. These tin compounds are by no means innocuous; yet poisoning from tinned vegetable foods is of rare occurrence. On the whole, tin-plate is a very unsuitable material for the storage and preservation of acid goods. Certain enamels, used for glazing earthenware or for coating metal cooking pots, contain lead, which they yield to the food prepared in them. Food materials that have been in contact with galvanized vessels sometimes are contaminated with zinc. Zinc is also not infrequently present in wines.

Results of English Food Acts.

The effect of the application of the food laws has been entirely beneficial. Not only has the percentage proportion of samples found adulterated largely declined, but the gross forms of adulteration which prevailed in the middle of the 19th century have almost vanished. Plenty of fraud still prevails, but poisoning by reckless admixture is of exceedingly rare occurrence. Whilst formerly milk was not infrequently adulterated with an equal bulk of water, few fraudulent milkmen now venture to exceed an addition of 10 or 15%. A bird's-eye view over the effect is obtained from the following figures for England and Wales:—

Year.	Number of Samples.		Percentage of Adulteration.
	Examined.	Adulterated.	
1877	14,706	2,826	19·2
1879	17,049	2,535	14·8
1884	22,951	3,311	14·4
1889	26,956	3,096	11·5
1894	39,516	4,060	10·3
1899	53,056	4,970	9·4
1904	84,678	7,173	8·5

The details of the working of the Food Acts in 1904 in England and Wales are set out in the table on the next page.

United States.—Each separate state has food laws of its own. From the 1st of January 1907 the "American National Pure Food Law," applicable to the United States generally, came into force, without superseding the State food laws, the only effect of the National Law being the legalization of shipments of any food which complies with the provisions of the National Law into any state from another state, even though the food is adulterated within the meaning of the state law. The law applies to every person in the United States who receives food from another state and offers it for sale in the original unbroken packages in which he receives it, and if it is adulterated or misbranded within the meaning of the National Law he can be punished for having received it and offering it for sale in the original unbroken package to the same extent as the person who shipped it to him can be punished. The mere fact that he is a citizen of a state selling food within that state will not excuse him; and he will be subject to prosecution to the same extent as he would be if he uttered counterfeit money. Retailers.

however, can protect themselves from prosecution when they sell goods in original unbroken packages by procuring a written guarantee, signed by the person from whom they received the goods, such guarantee stating that the goods are not adulterated within the meaning of the National Law. The guarantee must also contain the name and address of the wholesale vendor, but unless the parties signing the guarantee are residents of the United States the guarantee is void. The law affects all foods shipped from one state or district into another and also all foods intended for export to a foreign country. It also affects all food products manufactured or offered for sale in any territory or the District of Columbia, wherever such foods may have been produced. The law does not affect foods manufactured and sold wholly within one state, nor such as have been shipped from another state but not in the original package. While thus the National Food Law is mainly intended to regulate the food traffic between the different states, and leaves to the states freedom to regulate their internal traffic, it must gradually tend to unify the present complicated state food legislation, and it is therefore here more usefully considered than would be the separate state laws.

Table showing working of British Food Acts, 1904.

	Samples Examined.	Found Adulterated.	Percentage Adulterated.
Milk	36,413	4,031	11·1
Butter	15,124	867	5·7
Cheese	2,176	20	0·9
Margarine	1,169	83	7·1
Lard	2,489	4	0·2
Bread	473	1	0·2
Flour	476	3	0·6
Tea	486	.	..
Coffee	2,550	161	6·3
Cocoa	477	42	8·8
Sugar	901	49	5·4
Mustard	812	39	4·8
Confectionery and Jam	1,303	72	5·5
Pepper	2,393	43	1·8
Wine	308	54	17·5
Beer	1,065	75	7·0
Spirits	6,938	832	12·0
Drugs:—			
Camphorated Oil	395	24	6·1
Sweet Spirit of Nitre	243	66	27·2
Sulphur	131	7	5·3
Cream of Tartar	441	88	20·0
Glycerin.	192	21	10·9
Rhubarb preparations	96	5	5·2
Seidlitz Powders	81	3	3·7
Linseed	70	1	1·4
Magnesia	48	9	18·8
Mercury preparations	28	4	14·3
Cod Liver Oil	245	7	2·9
Iron Pills	16	..	..
Compound Liquorice Powder	111	2	1·8
Tincture of Iodine	23	4	17·4
Other Drugs	1,124	124	11·0
Total Drugs	3,214	365	11·3
Other Articles:—			
Ginger	704	..	..
Syrup and Treacle	183	8	4·4
Baking Powder	281	11	3·9
Vinegar	773	57	7·4
Arrowroot	467	3	0·6
Oatmeal	359	..	..
Sago	227	14	6·2
Olive Oil	306	9	2·9
Dripping and Fat	85	1	1·2
Sundries.	2,496	329	13·2
Total other Articles	5,881	432	7·3
All Articles	84,678	7,173	8·5

The definition of adulteration as set forth in sec. 7 is as follows:—" For the purpose of this act an article shall be deemed to be adulterated: *In the case of drugs*: (1) If, when a drug is sold under or by a name recognized in the United States Pharmacopoeia or National Formulary, it differs from the standard of strength, quality or purity, as determined by the test laid down in the United States Pharmacopoeia or National Formulary official at the time of investigation; provided that no drug defined in the United States Pharmacopoeia or National Formulary shall be deemed to be adulterated under this provision if the standard of strength, quality or purity be plainly stated upon the bottle, box or other container thereof although the standard may differ from that determined by the test laid down in the United States Pharmacopoeia or National Formulary. (2) If its strength or purity fall below the professed standard or quality under which it is sold. *In the case of confectionery*: If it contains terra alba, barytes, talc, chrome yellow or other mineral substance or poisonous colour or flavour, or other ingredient deleterious or detrimental to health, or any vinous, malt or spirituous liquor or compound or narcotic drug. *In the case of food*: (1) If any substance has been mixed and packed with it so as to reduce or lower or injuriously affect its quality or strength. (2) If any substance has been substituted wholly or in part for the article. (3) If any valuable constituent of the article has been wholly or in part abstracted. (4) If it be mixed, coloured, powdered, coated or stained in a manner whereby damage or inferiority is concealed. (5) If it contain any added poisonous or other added deleterious ingredient which may render such article injurious to health: provided that when in the preparation of food products for shipment they are preserved by any external application applied in such manner that the preservation is necessarily removed mechanically, or by maceration in water, or otherwise, and directions for removal of said preservations shall be printed on the covering of the package, the provisions of the act shall be construed as applying only when said products are ready for consumption. (6) If it consists in whole or in part of a filthy, decomposed or putrid animal or vegetable substance, or any portion of an animal unfit for food, whether manufactured or not, or if it is the product of a diseased animal or one that has died otherwise than by slaughter. . . ."

Whatever vagueness attaches to these definitions is intended to be removed by secs. 3 and 4, which provide that the secretaries of the Treasury, of Agriculture, and of Commerce and Labour " shall make uniform rules and regulations for carrying out the provisions of the act, including the collection and examination of specimens of food and drugs," which examination " shall be made in the bureau of chemistry of the department of agriculture, or under the direction and supervision of such bureau, for the purpose of determining from such examinations whether such articles are adulterated or misbranded within the meaning of the act." Contravention of the act is punishable for the first offence by a fine not exceeding 500 dollars or 1 year's imprisonment or both, and for each subsequent offence by a fine not less than 1000 dollars or 1 year's imprisonment or both. Under an act of congress, approved March 1903, the bureau of agriculture established standards of purity for food products, " to determine what are regarded as adulterations therein for the guidance of the officials of the various states and of the courts of justice." The elaborate set of food definitions and standards worked out under the guidance of the chief of the bureau, Dr H. W. Wiley, have also received legal sanction and form a corollary to the National Food Law. For each of the more important articles of food an official definition of its nature and composition has thus been established, of the utmost value to food officers, manufacturers and merchants not only in the United States but throughout the world. A few of these definitions may here find a place:—

" Lard is the rendered fresh fat from slaughtered healthy hogs. Leaf-lard is the lard rendered at moderately high temperatures from the internal fat of the abdomen of the hog, excluding that adherent to the intestines. Standard lard and standard leaf-lard are lard and leaf-lard respectively, free from rancidity, containing not more than 1% of substances other than fatty acids, not fat, necessarily incorporated therewith in the process of rendering, and standard leaf-lard has an iodine number **not** greater than 60. Milk is the lacteal secretion obtained by the complete milking of one or more healthy cows, properly fed and kept, excluding that obtained within 15 days before and 5 days after calving. Standard milk is milk containing not less than 12 % of total solids and not less than $8\frac{1}{2}$ % of solids not fat, nor less than $3\frac{1}{4}$ % of milk-fat. Standard skim-milk is skim-milk containing not less than $9\frac{1}{4}$ % of milk-solids. Standard condensed milk and standard sweetened condensed milk are condensed milk and sweetened condensed milk respectively, containing no less than 28 % of milk-solids, of which not less than one-fourth is milk-fat. Standard milk-fat or butter-fat has a Reichert-Meissl number not less than 24 and a specific gravity at 40° C. not less than 0·905. Standard butter is butter containing not less than 82·5 % of butter-fat. Standard whole-milk cheese is cheese containing in the water-free substance not less than 50 % of butter-fat. Standard sugar contains at least 99·5 % of sucrose. Standard chocolate is chocolate containing not more than 3 % of ash insoluble in water, 3·5 % of crude fibre, and 9 % of starch, nor less than 45 % of cocoa-fat."

Numerous other standards with details too technical for reproduction here have also been fixed.

German Empire.—The law of the 14th of May 1879, largely based upon the English Food and Drugs Act 1875, regulates the trade in food. Each town or district appoints a public analyst, and there is a state laboratory in Berlin directly under the control of the ministry of the interior with advisory functions. The ministry, under the advice of this department, issues from time to time regulations concerning the sale of or details specifying the mode of analysis of various products of food or drink. Both in the United States and in Germany, therefore, the executive officers (public analysts) have some authoritative official department for guidance and information.

PARTICULAR ARTICLES ADULTERATED

We will now proceed to consider adulteration as practised during recent years in the more important articles of food.

Milk.—Milk adulteration means in modern times either addition of water, abstraction of cream, or both, or addition of chemical preservative. The old stories of the use of chalk or of sheep's brains are fables. Owing to the wide variation to which milk is naturally subjected in composition, it is exceedingly difficult to establish beyond doubt whether any given sample is in the state in which it came from the cow or has been impoverished. The composition of cow's milk varies with many conditions. (1) The race of the animal: the large cows of the plains yielding a great quantity of poor milk, the smaller cows from hilly districts less amount of rich milk. Hence, milk from Dutch cows compares very unfavourably with that of Jerseys or short-horns. Watery and acid foods like mangolds and brewers' grains produce a more aqueous milk than do albuminous and fatty foods like oil-cakes. (2) Sudden change of food, of weather and of temperature. (3) Nervous disturbances to which even a cow is subject, as, for instance, at shows, may greatly influence the composition of the milk. The portion obtained at the beginning of a milking is poorer in fat than that yielded towards the end. Morning milk is as a rule poorer in fat than evening milk. Soon after calving the animal gives a richer product than at later periods, both the quantity and the composition declining towards the end of the lactation. The variations due to these different circumstances may be very great, as is seen from the following analyses, fairly representing the maximum, minimum and mean composition of the milk of single cows:—

	Minimum.	Maximum.	Mean.
Specific Gravity	1·0264	1·0370	1·0316
Fat	1·67%	6·47%	3·59%
Casein	1·79%	6·29%	3·02%
Albumen	0·25%	1·44%	0·50%
Milk Sugar (lactose) . . .	2·11%	6·12%	4·78%
Salts	0·35%	1·21%	0·71%
Water	80·32%	90·69%	87·40%

In market milk such wide variations are not so liable to occur, as the milk from one animal tends to average that from another, but even in the milk from herds of cows the variations may be considerable. The average composition of genuine milk supplied by one of the largest dairy companies in London, as established by the analysis of 120,000 separate samples recorded by Dr P. Vieth, is fat 4·1 %, other milk solids ("solids not fat" or "non-fatty solids") 8·8 %, total dissolved matters (total solids) 12·9 %, the variations being from 3·6 to 4·6 % in the fat and 8·6 to 9·1 % in the solids not fat. It is clear that the 4·6 % of fat could be reduced, by skimming, to 3·0 %, and the 9·1 % of solids not fat to 8·5 % by addition of water, without bringing the composition of the milk thus adulterated outside that of genuine milk. In reality even wider limits of variation must be reckoned with, because small farmers sell the milk of single cows, and this, as shown above, may fluctuate enormously. The Board of Agriculture, in pursuance of the powers conferred upon it by the Food Act 1899, issued in 1901 "The Sale of Milk Regulations," which provide that where a sample of milk (not being milk sold as skimmed or separated or condensed milk) contains less than 3 % of milk-fat, or less than 8·5 % of non-fatty solids, it shall be presumed, until the contrary is proved, that the milk is not genuine. But even in these cases it is open to the vendor to show, if he can, that the deficiency was due to natural causes or to unavoidable circumstances. The courts have held that when deviations are the result of negligence or ignorance the vendor is nevertheless liable to punishment. Thus, when a vendor omits to stir up the contents of a pan so as to prevent the cream from rising to the top, he may be punished, if by such omission the milk becomes altered in composition so as no longer to comply with the regulations; or, when a farmer allows an undue interval between the milkings whereby the composition of the milk may be affected, he may be liable for the consequences. As the limits embodied in the milk regulations were necessarily fixed at figures lower than those which are usually afforded by genuine milk, and as it is a comparatively simple matter to ascertain the percentage of fatty and non-fatty solids, a strong tendency exists to bring down commercial milk to the low limits of the regulations without coming into collision with the law. The fat of milk is its most valuable and most important constituent. The exact determination of the percentage of fat is therefore the chief problem of the milk-analyst. All analyses made prior to the year 1885 are more or less inexact, because a complete separation of the fat from the other milk constituents had not been obtained. In that year M. A. Adams, by the simple and ingenious expedient of spreading a known volume of the milk to be analysed upon a strip of blotting-paper and extracting the paper, together with the dried milk, by a fat solvent, such as ether or benzene, succeeded in completely removing the fat from the other constituents. Since that time simpler and more rapid means have been based upon centrifugal separation of the fat. When a measured quantity of milk is mixed with strong sulphuric acid, which dissolves the casein and other nitrogenous constituents of the milk, but leaves the fat-globules quite untouched, the latter can easily be separated in a centrifugal, in the form of an oil the volume of which can be ascertained in a suitably constructed and graduated glass vessel, and thus the percentage ascertained very rapidly and accurately; such centrifugal contrivances constructed by H. Leffman, N. Gerber and others are now in general use in dairies, and cheese and butter factories. The amount of "total solids" contained in milk, that is to say, of all constituents other than water, is speedily ascertained by evaporating the water from a measured or weighed portion of milk and drying the residue obtained in a water-oven to constant weight. By subtracting from the percentage of total solids that of the fat the amount of "solids not fat" results, and by cautiously burning off the organic substances, the salts or mineral matters are left. When the percentage of "solids not fat" is less than 8·5 a simple proportion sum suffices to show what percentage of water must be present to reduce the "solids not fat" to the amount found. As the added water also reduces proportionately the percentage of mineral matter natural to normal milk (about 0·71 to 0·73%), the determination of the ash affords valuable assistance to the analyst. When the amount of ash is higher than normal, tests must be made for borax, soda or other mineral matters that are often added as preservatives or acid neutralizers. Borax is easily tested for by dissolving the milk ash in a drop or two of dilute hydrochloric acid, moistening a strip of yellow turmeric paper with the solution and drying it, when, in the presence of even very minute quantities of borax, the yellow colouring matter of the turmeric paper will be changed into a brilliant red-brown. Formaldehyde (which in 40% water solution forms the formalin of commerce) in milk affords a bright purple colour when the milk containing it is mixed with sulphuric acid containing a trace of an iron salt.

Condensed milk is milk that has been evaporated under reduced pressure with or without the addition of sugar. Generally one part of condensed milk corresponds to three parts of the original milk. There is no case on record of adulteration of unsweetened condensed milk, but sweetened milk has in the past been frequently prepared either from machine-skimmed or partly skimmed milk and sold as whole-milk. As sweetened condensed milk is largely used by the poorer part of the population for the feeding of infants, and as the fat of milk is, as stated before, its most valuable constituent, this class of fraud was a particularly mischievous one, and led to the inclusion in the Food Act of 1899 of a special proviso that every tin or other receptacle containing condensed, separated or skimmed milk must bear a conspicuous label showing the nature of the contents. As the bulk of condensed milk consumed in England is imported from abroad, the customs authorities now exercise a strict supervision over the imports, and object to the importation of such condensed milk as contains less than 9% of milk-fat. The average composition of sweetened condensed milk may be taken, with slight variations, to be: water 24·6%, fat 11·4%, casein and albumen 10%, milk-sugar 11·7%, cane-sugar 40·3%, mineral matters 2·0%.

Cream.—There are not any regulations nor official standards relating to this article, the value of which depends upon its contents in fat. Good stiff cream obtained by centrifugal skimming may contain as much as 60% of milk-fat, but generally dairymen's cream has only about 40%. On the other hand, milk that is abnormally rich in fat is in some places sold as cream. Attempts to compel dairymen to work up to any stated minimum of fat have failed, the English courts holding that cream is not an article that has any standard of quality, but varies with the character of the cows from which the milk is obtained and the food on which they are fed. Therefore, as regards the most important portion of cream, the amount of fat, adulteration does not exist unless there is a substitution for the milk-fat by an emulsified foreign fat, but cases of this description are exceedingly rare. On the other hand, such additions of foreign materials, like starch paste or gelatine, which have for object the giving of an appearance of richness to a naturally poor and dilute article, are not uncommon. While formerly the sale of cream was entirely in the hands of milkmen, there has been of late a tendency to regard cream as an article coming within the range of grocery goods. To enable this perishable article to be kept in a grocery store it has to receive an addition of preservative, as a rule boric preservative, in excessive amount. The purchaser may take it that all cream sold by others than milkmen, and much of that even, is thus preserved and should be shunned. The limit of boric preservative that might be permitted, but which is nearly always exceeded, is one-quarter of 1%.

Butter.—Of all articles of food butter has most fully received the attention of the sophisticator, because it is the most costly of the ordinary articles of diet, and because its composition is so intricate and variable that its analysis presents extraordinary difficulties and its nature exceptional and various opportunities for admixture with foreign substances. It is the intention of the producer of butter to separate the fatty portion of the milk as completely as is practicable from the other constituents of the milk without destroying the fat-globules. This can only be done by churning, by which operation the milk-globules are caused more or less to adhere to each other without losing their individual existence. Owing to this subdivision of the fat, and perhaps to the composition of the fat itself, butter is a more digestible fatty article of food than lard or oil. It is not possible by mechanical means to remove the whole of the water and curd of the milk from the butter; indeed "overworking" the butter with the object of removing the water as completely as possible ruins the structure to such an extent as to make the product unmerchantable. In well-made butter there are contained about 85% of pure milk-fat, from 12 to 13% of water, and 2 or 3% of curd and albumen, milk-sugar or its product of transformation—lactic acid,—and phosphates and other milk-salts. In some kinds of butter, Russian for instance, the percentage of water is rather less. Generally, by churning at a low temperature, a drier, at higher temperatures a wetter, butter is obtained. The curd must be got rid of as completely as practicable if the product is to have reasonable keeping properties. To prevent rapid decomposition salt in various quantities is added. Considering that 100 ℔ (10 gallons) of milk yield only from 3½ to 4 ℔ of properly made butter, it is obvious that a great inducement exists to increase the yield either by leaving an undue proportion of water or curd, or by adding an excessive quantity of salt. In some parts of Ireland the butter is worked up with warm brine into so-called pickle butter, whereby it becomes both watered and salted in one operation. Until lately, when the English Board of Agriculture fixed a limit of 16 for the percentage of water that may legitimately be present in butter, this kind of debasement could not easily be dealt with, but even now, where a legal water-limit exists, the addition of water either as such, or in the shape of milk or of condensed milk, is very commonly practised, more or less care being taken not to exceed the legalized limit. It is obvious that there is an ample margin of profit for the mixer who starts with Russian butter containing 10% of water and works it up with milk, fresh or condensed, to 16%, all the other milk-constituents, namely, sugar, curd and salt, thus introduced counting as "butter" in the eyes of the law. A very considerable number of butter-factors in London and in other parts of England thus dilute dry butter and consider this a legitimate operation so long as they keep within the legal water-limit. Nay, they may even exceed this, if only they give to their adulterated article a euphonious name, which, while legally notifying the admixture, raises in the mind of the ignorant purchaser the belief that he is purchasing something particularly choice and excellent. "Milk-blended butter," with as much as 24 or more per cent of water and as little as 68 % of fat, is still largely sold to purchasers who think that they are obtaining extra value for their money; several attempts to deal with the scandal by legislature having led to no result. The introduction of water into butter is also practised on a large scale in the United States, where a branch of trade in "renovated" butter has sprung up. In the States a considerable quantity of butter is produced by small farmers, and by the time the product comes into the market—the addition of chemical preservatives to prevent decomposition not being permitted—the butter has so much deteriorated in quality that it fetches a very low price. It is bought up by factors, the fat melted out and washed, then again worked up with water and salt, care being generally taken to leave about 16% of water in the product, which finds a ready sale in England. It may here be pointed out that England imports an enormous quantity of butter from the continent of Europe, the colonies, Siberia and America, the imports, less exports, averaging during 1903–1906 no less than 203,300 tons annually, and the total consumption (home produce plus imports) 366,441 tons, the consumption per head of population being 19·2 ℔ per annum. In butter, as in most other articles of food, adulteration with water is the most common, most profitable, and least risky form of fraud. Great fortunes are thus made out of water.

There is an altogether different class of butter adulteration which concerns itself with the substitution of other fatty matters for the whole or part of the really valuable portion of the butter-fat. Margarine is the legalized and therefore legitimate butter-surrogate, prepared by churning any suitable fat with milk into a cream, solidifying the latter by injection into cold water and working the lumps together, precisely as is done in the case of the churned cream of milk. The substitution of margarine for butter is frequent, in spite of all legal enactments directed against this fraud, the semblance between butter and margarine being so great that a trained palate is necessary to distinguish the two articles. Much more frequent and much more difficult to deal with is the sale of mixtures of butter and of margarine. In order to show the difficulties inherent to this subject, it will be necessary to consider the chemical nature of butter-fat, and to compare it with other fats that may enter into the composition of margarine. Butter-fat is butter freed from water, curd and salt and extraneous matter. Like the greater number of natural fats it consists of a mixture of triglycerides, that is, combinations of glycerin with substances of the nature of acids. These acids, in the case of fats other than butter-fat, are mainly oleic, palmitic and stearic acids. Butter-fat, in addition to these, contains other acids which sharply distinguish it from the vast majority of other fats and, with the exception of cocoa-nut oil, from those substances which are or may be used to mix with butter, by the circumstance that a considerable proportion of its acids, when separated by chemical means from the glycerin, are readily soluble in water, or may be easily volatilized either alone or in a current of steam, whereas the acids separated from the foreign fats are practically both insoluble and non-volatile. This fundamental principle serves at once to distinguish, for example, between butter and margarine, and has been made use of by analysts not only for this purpose but also with a view to determine the relative amounts of butter and margarine in a mixture of these substances. Thus butter-fat contains about 88%, more or less, of "insoluble fatty acids," while margarine contains about 95.5%; 5 grammes of butter-fat when chemically decomposed yield an amount of volatile fatty acids which requires about 26 cubic centimetres (more or less) of deci-normal alkali solution for neutralization, while margarine requires mostly less than 1 cubic centimetre (Wollny or Reichert-Meissl method). There are other differences between the two kinds of fat: the specific gravity of butter-fat is higher than that of most other fats; its power of refracting a ray of light is less; the "iodine absorption" of butter-fat is smaller than that of many other fatty matters, and so on. But the composition of perfectly genuine butter-fat varies within somewhat wide limits. The milk from a cow fed on good and ample food in warm weather yields a fat that is rich in characteristic butter-constituents, while a poorly fed animal, kept in the open till late in the autumn, when the nights are cold, gives milk exceptionally poor in fat, the differences expressed as "insoluble fatty acids" lying between 86 and 91%, and in volatile acids, expressed as "Wollny" numbers, between 18 and 36. Generally, therefore, summer butter is rich and autumn butter poor in volatile acids, or, geographically, Australian butter is more frequently high, Siberian often exceedingly low in these acids. The food of the animal also may, under certain conditions, yield a notable proportion of its fatty matter to the butter; cows that have, for instance, been fed upon large quantities of cotton-seed cake yield butter in which the cotton-seed oil may be traced, and the same holds good with other fatty foods. All these, and other circumstances, combine to render the detection of small quantities of foreign fats that have been fraudulently added to butter almost a matter of impossibility. This is perfectly well known to unscrupulous butter dealers, and an enormous amount of adulteration is known to be practised. Even small amounts of adulteration could, nevertheless, often be discovered while margarine manufacturers employed considerable proportions of vegetable oils in their products, some of these oils furnishing characteristic chemical reactions allowing of their discovery. Here some firms of margarine manufacturers came to the aid of the butter-mixer and produced margarine containing nothing but animal fat, so-called "neutral" margarine being freely offered for fraudulent purposes. There is one fat besides butter which contains "volatile fatty acids," namely, cocoa-nut oil. Since means have been found to deprive this fat of its strong cocoa-nut odour and taste, it has largely been used in the adulteration of butter, and margarine containing cocoa-nut oil and other fatty substances has freely been manufactured and sold specially for butter adulteration. The seat of this class of fraud is mainly in Holland. Analysts happily found means to detect this oil when present above 10%, and numerous prosecutions made mixers more careful. Abundant evidence, however, exists showing that the simultaneous addition of water or milk so as to keep the water limit below 16% and that of margarine entirely composed of animal fats below 10% leaves a large margin of profit with a very small chance of detection. For the moment at least analysis has had the worst of it in the battle between honesty and "business methods."

Margarine itself is a legitimate article of commerce (when sold with due notice to the purchaser), but is frequently adulterated. As regards the fats used in its manufacture there does not exist any legal restriction, and as long as the fat is in a state fit for human consumption the manufacturer can make whatever mixture he pleases. In general there is no reason to think that any bad or disgusting fats are finding their way into the factories, which in most countries are under proper supervision; the old stories about recovered grease from all sorts of offal are quite without foundation. But a considerable percentage of solid paraffin has been met with as an admixture of the fatty part of margarine. As the fatty portion of the article is the only one of value, some manufacturers make great efforts to produce margarine with as small a percentage of fatty matter as possible, either by incorporating excessive amounts of water or of milk—margarines with over 30% of water being met with—or by introducing sugar, glucose, starch, gelatinous matter, in fact anything that is cheaper than fat. The English law imposes a limitation upon the percentage of butter-fat that may be contained in margarine, but at present at least the tendency of manufacturers is all for having as little butter or other valuable fat in margarine as is practicable, and not to err on the other side. For the purpose of facilitating the discovery of margarine when it has been fraudulently added to butter, some countries (Germany, Belgium, Sweden) insist upon the use of from 5 to 10% of sesame oil (from the seed of *Sesamum orientale* or *S. indicum*, belonging to the family of Bignoniaceae) in the manufacture of such margarine as is to be consumed within the countries in question. This oil yields a characteristic red colour when it, or any mixture containing it, is shaken with an hydrochloric solution of either sugar or furfurol, and is intended to serve as an "ear-marking" substance. The addition of a little starch or arrowroot, easily discoverable chemically or by the microscope, is also required by Belgium, but in the absence of any international agreement these ear-marking additions are of little practical use. It is, however, interesting to point out that, while complying with the regulations of the governments, margarine manufacturers of the countries named have found an easy way of rendering the regulations quite nugatory: they add methyl-orange, a colouring matter which itself produces a red colour with acid and quite obscures the red colour obtained by the official test for sesame oil.

Cheese may be legitimately made from full-milk, milk that has been enriched by addition of cream, or from milk that has been more or less skimmed. It varies consequently very widely in composition, so-called cream cheese containing not less than 60% of fat; Stilton upwards of 40%; Cheddar about 30%; Dutch, Parmesan and some Swiss and Danish less than 20%. The amount of water varies with the kind and age of the cheese and may be as low as 20 and as high as 60%. Under these circumstances it is impracticable to lay down any hard-and-fast rules as to the composition of cheese. When, however, cheese is made from skimmed milk and the fat is replaced by margarine, as is the case in so-called "filled" or margarine cheeses, the sale of these amounts to an adulteration, unless the presence of the foreign substance is declared. It may at first sight appear strange that the person who robs milk of its most valuable portion, the cream, may prepare a legitimate article of food from the remainder, while he who to that remainder adds something to replace the fat does an illegitimate act, but it must be taken into consideration that the replacement is frequently made with fraudulent intent and that the ordinary purchaser cannot by taste or smell distinguish the adulterated from the genuine article, while there is no difficulty in recognizing skim-milk cheese.

Lard.—Between the years 1880 and 1890 a gigantic fraudulent trade in adulterated lard was carried on from the United States. A great proportion of the American lard imported into England was found to consist of a mixture of more or less real lard with cotton-seed oil and beef-stearine. Cotton-seed oil is one of the cheapest vegetable oils fit for human consumption, beef-stearine the hard residue obtained in the manufacture of oleo-margarine after the more fluid fat has been pressed from the beef fat. These mixtures were made so skilfully by large Chicago manufacturers that for some years they escaped detection. A bill introduced in 1888 into the American Senate to stop this imposture directed general attention to the subject, and energetic measures, taken both in America and in England, quickly put an end to it. From the memorial presented in the United States Senate in support of the bill, it appeared that in about 1887 the annual production of lard in the States was estimated at 600 million pounds, of which more than 35% was adulterated. Compounds were made containing only a small quantity of lard or none at all, yet were sold as "choice refined lard" or under other eulogistic names. Many lard substitutes, chiefly made from cotton-seed oil, are still met with, but are mostly sold in a legitimate manner. From the germ of maize—which must be separated from the starchy portion of the seed before the latter can be manufactured into glucose—the oil (maize-oil) is expressed, and this now is used as a lard adulterant, its detection being far more difficult than that of cotton-seed oil.

Oils.—For very many years all oils were considered to be composed of olein, that is to say, the triglyceride of oleic acid, with small quantities of impurities; chemists, therefore, to distinguish oils of various origin, confined themselves to tests for these impurities, employing so-called colour reactions based upon the change of colour of the oil by various reagents such as sulphuric, nitric or phosphoric acids. These reactions were exceedingly indefinite and unsatisfactory and oil adulteration was prevalent and almost undiscoverable. It has been found, however, that the old ideas concerning the believed uniformity in the nature and constitution of oils were erroneous. Some oils, indeed, do consist of olein, almond oil being a type, others contain a glyceride of an acid which is distinguished from oleic acid by containing one molecule less hydrogen, called linoleic acid. To this class belong cotton-seed and sesame oils. Others again include a glyceride of an acid containing still less hydrogen, linolenic acid (linseed and similar drying oils), and lastly the liver oils are still poorer in hydrogen. These various acids or the oils contained in them combine with various percentages of iodine, oleic acid absorbing the smallest proportion (about 80%). For each oil the iodine absorption is a fairly constant quantity; this number, together with the determination of the amount of caustic alkali needed for complete saponification, the thermal rise with strong sulphuric acid or with bromine, the refraction of light and the specific gravity, now enable the analyst to form a fair idea of the nature of any sample under examination, and, in consequence of this advance in knowledge, adulteration of oils has much declined. The most common adulterant of the more valuable oils, like olive oil, is cotton-seed oil. The oils expressed from the sesame seed or the earth-nut (arachis oil) are also frequently admixed with olive oil. Almond oil is adulterated with the closely allied oils from the peach-kernel or the pine-seed. Deodorized paraffin hydrocarbons also enter sometimes as adulterants into edible oils. There is, however, a marked improvement in the purity of oils generally.

Flour and *bread* as sold in England are almost invariably genuine. The old forms of adulteration, such as the use of alum for the production of a white but indigestible loaf from bad flour, have disappeared. The only admixture which has been met with during recent years is maize-meal in American produce. This is of inferior food value to wheat-meal.

Sugar in its various forms can hardly be said to be subject to adulteration by the addition of inferior substitutes. One single case of such substitution analogous to the proverbial but probably mythical sanding of sugar occurred between 1880 and 1905 in England, some crushed marble having been found in a consignment of German sugar in a large British establishment. There have, however, been numerous prosecutions for a fraud of another class, namely, the substitution of dyed beetroot sugar for Demerara sugar. Formerly the sugar produced by the old imperfect and wasteful methods of manufacture was more or less yellow or brown from adhering molasses. Sugar, as now obtained, be it from cane or beet, is white; yet the public is so wedded to its customs that white sugar except as lump or castor sugar does not find a ready sale. The manufacturer is obliged to colour his product yellow by artificial means, that is to say, either by the addition of a little aniline dye, harmless in itself, or, as in the West Indies, mostly by the use of a small quantity of chloride of tin, so-called "bloomer." European refined beet-sugar coloured with aniline dye to distinguish it from Demerara cane sugar is sold under the name of "yellow crystals." These, although richer in real sugar than Demerara, are without the delicious aroma of cane syrup which belongs to the latter, and are not infrequently fraudulently substituted for Demerara.

Marmalade and Jams.—In the preparation of marmalade and jams, which articles were for a long time made from fruit and sugar only, a part of the sugar, from 10 to 15 %, is often now replaced by starch glucose. This material, consisting mainly of a mixture of dextrose and dextrin, is of much less sweetening power than ordinary sugar and mostly cheaper. It is said to prevent the crystallization which frequently used to occur in some jams. The use of glucose has been declared by the High Court (*Smith* v. *Wisden*, 1901) to be legitimate, the court holding that as there was no recognized standard for the composition of marmalade the addition of saccharine material not injurious to health could not constitute an offence. Artificial colouring matters and chemical preservatives are almost constant ingredients of jams. To such fruits which, when boiled with sugar, do not readily yield a jelly (strawberries, raspberries) an addition of apple juice is frequently made in the manufacture of jam, without much objection; the pulp of the apple, however, is sometimes bodily added as an adulterant.

Tea.—In consequence of the proviso contained in the Food Act of 1875 that tea was to be examined by the Customs on importation, such tea as was found to be admixed with other substance or exhausted tea being refused entry into England, the adulteration of tea has been virtually suppressed. Great numbers of samples are annually examined by the Customs, and a not inconsiderable proportion of these are condemned because they are either damaged or dirty, their use for the manufacture of theine being permitted, only sound and genuine tea coming to the British public. The practice, very common a generation ago, of artificially colouring tea green with a mixture of Prussian blue and turmeric, has quite vanished with the decline of the consumption of green tea.

Coffee.—A few cases of artificially manufactured coffee berries, made from flour and chicory, have been observed, but it would not be fair to speak of a practice of adulteration regarding coffee berries. Not infrequently coffee is roasted with the addition of some fatty matter or paraffin or sugar, to give to the roasted coffee a glossy appearance. These additions as a rule are small in amount. Ground coffee is often sold adulterated with chicory, sugar or caramel. Other adulterations, reference to which is found in literature relating to the second half of the 19th century, do not seem now to occur.

Cocoa and *chocolate* are liable to a number of fraudulent or questionable additions. In the cheaper qualities of cocoa-powder sugar and starch—the latter in the form of sago flour or arrowroot—are admixed in very large proportions, and, in order to give to such mixtures something like the appearance of genuine cocoa, red oxide of iron is added. This almost invariably is more or less arsenical. Cocoa-shell, a perfectly valueless material, is mixed in a very finely ground state with cocoa of the commoner kind. Owing to the enormous increase in the consumption of so-called chocolate-creams, which are masses of sugar confectionery coated with a cocoa-paste containing a large proportion of the fat of cocoa (cocoa-butter), the quantity of cocoa-butter that is obtained in the manufacture of cocoa-powders is no longer sufficient to cover the demand. Substitutes of cocoa-butter prepared from cocoa-nut oil are manufactured on a large scale, and all enter without acknowledgment into chocolates or chocolate creams. As there are not any regulations touching the composition of chocolate, sugar or starch or both are used in chocolate manufacture, and especially in that of chocolate powders in often excessive quantities. In the Dutch mode of manufacture of cocoa-powders an addition of from 3% to 4% of an alkaline salt is made for the purpose of rendering the cocoa "soluble," or, more strictly, for putting it into such a physical condition that it does not settle in the cup. This addition does not, as is often alleged, render the cocoa alkaline, and is not made with any fraudulent object; several countries, however, have passed regulations fixing the maximum of the addition which may thus legitimately be made. Most of the cocoa-powders sold in England are prepared in accordance with the Dutch method.

Wine.—If under this term a beverage is understood which consists of nothing but fermented grape juice, a great proportion of the wine consumed in England is not genuine wine. All port and sherry comes into commerce after having received an addition of spirit, generally made from potatoes; port and sherry would not be what they are and as they have been for generations unless they were thus fortified. The practice can now hardly be classed among adulterations. A well-fermented wine made from the juice of properly matured grapes does not require any added alcohol in order that it should keep; imperfectly made wine is liable to turn sour; the addition of alcohol prevents this. French wines, both red and white, are hardly subject to adulteration. In wine-growing countries like France wine is so cheap and plentiful that it would be difficult to manufacture an imitation beverage cheaper than genuine wine. In Germany the conditions are different, the districts from which those wines that are exported are nominally derived being small and insufficient to cover the world's demands. The addition of sugar solution or of starch sugar is allowed within limits by German law, which not even requires that notification to the purchaser be made of the addition, and it is notorious that a very large proportion of the wine sold under the name of "hock" and some of that coming from the Moselle are thus diluted, sugared and lengthened, or, in plain terms, adulterated. Wines from the Palatinate which under their own names would not sell out of Germany are often passed off as hocks. As there is but little German red wine the law also permits this to be lengthened by the addition of white wine. For the removal of part of the acid from sour wine produced in bad vintages the addition of precipitated chalk is also permitted. Attention has been drawn in England to the very serious fact that German wines sometimes contain salts of zinc in small quantities. These are introduced by a fining agent protected by a German patent, consisting of solutions of sulphate of zinc and potassium ferrocyanide, which, when added together in "suitable proportions," produce a precipitate of zinc-ferrocyanide which carries down all turbidity in the wine and is supposed to leave neither zinc nor ferrocyanide behind in solution. As a matter of fact, one or other of these highly objectionable substances is almost invariably left behind. The use of artificial colouring matters in wines does not appear now to occur.

Beer cannot be said to be adulterated, although it is well known that materials often very different from those which the general public believe to be the proper raw materials for the manufacture of beer, namely, water, malt and hops, are largely used. By the Customs and Inland Revenue Act 1885, sec. 4, beer is defined as any liquor "which is made or sold as a description of beer, or as a substitute for beer, and which on analysis of a sample thereof shall be found to contain more than 2% of proof spirit." That is to say, beer is legally anything that is sold as beer provided that it has 2% of proof spirit. There is not any restriction upon the materials that are employed provided that they are not positively poisonous. For Inland Revenue purposes, however, a prohibition has been made against the admixture of anything to beer after it has been manufactured, and excise prosecutions of publicans for watering beer are not infrequent. Formerly there was a restriction on the amount of salt that might be present in beer; this no longer exists. On the other hand it cannot be said that any injurious materials are being used by brewers, the brewing industry being, broadly speaking, most efficiently supervised and controlled by scientifically trained men. The addition to beer of bisulphate of lime, which is almost universally practised in England, is not an adulteration in the ordinary acceptation of the term. The thin beer which has taken the place of the strong ales of the past generation contains an insufficiency of alcohol to ensure keeping qualities, and it is difficult to see how modern English beers could be sold without the addition of some sort of preservative.

Non-Alcoholic Drinks.—The same remark applies to a good many of so-called temperance beverages. Of these again it is hardly proper to speak as liable to adulteration. So-called soda-water is very often devoid of soda and is only carbonated water, but the term "soda-water" is a survival from the times when this was a medicinal beverage and when soda was prescribed to be present in definite amount by the pharmacopoeia. Potash and especially lithia waters very frequently contain only mere traces of the substances from which they derive their names. The sweetness of ginger-beer and often of lemonade is no longer due to sugar, as used to be the case, but to saccharine (the toluol derivative), which is possessed of sweetness but not of nourishment; and since, as an antiseptic, it may affect the digestion, its use in these beverages is to be deprecated.

Vinegar ought to be the product obtained by the successive alcoholic and acetous fermentation of a sugary liquor. When this is obtained from malt or from malt admixed with other grain the vinegar is called a malt vinegar. Often, however, acid liquors pass under that name which have been made by the action of a mineral acid upon any starchy material such as maize or tapioca, with or without the addition of beet sugar. Dilute acetic acid, obtained from wood, is very frequently used as an adulterant of vinegar. When properly purified such acid is unobjectionable physiologically, but it is improper to sell it as vinegar. Adulteration of vinegar by sulphuric or other acids, formerly a common practice, is now exceedingly rare.

Spirits.—By the Sale of Food and Drugs Act Amendment Act, whisky, brandy and rum must not be sold of a less alcoholic strength than 25 under proof (corresponding to 43% of alcohol by volume), and gin 35 under proof (37% alcohol). For many years the only form of adulteration recorded by public analysts related to the alcoholic strength, the undue dilution of spirits with water being, of course, a profitable form of fraud. No addition of any injurious matters to commercial spirits has been observed. It was, however, well known that a very considerable proportion of so-called brandies was not the product of the grape, but that spirits of other origin were frequently admixed with grape brandy. A report which appeared in 1902 in the *Lancet* on "Brandy, its production at Cognac and the supply of genuine brandy to this country," served as a stimulus to public analysts to analyse commercial brandies, and convictions of retailers for selling so-called brandy followed. It was shown that genuine brandy made in the orthodox style from wine in pot-stills contained a considerable proportion of substances other than alcohol to which the flavour and character of brandy is due; among these flavouring materials combinations of a variety of organic acids with alcohols (chemically described as "esters") predominate. For the present a brandy is not considered genuine unless it contains in 100,000 parts (calculated free from water) at least 60 parts of "esters." As a consequence a trade has sprung up in artificially produced esters, sold for the purpose of adding them to any spirit to fraudulently convert it into a liquor passing as "brandy." The inquiries into the nature of brandy led to investigations into whisky. Formerly whisky was made from grain only and obtained by pot-still distillation, that form of "still" yielding a product containing a comparatively large proportion of volatile matters other than alcohol. For many years past, however, improved stills—so-called patent stills—have been adopted, enabling manufacturers to obtain a purer and far stronger product, saving carriage and storage. Attempts were made in England in 1905–1907 to restrict the term "whisky" solely to the pot-still product. But the question was referred in 1908 to a Royal Commission which reported against such a restriction. A common form of adulteration of whisky is the addition to it of spirit made on the Continent mainly from potatoes. This spirit is almost pure alcohol and is quite devoid of the injurious properties which are popularly but falsely attributed to it. The substitution of this—a very cheap and quite flavourless material—for one which owes its value more to its flavour than to its alcoholic contents, is clearly fraudulent.

Drugs.—To the adulteration of drugs but very brief reference can here be made. It is satisfactory to record that but very few of the great number of drugs included in the pharmacopoeias are liable to serious adulteration, and there are very few cases on record during recent years where real fraudulent adulteration was involved. The numerous preparations used by druggists are mostly prepared in factories under competent and careful supervision, and the standards laid down in the British Pharmacopoeia are, broadly speaking, carefully adhered to. The occurrence of unlooked-for impurities, such as that of arsenic in sodium-phosphate or in various iron preparations, can hardly be included in the list of adulterations. In the making up of prescriptions, however, a good deal of laxity is displayed; thus, the Local Government Board report of the years 1904–1905 refers to an instance of a quinine mixture containing 23 grains of quinine-sulphate instead of 240 grains. A certain latitude in the making up of physicians' prescriptions must necessarily be allowed, but much too frequently the reasonable limit of a 10% error over or under the amount of drug prescribed is exceeded. Certain perishable drugs, such as sweet spirits of nitre, or others liable to contain from their mode of manufacture metallic impurities, form the subjects of frequent prosecutions. The element of intentional fraud which characterizes many forms of food adulteration is happily generally absent in the case of drugs. (O. H.*)

ADULTERY (from Lat. *adulterium*), the sexual intercourse of a married person with another than the offender's husband or wife. Among the Greeks, and in the earlier period of Roman law, it was not adultery unless a married woman was the offender. The foundation of the later Roman law with regard to adultery was the *lex Julia de adulteriis coercendis* passed by Augustus about 17 B.C. (See *Dig.* 48. 5; Paull. *Rec. Sent.* ii. 26; Brisson, *Ad Leg. Jul. de Adult.*) In Great Britain it was reckoned a spiritual offence, that is, cognizable by the spiritual courts only. The common law took no further notice of it than to allow the party aggrieved an action of damages. In England, however, the action for "criminal conversation," as it was called, was nominally abolished by the Matrimonial Causes Act 1857; but by the 33rd section of the same act, the husband may claim damages from one who has committed adultery with his wife in a petition for dissolution of the marriage, or for judicial separation. In Ireland the action for criminal conversation is still retained. In Scotland damages may be recovered against an adulterer in an ordinary action of damages in the civil court, and the latter may be found liable for the expenses of an action of divorce if joined with the guilty spouse as a co-defender.

Adultery on the part of the wife is, by the law of England, a ground for divorce, but on the part of the husband must be either incestuous or bigamous, or coupled with cruelty or desertion for two or more years. In the United States adultery is everywhere ground of divorce, and there is commonly no prohibition against marrying the paramour or other re-marriage by the guilty party. Even if there be such a prohibition, it would be unavailing out of the state in which the divorce was granted; marriage being a contract which, if valid where executed, is generally treated as valid everywhere. Adultery gives a cause of action for damages to the wronged husband. It is in some states a criminal offence on the part of each party to the act, for which imprisonment in the penitentiary or state prison for a term of years may be awarded.

In England, a *complete* divorce or dissolution of the marriage could, until the creation of the Court of Probate and Divorce, be obtained only by an act of parliament. This procedure is still pursued in the case of Irish divorces. In Scotland a complete divorce may be effected by proceedings in the Court of Session, as succeeding to the old ecclesiastical jurisdiction of the commissioners. A person divorced for adultery is, by the law of Scotland, prohibited from intermarrying with the paramour. In France, Germany, Austria and other countries in Europe, as well as in some of the states of the United States, adultery is a criminal offence, punishable by imprisonment or fine. (See DIVORCE.)

AD VALOREM (Lat. for "according to value"), the term given in commerce to a duty which is levied by customs authorities on goods or commodities in proportion to their value. An ad valorem duty is the opposite of a specific duty, which is chargeable on the measure or weight of goods. The United States is the one important country which has adopted in its tariff an extensive system of ad valorem duties, though it has not altogether disregarded specific duties; in some cases, indeed, the two are combined. Ad valorem duties, in the United States, are levied according to the saleable value of the goods in the country of their origin, and it is usual to require at the port of entry the production of an invoice with full particulars as to the place where, time when, and person from whom the goods were purchased, and the actual cost of the goods and the charges on them. Such an invoice is countersigned by the consul of the country for which the goods are intended. On arrival at the port of consignment the invoice is sworn to by the importer. The goods are then valued by an appraiser, and if the valuation of the appraiser exceeds that which appears on the invoice, double duty is levied, subject to appeal to a general appraiser and to boards of general appraisers.

It has been argued that, theoretically, an ad valorem duty is preferable to a specific duty, inasmuch as it falls in proper proportion alike on the high-priced and low-priced grades of a commodity, and, no matter how the value of any article fluctuates, the rate of taxation automatically adjusts itself to the new value. In practice, however, ad valorem duties lead to great inequalities, and are very difficult to levy; while the relative value of two commodities may remain apparently unchanged under an ad valorem duty, yet owing to the difference in the cost of production, or through the different proportions of fixed and circulating capital employed in their manufacture, an ad valorem tax will be felt much more severely by one commodity than by another. Again, there is always a difficulty in obtaining a true valuation on the exported goods, for values from their very nature are variable; while specific duties remain steady, and the buyer can always ascertain exactly what he will have to pay. The opening to fraud is also very great, for where, as in the United States, the object of the duty is to keep out foreign goods, every valuation at the port of shipment will be looked upon with the utmost suspicion, while it will always be a temptation to the foreign seller to undervalue, a temptation in many cases encouraged by the importer, for it lessens his tax, while the seller's market is increased. The staff of appraisers which must necessarily be kept at each port of entry considerably raises the expense, to say nothing of the annoyance and delay caused both to importers and foreign shippers.

The term "ad valorem" is used also of stamp duties. By the Stamp Act 1891 certain classes of instruments, *e.g.* awards, bills of exchange, conveyances or transfers, leases, &c., must be stamped in England with the proper ad valorem duty, that is, the duty chargeable according to the value of the subject matter of the particular instruments or writings. (See STAMP DUTIES.)

ADVANCEMENT, a term technically used in English law for a sum of money or other benefit, given by a father during his lifetime to his child, which must be brought into account by the child on a distribution of the father's estate upon an intestacy on pain of his being excluded from participating in such distribution. The principle is of ancient origin; as regards goods and chattels it was part of the ancient customs of London and the province of York, and as regards land descending in coparcenary it has always been part of the common law of England under the name of *hotch-pot* (*q.v.*). The general rule was established by the Statutes of Distribution. The conditions under which cases of advancement arise are as follows: There must be a complete intestacy; the intestate estate must be that of the father; and the advancement must have been made in the lifetime of the father. Land which belongs or would belong to a child as heir at law or customary heir need not be brought in to the common fund, even though such land was given during the father's life. The widow can gain no advantage from any advancement. No child can be forced to account for his or her advancement, but in default thereof he will be excluded from a share in the intestate's estate. As to what is an advancement there has been much conflict of judicial opinion. According to one view, nothing is an advancement unless it be given "on marriage or to establish the child in life." The other and probably the correct view is that any considerable sum of money paid to a child at that child's request is an advancement; thus payment of a son's debts of honour has been held to be an advancement. On the other hand, trivial gifts and presents to a child are undoubtedly not advancements.

ADVANTAGE, that which gives gain or helps forward in any way. The Fr. *avant* (before) shows the origin and meaning of this word, the *d* having subsequently crept in and corrupted the spelling. It is often contracted to "vantage." In some games (*e.g.* lawn tennis) the term "vantage" is used technically in scoring ("deuce" and "vantage"; "vantage sets"). A position which gives a better chance of success than its surroundings is called a "vantage ground." In an unfavourable sense the word "advantage" is used to express a mean use made of some favourable condition (*e.g.* to take advantage of another man's misfortunes).

ADVENT (Lat. *Adventus*, sc. *Redemptoris*, "the coming of the Saviour"), a holy season of the Christian church, the period of preparation for the celebration of the nativity or Christmas. In the Eastern church it lasts from St Martin's Day (11th of November), and in other churches from the Sunday nearest to St Andrew's Day (30th of November) till Christmas. It is uncertain at what date the season began to be observed. A canon of a council at Saragossa in 380, forbidding the faithful to be absent from church during the three weeks from the 17th of December to the Epiphany, is thought to be an early reference to Advent. The first authoritative mention of it is in the Synod of Lerida (524), and since the 6th century it has been recognized as the beginning of the ecclesiastical year. With the view of directing the thoughts of Christians to the first coming of Christ as Saviour, and to his second coming as Judge, special lessons are prescribed for the four Sundays in Advent. From the 6th century the season was kept as a period of fasting as strict as that of Lent; but in the Anglican and Lutheran churches the rule is now relaxed. In the Roman Catholic church Advent is still kept as a season of penitence. Dancing and festivities are forbidden, fasting enjoined and purple vestments are worn in the church services.

In many countries Advent was long marked by diverse popular observances, some of which even still survive. Thus in England, especially the northern counties, there was a custom (now extinct) for poor women to carry round the "Advent images," two dolls dressed one to represent Christ and the other the Virgin Mary. A halfpenny was expected from every one to whom these were exhibited, and bad luck was thought to menace the household not visited by the doll-bearers before Christmas Eve at the latest.

In Normandy the farmers still employ children under twelve to run through the fields and orchards armed with torches, setting fire to bundles of straw, and thus it is believed driving out such vermin as are likely to damage the crops. In Italy among other Advent celebrations is the entry into Rome in the last days of Advent of the Calabrian pifferari or bagpipe players, who play before the shrines of the Holy Mother. The Italian tradition is that the shepherds played on these pipes when they came to the manger at Bethlehem to do homage to the Saviour.

ADVENTISTS, SECOND, members of religious bodies whose distinctive feature is a belief in the imminent physical return of Jesus Christ. The first to bear the name were the followers of William Miller, and adherents have always been more numerous in America than in Europe. There is a body of Seventh Day Adventists who observe the old Sabbath (Saturday) rather than the Christian Sunday. They counsel abstemious habits, but set no time for the coming of Christ, and so are spared the perpetual disappointments that overtake the ordinary adventist. They have some 400 ministers and 60,000 members.

ADVENTITIOUS (from Lat. *adventicius*, coming from abroad), a quality from outside, in no sense part of the substance or circumstance: a man's clothes, or condition of life, his wealth or his poverty, are called by Carlyle "adventitious wrappages," as being extrinsic, superadded and not a natural part of him. In botany the word means that which is not normal to the plant, which appears irregularly and accidentally, *e.g.* buds or roots out of place, or strange spots and streaks not native to the flower.

ADVENTURE (from Lat. *res adventura*, a thing about to happen), chance, and especially chance of danger; so a hazardous enterprise or remarkable incident. Thus an "adventurer," from meaning one who takes part in some speculative course of action, came to mean one who lived by his wits and a person of no character. The word is also used in certain restricted legal connexions. *Joint adventure*, for instance, may be distinguished from partnership (*q.v.*). A *bill of adventure* in maritime law (now apparently obsolete) is a writing signed by the shipmaster declaring that goods shipped in his name really belong to another, to whom he is responsible. The *bill of gross adventure* in French maritime law is an instrument making a loan on maritime security.

ADVERTISEMENT, or ADVERTISING (Fr. *avertissement*, warning, or notice), the process of obtaining and particularly of purchasing publicity. The business of advertising is of very recent origin if it be regarded as a serious adjunct to other phases of commercial activity. In some rudimentary form the seller's appeal to the buyer must, however, have accompanied the earliest development of trade. Under conditions of primitive barter, communities were so small that every producer was in immediate personal contact with every consumer. As the primeval man's wolfish antipathy to the stranger of another pack gradually diminished, and as intercourse spread the infection of larger desires, the trapper could no longer satisfy his more complicated wants by the mere exchange of his pelts for his lowland neighbour's corn and oil. A began to accept from B the commodity which he could in turn deliver to C, while C in exchange for B's product gave to A what D had produced and bartered to C. The mere statement of such a transaction sufficiently presents its clumsiness, and the use of primitive forms of coin soon simplified the original process of bare barter. It is reasonable to suppose that as soon as the introduction of currency marked the abandonment of direct relations between purchaser and consumer an informal system of advertisement in turn rose to meet the need of publicity. At first the offer of the producer must have been brought to the trader's attention, and the trader's offer to the notice of the consumer, by casual personal contact, supplemented by local rumour. The gradual growth of markets and their development into periodical fairs, to which merchants from distant places resorted, afforded, until printing was invented, the only means of extended advertisement. In England, during the 3rd century, Stourbridge Fair attracted traders from abroad as well as from all parts of England, and it may be conjectured that the crying of wares before the booths on the banks of the Stour was the first form of advertisement which had any marked effect upon English commerce. As the fairs of the middle ages, with the tedious and hazardous journeys they involved, gradually gave place to a more convenient system of trade, the 15th century brought the invention of printing, and led the way to the modern development of advertising. The Americans, to whom the elaboration of newspaper advertising is primarily due, had but just founded the first English-speaking community in the western hemisphere when the first newspaper was published in England. But although the first periodical publication containing news appeared in the month of May 1622, the first newspaper advertisement does not seem to have been published until April 1647. It formed a part of No. 13 of *Perfect Occurrences of Every Daie journall in Parliament, and other Moderate Intelligence*, and it read as follows:—

> A Book applauded by the Clergy of *England*, called *The Divine Right of Church Government*, Collected by sundry eminent Ministers in the Citie of *London*; Corrected and augmented in many places, with a briefe Reply to certain *Queries* against the Ministery of *England*; Is printed and published for *Joseph Hunscot* and *George Calvert*, and are to be sold at the Stationers' Hall, and at the Golden Fleece in the Old Change.

Among the *Mercuries*, as the weekly newspapers of the day were called, was the *Mercurius Elencticus*, and in its 45th number, published on the 4th of October 1648, there appeared the following advertisement:—

> The Reader is desired to peruse a Sermon,
> Entituled *A Looking-Glasse for Levellers*,
> Preached at St. Peters, Paules Wharf, on Sunday, Sept. 24th 1648,
> by Paul Knell, Mr. of Arts. Another Tract called *A Reflex upon our Reformers, with a prayer for the Parliament.*

In an issue of the *Mercurius Politicus*, published by Marchmont Nedham, who is described as "perhaps both the ablest and the readiest man that had yet tried his hand at a newspaper," there appeared in January 1652 an advertisement, which has often been erroneously cited as the first among newspaper advertisements. It read as follows:—

> Irenodia Gratulatoria, a heroic poem, being a congratulatory panegyrick for my Lord General's return, summing up his successes in an exquisite manner. To be sold by John Holden, in the New Exchange, London, Printed by Thomas Newcourt, 1652.

The article "On the Advertising System," published in the *Edinburgh Review* for February 1843, contains the fullest account of early English advertising that has ever been given, and it has been very freely drawn upon by all writers who have since discussed the subject. But it describes this advertisement in the *Mercurius Politicus* as "the very first," and the discovery of the two earlier instances above quoted was due to the researches of a contributor to *Notes and Queries*.

In *The Crosby Records*, the commonplace-books of William Blundell, there is an interesting comment, dated 1659, on the lack of advertising facilities at that period—

> It would be very expedient if each parish or village might have some place, as the church or smithy, wherein to publish (by papers posted up) the wants either of the buyer or the seller, as such a field to be let, such a servant, or such a service, to be had, &c. There was a book published in London weekly about the year 1657 which was called (as I remember) *The Publick Advice.* It gave information in very many of these particulars.

A year later the same diarist says—

> There is an office near the Old Exchange in London called the office of Publick Advice. From thence both printed and private information of this useful nature are always to be had. But what they print is no more than a leaf or less in a diurnal. I was in this office. The diurnal consisted of sixteen pages quarto in 1689.

In No. 62 of the *London Gazette*, published in June 1666, the first advertisement supplement was announced—

> An Advertisement—Being daily prest to the Publication of Books, Medicines, and other things not properly the business of a Paper of Intelligence, This is to notifie, once for all, that we will not charge the *Gazette* with Advertisements, unless they be matter of State: but that a Paper of Advertisements will be forthwith printed apart, & recommended to the Publick by another hand.

In No. 94 of the same journal, published in October 1666, there appeared a suggestion that sufferers from the Great Fire should avail themselves of this means of publicity—

> Such as have settled in new habitations since the late Fire, and desire for the convenience of their correspondence to publish the place of their present abode, or to give notice of Goods lost or found may repair to the corner House in Bloomsbury on the East Side of the Great Square, before the House of the Right Honourable the Lord Treasurer, where there is care taken for the Receipt and Publication of such Advertisements.

The earlier advertisements, with the exception of formal notices, seem to have been concerned exclusively with either books or quack remedies. The first trade advertisement, which does not fall within either of these categories, was curiously enough the first advertisement of a new commodity, tea. The following advertisement appeared in the *Mercurius Politicus*, No. 435, for September 1658—

> That excellent and by all Physitians approved China Drink, called by the Chineans *Tcha*, by other nations *Tay*, alias *Tee*, is sold at the Sultaness Head, a cophee-house in Sweetings Rents, by the Royal Exchange, London.

The history of slavery, of privateering and of many other curious incidents and episodes of English history during the 17th and 18th centuries might be traced by examination of the antiquated advertisements which writers upon such subjects have already collected. In order that space may be found for some consideration of the practical aspects of modern advertising, the discussion of its gradual development must be curtailed. Nor is it necessary to preface this consideration by any laboured statement of the importance which advertising has assumed.

It is a matter of common knowledge that several business houses are to be found in Great Britain, and a larger number in the United States, who spend not less than £50,000 a year in advertising, while one patent medicine company, operating both in England and the United States, has probably spent not less than £200,000 in Great Britain in one year, and an English cocoa manufacturer is supposed to have spent £150,000 in Great Britain. Some of the best works of artists as distinguished as Sir John Millais, Sir H. von Herkomer and Mr Stacy Marks have been scattered broadcast by advertisers. The purchase of Sir John Millais' picture "Bubbles" for £2200 by the proprietors of a well-known brand of soap is probably the most remarkable instance of the expenditure in this direction which an advertiser may find profitable. There are in London alone more than 350 advertising agents, of whom upwards of a hundred are known as men in a considerable way of business. The statements which from time to time find currency in the newspapers with regard to the total amount of money annually spent upon advertising in Great Britain and in the United States are necessarily no better than conjectures, but no detailed statistics are required in order to demonstrate what every reader can plainly see for himself, that advertising has definitely assumed its position as a serious field of commercial enterprise.

Advertising, as practised at the beginning of the 20th century, may be divided into three general classes:—

1. Advertising in periodical publications.
2. Advertising by posters, signboards (other than those placed upon premises where the advertised business is conducted), transparencies and similar devices.
3. Circulars, sent in quantities to specific classes of persons to whom the advertiser specially desired to address himself.

It may be noted at the outset that advertising in periodical publications exercises a reflex influence upon these publications. The daily, weekly and monthly publications of the day are accustomed to look to advertisements for so large a part of their revenue that the purchaser of a periodical publication receives much greater value for his money than he could reasonably expect from the publisher if the aggregate advertising receipts did not constitute a perpetual subsidy to the publisher. It is not to be supposed, however, that the receipts from the sale of a paper cover all its expenses and that the advertising revenue is all clear profit. The average newspaper reader would be amazed if he knew at how great a cost the day's news is laid before him. A dignified journal displays no inclination to cry from the housetops the vastness of its expenditure, but from time to time an accident enables the public to obtain information in this connexion. The evidence taken by a recent Copyright Commission disclosed that the expenditure of the leading English journal upon foreign news alone amounted to more than £50,000 in the course of one year, and that a year not characterized by any great war to swell the ordinary volume of cable despatches.

In the case of daily papers sold at the minimum price, it is not less obvious that the costliness of news service renders advertising revenue indispensable, for although these less important journals spend less money, the price at which they are supplied to the news agents is very small in proportion to the cost of their production. If, however, this thought be pursued to its logical conclusion, the advertiser must admit that he in turn receives, from those among newspaper readers who purchase his wares, prices sufficiently high to cover the cost of his advertising. So that the reader is in the curious position of directly paying a certain price for his newspaper, receiving a newspaper fairly worth more than that price, while this price is supplemented by the indirect incidence of a sort of tax upon many of the commodities he consumes. On the other hand, a great part of the advertisements in a daily newspaper have themselves an interest and utility not less than that possessed by the news. The man who desires to hire a house turns to the classified lists which the newspaper publishes day after day, and servants and employers find one another by the same means. The theatrical announcements are so much a part of the news that even if a journal were not paid for their insertion they could not be altogether omitted without inconvenience to the reader. In the main, however, it is the advertiser who seeks the reader, not the reader who seeks the advertiser, and the care with which advertisements are prepared, and the certainty with which the success or failure of a trader may be traced to his skill or want of skill as an advertiser, show that the proper use of advertising is one of the most indispensable branches of commercial training.

Poster and sign advertisements.

Before discussing in detail the methods of advertising in periodical publications it may be well to complete, for the use of the general reader, a brief survey of the whole subject by examining the two other classes of advertisement. The most enthusiastic partisan of advertising will admit that posters and similar devices are very generally regarded by the public as sources of annoyance. A bold headline or a conspicuous illustration in a newspaper advertisement may for a moment force itself upon the reader's attention. In the French, and in some English newspapers, where an advertisement is often given the form of an item of news, the reader is distressed by the constant fear of being hoodwinked. He begins to read an account of a street accident, and finds at the end of the paragraph a puff of a panacea for bruises. The best English and American journals have refused to lend themselves to this sort of trickery, and in no one of the best journals printed in the English language will there be found an advertisement which is not so plainly differentiated from news matter that the reader may avoid it if he sees fit to do so. On the whole, then, newspaper advertisements ask, but do not compel attention. The whole theory of poster advertising is, on the other hand, one of tyranny. The advertiser who pays for space upon a hoarding or wall, although he may encourage a form of art, deliberately violates the wayfarer's mind. A trade-mark or a catch-word presents itself when eye and thought are occupied with other subjects. Those who object to this class of advertisement assert, with some show of reason, that an advertisement has no more right to assault the eye in this fashion than to storm the ear by an inordinate din; and a man who came up behind another man in the street, placed his mouth close to the other's ear, and bawled a recommendation of some brand of soap or tobacco, would be regarded as an intolerable disturber of public peace and comfort. Yet if the owner of a house sees fit to paint advertisements upon his walls, his exercise of the jealously guarded rights of private property may not lightly be disturbed. For the most part, both law and public opinion content themselves with restraining the worst excesses of the advertiser, leaving many sensitive persons to suffer. The National Society for Checking the Abuses of Public Advertising (known as SCAPA), founded in 1893 in London, was organized for purposes which it describes as follows:—

> The society aims at protecting the picturesque simplicity of rural and river scenery, and promoting a regard for dignity and propriety of aspect in towns—with especial reference to the abuses of spectacular advertising.
>
> It seeks to procure legislation whereby local representative bodies would be enabled to exercise control, by means of by-laws framed with a view to enabling them, at any rate, to grant relief in cases of flagrant and acknowledged abuse.
>
> It is believed that, when regulation is applied in cases where local conditions are peculiarly favourable, the advantage will be so apparent that, by force of imitation and competition, the enforcement of a reasonable standard will gradually become common. The degree of restraint will, of course, depend upon the varying requirements of different places and positions. No hard-and-fast rule is suggested; no particular class of advertisement is proscribed; certainly no general prohibition of posters on temporary hoardings is contemplated. Within the metropolitan area sky signs have already been prohibited, and it is hoped that some corresponding check will be placed on the multiplication of the field boards which so materially diminish the pleasure or comfort of railway journeys.
>
> The society regards with favour the imposition of a moderate tax or duty for imperial or local purposes on exposed advertisements not coming within certain categories of obviously necessary notices. The difficulty of inducing a chancellor of the exchequer to move in a matter where revenue is not the primary consideration is not overlooked. But it is thought that any impost would materially reduce the volume of exposed advertisements, and would at once extinguish the most offensive and the most annoying class, *i.e.* the quack advertisements by the road sides and the bills stuck by unauthorized persons on trees, walls and palings.
>
> Members are recommended to make it known that there exists an active repugnance to the present practice of advertising disfigurement, by giving preference, in private transactions, to makers and dealers who do not employ objectionable methods, and by avoiding, as far as possible, the purchase of wares which, in their individual opinion, are offensively puffed. Action on these lines is advised rather for its educational than for its immediately deterrent effect; although, in the case of many of the more expensive commodities, makers would undoubtedly be much influenced by the knowledge that they would lose, rather than gain, custom.
>
> The foregoing proposals are based on the following estimate of the conditions of the problem. It is believed that the present licence causes discomfort or loss of enjoyment to many, and that, in the absence of authoritative restriction, it must grow far beyond its present limits; that beauty or propriety of aspect in town and country forms as real a part of the national wealth as any material product, and that to save these from impairment is a national interest; that the recent developments of vexatiously obtrusive advertising have not grown out of any necessities of honourable business, but are partly the result of a mere instinct of imitation, and partly are a morbid phase of competition by which both the consumers and the trade as a whole lose; that restriction as regards the size and positions of advertising notices would not be a hardship to those who want publicity—since all competitors would be treated alike, each would have the same relative prominence; that, as large sums of public money are expended on institutions intended to develop the finer taste, and on edifices of elaborate design, it must be held inconsistent with established public policy to permit the sensibilities thus imparted to be wounded, and architectural effect to be destroyed at the discretion of a limited class.

The influence of this society is to be seen in many of the restrictions which have been imposed upon advertisers since its work began. About a year after its foundation the London County Council abolished (under statutory powers obtained from Parliament) advertisements coming within the definition of sky-signs in the London Building Act of 1894. These specifications are as follows:—

> "Sky sign" means any word, letter, model, sign, device, or representation in the nature of an advertisement, announcement, or direction supported on or attached to any post, pole, standard, framework, or other support, wholly or in part upon, over, or above any building or structure, which, or any part of which, sky sign shall be visible against the sky from any point in any street or public way, and includes all and every part of any such post, pole, standard, framework, or other support. The expression "sky sign" shall also include any balloon, parachute, or similar device employed wholly or in part for the purposes of any advertisements or announcement on, over, or above any building, structure, or erection of any kind, or on or over any street or public way.

The act proceeds to exclude from its restrictions flagstaffs, weathercocks and any solid signs not rising more than 3 feet above the roof.

Another by-law of the London County Council, in great measure due to the observations made at coroners' inquests, protects the public against the annoyances and the perils to traffic occasioned by flashlight and searchlight advertisements. This by-law reads as follows:—

> No person shall exhibit any flashlight so as to be visible from any street and to cause danger to the traffic therein, nor shall any owner or occupier of premises permit or suffer any flashlight to be so exhibited on such premises.
>
> The expression "flashlight" means and includes any light used for the purpose of illuminating, lighting, or exhibiting any word, letter, model, sign, device, or representation in the nature of an advertisement, announcement, or direction which alters suddenly either in intensity, colour, or direction.
>
> No person shall exhibit any searchlight so as to be visible from any street, and to cause danger to the traffic therein, nor shall any owner or occupier of premises permit or suffer any searchlight to be so exhibited on such premises.
>
> The expression "searchlight" means and includes any light exceeding 500-candle power, whether in one lamp or lantern, or in a series of lamps or lanterns used together and projected as one concentrated light, and which alters either in intensity, colour, or direction.

Advertising vans were so troublesome in London as to be prohibited in 1853; the "sandwich-man" has in the City of London and many towns been ousted from the pavement to the gutter, from the more crowded to the less crowded streets, and as the traffic problem in the great centres of population becomes more urgent, he will probably be altogether suppressed.

Hoardings are now so restricted by the London Building Acts that new hoardings cannot, except under special conditions, be erected exceeding 12 feet in height, and no existing hoardings can be increased in height so as to exceed that limit.

The huge signs which some advertisers, both in England and the United States, have placed in such positions as to mar the landscape, have so far aroused public antagonism that there is reason to hope that this form of nuisance will not increase.

In 1899 Edinburgh obtained effective powers of control over all sorts of advertising in public places, and this achievement has been followed by no little agitation in favour of a Parliamentary enactment which should once for all do away with the defacing of the landscape in any part of the United Kingdom.

In 1907 an act was passed (Advertisements Regulation Act) of a permissive character purely, under which a local authority is enabled to make by-laws, subject to the confirmation of the Home Secretary, regulating (1) the erection of hoardings, &c., exceeding 12 feet in height, and (2) the exhibition of advertisements which might affect the "amenities" of a public place or landscape.

The English law with regard to posters has undergone very little change. The Metropolitan Police Act 1839 (2 and 3 Vict. cap. 47) first put a stop to unauthorized posting, and the Indecent Advertisements Act of 1889 (§ 3) penalized the public exposure of any picture or printed or written matter of an indecent or obscene nature. But in general practice there is hardly any limitation to the size or character of poster advertisements, other than good taste and public opinion. On the other hand, public opinion is a somewhat vague entity, and there have been cases in which a conflict has arisen as to what public opinion really was, when its legally authorized exponent was in a position to insist on its own arbitrary definition. Such an instance occurred some few years ago in the case of a large poster issued by a well-known London music-hall. The Progressive majority on the London County Council, led by Mr (afterwards Sir) J. M'Dougall, a well-known "purity" advocate, took exception to this poster, which represented a female gymnast in "tights" posed in what was doubtless intended for an alluring and attractive attitude; and, in spite of any argument, the fact remained that the decision as to renewing the licence of this music-hall rested solely with the Council. In showing that it would have no hesitation in provoking even a charge of meddling prudery, the Council probably gave a salutary warning to people who were inclined to sail rather too near the wind. But in Great Britain and America, at all events (though a doubt may perhaps exist as to some Continental countries), the advertiser and the artist are restrained, not only by their own sense of propriety, but by fear of offending the sense of propriety in their customers.

Posters and placards in railway stations and upon public vehicles still embarrass the traveller who desires to find the name of a station or the destination of a vehicle. In respect of all these abuses it is a regrettable fact that unpopularity cannot be expected to deter the advertiser. If a name has once been fixed in the memory, it remains there long after the method of its impression has been forgotten, and the purpose of advertisements of the class under discussion is really no more than the fixing of a trade name in the mind. The average man or woman who goes into a shop to buy soap is more or less affected by a vague sense of antagonism towards the seller. There is a rudimentary feeling that even the most ordinary transaction of purchase brings into contact two minds actuated by diametrically opposed interests. The purchaser, who is not asking for a soap he has used before, has some hazy suspicion that the shopkeeper will try to sell, not the article best worth the price, but the article which leaves the largest margin of profit; and the purchaser imagines that he in some measure secures himself against a bad bargain when he exercises his authority by asking for some specific brand or make of the commodity he seeks. If he has seen any one soap so persistently advertised that his memory retains its name, he will ask for it, not because he has any reason to believe it to be better or cheaper than others, but simply because he baffles the shopkeeper, and assumes an authoritative attitude by exerting his own freedom of choice. This curious and obscure principle of action probably lies at the root of all poster advertising, for the poster does not set forth an argument as does the newspaper advertisement. It hardly attempts to reason with the reader, but merely impresses a name upon his memory. It is possible, by lavish advertising, to go so far in this direction that the trade-mark of a certain manufacturer becomes synonymous with the name of a commodity, so that when the consumer thinks of soap or asks for soap, his concept inevitably couples the maker's name with the word "soap" itself. In order that the poster may leave any impression upon his mind, it must of course first attract his attention. The assistance which the advertiser receives from the artist in this connexion is discussed in the article POSTER.

Advertisement by circular.

The fact that the verb "to circularize" was first used in 1848, sufficiently indicates the very recent origin of the practice of plying possible purchasers with printed letters and pamphlets. The penny postage was not established in England until 1840; the halfpenny post for circulars was not introduced until 1855. In the United States a uniform rate of postage at two cents was not established until 1883. In both countries cheap postage and cheap printing have so greatly encouraged the use of circulars that the sort of people whom the advertiser desires to reach—those who have the most money to spend, and whose addresses, published in directories, indicate their prosperous condition—are overwhelmed by tradesmen's price-lists, appeals from charitable institutions, and other suggestions for the spending of money. The addressing of envelopes and enclosing of circulars is now a recognized industry in many large towns both in Great Britain and in the United States. It seems, however, to be the opinion of expert advertisers that what is called "general circularizing" is unprofitable, and that circulars should only be sent to persons who have peculiar reason to be interested by their specific subject-matter. It may be noted, as an instance of the assiduity with which specialized circularizing is pursued, that the announcement of a birth, marriage or death in the newspapers serves to call forth a grotesque variety of circulars supposed to be adapted to the momentary needs of the recipient.

In concluding this review of methods of advertising, other than advertisements in periodical publications, we may add that the most extraordinary attempt at advertisement which is known to exist is to be found at the churchyard at Godalming, Surrey, where the following epitaph was placed upon a tombstone:—

Sacred
To the memory of
Nathaniel Godbold Esq.
Inventor & Proprietor
of that excellent medicine
The Vegetable Balsam
For the Cure of Consumptions & Asthmas.
. . . He departed this Life
The 17th. day of Decr. 1799
Aged 69 years.
Hic Cineres, ubique Fama.

Advertising in periodical publications.

The preparation of advertisements for the periodical press has within the last twenty years or so become so important a task that a great number of writers and artists—many of the latter possessing considerable abilities—gain a livelihood from this pursuit. The ingenuity displayed in modern newspaper advertising is unquestionably due to American initiative. The English newspaper advertisement of twenty years ago consisted for the most part of the mere reiteration of a name. An advertiser who took a column's space supplied enough matter to fill an inch, and ingenuously repeated his statement throughout the column. Such departures from this childlike method as were made were for the most part eccentric to the point of incoherence. It may, however, be said in defence of English advertisers, that newspaper publishers for a long time sternly discountenanced any attempt to render advertisements attractive. So long as an advertiser was rigidly confined to the ordinary single-column measure, and so long as he was forbidden to use anything but the smallest sort of type, there was very little opportunity for him to attract the reader's attention. The newspaper publisher must always remember that the public buy a newspaper for the sake of the news, not for the sake of the advertisements, and that if the advertisements are relegated to a position and a scope, in respect of display, so inferior that they may be overlooked, the advertiser cannot afford to bear his share of the cost of publication. Of late *The Times*, followed by almost all newspapers in the United Kingdom, has given the advertiser as great a degree of liberty as he really needs, and many experienced advertisers in America incline to the belief that the larger licence accorded to American advertisers defeats its own ends. The truth would seem to be that the advertiser will always demand, and may fairly expect, the right to make his space as fantastic in appearance as that allotted to the editor. When some American editors see fit to print a headline in letters as large as a man's hand, and to begin half-a-dozen different articles on the first page of a newspaper, continuing one on page 2, another on page 4, and another on page 6, to the bewilderment of the reader, it can hardly be expected that the American advertiser should submit to any very strict code of decorum. The subject of the relation between a newspaper proprietor and his advertisers cannot be dismissed without reference to the notable independence of advertisers' influence, which English and American newspaper proprietors authorize their editors to display. Whenever an insurance company or a bank goes wrong, the cry is raised that all the editors in Christendom had known for years that the directors were imbeciles and rogues, but had conspired to keep mute for the sake of an occasional advertisement. When the British public persisted, not long ago, in paying premium prices for the shares of over-capitalized companies, the crash had no sooner come than the newspapers were accused of having puffed promotions for the sake of the money received for publishing prospectuses. As a matter of fact, in the case of the best dailies in England and America, the editor does not stand at all in awe of the advertiser, and time after time the Money Article has ruthlessly attacked a promotion of which the prospectus appeared in the very same issue. It is indeed to the interest of the advertiser, as well as to the interest of the reader, that this independence should be preserved, for the worth of any journal as an advertising medium depends upon its possessing a *bona fide* circulation among persons who believe it to be a serious and honestly conducted newspaper. All advertisers know that the minor weeklies, which contain nothing but trade puffs, and are scattered broadcast among people who pay nothing for their copies, are absolutely worthless from the advertiser's point of view. The most striking difference between the periodical press of Great Britain and that of America is, that in the former country the magazines and reviews play but a secondary rôle, while in the United States the three or four monthlies possessing the largest circulation are of the very first importance as advertising mediums. One reason for this is that the advertisements in an American magazine are printed on as good paper, and printed with as great care, as any other part of the contents. There are probably very few among American magazine readers who do not habitually look through the advertising pages, with the certainty that they will be entertained by the beauty of the advertiser's illustrations and the quaint curtness of his phrases. Another reason is that the American monthly magazine goes to all parts of the United States, while, owing to the time required for long journeys on even the swiftest trains, no American daily paper can have so general a circulation as *The Times* in the United Kingdom. In comparison with points on the Pacific coast, Chicago does not seem far from New York, yet, with the exception of one frenzied and altogether unsuccessful attempt, no New York daily has ever attempted to force a circulation in Chicago. The American advertiser would, therefore, have to spend money on a great number of daily papers in order to reach as widespread a public as one successful magazine offers him.

There is reason to believe that the English magazine publishers have erred gravely in taking what are known in the trade as "insets," consisting of separate cards or sheets printed at the advertiser's cost, and accepted by the publisher at a specific charge for every thousand copies. This system of insetting has the grave inconvenience that the advertiser finds himself compelled to print as many insets as the publisher asserts that he can use. The publisher, on the other hand, is somewhat at the mercy of too enthusiastic agents and employés, who estimate over-confidently the edition of the periodical which will probably be printed for a certain month, and advertisers have had reason to fear that many of their insets were wasted. The added weight and bulk of the insets cause inconvenience and expense to the newsdealer, as two or three insets printed upon cardboard are equivalent to at least sixteen additional pages. Some newsdealers have further complicated the inset question by threatening to remove insets unless special tribute be paid to them; and with all these difficulties to be considered, many magazine publishers have seriously considered the advisability of altogether discontinuing the practice of taking insets, and of confining their advertisements to the sheets they themselves print. In connexion with this subject, it may be added that many readers habitually shake loose bills out of a magazine before they begin to turn the pages, and that railway stations, railway carriages and even public streets are thus littered with trampled and muddy advertisements. The old practice of distributing handbills in the streets is dying a natural death, more or less hastened by local by-laws, and when the loose bills in magazines and cheap novels have ceased to exist no one will be the loser.

Advertisements in the weekly press are on the whole more successful in England than in America. A few American weeklies cope successfully with the increasing competition of the huge Sunday editions of American daily papers. But even the most successful among them—a paper for boys—has hardly attained the prosperity of some among its English contemporaries in the field of weekly journalism.

The merchant who turns to these pages for practical suggestions concerning the advertising of his own business, can be given no better advice than to betake himself to an established advertising agent of good repute, and be guided by his counsels. The chief part that he can himself play with advantage is to note from day to day whether the agent is obtaining advantageous positions for his announcements. Every advertiser will naturally prefer a right-hand page to a left-hand page, and the right side of the page to the left side of the page; while the advertiser who most indefatigably urges his claims upon the agent will, in the long run, obtain the largest share of the favours to be distributed. To the merchant who inclines to consider advertising in connexion with the broader aspects of his calling, it may be suggested that a new channel of trade demands very serious attention. What is called in England "postal trade," and in America "mail order business," is growing very rapidly. Small dealers in both countries have complained very bitterly of the competition they suffer from the general dealers and from stores made up of departments which, under one roof, offer to the consumer every imaginable sort of merchandise. This general trading, which, on the one hand, seriously threatens the small trader, and on the other hand offers greater possibilities of profit to the proportionately small number of persons who can undertake business on so large a scale, becomes infinitely more formidable when the general dealer endeavours not only to attract the trade of a town, but to make his place of business a centre from which he distributes by post his goods to remote parts of the country. In America, where the weight of parcels carried by post is limited to 4 ℔, and where the private carrying companies are forced to charge a very much higher rate for carriage from New York to California than for shorter distances, the centralization of trade is necessarily limited; but it is no secret that, at the present moment, persons residing in those parts of the United Kingdom most remote from London habitually avail themselves of the English parcel post, which carries packages up to 11 ℔, in order to procure a great part of their household supplies direct from general dealers in London. A trading company, which conducts its operations upon such a scale as this, can afford to spend an almost unlimited sum in advertising throughout the United Kingdom, and even the trader who offers only one specific class of merchandise is beginning to recognize the possibility of appealing to the whole country.

Legal regulation.

The following is a brief summary of the laws and regulations dealing with advertisements in public places in certain of the countries of Continental Europe and in the United States of America, the chief authority for which is an official return issued by the British Home Office in 1903.

France.—The permission of the owner is alone required for the placing of advertisements on private buildings; but buildings, walls, &c., belonging to the government or local authorities are reserved exclusively for official notices, &c.; these alone can be printed on white paper, all others must be on coloured paper. Municipal authorities control the size, construction, &c., of hoardings used for advertising purposes, and the police have full powers over the exhibition of indecent or other objectionable advertisements. The *Société pour la protection des paysages*, founded in 1901, has for one of its objects the prevention of advertisements which disfigure the scenery or are otherwise objectionable.

Germany.—By §43 of the Imperial Commercial Ordinance permission to post any trade advertisement in a public street, square, &c., must be first obtained from the local police. The police also control (by §55 of the Imperial Press Law 1874) advertisements which are not of a trade character, but this regulation does not affect the right of the federal legislatures to make regulations in regard to them (§30). It would be impossible to give in any detail the police regulations as to advertisements which exist, *e.g.* in Prussia, but the following rules in force in Berlin may be given:—Public advertisements in public streets and places may be posted only on the appliances, such as pillar posts, &c., provided for the purpose. Owners of property may post advertisements on their own property but only such as concern their own interests. Advertisements on public conveyances are forbidden. In 1902 a Prussian law was passed authorizing the police to forbid all advertisement hoardings, &c., which would disfigure particularly beautiful landscapes in rural districts. The Hesse-Darmstadt Act of 1902 prohibits the placing of any advertisements, posters, &c., on a monument officially protected under the act, if it would be likely to injure the appearance of the monument. As instances of the numerous local provisions against the abuse of advertising may be cited those of Augsburg and Lübeck, by which any advertisement that would injure the *Stadtbild* or appearance of the town may be prohibited and removed by the local authority (see G. Baldwin Brown, *The Care of Ancient Monuments*, 1905). Full powers exist under the Imperial Criminal Code for the suppression of indecent or objectionable advertisements.

Austria.—Permission of the police is required for the exhibition of printed notices in public places other than such as are of purely local or industrial interest, such as notices of entertainment, leases, sales, &c., or theatre programmes, and these can only be shown in places approved by the local authorities (Press Law 1862). The press-police act as advertisement censors and determine whether an advertisement can be allowed or not. In Hungary there are no general laws or regulations, but the municipalities have power to issue ordinances dealing with the question.

Italy.—All control rests with the municipal and communal authorities, who may decide on the places where advertisements may or may not be posted, and can prevent hoardings being placed on or near ancient monuments or public buildings.

Switzerland.—The Federal Government has no authority to deal with this question; certain of the cantons have regulations, *e.g.* Lucerne prohibits the public advertising of inferior goods by means of a false description, Basel-Stadt gives the police the power of censoring all advertisements. Many of the communal authorities throughout Switzerland have special restrictions and regulations. In Zurich the police choose the advertising stations, in Berne the municipality possesses a monopoly of the right of erecting advertisements. The Society known as the *Ligue pour la conservation de la Suisse pittoresque* or *Schweitzerischer Heimatschutz* has for one of its objects the preservation of scenery from disfiguring advertisements.

United States.—There is no federal legislation on the subject, the matter being one for regulation by the states, which in most cases have left it to the various municipalities and other local authorities. With regard to indecent and objectionable advertisements some states have special legislation on the matter, others are content with the ordinary criminal laws or police powers or with the law of nuisance or of trespass. Thus control can be exercised over such advertisements as are dangerous to public safety, health or morals. The state of New York prohibits advertisements of lotteries. It would be impossible to give in detail the different laws and regulations passed in the various states or by municipalities. The following are some of the more striking measures adopted in certain of the states. In Massachusetts no advertising signs or devices are allowed on the public highways. Power has been granted to city and town authorities to regulate advertisements in, near or visible from public parks. In the District of Columbia no advertisement is allowed which obstructs a highway, and all distribution of handbills, circulars, &c., in public streets, parks, &c., is prohibited. This prohibition against what are generally known as "dodgers" is very general in the local regulations throughout the states. In Illinois, city councils are empowered on the incorporation of the city to regulate and prevent the use of streets, sidewalks and public grounds for signs, handbills and advertisements, &c., and also the exhibition of banners, placards, in the streets or sidewalks. Chicago has a body of most stringent rules, but they apparently have been found impossible to enforce; thus no advertisement board more than 12 ft. square within 400 ft. of a public park or boulevard, no advertisements other than small ones relating to the business carried on in the premises where the advertisement is posted, or of sales, &c., are allowed in streets where three-quarters of the houses are "residences" only. Prohibition is also extended to the advertisements of those professing to cure diseases or giving notice of the sale of medicines. In Boston there are regulations prohibiting projecting or overhanging signs in the streets, and special rules as to the height at which street signs and advertisements must be placed. The distribution of "dodgers" in the streets is prohibited. Advertisements for places of amusement must be approved by the committee on licences.

Taxation.

France, Belgium, Italy and certain of the cantons in Switzerland impose a tax on advertisements, as do certain of the United States of America, where the form is usually that of a licence duty on billposters or advertising agencies. In many cases in the United States this is imposed by the municipalities. In every case both in Europe and America advertisements in newspapers are not subject to any tax.

With regard to the literature of advertising, in addition to the historical article in the *Edinburgh Review* for February 1843, already mentioned, and that in the *Quarterly Review* for June 1855, the Society for Checking the Abuses of Public Advertising issue a journal, *A Beautiful World*. The *Journal of the Society of Comparative Legislation* (N.S. xvi. 1906) contains an article by W.J.B. Byles on Foreign Law and the Control of Advertisements in Public Places. The advertisers' handbooks, issued by the leading advertising agents, will also be found to contain practical information of great use to the advertiser. (H. R. H.*; C. We.)

ADVICE (Fr. *avis*, from Lat. *ad*, to, and *visum*, viewed), counsel given after consideration, or information from a distance giving particulars of something prospective (*e.g.* "advice" of an imminent battle, or of a cargo due). In commerce it is a common word for a formal notice from one person concerned in a transaction to another.

ADVOCATE (Lat. *advocatus*, from *advocare*, to summon, especially in law to call in the aid of a counsel or witness, and so generally to summon to one's assistance), a lawyer authorized to plead the causes of litigants in courts of law. The word is used technically in Scotland (see Advocates, Faculty of) in a sense virtually equivalent to the English term barrister, and a derivative from the same Latin source is so used in most of the countries of Europe where the civil law is in force. The word *advocatus* is not often used among the earlier jurists, and appears not to have had a strict meaning. It is not always associated with legal proceedings, and might apparently be applied to a supporter or coadjutor in the pursuit of any desired object. When it came to be applied with a more specific limitation to legal services, the position of the *advocatus* was still uncertain. It was different from, and evidently inferior to, that of the *juris-consultus*, who gave his opinion and advice in questions of law, and may be identified with the consulting counsel of the present day. Nor is the merely professional advocate to be confounded with the more distinguished *orator*, or *patronus*, who came forward in the guise of the disinterested vindicator of justice. This distinction, however, appears to have arisen in later times, when the profession became mercenary. By the *lex Cincia*, passed about two centuries B.C., and subsequently renewed, the acceptance of remuneration for professional assistance in lawsuits was prohibited. This law, like all others of the kind, was evaded. The skilful debater was propitiated with a present; and though he could not sue for the value of his services, it was ruled that any honorarium so given could not be demanded back, even though he died before the anticipated service was performed. The traces of this evasion of a law may be found in the existing practice of rewarding counsel by fees in anticipation of services.

The term *advocatus* came eventually to be the word employed when the bar had become a profession, and the qualifications, admission, numbers and fees of counsel had become a matter of state regulation, to designate the pleaders as a class of professional men, each individual advocate, however, being still spoken of as patron in reference to the litigant with whose interest he was entrusted. The *advocatus fisci*, or fiscal advocate, was an officer whose function, like that of a solicitor of taxes at the present day, was connected with the collection of the revenue.

The lawyers who practised in the English courts of common law were never officially known as advocates, the word being reserved for those who practised in the courts of the civil and canon law (see Doctors' Commons). There was formerly an important official termed his majesty's advocate-general, or more shortly, the king's advocate, who was the principal law officer of the crown in the College of Advocates or Doctors' Commons, and in the admiralty and ecclesiastical courts. He discharged for these courts the duties which correspond to those of the solicitor of the treasury (see Solicitor). His opinion was taken by the foreign office on international matters, and on high ecclesiastical matters he was also consulted; all orders in council were submitted to him for approval. The office may now be said to be obsolete, for after the resignation of Sir Travers Twiss, the last holder, in 1872, it was not filled up. There was also a second law officer of the crown in the admiralty court called the admiralty advocate. This office has long been vacant. Advocate is also the title still in use in some of the British colonies to denote the chief law officer of the crown there. For instance, in Sierra Leone (until 1896), Lagos and Cyprus he is called the king's advocate; in Malta, crown advocate; in Mauritius, procureur and advocate-general, and in the provinces of India advocate-general. In France, the *avocats*, as a body, were reorganized under the empire by a decree of the 15th of December 1810. There is, however, a distinction between *avocats* and *avoués*. The latter, whose number is limited, act as procurators or agents, representing the parties before the tribunals, draft and prepare for them all formal acts and writings, and prepare their lawsuits for the oral debates. The office of the *avocat*, on the other hand, consists in giving advice as to the law, and conducting the causes of his clients by written and oral pleadings. The number of *avocats* is not limited; every licentiate of law being entitled to apply to the corporation of *avocats* attached to each court, and after presentation to the court, taking the oath of office and passing three years in attendance on some older advocate, to have himself recognised as an advocate.

In Germany the *advocat* no longer forms a distinct class of lawyer. Since 1879, when a sweeping judicature act (*Deutsche Justizgesetzgebung*) reconstituted the judicial system, the *advocat* in his character of adviser, as distinguished from the *procurator*, who formerly represented the client in the courts, has become merged in the *Rechtsanwalt*, who has the dual character of counsellor and pleader.

The advocatus ecclesiae.

In the middle ages the word *advocatus* (Fr. *avoué*, Ger. *Vogt*) was used on the continent as the title of the lay lord charged with the protection and representation in secular matters of an abbey. The office is traceable as early as the beginning of the 5th century in the Roman empire, the churches being allowed to choose *defensores* from the body of advocates to represent them in the courts. In the Frankish kingdom, under the Merovingians, these lay representatives of the churches appear as *agentes*, *defensores* and *advocati*; and under the Carolingians it was made obligatory on bishops, abbots and abbesses to appoint such officials in every county where they held property. The office was not hereditary, the *advocatus* being chosen, either by the abbot alone, or by the abbot and bishop concurrently with the count. The same causes that led to the development of the feudal system also affected the *advocatus*. In times of confusion churches and abbeys needed not so much a legal representative as an armed protector, while as feudal immunities were conceded to the ecclesiastical foundations, these required a representative to defend their rights and to fulfil their secular obligations to the state, *e.g.* to lead the ecclesiastical levies to war. A new class of *advocatus* thus arose, whose office, commonly rewarded by a grant of land, crystallized into a fief, which, like other fiefs, had by the beginning of the 11th century become hereditary.

The French avoué.

In France the *advocati* (*avoués*) were of two classes—(1) great barons, who held the advocateship of an abbey or abbeys rather as an office than a fief, though they were indemnified for the protection they afforded by a domain and revenues granted by the abbey: thus the duke of Normandy was *advocatus* of nearly all the abbeys in the duchy; (2) petty seigneurs, who held their *avoueries* as hereditary fiefs and often as their sole means of subsistence. The *avoué* of an abbey, of this class, corresponded to the *vidame* (*q.v.*) of a bishop. Their function was generally to represent the abbot in his capacity as feudal lord; to act as his representative in the courts of his superior lord; to exercise secular justice in the abbot's name in the abbatial court; to lead the retainers of the abbey to battle under the banner of the patron saint.

In England.

In England the word *advocatus* was never used to denote an hereditary representative of an abbot; but in some of the larger abbeys there were hereditary stewards whose functions and privileges were not dissimilar to those of the continental *advocati.* The word *advocatus*, however, was in constant use in England to denote the patron of an ecclesiastical benefice, whose sole right of any importance was an hereditary one of presenting a parson to the bishop for institution. In this way the hereditary right of presentation to a benefice came to be called in English an "advowson" (*advocatio*).

The *advocatus* played a more important part in the feudal polity of the Empire and of the Low Countries than in France, where his functions, confined to the protection of the interests of religious houses, were superseded from the 13th century onwards by the growth of the central power and the increasing efficiency of the royal administration. They had, indeed, long ceased to be effective for their original purpose; and from the time when their office became a fief they had taken advantage of their position to pillage and suppress those whom it was their function to defend. The medieval records, not in France only, are full of complaints by abbots of their usurpations, exactions and acts of violence.

The German Vogt.

In Germany the title of *advocatus* (*Vogt*) was given not only to the *advocati* of churches and abbeys, but to the officials appointed, from early in the middle ages, by the emperor to administer their immediate domains, in contradistinction to the counts, who had become hereditary princes of the Empire. The territory so administered was known as *Vogtland* (*terra advocatorum*), a name still sometimes employed to designate the strip of country which embraces the principalities of Reuss and adjacent portions of Saxony, Prussia and Bavaria. These imperial *advocati* tended in their turn to become hereditary. Sometimes the emperor himself assumed the title of *Vogt* of some particular part of his immediate domain. In the Netherlands as well as in Germany *advocati* were often appointed in the cities, by the overlord or by the emperor, sometimes to take the place of the bailiff (Ger. *Schultheiss*, Dutch *schout*, Lat. *scultetus*), sometimes alongside this official.

See Du Cange, *Glossarium* (ed. 1883, Niort), s. "Advocati"; A. Luchaire, *Manuel des institutions françaises* (Paris, 1892); Herzog-Hauck, *Realencyklopädie* (ed. Leipzig, 1896), s. "Advocatus ecclesiae," where further references will be found.

ADVOCATES, FACULTY OF, the collective term by which what in England are called barristers are known in Scotland. They professionally attend the supreme courts in Edinburgh; but they are privileged to plead in any cause before the inferior courts, where counsel are not excluded by statute. They may act in cases of appeal before the House of Lords; and in some of the British colonies, where the civil law is in force, it is customary for those who practise as barristers to pass as advocates in Scotland. This body has existed by immemorial custom. Its privileges are constitutional, and are founded on no statute or charter of incorporation. The body formed itself gradually, from time to time, on the model of the French corporations of *avocats*, appointing like them by a general vote, a dean or *doyen*, who is their principal officer. It also differs from the English and Irish societies in that there is no governing body similar to the benchers, nor is there any resemblance to the quasi-collegiate discipline and the usages and customs prevailing in an inn of court. No curriculum of study, residence or professional training was, until 1856, required on entering this profession; but the faculty have always had the power, believed to be liable to control by the Court of Session, of rejecting any candidate for admission. The candidate undergoes two private examinations—the one in general scholarship, in lieu of which, however, he may produce evidence of his having graduated as master of arts in a Scottish university, or obtained an equivalent degree in an English or foreign university; and the other, at the interval of a year, in Roman, private international and Scots law. He must, before the latter examination, produce evidence of attendance at classes of Scots law and conveyancing in a Scottish university, and at classes of civil law, public or international law, constitutional law and medical jurisprudence in a Scottish or other approved university. He has then to undergo the old academic form of the public impugnment of a thesis on some title of the pandects; but this ceremony, called the public examination, has degenerated into a mere form. A large proportion of the candidate's entrance fees (amounting to £339) is devoted to the magnificent library belonging to the faculty, which literary investigators in Edinburgh find so eminently useful.

ADVOCATUS DIABOLI, devil's advocate, the name popularly given to the promoter of the Faith (*promotor fidei*), and officer of the Sacred Congregation of Rites at Rome, whose duty is to prepare all possible arguments against the admission of any one to the posthumous honours of beatification and canonization. This functionary is first formally mentioned under Leo X. (1513–1521) in the proceedings in connexion with the canonization of St Lorenzo Giustiniani. In 1631 Urban VIII. made his presence, either in person or by deputy, necessary for the validity of any act connected with the process of beatification or canonization (see CANONIZATION). The phrase, "devil's advocate," has by an easy transference come to be used of any one who puts himself up, or is put up, for the sake of promoting debate, to argue a case in which he does not necessarily believe.

ADVOWSON, or ADVOWZEN (through O. Fr. *advouson*, from Lat. *advocatio*, a summons to), the right of presentation to a vacant ecclesiastical benefice, so called because the patron defends or advocates the claims of the person whom he presents. At what period the right of advowson arose is uncertain; it was probably the result of gradual growth. The earliest trace of the practice is found in the decree of the council of Orange, A.D. 441, which allowed a bishop, who had built a church in the diocese of another bishop, to nominate the clerk, but not to consecrate the church. The 123rd Novel of Justinian, promulgated about the end of the 5th century, decreed "that if any man should erect an oratory, and desire to present a clerk thereto by himself or his heirs, if they furnish a competency for his livelihood, and nominate to the bishop such as are worthy, they may be ordained." The 57th Novel empowered the bishop to examine them and judge of their qualifications, and, where those were sufficient, obliged him to admit the clerk. In England, for quite two centuries after its conversion, the clergy administered only *pro tempore* in the parochial churches, receiving their maintenance from the cathedral church, all the appointments within the diocese lying with the bishop. But in order to promote the building and endowment of parochial churches those who had contributed to their erection either by a grant of land, by building or by endowment, became entitled to present a clerk of their own choice to the bishop, who was invested with the revenues derived from such contribution. After the Norman Conquest, when the boundaries between church and state were more clearly marked, it became usual for patrons to appoint to livings not only without the consent, but even against the will, of the bishops.

Advowsons are divided into two kinds, *appendant* and *in gross*. Originally the right of nominating[1] or presenting was annexed to the person who built or endowed the church, but the right gradually became annexed to the manor in which it was built, for the endowment was considered parcel of the manor, the church being built for the use of the inhabitants, and the tithes of the manor being attached to the church. Consequently where the right of patronage (the right of the patron to present to the bishop the person whom he has nominated to become rector or vicar of the parish to the benefice of which he claims the right of advowson) remains attached to the manor, it is called an advowson *appendant*, and passes with the estate by inheritance or sale without any special conveyance. But where, as is often the case, the right of presentation has been sold by itself, and so separated from the manor, it is called an advowson *in gross*. An advowson may also be partly *appendant*, and partly *in gross*, *e.g.* if an owner granted to another every second presentment, the advowson would be appendant for the grantor's turn and in gross for the grantee's.

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[1] The distinction between *nomination* to a living and *presentation* is to be noted. *Nomination* is the power, by virtue of a manor or otherwise, to appoint a clerk to the patron of a benefice, to be by him presented to the ordinary. *Presentation* is the act of a patron in offering his clerk to the bishop, to be instituted in a benefice of his gift. Nomination and presentation, though generally used in law for the same thing, must be so distinguished, for it is possible that the rights of nomination may be in one person, and the rights of presentation in another.

Advowsons are further distinguished into *presentative* and *collative*. In a *presentative* advowson, the patron presents a clergyman to the bishop, with the petition that he be instituted into the vacant living. The bishop is bound to induct if he find the clergyman canonically qualified, and a refusal on his part is subject to an appeal to an ecclesiastical court either by patron or by presentee. In a *collative* advowson the bishop is himself the patron, either in his own right or in the right of the proper patron, which has lapsed to him through not being exercised within the statutory period of six months after the vacancy occurred. No petition is necessary in this case, and the bishop is said to *collate* to the benefice. Before 1898 there were also *donative* advowsons, but the Benefices Act 1898 made all donations with cure of souls *presentative*. In a *donative* advowson, the sovereign, or any subject by special licence from the sovereign, conferred a benefice by a simple letter of gift, without any reference to the bishop, and without presentation and institution. The incumbent of such a living was to a great extent free from the jurisdiction of the bishop, who could only reach him through the action of an ecclesiastical court.

The Benefices Act of 1898 did not make any substantial change in the legal character of advowsons, which remain practically the same as before the act. Briefly, it prevents the dealing with the right of presentation as a thing apart from the advowson itself; increases the power of the bishops to refuse the presentation of unfit persons, and removes several abuses which had arisen in the transfer of patronage. Under the previously existing law, simony, or "the corrupt presentation of any person to an ecclesiastical benefice for gift, money or reward," renders the presentation void, and subjects the persons privy or party to it to penalties; a presentation to a vacant benefice cannot be sold, and no clerk in holy orders can purchase for himself a next presentation. An advowson may, however, be sold during a vacancy, though that will not give the right to present to that vacancy; and a clerk may buy an advowson even though it be only an estate for life, and present himself on the next vacancy. Under the Benefices Act, advowsons may not be sold by public auction except in conjunction with landed property adjacent to the benefice; transfers of patronage must be registered in the registry of the diocese, and no such transfers can be made within twelve months after the last admission or institution to the benefice. Restrictions had also been imposed on the transfer of patronage of churches built under the Church Building Acts and New Parishes Acts, and on that of benefices in the gift of the lord chancellor, and sold by him in order to augment others; but agreements may be made as to the patronage of such churches in favour of persons who have contributed to their building or enlargement without being void for simony.

The right of presentation may be exercised by its owner whether he be an infant, executors, trustees, coparceners (who, if they cannot agree, present in turn in order of age) or mortgagee (who must present the nominee of the mortgagor), or a bankrupt (who, although the advowson belongs to his creditors, yet has the right to present to a vacancy). Certain owners of advowsons are temporarily or permanently disabled from exercising the right which devolves upon other persons; and the crown as patron paramount of all benefices can fill all churches not regularly filled by other patrons. It thus presents to all vacancies caused by simoniacal presentations, or by the incumbent having been presented to a bishopric or in benefices belonging to a bishopric when the see is vacant by the bishop's death, translation or deprivation. Where a presentation belongs to a lunatic, the lord chancellor presents for him. Where it belongs to a Roman Catholic the right is exercised in his behalf by the university of Oxford if the benefice be situate south of the river Trent, and by that of Cambridge if it be north of that river.

Besides the qualifications required of a presentee by canon law, such as being of the canonical age, and in priest's orders before admission, sufficient learning and proper orthodoxy or morals, the Benefices Act requires that a year shall have elapsed since a transfer of the right of patronage, unless it can be shown that such transfer was not made in view of a probable vacancy; that the presentee has been a deacon for three years; and that he is not unfit for the discharge of his duties by reason of physical or mental infirmity or incapacity, grave pecuniary embarrassment, grave misconduct or neglect of duty in an ecclesiastical office, evil life, or conduct causing grave scandal concerning his moral character since his ordination, or being party to an illegal agreement with regard to the presentation; that notice of the presentation has been given to the parish of the benefice. Except by leave of the bishop or sequestrator, the incumbent of a sequestered benefice cannot be presented. The act also gives to both patron and presentee an alternative mode of appeal against a bishop's refusal to institute or admit, except on a ground of doctrine or ritual, to a court composed of an archbishop of the province and a judge of the High Court nominated for that purpose by the lord chancellor, a course which, however, bars resort being had to the ordinary suits of *duplex querela* or action of *quare impedit*. In case of refusal of one presentee, a lay patron may present another, and a clerical patron may do so after an unsuccessful appeal against the refusal.

Upon institution the church is full against everybody except the crown, and after six months' peaceable possession the clerk is secured in possession of the benefice, even though he may have been presented by a person who is not the proper patron. The true patron can, however, exercise his right to present at the next vacancy, and can reserve the advowson from an usurper at any time within three successive incumbencies so created adversely to his right, or within sixty years. Collation, which otherwise corresponds to institution, does not make the church full, and the true patron can dispossess the clerk at any time, unless he is a patron who collates. Possession of the benefice is completed by induction, which makes the church full against any one, including the crown. If the proper patron fails to exercise his right within six calendar months from the vacancy, the right devolves or lapses to the next superior patron, *e.g.* from an ordinary patron to the bishop, and if he makes similar default to the archbishop, and from him on similar default to the crown. If a bishopric becomes vacant after a lapse has accrued to it, it goes to the metropolitan; but in case of a vacancy of a benefice during the vacancy of the see the crown presents. Until the right of presentation so accruing to a bishop or archbishop is exercised, the patron can still effectually present but not if lapse has gone to the crown.

(See also BENEFICE; GLEBE; INCUMBENT; VICAR.)

AUTHORITIES.—Burn, *Ecclesiastical Law*; Bingham's *Origines Ecclesiasticae, or, the Antiquities of the English Church*; Mirehouse, *On Advowson*; Phillimore, *Ecclesiastical Law*.

ADYE, SIR JOHN MILLER (1819–1900), British general, son of Major James P. Adye, was born at Sevenoaks, Kent, on the 1st of November 1819. He entered the Royal Artillery in 1836, was promoted captain in 1846, and served throughout the Crimean War as brigade-major and assistant adjutant-general of artillery (C.B., brevets of major and lieutenant-colonel). In the Indian Mutiny he served on the staff in a similar capacity. Promoted brevet-colonel in 1860, he was specially employed in 1863 in the N.W. frontier of India campaign, and was deputy-adjutant-general, Bengal, from 1863 to 1866, when he returned home. From 1870 to 1875 Adye was director of artillery and stores at the War Office. He was made a K.C.B. in 1873, and was promoted to be major-general and appointed governor of the Royal Military Academy, Woolwich, in 1875, and surveyor-general of the ordnance in 1880. In 1882 he was chief of staff and second in command of the expedition to Egypt, and served throughout the campaign (G.C.B. and thanks of parliament). He held the government of Gibraltar from 1883 to 1886. Promoted lieutenant-general in 1879, general and colonel commandant of the Royal Artillery in 1884, he retired in 1886. He unsuccessfully contested Bath in the Liberal interest in 1892. He died on the 26th of August 1900. He was author of *A Review of The Crimean War*; *The Defence of Cawnpore*; *A Frontier Campaign in Afghanistan*; *Recollections of a Military Life*; and *Indian Frontier Policy*.

ADYTUM, the Latinized form of *ἄδυτον* (not to be entered), the innermost sanctuary in ancient temples, access to which was forbidden to all but the officiating priests. The most famous adytum in Greece was in the temple of Apollo at Delphi.

ADZE (from the Old Eng. *adesa*, of which the origin is unknown), a tool used for cutting and planing. It is somewhat like an axe reversed, the edge of the blade curving inward and placed at right angles to the handle. This shape is most suitable for planing uneven timber, as inequalities are " hooked off " by the curved blade. (See Tools.)

AEACUS, in Greek legend, ancestor of the Aeacidae, was the son of Zeus and Aegina, daughter of the river-god Asopus. His mother was carried off by Zeus to the island of Oenone, which was afterwards called by her name. The island having been depopulated by a pestilence, Zeus changed the ants upon it into human beings (Ovid, *Met.* vii. 520), who were called Myrmidones (*μύρμηκες*=ants). Aeacus ruled over his people with such justice and impartiality that after his death he was made judge of the lower world together with Minos and Rhadamanthus. By his wife Endeis he was the father of Telamon and Peleus. His successful prayer to Zeus for rain at a time of drought (Isocrates, *Evagoras*, 14) was commemorated by a temple at Aegina (Pausanias ii. 29). He himself erected a temple to Zeus Panhellenios and helped Poseidon and Apollo to build the walls of Troy.

See Hutchinson, *Aeacus*, 1901.

AECLANUM, an ancient town of Samnium, Italy, 15 m. E.S.E. of Beneventum, on the Via Appia (near the modern Mirabella). It became the chief town of the Hirpini after Beneventum had become a Roman colony. Sulla captured it in 89 B.C. by setting on fire the wooden breastwork by which it was defended, and new fortifications were erected. Hadrian, who repaired the Via Appia from Beneventum to this point, made it a colony; it has ruins of the city walls, of an aqueduct, baths and an amphitheatre; nearly 400 inscriptions have also been discovered. Two different routes to Apulia diverged at this point, one (Via Aurelia Aeclanensis) leading through the modern Ariano to Herdoniae, the other (the Via Appia of the Empire) passing the Lacus Ampsanctus and going on to Aquilonia and Venusia; while the road from Aeclanum to Abellinum (mod. Avellini) may also follow an ancient line. H. Nissen (*Italische Landeskunde*, Berlin, 1902, ii. 819) speaks of another road, which he believes to have been that followed by Horace, from Aeclanum to Trevicum and thence to Ausculum; but Th. Mommsen (*Corpus Inscrip. Lat.*, Berlin, 1883, ix. 602) is more likely to be right in supposing that the road taken by Horace ran directly from Beneventum to Trevicum and thence to Aquilonia (though the course of this road is not yet determined in detail), and that the easier, though somewhat longer, road by Aeclanum was of later date.

AEDESIUS (d. A.D. 355), Neoplatonist philosopher, was born of a noble Cappadocian family. He migrated to Syria, attracted by the lectures of Iamblichus, whose follower he became. According to Eunapius, he differed from Iamblichus on certain points connected with magic. He taught at Pergamum, his chief disciples being Eusebius and Maximus. He seems to have modified his doctrines through fear of Constantine.

See Ritter and Preller, 552; Ritter's *Geschichte der Philosophie*; T. Whittaker, *The Neoplatonists* (Cambridge, 1901).

AEDICULA (diminutive of Lat. *aedis* or *aedes*, a temple or house), a small house or temple,—a household shrine holding small altars or the statues of the Lares and Penates.

AEDILE (Lat. *aedilis*), in Roman antiquities, the name of certain Roman magistrates, probably derived from *aedis* (a temple), because they had the care of the temple of Ceres, where the plebeian archives were kept. They were originally two in number, called " plebeian " aediles. They were created in the same year as the tribunes of the people (494 B.C.), their persons were sacrosanct or inviolable, and (at least after 471) they were elected at the Comitia Tributa out of the plebeians alone. Originally intended as assistants to the tribunes, they exercised certain police functions, were empowered to inflict fines and managed the plebeian and Roman games. According to Livy (vi. 42), after the passing of the Licinian rogations, an extra day was added to the Roman games; the aediles refused to bear the additional expense, whereupon the patricians offered to undertake it, on condition that they were admitted to the aedileship. The plebeians accepted the offer, and accordingly two " curule " aediles were appointed—at first from the patricians alone, then from patricians and plebeians in turn, lastly, from either—at the Comitia Tributa under the presidency of the consul. Although not sacrosanct, they had the right of sitting in a curule chair and wore the distinctive toga praetexta. They took over the management of the Roman and Megalesian games, the care of the patrician temples and had the right of issuing edicts as superintendents of the markets. But although the curule aediles always ranked higher than the plebeian, their functions gradually approximated and became practically identical.

Cicero (*Legg.* iii. 3, 7) divides these functions under three heads:—(1) *Care of the city*: the repair and preservation of temples, sewers and aqueducts; street cleansing and paving; regulations regarding traffic, dangerous animals and dilapidated buildings; precautions against fire; superintendence of baths and taverns; enforcement of sumptuary laws; punishment of gamblers and usurers; the care of public morals generally, including the prevention of foreign superstitions. They also punished those who had too large a share of the *ager publicus*, or kept too many cattle on the state pastures. (2) *Care of provisions*: investigation of the quality of the articles supplied and the correctness of weights and measures; the purchase of corn for disposal at a low price in case of necessity. (3) *Care of the games*: superintendence and organization of the public games, as well as of those given by themselves and private individuals (*e.g.* at funerals) at their own expense. Ambitious persons often spent enormous sums in this manner to win the popular favour with a view to official advancement.

In 44 Caesar added two patrician aediles, called *Cereales*, whose special duty was the care of the corn-supply. Under Augustus the office lost much of its importance, its juridical functions and the care of the games being transferred to the praetor, while its city responsibilities were limited by the appointment of a praefectus urbi. In the 3rd century A.D. it disappeared altogether.

Authorities.—Schubert, *De Romanorum Aedilibus* (1828); Hoffmann, *De Aedilibus Romanis* (1842); Göll, *De Aedilibus sub Caesarum Imperio* (1860); Labatut, *Les Édiles et les mœurs* (1868); Marquardt-Mommsen, *Handbuch der römischen Altertümer*, ii. (1888); Soltau, *Die ursprüngliche Bedeutung und Competenz der Aediles Plebis* (Bonn, 1882).

AEDUI, Haedui or Hedui (Gr. *Αἴδουοι*), a Gallic people of Gallia Lugdunensis, who inhabited the country between the Arar (Saône) and Liger (Loire). The statement in Strabo (ii. 3. 192) that they dwelt between the Arar and Dubis (Doubs) is incorrect. Their territory thus included the greater part of the modern departments of Saône-et-Loire, Côte d'Or and Nièvre. According to Livy (v. 34), they took part in the expedition of Bellovesus into Italy in the 6th century B.C. Before Caesar's time they had attached themselves to the Romans, and were honoured with the title of brothers and kinsmen of the Roman people. When the Sequani, their neighbours on the other side of the Arar, with whom they were continually quarrelling, invaded their country and subjugated them with the assistance of a German chieftain named Ariovistus, the Aedui sent Divitiacus, the druid, to Rome to appeal to the senate for help, but his mission was unsuccessful. On his arrival in Gaul (58 B.C.), Caesar restored their independence. In spite of this, the Aedui joined the Gallic coalition against Caesar (*B.G.* vii. 42), but after the surrender of Vercingetorix at Alesia were glad to return to their allegiance. Augustus dismantled their native capital Bibracte on Mont Beuvray, and substituted a new town with a half-Roman, half-Gaulish name, Augustodunum (mod. Autun). During the reign of Tiberius (A.D. 21), they revolted under Julius Sacrovir, and seized Augustodunum, but were soon put down by Gaius Silius (Tacitus, *Ann.* iii. 43-46). The Aedui were the first of the Gauls to receive from the emperor Claudius the distinction of the *jus honorum*. The oration of Eumenius (*q.v.*), in which he pleaded for the restoration of the schools of his native place Augustodunum, shows that the district was neglected. The chief magistrate of the Aedui in Caesar's time was called *Vergobretus* (according to Mommsen, "judgment-worker"), who was elected annually, possessed powers of life and death, but was forbidden to go beyond the frontier. Certain *clientes*, or small communities, were also dependent upon the Aedui.

See A. E. Desjardins, *Géographie de la Gaule*, ii. (1876–1893); T. R. Holmes, *Caesar's Conquest of Gaul* (1899).

AEGADIAN ISLANDS (Ital. *Isole Egati*; anc. *Aegates Insulae*), a group of small mountainous islands off the western coast of Sicily, chiefly remarkable as the scene of the defeat of the Carthaginian fleet by C. Lutatius Catulus in 241 B.C., which ended the First Punic War. Favignana (Aegusa), the largest, pop. (1901) 6414, lies 10 m. S.W. of Trapani; Levanzo (Phorbantia) 8 m. W.; while Maritimo, the ancient ἱερὰ νῆσος, 15 m. W. of Trapani, is now reckoned as a part of the group. They belonged to the Pallavicini family of Genoa until 1874, when they were bought by Signor Florio of Palermo.

AEGEAN CIVILIZATION, the general term for the prehistoric civilization, previously called "Mycenaean" because its existence was first brought to popular notice by Heinrich Schliemann's excavations at Mycenae in 1876. Subsequent discoveries, however, have made it clear that Mycenae was not its chief centre in its earlier stages, or, perhaps, at any period; and, accordingly, it is more usual now to adopt a wider geographical title.

I. *History of Discovery and Distribution of Remains.*—Mycenae and Tiryns are the two principal sites on which evidence of a prehistoric civilization was remarked long ago by the classical Greeks. The curtain-wall and towers of the Mycenaean citadel, its gate with heraldic lions, and the great "Treasury of Atreus" had borne silent witness for ages before Schliemann's time; but they were supposed only to speak to the Homeric, or at farthest a rude Heroic beginning of purely Hellenic, civilization. It was not till Schliemann exposed the contents of the graves which lay just inside the gate (see MYCENAE), that scholars recognized the advanced stage of art to which prehistoric dwellers in the Mycenaean citadel had attained. There had been, however, a good deal of other evidence available before 1876, which, had it been collated and seriously studied, might have discounted the sensation that the discovery of the citadel graves eventually made. Although it was recognized that certain tributaries, represented *e.g.* in the XVIIIth Dynasty tomb of Rekhmara at Egyptian Thebes as bearing vases of peculiar forms, were of some Mediterranean race, neither their precise habitat nor the degree of their civilization could be determined while so few actual prehistoric remains were known in the Mediterranean lands. Nor did the Aegean objects which were lying obscurely in museums in 1870, or thereabouts, provide a sufficient test of the real basis underlying the Hellenic myths of the Argolid, the Troad and Crete, to cause these to be taken seriously. Both at Sèvres and Neuchâtel Aegean vases have been exhibited since about 1840, the provenience being in the one case Phylakope in Melos, in the other Cephalonia. Ludwig Ross, by his explorations in the Greek islands from 1835 onwards, called attention to certain early intaglios, since known as *Inselsteine*; but it was not till 1878 that C. T. Newton demonstrated these to be no strayed Phoenician products. In 1866 primitive structures were discovered in the island of Therasia by quarrymen extracting pozzolana for the Suez Canal works; and when this discovery was followed up in 1870, on the neighbouring Santorin (Thera), by representatives of the French School at Athens, much pottery of a class now known immediately to precede the typical late Aegean ware, and many stone and metal objects, were found and dated by the geologist Fouqué, somewhat arbitrarily, to 2000 B.C., by consideration of the superincumbent eruptive stratum. Meanwhile, in 1868, tombs at Ialysus in Rhodes had yielded to M. A. Biliotti many fine painted vases of styles which were called later the third and fourth "Mycenaean"; but these, bought by John Ruskin, and presented to the British Museum, excited less attention than they deserved, being supposed to be of some local Asiatic fabric of uncertain date. Nor was a connexion immediately detected between them and the objects found four years later in a tomb at Menidi in Attica and a rock-cut "bee-hive" grave near the Argive Heraeum.

Even Schliemann's first excavations at Hissarlik in the Troad (*q.v.*) did not excite surprise. But the "Burnt City" of his second stratum, revealed in 1873, with its fortifications and vases, and a hoard of gold, silver and bronze objects, which the discoverer connected with it, began to arouse a curiosity which was destined presently to spread far outside the narrow circle of scholars. As soon as Schliemann came on the Mycenae graves three years later, light poured from all sides on the prehistoric period of Greece. It was recognized that the character of both the fabric and the decoration of the Mycenaean objects was not that of any well-known art. A wide range in space was proved by the identification of the *Inselsteine* and the Ialysus vases with the new style, and a wide range in time by collation of the earlier Theraean and Hissarlik discoveries. A relation between objects of art described by Homer and the Mycenaean treasure was generally allowed, and a correct opinion prevailed that, while certainly posterior, the civilization of the *Iliad* was reminiscent of the Mycenaean. Schliemann got to work again at Hissarlik in 1878, and greatly increased our knowledge of the lower strata, but did not recognize the Aegean remains in his "Lydian" city of the sixth stratum, which were not to be fully revealed till Dr W. Dörpfeld resumed the work at Hissarlik in 1892 after the first explorer's death (see TROAD). But by laying bare in 1884 the upper stratum of remains on the rock of Tiryns (*q.v.*), Schliemann made a contribution to our knowledge of prehistoric domestic life which was amplified two years later by Chr. Tsountas's discovery of the Mycenae palace. Schliemann's work at Tiryns was not resumed till 1905, when it was proved, as had long been suspected, that an earlier palace underlies the one he had exposed. From 1886 dates the finding of Mycenaean sepulchres outside the Argolid, from which, and from the continuation of Tsountas's exploration of the buildings and lesser graves at Mycenae, a large treasure, independent of Schliemann's princely gift, has been gathered into the National Museum at Athens. In that year were excavated dome-tombs, most already rifled but retaining some of their furniture, at Arkina and Eleusis in Attica, at Dimini near Volo in Thessaly, at Kampos on the west of Mount Taygetus, and at Maskarata in Cephalonia. The richest grave of all was explored at Vaphio in Laconia in 1889, and yielded, besides many gems and miscellaneous goldsmiths' work, two golden goblets chased with scenes of bull-hunting, and certain broken vases painted in a large bold style which remained an enigma till the excavation of Cnossus. In 1890 and 1893 Staës cleared out certain less rich dome-tombs at Thoricus in Attica; and other graves, either rock-cut "bee-hives" or chambers, were found at Spata and Aphidna in Attica, in Aegina and Salamis, at the Heraeum (see ARGOS) and Nauplia in the Argolid, near Thebes and Delphi, and not far from the Thessalian Larissa. During the excavations on the Acropolis at Athens, terminated in 1888, many potsherds of the Mycenaean style were found; but Olympia had yielded either none, or such as had not been recognized before being thrown away, and the temple site at Delphi produced nothing distinctively Aegean. The American explorations of the Argive Heraeum, concluded in 1895, also failed to prove that site to have been important in the prehistoric time, though, as was to be expected from its neighbourhood to Mycenae itself, there were traces of occupation in the later Aegean periods. Prehistoric research had now begun to extend beyond the Greek mainland. Certain central Aegean islands, Antiparos, Ios, Amorgos, Syros and Siphnos, were all found to be singularly rich in evidence of the middle-Aegean period. The series of Syran built graves, containing crouching corpses, is the best and most representative that is known in the Aegean. Melos, long marked as a source of early objects, but not systematically excavated until taken in hand by the British School at Athens in 1896, yielded at Phylakope remains of all the Aegean periods, except the Neolithic. A map of Cyprus in the later Bronze Age (such as is given by J. L. Myres and M. O. Richter in *Catalogue of the Cyprus Museum*) shows more than five-and-twenty settlements in and about the Mesaoréa district alone, of which one, that at Enkomi, near the site of Salamis, has yielded the richest Aegean treasure in precious metal found outside Mycenae. E. Chantre in 1894 picked up lustreless ware, like that of Hissarlik, in central Phrygia and at Pteria (*q.v.*), and the English archaeological expeditions, sent subsequently into north-western Anatolia, have never failed to bring back ceramic specimens of Aegean appearance from the valleys of the Rhyndacus, Sangarius and Halys. In Egypt in 1887 W. M. F. Petrie found painted sherds of Cretan style at Kahun in the Fayum, and farther up the Nile, at Tell el-Amarna, chanced on bits of no fewer than 800 Aegean vases in 1889. There have now been recognized in the collections at Cairo, Florence, London, Paris and Bologna several Egyptian imitations of the Aegean style which can be set off against the many debts which the centres of Aegean culture owed to Egypt. Two Aegean vases were found at Sidon in 1885, and many fragments of Aegean and especially Cypriote pottery have been turned up during recent excavations of sites in Philistia by the Palestine Fund. South-eastern Sicily, ever since P. Orsi excavated the Sicel cemetery near Lentini in 1877, has proved a mine of early remains, among which appear in regular succession Aegean fabrics and motives of decoration from the period of the second stratum at Hissarlik. Sardinia has Aegean sites, *e.g.* at Abini near Teti; and Spain has yielded objects recognized as Aegean from tombs near Cadiz and from Saragossa. One land, however, has eclipsed all others in the Aegean by the wealth of its remains of all the prehistoric ages, viz. Crete, so much so that, for the present, we must regard it as the fountain-head of Aegean civilization, and probably for long its political and social centre. The island first attracted the notice of archaeologists by the remarkable archaic Greek bronzes found in a cave on Mount Ida in 1885, as well as by epigraphic monuments such as the famous law of Gortyna; but the first undoubted Aegean remains reported from it were a few objects extracted from Cnossus by Minos Kalokhairinos of Candia in 1878. These were followed by certain discoveries made in the S. plain (Messará) by F. Halbherr. W. J. Stillman and H. Schliemann both made unsuccessful attempts at Cnossus, and A. J. Evans, coming on the scene in 1893, travelled in succeeding years about the island picking up trifles of unconsidered evidence, which gradually convinced him that greater things would eventually be found. He obtained enough to enable him to forecast the discovery of written characters, till then not suspected in Aegean civilization. The revolution of 1897–98 opened the door to wider knowledge, and much exploration has ensued, for which see CRETE. Thus the "Aegean Area" has now come to mean the Archipelago with Crete and Cyprus, the Hellenic peninsula with the Ionian isles, and Western Anatolia. Evidence is still wanting for the Macedonian and Thracian coasts. Offshoots are found in the W. Mediterranean, in Sicily, Italy, Sardinia and Spain, and in the E. in Syria and Egypt. About the Cyrenaica we are still insufficiently informed.

II. *General Nature of the Evidence.*—For details of monumental evidence the articles on CRETE, MYCENAE, TIRYNS, TROAD, CYPRUS, &c., must be consulted. The most representative site explored up to now is Cnossus (see CRETE, sect. *Archaeology*), which has yielded not only the most various but the most continuous evidence from the Neolithic age to the twilight of classical civilization. Next in importance come Hissarlik, Mycenae, Phaestus, Hagia, Triada, Tiryns, Phylakope, Palaikastro and Gournia.

A. The *internal* evidence at present available comprises—

(1) *Structures.*—Ruins of palaces, palatial villas, houses, built dome- or cist-graves and fortifications (Aegean isles, Greek mainland and N.W. Anatolia), but not distinct temples; small shrines, however, and *temenê* (religious enclosures, remains of one of which were probably found at Petsofa near Palaikastro by J. L. Myres in 1904) are represented on intaglios and frescoes. From like sources and from inlay-work we have also representations of palaces and houses.

(2) *Structural Decoration.*—Architectural features, such as columns, friezes and various mouldings; mural decoration, such as fresco-paintings, coloured reliefs and mosaic inlay.

(3) *Furniture.*—(*a*) *Domestic*, such as vessels of all sorts and in many materials, from huge store-jars down to tiny unguent-pots; culinary and other implements; thrones, seats, tables, &c., these all in stone or plastered terra-cotta. (*b*) *Sacred*, such as models or actual examples of ritual objects; of these we have also numerous pictorial representations. (*c*) *Funerary*, *e.g.* coffins in painted terra-cotta.

(4) *Artistic fabrics*, *e.g.* plastic objects, carved in stone or ivory, cast or beaten in metals (gold, silver, copper and bronze), or modelled in clay, faience, paste, &c. Very little trace has yet been found of large free sculpture, but many examples exist of sculptors' smaller work. Vases of all kinds, carved in marble or other stones, cast or beaten in metals or fashioned in clay, the latter in enormous number and variety, richly ornamented with coloured schemes, and sometimes bearing moulded decoration. Examples of painting on stone, opaque and transparent. Engraved objects in great number, *e.g.* ring-bezels and gems; and an immense quantity of clay impressions, taken from these.

(5) *Weapons, tools and implements*, in stone, clay and bronze, and at the last iron, sometimes richly ornamented or inlaid. Numerous representations also of the same. No actual body-armour, except such as was ceremonial and buried with the dead, like the gold breastplates in the circle-graves at Mycenae.

(6) *Articles of personal use*, *e.g.* brooches (*fibulae*), pins, razors, tweezers, &c., often found as dedications to a deity, *e.g.* in the Dictaean Cavern of Crete. No textiles have survived.

(7) *Written documents*, *e.g.* clay tablets and discs (so far in Crete only), but nothing of more perishable nature, such as skin, papyrus, &c.; engraved gems and gem impressions; legends written with pigment on pottery (rare); characters incised on stone or pottery. These show two main systems of script (see CRETE).

(8) *Excavated tombs*, of either the pit or the grotto kind, in which the dead were laid, together with various objects of use and luxury, without cremation, and in either coffins or *loculi* or simple wrappings.

(9) *Public works*, such as paved and stepped roadways, bridges, systems of drainage, &c.

B. There is also a certain amount of *external* evidence to be gathered from—

(1) Monuments and records of other contemporary civilizations, *e.g.* representations of alien peoples in Egyptian frescoes; imitation of Aegean fabrics and style in non-Aegean lands; allusions to Mediterranean peoples in Egyptian, Semitic or Babylonian records.

(2) Literary traditions of subsequent civilizations, especially the Hellenic, such as, *e.g.*, those embodied in the Homeric poems, the legends concerning Crete, Mycenae, &c.; statements as to the origin of gods, cults and so forth, transmitted to us by Hellenic antiquarians such as Strabo, Pausanias, Diodorus Siculus, &c.

(3) Traces of customs, creeds, rituals, &c., in the Aegean area at a later time, discordant with the civilization in which they were practised and indicating survival from earlier systems. There are also possible linguistic and even physical survivals to be considered.

III. *General Features of Aegean Civilization.*—The leading features of Aegean civilization, as deduced from the evidence, must be stated very briefly.

(1) *Political Organization.*—The great Cretan palaces and the fortified citadels of Mycenae, Tiryns and Hissarlik, each

AEGEAN CIVILIZATION

PLATE I

GRAPHIC ART

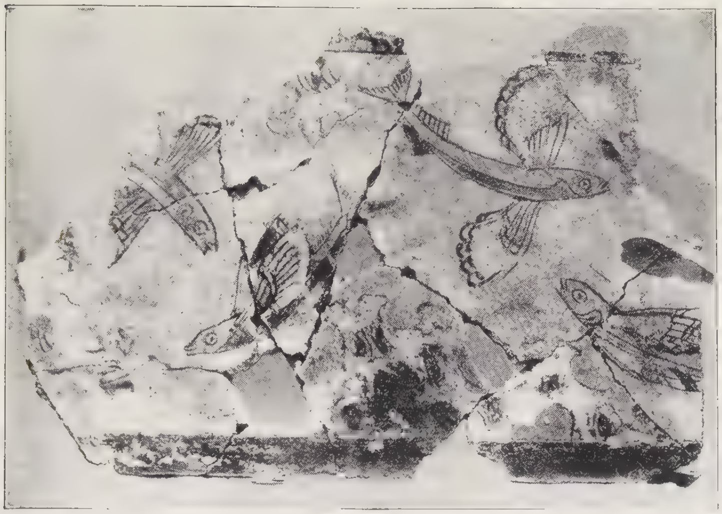


FIG. 1.—FLYING FISH FRESCO, PHYLAKOPI.
Cf. *J.H.S.* Suppl. Papers, iv.

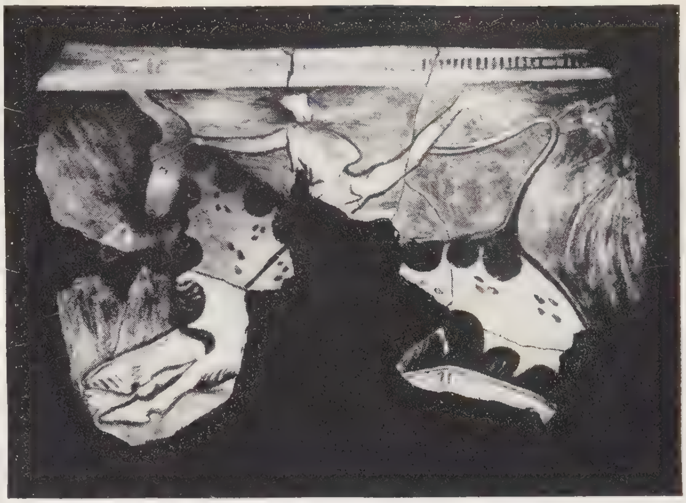


FIG. 2.—BULL, WITH LEAPING BULL-FIGHTER, TIRYNS.
Cf. Schliemann, *Tiryns*, Plate XIII.

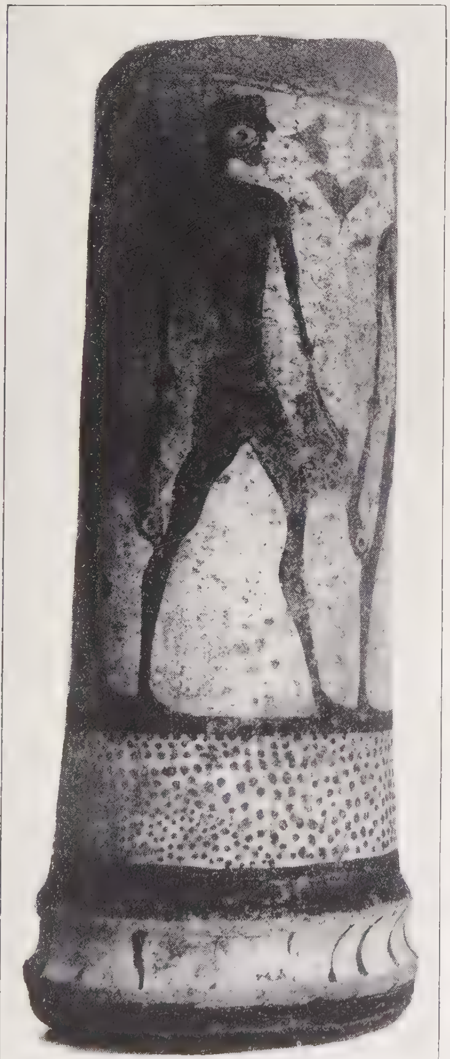


FIG. 3.—LAMP-STAND, PHYLAKOPI.
Cf. *J.H.S.* Suppl. Papers, iv. Plate XXII.

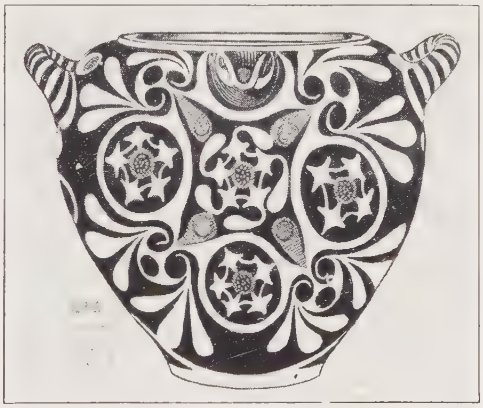


FIG. 4.—MIDDLE MINOAN VASE, CNOSSUS.
B.S.A. ix. 120, Fig. 75.

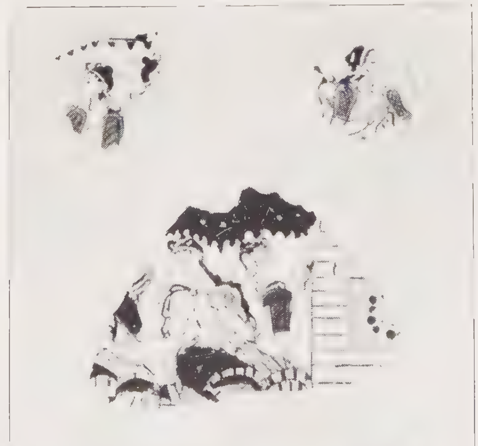


FIG. 5.—MINIATURE FRESCOES, SHOWING SPECTATORS AT ATHLETIC SPORTS, CNOSSUS.
From Photo by Dr A. J. Evans.

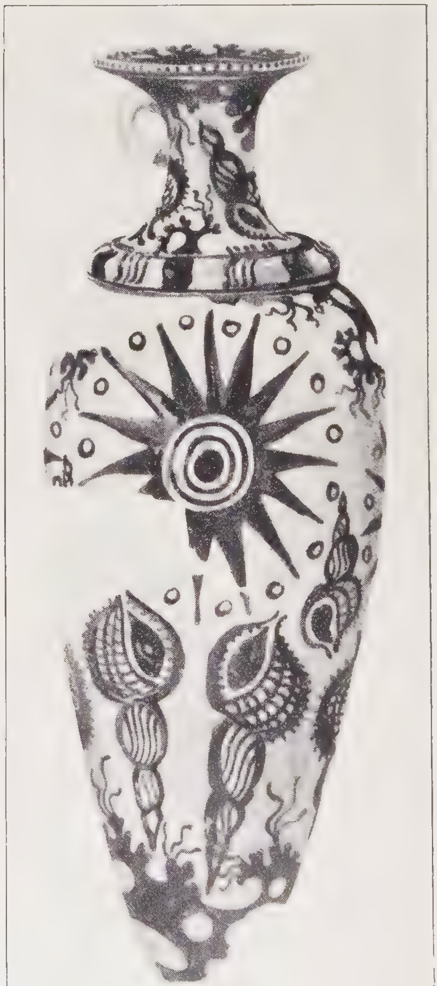


FIG. 6.—FILLER VASE, ZAKRO
J.H.S. vol. xxii. Plate XII.

By permission of the Society for the Promotion of Hellenic Studies.

AEGEAN CIVILIZATION

PLASTIC ART

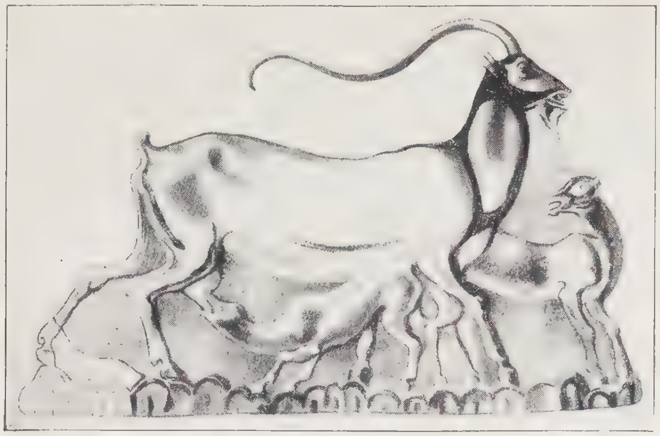


Fig. 1.—FAIENCE PLAGUE, CNOSSUS.

B.S.A. ix. Plate III.

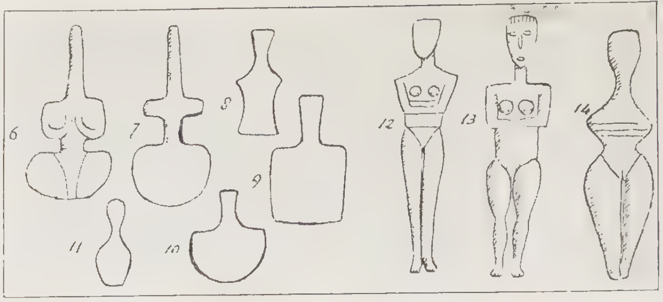


Fig. 2.—MARBLE IDOLS, AMORGOS; 6–11 FIDDLE AND MALLET TYPES, 12–14, DEVELOPED TYPES

Man, 1901, 185, No 146

By permission of the Royal Anthropological Institute.

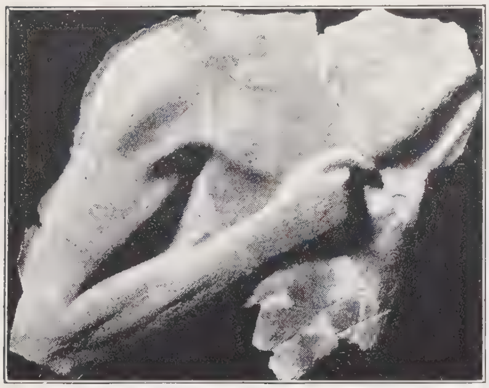


Fig. 3.—COLOURED BAS-RELIEF IN *GESSO DURO*, REPRESENTING MALE FOSSO WITH *FLEUR-DE-LIS* COLLAR.

B.S.A. vii. 17 Fig. 6.

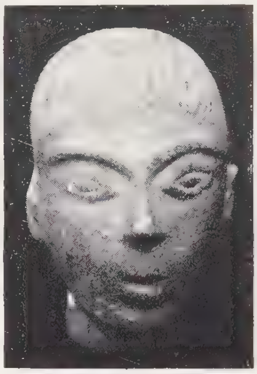


Fig. 4.—MARBLE HEAD FROM AMORGOS (ASHMOLEAN MUSEUM).

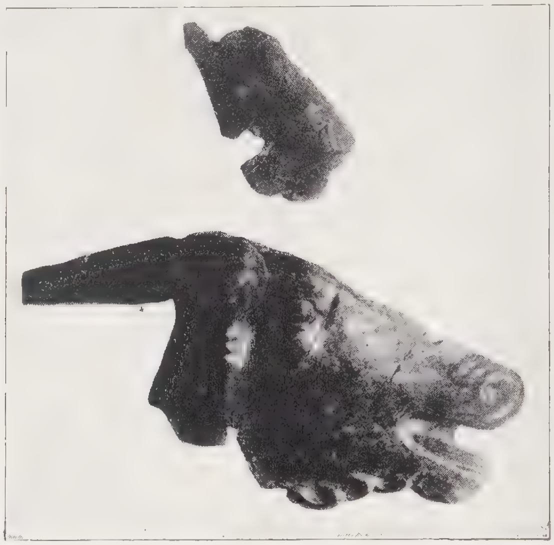
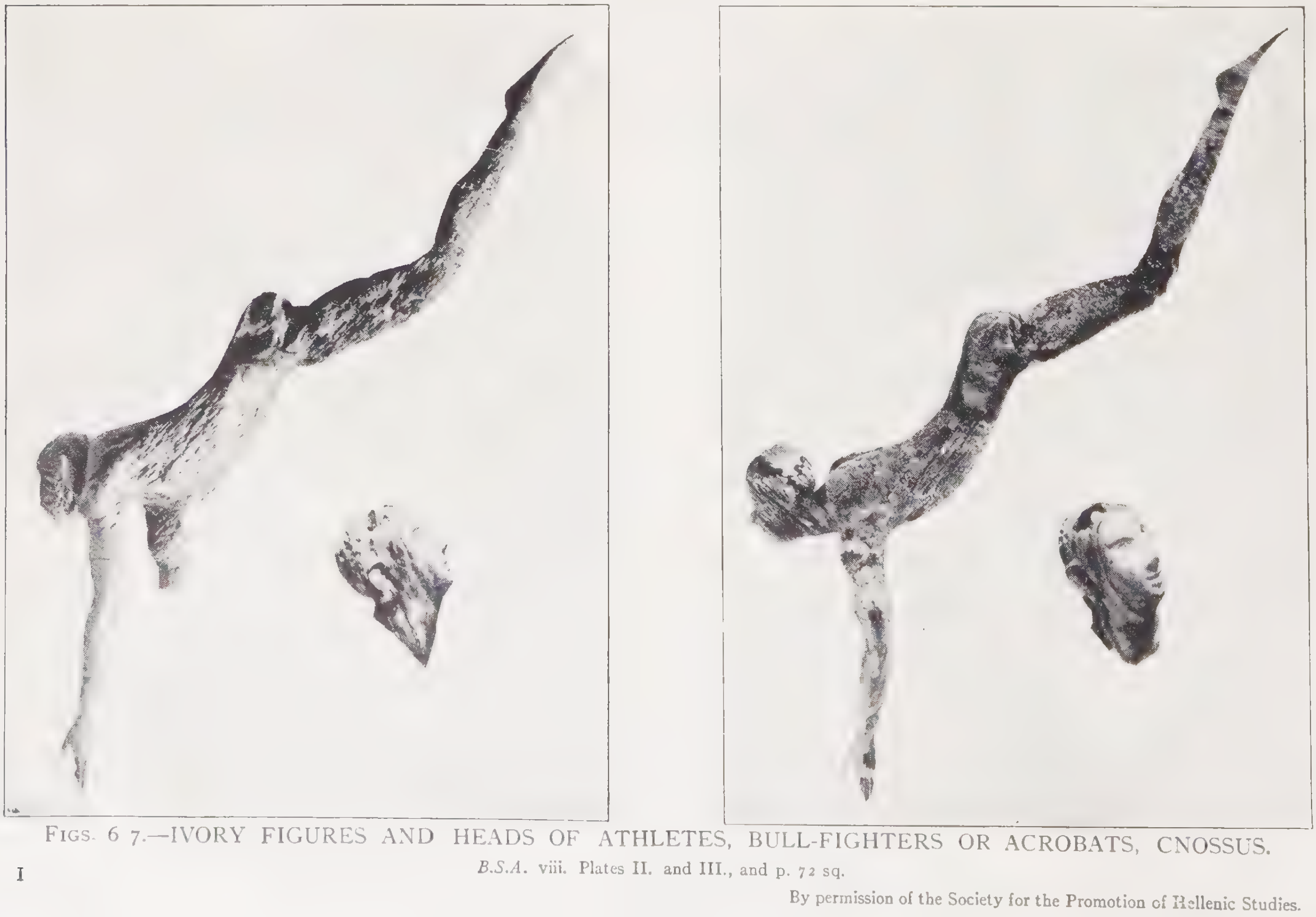


Fig. 5.—BULL IN PAINTED PLASTER, CNOSSUS.

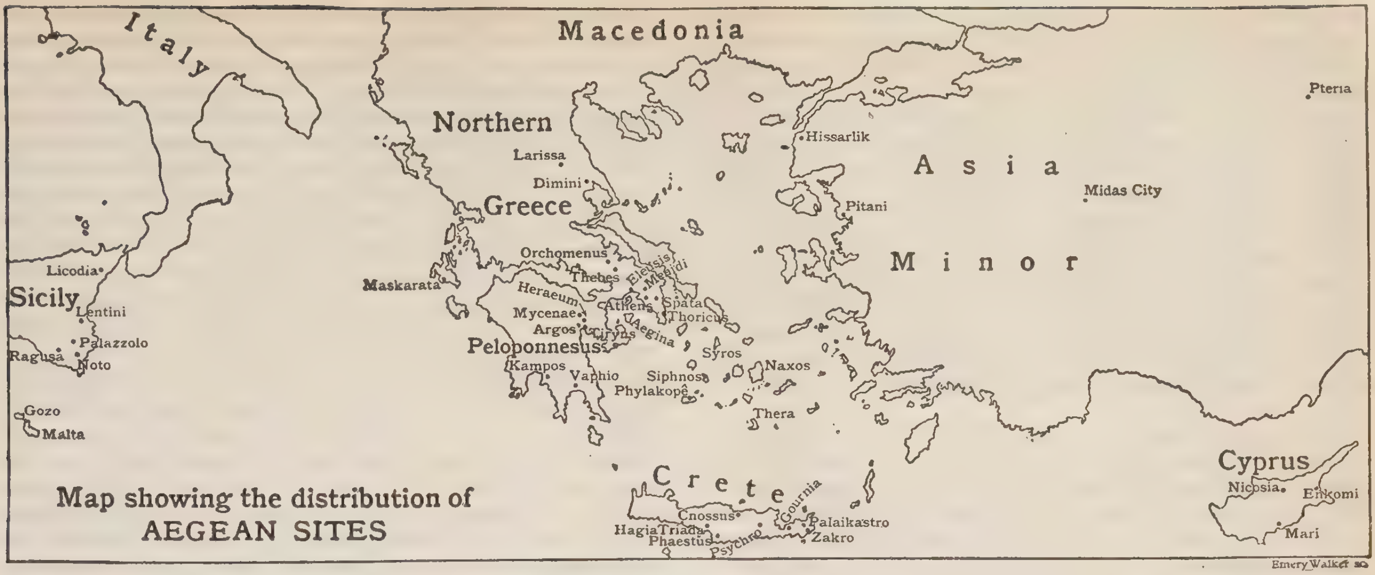
Photo by Dr A. J. Evans.



Figs. 6 7.—IVORY FIGURES AND HEADS OF ATHLETES, BULL-FIGHTERS OR ACROBATS, CNOSSUS.

B.S.A. viii. Plates II. and III., and p. 72 sq.

By permission of the Society for the Promotion of Hellenic Studies.



Map showing the distribution of
AEGEAN SITES

Emery Walker sc.

containing little more than one great residence, and dominating lower towns of meaner houses, point to monarchy at all periods. Independent local developments of art before the middle of the 2nd millennium B.C. suggest the early existence of independent units in various parts, of which the strongest was the Cnossian. After that date the evidence goes strongly to show that one political dominion was spread for a brief period, or for two brief periods, over almost all the area (see later). The great number of tribute-tallies found at Cnossus perhaps indicates that the centre of power was always there.

(2) *Religion.*—The fact that shrines have so far been found within palaces and not certainly anywhere else indicates that the kings kept religious power in their own hands; perhaps they were themselves high-priests. Religion in the area seems to have been essentially the same everywhere from the earliest period, viz. the cult of a Divine Principle, resident in dominant features of nature (sun, stars, mountains, trees, &c.) and controlling fertility. This cult passed through an aniconic stage, from which fetishes survived to the last, these being rocks or pillars, trees, weapons (*e.g. bipennis*, or double war-axe, shield), &c. When the iconic stage was reached, about 2000 B.C., we find the Divine Spirit represented as a goddess with a subordinate young god, as in many other E. Mediterranean lands. The god was probably son and mate of the goddess, and the divine pair represented the genius of Reproductive Fertility in its relations with humanity. The goddess sometimes appears with doves, as uranic, at others with snakes, as chthonic. In the ritual fetishes, often of miniature form, played a great part: all sorts of plants and animals were sacred: sacrifice (not burnt, and human very doubtful), dedication of all sorts of offerings and *simulacra*, invocation, &c., were practised. The dead, who returned to the Great Mother, were objects of a sort of hero-worship. This early nature-cult explains many anomalous features of Hellenic religion, especially in the cults of Artemis and Aphrodite. (See CRETE.)

(3) *Social Organization.*—There is a possibility that features of a primeval matriarchate long survived; but there is no certain evidence. Of the organization of the people under the monarch we are ignorant. There are so few representations of armed men that it seems doubtful if there can have been any professional military class. Theatral structures found at Cnossus and Phaestus, within the precincts of the palaces, were perhaps used for shows or for sittings of a royal assize, rather than for popular assemblies. The Cnossian remains contain evidence of an elaborate system of registration, account-keeping and other secretarial work, which perhaps indicates a considerable body of law. The life of the ruling class was comfortable and even luxurious from early times. Fine stone palaces, richly decorated, with separate sleeping apartments, large halls, ingenious devices for admitting light and air, sanitary conveniences and marvellously modern arrangements for supply of water and for drainage, attest this fact. Even the smaller houses, after the Neolithic period, seem also to have been of stone, plastered within. After 1600 B.C. the palaces in Crete had more than one story, fine stairways, bath-chambers, windows, folding and sliding doors, &c. In this later period, the distinction of blocks of apartments in some palaces has been held to indicate the seclusion of women in *harems*, at least among the ruling caste. Cnossian frescoes show women grouped apart, and they appear alone on gems. Flesh and fish and many kinds of vegetables were evidently eaten, and wine and beer were drunk. Vessels for culinary, table, and luxurious uses show an infinite variety of form and purpose. Artificers' implements of many kinds were in use, bronze succeeding obsidian and other hard stones as the material. Seats are found carefully shaped to the human person. There was evidently olive- and vine-culture on a large scale in Crete at any rate. Chariots were in use in the later period, as is proved by the pictures of them on Cretan tablets, and therefore, probably, the horse also was known. Indeed a horse appears on a gem impression. Main ways were paved. Sports, probably more or less religious, are often represented, *e.g.* bull-fighting, dancing, boxing, armed combats.

(4) *Commerce* was practised to some extent in very early times, as is proved by the distribution of Melian obsidian over all the Aegean area and by the Nilotic influence on early Minoan art. We find Cretan vessels exported to Melos, Egypt and the Greek mainland. Melian vases came in their turn to Crete. After 1600 B.C. there is very close intercourse with Egypt, and Aegean things find their way to all coasts of the Mediterranean (see below). No traces of currency have come to light, unless certain axe-heads, too slight for practical use, had that character; but standard weights have been found, and representations of ingots. The Aegean written documents have not yet proved (by being found outside the area) epistolary correspondence with other lands. Representations of ships are not common, but several have been observed on Aegean gems, gem-sealings and vases. They are vessels of low free-board, with masts. Familiarity with the sea is proved by the free use of marine motives in decoration.

(5) *Treatment of the Dead.*—The dead in the earlier period were laid (so far as we know at present) within cists constructed of upright stones. These were sometimes inside caves. After the burial the cist was covered in with earth. A little later, in Crete, bone-pits seem to have come into use, containing the remains of many burials. Possibly the flesh was boiled off the bones at once ("scarification"), or left to rot in separate cists awhile; afterwards the skeletons were collected and the cists

re-used. The coffins are of small size, contain corpses with the knees drawn up to the chin and are found in excavated chambers or pits. In the later period a peculiar "bee-hive" tomb became common, sometimes wholly or partly excavated, sometimes (as in the magnificent Mycenaean "Treasuries") constructed domewise. The shaft-graves in the Mycenae circle are also a late type, paralleled in the later Cnossian cemetery. The latest type of tomb is a flatly vaulted chamber approached by a horizontal or slightly inclined way, whose sides converge above. At no period do the Aegean dead seem to have been burned. Weapons, food, water, unguents and various trinkets were laid with the corpse at all periods. In the Mycenae circle an altar seems to have been erected over the graves, and perhaps slaves were killed to bear the dead chiefs company. A painted sarcophagus, found at Hagia Triada, also possibly shows a hero-cult of the dead.

(6) *Artistic Production.*—Ceramic art reached a specially high standard in fabric, form and decoration by the middle of the 3rd millennium B.C. in Crete. The products of that period compare favourably with any potters' work in the world. The same may be said of fresco-painting, and probably of metal work. Modelling in terra-cotta, sculpture in stone and ivory, engraving on gems, were following it closely by the beginning of the 2nd millennium. After 2000 B.C. all these arts revived, and sculpture, as evidenced by relief work, both on a large and on a small scale, carved stone vessels, metallurgy in gold, silver and bronze, advanced farther. This art and those of fresco- and vase-painting and of gem-engraving stood higher about the 15th century B.C. than at any subsequent period before the 6th century. The manufacture, modelling and painting of faience objects, and the making of inlays in many materials were also familiar to Aegean craftsmen, who show in all their best work a strong sense of natural form and an appreciation of ideal balance and decorative effect, such as are seen in the best products of later Hellenic art. Architectural ornament was also highly developed. The richness of the Aegean capitals and columns may be judged by those from the "Treasury of Atreus" now set up in the British Museum; and of the friezes we have examples in Mycenaean and Cnossian fragments, and Cnossian paintings. The magnificent gold work of the later period, preserved to us at Mycenae and Vaphio, needs only to be mentioned. It should be compared with stone work in Crete, especially the steatite vases with reliefs found at Hagia Triada. On the whole, Aegean art, at its two great periods, in the middle of the 3rd and 2nd millennia respectively, will bear comparison with any contemporary arts.

IV. *Origin, Nature and History of Aegean Civilization.*—The evidence, summarized above, though very various and voluminous, is not yet sufficient to answer all the questions which may be asked as to the origin, nature and history of this civilization, or to answer any but a few questions with absolute certainty. We shall try to indicate the extent to which it can legitimately be applied.

A. *Distinctive Features.*—The fact that Aegean civilization is distinguished from all others, prior or contemporary, not only by its geographical area, but by leading organic characteristics, has never been in doubt, since its remains came to be studied seriously and impartially. The truth was indeed obscured for a time by persistent prejudices in favour of certain alien Mediterranean races long known to have been in relation with the Aegean area in prehistoric times, *e.g.* the Egyptians and especially the Phoenicians. But their claims to be the principal authors of the Aegean remains grew fainter with every fresh Aegean discovery, and every new light thrown on their own proper products; with the Cretan revelations they ceased altogether to be considered except by a few Homeric enthusiasts. Briefly, we now know that the Aegean civilization developed these distinctive features. (1) *An indigenous script* expressed in characters of which only a very small percentage are identical, or even obviously connected, with those of any other script. This is equally true both of the pictographic and the linear Aegean systems. Its nearest affinities are with the "Asianic" scripts, preserved to us by Hittite, Cypriote and south-west Anatolian (Pamphylian, Lycian and Carian) inscriptions. But neither are these affinities close enough to be of any practical aid in deciphering Aegean characters, nor is it by any means certain that there is parentage. The Aegean script may be, and probably is, prior in origin to the "Asianic"; and it may equally well be owed to a remote common ancestor, or (the small number of common characters being considered) be an entirely independent evolution from representations of natural objects (see CRETE). (2) *An Art,* whose products cannot be confounded with those of any other known art by a trained eye. Its obligations to other contemporary arts are many and obvious, especially in its later stages; but every borrowed form and motive undergoes an essential modification at the hands of the Aegean craftsman, and the product is stamped with a new character. The secret of this character lies evidently in a constant attempt to express an ideal in forms more and more closely approaching to realities. We detect the dawn of that spirit which afterwards animated Hellenic art. The fresco-paintings, ceramic motives, reliefs, free sculpture and toreutic handiwork of Crete have supplied the clearest proof of it, confirming the impression already created by the goldsmiths' and painters' work of the Greek mainland (Mycenae, Vaphio, Tiryns). (3) *Architectural plans and decoration.* The arrangement of Aegean palaces is of two main types. First (and perhaps earliest in time), the chambers are grouped round a central court, being engaged one with the other in a labyrinthine complexity, and the greater oblongs are entered from a long side and divided longitudinally by pillars. Second, the main chamber is of what is known as the *megaron* type, *i.e.* it stands free, isolated from the rest of the plan by corridors, is entered from a vestibule on a short side, and has a central hearth, surrounded by pillars and perhaps hypaethral; there is no central court, and other apartments form distinct blocks. For possible geographical reasons for this duality of type see CRETE. In spite of many comparisons made with Egyptian, Babylonian and "Hittite" plans, both these arrangements remain incongruous with any remains of prior or contemporary structures elsewhere. Whether either plan suits the "Homeric palace" does not affect the present question. (4) *A type of tomb,* the dome or "bee-hive," of which the grandest examples known are at Mycenae. The Cretan "larnax" coffins, also, have no parallels outside the Aegean. There are other infinite singularities of detail; but the above are more than sufficient to establish the point.

B. *Origin and Continuity.*—With the immense expansion of the evidence, due to the Cretan excavations, a question has arisen how far the Aegean civilization, whose total duration covers at least three thousand years, can be regarded as one and continuous. Thanks to the exploration of Cnossus, we now know that Aegean civilization had its roots in a primitive Neolithic period, of uncertain but very long duration, represented by a stratum which (on that site in particular) is in places nearly 20 ft. thick, and contains stone implements and sherds of hand-made and hand-polished vessels, showing a progressive development in technique from bottom to top. This Cnossian stratum seems to be throughout earlier than the lowest layer at Hissarlik. It closes with the introduction of incised, white-filled decoration on pottery, whose motives are presently found reproduced in monochrome pigment. We are now in the beginning of the Bronze Age, and the first of Evans's "Minoan" periods (see CRETE). Thereafter, by exact observation of stratification, eight more periods have been distinguished by the explorer of Cnossus, each marked by some important development in the universal and necessary products of the potter's art, the least destructible and therefore most generally used archaeological criterion. These periods fill the whole Bronze Age, with whose close, by the introduction of the superior metal, iron, the Aegean Age is conventionally held to end. Iron came into general Aegean use about 1000 B.C., and possibly was the means by which a body of northern invaders established their power on the ruins of the earlier dominion. The important point is this, that throughout the nine Cnossian periods, following the Neolithic Age (named by Evans, "Minoan I. 1, 2, 3; II. 1, 2, 3; III. 1, 2, 3"; see CRETE), there is evidence of a perfectly orderly and continuous evolution in, at any rate, ceramic art. From one stage to another, fabrics, forms and motives of decoration develop gradually; so that, at the close of a span of more than two thousand years, at the least, the influences of the beginning can still be clearly seen and no trace of violent artistic intrusion can be detected. This fact, by itself, would go far to prove that the civilization continued fundamentally and essentially the same throughout. It is, moreover, supported by less abundant remains of other arts. That of painting in fresco, for instance, shows the same orderly development from at any rate Period II. 2 to the end. About institutions we have less certain knowledge, there being but little evidence for the earlier periods; but in the documents relating to religion, the most significant of all, it can at least be said that there is no trace of sharp change. We see evidence of a uniform Nature Worship passing through all the normal stages down to theoanthropism in the latest period. There is no appearance of intrusive deities or cult-ideas. We may take it then (and the fact is not disputed even by those who, like Dörpfeld, believe in one thorough racial change, at least, during the Bronze Age) that the Aegean civilization was indigenous, firmly rooted and strong enough to persist essentially unchanged and dominant in its own geographical area throughout the Neolithic and Bronze Ages. This conclusion can hardly entail less than a belief that, at any rate, the mass of those who possessed this civilization continued racially the same.

There are, however, in certain respects at certain periods, evidences of such changes as might be due to the intrusion of small conquering castes, which adopted the superior civilization of the conquered people and became assimilated to the latter. The earliest palace at Cnossus was built probably in Period II. 1 or 2. It was of the type mentioned first in the description of palace-plans above. Before Period III. 1 it was largely rebuilt, and arguments have been brought forward by Dörpfeld to show that features of the second type were then introduced. A similar rebuilding took place at the same epoch at Phaestus, and possibly at Hagia Triada. Now the second type, the "megaron" arrangement, characterizes peculiarly the palaces discovered in the north of the Aegean area, at Mycenae, Tiryns and Hissarlik, where up to the present no signs of the first type, so characteristic of Crete, have been observed. These northern "megara" are all of late date, none being prior to Minoan III. 1. At Phylakope, a "megaron" appears only in the uppermost Aegean stratum, the underlying structures being more in conformity with the earlier Cretan. At the same epoch a notable change took place in the Aegean script. The pictographic characters, found on seals and discs of Period II. in Crete, had given way entirely to a linear system by Period III. That system thenceforward prevailed exclusively, suffering a slight modification again in III. 2 and 3.

These and other less well marked changes, say some critics, are signs of a racial convulsion not long after 2000 B.C. An old race was conquered by a new, even if, in matters of civilization, the former *capta victorem cepit*. For these races respectively Dörpfeld suggests the names "Lycian" and "Carian," the latter coming in from the north Aegean, where Greek tradition remembered its former dominance. These names do not greatly help us. If we are to accept and profit by Dörpfeld's nomenclature, we must be satisfied that, in their later historic habitats, both Lycians and Carians showed unmistakable signs of having formerly possessed the civilizations attributed to them in prehistoric times—signs which research has hitherto wholly failed to find. The most that can be said to be capable of proof is the infiltration of some northern influence into Crete at the end of Minoan Period II.; but it probably brought about no change of dynasty and certainly no change in the prevailing race.

A good deal of anthropometric investigation has been devoted to human remains of the Aegean epoch, especially to skulls and bones found in Crete in tombs of Period II. The result of this, however, has not so far established more than the fact that the Aegean races, as a whole, belonged to the dark, long-headed *Homo Mediterraneus*, whose probable origin lay in mid-eastern Africa—a fact only valuable in the present connexion in so far as it tends to discredit an Asiatic source for Aegean civilization. Not enough evidence has been collected to affect the question of racial change during the Aegean period. From the skull-forms studied, it would appear, as we should expect, that the Aegean race was by no means pure even in the earlier Minoan periods. It only remains to be added that there is some ground for supposing that the language spoken in Crete before the later Doric was non-Hellenic, but Indo-European. This inference rests on three inscriptions in Greek characters but non-Greek language found in E. Crete. The language has some apparent affinities with Phrygian. The inscriptions are post-Aegean by many centuries, but they occur in the part of the island known to Homer as that inhabited by the Eteo-Cretans, or aborigines. Their language may prove to be that of the Linear tablets.

C. *History of Aegean Civilization.*—History of an inferential and summary sort only can be derived from monuments in the absence of written records. The latter do, indeed, exist in the case of the Cretan civilization and in great numbers; but they are undeciphered and likely to remain so, except in the improbable event of the discovery of a long bi-lingual text, partly couched in some familiar script and language. Even in that event, the information which would be derived from the Cnossian tablets would probably make but a small addition to history, since in very large part they are evidently mere inventories of tribute and stores. The engraved gems probably record divine or human names. (See CRETE.)

(1) *Chronology.*—The earliest chronological *datum* that we possess is inferred from a close similarity between certain Cretan hand-made and polished vases of Minoan Period I. 1 and others discovered by Petrie at Abydos in Egypt and referred by him to the Ist Dynasty. He goes so far as to pronounce the latter to be Cretan importations, their fabric and forms being unlike anything Nilotic. If that be so, the period at which stone implements were beginning to be superseded by bronze in Crete must be dated before 4000 B.C. But it will be remembered that below all Evans's "Minoan" strata lies the immensely thick Neolithic deposit. To date the beginning of this earliest record of human production is impossible at present. The Neolithic stratum varies very much in depth, ranging from nearly 20 ft. to 3 ft., but is deepest on the highest part of the hillock. Its variations may be due equally to natural denudation of a stratum once of uniform depth, or to the artificial heaping up of a mound by later builders. Even were certainty as to these alternatives attained, we could only guess at the average rate of accumulation, which experience shows to proceed very differently on different sites and under different social and climatic conditions. In later periods at Cnossus accumulation seems to have proceeded at a rate of, roughly, 3 ft. per thousand years. Reckoning by that standard we might push the earliest Neolithic remains back behind 10,000 B.C.; but the calculation would be worthy of little credence.

Passing by certain fragments of stone vessels, found at Cnossus, and coincident with forms characteristic of the IVth Pharaonic Dynasty, we reach another fairly certain date in the synchronism of remains belonging to the XIIth Dynasty (*c.* 2500 B.C. according to Petrie, but later according to the Berlin School) with products of Minoan Period II. 2. Characteristic Cretan pottery of this period was found by Petrie in the Fayum in conjunction with XIIth Dynasty remains, and various Cretan products of the period show striking coincidences with XIIth Dynasty styles, especially in their adoption of spiraliform ornament. The spiral, however, it must be confessed, occurs so often in natural objects (*e.g.* horns, climbing plants, shavings of wood or metal) that too much stress must not be laid on the mutual parentage of spiraliform ornament in different civilizations. A diorite statuette, referable by its style and inscription to Dynasty XIII., was discovered in deposit of Period II. 3 in the Central Court, and a cartouche of the "Shepherd King," Khyan, was also found at Cnossus. He is usually dated about 1900 B.C. This brings us to the next and most certain synchronism, that of Minoan Periods

III. 1, 2, with Dynasty XVIII. (*c.* 1600–1400 B.C.). This coincidence has been observed not only at Cnossus, but previously, in connexion with discoveries of scarabs and other Egyptian objects made at Mycenae, Ialysus, Vaphio, &c. In Egypt itself Kefti tributaries, bearing vases of Aegean form, and themselves similar in fashion of dress and arrangement of hair to figures on Cretan frescoes and gems of Period III., are depicted under this and the succeeding Dynasties (*e.g.* Rekhmara tomb at Thebes). Actual vases of late Minoan style have been found with remains of Dynasty XVIII., especially in the town of Amenophis IV. Akhenaton at Tell el-Amarna; while in the Aegean area itself we have abundant evidence of a great wave of Egyptian influence beginning with this same Dynasty. To this wave were owed in all probability the Nilotic scenes depicted on the Mycenae daggers, on frescoes of Hagia Triada and Cnossus, on pottery of Zakro, on the shell-relief of Phaestus, &c.; and also many forms and fabrics, *e.g.* certain Cretan coffins, and the faience industry of Cnossus. These serve to date, beyond all reasonable question, Periods III. 1-2 in Crete, the shaft-graves in the Mycenae circle, the Vaphio tomb, &c., to the 16th and 15th centuries B.C., and Period III. 3 with the lower town at Mycenae, the majority of the sixth stratum at Hissarlik, the Ialysus burials, the upper stratum at Phylakope, &c., to the century immediately succeeding.

The *terminus ad quem* is less certain—iron does not begin to be used for weapons in the Aegean till after Period III. 3, and then not exclusively. If we fix its introduction to about 1000 B.C. and make it coincident with the incursion of northern tribes, remembered by the classical Greeks as the Dorian Invasion, we must allow that this incursion did not altogether stamp out Aegean civilization, at least in the southern part of its area. But it finally destroyed the Cnossian palace and initiated the "Geometric" Age, with which, for convenience at any rate, we may close the history of Aegean civilization proper.

(2) *Annals.*—From these and other data the outlines of primitive history in the Aegean may be sketched thus. A people, agreeing in its prevailing skull-forms with the Mediterranean race of N. Africa, was settled in the Aegean area from a remote Neolithic antiquity, but, except in Crete, where insular security was combined with great natural fertility, remained in a savage and unproductive condition until far into the 4th millennium B.C. In Crete, however, it had long been developing a certain civilization, and at a period more or less contemporary with Dynasties XI. and XII. (2500 B.C.?) the scattered communities of the centre of the island coalesced into a strong monarchical state, whose capital was at Cnossus. There the king, probably also high priest of the prevailing nature-cult, built a great stone palace, and received the tribute of feudatories, of whom, probably, the prince of Phaestus, who commanded the Messará plain, was chief. The Cnossian monarch had maritime relations with Egypt, and presently sent his wares all over the S. Aegean (*e.g.* to Melos in the earlier Second City Period of Phylakope) and to Cyprus, receiving in return such commodities as Melian obsidian knives. A system of pictographic writing came into use early in this Palace period, but only a few documents, made of durable material, have survived. Pictorial art of a purely indigenous character, whether on ceramic material or plaster, made great strides, and from ceramic forms we may legitimately infer also a high skill in metallurgy. The absence of fortifications both at Cnossus and Phaestus suggest that at this time Crete was internally peaceful and externally secure. Small settlements, in very close relation with the capital, were founded in the east of the island to command fertile districts and assist maritime commerce. Gournia and Palaikastro fulfilled both these ends: Zakro must have had mainly a commercial purpose, as the starting-point for the African coast. The acme of this dominion was reached about the end of the 3rd millennium B.C., and thereafter there ensued a certain, though not very serious, decline. Meanwhile, at other favourable spots in the Aegean, but chiefly, it appears, on sites in easy relation to maritime commerce, *e.g.* Tiryns and Hissarlik, other communities of the early race began to arrive at civilization, but were naturally influenced by the more advanced culture of Crete, in proportion to their nearness of vicinity. Early Hissarlik shows less Cretan influence and more external (*i.e.* Asiatic) than early Melos. The inner Greek mainland remained still in a backward state. Five hundred years later—about 1600 B.C.—we observe that certain striking changes have taken place. The Aegean remains have become astonishingly uniform over the whole area; the local ceramic developments have almost ceased and been replaced by ware of one general type both of fabric and decoration. The Cretans have stayed their previous decadence, and are once more possessors of a progressive civilization. They have developed a more convenient and expressive written character by stages of which one is best represented by the tablets of Hagia Triada. The art of all the area gives evidence of one spirit and common models; in religious representations it shows the same anthropomorphic personification and the same ritual furniture. Objects produced in one locality are found in others. The area of Aegean intercourse has widened and become more busy. Commerce with Egypt, for example, has increased in a marked degree, and Aegean objects or imitations of them are found to have begun to penetrate into Syria, inland Asia Minor, and the central and western Mediterranean lands, *e.g.* Sicily, Sardinia and Spain. There can be little doubt that a strong power was now fixed in one Aegean centre, and that all the area had come under its political, social and artistic influence.

How was this brought about, and what was the imperial centre? Some change seems to have come from the north; and there are those who go so far as to say that the centre henceforward was the Argolid, and especially "golden" Mycenae, whose lords imposed a new type of palace and a modification of Aegean art on all other Aegean lands. Others again cite the old-established power and productivity of Crete; the immense advantage it derived from insularity, natural fertility and geographical relation to the wider area of east Mediterranean civilizations; and the absence of evidence elsewhere for the gradual growth of a culture powerful enough to dominate the Aegean. They point to the fact that, even in the new period, the palm for wealth and variety of civilized production still remained with Crete. There alone we have proof that the art of writing was commonly practised, and there tribute-tallies suggest an imperial organization; there the arts of painting and sculpture in stone were most highly developed; there the royal residences, which had never been violently destroyed, though remodelled, continued unfortified; whereas on the Greek mainland they required strong protective works. The golden treasure of the Mycenae graves, these critics urge, is not more splendid than would have been found at Cnossus had royal burials been spared by plunderers, or been happened upon intact by modern explorers. It is not impossible to combine these views, and place the seat of power still in Crete, but ascribe the Renascence there to an influx of new blood from the north, large enough to instil fresh vigour, but too small to change the civilization in its essential character.

If this dominance was Cretan, it was short-lived. The security of the island was apparently violated not long after 1500 B.C., the Cnossian palace was sacked and burned, and Cretan art suffered an irreparable blow. As the comparatively lifeless character which it possesses in the succeeding period (III. 3) is coincident with a similar decadence all over the Aegean area, we can hardly escape from the conclusion that it was due to the invasion of all the Aegean lands (or at least the Greek mainland and isles) by some less civilized conquerors, who remained politically dominant, but, like their forerunners, having no culture of their own, adopted, while they spoiled, that which they found. Who these were we cannot say; but the probability is that they too came from the north, and were precursors of the later "Hellenes." Under their rule peace was re-established, and art production became again abundant among the subject population, though of inferior quality. The Cnossian palace was re-occupied in its northern part by chieftains who have left numerous rich graves; and general commercial intercourse must have been resumed, for the uniformity of the

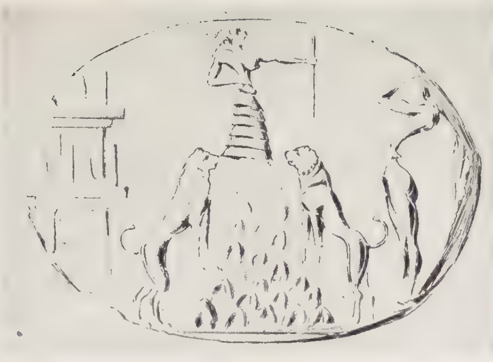


FIG. 1.—LION-GUARDED GODDESS AND SHRINE, ON A CLAY SEALING FROM CNOSSUS.

B.S.A. vii. 29, Fig. 9.

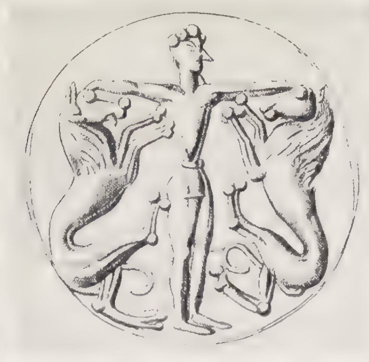


FIG. 2.—MALE DIVINITY BETWEEN LIONS, ON A LENTOID GEM FROM KYDONIA, CRETE.

J.H.S. xxi. 163, Fig. 43.

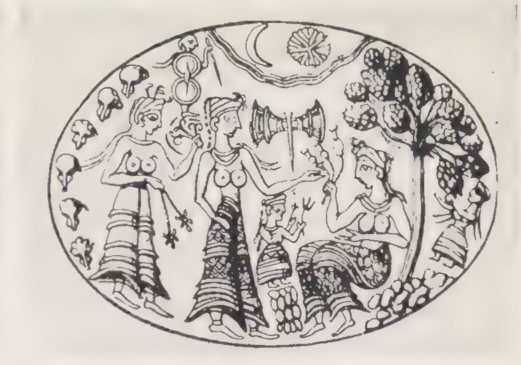


FIG. 3.—GOLD SIGNET FROM ACROPOLIS TREASURE, MYCENAE, SHOWING THE GODDESS BENEATH A SACRED TREE, WITH ADORANTS AND SACRED EMBLEMS.

J.H.S. xxi. 108, Fig. 4.

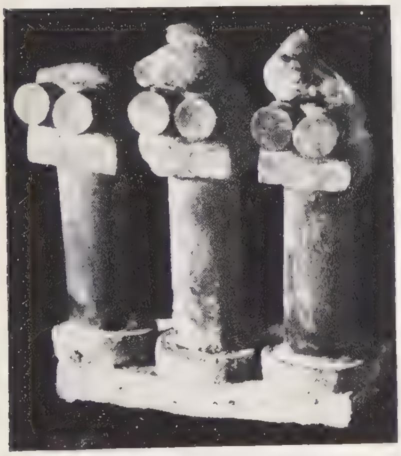


FIG. 4.—BIRDS ON A TRIAD OF PILLARS, CNOSSUS.

B.S.A. viii. 29, Fig. 14.

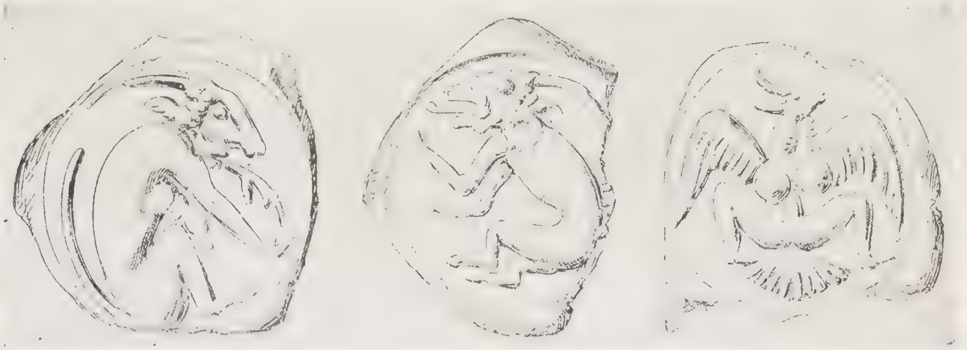


FIG. 5.—CLAY SEALINGS FROM ZAKRO, WITH MINOTAUR TYPES.

B.S.A. vii. 133, Fig. 45.

By permission of the Society for the Promotion of Hellenic Studies.

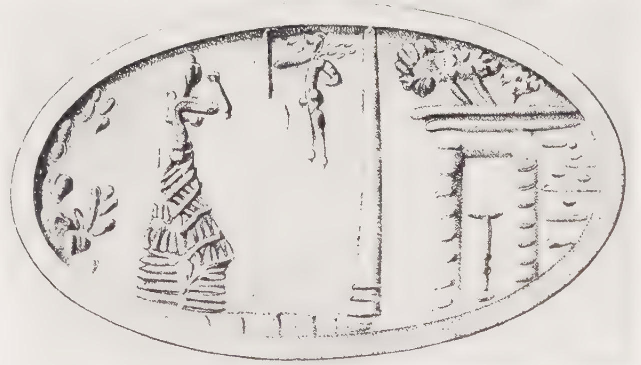


FIG. 6.—DUAL PILLAR WORSHIP, ON A GOLD SIGNET RING, CNOSSUS.

J.H.S. xxi. 170, Fig. 48.

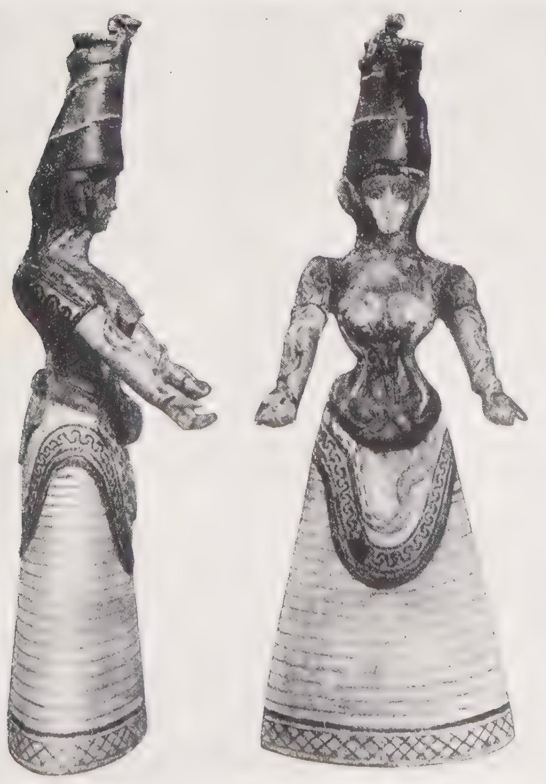


FIG. 7.—FAÏENCE FIGURE OF THE GODDESS, WITH SERPENT ATTRIBUTES, CNOSSUS.

B.S.A. ix. 75, Fig. 54.

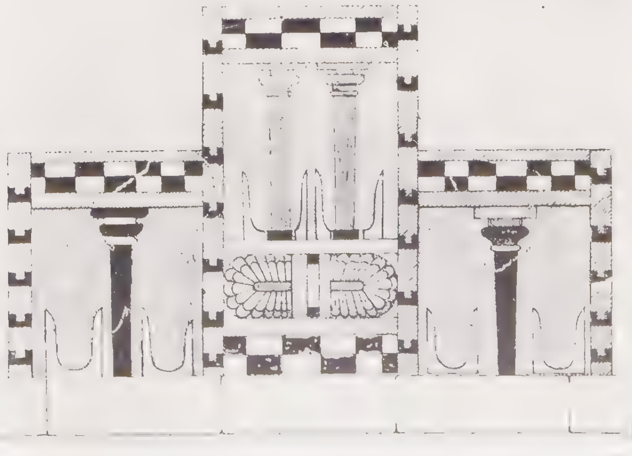


FIG. 8.—FAÇADE OF SMALL TEMPLES, COMPLETED FROM A FRESCO PAINTING, CNOSSUS.

J.H.S. xxi. 193, Fig. 66.

PLATE IV.

AEGEAN CIVILIZATION TYPES AND COSTUMES, ETC.

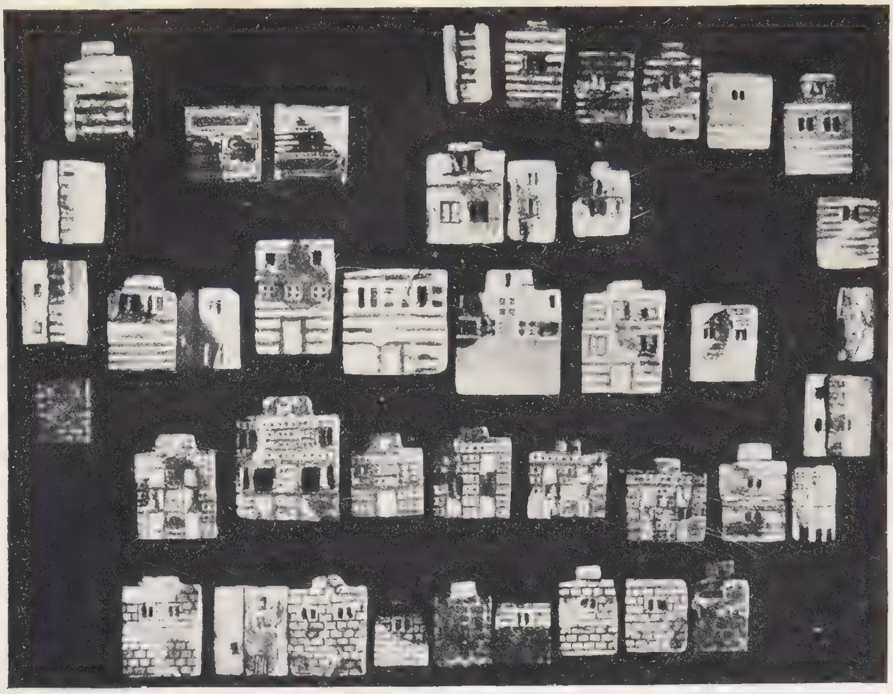


FIG. 1.—TESSERAE OF PORCELAIN MOSAIC IN FORM OF HOUSES AND TOWERS, CNOSSUS. *B.S.A.* viii. 15, Fig. 8.

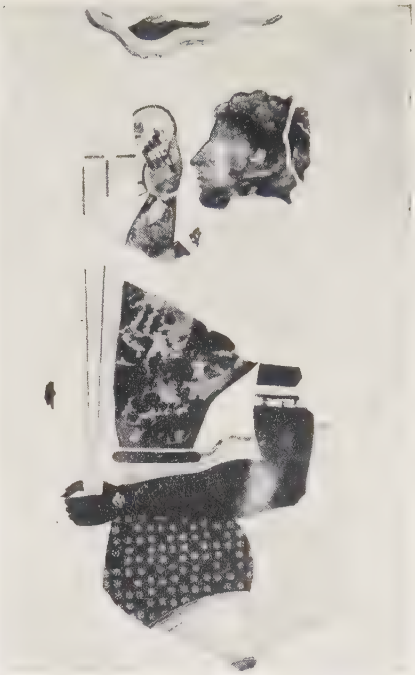
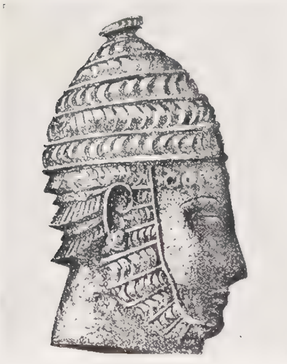


FIG. 2.—CUP-BEARER, CNOSSUS.
Photo by Dr A. J. Evans.



FIGS. 3, 5.—IVORY HEADS FROM SPATA (ATTICA).
Reichel, *Homerische Waffen*, 1901, p. 103.
By permission of A. Hölder, Vienna.

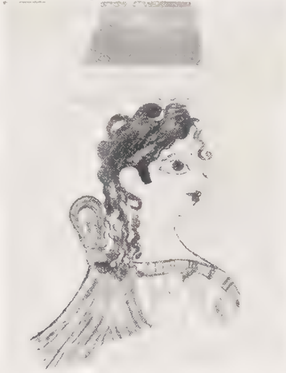


FIG. 4.—FRESCO PAINTING OF GIRL, CNOSSUS.
B.S.A. vii. 57, Fig. 17.

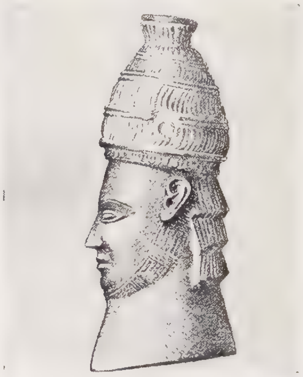


FIG. 5.—See FIG. 3.

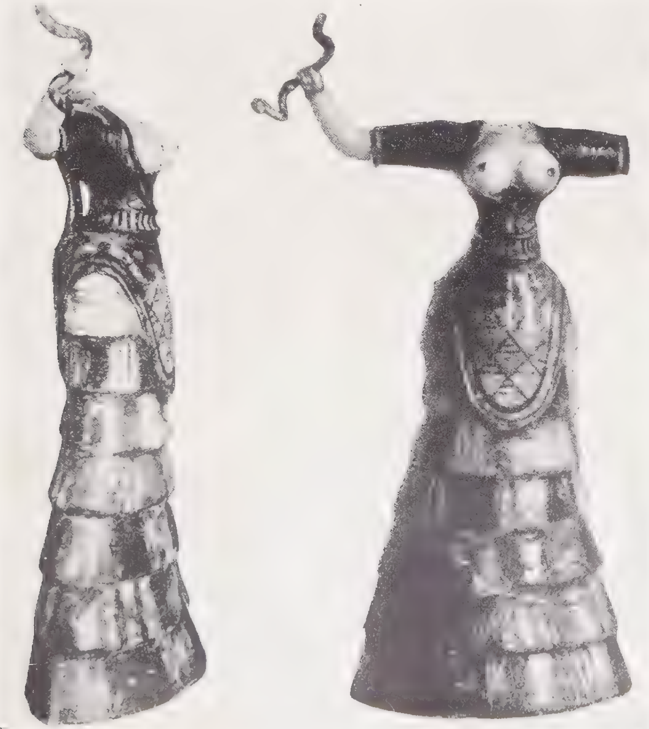
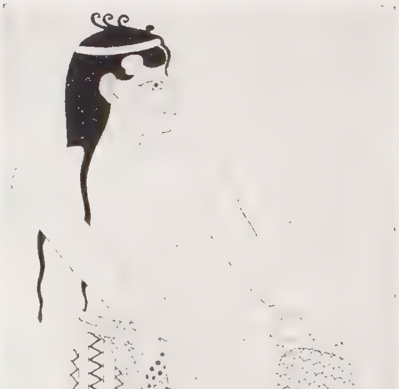


FIG. 6.—FAÏENCE FIGURE OF FEMALE VOTARY OF SNAKE-GODDESS, CNOSSUS.
B.S.A. ix. 77, Fig. 56.

FIG. 7.—KEFTIU (CRETAN) BEARING AEGEAN VASE AS TRIBUTE TO PHARAOH.
From H. R. Hall, *Oldest Civilization in Greece* (1901).
By permission of the Society for the Promotion of Hellenic Studies.



decadent Aegean products and their wide distribution become more marked than ever.

About 1000 B.C. there happened a final catastrophe. The palace at Cnossus was once more destroyed, and never rebuilt or re-inhabited. Iron took the place of Bronze, and Aegean art, as a living thing, ceased on the Greek mainland and in the Aegean isles including Crete, together with Aegean writing. In Cyprus, and perhaps on the south-west Anatolian coasts, there is some reason to think that the cataclysm was less complete, and Aegean art continued to languish, cut off from its fountain-head. Such artistic faculty as survived elsewhere issued in the lifeless geometric style which is reminiscent of the later Aegean, but wholly unworthy of it. Cremation took the place of burial of the dead. This great disaster, which cleared the ground for a new growth of local art, was probably due to yet another incursion of northern tribes, more barbarous than their predecessors, but possessed of superior iron weapons—those tribes which later Greek tradition and Homer knew as the Dorians. They crushed a civilization already hard hit; and it took two or three centuries for the artistic spirit, instinct in the Aegean area, and probably preserved in suspended animation by the survival of Aegean racial elements, to blossom anew. On this conquest seems to have ensued a long period of unrest and popular movements, known to Greek tradition as the Ionian Migration and the Aeolic and Dorian "colonizations"; and when once more we see the Aegean area clearly, it is dominated by Hellenes, though it has not lost all memory of its earlier culture.

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AEGEAN SEA, a part of the Mediterranean Sea, being the archipelago between Greece on the west and Asia Minor on the east, bounded N. by European Turkey, and connected by the Dardanelles with the Sea of Marmora, and so with the Black Sea. The name Archipelago (*q.v.*) was formerly applied specifically to this sea. The origin of the name Aegean is uncertain. Various derivations are given by the ancient grammarians—one from the town of Aegae; another from Aegea, a queen of the Amazons who perished in this sea; and a third from Aegeus, the father of Theseus, who, supposing his son dead, drowned himself in it. The following are the chief islands:—Thasos, in the extreme north, off the Macedonian coast; Samothrace, fronting the Gulf of Saros; Imbros and Lemnos, in prolongation of the peninsula of Gallipoli (*Thracian Chersonese*); Euboea, the largest of all, lying close along the east coast of Greece; the Northern Sporades, including Sciathos, Scopelos and Halonesos, running out from the southern extremity of the Thessalian coast, and Scyros, with its satellites, north-east of Euboea; Lesbos and Chios; Samos and Nikaria; Cos, with Calymnos to the north; all off Asia Minor, with the many other islands of the Sporades; and, finally, the great group of the Cyclades, of which the largest are Andros and Tenos, Naxos and Paros. Many of the Aegean islands, or chains of islands, are actually prolongations of promontories of the mainland. Two main chains extend right across the sea—the one through Scyros and Psara (between which shallow banks intervene) to Chios and the hammer-shaped promontory east of it; and the other running from the south-eastern promontory of Euboea and continuing the axis of that island, in a southward curve through Andros, Tenos, Myconos, Nikaria and Samos. A third curve, from the south-easternmost promontory of the Peloponnese through Cerigo, Crete, Carpathos and Rhodes, marks off the outer deeps of the open Mediterranean from the shallow seas of the archipelago, but the Cretan Sea, in which depths occur over 1000 fathoms, intervenes, north of the line, between it and the Aegean proper. The Aegean itself is naturally divided by the island-chains and the ridges from which they rise into a series of basins or troughs, the deepest of which is that in the north, extending from the coast of Thessaly to the Gulf of Saros, and demarcated southward by the Northern Sporades, Lemnos, Imbros and the peninsula of Gallipoli. The greater part of this trough is over 600 fathoms deep. The profusion of islands and their usually bold elevation give beauty and picturesqueness to the sea, but its navigation is difficult and dangerous, notwithstanding the large number of safe and commodious gulfs and bays. Many of the islands are of volcanic formation; and a well-defined volcanic chain bounds the Cretan Sea on the north, including Milo and Kimolos, Santorin (Thera) and Therasia, and extends to Nisyros. Others, such as Paros, are mainly composed of marble, and iron ore occurs in some. The larger islands have some fertile and well-watered valleys and plains. The chief productions are wheat, wine, oil, mastic, figs, raisins, honey, wax, cotton and silk. The people are employed in fishing for coral and sponges, as well as for bream, mullet and other fish. The men are hardy, well built and handsome; and the women are noted for their beauty, the ancient Greek type being well preserved. The Cyclades and Northern Sporades, with Euboea and small islands under the Greek shore, belong to Greece; the other islands to Turkey.

AEGEUS, in Greek legend, son of Pandion and grandson of Cecrops, was king of Athens and the father of Theseus. He was deposed by his nephews, but Theseus defeated them and reinstated his father. When Theseus set out for Crete to deliver Athens from the tribute to the Minotaur he promised Aegeus that, if he were successful, he would change the black sail carried by his ship for a white one. But, on his return, he forgot to hoist the white sail, and his father, supposing that his son had lost his life, threw himself from a high rock on which he was keeping watch into the sea, which was afterwards called the Aegean. The Athenians honoured him with a statue and a shrine, and one of the Attic demes was named after him.

Plutarch, *Theseus*; Pausanias i. 22; Hyginus, *Fab.* 43; Catullus lxiv. 207.

AEGINA (EGINA or ENGIA), an island of Greece in the Saronic Gulf, 20 m. from the Peiraeus. Tradition derives the name from Aegina, the mother of Aeacus, who was born in and ruled the island. In shape Aegina is triangular, 8 m. long from N.W. to S.E., and 6 m. broad, with an area of about 41 sq. m. The western side consists of stony but fertile plains, which are well cultivated and produce luxuriant crops of grain, with some cotton, vines, almonds and figs. The rest of the island is rugged and mountainous. The southern end rises in the conical Mount Oros, and the Panhellenian ridge stretches northward with narrow fertile valleys on either side. From the absence of marshes the climate is the most healthy in Greece. The island forms part of the modern *nomos* of Attica and Boeotia, of which it forms an *eparchy*. The sponge fisheries are of considerable importance. The chief town is Aegina, situated at the north-west end of the island, the summer residence of many Athenian merchants. Capo d'Istria, to whom there is a statue in the principal square, erected there a large building, intended for a barracks, which was subsequently used as a museum, a library and a school. The museum was the first institution of its kind in Greece, but the collection was transferred to Athens in 1834.

Antiquities.—The archaeological interest of Aegina is centred in the well-known temple on the ridge near the northern corner of the island. Excavations were made on its site in 1811 by

Baron Haller von Hallerstein and the English architect C. R. Cockerell, who discovered a considerable amount of sculpture from the pediments, which was bought in 1812 by the crown prince Louis of Bavaria; the groups were set up in the Glyptothek at Munich after the figures had been restored by B. Thorvaldsen. Their restoration was somewhat drastic, the ancient parts being cut away to allow of additions in marble, and the new parts treated in imitation of the ancient weathering. Various conjectures were made as to the arrangement of the figures. That according to which they were set up at Munich was in the main suggested by Cockerell; in the middle of each pediment was a figure of Athena, set well back, and a fallen warrior at her feet; on each side were standing spearmen, kneeling spearmen and bowmen, all facing towards the centre of the composition; the corners were filled with fallen warriors. In 1901 Professor Furtwängler began a more systematic excavation of the site, and the new discoveries he then made, together with a fresh and complete study of the figures and fragments in Munich, have led to a rearrangement of the whole, which, if not certain in all details, may be regarded as approaching finality. According to this the figures of combatants do not all face towards the centre, but are broken up, as in other early compositions, into a series of groups of two or three figures each. A figure of Athena still occupies the centre of each pediment, but is set farther forward than in the old reconstruction. On each side of this, in the western pediment, is a group of two combatants over a fallen warrior; in the eastern pediment, a warrior whose opponent is falling into the arms of a supporting figure; other figures also—the bowmen especially—face towards the angles, and so give more variety to the composition. The western pediment, which is more conservative in type, represents the earlier expedition of Heracles and Telamon against Troy; the eastern, which is bolder and more advanced, probably refers to episodes in the Trojan war. There are also remains of a third pediment, which may have been produced in competition, but never placed on the temple. For the character of the sculptures see GREEK ART. The plan of the temple is chiefly remarkable for the unsymmetrically placed door leading from the back of the cella into the opisthodomus. This opisthodomus was completely fenced in with bronze gratings; and the excavators believe it to have been adapted for use as an *adytum* (shrine).

It was disputed in earlier times whether the temple was dedicated to Zeus or Athena. Inscriptions found by the recent excavations seem to prove that it must be identified as the shrine of the local goddess Aphaea, identified by Pausanias with Britomartis and Dictynna.

The excavations have laid bare several other buildings, including an altar, early propylaea, houses for the priests and remains of an earlier temple. The present temple probably dates from the time of the Persian wars. In the town of Aegina itself are the remains of another temple, dedicated to Aphrodite; one column of this still remains standing, and its foundations are fairly preserved.

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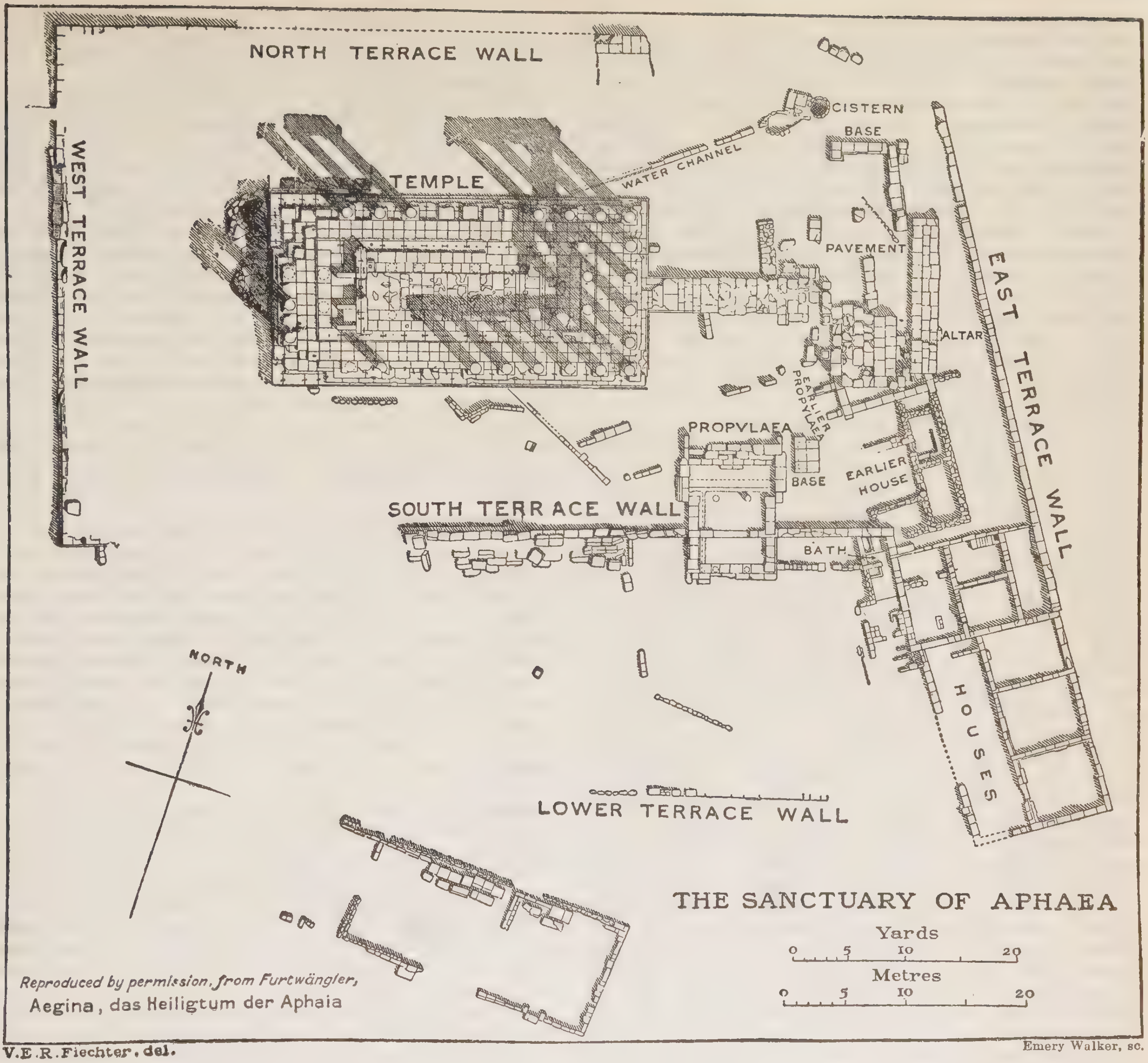
History.—(1) *Ancient.* Aegina, according to Herodotus (v. 83), was a colony of Epidaurus, to which state it was originally subject. The discovery in the island of a number of gold ornaments belonging to the latest period of Mycenaean art suggests the inference that the Mycenaean culture held its own in Aegina for some generations after the Dorian conquest of Argos and Lacedaemon (see A. J. Evans, in *Journal of Hellenic Studies*, vol. xiii. p. 195). It is probable that the island was not dorized before the 9th century B.C. One of the earliest facts known to us in its history is its membership in the League of Calauria, which included, besides Aegina, Athens, the Minyan (Boeotian) Orchomenos, Troezen, Hermione, Nauplia and Prasiae, and was probably an organization of states which were still Mycenaean, for the suppression of the piracy which had sprung up in the Aegean as a result of the decay of the naval supremacy of the Mycenaean princes. It follows, therefore, that the maritime importance of the island dates back to pre-Dorian times. It is usually stated, on the authority of Ephorus, that Pheidon (*q.v.*) of Argos established a mint in Aegina. Though this statement is probably to be rejected, it may be regarded as certain that Aegina was the first state of European Greece to coin money. Thus it was the Aeginetans who, within thirty or forty years of the invention of coinage by the Lydians (*c.* 700 B.C.), introduced to the western world a system of such incalculable value to trade. The fact that the Aeginetan scale of coins, weights and measures was one of the two scales in general use in the Greek world is sufficient evidence of the early commercial importance of the island. It appears to have belonged to the Eretrian league; hence, perhaps, we may explain the war with Samos, a leading member of the rival Chalcidian league in the reign of King Amphicrates (Herod. iii. 59), *i.e.* not later than the earlier half of the 7th century B.C. In the next century Aegina is one of the three principal states trading at the emporium of Naucratis (*q.v.*), and it is the only state of European Greece that has a share in this factory (Herod. ii. 178). At the beginning of the 5th century it seems to have been an entrepôt of the Pontic grain trade, at a later date an Athenian monopoly (Herod. vii. 147). Unlike the other commercial states of the 7th and 6th centuries B.C., *e.g.* Corinth, Chalcis, Eretria and Miletus, Aegina founded no colonies. The settlements to which Strabo refers (viii. 376) cannot be regarded as any real exceptions to this statement.

The history of Aegina, as it has come down to us, is almost exclusively a history of its relations with the neighbouring state of Athens. The history of these relations, as recorded by Herodotus (v. 79-89; vi. 49-51, 73, 85-94), involve critical problems of some difficulty and interest. He traces back the hostility of the two states to a dispute about the images of the goddesses Damia and Auxesia, which the Aeginetans had carried off from Epidaurus, their parent state. The Epidaurians had been accustomed to make annual offerings to the Athenian deities Athena and Erechtheus in payment for the Athenian olive-wood of which the statues were made. Upon the refusal of the Aeginetans to continue these offerings, the Athenians endeavoured to carry away the images. Their design was miraculously frustrated—according to the Aeginetan version, the statues fell upon their knees,—and only a single survivor returned to Athens, there to fall a victim to the fury of his comrades' widows, who pierced him with their brooch-pins. No date is assigned by Herodotus for this "old feud"; recent writers, *e.g.* J. B. Bury and R. W. Macan, suggest the period between Solon and Peisistratus, *c.* 570 B.C. It may be questioned, however, whether the whole episode is not mythical. A critical analysis of the narrative seems to reveal little else than a series of aetiological traditions, explanatory of cults and customs, *e.g.* of the kneeling posture of the images of Damia and Auxesia, of the use of native ware instead of Athenian in their worship, and of the change in women's dress at Athens from the Dorian to the Ionian style. The account which Herodotus gives of the hostilities between the two states in the early years of the 5th century B.C. is to the following effect. Thebes, after the defeat by Athens about 507 B.C., appealed to Aegina for assistance. The Aeginetans at first contented themselves with sending the images of the Aeacidae, the tutelary heroes of their island. Subsequently, however, they entered into an alliance, and ravaged the sea-board of Attica. The Athenians were preparing to make reprisals, in spite of the advice of the Delphic oracle that they should desist from attacking Aegina for thirty years, and content themselves meanwhile with dedicating a precinct to Aeacus, when their projects were interrupted by the Spartan intrigues for the restoration of Hippias. In 491 B.C. Aegina was one of the states which gave the symbols of submission ("earth and water") to Persia. Athens at once appealed to Sparta to punish this act of medism, and Cleomenes I. (*q.v.*), one of the Spartan kings, crossed over to the island, to arrest those who were responsible for it. His attempt was at first unsuccessful;



THE SANCTUARY OF APHAEA

Reproduced by permission, from Furtwängler, Aegina, das Heiligtum der Aphaia

V.E.R. Fiechter. del.

Emery Walker, sc.

but, after the deposition of Demaratus, he visited the island a second time, accompanied by his new colleague Leotychides, seized ten of the leading citizens and deposited them at Athens as hostages. After the death of Cleomenes and the refusal of the Athenians to restore the hostages to Leotychides, the Aeginetans retaliated by seizing a number of Athenians at a festival at Sunium. Thereupon the Athenians concerted a plot with Nicodromus, the leader of the democratic party in the island, for the betrayal of Aegina. He was to seize the old city, and they were to come to his aid on the same day with seventy vessels. The plot failed owing to the late arrival of the Athenian force, when Nicodromus had already fled the island. An engagement followed in which the Aeginetans were defeated. Subsequently, however, they succeeded in winning a victory over the Athenian fleet. All the incidents subsequent to the appeal of Athens to Sparta are expressly referred by Herodotus to the interval between the sending of the heralds in 491 B.C. and the invasion of Datis and Artaphernes in 490 B.C. (cf. Herod. vi. 49 with 94). There are difficulties in this story, of which the following are the principal:—(i.) Herodotus nowhere states or implies that peace was concluded between the two states before 481 B.C., nor does he distinguish between different wars during this period. Hence it would follow that the war lasted from shortly after 507 B.C. down to the congress at the Isthmus of Corinth in 481 B.C. (ii.) It is only for two years (490 and 491) out of the twenty-five that any details are given. It is the more remarkable that no incidents are recorded in the period between Marathon and Salamis, seeing that at the time of the Isthmian Congress the war is described as the most important one then being waged in Greece (Herod. vii. 145). (iii.) It is improbable that Athens would have sent twenty vessels to the aid of the Ionians in 498 B.C. if at the time she was at war with Aegina. (iv.) There is an incidental indication of time, which points to the period after Marathon as the true date for the events which are referred by Herodotus to the year before Marathon, viz. the thirty years that were to elapse between the dedication of the precinct to Aeacus and the final victory of Athens (Herod. v. 89). As the final victory of Athens over Aegina was in 458 B.C., the thirty years of the oracle would carry us back to the year 488 B.C. as the date of the dedication of the precinct and the outbreak of hostilities. This inference is supported by the date of the building of the 200 triremes "for the war against Aegina" on the advice of Themistocles, which is given in the *Constitution of Athens* as 483–482 B.C. (Herod. vii. 144; *Ath. Pol.* 22. 7). It is probable, therefore, that Herodotus is in error both in tracing back the beginning of hostilities to an alliance between Thebes and Aegina (*c.* 507) and in putting the episode of Nicodromus before Marathon. Overtures were unquestionably made by Thebes for an alliance with Aegina *c.* 507 B.C., but they came to nothing. The refusal of Aegina was veiled under the diplomatic form of "sending the Aeacidae." The real occasion of the outbreak of the war was the refusal of Athens to restore the hostages some twenty years later. There was but one war, and it lasted from 488 to 481. That Athens had the worst of it in this war is certain. Herodotus had no Athenian victories to record after the initial success, and the fact that Themistocles was able to carry his proposal to devote the surplus funds of the state to the building of so large a fleet seems to imply that the Athenians were themselves convinced that a supreme effort was necessary. It may be noted, in confirmation of this view, that the naval supremacy of Aegina is assigned by the ancient writers on chronology to precisely this period, *i.e.* the years 490–480 (Eusebius, *Chron. Can.* p. 337).

In the repulse of Xerxes it is possible that the Aeginetans played a larger part than is conceded to them by Herodotus. The Athenian tradition, which he follows in the main, would naturally seek to obscure their services. It was to Aegina rather than Athens that the prize of valour at Salamis was awarded, and the destruction of the Persian fleet appears to have been as much the work of the Aeginetan contingent as of the Athenian (Herod. viii. 91). There are other indications, too, of the importance of the Aeginetan fleet in the Greek scheme of defence. In view of these considerations it becomes difficult to credit the number of the vessels that is assigned to them by Herodotus (30 as against 180 Athenian vessels, cf. GREEK HISTORY, sect. *Authorities*). During the next twenty years the philo-laconian policy of Cimon (*q.v.*) secured Aegina, as a member of the Spartan league, from attack. The change in Athenian foreign policy, which was consequent upon the ostracism of Cimon in 461, led to what is sometimes called the First Peloponnesian War, in which the brunt of the fighting fell upon Corinth and Aegina. The latter state was forced to surrender to Athens after a siege, and to accept the position of a subject-ally (*c.* 456 B.C.). The tribute was fixed at 30 talents. By the terms of the Thirty Years' Truce (445 B.C.) Athens covenanted to restore to Aegina her autonomy, but the clause remained a dead letter. In the first winter of the Peloponnesian War (431 B.C.) Athens expelled the Aeginetans, and established a cleruchy in their island. The exiles were settled by Sparta in Thyreatis, on the frontiers of Laconia and Argolis. Even in their new home they were not safe from Athenian rancour.[1] A force landed under Nicias in 424, and put most of them to the sword. At the end of the Peloponnesian War Lysander restored the scattered remnants of the old inhabitants to the island, which was used by the Spartans as a base for operations against Athens in the Corinthian War. Its greatness, however, was at an end. The part which it plays henceforward is insignificant.

It would be a mistake to attribute the fall of Aegina solely to the development of the Athenian navy. It is probable that the power of Aegina had steadily declined during the twenty years after Salamis, and that it had declined absolutely, as well as relatively, to that of Athens. Commerce was the source of Aegina's greatness, and her trade, which appears to have been principally with the Levant, must have suffered seriously from the war with Persia. Her medism in 491 is to be explained by her commercial relations with the Persian Empire. She was forced into patriotism in spite of herself, and the glory won at Salamis was paid for by the loss of her trade and the decay of her marine. The completeness of the ruin of so powerful a state—we should look in vain for an analogous case in the history of the modern world—finds an explanation in the economic conditions of the island, the prosperity of which rested upon a basis of slave-labour. It is impossible, indeed, to accept Aristotle's (cf. Athenaeus vi. 272) estimate of 470,000 as the number of the slave-population; it is clear, however, that the number must have been out of all proportion to that of the free inhabitants. In this respect the history of Aegina does but anticipate the history of Greece as a whole.

The constitutional history of Aegina is unusually simple. So long as the island retained its independence the government was an oligarchy. There is no trace of the heroic monarchy and no tradition of a *tyrannis*. The story of Nicodromus, while it proves the existence of a democratic party, suggests, at the same time, that it could count upon little support.

(2) *Modern.*—Aegina passed with the rest of Greece under the successive dominations of Macedon, the Aetolians, Attalus of Pergamum and Rome. In 1537 the island, then a prosperous Venetian colony, was overrun and ruined by the pirate Barbarossa (Khair-ed-Din). One of the last Venetian strongholds in the Levant, it was ceded by the treaty of Passarowitz (1718) to the Turks. In 1826–1828 the town became for a time the capital of Greece and the centre of a large commercial population (about 10,000), which has dwindled to about 4300.

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AEGINETA, PAULUS, a celebrated surgeon of the island of Aegina, whence he derived his name. According to Le Clerc's calculation, he lived in the 4th century of the Christian era; but Abulfaragius (Barhebraeus) places him with more probability in the 7th. The title of his most important work, as given by Suidas, is Ἐπιτομῆς Ἰατρικῆς Βιβλία Ἑπτά (*Synopsis of Medicine in Seven Books*), the 6th book of which, treating of operative surgery, is of special interest for surgical history. The whole work in the original Greek was published at Venice in 1528, and another edition appeared at Basel in 1538. Several Latin translations have been published, and an excellent English version, with commentary, by Dr F. Adams (1844–1848).

AEGIS (Gr. *Aigis*), in Homer, the shield or buckler of Zeus, fashioned for him by Hephaestus, furnished with tassels and bearing the Gorgon's head in the centre. Originally symbolical of the storm-cloud, it is probably derived from ἀίσσω, signifying rapid, violent motion. When the god shakes it, Mount Ida is wrapped in clouds, the thunder rolls and men are smitten with fear. He sometimes lends it to Athene and (rarely) to Apollo. In the later story (Hyginus, *Poet. Astronom.* ii. 13) Zeus is said to have used the skin of the goat Amaltheia (αἰγίς = goat-skin), which suckled him in Crete, as a buckler when he went forth to do battle against the giants. Another legend represents the aegis as a fire-breathing monster like the Chimaera, which was slain by Athene, who afterwards wore its skin as a cuirass (Diodorus Siculus iii. 70). It appears to have been really the goat's skin used as a belt to support the shield. When so used it would generally be fastened on the right shoulder, and would partially envelop the chest as it passed obliquely round in front and behind to be attached to the shield under the left arm. Hence, by transference, it would be employed to denote at times the shield which it supported, and at other times a cuirass, the purpose of which it in part served. In accordance with this double meaning the aegis appears in works of art sometimes as an animal's skin thrown over the shoulders and arms, sometimes as a cuirass, with a border of snakes corresponding to the tassels of Homer, usually with the Gorgon's head in the centre. It is often represented on the statues of Roman emperors, heroes and warriors, and on cameos and vases.

See F. G. Welcker, *Griechische Götterlehre* (1857); L. Preller, *Griechische Mythologie*, i. (1887); articles in Pauly-Wissowa's *Realencyclopädie*, Roscher's *Lexikon der Mythologie*, Daremberg and Saglio's *Dictionnaire des Antiquités*, and Smith's *Dictionary of Greek and Roman Antiquities* (3rd ed., 1890).

AEGISTHUS, in Greek legend, was the son of Thyestes by his own daughter Pelopia. Having been exposed by his mother to conceal her shame, he was found by shepherds and suckled by a goat—whence his name. His uncle Atreus, who had married

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[1] Pericles called Aegina the "eye-sore" (λήμη) of the Peiraeus.

Pelopia, took him to Mycenae, and brought him up as his own son. When he grew up Aegisthus slew Atreus, and ruled jointly with his father over Mycenae, until they were deposed by Agamemnon on his return from exile. After the departure of Agamemnon to the Trojan war, Aegisthus seduced his wife Clytaemnestra (more correctly Clytaemestra) and with her assistance slew him on his return. Eight years later his murder was avenged by his son Orestes.

Homer, *Od.* iii. 263, iv. 517; Hyginus, *Fab.* 87.

AEGOSPOTAMI (*i.e.* "Goat Streams"), a small creek issuing into the Hellespont, N.E. of Sestos, the scene of the decisive battle in 405 B.C. by which Lysander destroyed the last Athenian armament in the Peloponnesian War (*q.v.*). The township of that name, whose existence is attested by coins of the 5th and 4th centuries, must have been quite insignificant.

ÆLFRIC, called the "Grammarian" (*c.* 955–1020?), English abbot and author, was born about 955. He was educated in the Benedictine monastery at Winchester under Æthelwold, who was bishop there from 963 to 984. Æthelwold had carried on the tradition of Dunstan in his government of the abbey of Abingdon, and at Winchester he continued his strenuous efforts. He seems to have actually taken part in the work of teaching. Ælfric no doubt gained some reputation as a scholar at Winchester, for when, in 987, the abbey of Cernel (Cerne Abbas, Dorsetshire) was finished, he was sent by Bishop Ælfheah (Alphege), Æthelwold's successor, at the request of the chief benefactor of the abbey, the ealdorman Æthelmær, to teach the Benedictine monks there. He was then in priest's orders. Æthelmær and his father Æthelweard were both enlightened patrons of learning, and became Ælfric's faithful friends. It was at Cernel, and partly at the desire, it appears, of Æthelweard, that he planned the two series of his English homilies (ed. Benjamin Thorpe, 1844–1846, for the Ælfric Society), compiled from the Christian fathers, and dedicated to Sigeric, archbishop of Canterbury (990–994). The Latin preface to the first series enumerates some of Ælfric's authorities, the chief of whom was Gregory the Great, but the short list there given by no means exhausts the authors whom he consulted. In the preface to the first volume he regrets that except for Alfred's translations Englishmen had no means of learning the true doctrine as expounded by the Latin fathers. Professor Earle (*A.S. Literature*, 1884) thinks he aimed at correcting the apocryphal, and to modern ideas superstitious, teaching of the earlier *Blickling Homilies*. The first series of forty homilies is devoted to plain and direct exposition of the chief events of the Christian year; the second deals more fully with church doctrine and history. Ælfric denied the immaculate birth of the Virgin (*Homilies*, ed. Thorpe, ii. 466), and his teaching on the Eucharist in the *Canons* and in the *Sermo de sacrificio in die pascae* (*ibid.* ii. 262 seq.) was appealed to by the Reformation writers as a proof that the early English church did not hold the Roman doctrine of transubstantiation.[1] His Latin *Grammar* and *Glossary*[2] were written for his pupils after the two books of homilies. A third series of homilies, the *Lives of the Saints*, dates from 996 to 997. Some of the sermons in the second series had been written in a kind of rhythmical, alliterative prose, and in the *Lives of the Saints* (ed. W. W. Skeat, 1881–1900, for the Early English Text Society) the practice is so regular that most of them are arranged as verse by Professor Skeat. By the wish of Æthelweard he also began a paraphrase[3] of parts of the Old Testament, but under protest, for the stories related in it were not, he thought, suitable for simple minds. There is no certain proof that he remained at Cernel. It has been suggested that this part of his life was chiefly spent at Winchester; but his writings for the patrons of Cernel, and the fact that he wrote in 998 his *Canons*[4] as a pastoral letter for Wulfsige, the bishop of Sherborne, the diocese in which the abbey was situated, afford presumption of continued residence there. He became in 1005 the first abbot of Eynsham or Ensham, near Oxford, another foundation of Æthelmær's. After his elevation he wrote an abridgment for his monks of Æthelwold's *De consuetudine monachorum*,[5] adapted to their rudimentary ideas of monastic life; a letter to Wulfgeat of Ylmandun[6]; an introduction to the study of the Old and New Testaments (about 1008, edited by William L'Isle in 1623); a Latin life of his master Æthelwold[7]; a pastoral letter for Wulfstan, archbishop of York and bishop of Worcester, in Latin and English; and an English version of Bede's *De Temporibus*.[8] The *Colloquium*,[9] a Latin dialogue designed to serve his scholars as a manual of Latin conversation, may date from his life at Cernel. It is safe to assume that the original draft of this, afterwards enlarged by his pupil, Ælfric Bata, was by Ælfric, and represents what his own scholar days were like. The last mention of Ælfric Abbot, probably the grammarian, is in a will dating from about 1020.

There have been three suppositions about Ælfric. (1) He was identified with Ælfric (995–1005), archbishop of Canterbury. This view was upheld by John Bale (*Ill. Maj. Brit. Scriptorum* . . . 2nd ed., Basel, 1557–1559; vol. i. p. 149, *s.v.* Alfric); by Humphrey Wanley (*Catalogus librorum septentrionalium*, &c., Oxford, 1705, forming vol. ii. of George Hickes's *Antiquae literaturae septentrionalis*); by Elizabeth Elstob, *The English-Saxon Homily on the Birthday of St Gregory* (1709; new edition, 1839); and by Edward Rowe Mores, *Ælfrico, Dorobernensi, archiepiscopo, Commentarius* (ed. G. J. Thorkelin, 1789), in which the conclusions of earlier writers on Ælfric are reviewed. Mores made him abbot of St Augustine's at Dover, and finally archbishop of Canterbury. (2) Sir Henry Spelman, in his *Concilia* . . . (1639, vol. i. p. 583), printed the *Canones ad Wulsinum episcopum*, and suggested Ælfric Putta or Putto, archbishop of York, as the author, adding some note of others bearing the name. The identity of Ælfric the grammarian with Ælfric archbishop of York was also discussed by Henry Wharton, in *Anglia Sacra* (1691, vol. i. pp. 125-134), in a dissertation reprinted in J. P. Migne's *Patrologia* (vol. 139, pp. 1459-70, Paris, 1853). (3) William of Malmesbury (*De gestis pontificum anglorum*, ed. N. E. S. A. Hamilton, Rolls Series, 1870, p. 406) suggested that he was abbot of Malmesbury and bishop of Crediton. The main facts of his career were finally elucidated by Eduard Dietrich in a series of articles contributed to C. W. Niedner's *Zeitschrift für historische Theologie* (vols. for 1855 and 1856, Gotha), which have formed the basis of all subsequent writings on the subject.

Sketches of Ælfric's career are in B. Ten Brink's *Early English Literature (to Wiclif)* (trans. H. M. Kennedy, New York, 1883, pp. 105-112), and by J. S. Westlake in *The Cambridge History of English Literature* (vol. i., 1907, pp. 116-129). An excellent bibliography and account of the critical apparatus is given in Dr R. Wülker's *Grundriss zur Geschichte der angelsächsischen Litteratur* (Leipzig, 1885, pp. 452-480). See also the account by Professor Skeat in Pt. iv. pp. 8-61 of his edition of the *Lives of the Saints*, already cited, which gives a full account of the MSS., and a discussion of Ælfric's sources, with further bibliographical references; and *Ælfric, a New Study of his Life and Writings*, by Miss C. L. White (Boston, New York and London, 1898) in the "Yale Studies in English." *Alcuini Interrogationes Sigewulfi Presbyteri in Genesin* (ed. G. E. McLean, Halle, 1883) is attributed to Ælfric by its editor. There are other isolated sermons and treatises by Ælfric, printed in vol. iii. of Grein's *Bibl. v. A.S. Prosa*.

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[1] See *A Testimonie of Antiquitie, shewing the auncient fayth in the Church of England touching the sacrament of the body and bloude of the Lord here publikely preached*, printed by John Day (1567). It was quoted in John Foxe's *Actes and Monuments* (ed. 1610).

[2] Ed. J. Zupitza in *Sammlung englischer Denkmäler* (vol. i., Berlin, 1880).

[3] Edited by Edward Thwaites as *Heptateuchus* (Oxford, 1698); modern edition in Grein's *Bibliothek der A.S. Prosa* (vol. i. Cassel and Göttingen, 1872). See also B. Assmann, *Abt Ælfric's . . . Esther* (Halle, 1885), and *Abt Ælfric's Judith* (in *Anglia*, vol. x.).

[4] Printed by Benjamin Thorpe in *Ancient Laws and Institutes of England* (1840), with the later pastoral for Wulfstan.

[5] See E. Breck, *A Fragment of Ælfric; translation of Æthelwold's De Consuetudine Monachorum and its relation to other MSS.* (Leipzig, 1887).

[6] Ilmington, on the borders of Warwickshire and Gloucestershire.

[7] Included by J. Stevenson in the *Chron. Monast. de Abingdon* (vol. ii. pp. 253-266, Rolls Series, 1858).

[8] See Oswald Cockayne, *Leechdoms, Wortcunning and Starcraft* (vol. iii., 1866, pp. xiv.-xix. and pp. 233 *et seq.*) in the Rolls Series.

[9] See an article by J. Zupitza in the *Zeitschrift für deutsches Altertum* (vol. xix., new series, 1887).

AELIA CAPITOLINA, the city built by the emperor Hadrian, A.D. 131, and occupied by a Roman colony, on the site of Jerusalem (*q.v.*), which was in ruins when he visited his Syrian dominions. *Aelia* is derived from the emperor's family name, and *Capitolina* from that of Jupiter Capitolinus, to whom a temple was built on the site of the Jewish temple.

AELIAN (AELIANUS TACTICUS), Greek military writer of the 2nd century A.D., resident at Rome. He is sometimes confused with Claudius Aelianus, the Roman writer referred to below. Aelian's military treatise, Τακτικὴ Θεωρία, is dedicated to Hadrian, though this is probably a mistake for Trajan, and the date A.D. 106 has been assigned to it. It is a handbook of Greek, *i.e.* Macedonian, drill and tactics as practised by the Hellenistic successors of Alexander the Great. The author claims to have consulted all the best authorities, the chief of which was a lost treatise on the subject by Polybius. Perhaps the chief value of Aelian's work lies in his critical account of preceding works on the art of war, and in the fulness of his technical details in matters of drill. Critics of the 18th century—Guichard Folard and the prince de Ligne—were unanimous in thinking Aelian greatly inferior to Arrian, but both on his immediate successors, the Byzantines, and on the Arabs, who translated the text for their own use, Aelian exercised a great influence. The emperor Leo VI. incorporated much of Aelian's text in his own work on the military art. The Arabic version of Aelian was made about 1350. In spite of its academic nature, the copious details to be found in the treatise rendered it of the highest value to the army organizers of the 16th century, who were engaged in fashioning a regular military system out of the semi-feudal systems of previous generations. The Macedonian phalanx of Aelian had many points of resemblance to the solid masses of pikemen and the "squadrons" of cavalry of the Spanish and Dutch systems, and the translations made in the 16th century formed the groundwork of numerous books on drill and tactics. Moreover, his works, with those of Xenophon, Polybius, Aeneas and Arrian, were minutely studied by every soldier of the 16th and 17th centuries who wished to be master of his profession. It has been suggested that Aelian was the real author of most of Arrian's *Tactica*, and that the Τακτικὴ Θεωρία is a later revision of this original, but the theory is not generally accepted.

The first edition of the Greek text is that of Robortelli (Venice, 1552); the Elzevir text (Leiden, 1613) has notes. The text in W. Rüstow and H. Köchly's *Griechische Kriegsschriftsteller* (1855) is accompanied by a translation, notes and reproductions of the original illustrations. A Latin translation by Theodore Gaza of Thessalonica was included in the famous collection *Veteres de re militari scriptores* (Rome and Venice, 1487, Cologne, 1528, &c.). The French translation of Machault, included in his *Milices des Grecs et Romains* (Paris, 1615) and entitled *De la Sergenterie des Grecs*, a German translation from Theodore Gaza (Cologne, 1524), and the English version of Jo. B(ingham), which includes a drill manual of the English troops in the Dutch service, *Tacticks of Aelian* (London, 1616), are of importance in the military literature of the period. A later French translation by Bouchard de Bussy, *La Milice des Grecs ou Tactique d'Élien* (Paris, 1737 and 1757); Baumgärtner's German translation in his incomplete *Sammlung aller Kriegsschriftsteller der Griechen* (Mannheim and Frankenthal, 1779), reproduced in 1786 as *Von Schlachtordnungen*, and Viscount Dillon's English version (London, 1814) may also be mentioned. See also R. Förster, *Studien zu den griechischen Taktikern* (*Hermes*, xii., 1877, pp. 444-449); F. Wüstenfeld, *Das Heerwesen der Muhammedaner und die arabische Uebersetzung der Taktik des Aelianus* (Göttingen, 1880); M. Jähns, *Gesch. der Kriegswissenschaften*, i. 95-97 (Munich, 1889); Rüstow and Köchly, *Gesch. des griechischen Kriegswesens* (1852); A. de Lort-Sérignan, *La Phalange* (1880); P. Serre, *Études sur l'histoire militaire et maritime des Grecs et des Romains* (1887); K. K. Müller, in Pauly-Wissowa, *Realencyclopädie* (Stuttgart, 1894).

AELIAN (CLAUDIUS AELIANUS), Roman author and teacher of rhetoric, born at Praeneste, flourished under Septimius Severus and probably outlived Elagabalus (d. 222). He spoke Greek so perfectly that he was called "honey-tongued" (μελίγλωσσος); although a Roman he preferred Greek authors, and wrote in Greek himself. His chief works are: *On the Nature of Animals*, curious and interesting stories of animal life, frequently used to convey moral lessons (ed. Schneider, 1784; Jacobs, 1832); *Various History*—for the most part preserved only in an abridged form—consisting mainly of anecdotes of men and customs (ed. Lünemann, 1811). Both works are valuable for the numerous excerpts from older writers. Considerable fragments of two other works *On Providence* and *Divine Manifestations* are preserved in Suidas; twenty *Peasants' Letters*, after the manner of Alciphron but inferior, are also attributed to him.

Editio princeps of complete works by Gesner, 1556; Hercher, 1864-1866. English translation of the *Various History* only by Fleming, 1576, and Stanley, 1665; of the *Letters* by Quillard (French), 1895.

ÆLRED, AILRED, ETHELRED (1109–1166), English theologian, historical writer and abbot of Rievaulx, was born at Hexham about the year 1109. In his youth he was at the court of Scotland as an attendant of Henry, son of David I. He was in high favour with that sovereign, but renounced the prospect of a bishopric to enter the Cistercian house of Rievaulx in Yorkshire, which was founded in 1131 by Walter Espec. Here Ælred remained for some time as master of the novices, but between the years 1142 and 1146 was elected abbot of Revesby in Lincolnshire and migrated thither. In 1146 he became abbot of Rievaulx. He led a life of the severest asceticism, and was credited with the power of working miracles; owing to his reputation the numbers of Rievaulx were greatly increased. In 1164 he went as a missionary to the Picts of Galloway. He found their religion at a low ebb, the regular clergy apathetic and sensual, the bishop little obeyed, the laity divided by the family feuds of their rulers, unchaste and ignorant. He induced a Galwegian chief to take the habit of religion, and restored the peace of the country. Two years later he died of a decline, at Rievaulx, in the fifty-seventh year of his age. In the year 1191 he was canonized. His writings are voluminous and have never been completely published. Amongst them are homilies "on the burden of Babylon in Isaiah"; three books "on spiritual friendship"; a life of Edward the Confessor; an account of miracles wrought at Hexham, and the tract called *Relatio de Standardo*. This last is an account of the Battle of the Standard (1138), better known than the similar account by Richard of Hexham, but less trustworthy, and in places obscured by a peculiarly turgid rhetoric.

See the *Vita Alredi* in John of Tynemouth's *Nova Legenda Anglie* (ed. C. Horstmann, 1901, vol. i. p. 41), whence it was taken by Capgrave. From Capgrave the work passed into the Bollandist *Acta Sanctorum* (Jan. ii. p. 30). This life is anonymous, but of an early date. The most complete printed collection of Ælred's works is in Migne's *Patrologia Latina*, vol. cxcv.; but this does not include the *Miracula Hagulstaldensis Ecclesiae* which are printed in J. Raine's *Priory of Hexham*, vol. i. (Surtees Society, 1864). A complete list of works attributed to Ælred is given in T. Tanner's *Bibliotheca Britannico-Hibernica* (1748), pp. 247-248. The *Relatio de Standardo* has been critically edited by R. Howlett in *Chronicles, &c., of Stephen, Henry II. and Richard I.*, vol. iii. (Rolls Series, 1886). (H. W. C. D.)

AEMILIA VIA, or AEMILIAN WAY. (1) A highroad of Italy, constructed in 187 B.C. by the consul M. Aemilius Lepidus, from whom it takes its name; it ran from Ariminum to Placentia, a distance of 176 m. almost straight N.W., with the plain of the Po (Padus) and its tributaries on the right, and the Apennines on the left. The 79th milestone from Ariminum found in the bed of the Rhenus at Bononia records the restoration of the road by Augustus from Ariminum to the river Trebia in 2 B.C. (*Notiz. Scav.*, 1902, 539). The bridge by which it crossed the Sillaro was restored by Trajan in A.D. 100 (*Notizie degli Scavi*, 1888, 621). The modern highroad follows the ancient line, and some of the original bridges still exist. After Augustus, the road gave its name to the district which formed the eighth region of Italy (previously known as Gallia or Provincia Ariminum), at first in popular usage (as in Martial), but in official language as early as the 2nd century; it is still in use (see EMILIA). The district was bounded on the N. by the Padus, E. by the Adriatic, S. by the river Crustumium (mod. Conca), and W. by the Apennines and the Ira (mod. Staffora) at Iria (mod. Voghera), and corresponds approximately with the modern district.

(2) A road constructed in 109 B.C. by the censor M. Aemilius Scaurus from Vada Volaterrana and Luna to Vada Sabatia and thence over the Apennines to Dertona (Tortona), where it joined

the Via Postumia from Genua to Cremona. We must, however (as Mommsen points out in *C.I.L.* v. p. 885), suppose that the portion of the coast road from Vada Volaterrana to Genua at least must have existed before the construction of the Via Postumia in 148 B.C. Indeed Polybius (iii. 39. 8) tells us (and this must refer to the time of the Gracchi if not earlier) that the Romans had in his time built the coast road from the Rhone to Carthago Nova; and it is incredible that the coast road in Italy itself should not have been constructed previously. It is, however, a very different thing to open a road for traffic, and so to construct it that it takes its name from that construction in perpetuity. (T. As.)

AEMILIUS, PAULUS (PAOLO EMILIO) (d. 1529), Italian historian, was born at Verona. He obtained such reputation in his own country that he was invited to France in the reign of Charles VIII., in order to write in Latin the history of the kings of France, and was presented to a canonry in Notre Dame. He enjoyed the patronage and support of Louis XII. He died at Paris on the 5th of May 1529. His *De Rebus gestis Francorum* was translated into French in 1581, and has also been translated into Italian and German.

AENEAS, the famous Trojan hero, son of Anchises and Aphrodite, one of the most important figures in Greek and Roman legendary history. In Homer, he is represented as the chief bulwark of the Trojans next to Hector, and the favourite of the gods, who frequently interpose to save him from danger (*Iliad*, v. 311). The legend that he remained in the country after the fall of Troy, and founded a new kingdom (*Iliad*, xx. 308; *Hymn to Aphrodite*, 196) is now generally considered to be of comparatively late origin. The story of his emigration is post-Homeric, and set forth in its fullest development by Virgil in the *Aeneid*. Carrying his aged father and household gods on his back and leading his little son Ascanius by the hand, he makes his way to the coast, his wife Creusa being lost during the confusion of the flight. After a perilous voyage to Thrace, Delos, Crete and Sicily (where his father dies), he is cast up by a storm, sent by Juno, on the African coast. Refusing to remain with Dido, queen of Carthage, who in despair puts an end to her life, he sets sail from Africa, and after seven years' wandering lands at the mouth of the Tiber. He is hospitably received by Latinus, king of Latium, is betrothed to his daughter Lavinia, and founds a city called after her, Lavinium. Turnus, king of Rutuli, a rejected suitor, takes up arms against him and Latinus, but is defeated and slain by Aeneas on the river Numicius. The story of the *Aeneid* ends with the death of Turnus. According to Livy (i. 1. 2), Aeneas, after reigning a few years over Latium, is slain by the Rutuli; after the battle, his body cannot be found, and he is supposed to have been carried up to heaven. He receives divine honours, and is worshipped under the name of Jupiter Indiges (Dionysius Halic. i. 64).

See J. A. Hild, *La Légende d'Énée avant Vergile* (1883); F. Cauer, *De Fabulis Graecis ad Romam conditam pertinentibus* (1884) and *Die Römische Aeneassage, von Naevius bis Vergilius* (1886); G. Boissier, "La Légende d'Énée" in *Revue des Deux Mondes*, Sept. 1883; A. Förstemann, *Zur Geschichte des Aeneasmythus* (1894); articles in Pauly-Wissowa's *Realencyclopädie* (new ed., 1894); Roscher's *Lexicon der Mythologie*; Daremberg and Saglio's *Dictionnaire des antiquités*; Preller's *Griechische und römische Mythologie*; and especially Schwegler, *Römische Geschichte* (1867).

Romances.—The story of Aeneas, as a sequel to the legend of Troy, formed the subject of several epic romances in the middle ages. The *Roman d'Énéas* (*c.* 1160, or later), of uncertain authorship (attributed by some to Benoît de Sainte-More), the first French poem directly imitated from the *Aeneid*, is a fairly close adaptation of the original. The trouvère, however, omits the greater part of the wanderings of Aeneas, and adorns his narrative with gorgeous descriptions, with accounts of the marvellous properties of beasts and stones, and of single combats among the knights who figure in the story. He also elaborates the episodes most attractive to his audience, notably those of Dido and Aeneas and Lavinia, the last of whom plays a far more important part than in the *Aeneid*. Where possible, he substitutes human for divine intervention, and ignores the idea of the glorification of Rome and Augustus, which dominates the Virgilian epic. On this work were founded the *Eneide* or *Eneit* (between 1180 and 1190) of Heinrich von Veldeke, written in Flemish and now only extant in a version in the Thuringian dialect, and the *Eneydos*, written by William Caxton in 1490.

See *Énéas*, ed. J. Salverda de Grave (Halle, 1891); see also A. Peij, *Essai sur li romans d' Énéas* (Paris, 1856); A. Duval in *Hist. littéraire de la France*, xix.; Veldeke's *Eneide*, ed. Ettmüller (Leipzig, 1852) and O. Behaghel (Heilbronn, 1882); *Eneydos*, ed. F. J. Furnivall (1890). For Italian versions see E. G. Parodi in *Studi di filologia romanza* (v. 1887).

AENEAS TACTICUS (4th century B.C.), one of the earliest Greek writers on the art of war. According to Aelianus Tacticus and Polybius, he wrote a number of treatises (Ὑπομνήματα) on the subject; the only one extant deals with the best methods of defending a fortified city. An epitome of the whole was made by Cineas, minister of Pyrrhus, king of Epirus. The work is chiefly valuable as containing a large number of historical illustrations. Aeneas was considered by Casaubon to have been a contemporary of Xenophon and identical with the Arcadian general Aeneas of Stymphalus, whom Xenophon (*Hellenica*, vii. 3) mentions as fighting at the battle of Mantinea (362 B.C.).

Editions in I. Casaubon's (1619), Gronovius' (1670) and Ernesti's (1763) editions of Polybius; also separately, with notes, by J. C. Orelli (Leipzig, 1818). Other texts are those of W. Rüstow and H. Köchly (*Griechische Kriegsschriftsteller*, vol. i. Leipzig, 1853) and A. Hug, *Prolegomena Critica ad Aeneae . . . editionem* (Zürich University, 1874). See also Count Beausobre, *Commentaires sur la défense des places d'Aeneas* (Amsterdam, 1757); A. Hug, *Aeneas von Stymphalos* (Zürich, 1877); C. C. Lange, *De Aeneae commentario poliorcetico* (Berlin, 1879); M. H. Meyer, *Observationes in Aeneam Tacticum* (Halle, 1835); Haase, in *Jahns Jahrbuch*, 1835, xiv. 1; Max Jähns, *Gesch. der Kriegswissenschaften*, i. pp. 26-28 (Munich, 1889); Ad. Bauer, in *Zeitschrift für allg. Geschichte, &c.*, 1886, i.; T. H. Williams in *American Journal of Philology*, xxv. 4; E. Schwartz in Pauly-Wissowa, *Realencyclopädie* (Stuttgart, 1894).

AENESIDEMUS, Greek philosopher, was born at Cnossus in Crete and taught at Alexandria, probably during the first century B.C. He was the leader of what is sometimes known as the third sceptical school and revived to a great extent the doctrine of Pyrrho and Timon. His chief work was the *Pyrrhonian Principles* addressed to Lucius Tubero. His philosophy consisted of four main parts, the reasons for scepticism and doubt, the attack on causality and truth, a physical theory and a theory of morality. Of these the two former are important. The reasons for doubt are given in the form of the ten "tropes": (1) different animals manifest different modes of perception; (2) similar differences are seen among individual men; (3) even for the same man, sense-given data are self-contradictory, (4) vary from time to time with physical changes, and (5) according to local relations; (6) and (7) objects are known only indirectly through the medium of air, moisture, &c., and are in a condition of perpetual change in colour, temperature, size and motion; (8) all perceptions are relative and interact one upon another; (9) our impressions become less deep by repetition and custom; and (10) all men are brought up with different beliefs, under different laws and social conditions. Truth varies infinitely under circumstances whose relative weight cannot be accurately gauged. There is, therefore, no absolute knowledge, for every man has different perceptions, and, further, arranges and groups his data in methods peculiar to himself; so that the sum total is a quantity with a purely subjective validity. The second part of his work consists in the attack upon the theory of causality, in which he adduces almost entirely those considerations which are the basis of modern scepticism. Cause has no existence apart from the mind which perceives; its validity is ideal, or, as Kant would have said, subjective. The relation between cause and effect is unthinkable. If the two things are different, they are either simultaneous or in succession. If simultaneous, cause is effect and effect cause. If not, since effect cannot precede cause, cause must precede effect, and there must be an instant when cause is not effective, that is, is not itself. By these and similar arguments he arrives at the fundamental principle of Scepticism, the radical and universal opposition of causes; παντὶ λόγῳ λόγος ἀντίκειται. Having reached this conclusion, he was able to assimilate the physical theory of Heraclitus, as is explained in the *Hypotyposes* of Sextus Empiricus. For admitting that contraries co-exist for the perceiving subject, he was able to assert the co-existence of contrary qualities in the same object. Having thus disposed of the ideas of truth and causality, he proceeds to undermine the ethical criterion, and denies that any man can aim at Good, Pleasure or Happiness as an absolute, concrete ideal. All actions are product of pleasure and pain, good and evil. The end of ethical endeavour is the conclusion that all endeavour is vain and illogical. The main tendency of this destructive scepticism is essentially the same from its first crystallization by Aenesidemus down to the most advanced sceptics of to-day (see SCEPTICISM). For the immediate successors of Aenesidemus see AGRIPPA, SEXTUS EMPIRICUS. See also CARNEADES and ARCESILAUS. Of the Πυρρώνειοι λόγοι nothing remains; we have, however, an analysis in the *Myriobiblion* of Photius.

See Zeller's *History of Greek Philosophy*; E. Saisset, *Ænésidème, Pascal, Kant*; Ritter and Preller, §§ 364-370.

AEOLIAN HARP (Fr. *harpe éolienne*; Ger. *Äolsharfe, Windharfe*; Ital. *arpa d' Eolo*), a stringed musical instrument, whose name is derived from Aeolus, god of the wind. The aeolian harp consists of a sound-box about 3 ft. long, 5 in. wide, and 3 in. deep, made of thin deal, or preferably of pine, and having beech ends to hold the tuning-pins and hitch-pins. A dozen or less catgut strings of different thickness, but tuned in exact unison, and left rather slack, are attached to the pins, and stretched over two narrow bridges of hard wood, one at each end of the sound-board, which is generally provided with two rose sound-holes. To ensure a proper passage for the wind, another pine board is placed over the strings, resting on pegs at the ends of the sound-board, or on a continuation of the ends raised from 1 to 3 in. above the strings. Kaufmann of Dresden and Heinrich Christoph Koch, who improved the aeolian harp, introduced this contrivance, which was called by them *Windfang* and *Windflügel*; the upper board was prolonged beyond the sound-box in the shape of a funnel, in order to direct the current of air on to the strings. The aeolian harp is placed across a window so that the wind blows obliquely across the strings, causing them to vibrate in aliquot parts, *i.e.* (the fundamental note not being heard) the half or octave, the third or interval of the twelfth, the second octave, and the third above it, in fact the upper partials of the strings in regular succession. With the increased pressure of the wind, the dissonances of the 11th and 13th overtones are heard in shrill discords, only to give place to beautiful harmonies as the force of the wind abates. The principle of the natural vibration of strings by the pressure of the wind was recognized in ancient times; King David, we hear from the Rabbinic records, used to hang his *kinnor* (*kithara*) over his bed at night, when it sounded in the midnight breeze. The same is related of St Dunstan of Canterbury, who was in consequence charged with sorcery. The Chinese at the present day fly kites of various sizes, having strings stretched across apertures in the paper, which produces the effect of an aerial chorus.

See Athanasius Kircher, *Musurgia Universalis*, where the aeolian harp is first described (1602–1608), p. 148; Mathew Young, Bishop of Clonfert, *Enquiry into the Principal Phenomena of Sounds and Musical Strings*, pp. 170-182 (London, 1784); Göttingen Pocket Calendar (1792); Mendel's *Musikalisches Conversations-Lexikon*, article "Aeolsharfe." An illustration is given in Rees' *Encyclopedia*, plates, vol. ii. Misc. pl. xxv. (K. S.)

AEOLIS (AEOLIA), an ancient district of Asia Minor, colonized at a very early date by Aeolian Greeks. The name was applied to the coast from the river Hermus to the promontory of Lectum, *i.e.* between Ionia to S. and Troas to N. The Aeolians founded twelve cities on the mainland, including Cyme, and numerous towns in Mytilene: they were said also to have settled in the Troad and even within the Hellespont.

AEOLUS, in Greek mythology, according to Homer the son of Hippotes, god and father of the winds, and ruler of the island of Aeolia. In the *Odyssey* (x. 1) he entertains Odysseus, gives him a favourable wind to help him on his journey, and a bag in which the unfavourable winds have been confined. Out of curiosity, or with the idea that it contains valuable treasures, Odysseus' companions open the bag; the winds escape and drive them back to the island, whence Aeolus dismisses them with bitter reproaches. According to Virgil, Aeolus dwells on one of the Aeolian islands to the north of Sicily, Lipara or Strongyle (Stromboli), where he keeps the winds imprisoned in a vast cavern (Virgil, *Aen.* i. 52). Another genealogy makes him the son of Poseidon and Arne, granddaughter of Hippotes, and a descendant of Aeolus, king of Magnesia in Thessaly, the mythical ancestor of the tribe of the Aeolians (Diodorus iv. 67).

AEON, a term often used in Greek (*αἰών*) to denote an indefinite or infinite duration of time; and hence, by metonymy, a being that exists for ever. In the latter sense it was chiefly used by the Gnostic sects to denote those eternal beings or manifestations which emanated from the one incomprehensible and ineffable God. (See GNOSTICISM.)

AEPINUS, FRANZ ULRICH THEODOR (1724–1802), German natural philosopher, was born at Rostock in Saxony on the 13th of December 1724. He was descended from John Aepinus (1499–1553), the first to adopt the Greek form (*αἰπεινός*) of the family name Hugk or Huck, and a leading theologian and controversialist at the time of the Reformation. After studying medicine for a time, Franz Aepinus devoted himself to the physical and mathematical sciences, in which he soon gained such distinction that he was admitted a member of the Berlin academy of sciences. In 1757 he settled in St Petersburg as member of the imperial academy of sciences and professor of physics, and remained there till his retirement in 1798. The rest of his life was spent at Dorpat, where he died on the 10th of August 1802. He enjoyed the special favour of the empress Catherine II., who appointed him tutor to her son Paul, and endeavoured, without success, to establish normal schools throughout the empire under his direction. Aepinus is best known by his researches, theoretical and experimental, in electricity and magnetism, and his principal work, *Tentamen Theoriae Electricitatis et Magnetismi*, published at St Petersburg in 1759, was the first systematic and successful attempt to apply mathematical reasoning to these subjects. He also published a treatise, in 1761, *De distributione caloris per tellurem*, and he was the author of memoirs on different subjects in astronomy, mechanics, optics and pure mathematics, contained in the journals of the learned societies of St Petersburg and Berlin. His discussion of the effects of parallax in the transit of a planet over the sun's disc excited great interest, having appeared (in 1764) between the dates of the two transits of Venus that took place in the 18th century.

AEQUI, an ancient people of Italy, whose name occurs constantly in Livy's first decade as hostile to Rome in the first three centuries of the city's existence. They occupied the upper reaches of the valleys of the Anio, Tolenus and Himella; the last two being mountain streams running northward to join the Nar. Their chief centre is said to have been taken by the Romans about 484 B.C. (Diodorus xi. 40) and again about ninety years later (*id.* xiv. 106), but they were not finally subdued till the end of the second Samnite war (Livy ix. 45, x. 1; Diod. xx. 101), when they seem to have received a limited form of franchise (Cic. *Off.* i. 11, 35). All we know of their subsequent political condition is that after the Social war the folk of Cliternia and Nersae appear united in a *res publica Aequiculorum*, which was a *municipium* of the ordinary type (*C.I.L.* ix. p. 388). The Latin colonies of Alba Fucens (304 B.C.) and Carsioli (298 B.C.) must have spread the use of Latin (or what passed as such) all over the district; through it lay the chief (and for some time the only) route (Via Valeria) to Luceria and the south.

Of the language spoken by the Aequi before the Roman conquest we have no record; but since the Marsi (*q.v.*), who lived farther east, spoke in the 3rd century B.C. a dialect closely akin to Latin, and since the Hernici (*q.v.*), their neighbours to the south-west, did the same, we have no ground for separating any of these tribes from the Latian group (see LATINI). If we could be certain of the origin of the *q* in their name and of the relation between its shorter and its longer form (note that the *i* in *Aequiculus* is long—Virgil, *Aen.* vii. 744—which seems to connect it with the locative of *aequum* "a plain," so that it would mean "dwellers in the plain"; but in the historical period they certainly lived mainly in the hills), we should know whether they were to be grouped with the *q* or the *p* dialects, that is to say, with Latin on the one hand, which preserved an original *q*, or with the dialect of Velitrae, commonly called Volscian (and the Volsci were the constant allies of the Aequi), on the other hand, in which, as in the Iguvine and Samnite dialects, an original *q* is changed into *p*. There is no decisive evidence to show whether the *q* in Latin *aequus* represents an Indo-European *q* as in Latin *quis*, Umbro-Volsc. *pis*, or an Indo-European *k* + *u* as in *equus*, Umb. *ekvo-*. The derivative adjective *Aequicus* might be taken to range them with the Volsci rather than the Sabini, but it is not clear that this adjective was ever used as a real ethnicon; the name of the tribe is always *Aequi*, or *Aequicoli*.

At the end of the Republican period the Aequi appear, under the name Aequiculi or Aequicoli, organized as a *municipium*, the territory of which seems to have comprised the upper part of the valley of the Salto, still known as Cicolano. It is probable, however, that they continued to live in their villages as before. Of these Nersae (mod. Nesce) was the most considerable. The polygonal terrace walls, which exist in considerable numbers in the district, are shortly described in *Römische Mitteilungen* (1903), 147 *seq.*, but require further study.

See further the articles MARSI, VOLSCI, LATINI, and the references there given; the place-names and other scanty records of the dialect are collected by R. S. Conway, *The Italic Dialects*, pp. 300 ff. (R. S. C.)

AERARII (from Lat. *aes*, in its subsidiary sense of "poll-tax"), originally a class of Roman citizens not included in the thirty tribes of Servius Tullius, and subject to a poll-tax arbitrarily fixed by the censor. They were (1) the inhabitants of conquered towns which had been deprived of local self-government, who possessed the *jus conubii* and *jus commercii*, but no political rights; Caere is said to have been the first example of this (353 B.C.); hence the expression "in tabulas Caeritum referre" came to mean "to degrade to the status of an *aerarius*": (2) full citizens subjected to civil degradation (*infamia*) as the result of following certain professions (*e.g.* acting), of dishonourable acts in private life (*e.g.* bigamy) or of conviction for certain crimes; (3) persons branded by the censor. Those who were thus excluded from the tribes and centuries had no vote, were incapable of filling Roman magistracies and could not serve in the army. According to Mommsen, the *aerarii* were originally the non-*assidui* (non-holders of land), excluded from the tribes, the comitia and the army. By a reform of the censor Appius Claudius in 312 B.C. these non-*assidui* were admitted into the tribes, and the *aerarii* as such disappeared. But in 304, Fabius Rullianus limited them to the four city tribes, and from that time the term meant a man degraded from a higher (country) to a lower (city) tribe, but not deprived of the right of voting or of serving in the army. The expressions "tribu movere" and "aerarium facere," regarded by Mommsen as identical in meaning ("to degrade from a higher tribe to a lower"), are explained by A. H. J. Greenidge—the first as relegation from a higher to a lower tribe or total exclusion from the tribes, the second as exclusion from the centuries. Other views of the original *aerarii* are that they were:—artisans and freedmen (Niebuhr); inhabitants of towns united with Rome by a *hospitium publicum*, who had become domiciled on Roman territory (Lange); only a class of degraded citizens, including neither the *cives sine suffragio* nor the artisans (Madvig); identical with the *capite censi* of the Servian constitution (Belot, Greenidge).

See A. H. J. Greenidge, *Infamia in Roman Law* (1894), where Mommsen's theory is criticized; E. Belot, *Histoire des chevaliers romains*, i. p. 200 (Paris, 1866); L. Pardon, *De Aerariis* (Berlin, 1853); P. Willems, *Le Droit public romain* (1883); A. S. Wilkins in Smith's *Dict. of Greek and Roman Antiquities* (3rd ed., 1891); and the usual handbooks of antiquities.

AERARIUM (from Lat. *aes*, in its derived sense of "money"), the name (in full, *aerarium stabulum*, treasure-house) given in ancient Rome to the public treasury, and in a secondary sense to the public finances. The treasury contained the moneys and accounts of the state, and also the standards of the legions; the public laws engraved on brass, the decrees of the senate and other papers and registers of importance. These public treasures were deposited in the temple of Saturn, on the eastern slope of the Capitoline hill, and, during the republic, were in charge of the urban quaestors (see QUAESTOR), under the superintendence and control of the senate. This arrangement continued (except for the year 45 B.C., when no quaestors were chosen) until 28 B.C., when Augustus transferred the *aerarium* to two *praefecti aerarii*, chosen annually by the senate from ex-praetors; in 23 these were replaced by two praetors (*praetores aerarii* or *ad aerarium*), selected by lot during their term of office; Claudius in A.D. 44 restored the quaestors, but nominated by the emperor for three years, for whom Nero in 56 substituted two ex-praetors, under the same conditions. In addition to the common treasury, supported by the general taxes and charged with the ordinary expenditure, there was a special reserve fund, also in the temple of Saturn, the *aerarium sanctum* (or *sanctius*), probably originally consisting of the spoils of war, afterwards maintained chiefly by a 5% tax on the value of all manumitted slaves, this source of revenue being established by a lex Manlia in 357. This fund was not to be touched except in cases of extreme necessity (Livy vii. 16, xxvii. 10). Under the emperors the senate continued to have at least the nominal management of the *aerarium*, while the emperor had a separate exchequer, called *fiscus*. But after a time, as the power of the emperors increased and their jurisdiction extended till the senate existed only in form and name, this distinction virtually ceased. Besides creating the *fiscus*, Augustus also established in A.D. 6 a military treasury (*aerarium militare*), containing all moneys raised for and appropriated to the maintenance of the army, including a pension fund for disabled soldiers. It was largely endowed by the emperor himself (see *Monumentum Ancyranum*, iii. 35) and supported by the proceeds of the tax on public sales and the succession duty. Its administration was in the hands of three *praefecti aerarii militaris*, at first appointed by lot, but afterwards by the emperor, from senators of praetorian rank, for three years. The later emperors had a separate *aerarium privatum*, containing the moneys allotted for their own use, distinct from the *fiscus*, which they administered in the interests of the empire.

The *tribuni aerarii* have been the subject of much discussion. They are supposed by some to be identical with the *curatores tribuum*, and to have been the officials who, under the Servian organization, levied the war-tax (*tributum*) in the tribes and the poll-tax on the *aerarii* (*q.v.*). They also acted as paymasters of the equites and of the soldiers on service in each tribe. By the *lex Aurelia* (70 B.C.) the list of judices was composed, in addition to senators and equites, of *tribuni aerarii*. Whether these were the successors of the above, or a new order closely connected with the equites, or even the same as the latter, is uncertain. According to Mommsen, they were persons who possessed the equestrian census, but no public horse. They were removed from the list of judices by Caesar, but replaced by Augustus. According to Madvig, the original *tribuni aerarii* were not officials at all, but private individuals of considerable means, quite distinct from the *curatores tribuum*, who undertook certain financial work connected with their own tribes. Then, as in the case of the equites, the term was subsequently extended to include all those who possessed the property qualification that would have entitled them to serve as *tribuni aerarii*.

See Tacitus, *Annals*, xiii. 29, with Furneaux's notes; O. Hirschfeld, "Das Aerarium militare in der römischen Kaiserzeit," in Fleckeisen's *Jahrbuch*, vol. xcvii. (1868); S. Herrlich, *De Aerario et Fisco Romanorum* (Berlin, 1872); and the usual handbooks and dictionaries of antiquities. On the *tribuni aerarii* see E. Belot, *Hist. des chevaliers romains*, ii. p. 276; J. N. Madvig, *Opuscula Academica*, ii. p. 242; J. B. Mispoulet, *Les Institutions politiques des Romains* (1883), ii. p. 208; Mommsen, *Römisches Staatsrecht*, iii. p. 189; A. S. Wilkins in Smith's *Dictionary of Greek and Roman Antiquities* (3rd ed., 1890).

AERATED WATERS. Waters charged with a larger proportion of carbon dioxide than they will dissolve at ordinary atmospheric pressure occur in springs in various parts of the world (see Mineral Waters). Such waters, which also generally hold in solution a considerable percentage of saline constituents, early acquired a reputation as medicinal agents, and when carbon dioxide (“ fixed air ”) became familiar to chemists the possibility was recognized, as by Joseph Priestley (*Directions for impregnating water with fixed air . . . to communicate the peculiar Spirit and Virtues of Pyrmont water*, 1772), of imitating them artificially. Many of the ordinary aerated waters of commerce, however, do not pretend to reproduce any known natural water; they are merely beverages owing their popularity to their effervescing properties and the flavour imparted by a small quantity of some salt such as sodium bicarbonate or a little fruit syrup. Their manufacture on a considerable scale was begun at Geneva so far back as 1790 by Nicholas Paul, and the excellence of the soda water prepared in London by J. Schweppe, who had been a partner of Paul's, is referred to by Tiberius Cavallo in his *Essay on the Medicinal Properties of Factitious Airs*, published in 1798. Many forms of apparatus are employed for charging the water with the gas. A simple machine for domestic use, called a gasogene or seltzogene, consists of two strong glass globes connected one above the other by a wide glass tube which rises nearly to the top of the upper and smaller globe. Surmounting the small globe there is a spring valve, fitted to a narrow tube that passes through the wide tube to the bottom of the large globe. To use the machine, the lower vessel is filled with water, and in the upper one, round the base of the wide tube, is placed a mixture, commonly of sodium bicarbonate and tartaric acid, which with water yields carbon dioxide. The valve head is then fastened on, and by tilting the apparatus some water is made to flow through the wide tube from the lower to the upper vessel. The water in the lower globe takes up the gas thus produced, and when required for use is withdrawn by the valve, being forced up the narrow tube by the pressure of the gas. In another arrangement the gas is supplied compressed in little steel capsules, and is liberated into a bottle containing the water which has to be aerated. On a large scale, use is made of continuously acting machinery which is essentially of the type devised by Joseph Bramah. The gas is prepared in a separate generator by the action of sulphuric acid on sodium bicarbonate or whiting, and after being washed is collected in a gas-holder, whence it is forced with water under pressure into a receiver or saturator in which an agitator is kept moving. Some manufacturers buy their gas compressed in steel cylinders. The water thus aerated or *carbonated* passes from the receiver, in which the pressure may be 100–200 lb on the square inch, to bottling machines which fill and close the bottles; if beverages like lemonade are being made the requisite quantity of fruit syrup is also injected into the bottles, though sometimes the fruit syrup mixture is aerated in bulk. For soda water sodium bicarbonate should be added to the water before aeration, in varying proportions up to about 15 grains per pint, but the simple carbonated water often does duty instead. Potash water, lithia water and many others are similarly prepared, the various salts being used in such amounts as are dictated by the experience and taste of the manufacturer. Aerated waters are sent out from the factories either in siphons (*q.v.*) or in bottles; the latter may be closed by corks, or by screw-stoppers or by internal stoppers consisting of a valve, such as a glass ball, held up against an indiarubber ring in the neck by the pressure of the gas. For use in “ soda-fountains ” the waters are sent out in large cylinders.

See W. Kirkby, *Evolution of Artificial Mineral Waters* (Manchester, 1902).

AERONAUTICS, the art of “ navigating ” the “ air.” It is divisible into two main branches—*aerostation*, dealing properly with machines which like balloons are lighter than the air, and *aviation*, dealing with the problem of artificial flight by means of flying machines which, like birds, are heavier than the air, and also with attempts to fly made by human beings by the aid of artificial wings fitted to their limbs.

Historically, *aviation* is the older of the two, and in the legends or myths of men or animals which are supposed to have travelled through the air, such as Pegasus, Medea's dragons and Daedalus, as well as in Egyptian bas-reliefs, wings appear as the means by which aerial locomotion is effected. In later times there are many stories of men who have attempted to fly in the same way. John Wilkins (1614–1672), one of the founders of the Royal Society and bishop of Chester, who in 1640 discussed the possibility of reaching the moon by volitation, says in his *Mathematical Magick* (1648) that it was related that “ a certain English monk called Elmerus, about the Confessor's time,” flew from a town in Spain for a distance of more than a furlong; and that other persons had flown from St Mark's, Venice, and at Nuremberg. Giovanni Battista Dante, of Perugia, is said to have flown several times across Lake Trasimene. At the beginning of the 16th century an Italian alchemist who was collated to the abbacy of Tungland, in Galloway, Scotland, by James IV., undertook to fly from the walls of Stirling Castle through the air to France. He actually attempted the feat, but soon came to the ground and broke his thigh-bone in the fall—an accident which he explained by asserting that the wings he employed contained some fowls' feathers, which had an “ affinity ” for the dung-hill, whereas if they had been composed solely of eagles' feathers they would have been attracted to the air. This anecdote furnished Dunbar, the Scottish poet, with the subject of one of his rude satires. Leonardo da Vinci about the same time approached the problem in a more scientific spirit, and his notebooks contain several sketches of wings to be fitted to the arms and legs. In the following century a lecture on flying delivered in 1617 by Fleyder, rector of the grammar school at Tübingen, and published eleven years later, incited a poor monk to attempt to put the theory into practice, but his machinery broke down and he was killed.

In Francis Bacon's *Natural History* there are two passages which refer to flying, though they scarcely bear out the assertion made by some writers that he first published the true principles of aeronautics.

> The first is styled *Experiment Solitary, touching Flying in the Air:*—“ Certainly many birds of good wing (as kites and the like) would bear up a good weight as they fly; and spreading feathers thin and close, and in great breadth, will likewise bear up a great weight, being even laid, without tilting up on the sides. *The farther extension of this experiment might be thought upon.*” The second passage is more diffuse, but less intelligible; it is styled *Experiment Solitary, touching the Flying of unequal Bodies in the Air:*—“Let there be a body of unequal weight (as of wool and lead or bone and lead); if you throw it from you with the light end forward, it will turn, and the weightier end will recover to be forwards, unless the body be over long. The cause is, for that the more dense body hath a more violent pressure of the parts from the first impulsion, which is the cause (though heretofore not found out, as hath been often said) of all violent motions; and when the hinder part moveth swifter (for that it less endureth pressure of parts) than the forward part can make way for it, it must needs be that the body turn over; for (turned) it can more easily draw forward the lighter part.” The fact here alluded to is the resistance that bodies experience in moving through the air, which, depending on the quantity of surface merely, must exert a proportionally greater effect on rare substances. The passage itself, however, after making every allowance for the period in which it was written, must be deemed confused, obscure and unphilosophical.

In his posthumous work, *De Motu Animalium*, published at Rome in 1680–1681, G. A. Borelli gave calculations of the enormous strength of the pectoral muscles in birds; and his proposition cciv. (vol. i. pp. 322-326), entitled *Est impossibile ut homines propriis viribus artificiose volare possint*, points out the impossibility of man being able by his muscular strength to give motion to wings of sufficient extent to keep him suspended in the air. But during his lifetime two Frenchmen, Allard in 1660 and Besnier about 1678, are said to have succeeded in making short flights. An account of some of the modern attempts to construct flying machines will be found in the article Flight and Flying; here we append a brief consideration of the mechanical aspects of the problem.

The very first essential for success is safety, which will probably only be attained with automatic stability. The underlying principle is that the centre of gravity shall at all times be on the same vertical line as the centre of pressure. The latter varies with the angle of incidence. For square planes it moves approximately as expressed by Joessel's formula, $C+(0{\cdot}2+0{\cdot}3\sin\alpha)L$, in which C is the distance from the front edge, L the length fore and aft, and α the angle of incidence. The movement is different on concave surfaces. The term *aeroplane* is understood to apply to flat sustaining surfaces, but experiment indicates that arched surfaces are more efficient. S. P. Langley proposed the word *aerodrome*, which seems the preferable term for apparatus with wing-like surfaces. This is the type to which results point as the proper one for further experiments. With this it seems probable that, with well-designed apparatus, 40 to 50 ℔ can be sustained per indicated h.p., or about twice that quantity per resistance or "thrust" h.p., and that some 30 or 40% of the weight can be devoted to the machinery, thus requiring motors, with their propellers, shafting, supplies, &c., weighing less than 20 ℔ per h.p. It is evident that the apparatus must be designed to be as light as possible, and also to reduce to a minimum all resistances to propulsion. This being kept in view, the strength and consequent section required for each member may be calculated by the methods employed in proportioning bridges, with the difference that the support (from air pressure) will be considered as uniformly distributed, and the load as concentrated at one or more points. Smaller factors of safety may also have to be used. Knowing the sections required and unit weights of the materials to be employed, the weight of each part can be computed. If a model has been made to absolutely exact scale, the weight of the full-sized apparatus may approximately be ascertained by the formula

$$W'=W\sqrt{\left(\frac{S'}{S}\right)^3},$$

in which W is the weight of the model, S its surface, and W′ and S′ the weight and surface of the intended apparatus. Thus if the model has been made one-quarter size in its homologous dimensions, the supporting surfaces will be sixteen times, and the total weight sixty-four times those of the model. The weight and the surface being determined, the three most important things to know are the angle of incidence, the "lift," and the required speed. The fundamental formula for rectangular air pressure is well known: $P=KV^2S$, in which P is the rectangular normal pressure, in pounds or kilograms, K a coefficient (0·0049 for British, and 0·11 for metric measures), V the velocity in miles per hour or in metres per second, and S the surface in square feet or in square metres. The normal on oblique surfaces, at various angles of incidence, is given by the formula $P=KV^2S\eta$, which latter factor is given both for planes and for arched surfaces in the subjoined table:—

PERCENTAGES OF AIR PRESSURE AT VARIOUS ANGLES OF INCIDENCE

PLANES (DUCHEMIN FORMULA, VERIFIED BY LANGLEY). $N=P\frac{2\sin\alpha}{1+\sin^2\alpha}$.				WINGS (LILIENTHAL). Concavity 1 in 12.			
Angle. α.	Normal. η.	Lift. $\eta\cos\alpha$.	Drift. $\eta\sin\alpha$.	Normal. η.	Lift. $\eta\cos\alpha$.	Drift. $\eta\sin\alpha$.	Tangential force. α.
−9°				0·0	0·0	0·0	+0·070
−8°				0·040	0·0396	−0·0055	+0·067
−7°				0·080	0·0741	−0·0097	+0·064
−6°				0·120	0·1193	−0·0125	+0·060
−5°				0·160	0·1594	−0·0139	+0·055
−4°				0·200	0·1995	−0·0139	+0·049
−3°				0·242	0·2416	−0·0126	+0·043
−2°				0·286	0·2858	−0·0100	+0·037
−1°				0·332	0·3318	−0·0058	+0·031
0°	0·0	0·0	0·0	0·381	0·3810	−0·0	+0·024
+1°	0·035	0·035	0·000611	0·434	0·434	+0·0075	+0·016
+2°	0·070	0·070	0·00244	0·489	0·489	+0·0170	+0·008
+3°	0·104	0·104	0·00543	0·546	0·545	+0·0285	0·0
+4°	0·139	0·139	0·0097	0·600	0·597	+0·0418	−0·007
+5°	0·174	0·173	0·0152	0·650	0·647	+0·0566	−0·014
+6°	0·207	0·206	0·0217	0·696	0·692	+0·0727	−0·021
+7°	0·240	0·238	0·0293	0·737	0·731	+0·0898	−0·028
+8°	0·273	0·270	0·0381	0·771	0·763	+0·1072	−0·035
+9°	0·305	0·300	0·0477	0·800	0·790	+0·1251	−0·042
10°	0·337	0·332	0·0585	0·825	0·812	+0·1432	−0·050
11°	0·369	0·362	0·0702	0·846	0·830	+0·1614	−0·058
12°	0·398	0·390	0·0828	0·864	0·845	+0·1803	−0·064
13°	0·431	0·419	0·0971	0·879	0·856	+0·1976	−0·070
14°	0·457	0·443	0·1155	0·891	0·864	+0·2156	−0·074
15°	0·486	0·468	0·1240	0·901	0·870	+0·2332	−0·076

The sustaining power, or "lift," which in horizontal flight must be equal to the weight, can be calculated by the formula $L=KV^2S\eta\cos\alpha$, or the factor may be taken direct from the table, in which the "lift" and the "drift" have been obtained by multiplying the normal η by the cosine and sine of the angle. The last column shows the tangential pressure on concave surfaces which O. Lilienthal found to possess a propelling component between 3° and 32°, and therefore to be negative to the relative wind. Former modes of computation indicated angles of 10° to 15° as necessary for support with planes. These were prohibitory in consequence of the great "drift"; but the present data indicate that, with concave surfaces, angles of 2° to 5° will produce adequate "lift." To compute the latter the angle at which the wings are to be set must first be assumed, and that of +3° will generally be found preferable. Then the required velocity is next to be computed by the formula

$$V=\sqrt{\frac{L}{KS\eta\cos\alpha}};$$

or for concave wings at +3°:

$$V=\sqrt{\frac{W}{0{\cdot}545KS}}.$$

Having thus determined the weight, the surface, the angle of incidence and the required speed for horizontal support, the next step is to calculate the power required. This is best accomplished by first obtaining the total resistances, which consist of the "drift" and of the head resistances due to the hull and framing. The latter are arrived at preferably by making a tabular statement showing all the spars and parts offering head resistance, and applying to each the coefficient appropriate to its "master section," as ascertained by experiment. Thus is obtained an "equivalent area" of resistance, which is to be multiplied by the wind pressure due to the speed. Care must be taken to resolve all the resistances at their proper angle of application, and to subtract or add the tangential force, which consists in the surface S, multiplied by the wind pressure, and by the factor in the table, which is, however, 0 for 3° and 32°, but positive or negative at other angles. When the aggregate resistances are known, the "thrust h.p." required is obtained by multiplying the resistance by the speed, and then allowing for mechanical losses in the motor and propeller, which losses will generally be 50% of indicated h.p. Close approximations are obtained by the above method when applied to full-sized apparatus. The following example will make the process clearer. The weight to be carried by an apparatus was 189 ℔ on concave wings of 143·5 sq. ft. area, set at a positive angle of 3°. There were in addition rear wings of 29·5 sq. ft., set at a negative angle of 3°; hence, $L=189=0{\cdot}005\times V^2\times 143{\cdot}5\times 0{\cdot}545$.

$$\text{Whence } V=\sqrt{\frac{189}{0{\cdot}005\times 143{\cdot}5\times 0{\cdot}545}}=22 \text{ miles per hour,}$$

at which the air pressure would be 2·42 ℔ per sq. ft. The area of spars and man was 17·86 sq. ft., reduced by various coefficients to an "equivalent surface" of 11·70 sq. ft., so that the resistances were:—

Drift front wings, 143·5×0·0285×2·42	=9·90 ℔
,, rear wings, 29·5×(0·043−0·242×0·0523)×2·42	=2·17 ,,
Tangential force at 3°	=0·00 ,,
Head resistance, 11·70×2·42	=28·31 ,,
Total resistance	=40·38 ℔

Speed 22 miles per hour. Power $=\frac{40{\cdot}38\times 22}{375}=2{\cdot}36$ h.p. for the "thrust" or 4·72 h.p. for the motor. The weight being 189 ℔, and the resistance 40·38 ℔, the gliding angle of descent was $\frac{40{\cdot}38}{189}=$ tangent of 12°, which was verified by many experiments.

The following expressions will be found useful in computing such projects, with the aid of the table above given:—

1. Wind force, $F=KV^2$.
2. Pressure, $P=KV^2S$.
3. Velocity, $V=\sqrt{\frac{W}{KS\eta\cos\alpha}}$.
4. Surface S varies as $\frac{1}{V^2}$.
5. Normal, $N=KSV^2\eta$.
6. Lift, $L=KSV^2\eta\cos\alpha$.
7. Weight, $W=L=N\cos\alpha$.
8. Drift, $D=KSV^2\eta\sin\alpha$.
9. Head area E, get an equivalent.
10. Head resistance, $H=EF$.
11. Tangential force, $T=P\alpha$.
12. Resistance, $R=D+H\pm T$.
13. Ft. ℔, $M=RV$.
14. Thrust, h.p., $=\frac{RV}{\text{factor}}$.

Aerostation.—Possibly the flying dove of Archytas of Tarentum is the earliest suggestion of true aerostation. According to Aulus Gellius (*Noctes Atticae*) it was a "model of a dove or pigeon formed in wood and so contrived as by a certain mechanical art and power to fly: so nicely was it balanced by weights and put in motion by hidden and enclosed air." This "hidden and enclosed air" may conceivably represent an anticipation of the hot-air balloon, but it is at least as probable that the apparent flight of the dove was a mere mechanical trick depending on the use of fine wires or strings invisible to the spectators.

In the middle ages vague ideas appear of some ethereal substance so light that vessels containing it would remain suspended in the air. Roger Bacon (1214–1294) conceived of a large hollow globe made of very thin metal and filled with ethereal air or liquid fire, which would float on the atmosphere like a ship on water. Albert of Saxony, who was bishop of Halberstadt from 1366 to 1390, had a similar notion, and considered that a small portion of the principle of fire enclosed in a light sphere would raise it and keep it suspended. The same speculation was advanced by Francis Mendoza, a Portuguese Jesuit, who died in 1626 at the age of forty-six, and by Gaspar Schott (1608–1666), also a Jesuit and professor of mathematics at Würzburg, though for fire he substituted the thin ethereal fluid which he believed to float above the atmosphere. So late as 1755 Joseph Galien (1699–1782), a Dominican friar and professor of philosophy and theology in the papal university of Avignon, proposed to collect the diffuse air of the upper regions and to enclose it in a huge vessel extending more than a mile every way, and intended to carry fifty-four times as much weight as did Noah's ark! A somewhat different but equally fantastic method of making heavy bodies rise is quoted by Schott from Lauretus Laurus, according to whom swans' eggs or leather balls filled with nitre, sulphur or mercury ascend when exposed to the sun. Laurus also stated that hens' eggs filled with dew will ascend in the same circumstances, because dew is shed by the stars and drawn up again to heaven by the sun's heat during the day. The same notion is utilized by Cyrano de Bergerac (1619–1655) in his romances describing journeys to the moon and sun, for his French traveller fastens round his body a multitude of very thin flasks filled with the morning's dew, whereby through the attractive power of the sun's heat on the dew he is raised to the middle regions of the atmosphere, to sink again, however, on the breaking of some of the flasks.

A distinct advance on Schott is marked by the scheme for aerial navigation proposed by the Jesuit, Francis Lana (1631–1687), in his book, published at Brescia in 1670, *Prodromo ovvero Saggio di alcune invenzioni nuove promesso all' Arte Maestra.* His idea, though useless and unpractical in so far that it could never be carried out, is yet deserving of notice, as the principles involved are sound; and this can be said of no earlier attempt. His project was to procure four copper balls of very large dimensions (fig. 1), yet so extremely thin that after the air was exhausted from them they would be lighter than the air they displaced and so would rise; and to those four balls he proposed to attach a boat, with sails, &c., which would carry up a man. He submitted the whole matter to calculation, and proposed that the globes should be about 25 ft. in diameter and $\frac{1}{225}$th of an inch in thickness; this would give from all four balls a total ascensional force of about 1200 lb, which would be quite enough to raise the boat, sails, passengers, &c. But the obvious objection to the whole scheme is, that it would be quite impossible to construct a globe of so large a size and of such small thickness which would even support its own weight without collapsing if placed on the ground, much less bear the external atmospheric pressure when the internal air was removed. Lana himself noticed this objection, but he thought that the spherical form of the copper shell would, notwithstanding its extreme thinness, enable it, after the exhaustion was effected, to sustain the enormous pressure, which, acting equally on every point of the surface, would tend to consolidate rather than to break the metal. His proposal to exhaust the air from the globes by attaching to each a tube 36 ft. long, fitted with a stopcock, and so producing a Torricellian vacuum, suggests that he was ignorant of the invention of the air-pump by Otto von Guericke about 1650.

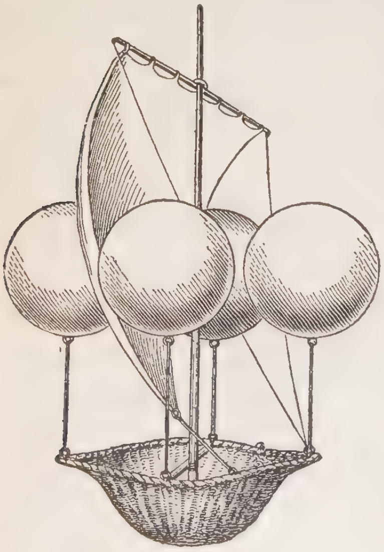

FIG. 1.—Lana's Aeronautical Machine.

Invention of the balloon.

We now come to the invention of the balloon, which was due to Joseph Michel Montgolfier (1740–1810) and Jacques Étienne Montgolfier (1745–1799), sons of Pierre Montgolfier, a large and celebrated papermaker at Annonay, a town about 40 m. from Lyons. The brothers had observed the suspension of clouds in the atmosphere, and it occurred to them that if they could enclose any vapour of the nature of a cloud in a large and very light bag, it might rise and carry the bag with it into the air. Towards the end of 1782 they inflated bags with smoke from a fire placed underneath, and found that either the smoke or some vapour emitted from the fire did ascend and carry the bag with it. Being thus assured of the correctness of their views, they determined to have a public ascent of a balloon on a large scale. They accordingly invited the States of Vivarais, then assembled at Annonay, to witness their aerostatic experiment; and on the 5th of June 1783, in the presence of a considerable concourse of spectators, a linen globe of 105 ft. in circumference was inflated over a fire fed with small bundles of chopped straw. When released it rapidly rose to a great height, and descended, at the expiration of ten minutes, at the distance of about $1\frac{1}{2}$m. This was the discovery of the balloon. The brothers Montgolfier imagined that the bag rose because of the levity of the smoke or other vapour given forth by the burning straw; and it was not till some time later that it was recognized that the ascending power was due merely to the lightness of heated air compared to an equal volume of air at a lower temperature. In this balloon, no source of heat was taken up, so that the air inside rapidly cooled, and the balloon soon descended.

The news of the experiment at Annonay attracted so much attention at Paris that Barthélemi Faujas de Saint-Fond (1741–1819), afterwards professor of geology at the Musée d'Histoire Naturelle, set on foot a subscription for paying the expense of repeating the experiment. The balloon was constructed by two brothers of the name of Robert, under the superintendence of the physicist, J. A. C. Charles. The first suggestion was to copy the process of Montgolfier, but Charles proposed the application of hydrogen gas, which was adopted. The filling of the balloon, which was made of thin silk varnished with a solution of elastic gum, and was about 13 ft. in diameter, was begun on the 23rd of August 1783, in the Place des Victoires. The hydrogen gas was obtained by the action of dilute sulphuric acid upon iron filings, and was introduced through leaden pipes; but as the gas was not passed through cold water, great difficulty was experienced in filling the balloon completely; and altogether about 500 lb of sulphuric acid and twice that amount of iron filings were used (fig. 2). Bulletins were issued daily of the progress of the inflation; and the crowd was so great that on the 26th the balloon was moved secretly by night to the Champ de Mars, a distance of 2 m. On the next day an immense concourse of people covered the Champ de Mars, and every spot from which a view could be obtained was crowded. About five o'clock a cannon was discharged as the signal for the ascent, and the balloon when liberated rose to the height of about 3000 ft. with great rapidity. A shower of rain which began to fall directly after it had left the earth in no way checked its progress; and the excitement was so great, that thousands of well-dressed spectators, many of them ladies, stood exposed, watching it intently the whole time it was in sight and

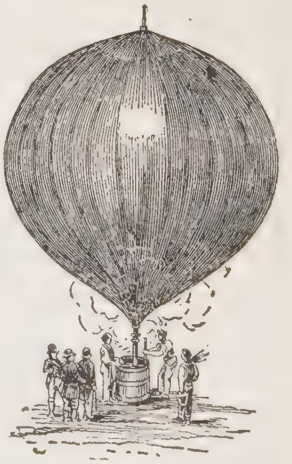

FIG. 2.—Charles' and Robert's Balloon.

were drenched to the skin. The balloon, after remaining in the air for about three-quarters of an hour, fell in a field near Gonesse, about 15 m. off, and terrified the peasantry so much that it was torn into shreds by them. Hydrogen gas was at this time known by the name of inflammable air; and balloons inflated with gas have ever since been called by the people air-balloons, the kind invented by the Montgolfiers being designated fire-balloons. French writers have also very frequently styled them after their inventors, *Charlières* and *Montgolfières*.

On the 19th of September 1783 Joseph Montgolfier repeated the Annonay experiment at Versailles, in the presence of the king, the queen, the court and an immense number of spectators. The inflation was begun at one o'clock, and completed in eleven minutes, when the balloon rose to the height of about 1500 ft., and descended after eight minutes, at a distance of about 2 m., in the wood of Vaucresson. Suspended below the balloon, in a cage, had been placed a sheep, a cock and a duck, which were thus the first aerial travellers. They were quite uninjured, except the cock, which had its right wing hurt in consequence of a kick it had received from the sheep; but this took place before the ascent. The balloon, which was painted with ornaments in oil colours, had a very showy appearance (fig. 3).

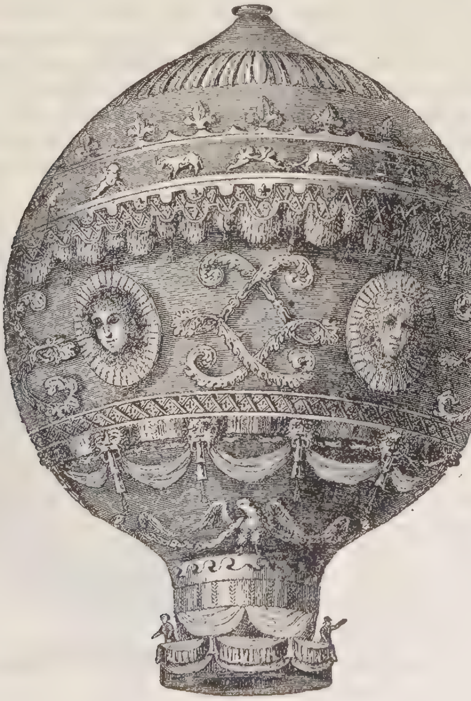

Fig. 3.—Montgolfier's Balloon.

The first human being who ascended in a balloon was Jean François Pilâtre de Rozier (1756–1785), a native of Metz, who was appointed superintendent of the natural history collections of Louis XVIII. On the 15th of October 1783, and following days, he made several ascents (generally alone, but once with a companion, Girond de Villette) in a captive balloon (*i.e.* one attached by ropes to the ground), and demonstrated that there was no difficulty in taking up fuel and feeding the fire, which was kindled in a brazier suspended under the balloon, when in the air. The way being thus prepared for aerial navigation, on the 21st of November 1783, Pilâtre de Rozier and the marquis d'Arlandes first trusted themselves to a free fire-balloon. The experiment was made from the Jardin du Château de la Muette, in the Bois de Boulogne. A large fire-balloon was inflated at about two o'clock, rose to a height of about 500 ft., and passing over the Invalides and the École Militaire, descended beyond the Boulevards, about 9000 yds. from the place of ascent, having been between twenty and twenty-five minutes in the air.

Only ten days later, viz. on the 1st of December 1783, Charles ascended from Paris in a balloon inflated with hydrogen gas. The balloon, as in the case of the small one of the same kind previously launched from the Champ de Mars, was constructed by the brothers Robert, one of whom took part in the ascent. It was 27 ft. in diameter, and the car was suspended from a hoop surrounding the middle of the balloon, and fastened to a net, which covered the upper hemisphere. The balloon ascended very gently from the Tuileries at a quarter to two o'clock, and after remaining for some time at an elevation of about 2000 ft., it descended in about two hours at Nesle, a small town about 27 m. from Paris, when Robert left the car, and Charles made a second ascent by himself. He had intended to have replaced the weight of his companion by a nearly equivalent quantity of ballast; but not having any suitable means of obtaining such at the place of descent, and it being just upon sunset, he gave the word to let go, and the balloon being thus so greatly lightened, ascended very rapidly to a height of about 2 m. After staying in the air about half an hour, he descended 3 m. from the place of ascent, although he believed the distance traversed, owing to different currents, to have been about 9 m. In this second journey he experienced a violent pain in his right ear and jaw, no doubt produced by the rapidity of the ascent. He also witnessed the phenomenon of a double sunset on the same day; for when he ascended, the sun had set in the valleys, and as he mounted he saw it rise again, and set a second time as he descended.

All the features of the modern balloon as now used are more or less due to Charles, who invented the valve at the top, suspended the car from a hoop, which was itself attached to the balloon by netting, &c. With regard to his use of hydrogen gas, there are anticipations that must be noticed. As early as 1766 Henry Cavendish showed that this gas was at least seven times lighter than ordinary air, and it immediately occurred to Dr. Joseph Black, of Edinburgh, that a thin bag filled with hydrogen gas would rise to the ceiling of a room. He provided, accordingly, the allantois of a calf, with the view of showing at a public lecture such a curious experiment; but for some reason it seems to have failed, and Black did not repeat it, thus allowing a great discovery, almost within his reach, to escape him. Several years afterwards a similar idea occurred to Tiberius Cavallo, who found that bladders, even when carefully scraped, are too heavy, and that China paper is permeable to the gas. But in 1782, the year before the invention of the Montgolfiers, he succeeded in elevating soap-bubbles by inflating them with hydrogen gas.

Researches on the use of gas for inflating balloons seem to have been carried on at Philadelphia nearly simultaneously with the experiments of the Montgolfiers; and when the news of the latter reached America, D. Rittenhouse and F. Hopkinson, members of the Philosophical Society at Philadelphia, constructed a machine consisting of forty-seven small hydrogen gas-balloons attached to a car or cage. After several preliminary experiments, in which animals were let up to a certain height by a rope, a carpenter, one James Wilcox, was induced to enter the car for a small sum of money; the ropes were cut, and he remained in the air about ten minutes, and only then effected his descent by making incisions in a number of the balloons, through fear of falling into the river, which he was approaching.

First ascents in Great Britain.

Although the news of the Annonay and subsequent experiments in France rapidly spread all over Europe, and formed a topic of general discussion, still it was not till five months after the Montgolfiers had first publicly sent a balloon into the air that any aerostatic experiment was made in England. In November 1783 Count Francesco Zambeccari (1756–1812), an Italian who happened to be in London, made a balloon of oil-silk, 10 ft. in diameter, and weighing 11 lb. It was publicly shown for several days, and on the 25th it was three-quarters filled with hydrogen gas and launched from the Artillery ground at one o'clock. It descended after two hours and a half near Petworth, in Sussex, 48 m. from London. This was the first balloon that ascended from English ground. On the 22nd of February 1784 a hydrogen gas balloon, 5 ft. in diameter, was let up from Sandwich, in Kent, and descended at Warneton, in French Flanders, 75 m. distant. This was the first balloon that crossed the Channel. The first person who rose into the air from British ground appears to have been J. Tytler,[1] who ascended from the Comely Gardens, Edinburgh, on the 27th of August 1784, in a fire-balloon of his own construction. He descended on the road to Restalrig, about half a mile from the place where he rose.

But it was Vincent Lunardi who practically introduced aerostation into Great Britain. Although Tytler had the precedence by a few days still his attempts and partial success were all but unknown; whereas Lunardi's experiments excited an enormous amount of enthusiasm in London. He was secretary to Prince Caramanico, the Neapolitan ambassador, and his published letters to his guardian, the chevalier Compagni, written while he was carrying out his project, and detailing all the difficulties, &c., he met with as they occurred, give an interesting and vivid account of the whole matter. His balloon was 33 ft. in circumference (fig.4), and was exposed to the public view at the Lyceum in the Strand, where it was visited by upwards of 20,000 people. He originally intended to ascend from Chelsea Hospital, but the conduct of a crowd at a garden at Chelsea, which destroyed the fire-balloon of a Frenchman named de Moret, who announced an ascent on the 11th of August, but was unable to keep his word, led to the withdrawal of the leave that had been granted. Ultimately he was permitted to ascend from the Artillery ground, and on the 15th of September 1784 the inflation with hydrogen gas took place. It was intended that an English gentleman named Biggin should accompany Lunardi; but the crowd becoming impatient, the latter judged it prudent to ascend with the balloon only partially full rather than risk a longer delay, and accordingly Mr Biggin was obliged to leave the car. Lunardi therefore ascended alone, in presence of the prince of Wales and an enormous crowd of spectators. He took up with him a pigeon, a dog and a cat, and the balloon was provided with oars, by means of which he hoped to raise or lower it at pleasure. Shortly after starting the pigeon escaped, and one of the oars became broken and fell to the ground. In about an hour and a half he descended at South Mimms, in Hertfordshire, and landed the cat, which had suffered from the cold: he then ascended again, and descended, after the lapse of about three-quarters of an hour, at Standon, near Ware, where he had great difficulty in inducing the peasants to come to his assistance; but at length a young woman, taking hold of one of the cords, urged the men to follow her example, which they then did. The excitement caused by this ascent was immense, and Lunardi at once became the star of the hour. He was presented to the king, and was courted and flattered on all sides. To show the enthusiasm displayed by the people during his ascent, he tells himself, in his sixth letter, how a lady, mistaking the oar which fell for himself, was so affected by his supposed destruction that she died in a few days; but, on the other hand, he says he was told by the judges "that he had certainly saved the life of a young man who might possibly be reformed, and be to the public a compensation for the death of the lady"; for the jury were deliberating on the fate of a criminal, whom they must ultimately have condemned, when the balloon appeared, and to save time they gave a verdict of acquittal, and the whole court came out to view the balloon. The king also was in conference with his ministers; but on hearing that the balloon was passing, he broke up the discussion, and with them watched the balloon through telescopes. The balloon was afterwards exhibited in the Pantheon. In the latter part of the following year (1785) Lunardi made several successful ascents from Kelso, Edinburgh and Glasgow (in one of which he traversed a distance of 110 m.); these he described in a second series of letters.

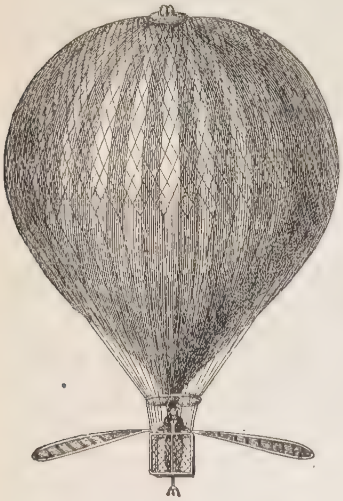

FIG. 4.—Lunardi's Balloon.

The first ascent from Ireland was made on the 19th of January 1785 by a Mr Crosbie, who on the following 19th of July attempted to cross St George's Channel to England but fell into the sea. The second person who ascended from Ireland was Richard Maguire. Mr Crosbie had inflated his balloon on the 12th of May 1785, but it was unable to take him up. Maguire in these circumstances offered himself as a substitute, and his offer being accepted he made the ascent. For this he was knighted by the Lord-Lieutenant. Another attempt to cross St George's Channel was made by James Sadler on the 1st of October 1812, and he had nearly succeeded when in consequence of a change of wind he was forced to descend into the sea off Liverpool, whence he was rescued by a fishing-boat. But on the 22nd of July 1817 his second son, Windham Sadler, succeeded in crossing from Dublin to Holyhead.

Voyages across English Channel.

The first balloon voyage across the English Channel was accomplished by Jean Pierre Blanchard (1753–1809) and Dr. J. Jeffries, an American physician, on the 7th of January 1785. In the preceding year, on the 2nd of March, Blanchard, who was one of the most celebrated of the earlier aeronauts, made his first voyage from Paris in a balloon 27 ft. in diameter (fig. 5), and descended at Billancourt near Sèvres. Just as the balloon was about to start, a young man jumped into the car and drawing his sword declared his determination to ascend with Blanchard. He was ultimately removed by force. It has sometimes been incorrectly stated that he was Napoleon Bonaparte; his name in reality was Dupont de Chambon. In their Channel crossing Blanchard and his companion, who started from Dover, when about one-third across found themselves descending, and threw out every available thing from the boat or car. When about three-quarters across they were descending again, and had to throw out not only the anchor and cords, but also to strip and throw away part of their clothing, after which they found they were rising, and their last resource, viz. to cut away the car, was rendered unnecessary. As they approached the shore the balloon rose, describing a magnificent arch high over the land. They descended in the forest of Guinnes.

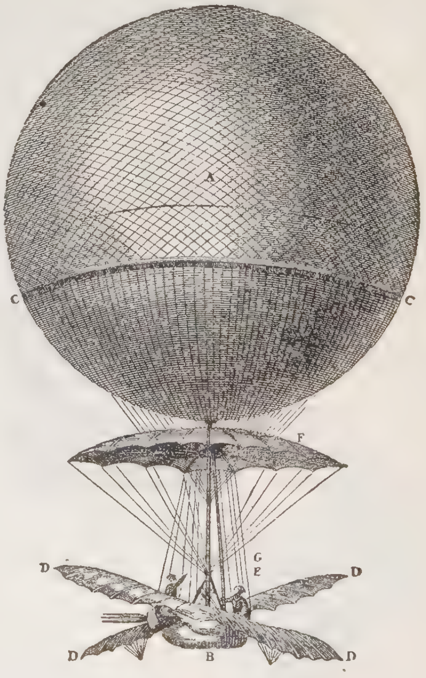

FIG. 5.—Blanchard's Balloon.

A, Balloon of taffeta, 26 ft. in diameter, covered with a net.
B, Car suspended by cords from hoop C.
D, D, D, D, Wings worked by rack-work E.
F, Parachute to break the force of descent should the balloon burst.
G, Tube communicating with inside of balloon.

On the 15th of June 1785, Pilâtre de Rozier made an attempt to repeat the exploit of Blanchard and Jeffries in the reverse direction, and cross from Boulogne to England. For this purpose he contrived a double balloon, which he expected would combine the advantages of both kinds—a fire-balloon, 10 ft. in diameter, being placed underneath a gas-balloon of 37 ft. in diameter, so that by increasing or diminishing the fire in the former it might be possible to ascend or descend without waste of gas. Rozier was accompanied by P. A. Romain, and for rather less than half an hour after the aerostat ascended all seemed to be going on well, when suddenly the whole apparatus was seen in flames, and the unfortunate adventurers came to the ground from the supposed height of more than 3000 ft. Rozier was killed on the spot, and Romain only survived about ten minutes. A monument was erected on the place where they fell, which was near the sea-shore, about 4 m. from the starting-point.

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[1] Mr Tytler contributed largely to, and, indeed, appears to have been virtually editor of the second edition (1778–1783) of the *Encyclopaedia Britannica.*

Early large balloons.

The largest balloon on record (if the contemporary accounts are correct) ascended from Lyons on the 19th of January 1784. It was more than 100 ft. in diameter, about 130 ft. in height, and when distended had a capacity, it is said, of over half a million cubic feet. It was called the "Flesselles" (from the name of its proprietor, we believe), and after having been inflated from a straw fire in seventeen minutes, it rose with seven persons in the car to the height of about 3000 ft., but descended again after the lapse of about a quarter of an hour from the time of starting, in consequence of a rent in the upper part.

Another large fire-balloon, 68 ft. in diameter, was constructed by the chevalier Paul Andreani of Milan, and on the 25th of February he ascended in it from Milan, remaining in the air for about twenty minutes. This is usually regarded as the first ascent in Italy (but see Monck Mason's *Aeronautica*, p. 247).

On the 7th of November 1836, at half-past one o'clock, a large balloon containing about 85,000 cub. ft. of gas ascended from Vauxhall Gardens, London, carrying Robert Hollond, M.P., Monck Mason and Charles Green, and descended about two leagues from Weilburg, in the duchy of Nassau, at half-past seven the next morning, having thus traversed a distance of about 500 m. in 18 hours; Liége was passed in the course of the night, and Coblentz in the early morning. In consequence of this journey the balloon became famous as the "Nassau Balloon" (fig. 6). Charles Green (1785–1870), who constructed it and subsequently became its owner, was the most celebrated of English aeronauts, and made an extraordinary number of ascents. His first, made from the Green Park, London, on the 19th of July 1821 at the coronation of George IV., was distinguished for the fact that for the first time coal-gas was used instead of hydrogen for inflating the balloon. In 1828 he made an equestrian ascent from the Eagle Tavern, City Road, London, seated on his favourite pony. Such ascents have since been repeated; in 1852 Madame Poitevin made one from Cremorne Gardens, but was prevented from giving a second performance by police interference, the exhibition outraging public opinion. It was in descending from the "Nassau Balloon" in a parachute that Robert Cocking was killed in 1837 (see PARACHUTE). Green was the inventor of the guide-rope, which consists of a long rope trailing below the car. Its function is to reduce the waste of gas and ballast required to keep the balloon at a proper altitude. When a balloon sinks so low that a good deal of the guide-rope rests on the ground, it is relieved of so much weight and therefore tends to rise; if on the other hand it rises so that most of the rope is lifted off the ground, it has to bear a greater weight and tends to sink.

In 1863 A. Nadar, a Paris photographer, constructed "Le Géant," which was the largest gas-balloon made up to that time and contained over 200,000 cub. ft. of gas. Underneath it was placed a smaller balloon, called a compensator, the object of which was to prevent loss of gas during the voyage. The car had two stories, and was, in fact, a model of a cottage in wicker-work, 8 ft. in height by 13 ft. in length, containing a small printing-office, a photographic department, a refreshment-room, a lavatory, &c. The first ascent took place at five o'clock on Sunday the 4th of October 1863, from the Champ de Mars. There were thirteen persons in the car, including one lady, the princess de la Tour d'Auvergne, and the two aeronauts Louis and Jules Godard. In spite of the elaborate preparations that had been made and the stores of provisions that were taken up, the balloon descended at nine o'clock, at Meaux, the early descent being rendered necessary, it was said, by an accident to the valve-line. At a second ascent, made a fortnight later, there were nine passengers, including Madame Nadar. The balloon descended at the expiration of seventeen hours, near Nienburg in Hanover, a distance of about 400 m. A strong wind was blowing, and it was dragged over the ground for 7 or 8 m. All the passengers were bruised, and some seriously hurt. The balloon and car were then brought to England, and exhibited at the Crystal Palace at the end of 1863 and beginning of 1864. The two ascents of Nadar's balloon excited an extraordinary amount of enthusiasm and interest, vastly out of proportion to what they were entitled to. Nadar's idea was to obtain sufficient money, by the exhibition of his balloon, to carry out a plan of aerial locomotion he had conceived possible by means of the principle of the screw; in fact, he spoke of "Le Géant" as "the last balloon." He also started *L'Aeronaute*, a newspaper devoted to aerostation, and published a small book, which was translated into English under the title *The Right to Fly*.

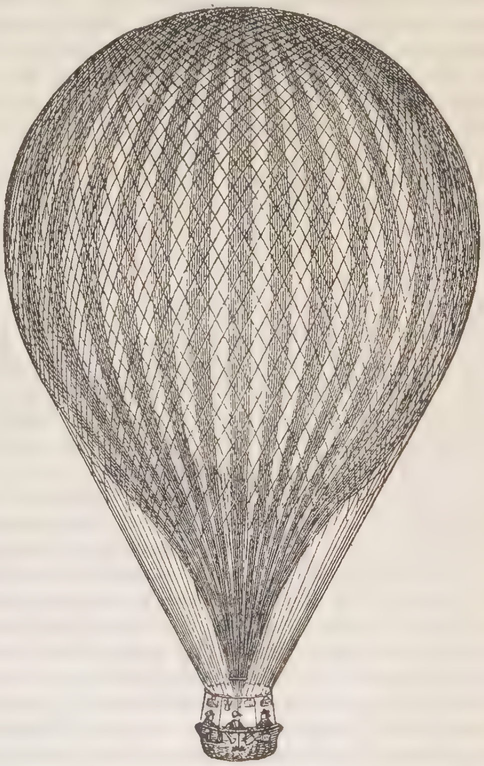


FIG. 6.—The Great Nassau Balloon.

Directly after Nadar's two ascents, Eugene Godard constructed a fire-balloon of nearly half a million cubic feet capacity—more than double that of Nadar's and only slightly less than that attributed to the "Flesselles" of 1783. The air was heated by an 18-ft. stove, weighing, with the chimney, 980 ℔. This furnace was fed by straw; and the "car" consisted of a gallery surrounding it. Two ascents of this balloon, the first fire-balloon seen in London, were made from Cremorne Gardens in July 1864. After the first journey the balloon descended at Greenwich, and after the second at Walthamstow, where it was injured by being blown against a tree. Notwithstanding its enormous size, Godard asserted that it could be inflated in half an hour, and the inflation at Cremorne did not occupy more than an hour. In spite of the rapidity with which the inflation was effected, few who saw the ascent could fail to receive an impression unfavourable to the fire-balloon in the matter of safety, as a rough descent, with a heated furnace as it were in the car, could not be other than most dangerous.

Long balloon voyages.

In the summer of 1873 the proprietors of the New York *Daily Graphic*, reviving a project discussed by Green in 1840, determined to construct a very large balloon, and enable the American aeronaut, John Wise, to realize his favourite scheme of crossing the Atlantic Ocean to Europe, by taking advantage of the current from west to east which was believed by many to exist constantly at heights above 10,000 ft. The project came to nothing owing to the quality of the material of which the balloon was made. When it was being inflated in September 1873 a rent was observed after 325,000 cub. ft. of gas had been put in, and the whole rapidly collapsed. The size was said to be such as to contain 400,000 cub. ft., so that it would lift a weight of 14,000 lb. No balloon voyage has yet been made of a length comparable to the breadth of the Atlantic. In fact only two voyages exceeding 1000 m. are on record—that of John Wise from St Louis to Henderson, N.Y., 1120 m., in 1859, and that of Count Henry de la Vaulx from Paris to Korosticheff in Russia, 1193 m., in 1900. On the 11th of July 1897 Salomon Andrée, with two companions, Strendberg and Fränkel, ascended from Spitzbergen in a daring attempt to reach the North Pole, about 600 m. distant. One carrier pigeon, apparently liberated 48 hours after the start, was shot, and two floating buoys with messages were found, but nothing more was heard of the explorers.

Scientific ascents.

At an early date the balloon was applied to scientific purposes. So far back as 1784, Dr Jeffries made an ascent from London in which he carried out barometric, thermometric and hygrometric observations, also collecting samples of the air at different heights. In 1803 the St Petersburg Academy of Sciences, entertaining the opinion that the experiments made on mountain-sides by J. A. Deluc, H. B. de Saussure, A. von Humboldt and others must give results different from those made in free air at the same heights, resolved to arrange a balloon ascent. Accordingly, on the 30th of January 1804, Sacharof, a member of the academy, ascended in a gas-balloon, in company with a French aeronaut, É. G. Robertson, who at one time gave conjuring entertainments in Paris. The ascent was made at a quarter past seven, and the descent effected at a quarter to eleven. The height reached was less than 1½ m. The experiments were not very systematically made, and the chief results were the filling and bringing down of several flasks of air collected at different elevations, and the supposed observation that the magnetic dip was altered. A telescope fixed in the bottom of the car and pointing vertically downwards enabled the travellers to ascertain exactly the spot over which they were floating at any moment. Sacharof found that, on shouting downwards through his speaking-trumpet, the echo from the earth was quite distinct, and at his height was audible after an interval of about ten seconds (*Phil. Mag.*, 1805, 21, p. 193).

Some of the results reported by Robertson appearing doubtful, Laplace proposed to the members of the French Academy of Sciences that the funds placed by the government at their disposal for the prosecution of useful experiments should be utilized in sending up balloons to test their accuracy. The proposition was supported by J. A. C. Chaptal, the chemist, who was then minister of the interior, and accordingly the necessary arrangements were speedily effected, the charge of the experiments being given to L. J. Gay-Lussac and J. B. Biot. The principal object of this ascent was to determine whether the magnetic force experienced any appreciable diminution at heights above the earth's surface. On the 24th of August 1804, Gay-Lussac and Biot ascended from the Conservatoire des Arts at ten o'clock in the morning. Their magnetic experiments were incommoded by the rotation of the balloon, but they found that, up to the height of 13,000 ft., the time of vibration of a magnet was appreciably the same as on the earth's surface. They found also that the air became drier as they ascended. The height reached was about 13,000 ft., and the temperature declined from 63° to 51° F. The descent was effected about half-past one, at Meriville, 18 leagues from Paris.

In a second experiment, which was made on the 16th of September 1804, Gay-Lussac ascended alone. The balloon left the Conservatoire des Arts at 9.40 A.M., and descended at 3.45 P.M. between Rouen and Dieppe. The chief result obtained was that the magnetic force, like gravitation, did not experience any sensible variation at heights from the earth's surface which we can attain to. Gay-Lussac also brought down air collected at the height of nearly 23,000 ft., and on analysis it appeared that its composition was the same as that of air collected at the earth's surface. At the time of leaving the earth the thermometer stood at 82° F., and at the highest point reached (23,000 ft.) it was 14·9° F. Gay-Lussac remarked that at his highest point there were still clouds above him.

From 1804 to 1850 there is no record of any scientific ascents in balloons having been undertaken. In the latter year J. A. Bixio (1808–1865) and J. A. Barral (1819–1884) made two ascents of this kind. In the first they ascended from the Paris observatory on the 29th of June 1850, at 10.27 A.M., the balloon being inflated with hydrogen gas. The day was a rough one, and the ascent took place without any previous attempt having been made to test the ascensional force of the balloon. When liberated, it rose with great rapidity, and becoming fully inflated it pressed upon the network, bulging out at the top and bottom. The ropes by which the car was suspended being too short, the balloon soon covered the travellers like an immense hood. In endeavouring to secure the valve-rope, they made a rent in the balloon, and the gas escaped so close to their faces as almost to suffocate them. Finding that they were descending then too rapidly, they threw overboard everything available, including their coats and only excepting the instruments. The ground was reached at 10h. 45m., near Lagny. Of course no observations were made. Their second ascent was made on the 27th of July, and was remarkable on account of the extreme cold met with. At about 20,000 ft. the temperature was 15° F., the balloon being enveloped in cloud; but on emerging from the cloud, at 23,000 ft., the temperature sank to −38° F., no less than 53° F. below that experienced by Gay-Lussac at the same elevation. The existence of these very cold clouds served to explain certain meteorological phenomena that were observed on the earth both the day before and the day after the ascent. Some pigeons were taken up in this, as in most other high ascents; when liberated, they showed a reluctance to leave the car, and then fell heavily downwards.

In July 1852 the committee of the Kew Observatory resolved to institute a series of balloon ascents, with the view of investigating such meteorological and physical phenomena as require the presence of an observer at a great height in the atmosphere. John Welsh (1824–1859) of the Kew Observatory was the observer, and the great "Nassau Balloon" was employed, with Green himself as the aeronaut. Four ascents were made in 1852, viz. on the 17th and 26th of August, the 31st of October and the 10th of November. The heights attained were 19,510, 19,100, 12,640 and 22,930 ft., and the lowest temperatures met with in the four ascents were 8·7° F. (19,380 ft.), 12·4° F. (18,370 ft.), 16·4° F. (12,640 ft.) and 10·5° F. (22,370 ft.). The decline of temperature was very regular. A siphon barometer, dry and wet bulb thermometers, aspirated and free, and a Regnault hygrometer were taken up. Some air collected at a considerable height was found on analysis not to differ appreciably in its composition from air collected near the ground. For the original observations see *Phil. Trans.*, 1853, pp. 311-346.

Glaisher's ascents.

At the meeting of the British Association for the Advancement of Science held at Aberdeen in 1859, a committee was appointed for the purpose of making observations in the higher strata of the atmosphere by means of the balloon. For two years nothing was effected, owing to the want both of an observer and of a suitable balloon. After its reappointment at the Manchester meeting of 1861, the committee communicated with Henry Tracey Coxwell (1819–1900), an aeronaut who had made a good many ascents, and he agreed to construct a new balloon, of 90,000 cub. ft. capacity, on the condition that the committee would undertake to use it, and pay £25 for each high ascent made especially on its behalf, defraying also the cost of gas, &c., so that the expense of each high ascent amounted to nearly £50. An observer being still wanted, James Glaisher, a member of the committee, offered himself to take the observations, and accordingly the first ascent was made on the 17th of July 1862, from the gas-works at Wolverhampton, this town being chosen on account of its central position in the country. Altogether, Glaisher made twenty-eight ascents, the last being on the 26th of May 1866. Of these only seven were specially high ascents, although six others were undertaken for the objects of the committee alone. On the other occasions he availed himself of public ascents from the Crystal Palace and other places of entertainment, merely taking his place like the other passengers. In the last six ascents another aëronaut and a smaller balloon were employed. The dates, places of ascent and greatest heights (in feet) attained in the twenty-eight ascents were—1862: July 17, Wolverhampton, 26,177; July 30, Crystal Palace, 6937; August 18, Wolverhampton, 23,377; August 20, Crystal Palace, 5900; August 21, Hendon, 14,355; September 1, Crystal Palace, 4190; September 5, Wolverhampton, 37,000; September 8, Crystal Palace, 5428. 1863: March 31, Crystal Palace, 22,884; April 18, Crystal Palace, 24,163; June 26, Wolverton, 23,200; July 11, Crystal Palace, 6623; July 21, Crystal Palace, 3298; August 31, Newcastle-upon-Tyne, 8033; September 29, Wolverhampton, 16,590; October 9, Crystal Palace, 7310. 1864: January 12, Woolwich, 11,897; April 6, Woolwich, 11,075; June 13, Crystal Palace, 3543; June 20, Derby, 4280; June 27, Crystal Palace, 4898; August 29, Crystal Palace, 14,581; December 1, Woolwich, 5431; December 30, Woolwich, 3735. 1865: February 27, Woolwich, 4865; October 2, Woolwich, 1949; December 2, Woolwich, 4628. 1866: May 26, Windsor, 6325.

The primary object of the ascents was to determine the temperature of the air, and its hygrometrical state at different elevations to as great a height as could be reached; and the secondary objects were—(1) to determine the temperature of the dew-point by Daniell's and Regnault's hygrometers, as well as by the dry and wet bulb thermometers, and to compare the results; (2) to compare the readings of an aneroid barometer with those of a mercurial barometer up to the height of 5 m.; (3) to determine the electrical state of the air, (4) the oxygenic condition of the atmosphere, and (5) the time of vibration of a magnet; (6) to collect air at different elevations; (7) to note the height and kind of clouds, their density and thickness; (8) to determine the rate and direction of different currents in the atmosphere; and (9) to make observations on sound. The instruments used were mercurial and aneroid barometers, dry and wet bulb thermometers, Daniell's dew-point hygrometer, Regnault's condensing hygrometer, maximum and minimum thermometers, a magnet for horizontal vibration, hermetically sealed glass tubes exhausted of air, and an electrometer. In one or two of the ascents a camera was taken up.

The complete observations, both as made and after reduction, are printed in the *British Association Reports*, 1862–1866; here only a general account of the results can be given. It appeared that the rate of the decline of temperature with elevation near the earth was very different according as the sky was clear or cloudy; and the equality of temperature at sunset and increase with height after sunset were very remarkable facts which were not anticipated. Even at the height of 5 m., cirrus clouds were seen high in the air, apparently as far above as they seem when viewed from the earth. The results of the observations differed very much, and no doubt the atmospheric conditions depended not only on the time of day, but also on the season of the year, and were such that a vast number of ascents would be requisite to determine the true laws with anything approaching to certainty and completeness. It was also clear that England is a most unfit country for the pursuit of such investigations, as, from whatever place the balloon started, it was never safe to be more than an hour above the clouds for fear of reaching the sea. It appeared from the observations that an aneroid barometer could be trusted to read as accurately as a mercurial barometer to the heights reached. The time of vibration of a horizontal magnet was taken in very many of the ascents, and the results of ten different sets of observations indicated that the time of vibration was longer than on the earth. In almost all the ascents the balloon was under the influence of currents of air in different directions which varied greatly in thickness. The direction of the wind on the earth was sometimes that of the whole mass of air up to 20,000 ft., whilst at other times the direction changed within 500 ft. of the earth. Sometimes directly opposite currents were met with at different heights in the same ascent, and three or four streams of air were encountered moving in different directions. The direct distances between the places of ascent and descent, apart from the movements of the balloon under the influence of these various currents, were always very much greater than the horizontal movement of the air as measured by anemometers. For example, on the 12th of January 1862, the balloon left Woolwich at 2h. 8m. P.M., and descended at Lakenheath, 70 m. distant from the place of ascent, at 4h. 19m. P.M. At the Greenwich Observatory, by a Robinson anemometer, during this time the motion of the air was 6 m. only. With regard to physiological observations, Glaisher found that the frequency of his pulse increased with elevation, as also did the number of inspirations. The number of his pulsations was generally 76 per minute before starting, about 90 at 10,000 ft., 100 at 20,000 ft., and 110 at higher elevations. But a good deal depended on the temperament of the individual. This was also the case in respect to colour; at 10,000 ft. the faces of some would be a glowing purple, whilst others would be scarcely affected; at 4 m. high Glaisher found the pulsations of his heart distinctly audible, and his breathing was very much affected, so that panting was produced by the slightest exertion; at 29,000 ft. he became insensible. In reference to the propagation of sound, it was at all times found that sounds from the earth were more or less audible according to the amount of moisture in the air. When in clouds at 4 m. high, a railway train was heard; but when clouds were far below, no sound ever reached the ear at this elevation. The discharge of a gun was heard at 10,000 ft. The barking of a dog was heard at the height of 2 m., while the shouting of a multitude of people was not audible at heights exceeding 4000 ft. In his ascent of the 5th of September 1862, Glaisher considered that he reached a height of 37,000 ft. But that figure was based, not on actual record, but on the circumstances that at 29,000 ft., when he became insensible, the balloon was rising 1000 ft. a minute, and that when he recovered consciousness thirteen minutes later it was falling 2000 ft. a minute, and the accuracy of his conclusions has been questioned. Few scientific men have imitated Glaisher in making high ascents for meteorological observations. In 1867 and 1868 Camille Flammarion made eight or nine ascents from Paris for scientific purposes. The heights attained were not great, but the general result was to confirm the observations of Glaisher; for an account see *Voyages aëriens*, Paris, 1870, or *Travels in the Air*, London, 1871, in which also some ascents by W. de Fonvielle are noticed. On the 15th of April 1875, H. T. Sivel, J. E. Crocé-Spinelli and Gaston Tissandier ascended from Paris in the balloon "Zenith," and reached a height of 27,950 ft.; but only Tissandier came down alive, his two companions being asphyxiated. This put an end to such attempts for a time. But Dr A. Berson and Lieut. Gross attained 25,840 ft. on the 11th of May 1894; Berson, ascending alone from Strassfurt on the 4th of December 1894, attained about 31,500 ft. and recorded a temperature of −54° F.; and Berson and Stanley Spencer are stated by the latter to have attained 27,500 ft. on the 15th of September 1898 when they ascended in a hydrogen balloon from the Crystal Palace, the thermometer registering −29° F. On the 31st of July 1901, Berson and R. J. Süring, ascending at Berlin, actually noted a barometric reading corresponding to a height of 34,500 ft., and possibly rose 1000 or 1500 ft. higher, though in spite of oxygen inhalations they were unconscious during the highest portion of the ascent.

The personal danger attending high ascents led Gustave Hermite and Besançon in November 1892 to inaugurate the sending up of unmanned balloons (*ballons sondes*) equipped with automatic recording instruments, and kites (*q.v.*) have also been employed for similar meteorological purposes. (See also METEOROLOGY.)

Military balloons.

The balloon had not been discovered very long before it received a military status, and soon after the beginning of the French revolutionary war an aeronautic school was founded at Meudon, in charge of Guyton de Morveau, the chemist, and Colonel J. M. J. Coutelle (1748–1835). Four balloons were constructed for the armies of the north, of the Sambre and Meuse, of the Rhine and Moselle, and of Egypt. In June 1794 Coutelle ascended with the adjutant and general to reconnoitre the hostile army just before the battle of Fleurus, and two reconnaissances were made, each occupying four hours. It is generally stated that it was to the information so gained that the French victory was due. The balloon corps was in constant requisition during the campaign, but it does not appear that, with the exception of the reconnaissances just mentioned, any great advantages resulted, except in a moral point of view. But even this was of importance, as the enemy were much disconcerted at having their movements so completely watched, while the French were correspondingly elated at the superior information it was believed they were gaining. An attempt was made to revive the use of balloons in the African campaign of 1830, but no opportunity occurred in which they could be employed. It is said that in 1849 a reconnoitring balloon was sent up from before Venice, as also were small balloons loaded with bombs to be exploded by time-fuses. In the French campaign against Italy in 1859 the French had recourse to the use of balloons, but this time there was not any aerostatic corps, and their management was entrusted to the brothers Godard. Several reconnaissances were made, and one of especial interest the day before the battle of Solferino. No information of much importance seems, however, to have been gained thereby.

In the American Civil War (1861) balloons were a good deal used by the Federals. There was a regular balloon staff attached to McClellan's army, with a captain, an assistant-captain and about 50 non-commissioned officers and privates. The apparatus consisted of two generators, drawn by four horses each; two balloons, drawn by four horses each, and an acid-cart, drawn by two horses. The two balloons used contained about 13,000 and 26,000 ft. of gas, and the inflation usually occupied about three hours. (See *Royal Engineers' Papers*, vol. xii.) By their aid useful information was gained about the enemy round Richmond and in other places, but eventually difficulties of transport and the topography of the theatre of war made ballooning impracticable; and little was heard of it after the first two years of the war.

The balloon proved itself very valuable during the siege of Paris (1870–71). It was by it alone that communication was kept up between the besieged city and the external world, as the balloons carried away from Paris the pigeons which afterwards brought back to it the news of the provinces. The total number of balloons that ascended from Paris during the siege, conveying persons and despatches, was sixty-four—the first having started on the 23rd of September 1870, and the last on the 28th of January 1871. Gambetta effected his escape from Paris, on the 7th of October, in the balloon "Armand-Barbés," an event which doubtless led to the prolongation of the war. Of the sixty-four balloons only two were never heard of; they were blown out to sea. One of the most remarkable voyages was that of the "Ville d'Orléans," which, leaving Paris at eleven o'clock on the 21st of November, descended fifteen hours afterwards near Christiania, having crossed the North Sea. Several of the balloons on their descent were taken by the Prussians, and a good many were fired at while in the air. The average size of the balloons was from 2000 to 2050 metres, or from 70,000 to 72,000 cub. ft. The above facts are extracted from *Les Ballons du siège de Paris*, a sheet published by Bulla and Sons, Paris, and compiled by the brothers Tissandier, well-known French aeronauts, which gives the name, size and times of ascent and descent of every balloon that left Paris, with the names of the aeronaut and generally also of the passengers, the weight of despatches, the number of pigeons, &c. Only those balloons, however, are noticed in which some person ascended. The balloons were manufactured and despatched (generally from the platforms of the Orleans or the Northern railway) under the direction of the Post Office. The aeronauts employed were mostly sailors, who did their work very well. No use whatever was made in the war of balloons for purposes of reconnaissance.

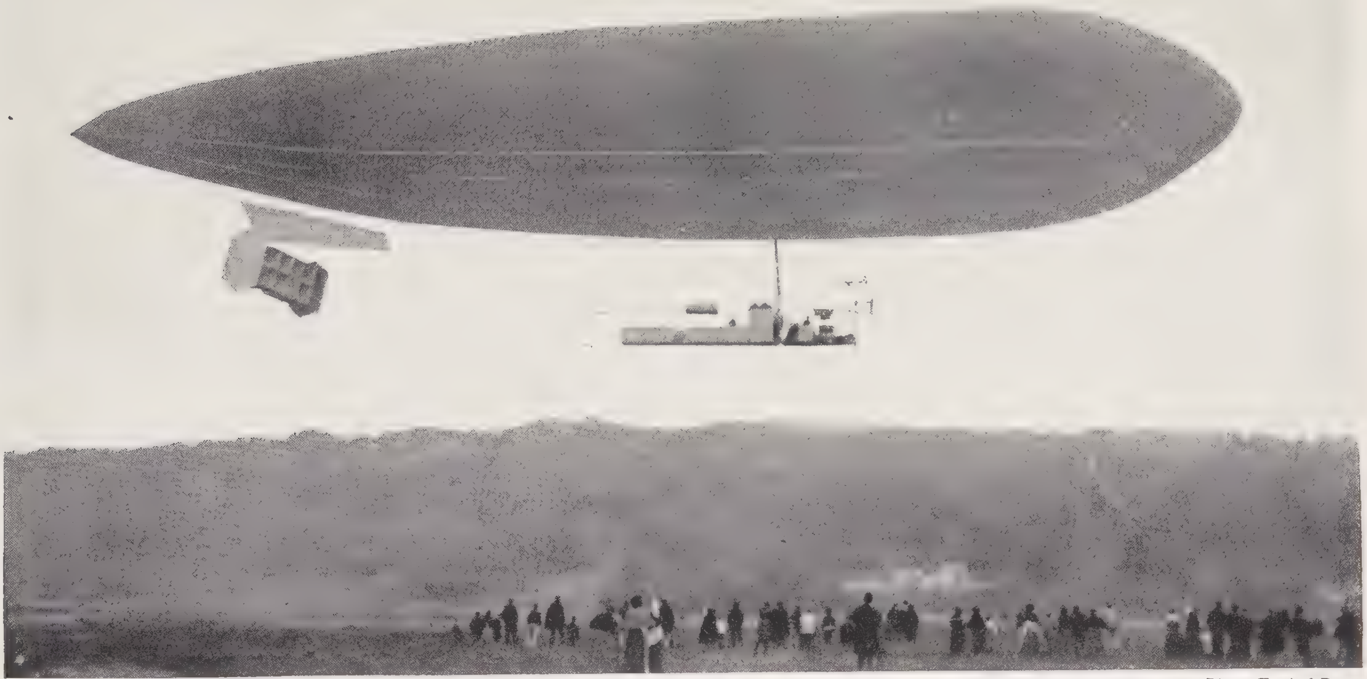
Ballooning, however, as a recognized military science, only dates back to about the year 1883 or 1884, when most of the powers organized regular balloon establishments. In 1884–85 the French found balloons very useful during their campaign in Tongking; and the British government also despatched balloons with the Bechuanaland expedition, and also with that to Suakin in those years. During the latter campaign several ascents were made in the presence of the enemy, on whom it was said that a great moral effect was produced. The employment of balloons has been common in nearly all modern wars.

We may briefly describe the apparatus used in military operations. The French in the campaigns of the 19th century used varnished silk balloons of about 10,000 cub. ft. capacity. The Americans in the Civil War used much larger ones, those of 26,000 cub. ft. being found the most suitable. These were also of varnished silk. In the present day most nations use balloons of about 20,000 cub. ft., made of varnished cambric; but the British war balloons, made of goldbeater skin, are usually of comparatively small size, the normal capacity being 10,000 cub. ft., though others of 7000 and 4500 cub. ft. have also been used, as at Suakin. The usual shape is spherical; but since 1896 the Germans, and now other nations, have adopted a long cylindrical-shaped balloon, so affixed to its cable as to present an inclined surface to the wind and thus act partly on the principle of a kite. Though coal-gas and even hot air may occasionally be used for inflation, hydrogen gas is on account of its lightness far preferable. In the early days of ballooning this had to be manufactured in the field, but nowadays it is almost universally carried compressed in steel tubes. About 100 such tubes, each weighing 75℔, are required to fill a 10,000-ft. balloon. Tubes of greater capacity have also been tried.

The balloon is almost always used *captive*. If allowed to go free it will usually be rapidly carried away by the wind and the results of the observations cannot easily be transmitted back. Occasions may occur when such ascents will be of value, but the usual method is to send up a captive balloon to a height of somewhere about 1000 ft. With the standard British balloon two officers are sent up, one of whom has now particularly to attend to the management of the balloon, while the other makes the observations.

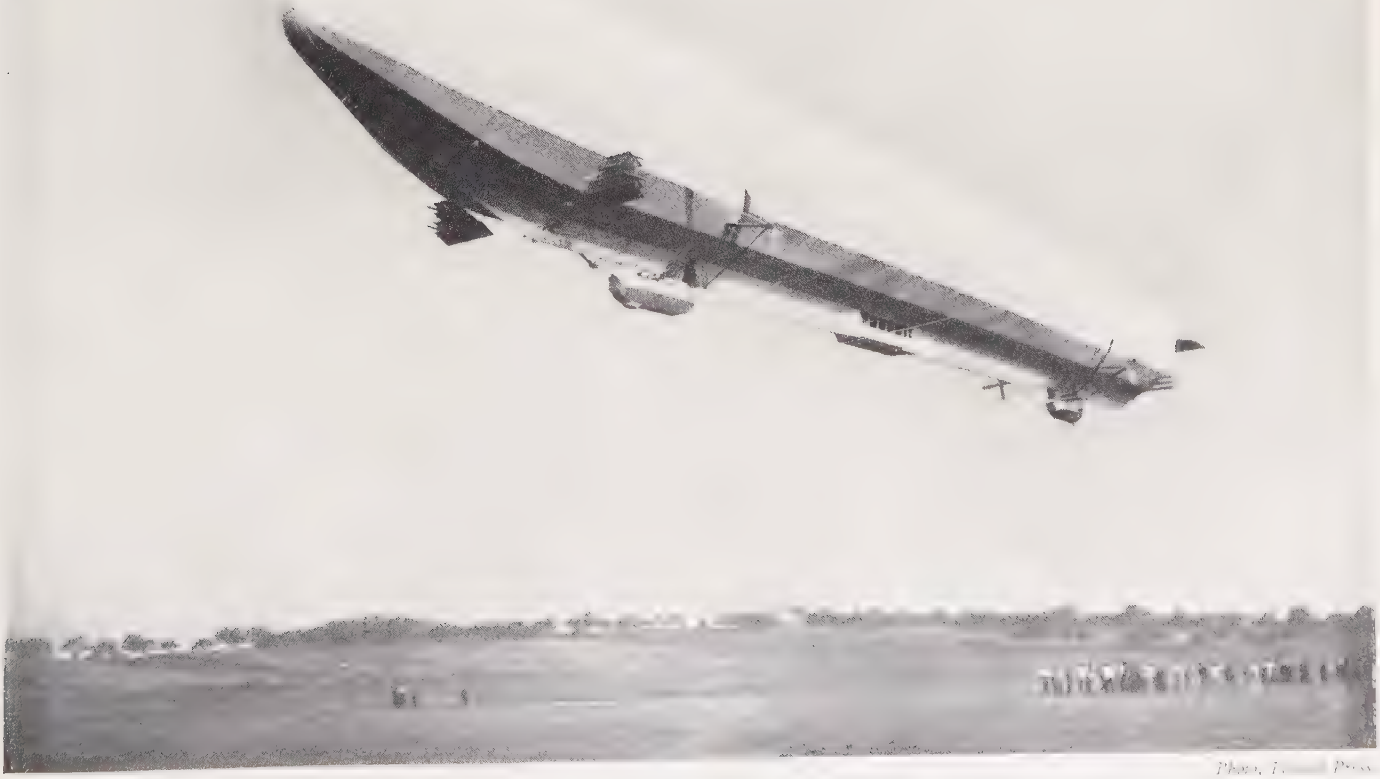
With regard to observations from captive balloons much depends on circumstances. In a thickly wooded country, such as that in which the balloons were used in the American Civil War, and in the war in Cuba (in which the balloon merely served to expose the troops to severe fire), no very valuable information is, as a rule, to be obtained; but in fairly open country all important movements of troops should be discernible by an experienced observer at any point within about four or five miles of the balloon. The circumstances, it may be mentioned, are such as would usually preclude one unaccustomed to ballooning from affording valuable reports. Not only is he liable to be disturbed by the novel and apparently hazardous situation, but troops and features of the ground often have so peculiar an appearance from that point of view, that a novice will often have a difficulty in deciding whether an object be a column of troops or a ploughed field. Then again, much will depend on atmospheric conditions. Thus, in misty weather a balloon is well-nigh useless; and in strong winds, with a velocity of anything over 20 m. an hour, efficient observation becomes a matter of difficulty. When some special point has to be reported on, such as whether there is any large body of troops behind a certain hill or wood, a rapid ascent may still be made in winds up to 30 m. an hour, but the balloon would then be so unsteady that no careful scouting could be made. It is usually estimated that a successful captive ascent can only be made in England on half the days of the year. As a general rule balloon ascents would be made for one of the following objects:—to examine the country for an enemy; to reconnoitre the enemy's position; to ascertain the strength of his force, number of guns and exact situation of the various arms; also to note the plan of his earthworks or fortifications. During an action the aerial observer would be on the look-out for any movements of the enemy and give warning of flank attacks or surprises. Such an observer could also keep the general informed as to the progress of various detached parties of his own force, as to the advance of reinforcements, or to the conduct of any fighting going on at a distance. Balloon observations are also of especial aid to artillery in correcting their aim.

The vulnerability of a captive balloon to the enemy's fire has been tested by many experiments with variable results. One established



Photo, Topical Press.

FIG. 1.—CLÉMENT-BAYARD DIRIGIBLE.



Photo, Topical Press.

FIG. 2.—ZEPPELIN VII. (DEUTSCHLAND), WRECKED JUNE 28, 1910.

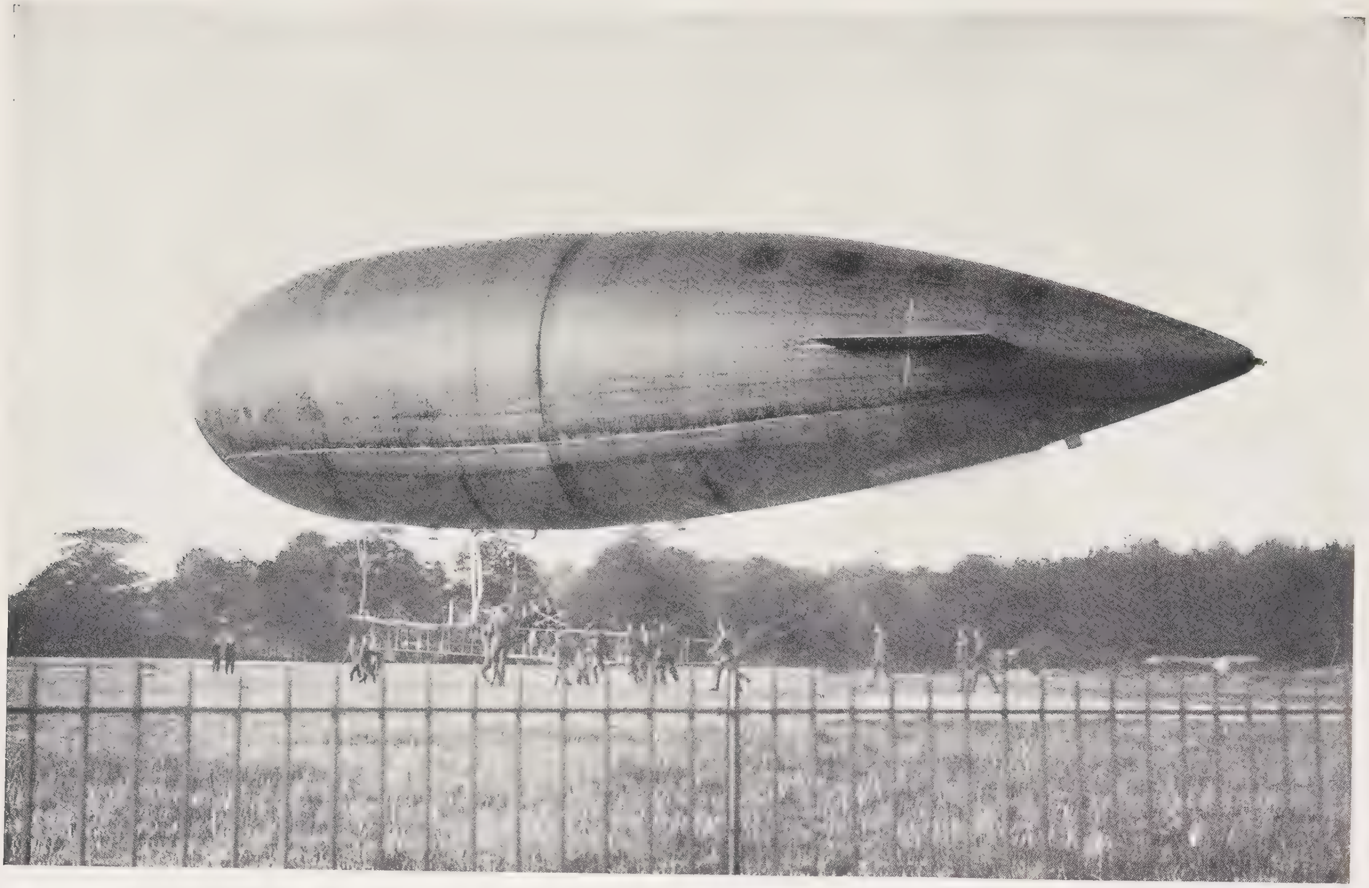


FIG. 3.—BRITISH ARMY DIRIGIBLE, BETA. *Photo, Topical Press.*

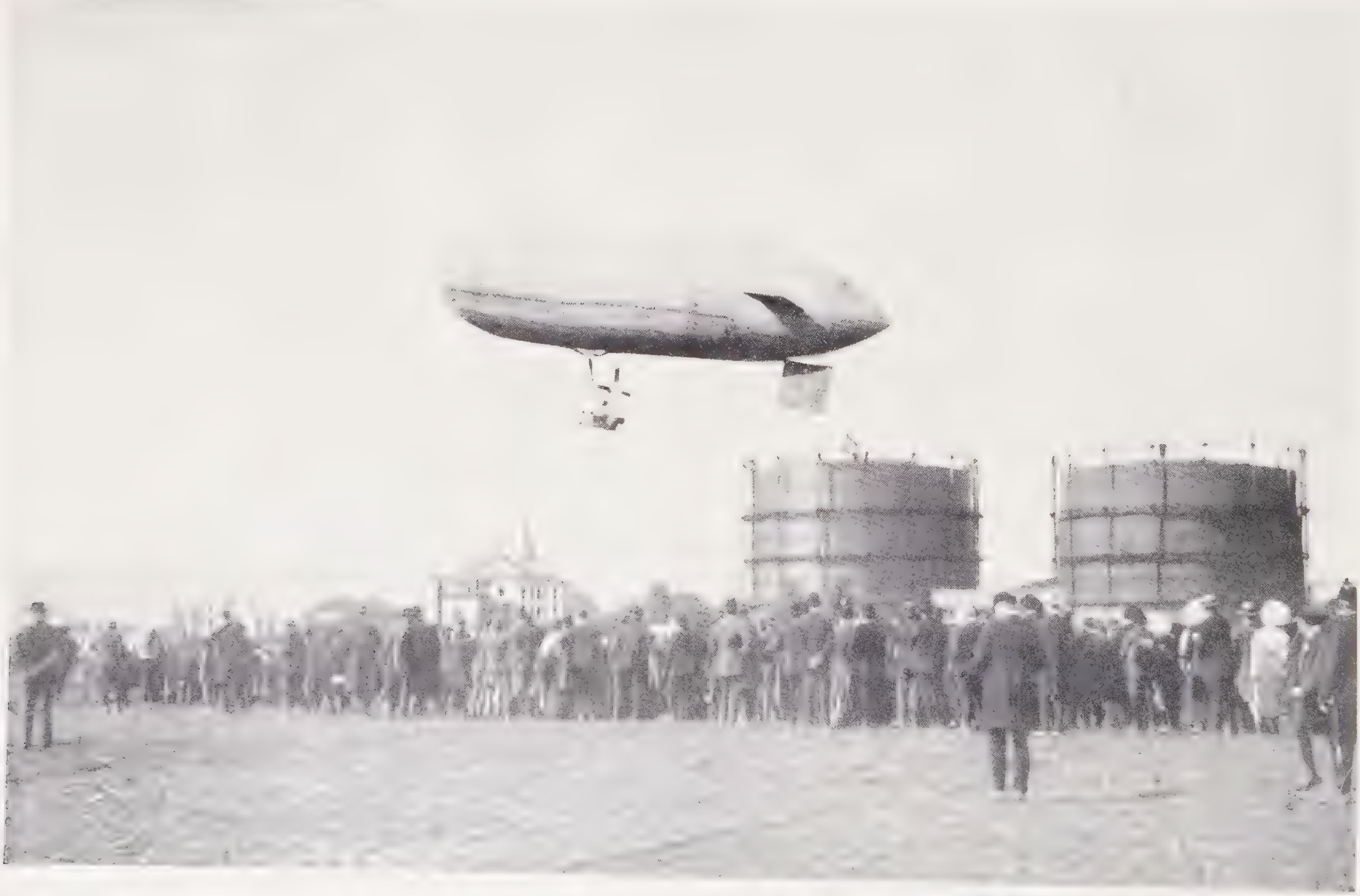


FIG. 4.—PARSEVAL DIRIGIBLE. *Photo, Topical Press.*

fact is that the range of a balloon in mid-air is extremely difficult to judge, and, as its altitude can be very rapidly altered, it becomes a very difficult mark for artillery to hit. A few bullet-holes in the fabric of a balloon make but little difference, since the size of the perforation is very minute as compared with the great surface of material, but on the other hand, a shrapnel bursting just in front of it may cause a rapid fall. It is therefore considered prudent to keep the balloon well away from an enemy, and two miles are laid down as the nearest approach it should make habitually.

Besides being of use on land for war purposes, balloons have also been tried in connexion with the naval service. In France especially regular trials have been made of inflating balloons on board ships, and sending them aloft as a look-out; but it is now generally contended that the difficulties of storing the gas and of manœuvring the balloon are so great on board ship as to be hardly worth the results to be gained.

A very important development of military ballooning is that of the navigable balloon. If only a balloon could be sent up and driven in any required direction, and brought back to its starting-point, it is obvious that it would be of the very greatest use in war.

Dirigible balloons.

From the very first invention of balloons the problem has been how to navigate them by propulsion. General J. B. M. C. Meusnier (1754–1793) proposed an elongated balloon in 1784. It was experimented on by the brothers Robert, who made two ascensions and claimed to have obtained a deviation of 22° from the direction of a light wind by means of aerial oars worked by hand. The relative speed was probably about 3 m. an hour, and it was so evident that a very much more energetic light motor than any then known was required to stem ordinary winds that nothing more was attempted till 1852, when Henri Giffard (1825–1882) ascended with a steam-engine of then unprecedented lightness. The subjoined table exhibits some of the results subsequently obtained :—

Experiments with Dirigible Balloons

Year.	Inventor.	Length.	Diameter.	Contents.	Lifting Capacity.	Weight of Balloon.	Weight of Motor.	H.P.	Speed per hour.
		Ft.	Ft.	Cub. ft.	℔.	℔.	℔.		Miles.
1852	Giffard . . .	144	39	88,300	3,978	2,794	462	3·0	6·71
1872	Dupuy de Lôme . . .	118	49	120,088	8,358	4,728	2000	0·8	6·26
1884	Tissandier .	92	30	37,439	2,728	933	616	1·5	7·82
1885	Renard and Krebs . .	165	27	65,836	4,402	2,449	1174	9·0	14·00
1897	Schwarz . .	157	{46 39}	130,500	8,133	6,800	800 ?	16·0	17·00
1900	Zeppelin I. .	420	39	400,000	25,000	19,000	1500	32·0	18·00
1901	Santos Dumont VI. .	108	20	22,200	..	..	..	16·20	19·00
1908	"République"	195	35	130,000	3,100	..	..	80	30
1908	Zeppelin IV. .	446	42½	450,000	..	..	..	220	..

Giffard, the future inventor of the injector, devised a steam-engine weighing, with fuel and water for one hour, 154 ℔ per horse-power, and was bold enough to employ it in proximity to a balloon inflated with coal gas. He was not able to stem a medium wind, but attained some deviation. He repeated the experiment in 1855 with a more elongated spindle, which proved unstable and dangerous. During the siege of Paris the French government decided to build a navigable balloon, and entrusted the work to the chief naval constructor, Dupuy de Lôme. He went into the subject very carefully, made estimates of all the strains, resistances and speeds, and tested the balloon in 1872. Deviations of 12° were obtained from the course of a wind blowing 27 to 37 m. per hour. The screw propeller was driven by eight labourers, a steam-engine being deemed too dangerous; but it was estimated that had one been used, weighing as much as the men, the speed would have been doubled. Tissandier and his brother applied an electric motor, lighter than any previously built, to a spindle-shaped balloon, and went up twice in 1883 and 1884. On the latter occasion he stemmed a wind of 7 m. per hour. The brothers abandoned these experiments, which had been carried on at their own expense, when the French War Department took up the problem. Renard and Krebs, the officers in charge of the War Aeronautical Department at Meudon, built and experimented with in 1884 and 1885 the fusiform balloon "La France," in which the "master" or maximum section was about one-quarter of the distance from the stem. The propelling screw was at the front of the car and driven by an electric motor of unprecedented lightness. Seven ascents were made on very calm days, a maximum speed of 14 m. an hour was obtained, and the balloon returned to its starting-point on five of the seven occasions. Subsequently another balloon was constructed, said to be capable of a speed of 22 to 28 m. per hour, with a different motor. After many years of experiment Dr Wölfert built and experimented with in Berlin, in 1897, a cigar-shaped balloon driven by a gasoline motor. An explosion took place in the air, the balloon fell and Dr Wölfert and his assistant were killed. It was also in 1897 that an aluminium balloon was built from the designs of D. Schwarz and tested in Berlin. It was driven by a Daimler benzine motor, and attained a greater speed than "La France"; but a driving belt slipped, and in coming down the balloon was injured beyond repair.

From 1897 onwards Count Ferdinand von Zeppelin, of the German army, was engaged in constructing an immense balloon, truly an airship, of most careful and most intelligent design, to carry five men. It consisted of an aluminium framework containing sixteen gas bags with a total capacity of nearly 400,000 cub. ft., and it had two cars, each containing a 16 h.p. motor. It was first tested in June 1900, when it attained a speed of 18 m. an hour and travelled a distance of 3½ m. before an accident to the steering gear necessitated the discontinuance of the experiment. In 1905 Zeppelin built a second airship which had a slightly smaller capacity but much greater power, its two motors each developing 85 h.p. This, after making some successful trips, was wrecked in a violent gale, and was succeeded by a third airship, which, at its trial in October 1906, travelled round Lake Constance and showed itself able to execute numerous curves and traverses. At a second series of trials in September 1907, after some alterations had been effected, it attained a speed of 36 m. an hour, remaining in the air for many hours and carrying nine or eleven passengers. A fourth vessel of similar design, but with more powerful motors, was tried in 1908, and succeeded in travelling 250 m. in 11 hours, but owing to a storm it was wrecked when on land and burnt at Echterdingen on the 5th of August. Subscriptions, headed by the emperor, were at once raised to enable Zeppelin to build another.

Meanwhile in 1901 Alberto Santos Dumont had begun experiments with dirigible balloons in Paris, and on the 19th of October won the Deutsch prize by steering a balloon from St Cloud round the Eiffel tower and back in half an hour, encountering on his return journey a wind of nearly 5 metres a second. An airship constructed by Pierre and Paul Lebaudy in 1904 also made a number of successful trials in the vicinity of Paris; with a motor of 40 h.p., its speed was about 25 m. an hour, and it regularly carried three passengers. In October 1907 the "Nulli Secundus," an airship constructed for the British War Office, sailed from Farnborough round St Paul's Cathedral, London, to the Crystal Palace, Sydenham, a distance of about 50 m., in 3 hours 35 minutes. The weight carried, including two occupants, was 3400 ℔, and the maximum speed was 24 m. an hour, with a following wind of 8 m. an hour.

Thus the principles which govern the design of the dirigible balloon may be said to have been evolved. As the lifting power grows as the cube of the dimensions, and the resistance approximately as the square, the advantage lies with the larger sizes of balloons, as of ocean steamers, up to the limits within which they may be found practicable. Count Zeppelin gained an advantage by attaching his propellers to the balloon, instead of to the car as heretofore; but this requires a rigid framework and a great increase of weight. Le Compagnon endeavoured, in 1892, to substitute flapping wings for rotary propellers, as the former can be suspended near the centre of resistance. C. Danilewsky followed him in 1898 and 1899, but without remarkable results. Dupuy de Lôme was the first to estimate in detail the resistances to balloon propulsion, but experiment showed that in the aggregate they were greater than he calculated. Renard and Krebs also found that their computed resistances were largely exceeded, and after revising the results they gave the formula $R=0{\cdot}01685\ D^2V^2$, R being the resistance in kilograms, D the diameter in metres and V the velocity in metres per second. Reduced to British measures, in pounds, feet and miles per hour, $R=0{\cdot}0006876\ D^2V^2$, which is somewhat in excess of the formula computed by Dr William Pole from Dupuy de Lôme's experiments. The above coefficient applies only to the shape and rigging of the balloon "La France," and combines all resistances into one equivalent, which is equal to that of a flat plane 18% of the "master section." This coefficient may perhaps hereafter be reduced by one-half through a better form of hull and car, more like a fish than a spindle, by diminished sections of suspension lines and net, and by placing the propeller at the centre of resistance. To compute the results to be expected from new projects, it will be preferable to estimate the resistances in detail. The following table shows how this was done by Dupuy de Lôme, and the probable corrections which should have been made by him:—

Resistances—Dupuy de Lôme's Balloon

	Computed by Dupuy de Lôme. V=2·22 m. per sec.				More Probable Values. V=2·82 m. per sec.		
Part.	Area, Sq. Metres.	Co-efficient.	Air Pressure.	Resistance, Kg.	Co-efficient.	Air Pressure.	Resistance, Kg.
Hull, without net. .	172·96	1/30	0·665	3·830	1/15	0·875	10·091
Car . . .	3·25	1/5	,,	0·432	1/5	,,	0·569
Men's bodies	3·00	1/5	,,	0·400	1/2	,,	1·312
Gas tubes .	6·40	1/5	,,	0·850	1/2	,,	2·750
Small cords	10·00	1/2	,,	3·325	1/2	,,	4·375
Large cords	9·90	1/3	,,	2·194	1/3	,,	2·887
				11·031			21·984

When the resistances have been reduced to the lowest possible minimum by careful design, the attainable speed must depend upon the efficiency of the propeller and the relative lightness of the motor. The commercial uses of dirigible balloons, however, will be small, as they must remain housed when the wind aloft is brisk. The sizes will be great and costly, the loads small, and the craft frail and short-lived, yet dirigible balloons constitute the obvious type for governments to evolve, until they are superseded by efficient flying machines. (See further, as to the latter, the article Flight and Flying.)

Practice of aerostation.

The chief danger attending ballooning lies in the descent; for if a strong wind be blowing, the grapnel will sometimes trail for miles over the ground at the rate of ten or twenty miles an hour, catching now and then in hedges, ditches, roots of trees, &c.; and, after giving the balloon a terrible jerk, breaking loose again, till at length some obstruction, such as the wooded bank of a stream, affords a firm hold. This danger, however, has been much reduced by the use of the "ripping-cord," which enables a panel to be ripped open and the balloon to be completely deflated in a few seconds, just as it is reaching the earth. But even a very rough descent is usually not productive of any very serious consequences; as, although the occupants of the car generally receive many bruises and are perhaps cut by the ropes, it rarely happens that anything worse occurs. On a day when the wind is light (supposing that there is no want of ballast) nothing can be easier than the descent, and the aeronaut can decide several miles off on the field in which he will alight. It is very important to have a good supply of ballast, so as to be able to check the rapidity of the descent, as in passing downwards through a wet cloud the weight of the balloon is enormously increased by the water deposited on it; and if there is no ballast to throw out in compensation, the velocity is sometimes very great. It is also convenient, if the district upon which the balloon is descending appear unsuitable for landing, to be able to rise again. The ballast consists of fine baked sand, which becomes so scattered as to be inappreciable before it has fallen far below the balloon. It is taken up in bags containing about $\frac{1}{2}$ cwt. each. The balloon at starting is liberated by a spring catch which the aeronaut releases, and the ballast should be so adjusted that there is nearly equilibrium before leaving, else the rapidity of ascent is too great, and has to be checked by parting with gas. It is almost impossible to liberate the balloon in such a way as to avoid giving it a rotary motion about a vertical axis, which continues during the whole time it is in the air. This rotation makes it difficult for those in the car to discover in what direction they are moving; and it is only by looking down along the rope to which the grapnel is suspended that the motion of the balloon over the country below can be traced. The upward and downward motion at any instant is at once known by merely dropping over the side of the car a small piece of paper: if the paper ascends or remains on the same level or stationary, the balloon is descending; while, if it descends, the balloon is ascending. This test is exceedingly delicate.

References.—Tiberius Cavallo, *Treatise on the Nature and Properties of Air and other permanently Elastic Fluids* (London, 1781); Idem, *History and Practice of Aerostation* (London, 1785); Vincent Lunardi, *Account of the First Aerial Voyage in England, in a Series of Letters to his Guardian* (London, 1785); T. Forster, *Annals of some Remarkable Aerial and Alpine Voyages* (London, 1832); Monck Mason, *Aeronautica* (London, 1838); John Wise, *A System of Aeronautics, comprehending its Earliest Investigations* (Philadelphia, 1850); Hatton Turnor, *Astra Castra, Experiments and Adventures in the Atmosphere* (London, 1865); J. Glaisher, C. Flammarion, W. de Fonvielle and G. Tissandier, *Voyages aériens* (Paris, 1870) (translated and edited by James Glaisher under the title *Travels in the Air* (London, 1871); O. Chanute, *Progress in Flying Machines* (New York, 1894); W. de Fonvielle, *Les Ballons sondes* (Paris, 1899); Idem, *Histoire de la navigation aérienne* (Paris, 1907); F. Walker, *Aerial Navigation* (London, 1902); J. Lecornu, *La Navigation aérienne* (Paris, 1903); M. L. Marchis, *Leçons sur la navigation aérienne* (Paris, 1904), containing many references to books and periodicals on pp. 701-704; *Navigating the Air* (papers collected by the Aero Club of America) (New York, 1907); A. Hildebrandt, *Airships past and present* (London, 1908).

AEROTHERAPEUTICS, the treatment of disease by atmospheric air: a term which of late has come to be used somewhat more loosely to include also pneumotherapeutics, or the treatment of disease by artificially prepared atmospheres. The physical and chemical properties of atmospheric air, under ordinary pressure or under modified pressure, may be therapeutically utilized either on the external surface of the body, on the respiratory surface, or on both surfaces together. Also modifications may be induced in the ventilation of the lungs by general gymnastics or respiratory gymnastics.

The beneficial effects of air under ordinary pressure are now utilized in the open-air treatment of phthisical patients, and the main indications of benefit resulting therefrom are reduction of the fever, improvement of appetite and the induction of sleep.

The air, however, may be modified in composition or in temperature. Inhalation is the most common and successful method of applying it—when modified in composition—to the human body. The methods in use are as follows: (1) Inhalation of gases, as oxygen and nitrous oxide. The dyspnoea and cyanosis of pneumonia, capillary bronchitis, heart failure, &c., are much relieved by the inhalation of oxygen; and nitrous oxide is largely used as an anaesthetic in minor operations. (2) Certain liquids are used as anaesthetics, which volatilize at low temperatures, as chloroform and ether. (3) Mercury and sulphur, both of which require heat for volatilization, are very largely used. In a mercurial or sulphur bath, the patient, enveloped in a sheet, sits on a chair beneath which a spirit lamp is placed to vaporize the drug, the best results being obtained when the atmosphere is surcharged with steam at the same time. The vapour envelops the patient and is absorbed by the skin. This method is extensively used in the treatment of syphilis, and also for scabies and other parasitic affections of the skin. (4) Moist inhalations are rather losing repute in the light of modern investigations, which tend to show that nothing lower than the larger bronchial tubes is affected. Complicated apparatus has been devised for the application, although a wide-mouthed jug filled with boiling water, into which the drug is thrown, is almost equally efficacious.

Artificial atmospheres may be made for invalids by respirators which cover the mouth and nose, the air being drawn through tow or sponge, on which is sprinkled the disinfectant to be used. This is most valuable in the intensely offensive breath of some cases of bronchiectasis.

The air may be modified as to temperature. Cold air at 32–33° F. has been used in chronic catarrhal conditions of the lungs, with the result that cough diminishes, the pulse becomes fuller and slower and the general condition improves. The more recent observations of Pasquale di Tullio go far to show that this may be immensely valuable in the treatment of haemoptysis. The inspiration of superheated dry air has been the subject of much investigation, but with very doubtful results.

Hot air applied to the skin is more noteworthy in its therapeutic effects. If a current of hot air is directed upon healthy skin, the latter becomes pale and contracts in consequence of vaso-constriction. But if it is directed on a patch of diseased skin, as in lupus, an inflammatory reaction is set up and the diseased part begins to undergo necrosis. This fact has been used with good results in lupus, otorrhoea, rhinitis and other nasal and laryngeal troubles.

Lastly the air may be either compressed or rarefied. The physiological effects of compressed air were first studied in diving-bells, and more recently in caissons. Caisson workers at first enjoy increased strength, vigour and appetite; later, however, the opposite effect is produced and intense debility supervenes. In addition, caisson workers suffer from a series of troubles which are known as accidents of decompression. (See Caisson Disease.) But, therapeutically, compressed air has been utilized by means of pneumatic chambers large enough to hold one or more adults at the time, in which the pressure of the atmosphere can be exactly regulated. This form of treatment has been found of much value in the treatment of emphysema, early pulmonary tuberculosis (not in the presence of persistent high temperature, haemorrhage, softening or suppuration), delayed absorption of pleural effusions, heart disease, anaemia and chlorosis. But compressed air is contra-indicated in advanced tubercle, fever, and in diseases of kidneys, liver or intestines.

Rarefied air was used as long ago as 1835, by V. T. Junod, who utilized it for local application by inventing the Junod Boot. By means of this the blood could be drawn into any part to which it was applied, the vessels of which became gorged with blood at the expense of internal organs. More recently this method of treatment has undergone far-reaching developments and is known as the passive hyperaemic treatment.

There are also various forms of apparatus by means of which air at greater or lesser pressures may be drawn into the lungs, and for the performance of lung gymnastics of various kinds. Mr Ketchum of the United States has invented one which is much used. A committee of the Brompton Hospital, London, investigating its capabilities, decided that its use brought about (1) an increase of chest circumference, and (2) in cases of consolidation of the lung a diminution in the area of dulness.

AERTSZEN (or Aartsen), **PIETER** (1507–1573), called "Long Peter" on account of his height, Dutch historical painter, was born and died at Amsterdam. When a youth he distinguished himself by painting homely scenes, in which he reproduced articles of furniture, cooking utensils, &c., with marvellous fidelity, but he afterwards cultivated historical painting. Several of his best works—altar-pieces in various churches—were destroyed in the religious wars of the Netherlands. An excellent specimen of his style on a small scale, a picture of the crucifixion, may be seen in the Antwerp Museum. Aertszen was a member of the Academy of St Luke, in whose books he is entered as *Langhe Peter, schilder.* Three of his sons attained to some note as painters.

AESCHINES (389–314 B.C.), Greek statesman and orator, was born at Athens. The statements as to his parentage and early life are conflicting; but it seems probable that his parents, though poor, were respectable. After assisting his father in his school, he tried his hand at acting with indifferent success, served with distinction in the army, and held several clerkships, amongst them the office of clerk to the Boulē. The fall of Olynthus (348) brought Aeschines into the political arena, and he was sent on an embassy to rouse the Peloponnesus against Philip. In 347 he was a member of the peace embassy to Philip of Macedon, who seems to have won him over entirely to his side. His dilatoriness during the second embassy (346) sent to ratify the terms of peace led to his accusation by Demosthenes and Timarchus on a charge of high treason, but he was acquitted as the result of a powerful speech, in which he showed that his accuser Timarchus had, by his immoral conduct, forfeited the right to speak before the people. In 343 the attack was renewed by Demosthenes in his speech *On the False Embassy*; Aeschines replied in a speech with the same title and was again acquitted. In 339, as one of the Athenian deputies (*pylagorae*) in the Amphictyonic Council, he made a speech which brought about the Sacred War. By way of revenge, Aeschines endeavoured to fix the blame for these disasters upon Demosthenes. In 336, when Ctesiphon proposed that his friend Demosthenes should be rewarded with a golden crown for his distinguished services to the state, he was accused by Aeschines of having violated the law in bringing forward the motion. The matter remained in abeyance till 330, when the two rivals delivered their speeches *Against Ctesiphon* and *On the Crown.* The result was a complete victory for Demosthenes. Aeschines went into voluntary exile at Rhodes, where he opened a school of rhetoric. He afterwards removed to Samos, where he died in the seventy-fifth year of his age. His three speeches, called by the ancients "the Three Graces," rank next to those of Demosthenes. Photius knew of nine letters by him which he called the Nine Muses; the twelve published under his name (Hercher, *Epistolographi Graeci*) are not genuine.

Ancient Authorities.—Demosthenes, *De Corona* and *De Falsa Legatione*; Aeschines, *De Falsa Legatione* and *In Ctesiphontem*; Lives by Plutarch, Philostratus and Libanius; the *Exegesis* of Apollonius. Editions.—Benseler (1855–1860) (trans. and notes), Weidner (1872), Blass (1896); *Against Ctesiphon*, Weidner (1872), (1878), G.A. and W.H. Simcox (1866), Drake (1872), Richardson (1889), Gwatkin and Shuckburgh (1890). English Translations.—Leland (1771), Biddle (1881), and others. See also Stechow, *Aeschinis Oratoris vita* (1841); Marchand, *Charakteristik des Redners Äschines* (1876); Castets, *Eschine, l'Orateur* (1875); for the political problems see histories of Greece, esp. A. Holm, vol. iii. (Eng. trans., 1896); A. Schäfer, *Demosth. und seine Zeit* (Leipzig, 1856–1858); also Demosthenes.

AESCHINES (5th century B.C.), an Athenian philosopher. According to some accounts he was the son of a sausage-maker, but others say that his father was Lysanias (Diog. Laert. ii. 60; Suidas, *s.v.*). He was an intimate friend of Socrates, who is reported to have said that the sausage-maker's son alone knew how to honour him. Diogenes Laertius preserves a tradition that it was he, not Crito, who offered to help Socrates to escape from prison. He was always a poor man, and Socrates advised him "to borrow from himself, by diminishing his expenditure." He started a perfumery shop in Athens on borrowed capital, became bankrupt and retired to the Syracusan court, where he was well received by Aristippus. According to Diog. Laert. (ii. 61), Plato, then at Syracuse, pointedly ignored Aeschines, but this does not agree with Plutarch, *De adulatore et amico* (c. 26). On the expulsion of the younger Dionysius, he returned to Athens, and, finding it impossible to profess philosophy publicly owing to the contempt of Plato and Aristotle, was compelled to teach privately. He wrote also forensic speeches; Phrynichus, in Photius, ranks him amongst the best orators, and mentions his orations as the standard of the pure Attic style. Hermogenes also spoke highly of him (Περὶ ἰδεῶν). He wrote several philosophical dialogues: (1) *Concerning virtue, whether it can be* *taught*; (2) *Eryxias, or Erasistratus; concerning riches, whether they are good*; (3) *Axiochus: concerning death, whether it is to be feared*,—but those extant on the several subjects are not genuine remains. J. le Clerc has given a Latin translation of them, with notes and several dissertations, entitled *Silvae Philologicae*, and they have been edited by S. N. Fischer (Leipzig, 1786), and K. F. Hermann, *De Aeschin. Socrat. relig.* (Gött. 1850). The genuine dialogues appear to have been marked by the Socratic irony; an amusing passage is quoted by Cicero in the *De inventione* (i. 31).

See Hirzel, *Der Dialog.* i. 129-140; T. Gomperz, *Greek Thinkers*, vol. iii. p. 342 (Eng. trans. G. G. Berry, London, 1905).

AESCHYLUS (525–456 B.C.), Greek poet, the first of the only three Attic Tragedians of whose work entire plays survive, and in a very real sense (as we shall see) the founder of the Greek drama, was born at Eleusis in the year 525 B.C. His father, Euphorion, belonged to the "Eupatridae" or old nobility of Athens, as we know on the authority of the short *Life* of the poet given in the Medicean Manuscript (see note on "authorities" at the end). According to the same tradition he took part as a soldier in the great struggle of Greece against Persia; and was present at the battles of Marathon, Artemisium, Salamis and Plataea, in the years 490–479. At least one of his brothers, Cynaegirus, fought with him at Marathon, and was killed in attempting a conspicuous act of bravery; and the brothers' portraits found a place in the national picture of the battle which the Athenians set up as a memorial in the Stoa Poecile (or "Pictured Porch") at Athens.

Life.

The vigour and loftiness of tone which mark Aeschylus' poetic work was not only due, we may be sure, to his native genius and gifts, powerful as they were, but were partly inspired by the personal share he took in the great actions of a heroic national uprising. In the same way, the poet's brooding thoughtfulness on deep questions—the power of the gods, their dealings with man, the dark mysteries of fate, the future life in Hades—though largely due to his turn of mind and temperament, was doubtless connected with the place where his childhood was passed. Eleusis was the centre of the most famous worship of Demeter, with its processions, its ceremonies, its mysteries, its impressive spectacles and nocturnal rites; and these were intimately connected with the Greek beliefs about the human soul, and the underworld.

His dramatic career began early, and was continued for more than forty years. In 499, his 26th year, he first exhibited at Athens; and his last work, acted during his lifetime at Athens, was the trilogy of the *Oresteia*, exhibited in 458. The total number of his plays is stated by Suidas to have been ninety; and the seven extant plays, with the dramas named or nameable which survive only in fragments, amount to over eighty, so that Suidas' figure is probably based on reliable tradition. It is well known that in the 5th century each exhibitor at the tragic contests produced four plays; and Aeschylus must therefore have competed (between 499 and 458) more than twenty times, or once in two years. His first victory is recorded in 484, fifteen years after his earliest appearance on the stage; but in the remaining twenty-six years of his dramatic activity at Athens he was successful at least twelve times. This clearly shows that he was the most commanding figure among the tragedians of 500–458; and for more than half that time was usually the victor in the contests. Perhaps the most striking evidence of his exceptional position among his contemporaries is the well-known decree passed shortly after his death that whosoever desired to exhibit a play of Aeschylus should "receive a chorus," *i.e.* be officially allowed to produce the drama at the Dionysia. The existence of this decree, mentioned in the *Life*, is strongly confirmed by two passages in Aristophanes: first in the prologue of the *Acharnians* (which was acted in 425, thirty-one years after the poet's death), where the citizen, grumbling about his griefs and troubles, relates his great disappointment, when he took his seat in the theatre "expecting Aeschylus," to find that when the play came on it was Theognis; and secondly in a scene of the *Frogs* (acted 405 B.C.), where the throne of poetry is contested in Hades between Aeschylus and Euripides, the former complains (*Fr.* 866) that "the battle is not fair, because my own poetry has not died with me, while Euripides' has died, and therefore *he will have it with him to recite*"—a clear reference, as the scholiast points out, to the continued production at Athens of Aeschylus' plays after his death.

Apart from fables, guesses and blunders, of which a word is said below, the only other incidents recorded of the poet's life that deserve mention are connected with his Sicilian visits, and the charge preferred against him of revealing the "secrets of Demeter." This tale is briefly mentioned by Aristotle (*Eth.* iii. 2), and a late commentator (Eustratius, 12th century) quotes from one Heraclides Pontius the version which may be briefly given as follows:—

The poet was acting a part in one of his own plays, where there was a reference to Demeter. The audience suspected him of revealing the inviolable secrets, and rose in fury; the poet fled to the altar of Dionysus in the orchestra and so saved his life for the moment; for even an angry Athenian crowd respected the inviolable sanctuary. He was afterwards charged with the crime before the Areopagus; and his plea "that he did not know that what he said was secret" was accepted by the court and secured his acquittal. The commentator adds that the prowess of the poet (and his brother) at Marathon was the real cause of the leniency of his judges. The story was afterwards developed, and embellished by additions; but in the above shape it dates back to the 4th century; and as the main fact seems accepted by Aristotle, it is probably authentic.

As to his foreign travel, the suggestion has been made that certain descriptions in the *Persae*, and the known facts that he wrote a trilogy on the story of the Thracian king Lycurgus, persecutor of Dionysus, seem to point to his having a special knowledge of Thrace, which makes it likely that he had visited it. This, however, remains at best a conjecture. For his repeated visits to Sicily, on the other hand, there is conclusive ancient evidence. Hiero the First, tyrant of Syracuse, who reigned about twelve years (478–467), and amongst other efforts after magnificence invited to his court famous poets and men of letters, had founded a new town, Aetna, on the site of Catana which he captured, expelling the inhabitants. Among his guests were Aeschylus, Pindar, Bacchylides and Simonides. About 476 Aeschylus was entertained by him, and at his request wrote and exhibited a play called *The Women of Aetna* in honour of the new town. He paid a second visit about 472, the year in which he had produced the *Persae* at Athens; and the play is said to have been repeated at Syracuse at his patron's request. Hiero died in 467, the year of the *Seven against Thebes*; but after 458, when the *Oresteia* was exhibited at Athens, we find the poet again in Sicily for the last time. In 456 he died, and was buried at Gela; and on his tomb was placed an epitaph in two elegiac couplets saying: "Beneath this stone lies Aeschylus, son of Euphorion, the Athenian, who perished in the wheat-bearing land of Gela; of his noble prowess the grove of Marathon can speak, or the long-haired Persian who knows it well." The authorship of this epitaph is uncertain, as the *Life* says it was inscribed on his grave by the people of Gela, while Athenaeus and Pausanias attribute it to Aeschylus. Probably most people would agree that only the poet himself could have praised the soldier and kept silence about the poetry.

Of the marvellous traditions which gathered round his name little need be said. Pausanias' tale, how Dionysus appeared to the poet when a boy, asleep in his father's vineyard, and bade him write a tragedy—or the account in the *Life*, how he was killed by an eagle letting fall on his head a tortoise whose shell the bird was unable to crack—clearly belong to the same class of legends as the story that Plato was son of Apollo, and that a swarm of bees settled upon his infant lips as he lay in his mother's arms. Less supernatural, but hardly more historical, is the statement in the *Life* that the poet left Athens for Sicily in consequence of his defeat in the dramatic contest of 468 by Sophocles; or the alternative story of the same authority that the cause of his chagrin was that Simonides' elegy on the heroes slain at Marathon was preferred to his own. Apart from the inherent improbability of such pettiness in such a man, neither story fits the facts; for in 467, the next year after Sophocles' success, we know that Aeschylus won the prize of tragedy with the *Septem*; and the Marathon elegy must have been written in 490, fourteen years before his first visit to Sicily.

In passing from Aeschylus' life to his work, we have obviously far more trustworthy data, in the seven extant plays (with the fragments of more than seventy others), and particularly in the invaluable help of Aristotle's *Poetics*. The real importance of our poet in the development of the drama (see DRAMA: *Greek*) as compared with any of his three or four known predecessors—who are at best hardly more than names to us—is shown by the fact that Aristotle, in his brief review of the rise of tragedy (*Poet.* iv. 13), names no one before Aeschylus. He recognizes, it is true, a long process of growth, with several stages, from the dithyramb to the drama; and it is not difficult to see what these stages were. The first step was the addition to the old choric song of an interlude spoken, and in early days *improvised*, by the leader of the chorus (*Poet.* iv. 12). The next was the introduction of an actor (ὑποκριτής or "answerer"), to reply to the leader; and thus we get dialogue added to recitation. The "answerer" was at first the poet himself (Ar. *Rhet.* iii. 1). This change is traditionally attributed to Thespis (536 B.C.), who is, however, not mentioned by Aristotle. The mask, to enable the actor to assume different parts, by whomsoever invented, was in regular use before Aeschylus' day. The third change was the enlarged range of subjects. The lyric dithyramb-tales were necessarily about Dionysus, and the interludes had, of course, to follow suit. Nothing in the world so tenaciously resists innovation as religious ceremony; and it is interesting to learn that the Athenian populace (then, as ever, eager for "some new thing") nevertheless opposed at first the introduction of other tales. But the innovators won; or otherwise there would have been no Attic drama.

Work.

In this way, then, to the original lyric song and dances in honour of Dionysus was added a spoken (but still metrical) interlude by the chorus-leader, and later a dialogue with one actor (at first the poet), whom the mask enabled to appear in more than one part.

But everything points to the fact that in the development of the drama Aeschylus was the decisive innovator. The two things that were important, when the 5th century began, if tragedy was to realize its possibilities, were (1) the disentanglement of the dialogue from its position as an interlude in an artistic and religious pageant that was primarily lyric; and (2) its general elevation of tone. Aeschylus, as we know on the express authority of Aristotle (*Poet.* iv. 13), achieved the first by the introduction of the second actor; and though he did not begin the second, he gave it the decisive impulse and consummation by the overwhelming effect of his serious thought, the stately splendour of his style, his high dramatic purpose, and the artistic grandeur and impressiveness of the construction and presentment of his tragedies.

As to the importance of the second actor no argument is needed. The essence of a play is dialogue; and a colloquy between the coryphaeus and a messenger (or, by aid of the mask, a series of messengers), as must have been the case when Aeschylus began, is in reality not dialogue in the dramatic sense at all, but rather narrative. The discussion, the persuasion, the instruction, the pleading, the contention—in short, the interacting personal influences of different characters on each other—are indispensable to anything that can be called a play, as we understand the word; and, without two "personae dramatis" at the least, the drama in the strict sense is clearly impossible. The number of actors was afterwards increased; but to Aeschylus are due the perception and the adoption of the essential step; and therefore, as was said above, he deserves in a very real sense to be called the founder of Athenian tragedy.

Of the seven extant plays, *Supplices*, *Persae*, *Septem contra Thebas*, *Prometheus*, *Agamemnon*, *Choephoroe* and *Eumenides*, five can fortunately be dated with certainty, as the archon's name is preserved in the Arguments; and the other two approximately. The dates rest, in the last resort, on the διδασκαλίαι, or the official records of the contests, of which we know that Aristotle (and others) compiled catalogues; and some actual fragments have been recovered. The order of the plays is probably that given above; and certainly the *Persae* was acted in 472, *Septem* in 467, and the last three, the trilogy, in 458. The *Supplices* is generally, though not unanimously, regarded as the oldest; and the best authorities tend to place it not far from 490. The early date is strongly confirmed by three things: the extreme simplicity of the plot, the choric (instead of dramatic) opening, and the fact that the percentage of lyric passages is 54, or the highest of all the seven plays. The chief doubt is in regard to *Prometheus*, which is variously placed by good authorities; but the very low percentage of lyrics (only 27, or roughly a quarter of the whole), and still more the strong characterization, a marked advance on anything in the first three plays, point to its being later than any except the trilogy, and suggest a date somewhere about 460, or perhaps a little earlier. A few comments on the extant plays will help to indicate the main points of Aeschylus' work.

Supplices.—The exceptional interest of the *Supplices* is due to its date. Being nearly twenty years earlier than any other extant play, it furnishes evidence of a stage in the evolution of Attic drama which would otherwise have been unrepresented. Genius, as Patin says, is a "puissance libre," and none more so than that of Aeschylus; but with all allowance for the "uncontrolled power" of this poet, we may feel confident that we have in the *Supplices* something resembling in general structure the lost works of Choerilus, Phrynichus, Pratinas and the 6th-century pioneers of drama.

The plot is briefly as follows: the fifty daughters of Danaus (who are the chorus), betrothed by the fiat of Aegyptus (their father's brother) to his fifty sons, flee with Danaus to Argos, to escape the marriage which they abhor. They claim the protection of the Argive king, Pelasgus, who is kind but timid; and he (by a pleasing anachronism) refers the matter to the people, who agree to protect the fugitives. The pursuing fleet of suitors is seen approaching; the herald arrives (with a company of followers), blusters, threatens, orders off the cowering Danaids to the ships and finally attempts to drag them away. Pelasgus interposes with a force, drives off the Egyptians and saves the suppliants. Danaus urges them to prayer, thanksgiving and maidenly modesty, and the grateful chorus pass away to the shelter offered by their protectors.

It is clear that we have here the drama in its nascent stage, just developing out of the lyric pageant from which it sprang. The interest still centres round the chorus, who are in fact the "protagonists" of the play. Character and plot—the two essentials of drama, in the view of all critics from Aristotle downwards—are both here rudimentary. There are some fluctuations of hope and fear; but the play is a single situation. The stages are: the appeal; the hesitation of the king, the resolve of the people; the defeat of insolent violence; and the rescue. It should not be forgotten, indeed, that the play is one of a trilogy—an act, therefore, rather than a complete drama. But we have only to compare it with those later plays of which the same is true, to see the difference. Even in a trilogy, each play is a complete whole in itself, though also a portion of a larger whole.

Persae.—The next play that has survived is the *Persae*, which has again a special interest, viz. that it is the only extant Greek historical drama. We know that Aeschylus' predecessor, Phrynichus, had already twice tried this experiment, with the *Capture of Miletus* and the *Phoenician Women*; that the latter play dealt with the same subject as the *Persae*, and the handling of its opening scene was imitated by the younger poet. The plot of the *Persae* is still severely simple, though more developed than that of the *Suppliants*. The opening is still lyric, and the first quarter of the play brings out, by song and speech, the anxiety of the people and queen as to the fate of Xerxes' huge army. Then comes the messenger with the news of Salamis, including a description of the sea-fight itself which can only be called magnificent. We realize what it must have been for the vast audience—30,000, according to Plato (*Symp.* 175 E)—to hear, eight years only after the event, from the supreme poet of Athens, who was himself a distinguished actor in the war, this thrilling narrative of the great battle. But this reflexion at once suggests another; it is not a tragedy in the true Greek sense, according to the practice of the 5th-century poets. It may be called in one point of view a tragedy, since the scene is laid in Persia, and the drama forcibly depicts the downfall of the Persian pride. But its real aim is not the "pity and terror" of the developed drama; it is the triumphant glorification of Athens, the exultation of the whole nation gathered in one place, over the ruin of their foe. This is best shown by the praise of Aeschylus' great admirer and defender Aristophanes, who (*Frogs*, 1026-1027) puts into the poet's mouth the boast that in the *Persae* he had "glorified a noble exploit, and taught men to be eager to conquer their foe."

Thus, both as an historic drama and in its real effect, the *Persae* was an experiment; and, as far as we know, the experiment was not repeated either by the author or his successors. One further point may be noted. Aeschylus always has a taste for the unseen and the supernatural; and one effective incident here is the raising of Darius's ghost, and his prophecy of the disastrous battle of Plataea. But in the ghost's revelations there is a mixture of audacity and naïveté, characteristic at once of the poet and the early youth of the drama. The dead Darius prophesies Plataea, but has not heard of Salamis; he gives a brief (and inaccurate) list of the Persian kings, which the queen and chorus, whom he addresses, presumably know; and his only practical suggestion, that the Persians should not again invade Greece, seems attainable without the aid of superhuman foresight.

Septem contra Thebas.—Five years later came the Theban Tragedy. It is not only, as Aristophanes says (*Frogs*, 1024), "a play full of the martial spirit," but is (like the *Supplices*) one of a connected series, dealing with the evil fate of the Theban House. But instead of being three acts of a single story like the *Supplices*, these three plays trace the fate through three generations, Laius, Oedipus and the two sons who die by each other's hands in the fight for the Theban sovereignty. This family fate, where one evil deed leads to another after many years, is a larger conception, strikingly suited to Aeschylus' genius, and constitutes a notable stage in the development of the Aeschylean drama. And just as here we have the tragedy of the Theban house, so in the last extant work, the *Oresteia*, the poet traces the tragedy of the Pelopid family, from Agamemnon's first sin to Orestes' vengeance and purification. And the names of several lost plays point to similar handling of the tragic trilogy.

The *Seven against Thebes* is the last play of its series; and again the plot is severely simple, not only in outline, but in detail. Father and grandfather have both perished miserably; and the two princes have quarrelled, both claiming the kingdom. Eteocles has driven out Polynices, who fled to Argos, gathered a host under seven leaders (himself being one), and when the play opens has begun the siege of his own city. The king appears, warns the people, chides the clamour of women, appoints seven Thebans, including himself, to defend the seven gates, departs to his post, meets his brother in battle and both are killed. The other six chieftains are all slain, and the enemy beaten off. The two dead princes are buried by their two sisters, who alone are left of the royal house.

Various signs of the early drama are here manifest. Half the play is lyric; there is no complication of plot; the whole action is recited by messengers; and the fatality whereby the predicted mutual slaughter of the princes is brought about is no accidental stroke of destiny, but the choice of the king Eteocles himself. On the other hand, the opening is no longer lyric (like the two earlier plays) but dramatic; the main scene, where the messenger reports at length the names of the seven assailants, and the king appoints the seven defenders, each man going off in silence to his post, must have been an impressive spectacle. One novelty should not be overlooked. There is here the first passage of διάνοια, or general reflexion of life, which later became a regular feature of tragedy. Eteocles muses on the fate which involves an innocent man in the company of the wicked so that he shares unjustly their deserved fate. The passage (*Theb.* 597-608) is interesting; and the whole part of Eteocles shows a new effort of the poet to draw character, which may have something to do with the rise of Sophocles, who in the year before (468) won with his first play, now lost, the prize of tragedy.

There remain only the *Prometheus* and the *Oresteia*, which show such marked advance that (it may almost be said) when we think of Aeschylus it is these four plays we have in mind.

Prometheus.—The Prometheus-trilogy consisted of three plays: *Prometheus the Fire-bringer*, *Prometheus Bound*, *Prometheus Unbound.* The two last necessarily came in that order; the *Fire-bringer* is probably the first, though recently it has been held by some scholars to be the last, of the trilogy. That Prometheus sinned against Zeus, by stealing fire from heaven; that he was punished by fearful tortures for ages; that he finally was reconciled to Zeus and set free,—all this was the ancient tale indisputably. Those who hold the *Fire-bringer* (Πυρφόρος) to be the final play, conjecture that it dealt with the establishment of the worship of Prometheus under that title, which is known to have existed at Athens. But the other order is on all grounds more probable; it keeps the natural sequence—crime, punishment, reconciliation, which is also the sequence in the *Oresteia.* And if the reconciliation was achieved in the second play, no scheme of action sufficing for the third drama seems even plausible.[1]

However that may be, the play that survives is a poem of unsurpassed force and impressiveness. Nevertheless, from the point of view of the development of drama, there seems at first sight little scope in the story for the normal human interest of a tragedy, since the actors are all divine, except Io, who is a distracted wanderer, victim of Zeus' cruelty; and between the opening where Prometheus is nailed to the Scythian rock, and the close where the earthquake engulfs the rock, the hero and the chorus, action in the ordinary sense is *ipso facto* impossible. This is just the opportunity for the poet's bold inventiveness and fine imagination. The tortured sufferer is visited by the Oceanic Nymphs, who float in, borne by an (imaginary) winged car, to console; Oceanus (riding a griffin, doubtless also imaginary) follows, kind but timid, to advise submission; then appears Io, victim of Zeus' love and Hera's jealousy, to whom Prometheus prophesies her future wanderings and his own fate; lastly Hermes, insolent messenger of the gods, who tries in vain to extort Prometheus' secret knowledge of the future. Oceanus, the well-meaning palavering old mentor, and Hermes, the blustering and futile jack-in-office, gods though they be, are vigorous, audacious and very human character-sketches; the soft entrance of the consoling nymphs is unspeakably beautiful; and the prophecy of Io's wanderings is a striking example of that new keen interest in the world outside which was felt by the Greeks of the 5th century, as it was felt by the Elizabethan English in a very similar epoch of national spirit and enterprise two thousand years later. Thus, though dramatic action is by the nature of the case impossible for the hero, the visitors provide real drama.

Another important point in the development of tragedy is what we may call the "balanced issue." The question in *Suppliants* is the protection of the threatened fugitives; in *Persae* the humiliation of overweening pride. So far the sympathy of the audience is not doubtful or divided. In the *Septem* there is an approach to conflict of feeling; the banished brother has a personal grievance, though guilty of the impious crime of attacking his own country. The sympathy must be for the defender Eteocles; but it is at least somewhat qualified by his injustice to his brother. In *Prometheus* the issue is more nearly balanced. The hero is both a victim and a rebel. He is punished for his benefits to man; but though Zeus is tyrannous and ungrateful, the hero's reckless defiance is shocking to Greek feeling. As the play goes on, this is subtly and delicately indicated by the attitude of the chorus. They enter overflowing with pity. They are slowly chilled and alienated by the hero's violence and impiety; but they nobly decline, at the last crisis, the mean advice of Hermes to desert Prometheus and save themselves; and in the final crash they share his fate.

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[1] The *Eumenides* is quoted as a parallel, because there the establishment of this worship at Athens concludes the whole trilogy; but it is forgotten that in *Eumenides* there is much besides—the pursuit of Orestes, the refuge at Athens, the trial, the acquittal, the conciliation by Athena of the Furies; while here the story would be finished before the last play began.

Oresteia.—The last and greatest work of Aeschylus is the *Oresteia*, which also has the interest of being the only complete trilogy preserved to us. It is a three-act drama of family fate, like the Oedipus-trilogy; and the acts are the sin, the revenge, the reconciliation, as in the Prometheus-trilogy. Again, as in *Prometheus*, the plot, at first sight, is such that the conditions of drama seem to exclude much development in character-drawing. The gods are everywhere at the root of the action. The inspired prophet, Calchas, has demanded the sacrifice of the king's daughter Iphigenia, to appease the offended Artemis. The inspired Cassandra, brought in as a spear-won slave from conquered Troy, reveals the murderous past of the Pelopid house, and the imminent slaughter of the king by his wife. Apollo orders the son, Orestes, to avenge his father by killing the murderess, and protects him when after the deed he takes sanctuary at Delphi. The Erinnyes (" Furies ") pursue him over land and sea; and at last Athena gives him shelter at Athens, summons an Athenian council to judge his guilt, and when the court is equally divided gives her casting vote for mercy. The last act ends with the reconciliation of Athena and the Furies; and the latter receive a shrine and worship at Athens, and promise favour and prosperity to the great city. The scope for human drama seems deliberately restricted, if not closed, by such a story so handled. Nevertheless, as a fact, the growth of characterization is, in spite of all, not only visible but remarkable. Clytemnestra is one of the most powerfully presented characters of the Greek drama. Her manly courage, her vindictive and unshaken purpose, her hardly hidden contempt for her tool and accomplice, Aegisthus, her cold scorn for the feebly vacillating elders, and her unflinching acceptance (in the second play) of inevitable fate, when she faces at last the avowed avenger, are all portrayed with matchless force—her very craft being scornfully assumed, as needful to her purpose, and contemptuously dropped when the purpose is served. And there is one other noticeable point. In this trilogy Aeschylus, for the first time, has attempted some touches of character in two of the humbler parts, the Watchman in *Agamemnon*, and the Nurse in the *Choephoroe*. The Watchman opens the play, and the vivid and almost humorous sententiousness of his language, his dark hints, his pregnant metaphors drawn from common speech, at once give a striking touch of realism, and form a pointed contrast to the terrible drama that impends. A very similar effect is produced at the crisis of the *Choephoroe* by the speech of the Nurse, who coming on a message to Aegisthus pours out to the chorus her sorrow at the reported death of Orestes and her fond memories of his babyhood—with the most homely details; and the most striking realistic touch is perhaps the broken structure and almost inconsequent utterance of the old faithful slave's speech. These two are veritable figures drawn from contemporary life; and though both appear only once, and are quite unimportant in the drama, the innovation is most significant, and especially as adopted by Aeschylus.

It remains to say a word on two more points, the religious ideas of Aeschylus and some of the main characteristics of his poetry.

Characteristics.

The religious aspect of the drama in one sense was prominent from the first, owing to its evolution from the choral celebration of the god Dionysus. But the new spirit imported by the genius of Aeschylus into the early drama was religious in a profounder meaning of the term. The sadness of human lot, the power and mysterious dealings of the gods, their terrible and inscrutable wrath and jealousy (*ἄγα* and *φθόνος*), their certain vengeance upon sinners, all the more fearful if delayed,—such are the poet's constant themes, delivered with strange solemnity and impressiveness in the lyric songs, especially in the *Oresteia*. And at times, particularly in the *Trilogy*, in his reference to the divine power of Zeus, he almost approaches a stern and sombre monotheism. " One God above all, who directs all, who is the cause of all " (*Ag.* 163, 1485); the watchfulness of this Power over human action (363-367), especially over the punishment of their sins; and the mysterious law whereby sin always begets new sin (*Ag.* 758-760):—these are ideas on which Aeschylus dwells in the *Agamemnon* with peculiar force, in a strain at once lofty and sombre. One specially noteworthy point in that play is his explicit repudiation of the common Hellenic view that prosperity brings ruin. In other places he seems to share the feeling; but here (*Ag.* 730) he goes deeper, and declares that it is not *ὄλβος* but always wickedness that brings about men's fall. All through there is a recurring note of *fear* in his view of man's destiny, expressed in vivid images—the " death that lurks behind the wall " (*Ag.* 1004), the " hidden reef which wrecks the bark, unable to weather the headland " (*Eum.* 561-565). In one remarkable passage of the *Eumenides* (517-525) this fear is extolled as a moral power which ought to be enthroned in men's hearts, to deter them from impious or violent acts, or from the pride that impels them to such sins.

Of the poetic qualities of Aeschylus' drama and diction, both in the lyrics and the dialogue, no adequate account can be attempted; the briefest word must here suffice. He is everywhere distinguished by grandeur and power of conception, presentation and expression, and most of all in the latest works, the *Prometheus* and the *Trilogy*. He is pre-eminent in depicting the slow approach of fear, as in the *Persae*; the imminent horror of impending fate, as in the broken cries and visions of Cassandra in the *Agamemnon* (1072-1177), the long lament and prayers to the nether powers in the *Choephoroe* (315-478), and the gradual rousing of the slumbering Furies in the *Eumenides* (117-139). The fatal end in these tragedies is foreseen; but the effect is due to its measured advance, to the slowly darkening suspense which no poet has more powerfully rendered. Again, he is a master of contrasts, especially of the Beautiful with the Tragic: as when the floating vision of consoling nymphs appears to the tortured Prometheus (115-135); or the unmatched lyrics which tell (in the *Agamemnon*, 228-247) of the death of Iphigenia; or the vision of his lost love that the night brings to Menelaus (410-426). And not least noticeable is the extraordinary range, force and imaginativeness of his diction. One example of his lyrics may be given which will illustrate more than one of these points. It is taken from the long lament in the *Septem*, sung by the chorus and the two sisters, while following the funeral procession of the two princes. These laments may at times be wearisome to the modern reader, who does not see, and imperfectly imagines, the stately and pathetic spectacle; but to the ancient feeling they were as solemn and impressive as they were ceremonially indispensable. The solemnity is here heightened by the following lines sung by one of the chorus of Theban women (*Sept.* 854-860):—

> Nay, with the wafting gale of your sighs, my sisters,
> Beat on your heads with your hands the stroke as of oars,
> The stroke that passes ever across Acheron,
> Speeding on its way the black-robed sacred bark,—
> The bark Apollo comes not near,
> The bark that is hidden from the sunlight—
> To the shore of darkness that welcomes all!

AUTHORITIES.—The chief authority for the text is a single MS. at Florence, of the early 11th century, known as the Medicean or M., written by a professional scribe and revised by a contemporary scholar, who corrected the copyist's mistakes, added the scholia, the arguments and the dramatis personae of three plays (*Theb.*, *Agam.*, *Eum.*), and at the end the *Life of Aeschylus* and the *Catalogue* of his Dramas. The MS. has also been further corrected by later hands. In 1896 the Italian Ministry of Public Instruction publishd the MS. in photographic facsimile, with an instructive preface by Signor Rostagno. Besides M. there are some eight later MSS. (13th to 15th century), and numerous copies of the three select plays (*Sept.*, *Pers.*, *Prom.*) which were most read in the later Byzantine period, when Greek literature was reduced to gradually diminishing excerpts. These later MSS. are of little value or authority.

The editions, from the beginning of the 15th century to the present time, are very numerous, and the text has been further continuously improved by isolated suggestions from a host of scholars. The three first printed copies (Aldine, 1518; Turnebus and Robortello, 1552) give only those parts of *Agamemnon* found in M., from which MS. some leaves were lost; in 1557 the full text was restored by Vettori (Victorius) from later MSS. After these four, the chief editions of the seven plays were those of Schütz, Porson, Butler, Wellauer, Dindorf, Bothe, Ahrens, Paley, Hermann, Hartung, Weil, Merkel, Kirchhoff and Wecklein. Besides these, over a hundred scholars have thrown light on the corruptions or obscurities of the text, by editions of separate plays, by emendations, by special studies of the poet's work, or in other ways. Among recent writers who have made such contributions may be mentioned Wilamowitz-Moellendorf, Enger, Conington, Blaydes, Cobet, Meineke, Madvig, Ellis, W. Headlam, Davies, Tucker, Verrall and Haigh. The *Fragments* have been edited by Nauck and also by Wecklein. The Aeschylean staging is discussed in Albert Müller's *Lehrbuch der griechischen Bühnenalterthümer*; in "Die Bühne des Aeschylos," by Wilamowitz (*Hermes*, xxi.); in Smith's *Dict. of Antiquities*, art. "Theatrum" (R. C. Jebb); in Dörpfeld and Reisch (*Das griechische Theater*), Haigh's *Attic Theatre*, and Gardner and Jevons' *Manual of Greek Antiquities*. English Verse Translations: *Agamemnon*, Milman and R. Browning; *Oresteia, Suppliants, Persae, Seven against Thebes, Prometheus Vinctus*, by E. D. A. Morshead; *Prometheus*, E. B. Browning; the whole seven plays, Lewis Campbell. (A. Si.)

AESCULAPIUS (Gr. Ἀσκλήπιος), the legendary Greek god of medicine, the son of Apollo and the nymph Coronis. Tricca in Thessaly and Epidaurus in Argolis disputed the honour of his birthplace, but an oracle declared in favour of Epidaurus. He was educated by the centaur Cheiron, who taught him the art of healing and hunting. His skill in curing disease and restoring the dead to life aroused the anger of Zeus, who, being afraid that he might render all men immortal, slew him with a thunderbolt (Apollodorus iii. 10; Pindar, *Phthia*, 3; Diod. Sic. iv. 71). Homer mentions him as a skilful physician, whose sons, Machaon and Podalirius, are the physicians in the Greek camp before Troy (*Iliad*, ii. 731). Temples were erected to Aesculapius in many parts of Greece, near healing springs or on high mountains. The practice of sleeping (*incubatio*) in these sanctuaries was very common, it being supposed that the god effected cures or prescribed remedies to the sick in dreams. All who were healed offered sacrifice—especially a cock—and hung up votive tablets, on which were recorded their names, their diseases and the manner in which they had been cured. Many of these votive tablets have been discovered in the course of excavations at Epidaurus. Here was the god's most famous shrine, and games were celebrated in his honour every five years, accompanied by solemn processions. Herodas (*Mimes*, 4) gives a description of one of his temples, and of the offerings made to him. His worship was introduced into Rome by order of the Sibylline books (293 B.C.), to avert a pestilence. The god was fetched from Epidaurus in the form of a snake and a temple assigned him on the island in the Tiber (Livy x. 47; Ovid, *Metam.* xv. 622). Aesculapius was a favourite subject of ancient artists. He is commonly represented standing, dressed in a long cloak, with bare breast; his usual attribute is a club-like staff with a serpent (the symbol of renovation) coiled round it. He is often accompanied by Telesphorus, the boy genius of healing, and his daughter Hygieia, the goddess of health. Votive reliefs representing such groups have been found near the temple of Aesculapius at Athens. The British Museum possesses a beautiful head of Aesculapius (or possibly Zeus) from Melos, and the Louvre a magnificent statue.

Authorities.—L. Dyer, *The Gods in Greece* (1891); Jane E. Harrison, *Prolegomena to the Study of Greek Religion* (1903); R. Caton, *Temples and Ritual of A. at Epidaurus and Athens* (1900); articles in Pauly-Wissowa's *Real-Encyclopädie*, Roscher's *Lexikon der Mythologie*; T. Panofka, *Asklepios und die Asklepiaden* (1846); Alice Walton, "The Cult of Asklepios," in *Cornell Studies in Classical Philology*, iii. (New York, 1894); W. H. D. Rouse, *Greek Votive Offerings* (1902).

AESERNIA (mod. *Isernia*), a Samnite town on the road from Beneventum to Corfinium, 58 m. to the north-east of the former, at the junction of a road going past Venafrum to the Via Latina. These routes are all followed by modern railways—the lines to Campobasso, Sulmona and Caianello. A Roman colony was established there in 263 B.C. It became the headquarters of the Italian revolt after the loss of Corfinium, and was only recovered by Sulla at the end of the war, in 80 B.C. Remains of its fortifications are still preserved—massive cyclopean walls, which serve as foundation to the walls of the modern town and of a Roman bridge, and the subterranean channel of an aqueduct, cut in the rock, and dating from Roman times.

AESOP (Gr. Αἴσωπος), famous for his *Fables*, is supposed to have lived from about 620 to 560 B.C. The place of his birth is uncertain—Thrace, Phrygia, Aethiopia, Samos, Athens and Sardis all claiming the honour. We possess little trustworthy information concerning his life, except that he was the slave of Iadmon of Samos and met with a violent death at the hands of the inhabitants of Delphi. A pestilence that ensued being attributed to this crime, the Delphians declared their willingness to make compensation, which, in default of a nearer connexion, was claimed and received by Iadmon, the grandson of his old master. Herodotus, who is our authority for this (ii. 134), does not state the cause of his death; various reasons are assigned by later writers—his insulting sarcasms, the embezzlement of money entrusted to him by Croesus for distribution at Delphi, the theft of a silver cup.

Aesop must have received his freedom from Iadmon, or he could not have conducted the public defence of a certain Samian demagogue (Aristotle, *Rhetoric*, ii. 20). According to the story, he subsequently lived at the court of Croesus, where he met Solon, and dined in the company of the Seven Sages of Greece with Periander at Corinth. During the reign of Peisistratus he is said to have visited Athens, on which occasion he related the fable of *The Frogs asking for a King*, to dissuade the citizens from attempting to exchange Peisistratus for another ruler. The popular stories current regarding him are derived from a life, or rather romance, prefixed to a book of fables, purporting to be his, collected by Maximus Planudes, a monk of the 14th century. In this he is described as a monster of ugliness and deformity, as he is also represented in a well-known marble figure in the Villa Albani at Rome. That this life, however, was in existence a century before Planudes, appears from a 13th-century MS. of it found at Florence. In Plutarch's *Symposium of the Seven Sages*, at which Aesop is a guest, there are many jests on his original servile condition, but nothing derogatory is said about his personal appearance. We are further told that the Athenians erected in his honour a noble statue by the famous sculptor Lysippus, which furnishes a strong argument against the fiction of his deformity. Lastly, the obscurity in which the history of Aesop is involved has induced some scholars to deny his existence altogether.

It is probable that Aesop did not commit his fables to writing; Aristophanes (*Wasps*, 1259) represents Philocleon as having learnt the "absurdities" of Aesop from conversation at banquets, and Socrates whiles away his time in prison by turning some of Aesop's fables "which he knew" into verse (Plato, *Phaedo*, 61 b). Demetrius of Phalerum (345–283 B.C.) made a collection in ten books, probably in prose (*Λόγων Αἰσωπείων συναγωγαί*) for the use of orators, which has been lost. Next appeared an edition in elegiac verse, often cited by Suidas, but the author's name is unknown. Babrius, according to Crusius, a Roman and tutor to the son of Alexander Severus, turned the fables into choliambics in the earlier part of the 3rd century A.D. The most celebrated of the Latin adapters is Phaedrus, a freedman of Augustus. Avianus (of uncertain date, perhaps the 4th century) translated 42 of the fables into Latin elegiacs. The collections which we possess under the name of *Aesop's Fables* are late renderings of Babrius's version or Προγυμνάσματα, rhetorical exercises of varying age and merit. Syntipas translated Babrius into Syriac, and Andreopulos put the Syriac back again into Greek. Ignatius Diaconus, in the 9th century, made a version of 53 fables in choliambic tetrameters. Stories from Oriental sources were added, and from these collections Maximus Planudes made and edited the collection which has come down to us under the name of Aesop, and from which the popular fables of modern Europe have been derived.

For further information see the article Fable; Bentley, *Dissertation on the Fables of Aesop*; Du Méril, *Poésies inédites du moyen âge* (1854); J. Jacobs, *The Fables of Aesop* (1889): i. The history of the Aesopic fable; ii. The Fables of Aesop, as first printed by William Caxton, 1484, from his French translation; Hervieux, *Les Fabulistes Latins* (1893–1899).

Before any Greek text appeared, a Latin translation of 100 *Fabulae Aesopicae* by an Italian scholar named Ranuzio (Renutius) was published at Rome, 1476. About 1480 the collection of Planudes was brought out at Milan by Buono Accorso (Accursius), together with Ranuzio's translation. This edition, which contained 144 fables, was frequently reprinted and additions made from time to time from various MSS.—the Heidelberg (Palatine), Florentine, Vatican and Augsburg—by Stephanus (1547), Nevelet (1610), Hudson (1718), Hauptmann (1741), Furia (1810), Coray (1810), Schneider (1812) and others. A critical edition of all the previously known fables, prepared by Carl von Halm from the collections of Furia, Coray and Schneider, was published in the Teubner series of Greek and Latin texts. A *Fabularum Aesopicarum sylloge* (233 in number) from a Paris MS., with critical notes by Sternbach, appeared in a Cracow University publication, *Rozprawy akademii umiejetnosci* (1894).

AESOPUS, a Greek historian who wrote a history of Alexander the Great, a Latin translation of which, by Julius Valerius, was discovered by Mai in 1816.

AESOPUS, CLODIUS, the most eminent Roman tragedian, flourished during the time of Cicero, but the dates of his birth and death are not known. The name seems to show that he was a freedman of some member of the Clodian gens. Cicero was on friendly terms with both him and Roscius, the equally distinguished comedian, and did not disdain to profit by their instruction. Plutarch (*Cicero*, 5) mentions it as reported of Aesopus, that, while representing Atreus deliberating how he should revenge himself on Thyestes, the actor forgot himself so far in the heat of action that with his truncheon he struck and killed one of the servants crossing the stage. Aesopus made a last appearance in 55 B.C.—when Cicero tells us that he was advanced in years—on the occasion of the splendid games given by Pompey at the dedication of his theatre. In spite of his somewhat extravagant living, he left an ample fortune to his spendthrift son, who did his best to squander it as soon as possible. Horace (*Sat.* iii. 3. 239) mentions his taking a pearl from the ear-drop of Caecilia Metella and dissolving it in vinegar, that he might have the satisfaction of swallowing eight thousand pounds' worth at a draught.

Cicero, *De Divinatione*, i. 37; *pro Sestio*, 56, 58; Quint., *Instit.* xi. 3, 111; Macrobius, *Sat.* iii. 14.

Preliminary definition.

AESTHETICS, a branch of study variously defined as the philosophy or science of the beautiful, of taste or of the fine arts. The name is something of an accident. In its original Greek form (αἰσθητικός) it means what has to do with sense-perception as a source of knowledge; and this is still its meaning in Kant's philosophy ("Transcendental Aesthetic"). Its limitation to that function of sensuous perception which we know as the contemplative enjoyment of beauty is due to A. G. Baumgarten. Although the subject does not readily lend itself to precise definition at the outset, we may indicate its scope and aim, as understood by recent writers, by saying that it deals successively with one great department of human experience, viz. the pleasurable activities of pure contemplation. By pure contemplation is here understood that manner of regarding objects of sense-perception, and more particularly sights and sounds, which is entirely motived by the pleasure of the act itself. The term "object" means whatever can be perceived through one of the senses, *e.g.* a flower, a landscape, the flight of a bird, a sequence of tones. The contemplation may be *immediate* when (as mostly happens) the object is present to sense; or it may be *mediate*, when as in reading poetry we dwell on images of objects of sense. Whenever we become interested in an object merely as presented for our contemplation our whole state of mind may be described as an aesthetic attitude, and our experience as an aesthetic experience. Other expressions such as the pleasure of taste, the enjoyment and appreciation of beauty (in the larger sense of this term), will serve less precisely to mark off this department of experience.

Aesthetic experience is differentiated from other kinds of experience by a number of characteristics. We commonly speak of it as enjoyment, as an exercise and cultivation of feeling. The appreciation of beauty is pervaded and sustained by pleasurable feeling. In aesthetic enjoyment our capacities of feeling attain their fullest and most perfect development. Yet, as its dependence on a quiet attitude of contemplation might tell us, aesthetic experience is characterized by a certain degree of calmness and moderation of feeling. Even when we are moved by a tragedy our feeling is comparatively restrained. A rare exhibition of beauty may thrill the soul for a moment, yet in general the enjoyment of it is far removed from the excitement of passion. On the other hand, aesthetic pleasure is pure enjoyment. Even when a disagreeable element is present, as in a musical dissonance or in the suffering of a tragic hero, it contributes to a higher measure of enjoyment. It is, moreover, free from the painful elements of craving, fatigue, conflict, anxiety and disappointment, which are apt to accompany other kinds of enjoyment; such as the satisfaction of the appetites and other needs. To this purity of aesthetic pleasure must be added its refinement, which implies not merely a certain remoteness from the bodily needs, but the effect of a union of sense and mind in giving amplitude as well as delicacy to our enjoyment of beauty. As the region of most pure and refined feeling, aesthetic experience is clearly marked off from practical life, with its urgent desires and the rest. In aesthetic contemplation desire and will as a whole are almost dormant. This detachment from the daily life of practical needs and aims is brought out in Kant's postulate that aesthetic enjoyment must be disinterested ("ohne Interesse"), that when we regard an object aesthetically we are not in the least concerned with its practical significance and value: one cannot, for example, at the same moment aesthetically enjoy looking at a painting and desire to be its possessor. In like manner, even if less apparently, aesthetic contemplation is marked off from the arduous mental work which enters into the pursuit of knowledge. In contemplating an aesthetic object we are mentally occupied with the *concrete*, whereas all the more serious intellectual work of science involves the difficulties of the *abstract*. The contemplation is, moreover, free from those restraints which are imposed on our mental activity by the desire to obtain knowledge.

Differentiation of aesthetic experience. Its characteristics as feeling.

Marked off from practical activity,

also from intellectual activity.

Uniformity of aesthetic experience.

The aesthetic judgment.

While as the highest phase of feeling aesthetic experience appears to belong to our subjective life, the hidden region of the soul, it is connected just as clearly, through the act of sense-perception, with the world of objects which is our common possession. Being thus dependent on a contemplation of things in this common world it raises the question whether, like the perception of these objects, it is a uniform experience, the same for others as for myself. We touch here on the last characteristic of aesthetic experience which needs to be noted at this stage, its uniformity or subjection to law. It is a common idea that men's judgments about matters of taste disagree to so large an extent that each individual is left very much to his subjective impressions. With regard to many of the subtler matters of aesthetic appreciation, at any rate, there is undoubtedly on a first view the appearance of a want of agreement. Contrasted with logical judgments or even with ethical ones, aesthetic judgments may no doubt look uncertain and "subjective." The proposition "this tree is a birch" seems to lend itself much better to critical discussion and to general acceptance or rejection than the proposition "this tree is beautiful." This circumstance, as Kant shrewdly suggests, helps to explain why we have come to employ the word "taste" in dealing with aesthetic matters; for the pronouncements of the sense of taste are recognized as among the most uncertain and "subjective" of our sense-impressions. Yet viewed as a species of pleasurable feelings, aesthetic experiences will be found to exhibit a large amount of uniformity, of objective agreement as between different experiences of the same person and experiences of different persons. This general agreement appears to be clearly implied in the ordinary form of our aesthetic judgments. To say "this rose is beautiful" means more than to say "the sight of this rose affects

Logical judgment and judgment of value.

me agreeably." It means that the rose has a general power of so affecting me (at different times) and others as well. The judgment is not the same as a logical one. It does not say or imply that as a matter of fact it always does please—even if we add the limitation, those who possess the sensibilities and the taste presupposed; for, as we know, our varying mood and state of receptivity make a profound difference in the fulness of the aesthetic enjoyment. It is a "judgment of value" which claims for the rose aesthetic rank as an object properly qualified to please contemplative subjects. This value, it is plain, is relative to conscious subjects; yet since it is relative to *all* competent ones, it may be regarded as "objective"—that is to say, as belonging to the object.[1]

Late development of the science.

This slight preliminary inspection of the subject will prepare one for the circumstance that the scientific treatment of it has begun late, and is even now far from being complete. This slowness of development is in part explained by the detachment of aesthetic experience from the urgent needs of life. In a comparatively early stage of human progress some thought had to be bestowed on such pressing problems as to how to cope with the forces of nature and to turn them to useful account; how to secure in human communities obedience to custom and law. But the problem of throwing light on our aesthetic pleasures had no such urgency.[2] To this it must be added that aesthetic experience (in all but its simpler and cruder forms) has been, and still is confined to a small number of persons; so that the subject does not appeal to a wide popular interest; while, on the other hand, the subjects of this experience not infrequently have a strong sentimental dislike to the idea of introducing into the region of refined feeling the cold light of scientific investigation. Lastly, there are special difficulties inherent in the subject. One serious obstacle to a scientific theory of aesthetic experience is the illusive character of many of its finer elements—for example, the subtle differences of feeling-tone produced by the several colours as well as by their several tones and shades, by the several musical intervals, and so forth. Finally, there is the circumstance just touched on that much of this region of experience, instead of at once disclosing uniformity, seems to be rather the abode of caprice and uncertainty. The variations in taste at different levels of culture, among different races and nations and among the individual members of the same community are numerous and striking, and might at first seem to bar the way to a scientific treatment of the subject. These considerations suggest that an adequate theory of aesthetic experience could only be attempted after the requisite scientific skill had been developed in other and more pressing departments of inquiry.

Inadequate theories of subject.

If we glance at the modes of treating the subject up to a quite recent date we find but little of serious effort to apply to it a strictly scientific method of investigation. The whole extent of concrete experience has not been adequately recognized, still less adequately examined. For the greater part thinkers have been in haste to reach some simple formula of beauty which might seem to cover the more obvious facts. This has commonly been derived deductively from some more comprehensive idea of experience or human life as a whole. Thus in German treatises on aesthetics which have been largely thought out under the influence of philosophic idealism the beautiful is subsumed under the idea, of which it is regarded as one special manifestation, and its place in human experience has been determined by defining its logical relations to the other great co-ordinate concepts, the good and the true. These attempts to reach a general conception of beauty have often led to one-sidedness of view. And this one-sidedness has sometimes characterized the theories of those who, like Alison, have made a wider survey of aesthetic facts.

Aesthetics as normative science.

Aesthetics not a practical science.

Aesthetics, like Ethics, is a Normative Science, that is to say, concerned with determining the nature of a species of the desirable or the good (in the large sense). It seeks one or more regulative principles which may help us to distinguish a real from an apparent aesthetic value, and to set the higher and more perfect illustrations of beauty above the lower and less perfect. As a science it will seek to realize its normative function by the aid of a patient, methodical investigation of facts, and by processes of observation, analysis and induction similar to those carried out in the natural sciences. In speaking of aesthetics as a normative science we do not mean that it is a practical one in the sense that it supplies practical rules which may serve as definite guidance for the artist and the lover of beauty, in their particular problems of selecting and arranging elements of aesthetic value. It is no more a practical science than logic. The supposition that it is so is probably favoured by the idea that aesthetic theory has art for its special subject. But this is to confuse a general aesthetic theory—what the Germans call "General Aesthetics"—with a theory of art (Kunstwissenschaft). The former, with which we are here concerned, has to examine aesthetic experience as a whole; which, as we shall presently see, includes more than the enjoyment and appreciation of art.

Problems of the science.

Is beauty a single quality in objects?

Beauty not a physical quality.

We may now indicate with more fulness the main problems of our science, seeking to give them as precise a form as possible. At the outset we are confronted with an old and almost baffling question: "Is beauty a single quality inherent in objects of perception like form or colour?" Common language certainly suggests that it is. Aesthetics, too, began its inquiry at the same point of view, and its history shows how much pains men have taken in trying to determine the nature of this attribute, as well as that of the faculty of the soul by which it is perceived. Yet a little examination of the facts suffices to show that the theory is beset with serious difficulties. Whatever beauty may be it is certainly not a quality of an object in the same way in which the colour or the form of it is a quality. These are physical qualities, known to us by specific modifications of our sensations. The beauty of a rose or of a peach is clearly not a physical quality. Nor do we in attributing beauty to some particular quality in an object, say colour, conceive of it as a phase of this quality, like depth or brilliance of colour, which, again, is known by a special modification of the sensations of colour. Hence we must say that beauty, though undoubtedly referred to a physical object, is extraneous to the group of qualities which makes it a physical object.

Beauty attributed to different qualities in objects.

Formalists and expressionalists.

Beauty is frequently attributed to a concrete object as a whole—to a flower or shell, for example, as a visible whole. Our everyday aesthetic judgments are wont to leave the attributes thus vaguely referred to the concrete object. Yet it is equally certain that we not infrequently speak of the beauty of some definable aspect or quality of an object, as when we pronounce the contour of a mountain or of a vase to be beautiful. And it may be asked whether, in thus localizing beauty, so to speak, in one of the constituent qualities of an object, we always place it in the same quality. A mere glance at the facts will suffice to convince us that we do not. We call the façade of a Greek temple beautiful with special reference to its admirable form; whereas in predicating beauty of the ruin of a Norman castle we refer rather to what the ruin means—to the effect of an imagination of its past proud strength and slow vanquishment by the unrelenting strokes of time. This fact that beauty appertains now more to one quality, now more to another, helps us to understand why certain theorists, known as formalists, regard all beauty as formal or residing in *form*, whereas others, the idealists or expressionalists, view it as residing in ideal content or *expression*. These theories, however, like other attempts to find an adequate single principle of beauty, are unsatisfactory. Form and ideal content are each a great source of aesthetic enjoyment, and either can be found in a degree of supremacy which practically renders the co-operation of the other unimportant. The two buildings cited above, two human faces, two musical compositions, may exhibit in an impressive and engrossing way the beauty of form and of expression respectively. Nor is this all. Beauty refuses to be confined even to these two. There are the various beauties of colour, for example, as exhibited in such familiar phenomena of nature as sea and sky, autumn moors and woods. A slight analysis of the constituents of objects to which we attribute beauty shows that there are at least three distinct modes of this attribute, namely (1) sensuous beauty, (2) beauty of form and (3) beauty of meaning or expression, nor do these appear to be reducible to any higher or more comprehensive principle. It requires a certain boldness to attempt to effect a *rapprochement* between the formal and the expressional factor.[1] An apparent unification of the three seems at present only possible by substituting for beauty another concept at least equally vague, such as perfection,[2] which seems to imply the idea of purposiveness, and to apply clearly only to certain domains of beauty, *e.g.* organic form.

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[1] See below for Kant's view of the aesthetic judgment, as having subjective universal validity. On the meaning of judgments of value see J. Cohn, *Allgem. Ästhetik*, Einleitung, pp. 7 ff., and Teil i., Kap. 2 and 3.

[2] Cf. Ladd, *Introduction to Philosophy*, pp. 330, 331.

Three ultimate modes of beauty.

Beauty and allied conceptions.

We may now take another step and say that beauty appears to be a quality in objects which is not sharply differentiated from other and allied qualities. If we look at the usages of speech we shall find that beauty has its kindred conceptions, such as gracefulness, prettiness and others. Writers on aesthetics have spent much time on these "Modifications of the Beautiful." The point emphasized here is the difficulty of drawing the line between them. Even an expert may hesitate long before saying whether a human face, a flower or a cameo should be called beautiful or pretty. Must we postulate as many allied qualities as there are names for these pleasing aspects of objects? Or must we do violence to usage and so stretch the word "Beauty" as to make it cover all qualities or aspects of objects which have aesthetic value, including those "modifications of the beautiful" which we know as the sublime, the comic and the rest? But the wider we try in this way to make the denotation of the term the vaguer grows the connotation. We are thus left equally incapable of saying what the quality is, and in which aspect or attribute of the object it inheres.[3]

Assumption of objective quality of beauty dispensed with.

Aesthetic qualities.

It seems to follow that in constructing a scientific theory we do well to dispense with the assumption of an objective quality of beauty. Aesthetics will return to Kant and confine itself to the examination of objects called beautiful in their relation to, and in their manner of affecting our minds.[4] The aesthetic value of such an object will be viewed as consisting in the possession of certain assignable characteristics by means of which it is fitted to affect us in a certain desirable way, to draw us into the enjoyable mood of aesthetic contemplation. These characteristics may conveniently be called aesthetic qualities.[5] Objects which are found to possess one or more of these qualities in the required degree of fulness claim a certain aesthetic value, even though they fall short of being "beautiful," in the more exacting use of this word. They are *in the direction*—"im Sinne," as Fechner says—of beauty, conceived as something fuller and richer, answering to a higher standard of aesthetic enjoyment and a severer demand on our part. The word "beauty" may still be used occasionally, where no ambiguity arises, as a convenient expression for aesthetic value in all its degrees. Yet it is better to keep the term applicable to the objects commonly denoted by it by making it represent the fuller aesthetic satisfactions which flow from a rare and commanding exhibition of one or more of these qualities, from what may be described as an appreciable excellence of aesthetic quality.

By thus dispensing with the concept of beauty as some occult undefinable quality, we get rid of much of the contradiction which appears to inhere in our aesthetic experience. For example, a bit of brilliant colour in a bonnet which pleases the wearer but offends her superior in aesthetic matters takes its place as something which *per se* has a certain degree of aesthetic value even though the particular relations into which it has now thrust itself, palpable to the trained eye, may practically rob it of its value. In thus substituting the relative idea of aesthetic value for the absolute idea of beauty we may no doubt seem to be destroying the reality of the object of aesthetic perception. This point may more conveniently be taken up later when we consider the whole question of aesthetic illusion.

Problem of aesthetic effect.

Aesthetics and laws of pleasure.

Problem of aesthetic enjoyment a special one.

The attitude of aesthetic contemplation.

Intellectual and aesthetic activity further differentiated.

This new way of envisaging aesthetic objects requires us to make the study of their effect a prominent part of our investigation. In all the valuable recent work on the subject, attention has been largely concentrated on this effect. More particularly we have to investigate and illumine scientifically the pleasurable side of the experience. In doing this we shall make use of all the light we can obtain from a study of known laws of pleasure. Thus we shall avail ourselves not only of the theory of the pleasure-tones of sensation but of that of the conditions of an agreeable exercise of the attention upon objects, more particularly of the characteristics of objects which adequately stimulate the attention without confusing or burdening it. Yet this does not require that we should treat the aesthetic problem as a part of the more general science of pleasure, as has been attempted by some, *e.g.* Grant Allen (*Physiological Aesthetics*) and Rutgers Marshall (*Pain, Pleasure and Aesthetics*, and *Aesthetic Principles*). To do so would be to run the risk of considering only the more general aspects and conditions of aesthetic enjoyment, whereas what we need is a theory of it as a specific kind of pleasurable experience. What is required at the present stage of development of the science is a deeper investigation of the aesthetic attitude of mind as a whole, of what we may call the aesthetic psychosis. We need to probe the act of contemplation itself, the mode of activity of attention involved in this calm, half-dreamlike gazing on the mere look of things unconcerned with their ordinary and weightier imports. We need further to determine the effect of this contemplative attitude upon the several mental processes involved, the act of perception itself, with its grasp of manifold relations, the flow of ideas, the partial resurgence and transformation of emotion. In examining these effects we must keep in view the double side of the contemplative attitude, the wide range of free movement which perception and imagination claim and enjoy, and the willing subjection of the contemplative mind to the spell of the object. A deeper inspection of the contemplative mood may be expected to render clearer the difference between the mental activity employed in aesthetic perception and imagination and intellectual activity proper; between, say, the differencing of allied tints involved in the finer aesthetic enjoyment of colour and the sharper, clearer discrimination of tints required in scientific observation, and between such a grasp of relations as is required for a just appreciation of beautiful form and that severe analysis and measurement of formal elements and their relations which is insisted upon by science. As a result of a finer distinction here we may probably be in a better position to determine the point—touched on more than once in recent works on aesthetics—how far intellectual pleasure proper, *e.g.* that of recognizing and classifying objects, enters as a subordinate element into aesthetic enjoyment.

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[1] For example, that hinted at by Bosanquet in his definition of the beautiful, *History of Aesthetic*, p. 5.

[2] Beauty is defined as Perfection by P. Souriau, *La Beauté rationnelle*, 2ème partie.

[3] K. Groos argues well against this violent stretching of the word beautiful, *Einleitung in die Ästhetik*, pp. 46 seq.

[4] Kant, in developing his idea of beauty as subjective, was probably influenced by Hume, who wrote: "Beauty is no quality in things themselves; it exists merely in the mind which contemplates them" (*Essays*, xxii.).

[5] On the nature of these qualities see S. Witasek, *Grundzüge der allgem. Ästhetik*, p. 11.

Is aesthetic enjoyment essentially social?

One point in the characterization of aesthetic experience has been reserved, namely, the question whether it is essentially a form of *social* enjoyment. No one doubts that a man often enjoys beauty, *e.g.* that of a landscape, when alone; yet at such a moment he not only recognizes that his pleasure is a possible one for others, but is probably aware of a sub-conscious wish that others were present to share his enjoyment. Kant went so far as to say that on a desert island a man would adorn neither his hut nor his person. However this be, it seems certain that as a rule we tend to indulge our aesthetic tastes in company with others. This habit of making aesthetic enjoyment a social experience would in itself tend to develop the sympathies and the sympathetic intelligence and thus to promote exchanges of aesthetic experience. The content, too, of our aesthetic experiences would be favourable to such conjoint acts of aesthetic contemplation, and to the mutual sharing of aesthetic experiences; for, as disinterested and universal modes of enjoyment detached from personal interests, they are clearly free from the egoistic exclusiveness which characterizes our private enjoyments which at best can only be participated in by one or two closely attached friends. Our aesthetic enjoyments are thus eminently fitted to be social ones; and as such they become greatly amplified by sympathetic resonance.

The aesthetic senses.

Aesthetic claims of touch.

We are now in a position to consider a point much discussed of late, namely, the special connexion of aesthetic enjoyment with the two senses, sight and hearing. Two questions arise here: (1) Do the other and "lower" senses take any part in aesthetic experience? (2) What are the characteristics which give the predominance to the two "higher" ones? With regard to the first it is coming to be recognized that aesthetic pleasure is not strictly confined to the two senses in question. Common language suggests that we find in certain odours and even in certain flavours a value analogous to that implied in calling an object beautiful. Hegel excluded the other senses—even touch—on the ground that aesthetics had to do only with art, in which there was no place for perceptions of touch. A closer examination has shown that this important sense plays a considerable part in art-effects. And even if this were not so, Hegel's exclusion of touch from the rank of aesthetic senses would be a striking illustration of the narrowing effect on scientific theory of the identification of aesthetic objects with productions of art. To say that the experience of exploring with the fingers a velvety petal or the smooth surface of a sea-rounded pebble has no aesthetic element savours of a perverse arbitrariness. Touch is no doubt wanting in a prerogative of hearing and sight which we shall presently see to be important, namely, that being acted on by objects at a distance they admit of a simultaneous perception by a number of persons—as indeed even the sense of smell does in a measure. This is probably the chief reason why, according to certain testimony, the blind receive but little aesthetic enjoyment from tactual experience.[1] Yet this drawback is compensated to some extent by the fact that agreeable tactual experience may be taken up as suggested meaning into our visual perceptions.

Prerogatives of sight and hearing.

The two privileged senses, sight and hearing, owe their superiority to a number of considerations. They are the farthest removed from the necessary life functions, with the pressing needs and disturbing cravings which belong to these. Even touch, though important as a source of knowledge, has for its primary function to examine the things which approach our organisms in their relation to this as injurious or harmless. The two higher senses present to us material objects in their least aggressive and menacing manner: visible forms and colours, tones and their combinations, appear when compared with objects felt to be in contact with our body, to be rather semblances or distant signs of material realities than these realities themselves; and this circumstance fits these senses to be in a special way the organs of aesthetic perception with its calm, dreamlike detachment and its enjoyable freedom of movement. They are, moreover, the two senses by the use of which a number of persons may join most perfectly in a common act of aesthetic contemplation. This distinction strengthens their claims to be in a special manner the aesthetic senses, and this for a double reason. (1) It makes them sense-avenues by which each of us obtains the most immediate and most impressive conviction that aesthetic experience is a common possession of the many, and is largely similar in the case of different individuals. (2) It marks them off as the senses by the exercise of which perceptual enjoyment may most readily and certainly be increased through the resonant effects of sympathy. The experiences of the theatre and of the concert-hall sufficiently illustrate these distinguishing functions of the two senses. Other distinguishing prerogatives of sight and hearing flow from the characteristics of their sensations and perceptions, a point to be touched on later.[2]

Aesthetic activity and play.* (a) *Points of affinity between them.

(b) Points of difference.

Our determination of the characteristics of the aesthetic attitude has now been carried far enough to enable us to consider another point much discussed in recent aesthetic literature, viz. the relation of this attitude to that of Play. The affinities of the two are striking and are disclosed in everyday language, as when we speak of the "play" of imagination or of "playing" on a musical instrument. Both play and aesthetic contemplation are activities which are controlled by no extraneous end, which run on freely directed only by the intrinsic delight of the activity. Hence they both contrast with the serious work imposed on us and controlled by what we mark off as the necessities of life, such as providing for bodily wants, or rearing a family. They each add a sort of luxurious fringe to life. In aesthetic enjoyment our senses, our intelligence and our emotions are alike released from the constraint of these necessary ends, and may be said to refresh themselves in a kind of play. Finally, they are both characterized by a strong infusion of make-believe, a disposition to substitute productions of the imagination for everyday realities. In this respect, again, they form a contrast to that serious concern with fact and practical truth which the necessary aims of life impose on us. Little wonder, then, that Plato recognized in the contrast between the representative and the useful arts an analogy between play and earnest,[3] and that since the time of Schiller so much use has been made of the analogy in aesthetic works. Yet though similar, the two kinds of activity are distinguishable in important respects. For one thing, aesthetic contemplation pure and simple is a comparatively tranquil and passive attitude, whereas play means doing something and commonly involves some amount of strenuous exertion, either of body or of mind. A closer analogy might be drawn between play and artistic production. Yet even when the parallel is thus narrowed, pretty obvious differences disclose themselves. It is only in their more primitive phases that the two attitudes exhibit a close similarity. As they develop, striking divergences begin to appear. The play mood, instead of approaching the calm contemplative mood of the lover of beauty, involves feelings and impulses which lie at the roots of our practical interests, viz. ambition, rivalry and struggle. It has, moreover, in all its stages a palpable utility—even though this is not realized by the player—serving for the exercise and development of body, intelligence and character. Beauty and art rise high above play in purity of the disinterested attitude, in placid detachment from the serviceable and the necessary, and, still more, in range and variety of refined interest, comprehended in "the love of beauty." Finally, aesthetic activities are directed by ideal conceptions and standards to which hardly anything corresponds in play save where games of skill take on something of the dignity of a fine art.[1]

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[1] See J. Cohn, *Allgem. Ästhetik*, p. 95.

[2] Originally, as pointed out by Home and others, sight was regarded as the sense by which we received impressions of beauty. Yet the recognition of the claims of hearing date back to Plato. (See Bosanquet, *Hist. of Aesth.* pp. 51-52). For recent discussions of the claims of sight and hearing see article by J. Volkelt, "Der Aesth. Werth der niederen Sinne," in *Zeitschrift für Psych. u. Phys. der Sinnesorgane*, vol. xxix. pp. 402 ff.; see also below, ***Bibliography.***

[3] *Laws*, 889 (see Bosanquet, *op. cit.* p. 54).

Methods of research in aesthetics.

So far as to the preliminary delimiting work in aesthetic science. Only a bare indication can be made as to the methods of research by which its advance can be furthered, and as to the several directions of inquiry which it will have to follow. With regard to the former the method of investigation will consist in a careful inquiry into two orders of fact: (1) Objects which common testimony or the history of art show to be widely recognized objects of aesthetic value; (2) records of the aesthetic experience of individuals, whether artists or amateurs.

Examination of aesthetic objects.

Nature as supplying aesthetic objects.

Since aesthetic experience is brought about and its modes determined by objects possessing certain qualities, it seems evident that scientific aesthetics must make an examination and comparison of these a fundamental part of its problem. These objects will, as already hinted, include both natural ones in the inorganic and organic worlds, and works of art which can be shown to be objects of general or widely recognized aesthetic value. Without attempting here to discuss adequately the relation of natural beauty to that of art we may note one or two points. Some contemplation and appreciation of the beautiful aspects of nature is not only prior in time to art, but is a condition of its genesis. The enjoyment of the pleasing aspects of land and sea, of mountain and dale, of the innumerable organic forms, has steadily grown with the development of culture; and this growth, though undoubtedly aided by that of the feeling for art—especially painting and poetry—is to a large extent independent of it.[2] Some of the finest insight into the secrets of beauty has been gained by those who had only a limited acquaintance with art. What is still more important in the present connexion is that the aesthetic experience gained by the direct contemplation of nature includes varieties which art cannot reproduce. It is enough to recall what Helmholtz and others have told us about the limitations of the powers of pictorial art to represent the more brilliant degrees of light; the admissions of painters themselves as to the limits of their art when it seeks to render the finer gradations of light and colour in such common objects as a tree-trunk or a bit of old wall. Nature, moreover, in spreading out her spaces of earth, sea and sky, and in exhibiting the action of her forces, does so on a scale which seems to make sublimity her prerogative in which art vainly endeavours to participate.

Use of works of art by the theorist.

Difficulties in using works of art as material.

Effects of custom on artistic preference.

On the other hand, it is coming to be seen that the construction of a theory of aesthetic values must be assisted by a much more precise examination than aestheticists are commonly content to make, of works of art. The importance of including these is that they are well-defined objective expressions of what the aesthetic consciousness approves and prefers. In inquiring, for example, into the pleasing relations of colour we might have to wait long for a theory if we were dependent on what even so gifted a writer as Ruskin can tell us about nature's juxtapositions: whereas if it can be shown that throughout the history of chromatic art or during its better period there has been a tendency to prefer certain combinations, this fact becomes a piece of convincing evidence as to their aesthetic value. Even here, however, there are sources of uncertainty. It is not true to say that a work of art is a pure outcome of the aesthetic feeling of the artist, even if we take this in a comprehensive sense. It is subject to the influence of all the temporary feelings and tendencies of the time which produced it. The aesthetic motive which is supposed to originate it is apt to be complicated and disguised by other motives, *e.g.* utility in architecture,[3] an impulse to instruct if not to reform in modern fiction. Again, if it is said that a certain degree of permanence assures us of the aesthetic value of a feature of art, we are met by the difficulty that custom plays an important part in art, the result of convention fixed by tradition often simulating the aspect of a deep-seated aesthetic preference. In this connexion it is to be remarked that even so permanent an element as symmetry may owe its quasi-aesthetic value to custom, by which is understood its wide and impressive display in the organic and even the inorganic world.[4] Yet the influence of custom taken in this larger sense need not greatly disturb us. In aesthetics, as in ethics, the question of validity has to be kept distinct from that of origin. If symmetry (in general) is appreciated as aesthetically pleasing, the question of its genesis becomes immaterial. Another difficulty, not peculiar to aesthetic investigation, is that of reconstructing the modes of aesthetic consciousness represented by forms of art which differ widely from those of our own age and type of culture.

Value of primitive art for aesthetics.

Evolution as criterion of aesthetic height.

Exact measurement of characteristics of art-work.

In utilizing art material for aesthetic theory the theorist will need to note the work recently done by English and German writers on primitive art. And this not merely because of the value of the early forms of art for a theory of the evolution of the aesthetic consciousness; but because the embryonic stages of art are likely to have a peculiar interest as illustrating in a comparatively isolated form some of the simpler modes of aesthetic appreciation, *e.g.* in the grouping of colours, in the mode of covering a surface with linear ornament. Yet it is not necessary to give primitive art a considerable place in a general aesthetics. As a normative science, it is to be remembered, this is much more immediately concerned with the higher stages of aesthetic culture. In seeking to establish norms or regulative principles, we must, it is evident, make a special study of objects of art which belong to our own level of culture. For these reasons it would appear necessary to include in a general aesthetic theory some reference to the evolution of art and of the aesthetic consciousness. A further reason for including it is that the evolution of art supplies a most valuable auxiliary criterion of degree or height of aesthetic value. Provided that we distinguish what is a real process of evolution from one of mere change of fashion in taste, and that we confine ourselves to the larger features of the process, we may make the principle of evolution a serviceable one by regarding those forms and features of art as higher in respect of aesthetic value which grow distinct and relatively fixed in the later and better stages of the evolution of art.[5] This part of aesthetic investigation should be made as exact as possible. Thus in dealing with the triads of colour said to be most frequently employed in the best period of Italian painting the observer should note and record as far as this is possible not only the precise tints, but also the precise degrees of their several luminosities. With regard to elements of form in art, the judicious use of photography and careful measurement would probably help us to understand the practices of art in its better periods. This examination of art material by the aesthetic theorist should be supplemented by a study of what artists have written about their methods, of the rules laid down for students of art, and lastly of the generalizations reached by the more scientific kind of writer upon art.[6]

A proper methodical inquiry into aesthetic objects aided by a knowledge of the practices of art would lead to inductions of the type "objects in so far as they possess such and such characteristics are aesthetically valuable."[1]

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[1] Plato had a glimpse of the resemblance of art to play (see Bosanquet, *op. cit.* p. 54). Among modern writers the idea is specially connected with the names of Schiller and Herbert Spencer. In recent works the subject is touched on by S. Wittasek, *Grundzüge der allgem. Ästhetik*, pp. 223 ff.; Bray, *Du Beau*, pp. 62 ff., and by Rutgers Marshall and others referred to below in *Bibliography*.

[2] Hence to say, as Bosanquet says (*op. cit.* pp. 3-4), that art is to nature as the scientific conception of the world to that of the ordinary observer, seems wide of the mark.

[3] K. Lange goes very far in attributing a practical motive to features of architecture commonly supposed to have aesthetic value, *e.g.* a regular series of similar forms (*Das Wesen der Kunst*, Bd. i. pp. 277 ff.).

[4] K. Lange thinks that even symmetry probably has a technical origin (*op. cit.* pp. 283-284).

[5] The question of the place of the historical development of art in aesthetic theory is carefully considered by J. Volkelt, *System der Ästhetik*, Bd. i. 5^es Kap.

[6] See, for example, a little work, *The Genesis of Art-form*, by G. L. Raymond.

Aesthetic inductions.

This preliminary work of aesthetic science in collecting and analysing facts may be extended in two directions: by an examination (*a*) of the earlier and simpler forms of aesthetic experience, and (*b*) of the fuller and more complex experiences of those specially trained in the perception and enjoyment of beauty.

Germs of aesthetic preference in children, etc.

(*a*) The former would be illustrated by a more methodical investigation into the rudimentary aesthetic likings of children, and of the surviving lower races. Such inquiries may be expected to add to our knowledge of the simpler and more universal forms of aesthetic enjoyment. Some attention has been paid by Darwin and others to germs of taste in birds and other animals. Yet this line of inquiry, though of some value for a theory of the evolution of taste, seems to throw but little light on aesthetic preferences as found in man.[2]

Aesthetic experiment.

An important feature in this new investigation into simpler modes of aesthetic preference is that it proceeds by way of *experiment*, that is to say, a methodical testing of the aesthetic preferences of a number of individuals. Fechner introduced the method of experiment into aesthetics in his researches on the preferability (according to Zeising) of the proportion known as the "golden section."[3] Since his time other experimental inquiries have been made, both as to what forms (*e.g.* what variety of rectangle) and what combinations of colours are most pleasing. The results of these experiments are distinctly promising, though they have not yet been carried far enough to be made the basis of perfectly trustworthy generalizations.[4]

Experience and judgments of experts.

(*b*) A valuable portion of the data for a science of aesthetics lies in the recorded experiences of artists, art critics and others who have specially developed their tastes. This source of information has certainly never been made use of in a complete and methodical manner by theorists, a quotation now and again from writers like Goethe and Ruskin having been deemed sufficient. Yet it is safe to say that an adequate understanding of the finer effects of beauty, both in nature and in art, presupposes the assimilation of what is best in these records. And this not only because they commonly supply us with new and valuable varieties of experience of the more refined kind, but because the aesthetic judgments on nature and art of men in whom the feeling of beauty has been specially cultivated have a greater value than those of others.[5] It may be added that these records are wont to contain reflexions which, though wanting in scientific precision, can be utilized by science.

We now come to the work of scientific construction proper.

Psychological analysis of material.

The finer analysis of the objects which please aesthetically as well as of the agreeable type of consciousness to which they minister belongs to the psychologist, and it is noteworthy that the best recent contributions to the science have been made by men who were either known as psychologists or at least had trained themselves in psychological analysis. A word or two must suffice to indicate the more important directions of the theoretic interpretation. We may in illustrating this set out from the convenient triple division of the factors in aesthetic experience: (A) the sensuous, (B) the perceptual or formal, (C) the imaginative, including all that is suggested by the aesthetic presentation, its meaning and expressiveness.

The sensuous factor. Physiological aesthetics.

(A) In dealing with the sensuous factor the psychologist is materially aided by the physiologist. It is sufficient to point to the contribution made to the analysis of musical sensations by the classical researches of Helmholtz (see below). Yet the application of a knowledge of physiological conditions seems as yet to be of little service when we come to the finer aspects of this sensuous experience, to the subtle effects of colour-combination, for example, and to the nuances of feeling-tone attaching to different tints. In the finer analysis of the sensuous material of aesthetic enjoyment it is the psychologist who counts.[6]

Psychological problems.

Among the valuable contributions recently made in this domain one may instance the careful determination of the aesthetically important characteristics of the sensations of sight and hearing, such as the finely graduated variety of their qualities (colour and tone), their capability of entering into combinations in which they preserve their individuality, including the important combinations of time and space form. With these are to be included the distinguishing characteristics of the concomitant feeling-tones, *e.g.* their comparative calmness and their clear separation from the sensations which they accompany. These characteristics help us to understand the greater refinement of these senses and also the more prolonged as well as varying enjoyment which they contribute, as well as the extension of this enjoyment by imaginative reproduction.[7] Next to this determination of important aesthetic characteristics of the two senses may be named a finer probing of the nuances of pleasurable tone exhibited by the several colours and tones. A point still needing special investigation is extent of the sensuous factor in aesthetic enjoyment. There has been a tendency in aesthetic theory to over-intellectualize aesthetic experience and to find the value even of the sensuous factor in some intellectual principle, as when it is said (by Plato and Hegel among others) that a smooth or level tone and a uniform mass of colour owe their value to the principle of unity. But such prolongation (within obvious limits) in time or space is a condition of the full enjoyment of the distinctive quality of an individual tone or colour, and as such has a sensuous value. Aesthetics has to prove the sensuous value, the pleasure which is due not only to the feeling-tones of the several sensations but to those of their various combinations. Spite of a tendency of late to disparage the co-operation of the "motor sensations" connected with movements of the eye in the aesthetic appreciation of linear form, *e.g.* curves, evidence suggests that certain curves, like fine gradations of colour, may owe a considerable part of their value to a mode of varying the sensuous experience which is in a peculiar manner agreeable. On the other hand, this theoretic investigation of sense-material will need to determine with care the added value due to the action of experience in giving something of meaning to particular colours and tones and their combinations, *e.g.* warmth of colour, height of tone.

(B) Under the scientific treatment of the perceptual or formal factor in aesthetic experience we have many special problems, of which only a few can be touched on here.

The perceptual factor.

Taking this factor to include all combinations of elements in which there is a more or less distinct perception of pleasing relations, we meet here with such work as that of C. Stumpf (*Ton-psychologie*) in determining the way in which tones combine and tend to fuse. Later experiments have added to our knowledge of the obscure subject of colour harmony, enabling us to distinguish pleasing contrasts of colour from the more restful combinations of nearly allied tints. Our knowledge of pleasing form in the narrower sense, that is to say, space and time form, has been advanced by a number of recent inquiries. The value of symmetry, the meaning of proportion and the aesthetic value to be set on certain proportions, the forms of rhythm—these are some of the points dealt with in more general and in special works.[1] In the case of forms, still more than in that of sensuous elements, it is needful to determine the extent to which the value of the formal aspect is modified by experience and the acquisition of meaning. This is pretty certainly the source of the aesthetic value claimed for certain proportions, whether in the human figure or other organic forms or in the freer constructions of form in art.[2] Another problem is to determine the influence of the feeling-tones of the combining elements on the pleasing character of the whole. It is probable that a particular combination of colours owes something of its pleasure-value to a harmony of the feeling-tones of the elements. This is pretty certainly the case where the feeling-tones of the elements are closely akin, as in the case of a number of low tones of colours, or of architectural or other forms where one formal element—say, a vertical line, a rectangle of a certain proportion or a particular variety of arch—repeats itself and becomes a dominating feature of the whole.

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[1] Kant, stopping short of an analysis of the beauty of a concrete object, said there were no aesthetic judgments of this universal form (see below). On the importance of these inductions see K. H. von Stein, *Vorlesungen über Ästhetik* (Einleitung).

[2] Curiously enough Thomas Reid recognized a germ of aesthetic taste in animals. *Essays*, Of Taste, ch. v. The aesthetic importance of the observations made on animals is dealt with by L. Bray, *Du Beau*, pp. 233 ff.

[3] See below, and Bosanquet, *op. cit.* pp. 382 ff.

[4] The chief lines of experimental aesthetics are indicated by W. Wundt in his *Physiol. Psychologie* (5^{e} Auflage), Bd. iii. pp. 142 ff. and 147 ff.

[5] On the value of judgments of experts see K. Groos, *Der ästh. Genuss*, p. 149.

[6] Examples of a forcing of the physiological method in aesthetics may be found in the *Physiological Aesthetics* of Grant Allen, and the *Aufgabe der Kunstphysiologie*, by Georg Hirsch.

[7] These aesthetic prerogatives of the sensations of hearing and sight have been well brought out in the article by J. Volkelt, already referred to.

The imaginative factor.

(C) The imaginative factor—which corresponds with what Fechner calls the "indirect"—includes all that imaginative activity adds to our enjoyment when we contemplate an aesthetic object. It may consist first of all in recalling concrete experiences firmly associated with the object, as when the sight of wild-flowers in a London street calls up an image of fields and lanes. In order that these images may add to the aesthetic value of the object they must correspond to our common associations, as distinguished from accidental individual ones. A large increase of aesthetic enjoyment comes to us through such suggested images. Although in general it is images of concrete objects which are called up, ideas of a more abstract character may take part though they tend in this case to assume a concrete aspect. This is illustrated in the appreciation of "typical beauty" in which a concrete form represents in an exceptional way the common form of a species, and in that of symbolic representation. An important part of this work of association is to render objects expressive of mental states, as when we read off the particular shade of feeling expressed by a natural scene.[3]

Freer play of imagination.

In the poetic contemplation of nature, her forces, her gladness and other moods, this imaginative activity, though still deriving its material from association, takes a freer form, leading to an investment of natural objects with a new and more fanciful meaning, as when we "apperceive" a willow drooping over a pond or the front of an old cottage under a quasi-human form, endowing it with something akin to our own feelings and memories. What, it may be asked, is the whole range of this freer play of a life-giving fancy in our aesthetic enjoyment? Some recent theorists have attempted to answer this question by saying that it constitutes a vital element in all aesthetic contemplation. Th. Lipps and others who follow him seek to show that this vitalizing activity of the fancy, which produces a new and illusory object, is the essential ingredient in the aesthetic enjoyment of the forms of material objects. According to this theory, when in the aesthetic mood I enjoy the form of a tree, of a church steeple or of the front of a Greek temple, I am not only ascribing life and feeling to it, but am projecting myself in fancy into the object thus constructed, feeling for the moment that I *am* the tree or the steeple. The process of vivification is carried out as follows. Lines represent certain movements, and in the aesthetic mood we translate all lines and so all forms back into the corresponding movements, which may be merely imagined (as Lipps himself thinks) or may be realized in part by sensuous elements, viz. motor sensations; which again may be regarded either as concomitants of eye movements, or as arising from an organically connected impulse to move the hand along the lines followed by the eye.[4] Thus the columns of a temple represent upward movement, and are apperceived as striving upwards so as to resist the downward pressure of the entablature. Since movements are the great means of expression in man, this imaginative reading of movement into motionless and even massive and stable forms enables us to endow them with quasi-human feelings. In looking, for example, at the weighty masses of a building we enter sympathetically into the successful strivings of the supporting structures to resist the downward thrust of gravity in the supported masses. The theory here briefly indicated[5] is interesting as illustrating an attempt from the psychological side to find a scientific support for philosophic idealism or expressionalism. It is already beginning to be recognized in Germany as an exaggeration. It may be enough to say that as applied to forms generally, including those of sculpture and architecture, the theory is opposed by our ordinary way of speaking, which implies quite another point of view in the aesthetic contemplation of form, namely, that of a spectator external to the object contemplated. When our eye glides over the beauties of a statue, our imaginative activity so far from transporting us *within* the object carries us as tactual feelers *outside* the surface. Similarly, when we delight in the divided spaces of a Gothic roof, so far from being imaginatively engaged in taking part in the efforts and strains of pillar, arch and the rest, we move in fancy along the pathways defined by the designer, tactually feeling and appreciating each dimension, each detail of form. The attempt to force a theory fitted for poetry on sculpture and architecture would rob these of their distinctive aesthetic values; in the one case, of the plastic beauty of finely moulded marble surfaces as realized by imaginative excursions of the hand; and in the other case, of the perfect stillness and stability which give to great structures their solemn and quieting aspect.[6]

Aesthetic Illusion.

The theory of a vitalizing play of imagination (*Einfühlung*) running through all modes of aesthetic contemplation is an exaggeration of the element of illusion which certainly characterizes this contemplation. As suggested above, by blotting out for the moment the perception of all save that which pleases it substitutes a new for the more solid reality of our practical mood. Moreover, as a state of perceptual absorption in which one loses consciousness of the ordinary self and its world, it has a certain resemblance to the state of ecstasy and of the hypnotic trance.[7] It is favourable to the play-like indulgence in a fanciful transformation of what is seen or heard, which may be described as a "willing self-deception," more or less complete. Yet as we have seen, something of the real everyday world survives even in our freer aesthetic contemplation of form. Hence there is much to be said for the idea that we have in aesthetic illusion to do with a kind of double consciousness, a tendency to an illusory acceptance of the product of our fancy as the reality, restrained by a subconscious recognition of the everyday tangible reality behind.[8]

It is evident that both in the more confined and in the freer form the element of imaginative activity in aesthetic experience will vary greatly among individuals and among peoples. Differences in past experience leading to diverse habits of association,

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[1] On the later investigations into musical consonance and harmony, harmony of colours, rhythmic and pleasing spatial forms, see Wundt, *op. cit.* Bd. ii. pp. 419 ff., and iii. 135 ff., 140 ff., 147 ff. and 154 ff. Time-form in music is specially discussed by E. Gurney, *The Power of Sound*, v.

[2] K. Lange, who recognizes the influence of nature and custom, here denies that proportion is an aesthetic principle (*Das Wesen der Kunst*, 11$^{\text{es}}$ Kap.).

[3] Alison and other English Associationists have emphasized the aesthetic importance of the principle of association. Among more recent advocates of it is G. T. Fechner, *Vorschule der Ästhetik*, and O. Külpe, "Über den associativ. Factor des ästhet. Eindrucks," *Vierteljahrsschrift für wissensch. Philosophie*, xxiii. pp. 145 ff.

[4] This idea of imitative hand-movement in contemplating form is supported by K. Groos, *Der ästh. Genuss*, pp. 49 ff.

[5] It is commonly spoken of as "feeling oneself into" (*Einfühlen*), or as "sympathetic feeling" (*Mitempfinden*).

[6] Lipps' theory is developed in a number of works, the chief of which is *Ästhetik: Psychologie des Schönen und der Kunst*, see esp. 1$^{\text{er}}$ Theil, 1$^{\text{er}}$ to 3$^{\text{er}}$ Abschnitt; cf. Paul Stern, *Einfühlung und Association*, in which is to be found an historical sketch of the theory, and A. Hildebrand, *Form in der bildenden Kunst*. The play of imagination in the contemplation of form is discussed also by P. Souriau, *L'Esthétique du mouvement*, 3$^{\text{ème}}$ part., and *La Suggestion dans l'art*, pp. 300 ff. Cf. works of Karl Groos and K. Lange named below (*Bibliography*).

[7] See P. Souriau, *La Suggestion dans l'art* (1$^{\text{ère}}$ partie).

[8] Cf. K. Lange, *op. cit.* Bd. i. p. 208.

Variations of imaginative activity.

as well as in those natural dispositions which prompt one person to prefer motor images, another visual, another audile, will modify the process in this enjoyable enlargement and transformation of what is presented to sense. It is for aesthetics at once to recognize these variations of imaginative activity and to determine the more common and universal directions which it follows.

Form and expression not absolutely distinct.

The recent inquiry into our way of contemplating form is, in spite of exaggeration, valuable as showing that our distinctions of form and expression are not absolute. Just as there is the rudiment of ideal significance in colour, so form, even in its more abstract and elementary aspects, is not wholly expressionless, but may be endowed with something of life by the imagination. The recognition of this truth does not, however, affect the validity of our treating form and expression as two broadly distinguishable factors of aesthetic pleasure. A line may be pleasing to sense-perception, and in addition illustrate expressional value by suggested ease of movement or pose. Similarly, a concrete form, *e.g.* that of a sculptured human figure in repose, or of a graceful birch or fern, owes its aesthetic value to a happy combination of pleasing lines and of interesting ideas.

Aesthetic emotion.

In close connexion with the determination of the imaginative factor in aesthetic contemplation, the psychologist is called on to define the special characteristics of aesthetic emotion. That our attitude when we watch a beautiful object, say the curl of a breaker as it falls, or some choice piece of sculpture, is an emotional one is certain, and ingenious attempts have been made by Home (Lord Kames) and others to equip the emotion with a full accompaniment of corporeal activity, such as heightened respiratory activity.[1] Yet aesthetic emotion is to be contrasted with the more violent and passionate state of love and other emotions, and this difference calls for further investigation. A closer inquiry into the features of that calm yet intense emotion which a rapt state of aesthetic contemplation induces is a necessary preliminary to a scientific demarcation of the sphere of beauty in the narrow or more exclusive sense, from that of the sublime, the tragic and the comic. Each of these departments of aesthetic experience has well-marked emotional characteristics; and the definition of these "modifications of the beautiful" has in the main been reached through an analysis of the emotional states involved. This chapter in the psychological treatment of aesthetic experience has to consider two points which have occupied a prominent place in aesthetic theory. The first is the nature of "revived" or "ideal" emotion, such as is illustrated in the feeling excited sympathetically when we witness or hear of another's sorrow or joy. The second point is the nature of those mixed emotional states which are illustrated in our aesthetic enjoyment of the sublime and the other "modifications," in all of which we can recognize a kind of double emotional consciousness in which painful elements accompany and modify pleasurable ones, in such a manner that in the end the latter appear to be rather strengthened than weakened.[2]

Limits of analysis in aesthetics.

The psychological treatment of aesthetic data here sketched out cannot stop at an analysis of the aesthetic state or attitude into a number of recognizable elements each of which contributes its own quantum of pleasurableness. Our enjoyment in contemplating, say, a green alp set above dark crags, is an indivisible whole. And it is a consciousness of this fact which makes men disposed to resent the dissection of their aesthetic enjoyment into a number of constituent pleasures. Nor is this all. Every aesthetic object is something unique, differing in individual characteristics from all others; and as the object, so the mood of the contemplator. One may almost say that there are as many modes of musical delight as there are worthy compositions. It would seem either that this feeling of a unique indivisible whole must be dismissed as an illusion, or that we have to admit an unexplained residue in our aesthetic experience, which may some day be explained by help of a larger and more exact conception of aesthetic harmony, of the laws of interaction and of fusion of psychical elements.[3]

Construction of aesthetic norms.

We may now glance at the *ideal* purpose of this scientific analysis and interpretation, namely, the construction of norms or regulative principles corresponding to the severally essential elements of aesthetic value ascertained. The later psychological treatment of the subject has led up to the formulation of certain ideal requirements in beautiful objects. The work of Fechner in this direction (*Vorschule der Ästhetik*) was a noteworthy contribution to this kind of construction, at once scientific and directed to the construction of ideal demands, and is still a model for workers in the same field. He has taught us how the attempt to formulate one all-comprehensive principle—*e.g.* unity in variety, has led to a barren abstractedness, and that we need in its place a number of more concrete principles. In formulating these principles care must be taken to determine their respective scopes and their mutual relations—to decide, for example, whether expression, to which our modern feeling undoubtedly ascribes a high value, is a universal demand in the same sense as unity or harmony of parts is admitted to be. A system of norms must further supply some comprehensive criterion by help of which *degrees* of aesthetic value may be determined, as determined by the degrees of completeness of the several pleasurable activities,—sensuous, perceptual and imaginative,—and justify the form of judgment "this object is more beautiful (or of a higher kind of beauty) than that." Such regulative principles and standards of comparison will, it is clear, fail us just at the point where analysis stops. Edmund Gurney urges that an aesthetic principle such as unity in variety is complied with equally well by musical compositions which are commonplace and leave us cold and by those which evoke the full thrill of aesthetic delight, and he concludes that the special beauty of form in the latter instance is appreciated by a kind of intuition which cannot be analysed (see *The Power of Sound*, ix.). The argument is hard to combat. It would seem that after all our efforts to define aesthetic qualities and enumerate corresponding ideal requirements we are left with an unexplained remainder. This can only be tentatively defined as the concrete object itself in its wholeness, which is not only a perfectly harmonized combination of sensuous, formal and expressional values, but impresses us as something which has a fresh individuality and the distinction of aesthetic excellence.

Connexion between aesthetic and other experience: (a) with intellectual interests.

Aesthetics is wont to treat of a certain kind of experience as if it were a closed compartment. Yet there is in reality no such perfect seclusion. Our enjoyment of beauty, though to be distinguished from our intellectual and our practical interests, touches and interacts with these. With regard to intellectual interests it is clear that much of the mental activity which enters into our aesthetic enjoyment is intellectual—*e.g.* in the perception of the relations of form, even though it stops short of the abstract analysis of scientific observation. Again, in appreciating beauty of type which involves according to Taine a recognition of the most important characters of the species, we are, it is evident, close to the scientific point of view. Similarly, when scientific knowledge enables us in the mood of aesthetic contemplation to retrace imaginatively the mode of formation of a cloud or a mountain form, or the mode in which a climbing plant finds its way upwards. It is for aesthetics to recognize the fact, and to discriminate a legitimate aesthetic function of scientific ideas when they enlarge the scope of a pleasurable play of the imagination, and are freed from the control of a serious purpose of explaining what is seen.

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[1] See a curious passage in Home's *Elements of Criticism*, chap. iv., in which the emotions excited by great and elevated objects are said to express themselves externally by a special inflating inspiration, and by stretching upward and standing "a-tiptoe" respectively; also an article on "Recent Aesthetics" by Vernon Lee in the *Quarterly Review*, 1904, part i. pp. 420-443.

[2] See Hume, *Essays*, "Essay of Tragedy," and the important discussions on the meaning of Aristotle's doctrine of the emotions of tragedy and of emotional purification or "alleviating discharge" (κάθαρσις) touched on by Bosanquet, *op. cit.* pp. 64 ff. and 234 ff.

[3] That beauty implies a peculiar blending of formal and spiritual (*geistige*) factors is recognized by H. Riegel, *Die bildende Künste*, pp. 16 ff.

(b) with practical interests.

Biological treatment of beauty.

Aesthetics and ethics.

A similar remark applies to the contacts of our aesthetic with our practical interests. While as dominant factors the latter are excluded from aesthetic activity they may influence our feeling for beauty in an indirect and subordinate way. This is recognized by those (*e.g.* Home) who insist on a particular kind of aesthetic value under the name of *relative beauty*, or the pleasing aspect of fitness for a purpose. If a drinking-vessel please in part because of its perfect adaptation to its purpose, the aesthetic value ascribed to it seems to derive something from a feeling of respect for utility itself. In another way beauty reasserts in modern aesthetics that kinship with utility on which it insisted in the days of Socrates. The idea that typical beauty coincides with what is vigorous and conducive to the conservation of the species is as old as Hobbes.[1] Darwin and his followers have developed the biological conception that sexual selection tends to develop aesthetic preferences along lines which correspond to what subserves the maintenance of the species or tribe. Recent writers have shown how the rude germs of aesthetic activity in primitive types of community would subserve necessary tribal ends—*e.g.* musical rhythm by exercising members of the tribe in concerted war-like action.[2] Yet these interesting speculations have to do rather with the earlier stages of the evolution of the aesthetic faculty than with its functions in the higher stages. An idea of a social utility in aesthetic experience which does demand the attention of the theorist is that the culture of beauty and art has a socializing influence, helping to give to our emotional experience new forms of expression whereby our sympathies are deepened and enlarged.[3] The further elucidation of this element of humanizing influence in aesthetic enjoyment may be expected to throw new light on the question, much discussed throughout the history of aesthetics, of the relation of the science to ethics, by showing that they have a common root in our sympathetic nature and interest in humanity.

Aesthetic theory and problems of art.

In order to complete the outline of aesthetic theory we need to glance at the relation of general aesthetics to the special problems of Fine Art. It is evident that the definition of the aims and methods of art, both as a whole and in its several forms, involving as it does special technical knowledge, may with advantage be treated apart from a general theory. (See FINE ARTS.) At the same time the study of art raises larger problems which require to be dealt with to some extent by this theory. We may instance the group of problems which have to do with the relation of art to "beauty" in its narrower sense, such as the function of the painful and of the ugly in art, the meaning of artistic imitation and truth to nature, of idealization, and the nature of artistic illusion; also the question of the didactic and of the moral function of art. Even more special problems of art, such as the effect of the tragic, the nature of musical expression, can only be adequately treated in the light of a general aesthetic theory.

In conclusion, it may be pointed out that the psychological theorist has of late been busy in an outlying region of art-lore, inquiring into the nature of the artistic impulse and temperament, and into the processes of imaginative creation. These inquiries have been carried out to some extent in connexion with studies of the origin of art, and of the relation of art to the social environment. Their importance for aesthetics lies in the circumstance that they are fitted to throw light upon the aesthetic consciousness as it is developed in those who are not only in a special sense cultivators of it, but represent in a peculiar manner the ideas and the aims of art.[1]

HISTORY OF THEORIES

In the following summary of the most important contributions to aesthetic doctrine, only such writings will be recognized as contribute to a general conception of aesthetic objects or experience. These include the more systematic treatment of the subject in philosophic works as well as the more thoughtful kind of discussion of principles to be met with in writings on art by critics and others.

1. *Greek Speculations.*—Ancient Greece supplies us with the first important contributions to aesthetic theory, though these are scarcely, in quality or in quantity, what one might have expected from a people which had so high an appreciation of beauty and so strong a bent for philosophic speculation. The first Greek thinker of whose views on the subject we really know something is Socrates. We learn from Xenophon's account of him that he regarded the beautiful as coincident with the good, and both of them are resolvable into the useful. Every beautiful object is so called because it serves some rational end, whether the security or the gratification of man. Socrates appears to have attached little importance to the *immediate* gratification which a beautiful object affords to perception and contemplation, but to have emphasized rather its power of furthering the more necessary ends of life. The really valuable point in his doctrine is the relativity of beauty. Unlike Plato, he recognized no self-beauty (αὐτὸ τὸ καλόν) existing absolutely and out of all relation to a percipient mind.

Plato.

Of the views of Plato on the subject, it is hardly less difficult to gain a clear conception from the *Dialogues*, than it is in the case of ethical good. In some of these, various definitions of the beautiful are rejected as inadequate by the Platonic Socrates. At the same time we may conclude that Plato's mind leaned decidedly to the conception of an absolute beauty, which took its place in his scheme of ideas or self-existing forms. This true beauty is nothing discoverable as an attribute in another thing, for these are only beautiful things, not the beautiful itself. Love (Eros) produces aspiration towards this pure idea. Elsewhere the soul's intuition of the self-beautiful is said to be a reminiscence of its prenatal existence. As to the precise forms in which the idea of beauty reveals itself, Plato is not very decided. His theory of an absolute beauty does not easily adjust itself to the notion of its contributing merely a variety of sensuous pleasure, to which he appears to lean in some dialogues. He tends to identify the self-beautiful with the conceptions of the true and the good, and thus there arose the Platonic formula καλοκἀγαθία. So far as his writings embody the notion of any common element in beautiful objects, it is proportion, harmony or unity among their parts. He emphasizes unity in its simplest aspect as seen in evenness of line and purity of colour. He recognizes in places the beauty of the mind, and seems to think that the highest beauty of proportion is to be found in the union of a beautiful mind with a beautiful body. He had but a poor opinion of art, regarding it as a trick of imitation (μίμησις) which takes us another step farther from the luminous sphere of rational intuition into the shadowy region of the semblances of sense. Accordingly, in his scheme for an ideal republic, he provided for the most inexorable censorship of poets, &c., so as to make art as far as possible an instrument of moral and political training.

Aristotle.

Aristotle proceeded to a more serious investigation of the aesthetic phenomena so as to develop by scientific analysis certain principles of beauty and art. In his treatises on poetry and rhetoric he gives us, along with a theory of these arts, certain general principles of beauty; and scattered among his other writings we find many valuable suggestions on the same subject. He seeks (in the *Metaphysics*) to distinguish the good and the beautiful by saying that the former is always in action (ἐν πράξει) whereas the latter may exist in motionless things as well (ἐν ἀκινήτοις). At the same time he had as a Greek to allow that though essentially different things the good might under certain conditions be called beautiful. He further distinguished the beautiful from the fit, and in a passage of the *Politics* set beauty above the useful and necessary. He helped to determine another characteristic of the beautiful, the absence of all lust or desire in the pleasure it bestows. The universal elements of beauty, again, Aristotle finds (in the *Metaphysics*) to be order (τάξις), symmetry and definiteness or determinateness (τὸ ὡρισμένον). In the *Poetics* he adds another essential, namely, a certain magnitude; it being desirable for a synoptic view of the whole that the object should not be too large, while clearness of perception requires that it should not be too small. Aristotle's views on art are an immense advance on those of Plato. He distinctly recognized (in the *Politics* and elsewhere) that its aim is immediate pleasure, as distinct from utility, which is the end of the mechanical arts. He took a higher view of artistic imitation than Plato, holding that so far from being an unworthy trick, it implied knowledge and discovery, that its objects not only comprised particular things which happen to most, but contemplated what is probable and what necessarily exists. The celebrated passage in the *Poetics*, where he declares poetry to be more philosophical and serious a matter (σπουδαιότερον) than philosophy, brings out the advance of Aristotle on his predecessor. He gives us no complete classification of the fine arts, and it is doubtful how far his principles, *e.g.* his celebrated idea of a purification of the passions by tragedy, are to be taken as applicable to other than the poetic art.

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[1] See passage in *Human Nature* (first part of *Tripos*), ch. viii. § 5 (Molesworth's edition of *Works*, vol. iv. p. 38).

[2] See among others, R. Wallascheck, *Primitive Music*, pp. 270 ff., and Y. Hirn, *The Origin of Art*, pp. 9 ff.; cf. W. Jerusalem, *Einleitung in die Philosophie*, pp. 116, 117.

[3] The idea of this social utility in aesthetic enjoyment is touched on by Kant, *Critique of Judgment* (Bernard's trans.), p. 174; and is more fully worked out by Guyau, *L'Art au point de vue sociologique*, ch. ii. and iii.; cf. Rutgers Marshall, *Aesthetic Principles*, pp. 81-82.

[1] On the nature of the primitive art-culture, see Rutgers Marshall, *Aesthetic Principles*, ch. iii.; M. Baldwin, *Social and Ethical Interpretations*, pp. 151 ff: Y. Hirn, *The Origin of Art*, ch. ii. On artistic genius and its creative process, see H. Taine, *The Philosophy of Art*, Part ii.; P. Souriau, *L'Imagination de l'artiste*; G. Séailles, *Essai sur la génie dans l'art*; E. Grosse, *Kunstwissenschaftliche Studien* iii.; Arréat, *Psychologie du peintre*; L. Dauriac, *Essai sur l'esprit musical.*

Plotinus.

Of the later Greek and Roman writers the Neo-Platonist Plotinus deserves to be mentioned. According to him, objective reason (νοῦς) as self-moving, becomes the formative influence which reduces dead matter to form. Matter when thus formed becomes a notion (λόγος), and its form is beauty. Objects are ugly so far as they are unacted upon by reason, and therefore formless. The creative reason is absolute beauty, and is called the more than beautiful. There are three degrees or stages of manifested beauty: that of human reason, which is the highest; of the human soul, which is less perfect through its connexion with a material body; and of real objects, which is the lowest manifestation of all. As to the precise forms of beauty, he supposed, in opposition to Aristotle, that a single thing not divisible into parts might be beautiful through its unity and simplicity. He gives a high place to the beauty of colours in which material darkness is overpowered by light and warmth. In reference to artistic beauty he said that when the artist has notions as models for his creations, these may become more beautiful than natural objects. This is clearly a step away from Plato's doctrine towards our modern conception of artistic idealization.

German writers. (a) Systematic treatises: Baumgarten.

2. *German Writers.*—We may pass by the few thoughts on the subject to be found among medieval writers and turn to modern theories, beginning with those of German writers as the most numerous and most elaborately set forth. The first of the Germans who attempted to develop an aesthetic theory as a part of a system of philosophy was Baumgarten (*Aesthetica*). Adopting the Leibnitz-Wolffian theory of knowledge, he sought to complete it by setting over against the clear scientific or "logical" knowledge of the understanding, the confused knowledge of the senses, to which (as we have seen) he gave the name "aesthetic." Beauty with him thus corresponds with perfect sense-knowledge. Baumgarten is clearly an intellectualist in aesthetics, reducing taste to an intellectual act and ignoring the element of feeling. The details of his aesthetics are mostly unimportant. Arguing from Leibnitz's theory of the world as the best possible, Baumgarten concluded that nature is the highest embodiment of beauty, and that art must seek its supreme function in the strictest possible imitation of nature.

Kant.

The next important treatment of aesthetics by a philosopher is that of Kant. He deals with the "Judgment of Taste" in the *Critique of the Power of Judgment* (J. H. Bernard's translation, 1892), which treatise supplements the two better-known critiques (*vide* Kant), and by investigating the conditions of the validity of feeling mediates between their respective subjects, cognition and desire (volition). He takes an important step in denying objective existence to beauty. Aesthetic value for him is fitness to please as object of pure contemplation. This aesthetic satisfaction is more than mere agreeableness, since it must be disinterested and free—that is to say, from all concern about the real existence of the object, and about our dependence on it. He appears to concede a certain formal objectivity to beauty in his doctrine of an appearance of purposiveness (*Zweckmässigkeit*) in the beautiful object, this being defined as its harmony with the cognative faculties involved in an aesthetic judgment (imagination and understanding); a harmony the consciousness of which underlies our aesthetic pleasure. Yet this part of his doctrine is very imperfectly developed. While beauty thus ceases with Kant to have objective validity and remains valid only for the contemplator, he claims for it *universal* subjective validity, since the object we pronounce to be beautiful is fitted to please all men. We know that this must be so from reflecting on the disinterestedness of our pleasure, on its entire independence of personal inclination. Kant insists that the aesthetic judgment is always, in logical phrase, an "individual," *i.e.* a singular one, of the form "This object (*e.g.* rose) is beautiful." He denies that we can reach a valid universal aesthetic judgment of the form "All objects possessing such and such qualities are beautiful." (A judgment of this form would, he considers, be logical, not aesthetic.) In dealing with beauty Kant is thinking of nature, ranking this as a source of aesthetic pleasure high above art, for which he shows something of contempt. He seems to retreat from his doctrine of pure subjectivity when he says that the highest significance of beauty is to symbolize moral good; going further than Ruskin when he attaches ideals of modesty, frankness, courage, &c., to the seven primary colours of Newton's system. He has made a solid contribution to the theory of the sublime, and has put forth a suggestive if a rather inadequate view of the ludicrous. But his main service to aesthetics consists in the preliminary critical determination of its aim and its fundamental problems.

Schelling.

Schelling is the first thinker to attempt a Philosophy of Art. He develops this as the third part of his system of transcendental idealism following theoretic and practical philosophy. (See Schelling; also Schelling's *Werke*, Bd. v., and J. Watson, *Schelling's Transcendental Idealism*, ch. vii., Chicago, 1882.) According to Schelling a new philosophical significance is given to art by the doctrine that the identity of subject and object—which is half disguised in ordinary perception and volition—is only clearly seen in artistic perception. The perfect perception of its real self by intelligence in the work of art is accompanied by a feeling of infinite satisfaction. Art in thus effecting a revelation of the absolute seems to attain a dignity not merely above that of nature but above that of philosophy itself. Schelling throws but little light on the concrete forms of beauty. His classification of the arts, based on his antithesis of object and subject, is a curiosity in intricate arrangement. He applies his conception in a suggestive way to classical tragedy.

Hegel.

In Hegel's system of philosophy art is viewed as the first stage of the absolute spirit. (See Hegel; also *Werke*, Bd. x., and Bosanquet's *Introduction to Hegel's Philosophy of Fine Art.*) In this stage the absolute is immediately present to sense-perception, an idea which shows the writer's complete rupture with Kant's doctrine of the "subjectivity" of beauty. The beautiful is defined as the ideal showing itself to sense or through a sensuous medium. It is said to have its life in show or semblance (*Schein*) and so differs from the true, which is not really sensuous, but the universal idea contained in sense for thought. The form of the beautiful is unity of the manifold. The notion (*Begriff*) gives necessity in mutual dependence of parts (unity), while the reality demands the semblance (*Schein*) of liberty in the parts. He discusses very fully the beauty of nature as immediate unity of notion and reality, and lays great emphasis on the beauty of organic life. But it is in art that, like Schelling, Hegel finds the highest revelation of the beautiful. Art makes up for the deficiencies of natural beauty by bringing the idea into clearer light, by showing the external world in its life and spiritual animation. The several species of art in the ancient and modern worlds depend on the various combinations of matter and form. He classifies the individual arts according to this same principle of the relative supremacy of form and matter, the lowest being architecture, the highest, poetry.

Dialectic of the Hegelians.

Curious developments of the Hegelian conception are to be found in the dialectical treatment of beauty in its relation to the ugly, the sublime, &c., by Hegel's disciples, *e.g.* C. H. Weisse and J. K. F. Rosenkranz. The most important product of the Hegelian School is the elaborate system of aesthetics published by F. T. Vischer (*Ästhetik*, 3 Theile, 1846–1854). It illustrates the difficulties of the Hegelian thought and terminology; yet in dealing with art it is full of knowledge and highly suggestive.

Schopenhauer.

The aesthetic problem is also treated by two other philosophers whose thought set out from certain tendencies in Kant's system, viz. Schopenhauer and Herbart. Schopenhauer (see Schopenhauer, also *The World as Will and Idea*, translated by R. B. Haldane, esp. vol. i. pp. 219-346), abandoning also Kant's doctrine of the subjectivity of beauty, found in aesthetic contemplation the perfect emancipation of intellect from will. In this contemplation the mind is filled with pure intellectual forms, the "Platonic Ideas" as he calls them, which are objectifications of the will at a certain grade of completeness of representation. He exalts the state of artistic contemplation as the one in which, as pure intellect set free from will, the misery of existence is surmounted and something of blissful ecstasy attained. He holds that all things are in some degree beautiful, ugliness being viewed as merely imperfect manifestation or objectification of will. In this way the beauty of nature, somewhat slighted by Schelling and Hegel, is rehabilitated.

Herbart

J. F. Herbart (*q.v.*) struck out another way of escaping from Kant's idea of a purely subjective beauty (Kerbach's edition of *Werke*, Bd. ii. pp. 339 *et seq.*; Bd. iv. pp. 105 *et seq.*, and Bd. ix. pp. 92 *et seq.*). He did, indeed, adopt Kant's view of the aesthetic judgment as singular ("individual"); though he secures a certain degree of logical universality for it by emphasizing the point that the predicate (beauty) is permanently true of the same aesthetic object. At the same time, by referring the beauty of concrete objects to certain aesthetic relations, he virtually accepted the possibility of universal aesthetic judgments (cf. *supra*). Since he thus reduces beauty to abstract relations he is known as a formalist, and the founder of the formalistic school in aesthetics. He sets out with the idea that only relations please—in the Kantian sense of producing pleasure devoid of desire; and his aim is to determine the "aesthetic elementary relations," or the simplest relations which produce this pleasure. These include those of will, so that, as he admits, ethical judgments are in a manner brought under an aesthetic form. His typical example of aesthetic relations in objects of sense-perception is that of harmony between tones. The science of thorough-bass has, he thinks, done for music what should be done also for other departments of aesthetic experience. This doctrine of elementary relations is brought into connexion with the author's psychological doctrine of presentations with their tendencies to mutual inhibition and to fusion, and of the varying feeling-tones to which these processes give rise. This mode of treating the problem of beauty and aesthetic perception has been greatly developed and worked up into a complete system of aesthetics by one of Herbart's disciples, Robert Zimmermann (*Ästhetik*, 1858).

Lessing.

Lessing, in his *Laocoon* and elsewhere, sought to deduce the special function of an art from a consideration of the means at its disposal. He took pains to define the boundaries of poetry and painting, and in so doing he reached general reflexions upon the ends and appliances of art. Among these his distinction between arts which employ the coexistent in space and those which employ the successive (as poetry and music) is of lasting value. In his dramatic criticisms he similarly endeavoured to develop clear general principles on such points as poetic truth, improving upon Aristotle, on whose teaching he mainly relies.

Goethe. Schiller.

Jean Paul.

Goethe wrote several tracts on aesthetic topics, as well as many aphorisms. He attempts to mediate between the claims of ideal beauty, as taught by J. J. Winckelmann, and the aims of individualization. Schiller (*q.v.*) discusses, in a number of disconnected essays and letters, some of the main questions in the philosophy of art. He looks at art from the side of culture and the forces of human nature, and finds in an aesthetically cultivated soul the reconciliation of the sensual and rational. His letters on aesthetic education (*Über die ästhetische Erziehung des Menschen*, trans. by J. Weiss, Boston, 1845) are valuable, bringing out among other points the connexion between aesthetic activity and the universal impulse to play (*Spieltrieb*). Schiller's thoughts on aesthetic subjects are pervaded with the spirit of Kant's philosophy. Another example of this kind of reflective discussion of art by literary men is afforded us in the *Vorschule der Ästhetik* of Jean Paul Richter. This is a rather ambitious discussion of the sublime and ludicrous, which, however, contains much valuable matter on the nature of humour in romantic poetry. Among other writers who reflect more or less philosophically on the problems to which modern poetry gives rise are Wilhelm von Humboldt, the two Schlegels and Gervinus.

Contributions by German savants.

A word may be said in conclusion on the attempts of German savants to apply a knowledge of physiological conditions to the investigation of the sensuous elements of aesthetic effect, as well as to introduce into the study of the simpler aesthetic forms the methods of natural science. The classic work of Helmholtz on "Sensations of Tone" is a highly successful attempt to ground the known facts and laws of musical composition on physics and physiology. The endeavour to determine with a like degree of precision the physiological conditions of the pleasurable effects of colours and their combinations by E. W. Brücke, Ewald Hering and more recent investigators, has so far failed to realize the desideratum laid down by Herbart, that there should be a theory of colour-relations equal in completeness and exactness to that of tone-relations. The experimental inquiry into simple aesthetically pleasing forms was begun by G. T. Fechner in seeking to test the soundness of Adolf Zeising's hypothesis that the most pleasing proportion in dividing a line, say the vertical part of a cross, is the "golden section," where the smaller division is to the larger as the latter to the sum. He describes in his work on "Experimental Aesthetics" (*Zur experimentalen Ästhetik*) a series of experiments carried out on a large number of persons, bearing on this point, the results of which he considers to be in favour of Zeising's hypothesis.

Discussions of more concrete problems.

3. *French Writers.*—In France aesthetic speculation grew out of the discussion by poets and critics on the relation of modern art, and especially poetry, to ancient. The writings of Malherbe and Boileau in the 17th century, the development of the dispute between the "ancients" and the "moderns" at the end of the 17th century by B. le Bouvier de Fontenelle and Charles Perrault, and the continuation of the discussion as to the aims of poetry and of art generally in the 18th century by Voltaire, Bayle, Diderot and others, not only offer to the modern theorists valuable material in the shape of a record by experts of their aesthetic experience, but disclose glimpses of important aesthetic principles. A more systematic examination of the several arts (corresponding to that of Lessing) is to be found in the *Cours de belles lettres* of Charles Batteux (1765), in which the meaning and value of the imitation of nature by art are further elucidated, and the arts are classified (as by Lessing) according as they employ the forms of space or those of time.

Theories of organic beauty. Buffier.

Taine.

The beginning of a more scientific investigation of beauty in general is connected with the name of Père Buffier (see *First Truths*, English translation, 1780). He confines himself to organic form, and illustrates his theory by the human face. A beautiful face is at once the most common and most rare among members of the species. This seems to be a clumsy way of saying that it is a clear expression of the typical form of the species. This idea of typical beauty (which was adopted by Reynolds) has been worked out more recently by H. Taine. In his work, *The Ideal in Art* (trans. by J. Durand), he proceeds in the manner of a botanist to determine a scale of characters in the physical and moral man. The degree of the universality or importance of a character, and of its beneficence or adaptation to the ends of life, determine the measure of its aesthetic value, and render the work of art, which seeks to represent it in its purity, an ideal work.

French systems of aesthetics: The spiritualistes.

Lévêque.

The only elaborated systems of aesthetics in French literature are those constructed by the *spiritualistes*, the philosophic writers who under the influence of German thinkers effected a reaction against the crude sensationalism of the 18th century. They aim at elucidating the higher and spiritual element in aesthetic impressions, appearing to ignore any capability in the sensuous material of affording a true aesthetic delight. V. Cousin and Jean Charles Lévêque are the principal writers of this school. The latter developed an elaborate system of the subject (*La Science du beau*). All beauty is regarded as spiritual in its nature. The several beautiful characters of an organic body—of which the principal are magnitude, unity and variety of parts, intensity of colour, grace or flexibility, and correspondence to environment—may be brought under the conception of the ideal grandeur and order of the species. These are perceived by reason to be the manifestations of an invisible vital force. Similarly the beauties of inorganic nature are to be viewed as the grand and orderly displays of an immaterial physical force. Thus all beauty is in its objective essence either spirit or unconscious force acting with fulness and in order.

4. *English Writers.*—There is nothing answering to the German conception of a system of aesthetics in English literature. The inquiries of English thinkers have been directed for the most part to such modest problems as the psychological process by which we perceive the beautiful—discussions which are apt to be regarded by German historians as devoid of real philosophical value. The writers may be conveniently arranged in two divisions, answering to the two opposed directions of English thought: (1) the Intuitionalists, those who recognize the existence of an objective beauty which is a simple unanalysable attribute or principle of things; and (2) the Analytical theorists, those who follow the analytical and psychological method, concerning themselves with the sentiment of beauty as a complex growth out of simpler elements.

The Intuitionalists. Shaftesbury.

Shaftesbury is the first of the intuitional writers on beauty. In his *Characteristics* the beautiful and the good are combined in one ideal conception, much as with Plato. Matter in itself is ugly. The order of the world, wherein all beauty really resides, is a spiritual principle, all motion and life being the product of spirit. The principle of beauty is perceived not with the outer sense, but with an internal or moral sense which apprehends the good as well. This perception yields the only true delight, namely, spiritual enjoyment.

Hutcheson.

Francis Hutcheson, in his *System of Moral Philosophy*, though he adopts many of Shaftesbury's ideas, distinctly disclaims any independent self-existing beauty in objects. "All beauty," he says, "is relative to the sense of some mind perceiving it." The cause of beauty is to be found not in a simple sensation such as colour or tone, but in a certain order among the parts, or "uniformity amidst variety." The faculty by which this principle is discerned is an internal sense which is defined as "a passive power of receiving ideas of beauty from all objects in which there is uniformity in variety." This inner sense resembles the external senses in the immediateness of the pleasure which its activity brings; and further in the necessity of its impressions: a beautiful thing being always, whether we will or no, beautiful. He distinguishes two kinds of beauty, absolute or original, and relative or comparative. The latter is discerned in an object which is regarded as an imitation or semblance of another. He distinctly states that "an exact imitation may still be beautiful though the original were entirely devoid of it." He seeks to prove the universality of this sense of beauty, by showing that all men, in proportion to the enlargement of their intellectual capacity, are more delighted with uniformity than the opposite.

Reid.

In his *Essays on the Intellectual Powers* (viii. "Of Taste") Thomas Reid applies his principle of common sense to the problem of beauty by saying that objects of beauty agree not only in producing a certain agreeable emotion, but in the excitation along with this emotion of a belief that they possess some perfection or excellence, that beauty exists in the objects independently of our minds. His theory of beauty is severely spiritual. All beauty resides primarily in the faculties of the mind, intellectual and moral. The beauty which is spread over the face of visible nature is an emanation from this spiritual beauty, and is beauty because it symbolizes and expresses the latter. Thus the beauty of a plant resides in its perfect adaptation to its end, a perfection which is an expression of the wisdom of its Creator.

Hamilton.

In his *Lectures on Metaphysics* Sir W. Hamilton gives a short account of the sentiments of taste, which (with a superficial resemblance to Kant) he regards as subserving both the subsidiary and the elaborative faculties in cognition, that is, the imagination and the understanding. The activity of the former corresponds to the element of variety in a beautiful object, that of the latter with its unity. He explicitly excludes all other kinds of pleasure, such as the sensuous, from the proper gratification of beauty. He denies that the attribute of beauty belongs to fitness.

Ruskin.

John Ruskin's well-known speculations on the nature of beauty in *Modern Painters* (" Of ideas of beauty "), though sadly wanting in scientific precision, have a certain value in the history of aesthetics. For him beauty is spiritual and typical of divine attributes. Its true nature is appreciated by the theoretic faculty which is concerned in the moral conception and appreciation of ideas of beauty, and must be distinguished from the imaginative or artistic faculty, which is employed in regarding in a certain way and combining the ideas received from external nature. He distinguishes between typical and vital beauty. The former is the external quality of bodies which typifies some divine attribute. The latter consists in " the appearance of felicitous fulfilment of function in living things." The forms of typical beauty are:—(1) infinity, the type of the divine incomprehensibility; (2) unity, the type of the divine comprehensiveness; (3) repose, the type of the divine permanence; (4) symmetry, the type of the divine justice; (5) purity, the type of the divine energy; and (6) moderation, the type of government by law. Vital beauty, again, is regarded as relative when the degree of exaltation of the function is estimated, or generic if only the degree of conformity of an individual to the appointed functions of the species is taken into account. Ruskin's writings illustrate the extreme tendency to identify aesthetic with moral perception.

The analytical theorists. Addison.

Addison's " Essays on the Imagination," contributed to the *Spectator*, though they belong to popular literature, contain the germ of scientific analysis in the statement that the pleasures of imagination (which arise originally from sight) fall into two classes:—(1) primary pleasures, which entirely proceed from objects before our eyes; and (2) secondary pleasures, flowing from the *ideas* of visible objects. The latter are greatly extended by the addition of the proper enjoyment of resemblance, which is at the basis of all mimicry and wit. Addison recognizes, too, to some extent, the influence of association upon our aesthetic preferences.

Home.

In the *Elements of Criticism* of Home (Lord Kames) another attempt is made to resolve the pleasure of beauty into its elements. Beauty and ugliness are simply the pleasant and unpleasant in the higher senses of sight and hearing. He appears to admit no general characteristic of beautiful objects beyond this power of yielding pleasure. Like Hutcheson, he divides beauty into intrinsic and relative, but understands by the latter the appearance of fitness and utility, which is excluded from the beautiful by Hutcheson.

Hogarth.

Passing by the name of Sir Joshua Reynolds, whose theory of beauty closely resembles that of Père Buffier, we come to the speculations of another artist and painter, William Hogarth. He discusses, in his *Analysis of Beauty*, all the elements of visual beauty. He finds in this the following elements:—(1) fitness of the parts to some design; (2) variety in as many ways as possible; (3) uniformity, regularity or symmetry, which is only beautiful when it helps to preserve the character of fitness; (4) simplicity or distinctness, which gives pleasure not in itself, but through its enabling the eye to enjoy variety with ease; (5) intricacy, which provides employment for our active energies, leading the eye " a wanton kind of chase "; (6) quantity or magnitude, which draws our attention and produces admiration and awe. The beauty of proportion he resolves into the needs of fitness. Hogarth applies these principles to the determination of the degrees of beauty in lines, figures and groups of forms. Among lines he singles out for special honour the serpentine (formed by drawing a line once round from the base to the apex of a long slender cone).

Burke.

Burke's speculations, in his *Inquiry into the Origin of our Ideas of the Sublime and Beautiful*, illustrate the tendency of English writers to treat the problem as a psychological one and to introduce physiological considerations. He finds the elements of beauty to be:—(1) smallness; (2) smoothness; (3) gradual variation of direction in gentle curves; (4) delicacy, or the appearance of fragility; (5) brightness, purity and softness of colour. The sublime is rather crudely resolved into astonishment, which he thinks always contains an element of terror. Thus " infinity has a tendency to fill the mind with a delightful horror." Burke seeks what he calls " efficient causes " for these aesthetic impressions in certain affections of the nerves of sight analogous to those of other senses, namely, the soothing effect of a relaxation of the nerve fibres. The arbitrariness and narrowness of this theory cannot well escape the reader's attention.

Alison.

Alison, in his well-known *Essays on the Nature and Principles of Taste*, proceeds by a method exactly the opposite to that of Hogarth and Burke. He seeks to analyse the mental process when we experience the emotion of beauty or sublimity. He finds that this consists in a peculiar operation of the imagination, namely, the flow of a train of ideas through the mind, which ideas always correspond to some simple affection or emotion (*e.g.* cheerfulness, sadness, awe) awakened by the object. He thus makes association the sole source of aesthetic delight, and denies the existence of a primary source in sensations themselves. He illustrates the working of the principle of association at great length, and with much skill; yet his attempt to make it the unique source of aesthetic pleasure fails completely. Francis Jeffrey's Essays on Beauty (in the *Edinburgh Review*, and *Encyclopaedia Britannica*, 8th edition) are little more than a modification of Alison's theory.

Dugald Stewart.

D. Stewart's chief contribution to aesthetic discussion in his *Philosophical Essays* consists in pointing out the unwarranted assumption lurking in the doctrine of a single quality running through all varieties of beautiful object. He seeks to show how the successive changes in the meaning of the term " beautiful " have arisen. He suggests that it originally connoted the pleasure of colour. The value of his discussion resides more in the criticism of his predecessors than in the contribution of new ideas. His conception of the sublime, suggested by the etymology of the word, emphasizes the element of height in objects.

Bain.

Of the association psychologists James Mill did little more towards the analysis of the sentiments of beauty than re-state Alison's doctrine. Alexander Bain, in his treatise, *The Emotions and the Will* (" Aesthetic Emotions "), carries this examination considerably further. He seeks to differentiate aesthetic from other varieties of pleasurable emotion by three characteristics:—(1) their freedom from life-serving uses, being gratifications sought for their own sakes; (2) their purity from all disagreeable concomitants; (3) their eminently sympathetic or shareable nature. He takes a comprehensive view of the constituents of aesthetic enjoyment, including the pleasures of sensation and of its revived or its " ideal " form; of revived emotional states; and lastly the satisfaction of those wide-ranging susceptibilities which we call the love of novelty, of contrast and of harmony. The effect of sublimity is connected with the manifestation of superior power in its highest degrees, which manifestation excites a sympathetic elation in the beholder. The ludicrous, again, is defined by Bain, improving on Aristotle and Hobbes, as the degradation of something possessing dignity in circumstances that excite no other strong emotion.

Herbert Spencer.

Herbert Spencer, in his *First Principles*, *Principles of Psychology* and *Essays*, has given an interesting turn to the psychology of aesthetics by the application of his doctrine of evolution. Adopting Schiller's idea of a connexion between aesthetic activity and play, he seeks to make it the starting-point in tracing the evolution of aesthetic activity. Play is defined as the outcome of the superfluous energies of the organism: as the activity of organs and faculties which, owing to a prolonged period of inactivity, have become specially ready to discharge their function, and as a consequence vent themselves in *simulated* actions. Aesthetic activities supply a similar mode of self-relieving discharge to the higher organs of perception and emotion; and they further agree with play in not directly subserving any processes conducive to life; in being gratifications sought for their own sake only. Spencer seeks to construct a hierarchy of aesthetic pleasures according to the degree of complexity of the faculty exercised: from those of sensation up to the revived emotional experiences which constitute the aesthetic sentiment proper. Among the more vaguely revived emotions Spencer includes more permanent feelings of the race transmitted by heredity; as when he refers the deep and indefinable emotion excited by music to associations with vocal tones expressive of feeling built up during the past history of our species. His biological treatment of aesthetic activity has had a wide influence, some (*e.g.* Grant Allen) being content to develop his evolutional method. Yet, as suggested above, his theory is now recognized as taking us only a little way towards an adequate understanding of our aesthetic experience.

BIBLIOGRAPHY.[1]—(a) *Works on General Aesthetics.*

English and American.—There are no important recent works which deal with the whole subject. The following will be found helpful: Herbert Spencer, *Principles of Psychology*, pt. viii. c. 9, " Aesthetic Sentiments," and the papers on " Use and Beauty," " Origin and Function of Music " and others in the *Essays;* A. Bain, *Emotions and Will*, " Aesthetic Emotions "; J. Sully, *Human Mind*, ii. " Aesthetic Sentiment "; Grant Allen, " Physiological Aesthetics " (Meth., Pl., Senses, Play); Rutgers Marshall, *Pain, Pleasure and Aesthetics*, and *Aesthetic Principles* (Meth., Pl., Play).

French and Italian Works.—M. Guyau, *Les Problèmes de l'esthétique contemporaine* (1884) (Pl., Play); E. Véron, *L'Esthétique* (1890) (slight Pl.); L. Bray, *Du Beau* (1902). (Pl., Play); P. Sauriau, *La Beauté rationnelle* (1904) (Meth., Pl., Senses, Einf.); M. Pilo, *Estetica* (Pl., Senses); A. Rolla, *Storia delle idee estetiche in Italia* (1905) (full account of ideas of Dante and other medieval writers, as well as of modern systems).

German Works.—K. Köstlin, *Prolegomena zur Ästhetik* (1889)

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[1] Only recent works are included. Important points in each are indicated by abbreviations, namely:—

Einf., for Einfühlung (expressional element in form).
Evol., for bearings of evolution.
Ill., for aesthetic illusion.
Judg., for aesthetic judgment.
Meth., for method of aesthetics.
Norm., for normative function of aesthetics.
Pl., for theory of pleasure.
Play, for Play and aesthetic enjoyment.
Senses, for aesthetic value of higher senses.
Val., for aesthetic value.

(good introduction to subject); K. Groos, *Der ästhetische Genuss* (1902) (Meth., Judg., Play, Senses, Einf. and Ill.); J. Volkelt, *System der Ästhetik* (1905) (very full and clear) (Meth., Norm., Evol., Senses, Einf.); J. Cohn, *Allgemeine Ästhetik* (1901) (Val., Play, Einf.); K. Lange, *Das Wesen der Kunst* (1901) (Meth., Einf., Ill., Play).

(b) *Works on History of Aesthetics.*—H. Lotze, *Geschichte der Ästhetik in Deutschland*; M. Schasler, *Kritische Geschichte der Ästhetik* (full and elaborate, dealing with ancient and modern theories); E. von Hartmann, *Die deutsche Ästhetik seit Kant* (Ausgewählte Werke, iii.); K. H. von Stein, *Die Entstehung der neueren Ästhetik* (theories of French critics, &c.); F. Brunetière, *L'Évolution des genres* (History of critical discussions in the 17th and 18th centuries); B. Bosanquet, *History of Aesthetics* (very full, especially on ancient theories and German systems); W. Knight, *Philosophy of the Beautiful*, pt. i. "History" (Univ. Extension Manuals, a popular résumé with quotations). (J. S.)

AESTIVATION (from Lat. *aestivare*, to spend the *aestas*, or summer; the word is sometimes spelled "estivation"), literally "summer residence," a term used in zoology for the condition of torpor into which certain animals pass during the hottest season in hot and dry countries, contrasted with the similar winter condition known as hibernation (*q.v.*). In botany the word is used of the praefloration or folded arrangement of the petals in a flower before expansion in the summer, contrasted with "vernation" of leaves which unfold in the spring.

ÆTHELBALD, king of Mercia, succeeded Ceolred A.D. 716. According to Felix, *Life of St Guthlac*, he visited the saint at Crowland, when exiled by Ceolred and pursued by his emissaries before his accession, and was cheered by predictions of his future greatness. According to Bede, the whole of Britain as far north as the Humber was included within the sphere of his authority. His energy in preserving his influence is shown by several entries in the *Chronicle*. He made an expedition against Wessex in 733, in which year he took the royal vill of Somerton. In 740 he took advantage of the absence of Eadberht of Northumbria in a campaign against the Picts to invade his kingdom. In 743 he fought with Cuthred, king of Wessex, against the Welsh, but the alliance did not last long, as in 752 Cuthred took up arms against him. In 757 Æthelbald was slain by his guards at Seckington (Warwickshire) and buried at Repton. He seems to have been the most powerful and energetic king of Mercia between Penda and Offa. A letter of St Boniface is preserved, in which he rebukes this king for his immoralities and encroachments on church property, while recognizing his merits as a monarch. By a charter of 749 he freed ecclesiastical lands from all obligations except the *trinoda necessitas*.

See Bede, *Hist. Ecc.* (ed. Plummer), v. 23 and Continuatio *s.a.* 740, 750, 757; *Saxon Chronicle* (Earle and Plummer), *s.a.* 716, 733, 737, 740, 741, 743, 755; Mabillon, *Acta Sanctorum*, ii. pp. 264, 275, 276, 279, 283-284; P. Jaffé, *Monumenta Moguntiaca*, iii. pp. 168-177; W. de G. Birch, *Cartul. Saxon.* 178 (1885-1893). (F. G. M. B.)

ÆTHELBALD, king of Wessex, was the son of Æthelwulf, with whom he led the West Saxons to victory against the Danes at Aclea, 851. According to Asser he rebelled against his father on the latter's return from Rome in 856, and deprived him of Wessex, which he ruled until his death in 860. On his father's death in 858 he married his widow, Judith.

See Asser, *Life of Alfred* (W. H. Stevenson, 1904), 12; *Saxon Chronicle, s.a.* 851, 855, 860.

ÆTHELBERHT, king of Kent, son of Eormenric, probably came to the throne in A.D. 560. The first recorded event of his reign was a serious reverse at the hands of Ceawlin of Wessex in the year 568 (*Chronicle*) at a place called Wibbandune. Æthelberht married Berhta, daughter of Charibert, king of Paris, who brought over Bishop Liudhard as her private confessor. According to Bede, Æthelberht's supremacy in 597 stretched over all the English kingdoms as far as the Humber. The nature of this supremacy has been much disputed, but it was at any rate sufficient to guarantee the safety of Augustine in his conference with the British bishops. Æthelberht exercised a stricter sway over Essex, where his nephew Saberht was king. In 597 the mission of Augustine landed in Thanet and was received at first with some hesitation by the king. He seems to have acted with prudence and moderation during the conversion of his kingdom and did not countenance compulsory proselytism. Æthelberht gave Augustine a dwelling-place in Canterbury, and Christ Church was consecrated in 603. He also made grants to found the see of Rochester, of which Justus became first bishop in 604, and his influence established Mellitus at London in the same year. A code of laws issued by him which is still extant is probably the oldest document in the English language, and contains a list of money fines for various crimes. Towards the close of his reign his pre-eminence as Bretwalda was disturbed by the increasing power of Rædwald of East Anglia. He died probably in 616, and was succeeded by his son Eadbald.

See Bede, *Hist. Ecc.* (Plummer) i. 25, 26, ii. 3, 5; *Saxon Chronicle* (Earle and Plummer), *s.a.* 568. (F. G. M. B.)

ÆTHELBERHT, king of the West Saxons, succeeded to the sub-kingdom of Kent during the lifetime of his father Æthelwulf, and retained it until the death of his elder brother Æthelbald in 860, when he became sole king of Wessex and Kent, the younger brothers Æthelred and Alfred renouncing their claim. He ruled these kingdoms for five years and died in 865. His reign was marked by two serious attacks on the part of the Danes, who destroyed Winchester in 860, in spite of the resistance of the ealdormen Osric and Æthelwulf with the levies of Hampshire and Berkshire, while in 865 they treacherously ravaged Kent.

See *Saxon Chronicle* (Earle and Plummer), *s.a.* 860, 865; *King Alfred's Will*; W. de G. Birch, *Cartul. Saxon.* 553.

ÆTHELFLAED (ETHELFLEDA), the "Lady of the Mercians," the eldest child of Alfred the Great, was educated with her brother Edward at her father's court. As soon as she was of marriageable age (probably about A.D. 886), she was married to Æthelred, earl of Mercia, to whom Alfred entrusted the control of Mercia. On the accession of her brother Edward, Æthelflaed and her husband continued to hold Mercia. In 907 they fortified Chester, and in 909 and 910 either Æthelflaed or her husband must have led the Mercian host at the battles of Tettenhall and Wednesfield (or Tettenhall-Wednesfield, if these battles are one and the same). It was probably about this time that Æthelred fell ill, and the Norwegians and Danes from Ireland unsuccessfully besieged Chester. Æthelflaed won the support of the Danes against the Norwegians, and seems also to have entered into an alliance with the Scots and the Welsh against the pagans. In 911 Æthelred died and Edward took over Middlesex and Oxfordshire. Except for this Æthelflaed's authority remained unimpaired. In 912 she fortified "Scergeat" and Bridgenorth, Tamworth and Stafford in 913, Eddisbury and Warwick in 914, Cherbury, "Weardbyrig" and Runcorn in 915. In 916 she sent an expedition against the Welsh, which advanced as far as Brecknock. In 917 Derby was captured from the Danes, and in the next year Leicester and York both submitted to her. She died in the same year at Tamworth (June 12), and was buried in St Peter's church at Gloucester. This noble queen, whose career was as distinguished as that of her father and brother, left one daughter, Ælfwyn. For some eighteen months Ælfwyn seems to have wielded her mother's authority, and then, just before the Christmas of 919, Edward took Mercia into his own hands, and Ælfwyn was "led away" into Wessex. Æthelflaed and her husband wielded almost kingly authority, and the royal title is often given them by the chroniclers.

See *The Saxon Chronicle, sub ann.* (especially the Mercian register in MSS. B, C and D); Florence of Worcester; *Fragments of Irish Annals* (ed. O'Conor), pp. 227-237; D.N.B., *s.v.* (A. Mw.)

ÆTHELFRITH, king of Northumbria, is said to have come to the throne in A.D. 593, being the son of Æthelric (probably reigned 568-572). He married Acha, daughter of Ella (Ælle), king of Deira, whom he succeeded probably in 605, expelling his son Edwin. In 603 he repelled the attack of Aidan, king of the Dalriad Scots, at Daegsastan, defeating him with great loss. The appearance of Hering, son of Hussa, Æthelfrith's predecessor, on the side of the invaders seems to indicate family quarrels in the royal house of Bernicia. Later in his reign, probably in 614, he defeated the Welsh in a great battle at Chester and massacred the monks of Bangor who were assembled to aid them by their prayers. This war may have been due partly to Æthelfrith's persecution of Edwin, but it had a strategic importance in the separation of the North Welsh from the Strathclyde Britons. In 617 Æthelfrith was defeated and slain at the river Idle by Rædwald of East Anglia, whom Edwin had persuaded to take up his cause.

See Bede, *Chronica Majora*, § 531; *Hist. Ecc.* (Plummer) i. 34, ii. 2; *Saxon Chronicle*, *s.a.* 593, 603, 605, 616; *Hist. Brittonum*, §§ 57, 63; *Annales Cambriae*, *s.a.* 613. (F. G. M. B.)

ÆTHELING, an Anglo-Saxon word compounded of *æthele*, or *ethel*, meaning noble, and *ing*, belonging to, and akin to the modern German words *Adel*, nobility, and *adelig*, noble. During the earliest years of the Anglo-Saxon rule in England the word was probably used to denote any person of noble birth. Its use was, however, soon restricted to members of a royal family, and in the *Anglo-Saxon Chronicle* it is used almost exclusively for members of the royal house of Wessex. It was occasionally used after the Norman Conquest to designate members of the royal family. The earlier part of the word formed part of the name of several Anglo-Saxon kings, *e.g.* Æthelbert, Æthelwulf, Æthelred, and was used obviously to indicate their noble birth. According to a document which probably dates from the 10th century, the wergild of an ætheling was fixed at 15,000 thrymsas, or 11,250 shillings. This wergild is equal to that of an archbishop and one-half of that of a king.

ÆTHELNOTH (d. 1038), archbishop of Canterbury, known also as EGELNODUS or EDNODUS, was a son of the ealdorman Æthelmaer, and a member of the royal family of Wessex. He became a monk at Glastonbury, then dean of the monastery of Christ Church, Canterbury, and chaplain to King Canute, and on the 13th of November 1020 was consecrated archbishop of Canterbury. In 1022 he went to Rome to obtain the pallium, and was received with great respect by Pope Benedict VIII. Returning from Rome he purchased at Pavia a relic said to be an arm of St Augustine of Hippo, for a hundred talents of silver and one of gold, and presented it to the abbey of Coventry. He appears to have exercised considerable influence over Canute, largely by whose aid he restored his cathedral at Canterbury. A story of doubtful authenticity tells how he refused to crown King Harold I., as he had promised Canute to crown none but a son of the king by his wife, Emma. Æthelnoth, who was called the "Good," died on the 29th of October 1038, and his name appears in the lists of saints.

ÆTHELRED, king of Mercia, succeeded his brother Wulfhere in A.D. 675. In 676 he ravaged Kent with fire and sword, destroying the monasteries and churches and taking Rochester. Æthelred married Osthryth, the sister of Ecgfrith, king of Northumbria, but in spite of this connexion a quarrel arose between the two kings, presumably over the possession of the province of Lindsey, which Ecgfrith had won back at the close of the reign of Wulfhere. In a battle on the banks of the Trent in 679, the king of Mercia was victorious and regained the province. Ælfwine, the brother of Ecgfrith, was slain on this occasion, but at the intervention of Theodore, archbishop of Canterbury, Æthelred agreed to pay a wergild for the Northumbrian prince and so prevented further hostilities. Osthryth was murdered in 697 and Æthelred abdicated in 704, choosing Cœnred as his successor. He then became abbot of Bardney, and, according to Eddius, recommended Wilfrid to Cœnred on his return from Rome. Æthelred died at Bardney in 716. (See WILFRID.)

SOURCES.—Eddius, *Vita Wilfridi* (Raine), 23 40, 43, 45-48, 57; Bede, *Hist. Ecc.* (ed. Plummer), iii. 11, iv. 12, 21; *Saxon Chronicle*, *s.a.* 676, 679, 704, 716. (F. G. M. B.)

ÆTHELRED I., king of Wessex and Kent (866–871), was the fourth son of Æthelwulf of Wessex, and should, by his father's will, have succeeded to Wessex on the death of his eldest brother Æthelbald. He seems, however, to have stood aside in favour of his brother Æthelberht, king of Kent, to whose joint kingdoms he succeeded in 866. Æthelred's reign was one long struggle against the Danes. In the year of his succession a large Danish force landed in East Anglia, and in the year 868 Æthelred and his brother Alfred went to help Burgred, or Burhred, of Mercia, against this host, but the Mercians soon made peace with their foes. In 871 the Danes encamped at Reading, where they defeated Æthelred and his brother, but later in the year the English won a great victory at "Æscesdun." A fortnight later they were defeated at Basing, but partially retrieved their fortune by a victory at "Mæretun" (perhaps Marden in Wiltshire), though the Danes held the field. In the Easter of this year Æthelred died, perhaps of wounds received in the wars against the Danes, and was buried at Wimborne. He left a son, Æthelwold, who gave some trouble to his cousin Edward the Elder, when the latter succeeded to the kingdom. Æthelweard the historian was also a descendant of this king.

AUTHORITIES.—*The Saxon Chronicle*, *sub ann.*; Birch, *Cartul. Saxon.* vol. ii. Nos. 516-526; D.N.B., *s.v.*; *Eng. Hist. Review*, i. 218-234. (A. Mw.)

ÆTHELRED II. (or ETHELRED) (*c.* 968–1016), king of the English (surnamed THE UNREADY, *i.e.* without *rede* or counsel), son of King Edgar by his second wife Ælfthryth, was born in 968 or 969 and succeeded to the throne on the murder of his step-brother Edward (the Martyr) in 979. His reign was disastrous from the beginning. The year after his accession the Danish invasions, long unintermitted under Edgar the Peaceful, recommenced; though as yet their object was plunder only, not conquest, and the attacks were repeated in 981, 982 and 988. In 991 the Danes burned Ipswich, and defeated and slew the East Saxon ealdorman Brihtnoth at Maldon. After this, peace was purchased by a payment of £10,000—a disastrous expedient. The Danes were to desist from their ravages, but were allowed to stay in England. Next year Æthelred himself broke the peace by an attack on the Danish ships. Despite the treachery of Ælfric, the English were victorious; and the Danes sailed off to ravage Lindsey and Northumbria. In 994 Olaf Tryggvason, king of Norway, and Sweyn, king of Denmark, united in a great invasion and attacked London. Foiled by the valour of the citizens, they sailed away and harried the coast from Essex to Hampshire. Æthelred now resorted to the old experiment and bought them off for £16,000 and a promise of supplies. Olaf also visited Æthelred at the latter's request and, receiving a most honourable welcome, was induced to promise that he would never again come to England with hostile intent, an engagement which he faithfully kept. The Danish attacks were repeated in 997, 998, 999, and in 1000 Æthelred availed himself of the temporary absence of the Danes in Normandy to invade Cumberland, at that time a Viking stronghold. Next year, however, the Northmen returned and inflicted worse evil than ever. The national defence seemed to have broken down altogether. In despair Æthelred again offered them money, which they again accepted, the sum paid on this occasion being £24,000. But soon afterwards the king, suspecting treachery, resolved to get rid of his enemies once and for all. Orders were issued commanding the slaughter on St Brice's day (December 2) of "all the Danish men who were in England." Such a decree could obviously not be carried out literally; but we cannot doubt that the slaughter was great. This violence, however, only made matters worse. Next year Sweyn returned, his hostility fanned by the desire for revenge. For two years he ravaged and slew; in 1003 Exeter was destroyed; Norwich and Thetford in 1004. No effectual resistance was offered, despite a gallant effort here and there; the disorganization of the country was complete. In 1005 the Danes were absent in Denmark, but came back next year, and emboldened by the utter lack of resistance, they ranged far inland. In 1007 Æthelred bought them off for a larger sum than ever (£36,000), and for two years the land enjoyed peace. In 1009, however, in accordance with a resolution made by the witan in the preceding year, Æthelred collected such a fleet "as never before had been in England in any king's day"; but owing to a miserable court quarrel the effort came to nothing. The king then summoned a general levy of the nation, with no better result. Just as he was about to attack, the traitor Edric prevented him from doing so, and the opportunity was lost. In 1010 the Danes returned, to find the kingdom more utterly disorganized than ever. "There was not a chief man in the kingdom who could gather a force, but each fled as he best might; nor even at last would any there resist another." Incapable of offering resistance, the king again offered money, this time no less than £48,000. While it was being collected, the Danes sacked Canterbury and barbarously slew the archbishop Alphege. The tribute was paid soon afterwards; and about the same time the Danish leader Thurkill entered the English service. From 1013 an important change is discernible in the character of the Danish attacks, which now became definitely political in their aim. In this year Sweyn sailed up the Trent and received the submission of northern England, and then marching south, he attacked London. Failing to take it, he hastened west and at Bath received the submission of Wessex. Then he returned northwards, and after that "all the nation considered him as full king." London soon acknowledged him, and Æthelred, after taking refuge for a while with Thurkill's fleet, escaped to Normandy. Sweyn died in February 1014, and Æthelred was recalled by the witan, on giving a promise to reign better in future. At once he hastened north against Canute, Sweyn's son, who claimed to succeed his father, but Canute sailed away, only to return next year, when the traitor Edric joined him and Wessex submitted. Together Canute and Edric harried Mercia, and were preparing to reduce London, when Æthelred died there on the 23rd of April 1016. Weak, self-indulgent, improvident, he had pursued a policy of opportunism to a fatal conclusion.

Æthelred's wife was Emma, or Ælfgifu, daughter of Richard I. the Fearless, duke of the Normans, whom he married in 1002. After the king's death Emma became the wife of Canute the Great, and after his death in 1035 she struggled hard to secure England for her son, Hardicanute. In 1037, however, when Harold Harefoot became sole king, she was banished; she went to Flanders, returning to England with Hardicanute in 1040. In 1043, after Edward the Confessor had become king he seized the greater part of Emma's great wealth, and the queen lived in retirement at Winchester until her death on the 6th of March 1052. By Æthelred Emma had two sons, Edward the Confessor and the ætheling Ælfred (d. 1036), and by Canute she was the mother of Hardicanute. Emma's marriage with Æthelred was an important step in the history of the relations between England and Normandy, and J. R. Green says "it suddenly opened for its rulers a distinct policy, a distinct course of action, which led to the Norman conquest of England. From the moment of Emma's marriage Normandy became a chief factor in English politics."

AUTHORITIES.—*The Anglo-Saxon Chronicle* (edition by C. Plummer, 2 vols. Oxford, 1892–1899); Florence of Worcester (ed. B. Thorpe, London, 1848–1849); *Encomium Emmae* (ed. by G. H. Pertz in the *Scriptores Rerum Germanicarum*, Band xix., Hanover, 1866) for the latter part of the reign. See also J. M. Kemble, *Codex Diplomaticus aevi Saxonici* (London, 1839–1848); and B. Thorpe, *Ancient Laws* (London, 1840). (C. S. P.*)

ÆTHELSTAN (*c.* 894–940), Saxon king, was the son (probably illegitimate) of Edward the elder. He had been the favourite of his grandfather Alfred, and was brought up in the household of his aunt Æthelflaed, the "Lady of the Mercians." On the death of his father in 924, at some date after the 12th of November, Æthelstan succeeded him and was crowned at Kingston shortly after. The succession did not, however, take place without opposition. One Ælfred, probably a descendant of Æthelred I., formed a plot to seize the king at Winchester; the plot was discovered and Ælfred was sent to Rome to defend himself, but died shortly after. The king's own legitimate brother Edwin made no attempt on the throne, but in 933 he was drowned at sea under somewhat mysterious circumstances; the later chroniclers ascribe his death to foul play on the part of the king, but this seems more than doubtful.

One of Æthelstan's first public acts was to hold a conference at Tamworth with Sihtric, the Scandinavian king of Northumbria, and as a result Sihtric received Æthelstan's sister in marriage. In the next year Sihtric died and Æthelstan took over the Northumbrian kingdom. He now received, at Dacre in Cumberland, the submission of all the kings of the island, viz. Howel Dda, king of West Wales, Owen, king of Cumbria, Constantine, king of the Scots, and Ealdred of Bamburgh, and henceforth he calls himself "rex totius Britanniae." About this time (the exact chronology is uncertain) Æthelstan expelled Sihtric's brother Guthfrith, destroyed the Danish fortress at York, received the submission of the Welsh at Hereford, fixing their boundary along the line of the Wye, and drove the Cornishmen west of the Tamar, fortifying Exeter as an English city.

In 934 he invaded Scotland by land and sea, perhaps owing to an alliance between Constantine and Anlaf Sihtricsson. The army advanced as far north as Dunottar, in Kincardineshire, while the navy sailed to Caithness. Simeon of Durham speaks of a submission of Scotland as a result; if it ever took place it was a mere form, for three years later we find a great confederacy formed in Scotland against Æthelstan. This confederacy of 937 was joined by Constantine, king of Scotland, the Welsh of Strathclyde, and the Norwegian chieftains Anlaf Sihtricsson and Anlaf Godfredsson, who, though they came from Ireland, had powerful English connexions. A great battle was fought at Brunanburh (perhaps Brunswark or Birrenswark hill in S.E. Dumfriesshire), in which Æthelstan and his brother Edmund were completely victorious. England had been freed from its greatest danger since the days of the struggle of Alfred against Guthrum.

Æthelstan was the first Saxon king who could claim in any real sense to be lord paramount of Britain. In his charters he is continually called "rex totius Britanniae," and he adopts for the first time the Greek title *basileus*. This was not merely an idle flourish, for some of his charters are signed by Welsh and Scottish kings as *subreguli*. Further, Æthelstan was the first king to bring England into close touch with continental Europe. By the marriage of his half-sisters he was brought into connexion with the chief royal and princely houses of France and Germany. His sister Eadgifu married Charles the Simple, Eadhild became the wife of Hugh the Great, duke of France, Eadgyth was married to the emperor Otto the Great, and her sister Ælfgifu to a petty German prince. Embassies passed between Æthelstan and Harold Fairhair, first king of Norway, with the result that Harold's son Haakon was brought up in England and is known in Scandinavian history as Haakon Adalsteinsfóstri.

Æthelstan died at Gloucester in 940, and was buried at Malmesbury, an abbey which he had munificently endowed during his lifetime. Apparently he was never married, and he certainly had no issue.

A considerable body of law has come down to us in Æthelstan's name. The chief collections are those issued at Grately in Hampshire, at Exeter, at *Thunresfeld*, and the *Judicia civitatis Lundonie*. In the last-named one personal touch is found when the king tells the archbishop how grievous it is to put to death persons of twelve winters for stealing. The king secured the raising of the age limit to fifteen.

AUTHORITIES.—Primary: *The Saxon Chronicle*, *sub ann.*; William of Malmesbury, *Gesta Regum*, i. 141-157, Rolls Series, containing valuable original information (*v.* Stubbs' Introduction, II. lx.-lxvii.); Birch, *Cartul. Saxon.* vol. ii. Nos. 641-747; A.S. Laws, (ed. Liebermann), i. 146-183; Æthelweard, Florence of Worcester. Secondary: *Saxon Chronicle* (ed. Plummer), vol. ii. pp. 132-142; D.N.B., *s.v.* (A. Mw.)

ÆTHELWEARD (ETHELWARD), Anglo-Saxon historian, was the great-grandson of Æthelred, the brother of Alfred, and ealdorman or earl of the western provinces (*i.e.* probably of the whole of Wessex). He first signs as *dux* or ealdorman in 973, and continues to sign until 998, about which time his death must have taken place. In the year 991 he was associated with archbishop Sigeric in the conclusion of a peace with the victorious Danes from Maldon, and in 994 he was sent with Bishop Ælfheah (Alphege) of Winchester to make peace with Olaf at Andover. Æthelweard was the author of a Latin Chronicle extending to the year 975. Up to the year 892 he is largely dependent on the *Saxon Chronicle*, with a few details of his own; later he is largely independent of it. Æthelweard gave himself the bombastic title "Patricius Consul Quaestor Ethelwerdus," and unfortunately this title is only too characteristic of the man. His narrative is highly rhetorical, and as he at the same time attempts more than Tacitean brevity his narrative is often very obscure. Æthelweard was the friend and patron of Ælfric the grammarian.

AUTHORITIES.—Primary: *The Saxon Chronicle*, 994 E; Birch, *Cartularium Saxonicum*; A.S. Laws (ed. Liebermann), pp. 220-224; *Fabii Ethelwerdi Chron.*, Mon. Hist. Brit. 449-454. Secondary: Plummer, *Saxon Chronicle*, vol. ii. p. ci.; Napier and Stevenson, *Crawford Charters*, pp. 118-120; D.N.B., *s.v.* (A. Mw.)

ÆTHELWULF, king of the West Saxons, succeeded his father Ecgberht in A.D. 839. It is recorded in the *Saxon Chronicle* for 823 that he was sent with Eahlstan, bishop of Sherborne, and the ealdorman Wulfheard to drive out Baldred, king of Kent, which was successfully accomplished. On the accession of Æthelwulf, Æthelstan, his son or brother, was made sub-king of Kent, Surrey, Sussex and Essex. Æthelwulf's reign was chiefly occupied with struggles against the Danes. After the king's defeat 843–844, the Somerset and Dorset levies won a victory at the mouth of the Parret, *c.* 850. In 851 Ceorl, with the men of Devon, defeated the Danes at Wigganburg, and Æthelstan of Kent was victorious at Sandwich, in spite of which they wintered in England that year for the first time. In 851 also Æthelwulf and Æthelbald won their great victory at Aclea, probably the modern Ockley. In 853 Æthelwulf subdued the North Welsh, in answer to the appeal of Burgred of Mercia, and gave him his daughter Æthelswith in marriage. 855 is the year of the Donation of Æthelwulf and of his journey to Rome with Alfred. On his way home he married Judith, daughter of Charles the Bald. According to Asser he was compelled to give up Wessex to his son Æthelbald on his return, and content himself with the eastern sub-kingdom. He died in 858.

See Asser, *Life of Alfred* (W. H. Stevenson, 1904), 1-16; *Saxon Chronicle, s.a.* 823, 836, 840, 851, 853, 855. (F. G. M. B.)

AETHER, or ETHER (Gr. *αἰθήρ*, probably from *αἴθω*, I burn, though Plato in his *Cratylus* (410 B) derives the name from its perpetual motion—*ὅτι ἀεὶ θεῖ περὶ τὸν ἀέρα ῥέων, ἀειθεὴρ δικαίως ἂν καλοῖτο*), a material substance of a more subtle kind than visible bodies, supposed to exist in those parts of space which are apparently empty.

"The hypothesis of an aether has been maintained by different speculators for very different reasons. To those who maintained the existence of a plenum as a philosophical principle, nature's abhorrence of a vacuum was a sufficient reason for imagining an all-surrounding aether, even though every other argument should be against it. To Descartes, who made extension the sole essential property of matter, and matter a necessary condition of extension, the bare existence of bodies apparently at a distance was a proof of the existence of a continuous medium between them. But besides these high metaphysical necessities for a medium, there were more mundane uses to be fulfilled by aethers. Aethers were invented for the planets to swim in, to constitute electric atmospheres and magnetic effluvia, to convey sensations from one part of our bodies to another, and so on, till all space had been filled three or four times over with aethers. It is only when we remember the extensive and mischievous influence on science which hypotheses about aethers used formerly to exercise, that we can appreciate the horror of aethers which sober-minded men had during the 18th century, and which, probably as a sort of hereditary prejudice, descended even to John Stuart Mill. The disciples of Newton maintained that in the fact of the mutual gravitation of the heavenly bodies, according to Newton's law, they had a complete quantitative account of their motions; and they endeavoured to follow out the path which Newton had opened up by investigating and measuring the attractions and repulsions of electrified and magnetic bodies, and the cohesive forces in the interior of bodies, without attempting to account for these forces. Newton himself, however, endeavoured to account for gravitation by differences of pressure in an aether; but he did not publish his theory, 'because he was not able from experiment and observation to give a satisfactory account of this medium, and the manner of its operation in producing the chief phenomena of nature.' On the other hand, those who imagined aethers in order to explain phenomena could not specify the nature of the motion of these media, and could not prove that the media, as imagined by them, would produce the effects they were meant to explain. The only aether which has survived is that which was invented by Huygens to explain the propagation of light. The evidence for the existence of the luminiferous aether has accumulated as additional phenomena of light and other radiations have been discovered; and the properties of this medium, as deduced from the phenomena of light, have been found to be precisely those required to explain electromagnetic phenomena."

This description, quoted from James Clerk Maxwell's article in the 9th edition of the *Encyclopaedia Britannica*, represents the historical position of the subject up till about 1860, when Maxwell began those constructive speculations in electrical theory, based on the influence of the physical views of Faraday and Lord Kelvin, which have in their subsequent development largely transformed theoretical physics into the science of the aether.

In the remainder of the article referred to, Maxwell reviews the evidence for the necessity of an aether, from the fact that light takes time to travel, while it cannot travel as a substance, for if so two interfering lights could not mask each other in the dark fringes (see INTERFERENCE OF LIGHT). Light is therefore an influence propagated as wave-motion, and moreover by transverse undulations, for the reasons brought out by Thomas Young and Augustin Fresnel; so that the aether is a medium which possesses elasticity of a type analogous to rigidity. It must be very different from ordinary matter as we know it, for waves travelling in matter constitute sound, which is propagated hundreds of thousands of times slower than light.

If we suppose that the aether differs from ordinary matter in degree but not in kind, we can obtain some idea of its quality from a knowledge of the velocity of radiation and of its possible intensity near the sun, in a manner applied long ago by Lord Kelvin (*Trans. R. S. Edin.* xxi. 1854). According to modern measurements the solar radiation imparts almost 3 gramme-calories of energy per minute per square centimetre at the distance of the earth, which is about $1\cdot3\times10^6$ ergs per sec. per cm.^{2} The energy in sunlight per cubic cm. just outside the earth's atmosphere is therefore about 4×10^{-5} ergs; applying the law of inverse squares the value near the sun's surface would be $1\cdot8$ ergs. Let E be the effective elasticity of the aether; then $\mathrm{E}=\rho c^2$, where ρ is its density, and c the velocity of light which is 3×10^{10} cm./sec. If $\xi=\mathrm{A}\cos^{n}(t-x/c)$ is the linear vibration, the stress is $\mathrm{E}\, d\xi/dx$; and the total energy, which is twice the kinetic energy $\frac{1}{2}\rho(d\xi/dt)^2dx$, is $\frac{1}{2}\rho n^2\mathrm{A}^2$ per cm., which is thus equal to $1\cdot8$ ergs as above. Now $\lambda=2\pi c/n$, so that if $\mathrm{A}/\lambda=k$, we have $\frac{1}{2}\rho(2\pi ck)^2=1\cdot8$, giving $\rho=10^{-22}k^{-2}$ and $\mathrm{E}=10^{-1}k^{-2}$. Lord Kelvin assumed as a superior limit of k, the ratio of amplitude to wave-length, the value 10^{-2}, which is a very safe limit. It follows that the density of the aether must exceed 10^{-18}, and its elastic modulus must exceed 10^3, which is only about 10^{-8} of the modulus of rigidity of glass. It thus appears that if the amplitude of vibration could be as much as 10^{-2} of the wave-length, the aether would be an excessively rare medium with very slight elasticity; and yet it would be capable of transmitting the supply of solar energy on which all terrestrial activity depends. But on the modern theory, which includes the play of electrical phenomena as a function of the aether, there are other considerations which show that this number 10^{-2} is really an enormous overestimate; and it is not impossible that the co-efficient of ultimate inertia of the aether is greater than the co-efficient of inertia (of different kind) of any existing material substance.

The question of whether the aether is carried along by the earth's motion has been considered from the early days of the undulatory theory of light. In reviving that theory at the beginning of the 19th century, Thomas Young stated his conviction that material media offered an open structure to the substance called aether, which passed through them without hindrance "like the wind through a grove of trees." Any convection of that medium could be tested by the change of effective velocity of light, which would be revealed by a prism as was suggested by F. J. D. Arago. Before 1868 Maxwell conducted the experiment by sending light from the illuminated cross-wires of an observing telescope forward through the object-glass, and through a train of prisms, and then reflecting it back along the same path; any influence of convection would conspire in altering both refractions, but yet no displacement of the image depending on the earth's motion was detected. As will be seen later, modern experiments have confirmed the entire absence of any effect, such as convection would produce, to very high precision. It has further been verified by Sir Oliver Lodge that even in very narrow spaces the aether is not entrained by its surroundings when they are put into rapid motion.

A train of ideas which strongly impressed itself on Clerk Maxwell's mind, in the early stages of his theoretical views, was put forward by Lord Kelvin in 1858; he showed that the special characteristics of the rotation of the plane of polarization, discovered by Faraday in light propagated along a magnetic field, viz. that it is doubled instead of being undone when the light retraces its path, requires the operation of some directed agency of a rotational kind, which must be related to the magnetic field. Lord Kelvin was thereby induced to identify magnetic force with rotation, involving, therefore, angular momentum in the aether. Modern theory accepts the deduction, but ascribes the momentum to the revolving ions in the molecules of matter traversed by the light; for the magneto-optic effect is present only in material media. Long previously Lord Kelvin himself came nearer this view, in offering the opinion that magnetism consisted, in some way, in the angular momentum of the material molecules, of which the energy of irregular translations constitutes heat; but the essential idea of moving electric ions of both kinds, positive and negative, in the molecules had still to be introduced.

The question of the transparency of the celestial spaces presents itself in the present connexion. Light from stars at unfathomable distances reaches us in such quantity as to suggest that space itself is absolutely transparent, leaving open the question as to whether there is enough matter scattered through it to absorb a sensible part of the light in its journey of years from the luminous body. If the aether were itself constituted of discrete molecules, on the model of material bodies, such transparency would not be conceivable. We must be content to treat the aether as a *plenum*, which places it in a class by itself; and we can thus recognize that it may behave very differently from matter, though in some manner consistent with itself—a remark which is fundamental in the modern theory.

Action across a Distance contrasted with Transmitted Action.—In the mechanical processes which we can experimentally modify at will, and which therefore we learn to apprehend with greatest fulness, whenever an effect on a body, B, is in causal connexion with a process instituted in another body, A, it is usually possible to discover a mechanical connexion between the two bodies which allows the influence of A to be traced all the way across the intervening region. The question thus arises whether, in electric attractions across apparently empty space and in gravitational attraction across the celestial regions, we are invited or required to make search for some similar method of continuous transmission of the physical effect, or whether we should rest content with an exact knowledge of the laws according to which one body affects mechanically another body at a distance. The view that our knowledge in such cases may be completely represented by means of laws of action at a distance, expressible in terms of the positions (and possibly motions) of the interacting bodies without taking any heed of the intervening space, belongs to modern times. It could hardly have been thought of before Sir Isaac Newton's discovery of the actual facts regarding universal gravitation. Although, however, gravitation has formed the most perfect instance of an influence completely expressible, up to the most extreme refinement of accuracy, in terms of laws of direct action across space, yet, as is well known, the author of this ideally simple and perfect theory held the view that it is not possible to conceive of direct mechanical action independent of means of transmission. In this belief he differed from his pupil, Roger Cotes, and from most of the great mathematical astronomers of the 18th century, who worked out in detail the task sketched by the genius of Newton. They were content with a knowledge of the truth of the principle of gravitation; instead of essaying to explain it further by the properties of a transmitting medium, they in fact modelled the whole of their natural philosophy on that principle, and tried to express all kinds of material interaction in terms of laws of direct mechanical attraction across space. If material systems are constituted of discrete atoms, separated from each other by many times the diameter of any of them, this simple plan of exhibiting their interactions in terms of direct forces between them would indeed be exact enough to apply to a wide range of questions, provided we could be certain that the laws of the forces depended only on the positions and not also on the motions of the atoms. The most important example of its successful application has been the theory of capillary action elaborated by P. S. Laplace; though even here it appeared, in the hands of Young, and in complete fulness afterwards in those of C. F. Gauss, that the definite results attainable by the hypothesis of mutual atomic attractions really reposed on much wider and less special principles—those, namely, connected with the modern doctrine of energy.

Idea of an Aether.—The wider view, according to which the hypothesis of direct transmission of physical influences expresses only part of the facts, is that all space is filled with physical activity, and that while an influence is passing across from a body, A, to another body, B, there is some dynamical process in action in the intervening region, though it appears to the senses to be mere empty space. The problem is whether we can represent the facts more simply by supposing the intervening space to be occupied by a medium which transmits physical actions, after the manner that a continuous material medium, solid or liquid, transmits mechanical disturbance. Various analogies of this sort are open to us to follow up: for example, the way in which a fluid medium transmits pressure from one immersed solid to another—or from one vortex ring belonging to the fluid to another, which is a much wider and more suggestive case; or the way in which an elastic fluid like the atmosphere transmits sound; or the way in which an elastic solid transmits waves of transverse as well as longitudinal displacement. It is on our familiarity with modes of transmission such as these, and with the exact analyses of them which the science of mathematical physics has been able to make, that our predilection for filling space with an aethereal transmitting medium, constituting a universal connexion between material bodies, largely depends; perhaps ultimately it depends most of all, like all our physical conceptions, on the intimate knowledge that we can ourselves exert mechanical effect on outside bodies only through the agencies of our limbs and sinews. The problem thus arises, Can we form a consistent notion of such a connecting medium? It must be a medium which can be effective for transmitting all the types of physical action known to us; it would be worse than no solution to have one medium to transmit gravitation, another to transmit electric effects, another to transmit light, and so on. Thus the attempt to find out a constitution for the aether will involve a synthesis of intimate correlation of the various types of physical agencies, which appear so different to us mainly because we perceive them through different senses. The evidence for this view, that all these agencies are at bottom connected together and parts of the same scheme, was enormously strengthened during the latter half of the 19th century by the development of a relation of simple quantitative equivalence between them; it has been found that we can define quantities relating to them, under the names of mechanical energy, electric energy, thermal energy, and so on, so that when one of them disappears, it is replaced by the others to exactly equal amount. This single principle of energy has transformed physical science by making possible the construction of a network of ramifying connexions between its various departments; it thus stimulates the belief that these constitute a single whole, and encourages the search for the complete scheme of interconnexion of which the principle of energy and the links which it suggests form only a single feature.

In carrying out this scientific procedure false steps will from time to time be made, which will have to be retraced, or rather amended; but the combination of experimental science with theory has elevated our presumption of the rationality of all natural processes, so far as we can apprehend them at all, into practical certainty; so that, though the mode of presentation of the results may vary from age to age, it is hardly conceivable that the essentials of the method are not of permanent validity.

Atomic Structure of Matter.—The greatest obstacle to such a search for the fundamental medium is the illimitable complexity of matter, as contrasted with the theoretical simplicity and uniformity of the physical agencies which connect together its different parts. It has been maintained since the times of the early Greek philosophers, and possibly even more remote ages, that matter is constituted of independent indestructible units, which cannot ever become divided by means of any mutual actions they can exert. Since the period, a century ago, when Dalton and his contemporaries constructed from this idea a scientific basis for chemistry, the progress of that subject has been wonderful beyond any conception that could previously have been entertained; and the atomic theory in some form appears to be an indispensable part of the framework of physical science. Now this doctrine of material atoms is an almost necessary corollary to the doctrine of a universal aether. For if we held that matter is continuous, one of two alternatives would be open. We might consider that matter and aether can coexist in the same space; this would involve the co-existence and interaction of a double set of properties, introducing great complication, which would place any coherent scheme of physical action probably beyond the powers of human analysis. Or we might consider that aether exists only where matter is not, thus making it a very rare and subtle and elastic kind of matter; then we should have to assign these very properties to the matter itself where it replaces aether, in addition to its more familiar properties, and the complication would remain. The other course is to consider matter as formed of ultimate atoms, each the nucleus or core of an intrinsic modification impressed on the surrounding region of the aether; this might conceivably be of the nature of vortical motion of a liquid round a ring-core, thus giving a vortex atom, or of an intrinsic strain of some sort radiating from a core, which would give an electric atom. We recognize an atom only through its physical activities, as manifested in its interactions with other atoms at a distance from it; this field of physical activity would be identical with the surrounding field of aethereal motion or strain that is inseparably associated with the nucleus, and is carried on along with it as it moves. Here then we have the basis of a view in which there are not two media to be considered, but one medium, homogeneous in essence and differentiated as regards its parts only by the presence of nuclei of intrinsic strain or motion—in which the physical activities of matter are identified with those arising from the atmospheres of modified aether which thus belong to its atoms. As regards laws of general physical interactions, the atom is fully represented by the constitution of this atmosphere, and its nucleus may be left out of our discussions; but in the problems of biology great tracts of invariable correlations have to be dealt with, which seem hopelessly more complex than any known or humanly possible physical scheme. To make room for these we have to remember that the atomic nucleus has remained entirely undefined and beyond our problem; so that what may occur, say when two molecules come into close relations, is outside physical science—not, however, altogether outside, for we know that when the vital *nexus* in any portion of matter is dissolved, the atoms will remain, in their number, and their atmospheres, and all inorganic relations, as they were before vitality supervened.

Nature of Properties of Material Bodies.—It thus appears that the doctrine of atomic material constitution and the doctrine of a universal aether stand to each other in a relation of mutual support; if the scheme of physical laws is to be as precise as observation and measurement appear to make it, both doctrines are required in our efforts towards synthesis. Our direct knowledge of matter can, however, never be more than a rough knowledge of the general average behaviour of its molecules; for the smallest material speck that is sensible to our coarse perceptions contains myriads of atoms. The properties of the most minute portion of matter which we can examine are thus of the nature of averages. We may gradually invent means of tracing more and more closely the average drifts of translation or orientation, or of changes of arrangement, of the atoms; but there will always remain an unaveraged residue devoid of any recognized regularity, which we can only estimate by its total amount. Thus, if we are treating of energy, we can separate out mechanical and electric and other constituents in it; and there will be a residue of which we know nothing except its quantity, and which we call thermal. This merely thermal energy—which is gradually but very slowly being restricted in amount as new subsidiary organized types become recognized in it—though transmutable in equivalent quantities with the other kinds, yet is so only to a limited extent; the tracing out of the laws of this limitation belongs to the science of thermodynamics. It is the business of that science to find out what is the greatest amount of thermal energy that can possibly be recoverable into organized kinds under given circumstances. The discovery of definite laws in this region might at first sight seem hopeless; but the argument rests on an implied postulate of stability and continuity of constitution of material substances, so that after a cycle of transformations we expect to recover them again as they were originally—on the postulate, in fact, that we do not expect them to melt out of organized existence in our hands. The laws of thermodynamics, including the fundamental principle that a physical property, called temperature, can be defined, which tends towards uniformity, are thus relations between the properties of types of material bodies that can exist permanently in presence of each other; why they so maintain themselves remains unknown, but the fact gives the *point d'appui*. The fundamental character of energy in material systems here comes into view; if there were any other independent scalar entity, besides mass and energy, that pervaded them with relations of equivalence, we should expect the existence of yet another set of qualities analogous to those connected with temperature. (See ENERGETICS.)

Returning now to the aether, on our present point of view no such complications there arise; it must be regarded as a continuous uniform medium free from any complexities of atomic aggregation, whose function is confined to the transmission of the various types of physical effect between the portions of matter. The problem of its constitution is thus one which can be attacked and continually approximated to, and which may possibly be definitely resolved. It has to be competent to transmit the transverse waves of light and electricity, and the other known radiant and electric actions; the way in which this is done is now in the main known, though there are still questions as to the mode of expression and formulation of our knowledge, and also as regards points of detail. This great advance, which is the result of the gradual focussing of a century's work in the minute exploration of the exact laws of optical and electric phenomena, clearly carries with it deeper insight into the physical nature of matter itself and its modes of inanimate interaction.

If we rest on the synthesis here described, the energy of the matter, even the thermal part, appears largely as potential energy of strain in the aether which interacts with the kinetic energy associated with disturbances involving finite velocity of matter. It may, however, be maintained that an ultimate analysis would go deeper, and resolve all phenomena of elastic resilience into consequences of the kinetic stability of steady motional states, so that only motions, but not strains, would remain. On such a view the aether might conceivably be a perfect fluid, its fundamental property of elastic reaction arising (as at one time suggested by Kelvin and G. F. FitzGerald) from a structure of tangled or interlaced vortex filaments pervading its substance, which might conceivably arrange themselves into a stable configuration and so resist deformation. This raises the further question as to whether the transmission of gravitation can be definitely recognized among the properties of an ultimate medium; if so, we know that it must be associated with some feature, perhaps very deep-seated, or on the other hand perhaps depending simply on incompressibility, which is not sensibly implicated in the electric and optical activities. With reference to all such further refinements of theory, it is to be borne in mind that the perfect fluid of hydrodynamic analysis is not a merely passive inert *plenum*; it is also a *continuum* with the property that no finite internal slip or discontinuity of motion can ever arise in it through any kind of disturbance; and this property must be postulated, as it cannot be explained.

Motion of Material Atoms through the Aether.—An important question arises whether, when a material body is moved through the aether, the nucleus of each atom carries some of the surrounding aether along with it; or whether it practically only carries on its strain-form or physical atmosphere, which is transferred from one portion of aether to another after the manner of a shadow, or rather like a loose knot which can slip along a rope without the rope being required to go with it. We can obtain a pertinent illustration from the motion of a vortex ring in a fluid; if the circular core of the ring is thin compared with its diameter, and the vorticity is not very great, it is the vortical state of motion that travels across the fluid without transporting the latter bodily with it except to a slight extent very close to the core. We might thus examine a structure formed of an aggregation of very thin vortex rings, which would move across the fluid without sensibly disturbing it; on the other hand, if formed of stronger vortices, it may transport the portion of the fluid that is within, or adjacent to, its own structure along with it as if it were a solid mass, and therefore also push aside the surrounding fluid as it passes. The motion of the well-known steady spherical vortex is an example of the latter case.

Convection of Optical Waves.—The nature of the motion, if any, that is produced in the surrounding regions of the aether by the translation of matter through it can be investigated by optical experiment. The obvious body to take in the first instance is the earth itself, which on account of its annual orbital motion is travelling through space at the rate of about 18 miles per second. If the surrounding aether is thereby disturbed, the waves of light arriving from the stars will partake of its movement; the ascertained phenomena of the astronomical aberration of light show that the rays travel to the observer, across this disturbed aether near the earth, in straight lines. Again, we may split a narrow beam of light by partial reflexion from a transparent plate, and recombine the constituent beams after they have traversed different circuits of nearly equivalent lengths, so as to obtain interference fringes. The position of these fringes will depend on the total retardation in time of the one beam with respect to the other; and thus it might be expected to vary with the direction of the earth's motion relative to the apparatus. But it is found not to vary at all, even up to the second order of the ratio of the earth's velocity to that of light. It has in fact been found, with the very great precision of which optical experiment is capable, that all terrestrial optical phenomena—reflexion, refraction, polarization linear and circular, diffraction—are entirely unaffected by the direction of the earth's motion, while the same result has recently been extended to electrostatic forces; and this is our main experimental clue.

We pass on now to the theory. We shall make the natural supposition that motion of the aether, say with velocity (u,v,w) at the point (x,y,z), is simply superposed on the velocity V of the optical undulations through that medium, the latter not being intrinsically altered. Now the direction and phase of the light are those of the ray which reaches the eye; and by Fermat's principle, established by Huygens for undulatory motion, the path of a ray is that track along which the disturbance travels in least time, in the restricted sense that any alteration of any *short* reach of the path will increase the time. Thus the path of the ray when the aether is at rest is the curve which makes $\int ds/\mathrm{V}$ least; but when it is in motion it is the curve which makes $\int ds/(\mathrm{V}+lu+mv+nw)$ least, where (l,m,n) is the direction vector of δs. The latter integral becomes, on expanding in a series,

$$\int ds/\mathrm{V} - \int(udx+vdy+wdz)/\mathrm{V}^2 + \int(udx+vdy+wdz)^2/\mathrm{V}^3ds + \ldots,$$

since $lds=dx$. If the path is to be unaltered by the motion of the aether, as the law of astronomical aberration suggests, this must differ from $\int ds/\mathrm{V}$ by terms not depending on the path—that is, by terms involving only the beginning and end of it. In the case of the free aether V is constant; thus, if we neglect squares like $(u/\mathrm{V})^2$, the condition is that $udx+vdy+wdz$ be the exact differential of some function ϕ. If this relation is true along all paths, the velocity of the aether must be of irrotational type, like that of frictionless fluid. Moreover, this is precisely the condition for the absence of interference between the component of a split beam; because, the time of passage being to the first order

$$\int ds/\mathrm{V} - \int(udx+vdy+wdz)\mathrm{V}^2,$$

the second term will then be independent of the path (ϕ being a single valued function) and therefore the same for the paths of both the interfering beams. If therefore the aether can be put into motion, we conclude (with Stokes) that such motion, in free space, must be of strictly irrotational type.

But our experimental data are not confined to free space. If c is the velocity of radiation in free space and μ the refractive index of a transparent body, $\mathrm{V}=c/\mu$; thus it is the expression $c^{-2}\int\mu^2(u'dx+v'dy+w'dz)$ that is to be integrable explicitly, where now (u',v',w') is what is added to V owing to the velocity (u,v,w) of the medium. As, however, our terrestrial optical apparatus is now all in motion along with the matter, we must deal with the rays relative to the moving system, and to these also Fermat's principle clearly applies; thus $\mathrm{V}+(lu'+mv'+nw')$ is here the velocity of radiation in the direction of the ray, but relative to the moving material system. Now the expression above given cannot be integrable exactly, under all circumstances and whatever be the axes of co-ordinates, unless $(\mu^2u',\mu^2v^1,\mu^2w')$ is the gradient of a continuous function. In the simplest case, that of uniform translation, these components of the gradient will each be constant throughout the region; at a distant place in free aether where there is no motion, they must thus be equal to $-u,-v,-w$, as they refer to axes moving with the matter. Hence the paths and times of passage of all rays relative to the material system will not be altered by a uniform motion of the system, provided the velocity of radiation relative to the system, in material of index μ, is diminished by μ^{-2} times the velocity of the system in the direction of the radiation, that is, provided the absolute velocity of radiation is increased by $1-\mu^{-2}$ times the velocity of the material system; this involves that the free aether for which μ is unity shall remain at rest. This statement constitutes the famous hypothesis of Fresnel, which thus ensures that all phenomena of ray-path and refraction, and all those depending on phase, shall be unaffected by uniform convection of the material medium, in accordance with the results of experiment.

Is the Aether Stationary or Mobile?—This theory secures that the times of passage of the rays shall be independent of the motion of the system, only up to the first order of the ratio of its velocity to that of radiation. But a classical experiment of A. A. Michelson, in which the ray-path was wholly in air, showed that the independence extends to higher orders. This result is inconsistent with the aether remaining at rest, unless we assume that the dimensions of the moving system depend, though to an extent so small as to be not otherwise detectable, on its orientation with regard to the aether that is streaming through it. It is, however, in complete accordance with a view that would make the aether near the earth fully partake in its orbital motion—a view which the null effect of convection on all terrestrial optical and electrical phenomena also strongly suggests. But the aether at a great distance must in any case be at rest; while the facts of astronomical aberration require that the motion of that medium must be irrotational. These conditions cannot be consistent with sensible convection of the aether near the earth without involving discontinuity in its motion at some intermediate distance, so that we are thrown back on the previous theory.

Another powerful reason for taking the aether to be stationary is afforded by the character of the equations of electrodynamics; they are all of linear type, and superposition of effects is possible. Now the kinetics of a medium in which the parts can have finite relative motions will lead to equations which are not linear—as, for example, those of hydrodynamics—and the phenomena will be far more complexly involved. It is true that the theory of vortex rings in hydrodynamics is of a simpler type; but electric currents cannot be likened to permanent vortex rings, because their circuits can be broken and the element of cyclic steadiness on which the simplicity depends is thereby destroyed.

Dynamical Theories of the Aether.—The analytical equations which represent the propagation of light in free aether, and also in aether modified by the presence of matter, were originally developed on the analogy of the equations of propagation of elastic effects in solid media. Various types of elastic solid medium have thus been invented to represent the aether, without complete success in any case. In T. MacCullagh's hands the correct equations were derived from a single energy formula by the principle of least action; and while the validity of this dynamical method was maintained, it was frankly admitted that no mechanical analogy was forthcoming. When Clerk Maxwell pointed out the way to the common origin of optical and electrical phenomena, these equations naturally came to repose on an electric basis, the connexion having been first definitely exhibited by FitzGerald in 1878; and according as the independent variable was one or other of the vectors which represent electric force, magnetic force or electric polarity, they took the form appropriate to one or other of the elastic theories above mentioned.

In this place it must suffice to indicate the gist of the more recent developments of the electro-optical theory, which involve the dynamical verification of Fresnel's hypothesis regarding optical convection and the other relations above described. The aether is taken to be at rest; and the strain-forms belonging to the atoms are the electric fields of the intrinsic charges, or electrones, involved in their constitution. When the atoms are in motion these strain-forms produce straining and unstraining in the aether as they pass across it, which in its motional or kinetic aspect constitutes the resulting magnetic field; as the strains are slight the coefficient of ultimate inertia here involved must be great. True electric current arises solely from convection of the atomic charges or electrons; this current is therefore not restricted as to form in any way. But when the rate of change of aethereal strain—that is, of (f,g,h) specified as Maxwell's electric displacement in free aether—is added to it, an analytically convenient vector (u,v,w) is obtained which possesses the characteristic property of being circuital like the flow of an incompressible fluid, and has therefore been made fundamental in the theory by Maxwell under the name of the total electric current.

As already mentioned, all efforts to assimilate optical propagation to transmission of waves in an ordinary solid medium have failed; and though the idea of regions of intrinsic strain, as for example in unannealed glass, is familiar in physics, yet on account of the absence of mobility of the strain no attempt had been made to employ them to illustrate the electric fields of atomic charges. The idea of MacCullagh's aether, and its property of purely rotational elasticity which had been expounded objectively by W. J. M. Rankine, was therefore much vivified by Lord Kelvin's specification (*Comptes Rendus*, 1889) of a material gyrostatically constituted medium which would possess this character. More recently a way has been pointed out in which a mobile permanent field of electric force could exist in such a medium so as to travel freely in company with its nucleus or intrinsic charge—the nature of the mobility of the latter, as well as its intimate constitution, remaining unknown.

A dielectric substance is electrically polarized by a field of electric force, the atomic poles being made up of the displaced positive and negative intrinsic charges in the atom: the polarization per unit volume (f',g',h') may be defined on the analogy of magnetism, and $d/dt(f',g',h')$ thus constitutes true electric current of polarization, *i.e.* of electric separation in the molecules, specified per unit volume. The convection of a medium thus polarized involves electric disturbance, and therefore must contribute to the true electric current; the determination of this constituent of the current is the most delicate point in the investigation. The usual definition of the component current in any direction, as the net amount of electrons which crosses, towards the positive side, an element of surface *fixed in space* at right angles to that direction, per unit area per unit time, here gives no definite result. The establishment and convection of a single polar atom constitutes in fact a *quasi*-magnetization, in addition to the polarization current as above defined, the negative poles completing the current circuits of the positive ones. But in the transition from molecular theory to the electrodynamics of extended media, all magnetism has to be replaced by a distribution of current; the latter being now specified by volume as well as by flow so that $(u,v,w)\,\delta\tau$ is the current in the element of volume $\delta\tau$. In the present case the total dielectric contribution to this current works out to be the change per unit time in the electric separation in the molecules of the element of volume, as it moves *uniformly* with the matter, all other effects being compensated molecularly without affecting the propagation.[1] On subtracting from this total the current of establishment of polarization $d/dt/(f',g',h')$ as formulated above, there remains $vd/dx(f',g',h')$ as the current of convection of polarization when the convection is taken for simplicity to be in the direction of the axis of x with velocity v. The polarization itself is determined from the electric force (P,Q,R) by the usual statical formula of linear type which becomes for an isotropic medium

$$(f',g',h')=\frac{\mathrm{K}-1}{4\pi\mathrm{c}^2}(\mathrm{P},\mathrm{Q},\mathrm{R}),$$

because any change of the dielectric constant K arising from the convection of the material through the aether must be independent of the sign of v and therefore be of the second order. Now the *electric force* (P,Q,R) is the force acting on the electrons of the medium moving with velocity v; consequently by Faraday's electrodynamic law

$$(\mathrm{P},\mathrm{Q},\mathrm{R})=(\mathrm{P}',\mathrm{Q}'-v\mathrm{c},\ \mathrm{R}'+vb)$$

where (P′,Q′,R′) is the force that would act on electrons at rest, and (a,b,c) is the magnetic induction. The latter force is, by Maxwell's hypothesis or by the dynamical theory of an aether pervaded by electrons, the same as that which strains the aether, and may be called the *aethereal force*; it thereby produces an aethereal electric displacement, say (f,g,h), according to the relation $(f,g,h)=(4\pi\mathrm{c}^2)^{-1}(\mathrm{P}',\mathrm{Q}',\mathrm{R}^1)$, in which c is a constant belonging to the aether, which turns out to be the velocity of light. The current of aethereal displacement $d/dt(f,g,h)$ is what adds on to the true electric current to produce the total circuital current of Maxwell.

We have now to substitute these data in the universally valid circuital relations—namely, (i) line integral of magnetic force round a circuit is equal to 4π times the current through its aperture, which may be regarded as a definition of the constitution of the aether and its relation to the electrons involved in it; and (ii) line integral of the electric force belonging to any material circuit (*i.e.* acting on the electrons situated on it which move with the velocity of the matter) is equal to *minus* the time-rate of change of the magnetic induction through that circuit as it moves with the matter, this being a dynamical consequence of the aethereal constitution assigned in (i).

We may now, as is somewhat the more natural course in the terrestrial application, take axes (x,y,z) which move with the matter; but the current must be invariably defined by the flux across surfaces fixed in space, so that we may say that relation (i) refers to a circuit fixed in space, while (ii) refers to one moving with the matter. These circuital relations, when expressed analytically, are then for a dielectric medium of types

$$\frac{d\gamma}{dy}-\frac{d\beta}{dz}=4\pi u,\ldots,\ldots,$$

where $$(u,v,w)=\left(\frac{d}{dt}+v\frac{d}{dx}\right)(f',g',h')+\frac{d}{dt}(f,g,h),$$

and $$\frac{d\mathrm{R}}{dy}-\frac{d\mathrm{Q}}{dz}=-\frac{da}{dt},\ldots,\ldots,\ .$$

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[1] See H. A. Lorentz, *loc. cit. infra*; J. Larmor, *Aether and Matter*, p. 262 and *passim*.

where, when magnetic quality is inoperative, the magnetic induction (a,b,c) is identical with the magnetic force (α,β,γ).

These equations determine all the phenomena. They take this simple form, however, only when the movement of the matter is one of translation. If v varies with respect to locality, or if there is a velocity of convection (p,q,r) variable with respect to direction and position, and analytical expression of the relation (ii) assumes a more complex form; we thus derive the most general equations of electrodynamic propagation for matter treated as continuous, anyhow distributed and moving in any manner.

For the simplest case of polarized waves travelling parallel to the axis of x, with the magnetic oscillation γ along z and the electric oscillation Q along y, all the quantities are functions of x and t alone; the total current is along y and given with respect to our moving axes by

$$v=\left(\frac{d}{dt}-v\frac{d}{dx}\right)\frac{\mathrm{Q}+v\gamma}{4\pi\mathrm{c}^2}+\frac{d}{dt}\left(\frac{\mathrm{K}-1}{4\pi\mathrm{c}^2}\right)\mathrm{Q};$$

also the circuital relations here reduce to

$$-\frac{d\gamma}{dx}=4\pi v,\quad \frac{d\mathrm{Q}}{dx}=-\frac{d\gamma}{dt};$$

thus

$$\frac{d^2\mathrm{Q}}{dx^2}=4\pi\frac{dv}{dt}$$

giving, on substitution for v,

$$(\mathrm{c}^2-v^2)\frac{d^2\mathrm{Q}}{dx^2}=\mathrm{K}\frac{d^2\mathrm{Q}}{dt^2}-2v\frac{d^2\mathrm{Q}}{dxdt}.$$

For a simple wave-train, Q varies as sin $m(x-\mathrm{V}t)$, leading on substitution to the velocity of propagation V relative to the moving material, by means of the equation $\mathrm{KV}^2+2v\mathrm{V}=\mathrm{c}^2-v^2$; this gives, to the first order of v/c, $\mathrm{V}=\mathrm{c}/\mathrm{K}^{\frac{1}{2}}-v/\mathrm{K}$, which is in accordance with Fresnel's law. Trains of waves nearly but not quite homogeneous as regards wave-length will as usual be propagated as wave-groups travelling with the slightly different velocity $d(\mathrm{V}\lambda^{-1})/d\lambda^{-1}$, the value of K occurring in V being a function of λ determined by the law of optical dispersion of the medium.

For purposes of theoretical discussions relating to moving radiators and reflectors, it is important to remember that the dynamics of all this theory of electrons involves the neglect of terms of the order $(v/\mathrm{c})^2$, not merely in the value of K but throughout.

Recent Experimental Developments.—The modification of the spectrum of a radiating gas by a magnetic field, such as would result from the hypothesis that the radiators are the system of revolving or oscillating electrons in the molecule, was detected by P. Zeeman in 1896, and worked up, in conjunction with H. A. Lorentz, on the general lines suggested by the electron-theory of molecular constitution. While it cannot be said that the full significance of this very definite phenomenon, consisting of the splitting of the spectral line into a number of polarized components, has yet been made out, a wide field of correlation with optical theory, especially in the neighbourhood of absorption bands, has been developed by Zeeman himself, by A. H. Becquerel, by D. Macaluso and O. M. Corbino, and by other workers.

The most fundamental experimental confirmation that the theory of the aether has received on the optical side in recent years has been the verification of Maxwell's proposition that radiation exerts mechanical force on a material system, on which it falls, which may be represented in all cases as the resultant of pressures operating along the rays, and of intensity equal at each point of free space to the density of radiant energy. A high vacuum is needed for the detection of the minute forces here concerned; but just in that case the indirect radiometer-effect of the heating of the residual gas masks the effect. P. N. Lebedew in 1900 succeeded, by operating on metallic vanes so thin that the exposed and averted faces were practically at the same temperature, in satisfactorily verifying the relation for metals; and very soon after, E. F. Nichols and G. F. Hull published accounts of an exact and extensive research, in which the principle had been fully and precisely confirmed as regards both transparent and opaque bodies. The experiment of J. H. Poynting may also be mentioned, in which the tangential component of the thrust of obliquely incident radiation is separately put in evidence, by the torsion produced in an arrangement which is not sensitive to the normal component or to the radiometer-pressure of the residual gas. (See RADIOMETER.)

Next to these researches on the pressure of radiation, which, by forming the mechanical link between radiation and matter, are fundamental for the thermodynamics of radiant energy, the most striking recent result has been the discovery of H. Rubens and E. Hagen that for dark heat rays of only about ten times the wave-length of luminous radiation, the properties of metals are determined by their electric resistance alone, which then masks all resonance due to periods of free vibration of the molecules; and, moreover, that the resistance for such alternations is practically the same as the ohmic resistance for ordinary steady currents. They found that the absorbing powers of the metals, and therefore, by the principle of exchanges, their radiating powers also, are proportional to the square roots of their electric conductivities. Maxwell had himself, at an early stage of his theory, tested the absorbing power of gold-leaf for light, and found that the effective conductivity for luminous vibrations must be very much greater than its steady ohmic value; it is, in fact, there a case of *incipient* conductivity, which is continually being undone on account of the rapid alternation of force before it is fully established. That, however, complete conduction should arrive with alternations only ten times slower than light was an unexpected and remarkable fact, which verifies the presumption that the process of conduction is one in which the dynamic activities of the molecules do not come into play. The corollary, that the electric resistance of a metal can be determined in absolute units by experiments on the reflexion of heat-rays from its surface, is a striking illustration of the unification of the various branches of physical science, which has come in the train of the development of the theory of the aether. (See RADIATION.)

Finally, reference should be made to the phenomena of radio-activity, whether excited by the electric discharge in vacuum tubes, foreshadowed in part by Sir Wm. Crookes and G. G. Stokes, and later by A. Schuster and others, but first fully developed with astonishing results including the experimental discovery of the free electron by J. J. Thomson, or the correlated phenomena occurring spontaneously in radio-active bodies as discovered by H. Becquerel and by M. and Mme Curie, and investigated by them and by E. Rutherford and others. These results constitute a far-reaching development of the modern or electrodynamic theory of the aether, of which the issue can hardly yet be foreseen.

REFERENCES.—Maxwell, *Collected Papers;* H. A. Lorentz, *Archives Néerlandaises*, xxi. 1887, and xxv. 1892, and a tract, *Versuch einer Theorie der electrischen und optischen Erscheinungen in bewegten Körpern* (Leyden, 1895); also recent articles "Elektrodynamik" and "Elektronentheorie" in the *Encyk. der Math. Wissenschaften*, Band v. 13, 14; O. Lodge, "On Aberration Problems," *Phil. Trans.* 1893 and 1897; J. Larmor, *Phil. Trans.* 1894–95–97, and a treatise, *Aether and Matter* (1900), where full references are given. Of recent years most treatises on physical optics, *e.g.* those of P. K. L. Drude, A. Schuster, R. W. Wood, have been written largely on the basis of the general physics of the aether; while the *Collected Papers* of Lord Rayleigh should be accessible to all who desire a first-hand knowledge of the development of the optical side of the subject. See also MOLECULE, ELECTRICITY, LIGHT and RADIATION. (J. L.*)

AETHICUS (=ETHICUS) **ISTER,** "the philosopher of Istria," the supposed but unknown author of a description of the world written in Greek. An abridgment, under the title of *Cosmographia Ethici*, written in barbarous Latin, and wrongly described as the work of St Jerome, probably belongs to the 7th century. After a discussion of the creation of the world and a description of the earth, an account of the wonderful journeys of Aethicus is given, with digressions on various subjects, such as Alexander the Great and the kings of Rome, full of obscure and fabulous details.

The name Aethicus is also attached to another geographical treatise probably dating from the 6th century, a reproduction, with some unimportant additions, of the cosmography—little else than a dry list of names—of Julius Honorius.

Editions.—D'Avezac (1852); Pertz (1853); Wuttke (1854); Riese's *Geographi Latini Minores* (1878); see also Bunbury, *History of Ancient Geography*.

AETIOLOGY, or Etiology (from Gr. *αἰτία*, cause, and *λογία*, discourse), strictly, the science or philosophy of causation, but generally used to denote the part of any special science (and especially of that of medicine and disease) which investigates the causes and origin of its phenomena. An *aetiological myth* is one which is regarded as having been invented *ex post facto* to explain some fact, name or coincidence, the true account or origin of which has been forgotten. Such myths were often based on grotesque philological analogies, according to which an existing connexion between two personalities (cities, &c.) was traced back to a common mythical origin. For a good example of the evolution of such myths, see the argument under Aegina, *History*.

AETION, or Eetion, a Greek painter, mentioned by Cicero, Pliny and Lucian. His most noted work, described in detail by Lucian (*Herodotus or Eetion*, 5), was a picture representing the marriage of Alexander and Roxana. He is said to have exhibited it at the Olympic games, and by it so to have won the favour of the president that he gave him his daughter in marriage. Through a misunderstanding of the words of Lucian, Aetion has been supposed to belong to the age of the Antonines; but there can be little doubt that he was a contemporary of Alexander and of Apelles (Brunn, *Geschichte der griechischen Künstler*, ii. p. 243). Pliny gives his date as 350 B.C.

AETIUS (fl. 350), surnamed "the Atheist," founder of an extreme sect of Arians, was a native of Coele-Syria. After working as a vine-dresser and then as a goldsmith he became a travelling doctor, and displayed great skill in disputations on medical subjects; but his controversial power soon found a wider field for its exercise in the great theological question of the time. He studied successively under the Arians, Paulinus, bishop of Antioch, Athanasius, bishop of Anazarbus, and the presbyter Antonius of Tarsus. In 350 he was ordained a deacon by Leontius of Antioch, but was shortly afterwards forced by the orthodox party to leave that town. At the first synod of Sirmium he won a dialectic victory over the homoiousian bishops, Basilius and Eustathius, who sought in consequence to stir up against him the enmity of Caesar Gallus. In 356 he went to Alexandria with Eunomius (*q.v.*) in order to advocate Arianism, but he was banished by Constantius. Julian recalled him from exile, bestowed upon him an estate in Lesbos, and retained him for a time at his court in Constantinople. Being consecrated a bishop, he used his office in the interests of Arianism by creating other bishops of that party. At the accession of Valens (364) he retired to his estate at Lesbos, but soon returned to Constantinople, where he died in 367. The Anomoean sect of the Arians, of whom he was the leader, are sometimes called after him *Aetians*. His work *De Fide* has been preserved in connexion with a refutation written by Epiphanius (*Haer.* lxxvi. 10). Its main thought is that the Homousia, *i.e.* the doctrine that the Son (therefore the Begotten) is essentially God, is self-contradictory, since the idea of unbegottenness is just that which constitutes the nature of God.

See A. Harnack, *History of Dogma*, vol. iv. *passim*.

AETIUS, a Greek physician, born at Amida in Mesopotamia, flourished at the beginning of the 6th century A.D. He studied at Alexandria, and became court physician at Byzantium and *comes obsequii*, one of the chief officers of the imperial household. He wrote a large medical work in sixteen books, founded on Oribasius and compiled from various sources, especially Galen [Galenos]. Superstition and mysticism play a great part in his remedies. Eight books of the Greek original were printed at Venice, 1534, and a complete Latin translation by Cornarius appeared at Basel, 1542.

See Weigel, *Aetianarum exercitationum specimen* (1791); Danelius, *Beitrag zur Augenheilkunde des Aetius* (1889); Zernos, *Aetii sermo sextidecimus et ultimus*, editio princeps (1901).

AETIUS (d. 454), a Roman general of the closing period of the Western empire, born at Dorostolus in Moesia, late in the 4th century. He was the son of Gaudentius, who, although possibly of barbarian family, rose in the service of the Western empire to be master of the horse, and later count of Africa. Aetius passed some years as hostage, first with Alaric and the Goths, and later in the camp of Rhuas, king of the Huns, acquiring in this way the knowledge which enabled him afterwards to defeat them. In 424 he led into Italy an army of 60,000 barbarians, mostly Huns, which he employed first to support the *primicerius* Joannes, who had proclaimed himself emperor, and, on the defeat of the latter, to enforce his claim to the supreme command of the army in Gaul upon Placidia, the empress-mother and regent for Valentinian III. His calumnies against his rival, Count Boniface, which were at first believed by the emperor, led Boniface to revolt and call the Vandals to Africa. Upon the discovery of the truth, Boniface, although defeated in Africa, was received into favour by Valentinian; but Aetius came down against Boniface from his Gallic wars, like another Julius Caesar, and in the battle which followed wounded Boniface fatally with his own javelin. From 433 to 450 Aetius was the dominating personality in the Western empire. In Gaul he won his military reputation, upholding for nearly twenty years, by combined policy and daring, the falling fortunes of the empire. His greatest victory was that of Châlons-sur-Marne (September 20, 451), in which he led the Gallic forces against Attila and the Huns. This was the last triumph of the empire. Three years later (454) Aetius presented himself at court to claim the emperor's daughter in marriage for his son Gaudentius; but Valentinian, suspecting him of designs upon the crown, slew him with his own hand.

See T. Hodgkin, *Italy and her Invaders*, vols. i. and ii. (1880).

AETOLIA, a district of northern Greece, bounded on the S. by the Corinthian Gulf, on the W. by the river Achelous, on the N. and E. by the western spurs of Parnassus and Oeta. The land naturally falls into two divisions. The basins of the lower Achelous (mod. *Aspropotamo*) and Euenus (*Phidharis*) form a series of alluvial valleys intersected by detached ridges which mostly run parallel to the coast. This district of "Old Aetolia" lacks a suitable sea-board, but the inland, and especially the plain of central Aetolia lying to the north of Lakes Hyria and Trichonis and Mount Aracynthus, forms a rich agricultural country. The northern and eastern regions are broken by an extensive complex of chains and peaks, whose rugged limestone flanks are clad at most with stunted shrubs and barely leave room for a few precarious mule-tracks. These heights often rise in the frontier-ranges of Tymphrestus, Oxia and Corax to more than 7000 ft.; the snow-capped pinnacle of Kiona attains to 8240 ft. A few defiles pass through this barrier to the other side of the north Greek watershed.

In early legend Old Aetolia, with its cities of Pleuron and Calydon, figures prominently. During the great migrations (see Dorians) the population was largely displaced, and the old inhabitants long remained in a backward condition. In the 5th century some tribes were still living in open villages under petty kings, addicted to plunder and piracy, and hardly recognized as Hellenes at all. Yet their military strength was not to be despised: in 426 their archers and slingers easily repelled an Athenian invasion under Demosthenes. In the 4th century the Aetolians began to take a greater part in Greek politics, and, in return for helping Epaminondas (367) and Philip of Macedon (338), recovered control of their sea-board, to which they annexed the Acarnanian coast and the Oeniadae. Aetolia's prosperity dates from the period of Macedonian supremacy. It may be ascribed partly to the wealth and influence acquired by Aetolian mercenaries in Hellenistic courts, but chiefly to the formation of a national Aetolian league, the first effective institution of this kind in Greece. Created originally to meet the peril of an invasion by the Macedonian regents Antipater and Craterus, who had undertaken a punitive expedition against Aetolia after the Lamian War (322), and by Cassander (314–311), the confederacy grew rapidly during the subsequent period of Macedonian weakness. Since 290 it had extended its power over all the uplands of central Greece, where its command over Heracleia (280) provided it with an important defensive position against northern invaders, its control of Delphi and the Amphictyonic council with a useful political instrument. The valour of the Aetolians was conspicuously displayed in 279, when they broke the strength of the Celtic irruption by slaughtering great hordes of marauders. The commemorative festival of the Soteria, which the league established at Delphi, obtained recognition from many leading Greek states. After annexing Boeotia (by 245) the Aetolians controlled all central Greece. Endeavouring next to expand into Peloponnesus, they allied themselves with Antigonus Gonatas of Macedonia against the Achaean league (*q.v.*), and besides becoming protectors of Elis and Messenia won several Arcadian cities. Their naval power extended to Cephalonia, to the Aegaean islands and even to the Hellespont. The league at its zenith had thus a truly imperial status.

Later in the century its power began to be sapped by Macedonia. To check King Demetrius (239–229) the Aetolians joined arms with the Achaeans. In 224 they held Heracleia Trachis against Antigonus Doson, but lost control of Boeotia and Phocis. Since 228 their Arcadian possessions had been abandoned to Sparta. At the same time a new enemy arose in the Illyrian pirate fleets, which outdid them in unscrupulousness and violence. The raids of two Aetolian chiefs in Achaean territory (220) led to a coalition between Achaea and Philip V. of Macedon, who assailed the invaders with great energy, driving them out of Peloponnesus and marching into Aetolia itself, where he surprised and sacked the federal capital Thermon. After buying peace by the cession of Acarnania (217) the league concluded a compact with Rome, in which both states agreed to plunder ruthlessly their common enemies (211). In the great war of their Roman allies against Philip the federal troops took a prominent part, their cavalry being largely responsible for the victory of Cynoscephalae (197). The Romans in return restored central Greece to the league, but by withholding its former Thessalian possessions excited its deep resentment. The Aetolians now invited Antiochus III. of Syria to European Greece, and so precipitated a conflict with Rome. But in the war they threw away their chances. In 192 they wasted themselves in an unsuccessful attempt to secure Sparta. In 191 they supported Antiochus badly, and by their slackness in the defence of Thermopylae made his position in Greece untenable. Having thus isolated themselves the Aetolians stood at bay behind their walls against the Romans, who refused all compromises, and, after the general surrender in 189, restricted the league to Aetolia proper and assumed control over its foreign relations. In 167 the country suffered severely from the intrigues of a philo-Roman party, which caused a series of judicial murders and the deportation of many patriots to Italy. By the time of Sulla, when the league is mentioned for the last time, its functions were purely nominal. The federal constitution closely resembled that of the Achaean league (*q.v.*), for which it doubtless served as a model. The general assembly, convoked every autumn at Thermon to elect officials, and at other places in special emergencies, shaped the league's general policy; it was nominally open to all freemen, though no doubt the Aetolian chieftains really controlled it. The council of deputies from the confederate cities undertook the routine of administration and jurisdiction. The *strategus* (general), aided by 30 *apocleti* (ministers), had complete control in the field and presided over the assembly, though with restricted advisory powers. The Aetolians also used the Amphictyonic synod for passing solemn enactments. The league's relation to outlying dependencies is obscure; many of these were probably mere protectorates or "allied states" and secured no representation. The federal executive was certainly much more efficient than that of the Achaeans, and its councils suffered less from disunion; but its generals and admirals, official or otherwise, enjoyed undue licence; hence the league deservedly gained an evil name for the numerous acts of lawlessness or violence which its troops committed. But as a champion of republican Greece against foreign enemies no other power of the age rendered equal services. After the first overthrow of the Byzantine empire Aetolia passed to a branch of the old imperial house (1205). In the 15th century it was held by Scanderbeg (*q.v.*) and by the Venetians, but Mahommed II. brought it definitely under Turkish rule. In the War of Independence the Aetolians by their stubborn defence, culminating in the sieges of Missolonghi (*q.v.*), formed the backbone of the rebellion. Northern Aetolia remains a desolate region, inhabited mainly by Vlach shepherds. The south-western plain, though rendered unhealthy by lagoons, and central Aetolia yield good crops of currants, vine, maize and tobacco, which are conveyed by railway from Agrinion and Anatolikon to the coast. The country, which forms part of the modern department of Acarnania and Aetolia, contains numerous fragments of ancient fortifications. It has contributed a notable proportion of distinguished men to modern Greece.

AUTHORITIES.—Strabo pp. 450 sqq.; Thucydides iii. 94-98; Diodorus xviii. 24. 5; Pausanias x. 20 sq.; Polybius and Livy *passim*; W. J. Woodhouse, *Aetolia* (Oxford, 1897); M. Dubois, *Les Ligues achéenne et étolienne* (Paris, 1885); E. A. Freeman, *Federal Government* (ed. 1893, London), ch. vi.; B. V. Head, *Historia Numorum* (Oxford, 1887), pp. 283-284; M. Holleaux in *Bulletin de Correspondance Hellénique* (1905, pp. 362-372); G. Sotiriades in Ἐφημερὶς Ἀρχαιολογική, (1900) pp. 163-212, (1903) pp. 73-94, and in *Bulletin de Correspondance Hellénique* (1907), pp. 139-184; C. Salvetti in *Studi di Storia Antica*, vol. ii. (Rome, 1893), pp. 270-320. (M. O. B. C.)

AFARS (DANAKIL), a tribe of African "Arabs" of Hamitic stock. They occupy the arid coast-lands between Abyssinia and the sea. They claim to be Arabs, but are more akin to the Galla and Somali. The tribe is roughly divisible into a pastoral and a coast-dwelling group. Their religion is chiefly fetich and tree-worship; many, nominally, profess Mahommedanism. They are distinguished by narrow straight noses, thin lips and small pointed chins; their cheekbones are not prominent. They are more scantily clothed than the Abyssinians or Galla, wearing, generally, nothing but a waist-cloth. Their women, when quite young, are pretty and graceful. Their huts are often tastefully decorated, the floors being spread with yellow mats, embroidered with red and violet designs. The Afars are divided into many sub-tribes, each having an hereditary sultan, whose power is, however, limited. They are desperate fighters and in 1875 successfully resisted an attempt to bring them under Egyptian rule. In 1883–1888, however, their most important sultan concluded treaties placing his country under Italian protection. The Afar region is now partly under Abyssinian and partly under Italian authority. The Afars are also found in considerable numbers in French Somaliland. They have a saying "Guns are only useful to frighten cowards." They were formerly redoubtable pirates, but the descendants of these corsairs are now fishermen, and are the only sailors in the Red Sea who hunt the dugong.

See Fr. Scazamucci and E. H. Giglioli, *Notizie sui Danakil* (1884); P. Paulitschke, *Ethnographie Nordost-Afrikas* (2 vols., Berlin, 1893–1896), and *Die geographische Erforschung der Adâl-Länder und Harârs in Ost-Afrika* (Leipzig, 1884).

AFER, DOMITIUS, a Roman orator and advocate, born at Nemausus (Nîmes) in Gallia Narbonensis, flourished in the reigns of Tiberius, Caligula, Claudius and Nero. His pupil Quintilian calls him the greatest orator he had ever known; but he disgraced his talents by acting as public informer against some of the most distinguished personages in Rome. He gained the favour of Tiberius by accusing Claudia Pulcra, the widow of Germanicus, of adultery and the use of magic arts against the emperor. Judicious flattery secured him the consulship under Caligula (39); and under Nero he was superintendent of the water supply. He died A.D. 60, according to Jerome, of over-eating. Quintilian quotes some of his witty sayings (*dicta*), collections of which were published, and mentions two books by him *On Witnesses*.

Quintilian, *Instit.* vi. 3. 42, viii. 5. 16, x. 1. 118, &c.; Tac. *Ann* iv. 52; Dio Cassius lix. 19, lx. 33; Pliny, *Epp.* viii. 18.

AFFECTION (Lat. *ad*, and *facere*, to do something to, *sc.* a person), literally, a mental state resulting generally from an external influence. It is popularly used of a relation between persons amounting to more than goodwill or friendship. By ethical writers the word has been used generally of distinct states of feeling, both lasting and spasmodic; some contrast it with "passion" as being free from the distinctively sensual element. More specifically the word has been restricted to emotional states which are in relation to persons. In the former sense, it is the Gr. πάθος, and as such it appears in Descartes and most of the early British ethical writers. On various grounds, however—*e.g.* that it does not involve anxiety or excitement, that it is comparatively inert and compatible with the entire absence of the sensuous element—it is generally and usefully distinguished from passion. In this narrower sense the word has played a great part in ethical systems, which have spoken of the social or parental "affections" as in some sense a part of moral obligation. For a consideration of these and similar problems, which depend ultimately on the degree in which the affections are regarded as voluntary, see H. Sidgwick, *Methods of Ethics*, pp. 345-349.

In psychology the terms "affection" and "affective" are of great importance. As all intellectual phenomena have by experimentalists been reduced to sensation, so all emotion has been and is regarded as reducible to simple mental affection, the element of which all emotional manifestations are ultimately composed. The nature of this element is a problem which has been provisionally, but not conclusively, solved by many psychologists; the method is necessarily experimental, and all experiments on feeling are peculiarly difficult. The solutions proposed are two. In the first, all affection phenomena are primarily divisible into those which are pleasurable and those which are the reverse. The main objections to this are that it does not explain the infinite variety of phenomena, and that it disregards the distinction which most philosophers admit between higher and lower pleasures. The second solution is that every sensation has its specific affective quality, though by reason of the poverty of language many of these have no name. W. Wundt, *Outlines of Psychology* (trans. C. H. Judd, Leipzig, 1897), maintains that we may group under three main affective directions, each with its negative, all the infinite varieties in question; these are (*a*) pleasure, or rather pleasantness, and the reverse, (*b*) tension and relaxation, (*c*) excitement and depression. These two views are antithetic and no solution has been discovered.

Two obvious methods of experiment have been tried. The first, introduced by A. Mosso, the Italian psychologist, consists in recording the physical phenomena which are observed to accompany modifications of the affective consciousness. Thus it is found that the action of the heart is accelerated by pleasant, and retarded by unpleasant, stimuli; again, changes of weight and volume are found to accompany modifications of affection—and so on. Apart altogether from the facts that this investigation is still in its infancy and that the conditions of experiment are insufficiently understood, its ultimate success is rendered highly problematical by the essential fact that real scientific results can be achieved only by data recorded in connexion with a perfectly normal subject; a conscious or interested subject introduces variable factors which are probably incalculable.

The second is Fechner's method; it consists of recording the changes in feeling-tone produced in a subject by bringing him in contact with a series of conditions, objects or stimuli graduated according to a scientific plan and presented singly in pairs or in groups. The result is a comparative table of likes and dislikes.

Mention should also be made of a third method which has hardly yet been tried, namely, that of endeavouring to isolate one of the three "directions" by the method of suggestion or even hypnotic trance observations.

For the subject of emotion in general see modern text-books of psychology, *e.g.* those of J. Sully, W. James, G. T. Fechner, O. Külpe; Angelo Mosso, *La Paura* (Milan, 1884, 1900; Eng. trans. E. Lough and F. Kiesow, Lond. 1896); E. B. Titchener, *Experimental Psychology* (1905); art. PSYCHOLOGY and works there quoted.

AFFIDAVIT (Med. Lat. for "he has declared upon oath," from *affidare*, *fides*, faith), a written statement sworn or affirmed to before some person who has authority to administer an oath or affirmation. Evidence is chiefly taken by means of affidavits in the Chancery Division of the High Court of Justice in England on a petition, summons or motion. Interlocutory proceedings before trial are conducted by affidavits, *e.g.* for discovery of documents, hence called *affidavit of documents*. Affidavits are sometimes necessary as certificates that certain formalities have been duly and legally performed (such as service of proceedings, &c.). They are extensively used in bankruptcy practice, in the administration of the revenue and in the inferior and county courts. In testamentary causes, all documents of any kind, such as wills, codicils, drafts or instructions of same must be filed in the form of affidavits (termed *affidavits of scripts*). In Scotland the testimony of witnesses by affidavit is almost unknown, except in a few non-contentious cases as *prima facie* evidence. In the rules of the Supreme Court (R.S.C. Ord. XXXVIII.) certain formal requirements are laid down for all affidavits and affirmations in causes or matters depending in the High Court. An affidavit must consist of title, body or statement and jurat. It must be written or printed on foolscap, bookwise, in the first person; give correctly the names of the parties to the action; and the description and true place of abode of the deponent. An affidavit is confined, except on interlocutory motions, to such facts as the witness is able of his own knowledge to prove. The signature of the deponent must be written opposite to the jurat, which must contain the place, date and time of swearing, and this signed by the officer or magistrate before whom the affidavit is sworn. An affidavit sworn on a Sunday is not invalid. Quakers, Moravians and Separatists were first privileged to make a solemn declaration or affirmation, and by the Common Law Procedure Act 1852 and other statutes all persons prevented by religious belief from taking an oath were allowed to affirm; and, finally, by the Oaths Act 1888, every person who objects to be sworn is allowed to affirm in all places and for all purposes where an oath is required by law. By an act of 1835 justices are permitted to take affidavits in any matter by declaration, and a person making a false affidavit in this way is liable to punishment. The same act prohibited justices of peace from administering oaths in any matter in which they had not jurisdiction as judges, except when an oath was specially authorized by statute, as in the bankruptcy law, and excepting criminal inquiries, parliamentary proceedings and instances where oaths are required to give validity to documents abroad. Scottish justices can act in England and *vice versa*. The Oaths Act 1888 and the Commissioner of Oaths Act 1889 consolidated all previous enactments relating to oaths and gave the lord chancellor power to appoint commissioners for oaths to take affidavits for all purposes (see OATH). Under the Debtors Act 1869 a plaintiff may file an affidavit for the arrest of a debtor (*affidavit to hold to bail*) when the debt amounts to £50 or upwards, where it can be shown that the debtor's absence from the kingdom would materially prejudice the prosecution of the action.

Affidavits may be made abroad before any British ambassador, envoy, minister, *chargé d'affaires*, secretary of embassy or legation, consul or consular agent.

In the United States affidavit has the same meaning as in England and its general uses are the same, but it is not substituted for oral evidence in court to anything like the extent to which that is done in the English courts of chancery. The statutes of each state designate the persons before whom affidavits may be made outside the state, and special commissioners are appointed for that purpose by each state. Affidavits made abroad must be made before such commissioners or persons so designated, who are usually diplomatic and consular officials, justices, notaries public or mayors. "Affidavit of documents" is not generally used in the United States; discovery is procured by motion.

AFFILIATION (from Lat. *ad-filiare*, to adopt as a son), in law, the procedure by which the paternity of a bastard child is determined, and the obligation of contributing to its support enforced. In England a number of statutes on the subject have been passed, the chief being the Bastardy Act of 1845, and the Bastardy Laws Amendment Acts of 1872 and 1873. The mother of a bastard may summon the putative father to petty sessions within twelve months of the birth (or at any later time if he is proved to have contributed to the child's support within twelve months after the birth), and the justices, after hearing evidence on both sides, may, if the mother's evidence be corroborated in some material particular, adjudge the man to be the putative father of the child, and order him to pay a sum not exceeding five shillings a week for its maintenance, together with a sum for expenses incidental to the birth, or the funeral expenses, if it has died before the date of order, and the costs of the proceedings. An order ceases to be valid after the child reaches the age of thirteen, but the justices may in the order direct the payments to be continued until the child is sixteen years of age. An appeal to quarter sessions is open to the defendant, and a further appeal on questions of law to the King's Bench by rule *nisi* or *certiorari*. Should the child afterwards become chargeable to the parish, the sum due by the father may be received by the parish officer. When a bastard child, whose mother has not obtained an order, becomes chargeable to the parish, the guardians may proceed against the putative father for a contribution. Any woman who is single, a widow, or a married woman living apart from her husband, may make an application for a summons, and it is immaterial where the child is begotten, provided it is born in England. An application for a summons may be made before the birth of the child, but in this case the statement of the mother must be in the form of a sworn deposition. The defendant must be over fourteen years of age. No agreement on the part of the woman to take a sum down in discharge of the liability of the father is a bar to the making of an affiliation order. In the case of twins it is usual to make separate applications and obtain separate summonses. The Summary Jurisdiction Act 1879 makes due provision for the enforcement of an order of affiliation. In the case of soldiers an affiliation order cannot be enforced in the usual way, but by the Army Act 1881, if an order has been made against a soldier of the regular forces, and a copy of such order be sent to the secretary of state, he may order a portion of the soldier's pay to be retained. There is no such special legislation with regard to sailors in the royal navy.

In the British colonies, and in the states of the United States (with the exception of California, Idaho, Missouri, Oregon, Texas and Utah), there is some procedure (usually termed *filiation*) akin to that described above, by means of which a mother can obtain a contribution to the support of her illegitimate child from the putative father. The amount ordered to be paid may subsequently be increased or diminished (1905; 94 N.Y. Supplt. 372). On the continent of Europe, however, the legislation of the various countries differs rather widely. France, Belgium, Holland, Italy, Russia, Servia and the canton of Geneva provide no means of inquiry into the paternity of an illegitimate child, and consequently all support of the child falls upon the mother; on the other hand, Germany, Austria, Norway, Sweden, Denmark and the majority of the Swiss cantons provide for an inquiry into the paternity of illegitimate children, and the law casts a certain amount of responsibility upon the father.

Affiliation, in France, is a term applied to a species of adoption by which the person adopted succeeds equally with other heirs to the acquired, but not to the inherited, property of the deceased. (See ADOPTION. Also BASTARD; POOR LAWS.)

AUTHORITIES.—Saunders, *Law and Practice of Orders of Affiliation*; Lushington, *Law of Affiliation and Bastardy*; Little, *Poor Law Statutes*. (T. A. I.)

AFFINITY (Lat. *affinitas*, relationship by marriage, from *affinis*, bordering on, related to; *finis*, border, boundary), in law, as distinguished from consanguinity (*q.v.*), the term applied to the relation which each party to a marriage, the husband and wife, bears to the kindred of the other. Affinity is usually described as of three kinds. (1) *Direct*: that relationship which subsists between the husband and his wife's relations by blood or between the wife and the husband's relations by blood. The marriage having made them one person, the blood relations of each are held as related by affinity in the same degree to the one spouse as by consanguinity to the other. But the relation is only with the married parties themselves, and does not bring those in affinity with them in affinity with each other; so a wife's sister has no affinity to her husband's brother. This is (2) *Secondary* affinity. (3) *Collateral* affinity is the relationship subsisting between the husband and the relations of his wife's relations.

The subject is chiefly important from the matrimonial prohibitions by which the canon law has restricted relations by affinity. Taking the table of degrees within which marriage is prohibited on account of consanguinity, the rule has been thus extended to affinity, so that wherever relationship to a man himself would be a bar to marriage, relationship to his deceased wife will be the same bar, and *vice versa* on the husband's decease.

Briefly, *direct* affinity is a bar to marriage. This rule has been founded chiefly on interpretations of the eighteenth chapter of Leviticus. Formerly by law in England, marriages within the degrees of affinity were not absolutely null, but they were liable to be annulled by ecclesiastical process during the lives of both parties; in other words, the incapacity was only a canonical, not a civil, disability. By the Marriage Act 1835 all marriages of this kind not disputed before the passing of the act were declared absolutely valid, while all subsequent to it were declared null. This rendered null in England, and not merely voidable, a marriage with a deceased wife's sister or niece. (See CONSANGUINITY; MARRIAGE.)

AFFINITY, CHEMICAL, the property or relation in virtue of which dissimilar substances are capable of entering into chemical combination with each other. (See CHEMISTRY; CHEMICAL ACTION; VALENCY.)

AFFIRMATION (from Lat. *affirmare*, to assert), the declaration that something is true; in logic, a positive judgment, the union of the subject and predicate of a proposition; particularly, in law, the solemn declaration allowed to those who conscientiously object to taking an oath. (See OATH.)

AFFRAY, in law, the fighting of two or more persons in a public place to the terror (*à l' effroi*) of the lieges. The offence is a misdemeanour at English common law, punishable by fine and imprisonment. A fight in private is an assault and battery, not an affray. As those engaged in an affray render themselves also liable to prosecution for Assault (*q.v.*), Unlawful Assembly (see ASSEMBLY, UNLAWFUL), or Riot (*q.v.*), it is for one of these offences that they are usually charged. Any private person may, and constables and justices must, interfere to put a stop to an affray. In the United States the English common law as to affray applies, subject to certain modifications by the statutes of particular states (Bishop, *Amer. Crim. Law*, 8th ed., 1892, vol. i. § 535). The Indian Penal Code (sect. 159) adopts the English definition of affray, with the substitution of "actual disturbance of the peace" for "causing terror to the lieges." The Queensland Criminal Code of 1899 (sect. 72) defines affray as taking part in a fight in a public highway or taking part in a fight of such a nature as to alarm the public in any other place to which the public have access. This definition is taken from that in the English Criminal Code Bill of 1880, cl. 96. Under the Roman Dutch law in force in South Africa affray falls within the definition of *vis publica*.

AFFRE, DENIS AUGUSTE (1793–1848), archbishop of Paris, was born at St Rome, in the department of Tarn, on the 27th of September 1793. He was educated for the priesthood at St Sulpice, where in 1818 he became professor of dogmatic theology. After filling a number of ecclesiastical offices, he was elevated to the archbishopric of Paris in 1840. Though opposed to the government of Louis Philippe, he took no part in politics, but devoted himself to his pastoral work. His episcopate, however, is chiefly remembered owing to its tragic close. During the insurrection of June 1848 the archbishop was led to believe that by his personal interference peace might be restored between the soldiery and the insurgents. Accordingly, in spite of the warning of General Cavaignac, he mounted the barricade at the entrance to the Faubourg St Antoine, bearing a green branch as sign of peace. He had spoken only a few words, however, when the insurgents, hearing some shots, and fancying they were betrayed, opened fire upon the national guard, and the archbishop fell, struck by a stray bullet. He was removed to his palace, where he died on the 27th of June 1848. Next day the National Assembly issued a decree expressing their great sorrow on account of his death; and the public funeral on the 7th of July was one of the most striking spectacles of its kind. The archbishop wrote several treatises of considerable value, including an *Essai sur les hiéroglyphes egyptiens* (Paris, 1834), in which he showed that Champollion's system was insufficient to explain the hieroglyphics.

See Ricard, *Les grands évêques de l'église de France au XIXe siècle* (Lille, 1893); L. Alazard, *Denis-Auguste Affre, archevêque de Paris* (Paris, 1905).

AFFREIGHTMENT (from "freight," *q.v.*). *Contract of Affreightment* is the expression usually employed to describe the contract between a shipowner and some other person called the freighter, by which the shipowner agrees to carry goods of the freighter in his ship, or to give to the freighter the use of the whole or part of the cargo-carrying space of the ship for the carriage of his goods on a specified voyage or voyages or for a specified time; the freighter on his part agreeing to pay a specified price, called "freight," for the carriage of the goods or the use of the ship. A ship may be let like a house to some person who takes possession and control of it for a specified term. The person who hires a ship in this way occupies during the currency of his term the position of shipowner. The contract by which a ship is so let may be called a *charter-party*; but it is not, properly speaking, a contract of affreightment, and is mentioned here only because it is necessary to remember the distinction between a *charter-party* of this kind, which is sometimes called a demise of the ship, and a *charter-party* which is a form of contract of affreightment, as will hereinafter appear.

The law with regard to the contract of affreightment is, of course, a branch of the general law of contract. The rights and obligations of the shipowner and the freighter depend, as in the case of all parties to contracts, upon the terms of the agreement entered into between them. The law, however, interferes to some extent in regulating the effect to be given to contracts. Certain contracts are forbidden by the law, and being illegal are, therefore, incapable of enforcement. The most important example of illegality in the case of contracts of affreightment is when the contract involves trading with an enemy. The law interferes again with regard to the interpretation of the contract. The meaning to be given to the words of the contract, or, in other words, its construction, when a dispute arises about it, must be determined by the judge or court. The result is, that certain more or less common clauses in contracts of affreightment have come before the courts for construction, and the decisions in these cases are treated practically, though not perhaps quite logically, as rules of law determining the sense to be put upon certain forms of expression in common use in shipping contracts. A third way in which the law interferes is by laying down certain rules by which the rights of the parties are to be regulated in the absence of any express stipulation with regard to the matter dealt with by such rules. This is done either by statutory enactment, as by that part (Part VIII.) of the Merchant Shipping Act 1894 which deals with the liability of shipowners; or by established rules of the unwritten law, the "common law" as it is called, as, for instance, the rule that the common carrier is absolutely responsible for the safe delivery of the goods carried, unless it is prevented by the act of God or the king's enemies. These rules of law, whether common law or statute law, regulating the obligations of carriers of goods by sea, are of most importance in cases which are uncommon though not unknown at the present day, in which there is an affreightment without any written agreement of any kind. It will, therefore, be convenient to consider first cases of this kind where there is no express agreement, oral or written, except as to the freight and destination of the goods, and where, consequently, the rights and obligations of the parties as to all other terms of carriage depend wholly upon the rules of law, remembering always that these same rules apply when there is a written contract, except in so far as they are qualified or negatived by the terms of such contract.

Rules of law.

The rules of the common or ancient customary law of England with regard to the carriage of goods were no doubt first considered by the courts and established with regard to the carriage of goods by common carriers on land. These rules were applied to common carriers by water, and it may now be taken to be the general rule that shipowners who carry goods by sea are by the English law subject to the liabilities of common carriers. (See, as to the grounds and precise extent of this doctrine, the judgments in *Liver Alkali Company* v. *Johnson* (1874), L.R., 9 Ex. 338, and *Nugent* v. *Smith* (1876) 1 C.P.D. 423.) In practice goods are not often shipped without a written contract or acknowledgment of the terms upon which they are to be carried. For each separate consignment or parcel of goods shipped a *bill of lading* is almost invariably given, and when a whole cargo is agreed to be carried the terms are set out in a document called a *charter-party*, signed by or on behalf of the shipowner on the one part, and the shipper, who is called the *charterer*, on the other part. But at present we are considering the relations of shipowner and shipper independently of any express contract, as in a case when goods are shipped and received to be carried to the place to which the ship is bound for a certain freight, but without any further agreement as to the terms of carriage. In such a case the rights of the parties depend on the rules of law, or, which is much the same thing, upon the warranties or promises which though not expressed must, as the courts have held, be implied as arising from the relation between the parties as shipper and carrier. The obligations on the one side and the other may be defined shortly to be as follows:—The shipper must not ship goods of a nature or in a condition which he knows, or ought, if he used reasonable care, to know to be dangerous to the ship, or to other goods, unless the shipowner has notice of or has sufficient opportunity to observe their dangerous character. The shipper must be prepared, without notice from the shipowner, to take delivery of his goods with reasonable despatch on the arrival of the ship at the place of destination, being ready there to discharge in some usual discharging place. The shipper must pay the agreed freight, and will not be entitled to claim delivery until the freight has been paid. In other words, the shipowner has a *lien* on the goods carried for the freight payable in respect of the carriage. On the other hand, the obligation upon the shipowner is first and foremost to deliver safely at their destination the goods shipped, and this obligation is, by the common law, subject to this exception only that the shipowner is not liable for loss or damage caused by the act of God or the king's enemies; but by statute (Merchant Shipping Act 1894, Part VIII.) it is further qualified to this extent that the shipowner is not liable for loss, happening without his actual fault or privity, by fire on board the ship, or by the robbery or embezzlement of or making away with gold or silver or jewellery, the true nature and value of which have not been declared in writing at the time of shipment; and, further, the shipowner is not liable for damage to or loss of goods or merchandise beyond an aggregate amount, not exceeding eight pounds per ton for each ton of the ship's tonnage. The shipowner is bound by an implied undertaking, or, in other words, is made responsible by the law as if he had entered into an express undertaking: (1) that the ship is seaworthy; (2) that she shall proceed upon the voyage with reasonable despatch, and shall not deviate without necessity from the usual course of the voyage.

In default of express contract.

It is not our purpose in this article to discuss minute or doubtful questions; but in their general outline the obligations of shipper and shipowner, where no terms of carriage have been agreed, except as to the freight and destination of the goods, are such as have been described above. The importance of appreciating clearly this view of the relations of shipper and shipowner arises from the fact that these fundamental rules apply to all contracts of affreightment, whether by bill of lading, charter-party or otherwise, except in so far as they are modified or negatived by the express terms of the contract.

Bills of Lading.

The document signed by the master or agent for the shipowner, by which are acknowledged the shipment of a parcel of goods and the terms upon which it is to be carried, is called a Bill of Lading. Very many different forms of bills of lading are used. For the purpose of illustration the following form (from Mr Scrutton's book on *Charter-parties and Bills of Lading*) has been selected as a sample:—

> Shipped, in apparent good order and condition by in and upon the good Vessel called the now lying in the port of and bound for , with liberty to call at any ports in any order, to sail without Pilots, and to tow and assist Vessels in distress, and to deviate for the purpose of saving life or property; and to be delivered in the like good order and condition at the aforesaid port of unto or to his or their assigns, freight and all other conditions as per Charter Party. The act of God, perils of the sea, fire, barratry of the Master and Crew, enemies, pirates, and thieves, arrests, and restraints of princes, rulers, and people, collisions, stranding, and other accidents of navigation excepted, even when occasioned by negligence, default, or error in judgment of the Pilot, Master, Mariners, or other servants of the Shipowners.
>
> Ship not answerable for losses through explosion, bursting of boilers, breakage of shafts, or any latent defect in the machinery or hull, not resulting from want of due diligence by the Owners of the Ship, or any of them, or by the Ship's Husband or Manager.
>
> General Average payable according to York-Antwerp Rules.
>
> In Witness whereof, the Master or Agent of the said Ship hath affirmed to three Bills of Lading, all of this tenor and date, drawn as first, second and third, one of which Bills being accomplished, the others to stand void.
>
> Dated in this day of 188 .

The bill of lading is an acknowledgment of the shipment of goods in a named vessel for carriage to a specified destination on terms set forth in the document. It is usually signed by the master of the vessel, but very commonly by the agents of the shipowner or sometimes of the charterers of the vessel. A vessel may be employed by its owners to earn freight in various ways: (1) It may be placed, as it is said, on the berth as a general ship, to receive cargo from any shippers who may desire to send goods to the port, or one of the ports, to which the vessel is bound. The mate or chief officer usually superintends the loading, and, as goods are shipped, a *mate's receipt* is given as an acknowledgment of the shipment. The *mate's receipt* is afterwards exchanged for the *bill of lading*. In the case of a shipment by a general ship the bill of lading is the evidence and memorandum of the contract between the shipowner and the shipper. (2) A shipper may, however, require the whole cargo space of the vessel to carry, for example, a full cargo of grain. In such a case the vessel will be chartered by the shipowner to the shipper, and the contract will be the charter-party. Even in such a case a bill or bills of lading will usually be given to enable the shipper to deal more conveniently with the goods by way of sale or otherwise. By the ancient custom of merchants recognized and incorporated in the law, the bill of lading is a document of title, representing the goods themselves, by the transfer of which symbolical delivery of the goods may be made. But when a cargo is shipped under a charter-party, although bills of lading may be given to the charterer, it is the charter-party, and not the bills of lading, which constitutes the record of the contract between the parties—of *charter-parties* we shall treat below. (3) There is a third class of case which is a combination of the two with which we have dealt above. A vessel is very commonly chartered by her owner to a charterer who has no intention to ship and does not ship any cargo on his own account, but places the vessel on the berth to receive cargo from shippers who ship under bills of lading. The charterer receives the bill of lading freight and pays the charter-party freight, his object being of course to obtain a total bill of lading freight in excess of the chartered freight, and so make a profit. The master, although he usually remains the servant of the shipowner during the term of the charter-party, acts nevertheless under the directions and on behalf of the charterer in signing bills of lading. The legal effect of this situation is that shippers who ship goods under bills of lading without knowledge of the terms of the charter-party are entitled to look to the shipowner as the person responsible to them for the safe carriage of their goods. This right depends essentially on the fact that the master who signs the bills of lading, although in doing so he is acting for the charterer, remains nevertheless the servant of the shipowner, who is not allowed to deny as against third persons, who do not know the relations between the charterer and the shipowner, that his servant, the master of the ship, has the ordinary authority of a master to bind his owner by signing bills of lading.

The forms of bills of lading vary very much, and their clauses have been the subject of judicial consideration and decision in a vast number of reported cases. The essential particulars, or at all events those common to all bills of lading, may be stated as follows:

1. The name of the shipper.
2. The name of the ship.
3. The place of loading and destination of the ship.
4. A description of the goods shipped.
5. The place of delivery.
6. The persons to whom delivery is to be made.
7. The freight to be paid.
8. The excepted perils.
9. The shipowner's lien.

The description of (1) the shipper and (2) the ship calls for no remark. The (3) description of the voyage is important, because there is, as we have already explained, an implied undertaking by the shipowner in every contract of carriage not unnecessarily to deviate from the ordinary route of the voyage upon which the goods are received to be carried. The consequences of a deviation are serious, inasmuch as the shipowner is liable, not only for any loss or damage which the shipper suffers in consequence of the deviation, but for any loss of goods which occurs after the deviation, even though such loss is caused by one of the excepted perils. The only exception to this rule is that a deviation may be made to save life, but not to save property. It is, however, very usual to qualify the strictness of this implied undertaking by introducing in the bill of lading certain "liberties" to deviate, as, for example, in the form given above, "liberty to call at any ports in any order, to tow and assist vessels in distress, and to deviate for the purpose of saving life and property." The nature and extent of the liberty will depend on the words of the contract. The inclination of English courts has been to construe clauses giving a liberty to deviate somewhat strictly against the shipowner.

The (4) importance of the description of the goods shipped and their condition is obvious, as the contract is to deliver them as described and in the like good condition, subject, of course, to the exceptions. It must, moreover, be noted that, as against the master or person who has himself signed the bill of lading, the statement therein of the goods shipped is absolutely conclusive. But as against the shipowner, unless he has himself signed the bill of lading, the statement of the goods shipped is not conclusive. It is evidence as against him that the goods described were shipped, but he is allowed to rebut this evidence by proving, if he can, that the goods mentioned, or some of them, were not in fact shipped.

As to (5) the place of delivery, very serious questions frequently arise. Primarily, of course, the shipowner is bound to deliver at the place named. Should he be prevented by some obstacle or difficulty which is of a temporary nature, the vessel must wait, and delivery must be made as soon as possible. Where, however, the obstacle is permanent, or at all events such as must cause unreasonable delay, having regard to the nature of the adventure, the shipowner is excused from delivery at the place named in the bill of lading, provided the difficulty arises from an excepted peril, or in consequence of delivery at the place named being forbidden by the law of England, as may happen, for example, in the case of a declaration of war between Great Britain and the state in which the port named in the bill of lading is situate. A party to a contract cannot be held liable for breaking his contract if its performance has become illegal. There may be other cases in which, from the circumstances of the voyage and adventure, it must be inferred that the parties intended the performance of the contract to be conditional on the existence at the time of performance of a certain state of things, the non-existence of which would render performance impossible. For instance, if the port named in the bill of lading became permanently closed and inaccessible to shipping in consequence of an earthquake, it would probably be held that the continued existence of the place named as a port was an implied condition of the contract, and that the shipowner was excused. Where, however, the performance of the contract remains lawful, and is not excused by the express terms of the contract, or by some implied condition, the shipowner is liable for any loss or damage suffered by the shipper by reason of his goods not being delivered at the named place, even though such delivery has become impossible. There is another reason why the precise description of the place of delivery often becomes important. It is only on the arrival of the ship at the place described as the place of delivery that the obligation of the consignee of the goods to take delivery commences. Delay involves considerable loss and expense to the shipowner. The shipper or consignee is not responsible for any delay which occurs before the ship has arrived at the place of delivery described in the bill of lading.

(6) The goods may be deliverable by the terms of the bill of lading to a named consignee, and to him only, but more usually they are made deliverable to the "order or assigns" of the named consignee or of the shipper. If the goods are made deliverable to order or assigns the bill of lading is a negotiable instrument, or, in other words, the right to the goods, and the rights and liabilities under the contract contained in the bill of lading, may be transferred by indorsement and delivery of the document. When an indorsement has once been made by the shipper or consignee writing his name and nothing more on the back of the bill of lading, the rights in and under it may be transferred from hand to hand by mere delivery. A bill of lading so indorsed is said to be indorsed "in blank." But the shipper or consignee may restrict the negotiability of the bill of lading by indorsing it not "in blank," but with a direction requiring delivery to be made to a particular person or indorsee, or to his order. This is called an indorsement "in full." When an indorsement has been made "in full" to a named indorsee or order, such indorsee must again indorse "in blank" or "in full" to effect a new transfer of the rights in the bill of lading.

(7) The amount or rate of *freight* payable is stated in the bill of lading, either expressly, or, not uncommonly when the freight under the bill of lading is the same as under the charter-party, by reference to the charter-party. A common form of such reference is "freight and other conditions, as per charter-party." It may here be mentioned that this form of words does not incorporate in the contract under the bill of lading all the terms and conditions of the charter-party, but only those which apply to the person who is to take delivery, and relate to matters *ejusdem generis*, or similar to the payment of freight, such as demurrage and the like. The conditions of the charter-party thus incorporated do not include, for instance, the exceptions in the charter-party so as to add them to the exceptions in the bill of lading. Freight, unless it is otherwise provided by the contract, is payable only on delivery of the goods at their destination. If the voyage is interrupted and its completion becomes impossible, the shipowner cannot claim payment of freight even *pro rata itineris*. He loses his freight altogether. This is so even when the completion of the voyage is prevented by causes for which the shipowner is not responsible, such as the act of God or the king's enemies, or perils which are within the express exceptions in the bill of lading. When the voyage is interrupted by accident, and indeed in any case, the goods may, by agreement between the shipowner and the consignee, be delivered at some place short of their destination upon payment of a freight *pro rata*; that is to say, proportional to the length of voyage accomplished, and such an agreement may be implied in certain circumstances from the conduct of the consignee in taking delivery before they arrive at their destination. In all such cases it will be a question of fact whether the goods were in fact delivered upon the terms, express or implied, that freight *pro rata* should be paid. As a rule such an agreement would not be implied where the shipowner is unable or unwilling to forward the goods to their destination, and the owner of the goods, therefore, has no option but to take delivery where offered.

When the ship is disabled and cannot proceed, or she is prevented by some obstacle from proceeding to the place of delivery named in the bill of lading, and the shipowner is unwilling or unable to forward the goods by another ship, even though he may be excused for his failure to carry the goods to their destination, he is not entitled to be paid any part of the freight; and the consignee is entitled to have the goods delivered to him either at the place where the vessel has taken refuge in her disabled condition, or, if the obstacle arises without disablement of the vessel, at the place which is nearest and most reasonably convenient at the time and in the circumstances when the further prosecution of the voyage has to be abandoned. On the other hand, after the goods have been shipped, so long as the shipowner is ready and willing to carry the goods to their destination, or, if the ship is disabled, to forward them to their destination by some other ship without unreasonable delay, the owner of the goods cannot require the goods to be delivered to him at any place short of their destination without payment of the full freight. Sometimes the freight, either wholly or in part, is made payable *in advance*. If freight payable in advance has become due, even though the ship is lost before it is paid, it must, in the absence of some special provision to the contrary, still be paid, and freight already paid in advance does not become repayable because the goods do not reach their destination. If, however, goods upon which freight has been paid in advance are lost, and the shipowner is liable for their loss, the amount of freight paid in advance must be taken into account in assessing the damage recoverable from the shipowner.

(8) There is no part of the bill of lading which is of greater practical importance or which demands more careful consideration by shipowner and shipper alike than that which sets forth the excepted perils: those perils, or in other words causes of loss, for which the shipowner is to be exempt from liability. By the common law, as we have seen, the exemption of the carrier, apart from express contract, extended only to loss by the act of God or the king's enemies. The expression "act of God" requires a word of explanation. It will be sufficient to say that it is not synonymous with *force majeure*; but it includes every loss by *force majeure* in which human agency, by act or negligence, has had no part. The list of excepted perils varies much in different forms of bills of lading. In the older forms it usually included perils of the seas, robbers and pirates, restraint of princes and rulers, fire and barratry (that is, wilful wrongdoing) of the master and crew. The list, however, has grown in modern times, and is still growing; the tendency being to exempt the shipowner from liability for all loss which does not arise from his own personal default, or from the negligence of his managers or agents in failing to provide a vessel seaworthy and fit for the voyage at its commencement. It is important to point out in this connexion that there are two duties which the shipowner is always presumed to undertake, and which are assumed to be unaffected and unqualified by the exceptions, unless a contrary intention is very clearly expressed by the terms of the contract. In the first place, he undertakes absolutely that the ship in which the goods are shipped is fit at the commencement of the voyage for the service to be performed. If during the voyage loss arises even from dangers of the seas or other excepted peril which would not have occurred if the vessel had been seaworthy and fit for the voyage at its commencement, the shipowner is not protected by the exceptions, and is liable for the loss. In the second place, there is an implied undertaking by the shipowner that all reasonable care will be taken by himself, his servants and agents, safely to carry and deliver at their destination the goods received by him for carriage. Should loss or damage occur during the voyage, though the direct cause of such loss or damage be perils of the seas or other excepted peril, still the shipowner cannot claim exemption under the exceptions, if the shipper can prove that the loss or damage

would not have occurred but for the negligence of the master or crew, or other servants of the shipowner. The shipowner, in other words, is bound, with his servants, to use all reasonable care to prevent loss by excepted perils and by any other cause.

Express stipulations.

It must not be supposed that even these primary obligations, which are introduced into every contract of affreightment not by words but by implication, may not be excluded by the express terms of the contract. It has now become common form to stipulate that the shipowner shall not be liable for any loss arising from the negligence of his servants, or that he shall not be liable for loss by the excepted perils even when brought about by the negligence of his servants. And with regard to seaworthiness, it is not uncommon for the shipowner to stipulate that he shall not be responsible for loss arising even from the unseaworthiness of the ship on sailing, provided that due care has been taken by the owner and his agents and servants to make the ship seaworthy at the commencement of the voyage. There is indeed no rule of English law which prevents a shipowner from exempting himself by the terms of the bill of lading from liability for damage and loss of every kind, whether arising from unseaworthiness or any other cause whatsoever. In such a case the goods are carried at their owner's risk, and if he desires protection he must obtain it by insurance. In this respect the law of England permits greater freedom of contract than is allowed by the law of some other states. The owners, agents and masters of vessels loading in the United States of America are forbidden by an act of Congress, commonly called the Harter Act, passed in the year 1893, to insert in their contracts of affreightment any clause exempting the shipowner from liability for the negligence of his servants; but it is at the same time enacted that, provided all reasonable skill and care has been exercised by the shipowner to make the vessel seaworthy and fit for the voyage at its commencement, the shipowner shall not be liable for any loss caused by the negligence of the master or crew in the navigation of the vessel, or by perils of the sea or certain other causes set forth in the act. It is now very usual to insert in the bills of lading of British vessels loading in the United States a reference to the Harter Act, incorporating its provisions so as to make them terms and conditions of the bill of lading.

The difficulty of construing the terms of bills of lading with regard to the excepted perils, often expressed in obscure and inexact language, has given rise to much litigation, the results of which are recorded in the law reports. Where such difficulties arise the question must be, What is the true and natural meaning of the language used by the parties? This question is not governed by the general rules which we have endeavoured to explain; but the words of the contract must always be considered with reference to these rules, which are founded upon the well-established customs of merchants recognized and formulated by the courts of law.

(9) The bill of lading sometimes contains a clause as to the shipowner's *lien*. Without any express provision for it the shipowner has by the common law a lien for freight. If it is desired to give the shipowner a lien for *demurrage* (see below) or other charges, it must be expressly provided for. The *lien* is the right of the shipowner to retain the goods carried until payment has been made of the freight or the demurrage, or other charge for which a lien has been given. The lien may be waived, and is lost by delivery of the goods, or by any dealing with the consignee which is inconsistent with a right of the shipowner to retain possession of the goods until payment has been made. The shipowner may preserve his lien by landing the goods and retaining them in his own warehouse, or by storing them in a public warehouse, subject to the conditions required by the Merchant Shipping Act 1894.

Charter-parties.

Charter-parties are, as we have already explained, either for a voyage or for a period of time. (1) A charter-party for a voyage is a formal agreement made between the owner of the vessel and the charterers by which it is agreed that the vessel "being tight, staunch and strong, and every way fitted for the voyage," shall load at a certain named place a full cargo either of goods of a specified description or of general merchandise, and being so loaded shall proceed with all possible despatch either to a specified place or to a place to be named at a specified port of call, and there deliver the cargo to the charterers or their assigns. There are clauses which provide for the amount of freight to be paid and the manner and time of payment; for the time, usually described as *lay days*, to be allowed for loading and discharging, and for the *demurrage* to be paid if the vessel is detained beyond the lay days; usually also a clause requiring "the cargo to be brought to and taken from alongside at merchant's risk and expense"; a clause that the master shall sign bills of lading for the cargo shipped either at the same rate of freight as is payable under the charter-party or very commonly at any rate of freight (but in this case with a stipulation that, if the total bill of lading freight is less than the total freight payable under the charter-party, the difference is to be paid by the charterers to the master before the sailing of the vessel); and there is usually what is called the *cesser clause*, by which the charterer's liability under the charter-party is to cease on shipment of the cargo, the shipowner taking a lien on the cargo for freight, dead freight and demurrage. The charter-party is made subject to exceptions similar to those which are found in bills of lading. There are also usually clauses providing for the commissions to be paid to the brokers on signing the charter-party, the "address" commission to be paid to the agents for the vessel at the port of discharge, and other matters of detail. The clauses in charter-parties vary, of course, indefinitely, but the above is probably a sufficient outline of the ordinary form of a charter-party for a voyage.

What has been said with regard to bills of lading as to the voyage, the place of delivery, the exceptions and excepted perils, and the liability of the shipowner and his lien applies equally to charter-parties. It may be desirable to add a few words on *demurrage, dead freight*, and on the *cesser clause*.

Demurrage is, properly speaking, a fixed sum per day or per hour agreed to be paid by the charterer for any time during which the vessel is detained in loading or discharging over and above the time allowed, which is, as we have said, usually described as the *lay days*. Sometimes the number of days during which the vessel may be kept on demurrage at the agreed rate is fixed by the charter-party. If no demurrage is provided for by the charter-party, and the vessel is kept loading or discharging beyond the lay days, the shipowner is entitled to claim damages in respect of the loss which he has suffered by the detention of his ship; or, if the vessel is detained beyond the fixed number of demurrage days, damages for detention will be recoverable. Sometimes there is no time fixed by the charter-party for loading or discharging. The obligation in such cases is to load or discharge with all despatch that is possible and reasonable in the circumstances; and if the loading or discharging is not done with such reasonable despatch, the shipowner will be entitled to claim damages for detention of his ship. The rate of demurrage (if any) will generally be accepted as the measure of the damages for detention, but is not necessarily the true measure. When the claim is for detention and not demurrage the actual loss is recoverable, which may be more or may be less than the agreed rate of demurrage. The contract usually provides that Sundays and holidays shall be excepted in counting the lay days, but unless expressly stipulated this exception does not apply to the computation of the period of detention after the lay days have expired.

Dead freight is the name given to the amount of freight lost, and therefore recoverable by the shipowner from the charterer as damages if a full and complete cargo is not loaded in accordance with the terms of the charter-party.

The *cesser clause* has come into common use because very frequently the charterers are not personally interested in the cargo shipped. They may be agents merely, or they may have chartered the vessel as a speculation to make a profit upon the bill of lading freight. The effect of the clause is that when the charterers have shipped a full cargo they have fulfilled all their obligations, the shipowner discharging them from all further liability and taking instead a lien on the cargo for payment of all freight, demurrage or dead freight that may be payable to him. It has become an established rule for the construction of the *cesser clause* that, if the language used will permit it, the cesser of liability is assumed to be co-extensive only with the lien given to the shipowner; or, in other words, the charterers are released from those liabilities only for which a lien is given to the shipowner. The shipowner is further secured by the stipulation already referred to, that if the total freight payable under the bills of lading is less than the full chartered freight the difference shall be paid to the shipowner before the vessel sails. A difficulty which sometimes arises, notwithstanding these precautions, is that although an ample lien is given by the charter-party, the terms of the bills of lading may be insufficient to preserve the same extensive lien as against the holder of the bills of lading. The shippers under the bills of lading, if they are not the charterers, are not liable for the chartered freight, but only for the bill of lading freight; and unless the bill of lading expressly reserves it, they are not subject to a lien for the chartered freight. The master may guard against this difficulty by refusing to sign bills of lading which do not preserve the shipowner's lien for his full chartered freight. But he is often put into a difficulty by a somewhat improvident clause in the charter-party requiring him to sign bills of lading *as presented*. See *Kruger* v. *Moel Tryvan*, 1907 A. C. 272.

(2) A time charter-party is a contract between the shipowner and charterers, by which the shipowner agrees to let and the

charterers to hire the vessel for a specified term for employment, either generally in any lawful trade or upon voyages within certain limits. A place is usually named at which the vessel is to be re-delivered to the owners at the end of the term, and the freight is payable until such re-delivery; the owner almost always pays the wages of the master and crew, and the charterers provide coals and pay port charges; the freight is usually fixed at a certain rate per gross register ton per month, and made payable monthly in advance, and provision is made for suspension of hire in certain cases if the vessel is disabled; the master, though he usually is and remains the servant of the owner, is required to obey the orders of the charterers as regards the employment of the vessel, they agreeing to indemnify the owners from all liability to which they may be exposed by the master signing bills of lading or otherwise complying with the orders of the charterers; and the contract is made subject to exceptions similar to those in bills of lading and voyage charter-parties. This is the general outline of the ordinary form of a time charter-party, but the forms and their clauses vary, of course, very much, according to the circumstances of each case.

It is apparent that under a time charter-party the shipowner to a large extent parts with the control of his ship, which is employed within certain limits according to the wish and directions, and for the purposes and profit of, the charterers. But, as we have already explained at the beginning of this article, the shipowner continues in possession of his vessel by his servant the master, who remains responsible to his owner for the safety and proper navigation of the ship. The result of this, as has been already pointed out, is that the holder of a bill of lading signed by the master, if he has taken the bill of lading without knowledge of the terms of the time charter-party, may hold the owner responsible for the due performance of the contract signed by the master in the ordinary course of his duties, and within his ostensible authority as servant of the shipowner, although in fact in signing the bill of lading the master was acting as agent for and at the direction of the time charterer, and not the shipowner. In the language of the ordinary time charter-party the ship is *let* to the charterers; but there is no true demise, because, as we have pointed out, the vessel remains in the possession of the shipowner, the charterer enjoying the advantages and control of its employment. Where the possession of a ship is given up to a hirer, who appoints his own master and crew, different considerations apply; but though the instrument by which the ship is let may be called a charter-party, it is not truly a contract of affreightment.

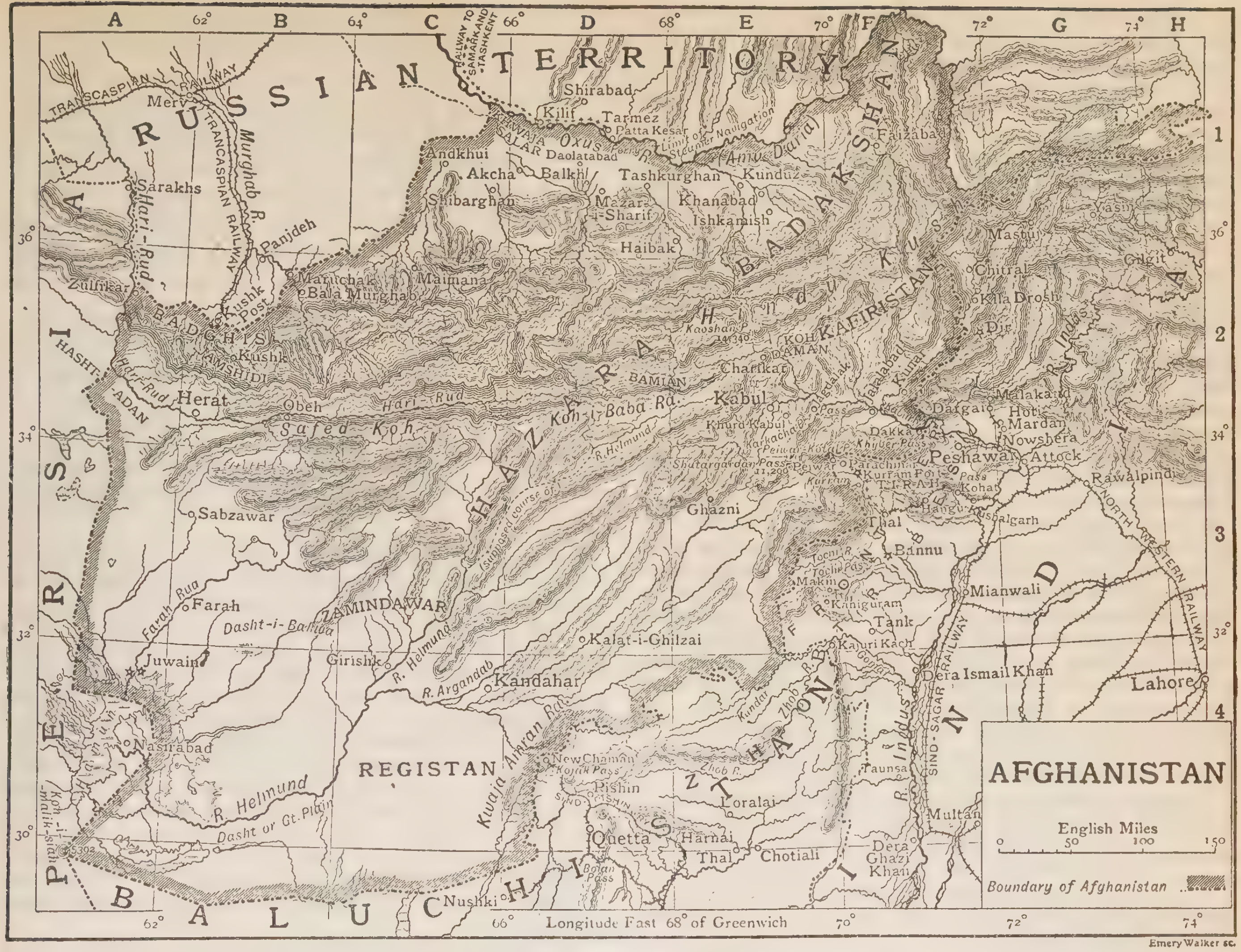
Customary rights.

There are certain rights and obligations arising out of the relationship of shipowner and cargo-owner in circumstances of extraordinary peril or urgency in the course of a voyage, which, though not strictly contractual, are well established by the customs of merchants and recognized by the law. It is obvious that, when a ship carrying a cargo is in the course of a voyage, the master to some extent represents the owners of both ship and cargo. In cases of emergency it may be necessary that the master should, without waiting for authority or instructions, incur expense or make sacrifices as agent not only of his employer, the shipowner, but also of the cargo-owner. Ship and cargo may be in peril, and it may be necessary for the safety of both to put into a port of refuge. There it may be necessary to repair the ship, and to land and warehouse, and afterwards re-ship the cargo. For these purposes the master will be obliged to incur expense, of which some part, such as the cost of repairing the ship, will be for the benefit of the shipowner; part, such as the warehousing expenses, will be for the benefit of the cargo-owner; and part, such as the port charges incurred in order to enter the port of refuge, are for the common benefit and safety of ship and cargo. Again, in a storm at sea, it may be necessary for the safety of ship and cargo to cut away a mast or to jettison, that is to say, throw overboard part of the cargo. In such a case the master, acting for the shipowner or cargo-owner, as the case may be, makes a sacrifice of part of the ship or part of the cargo, in either case for the purpose of saving ship and cargo from a danger common to both. Voluntary sacrifices so made and extraordinary expenses incurred for the common safety are called general average (see AVERAGE) sacrifices and expenses, and are made good to the person who has made the sacrifice or incurred the expense by a general average contribution, which is recoverable from the owners of the property saved in proportion to its value, or, in other words, each contributes rateably according to the benefit received. The law regulating the rights of the parties with regard to such contribution is called the law of General Average. It must, however, be remembered that the owner of the cargo is entitled under the contract of affreightment to the ordinary service of the ship and crew for the safe carriage of the cargo to its destination, and the shipowner is bound to pay all ordinary expenses incurred for the purpose of the voyage. He must also bear all losses arising from damage to the ship by accidents. But when extraordinary expense has been incurred by the shipowner for the safety of the cargo, he can recover such expense from the owner of the cargo as a *special charge* on cargo; or when an extraordinary expense has been incurred or a voluntary sacrifice made by the shipowner to save the ship and cargo from a peril common to both, he may require the owner of cargo to contribute in *general average* to make good the loss.

See Carver, *Carriage by Sea* (London, 1905); Scrutton, *Charter-parties and Bills of Lading* (London, 1904). (W.)

AFGHANISTAN, a country of Central Asia. Estimated area 245,000 sq. m. (including Badakshan and Kafiristan). Pop. about 5,000,000. It is bounded on the N. by Russian Turkestan, on the W. by Persia, and on the E. and S. by Kashmir and the independent tribes of the North-West Frontier of India and Baluchistan. The chief importance of Afghanistan in modern days is due to its position as a “ buffer state ” intervening between the two great empires of Asiatic Russia and British India. During the last quarter of the 19th century our knowledge of the country was greatly increased, and its boundaries on the N., E. and S. were strictly delimited. The second Afghan war of 1878–80 afforded an opportunity for the extension of wide geographical surveys on a scientific basis. The Russian-Afghan Boundary Commission of 1884–1886 resulted in the delimitation and mapping of the northern frontier. The Durand agreement of 1893 led to the partition of the Pathan tribes on the southern and eastern frontiers. The Pamir Commission of 1895 settled its north-eastern border. Finally the Perso-Baluch Commission of 1904–1905 defined its western face.

Beginning with the Persian border at Zulfikar on the Hari Rud river, the boundary between Afghanistan and Russia follows a line roughly parallel to the course of the Paropamisus, and about 35 m. to the north of it, till it strikes the Kushk river in Jamshidi territory at a point which was once known as Chahil Dukteran, but is now the Russian post Kushkinski, and the terminus of a branch railway from Merv. Kushkinski is about 20 m. below the old Jamshidi settlement of Kushk, which is the capital of Badghis. The settlement and the post originally called Kushk must not be confused together. From Kushkinski the boundary runs north-east, crossing the Murghab river near Maruchak (which is an Afghan fortress), and thence passes north-east through the hills of the Chul, and the undulating deserts of the Aleli Turkmans, to the Oxus, leaving the valleys of Charshamba and of Andkhui (to which it runs approximately parallel) within Afghan limits. These valleys denote the limits of cultivation in this direction. Throughout all this region the boundary is generally of an artificial character, marked by pillars, but it is here and there indicated by natural features forming local lines of water-parting or water-course. The boundary meets the Oxus at Khamiab at the western extremity of the cultivated district of Khwaja Salar, and from that point to the eastern end of Lake Victoria in the Pamirs the main channel of the Oxus river forms the northern limits of Afghanistan. (See OXUS.) Eastwards from Lake Victoria the frontier line was determined by the Pamir Boundary Commission of 1895. A part of the little Pamir is included in Afghan territory, but the boundary crosses this Pamir before the great bend northwards of the Aksu takes place, and, passing over a series of crags and untraversable mountain ridges, is lost on the Chinese frontier in the


AFGHANISTAN
English Miles
0 50 100 150
Boundary of Afghanistan
Longitude East 68° of Greenwich
RUSSIAN TERRITORY
PERSIA
BALUCHISTAN
INDIA
Merv
Sarakhs
Panjdeh
Zulfikar
Herat
Obeh
Sabzawar
Farah
Juwain
Nasirabad
Girishk
Kandahar
Kalat-i-Ghilzai
Ghazni
Kabul
Charikar
Bamian
Khanabad
Ishkamish
Kunduz
Tashkurghan
Mazar-i-Sharif
Haibak
Balkh
Akcha
Andkhui
Shibarghan
Maimana
Maruchak
Bala Murghab
Kushk
Faizabad
Chitral
Mastuj
Yasin
Gilgit
Dir
Peshawar
Attock
Rawalpindi
Mardan
Nowshera
Kohat
Thal
Bannu
Mianwali
Tank
Dera Ismail Khan
Lahore
Multan
Dera Ghazi Khan
Loralai
Quetta
Pishin
New Chaman
Harnai
Chotiali
Nushki
Shirabad
Kilif
Tarmez
Patta Kesar
REGISTAN
ZAMINDAWAR
Dasht-i-Bakwa
Dasht or Gt. Plain
HAZARA
BADAKSHAN
KAFIRISTAN
BADGHIS
HINDU KUSH
Safed Koh
Koh-i-Baba Ra.
R. Helmund
R. Argandab
Hari-Rud
Murghab R.
Oxus
Amu Darya
Indus R.
TRANSCASPIAN RAILWAY
NORTH WESTERN RAILWAY
SIND-SAGAR RAILWAY
Khyber Pass
Shutargardan Pass
Kurram
Bolan Pass
Khojak Pass
Zhob R.
Kundar R.
Gomal R.
Tochi R.
WAZIRISTAN
A B C D E F G H
1 2 3 4
62° 64° 66° 68° 70° 72° 74°
30° 32° 34° 36°

Emery Walker sc.

snowfields of Sarikol. Bending back westwards upon itself, the line of Afghan frontier now follows the water-parting of the Hindu Kush; and as the Hindu Kush absolutely overhangs the Oxus nearly opposite Ishkashim, it follows that, at this point, Afghanistan is about 10 m. wide. Thus a small and highly elevated portion of the state extends eastwards from its extreme north-eastern corner, and is attached to the great Afghan quadrilateral by the thin link of the Panja valley. These narrow limits (called Wakhan) include the lofty spurs of the northern flank of the Hindu Kush, an impassable barrier at this point, where the glacial passes reach 19,000 ft. in altitude, and the enclosing peaks 24,000 ft. The backbone or main water-divide of the Hindu Kush continues to form the boundary between Afghanistan and those semi-independent native states which fringe Kashmir in this mountain region, until it reaches Kafiristan. From near the Dorah pass (14,800 ft.), which connects Chitral with the Panja (or Oxus) river, a long, straight, snow-clad spur reaches southwards, which divides the Kafiristan valley of Bashgol from that of Chitral, and this continues to denote the eastern limits of Afghanistan till it nearly touches the Chitral river opposite the village of Arnawai, 45 m. south of Chitral. Here the Bashgol and Chitral valleys unite and the boundary passes to the water-divide east of the Chitral river, after crossing it by a spur which leaves the insignificant Arnawai valley to the north; along this water-divide it extends to a point nearly opposite the quaint old town of Pashat in the Kunar valley (the Chitral river has become the Kunar in its course southwards), and then stretches away in an uneven and undefined line, dividing certain sections of the Mohmands from each other by hypothetical landmarks, till it strikes the Kabul river near Palosi. Thence following a course nearly due south, it reaches Landi Kotal. From the abutment of the Hindu Kush on the Sarikol in the Pamir regions to Landi Kotal, and throughout its eastern and southern limits, the boundary of Afghanistan touches districts which were brought under British political control with the formation of the North-West Frontier Provinces of India in 1901. From the neighbourhood of Landi Kotal the boundary is carried to the Safed Koh overlooking the Afridi Tirah, and then, rounding off the cultivated portions of the Kurram valley below the Peiwar, it crosses the Kaitu and passes to the upper reaches of the Tochi. Crossing these again, it is continued on the west of Waziristan, finally striking the Gomal river at Domandi. South of the Gomal it separates the interests of Afghanistan from those of Baluchistan, which here adjoins the North-West Frontier Province. From Domandi (the junction of the Kundar river with the Gomal) the Afghan boundary marches with that of Baluchistan. (See BALUCHISTAN.) It is carried to the south-west on a line which is largely defined by the channels of the Kundar and the Kadanai to a point beyond the Sind-Peshin terminal station of New Chaman, west of the Khojak range, and then drops southward to Shorawak and Nushki. From Nushki it crosses the Helmund desert, touching the crest of a well-defined mountain watershed for a great part of the way, and, leaving Chagai to Baluchistan, it strikes nearly west to the Persian frontier, and joins it on the Koh-i-Malik Siah mountain, south of Seistan. Two points of this part of the Afghan boundary are notable. It leaves some of the most fanatical of the Durani Afghan people on the Baluch side of the frontier in the Toba district, north of the Quetta–Chaman line of railway; and it passes 50 m. south of the Helmund river, enclosing within Afghanistan the only approach to Seistan from India which is available during the seasons of Helmund overflow. Between Afghanistan and Persia the boundary was defined by Sir F. Goldsmid's Commission in 1872 from the Malik-Siah-Koh to the Helmund Lagoons, and rectified by the Commission under Sir Henry MacMahon in 1903–1905. Beyond these lagoons to Hashtadan it is still indefinite. The eastern limits of Hashtadan had been previously fixed as far north as the Hari Rud river at Toman Agha. From this point to Zulfikar the Hari Rud is itself the boundary.

Afghan provinces.

Within the limits of this boundary Afghanistan comprises four main provinces, Northern Afghanistan or Kabul, Southern Afghanistan or Kandahar, Herat and Afghan Turkestan, together with the minor dependencies of the Ghilzai and Hazara Highlands, Ghazni, Jalalabad and Kafiristan. All these are described in separate articles. The kingdom of Kabul is the historic Afghanistan; the link which unites it to Kandahar, Herat and the other outlying provinces having been frequently broken and again restored by amirs of sufficient strength and capability. The Herat province is largely Persian, while Afghan Turkestan is chiefly Usbeg; and in neither is the sentiment of loyalty to the central government very strong. The bond is geographical and political rather than racial. The geographical divisions of the country are created by the basins of its chief rivers, the Kabul, the Helmund, the Hari Rud and the Oxus. The Kabul river drains Northern Afghanistan, the Hari Rud the province of Herat, and the Oxus that of Afghan Turkestan. Afghanistan is largely a country of mountains and deserts; but there are wide tracts of highly irrigated and most productive country where fruit is grown in such abundance as to become an important item in the export trade. The Afghans are expert agriculturists and make profitable use of all the natural sources of water-supply. As practical irrigation engineers they are only rivalled by the Chinese.

Mountain systems.

The dominant mountain system of Afghanistan is the Hindu Kush, and that extension westwards of its water-divide which is indicated by the Koh-i-Baba to the north-west of Kabul, and by the Firozkhoi plateau (Karjistan), which merges still farther to the west by gentle gradients into the Paropamisus, and which may be traced across the Hari Rud to Mashad.

The culminating peaks of the Koh-i-Baba overlooking the sources of the Hari Rud, the Helmund, the Kunduz and the Kabul very nearly reach 17,000 ft. in height (Shah Fuladi, the highest, is 16,870), and from them to the south-west long spurs divide the upper tributaries of the Helmund, and separate its basin from that of the Farah Rud. These spurs retain a considerable altitude, for they are marked by peaks exceeding 11,000 ft. They sweep in a broad band of roughly parallel ranges to the south-west, preserving their general direction till they abut on the Great Registan desert to the west of Kandahar, where they terminate in a series of detached and broken anticlinals whose sides are swept by a sea of encroaching sand. The long, straight, level-backed ridges which divide the Argandab, the Tarnak and Arghastan valleys, and flank the route from Kandahar to Ghazni, determining the direction of that route, are outliers of this system, which geographically includes the Khojak, or Kwaja Amran, range in Baluchistan.

North of the main water-parting of Afghanistan the broad synclinal plateau into which the Hindu Kush is merged is traversed by the gorges of the Saighan, Bamian and Kamard tributaries of the Kunduz, and farther to the west by the Band-i-Amir or Balkh river. Between the debouchment of the Upper Murghab from the Firozkhoi uplands into the comparatively low level of the valley above Bala Murghab, extending eastwards in a nearly straight line to the upper sources of the Shibarghan stream, the Band-i-Turkestan range forms the northern ridge between the plateau and the sand formations of the Chul. It is a level, straight-backed line of sombre mountain ridge, from the crest of which, as from a wall, the extraordinary configuration of that immense loess deposit called the Chul can be seen stretching away northwards to the Oxus—ridge upon ridge, wave upon wave, like a vast yellow-grey sea of storm-twisted billows. The Band-i-Turkestan anticlinal may be traced eastwards of the Balkh-ab (the Band-i-Amir) within the folds of the Kara Koh to the Kunduz, and beyond; but the Kara Koh does not mark the northern wall of the great plateau nor overlook the sands of the Oxus plain, as does the Band-i-Turkestan. Here there intervenes a second wide synclinal plateau, of which the northern edge is defined by the flat outlines of the Elburz to the south of Mazar-i-Sharif, and immediately at the foot of this range lie the alluvial plains of Mazar and Tashkurghan. Opposite Tashkurghan the Oxus plain narrows to a short 25 m. On the south this great band of roughly undulating central plateau is bounded by the Koh-i-Baba, to the west of Kabul, and by the Hindu Kush to the north and north-east of that city. Thus the main routes from Kabul to Afghan Turkestan must cross either one or other of these ranges, and must traverse one or other of the terrific defiles which have been carved out of them by the upper tributaries of the rivers running northwards towards the Oxus. Probably in no country in the world are there gathered together within comparatively narrow limits so many clean-cut waterways, measuring thousands of feet in depth, affording such a stupendous system of narrow roadways through the hills.

After the Hindu Kush and the Turkestan mountains, that range which divides Ningrahar (or the valley of Jalalabad) from Kurram and the Afridi Tirah, and is called Safed Koh (also the name of the range south of the Hari Rud), is the most important, as it is the most impressive, in Afghanistan.

The highest peak of the Safed Koh, Sikaram, is 15,600 ft. above sea-level. From this central dominating peak it falls gently towards the west, and gradually subsides in long spurs, reaching to within a few miles of Kabul and barring the road from Kabul to Ghazni. At a point which is not far east of the Kabul meridian an offshoot is directed southwards, which becomes the water-parting between the Kurram and the Logar at Shutargardan, and can be traced to a connexion with the great watershed of the frontier dividing the Indus basin from that of the Helmund. This main watershed retains its high altitude far to the south. There are peaks measuring over 12,000 ft. on the divide between the Tochi and the Ghazni plains.

Geology.

So far as we know at present the geological history of Afghanistan differs widely from that of India. When, somewhere at the commencement of the Cretaceous period, the peninsula of India was connected by land with Madagascar and Southern Africa, all Afghanistan, Baluchistan and Persia formed part of an area which was not continuously below sea-level, but exhibited alternations of land and sea. The end of the Cretaceous period saw the beginning of a series of great earth movements ushered in by volcanic eruptions on a scale such as the earth has never since witnessed, which resulted in the upheaval of the Himalayas by a process of crushing and folding of the sedimentary rocks till marine fossils were forced to an altitude of 20,000 ft. above the sea. It was not till the Tertiary age, and even late in that age, that much of the land area of Afghanistan was raised above the sea-level. Then the ocean gradually retired into the great Central Asian depressions.

Everywhere there have been great and constant changes of level since that period, and the process of flexure and the formation of anticlinals traversing the northern districts of Afghanistan is a process which is still in action. So rapid has been the land elevation of Central Afghanistan that the erosive action of rivers has not been able to keep pace with that of upheaval; and the result all through Afghanistan (but specially marked in the great central highlands between Kabul and Herat) is the formation of those immensely deep gorges and defiles which are locally known as *daras*. One of these, in the Astarab, to the south-east of Maimana, is but 30 yds. wide, and is enclosed between perpendicular limestone cliffs 1500 ft. high. C. L. Griesbach considers that the general outline of the land configuration has remained much the same since Pliocene times, and that the force which brought about the wrinkling of the older deposits still continues to add fold on fold. The highlands which shut off the Turkestan provinces from Southern Afghanistan have afforded the best opportunities for geological investigation, and as might be expected from their geographical position, the general result of the examination of exposed sections leads to the identification of geological affinity with Himalayan, Indian and Persian regions. The general configuration of the Turkestan highlands has been already indicated.

Against the last great fold which terminates this mountain area northwards are ranged the Tertiaries and recent deposits. North of Maimana they form low undulating loess hills, in which most of the Band-i-Turkestan drainage is lost. This wide-spreading loess area, formed partly of wind-blown sand and partly of detritus from the mountains, is known as Chul, and merges into the great plains south of the Oxus river, a great part of which is covered with modern aerial deposits. Beneath this Chul formation the older beds of the outer and Turkestan ranges dip and pass to an irregular outcrop near the banks of the Oxus. Between the Oxus and the hills there has already been formed a rise or flexure in the ground, which extends more or less parallel to the northern edge of the hills, and, shutting in the cultivated area of the plains, arrests all tributaries seeking to effect a junction with the Oxus from the south, and leads to the formation of marshes and swamps. This appears to be the beginning of a new anticlinal which has altered the levels of the Balkh plain, and is indicative of those elevating processes which may have been effective within historic times in changing the climate and the agricultural prospects of this part of Central Asia. The Oxus itself is steadily encroaching on its right banks and depositing detritus on the left.

No fresh discoveries of minerals likely to be of high economic value to Afghanistan have been made of late years. Such as are known and worked at present have been worked from very ancient times, and their capacity is not likely to develop greatly under the Kabul government. The most important feature in this connexion which was noted by the geologist of the Russo-Afghan Commission is the existence of vast coal beds in northern Afghanistan. In 1903 some coal mines were discovered in the Jagdalak districts.

There are no glaciers now to be found in Afghan Turkestan; but evidences of their recent existence are abundant. The great boulder bed terraces in some of the valleys of the northern slopes of the Ferozkhoi plateau are probably of glacial origin. In the mountains west of Kabul glaciers have retired, leaving the moraines perfectly undisturbed. They are probably contemporary with the older alluvia. (T. H. H.*)

Rocks.

The oldest rocks which have yet been identified[1] in Afghanistan occur along the axis of the main watershed, and have been referred to the Carboniferous. At Robat-i-Pai near Herat, for example, there is a dark *Productus* limestone which seems to be identical with the *Productus* limestone of the Central Himalayas. These beds are conformably succeeded, along the Central Asian watershed, by a continuous series of strata which apparently represent the Permian, Trias and Jurassic of Europe. They consist of marine beds alternating with freshwater and littoral deposits, together with plant beds and coal-seams of considerable thickness. The lowest beds of this series, which from their position may belong either to the Permian or to the upper part of the Carboniferous, have yielded no recognizable fossils; but they include a conglomerate which closely resembles the boulder bed near the base of the Talchir series in India. The Upper Trias has been definitely identified by the occurrence of *Halobia* and other fossils; while in the higher beds of the series marine forms belonging to the middle and upper Jurassic have been found.

The plant beds occur at several horizons, and among the remains which have been found in them are several forms which occur also in the Gondwana beds of India. There can be no doubt that the series as a whole is the equivalent of the Gondwana system, and when the country has been more closely examined the association of marine fossils with Gondwana plants will be of the greatest value in determining the precise homotaxis of the Indian deposits.

The Jurassic beds are followed, generally with perfect conformity, by the Cretaceous, which covers a large part of Afghan Turkestan and probably forms the greater part of the ranges which run south and south-west from the principal watershed. The lowest beds consist of red grits which contain Neocomian fossils, while the middle and upper Cretaceous consist chiefly of limestone and chalk. The entire system may be represented in the west, but in the Herat province and in Afghan Turkestan the middle Cretaceous seems to be absent, and it is probable that, as in other regions, the upper Cretaceous covers a much wider area than the lower beds. Tertiary and recent deposits are widely spread, filling most of the valleys and covering the plains of the Helmund. Eocene beds have not yet been proved to exist; but this is probably owing to the imperfect knowledge of the country, for the formation is known in Persia, Baluchistan and the Suliman Hills. The lower part of the Miocene is marine in Herat and Afghan Turkestan; but the upper Miocene is usually of freshwater or estuarine origin. In Afghanistan, as in other regions near the great Eurasian system of folds, the Miocene includes extensive deposits of gypsum and salt. It was during this period that the forces which finally raised the country above the level of the sea began to take effect. The Pliocene consists entirely of freshwater and terrestrial deposits, which were probably laid down at the foot of the rising hills and on the floors of the intervening valleys. As the elevation continued, they were sometimes involved in the folding to which the mountains owe their origin. During this period the gradual desiccation of the country continued, and wind-blown deposits, such as the loess, began to make their appearance.

Although volcanic cones are known both in Persia and in Baluchistan, none have yet been described in Afghanistan itself. There is, however, ample evidence that at several distinct geological periods the region has been the seat of great volcanic activity. According to C. L. Griesbach, basic volcanic rocks are interbedded with the lowest part of the plant-bearing series, and enormous outbursts took place during the Neocomian period. But the most important igneous masses are the great intrusions of syenitic granite and of basic rock which penetrate the Cretaceous beds. These are probably of Eocene or of late Cretaceous age. (P. La.)

Roads and passes.

Omitting the group of northern routes to India from Central Asia, which pass between Kashmir and Afghanistan through the defiles of Chitral and of the Indus (see Hindu Kush), the highways of Afghanistan may be classed under two heads: (1) Foreign trade routes, and (2) Internal communications.

(1) Of the many routes which cross the frontiers of Afghanistan the most important commercially are those which connect the Oxus regions and the Central Asian khanates with Kabul, and those which lead from Kabul, Ghazni and Kandahar to the plains of India.

Kabul is linked with Afghan Turkestan and Badakshan by three main lines of communication across the Koh-i-Baba and the Hindu Kush. One of these routes follows the Balkh river to its head from Tashkurghan, and then, preserving a high general level of 8000 to 9000 ft., it passes over the water-divides separating the upper tributaries of the Kunduz river, and drops into the valley formed by another tributary at Bamian. From Bamian it passes over the central mountain chain to Kabul either by the well-known passes of Irak (marking the water-divide of the Koh-i-Baba) and of Unai (marking the summit of the Sanglakh, a branch of the Hindu Kush), or else, turning eastwards, it crosses into the Ghorband valley by the Shibar, a pass which is considerably lower than the Irak and is very seldom snowbound. From the foot of the Unai pass it follows the Kabul river, and from the foot of the Shibar it follows the circuitous route which is offered by the drainage of the Ghorband valley to Charikar, and thence southwards to Kabul. The main points on this route are Haibak, Bajgah and Bamian. It is full of awkward grades and minor passes, but it does not maintain a high level generally, no pass (if the Shibar route be adopted) much exceeding 10,000 ft. That this has for centuries been regarded as the main route northward from Kabul, the Buddhist relics of Bamian and Haibak bear silent witness; but it may be doubted whether Abdur Rahman's talent for roadmaking has not opened out better alternative lines. One of his roads connects Haibak with the Ghorband valley by the Chahardar pass across the Hindu Kush. The pass is high (nearly 14,000 ft.), but the road is excellently well laid out, and the route, which, south of Haibak, traverses a corner of the Ghori and Baghlan districts of Badakshan, is more direct. A third route also passes through Badakshan, and connects Kunduz with Charikar by the Khawàk pass and Panjshir river. The latter joins the Ghorband close to Charikar. The Khawàk (11,600 ft.) is not a high pass; the grades are easy and the snowfall usually light. This high road is stated (on Afghan authority) to be kept open for khafila traffic all the year round by the employment of forced labour for clearing snow. It is a recently developed route and one of great importance to Kabul, both strategically and commercially.

Routes that pass through the mountain barriers of the frontier between Peshawar and the Gomal occur at intervals along the western border, and in the northern section of the Indian frontier they are all well marked. The Khyber, Kurram and Tochi are the best known, inasmuch as all these lines of advance into Afghanistan are held by British troops or Indian levies. But the Bara valley route into the heart of the Afridi Tirah is not to be altogether overlooked, although it is not a trade route of any importance. Between Kabul and Jalalabad there are two roads, one by the Lataband pass, and the other and more difficult by the Khurd-Kabul and Jagdalak passes, the latter being the scene of the massacre of a British brigade in 1842. Between Jalalabad and Peshawar is the Khyber pass (*q.v.*). The Khyber was not in ancient times the main route of advance from Kabul to Peshawar. From Kabul the old route followed the Kabul river through the valley of Laghman (or Lamghan, as the Afghans call it) over a gentle water-parting into the Kunar valley, leaving Ningrahar and Jalalabad to the south. From the Kunar it crossed into Bajour by one of several open and comparatively easy passes, and from Bajour descended into India either by the Malakand or some other contiguous frontier gateway to the plains of Peshawar.

The Kurram route involves the Peiwar and Shutargardan passes (8600 and 10,800 ft. respectively) across the southern extensions of the Safed Koh range, and has never been a great trade route, however suitable as an alternative military line of advance.

Trade does not extend largely between Afghanistan and India by the Tochi route, being locally confined to the valley and the districts at its head, yet this is the shortest and most direct route between Ghazni and the frontier, and in the palmy days of Ghazni raiding was the road by which the great robber Mahmud occasionally descended on to the Indus plains. Traces of his raiding and road-making are still visible, but it is certain that he made use of the more direct route to Peshawar far more frequently than he did of the Tochi. The exact nature of the connexion between the head of the Tochi and the Ghazni plain is still unknown to us.

The Gomal is the great central trade route between Afghanistan and India; and the position, which is held by a tribal post at Wana, will do much to ensure its continued popularity. The Gomal involves no passes of any great difficulty, although it is impossible to follow the actual course of the river on account of the narrow defiles which have been cut through the recent conglomerate beds which flank the plains of the Indus. It has been carefully surveyed for a possible railway alignment; and an excellent road now connects

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[1] We owe our knowledge of the geology of Afghanistan almost entirely to the observations of C. L. Griesbach, and a summary of his researches will be found in *Records of the Geological Survey of India*, vol. xx. (1887), pp. 93-103, with map.

Tank (at its foot) with the Zhob line of communications to Quetta, and with Wana on the southern flank of Waziristan. The Gomal route is of immense importance, both as a commercial and strategic line, and in both particulars is of far greater significance than either the Kurram or the Tochi.

(2) Of the interior lines of communication, those which connect the great cities of Afghanistan, Herat, Kabul and Kandahar, are obviously the most important. Between Kabul and Herat there is no "royal" road, the existing route passing over the frequently snowbound wastes that lie below the southern flank of the great Koh-i-Baba into the upper valleys of the Hari Rud tributaries. It is a waste, elevated, desolate region that the route traverses, and the road itself is only open at certain seasons of the year. Between Kabul and Kandahar exists the well-known and oft-traversed route by Ghazni and Kalat-i-Ghilzai. There is but one insignificant waterparting—or kotal—a little to the north of Ghazni; and the road, although unmade, may be considered equal to any road of its length in Europe for military purposes. Between Kandahar and Herat there is the recognized trade route which crosses the Helmund at Girishk and passes through Farah and Sabzawar. It includes about 360 miles of easy road, with spaces where water is scarce. There is not a pass of any great importance, nor a river of any great difficulty, to be encountered from end to end, but the route is flanked on the north between Kandahar and Girishk by the Zamindawar hills, containing the most truculent and fanatical clans of all the Southern Afghan tribes. Little need be said of the 65 m. of route between Kandahar and the Baluchistan frontier at New Chaman. It is on the whole a route across open plains and hard, stony "dasht"—a route which would offer no great difficulties to that railway extension from Chaman which has so long been contemplated. A very considerable trade now passes along this route to India, in spite of almost prohibitive imposts; but the trade does not follow the railway from New Chaman to the eastern foot of the Khojak. Long strings of camels may still be seen from the train windows patiently treading their slow way over the Khojak pass to Kila Abdullah, whilst the train alongside them rapidly twists through the mountain tunnel into the Peshin valley.

Climate.

The variety of climate is immense, as might be expected. Taking the highlands of the country as a whole, there is no great difference between the mean temperature of Afghanistan and that of the lower Himalayas. Each may be placed at a point between 50° and 60° F. But the remarkable feature of Afghan climate (as also of that of Baluchistan) is its extreme range of temperature within limited periods. The least daily range in the north is during the cold weather, the greatest in the hot. For seven months of the year (from May to November) this range exceeds 30° F. daily. Waves of intense cold occur, lasting for several days, and one may have to endure a cold of 12° below zero, rising to a maximum of 17° below freezing-point. On the other hand the summer temperature is exceedingly high, especially in the Oxus regions, where a shade maximum of 110° to 120° is not uncommon. At Kabul, and over all the northern part of the country to the descent at Gandamak, winter is rigorous, but especially so on the high Arachosian plateau. In Kabul the snow lies for two or three months; the people seldom leave their houses, and sleep close to stoves. At Ghazni the snow has been known to lie long beyond the vernal equinox; the thermometer sinks to 10° and 15° below zero (Fahr.); and tradition relates the entire destruction of the population of Ghazni by snowstorms more than once.

At Jalalabad the winter and the climate generally assume an Indian character. The summer heat is great everywhere in Afghanistan, but most of all in the districts bordering on the Indus, especially Sewi, on the lower Helmund and in Seistan. All over Kandahar province the summer heat is intense, and the simoon is not unknown. The hot season throughout this part of the country is rendered more trying by frequent dust storms and fiery winds; whilst the bare rocky ridges that traverse the country, absorbing heat by day and radiating it by night, render the summer nights most oppressive. At Kabul the summer sun has great power, though the heat is tempered occasionally by cool breezes from the Hindu Kush, and the nights are usually cool. At Kandahar snow seldom falls on the plains or lower hills; when it does, it melts at once.

At Herat, though 800 ft. lower than Kandahar, the summer climate is more temperate; and, in fact, the climate altogether is far from disagreeable. From May to September the wind blows from the N.W. with great violence, and this extends across the country to Kandahar. The winter is tolerably mild; snow melts as it falls, and even on the mountains does not lie long. Three years out of four at Herat it does not freeze hard enough for the people to store ice; yet it was not very far from Herat, and could not have been at a greatly higher level (at Kafir Kala, near Kassan) that, in 1750, Ahmad Shah's army, retreating from Persia, is said to have lost 18,000 men from cold in a single night. In the northern Herat districts, too, records of the coldest month (February) show the mean minimum as 17° F., and the maximum 38°. The eastern reaches of the Hari Rud river are frozen hard in the winter, rapids and all, and the people travel on it as on a road.

The summer rains that accompany the S.W. monsoon in India, beating along the southern slopes of the Himalaya, travel up the Kabul valley as far as Laghman, though they are more clearly felt in Bajour and Panjkora, under the high spurs of the Hindu Kush, and in the eastern branches of Safed Koh. Rain also falls at this season at the head of Kurram valley. South of this the Suliman mountains may be taken as the western limit of the monsoon's action. It is quite unfelt in the rest of Afghanistan, in which, as in all the west of Asia, the winter rains are the most considerable. The spring rain, though less copious, is more important to agriculture than the winter rain, unless where the latter falls in the form of snow. In the absence of monsoon influences there are steadier weather indications than in India. The north-west blizzards which occur in winter and spring are the most noticeable feature, and their influence is clearly felt on the Indian frontier. The cold is then intense and the force of the wind cyclonic. Speaking generally, the Afghanistan climate is a dry one. The sun shines with splendour for three-fourths of the year, and the nights are even more clear than the days. Marked characteristics are the great differences of summer and winter temperature and of day and night temperature, as well as the extent to which change of climate can be attained by slight change of place. As the emperor Baber said of Kabul, at one day's journey from it you may find a place where snow never falls, and at two hours' journey a place where snow almost never melts!

The Afghans vaunt the salubrity and charm of some local climates, as of the Toba hills above the Kakar country, and of some of the high valleys of the Safed Koh.

The people have by no means that immunity from disease which the bright, dry character of the climate and the fine physical aspect of a large proportion of them might lead us to expect. Intermittent and remittent fevers are very prevalent; bowel complaints are common, and often fatal in the autumn. The universal custom of sleeping on the house-top in summer promotes rheumatic and neuralgic affections; and in the Koh Daman of Kabul, which the natives regard as having the finest of climates, the mortality from fever and bowel complaint, between July and October, is great, the immoderate use of fruit predisposing to such ailments.

Population.

The term Afghan really applies to one section only of the mixed conglomeration of nationalities which forms the people of Afghanistan, but this is the dominant section known as the Durani. The Ghilzai (who is almost as powerful as the Durani) claims to be of Turkish origin; the Hazaras, the Chahar-Aimak, Tajiks, Uzbegs, Kafirs and others are more or less subject races. Popularly any inhabitant of Afghanistan is known as Afghan on the Indian frontier without distinction of origin or language; but the language division between the Parsiwan (or Persian-speaking Afghan) and the Pathan is a very distinct one. The predominance of the Afghan in Afghanistan dates from the middle of the 18th century, when Ahmad Shah carved out Afghanistan from the previous conquests of Nadir Shah and called it the Durani empire.

The Durani Afghans claim to be Ben-i-Israel, and insist on their descent from the tribes who were carried away captive from Palestine to Media by Nebuchadrezzar. Yet they also claim to be Pukhtun (or Pathan) in common with all other Pushtu-speaking tribes, whom they do not admit to be Afghan. The bond of affinity between the various peoples who compose the Pathan community is simply the bond of a common language.

All of them recognize a common code or unwritten law called Pukhtunwali, which appears to be similar in general character to the old Hebraic law, though modified by Mahommedan ordinances, and strangely similar in certain particulars to Rajput custom. Besides their division into clans and tribes, the whole Afghan people may be divided into dwellers in tents and dwellers in houses; and this division is apparently not coincident with tribal divisions, for of several of the great clans at least a part is nomad and a part settled. Such, *e.g.*, is the case with the Durani and with the Ghilzai.

The settled Afghans form the village communities, and in part the population of the few towns. Their chief occupation is with the soil. They form the core of the nation and the main part of the army. Nearly all own the land on which they live, and which they cultivate with their own hands or by hired labour. Roundly speaking, agriculture and soldiering are their sole occupations. No Afghan will pursue a handicraft or keep a shop, though the Ghilzai Povindahs engage largely in travelling trade and transport of goods. As a race the Afghans are very handsome and athletic, often with fair complexion and flowing beard, generally black or brown, sometimes, though rarely, red; the features highly aquiline. The hair is shaved off from the forehead to the top of the head, the remainder at the sides being allowed to fall in large curls over the shoulders. Their step is full of resolution; their bearing proud and apt to be rough.

The women have handsome features of Jewish cast (the last trait often true also of the men); fair complexions, sometimes rosy, though usually a pale sallow; hair braided and plaited behind in two long tresses terminating in silken tassels. They are rigidly secluded, but intrigue is frequent.

The Afghans, inured to bloodshed from childhood, are familiar with death, and audacious in attack, but easily discouraged by failure; excessively turbulent and unsubmissive to law or discipline; apparently frank and affable in manner, especially when they hope to gain some object, but capable of the grossest brutality when that hope ceases. They are unscrupulous in perjury, treacherous, vain and insatiable, passionate in vindictiveness, which they will satisfy at the cost of their own lives and in the most cruel manner. Nowhere is crime committed on such trifling grounds, or with such general impunity, though when it is punished the punishment is atrocious. Among themselves the Afghans are quarrelsome, intriguing and distrustful; estrangements and affrays are of constant occurrence; the traveller conceals and misrepresents the time and direction of his journey. The Afghan is by breed and nature a bird of prey. If from habit and tradition he respects a stranger within his threshold, he yet considers it legitimate to warn a neighbour of the prey that is afoot, or even to overtake and plunder his guest after he has quitted his roof. The repression of crime and the demand of taxation he regards alike as tyranny. The Afghans are eternally boasting of their lineage, their independence and their prowess. They look on the Afghans as the first of nations, and each man looks on himself as the equal of any Afghan.

They are capable of enduring great privation, and make excellent soldiers under British discipline, though there are but few in the Indian army. Sobriety and hardiness characterize the bulk of the people, though the higher classes are too often stained with deep and degrading debauchery. The first impression made by the Afghan is favourable. The European, especially if he come from India, is charmed by their apparently frank, open-hearted, hospitable and manly manners; but the charm is not of long duration, and he finds that the Afghan is as cruel and crafty as he is independent. No trustworthy statistics exist showing either present numbers or fluctuations in the population of Afghanistan. Within the amir's dominions there are probably from four to five millions of people, and of these the vast majority are agriculturists.

The cultivators, including landowners, tenants, hired labourers and slaves, represent the working population of the country, and as industrious and successful agriculturists they are unsurpassed in Asia. They have carried the art of irrigation to great perfection, and they utilize every acre of profitable soil. Certain Ghilzai clans are specially famous for their skill in the construction of the karez or underground water-channel.

Religion.

The religion of the country throughout is Mahommedan. Next to Turkey, Afghanistan is the most powerful Mahommedan kingdom in existence. The vast majority of Afghans are of the Sunni sect; but there are, in their midst, such powerful communities of Shiahs as the Hazaras of the central districts, the Kizilbashes of Kabul and the Turis of the Kurram border, nor is there between them that bitterness of sectarian animosity which is so marked a feature in India. The Kafirs of the mountainous region of Kafiristan alone are non-Mahommedan. They are sunk in a paganism which seems to embrace some faint reflexion of Greek mythology, Zoroastrian principles and the tenets of Buddhism, originally gathered, no doubt, from the varied elements of their mixed extraction. Those contiguous Afghan tribes, who have not so long ago been converted to the faith of Islam, are naturally the most fanatical and the most virulent upholders of the faith around them. In and about the centre of civilization at Kabul, instances of Ghazism are comparatively rare. In the western provinces about Kandahar (amongst the Durani Afghans—the people who claim to be Beni-Israel), and especially in Zamindawar, the spirit of fanaticism runs high, and every other Afghan is a possible Ghazi—a man who has devoted his life to the extinction of other creeds.

Language and literature.

Persian is the vernacular of a large part of the non-Afghan population, and is familiar to all educated Afghans; it is the language of the court and of literature. Pushtu, however, is the prevailing language, though it does not seem to be spoken in Herat, or, roughly speaking, west of the Helmund. Turki is spoken in Afghan Turkestan. There is a respectable amount of Afghan literature. The oldest work in Pushtu is a history of the conquest of Swat by Shaikh Mali, a chief of the Yusafzais, and leader in the conquest (A.D. 1413–24). In 1494 Kaju Khan became chief of the same clan; during his rule Buner and Panjkora were completely conquered, and he wrote a history of the events. In the reign of Akbar, Bayazid Ansari, called Pir-i-Roshan, "the Saint of Light," the founder of an heretical sect, wrote in Pushtu; as did his chief antagonist, a famous Afghan saint called Akhund Darweza. The literature is richest in poetry. Abdur Rahman (17th century) is the best known poet. Another very popular poet is Khushal Khan, the warlike chief of the Khattaks in the time of Aurangzeb. Many other members of his family were poets also. Ahmad Shah, the founder of the monarchy, likewise wrote poetry. Ballads are numerous.

Education.

Education is confined to most elementary principles in Afghanistan. Of schools or colleges for the purposes of a higher education befitted to the sons of noblemen and the more wealthy merchants there are absolutely none; but the village school is an ever-present and very open spectacle to the passer-by. Here the younger boys are collected and instructed in the rudiments of reading, writing and religious creed by the village mullah, or priest, who thereby acquires an early influence over the Afghan mind. The method of teaching is confined to that wearisome system of loud-voiced repetition which is so annoying a feature in Indian schools; and the Koran is, of course, the text-book in all forms of education. Every Afghan gentleman can read and speak Persian, but beyond this acquirement education seems to be limited to the physical development of the youth by instruction in horsemanship and feats of skill. Such advanced education as exists in Afghanistan is centred in the priests and physicians; but the ignorance of both is extreme.

Constitution and laws.

The government of Afghanistan is an absolute monarchy under the amir, and succession to the throne is hereditary. There are five chief political divisions in the country—namely, Kabul, Turkestan, Herat, Kandahar and Badakshan, each of which is ruled by a "naib" or governor, who is directly responsible to the amir. Under the governors of provinces the nobles and kazis (or district judges) dispense justice much in the feudal fashion. There are three classes of chiefs who form the council or durbar of the king. These are the sirdars, the khans and the mullahs. The sirdars are hereditary nobles, the khans are representatives of the people, and the mullahs of Mahommedan religion. The khan is elected by the clan or tribe. The clannish attachment of the Afghans is rather to the community than to the chief. These three classes of representatives are divided into two assemblies, the Durbar Shahi or royal assembly, and the Kharwanin Mulkhi or commons. The mullahs take their place in one or the other according to their individual rank. The executive officials of the amir have a selected body, called the Khilwat, which acts as a cabinet council, but no member can give advice to the crown without being asked to do so, or beyond the jurisdiction of his own department. The amir, in addition to being chief executive officer, is chief judge and supreme court of appeal. Any one has the right to appeal to the amir for trial, and the great amirs, Dost Mahommed and Abdur Rahman, were accessible at all times to the petitions of their subjects. Next to the amir comes the court of the kazi, the chief centre of justice, and beneath the kazi comes the kotwal, who performs, as in India, the ordinary functions of a magistrate. In large provincial towns there is a punchait, or council, for the trial of commercial cases. There are government departments for the administration of revenue, customs, post-office, military affairs, &c. The general law administered in all the courts of Afghanistan is that of Islam and of the customs of the country, with developments introduced by the Amir Abdur Rahman.

Defence. The Afghan army probably numbers 50,000 regulars distributed between the military centres of Herat, Kandahar, Kabul, Mazar-i-Sharif, Jalalabad and Asmar, with detachments at frontier outposts on the side of India. Abdur Rahman claimed that he could put 100,000 men into the field within a week for the defence of Herat. In 1896 he introduced a system of semi-enforced service whereby one man in every eight between the ages of sixteen and seventy takes his turn at military training. In this way he calculated that he could have raised 1,000,000 men armed with modern weapons, but his chief difficulty would be money and transport. The pay of the army is apt to be irregular. The amir's factories at Kabul for arms and ammunition are said to turn out about 20,000 cartridges and 15 rifles daily, with 2 guns per week; but the arms thus produced are very heterogeneous, and the different varieties of cartridge used would cause endless complications. The two chief fastnesses of Northern Afghanistan are Herat and Dehdadi near Balkh. The latter fort took twelve years to build, and commands all the roads leading from the Oxus into Afghan Turkestan. It is armed with naval quick-firing guns, Krupp, Hotchkiss, Nordenfeld and Maxim. The chief cantonment for the same district is at Mazar-i-Sharif, 12 m. from Balkh.

Finance. Financially, Afghanistan has never, since it first became a kingdom, been able to pay for its own government, public works and army. There appears to be no inherent reason why this should be so. Whilst it can never (in the absence of any great mineral wealth) develop into a wealthy country, it can at least support its own population; and it would, but for the short-sighted trade policy of Abdur Rahman, certainly have risen to a position of respectable solvency. Its revenues (about which no trustworthy information is available) are subject to great fluctuations, and probably never exceed the value of one million sterling per annum. They fell in Shere Ali's time to £700,000. The original subsidy to the amir from the Indian government was fixed at 12 lakhs of rupees (£80,000) per annum, but in 1893, in connexion with the boundary settlement, it was increased to £120,000.

Minerals. Few minerals are wrought in Afghanistan, though Abdur Rahman claims in his autobiography that the country is rich in mines. Some small quantity of gold is taken from the streams in Laghman and the adjoining districts. Famous silver mines were formerly worked near the head of the Panjshir valley in Hindu Kush. Kabul is chiefly supplied with iron from the Permuli (or Farmuli) district, between the Upper Kurram and Gomal, where it is said to be abundant. Iron ore is most abundant near the passes leading to Bamian, and in other parts of Hindu Kush. Copper ore from various parts of Afghanistan has been seen, but it is nowhere worked. Lead is found in Upper Bangash (Kurram district), and in the Shinwari country (also among the branches of Safed Koh), and in the Kakar country. There are reported to be rich lead mines near Herat scarcely worked. Lead, with antimony, is found near the Arghand-ab, 32 m. north-west of Ghazni, and in the Ghorband valley, north of Kabul. Most of the lead used, however, comes from the Hazara country, where the ore is described as being gathered on the surface. An ancient mine of great extent and elaborate character exists at Feringal, in the Ghorband valley. Antimony is obtained in considerable quantities at Shah-Maksud, about 30 m. north of Kandahar. Sulphur is said to be found at Herat, dug from the soil in small fragments, but the chief supply comes from the Hazara country and from Pirkisri, on the confines of Seistan, where there would seem to be a crater, or fumarole. Sal-ammoniac is brought from the same place. Gypsum is found in large quantities in the plain of Kandahar, being dug out in fragile coralline masses from near the surface. Coal (perhaps lignite) is said to be found in Zurmat (between the Upper Kurram and the Gomal) and near Ghazni. Nitre abounds in the soil over all the south-west of Afghanistan, and often affects the water of the karez or subterranean canals.

Vegetation. The characteristic distribution of vegetation on the mountains of Afghanistan is worthy of attention. The great mass of it is confined to the main ranges and their immediate off-shoots, whilst on the more distant and terminal prolongations it is almost entirely absent; in fact, these are naked rock and stone.

Take, for example, the Safed Koh. On the alpine range itself and its immediate branches, at a height of 6000 to 10,000 ft., we have abundant growth of large forest trees, among which conifers are the most noble and prominent, such as *Cedrus Deodara*, *Abies excelsa*, *Pinus longifolia*, *P. Pinaster*, *P. Pinea* (the edible pine) and the larch. We have also the yew, the hazel, juniper, walnut, wild peach and almond. Growing under the shade of these are several varieties of rose, honeysuckle, currant, gooseberry, hawthorn, rhododendron and a luxuriant herbage, among which the ranunculus family is important for frequency and number of genera. The lemon and wild vine are also here met with, but are more common on the northern mountains. The walnut and oak (evergreen, holly-leaved and kermes) descend to the secondary heights, where they become mixed with alder, ash, khinjak, *Arbor-vitae*, juniper, with species of *Astragalus*, &c. Here also are *Indigoferae* and dwarf laburnum.

Lower again, and down to 3000 ft. we have wild olive, species of rock-rose, wild privet, acacias and mimosas, barberry and *Zizyphus*; and in the eastern ramifications of the chain, *Chamaerops humilis* (which is applied to a variety of useful purposes), *Bignonia* or trumpet flower, sissu, *Salvadora persica*, verbena, acanthus, varieties of *Gesnerae*.

The lowest terminal ridges, especially towards the west, are, as has been said, naked in aspect. Their scanty vegetation is almost wholly herbal; shrubs are only occasional; trees almost non-existent. Labiate, composite and umbelliferous plants are most common. Ferns and mosses are almost confined to the higher ranges.

In the low brushwood scattered over portions of the dreary plains of the Kandahar table-lands, we find leguminous thorny plants of the papilionaceous sub-order, such as camel-thorn (*Hedysarum Alhagi*), *Astragalus* in several varieties, spiny rest-harrow (*Ononis spinosa*), the fibrous roots of which often serve as a tooth-brush; plants of the sub-order *Mimosae*, as the sensitive mimosa; a plant of the rue family, called by the natives *lipâd;* the common wormwood; also certain orchids, and several species of *Salsola*. The rue and wormwood are in general use as domestic medicines—the former for rheumatism and neuralgia; the latter in fever, debility and dyspepsia, as well as for a vermifuge. The *lipâd*, owing to its heavy nauseous odour, is believed to keep off evil spirits. In some places, occupying the sides and hollows of ravines, are found the rose bay (*Nerium Oleander*), called in Persian *khar-zarah*, or ass-bane, the wild laburnum and various *Indigoferae*.

In cultivated districts the chief trees seen are mulberry, willow, poplar, ash, and occasionally the plane; but these are due to man's planting.

Uncultivated products of value. One of the most important of these is the gum-resin of *Narthex asafetida*, which grows abundantly in the high and dry plains of Western Afghanistan, especially between Kandahar and Herat. The depot for it is Kandahar, whence it finds its way to India, where it is much used as a condiment. It is not so used in Afghanistan, but the Seistan people eat the green stalks of the plant preserved in brine. The collection of the gum-resin is almost entirely in the hands of the Kakar clan of Afghans.

In the highlands of Kabul edible rhubarb is an important local luxury. The plants grow wild in the mountains. The bleached rhubarb, which has a very delicate flavour, is altered by covering the young leaves, as they sprout from the soil, with loose stones or an empty jar. The leaf-stalks are gathered by the neighbouring hill people, and carried down for sale. Bleached and unbleached rhubarb are both largely consumed, both raw and cooked.

The walnut and edible pine-nut are both wild growths, which are exported.

The *sanjît* (*Elaeaguns orientalis*), common on the banks of water-courses, furnishes an edible fruit. An orchis found in the mountain yields the dried tuber which affords the nutritious mucilage called *salep*; a good deal of this goes to India.

Pistacia khinjak affords a mastic. The fruit, mixed with its resin, is used for food by the Achakzais in Southern Afghanistan. The true pistachio is found only on the northern frontier; the nuts are imported from Badakshan and Kunduz.

Mushrooms and other fungi are largely used as food, especially by the Hindus of the towns, to whom they supply a substitute for meat.

Manna, of at least two kinds, is sold in the bazaars. One, called *turanjbîn*, appears to exude, in small round tears, from the camel-thorn, and also from the dwarf tamarisk; the other, *sir-kasht*, in large grains and irregular masses or cakes with bits of twig imbedded, is obtained from a tree which the natives call *siah chob* (black wood), thought by Bellew to be a *Fraxinus* or *Ornus*.

Agriculture.

In most parts of the country there are two harvests, as generally in India. One of these, called by the Afghans *bahârak*, or the spring crop, is sown in the end of autumn and reaped in summer. It consists of wheat, barley and a variety of lentils. The other, called *pâizah* or *tîrmâi*, the autumnal, is sown in the end of spring, and reaped in autumn. It consists of rice, varieties of millet and sorghum, of maize, *Phaseolus Mungo*, tobacco, beet, turnips, &c. The loftier regions have but one harvest.

Wheat is the staple food over the greater part of the country. Rice is not largely distributed. In much of the eastern mountainous country *bâjra* (*Holcus spicatus*) is the chief grain. Most English and Indian garden-stuffs are cultivated; turnips in some places very largely, as cattle food.

The growth of melons, water-melons and other cucurbitaceous plants is reckoned very important, especially near towns; and this crop counts for a distinct harvest.

Sugar-cane is grown only in the rich plains; and though cotton is grown in the warmer tracts, most of the cotton cloth is imported.

Madder is an important item of the spring crop in Ghazni and Kandahar districts, and generally over the west, and supplies the Indian demand. It is said to be very profitable, though it takes three years to mature. Saffron is grown and exported. The castor-oil plant is everywhere common, and furnishes most of the oil of the country. Tobacco is grown very generally; that of Kandahar has much repute, and is exported to India and Bokhara. Two crops of leaves are taken.

Lucerne and a trefoil called *shaftal* form important fodder crops in the western parts of the country, and, when irrigated, are said to afford ten or twelve cuttings in the season. The *komal* (*Prangos pabularia*) is abundant in the hill country of Ghazni, and is said to extend through the Hazara country to Herat. It is stored for winter use, and forms an excellent fodder. Others are derived from the *Holcus sorghum*, and from two kinds of panick. It is common to cut down the green wheat and barley before the ear forms, for fodder, and the repetition of this, with barley at least, is said not to injure the grain crop. Bellew gives the following statement of the manner in which the soil is sometimes worked in the Kandahar district:—Barley is sown in November; in March and April it is twice cut for fodder; in June the grain is reaped, the ground is ploughed and manured and sown with tobacco, which yields two cuttings. The ground is then prepared for carrots and turnips, which are gathered in November or December.

Of great moment are the fruit crops. All European fruits are produced profusely, in many varieties and of excellent quality. Fresh or preserved, they form a principal food of a large class of the people, and the dry fruit is largely exported. In the valleys of Kabul mulberries are dried, and packed in skins for winter use. This mulberry cake is often reduced to flour, and used as such, forming in some valleys the main food of the people.

Grapes are grown very extensively, and the varieties are very numerous. The vines are sometimes trained on trellises, but most frequently over ridges of earth 8 or 10 ft. high. The principal part of the garden lands in villages round Kandahar is vineyard, and the produce must be enormous.

Open canals are usual in the Kabul valley, and in eastern Afghanistan generally; but over all the western parts of the country much use is made of the *karez*, which is a subterranean aqueduct uniting the waters of several springs, and conducting their combined volume to the surface at a lower level.

Fauna.

As regards vertebrate zoology, Afghanistan lies on the frontier of three regions, viz. the *Eurasian*, the *Ethiopian* (to which region Baluchistan seems to belong) and the *Indo-Malayan*. Hence it naturally partakes somewhat of the forms of each, but is in the main *Eurasian*.

Felidae.—*F. catus*, *F. chaus* (both Eurasian); *F. caracal* (Eur., Ind., Eth.), about Kandahar; a small leopard, stated to be found almost all over the country, perhaps rather the cheetah (*F. jubatus*, Ind. and Eth.); *F. pardus*, the common leopard (Eth. and Ind.). The tiger exists in Afghan Turkestan.

Canidae.—The jackal (*C. aureus*, Eur., Ind., Eth.) abounds on the Helmund and Argand-ab, and probably elsewhere. Wolves (*C. Bengalensis*) are formidable in the wilder tracts, and assemble in troops on the snow, destroying cattle and sometimes attacking single horsemen. The hyena (*H. striata*, Africa to India) is common. These do not hunt in packs, but will sometimes singly attack a bullock; they and the wolves make havoc among sheep. A favourite feat of the boldest of the young men of southern Afghanistan is to enter the hyena's den, single-handed, muffle and tie him. There are wild dogs, according to Elphinstone and Conolly. The small Indian fox (*Vulpes Bengalensis*) is found; also *V. flavescens*, common to India and Persia, the skin of which is much used as a fur.

Mustelidae.—Species of mungoose (*Herpestes*), species of otter, *Mustela erminea*, and two ferrets, one of them with tortoise-shell marks, tamed by the Afghans to keep down vermin; a marten (*M. flavigula*, Indian).

Bears are two: a black one, probably *Ursus torquatus*; and one of a dirty yellow, *U. Isabellinus*, both Himalayan species.

Ruminants.—*Capra aegagrus* and *C. megaceros*; a wild sheep (*Ovis cycloceros* or *Vignei*); *Gazella subgutturosa*—these are often netted in batches when they descend to drink at a stream; *G. dorcas* perhaps; *Cervus Wallichii*, the Indian barasingha, and probably some other Indian deer, in the north-eastern mountains.

The wild hog (*Sus scrofa*) is found on the lower Helmund. The wild ass, *Gorkhar* of Persia (*Equus onager*), is frequent on the sandy tracts in the south-west.

The Himalayan varieties of the markhor and ibex are abundant in Kafiristan.

Talpidae.—A mole, probably *Talpa Europaea*; *Sorex Indicus*; *Erinaceus collaris* (Indian), and *Er. auritus* (Eurasian).

Bats believed to be *Phyllorhinus cineraceus* (Punjab species), *Scotophilus Bellii* (W. India), *Vesp. auritus* and *V. barbastellus*, both found from England to India.

Rodentia.—A squirrel (*Sciurus Syriacus?*); *Mus Indicus* and *M. Gerbellinus*; a jerboa (*Dipus telum?*); *Alactaga Bactriana*; *Gerbillus Indicus*, and *G. erythrinus* (Persian and Indian); *Lagomys Nepalensis*, a Central Asian species. A hare, probably *L. ruficaudatus*.

BIRDS.—The largest list of Afghan birds that we know of is given by Captain Hutton in the *J. As. Soc. Bengal*, vol. xvi. pp. 775 seq.; but it is confessedly far from complete. Of 124 species in that list, 95 are pronounced to be Eurasian, 17 Indian, 10 both Eurasian and Indian, 1 (*Turtur risorius*) Eur., Ind. and Eth.; and 1 only, *Carpodacus* (*Bucanetes*) *crassirostris*, peculiar to the country. Afghanistan appears to be, during the breeding season, the retreat of a variety of Indian and some African (desert) forms, whilst in winter the *avifauna* becomes overwhelmingly Eurasian.

REPTILES.—The following particulars are from Gray:—Lizards—*Pseudopus gracilis* (Eur.), *Argyrophis Horsfieldii*, *Salea Horsfieldii*, *Calotes Maria*, *C. versicolor*, *C. minor*, *C. Emma*, *Phrynocephalus Tickelii*—all Indian forms. A tortoise (*Testudo Horsfieldii*) appears to be peculiar to Kabul. There are apparently no salamanders or tailed Amphibia. The frogs are partly Eurasian, partly Indian; and the same may be said of the fish, but they are as yet most imperfectly known.

The camel is of a more robust and compact breed than the tall beast used in India, and is more carefully tended. The two-humped Bactrian camel is commonly used in the Oxus regions, but is seldom seen near the Indian frontier.

Horses form a staple export to India. The best of these, however, are reserved for the Afghan cavalry. Those exported to India are usually bred in Maimana and other places in Afghan

Turkestan. The indigenous horse is the *yabu*, a stout, heavy-shouldered animal, of about 14 hands high, used chiefly for burden, but also for riding. It gets over incredible distances at an ambling shuffle, but is unfit for fast work and cannot stand excessive heat. The breed of horses was much improved under the amir Abdur Rahman, who took much interest in it. Generally, colts are sold and worked too young.

The cows of Kandahar and Seistan give very large quantities of milk. They seem to be of the humped variety, but with the hump evanescent. Dairy produce is important in Afghan diet, especially the pressed and dried curd called *krūt* (an article and name perhaps introduced by the Mongols).

There are two varieties of sheep, both having the fat tail. One bears a white fleece, the other a russet or black one. Much of the white wool is exported to Persia, and now largely to Europe by Bombay. Flocks of sheep are the main wealth of the nomad population, and mutton is the chief animal food of the nation. In autumn large numbers are slaughtered, their carcases cut up, rubbed with salt and dried in the sun. The same is done with beef and camel's flesh.

The goats, generally black or parti-coloured, seem to be a degenerate variety of the shawl-goat.

The climate is found to be favourable to dog-breeding. Pointers are bred in the Kohistan of Kabul and above Jalalabad—large, heavy, slow-hunting, but fine-nosed and staunch; very like the old double-nosed Spanish pointer. There are greyhounds also, but inferior in speed to second-rate English dogs.

Trade and commerce.

The manufactures of the country have not developed much during recent years. Poshtins (sheepskin clothing) and the many varieties of camel and goat's hair-cloth which, under the name of "barak," "karak," &c., are manufactured in the northern districts, are still the chief local products of that part of Afghanistan. Herat and Kandahar are famous for their silks, although a large proportion of the manufactured silk found on the Herat market, as well as many of the felts, carpets and embroideries, are brought from the Central Asian khanates. The district of Herat produces many of the smaller sorts of carpets ("*galichas*" or prayer-carpets), of excellent design and colour, the little town of Adraskand being especially famous for this industry; but they are not to be compared with the best products of eastern Persia or of the Turkman districts about Panjdeh.

The nomadic Afghan tribes of the west are chiefly pastoral, and the wool of the southern Herat and Kandahar provinces is famous for its quality. In this direction, the late boundary settlements have undoubtedly led to a considerable development of local resources. A large quantity of wool, together with silk, dried fruit, madder and asafetida, finds its way to India by the Kandahar route.

It is impossible to give accurate trade statistics, there being no trustworthy system of registration. The value of the imports from Kabul to India in 1892–1893 was estimated at 221,000 Rx(or tens of rupees). In 1899 it was little over 217,000 Rx, the period of lowest intermediate depression being in 1897. These imports include horses, cattle, fruits, grain, wool, silk, hides, tobacco, drugs and provisions (ghi, &c.). All this trade emanates from Kabul, there being no transit trade with Bokhara owing to the heavy dues levied by the amir. The value of the exports from India to Kabul also shows great fluctuation. In the year 1892–1893 it was registered at nearly 611,000 Rx. In 1894–1895 it had sunk to 274,000 Rx, and in 1899 it figured at 294,600 Rx. The chief items are cotton goods, sugar and tea. In 1898–1899 the imports from Kandahar to India were valued at 330,000 Rx, and the exports from India to Kandahar at about 264,000 Rx. Three-fourths of the exports consist of cotton goods, and three-eighths of the imports were raw wool. The balance of the imports was chiefly made up of dried fruits. Comparison with trade statistics of previous years on this side Afghanistan is difficult, owing to the inclusion of a large section of Baluchistan and Persia within the official "Kandahar" returns; but it does not appear that the value of the western Afghanistan trade is much on the increase. The opening up of the route between Quetta and Seistan has doubtless affected a trade which was already seriously hampered by restrictions. In the year after the mission of Sir Louis Dane to Kabul in 1905 it was authoritatively stated that the trade between Afghanistan and India had nearly doubled in value.

Antiquities.

The basin of the Kabul river especially abounds in remains of the period when Buddhism flourished. Bamian is famous for its wall-cut figures, and at Haibak (on the route between Tashkurghan and Kabul) there are some most interesting Buddhist remains. In the Koh-Daman, north of Kabul, are the sites of several ancient cities, the greatest of which, called Beghram, has furnished coins in scores of thousands, and has been supposed to represent Alexander's Nicaea. Nearer Kabul, and especially on the hills some miles south of the city, are numerous topes. In the valley of Jalalabad are many remains of the same character.

In the valley of the Tarnak are the ruins of a great city (Ulan Robat) supposed to be the ancient Arachosia. About Girishk, on the Helmund, are extensive mounds and other traces of buildings; and the remains of several great cities exist in the plain of Seistan, as at Pulki, Peshawaran and Lakh, relics of ancient Drangiana. An ancient stone vessel preserved in a mosque at Kandahar is almost certainly the same that was treasured at Peshawar in the 5th century as the begging pot of Sakya-Muni. In architectural relics of a later date than the Graeco-Buddhist period Afghanistan is remarkably deficient. Of the city of Ghazni, the vast capital of Mahmud and his race, no substantial relics survive, except the tomb of Mahmud and two remarkable brick minarets. A vast and fruitful harvest of coins has been gathered in Afghanistan and the adjoining regions.

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HISTORY

The Afghan chroniclers call their people *Beni-Israil* (Arab. for Children of Israel), and claim descent from King Saul (whom they call by the Mahommedan corruption *Tālūt*) through a son whom they ascribe to him, called Jeremiah, who again had a son called Afghâna. The numerous stock of Afghâna were removed by Nebuchadrezzar, and found their way to the mountains of Ghor and Feroza (east and north of Herat). Only nine years after Mahommed's announcement of his mission they heard of the new prophet, and sent to Medina a deputation headed by a wise and holy man called Kais, to make inquiry. The deputation became zealous converts, and on their return converted their countrymen. From Kais and his three sons the whole of the genuine Afghans claim descent.

This story is repeated in great and varying detail in sundry books by Afghans, the oldest of which appears to be of the 16th century; nor do we know that any trace of the legend is found of older date. In the version given by Major Raverty (Introd. to *Afghan Grammar*), Afghanah is settled by King Solomon himself *in the Sulimani mountains*; there is nothing about Nebuchadrezzar or Ghor. The historian Ferishta says he had read that the Afghans were descended from Copts of the race of Pharaoh. And one of the Afghan histories, quoted by Mr Bellew, relates "a current tradition" that, previous to the time of Kais, *Bilo* the father of the Biluchis, *Uzbak* (evidently the father of the Usbegs) and *Afghana* were considered as brethren. As Mahommed Usbeg Khan, the *eponymus* of the medley of Tatar tribes called Usbegs, reigned in the 14th century A.D., this gives some possible light on the value of these so-called traditions.

We have analogous stories in the literature of almost all nations that derive their religion or their civilization from a foreign source. To say nothing of the *Book of Mormon*, a considerable number of persons have been found to propagate the doctrine that the English people are descended from the tribes of Israel. But the Hebrew ancestry of the Afghans is more worthy at least of consideration, for a respectable number of intelligent officers, well acquainted with the Afghans, have been strong in their belief of it; and though the customs alleged in proof will not bear the stress laid on them, undoubtedly a prevailing type of the Afghan physiognomy has a character strongly Jewish. This characteristic is certainly a remarkable one; but it is shared, to a considerable extent, by the Kashmiris (a circumstance which led Bernier to speculate on the Kashmiris representing the lost tribes of Israel), and, we believe, by the Tajik people of Badakshan.

Relations with the Greeks.—In the time of Darius Hystaspes (500 B.C.) we find the region now called Afghanistan embraced in the Achaemenian satrapies, and various parts of it occupied by *Sarangians* (in Seistan), *Arians* (in Herat), *Sattagydians* (supposed in highlands of upper Helmund and the plateau of Ghazni), *Dadicae* (suggested to be Tajiks), *Aparytae* (mountaineers, perhaps of Safed Koh, where lay the *Paryetae* of Ptolemy), *Gandarii* (in Lower Kabul basin) and *Paktyes*, on or near the Indus. In the last name it has been plausibly suggested that we have the *Pukhtun*, as the eastern Afghans pronounce their name. Indeed, *Pusht*, *Pasht* or *Pakht* would seem to be the oldest name of the country of the Afghans in their traditions.

The *Ariana* of Strabo corresponds generally with the existing dominions of Kabul, but overpasses their limits on the west and south.

About 310 B.C. Seleucus is said by Strabo to have given to the Indian Sandrocottus (Chandragupta), in consequence of a marriage-contract, some part of the country west of the Indus occupied by an Indian population, and no doubt embracing a part of the Kabul basin. Some sixty years later occurred the establishment of an independent Greek dynasty in Bactria. (See BACTRIA, MEDIA, EUCRATIDES, MENANDER of India, EUTHYDEMUS, and PERSIA, *Ancient History*.) Of the details of their history and extent of their dominion in different reigns we know almost nothing, and conjecture is often dependent on such vague data as are afforded by the collation of the localities in which the coins of independent princes have been found. But their power extended certainly over the Kabul basin, and probably, at times, over the whole of Afghanistan. The ancient architecture of Kashmir, the tope of Manikyala in the Punjab, and many sculptures found in the Peshawar valley, show unmistakable Greek influence. Demetrius (*c.* 190 B.C.) is supposed to have reigned in Arachosia after being expelled from Bactria, much as, at a later date, Baber reigned in Kabul after his expulsion from Samarkand. Eucratides (181 B.C.) is alleged by Justin to have warred in India. With his coins, found abundantly in the Kabul basin, commences the use of an Arianian inscription, in addition to the Greek, supposed to imply the transfer of rule to the south of the mountains, over a people whom the Greek dynasty sought to conciliate. Under Heliocles (147 B.C.?), the Parthians, who had already encroached on Ariana, pressed their conquests into India. Menander (126 B.C.) invaded India at least to the Jumna, and perhaps also to the Indus delta. The coinage of a succeeding king, Hermaeus, indicates a barbaric irruption. There is a general correspondence between classical and Chinese accounts of the time when Bactria was overrun by Scythian invaders. The chief nation among these, called by the Chinese *Yue-Chi*, about 126 B.C. established themselves in Sogdiana and on the Oxus in five hordes. Near the Christian era the chief of one of these, which was called Kushan, subdued the rest, and extended his conquests over the countries south of the Hindu Kush, including Sind as well as Afghanistan, thus establishing a great dominion, of which we hear from Greek writers as Indo-Scythia. (See YUE-CHI.)

Buddhism had already acquired influence over the people of the Kabul basin, and some of the barbaric invaders adopted that system. Its traces are extensive, especially in the plains of Jalalabad and Peshawar, but also in the vicinity of Kabul.

Various barbaric dynasties succeeded each other. A notable monarch was Kanishka (see INDIA, *History*) or Kanerkes, whose date is variously fixed at from 58 B C. to A.D. 125, and whose power extended over the upper Oxus basin, Kabul, Peshawar, Kashmir and probably far into India. His name and legends still filled the land, or at least the Buddhist portion of it, 600 years later, when the Chinese pilgrim, Hsüan Tsang, travelled in India; they had even reached the great Mahommedan philosopher, traveller and geographer, Abū-r-Raihān Muhammad al-Bīrūnī (see BĪRŪNĪ), in the 11th century; and they are still celebrated in the Mongol versions of Buddhist ecclesiastical story.

Turkoman Dynasties.—In the time of Hsüan Tsang (A.D. 630–645) there were both Indian and Turk princes in the Kabul valley, and in the succeeding centuries both these races seem to have predominated in succession. The first Mahommedan attempts at the conquest of Kabul were unsuccessful, though Seistan and Arachosia were permanently held from an early date. It was not till the end of the 10th century that a Hindu prince ceased to reign in Kabul, and it fell into the hands of the Turk Sabuktagin, who had established his capital at Ghazni. There, too, reigned his famous son Mahmud, and a series of descendants, till the middle of the 12th century, rendering the city one of the most splendid in Asia. We then have a powerful dynasty, commonly believed to have been of Afghan race; and if so, the first. But the historians give them a legendary descent from Zohak, which is no Afghan genealogy. The founder of the dynasty was Alauddin, chief of Ghor, whose vengeance for the cruel death of his brother at the hands of Bahram the Ghaznevide was wreaked in devastating the great city. His nephew, Shahabuddin Mahommed, repeatedly invaded India, conquering as far as Benares. His empire in India indeed—ruled by his freedmen who after his death became independent—may be regarded as the origin of that great Mahommedan monarchy which endured nominally till 1857. For a brief period the Afghan countries were subject to the king of Khwarizm, and it was here chiefly that occurred the gallant attempts of Jalaluddin of Khwarizm to withstand the progress of Jenghiz Khan.

A passage in Ferishta seems to imply that the Afghans in the Sulimani mountains were already known by that name in the first century of the Hegira, but it is uncertain how far this may be built on. The name *Afghans* is very distinctly mentioned in 'Utbi's *History of Sultan Mahmud*, written about A.D. 1030, coupled with that of the *Khiljis*. It also appears frequently in connexion with the history of India in the 13th and 14th centuries. The successive dynasties of Delhi are generally called *Pathan*, but were really so only in part. Of the *Khiljis* (1288–1321) we have already spoken. The Tughlaks (1321–1421) were originally Tatars of the Karauna tribe. The Lodis (1450–1526) were pure Pathans. For a century and more after the Mongol invasion the whole of the Afghan countries were under Mongol rule; but in the middle of the 14th century a native dynasty sprang up in western Afghanistan, that of the *Kurts*, which extended its rule over Ghor, Herat and Kandahar. The history of the Afghan countries under the Mongols is obscure; but that régime must have left its mark upon the country, if we judge from the occurrence of frequent Mongol names of places, and even of Mongol expressions adopted into familiar language.

The Mogul Dynasty.—All these countries were included in Timur's conquests, and Kabul at least had remained in the possession of one of his descendants till 1501, only three years before it fell into the hands of another and more illustrious one, Sultan Baber. It was not till 1522 that Baber succeeded in permanently wresting Kandahar from the Arghuns, a family of Mongol descent, who had long held it. From the time of his conquest of Hindustan (victory at Panipat, April 21, 1526), Kabul and Kandahar may be regarded as part of the empire of Delhi under the (so-called) Mogul dynasty which Baber founded. Kabul so continued till the invasion of Nadir Shah (1738). Kandahar often changed hands between the Moguls and the rising Safavis (or Sufis) of Persia. Under the latter it had remained from 1642 till 1708, when in the reign of Husain, the last of them, the Ghilzais, provoked by the oppressive Persian governor Shahnawaz Khan (a Georgian prince of the Bagratid house), revolted under Mir Wais, and expelled the Persians. Mir Wais was acknowledged sovereign of Kandahar, and eventually defeated the Persian armies sent against him, but did not long survive (*d.* 1715).

Mahmud, the son of Mir Wais, a man of great courage and energy, carried out a project of his father's, the conquest of Persia itself. After a long siege, Shah Husain came forth from Ispahan with all his court, and surrendered the sword and diadem of the Sufis into the hands of the Ghilzai (October 1722). Two years later Mahmud died mad, and a few years saw the end of Ghilzai rule in Persia.

The Durani Dynasty.—In 1737-38 Nadir Shah both recovered Kandahar and took Kabul. But he gained the goodwill of the Afghans, and enrolled many in his army. Among these was a noble young soldier, Ahmad Khan, of the Saddozai family of the Abdali clan, who after the assassination of Nadir (1747) was chosen by the Afghan chiefs at Kandahar to be their leader, and assumed kingly authority over the eastern part of Nadir's empire, with the style of *Dur-i-Durân*, "Pearl of the Age," bestowing that of *Durani* upon his clan, the Abdalis. With Ahmad Shah, Afghanistan, as such, first took a place among the kingdoms of the earth, and the Durani dynasty, which he founded, still occupies its throne. During the twenty-six years of his reign he carried his warlike expeditions far and wide. Westward they extended nearly to the shores of the Caspian; eastward he repeatedly entered India as a conqueror. At his great battle of Panipat (January 6, 1761), with vastly inferior numbers, he inflicted on the Mahrattas, then at the zenith of their power, a tremendous defeat, almost annihilating their vast army; but the success had for him no important result. Having long suffered from a terrible disease, he died in 1773, bequeathing to his son Timur a dominion which embraced not only Afghanistan to its utmost limits, but the Punjab, Kashmir and Turkestan to the Oxus, with Sind, Baluchistan and Khorasan as tributary governments.

Timur transferred his residence from Kandahar to Kabul, and continued during a reign of twenty years to stave off the anarchy which followed close on his death. He left twenty-three sons, of whom the fifth, Zaman Mirza, by help of Payindah Khan, head of the Barakzai family of the Abdalis, succeeded in grasping the royal power. For many years barbarous wars raged between the brothers, during which Zaman Shah, Shuja-ul-Mulk and Mahmud successively held the throne. The last owed success to Payindah's son, Fatteh Khan (known as the "Afghan Warwick"), a man of masterly ability in war and politics, the eldest of twenty-one brothers, a family of notable intelligence and force of character, and many of these he placed over the provinces. Fatteh Khan, however, excited the king's jealously by his powerful position, and provoked the malignity of the king's son, Kamran, by a gross outrage on the Saddozai family. He was accordingly seized, blinded and afterwards murdered with prolonged torture, the brutal Kamran striking the first blow.

The Barakzai brothers united to avenge Fatteh Khan. The Saddozais were driven from Kabul, Ghazni and Kandahar, and with difficulty reached Herat (1818). Herat remained thus till Kamran's death (1842), and after that was held by his able and wicked minister Yar Mahommed. The rest of the country was divided among the Barakzais—Dost Mahommed, the ablest, getting Kabul. Peshawar and the right bank of the Indus fell to the Sikhs after their victory at Nowshera in 1823. The last Afghan hold of the Punjab had been lost long before—Kashmir in 1819; Sind had cast off all allegiance since 1808; the Turkestan provinces had been practically independent since the death of Timur Shah.

The First Afghan War, 1838–42.—In 1809, in consequence of the intrigues of Napoleon in Persia, the Hon. Mountstuart Elphinstone had been sent as envoy to Shah Shuja, then in power, and had been well received by him at Peshawar. This was the first time the Afghans made any acquaintance with Englishmen. Lieut. Alex. Burnes (afterwards Sir Alex. Burnes) visited Kabul on his way to Bokhara in 1832. In 1837 the Persian siege of Herat and the proceedings of Russia created uneasiness, and Burnes was sent by the governor-general as resident to the amir's court at Kabul. But the terms which the Dost sought were not conceded by the government, and the rash resolution was taken of re-establishing Shah Shuja, long a refugee in British territory. Ranjit Singh, king of the Punjab, bound himself to co-operate, but eventually declined to let the expedition cross his territories.

The war began in March 1838, when the "Army of the Indus," amounting to 21,000 men, assembled in Upper Sind and advanced through the Bolan Pass under the command of Sir John Keane. There was hardship, but scarcely any opposition. Kohandil Khan of Kandahar fled to Persia. That city was occupied in April 1839, and Shah Shuja was crowned in his grandfather's mosque. Ghazni was reached 21st July; a gate of the city was blown open by the engineers (the match was fired by Lieut., afterwards Sir Henry, Durand), and the place was taken by storm. Dost Mahommed, finding his troops deserting, passed the Hindu Kush, and Shah Shuja entered the capital (August 7). The war was thought at an end, and Sir John Keane (made a peer) returned to India with a considerable part of the force, leaving behind 8000 men, besides the Shah's force, with Sir W. Macnaghten as envoy, and Sir A. Burnes as his colleague.

During the two following years Shah Shuja and his allies remained in possession of Kabul and Kandahar. The British outposts extended to Saighan, in the Oxus basin, and to Mullah Khan, in the plain of Seistan. Dost Mahommed surrendered (November 3, 1840) and was sent to India, where he was honourably treated. From the beginning, insurrection against the new government had been rife. The political authorities were over-confident, and neglected warnings. On the 2nd of November 1841 the revolt broke out violently at Kabul, with the massacre of Burnes and other officers. The position of the British camp, its communications with the citadel and the location of the stores were the worst possible; and the general (Elphinstone) was shattered in constitution. Disaster after disaster occurred, not without misconduct. At a conference (December 23) with the Dost's son, Akbar Khan, who had taken the lead of the Afghans, Sir W. Macnaghten was murdered by that chief's own hand. On the 6th of January 1842, after a convention to evacuate the country had been signed, the British garrison, still numbering 4500 soldiers (of whom 690 were Europeans), with some 12,000 followers, marched out of the camp. The winter was severe, the troops demoralised, the march a mass of confusion and massacre, and the force was finally overwhelmed in the Jagdalak pass between Kabul and Jalalabad.

On the 13th the last survivors mustered at Gandamak only twenty muskets. Of those who left Kabul, only Dr Brydon reached Jalalabad, wounded and half dead. Ninety-five prisoners were afterwards recovered. The garrison of Ghazni had already been forced to surrender (December 10). But General Nott held Kandahar with a stern hand, and General Sale, who had reached Jalalabad from Kabul at the beginning of the outbreak, maintained that important point gallantly.

To avenge these disasters and recover the prisoners preparations were made in India on a fitting scale; but it was the 16th of April 1842 before General Pollock could relieve Jalalabad, after forcing the Khyber Pass. After a long halt there he advanced (August 20), and gaining rapid successes, occupied Kabul (September 15), where Nott, after retaking and dismantling Ghazni, joined him two days later. The prisoners were happily recovered from Bamian. The citadel and central bazaar of Kabul were destroyed, and the army finally evacuated Afghanistan, December 1842.

This ill-planned and hazardous enterprise was fraught with the elements of inevitable failure. A ruler imposed upon a free people by foreign arms is always unpopular; he is unable to stand alone; and his foreign auxiliaries soon find themselves obliged to choose between remaining to uphold his power, or retiring with the probability that it will fall after their departure. The leading chiefs of Afghanistan perceived that the maintenance of Shah Shuja's rule by British troops would soon be fatal to their own power and position in the country, and probably to their national independence. They were insatiable in their demands for office and emolument, and when they discovered that the shah, acting by the advice of the British envoy, was levying from among their tribesmen regiments to be directly under his control, they took care that the plan should fail. Without a regular revenue no effective administration could be organized; but the attempt to raise taxes showed that it might raise the people, so that for both men and money the shah's government was still obliged to rely principally upon British aid. All these circumstances combined to render the new régime weak and unpopular, since there was no force at the ruler's command except foreign troops to put down disorder or to protect those who submitted, while the discontented nobles fomented disaffection and the inbred hatred of strangers in race and religion among the general Afghan population.

British and Russian Relations.—It has been said that the declared object of this policy had been to maintain the independence and integrity of Afghanistan, to secure the friendly alliance of its ruler, and thus to interpose a great barrier of mountainous country between the expanding power of Russia in Central Asia and the British dominion in India. After 1849, when the annexation of the Punjab had carried the Indian north-western frontier up to the skirts of the Afghan highlands, the corresponding advance of the Russians south-eastward along the Oxus river became of closer interest to the British, particularly when, in 1856, the Persians again attempted to take possession of Herat. Dost Mahommed now became the British ally, but on his death in 1863 the kingdom fell back into civil war, until his son, Shere Ali, had won his way to undisputed rulership in 1868. In the same year Bokhara became a dependency of Russia. To the British government an attitude of non-intervention in Afghan affairs appeared in this situation to be no longer possible. The meeting between the amir Shere Ali and the viceroy of India (Lord Mayo) at Umballa in 1869 drew nearer the relations between the two governments; the amir consolidated and began to centralize his power; and the establishment of a strong, friendly and united Afghanistan became again the keynote of British policy beyond the north-western frontier of India.

When, therefore, the conquest of Khiva in 1873 by the Russians, and their gradual approach towards the amir's northern border, had seriously alarmed Shere Ali, he applied for support to the British; and his disappointment at his failure to obtain distinct pledges of material assistance, and at Great Britain's refusal to endorse all his claims in a dispute with Persia over Seistan, so far estranged him from the British connexion that he began to entertain amicable overtures from the Russian authorities at Tashkend. In 1869 the Russian government had assured Lord Clarendon that they regarded Afghanistan as completely outside the sphere of their influence; and in 1872 the boundary line of Afghanistan on the north-west had been settled between England and Russia so far eastward as Lake Victoria.

Nevertheless the correspondence between Kabul and Tashkend continued, and as the Russians were now extending their dominion over all the region beyond Afghanistan on the north-west, the British government determined, in 1876, once more to undertake active measures for securing their political ascendancy in that country. But the amir, whose feelings of resentment had by no means abated, was now leaning toward Russia, though he mainly desired to hold the balance between two equally formidable rivals. The result of overtures made to him from India was that in 1877, when Lord Lytton, acting under direct instructions from Her Majesty's ministry, proposed to Shere Ali a treaty of alliance, Shere Ali showed himself very little disposed to welcome the offer; and upon his refusal to admit a British agent into Afghanistan the negotiations finally broke down.

Second Afghan War, 1878–80.—In the course of the following year (1878) the Russian government, to counteract the interference of England with their advance upon Constantinople, sent an envoy to Kabul empowered to make a treaty with the amir. It was immediately notified to him from India that a British mission would be deputed to his capital, but he demurred to receiving it; and when the British envoy was turned back on the Afghan frontier hostilities were proclaimed by the viceroy in November 1878, and the second Afghan War began. Sir Donald Stewart's force, marching up through Baluchistan by the Bolan Pass, entered Kandahar with little or no resistance; while another army passed through the Khyber Pass and took up positions at Jalalabad and other places on the direct road to Kabul. Another force under Sir Frederick Roberts marched up to the high passes leading out of Kurram into the interior of Afghanistan, defeated the amir's troops at the Peiwar Kotal, and seized the Shutargardan Pass which commands a direct route to Kabul through the Logar valley. The amir Shere Ali fled from his capital into the northern province, where he died at Mazar-i-Sharif in February 1879. In the course of the next six months there was much desultory skirmishing between the tribes and the British troops, who defeated various attempts to dislodge them from the positions that had been taken up; but the sphere of British military operations was not materially extended. It was seen that the farther they advanced the more difficult would become their eventual retirement; and the problem was to find a successor to Shere Ali who could and would make terms with the British government.

In the meantime Yakub Khan, one of Shere Ali's sons, had announced to Major Cavagnari, the political agent at the headquarters of the British army, that he had succeeded his father at Kabul. The negotiations that followed ended in the conclusion of the treaty of Gandamak in May 1879, by which Yakub Khan was recognized as amir; certain outlying tracts of Afghanistan were transferred to the British government; the amir placed in its hands the entire control of his foreign relations, receiving in return a guarantee against foreign aggression; and the establishment of a British envoy at Kabul was at last conceded. By this convention the complete success of the British political and military operations seemed to have been attained; for whereas Shere Ali had made a treaty of alliance with, and had received an embassy from Russia, his son had now made an exclusive treaty with the British government, and had agreed that a British envoy should reside permanently at his court. Yet it was just this final concession, the chief and original object of British policy, that proved speedily fatal to the whole settlement. For in September the envoy, Sir Louis Cavagnari, with his staff and escort, was massacred at Kabul, and the entire fabric of a friendly alliance went to pieces. A fresh expedition was instantly despatched across the Shutargardan Pass under Sir Frederick Roberts, who defeated the Afghans at Charasia near Kabul, and entered the city in October. Yakub Khan, who had surrendered, was sent to India; and the British army remained in military occupation of the district round Kabul until in December (1879) its communications with India were interrupted, and its position at the capital placed in serious jeopardy, by a general rising of the tribes. After they had been repulsed and put down, not without some hard fighting, Sir Donald Stewart, who had not quitted Kandahar, brought a force up by Ghazni to Kabul, overcoming some resistance on his way, and assumed the supreme command. Nevertheless the political situation was still embarrassing, for as the whole country beyond the range of British effective military control was masterless, it was undesirable to withdraw the troops before a government could be reconstructed which could stand without foreign support, and with which diplomatic relations of some kind might be arranged. The general position and prospect of political affairs in Afghanistan bore, indeed, an instructive resemblance to the situation just forty years earlier, in 1840, with the important differences that the Punjab and Sind had since become British, and that communications between Kabul and India were this time secure.

Reign of Abdur Rahman.—Abdur Rahman, the son of the late amir Shere Ali's elder brother, had fought against Shere Ali in the war for succession to Dost Mahommed, had been driven beyond the Oxus, and had lived for ten years in exile with the Russians. In March 1880 he came back across the river, and began to establish himself in the northern province of Afghanistan. The viceroy of India, Lord Lytton, on hearing of his reappearance, instructed the political authorities at Kabul to communicate with him. By skilful negotiations a meeting was arranged, and after pressing in vain for a treaty he was induced to assume charge of the country upon his recognition by the British as amir, with the understanding that he should have no relations with other foreign powers, and with a formal assurance from the viceroy of protection from foreign aggression, so long as he should unreservedly follow the advice of the British government in regard to his external affairs. The province of Kandahar was severed from the Kabul dominion; and the sirdar Shere Ali Khan, a member of the Barakzai family, was installed by the British representative as its independent ruler.

For the second time in the course of this war a conclusive settlement of Afghan affairs seemed now to have been attained; and again, as in 1879, it was immediately dissolved. In July 1880, a few days after the proclamation of Abdur Rahman as amir at Kabul, came news that Ayub Khan, Shere Ali's younger son, who had been holding Herat since his father's death, had marched upon Kandahar, had utterly defeated at Maiwand a British force that went out from Kandahar to oppose him, and was besieging that city. Sir Frederick Roberts at once set out from Kabul with 10,000 men to its relief, reached Kandahar after a rapid march of 313 miles, attacked and routed Ayub Khan's army on the 1st of September, and restored British authority in southern Afghanistan. As the British ministry had resolved to evacuate Kandahar, the sirdar Shere Ali Khan, who saw that he could not stand alone, resigned and withdrew to India, and the amir Abdur Rahman was invited to take possession of the province. But when Ayub Khan, who had meanwhile retreated to Herat, heard that the British forces had retired, early in 1881, to India, he mustered a fresh army and again approached Kandahar. In June the fort of Girishk, on the Helmund, was seized by his adherents; the amir's troops were defeated some days later in an engagement, and Ayub Khan took possession of Kandahar at the end of July. The amir Abdur Rahman, whose movements had hitherto been slow and uncertain, now acted with vigour and decision. He marched rapidly from Kabul at the head of a force, with which he encountered Ayub Khan under the walls of Kandahar, and routed his army on 22nd September, taking all his guns and equipage. Ayub Khan fled toward Herat, but as the place had meanwhile been occupied by one of the amir's generals he took refuge in Persia. By this victory Abdur Rahman's rulership was established.

In 1884 it was determined to resume the demarcation, by a joint commission of British and Russian officers, of the northern boundary of Afghanistan. The work went on with much difficulty and contention, until in March 1885, when the amir was at Rawalpindi for a conference with the viceroy of India, Lord Dufferin, the news came that at Panjdeh, a disputed place on the boundary held by the Afghans, the Russians had attacked and driven out with some loss the amir's troops. For the moment the consequences seemed likely to be serious; but the affair was arranged diplomatically, and the demarcation proceeded up to a point near the Oxus river, beyond which the commission were unable to settle an agreement.

During the ten years following his accession in 1880 Abdur Rahman employed himself in extending and consolidating his dominion over the whole country. Some local revolts among the tribes were rigorously suppressed; and two attempts to upset his rulership—the first by Ayub Khan, who entered Afghanistan from Persia, the second and more dangerous one by Ishak Khan, the amir's cousin, who rebelled against him in Afghan Turkestan—were defeated. By 1891 the amir had enforced his supreme authority throughout Afghanistan more completely than any of his predecessors. In 1895 the amir's troops entered Kafiristan, a wild mountainous tract on the north-east, inhabited by a peculiar race that had hitherto defied all efforts to subjugate them, but were now gradually reduced to submission. Meanwhile the delimitation of the northern frontier, up to the point where it meets Chinese territory on the east, was completed and fixed by arrangements between the governments of Russia and Great Britain; and the eastern border of the Afghan territory, towards India, was also mapped out and partially laid down, in accordance with a convention between the two governments. The amir not only received a large annual subsidy of money from the British government, but he also obtained considerable supplies of war material; and he, moreover, availed himself very freely of facilities that were given him for the importation at his own cost of arms through India. With these resources, and with the advantage of an assurance from the British government that he would be aided against foreign aggression, he was able to establish an absolute military despotism inside his kingdom, by breaking down the power of the warlike tribes which held in check, up to his time, the personal autocracy of the Kabul rulers, and by organizing a regular army well furnished with European rifles and artillery. Taxation of all kinds was heavily increased, and systematically collected. The result was that whereas in former times the forces of an Afghan ruler consisted mainly of a militia, furnished by the chiefs of tribes who held land on condition of military service, and who stoutly resisted any attempt to commute this service for money payment, the amir had at his command a large standing army, and disposed of a substantial revenue paid direct to his treasury. Abdur Rahman executed or exiled all those whose political influence he saw reason to fear, or of whose disaffection he had the slightest suspicion; his administration was severe and his punishments were cruel; but undoubtedly he put down disorder, stopped the petty tyranny of local chiefs and brought violent crime under some effective control in the districts. Travelling by the high roads during his reign was comparatively safe; although it must be added that the excessive exactions of dues and customs very seriously damaged the external trade. In short, Abdur Rahman's reign produced an important political revolution, or reformation, in Afghanistan, which rose from the condition of a country distracted by chronic civil wars, under rulers whose authority depended upon their power to hold down or conciliate fierce and semi-independent tribes in the outlying parts of the dominion, to the rank of a formidable military state governed autocratically. He established, for the first time in the history of the Afghan kingdom, a powerfully centralized administration strong enough to maintain order and to enforce obedience over all the country which he had united under his dominion, supported by a force sufficiently armed and disciplined to put down attempts at resistance or revolt. His policy, consistently maintained, was to permit no kind of foreign interference, on any pretext, with the interior concerns or the economical conditions of his country. From the British government he accepted supplies of arms and subsidies of money; but he would make no concessions in return, and all projects of a strategical or commercial nature, such as railways and telegraphs, proposed either for the defence or the development of his possessions, seem to have been regarded by the amir with extreme distrust, as methods of what has been called pacific penetration—so that on these points he was immovable. It was probably due to the strength and solidity of the executive administration organized, during his lifetime, by Abdur Rahman that, for the first time in the records of the dynasty founded by Ahmad Shah in the latter part of the 18th century, his death was not followed by disputes over the succession or by civil war.

Succession of Habibullah.—The amir Abdur Rahman died on the 1st of October 1901; and two days later his eldest son, Habibullah, formally announced his accession to the rulership. He was recognized with acclamation by the army, by the religious bodies, by the principal tribal chiefs and by all classes of the people as their lawful sovereign; while a deputation of Indian Mahommedans was despatched to Kabul from India to convey the condolences and congratulations of the viceroy. The amir's first measures were designed to enhance his popularity and to improve his internal administration, particularly with regard to the relations of his government with the tribes, and to the system introduced by the late amir of compulsory military service, whereby each tribe was required to supply a proportionate number of recruits. With this object a council of state for tribal affairs was established; and it was arranged that a representative of each tribe should be associated with the provincial governors for the adjudication of tribal cases.

In the important matter of foreign relations Habibullah showed a determination to adopt the policy of his father, to whom the British government had given an assurance of aid to repel foreign aggression, on the condition that the amir should follow the advice of that government in regard to external affairs. This condition was loyally observed by the new amir, who referred to India all communications of an official kind received from the Russian authorities in the provinces bordering on Afghanistan. But toward the various questions left pending between the governments of India and Afghanistan the new amir maintained also his father's attitude. He gave no indications of a disposition to continue the discussion of them, or to entertain proposals for extending or altering his relations with the Indian government. An invitation from the viceroy to meet him in India, with the hope that these points might be settled in conference, was put aside by dilatory excuses, until at last the project was abandoned, and finally the amir agreed to receive at Kabul a diplomatic mission. The mission, whose chief was Sir Louis Dane, foreign secretary to the Indian government, reached Kabul early in December 1904, and remained there four months in negotiation with the amir personally and with his representatives. It was found impossible, after many interviews, to obtain from Habibullah his consent to any addition to or variation of the terms of the assurance given by the British government in 1880, with which he professed himself entirely satisfied, so that the treaty finally settled in March 1905 went no further than a formal confirmation of all engagements previously concluded with the amir's predecessor. It was felt in British circles at the time that a very considerable concession to Habibullah's independence of attitude was displayed in the fact that he was styled in the treaty "His Majesty"; but, in the circumstances, it seems to have been thought diplomatic to accede to the amir's determination to insist on this matter of style. But the rebuff showed that it was desirable in the interests both of the British government and of Afghanistan that an opportunity should be made for enabling the amir to have personal acquaintance with the highest Indian authorities. A further step, calculated to strengthen the relations of amity between the two governments, was taken when it was arranged that the amir should pay a visit to the viceroy, Lord Minto, in India, in January 1907; and this visit took place with great cordiality and success.

The Anglo-Russian Convention, signed on the 31st of August 1907, contained the following important declarations with regard to Afghanistan. Great Britain disclaimed any intention of altering the political status or (subject to the observance of the treaty of 1905) of interfering in the administration or annexing any territory of Afghanistan, and engaged to use her influence there in no manner threatening to Russia. Russia, on her part, recognized Afghanistan as outside her sphere of influence.

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(H. Y.; A. C. L.)

AFGHAN TURKESTAN, the most northern province of Afghanistan. It is bounded on the E. by Badakshan, on the N. by the Oxus river, on the N.W. and W. by Russia and the Hari Rud river, and on the S. by the Hindu Kush, the Koh-i-Baba and the northern watershed of the Hari Rud basin. Its northern frontier was decided by the Anglo-Russian agreement of 1873, and delimited by the Russo-Afghan boundary commission of 1885, which gave rise to the Panjdeh incident. The whole territory, from the junction of the Kokcha river with the Oxus on the north-east to the province of Herat on the south-west, is some 500 m. in length, with an average width from the Russian frontier to the Hindu Kush of 114 m. It thus comprises about 57,000 sq. m. or roughly two-ninths of the kingdom of Afghanistan. Except in the river valleys it is a poor territory, rough and mountainous towards the south, but subsiding into undulating wastes and pasture-lands towards the Turkman desert, and the Oxus riverain which is highly cultivated. The population, which is mostly agricultural, settled in and around its towns and villages, is estimated at 750,000. The province includes the khanates of Kunduz, Tashkurgan, Balkh with Akcha; the western khanates of Saripul, Shibarghan, Andkhui and Maimana, sometimes classed together as the Chahar Villayet, or "Four Domains"; and such parts of the Hazara tribes as lie north of the Hindu Kush and its prolongation. The principal town is Mazar-i-Sharif, which in modern times has supplanted the ancient city of Balkh; and Takhtapul, near Mazar, is the chief Afghan cantonment north of the Hindu Kush.

Ethnically and historically Afghan Turkestan is more connected with Bokhara than with Kabul, of which government it has been a dependency only since the time of Dost Mahommed. The bulk of the people of the cities are of Persian and Uzbeg stock, but interspersed with them are Mongol Hazaras and Hindus with Turkoman tribes in the Oxus plains. Over these races the Afghans rule as conquerors and there is no bond of racial unity between them. Ancient Balkh or Bactriana was a province of the Achaemenian empire, and probably was occupied in great measure by a race of Iranian blood. About 250 B.C. Diodotus (Theodotus), governor of Bactria under the Seleucidae, declared his independence, and commenced the history of the Greco-Bactrian dynasties, which succumbed to Parthian and nomadic movements about 126 B.C. After this came a Buddhist era which has left its traces in the gigantic sculptures at Bamian and the rock-cut topes of Haibak. The district was devastated by Jenghiz Khan, and has never since fully recovered its prosperity. For about a century it belonged to the Delhi empire, and then fell into Uzbeg hands. In the 18th century it formed part of the dominion of Ahmad Khan Durani, and so remained under his son Timur. But under the fratricidal wars of Timur's sons the separate khanates fell back under the independent rule of various Uzbeg chiefs. At the beginning of the 19th century they belonged to Bokhara; but under the great amir Dost Mahommed the Afghans recovered Balkh and Tashkurgan in 1850, Akcha and the four western khanates in 1855, and Kunduz in 1859. The sovereignty over Andkhui, Shibarghan, Saripul and Maimana was in dispute between Bokhara and Kabul until settled by the Anglo-Russian agreement of 1873 in favour of the Afghan claim. Under the strong rule of Abdur Rahman these outlying territories were closely welded to Kabul; but after the accession of Habibullah the bonds once more relaxed. (T. H. H.*)

AFIUM-KARA-HISSAR (*afium*, opium), the popular name of Kara-hissar Sahib, a city of Asiatic Turkey, in the vilayet of Brusa, nearly 200 m. E. of Smyrna, and 50 m. S.S.E. of Kutaiah. Pop. 18,000 (Moslems, 13,000; Christians, 5000). Called Nicopolis by Leo III. after his victory over the Arabs in 740, its name was changed by the Seljuk Turks to Kara-hissar. It stands partly on level ground, partly on a declivity, and above it rises a precipitous trachytic rock (400 ft.) on the summit of which are the ruins of an ancient castle. From its situation on the route of the caravans between Smyrna and western Asia on the one hand, and Armenia, Georgia, &c., on the other, the city became a place of extensive trade, and its bazaars are well stocked with the merchandise of both Europe and the East. Opium in large quantities is produced in its vicinity and forms the staple article of its commerce; and there are, besides, manufactures of black felts, carpets, arms and saddlery. Afium contains several mosques (one of them a very handsome building), and is the seat of an Armenian bishop. The town is connected by railway with Smyrna, Konia, Angora and Constantinople.

See V. Cuinet, *Turquie d'Asie* (Paris, 1894), vol. iv.

A FORTIORI (Lat. " from a stronger [reason] "), a term used of an argument which justifies a statement not itself specifically demonstrated by reference to a proved conclusion which includes it; thus, if A is proved less than B, and is known to be greater than C, it follows *a fortiori* that C is less than B without further proof. The argument is frequently based merely on a comparison of probabilities (cf. Matt. vi. 30), when it constitutes an appeal to common sense.

AFRANIUS, LUCIUS, Roman general, lived in the times of the Sertorian (79–72), third Mithradatic (74–61) and Civil Wars. Of humble origin (Cic. *ad Att.* i. 16. 20), from his early years he was a devoted adherent of Pompey. In 60, chiefly by Pompey's support, he was raised to the consulship, but in performing the duties of that office he showed an utter incapacity to manage civil affairs. In the following year, while governor of Cisalpine Gaul, he obtained the honour of a triumph, and on the allotment of Spain to Pompey (55), Afranius and Marcus Petreius were sent to take charge of the government. On the rupture between Caesar and Pompey they were compelled, after a short campaign in which they were at first successful, to surrender to Caesar at Ilerda (49), and were dismissed on promising not to serve again in the war. Afranius, regardless of his promise, joined Pompey at Dyrrhachium, and at the battle of Pharsalus (48) had charge of Pompey's camp. On the defeat of Pompey, Afranius, despairing of pardon from Caesar, went to Africa, and was present at the disastrous battle of Thapsus (46). Escaping from the field with a strong body of cavalry, he was afterwards taken prisoner, along with Faustus Sulla, by the troops of Sittius, and handed over to Caesar, whose veterans rose in tumult and put them to death.

See Hirtius, *Bell. Afric.* 95; Plutarch, *Pompey*; Dio Cassius xxxvii., xli.-xliii.; Caesar, *B.C.* i. 37-87; Appian, *B.C.* ii.; for the history of the period, articles on Caesar and Pompey.

AFRANIUS, LUCIUS, Roman comic poet, flourished about 94 B.C. His comedies chiefly dealt with everyday subjects from Roman middle-class life, and he himself tells us that he borrowed freely from Menander and others. His style was vigorous and correct; his moral tone that of the period.

Horace, *Epp.* ii. 1. 57; Cicero, *Brutus*, 45, *de Fin.* i. 3; Quintilian x. 1. 100; fragments, about 400 lines, in Ribbeck, *Scaenicae Romanorum Poesis Fragmenta*, ii. (1898).

AFRICA, the name of a continent representing the largest of the three great southward projections from the main mass of the earth's surface. It includes within its remarkably regular outline an area, according to the most recent computations, of 11,262,000 sq. m., excluding the islands.[1] Separated from Europe by the Mediterranean Sea, it is joined to Asia at its N.E. extremity by the Isthmus of Suez, 80 m. wide. From the most northerly point, Ras ben Sakka, a little west of Cape Blanc, in 37° 21′ N., to the most southerly point, Cape Agulhas, 34° 51′ 15″ S., is a distance approximately of 5000 m.; from Cape Verde, 17° 33′ 22″ W., the westernmost point, to Ras Hafun, 51° 27′ 52″ E., the most easterly projection, is a distance (also approximately) of 4600 m. The length of coast-line is 16,100 m. and the absence of deep indentations of the shore is shown by the fact that Europe, which covers only 3,760,000 sq. m., has a coast-line of 19,800 m.

I. Physical Geography

The main structural lines of the continent show both the east-to-west direction characteristic, at least in the eastern hemisphere, of the more northern parts of the world, and the north-to-south direction seen in the southern peninsulas. Africa is thus composed of two segments at right angles, the northern running from east to west, the southern from north to south, the subordinate lines corresponding in the main to these two directions.

Main Orographical Features.—The mean elevation of the continent approximates closely to 2000 ft., which is roughly the elevation of both North and South America, but is considerably less than that of Asia (3117 ft.). In contrast with the other continents it is marked by the comparatively small area both of very high and of very low ground, lands under 600 ft. occupying an unusually small part of the surface; while not only are the highest elevations inferior to those of Asia and South America, but the area of land over 10,000 ft. is also quite insignificant, being represented almost entirely by individual peaks and mountain ranges. Moderately elevated tablelands are thus the characteristic feature of the continent, though the surface of these is broken by higher peaks and ridges. (So prevalent are these isolated peaks and ridges that a special term [*Inselberglandschaft*] has been adopted in Germany to describe this kind of country, which is thought to be in great part the result of wind action.) As a general rule, the higher tablelands lie to the east and south, while a progressive diminution in altitude towards the west and north is observable. Apart from the lowlands and the Atlas range, the continent may be divided into two regions of higher and lower plateaus, the dividing line (somewhat concave to the north-west) running from the middle of the Red Sea to about 6° S. on the west coast. We thus obtain the following four main divisions of the continent:—(1) The coast plains—often fringed seawards by mangrove swamps—never stretching far from the coast, except on the lower courses of streams. Recent alluvial flats are found chiefly in the delta of the more important rivers. Elsewhere the coast lowlands merely form the lowest steps of the system of terraces which constitutes the ascent to the inner plateaus. (2) The Atlas range, which, orographically, is distinct from the rest of the continent, being unconnected with any other area of high ground, and separated from the rest of the continent on the south by a depressed and desert area (the Sahara), in places below sea-level. (3) The high southern and eastern plateaus, rarely falling below 2000 ft., and having a mean elevation of about 3500 ft. (4) The north and west African plains, bordered and traversed by bands of higher ground, but generally below 2000 ft. This division includes the great desert of the Sahara.

The third and fourth divisions may be again subdivided. Thus the high plateaus include:—(*a*) The South African plateau as far as about 12° S., bounded east, west and south by bands of high ground which fall steeply to the coasts. On this account South Africa has a general resemblance to an inverted saucer. Due south the plateau rim is formed by three parallel steps with level ground between them. The largest of these level areas, the Great Karroo, is a dry, barren region, and a large tract of the plateau proper is of a still more arid character and is known as the Kalahari Desert. The South African plateau is connected towards the north-east with (*b*) the East African plateau, with probably a slightly greater average elevation, and marked by some distinct features. It is formed by a widening out of the eastern axis of high ground, which becomes subdivided into a number of zones running north and south and consisting in turn of ranges, tablelands and depressions. The most striking feature is the existence of two great lines of depression, due largely to the subsidence of whole segments of the earth's crust, the lowest parts of which are occupied by vast lakes Towards the south the two lines converge and give place to one great valley (occupied by Lake Nyasa), the southern part of which is less distinctly due to rifting and subsidence than the rest of the system. Farther north the western depression, sometimes known as the Central African trough or Albertine rift-valley, is occupied for more than half its length by water, forming the four lakes of Tanganyika, Kivu, Albert Edward and Albert, the first-named over 400 m. long and the longest freshwater lake in the world. Associated with these great valleys are a number of volcanic peaks, the greatest of which occur on a meridional line east of the eastern trough. The eastern depression, known as the East African trough or rift-valley, contains much smaller lakes, many of them brackish and without outlet, the only one comparable to those of the western trough being Lake Rudolf or Basso Norok. At no great distance east

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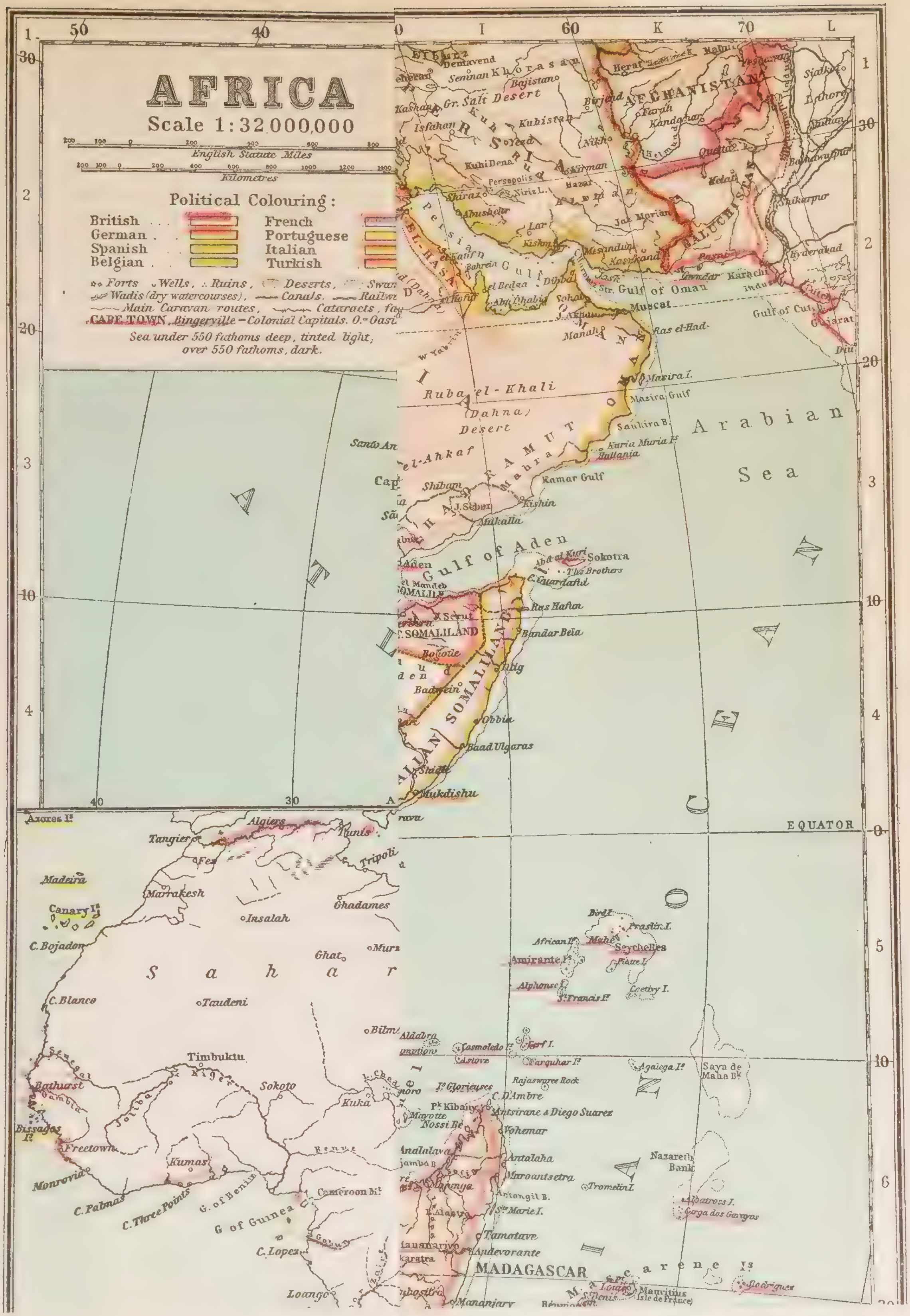
[1] With the islands, 11,498,000 sq. m.


AFRICA
Scale 1:32,000,000
English Statute Miles
Kilometres
Political Colouring:
British
German
Spanish
Belgian
French
Portuguese
Italian
Turkish
Forts, Wells, Ruins, Deserts
Wadis (dry watercourses), Canals, Main Caravan routes, Cataracts
CAPE TOWN, Bingerville = Colonial Capitals. O. = Oasis
Sea under 550 fathoms deep, tinted light; over 550 fathoms, dark.
AFGHANISTAN
BALUCHISTAN
Herat
Farah
Kandahar
Quetta
Kelat
Lahore
Multan
Bahawalpur
Shikarpur
Hyderabad
Karachi
Indus
Gulf of Cutch
Gujarat
Diu
Demavend
Teheran
Semnan
Khorasan
Gr. Salt Desert
Kashan
Isfahan
Yezd
Kubistan
Birjand
Kirman
Persepolis
Shiraz
Abushehr
Lar
Persian Gulf
Bahrein
Str.
Gulf of Oman
Jask
Gwadar
Muscat
Ras el-Had
OMAN
Masira I.
Masira Gulf
Ruba el-Khali
(Dahna) Desert
Arabian Sea
Sauhira B.
Kuria Muria Is.
Hallania
HADRAMUT
Mahra
Kamar Gulf
Shibam
Mukalla
Kishin
Aden
Gulf of Aden
Abd al Kuri
Sokotra
The Brothers
C. Guardafui
Bab el Mandeb
SOMALILAND
Ras Hafun
Bandar Bela
ITALIAN SOMALILAND
Obbia
Baad Ulgaras
Mukdishu
EQUATOR
ATLANTIC
INDIAN OCEAN
Bird I.
Praslin I.
African Is.
Mahé
Seychelles
Amirante Is.
Alphonse
St. Francis Is.
Coetivy I.
Aldabra
Cosmoledo Is.
Astove
Farquhar Is.
Agalega Is.
Saya de Malha Bk.
Is. Glorieuses
Rajaswaree Rock
C. D'Ambre
Mayotte
Nossi Bé
Antsirane & Diego Suarez
Vohemar
Antalaha
Maroantsetra
Antongil B.
Ste. Marie I.
Tamatave
Andevorante
MADAGASCAR
Tromelin I.
Nazareth Bank
Albatross I.
Carga dos Garajos
Mascarene Is.
Mauritius (Isle de France)
Rodrigues
Mananjary
Azores Is.
Madeira
Canary Is.
Tangier
Algiers
Tunis
Tripoli
Fez
Marrakesh
Insalah
Ghadames
C. Bojador
Ghat
Sahara
C. Blanco
Taudeni
Timbuktu
Senegal
Bathurst
Gambia
Bissagos Is.
Niger
Sokoto
Kuka
Freetown
Monrovia
Kumasi
C. Palmas
C. Three Points
G. of Benin
G. of Guinea
Cameroon Mt.
C. Lopez
Loango

of this rift-valley are Kilimanjaro—with its two peaks Kibo and Mawenzi, the former 19,321 ft., and the culminating point of the whole continent—and Kenya (17,007 ft.). Hardly less important is the Ruwenzori range (over 16,600 ft.), which lies east of the western trough. Other volcanic peaks rise from the floor of the valleys, some of the Kirunga (Mfumbiro) group, north of Lake Kivu, being still partially active. (*c*) The third division of the higher region of Africa is formed by the Abyssinian highlands, a rugged mass of mountains forming the largest continuous area of its altitude in the whole continent, little of its surface falling below 5000 ft., while the summits reach heights of 15,000 to 16,000 ft. This block of country lies just west of the line of the great East African trough, the northern continuation of which passes along its eastern escarpment as it runs up to join the Red Sea. There is, however, in the centre a circular basin occupied by Lake Tsana.

Both in the east and west of the continent the bordering highlands are continued as strips of plateau parallel to the coast, the Abyssinian mountains being continued northwards along the Red Sea coast by a series of ridges reaching in places a height of 7000 ft. In the west the zone of high land is broader but somewhat lower. The most mountainous districts lie inland from the head of the Gulf of Guinea (Adamawa, &c.), where heights of 6000 to 8000 ft. are reached. Exactly at the head of the gulf the great peak of the Cameroon, on a line of volcanic action continued by the islands to the south-west, has a height of 13,370 ft., while Clarence Peak, in Fernando Po, the first of the line of islands, rises to over 9000. Towards the extreme west the Futa Jallon highlands form an important diverging point of rivers, but beyond this, as far as the Atlas chain, the elevated rim of the continent is almost wanting.

The area between the east and west coast highlands, which north of 17° N. is mainly desert, is divided into separate basins by other bands of high ground, one of which runs nearly centrally through North Africa in a line corresponding roughly with the curved axis of the continent as a whole. The best marked of the basins so formed (the Congo basin) occupies a circular area bisected by the equator, once probably the site of an inland sea. The arid region, the Sahara—the largest desert in the world, covering 3,500,000 sq. m.—extends from the Atlantic to the Red Sea. Though generally of slight elevation it contains mountain ranges with peaks rising to 8000 ft. Bordered N.W. by the Atlas range, to the N.E. a rocky plateau separates it from the Mediterranean; this plateau gives place at the extreme east to the delta of the Nile. That river (see below) pierces the desert without modifying its character. The Atlas range, the north-westerly part of the continent, between its seaward and landward heights encloses elevated steppes in places 100 m. broad. From the inner slopes of the plateau numerous wadis take a direction towards the Sahara. The greater part of that now desert region is, indeed, furrowed by old water-channels.

The following table gives the approximate altitudes of the chief mountains and lakes of the continent:—

Mountains.	Ft.	Lakes.	Ft.
Rungwe (Nyasa) .	10,400	Chad	850[1]
Drakensberg . .	11,700[1]	Leopold II . .	1100
Lereko or Sattima	13,214[2]	Rudolf . . .	1250
(Aberdare Range)		Nyasa . . .	1645[2]
Cameroon . .	13,370	Albert Nyanza .	2028[1]
Elgon . . .	14,152[2]	Tanganyika . .	2624[2]
Karissimbi (Mfumbiro) . . .		Ngami . . .	2950
	14,683[2]	Mweru . . .	3000
Meru . . .	14,955[2]	Albert Edward .	3004[2]
Tagharat (Atlas) .	15,000[1]	Bangweulu. . .	3700
Simen Mountains,	15,160[1]	Victoria Nyanza .	3720[2]
Abyssinia		Abai . . .	4200
Ruwenzori . .	16,619[2]	Kivu . . .	4829[2]
Kenya . . .	17,007[2]	Tsana . . .	5690
Kilimanjaro . .	19,321[2]	Naivasha . .	6135[2]

The Hydrographic Systems.—From the outer margin of the African plateaus a large number of streams run to the sea with comparatively short courses, while the larger rivers flow for long distances on the interior highlands before breaking through the outer ranges. The main drainage of the continent is to the north and west, or towards the basin of the Atlantic Ocean. The high lake plateau of East Africa contains the head-waters of the Nile and Congo: the former the longest, the latter the largest river of the continent. The upper Nile receives its chief supplies from the mountainous region adjoining the Central African trough in the neighbourhood of the equator. Thence streams pour east to the Victoria Nyanza, the largest African lake (covering over 26,000 sq. m.), and west and north to the Albert Edward and Albert Nyanzas, to the latter of which the effluents of the other two lakes add their waters. Issuing from it the Nile flows north, and between 7° and 10° N. traverses a vast marshy level during which its course is liable to blocking by floating vegetation. After receiving the Bahr-el-Ghazal from the west and the Sobat, Blue Nile and Atbara from the Abyssinian highlands (the chief gathering ground of the flood-water), it crosses the great desert and enters the Mediterranean by a vast delta. The most remote head-stream of the Congo is the Chambezi, which flows south-west into the marshy Lake Bangweulu. From this lake issues the Congo, known in its upper course by various names. Flowing first south, it afterwards turns north through Lake Mweru and descends to the forest-clad basin of west equatorial Africa. Traversing this in a majestic northward curve and receiving vast supplies of water from many great tributaries, it finally turns south-west and cuts a way to the Atlantic Ocean through the western highlands. North of the Congo basin and separated from it by a broad undulation of the surface is the basin of Lake Chad—a flat-shored, shallow lake filled principally by the Shari coming from the south-east. West of this is the basin of the Niger, the third river of Africa, which, though flowing to the Atlantic, has its principal source in the far west, and reverses the direction of flow exhibited by the Nile and Congo. An important branch, however—the Benue—comes from the south-east. These four river-basins occupy the greater part of the lower plateaus of North and West Africa, the remainder consisting of arid regions watered only by intermittent streams which do not reach the sea. Of the remaining rivers of the Atlantic basin the Orange, in the extreme south, brings the drainage from the Drakensberg on the opposite side of the continent, while the Kunene, Kwanza, Ogowé and Sanaga drain the west coast highlands of the southern limb; the Volta, Komoe, Bandama, Gambia and Senegal the highlands of the western limb. North of the Senegal for over 1000 m. of coast the arid region reaches to the Atlantic. Farther north are the streams, with comparatively short courses, which reach the Atlantic and Mediterranean from the Atlas mountains.

Of the rivers flowing to the Indian Ocean the only one draining any large part of the interior plateaus is the Zambezi, whose western branches rise in the west coast highlands. The main stream has its rise in 11° 21′ 3″ S. 24° 22′ E. at an elevation of 5000 ft. It flows west and south for a considerable distance before turning to the east. All the largest tributaries, including the Shiré, the outflow of Lake Nyasa, flow down the southern slopes of the band of high ground which stretches across the continent in 10° to 12° S. In the south-west the Zambezi system interlaces with that of the Taukhe (or Tioghe), from which it at times receives surplus water. The rest of the water of the Taukhe, known in its middle course as the Okavango, is lost in a system of swamps and saltpans which formerly centred in Lake Ngami, now dried up. Farther south the Limpopo drains a portion of the interior plateau but breaks through the bounding highlands on the side of the continent nearest its source. The Rovuma, Rufiji, Tana, Juba and Webi Shebeli principally drain the outer slopes of the East African highlands, the last named losing itself in the sands in close proximity to the sea. Another large stream, the Hawash, rising in the Abyssinian mountains, is lost in a saline depression near the Gulf of Aden. Lastly, between the basins of the Atlantic and Indian Oceans there is an area of inland drainage along the centre of the East African plateau, directed chiefly into the lakes in the great rift-valley. The largest river is the Omo, which, fed by the rains of the Abyssinian highlands, carries down a large body of water into Lake Rudolf. The rivers of Africa are generally obstructed either by bars at their mouths or by cataracts at no great distance up-stream. But when these obstacles have been overcome the rivers and lakes afford a network of navigable waters of vast extent.

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[1] Estimated.

[2] See the calculations of Capt. T. T. Behrens, *Geog. Journal*, vol. xxix. (1907).

The calculation of the areas of African drainage systems, made by Dr A. Bludau (*Petermanns Mitteilungen*, 43, 1897, pp. 184-186) gives the following general results:—

Basin of the Atlantic	4,070,000 sq. m.
,, ,, Mediterranean	1,680,000 ,,
,, ,, Indian Ocean	2,086,000 ,,
Inland drainage area	3,452,000 ,,

The areas of individual river-basins are:—

Congo	(length over 3000 m.)	1,425,000 sq. m.
Nile	(,, fully 4000 m.)	1,082,000[1] ,,
Niger	(,, about 2600 m.)	808,000[2] ,,
Zambezi	(,, ,, 2000 m.)	513,500 ,,
Lake Chad		394,000 ,,
Orange	(length about 1300 m.)	370,500[2] ,,
,,	(actual drainage area)	172,500 ,,

The area of the Congo basin is greater than that of any other river except the Amazon, while the African inland drainage area is greater than that of any continent but Asia, in which the corresponding area is 4,900,000 sq. m.

The principal African lakes have been mentioned in the description of the East African plateau, but some of the phenomena connected with them may be spoken of more particularly here. As a rule the lakes which occupy portions of the great rift-valleys have steep sides and are very deep. This is the case with the two largest of the type, Tanganyika and Nyasa, the latter of which has depths of 430 fathoms. Others, however, are shallow, and hardly reach the steep sides of the valleys in the dry season. Such are Lake Rukwa, in a subsidiary depression north of Nyasa, and Eiassi and Manyara in the system of the eastern rift-valley. Lakes of the broad type are of moderate depth, the deepest sounding in Victoria Nyanza being under 50 fathoms. Apart from the seasonal variations of level, most of the lakes show periodic fluctuations, while a progressive desiccation of the whole region is said to be traceable, tending to the ultimate disappearance of the lakes. Such a drying up has been in progress during long geologic ages, but doubt exists as to its practical importance at the present time. The periodic fluctuations in the level of Lake Tanganyika are such that its outflow is intermittent. Besides the East African lakes the principal are:—Lake Chad, in the northern area of inland drainage; Bangweulu and Mweru, traversed by the head-stream of the Congo; and Leopold II. and Ntomba (Mantumba), within the great bend of that river. All, except possibly Mweru, are more or less shallow, and Chad appears to by drying up. The altitudes of the African lakes have already been stated.

Divergent opinions have been held as to the mode of origin of the East African lakes, especially Tanganyika, which some geologists have considered to represent an old arm of the sea, dating from a time when the whole central Congo basin was under water; others holding that the lake water has accumulated in a depression caused by subsidence. The former view is based on the existence in the lake of organisms of a decidedly marine type. They include a jelly-fish, molluscs, prawns, crabs, &c., and were at first considered to form an isolated group found in no other of the African lakes; but this supposition has been proved to be erroneous.

Islands.—With one exception—Madagascar—the African islands are small. Madagascar, with an area of 229,820 sq. m., is, after New Guinea and Borneo, the largest island of the world. It lies off the S.E. coast of the continent, from which it is separated by the deep Mozambique channel, 250 m. wide at its narrowest point. Madagascar in its general structure, as in flora and fauna, forms a connecting link between Africa and southern Asia. East of Madagascar are the small islands of Mauritius and Réunion. Sokotra lies E.N.E. of Cape Guardafui. Off the north-west coast are the Canary and Cape Verde archipelagoes. which, like some small islands in the Gulf of Guinea, are of volcanic origin.

Climate and Health.—Lying almost entirely within the tropics, and equally to north and south of the equator, Africa does not show excessive variations of temperature. Great heat is experienced in the lower plains and desert regions of North Africa, removed by the great width of the continent from the influence of the ocean, and here, too, the contrast between day and night, and between summer and winter, is greatest. (The rarity of the air and the great radiation during the night cause the temperature in the Sahara to fall occasionally to freezing point.) Farther south, the heat is to some extent modified by the moisture brought from the ocean, and by the greater elevation of a large part of the surface, especially in East Africa, where the range of temperature is wider than in the Congo basin or on the Guinea coast. In the extreme north and south the climate is a warm temperate one, the northern countries being on the whole hotter and drier than those in the southern zone; the south of the continent being narrower than the north, the influence of the surrounding ocean is more felt. The most important climatic differences are due to variations in the amount of rainfall. The wide heated plains of the Sahara, and in a lesser degree the corresponding zone of the Kalahari in the south, have an exceedingly scanty rainfall, the winds which blow over them from the ocean losing part of their moisture as they pass over the outer highlands, and becoming constantly drier owing to the heating effects of the burning soil of the interior; while the scarcity of mountain ranges in the more central parts likewise tends to prevent condensation. In the inter-tropical zone of summer precipitation, the rainfall is greatest when the sun is vertical or soon after. It is therefore greatest of all near the equator, where the sun is twice vertical, and less in the direction of both tropics. The rainfall zones are, however, somewhat deflected from a due west-to-east direction, the drier northern conditions extending southwards along the east coast, and those of the south northwards along the west. Within the equatorial zone certain areas, especially on the shores of the Gulf of Guinea and in the upper Nile basin, have an intensified rainfall, but this rarely approaches that of the rainiest regions of the world. The rainiest district in all Africa is a strip of coastland west of Mount Cameroon, where there is a mean annual rainfall of about 390 in. as compared with a mean of 458 in. at Cherrapunji, in Assam. The two distinct rainy seasons of the equatorial zone, where the sun is vertical at half-yearly intervals, become gradually merged into one in the direction of the tropics, where the sun is overhead but once. Snow falls on all the higher mountain ranges, and on the highest the climate is thoroughly Alpine. The countries bordering the Sahara are much exposed to a very dry wind, full of fine particles of sand, blowing from the desert towards the sea. Known in Egypt as the khamsin, on the Mediterranean as the sirocco, it is called on the Guinea coast the harmattan. This wind is not invariably hot; its great dryness causes so much evaporation that cold is not infrequently the result. Similar dry winds blow from the Kalahari in the south. On the eastern coast the monsoons of the Indian Ocean are regularly felt, and on the south-east hurricanes are occasionally experienced.

While the climate of the north and south, especially the south, is eminently healthy, and even the intensely heated Sahara is salubrious by reason of its dryness, the tropical zone as a whole is, for European races, the most unhealthy portion of the world. This is especially the case in the lower and moister regions, such as the west coast, where malarial fever is very prevalent and deadly; the most unfavourable factors being humidity with absence of climatic variation (daily or seasonal). The higher plateaus, where not only is the average temperature lower, but such variations are more extensive, are more healthy; and in certain localities (*e.g.* Abyssinia and parts of British East Africa) Europeans find the climate suitable for permanent residence. On tablelands over 6500 ft. above the sea, frost is not uncommon at night, even in places directly under the equator. The acclimatization of white men in tropical Africa generally is dependent largely on the successful treatment of tropical diseases. Districts which had been notoriously deadly to Europeans were rendered comparatively healthy after the discovery, in 1899, of the species of mosquito which propagates malarial fever, and the measures thereafter taken for its destruction and the filling up of swamps. The rate of mortality among the natives from tropical diseases is also high, one of the most fatal being that known as sleeping sickness. (The ravages of this disease, which also attacks Europeans, reached alarming proportions between 1893 and 1907, and in the last-named year an international conference was held in London to consider measures to combat it.) When removed to colder regions natives of the equatorial districts suffer greatly from chest complaints. Smallpox also makes great ravages among the negro population.

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[1] The estimate of Capt. H. G. Lyons in 1905 was 1,107,227 sq. m.

[2] Including waterless tracts naturally belonging to the river-basin.

Flora.—The vegetation of Africa follows very closely the distribution of heat and moisture. The northern and southern temperate zones have a flora distinct from that of the continent generally, which is tropical. In the countries bordering the Mediterranean are groves of oranges and olive trees, evergreen oaks, cork trees and pines, intermixed with cypresses, myrtles, arbutus and fragrant tree-heaths. South of the Atlas range the conditions alter. The zones of minimum rainfall have a very scanty flora, consisting of plants adapted to resist the great dryness. Characteristic of the Sahara is the date-palm, which flourishes where other vegetation can scarcely maintain existence, while in the semi-desert regions the acacia (whence is obtained gum-arabic) is abundant. The more humid regions have a richer vegetation —dense forest where the rainfall is greatest and variations of temperature least, conditions found chiefly on the tropical coasts, and in the west African equatorial basin with its extension towards the upper Nile; and savanna interspersed with trees on the greater part of the plateaus, passing as the desert regions are approached into a scrub vegetation consisting of thorny acacias, &c. Forests also occur on the humid slopes of mountain ranges up to a certain elevation. In the coast regions the typical tree is the mangrove, which flourishes wherever the soil is of a swamp character. The dense forests of West Africa contain, in addition to a great variety of dicotyledonous trees, two palms, the *Elaeis guineensis* (oil-palm) and *Raphia vinifera* (bamboo-palm), not found, generally speaking, in the savanna regions. The bombax or silk-cotton tree attains gigantic proportions in the forests, which are the home of the indiarubber-producing plants and of many valuable kinds of timber trees, such as odum (*Chlorophora excelsa*), ebony, mahogany (*Khaya senegalensis*), African teak or oak (*Oldfieldia africana*) and camwood (*Baphia nitida*). The climbing plants in the tropical forests are exceedingly luxuriant and the undergrowth or "bush" is extremely dense. In the savannas the most characteristic trees are the monkey bread tree or baobab (*Adansonia digitata*), doom palm (*Hyphaene*) and euphorbias. The coffee plant grows wild in such widely separated places as Liberia and southern Abyssinia. The higher mountains have a special flora showing close agreement over wide intervals of space, as well as affinities with the mountain flora of the eastern Mediterranean, the Himalayas and Indo-China (cf. A. Engler, *Über die Hochgebirgsflora des tropischen Afrika*, 1892).

In the swamp regions of north-east Africa the papyrus and associated plants, including the soft-wooded ambach, flourish in immense quantities—and little else is found in the way of vegetation. South Africa is largely destitute of forest save in the lower valleys and coast regions. Tropical flora disappears, and in the semi-desert plains the fleshy, leafless, contorted species of kapsias, mesembryanthemums, aloes and other succulent plants make their appearance. There are, too, valuable timber trees, such as the yellow pine (*Podocarpus elongatus*), stinkwood (*Ocotea*), sneezewood or Cape ebony (*Pteroxylon utile*) and ironwood. Extensive miniature woods of heaths are found in almost endless variety and covered throughout the greater part of the year with innumerable blossoms in which red is very prevalent. Of the grasses of Africa alfa is very abundant in the plateaus of the Atlas range.

Fauna.—The fauna again shows the effect of the characteristics of the vegetation. The open savannas are the home of large ungulates, especially antelopes, the giraffe (peculiar to Africa), zebra, buffalo, wild ass and four species of rhinoceros; and of carnivores, such as the lion, leopard, hyaena, &c. The okapi (a genus restricted to Africa) is found only in the dense forests of the Congo basin. Bears are confined to the Atlas region, wolves and foxes to North Africa. The elephant (though its range has become restricted through the attacks of hunters) is found both in the savannas and forest regions, the latter being otherwise poor in large game, though the special habitat of the chimpanzee and gorilla. Baboons and mandrills, with few exceptions, are peculiar to Africa. The single-humped camel—as a domestic animal—is especially characteristic of the northern deserts and steppes.

The rivers in the tropical zone abound with hippopotami and crocodiles, the former entirely confined to Africa. The vast herds of game, formerly so characteristic of many parts of Africa, have much diminished with the increase of intercourse with the interior. Game reserves have, however, been established in South Africa, British Central Africa, British East Africa, Somaliland, &c., while measures for the protection of wild animals were laid down in an international convention signed in May 1900.

The ornithology of northern Africa presents a close resemblance to that of southern Europe, scarcely a species being found which does not also occur in the other countries bordering the Mediterranean. Among the birds most characteristic of Africa are the ostrich and the secretary-bird. The ostrich is widely dispersed, but is found chiefly in the desert and steppe regions. The secretary-bird is common in the south. The weaver birds and their allies, including the long-tailed whydahs, are abundant, as are, among game-birds, the francolin and guinea-fowl. Many of the smaller birds, such as the sun-birds, bee-eaters, the parrots and halcyons, as well as the larger plantain-eaters, are noted for the brilliance of their plumage. Of reptiles the lizard and chameleon are common, and there are a number of venomous serpents, though these are not so numerous as in other tropical countries. The scorpion is abundant. Of insects Africa has many thousand different kinds; of these the locust is the proverbial scourge of the continent, and the ravages of the termites or white ants are almost incredible. The spread of malaria by means of mosquitoes has already been mentioned. The tsetse fly, whose bite is fatal to all domestic animals, is common in many districts of South and East Africa. Fortunately it is found nowhere outside Africa. (E. He.; F. R. C.)

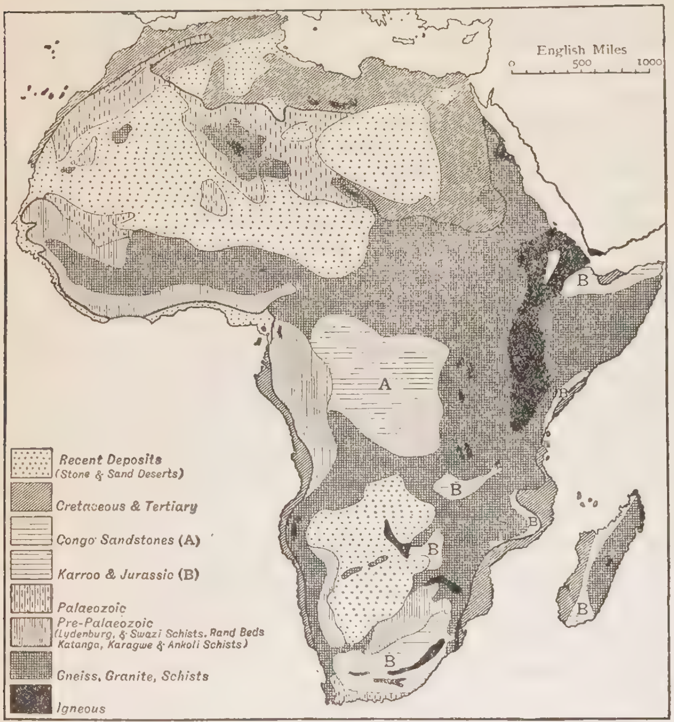
II. GEOLOGY

In shape and general geological structure Africa bears a close resemblance to India. Both possess a meridional extension with a broad east and west folded region in the north. In both a successive series of continental deposits, ranging from the Carboniferous to the Rhaetic, rests on an older base of crystalline rocks. In the words of Professor Suess, "India and Africa are true plateau countries."

Of the primitive axes of Africa few traces remain. Both on the east and west a broad zone of crystalline rocks extends parallel with the coast-line to form the margin of the elevated plateau of the interior. Occasionally the crystalline belt comes to the coast, but it is usually reached by two steps known as the coastal belt and foot-plateau. On the flanks of the primitive western axis certain ancient sedimentary strata are thrown into folds which were completed before the commencement of the mesozoic period. In the south, the later palaeozoic rocks are also thrown into acute folds by a movement acting from the south, and which ceased towards the close of the mesozoic period. In northern Africa the folded region of the Atlas belongs to the comparatively recent date of the Alpine system. None of these earth movements affected the interior, for here the continental mesozoic deposits rest, undisturbed by folding, on the primary sedimentary and crystalline rocks. The crystalline *massif*, therefore, presents a solid block which has remained elevated since early palaeozoic times, and against which earth waves of several geological periods have broken.

The formations older than the mesozoic are remarkably unfossiliferous, so that the determination of their age is frequently a matter of speculation, and in the following table the European equivalents of the pre-Karroo formations in many regions must be regarded as subject to considerable revision.

Rocks of Archean age cover wide areas in the interior, in West and East Africa and across the Sahara. Along the coastal margins they underlie the newer formations and appear in the deep valleys and kloofs wherever denudation has laid them bare. The prevailing types are granites, gneisses and schists. In the central regions the predominant strike of the foliae is north and south. The rocks, for convenience classed as pre-Cambrian, occur as several unconformable groups, chiefly developed in the south where alone their stratigraphy has been determined. They are unfossiliferous, and in the absence of undoubted Cambrian, Ordovician and Silurian strata in Africa they may be regarded as of older date than any of these formations. The general occurrence of jasper-bearing rocks is of interest, as these are always present in the ancient pressure-altered sedimentary formations of America and Europe. Some unfossiliferous conglomerates, sandstones and dolomites in South Africa and on the west coast are considered to belong to the Cambrian, Ordovician and Silurian formations, but merely from their occurrence beneath strata yielding Devonian fossils. In Cape Colony the Silurian age of the Table Mountain Sandstone is based on such evidence.



Emery Walker sc.

The Devonian and Carboniferous formations are well represented in the north and south and in northern Angola.

Up to the close of the palaeozoic period the relative positions of the ancient land masses and oceans remain unsolved; but the absence of marine strata of early palaeozoic age from Central Africa points to there being land in this direction. In late Carboniferous times Africa and India were undoubtedly united to form a large continent, called by Suess Gondwana Land. In each country the same succession of the rocks is met with; over both the same specialized orders of reptiles roamed and were entombed.

The interior of the African portion of Gondwana Land was occupied by several large lakes in which an immense thickness—amounting to over 18,000 ft. in South Africa—of sandstones and marls, forming the Karroo system, was laid down. This is *par excellence* the African formation, and covers immense areas in South Africa and the Congo basin, with detached portions in East Africa. During the whole of the time—Carboniferous to Rhaetic—that this great accumulation of freshwater beds was taking place, the interior of the continent must have been undergoing depression. The commencement of the period was marked by one of the most wonderful episodes in the geological history of Africa. Preserved in the formation known as the Dwyka Conglomerate, are evidences that at this time the greater portion of South Africa was undergoing extreme glaciation, while the same conditions appear to have prevailed in India and Australia. At the close of the Karroo period there was a remarkable manifestation of volcanic activity which again has its parallel in the Deccan traps of India.

Table of Formations

		Sedimentary.	*Igneous.*
	Recent.	Alluvium; travertine; coral; sand dunes; continental dunes. Generally distributed.	Some volcanic islands; rift-valley volcanoes.
	Pleistocene.	Ancient alluviums and gravels; travertine. Generally distributed.	A long-continued succession in the central and northern regions and among the island groups. Doubtfully represented south of the Zambezi.
	Pliocene.	N. Africa; Madagascar.	
	Miocene.	N. Africa.	
	Oligocene.	N. Africa.	
	Eocene.	N. Africa, along east and west coasts; Madagascar.	
	Cretaceous.	Extensively developed in N. Africa; along coast and foot-plateaus in east and west; Madagascar.	Diamond pipes of S. Africa; Kaptian fissure eruptions; Ashangi traps of Abyssinia.
Karroo System.	*Jurassic.*	N. Africa; E. Africa; Madagascar; Stormberg period (Rhaetic) in S. Africa.	Chief volcanic period in S. Africa.
	Trias.	Beaufort Series in S. Africa; Congo basin; Central Africa; Algeria; Tunis.	
	Permian.	Ecca Series in S. Africa.	Feebly, if anywhere developed.
	Carboniferous.	N. Africa; Sabaki Shales in E. Africa; Dwyka and Witteberg Series in S. Africa.	
	Devonian.	N. Africa; Angola; Bokkeveld Series in S. Africa.	Not recorded.
	Silurian. *Ordovician.* *Cambrian.*	Table Mountain Sandstone in S. Africa, Silurian(?). Doubtfully represented in N. Africa, French Congo, Angola, and by Vaal River and Waterberg Series in S. Africa.	Klipriversberg and Ventersdorp Series of the Transvaal (?).
	Pre-Cambrian.	Quartzites, conglomerates, phyllites, jasper-bearing rocks and schists. Generally distributed.	S. Africa and generally.
	Archean.	Gneisses and schists of the continental platform.	Igneous complex of sheared igneous rocks; granites.

How far the Karroo formation extended beyond its present confines has not been determined. To the east it reached India. In the south all that can be said is that it extended to the south of Worcester in Cape Colony. The Crystal Mountains of Angola may represent its western boundary; while the absence of mesozoic strata beneath the Cretaceous rocks of the mid-Sahara indicates that the system of Karroo lakeland had here reached its most northerly extension. Towards the close of the Karroo period, possibly about the middle, the southern rim of the great central depression became ridged up to form the folded regions of the Zwaarteberg, Cedarberg and Langeberg mountains in Cape Colony. This folded belt gives Africa its abrupt southern termination, and may be regarded as an embryonic indication of its present outline. The exact date of the maximum development of this folding is unknown, but it had done its work and some 10,000 ft. of strata had been removed before the commencement of the Cretaceous period. It appears to approximate in time to the similar earth movement and denudation at the close of the palaeozoic period in Europe. It was doubtless connected with the disruption of Gondwana Land, since it is known that this great alteration of geographical outline commenced in Jurassic times.

The breaking up of Gondwana Land is usually considered to have been caused by a series of blocks of country being let down by faulting with the consequent formation of the Indian Ocean. Other blocks, termed horsts, remained unmoved, the island of Madagascar affording a striking example. In the African portion Ruwenzori is regarded by some geologists to be a block mountain or horst.

In Jurassic times the sea gained access to East Africa north of Mozambique, but does not appear to have reached far beyond the foot-plateau except in Abyssinia.

The Cretaceous seas appear to have extended into the central Saharan regions, for fossils of this age have been discovered in the interior. On the west coast Cretaceous rocks extend continuously from Mogador to Cape Blanco. From here they are absent up to the Gabun river, where they commence to form a narrow fringe as far as the Kunene river, though often overlain by recent deposits. They are again absent up to the Sunday river in Cape Colony, where Lower Cretaceous rocks (for long considered to be of Oolitic age) of an inshore character are met with. Strata of Upper Cretaceous age occur in Pondoland and Natal, and are of exceptional interest since the fossils show an intermingling of Pacific types with other forms having European affinities. In Mozambique and in German East Africa, Cretaceous rocks extend from the coast to a distance inland of over 100 m.

Except in northern Africa, the Tertiary formations only occur in a few isolated patches on the east and west coasts. In northern Africa they are well developed and of much interest. They contain the well-known nummulitic limestone of Eocene age, which has been traced from Egypt across Asia to China. The Upper Eocene rocks of Egypt have also yielded primeval types of the *Proboscidea* and other mammalia. Evidences for the greater extension of the Eocene seas than was formerly considered to be the case have been discovered around Sokoto. During Miocene times Passarge considers that the region of the Zambezi underwent extreme desiccation.

The effect of the Glacial epoch in Europe is shown in northern Africa by the moraines of the higher Atlas, and the wider extension of the glaciers on Kilimanjaro, Kenya and Ruwenzori, and by the extensive accumulations of gravel over the Sahara.

The earliest signs of igneous activity in Africa are to be found in the granites, intrusive into the older rocks of the Cape peninsula, into those of the Transvaal, and into the gneisses and schists of Central Africa. The Ventersdorp boulder beds of the Transvaal may be of early palaeozoic age; but as a whole the palaeozoic period in Africa was remarkably free from volcanic and igneous disturbances. The close of the Stormberg period (Rhaetic) was one of great volcanic activity in South Africa. Whilst the later Secondary and Tertiary formations were being laid down in North Africa and around the margins of the rest of the continent, Africa received its last great accumulation of strata and at the same time underwent a consecutive series of earth-movements. The additional strata consist of the immense quantities of volcanic material on the plateau of East Africa, the basalt flows of West Africa and possibly those of the Zambezi basin. The exact period of the commencement of volcanic activity is unknown. In Abyssinia the Ashangi traps are certainly post-Oolitic. In East Africa the fissure eruptions are considered to belong to the Cretaceous. These early eruptions were followed by those of Kenya, Mawenzi, Elgon, Chibcharagnani, and these by the eruptions of Kibo, Longonot, Suswa and the Kyulu Mountains. The last phase of vulcanicity took place along the great meridional rifts of East Africa, and though feebly manifested has not entirely passed away. In northern Africa a continuous sequence of volcanic events has taken place from Eocene times to latest Tertiary; but in South Africa it is doubtful if there have been any intrusions later then Cretaceous.

During this long continuance of vulcanicity, earth-movements were in progress. In the north the chief movements gave rise to the system of latitudinal folding and faulting of the Moroccan and Algerian Atlas, the last stages being represented by the formation of the Algerian and Moroccan coast-outline and the sundering of Europe from Africa at the Straits of Gibraltar. Whilst northern Africa was being folded, the East African plateau was broken up by a series of longitudinal rifts extending from Nyasaland to Egypt. The depressed areas contain the long, narrow, precipitously walled lakes of East Africa. The Red Sea also occupies a meridional trough.

Lastly there are the recent elevations of the northern coastal regions, the Barbary coast and along the east coast. (W. G.*)

III. ETHNOLOGY

In attempting a review of the races and tribes which inhabit Africa, their distribution, movements and culture, it is advisable that three points be borne in mind. The first of these is the comparative absence of natural barriers in the interior, owing to which intercommunication between tribes, the dissemination of culture and tribal migration have been considerably facilitated. Hence the student must be prepared to find that, for the most part, there are no sharp divisions to mark the extent of the various races composing the population, but that the number of what may be termed "transitional" peoples is unusually large. The second point is that Africa, with the exception of the lower Nile valley and what is known as Roman Africa (see AFRICA, ROMAN), is, so far as its native inhabitants are concerned, a continent practically without a history, and possessing no records from which such a history might be reconstructed. The early movements of tribes, the routes by which they reached their present abodes, and the origin of such forms of culture as may be distinguished in the general mass of customs, beliefs, &c., are largely matters of conjecture. The negro is essentially the child of the moment; and his memory, both tribal and individual, is very short. The third point is that many theories which have been formulated with respect to such matters are unsatisfactory owing to the small amount of information concerning many of the tribes in the interior.

The chief African races.

Excluding the Europeans who have found a home in various parts of Africa, and the Asiatics, Chinese and natives of India introduced by them (see section *History* below), the population of Africa consists of the following elements:—the Bushman, the Negro, the Eastern Hamite, the Libyan and the Semite, from the intermingling of which in various proportions a vast number of "transitional" tribes has arisen. The Bushmen (*q.v.*), a race of short yellowish-brown nomad hunters, inhabited, in the earliest times of which there is historic knowledge, the land adjoining the southern and eastern borders of the Kalahari desert, into which they were gradually being forced by the encroachment of the Hottentots and Bantu tribes. But signs of their former presence are not wanting as far north as Lake Tanganyika, and even, it is rumoured, still farther north. With them may be classed provisionally the Hottentots, a pastoral people of medium stature and yellowish-brown complexion, who in early times shared with the Bushmen the whole of what is now Cape Colony. Though the racial affinities of the Hottentots have been disputed, the most satisfactory view on the whole is that they represent a blend of Bushman, Negroid and Hamitic elements. Practically the rest of Africa, from the southern fringe of the Sahara and the upper valley of the Nile to the Cape, with the exception of Abyssinia and Galla and Somali-lands, is peopled by Negroes and the "transitional" tribes to which their admixture with Libyans on the north, and Semites (Arabs) and Hamites on the north-east and east, has given rise. A slight qualification of the last statement is necessary, in so far as, among the Fula in the western Sudan, and the Ba-Hima, &c., of the Victoria Nyanza, Libyan and Hamitic elements are respectively stronger than the Negroid. Of the tracts excepted, Abyssinia is inhabited mainly by Semito-Hamites (though a fairly strong negroid element can be found), and Somali and Galla-lands by Hamites. North of the Sahara in Algeria and Morocco are the Libyans (Berbers, *q.v.*), a distinctively white people, who have in certain respects (*e.g.* religion) fallen under Arab influence. In the north-east the brown-skinned Hamite and the Semite mingle in varied proportions. The Negroid peoples, which inhabit the vast tracts of forest and savanna between the areas held by Bushmen to the south and the Hamites, Semites and Libyans to the north, fall into two groups divided by a line running from the Cameroon (Rio del Rey) crossing the Ubangi river below the bend and passing between the Ituri and the Semliki rivers, to Lake Albert and thence with a slight southerly trend to the coast. North of this line are the Negroes proper, south are the Bantu. The division is primarily philological. Among the true Negroes the greatest linguistic confusion prevails; for instance, in certain parts of Nigeria it is possible to find half-a-dozen villages within a comparatively small area speaking, not different dialects, but different languages, a fact which adds greatly to the difficulty of political administration. To the south of the line the condition of affairs is entirely different; here the entire population speaks one or another dialect of the Bantu Languages (*q.v.*). As said before, the division is primarily linguistic and, especially upon the border line, does not always correspond with the variations of physical type. At the same time it is extremely convenient and to a certain extent justifiable on physical and psychological grounds; and it may be said roughly that while the linguistic uniformity of the Bantu is accompanied by great variation of physical type, the converse is in the main true of the Negro proper, especially where least affected by Libyan and Hamitic admixture, *e.g.* on the Guinea coast. The variation of type among the Bantu is due probably to a varying admixture of alien blood, which is more apparent as the east coast is approached. This foreign element cannot be identified with certainty, but since the Bantu seem to approach the Hamites in those points where they differ from the Negro proper, and since the physical characteristics of Hamites and Semites are very similar, it seems probable that the last two races have entered into the composition of the Bantu, though it is highly improbable that Semitic influence should have permeated any distance from the east coast. An extremely interesting section of the population not hitherto mentioned is constituted by the Pygmy tribes inhabiting the densely forested regions along the equator from Uganda to the Gabun and living the life of nomadic hunters. The affinities of this little people are undecided, owing to the small amount of knowledge concerning them. The theories which connected them with the Bushmen do not seem to be correct. It is more probable that they are to be classed among the Negroids, with whom they appear to have intermingled to a certain extent in the upper basin of the Ituri, and perhaps elsewhere. As far as is known they speak no language peculiar to themselves but adopt that of the nearest agricultural tribe. They are of a dark brown complexion, with very broad noses, lips but slightly everted, and small but usually sturdy physique, though often considerably emaciated owing to insufficiency of food. Another peculiar tribe, also of short stature, are the Vaalpens of the steppe region of the north Transvaal. Practically nothing is known of them except that they are said to be very dark in colour and live in holes in the ground, and under rock shelters.

Principal ethnological zones.

Having indicated the chief races of which in various degrees of purity and intermixture the population of Africa is formed, it remains to consider them in greater detail, particularly from the cultural standpoint. This is hardly possible without drawing attention to the main physical characters of the continent, as far as they affect the inhabitants. For ethnological purposes three principal zones may be distinguished; the first two are respectively a large region of steppes and desert in the north, and a smaller region of steppes and desert in the south. These two zones are connected by a vertical strip of grassy highland lying mainly to the east of the chain of great lakes. The third zone is a vast region of forest and rivers in the west centre, comprising the greater part of the basin of the Congo and the Guinea coast. The rainfall, which also has an important bearing upon the culture of peoples, will be found on the whole to be greatest in the third zone and also in the eastern highlands, and of course least in the desert, the steppes and savannas standing midway between the two. As might be expected these variations are accompanied by certain variations in culture. In the best-watered districts agriculture is naturally of the greatest importance, except where the density of the forest renders the work of clearing too arduous. The main portion therefore of the inhabitants of the forest zone are agriculturists, save only the nomad Pygmies, who live in the inmost recesses of the forest and support themselves by hunting the game with which it abounds. Agriculture, too, flourishes in the eastern highlands, and throughout the greater part of the steppe and savanna region of the northern and southern zones, especially the latter. In fact the only Bantu tribes who are not agriculturists are the Ova-Herero of German South-West Africa, whose purely pastoral habits are the natural outcome of the barren country they inhabit. But the wide open plains and slopes surrounding the forest area are eminently suited to cattle-breeding, and there are few tribes who do not take advantage of the fact. At the same time a natural check is imposed upon the desire for cattle, which is so characteristic of the Bantu peoples. This is constituted by the tsetse fly, which renders a pastoral life absolutely impossible throughout large tracts in central and southern Africa. In the northern zone this check is absent, and the number of more essentially pastoral peoples, such as the eastern Hamites, Masai, Dinka, Fula, &c., correspondingly greater. The desert regions yield support only to nomadic peoples, such as the Tuareg, Tibbu, Bedouins and Bushmen, though the presence of numerous oases in the north renders the condition of life easier for the inhabitants. Upon geographical conditions likewise depend to a large extent the political conditions prevailing among the various tribes. Thus among the wandering tribes of the desert and of the heart of the forests, where large communities are impossible, a patriarchal system prevails with the family as the unit. Where the forest is less dense and small agricultural communities begin to make their appearance, the unit expands to the village with its headman. Where the forest thins to the savanna and steppe, and communication is easier, are found the larger kingdoms and "empires" such as, in the north those established by the Songhai, Hausa, Fula, Bagirmi, Ba-Hima, &c., and in the south the states of Lunda, Kazembe, the Ba-Rotse, &c.

But if ease of communication is favourable to the rise of large states and the cultural progress that usually accompanies it, it is, nevertheless, often fatal to the very culture which, at first, it fostered, in so far as the absence of natural boundaries renders invasion easy. A good example of this is furnished by the history of the western Sudan and particularly of East and South-East Africa. From its geographical position Africa looks naturally to the east, and it is on this side that it has been most affected by external culture both by land (across the Sinaitic peninsula) and by sea. Though a certain amount of Indonesian and even aboriginal Indian influence has been traced in African ethnography, the people who have produced the most serious ethnic disturbances (apart from modern Europeans) are the Arabs. This is particularly the case in East Africa, where the systematic slave raids organized by them and carried out with the assistance of various warlike tribes reduced vast regions to a state of desolation. In the north and west of Africa, however, the Arab has had a less destructive but more extensive and permanent influence in spreading the Mahommedan religion throughout the whole of the Sudan.

The fact that the physical geography of Africa affords fewer natural obstacles to racial movements on the side most exposed to foreign influence, renders it obvious that the culture most characteristically African must be sought on the other side

The characteristic African culture.

It is therefore in the forests of the Congo, and among the lagoons and estuaries of the Guinea coast, that this earlier culture will most probably be found. That there is a culture distinctive of this area, irrespective of the linguistic line dividing the Bantu from the Negro proper, has now been recognized. Its main features may be summed as follows:—a purely agricultural life, with the plantain, yam and manioc (the last two of American origin) as the staple food; cannibalism common; rectangular houses with ridged roofs; scar-tattooing; clothing of bark-cloth or palm-fibre; occasional chipping or extraction of upper incisors; bows with strings of cane, as the principal weapons, shields of wood or wickerwork; religion, a primitive form of fetishism with the belief that death is due to witchcraft; ordeals, secret societies, the use of masks and anthropomorphic figures, and wooden gongs. With this may be contrasted the culture of the Bantu peoples to the south and east, also agriculturists, but in addition, where possible, great cattle-breeders, whose staple food is millet and milk. These are distinguished by circular huts with domed or conical roofs; clothing of skin or leather; occasional chipping or extraction of lower incisors; spears as the principal weapons, bows, where found, with a sinew cord, shields of hide or leather; religion, ancestor-worship with belief in the power of the magicians as rain-makers. Though this difference in culture may well be explained on the supposition that the first is the older and more representative of Africa, this theory must not be pushed too far. Many of the distinguishing characteristics of the two regions are doubtless due simply to environment, even the difference in religion. Ancestor-worship occurs most naturally among a people where tribal organization has reached a fairly advanced stage, and is the natural outcome of patriotic reverence for a successful chief and his councillors. Rain-making, too, is of little importance in a well-watered region, but a matter of vital interest to an agricultural people where the rainfall is slight and irregular.

Within the eastern and southern Bantu area certain cultural variations occur; beehive huts are found among the Zulu-Xosa and Herero, giving place among the Bechuana to the cylindrical variety with conical roof, a type which, with few exceptions, extends north to Abyssinia. The tanged spear-head characteristic of the south is replaced by the socketed variety towards the north. Circumcision, characteristic of the Zulu-Xosa and Bechuana, is not practised by many tribes farther north; tooth-mutilation, on the contrary, is absent among the more southern tribes. The lip-plug is found in the eastern area, especially among the Nyasa tribes, but not in the south. The head-rest common in the south-east and the southern fringe of the forest area is not found far north of Tanganyika until the Horn of Africa is reached.

In the regions outside the western area occupied by the Negro proper, exclusive of the upper Nile, the similarities of culture outweigh the differences. Here the cylindrical type of hut prevails; clothing is of skin or leather but is very scanty; iron ornaments are worn in profusion; arrows are not feathered; shields of hide, spears with leather sheaths are found and also fighting bracelets. Certain small differences appear between the eastern and western portions, the dividing line being formed by the boundary between Bornu and Hausaland. Characteristic of the east are the harp and the throwing-club and throwing-knife, the last of which has penetrated into the forest area. Typical of the west are the bow and the dagger with the ring hilt. The tribes of the upper Nile are somewhat specialized, though here, too, are found the cylindrical hut, iron ornaments, fighting bracelets, &c., characteristic of the Sudanese tribes. Here the removal of the lower incisors is common, and circumcision entirely absent.

Throughout the rest of the Sudan is found Semitic culture introduced by the Arabized Libyan. Circumcision, as is usual among Mahommedan tribes, is universal, and tooth-mutilation absent; of other characteristics, the use of the sword has penetrated to the northern portion of the forest area. The culture prevailing in the Horn of Africa is, naturally, mainly Hamito-Semitic; here are found both cylindrical and bee-hive huts, the sword (which has been adopted by the Masai to the south), the lyre (which has found its way to some of the Nilotic tribes) and the head-rest. Circumcision is practically universal.

As has been said earlier, the history of Africa reaches back but a short distance, except, of course, as far as the lower Nile valley and Roman Africa is concerned; elsewhere no records exist, save tribal traditions, and these only relate to very recent events. Even archaeology, which can often sketch the main outlines of a people's history, is here practically powerless, owing to the insufficiency of data. It is true that stone implements of palaeolithic and neolithic types are found sporadically in the Nile valley, Somaliland, on the Zambezi, in Cape Colony and the northern portions of the Congo Free State, as well as in Algeria and Tunisia; but the localities are far too few and too widely separated to warrant the inference that they are to be in any way connected. Moreover, where stone implements are found they are, as a rule, very near, even actually on, the surface of the earth; nothing occurs resembling the regular stratification of Europe, and consequently no argument based on geological grounds is possible.

The lower Nile valley, however, forms an exception; flint implements of a palaeolithic type have been found near Thebes, not only on the surface of the ground, which for several thousand years has been desert owing to the contraction of the river-bed, but also in stratified gravel of an older date. References to a number of papers bearing on the discussion to which their discovery has given rise may be found in an article by Mr H. R. Hall in *Man*, 1905, No. 19. The Egyptian and also the Somaliland finds appear to be true palaeoliths in type and remarkably similar to those found in Europe. But evidence bearing on the Stone age in Africa, if the latter existed apart from the localities mentioned, is so slight that little can be said save that from the available evidence the palaeoliths of the Nile valley alone can with any degree of certainty be assigned to a remote period of antiquity, and that the chips scattered over Mashonaland and the regions occupied within historic times by Bushmen are the most recent; since it has been shown that the stone flakes were used by the medieval Makalanga to engrave their hard pottery and the Bushmen were still using stone implements in the 19th century. Other early remains, but of equally uncertain date, are the stone circles of Algeria, the Cross river and the Gambia. The large system of ruined forts and "cities" in Mashonaland, at Zimbabwe and elsewhere, concerning which so many ingenious theories have been woven, have been proved to date from medieval times.

Origin and spread of the racial stocks.

Thus while in Europe there is a Stone age, divided into periods according to various types of implement disposed in geological strata, and followed in orderly succession by the ages of Bronze and Iron, in Africa can be found no true Stone age and practically no Bronze at all. The reason is not far to seek; Africa is a country of iron, which is found distributed widely throughout the continent in ores so rich that the metal can be extracted with very little trouble and by the simplest methods. Iron has been worked from time immemorial by the Negroid peoples, and whole tribes are found whose chief industry is the smelting and forging of the metal. Under such conditions, questions relating to the origin and spread of the racial stocks which form the population of Africa cannot be answered with any certainty; at best only a certain amount of probability can be attained.

Five of these racial stocks have been mentioned: Bushman, Negro, Hamite, Semite, Libyan, the last three probably related through some common ancestor. Of these the honour of being considered the most truly African belongs to the two first. It is true that people of Negroid type are found elsewhere, principally in Melanesia, but as yet their possible connexion with the African Negro is little more than theoretical, and for the present purposes it need not be considered.

The origin of the Bushman is lost in obscurity, but he may be conceived as the original inhabitant of the southern portion of the continent. The original home of the Negro, at first an agriculturist, is most probably to be found in the neighbourhood of the great lakes, whence he penetrated along the fringe of the Sahara to the west and across the eastern highlands southward. Northerly expansion was prevented by the early occupation of the Nile valley, the only easy route to the Mediterranean, but there seems no doubt that the population of ancient Egypt contained a distinct Negroid element. The question as to the ethnic affinities of the pre-dynastic Egyptians is still unsolved; but they may be regarded as, in the main, Hamitic, though it is a question how far it is just to apply a name which implies a definite specialization in what may be comparatively modern times to a people of such antiquity.

The Horn of Africa appears to have been the centre from which the Hamites spread, and the pressure they seem to have applied to the Negro tribes, themselves also in process of expansion, sent forth larger waves of emigrants from the latter. These emigrants, already affected by the Hamitic pastoral culture, and with a strain of Hamitic blood in their veins, passed rapidly down the open tract in the east, doubtless exterminating their predecessors, except such few as took refuge in the mountains and swamps. The advance-guard of this wave of pastoral Negroids, in fact primitive Bantu, mingled with the Bushmen and produced the Hottentots. The penetration of the forest area must certainly have taken longer and was probably accomplished as much from the south-east, up the Zambezi valley, as from any other quarter. It was a more peaceful process, since natural obstacles are unfavourable to rapid movements of large bodies of immigrants, though not so serious as to prevent the spread of language and culture. A modern parallel to the spread of Bantu speech is found in the rise of the Hausa language, which is gradually enlarging its sphere of influence in the western and central Sudan. Thus those qualities, physical and otherwise, in which the Bantu approach the Hamites gradually fade as we proceed westward through the Congo basin, while in the east, among the tribes to the west of Tanganyika and on the upper Zambezi, "transitional" forms of culture are found. In later times this gradual pressure from the south-east became greater, and resulted, at a comparatively recent date, in the irruption of the Fang into the Gabun.

The earlier stages of the southern movement must have been accompanied by a similar movement westward between the Sahara and the forest; and, probably, at the same time, or even earlier, the Libyans crossing the desert had begun to press upon the primitive Negroes from the north. In this way were produced the Fula, who mingled further with the Negro to give birth to the Mandingo, Wolof and Tukulor. It would appear that either Libyan (Fula) or, less probably, Hamitic, blood enters into the composition of the Zandeh peoples on the Nile-Congo watershed. These Libyans or Berbers, included by G. Sergi in his "Mediterranean Race," were active on the north coast of Africa in very early times, and had relations with the Egyptians from a prehistoric period. For long these movements continued, always in the same direction, from north to south and from east to west; though, of course, more rapid changes took place in the open country, especially in the great eastern highway from north to south, than in the forest area. Large states arose in the western Sudan; Ghana flourished in the 7th century A.D., Melle in the 11th, Songhai in the 14th, and Bornu in the 16th.

Meanwhile in the east began the southerly movement of the Bechuana, which was probably spread over a considerable period. Later than they, but proceeding faster, came the Zulu-Xosa ("Kaffir") peoples, who followed a line nearer the coast and outflanked them, surrounding them on the south. Then followed a time of great ethnical confusion in South Africa, during which tribes flourished, split up and disappeared; but ere this the culture represented by the ruins in Rhodesia had waxed and waned. It is uncertain who were the builders of the forts and "cities," but it is not improbable that they may be found to have been early Bechuana. The Zulu-Xosa, Bechuana and Herero together form a group which may conveniently be termed "Southern Bantu."

Finally began a movement hitherto unparalleled in the history of African migration; certain peoples of Zulu blood began to press north, spreading destruction in their wake. Of these the principal were the Matabele and Angoni. The movement continued as far as the Victoria Nyanza. Here, on the border-line of Negro, Bantu and Hamite, important changes had taken place. Certain of the Negro tribes had retired to the swamps of the Nile, and had become somewhat specialized, both physically and culturally (Shilluk, Dinka, Alur, Acholi, &c.). These had blended with the Hamites to produce such races as the Masai and kindred tribes. The old Kitwara empire, which comprised the plateau land between the Ruwenzori range and Kavirondo, had broken up into small states, usually governed by a Hamitic (Ba-Hima) aristocracy. The more extensive Zang (Zenj) empire, of which the name Zanzibar (Zanguebar) is a lasting memorial, extending along the sea-board from Somaliland to the Zambezi, was also extinct. The Arabs had established themselves firmly on the coast, and thence made continual slave-raids into the interior, penetrating later to the Congo. The Swahili, inhabiting the coast-line from the equator to about 16° S., are a somewhat heterogeneous mixture of Bantu with a tinge of Arab blood.

In the neighbourhood of Victoria Nyanza, where Hamite, Bantu, Nilotic Negro and Pygmy are found in close contact, the ethnic relations of tribes are often puzzling, but the Bantu not under a Hamitic domination have been divided by F. Stuhlmann into the Older Bantu (Wanyamwezi, Wasukuma, Wasambara, Waseguha, Wasagara, Wasaramo, &c.) and the Bantu of Later Immigration (Wakikuyu, Wakamba, Wapokomo, Wataita, Wachaga, &c.), who are more strongly Hamitized and in many cases have adopted Masai customs. These peoples, from the Victoria Nyanza to the Zambezi, may conveniently be termed the "Eastern Bantu."

Turning to the Congo basin in the south, the great Luba and Lunda peoples are found stretching nearly across the continent, the latter, from at any rate the end of the 16th century until the close of the 19th century, more or less united under a single ruler, styled Muata Yanvo. These seem to have been the most recent immigrants from the south-east, and to exhibit certain affinities with the Barotse on the upper Zambezi. Among the western Baluba, or Bashilange, a remarkable politico-religious revolution took place at a comparatively recent date, initiated by a secret society termed *Bena Riamba* or "Sons of Hemp," and resulted in the subordination of the old fetishism to a cult of hemp, in accordance with which all hemp-smokers consider themselves brothers, and the duty of mutual hospitality, &c., is acknowledged. North of these, in the great bend of the Congo, are the Balolo, &c., the Balolo a nation of iron-workers; and westward, on the Kasai, the Bakuba, and a large number of tribes as yet imperfectly known. Farther west are the tribes of Angola, many of whom were included within the old "Congo empire," of which the kingdom of Loango was an offshoot. North of the latter lies the Gabun, with a large number of small tribes dominated by the Fang who are recent arrivals from the Congo. Farther to the north are the Bali and other tribes of the Cameroon, among whom many primitive Negroid elements begin to appear. Eastward are the Zandeh peoples of the Welle district (primitive Negroids with a Hamitic or, more probably, Libyan strain), with whom the Dor tribe of Nilotes on their eastern border show certain affinities; while to the west along the coast are the Guinea Negroes of primitive type. Here, amidst great linguistic confusion, may be distinguished the tribes of Yoruba speech in the Niger delta and the east portion of the Slave Coast; those of Ewe speech, in the western portion of the latter; and those of Ga and Tshi speech, on the Gold Coast. Among the last two groups respectively may be mentioned the Dahomi and Ashanti. Similar tribes are found along the coast to the Bissagos Islands, though the introduction in Sierra Leone and Liberia of settlements of repatriated slaves from the American plantations has in those places modified the original ethnic distribution. Leaving the forest zone and entering the more open country there are, on the north from the Niger to the Nile, a number of Negroids strongly tinged with Libyan blood and professing the Mahommedan religion. Such are the

Mandingo, the Songhai, the Fula, Hausa, Kanuri, Bagirmi, Kanembu, and the peoples of Wadai and Darfur; the few aborigines who persist, on the southern fringe of the Chad basin, are imperfectly known.

Peculiar conditions in Madagascar.

The island of Madagascar, belonging to the African continent, still remains for discussion. Here the ethnological conditions are peculiar. Before the French occupation the dominant people were the Hova, a Malayo-Indonesian people who must have come from the Malay Peninsula or the adjacent islands. The date of their immigration has been the subject of a good deal of dispute, but it may be argued that their arrival must have taken place in early times, since Malagasy speech, which is the language of the island, is principally Malayo-Polynesian in origin, and contains no traces of Sanskrit. Such traces, introduced with Hinduism, are present in all the cultivated languages of Malaysia at the present day. The Hova occupy the table-land of Imerina and form the first of the three main groups into which the population of Madagascar may be divided. They are short, of an olive-yellow complexion and have straight or faintly wavy hair. On the east coast are the Malagasy, who in physical characteristics stand halfway between the Hova and the Sakalava, the last occupying the remaining portion of the island and displaying almost pure Negroid characteristics.

Though the Hova belong to a race naturally addicted to seafaring, the contrary is the case respecting the Negroid population, and the presence of the latter in the island has been explained by the supposition that they were imported by the Hova. Other authorities assign less antiquity to the Hova immigration and believe that they found the Negroid tribes already in occupation of the island.

As might be expected, the culture found in Madagascar contains two elements, Negroid and Malayo-Indonesian. The first of these two shows certain affinities with the culture characteristic of the western area of Africa, such as rectangular huts, clothing of bark and palm-fibre, fetishism, &c., but cattle-breeding is found as well as agriculture. However, the Negroid tribes are more and more adopting the customs and mode of life of the Hova, among whom are found pile-houses, the *sarong*, *fadi* or tabu applied to food, a non-African form of bellows, &c., all characteristic of their original home. The Hova, during the 19th century, embraced Christianity, but retain, nevertheless, many of their old animistic beliefs; their original social organization in three classes, *andriana* or nobles, *hova* or freemen, and *andevo* or slaves, has been modified by the French, who have abolished kingship and slavery. An Arab infusion is also to be noticed, especially on the north-east and south-east coasts.

It is impossible to give a complete list of the tribes inhabiting Africa, owing to the fact that the country is not fully explored. Even where the names of the tribes are known their ethnic relations are still a matter of uncertainty in many localities.

The following list, therefore, must be regarded as purely tentative, and liable to correction in the light of fuller information:—

AFRICAN TRIBAL DISTRIBUTION

LIBYANS

(North Africa, excluding Egypt)

- Berbers, including—
  - Kabyles
  - Mzab
  - Shawia
  - Tuareg

LIBYO-NEGROID TRANSITIONAL

- Fula (West Sudan)
- Tibbu (Central Sudan)

HAMITES

(East Sudan and Horn of Africa)

- Beja, including—
  - Ababda
  - Hadendoa
  - Bisharin
  - Beni-Amer
  - Hamran

HAMITES—continued

(East Sudan and Horn of Africa)—continued

- Galla
- Somali
- Danakil (Afar)
- Ba-Hima, including—
  - Wa-Tussi
  - Wa-Hha
  - Wa-Rundi
  - Wa-Ruanda

HAMITO-SEMITES

- Fellahin (Egypt)
- Abyssinians (with Negroid admixture)

HAMITO-NEGROID TRANSITIONAL

- Masai
- Wa-Kuafi

NEGROID TRIBES

West Sudan

- Tukulor
- Wolof
- Serer
- Leybu
- Mandingo, including—
  - Kassonké
  - Yallonké
  - Soninké
  - Bambara
  - Vei
  - Susu
  - Solima
  - Malinké

Probably also—
- Mossi
- Borgu

- Tombo
- Gurma
- Gurunga
- Dagomba
- Mampursi
- Gonja
- &c.

Probably with Mandingan elements

Central Sudan

- Songhai
- Hausa
- Bagirmi
- Kanembu
- Kanuri
- Tama
- Maba
- Birkit
- Massalit
- Korunga
- Kabbaga
- &c.

Eastern

- Fur
- Dago
- Kunjara
- Tegele
- Nuba
- Kargo
- Kulfan
- Kolaji
- Tumali

Zandeh Tribes

(Akin to Nilotics, but probably with Fula element)

- Azandeh (Niam Niam)
- Makaraka
- Mundu
- Mangbettu
- Ababwa
- Mege
- Abisanga
- Mabode
- Momfu

probably with Pygmy element

Allied are—
- Banziri
- Ndris
- Togbo
- Languassi
- Wia-Wia
- Awaka
- &c.

NEGROES

West African Tribes

- Khabunké
- Balanta
- Bagnori
- Bagnum
- Felup, including—
  - Ayamat
  - Jola
  - Jigush
  - Vaca
  - Joat
  - Karon
  - Banyum
  - Banjar
  - Fulum
  - Bayot
  - &c.
- Bujagos
- Biafare
- Landuman
- Nalu
- Baga
- Sapé
- Bulam
- Mendi
- Limba
- Gallina
- Timni
- Pessi
- Gola
- Kondo
- Bassa
- Kru
- Grebo
- Awekwom
- Agni
- Oshiu

Tribes of Tshi and Ga speech, including—

- Ashanti
- Safwi
- Denkera
- Bekwai
- Nkoranza
- Adansi
- Assin
- Wassaw
- Ahanta
- Fanti
- Agona
- Akwapim
- Akim
- Akwamu
- Kwao
- Ga

Tribes of Ewe speech, including—

- Dahomi
- Eweawo
- Agotine
- Krepi
- Avenor
- Awuna
- Agbosomi
- Aflao
- Ataklu
- Krikor
- Geng
- Attakpami
- Aja
- Ewemi
- Appa

Tribes of Yoruba speech, including—

- Yoruba
- Ibadan
- Ketu
- Egba
- Jebu
- Remo
- Ode
- Illorin
- Ijesa
- Ondo
- Mahin
- Bini
- Kakanda
- Wari
- Ibo
- Efik
- Andoni
- Kwa
- Ibibio
- Ekoi
- Inokun
- Akunakuna
- Munshi
- Ikwe

NEGROES—continued

Central Negroes

- Bolo
- Yako
- Tangala
- Kali
- Mishi
- Doma
- Mosgu, including—
  - Mandara
  - Margi
  - Logon
  - Gamergu
  - Keribina
- Yedina
- Kuri
- &c.

Nilotics with affinity with Zandeh tribes

- Dor (Bongo)

Eastern Negroes

Pure Nilotics

- Shilluk
- Nuer
- Dinka
- Jur (Diur)
- Mittu
- Jibbeh
- Madi
- Lendu
- Alur (Lur)
- Acholi
- Lango
- Abaka
- Golo

Nilotics with affinity with Masai

- Latuka
- Bari

NEGRO-BANTU TRANSITIONAL

- Bali
- Ba-Kossi
- Ba-Ngwa
- Ba-Nyang
- Ngolo
- Ba-Fo
- Ba-Kundu
- Isubu
- Ba-Kwiri
- Abo
- Dualla
- Bassa
- Ba-Noko
- Ba-Puko
- Ba-Koko

NILOTIC-BANTU TRANSITIONAL

- Ja-Luo

PYGMY TRIBES (Central Africa)

- Akka
- Ba-Mbute
- Ba-Bongo
- Ashango
- &c.

BANTU NEGROIDS

Western

- Ogowé
- Ashira
- Ishogo
- Ashango
- Bakalai
- Nkomi
- Orungu
- Mpongwe
- Oshekiani
- Benga
- Ininga
- Galao
- Apingi
- Okanda
- Osaka
- Aduma
- Mbamba
- Umbete
- Bule
- Bane
- Yaunde
- Maka
- Bomone
- Kunabembe
- Fang (recent immigrants from the Congo group)
- &c.
- Ba-Kongo, including—
  - Mushi-Kongo
  - Mussorongo
  - Kabinda
  - Ka-Kongo
  - Ba-Vili
  - Ma-Yumbe
  - Ba-Lumbo
  - Ba-Sundi
  - Ba-Bwende
  - Ba-Lali
  - Ba-Kunya

Central

Luba-Lunda Group

- Ba-Luba, including—
  - Ba-Songe
  - Wa-Rua
  - Wa-Guha
  - Katanga
  - Ba-Shilange (with Ba-Kete element)
- Ba-Lunda
  - Probably connected are—
- Manyema
- Ba-Kumu
- Wa-Regga
- Ba-Rotse, including—
  - Ma-Mbunda
  - Ma-Supia
  - Ma-Shukulumbwe
  - Ba-Tonga
  - and probably
  - Va-Lovale

Tribes of the Congo Bend

- Ba-Kussu
- Ba-Tetela
- Ba-Songo Mino
- Ba-Kuba
- Ba-Lolo
- Ba-Kuti
- Ba-Mbala
- Ba-Huana
- Ba-Yaka
- Ba-Pindi
- Ba-Kwese
- &c.

Tribes of the Congo Bank

- Wa-Genia
- Ba-Soko
- Ba-Poto
- Mobali
- Mogwandi
- Ba-Ngala
- Ba-Bangi

connected with Zandeh group

- Wa-Buma

Eastern

Lacustrians

- Ba-Nyoro
- Ba-Toro
- Wa-Siba
- Wa-Sinja
- Wa-Kerewe
- Wa-Shashi
- Wa-Rundi
- Ba-Iro
- Ba-Ganda
- Ba-Soga
- Ba-Kavirondo, including—
  - Awaware
  - Awarimi
  - Awakisii
  - &c.

Bantu of Recent Immigration

- Wa-Kikuyu
- Wa-Kamba
- Wa-Pokomo
- Wa-Duruma
- Wa-Digo
- Wa-Giriama
- Wa-Taita
- Wa-Nyaturu
- Wa-Iramba
- Wa-Mbugwe
- Wa-Kaguru
- Wa-Gogo
- Wa-Chaga

possible Masai element

Older Bantu

- Wa-Nyamwezi, including—
  - Wa-Sukuma
  - Wa-Sumbwa
  - Wa-Nyanyembe
  - Wa-Jui
  - Wa-Kimbu
  - Wa-Kanongo
  - Wa-Wende

Transitional to Bantu of Recent Immigration

BANTU NEGROIDS—continued

Western

- Ba-Nunu
- Ba-Loi
- Ba-Teke
- Wa-Pfuru
- Wa-Mbundu
- Wa-Mfumu
- Ba-Nsinik
- Ma-Wumba
- Ma-Yakalla
- &c.

(*Central*)

TRANSITIONAL FROM CENTRAL TO SOUTHERN BANTU

- Amboela
- Ganguela
- Kioko
- Minungo
- Imbangala
- Ba-Achinji
- Golo
- Hollo
- &c.
- Mbunda peoples including—
  - Bihé
  - Dembo
  - Mbaka
  - Ngola
  - Bondo
  - Ba-Ngala
  - Songo
  - Haku
  - Lubolo
  - Kisama
  - &c.

Eastern

- Wa-Gunda
- Wa-Guru
- Wa-Galla
- Wa-Sambara
- Wa-Seguha
- Wa-Nguru
- Wa-Sagara
- Wa-Doe
- Wa-Khutu
- Wa-Saramo
- Wa-Hehe
- Wa-Bena
- Wa-Sanga
- Wa-Swahili (with Arab elements)
  - Connected are—
- Wa-Kisi
- Wa-Mpoto
- Ba-Tonga
- Ba-Tumbuka
- Wa-Nyika
- Wa-Nyamwanga
- A-Mambwe
- Wa-Fipa
- Wa-Rungu
- A-Wemba
- A-Chewa
- A-Maravi
- Ba-Senga
- Ba-Bisa

Akin to Luba-Lunda group

- A-Jawa (Yaos)
- Wa-Mwera
- Wa-Gindo
- Ma-Konde
- Ma-Wia
- Ma-Nganja
- Ma-Kua

SOUTHERN BANTU

(South and South-East Africa)

- Ba-Nyai
- Ma-Kalanga, including
  - Mashona
- Ba-Ronga

Affinity with Bechuana

- Be-Chuana, including—
  - Ba-Tlapin
  - Ba-Rolong
  - Ba-Ratlou
  - Ba-Taung
  - Ba-Rapulana
  - Ba-Seleka
  - Ba-Hurutsi
  - Ba-Tlaru
  - Ba-Mangwato
  - Ba-Tauana
  - Ba-Ngwaketse
  - Ba-Kuena
  - &c.
- Ama-Zulu, including—
  - Ama-Swazi
  - Ama-Tonga
  - Matabele
  - Angoni
  - Ma-Gwangwara
  - Ma-Huhu
  - Ma-Viti
  - Ma-Situ
  - Ma-Henge
  - &c.
- Ama-Xosa, including—
  - Ama-Gcaleka
  - Ama-Hahabe
  - Ama-Ngqika
  - Ama-Tembu
  - Ama-Pondo
  - &c.
- Ova-Herero
- Ova-Mpo

HAMITO-BANTU BUSHMAN TRANSITIONAL

- Hottentots, including—
  - Namaqua
  - Koranna

S.W. Africa

BUSHMEN

TRIBES IN MADAGASCAR

MALAYO-INDONESIANS

- Hova
- Betsileo (slight Bantu admixture)

HOVA-BANTU TRANSITIONAL

- Malagasy, including—
  - Bestimisaraka
  - Antambahoaka
  - Antaimoro
  - Antaifasina
  - Antaisaka
  - Antanosi
  - Antsihanaka
  - Antanala
  - Antaisara
  - &c.

BANTU-NEGROIDS

- Sakalava, including—
  - Menabe
  - Milaka
  - Ronondra
  - Mahafali
  - &c.

(T. A. J.)

IV. History

The origin and meaning of the name of the continent are discussed elsewhere (see Africa, Roman). The word Africa was applied originally to the country in the immediate neighbourhood of Carthage, that part of the continent first known to the Romans, and it was subsequently extended with their increasing knowledge, till it came at last to include all that they knew of the continent. The Arabs still confine the name Ifrikia to the territory of Tunisia.

Phoenician and Greek colonization.

The valley of the lower Nile was the home in remotest antiquity of a civilized race. Egyptian culture had, however, remarkably little direct influence on the rest of the continent, a result due in large measure to the fact that Egypt is shut off landwards by immense deserts. If ancient Egypt and Ethiopia (*q.v.*) be excluded, the story of Africa is largely a record of the doings of its Asiatic and European conquerors and colonizers, Abyssinia being the only state which throughout historic times has maintained its independence. The countries bordering the Mediterranean were first exploited by the Phoenicians, whose earliest settlements were made before 1000 B.C. Carthage, founded about 800 B.C., speedily grew into a city without rival in the Mediterranean, and the Phoenicians, subduing the Berber tribes, who then as now formed the bulk of the population, became masters of all the habitable region of North Africa west of the Great Syrtis, and found in commerce a source of immense prosperity. Both Egyptians and Carthaginians made attempts to reach the unknown parts of the continent by sea. Herodotus relates that an expedition under Phoenician navigators, employed by Necho, king of Egypt, *c.* 600 B.C., circumnavigated Africa from the Red Sea to the Mediterranean, a voyage stated to have been accomplished in three years. Apart from the reported circumnavigation of the continent, the west coast was well known to the Phoenicians as far as Cape Nun, and *c.* 520 B.C. Hanno, a Carthaginian, explored the coast as far, perhaps, as the Bight of Benin, certainly as far as Sierra Leone. A vague knowledge of the Niger regions was also possessed by the Phoenicians.

Meantime the first European colonists had planted themselves in Africa. At the point where the continent approaches nearest the Greek islands, Greeks founded the city of Cyrene (*c.* 631 B.C.). Cyrenaica became a flourishing colony, though being hemmed in on all sides by absolute desert it had little or no influence on inner Africa. The Greeks, however, exerted a powerful influence in Egypt. To Alexander the Great the city of Alexandria owes its foundation (332 B.C.), and under the Hellenistic dynasty of the Ptolemies attempts were made to penetrate southward, and in this way was obtained some knowledge of Abyssinia. Neither Cyrenaica nor Egypt was a serious rival to the Carthaginians, but all three powers were eventually supplanted by the Romans. After centuries of rivalry for supremacy[1] the struggle was ended by the fall of Carthage in 146 B.C. Within little more than a century from that date Egypt and Cyrene had become incorporated in the Roman empire. Under Rome the settled portions of the country were very prosperous, and a Latin strain was introduced into the land. Though Fezzan was occupied by them, the Romans elsewhere found the Sahara an impassable barrier. Nubia and Abyssinia were reached, but an expedition sent by the emperor Nero to discover the source of the Nile ended in failure. The utmost extent of geographical knowledge of the continent is shown in the writings of Ptolemy (2nd century A.D.), who knew of or guessed the existence of the great lake reservoirs of the Nile and had heard of the river Niger. Still Africa for the civilized world remained simply the countries bordering the Mediterranean. The continual struggle between Rome and the Berber tribes; the introduction of Christianity and the glories and sufferings of the Egyptian and African Churches; the invasion and conquest of the African provinces by the Vandals in the 5th century; the passing of the supreme power in the following century to the Byzantine empire—all these events are told fully elsewhere.

North Africa conquered by the Arabs.

In the 7th century of the Christian era occurred an event destined to have a permanent influence on the whole continent. Invading first Egypt, an Arab host, fanatical believers in the new faith of Mahommed, conquered the whole country from the Red Sea to the Atlantic and carried the Crescent into Spain. Throughout North Africa Christianity well-nigh disappeared, save in Egypt (where the Coptic Church was suffered to exist), and Upper Nubia and Abyssinia, which were not subdued by the Moslems. In the 8th, 9th and 10th centuries the Arabs in Africa were numerically weak; they held the countries they had conquered by the sword only, but in the 11th century there was a great Arab immigration, resulting in a large absorption of Berber blood. Even before this the Berbers had very generally adopted the speech and religion of their conquerors. Arab influence and the Mahommedan religion thus became indelibly stamped on northern Africa. Together they spread southward across the Sahara. They also became firmly established along the eastern sea-board, where Arabs, Persians and Indians planted flourishing colonies, such as Mombasa, Malindi and Sofala, playing a rôle, maritime and commercial, analogous to that filled in earlier centuries by the Carthaginians on the northern sea-board. Of these eastern cities and states both Europe and the Arabs of North Africa were long ignorant.

Appearance of the Turks.

The first Arab invaders had recognized the authority of the caliphs of Bagdad, and the Aghlabite dynasty—founded by Aghlab, one of Haroun al Raschid's generals, at the close of the 8th century— ruled as vassals of the caliphate. However, early in the 10th century the Fatimite dynasty established itself in Egypt, where Cairo had been founded A.D. 968, and from there ruled as far west as the Atlantic. Later still arose other dynasties such as the Almoravides and Almohades. Eventually the Turks, who had conquered Constantinople in 1453, and had seized Egypt in 1517, established the regencies of Algeria, Tunisia and Tripoli (between 1519 and 1551), Morocco remaining an independent Arabized Berber state under the Sharifan dynasty, which had its beginnings at the end of the 13th century. Under the earlier dynasties Arabian or Moorish culture had attained a high degree of excellence, while the spirit of adventure and the proselytizing zeal of the followers of Islam led to a considerable extension of the knowledge of the continent. This was rendered more easy by their use of the camel (first introduced into Africa by the Persian conquerors of Egypt), which enabled the Arabs to traverse the desert. In this way Senegambia and the middle Niger regions fell under the influence of the Arabs and Berbers, but it was not until 1591 that Timbuktu—a city founded in the 11th century—became Moslem. That city had been reached in 1352 by the great Arab traveller Ibn Batuta, to whose journey to Mombasa and Quiloa (Kilwa) was due the first accurate knowledge of those flourishing Moslem cities on the east African sea-boards. Except along this sea-board, which was colonized directly from Asia, Arab progress southward was stopped by the broad belt of dense forest which, stretching almost across the continent somewhat south of 10° N., barred their advance as effectually as had the Sahara that of their predecessors, and cut them off from knowledge of the Guinea coast and of all Africa beyond. One of the regions which came latest under Arab control was that of Nubia, where a Christian civilization and state existed up to the 14th century.

For a time the Moslem conquests in South Europe had virtually made of the Mediterranean an Arab lake, but the expulsion in the 11th century of the Saracens from Sicily and southern Italy by the Normans was followed by descents of the conquerors on Tunisia and Tripoli. Somewhat later a busy trade with the African coast-lands, and especially with Egypt, was developed by Venice, Pisa, Genoa and other cities of North Italy. By the end of the 15th century Spain had completely thrown off the Moslem yoke, but even while the Moors were still in Granada, Portugal was strong enough to carry the war into Africa.

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[1] Commercial treaties between Carthage and Rome were made in the 6th and 5th centuries B.C. The first armed conflict between the rival powers, begun in 264 B.C., was a contest for the possession of Sicily.

Spain and Portugal invade the Barbary States.

In 1415 a Portuguese force captured the citadel of Ceuta on the Moorish coast. From that time onward Portugal repeatedly interfered in the affairs of Morocco, while Spain acquired many ports in Algeria and Tunisia. Portugal, however, suffered a crushing defeat in 1578 at al Kasr al Kebir, the Moors being led by Abd el Malek I. of the then recently established Sharifan dynasty. By that time the Spaniards had lost almost all their African possessions. The Barbary states, primarily from the example of the Moors expelled from Spain, degenerated into mere communities of pirates, and under Turkish influence civilization and commerce declined. The story of these states from the beginning of the 16th century to the third decade of the 19th century is largely made up of piratical exploits on the one hand and of ineffectual reprisals on the other. In Algiers, Tunis and other cities were thousands of Christian slaves.

Discovery of the Guinea Coast—Rise of the slave trade.

But with the battle of Ceuta Africa had ceased to belong solely to the Mediterranean world. Among those who fought there was one, Prince Henry "the Navigator," son of King John I., who was fired with the ambition to acquire for Portugal the unknown parts of Africa. Under his inspiration and direction was begun that series of voyages of exploration which resulted in the circumnavigation of Africa and the establishment of Portuguese sovereignty over large areas of the coast-lands. Cape Bojador was doubled in 1434, Cape Verde in 1445, and by 1480 the whole Guinea coast was known. In 1482 Diogo Cam or Cão discovered the mouth of the Congo, the Cape of Good Hope was doubled by Bartholomew Diaz in 1488, and in 1498 Vasco da Gama, after having rounded the Cape, sailed up the east coast, touched at Sofala and Malindi, and went thence to India. Over all the countries discovered by their navigators Portugal claimed sovereign rights, but these were not exercised in the extreme south of the continent. The Guinea coast, as the first discovered and the nearest to Europe, was first exploited. Numerous forts and trading stations were established, the earliest being São Jorge da Mina (Elmina), begun in 1482. The chief commodities dealt in were slaves, gold, ivory and spices. The discovery of America (1492) was followed by a great development of the slave trade, which, before the Portuguese era, had been an overland trade almost exclusively confined to Mahommedan Africa. The lucrative nature of this trade and the large quantities of alluvial gold obtained by the Portuguese drew other nations to the Guinea coast. English mariners went thither as early as 1553, and they were followed by Spaniards, Dutch, French, Danish and other adventurers. Much of Senegambia was made known as a result of quests during the 16th century for the "hills of gold" in Bambuk and the fabled wealth of Timbuktu, but the middle Niger was not reached. The supremacy along the coast passed in the 17th century from Portugal to Holland and from Holland in the 18th and 19th centuries to France and England. The whole coast from Senegal to Lagos was dotted with forts and "factories" of rival powers, and this international patchwork persists though all the *hinterland* has become either French or British territory.

Southward from the mouth of the Congo[1] to the inhospitable region of Damaraland, the Portuguese, from 1491 onward, acquired influence over the Bantu-Negro inhabitants, and in the early part of the 16th century through their efforts Christianity was largely adopted in the native kingdom of Congo. An irruption of cannibals from the interior later in the same century broke the power of this semi-Christian state, and Portuguese activity was transferred to a great extent farther south, São Paulo de Loanda being founded in 1576. The sovereignty of Portugal over this coast region, except for the mouth of the Congo, has been once only challenged by a European power, and that was in 1640–1648, when the Dutch held the seaports.

The Portuguese in East Africa and Abyssinia.

Neglecting the comparatively poor and thinly inhabited regions of South Africa, the Portuguese no sooner discovered than they coveted the flourishing cities held by Arabized peoples between Sofala and Cape Guardafui. By 1520 all these Moslem sultanates had been seized by Portugal, Mozambique being chosen as the chief city of her East African possessions. Nor was Portuguese activity confined to the coast-lands. The lower and middle Zambezi valley was explored (16th and 17th centuries), and here the Portuguese found semi-civilized Bantu-Negro tribes, who had been for many years in contact with the coast Arabs. Strenuous efforts were made to obtain possession of the country (modern Rhodesia) known to them as the kingdom or empire of Monomotapa, where gold had been worked by the natives from about the 12th century A.D., and whence the Arabs, whom the Portuguese dispossessed, were still obtaining supplies in the 16th century. Several expeditions were despatched inland from 1569 onward and considerable quantities of gold were obtained. Portugal's hold on the interior, never very effective, weakened during the 17th century, and in the middle of the 18th century ceased with the abandonment of the forts in the Manica district.

At the period of her greatest power Portugal exercised a strong influence in Abyssinia also. In the ruler of Abyssinia (to whose dominions a Portuguese traveller had penetrated before Vasco da Gama's memorable voyage) the Portuguese imagined they had found the legendary Christian king, Prester John, and when the complete overthrow of the native dynasty and the Christian religion was imminent by the victories of Mahommedan invaders, the exploits of a band of 400 Portuguese under Christopher da Gama during 1541–1543 turned the scale in favour of Abyssinia and had thus an enduring result on the future of North-East Africa. After da Gama's time Portuguese Jesuits resorted to Abyssinia. While they failed in their efforts to convert the Abyssinians to Roman Catholicism they acquired an extensive knowledge of the country. Pedro Paez in 1615, and, ten years later, Jeronimo Lobo, both visited the sources of the Blue Nile. In 1663 the Portuguese, who had outstayed their welcome, were expelled from the Abyssinian dominions. At this time Portuguese influence on the Zanzibar coast was waning before the power of the Arabs of Muscat, and by 1730 no point on the east coast north of Cape Delgado was held by Portugal.

English and Dutch at Table Bay—Cape Colony founded.

It has been seen that Portugal took no steps to acquire the southern part of the continent. To the Portuguese the Cape of Good Hope was simply a landmark on the road to India, and mariners of other nations who followed in their wake used Table Bay only as a convenient spot wherein to refit on their voyage to the East. By the beginning of the 17th century the bay was much resorted to for this purpose, chiefly by English and Dutch vessels. In 1620, with the object of forestalling the Dutch, two officers of the East India Company, on their own initiative, took possession of Table Bay in the name of King James, fearing otherwise that English ships would be "frustrated of watering but by license." Their action was not approved in London and the proclamation they issued remained without effect. The Netherlands profited by the apathy of the English. On the advice of sailors who had been shipwrecked in Table Bay the Netherlands East India Company, in 1651, sent out a fleet of three small vessels under Jan van Riebeek which reached Table Bay on the 6th of April 1652, when, 164 years after its discovery, the first permanent white settlement was made in South Africa. The Portuguese, whose power in Africa was already waning, were not in a position to interfere with the Dutch plans, and England was content to seize the island of St Helena as her half-way house to the East.[2] In its inception the settlement at the Cape was not intended to become an African colony, but was regarded as the most westerly outpost of the Dutch East Indies. Nevertheless, despite the paucity of ports and the absence of navigable rivers, the Dutch colonists, freed from any apprehension of European trouble by the friendship between Great Britain and Holland, and leavened by Huguenot blood, gradually spread northward, stamping their language, law and religion indelibly upon South Africa. This process, however, was exceedingly slow.

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[1] This river was called by the Portuguese the Zaire. They appear to have made no attempt to trace its course beyond the rapids which stop navigation from the sea.

[2] France acquired, as stations for her ships on the voyage to and from India, settlements in Madagascar and the neighbouring islands. The first settlement was made in 1642.

Waning and revival of interest in Africa.

During the 18th century there is little to record in the history of Africa. The nations of Europe, engaged in the later half of the century in almost constant warfare, and struggling for supremacy in America and the East, to a large extent lost their interest in the continent. Only on the west coast was there keen rivalry, and here the motive was the securance of trade rather than territorial acquisitions. In this century the slave trade reached its highest development, the trade in gold, ivory, gum and spices being small in comparison. In the interior of the continent—Portugal's energy being expended—no interest was shown, the nations with establishments on the coast "taking no further notice of the inhabitants or their land than to obtain at the easiest rate what they procure with as little trouble as possible, or to carry them off for slaves to their plantations in America" (*Encyclopaedia Britannica*, 3rd ed., 1797). Even the scanty knowledge acquired by the ancients and the Arabs was in the main forgotten or disbelieved. It was the period when—

> Geographers, in Afric maps,
> With savage pictures filled their gaps,
> And o'er unhabitable downs
> Placed elephants for want of towns.
> (*Poetry, a Rhapsody*. By Jonathan Swift.)

The prevailing ignorance may be gauged by the statement in the third edition of the *Encyclopaedia Britannica* that "the Gambia and Senegal rivers are only branches of the Niger." But the closing years of the 18th century, which witnessed the partial awakening of the public conscience of Europe to the iniquities of the slave trade, were also notable for the revival of interest in inner Africa. A society, the African Association,[1] was formed in London in 1788 for the exploration of the interior of the continent. The era of great discoveries had begun a little earlier in the famous journey (1770–1772) of James Bruce through Abyssinia and Sennar, during which he determined the course of the Blue Nile. But it was through the agents of the African Association that knowledge was gained of the Niger regions. The Niger itself was first reached by Mungo Park, who travelled by way of the Gambia, in 1795. Park, on a second journey in 1805, passed Timbuktu and descended the Niger to Bussa, where he lost his life, having just failed to solve the question as to where the river reached the ocean. (This problem was ultimately solved by Richard Lander and his brother in 1830.) The first scientific explorer of South-East Africa, Dr Francisco de Lacerda, a Portuguese, also lost his life in that country. Lacerda travelled up the Zambezi to Tete, going thence towards Lake Mweru, near which he died in 1798. The first recorded crossing of Africa was accomplished between the years 1802 and 1811 by two half-caste Portuguese traders, Pedro Baptista and A. José, who passed from Angola eastward to the Zambezi.

Effects of the Napoleonic wars—Britain seizes the Cape.

Although the Napoleonic wars distracted the attention of Europe from exploratory work in Africa, those wars nevertheless exercised great influence on the future of the continent, both in Egypt and South Africa. The occupation of Egypt (1798–1803) first by France and then by Great Britain resulted in an effort by Turkey to regain direct control over that country,[2] followed in 1811 by the establishment under Mehemet Ali of an almost independent state, and the extension of Egyptian rule over the eastern Sudan (from 1820 onward). In South Africa the struggle with Napoleon caused Great Britain to take possession of the Dutch settlements at the Cape, and in 1814 Cape Colony, which had been continuously occupied by British troops since 1806, was formally ceded to the British crown.

The close of the European conflicts with the battle of Waterloo was followed by vigorous efforts on the part of the British government to become better acquainted with Africa, and to substitute colonization and legitimate trade for the slave traffic, declared illegal for British subjects in 1807 and abolished by all other European powers by 1836. To West Africa Britain devoted much attention. The slave trade abolitionists had already, in 1788, formed a settlement at Sierra Leone, on the Guinea coast, for freed slaves, and from this establishment grew the colony of Sierra Leone, long notorious, by reason of its deadly climate, as "The White Man's Grave."[3] Farther east the establishments on the Gold Coast began to take a part in the politics of the interior, and the first British mission to Kumasi, despatched in 1817, led to the assumption of a protectorate over the maritime tribes heretofore governed by the Ashanti.

An expedition sent in 1816 to explore the Congo from its mouth did not succeed in getting beyond the rapids which bar the way to the interior, but in the central Sudan much better results were obtained. In 1823 three English travellers, Walter Oudney, Dixon Denham and Hugh Clapperton, reached Lake Chad from Tripoli—the first white men to reach that lake. The partial exploration of Bornu and the Hausa states by Clapperton, which followed, revealed the existence of large and flourishing cities and a semi-civilized people in a region hitherto unknown. The discovery in 1830 of the mouth of the Niger by Clapperton's servant Lander, already mentioned, had been preceded by the journeys of Major A. G. Laing (1826) and René Caillié (1827) to Timbuktu, and was followed (1832–1833) by the partial ascent of the Benue affluent of the Niger by MacGregor Laird. In 1841 a disastrous attempt was made to plant a white colony on the lower Niger, an expedition (largely philanthropic and anti-slavery in its inception) which ended in utter failure. Nevertheless from that time British traders remained on the lower Niger, their continued presence leading ultimately to the acquisition of political rights over the delta and the Hausa states by Great Britain.[4] Another endeavour by the British government to open up commercial relations with the Niger countries resulted in the addition of a vast amount of information concerning the countries between Timbuktu and Lake Chad, owing to the labours of Heinrich Barth (1850–1855), originally a subordinate, but the only surviving member of the expedition sent out.

Meantime considerable changes had been made in other parts of the continent, the most notable being—the occupation of Algiers by France in 1830, an end being thereby put to the piratical proceedings of the Barbary states; the continued expansion southward of Egyptian authority with the consequent additions to the knowledge of the Nile; and the establishment of independent states (Orange Free State and the Transvaal) by Dutch farmers (Boers) dissatisfied with British rule in Cape Colony. Natal, so named by Vasco da Gama, had been made a British colony (1843), the attempt of the Boers to acquire it being frustrated. The city of Zanzibar, on the island of that name, founded in 1832 by Seyyid Said of Muscat, rapidly attained importance, and Arabs began to penetrate to the great lakes of East Africa,[5] concerning which little more was known (and less believed) than in the time of Ptolemy. Accounts of a vast inland sea, and the discovery in 1848–1849, by the missionaries Ludwig Krapf and J. Rebmann, of the snow-clad mountains of Kilimanjaro and Kenya, stimulated in Europe the desire for further knowledge.

The era of great explorers.

At this period, the middle of the 19th century, Protestant missions were carrying on active propaganda on the Guinea coast, in South Africa and in the Zanzibar dominions. Their work, largely beneficent, was being conducted in regions and among peoples little known, and in many instances missionaries turned explorers and became pioneers of trade and empire. One of the first to attempt to fill up the remaining blank spaces in the map was David Livingstone, who had been engaged since 1840 in missionary work north of the Orange. In 1849 Livingstone crossed the Kalahari Desert from south to north and reached Lake Ngami.

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[1] The Association, in 1831, was merged in the Royal Geographical Society.

[2] The Mamelukes, whom the Turks had overthrown in the 16th century, had regained practically independent power.

[3] In imitation of the British example, an American society founded in 1822 the negro colony (now republic) of Liberia.

[4] The first territorial acquisition made by Great Britain in this region was in 1851, when Lagos Island was annexed.

[5] As early as 1848 an Arab from Zanzibar journeying across the continent had arrived at Benguella.

and between 1851 and 1856 he traversed the continent from west to east, making known the great waterways of the upper Zambezi. During these journeyings Livingstone discovered, November 1855, the famous Victoria Falls, so named after the queen of England. In 1858–1864 the lower Zambezi, the Shiré and Lake Nyasa were explored by Livingstone, Nyasa having been first reached by the confidential slave of Antonio da Silva Porto, a Portuguese trader established at Bihé in Angola, who crossed Africa during 1853–1856 from Benguella to the mouth of the Rovuma. While Livingstone circumnavigated Nyasa, the more northerly lake, Tanganyika, had been visited (1858) by Richard Burton and J. H. Speke, and the last named had sighted Victoria Nyanza. Returning to East Africa with J. A. Grant, Speke reached, in 1862, the river which flowed from Victoria Nyanza, and following it (in the main) down to Egypt, had the distinction of being the first man to read the riddle of the Nile. In 1864 another Nile explorer, Samuel Baker, discovered the Albert Nyanza, the chief western reservoir of the river. In 1866 Livingstone began his last great journey, in which he made known Lakes Mweru and Bangweulu and discovered the Lualaba (the upper part of the Congo), but died (1873) before he had been able to demonstrate its ultimate course, believing indeed that the Lualaba belonged to the Nile system. Livingstone's lonely death in the heart of Africa evoked a keener desire than ever to complete the work he left undone. H. M. Stanley, who had in 1871 succeeded in finding and succouring Livingstone, started again for Zanzibar in 1874, and in the most memorable of all exploring expeditions in Africa circumnavigated Victoria Nyanza and Tanganyika, and, striking farther inland to the Lualaba, followed that river down to the Atlantic Ocean—reached in August 1877—and proved it to be the Congo. Stanley had been preceded, in 1874, at Nyangwe, Livingstone's farthest point on the Lualaba, by Lovett Cameron, who was, however, unable farther to explore its course, making his way to the west coast by a route south of the Congo.

While the great mystery of Central Africa was being solved explorers were also active in other parts of the continent. Southern Morocco, the Sahara and the Sudan were traversed in many directions between 1860 and 1875 by Gerhard Rohlfs, Georg Schweinfurth and Gustav Nachtigal. These travellers not only added considerably to geographical knowledge, but obtained invaluable information concerning the people, languages and natural history of the countries in which they sojourned.[1] Among the discoveries of Schweinfurth was one that confirmed the Greek legends of the existence beyond Egypt of a pygmy race. But the first discoverer of the dwarf races of Central Africa was Paul du Chaillu, who found them in the Ogowé district of the west coast in 1865, five years before Schweinfurth's first meeting with the Pygmies; du Chaillu having previously, as the result of journeys in the Gabun country between 1855 and 1859, made popular in Europe the knowledge of the existence of the gorilla, perhaps the gigantic ape seen by Hanno the Carthaginian, and whose existence, up to the middle of the 19th century, was thought to be as legendary as that of the Pygmies of Aristotle.

In South Africa the filling up of the map also proceeded apace. The finding, in 1869, of rich diamond fields in the valley of the Vaal river, near its confluence with the Orange, caused a rush of emigrants to that district, and led to conflicts between the Dutch and British authorities and the extension of British authority northward. In 1871 the ruins of the great Zimbabwe in Mashonaland, the chief fortress and distributing centre of the race which in medieval times worked the goldfields of South-East Africa, were explored by Karl Mauch. In the following year F. C. Selous began his journeys over South Central Africa, which continued for more than twenty years and extended over every part of Mashonaland and Matabeleland. (F. R. C.)

V. PARTITION AMONG EUROPEAN POWERS

In the last quarter of the 19th century the map of Africa was transformed. After the discovery of the Congo the story of exploration takes second place; the continent becomes the theatre of European expansion. Lines of partition, drawn often through trackless wildernesses, marked out the possessions of Germany, France, Great Britain and other powers. Railways penetrated the interior, vast areas were opened up to civilized occupation, and from ancient Egypt to the Zambezi the continent was startled into new life.

Before 1875 the only powers with any considerable interest in Africa were Britain, Portugal and France. Between 1815 and 1850, as has been shown above, the British government devoted much energy, not always informed by knowledge, to western and southern Africa. In both directions Great Britain had met with much discouragement; on the west coast, disease, death, decaying trade and useless conflicts with savage foes had been the normal experience; in the south recalcitrant Boers and hostile Kaffirs caused almost endless trouble. The visions once entertained of vigorous negro communities at once civilized and Christian faded away; to the hot fit of philanthropy succeeded the cold fit of indifference and a disinclination to bear the burden of empire. The low-water mark of British interest in South Africa was reached in 1854 when independence was forced on the Orange River Boers, while in 1865 the mind of the nation was fairly reflected by the unanimous resolution of a representative House of Commons committee:[2] "that all further extension of territory or assumption of government, or new treaty offering any protection to native tribes, would be inexpedient." For nearly twenty years the spirit of that resolution paralysed British action in Africa, although many circumstances—the absence of any serious European rival, the inevitable border disputes with uncivilized races, and the activity of missionary and trader—conspired to make British influence dominant in large areas of the continent over which the government exercised no definite authority. The freedom with which blood and treasure were spent to enforce respect for the British flag or to succour British subjects in distress, as in the Abyssinian campaign of 1867–68 and the Ashanti war of 1873, tended further to enhance the reputation of Great Britain among African races, while, as an inevitable result of the possession of India, British officials exercised considerable power at the court of Zanzibar, which indeed owed its separate existence to a decision of Lord Canning, the governor-general of India, in 1861 recognizing the division of the Arabian and African dominions of the imam of Muscat.

It has been said that Great Britain was without serious rival. On the Gold Coast she had bought the Danish forts in 1850 and acquired the Dutch, 1871–1872, in exchange for establishments in Sumatra. But Portugal still held, both in the east and west of Africa, considerable stretches of the tropical coast-lands, and it was in 1875 that she obtained, as a result of the arbitration of Marshal MacMahon, possession of the whole of Delagoa Bay, to the southern part of which England also laid claim by virtue of a treaty of cession concluded with native chiefs in 1823. The only other European power which at the period under consideration had considerable possessions in Africa was France. Besides Algeria, France had settlements on the Senegal, where in 1854 the appointment of General Faidherbe as governor marked the beginning of a policy of expansion; she had also various posts on the upper Guinea coast, had taken the estuary of the Gabun as a station for her navy, and had acquired (1862) Obok at the southern entrance to the Red Sea.

In North Africa the Turks had (in 1835) assumed direct control of Tripoli, while Morocco had fallen into a state of decay though retaining its independence. The most remarkable change was in Egypt, where the Khedive Ismail had introduced a somewhat fantastic imitation of European civilization. In addition Ismail had conquered Darfur, annexed Harrar and the Somali ports on the Gulf of Aden, was extending his power southward to the equatorial lakes, and even contemplated reaching the Indian Ocean. The Suez Canal, opened in 1869, had a great influence on the future of Africa, as it again made Egypt the highway to the East, to the detriment of the Cape route.

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[1] Another great traveller of this stamp was Wilhelm Junker, who spent the greater part of the period 1875–1886 in the east central Sudan.

[2] Specially appointed to consider West African affairs.

The division of the continent in 1875.

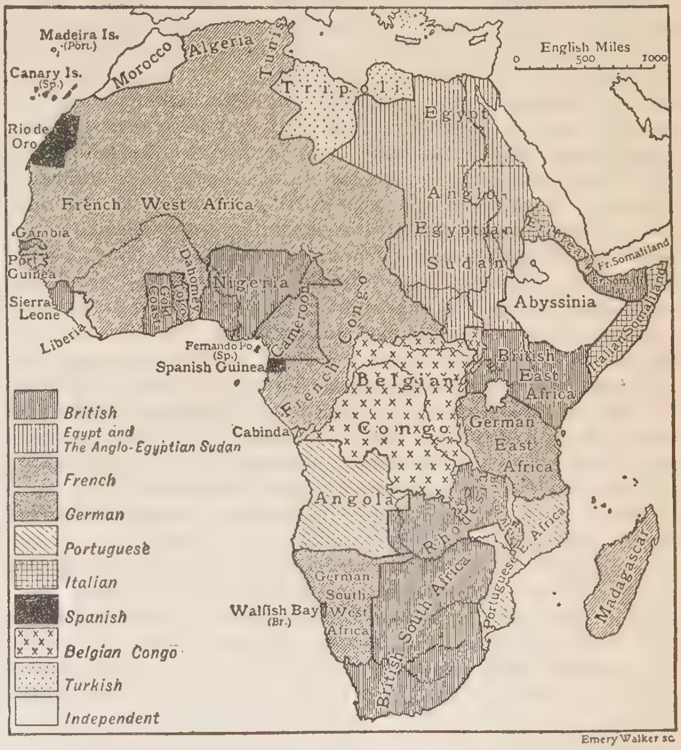
Any estimate of the area of African territory held by European nations in 1875 is necessarily but approximate, and varies chiefly as the compiler of statistics rejects or accepts the vague claims of Portugal to sovereignty over the hinterland of her coast possessions. At that period other European nations—with the occasional exception of Great Britain—were indifferent to Portugal's pretensions, and her estimate of her African empire as covering over 700,000 sq. m. was not challenged.[1] But the area under effective control of Portugal at that time did not exceed 40,000 sq. m. Great Britain then held some 250,000 sq. m., France about 170,000 sq. m. and Spain 1000 sq. m. The area of the independent Dutch republics (the Transvaal and Orange Free State) was some 150,000 sq. m., so that the total area of Africa ruled by Europeans did not exceed 1,271,000 sq. m.; roughly one-tenth of the continent. This estimate, as it admits the full extent of Portuguese claims and does not include Madagascar, in reality considerably overstates the case.

Egypt and the Egyptian Sudan, Tunisia and Tripoli were subject in differing ways to the overlordship of the sultan of Turkey, and with these may be ranked, in the scale of organized governments, the three principal independent states, Morocco, Abyssinia and Zanzibar, as also the negro republic of Liberia. There remained, apart from the Sahara, roughly one half of Africa, lying mostly within the tropics, inhabited by a multitude of tribes and peoples living under various forms of government and subject to frequent changes in respect of political organization. In this region were the negro states of Ashanti, Dahomey and Benin on the west coast, the Mahommedan sultanates of the central Sudan, and a number of negro kingdoms in the east central and south central regions. Of these Uganda on the north-west shores of Victoria Nyanza, Cazembe and Muata Hianvo (or Yanvo) may be mentioned. The two last-named kingdoms occupied respectively the south-eastern and south-western parts of the Congo basin. In all this vast region the Negro and Negro-Bantu races predominated, for the most part untouched by Mahommedanism or Christian influences. They lacked political cohesion, and possessed neither the means nor the inclination to extend their influence beyond their own borders. The exploitation of Africa continued to be entirely the work of alien races.

Causes which led to partition.

The causes which led to the partition of Africa may now be considered. They are to be found in the economic and political state of western Europe at the time. Germany, strong and united as the result of the Franco-Prussian War of 1870, was seeking new outlets for her energies—new markets for her growing industries, and with the markets, colonies. Yet the idea of colonial expansion was of slow growth in Germany, and when Prince Bismarck at length acted Africa was the only field left to exploit, South America being protected from interference by the known determination of the United States to enforce the Monroe Doctrine, while Great Britain, France, the Netherlands, Portugal and Spain already held most of the other regions of the world where colonization was possible. For different reasons the war of 1870 was also the starting-point for France in the building up of a new colonial empire. In her endeavour to regain the position lost in that war France had to look beyond Europe. To the two causes mentioned must be added others. Great Britain and Portugal, when they found their interests threatened, bestirred themselves, while Italy also conceived it necessary to become an African power. Great Britain awoke to the need for action too late to secure predominance in all the regions where formerly hers was the only European influence. She had to contend not only with the economic forces which urged her rivals to action, but had also to combat the jealous opposition of almost every European nation to the further growth of British power. Italy alone acted throughout in cordial co-operation with Great Britain.

It was not, however, the action of any of the great powers of Europe which precipitated the struggle. This was brought about by the ambitious projects of Leopold II., king of the Belgians. The discoveries of Livingstone, Stanley and others had aroused especial interest among two classes of men in western Europe, one the manufacturing and trading class, which saw in Central Africa possibilities of commercial development, the other the philanthropic and missionary class, which beheld in the newly discovered lands millions of savages to Christianize and civilize. The possibility of utilizing both these classes in the creation of a vast state, of which he should be the chief, formed itself in the mind of Leopold II. even before Stanley had navigated the Congo. The king's action was immediate; it proved successful; but no sooner was the nature of his project understood in Europe than it provoked the rivalry of France and Germany, and thus the international struggle was begun.



Emery Walker sc.

Conflicting ambitions of the European powers.

At this point it is expedient, in the light of subsequent events, to set forth the designs then entertained by the European powers that participated in the struggle for Africa. Portugal was striving to retain as large a share as possible of her shadowy empire, and particularly to establish her claims to the Zambezi region, so as to secure a belt of territory across Africa from Mozambique to Angola. Great Britain, once aroused to the imminence of danger, put forth vigorous efforts in East Africa and on the Niger, but her most ambitious dream was the establishment of an unbroken line of British possessions and spheres of influence from south to north of the continent, from Cape Colony to Egypt. Germany's ambition can be easily described. It was to secure as much as possible, so as to make up for lost opportunities. Italy coveted Tripoli, but that province could not be seized without risking war. For the rest Italy's territorial ambitions were confined to North-East Africa, where she hoped to acquire a dominating influence over Abyssinia. French ambitions, apart from Madagascar, were confined to the northern and central portions of the continent. To extend her possessions on the Mediterranean littoral, and to connect them with her colonies in West Africa, the western Sudan, and on the Congo, by establishing her influence over the vast intermediate regions, was France's first ambition. But the defeat of the Italians in Abyssinia and the impending downfall of the khalifa's power in the valley of the upper Nile suggested a still more daring project to the French government—none other than the establishment of French influence over a broad belt of territory stretching across the continent from west to east, from Senegal on the Atlantic coast to the Gulf of Aden. The fact that France possessed a small part of the Red Sea coast gave point to this design. But these conflicting ambitions could not all be realized, and Germany succeeded in preventing Great Britain obtaining a continuous band of British territory from south to north, while Great Britain, by excluding France from the upper Nile valley, dispelled the French dream of an empire from west to east.

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[1] See the tables in Behm and Wagner's *Bevölkerung der Erde* (Gotha, 1872).

King Leopold's ambitions have already been indicated. The part of the continent to which from the first he directed his energies was the equatorial region. In September 1876 he took what may be described as the first definite step in the modern partition of the continent. He summoned to a conference at Brussels representatives of Great Britain, Belgium, France, Germany, Austria-Hungary, Italy and Russia, to deliberate on the best methods to be adopted for the exploration and civilization of Africa, and the opening up of the interior of the continent to commerce and industry. The conference was entirely unofficial. The delegates who attended neither represented nor pledged their respective governments. Their deliberations lasted three days and resulted in the foundation of "The International African Association," with its headquarters at Brussels. It was further resolved to establish national committees in the various countries represented, which should collect funds and appoint delegates to the International Association. The central idea appears to have been to put the exploration and development of Africa upon an international footing. But it quickly became apparent that this was an unattainable ideal. The national committees were soon working independently of the International Association, and the Association itself passed through a succession of stages until it became purely Belgian in character, and at last developed into the Congo Free State, under the personal sovereignty of King Leopold. At first the Association devoted itself to sending expeditions to the great central lakes from the east coast; but failure, more or less complete, attended its efforts in this direction, and it was not until the return of Stanley, in January 1878, from his great journey down the Congo, that its ruling spirit, King Leopold, definitely turned his thoughts towards the Congo. In June of that year, Stanley visited the king at Brussels, and in the following November a private conference was held, and a committee was appointed for the investigation of the upper Congo.

The struggle for the Congo.

Stanley's remarkable discovery had stirred ambition in other capitals than Brussels. France had always taken a keen interest in West Africa, and in the years 1875 to 1878 Savorgnan de Brazza had carried out a successful exploration of the Ogowé river to the south of the Gabun. De Brazza determined that the Ogowé did not offer that great waterway into the interior of which he was in search, and he returned to Europe without having heard of the discoveries of Stanley farther south. Naturally, however, Stanley's discoveries were keenly followed in France. In Portugal, too, the discovery of the Congo, with its magnificent unbroken waterway of more than a thousand miles into the heart of the continent, served to revive the languid energies of the Portuguese, who promptly began to furbish up claims whose age was in inverse ratio to their validity. Claims, annexations and occupations were in the air, and when in January 1879 Stanley left Europe as the accredited agent of King Leopold and the Congo committee, the strictest secrecy was observed as to his real aims and intentions. The expedition was, it was alleged, proceeding up the Congo to assist the Belgian expedition which had entered from the east coast, and Stanley himself went first to Zanzibar. But in August 1879 Stanley found himself again at Banana Point, at the mouth of the Congo, with, as he himself has written, "the novel mission of sowing along its banks civilized settlements to peacefully conquer and subdue it, to remould it in harmony with modern ideas into national states, within whose limits the European merchant shall go hand in hand with the dark African trader, and justice and law and order shall prevail, and murder and lawlessness and the cruel barter of slaves shall be overcome." The irony of human aspirations was never perhaps more plainly demonstrated than in the contrast between the ideal thus set before themselves by those who employed Stanley, and the actual results of their intervention in Africa. Stanley founded his first station at Vivi, between the mouth of the Congo and the rapids that obstruct its course where it breaks over the western edge of the central continental plateau. Above the rapids he established a station on Stanley Pool and named it Leopoldville, founding other stations on the main stream in the direction of the falls that bear his name.

Meanwhile de Brazza was far from idle. He had returned to Africa at the beginning of 1880, and while the agents of King Leopold were making treaties and founding stations along the southern bank of the river, de Brazza and other French agents were equally busy on the northern bank. De Brazza was sent out to Africa by the French committee of the International African Association, which provided him with the funds for the expedition. His avowed object was to explore the region between the Gabun and Lake Chad. But his real object was to anticipate Stanley on the Congo. The international character of the association founded by King Leopold was never more than a polite fiction, and the rivalry between the French and the Belgians on the Congo was soon open, if not avowed. In October 1880 de Brazza made a solemn treaty with a chief on the north bank of the Congo, who claimed that his authority extended over a large area, including territory on the southern bank of the river. As soon as this chief had accepted French protection, de Brazza crossed over to the south of the river, and founded a station close to the present site of Leopoldville. The discovery by Stanley of the French station annoyed King Leopold's agent, and he promptly challenged the rights of the chief who purported to have placed the country under French protection, and himself founded a Belgian station close to the site selected by de Brazza. In the result, the French station was withdrawn to the northern side of Stanley Pool, where it is now known as Brazzaville.

The activity of French and Belgian agents on the Congo had not passed unnoticed in Lisbon, and the Portuguese government saw that no time was to be lost if the claims it had never ceased to put forward on the west coast were not to go by default. At varying periods during the 19th century Portugal had put forward claims to the whole of the West African coast, between 5° 12′ and 8° south. North of the Congo mouth she claimed the territories of Kabinda and Molemba, alleging that they had been in her possession since 1484. Great Britain had never, however, admitted this claim, and south of the Congo had declined to recognize Portuguese possessions as extending north of Ambriz. In 1856 orders were given to British cruisers to prevent by force any attempt to extend Portuguese dominion north of that place. But the Portuguese had been persistent in urging their claims, and in 1882 negotiations were again opened with the British government for recognition of Portuguese rights over both banks of the Congo on the coast, and for some distance inland. Into the details of the negotiations, which were conducted for Great Britain by the 2nd Earl Granville, who was then secretary for foreign affairs, it is unnecessary to enter; they resulted in the signing on the 26th of February 1884 of a treaty, by which Great Britain recognized the sovereignty of the king of Portugal "over that part of the west coast of Africa, situated between 8° and 5° 12′ south latitude," and inland as far as Noki, on the south bank of the Congo, below Vivi. The navigation of the Congo was to be controlled by an Anglo-Portuguese commission. The publication of this treaty evoked immediate protests, not only on the continent but in Great Britain. In face of the disapproval aroused by the treaty, Lord Granville found himself unable to ratify it. The protests had not been confined to France and the king of the Belgians. Germany had not yet acquired formal footing in Africa, but she was crouching for the spring prior to taking her part in the scramble, and Prince Bismarck had expressed, in vigorous language, the objections entertained by Germany to the Anglo-Portuguese treaty.

British influence consolidated in South Africa.

For some time before 1884 there had been growing up a general conviction that it would be desirable for the powers who were interesting themselves in Africa to come to some agreement as to "the rules of the game," and to define their respective interests so far as that was practicable. Lord Granville's ill-fated treaty brought this sentiment to a head, and it was agreed to hold an international conference on African affairs. But before discussing the Berlin conference of 1884–1885, it will be well to see what was the position, on the eve of the conference, in other parts of the African continent. In the southern section of Africa, south of the Zambezi, important events had been happening. In 1876 Great Britain had concluded an agreement with the Orange Free State for an adjustment of frontiers, the result of which was to leave the Kimberley diamond fields in British territory, in exchange for a payment of £90,000 to the Orange Free State. On the 12th of April 1877 Sir Theophilus Shepstone had issued a proclamation declaring the Transvaal—the South African Republic, as it was officially designated—to be British territory (see TRANSVAAL). In December 1880 war broke out and lasted until March 1881, when a treaty of peace was signed. This treaty of peace was followed by a convention, signed in August of the same year, under which complete self-government was guaranteed to the inhabitants of the Transvaal, subject to the suzerainty of Great Britain, upon certain terms and conditions and subject to certain reservations and limitations. No sooner was the convention signed than it became the object of the Boers to obtain a modification of the conditions and limitations imposed, and in February 1884 a fresh convention was signed, amending the convention of 1881. Article IV. of the new convention provided that "The South African Republic will conclude no treaty or engagement with any state or nation other than the Orange Free State, nor with any native tribe to the eastward or westward of the Republic, until the same has been approved by Her Majesty the Queen." The precise effect of the two conventions has been the occasion for interminable discussions, but as the subject is now one of merely academic interest, it is sufficient to say that when the Berlin conference held its first meeting in 1884 the Transvaal was practically independent, so far as its internal administration was concerned, while its foreign relations were subject to the control just quoted.

But although the Transvaal had thus, between the years 1875 and 1884, become and ceased to be British territory, British influence in other parts of Africa south of the Zambezi had been steadily extended. To the west of the Orange Free State, Griqualand West was annexed to the Cape in 1880, while to the east the territories beyond the Kei river were included in Cape Colony between 1877 and 1884, so that in the latter year, with the exception of Pondoland, the whole of South-East Africa was in one form or another under British control. North of Natal, Zululand was not actually annexed until 1887, although since 1879, when the military power of the Zulus was broken up, British influence had been admittedly supreme. In December 1884 St Lucia Bay—upon which Germany was casting covetous eyes—had been taken possession of in virtue of its cession to Great Britain by the Zulu king in 1843, and three years later an agreement of non-cession to foreign powers made by Great Britain with the regent and paramount chief of Tongaland completed the chain of British possessions on the coast of South Africa, from the mouth of the Orange river on the west to Kosi Bay and the Portuguese frontier on the east. In the interior of South Africa the year 1884 witnessed the beginning of that final stage of the British advance towards the north which was to extend British influence from the Cape to the southern shores of Lake Tanganyika. The activity of the Germans on the west, and of the Boer republic on the east, had brought home to both the imperial and colonial authorities the impossibility of relying on vague traditional claims. In May 1884 treaties were made with native chiefs by which the whole of the country north of Cape Colony, west of the Transvaal, south of 22° S. and east of 20° E., was placed under British protection, though a protectorate was not formally declared until the following January.

Germany enters the field.

Meanwhile some very interesting events had been taking place on the west coast, north of the Orange river and south of the Portuguese province of Mossamedes. It must be sufficient here to touch very briefly on the events that preceded the foundation of the colony of German South-West Africa. For many years before 1884 German missionaries had settled among the Damaras (Herero) and Namaquas, often combining small trading operations with their missionary work. From time to time trouble arose between the missionaries and the native chiefs, and appeals were made to the German government for protection. The German government in its turn begged the British government to say whether it assumed responsibility for the protection of Europeans in Damaraland and Namaqualand. The position of the British government was intelligible, if not very intelligent. It did not desire to see any other European power in these countries, and it did not want to assume the responsibility and incur the expense of protecting the few Europeans settled there. Sir Bartle Frere, when governor of the Cape (1877–1880), had foreseen that this attitude portended trouble, and had urged that the whole of the unoccupied coast-line, up to the Portuguese frontier, should be declared under British protection. But he preached to deaf ears, and it was as something of a concession to him that in March 1878 the British flag was hoisted at Walfish Bay, and a small part of the adjacent land declared to be British. The fact appears to be that British statesmen failed to understand the change that had come over Germany. They believed that Prince Bismarck would never give his sanction to the creation of a colonial empire, and, to the German inquiries as to what rights Great Britain claimed in Damaraland and Namaqualand, procrastinating replies were sent. Meanwhile the various colonial societies established in Germany had effected a revolution in public opinion, and, more important still, they had convinced the great chancellor. Accordingly when, in November 1882, F. A. E. Lüderitz, a Bremen merchant, informed the German government of his intention to establish a factory on the coast between the Orange river and the Little Fish river, and asked if he might rely on the protection of his government in case of need, he met with no discouragement from Prince Bismarck. In February 1883 the German ambassador in London informed Lord Granville of Lüderitz's design, and asked "whether Her Majesty's government exercise any authority in that locality." It was intimated that if Her Majesty's government did not, the German government would extend to Lüderitz's factory "the same measure of protection which they give to their subjects in remote parts of the world, but without having the least design to establish any footing in South Africa." An inconclusive reply was sent, and on the 9th of April Lüderitz's agent landed at Angra Pequeña, and after a short delay concluded a treaty with the local chief, by which some 215 square miles around Angra Pequeña were ceded to Lüderitz. In England and at the Cape irritation at the news was mingled with incredulity, and it was fully anticipated that Lüderitz would be disavowed by his government. But for this belief it can scarcely be doubted that the rest of the unoccupied coast-line would have been promptly declared under British protection. Still Prince Bismarck was slow to act. In November the German ambassador again inquired if Great Britain made any claim over this coast, and Lord Granville replied that Her Majesty exercised sovereignty only over certain parts of the coast, as at Walfish Bay, and suggested that arrangements might be made by which Germany might assist in the settlement of Angra Pequeña. By this time Lüderitz had extended his acquisitions southwards to the Orange river, which had been declared by the British government to be the northern frontier of Cape Colony. Both at the Cape and in England it was now realized that Germany had broken away from her former purely continental policy, and, when too late, the Cape parliament showed great eagerness to acquire the territory which had lain so long at its very doors, to be had for the taking. It is not necessary to follow the course of the subsequent negotiations. On the 15th of August 1884 an official note was addressed by the German consul at Capetown to the high commissioner, intimating that the German emperor had by proclamation taken “ the territory belonging to Mr A. Lüderitz on the west coast of Africa under the direct protection of His Majesty.” This proclamation covered the coast-line from the north bank of the Orange river to 26° S. latitude, and 20 geographical miles inland, including “ the islands belonging thereto by the law of nations.” On the 8th of September 1884 the German government intimated to Her Majesty's government “ that the west coast of Africa from 26° S. latitude to Cape Frio, excepting Walfish Bay, had been placed under the protection of the German emperor.” Thus, before the end of the year 1884, the foundations of Germany's colonial empire had been laid in South-West Africa.

Nachtigal's mission to West Africa.

In April of that year Prince Bismarck intimated to the British government, through the German chargé d'affaires in London, that “ the imperial consul-general, Dr Nachtigal, has been commissioned by my government to visit the west coast of Africa in the course of the next few months, in order to complete the information now in the possession of the Foreign Office at Berlin, on the state of German commerce on that coast. With this object Dr Nachtigal will shortly embark at Lisbon, on board the gunboat ‘ Möwe.’ He will put himself into communication with the authorities in the British possessions on the said coast, and is authorized to conduct, on behalf of the imperial government, negotiations connected with certain questions. I venture,” the official communication proceeds, “ in accordance with my instructions, to beg your excellency to be so good as to cause the authorities in the British possessions in West Africa to be furnished with suitable recommendations.” Although at the date of this communication it must have been apparent, from what was happening in South Africa, that Germany was prepared to enter on a policy of colonial expansion, and although the wording of the letter was studiously vague, it does not seem to have occurred to the British government that the real object of Gustav Nachtigal's journey was to make other annexations on the west coast. Yet such was indeed his mission. German traders and missionaries had been particularly active of late years on the coast of the Gulf of Guinea. German factories were dotted all along the coast in districts under British protection, under French protection and under the definite protection of no European power at all. It was to these latter places that Nachtigal turned his attention. The net result of his operations was that on the 5th of July 1884 a treaty was signed with the king of Togo, placing his country under German protection, and that just one week later a German protectorate was proclaimed over the Cameroon district. Before either of these events had occurred Great Britain had become alive to the fact that she could no longer dally with the subject, if she desired to consolidate her possessions in West Africa. The British government had again and again refused to accord native chiefs the protection they demanded. The Cameroon chiefs had several times asked for British protection, and always in vain. But at last it became apparent, even to the official mind, that rapid changes were being effected in Africa, and on the 16th of May Edward Hyde Hewett, British consul, received instructions to return to the west coast and to make arrangements for extending British protection over certain regions. He arrived too late to save either Togoland or Cameroon, in the latter case arriving five days after King Bell and the other chiefs on the river had signed treaties with Nachtigal. But the British consul was in time to secure the delta of the river Niger and the Oil Rivers District, extending from Rio del Rey to the Lagos frontier, where for a long period British traders had held almost a monopoly of the trade.

French and British rivalry in West Africa.

Meanwhile France, too, had been busy treaty-making. While the British government still remained under the spell of the fatal resolution of 1865, the French government was strenuously endeavouring to extend France's influence in West Africa, in the countries lying behind the coast-line. During the year 1884 no fewer than forty-two treaties were concluded with native chiefs, an even larger number having been concluded in the previous twelve months. In this fashion France was pushing on towards Timbuktu, in steady pursuance of the policy which resulted in surrounding all the old British possessions in West Africa with a continuous band of French territory. There was, however, one region on the west coast where, notwithstanding the lethargy of the British government, British interests were being vigorously pushed, protected and consolidated. This was on the lower Niger, and the leading spirit in the enterprise was Mr Goldie Taubman (afterwards Sir George Taubman Goldie). In 1877 Sir George Goldie visited the Niger and conceived the idea of establishing a settled government in that region. Through his efforts the various trading firms on the lower Niger formed themselves in 1879 into the “ United African Company,” and the foundations were laid of something like settled administration. An application was made to the British government for a charter in 1881, and the capital of the company increased to a million sterling. Henceforth the company was known as the “ National African Company,” and it was acknowledged that its object was not only to develop the trade of the lower Niger, but to extend its operations to the middle reaches of the river, and to open up direct relations with the great Fula empire of Sokoto and the smaller states associated with Sokoto under a somewhat loosely defined suzerainty. The great development of trade which followed the combination of British interests carried out under Goldie's skilful guidance did not pass unnoticed in France, and, encouraged by Gambetta, French traders made a bold bid for a position on the river. Two French companies, with ample capital, were formed, and various stations were established on the lower Niger. Goldie realized at once the seriousness of the situation, and lost no time in declaring commercial war on the newcomers. His bold tactics were entirely successful, and a few days before the meeting of the Berlin conference he had the satisfaction of announcing that he had bought out the whole of the French interests on the river, and that Great Britain alone possessed any interests on the lower Niger.

The position in Tunisia and Egypt.

To complete the survey of the political situation in Africa at the time the plenipotentiaries met at Berlin, it is necessary to refer briefly to the course of events in North and East Africa since 1875. In 1881 a French army entered Tunisia, and compelled the bey to sign a treaty placing that country under French protection. The sultan of Turkey formally protested against this invasion of Ottoman rights, but the great powers took no action, and France was left in undisturbed possession of her newly acquired territory. In Egypt the extravagance of Ismail Pasha had led to the establishment in 1879, in the interests of European bondholders, of a Dual Control exercised by France and Great Britain. France had, however, in 1882 refused to take part in the suppression of a revolt under Arabi Pasha, which England accomplished unaided. As a consequence the Dual Control had been abolished in January 1883, since when Great Britain, with an army quartered in the country, had assumed a predominant position in Egyptian affairs (see Egypt). In East Africa, north of the Portuguese possessions, where the sultan of Zanzibar was the most considerable native potentate, Germany was secretly preparing the foundations of her present colony of German East Africa. But no overt act had warned Europe of what was impending. The story of the foundation of German East Africa is one of the romances of the continent. Early in 1884 the Society for German Colonization was founded, with the avowed object of furthering the newly awakened colonial aspirations of the German people.[1] It was a society inspired and controlled by young men, and on the 4th of November 1884, eleven days before the conference assembled at Berlin, three young Germans arrived as deck passengers at Zanzibar. They were disguised as mechanics, but were in fact Dr Karl Peters, the president of the Colonization Society, Joachim Count Pfeil, and Dr Jühlke, and their stock-in-trade consisted of a number

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[1] In 1887 this society united with the German Colonial Society, an organization founded in 1882. The united society took the title of the German Colonial Company.

The German flag raised in East Africa.

of German flags and a supply of blank treaty forms. They proposed to land on the mainland opposite Zanzibar, and to conclude treaties in the back country with native chiefs placing their territories under German protection. The enterprise was frowned upon by the German government; but, encouraged by German residents at Zanzibar, the three young pioneers crossed to the mainland, and on the 19th of November, while the diplomatists assembled at Berlin were solemnly discussing the rules which were to govern the game of partition, the first "treaty" was signed at Mbuzini, and the German flag raised for the first time in East Africa.

Italy had also obtained a footing on the African continent before the meeting of the Berlin conference. The Rubattino Steamship Company as far back as 1870 had bought the port of Assab as a coaling station, but it was not until 1882 that it was declared an Italian colony. This was followed by the conclusion of a treaty with the sultan of Assab, chief of the Danakil, signed on the 15th of March 1883, and subsequently approved by the king of Shoa, whereby Italy obtained the cession of part of Ablis (Aussa) on the Red Sea, Italy undertaking to protect with her fleet the Danakil littoral.

Recognition of the International Association.

One other event must be recorded as happening before the meeting of the Berlin conference. The king of the Belgians had been driven to the conclusion that, if his African enterprise was to obtain any measure of permanent success, its international status must be recognized. To this end negotiations were opened with various governments. The first government to "recognize the flag of the International Association of the Congo as the flag of a friendly government" was that of the United States, its declaration to that effect bearing date the 22nd of April 1884. There were, however, difficulties in the way of obtaining the recognition of the European powers, and in order to obtain that of France, King Leopold, on the 23rd of April 1884, while labouring under the feelings of annoyance which had been aroused by the Anglo-Portuguese treaty concluded by Lord Granville in February, authorized Colonel Strauch, president of the International Association, to engage to give France "the right of preference if, through unforeseen circumstances, the Association were compelled to sell its possessions." France's formal recognition of the Association as a government was, however, delayed by the discussion of boundary questions until the following February, and in the meantime Germany, Great Britain, Italy, Austria-Hungary, Holland and Spain had all recognized the Association; though Germany alone had done so—on the 8th of November—before the assembling of the conference.

The Berlin Conference of 1884-85.

The conference assembled at Berlin on the 15th of November 1884, and after protracted deliberations the "General Act of the Berlin Conference" was signed by the representatives of all the powers attending the conference, on the 26th of February 1885. The powers represented were Germany, Austria-Hungary, Belgium, Denmark, Spain, the United States, France, Great Britain, Italy, Holland, Portugal, Russia, Sweden and Norway, and Turkey, to name them in the alphabetical order adopted in the preamble to the French text of the General Act. Ratifications were deposited by all the signatory powers with the exception of the United States. It is unnecessary to examine in detail the results of the labours of the conference. The General Act dealt with six specific subjects: (1) freedom of trade in the basin of the Congo, (2) the slave trade, (3) neutrality of territories in the basin of the Congo, (4) navigation of the Congo, (5) navigation of the Niger, (6) rules for future occupation on the coasts of the African continent. It will be seen that the act dealt with other matters than the political partition of Africa; but, so far as they concern the present purpose, the results effected by the Berlin Act may be summed up as follows. The signatory powers undertook that any fresh act of taking possession on any portion of the African coast must be notified by the power taking possession, or assuming a protectorate, to the other signatory powers. It was further provided that any such occupation to be valid must be effective. It is also noteworthy that the first reference in an international act to the obligations attaching to "spheres of influence" is contained in the Berlin Act.

Constitution of the Congo State.

It will be remembered that when the conference assembled, the International Association of the Congo had only been recognized as a sovereign state by the United States and Germany. But King Leopold and his agents had taken full advantage of the opportunity which the conference afforded, and before the General Act was signed the Association had been recognized by all the signatory powers, with the not very important exception of Turkey, and the fact communicated to the conference by Colonel Strauch. It was not, however, until two months later, in April 1885, that King Leopold, with the sanction of the Belgian legislature, formally assumed the headship of the new state; and on the 1st of August in the same year His Majesty notified the powers that from that date the "Independent State of the Congo" declared that "it shall be perpetually neutral" in conformity with the provisions of the Berlin Act. Thus was finally constituted the Congo Free State, under the sovereignty of King Leopold, though the boundaries claimed for it at that time were considerably modified by subsequent agreements.

The chief partition treaties.

From 1885 the scramble among the powers went on with renewed vigour, and in the fifteen years that remained of the century the work of partition, so far as international agreements were concerned, was practically completed. To attempt to follow the process of acquisition year by year would involve a constant shifting of attention from one part of the continent to another, inasmuch as the scramble was proceeding simultaneously all over Africa. It will therefore be the most convenient plan to deal with the continent in sections. Before doing so, however, the international agreements which determined in the main the limits of the possessions of the various powers may be set forth. They are:—

I. The agreement of the 1st of July 1890 between Great Britain and Germany defining their spheres of influence in East, West and South-West Africa. This agreement was the most comprehensive of all the "deals" in African territory, and included in return for the recognition of a British protectorate over Zanzibar the cession of Heligoland to Germany.

II. The Anglo-French declaration of the 5th of August 1890, which recognized a French protectorate over Madagascar, French influence in the Sahara, and British influence between the Niger and Lake Chad.

III. The Anglo-Portuguese treaty of the 11th of June 1891, whereby the Portuguese possessions on the west and east coasts were separated by a broad belt of British territory, extending north to Lake Tanganyika.

IV. The Franco-German convention of the 15th of March 1894, by which the Central Sudan was left to France (this region by an Anglo-German agreement of the 15th of November 1893 having been recognized as in the German sphere). By this convention France was able to effect a territorial junction of her possessions in North and West Africa with those in the Congo region.

V. Protocols of the 24th of March and the 15th of April 1891, for the demarcation of the Anglo-Italian spheres in East Africa.

VI. The Anglo-French convention of the 14th of June 1898, for the delimitation of the possessions of the two countries west of Lake Chad, with the supplementary declaration of the 21st of March 1899 whereby France recognized the upper Nile valley as in the British sphere of influence.

The growth of the Congo State.

Coming now to a more detailed consideration of the operations of the powers, the growth of the Congo Free State, which occupied, geographically, a central position, may serve as the starting-point for the story of the partition after the Berlin conference. In the notification to the powers of the 1st of August 1885, the boundaries of the Free State were set out in considerable detail. The limits thus determined resulted partly from agreements made with France, Germany and Portugal, and partly from treaties with native chiefs. The state acquired the north bank of the Congo from its mouth to a point in the unnavigable reaches, and in the interior the major part of the Congo basin. In the north-east the northern limit was 4° N. up to 30° E., which formed the eastern boundary of the state. The south-eastern frontier claimed by King Leopold extended to Lakes Tanganyika, Mweru and Bangweulu, but it was not until some years later that it was recognized and defined by the agreement of May 1894 with Great Britain. The international character of King Leopold's enterprise had not long been maintained, and his recognition as sovereign of the Free State confirmed the distinctive character which the Association had assumed, even before that event.

In April 1887 France was informed that the right of pre-emption accorded to her in 1884 had not been intended by King Leopold to prejudice Belgium's right to acquire the Congo State, and in reply the French minister at Brussels took note of the explanation, "in so far as this interpretation is not contrary to pre-existing international engagements." By his will, dated the 2nd of August 1889, King Leopold made Belgium formally heir to the sovereign rights of the Congo Free State. In 1895 an annexation bill was introduced into the Belgian parliament, but at that time Belgium had no desire to assume responsibility for the Congo State, and the bill was withdrawn. In 1901, by the terms of a loan granted in 1890, Belgium had again an opportunity of annexing the Congo State, but a bill in favour of annexation was opposed by the government and was withdrawn after King Leopold had declared that the time was not ripe for the transfer. Concessionaire companies and a *Domaine de la Couronne* had been created in the state, from which the sovereign derived considerable revenues—facts which helped to explain the altered attitude of Leopold II. The agitation in Great Britain and America against the Congo system of government, and the admissions of an official commission of inquiry concerning its maladministration, strengthened, however, the movement in favour of transfer. Nevertheless in June 1906 the king again declared himself opposed to immediate annexation. But under pressure of public opinion the Congo government concluded, 28th of November 1907, a new annexation treaty. As it stipulated for the continued existence of the crown domain the treaty provoked vehement opposition. Leopold II. was forced to yield, and an additional act was signed, 5th of March 1908, providing for the suppression of the domain in return for financial subsidies. The treaty, as amended, was approved by the Belgian parliament in the session of 1908. Thus the Congo state, after an existence of 24 years as an independent power, became a Belgian colony. (See CONGO FREE STATE.)

The contest for the upper Nile.

The area of the Free State, vast as it was, did not suffice to satisfy the ambition of its sovereign. King Leopold maintained that the Free State enjoyed equally with any other state the right to extend its frontiers. His ambition involved the state in the struggle between Great Britain and France for the upper Nile. To understand the situation it is necessary to remember the condition of the Egyptian Sudan at that time. The mahdi, Mahommed Ahmed, had preached a holy war against the Egyptians, and, after the capture of Khartum and the death of General C. G. Gordon, the Sudan was abandoned to the dervishes. The Egyptian frontier was withdrawn to Wadi Halfa, and the vast provinces of Kordofan, Darfur and the Bahr-el-Ghazal were given over to dervish tyranny and misrule. It was obvious that Egypt would sooner or later seek to recover her position in the Sudan, as the command of the upper Nile was recognized as essential to her continued prosperity. But the international position of the abandoned provinces was by no means clear. The British government, by the Anglo-German agreement of July 1890, had secured the assent of Germany to the statement that the British sphere of influence in East Africa was bounded on the west by the Congo Free State and by "the western watershed of the basin of the upper Nile"; but this claim was not recognized either by France or by the Congo Free State. From her base on the Congo, France was busily engaged pushing forward along the northern tributaries of the great river. On the 27th of April 1887 an agreement was signed with the Congo Free State by which the right bank of the Ubangi river was secured to French influence, and the left bank to the Congo Free State. The desire of France to secure a footing in the upper Nile valley was partly due, as has been seen, to her anxiety to extend a French zone across Africa, but it was also and to a large extent attributable to the belief, widely entertained in France, that by establishing herself on the upper Nile France could regain the position in Egyptian affairs which she had sacrificed in 1882. With these strong inducements France set steadily to work to consolidate her position on the tributary streams of the upper Congo basin, preparatory to crossing into the valley of the upper Nile. Meanwhile a similar advance was being made from the Congo Free State northwards and eastwards. King Leopold had two objects in view—to obtain control of the rich province of the Bahr-el-Ghazal and to secure an outlet on the Nile. Stations were established on the Welle river, and in February 1891 Captain van Kerckhoven left Leopoldville for the upper Welle with the most powerful expedition which had, up to that time, been organized by the Free State. After some heavy fighting the expedition reached the Nile in September 1892, and opened up communications with the remains of the old Egyptian garrison at Wadelai. Other expeditions under Belgian officers penetrated into the Bahr-el-Ghazal, and it was apparent that King Leopold proposed to rely on effective occupation as an answer to any claims which might be advanced by either Great Britain or France. The news of what was happening in this remote region of Africa filtered through to Europe very slowly, but King Leopold was warned on several occasions that Great Britain would not recognize any claims by the Congo Free State on the Bahr-el-Ghazal. The difficulty was, however, that neither from Egypt, whence the road was barred by the khalifa (the successor of the mahdi), nor from Uganda, which was far too remote from the coast to serve as the base of a large expedition, could a British force be despatched to take effective occupation of the upper Nile valley. There was, therefore, danger lest the French should succeed in establishing themselves on the upper Nile before the preparations which were being made in Egypt for "smashing" the khalifa were completed.

The Anglo-Congolese agreement of 1894.

In these circumstances Lord Rosebery, who was then British foreign minister, began, and his successor, the 1st earl of Kimberley, completed, negotiations with King Leopold which resulted in the conclusion of the Anglo-Congolese agreement of 12th May 1894. By this agreement King Leopold recognized the British sphere of influence as laid down in the Anglo-German agreement of July 1890, and Great Britain granted a lease to King Leopold of certain territories in the western basin of the upper Nile, extending on the Nile from a point on Lake Albert to Fashoda, and westwards to the Congo-Nile watershed. The practical effect of this agreement was to give the Congo Free State a lease, during its sovereign's lifetime, of the old Bahr-el-Ghazal province, and to secure after His Majesty's death as much of that territory as lay west of the 30th meridian, together with access to a port on Lake Albert, to his successor. At the same time the Congo Free State leased to Great Britain a strip of territory, $15\frac{1}{2}$ m. in breadth, between the north end of Lake Tanganyika and the south end of Lake Albert Edward. This agreement was hailed as a notable triumph for British diplomacy. But the triumph was short-lived. By the agreement of July 1890 with Germany, Great Britain had been reluctantly compelled to abandon her hopes of through communication between the British spheres in the northern and southern parts of the continent, and to consent to the boundary of German East Africa marching with the eastern frontier of the Congo Free State. Germany frankly avowed that she did not wish to have a powerful neighbour interposed between herself and the Congo Free State. It was obvious that the new agreement would effect precisely what Germany had declined to agree to in 1890. Accordingly Germany protested in such vigorous terms that, on the 22nd of June 1894, the offending article was withdrawn by an exchange of notes between Great Britain and the Congo Free State. Opinion in France was equally excited by the new agreement. It was obvious that the lease to the Congo Free State was intended to exclude France from the Nile by placing the Congo Free State as a barrier across her path. Pressure was brought to bear on King Leopold, from Paris, to renounce the rights acquired under the agreement, and on the 14th of August 1894 King Leopold signed an agreement with France by which, in exchange for France's acknowledgment of the Mbomu river as his northern frontier, His Majesty renounced all occupation and all exercise of political influence west of 30° E., and north of a line drawn from that meridian to the Nile along 5° 30′ N.

The French at Fashoda.

This left the way still open for France to the Nile, and in June 1896 Captain J. Marchand left France with secret instructions to lead an expedition into the Nile valley. On the 1st of March in the following year he left Brazzaville, and began a journey which all but plunged Great Britain and France into war. The difficulties which Captain Marchand had to overcome were mainly those connected with transport. In October 1897 the expedition reached the banks of the Sue, the waters of which eventually flow into the Nile. Here a post was established and the "Faidherbe," a steamer which had been carried across the Congo-Nile watershed in sections, was put together and launched. On the 1st of May 1898 Marchand started on the final stage of his journey, and reached Fashoda on the 10th of July, having established a chain of posts *en route*. At Fashoda the French flag was at once raised, and a "treaty" made with the local chief. Meanwhile other expeditions had been concentrating on Fashoda—a mud-flat situated in a swamp, round which for many months raged the angry passions of two great peoples. French expeditions, with a certain amount of assistance from the emperor Menelek of Abyssinia, had been striving to reach the Nile from the east, so as to join hands with Marchand and complete the line of posts into the Abyssinian frontier. In this, however, they were unsuccessful. No better success attended the expedition under Colonel (afterwards Sir) Ronald Macdonald, R.E., sent by the British government from Uganda to anticipate the French in the occupation of the upper Nile. It was from the north that claimants arrived to dispute with the French their right to Fashoda, and all that the occupation of that dismal post implied. In 1896 an Anglo-Egyptian army, under the direction of Sir Herbert (afterwards Lord) Kitchener, had begun to advance southwards for the reconquest of the Egyptian Sudan. On the 2nd of September 1898 Khartum was captured, and the khalifa's army dispersed. It was then that news reached the Anglo-Egyptian commander, from native sources, that there were white men flying a strange flag at Fashoda. The sirdar at once proceeded in a steamer up the Nile, and courteously but firmly requested Captain Marchand to remove the French flag. On his refusal the Egyptian flag was raised close to the French flag, and the dispute was referred to Europe for adjustment between the British and French governments. A critical situation ensued. Neither government was inclined to give way, and for a time war seemed imminent. Happily Lord Salisbury was able to announce, on the 4th of November, that France was willing to recognize the British claims, and the incident was finally closed on the 21st of March 1899, when an Anglo-French declaration was signed, by the terms of which France withdrew from the Nile valley and accepted a boundary line which satisfied her earlier ambition by uniting the whole of her territories in North, West and Central Africa into a homogeneous whole, while effectually preventing the realization of her dream of a transcontinental empire from west to east. By this declaration it was agreed that the dividing line between the British and French spheres, north of the Congo Free State, should follow the Congo-Nile water-parting up to its intersection with the 11th parallel of north latitude, from which point it was to be "drawn as far as the 15th parallel in such a manner as to separate in principle the kingdom of Wadai from what constituted in 1882 the province of Darfur," but in no case was it to be drawn west of the 21st degree of east longitude, or east of the 23rd degree. From the 15th parallel the line was continued north and north-west to the intersection of the Tropic of Cancer with 16° E. French influence was to prevail west of this line, British influence to the east. Wadai was thus definitely assigned to France.

Fate of the Bahr-el-Ghazal.

When, by the declaration of the 21st of March 1899, France renounced all territorial ambitions in the upper Nile basin, King Leopold revived his claims to the Bahr-el-Ghazal province under the terms of the lease granted by Article 2 of the Anglo-Congolese agreement of 1894. This step he was encouraged to take by the assertion of Lord Salisbury, in his capacity as secretary of state for foreign affairs during the negotiations with France concerning Fashoda, that the lease to King Leopold was still in full force. But the assertion was made simply as a declaration of British right to dispose of the territory, and the sovereign of the Congo State found that there was no disposition in Great Britain to allow the Bahr-el-Ghazal to fall into his hands. Long and fruitless negotiations ensued. The king at length (1904) sought to force a settlement by sending armed forces into the province. Diplomatic representations having failed to secure the withdrawal of these forces, the Sudan government issued a proclamation which had the effect of cutting off the Congo stations from communication with the Nile, and finally King Leopold consented to an agreement, signed in London on the 9th of May 1906, whereby the 1894 lease was formally annulled. The Bahr-el-Ghazal thenceforth became undisputedly an integral part of the Anglo-Egyptian Sudan. King Leopold had, however, by virtue of the 1894 agreement administered the comparatively small portion of the leased area in which his presence was not resented by France. This territory, including part of the west bank of the Nile and known as the Lado Enclave, the 1906 agreement allowed King Leopold to "continue during his reign to occupy." Provision was made that within six months of the termination of His Majesty's reign the enclave should be handed over to the Sudan government (see CONGO FREE STATE). In this manner ended the long struggle for supremacy on the upper Nile, Great Britain securing the withdrawal of all European rivals.

Portugal's trans-African schemes.

The course of events in the southern half of the continent may now be traced. By the convention of the 14th of February 1885, in which Portugal recognized the sovereignty of the Congo Free State, and by a further convention concluded with France in 1886, Portugal secured recognition of her claim to the territory known as the Kabinda enclave, lying north of the Congo, but not to the northern bank of the river. By the same convention of 1885 Portugal's claim to the southern bank of the river as far as Noki (the limit of navigation from the sea) had been admitted. Thus Portuguese possessions on the west coast extended from the Congo to the mouth of the Kunene river. In the interior the boundary with the Free State was settled as far as the Kwango river, but disputes arose as to the right to the country of Lunda, otherwise known as the territory of the Muato Yanvo. On the 25th of May 1891 a treaty was signed at Lisbon, by which this large territory was divided between Portugal and the Free State. The interior limits of the Portuguese possessions in Africa south of the equator gave rise, however, to much more serious discussions than were involved in the dispute as to the Muato Yanvo's kingdom. Portugal, as has been stated, claimed all the territories between Angola and Mozambique, and she succeeded in inducing both France and Germany, in 1886, to recognize the king of Portugal's "right to exercise his sovereign and civilizing influence in the territories which separate the Portuguese possessions of Angola and Mozambique." The publication of the treaties containing this declaration, together with a map showing Portuguese claims extending over the whole of the Zambezi valley, and over Matabeleland to the south and the greater part of Lake Nyasa to the north, immediately provoked a formal protest from the British government. On the 13th of August 1887 the British chargé d'affaires at Lisbon transmitted to the Portuguese minister for foreign affairs a memorandum from Lord Salisbury, in which the latter formally protested "against any claims not founded on occupation," and contended that the doctrine of effective occupation had been admitted in principle

Rhodesia secured for Great Britain.

by all the parties to the Act of Berlin. Lord Salisbury further stated that "Her Majesty's government cannot recognize Portuguese sovereignty in territory not occupied by her in sufficient strength to enable her to maintain order, protect foreigners and control the natives." To this Portugal replied that the doctrine of effective occupation was expressly confined by the Berlin Act to the African coast, but at the same time expeditions were hastily despatched up the Zambezi and some of its tributaries to discover traces of former Portuguese occupation. Matabeleland and the districts of Lake Nyasa were specially mentioned in the British protest as countries in which Her Majesty's government took a special interest. As a matter of fact the extension of British influence northwards to the Zambezi had engaged the attention of the British authorities ever since the appearance of Germany in South-West Africa and the declaration of a British protectorate over Bechuanaland. There were rumours of German activity in Matabeleland, and of a Boer trek north of the Limpopo. Hunters and explorers had reported in eulogistic terms on the rich goldfields and healthy plateau lands of Matabeleland and Mashonaland, over both of which countries a powerful chief, Lobengula, claimed authority. There were many suitors for Lobengula's favours; but on the 11th of February 1888 he signed a treaty with J. S. Moffat, the assistant commissioner in Bechuanaland, the effect of which was to place all his territory under British protection. Both the Portuguese and the Transvaal Boers were chagrined at this extension of British influence. A number of Boers attempted unsuccessfully to trek into the country, and Portugal opposed her ancient claims to the new treaty. She contended that Lobengula's authority did not extend over Mashonaland, which she claimed as part of the Portuguese province of Sofala.

Meanwhile preparations were being actively made by British capitalists for the exploitation of the mineral and other resources of Lobengula's territories. Two rival syndicates obtained, or claimed to have obtained, concessions from Lobengula; but in the summer of 1889 Cecil Rhodes succeeded in amalgamating the conflicting interests, and on the 29th of October of that year the British government granted a charter to the British South Africa Company (see RHODESIA). The first article of the charter declared that "the principal field of the operations" of the company "shall be the region of South Africa lying immediately to the north of British Bechuanaland, and to the north and west of the South African Republic, and to the west of the Portuguese dominions." No time was lost in making preparations for effective occupation. On the advice of F. C. Selous it was determined to despatch an expedition to eastern Mashonaland by a new route, which would avoid the Matabele country. This plan was carried out in the summer of 1890, and, thanks to the rapidity with which the column moved and Selous's intimate knowledge of the country, the British flag was, on the 11th of September, hoisted at a spot on the Makubusi river, where the town of Salisbury now stands, and the country taken possession of in the name of Queen Victoria. Disputes with the Portuguese ensued, and there were several frontier incidents which for a time embittered the relations between the two countries.

Anglo-Portuguese disputes in Central Africa.

Meanwhile, north of the Zambezi, the Portuguese were making desperate but futile attempts to repair the neglect of centuries by hastily organized expeditions and the hoisting of flags. In 1888 an attempt to close the Zambezi to British vessels was frustrated by the firmness of Lord Salisbury. In a despatch to the British minister at Lisbon, dated the 25th of June 1888, Lord Salisbury, after brushing aside the Portuguese claims founded on doubtful discoveries three centuries old, stated the British case in a few sentences:—

> It is (he wrote) an undisputed point that the recent discoveries of the English traveller, Livingstone, were followed by organized attempts on the part of English religious and commercial bodies to open up and civilize the districts surrounding and adjoining the lake. Many British settlements have been established, the access to which from the sea is by the rivers Zambesi and Shiré. Her Majesty's government and the British public are much interested in the welfare of these settlements. Portugal does not occupy, and has never occupied, any portion of the lake, nor of the Shiré; she has neither authority nor influence beyond the confluence of the Shiré and Zambesi, where her interior custom-house, now withdrawn, was placed by the terms of the Mozambique Tariff of 1877.

British and Portuguese spheres defined.

In 1889 it became known to the British government that a considerable Portuguese expedition was being organized under the command of Major Serpa Pinto, for operating in the Zambezi region. In answer to inquiries addressed to the Portuguese government, the foreign minister stated that the object of the expedition was to visit the Portuguese settlements on the upper Zambezi. The British government was, even so late as 1889, averse from declaring a formal protectorate over the Nyasa region; but early in that year H. H. (afterwards Sir Harry) Johnston was sent out to Mozambique as British consul, with instructions to travel in the interior and report on the troubles that had arisen with the Arabs on Lake Nyasa and with the Portuguese. The discovery by D. J. Rankin in 1889 of a navigable mouth of the Zambezi—the Chinde—and the offer by Cecil Rhodes of a subsidy of £10,000 a year from the British South Africa Company, removed some of the objections to a protectorate entertained by the British government; but Johnston's instructions were not to proclaim a protectorate unless circumstances compelled him to take that course. To his surprise Johnston learnt on his arrival at the Zambezi that Major Serpa Pinto's expedition had been suddenly deflected to the north. Hurrying forward, Johnston overtook the Portuguese expedition and warned its leader that any attempt to establish political influence north of the Ruo river would compel him to take steps to protect British interests. On arrival at the Ruo, Major Serpa Pinto returned to Mozambique for instructions, and in his absence Lieutenant Coutinho crossed the river, attacked the Makololo chiefs and sought to obtain possession of the Shiré highlands by a *coup de main*. John Buchanan, the British vice-consul, lost no time in declaring the country under British protection, and his action was subsequently confirmed by Johnston on his return from a treaty-making expedition on Lake Nyasa. On the news of these events reaching Europe the British government addressed an ultimatum to Portugal, as the result of which Lieutenant Coutinho's action was disavowed, and he was ordered to withdraw the Portuguese forces south of the Ruo. After prolonged negotiations, a convention was signed between Great Britain and Portugal on the 20th of August 1890, by which Great Britain obtained a broad belt of territory north of the Zambezi, stretching from Lake Nyasa on the east, the southern end of Tanganyika on the north, and the Kabompo tributary of the Zambezi on the west; while south of the Zambezi Portugal retained the right bank of the river from a point ten miles above Zumbo, and the western boundary of her territory south of the river was made to coincide roughly with the 33rd degree of east longitude. The publication of the convention aroused deep resentment in Portugal, and the government, unable to obtain its ratification by the chamber of deputies, resigned. In October the abandonment of the convention was accepted by the new Portuguese ministry as a *fait accompli*; but on the 14th of November the two governments signed an agreement for a *modus vivendi*, by which they engaged to recognize the territorial limits indicated in the convention of 20th August "in so far that from the date of the present agreement to the termination thereof neither Power will make treaties, accept protectorates, nor exercise any act of sovereignty within the spheres of influence assigned to the other party by the said convention." The breathing-space thus gained enabled feeling in Portugal to cool down, and on the 11th of June 1891 another treaty was signed, the ratifications being exchanged on the 3rd of July. As already stated, this is the main treaty defining the British and Portuguese spheres both south and north of the Zambezi. It contained many other provisions relating to trade and navigation, providing, *inter alia*, a maximum transit duty of 3% on imports and exports crossing Portuguese territories on the east coast to the British sphere, freedom of navigation of the

Zambezi and Shiré for the ships of all nations, and stipulations as to the making of railways, roads and telegraphs. The territorial readjustment effected was slightly more favourable to Portugal than that agreed upon by the 1890 convention. Portugal was given both banks of the Zambezi to a point ten miles west of Zumbo—the farthest settlement of the Portuguese on the river. South of the Zambezi the frontier takes a south and then an east course till it reaches the edge of the continental plateau, thence running, roughly, along the line of 33° E. southward to the north-eastern frontier of the Transvaal. Thus by this treaty Portugal was left in the possession of the coast-lands, while Great Britain maintained her right to Matabele and Mashona lands. The boundary between the Portuguese sphere of influence on the west coast and the British sphere of influence north of the Zambezi was only vaguely indicated; but it was to be drawn in such a manner as to leave the Barotse country within the British sphere, Lewanika, the paramount chief of the Marotse, claiming that his territory extended much farther to the west than was admitted by the Portuguese. In August 1903 the question what were the limits of the Barotse kingdom was referred to the arbitration of the king of Italy. By his award, delivered in June 1905, the western limit of the British sphere runs from the northern frontier of German South-West Africa up the Kwando river to 22° E., follows that meridian north to 13° S., then runs due east to 24° E., and then north again to the frontier of the Congo State.

Before the conclusion of the treaty of June 1891 with Portugal, the British government had made certain arrangements for the administration of the large area north of the Zambezi reserved to British influence. On the 1st of February Sir Harry Johnston was appointed imperial commissioner in Nyasaland, and a fortnight later the British South Africa Company intimated a desire to extend its operations north of the Zambezi. Negotiations followed, and the field of operations of the Chartered Company was, on the 2nd of April 1891, extended so as to cover (with the exception of Nyasaland) the whole of the British sphere of influence north of the Zambezi (now known as Northern Rhodesia). On the 14th of May a formal protectorate was declared over Nyasaland, including the Shiré highlands and a belt of territory extending along the whole of the western shore of Lake Nyasa. The name was changed in 1893 to that of the British Central Africa Protectorate, for which designation was substituted in 1907 the more appropriate title of Nyasaland Protectorate.

Germany's share of South Africa.

At the date of the assembling of the Berlin conference the German government had notified that the coast-line on the south-west of the continent, from the Orange river to Cape Frio, had been placed under German protection. On the 13th of April 1885 the German South-West Africa Company was constituted under an order of the imperial cabinet with the rights of state sovereignty, including mining royalties and rights, and a railway and telegraph monopoly. In that and the following years the Germans vigorously pursued the business of treaty-making with the native chiefs in the interior; and when, in July 1890, the British and German governments came to an agreement as to the limits of their respective spheres of influence in various parts of Africa, the boundaries of German South-West Africa were fixed in their present position. By Article III. of this agreement the north bank of the Orange river up to the point of its intersection by the 20th degree of east longitude was made the southern boundary of the German sphere of influence. The eastern boundary followed the 20th degree of east longitude to its intersection by the 22nd parallel of south latitude, then ran eastwards along that parallel to the point of its intersection by the 21st degree of east longitude. From that point it ran northwards along the last-named meridian to the point of its intersection by the 18th parallel of south latitude, thence eastwards along that parallel to the river Chobe or Kwando, and along the main channel of that river to its junction with the Zambezi, where it terminated. The northern frontier marched with the southern boundary of Portuguese West Africa. The object of deflecting the eastern boundary near its northern termination was to give Germany access by her own territory to the upper waters of the Zambezi, and it was declared that this strip of territory was at no part to be less than 20 English miles in width.

Fate of the Dutch Republics.

To complete the survey of the political partition of Africa south of the Zambezi, it is necessary briefly to refer to the events connected with the South African Republic and the Orange Free State. In October 1886 the British government made an agreement with the New Republic, a small community of Boer farmers who had in 1884–85 seized part of Zululand and set up a government of their own, defining the frontier between the New Republic and Zululand; but in July 1888 the New Republic was incorporated in the South African Republic. In a convention of July–August 1890 the British government and the government of the South African Republic confirmed the independence of Swaziland, and on the 8th of November 1893 another convention was signed with the same object; but on the 19th of December 1894 the British government agreed to the South African Republic exercising "all rights and powers of protection, legislation, jurisdiction and administration over Swaziland and the inhabitants thereof," subject to certain conditions and provisions, and to the non-incorporation of Swaziland in the Republic. In the previous September Pondoland had been annexed to Cape Colony; on the 23rd of April 1895 Tongaland was declared by proclamation to be added to the dominions of Queen Victoria, and in December 1897 Zululand and Tongaland, or Amatongaland, were incorporated with the colony of Natal. The history of the events that led up to the Boer War of 1899–1902 cannot be recounted here (see TRANSVAAL, *History*), but in October 1899 the South African Republic and the Orange Free State addressed an ultimatum to Great Britain and invaded Natal and Cape Colony. As a result of the military operations that followed, the Orange Free State was, on the 28th of May 1900, proclaimed by Lord Roberts a British colony under the name "Orange River Colony," and the South African Republic was on the 25th of October 1900 incorporated in the British empire as the "Transvaal Colony." In January 1903 the districts of Vryheid (formerly the New Republic), Utrecht and part of the Wakkerstroom district, a tract of territory comprising in all about 7000 sq. m., were transferred from the Transvaal colony to Natal. In 1907 both the Transvaal and Orange River Colony were granted responsible government.

Anglo-German rivalry in East Africa.

On the east coast the two great rivals were Germany and Great Britain. Germany on the 30th of December 1886, and Great Britain on the 11th of June 1891, formally recognized the Rovuma river as the northern boundary of the Portuguese sphere of influence on that coast; but it was to the north of that river, over the vast area of East or East Central Africa in which the sultan of Zanzibar claimed to exercise suzerainty, that the struggle between the two rival powers was most acute. The independence of the sultans of Zanzibar had been recognized by the governments of Great Britain and France in 1862, and the sultan's authority extended almost uninterruptedly along the coast of the mainland, from Cape Delgado in the south to Warsheik on the north—a stretch of coast more than a thousand miles long—though to the north the sultan's authority was confined to certain ports. In Zanzibar itself, where Sir John Kirk, Livingstone's companion in his second expedition, was British consul-general, British influence was, when the Berlin conference met, practically supreme, though German traders had established themselves on the island and created considerable commercial interests. Away from the coasts the limits and extent of the sultan's authority were far from being clearly defined. The sultan himself claimed that it extended as far as Lake Tanganyika, but the claim did not rest on any very solid ground of effective occupation. The little-known region of the Great Lakes had for some time attracted the attention of the men who were directing the colonial movement in Germany; and, as has been stated, a small band of pioneers actually landed on the mainland opposite Zanzibar in November 1884, and made their first "treaty" with the chief of Mbuzini on the 19th of that month. Pushing up the Wami river the three adventurers reached the Usagara country, and concluded more "treaties," the net result being that when, in the middle of December, Karl Peters returned to the coast he brought back with him documents which were claimed to concede some 60,000 sq. m. of country to the German Colonization Society. Peters hurried back to Berlin, and on the 17th of February 1885 the German emperor issued a "Charter of Protection" by which His Majesty accepted the suzerainty of the newly-acquired territory, and "placed under our Imperial protection the territories in question." The conclusion of these treaties was, on the 6th of March, notified to the British government and to the sultan of Zanzibar. Immediately on receipt of the notification the sultan telegraphed an energetic protest to Berlin, alleging that the places placed under German protection had belonged to the sultanate of Zanzibar from the time of his fathers. The German consul-general refused to admit the sultan's claims, and meanwhile agents of the German society were energetically pursuing the task of treaty-making. The sultan (Seyyid Bargash) despatched a small force to the disputed territory, which was subsequently withdrawn, and in May sent a more imposing expedition under the command of General Lloyd Mathews, the commander-in-chief of the Zanzibar army, to the Kilimanjaro district, in order to anticipate the action of German agents. Meanwhile Lord Granville, then at the British Foreign Office, had taken up an extremely friendly attitude towards the German claims. Before these events the sultan of Zanzibar had, on more than one occasion, practically invited Great Britain to assume a protectorate over his dominions. But the invitations had been declined. Egyptian affairs were, in the year 1885, causing considerable anxiety to the British government, and the fact was not without influence on the attitude of the British foreign secretary. On the 25th of May 1885, in a despatch to the British ambassador at Berlin, Lord Granville instructed Sir E. Malet to communicate the views of the British cabinet to Prince Bismarck:—

Lord Granville's complaisance towards Germany.

> I have to request your Excellency to state that the supposition that Her Majesty's Government have no intention of opposing the German scheme of colonization in the neighbourhood of Zanzibar is absolutely correct. Her Majesty's Government, on the contrary, view with favour these schemes, the realization of which will entail the civilization of large tracts over which hitherto no European influence has been exercised, the co-operation of Germany with Great Britain in the work of the suppression of the slave gangs, and the encouragement of the efforts of the Sultan both in the extinction of the slave trade and in the commercial development of his dominions.

In the same despatch Lord Granville instructed Sir E. Malet to intimate to the German government that some prominent capitalists had originated a plan for a British settlement in the country between the coast and the lakes, which are the sources of the White Nile, "and for its connexion with the coast by a railway." But Her Majesty's government would not accord to these prominent capitalists the support they had called for, "unless they were fully satisfied that every precaution was taken to ensure that it should in no way conflict with the interests of the territory that has been taken under German protectorate," and Prince Bismarck was practically invited to say whether British capitalists were or were not to receive the protection of the British government. The reference in Lord Granville's despatch was to a proposal made by a number of British merchants and others who had long been interested in Zanzibar, and who saw in the rapid advance of Germany a menace to the interests which had hitherto been regarded as paramount in the sultanate. In 1884 H. H. Johnston had concluded treaties with the chief of Taveta in the Kilimanjaro district, and had transferred these treaties to John Hutton of Manchester. Hutton, with Mr (afterwards Sir William) Mackinnon, was one of the founders of what subsequently became the Imperial British East Africa Company. But in the early stages the champions of British interests in East Africa received no support from their own government, while Germany was pushing her advantage with the energy of a recent convert to colonial expansion, and had even, on the coast, opened negotiations with the sultan of Witu, a small territory situated north of the Tana river, whose ruler claimed to be independent of Zanzibar. On the 5th of May 1885 the sultan of Witu executed a deed of sale and cession to a German subject of certain tracts of land on the coast, and later in the same year other treaties or sales of territory were effected, by which German subjects acquired rights on the coast-line claimed by the sultan. Inland, treaties had been concluded on behalf of Germany with the chiefs of the Kilimanjaro region, and an intimation to that effect made to the British government. But before this occurred the German government had succeeded in extracting an acknowledgment of the validity of the earlier treaties from the sultan of Zanzibar. Early in August a powerful German squadron appeared off Zanzibar, and on the 14th of that month the sultan yielded to the inevitable, acknowledged the German protectorate over Usagara and Witu, and undertook to withdraw his soldiers.

Partition of the sultanate of Zanzibar.

Meanwhile negotiations had been opened for the appointment of an international commission, "for the purpose of inquiring into the claims of the sultans of Zanzibar to sovereignty over certain territories on the east coast of Africa, and of ascertaining their precise limits." The governments to be represented were Great Britain, France and Germany, and towards the end of 1885 commissioners were appointed. The commissioners reported on the 9th of June 1886, and assigned to the sultan the islands of Zanzibar, Pemba, Lamu, Mafia and a number of other small islands. On the mainland they recognized as belonging to the sultan a continuous strip of territory, 10 sea-miles in depth, from the south bank of the Minengani river, a stream a short distance south of the Rovuma, to Kipini, at the mouth of the Tana river, some 600 m. in length. North of Kipini the commissioners recognized as belonging to the sultan the stations of Kismayu, Brava, Marka and Mukdishu, with radii landwards of 10 sea-miles, and of Warsheik with a radius of 5 sea-miles. By an exchange of notes in October–November 1886 the governments of Great Britain and Germany accepted the reports of the delimitation commissioners, to which the sultan adhered on the 4th of the following December. But the British and German governments did more than determine what territories were to be assigned to the sultanate of Zanzibar. They agreed to a delimitation of their respective spheres of influence in East Africa. The territory to be affected by this arrangement was to be bounded on the south by the Rovuma river, "and on the north by a line which, starting from the mouth of the Tana river, follows the course of that river or its affluents to the point of intersection of the equator and the 38th degree of east longitude, thence strikes direct to the point of intersection of the 1st degree of north latitude with the 37th degree of east longitude, where the line terminates." The line of demarcation between the British and the German spheres of influence was to start from the mouth of the river Wanga or Umba (which enters the ocean opposite Pemba Island to the north of Zanzibar), and running north-west was to skirt the northern base of the Kilimanjaro range, and thence to be drawn direct to the point on the eastern side of Victoria Nyanza intersected by the 1st degree of south latitude. South of this line German influence was to prevail; north of the line was the British sphere. The sultan's dominions having been thus truncated, Germany associated herself with the recognition of the "independence" of Zanzibar in which France and Great Britain had joined in 1862. The effect of this agreement was to define the spheres of influence of the two countries as far as Victoria Nyanza, but it provided no limit westwards, and left the country north of the Tana river, in which Germany had already acquired some interests near the coast, open for fresh annexations. The conclusion of the agreement immediately stimulated the enterprise both of the German East African Company, to which Peters's earlier treaties had been transferred, and of the British capitalists to whom reference had been made in Lord Granville's despatch. The German East African Company was incorporated by imperial charter in March 1887, and the British capitalists formed themselves into the British East Africa Association, and on the 24th of May 1887 obtained, through the good offices of Sir William Mackinnon, a concession of the 10-miles strip of coast from the Umba river in the south to Kipini in the north. The British association further sought to extend its rights in the sphere reserved to British influence by making treaties with the native chiefs behind the coast strip, and for this purpose various expeditions were sent into the interior. When they had obtained concessions over the country for some 200 m. inland the associated capitalists applied to the British government for a charter, which was granted on the 3rd of September 1888, and the association became the Imperial British East Africa Company (see BRITISH EAST AFRICA).

Formation of British East Africa.

The example set by the British company in obtaining a lease of the coast strip between the British sphere of influence and the sea was quickly followed by the German association, which, on the 28th of April 1888, concluded an agreement with the sultan Khalifa, who had succeeded his brother Bargash, by which the association leased the strip of Zanzibar territory between the German sphere and the sea. It was not, however, until August that the German officials took over the administration, and their want of tact and ignorance of native administration almost immediately provoked a rebellion of so serious a character that it was not suppressed until the imperial authorities had taken the matter in hand. Shortly after its suppression the administration was entrusted to an imperial officer, and the sultan's rights on the mainland strip were bought outright by Germany for four millions of marks (£200,000).

Events of great importance had been happening, meanwhile, in the country to the west and north of the British sphere of influence. The British company had sent caravans into the interior to survey the country, to make treaties with the native chiefs and to report on the commercial and agricultural possibilities. One of these had gone up the Tana river. But another and a rival expedition was proceeding along the northern bank of this same river. Karl Peters, whose energy cannot be denied, whatever may be thought of his methods, set out with an armed caravan up the Tana on the pretext of leading an expedition to the relief of Emin Pasha, the governor of the equatorial province of the Egyptian Sudan, then reported to be hemmed in by the dervishes at Wadelai. His expedition was not sanctioned by the German government, and the British naval commander had orders to prevent his landing. But Peters succeeded in evading the British vessels and proceeded up the river, planting German flags and fighting the natives who opposed his progress. Early in 1890 he reached Kavirondo, and there found letters from Mwanga, king of Uganda, addressed to F. J. Jackson, the leader of an expedition sent out by the British East Africa Company, imploring the company's representative to come to his assistance and offering to accept the British flag. To previous letters, less plainly couched, from the king, Jackson had returned the answer that his instructions were not to enter Uganda, but that he would do so in case of need. The letters that fell into Peters's hands were in reply to those from Jackson. Peters did not hesitate to open the letters, and on reading them he at once proceeded to Uganda, where, with the assistance of the French Roman Catholic priests, he succeeded in inducing Mwanga to sign a loosely worded treaty intended to place him under German protection. On hearing of this Jackson at once set out for Uganda, but Peters did not wait for his arrival, leaving for the south of Victoria Nyanza some days before Jackson arrived at Mengo, Mwanga's capital. As Mwanga would not agree to Jackson's proposals, Jackson returned to the coast, leaving a representative at Mengo to protect the company's interests. Captain (afterwards Sir) F. D. Lugard, who had recently entered the company's employment, was at once ordered to proceed to Uganda. But in the meantime an event of great importance had taken place, the conclusion of the agreement between Great Britain and Germany with reference to their different spheres of influence in various parts of Africa.

Uganda secured by Great Britain.

The Anglo-German agreement of the 1st of July 1890 has already been referred to and its importance insisted upon. Here we have to deal with the provisions in reference to East Africa. In return for the cession of Heligoland, Lord Salisbury obtained from Germany the recognition of a British protectorate over the dominions of the sultan of Zanzibar, including the islands of Zanzibar and Pemba, but excluding the strip leased to Germany, which was subsequently ceded absolutely to Germany. Germany further agreed to withdraw the protectorate declared over Witu and the adjoining coast up to Kismayu in favour of Great Britain, and to recognize as within the British sphere of influence the vast area bounded, on the south by the frontier line laid down in the agreement of 1886, which was to be extended along the first parallel of south latitude across Victoria Nyanza to the frontiers of the Congo Free State, on the west by the Congo Free State and the western watershed of the Nile, and on the north by a line commencing on the coast at the north bank of the mouth of the river Juba, then ascending that bank of the river until it reached the territory at that time regarded as reserved to the influence of Italy[1] in Gallaland and Abyssinia, when it followed the frontier of the Italian sphere to the confines of Egypt. To the south-west of the German sphere in East Africa the boundary was formed by the eastern and northern shore of Lake Nyasa, and round the western shore to the mouth of the Songwe river, from which point it crossed the Nyasa-Tanganyika plateau to the southern end of the last-named lake, leaving the Stevenson Road on the British side of the boundary. The effect of this treaty was to remove all serious causes of dispute about territory between Germany and Great Britain in East Africa. It rendered quite valueless Peters's treaty with Mwanga and his promenade along the Tana; it freed Great Britain from any fear of German competition to the northwards, and recognized that her influence extended to the western limits of the Nile valley. But, on the other hand, Great Britain had to relinquish the ambition of connecting her sphere of influence in the Nile valley with her possessions in Central and South Africa. On this point Germany was quite obdurate; and, as already stated, an attempt subsequently made (May 1894) to secure this object by the lease of a strip of territory from the Congo Free State was frustrated by German opposition.

Limits of German East Africa defined.

Uganda having thus been assigned to the British sphere of influence by the only European power in a position to contest its possession with her, the subsequent history of that region, and of the country between the Victoria Nyanza and the coast, must be traced in the articles on BRITISH EAST AFRICA and UGANDA, but it may be well briefly to record here the following facts:—The Imperial British East Africa Company, finding the burden of administration too heavy for its financial resources, and not receiving the assistance it felt itself entitled to receive from the imperial authorities, intimated that it would be compelled to withdraw at the end of the year 1892. Funds were raised to enable the company to continue its administration until the end of March 1893, and a strong public protest against evacuation compelled the government to determine in favour of the retention of the country. In January 1893 Sir Gerald Portal left the coast as a special commissioner to inquire into the "best means of dealing with the country, whether through Zanzibar or otherwise." On the 31st of March the union jack was raised, and on the 29th of May a fresh treaty was concluded with King Mwanga placing his country under British protection. A formal protectorate was declared over Uganda proper on the 19th of June 1894, which was subsequently extended so as to include the countries westwards towards the Congo Free State, eastwards to the British East Africa protectorate and Abyssinia, and northwards to the Anglo-Egyptian Sudan. The British East Africa protectorate was constituted in June 1895, when the Imperial British East Africa Company relinquished all its rights in exchange for a money payment, and the administration was assumed by the imperial authorities. On the 1st of April 1902 the eastern province of the Uganda protectorate was transferred to the British East Africa protectorate, which thus secured control of the whole length of the so-called Uganda railway, and at the same time obtained access to the Victoria Nyanza.

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[1] At this period negotiations between Great Britain and Italy had begun but were not concluded.

Italy in East Africa.

Early in the 'eighties, as already seen, Italy had obtained her first formal footing on the African coast at the Bay of Assab (Aussa) on the Red Sea. In 1885 the troubles in which Egypt found herself involved compelled the khedive and his advisers to loosen their hold on the Red Sea littoral, and, with the tacit approval of Great Britain, Italy took possession of Massawa and other ports on that coast. By 1888 Italian influence had been extended from Ras Kasar on the north to the northern frontier of the French colony of Obok on the south, a distance of some 650 m. The interior limits of Italian influence were but ill defined, and the negus Johannes (King John) of Abyssinia viewed with anything but a favourable eye the approach of the Italians towards the Abyssinian highlands. In January 1887 an Italian force was almost annihilated at Dogali, but the check only served to spur on the Italian government to fresh efforts. The Italians occupied Keren and Asmara in the highlands, and eventually, in May 1889, concluded a treaty of peace and friendship with the negus Menelek, who had seized the throne on the death of Johannes, killed in battle with the dervishes in March of the same year. This agreement, known as the treaty of Uccialli, settled the frontiers between Abyssinia and the Italian sphere, and contained the following article:—

> XVII. His Majesty the King of Kings of Ethiopia consents to avail himself of the Italian government for any negotiations which he may enter into with the other powers or governments.

In Italy and by other European governments this article was generally regarded as establishing an Italian protectorate over Abyssinia; but this interpretation was never accepted by the emperor Menelek, and at no time did Italy succeed in establishing any very effective control over Abyssinian affairs. North of the Italian coast sphere the Red Sea littoral was still under Egyptian rule, while immediately to the south a small stretch of coast on the Gulf of Tajura constituted the sole French possession on the East African mainland (see SOMALILAND). Moreover, when Egyptian claims to the Somali coast were withdrawn, Great Britain took the opportunity to establish her influence on the northern Somali coast, opposite Aden. Between the 1st of May 1884 and the 15th of March 1886 ten treaties were concluded, placing under British influence the northern Somali coast from Ras Jibuti on the west to Bandar Ziada on the east. In the meantime Italy, not content with her acquisitions on the Red Sea, had been concluding treaties with the Somali chiefs on the east coast. The first treaty was made with the sultan of Obbia on the 8th of February 1889. Later in the same year the British East Africa Company transferred to Italy—the transference being subsequently approved by the sultan of Zanzibar—the ports of Brava, Marka, Mukdishu and Warsheik, leased from Zanzibar. On the 24th of March 1891 an agreement between Italy and Great Britain fixed the northern bank of the Juba up to latitude 6° N. as the southern boundary of Italian influence in Somaliland, the boundary being provisionally prolonged along lines of latitude and longitude to the intersection of the Blue Nile with 35° E. longitude. On the 15th of April 1891 a further agreement fixed the northern limit of the Italian sphere from Ras Kasar on the Red Sea to the point on the Blue Nile just mentioned. By this agreement Italy was to have the right temporarily to occupy Kassala, which was left in the Anglo-Egyptian sphere, in trust for Egypt—a right of which she availed herself in 1894. To complete the work of delimitation the British and Italian governments, on the 5th of May 1894, fixed the boundary of the British sphere of influence in Somaliland from the Anglo-French boundary, which had been settled in February 1888.

The independence of Abyssinia recognized.

But while Great Britain was thus lending her sanction to Italy's ambitious schemes, the Abyssinian emperor was becoming more and more incensed at Italy's pretensions to exercise a protectorate over Ethiopia. In 1893 Menelek denounced the treaty of Uccialli, and eventually, in a great battle, fought at Adowa on the 1st of March 1896, the Italians were disastrously defeated. By the subsequent treaty of Adis Ababa, concluded on the 26th of October 1896, the whole of the country to the south of the Mareb, Belesa and Muna rivers was restored to Abyssinia, and Italy acknowledged the absolute independence of Abyssinia. The effect of this was practically to destroy the value of the Anglo-Italian agreement as to the boundaries to the south and west of Abyssinia; and negotiations were afterwards set on foot between the emperor Menelek and his European neighbours with the object of determining the Abyssinian frontiers. Italian Somaliland, bordering on the south-eastern frontier of Abyssinia, became limited to a belt of territory with a depth inland from the Indian Ocean of from 180 to 250 m. The negotiations concerning the frontier lasted until 1908, being protracted over the question as to the possession of Lugh, a town on the Juba, which eventually fell to Italy. After the battle of Adowa the Italian government handed over the administration of the southern part of the country to the Benadir Company, but in January 1905 the government resumed control and at the same time transformed the leasehold rights it held from the sultan of Zanzibar into sovereign rights by the payment to the sultan of £144,000. To facilitate her communications with the interior, Italy also secured from the British government the lease of a small area of land immediately to the north of Kismayu. In British Somaliland the frontier fixed by agreement with Italy in 1894 was modified, in so far as it marched with Abyssinian territory, by an agreement which Sir Rennell Rodd concluded with the emperor Menelek in 1897. The effect of this agreement was to reduce the area of British Somaliland from 75,000 to 68,000 sq. m. In the same year France concluded an agreement with the emperor, which is known to have fixed the frontier of the French Somali Coast protectorate at a distance of 90 kilometres (56 m.) from the coast. The determination of the northern, western and southern limits of Abyssinia proved a more difficult matter. A treaty of July 1900 followed by an agreement of November 1901 defined the boundaries of Eritrea on the side of Abyssinia and the Sudan respectively. In certain details the boundaries thus laid down were modified by an Anglo-Italian-Abyssinian treaty signed at Adis Ababa on the 15th of May 1902. On the same day another treaty was signed at the Abyssinian capital by Sir John Harrington, the British minister plenipotentiary, and the emperor Menelek, whereby the western, or Sudan-Abyssinian, frontier was defined as far south as the intersection of 6° N. and 35° E. Within the British sphere were left the Atbara up to Gallabat, the Blue Nile up to Famaka and the Sobat up to the junction of the Baro and Pibor. While not satisfying Abyssinian claims to their full extent, the frontier laid down was on the whole more favourable to Abyssinia than was the line fixed in the Anglo-Italian agreement of 1891. On the other hand, Menelek gave important economic guarantees and concessions to the Sudan government.

The Anglo-French agreements of April 1904.

In Egypt the result of the abolition of the Dual Control was to make British influence virtually predominant, though theoretically Turkey remained the suzerain power; and after the reconquest of the Sudan by the Anglo-Egyptian army a convention between the British and Egyptian governments was signed at Cairo on the 19th of January 1899, which, *inter alia*, provided for the joint use of the British and Egyptian flags in the territories south of the 22nd parallel of north latitude. From the international point of view the British position in Egypt was strengthened by the Anglo-French declaration of the 8th of April 1904. For some time previously there had been a movement on both sides of the Channel in favour of the settlement of a number of important questions in which British and French interests were involved. The movement was no doubt strengthened by the desire to reduce to their least dimensions the possible causes of trouble between the two countries at a time when the outbreak of hostilities between Russia (the ally of France) and Japan (the ally of Great Britain) rendered the European situation peculiarly delicate. On the 8th of April

1904 there was signed in London by the British foreign secretary, the marquess of Lansdowne, and the French ambassador, M. Paul Cambon, a series of agreements relating to several parts of the globe. Here we are concerned only with the joint declaration respecting Egypt and Morocco and a convention relating, in part, to British and French frontiers in West Africa. The latter we shall have occasion to refer to later. The former, notwithstanding the declarations embodied in it that there was "no intention of altering the political status" either of Egypt or of Morocco, cannot be ignored in any account of the partition in Africa. With regard to Egypt the French government declared "that they will not obstruct the action of Great Britain in that country by asking that a limit of time be fixed for the British occupation or in any other manner." France also assented—as did subsequently the other powers interested—to a khedivial decree simplifying the international control exercised by the Caisse de la Dette over the finances of Egypt.

France's privileged position in Morocco.

In order to appreciate aright that portion of the declaration relating to Morocco it is necessary to say a few words about the course of French policy in North-West Africa. In Tunisia the work of strengthening the protectorate established in 1881 had gone steadily forward; but it was in Algeria that the extension of French influence had been most marked. The movement of expansion southwards was inevitable. With the progress of exploration it became increasingly evident that the Sahara constituted no insurmountable barrier between the French possessions in North and West Central Africa. But France had not only the hope of placing Algeria in touch with the Sudan to spur her forward. To consolidate her position in North-West Africa she desired to make French influence supreme in Morocco. The relations between the two countries did not favour the realization of that ambition. The advance southwards of the French forces of occupation evoked loud protests from the Moorish government, particularly with regard to the occupation in 1900–1901 of the Tuat Oases. Under the Franco-Moorish treaty of 1845 the frontier between Algeria and Morocco was defined from the Mediterranean coast as far south as the pass of Teniet el Sassi, in about 34° N.; beyond that came a zone in which no frontier was defined, but in which the tribes and desert villages (*ksurs*) belonging to the respective spheres of influence were named; while south of the desert villages the treaty stated that in view of the character of the country "the delimitation of it would be superfluous." Though the frontier was thus left undefined, the sultan maintained that in her advance southwards France had trespassed on territories that unmistakably belonged to Morocco. After some negotiation, however, a protocol was signed in Paris on the 20th of July 1901, and commissioners appointed to devise measures for the co-operation of the French and Moorish authorities in the maintenance of peaceful conditions in the frontier region. It was reported that in April 1902 the commissioners signed an agreement whereby the Sharifan government undertook to consolidate its authority on the Moorish side of the frontier as far south as Figig. The agreement continued: "*Le Gouvernement français, en raison de son voisinage, lui prêtera son appui, en cas de besoin. Le Gouvernement français établira son autorité et la paix dans les régions du Sahara, et le Gouvernement marocain, son voisin, lui aidera de tout son pouvoir.*" Meanwhile in the northern districts of Morocco the conditions of unrest under the rule of the young sultan, Abd el Aziz IV., were attracting an increasing amount of attention in Europe and were calling forth demands for their suppression. It was in these circumstances that in the Anglo-French declaration of April 1904 the British government recognized "that it appertains to France, more particularly as a power whose dominions are conterminous for a great distance with those of Morocco, to preserve order in that country, and to provide assistance for the purpose of all administrative, economic, financial and military reforms which it may require." Both parties to the declaration, "inspired by their feeling of sincere friendship for Spain, take into special consideration the interests which that country derives from her geographical position and from her territorial possessions on the Moorish coast of the Mediterranean. In regard to these interests the French government will come to an understanding with the Spanish government." The understanding thus foreshadowed was reached later in the same year, Spain securing a sphere of interest on the Mediterranean coast. In pursuance of the policy marked out in the Anglo-French declaration, France was seeking to strengthen her influence in Morocco when in 1905 the attitude of Germany seriously affected her position. On the 8th of July France secured from the German government formal "recognition of the situation created for France in Morocco by the contiguity of a vast extent of territory of Algeria and the Sharifan empire, and by the special relations resulting therefrom between the two adjacent countries, as well as by the special interest for France, due to this fact, that order should reign in the Sharifan Empire." Finally, in January–April 1906, a conference of the powers was held at Algeciras to devise, by invitation of the sultan, a scheme of reforms to be introduced into Morocco (*q.v.*). French capital was allotted a larger share than that of any other power in the Moorish state bank which it was decided to institute, and French and Spanish officers were entrusted with the organization of a police force for the maintenance of order in the principal coast towns. The new régime had not been fully inaugurated, however, when a series of outrages led, in 1907, to the military occupation by France of Udja, a town near the Algerian frontier, and of the port of Casablanca on the Atlantic coast of Morocco.

It only remains to be noted, in connexion with the story of French activity in North-West Africa, that with such energy was the penetration of the Sahara pursued that in April 1904 flying columns from Insalah and Timbuktu met by arrangement in mid-desert, and in the following year it was deemed advisable to indicate on the maps the boundary between the Algerian and French West African territories.

Italy's interest in Tripoli.

Brief reference must be made to the position of Tripoli. While Egypt was brought under British control and Tunisia became a French protectorate, Tripoli remained a province of the Turkish empire with undefined frontiers in the hinterland, a state of affairs which more than once threatened to lead to trouble with France during the expansion of the latter's influence in the Sahara. As already stated, Italy early gave evidence that it was her ambition to succeed to the province, and, not only by the sultan of Turkey but in Italy also, the Anglo-French declaration of March 1899, respecting the limits of the British and French spheres of influence in north Central Africa, was viewed with some concern. By means of a series of public utterances on the part of French and Italian statesmen in the winter 1901–1902 it was made known that the two powers had come to an understanding with regard to their interests in North Africa, and in May 1902 Signor Prinetti, then Italian minister for foreign affairs, speaking in parliament in reply to an interpellation on the subject of Tripoli, declared that if "the *status quo* in the Mediterranean were ever disturbed, Italy would be sure of finding no one to bar the way to her legitimate aspirations."

Spanish colonies.

At the opening of the Berlin conference Spain had established no formal claim to any part of the coast to the south of Morocco; but while the conference was sitting, on the 9th of January 1885, the Spanish government intimated that in view of the importance of the Spanish settlements on the Rio de Oro, at Angra de Cintra, and at Western Bay (Cape Blanco), and of the documents signed with the independent tribes on that coast, the king of Spain had taken under his protection "the territories of the western coast of Africa comprised between the fore-mentioned Western Bay and Cape Bojador." The interior limits of the Spanish sphere were defined by an agreement concluded in 1900 with France. By this document some 70,000 sq. m. of the western Sahara were recognized as Spanish.

The same agreement settled a long-standing dispute between Spain and France as to the ownership of the district around the Muni river to be south of Cameroon, Spain securing a block of territory with a coast-line from the Campo river on the north to the Muni river on the south. The northern frontier is formed by the German Cameroon colony, the eastern by 11° 20′ E., and the southern by the first parallel of north latitude to its point of intersection with the Muni river.

Division of the Guinea coast.

Apart from this small block of Spanish territory south of Cameroon, the stretch of coast between Cape Blanco and the mouth of the Congo is partitioned among four European powers—Great Britain, France, Germany and Portugal—and the negro republic of Liberia. Following the coast southwards from Cape Blanco is first the French colony of Senegal, which is indented, along the Gambia river, by the small British colony of that name, and then the comparatively small territory of Portuguese Guinea, all that remains on this coast to represent Portugal's share in the scramble in a region where she once played so conspicuous a part. To the south of Portuguese Guinea is the French Guinea colony, and still going south and east are the British colony of Sierra Leone, the republic of Liberia, the French colony of the Ivory coast, the British Gold Coast, German Togoland, French Dahomey, the British colony (formerly known as the Lagos colony) and protectorate of Southern Nigeria, the German colony of Cameroon, the Spanish settlements on the Muni river, the French Congo colony, and the small Portuguese enclave north of the Congo to which reference has already been made, which is administratively part of the Angola colony. When the General Act of the Berlin conference was signed the whole of this coast-line had not been formally claimed; but no time was lost by the powers interested in notifying claims to the unappropriated sections, and the conflicting claims put forward necessitated frequent adjustments by international agreements. By a Franco-Portuguese agreement of the 12th of May 1886 the limits of Portuguese Guinea—surrounded landwards by French territory—were defined, and by agreements with Great Britain in 1885 and France in 1892 and 1907 the Liberian republic was confined to an area of about 43,000 sq. m.

The real struggle in West Africa was between France and Great Britain, and France played the dominant part, the exhaustion of Portugal, the apathy of the British government and the late appearance of Germany in the field being all elements that favoured the success of French policy. Before tracing the steps in the historic contest between France and Great Britain it is necessary, however, to deal briefly with the part played by Germany. She naturally could not be disposed of by the chief rivals as easily as were Portugal and Liberia. It will be remembered that Dr Nachtigal, while the proposals for the Berlin conference were under discussion, had planted the German flag on the coast of Togo and in Cameroon in the month of July 1884. In Cameroon Germany found herself with Great Britain for a neighbour to the north, and with France as her southern neighbour on the Gabun river. The utmost activity was displayed in making treaties with native chiefs, and in securing as wide a range of coast for German enterprise as was possible. After various provisional agreements had been concluded between Great Britain and Germany, a "provisional line of demarcation" was adopted in the famous agreement of the 1st of July 1890, starting from the head of the Rio del Rey creek and going to the point, about 9° 8′ E., marked "rapids" on the British Admiralty chart. By a further agreement of the 14th of April 1893, the right bank of the Rio del Rey was made the boundary between the Oil Rivers Protectorate (now Southern Nigeria) and Cameroon. In the following November (1893) the boundary was continued from the "rapids" before mentioned, on the Calabar or Cross river, in a straight line towards the centre of the town of Yola, on the Benue river. Yola itself, with a radius of some 3 m., was left in the British sphere, and the German boundary followed the circle eastwards from the point of intersection as it neared Yola until it met the Benue river. From that point it crossed the river to the intersection of the 13th degree of longitude with the 10th degree of north latitude, and then made direct for a point on the southern shore of Lake Chad "situated 35 minutes east of the meridian of Kuka." By this agreement the British government withdrew from a considerable section of the upper waters of the Benue with which the Royal Niger Company had entered into relations. The limit of Germany's possible extension eastwards was fixed at the basin of the river Shari, and Darfur, Kordofan and the Bahr-el-Ghazal were to be excluded from her sphere of influence. The object of Great Britain in making the sacrifice she did was two-fold. By satisfying Germany's desire for a part of Lake Chad a check was put on French designs on the Benue region, while by recognizing the central Sudan (Wadai, &c.) in the German sphere, a barrier was interposed to the advance of France from the Congo to the Nile. This last object was not attained, inasmuch as Germany in coming to terms with France as to the southern and eastern limits of Cameroon abandoned her claims to the central Sudan. She had already, on the 24th of December 1885, signed a protocol with France fixing her southern frontier, where it was coterminous with the French Congo colony. But to the east German explorers were crossing the track of French explorers from the northern bank of the Ubangi, and the need for an agreement was obvious. Accordingly, on the 4th of February 1894, a protocol—which, some weeks later, was confirmed by a convention— was signed at Berlin, by which France accepted the presence of Germany on Lake Chad as a *fait accompli* and effected the best bargain she could by making the left bank of the Shari river, from its outlet into Lake Chad to the 10th parallel of north latitude, the eastern limit of German extension. From this point the boundary line went due west some 230 m., then turned south, and with various indentations joined the south-eastern frontier, which had been slightly extended so as to give Germany access to the Sanga river— a tributary of the Congo. Thus, early in 1894, the German Cameroon colony had reached fairly definite limits. In 1908 another convention, modifying the frontier, gave Germany a larger share of the Sanga, while France, among other advantages, gained the left bank of the Shari to 10° 40′ N.

Germany in west Central Africa.

Exclusion of Germany from the Niger.

The German Togoland settlements occupy a narrow strip of the Guinea coast, some 35 m. only in length, wedged in between the British Gold Coast and French Dahomey. At first France was inclined to dispute Germany's claims to Little Popo and Porto Seguro; but in December 1885 the French government acknowledged the German protectorate over these places, and the boundary between French and German territory, which runs north from the coast to the 11th degree of latitude, was laid down by the Franco-German convention of the 12th of July 1897. The fixing of the 11th parallel as the northern boundary of German expansion towards the interior was not accomplished without some sacrifice of German ambitions. Having secured an opening on Lake Chad for her Cameroon colony, Germany was anxious to obtain a footing on the middle Niger for Togoland. German expeditions reached Gando, one of the tributary states of the Sokoto empire on the middle Niger, and, notwithstanding the existence of prior treaties with Great Britain, sought to conclude agreements with the sultan of that country. But this German ambition conflicted both with the British and the French designs in West Africa, and eventually Germany had to be content with the 11th parallel as her northern frontier. On the west the Togoland frontier on the coast was fixed in July 1886 by British and German commissioners at 1° 10′ E. longitude, and its extension towards the interior laid down for a short distance. A curious feature in the history of its prolongation was the establishment in 1888 of a neutral zone wherein neither power was to seek to acquire protectorates nor exclusive influence. It was not until November 1899 that, as part of the Samoa settlement, this neutral zone was partitioned between the two powers and the frontier extended to the 11th parallel.

Anglo-French rivalry in West Africa.

The story of the struggle between France and Great Britain in West Africa may roughly be divided into two sections, the first dealing with the Coast colonies, the second dealing with the struggle for the middle Niger and Lake Chad. As regards the Coast colonies, France was wholly successful in her design of isolating all Great Britain's separate possessions in that region, and of securing for herself undisputed possession of the upper Niger and of the countries lying within the great bend of that river.

When the British government awoke to the consciousness of what was at stake France had obtained too great a start. French governors of the Senegal had succeeded, before the Berlin conference, in establishing forts on the upper Niger, and the advantage thus gained was steadily pursued. Every winter season French posts were pushed farther and farther along the river, or in the vast regions watered by the southern tributaries of the Senegal and Niger rivers. This ceaseless activity met with its reward. Great Britain found herself compelled to acknowledge accomplished facts and to conclude agreements with France, which left her colonies mere coast patches, with a very limited extension towards the interior. On the 10th of August 1889 an agreement was signed by which the Gambia colony and protectorate was confined to a narrow strip of territory on both banks of the river for about 200 m. from the sea. In June 1882 and in August 1889 provisional agreements were made with France fixing the western and northern limits of Sierra Leone, and commissioners were appointed to trace the line of demarcation agreed upon by the two governments. But the commissioners failed to agree, and on the 21st of January 1895 a fresh agreement was made, the boundary being subsequently traced by a mixed commission. Sierra Leone, as now definitely constituted, has a coast-line of about 180 m. and a maximum extension towards the interior of some 200 m.

At the date of the Berlin conference the present colonies of Southern Nigeria and the Gold Coast constituted a single colony under the title of the Gold Coast colony, but on the 13th of January 1886 the territory comprised under that title was erected into two separate colonies—Lagos and the Gold Coast (the name of the former being changed in February 1906 to the colony of Southern Nigeria). The coast limits of the new Gold Coast colony were declared to extend from 5° W. to 2° E., but these limits were subsequently curtailed by agreements with France and Germany. The arrangements that fixed the eastern frontier of the Gold Coast colony and its hinterland have already been stated in connexion with German Togoland. On the western frontier it marches with the French colony of the Ivory Coast, and in July 1893, after an unsuccessful attempt to achieve the same end by an agreement concluded in 1889, the frontier was defined from the neighbourhood of the Tano lagoon and river of the same name, to the 9th degree of north latitude. In August 1896, following the destruction of the Ashanti power and the deportation of King Prempeh, as a result of the second Ashanti campaign, a British protectorate was declared over the whole of the Ashanti territories and a resident was installed at Kumasi. But no northern limit had been fixed by the 1893 agreement beyond the 9th parallel, and the countries to the north—Gurunsi (Grusi), Mossi and Gurma—were entered from all sides by rival British, French and German expeditions. The conflicting claims established by these rival expeditions may, however, best be considered in connexion with the struggle for supremacy on the middle Niger and in the Chad region, to which it is now necessary to turn.

A few days before the meeting of the Berlin conference Sir George Goldie had succeeded in buying up all the French interests on the lower Niger. The British company's influence had at that date been extended by treaties with the native chiefs up the main Niger stream to its junction with the Benue, and some distance along this latter river. But the great Fula states of the central Sudan were still outside European influence, and this fact did not escape attention in Germany. German merchants had been settled for some years on the coast, and one of them, E. R. Flegel, had displayed great interest in, and activity on, the river. He recognized that in the densely populated states of the middle Niger, Sokoto and Gando, and in Bornu to the west of Lake Chad, there was a magnificent field for Germany's new-born colonizing zeal. The German African Company[1] and the German Colonial Society listened eagerly to Flegel's proposals, and in April 1885 he left Berlin on a mission to the Fula states of Sokoto and Gando. But it was impossible to keep his intentions entirely secret, and the (British) National African Company had no desire to see the French rivals, whom they had with so much difficulty dislodged from the river, replaced by the even more troublesome German. Accordingly Joseph Thomson, the young Scottish explorer, was sent out to the Niger, and had the satisfaction of concluding on the 1st of June 1885 a treaty with "Umoru, King of the Mussulmans of the Sudan and Sultan of Sokoto," which practically secured the whole of the trading rights and the control of the sultan's foreign relations to the British company. Thomson concluded a similar treaty with the sultan of Gando, so as to provide against the possibility of its being alleged that Gando was an independent state and not subject to the suzerainty of the sultan of Sokoto. As Thomson descended the river with his treaties, he met Flegel going up the river, with bundles of German flags and presents for the chiefs. The German government continued its efforts to secure a footing on the lower Niger until the fall of Prince Bismarck from power in March 1890, when opposition ceased, and on the failure of the half-hearted attempt made later to establish relations with Gando from Togoland, Germany dropped out of the competition for the western Sudan and left the field to France and Great Britain. After its first great success the National African Company renewed its efforts to obtain a charter from the British government, and on the 10th of July 1886 the charter was granted, and the company became "The Royal Niger Company, chartered and limited." In June of the previous year a British protectorate had been proclaimed over the whole of the coast from the Rio del Rey to the Lagos frontier, and as already stated, on the 13th of January 1886 the Lagos settlements had been separated from the Gold Coast and erected into a separate colony. It may be convenient to state here that the western boundary of Lagos with French territory (Dahomey) was determined in the Anglo-French agreement of the 10th of August 1889, "as far as the 9th degree of north latitude, where it shall stop." Thus both in the Gold Coast hinterland and in the Lagos hinterland a door was left wide open to the north of the 9th parallel.

The Niger Company granted a charter.

Notwithstanding her strenuous efforts, France, in her advance down the Niger from Senegal, did not succeed in reaching Sego on the upper Niger, a considerable distance above Timbuktu, until the winter of 1890–1891, and the rapid advance of British influence up the river raised serious fears lest the Royal Niger Company should reach Timbuktu before France could forestall her. It was, no doubt, this consideration that induced the French government to consent to the insertion in the agreement of the 5th of August 1890, by which Great Britain recognized France's protectorate over Madagascar, of the following article:

> The Government of Her Britannic Majesty recognizes the sphere of influence of France to the south of her Mediterranean possessions up to a line from Say on the Niger to Barrua on Lake Chad, drawn in such a manner as to comprise in the sphere of action of the Niger Company all that fairly belongs to the kingdom of Sokoto; the line to be determined by the commissioners to be appointed.

The commissioners never were in fact appointed, and the proper meaning to be attached to this article subsequently became a subject of bitter controversy between the two countries. An examination of the map of West Africa will show what possibilities of trouble were left open at the end of 1890 by the various agreements concluded up to that date. From Say on the Niger to where the Lagos frontier came to an abrupt stop in 9° N. there was no boundary line between the French and British spheres of influence. To the north of the Gold Coast and of the French Ivory Coast colony the way was equally open to Great Britain and to France, while the vagueness of the Say-Barrua line left an opening of which France was quick to avail herself. Captain P. L. Monteil, who was despatched by the French government to West Africa in 1890, immediately after the conclusion of the August agreement, did not hesitate to pass well to the south of the Say-Barrua line, and to attempt to conclude treaties with chiefs who were, beyond all question, within the British sphere. Still farther south, on the Benue river, the two expeditions of Lieutenant Mizon—in 1890 and 1892—failed to do any real

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[1] This association, formed in 1878 by a union of associations primarily intended for the exploration of Africa, ceased to exist in 1891.

French advance to Timbuktu.

harm to British interests. In 1892 an event happened which had an important bearing on the future course of the dispute. After a troublesome war with Behanzin, king of the native state of Dahomey, France annexed some portion of Dahomeyan territory on the coast, and declared a protectorate over the rest of the kingdom. Thus was removed the barrier which had up to that time prevented France from pushing her way Nigerwards from her possessions on the Slave Coast, as well as from the upper Niger and the Ivory Coast. Henceforth her progress from all these directions was rapid, and in particular Timbuktu was occupied in the last days of 1893.

The Franco-British settlement of 1898.

In 1894 it appears to have been suddenly realized in France that, for the development of the vast regions which she was placing under her protection in West Africa, it was extremely desirable that she should obtain free access to the navigable portions of the Niger, if not on the left bank, from which she was excluded by the Say-Barrua agreement, then on the right bank, where the frontier had still to be fixed by international agreement. In the neighbourhood of Bussa there is a long stretch of the river so impeded by rapids that navigation is practically impossible, except in small boats and at considerable risk. Below these rapids France had no foothold on the river, both banks from Bussa to the sea being within the British sphere. In 1890 the Royal Niger Company had concluded a treaty with the emir and chiefs of Bussa (or Borgu); but the French declared that the real paramount chief of Borgu was not the king of Bussa, but the king of Nikki, and three expeditions were despatched in hot haste to Nikki to take the king under French protection. Sir George Goldie, however, was not to be baffled. While maintaining the validity of the earlier treaty with Bussa, he despatched Captain (afterwards General Sir) F. D. Lugard to Nikki, and Lugard was successful in distancing all his French competitors by several days, reaching Nikki on the 5th of November 1894 and concluding a treaty with the king and chiefs. The French expeditions, which were in great strength, did not hesitate on their arrival to compel the king to execute fresh treaties with France, and with these in their possession they returned to Dahomey. Shortly afterwards a fresh act of aggression was committed. On the 13th of February 1895 a French officer, Commandant Toutée, arrived on the right bank of the Niger opposite Bajibo and built a fort. His presence there was notified to the Royal Niger Company, who protested to the British government against this invasion of their territory. Lord Rosebery, who was then foreign minister, at once made inquiries in Paris, and received the assurance that Commandant Toutée was "a private traveller." Eventually Commandant Toutée was ordered to withdraw, and the fort was occupied by the Royal Niger Company's troops. Commandant Toutée subsequently published the official instructions from the French government under which he had acted. It was thought that the recognition of the British claims, involved in the withdrawal of Commandant Toutée, had marked the final abandonment by France of the attempt to establish herself on the navigable portions of the Niger below Bussa, but in 1897 the attempt was renewed in the most determined manner. In February of that year a French force suddenly occupied Bussa, and this act was quickly followed by the occupation of Gomba and Illo higher up the river. In November 1897 Nikki was occupied. The situation on the Niger had so obviously been outgrowing the capacity of a chartered company that for some time before these occurrences the assumption of responsibility for the whole of the Niger region by the imperial authorities had been practically decided on; and early in 1898 Lugard was sent out to the Niger with a number of imperial officers to raise a local force in preparation for the contemplated change.

The advance of the French forces from the south and west was the signal for an advance of British troops from the Niger, from Lagos and from the Gold Coast protectorate. The situation thus created was extremely serious. The British and French flags were flying in close proximity, in some cases in the same village. Meanwhile the diplomatists were busy in London and in Paris, and in the latter capital a commission sat for many months to adjust the conflicting claims. Fortunately, by the tact and forbearance of the officers on both sides, no local incident occurred to precipitate a collision, and on the 14th of June 1898 a convention was signed by Sir Edmund Monson and M. G. Hanotaux which practically completed the partition of this part of the continent.

The settlement effected was in the nature of a compromise. France withdrew from Bussa, Gomba and Illo, the frontier line west of the Niger being drawn from the 9th parallel to a point ten miles, as the crow flies, above Giri, the port of Illo. France was thus shut out from the navigable portion of the middle and lower Niger; but for purely commercial purposes Great Britain agreed to lease to France two small plots of land on the river—the one on the right bank between Leaba and the mouth of the Moshi river, the other at one of the mouths of the Niger. By accepting this line Great Britain abandoned Nikki and a great part of Borgu as well as some part of Gando to France. East of the Niger the Say-Barrua line was modified in favour of France, which gained parts of both Sokoto and Bornu where they meet the southern edge of the Sahara. In the Gold Coast hinterland the French withdrew from Wa, and Great Britain abandoned all claim to Mossi, though the capital of the latter country, together with a further extensive area in the territory assigned to both powers, was declared to be equally free, so far as trade and navigation were concerned, to the subjects and protected persons of both nationalities. The western boundary of the Gold Coast was prolonged along the Black Volta as far as latitude 11° N., and this parallel was followed with slight deflexions to the Togoland frontier. In consequence of the acute crisis which shortly afterwards occurred between France and Great Britain on the upper Nile, the ratification of this agreement was delayed until after the conclusion of the Fashoda agreement of March 1899 already referred to. In 1900 the two patches on the Niger leased to France were selected by commissioners representing the two countries, and in the same year the Anglo-French frontier from Lagos to the west bank of the Niger was delimited.

Further concessions to France.

East of the Niger the frontier, even as modified in 1898, failed to satisfy the French need for a practicable route to Lake Chad, and in the convention of the 8th of April 1904, to which reference has been made under Egypt and Morocco, it was agreed, as part of the settlement of the French shore question in Newfoundland, to deflect the frontier line more to the south. The new boundary was described at some length, but provision was made for its modification in points of detail on the return of the commissioners engaged in surveying the frontier region. In 1906 an agreement was reached on all points, and the frontier at last definitely settled, sixteen years after the Say-Barrua line had been fixed. This revision of the Niger-Chad frontier did not, however, represent the only territorial compensation received by France in West Africa in connexion with the settlement of the Newfoundland question. By the same convention of April 1904 the British government consented to modify the frontier between Senegal and the Gambia colony "so as to give to France Yarbutenda and the lands and landing-places belonging to that locality," and further agreed to cede to France the tiny group of islands off the coast of French Guinea known as the Los Islands.

Meantime the conclusion of the 1898 convention had left both the British and the French governments free to devote increased attention to the subdivision and control of their West African possessions. On the 1st of January 1900 the imperial authorities assumed direct responsibility for the whole of the territories of the Royal Niger Company, which became henceforth a purely commercial undertaking. The Lagos protectorate was extended northwards; the Niger Coast protectorate, likewise with extended frontiers, became Southern Nigeria; while the greater part of the territories formerly administered by the company were constituted into the protectorate of Northern Nigeria—all three administrations being directly under the Colonial Office. In February 1906 the administration of the

Organization of the British and French protectorates.

Southern Nigerian protectorate was placed under that of Lagos at the same time as the name of the latter was changed to the Colony of Southern Nigeria, this being a step towards the eventual amalgamation of all three dependencies under one governor or governor-general. In French West Africa changes in the internal frontiers have been numerous and important. The coast colonies have all been increased in size at the expense of the French Sudan, which has vanished from the maps as an administrative entity. There are carved out of the territories comprised in what is officially known as French West Africa five colonies—Senegal, French Guinea, the Ivory Coast, Dahomey and the Upper Senegal and Niger, this last being entirely cut off from the sea—and the civil territory of Mauritania. To the colony of the Upper Senegal and Niger is attached the military territory of the Niger, embracing the French Sahara up to the limit of the Algerian sphere of influence. Not only are all these divisions of French West Africa connected territorially, but administratively they are united under a governor-general. Similarly the French Congo territories have been divided into three colonies—the Gabun, the Middle Congo and the Ubangi-Shari-Chad—all united administratively under a commissioner-general.

Ownership of the African islands.

There are, around the coast, numerous islands or groups of islands, which are regarded by geographers as outliers of the African mainland. The majority of these African islands were occupied by one or other of the European powers long before the period of continental partition. The Madeira Islands to the west of Morocco, the Bissagos Islands, off the Guinea coast, and Prince's Island and St Thomas' Island, in the Gulf of Guinea, are Portuguese possessions of old standing; while in the Canary Islands and Fernando Po Spain possesses remnants of her ancient colonial empire which are a more valuable asset than any she has acquired in recent times on the mainland. St Helena in the Atlantic, Mauritius and some small groups north of Madagascar in the Indian Ocean, are British possessions acquired long before the opening of the last quarter of the 19th century. Zanzibar, Pemba and some smaller islands which the sultan was allowed to retain were, as has already been stated, placed under British protection in 1890, and the island of Sokotra was placed under the "gracious favour and protection" of Great Britain on the 23rd of April 1886. France's ownership of Réunion dates back to the 17th century, but the Comoro archipelago was not placed under French protection until April 1886. None of these islands, with the exception of the Zanzibar group, have, however, materially affected the partition of the continent, and they need not be enumerated in the table which follows. But the important island of Madagascar stands in a different category, both on account of its size and because it was during the period under review that it passed through the various stages which led to its becoming a French colony. The first step was the placing of the foreign relations of the island under French control, which was effected by the treaty of the 17th of December 1885, after the Franco-Malagasy war that had broken out in 1883. In 1890 Great Britain and Germany recognized a French protectorate over the island, but the Hova government declined to acquiesce in this view, and in May 1895 France sent an expedition to enforce her claims. The capital was occupied on the 30th of September in the same year, and on the day following Queen Ranavalona signed a convention recognizing the French protectorate. In January 1896 the island was declared a French possession, and on the 6th of August was declared to be a French colony. In February 1897 the last vestige of ancient rule was swept away by the deportation of the queen.

Thus in its broad outlines the partition of Africa was begun and ended in the short space of a quarter of a century. There are still many finishing touches to be put to the structure. The southern frontiers of Morocco and Tripoli remain undefined, while the mathematical lines by which the spheres of influence of the powers were separated one from the other are being variously modified on the *do ut des* principle as they come to be surveyed and as the effective occupation of the continent progresses. Much labour is necessary before the actual area of Africa and its subdivisions can be accurately determined, but in the following table the figures are at least approximately correct. Large areas of the spheres assigned to different European powers have still to be brought under European control; but this work is advancing by rapid strides.

		Sq. m.
BRITISH—		
Cape Colony		276,995
Natal and Zululand		35,371
Basutoland		10,293
Bechuanaland Protectorate		225,000
Transvaal and Swaziland		117,732
Orange River Colony		50,392
Rhodesia		450,000
Nyasaland Protectorate		43,608
British East Africa Protectorate		240,000
Uganda Protectorate		125,000
Zanzibar Protectorate		1,020
Somaliland		68,000
Northern Nigeria		258,000
Southern Nigeria (colony and protectorate)		80,000
Gold Coast and *hinterland*		82,000
Sierre Leone (colony and protectorate)		34,000
Gambia		4,000
Total British Africa		2,101,411
Egypt and Libyan Desert		650,000
Anglo-Egyptian Sudan		950,000
		1,600,000
FRENCH—		
Algeria and Algerian Sahara		945,000
Tunisia		51,000
French West Africa—		
Senegal	74,000	
French Guinea	107,000	
Ivory Coast	129,000	
Dahomey	40,000	
Upper Senegal and Niger, and Mauritania (including French West African Sahara)	1,581,000	1,931,000
French Congo		700,000
French Somaliland		12,000
Madagascar		227,950
Total French Africa		3,866,950
GERMAN—		
East Africa		364,000
South-West Africa		322,450
Cameroon		190,000
Togoland		33,700
Total German Africa		910,150
ITALIAN—		
Eritrea		60,000
Italian Somaliland		140,000
Total Italian Africa		200,000
PORTUGUESE—		
Guinea		14,000
West Africa		480,000
East Africa		293,500
Total Portuguese Africa		787,500
SPANISH—		
Rio de Oro		70,000
Muni River Settlements		9,800
Total Spanish Africa		79,800
BELGIAN—		
Congo State		900,000
TURKISH—		
Tripoli and Benghazi		400,000
SEPARATE STATES—		
Liberia		43,000
Morocco		220,000
Abyssinia		350,000
Total Independent Africa		613,000

Thus, collecting the totals, the result of the "scramble" has been to divide Africa among the powers as follows:—

	Sq. m.
British Africa	2,101,411
Egyptian Africa	1,600,000
French Africa	3,866,950
German Africa	910,150
Italian Africa	200,000
Portuguese Africa	787,500
Spanish Africa	79,800
Belgian Africa	900,000
Turkish Africa	400,000
Independent Africa	613,000
	11,458,811

(J. S. K.)

VI. EXPLORATION AND SURVEY SINCE 1875

In giving the history of the partition of the continent, the later work of exploration, except where, as in the case of de Brazza's expeditions, it had direct political consequences, has of necessity not been told. The results achieved during and after the period of partition may now be indicated. Stanley's great journey down the Congo in 1875–1876 initiated a new era in African exploration. The numbers of travellers soon became so great that the once marvellous feat of crossing the continent from sea to sea became common. With increased knowledge and much ampler means of communication trans-African travel now presents few difficulties. While d'Anville and other cartographers of the 18th century, by omitting all that was uncertain, had left a great blank on the map, the work accomplished since 1875 has filled it with authentic topographical details. Moreover surveys of high accuracy have been made at several points. As the work of exploration and survey progressed journeys of startling novelty became impossible—save in the eastern Sahara, where the absence of water and boundless wastes of sand render exploration more difficult, perhaps, than in any other region of the globe. Within their respective spheres of influence each power undertook detailed surveys, and the most solid of the latest accessions to knowledge have resulted from the labours of hard-working colonial officials toiling individually in obscurity. Their work it is impossible here to recognize adequately; the following lines record only the more obvious achievements.

The relations of the Congo basin to the neighbouring river systems was brought out by the journeys of many travellers. In 1877 an important expedition was sent out by the Portuguese government under Serpa Pinto, Brito Capello and Roberto Ivens for the exploration of the interior of Angola. The first named made his way by the head-streams of the Kubango to the upper Zambezi, which he descended to the Victoria Falls, proceeding thence to Pretoria and Durban. Capello and Ivens confined their attention to the south-west Congo basin, where they disproved the existence of Lake Aquilunda, which had figured on the maps of that region since the 16th century. In a later journey (1884–1885) Capello and Ivens crossed the continent from Mossamedes to the mouth of the Zambezi, adding considerably to the knowledge of the borderlands between the upper Congo and the upper Zambezi. More important results were obtained by the German travellers Paul Pogge and Hermann von Wissmann, who (1880–1882) passed through previously unknown regions beyond Muata Yanvo's kingdom, and reached the upper Congo at Nyangwe, whence Wissmann made his way to the east coast. In 1884–1885 a German expedition under Wissmann solved the most important geographical problem relating to the southern Congo basin by descending the Kasai, the largest southern tributary, which, contrary to expectation, proved to unite with the Kwango and other streams before joining the main river. Further additions to the knowledge of the Congo tributaries were made at the same time by the Rev. George Grenfell, a Baptist missionary, who (accompanied in 1885 by K. von François) made several voyages in the steamer "Peace," especially up the great Ubangi, ultimately proved to be the lower course of the Welle, discovered in 1870 by Schweinfurth.

Work in the Congo basin.

In East as in West Africa operations were started by agents of the Belgian committee, but with less success than on the Congo. The first new journey of importance on this side was made (1878–1880) on behalf of the British African Exploration Committee by Joseph Thomson, who after the death of his leader, Keith Johnston, made his way from the coast to the north end of Nyasa, thence to Tanganyika, on both sides of which he broke new ground, sighting the north end of Lake Rukwa on the east. In 1882–1884 the French naval lieutenant Victor Giraud proceeded by the north of Nyasa to Lake Bangweulu, of which he made the first fairly correct map. North of the Zanzibar-Tanganyika route a large area of new ground was opened in 1883–1884 by Joseph Thomson, who traversed the whole length of the Masai country to Lake Baringo and Victoria Nyanza, shedding the first clear light on the great East African rift-valley and neighbouring highlands, including Mounts Kenya and Elgon. A great advance in the region between Victoria Nyanza and Abyssinia was made in 1887–1889 by the Austrians, Count Samuel Teleki and Lieut. Ludwig von Höhnel, who discovered the large Basso Norok, now known as Lake Rudolf, till then only vaguely indicated on the map as Samburu. At this time Somaliland was being opened up by English and Italian travellers. In 1883 the brothers F. L. and W. D. James penetrated from Berbera to the Webi Shebeli; in 1892 Vittorio Bottego (afterwards murdered in the Abyssinian highlands) started from Berbera and reached the upper Juba, which he explored to its source. The first person, however, to cross from the Gulf of Aden to the Indian Ocean was an American, A. Donaldson Smith, who in 1894–1895 explored the head-streams of the Webi Shebeli and also explored the Omo, the feeder of Lake Rudolf.

Opening up East Africa.

In the region north-west of Victoria Nyanza the greatest additions to geographical knowledge were made by H. M. Stanley in his last expedition, undertaken for the relief of Emin Pasha. The expedition set out in 1887 by way of the Congo to carry supplies to the governor of the old Egyptian Equatorial province. The route lay up the Aruwimi, the principal tributary of the Congo from the north-east, by which the expedition made its way, encountering immense difficulties, through the great equatorial forest, the character and extent of which were thus for the first time brought to light. The return was made to the east coast, and resulted in the discovery of the great snowy range of Ruwenzori or Runsoro, and the confirmation of the existence of a third Nile lake discharging its waters into the Albert Nyanza by the Semliki river. A further discovery was that of a large bay, hitherto unsuspected, forming the south-west corner of the Victoria Nyanza.

Great activity was also displayed in completing the work of earlier explorers in North and West Africa. Morocco was in 1883–1884 the scene of important explorations by de Foucauld, a Frenchman who, disguised as a Jew, crossed and re-crossed the Atlas and supplied the first trustworthy information as to the orography of many parts of the chain. In 1887–1889 Louis Gustave Binger, a French officer, made a great journey through the countries enclosed in the Niger bend, and in 1890–1892 Col. P. F. Monteil went from St Louis to Say, on the Niger, thence through Sokoto to Bornu and Lake Chad, whence he crossed the Sahara to Tripoli. Meantime explorers had been busy in the region between Lake Chad, the Gulf of Guinea and the Congo. The Sanga, one of the principal northern tributaries of the Congo, was reached from the north by Lieut. Louis Mizon, a French naval officer, who drew the first line of communication between the Benue and the Congo (1890–1892). In 1890 Paul Crampel, who in the previous year had explored north of the Ogowé, undertook a great expedition from the Ubangi to the Shari, but was attacked and killed, with several of his companions, on the borders of the Bagirmi. Several other expeditions followed, and in 1896 Emile Gentil reached the Shari, launched a steamer on its waters and pushed on to Lake Chad. Early in 1900 Lake Chad was also reached by F. Foureau, a French traveller, who had already devoted twelve years to the exploration of the

Expeditions in North and West Africa.

Sahara and who on this occasion had crossed the desert from Algeria and had reached the lake *via* Air and Zinder.

Lakes and mountains of Equatorial Africa.

The last ten years of the 19th century also witnessed many interesting expeditions in east Central Africa. In 1891 Emin Pasha, accompanied by Dr F. Stuhlmann, made his way south of Victoria Nyanza to the western Nile lakes, visiting for the first time the southern and western shores of Albert Edward. Stuhlmann also ascended the Ruwenzori range to a height of over 13,000 ft. In the same year Dr O. Baumann, who had already done good work in Usambara, near the coast, started on a more extended journey through the region of steppes between Kilimanjaro and Victoria Nyanza, afterwards exploring the headstreams of the Kagera, the ultimate sources of the Nile. In the steppe region referred to he discovered two new lakes, Manyara and Eiassi, occupying parts of the East African valley system. This region was again traversed in 1893–1894 by Count von Götzen, who continued his route westwards to Lake Kivu, north of Tanganyika, which, though heard of by Speke over thirty years before, had never yet been visited. He also reached for the first time the line of volcanic peaks north of Kivu, one of which he ascended, afterwards crossing the great equatorial forest by a new route to the Congo and the west coast. Valuable scientific work was done in 1893 by Dr J. W. Gregory, who ascended Mount Kenya to a height of 16,000 ft. In 1893–1894 Scott Elliot reached Ruwenzori by way of Uganda, returning by Tanganyika and Nyasa, and in 1896 C. W. Hobley made the circuit of the great mountain Elgon, north-east of Victoria Nyanza. In 1899 Mount Kenya was ascended to its summit by a party under H. J. Mackinder. The exploration of Mount Kilimanjaro has been the special work of Dr Hans Meyer, who first directed his attention to it in 1887.

The region south of Abyssinia proper and north of Lake Rudolf, being largely the basin of the Sobat tributary of the Nile, was traversed by several explorers, among whom may be mentioned Capt. M. S. Wellby, who in 1898–1899 explored the chain of small lakes in south-east Abyssinia, pushed on to Lake Rudolf, and thence traversed hitherto unknown country to the lower Sobat. Donaldson Smith crossed from Berbera to the Nile by Lake Rudolf in 1899–1900, and Major H. H. Austin commanded two survey parties between the Anglo-Egyptian Sudan and Lake Rudolf during 1899–1901. Meantime in south Central Africa the Barotse country had been partly made known by the missionary F. Coillard, who settled there in 1884, while the middle and upper Zambezi basin were scientifically explored and mapped by Major A. St H. Gibbons and his assistants in 1895–1896 and 1898–1900. In the same period the Congo-Zambezi watershed was traced by a Belgian officer, Capt. C. Lemaire, who had ascended one of the upper tributaries of the Kasai.

In the early years of the 19th century the first recorded crossing of Africa took place. That crossing and all subsequent crossings had been made either from west to east or east to west. The first journey through the whole length of the continent was accomplished in the two last years of the century when a young Englishman, E. S. Grogan, starting from Cape Town reached the Mediterranean by way of the Zambezi, the central line of lakes and the Nile. Other travellers followed in Grogan's footsteps, among the first, Major Gibbons.

Work of international commissions and surveying parties.

Additions to topographical knowledge were made from about 1890 onwards by the international commissions which traced the frontiers of the protectorates of the European powers. On several occasions the labours of the commissions disclosed errors of importance in the maps upon which international agreements had been based. Among those which yielded valuable results were the Anglo-French commission which in 1903 traced the Nigerian frontier from the Niger to Lake Chad, and the Anglo-German commission which in 1903–1904 fixed the Cameroon boundary between Yola, on the Benue, and Lake Chad. These expeditions and French surveys in the same region during 1902–1903 resulted in the discovery that Lake Chad had greatly decreased in area since the middle of the 19th century. In 1903 a French officer, Capt. E. Lenfant, succeeded in establishing the fact of a connexion between the Niger and Chad basins. Subsequently Lenfant explored the western basin of the Shari, determining (1907) the true upper branch of that river.

In East Africa a German-Congolese commission surveyed (1901–1902) Lake Kivu and the volcanic region north of the lake, R. Kandt making a special study of Kivu and the Kagera sources, while the Anglo-German boundary commission of 1902–1904 surveyed the valley of the lower Kagera, and fixed the exact position of Albert Edward Nyanza. Much new information concerning the border-lands of British East Africa and Abyssinia between Lake Rudolf and the lower Juba was obtained by the survey executed in 1902–1903 by a British officer, Captain P. Maud.

While political requirements led to the exact determination of frontiers, administrative needs forced the governments concerned to take in hand the survey of the countries under their protection. Before the close of the first decade of the 20th century tolerably accurate maps had been made of the German colonies, of a considerable part of West Africa, the Algerian Sahara and the Anglo-Egyptian Sudan, mainly by military officers. A British naval officer, Commander B. Whitehouse, mapped the entire coast-line of Victoria Nyanza. Government and railway surveys apart, the chief points of interest for explorers during 1904–1906 were the Ruwenzori range and the connexion of the basin of Lake Chad with the Niger and Congo systems. Lieut. Boyd Alexander was the leader of a party which during the years named surveyed Lake Chad and a considerable part of eastern Nigeria, returning to England via the Shari, the Ubangi and the Nile. Two members of the party, Capt. Claud Alexander and Capt. G. B. Gosling, died during the expedition. The Ruwenzori Mountains proved a great source of attraction. Sir H. H. Johnston had in 1900 ascended beyond the snow-line to 14,800 ft.; in 1903 Dr J. J. David had reached from the west to a height he believed to exceed 16,000 ft.; and in the same year Capt. T. T. Behrens, of the Anglo-German Uganda boundary commission, fixed the highest summit at 16,619 ft. During 1904–1906 some half-dozen expeditions were at work in the region. That of the duke of the Abruzzi was the most successful. In the summer of 1906 the duke or members of his party climbed all the highest peaks, none of which reaches 17,000 ft., and determined the main lines of the watershed. Major Powell-Cotton, a British officer who had previously done good work in Abyssinia and British East Africa, spent 1905–1906 in a detailed examination of the Lado enclave and the country west of Ruwenzori and Albert and Albert Edward lakes. This expedition was specially fruitful in additions to zoological knowledge.

Archaeological research, stimulated by the reports of Thomas Shaw, British consular chaplain at Algiers in 1719–1731, by James Bruce's exploration, 1765–1767, of the ruins in Barbary, and by the French conquest of Egypt in 1798, has been systematically carried out in North Africa since the middle of the 19th century (see Egypt and Africa, Roman). In South Africa the first thorough examination of the ruins in Rhodesia was made in 1905, when Randall-MacIver demonstrated that the great Zimbabwe and similar buildings were of medieval or post-medieval origin. (F. R. C.)

VII. Social and Economic Conditions

The eagerness with which the nations of western Europe partitioned Africa between them was due, as has been seen, more to the necessities of commerce than to mere land hunger. Yet, except in the north and south temperate regions, the commercial intercourse of the continent with the rest of the world had been until the closing years of the 19th century of insignificant proportions. In addition to slaves, furnished by the continent from the earliest times, a certain amount of gold and ivory was exported from the tropical regions, but no other product supplied the material for a flourishing trade with those parts. To their

Causes of isolation.

Asiatic and European invaders the Africans indeed owed many creature comforts—the introduction of maize, rice, the sugar cane, the orange, the lemon and the lime, cloves, tobacco and many other vegetable products, the camel, the horse and other animals—but invaluable to Africa as were these gifts they led to little development of commerce. The continent continued in virtual isolation from the great trade movements of the world, an isolation due not so much to its poverty in natural resources, as to the special circumstances which likewise caused so large a part of the continent to remain so long a *terra incognita*. The principal drawbacks may be summarized as: (1) the absence of means of communication with the interior; (2) the unhealthiness of the coast-lands; (3) the small productive activity of the natives; (4) the effects of the slave trade in discouraging legitimate commerce. None of these causes is necessarily permanent, that most difficult to remove being the third; the negro races finding the means of existence easy have little incentive to toil. The first drawback has almost disappeared, and the building of railways and the placing of steamers on the rivers and lakes—a work continually progressing—renders it year by year easier for producer and consumer to come together. As to the second drawback, while the coast-lands in the tropics will always remain comparatively unhealthy, improved sanitation and the destruction of the malarial mosquito have rendered tolerable to Europeans regions formerly notorious for their deadly climate.

Suppression of the slave trade.

At various periods since the partition of the continent began, united action has been taken by the powers of Europe in the interests of African trade. The Berlin conference of 1884–1885 decreed freedom of navigation and trade on the Congo and the Niger, and the Anglo-Portuguese treaty of 1891 secured like privileges for the Zambezi. The Berlin conference likewise enacted that over a wide area of Central Africa—the conventional basin of the Congo—there should be complete freedom of trade, a freedom which later on was held to be infringed in the Congo State and French Congo by the granting to various companies proprietary rights in the disposal of the product of the soil. More important in their effect on the economic condition of the continent than the steps taken to ensure freedom of trade were the measures concerted by the powers for the suppression of the slave trade. The British government had for long borne the greater part of the burden of combating the slave trade on the east coast of Africa and in the Indian Ocean, but the changed conditions which resulted from the appearance of other European powers in Africa induced Lord Salisbury, then foreign secretary, to address, in the autumn of 1888, an invitation to the king of the Belgians to take the initiative in inviting a conference of the powers at Brussels to concert measures for "the gradual suppression of the slave trade on the continent of Africa, and the immediate closing of all the external markets which it still supplies." The conference assembled in November 1889, and on the 2nd of July 1890 a general act was signed subject to the ratification of the various governments represented, ratification taking place subsequently at different dates, and in the case of France with certain reservations. The general act began with a declaration of the means which the powers were of opinion might be most effectually adopted for "putting an end to the crimes and devastations engendered by the traffic in African slaves, protecting effectively the aboriginal populations of Africa, and ensuring for that vast continent the benefits of peace and civilization." It proceeded to lay down certain rules and regulations of a practical character on the lines suggested. The act covers a wide field, and includes no fewer than a hundred separate articles. It established a zone "between the 20th parallel of north latitude, and the 22nd parallel of south latitude, and extending westward to the Atlantic and eastward to the Indian Ocean and its dependencies, comprising the islands adjacent to the coast as far as 100 nautical miles from the shore," within which the importation of firearms and ammunition was forbidden except in certain specified cases, and within which also the powers undertook either to prohibit altogether the importation and manufacture of spirituous liquors, or to impose duties not below an agreed-on minimum.[1] An elaborate series of rules was framed for the prevention of the transit of slaves by sea, the conditions on which European powers were to grant to natives the right to fly the flag of the protecting power, and regulating the procedure connected with the right of search on vessels flying a foreign flag. The Brussels Act was in effect a joint declaration by the signatory powers of their joint and several responsibility towards the African native, and notwithstanding the fact that many of its articles have proved difficult, if not impossible, of enforcement, the solemn engagement taken by Europe in the face of the world has undoubtedly exercised a material influence on the action of several of the powers. Moreover, with the increase of means of communication and the extension of effective European control, slave-raiding in the interior was largely checked and inter-tribal wars prevented, the natives being thus given security in the pursuit of trade and agriculture.

Other important factors in the economic as well as the social conditions of Africa are the advance in civilization made by the natives in several regions and the increase of the areas found suitable for white colonization. The advance in civilization among the natives, exemplified by the granting to them of political rights in such countries as Algeria and Cape Colony, leads directly to increased commercial activity; and commerce increases in a much greater degree when new countries—*e.g.* Rhodesia and British East Africa—become the homes of Europeans. Finally, in reviewing the chief factors which govern the commercial development of the continent, note must be taken of the sparsity of the population over the greater part of Africa, and the efforts made to supplement the insufficient and often ineffective native labour by the introduction of Asiatic labourers in various districts—of Indian coolies in Natal and elsewhere, and of Chinese for the gold mines of the Transvaal.

Chief economic resources.

The resources of Africa may be considered under the head of: (1) jungle products; (2) cultivated products; (3) animal products; (4) minerals. Of the first named the most important are india-rubber and palm-oil, which in tropical Africa supply by far the largest items in the export list. The rubber-producing plants are found throughout the whole tropical belt, and the most important are creepers of the order Apocynaceae, especially various species of *Landolphia* (with which genus *Vahea* is now united). In East Africa *Landolphia kirkii* (Dyer) supplies the largest amount, though various other species are known. Forms of apparently wider distribution are *L. hendelotii*, which is found in the Bahr-el-Ghazal, and extends right across the continent to Senegambia; and *L.* (formerly *Vahea*) *comorensis*, which, including its variety *L. florida*, has the widest distribution of all the species, occurring in Upper and Lower Guinea, the whole of Central Africa, the east coast, the Comoro Islands and Madagascar. In parts of East Africa *Clitandra orientalis* is a valuable rubber vine. In Lagos and elsewhere rubber is produced by the apocynaceous tree, *Funtumia elastica*, and in West Africa generally by various species of Ficus, some species of which are also found in East Africa. The rubber produced is somewhat inferior to that of South America, but this is largely due to careless methods of preparation. The great destruction of vines brought about by native methods of collection much reduced the supply in some districts, and rendered it necessary to take steps to preserve and cultivate the rubber-yielding plants. This has been done in many districts with usually encouraging results. Experiments have been made in the introduction of South American rubber plants, but opinions differ as to the prospects of success, as the plants in question seem to demand very definite conditions of soil and climate. The second product, palm-oil, is derived from a much more limited area than rubber, for although the oil palm is found throughout the greater part of West Africa, from 10° N. to 10° S., the great bulk of the export comes from the coast districts at the head of the Gulf of Guinea. A larger supply, equal to any market demand, could easily be obtained. A third valuable product is the timber supplied by the forest regions, principally in West Africa. It includes African teak or oak (*Oldfieldia africana*), excellent for shipbuilding; the durable odum of the Gold Coast (*Chlorophora excelsa*); African mahogany (*Khaya senegalensis*); ebony (*Diospyros ebenum*); camwood (*Baphia nitida*); and many other ornamental and dye woods. The timber industry on the west coast was long neglected, but since 1898 there have been large exports to Europe. In parts of East Africa the *Podocarpus milanjianus*, a conifer, is economically important. Valuable timber grows too in South Africa, including the yellow wood (*Podocarpus*), stinkwood (*Ocotea*), sneezewood or Cape ebony (*Euclea*) and ironwood.

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[1] Further conferences respecting the liquor traffic in Africa were held in Brussels in 1899 and 1906. In both instances conventions were signed by the powers, raising the minimum duty on imported spirituous liquors.

Other vegetable products of importance are: Gum arabic, obtained from various species of acacia (especially *A. senegal*), the chief supplies of which are obtained from Senegambia and the steppe regions of North Africa (Kordofan, &c.); gum copal, a valuable resin produced by trees of the leguminous order, the best, known as Zanzibar or Mozambique copal, coming from the East African *Trachylobium hornemannianum*, and also found in a fossil state under the soil; kola nuts, produced chiefly in the coast-lands of Upper Guinea by a tree of the order Sterculiaceae (*Kola acuminata*); archil or orchilla, a dye-yielding lichen (*Rocella tinctoria* and *triciformis*) growing on trees and rocks in East Africa, the Congo basin, &c.; cork, the bark of the cork oak, which flourishes in Algeria; and alfa, a grass used in paper manufacture (*Machrochloa tenacissima*), growing in great abundance on the dry steppes of Algeria, Tripoli, &c. A product to which attention has been paid in Angola is the Almeidina gum or resin, derived from the juice of *Euphorbia tirucalli*.

The cultivated products include those of the tropical and warm temperate zones. Of the former, coffee is perhaps the most valuable indigenous plant. It grows wild in many parts, the home of one species being in Kaffa and other Galla countries south of Abyssinia, and of another in Liberia. The Abyssinian coffee is equal to the best produced in any other part of the world. Cultivation is, however, necessary to ensure the best results, and attention has been given to this in various European colonies. Plantations have been established in Angola, Nyasaland, German East Africa, Cameroon, the Congo Free State, &c.

Copra, the produce of the cocoa-nut palm, is supplied chiefly by Zanzibar and neighbouring parts of the east coast. Ground-nuts, produced by the leguminous plant, *Arachis hypogaea*, are grown chiefly in West Africa, and the largest export is from Senegal and the Gambia; while Bambarra ground-nuts (*Voandzeia subterranea*) are very generally cultivated from Guinea to Natal. Cloves are extensively grown on Zanzibar and Pemba islands, Pemba being the chief source of the world's supply of cloves. The chief drawbacks to the industry are the fluctuations of the yield of the trees, and the risk of over-production in good seasons.

Cotton grows wild in many parts of tropical Africa, and is exported in small quantities in the raw state; but the main export is from Egypt, which comes third among the world's sources of supply of the article. It is also cultivated in West Africa—the industry in the Guinea coast colonies having been developed since the beginning of the 20th century—and in the Anglo-Egyptian Sudan, whence came the plants from which Egyptian cotton is grown. Sugar, which is the staple crop of Mauritius, and in a lesser degree of Réunion, is also produced in Natal, Egypt, and, to a certain extent, in Mozambique. Dates are grown in Tunisia and the Saharan oases, especially Tafilet; maize in Egypt, South Africa and parts of the tropical zone; wheat in Egypt, Algeria and the higher regions of Abyssinia; rice in Madagascar. Wine is largely exported from Algeria, and in a much smaller quantity from Cape Colony; fruit and vegetables from Algeria. Tobacco is widely grown on a small scale, but, except perhaps from Algeria, has not become an important article of export, though plantations have been established in various tropical colonies. The cultivation of cocoa has proved successful in the Gold Coast, Cameroon and other colonies, and in various districts the tea plant is cultivated.

Indigo, though not originally an African product, has become naturalized and grows wild in many parts, while it is also cultivated on a small scale. The main difficulty in the way of tropical cultivation is the labour question, which has already been referred to.

Of animal products one of the most important is ivory, the largest export of which is from the Congo Free State. The diminution in the number of elephants with the opening up of the remoter districts must in time cause a falling-off in this export. Beeswax is obtained from various parts of the interior of West Africa, and from Madagascar. Raw hides are exported in large quantities from South Africa, as are also the wool and hair of the merino sheep and Angora goat. Both hides and wool are also exported from Algeria and Morocco, and hides from Abyssinia and Somaliland. Ostrich feathers are produced chiefly by the ostrich farms of Cape Colony, but some are also obtained from the steppes to the north of the Central Sudan. Live stock, principally sheep, is exported from Algeria and cattle from Morocco.

Mineral Wealth.

The exploited minerals of Africa are confined to a few districts, the resources of the continent in this respect being largely undeveloped. Since the discovery of gold in the Transvaal, particularly in the district known as the Rand (1885), the output has grown enormously, so that in 1898 the output of gold from South Africa was greater than from any other gold-field in the world. The Anglo-Boer War of 1899–1902 lost the Rand the leading position, but by 1905 the output—in that year over £20,800,000—was greater than it had ever been. The supply of gold from South Africa is roughly 25% of the world's output. The gold-yielding formations extend northwards through Rhodesia. The Gold Coast is so named from the quantity of gold obtained there, and since the close of the 19th century the industry has developed largely in the hands of Europeans. In the Galla countries gold has long been an article of native commerce. It is also found in various parts of the Anglo-Egyptian Sudan and along the western shore of the Red Sea. Diamonds are found in large quantities in a series of beds known as the Kimberley shales, the principal mines being at Kimberley, Cape Colony. Diamonds are also found in Orange River Colony, while one of the richest diamond mines in the world—the Premier—is situated in the Transvaal near Pretoria. Some 80% of the world's production of diamonds comes from South Africa. Copper is found in the west of Cape Colony, in German South-West Africa, and in the Katanga country in the southern Congo basin, where vast beds of copper ore exist. There are also extensive deposits of copper in the Broken Hill district of Northern Rhodesia. It also occurs in Morocco, Algeria, the Bahr-el-Ghazal, &c. Rich tin deposits have been found in the southern Congo basin and in Northern Rhodesia. Iron is found in Morocco, Algeria (whence there is an export trade), and is widely diffused, and worked by the natives, in the tropical zone. But the deposits are generally not rich. Coal is worked, principally for home consumption, in Cape Colony, Natal, the Transvaal, Orange River Colony, and in Rhodesia in the neighbourhood of the Zambezi. Coal deposits also exist in the German territory north of Lake Nyasa. Phosphates are exported from Algeria and Tunisia. Of other minerals which occur, but are little worked, zinc, lead and antimony are found in Algeria, lead and manganese in Cape Colony, plumbago in Sierra Leone.

The imports from foreign countries into Africa consist chiefly of manufactured goods, varying in character according to the development of the different countries in civilization. In Egypt, Algeria and South Africa they include most of the necessaries and luxuries of civilized life, manufactured cotton and woollen goods, especially the former, taking the first place, but various food stuffs, metal goods, coal and miscellaneous articles being also included. In tropical Africa, and generally where few Europeans have settled, the great bulk of the imports consists as a rule of cotton goods, articles for which there is a constant native demand.

No continent has in the past been so lacking in means of

Development of means of communication.

communication as Africa, and it was only in the last decade of the 19th century that decided steps were taken to remedy these defects. The African rivers, with the exception of the middle Congo and its affluents, and the middle course of the three other chief rivers, are generally unfavourable to navigation, and throughout the tropical region almost the sole routes have been native footpaths, admitting the passage of a single file of porters, on whose heads all goods have been carried from place to place. Certain of these native trade routes are, however, much frequented, and lead for hundreds of miles from the coast to the interior. In the desert regions of the north transport is by caravans of camels, and in the south ox-wagons, before the advent of railways, supplied the general means of locomotion. The native trade routes led generally from the centres of greatest population or production to the seaports by the nearest route, but to this rule there was a striking exception. The dense forests of Upper Guinea and the upper Congo proved a barrier which kept the peoples of the Sudan from direct access to the sea, and from Timbuktu to Darfur the great trade routes were either west to east or south to north across the Sahara. The principal caravan routes across the desert lead from different points in Morocco and Algeria to Timbuktu; from Tripoli to Timbuktu, Kano and other great marts of the western and central Sudan; from Bengazi to Wadai; and from Assiut on the Nile through the Great Oasis and the Libyan desert to Darfur. South of the equator the principal long-established routes are those from Loanda to the Lunda and Baluba countries; from Benguella via Bihé to Urua and the upper Zambezi; from Mossamedes across the Kunene to the upper Zambezi; and from Bagamoyo, opposite Zanzibar, to Tanganyika. Many of the native routes have been superseded by the improved communications introduced by Europeans in the utilization of waterways and the construction of roads and railways. Steamers have been conveyed overland in sections and launched on the interior waterways above the obstructions to navigation. On the upper Nile and Albert Nyanza their introduction was due to Sir S. Baker and General C. G. Gordon (1871–1876); on the middle Congo and its affluents to Sir H. M. Stanley and the officials of the Congo Free State, as well as to the Baptist missionaries on the river; and on Lake Nyasa to the supporters of the Scottish mission. A small vessel was launched on Victoria Nyanza in 1896 by a British mercantile firm, and a British government steamer made its first trip in November 1900. On the other great lakes and on most of the navigable rivers steamers were plying regularly before the close of the 19th century. However, the shallowness of the water in the Niger and Zambezi renders their navigation possible only to light-draught steamers. Roads suitable for wheeled traffic are few. The first attempt at road-making in Central Africa on a large scale was that of Sir T. Fowell Buxton and Mr (afterwards Sir W.) Mackinnon, who completed the first section of a track leading into the interior from Dar-es-Salaam (1879). A still more important undertaking was the "Stevenson road," begun in 1881 from the head of Lake Nyasa to the south end of Tanganyika, and constructed mainly at the expense of Mr James Stevenson, a director of the African Lakes Company—a company which helped materially in the opening up of Nyasaland. The Stevenson road forms a link in the "Lakes route" into the heart of the continent. In British East Africa a road connecting Mombasa with Victoria Nyanza was completed in 1897, but has since been in great measure superseded by the railway. Good roads have also been made in German East Africa and Cameroon and in Madagascar.

Railways, the chief means of affording easy access to the interior of the continent, were for many years after their first introduction to Africa almost entirely confined to the extreme north and south (Egypt, Algeria, Cape Colony and Natal). Apart from short lines in Senegal, Angola and at Lourenço Marques, the rest of the continent was in 1890 without a railway system. In Egypt the Alexandria and Cairo railway dates from 1855, while in 1877 the lines open reached about 1100 miles, and in 1890, in addition to the lines traversing the delta, the Nile had been ascended to Assiut. In Algeria the construction of an inter-provincial railway was decreed in 1857, but was still incomplete twenty years later, when the total length of the lines open hardly exceeded 300 miles. Before 1890 an extension to Tunis had been opened, while the plateau had been crossed by the lines to Ain Sefra in the west and Biskra in the east. In Senegal the railway from Dakar to St Louis had been commenced and completed during the 'eighties, while the first section of the Senegal-Niger railway, that from Kayes to Bafulabe, was also constructed during the same decade. In Cape Colony, where in about 1880 the railways were limited to the neighbourhood of Cape Town, Port Elizabeth and East London, the next decade saw the completion of the trunk-line from Cape Town to Kimberley, with a junction at De Aar with that from Port Elizabeth. The northern frontier had, however, nowhere been crossed. In Natal, also, the main line had not advanced beyond Ladysmith. The settlement, *c.* 1890, of the main lines of the partition of the continent was followed by many projects for the opening up of the possessions and spheres of influence of the various powers by the building of railways; several of these schemes being carried through in a comparatively short time. The building of railways was undertaken by the governments concerned, nearly all the African lines being state-owned. In the Congo Free State a railway, which took some ten years to build, connecting the navigable waters of the lower and middle Congo, was completed in 1898, while in 1906 the middle and upper courses of the river were linked by the opening of a line past Stanley Falls. Thus the vast basin of the Congo was rendered easily accessible to commercial enterprise. In North Africa the Algerian and Tunisian railways were largely extended, and proposals were made for a great trunk-line from Tangier to Alexandria. The railway from Ain Sefra was continued southward towards Tuat, the project of a trans-Saharan line having occupied the attention of French engineers since 1880. In French West Africa railway communication between the upper Senegal and the upper Niger was completed in 1904; from the Guinea coast at Konakry another line runs north-east to the upper Niger, while from Dahomey a third line goes to the Niger at Garu. In the British colonies on the same coast the building of railways was begun in 1896. A line to Kumasi was completed in 1903, and the line from Lagos to the lower Niger had reached Illorin in 1908. Thence the railway was continued to the Niger at Jebba. From Baro, a port on the lower Niger which can be reached by steamers all the year round, another railway, begun in 1907, goes via Bida, Zungeru and Zaria to Kano, a total distance of 400 miles. A line from Jebba to Zungeru affords connexion with the Lagos railway.

But the greatest development of the railway systems was in the south and east of the continent. In British East Africa a survey for a railway from Mombasa to Victoria Nyanza was made in 1892. The first rails were laid in 1896 and the line reached the lake in December 1901. Meanwhile, there had been a great extension of railways in South Africa. Lines from Cape Town, Port Elizabeth, East London, Durban and Delagoa Bay all converged on the newly risen city of Johannesburg, the centre of the Rand gold mines. A more ambitious project was that identified with the name of Cecil Rhodes, namely, the extension northward of the railway from Kimberley with the object of effecting a continuous railway connexion from Cape Town to Cairo. The line from Kimberley reached Bulawayo in 1897. (Bulawayo is also reached from Beira on the east coast by another line, completed in 1902, which goes through Portuguese territory and Mashonaland.) The extension of the line northward from Bulawayo was begun in 1899, the Zambezi being bridged, immediately below the Victoria Falls, in 1905. From this point the railway goes north to the Katanga district of the Congo State. In the north of the continent a step towards the completion of the Cape to Cairo route was taken in the opening in 1899 of the railway from Wadi Halfa to Khartum. A line of greater economic importance than the last named is the railway (completed in 1905) from Port Sudan on the Red Sea to the Nile a little south of Berber, thus placing the Anglo-

Egyptian Sudan within easy reach of the markets of the world. A west to east connexion across the continent by rail and steamer, from the mouth of the Congo to Port Sudan, was arranged in 1906 when an agreement was entered into by the Congo and Sudan governments for the building of a railway from Lado, on the Nile, to the Congo frontier, there to meet a railway starting from the river Congo near Stanley Falls. A railway of considerable importance is that from Jibuti in the Gulf of Aden to Harrar, giving access to the markets of southern Abyssinia.

Besides the railways mentioned there are several others of less importance. Lines run from Loanda and other ports of Angola towards the Congo State frontier, and from Tanga and Dar-es-Salaam on the coast of German East Africa towards the great lakes. In British Central Africa a railway connects Lake Nyasa with the navigable waters of the Shiré, and various lines have been built by the French in Madagascar.

All the main railways in South Africa, the lines in British West Africa, in the Anglo-Egyptian Sudan and in Egypt south of Luxor are of 3 ft. 6 in. gauge. The main lines in Lower Egypt and in Algeria and Tunisia are of 4 ft. 8½ in. gauge. Elsewhere as in French West and British East Africa the lines are of metre (3·28 ft.) gauge.

The telegraphic system of Africa is on the whole older than that of the railways, the newer European possessions having in most cases been provided with telegraph lines before railway projects had been set on foot. In Algeria, Egypt and Cape Colony the systems date back to the middle of the 19th century, before the end of which the lines had in each country reached some thousands of miles. In tropical Africa the systems of French West Africa, where the line from Dakar to St Louis was begun in 1862, were the first to be fully developed, lines having been carried from different points on the coast of Senegal and Guinea towards the Niger, the main line being prolonged northwest to Timbuktu, and west and south to the coast of Dahomey. The route for a telegraph line to connect Timbuktu with Algeria was surveyed in 1905. The Congo region is furnished with several telegraphic systems, the longest going from the mouth of the river to Lake Tanganyika. From Ujiji on the east coast of that lake there is telegraphic communication via Tabora with Dar-es-Salaam and via Nyasa and Rhodesia with Cape Town. The last-named line is the longest link in the trans-continental line first suggested in 1876 by Sir (then Mr) Edwin Arnold and afterwards taken up by Cecil Rhodes. The northern link from Egypt to Khartum has been continued southward to Uganda, while another line connects Uganda with Mombasa. At the principal seaports the inland systems are connected with submarine cables which place Africa in telegraphic communication with the rest of the world.

Numerous steamship lines run from Great Britain, Germany, France and other countries to the African seaports, the journey from any place in western Europe to any port on the African coast occupying, by the shortest route, not more than three weeks. (E. HE., F. R. C.)

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AFRICA, ROMAN. The Romans gave the name of Africa to that part of the world which the Greeks called Libya (Λιβύη). It comprised the whole of the portion of the African continent known to the ancients, except Egypt and Ethiopia. But besides this general sense, which occurs in Pliny (iii. 3), Pomponius Mela (i. 8) and other authors, the official and administrative language used the word Africa in a narrower sense, which is noticed below. The term was certainly borrowed by the Romans from the language of the natives. In Latin literature it was employed for the first time by the poet Ennius, who wrote in the interval between the First and Second Punic Wars (*Ann.* vi. *Sat.* iii.). By him the term was confined to the territory of

Carthage and the regions composing the eastern group of the Atlas. Among the numerous conjectures which have been made as to the etymology of the term Africa ('Αφρική) may be quoted that which derives it from the Semitic radical פרר ("separate"), Africa being considered, in this connexion, as a Phoenician settlement "separated" from the mother country, Asiatic Phoenicia. It has also been held that the word Africa comes from *friqi*, *farikia* (the country of fruit). The best hypothesis in the writer's opinion is that maintained by Charles Tissot, who sees in the word "Africa" the name of the great Berber tribe, the Aourigha (whose name would have been pronounced Afarika), the modern Aouraghen, now driven back into the Sahara, but in ancient times the principal indigenous element of the African empire of Carthage (Tissot, *Géogr. comp.* i. 389). Thus Africa was originally, in the eyes of the Romans and Carthaginians alike, the country inhabited by the great tribe of Berbers or Numidians called Afarik. Cyrenaica, on the east, attached to Egypt, was then excluded from it, and, similarly, Mauretania, on the west.

At the time of the Third Punic War the Africa of the Carthaginians was but a fragment of their ancient native empire. It comprised the territory bounded by a vague line running from the mouth of the Tusca (Wad el Kebir), opposite the island of Tabraca (Tabarca), as far as the town of Thenae (Tina), at the mouth of the Gulf of Gabes. The rest of Africa had passed into the hands of the kings of Numidia, who were allies of the Romans.

After the capture of Carthage by Scipio (146 B.C.) this territory was erected into a Roman province, and a trench, the *fossa regia*, was dug to mark the boundary of the Roman province of Africa and the dominions of the Numidian princes. There have been discovered (1907) the remains of this ditch protected by a low wall or a stone dyke; some of the boundary stones which marked its course, and inscriptions mentioning it, have also been found. From Testur on the Mejerda the *fossa regia* can be followed by these indications for several miles along the Jebel esh-Sheid. The ditch ran northward to Tabarca and southward to Tina. The importance of the discoveries lies in the fact that the ditch which in later times divided the provinces of Africa *vetus* and Africa *nova* was at the time of the Third Punic War the boundary of Carthaginian territory (R. Cagnat, "Le fossé des frontières romaines" in *Mélanges Boissier*, 1905, p. 227; L. Poinssot in *Comptes rendus de l'Acad. des Inscript. et Belles Lettres*, 1907, p. 466; *Classical Review*, 1907, December, p. 255). The government of the Roman province thus delimited was entrusted to a *praetor* or *propraetor*, of whom several are now known, *e.g.* P. Sextilius, *propraetor Africae*, according to coins of Hadrumetum of the year 94 B.C. The towns which had fought on the side of the Romans during the Third Punic War were declared *civitates liberae*, and became exceedingly prosperous. They were Utica (Bu Shatir), Hadrumetum (Susa), Thapsus (Dimas), Leptis Minor (Lemta), Achulla (Badria), Uzalis (about 11 m. from Utica) and Theudalis. Those towns, however, which had remained faithful to Carthage were destroyed, like Carthage itself.

After the Jugurthine war in 106, the whole of the *regio Tripolitana*, comprising Leptis Magna (Lebda), Oea (Tripoli), Sabrata, and the other towns on the littoral of the two Syrtes, appears to have been annexed to the Roman province in a more or less regular manner (Tissot ii. 21). The battle of Thapsus in 46 made the Romans definitely masters of Numidia, and the spheres of administration were clearly marked out. Numidia was converted into a new province called "Africa Nova," and of this province the historian Sallust was appointed proconsul and invested with the *imperium*. From that time the old province of Africa was known as "Africa Vetus" or "Africa Propria."

This state of affairs, however, lasted but a short time. In 31 B.C. Octavius gave up Numidia, or Africa Nova, to King Juba II. Five years later Augustus gave Mauretania and some Gaetulian districts to Juba, and received in exchange Numidia, which thus reverted to direct Roman control. Numidia, however, no longer formed a distinct government, but was attached to the old province of Africa. From 25 B.C. the Roman province of Africa comprised the whole of the region between the mouth of the Ampsaga (Wad Rummel, Wad el Kebir) on the west, and the two tumuli called the altars of the Philaeni, the immutable boundary between Tripolitana and Cyrenaica, on the east (Tissot ii. 261). In the partition of the government of the provinces of the Roman empire between the senate and the emperor, Africa fell to the senate, and was henceforth administered by a proconsul. Subordinate to him were the *legati pro consule*, who were placed at the head of districts called dioceses. At first there were only three dioceses: *Carthaginiensis*, *Hipponiensis* (headquarters Hippo Diarrhytus, now Bizerta), and *Numidica* (headquarters Cirta, now Constantine). At a later date the *diocesis Hadrumetina* was formed, and perhaps at some date unknown the *diocesis Tripolitana*.

The province of Africa was the only senatorial province whose governor had originally been invested with military powers. The proconsul of Africa, in fact, had command of the *legio III. Augusta* and the auxiliary corps. But in A.D. 37 Caligula deprived the proconsul of his military powers and gave them to the imperial legate (*legatus Augusti pro praetore provinciae Africae*), who was nominated directly by the emperor, and whose special duty it was to guard the frontier zone (Tacitus, *Hist.* iv. 48; Dio Cass. lix. 20). The headquarters of the imperial legate were originally at Cirta and afterwards at Lambaesa (Lambessa). The military posts were drawn up in échelon along the frontier of the desert, especially along the southern slopes of the Aurès, as far as Ad Majores (Besseriani), and on the Tripolitan frontier as far as Cydamus (Ghadamès), forming an immense arc extending from Cyrenaica to Mauretania. A network of military routes, constructed and kept in repair by the soldiers, led from Lambaesa in all directions, and stretched along the frontier as far as Leptis Magna, passing Theveste (Tebessa), Thenae and Tacape (Gabès). The powers of the proconsul, however, extended scarcely beyond the ancient Africa Vetus and the towns on the littoral. Towards 194 Septimius Severus completed the reform of Caligula by detaching from the province of Africa the greater part of Numidia to constitute a special province governed by a *procurator*, subordinate to the imperial legate and resident at Cirta (Tissot ii. 34). This province was called Numidia Cirtensis, as opposed to Numidia Inferior or proconsular Numidia.

In Diocletian's great reform of the administrative system of the empire, the whole of Roman Africa, with the exception of Mauretania Tingitana (which was attached to the province of Spain), constituted a single diocese subdivided into six provinces: Zeugitana (Carthage), Byzacium (Hadrumetum, now Susa), Numidia Cirtensis (Cirta, Constantine), Tripolitana (Tripolis), Mauretania Sitifensis (Sitifis, Setif), and Mauretania Caesariensis (Caesarea, now Cherchel). These provinces were administered, according to circumstances, by a *praeses* of senatorial rank, a *legatus pro praetore*, or a *vir clarissimus consularis*. Some changes were eventually necessitated by the wars with the Moors and the Vandals. By a treaty concluded in 476, the emperor Zeno recognized Genseric as master of all Africa. Reconquered by Belisarius in 534, Africa formed, under the name of *praefectura Africae*, one of the great administrative districts of the Byzantine empire. It was subdivided into six provinces, which were placed under the authority of the praetorian prefect of Africa. These provinces were Zeugitana (the former Proconsularis), Carthage, Byzacium, Tripolitana, Numidia and Mauretania. The civil government was carried on by *consulares* or *praesides*, while the military government was in the hands of four *duces militum*, who made strenuous efforts to drive out the barbarians. The country was studded thickly with *burgi* (small forts) and *clausurae* (long walls), the ruins of which still subsist. In 647 the Arabs penetrated into *Ifrikia*, which was destined to fall for ever out of the grasp of the Romans. In 697 Carthage was taken.

The bulk of the population of Roman Africa was invariably composed of three chief elements: the indigenous Berber tribes, the ancient Carthaginians of Phoenician origin and the Roman colonists. The Berber tribes, whose racial unity is attested by their common spoken language and by the comparatively numerous Berber inscriptions that have come down to us, bore in ancient times the generic names of Numidians, Gaetulians and Moors or Maurusiani. Herodotus mentions a great number of these tribes. During the Roman period, according to Pliny, there were settlements of 26 indigenous tribes extending from the Ampsaga as far as Cyrenaica. The much more detailed list of Ptolemy enumerates 39 indigenous tribes in the province of Africa and 25 in Mauretania Caesariensis. Ammianus Marcellinus, Procopius and Flavius Cresconius Corippus give still further names. Besides the Afri (Aourigha) of the territory of Carthage, the principal tribes that took part in the wars against the Romans were the Lotophagi, the Garamantes, the Maces, the Nasamones in the regions of the S.E., the Misulani or Musulamii (whence the name Mussulman), the Massyli and the Massaesyli in the E., who were neighbours of the Moors. The non-nomads of these Libyan tribes dwelt in huts made of stakes supporting plaited mats of rush or asphodel. These dwellings, which were called *mapalia*, are the modern *gourbis*. African epigraphy has revealed the names of some of their deities: *deus invictus Aulisva*; the god Motmanius, associated with Mercury; the god Lilleus; *Baldir Augustus; Kautus pater*; the goddess Gilva, identified with Tellus, and *Ifru Augustus* (Tissot i. 486). The *Johannis* of Corippus mentions three native divinities: Sinifere, Mastiman and Gurzil. There were also local divinities in all the principal districts. The rock bas-reliefs and other monuments showing native divinities are rare, and give only very summary representations. Dolmens, however, occur in great numbers in Tunisia and the province of Constantine. Tumuli, too, are found throughout northern Africa, the most celebrated being that near Cherchel, the Kubr-er-Rumia (" tomb of the Christian lady "), which was regarded by Pomponius Mela as the royal burying-place of the kings of Numidia.

During the Roman period the ancient Carthaginians of Phoenician origin and the bastard population termed by ancient authors Libyo-Phoenicians, like the modern Maltese, invariably formed the predominant population of the towns on the littoral, and retained the Punic language until the 6th century of the Christian era. The municipal magistrates took the title of *suffetes* in place of that of *duumvirs*, and in certain towns the Christian bishops were obliged to know the *lingua Punica*, since it was the only language that the people understood. Nevertheless, the Roman functionaries, the army and the colonists from Italy soon brought the Latin element into Africa, where it flourished with such vigour that, in the 3rd century, Carthage became the centre of a Romano-African civilization of extraordinary literary brilliancy, which numbered among its leaders such men as Apuleius, Tertullian, Arnobius, Cyprian, Augustine and many others.

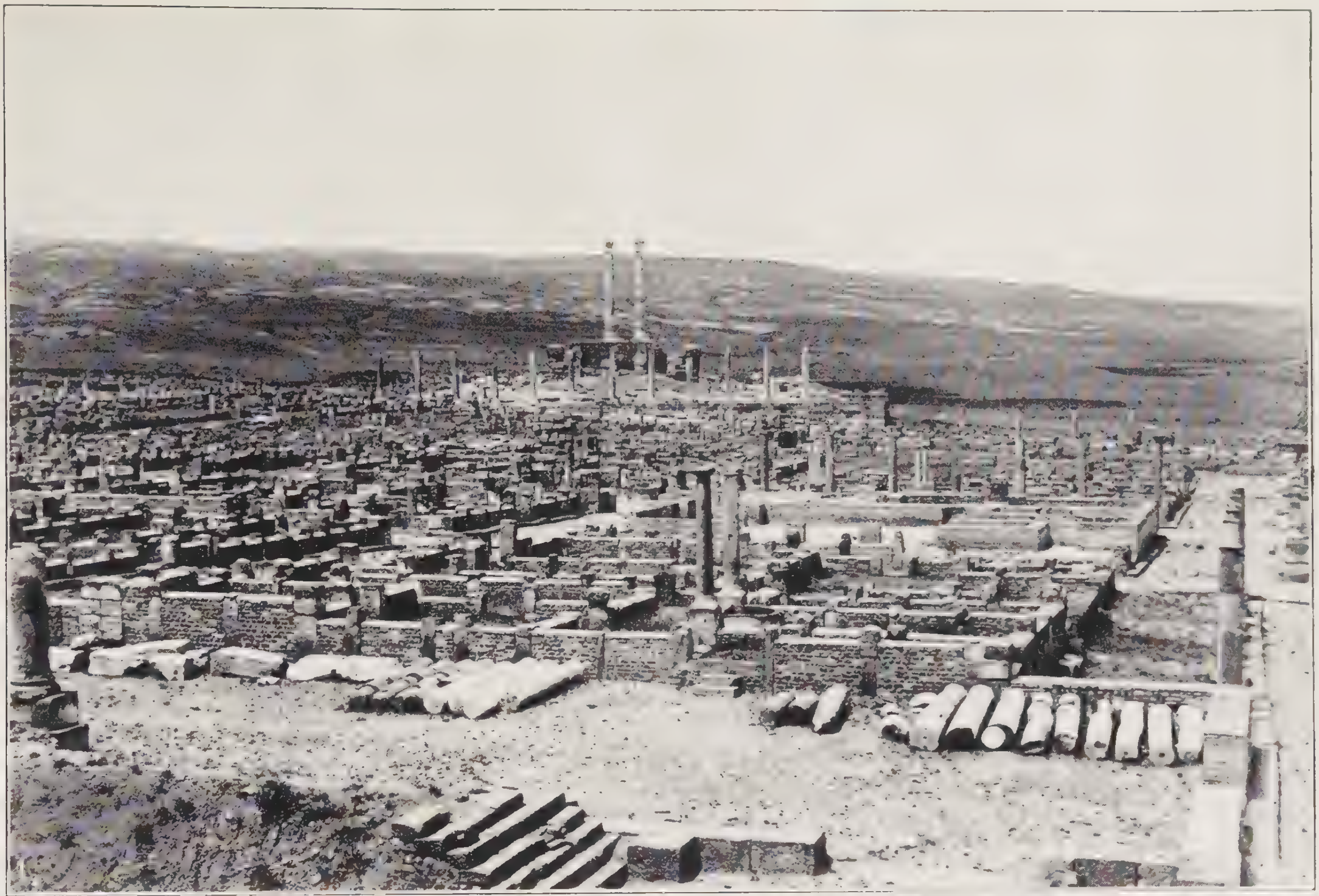
Carthage regained its rank of capital of Africa under Augustus, when thousands of Roman colonists flocked to the town. Utica became a Roman colony under Hadrian, and the *civitates liberae*, *municipia*, *castella*, *pagi* and *turres* were peopled with Latins. The towns of the ancient province of Africa which received *coloniae* were very numerous: Abitensis (*civitas Avittensis Bibba*), Bisica Lucana (Tastour), Byzacium, Capsa (Gafsa), Carthage, Cuina, Curubis (Kurba), Hadrumetum (Susa), Hippo Diarrhytus or Zarytus (Bizerta), Leptis Magna (Lebda), Maxula (Ghades, Rades or Gades), Neapolis (Nabel, Nebeul), Oea (Tripoli), Sabrata (Zoara), *colonia Scillitana* (Ghasrin), Sufes (Sbiba), Tacape (Gabes), Thaenae or Thenae (Tina), Thelepte (Medinet Kedima), Thugga (Dugga), Thuburbo maius (Kasbat), Thysdrus (El Jem), Uthina (Wadna) and Vallis (Median). Of the *municipia* may be mentioned Gigthis or Gigthi (Bu Grara), Thibussicensium Bure (Tebursuk), Zita and the *turris Tamalleni* (Telmin).

The province of Numidia was at first colonized principally by the military settlements of the Romans. Cirta (Constantine) and Bulla Regia (Hammam Darraj), its chief towns, received *coloniae* of soldiers and veterans, as well as Theveste (Tebessa) and Thamugas (Timgad). The fine ruins which have been discovered at the last-mentioned place have earned for it the surname of the African Pompeii (see below).

Archaeology.—Roman Africa has been the subject of innumerable historical and archaeological researches, especially since the conquest of Algeria and Tunisia by the French. The country is covered with Roman and Byzantine remains. Each of these ruins has been visited by archaeologists who have copied inscriptions, described the temples, triumphal arches, porticos, mausoleums and the other monuments which are still standing, collected statues or other antiquities; and in many cases they have actually excavated. The results of all these labours have been published, from about 1850 onwards, annually, and, indeed, almost from day to day, in various scientific periodicals. Among the principal of these are:—*Mémoires de la Société archéologique de Constantine*, *Bulletin de la Société géographique et archéologique d'Oran*, *Revue africaine* of Algiers, to which we should add the *Revue archéologique* of Paris, the *Archives des missions scientifiques* and the *Bulletin archéologique du Comité des travaux historiques* and the *Mélanges* of the French School at Rome. In all the towns of Algeria and Tunisia museums have been founded for storing the antiquities of the region; the most important of these are the museums of St Louis, Carthage and the palace of Bardo (musée Alaoui) near Tunis, those of Susa, Constantine, Lambessa, Timgad, Tebessa, Philippeville, Cherchel and Oran. Under the title of *Musées et collections archéologiques de l'Algérie et de la Tunisie*, the Ministry of Public Instruction publishes from time to time illustrated descriptions of all these archaeological treasures. In this collection have already appeared descriptions of the museums of Algiers by G. Doublet; of Constantine by G. Doublet and P. Gauckler; of Oran by R. de La Blanchère; of Cherchel by P. Gauckler; of Lambessa by R. Cagnat; of Philippeville by S. Gsell and Bertrand; of the Bardo by R. de La Blanchère and P. Gauckler; of Carthage by R. P. Delattre; of Tebessa by S. Gsell; of Susa by P. Gauckler; of Timgad by R. Cagnat and A. Ballu.

The archaeological exploration of Algeria has kept pace with the expansion of French dominion. From 1846 to 1854 Delamarre published his *Exploration archéologique de l'Algérie*, in collaboration with the French officers. In 1850 Léon Renier was officially instructed to collect all the inscriptions in Algeria which should be found by the military expeditionary columns. This scholar examined first the ruins of Lambessa, an account of which he published in 1854 in his *Mélanges d'épigraphie*; subsequently he made his important collection of *Inscriptions romaines de l'Algérie* (1855–1858) which formed the groundwork of the volume of the *Corpus Inscr. Lat.* of the Academy of Berlin, devoted to Roman Africa. A little later General Faidherbe published his *Collection complète des inscriptions numidiques* (1870). Apart from the province of Constantine, Algeria is less rich in Roman remains than Tunisia; mention must, however, be made of the excavations of Victor Waille at Cherchel, where were found fine statues in the Greek style of the time of King Juba II.; of P. Gavault at Tigzirt (Rusuccuru), and finally of those of Stéphane Gsell at Tipasa (basilica of St Salsa) and throughout the district of Setif and at Khamissa (Thuburticum Numidarum). In the department of Constantine, which is peculiarly rich in Roman remains, Tebessa has been most carefully explored by M. Héron de Villefosse, who has laid bare a beautiful temple of Jupiter, a triumphal arch of Caracalla, a Byzantine basilica and the gate of the Byzantine general Solomon. But all these ruins fade into insignificance in comparison with the majestic grandeur of those of Timgad which are almost entirely laid bare; they are described in *Timgad, une cité africaine sous l'empire romain*, by R. Cagnat, G. Boeswillwald and A. Ballu.

In Tunisia, Carthage early became the object of archaeological investigation. Major Humbert was sent there by Napoleon in 1808 and his notes are still preserved in the museum of Leiden. Chateaubriand visited and described the ruins; the Dane Falbe, the Englishman Nathan Davis, Beulé, P. de Sainte-Marie and others also have carried out researches; for more than twenty years Père Delattre has explored the ruins of Carthage (*q.v.*) with extraordinary success. For the rest of Tunisia, the first explorer interested in archaeology was Victor Guérin in 1860; his results are contained in his remarkable *Voyage archéologique dans la Régence de Tunis* (1862, 2 vols.). A. Daux, in the years preceding 1869, explored the sites of the



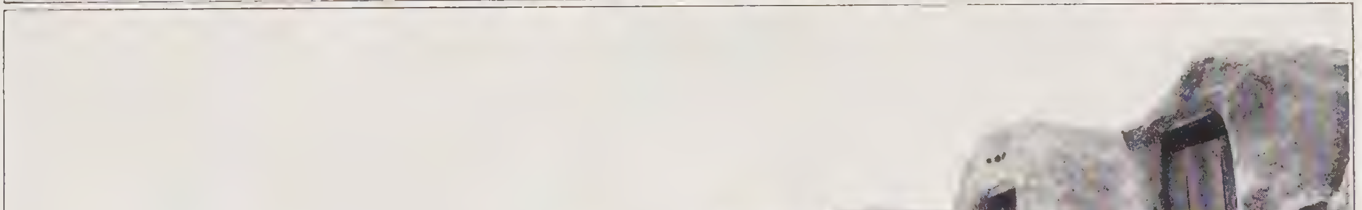


Fig. 1. THE RUINS OF TIMGAD (ANCIENT THAMUGAS) LOOKING TOWARD THE CAPITOL, WITH ITS LOFTY CORINTHIAN COLUMNS (45 FT. HIGH). Fig. 2. ANCIENT RUINS, ALGERIA

The southern shore of the Mediterranean sea has at times played an important part in world affairs. The Phoenician, Carthaginian, Roman, Vandal, Arab, Turk each has left traces of his domination. For the latest discoveries in its rich and varied archaeology, see the article Archaeology, *Africa, North and Tripoli*, Vol. 29.

(Fig. 1. Photo, Elmendorf, from Ewing Galloway. Fig. 2. "Wide World.")

ancient harbours of Utica, Hadrumetum, Thapsus (Dimas). But it was the occupation of Tunisia by the French in 1881 which really gave the impetus to modern investigations in this district of ruined cities. They were put on a solid foundation by the publication of the *Géographie comparée* of Charles Tissot (1884). Trained scholars were sent there annually by the French government: Cagnat, Saladin, Poinssot, La Blanchère, S. Reinach, E. Babelon, Carton, Audollent, Stéph. Gsell, J. Toutain, Espérandieu, Gauckler, Merlin, Homo and many others, to say nothing of German scholars, such as Willmans and Schulten, and especially of a great number of enthusiastic officers of the army of occupation, who explored all the ancient sites, and in many cases excavated with great success (for their results see the works quoted above). It would be impossible to enumerate here all the monographs describing, for example, the ruins of Carthage, those of the temple of the waters at Mount Zaghuan, the amphitheatre of El Jem (Thysdrus), the temple of Saturn, the royal tomb and the theatre of Dugga (Thugga), the bridge of Chemtu (Simitthu), the ruins and cemeteries of Tebursuk and Medeina (*Althiburus*), the rich villa of the Laberii at Wadna (*Uthina*), the sanctuary of Saturn Balcaranensis on the hill called Bu-Kornaïn, the ruins of the district of Enfida (Aphrodisium, Uppenna, Segermes), those of Leptis minor (Lemta), of Thenae (near Sfax), those of the island of Meninx (Jerba), of the peninsula of Zarzis, of Mactar, Sbeitla (Sufetula), Gigthis (Bu-Grara), Gafsa (Capsa), Kef (Sicca Veneria), Bulla Regia, &c.

From this accumulation of results most valuable evidence as to the history and more especially the internal administration of Africa under the Romans has been derived. In particular we know how rural life was there developed, and with what care the water necessary for the growing of cereals was everywhere provided. Sculpture throughout the district is very provincial and of minor importance; the only exceptions are certain statues found at Carthage and Cherchel, the capital of the Mauretanian kings.

AUTHORITIES.—Among general works on the subject may be mentioned: Morcelli, *Africa christiana* (1816); Gustave Boissière, *L'Algérie romaine* (2nd ed., 1883); E. Mercier, *Histoire de l'Afrique septentrionale* (1888); Charles Tissot, *Géographie comparée de la province romaine d'Afrique* (1884–1888), with atlas; Vivien de Saint-Martin, *Le Nord de l'Afrique dans l'antiquité grecque et romaine* (1883); Gaston Boissier, *L'Afrique romaine* (1895); Cl. Pallu de Lessert, *Fastes des provinces africaines* (*Proconsulaire, Numidie, Maurétanie*) *sous la domination romaine* (1896–1901); R. Cagnat, *L'Armée romaine d'Afrique* (1892); A. Daux, *Les Emporia phéniciens dans le Zeugis et le Byzacium* (1869); Ludwig Muller, *Numismatique de l'ancienne Afrique* (1860–1862; Supplement, 1874); Ch. Diehl, *L'Afrique byzantine* (1896); Stéphane Gsell, *Recherches archéologiques en Afrique* (1893); Paul Monceaux, *Histoire littéraire de l'Afrique chrétienne* (1901–1905); J. Toutain, *Les Cités romaines de la Tunisie* (1895); *Atlas archéologique de la Tunisie*, published by the Ministry of Public Instruction (1895 foll.); *Atlas archéologique de l'Algérie*, published by Stéphane Gsell (1900 foll.); Toulotte, *Géographie de l'Afrique chrétienne* (1892–1894); *Corpus inscriptionum latinarum*, vol. viii. and Supplement (1881). Cf. also articles CARTHAGE, NUMIDIA, &c., JUGURTHA, and articles relating to Roman History. (E. B.*)

AFRICAN LILY (*Agapanthus umbellatus*), a member of the natural order Liliaceae, a native of the Cape of Good Hope, whence it was introduced at the close of the 17th century. It is a handsome greenhouse plant, which is hardy in the south of England and Ireland if protected from severe frosts. It has a short stem bearing a tuft of long, narrow, arching leaves, ½ to 2 ft. long, and a central flower-stalk, 2 to 3 ft. high, ending in an umbel of bright blue, funnel-shaped flowers. The plants are easy to cultivate, and are generally grown in large pots or tubs which can be protected from frost in winter. During the summer they require plenty of water, and are very effective on the margins of lakes or running streams, where they thrive admirably. They increase by offsets, or may be propagated by dividing the root-stock in early spring or autumn. A number of forms are known in cultivation; such are *albidus*, with white flowers, *aureus*, with leaves striped with yellow, and *variegatus*, with leaves almost entirely white with a few green bands. There are also double-flowered and larger and smaller flowered forms.

AFRICANUS, SEXTUS JULIUS, a Christian traveller and historian of the 3rd century, was probably born in Libya, and may have served under Septimius Severus against the Osrhoenians in A.D. 195. Little is known of his personal history, except that he lived at Emmaus, and that he went on an embassy to the emperor Heliogabalus[1] to ask for the restoration of the town, which had fallen into ruins. His mission succeeded, and Emmaus was henceforward known as Nicopolis. Dionysius bar-Salibi makes him a bishop, but probably he was not even a presbyter. He wrote a history of the world (Χρονογραφίαι, in five books) from the creation to the year A.D. 221, a period, according to his computation, of 5723 years. He calculated the period between the creation and the birth of Christ as 5499 years, and ante-dated the latter event by three years. This method of reckoning became known as the Alexandrian era, and was adopted by almost all the eastern churches. The history, which had an apologetic aim, is no longer extant, but copious extracts from it are to be found in the *Chronicon* of Eusebius, who used it extensively in compiling the early episcopal lists. There are also fragments in Syncellus, Cedrenus and the *Paschale Chronicon*. Eusebius (*Hist. Ecc.* i. 7, cf. vi. 31) gives some extracts from his letter to one Aristides, reconciling the apparent discrepancy between Matthew and Luke in the genealogy of Christ by a reference to the Jewish law, which compelled a man to marry the widow of his deceased brother, if the latter died without issue. His terse and pertinent letter to Origen, impugning the authority of the apocryphal book of Susanna, and Origen's wordy and uncritical answer, are both extant. The ascription to Africanus of an encyclopaedic work entitled Κεστοί (embroidered girdles), treating of agriculture, natural history, military science, &c., has been needlessly disputed on account of its secular and often credulous character. Neander suggests that it was written by Africanus before he had devoted himself to religious subjects. For a new fragment of this work see *Oxyrhynchus Papyri* (Grenfell and Hunt), iii. 36 ff.

AUTHORITIES.—Edition in M. J. Routh, *Rel. Sac.* ii. 219-509; translation in *Ante-Nicene Fathers* (S. D. F. Salmond) vi. 125-140. See H. Gelzer, *Sex. Jul. Africanus und die byzant. Chronographie*, 2 vols. (Leipzig, 1880–1885); G. Krüger, *Early Christian Literature*, 248–253; A. Harnack, *Altchristl. Litt. Gesch.* i. 507, ii. 70.

AFRIDI, a Pathan tribe inhabiting the mountains on the Peshawar border of the North-West Frontier province of India. The Afridis are the most powerful and independent tribe on the border, and the largest with the exception of the Waziris. Their special country is the lower and easternmost spurs of the Safed Koh range, to the west and south of the Peshawar district, including the Bazar and Bara valleys. On their east they are bounded by British districts, on the north by the Mohmands, on the west by the Shinwaris and on the south by the Orakzai and Bangash tribes. Their origin is obscure, but they are said to have Israelitish blood in their veins, and they have a decidedly Semitic cast of features. They are possibly the Aparytai of Herodotus, the names and positions being identical. If this theory is correct, they were then a powerful people, and held a large tract of country, but have been gradually driven back by the encroachments of other tribes. The tribe is divided into the following eight clans:—Kuki Khel, Malikdin Khel, Kambar Khel, Kamar Khel, Zakka Khel (the most numerous and the most turbulent), Sipah, Aka Khel and Adam Khel. The first seven clans live in the vicinity of the Khyber Pass, and migrate to Tirah in the summer months. The Adam Khel (5900 fighting men) live round the Kohat Pass, and are more settled and less migratory in their habits. In appearance the Afridi is a fine, tall, athletic highlander with a long, gaunt face, high nose and cheek-bones, and a fair complexion. On his own hillside he is one of the finest skirmishers in the world, and in the Indian army makes a first-rate soldier, but he is apt to be home-sick when removed from the air of his native mountains. In character the Afridi has obtained an evil name for ferocity, craft and treachery, but Colonel Sir Robert Warburton, who lived eighteen years in charge of the Khyber Pass and knew the Afridi better than any other Englishman, says:—" The Afridi lad from his earliest childhood is taught by the circumstances of his existence and life to distrust all mankind, and very often his near relations, heirs to his small plot of land by right of inheritance, are his deadliest enemies. Distrust of all mankind, and readiness to strike the first blow for the safety of his own life, have therefore become the maxims of the Afridi. If you can overcome this mistrust, and be kind in words to him, he will repay you by a great devotion, and he will put up with any treatment you like to give him except abuse." In short the Afridi has the vices and virtues of all Pathans in an enhanced degree. The fighting strength of the Afridis is said to be 27,000, but this estimate is excessive, judged by the number and size of their villages. They derive their importance from their geographical position, which gives them command of the Khyber and Kohat roads, and the history of the British connexion with them has been almost entirely with reference to these two passes.

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[1] So Eusebius. Syncellus says Alexander Severus

There have been several British expeditions against the separate clans:—

(1) Expedition against the Kohat Pass Afridis under Sir Colin Campbell in 1850. The British connexion with the Adam Khel Afridis commenced immediately after the annexation of the Peshawar and Kohat districts. Following the example of all previous rulers of the country, the British agreed to pay the tribe a subsidy to protect the pass. But in 1850 a thousand Afridis attacked a body of sappers engaged in making the road, killing twelve and wounding six. It was supposed that they disliked the making of a road which would lay open their fastnesses to regular troops. An expedition of 3200 British troops was despatched, which traversed the country and punished them.

(2) Expedition against the Jowaki Afridis of the Bori villages in 1853. When the Afridis of the Kohat Pass misbehaved in 1850, the Jowaki Afridis offered the use of their route instead; but they turned out worse than the others, and in 1853 a force of 1700 British traversed their country and destroyed their stronghold at Bori. The Jowaki Afridis are a clan of the Adam Khel, who inhabit the country lying between the Kohat Pass and the river Indus.

(3) Expedition against the Aka Khel Afridis under Colonel Craigie in 1855. In 1854 the Aka Khels, not finding themselves admitted to a share of the allowances of the Kohat Pass, commenced a series of raids on the Peshawar border and attacked a British camp. An expedition of 1500 troops entered the country and inflicted severe punishment on the tribe, who made their submission and paid a fine.

(4) Expedition against the Jowaki Afridis under Colonel Mocatta in 1877. In that year the government proposed to reduce the Jowaki allowance for guarding the Kohat Pass, and the tribesmen resented this by cutting the telegraph wire and raiding into British territory. A force of 1500 troops penetrated their country in three columns, and did considerable damage by way of punishment.

(5) Expedition against the Jowaki Afridis under Brigadier-General Keyes in 1877–78. The punishment inflicted by the previous expedition did not prove sufficiently severe, the attitude of the Jowakis continued the same and their raids into British territory went on. A much stronger force, therefore, of 7400 British troops, divided into three columns, destroyed their principal villages and occupied their country for some time, until the tribe submitted and accepted government terms. The Kohat Pass was afterwards practically undisturbed.

(6) Expedition against the Zakka Khel Afridis of the Bazar Valley under Brigadier-General Tytler in 1878. At the time of the British advance into Afghanistan, during the second Afghan War, the Zakka Khel opposed the British advance and attacked their outposts. A force of 2500 British troops traversed their country, and the tribesmen made their submission.

(7) Expedition against the Zakka Khel Afridis of the Bazar Valley under Lieutenant-General Maude in 1879. After the previous expedition the Afridis of the Khyber Pass continued to give trouble during the progress of the second Afghan War, so another force of 3750 British troops traversed their country, and after suffering some loss the tribesmen made their submission. After this both the Khyber and Kohat Passes were put on a stable footing, and no further trouble of any consequence occurred in either down to the time of the frontier risings of 1897, when the Afridis attacked the Khyber Pass, which was defended by Afridi levies.

(8) For the Tirah Campaign of 1897 see TIRAH CAMPAIGN.

(9) In the February of 1908 the restlessness of the Zakka Khel again made a British expedition necessary, under Sir James Willcocks; but the campaign was speedily ended, though in the following April he had again to proceed against the Mohmands, the situation being complicated by an incursion from Afghanistan.

See also Paget and Mason's *Frontier Expeditions* (1884); Warburton's *Eighteen Years in the Khyber* (1900). (C. L.)

AFTERGLOW, a broad high arch of whitish or rosy light appearing occasionally in the sky above the highest clouds in the hour of deepening twilight, or reflected from the high snowfields in mountain regions long after sunset. The phenomenon is due to very fine particles of dust suspended in the high regions of the atmosphere that produce a scattering effect upon the component parts of white light. After the eruption of Krakatoa in 1883, a remarkable series of red sunsets appeared all over the world. These were due to an enormous amount of exceedingly fine dust blown to a great height by that terrific explosion, and then universally diffused by the high atmospheric currents.

AFZELIUS, ADAM (1750–1837), Swedish botanist, was born at Larf, Vestergötland, in 1750. He was appointed teacher of oriental languages at Upsala in 1777, and in 1785 demonstrator of botany. From 1792 he spent some years on the west coast of Africa, and in 1797–1798 acted as secretary of the Swedish embassy in London. Returning to Sweden, he founded the Linnaean institute at Upsala in 1802, and in 1812 became professor of materia medica at the university. He died at Upsala in 1837. In addition to various botanical writings, he published the autobiography of Linnaeus in 1823.

His brother, JOHAN AFZELIUS (1753–1837), known as ARVIDSON, was professor of chemistry at Upsala; and another brother, PER AF (1760–1843), who became professor of medicine at Upsala in 1801, was distinguished as a medical teacher and practitioner.

AFZELIUS, ARVID AUGUST (1785–1871), Swedish pastor, poet, historian and mythologist, was born on the 8th of October 1785. From 1828 till his death on the 25th of September 1871 he was parish priest of Enköping. He is mainly known as a collaborator with the learned historian, Erik Gustaf Geijer, in the great collection of Swedish folk-songs, *Svenske folkirsor från forntiden*, 3 vols. (Stockholm, 1814–1816). He published also translations of the *Sämunder Edda* and *Herwara-Saga*, and a history of Sweden to Charles XII. (of which a German translation was published in 1842), as well as original poems.

AGA, or AGHA, a word, said to be of Tatar origin, signifying a dignitary or lord. Among the Turks it is applied to the chief of the janissaries, to the commanders of the artillery, cavalry and infantry, and to the eunuchs in charge of the seraglio. It is also employed generally as a term of respect in addressing wealthy men of leisure, landowners, &c.

AGAIAMBO, or AGAUMBU, a race of dwarf marsh-dwellers in British New Guinea, now almost extinct. In his annual report for 1904 the acting administrator of British New Guinea stated that on a visit he paid to their district he saw six males and four females. The Agaiambo live in huts erected on piles in the lakes and marshes. Dwarfish in stature but broadly built, they are remarkable for the shortness of their legs. They live almost entirely in their "dug-outs" or canoes, or actually wading in the water. Their food consists of sago, the roots of the water-lily and fish. The Agaiambo are believed to have been formerly numerous, but within the last few years have suffered from the raids of their cannibalistic Papuan neighbours. In features, colour and hair they closely resemble the true Papuans.

AGA KHAN I., HIS HIGHNESS THE (1800–1881), the title accorded by general consent to HASAN ALI SHAH (born in Persia, 1800), when, in early life, he first settled in Bombay under the protection of the British government. He was believed to have descended in direct line from Ali by his wife Fatima, the daughter of the Prophet Mahomet. Ali's son, Hosain, having married a daughter of one of the rulers of Persia before the time of Mahomet, the Aga Khan traced his descent from the royal house of Persia from the most remote, almost prehistoric, times. His ancestors had also ruled in Egypt as caliphs of the Beni-Fatimites for a number of years, at a period coeval with the Crusades. Before the Aga Khan emigrated from Persia, he was appointed by the emperor Fateh Ali Shah to be governor-general of the extensive and important province of Kerman. His rule was noted for firmness, moderation and high political sagacity, and he succeeded for a long time in retaining the friendship and confidence of his master the shah, although his career was beset with political intrigues and jealousy on the part of rival and court favourites, and with internal turbulence. At last, however, the fate usual to statesmen in oriental countries overtook him, and he incurred the mortal displeasure of Fateh Ali Shah. He fled from Persia and sought protection in British territory, preferring to settle down eventually in India, making Bombay his headquarters. At that period the first Afghan War was at its height, and in crossing over from Persia through Afghanistan the Aga Khan found opportunities of rendering valuable services to the British army, and thus cast in his lot for ever with the British. A few years later he rendered similar conspicuous services in the course of the Sind campaign, when his help was utilized by Napier in the process of subduing the frontier tribes, a large number of whom acknowledged the Aga's authority as their spiritual head. Napier held his Moslem ally in great esteem, and entertained a very high opinion of his political acumen and chivalry as a leader and soldier. The Aga Khan reciprocated the British commander's confidence and friendship by giving repeated proofs of his devotion and attachment to the British government, and when he finally settled down in India, his position as the leader of the large Ismailiah section of Mahommedan British subjects was recognized by the government, and the title of His Highness was conferred on him, with a large pension. From that time until his death in 1881 the Aga Khan, while leading the life of a peaceful and peacemaking citizen, under the protection of British rule, continued to discharge his sacerdotal functions, not only among his followers in India, but towards the more numerous communities which acknowledged his religious sway in distant countries, such as Afghanistan, Khorasan, Persia, Arabia, Central Asia, and even distant Syria and Morocco. He remained throughout unflinchingly loyal to the British *Raj*, and by his vast and unquestioned influence among the frontier tribes on the northern borders of India he exercised a control over their unruly passions in times of trouble, which proved of invaluable service in the several expeditions led by British arms on the north-west frontier of India. He was also the means of checking the fanaticism of the more turbulent Mahommedans in British India, which in times of internal troubles and misunderstandings finds vent in the shape of religious or political riots.

He was succeeded by his eldest son, AGA KHAN II. This prince continued the traditions and work of his father in a manner that won the approbation of the local government, and earned for him the distinction of a knighthood of the Order of the Indian Empire and a seat in the legislative council of Bombay.

AGA KHAN III. (Sultan Mahommed Shah), only son of the foregoing, succeeded him on his death in 1885, and became the head of the family and its devotees. He was born in 1877, and, under the care of his mother, a daughter of the ruling house of Persia, was given not only that religious and oriental education which his position as the religious leader of the Ismailiahs made indispensable, but a sound European training, a boon denied to his father and grandfather. This blending of the two systems of education produced the happy result of fitting this Moslem chief in an eminent degree both for the sacerdotal functions which appertain to his spiritual position, and for those social duties of a great and enlightened leader which he was called upon to discharge by virtue of that position. He travelled in distant parts of the world to receive the homage of his followers, and with the object either of settling differences or of advancing their welfare by pecuniary help and personal advice and guidance. The distinction of a knight commander of the Indian Empire was conferred upon him by Queen Victoria in 1897, and he received like recognition for his public services from the German emperor, the sultan of Turkey, the shah of Persia and other potentates.

See Naoroji M. Dumasia, *A Brief History of the Aga Khan* (1903). (M. M. BH.)

AGALMATOLITE (from Gr. ἄγαλμα, statue, and λίθος, stone), a soft species of mineral, also called *pagodite*, used by the Chinese for carving, especially into grotesque figures (whence called "figure-stone").

AGAMEDES, in Greek legend, son of Erginus, king of Orchomenus in Boeotia. He is always associated with his brother Trophonius as a wonderful architect, the constructor of underground shrines and grottos for the reception of hidden treasure. When building a treasure-house for Hyrieus, the brothers fixed one of the stones in the wall so that they could remove it whenever they pleased, and from time to time carried off some of the treasure. Hyrieus thereupon set a trap in which Agamedes was caught; Trophonius, to prevent discovery, cut off his brother's head and fled with it. He was pursued by Hyrieus, and swallowed up by the earth in the grove of Lebadeia. On this spot was the oracle of Trophonius in an underground cave; those who wished to consult it first offered the sacrifice of a ram and called upon the name of Agamedes. A similar story is told of Rhampsinitus by Herodotus (ii. 121). According to Pindar (*apud* Plutarch), the brothers built the temple of Apollo at Delphi; when they asked for a reward, the god promised them one in seven days; on the seventh day they died.

Pausanias ix. 37; Plutarch, *Consolatio ad Apollonium*, 14; Cicero, *Tusc. Disp.* i. 47.

AGAMEMNON, one of the most distinguished of the Greek heroes, was the son of Atreus (king of Mycenae) and Aërope, grandson of Pelops, great-grandson of Tantalus and brother of Menelaus. Another account makes him the son of Pleisthenes (the son or father of Atreus), who is said to have been Aërope's first husband. Atreus was murdered by Aegisthus (*q.v.*), who took possession of the throne of Mycenae and ruled jointly with his father Thyestes. During this period Agamemnon and Menelaus took refuge with Tyndareus, king of Sparta, whose daughters Clytaemnestra (more correctly Clytaemestra) and Helen they respectively married. By Clytaemnestra, Agamemnon had three daughters, Iphigeneia (Iphianassa), Electra (Laodice), Chrysothemis, and a son, Orestes. Menelaus succeeded Tyndareus, and Agamemnon, with his brother's assistance, drove out Aegisthus and Thyestes, and recovered his father's kingdom. He extended his dominion by conquest and became the most powerful prince in Greece. When Paris (Alexander), son of Priam, had carried off his brother's wife, he went round to the princes of the country and called upon them to unite in a war of revenge against the Trojans. He himself furnished 100 ships, and was chosen commander-in-chief of the combined forces. The fleet, numbering 1200 ships, assembled at the port of Aulis in Boeotia. But Agamemnon had offended the goddess Artemis by slaying a hind sacred to her, and boasting himself a better hunter. The army was visited by a plague, and the fleet was prevented from sailing by the total absence of wind. Calchas announced that the wrath of the goddess could only be appeased by the sacrifice of Iphigeneia (*q.v.*). The fleet then set sail. Little is heard of Agamemnon until his quarrel with Achilles (*q.v.*). After the capture of Troy, Cassandra, the daughter of Priam, fell to his lot in the distribution of the prizes of war. On his return, after a stormy voyage, he landed in Argolis. His kinsman, Aegisthus, who in the interval had seduced his wife Clytaemnestra, invited him to a banquet at which he was treacherously slain, Cassandra also being put to death by Clytaemnestra. According to the account given by Pindar and the tragedians, Agamemnon was slain by his wife alone in a bath, a piece of cloth or a net having first been thrown over him to prevent resistance. Her wrath at the sacrifice of Iphigeneia, and her jealousy of Cassandra, are said to have been the motives of her crime. The murder of Agamemnon was avenged by his son Orestes (*q.v.*). Although not the equal of

Achilles in bravery, Agamemnon is a dignified representative of kingly authority. As commander-in-chief, he summons the princes to the council and leads the army in battle. He takes the field himself, and performs many heroic deeds until he is wounded and forced to withdraw to his tent. His chief fault is his overweening haughtiness, due to an over-exalted opinion of his position, which leads him to insult Chryses and Achilles, thereby bringing great disaster upon the Greeks. But his family had been marked out for misfortune from the outset. His kingly office had come to him from Pelops through the blood-stained hands of Atreus and Thyestes, and had brought with it a certain fatality which explained the hostile destiny which pursued him. The fortunes of Agamemnon have formed the subject of numerous tragedies, ancient and modern, the most famous being the *Oresteia* of Aeschylus. In the legends of Peloponnesus, Agamemnon was regarded as the highest type of a powerful monarch, and in Sparta he was worshipped under the title of Zeus Agamemnon. His tomb was pointed out among the ruins of Mycenae and at Amyclae.

In works of art there is considerable resemblance between the representations of Zeus, king of the gods, and Agamemnon, king of men. He is generally characterized by the sceptre and diadem, the usual attributes of kings.

See articles in Pauly-Wissowa's *Realencyclopädie* and Roscher's *Lexikon der Mythologie*.

AGAPĒ (Gr. ἀγάπη, "Love"), the early Christian love-feast. The word seems to be used in this sense in the epistle of Jude 12: "These are they who are hidden rocks in your love-feasts when they banquet with you." But this is not certain, for in 2 Pet. ii. 13 the verse is cited, but reading ἀπάταις ("deceits") for ἀγάπαις, and the oldest MSS. hesitate. The history of the *agapē* coincides, until the end of the 2nd century, with that of the eucharist (*q.v.*), and it is doubtful whether the following detailed account of the *agapē* given in Tertullian's *Apology* (c. 39) is to be regarded as exclusive of an accompanying eucharist: "It is the banquet (*triclinium*) alone of the Christians that is criticised. Our supper (*coena*) shows its character by its name. It is called by a word which in Greek signifies love (*i.e. agapē*). Whatever it costs, it is anyhow a clear gain that it is incurred on the score of piety, seeing that we succour the poorest by such entertainments (*refrigerio*). We do not lie down at table until prayer has been offered to God, as it were a first taste. We eat only to appease our hunger, we drink only so much as it is good for temperate persons to do. If we satisfy our appetites, we do so without forgetting that throughout the night we must say our prayers to God. If we converse, it is with the knowledge that the Lord is listening. After washing our hands and lighting the lamps, each is invited to sing a hymn before all to God, either taken from holy writ or of his own composition. So we prove him, and see how well he has drunk. Prayer ends, as it began, the banquet; and we break up not in bands of brigands, nor in groups of vagabonds, nor do we burst out into debauchery. . . . This meeting of Christians we admit deserves to be made illicit, if it resembles illicit acts; it deserves to be condemned, if any complain of it on the same score on which complaints are levelled at factious meetings. But to do harm to whom do we ever thus come together?"

The evidence of Tertullian is good for Africa. But in Egypt about the same time (180–210), Clement of Alexandria in his *Pedagogus* (ii. 1) condemns the "little suppers which were called, not without presumption, *agapē*." This word, he complains, should denote the heavenly food, the reasonable feast alone, and the Lord never used it of mere junketings. Clement wished the name to be reserved for the eucharist, because the love-feasts of the church had degenerated, as Tertullian too discovered, as soon as he turned Montanist. For in his tract on fasting (ch. xvii.) he complains that the young men misbehaved with the sisters after the *agapē*.

Among the spurious works of Athanasius is printed a tract entitled *About Virginity*, ch. xiii. of which directs how the sisters after the *synaxis* of the ninth hour (3 P.M.) are to dine: "When you sit down at a table and come to break bread, seal it thrice with the sign of the cross and thus give thanks: 'We thank thee, our Father, for thy holy resurrection; for through Jesus thy servant thou hast shewn it unto us. And as this bread on this table was scattered, but has been brought together and become one, so may thy church be brought together into thy kingdom. For thine is the power and the glory, for ever and ever, Amen.' This prayer as you break the bread, and are about to eat, you must say. And when you lay it on the table and desire to eat it, repeat the 'Our Father' entire. But after dinner (or breakfast), and when we rise from table, we use the prayer given above, viz. 'Blessed be God, who hath pity and nourisheth us from our infancy, who giveth food to all flesh. Fill our hearts with joy and gladness, that ever having of all things a sufficiency, we may superabound in all good works, in Christ Jesus our Lord, &c.'" The writer then enjoins that, "if two or three other virgins are present, they also shall give thanks over the bread set out, and join in the prayers. But if a catechumen be found at the table, she shall not be suffered to join with the full believers in their prayers, nor shall the latter sit with her to eat the morsel" (ψωμόν, used specially of the sanctified bread). "Nor shall they sit with frivolous and joking women, if they can help it, for they are sanctified to God, and their food and drink have been hallowed by the prayers and holy words used over them. . . . If a rich woman sits down with them at table, and they see a poor woman, they shall invite her also to eat with them, and not put her to shame because of the rich one." The last words echo 1 Cor. x., and the prayer is nearly the same as that which the teaching of the Apostles assigns for the eucharistic rite. Here, then, we have pictured as late as the 4th century a Lord's supper, which like the one described in 1 Cor. x. is *agapē* and eucharist in one, and it is held in a private house and not in church, and the celebrants are holy women!

The historian Socrates (*Hist. Eccl.* v. 22) testifies to the survival in Egypt of such Lord's suppers as were love-feasts and eucharists in one. Around Alexandria and in the Thebaid, he says, they hold services on the sabbath, and unlike other Christians partake of the mysteries (*i.e.* sacrament). For after holding good cheer and filling themselves with meats of all kinds, they at eventide make the offering (προσφορά) and partake of it. So Basil of Cappadocia (Epistle 93), about the year 350, records that in Egypt the laity, as a rule, celebrated the communion in their own houses, and partook of the sacrament by themselves whenever they chose. In the old Egyptian church order, known as the *Canons of Hippolytus*, there are numerous directions for the service of the *agapē*, held on Sundays, saints' days or at commemorations of the dead. The 74th canon of the council of Trullo (A.D. 692) forbade the holding of symposia known as *agapēs* in church. In his 54th homily (tom. v. p. 365) Chrysostom describes how after the eucharistic synaxis was over, the faithful remained in church, while the rich brought out meats and drink from their houses, and invited the poor, and furnished "common tables, common banquets, common symposia in the church itself." The council of Gangra (A.D. 355) anathematized the over-ascetic people who despised "the *agapēs* based on faith." Only a few years later, however, the council of Laodicea forbade the holding of *agapēs* in churches. The 42nd canon of the council of Carthage under Aurelius likewise forbade them, but these were only local councils. In the age of Chrysostom and Augustine the *agapē* was frequent.

In the east Syrian, the Armenian and the Georgian churches, respectively Nestorian, Monophysite and Greek Orthodox in their tenets, the *agapē* was from the first a survival, under Christian and Jewish forms, of the old sacrificial systems of a pre-Christian age. Sheep, rams, bullocks, fowls are given sacrificial salt to lick, and then sacrificed by the priest and deacon, who has the levitical portions of the victim as his perquisite. In Armenia the Greek word *agapē* has been used ever since the 4th century to indicate these sacrificial meals, which either began or ended with a eucharistic celebration. The earlier usage of the Armenians is expressed in the two following rules recorded against them by a renegade Armenian prelate named Isaac, who in the 8th century went over to the Byzantine church: "Christ did not hand down to us the teaching to celebrate the mystery of the offering of the bread in church, but in an ordinary house, and sitting at a common table. So then let them not sacrifice the offering of bread in churches. It was after supper, when his disciples were thoroughly sated, that Christ gave them of his own body to eat. Therefore let them first eat meats and be sated, and then let them partake of the mysteries." These old canons are adduced by way of ridiculing the Armenians, yet they reflect old usage. They are given in the *Historia Monothelitarum* of Combefisius, col. 317. Older MSS. of the Greek Euchologion contain numerous prayers to be offered over animals sacrificed; and in the form of *agapē* such sacrifices were common in Italy and Gaul on the *natalis dies* of a saint, and Paulinus of Nola, the friend of Augustine, in his Latin poems, describes them (*c.* 400) in detail. Gregory the Great sent to Mellitus, bishop of London, a written rite of sacrificing bulls for use in the English church of the early 7th century. In Augustine's work against Faustus the Manichean (xx. 4), the latter taxes the Catholics with having turned the sacrifices of the heathen into *agapēs*, their idols into martyrs, whom they worship with similar rites. "You appease," he says, "the shades of the dead with wines and banquets, you celebrate the feast-days of the heathen along with them . . . in their way of living you have certainly changed nothing." This was true enough, but there is truth also in the remark of Prof. Sanday ("Eucharist" in Hastings' *Dictionary of the Bible*) that Providence even in its revolutions is conservative. The world could only be christianized on condition that old holy days and customs were continued. The early Christian *agapē* admitted of adaptation to the older funeral and sacrificial feasts, and was so adapted. The association in the synoptics of the earliest eucharist with the paschal sacrifice provided a model, and long after the eucharist was separated with the *agapē* on other days of the year, we still find celebrated on the evening of Maundy Thursday the sacrifice of the paschal lamb, immediately followed by an eucharist. The 41st canon of the council of Carthage enacted that the sacraments of the altar should be received fasting, except on the anniversary of the Lord's supper. It is clear that at an earlier date the *agapē* preceded the eucharist.

Pagan Analogues.—In ancient states common meals called *sussitia* (συσσιτια) were instituted, particularly in the Doric states, *e.g.* in Lacaedemon and in Crete. Plato advocated them, and perhaps the later Jews imitated the Spartan community. Trade and other gilds in antiquity held subscription suppers or ἔρανοι, similar to those of the early Corinthian church, usually to support the needs of the poorer members. These *hetairiae* or clubs were forbidden (except in cities formally allied to Rome) by Trajan and other emperors, as being likely to be centres of disaffection; and on this ground Pliny forbade the *agapē* of the Bithynian churches, Christianity not being a lawful religion licensed for such gatherings. The custom which most resembles the eucharist and *agapē* was that known as *charistia* described by Valerius Maximus ii. 1. 8. It was a solemn feast attended only by members of one clan, at which those who had quarrelled were at the sacrament of the table (*apud sacra mensae*) reconciled. It was held on the 20th of February. Ovid in his *Fasti*, ii. 617, alludes to it—

> *Proxima cognati dixere charistia cari,*
> *Et venit ad socios turba propinqua deos.*

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AGAPEMONITES, or COMMUNITY OF THE SON OF MAN. This sect, based upon the theories of various German religious mystics, and having for its primary object the spiritualization of the matrimonial state, was founded in 1846 by the Rev. Henry James Prince, a clergyman of the Church of England (1811-1899). He studied medicine, obtained his qualifications in 1832 and was appointed medical officer to the General Hospital in Bath, his native city. Compelled by ill-health to abandon his profession, he entered himself in 1837 as a student at St. David's Theological College, Lampeter, where he gathered about him a band of earnest religious enthusiasts, known as the Lampeter Brethren, and was eventually ordained to the curacy of Charlinch in Somerset, where he had sole charge in the illness and absence of the rector, the Rev. Samuel Starkey. By that time he had contracted his first "spiritual marriage," and had persuaded himself that he had been absorbed into the personality of God and had become a visible embodiment of the Holy Spirit. During his illness Mr. Starkey read one of his curate's sermons and was not only "cured" forthwith, but embraced his strange doctrines, and together they procured many conversions in the countryside and the neighbouring towns. In the end the rector was deprived of his living and Prince's licence withdrawn, and together with a few disciples they started the Charlinch Free Church, which had a very brief existence. Prince shortly afterwards became curate of Stoke in Suffolk, where, however, the character of his revivalist zeal caused his departure at the end of twelve months. It was now decided that Prince, Starkey (whose sister Prince had married as his second wife) and the Rev. Lewis Prince should leave the Church of England and preach their own gospel; Prince opened Adullam Chapel, Brighton, and Starkey established himself at Weymouth. The chief success lay in the latter town, and thither Prince soon migrated. A number of followers, estimated by Prince at 500, but by his critics at one-fifth of the number, were got together, and it was given out by "Beloved" or "The Lamb"—the names by which the Agapemonites designated their leader—that his disciples must divest themselves of their possessions and throw them into the common stock. This was done, even by the poor or ill-furnished, all of whom looked forward to the speedy end of the present dispensation, and were content, for the short remainder of this world, to live in common, and, while not repudiating earthly ties, to treat them as purely spiritual. With the money thus obtained the house at Spaxton, which was to become the "Abode of Love," was enlarged and furnished luxuriously, and three sisters, who contributed £6000 each, were immediately married to three of Prince's nearest disciples. Despite the purely spiritual ideas which underlay the Agapemonite view of marriage, a son was born to one of these couples, and when the father endeavoured to carry it away an action was brought which resulted in the affirmation of the mother's right to its custody. The circumstance in which a fourth sister who joined the community was abducted by her brothers led to an inquiry in lunacy and to her final settlement at Spaxton. A few years after the establishment of the "Abode of Love," a peculiarly gross scandal, in which Prince and one of his female followers were involved, led to the secession of some of his most faithful friends, who were unable any longer to endure what they regarded as the amazing mixture of blasphemy and immorality offered for their acceptance. The most prominent of those who remained received such titles as the "Anointed Ones," the "Angel of the Last Trumpet," the "Seven Witnesses" and so forth. In 1862 "Brother Prince" sent "to the kings and people of the earth" letters "making known to all men that flesh is saved from death." At that period the Agapemonites counted their adherents at 600, and it was no doubt a grievous shock to them when their deathless founder died on the 8th of March 1899, four years after he had opened a branch church at Clapton, London, which is said to have cost £20,000. This church, decorated with elaborate symbolism, was styled the "Ark of the Covenant," and in it the elect were to await the coming of the Lord.

On the death of "Brother" Prince, the Rev. T. H. Smyth-Pigott, pastor of the "Ark," became the acknowledged head of the sect. He was born in 1852, of an old Somersetshire county family, and, after a varied career as university man, sailor before the mast, soldier, coffee-planter, curate in the Church of England and evangelist in the Salvation Army, was converted about 1897 to the views of Prince. For five years after this he was not heard of outside his own sect. On the 7th of September 1902, however, the congregation, assembled at the Ark of the Covenant for service, found the communion table replaced by a chair. In this Pigott presently seated himself and proclaimed himself as the Messiah with the words, "God is no longer there," pointing upwards, "but here," pointing to himself. This astonishing announcement was followed by an excellent sermon on Christian love. Pigott's claim was at once admitted by the members of his sect, including even his own wife, as the fulfilment of the promise of Christ to appear in due time in the "Ark." By the outside world the affair was greeted with mingled ridicule and indignation, and the new Messiah had to be protected by the police from the violence of an angry mob. After providing "copy" for the newspapers for a few days, however, the whole thing was forgotten. Pigott retired to the headquarters of the sect, the "Abode of Love" in Somerset, and all efforts to interview him or to obtain details of the life of the community were abortive. At last, in August 1905, the long and mysterious silence was broken by the announcement that a son had been born to Pigott by his "spiritual wife," Miss Ruth Preece, an inmate of the Agapemone. This event by no means disconcerted the believers, who saw in it only another manifestation of Pigott's divinity, and proclaimed it as "an earnest of the total redemption of man." The child was registered as "Glory," and, at the christening service in the chapel of the Abode, hymns were sung in its honour as it lay in a jewelled cradle in the chancel. Another child by Miss Preece, christened "Power," was born on the 20th of August 1908. The publicity given to this event renewed the scandal, and in November an attempt to "tar and feather" Mr Pigott resulted in two men being sent to prison. Later in the month proceedings were instituted against him by the bishop of Bath and Wells under the Clergy Discipline Act.

One outcome of the disclosures connected with the Agapemone deserves passing mention, as throwing some light on the origin of the wealth of the community. Mr Charles Stokes Read, a resident at the Agapemone and director of the V. V. Bread Company, was requested by his fellow-directors to resign, on the ground that his connexion with the sect was damaging the business of the company. He denied this to be the case and refused to resign, pleading religious liberty and the large interests of Agapemonites in the concern. On the 13th of September 1905, a meeting of the shareholders of the company was held, and Read "asked them to believe that it was not in the interests of the company, but because he knew that the Lord Jesus Christ had come again and was now dwelling at the Agapemone, that he was thus cast out by his colleagues." The motion calling on him to resign was carried on a poll being taken by 46,770 votes to 2953. (See *The Times*, 14th of September 1905.)

AGAPETAE, a class of "virgins" who, in the church of the early middle ages, lived with professedly celibate monks to whom they were said to be united by spiritual love. The practice was suppressed by the Lateran Council of 1139.

AGAPETUS, the name of two popes:—

Agapetus I., pope from 535 to 536. He was an enlightened pontiff and collaborated with Cassiodorus in founding at Rome a library of ecclesiastical authors. King Theodahad sent him on an embassy to Constantinople, where he died, after having deposed Anthimus, the monophysite bishop of that town, and ordained Menas his successor.

Agapetus II., pope from 946 to 955, at the time when Alberic, son of Marozia, was governing the independent republic of Rome under the title of "prince and senator of the Romans." Agapetus, a man of some force of character, did his best to put a stop to the degradation into which the papacy had fallen, the so-called "Pornocracy," which lasted from the accession of Sergius III. in 904 to the deposition of John XII. in 963. His appeal to Otto the Great to intervene in Rome remained without immediate effect, since Alberic's position was too strong to be attacked, but it bore fruit after his death. Agapetus died on the 8th of November 955.

AGAPETUS, a deacon of the church of St Sophia at Constantinople. He presented to the emperor Justinian, on his accession in 527, a work entitled *Scheda regia sive de officio regis*, which contained advice on the duties of a Christian prince. The work was often reprinted and is included in Dom Anselme Banduri's *Imperium Orientale* (Paris, 1711). There is an English translation by Thomas Paynell (1550) and a French translation, executed in 1612 from a Latin version by Louis XIII., with the assistance of his tutor, David Rivault.

AGARDE, ARTHUR (1540–1615), English antiquary, was born at Foston, Derbyshire, in 1540. He was trained as a lawyer, but entered the exchequer as a clerk. On the authority of Anthony à Wood it has been stated that he was appointed by Sir Nicholas Throckmorton to be deputy-chamberlain in 1570, and that he held this office for forty-five years. His patent of appointment, however, preserved in the Rolls Office, proves that he succeeded one Thomas Reve in the post on the 11th of July 1603. With his friends, Sir Robert Cotton and Camden, he was one of the original members of the Society of Antiquaries. He spent much labour in cataloguing the records and state papers, and made a special study of the Domesday Book, preparing an explanation of its more obscure terms. Thomas Hearne, in his *Collection of Curious Discourses written by Eminent Antiquaries* (Oxford, 1720), includes six by Agarde on such subjects as the origin of parliament, the antiquity of shires, the authority and privileges of heralds, &c. Agarde died on the 22nd of August 1615 and was buried in the cloister of Westminster Abbey, on his tomb being inscribed "*Recordorum regiorum hic prope depositorum diligens scrutator*." He bequeathed to the exchequer all his papers relating to that court, and to his friend Sir Robert Cotton his other manuscripts, amounting to twenty volumes, most of which are now in the British Museum.

AGAS, RADULPH, or Ralph (*c.* 1540–1621), English land-surveyor, was born at Stoke-by-Nayland, Suffolk, about 1540, and entered upon the practice of his profession in 1566. Letters which he wrote to Lord Burghley, describing the methods of surveying, are extant, and a kind of advertising prospectus of his abilities, in which he describes himself as clever at arithmetic and "skilled in writing smaule, after the skantelinge & proportion of copiynge the Oulde & New Testamentes seven tymes in one skinne of partchmente without anie woorde abreviate or contracted, which maie also serve for drawinge discriptions of contries into volumes portable in verie little cases." He is best known for his maps of Oxford (1578), Cambridge (1592) and London. Copies of the first two are preserved in the Bodleian Library. Of the map of London and Westminster, which was probably prepared about 1591, two copies have been preserved, one by the Corporation of London and the other in the Pepysian collection at Magdalene College, Cambridge. The map is over six feet long, printed from wooden blocks, and gives a valuable picture of the London of Elizabeth's time. Agas died on the 26th of November 1621.

AGASIAS. There were two Greek sculptors of this name. Agasias, son of Dositheus, has signed the remarkable statue called the Borghese Warrior, in the Louvre. Agasias, son of Menophilus, is the author of another striking figure of a warrior in the museum of Athens. Both belonged to the school of Ephesus and flourished about 100 B.C.

See E. A. Gardner, *Handbook of Greek Sculpture*, ii. p. 475.

AGASSIZ, ALEXANDER EMANUEL (1835–1910), American man of science, son of J. L. R. Agassiz, was born in Neuchâtel, Switzerland, on the 17th of December 1835. He came to the

United States with his father in 1846; graduated at Harvard in 1855, subsequently studying engineering and chemistry, and taking the degree of bachelor of science at the Lawrence scientific school of the same institution in 1857; and in 1859 became an assistant in the United States Coast Survey. Thenceforward he became a specialist in marine ichthyology, but devoted much time to the investigation, superintendence and exploitation of mines, being superintendent of the Calumet and Hecla copper mines, Lake Superior, from 1866 to 1869, and afterwards, as a stockholder, acquiring a fortune, out of which he gave to Harvard, for the museum of comparative zoology and other purposes, some $500,000. In 1875 he surveyed Lake Titicaca, Peru, examined the copper mines of Peru and Chile, and made a collection of Peruvian antiquities for that museum, of which he was curator from 1874 to 1885. He assisted Sir Wyville Thomson in the examination and classification of the collections of the "Challenger" exploring expedition, and wrote the *Review of the Echini* (2 vols., 1872–1874) in the reports. Between 1877 and 1880 he took part in the three dredging expeditions of the steamer "Blake," of the United States Coast Survey, and presented a full account of them in two volumes (1888). Of his other writings on marine zoology, most are contained in the bulletins and memoirs of the museum of comparative zoology; but he published in 1865 (with Elizabeth Cary Agassiz, his stepmother) *Seaside Studies in Natural History*, a work at once exact and stimulating, and in 1871 *Marine Animals of Massachusetts Bay*.

AGASSIZ, JEAN LOUIS RODOLPHE (1807–1873), Swiss naturalist and geologist, was the son of the Protestant pastor of the parish of Motier, on the north-eastern shore of the Lake of Morat (Murten See), and not far from the eastern extremity of the Lake of Neuchâtel. Agassiz was born at this retired place on the 28th of May 1807. Educated first at home, then spending four years at the gymnasium of Bienne, he completed his elementary studies at the academy of Lausanne. Having adopted medicine as his profession, he studied successively at the universities of Zurich, Heidelberg and Munich; and he availed himself of the advantages afforded by these universities for extending his knowledge of natural history, especially of botany. After completing his academical course, he took in 1829 his degree of doctor of philosophy at Erlangen, and in 1830 that of doctor of medicine at Munich.

Up to this time he had paid no special attention to the study of ichthyology, which soon afterwards became the great occupation of his life. Agassiz always declared that he was led into ichthyological pursuits through the following circumstances:—In 1819-1820, J. B. Spix and C. F. P. von Martius were engaged in their celebrated Brazilian tour, and on their return to Europe, amongst other collections of natural objects they brought home an important set of the freshwater fishes of Brazil, and especially of the Amazon river. Spix, who died in 1826, did not live long enough to work out the history of these fishes; and Agassiz, though little more than a youth just liberated from his academic studies, was selected by Prof. Martius for this purpose. He at once threw himself into the work with that earnestness of spirit which characterized him to the end of his busy life, and the task of describing and figuring the Brazilian fishes was completed and published in 1829. This was followed by an elaborate research into the history of the fishes found in the Lake of Neuchâtel. Enlarging his plans, he issued in 1830 a prospectus of a *History of the Freshwater Fishes of Central Europe*. It was only in 1839, however, that the first part of this publication appeared, and it was completed in 1842. In 1832 he was appointed professor of natural history in the university of Neuchâtel. Having become a professed ichthyologist, it was impossible that the fossil fishes should fail to attract his attention. The rich stores furnished by the slates of Glarus and the limestones of Monte Bolca were already well known; but very little had been accomplished in the way of scientific study of them. Agassiz, as early as 1829, with his wonted enthusiasm, planned the publication of the work which, more than any other, laid the foundation of his world-wide fame. Five volumes of his *Recherches sur les poissons fossiles* appeared at intervals from 1833 to 1843 [1844]. They were magnificently illustrated, chiefly through the labours of Joseph Dinkel, an artist of remarkable power in delineating natural objects. In gathering materials for this great work Agassiz visited the principal museums in Europe, and meeting Cuvier in Paris, he received much encouragement and assistance from him.

Agassiz found that his palaeontological labours rendered necessary a new basis of ichthyological classification. The fossils rarely exhibited any traces of the soft tissues of fishes. They consisted chiefly of the teeth, scales and fins, even the bones being perfectly preserved in comparatively few instances. He therefore adopted his well-known classification, which divided fishes into four groups—viz. Ganoids, Placoids, Cycloids and Ctenoids, based on the nature of the scales and other dermal appendages. While Agassiz did much to place the subject on a scientific basis, his classification has not been found to meet the requirements of modern research. As remarked by Dr A. Smith Woodward, he sought to interpret the past structures by too rigorous a comparison with those of living forms. (See *Catalogue of Fossil Fishes in the British Natural History Museum*.)

As the important descriptive work of Agassiz proceeded, it became obvious that it would over-tax his resources, unless assistance could be afforded. The British Association came to his aid, and the earl of Ellesmere—then Lord Francis Egerton—gave him yet more efficient help. The original drawings made for the work, chiefly by Dinkel, amounted to 1290 in number. These were purchased by the Earl, and presented by him to the Geological Society of London. In 1836 the Wollaston medal was awarded by the council of that society to Agassiz for his work on fossil ichthyology; and in 1838 he was elected a foreign member of the Royal Society. Meanwhile the invertebrate animals engaged his attention. In 1837 he issued the "Prodrome" of a monograph on the recent and fossil Echinodermata, the first part of which appeared in 1838; in 1839–1840 he published two quarto volumes on the fossil Echinoderms of Switzerland; and in 1840-1845 he issued his *Études critiques sur les mollusques fossiles*.

Subsequently to his first visit to England in 1834, the labours of Hugh Miller and other geologists brought to light the remarkable fishes of the Old Red Sandstone of the north-east of Scotland. The strange forms of the *Pterichthys*, the *Coccosteus* and other genera were then made known to geologists for the first time. They naturally were of intense interest to Agassiz, and formed the subject of a special monograph by him published in 1844–1845: *Monographie des poissons fossiles du Vieux Grès Rouge, ou Système Dévonien (Old Red Sandstone) des Iles Britanniques et de Russie*.

The year 1836 witnessed the inauguration of a new investigation, which proved to be of the utmost importance to geological science. Previously to this date de Saussure, Venetz, Charpentier and others had made the glaciers of the Alps the subjects of special study, and Charpentier had even arrived at the conclusion that the erratic blocks of alpine rocks scattered over the slopes and summits of the Jura mountains had been conveyed thither by glaciers. The question having attracted the attention of Agassiz, he not only made successive journeys to the alpine regions in company with Charpentier, but he had a hut constructed upon one of the Aar glaciers, which for a time he made his home, in order to investigate thoroughly the structure and movements of the ice. These labours resulted in the publication of his grand work in two volumes entitled *Études sur les glaciers*, 1840. Therein he discussed the movements of the glaciers, their moraines, their influence in grooving and rounding the rocks over which they travelled, and in producing the striations and *roches moutonnées* with which we are now so familiar. He not only accepted Charpentier's idea that some of the alpine glaciers had extended across the wide plains and valleys drained by the Aar and the Rhone, and thus landed parts of their remains upon the uplands of the Jura, but he went still farther. He concluded that, at a period geologically recent, Switzerland had been another Greenland; that instead of a few glaciers stretching across the areas referred to, one vast sheet of ice, originating in the higher Alps, had extended over the entire valley of north-western Switzerland until it reached the southern slopes of the Jura, which, though they checked and deflected its further extension, did not prevent the ice from reaching in many places the summit of the range. The publication of this work gave a fresh impetus to the study of glacial phenomena in all parts of the world.

Thus familiarized with the phenomena attendant on the movements of recent glaciers, Agassiz was prepared for a discovery which he made in 1840, in conjunction with William Buckland. These two *savants* visited the mountains of Scotland together, and found in different localities clear evidence of ancient glacial action. The discovery was announced to the Geological Society of London in successive communications from the two distinguished observers. The mountainous districts of England and Wales and Ireland were also considered to constitute centres for the dispersion of glacial débris; and Agassiz remarked "that great sheets of ice, resembling those now existing in Greenland, once covered all the countries in which unstratified gravel (boulder drift) is found; that this gravel was in general produced by the trituration of the sheets of ice upon the subjacent surface, &c."

In 1842–1846 he issued his *Nomenclator Zoologicus*, a classified list, with references, of all names employed in zoology for genera and groups—a work of great labour and research. With the aid of a grant of money from the king of Prussia, Agassiz, in the autumn of 1846, crossed the Atlantic, with the twofold design of investigating the natural history and geology of the United States and delivering a course of lectures on zoology, by invitation from J. A. Lowell, at the Lowell Institute at Boston; the tempting advantages, pecuniary and scientific, presented to him in the New World induced him to settle in the United States, where he remained to the end of his life. He was appointed professor of zoology and geology in Harvard University, Cambridge, U.S., in 1847. In 1852 he accepted a medical professorship of comparative anatomy at Charlestown, but this he resigned in two years.

The transfer to a new field and the association with fresh objects of interest gave his energies an increased stimulus. Volume after volume now proceeded from his pen: some of his writings were popular, but most of them dealt with the higher departments of scientific research. His work on Lake Superior, and his four volumes of *Contributions to the Natural History of the United States*, 1857–1862, were of this latter character. We must not overlook the valuable service he rendered to science by the formation, for his own use, of a catalogue of scientific memoirs—an extraordinary work for a man whose hands were already so full. This catalogue, edited and materially enlarged by the late Hugh E. Strickland, was published by the Ray Society under the title of *Bibliographia Zoologiae et Geologiae*, in 4 vols., 1848–1854. Nor must we forget that he was building up another magnificent monument of his industry in the Museum of Natural History, which rose under his fostering care, at Cambridge. But at length the great strain on his physical powers began to tell. His early labours among the fishes of Brazil had often caused him to cast a longing glance towards that country, and he now resolved to combine the pursuit of health with the gratification of his long-cherished desires. In April 1865 he started for Brazil, with his wife and class of qualified assistants. An interesting account of this expedition, entitled *A Journey in Brazil* (1868), was published by Mrs Agassiz and himself after they returned home in August 1866.

In 1871 he made a second excursion, visiting the southern shores of the North American continent, both on its Atlantic and its Pacific sea-boards. He had for many years yearned after the establishment of a permanent school where zoological science could be pursued amidst the haunts of the living subjects of study. The last, and possibly the most influential, of the labours of his life was the establishment of such an institution, which he was enabled to effect through the liberality of Mr John Anderson, a citizen of New York. That gentleman, in 1873, not only handed over to Agassiz the island of Penikese, in Buzzard's Bay, on the east coast, but also presented him with $50,000 wherewith permanently to endow it as a practical school of natural science, especially devoted to the study of marine zoology. Unfortunately he did not long survive the establishment of this institution. The disease with which he had struggled for some years proved fatal on the 14th of December 1873. He was buried at Mount Auburn. His monument is a boulder selected from the moraine of the glacier of the Aar near the site of the old Hôtel des Neuchâtelois, not far from the spot where his hut once stood; and the pine-trees which shelter his grave were sent from his old home in Switzerland. His extensive knowledge of natural history makes it somewhat remarkable to find that from first to last he steadily rejected the doctrine of evolution, and affirmed his belief in independent creations. When studying the superficial deposits of the Brazilian plains in 1865, his vivid imagination covered even that wide tropical area, as it had covered Switzerland before, with one vast glacier, extending from the Andes to the sea. This view, however, has not been generally accepted. His daring conceptions were only equalled by the unwearied industry and genuine enthusiasm with which he worked them out; and if in details his labours were somewhat defective, it was only because he had ventured to attempt what was too much for any one man to accomplish.

It may be interesting to mention that the charming verses written by Longfellow on "The fiftieth birthday of Agassiz" were read by the author at a dinner given to Agassiz by the Saturday Club in Cambridge, Mass., in 1857.

Louis Agassiz was twice married, and by his first wife he had an only son, Alexander Agassiz (*q.v.*), born in 1835; in 1850, after her death, he married his second wife, Elizabeth Cabot Cary of Boston, Mass., afterwards well known as a writer and as an active promoter of educational work in connexion with Radcliffe College (see an article on Radcliffe College, by Helen Leah Reed in the *New England Magazine* for January 1895).

AUTHORITIES.—*L. Agassiz, His Life and Correspondence*, 2 vols., by E. C. (Mrs) Agassiz (London, 1885); *Louis Agassiz, His Life and Work*, by C. F. Holder (New York and London, 1893). (H. B. Wo.)

AGATE, a term applied not to a distinct mineral species, but to an aggregate of various forms of silica, chiefly *Chalcedony* (*q.v.*). According to Theophrastus the agate (ἀχάτης) was named from the river Achates, now the Drillo, in Sicily, where the stone was originally found. Most agates occur as nodules in eruptive rocks, or ancient lavas, where they represent cavities originally produced by the disengagement of vapour in the molten mass, and since filled, wholly or partially, by siliceous matter deposited in regular layers upon the walls. Such agates, when cut transversely, exhibit a succession of parallel lines, often of extreme tenuity, giving a banded appearance to the section, whence such stones are known as banded agate, riband agate and striped agate. Certain agates also occur, to a limited extent, in veins, of which a notable example is the beautiful brecciated agate of Schlottwitz, near Wesenstein in Saxony—a stone mostly composed of angular fragments of agate cemented with amethystine quartz.

In the formation of an ordinary agate, it is probable that waters containing silica in solution—derived, perhaps, from the decomposition of some of the silicates in the lava itself—percolated through the rock, and deposited a siliceous coating on the interior of the vapour-vesicles. Variations in the character of the solution, or in the conditions of deposit, may have caused corresponding variation in the successive layers, so that bands of chalcedony often alternate with layers of crystalline quartz, and occasionally of opaline silica. By movement of the lava, when originally viscous, the vesicles were in many cases drawn out and compressed, whence the mineral matter with which they became filled assumed an elongated form, having the longer axis in the direction in which the magma flowed. From the fact that these kernels are more or less almond-shaped they are called amygdales, whilst the rock which encloses them is known as an amygdaloid. Several vapour-vesicles may unite while the rock is viscous, and thus form a large cavity which may become the home of an agate of exceptional size; thus a Brazilian geode, lined with amethyst, of the weight of 35 tons, was exhibited at the Düsseldorf Exhibition of 1902.

The first deposit on the wall of a cavity, forming the "skin" of the agate, is generally a dark greenish mineral substance, like celadonite, delessite or "green earth," which are hydrous silicates rich in iron, derived probably from the decomposition of the augite in the mother-rock. This green silicate may give rise by alteration to a brown oxide of iron (limonite), producing a rusty appearance on the outside of the agate-nodule. The outer surface of an agate, freed from its matrix, is often pitted and rough, apparently in consequence of the removal of the original coating. The first layer spread over the wall of the cavity has been called the "priming," and upon this basis zeolitic minerals may be deposited, as was pointed out by Dr M. F. Heddle. Chalcedony is generally one of the earlier deposits and crystallized quartz one of later formation. Tubular channels, usually choked with siliceous deposits, are often visible in sections of agate, and were formerly regarded, especially by L. von Buch and J. Nöggerath, as inlets of infiltration, by which the siliceous solutions gained access to the interior of the amygdaloidal cavity. It seems likely, however, that the solution transuded through the walls generally, penetrating the chalcedonic layers, as Heddle maintained, by osmotic action. Much of the chalcedony in an agate is known, from the method of artificially staining the stone, to be readily permeable. It was argued by E. Reusch that the cavities were alternately filled and emptied by means of intermittent hot springs carrying silica; while G. Lange, of Idar, suggested that the tension of the confined steam might pierce an outlet through some weak point in the coating of gelatinous silica, deposited on the walls, so that the tubes would be channels of egress rather than of ingress—a view supported by Heddle, who described them as "tubes of escape."

It sometimes happens that horizontal deposits, or strata usually opaline in character, are formed on the floor of a cavity after the walls have been lined with successive layers of chalcedony. Many agates are hollow, since deposition has not proceeded far enough to fill the cavity, and in such cases the last deposit commonly consists of quartz, often amethystine, having the apices of the crystals directed towards the free space, so as to form a crystal-lined cavity or geode.

When the deposits in an agate have been formed on a crop of crystals, or on a rugose base, the cross-section presents a zigzag pattern, rather like the plan of a fortress with salient and retiring angles, whence the stone is termed fortification agate. If the section shows concentric circles, due either to stalactitic growth or to deposition in the form of bosses and beads on the floor, the stone is known as ring agate or eye agate. A Mexican agate, showing only a single eye, has received the name of "cyclops." Included matter of a green colour, like fragments of "green earth," embedded in the chalcedony and disposed in filaments and other forms suggestive of vegetable growth, gives rise to moss agate. These inorganic enclosures in the agate have been sometimes described, even after microscopic examination, as true vegetable structures. Dendritic markings of black or brown colour, due to infiltration of oxides of manganese and iron, produce the variety of agate known as Mocha stone. Agates of exceptional beauty often pass in trade under the name of Oriental agate. Certain stones, when examined in thin sections by transmitted light, show a diffraction spectrum, due to the extreme delicacy of the successive bands, whence they are termed rainbow agates.

On the disintegration of the matrix in which the agates are embedded, they are set free, and, being by their siliceous nature extremely resistant to the action of air and water, remain as nodules in the soil and gravel, or become rolled as pebbles in the streams. Such is the origin of the "Scotch pebbles," used as ornamental stones. They are agates derived from the andesitic lavas of Old Red Sandstone age, chiefly in the Ochils and the Sidlaws. In like manner, the South American agates, so largely cut and polished at the present time, are found mostly as boulders in the beds of rivers.

An enormous trade in agate-working is carried on in a small district in Germany, around Oberstein on the Nahe, a tributary of the Rhine at Bingen. Here the industry was located many centuries ago, in consequence of the abundant occurrence of agates in the amygdaloidal melaphyre of the district, notably in the Galgenberg, or Steinkaulenberg, overlooking the village of Idar, on the Idar Bach, about two miles from Oberstein. The abundant water-power in the neighbourhood had also a share in the determination of the industrial site. At the present time, however, steam power and even electricity are employed in the mills of the Oberstein district. Although the agate-industry is still carried on there, especially at Idar, the stones operated on are not of indigenous origin, but are imported mostly from Brazil (Rio Grande do Sul) and from Uruguay, where they were discovered in 1827. Agate-working is also carried on to a limited extent at Waldkirch in the Black Forest.

Most commercial agate is artificially stained, so that stones naturally unattractive by their dull grey tints come to be valuable for ornamental purposes. The art of staining the stone is believed to be very ancient. Possibly referred to by Pliny (bk. xxxvii. cap. 75), it was certainly practised at an early date by the Italian cameo-workers, and from Italy a knowledge of the art—long kept secret and practised traditionally—passed in the early part of the 19th century to the agate-workers in Germany, by whom it has since been greatly developed. The colouring matter is absorbed by the porosity of the stone, but different stones and even different layers in the same stone exhibit great variation in absorptive power. The Brazilian agates lend themselves readily to coloration, while the German agates are much less receptive.

To produce a dark brown or black colour, the stone is kept perhaps for two or three weeks in a saccharine solution, or in olive oil, at a moderate temperature. After removal from this medium, the agate is well washed and then digested for a short time in sulphuric acid, which entering the pores chars or carbonizes the absorbed sugar or oil. Certain layers of chalcedony are practically impermeable, and these consequently remain uncoloured, so that an alternation of dark and white bands is obtained, thus giving rise to an onyx. If stained too dark, the colour may be "drawn," or lightened, by the action of nitric acid.

Agate is stained red, so as to form carnelian and sardonyx, by means of ferric oxide. This may be derived from any iron compound naturally present in the stone, especially from limonite by dehydration on baking. Some stones are "burnt" by mere exposure to the heat of the sun, whereby the brown colour passes to red. Usually, however, an iron-salt, like ferrous sulphate, is artificially introduced in solution and then decomposed by heat, so as to form in the pores a rich red pigment.

A blue colour, supposed to render the agate rather like lapis lazuli, is produced by using first an iron salt and then a solution of ferrocyanide or ferricyanide of potassium; a green colour, like that of chrysoprase, is obtained by means of salts of nickel or of chromium; and a yellow tint is developed by the action of hydrochloric acid.

Among the uses to which agate is applied may be mentioned the formation of knife-edges of delicate balances, small mortars and pestles for chemical work, burnishers and writing styles, umbrella-handles, paper-knives, seals, brooches and other trivial ornaments. Most of these are cut and polished in the Oberstein district, at a very cheap rate, from South American stones.

Numerous localities in the United States and Canada yield agates, as described by Dr G. F. Kunz. They are abundant in the trap rocks of the Lake Superior region, some of the finest coming from Michipicoten Island, Ontario. A locality on the shore of the lake is called Agate Bay. Wood agate, or agatized wood, is not infrequently found in Colorado, California and elsewhere in the West, the most notable locality being the famous "silicified forest" known as Chalcedony Park, in Apache county, Arizona. Here there are vast numbers of water-rolled logs of silicified wood, in rocks of Triassic age, but only a small quantity of the wood is fine enough for ornamental purposes. The cellular tissue of the vegetable matter is filled, or even replaced, by various siliceous minerals like chalcedony, jasper, crystalline quartz and semi-opal, the silica having probably been introduced by thermal waters. Some of the agate shows the microscopic structure of araucarian wood. The agatized wood is sometimes known by the Indian name of shinarump.

In India agates occur abundantly in the amygdaloidal varieties of the Deccan and Rájmahàl traps, and as pebbles in the detritus derived from these rocks. Some of the finest are found in the agate-gravels near Ratanpur, in Rájpipla. The trade in agates has been carried on from early times at Cambay, where the stones are cut and polished. Agates are also worked at Jubbulpore.

In many parts of New South Wales, agates, resulting from the disintegration of trap rocks, are common in the river-beds and old drifts. They occur also in Queensland, as at Agate Creek, running into the Gilbert river. South Africa likewise yields numerous agates, especially in the gravels of the Orange and Vaal rivers.

It should be noted that in England agates are found not only in old lavas, like the andesites of the Cheviots, but also to a limited extent in the Dolomitic Conglomerate, an old beach-deposit of Triassic age in the Mendips and the neighbourhood of Bristol. They are also found as weathered pebbles in the drift of Lichfield in Staffordshire.

For Scottish agates see M. F. Heddle, "On the Structure of Agates," *Trans. Geolog. Soc. Glasgow*, vol. xi. part ii., 1900, p. 153; and *Mineralogy of Scotland* (1901), vol. i. p. 58; J. G. Goodchild, *Proc. Phys. Soc. Edinburgh*, vol. xiv., 1899, p. 191. For the agate-industry see G. Lange, *Die Halbedelsteine* (Kreuznach, 1868). For American agates, G. F. Kunz, *Gems and Precious Stones of North America* (1890), p. 128. For agates in general see Max Bauer's *Precious Stones*, translated by L. J. Spencer (London, 1904). (F. W. R.*)

AGATHA, SAINT, the patron saint of Catania, Sicily, where her festival is celebrated on the 5th of February. The legend is that she was a native of Sicily (probably of Catania, though Palermo also claims her), of noble birth and great beauty. She repelled the advances of the Roman prefect sent by the emperor Decius to govern Sicily, and was by his orders brutally tortured and finally sent to the stake. As soon as the fire was lighted, an earthquake occurred, and the people insisted on her release. She died in prison on the 5th of February 251. The rescue of Catania from fire during an eruption of Mount Etna was later attributed to St Agatha's veil.

AGATHANGELUS, Agathange or Akathankelos, Armenian historian, lived during the 4th century, and wrote a *History of the Reign of Dertad, or Tiridates, and of the Preaching of St Gregory the Illuminator.* The text of this history has been considerably altered, but it has always been in high favour with the Armenians. It has been translated into several languages, and Greek and Latin translations are found in the *Acta Sanctorum Bollandistarum*, tome viii. As known to us the history consists of three parts, a history of St Gregory and his companions, the doctrine of Gregory, and the conversion of Armenia to Christianity.

See V. Langlois, *Collection des historiens anciens et modernes de l'Arménie* (Paris, 1868).

AGATHARCHIDES, or Agatharchus, of Cnidus, Greek historian and geographer, lived in the time of Ptolemy Philometor (181–146 B.C.) and his successors. Amongst other works, he wrote treatises on *Asia*, *Europe* and *The Red Sea*. Interesting extracts from the last, of some length, are preserved in Photius (cod. 213), who praises the style of the author, which was modelled on that of Thucydides.

See H. Leopoldi, *De Agatharchide Cnidio Dissertatio* (1892); C. W. Müller, *Fragmenta Historicorum Graecorum*, iii., and *Geographi Graeci Minores*, i.; E. H. Bunbury, *Hist. of Ancient Geography*, ii. (1879).

AGATHARCHUS, an Athenian painter of the 5th century B.C. He is said by Vitruvius to have been the first to paint a scene for the acting of tragedies. Hence some writers, such as Karl Woermann, have supposed that he introduced perspective and illusion into painting. This is a mistaken view, for ancient writers know nothing of canvas scenes; the background painted by Agatharchus was the wooden front of the stage building, and it was painted, not with reference to any particular play, but as a permanent decorative background, representing no doubt a palace or temple. Agatharchus is said to have been seized by Alcibiades and compelled by him to paint the interior of his house, which shows that at the time (about 435 B.C.) decorative painting of rooms was the fashion.

AGATHIAS (*c.* A.D. 536–582), of Myrina in Aeolis, Greek poet and historian. He studied law at Alexandria, completed his training at Constantinople and practised as an advocate (*scholasticus*) in the courts. Literature, however, was his favourite pursuit. He wrote a number of short love-poems in epic metre, called *Daphniaca*. He next put together a kind of anthology, containing epigrams by earlier and contemporary poets and himself, under the title of a *Cycle of New Epigrams.* About a hundred epigrams by Agathias have been preserved in the *Greek Anthology* and show considerable taste and elegance. After the death of Justinian (565), some of Agathias's friends persuaded him to write the history of his own times. This work, in five books, begins where Procopius ends, and is the chief authority for the period 552–558. It deals chiefly with the struggles of the Byzantine army, under the command of the eunuch Narses, against the Goths, Vandals, Franks and Persians. The author prides himself on his honesty and impartiality, but he is lacking in judgment and knowledge of facts; the work, however, is valuable from the importance of the events of which it treats. Gibbon contrasts Agathias as "a poet and rhetorician" with Procopius "a statesman and soldier."

Authorities.—Editio princeps, by B. Vulcanius (1594); in the Bonn *Corpus Scriptorum Byz. Hist.*, by B. G. Niebuhr (1828); in Migne, *Patrologia Graeca*, lxxxviii.; L. Dindorf, *Historici Graeci Minores* (1871); W. S. Teuffel, "Agathias von Myrine," in *Philologus* (i. 1846); C. Krumbacher, *Geschichte der byzantinischen Litteratur* (2nd ed. 1897).

AGATHO, pope from 678 to 681, was born in Sicily. He is noteworthy as the pope who ordered St Wilfrid to be restored to his bishopric at York in 679, and as the first to cease payment of the tribute hitherto paid on election to the emperor at Constantinople. It was during his pontificate that the 6th oecumenical council was held at Constantinople, to which he sent his legates and those from a Roman council held in 679. Agatho died on the 10th of January 681.

AGATHOCLES (361–289 B.C.), tyrant of Syracuse, was born at Thermae Himeraeae (mod. *Termini Imerese*) in Sicily. The son of a potter who had removed to Syracuse, he learned his father's trade, but afterwards entered the army. In 333 he married the widow of his patron Damas, a distinguished and wealthy citizen. He was twice banished for attempting to overthrow the oligarchical party in Syracuse (*q.v.*); in 317 he returned with an army of mercenaries under a solemn oath to observe the democratic constitution which was then set up. Having banished or murdered some 10,000 citizens, and thus made himself master of Syracuse, he created a strong army and fleet and subdued the greater part of Sicily. War with Carthage followed. In 310 Agathocles, defeated and besieged in Syracuse, took the desperate resolve of breaking through the blockade and attacking the enemy in Africa. After several victories he was at last completely defeated (306) and fled secretly to Sicily. After concluding peace with Carthage, Agathocles styled himself king of Sicily, and established his rule over the Greek cities of the island more firmly than ever. Even in his old age he displayed the same restless energy, and is said to have been meditating a fresh attack on Carthage at the time of his death. His last years were harassed by ill-health and the turbulence of his grandson Archagathus, at whose instigation he is said to have been poisoned; according to others, he died a natural death. He was a born leader of mercenaries, and, although he did not shrink from cruelty to gain his ends, he afterwards showed himself a mild and popular "tyrant."

See Justin xxii., xxiii.; Diodorus Siculus xix., xxi., xxii. (follows generally Timaeus who had a special grudge against Agathocles); Polybius ix. 23; Schubert, *Geschichte des Agathokles* (1887); Grote, *History of Greece*, ch. 97; also Sicily, *History*.

AGATHODAEMON, in Greek mythology, the "good spirit" of cornfields and vineyards. It was the custom of the Greeks to drink a cup of pure wine in his honour at the end of each meal (Aristophanes, *Equites*, 106). He was also regarded as the protecting spirit of the state and of individuals. He was often accompanied by Ἀγαθὴ Τύχη (good fortune), and in this aspect may be compared with the Roman Bonus Eventus (Pliny, *Nat Hist.* xxxvi. 23), and Genius. He is represented in works of art in the form of a serpent, or of a young man with a cornucopia and a bowl in one hand, and a poppy and ears of corn in the other.

See Gerhard, *Über Agathodämon und Bona Dea* (Berlin, 1849).

AGATHODAEMON, of Alexandria, map designer, probably lived in the 2nd century A.D. Some MSS. of the *Geography* of Ptolemy contain twenty-seven maps, which are stated to have been drawn by Agathodaemon of Alexandria, who "delineated the whole world according to the eight books of Ptolemy's geography." As Ptolemy speaks of Πίνακες to accompany his treatise, these maps were probably the work of a contemporary acting under his instructions. About 1470 Nicolaus Doris, a Benedictine monk, brought out a revised edition of them, the names being inserted in Latin instead of Greek.

See Bunbury, *History of Ancient Geography*, ii.

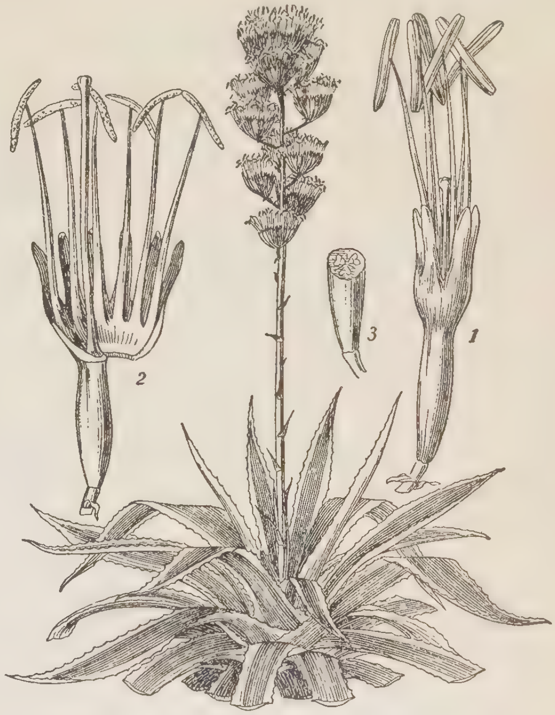
AGATHON (c. 448–400 B.C.), Athenian tragic poet, friend of Euripides and Plato, best known from his mention by Aristophanes (*Thesmophoriazusae*) and in Plato's *Symposium*, which describes the banquet given to celebrate his obtaining a prize for a tragedy (416). He probably died at the court of Archelaus, king of Macedonia. He introduced certain innovations, and Aristotle (*Poetica*, 9) tells us that the plot of his Ἄνθος was original, not, as usually, borrowed from mythological subjects.

See Aristophanes, *Thesmoph.* 59, 106, *Eccles.* 100; Plato, *Symp.* 198 c; Plutarch, *Symp.* 3; Aelian, *Var. Hist.* xiv. 13; Ritsch, *Opuscula*, i.; fragments in Nauck, *Tragicorum Graecorum Fragmenta.*

AGATHYRSI, a people of Thracian origin, who in the earliest historical times occupied the plain of the Maris (Maros), in the region now known as Transylvania. Thyrsi is supposed to be a Scythian form of Τραυσοί (Trausi), a Thracian tribe mentioned by Stephanus of Byzantium. They are described by Herodotus (iv. 104) as of luxurious habits, wearing gold ornaments (the district is still auriferous) and having wives in common. They tattooed their bodies (*picti*, *Aeneid* iv. 136), degrees of rank being indicated by the manner in which this was done, and coloured their hair dark blue. Like the Gallic Druids, they recited their laws in a kind of sing-song to prevent their being forgotten, a practice still in existence in the days of Aristotle (*Problemata*, xix. 28). Valerius Flaccus (*Argonautica*, vi. 135) calls them Thyrsagetae, probably in reference to their celebration of orgiastic rites in honour of some divinity akin to the Thracian Dionysus. In later times the Agathyrsi were driven farther north, and their name was unknown to the Romans in their original home.

See Ammianus Marcellinus xxxi. 2. 17; Pliny, *Nat. Hist.* iv. 12 [26]. 88; Pomponius Mela ii. 1. 10; W. Tomaschek, "Die alten Thraker," in *Sitzungsber. der philosophisch-historischen Klasse der kaiserl. Akad. der Wiss.* cxxviii. (Vienna, 1893).

AGAVE, a large botanical genus of the natural order Amaryllidaceae, chiefly Mexican, but occurring also in the southern and western United States and in central and tropical South America. The plants have a large rosette of thick fleshy leaves generally ending in a sharp point and with a spiny margin; the stout stem is usually short, the leaves apparently springing from the root. They grow slowly and flower but once after a number of years, when a tall stem or "mast" grows from the centre of the leaf-rosette and bears a large number of shortly tubular flowers. After development of fruit the plant dies down, but suckers are frequently produced from the base of the stem which become new plants. The most familiar species is *Agave americana* (see fig.), a native of tropical America, the so-called century plant or American aloe (the maguey of Mexico). The number of years before flowering occurs depends on the vigour of the individual, the richness of the soil and the climate; during these years the plant is storing in its fleshy leaves the nourishment required for the effort of flowering. During the development of the inflorescence there is a rush of sap to the base of the young flower-stalk. In the case of *A. americana* and other species this is used by the Mexicans to make their national beverage, *pulque*; the flower shoot is cut out and the sap collected and subsequently fermented. By distillation a spirit called mescal is prepared. The leaves of several species yield fibre, as for instance, *A. rigida* var. *sisalana*, sisal hemp (*q.v.*), *A. decipiens*, false sisal hemp; *A. americana* is the source of *pita* fibre, and is used as a fibre plant in Mexico, the West Indies and southern Europe. The flowering stem of the last named, dried and cut in slices, forms natural razor strops, and the expressed juice of the leaves will lather in water like soap. In the Madras Presidency the plant is extensively used for hedges along railroads. *Agave americana*, century plant, was introduced into Europe about the middle of the 16th century and is now widely cultivated for its handsome appearance; in the variegated forms the leaf has a white or yellow marginal or central stripe from base to apex. As the leaves unfold from the centre of the rosette the impression of the marginal spines is very conspicuous on the still erect younger leaves. The plants are usually grown in tubs and put out in the summer months, but in the winter require to be protected from frost. They mature very slowly and die after flowering, but are easily propagated by the offsets from the base of the stem.



Agave americana, Century plant or American aloe. About $\frac{1}{40}$ nat. size. 1, Flower; 2, same flower split open above the ovary; 3, ovary cut across; 1, 2, and 3, about $\frac{1}{2}$ nat. size.

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AGDE, a town of southern France, in the department of Hérault, on the left bank of the river of that name, $2\frac{1}{2}$ m. from the Mediterranean Sea and 32 m. S.W. of Montpellier on the Southern railway. Pop. (1906) 7146. The town lies at the foot of an extinct volcano, the Montagne St Loup, and is built of black volcanic basalt, which gives it a gloomy appearance. Overlooking the river is the church of St André, which dates partly from the 12th century, and, till the Revolution, was a cathedral. It is a plain and massive structure with crenelated walls, and has the aspect of a fortress rather than of a church. The exterior is diversified by arched recesses forming machicolations, and the same architectural feature is reproduced in the square tower which rises like a donjon above the building. The *Canal du Midi*, or Languedoc canal, uniting the Garonne with the Mediterranean, passes under the walls of the town, and the mouth of the Hérault forms a harbour which is protected by a fort. The maritime commerce of the town has declined, owing partly to the neighbourhood of Cette, partly to the shallowness of the Hérault. The fishing industry is, however, still active. The chief public institutions are the tribunal of commerce and the communal college.

Agde is a place of great antiquity and is said to have been founded under the name of ἀγαθὴ πόλις (Good City) by the Phocaeans. The bishopric was established about the year 400 and was suppressed in 1790.

Synod of Agde (*Concilium Agathense*).—With the permission of the West Goth Alaric II. thirty-five bishops of southern Gaul assembled in person or sent deputies to Agde on the 11th of September 506. Caesarius, bishop of Arles, presided. The forty-seven genuine canons of the synod deal with discipline, church life, the alienation of ecclesiastical property and the treatment of Jews. While favouring sacerdotal celibacy the council laid rather rigid restrictions on monasticism. It commanded that the laity communicate at Christmas, Easter and Whitsuntide. The canons of Agde are based in part on earlier Gallic, African and Spanish legislation; and some of them were re-enacted by later councils, and found their way into collections such as the Hispana, Pseudo-Isidore and Gratian.

See Mansi viii. 319 ff.; Hefele, *Conciliengeschichte*, 2nd edition, ii. 649 ff. (English translation, iv. 76 ff.); Herzog-Hauck, *Realencyklopädie*, i. 242.

AGE (Fr. *âge*, through late Lat. *aetaticum*, from *aetas*), a term used (1) of the divisions into which it is suggested that human history may be divided, whether regarded from the geological, cultural or moral aspects, *e.g.* the palaeolithic age, the bronze age, the dark ages; (2) of an historic epoch or generation; (3) of any period or stage in the physical life of a person, animal or thing; (4) of that time of life at which the law attributes full responsibility for his or her acts to the individual.

(1) From the earliest times there would appear to have been the belief that the history of the earth and of mankind falls naturally into periods or ages. Classical mythology popularized the idea. Hesiod, for example, in his poem *Works and Days*, describes minutely five successive ages, during each of which the earth was peopled by an entirely distinct race. The first or *golden* race lived in perfect happiness on the fruits of the untilled earth, suffered from no bodily infirmity, passed away in a gentle sleep, and became after death guardian daemons of this world. The second or *silver* race was degenerate, and refusing to worship the immortal gods, was buried by Jove in the earth. The third or *brazen* race, still more degraded, was warlike and cruel, and perished at last by internal violence. The fourth or *heroic* race was a marked advance upon the preceding, its members being the heroes or demi-gods who fought at Troy and Thebes, and who were rewarded after death by being permitted to reap thrice a year the free produce of the earth. The fifth or *iron* race, to which the poet supposes himself to belong, is the most degenerate of all, sunk so low in every vice that any new change must be for the better. Ovid, in his *Metamorphoses*, follows Hesiod exactly as to nomenclature and very closely as to substance. He makes the degeneracy continuous, however, by omitting the heroic race or age, which, as Grote points out, was probably introduced by Hesiod, not as part of his didactic plan, but from a desire to conciliate popular feeling by including in his poem the chief myths that were already current among the Greeks. Varro recognized three ages: (1) from the beginning of mankind to the Deluge, a quite indefinite period; (2) from the Deluge to the First Olympiad, called the Mythical Period; (3) from the First Olympiad to his own time, called the Historic Period. Lucretius divided man's history into three cultural periods: (1) the Age of Stone; (2) the Age of Bronze; (3) the Age of Iron. He thus anticipated the conclusions of some of the greatest of modern archaeologists.

(2) A definite period in history, distinguished by some special characteristic, such as great literary activity, is generally styled, with some appropriate epithet, an age. It is usual, for example, to speak of the Age of Pericles, the Augustan, the Elizabethan or the Victorian Ages; of the Age of the Crusades, the Dark Ages, the Middle Ages, the Age of Steam. Such isolated periods, with no continuity or necessary connexion of any kind, are obviously quite distinct from the ages or organically related periods into which philosophers have divided the whole course of human history. Auguste Comte, for instance, distinguishes three ages according to the state of knowledge in each, and he supposes that we are now entering upon the third of these. In the first age of his scheme knowledge is *supernatural* or fictitious; in the second it is *metaphysical* or abstract; in the third it is *positive* or scientific. Schemes somewhat similar have been proposed by other philosophers, chiefly of France and Germany, and seem to be regarded by them as essential to any complete science of history.

(3) The subject of the duration of human and animal life does not fall within the scope of this article, and the reader is referred to Longevity. But the word "age" has been used by physiologists to express certain natural divisions in human development and decay. These are usually regarded as numbering five, viz. *infancy*, lasting to the seventh year; *childhood* to the fourteenth; *youth* to the twenty-first; *adult life* till fifty; and *old age*.

(4) The division of human life into periods for legal purposes is naturally more sharp and definite than in physiology. It would be unscientific in the physiologist to name any precise year for the transition from one of his stages to another, inasmuch as that differs very considerably among different nations, and even to some extent among different individuals of the same nation. But the law must necessarily be fixed and uniform, and even where it professes to proceed according to nature, must be more precise than nature. The Roman law divided human life for its purposes into four chief periods, which had their subdivisions—(1) *infantia*, lasting till the close of the seventh year; (2) the period between *infantia* and *pubertas*, males becoming *puberes* at fourteen and females at twelve; (3) *adolescentia*, the period between puberty and majority; and (4) the period after the twenty-fifth year, when males became *majores*. The first period was one of total legal incapacity; in the second period a person could lawfully do certain specified acts, but only with the sanction of his tutor or guardian; in the third the restrictions were fewer, males being permitted to manage their own property, contract marriage and make a will; but majority was not reached until the age of twenty-five. By English law there are two great periods into which life is divided—*infancy*, which lasts in both sexes until the twenty-first year, and manhood or womanhood The period of infancy, again, is divided into several stages, marked by the growing development both of rights and obligations. Thus at twelve years of age a male may take the oath of allegiance; at fourteen both sexes are held to have arrived at years of discretion, and may therefore choose guardians, give evidence and consent or disagree to a marriage. A female has the last privilege from the twelfth year, but the marriage cannot be celebrated until the majority of the parties without the consent of parents or guardians. At fourteen, too, both sexes are fully responsible to the criminal law. Between seven and fourteen there is responsibility only if the accused be proved *doli capax*, capable of discerning between right and wrong, the principle in that case being that *malitia supplet aetatem*. At twenty-one both males and females obtain their full legal rights, and become liable to all legal obligations. A seat in the British parliament may be taken at twenty-one. Certain professions, however, demand as a qualification in entrants a more advanced age than that of legal manhood. In the Church of England a candidate for deacon's orders must be twenty-three (in the Roman Catholic Church, twenty-two) and for priest's orders twenty-four years of age; and no clergyman is eligible for a bishopric under thirty. In Scotland infancy is not a legal term. The time previous to majority, which, as in England, is reached by both sexes at twenty-one, is divided into two stages: *pupilage* lasts until the attainment of puberty, which the law fixes at fourteen in males and twelve in females; *minority* lasts from these ages respectively until twenty-one. *Minority* obviously corresponds in some degree to the English *years of discretion*, but a Scottish minor has more personal rights than an English infant in the last stage of his infancy, *e.g*

he may dispose by will of movable property, make contracts, carry on trade, and, as a necessary consequence, is liable to be declared a bankrupt. In France the year of majority is twenty-one, and the nubile age eighteen for males and fifteen for females, with a restriction as to the consent of guardians. Age qualification for the chamber of deputies is twenty-five and for the senate forty years. In Germany, majority is reached at twenty-one, the nubile age is twenty for males and sixteen for females, subject to the consent of parents. Without the consent of parents, the age is twenty-five for males and twenty-four for females. The age qualification for the Reichstag is twenty-five. In Austria the age of majority is twenty-four, and the nubile age fourteen for either sex, subject to the consent of the parents. In Denmark, qualified majority is reached at eighteen and full majority at twenty-five. The nubile age is twenty for males and sixteen for females. In Spain, majority is reached at twenty-three; the nubile age is eighteen for males and sixteen for females. In Greece the age of majority is twenty-one, and the nubile age sixteen for males and fourteen for females. In Holland the age of majority is twenty-one, and the nubile age eighteen for males and sixteen for females. In Italy, majority is reached at twenty-one; the nubile age is eighteen for males and fifteen for females. In Switzerland the age of majority is twenty, and the nubile age is eighteen for males and sixteen for females. In the United States the age qualification for a president is thirty-five, for a senator thirty and for a representative twenty-five.

AGELADAS, or (as the name is spelt in an inscription) HAGELAIDAS, a great Argive sculptor, who flourished in the latter part of the 6th and the early part of the 5th century B.C. He was specially noted for his statues of Olympic victors (of 520, 516, 508 B.C.); also for a statue at Messene of Zeus, copied on the coins of that city. Ageladas was said to have been the teacher of Myron, Phidias and Polyclitus; this tradition is a testimony to his wide fame, though historically doubtful. We have no work of Ageladas surviving; but we have an inscription which contains the name of his son Argeiadas.

AGEN, a city of south-western France, capital of the department of Lot-et-Garonne, 84 m. S.E. of Bordeaux by the Southern railway between Bordeaux and Toulouse. Pop. (1906) 18,640. It is skirted on the west by the Garonne itself, and on the north by its lateral canal. The river is crossed by a stone bridge, by a suspension bridge for foot-passengers, and by a fine canal-bridge, carrying the lateral canal. Pleasant promenades stretch for some distance along the right bank. The town is a medley of old narrow streets contrasting with the wide modern boulevards which cross it at intervals. The chief building in Agen is the cathedral of St Caprais, the most interesting portion of which is the apse of the 12th century with its three apse-chapels; the transept dates from the 12th and 13th centuries, the nave from the 14th to the 16th centuries; the tower flanking the south façade is modern. The interior is decorated with modern paintings and frescoes. There are several other churches, among them the church of the Jacobins, a brick building of the 13th century, and the church of St Hilaire of the 16th century, which has a modern tower. In the prefecture, a building of the 18th century, once the bishop's palace, is a collection of historical portraits. The hôtel de ville occupies the former Hôtel du Présidial, an obsolete tribunal, and contains the municipal library. Two houses of the 16th century, the Hôtel d'Estrades and the Hôtel de Vaurs, are used as the museum, which has a rich collection of fossils, prehistoric and Roman remains, and other antiquities and curiosities. The poet Jacques Jasmin was a native of the town, which has erected a statue to him. Through its excellent water communication it affords an outlet for the agricultural produce of the district, and forms an *entrepôt* of trade between Bordeaux and Toulouse. Agen is the seat of a bishop. It is the seat of a court of appeal and a court of assizes, and has tribunals of first instance and of commerce and a chamber of commerce. There are also ecclesiastical seminaries, lycées for boys and girls, training-colleges, a school of commerce and industry, and a branch of the Bank of France. Agen is the market for a rich agricultural region. The chief articles of commerce are fattened poultry, prunes (*pruneaux d'Agen*) and other fruit, cork, wine, vegetables and cattle. Manufactures include flour, dried plums, *pâté de foie gras* and other delicacies, hardware, manures, brooms, drugs, woven goods tiles.

Agen (Aginnum) was the capital of the Celtic tribe of the Nitiobroges, and the discovery of extensive ruins attests its importance under the Romans. In later times it was the capital of the Agenais. Its bishopric was founded in the 4th century. Agen changed hands more than once in the course of the Albigensian wars, and at their close a tribunal of inquisition was established in the town and inflicted cruel persecution on the heretics. During the religious wars of the 16th century Agen took the part of the Catholics and openly joined the League in 1589.

See Labenazie, *Histoire de la ville d'Agen et pays d'Agenois*, ed. by A.-G. de Dampierre (1888); A. Ducom, *La Commune d'Agen: essai sur son histoire et son organisation depuis son origine jusqu'au traité de Brétigny* (1892).

AGENAIS, or AGENOIS, a former province of France. In ancient Gaul it was the country of the Nitiobroges with *Aginnum* for its capital, and in the 4th century it was the *Civitas Agennensium* which was a part of *Aquitania Secunda* and which formed the diocese of Agen. Having in general shared the fortunes of Aquitaine during the Merovingian and Carolingian periods, Agenais next became an hereditary countship in the part of the country now called Gascony (*Vasconia*). In 1038 this countship was purchased by the dukes of Aquitaine and counts of Poitiers. The marriage of Eleanor of Aquitaine with Henry Plantagenet in 1152 brought it under the sway of England; but when Richard Cœur-de-Lion married his sister Joan to Raymund VI., count of Toulouse, in 1196, Agenais formed part of the princess's dowry; and with the other estates of the last independent count of Toulouse it lapsed to the crown of France in 1271. This, however, was not for long; the king of France had to recognize the prior rights of the king of England to the possession of the countship, and restored it to him in 1279. During the wars between the English and the French in the 14th and 15th centuries, Agenais was frequently taken and retaken, the final retreat of the English in 1453 at last leaving the king of France in peaceable possession. Thenceforth Agenais was no more than an administrative term. At the end of the *ancien régime* it formed part of the "Gouvernement" of Guienne, and at the Revolution it was incorporated in the département of Lot-et-Garonne, of which it constitutes nearly the whole. The title of count of Agenais, which the kings of England had allowed to fall into desuetude, was revived by the kings of France, and in 1789 was held by the family of the dukes of Richelieu.

There is no good history of Agenais; that published by Jules Andrieu in 1893 (*Histoire de l'Agenais*, 2 vols.) being quite inadequate. The *Bibliographie générale de l'Agenais*, by the same author (1886–1891, 3 vols.), may be found useful. (C. B.*)

AGENT (from Lat. *agere*, to act), a name applied generally to any person who acts for another. It has probably been adopted from France, as its function in modern civil law was otherwise expressed in Roman jurisprudence. Ducange (s.v. *Agentes*) tells us that in the later Roman empire the officers who collected the grain in the provinces for the troops and the household, and afterwards extended their functions so as to include those of government postmasters or spies, came to be called *agentes in rebus*, their earlier name having been *frumentarii*. In law an agent is a person authorized, expressedly or impliedly, to act for another, who is thence called the principal, and who is, in consequence of, and to the extent of, the authority delegated by him, bound by the acts of his agent. (See PRINCIPAL AND AGENT; FACTOR, &c.)

In Scotland the procurators or solicitors who act in the preparation of cases in the various law-courts are called agents. (See SOLICITOR.)

In France the *agents de change* were formerly the class generally licensed for conducting all negotiations, as they were termed, whether in commerce or the money market. The term has, however, become practically limited to those who conduct transactions in public stock. The laws and regulations as to *courtiers*, or those whose functions were more distinctly confined to transactions in merchandise, have been mixed up with those applicable to *agents de change*. Down to the year 1572 both functions were free; but at that period, partly for financial reasons, a system of licensing was adopted at the suggestion of the chancellor, l'Hôpital. Among the other revolutionary measures of the year 1791, the professions of agent and *courtier* were again opened to the public. Many of the financial convulsions of the ensuing years, which were due to more serious causes, were attributed to this indiscriminate removal of restrictions, and they were reimposed in 1801. From that period regulations have been made from time to time as to the qualifications of agents, the security to be found by them and the like. They are now regarded as public officers, appointed, with certain privileges and duties, by the government to act as intermediaries in negotiating transfers of public funds and commercial stocks and for dealing in metallic currency. (See Stock Exchange: *France*.)

In diplomacy the term "agent" was originally applied to all "diplomatic agents," including ambassadors. With the evolution of the diplomatic hierarchy, however, the term gradually sank until it was technically applied only to the lowest class of "diplomatic agents," without a representative character and of a status and character so dubious that, by the regulation of the congress of Vienna, they were wholly excluded from the immunities of the diplomatic service. (See Diplomacy.)

AGENT-GENERAL, the term given to a representative in England of one of the self-governing British colonies. Agents-general may be said to hold a position mid-way between agents of provinces and ambassadors of foreign countries. They are appointed, and their expenses and salaries provided, by the governments of the colonies they represent, viz. Cape of Good Hope, Natal, the Transvaal, New South Wales, Queensland, South Australia, Tasmania, Victoria, Western Australia, New Zealand and Canada (whose representatives are termed high commissioners). Their duties are to look after the political and economic interests of their colonies in London, to assist in all financial and commercial matters in which their colonies may be concerned, such as shipping arrangements and rates of freight, cable communications and rates, tenders for public works, &c., and to make known the products of their colonies. Those colonies which are not under responsible government are represented in London by crown agents.

AGESANDER, a Rhodian sculptor, whose title to fame is that he is mentioned by Pliny (*Nat. Hist.* xxxvi. 37) as author (with Polydorus and Athenodorus) of the group of the Laocoon. Inscriptions recently found at Lindus in Rhodes date Agesander and Athenodorus to the period 42–21 B.C. The date of the Laocoon seems thus finally settled, after long controversy. It represents the culmination of a sentimental or pathetic tendency in art, which is prominent in the somewhat earlier sculpture of Pergamum. (See Greek Art.)

AGESILAUS II., king of Sparta, of the Eurypontid family, was the son of Archidamus II. and Eupolia, and younger step-brother of Agis II., whom he succeeded about 401 B.C. Agis had, indeed, a son Leotychides, but he was set aside as illegitimate, current rumour representing him as the son of Alcibiades. Agesilaus' success was largely due to Lysander, who hoped to find in him a willing tool for the furtherance of his political designs; in this hope, however, Lysander was disappointed, and the increasing power of Agesilaus soon led to his downfall. In 396 Agesilaus was sent to Asia with a force of 2000 Neodamodes (enfranchized Helots) and 6000 allies to secure the Greek cities against a Persian attack. On the eve of sailing from Aulis he attempted to offer a sacrifice, as Agamemnon had done before the Trojan expedition, but the Thebans intervened to prevent it, an insult for which he never forgave them. On his arrival at Ephesus a three months' truce was concluded with Tissaphernes, the satrap of Lydia and Caria, but negotiations conducted during that time proved fruitless, and on its termination Agesilaus raided Phrygia, where he easily won immense booty since Tissaphernes had concentrated his troops in Caria. After spending the winter in organizing a cavalry force, he made a successful incursion into Lydia in the spring of 395. Tithraustes was thereupon sent to replace Tissaphernes, who paid with his life for his continued failure. An armistice was concluded between Tithraustes and Agesilaus, who left the southern satrapy and again invaded Phrygia, which he ravaged until the following spring. He then came to an agreement with the satrap Pharnabazus and once more turned southward. It was said that he was planning a campaign in the interior, or even an attack on Artaxerxes himself, when he was recalled to Greece owing to the war between Sparta and the combined forces of Athens, Thebes, Corinth, Argos and several minor states. A rapid march through Thrace and Macedonia brought him to Thessaly, where he repulsed the Thessalian cavalry who tried to impede him. Reinforced by Phocian and Orchomenian troops and a Spartan army, he met the confederate forces at Coronea in Boeotia, and in a hotly contested battle was technically victorious, but the success was a barren one and he had to retire by way of Delphi to the Peloponnese. Shortly before this battle the Spartan navy, of which he had received the supreme command, was totally defeated off Cnidus by a powerful Persian fleet under Conon and Pharnabazus.

Subsequently Agesilaus took a prominent part in the Corinthian war, making several successful expeditions into Corinthian territory and capturing Lechaeum and Piraeum. The loss, however, of a *mora*, which was destroyed by Iphicrates, neutralized these successes, and Agesilaus returned to Sparta. In 389 he conducted a campaign in Acarnania, but two years later the Peace of Antalcidas, which was warmly supported by Agesilaus, put an end to hostilities. When war broke out afresh with Thebes the king twice invaded Boeotia (378, 377), and it was on his advice that Cleombrotus was ordered to march against Thebes in 371. Cleombrotus was defeated at Leuctra and the Spartan supremacy overthrown. In 370 Agesilaus tried to restore Spartan prestige by an invasion of Mantinean territory, and his prudence and heroism saved Sparta when her enemies, led by Epaminondas, penetrated Laconia that same year, and again in 362 when they all but succeeded in seizing the city by a rapid and unexpected march. The battle of Mantinea (362), in which Agesilaus took no part, was followed by a general peace: Sparta, however, stood aloof, hoping even yet to recover her supremacy. In order to gain money for prosecuting the war Agesilaus had supported the revolted satraps, and in 361 he went to Egypt at the head of a mercenary force to aid Tachos against Persia. He soon transferred his services to Tachos's cousin and rival Nectanabis, who, in return for his help, gave him a sum of over 200 talents. On his way home Agesilaus died at the age of 84, after a reign of some 41 years.

A man of small stature and unimpressive appearance, he was somewhat lame from birth, a fact which was used as an argument against his succession, an oracle having warned Sparta against a "lame reign." He was a successful leader in guerilla warfare, alert and quick, yet cautious—a man, moreover, whose personal bravery was unquestioned. As a statesman he won himself both enthusiastic adherents and bitter enemies, but of his patriotism there can be no doubt. He lived in the most frugal style alike at home and in the field, and though his campaigns were undertaken largely to secure booty, he was content to enrich the state and his friends and to return as poor as he had set forth. The worst trait in his character is his implacable hatred of Thebes, which led directly to the battle of Leuctra and Sparta's fall from her position of supremacy.

See lives of Agesilaus by Xenophon (the panegyric of a friend), Cornelius Nepos and Plutarch; Xenophon's *Hellenica* and Diodorus xiv., xv. Among modern authorities, besides the general histories of Greece, J. C. F. Manso, *Sparta*, iii. 39 ff.; G. F. Hertzberg, *Das Leben des Königs Agesilaos II. von Sparta* (1856); Buttmann, *Agesilaus Sohn des Archidamus* (1872); C. Haupt, *Agesilaus in Asien* (1874); E. von Stern, *Geschichte der spartanischen und thebanischen Hegemonie* (1884). (M. N. T.)

AGGLOMERATE (from the Lat. *agglomerare*, to form into a ball, *glomus*, *glomeris*), a term used in botany, meaning crowded in a close cluster or head, and, in geology, applied to the accumulations of coarse volcanic ejectamenta such as frequently occur near extinct or active volcanoes. Agglomerates in the geological sense, with which this article is concerned, consist typically of blocks of various igneous rocks, mixed often with more or less material of rudimentary origin and embedded in a finer-grained matrix, similar in nature to the coarser fragments. As distinguished from ordinary ash beds or tuffs, they are essentially coarser, less frequently well-bedded; they are less persistent and tend to occur locally, but may attain a very great thickness. Showers of fine ash may be distributed over a wide area of country and will form thin layers of great extent. Coarser accumulations gather only near the actual foci of eruption (craters, fissures, &c.). When the activity of a volcanic vent comes to an end, the orifice is often choked by masses of débris, which will in time become compacted into firm agglomerates. Hence rocks of this type very commonly mark the sites of necks, the remains of once-active volcanic craters. In this connexion they are of especial interest to geologists, as it is always important to be able tc locate the exact points at which volcanic products, such as lavas and ash-beds, were emitted.

The blocks in agglomerates vary greatly in size. Some are thirty or forty feet in diameter, and weigh many tons; these are usually pieces of the strata through which the volcano has forced an outlet. They are never far from the crater; most of them, in fact, lie within its boundaries, and cases are known in which enormous masses of this kind (half an acre in area) have been found in such situations. They are masses which have been dislodged, by fissures and landslides, from the crater's walls and have tumbled into the cavity. Pieces of sandstone, limestone and shale occur in the agglomerates mixed with volcanic materials, and very often have been baked and partly recrystallized by contact with the hot igneous rocks and the gases discharged by the volcano. At Vesuvius such blocks of altered limestone are rich in new minerals and are well known to collectors.

Agglomerates also are usually full of volcanic bombs. These are spongy globular masses of lava which have been shot from the crater at a time when liquid molten lava was exposed in it, and was frequently shattered by the sudden outbursts of steam. These bombs were more or less viscous at the moment of ejection and by rotation in the air acquired their spheroidal form. They are commonly one or two feet in diameter, but specimens as large as nine or twelve feet have been observed. There is less variety in their composition at any volcanic centre than in the case of the foreign blocks above described. They correspond in nature to the lava which at the time fills the crater of the volcano, and as this varies only very slowly the bombs belong mostly to only a few kinds of rock and are similar in composition to the lava flows.

Crystalline masses of a different kind occur in some numbers in certain agglomerates. They consist of volcanic minerals very much the same as those formed in the lavas, but exhibiting certain peculiarities which indicate that they have formed slowly under pressure at considerable depths. Hence they bear a resemblance to plutonic igneous rocks, but are more correctly to be regarded as agglomerations of crystals formed within the liquid lava as it slowly rose towards the surface, and at a subsequent period cast out by violent steam explosions. The sanidinites of the Eifel belong to this group. At Vesuvius, Ascension, St Vincent and many other volcanoes, they form a not inconsiderable part of the coarser ash-beds. Their commonest minerals are olivine, anorthite, hornblende, augite, biotite and leucite.

Agglomerates occur wherever volcanoes are known. In many parts of Britain they attain a great development either in beds alternating with lavas or as the material occupying necks. In the latter case they are often penetrated by dikes. They also show a steep, angular, funnel-shaped dip (*e.g.* Arthur's Seat, Edinburgh), and may contain thin layers of clay or ashy sand-stone, which gathered in the crater during intervals of repose. (J. S. F.)

AGGLUTINATION (Lat. *ad*, and *gluten*, *glutinare*, literally to fasten together with glue), a term used technically in philology for the method of word-formation by which two significant words or roots are joined together in a single word to express a combination of the two meanings each of which retains its force. This juxtaposition or conjoining of roots is characteristic of languages such as the Turkish and Japanese, which are therefore known as agglutinative, as opposed to others, known generically as inflexional, in which differences of termination or combinations in which all separate identity disappears are predominant.

The term was also formerly used by associationist philosophers for those mental associations which were regarded as peculiarly close. Combination in its simplest form has been called Agglutination by W. Wundt.

AGGRAVATION (from Lat. *ad*, increasing, and *gravis*, heavy), the making anything graver or more serious, especially of offences; also used as synonymous with "irritation." In the canon law "aggravation" was a form of ecclesiastical censure, threatening excommunication after three disregarded admonitions.

AGGREGATION (from the Lat. *ad*, to, *gregare*, to collect together), in physics, a collective term for the forms or states in which matter exists. Three primary "states of aggregation" are recognized—gaseous, liquid and solid. Generally, if a solid be heated to a certain temperature, it melts or fuses, assuming the liquid condition (see FUSION); if the heating be continued the liquid boils and becomes a vapour (see VAPORIZATION). On the other hand, if a gas be sufficiently cooled and compressed, it liquefies; this transition is treated theoretically in the article CONDENSATION OF GASES, and experimentally in the article LIQUID GASES.

AGGTELEK, a village of Hungary, in the county of Gömör, situated to the south of Rozsnyó, on the road from Budapest to Dobsina. Pop. (1900) 557. In the neighbourhood is the celebrated Aggtelek or Baradla cavern, one of the largest and most remarkable stalactite grottos in Europe. It has a length, together with its ramifications, of over 5 miles, and is formed of two caverns—one known for several centuries, and another discovered by the naturalist Adolf Schmidl in 1856. Two entrances give access to the grotto, an old one extremely narrow, and a new one, made in 1890, through which the exploration of the cavern can be made in about 8 hours, half the time it took before. The cavern is composed of a labyrinth of passages and large and small halls, and is traversed by a stream. In these caverns there are numerous stalactite structures, which, from their curious and fantastic shapes, have received such names as the Image of the Virgin, the Mosaic Altar, &c. The principal parts are the Paradies with the finest stalactites, the Astronomical Tower and the Beinhaus. Rats, frogs and bats form actually the only animal life in the caves, but a great number of antediluvian animal bones have been found here, as well as human bones and numerous remains of prehistoric human settlements.

AGINCOURT (AZINCOURT), a village of northern France in the department of Pas de Calais, 14 m. N.W. of St Pol by road, famous on account of the victory, on the 25th of October 1415, of Henry V. of England over the French. The battle was fought in the defile formed by the wood of Agincourt and that of Tramecourt, at the northern exit of which the army under d'Albret, constable of France, had placed itself so as to bar the way to Calais against the English forces which had been campaigning on the Somme. The night of the 24th of October was spent by the two armies on the ground, and the English had but little shelter from the heavy rain which fell. Early on the 25th, St Crispin's day, Henry arrayed his little army (about 1000 men-at-arms, 6000 archers, and a few thousands of other foot). It is probable that the usual three "battles" were drawn up in line, each with its archers on the flanks and the dismounted men-at-arms in the centre; the archers being thrown forward in wedge-shaped salients, almost exactly as at Crécy (*q.v.*). The French, on the other hand, were drawn up in three lines, each line formed in deep masses. They were at least four times more numerous than the English, but restricted by the nature of the ground to the same extent of front, they were unable to use their full weight (cf. Bannockburn); further, the deep mud prevented their artillery from taking part, and the crossbowmen were as usual relegated to the rear of the knights and men-at-arms. All were dismounted save a few knights and men-at-arms on the flanks, who were intended to charge the archers of the enemy. For three hours after sunrise there was no fighting; then Henry, finding that the French would not advance, moved his army farther into the defile. The archers fixed the pointed stakes, which they carried to ward off cavalry charges, and opened the engagement with flights of arrows. The chivalry of France, undisciplined and careless of the lesson of Crécy and Poitiers, was quickly stung into action, and the French mounted men charged, only to be driven back in confusion. The constable himself headed the leading line of dismounted men-at-arms; weighted with their armour, and sinking deep into the mud with every step, they yet reached and engaged the English men-at-arms; for a time the fighting was severe. The thin line of the defenders was borne back and King Henry was almost beaten to the ground. But at this moment the archers, taking their hatchets, swords or other weapons, penetrated the gaps in the now disordered French, who could not move to cope with their unarmoured assailants, and were slaughtered or taken prisoners to a man. The second line of the French came on, only to be engulfed in the *mêlée;* its leaders, like those of the first line, were killed or taken, and the commanders of the third sought and found their death in the battle, while their men rode off to safety. The closing scene of the battle was a half-hearted attack made by a body of fugitives, which led merely to the slaughter of the French prisoners, which was ordered by Henry because he had not enough men both to guard them and to meet the attack. The slaughter ceased when the assailants drew off. The total loss of the English is stated at thirteen men-at-arms (including the duke of York, grandson of Edward III.) and about 100 of the foot. The French lost 5000 of noble birth killed, including the constable, 3 dukes, 5 counts and 90 barons; 1000 more were taken prisoners, amongst them the duke of Orleans (the Charles d'Orléans of literature).

See Sir Harris Nicolas, *Battle of Agincourt*; Fortescue, *History of the British Army*, vol. i.; and H. B. George, *Battles of English History*.

AGIO (Ital. *aggio*, exchange, discount, premium), a term used in commerce in three slightly different connexions. (*a*) The variations from fixed pars or rates of exchange in the currencies of different countries. For example, in most of the gold-standard countries, the standard coin is kept up to a uniform point of fineness, so that an English sovereign fresh from the mint will bear the following constant relation to coins of other countries in a similar condition:—£1 = frcs. 25·221 = mks. 20·429 = $4·867, &c. This is what is known as the mint par of exchange. But the mint par of exchange, say, between France and England is not necessarily the market value of French currency in England, or English currency in France. The balance of trade between the various countries is the factor determining the rate of exchange. Should the *balance of trade* (*q.v.*) be against England, money must be remitted to France in payment of the indebtedness, but owing to the cost for the transmission of specie there will be a demand for bills drawn on Paris as a cheaper and more expeditious method of sending money, and it therefore will be necessary, in order to procure the one of the higher current value, to pay a premium for it, called the agio. (*b*) The term is also used to denote the difference in exchange between two currencies in the same country; where silver coinage is the legal tender, agio is sometimes allowed for payment in the more convenient form of gold, or where the paper currency of a country is reduced below the bullion which it professes to represent, an agio is payable on the appreciated currency. (*c*) Lastly, in some states the coinage is so debased, owing to the wear of circulation, that the real is greatly reduced below the nominal value. Supposing that this reduction amounts to 5%, then if 100 sovereigns were offered as payment of a debt in England while such sovereigns were current there at their nominal value, they would be received as just payment; but if they were offered as payment of the same amount of debt in a foreign state, they would be received only at their intrinsic value of £95, the additional £5 constituting the agio. Where the state keeps its coinage up to a standard value no agio is required.

AGIRA (formerly San Filippo d'Argiro), a town of the province of Catania, Sicily, with a railway station 4½ m. to the south of the town, 35 m. W. of Catania. Pop. (1901) 17,738. It occupies the site of *Agyrion*, an ancient Sicel city which was ruled by tyrants, one of whom, Agyris, was the most powerful ruler in the centre of Sicily. He was a contemporary of Dionysius I., and with him successfully resisted the Carthaginians when they invaded the territory of Agyrium in 392 B.C. Agira was not colonized by the Greeks until Timoleon drove out the last tyrant in 339 B.C. and erected various splendid buildings of which no traces remain. Agyrion was the birthplace of the historian Diodorus Siculus.

AGIS, the name of four Spartan kings:—

(1) Son of Eurysthenes, founder of the royal house of the Agiadae (Pausanias iii. 2.1). His genealogy was traced through Aristodemus, Aristomachus, Cleodaeus and Hyllus to Heracles (Herodotus vii. 204), and he belongs rather to mythology than to history. Tradition ascribed to him the capture of the maritime town of Helos, which resisted his attempt to curtail its guaranteed rights, and the institution of the class of serfs called *Helots* (*q.v.*).

Ephorus *ap.* Strabo, viii. p. 365.

(2) Son of Archidamus II., Eurypontid, commonly called Agis I. He succeeded his father, probably in 427 B.C., and from his first invasion of Attica in 425 down to the close of the Peloponnesian war was the chief leader of the Spartan operations on land. After the conclusion of the peace of Nicias (421 B.C.) he marched against the Argives in defence of Epidaurus, and after skilful manœuvring surrounded the Argive army, and seemed to have victory within his grasp when he unaccountably concluded a four months' truce and withdrew his forces. The Spartans were indignant, and when the Argives and their allies, in flagrant disregard of the truce, took Arcadian Orchomenus and prepared to march on Tegea, their fury knew no bounds, and Agis escaped having his house razed and a fine of 100,000 drachmae imposed only by promising to atone for his error by a signal victory. This promise he brilliantly fulfilled by routing the forces of the Argive confederacy at the battle of Mantinea (418), the moral effect of which was out of all proportion to the losses inflicted on the enemy. In the winter 417–416 a further expedition to Argos resulted in the destruction of the half-finished Long Walls and the capture of Hysiae. In 413, on the suggestion of Alcibiades, he fortified Decelea in Attica, where he remained directing operations until, after the battle of Aegospotami (405), he took the leading part in the blockade of Athens, which was ended in spring 404 by the surrender of the city. Subsequently he invaded and ravaged Elis, forcing the Eleans to acknowledge the freedom of their perioeci and to allow Spartans to take part in the Olympic games and sacrifices. He fell ill on his return from Delphi, where he had gone to dedicate a tithe of the spoils, and, probably in 401, died at Sparta, where he was buried with unparalleled solemnity and pomp.

Thuc. iii. 89, iv. 2. 6, v., vii. 19. 27, viii.; Xenophon, *Hellenica*, i. 1, ii. 2. 3, iii. 2. 3; Diodorus xii. 35, xiii. 72, 73, 107; Pausanias iii. 8. 3-8; Plutarch, *Lysander* ix. 14. 22, *Alcibiades* 23-25, *Lycurgus* 12, *Agesilaus* i. 3, *de Tranquill. Anim.* 6. (See Peloponnesian War.)

(3) Son of Archidamus III., of the Eurypontid line, commonly called Agis II. He succeeded his father in 338 B.C., on the very day of the battle of Chaeronea. During Alexander's Asiatic campaign he revolted against Macedonia (333 B.C.) and, with the aid of Persian money and ships and a force of 8000 Greek mercenaries, gained considerable successes in Crete. In the Peloponnese he routed a force under Corragus and, although Athens held aloof, he was joined by Elis, Achaea (except Pellene) and Arcadia, with the exception of Megalopolis, which the allies besieged. Antipater marched rapidly to its relief at the head of a large army, and the allied force was defeated after a desperate struggle (331) and Agis was slain.

Pausanias iii. 10. 5; Diodorus xvii. 48, 62, 63; Justin xii. 1; Quintus Curtius iv. 1, 39, vi. 1; Arrian, *Anabasis*, ii. 13.

(4) Son of Eudamidas II., of the Eurypontid family, commonly called Agis III. He succeeded his father probably in 245 B.C., in his twentieth year. At this time the state had been brought to the brink of ruin by the growth of avarice and luxury; there was a glaring inequality in the distribution of land and wealth, and the number of full citizens had sunk to 700, of whom about 100 practically monopolized the land. Though reared in the height of luxury he at once determined to restore the traditional institutions of Lycurgus, with the aid of Lysander, a descendant of the victor of Aegospotami, and Mandrocleidas, a man of noted prudence and courage; even his mother, the wealthy Agesistrata, threw herself heartily into the cause. A powerful but not disinterested ally was found in the king's uncle, Agesilaus, who hoped to rid himself of his debts without losing his vast estates. Lysander as ephor proposed on behalf of Agis that all debts should be cancelled and that Laconia should be divided into 19,500 lots, of which 4500 should be given to Spartiates, whose number was to be recruited from the best of the perioeci and foreigners, and the remaining 15,000 to perioeci who could bear arms. The Agiad king Leonidas having prevailed on the council to reject this measure, though by a majority of only one, was deposed in favour of his son-in-law Cleombrotus, who assisted Agis in bearing down opposition by the threat of force. The abolition of debts was carried into effect, but the land distribution was put off by Agesilaus on various pretexts. At this point Aratus appealed to Sparta to help the Achaeans in repelling an expected Aetolian attack, and Agis was sent to the Isthmus at the head of an army. In his absence the open violence and extortion of Agesilaus, combined with the popular disappointment at the failure of the agrarian scheme, brought about the restoration of Leonidas and the deposition of Cleombrotus, who took refuge at the temple of Apollo at Taenarum and escaped death only at the entreaty of his wife, Leonidas's daughter Chilonis. On his return Agis fled to the temple of Athene Chalcioecus at Sparta, but soon afterwards he was treacherously induced to leave his asylum and, after a mockery of a trial, was strangled in prison, his mother and grandmother sharing the same fate (241). Though too weak and good-natured to cope with the problem which confronted him, Agis was characterized by a sincerity of purpose and a blend of youthful modesty with royal dignity, which render him perhaps the most attractive figure in the whole of Spartan history.

See Plutarch's biography. Pausanias' accounts (ii. 8. 5, vii. 7. 3, viii. 10. 5-8, 27. 13) of his attack on Megalopolis, his seizure of Pellene and his death at Mantinea fighting against the Arcadians, Achaeans and Sicyonians are without foundation (J. C. F. Manso, *Sparta*, iii. 2. 123-127). See also Manso, *op. cit.* iii. 1. 276-302; B. Niese, *Geschichte der griechischen und makedonischen Staaten*, ii. 299-303. (M. N. T.)

AGISTMENT. To "agist" (from O. Fr. *agister*, derived from *gésir*—Lat. *jacere*—to lie) is, in law, to take cattle to graze, for a remuneration. "Agistment," in the first instance, referred more particularly to the proceeds of pasturage in the king's forests, but now means either (*a*) the contract for taking in and feeding horses or other cattle on pasture land, for the consideration of a weekly payment of money, or (*b*) the profit derived from such pasturing. Agistment is a contract of bailment, and the bailer is bound to take reasonable care of the animals entrusted to him; he is responsible for damages and injury which result from ordinary casualties, if it be proved that such might have been prevented by the exercise of great care. There is no lien on the cattle for the price of the agistment, unless by express agreement. Under the Agricultural Holdings Act 1883, agisted cattle cannot be distrained on for rent if there be other sufficient distress to be found, and if such other distress be not found, and the cattle be distrained, the owner may redeem them on paying the price of their agistment. The tithe of agistment or "tithe of cattle and other produce of grass lands," was formally abolished by the act of union in 1707, on a motion submitted with a view to defeat that measure.

AGITATORS, or ADJUTATORS, the name given to representatives elected in 1647 by the different regiments of the English Parliamentary army. The word really means an agent, but it was confused with "adjutant," often called "agitant," a title familiar to the soldiers, and thus the form "adjutator" came into use. Early in 1647 the Long Parliament wished either to disband many of the regiments or to send them to Ireland. The soldiers, whose pay was largely in arrear, refused to accept either alternative, and eight of the cavalry regiments elected agitators, called at first commissioners, who laid their grievances before the three generals, and whose letter was read in the House of Commons on the 30th of April 1647. The other regiments followed the example of the cavalry, and the agitators, who belonged to the lower ranks of the army, were supported by many of the officers, who showed their sympathy by signing the *Declaration of the army*. Cromwell and other generals succeeded to some extent in pacifying the troops by promising the payment of arrears for eight weeks at once; but before the return of the generals to London parliament had again decided to disband the army, and soon afterwards fixed the 1st of June as the date on which this process was to begin. Again alarmed, the agitators decided to resist; a mutiny occurred in one regiment and the attempt at disbandment failed. Then followed the seizure of the king by Cornet Joyce, Cromwell's definite adherence to the policy of the army, the signing of the manifestoes, a *Humble Representation* and a *Solemn Engagement* and the establishment of the army council composed of officers and agitators. Having, at an assembly on Thriplow Heath, near Royston, virtually refused the offers made by parliament, the agitators demanded a march towards London and the "purging" of the House of Commons. Subsequent events are part of the general history of England. Gradually the agitators ceased to exist, but many of their ideas were adopted by the Levellers (*q.v.*), who may perhaps be regarded as their successors. Gardiner says of them, "Little as it was intended at the time, nothing was more calculated than the existence of this elected body of agitators to give to the army that distinctive political and religious character which it ultimately bore."

See S. R. Gardiner, *History of the Great Civil War*, vols. iii. and iv. (London, 1905).

AGLIARDI, ANTONIO (1832–), papal diplomatist, was born at Cologno (Bergamo), Italy, on the 4th of September 1832. He studied theology and canon law, and, after acting as parish priest in his native diocese for twelve years, was sent by the pope to Canada as a bishop's chaplain. On his return he was appointed secretary to the Propaganda. In 1884 he was created by Leo XIII. archbishop of Caesarea *in partibus* and sent to India to report on the establishment of the hierarchy there. In 1887 he again visited India, to carry out the terms of the concordat arranged with Portugal. The same year he was appointed secretary to the Congregation *super negotiis ecclesiae extraordinariis*, in 1889 became papal nuncio at Munich and in 1892 at Vienna. Allowing himself to be involved in the ecclesiastical disputes by which Hungary was divided in 1895, he was made the subject of formal complaint by the Hungarian government and in 1896 was recalled. His services were rewarded by a cardinalate and the archbishopric of Ferrara. In 1903 he was named vice-chancellor of the Roman Church.

AGNANO, LAGO DI, a circular lake, 5 m. W. of Naples, Italy. It was apparently not formed until the middle ages, as it is not mentioned by ancient writers; it was drained in 1870. It occupied the crater of an extinct volcano, 4 m. in circumference. On the south bank are the Stufe di S. Germano, natural sulphureous vapour baths, and close by is the Grotta del Cane, from the floor of which warm carbonic acid gas constantly rises to a height of 18 in., the fumes of which render a dog insensible in a few seconds. It is mentioned by Pliny (*Nat. Hist.* ii. 93). Remains of an extensive Roman building and some statues have been discovered close by.

AGNATES (*Agnati*), in Roman law, persons related through males only, as opposed to cognates. Agnation was founded on the idea of the family held together by the *patria potestas*; *cognatio* involves simply the modern idea of kindred.

AGNES, SAINT, a virgin martyr of the Catholic Church. The legend of St Agnes is that she was a Roman maid, by birth a

Christian, who suffered martyrdom when but thirteen during the reign of the emperor Diocletian, on the 21st of January 304. The prefect Sempronius wished her to marry his son, and on her refusal condemned her to be outraged before her execution, but her honour was miraculously preserved. When led out to die she was tied to a stake, but the faggots would not burn, whereupon the officer in charge of the troops drew his sword and struck off her head. St Agnes is the patron saint of young girls, who, in rural districts, formerly indulged in all sorts of quaint country magic on St Agnes' Eve (20th–21st January) with a view to discovering their future husbands. This superstition has been immortalized in Keats's poem, "The Eve of St Agnes." St Agnes's bones are supposed to rest in the church of her name at Rome, originally built by Constantine and repaired by Pope Honorius in the 7th century. Here on her festival (21st of January) two lambs are specially blessed after pontifical high mass, and their wool is later woven into pallia (see PALLIUM).

AGNES OF MERAN (d. 1201), queen of France, was the daughter of Bertold IV., duke of Meran in Tirol. She is called Marie by some of the chroniclers. In June 1196 she married Philip II., king of France, who had repudiated Ingeborg of Denmark in 1193. The pope espoused the cause of Ingeborg; but Philip did not submit until 1200, when, interdict having been added to excommunication, he consented to a separation from Agnes. She died in July of the next year, at the castle of Poissy, and was buried in the church of St Corentin, near Nantes. Her two children by Philip II., Philip, count of Clermont (d. 1234), and Mary, who married Philip, count of Namur, were legitimized by Innocent III. in 1201 on the demand of the king. Little is known of the personality of Agnes, beyond the remarkable influence which she exercised over Philip II. She has been made the heroine of a tragedy by François Ponsard, *Agnes de Méranie*.

See the notes of Robert Davidsohn in *Philipp. II. August von Frankreich und Ingeborg* (Stuttgart, 1888). A genealogical notice is furnished by the *Chronicon* of the monk Alberic (Aubry) of Trois-Fontaines, (Albericus Trium Fontium) in Pertz, *Scriptores*, vol. xxiii. pp. 872 f., and by the *Genealogia Wettinensis*, ibid. p. 229.

AGNESI, MARIA GAETANA (1718–1799), Italian mathematician, linguist and philosopher, was born at Milan on the 16th of May 1718, her father being professor of mathematics in the university of Bologna. When only nine years old she had such command of Latin as to be able to publish an elaborate address in that language, maintaining that the pursuit of liberal studies was not improper for her sex. By her thirteenth year she had acquired Greek, Hebrew, French, Spanish, German and other languages. Two years later her father began to assemble in his house at stated intervals a circle of the most learned men in Bologna, before whom she read and maintained a series of theses on the most abstruse philosophical questions. Records of these meetings are given in de Brosse's *Lettres sur l'Italie* and in the *Propositiones Philosophicae*, which her father caused to be published in 1738. These displays, being probably not altogether congenial to Maria, who was of a retiring disposition, ceased in her twentieth year, and it is even said that she had at that age a strong desire to enter a convent. Though the wish was not gratified, she lived from that time in a retirement almost conventual, avoiding all society and devoting herself entirely to the study of mathematics. The most valuable result of her labours was the *Instituzioni analitiche ad uso della gioventu italiana*, a work of great merit, which was published at Milan in 1748. The first volume treats of the analysis of finite quantities, and the second of the analysis of infinitesimals. A French translation of the second volume by P. T. d'Antelmy, with additions by Charles Bossut (1730–1814), appeared at Paris in 1775; and an English translation of the whole work by John Colson (1680–1760), the Lucasian professor of mathematics at Cambridge, was published in 1801 at the expense of Baron Maseres. Madame Agnesi also wrote a commentary on the *Traité analytique des sections coniques* of the marquis de l'Hôpital, which, though highly praised by those who saw it in manuscript, was never published. She invented and discussed the curve known as the "witch of Agnesi" (*q.v.*) or versiera. In 1750, on the illness of her father, she was appointed by Pope Benedict XIV. to the chair of mathematics and natural philosophy at Bologna. After the death of her father in 1752 she carried out a long-cherished purpose by giving herself to the study of theology, and especially of the Fathers. After holding for some years the office of directress of the Hospice Trivulzio for Blue Nuns at Milan, she herself joined the sisterhood, and in this austere order ended her days on the 9th of January 1799.

Her sister, MARIA TERESA AGNESI (1724–1780), a well-known Italian pianist and composer, was born at Milan in 1724. She composed several cantatas, two pianoforte concertos and five operas, *Sofonisbe*, *Ciro in Armenia*, *Nitocri*, *Il Re Pastore* and *Insubria consolata*.

See Antonio Francesco Frisi, *Éloge historique de Mademoiselle Agnesi*, translated by Boulard (Paris, 1807); Milesi-Mojon, *Vita di M. G. Agnesi* (Milan, 1836); J. Boyer, "La Mathématicienne Agnesi," in the *Revue Catholique des revues françaises et étrangères* (Paris, 1897).

AGNEW, DAVID HAYES (1818–1892), American surgeon, was born in Lancaster county, Pennsylvania, on the 24th of November 1818. He graduated from the medical department of the university of Pennsylvania in 1838, and a few years later set up in practice at Philadelphia and became a lecturer at the Philadelphia School of Anatomy. He was appointed surgeon at the Philadelphia Hospital in 1854 and was the founder of its pathological museum. For twenty-six years (1863–1889) he was connected with the medical faculty of the university of Pennsylvania, being elected professor of operative surgery in 1870 and professor of the principles and practice of surgery in the following year. From 1865 to 1884—except for a brief interval—he was a surgeon at the Pennsylvania Hospital. During the American Civil War he was consulting surgeon in the Mower Army Hospital, near Philadelphia, and acquired considerable reputation for his operations in cases of gun-shot wounds. He attended as operating surgeon when President Garfield was fatally wounded by the bullet of an assassin in 1881. He was the author of several works, the most important being *The Principles and Practice of Surgery* (1878–1883). He died at Philadelphia on the 22nd of March 1892.

AGNI, the Hindu God of Fire, second only to Indra in the power and importance attributed to him in Vedic mythology. His name is the first word of the first hymn of the Rig-veda: "Agni, I entreat, divine appointed priest of sacrifice." The sacrifices made to Agni pass to the gods, for Agni is a messenger from and to the gods; but, at the same time, he is more than a mere messenger, he is an immortal, for another hymn runs: "No god indeed, no mortal is beyond the might of thee, the mighty One. . . ." He is a god who lives among men, miraculously reborn each day by the fire-drill, by the friction of the two sticks which are regarded as his parents; he is the supreme director of religious ceremonies and duties, and even has the power of influencing the lot of man in the future world. He is worshipped under a threefold form, fire on earth, lightning and the sun. His cult survived the metamorphosis of the ancient Vedic nature-worship into modern Hinduism, and there still are in India fire-priests (*agnihotri*) whose duty is to superintend his worship. The sacred fire-drill for procuring the temple-fire by friction—symbolic of Agni's daily miraculous birth—is still used. In pictorial art Agni is always represented as red, two-faced, suggesting his destructive and beneficent qualities, and with three legs and seven arms.

See W. J. Wilkins, *Hindu Mythology* (London, 1900); A. A. Macdonell, *Vedic Mythology* (Strassburg, 1897).

AGNOETAE (Gr. ἀγνοέω, to be ignorant of), a monophysite sect who maintained that Christ's human nature was like other men's in all respects, including limited knowledge. Its founder was Themistius, a deacon in Alexandria in the 6th century. The sect was anathematized by Gregory the Great.

AGNOIOLOGY (from Gr. ἄγνοι-α, ignorance), the science or study of ignorance, which determines its quality and conditions.

AGNOSTICISM. The term "agnostic" was invented by Huxley in 1869 to describe the philosophical and religious attitude of those who hold that we can have scientific or real knowledge of phenomena only, and that so far as what may lie behind phenomena is concerned—God, immortality, &c.—there is no evidence which entitles us either to deny or affirm anything. The attitude itself is as old as Scepticism (*q.v.*); but the expressions "agnostic" and "agnosticism" were applied by Huxley to sum up his deductions from those contemporary developments of metaphysics with which the names of Hamilton ("the Unconditioned") and Herbert Spencer ("the Unknowable") were associated; and it is important, therefore, to fix precisely his own intellectual standpoint in the matter. Though Huxley only began to use the term "agnostic" in 1869, his opinions had taken shape some time before that date. In a letter to Charles Kingsley (September 23, 1860) he wrote very fully concerning his beliefs:—

> "I neither affirm nor deny the immortality of man. I see no reason for believing it, but, on the other hand, I have no means of disproving it. I have no *a priori* objections to the doctrine. No man who has to deal daily and hourly with nature can trouble himself about *a priori* difficulties. Give me such evidence as would justify me in believing in anything else, and I will believe that. Why should I not? It is not half so wonderful as the conservation of force or the indestructibility of matter. . . .
>
> "It is no use to talk to me of analogies and probabilities. I know what I mean when I say I believe in the law of the inverse squares, and I will not rest my life and my hopes upon weaker convictions. . . .
>
> "That my personality is the surest thing I know may be true. But the attempt to conceive what it is leads me into mere verbal subtleties. I have champed up all that chaff about the ego and the non-ego, noumena and phenomena, and all the rest of it, too often not to know that in attempting even to think of these questions, the human intellect flounders at once out of its depth."

And again, to the same correspondent, the 5th of May 1863:—

> "I have never had the least sympathy with the *a priori* reasons against orthodoxy, and I have by nature and disposition the greatest possible antipathy to all the atheistic and infidel school. Nevertheless I know that I am, in spite of myself, exactly what the Christian would call, and, so far as I can see, is justified in calling, atheist and infidel. I cannot see one shadow or tittle of evidence that the great unknown underlying the phenomenon of the universe stands to us in the relation of a Father—loves us and cares for us as Christianity asserts. So with regard to the other great Christian dogmas, immortality of soul and future state of rewards and punishments, what possible objection can I—who am compelled perforce to believe in the immortality of what we call Matter and Force, and in a very unmistakable *present* state of rewards and punishments for our deeds—have to these doctrines? Give me a scintilla of evidence, and I am ready to jump at them."

Of the origin of the name "agnostic" to cover this attitude, Huxley gave (*Coll. Ess.* v. pp. 237-239) the following account:—

> "When I reached intellectual maturity, and began to ask myself whether I was an atheist, a theist or a pantheist, a materialist or an idealist, a Christian or a freethinker, I found that the more I learned and reflected, the less ready was the answer. The one thing on which most of these good people were agreed was the one thing in which I differed from them. They were quite sure they had attained a certain 'gnosis'—had more or less successfully solved the problem of existence; while I was quite sure that I had not, and had a pretty strong conviction that the problem was insoluble. This was my situation when I had the good fortune to find a place among the members of that remarkable confraternity of antagonists, the Metaphysical Society. Every variety of philosophical and theological opinion was represented there; most of my colleagues were *-ists* of one sort or another; and I, the man without a rag of a belief to cover himself with, could not fail to have some of the uneasy feelings which must have beset the historical fox when, after leaving the trap in which his tail remained, he presented himself to his normally elongated companions. So I took thought, and invented what I conceived to be the appropriate title of 'agnostic.' It came into my head as suggestively antithetic to the 'gnostic' of Church history, who professed to know so much about the very things of which I was ignorant. To my great satisfaction the term took."

This account is confirmed by R. H. Hutton, who in 1881 wrote that the word "was suggested by Huxley at a meeting held previous to the formation of the now defunct Metaphysical Society at Mr Knowles's house on Clapham Common in 1869, in my hearing. He took it from St Paul's mention of the altar to the Unknown God." Hutton here gives a variant etymology for the word, which may be therefore taken as partly derived from ἄγνωστος (the "unknown" God), and partly from an antithesis to "gnostic"; but the meaning remains the same in either case. The name, as Huxley said, "took"; it was constantly used by Hutton in the *Spectator* and became a fashionable label for contemporary unbelief in Christian dogma. Hutton himself frequently misrepresented the doctrine by describing it as "belief in an unknown and unknowable God"; but agnosticism as defined by Huxley meant not belief, but absence of belief, as much distinct from belief on the one hand as from disbelief on the other; it was the half-way house between the two, where all questions were "open." All that Huxley asked for was evidence, either for or against; but this he believed it impossible to get. Occasionally he too mis-stated the meaning of the word he had invented, and described agnosticism as meaning "that a man shall not say he knows or believes what he has no scientific ground for professing to know or believe." But as the late Rev. A. W. Momerie remarked, this would merely be "a definition of honesty; in that sense we ought all to be agnostics."

Agnosticism really rests on the doctrine of the Unknowable, the assertion that concerning certain objects—among them the Deity—we never can have any "scientific" ground for belief. This way of solving, or passing over, the ultimate problems of thought has had many followers in cultured circles imbued with the new physical science of the day, and with disgust for the dogmatic creeds of contemporary orthodoxy; and its outspoken and even aggressive vindication by physicists of the eminence of Huxley had a potent influence upon the attitude taken towards metaphysics, and upon the form which subsequent Christian apologetics adopted. As a nickname the term "agnostic" was soon misused to cover any and every variation of scepticism, and just as popular preachers confused it with atheism (*q.v.*) in their denunciations, so the callow freethinker—following Tennyson's path of "honest doubt"—classed himself with the agnostics, even while he combined an instinctively Christian theism with a facile rejection of the historical evidences for Christianity.

The term is now less fashionable, though the state of mind persists. Huxley's agnosticism was a natural consequence of the intellectual and philosophical conditions of the 'sixties, when clerical intolerance was trying to excommunicate scientific discovery because it appeared to clash with the book of Genesis. But as the theory of evolution was accepted, a new spirit was gradually introduced into Christian theology, which has turned the controversies between religion and science into other channels and removed the temptation to flaunt a disagreement. A similar effect has been produced by the philosophical reaction against Herbert Spencer, and by the perception that the canons of evidence required in physical science must not be exalted into universal rules of thought. It does not follow that justification by faith must be eliminated in spiritual matters where sight cannot follow, because the physicist's duty and success lie in pinning belief solely on verification by physical phenomena, when they alone are in question; and for mankind generally, though possibly not for an exceptional man like Huxley, an impotent suspension of judgment on such issues as a future life or the Being of God is both unsatisfying and demoralizing.

It is impossible here to do more than indicate the path out of the difficulties raised by Huxley in the letter to Kingsley quoted above. They involve an elaborate discussion, not only of Christian evidences, but of the entire subject-matter alike of Ethics and Metaphysics, of Philosophy as a whole, and of the philosophies of individual writers who have dealt in their different ways with the problems of existence and epistemology. It is, however, permissible to point out that, as has been exhaustively argued by Professor J. Ward in his Gifford lectures for 1896–1898 (*Naturalism and Agnosticism*, 1899), Huxley's challenge ("I know what I mean when I say I believe in the law of the inverse squares, and I will not rest my life and my hopes upon weaker convictions") is one which a spiritualistic philosophy need not shrink from accepting at the hands of naturalistic agnosticism. If, as Huxley admits, even putting it with unnecessary force against himself, "the immortality of man is not half so wonderful as the conservation of force or the indestructibility of matter," the question then is, how far a critical analysis of our belief in the last-named doctrines will leave us in a position to regard them as the last stage in systematic thinking. It is the pitfall of physical science, immersed as its students are apt to be in problems dealing with tangible facts in the world of experience, that there is a tendency among them to claim a superior status of objective reality and finality for the laws to which their data are found to conform. But these generalizations are not ultimate truths, when we have to consider the nature of experience itself. "Because reference to the Deity will not serve for a physical explanation in physics, or a chemical explanation in chemistry, it does not therefore follow," as Professor Ward says (*op. cit.* vol. i. p. 24), "that the sum total of scientific knowledge is equally intelligible whether we accept the theistic hypothesis or not. It is true that every item of scientific knowledge is concerned with some definite relation of definite phenomena, and with nothing else; but, for all that, the systematic organization of such items may quite well yield further knowledge, which transcends the special relations of definite phenomena."

At the opening of the era of modern scientific discovery, with all its fruitful new generalizations, the still more highly generalized laws of epistemology and of the spiritual constitution of man might well baffle the physicist and lead his intellect to "flounder." It is fundamentally necessary, in order to avoid such floundering, that the "knowledge" of things sensible should be kept distinct from the "knowledge" of things spiritual; yet in practice they are constantly confused. When the physicist limits the term "knowledge" to the conclusions from physical apprehensions, his refusal to extend it to conclusions from moral and spiritual apprehensions is merely the consequence of an illegitimate definition. He relies on the validity of his perceptions of physical facts; but the saint and the theologian are no less entitled to rely on the validity of their moral and spiritual experiences. In each case the data rest on an ultimate basis, undemonstrable, indeed, to any one who denies them (even if he be called mad for doing so), except by the continuous process of working out their own proofs, and showing their consistency with, or necessity in, the scheme of things terrestrial on the one hand, or the mind and happiness of man on the other. The tests in each case differ; and it is as irrelevant for the theologian to dispute the "knowledge" of the physicist, by arguments from faith and religion, as it is for the physicist to deny the "knowledge" of the theologian from the point of view of one who ignores the possibility of spiritual apprehension altogether. On the ground of secular history and secular evidence both might reasonably meet, as regards the facts, though not perhaps as to their interpretation; but the reason why they ultimately differ is to be found simply in the difference of their mental attitude towards the nature of "knowledge"—itself a difference of opinion as to the nature of man.

In addition to the literature cited above, see L. Stephen, *An Agnostic's Apology* (1893); R. Flint, *Agnosticism* (1903); T. Bailey Saunders, *The Quest of Faith*, chap. ii. (1899); A. W. Benn, *English Rationalism in the XIXth Century* (London, 1906). (H. Ch.)

AGNUS DEI, the figure of a lamb bearing a cross, symbolical of the Saviour as the "Lamb of God." The device is common in ecclesiastical art, but the name is especially given in the Church of Rome to a small cake made of the wax of the Easter candles and impressed with this figure. Since the 9th century it has been customary for the popes to bless these cakes, and distribute them on the Sunday after Easter among the faithful, by whom they are highly prized as having the power to avert evil. In modern times the distribution has been limited to persons of distinction, and is made by the pope on his accession and every seven years thereafter.

Agnus Dei is also the popular name for the anthem beginning with these words, which is said to have been introduced into the missal by Pope Sergius I. (687–701). Based upon John i. 29, the Latin form is *Agnus Dei, qui tollis peccata mundi, miserere nobis.* In the celebration of the mass it is repeated three times before the communion, and it is also appended to many of the litanies. By the judgment in the case of "Read and others *v.* The Bishop of Lincoln" it was decided in 1890 that the singing of the *Agnus Dei* in English by the choir during the administration of the Holy Communion, provided that the reception of the elements be not delayed till its conclusion, is not illegal in the Church of England.

For the various ceremonies in the blessing of the *Agnus Dei* see A. Vacant, *Dict. de théologie* (cols. 605-613).

AGOBARD (*c.* 779–840), Carolingian prelate and reformer, became coadjutor to Leidrad, archbishop of Lyons, in 813, and on the death of the latter succeeded him in the see (816). We know nothing of his early life nor of his descent. He pursued the same vigorous policy as his predecessor, who had been one of Charlemagne's most active agents in the reformation of the Church. He was strongly opposed to the schemes of the empress Judith for a redivision of the empire in favour of her son Charles the Bald, which he regarded as the cause of all the subsequent evils, and supported Lothair and Pippin against their father the emperor Louis I. Deposed in 835 by the council of Thionville, he made his peace with the emperor and was reinstated in 837. Agobard occupies an important place in the Carolingian renaissance. He wrote extensively not only theological works but also political pamphlets and dissertations directed against popular superstitions. These last works are unique in the literature of the time. He denounced the trial by ordeal of fire and water, the belief in witchcraft, and the ascription of tempests to magic, maintained the Carolingian opposition to image-worship, but carried his logic farther and opposed the adoration of the saints. The basis for this crusade was theological, not scientific; but it reveals a clear intellect and independent judgment. In his purely theological works Agobard was strictly orthodox, except that he denied the verbal inspiration of the Scriptures. Agobard was reverenced as a saint in Lyons, and although his canonization is disputed his life is given by the Bollandists, *Acta Sanctorum*, Jun. ii. 748.

Bibliography.—Agobard's works were lost until 1605, when a manuscript was discovered in Lyons and published by Papirius Masson, again by Baluze in 1666. For later editions see Potthast, *Bibliotheca Historica Medii Aevi.* The life of Agobard in Ebert's *Geschichte der Litteratur des Mittelalters* (1880), Band ii., is still one of the best to consult. For further indications see A. Molinier, *Sources de l'histoire de France*, i. p. 235.

AGONALIA, in ancient Rome, festivals celebrated on the 9th of January, 17th of March, 21st of May, and 11th of December in each year in honour of various divinities (Ovid, *Fasti*, i. 319-332). The word is derived either from *agonia*, "a victim," or from *agonium*, "a festival."

AGONIC LINES (from Gr. α-, privative, and γωνία, an angle), the term given to the imaginary lines on the earth's surface connecting points at which the magnetic needle points to the geographical north and south. (See Magnetism, Terrestrial.)

AGONOTHETES, in ancient Greece, the president or superintendent of the sacred games. At first the person who instituted the games and defrayed the expenses was the Agonothetes; but in the great public games, such as the Olympic and Pythian, these presidents were the representatives of different states, or were chosen from the people in whose country the games were celebrated; thus at the Panathenaic festival at Athens ten *athlothetae* were elected for four years to superintend the various contests. They were variously called *αἰσυμνῆται*, *βραβευταί*, *ἀγωνάρχαι*, *ἀγωνοδίκαι*, *ἀθλοθέται* (at Athens), *ῥαβδοῦχοι* or *ῥαβδονόμοι* (from the rod or sceptre emblematic of their authority), but their functions were generally the same.

AGORA, originally, in primitive times, the assembly of the Greek people, convoked by the king or one of his nobles. The right of speech and vote was restricted to the nobles, the people being permitted to express their opinion only by signs of applause or disapproval. The word then came to be used for the place where assemblies were held, and thus from its convenience as a meeting-place the agora became in most of the cities of Greece the general resort for public and especially commercial intercourse, corresponding in general with the Roman forum. At Athens, with the increase of commerce and political interest, it was found advisable to call public meetings at the Pnyx or the temple of Dionysus; but the important assemblies, such as meetings for ostracism, were held in the agora. In the best days of Greece the agora was the place where nearly all public traffic was conducted. It was most frequented in the forenoon, and then only by men. Slaves did the greater part of the purchasing, though even the noblest citizens of Athens did not scruple to buy and sell there. Citizens were allowed a free market; foreigners and metics had to pay a toll. Public festivals also were celebrated in the open area of the agora. At Athens the agora of classical times was adorned with trees planted by Cimon; around it numerous public buildings were erected, such as the council chamber and the law courts (for its topography, see ATHENS). Pausanias (especially vi. 24) is the great architectural authority on the agorae of various Greek cities, and details are also given by Vitruvius (v. 1).

AGORACRITUS, a Parian and Athenian sculptor of the age of Phidias, and said to have been his favourite pupil. His most noted work was the statue at Rhamnus of Nemesis, by some attributed to Phidias himself. Of this statue part of the head is in the British Museum; some fragments of the reliefs which adorned the pedestal are in the museum at Athens.

AGORANOMI, magistrates in the republics of Greece, whose position and duties were in many respects similar to those of the aediles of Rome. In Athens there were ten, chosen annually by lot, five of whom took charge of the city and five of the Peiraeus. They maintained order in the markets, settled disputes, examined the quality of the articles exposed for sale, tested weights and measures, collected the harbour dues and enforced the shipping regulations.

AGORDAT, a town of Eritrea, N.E. Africa, on the route between Massawa and Kassala. At Agordat on the 21st of December 1893 the Italian troops under Colonel Arimondi inflicted a severe defeat on the followers of the khalifa. Agordat is protected by a strong fort. (See ERITREA and SUDAN, *History.*)

AGOSTINI, LEONARDO, Italian antiquary of the 17th century, was born at Siena. After being employed for some time to collect works of art for the Barberini palace, he was appointed by Pope Alexander VII. superintendent of antiquities in the Roman states. He issued a new edition of Paruta's *Sicilian Medals*, with engravings of 400 additional specimens; and in conjunction with Giovanni Bellori (1615–1696) he also published a work on antique sculptured gems, which was translated into Latin by Jakob Gronovius (Amsterdam, 1685).

AGOSTINO, or AGOSTINI [AUGUSTINUS], **PAOLO** (1593–1629), Italian musician, was born at Valerano, and studied under G. B. Nanini, as we learn from the dedication in the third and fourth books of his masses, subsequently becoming the son-in-law of his master. He succeeded Ugolini as conductor of the pope's orchestra in St. Peter's. His musical compositions are numerous and of great merit, an *Agnus Dei* for eight voices being specially admired.

AGOSTINO and **AGNOLO** (or ANGELO) **DA SIENA,** Italian architects and sculptors in the first half of the 14th century. Della Valle and other commentators deny that they were brothers. They certainly studied together under Giovanni Pisano, and in 1317 were jointly appointed architects of their native town, for which they designed the Porto Romana, the church and convent of St Francis, and other buildings. On the recommendation of the celebrated Giotto, who styled them the best sculptors of the time, they executed in 1330 the tomb of Bishop Guido Tarlati in the cathedral of Arezzo, which Giotto had designed. It was esteemed one of the finest artistic works of the 14th century, but unfortunately was destroyed by the French under the duke of Anjou.

AGOULT, MARIE CATHERINE SOPHIE DE FLAVIGNY, COMTESSE D' (1805–1876), French author, whose *nom de plume* was "Daniel Stern," was born at Frankfort-on-Main on the 31st of December 1805. Her father was a French officer who had served in the army of the emigrant princes, and her mother was the daughter of a Frankfort banker. She was married in 1827 to the comte Charles d'Agoult. In Paris she gathered round her a brilliant society which included Alfred de Vigny, Sainte-Beuve, Ingres, Chopin, Meyerbeer, Heine and others. She was separated from her husband, and became the mistress of Franz Liszt. During her frequent travels in Switzerland, France and Italy she made the acquaintance of George Sand, and figures in the *Lettres d'un voyageur* as "Arabella." By Liszt she had three children—a son who died young; Blandine, who married M. Émile Ollivier; and Cosima, who married first Hans von Bülow and later Richard Wagner. The story of her breach with Liszt is told under a very slight disguise in her novel *Nélida* (1845). On her return to Paris in 1841 she began to write art criticisms for the *Presse*, and in 1844 she contributed to the *Revue des deux Mondes* articles on Bettina von Arnim and on Heinrich Heine, but her views were not acceptable to the editor, and Daniel Stern withdrew to become a contributor to the *Revue indépendante*. Mme. d'Agoult was an ardent apostle of the ideas of '48, and from this date her *salon*, which had been literary and artistic, took on a more political tone; revolutionists of various nationalities were welcomed by her, and she had an especial friendship and sympathy for Daniele Manin. In 1857 she produced a national drama, *Jeanne Darc*, which was translated into Italian and presented with brilliant success at Turin. The most important section of Daniel Stern's work is her political and historical essays: *Lettres républicaines* (1848), *Esquisses morales et politiques* (1849), *Histoire de la Révolution de* 1848 (3 vols., 1850–1853), *Histoire des commencements de la République aux Pays-Bas* (1872). Mme. d'Agoult died in Paris on the 5th of March 1876. Her daughter Claire Christine (b. 1830), who married Guy de Charnacé, is known as a writer.

See Mme. d'Agoult, *Mes Souvenirs* (1806–1833), 1877; A. Cuvillier Fleury, *Portraits révolutionnaires*, vol. i. (1889); J. Mazzini, *Lettres de Joseph Mazzini à Daniel Stern* (1872); A. Pommier, *Madame la comtesse d'Agoult* (Daniel Stern), 1876; A. Ungherini, "Daniel Stern" in the *Revista repubblicana* (1880, No. 9); S. Rocheblave, *Une Amitié romanesque, George Sand et Madame d'Agoult* (1895).

AGOUTI, or AGUTI, the West Indian name of *Dasyprocta aguti*, a terrestrial rodent of the size of a rabbit, common to Trinidad and Guiana, and classed in the family *Caviidae*. Under the same term may be included the other species of *Dasyprocta*, of which there are about half a score in tropical America. Agoutis are slender-limbed rodents, with five front and three hind toes (the first front toe very minute), and very short tails. The hair, especially on the hind-quarters, is coarse and somewhat rough; the colour being generally rufous brown. The molar teeth have cylindrical crowns, with several islands and a single lateral fold of enamel when worn. In habits agoutis are nocturnal, dwelling in forests, where they conceal themselves during the day in hollow tree-trunks, or in burrows among roots. Active and graceful in their movements, their pace is either a kind of trot or a series of springs following one another so rapidly as to look like a gallop. They take readily to water, in which they swim well. Their food comprises leaves, roots, nuts and other fruits. They do much harm to plantations of sugar-cane and bananas. In captivity the females produce only one or two young at a birth.

AGRA, an ancient city of India, which gives its name to a district and division in the United Provinces. It is famous for containing the most perfect specimens of Mogul architecture. Agra, like Delhi, owes much of its importance in both historical and modern times to the commercial and strategical advantages of its position. The river Jumna, which washes the walls of its fort, was the natural highway for the traffic of the rich delta of Bengal to the heart of India, and it formed, moreover, from very ancient times, the frontier defence of the Aryan stock settled in the plain between the Ganges and the Jumna against their western neighbours, hereditary freebooters who occupied the highlands of Central India. No place was better fitted for both an emporium and a frontier fortress. The river formed an unfordable barrier and also a useful means of communication. Jehangir tells us in his autobiography that before his father Akbar built the present fort, the town was defended by a citadel of great antiquity. For three hundred years the Afghans and other tribes came down from the north and founded kingdoms; and their power radiated from Delhi and Agra. It was Sikandar, of the house of Lodi (A.D. 1500), the last of the Afghan dynasties, who realized the strategic importance of Agra as a point for keeping in check his rebellious vassals to the south. He removed his court there, and Agra from being "a mere village of old standing," says a Persian chronicler, became the capital of a kingdom. In 1526 the city was captured by the emperor Baber, the famous Koh-i-noor diamond being part of the loot; and it was here that Baber announced that his invasion was to be a permanent conquest, and not a mere temporary inroad. It was Baber's grandson Akbar that built the present fort, whose strong and lofty walls of red sandstone are a mile and a half in circumference. The building was completed in 1665, when Charles II. was on the throne of England and the plague was devastating London. Another building of much the same date is the red stone palace generally attributed to Akbar, but probably of an earlier time, which is the finest example of pure Hindu architecture; while the Moti Masjid, or Pearl Mosque, is an equally perfect example of the Mahommedan style.

Taj Mahal.

But the glory of Agra, the most splendidly poetic building in the world, is the Taj Mahal, the mausoleum built (A.D. 1632) by the emperor Shah Jahan for the remains of his favourite wife, Mumtaz Mahal, in which he himself also lies buried. The building is built of white marble throughout, crowned with a great white dome in the centre, and with a smaller dome at each of its four corners. From the marble terrace which surrounds it rise four tall minarets of the same material, one at each corner. The Taj has been modelled and painted more frequently than any other building in the world, and the word pictures of it are numberless. But it can only be described as a dream in marble. It amply justifies the saying that the Moguls designed like Titans and finished like jewellers. In regard to colour and design the Taj ranks first in the world for purely decorative workmanship; while the perfect symmetry of its exterior once seen can never be forgotten, nor the aerial grace of its domes, rising like marble bubbles into the azure sky. In his *History of Architecture*, Fergusson says of it:—

> "This building is an early example of that system of inlaying with precious stones which became the great characteristic of the style of the Moghals after the death of Akbar. All the spandrils of the Taj, all the angles and more important architectural details, are heightened by being inlaid with precious stones such as agates, bloodstones, jaspers and the like. These are combined in wreaths, scrolls and frets, as exquisite in design as they are beautiful in colour, and relieved by the pure white marble in which they are inlaid, they form the most beautiful and precious style of ornament ever adopted in architecture. It is lavishly bestowed on the tombs themselves and the screens which surround them, but more sparingly introduced on the mosque that forms one wing of the Taj, and on the fountains and surrounding buildings. The judgment, indeed, with which this style of ornament is apportioned to the various parts, is almost as remarkable as the ornament itself, and conveys a high idea of the taste and skill of the architects of this age."

Of the Taj as a whole Lord Roberts says in his *Forty-one Years in India*:—

> "Neither words nor pencil could give to the most imaginative reader the slightest idea of the all-satisfying beauty and purity of this glorious conception. To those who have not already seen it I would say, 'Go to India. The Taj alone is well worth the journey.'"

The Taj was designed by Ustad Isa, variously described as a Byzantine Turk and a native of Shiraz in Persia. The *pietra dura* work belongs to the Persian school; and the common belief that it was designed by Austin de Bordeaux, a French architect in the service of Shah Jahan, is probably incorrect.

Agra was formerly the capital of the North-West Provinces, but after the Mutiny the seat of government was removed to Allahabad. Situated 841 m. from Calcutta it is now an important railway centre, whence two main lines diverge southwards towards Bombay. In 1901 the population was 188,022, showing an increase of 12 % during the decade. The city contains cotton mills, factories for ginning and pressing cotton, a tannery and boot factory and flour mill. There are also two missionary colleges.

The DISTRICT OF AGRA has an area of 1856 sq. m. Its general appearance is that common to the Doab, a level plain intersected by watercourses and ravines. Its general elevation is estimated at from 650 to 700 ft. above the level of the sea. The district is intersected by the Jumna, and is also watered by the Agra canal. The principal crops are millets, pulses, barley, wheat, cotton and a little indigo. The population in 1901 was 1,060,528, showing an increase of 6 % during the decade.

The DIVISION OF AGRA has an area of 10,154 sq. m. In 1901 the population was 5,249,542, showing an increase of 10 % during the decade, attributed to the extension of irrigation from canals. It comprises the six districts of Muttra, Agra, Farukhabad, Mainpuri, Etawah and Etah.

For an account of the architecture of Agra see Fergusson's *History of Architecture*; *Cities of India* (1903), by G. W. Forrest; *Enchanted India* (1899), by Prince Bojidar Karageorgevitch; and E. B. Havell, *Handbook to Agra and the Taj* (1904). (C. L.)

AGRA CANAL, an important Indian irrigation work, available also for navigation, in Delhi, Gurgaon, Muttra and Agra districts, and Bharatpur state. The canal receives its water from the Jumna river at Okla, about 10 m. below Delhi. The weir across the Jumna was the first attempted in Upper India upon a foundation of fine sand; it is about 800 yds. long, and rises 7 ft. above the summer level of the river. From Okla the canal follows the high land between the Khari-nadi and the Jumna, and finally joins the Banganga river about 20 m. below Agra. Navigable branches connect the canal with Muttra and Agra. It was opened in 1874.

AGRAM (Hungarian *Zágráb*, Croatian *Zagreb*), the capital of Croatia-Slavonia, and a royal free town of Hungary; pleasantly situated between the north bank of the Save and the mountains which culminate in Sljeme (3396 ft.); 187 m. by rail S. of Vienna. Pop. (1890) 38,742; (1900) 57,930, or with garrison 61,002. Agram is the seat of the ban, or viceroy, of Croatia-Slavonia, of the Banal and Septemviral courts, the highest in the land, and of a chamber of commerce. It is also the meeting-place of the parliament; but local affairs are conducted by a municipal council. The city is divided into three districts. The Kapitel-Stadt, sometimes called the Bishop's Town, with the palace of the Roman Catholic archbishop, and his late Gothic cathedral, dating from the 15th century, lies eastward of the Medvešćak, a brook which flows into the Save. The *Upper Town*, on high ground west of the Medvešćak, contains the palace of the ban and the natural history museum. On the south, the *Lower Town* is separated from the other districts by the Ilica, a long street traversed by a cable tramway. In it are the business and industrial quarters; the palace of justice; the academy of science, with picture-galleries, a library and a collection of antiquities; the theatre; the Franz Josef University, founded in 1874 to teach theology, law and philosophy; the synagogue; and the only Protestant church existing in the country at the beginning of the 20th century. Roman Catholic churches and schools are numerous. Besides the large Maximir park and botanical gardens, many of the squares are planted with trees and adorned with statues; while the whole city is surrounded by vineyards and country houses. Tobacco, leather, linen, carpets and war-material are manufactured in Agram, which also contains the works of the Hungarian state railways, and has a brisk trade in grain, wine, potash, honey, silk and porcelain.

In 1094 Agram was founded by Ladislaus I. of Hungary, as the seat of a bishop; and on the expulsion of its Mongol colony, in 1242, it was raised to the rank of a royal free city. For centuries a bitter feud raged between the Kapitel-Stadt and the Upper Town, until these rivals were forced to join hands against the Turks. Agram, already the political centre of Croatia-Slavonia, was selected as the capital in 1867. It suffered severely from earthquake in 1880 and 1901.

AGRAPHA (*i.e.* "unwritten"), the name given to certain utterances ascribed, with some degree of certainty, to Jesus, which have been preserved in documents other than the Gospels, *e.g.* Acts xx. 35; 1 Tim. v. 18; 1 Cor. vii. 10-12, and the Logia (*q.v.*) discovered in 1897 and 1903 at Oxyrhyncus. Two interesting examples of such sayings may be quoted: (1) "That which is weak shall be saved by that which is strong"; (2) "Jesus, on whom be peace, has said: 'The world is merely a bridge; ye are to pass over it, and not to build your dwellings upon it.'" The first of these is from the Apostolic Canons (*c.* A.D. 300), the second was found by the missionary Alexander Duff inscribed in Arabic on the gateway of the mosque at Fatehpur Sikri.

The earliest modern collection of such sayings was by Cotelerius, *Ecclesiae Graecae Monumenta* (1677–1688), followed by J. E. Grabe, *Spicelegium* (1698 and 1700), and J. B. Fabricius, *Codex Apocryph. N. T.* (2nd ed., 1719). See also A. Resch, *Agrapha* (Leipzig, 1889); J. H. Ropes, *Die Sprüche Jesu* (Leipzig, 1896); and the article "Sayings" in J. Hastings' *Dictionary of Christ and the Gospels.*

AGRARIAN LAWS (Lat. *ager*, land). Under this heading we deal with the disposal of the public land (*ager publicus*) of ancient Rome. It was a principle of the Republican constitution that no gratuitous disposition of state property should be made without the consent of the people. Hence many of the ordinances affecting the public land were laws (*leges*) in the strictest sense of that word. It is, however, both justifiable and convenient to consider in this article all the regulations that were made for the administration of the public land by the executive authorities, as well as by the people during the Republic, and by the commands of the emperor, which had the force of law during the Principate.

The existence of public land, first in Italy, and then in the Mediterranean world, was the outcome of two ideas which are very familiar to students of antiquity. This land was the prize of conquest and was one of the means of defraying the current expenses of state-administration. For the latter purpose land is often leased or allowed to be occupied on the condition of the payment of dues. But it may be made to fufil another purpose as well—this purpose being the satisfaction of the individual needs of poorer citizens. To meet this object the land is usually assigned, and on assignment generally ceases to be the property of the state. But it often happens that the state is not wholly disinterested in undertaking such acts of assignment. It gains security and territorial control by planting garrisons in conquered country, and it relieves itself of the necessity of providing for its poorer classes whether by state-aid or by a hazardous tampering with the rights of private property. In this use to which public land could be turned we see at once the connexion between agrarian legislation and colonization—a connexion which was so close that when a Roman spoke of an agrarian law he seems generally to have understood by it a law establishing a colony—and also the two aspects of colonization, the military and the social. These two objects were indissolubly connected throughout the whole of the earlier period of Roman agrarian assignation. They only became separated in the period subsequent to the Gracchi in so far as social motives still continued to be operative when military precautions had ceased to be necessary. It is probable that one of the chief motives which prompted infant Rome to war with her neighbours was the land-hunger of her citizens. This hunger she satisfied after conquest by annexing a portion of the enemy's territory. The amount thus confiscated varied from time to time. It was usually a third, but sometimes a half or even two-thirds, and after the fall of Capua in the Second Punic War the whole territory of the state was annexed. It is possible that by the close of the 2nd century B.C. one-half of the land of Italy belonged to Rome whether in private ownership or as the property of the state. Annexation was carried on in the provinces on a relatively smaller scale; but Rome retained as domain-land much of the territory of communities which had been destroyed, such as Carthage and Corinth, and the estates of former kings, such as the lands of the Attalids in the Chersonese. Other domains in Sicily and Greece, such as the territory of Leontini in the former, or Oropus in the latter case, are also found. This peculiar property of the Roman state in the provinces must be carefully distinguished from the general overlordship which Rome was supposed to hold over all provincial soil, expressed in the statement that provincials had only possession or usufruct of their land (Gaius ii. 7; *Gromatici*, p. 36, Lachmann). This overlordship was probably merely a legal fiction by which the juristic mind assigned a reason for the fact that the provincials paid a land tax from which Italians were exempt.

Such portions of the territories of conquered cities as were not claimed by Rome were as a matter of course left in the undisturbed possession of these cities. If the city was a federate state (*civitas foederata*) his possession was guaranteed by a treaty; if it was a free city, the guarantee was made by charter; if it was neither federate nor free, the abandonment of the territory by Rome must have been taken as a sufficient guarantee of the city's right to possess, although statements relative to the surrender may have been contained in the charter of the province (*lex provinciae*) to which the city belonged. But, whether the states were federate, free or stipendiary, there was only one case in which it was important to specify precisely that land had been restored (*redditus*) to its former occupants. This was the case where Rome had marked out a territory for assignment to her own citizens, but where in or near the limits of the assignment some of the land had been left in the hands of its former proprietors. Such land was noted in the state registers as *redditus veteri possessori.* Sometimes it was found that such an ancient possessor owned pieces of land separated from one another. In such cases an exchange might be effected between him and some other possessor, so that his possessions might be continuous. The fact of such an exchange was symbolized in the registers by the entry of land *redditus et commutatus pro suo.*

When the claims of earlier owners had been satisfied, the state proceeded to deal with such land as it retained. It dealt with it in two ways. It either alienated it, whether in exchange for a price or gratuitously; or it kept it as a source of revenue, whether on a system of lease or on some system of remunerative occupation. We may first consider the cases in which the state decided to alienate. The land might be sold for the benefit of the treasury. Typical instances of this treatment are furnished by the sale of some Campanian land during the Second Punic War (Livy xxviii. 46, xxxii. 7). The censors may have directed the sale, but it was executed by the quaestors as the regular officials of the treasury. Hence such land was described as *ager quaestorius.* The land was sold in definitely marked out plots, and we must suppose that, as a rule, when this sale had been effected, the lots fell under the absolute ownership of their purchasers. Yet there was some period of Roman history when this ownership was (at least in certain cases) conditioned. The Roman writers on agriculture speak of conditions and their neglect (*Gromatici*, p. 115). The conditions were probably those of military service or frontier defence. The epoch of history at which this conditioned ownership was recognized cannot be determined. It is a form of tenure that would be equally appropriate to the needs of the earliest period of Roman history and to those of imperial times.

The second mode of alienation was that by assignation. Lands thus assigned were known as *agri dati assignati.* The gift on the part of the state was gratuitous, and ownership passed wholly to the assignee. The land so given was definitely surveyed, marked out and registered. Such an assignment might take one of two possible forms. It might be the means of establishing a new "plantation" (*colonia*), with some independent political organization of its own, however slight—a settlement, therefore, which could be thought of as an entity separate from the city of Rome and from any other municipality. Or it might be the means of providing allotments for individuals who remained domiciled at Rome or continued to be members of some already existing municipality. It has been frequently held in modern times that this latter method of assignment is the one which our ancient authorities describe as assignment to individuals (*viritim*), and that the antithesis lies between the "colonial" and the "viritane" method of distribution. It is true that the passages which speak of the latter mode of assignation need not, and perhaps cannot, be interpreted as presenting the antithesis (Varro, *de Re Rustica*, i. 2. 7, i. 10. 2; Livy iv. 48, v. 24; Festus, p. 373; *Gromatici*, pp. 154, 160); yet it is not improbable that the antithesis is latent in this specific use of the term. It seems clear that the idea of assignation to, and, therefore, of ownership by, individuals must originally have been developed in contrast to the idea of ownership by some larger group (see ROMAN LAW). When the stage of individual ownership was reached, all assignation was "viritane," but only some assignation was "colonial." "Viritane" was, therefore, the wider term which would cover, and may sometimes have been used specially to denote, the system of non-colonial assignment. The amount granted to individuals in assignments of both types varied from time to time. It was reckoned in terms of the *jugerum*. which was approximately $\frac{5}{8}$ of an English acre. The earliest and smallest assignment was 2 *jugera*—an amount so small that it seems to presuppose on the part of the recipient some share in common or gentile property or some additional private property of his own. Other quotas were 3, $3\frac{7}{12}$, 7, 10+14 *jugera*. The last was the maximum amount granted before the time of Ti. Gracchus (133 B.C.), and it was held by representatives of the old school that 7 *jugera* were as much as any frugal Roman should want (Pliny, *Historia Naturalis*, xviii. 18). The division was carried out by commissions of 3, 5 or 10 men appointed by the people (Cicero, *de Lege Agraria* ii. 7. 17). The land which the state retained as *ager publicus* was always placed in the hands of individuals, who occupied it in some manner remunerative to the state. These individuals (*possessores*) were never regarded as owners of the land thus occupied. It remained the property of the state, was held without a contract (*precario*) and could be resumed by the state at will. But though the possessors had no claim against the state, their ownership could be defended against all other individual claimants; and it seems probable that from an early date the praetor's possessory interdict was used to protect all occupiers, provided their tenure had been acquired neither by force (*vi*) nor by seizure of land in its occupiers' absence (*clam*), nor by mere permission of the previous holder to occupy (*precario alter ab altero*). Moreover, Appian says that possessors of this type could transfer their land by inheritance, and that the land was accepted as security by creditors. This kind of occupation, therefore, though clearly distinguished from ownership (*dominium*), was yet regarded as a perfectly secure form of tenure. All occupiers of public land paid dues to the state through a state contractor (*publicanus*). These dues varied in amount, and in the method of their collection. We learn from Appian that the ordinary dues paid by occupiers of arable land in Italy were $\frac{1}{10}$ of seed crops and $\frac{1}{5}$ of plant produce. Owners who turned cattle or sheep on pasture land belonging to the state also paid fixed dues to the treasury. The occupiers of the Roman public land in Campania paid a large rent (Cic. *de leg. Agr.* i. 7. 21). Appian's account of the public land (*Bell. Civ.* i. 7) would lead us to suppose that the amount of tax paid by the occupier, and the method adopted by the state for the collection of the revenues, depended upon the nature of the land at the time when it first passed to a *possessor*. He says that some of the public land which was in a good state of cultivation was let on lease; but that with regard to the poor or devastated land proclamation was made that anyone might squat on it and till it in return for the small payment in kind mentioned above. It has been questioned whether the land described by Appian and by Cicero as let on lease, of which the Campanian land and some lands in Sicily are typical, represents a legally distinct class. It seems probable that the distinction is one of practice rather than of law, and that the difference lay not in the relation between the state and the possessor (as would be the case if the leased land were really let to individuals by the censor, while the occupied land was held by mere permission of the state without any contract) but in the details of the contract between the censor and the *publicanus* with regard to the collection of the dues. The conditions of the tenure of the Roman public land in Africa are known to us from the *Lex Agraria* of 111 B.C. (Bruns, *Fontes*, i. 3. 11, vv. 85 foll.). Here the *publicanus* is the middleman between the state and the *possessor*, and purchases from the censor the right of collecting dues. The law places no restriction on bargaining between the censor and the *publicanus*, but enacts that no *possessor* or *pastor* shall ever be required by the *publicanus* to pay more than the amount prescribed by the censors of 115 B.C. These conditions may be regarded as typical for the occupation of public lands. And when Cicero speaks of public land as let on lease (*locatus*) by the censor, he no doubt refers to the farming of the taxes to a *publicanus* for a fixed period, and not to the letting of the land. This seems clear from a passage (in *Verr.* iii. 6. 12) where he speaks of land in Sicily which had been restored by Rome to former owners as being leased. The land itself could not be leased by Rome if it belonged not to Rome but to the Sicilian inhabitants; but the collection of the revenues due to Rome could be so leased to *Publicani* (*q.v.*). And the same explanation would apply to Cicero's statements that the Campanian land was let on lease by the censors (cf. Festus, s.v. *venditiones*). The view that there was a distinct class of the public land which was let out for a fixed term of years to tenants on a definite lease, unlike the ordinary public land which was always held in occupation merely at will (*precario*), has been maintained by W. A. Becker, and seems to be supported, with the help of conjecture, by a few passages in Cicero and by Hyginus (*Gromatici*, p. 116). But the passage of Hyginus is barely intelligible even on this supposition; and Cicero's repeated statement that the Campanian land was expressly exempted from the legislation of the Gracchi (cf. *Lex Agraria*, Bruns, *loc. cit.* v. 6) shows that there was not sufficient distinction between the Campanian tenure and that of other public land in Italy to make this definite exception by name superfluous. The Sempronian law could obviously not touch land which the state had leased to occupiers on the basis of a definite contract. Moreover, we have absolutely no evidence for such a contract, even in Cicero's speeches against Rullus, when he might be expected to mention it as an objection to Rullus's bill. That there were some distinctive characteristics about the tenure of certain lands, of which the Campanian land is typical, seems proved by the repeated association of these lands with certain special lands in the provinces, especially at Leontini in Sicily, and by some passages in the *Gromatici* where *agri vectigales* are spoken of as a distinct class. But what these characteristics were cannot be clearly determined. It seems certain that in every case the possessor occupied *precario*, and that only in the bargain between the censor and the middleman was there room for contract. Thus the state was justified in the claim to resume public land which it made in many of the Agrarian laws.

The earliest agrarian measures of which we have any record are the distributions of land conquered in war to poor citizens, which later authorities attribute to Numa and Servius Tullius. Such assignments, however, are not the result of legislative acts, but of a voluntary surrender on the king's part of his own portion of the spoils. It is probable that the agrarian law which resulted from the proposals of Spurius Cassius (consul 486 B.C.) was the first attempt made by the Roman people to exercise its control over the occupation of state territory. According to the traditional account, Cassius proposed that such portion of lands lately conquered from the Hernici as fell to the Roman state should be divided in equal shares between the Roman *plebs* and the Latins; and further that poor citizens should receive allotments of land previously conquered, and occupied without any legal right by the Patricians. The inclusion of the Latins in the distribution was afterwards dropped; but the law in its final form certainly asserted the right of the Plebeians to take their share in the public land. The accounts given of it by Livy and Dionysius are no doubt coloured by their knowledge of later agrarian legislation, and it seems hardly likely that the proposal to resume and redistribute public land already occupied was made at this early stage; but it probably challenged the exclusive claim of Patricians to occupy. We hear of another agrarian law proposed by the tribune Lucius Icilius in 456 B.C. (*Lex Icilia de Aventino publicando*) which regulated in some way the tenure of public land on the Aventine. In 376 B.C. the tribunes Licinius and Sextius introduced into their laws, for the promotion of the privileges of the *plebs*, a clause enacting that no more than 500 *jugera* of land should be occupied by a single cultivator. It seems almost certain from Livy's account that this measure referred only to the occupation of *ager publicus*, though some modern authorities have upheld the view that it dealt with land held on any kind of tenure, others again that it dealt only with private property in land. According to Appian, the law also enacted that only 100 cattle and 500 sheep might be turned by one owner on the public pastures. But it failed of its object because it did not provide any adequate machinery for the resumption by the state of land held in excess of the prescribed amount, and was therefore easily evaded. The next agrarian law we hear of was a more special measure dealing with lands conquered from the Senones and Picentines. In 232 B.C. C. Flaminius, then tribune of the *plebs*, proposed to resume these lands for the state, although they were already occupied by large landholders, and to distribute them in allotments to poor citizens. The measure met with much opposition from the richer classes, and did not gain the sanction of the senate; but C. Flaminius ignored constitutional usage and brought it direct before the council of the *plebs*, by which it was made law. In 133 B.C. the tribune Tiberius Gracchus (*q.v.*) re-enacted the earlier measure of Licinius and Sextius, with the additional provisions that each owner might occupy 250 *jugera* for each son, in addition to the original 500, and that a commission of three (*iii. viri agris dandis adsignandis*) should be appointed to carry out the terms of the law. He also enacted that the land occupied in excess of the prescribed amount, and on that account resumed for the state by the land commission, should be distributed in inalienable lots to poor citizens. Subsequent modifications of those provisions which dealt with the powers of the land commission led to a re-enactment of the whole by C. Gracchus, the brother of Tiberius, tribune in 123 B.C. But within 15 years from the tribunate of C. Gracchus the whole of his law had been rendered null by three further enactments. The first of these permitted the sale of land allotted under the law, which thus tended to return into the hands of its former occupiers as private property, which the state had no longer any right to resume. The second abolished the commission appointed to carry out the terms of the law, thus putting a stop to further resumption and distribution, and also transformed existing occupiers into owners of the land they occupied, paying only a small due to the treasury. The third (probably the surviving *Lex Agraria*, Bruns, *loc. cit.*) abolished the payment. This law belongs to the year 111 B.C. The dates of the two former laws are uncertain, but it is probable that the first was passed in 121, the second in 119 or 118. From this time forward a change comes over land legislation. The ordinary public land in Italy, in the hands of occupiers, which had given rise to all the agrarian legislation between 376 and 111, had practically ceased to exist. The Campanian land still remained, but the same reasons which led to its exemption from the Gracchan legislation seem to have continued to protect its holders until 63 B.C. In the meantime several agrarian laws were passed which provided for the distribution of land placed in some other way at the disposal of the state. In 100 B.C. Appuleius Saturninus (*q.v.*), tribune of the *plebs*, proposed the allotment of lands recently taken from the Cimbri in Gaul. This law was passed, but eventually declared null by the senate, with the rest of Saturninus's laws. A more dangerous precedent was set by Sulla in his dictatorship (82–81 B.C.). He was the first to confiscate the lands of his political foes, and of communities which had resisted him, and treating them as *ager publicus*, assign them to his veterans as a prize. This example was followed by Octavian (Augustus) and Antony (M. Antonius) after their proscriptions in 43 B.C. A third method of providing land for distribution was that adopted by Servilius Rullus (*q.v.*) in 63 B.C. His bill enacted that land should be purchased in Italy with money gained by the sale of Roman territories abroad, and allotted to citizens. A commission of ten (*x. viri agris dandis adsignandis*), annually elected by 9 out of the 35 tribes, was to carry out the terms of the law. Rullus also ventured to propose the distribution of the Campanian land, which had hitherto been respected by all agrarian reformers. It was chiefly on this ground that Cicero in his three speeches on the Agrarian law succeeded in exciting such a general feeling against it that it was eventually withdrawn. In 60 B.C. the tribune L. Flavius brought forward a bill for the distribution of lands to Pompey's veterans. The Campanian land was certainly to be included in the distribution, and it is clear from Cicero that the bill in some way dealt violently with the rights of private owners. It also, however, enacted that land should be purchased by the state with the wealth which Pompey's conquests had brought into the treasury. The last proposal was supported by Cicero, but the bill seems to have been dropped, only to reappear in more moderate form in the following year. A consular bill, the *lex Julia Campana*, was passed by Julius Caesar in 59 B.C., which provided for the settlement of Pompey's veterans on the Campanian land, and other lands purchased by the state from private owners in Italy with the full consent of the latter. In its original form, the bill omitted all reference to the Campanian land, which seems to have been included by Caesar in the distribution only when the continued and unreasoning opposition of the senate had goaded him to extreme measures. A commission of twenty was to be appointed to carry out the law, from which Caesar himself was expressly excluded. This measure finally settled the question of the Campanian land, which now passed out of the category of *ager publicus*. The last agrarian law of the republic was that passed in 44 B.C. on the proposal of the consul M. Antonius, or of his brother L. Antonius. We have no detailed account of the measure, but it seems to have provided grants of land for veterans, and was to be administered by seven commissioners. The law was afterwards cancelled by decree of the senate, probably on the ground of some technical flaw. The emperor Vespasian attempted to reclaim for the state small oddments of land (*subseciva*) which were held by neighbouring owners to whom they had never been definitely assigned. The attempt met with violent opposition, and though resumed by Titus, was finally crushed by Domitian, who issued an edict recognizing all oddments of land thus held to be private property.

AUTHORITIES.—Niebuhr, *History of Rome* (English translation), ii. p. 129 foll. (Cambridge, 1832); Becker, *Handbuch der römischen Alterthümer*, iii. 2, p. 142 (Leipzig, 1843); Marquardt, *Römische Staatsverwaltung*, i. p. 96 foll. (Leipzig, 1881); Madvig, *Verfassung und Verwaltung des römischen Staates*, ii. p. 364 foll. (Leipzig, 1882), (See also ROME, *History*.) (A. H. J. G.; A. M. CL.)

AGREDA, MARIA FERNANDEZ CORONEL, ABBESS OF, known in religion as Sor (Sister) Maria de Jesus (1602–1665), was the daughter of Don Francisco Coronel and of his wife Catalina de Arana. She was born at Agreda, on the borders of Navarre and Aragon, on the 2nd of April 1602. All her family were powerfully influenced by the ecstatic piety of Spain in that age. Her biographer, Samaniego, records that even as an infant in arms she was filled with divine knowledge. Her stupidity as a child is piously accounted for by extreme humility. From childhood she was favoured by ecstasies and visions. When she was fifteen the whole family entered religion. The father, now an old man, and the two sons entered the Franciscan house of San Antonio de Nalda. Maria, her mother and sister established a Franciscan nunnery in the family house at Agreda, which, when Maria's reputation had extended, was replaced by the existing building. She began it with one hundred reals (one pound sterling) lent her by a devotee, and it was completed in fourteen years by voluntary gifts. Much against her own wish, we are told, she was appointed abbess at the age of twenty-five. In 1668, four years after her death, the Franciscans published a story that at the age of twenty-two she had been miraculously conveyed to Mexico, to convert a native people, and had made five hundred journeys through the air for that purpose in one year. Though the rule required the abbess to be changed every three years, Maria remained the effective ruler of Agreda till her death. The Virgin was declared abbess, and Maria acted as her *locum tenens*. In her later years she inclined to the "internal prayer," and neglect of the outward offices of the church, which was usual with the "alumbrados" or Quietists. The Inquisition took notice of her, but she was not proceeded against with severity. Maria's importance in religion and Spanish history is based on two grounds. In the earlier part of her life, while the Franciscan, Francisco Andres de la Torre, was her confessor, she wrote an *Introduction to the History of the Most Blessed Virgin*. It was destroyed by the direction of another confessor. Later on, by the order of her superiors, and under the guidance of her Franciscan confessor, Andres de Fuen Mayor, she wrote *The Mystic City of God*. It is an extraordinary book, full of apocryphal history visions and scholasticism, which professes to have been written by divine inspiration, and is devoted to praise of the Virgin. In 1642 she sent to Philip IV. an account of a vision she had had, of a council of the infernal powers for the destruction of Catholicism and Spain. The king visited her when on his way to Aragon to suppress the rebellion of Catalonia. A long correspondence, which lasted till her death on the 29th of March 1665, was begun. The king folded a sheet of paper down the middle and wrote on the one side of the division. The answers were to be written on the other and the sheet returned. By a pious fraud copies were kept at Agreda. How far Maria was only the mouthpiece of the Franciscans must of course be a matter of doubt. Her correspondence was apparently suspended whenever her confessor was absent. She must, however, have co-operated at least, and it is certain that the Franciscans, who were very unfortunate in some of their pious women, owed not a little to her. The letters are in excellent Spanish, are curious reading, and are invaluable as illustrations for the second part of the reign of Philip IV.

The correspondence of Sor Maria with the king has been published in full by Don F. Siluela, *Cartas de la Venerable Madre Sor Maria de Agreda y del Señor Rey Don Filipe IV.* (Madrid, 1885). *The Mystic City of God* is one of the most characteristic monuments of Mariolatry, and has continued to be much in favour with supporters of the dogma of the Immaculate Conception. It appeared in Madrid in 1668, with a biographical introduction by Samaniego, has been often reprinted, and was translated into French and Italian. It was for a time reserved by the Index, both Spanish and Papal, but was taken off by the influence of the Franciscans and of Spain, the chief supporters of the Immaculate Conception. An account of Maria de Agreda will be found in the *Tracts* of Michael Geddes (London, 1706), vol. iii., written by a competent critic and Anglican divine of the 18th century who detested "enthusiasm." (D. H.)

AGRICOLA, CHRISTOPH LUDWIG (1667–1719), German landscape painter, was born and died at Regensburg (Ratisbon). He spent a great part of his life in travel, visiting England, Holland and France, and residing for a considerable period at Naples. His numerous landscapes, chiefly cabinet pictures, are remarkable for fidelity to nature, and especially for their skilful representation of varied phases of climate. In composition his style shows the influence of Caspar Poussin, while in light and colour he imitates Claude Lorraine. His pictures are to be found in Dresden, Brunswick, Vienna, Florence, Naples and many other towns of both Germany and Italy.

AGRICOLA (the Latinized form of the name BAUER), **GEORG** (1490–1555), German scholar and man of science, known as "the father of mineralogy," was born at Glauchau in Saxony on the 24th of March 1490. Gifted with a precocious intellect, he early threw himself into the pursuit of the "new learning," with such effect that at the age of twenty he was appointed *Rector extraordinarius* of Greek at the so-called Great School of Zwickau, and made his appearance as a writer on philology. After two years he gave up his appointment in order to pursue his studies at Leipzig, where, as rector, he received the powerful support of the professor of classics, Peter Mosellanus (1493–1524), a celebrated humanist of the time, with whom he had already been in correspondence. Here he also devoted himself to the study of medicine, physics and chemistry. After the death of Mosellanus he went for a short time to Italy, where he took his doctor's degree. On his return he settled as practising physician in the Joachimstal, a centre of mining and smelting works, his object being partly "to fill in the gaps in the art of healing," partly to test what had been written about mineralogy by careful observation of ores and the methods of their treatment. His thorough grounding in philology and philosophy had accustomed him to systematic thinking, and this enabled him to construct out of his studies and observations of minerals a logical system which he began to publish in 1528. *Bermannus, sive de re metallica dialogus*, the first attempt to reduce to scientific order the knowledge won by practical work, brought Agricola into notice. In 1530 Prince Maurice of Saxony appointed him historiographer with an annual allowance, and he migrated to Chemnitz, the centre of the mining industry, in order to widen the range of his observations. The citizens showed their appreciation of his learning by appointing him town physician and electing him burgomaster. His popularity was, however, short-lived. Chemnitz was a violent centre of the Protestant movement, while Agricola never wavered in his allegiance to the old religion; and he was forced to resign his office. He now lived apart from the contentious movements of the time, devoting himself wholly to learning. His chief interest was still in mineralogy; but he occupied himself also with medical, mathematical, theological and historical subjects, his chief historical work being the *Dominatores Saxonici a prima origine ad hanc aetatem*, published at Freiberg. In 1544 he published the *De ortu et causis subterraneorum*, in which he laid the first foundations of a physical geology, and criticized the theories of the ancients. In 1545 followed the *De natura eorum quae effluunt e terra*; in 1546 the *De veteribus et novis metallis*, a comprehensive account of the discovery and occurrence of minerals; in 1548 the *De animantibus subterraneis*; and in the two following years a number of smaller works on the metals. His most famous work, the *De re metallica, libri xii.*, was published in 1556, though apparently finished several years before, since the dedication to the elector and his brother is dated 1550. It is a complete and systematic treatise on mining and metallurgy, illustrated with many fine and interesting woodcuts and containing, in an appendix, the German equivalents for the technical terms used in the Latin text. It long remained a standard work, and marks its author as one of the most accomplished chemists of his time. Believing the black rock of the Schlossberg at Stolpen to be the same as Pliny's basalt, he applied this name to it, and thus originated a petrological term which has been permanently incorporated in the vocabulary of science.

In spite of the early proof that Agricola had given of the tolerance of his own religious attitude, he was not suffered to end his days in peace. He remained to the end a staunch Catholic, though all Chemnitz had gone over to the Lutheran creed; and it is said that his life was ended by a fit of apoplexy brought on by a heated discussion with a Protestant divine. He died at Chemnitz on the 21st of November 1555, and so violent was the theological feeling against him, that he was not suffered to rest in the town to which he had added lustre. Amidst hostile demonstrations he was carried to Zeitz, seven miles from Chemnitz, and there buried.

See article by Gümbel in *Allgem. Deutsche Biog.* (1875); F. L. Becher, *Georg Agricola und Werner* (Freiberg, 1819); F. A. Schmidt, *Georg Agricola's Bermannus mit Einleitung* (Freiberg, 1806); Poggendorff, *Biographisches Handwörterbuch*; Agricola's works *passim*.

AGRICOLA, GNAEUS JULIUS (A.D. 37–93), Roman statesman and general, father-in-law of the historian Tacitus, was born on the 13th of June A.D. 37 (according to others, 39) at Forum Julii (Fréjus) in Gallia Narbonensis. His father, Julius Graecinus, having been put to death by Caligula, Agricola was brought up by his mother Julia Procilla. After studying philosophy at Massilia, he entered the army and served (59) under Suetonius Paulinus in Britain. In 61 he returned to Rome, where he married Domitia Decidiana, a Roman lady of distinction. In 63 he was quaestor in Asia, in 65 tribune, in 68 praetor, and when Vespasian was proclaimed emperor, he immediately declared himself his supporter. In 70 he was appointed to the command of the 20th legion in Britain, then stationed at Deva (Chester). On his return to Rome at the end of three years he was made censor, raised to the rank of patrician, and appointed governor of Aquitania (74–78). Appointed *consul suffectus* in the following year, he was admitted into the college of pontiffs and made governor of Britain. In the same year he betrothed his daughter to Tacitus. Although the legation of Britain lasted as a rule only three years, Agricola held the post for at least seven and succeeded in reconciling the inhabitants to Roman rule and inducing them to adopt the customs and civilization of their conquerors. His military achievements were equally brilliant. After conquering the Ordovices in North Wales and the island of Mona (Anglesey), during the next two years he carried his victorious arms to the Taüs (Tay; others read Tanaus, perhaps the north Tyne), and in his fourth campaign fortified the country between Clota and Bodotria (the firths of Clyde and Forth) as a protection against the attacks of the Caledonians. Having explored the coasts of Fife and Forfar, he gained a decisive victory over the Caledonians under Galgacus at the Graupian hill (see BRITAIN, *Roman*). His successes, however, had aroused the envy and suspicion of Domitian. He was recalled to Rome, where he lived a life of studied retirement, to avoid the possibility of giving offence to the tyrant. He died in 93, poisoned, it was rumoured, by the emperor's orders. The *Life of Agricola* by his son-in-law Tacitus is practically a panegyric or funeral oration.

See Urlichs, *De Vita et Honoribus Agricolae* (1868); Dio Cassius xxxix. 50, lxvi. 20; Mommsen, *Provinces of the Roman Empire* (Eng. trans., 1886), i. 183-184, 194.

AGRICOLA, JOHANN FRIEDRICH (1720–1774), German musician, was born at Dobitschen in Saxe-Altenburg, on the 4th of January 1720. While a student of law at Leipzig he studied music under Johann Sebastian Bach. In 1741 he went to Berlin, where he studied musical composition. He was soon generally recognized as one of the most skilful organists of his time; and in 1751, as the result of a comic opera, *Il Filosofo convinto in amore*, performed at Potsdam, he was made court composer to Frederick the Great. He died in Berlin on the 1st of December 1774. In 1759, on the death of Karl Heinrich Graun, he was appointed conductor of the royal orchestra. Besides several operas of merit, he composed instrumental pieces and church music. His reputation chiefly rests, however, on his theoretical and critical writings on musical subjects. He wrote under the pseudonym of Flavio Anicio Olibrio.

AGRICOLA (originally SCHNEIDER, then SCHNITTER), **JOHANNES** (1494–1566), German Protestant reformer, was born on the 20th of April 1494, at Eisleben, whence he is sometimes called *Magister Islebius*. He studied at Wittenberg, where he soon gained the friendship of Luther. In 1519 he accompanied Luther to the great assembly of German divines at Leipzig, and acted as recording secretary. After teaching for some time in Wittenberg, he went to Frankfort in 1525 to establish the reformed mode of worship. He had resided there only a month when he was called to Eisleben, where he remained till 1526 as teacher in the school of St Andrew, and preacher in the Nicolai church. In 1536 he was recalled to teach in Wittenberg, and was welcomed by Luther. Almost immediately, however, a controversy, which had been begun ten years before and been temporarily silenced, broke out more violently than ever. Agricola was the first to teach the views which Luther was the first to stigmatize by the now well-known name Antinomian (*q.v.*), maintaining that while the unregenerate were still under the Mosaic law, Christians were entirely free from it, being under the gospel alone. In consequence of the bitter controversy with Luther that resulted, Agricola in 1540 left Wittenberg secretly for Berlin, where he published a letter addressed to the elector of Saxony, which was generally interpreted as a recantation of his obnoxious views. Luther, however, seems not to have so accepted it, and Agricola remained at Berlin. The elector Joachim II. of Brandenburg, having taken him into his favour, appointed him court preacher and general superintendent. He held both offices until his death in 1566, and his career in Brandenburg was one of great activity and influence. Along with Julius von Pflug, bishop of Naumburg-Zeitz, and Michael Helding, titular bishop of Sidon, he prepared the Augsburg Interim of 1548. He endeavoured in vain to appease the Adiaphoristic controversy (see ADIAPHORISTS). He died during an epidemic of plague on the 22nd of September 1566. Agricola wrote a number of theological works which are now of little interest. He was the first to make a collection of German proverbs which he illustrated with a commentary. The most complete edition, which contains seven hundred and fifty proverbs, is that published at Wittenberg in 1592; a modern one is that of Latendorf, 1862.

See Cordes, *Joh. Agricola's Schriften möglichst verzeichnet* (Altona, 1817); *Life* by G. Kawerau (1881), who also wrote the notice in Hauck-Herzog, *Realencyk. für prot. Theol.*, where other literature is cited.

AGRICOLA, MARTIN (*c.* 1500–1556), German musician, was born about 1500 in Lower Silesia. His German name was Sohr or Sore. From 1524 till his death he lived at Magdeburg, where he occupied the post of teacher or cantor in the Protestant school. The senator and music-printer Rhau, of Wittenberg, was a close friend of Agricola, whose theoretical works, providing valuable material concerning the change from the old to the new system of notation, he published. Agricola was also the first to harmonize in four parts Luther's chorale, *Ein' feste Burg*.

Four other Agricolas[1] are known as composers between the end of the 15th century and the middle of the 17th.

In the 18th century we find Burney, in the course of his tour in Germany (1772), much impressed by JOHANN FRIEDRICH AGRICOLA (1720–1774), court composer and director of the royal chapel to Frederick the Great. This Agricola was a pupil of Bach, and a fine organist and clever writer on music, especially on operatic style, the problems of which were beginning to be raised by French writers and composers in preparation for the work of Gluck.

AGRICOLA, RODOLPHUS (properly ROELOF HUYSMANN) (1443–1485), Dutch scholar, was born at Baflo, near Groningen, in 1443. He was educated at Louvain, where he graduated as master of arts. After residing for some time in Paris, he went in 1476 to Ferrara in Italy, and attended the lectures of the celebrated Theodorus Gaza (1400–1478) on the Greek language. Having visited Pavia and Rome, he returned to his native country about 1479, and was soon afterwards appointed syndic of Groningen. In 1482, on the invitation of Johann von Dalberg, bishop of Worms (1445–1503), whose friendship he had gained in Italy, he accepted a professorship at Heidelberg, and for three years delivered lectures there and at Worms on the literature of Greece and Rome. By his personal influence much more than by his writings he did much for the promotion of learning in Germany; and Erasmus and other critics of the generation immediately succeeding his own are full of his praises. In his opposition to the scholastic philosophy he in some degree anticipated the great intellectual revolution in which many of his pupils were conspicuous actors. He died at Heidelberg on the 28th of October 1485. His principal work is *De inventione dialectica, libri iii.*, in which he attempts to change the scholastic philosophy of the day.

See T. F. Tresling, *Vita et Merita Rudolphi Agricolae* (Groningen, 1830); v. Bezold, *R. Agricola* (München, 1884); and Ihm, *Der Humanist R. Agricola, sein Leben und seine Schriften* (Paderb., 1893).

AGRICULTURAL GANGS, groups of women, girls and boys organized by an independent gang-master, under whose supervision they execute agricultural piece-work for farmers in certain parts of England. They are sometimes called "public gangs" to distinguish them from "private gangs" consisting of workers engaged by the farmer himself, and undertaking work solely for him, under his own supervision or under that of one of his men. The system was for long prevalent in the counties of Cambridgeshire, Huntingdonshire, Lincolnshire, Nottinghamshire, Norfolk and Suffolk, and is still to be found in a much modified form in the fen district. The practice dates from the latter years of the reign of George III., when the low-lying, marshy lands surrounding the basin of the Wash were being rapidly drained and converted into rich alluvial districts. The unreformed condition of the poor-law, under which the support of the poor fell upon each individual parish, instead of a union of parishes, made landlords reluctant to erect cottages on the reclaimed land for the benefit of their tenants. Labour had to be obtained for the cultivation of these new lands, and that of women, girls and boys, being cheaper than the labour of men, was consequently very largely employed. The tendency to moral and physical ruin which resulted from this nomadic life was so great that an inquiry into the condition of agricultural child-labour was included in the reference to the commission on child-labour appointed in 1862, and the results were so startling that the Agricultural Gangs Act was passed in 1867, forbidding the employment of any child under eight years old, and of any female under a male gang-master unless a female licensed to act as gang-mistress were also present. Gang-masters must be licensed by two justices, and may not hold a liquor license. The distance to be traversed on foot is fixed by the justices, and the licenses must be renewed every six months. Later legislation made more stringent the regulations under which children are employed in agricultural gangs. By the Elementary Education Act 1876, repealing and re-enacting the principal provisions of the Agricultural (Children) Act 1873, no child shall be employed under the age of eleven years, and none between eleven years and thirteen years before the child has obtained a certificate of having reached the standard of education fixed by a by-law in force in the district.

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[1] Alexander, died 1506; Johann, *flor.* 1600; Wolfgang Christoph, *flor.* 1630; and George Ludwig, 1643–1676.

AGRICULTURE (from Lat. *ager*, field, and *colere*, to cultivate), the science, art and industry of utilizing the soil so as to produce the means of human subsistence, embracing in its widest sense the rearing of live-stock as well as the raising of crops. The history of agriculture is the history of man in his most primitive, and most permanent aspect. Hence the nations of antiquity ascribed to it a divine origin; Brahma in Hindustan, Isis in Egypt, Demeter in Greece, and Ceres in Italy, were its founders. The simplest form of agriculture is that in which crops are raised from one patch of ground till it is exhausted, when it is allowed to go wild and abandoned for another. This "extensive" husbandry is found in combination with a nomadic or semi-nomadic and pastoral organization, such as that of the German tribes described by Caesar and Tacitus (see especially *Germania*, 26). The discovery of the uses of the bare fallow and of manure, by making it possible to raise crops from the same area for an indefinite period, marks a stage of progress. This "intensive" culture in a more or less developed form was practised by the great nations of antiquity, and little decided advance was made till after the middle ages. The introduction of new plants, which made it possible to dispense with the bare fallow, and still later the application to husbandry of scientific discoveries as to soils, plant constituents and manures, brought about a revolution in farming. But the progress of husbandry, evidenced by the production of larger and better crops with more certainty, is due to that rationalizing of agricultural practices which is the work of modern times. What before was done in the light of experience is nowadays done in the light of knowledge. Even the earliest forms of intensive cultivation demand the practice of the fundamental processes of husbandry—ploughing, manuring, sowing, weeding, reaping. It is the improvements in methods, implements and materials, brought about by the application of science, that distinguish the husbandry of the 20th century from that of medieval and ancient times.

Egypt.

Ancient Husbandry.—The monumental records of Egypt are the source of the earliest information on farming. The Egypt of the Pharaohs was a country of great estates farmed either by tenants or by slaves or labourers under the superintendence of stewards. It owed its fertility to the Nile, which, inundating the land near its banks, was distributed by means of canals over more distant portions of its valley. The autumnal subsidence of the river was followed by shallow ploughing performed by oxen yoked to clumsy wooden ploughs, the clods being afterwards levelled with wooden hoes by hand. Next came the sowing, the seed being pressed into the soil by the feet of sheep which were driven over the fields. At harvest the corn was cut high on the stalk with short sickles and put up in sheaves, after which it was carried to the threshing-floor and there trodden out by the hoofs of oxen. Winnowing was done by women, who tossed the grain into the air with small wooden boards, the chaff being blown away by the winds. Wheat and barley were the chief crops, and another plant, perhaps identical with the durra, *i.e.* millet, of modern Egypt, was also cultivated. The latter, when ripe, was pulled up by the roots, and the grain was separated by means of an implement resembling a comb. To these crops may be added peas, beans and many herbs and esculent roots. Oxen were much prized, and breeding was carried on with a careful eye to selection. Immense numbers of ducks and geese were reared.

Diodorus Siculus, writing of later times, says that cattle were sent during a portion of each year to the marshy pastures of the delta, where they roamed under the care of herdsmen. They were fed with hay during the annual inundation, and at other times tethered in meadows of green clover. The flocks were shorn twice annually (a practice common to several Asiatic countries), and the ewes yeaned twice a year. (See also EGYPT.)

The agriculture of the region bordering the Tigris and Euphrates, like that of Egypt, depended largely on irrigation, and traces of ancient canals are still to be seen in Babylonia. But beyond the fact that both Babylonia and Assyria were large producers of cereals, little is known of their husbandry.

Biblical accounts among the Israelites.

The nomads of the patriarchal ages, whilst mainly dependent upon their flocks and herds, practised also agriculture proper. The tracts over which they roamed were in ordinary circumstances common to all shepherds alike. During the summer they frequented the mountainous districts, and retired to the valleys to winter. Vast flocks of sheep and of goat constituted their wealth, although they also possessed oxen. When the last were abundant, it seems to be an indication that tillage was practised. Job, besides immense possessions in flocks and herds, had 500 yoke of oxen, which he employed in ploughing, and a "very great husbandry." Isaac, too, conjoined tillage with pastoral husbandry, and that with success, for "he sowed in the land Gerar, and reaped an hundred-fold"—a return which, it would appear, in some favoured regions, occasionally rewarded the labour of the husbandman. In the parable of the sower, Jesus Christ mentions an increase of thirty, sixty and an hundred fold.

Along with the Babylonians, Egyptians and Romans, the Israelites are classed as one of the great agricultural nations of antiquity. The Mosaic Institute contained an agrarian law, based upon an equal division of the soil amongst the adult males, a census of whom was taken just before their entrance into Canaan. Provision was thus made for 600,000 yeomen, assigning (according to different calculations) from sixteen to twenty-five acres of land to each. This land, held in direct tenure from Jehovah, their sovereign, was in theory inalienable. The accumulation of debt upon it was prevented by the prohibition of interest, the release of debts every seventh year, and the reversion of the land to the proprietor, or his heirs, at each return of the year of jubilee. The owners of these small farms cultivated them with much care, and rendered them highly productive. They were favoured with a soil extremely fertile, and one which their skill and diligence kept in good condition. The stones were carefully cleared from the fields, which were also watered from canals and conduits, communicating with the brooks and streams with which the country "was well watered everywhere," and enriched by the application of manures. The seventh year's fallow prevented the exhaustion of the soil, which was further enriched by the burning of the weeds and spontaneous growth of the Sabbatical year. The crops chiefly cultivated were wheat, millet, barley, beans and lentils; to which it is supposed, on grounds not improbable, may be added rice and cotton. The chief implements were a wooden plough of simple and light construction, a hoe or mattock, and a light harrow. The ox and the ass were used for labour. The word "oxen," which occurs in our version of the Scriptures, as well as in the Septuagint and Vulgate, denotes the species, rather than the sex. As the Hebrews did not mutilate any of their animals, bulls were in common use. The quantity of land ploughed by a yoke of oxen in one day was called a yoke or acre. Towards the end of October, with which month the rainy season begins, seed-time commenced, and of course does so still. The seedtime, begun in October, extends, for wheat and some other white crops, through November and December; and barley continues to be sown until about the middle of February. The seed appears to have been sometimes ploughed in, and at other times to have been covered by harrowing. The cold winds which prevail in January and February frequently injured the crops in the more exposed and higher districts. The rainy season extends from October to April, during which time refreshing showers fall, chiefly during the night, and generally at intervals of a few days. The harvest was earlier or later as the rains towards the end of the season were more or less copious. It, however, generally began in April, and continued through May for the different crops in succession. In the south, and in the plains, the harvest, as might be expected, commenced some weeks earlier than in the northern and mountainous districts. The slopes of the hills were carefully terraced and irrigated wherever practicable, and on these slopes the vine and olive were cultivated with great success. At the same time the hill districts and neighbouring deserts afforded pasturage for numerous flocks and herds, and thus admitted of the benefits of a mixed husbandry. Not by a figure of speech but literally, every Israelite sat under the shadow of his own vine and fig-tree; whilst the country as a whole is described (2 Kings xviii. 32) as "a land of corn and wine, a land of bread and vineyards, a land of oil olive and of honey."

Greece.

The earliest known forms of intensive husbandry were based chiefly upon the proximity of rivers and irrigation. The agriculture of classical ages was slightly more developed in so far as the husbandman of Greece and Rome was less able to leave to nature the fertilization of the soil. Greece being a mountainous land was favourable to the culture of the vine rather than to that of cereals. Scanty information on its agriculture is to be derived from the *Works and Days* of Hesiod (about the 8th century B.C.), the *Oeconomicus* of Xenophon (4th century B.C.), the *History of Plants* and the *Origin of Plants* of Theophrastus (4th century B.C.). The latter is the first writer on botany, and his works also contain interesting remarks on manures, the mixing of soils and other agricultural topics (see also GEOPONICI). Greek husbandry had no salient characteristics. The summer fallow with repeated ploughing was its basis. The young crop was hoed, reaping was performed with a sickle, and a high stubble left on the ground as manure. The methods of threshing and winnowing were the same as those in use in ancient Egypt. Wheat, barley and spelt were the leading crops. Meadows were pastured rather than mown. Attica was famous for its olives and figs, but general agriculture excelled in Peloponnesus, where, by means of irrigation and drainage, all the available land was utilized.

Rome.

In the early days of the Roman republic land in Italy was held largely by small proprietors, and agriculture was highly esteemed and classed with war as an occupation becoming a free man. The story of Cincinnatus, twice summoned from the plough to the highest offices in the state, illustrates the status of the Roman husbandman. The later tendency was towards the absorption of smaller holdings into large estates. As wealth increased the peasant-farmer gave way before the large landowner, who cultivated his property by means of slave-labour, superintended by slave-bailiffs. The low price of grain, which was imported in huge quantities from Sicily and other Roman provinces, operated to crush the small holder, at the same time as it made arable farming unremunerative. Sheep-raising, involving larger holdings, less supervision and less labour, was preferred by the capitalist land-holder to the cultivation of the wheat, spelt, vines or olives which were the chief crops of the country. Lupine, beans, peas and vetches were grown for fodder, and meadows, often artificially watered, supplied hay. Swine and poultry were used for food to a greater extent than oxen, which were bred chiefly for ploughing. The following epitome of Virgil's advice to the husbandman in the first book of the *Georgics* suggests the outline of Roman husbandry: "First learn the peculiarities of your soil and climate. Plough the fallow in early spring, and plough frequently—twice in winter, twice in summer unless your land is poor, when a light ploughing in September will do. Either let the land lie fallow every other year or else let spelt follow pulse, vetches or lupine. Repetition of one crop exhausts the ground; rotation will lighten the strain, only the exhausted soil must be copiously dressed with manure or ashes. It often does good to burn the stubble on the ground. Harrow down the clods, level the ridges by cross ploughing, work the land thoroughly. Irrigation benefits a sandy soil, draining a marshy soil. It is well to feed down a luxuriant crop when the plants are level with the ridge tops. Geese and cranes, chicory, mildew, thistles, cleavers, caltrops, darnel and shade are farmer's enemies. Scare off the birds, harrow up the weeds, cut down all that shades the crop. Ploughs, waggons, threshing-sledges, harrows, baskets, hurdles, winnowing-fans are the farmer's implements. The plough consists of several parts made of seasoned wood. The threshing-floor must be smooth and rammed hard to leave no crevices for weeds and small animals to get through. Some steep seed in soda and oil lees to get a larger produce. Careful annual selection by hand of the best seed is the only way to prevent degeneration. It is best to mow stubble and hay at night when they are moist."

In addition to the use of several kinds of animal and other manures, green crops were sometimes ploughed in by the Romans. The shrewdness which, more than inventiveness, characterized their husbandry comes out well in the following quotation from the 18th book of the *Natural History* of Pliny:—"Cato would have this point especially to be considered, that the soil of a farm be good and fertile; also, that near it there be plenty of labourers and that it be not far from a large town; moreover, that it have sufficient means for transporting its produce, either by water or land. Also that the house be well built, and the land about it as well managed. They are in error who hold the opinion that the negligence and bad husbandry of the former owner is good for his successor. Now, I say there is nothing more dangerous and disadvantageous to the buyer than land so left waste and out of heart; and therefore Cato counsels well to purchase land of one who has managed it well, and not rashly to despise and make light of the skill and knowledge of another."

Roman writers on agriculture (see GEOPONICI) are more numerous than those of Greece. The earliest important treatises are the *De re Rustica* of Cato (234–149 B.C.) and the *Rerum Rusticarum Libri* of Varro. More famous than either are the *Georgics* of Virgil, published about 30 B.C., and treating of tillage, horticulture, cattle-breeding and bee-keeping. The works of Columella (1st century A.D.) and of Palladius (4th century A.D.) are exhaustive treatises, and the *Natural History* of the elder Pliny (A.D. 23–70) contains considerable information on husbandry. Under the later empire agriculture sank into a condition of neglect, in which it remained throughout the Dark Ages. In Spain its revival was due to the Saracens, and by them, and their successors the Moors, agriculture was carried to a high pitch of excellence. The work on agriculture[1] of Ibn-al-Awam, who lived in the 12th century A.D., treats of the varieties of soils, manuring, irrigation, ploughing, sowing, harvesting, stock, horticulture, arboriculture and plant diseases, and is a lasting record of their skill and industry.

The subsequent history of agriculture is treated in the following pages primarily from the British standpoint. Doubtless Flanders may claim to be the pioneer of "high farming" in medieval times, other countries following her lead in many respects. It is not, however, necessary to deal with the agricultural evolution of continental Europe, the gradual progress of agriculture as a whole being well enough typified in the story of its development in England, which indeed has led the way in modern times. After sections on the history and chief modern features of British agriculture, a separate account is given of the general features of American agriculture.

History of English Agriculture

The "combined" or "common-field" system of husbandry practised by the village community or township (see VILLAGE COMMUNITIES) may be taken as the starting-point of English agriculture, in which, till the end of the 18th century, it is a dominant influence. The territory of the "township" consisted of arable land, meadow, pasture and waste. The arable land was divided into two or, more usually, three fields, which were cut up into strips bounded by balks and allotted to the villagers in such a way that one holding might include several disconnected strips in each field—a measure designed to prevent the whole of the best land falling to one man. The fields were fenced in from seed-time to harvest, after which the fences were taken down and the cattle turned in to feed on the stubble. According to early methods of cropping, which were destined to prevail for centuries, wheat, the chief article of food, was sown in one autumn, reaped the next August; the following spring, oats or barley were sown, and the year following the harvest was a period of fallow. This procedure was followed on each of the three fields so that in every year one of them was fallow. In addition to the cereals, beans, peas and vetches were grown to some extent. The meadow-land was also divided into strips from which the various holders drew their supply of hay. The pasture-land was common to all, though the number of beasts which one man might turn into it was sometimes limited. Rough grazing could also be had on the outlying waste lands. In the absence of artificial grasses and roots, hay was very valuable; it constituted almost the only winter food for live stock, which were consequently in poor condition in spring.

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[1] Translation by Clément-Mullet (Paris, 1864).

Under the manorial system, the rise of which preceded the Norman Conquest, communal methods of husbandry remained, but the position of the cultivator was radically altered. "Villeins," instead of free-holders, formed the most numerous class of the population. They were bound to the soil and occupied holdings of scattered strips (amounting usually to a virgate or 30 acres) in return for a payment partly in labour and partly in kind. A portion of the manor, generally about a third, constituted the lord's demesne, which, though sometimes separate, usually consisted of strips intermingled with those of his villeins. It thus formed part of the common farm and was cultivated by the villeins and their oxen under the superintendence of a bailiff. Below the villeins in the social scale came the cottiers possessing smaller holdings, sometimes only a garden, and no oxen. Free tenants and, after the Norman Conquest, slaves formed small proportions of the population. During the middle ages cattle and sheep were the chief farm animals, but the intermixture of stock consequent on the common-field system was a barrier to improvement in the breed and conduced to the propagation of disease. Oxen, usually yoked in teams of eight, were used for ploughing. Sheep were small and their fleeces light, nevertheless, owing to the meagreness of the yields of cereals[1] and the demand for wool for export, sheep-farming was looked to, as early as the 12th century, as the chief source of profit. Pigs and poultry were universally kept. The treatise on husbandry of Walter of Henley, dating from the early 13th century, is very valuable as describing the management of the demesne under the two- or three-field system. The following are typical passages:—

> " April is a good season for fallowing, if the earth breaks up behind the plough; for second fallowing after St John's Day when the dust rises behind the plough; for seed-ploughing when the earth is well settled and not too cracked; however, the busy man cannot be always waiting on the seasons." " At sowing do not plough large furrows, but little and well laid together, that the seed may fall evenly."
>
> " Know that an acre sown with wheat takes three ploughings, except lands that are sown each year, and that each ploughing costs 6d. more or less and the harrowing 1d. It is well to sow at least two bushels to the acre."
>
> " Change your seed every year at Michaelmas, for the seed grown on other land will bring you more than that grown on your own."
>
> " Neither sell your stubble nor move it from the ground unless you need it for thatching. Have manure put up in heaps and mixed with earth."
>
> " Ridge marshy ground so as to let the water run off."

During the 13th century there arose a tendency to commute labour-rents for money payments. This change led to the gradual disappearance of tenants in villeinage—the villeins and cottiers—and the rise on the one hand of the small independent farmer, on the other of the hired labourer. The plague of 1348 marks an epoch in English agriculture. The diminution of the population by one-half led to a scarcity of labour and an increase of wages which deprived the landowner of his narrow margin of profit. To meet this situation, the Statute of Labourers (1351) enacted that no man should refuse to work at the same rate of wages as prevailed before the plague. In addition the landowners attempted to revive the disappearing system of labour-rents. The bitter feelings engendered between employer and employed culminated in the peasants' revolt of 1381. Meanwhile large numbers of landowners were forced to adopt one of two alternatives. In some cases they ceased to farm their own land and let it out on lease often together with the stock upon it; or else they abandoned arable culture, laid down their demesnes to pasture, enclosed the waste lands and devoted themselves to sheep-farming. In the latter course they were encouraged by the high prices of wool during the 14th century, and by Edward III.'s policy of fostering both the export of wool and the home manufacture of woollen goods. The 15th century, barren of progress in methods of husbandry, was in its early years moderately prosperous. Later on the increasing abandonment of arable husbandry for sheep-farming brought about a less demand for labour, and rural depopulation was accelerated as the peasant was deprived of his grazing-ground by the enclosure of more and more of the waste land.[2]

Agriculture under the Tudors and Stuarts.

From the beginning of the reign of Henry VII. to the end of Elizabeth's, a number of statutes were made for the encouragement of tillage, though probably to little purpose. "Where in some towns," says the statute 4th Henry VII. (1488), " two hundred persons were occupied and lived of their lawful labours, now there are occupied two or three herdsmen, and the residue fall into idleness "; therefore it is ordained that houses which within three years have been let for farms, with twenty acres of land lying in tillage or husbandry, shall be upheld, under the penalty of half the profits, to be forfeited to the king or the lord of the fee. Almost half a century afterwards the practice had become still more alarming; and in 1534 a new act was tried, apparently with as little success. " Some have 24,000 sheep, some 20,000 sheep, some 10,000, some 6000, some 4000, and some more and some less "; and yet it is alleged the price of wool had nearly doubled, " sheep being come to a few persons' hands." A penalty was therefore imposed on all who kept above 2000 sheep; and no person was to take in farm more than two tenements of husbandry. By the 39th Elizabeth (1597) arable land made pasture since the 1st Elizabeth shall be again converted into tillage, and what is arable shall not be converted into pasture.

The literature of agriculture, in abeyance since the treatise of Walter of Henley, makes another beginning in the 16th century. The best of the early works is the *Book of Husbandry* (1st ed. 1523), commonly ascribed to Sir Anthony Fitzherbert, a judge of the Common Pleas in the reign of Henry VIII., but more probably written by his elder brother John. This was followed by the *Book of Surveying and Improvements* (1523), by the same author. In the former treatise we have a clear and minute description of the rural practices of that period, and from the latter may be learned a good deal of the economy of the feudal system in its decline.

The *Book of Husbandry* begins with a description of the plough and other implements, after which about a third part of it is occupied with the several operations as they succeed one another throughout the year. Among other passages in this part of the work, the following deserve notice:—

"Somme (ploughs) wyll tourn the sheld bredith at every landsende, and plowe all one way "; the same kind of plough that is now found so useful on hilly grounds. Of wheel-ploughs he observes, that " they be good on even grounde that lyeth lyghte "; and on such lands they are still most commonly employed. Cart-wheels were sometimes bound with iron, of which he greatly approves. On the much agitated question about the employment of horses or oxen in labour, the most important arguments are distinctly stated.

" In some places," he says, " a horse plough is better," and in others an oxen plough, to which, upon the whole, he gives the preference. Beans and peas seem to have been common crops. He mentions the different kinds of wheat, barley and oats; and after describing the method of harrowing " all maner of cornnes," we find the roller employed. "They used to role their barley grounde after a showr of rayne, to make the grounde even to mowe." Under the article "To falowe," he observes, "the greater clottes (clods) the better wheate, for the clottes kepe the wheat warme all wynter; and at March they will melte and breake and fal in manye small peces, the whiche is a new dongynge and refreshynge of the corne." This is agreeable to the present practice, founded on the very same reasons. "In May, the shepe folde is to be set out"; but Fitzherbert does not much approve of folding, and points out its disadvantages in a very judicious manner. "In the latter end of May and the begynnynge of June, is tyme to wede the corne"; and then we have an accurate description of the different weeds, and the instruments and mode of weeding. Next comes a second ploughing of the fallow; and afterwards, in the latter end of June, the mowing of the meadows begins. Of this operation, and of the forks and rakes and the hay-making there is a very good account. The corn harvest naturally follows: rye and wheat were usually *shorn*, and barley and oats cut with the scythe. The writer does not approve of the common practice of cutting wheat high and then mowing the stubbles. "In Somersetshire," he says, "they do shere theyr wheat very lowe; and the wheate strawe that they purpose to make *thacke* of, they do not threshe it, but cut off the ears, and bynd it in sheves, and call it *rede*, and therewith they thacke theyr houses." He recommends the practice of setting up corn in shocks, with two sheaves to cover eight, instead of ten sheaves as at present—probably owing to the straw being then shorter. The corn was commonly housed; but if there be a want of room, he advises that the ricks be built on a scaffold and not upon the ground. The fallow received a third ploughing in September, and was sown about Michaelmas. "Wheat is moost commonlye sowne under the forowe, that is to say, cast it uppon the falowe, and then plowe it under"; and this branch of his subject is concluded with directions about threshing, winnowing and other kinds of barn-work.

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[1] Walter of Henley mentions six bushels per acre as a satisfactory crop.

[2] This process of enclosure must be distinguished from that of enclosing the arable common fields which, though advocated by Fitzherbert in a passage quoted below proceeded slowly till the 18th century.

Fitzherbert next proceeds to live stock. "An housbande," he says, "can not well thryue by his corne without he have other cattell, nor by his cattell without corne. And bycause that shepe, in myne opynyon, is the mooste profytablest cattell that any man can haue, therefore I pourpose to speake fyrst of shepe." His remarks on this subject are so accurate that one might imagine they came from a storemaster of the present day.

In some places at present "they neuer seuer their lambes from their dammes"; "and the poore of the peeke (high) countreye, and such other places, where, as they vse to mylke theyr ewes, they vse to wayne theyr lambes at 12 weekes olde, and to mylke their ewes fiue or syxe weekes"; but that, he observes, "is greate hurte to the ewes, and wyll cause them that they wyll not take the ramme at the tyme of the yere for pouertye, but goo barreyne." "In June is tyme to shere shepe; and ere they be shorne, they must be verye well washen, the which shall be to the owner greate profyte in the sale of his wool, and also to the clothe-maker."

His remarks on horses, cattle, &c., are not less interesting; and there is a very good account of the diseases of each species, and some just observations on the advantage of mixing different kinds on the same pasture. Swine and bees conclude this branch of the work.

The author then points out the great advantages of enclosure; recommends "quycksettynge, dychynge and hedgeyng"; and gives particular directions about *settes*, and the method of training a hedge, as well as concerning the planting and management of trees. Fitzherbert throws some light on the position of women in the agriculture of his day. "It is a wyues occupation," he says, "to wynowe all maner of cornes, to make malte, to washe and wrynge, to make heye, shere corne, and, in time of nede, to helpe her husbande to fyll the mucke wayne or dounge carte, dryue the ploughe, to loode heye, corne and suche other; and to go or ride to the market to sel butter, chese, mylke, egges, chekyns, capons, hennes, pygges, gese, and all maner of cornes."

The *Book of Surveying* adds considerably to our knowledge of the rural economy of that age. "Four maner of commens" are described; several kinds of mills for corn and other purposes, and also "quernes that goo with hand"; different orders of tenants, down to the "boundmen," who "in some places contynue as yet"; "and many tymes, by colour thereof, there be many freemen taken as boundmen, and their lands and goods is taken from them." Lime and marl are mentioned as common manures, and the former was sometimes spread on the surface to destroy heath. Both draining and irrigation are noticed, though the latter but slightly. And the work concludes with an inquiry "how to make a township that is worth XX. marke a yere, worth XX. li. a year," advocating the transition from communal or open field to individual or enclosure farming.

"It is undoubted, that to every townshyppe that standeth in tyllage in the playne countrey, there be errable landes to plowe and sowe, and leyse to tye or tedder theyr horses and mares upon, and common pasture to kepe and pasture their catell, beestes and shepe upon; and also they have medowe grounde to get theyr hey upon. Than to let it be known how many acres of errable lande euery man hath in tyllage, and of the same acres in euery felde to chaunge with his neyghbours, and to leve them toguyther, and to make hym one seuerall close in euery felde for his errable lands; and his leyse in euery felde to leve them togyther in one felde, and to make one seuerall close for them all. And also another seuerall close for his portion of his common pasture, and also his porcion of his medowe in a seuerall close by itselfe, and al kept in seureall both in wynter and somer; and euery cottage shall haue his portion assigned hym accordynge to his rent, and than shall nat the ryche man ouerpresse the poore man with his cattell; and euery man may eate his oun close at his pleasure. And vndoubted, that hay and strawe that will find one beest in the house wyll finde two beestes in the close, and better they shall lyke. For those beestis in the house have short heare and thynne, and towards March they will pylle and be bare; and therefore they may nat abyde in the fylde before the heerdmen in wintertyme for colde. And those that lye in a close under a hedge haue longe heare and thyck, and they will neuer pylle nor be bare; and by this reason the husbande maye kepe twyse so many catell as he did before.

"This is the cause of this approwment. Nowe euery husbande hath sixe seuerall closes, whereof iii. be for corne, the fourthe for his leyse, the fyfte for his commen pastures, and the sixte for his haye; and in wynter time there is but one occupied with corne, and than hath the husbande other fyue to occupy tyll lente come, and that he hath his falowe felde, his ley felde, and his pasture felde al sommer. And when he hath mowen his medowe, then he hath his medowe grounde, soo that if he hath any weyke catell that wold be amended, or dyvers maner of catell, he may put them in any close he wyll, the which is a great advantage; and if all shulde lye commen, than wolde the edyche of the corne feldes and the aftermath of all the medowes be eaten in X. or XII. dayes. And the rych men that hath moche catell wold have the advantage, and the poore man can have no help nor relefe in wynter when he hath moste nede; and if an acre of lande be worthe sixe pens, or it be enclosed, it will be worth VIII. pens, when it is enclosed by reason of the compostying and dongyng of the catell that shall go and lye upon it both day and nighte; and if any of his thre closes that he hath for his corne be worne or ware bare, than he may breke and plowe up his close that he hadde for his layse, or the close that he hadde for his commen pasture, or bothe, and sowe them with corne, and let the other lye for a time, and so shall he have always reist grounde, the which will bear moche corne with lytel donge; and also he shall have a great profyte of the wod in the hedges whan it is growen; and not only these profytes and advantages beforesaid, but he shall save moche more than al these, for by reason of these closes he shall save meate, drinke and wages of a shepherde, the wages of the heerdmen, and the wages of the swine herde, the which may fortune to be as chargeable as all his holle rente; and also his corne shall be better saved from eatinge or destroyeng with catel. For dout ye nat but heerdemen with their catell, shepeherdes with their shepe, and tieng of horses and mares, destroyeth moch corne, the which the hedges wold save. Paraduenture some men would say that this shuld be against the common weale, bicause the shepeherdes, heerdmen and swyne-herdes shuld than be put out of wages. To that it may be answered, though these occupations be not used, there be as many newe occupations that were not used before; as getting of quicke settes, diching, hedging and plashing, the which the same men may use and occupye."

The next author who writes professedly on agriculture is Thomas Tusser, whose *Five Hundred Points of Husbandry*, published in 1562, enjoyed such lasting repute that in 1723 Lord Molesworth recommended that it should be taught in schools. In it the book of husbandry consists of 118 pages, and then follows the *Points of Housewifrie*, occupying 42 pages more. It is written in verse. Amidst much that is valueless there are some useful notices concerning the state of agriculture at the time in different parts of England. Hops, which had been introduced in the early part of the 16th century, and on the culture of which a treatise was published in 1574 by Reginald Scott, are mentioned as a well-known crop. Buckwheat was sown after barley. Hemp and flax are mentioned as common crops. Enclosures must have been numerous in some counties; and there is a very good comparison between "champion (open fields) country and several," which Blith afterwards transcribed into his *Improver Improved*. Carrots, cabbages, turnips and rape, not yet cultivated in the fields, are mentioned among the herbs and roots for the kitchen. There is nothing to be found in Tusser about serfs or bondmen, as in Fitzherbert's works.

In 1577 appeared the *Foure Bookes of Husbandry*, translated, with augmentation, from the work of Conrad Heresbach. Much stress is laid on the value of manure, and mention is made of clover.

Fitzherbert, in deploring the gradual discontinuance of the practice of marling land, had alluded to the grievance familiar in modern times of tenants "who, if they should marl and make their holdings much better, fear lest they should be put out, or make a great fine or else pay more rent." This subject is treated at length in Sir John Norden's *Surveyor's Dialogue* (1st ed. 1607), the next agricultural work demanding notice. The author, writing from the landowner's point of view, ascribes the rise in rents and the rise in the price of corn[1] to the "emulation" of tenants in competing for holdings, a practice implying that the agriculture of the period was prosperous. Norden's work contains many judicious observations on the "different natures of grounds, how they may be employed, how they may be bettered, reformed and amended." The famous meadows near Salisbury are mentioned, where, when cattle have fed their fill, hogs, it is said, "are made fat with the remnant—namely, with the knots and sappe of the grasse." "Clouer grasse, or the grasse honey suckle" (white clover), is directed to be sown with other hay seeds. "Carrot rootes" were then raised in several parts of England, and sometimes by farmers. London street and stable dung was carried to a distance by water, and appears from later writers to have been got for the trouble of removing. Leases of 21 years are recommended for persons of small capital as better than employing it in purchasing land. The works of Gervase Markham, Leonard Mascall, Gabriel Plattes and other authors of the first half of the 17th century may be passed over, the best part of them being preserved by Blith and Hartlib, who are referred to below.

Sir Richard Weston's *Discourse on the Husbandry of Brabant and Flanders* was published by Hartlib in 1645, and its title indicates the source to which England owed much of its subsequent agricultural advancement. Weston was ambassador from England to the elector palatine in 1619, and had the merit of being the first who introduced the *great clover*, as it was then called, into English agriculture, about 1652, and probably turnips also. Clover thrives best, he says, when you sow it on the barrenest ground, such as the worst heath ground in England. The ground is to be pared and burnt, and unslacked lime must be added to the ashes. It is next to be well ploughed and harrowed; and about 10 ℔ of clover seed must be sown on an acre in April or the end of March. If you intend to preserve seed, then the second crop must be let stand till it come to a full and dead ripeness, and you shall have at the least five bushels per acre. Being once sown, it will last five years; the land, when ploughed, will yield, three or four years together, rich crops of wheat, and after that a crop of oats, with which clover seed is to be sown again. It is in itself an excellent manure, Sir Richard adds; and so it should be, to enable land to bear this treatment. Before 1655 the culture of clover, exactly according to the present method, seems to have been well known in England, and it had also made its way to Ireland.

A great many works on agriculture appeared during the time of the Commonwealth, of which Walter Blith's *Improver Improved* and Samuel Hartlib's *Legacie* are the most valuable. The first edition of the former was published in 1649, and of the latter in 1651; and both of them were enlarged in subsequent editions. In the first edition of the *Improver Improved* no mention is made of clover, nor in the second of turnips, but in the third, clover is treated of at some length, and turnips are recommended as an excellent cattle crop, the culture of which should be extended from the kitchen garden to the field. Sir Richard Weston must have cultivated turnips before this; for Blith says that Sir Richard affirmed to himself that he fed his swine with them. They were first given boiled, but afterwards the swine came to eat them raw, and would run after the carts, and pull them forth as they gathered them—an expression which conveys an idea of their being cultivated in the fields.

Blith's book is the first systematic work in which there are some traces of alternate husbandry or the practice of interposing clover and turnip between culmiferous crops. He is a great enemy to commons and common fields, and to retaining land in old pasture, unless it be of the best quality. His description of the different kinds of ploughs is interesting; and he justly recommends such as were drawn by two horses (some even by one horse) in preference to the weighty and clumsy machines which required four or more horses or oxen. The following passage indicates the contemporary theory of manuring:—"In thy tillage are these special opportunities to improve it, either by liming, marling, sanding, earthing, mudding, snayl-codding, mucking, chalking, pidgeons-dung, hens-dung, hogs-dung or by any other means as some by rags, some by coarse wool, by pitch marks, and tarry stuff, any oyly stuff, salt and many things more, yea indeed any thing almost that hath any liquidness, foulness, saltness or good moysture in it, is very naturall inrichment to almost any sort of land." Blith speaks of an instrument which ploughed, sowed and harrowed at the same time; and the setting of corn was then a subject of much discussion. Blith was a zealous advocate of drainage and holds that drains to be efficient must be laid 3 or 4 ft. deep. The drainage of the Great Level of the Fens was prosecuted during the 17th century, but lack of engineering skill and the opposition of the fen-men hindered the reclamation of a now fertile region.

Hartlib's *Legacie* contains, among some very judicious directions, a great deal of rash speculation. Several of the deficiencies which the writer complains of in English agriculture must be placed to the account of climate, and never have been or can be supplied. Some of his recommendations are quite unsuitable to the state of the country, and display more of general knowledge and good intention than of either the theory or practice of agriculture. Among the subjects deserving notice may be mentioned the practice of steeping and liming seed corn as a preventive of smut; changing every year the *species* of grain, and bringing seed corn from a distance; ploughing down green crops as manure; and feeding horses with broken oats and chaff. This writer seems to differ a good deal from Blith about the advantage of interchanging tillage and pasture. "It were no losse to this island," he says, "if that we should not plough at all, if so be that we could certainly have corn at a reasonable rate, and likewise vent for all our manufactures of wool"; and one reason for this is, that pasture employs more hands than tillage, instead of depopulating the country, as was commonly imagined. The *grout*, which he mentions as "coming over to us in Holland ships," about which he desires information, was probably the same as shelled barley; and mills for manufacturing it were introduced into Scotland from Holland towards the beginning of the 18th century.

Among the other writers previous to the Revolution mention must be made of John Ray the botanist and of John Evelyn, both men of great talent and research, whose works are still in high estimation.

The first half of the 17th century was a period of agricultural activity, partly due, no doubt, to the increase of enclosed farms. Marling and liming are again practised, new agricultural implements and manures introduced, and the new crops more widely used. But the Civil War and the subsequent political disturbances intervened to prevent the continuance of this progress, and the agriculture of the end of the century seems to have relapsed into stagnation.

Scottish agriculture of the 17th century.

Of the state of agriculture in Scotland in the 16th and the greater part of the 17th century very little is known; no professed treatise on the subject appeared till after the Revolution. The south-eastern counties were the earliest improved, and yet in 1660 their condition seems to have been very wretched. Ray, who made a tour along the eastern coast in that year, says, "We observed *little or no fallow ground* in Scotland; some ley ground we saw, which they manured with sea wreck. The men seemed to be very lazy, and may be frequently observed to plough in their cloaks. It is the fashion of them to wear cloaks when they go abroad, but especially on Sundays. They have neither good bread, cheese nor drink. They cannot make them, nor will they learn. Their butter is very indifferent, and one would wonder how they could contrive to make it so bad. They use much pottage made of coal-wort, which they call *kail*, sometimes broth of decorticated barley. The ordinary country-houses are pitiful cots, built of stone and covered with turfs, having in them but one room, many of them no chimneys, the windows very small holes and not glazed. The ground in the valleys and plains bear very good corn, but especially bears barley or bigge, and oats, but rarely wheat and rye."

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[1] During the 16th century wheat had risen in price, and between 1606 and 1618 never fell below 30s. a quarter. At the same time wages remained low.

It is probable that no great change had taken place in Scotland from the end of the 15th century, except that tenants gradually became possessed of a little stock of their own, instead of having their farm stocked by the landlord. "The minority of James V., the reign of Mary Stuart, the infancy of her son, and the civil wars of her grandson Charles I., were all periods of lasting waste. The very laws which were made during successive reigns for protecting the tillers of the soil from spoil are the best proofs of the deplorable state of the husbandman."[1]

In the 17th century those laws were made which paved the way for an improved system of agriculture in Scotland. By a statute of 1633 landholders were enabled to have their tithes valued, and to buy them either at nine or six years' purchase, according to the nature of the property. The statute of 1685, conferring on landlords a power to entail their estates, was indeed of a very different tendency in regard to its effects on agriculture. But the two Acts in 1695, for the division of commons and separation of intermixed properties, facilitated improvements.

Progress of agriculture from 1688 to 1760.

From the Revolution to the accession of George III. the progress of agriculture was by no means so considerable as might be imagined from the great exportation of corn. It is probable that very little improvement had taken place, either in the cultivation of the soil or in the management of live stock, from the Restoration down to the middle of the 18th century. Clover and turnips were confined to a few districts, and at the latter period were scarcely cultivated at all by common farmers in the northern part of the island. Of the writers of this period, therefore, it is necessary to notice only such as describe some improvement in the modes of culture, or some extension of the practices that were formerly little known.

In John Houghton's *Collections on Husbandry and Trade*, a periodical work begun in 1681, there is one of the earliest notices of turnips being eaten by sheep:—"Some in Essex have their fallow after turnips, which feed their sheep in winter, by which means the turnips are scooped, and so made capable to hold dews and rain water, which, by corrupting, imbibes the nitre of the air, and when the shell breaks it runs about and fertilizes. By feeding the sheep, the land is dunged as if it had been folded; and those turnips, though few or none be carried off for human use, are a very excellent improvement, nay, some reckon it so, though they only plough the turnips in without feeding." This was written in February 1694. Ten years before, John Worlidge, one of his correspondents, and the author of the *Systema Agriculturae* (1669), observes, "Sheep fatten very well on turnips, which prove an excellent nourishment for them in hard winters when fodder is scarce; for they will not only eat the greens, but feed on the roots in the ground, and scoop them hollow even to the very skin. Ten acres (he adds) sown with clover, turnips, &c., will feed as many sheep as one hundred acres thereof would before have done."

The next writer of note is John Mortimer, whose *Whole Art of Husbandry*, a regular, systematic work of considerable merit, was published in 1707.

From the third edition of Hartlib's *Legacie* we learn that clover was cut green and given to cattle; and it appears that this practice of *soiling*, as it is now called, had become very common about the beginning of the 18th century, wherever clover was cultivated. Rye-grass was now sown along with it. Turnips were hand-hoed and extensively employed in feeding sheep and cattle.

The first considerable improvement in the practice of that period was introduced by Jethro Tull, a gentleman of Berkshire, who about the year 1701 invented the drill, and whose *Horse-hoeing Husbandry*, published in 1731, exhibits the first decided step in advance upon the principles and practices of his predecessors. Not contented with a careful attention to details, Tull set himself, with admirable skill and perseverance, to investigate the growth of plants, and thus to arrive at a knowledge of the principles by which the cultivation of field-crops should be regulated. Having arrived at the conclusion that the food of plants consists of minute particles of earth taken up by their rootlets, it followed that the more thoroughly the soil in which they grew was disintegrated, the more abundant would be the "pasture" (as he called it) to which their fibres would have access. He was thus led to adopt that system of sowing his crops in rows or drills, so wide apart as to admit of tillage of the intervals, both by ploughing and hoeing, being continued until they had well-nigh arrived at maturity. Such reliance did he place in the pulverization of the soil that he grew as many as thirteen crops of wheat on the same field without manure.

As the distance between his rows appeared much greater than was necessary for the range of the roots of the plants, he begins by showing that these roots extend much farther than is commonly believed, and then proceeds to inquire into the nature of their food. After examining several hypotheses, he decides this to be fine particles of earth. The chief and almost the only use of dung, he thinks, is to divide the earth, to dissolve "this terrestrial matter, which affords nutriment to the mouths of vegetable roots"; and this can be done more completely by tillage. It is therefore necessary not only to pulverize the soil by repeated ploughings before it be seeded, but, as it becomes gradually more and more compressed afterwards, recourse must be had to tillage while the plants are growing; and this is *hoeing*, which also destroys the weeds that would deprive the plants of their nourishment.

The leading features of Tull's husbandry are his practice of laying the land into narrow ridges of 5 or 6 ft., and upon the middle of these drilling one, two, or three rows, distant from one another about 7 in. when there were three, and 10 in. when only two. The distance of the plants on one ridge from those on the contiguous one he called an *interval*; the distance between the rows on the same ridge, a *space* or *partition*; the former was stirred repeatedly by the horse-hoe, the latter by the hand-hoe.

"Hoeing," he says, "may be divided into deep, which is our horse-hoeing; and shallow, which is the English hand-hoeing; and also the shallow horse-hoeing used in some places betwixt rows, where the intervals are very narrow, as 16 or 18 inches. This is but an imitation of the hand-hoe, or a succenadeum to it, and can neither supply the use of dung nor fallow, and may be properly called scratch-hoeing." But in his mode of forming ridges his practice seems to have been original; his implements, especially his drill, display much ingenuity; and his claim to the title of founder of the present horse-hoeing husbandry of Great Britain seems indisputable.

Contemporary with Tull was Charles, 2nd Viscount Townshend, a typical representative of the large landowners to whom the strides made by agriculture in the 18th century were due. The class to which he belonged was the only one which could afford to initiate improvements. The bulk of the land was still farmed by small tenants on the old common-field system, which made it impossible for the individual to adopt a new crop rotation and hindered innovation of every kind. On the other hand, the small farmers who occupied separated holdings were deterred from improving by the fear of a rise in rent. Townshend's belief in the growing of turnips gained him the nickname of "Turnip Townshend." In their cultivation he adopted Tull's practice of drilling and horse-hoeing, and he was also the founder of the Norfolk or four-course system, the first of those rotations which dispense with the necessity of a summer-fallow and provide winter-keep for live-stock (see below, *Rotation of Crops*). The spread of these principles in Norfolk made it, according to Arthur Young (writing in 1770), one of the best cultivated counties in England. In the latter half of the century another Norfolk farmer, Thomas William Coke of Holkham, earl of Leicester

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[1] Chalmers' *Caledonia*, vol. ii. p. 732.

(1752–1842), figures as a pioneer of high-farming. He was one of the first to use oil-cake and bone-manure, to distinguish the feeding values of grasses, to appreciate to the full the beneficial effects of stock on light lands and to realize the value of long leases as an incentive to good farming.

Agriculture in Scotland in the 18th century.

Of the progress of the art in Scotland, till towards the end of the 17th century, we are almost entirely ignorant. The first work, written by James Donaldson, was printed in 1697, under the title of *Husbandry Anatomized; or, an Inquiry into the Present Manner of Tilling and Manuring the Ground in Scotland.* It appears from this treatise that the state of the art was not more advanced at that time in North Britain than it had been in England in the time of Fitzherbert. Farms were divided into infield and outfield; corn crops followed one another without the intervention of fallow, cultivated herbage or turnips, though something is said about fallowing the outfield; enclosures were very rare; the tenantry had not begun to emerge from a state of great poverty and depression; and the wages of labour, compared with the price of corn, were much lower than at present, though that price, at least in ordinary years, must appear extremely moderate in our times. Leases for a term of years, however, were not uncommon; but the want of capital rendered it impossible for the tenantry to attempt any spirited improvements.

The next work on the husbandry of Scotland is *The Countryman's Rudiments, or an Advice to the Farmers in East Lothian, how to labour and improve their Grounds*, said to have been written by John Hamilton, 2nd Lord Belhaven about the time of the Union, and reprinted in 1723. The author bespeaks the favour of those to whom he addresses himself in the following significant terms:—"Neither shall I affright you with hedging, ditching, marling, chalking, paring and burning, draining, watering and such like, which are all very good improvements indeed, and very agreeable with the soil and situation of East Lothian, but I know ye cannot bear as yet a crowd of improvements, this being only intended to initiate you in the true method and principles of husbandry." The farm-rooms in East Lothian, as in other districts, were divided into infield and outfield.

> "The infield (where wheat is sown) is generally divided by the tenant into four divisions or breaks, as they call them, viz. one of wheat, one of barley, one of pease and one of oats, so that the wheat is sowd after the pease, the barley after the wheat and the oats after the barley. The outfield land is ordinarily made use of promiscuously for feeding of their cows, horse, sheep and oxen; 'tis also dunged by their sheep who lay in earthen folds; and sometimes, when they have much of it, they fauch or fallow a part of it yearly."

Under this management the produce seems to have been three times the seed; and yet, says the writer, "if in East Lothian they did not leave a higher stubble than in other places of the kingdom, their grounds would be in a much worse condition than at present they are, though bad enough." "A good crop of corn makes a good stubble, and a good stubble is the equalest mucking that is." Among the advantages of enclosures, he observes, "you will gain much more labour from your servants, a great part of whose time was taken up in gathering thistles and other garbage for their horses to feed upon in their stables; and thereby the great trampling and pulling up and other destruction of the corns while they are yet tender will be prevented." Potatoes and turnips are recommended to be sown in the yard (kitchen-garden). Clover does not seem to have been in use. Rents were paid in corn; and for the largest farm, which he thinks should employ no more than two ploughs, the rent was about six chalders of victual "when the ground is very good, and four in that which is not so good. But I am most fully convinced they should take long leases or tacks, that they may not be straitened with time in the improvement of their rooms; and this is profitable both for master and tenant."

Such was the state of the husbandry of Scotland in the early part of the 18th century. The first attempts at improvement cannot be traced farther back than 1723, when a number of landholders formed themselves into a society, under the title of the *Society of Improvers in the Knowledge of Agriculture in Scotland.* John, 2nd earl of Stair, one of their most active members, is said to have been the first who cultivated turnips in that country. The *Select Transactions* of this society were collected and published in 1743 by Robert Maxwell, who took a large part in its proceedings. It is evident from this book that the society had exerted itself with success in introducing cultivated herbage and turnips, as well as in improving the former methods of culture. But there is reason to believe that the influence of the example of its numerous members did not extend to the common tenantry, who not unnaturally were reluctant to adopt the practices of those by whom farming was perhaps regarded as primarily a source of pleasure rather than of profit. Though this society, the earliest probably in the United Kingdom, soon counted upwards of 300 members, it existed little more than 20 years.

In the introductory paper in Maxwell's collection we are told that—

> "The practice of draining, enclosing, summer fallowing, sowing flax, hemp, rape, turnip and grass seeds, planting cabbages after, and potatoes with, the plough, in fields of great extent, is introduced; and that, according to the general opinion, more corn grows now yearly where it was never known to grow before, these twenty years last past, than perhaps a sixth of all that the kingdom was in use to produce at any time before."

In 1757 Maxwell issued another work entitled *The Practical Husbandman; being a collection of Miscellaneous papers on Husbandry, &c.* In it the greater part of the *Select Transactions* is republished, with a number of new papers, among which an *Essay on the Husbandry of Scotland*, with a proposal for the improvement of it, is the most valuable. In this he lays it down as a rule that it is bad husbandry to take two crops of grain successively, which marks a considerable progress in the knowledge of modern husbandry; though he adds that in Scotland the best husbandmen after a fallow take a crop of wheat; after the wheat, peas; then barley, and then oats; and after that they fallow again. The want of enclosures was still a matter of complaint. The ground continued to be cropped so long as it produced two seeds; the best farmers were contented with four seeds, which was more than the general produce.

1760 to 1815.

The gradual advance in the price of farm produce soon after the year 1760, occasioned by the increase of population and of wealth derived from manufactures and commerce, gave a powerful stimulus to rural industry, augmented agricultural capital and called forth a more skilful and enterprising race of farmers.

A more rational system of cropping now began to take the place of the thriftless and barbarous practice of sowing successive crops of corn until the land was utterly exhausted, and then leaving it foul with weeds to recover its power by an indefinite period of rest. Green crops, such as turnips, clover and rye grass, began to be alternated with grain crops, whence the name *alternate husbandry.*

The writings of Arthur Young (*q.v.*), secretary to the Board of Agriculture, describe the transition from the old to the new agriculture. In many places turnips and clover were still unknown or ignored. Large districts still clung to the old common-field system, to the old habits of ploughing with teams of four or eight, and to slovenly methods of cultivation. Young's condemnation of these survivals was as pronounced as his support of the methods of the large farmers to whom he ascribed the excellence of the husbandry of Kent, Norfolk and Essex. He realized that with the enclosure of the waste lands and the absorption of small into large holdings, the common-field farmer must migrate to the town or become a hired labourer; but he also realized that to feed a rapidly growing industrial population, the land must be improved by draining, marling, manuring and the use of better implements, in short by the investment of the capital which the yeoman farmer, content to feed himself and his own family, did not possess. The enlargement of farms, and in Scotland the letting of them under leases for a considerable term of years, continued to be a marked feature in the agricultural progress of the country until the end of the century, and is to be regarded both as a cause and a consequence of that progress. The passing of some 3500 enclosure bills, affecting between 5 and 5½ million acres, during the reign of George III., before which the whole number was between 200 and 250, shows how rapidly the break-up of the common-field husbandry and the cultivation of new land now proceeded. The disastrous American War for a time interfered with the national prosperity; but with the return of peace in 1783 the cultivation of the country made more rapid progress. The quarter of a century immediately following 1760 is memorable for the introduction of various important improvements. It was during this period that the genius of Robert Bakewell produced an extraordinary change in the character of our more important breeds of live stock, more especially by the perfecting of a new race of sheep—the well-known Leicesters. Bakewell's fame as a breeder was for a time enhanced by the improvement which he effected on the Long-horned cattle, then the prevailing breed of the midland counties of England. These, however, were ere long rivalled and afterwards superseded by the Shorthorn or Durham breed, which the brothers Charles and Robert Colling obtained from the useful race of cattle that had long existed in the valley of the Tees, by applying to them the principle of breeding which Bakewell had already established. To this period also belong George and Matthew Culley—the former a pupil of Bakewell—who left their paternal property on the bank of the Tees and settled on the Northumbrian side of the Tweed, bringing with them the valuable breeds of live stock and improved husbandry of their native district. The improvements introduced by these energetic and skilful farmers spread rapidly, and exerted a most beneficial influence upon the border counties.

From 1784 to 1795 improvements advanced with steady steps. This period was distinguished for the adoption and working out of ascertained improvements. Small's swing plough and Andrew Meikle's threshing-machine, although invented some years before this, were now perfected and brought into general use, to the great furtherance of agriculture. Two important additions were about this time made to the field crops, viz. the Swedish turnip and potato oat. The latter was accidentally discovered in 1788, and both soon came into general cultivation. In the same year Merino sheep were introduced by George III., who was a zealous farmer. For a time this breed attracted much attention, and sanguine expectations were entertained that it would prove of national importance. Its unfitness for the production of mutton, and increasing supplies of fine clothing wool from other countries, soon led to its total rejection.

In Scotland the opening up of the country by the construction of practicable roads, and the enclosing and subdividing of farms by hedge and ditch, was now in active progress. The former admitted of the general use of wheel-carriages, of the ready conveyance of produce to markets, and in particular of the extended use of lime, the application of which was immediately followed by a great increase of produce. The latter, besides its more obvious advantages, speedily freed large tracts of country from stagnant water and their inhabitants from ague, and prepared the way for the underground draining which soon after began to be practised. Dawson of Frogden in Roxburghshire is believed to have been the first who grew turnips as a field crop to any extent. It is on record that as early as 1764 he had 100 acres of drilled turnips on his farm in one year. An Act passed in 1770, which relaxed the rigour of strict entails and afforded power to landlords to grant leases and otherwise improve their estates, had a beneficial effect on Scottish agriculture.

The husbandry of the country was thus steadily improving, when suddenly the whole of Europe became involved in the wars of the French Revolution. In 1795, under the joint operation of a deficient harvest and the diminution in foreign supplies of grain owing to outbreak of war, the price of wheat, which, for the twenty preceding years, had been under 50s. a quarter, suddenly rose to 81s. 6d., and in the following year reached 96s. In 1797 the fear of foreign invasion led to a panic and run upon the banks, in which emergency the Bank Restriction Act, suspending cash payment, was passed, and ushered in a system of unlimited credit transactions. Under the unnatural stimulus of these extraordinary events, every branch of industry extended with unexampled rapidity. But in nothing was this so apparent as in agriculture; the high prices of produce holding out a great inducement to improve lands then arable, to reclaim others that had previously lain waste, and to bring much pasture-land under the plough. Nor did this increased tillage interfere with the increase of live stock, as the green crops of the alternate husbandry more than compensated for the diminished pasturage. This extraordinary state of matters lasted from 1795 to 1814, the prices of produce even increasing towards the close of that period. The average price of wheat for the whole period was 89s. 7d. per quarter; but for the last five years it was 107s., and in 1812 it reached 126s. 6d. The agriculture of Great Britain, as a whole, advanced with rapid strides during this period; but nowhere was the change so great as in Scotland. Indeed, its progress there, during these twenty years, is probably without parallel in the history of any other country. This is accounted for by a concurrence of circumstances. Previous to this period the husbandry of Scotland was still in a backward state as compared with the best districts of England, where many practices, only of recent introduction in the north, had been in general use for generations. This disparity made the subsequent contrast the more striking. The land in Scotland was now, with trifling exceptions, let on leases for terms varying from twenty to thirty years, and in farms of sufficient size to employ at the least two or three ploughs. The unlimited issues of government paper and the security afforded by these leases induced the Scottish banks to afford every facility to landlords and tenants to embark capital in the improvement of the land. The substantial education supplied by the parish schools, of which nearly the whole population could then avail themselves, had diffused through all ranks such a measure of intelligence as enabled them promptly to discern and skilfully and energetically to take advantage of this spring-tide of prosperity, and to profit by the agricultural information now plentifully furnished by means of the Bath and West of England Society, established in 1777; the Highland Society, instituted in 1784; and the National Board of Agriculture, in 1793.

1815 to 1875.

The restoration of peace to Europe, and the re-enactment of the Corn Laws in 1815, mark the beginning of another era in the history of agriculture. The sudden return to peace-prices was followed by a time of severe depression, low wages, diminished rents and bad farming. The fall in prices was aggravated, first by the unpropitious weather and deficient harvest of the years 1816, 1817, and still more by the passing in 1819 of the bill restoring cash payments, which, coming into operation in 1821, caused serious embarrassment to all persons who had entered into engagements at a depreciated currency, which had now to be met with the lower prices of an enhanced one. The frequency of select-committees and commissions, which sat in 1814, 1821 and 1822, 1833 and 1836, testifies to the gravity of the crisis. The years 1830–1833 are especially memorable for a disastrous outbreak of sheep-rot and for agrarian outrages, caused partly by the dislike of the labourers to the introduction of agricultural machines.

During this period of depression, which lasted till the 'forties, want of confidence prevented any general improvement in agricultural methods. At the same time, certain developments destined to exercise considerable influence in later times are to be noted. Before the close of the 18th century, and during the first quarter of the 19th, a good deal had been done in the way of draining the land, either by open ditches or by James Elkington's system of deep covered drains. In 1834 James Smith of Deanston promulgated his system of thorough draining and deep ploughing, the adoption of which immeasurably improved the clay lands of the country. The early years of the reign of Queen Victoria witnessed the strengthening of the union between agriculture and chemistry. The Board of Agriculture in 1803 had commissioned Sir Humphry Davy to deliver a course of lectures on the connexion of chemistry with vegetable physiology. In 1840 the appearance of *Chemistry in its Application to Agriculture and Physiology* by Justus von Liebig set on foot a movement in favour of scientific husbandry, the most notable outcome of which was the establishment by Sir John Bennet Lawes in 1843 of the experimental station of Rothamsted. Since Blith's time bone was the one new fertilizer that had come into use. Nitrate of soda, Peruvian guano and superphosphate of lime in the form of bones dissolved by sulphuric acid were now added to the list of manures, and the practice of analysing soils became more general. Manual labour in farming operations began to be superseded by the use of drills, hay-makers and horse-rakes, chaff-cutters and root-pulpers. The reaping-machine, invented in 1812 by John Common, improved upon by the Rev. Patrick Bell in England and by Cyrus H. McCormick and others in America, and finally perfected about 1879 by the addition of an efficient self-binding apparatus, is the most striking example of the application of mechanics to agriculture. Improvements in the plough, harrow and roller were introduced, adapting those implements to different soils and purposes. The steam-engine first took the place of horses as a threshing power in 1803, but it was not until after 1850 that it was applied to the plough and cultivator. The employment of agricultural machines received considerable impetus from the Great Exhibition of 1851. The much-debated Corn Laws, after undergoing various modifications, and proving the fruitful source of business uncertainty, social discontent and angry partisanship, were finally abolished in 1846, although the act was not consummated until three years later. Several other acts of the legislature passed during this period exerted a beneficial influence on agriculture. Of these, the first in date and importance is the Tithe Commutation Act of 1836. Improvement was also stimulated by the Public Money Drainage Acts 1846–1856, under which government was empowered to advance money on certain conditions for the improvement of estates. Additional facilities were granted by the act passed in 1848 for disentailing estates, and for burdening such as are entailed with the share of the cost of certain specified improvements.

Meanwhile much had been done in the organization of agricultural knowledge. Mention has already been made of the institution of the Highland Society and the National Board of Agriculture. These institutions were the means of collecting a vast amount of statistical and general information connected with agriculture, and by their publications and premiums made known the practices of the best-farmed districts and encouraged their adoption elsewhere. These associations were soon aided in their important labours by numerous local societies which sprang up in all parts of the kingdom. After a highly useful career, under the presidency till 1813 of Sir John Sinclair, the Board of Agriculture was dissolved in 1819, but left in its statistical account, county surveys and other documents much interesting and valuable information regarding the agriculture of the period. In 1800 the original *Farmers' Magazine* came into existence under the editorship of Robert Brown of Markle, the author of the well-known treatise on *Rural Affairs*. The Highland Society having early extended its operations to the whole of Scotland, by and by made a corresponding addition to its title, and as the Highland and Agricultural Society of Scotland gradually extended its operations. In 1828, shortly after the discontinuance of the *Farmers' Magazine*, its *Prize Essays and Transactions* began to be issued statedly in connexion with the *Quarterly Journal of Agriculture*. This society early began to hold a great show of live stock, implements, &c. In 1842 certain Midlothian tenant-farmers had the merit of originating an Agricultural Chemistry Association (the first of its kind), by which funds were raised for the purpose of conducting such investigations as the title of the society implies. After a successful trial of a few years this association was dissolved, transferring its functions to the Highland and Agricultural Society.

In England the Agricultural Society was founded in 1838, with the motto "Practice with Science," and shortly afterwards incorporated by royal charter. In 1845 the Royal Agricultural College at Cirencester was incorporated. This era of revival was not, however, without its calamities. The foot-and-mouth disease first appeared about 1840, having been introduced, as is supposed, by foreign cattle. It spread rapidly over the country, affecting all domesticated animals except horses, and although seldom attended by fatal results, caused everywhere great alarm and loss. It was soon followed by the more terrible lung-disease, or pleuro-pneumonia. In 1865 the rinderpest, or steppe murrain, originating amongst the vast herds of the Russian steppes, had spread westward over Europe, until it was brought to London by foreign cattle. Several weeks elapsed before the true character of the disease was known, and in this brief space it had already been carried by animals purchased in Smithfield market to all parts of the country. After causing the most frightful losses, it was at last stamped out by the resolute slaughter of all affected animals and of all that had been in contact with them. Severe as were the losses in flocks and herds from these imported diseases, they were eclipsed by the ravages of the mysterious potato blight, which, first appearing in 1845, pervaded the whole of Europe, and in Ireland especially proved the precursor of famine and pestilence.

A short period of low prices followed the repeal of the Corn Laws, wheat averaging only 38s. 6d. a quarter in 1851, but the years from 1852 to 1875 were the most prosperous of the century. The letters written by Sir James Caird to *The Times* during 1850, and republished in 1852 under the title *English Agriculture in 1850-1851*, give a general review of English agriculture at the time. The scientific and mechanical improvements of the first half of the century were widely adopted, while the prices of the protectionist period showed little decline. Amelioration in all breeds of domesticated animals was manifested, not so much in the production of individual specimens of high merit as in the diffusion of these and other good breeds over the country, and in the improved quality of live stock as a whole. The fattening of animals was conducted on more scientific principles. Increased attention was successfully bestowed on the improvement of field crops. Improved varieties, obtained by cross-impregnation either naturally or artificially brought about, were carefully propagated and generally adopted, and increased attention was bestowed on the cultivation of the natural grasses. The most important additions to the list of field crops were Italian rye-grass, winter beans, white Belgian carrot and alsike clover.

Agriculture since 1875.

The last quarter of the 19th century proved, however, a fateful period for British agriculture. The great future that seemed to await the application of steam power to the tillage of the soil proved illusory. The clay soils of England, the latent fertility of which was to be brought into play in a fashion that should mightily augment the home-grown supplies of food, remained intractable, and the extent of land devoted to the cultivation of corn crops, instead of expanding, diminished in a marked degree. British farmers of long experience look back to 1874 as the last of the really good years, and consider that the palmy days of British agriculture began to dwindle at about that time. The shadow of the approaching depression had already fallen upon the land before the year 1875 had run its course, and the outlook became ominous as the decade of the 'seventies neared its close. One memorable feature was associated with 1877 in that this was the last year in which the dreaded cattle plague (rinderpest) made its appearance in England. The same year, 1877, was the last also in which the annual average price of English wheat (then 56s. 9d.) exceeded 50s. a quarter. With declining prices for farm produce came that year of unhappy memory, 1879, when persistent rains and an almost sunless summer ruined the crops and reduced many farmers to a state of destitution. Much of the grain was never harvested, whilst owing mainly to the excessive floods there commenced an outbreak of liver-rot in sheep, due to the ravages of the fluke parasite. This continued for several years, and the mortality was so great that its adverse effects upon the ovine population of the country were still perceptible ten years afterwards. A fall in rents was the necessary sequel of the agricultural distress, to inquire into which a royal commission was appointed in 1879, under the chairmanship of the duke of Richmond and Gordon. Its report, published in 1882, testified to "the great extent and intensity of the distress which has fallen upon the agricultural community. Owners and occupiers have alike suffered from it. No description of estate or tenure has been exempted. The owner in fee and life tenant, the occupier, whether of large or of small holding, whether under lease, or custom, or agreement, or the provisions of the Agricultural Holdings Act—all without distinction have been involved in a general calamity." The two most prominent causes assigned for the depression were bad seasons and foreign competition, aggravated by the increased cost of production and the heavy losses of live stock. Abundant evidence was forthcoming as to the extent to which agriculture had been injuriously affected "by an unprecedented succession of bad seasons." As regards the pressure of foreign competition, it was stated to be greatly in excess of the anticipations of the supporters, and of the apprehensions of the opponents of the repeal of the Corn Laws. Whereas formerly the farmer was to some extent compensated by a higher price for a smaller yield, in recent years he had had to compete with an unusually large supply at greatly reduced prices. On the other hand, he had enjoyed the advantage of an extended supply of feeding-stuffs—such as maize, linseed-cake and cotton-cake—and of artificial manures imported from abroad. The low price of agricultural produce, beneficial though it might be to the general community, had lessened the ability of the land to bear the proportion of taxation which had heretofore been imposed upon it. The legislative outcome of the findings of this royal commission was the Agricultural Holdings Act 1883, a measure which continued in force in its entirety till 1901, when a new act came into operation.

The apparently hopeless outlook for corn-growing compelled farmers to cast about for some other means of subsistence, and to rely more than they had hitherto done upon the possibilities of stock-breeding. It was in particular the misfortunes of the later 'seventies that gave the needed fillip to that branch of stock-farming concerned with the production of milk, butter and cheese, and from this period may be said to date the revival of the dairying industry, which received a powerful impetus through the introduction of the centrifugal cream separator, and was fostered by the British Dairy Farmers' Association (formed in 1875). The generally wet character of the seasons in 1879 and the two or three years following was mainly responsible for the high prices of meat, so that the supplies of fresh beef and mutton from Australia which now began to arrive found a ready market, and the trade in imported fresh meat which was thus commenced has practically continued to expand ever since. The great losses arising from spoilt hay crops served to stimulate experimental inquiry into the method of preserving green fodder known as ensilage, with the result that the system eventually became successfully incorporated in the ordinary routine of agricultural practice. A contemporaneous effort in the direction of drying hay by artificial means led to nothing of practical importance. By 1882 the cry as to land going out of cultivation became loud and general, and the migration of the rural population into the towns in search of work continued unchecked (see below, *Agricultural Population*). In 1883 foot-and-mouth disease was terribly rampant amongst the herds and flocks of Great Britain, and was far more prevalent than it has ever been since. It was about this time that the first experiments were made (in Germany) with basic slag, a material which had hitherto been regarded as a worthless by-product of steel manufacture. A year or two later field trials were begun in England, with the final result that basic slag has become recognized as a valuable source of phosphorus for growing crops, and is now in constant demand for application to the soil as a fertilizer.

In 1883 the veterinary department of the Privy Council—which had been constituted in 1865 when the country was ravaged by cattle plague—was abolished by order in council, and the "Agricultural Department" was substituted, but no alteration was effected in the work of the department, so far as it related to animals. In 1889 the Board of Agriculture (for Great Britain) was formed under an act of parliament of that year (see AGRICULTURE, BOARD OF). The election took place in the same year (1889) of the first county councils, and the allotment to them of various sums of money under the Local Taxation (Customs and Excise) Act 1890 enabled local provision to be made for the promotion of technical instruction in agriculture (see below, *Agricultural Education*). It was about this time that the value of a mixture of lime and sulphate of copper (*bouillie bordelaise*), sprayed in solution upon the growing plants, came to be recognized as a check upon the ravages of potato disease.

The general experience of the decade of the 'eighties was that of disappointing summers, harsh winters, falling prices, declining rents and the shrinkage of land values. It is true that one season of the series, that of 1887, was hot and droughty, but the following summer was exceedingly wet. Nevertheless, the decade closed more hopefully than it opened, and found farmers taking a keener interest in grass land, in live stock and in dairying. Cattle-breeders did well in 1889, but sheep-breeders fared better; on the other hand, owing to receding prices, corn-growers were more disheartened than ever. With the incoming of the last decade of the century there seemed to be some justifiable hopes of the dawn of better times, but they were speedily doomed to disappointment. In 1891 excessively heavy autumn rains washed the arable soils to such an extent that the next season's corn crops were below average. Wheat in particular was a poor crop in 1892, and the low yield was associated with falling prices due to large imports. The hay crop was very inferior, and in some cases it was practically ruined. This gave a stimulus to the trade in imported hay, which rose from 61,237 tons in 1892 to 263,050 tons in 1893, and despite some large home-grown crops in certain subsequent years (1897 and 1898) this expansion has never since been wholly lost.

The misfortunes of 1892 proved to be merely a preparation for the disasters of 1893, in which year occurred the most destructive drought within living memory. Its worst effects were seen upon the light land farms of England, and so deplorable was the position that a royal commission on agricultural depression was appointed in September of that year under the chairmanship of Mr Shaw Lefevre (afterwards Lord Eversley). Thus, within the last quarter of the 19th century—and, as a matter of fact, only fourteen years apart—two royal commissions on agriculture were appointed, the one in a year of memorable flood, 1879, and the other in a year of disastrous drought, 1893. The report of the commission of 1893 was issued in March 1896. Amongst its chief recommendations were those relating to amendments in the Agricultural Holdings Acts, and to tithe rent-charge, railway rates, damage by game, sale of adulterated products, and sale of imported goods (meat, for example) as home produce. Two legislative enactments arose out of the work of this commission. In the majority report it was stated "that, in order to place agricultural lands in their right position as compared with other ratable properties, it is essential that they should be assessed to all local rates in a reduced proportion of their ratable value." The Agricultural Rates Act 1896 gave effect to this recommendation. Its objects were to relieve agricultural land from half the local rates, and to provide the means of making good out of imperial funds the deficiency in local taxation caused thereby. It was provided that the act should continue in force only till the 31st of March 1902, but a further act in 1901 extended the period by four years, and in 1905 its operation was extended to the 31st of March 1910. The other measure arising out of the report of the royal commission of 1893 was the Agricultural Holdings Act 1900. This was an amending act and not a consolidating act; consequently it had to be read as if incorporated into the already existing acts. As affecting agricultural practice there were three noteworthy improvements in respect of the making of which, without the consent of or notice to his landlord, a tenant might claim compensation—(1) the consumption on the holding "by horses, other than those regularly employed on the holding," of corn, cake or other feeding-stuff not produced on the holding; (2) the "consumption on the holding by cattle, sheep, or pigs, or by horses other than those regularly employed on the holding, of corn proved by satisfactory evidence to have been produced and consumed on the holding"; (3) "laying down temporary pasture with clover, grass, lucerne, sainfoin or other seeds sown more than two years prior to the determination of the tenancy." A further act was passed in 1906 (the Agricultural Holdings Act 1906) which improved the tenant's position in respect of freedom of cropping, disposal of produce and compensation for disturbance.

After 1894, in which year the brilliant prospects of a bountiful harvest were ultimately extinguished by untimely and heavy rains, all the remaining seasons of the closing decade of the 19th century were dominated by drought. A fact that was amply illustrated, moreover, is that the period of incidence of a drought is not less important than its duration, and the same is true of abnormal rainfall. A spring drought, a summer drought, an autumn drought, each has its distinctive characteristics in so far as the effect upon the crops is concerned. The hot drought of 1893 extended over the spring and summer months, but there was an abundant rainfall in the autumn; correspondingly there was an unprecedentedly bad yield of corn and hay crops, but a moderately fair yield of the main root crops (turnips and swedes). In 1899 the drought became most intense in the autumn after the corn crops had been harvested, but during the chief period, of growth of the root crops; correspondingly the corn crops of that year rank very well amongst the crops of the decade, but the yield of turnips and swedes was the worst on record. It is quite possible for a hot dry season to be associated with a large yield of corn, provided the drought is confined to a suitable period, as was the case in 1896 and still more so in 1898; the English wheat crops in those years were probably the biggest in yield per acre that had been harvested since 1868, which is always looked back upon as a remarkable year for wheat. The drought of 1898 was interrupted by copious rains in June, and these falling on a warm soil led to a rapid growth of grass and, as measured by yield per acre, an exceedingly heavy crop of hay.

With the exceptions of 1891 and 1894, every year in the period 1891–1900 was stricken by drought. The two meteorological events of the decade which will probably live longest in the recollection were, however, the terrible drought of 1893, resulting in a fodder famine in the succeeding winter, and the severe frost of ten weeks' duration at the beginning of 1895. Between these two occurrences came the disastrous decline in the value of grain in the autumn of 1894, when the weekly average price of English wheat fell to the record *minimum* of 17s. 6d. per imperial quarter. As a consequence, the extent of land devoted to wheat in the British Isles receded in 1895 to less than 1½ million acres. The year 1903 was memorable for a very heavy rainfall, comparable though not equal in its disastrous effects to that of 1879. Successful trials of sulphate of copper solution as a means of destroying charlock in corn crops took place in the years 1898–1900. Charlock is a most persistent cruciferous weed, but if sprayed when young with the solution named it is killed, the corn plants being uninjured. In 1901 the formation of the Agricultural Organization Society marked the first systematic attempt to organize co-operation among the farmers of Great Britain. In the subsequent years the principle, which had already made great progress in Ireland, began to obtain a hold in England and Wales, where, in 1906, there were 145 local co-operative societies with a turn-over of £350,000.

Amongst legislative measures of importance to agriculturists mention should be made, in addition to those that have been referred to, of the Tithe Rent-charge Recovery Act 1891, which transfers the liability for payment of tithe from the occupier to the owner. In the same year was passed the Markets and Fairs (Weighing of Cattle) Act. The object of the Small Holdings Act 1892 was to facilitate the acquisition of small agricultural holdings. It provided that a county council might acquire any suitable land, with the object of allotting from one to fifty acres, or, if more than fifty acres, of an annual value not exceeding £50, to persons who desired to buy, and would themselves cultivate, the holdings. If, owing to proximity to a town or otherwise, the prospective value were too high, the council might hire such land for the purpose of letting it. (See ALLOTMENTS AND SMALL HOLDINGS for this and other acts.) The Fertilizers and Feeding Stuffs Act 1893 compelled sellers of fertilizers (*i.e.* manures), manufactured or imported, to state the percentage of the nitrogen, of the soluble and insoluble phosphates, and of the potash in each article sold, and this statement was to have the effect of a warranty. Similar stringent conditions applied as regards the sale of feeding-stuffs for live stock. The Fertilizers and Feeding Stuffs Act 1906, amending and re-enacting the act of 1893, provided for the compulsory appointment by county councils of official samplers. It also provides penalties for breaches of duty by the seller, but grants him protection in cases where he is not morally responsible. The Finance Act of 1894, with its great changes in the death duties, overshadowed all other acts of that year both in its immediate effects and in its far-reaching consequences. The Copyhold Consolidation Act 1894 supersedes six previous copyhold statutes, but does not effect any alteration in the law concerning enfranchisement. The Diseases of Animals Act 1896 provided for the compulsory slaughter of imported live stock at the place of landing. The Light Railways Act and the Locomotives on Highways Act were added to the statute book in 1896, and various clauses in the Finance Act effected reforms in respect of the death duties, the land-tax, farmers' income-tax and the beer duty. The Chaff-cutting Machines (Accidents) Act 1897 is a measure very similar in its intention to the Threshing Machines Act 1878, and provides for the automatic prevention of accidents to persons in charge of chaff-cutting machines. The Sale of Food and Drugs Act 1899 has special reference in its earlier sections to the trade in dairy produce and margarine. In 1899 was also passed the act establishing the Department of Agriculture and Technical Instruction in Ireland.

The year 1900 saw the passing of a Workmen's Compensation Act, which extended the benefits of the act of 1897 to agricultural labourers.

Acreage and Yields of British Crops.

The most notable feature in connexion with the cropping of the land of the United Kingdom between 1875 and 1905 was the lessened cultivation of the cereal crops associated with an expansion in the area of grass land. At the beginning of the period the aggregate area under wheat, barley and oats was nearly 10½ million acres; at the close it did not amount to 8 million acres. There was thus a withdrawal during the period of over 2½ million acres from cereal cultivation. From Table I., showing the acreages at intervals of five years, it will be learnt that the loss fell chiefly upon the wheat crop, which at the close of the period occupied barely more than half the area assigned to it at the beginning. If the land taken from wheat had been cropped with one or both of the other cereals, the aggregate area would have remained about the same. This, however, was not the case, for a fairly uniform decrease in the barley area was accompanied by somewhat irregular fluctuations in the acreage of oats. To the decline in prices of home-grown cereals the decrease in area is largely attributable. The extent of this decline is seen in Table II., wherein are given the annual average prices from 1875 to 1905, calculated upon returns from the 190 statutory markets of England and Wales (Corn Returns Act 1882). These prices are per imperial quarter,—that is, 480 lb of wheat, 400 lb of barley and 312 lb of oats, representing 60 lb, 50 lb and 39 lb per bushel respectively. After 1883 the annual average price of English wheat was never so high as 40s. per quarter, and only twice after

TABLE I.—*Areas of Cereal Crops in the United Kingdom —Acres.*

Year.	Wheat.	Barley.	Oats.	Total.
1875	3,514,088	2,751,362	4,176,177	10,441,627
1880	3,065,895	2,695,000	4,191,716	9,952,611
1885	2,553,092	2,447,169	4,282,594	9,282,855
1890	2,483,595	2,300,994	4,137,790	8,922,379
1895	1,456,042	2,346,367	4,527,899	8,330,308
1900	1,901,014	2,172,140	4,145,633	8,218,787
1905	1,836,598	1,872,305	4,137,406	7,846,309

1892 did it exceed 30s. In one of these exceptional years, 1898, the average rose to 34s., but this was due entirely to a couple of months of inflated prices in the early half of the year, when the outbreak of war between Spain and the United States of America coincided with a huge speculative deal in the latter country. The weekly average prices of English wheat in 1898 fluctuated between 48s. 1d. and 25s. 5d. per quarter, the former being the highest weekly average since 1882. The *minimum* annual average was 22s. 10d. in 1894, in the autumn of which year the weekly average sank to 17s. 6d. per quarter, the lowest on record. Wheat was so great a glut in the market that various methods were devised for feeding it to stock, a purpose for which it is not specially suited; in thus utilizing the grain, however, a smaller loss was often incurred than in sending it to market. In 1894 the monthly average price for October, the chief month for wheat-sowing in England, was only 17s. 8d. per quarter, and farmers naturally shrank from seeding the land freely with a crop which could not be grown except at a heavy loss. The result was that in the following year the wheat crop of the United Kingdom was harvested upon the smallest area on record—less than 1½ million acres. In only one year, 1878, did the annual average price of English barley touch 40s. per quarter; it never reached 30s. after 1885, whilst in 1895 it fell to so low a level as 21s. 11d. The same story of declining prices applies to oats. An average of 20s. per quarter was touched in 1891 and 1902, but with those exceptions this useful feeding grain did not reach that figure after 1885. In 1895 the average price of 480 ℔ of wheat, at 23s. 1d., was identical with that of 312 ℔ of oats in 1880, and it was less in the preceding year. The declining prices that have operated against the growers of wheat should be studied in conjunction with Table III., which shows, at intervals of five years, the imports of wheat grain and of wheat meal and flour into the United Kingdom. The import of the manufactured product from 1875 to 1900 increased at a much greater ratio than that of the raw grain, for whilst in 1875 the former represented less than one-ninth of the total, by 1900 the proportion had risen to nearly one-fourth. The offal, which is quite as valuable as the flour itself, was thus retained abroad instead of being utilized for stock-feeding purposes in the United Kingdom. In the five subsequent years the proportion was fundamentally altered, so that with a greatly increased importation of grain, that of meal and flour was in the proportion of about one-ninth. The highest and lowest areas of wheat, barley and oats in the United Kingdom during the period 1875-1905 were the following:—

Wheat . 3,514,088 acres in 1875; 1,407,618 acres in 1904.
Barley . 2,931,809 ,, ,, 1879; 1,872,305 ,, ,, 1905.
Oats . 4,527,899 ,, ,, 1895; 3,998,200 ,, ,, 1879.

These show differences amounting to 2,106,470 acres for wheat, 1,059,504 acres for barley, and 529,699 acres for oats. The acreage of wheat, therefore, fluctuated the most, and that of oats the least. Going back to 1869, it is found that the extent of wheat in that year was 3,981,989 acres or very little short of four million acres.

TABLE II.—*Gazette Annual Average Prices per Imperial Quarter of British Cereals in England and Wales*, 1875–1905.

Year.	Wheat.		Barley.		Oats.	
	s.	d.	s.	d.	s.	d.
1875	45	2	38	5	28	8
1876	46	2	35	2	26	3
1877	56	9	39	8	25	11
1878	46	5	40	2	24	4
1879	43	10	34	0	21	9
1880	44	4	33	1	23	1
1881	45	4	31	11	21	9
1882	45	1	31	2	21	10
1883	41	7	31	10	21	5
1884	35	8	30	8	20	3
1885	32	10	30	1	20	7
1886	31	0	26	7	19	0
1887	32	6	25	4	16	3
1888	31	10	27	10	16	9
1889	29	9	25	10	17	9
1890	31	11	28	8	18	7
1891	37	0	28	2	20	0
1892	30	3	26	2	19	10
1893	26	4	25	7	18	9
1894	22	10	24	6	17	1
1895	23	1	21	11	14	6
1896	26	2	22	11	14	9
1897	30	2	23	6	16	11
1898	34	0	27	2	18	5
1899	25	8	25	7	17	0
1900	26	11	24	11	17	7
1901	26	9	25	2	18	5
1902	28	1	25	8	20	2
1903	26	9	22	8	17	2
1904	28	4	22	4	16	4
1905	29	8	24	4	17	4

TABLE III.—*Imports into the United Kingdom of Wheat Grain, and of Wheat Meal and Flour—Cwt.*

Year.	Wheat Grain.	Meal and Flour.	Total.
1875	51,876,517	6,136,083	58,012,600
1880	55,261,924	10,558,312	65,820,236
1885	61,498,864	15,832,843	77,331,707
1890	60,474,180	15,773,336	76,247,516
1895	81,749,955	18,368,410	100,118,365
1900	68,669,490	21,548,131	90,217,621
1905	97,622,752	11,954,763	109,577,515

The acreage of rye grown in the United Kingdom as a grain crop is small, the respective *maximum* and *minimum* areas during the period 1875–1905 having been 102,676 acres in 1894 and 47,937 acres in 1880. Rye is perhaps more largely grown as a green crop to be fed off by sheep, or cut green for soiling, in the spring months.

Of corn crops other than cereals, beans and peas are both less cultivated than formerly. In the period 1875–1905 the area of beans in the United Kingdom fluctuated between 574,414 acres in 1875 and 230,429 acres in 1897, and that of peas between 318,410 acres in 1875 and 155,668 acres in 1901. The area of peas (175,624 acres in 1905) shrank by nearly one-half, and that of beans (256,383 acres in 1905) by more than one-half. Taking cereals and pulse corn together, the aggregate areas of wheat, barley, oats, rye, beans and peas in the United Kingdom varied as follows over the six quinquennial intervals embraced in the period 1875–1905:—

Year.	Acres.	Year.	Acres.
1875 . .	11,399,030	1890 . .	9,574,249
1880 . .	10,672,086	1895 . .	8,865,338
1885 . .	10,014,625	1900 . .	8,707,602
		1905 . .	8,333,770

Disregarding minor fluctuations, there was thus a loss of corn land over the 30 years of 3,065,260 acres, or 27%.

The area withdrawn from corn-growing is not to be found under the head of what are termed "green crops." In 1905 the total area of these crops in the United Kingdom was 4,144,374 acres, made up thus:—

Crop.	Acres.
Potatoes	1,236,768
Turnips and swedes	1,879,384
Mangel	477,540
Cabbage, kohl-rabi and rape	225,315
Vetches or tares	139,285
Other green crops	186,082

The extreme aggregate areas of these crops during the thirty years were 5,057,029 acres in 1875 and 4,109,394 acres in 1904. At five-year intervals the areas were:—

Year.	Acres.	Year.	Acres.
1875 . .	5,057,029	1890 . .	4,534,145
1880 . .	4,746,293	1895 . .	4,399,949
1885 . .	4,765,195	1900 . .	4,301,774
		1905 . .	4,144,374

These crops, therefore, which, except potatoes, are used mainly for stock-feeding, have like the corn crops been grown on gradually diminishing areas.

The land that has been lost to the plough is found to be still further augmented when an inquiry is instituted into the area devoted to clover, sainfoin and grasses under rotation. The areas of five-year intervals are given in Table IV. Under the old Norfolk or four-course rotation (roots, barley, clover, wheat) land thus seeded with clover or grass seeds was intended to be ploughed up at the end of a year. Labour difficulties, low prices of produce, bad seasons and similar causes provided inducements for leaving the land in grass for two years, or over three years or more, before breaking it up for wheat. In many cases it would be decided to let such land remain under grass indefinitely, and thus it would no longer be enumerated in the Agricultural Returns as temporary grass land, but would pass into the category of permanent grass land, or what is often spoken of as "permanent pasture." Whilst much grass land has been laid down with the intention from the outset that it should be permanent, at the same time some considerable areas have through stress of circumstances been allowed to drift from the temporary or rotation grass area to the permanent list, and have thus still further diminished the area formerly under the dominion of the plough. The column relating to permanent grass in Table IV. shows clearly enough how the British Isles became more pastoral, while the figures already given demonstrate the extent to which they became less arable. In the period 1875–1905 the extreme areas returned as "permanent pasture"—a term which, it should be clearly understood, does not include heath or mountain land, of which there are in Great Britain alone about 13 million acres used for grazing—were 23,772,602 acres in 1875, and 28,865,373 acres in 1905. Comparing 1905 with 1875 the increase in permanent grass land amounted to over five million acres, or about 21 %.

TABLE IV.—*Areas of Grass Land (excluding Heath and Mountain Land) in the United Kingdom—Acres.*

Year.	Temporary (*i.e.* under rotation).	Permanent (*i.e.* not broken up in rotation).	Total.
1875	6,337,953	23,772,602	30,110,555
1880	6,389,232	24,717,092	31,106,324
1885	6,738,206	25,616,071	32,354,277
1890	6,097,210	27,115,425	33,212,635
1895	6,061,139	27,831,117	33,892,256
1900	6,025,025	28,266,712	34,291,737
1905	5,779,323	28,865,373	34,644,696

On account of the greater humidity and mildness of its climate, Ireland is more essentially a pastoral country than Great Britain. The distribution between the two islands of such important crops of arable land as cereals and potatoes is indicated in Table V. The figures are those for 1905, but, though the absolute acreages vary somewhat from year to year, there is not much variation in the proportions. The comparative insignificance of Ireland in the case of the wheat and barley crops, represented by 2 and 8 % respectively, receives some compensation when oats and potatoes are considered, about one-fourth of the area of the former and more than half that of the latter being claimed by Ireland. It is noteworthy, however, that Ireland year by year places less reliance upon the potato crop. In 1888 the area of potatoes in Ireland was 804,566 acres, but it continuously contracted each year, until in 1905 it was only 616,755 acres, or 187,811 acres less than 17 years previously.

TABLE V.—*Areas of Cereal and Potato Crops in Great Britain and Ireland in* 1905.

	Wheat.	Barley.
	Acres.	Acres.
Great Britain .	1,796,993	1,713,664
Ireland . .	37,860	154,645
Total . .	1 834,853	1,868,309
	Oats.	Potatoes.
Great Britain .	3,051,376	608,473
Ireland . .	1,066,806	616,755
Total . .	4,118,182	1,225,228

A similar comparison for the several sections of Great Britain, as set forth in Table VI., shows that to England belong about 95 % of the wheat area, over 80 % of the barley area, over 60 % of the oats area, and over 70 % of the potato area, and these proportions do not vary much from year to year. The figures for cereals are important, as they indicate that it is the farmers of England who are the chief sufferers through the diminishing prices of corn; and particularly is this true of East Anglia, where corn-growing is more largely pursued than in any other part of the country. Scotland possesses nearly one-third of the area of oats and nearly one-fourth of that of potatoes. Beans are almost entirely confined to England, and this is even more the case with peas. The mangel crop also is mainly English, the summer in most parts of Scotland being neither long enough nor warm enough to bring it to maturity.

TABLE VI.—*Areas of Cereal and Potato Crops in England, Wales and Scotland, and in Great Britain, in* 1905.

	Wheat.	Barley.
	Acres.	Acres.
England . .	1,704,281	1,410,287
Wales . .	44,073	91,243
Scotland . .	48,641	212,134
Great Britain	1,796,995	1,713,664
	Oats.	Potatoes.
England . .	1,880,475	434,773
Wales . .	207,929	29,435
Scotland . .	962,972	144,265
Great Britain	3,051,376	608,473

The Produce of British Crops.

Whilst the returns relating to the acreage of crops and the number of live stock in Great Britain have been officially collected in each year since 1866, the annual official estimates of the produce of the crops in the several sections of the kingdom do not extend back beyond 1885. The practice is for the Board of Agriculture to appoint local estimators, who report in the autumn as to the total production of the crops in the localities respectively assigned to them. By dividing the total production, say of wheat, in each county by the number of acres of wheat as returned by the occupiers on June 4, the estimated average yield per acre is obtained. It is important to notice that the figures relating to total production and yield per acre are only *estimates*, and it is not claimed for them that they are anything more. The fact that much of the wheat to which the figures apply is still in the stack after the publication of the figures shows that the latter are essentially estimates. The total produce of any crop in a given year must depend mainly upon the acreage grown, whilst the average yield per acre will be determined chiefly by the character of the season. In Table VII. are shown, in thousands of bushels, the estimated produce of the corn crops of the United Kingdom in the years 1890–1905. The largest area of wheat in the period was that of 1890, and the smallest was that of 1904; the same two years are seen to have been respectively those of highest and lowest total produce. It is noteworthy that in 1895 the country produced about half as much wheat

TABLE VII.—*Estimated Annual Total Produce of Corn Crops in the United Kingdom*, 1890–1905—*Thousands of Bushels.*

Year.	Wheat.	Barley.	Oats.	Beans.	Peas.
1890	75,994	80,794	171,295	11,860	6313
1891	74,743	79,555	166,472	10,694	5777
1892	60,775	76,939	168,181	7,054	5028
1893	50,913	65,746	168,588	4,863	4756
1894	60,704	78,601	190,863	7,198	6229
1895	38,285	75,028	174,476	5,626	4732
1896	58,247	77,825	162,860	6,491	4979
1897	56,296	72,613	163,556	6,650	5250
1898	74,885	74,731	172,578	7,267	4858
1899	67,261	74,532	166,140	7,566	4431
1900	54,322	68,546	165,137	7,469	4072
1901	53,928	67,643	161,175	6,154	4017
1902	58,278	74,439	184,184	7,704	5106
1903	48,819	65,310	172,941	7,535	4812
1904	37,920	62,453	176,755	5,901	4446
1905	60,333	65,004	166,286	8,262	4446

as in any one of the years 1890, 1891 and 1898. The produce of barley, like that of oats, is less irregular than that of wheat, the extremes for barley being 80,794,000 bushels (1890) and 62,453,000 bushels (1904), and those for oats 190,863,000 bushels (1894) and 161,175,000 bushels (1901). Similar details for potatoes, roots and hay, brought together in Table VIII., show that the production of potatoes varies much from year to year. The imports of potatoes into the United Kingdom vary, to some extent inversely; thus, the low production in 1897 was accompanied by an increase of imports from 3,921,205 cwt. in 1897 to 6,751,728 cwt. in 1898. No very great reliance can be placed upon the figures relating to turnips (which include swedes), as these are mostly fed to sheep on the ground, so that the estimates as to yield are necessarily vague. Mangels are probably more closely estimated, as these valuable roots are carted and stored for subsequent use for feeding stock. Under hay are included the produce of clover, sainfoin and rotation grasses, and also that of permanent meadow. The extent to which the annual production of the leading fodder crop may vary is shown in the table by the two consecutive years 1893 and 1894; from only nine million tons in the former year the production rose to upwards of fifteen million tons in the latter, an increase of over 70 %.

TABLE VIII.—*Estimated Annual Total Produce of Potatoes, Roots and Hay in the United Kingdom*, 1890–1905—*Thousands of Tons.*

Year.	Potatoes.	Turnips.	Mangels.	Hay.
1890	4622	32,002	6709	14,466
1891	6090	29,742	7558	12,671
1892	5634	31,419	7428	11,567
1893	6541	31,110	5225	9,082
1894	4662	30,678	7310	15,699
1895	7065	29,221	6376	12,238
1896	6263	28,037	5875	11,416
1897	4107	29,785	7379	14,043
1898	6225	26,499	7228	15,916
1899	5837	20,370	7604	12,898
1900	4577	28,387	9650	13,742
1901	7043	25,298	9224	11,358
1902	5920	29,116	10,809	15,246
1903	5277	23,523	8212	14,955
1904	6230	28,033	8813	14,860
1905	7186	26,563	9493	13,554

Turning to the average yields per acre, as ascertained by dividing the number of acres into the total produce, the results of a decade are collected in Table IX. The effects of a prolonged spring and summer drought, like that of 1893, are exemplified in the circumstance that four corn crops and the two hay crops all registered very low average yields that year, viz. wheat 26·08 bushels, barley 29·30 bushels, oats 38·14 bushels, beans 19·61 bushels, rotation hay 23·55 cwt., permanent hay 20·41 cwt. On the other hand, the season of 1898 was exceptionally favourable to cereals and to hay. The effects of a prolonged autumn drought, as distinguished from spring and summer drought, are shown in the very low yield of turnips in 1899. Mangels are sown earlier and have a longer period of growth than turnips; if they become well established in the summer they are less susceptible to autumn drought. The hay made from clover, sainfoin and grasses under rotation generally gives a bigger average yield than that from permanent grass land. The mean values at the foot of the table—they are not, strictly speaking, exact averages—indicate the average yields per acre in the United Kingdom to be about 31 bushels of wheat, 33 bushels of barley, 40 bushels of oats, 28 bushels of beans, 26 bushels of peas, $4\frac{3}{4}$ tons of potatoes, $13\frac{1}{4}$ tons of turnips and swedes, $18\frac{1}{4}$ tons of mangels, 32 cwt. of hay from temporary grass, and 29 cwt. of hay from permanent grass. Although enormous single crops of mangels are sometimes grown, amounting occasionally to 100 tons per acre, the general average yield of $18\frac{1}{4}$ tons is about 5 tons more than that of turnips and swedes. Again, although from the richest old permanent meadow-lands very heavy crops of hay are taken season after season, the general average yield of permanent grass is about 3 cwt. of hay per acre less than that from clover, sainfoin and grasses under rotation. The general average yields of the corn crops are not fairly comparable one with the other, because they are given by measure and not by weight, whereas the weight per bushel varies considerably. For purposes of comparison it would be much better if the yields of corn crops were estimated in cwt. per acre. This, indeed, is the practice in Ireland, and in order to incorporate the Irish figures with those for Great Britain so as to obtain average values for the United Kingdom, the Irish yields are calculated into bushels at the rate of 60 lb to the bushel of wheat, of beans and of peas, 50 lb to the bushel of barley and 39 lb to the bushel of oats.

TABLE IX.—*Estimated Annual Average Yield per Acre of Crops in United Kingdom*, 1895–1904.

Year.	Wheat.	Barley.	Oats.	Beans.	Peas.	Potatoes.	Turnips and Swedes.	Mangels.	Hay.	
									Rotation.	Permanent.
	Bush.	Bush.	Bush.	Bush.	Bush.	Tons.	Tons.	Tons.	Cwt.	Cwt.
1895	26·33	32·09	38·67	22·98	22·62	5·64	13·11	16·44	29·08	25·21
1896	33·63	34·16	37·97	25·69	25·34	4·93	12·79	14·99	27·95	24·14
1897	29·07	32·91	38·84	28·91	27·55	3·47	13·90	18·03	32·53	30·71
1898	34·75	36·24	42·27	31·13	27·60	5·23	12·74	17·71	36·49	34·27
1899	32·76	34·64	40·57	30·19	27·22	4·82	9·97	17·41	31·04	29·11
1900	28·61	31·67	39·97	28·18	25·89	3·77	14·29	19·97	32·42	30·98
1901	30·93	31·70	39·35	24·29	25·97	5·81	12·95	19·37	28·98	23·85
1902	32·91	35·83	44·50	31·49	28·51	4·92	15·35	20·85	35·29	32·57
1903	30·15	32·38	40·81	31·27	26·56	4·45	12·44	17·19	33·07	31·27
1904	26·97	31·25	40·80	23·23	25·75	5·24	14·83	18·57	33·43	31·04
Mean, 10 years	30·85	33·28	40·35	27·68	26·24	4·84	13·21	18·18	32·06	29·32
1905	32·88	34·79	40·38	32·33	25·71	5·86	14·19	19·91	32·24	28·37

TABLE X.—*Decennial Average Yields in Great Britain of Wheat, Barley and Oats—Bushels per acre.*

10-Year Periods.	Wheat.	Barley.	Oats.
1885–1894	29·32	33·02	38·21
1886–1895	28·81	32·68	38·23
1887–1896	29·49	32·82	38·13
1888–1897	29·19	32·97	38·51
1889–1898	29·86	33·26	38·86
1890–1899	30·15	33·50	38·81
1891–1900	29·92	33·13	38·46
1892–1901	29·88	32·80	38·26
1893–1902	30·53	32·83	38·64
1894–1903	30·95	33·16	39·05
1895–1904	30·56	32·82	38·81
1896–1905	31·21	33·04	38·92

The figure denoting the general average yield per acre of any class of crop needs readjustment after every successive harvest. If a decennial period be taken, then—for the purpose of the new calculation—the earliest year is omitted and the latest year added, the number of years continuing at ten. Adopting this course in the case of the cereal crops of Great Britain the decennial averages recorded in Table X. are obtained, the period 1885–1894 being the earliest decade for which the official figures are available. It thus appears that the average yield of wheat in Great Britain, as calculated upon the crops harvested during the ten years (1896–1905), exceeded 31 bushels to the acre, whereas, for the ten years ended 1895, it fell below 29 bushels. A large expansion in the acreage of the wheat crop would probably be attended by a decline in the average yield per acre, for when a crop is shrinking in area the tendency is to withdraw from it first the land least suited to its growth. The general average for the United Kingdom might then recede to rather less than 28 bushels of 60 ℔ per bushel, which was for a long time the accepted average—unless, of course, improved methods of cultivating and manuring the soil were to increase its general wheat-yielding capacity.[1]

Crops and Cropping.

The greater freedom of cropping and the less close adherence to the formal system of rotation of crops, which characterize the early years of the 20th century, rest upon a scientific basis. Experimental inquiry has done much to enlighten the farmer as to the requirements of plant-life, and to enable him to see how best to meet these requirements in the case of field crops. He cannot afford to ignore the results that have been gradually accumulated—the truths that have been slowly established—at the agricultural experiment stations in various parts of the world. Of these stations the greatest, and the oldest now existing, is that at Rothamsted, Harpenden, Herts, England, which was founded in 1843 by Sir John Bennet Lawes (*q.v.*). The results of more than half a century of sustained experimental inquiry were communicated to the world by Lawes and his collaborator, Sir J. H. Gilbert, in about 130 separate papers or reports, many of which were published, from 1847 onwards, in the *Journal of the Royal Agricultural Society of England*.[2]

In the case of plants the method of procedure was to grow some of the most important crops of rotation, each separately year after year, for many years in succession on the same land, (*a*) without manure, (*b*) with farmyard manure and (*c*) with a great variety of chemical manures; the same description of manure being, as a rule, applied year after year on the same plot. Experiments on an actual course of rotation, without manure, and with different manures, have also been made. Wheat, barley, oats, beans, clover and other leguminous plants, turnips, sugar beet, mangels, potatoes and grass crops have thus been experimented upon. Incidentally there have been extensive sampling and analysing of soils, investigations into rainfall and the composition of drainage waters, inquiries into the amount of water transpired by plants, and experiments on the assimilation of free nitrogen.

Cereals.—Amongst the field experiments there is, perhaps, not one of more universal interest than that in which wheat was grown for fifty-seven years in succession, (*a*) without manure, (*b*) with farmyard manure and (*c*) with various artificial manures. The results show that, unlike leguminous crops such as beans or clover, wheat may be successfully grown for many years in succession on ordinary arable land, provided suitable manures be applied and the land be kept clean. Even without manure the average produce over forty-six years, 1852–1897, was nearly thirteen bushels per acre, or about the average yield per acre of the wheat lands of the whole world. Mineral manures alone give very little increase, nitrogenous manures alone considerably more than mineral manures alone, but the mixture of the two considerably more than either separately. In one case, indeed, the average produce by mixed minerals and nitrogenous manure was more than that by the annual application of farmyard manure; and in seven out of the ten cases in which such mixtures were used the average yield per acre was from over two to over eight bushels more than the average yield of the United Kingdom (assuming this to be about twenty-eight bushels of 60 ℔ per bushel) under ordinary rotation. It is estimated that the reduction in yield of the unmanured plot over the forty years, 1852–1891, after the growth of the crops without manure during the eight preceding years, was, provided it had been uniform throughout, equivalent to a decline of one-sixth of a bushel from year to year due to exhaustion—that is, irrespectively of fluctuations due to season. It is related that a visitor from the United States, talking to Sir John Lawes, said, "Americans have learnt more from this field than from any other agricultural experiment in the world."

Experiments upon the growth of barley for fifty years in succession on rather heavy ordinary arable soil resulted in showing that the produce by mineral manures alone is larger than that without manure; that nitrogenous manures alone give more produce than mineral manures alone; and that mixtures of mineral and nitrogenous manure give much more than either used alone—generally twice, or more than twice, as much as mineral manures alone. Of mineral constituents, whether used alone or in mixture with nitrogenous manures, phosphates are much more effective than mixtures of salts of potash, soda and magnesia. The average results show that, under all conditions of manuring—excepting with farmyard manure—the produce was less over the later than over the earlier periods of the experiments, an effect partly due to the seasons. But the average produce over forty years of continuous growth of barley was, in all cases where nitrogenous and mineral manures (containing phosphates) were used together, much higher than the average produce of the crop grown in ordinary rotation in the United Kingdom, and very much higher than the average in most other countries when so grown. The requirements of barley within the soil, and its susceptibility to the external influences of season, are very similar to those of its near ally, wheat. Nevertheless there are distinctions of result dependent on differences in the habits of the two plants, and in the conditions of their cultivation accordingly. In the British Isles wheat is, as a rule, sown in the autumn on a heavier soil, and has four or five months in which to distribute its roots, and so it gets possession of a wide range of soil and subsoil before barley is sown in the spring. Barley, on the other hand, is sown in a lighter surface soil, and, with its short period for root-development, relies in a much greater degree on the stores of plant-food within the surface soil. Accordingly it is more susceptible to exhaustion of surface soil as to its nitrogenous, and especially as to its mineral supplies; and in the common practice of agriculture it is found to be more benefited by direct mineral manures, especially phosphatic manures, than is wheat when sown under equal soil conditions. The exhaustion of the soil induced by both barley and wheat is, however, characteristically that of available nitrogen; and when, under the ordinary conditions of manuring and cropping, artificial manure is still required, nitrogenous manures are, as a rule, necessary for both crops, and, for the spring-sown barley, superphosphate also. Although barley is appropriately grown on lighter soils than wheat, good crops, of fair quality, may be grown on the heavier soils after another grain crop by the aid of artificial manures, provided that the land is sufficiently clean. Experiments similar to the foregoing were carried on for many years in succession at Rothamsted upon oats, and gave results which were in general accordance with those on the other cereal crops.

Additional significance to the value of the above experiments on wheat and barley is afforded by the fact that the same series, with but slight modifications, has also been carried out since 1876 at the Woburn (Bedfordshire) experimental farm of the

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[1] The higher yield of wheat in the later years of the 19th century appears to be largely attributable to better grain-growing seasons. The yields in the experimental wheat-field at Rothamsted—where there is no change either of land or of treatment—indicate this. The following figures show the average yields per acre of the selected plots at Rothamsted over six 8-yearly periods from 1852 to 1899, and afford evidence that the higher yield of later years is due to the seasons:—

Average of—			Bushels (of 60 ℔) per acre.
8	years	1852–1859	$28\frac{3}{8}$
8	,,	1860–1867	$28\frac{7}{8}$
8	,,	1868–1875	$27\frac{1}{8}$
8	,,	1876–1883	$25\frac{1}{4}$
8	,,	1884–1891	$29\frac{7}{8}$
8	,,	1892–1899	30
32	,,	1852–1883	$27\frac{3}{8}$
16	,,	1884–1899	30
48	,,	1852–1899	$28\frac{1}{4}$

The average of the first thirty-two years was thus $27\frac{3}{8}$ bushels per acre, of the last sixteen years 30 bushels, and of the whole forty-eight years $28\frac{1}{4}$ bushels.

[2] See J. B. Lawes and J. H. Gilbert, *Rothamsted Memoirs on Agricultural Chemistry and Physiology*, 7 vols. (1893–1899); A. D. Hall, *Book of the Rothamsted Experiments* (1905).

Royal Agricultural Society of England, the soil here being of light sandy character, and thus very different from the heavy soil of Rothamsted. The results for the thirty years, 1877–1906, are in their general features entirely confirmatory of those obtained at Rothamsted.

Root-Crops.—Experiments upon root-crops—chiefly white turnips, Swedish turnips (swedes) and mangels—have resulted in the establishment of the following conclusions. Both the quantity and the quality of the produce, and consequently its feeding value, must depend greatly upon the selection of the best description of roots to be grown, and on the character and the amount of the manures, and especially on the amount of nitrogenous manure employed. At the same time, no hard-and-fast rules can be laid down concerning these points. Independently of the necessary consideration of the general economy of the farm, the choice must be influenced partly by the character of the soil, but very much more by that of the climate. Judgment founded on knowledge and aided by careful observation, both in the field and in the feeding-shed, must be relied upon as the guide of the practical farmer. Over and above the great advantage arising from the opportunity which the growth of root-crops affords for the cleaning of the land, the benefits of growing the root-crop in rotation are due (1) to the large amount of manure applied for its growth, (2) to the large residue of the manure left in the soil for future crops, (3) to the large amount of matter at once returned as manure again in the leaves, (4) to the large amount of food produced, and (5) to the small proportion of the most important manurial constituents of the roots which is retained by store or fattening animals consuming them, the rest returning as manure again; though, when the roots are consumed for the production of milk, a much larger proportion of the constituents is lost to the manure.

Leguminous Crops and the Acquisition of Nitrogen.—The fact that the growth of a leguminous crop, such as red clover, leaves the soil in a higher condition for the subsequent growth of a grain crop—that, indeed, the growth of such a leguminous crop is to a great extent equivalent to the application of a nitrogenous manure for the cereal crop—was in effect known ages ago. Nevertheless it was not till near the approach of the closing decade of the 19th century that the explanation of this long-established point of agricultural practice was forthcoming. It was in the year 1886 that Hellriegel and Wilfarth first published in Germany the results of investigations in which they demonstrated that, through the agency of micro-organisms dwelling in nodular outgrowths on the roots of ordinary leguminous plants, the latter are enabled to assimilate the free nitrogen of the air. The existence of the root nodules had long been recognized, but hitherto no adequate explanation had been afforded as to their function.

Since Hellriegel's striking discovery farm crops have been conveniently classified as nitrogen-accumulating and nitrogen-consuming. To the former belong the ordinary leguminous crops—the clovers, beans, peas, vetches or tares, sainfoin, lucerne, for example—which obtain their nitrogen from the air, and are independent of the application of nitrogenous manures, whilst in their roots they accumulate a store of nitrogen which will ultimately become available for future crops of other kinds. It is, in fact, fully established that these leguminous crops acquire a considerable amount of nitrogen by the fixation of the free nitrogen of the atmosphere under the influence of the symbiotic growth of their root-nodule-microbes and the higher plant. The cereal crops (wheat, barley, oats, rye, maize); the cruciferous crops (turnips, cabbage, kale, rape, mustard); the solanaceous crops (potatoes); the chenopodiaceous crops (mangels, sugar-beets), and other non-leguminous crops have, so far as is known, no such power, and are therefore more or less benefited by the direct application of nitrogenous manures. The field experiments on leguminous plants at Rothamsted have shown that land which is, so to speak, exhausted so far as the growth of one leguminous crop is concerned, may still grow very luxuriant crops of another plant of the same natural order, but of different habits of growth, and especially of different character and range of roots. This result is doubtless largely dependent on the existence, the distribution and the condition of the appropriate microbes for the due infection of the different descriptions of plant, for the micro-organism that dwells symbiotically with one species is not identical with that which similarly dwells with another. It seems certain that success in any system involving a more extended growth of leguminous crops in rotations must be dependent on a considerable variation in the description grown. Other essential conditions of success will commonly include the liberal application of potash and phosphatic manures, and sometimes chalking or liming for the leguminous crop. As to how long the leguminous crop should occupy the land, the extent to which it should be consumed on the land, or the manure from its consumption be returned, and under what conditions the whole or part of it should be ploughed in—these are points which must be decided as they arise in practice. It seems obvious that the lighter and poorer soils would benefit more than the heavier or richer soils by the extended growth of leguminous crops.

Remarkable as Hellriegel's discovery was, it merely furnished the explanation of a fact which had been empirically established by the husbandman long before, and had received most intelligent application when the old four-course (or Norfolk) rotation was devised. But it gave some impetus to the practice of green manuring with leguminous crops, which are equally capable with such a crop as mustard of enriching the soil in humus, whilst in addition they bring into the soil from the atmosphere a quantity of nitrogen available for the use of subsequent crops of any kind. In Canada and the United States this rational employment of a leguminous crop for ploughing in green is largely resorted to for the amelioration of worn-out wheat lands and other soils, the condition of which has been lowered to an unremunerative level by the repeated growth year after year of a cereal crop. The well-known paper of Lawes, Gilbert and Pugh (1861), "On the Sources of the Nitrogen of Vegetation, with special reference to the Question whether Plants assimilate free or uncombined Nitrogen," answered the question referred to in the negative. The attitude taken up later on with regard to this problem is set forth in the following words, which are quoted from the Memoranda of the Rothamsted Experiments, 1900 (p. 7):—

> "Experiments were commenced in 1857, and conducted for several years in succession, to determine whether plants assimilate free or uncombined nitrogen, and also various collateral points. Plants of the gramineous, the leguminous and of other families were operated upon. The late Dr Pugh took a prominent part in this inquiry. The conclusion arrived at was that our agricultural plants do not themselves directly assimilate the free nitrogen of the air by their leaves.
>
> "In recent years, however, the question has assumed quite a new aspect. It now is—whether the free nitrogen of the atmosphere is brought into combination under the influence of micro-organisms, or other low forms, either within the soil or in symbiosis with a higher plant, thus serving indirectly as a source of nitrogen to plants of a higher order. Considering that the results of Hellriegel and Wilfarth on this point were, if confirmed, of great significance and importance, it was decided to make experiments at Rothamsted on somewhat similar lines. Accordingly, a preliminary series was undertaken in 1888; more extended series were conducted in 1889 and in 1890; and the investigation was continued up to the commencement of the year 1895. Further experiments relating to certain aspects of the subject were begun in 1898. The results have shown that, when a soil growing leguminous plants is infected with appropriate organisms, there is a development of the so-called leguminous nodules on the roots of the plants, and, coincidently, increased growth and gain of nitrogen."

The conclusions of Hellriegel and Wilfarth have thus been confirmed by the later experiences of Rothamsted, and since that time efforts have been directed energetically to the practical application of the discovery. This has taken the form of inoculating the soil with the particular organism required by the particular kind of leguminous crop. To this end the endeavour has been made to produce preparations which shall contain in portable form the organisms required by the several plants, and though, as yet, it can hardly be claimed that they have been generally successful, the work done justifies hopes that the problem will eventually be solved in a practical direction.

Grass.—Another field experiment of singular interest is that relating to the mixed herbage of permanent meadow, for which seven acres of old grass land were set apart in Rothamsted Park in 1856. Of the twenty plots into which this land is divided, two were left without manure from the outset, two received ordinary farmyard manure for a series of years, whilst the remainder each received a different description of artificial or chemical manure, the same being, except in special cases, applied year after year on the same plot. During the growing season the field affords striking evidence of the influence of different manurial dressings. So much, indeed, does the character of the herbage vary from plot to plot that the effect may fairly be described as kaleidoscopic. Repeated analyses have shown how greatly both the botanical constitution and the chemical composition of the mixed herbage vary according to the description of manure applied. They have further shown how dominant is the influence of season. Such, moreover, is the effect of different manures that the gross produce of the mixed herbage is totally different on the respective plots according to the manure employed, both as to the proportion of the various species composing it and as to their condition of development and maturity.

The Rotation of Crops.

The growth, year after year, on the same soil of one kind of plant unfits it for bearing further crops of the kind which has exhausted it, and renders them less vigorous and more liable to disease. The farmer therefore arranges his cropping in such a way that roots, or leguminous crops, succeed the cereal crops.

It is not only the conditions of growth, but the *uses* to which the different crops are put, that have to be considered in the case of rotation. Thus the cereal crops, when grown in rotation, yield more produce for sale in the season of growth than when grown continuously. Moreover, the crops alternated with the cereals accumulate very much more of mineral constituents and of nitrogen in their produce than do the cereals themselves. By far the greater proportion of those constituents remains in circulation in the manure of the farm, whilst the remainder yields highly valuable products for sale in the forms of meat and milk. For this reason these crops are known as "restorative," cereals the produce of which is sold off the farm being classed as "exhaustive." With a variety of crops, again, the mechanical operations of the farm, involving horse and hand labour, are better distributed over the year, and are therefore more economically performed. The opportunities which rotation cropping affords for the cleaning of the land from weeds is another distinct element of advantage. Although many different rotations of crops are practised, they may for the most part be considered as little more than local adaptations of the system of alternating root-crops and leguminous crops with cereal crops, as exemplified in the old four-course rotation—roots, barley, clover, wheat.

Under this system the clover is ploughed up in the autumn, the nitrogen stored up in its roots being left in the soil for the nourishment of the cereal crop. The following summer the wheat crop is harvested, and an opportunity is afforded for extirpating weeds which in the three previous years have received little check. Or, where the climate is warm and the soil light, a "catch-crop," *i.e.* rye, vetches, winter-oats or some other rapidly-growing crop may be sown in autumn and fed off or otherwise disposed of prior to the root-sowing. On heavy soils, however, the farmer cannot afford to curtail the time necessary for thorough cultivation of the land. The cleaning process is carried on through the next summer by means of successive hoeings of the spring-sown root-crop. As turnips or swedes may occupy the ground till after Christmas little time is left for the preparation of a seed-bed for barley, but as the latter is a shallow-rooted crop only surface-stirring is required. Clover is sown at the same time or shortly after the cereal and thus occupies the land for two years.

The rotations extending to five, six, seven or more years are, in most cases, only adaptations of the principle to variations of soil, altitude, aspect, climate, markets and other local conditions. They are effected chiefly by some alteration in the description of the root-crop, and perhaps by the introduction of the potato crop; by growing a different cereal, or it may be more than one cereal consecutively; by the growth of some other leguminous crop than clover, since "clover-sickness" may result if that crop is grown at too short intervals, or the intermixture of grass seeds with the clover, and perhaps by the extension by one or more years of the period allotted to this member of the rotation. Whatever the specific rotation, there may in practice be deviations from the plan of retaining on the farm the whole of the root-crops, the straw of the grain crops and the leguminous fodder crops (clover, vetches, sainfoin, &c.) for the production of meat or milk, and, coincidently, for that of manure to be returned to the land. It is equally true that, when under the influence of special local or other demand—proximity to towns, easy railway or other communication, for example—the products which would otherwise be retained on the farm are exported from it, the import of town or other manures is generally an essential condition of such practice. This system of free sale, indeed, frequently involves full compensation by purchased manures of some kind. Such deviations from the practice of merely selling grain and meat off the farm have much extended in recent years, and will probably continue to do so under the altered conditions of British agriculture, determined by very large imports of grain, increasing imports of meat and of other products of stock-feeding, and very large imports of cattle-food and other agricultural produce. More attention is thus being devoted to dairy produce, not only on grass farms, but on those that are mainly arable.

The benefits that accrue from the practice of rotation are well illustrated in the results obtained from the investigations at Rothamsted into the simple four-course system, which may fairly be regarded as a self-supporting system. Reference may first be made to the important mineral constituents of different crops of the four-course rotation. Of *phosphoric acid*, the cereal crops take up as much as, or more than, any other crops of the rotation, excepting clover; and the greater portion thus taken up is lost to the farm in the saleable product—the grain. The remainder, that in the straw, as well as that in the roots and the leguminous crops, is supposed to be retained on the farm, excepting the small amount exported in meat and milk. Of *potash*, each of the rotation crops takes up very much more than of phosphoric acid. But much less potash than phosphoric acid is exported in the cereal grains, much more being retained in the straw, whilst the other products of the rotation—the root and leguminous crops—which are also supposed to be retained on the farm, contain very much more potash than the cereals, and comparatively little of it is exported in meat and milk. Thus the whole of the crops of rotation take up very much more of potash than of phosphoric acid, whilst probably even less of it is ultimately lost to the land. Of *lime*, very little is taken up by the cereal crops, and by the root-crops much less than of potash; more by the leguminous than by the other crops, and, by the clover especially, sometimes much more than by all the other crops of the rotation put together. Very little of the lime of the crops, however, goes off in the saleable products of the farm in the case of the self-supporting rotation under consideration. Although, therefore, different, and sometimes very large, amounts of these typical mineral constituents are taken up by the various crops of rotation, there is no material export of any in the saleable products, *excepting of phosphoric acid and of potash*; and, so far at least as phosphoric acid is concerned, experience has shown that it may be advantageously supplied in purchased manures.

Of *nitrogen*, the cereal crops take up and retain much less than any of the crops alternated with them, notwithstanding the circumstance that the cereals are very characteristically benefited by nitrogenous manures. The root-crops, indeed, may contain two or more times as much nitrogen as either of the cereals, and the leguminous crops, especially the clover, much more than the root-crops. The greater part of the nitrogen of the cereals is, however, sold off the farm; but perhaps not more than 10 or 15% of that of either the root-crop or the clover (or other forage leguminous crop) is sold off in animal increase or in milk. Most of the nitrogen in the straw of the cereals, and a very large proportion of that of the much more highly nitrogen-yielding crops, returns to the land as manure, for the benefit of future cereals and other crops. As to the source of the nitrogen of the root-crops—the so-called "restorative crops"—these are as dependent as any crop that is grown on available nitrogen within the soil, which is generally supplied by the direct application of nitrogenous manures, natural or artificial. Under such conditions of supply, however, the root-crops, gross feeders as they are, and distributing a very large extent of fibrous feeding root within the soil, avail themselves of a much larger quantity of the nitrogen supplied than the cereal crops would do in similar circumstances. This result is partly due to their period of accumulation and growth extending even months after the period of collection by the ripening cereals has terminated, and at the season when nitrification within the soil is most active, and the accumulation of nitrates in it is the greatest. When a full supply of both mineral constituents and nitrogen is at command, these root-crops assimilate a very large amount of carbon from the atmosphere, and produce, besides nitrogenous food materials, a very large amount of the carbohydrate sugar, as respiratory and fat-forming food for the live stock of the farm. The still more highly nitrogenous leguminous crops, although not characteristically benefited by nitrogenous manures, nevertheless contribute much more nitrogen to the total produce of the rotation than any of the other crops comprised in it. It is the leguminous fodder crops—especially clover, which has a much more extended period of growth, and much wider range of collection within the soil and subsoil, than any of the other crops of the rotation—that yield in their produce the largest amount of nitrogen per acre. Much of this is doubtless taken up as nitrate, yet the direct application of nitrate of soda has comparatively little beneficial influence on their growth. The nitric acid is most likely taken up chiefly as nitrate of lime, but probably as nitrate of potash also, and it is significant that the high nitrogen-yielding clover takes up, or at least retains, very little soda. Table XI., from Warington's *Chemistry of the Farm*, 19th edition (Vinton and Co.), will serve to illustrate the subjects that have been discussed in this section.

TABLE XI.—*The Weight and Average Composition of Ordinary Crops, in lb. per Acre.*

Crop.	Weight of Crop.		Total Pure Ash.	Nitrogen.	Sulphur.	Potash.	Soda.	Lime.	Magnesia.	Phosphoric Acid.	Chlorine.	Silica.
	At Harvest.	Dry.										
Wheat, grain, 30 bushels	1,800	1530	30	34	2·7	9·3	0·6	1·0	3·6	14·2	0·1	0·6
,, straw	3,158	2653	142	16	5·1	19·5	2·0	8·2	3·5	6·9	2·4	96·3
Total crop	4,958	4183	172	50	7·8	28·8	2·6	9·2	7·1	21·1	2·5	96·9
Barley, grain, 40 bushels	2,080	1747	46	35	2·9	9·8	1·1	1·2	4·0	16·0	0·5	11·8
,, straw	2,447	2080	111	14	3·2	25·9	3·9	8·0	2·9	4·7	3·6	56·8
Total crop	4,527	3827	157	49	6·1	35·7	5·0	9·2	6·9	20·7	4·1	68·6
Oats, grain, 45 bushels	1,890	1625	51	34	3·2	9·1	0·8	1·8	3·6	13·0	0·5	19·9
,, straw	2,835	2353	140	18	4·8	37·0	4·6	9·8	5·1	6·4	6·1	65·4
Total crop	4,725	3978	191	52	8·0	46·1	5·4	11·6	8·7	19·4	6·6	85·3
Maize, grain, 30 bushels	1,680	1500	22	28	1·8	6·5	0·2	0·5	3·4	10·0	0·2	0·5
,, stalks, &c.	2,208	1877	99	15	..	29·8	..	..	..	8·0	..	..
Total crop	3,888	3377	121	43	..	36·3	..	..	..	18·0	..	..
Meadow hay, 1½ ton	3,360	2822	203	49	5·7	50·9	9·2	32·1	14·4	12·3	14·6	56·9
Red Clover hay, 2 tons	4,480	3763	258	98	9·4	83·4	5·1	90·1	28·2	24·9	9·8	7·0
Beans, grain, 30 bushels	1,920	1613	58	78	4·4	24·3	0·6	2·9	4·2	22·8	1·1	0·4
,, straw	2,240	1848	99	29	4·9	42·8	1·7	26·3	5·7	6·3	4·3	6·9
Total crop	4,160	3461	157	107	9·3	67·1	2·3	29·2	9·9	29·1	5·4	7·3
Turnips, root, 17 tons	38,080	3126	218	61	15·2	108·6	17·0	25·5	5·7	22·4	10·9	2·6
,, leaf	11,424	1531	146	49	5·7	40·2	7·5	48·5	3·8	10·7	11·2	5·1
Total crop	49,504	4657	364	110	20·9	148·8	24·5	74·0	9·5	33·1	22·1	7·7
Swedes, root, 14 tons	31,360	3349	163	70	14·6	63·3	22·8	19·7	6·8	16·9	6·8	3·1
,, leaf	4,704	706	75	28	3·2	16·4	9·2	22·7	2·4	4·8	8·3	3·6
Total crop	36,064	4055	238	98	17·8*	79·7	32·0	42·4	9·2	21·7	15·1	6·7
Mangels, root, 22 tons	49,280	5914	426	98	4·9	222·8	69·4	15·9	18·3	36·4	42·5	8·7
,, leaf	18,233	1654	254	51	9·1	77·9	49·3	27·0	24·2	16·5	40·6	9·2
Total crop	67,513	7568	680	149	14·0	300·7	118·7	42·9	42·5	52·9	83·1	17·9
Potatoes, tubers, 6 tons	13,440	3360	127	46	2·7	76·5	3·8	3·4	6·3	21·5	4·4	2·6

*Calculated from a single analysis only.

For further information on the routine and details of farming, reference may be made to the articles under the headings of the various crops and implements.

British Live Stock.

The numbers of live stock in the United Kingdom are shown at five-yearly intervals in Table XII. Under horses are embraced only unbroken horses and horses used solely for agriculture (including mares kept for breeding). The highest and lowest annual totals for the United Kingdom in the period 1875-1905 were the following:

	Highest.	Lowest.	Difference.
Horses . .	2,116,800 in 1905	1,819,687 in 1875	295,113
Cattle . .	11,674,019 ,, 1905	9,731,537 ,, 1877	1,942,482
Sheep . .	33,642,808 ,, 1892	27.448,220 ,, 1882	6,194,588
Pigs. . .	4,362,040 ,, 1890	2.863,488 ,, 1880	1,498,552

After 1892 cattle, which in that year numbered 11,519,417, and sheep declined continuously for three years to the totals of 1895, the diminution being mainly the result of the memorable drought of 1893. Sheep, which numbered 32,571,018 in 1878, declined continuously to 27,448,220 in 1882—a loss of over five million head in five years. This was chiefly attributable to the ravages of the liver fluke which began in the disastrously wet season of 1879. Pigs, being prolific breeders, fluctuate more widely in numbers than cattle or sheep, for the difference of 1,498,552 in their case represents one-third of the highest total, whereas the difference is less than one-seventh for horses, less than one-sixth for cattle, and less than one-fifth for sheep. The relative proportions— as distinguished from the actual numbers —in which stock are distributed over the several sections of the United Kingdom do not vary greatly from year to year. Table XIII., in which the totals for the United Kingdom include those for the Channel Islands and Isle of Man, illustrates the preponderance of the sheep-breeding industry in the drier climate of Great Britain, and of the cattle-breeding industry in the more humid atmosphere of Ireland. In Great Britain in 1905, for every head of cattle there were about four head of sheep, whereas in Ireland the cattle outnumbered the sheep. Again, whilst Great Britain possessed only half as many cattle more than Ireland, she possessed six times as many sheep. The cattle population of England alone slightly exceeded that of Ireland, but cattle are more at home on the broad plains of England than amongst the hills and mountains of Wales and Scotland, which are suitable for sheep. Hence, whilst in England sheep were not three times as numerous as cattle, in Wales they were nearly five times, and in Scotland nearly six times as many. Great Britain had twice as many pigs as Ireland, but the swine industry is mainly English and Irish, and England possessed more than six times as many pigs as Wales and Scotland together, the number in the last-named country being particularly small. One English county alone, Suffolk, maintained more pigs than the whole of Scotland.

Table XII.—*Numbers of Horses, Cattle, Sheep and Pigs in the United Kingdom.*

Year.	Horses.	Cattle.	Sheep.	Pigs.
1875	1,819,687	10.162,787	33,491,948	3,495,167
1880	1,929,680	9,871,153	30,239,620	2,863,488
1885	1,909,200	10,868,760	30,086,200	3,686,628
1890	1,964,911	10,789,858	31,667,195	4,362,040
1895	2,112,207	10.753,314	29,774,853	4,238,870
1900	2,000,402	11,454,902	31,054,547	3,663,669
1905	2,116,800	11,674,019	29,076,777	3,601,659

Table XIII.—*Numbers of Horses, Cattle, Sheep and Pigs in the United Kingdom in* 1905.

1905.	Horses.	Cattle.	Sheep.	Pigs.
England . .	1,204,124	5,020,936	14,698,018	2,083,226
Wales . .	161,923	738,789	3.534,967	211,479
Scotland . .	206,386	1,227,295	7,024,211	130,214
Great Britain .	1,572,433	6,987,020	25,257,196	2,424,919
Ireland . .	534,875	4,645,215	3,749,352	1,164,316
United Kingdom[1] .	2,116,800	11,674,019	29,076,777	3,601,659

British Imports of Live Animals and Meat.

The stock-breeders and graziers of the United Kingdom have, equally with the corn-growers, to face the brunt of foreign competition. Up to 1896 store cattle were admitted into the United Kingdom for the purpose of being fattened, but under the Diseases of Animals Act of that year animals imported since then have to be slaughtered at the place of landing. The dimensions of this trade are shown in Table XIV.

Table XIV.—*Numbers of Cattle, Sheep and Pigs imported into the United Kingdom,* 1891–1905.

Year.	Cattle.	Sheep.	Pigs.
1891	507,407	344,504	542
1892	502,237	79,048	3826
1893	340,045	62,682	138
1894	475,440	484,597	8
1895	415,565	1,065,470	321
1896	562,553	769,592	4
1897	618,321	611,504	..
1898	569,066	663,747	450
1899	503,504	607,755	..
1900	495,645	382,833	..
1901	495,635	383,594	..
1902	419,488	293,203	..
1903	522,546	354,241	..
1904	549,532	382,240	..
1905	565,139	183,084	150

The animals come mainly from the United States of America, Canada and Argentina, and the traffic in cattle is more uniform than that in sheep, whilst that in pigs seems practically to have reached extinction. The quantities of dead meat imported increased with great rapidity from 1891 to 1905, a circumstance largely due to the rise of the trade in chilled and frozen meat. Fresh beef in this form is imported chiefly from the United States and Australasia, fresh mutton from Australasia and Argentina.

Table XV. shows how rapidly this trade expanded during the decade of the 'nineties. The column headed bacon and hams indicates clearly enough that the imports of fresh meat did not displace those of preserved pig meat, for the latter expanded from 4,715,000 cwt. to 7,784,000 cwt. during the decade. The column for all dead meat includes not only the items tabulated, but also the following, the quantities stated being those for 1905:—Beef, salted, 142,806 cwt.; beef, otherwise preserved, 598,030 cwt.; preserved mutton, 30,111 cwt.; salted pork, 205,965 cwt.; dead rabbits, 656,078 cwt.; meat, unenumerated, 875,032 cwt. The quantities of these are relatively small, and, excepting rabbits from Australia, they show no general tendency to increase. The extent to which these growing imports were associated with a decline in value is shown in Table XVI.

Table XV.—*Quantities of Dead Meat imported into the United Kingdom,* 1891–1905—*Thousands of Cwt.*

Year.	Fresh. Beef.	Fresh Mutton.	Fresh Pork.	Bacon and Hams.	All Dead Meat.
1891	1921	1663	128	4715	9,790
1892	2080	1700	132	5135	10,500
1893	1808	1971	182	4187	9,305
1894	2104	2295	180	4819	10,610
1895	2191	2611	288	5353	11,977
1896	2660	2895	299	6009	13,347
1897	3010	3193	348	6731	14,729
1898	3101	3314	558	7684	16,445
1899	3803	3446	669	7784	17,658
1900	4128	3393	695	7444	17,912
1901	4509	3608	792	7633	18,764
1902	3707	3660	655	6572	16,971
1903	4160	4017	706	6298	17,498
1904	4350	3495	610	6696	17,517
1905	5038	3811	506	6817	18,680

The trend of the import trade in meat, live and dead (exclusive of rabbits), may be gathered from Table XVII., in which are given the annual average imports from the eight quinquennial periods embraced between 1866 and 1905. An increase in live cattle accompanied a decrease in live sheep and pigs, but the imports of dead meat expanded fifteen-fold over the period.

The rate at which the trade in imported frozen mutton increased as compared with the industry in home-grown mutton is illustrated in the figures published annually by Messrs W.

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[1] Including Channel Islands and Isle of Man.

Weddel and Company, from which those for 1885 and 1890 and for each year from 1895 to 1906 are given in Table XVIII. The home-grown is the *estimated* dead weight of sheep and lambs slaughtered, which is taken at 40 % of the total number of sheep and lambs returned each year in the United Kingdom. In the imported column is given the weight of fresh (frozen) mutton and lamb imported, plus the *estimated* dead weight of the sheep imported on the hoof for slaughter. The quantity imported in 1899 was double that in 1890, and quadruple that in 1885. Moreover, in 1885 the imported product was only about one-seventh as much as the home-grown, whereas in 1890 it was more than one-fourth, and in 1906 close on two-thirds. This large import trade in fresh meat, which sprang up entirely within the last quarter of the 19th century, has placed an abundance of cheap and wholesome food well within the reach of the great industrial populations of the United Kingdom. At the same time it cannot be gainsaid that it has opened the way to fraud. Butchers have palmed off upon their customers imported fresh meat as home-grown, and secured a dishonest profit by charging for it the prices of the latter, which are considerably in excess of those of the imported product.

TABLE XVI.—*Average Values of Fresh Meat, Bacon and Hams imported into the United Kingdom,* 1891–1905—*per Cwt.*

Year.	Fresh Beef.		Fresh Mutton.		Fresh Pork.		Bacon.		Hams.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
1891	42	1	39	6	47	6	37	11	46	4
1892	42	5	40	6	46	11	40	10	47	4
1893	42	4	39	3	50	0	53	0	58	5
1894	40	0	37	10	48	5	43	10	49	1
1895	39	0	35	2	46	1	39	0	44	11
1896	37	10	32	7	45	11	34	6	43	0
1897	38	5	30	3	44	0	35	5	42	8
1898	38	2	29	7	41	10	36	2	39	6
1899	38	8	31	7	41	11	35	10	41	5
1900	39	7	34	5	43	0	41	9	46	10
1901	39	6	36	7	43	4	47	1	48	8
1902	42	8	37	9	44	2	52	9	52	1
1903	40	3	39	0	44	1	52	10	55	1
1904	37	1	39	3	45	2	47	1	49	11
1905	35	6	38	6	46	0	46	6	47	4

TABLE XVII.—*Average Annual Imports of Cattle, Sheep and Figs, and of Dead Meat, into the United Kingdom over eight* 5-*yearly Periods.*

Period.	Cattle.	Sheep.	Pigs.	Dead Meat.
	No.	No.	No.	Cwt.
1866–1870	194,947	610,300	64,827	1,155,867
1871–1875	215,990	864,516	74,040	3,134,175
1876–1880	272,745	938,704	44,613	5,841,913
1881–1885	387,282	974,316	24,355	6,012,495
1886–1890	438,098	800,599	19,437	7,681,729
1891–1895	448,139	407,260	967	10,436,549
1896–1900	549,818	607,086	91	15,785,354
1901–1905	510,468	319,272	30	17,384,366

TABLE XVIII.—*Home Product and Imports of Sheep and Mutton into the United Kingdom—Thousands of Tons.*

Year.	Home-grown.	Imported.	Year.	Home-grown.	Imported.
1885	322	47	1900	332	179
1890	339	92	1901	330	191
1895	319	157	1902	322	191
1896	329	164	1903	318	210[1]
1897	327	175	1904	311	185
1898	333	182	1905	312	195
1899	339	187	1906	313	207

Sale of Cattle by Live Weight.

In connexion with the internal live stock trade of Great Britain attention must be directed to the Markets and Fairs (Weighing of Cattle) Act 1891. The object of this measure is to replace the old-fashioned system of guessing at the weight of an animal by the sounder method of obtaining the exact weight by means of the weighbridge. The grazier buys and sells cattle much less frequently than the butcher buys them, so that the latter is naturally more skilled in estimating the weight of a beast through the use of the eye and the hand. The resort to the weighbridge should put both on an equality, and its use tends to increase. Under the act, as supplemented by an order of the Board of Agriculture in 1905, there were in that year 26 scheduled places in England and 10 in Scotland, or 36 altogether, from which returns were obtained. The numbers of cattle (both fat and store) weighed at scheduled places in 1893 and 1905[2] were respectively 7·59 and 18 % of those entering those markets. The numbers for Scotland are greater throughout than those for England, 72 % of the *fat* cattle entering the scheduled markets in Scotland in 1905[2] having been weighed, while in England the proportion was only 20 %. Little use is made of the weighbridge in selling store-cattle, sheep or swine. As the main object of the act is to obtain records of prices, it follows that only in so far as statements of the prices realized, together with the description of the animals involved, are obtained, is the full advantage of the statute secured. In 1905 the average price per cwt. for fat cattle in Great Britain was 32s. 11d. as compared with 35s. 2d. in 1900.

Food-values and Early Maturity.

In the feeding experiments which have been carried on at Rothamsted it has been shown that the amount consumed both for a given live weight of animal within a given time, and for the production of a given amount of increase, is, as current food-stuffs go, measurable more by the amounts they contain of digestible and available non-nitrogenous constituents than by the amounts of the digestible and available nitrogenous constituents they supply. The non-nitrogenous substance (the fat) in the increase in live weight of an animal is, at any rate in great part, if not entirely, derived from the non-nitrogenous constituents of the food. Of the nitrogenous compounds in food, on the other hand, only a small proportion of the whole consumed is finally stored up in the increase of the animal—in other words, a very large amount of nitrogen passes through the body beyond that which is finally retained in the increase, and so remains for manure. Hence it is that the amount of food consumed to produce a given amount of increase in live weight, as well as that required for the sustentation of a given live weight for a given time, should—provided the food be not abnormally deficient in nitrogenous substance—be characteristically dependent on its supplies of digestible and available non-nitrogenous constituents. It has further been shown that, in the exercise of force by animals, there is a greatly increased expenditure of the non-nitrogenous constituents of food, but little, if any, of the nitrogenous. Thus, then, alike for maintenance, for increase, and for the exercise of force, the exigencies of the system are characterized more by the demand for the digestible non-nitrogenous or more specially respiratory and fat-forming constituents than by that for the nitrogenous or more specially flesh-forming ones. Hence, as current fattening food-stuffs go—assuming, of course, that they are not abnormally low in the nitrogenous constituents—they are, *as foods*, more valuable in proportion to their richness in digestible and available non-nitrogenous than to that of their nitrogenous constituents. As, however, the manure of the animals of the farm is valuable largely in proportion to the nitrogen it contains, there is, so far, an advantage in giving a food somewhat rich in nitrogen, provided it is in other respects a good one, and, weight for weight, not much more costly.

The quantity of digestible nutritive matter in 1000 ℔ of ordinary feeding-stuffs when supplied to sheep or oxen is shown in Table XIX. This table is taken from Warington's *Chemistry of the Farm*, 19th edition (Vinton and Co.), to which reference may be made for a detailed discussion of the feeding of animals.

In the fattening of animals for the butcher the principle of early maturity has received full recognition. If the sole purpose for which an animal is reared is to prepare it for the block—and this is the case with steers amongst cattle and with wethers amongst sheep—the sooner it is ready for slaughter the less should be the outlay involved. During the whole time the animal is living the feeder has to pay what has been termed the "life tax"—that is, so much of the food has to go to the maintenance of the animal as a living organism, independently of that which may be undergoing conversion into what will subsequently be available in the form of beef or mutton. If a bullock can be rendered fit for the butcher at the age of two or three years, will the animal repay another year's feeding? It has been proved at the Christmas fat stock shows that the older a bullock gets the less will he gain in weight per day as a result of the feeding. With regard to this point the work of the Smithfield Club deserves recognition. This body was instituted in 1798 as the Smithfield Cattle and Sheep Society, the title being changed to that of the Smithfield Club in 1802. The original object—the supply of the cattle markets of Smithfield and other places with the cheapest and best meat—is still kept strictly in view. The judges, in making their awards at the show held annually in December, at Islington, North London (since 1862), are instructed to decide according to quality of flesh, lightness of offal, age and early maturity, with no restrictions as to feeding, and thus to promote the primary aim of the club in encouraging the selection and breeding of the best and most useful animals for the production of meat, and testing their capabilities in respect of early maturity. At the first show, held at Smithfield in 1799, two classes were provided for cattle and two for sheep, the prizes offered amounting to £52 : 10s. In 1839 the classes comprised seven for cattle, six for sheep, and one for pigs, with prizes to the amount of £300. By 1862 the classes had risen to 29 for cattle, 17 for sheep and 4 for pigs, and the prize money to £2072. At the centenary show in 1898 provision was made for 40 classes for cattle, 29 for sheep, 18 for pigs, and 7 for animals to be slaughtered, whilst to mark the importance of the occasion the prizes offered amounted to close upon £5000 in value. In 1907 there were 38 classes for cattle, 29 for sheep, 20 for pigs, and 12 for carcase competitors, and the value of the prizes was £4113. The sections provided for cattle are properly restricted to what may be termed the beef breeds; in the catalogue order they are Devon, South Devon, Hereford, Shorthorn, Sussex, Red Polled, Aberdeen-Angus, Galloway, Welsh, Highland, Cross-bred, Kerry and Dexter, and Small Cross-bred.

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[1] In 1903 two of the principal sources of supply of mutton shipped in excess of their exportable surplus, for which they suffered severely in 1904—hence the somewhat irregular movements after 1903.

[2] Returns for only ten months were available for this year.

Table XIX.—*Digestible Matter in* 1000 *lb. of various Foods.*

	Total Organic Matter.	Nitrogenous Substances.		Fat.	Soluble Carbo-hydrates.	Fibre.
		Albu-minoids.	Amides, etc.			
Cotton cake (decorticated)	691	374	18	128	158	13
,, (undecorticated)	422	150	13	50	177	32
Linseed cake	655	230	11	103	266	45
Peas	747	175	25	12	499	36
Beans	733	196	28	12	446	51
Wheat [1]	786	92	13	15	656	10
Oats	600	81	7	45	441	26
Barley	715	70	4	19	607	15
Maize	786	73	6	44	651	12
Rice meal	612	67	10	102	411	22
Wheat bran	585	90	20	27	426	22
Malt sprouts	681	114	71	11	379	106
Brewers' grains	137	34	2	14	67	20
,, (dried)	529	136	8	57	266	62
Pasture grass	156	19	11	6	84	36
Clover (bloom beginning)	123	17	8	5	63	30
Clover hay (medium)	440	47	25	13	242	113
Meadow hay (best)	511	60	18	13	269	151
,, (medium)	485	40	12	12	269	152
,, (poor)	460	29	5	10	242	174
Maize silage	124	1	7	7	75	34
Bean straw	412	40		6	211	155
Oat straw	381	7	5	7	163	199
Barley straw	426	4	3	6	211	202
Wheat straw	351	4		4	150	193
Potatoes	213	5	9	1	195	3
Mangels (large)	89	1	8	½	74	6
,, (small)	109	2	6	½	96	5
Swedes	87	2	7	1	71	6
Turnips	68	1	5	1	56	5

It will be noticed that such characteristically milking breeds as the Ayrshire, Jersey and Guernsey have no place here. Provision is made, however, for all the well-known breeds of sheep and swine. In the cattle classes, aged beasts of huge size and of considerably over a ton in weight used to be common, but in recent years the tendency has been to reduce the upper limit of age, and thus to bring out animals ripe for the butcher in a shorter time than was formerly the case. An important step in this direction was taken in 1896, when the senior class for steers, viz. animals three to four years old, was abolished, the *maximum* age at which steers were allowed to compete for prizes being reduced to three years. The cow classes were abolished in 1897, and in the schedule of the 1905 exhibition the classes for each breed of cattle were (1) for steers not exceeding two years old, (2) for steers above two years and not exceeding three years old, and (3) for heifers not exceeding three years old. The single exception is provided by the slowly-maturing Highland breed of cattle, for which classes were allotted to (1) steers not exceeding three years old, (2) steers or oxen above three years old (with no *maximum* limit), and (3) heifers not exceeding four years old. As illustrating heavy weights, there were in the 1893 show, out of 310 entries of cattle, four beasts which weighed over a ton. They were all steers of three to four years old, one being a Hereford weighing 20 cwt. 2 qr. 4 ℔, and the others Shorthorns weighing respectively 20 cwt. 2 qr., 20 cwt. 3 qr. 21 ℔, and 22 cwt. 2 qr. 18 ℔. In the 1895 show, out of 356 entries of cattle, there were seven beasts of more than a ton in weight. They were all three to four years old, and comprised four Shorthorns (top weight 21 cwt. 1 qr. 18 ℔), one Sussex (22 cwt. 3 qr. 7 ℔), and two cross-breds (top weight 20 cwt. 3 qr. 24 ℔). In the 1899 show, with 311 entries of cattle, and the age limited to three years, no beast reached the weight of a ton, the heaviest animal being a cross-bred (Aberdeen-Angus and Shorthorn) which, at three years old, turned the scale at 19 cwt. 1 qr. 5 ℔. Out of 301 entries in 1905 the top weight was 19 cwt. 1 qr. 25 ℔ in the case of a Shorthorn steer. Useful figures for purposes of comparison are obtained by dividing the weight of a fat beast by the number of days in its age, the weight at birth being thrown in. The average daily gain in live weight is thus arrived at, and as the animal increases in age this average gradually diminishes, until the daily gain reaches a stage at which it does not afford any profitable return upon the food consumed. At the centenary show of the Smithfield Club in 1898 the highest average daily gains in weight amongst prize-winning cattle were provided by a Shorthorn-Aberdeen cross-bred steer (age, one year seven months; daily gain 2·47 ℔); a Shorthorn steer (age, one year seven months; daily gain, 2·44 ℔); and an Aberdeen-Shorthorn cross-bred steer (age, one year ten months; daily gain, 2·33 ℔). These beasts, it will be observed, were all under two years old. Amongst prize steers of two and a half to three years old, on the same occasion, the three highest daily average gains in live weight were 2·07 ℔ for an Aberdeen-Angus, 1·99 ℔ for a Shorthorn-Aberdeen cross-bred and 1·97 ℔ for a Sussex. In the sheep section of the Smithfield show the classes for ewes were finally abolished in 1898, and the classes restricted to wethers and wether lambs, whose function is exclusively the production of meat. At the 1905 show, sheep of each breed, and also cross-breds, competed as (1) wether lambs under twelve months old, and (2) wether sheep above twelve and under twenty-four months old. The only exception was in the case of the slowly-maturing Cheviot and mountain breeds, for which the second class was for wether sheep of any age above twelve months. Of prize sheep at the centenary show the largest average daily gain was 0·77 ℔ per head given by Oxford-Hampshire cross-bred wether lambs, aged nine months two weeks. In the case of wether sheep, twelve to twenty-four months old, the highest daily increase was 0·56 ℔ per head as yielded by Lincolns, aged twenty-one months. Within the last quarter of the 19th century the stock-feeding practices of the country were much modified in accordance with these ideas of early maturity. The three-year-old wethers and older oxen that used to be common in the fat stock markets are now rarely seen, excepting perhaps in the case of mountain breeds of sheep and Highland cattle. It was in 1875 that the Smithfield Club first provided the competitive classes for lambs, and in 1883 the champion plate offered for the best pen of sheep of any age in the show was for the first time won by lambs, a pen of Hampshire Downs. The young classes for bullocks were established in 1880. The time-honoured notion that an animal must have completed its growth before it could be profitably fattened is no longer held, and the improved breeds which now exist rival one another as regards the early period at which they may be made ready for the butcher by appropriate feeding and management.

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[1] In the absence of experiments it is assumed that wheat is digested like other foods of the same class.

In 1895 the Smithfield Club instituted a carcase competition in association with its annual show of fat stock, and it has been continued each year since. The cattle and sheep entered for this competition are shown alive on the first day, at the close of which they are slaughtered and the carcases hung up for exhibition, with details of live and dead weights. The competition thus constitutes what is termed a "block test," and it is instructive in affording the opportunity of seeing the quality of the carcases furnished by the several animals, and in particular the relative proportion and distribution of fat and lean meat. The live animals are judged and subsequently the carcases, and, though the results sometimes agree, more often they do not. Tables are constructed showing the fasted live weight, the carcase weight, and the weight of the various parts that are separated from and not included with the carcase. An abundance of lean meat and a moderate amount of fat well distributed constitutes a better carcase, and a more economical one for the consumer, than a carcase in which gross accumulations of fat are prominent. To add to the educational value of the display, information as to the methods of feeding would be desirable, as it would then be possible to correlate the quality of the meat with the mode of its manufacture. A point of high practical interest is the ratio of carcase weight to fasted live weight, and in the case of prize-winning carcases these ratios usually fluctuate within very narrow limits. At the 1899 show, for example, the highest proportion of the carcase weight to live weight was 68 % in the case of an Aberdeen-Angus steer and of a Cheviot wether, whilst the lowest was 61 %, afforded alike by a Shorthorn-Sussex cross-bred heifer and a mountain lamb. A familiar practical method of estimating carcase weight from live weight is to reckon one Smithfield stone (8 ℔) of carcase for each imperial stone (14 ℔) of live weight. This gives carcase weight as equal to 57 % of live weight, a ratio much inferior to the best results obtained at the carcase competition promoted by the Smithfield Club.

Breed Societies.

A noteworthy feature of the closing decades of the 19th century was the formation of voluntary associations of stockbreeders, with the object of promoting the interests of the respective breeds of live stock. As a typical example of these organizations the Shire Horse Society may be mentioned. It was incorporated in 1878 to improve and promote the breeding of the Shire or old English race of cart-horses, and to effect the distribution of sound and healthy sires throughout the country. The society holds annual shows, publishes annually the *Shire Horse Stud Book* and offers gold and silver medals for competition amongst Shire horses at agricultural shows in different parts of the country. The society has carried on a work of high national importance, and has effected a marked improvement in the character and quality of the Shire horse. What has thus voluntarily been done in England would in most other countries be left to the state, or would not be attempted at all. It is hardly necessary to say that the Shire Horse Society has never received a penny of public money, nor has any other of the voluntary breeders' societies. The Hackney Horse Society and the Hunters' Improvement Society are conducted on much the same lines as the Shire Horse Society, and, like it, they each hold a show in London in the spring of the year and publish an annual volume. Other horse-breeders' associations, all doing useful work in the interests of their respective breeds, are the Suffolk Horse Society, the Clydesdale Horse Society, the Yorkshire Coach Horse Society, the Cleveland Bay Horse Society, the Polo Pony Society, the Shetland Pony Stud Book Society, the Welsh Pony and Cob Society and the New Forest Pony Association. Thoroughbred race-horses are registered in the General Stud Book. The Royal Commission on Horse Breeding, which dates from 1887, is, as its name implies, not a voluntary organization. Through the commission the money previously spent upon Queen's Plates is offered in the form of "King's Premiums" (to the number of twenty-eight in 1907) of £150 each for thoroughbred stallions, on condition that each stallion winning a premium shall serve not less than fifty half-bred mares, if required. The winning stallions are distributed in districts throughout Great Britain, and the use of these selected sires has resulted in a decided improvement in the quality of half-bred horses. The annual show of the Royal Commission on Horse Breeding is held in London jointly and concurrently with that of the Hunters' Improvement Society.

Of organizations of cattle-breeders the English Jersey Cattle Society, established in 1878, may be taken as a type. It offers prizes in butter-test competitions and milking trials at various agricultural shows, and publishes the *English Herd Book and Register of Pure-bred Jersey Cattle.* This volume records the births in the herds of members of the society, and gives the pedigrees of cows and bulls, besides furnishing lists of prize-winners at the principal shows and butter-test awards, and reports of sales by auction of Jersey cattle. Other cattle societies, all well caring for the interest of their respective breeds, are the Shorthorn Society of Great Britain and Ireland, the Lincolnshire Red Shorthorn Association, the Hereford Herd Book Society, the Devon Cattle Breeders' Society, the South Devon Herd Book Society, the Sussex Herd Book Society, the Longhorned Cattle Society, the Red Polled Society, the English Guernsey Cattle Society, the English Kerry and Dexter Cattle Society, the Welsh Black Cattle Society, the Polled Cattle Society (for the Aberdeen-Angus breed), the English Aberdeen-Angus Cattle Association, the Galloway Cattle Society, the Ayrshire Cattle Herd Book Society, the Highland Cattle Society of Scotland and the Dairy Shorthorn Association.

In the case of sheep the National Sheep Breeders' Association looks after the interests of flockmasters in general, whilst most of the pure breeds are represented also by separate organizations. The Hampshire Down Sheep Breeders' Association may be taken as a type of the latter, its principal object being to encourage the breeding of Hampshire Down sheep at home and abroad, and to maintain the purity of the breed. It publishes an annual Flock Book, the first volume of which appeared in 1890. In this book are named the recognized and pure-bred sires which have been used, and ewes which have been bred from, whilst there are also registered the pedigrees of such sheep as are proved to be eligible for entry. Prizes are offered by the society at various agricultural shows where Hampshire Down sheep are exhibited. Other sheep societies include the Leicester Sheep Breeders' Association, the Cotswold Sheep Society, the Lincoln Longwool Sheep Breeders' Association, the Oxford Down Sheep Breeders' Association, the Shropshire Sheep Breeders' Association and Flock Book Society, the Southdown Sheep Society, the Suffolk

Sheep Society, the Border Leicester Sheep Breeders' Society, the Wensleydale Longwool Sheep Breeders' Association and Flock Book Society, the Incorporated Wensleydale Blue-faced Sheep Breeders' Association and Flock Book Society, the Kent Sheep Breeders' Association, the Devon Longwool Sheep Breeders' Society, the Dorset Horn Sheep Breeders' Association, the Cheviot Sheep Society and the Roscommon Sheep Breeders' Association.

The interests of pig-breeders are the care of the National Pig Breeders' Association, in addition to which there exist the British Berkshire, the Large Black Pig, and the Lincoln Curly-Coated White Pig Societies, and the Incorporated Tamworth Pig Breeders' Association.

The addresses of the secretaries of the various live-stock societies in the United Kingdom are published annually in the *Live Stock Journal Almanac.*

The Maintenance of the Health of Live Stock.

It was not till the closing decade of the 19th century that the stock-breeders of the United Kingdom found themselves in a position to prosecute their industry free from the fear of the introduction of contagious disease through the medium of store animals imported from abroad for fattening on the native pastures. By the Diseases of Animals Act 1896 (59 & 60 Vict. c. 15) it was provided that cattle, sheep and pigs imported into the United Kingdom should be slaughtered at the place of landing. The effect was to reduce to a *minimum* the risk of the introduction of disease amongst the herds and flocks of the country, and at the same time to confine the trade in store stock exclusively to the breeders of Great Britain and Ireland. This arrangement makes no difference to the food-supply of the people, for dead meat continues to arrive at British ports in ever-increasing quantity. Moreover, live animals are admitted freely from certain countries, provided such animals are slaughtered at the place of landing. At Deptford, for example, large numbers of cattle and sheep which thus arrive—mainly from Argentina, Canada and the United States—are at once slaughtered, and so furnish a steady supply of fresh-killed beef and mutton. The animals which are shipped in this way are necessarily of the best quality, because the freight on a superior beast is no more costly than on an inferior one, and the proportion of freight to sale price is therefore less. With this superior description of butchers' stock all classes of home-grown stock—good, bad and indifferent— have, of course, to compete. The Board of Agriculture has the power to close the ports of the United Kingdom against live animals from any country in which contagious disease is known to exist. This accounts for the circumstance that so few countries—none of them in Europe—enjoy the privilege of sending live animals to British ports. In 1900 the discovery early in the year of the existence of foot-and-mouth disease amongst cattle and sheep shipped from Argentina to the United Kingdom led to the issue of an order by which all British ports were closed against live animals from the country named. This order came into force on the 30th of April, and the result was a marked decline in the shipments of live cattle and sheep from the River Plate, but a decided increase in the quantity of frozen meat sent thence to the United Kingdom.

The last quarter of the 19th century witnessed an important change in the attitude of public opinion towards legislative control over the contagious diseases of animals. When, after the introduction of cattle plague or rinderpest in 1865, the proposal was made to resort to the extreme remedy of slaughter in order to check the ravages of a disease which was pursuing its course with ruinous results, the idea was received with public indignation and denounced as barbarous. Views have undergone profound modification since then, and the most drastic remedy has come to be regarded as the most effective, and in the long run the least costly. The Cattle Diseases Prevention Act 1866 (29 & 30 Vict. c. 2) made compulsory the slaughter of diseased cattle, and permitted the slaughter of cattle which had been exposed to infection, compensation being provided out of the rates. The Act 30 & 31 Vict. c. 125, 1867, is of historical interest, in that it contains the first mention of pleuro-pneumonia, and the exposure in any market of cattle suffering from that disease was made an offence. The Contagious Diseases (Animals) Act 1869 (32 & 33 Vict. c. 70) revoked all former acts, and defined disease to mean cattle plague, pleuro-pneumonia, foot-and-mouth disease, sheep-pox, sheep-scab and glanders, together with any disease which the Privy Council might by order specify. The principle of this act in regard to foreign animals was that of free importation, with power for the Privy Council to prohibit or subject to quarantine and slaughter, as circumstances seemed to require. The act of 1869 was at that time the most complete measure that had ever been passed for dealing with diseases of animals. The re-introduction of cattle plague into England in 1877 led to the passing of the Act 41 & 42 Vict. c. 74, 1878, which repealed the act of 1869, and affirmed as a principle the landing of foreign animals for slaughter only, though free importation or quarantine on the one hand and prohibition on the other were provided for in exceptional circumstances. By an order of council which came into operation in December 1878, swine fever was declared to be a disease for the purposes of the act of that year. It was not, however, till October 1886 that anthrax and rabies were officially declared to be contagious diseases for the purposes of certain sections of the act of 1878. In 1884 the Act 47 & 48 Vict. c. 13 empowered the Privy Council to prohibit the landing of animals from any country in respect of which the circumstances were not such as to afford reasonable security against the introduction of foot-and-mouth disease. After one or two other measures of minor importance came the Act 53 & 54 Vict. c. 14, known as the Pleuro-pneumonia Act 1890, which transferred the powers of local authorities to slaughter and pay compensation in cases of pleuro-pneumonia to the Board of Agriculture, and provided further for the payment of such compensation out of money specifically voted by parliament. This measure was regarded at the time as a marked step in advance, and was only carried after a vigorous campaign in its favour. In 1892 by the Act 55 & 56 Vict. c. 47 power was given to the Board of Agriculture to use the sums voted on account of pleuro-pneumonia for paying the costs involved in dealing with foot-and-mouth disease; under this act the board could order the slaughter of diseased animals and of animals in contact with these, and could pay compensation for animals so slaughtered. Under the provisions of the Contagious Diseases (Animals) Act 1893 (56 & 57 Vict. c. 43) swine fever in Great Britain was, from the 1st of November in that year, dealt with by the Board of Agriculture in the same way as pleuro-pneumonia, the slaughter of infected swine being carried out under directions from the central authority, and compensation allowed from the imperial exchequer. In 1894 was passed the Diseases of Animals Act (57 & 58 Vict. c. 57), the word "contagious" being omitted from the title. This was a measure to consolidate the Contagious Diseases (Animals) Acts 1878–1893. In it "the expression 'disease' means cattle plague (that is to say, rinderpest, or the disease commonly called cattle plague), contagious pleuro-pneumonia of cattle (in this act called pleuro-pneumonia), foot-and-mouth disease, sheep-pox, sheep-scab, or swine fever (that is to say, the disease known as typhoid fever of swine, soldier purples, red disease, hog cholera or swine plague)." The Diseases of Animals Act 1896 (59 & 60 Vict. c. 15) rendered compulsory the slaughter of imported live stock at the place of landing, a boon for which British stock-breeders had striven for many years. The ports in Great Britain at which foreign animals may be landed are Bristol, Cardiff, Glasgow, Hull, Liverpool, London, Manchester and Newcastle-upon-Tyne. Animals from the Channel Islands may be landed at Southampton.

The Diseases of Animals.

Under the Diseases of Animals Acts 1894 and 1896 weekly returns are issued by the Board of Agriculture of outbreaks of anthrax, foot-and-mouth disease, glanders (including farcy), pleuro-pneumonia, rabies and swine fever in the counties of Great Britain; also monthly returns of outbreaks of sheep-scab.

Cattle plague, or rinderpest, has not been recorded in Great

Britain since 1877. In that year there were 47 outbreaks distributed over five counties and involving 263 head of cattle.

The course of *foot-and-mouth* disease in Great Britain between 1877 and 1905 inclusive is told in Table XX., from which the years 1887 to 1891, 1895 to 1899 and 1903 to 1905 inclusive are omitted, because there was no outbreak during those periods. The disease is seen to have attained its maximum virulence in 1883.

TABLE XX.—*Outbreaks of Foot-and-Mouth Disease in Great Britain, 1877–1905.*

Year.	Counties.	Out-breaks.	Animals attacked.			
			Cattle.	Sheep.	Swine.	Other Animals.
1877	55	858	5,640	7,405	2,099	
1878	45	235	912	8,609	245	
1879	29	137	261	15,681	5	
1880	38	1,461	20,918	9,572	1,886	2
1881	49	4,833	59,484	117,152	6,330	80
1882	49	1,970	23,973	11,412	2,564	1
1883	75	18,732	219,289	217,492	24,332	32
1884	55	949	12,186	14,174	1,860	1
1885	10	30	354	34	30	
1886	1	1	10			
1892	15	95	1,248	3,412	107	
1893	2	2	30			
1894	3	3	7	261		
1900	9	21	214	50	2	
1901	3	12	43	626		
1902	1	1	2	118		

Sheep-scab is a loathsome skin disease due to an acarian parasite. Table XXI. shows the number of outbreaks and the number of counties over which they were distributed from 1877 to 1905. The recorded outbreaks were more numerous in the decade of the 'nineties than in that of the 'eighties, though possibly this may have been due to greater official activity in the later period. The largest number of sheep attacked was 68,715 (in 1877). It is compulsory on owners to notify the authorities as to the existence of scab amongst their sheep. By the Diseases of Animals Act (1903) powers to prescribe the dipping of sheep, irrespective of the presence or otherwise of sheep scab, were conferred upon the Board of Agriculture. An inspector of the board or of the local authority was by the same act authorized to enter premises and examine sheep. Each year the disorder runs a similar course, the outbreaks dwindling to a minimum in the summer months, June to August, and attaining a maximum in the winter months, December to February. It is chiefly in the "flying" flocks and not in the breeding flocks that the disease is rife, and it is so easily communicable that a drove of scab-infested sheep passing along a road may leave behind them traces sufficient to set up the disorder in a drove of healthy sheep that may follow. For its size and in relation to its sheep population Wales harbours the disease to a far greater extent than the other divisions of Great Britain.

TABLE XXI.—*Outbreaks of Sheep-Scab in Great Britain, 1877–1905.*

Year.	Counties.	Outbreaks.	Year.	Counties.	Outbreaks.
1877	77	3214	1890	75	1506
1880	70	1556	1895	88	3092
1885	69	1512	1900	78	1939
			1905	73	918

The fatal disease known as *anthrax* did not form the subject of official returns previous to the passing of the Anthrax Order of 1886. Isolated outbreaks are of common occurrence, and from the totals for Great Britain given in Table XXII. it would appear that there is little prospect of the eradication of this bacterial disorder.

Glanders (including farcy) was the subject during the twenty-four years 1877–1900 of outbreaks in Great Britain ranging between a minimum of 518 in 1877 and a maximum of 1657 in 1892; in the former year 758 horses were attacked, and in the latter 3001. A recrudescence of the disease marked the closing years of the 19th century, the outbreaks having been 748 in 1898, 853 in 1899 and 1119 in 1900. The counties of Great Britain over which the annual outbreaks have been distributed have ranged between 24 in 1890 and 52 in 1879. As a matter of fact, however, the disease is strongly centred upon the metropolitan area, more than half of the outbreaks being reported from the county of London alone.

TABLE XXII.—*Outbreaks of Anthrax in Great Britain, 1895–1905.*

Year.	Counties.	Outbreaks.	Animals attacked.			
			Cattle.	Sheep.	Swine.	Horses.
1895	66	434	604	158	140	32
1896	64	488	632	34	200	38
1897	67	433	521	39	284	38
1898	73	556	634	22	161	39
1899	67	534	634	69	253	30
1900	74	571	668	40	204	44
1901	63	651	708	76	152	35
1902	71	678	746	50	192	44
1903	78	767	809	48	234	51
1904	77	1049	1115	62	365	47
1905	84	970	1001	53	210	53

The *Rabies* order was passed in 1886, and the number of counties in Great Britain in which cases of rabies in dogs were reported in each subsequent year is shown in Table XXIII. In addition there have been some cases of rabies in animals other than dogs. The disease was very rife in 1895, but the extensive application of the muzzling restrictions of the Board of Agriculture was accompanied by so steady a diminution in the prevalence of the disease, that it was thought the latter had been extirpated. The entire revocation of the muzzling order, which accordingly followed, proved, however, to be premature, and it became necessary to reimpose it in the districts where it had last been operative, namely, certain parts of South Wales. No cases were reported in 1903, 1904 or 1905.

TABLE XXIII.—*Cases of Rabies in Dogs in Great Britain, 1887–1902.*

Year.	Counties.	Cases.	Year.	Counties.	Cases.
1887	28	217	1895	29	672
1888	19	160	1896	41	438
1889	20	312	1897	30	151
1890	20	129	1898	10	17
1891	17	79	1899	4	9
1892	12	38	1900	2	6
1893	18	93	1901	1	1
1894	17	248	1902	4	13

Pleuro-pneumonia in Great Britain was dealt with by the local authorities up to the year 1890. Between 1870 and 1889 the annual outbreaks had ranged between a minimum of 312 in 1884 and a maximum of 3262 in 1874, the largest number of cattle attacked in any one year being 7983 in 1872. The largest number of counties over which the outbreaks were distributed was 72 in 1873. On the 1st of September 1890 the Board of Agriculture assumed powers with respect to pleuro-pneumonia under the Diseases of Animals Act of that year. Their administration was attended by success, for from 192 outbreaks in Great Britain in 1891 the total fell to 35 in 1892 and to 9 in 1893. In the four subsequent years, 1894–1897, the outbreaks numbered 2, 1, 2, and 7 respectively. In January 1898 an outbreak was discovered in a London cow-shed. This proved to be the last case in the 19th century of what at one time had been a veritable scourge to cattle-owners and a source of heavy financial loss.

Between 1879 and 1892 inclusive, administration with regard to *swine-fever* was entrusted to local authorities. The largest number of outbreaks reported in any one of those years was 7926 in 1885, and the smallest 1717 in 1881. In 1893 the Board of Agriculture took over the management, and Table XXIV. shows the number of counties in which swine-fever existed, the number of outbreaks confirmed and the number of swine slaughtered by order of the board in each year since. The trouble with this disease has been mainly in England, the outbreaks in

Wales and Scotland being comparatively few. What are termed "swine-fever infected areas" are scheduled by the board when and where circumstances seem to require, and the movement of swine within such areas is prohibited, much inconvenience to trade resulting from restrictions of this kind. Frequently, moreover, the exhibition of pigs at agricultural shows has to be abandoned in consequence of these swine-fever regulations.

Table XXIV.—*Outbreaks of Swine Fever in Great Britain, 1894–1905.*

Year.	Counties.	Outbreaks confirmed.	Swine slaughtered as diseased, or as having been exposed to infection.
1894	73	5682	56,296
1895	73	6305	69,931
1896	77	5166	79,586
1897	74	2155	40,432
1898	72	2514	43,756
1899	71	2322	30,797
1900	62	1940	17,933
1901	71	3140	15,237
1902	67	1688	8,263
1903	63	1478	7,933
1904	64	1196	5,603
1905	58	817	3,876

The Trade in Live Stock between Ireland and Great Britain.

The compulsory slaughter at the place of landing does not extend to animals shipped from Ireland into Great Britain, and this is a matter of the highest importance to Irish stock-breeders, who find their best market close at hand on the east of St George's Channel. Table XXV. shows the number of cattle, sheep and pigs shipped from Ireland into Great Britain in each of the fifteen years 1891–1905, the numbers of horses similarly shipped being also indicated. On the average rather more than half the total of cattle is made up of store animals for fattening or breeding purposes, the fattening of Irish stores being a business of considerable magnitude in Norfolk and other counties. Calves constitute about one-twelfth of the total number of cattle.

Table XXV.—*Imports of Live Stock from Ireland into Great Britain*, 1891–1905.

Year.	Cattle.	Sheep.	Pigs.	Horses.
1891	630,802	893,175	503,584	33,396
1892	624,457	1,080,202	500,951	32,481
1893	688,669	1,107,960	456,571	30,390
1894	826,954	957,101	584,967	33,589
1895	791,607	652,578	547,220	34,560
1896	681,560	737,306	610,589	39,856
1897	746,012	804,515	695,307	38,422
1898	803,362	833,458	588,785	38,804
1899	772,272	871,953	688,553	42,087
1900	745,519	862,263	715,202	35,606
1901	642,638	843,325	596,129	25,607
1902	959,241	1,055,802	637,972	25,260
1903	897,645	825,679	569,920	27,719
1904	772,363	739,266	505,080	27,500
1905	749,131	700,626	363,823	30,723

Most of the pigs sent from Ireland into Great Britain are fat, the store pigs accounting for less than one-tenth of the total number. The returns from Ireland under the Diseases of Animals Acts 1894 and 1896 are less significant than those of Great Britain. Thus, in the year ending June 1905, they included 4 outbreaks of anthrax, 219 of swine-fever and 343 of sheep-scab, while there were no cases of rabies. Compared with the export trade in live stock from Ireland to Great Britain the reciprocal trade from Great Britain to Ireland is small, and is largely restricted to animals for breeding purposes. Owing to the reappearance of foot-and-mouth disease in Great Britain early in 1900 the importation of cattle, sheep, goats and swine therefrom into Ireland was temporarily suspended by the authorities in the latter country.

Exports of Animals from the United Kingdom.

The general export trade of the United Kingdom in living animals represented an aggregate average annual value over the five years 1896–1900 of £1,017,000 as against £935,801 over the five years 1901–1905. To these sums the value of horses alone contributed about three-fourths, Belgium taking more than half the number of exported horses. The export trade in cattle, sheep and pigs is practically restricted to pedigree animals required for breeding purposes, and though its aggregate value is not large it is of considerable importance to stock-breeders, as it is a frequent occurrence for buyers for export—to Argentina, Australasia, Canada, the United States and elsewhere—to bid freely at the sale rings, and often to pay the highest prices, thus stimulating the sales and encouraging the breeding of the best types of native stock. Details for the six years 1900–1905 are summarized in Table XXVI.

Table XXVI.—*Quantities and Value of Home-bred Live Stock exported from the United Kingdom*, 1900–1905.

Year.	Horses.	Cattle.	Sheep.	Pigs.	Other Animals.
1900	30,038	2,742	4,934	435	75,642
1901	27,612	1,648	2,761	378	68,012
1902	30,032	2,428	3,596	515	60,941
1903	34,798	2,736	5,579	776	52,095
1904	32,955	3,311	8,142	732	50,873
1905	47,708	3,938	8,378	931	50,307
	£	£	£	£	£
1900	681,927	118,337	53,306	3032	45,241
1901	605,699	61,812	25,727	3437	45,476
1902	635,661	96,153	29,069	5053	56,691
1903	734,598	140,244	67,758	7053	48,335
1904	581,339	146,210	88,421	7850	43,868
1905	875,647	190,406	133,413	8024	41,061

Implements and Machinery.

It is the custom of the Royal Agricultural Society of England to invite competitions at its annual shows in specified classes of implements, and an enumeration of these will indicate the character of the appliances which were thus brought into prominence in the latter years of the 19th and the early years of the 20th century. These trials taking place, with few intermissions, year after year serve to direct the public mind to the development, which is continually in progress, of the mechanical aids to agriculture. The awards here summarized are quite distinct from those of silver medals which are given by the society in the case of articles possessing sufficient merit, which are entered as "new implements for agricultural or estate purposes."

In 1875, at Taunton, special prizes were awarded for one-horse and two-horse mowing-machines, hay-making machines, horse-rakes (self-acting and not self-acting), guards to the drums of threshing-machines, and combined guards and feeders to the drums of threshing-machines. In 1876, at Birmingham, the competitions were of self-delivery reapers, one-horse reapers and combined mowers and reapers without self-delivery. In 1878, at Bristol, the special awards were all for dairy appliances—milk-can for conveying milk long distances, churn for milk, churn for cream, butter-worker for large dairies, butter-worker for small dairies, cheese-tub, curd knife, curd mill, cheese-turning apparatus, automatic means of preventing rising of cream, milk-cooler and cooling vat. A gold medal was awarded for a harvester and self-binder (McCormick's). In 1879, at Kilburn, the competition was of railway waggons to convey perishable goods long distances at low temperatures. In 1880 at Carlisle, and in 1881 at Derby, the special awards were for broadside steam-diggers and string sheaf-binders respectively. In 1882, at Reading, a gold medal was given for a cream separator for horse power, whilst a prize of 100 guineas offered for the most efficient and most economical method of drying hay or corn crops artificially, either before or after being stacked, was not awarded. In 1883, at York, a prize of £50 was given for a butter dairy suitable for not more than twenty cows. In 1884, at Shrewsbury, a prize of £100 was awarded for a sheaf-binding reaper, and one of £50 for a similar machine. In 1885, at Preston, the competitions were concerned with two-horse, three-horse and four-horse whipple-trees, and packages for conveying fresh butter by rail. In 1886, at Norwich, a prize of £25 was awarded for a thatch-making machine. In 1887, at Newcastle-on-Tyne, a prize of £200 went to a compound portable agricultural engine, one of £100 to a simple portable agricultural engine, and lesser prizes to a weighing-machine for horses and cattle, a weighing-machine for sheep and pigs, potato-raisers and one-man-power cream separators. In 1888, at Nottingham, hay and straw presses for steam-power, horse-power and hand-power were the subjects of competition. In 1889, at Windsor, prizes were awarded for a fruit and vegetable evaporator, a paring and coring machine, a dairy thermometer, parcel post butter-boxes to carry different weights, and a vessel to contain preserved butter. In 1890, at Plymouth, competitions took place of light portable engines (*a*) using solid fuel, (*b*) using liquid or gaseous fuel, grist mills for use on a farm, disintegrators, and cider-making plant for use on a farm. In 1891, at Doncaster, special prizes were given for combined portable threshing and finishing machines, and cream separators (hand and power). In 1892, at Warwick, the competitions related to ploughs—single furrow (*a*) for light land, (*b*) for strong land, (*c*) for press drill and broad-cast sowing; two-furrow; three-furrow; digging (*a*) for light land, (*b*) for heavy land; and one-way ploughs. In 1893, at Chester, self-binding harvesters and sheep-shearing machines (power) were the appliances respectively in competition. In 1894, at Cambridge, the awards were for fixed and portable oil engines, potato-spraying and tree-spraying machines, sheep-dipping apparatus and churns. In 1895, at Darlington, the competitions were confined to hay-making machines and clover-making machines. In 1896, at Leicester, prizes were awarded after trial to potato-planting machines, potato-raising machines and butter-drying machines. In 1897, at Manchester, special awards were made for fruit baskets and milk-testers. In 1898, at Birmingham, a prize of £100 was given for a self-moving vehicle for light loads, £100 and £50 for self-moving vehicles for heavy loads, and £10 for safety feeder to chaff-cutter, in accordance with the Chaff-cutting Machines (Accidents) Act 1897. In 1899, at Maidstone, special prizes were offered for machines for washing hops with liquid insecticides, cream separators (power and hand), machines for the evaporation of fruit and vegetables, and packages for the carriage of (*a*) soft fruit, (*b*) hard fruit. In 1900, at York, the competitions were concerned with horse-power cultivators, self-moving steam diggers, milking machines and sheep-shearing machines (power and hand). In 1901, at Cardiff, competition was invited in portable oil engines, agricultural locomotive oil engines and small ice-making plant suitable for a dairy. In the years 1903 and 1904 petrol motors adapted for ploughing and other agricultural operations formed a prominent feature of the exhibits.

The progress of steam cultivation has not justified the hopes that were once entertained in the United Kingdom concerning this method of working implements in the field. It was about the year 1870 that its advantages first came into prominent notice. At that time, owing to labour disputes, the supply of hands was short and horses were dear. The wet seasons that set in at the end of the 'seventies led to so much hindrance in the work on the land that the aid of steam was further called for, and it seemed probable that there would be a lessened demand for horse power. It was found, however, that the steam work was done with less care than had been bestowed upon the horse tillage, and the result was that steam came to be regarded as an auxiliary to horse labour rather than as a substitute for it. In this capacity it is capable of rendering most valuable assistance, for it can be utilized in moving extensive areas of land in a very short time. Accordingly, when a few days occur early in the season favourable to the working of the land, much of it can be got into a forward condition, whilst horses are set free for the lighter operations. The crops can then be sown in due time, which in wet years, and with the usual teams of horses kept on a farm, is not always practicable. Much advantage arises from the steam working of bastard fallows in summer, and after harvest a considerable amount of autumn cultivation can be done by steam power, thus materially lightening the work in the succeeding spring. On farms of moderate size it is usual to hire steam tackle as required, the outlay involved in the purchase of a set being justifiable only in the case of estates or of very big farms where, when not engaged in ploughing, or in cultivating, or in other work upon the land, the steam-engine may be employed in threshing, chaff-cutting, sawing and many similar operations which require power. The labour question again became acute in the early years of the 20th century, when, owing to the scarcity of hands and the high rate of wages, self-binding harvesters were resorted to in England for the ingathering of the corn crops to a greater extent than ever before. For the same reason potato-planting and potato-lifting machines were also in greater requisition.

Agricultural Population and Wages.

The last half of the 19th century witnessed a remarkable diminution of the British rural population. The decrease has assumed serious proportions since 1871, as before that date the supply of rural labour exceeded the demand. A large number of agricultural labourers were thus only in partial employment, and their withdrawal from the land was of minor importance as compared with the shrinkage in the number of those permanently employed. The following tables indicate the extent of rural depopulation:—

Number of "Persons engaged in Agriculture" in the United Kingdom, 1851–1901.

1851.	1861.	1871.	1881.	1891.	1901.
3,453,500	3,080,500	2,744,000	2,573,900	2,394,500	2,262,600

The number of "agricultural labourers and shepherds," which affords a more precise index, declined in a still more marked degree.

1851.	1861.	1871.	1881.	1891.	1901.
1,110,311	1,098,261	923,332	830,452	756,557	609,105

The decrease in the demand for labour is attributable chiefly to the reduction of the cultivated area and the laying down to pasture of land once under the plough, and to the increasing use of agricultural machinery. It may, however, be noticed that the period 1850–1903 was marked by a steady increase of the cash wages of the farm labourer, as indicated in the following table from the Report on the Earnings of Agricultural Labourers issued by the Board of Trade in 1905.

Average Weekly Cash Wages of ordinary Agricultural Labourers employed on certain Farms in England and Wales.

Year.	England and Wales, 69 farms.		Eastern counties, 12 farms.	
	s.	d.	s.	d.
1850	9	3½	8	8
1855	10	11½	11	5
1860	10	11	10	8
1865	11	3	10	5
1870	11	10½	11	1½
1875	13	7	12	11½
1880	13	2½	12	1
1885	13	1	11	5
1890	13	0½	11	0½
1895	13	2½	11	0
1900	14	5½	13	1½
1903	14	7	13	2½

(See also ALLOTMENTS AND SMALL HOLDINGS.)

Agricultural Education.

In Great Britain agricultural education as a whole lacks the scope and co-ordination which it has in some continental countries. Centres at which higher agricultural education is given are, however, numerous. The chief are:—

The Royal Agricultural College, Cirencester
Aspatria Agricultural College, Carlisle.
Tamworth Agricultural College.
*Agricultural and Horticultural College, Uckfield, Sussex.
*Agricultural and Horticultural College, Holme Chapel, Cheshire.

*Midland Agricultural and Dairy College, Kingston, Derby.
*Harper-Adams Agricultural College, Newport, Salop.
*Lancashire County School, Harris Institute, Preston.
*University College of North Wales, Bangor.
*University of Leeds.
*Armstrong College, Newcastle-on-Tyne.
*Cambridge University.
*University College, Reading.
*South-Eastern Agricultural College, Wye.
*University College of Wales, Aberystwyth.
*Agricultural Institute, Ridgmont (Bedfordshire County Council).
*Essex County Technical Laboratories, Chelmsford.

In the year 1904–1905 £10,600 was devoted by the Board of Agriculture to agricultural instruction and experiments. Of this sum the greater part was divided amongst the institutions marked with an asterisk in the above list. The first three named are private establishments. The county councils also expend sums varying at their own discretion on instruction in dairy-work, poultry-keeping, farriery and veterinary science, horticulture, agricultural experiments, agricultural lectures at various centres, scholarships at, and grants to, agricultural colleges and schools; the whole amount in 1904–1905 reaching £87,472.[1] The sum spent by individual counties varies considerably. In 1904–1905 Lancashire (£8510), Kent (£5922) and Cheshire (£4310) spent most in this direction. In some instances colleges are supported entirely by one county, as is the Holmes Chapel College, Cheshire; in others a college is supported by several affiliated counties, as in the case of the agricultural department of the University College, Reading, which acts in connexion with the counties of Berks, Oxon, Hants and Buckingham. The organization and supply of county agricultural instruction is often carried out through the medium of the institution to which the county is affiliated. In Scotland higher agricultural instruction is given at:—

Edinburgh and East of Scotland Agricultural College.
Edinburgh University, Agriculture Department.
West of Scotland Agricultural College, Glasgow.
Aberdeen and North of Scotland Agricultural College.
University of St. Andrews.

A typical course at one of the higher colleges lasts for two years and includes instruction under the heads of soils and manure, crops and pasture, live stock, foods and feeding, dairy work, farm and estate management and farm bookkeeping, surveying, agricultural buildings and machinery, agricultural chemistry, agricultural botany, veterinary science and agricultural entomology. Experimental farms are attached to the colleges.

The facilities for intermediate are far inferior to those for higher agricultural education. Schools for farmers' sons and daughters, and others, answering to the *écoles pratiques d'agriculture* (see FRANCE), are few, the principal being the Dauntsey Agricultural School, Wiltshire, the Hampshire Farm School, Basing, and the Farm School at Newton Rigg, Penrith, Cumberland, maintained by the county councils of Cumberland and Westmorland. Occasionally grammar schools have agricultural sides, and in evening continuation schools agricultural classes are sometimes held. Both elementary day schools and continuation schools are in many cases provided with gardens in which horticultural teaching is given.

In Ireland agricultural education is under the supervision of the Department of Agriculture and Technical Instruction for Ireland, founded in 1899. Higher education is given at the Royal College of Science, Dublin; the Albert Agricultural College, Glasnevin; and the Munster Institute, Cork, for female students, where dairying and poultry-keeping are prominent subjects. Winter classes for boys over sixteen years of age are held at centres in some counties, and there are winter schools of agriculture at Downpatrick, Monaghan and Mount Bellew (Co. Galway); while lectures are given at farmers' meetings by itinerant instructors. The Department carries on agricultural experiment-stations at Athenry (Co. Galway), Ballyhaise (Co. Cavan) and Clonakilty (Co. Cork), where farm apprentices are received and instructed.

AGRICULTURE IN THE UNITED STATES

Agriculture has been the chief and most characteristic work of the American people, that in which they have achieved the greatest results in proportion to the resources at command, that in which their economic superiority has been most strikingly manifest. In ten years from 1790, the mean population of the period being 4,500,000, 65,000 sq. m. were for the first time brought within the limits of settlement, crossed with roads and bridges, covered with dwellings, both public and private, much of it also cleared of primeval forest; and this in addition to keeping up and improving the whole extent of previous settlements, and building towns and cities, at a score of favoured points. In the next decade, the mean number of inhabitants being about 6,500,000, population extended itself over 98,000 sq. m. of absolutely new territory, an area eight times as large as Holland. Between 1810 and 1820, besides increasing the density of population on almost every league of the older territory, besides increasing their manufacturing capital twofold, in spite of a three years' war, the people of the United States advanced their frontier to occupy 101,000 sq. m., the mean population being 8,250,000. Between 1820 and 1830, 124,000 sq. m. were brought within the frontier and made the seat of habitation and cultivation; between 1830 and 1840, 175,000 sq. m.; between 1840 and 1850, 215,000 sq. m. The Civil War, indeed, checked the westward flow of population, though it caused no refluence, but after 1870 great progress was made in the creation of new farms and the development of old.

That which has allowed this great work to be done so rapidly and fortunately has been, first, the popular tenure of the soil, and, secondly, the character of the agricultural class. At no time have the cultivators of the soil north of the Potomac and Ohio constituted a peasantry in the ordinary sense of that term. They have been the same kind of men, out of precisely the same homes, generally with the same early training, as those who filled the learned professions or who were engaged in manufacturing or commercial pursuits. Switzerland and Scotland have, in a degree, approached the United States in this particular; but there is no other considerable country where as much mental activity and alertness has been applied to the cultivation of the soil as to trade and manufactures.

But even the causes which have been adduced would have failed to produce such effects but for the exceptional inventive ingenuity of the American. The mechanical genius which has entered into manufacturing in the United States, the engineering skill which has guided the construction of the greatest works of the continent, have been far exceeded in the hurried "improvements" of the pioneer farm; in the housing of women, children and live stock and gathered crops against the storms of the first few winters; in the rough-and-ready reconnaissances which determined the "lay of the land" and the capabilities of the soil; in the preparation for the thousand exigencies of primitive agriculture. It is no exaggeration to say that the chief manufacture of the United States, prior to 1900, was the manufacture of 5,740,000 farms, comprising 841,200,000 acres.

The people of the United States, finding themselves on a continent containing an almost limitless extent of land of fair average fertility, having at the start but little accumulated capital and urgent occasions for the economy of labour, have elected to regard the land in the earliest stages of occupation as practically of no value, and to regard labour as of high value. In pursuance of this view they have freely sacrificed the land, so far as was necessary, in order to save labour, systematically cropping the fields on the principle of obtaining the largest results with the least expenditure, limiting improvements to what was demanded for immediate uses, and caring little about returning to the soil an equivalent for the properties taken from it in the harvests of successive years. But, so far as the northern

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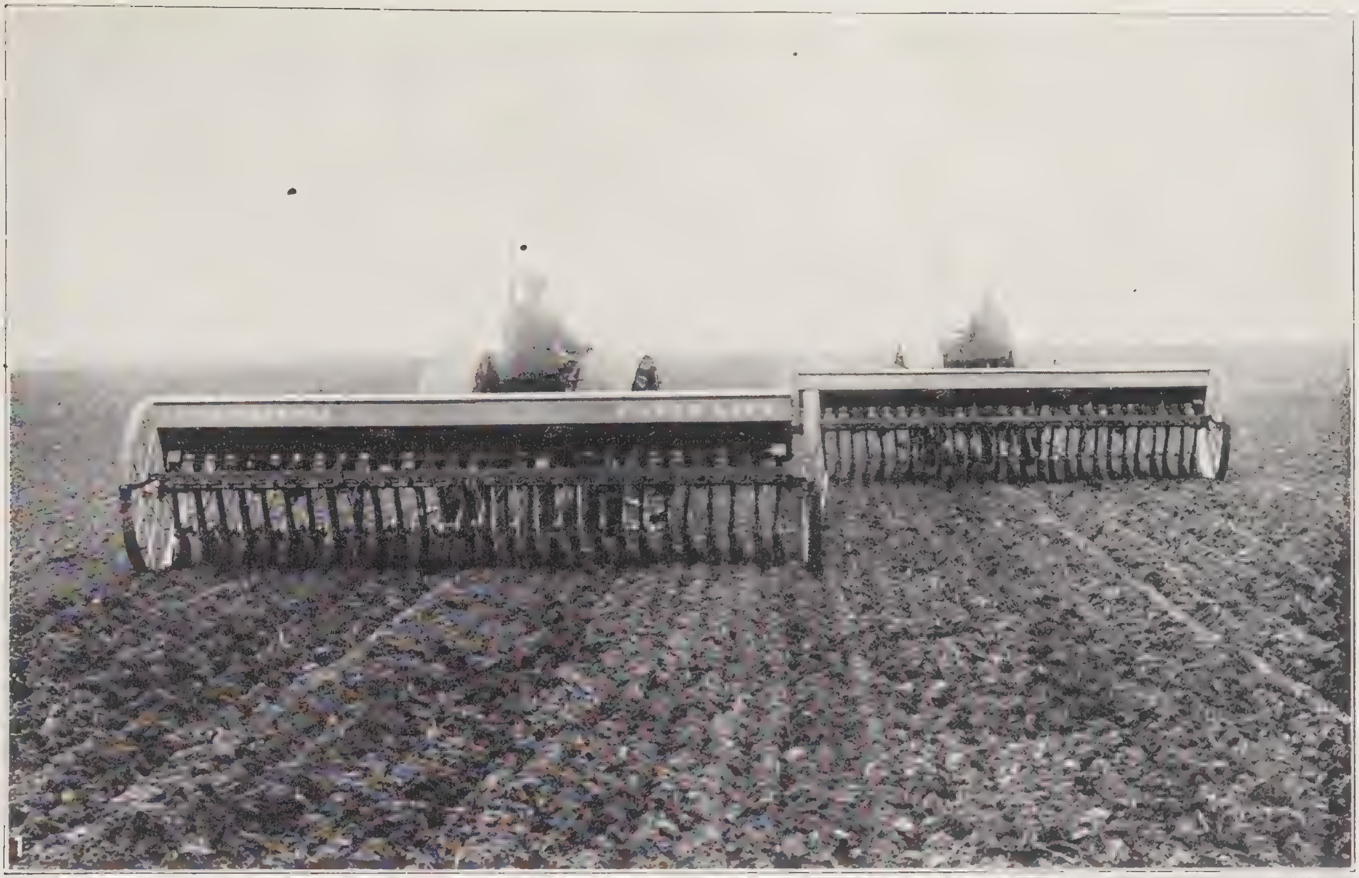
[1] This sum was furnished out of a total of £693,851, forming the residue grant allocated for the purposes of education to the various county councils of England and Wales under the Local Taxation (customs and Excise) Act 1890.



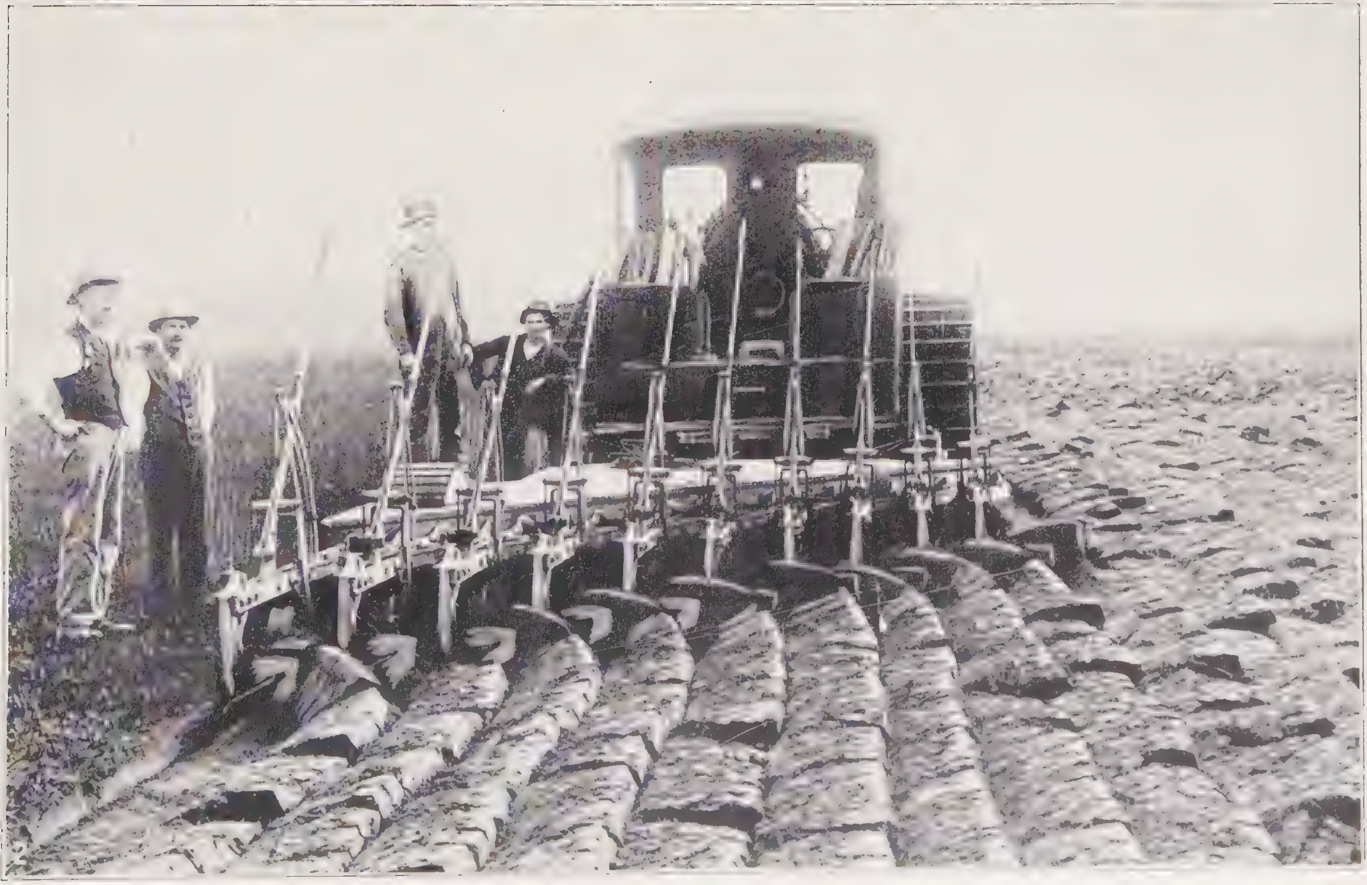


FIG. 1. PLANTING MACHINES, EACH FOR 28 ROWS. FIG. 2. TRACTOR-DRAWN 10-DISK PLOUGH

Such machinery, replacing the shallow ploughing and hand sowing of earlier days, has made it possible, in supplying the world's food requirements, to utilise far less man power than formerly. The newest methods are treated in the articles AGRICULTURE, Vol. 29, and FARM MACHINERY, Vol. 30, while FOOD SUPPLY, Vol. 30, covers a different phase.

(Fig. 1. Photo, Steele's Ltd., from Keystone. Fig. 2. Photo, "Wide World.")

states are concerned, the enormous profits of this alleged wasteful cultivation have in the main been applied, not to personal consumption, but to permanent improvements,—not indeed to improvements of the land, but to what were still more needed in the situation, namely, improvements upon the land. The first-fruits of a virgin soil have been expended in forms which have vastly enhanced the productive power of the country. The land, doubtless, as one factor of that productive power, became temporarily less efficient than it would have been under a conservative European treatment; but the joint product of the three factors—land, labour and capital—was for the time enormously increased. Under this regimen the fertility of the land, of course, in time necessarily declined, sooner or later, according to the nature of the crops grown and to the degree of original strength in the soil. Resort was then had to new fields farther west. The granary of the continent moved first to western New York, thence into the Ohio valley, and then, again, to the banks of the Mississippi. The north and south line dividing the wheat product of the United States into two equal parts was in 1850 drawn along the 82nd meridian (81° 58′ 49″). In 1860 that line was drawn along the 86th (86° 1′ 38″), in 1870 along the 89th (88° 48′ 40″), in 1880 along the 90th (90° 30′ 46″), in 1890 along the 93rd (93° 9′ 18″), and in 1900 along the 95th (94° 59′ 23″). Meanwhile one portion of the inhabitants of the earlier settlements joined in the movement across the face of the continent. As the grain centre passed on to the west they followed it, too restless by character and habit to find pleasure in the work of stable communities. A second portion of the inhabitants became engaged in raising, upon limited areas, small crops, garden vegetables and orchard fruits, and in producing butter, milk, poultry and eggs, for the supply of the cities and manufacturing towns which had been built up out of the abundant profits of the primitive agriculture. Still another portion of the agricultural population gradually became occupied in the more careful and intense culture of the cereal crops upon the better lands, the less eligible fields being allowed to spring up in brush and wood. Deep ploughing and thorough drainage were resorted to; fertilizers were employed to bring up and to keep up the soil; and thus began the serious systematic agriculture of the older states. Something continued to be done in wheat, but not much. New York raised 13 million bushels in 1850; thirty years later she raised 11½ million bushels; and fifty years later 10½ million bushels. Pennsylvania raised 15⅓ million bushels in 1850; in 1880 she raised 19½ million bushels; and in 1900 20⅔ million bushels. More is done in Indian corn (maize), that most prolific cereal, the backbone of American agriculture; still more is done relatively in buckwheat, barley and rye. Pennsylvania, though the eleventh state in wheat production in 1905, stood first in rye and second in buckwheat (ninth in oats). New York was only twenty-first in wheat, but first in buckwheat (tenth in barley), fourth in rye. We do not, however, reach the full significance of the situation until we account for the fourth portion of the former agricultural population, in noting how naturally and fortunately commercial and manufacturing cities spring up in the sites which have been prepared for them by the lavish expenditure of the enormous profits of a primitive agriculture upon permanently useful improvements of a constructive character. These towns are the gifts of agriculture.

Besides the extension of cultivated area, very little was accomplished in the way of agricultural improvement before 1850. With some few exceptions the methods of cultivation were substantially the same as those of colonial days, and were marked by crudeness, waste and a general adherence to rule-of-thumb principles. The year 1850 roughly marks the beginning of a period of improvement and development. The Irish famine of 1846 and the German political troubles of 1848 were followed by an unprecedented emigration to America of highly desirable European labourers, for whom there were cheap and abundant lands. The period from 1850 to 1870 was marked by a steady growth, which, in the western states, was highly stimulated by the Civil War. While this conflict withdrew a certain amount of productive energy from agricultural pursuits, it tended at the same time to increase the value of farm labour and of farm products and to extend the use of machinery in order to offset the deficient labour supply. Agricultural machinery had been employed before the war, but only to a very small extent. In 1864, 70,000 reapers and mowers were manufactured, twice as many as in 1862, and manufacturers were unable to supply the demand. Moreover, in the years 1860, 1861 and 1862 the wheat crops of Great Britain and the European continent were failures, while those of the United States, far removed from the theatre of military operations, were unusually large. The wheat exports to Great Britain in 1861 were three times as great as those of any previous year, and the strong demand from abroad was an additional stimulus to higher prices. In 1864 agricultural prices were from 100 to 200% higher than in 1861, while transportation charges had only slightly advanced and in some instances had actually decreased. In the middle of the war the farmers' profits were normal; toward the end they had increased enormously. This marvellous agricultural prosperity of a nation engaged in one of the world's most formidable wars has no counterpart in modern history. In the decade from 1860 to 1870 there was a steady increase in cultivated area, in agricultural products and in population. The value of the farm lands in the northern states in 1870 exceeded that of 1860 by five dollars an acre. On the other hand, the farm lands of the southern states had declined in value to an almost equal amount; but after 1870 these states also made substantial progress, and in 1880 they produced more cotton than in 1860, when the greatest crop under the slave system was grown.

Since 1870 the most important factors in this development have been the employment of more scientific methods of production and the more extensive use of machinery. The study of soils with a view of adapting to them the most suitable crops and fertilizers; the increased attention given to diversified farming and crop rotation; the introduction and successful growth of new plants (*e.g.* the date palm in Arizona and California, and tea in South Carolina); tile drainage; the ensilage of forage; more careful selection in breeding; the use of inoculation to prevent Texas fever in cattle and cholera in swine, of tuberculin to discover the presence of tuberculosis in cows, of organic ferments to hasten the progress of butter-making, of the "Babcock test" for ascertaining the amount of fat in milk, of fungicides and insecticides to destroy fruit and vegetable pests,—such are but a few manifestations of the spread of scientific knowledge among the farming population of the United States. Nearly every county has some sort of agricultural society; in 1899 there were about 1500 of these organizations, some of which, especially those holding annual fairs, received state aid.

With the improvement in technical processes of production came the conquest of the arid regions of the western states. Irrigation was first employed in the west by the Mormons in 1847; but as late as 1870 only about 20,000 acres had been irrigated. In 1880 the irrigated area was approximately 1,000,000 acres, and in the decade from 1889 to 1899 it increased from 3,631,381 to 7,539,545 acres, a gain of 107·6%. By 1902 there had been a still further increase to 9,478,852 acres, a gain of 25·7% in three years. As many of the streams available for irrigation purposes lie within more than one state, the control of water supply is a proper matter for federal jurisdiction, and in June 1902 Congress provided for an extensive system of irrigation works in thirteen states and three territories. The cost of the work is defrayed from the proceeds of the sales of government lands within the states and territories affected by the act. The measure is not paternalistic; the settlers on the lands, which are divided into farms of not less than 40 nor more than 160 acres, are required to make annual payments to the government in proportion to the water service they have received, until the original cost of the works has been met. The first of these works, the so-called Truckee-Carson project, of Nevada, was completed in June 1905, and at the end of that year eight projects, in as many different states, were under construction; bids had been received for three more, and the seven others had received the approval of the secretary of the interior. With these initial undertakings it was estimated that 1,000,859 acres could be reclaimed. In addition to supplying the soils with water, means have been found of ridding them of their alkali, or of rendering it harmless; and this is an element of reclamation hardly less important than irrigation itself. A third step in the reclamation of desert lands is arid farming—that is, the adapting to the soils of crops that require a minimum amount of moisture, and the utilization, to the fullest possible extent, of the meagre amount of rainfall in the region. Experiments conducted in this direction in Utah produced promising results.

The development of farming machinery has kept pace with the general progress in scientific agriculture. Although numerous patents were issued for such machinery before 1850, its use, with the exception of the cotton gin, was very restricted before that date. Even iron ploughs were not in general use until 1842, and a really scientific plough was practically unknown before 1870. Thirty years later the large farms of the Pacific states were ploughed, harrowed and sowed with wheat in a single operation by fifty-horse-power traction engines drawing ploughs, harrows and press drills. Since 1850 there has been a transition from the sickle and the scythe to a machine that in one operation mows, threshes, cleans and sacks the wheat, and in five minutes after touching the standing grain has it ready for the market. Hay-stackers, potato planters and diggers, feed choppers and grinders, manure-spreaders, check-row corn planters and ditch-digging machines are some of the common labour-saving devices. By the 28th of August 1907 the United States Patent Office had issued patents for 13,212 harvesting machines, 6352 threshers, 6680 harrows and diggers, 9649 seeders and planters, and 13,171 ploughs. In the manufacture of agricultural machinery the United States leads the world. The total value of the implements and machinery used by farmers of the United States in 1880 was $406,520,055; in 1890 $494,247,467; in 1900 $761,261,550, a gain in this last decade of 54%. The total value of the implements and machinery manufactured in 1850 was $6,842,611; in 1880 $68,640,486; in 1890 $81,271,651; in 1900 $101,207,428. These figures, however, are a very poor indication of the actual use of machinery, on account of the rapid decrease in prices following its manufacture on a more extensive scale and by improved methods.

The effects of the new agriculture are apparent from the following figures: By the methods of 1830 it required 64 hours and 15 minutes of man-labour and cost $3·71 to produce an acre of wheat; by the methods employed in 1896 it required 2 hours and 58 minutes of man-labour and cost 72 cents. To produce an acre of barley in 1830 required 63 hours of man-labour and cost $3·59; in 1896 it required 2 hours and 43 minutes and cost 60 cents. An acre of oats produced by the methods of 1830 required 66 hours and 15 minutes of man-labour and cost $3·73; the methods of 1893 required only 7 hours and 6 minutes and cost $1·07. With the same unit of labour the average quantity of all leading crops produced by modern methods is about five times as great as that produced by the methods employed in 1850, and the cost of production is reduced by one half. From 1880 to 1900 the average number of acres of leading crops per male worker increased from 23·3 to 31·0, or 34%; the number of horses per worker from 1·7 to 2·3, or 35%; and the value of agricultural product per person employed from $286·82 to $454·37, or 58·4%.

There are numerous other factors that have operated to the benefit of the agriculturist. Increased transportation facilities and lower freight charges have widened his market. The processes of canning, packing, preserving and refrigerating have produced a similar effect, and have also provided a means for the disposal of surplus perishable products that otherwise would be lost. The utilization of by-products, as, for example, the conversion of cotton seed into oil, fertilizers and food for live stock, has become another source of profit.

Great economic and social changes have resulted from this progress. There has been a great division of labour in agriculture. Makers of agricultural implements, of butter and cheese, cotton ginners, grist and wheat millers, are now classed in the United States census reports as manufacturers, but all their work was once done on the farm. The farmer is now more of a specialist and more dependent on other industries than formerly. He has changed from a producer for home consumption or a local market to a producer for a world market. Unfortunately, his knowledge of economic laws has lagged behind his progress in scientific agriculture. The farming class at times have experienced periods of great depression, largely on account of their inability to adjust their crops to changing conditions in the world's markets, and in such cases have been prone to seek a remedy in radical legislation. Periods of agricultural discontent at different times have been marked by the political activity of the "Grangers" and of the "Farmers' Alliance," and even by the formation of new political parties such as the Greenback party in 1874 and the Populist or People's party in 1892—whose strength lay mainly in the agricultural states. The new industrial conditions that produced combinations among manufacturers were much slower in their effect upon the farming element, but gradually led to increasing co-operation and to the organization of the growers of various commodities for marketing their crops. The fruit growers of California and the tobacco growers of Kentucky have furnished interesting examples of such organizations. Under the improved conditions there is less drudgery on the farm; the farmer does more work, produces more, and yet has more leisure than formerly. Better roads, rural free mail delivery, telephone and electric lines are removing the isolation of country life, and to some extent are diminishing the attractions of the cities for the rural population.

Covering as it does the breadth of the North American continent, with 3,000,000 sq. m. of land surface, not including Alaska and the islands, of which over 800,000,000 acres are in farms and over 400,000,000 in actual cultivation, representing every variety of soil and all the climatic life zones of the world, except the extreme boreal and the hottest tropical, the United States affords an important subject of study in respect of agriculture. Its cotton, wheat and meat are large factors in all markets, and its many other agricultural products are distributed throughout the civilized world. To the student the equipment and methods of agriculture in the United States form as interesting a subject of examination as do its resources and production. In quantity, distribution and inter-relation of heat and moisture—the chief factors in agricultural production—the United States is greatly blessed. We find in this vast territory all the agricultural belts mapped by the biologist, producing all varieties of cereals, fruits and breeds of live stock, whilst all kinds of soils, adapted to different crops, are spread out at all altitudes from 8000 ft. down to sea-level.

The story of the vast and varied agriculture of the United States can be outlined by extracts from the figures published by the Census, the Agricultural and other government departments.

Farms.

As a result of the great supply of available land the number of farms in the United States increased between 1850 and 1900 from 1,449,073 to 5,739,657; their total acreage increased from 293,560,614 to 841,201,546 acres; their improved acreage increased from 113,032,614 to 414,793,191 acres; and their unimproved[1] acreage from 180,528,000 to 426,408,355 acres. Table XXVII. exhibits the increases of number of farms, total and improved acreage by decades.

The largest percentage of increase of improved land was 50·7, from 1870 to 1880; the lowest was in the decade 1860 to 1870, the period of the Civil War, and was 15·8. The chief cause of this wonderful development of agriculture is the large area of cheap public lands which has been available for immigrants and natives alike. Up to 1906, under the Homestead Act of the 20th of May 1862, the number of entries, both final and pending, covered 185,385,000 acres. Between 1875 and 1905 the public and Indian lands sold for cash and under homestead and timber culture laws, as well as those allotted by scrip, granted to the colleges of agriculture and mechanic arts and other institutions, and by military bounty land warrants, and selected by states and railroad corporations, covered about 430,000,000 acres. In addition to this, the states and railroad corporations sold a large amount of land to farmers of which we have no accurate record. This vast territory, greater in extent than Germany and France combined, was added to the farms of the country in thirty years. In many cases railroad building has made the settlement of the public lands possible for the first time, and the building of branch lines, by providing means for transporting products to market, has greatly facilitated the acquisition of other lands. The mileage of railways increased 310·7 % between 1870 and 1905. The interesting fact is that this increase corresponds geographically to the increase in farms.

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[1] "Unimproved" land includes land which has never been ploughed, mown or cropped, and also land once cultivated but now overgrown with trees or shrubs.

TABLE XXVII.—*Percentage of Increase of Number and Acreage of Farms by Census Decades.*

The United States.	Number of Farms.	Acreage.	
		Total.	Improved.
1850 to 1860 . .	41·1	38·7	44·3
1860 ,, 1870 . .	30·1	0·1	15·8
1870 ,, 1880 . .	50·7	31·5	50·7
1880 ,, 1890 . .	13·9	16·2	25·6
1890 ,, 1900 . .	25·7	35·0	16·0
1850 to 1900 . .	296·0	186·5	267·1

The agricultural statistics do not include any farm of less than three acres unless it produced at least $500 worth of products in the preceding year. The census of 1900 showed that the average size of farms was 146 acres, or nine acres more than in 1890 and 57 acres less than in 1850. This fact, however, does not indicate a general tendency toward the consolidation of holdings. The increase in the average size of farms in the whole country is due to the extension of grazing lands in the Rocky Mountain region and in Texas, and to the enlargement of the wheat fields in the Mississippi valley. On the other hand, in the southern states there has been a steady breaking up of holdings and decrease in the average size of farms since the close of the Civil War. In the New England states, where dairying has become the leading agricultural industry, there was an increase of 2·2 acres in the size of farms during the decade 1890–1900. This increase was more than offset by the decrease in the Atlantic states from New York to Maryland inclusive (2·8 acres), where there has been a subdivision of farms following the increased attention given to the growing of fruits and vegetables for cities. The same tendency is noted in the states of Ohio, Indiana and Illinois. As will be seen from Table XXVIII., the average farm, which steadily diminished in size from 1850 to 1880, increased between 1880 and 1900.

TABLE XXVIII.—*Average Acreage of Farms and Proportion of Improved Land therein.*

	Whole Farm.	Proportion of Improved Land.
1850	202·6	38·5
1860	199·2	40·1
1870	153·3	46·3
1880	133·7	53·1
1890	136·5	57·4
1900	146·6	49·3

The acreage of North Atlantic farms decreased from 112·6 in 1850 to 95·3 in 1890, and increased in 1890–1900 to 96·5 acres. In the South Atlantic states the average was 376·4 acres in 1850, and there has been steady decrease, so that in 1900 it was 108·4, or one-third less than the average for the entire country. In the north central states the averages of 1850 and 1900 were nearly the same (143·3 and 144·5 respectively), with the minimum (121·9 acres) in 1880. The south central states averaged 291 acres in 1850, 321·3 in 1860, 144 in 1890, and 155·4 in 1900. The maximum decade for the western states was that ending in 1850 (694·9 acres), and the minimum 1880 (312·9); and the average in 1900 was 386·1 acres.

Table XXIX. gives the number of farms, together with their distribution, under different forms of tenure in the years 1880, 1890 and 1900.

The steady drift towards farm tenancy of late is believed to be injurious to production; but it is impossible to prove this, so great has been the aggregate increase in products.

Agricultural occupations.

The number of persons engaged in agriculture as a business in 1900 was 10,381,765, or 36 % of all persons in gainful occupations. It is interesting to note that 977,336 of these were women. This is an increase of 2,667,890 persons over 1880. Thus, if the farm family is the same size as that of the remainder of the population—it is probably slightly larger—the agricultural population would be 36 % of the whole. Statisticians usually put it at 40 %, and this is probably more nearly correct (Table XXX.).

The wages paid farm labourers, as ascertained by the Department of Agriculture, are rather low compared with the average wages of labour, but not lower than the wages of other unskilled labour. The average monthly wage of the agricultural labourer, without board, was $19·50 in 1870, $16·42 in 1880, $18·33 in 1890, $17·70 in 1895, and $20·23 in 1899, when the maximum for any state was $45·10 in Nevada, the minimum $10·06 in South Carolina. The wages of the American farm labourer were at this last date named (1899) higher than for any other farm labourer save in Canada and the British colonies of Australasia; though lower than wages paid in American cities, they have greater purchasing power. J. R. Dodge, in "Farm Labour in the United States" (vol. xi., *Report of Industrial Commission on Agriculture, &c.*, 1901), says: "In addition to wages the married labourer has a house free of rent, a garden, firewood, pasturage and other perquisites. The enterprising labourer usually becomes a tenant and afterwards a farm-owner."

Value of farms and products.

The figures for farm capital and the value of agricultural products are so vast that it is extremely difficult to put them in an intelligible form. The farm capital of the United States reported by the census of 1900 reached $20,514,002,000, a sum more than four times the capital invested in manufactures, the main classes being, in round numbers:—Land, fences and buildings, $16,674,690,000; machines and implements, $761,262,000; live stock $3,078,050,000. The products of the farms in the census year 1899 were valued at $4,739,119,000. Between 1850 and 1900 the aggregate farm capital increased 416 %. The greatest increase of farm capital was between 1850 and 1860, 101 %; the next was the decade 1880–1890, when the increase was 32 %. Between 1890 and 1900 the increase was 28%.

TABLE XXIX.—*Number of Farms of Specified Tenure.*

Year.	Number of Farms.	Number of farms operated by			Percentage of farms operated by		
		Owners.[1]	Cash Tenants.	Share Tenants.[2]	Owners.	Cash Tenants.	Share Tenants.
1880	4,008,907	2,984,306	322,357	702,244	74·5	8·0	17·5
1890	4,564,641	3,269,728	454,659	840,254	71·6	10·0	18·4
1900	5,737,372	3,712,408	751,665	1,273,299	64·7	13·1	22·2

TABLE XXX.—*Number of Persons of Ten Years of Age and over in the different Agricultural Pursuits in 1900.*

Occupation.	Total Persons.
Dairymen and women	10,875
Farmers and farm superintendents . . .	5,674,875
Farm labourers	4,410,877
Gardeners, nurserymen and viticulturists .	61,788
Lumbermen and raftsmen	72,020
Stock-raisers, herders, &c.	84,988
Turpentine-farmers and labourers . . .	24,737
Wood-choppers	36,075
Other pursuits	5,530
Total . .	10,381,765

The growth of farm area and of capital invested in agriculture was followed by a proportionate increase in the chief crops (Table XXXI.).

The distinguishing feature of the period 1870–1880 was the rate of increase of barley, Indian corn, wheat and oats. Since 1870 the production of nearly all of the farm crops increased more rapidly than the population, the most absolute proof of the substantial prosperity of the people. The increase in population for the fifty years from 1840 to 1890 was 267 %; from 1870 to 1880, 30 %; from 1880 to 1890, 25 %; from 1890 to 1900, 21 %; but the food and other supplies far exceeded the demands of even this great population.

TABLE XXXI.—*Production of certain Farm Crops from 1870 to 1905—Millions of Bushels.*

	Indian Corn.	Wheat.	Oats.	Barley.
1870	1094	235	247	26
1880	1717	498	418	45
1890	1489	399	523	67
1900	2105	522	809	58
1905	2707	693	953	136

Table XXXII. gives important facts with regard to the cereal production of the United States between 1870 and 1905.

The average farm price of wheat declined, as is shown in that table, from $1·05 per bushel for the decade 1870–1880 to 65·3 cents for the period 1890–1899. The farm prices of the other cereals declined less during the thirty years. Corn declined from an average farm price of 42·6 cents per bushel for 1870–1880 to 34·4 cents in 1890–1899. The average production per acre shows nothing conclusive with regard to the fertility of the soil of the country. The expansion of the crop area usually causes a lowering of the average yield per acre by distributing the culture, fertilizers, &c., over more surface. Likewise the contraction of crop area will usually increase the average yield per acre of the entire country.

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[1] Includes farms operated by owners, part-owners, owners and tenants, and managers.

[2] Tenants of farms rented for a share of the products.

TABLE XXXII.—*Average Yield and Value of Cereal Crops in the United States, by Periods of Years*, 1870–1905.

Period.	Indian Corn.		Wheat.		Oats.	
	Average Farm Price per Bushel.	Average Yield per Acre.	Average Farm Price per Bushel.	Average Yield per Acre.	Average Farm Price per Bushel.	Average Yield per Acre.
	Dollars.	Bushels.	Dollars.	Bushels.	Dollars.	Bushels.
1870 to 1880 . .	0·426	27·1	1·05	12·4	0·353	28·4
1880 ,, 1889 . .	·393	24·1	·827	12·1	·309	26·6
1890 ,, 1899 . .	·344	24·1	·653	13·1	·277	26·2
1900 ,, 1905 . .	·440	24·9	·706	13·6	·318	30·7
	Barley		Rye		Buckwheat	
1870 ,, 1880 . .	0·738	22·1	0·701	14·1	0·715	17·7
1880 ,, 1889 . .	·589	21·7	·622	11·9	·642	12·8
1890 ,, 1899 . .	·433	23·3	·522	14·0	·507	16·8
1900 ,, 1905 . .	·433	25·9	·570	15·7	·588	17·9

The average yield of wheat per acre was 12·4 bushels in the decade 1870–1880, and 13·1 in the period 1890–1899; of Indian corn, 27·1 in 1870–1880, and 24·1 in 1880–1899 continuously. Oats fell off from 28·4 in 1870–1880 to 26·2 bushels per acre in 1890–1899. The averages for the years 1900–1905 show an increase over the previous decade both in yields and (with the exception of the price of barley) in prices of all the cereals.

The agricultural returns for 1890–1905 may be taken as an illustration of the cereal production of the United States. The figures for wheat, oats and Indian corn are presented in Tables XXXIII., XXXIV. and XXXV.

The acreage and production of wheat have steadily increased. The acreage in Indian corn, the great American crop, reached its highest in 1902, 94,043,613 acres, and its production its highest figure in 1905, 2,707,993,540 bushels.

Producing as the United States does so much more than its people can consume, its exports form a large percentage of some of the crops, as Table XXXVI. shows.

Large portions of some of these crops, like Indian corn and oats, are exported in the form of animals and animal products (meats, lard, hides, &c.). The hay crop is almost entirely used in this way, and the tendency is to convert more and more of these crops into these higher-priced products. Still, the time is far distant when domestic consumption will come anywhere near overtaking domestic production, especially of wheat and the other cereals. The certain extension of acreage with the growth of demand and price, the increased use of agricultural implements, and the improvement of methods will be sure to keep up a large surplus for export for many years to come. The Department of Agriculture has found that for home use there were required per head 5·5 bushels of wheat, 28·6 bushels of Indian corn, and 10·7 bushels of oats, the computations being made from the figures for population, production and exports for 1888–1892; in 1905, 6·15 bushels of wheat and wheat-flour, 28·59 bushels of Indian corn and corn-meal. The following number of acres in these crops was required, therefore, to supply the home demand for 1888–1892:—0·43 of an acre in wheat, 1·15 acre in corn, and 0·43 acre in oats per head of the population. Taking the year

TABLE XXXIII.—*Acreage, Production, Value, Prices and Exports of Wheat in the United States in* 1890–1905.

Year.	Acreage.	Average Yield per Acre.	Production.	Average Farm Price per Bushel, 1st Dec.	Farm Value, 1st Dec.	Domestic Exports, including Flour, Fiscal Years beginning 1st July.
	Acres.	Bushels.	Bushels.	Cents.	Dollars.	Bushels.
1890	36,087,154	11·1	399,262,000	83·8	334,773,678	106,181,316
1891	39,916,897	15·3	611,780,000	83·9	513,472,711	225,665,812
1892	38,554,430	13·4	515,949,000	62·4	322,111,881	191,912,635
1893	34,629,418	11·4	396,131,725	53·8	213,171,381	164,283,129
1894	34,882,436	13·2	460,267,416	49·1	225,902,025	144,812,718
1895	34,047,332	13·7	467,102,947	50·9	237,938,998	126,443,968
1896	34,618,646	12·4	427,684,346	72·6	310,602,539	145,124,972
1897	39,465,066	13·4	530,149,168	80·8	428,547,121	217,306,005
1898	44,055,278	15·3	675,148,705	58·2	392,770,320	222,694,920
1899	44,592,516	12·3	547,303,846	58·4	319,545,259	186,096,762
1900	42,495,385	12·3	522,229,505	61·9	323,515,177	215,990,073
1901	49,895,514	15·0	748,460,218	62·4	467,350,156	234,772,516
1902	46,202,424	14·5	670,063,008	63·0	422,224,117	202,905,598
1903	49,464,967	12·9	637,821,835	69·5	443,024,826	120,727,613
1904	44,074,875	12·5	552,399,517	92·4	510,489,874	44,112,910
1905	47,854,079	14·5	692,979,489	74·8	518,372,727	. .

TABLE XXXIV.—*Acreage, Production, Value, Prices, Exports and Imports of Oats in the United States in* 1890–1905.

Year.	Acreage.	Average Yield per Acre.	Production.	Average Farm Price per Bushel, 1st Dec.	Farm Value, 1st Dec.	Domestic Exports, including Oatmeal, Fiscal Years beginning 1st July.	Imports during Fiscal Years beginning 1st July.
	Acres.	Bushels.	Bushels.	Cents.	Dollars.	Bushels.	Bushels.
1890	26,431,369	19·8	523,621,000	42·4	222,048,486	1,382,836	41,848
1891	25,581,861	28·9	738,394,000	31·5	232,312,267	10,586,644	47,782
1892	27,063,835	24·4	661,035,000	31·7	209,253,611	2,700,793	49,433
1893	27,273,033	23·4	638,854,850	29·4	187,576,092	6,290,229	31,759
1894	27,023,553	24·5	662,036,928	32·4	214,816,920	1,708,824	330,317
1895	27,878,406	29·6	824,443,537	19·9	163,655,068	15,156,618	66,602
1896	27,565,985	25·7	707,346,404	18·7	132,485,033	37,725,083	893,908
1897	25,730,375	27·2	698,767,809	21·2	147,974,719	73,880,307	25,093
1898	25,777,110	28·4	720,906,643	25·5	186,405,364	33,534,264	28,098
1899	26,341,380	30·2	796,177,713	24·9	198,167,975	45,048,857	54,576
1900	27,364,795	29·6	809,125,989	25·8	208,669,233	42,268,931	32,107
1901	28,541,476	25·8	736,808,724	39·9	293,658,777	13,277,612	38,978
1902	28,653,144	34·5	987,842,712	30·7	303,584,852	8,381,805	150,065
1903	27,638,126	28·4	784,094,199	34·1	267,661,665	1,960,740	183,983
1904	27,842,669	32·1	894,395,552	31·3	279,900,013	8,394,692	55,699
1905	28,046,746	34·0	953,216,197	29·1	277,047,537	. .	. .

TABLE XXXV.—*Acreage, Production, Value, Prices and Exports of Indian Corn in the United States in 1890–1905.*

Year.	Acreage.	Average Yield per Acre.	Production.	Average Farm Price per Bushel, 1st Dec.	Farm Value, 1st Dec.	Domestic Exports, including Corn-Meal, Fiscal Years beginning 1st July.
	Acres.	Bushels.	Bushels.	Cents.	Dollars.	Bushels.
1890	71,970,763	20·7	1,489,970,000	50·6	754,433,451	32,041,529
1891	76,204,515	27·0	2,060,154,000	40·6	836,439,228	76,602,285
1892	70,626,658	23·1	1,628,464,000	39·4	642,146,630	47,121,894
1893	72,036,465	22·5	1,619,496,131	36·5	591,625,627	66,489,529
1894	62,582,269	19·4	1,212,770,052	45·7	554,719,162	28,585,405
1895	82,075,830	26·2	2,151,138,580	25·3	544,985,534	101,100,375
1896	81,027,156	28·2	2,283,875,165	21·5	491,006,967	178,817,417
1897	80,095,051	23·8	1,902,967,933	26·3	501,072,952	212,055,543
1898	77,721,781	24·8	1,924,184,660	28·7	552,023,428	117,255,046
1899	82,108,587	25·3	2,078,143,933	30·3	629,210,110	213,123,412
1900	83,320,872	25·3	2,105,102,516	35·7	751,220,324	181,405,473
1901	91,349,928	16·7	1,522,519,891	60·5	921,555,768	28,028,688
1902	94,043,613	26·8	2,523,648,312	40·3	1,017,017,349	76,639,261
1903	88,091,993	25·5	2,244,176,925	42·5	952,868,801	58,222,061
1904	92,231,581	26·8	2,467,480,934	44·1	1,087,461,440	90,293,483
1905	94,011,369	28·8	2,707,993,540	41·2	1,116,696,738	..

1890 as an illustration, this gave a surplus area in wheat of 11,264,478 acres, of 2,648,404 acres in Indian corn, and of 238,162 acres in oats.

Tables XXXVII. and XXXVIII. give the number, total value and average price of farm animals in 1880, 1890, 1900 and 1906.

TABLE XXXVI.—*Percentage of Crops Exported. Averages for Period 1878–1905.*

Crop.	Annual Average.				1905.
	1878–1882.	1888–1892.	1894–1896.	1896–1904.	
Wheat . . .	27·84	17·68	15·96	29·9	7·99
Indian corn . .	4·82	3·49	5·39	6·4	3·66
Rye . . .	10·30	. .	12·21	19·5	. .
Oats . . .	·37	·80	2·22	3·7	. .
Barley . . .	1·55	. .	12·96	12·15	. .
Potatoes . . .	·37	. .	·30	0·31	. .
Cotton . . .	72·80	66·79	73·60	66·3[1]	61·55

TABLE XXXVII.—*Number and Value of Farm Animals in the United States, 1880–1906.*

January 1.	Horses.		Mules.		Milch Cows.	
	Number.	Value.	Number.	Value.	Number.	Value.
1880	11,201,800	$613,296,611	1,729,500	$105,948,319	12,027,000	$279,899,420
1890	14,213,837	978,516,562	2,331,027	182,394,099	15,952,883	352,152,133
1900	13,537,524	603,969,442	2,086,027	111,717,092	16,292,360	514,812,106
1906	18,718,578	1,510,889,906	3,404,061	334,680,520	19,793,866	582,788,592

January 1.	Other Cattle.		Sheep.		Swine.		Total Value of Farm Animals.
	Number.	Value.	Number.	Value.	Number.	Value.	
1880	21,231,000	$341,761,154	40,765,900	$90,230,537	34,034,100	$145,781,515	$1,576,917,556
1890	36,849,024	560,625,137	44,336,072	100,659,761	51,602,780	243,418,336	2,418,766,028
1900	27,610,054	689,486,260	41,883,065	122,665,913	37,079,356	185,472,321	2,228,123,134
1906	47,067,656	746,171,709	50,631,619	179,056,144	52,102,847	321,802,571	3,675,389,442

TABLE XXXVIII.—*Average Value of Farm Animals in the United States on 1st January, 1880–1906.*

Year.	Horses.	Mules.	Milch Cows.	Other Cattle.	Sheep.	Swine.
1880	$54·75	$61·26	$23·27	$16·10	$2·21	$4·28
1890	68·84	78·25	22·14	15·21	2·27	4·72
1900	44·61	53·56	31·60	24·97	2·93	5·00
1906	80·72	98·31	29·44	15·85	3·54	6·18

After the Civil War the number of horses increased and prices gradually declined. In 1893 the number of horses reached 16,206,802 (an increase of over 5,005,002 or 44·6 % over the number in 1880), and in 1906, 18,718,578. The average farm price of horses increased from $54·75 in 1880 to $74·64 in 1884, after which there was a decrease to $31·51 in 1896, followed by a rise to $80·72 in 1906. The extension of street-car lines, and the substitution of cable and electric power for that of horses, the use of bicycles and, later, of automobiles, and the improvement of farm-machinery, in which horses are less and less used as power-producers and steam is more common, have been factors in decreasing the demand for these animals. The fluctuation in prices of mules has been parallel to that for horses.

The returns for milch cows show an increase throughout the period 1880–1899 in every year, with the exception of 1895–1899, after which there was a steady rise in numbers. For the first ten years the numbers increased 32·6 %, and from 1890 to 1899, ·2 %. The total value of milch cows increased each year until 1884, then decreased until 1891, with a gradual increase until the end of the period. The farm price of milch cows rose from $23·27 in 1880 to $31·37 in 1884, then fell to $21·40 in 1892, after which there was a steady increase to $31·60 in 1899, and afterwards a slight fall, $29·44 being the average farm value on the 1st of January 1906.

No marked changes in the numbers of sheep have taken place. During the period 1880–1890 there was an increase in numbers amounting to about 8·8 %. After 1893 there was a rather steady decrease, with fluctuations amounting to a marked depression after 1894. This industry is very susceptible to adverse influences, and felt keenly a depression in the price of wool. The increase began again in 1898, and in 1903 the figure of 63,964,876 was reached; in 1906 it was 50,631,619.

The numbers and values of swine constantly fluctuate with the movement and value of the Indian corn crops. The returns for 1890 (51,602,780) showed a numerical increase of 51·6 % over those of 1880; then followed a steady decrease in numbers down to 1900 (37,079,356), since which time there has been considerable increase, so that in 1906 there were 52,102,847—the maximum excepting 1901, when there were 56,982,142 swine on farms. The movement in values was similar to that in numbers. From $4·28 in 1880, the average farm price of hogs increased steadily to $6·75 in 1883. The lowest figure, $4·15, was reached in 1891, and after numerous fluctuations it became $4·40 in 1899 and $7·78 in 1903; in 1906 it was $6·18.

The total value of farm animals showed a steady increase from 1880 to 1890, with slight variations in 1885 and 1886. Following 1890 there was a steady decrease with the exception of slight increases in 1892 and 1893. In 1880 the total value of farm animals in the United States was $1,576,917,556. In 1890 it had increased to $2,418,766,028, or 53·4 %. In 1896 the value had diminished to $1,727,926,084—a decrease of 28·6 % from the 1890 values, and an increase of 9·6 % over those of 1880. The value in 1906 showed an increase of 133 % over that of 1880.

The exports of live stock and its products have increased enormously in recent years, both in quantity and value. This is especially true of the exportation of beef, cattle and meat products. The exports of cattle increased from 182,750 in 1880 to 331,720 in 1895, or 81½ %, and to 567,806 in 1905 or 210 % over 1880, and values from $13,340,000 in 1880 to $30,600,000 in 1895, an increase of 129 %, and to $40,590,000 in 1905 or 204 %. The average value of cattle exported increased from $19 in 1870 to $73 in 1880 and $92 in 1895, decreasing to $71·50 in 1905. Only the best and heaviest cattle are exported, these, of course, commanding a much higher price than the average of the country.

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[1] For 1899-1900 to 1904-1905

The total value of farm animals exported from the United States has fluctuated greatly. On the whole, however, the value increased from $16,000,000 in round numbers in 1880 to $46,500,000 in 1905, or 190 %. Table XXXIX. shows the number and value of live animals exported between 1880 and 1905.

Table XXXIX.—*Number and Value of Farm Animals exported from the United States, 1880–1905.*

Year ending 30th June.	Horses.		Mules.		Cattle.		Sheep.		Swine.		Total Value.
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	
1880	3,060	$675,139	5,198	$532,362	182,756	$13,344,195	209,137	$892,647	83,434	$421,089	$15,865,432
1885	1,947	377,692	1,028	127,580	135,890	12,906,690	234,509	512,568	55,025	579,183	14,503,713
1890	3,501	680,410	3,544	447,108	394,836	31,261,131	67,521	243,077	91,148	909,042	33,540,768
1894	5,246	1,108,995	2,063	240,961	359,278	33,461,922	132,370	832,763	1,553	14,753	35,659,394
1895	13,984	2,209,298	2,515	186,452	331,722	30,603,796	405,748	2,630,686	7,130	72,424	35,702,656
1900[1]	64,722	7,612,616	43,369	3,919,478	397,286	30,635,153	125,772	733,477	51,180	394,813	43,295,537
1901[1]	82,250	8,873,845	34,405	3,210,267	459,218	37,566,980	297,925	1,933,000	22,318	238,465	51,822,557
1902[1]	103,020	10,048,046	27,586	2,692,298	392,884	29,902,212	358,720	1,940,060	8,368	88,330	44,670,946
1903	34,007	3,152,159	4,294	521,725	402,178	29,848,936	176,961	1,067,860	4,031	40,923	34,631,603
1904	42,001	3,189,100	3,658	412,971	593,409	42,256,291	301,313	1,954,604	6,345	53,780	47,866,746
1905	34,822	3,175,259	5,826	645,464	567,806	40,598,048	268,365	1,687,321	44,496	414,692	46,520,784

Since 1890 there has been a great development in the production of fruit and vegetables. Local market gardens are numerous in the vicinity of all cities, and highly specialized "truck gardening," that is, the growing of early fruits and vegetables for transportation to distant markets where the seasons are later, has made rapid progress in the South Atlantic states. The census reports of 1900 use the potato acreage in these states as an index of the rate of development of truck gardening; the southern potato being largely a truck garden crop. In seven counties of Virginia the increase in acreage from 1889 to 1899 was 100 %; in eleven counties of North Carolina, 314 %; in five counties of South Carolina, 134 %; in nine counties of Georgia, 111 %; in six counties of Florida, 309 %; in five counties of Alabama, 277 %. Irish and sweet potatoes are the most important vegetables raised; the North Central states leading in the production of the former and the South Atlantic states in the production of the latter. The growth of the Irish potato industry is shown by the following table:—

Year.	Acreage.	Yield (bushels).
1870	1,325,119	114,775,000
1880	1,842,510	167,659,570
1890	2,651,579	148,289,696
1900	2,611,054	210,926,897
1905	2,996,757	260,741,294

The production of sweet potatoes, as reported in census years, was as follows:—

Year.	Acreage.	Yield (bushels).
1869	. .	21,709,824
1879	444,817	33,378,693
1889	524,588	43,950,261
1899	537,447	42,526,696

The total acreage in vegetables reported in 1899 was 5,753,191 or 2 % of the acreage in all crops; the value of the yield was $242,170,148 or 8·3 % of the value of all crops.

The value of the fruit crop of 1899 was $131,423,517; the value of orchard fruits was $83,751,840; of grapes, $14,090,937; of small fruits, $25,030,877; of sub-tropical fruits, $8,549,863. The development of fruit-growing during the decade 1889–1899 appears from the following table:—

Crop.	Yield (bushels).	
	1889.	1899.
Apples	143,105,689	175,397,626
Apricots	1,001,482	2,642,128
Cherries	1,476,719	2,873,499
Peaches	36,367,747	15,433,623[2]
Pears	3,064,375	6,625,417
Plums and Prunes .	2,554,392	8,764,032

In 1899 California contributed 21.5 % of the fruit crop; New York, 12·1 %; Pennsylvania, 7·5 %; Ohio, 6·8 %; and Michigan 4·5 %.

Agricultural Education.

The agricultural schools of the United States owe their origin to the movement against the old classical school and in favour of technical education which began in most civilized nations about the middle of the 19th century. A rapidly growing country with great natural resources needed men educated in the sciences and arts of life, and this want was first manifested in the United States by a popular agitation on behalf of agricultural schools. A number of so-called agricultural schools were started between 1850 and 1860 in the eastern and middle states, where the movement made itself most felt, but without trained teachers and suitable methods they accomplished very little. They were only ordinary schools with farms attached. The second constitution of the state of Michigan, adopted in 1850, provided for an agricultural school, and this was the first one established in the United States. The General Assembly of the state of Pennsylvania incorporated the Farmers' High School, now the State College, in 1854. Maryland incorporated her agricultural college in 1856, and Massachusetts chartered a school of agriculture in the same year. The agitation, which finally reached Congress, led to the establishment of the so-called "land-grant" or agricultural colleges. The establishment of these colleges was due chiefly to the wisdom and foresight of Justin S. Morrill, who introduced the first bill for their endowment in the House of Representatives on the 14th of December 1857, saw the latest one approved by the president on the 30th of August 1890, and is justly known, therefore, as the father of the American agricultural colleges. The first act for the benefit of these colleges, passed in 1862, was entitled "An Act donating public lands to the several states and territories which may provide colleges for the benefit of agriculture and the mechanic arts," and granted to each state an amount of land equal to 30,000 acres for each senator and representative in Congress to which the state was entitled at that time. The object of the grant was stated to be "the endowment, support and maintenance of at least one college" (in each state), "where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts . . . in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life." The total number of acres of land granted to the states under this act was 10,320,843, of which by far the greater part is sold. This grant has produced an endowment fund amounting to $12,045,629. The land still unsold in 1905 amounted to 844,164 acres, valued at $4,168,746. The invested land-grant funds yielded these colleges a total annual income of $855,083 in 1905. Including the United States appropriation under a supplementary act of 1890, commonly known as the Second Morrill Act, which now gives each college $25,000 a year, the interest on the land-grant and all other invested funds, all state appropriations and other sources of revenue, these colleges had in 1904–1905 a total income of $11,659,955. Sixty-six institutions had been organized under this act up to 1905, of which sixty-three maintain courses in agriculture; twenty-one are departments of agriculture and engineering in state universities; twenty-seven are separate colleges of agriculture and mechanic arts; and the remainder are organized in various other ways. Separate schools for persons of African descent had been established under this act in sixteen southern states. These colleges take students prepared in the common schools and give them a course of from two to four years in the sciences pertaining to agriculture. Many of them offer short courses, varying from four to twelve weeks in length, in agriculture, horticulture, forestry and dairying, which are largely attended. Agricultural experiment stations are connected with all the colleges, and many of them conduct farmers' institutes, farmers' reading clubs and correspondence classes.

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[1] The demand for horses for the British troops in South Africa affected these years.

[2] Decrease due to a severe frost in the winter of 1898–1899, which destroyed the peach crop in most of the states.

The agricultural experiment stations of the United States grew up in connexion with the agricultural colleges. Several of the colleges early attempted to establish separate departments for research and practical experiments, on the plan of the German stations. The act establishing the Agricultural College of Maryland required it to conduct " a series of experiments upon the cultivation of cereals and other plants adapted to the latitude and climate of the state of Maryland." This was the first suggestion of an experiment station in America, but resulted in little. The first experiment station was established at Middletown, Connecticut, in 1875, partly under state aid, partly through a gift from Orange Judd, partly in connexion with the Sheffield Scientific School, which from 1863 to 1892 was the College of Agriculture and Mechanic Arts for the state of Connecticut, and partly under control of Wesleyan University, which contributed the use of its chemical laboratory; in 1877 it was removed to New Haven. The state of Connecticut made in 1875 an appropriation of $2800 (and in 1877 $5000 per annum) for this school—the first state appropriation of the kind. The state of North Carolina established, on the 12th of March 1877, an agricultural experiment and fertilizer control station in connexion with its state university. The Cornell University experiment station was organized by that institution in 1879. The New Jersey station was organized in 1880 and the station of the University of Tennessee in 1882. From these beginnings the experiment stations multiplied until, when Congress passed the National (or Hatch) Experiment Station Act in 1887, there were seventeen already in existence. The Hatch Experiment Station Act, so called from the fact that its leading advocate was William Henry Hatch (1833–1896) of Missouri, appropriated $15,000 a year to each agricultural college for the purpose of conducting an agricultural experiment station. The object of the stations was declared to be, " to conduct original researches or verify experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural or artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective states or territories." The stations were authorized to publish annual reports and also bulletins of progress for free distribution to farmers. The franking privilege was given to these publications. The office of experiment stations, in the Department of Agriculture, was established in 1888 to be the head office and clearing-house of these stations. Agricultural experiment stations are now in operation in all the states and territories, including Alaska, Hawaii, Porto Rico and the Philippines. Alabama, Hawaii, Connecticut, New Jersey and New York each maintain separate stations, supported wholly or in part by state funds; Louisiana has a station for sugar, and Missouri for fruit experiments. Excluding all branch stations, the total number of experiment stations in the United States is sixty, and of these fifty-five receive the national appropriation. The total income of the stations during 1904 was $1,508,820, of which $720,000 was received from the national government and the remainder was derived from societies, fees for analyses of fertilizers, sale of products, &c. The stations employed 795 persons in the work of administration and research; the chief classes being—directors, 71; chemists, 163; agriculturists, 47; agronomists, 41; besides numerous horticulturists, botanists, entomologists, physicists, bacteriologists, dairymen, weather observers and irrigation experts. The stations publish annual reports and bulletins, besides a large number of " press " bulletins, which are reproduced in the agricultural and county papers. They act as bureaus of information on all farm questions, and carry on an extensive correspondence covering all conceivable questions. Their mailing lists aggregate half a million names. In addition to the experiment stations there is in nearly every state an officer or a special board whose duty is to look after its agricultural interests. Eighteen states, one territory, Porto Rico and the Philippine Islands have a single official, usually called the Commissioner of Agriculture. Twenty-six states, one territory and Hawaii, have Boards of Agriculture. Information concerning the Agricultural Department of the United States will be found under Agriculture, Board of.

See the articles on the various sorts of crops; also Cattle, Horse, Pig, Sheep, &c.; Dairy and Dairy-Farming, Horticulture, Fruit and Flower-Farming, Poultry and Poultry-Farming; Soil, Grass and Grassland, Manure, Drainage of Land, Irrigation, Sowing, Reaping, Hay and Hay-Making, Plough, Harrow, Threshing.

Literature.—Besides the contemporary works cited in the text, see the article " Agricultura " in Smith's *Dictionary of Greek and Roman Antiquities* (1890), and the article " Agriculture " in J. A. Barral's *Dictionnaire d'Agriculture* (1885–1892); R. E. Prothero, *Pioneers and Progress of English Farming* (1888); sections on agriculture by W. J. Corbett, R. E. Prothero and W. E. Bear in Traill's *Social England* (1901–1904); J. E. T. Rogers, *History of Agriculture and Prices in England from 1259 to 1793* (7 vols., 1866–1902); W. Cunningham, *Growth of English Industry and Commerce during the Early and Middle Ages* (2 vols., 1905 and 1907); D. M'Donald, *Agricultural Writers from Sir Walter of Henley to Arthur Young, 1200–1800* (London, 1908); H. Rider Haggard, *Rural England*, 2 vols. (1902); *Encyclopaedia of Agriculture*, ed. by C. E. Green and D. Young (Edinburgh, 1907–1908); *Cyclopaedia of American Agriculture*, ed. by L. H. Bailey (New York and London, 1907–1908); W. S. Harwood, *The New Earth* (New York, 1906); T. B. Collins, *The New Agriculture* (New York, 1906); Journals of the Royal Agricultural Society of England and other agricultural societies. Amongst general works on practical agriculture the following may be mentioned:—Stephens's *Book of the Farm*, 3 vols., revised by J. Macdonald (Edinburgh, 1908); William Fream, *Elements of Agriculture* (London, 1905); *Rural Science Series*, ed. by L. H. Bailey (New York and London, 1895, &c.); *Morton's Handbooks of the Farm* (London); R. Wallace, *Farm Livestock of Great Britain* (Edinburgh, 1907); *Youatt's Complete Grazier*, rewritten by W. Fream (London, 1900); E. V. Wilcox, *Farm Animals* (New York, 1907). (W. Fr.; R. Tr.)

AGRICULTURE, BOARD OF. The Board of Agriculture and Fisheries, in England, owes its foundation to the establishment of a veterinary department of the privy council in 1865, when the country was ravaged by cattle plague. An order in council abolished the name " veterinary department " in 1883 and substituted that of " agricultural department," but no alteration was effected in the work of the department, so far as it related to animals. In 1889 the Board of Agriculture (for Great Britain) was formed under an act of parliament of that year, and the immediate control of the agricultural department was transferred from the clerk of the privy council to the secretary of the Board of Agriculture, where it remains.

A minister of agriculture had for years been asked for in the interests of the agricultural community, and the functions of this office are discharged by the president of the Board of Agriculture and Fisheries, whose appointment is a political one, and may or may not carry with it a seat in the cabinet. The board consists of the lord president of the council, the five principal secretaries of state, the first lord of the treasury, the chancellor of the exchequer, the chancellor of the duchy of Lancaster and the secretary for Scotland. The establishment consists of a president, secretary, assistant secretaries, &c. The salary of the president is £2000 a year, and that of the secretary £1500 a year.

The Board of Agriculture on its establishment took over from the privy council the responsibilities of the Contagious Diseases (Animals) Acts, besides the comprehensive duties of the Land Commission. The board, through its intelligence division, collects and prepares statistics relating to agriculture and forestry, and in 1904 appointed a number of honorary agricultural correspondents throughout the country for the purpose of bringing to the notice of the board any special circumstances affecting the practice of agriculture, horticulture and forestry, or the transport of farm, garden and forest produce in their districts. The land division of the board prepares the annual agricultural and produce returns, and the three divisions, the animals, intelligence and land, take proceedings under the following acts:—the Diseases of Animals Acts, the Markets and Fairs (Weighing of Cattle) Acts, the Sale of Food and Drugs Acts 1875 to 1899, the Merchandise Marks Acts 1887 to 1905, the Fertilizers and Feeding Stuffs Act 1893, the Tithe Acts 1836 to 1891, the Copyhold Act 1894, the Inclosure Acts 1845 to 1899, the Agricultural Holdings Acts 1883 to 1900, the Drainage and Improvement of Land Acts, the Universities and College Estates Acts 1858 to 1898, the Glebe Lands Act 1888, &c. The board also has charge of the inspection of schools (not being public elementary schools) in which technical instruction is given in agriculture or forestry, and institutes such experimental investigations as may be deemed conducive to the progress of agriculture and forestry.

The Ordnance Survey of the United Kingdom is under the control of the board, as well as the arrangements for the advertisement and sale of the publications of the Geological Survey. In 1903 the powers and duties formerly vested in the commissioners of the Office of Works, relating to the Royal Botanic Gardens, Kew, were transferred to the board. The various departments of the board are (1) chief clerk's branch and indoor branch of animals division; (2) outdoor branch of the animals division; (3) veterinary department; (4) fisheries branch; (5) intelligence department; (6) educational branch; (7) accounts branch; (8) inclosure and common branch; (9) copyhold and tithe branch; (10) statistical branch; (11) law branch; (12) survey, land improvement and land drainage branch.

In 1903, in pursuance of the Board of Agriculture and Fisheries Act 1903, the powers and duties of the Board of Trade under the Salmon and Freshwater Fisheries Acts, the Sea Fisheries Regulation Acts and other acts relating to the industry of fishing, were transferred from that department to the Board of Agriculture, and its name was changed to its present form. The Department of Agriculture and Technical Instruction for Ireland covers much the same ground. The *Annual Report of the Proceedings of the Board of Agriculture under the Tithe and other Acts for 1902* contains a full account of its powers and duties.

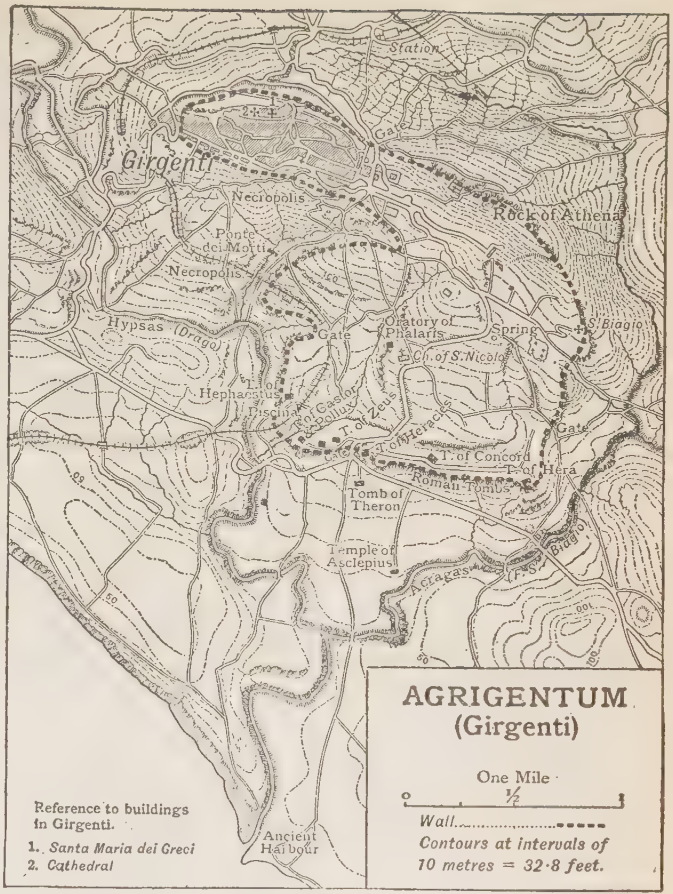
In the British colonies the interests of agriculture are looked after—in New South Wales, by an under-secretary for mines and agriculture; in Victoria, by a member of the executive council who holds the portfolio of lands and agriculture; in Queensland, by an under-secretary for agriculture; in New Zealand, by a minister for lands and agriculture; in Canada (see, for more detail, the article Canada, *Canadian Agriculture*), by a minister for agriculture (the various provinces have also departments of agriculture). The government of India has a secretary of revenue and agriculture. Cape Colony has a secretary for agriculture, a member of the cabinet; in the Transvaal Colony the director of agriculture is a departmental secretary; in Natal, the minister for agriculture is a member of the executive council, and the establishment consists, in addition, of a secretary, a director of agriculture, an entomologist, a dairy expert and a conservator of forests. Cyprus has a director of agriculture.

United States.—The Department of Agriculture dates its rank as an executive department from 1889. It was first established as a department in 1862, ranking as a bureau, with a commissioner in charge. In addition to the commissioner there were appointed a statistician, chemist, entomologist and superintendent of a propagatory and experimental farm. Its scope was then somewhat limited, but its work was gradually enlarged by the appointment of a botanist in 1868, a microscopist in 1871, the creation of a forestry department in 1877, a bureau of animal industry in 1884 and the establishment of agricultural experiment stations throughout the country in 1887. In 1889 the department became an executive department, the principal official being designated Secretary of Agriculture, with a seat in the president's cabinet. His salary is $8000 a year. The secretary is now charged with the supervision of all business relating to the agricultural and productive industries. The fisheries have a separate bureau, and the public lands and mining interests are cared for in the Department of the Interior; but with these exceptions, all the productive interests are looked after by the Department of Agriculture. The department now comprises (1) the weather bureau, which has charge of the forecasting of weather; the issue of storm warnings; the display of weather and flood signals for the benefit of agriculture, commerce and navigation; the gauging and reporting of rivers; the reporting of temperature and rainfall conditions for the cotton, rice, sugar and other interests; the display of frost and cold waves signals; and the distribution of meteorological information in the interest of agriculture and commerce; (2) the bureau of animal industry, which makes investigations as to the existence of contagious pleuro-pneumonia and other dangerous and communicable diseases of live stock, superintends the measures for their extirpation, makes original investigations as to the nature and prevention of such diseases, and reports on the conditions and means of improving the animal industries of the country; (3) the bureau of plant industry, which studies plant life in all its relations to agriculture. Its work is classified under the general subjects of pathological investigations, physiological investigations, taxonomic investigations, agronomic investigations, horticultural investigations and seed and plant introduction investigations; (4) the forest service, which is occupied with experiments, investigations and reports dealing with the subject of forestry, and with the dissemination of information upon forestry matters; (5) the bureau of chemistry, which investigates methods proposed for the analysis of plants, fertilizers and agricultural products, and makes such analyses as pertain in general to the interests of agriculture; (6) the bureau of soils, which is entrusted with the investigation, survey and mapping of soils; the investigation of the cause and prevention of the rise of alkali in the soil and the drainage of soils; and the investigation of the methods of growing, curing and fermentation of tobacco in the different tobacco districts; (7) the bureau of entomology, which obtains and disseminates information regarding insects injurious to vegetation; (8) the bureau of biological survey, which studies the geographic distribution of animals and plants, and maps the natural life zones of the country; it also investigates the economic relations of birds and mammals, and recommends measures for the preservation of beneficial, and the destruction of injurious, species; (9) the division of accounts and disbursements; (10) the division of publications; (11) the bureau of statistics, which collects information as to the condition, prospects and harvests of the principal crops, and of the number and status of farm animals. It records, tabulates and co-ordinates statistics of agricultural production, distribution and consumption, and issues monthly and annual crop reports for the information of producers and consumers. The section of foreign markets makes investigations and disseminates information concerning the feasibility of extending the demands of foreign markets for the agricultural products of the United States; the bureau also makes investigations of land tenures, cost of producing farm products, country life education, transportation and other lines of rural economies; (12) the library; (13) the office of experiment stations which represents the department in its relations to the experiment stations which are now in operation in all the states; it collects and disseminates general information regarding agricultural schools, colleges, stations, and publishes accounts of agricultural investigations at home and abroad; it also indicates lines of inquiry for the stations, aids in the conduct of co-operative experiments, reports upon their expenditures and work, and in general furnishes them with such advice and assistance as will best promote the purposes for which they were established; it conducts investigations relative to irrigation and drainage; (14) the office of public roads, which collects information concerning systems of road management, conducts investigations regarding the best method of road-making, and prepares publications on this subject.

In the following countries there are state departments of agriculture:—Argentina, Belgium, Brazil, (industry, agriculture and public works), Bulgaria (commerce and agriculture), Denmark, France, Norway (agriculture and public accounts), Italy, Japan (agriculture and commerce), Prussia (agriculture, woods and forests), Russia (agriculture and crown domains), Sweden.

AGRIGENTUM (Gr. Ἀκράγας, mod. *Girgenti* (*q.v.*)), an ancient city on the south coast of Sicily, 2½m. from the sea. It was founded (perhaps on the site of an early Sicanian settlement) by colonists from Gela about 582 B.C., and, though the lastest city of importance founded by the Greeks in Sicily, soon acquired a position second to that of Syracuse alone, owing to its favourable situation for trade with Carthage and to the fertility of its territory. Pindar (*Pyth.* xii. 2) calls it καλλίστα βροτεᾶν πολίων. The buildings for which it is famous all belong to the first two centuries of its existence. Phalaris, who is said to have roasted his enemies to death in a brazen bull (Pindar, *Pyth.* i. 184), ruled as tyrant from 570 to 554. What form of government was established after his fall is uncertain; we know only that, after a long interval, Theron became tyrant (488–473); but his son Thrasydaeus was expelled after an unsuccessful war with Hiero in 472 and a democracy established. In the struggle between Syracuse and Athens (415–413) the city remained absolutely neutral. Its prosperity continued to increase (its population is given at over 200,000) until in 405 B.C., despite the help of the Siceliot cities, it was captured and plundered by the Carthaginians, a blow from which it never entirely recovered. It was colonized by Timoleon in 338 B.C. with settlers from Velia in Lucania, and in the time of the tyrant Phintias (289–279) it had regained some of its power. In the First Punic War, however, it was sacked by the Romans (261) and the Carthaginians (255), and finally in the Second Punic War by the Romans (210). But it still retained its importance as a trading and agricultural centre, even in the Roman period, exporting not only agricultural products but textile fabrics and sulphur. In the local museum are tiles used for stamping cakes of sulphur, which show that the mines, at any rate from the 3rd century, were imperial property leased to contractors.

The site is one of great natural strength and remarkable beauty, though quite unlike that of other Greek cities in Sicily. The northern portion of it consists of a lofty ridge with two summits, the westernmost of which is occupied by the modern town (985 ft.), while the easternmost, which is slightly higher, bears the name of Rock of Athena, owing to its identification in modern days with the acropolis of Acragas as described by Polybius, who places upon it the temple of Zeus Atabyrius (the erection of which was attributed to the half mythical Phalaris) and that of Athena.[1] It must be confessed that the available space (about 70×20 yds.) on the eastern summit (where there are some remains of ancient buildings) is so small that there would be only room for a single temple, which must have been occupied by the two deities jointly, if the new theory is correct (see *Notizie degli scavi*, 1902, 387 and reff.). In the modern town, on the other hand, the remains of one temple are to be seen in the church of S. Maria dei Greci, while the other is generally supposed to have occupied the site of the cathedral, though no traces of it are visible. But whichever of these two summits was the acropolis proper,[2] it is certain that both were included in the circuit of the city walls. On the north both summits are defended by cliffs; on the south the ground slopes away somewhat abruptly from the eastern summit towards the plateau on which the town stood, while the western summit is separated from this plateau by a valley traversed by a branch of the Hypsas [mod. *Drago*], the deep ravine of which forms the western boundary and defence of the city. On the east of the city is the valley of the Acragas [Fiume S. Biagio], from which the city took its name and which, though shallower than that of the Hypsas, still affords a sufficient obstacle to attack, and the two unite a little way to the south of the town; at the mouth was the ancient harbour, small and now abandoned.



The most famous remains of the ancient city are the temples, the most important of which form a row along the low cliffs at the south end of the city. All are built in the Doric style, of the local porous stone, which is of a warm red brown colour, full of fossil shells and easily corroded when exposed to the air. It should be noted that their traditional names, with the exception of that of Zeus and that of Asclepius, have no foundation in fact, while the attribution of the temple *in antis*, into the *cella* of which the church of S. Biagio has been built, is uncertain.[3] They are described in R. Koldewey and O. Puchstein, *Die griechischen Tempel in Unteritalien und Sicilien* (Berlin, 1899), 138–184. Of all these temples the oldest is probably that of Heracles, while the best preserved are those of Hera and Concordia, which are very similar in dimensions; the latter, indeed, lacks nothing but its roof, owing its preservation to its conversion into the cathedral in 597 by Gregory II., bishop of Girgenti. Both temples belong to the best period of the Doric style and are among the finest in existence. In front of the former, as in front of those of Heracles and Zeus, stood a huge altar for burnt offerings, as long as the façade of the temple itself. The *cella* of the temple of Heracles underwent considerable modifications in Roman times, and the discovery in it of a statue of Asclepius seems to show that the cult of this deity superseded the original one.

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[1] E. A. Freeman, *History of Sicily* (Oxford, 1891), i. 433, accepts the name "Rock of Athena" and yet puts the acropolis on the site of the modern town, arguing further that the cathedral hill was an acropolis within an acropolis (II. and XVII.).

[2] Some writers place Kamikos, the city of the mythical Sican Kokalos, on the site of Acragas or its acropolis; but it appears to have lain to the north-west, possibly at Caltabellotta, 10m. north-east of Sciacca. We hear of it even in the Punic Wars as a fortified post of Acragas (E. A. Freeman, *Hist. of Sic.* i. 495).

[3] The attribution to Demeter is supported by the discovery of votive terra-cottas, representing Demeter and Kore in the neighbourhood, while the conjecture that it was dedicated to the river-god Acragas rests on its position above the river, in the valley of which, indeed, a statue which may represent the deity has been discovered.

In the colossal temple of Zeus the huge Atlantes (figures of Atlas), 25 ft. in height, are noticeable. They seem to have stood in the intercolumniations half-way up the outside wall and to have supported the epistyle. The collapse both of this temple and of that of Heracles must be attributed to an earthquake; many fallen blocks of the former were removed in 1756 for the construction of the harbour of Porto Empedocle. The four columns erected on the site of the temple of Castor and Pollux are a modern (and incorrect) restoration in which portions of two buildings have been used. Of that of Hephaestus only two columns remain, while of that of Asclepius, a mile to the south of the town, an *anta* and two pillars are preserved. It was in the latter temple that the statue of the god by Myron stood; it had probably been carried off to Carthage, was given to the temple by P. Scipio Africanus from the spoils of that city and aroused the cupidity of Verres.

The other remains within the city walls are of surprisingly small importance; near the picturesque church of S. Nicolo is the so-called Oratory of Phalaris, a shrine of the 2nd century B.C., 27¼ ft. long (including the porch) by 23⅓ ft. wide; and not far off on the east is a large private house with white tesselated pavements, probably pre-Roman in origin but slightly altered in the Roman period (R. P. Jones and E. A. Gardner in *Journal of Hellenic Studies*, xxvi., 1906, 207). Foundations of other buildings are to be seen in other parts of the site, but of little interest. The huge fishpond, spoken of by Diodorus as being 7 stadia in circumference (xi. 25), is to be seen at the south-west corner of the city; it is an enormous excavation in the rock with drains in its sides, at the bottom of which there is now a flourishing orange garden.

	Demeter (Acragas?).	Hera Lacinia.	Concordia.	Heracles.	Zeus.	Castor and Pollux.	Unnamed near Castor and Pollux.	Hephaestus.	Asclepius.	Athena.
Length excluding steps[1]	90?	125	129¼	220	361	. .	. .	. .	. .	. .
Breadth	40½	55½	55½	83	173⅓	. .	67¼	51½	30½	45
Length of cella	. .	93	96¼	156	332	91	. .	. .	. .	. .
Breadth of cella	. .	32½	31½	45¾	144¼	33	. .	. .	. .	. .
Height of columns with capitals	. .	21	22	33	62½?	19½	. .	. .	. .	. .
Diameter of columns at bottom	. .	4½	4½	6½	14	4	. .	5	3⅓	4⅔
Original number of columns	. .	34	34	38	38	34	. .	. .	. .	. .
Class	In antis.	Peripteros hexastylos.	Peripteros hexastylos.	Peripteros hexastylos.	Pseudo peripteros heptastylos.	Peripteros hexastylos.	. .	Peripteros hexastylos.	Prostylos pseudoperipteros.	Peripteros.
Approximate date	450 B.C.	480-440 B.C.	440–420 B.C.	500 B.C.	450 B.C.	338–210 B.C.	. .	after 338 B.C.	before 210 B.C.	488–472 B.C.

The line of the city walls can be distinctly traced for most of the circuit, but the actual remains of them are inconsiderable. On the east and west the ravines already mentioned afforded, in the main, a sufficient protection, so that a massive wall was unnecessary, while near the south-eastern angle a breastwork was formed by the excavation of the natural rock,[2] which in later times was honeycombed with tombs. E. A. Freeman attributes the southern portion of the walls to Theron (*Hist. of Sic.* ii. 224), but the question depends upon the date of the temple of Heracles; and if Koldewey and Puchstein are right in dating it so early as 500 B.C., it is probable that the wall was in existence by that time. Close to this temple on the west is the site of the gate known in later times as the *Porta Aurea*, through which the modern road passes, so that no traces now remain.

Tombs of the Greek period have mainly been found on the west of the town, outside the probable line of the walls, between the Hypsas and a small tributary, the latter having been spanned by a bridge, now called *Ponte dei Morti*, of which one massive pier, 45 ft. in width, still exists. Just outside the south wall is a Roman necropolis, with massive tombs in masonry, and a Christian catacomb, and a little farther south a tomb in two stories, a mixture of Doric and Ionic architecture, belonging probably to the 2nd century B.C., though groundlessly called the Tomb of Theron. A village of the Byzantine period has been explored at Balatizzo, immediately to the south of the modern town (*Notizie degli Scavi*, 1900, 511-520). The walls of the dwellings are entirely cut out of the natural rock.

See J. Schubring, *Historische Topographie von Akragas* (Leipzig, 1870); R. Koldewey and O. Puchstein, *op. cit.*; C. Hülsen in Pauly-Wissowa, *Encyclopädie*, i. 1187. (T. As.)

AGRIMONY (from the Lat. *agrimonia*, a transformation of ἀργεμώνη, a word of unknown etymology), a slender perennial herb (botanical name, *Agrimonia Eupatoria*, natural order Rosaceae), 1½ to 3 ft. high, growing in hedge-banks, copses and borders of fields. The leafy stem ends in spikes of small yellow flowers. The flower-stalk becomes recurved in the fruiting stage, and the fruit bears a number of hooks which enable it to cling to rough objects, such as the coat of an animal, thus ensuring distribution of the seed. The plant is common in Britain and widely spread through the north temperate region. The underground woody stem is astringent and yields a yellow dye.

The name has been unsystematically given to several other plants; for instance: bastard, Dutch, hemp or water agrimony (*Eupatorium cannabinum*); noble or three-leaved agrimony (*Anemone hepatica*); water agrimony (*Bidens*); and wild agrimony (*Potentilla anserina*).

AGRIONIA, an ancient Greek festival, which was celebrated annually at Orchomenus in Boeotia and elsewhere, in honour of Dionysus Agrionius, by women and priests at night. The women, after playfully pretending for some time to search for the god, desisted, saying that he had hidden himself among the Muses. The tradition is that the daughters of Minyas, king of Orchomenus, having despised the rites of the god, were seized with frenzy and ate the flesh of one of their children. At this festival it was originally the custom for the priest of the god to pursue a woman of the Minyan family with a drawn sword and kill her. (Plutarch, *Quaest. Rom.* 102, *Quaest. Graecae* 38.)

AGRIPPA, a sceptical philosopher, whose date cannot be accurately determined. He must have lived later than Aenesidemus, who is generally said to have been a contemporary of Cicero. To him are ascribed the five tropes (πέντε τρόποι) which, according to Sextus Empiricus, summarize the attitude of the later ancient sceptics. The first trope emphasizes the disagreement of philosophers on all fundamental points; knowledge comes either from the senses or from reason. Some thinkers hold that nothing is known but the things of sense; others that the things of reason alone are known; and so on. It follows that the only wise course is to be content with an attitude of indifference, neither to affirm nor to deny. The second trope deals with the validity of proof; the proof of one so-called fact depends on another fact which itself needs demonstration, and so on *ad infinitum.* The third points out that the data of sense are relative to the sentient being, those of reason to the intelligent mind; that in different conditions things themselves are seen or thought to be different. Where, then, is the absolute criterion? Fourthly, if we examine things fairly, we see that in point of fact all knowledge depends on certain hypotheses, or facts taken for granted. Such knowledge is fundamentally hypothetical, and might well be accepted as such without the labour of a demonstration which is logically invalid. The fifth trope points out the impossibility of proving the sensible by the intelligible inasmuch as it remains to establish the intelligible in its turn by the sensible. Such a process is a vicious circle and has no logical validity. A comparison of these tropes with the ten tropes enumerated in the article AENESIDEMUS shows that scepticism has made an advance into the more abtruse questions of metaphysics. The first and the third include all the ideas expressed in the ten tropes, and the other three systematize the more profound difficulties which new thinkers had developed. Aenesidemus was content to attack the validity of sense-given knowledge; Agrippa goes further and impugns the possibility of all truth whatever. His reasons are those of modern scepticism, the reasons which by their very nature are not susceptible of disproof.

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[1] Dimensions in English feet.

[2] Polybius ix. 27 *κεῖται τὸ τεῖχος ἐπὶ πέτρας ἀκροτόμου καὶ περιρρῶγος, ᾗ μὲν αὐτοφυοῦς ᾗ δὲ χειροποιήτου.*

See Diogenes Laertius x. 88, and Zeller's *Greek Philosophy.* Also the articles SCEPTICISM; AENESIDEMUS.

AGRIPPA, HEROD, I. (*c.* 10 B.C.–A.D. 44), king of Judea, the son of Aristobulus and Berenice, and grandson of Herod the Great, was born about 10 B.C. His original name was Marcus Julius Agrippa. Josephus informs us that, after the murder of his father, Herod the Great sent him to Rome to the court of Tiberius, who conceived a great affection for him, and placed him near his son Drusus, whose favour he very soon won. On the death of Drusus, Agrippa, who had been recklessly extravagant, was obliged to leave Rome, overwhelmed with debt. After a brief seclusion, Herod the Tetrarch, his uncle, who had married Herodias, his sister, made him *Agoranomos* (Overseer of Markets) of Tiberias, and presented him with a large sum of money; but his uncle being unwilling to continue his support, Agrippa left Judea for Antioch and soon after returned to Rome, where he was welcomed by Tiberius and became the constant campanion of the emperor Gaius (Caligula), then a popular favourite. Agrippa being one day overheard by Eutyches, a slave whom he had made free, to express a wish for Tiberius' death and the advancement of Gaius, was betrayed to the emperor and cast into prison. In A.D. 37 Caligula, having ascended the throne, heaped wealth and favours upon Agrippa, set a royal diadem upon his head and gave him the tetrarchy of Batanaea and Trachonitis, which Philip, the son of Herod the Great, had formerly possessed. To this he added that held by Lysanias; and Agrippa returned very soon into Judea to take possession of his new kingdom. In A.D. 39 he returned to Rome and brought about the banishment of Herod Antipas, to whose tetrarchy he succeeded. On the assassination of Caligula (A.D. 41) Agrippa contributed much by his advice to maintain Claudius in possession of the imperial dignity, while he made a show of being in the interest of the senate. The emperor, in acknowledgment, gave him the government of Judea, while the kingdom of Chalcis in Lebanon was at his request given to his brother Herod. Thus Agrippa became one of the greatest princes of the east, the territory he possessed equalling in extent that held by Herod the Great. He returned to Judea and governed it to the great satisfaction of the Jews. His zeal, private and public, for Judaism is celebrated by Josephus and the rabbis; and the narrative of Acts xii. gives a typical example of it. About the feast of the Passover A.D. 44, James the elder, the son of Zebedee and brother of John the evangelist, was seized by his order and put to death. He proceeded also to lay hands on Peter and imprisoned him. After the Passover he went to Caesarea, where he had games performed in honour of Claudius, and the inhabitants of Tyre and Sidon waited on him to sue for peace. According to the story in Acts xii., Agrippa, gorgeously arrayed, received them in the theatre, and addressed them from a throne, while the audience cried out that his was the voice of a god. But "the angel of the Lord smote him," and shortly afterwards he died "eaten of worms." The story in Acts differs slightly from that in Josephus, who describes how in the midst of his elation he saw an owl perched over his head. During his confinement by Tiberius a like omen had been interpreted as portending his speedy release, with the warning that should he behold the same sight again he would die within five days. He was immediately smitten with violent pains, and after a few days died. Josephus says nothing of his being "eaten of worms," but the discrepancies between the two stories are of slight moment. A third account omits all the apocryphal elements in the story and says that Agrippa was assassinated by the Romans, who objected to his growing power.

See articles in *Ency. Bibl.* (W. J. Woodhouse), *Jewish Ency.* (M. Brann), with further references; N. S. Libowitz, *Herod and Agrippa* (New York, 2nd ed., 1898); Grätz, *Geschichte d. Juden,* iii. 318-361.

AGRIPPA, HEROD, II. (27–100), son of the preceding, and like him originally Marcus Julius Agrippa, was born about A.D. 27, and received the tetrarchy of Chalcis and the oversight of the Temple on the death of his uncle Herod, A.D. 48. In A.D. 53 he was deprived of that kingdom by Claudius, who gave him other provinces instead of it. In the war which Vespasian carried on against the Jews Herod sent him 2000 men, by which it appears that, though a Jew in religion, he was yet entirely devoted to the Romans, whose assistance indeed he required to secure the peace of his own kingdom. He died at Rome in the third year of Trajan, A.D. 100. He was the seventh and last king of the family of Herod the Great. It was before him and his sister Berenice (*q.v.*, B.2) that St Paul pleaded his cause at Caesarea (Acts xxvi.). He supplied Josephus with information for his history.

AGRIPPA, MARCUS VIPSANIUS (63–12 B.C.), Roman statesman and general, son-in-law and minister of the emperor Augustus, was of humble origin. He was of the same age as Octavian (as the emperor was then called), and was studying with him at Apollonia when news of Julius Caesar's assassination (44) arrived. By his advice Octavian at once set out for Rome. Agrippa played a conspicuous part in the war against Lucius, brother of Mark Antony, which ended in the capture of Perusia (40). Two years later he put down a rising of the Aquitanians in Gaul, and crossed the Rhine to punish the aggressions of the Germans. On his return he refused a triumph but accepted the consulship (37). At this time Sextus Pompeius, with whom war was imminent, had command of the sea on the coasts of Italy. Agrippa's first care was to provide a safe harbour for his ships, which he accomplished by cutting through the strips of land which separated the Lacus Lucrinus from the sea, thus forming an outer harbour; an inner one was also made by joining the lake Avernus to the Lucrinus (Dio Cassius xlviii. 49; Pliny, *Nat. Hist.* xxxvi. 24). About this time Agrippa married Pomponia, daughter of Cicero's friend Pomponius Atticus. Having been appointed naval commander-in-chief he put his crews through a course of training, until he felt in a position to meet the fleet of Pompeius. In 36 he was victorious at Mylae and Naulochus, and received the honour of a naval crown for his services. In 33 he was chosen aedile and signalized his tenure of office by effecting great improvements in the city of Rome, restoring and building aqueducts, enlarging and cleansing the sewers, and constructing baths and porticos, and laying out gardens. He also first gave a stimulus to the public exhibition of works of art. The emperor's boast that he had found the city of brick but left it of marble ("marmoream se relinquere, quam latericiam accepisset," Suet. *Aug.* 29) might with greater propriety have been uttered by Agrippa. He was again called away to take command of the fleet when the war with Antony broke out. The victory at Actium (31), which gave the mastery of Rome and the empire of the world to Octavian, was mainly due to Agrippa. As a token of signal regard Octavian bestowed upon him the hand of his niece Marcella (28). We must suppose that his wife Pomponia was either dead or divorced. In 27 Agrippa was consul for the third time, and in the following year the senate bestowed upon Octavian the emperial title of Augustus. Probably in commemoration of the battle of Actium, Agrippa built and dedicated the Pantheum still in existence as *La Rotonda.* The inscription on the portico states that it was erected by him during his third consulship. His friendship with Augustus seems to have been clouded by the jealousy of his father-in-law Marcellus, which was probably fomented by the intrigues of Livia, the second wife of Augustus, who feared his influence with her husband. The result was that Agrippa left Rome, ostensibly to take over the governorship of Syria—a sort of honourable exile; but as a matter of fact he only sent his legate to the East, while he himself remained at Lesbos. On the death of Marcellus, which took place within a year, he was recalled to Rome by Augustus, who found he could not dispense with his services. It is said that by the advice of Maecenas he resolved to attach Agrippa still more closely to him by making him his son-in-law. He accordingly induced him to divorce Marcella and marry his daughter Julia (21), the widow of Marcellus, equally celebrated for her beauty and abilities and her shameless profligacy. In 19 Agrippa was employed in putting down a rising of the Cantabrians in Spain. He was appointed governor of Syria a second time (17), where his just and prudent administration won him the respect and good-will of the provincials, especially the Hebrew population. His last public service was the bloodless suppression of an insurrection in Pannonia (13). He died at Campania in March of the year following his fifty-first year. Augustus honoured his memory by a magnificent funeral.

Agrippa was also known as a writer, especially on geography. Under his supervision Julius Caesar's design of having a complete survey of the empire made was carried out. From the materials at hand he constructed a circular chart, which was engraved on marble by Augustus and afterwards placed in the colonnade built by his sister Polla. Amongst his writings an autobiography, now lost, is referred to. Agrippa left several children; by Pomponia, a daughter Vipsania, who became the wife of the emperor Tiberius; by Julia three sons, Gaius and Lucius Caesar and Agrippa Postumus, and two daughters, Agrippina the elder, afterwards the wife of Germanicus, and Julia, who married Lucius Aemilius Paullus.

See Dio Cassius xlix.-liv.; Suetonius, *Augustus*; Velleius Paterculus ii.; Josephus, *Antiq. Jud.* xv. 10, xvi. 2; Turnbull, *Three Dissertations*, one of the characters of Horace, Augustus and Agrippa (1740); Frandsen, *Marcus Vipsanius Agrippa* (1836); Motte, *Étude sur Marcus Agrippa* (1872); Nispi-Landi, *Marcus Agrippa e i suoi tempi* (1901); D. Detlefsen, *Ursprung, Einrichtung und Bedeutung der Erdkarte Agrippas* (1906); V. Gardthausen, *Augustus und seine Zeit*, vol. i. 762 foll., ii. 432 foll.

AGRIPPA VON NETTESHEIM, HENRY CORNELIUS (1486–1535), German writer, soldier, physician, and by common reputation a magician, belonged to a family many members of which had been in the service of the house of Habsburg, and was born at Cologne on the 14th of September 1486. The details of his early life are somewhat obscure, but he appears to have obtained a knowledge of eight languages, to have studied at the university of Cologne and to have passed some time in France. When quite young he entered the service of the German king, Maximilian I., and in 1508 was engaged in an adventurous enterprise in Catalonia. He probably served Maximilian both as soldier and as secretary, but his wonderful and varied genius was not satisfied with these occupations, and he soon began to take a lively interest in theosophy and magic. In 1509 he went to the university of Dôle, where he lectured on John Reuchlin's *De Verbo mirifico*, but his teaching soon caused charges of heresy to be brought against him, and he was denounced by a monk named John Catilinet in lectures delivered at Ghent. As a result Agrippa was compelled to leave Dôle; proceeding to the Netherlands he took service again with Maximilian. In 1510 the king sent him on a diplomatic mission to England, where he was the guest of Colet, dean of St Paul's, and where he replied to the accusations brought against him by Catilinet. Returning to Cologne he followed Maximilian to Italy in 1511, and as a theologian attended the council of Pisa, which was called by some cardinals in opposition to a council called by Pope Julius II. He remained in Italy for seven years, partly in the service of William VI., marquis of Monferrato, and partly in that of Charles III., duke of Savoy, probably occupied in teaching theology and practising medicine.

In 1515 he lectured at the university of Pavia on the *Pimander* of Hermes Trismegistus, but these lectures were abruptly terminated owing to the victories of Francis I., king of France. In 1518 the efforts of one or other of his patrons secured for Agrippa the position of town advocate and orator, or syndic, at Metz. Here, as at Dôle, his opinions soon brought him into collision with the monks, and his defence of a woman accused of witchcraft involved him in a dispute with the inquisitor, Nicholas Savin. The consequence of this was that in 1520 he resigned his office and returned to Cologne, where he stayed about two years. He then practised for a short time as a physician at Geneva and Freiburg, but in 1524 went to Lyons on being appointed physician to Louise of Savoy, mother of Francis I. In 1528 he gave up this position, and about this time was invited to take part in the dispute over the legality of the divorce of Catherine of Aragon by Henry VIII.; but he preferred an offer made by Margaret, duchess of Savoy and regent of the Netherlands, and became archivist and historiographer to the emperor Charles V. Margaret's death in 1530 weakened his position, and the publication of some of his writings about the same time aroused anew the hatred of his enemies; but after suffering a short imprisonment for debt at Brussels he lived at Cologne and Bonn, under the protection of Hermann of Wied, archbishop of Cologne. By publishing his works he brought himself into antagonism with the Inquisition, which sought to stop the printing of *De occulta philosophia.* He then went to France, where he was arrested by order of Francis I. for some disparaging words about the queen-mother; but he was soon released, and on the 18th of February 1535 died at Grenoble. He was married three times and had a large family. Agrippa was a man of great ability and undoubted courage, but he lacked perseverance and was himself responsible for many of his misfortunes. In spite of his inquiring nature and his delight in novelty, he remained a Catholic, and had scant sympathy with the teaching of the reformers. His memory was nevertheless long defamed in the writings of the monks, who placed a malignant inscription over his grave. Agrippa's work, *De occulta philosophia*, was written about 1510, partly under the influence of the author's friend, John Trithemius, abbot of Würzburg, but its publication was delayed until 1531, when it appeared at Antwerp. It is a defence of magic, by means of which men may come to a knowledge of nature and of God, and contains Agrippa's idea of the universe with its three worlds or spheres. His other principal work, *De Incertitudine et Vanitate Scientiarum et Artium atque Excellentia Verbi Dei Declamatio*, was written about 1527 and published at Antwerp in 1531. This is a sarcastic attack on the existing sciences and on the pretensions of learned men. In it Agrippa denounces the accretions which had grown up around the simple doctrines of Christianity, and wishes for a return to the primitive belief of the early Christian church. He also wrote *De Nobilitate et Praecellentia Feminei Sexus*, dedicated to Margaret of Burgundy, *De matrimonii sacramento* and other smaller works. An edition of his works was published at Leiden in 1550 and they have been republished several times.

See H. Morley, *Life of H. C. Agrippa* (London, 1856); A. Prost, *Les Sciences et les arts occultes au XVI. siècle: Corneille Agrippa, sa vie et ses œuvres* (Paris, 1881); A. Daguet, *Cornelius Agrippa* (Paris, 1856).

AGRIPPINA, the "elder," daughter of Marcus Vipsanius Agrippa by his third wife Julia, was the grand-daughter of Augustus and the wife of Germanicus. She accompanied her husband to Germany, when the legions on the Rhine revolted after the death of Augustus (A.D. 14). Three years later she was in the East with Germanicus (*q.v.*), who died at Antioch in 19, poisoned, it was said, by order of Cn. Calpurnius Piso, governor of Syria. Eager to avenge his death, she returned to Rome and boldly accused Piso of the murder of Germanicus. To avoid public infamy Piso committed suicide. Tiberius and his favourite Sejanus feared that her ambition might lead her to attempt to secure the throne for her children, and she was banished to the island of Pandataria off the coast of Campania, where she died on the 18th of October 33, starved to death by herself, or, according to some, by order of Tiberius. Two of her sons, Nero and Drusus, had already fallen victims to the machinations of Sejanus. Agrippina had a large family by Germanicus, several of whom died young, while only two are of importance—Agrippina the "younger" and Gaius Caesar, who succeeded Tiberius under the name of Caligula. It is remarkable that, although Tiberius had ordered the execution of his elder brothers, by his will he left Caligula one of the heirs of the Empire. Agrippina was a woman of the highest character and exemplary morality. There is a portrait of her in the Capitoline Museum at Rome, and a bronze medal in the British Museum representing the bringing back of her ashes to Rome by order of Caligula.

See Tac. *Ann.* i.-vi.; Suetonius, *Tiberius*, 53; Dio Cassius lvii. 6, lviii. 22, lix. 3; Elizabeth Hamilton, *Memoirs of the Life of Agrippina* (1804); Burkhard, *Agrippina, des Agrippa Tochter* (1846); Stahr, *Römische Kaiserfrauen* (1880).

AGRIPPINA, the "younger" (A.D. 16–59), daughter of Germanicus and Agrippina the elder, sister of Caligula and mother of Nero, was born at Oppidum Ubiorum on the Rhine, afterwards named in her honour Colonia Agrippinae (mod. Cologne). Her life was notorious for intrigue and perfidy. By her first husband, Gnaeus Domitius Ahenobarbus, she was the mother of the emperor Nero; her second husband was Passienus Crispus, whom she was accused of poisoning. Assisted by the influential freedman Pallas, she induced her uncle the emperor Claudius to marry her after the death of Messalina, and adopt the future Nero as heir to the throne in place of Britannicus. Soon afterwards she poisoned Claudius and secured the throne for her son, with the intention of practically ruling on his behalf. Being alarmed at the influence of the freedwoman Acte over Nero, she threatened to support the claims of the rightful heir Britannicus. Nero thereupon murdered the young prince and decided to get rid of his mother. Pretending a reconciliation, he invited her to Baiae, where an attempt was made to drown her on a vessel especially constructed to founder. As this proved a failure, he had her put to death at her country house. Agrippina wrote memoirs of her times, referred to by Tacitus (*Ann.* iv. 53). Her character is set forth in Racine's *Britannicus.*

See Tac. *Ann.* xii., xiii., xiv.; Dio Cassius lix.-lxi.; Suetonius, *Nero*, 34; Stahr, *Agrippina, die Mutter Neros* (1880); Raffay, *Die Memoiren der Kaiserin Agrippina* (1884); B. W. Henderson, *The Life and Principate of the Emperor Nero* (1903); also article NERO.

AGROTERAS THUSIA, an annual festival held at Agrae near Athens, in honour of Artemis Agrotera, in fulfilment of a vow made by the city, before the battle of Marathon, to offer in sacrifice a number of goats equal to that of the Persians slain in the conflict. The number being so great, it was decided to offer 500 goats yearly.

See Plutarch, *De Malignitate Herodoti*, 26; Xenophon, *Anab.* iii. 2. 12; Aelian, *Var. Hist.* ii. 25; Schol. on Aristophanes, *Equites*, 660.

AGUADILLA, a town and port near the northern extremity of the W. coast of Porto Rico. Pop. (1899) 6425. It has a fairly good and safe anchorage, and is the commercial outlet for a very fertile agricultural district. The town is attractively situated and well built, and is connected by railway with Mayaguez, 20 m. distant, and also with Ponce and San Juan. The neighbouring district produces sugar-cane, tobacco, cattle, cocoanuts, oranges and lemons. The bay is supposed to have been first visited by Columbus (November 1493), though the town was not founded until 1775.

AGUADO, ALEXANDRE MARIE, marquis de Las Marismas del Guadalquivir, viscount de Monte Ricco (1784–1842), Spanish banker, was born of Jewish parentage at Seville, on the 29th of June 1784. He began life as a soldier, fighting with distinction in the Spanish war of independence on the side of Joseph Bonaparte. After the battle of Baylen (1808) he entered the French army, in which he rose to be colonel and aide-de-camp to Marshal Soult. He was exiled in 1815, and immediately started business as a commission-agent in Paris, where, chiefly through his family connexions in Havana and Mexico, he acquired in a few years enough wealth to enable him to undertake banking. The Spanish government gave him full powers to negotiate the loans of 1823, 1828, 1830 and 1831; and Ferdinand VII. rewarded him with the title of marquis, the decorations of several orders and valuable mining concessions in Spain. Aguado also negotiated the Greek loan of 1834. In 1828, having become possessed of large estates in France, including the château Margaux, famous for its wine, he was naturalized as a French citizen. He died at Gijon in Spain on the 14th of April 1842, leaving a fortune computed at 60,000,000 francs, and a splendid collection of pictures which at his death was bought by the French government.

AGUASCALIENTES, an inland state of Mexico, bounded N., E. and W. by the state of Zacatecas, and S. by Jalisco. Pop. (est. 1900) 102,416, a gradual decrease since the census years of 1895 and 1879; area, 2970 sq. m. The state occupies an elevated plateau, extending from two spurs of the Sierra Madre, called the Sierra Fria and Sierra de Laurel, eastward to the rolling fertile plains of its eastern and south-eastern districts. It is well watered by numerous small streams and one larger river, the Aguascalientes or Rio Grande, and has a mild healthy climate with a moderate rainfall. The fertile valleys of the north and west are devoted to agriculture and the plains to stock-raising. Indian corn, flour, cattle, horses, mules and hides are exported to the neighbouring states. Mining industries are still undeveloped, but considerable progress has been made in manufactures, especially of textile fabrics. The state has good railway communications and a prosperous trade. The capital, Aguascalientes, named from the medicinal hot springs near it, is a flourishing commercial and manufacturing city. Pop. (est. 1900) 35,052. It has cotton factories, smelting works, potteries, tanneries, distilleries, and wagon and tobacco factories. It is a station on the Mexican Central railway, 364 m. by rail north-west of the city of Mexico, and is connected by rail with Tampico on the Gulf of Mexico. The city is well built, has many fine churches and good public buildings, street cars and electric lights. The surrounding district is well cultivated and produces an abundance of fruit and vegetables. Other prominent towns of the state are Rincón de Romos (or Victoria de Calpulalpam), Asientos de Ibarra and Calvillo, the first having more and the others less than 5000 inhabitants.

AGUE (from Lat. *acuta*, sharp; sc. *febris*, fever), the common name given to a form or stage of malarial disease; the ague fit is the cold, shivering stage, and hence the word is also loosely used for any such paroxysm. Simple ague is of much the same type whether in temperate or tropical climates, and may take various forms (quotidian, tertian, quartan), passing into "remittent fever." The symptoms are discussed, together with causation, &c., in the article MALARIA. For "brow-ague" see NEURALGIA.

AGUESSEAU, HENRI FRANÇOIS D' (1668–1751), chancellor of France, illustrious for his virtues, learning and talents, was born at Limoges, of a family of the magistrature. His father, Henri d' Aguesseau, a hereditary councillor of the parlement of Metz, was a man of singular ability and breadth of view who, after holding successively the posts of intendant of Limousin, Guyenne and Languedoc, was in 1685 called to Paris as councillor of state, appointed director-general of commerce and manufactures in 1695, president of the council of commerce in 1700 and a member of the council of the regency for finance. By him François d'Aguesseau was early initiated into affairs and brought up in religious principles deeply tinged with Jansenism. He studied law under Jean Domat, whose influence is apparent in both the legal writings and legislative work of the chancellor. When little more than twenty-one years of age he was, through his father's influence with the king, appointed one of the three advocates-general to the parlement of Paris; and the eloquence and learning which he displayed in his first speech gained him a very high reputation. D'Aguesseau was in fact the first great master of forensic eloquence in France.

In 1700 he was appointed procurator-general; and in this office, which he filled for seventeen years, he gained the greatest popularity by his defence of the rights of the Gallican Church in the Quietist troubles and in those connected with the bull *Unigenitus* (see JANSENISM). In February 1717 he was made chancellor by the regent Orleans; but was deprived of the seals in January of the following year and exiled to his estate of Fresnes in Brie, on account of his steady opposition to the projects of the famous John Law, which had been adopted by the regent and his ministers. In June 1720 he was recalled to satisfy public opinion; and he contributed not a little by the firmness and sagacity of his counsels to calm the public disturbance and repair the mischief which had been done. Law himself had acted as the messenger of his recall; and it is said that d'Aguesseau's consent to accept the seals from his hand greatly diminished his popularity. The parlement continuing its opposition to the registering of the bull *Unigenitus*, d'Aguesseau, fearing a schism and a religious war in France, assisted Guillaume Dubois, the favourite of the regent, in his endeavour to force the parlement to register the bull, acquiesced in the exile of the magistrates and allowed the Great Council to assume the power of registration, which legally belonged to the parlement alone. The people unjustly attributed his conduct to a base compliance with the favourite. He certainly opposed Dubois in other matters; and when Dubois became chief minister d'Aguesseau was deprived of his office (March 1, 1722).

He retired to his estate, where he passed five years of which he always spoke with delight. The Scriptures, which he read and compared in various languages, and the jurisprudence of his own and other countries, formed the subjects of his more serious studies; the rest of his time was devoted to philosophy, literature and gardening. From these occupations he was recalled to court by the advice of Cardinal Fleury in 1727, and on the 15th of August was named chancellor for the third time, but the seals were not restored to him till ten years later. During these years he endeavoured to mediate in the disputes between the court and the parlement. When he was at last reinstated in office, he completely withdrew from all political affairs, and devoted himself entirely to his duties as chancellor and to the achievement of those reforms which had long occupied his thoughts. He aimed, as others had tried before him, to draw up in a single code all the laws of France, but was unable to accomplish his task. Besides some important enactments regarding donations, testaments and successions, he introduced various regulations for improving the forms of procedure, for ascertaining the limits of jurisdictions and for effecting a greater uniformity in the execution of the laws throughout the several provinces. These reforms constitute an epoch in the history of French jurisprudence, and have placed the name of d'Aguesseau in the same rank with those of L'Hôpital and Lamoignon. As a magistrate also he was so conscientious that the duc de Saint-Simon in his *Memoirs* complained that he spent too much time over the cases that came before him.

In 1750, when upwards of eighty-two years of age, d'Aguesseau retired from the duties without giving up the rank of chancellor. He died on the 9th of February of the following year.

His grandson, HENRI CARDIN JEAN BAPTISTE, MARQUIS D'AGUESSEAU (1746–1826), was advocate-general in the parlement of Paris and deputy in the Estates-General. Under the Consulate he became president of the court of appeal and later minister at Copenhagen. He was elected to the French Academy in 1787.

Of d'Aguesseau's works the most complete edition is that of the eminent lawyer Jean Marie Pardessus, published in 16 vols. (1818-1820); his letters were edited separately by Rives (1823); a selection of his works, *Œuvres choisies*, was issued, with a biographical notice, by E. Falconnet in 2 vols. (Paris, 1865). The far greater part of his works relate to matters connected with his profession, but they also contain an elaborate treatise on money; several theological essays; a life of his father, which is interesting from the account which it gives of his own early education; and *Metaphysical Meditations*, written to prove that, independently of all revelation and all positive law, there is that in the constitution of the human mind which renders man a law to himself.

See Boullée, *Histoire de la vie et des ouvrages du chancelier d'Aguesseau* (Paris, 1835); Fr. Monnier, *Le Chancelier d'Aguesseau* (Paris, 1860; 2nd ed., 1863); Charles Butler, *Mem. of Life of H. F. d'Aguesseau*, &c. (1830).

AGUILAR, GRACE (1816–1847), English writer, the daughter of a Jewish merchant in London, was born in June 1816. Her works consist chiefly of religious fiction, such as *The Vale of Cedars* (1850) and *Home Influence* (1847). She also wrote, in defence of her faith and its professors, *The Spirit of Judaism* (1842) and other works. Her services were acknowledged gratefully by the "women of Israel" in a testimonial which they presented shortly before her death, which took place at Frankfort-on-the-Main on the 16th of September 1847.

AGUILAR, or AGUILAR DE LA FRONTERA, a town of southern Spain, in the province of Cordova; near the small river Cabra, and on the Cordova–Malaga railway. Pop. (1900) 13,236. Aguilar "of the Frontier" was so named in the middle ages from its position on the border of the Moorish territories, which were defended by the castle of Anzur, now a ruin; but the spacious squares and modern houses of the existing town retain few vestiges of Moorish dominion. The olives and white wine of Aguilar are celebrated in Spain, although the wine, which somewhat resembles sherry, is known as Montilla, from the adjacent town of that name. Salt springs exist in the neighbourhood, and to the south there are two small lakes, Zoñar and Rincon, which abound in fish.

ÁGUILAS, a seaport of south-eastern Spain, in the province of Murcia, on the Mediterranean Sea, at the terminus of a railway from Huércal-Overa. Pop. (1900) 15,868. Aguilas is built on the landward side of a small peninsula, between two bays—the Puerto Ponente, a good harbour, on the south-west, and the Puerto Levanto, which is somewhat dangerous to shipping in rough weather, on the north-east. It is the chief outlet for the Spanish trade in esparto grass, and for the iron ore and other mineral products of the neighbourhood. It has also some trade in fruit and grain. The imports consist chiefly of coal. In 1904, 296 vessels, of 238,274 tons, cleared at this port.

AGUILERA, VENTURA RUIZ (1820–1881), Spanish poet, was born in 1820 at Salamanca, where he graduated in medicine. He removed to Madrid in 1844, engaged in journalism and won considerable popularity with a collection of poems entitled *Ecos nacionales* (1849). His *Elegías y Armonías* (1863) was no less successful, but his *Sátiras* (1874) and *Estaciones del año* (1879) showed that his powers were declining. He wrote under the obvious influence of Lamartine, preaching the gospel of liberalism and Christianity in verses which, though deficient in force, leave the impression of a sincere devotion and a charming personality. He became director of the national archaeological museum at Madrid, where he died on the 1st of July 1881.

AGUILLON (AGUILONIUS), **FRANÇOIS D'** (1566–1617), Flemish mathematician. Having entered the Society of Jesus in 1586, he was successively professor of philosophy at Douai and rector of the Jesuit College at Antwerp. He wrote a treatise on optics in six books (Antwerp, 1613), notable for containing the principles of stereographic projection.

AHAB (in Heb. *'aḥ'āb*, "father's brother"), king of Israel, the son and successor of Omri, ascended the throne about 875 B.C. (1 Kings xvi. 29-34). He married Jezebel, the daughter of the king of Sidon, and the alliance was doubtless the means of procuring him great riches, which brought pomp and luxury in their train. We read of his building an ivory palace and founding new cities, the effect perhaps of a share in the flourishing commerce of Phoenicia.[1] The material prosperity of his reign, which is comparable with that of Solomon a century before, was overshadowed by the religious changes which his marriage involved. Although he was a worshipper of Yahweh, as the names of his children prove (cp. also xxii. 5 seq.), his wife was firmly attached to the worship of the Tyrian Baal, Melkart, and led by her he gave a great impulse to this cult by building a temple in honour of Baal in Samaria. This roused the indignation of those prophets whose aim it was to purify the worship of Yahweh (see ELIJAH). During Ahab’s reign Moab, which had been conquered by his father, remained tributary; Judah, with whose king, Jehoshaphat, he was allied by marriage, was probably his vassal; only with Damascus is he said to have had strained relations. The one event mentioned by external sources is the battle at Ḳarḳar (perhaps Apamea), where Shalmaneser II. of Assyria fought a great confederation of princes from Cilicia, N. Syria, Israel, Ammon and the tribes of the Syrian desert (854 B.C.). Here *Aḥabbu Sir’lai* (Ahab the Israelite) with Baasha, son of Ruḥub (Rehob) of Ammon and nine others are allied with Bir-’idri (Ben-hadad), Ahab’s contribution being reckoned at 2000 chariots and 10,000 men. The numbers are comparatively large and possibly include forces from Tyre, Judah, Edom and Moab. The Assyrian king claimed a victory, but his immediate return and subsequent expeditions in 849 and 846 against a similar but unspecified coalition seem to show that he met with no lasting success. According to the Old Testament narratives, however, Ahab with 7000 troops had previously overthrown Ben-hadad and his thirty-two kings, who had come to lay siege to Samaria, and in the following year obtained a remarkable victory over him at Aphek, probably in the plain of Sharon (1 Kings xx.). A treaty was made whereby Ben-hadad restored the cities which his father had taken from Ahab’s father (*i.e.* Omri, but see xv. 20, 2 Kings xiii. 25), and trading facilities between Damascus and Samaria were granted. A late popular story (xx. 35–42, akin in tone to xii. 33–xiii. 34) condemned Ahab for his leniency and foretold the destruction of the king and his land. Three years later, war broke out on the east of Jordan, and Ahab with Jehoshaphat of Judah went to recover Ramoth-Gilead and was mortally wounded (xxii.). He was succeeded by his sons (Ahaziah and Jehoram).

It is very difficult to obtain any clear idea of the order of these events (LXX. places 1 Kings xxi. immediately after xix.). How the hostile kings of Israel and Syria came to fight a common enemy, and how to correlate the Assyrian and Biblical records, are questions which have perplexed all recent writers. The reality of the difficulties will be apparent from the fact that it has been suggested that the Assyrian scribe wrote “ Ahab ” for his son “ Jehoram ” (Kamphausen, *Chronol. d. hebr. Kön.*, Kittel), and that the very identification of the name with Ahab of Israel has been questioned (Horner, *Proc. Soc. Bibl. Arch.*, 1898, p. 244).[2] Whilst the above passages in 1 Kings view Ahab not unfavourably, there are others which give a less friendly picture. The tragic murder of Naboth (see JEZEBEL), an act of royal encroachment, stirred up popular resentment just as the new cult aroused the opposition of certain of the prophets. The latter found their champion in Elijah, whose history reflects the prophetic teaching of more than one age. (See KINGS.) His denunciation of the royal dynasty, and his emphatic insistence on the worship of Yahweh and Yahweh alone, form the keynote to a period which culminated in the accession of Jehu, an event in which Elijah’s chosen disciple Elisha was the leading figure.

The allusions to the statutes and works of Omri and Ahab in Mic. vi. 16 may point to legislative measures of these kings, and the reference to the incidents at the building of Jericho (1 Kings xvi. 34) may be taken to show that foundation sacrifices, familiar in nearly all parts of the world, were not unknown in Israel at this period.[3] This has in fact been confirmed by excavation in Palestine.

Another Ahab is known only as an impious prophet in the time of the Babylonian exile (Jer. xxix. 21). (S. A. C.)

’AḤAI, of Sabḥa, an 8th-century Talmudist of high renown. He was author of *Quaestiones* (*Sheiltoth*), a collection of homilies (at once learned and popular) on Jewish law and ethics. This is recorded to have been the first work written by a Jewish scholar after the completion of the Talmud.

AHASUERUS (the Latinized form of the Hebrew אֲחַשְׁוֵרוֹשׁ; in LXX. *’Ασσούηρος*, once in Tobit *’Ασύηρος*), a royal Persian or Median name occurring in three of the books of the Old Testament and in one of the books of the Apocrypha. In every case the identification of the person named is a matter of controversy.

In Dan. ix. 1 Ahasuerus is the father of Darius the Mede, who “ was made king over the realm of the Chaldeans ” after the conquest of Babylon and death of Belshazzar. Who this Darius was is one of the most difficult questions in ancient history. Nabonidos (Nabunaid, Nabu-nahid) was immediately succeeded by Cyrus, who ruled the whole Persian empire. Darius may possibly have acted under Cyrus as governor of Babylon, but this view is not favoured by Dan. vi. 1, vi. 25, for Darius (v. 31) is said to have been sixty-two years old at the time (638 B.C.). This would make him contemporary with Nebuchadrezzar, which agrees with Tob. xiv. 15, where we read “ of the destruction of Nineveh, which Nebuchadnezzar and Ahasuerus took captive.” As a matter of fact, however, Cyaxares and Nabopolassar were the conquerors of Nineveh, and the latter was the father of Nebuchadrezzar. Cyrus did, on ascending the throne of Babylon, appoint a governor of the province, but his name was Gobryas, the son of Mardonius. The truth is, no doubt, as Prof. Sayce points out, that the book of Daniel was not meant to be strictly historical. As Prof. Driver says, “ tradition, it can hardly be doubted, has here confused persons and events in reality distinct ” (*Literature of the Old Test.* (6) p. 500).

In Ezra iv. 6 Ahasuerus is mentioned as a king of Persia, to whom the enemies of the Jews sent representations opposing the rebuilding of the temple at Jerusalem. Here the sequence of the reigns in the Biblical writer and in the profane historians—in the one, Cyrus, Ahasuerus, Artaxerxes, Darius; in the other, Cyrus, Cambyses, Smerdis, Darius—led in the past (Ewald, &c.) to the identification of Ahasuerus with Cambyses (529–522 B.C.), son of Cyrus. The name *Khshayārshā*, however, has been found in Persian inscriptions, and has been thought to be equivalent to the Xerxes (485–465 B.C.) of the Greeks. On Babylonian tablets both the forms *Khishiarshu* and *Akkashiarshi* occur amongst others. Modern scholars, therefore, identify the Ahasuerus of Ezra with Xerxes.

In the book of Esther the king of Persia is called Ahasuerus (rendered in LXX. “ Artaxerxes ” throughout). The identification of Ahasuerus with Artaxerxes I. Longimanus, the son and successor of Xerxes, though countenanced by Josephus, deserves little consideration. Most students are agreed that he must be a monarch of the Achaemenian dynasty, earlier than Artaxerxes I.; and opinion is divided between Darius Hystaspes and Xerxes. In support of the former view it is alleged, among other things, that Darius was the first Persian king of whom it could be said, as in Esther i. 1, that he “ reigned from India even unto Ethiopia, over an hundred and seven and twenty provinces ”; and that it was also the distinction of Darius that (Esther x. 1) he laid “ a tribute upon the land and upon the isles of the sea ” (cf. Herod. iii. 89). In support of the identification with Xerxes it is alleged (1) that the Hebrew ’Aḥashvērosh is the natural equivalent of the old Persian *Khshayarsha*, the true name of Xerxes; (2) that there is a striking similarity of character between the Xerxes of Herodotus and the Ahasuerus of Esther; (3) that certain coincidences in dates and events corroborate this identity, as, *e.g.*, the feast in the king's third year (cf. Esther i. 3 with Herod. vii. 8), the return of Xerxes to Susa in the seventh year of his reign and the marriage of Ahasuerus at Shushan in the same year of his. To this it may be added that the interval of four years between the divorce of Vashti and the marriage of Esther is well accounted for by the intervention of an important series of events fully occupying the monarch's thoughts, such as the invasion of Greece.

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[1] Ahab’s ivory palace found its imitators (1 Kings xxii. 39; Am. iii. 15). The ivory was probably brought by the Phoenicians from Cyprus or from one of the works on the coast of Asia Minor.

[2] See the discussions by Cheyne, *Ency. Bib.* col. 91 seq., and by Whitehouse, *Dict. Bib.* i. 53.

[3] See Trumbull, *Threshold Covenant*, pp. 46 sqq.; Haddon, *Study of Man*, pp. 347 sqq.; P. Sartori, *Zeitschr. für Ethnologie*, 1898, pp. 1 seq.

See articles "Ahasuerus" in the *Encyclopaedia Biblica*, Hastings' *Dictionary*, the *Jewish Encyclopaedia*; S. R. Driver, *Introd. to the Lit. of the Old Test.*; Friedrich Delitzsch in the *Calwer Bibellexikon* (1893).

AHAZ (Heb. for "[Yahweh] holds"), son of Jotham, grandson of Uzziah or Azariah and king of Judah. After the death of Menahem, Pekah, king of Israel, and Rezin (rather Rasun), king of Syria, allied against Assyria, invaded Judah, and laid siege to Jerusalem in the hope of setting up one of their puppets upon the throne. At the same time the Edomites recovered Elath on the Gulf of Akabah (so read in 2 Kings xvi. 6; cp. also 2 Chron. xxviii. 16 sqq.) and Judah was isolated. Notwithstanding the counsel of Isaiah (Is. vii. 1-17), Ahaz lost heart and used the temple funds to call in the aid of Tiglath-pileser IV., who after attacking the Philistines destroyed the power of Syria, taking care to exact heavy tribute from Judah, which led to further despoliation of the temple. It was as a vassal that Ahaz presented himself to the Assyrian king at Damascus, and he brought back religious innovations (2 Kings xvi. 10 sqq.; for the priest Urijah see Is. viii. 2) and new ideas to which he proceeded to give effect. His buildings are referred to in 2 Kings xx. 11, xxiii. 12; cf. perhaps Jer. xxii. 15: "art thou a true king because thou viest with Ahaz" (see the LXX.). Ahaz was succeeded by his son Hezekiah.

On the ritual changes which he introduced see W. R. Smith, *Relig. of Semites* (2), pp. 485 sqq.; and on his reign, idem, *Prophets of Israel* (2), pp. 415 sqq. On 2 Kings xvi. 3 (cf. 2 Chron. xxviii. 3) see MOLOCH. See further ISAIAH and JEWS.

AHAZIAH ("he whom Yahweh sustains"), the name of two kings in the Bible, one of Israel, the other of Judah. (1) Ahaziah, 8th king of Israel, was the son and successor of Ahab, and reigned for less than two years. On his accession the Moabites refused any longer to pay tribute. Ahaziah lost his life through a fall from the lattice of an upper room in his palace, and it is stated that in his illness he sent to consult the oracle of Baal-zebub at Ekron; his messengers, however, were met by Elijah, who bade them return and tell the king he must die (2 Kings i. 2-17; cf. Luke ix. 54-56). (2) Ahaziah, 6th king of Judah, was the son of Jehoram and Ahab's daughter Athaliah, and reigned one year. He is described as a wicked and idolatrous king, and was slain by Jehu, son of Nimshi. He is variously called Jehoahaz and Azariah.

AHENOBARBUS ("brazen-bearded"), the name of a plebeian Roman family of the gens Domitia. The name was derived from the red beard and hair by which many of the family were distinguished. Amongst its members the following may be mentioned:—

GNAEUS DOMITIUS AHENOBARBUS, tribune of the people 104 B.C., brought forward a law (*lex Domitia de Sacerdotiis*) by which the priests of the superior colleges were to be elected by the people in the *comitia tributa* (seventeen of the tribes voting) instead of by co-optation; the law was repealed by Sulla, revived by Julius Caesar and (perhaps) again repealed by Marcus Antonius, the triumvir (Cicero, *De Lege Agraria*, ii. 7; Suetonius, *Nero*, 2). Ahenobarbus was elected pontifex maximus in 103, consul in 96 and censor in 92 with Lucius Licinius Crassus the orator, with whom he was frequently at variance. They took joint action, however, in suppressing the recently established Latin rhetorical schools, which they regarded as injurious to public morality (Aulus Gellius xv. 11).

LUCIUS DOMITIUS AHENOBARBUS, son of the above, husband of Porcia the sister of Cato Uticensis, friend of Cicero and enemy of Caesar, and a strong supporter of the aristocratical party. At first strongly opposed to Pompey, he afterwards sided with him against Caesar. He was consul in 54 B.C., and in 49 he was appointed by the senate to succeed Caesar as governor of Gaul. After the outbreak of the civil war he commanded the Pompeian troops at Corfinium, but was obliged to surrender. Although treated with great generosity by Caesar, he stirred up Massilia (Marseilles) to an unsuccessful resistance against him. After its surrender, he joined Pompey in Greece and was slain in the flight after the battle of Pharsalus, in which he commanded the right wing against Antony (Caesar, *Bellum Civile*, i., ii., iii.; Dio Cassius xxxix., xli.; Appian, *B.C.* ii. 82).

GNAEUS DOMITIUS AHENOBARBUS, son of the above, accompanied his father at Corfinium and Pharsalus, and, having been pardoned by Caesar, returned to Rome in 46. After Caesar's assassination he attached himself to Brutus and Cassius, and in 43 was condemned by the lex Pedia as having been implicated in the plot. He obtained considerable naval successes in the Ionian Sea against the triumvirate, but finally, through the mediation of Asinius Pollio, became reconciled to Antony, who made him governor of Bithynia. He took part in Antony's Parthian campaigns, and was consul in 32. When war broke out between Antony and Octavian, he at first supported Antony, but, disgusted with his intrigue with Cleopatra, went over to Octavian shortly before the battle of Actium (31). He died soon afterwards (Dio Cassius xlviii.-l; Appian, *Bell. Civ.* iv., v.). His son was married to Antonia, daughter of Antony, and became the grandfather of the emperor Nero.

See Drumann, *Geschichte Rom.*, 2nd ed. by Groebe, vol. iii. pp. 14 ff.

AHITHOPHEL (Heb. for "brother of foolishness," *i.e.* foolish!), a man of Judah whose son was a member of David's bodyguard. He was possibly the grandfather of Bathsheba (see 2 Sam. xi. 3, xxiii. 34), a view which has been thought to have some bearing on his policy. He was one of David's most trusted advisers, and his counsel was "as though one inquired of the word of God." He took a leading part in Absalom's revolt, and his defection was a severe blow to the king, who prayed that God would bring his counsel to "foolishness."

The subsequent events are rather obscure. At Ahithophel's advice Absalom first took the precaution of asserting his claim to the throne by seizing his father's concubines (cf. ABNER). The immediate pursuit of David was then suggested; the advice was accepted, and the sequence of events shows that the king, being warned of this, fled across the Jordan (2 Sam. xvi. 20-23, xvii. 1-4, 22). Inconsistent with this is the account of the intervention of Hushai, whose counsel of delay (in order to gather all Israel "from Dan to Beersheba"), in spite of popular approbation, was not adopted, and with this episode is connected the tradition that the sagacious counsellor returned to his home and, having disposed of his estate, hanged himself. Instances of suicide are rare in the Old Testament (cf. SAUL), and it is noteworthy that in this case, at least, a burial was not refused. (See further ABSALOM; DAVID; SAMUEL, BOOKS OF.)

AḤMAD IBN ḤANBAL (780–855), the founder, involuntarily and after his death, of the Ḥanbalite school of canon law, was born at Bagdad in A.H. 164 (A.D. 780) of parents from Merv but of Arab stock. He studied the Koran and its traditions (*hadīth*, *sunna*) there and on a student journey through Mesopotamia, Arabia and Syria. After his return to Bagdad he studied under ash-Shāfi'ī between 195 and 198, and became, for his life, a devoted Shāfi-'ite. But his position in both theology and law was more narrowly traditional than that of ash-Shāfi'ī; he rejected all reasoning, whether orthodox or heretical in its conclusions, and stood for acceptance on tradition (*naql*) only from the Fathers. (See further on this, MAHOMMEDAN RELIGION and MAHOMMEDAN LAW.) In consequence, when al-Ma'mūn and, after him, al-Mo'tasim and al-Wāthiq tried to force upon the people the rationalistic Mo'tazilite doctrine that the Koran was created, Ibn Ḥanbal, the most prominent and popular theologian who stood for the old view, suffered with others grievous imprisonment and scourging. In 234, under al-Motawakkil, the Koran was finally decreed uncreated, and Ibn Ḥanbal, who had come through this trial better than any of the other theologians, enjoyed an immense popularity with the mass of the people as a saint, confessor and ascetic. He died at Bagdad in 241 (A.D. 855) and was buried there. There was much popular excitement at his funeral, and his tomb was known and visited until at least the 14th century A.D.

On his great work, the *Musnad*, a collection of some thirty thousand selected traditions, see Goldziher in *ZDMG*, l. 465 ff. For his life and works generally see W. M. Patten, *Ahmed ibn Hanbal and the Mihna*; C. Brockelmann, *Geschichte der Arab. Lit.* i. 181 ff.; F. Wüstenfeld, *Schāfi‘iten*, 55 ff.; M‘G. de Slane's transl. of *Ibn Khallikan*, i. 44 ff.; Macdonald, *Development of Muslim Theology*, 110, 157, index. (D. B. Ma.)

AHMAD SHAH (1724–1773), founder of the Durani dynasty in Afghanistan, was the son of Sammaun-Khan, hereditary chief of the Abdali tribe. While still a boy Ahmad fell into the hands of the hostile tribe of Ghilzais, by whom he was kept prisoner at Kandahar. In March 1738 he was rescued by Nadir Shah, who soon afterwards gave him the command of a body of cavalry composed chiefly of Abdalis. On the assassination of Nadir in 1747, Ahmad, having failed in an attempt to seize the Persian treasures, retreated to Afghanistan, where he easily persuaded the native tribes to assert their independence and accept him as their sovereign. He was crowned at Kandahar in October 1747, and about the same time he changed the name of his tribe to Durani. Two things may be said to have contributed greatly to the consolidation of his power. He interfered as little as possible with the independence of the different tribes, demanding from each only its due proportion of tribute and military service; and he kept his army constantly engaged in brilliant schemes of foreign conquest. Being possessed of the Koh-i-noor diamond, and being fortunate enough to intercept a consignment of treasure on its way to the shah of Persia, he had all the advantages which great wealth can give. He first crossed the Indus in 1748, when he took Lahore; and in 1751, after a feeble resistance on the part of the Mahommedan viceroy, he became master of the entire Punjab. In 1750 he took Nishapur, and in 1752 subdued Kashmir. His great expedition to Delhi was undertaken in 1756 in order to avenge himself on the Great Mogul for the recapture of Lahore. Ahmad entered Delhi with his army in triumph, and for more than a month the city was given over to pillage. The shah himself added to his wives a princess of the imperial family, and bestowed another upon his son Timur Shah, whom he made governor of the Punjab and Sirhind. As his viceroy in Delhi he left a Rohilla chief in whom he had all confidence, but scarcely had he crossed the Indus when the Mahommedan wazir drove the chief from the city, killed the Great Mogul and set another prince of the family, a tool of his own, upon the throne. The Mahratta chiefs availed themselves of these circumstances to endeavour to possess themselves of the whole country, and Ahmad was compelled more than once to cross the Indus in order to protect his territory from them and the Sikhs, who were constantly attacking his garrisons. In 1758 the Mahrattas obtained possession of the Punjab, but on the 6th of January 1761 they were totally routed by Ahmad in the great battle of Panipat. In a later expedition he inflicted a severe defeat upon the Sikhs, but had to hasten westwards immediately afterwards in order to quell an insurrection in Afghanistan. Meanwhile the Sikhs again rose, and Ahmad was now forced to abandon all hope of retaining the command of the Punjab. After lengthened suffering from a terrible disease, said to have been cancer in the face, he died in 1773, leaving to his son Timur the kingdom he had founded.

AHMED I. (1589–1617), sultan of Turkey, was the son of Mahommed III., whom he succeeded in 1603, being the first Ottoman sultan who reached the throne before attaining his majority. He was of kindly and humane disposition, as he showed by refusing to put to death his brother Mustafa, who eventually succeeded him. In the earlier part of his reign he gave proofs of decision and vigour, which were belied by his subsequent conduct. The wars which attended his accession both in Hungary and in Persia terminated unfavourably for Turkey, and her prestige received its first check in the peace of Sitvatörök, signed in 1606, whereby the annual tribute paid by Austria was abolished. Ahmed gave himself up to pleasure during the remainder of his reign, which ended in 1617, and demoralization and corruption became as general throughout the public service as indiscipline in the ranks of the army. The use of tobacco is said to have been introduced into Turkey during Ahmed I.'s reign.

AHMED II. (1643–1695), sultan of Turkey, son of Sultan Ibrahim, succeeded his brother Suleiman II. in 1691. His chief merit was to confirm Mustafa Kuprili as grand vizier. But a few weeks after his accession Turkey sustained a crushing defeat at Slankamen from the Austrians under Prince Louis of Baden and was driven from Hungary; during the four years of his reign disaster followed on disaster, and in 1695 Ahmed died, worn out by disease and sorrow.

AHMED III. (1637–1736), sultan of Turkey, son of Mahommed IV., succeeded to the throne in 1703 on the abdication of his brother Mustafa II. He cultivated good relations with England, in view doubtless of Russia's menacing attitude. He afforded a refuge in Turkey to Charles XII. of Sweden, after his defeat at Poltava (1709). Forced against his will into war with Russia, he came nearer than any Turkish sovereign before or since to breaking the power of his northern rival, whom his Grand Vizier Baltaji Mahommed Pasha succeeded in completely surrounding near the Pruth (1711). In the treaty which Russia was compelled to sign Turkey obtained the restitution of Azov, the destruction of the forts built by Russia and the undertaking that the tsar should abstain from future interference in the affairs of the Poles or the Cossacks. Discontent at the leniency of these terms was so strong at Constantinople that it nearly brought on a renewal of the war. In 1715 the Morea was taken from the Venetians. This led to hostilities with Austria, in which Turkey was unsuccessful, and Belgrade fell into the hands of Austria (1717). Through the mediation of England and Holland the peace of Passarowitz was concluded (1718), by which Turkey retained her conquests from the Venetians, but lost Hungary. A war with Persia terminated in disaster, leading to a revolt of the janissaries, who deposed Ahmed in September 1730. He died in captivity some years later.

AHMEDABAD, or AHMADABAD, a city and district of British India in the northern division of Bombay. The city was once the handsomest and most flourishing in western India, and it still ranks next to Agra and Delhi for the beauty and extent of its architectural remains. It was founded by Ahmad Shah in A.D. 1411 on the site of several Hindu towns, which had preceded it, and was embellished by him with fine buildings of marble, brought from a distance. The Portuguese traveller Barbosa, who visited Gujarat in A.D. 1511 and 1514, described Ahmedabad as "very rich and well embellished with good streets and squares supplied with houses of stone and cement." In Sir Thomas Roe's time, A.D. 1615, "it was a goodly city as large as London." During the course of its history it has passed through two periods of greatness, two of decay and one of revival. From 1411 to 1511 it grew in size and wealth; from 1512 to 1572 it declined with the decay of the dynasty of Gujarat; from 1572 to 1709 it renewed its greatness under the Mogul emperors; from 1709 to 1809 it dwindled with their decline; and from 1818 onwards it has again increased under British rule.

The consequence of all these changes of dynasty was that Ahmedabad became the meeting-place of Hindu, Mahommedan and Jain architecture. Ahmad Shah pulled down Hindu temples in order to build his mosques with the material. The Jama Masjid itself, which he built in A.D. 1424, with its three hundred pillars fantastically carved, is a Hindu temple converted into a mosque (see INDIAN ARCHITECTURE, Plate III., fig. 15). One of the finest buildings is the modern Jain temple of Hathi Singh outside the Delhi gate, which was built only in 1848, and is a standing monument to the endurance of Jain architectural art. The external porch, between two circular towers, is of great magnificence, most elaborately ornamented, and leads to an outer court, with sixteen cells on either side. In the centre of this court is a domed porch of the usual form with twenty pillars. The court leads to an inner porch of twenty-two pillars, two stories in height. This inner porch conducts to a triple sanctuary. James Fergusson wrote of this temple that "each part increases in dignity to the sanctuary; and whether looked at from its courts or from outside, it possesses variety without confusion, and an appropriateness of every part to the purpose for which it was intended." But perhaps the most unique sight in Ahmedabad is the two windows in Sidi Said's mosque of filigree marble work. The design is an imitation of twining and interlaced branches, a marvel of delicacy and grace, and finer than anything of the kind to be found in Agra or Delhi.

The modern city of Ahmedabad is situated on the left bank of the river Sabarmati, and is still surrounded by walls enclosing an area of about 2 sq. m. Its population in 1901 was 185,889. It has a station on the Bombay and Baroda railway, 309 m. from Bombay, whence branch lines diverge into Kathiawar and Mahi Kantha, and is a great centre for both trade and manufacture. Its native bankers, shopkeepers and workers are all strongly organized in gilds. It has cotton mills for spinning and weaving, besides many handlooms, and factories for ginning and pressing cotton. Other industries include the manufacture of gold and silver thread, silk brocades, pottery, paper and shoes. The prosperity of Ahmedabad, says a native proverb, hangs on three threads—silk, gold and cotton; and though its manufactures are on a smaller scale than formerly, they are still moderately flourishing. The military cantonment, 3 m. north of the native town, is the headquarters of the northern division of the Bombay command, with an arsenal.

The DISTRICT OF AHMEDABAD lies at the head of the Gulf of Cambay, between Baroda and Kathiawar. Area 3816 sq. m. The river Sabarmati and its tributaries, flowing from north-east to south-west into the Gulf of Cambay, are the principal streams that water the district. The north-eastern portion is slightly elevated, and dotted with low hills, which gradually sink into a vast plain, subject to inundation on its western extremity. With the exception of this latter portion, the soil is very fertile, and some parts of the district are beautifully wooded. The population in 1901 was 795,967, showing a decrease of 14 % in the decade, due to the effects of famine. The principal crops are millets, cotton, wheat and pulse. The district is traversed by the Bombay and Baroda railway, and has two seaports, Dholera and Gogo, the former of which has given its name to a mark of raw cotton in the Liverpool market. It suffered severely in the famine of 1899–1900.

AHMEDNAGAR, or AHMADNAGAR, a city and district of British India in the Central division of Bombay on the left bank of the river Sina. The town is of considerable antiquity, having been founded in 1494 by Ahmad Nizam Shah, on the site of a more ancient city, Bhingar. This Ahmad established a new monarchy, which lasted till its overthrow by Shah Jahan in 1636. In 1759 the Peshwa obtained possession of the place by bribing the Mahommedan commander, and in 1797 it was ceded by the Peshwa to the Mahratta chief Daulat Rao Sindhia. During the war with the Mahrattas in 1803 Ahmednagar was invested by a British force under General Wellesley and captured. It was afterwards restored to the Mahrattas, but again came into the possession of the British in 1817, according to the terms of the treaty of Poona. The town has rapidly advanced in prosperity under British rule. Several mosques and tombs have been converted to the use of British administration. The old industries of carpet-weaving and paper-making have died out; but there is a large trade in cotton and silk goods, and in copper and brass pots, and there are factories for ginning and pressing cotton. Ahmednagar is a station on the loop line of the Great Indian Peninsula railway, 218 m. from Bombay, and a military cantonment, being the headquarters of a brigade in the 6th division of the western army corps. The population in 1901 was 43,032.

The DISTRICT OF AHMEDNAGAR is a comparatively barren tract with a small rainfall. The area is 6586 sq. m. The population in 1901 was 837,695, showing a decrease of 6 % in the decade, due to the results of famine. The bulk of the population consists of Mahrattas and Kunbis, the latter being the agriculturists. On the north the district is watered by the Godavari and its tributaries the Prawara and the Mula; on the north-east by the Dor, another tributary of the Godavari; on the east by the Sephani, which flows through the valley below the Balaghat range; and in the extreme south by the Bhima and its tributary the Gor. The Sina river, another tributary of the Bhima, flows through the Nagar and Karjat talukas. The principal crops are millet, pulse, oil-seeds and wheat. The district suffered from drought in 1896–1897, and again in 1899–1900.

AHMED TEWFIK, PASHA (1845–), Turkish diplomatist, was the son of Ismail Hakki Pasha. He was at first in the army, but left the service in 1862; four years later he entered the diplomatic service, being employed at various European capitals. He became minister at Athens in 1883 and ambassador in Berlin in 1884. He was appointed minister for foreign affairs (*Kharijie Naziri*) in 1896.

AHMED VEFIK, PASHA (1819–1891), Turkish statesman and man of letters, was born in Stambul in 1819. He was the son of Rouheddin Effendi, at one time chargé d'affaires in Paris, an accomplished French scholar, who was, therefore, attached, in the capacity of secretary-interpreter, to Reshid Pasha's diplomatic mission to Paris in 1834. Reshid took Ahmed with him and placed him at school, where he remained about five years and completed his studies. He then returned to Constantinople, and was appointed to a post in the *bureau de traduction* of the ministry for foreign affairs. While thus employed he devoted his leisure to the translation of Molière's plays into Turkish and to the compilation of educational books—dictionaries, historical and geographical manuals, &c.—for use in Turkish schools, with the object of promoting cultivation of the French language among the rising generation. In 1847 he brought out the first edition of the *Salnameh*, the official annual of the Ottoman empire. Two years later he was appointed imperial commissioner in the Danubian principalities, and held that office till early in 1851 when he was sent to Persia as ambassador—a post which suited his temperament, and in which he rendered good service to his goverment for more than four years. Recalled in 1855, he was sent on a mission to inspect the eastern frontiers, and on his return was appointed member of the Grand Council of Justice, and was entrusted with the revision of the penal code and the code of procedure. This work occupied him until the beginning of 1860, when he was sent as ambassador to Paris, for the special purpose of averting the much-dreaded intervention of France in the affairs of Syria. But Ahmed Vefik's abrupt frankness, irascibility and abhorrence of compromise unfitted him for European diplomacy. He offended the French government; his mission failed, and he was recalled in January, 1861. None the less his integrity of purpose was fully understood and appreciated in Paris. On his return he was appointed minister of the *Evkaf*, but he only retained his seat in the cabinet for a few months. He was then for a brief period president of the Board of Audit, and subsequently inspector of the Anatolian provinces, where he was engaged for more than three years. His next appointment was that of director-general of customs, whence he was removed to the office of *musteshar* of the grand vizierate, and in the following year entered the cabinet of Midhat Pasha as minister of public instruction, but very soon retired to his seat in the Council of State and remained out of office until 1875, when he represented Turkey at the International Telegraphic Conference in St Petersburg. He was president of the short-lived Turkish parliament during its first session—March 19 to June 28, 1877—and at its close was appointed vali of Adrianople, where he rendered invaluable aid to the Red Cross Society. On his recall, at the beginning of 1878, he accepted the ministry of public instruction in the cabinet of Ahmed Hamdi Pasha, and on the abolition of the grand vizierate (February 5, 1878) he became prime minister and held office till about the middle of April, when he resigned. Early in the following year he was appointed vali of Brusa, where he remained nearly four years, and rendered admirable services to the province. The drainage of the pestilent marshes, the water-supply from the mountains, the numerous roads, the suppression of brigandage, the multiplication of schools, the vast development of the silk industry through the substitution of mulberry plantations for rice-fields, the opening out of the mineral springs of Chitli, the introduction of rose-trees and the production of otto of roses—all these were Ahmed Vefik's work; and he became so popular that when in 1882 he was recalled, it was thought advisable that he should be taken away secretly by night from the *konak* in Brusa and brought to his private residence on the Bosporus. A few days after his return he was again appointed prime minister (December 1, 1882), but Ahmed Vefik demanded, as the condition of his acceptance of office, that he should choose the other members of the cabinet, and that a number of persons in the sultan's *entourage* should be dismissed. Upon this, the sultan, on the 3rd of December, revoked the iradé of the 1st of December, and appointed Said Pasha prime minister. For the rest of his life Ahmed Vefik, by the sultan's orders, was practically a prisoner in his own house; and eventually he died, on the 1st of April 1891, of a renal complaint from which he had long been a sufferer. Ahmed Vefik was a great linguist. He spoke and wrote French perfectly, and thoroughly understood English, German, Italian, Greek, Arabic and Persian. From all these languages he translated many books into Turkish, but wrote no original work. His splendid library of 15,000 volumes contained priceless manuscripts in many languages. In his lifetime he appreciably aided the progress of education; but, as he had no following, the effects of his labour and influence in a great measure faded away after his death. In all his social and family relations Ahmed Vefik was most exemplary. His charity knew no bounds. He was devoted to his aged mother and to his one wife and children. To his friends and acquaintances he was hospitable, courteous and obliging; his conversation was intellectual and refined, and in every act of his private life he manifested the spirit of a true gentleman. At home his habits, attire and mode of life were quite Turkish, but he was perfectly at his ease in European society; he had strong English proclivities, and numbered many English men and women amongst his intimate friends. In public life his gifts were almost sterilized by peculiarities of temperament and incompatibility with official surroundings; and his mission as ambassador to Persia and his administration of Brusa were his only thorough successes. But his intellectual powers, literary erudition and noble character made him for the last forty years of his life a conspicuous figure in eastern Europe. (E. W.*)

AHOM, or AHAM, a tribe of Shan descent inhabiting the Assam valley, and, prior to the invasion of the Burmese at the commencement of the 19th century, the dominant race in that country. The Ahoms, together with the Shans of Burma and Eastern China and the Siamese, were members of the Tai race. The name is believed to be a corruption of the word "Ā-sām," the latter part of which is identical with "Shan" (properly "Shām") and with "Siam." Under their king Su-ka-pha they invaded Assam (*q.v.*) from the East in the year A.D. 1228, giving their name to the country. For a century and a half from 1228 the successors of Su-ka-pha appear to have ruled undisturbed over a small territory in Lakkimpur and Sibsagar districts. The extension of their power westward down the valley of the Brahmaputra was very gradual, and its success was by no means uniform. In the time of Aurangzeb the Ahom kings held sway over the entire Brahmaputra valley from Sadiya to near Goalpara, and from the skirts of the southern hills to the Bhutia frontier on the north. The dynasty attained the height of its power under Rudra Singh, who is said to have ascended the throne in 1695. In the following century the power of the Ahoms began to decay, alike from internal dissensions and the pressure of outside invaders. The Burmese were called in to the assistance of one of the contending factions in 1810. Having once obtained a foothold in the country, they established their power over the entire valley and ruled with merciless barbarity, until they were expelled by the British in 1824–1825. In the census of 1901 the total Ahom population in Assam was returned at 178,049.

The Ahoms retained the form of government in Assam peculiar to the Shan tribes, which may be briefly described as an organized system of personal service in lieu of taxation. Their religion was pagan, being quite distinct from Buddhism; but in Assam they gradually became Hinduized, and their kings finally adopted Hindu names and titles. They believed that there were in the beginning no heavenly bodies, air or earth, only water everywhere, over which at first hovered a formless Supreme Being called Pha. He took corporeal shape as a huge crab that lay floating, face upwards, upon the waters. In turn other animals took shape, the last being two golden spiders from whose excrement the earth gradually rose above the surrounding ocean. Pha then formed a female counterpart of himself, who laid four eggs, from which were hatched four sons. One of these was appointed to rule the earth, but died and became a spirit. His son also died and became the national household deity of the Ahoms. The origin of mankind is connected with a flood-legend. The only survivors of the flood, and of the conflagration that followed it, were an old man and a pumpkin-seed. From the latter there grew a gigantic gourd. This was split open by a thunderbolt, the old man sacrificing himself to save the lives of those who were inside, and from it there issued the progenitors of the present races of men, beasts, birds, fishes and plants. The kings claimed independent divine origin.

The religion and language have both died out, being only preserved by a few priests of the old cult; but even among them the tradition of the pronunciation of the language has been lost. The Ahoms had a considerable literature, much of which is still in existence. Their historic sense was very fully developed, and many priests and nobles maintained *bū-ran-jīs* (*i.e.* "stores of instruction for the ignorant"), or chronicles, which were carefully written up from time to time. A few of these have been translated, but as yet no European scholar possesses knowledge sufficient to enable him to study these valuable documents at first hand.

The Ahom language is the oldest member of the Tai branch of the Siamese-Chinese linguistic family of which we have any record. It bears much the same relationship to Siamese and Shan that Latin does to Italian. It is more nearly related to modern Siamese than to modern Shan, but possesses many groups of consonants which have become simplified in both. It is a language of the isolating class, in which every word is a monosyllable, and may be employed either as a noun or as a verb according to its context and its position in a sentence. In the order of words, the genitive follows the noun it governs, and, as usual in such cases, the relations of time and place are indicated by prefixes, not by suffixes. The meanings of the monosyllables were differentiated, as in the other Tai languages and in Chinese, by a system of tones, but these were rarely indicated in writing, and the tradition regarding them is lost. The language had an alphabet of its own, which was clearly related to that of Burmese.

See E. A. Gait, *A History of Assam* (Calcutta, 1906). For the language see *The Linguistic Survey of India*, vol. ii. (Calcutta, 1906) (contains grammar and vocabulary); G. A. Grierson, "Notes on Ahom," in the *Zeitschrift der deutschen morgenländischen Gesellschaft*, vol. lvi., 1902, pp. 1 ff. (contains grammar and vocabulary, with specimens), and "An Ahom Cosmogony, with a translation and a vocabulary of the Ahom language," in the *Journal of the Royal Asiatic Society for 1904*, pp. 181 ff. (G. A. Gr.)

AHR, a river of Germany. It is a left-bank tributary of the Rhine, into which it falls at Sinzig, rising in the Eifel mountains, and having a total length of 55 m. It flows at first through rather monotonous country, but the latter portion of its course, from the village of Altenahr, over which tower the ruins of the castle of Ahr, or Are (10th century), is full of romantic beauty. It is well stocked with trout, and the steep declivities of the lower valley furnish red wines of excellent quality.

AHRENS, FRANZ HEINRICH LUDOLF (1809–1881), German philologist, was born at Helmstedt on the 6th of June 1809. After studying at Göttingen (1826–1829) under K. O. Müller and Ludolf Dissen, and holding several educational appointments, in 1849 he succeeded G. F. Grotefend as director of the Lyceum at Hanover, a post which he filled with great success for thirty years. He died on the 25th of September 1881. His most important work is *De Graecae Linguae Dialectis* (1839–1843, new ed. by Meister, 1882–1889), which, although unfortunately incomplete, dealing only with Aeolic and Doric, and in some respects superseded by modern research, will always remain a standard treatise on the subject. He also published *Bucolicorum Graecorum Reliquiae* (1855–1859); studies on the dialects of Homer and the Greek lyrists; on Aeschylus; and some excellent school-books. A volume of his minor works (ed. Häberlin) was published in 1891, which also contains a complete list of his writings.

AHRIMAN (Gr. *'Αρειμάνιος* in Aristotle, or *'Αρειμάνης* in Agathias; in the *Avesta, Añgrô Mainyush*)—"the Destructive Spirit"), the name of the principle of evil in the dualistic doctrine of Zoroaster. The name does not occur in the Old Persian inscriptions. In the *Avesta* he is called the twin-brother of the Holy Spirits, and contrasted either with the Holy Spirit of Ormazd or with Ormazd himself. He is the all-destroying Satan, the source of all evil in the world and, like Ormazd, exists since the beginning of the world. Eventually, in the great world catastrophe, he will be defeated by Ormazd and disappear. The later sect of the Zervanites held that both were visible manifestations of the primeval principle *Zruvan akarana* (Infinite Time). (See ZOROASTER.)

AHRWEILER, a town of Germany, in the Prussian Rhine province, on the river Ahr and the Remagen-Adenau line of railway. Pop. 5000. It is a town of medieval aspect and is surrounded by ancient walls, with battlements and four gates in good repair. There is a Gothic church (dating from 1245). A convent school of the Ursuline nuns is a prominent feature on a hill to the south. The trade is almost exclusively confined to the manufacture and export of the wines of the district.

AHT, a confederacy of twenty-two tribes of North American Indians of the Wakashan stock. They are settled on the west coast of Vancouver, British Columbia. The chief tribes included are the Nitinaht, Tlaasaht or Makah, Tlaokiwaht or Clahoquaht, Ahansaht and Ehatishaht. The confederacy numbers some 3500.

AHTENA ("ice people"), the name of an Athapascan tribe of North American Indians, in the basin of Copper River, Alaska.

See *Handbook of American Indians*, ed. F. W. Hodge (Washington, 1907).

AHVAZ, a town of Persia, in the province of Arabistan, on the left bank of the river Karun, 48 m. S. of Shushter, in 31° 18′ N., 49° E. It has been identified with the Aginis of Nearchus, 500 stadia from Susa, and occupies the site of what was once an extensive and important city. Of this ancient city vast remains are left, extending several miles along the bank of the river. Among the most remarkable are the ruins of a bridge and a citadel, or palace, besides vestiges of canals and water-mills, which tell of former commercial activity. There are also the ruins of a band, or stone dam of great strength, which was thrown across the river for the purposes of irrigation. The band was 1150 yds. in length and had a diameter of 24 ft. at its base. Remains of massive structure are still visible, and many single blocks in it measure from 8 to 10 ft. in thickness. Ahvaz reached the height of its prosperity in the 12th and 13th centuries and is now a collection of wretched hovels, with a small rectangular fort in a state of ruin, and an Arab population of about 400. Since the opening of the Karun to foreign commerce in October 1888, another settlement called Benderi Nássiri, in compliment to the Shah Nássir ed din (d. 1896), has been established on a slight elevation overlooking the river at the point below the rapids where steamers come to anchor, about one mile below Ahvaz. It has post and telegraph offices; and agencies of some mercantile firms, a British vice-consul (since 1904) and a Russian consular agent (since 1902) are established there. The new caravan road to Isfahan, opened for traffic in 1900, promised, if successful, to give Ahvaz greater commercial importance.

AI [Sept. 'Αγγαί, 'Αγγαΐ and Γαΐ; Vulg. *Hai*], a small royal city of the Canaanites, E. of Bethel. The meaning of the name may be "the stone heap"; but it is not necessarily a Hebrew word. Abraham pitched his tent between Ai and Bethel (Gen. xii. 8, xiii. 3); but it is chiefly noted for its capture and destruction by Joshua (vii. 2-5, viii. 1-29), who made it "a heap for ever, even a desolation." It is mentioned by Isaiah (x. 28), and also after the captivity (Ezra ii. 28; Neh. vii. 32), but then probably was not more than a village. In the later Hebrew writings the name sometimes has a feminine form, Aiath (Is. x. 28), Aija (Neh. xi. 31). The definite article is usually prefixed to the name in Hebrew. The site was known, and some scanty ruins still existed, in the time of Eusebius and Jerome (*Onomast., s.v.* 'Αγγαί). Dr E. Robinson was unable to discover any certain traces of either name or ruins. He remarks, however (*Bib. Researches*, ed. 1856, i. p. 443), that it must have been close to Bethel on account of Biblical narrative (Josh. viii. 17). A little to the south of a village called Deir Diwân, and one hour's journey south-east from Bethel, is the site of an ancient place called *Khirbet Haiyân*, indicated by reservoirs hewn in the rock, excavated tombs and foundations of hewn stone. This may possibly be the site of Ai; it agrees with all the intimations as to its position. It has also been identified with a mound now called *et-Tell* ("the heap"), but though the name of a neighbouring village, *Ṫurmus Aya*, is suggestive, it is in the wrong direction from Bethel. In this view recent authorities, such as G. A. Smith, generally coincide.

See *Palestine Exploration Fund Quarterly Statement*, 1869, p. 123; 1874, p. 62; 1878, pp. 10, 132, 194; 1881, p. 254. (R. A. S. M.)

AIBONITO, an inland town of the electoral district of Guayama, Porto Rico, on the highway between San Juan and Ponce, 25 m. E.N.E. of the latter. It is the capital of a municipal district of the same name. Pop. (1899) of the town, 2085; of the district, 8596. The town is about 2200 ft. above sea level, and owing to its cool climate and freedom from malaria it has been chosen as an acclimatizing station and sanatorium for foreigners. It is surrounded by coffee plantations, and tobacco of excellent quality is raised in the vicinity. The town was considerably damaged by the great hurricane of the 8th of August 1899.

AICARD, JEAN FRANÇOIS VICTOR (1848–), French poet and dramatist, was born at Toulon on the 4th of February 1848. His father, Jean Aicard, was a journalist of some distinction, and the son early began his career in 1867 with *Les Jeunes Croyances*, followed in 1870 by a one-act play produced at the Marseilles theatre. His poems include: *Les Rébellions et les apaisements* (1871); *Poèmes de Provence* (1874), and *La Chanson de l' enfant* (1876), both of which were crowned by the Academy; *Miette et Noré* (1880), a Provençal idyll; *Le Livre d'heures de l'amour* (1887); *Jésus* (1896), &c. Of his plays the most successful was *Le Père Lebonnard* (1890), which was originally produced at the Théâtre Libre. Among his other works are the novels, *Le Roi de Camargue* (1890), *L'Âme d'un enfant* (1898) and *Tatas* (1901), *Benjamine* (1906) and *La Vênus de Milo* (1874), an account of the discovery of the statue from unpublished documents.

AICHINGER, GREGOR (*c.* 1565–1628), one of the greatest German composers of the Golden Age. He was organist to the Fugger family of Augsburg in 1584. In 1599 he went for a two years' visit to Rome. This was for musical and not for ecclesiastical reasons, though he had taken orders before his appointment under Fugger. Proske, in the preface to vol. ii. of his *Musica Divina*, calls him a priest of Regensburg, and is inclined to give him the palm for the devout and ingenuous mastery of his style. Certainly this impression is fully borne out by the beautiful and somewhat quaint works included in that great anthology.

AICKIN, FRANCIS (d. 1805), Irish actor, first appeared in London in 1765 as Dick Amlet in Vanbrugh's *The Confederacy* at Drury Lane. He acted there, and at Covent Garden, until 1792. His repertory consisted of over eighty characters, and among his best parts were the Ghost in *Hamlet* and Jaques in *As You Like It*. His success in impassioned declamatory rôles obtained for him the nickname of "Tyrant."

His younger brother JAMES AICKIN (d. 1803) was playing leading parts in both comedy and tragedy at the Edinburgh theatre, when he gave offence to his public by his protest against the discharge of a fellow-actor. He therefore went to London, and from 1767 to 1800 was a member of the Drury Lane Company and for some years a deputy manager. He quarrelled with John Philip Kemble, with whom, in 1792, he fought a bloodless duel.

AIDAN (d. 606), king of the Scottish kingdom of Dalriada, was the son of Gabran, king of Dalriada, and became king after the death of his kinsman King Conall, when he was crowned at Iona by St Columba. He refused to allow his kingdom to remain in dependence on the Irish Dalriada, but coming into collision with his southern neighbours he led a large force against Æthelfrith, king of the Northumbrians, and was defeated at a place called Daegsanstane, probably in Liddesdale.

See Bede, *Historiae Ecclesiasticae gentis Anglorum*, edited by C. Plummer (Oxford, 1896); Adamnan, *Vita S. Columbae*, edited by J. T. Fowler (Oxford, 1894).

AIDAN, or **ÆDAN**, first bishop of Lindisfarne, a monk of Hii (Iona), was sent by the abbot Senegi to Northumbria, at the request of King Oswald, A.D. 634–635. He restored Christianity, and in accordance with the traditions of Irish episcopacy chose the island of Lindisfarne, close to the royal city of Bamborough, as his see. Although he retained the Irish Easter, his character and energy in missionary work won him the respect of Honorius and Felix. He survived Oswald, and died shortly after the murder of his friend Oswine of Deira, on the 31st of August 651, in the 17th year of his episcopate.

See Bede, *Hist. Eccl.* (ed. Plummer), iii. 3, 5, 17, 25.

AIDE-DE-CAMP (Fr. for camp-assistant or, perhaps, field-assistant), an officer of the personal staff of a general, who acts as his confidential secretary in routine matters. In Great Britain the office of aide-de-camp to the king is given as a reward or an honorary distinction. In many foreign armies the word *adjutant* is used for an aide-de-camp, and *adjutant general* for a royal aide-de-camp. The common abbreviation for aide-de-camp in the British service is "A.D.C.," and in the United States "aid." Civil governors, such as the lord lieutenant of Ireland, have also, as a rule, officers on their staffs with the title and functions of aides-de-camp.

AIDIN. (1) A vilayet in the S.W. of Asia Minor including the ancient Lydia, Ionia, Caria and western Lycia. It derives its name from the Seljuk emir who took Tralles, and is the richest and most productive province of Asiatic Turkey. The seat of government is Smyrna. (2) The principal town of the valley of the Menderes or Maeander, about 70 m. E.S.E. of Smyrna. It is called also Güzel Hissar from the beauty of its situation on the lower slopes of Mons Messogis and along the course of the ancient Eudon. It is the capital of a sanjak. It was taken by the Seljuks, Aidin and Mentesh, late in the 13th century, and about 1390, when ruled by Isa Bey, a descendant of the first-named, acknowledged Ottoman suzerainty. In the Seljuk period it was a secondary city under the provincial capital, Tireh (*q.v.*). In the 17th century it came under the power of the Karasmans of Manisa and remained so till about 1820. Aidin is on the Smyrna-Dineir railway, has large tanneries and sweetmeat manufactories, and exports figs, cotton and raisins. It was greatly damaged by an earthquake in 1899. On a neighbouring height are to be seen the ruins of the ancient *Tralles* (*q.v.*), the site to which the name Güzel Hissar was particularly given by the Seljuks. Aidin is the seat of a British consular agent. As there are considerable numbers of Greeks, Armenians and Jews among the inhabitants, there are a Greek cathedral, several churches and synagogues in addition to the fine Turkish mosques. (D. G. H.)

AIDONE, a town of Sicily, in the province of Caltanisetta. From the town of Caltanisetta it is 22 m. E.S.E. direct (18 m. S.S.W. of the railway station of Raddusa, which is 41 m. W. of Catania). Pop. (1901) 8548. There are some interesting churches of the 14th century (see E. Mauceri in *L'Arte*, 1906, 17). On the Serra Orlando, a mountain not far off, are the extensive remains of an unknown city, the finest in eastern Sicily, but rapidly suffering destruction from the spread of cultivation and unauthorized excavations.

See P. Orsi in *Atti del Congresso di Scienze Storiche*, vol. v. 178 (Rome, 1904).

AIDS, a term of medieval finance, were part of the service due to a lord from his men, and appear to have been based upon the principle that they ought to assist him in special emergency or need. The occasions for demanding them and the amount to be demanded would thus be matters of dispute, while the loose use of the term to denote many different payments increases the difficulty of the subject.

Both in Normandy and in England, in the 12th century, the two recognized occasions on which, by custom, the lord could demand "aid," were (1) the knighting of his eldest son, (2) the marriage of his eldest daughter; but while in England the third occasion was, according to Glanvill, as in Normandy, his payment of "relief" on his succession, it was, according to the Great Charter (1215), the lord's ransom from captivity. By its provisions, the king covenanted to exact an "aid" from his barons on these three occasions alone—and then only a "reasonable" one—except by "the common counsel" of his realm. Enormous importance has been attached to this provision, as establishing the principle of taxation by consent, but its scope was limited to the barons (and the city of London), and the word "aids" was omitted from subsequent issues of the charter. The barons, on their part, covenanted to claim from their feudal tenants only the above three customary aids. The last levy by the crown was that of James I. on the knighting of his eldest son (1609) and the marriage of his daughter (1613).

From at least the days of Henry I. the term "aid" was also applied (1) to the special contributions of boroughs to the king's revenue, (2) to a payment in lieu of the military service due from the crown's knights. Both these occur on the pipe roll of 1130, the latter as *auxilium militum* (and possibly as *auxilium comitatus*). The borough "aids" were alternatively known as "gifts" (*dona*), resembling in this the "benevolences" of later days. When first met with, under Henry I., they are fixed round sums, but under Henry II. (as the *Dialogue on the Exchequer* explains) they were either assessed on a population basis by crown officers or were sums offered by the towns and accepted by them as sufficient. In the latter case the townsfolk were collectively responsible for the amount. The Great Charter, as stated above, extended specially to London the limitation on baronial "aids," but left untouched its liability to tallage, a lower and more arbitrary form of taxation, which the towns shared with the crown's demesne manors, and which London resisted in vain. The two exactions, although distinct, have to be studied together, and when in 1296–1297 Edward I. was forced to his great surrender, he was formerly supposed by historians to have pledged himself, under *De tallagio non concedendo*, to levy no tallage or aid except by common consent of his people. It is now held, however, that he limited this concession to "*aides, mises*," and "*prises*," retaining the right to tallage. Eventually, by a statute of 1340, it was provided that the nation should not be called upon "to make any common aid or sustain charge" except by consent of parliament. The aids spoken of at this period are of yet another character, namely, the grant of a certain proportion of all "movables" (*i.e.* personal property), a form of taxation introduced about 1188 and now rapidly increasing in importance. These subsidies were conveniently classed under the vague term "aids," as were also the grants made by the clergy in convocation, the term covering both feudal and non-feudal levies from the higher clergy and proportions not only of "movables" but of ecclesiastical revenues as well.

The "knight's aid" of 1130 spoken of above is probably identical with *auxilium exercitus* spoken of in the oldest custumals of Normandy, where the phrase appears to represent what was known in England as "scutage." Even in England the phrase "*quando Rex accipit auxilium de militibus*" occurs in 1166 and appears to be loosely used for scutage.

The same loose use enabled the early barons to demand "aid" from their tenants on various grounds, such as their indebtedness to the Jews, as is well seen in the Norfolk fragments of returns to the Inquest of Sheriffs (1170).

Sheriff's aid was a local payment of a fixed nature paid in early days to the sheriff for his service. It was the subject of a hot dispute between Henry II. and Becket in 1163.

Authorities.—Stubbs' *Constitutional History* and *Select Charters*; M'Kechnie's *Magna Carta*; Pollock and Maitland's *History of English Law*; Maitland's *Domesday Book and Beyond*; *Dialogus de Scaccario* (Oxford, 1892); Madox's *History of the Exchequer*; Round's *Feudal England* and *The Commune of London*; *The Pipe Rolls* (Record Commission and Pipe Roll Society). (J. H. R.)

AIGRETTE (from the Fr. for egret, or lesser white heron), the tufted crest, or head-plumes of the egret, used for adorning a woman's head-dress, the term being also given to any similar ornament, in gems, &c. An aigrette is also worn by certain ranks of officers in the French army. By analogy the word is used in various sciences for feathery excrescences of like appearance, as for the tufts on the heads of insects, the feathery down of the dandelion, the luminous rays at the end of electrified bodies, or the luminous rays seen in solar eclipses, diverging from the moon's edge.

AIGUES-MORTES, a town of south-eastern France, in the department of Gard 25 m. S.S.W. of Nîmes, on a branch line of the Paris-Lyon-Méditerranée railway. Pop. (1906) 3577. Aigues-Mortes occupies an isolated position in the marshy plain at the western extremity of the Rhone delta, 2½ m. from the Golfe du Lion. It owes its celebrity to the medieval fortifications of remarkable completeness with which it is surrounded. They form a parallelogram 596 yds. long by 149 yds. broad, and consist of crenellated walls from 25 to 36 ft. in height, dominated at intervals by towers. Of these, the Tour de Constance, built by Louis IX., is the most interesting; it commands the north-western angle of the ramparts, and contains two circular, vaulted chambers, used as prisons for Protestants after the revocation of the edict of Nantes. The remainder of the fortifications were built in the reign of Philip III. Aigues-Mortes is the meeting-place of several canals connecting it with Beaucaire, with Cette, with the Lesser Rhone and with the Mediterranean, on which it has a small port. Fishing and the manufacture of soda are the chief industries with which the town is connected. It has trade in coal, oranges and other fruits, and in wine. In the surrounding country there are important vineyards, which are preserved from disease by periodical submersion. There is a statue in the town in memory of Louis IX. who embarked from Aigues-Mortes in 1248 and 1270 for the seventh and eighth crusades. To further the prosperity of the town a most liberal charter was granted to it, and in addition the trade of the port was artificially fostered by a decree requiring that every vessel navigating within sight of its lights should put in there. This ordinance remained in force till the reign of Louis XIV.

AIGUILLE (Fr. for needle), the sharp jagged points above the snow-line, standing upon the massif of a mountain split by frost action along joints or planes of cleavage with sides too steep for snow to rest upon them. Aiguilles are thus the forms remaining from the splitting up of the high ridges with house-roof structure into detached pinnacles.

AIGUILLETTE (Fr. diminutive of *aiguille*, a needle; the obsolete English form is "aglet"), originally a tag of metal, often made of precious metals and richly chased, attached to the end of a lace or ribbon, and pointed, so as to pass more easily through eyelet holes. The term was, in time, applied to any bright ornament or pendant for the dress made of metal, and is now specially used of ornamental cords and tags of gold and silver lace, worn on naval and military uniforms. The aiguillette is fastened to the shoulder, the various cords hanging down therefrom being fastened at their other end on the front of the coat.

AIGUILLON, EMMANUEL ARMAND DE WIGNEROD DU PLESSIS DE RICHELIEU, Duc d' (1720–1782), French statesman, nephew of the maréchal de Richelieu, was born on the 31st of July 1720. He entered the army at the age of seventeen, and at the age of nineteen was made colonel of the regiment of Brie. He served in the campaigns in Italy during the War of the Austrian Succession, was seriously wounded at the siege of Château-Dauphin (1744), was taken prisoner (1746) and was made *maréchal de camp* in 1748. His marriage in 1740 with Louise Félicité de Bréhan, daughter of the comte de Plélo, coupled with his connexion with the Richelieu family, gave him an important place at court. He was a member of the so-called *parti dévot*, the faction opposed to Madame de Pompadour, to the Jansenists and to the parlement, and his hostility to the new ideas drew upon him the anger of the pamphleteers. In 1753 he was appointed commandant (governor) of Brittany and soon became unpopular in that province, which had retained a large number of privileges called "liberties." He first came into collision with the provincial estates on the question of the royal imposts (1758), but was then blamed for his inertia in the preparation of a squadron against England (1759), and finally alienated the parlement of Brittany by violating the privileges of the province (1762). In June 1764 the king, at the instance of d'Aiguillon, quashed a decree of the parlement forbidding the levying of new imposts without the consent of the estates, and refused to receive the remonstrances of the parlement against the duke. On the 11th of November 1765 La Chalotais, the *procureur* of the parlement, was arrested, but whether at the instigation of d'Aiguillon is not certain. The conflict between d'Aiguillon and the Bretons lasted two years. In the place of the parlement, which had resigned, d'Aiguillon organized a tribunal of more or less competent judges, who were ridiculed by the pamphleteers and ironically termed the *bailliage d'Aiguillon*. In 1768 the duke was forced to suppress this tribunal, and returned to court, where he resumed his intrigue with the *parti dévot* and finally obtained the dismissal of the minister Choiseul (December 24, 1770). When Louis XV., acting on the advice of Madame Dubarry, reorganized the government with a view to suppressing the resistance of the parlements, d'Aiguillon was made minister of foreign affairs, Maupeou and the Abbé Terray (1715–1778) also obtaining places in the ministry. The new ministry, albeit one of reform, was very unpopular, and was styled the "triumvirate." All the failures of the government were attributed to the mistakes of the ministers. Thus d'Aiguillon was blamed for having provoked the *coup d'état* of Gustavus III., king of Sweden, in 1772, although the instructions of the comte de Vergennes, the French ambassador in Sweden, had been written by the minister, the duc de la Vrillière. D'Aiguillon, however, could do nothing to rehabilitate French diplomacy; he acquiesced in the first division of Poland, renewed the Family Compact, and, although a supporter of the Jesuits, sanctioned the suppression of the society. After the death of Louis XV. he quarrelled with Maupeou and with the young queen, Marie Antoinette, who demanded his dismissal from the ministry (1774). He died, forgotten, in 1782. In no circumstances had he shown any special ability. He was more fitted for intrigue than for government, and his attempts to restore the status of French diplomacy met with scant success.

See *Mémoires du ministère du duc d'Aiguillon* (3rd ed., Paris and Lyons, 1792), probably written by J. L. Soulavie. On d'Aiguillon's governorship of Brittany see Carré, *La Chalotais et le duc d'Aiguillon* (Paris, 1893); Marion, *La Bretagne et le duc d'Aiguillon* (Paris, 1898); and Barthélemy Pocquet, *Le Duc d'Aiguillon et La Chalotais* (Paris, 1901–1902). The three last have full bibliographies. See also Flammermont, *Le Chancelier Maupeou et les parlements* (Paris, 1883); Frédéric Masson, *Le Cardinal de Bernis* (Paris, 1884).

AIGUILLON, MARIE MADELEINE DE WIGNEROD DU PONT DE COURLAY, Duchesse d' (1604–1675), daughter of Cardinal Richelieu's sister. In 1620 she married a nephew of the constable de Luynes, Antoine de Beauvoir du Roure, sieur de Combalet, who died in 1622. In 1625, through her uncle's influence, she was made a lady-in-waiting (*dame d'atour*) to the queen-mother, and in 1638 was created duchess of Aiguillon. She did not marry a second time, although Richelieu wished to marry her to a prince—either to the comte de Soissons or to the king's brother. After the death of the cardinal (1642) she retained her honours and titles, but withdrew from the court, and devoted herself entirely to works of charity. She entered into relations with Saint Vincent de Paul and helped him to establish the hospital for foundlings. She also took part in organizing the General Hospital and several others in the provinces. She died on the 17th of April 1675. She was the patroness of Corneille, who in 1636 dedicated to her his tragedy of *The Cid*.

See E. Fléchier, *Oraison funèbre de Mme. Marie de Wignerod, duchesse d'Aiguillon*; Bonneau-Avenant, *La duchesse d'Aiguillon* (1879); *Mémoires de Saint-Simon*, ed. by A. de Boislisle (1879 *et seq.*).

AIGUN, or Aihun (also *Sakhalyan-ula-khoto*), a town of China, province Hei-lung-kiang, in northern Manchuria, situated on the right bank of the Amur, in a fertile and populous region, 20 m. below Blagovyeshchensk, where it occupies nearly 2 m. on the bank of the river. There is a palisaded fort in the middle of the town, inside of which is the house of the *fu-tu* (governor). Its merchants carry on an active local trade in grain, mustard, oil and tobacco, and some of its firms supply the Russian administration with grain and flour. During the "Boxer" rising of 1900 it was, for a few weeks, the centre of military action directed against the Russians. The population, of some 20,000, includes a few hundred Mussulmans. The town was founded first on the left bank of the Amur, below the mouth of the Zeya, but was abandoned, and the present town was founded in 1684. It was here that Count Muraviev concluded, in May 1857, the Aihun treaty, according to which the left bank of the Amur was conceded to Russia.

AIKEN, a city and the county-seat of Aiken county, South Carolina, U.S.A., 17 m. E.N.E. of Augusta, Georgia. Pop. (1890) 2362; (1900) 3414 (2131 of negro descent); (1910) 3911. It is served by the Southern railway, and by an electric line connecting with Augusta. Aiken is a fashionable winter resort, chiefly frequented by Northerners, and is pleasantly situated about 500 ft. above sea level in the heart of the famous sand-hill and pine-forest region of the state. The dry and unusually equable temperature (mean for winter 50° F., for spring 57° F., and for autumn 64° F.) and the balmy air laden with the fragrance of the pine forests have combined to make Aiken a health and pleasure resort; its climate is said to be especially beneficial for those afflicted with pulmonary diseases. There are fine hotels, club houses and cottages, and the Palmetto Golf Links near the city are probably the finest in the southern states; fox-hunting, polo, tennis and shooting are among the popular sports. There are some excellent drives in the vicinity. The city is the seat of the Aiken Institute (for whites) and the Schofield Normal and Industrial School (for negroes). There are lumber mills, cotton mills and cotton-gins; and cotton, farm products and artificial stone are exported. Considerable quantities of aluminium are obtained from the kaolin deposits in the vicinity. The city's water supply is obtained from artesian wells. Aiken was settled in the early part of the 19th century, but was not incorporated until 1835, when it was named in honour of William Aiken (1806–1887), governor of the state in 1844–1847, and a representative in Congress in 1851–1857.

AIKIN, ARTHUR (1773–1854), English chemist and mineralogist, was born on the 19th of May 1773, at Warrington in Lancashire. He studied chemistry under Priestley and gave attention to the practical applications of the science. To mineralogy he was likewise attracted, and he was one of the founders of the Geological Society of London, 1807, and honorary secretary, 1812–1817. To the transactions of that society he contributed papers on the Wrekin and the Shropshire coalfield, &c. Later he became secretary of the Society of Arts, and in 1841 treasurer of the Chemical Society. In early life he had been for a short time a Unitarian minister. He was highly esteemed as a man of sound judgment and wide knowledge. He died in London on the 15th of April 1854.

Publications.—*Journal of a Tour through North Wales and part of Shropshire; with observations in Mineralogy and other branches of Natural History* (London, 1797); *A Manual of Mineralogy* (1814; ed. 2, 1815); *A Dictionary of Chemistry and Mineralogy* (with his brother C. R. Aikin), 2 vols. (London, 1807, 1814).

AIKIN, JOHN (1747–1822), English doctor and writer, was born at Kibworth-Harcourt, and received his elementary education at the Noncomformist academy at Warrington, where his father was tutor. He studied medicine in the university of Edinburgh, and in London under Dr William Hunter. He practised as a surgeon at Chester and Warrington. Finally, he went to Leyden, took the degree of M.D. (1780), and in 1784 established himself as a doctor in Yarmouth. In 1792 he removed to London, where he practised as a consulting physician. But he concerned himself more with the advocacy of liberty of conscience than with his professional duties, and he began at an early period to devote himself to literary pursuits. In conjunction with his sister, Mrs Barbauld (*q.v.*), he published a popular series of volumes entitled *Evenings at Home* (6 vols., 1792–1795), excellently adapted for elementary family reading, which were translated into almost every European language. In 1798 Dr Aikin retired from professional life and devoted himself with great industry to various literary undertakings, among which his *General Biography* (10 vols., 1799–1815) holds a conspicuous place. Besides these, he published *Biog. Memoirs of Medicine* (1780); *Lives of John Selden and Archbishop Usher* (1812) and other works. He edited the *Monthly Magazine* from 1796 to 1807, and conducted a paper called the *Athenaeum* from 1807 to 1809, when it was discontinued. Aikin died in 1822.

His daughter, Lucy Aikin (1781–1864), born at Warrington on the 6th of November 1781, had some repute as a historical writer. After producing various books for the young, and a novel, *Lorimer* (1814), she published in 1818 her *Memoirs of the Court of Queen Elizabeth*, which passed through several editions. This was followed by *Memoirs of the Court of James I.* (1822), *Memoirs of the Court of Charles I.* (1833) and a *Life of Addison* (1843). Miss Aikin died at Hampstead, where she had lived for forty years, on the 29th of January 1864.

See a *Memoir of John Aikin, with selections of his miscellaneous pieces* (1823), by his daughter; and the *Memoirs, Miscellanies and Letters of Lucy Aikin* (1864), including her correspondence (1826–1842) with William Ellery Channing, edited by P. H. Le Breton.

AIKMAN, WILLIAM (1682–1731), British portrait-painter, was born at Cairney, Forfarshire. He was intended by his father for the bar, but followed his natural bent by becoming a pupil under Sir John Medina, the leading painter of the day in Scotland. In 1707 he went to Italy, resided in Rome for three years, afterwards travelled to Constantinople and Smyrna, and in 1712 returned home. In Edinburgh, where he practised as a portrait-painter for some years, he enjoyed the patronage of the duke of Argyll; and on his removal to London in 1723 he soon obtained many important commissions. Perhaps his most successful work was the portrait of the poet Gay. He also painted portraits of himself, Fletcher of Saltoun, William Carstares and Thomson the poet. The likenesses were generally truthful and the style was modelled very closely upon that of Sir Godfrey Kneller. Aikman held a good position in literary society and counted among his personal friends Swift, Pope, Thomson, Allan Ramsay, Somervile and Mallet.

AILANTHUS (more correctly *ailantus*, from *ailanto*, an Amboyna word probably meaning "Tree of the Gods," or "Tree of Heaven"), a genus of trees belonging to the natural order Simarubaceae. The best known species, *A. glandulosa*, Chinese sumach or tree of heaven, is a handsome, quick-growing tree with spreading branches and large compound leaves, resembling those of the ash, and bearing numerous pairs of long pointed leaflets. The small greenish flowers are borne on branched panicles; and the male ones are characterized by having a disgusting odour. The fruits are free in clusters, and each is drawn out into a long wing with the seed in the middle. The wood is fine grained and satiny. The tree, which is a native of China and Japan, was introduced into England in 1751 and is a favourite in parks and gardens. A silk spinning moth, the ailanthus moth (*Bombyx* or *Philosamia cynthia*), lives on its leaves, and yields a silk more durable and cheaper than mulberry silk, but inferior to it in fineness and gloss. This moth is common near many towns in the eastern United States; it is about 5 in. across, with angulated wings, and in colour olive brown, with white markings. Other species of ailanthus are: *A. imberbiflora* and *A. punctata*, important Australian timber-trees; and *A. excelsa*, common in India.

AILLY, PIERRE D' (1350–1420), French theologian, was born at Compiègne in 1350 of a bourgeois family, and studied in Paris at the celebrated college of Navarre. He became a licentiate of arts in 1367, procurator of the French "nation" in 1372, bachelor of theology in 1372, and licentiate and doctor in that faculty in 1381.

Since 1378 Western Christendom, in consequence of the election of the two popes Urban VI. and Clement VII., had been divided into two obediences. In the spring of 1379 Pierre d'Ailly, in anticipation even of the decision of the university of Paris, had carried to the pope of Avignon the "rôle" of the French nation, but notwithstanding this prompt adhesion he was firm in his desire to put an end to the schism, and when, on the 20th of May 1381, the university decreed that the best means to this end was to try to gather together a general council, Pierre d'Ailly supported this motion before the king's council in the presence of the duke of Anjou. The dissatisfaction displayed shortly after by the government obliged the university to give up this scheme, and was probably the cause of Pierre d'Ailly's temporary retirement to Noyon, where he held a canonry. There he continued the struggle for his side in a humorous work, in which the partisans of the council are amusingly taken to task by the demon Leviathan.

After his return to Paris, where from 1384 onwards he filled the position of master of the college of Navarre, and took part in a violent campaign against the chancellor of Notre-Dame, he was twice entrusted with a mission to Clement VII. in 1388 to defend the doctrines of the university, and especially those concerning the Immaculate Conception of the Virgin, against the preaching friar Jean de Montson, and in 1389 to petition in the name of the king for the canonization of the young cardinal Peter of Luxemburg. The success which attended his efforts on these two occasions, and the eloquence which he displayed, perhaps contributed to his choice as the king's almoner and confessor. At the same time, by means of an exchange, he obtained to the highest dignity in the university, becoming chancellor of Notre-Dame de Paris.

When in 1394 Benedict XIII. succeeded Clement VII. at Avignon, Pierre d'Ailly was entrusted by the king with a mission of congratulation to the new pontiff. His obsequious language on this occasion, and the favours with which it was rewarded, formed a too violent contrast to the determined attitude of the university of Paris, which, tired of the schism, was even then demanding the resignation of the two pontiffs. Pierre d'Ailly himself had not long before taken part in the drawing up of a letter to the king in which the advantages of this double abdication were set forth, but since then his zeal had seemed to cool a little. None the less, on his return from Avignon, he again in the presence of the king enlarged upon the advantages offered by the way which the university commended. But the suspicions aroused by his conduct found further confirmation when he caused himself—or allowed himself—to be nominated bishop of Le Puy by Benedict XIII. (April 2, 1395). The great number of benefices which he held left room for some doubt as to his disinterestedness. Henceforward he was under suspicion at the university, and was excluded from the assemblies where the union was discussed.

Some time afterwards Pierre d'Ailly became bishop of Cambrai (March 19, 1397) by the favour of the pope, who had yielded no whit, and, by virtue of this position, became also a prince of the empire. In order to take possession of his new see, he had to brave the wrath of the duke of Burgundy, override the resistance of the clergy and bourgeoisie, and even withstand an armed attack on the part of several lords; but his protector, the duke of Orleans, had his investiture performed by Wenceslaus, king of the Romans. The latter, though a partisan of the pope of Rome, took the opportunity of enjoining on Pierre d'Ailly to go in his name and argue with the pope of Avignon, a move which had as its object to persuade Benedict XIII. to an abdication, the necessity of which was becoming more and more evident. However, the language of the bishop of Cambrai seems on this occasion to have been lacking in decision; however that may be, it led to no felicitous result.

France next tried to bring violent pressure to bear to conquer the obstinacy of Benedict XIII. by threatening a formal withdrawal from his obedience. Pierre d'Ailly, who, in spite of his attachment to the pope, had been carried away by the example of the kingdom, was among the first who, in 1403, after experience of what had happened, counselled and celebrated the restoration of obedience. He was sent by Charles VI. on an embassy to Benedict XIII. and seized this opportunity of lavishing on the pontiff friendly congratulations mingled with useful advice. Two years later, before the same pontiff, he preached in the city of Genoa a sermon which led to the general institution, in the countries of the obedience of Avignon, of the festival of the Holy Trinity.

At the ecclesiastical council which took place at Paris in 1406 Pierre d'Ailly made every effort to avert a new withdrawal from the obedience and, by order of the king, took the part of defender of Benedict XIII., a course which yet again exposed him to attacks from the university party. The following year he and his disciple Gerson formed part of the great embassy sent by the princes to the two pontiffs, and while in Italy he was occupied in praiseworthy but vain efforts to induce the pope of Rome to remove himself to a town on the Italian coast, in the neighbourhood of his rival, where it was hoped that the double abdication would take place. Discouraged by his failure to effect this, he returned to his diocese of Cambrai at the beginning of 1408. At this time he was still faithful to Benedict XIII., and the disinclination he felt to joining the members of the French clergy who were on the point of ratifying the royal declaration of neutrality excited the anger of Charles VI.'s government, and a mandate, which was however not executed, ordered the arrest of the bishop of Cambrai.

It was not till after the cardinals of the two colleges had led to the convocation of the general council of Pisa that Pierre d'Ailly renounced the support of Benedict XIII., and, for want of a better policy, again allied himself with the cause which he had championed in his youth. In the council lay now, to judge from his words, the only chance of salvation; and, in view of the requirements of the case, he began to argue that, in case of schism, a council could be convoked by any one of the faithful, and would have the right to judge and even to depose the rival pontiffs. This was, in fact, the procedure of the council of Pisa, in which Pierre d'Ailly took part. After the declaration of the deposition of Gregory XII. and Benedict XIII. it went on to the election of Alexander V. (June 26th, 1409). This pope reigned only ten months; his successor, John XXIII., raised Pierre d'Ailly to the rank of cardinal (June 6, 1411), and further, to indemnify him for the loss of the bishopric of Cambrai, conferred upon him the administration of that of Limoges (November 3, 1412), which was shortly after exchanged for the bishopric of Orange. He also nominated Pierre d'Ailly as his legate in Germany (March 18, 1413).

Forgetting these benefits, the cardinal of Cambrai was one of the most formidable adversaries of John XXIII. at the council of Constance. Convinced as he was of the necessity for union and reform, he contributed more than any one to the adoption of the principle that, since the schism had survived the council of Pisa, it was necessary again to take up the work for a fundamental union, without considering the rights of John XXIII. any more than they had those of Gregory XII. and Benedict XIII. From this point of view Pierre d'Ailly, together with his compatriot Cardinal Fillastre, took the preponderating part during the first few months. Afterwards, seeing the trend of events, he showed some uneasiness and hesitation. He refused, however, to undertake the defence of John XXIII., and only appeared in the trial of this pope to make depositions against him, which were sometimes of an overwhelming character.

Among the important matters which claimed his attention at Constance may be mentioned also the condemnation of the errors of Wycliffe and the trial of John Huss. The reading in public of his two treatises *De Potestate ecclesiastica* and *De Reformatione Ecclesiae* revealed, besides ideas very peculiar to himself on the reform and constitution of the church, his design of reducing the power of the English in the council by denying them the right of forming a separate nation (October 1–November 1, 1416). By this campaign, which exposed him to the worst retaliation of the English, he inaugurated his rôle of "procurator and defender of the king of France."

When at last the question arose of giving the Christian world a new pope, this time sole and uncontested, Pierre d'Ailly defended the right of the cardinals, if not to keep the election entirely in their own hands, at any rate to share in the election, and he brought forward an ingenious system for reconciling the pretensions of the council with the rights of the Sacred College. In this way was elected Pope Martin V. (November 11, 1417), and the task of Pierre d'Ailly was at last finished.

The predominance of the Anglo-Burgundians in France having made it impossible for him to stay there, he went to Avignon to end his days in melancholy calculations arising from the calamities of which he had been the witness, and the astrological reckonings, in which he found pleasure, of the chances for and against the world coming to an end in the near future. He died on the 9th of August 1420.

Pierre d'Ailly's written works are numerous. A great part of them was published with the works of Gerson (by Ellies du Pin, Antwerp, 1706); another part appeared in the 15th century, probably at Brussels, and there are many treatises and sermons still unpublished. In philosophy he was a nominalist. Many questions in science and astrology, such as the reform of the calendar, attracted his attention. His other works consisted of theological essays, ascetic or exegetic, questions of ecclesiastical discipline and reform, and of various polemical writings called forth for the most part by the schism.

Whatever reservations may be made as to a certain interested or ambitious side of his character, Pierre d'Ailly, whose devotion to the cause of union and reform is incontestable, remains one of the leading spirits of the end of the 14th and beginning of the 15th centuries.

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AILSA CRAIG, an island rock at the mouth of the Firth of Clyde, 10 m. W. of Girvan, Ayrshire, Scotland. It is of conoidal form, with an irregular elliptic base, and rises abruptly to a height of 1114 ft. The only side from which the rock can be ascended is the east; the other sides being for the most part perpendicular, and generally presenting lofty columnar forms, though not so regular as those of Staffa. This island is composed of micro-granite with riebeckite, of great interest on account of the rare occurrence of this type in Britain. It is comparatively fine-grained and of a greyish colour. Its essential constituents are felspar, quartz and riebeckite—a soda amphibole. The last of these minerals occurs in small irregular patches between the idiomorphic felspars which Dr J. J. H. Teall has found to be a soda orthoclase. The rock is allied to paisanite described by C. A. Osann and has been termed ailsite by Professor M. F. Heddle. It forms part of an intrusive mass which, on the south and west cliffs of the island, has a columnar arrangement and is traversed by dykes of dolerite, most of which run in a north-west direction. The age of this mass is uncertain, as its relations to other rocks are not visible in the island. As riebeckite-granophyre has been found in Skye it may be of Tertiary age. The rock is a favourite material for curling-stones, about three-fourths (according to estimate) of those in use in the countries where the game obtains being made of it. On this account curling-stones are popularly known as "Ailsas" or "Ailsa Craigs." A columnar cave exists towards the northern side of the island, and on the eastern are the remains of a tower, with several vaulted rooms. Two springs occur and some scanty grass affords subsistence to rabbits, and, on the higher levels, to goats. The precipitous parts are frequented by large flocks of solan geese and other sea birds. The lighthouse on the southern side shows a flashing light visible for 13 m. In 1831 the twelfth earl of Cassillis became first marquis of Ailsa, taking the title from the Craig, which was his property. When John Keats was in Girvan during his Scottish tour in 1818 he apostrophized the rock in a fine sonnet.

AIMAK, or EIMAK (Mongolian for "clan," or section of a tribe), the name given to certain nomadic or semi-nomadic tribes of Mongolian stock inhabiting the north and north-west Afghan highlands immediately to the north of Herat. They were originally known as "chahar (the four) Eimaks," because there were four principal tribes: the Taimani (the predominating element in the population of Ghur), the Ferozkhoi, the Jamshidi and, according to some authorities, the Hazara. The Aimak peoples number upwards of a quarter of a million, and speak a dialect said to be closely related to the Kalmuck. They are Sunnite Mahommedans in distinction from the Hazara who are Shiites. They are predominantly of Iranian or quasi-Iranian blood, while the Hazara are Turanian. They are a bold, wild people and renowned fighters.

AIMARD, GUSTAVE, the pen-name of OLIVIER GLOUX (1818–1883), French novelist, who was born in Paris on the 13th of September 1818. He made use of the materials collected in a roving and adventurous youth and early manhood in numerous romances in the style of J. Fenimore Cooper. Among the best of them are: *Les Trappeurs de l'Arkansas* (1858); *La Grande flibuste* (1860); *Nuits mexicaines* (1863); *La Forêt vierge* (1870). He died in Paris on the 20th of June 1883. Many of his novels have been translated into English.

AIMOIN (*c.* 960–*c.* 1010), French chronicler, was born at Villefranche de Longchapt about 960, and in early life entered the monastery of Fleury, where he became a monk and passed the greater part of his life. His chief work is a *Historia Francorum*, or *Libri V. de gestis Francorum*, which deals with the history of the Franks from the earliest times to 653, and was continued by other writers until the middle of the 12th century. It was much in vogue during the middle ages, but its historical value is now regarded as slight. It has been edited by G. Waitz and published in the *Monumenta Germaniae historica: Scriptores*, Band xxvi. (Hanover and Berlin, 1826–1892). He also wrote a *Vita Abbonis, abbatis Floriacensis*, the last of a series of lives of the abbots of Fleury, all of which, except the life of Abbo, have been lost. This has been published by J. Mabillon in the *Acta sanctorum ordinis sancti Benedicti* (Paris, 1668–1701). Aimoin's third work was the composition of books ii. and iii. of the *Miracula Sancti Benedicti*, the first book of which was written by another monk of Fleury named Adrevald. This also appears in the *Acta sanctorum ordinis sancti Benedicti*.

Aimoin, who died about 1010, must be distinguished from Aimoin, a monk of St Germain-des-Prés, who wrote *De miraculis sancti Germani*, and a fragment *De Normanorum gestis circa Parisiacam urbem et de divina in eos ultione tempore Caroli calvi*. Both of these are published in the *Historiae Francorum Scriptores*, Tome ii. (Paris, 1639–1649).

See *Histoire littéraire de la France*, tome vii. (Paris, 1865–1869).

AIN, a department on the eastern frontier of France, formed in 1790 from Bresse, the Pays de Gex, Bugey, Dombes and Valromey, districts of Burgundy. It is bounded N. by the departments of Jura and Saône-et-Loire, W. by Saône-et-Loire and Rhône, S. by Isère, and E. by the departments of Savoie and Haute-Savoie and the Swiss cantons Geneva and Vaud. Pop. (1906) 345,856. Area 2248 sq. m. The department takes its name from the river Ain, which traverses its centre in a southerly direction and separates it roughly into two well-marked physical divisions—a region of mountains to the east, and of plains to the west. The mountainous region is occupied by the southern portion of the Jura, which is divided into parallel chains running north and south and decreasing in height from east to west. The most easterly of these chains, that forming the Pays de Gex in the extreme north-east of the department, contains the Crêt de la Neige (6653 ft.) and other of the highest summits in the whole range. The district of Bugey occupies the triangle formed by the Rhone in the south-east of the department. West of the Ain, with the exception of the district covered by the Revermont, the westernmost chain of the Jura, the country is flat, consisting in the north of the south portion of the Bresse, in the south of the marshy Dombes. The chief rivers of the eastern region are the Valserine and the Seran, right-hand tributaries of the Rhone, which forms the eastern and southern boundary of the department; and the Albarine and Oignin, left-hand affluents of the Ain. The Bresse is watered by the Veyle and the Reyssouze, both flowing into the Saône, which washes the western limit of the department. The climate is cold in the eastern and central districts of Ain, but it is on the whole healthy, except in the Dombes. The average rainfall is about 38 in. The soil in the valleys and plains of the department, especially in the Bresse, is fertile, producing large quantities of wheat, as well as oats, buckwheat and maize. East of the Ain, forests of fir and oak abound on the mountains, the lower slopes of which give excellent pasture for sheep and cattle, and much cheese is produced. Horse-raising is carried on in the Dombes. The pigs and fowls of the Bresse and the geese and turkeys of the Dombes are largely exported. The vineyards of Bugey and Revermont yield good wines. The chief mineral product is the asphalt of the mines of Seyssel on the eastern frontier, besides which potter's clay, building stone, hydraulic lime and cement are produced in the department. There are many corn and saw mills and the wood-working industry is important. Silk fabrics, coarse woollen cloth, paper and clocks are manufactured. Live-stock and agricultural products are exported; the chief imports are wood and raw silk. The department is within the judicial circumscription of the appeal court of Lyons and the educational circumscription (académie) of Lyons. It forms part of the archiepiscopal province of Besançon. The Rhone and the Saône are navigable for considerable distances in the department; the chief railway is that of the Paris-Lyon-Méditerranée Company, whose line from Mâcon to Culoz traverses the department. Ain is divided into five arrondissements—those of Bourg and Trévoux in the west, and those of Gex, Nantua and Belley in the east; containing in all 36 cantons and 455 communes. Bourg is the capital and Belley is the seat of a bishop. Jujurieux, in the arrondissement of Nantua, has the most important silk factory in the department, occupying over 1000 workpeople. Bellegarde on the eastern frontier is an industrial centre; it has a manufactory of wood-pulp, and saw and flour mills, power for which is obtained from the waters of the Rhone. Oyonnax and its environs, north of Nantua, are noted for the production of articles in wood and horn, especially combs. St Rambert, in the arrondissement of Belley, besides being of industrial importance for its manufactures of silk and paper, possesses the remains of a Benedictine abbey, powerful in the 11th, 12th and 13th centuries. The Gothic church of Ambronay in the arrondissement of Belley, the church of St Paul de Varax (about 9 m. S.W. of Bourg), a building in the Romanesque style of Burgundy, and that of Nantua (12th century), are of architectural interest. Ferney, 4 m. S.W. of Gex, is famous as the residence of Voltaire from 1758–1778.

AINGER, ALFRED (1837–1904), English divine and man of letters, was born in London on the 9th of February 1837, the son of an architect. He was educated at King's College, London, and at Trinity College, Cambridge, and was ordained in 1860 to a curacy at Alrewas, near Rugeley. There he remained until 1864, when he became an assistant master at the Sheffield Collegiate School. His connexion with the Temple church, in London, began in 1866, when he was appointed reader; and in 1894 he succeeded Dr Vaughan as master. In 1887 he was presented to a canonry in Bristol cathedral, and he was chaplain-in-ordinary to Queen Victoria and King Edward VII. He died on the 8th of February 1904. Canon Ainger's gentle wit and humour, his generosity and lovable disposition, endeared him to a wide circle. In literature his name is chiefly associated with his sympathetic appreciation of Charles Lamb and Thomas Hood. His works include: *Charles Lamb* (1882) and *Crabbe* (1903) in the "English Men of Letters" series; editions of Lamb's *Essays of Elia* (1883) and of his *Letters* (1888; 2nd ed., 1904), of the *Poems* (1897) of Thomas Hood, with a biographical introduction; *The Life and Works of Charles Lamb* (12 vols., 1899–1900); articles on Tennyson and Du Maurier in the *Dictionary of National Biography*; *The Gospel and Human Life* (1904), sermons; *Lectures and Essays* (2 vols., 1905), edited by the Rev. H. C. Beeching.

See also Edith Sichel, *The Life and Letters of Canon Ainger* (1906).

AINMULLER, MAXIMILIAN EMMANUEL (1807–1870), German artist and glass-painter, was born at Munich on the 14th of February 1807. By the advice of Gartner, director of the royal porcelain manufactory, he devoted himself to the study of glass-painting, both as a mechanical process and as an art, and in 1828 he was appointed director of the newly-founded royal painted-glass manufactory at Munich. The method which he gradually perfected there was a development of the enamel process adopted in the Renaissance, and consisted in actually painting the design upon the glass, which was subjected, as each colour was laid on, to carefully-adjusted heating. The earliest specimens of Ainmuller's work are to be found in the cathedral of Regensburg. With a few exceptions, all the windows in Glasgow cathedral are from his hand. Specimens may also be seen in St Paul's cathedral, and Peterhouse, Cambridge, and Cologne cathedral contains some of his finest productions. Ainmuller had considerable skill as an oil-painter, especially in interiors, his pictures of the Chapel Royal at Windsor and of Westminster Abbey being much admired. He died on the 9th of December 1870.

AINSWORTH, HENRY (1571–1622), English Nonconformist divine and scholar, was born of yeoman stock in 1570/1 at Swanton Morley, Norfolk. He was for four years from December 1587 a scholar of Caius College, Cambridge, and, after associating with the Puritan party in the Church, eventually joined the Separatists. Driven abroad about the year 1593, he found a home in "a blind lane at Amsterdam." He acted as "porter" to a scholarly bookseller in that city, who, on discovering his skill in the Hebrew language, made him known to his countrymen. When part of the London church, of which Francis Johnson (then in prison) was pastor, reassembled in Amsterdam, Ainsworth was chosen as their doctor or teacher. In 1596 he took the lead in drawing up a confession of their faith, which he reissued in Latin in 1598 and dedicated to the various universities of Europe (including St Andrews, Scotland). Johnson joined his flock in 1597, and in 1604 he and Ainsworth composed *An Apology or Defence of such true Christians as are commonly but unjustly called Brownists.* The task of organizing the church was not easy and dissension was rife. Of Ainsworth it may be said that, though often embroiled in controversy, he never put himself forward; yet he was the most steadfast and cultured champion of the principles represented by the early Congregationalists. Amid all the strife of controversy, he steadily pursued his rabbinical studies. The combination was so unique that many, like the encyclopaedists L. Moréri and J. H. Zedler, have made two Henry Ainsworths—one Dr Henry Ainsworth, a learned biblical commentator; the other H. Ainsworth, an arch-heretic and "the ringleader of the Separatists at Amsterdam." Some confusion has also been occasioned through his not unfriendly controversy with one John Ainsworth, who abjured the Anglican for the Roman church. In 1608 Ainsworth answered Richard Bernard's *The Separatist Schisme.* But his ablest and most arduous minor work in controversy was his reply to John Smyth (commonly called "the Se-Baptist"), entitled a *Defence of Holy Scripture, Worship and Ministry used in the Christian Churches separated from Antichrist, against the Challenges, Cavils and Contradictions of Mr Smyth* (1609). In 1610 he was forced reluctantly to withdraw, with a large part of their church, from F. Johnson and those who adhered to him. For some time a difference of principle, as to the church's right to revise its officers' decisions, had been growing between them, Ainsworth taking the more Congregational view. (See CONGREGATIONALISM.) But in spirit he remained a man of peace. His memory abides through his rabbinical learning. The ripe fruit of many years' labour appeared in his *Annotations*—on *Genesis* (1616); *Exodus* (1617); *Leviticus* (1618); *Numbers* (1619); *Deuteronomy* (1619); *Psalms* (including a metrical version, 1612);

Song of Solomon (1623). These were collected in folio in 1627, and again in 1639, and later in various forms. From the outset the *Annotations* took a commanding place, especially among continental scholars, and he established for English nonconformity a tradition of culture and scholarship. There is no probability about the narrative given by Neal in his *History of the Puritans* (ii. 47) that he was poisoned by certain Jews. He died in 1622, or early in 1623, for in that year was published his *Seasonable Discourse, or a Censure upon a Dialogue of the Anabaptists*, in which the editor speaks of him as a departed worthy.

LITERATURE.—John Worthington's *Diary* (Chetham Society), by Crossley, i. 263-266; works of John Robinson (1851); H. M. Dexter, *Congregationalism of the Last Three Hundred Years* (1880); W. E. A. Axon, *H. Ainsworth, the Puritan Commentator* (1889); F. J. Powicke, *Henry Barrow and the Exiled Church of Amsterdam* (1900); J. H. Shakespeare, *Baptist and Congregational Pioneers* (1906).

AINSWORTH, ROBERT (1660–1743), English schoolmaster and author, was born at Eccles, near Manchester, in September 1660. After teaching for some time at Lever's Grammar School in Bolton, he removed to London, where he conducted a boarding-school, first at Bethnal Green and then at Hackney. He soon made a moderate fortune which gave him leisure to pursue his classical studies. Ainsworth's name is associated with his Latin-English Dictionary, begun in 1714, and published in 1736 as *Thesaurus linguae Latinae compendiarius*. It was long extensively used in schools, and often reprinted, the later editions being revised and enlarged by other hands, but it is now superseded. Ainsworth was also the author of some useful works on classical antiquities, and a sensible treatise on education, entitled *The most Natural and Easy Way of Institution* (1698), in which he advocates the teaching of Latin by conversational methods and deprecates punishment of any sort. He died in London on the 4th of April 1743.

AINSWORTH, WILLIAM HARRISON (1805–1882), English novelist, son of Thomas Ainsworth, solicitor, was born at Manchester on the 4th of February 1805. He was educated at Manchester Grammar School and articled to the firm of which his father was a member, proceeding to London in 1824 to complete his legal training at the Inner Temple. At the age of twenty-one he married a daughter of John Ebers the publisher, and started in his father-in-law's line of business. This, however, soon proved unprofitable and he decided to attempt literary work. A novel called *Sir John Chiverton*, in which he appears to have had a share, had attracted the praise of Sir Walter Scott, and this encouragement decided him to take up fiction as a career. In 1834 he published *Rookwood*, which had an immediate success, and thenceforth he was always occupied with the compilation of "historical" novels. He published about forty such stories, of which the best-known are *Jack Sheppard* (1839), *The Tower of London* (1840), *Guy Fawkes* (1841), *Old St Paul's* (1841) and *Windsor Castle* (1843). He edited *Bentley's Miscellany*, in which *Jack Sheppard* was published as a serial, and in 1842 he became proprietor of *Ainsworth's Magazine*. In 1853 it ceased to appear, and Ainsworth bought the *New Monthly Magazine*. He continued his literary activity until his death, but his later stories were less striking than the earlier ones. He died at Reigate on the 3rd of January 1882 and was buried at Kensal Green. Ainsworth had a lively talent for plot, and his books have many attractive qualities. The glorification of Dick Turpin in *Rookwood*, and of Jack Sheppard in the novel that bears his name, caused considerable outcry among straitlaced elders. In his later novels Ainsworth confined himself to heroes less open to criticism. His style was not without archaic affectation and awkwardness, but when his energies were aroused by a striking situation he could be brisk, vigorous and impressive. He did a great deal to interest the less educated classes in the historical romances of their country, and his tales were invariably instructive, clean and manly.

AINTAB (anc. *Doliché*), a town in the vilayet of Aleppo and ancient Cyrrhestica district of N. Syria. Pop. 45,000, two-thirds Moslem. The site of Doliche, famous for its worship of Baal (Zeus Dolichenus), adopted by the Seleucids and eventually spread all over the Roman empire, lies at Duluk, two hours N.W.; but nothing is to be seen there except a mound. The place was probably of Hittite origin and does not appear to have been settled by Greeks. The bazaars of Aintab are a great centre for "Hittite" antiquities, found at various sites from Sakchegözu on the west to Jerablus on the east. The modern town lies in the open treeless valley of the Sajur, a tributary of the Euphrates, and on the right bank, 65 m. north-east of Aleppo, with which it is connected by a *chaussée*, passing through Killis. This road proceeds east to the great crossing of Euphrates at Birejik, and thus Aintab lies on the highway between N. Syria and Urfa-Mosul and has much transit trade and numerous *khans*. In the middle ages its strong castle (Hamtab) was an important strategic point, taken by Saladin about A.D. 1183; and it supplied the last base from which Ibrahim Pasha marched in 1839 to win his decisive victory over the Turks at Nezib, about 25 m. distant north-east. Lying high (3500 ft.) and swept by purifying winds, Aintab is a comparatively clean and healthy spot, though not free from ophthalmia and the "Aleppo button," and it has been selected by the American Mission Board as its centre for N. Syria. "Central Turkey College," educational and medical, lies on high ground west. It was burnt down in 1891, but rebuilt; it has a dependency for girls within the town. Thanks to its presence the Armenian protestants are a large and rich community, which suffered less in the massacre of 1895 than the Gregorians. There is a small Episcopalian body, which has a large unfinished church, and a schismatic "catholicos," who has vainly tried to gain acceptance into the Anglican communion. There is also a flourishing Franciscan mission. Striped cloths and *pekmez*, a sweet paste made from grapes, are the principal manufactures; and tobacco and cereals the principal cultures. The town is unusually well and solidly built, good stone being obtained near at hand. The Moslem inhabitants are mainly of Turkoman origin, and used to owe fealty to chieftains of the family of Chapan Oglu, whose headquarters were at Yuzgat in Cappadocia. (D. G. H.)

AINU ("man"), a race inhabiting the northernmost islands of Japan. Little definite is known about their earliest history, but it is improbable that they are, as has been urged, the aborigines of Japan. The most accurate researches go to prove that they were immigrants, who reached Yezo from the Kuriles, and subsequently crossing Tsugaru strait, colonized a great part of the main island of Japan, exterminating a race of pit-dwellers to whom they gave the name of *koro-pok-guru* (men with sunken places). These *koro-pok-guru* were of such small stature as to be considered dwarfs. They wore skins of animals for clothing, and that they understood the potter's art and used flint arrow-heads is clearly proved by excavations at the sites of their pits. The Ainu, on the contrary, never had any knowledge of pottery. Ultimately the Ainu, coming into contact with the Japanese, who had immigrated from the south and west, were driven northward into the island of Yezo, where, as well as in the Kuriles and in the southern part of Sakhalin, they are still found in some numbers. When, at the close of the 18th and the beginning of the 19th century, Russian enterprises drew the attention of the Japanese government to the northern districts of the empire, the Tokugawa shoguns adopted towards the Ainu a policy of liberality and leniency consistent with the best principles of modern colonization. But the doom of unfitness appears to have begun to overtake the race long ago. History indicates that in ancient times they were fierce fighters, able to offer a stout resistance to the incomparably better armed and more civilized Japanese. To-day they are drunken, dirty, spiritless folk, whom it is difficult to suppose capable of the warlike *rôle* they once played. Their number, between 16,000 and 17,000, is virtually stationary. The Ainu are somewhat taller than the Japanese, stoutly built, well proportioned, with dark-brown eyes, high cheek-bones, short broad noses and faces lacking length. The hairiness of the Ainu has been much exaggerated. They are not more hairy than many Europeans. Never shaving after a certain age, the men have full beards and moustaches, but the stories of Ainu covered with hair like a bear are quite unjustified by facts. Men and women alike cut their hair level with the shoulders at the sides of the head, but trim it semicircularly behind. The women tattoo their mouths, arms, and sometimes their foreheads, using for colour the smut deposited on a pot hung over a fire of birch bark. Their original dress is a robe spun from the bark of the elm tree. It has long sleeves, reaches nearly to the feet, is folded round the body and tied with a girdle of the same material. Females wear also an undergarment of Japanese cloth. In winter the skins of animals are worn, with leggings of deerskin and boots made from the skin of dogs or salmon. Both sexes are fond of ear-rings, which are said to have been made of grape-vine in former times, but are now purchased from the Japanese, as also are bead necklaces, which the women prize highly. Their food is meat, whenever they can procure it—the flesh of the bear, the fox, the wolf, the badger, the ox or the horse—fish, fowl, millet, vegetables, herbs and roots. They never eat raw fish or flesh, but always either boil or roast it. Their habitations are reed-thatched huts, the largest 20 ft. square, without partitions and having a fireplace in the centre. There is no chimney, but only a hole at the angle of the roof; there is one window on the eastern side and there are two doors. Public buildings do not exist, whether in the shape of inn, meeting-place or temple. The furniture of their dwellings is exceedingly scanty. They have no chairs, stools or tables, but sit on the floor, which is covered with two layers of mats, one of rush, the other of flag; and for beds they spread planks, hanging mats around them on poles, and employing skins for coverlets. The men use chop-sticks and moustache-lifters when eating; the women have wooden spoons. Uncleanliness is characteristic of the Ainu, and all their intercourse with the Japanese has not improved them in that respect. The Rev. John Batchelor, in his *Notes on the Ainu*, says that he lived in one Ainu habitation for six weeks on one occasion, and for two months on another, and that he never once saw personal ablutions performed, or cooking or eating utensils washed.

Not having been at any period acquainted with the art of writing, they have no literature and are profoundly ignorant. But at schools established for them by the Japanese in recent times, they have shown that their intellectual capacity is not deficient. No distinct conception of a universe enters into their cosmology. They picture to themselves many floating worlds, yet they deduce the idea of rotundity from the course of the sun, and they imagine that the "Ainu world" rests on the back of a fish whose movements cause earthquakes. It is scarcely possible to doubt that this fancy is derived from the Japanese, who used to hold an identical theory. The Ainu believe in a supreme Creator, but also in a sun-god, a moon-god, a water-god and a mountain-god, deities whose river is the Milky Way, whose voices are heard in the thunder and whose glory is reflected in the lightning. Their chief object of actual worship appears to be the bear. Miss Isabella Bird (Mrs Bishop) writes: "The peculiarity which distinguishes their rude mythology is the worship of the bear, the Yezo bear being one of the finest of his species. But it is impossible to understand the feelings by which this cult is prompted, for although they worship the animal after their fashion and set up its head in their villages, yet they trap it, kill it, eat it and sell its skin. There is no doubt that this wild beast inspires more of the feeling which prompts worship than the inanimate forces of nature, and the Ainos may be distinguished as bear-worshippers, and their greatest religious festival or saturnalia as the Festival of the Bear. . . . Some of their rude chants are in praise of the bear, and their highest eulogy on a man is to compare him to a bear." They have no priests by profession. The village chief performs whatever religious ceremonies are necessary; ceremonies confined to making libations of wine, uttering short prayers and offering willow sticks with wooden shavings attached to them, much as the Japanese set up the well-known *gohei* (sacred offerings) at certain spots. The Ainu gives thanks to the gods before eating, and prays to the deity of fire in time of sickness. He thinks that his spirit is immortal, and that it will be rewarded hereafter in heaven or punished in hell, both of which places are beneath the earth, hell being the land of volcanoes; but he has no theory as to a resurrection of the body or metempsychosis. He preserves a tradition about a flood which seems to be the counterpart of the Biblical deluge, and about an earthquake which lasted a hundred days, produced the three volcanoes of Yezo and created the island by bridging the waters that had previously separated it into two parts.

The Ainu are now governed by Japanese laws and judged by Japanese tribunals, but in former times their affairs were administered by hereditary chiefs, three in each village, and for administrative purposes the country was divided into three districts, Saru, Usu and Ishikari, which were under the ultimate control of Saru, though the relations between their respective inhabitants were not close and intermarriages were avoided. The functions of judge were not entrusted to these chiefs; an indefinite number of a community's members sat in judgment upon its criminals. Capital punishment did not exist, nor was imprisonment resorted to, beating being considered a sufficient and final penalty, except in the case of murder, when the nose and ears of the assassin were cut off or the tendons of his feet severed. Little as the Japanese and the Ainu have in common, intermarriages are not infrequent, and at Sambutsu especially, on the eastern coast, many children of such marriages may be seen. Doenitz, Hilgendorf and Dr B. Scheube, arguing from a minute investigation of the physical traits of the Ainu, have concluded that they are Mongolians; according to Professor A. H. Keane the Ainu "are quite distinct from the surrounding Mongolic peoples, and present several remarkable physical characters which seem to point to a remote connexion with the Caucasic races. Such are a very full beard, shaggy or wavy black or dark-brown hair, sometimes covering the back and chest; a somewhat fair or even white complexion, large nose, straight eyes and regular features, often quite handsome and of European type. They seem to be a last remnant of the Neolithic peoples, who ranged in prehistoric times across the northern hemisphere from the British Isles to Manchuria and Japan. They are bear-worshippers, and have other customs in common with the Manchurian aborigines, but the language is entirely different, and they have traditions of a time when they were the dominant people in the surrounding lands." It should be noted finally that the Ainu are altogether free from ferocity or exclusiveness, and that they treat strangers with gentle kindness.

See Rev. John Batchelor, *The Ainu and their Folk-lore* (London, 1901); Romyn Hitchcock, *The Ainos of Japan* (Washington, 1892); H. von Siebold, *Über die Aino* (Berlin, 1881); Isabella Bird (Mrs Bishop), *Korea and her Neighbours* (1898); Basil Hall Chamberlain, *Language, Mythology and Geographical Nomenclature of Japan viewed in the Light of Aino Studies and Aino Fairy-tales* (1895).

AIR, or ASBEN, a country of West Africa, lying between 15° and 19° N. and 6° and 10° E. It is within the Sahara, of which it forms one of the most fertile regions. The northern portion of the country is mountainous, some of the peaks rising to a height of 5000 ft. Richly wooded hollows and extensive plains are interspersed between the hills. The mimosa, the dum palm and the date are abundant. Some of the plains afford good pasturage for camels, asses, goats and cattle; others are desert tablelands. In the less frequented districts wild animals abound, notably the lion and the gazelle. The country generally is of sandstone or granite formation, with occasional trachyte and basaltic ranges. There are no permanent rivers; but during the rainy season, from August to October, heavy floods convert the water-courses in the hollows of the mountains into broad and rapid streams. Numerous wells supply the wants of the people and their cattle. To the south of this variegated region lies a desert plateau, 2000 ft. above sea-level, destitute of water, and tenanted only by the wild ox, the ostrich and the giraffe. Still farther south is the fairly fertile district of Damerghu, of which Zinder is the chief town. Little of the soil is under cultivation except in the neighbourhood of the villages. Millet, dates, indigo and senna are the principal productions. The great bulk of the food supplies is brought from Damerghu, and the materials for clothing are also imported. A great caravan annually passes through Air, consisting of several thousand camels, carrying salt from Bilma to the Hausa states.

Air was called Asben by the native tribes until they were conquered by the Berbers. The present inhabitants are for the most part of a mixed race, combining the finer traits of the

Berbers with negro characteristics. The sultan of Air is to a great extent dependent on the chiefs of the Tuareg tribes inhabiting a vast tract of the Sahara to the north-west. A large part of his revenue is derived from tribute exacted from the salt caravans. Since 1890 Air has been included in the French sphere of influence in West Africa.

Agades, the capital of the country, which has a circuit of 3½ m., is built on the edge of a plateau 2500 ft. high, and is supposed to have been founded by the Berbers to serve as a secure magazine for their extensive trade with the Songhoi empire. The language of the people is a dialect of Songhoi. In former times Agades was a place of great traffic, and had a population of about 50,000. Since the beginning of the 16th century the prosperity of the town has, however, gradually declined. F. Foureau, who visited Agades in 1899, stated that more than half the total area was deserted and ruinous. The houses, which are built of clay, are low and flat-roofed; and the only buildings of importance are the chief mosque, which is surmounted by a tower 95 ft. high, and the sultan's residence, a massive two-storied structure pierced with small windows. The chief trade is grain. The great salt caravans pass through it, as well as pilgrims on their way to Mecca.

AIR (from an Indo-European root meaning "breathe," "blow"), the atmosphere that surrounds the earth; Gr. ἀήρ, the lower thick air, being distinguished from αἰθήρ, the upper pure air. With the development of analytical and especially of pneumatic chemistry, the air was recognized not to be one homogeneous substance, as was long supposed, and different "airs," or gases, came to be distinguished. Thus oxygen gas, at the end of the 18th century, was known as *dephlogisticated air*, nitrogen or azote as *phlogisticated air*, hydrogen as *inflammable air*, carbonic acid gas as *fixed air*. The name is now ordinarily restricted to what is more accurately called atmospheric air—the air we breathe—the invisible elastic fluid which surrounds the earth (see ATMOSPHERE). Probably the sense of atmosphere or environment led (though this is disputed by etymologists) to the further use of the word "air" to mean "manner" or "appearance"; and so to its employment (cf. Lat. *modus*) in music for "melody." (See ARIA.)

AIRAY, HENRY (1560?–1616), English Puritan divine, was born at Kentmere, Westmorland, but no record remains of the date of either birth or baptism. He was the son of William Airay, the favourite servant of Bernard Gilpin, "the apostle of the North," whose bounty showed itself in sending Henry and his brother Evan (or Ewan) to his own endowed school, where they were educated "in grammatical learning," and were in attendance at Oxford when Gilpin died. From Wood's *Athenae* we glean the details of Airay's college attendance. "He was sent to St Edmund's hall in 1579, aged nineteen or thereabouts. Soon after he was translated to Queen's College, where he became *pauper puer serviens*; that is, a poor serving child that waits on the fellows in the common hall at meals, and in their chambers, and does other servile work about the college." His transference to Queen's is perhaps explained by its having been Gilpin's college, and by his Westmorland origin giving him a claim on Eaglesfield's foundation. He graduated B.A. on the 19th of June 1583, M.A. on the 15th of June 1586, B.D. in 1594 and D.D. on the 17th of June 1600—all in Queen's College. "About the time he was master" (1586) "he entered holy orders, and became a frequent and zealous preacher in the university." His *Commentary on the Epistle to the Philippians* (1618, reprinted 1864) is a specimen of his preaching before his college, and of his fiery denunciation of popery and his fearless enunciation of that Calvinism which Oxford in common with all England then prized. In 1598 he was chosen provost of his college, and in 1606 was vice-chancellor of the university. In the discharge of his vice-chancellor's duties he came into conflict with Laud, who even thus early was manifesting his antagonism to the prevailing Puritanism.

He was also rector of Otmore (or Otmoor), near Oxford, a living which involved him in a trying but successful litigation, whereof later incumbents reaped the benefit. He died on the 6th of October 1616. His character as a man, preacher, divine, and as an important ruler in the university, will be found portrayed in the Epistle by John Potter, prefixed to the *Commentary*. He must have been a fine specimen of the more cultured Puritans—possessed of a robust common-sense in admirable contrast with some of his contemporaries.

AIRD, THOMAS (1802–1876), Scottish poet, was born at Bowden, Roxburghshire, on the 28th of August 1802. He was educated at Edinburgh University, where he made the acquaintance of Carlyle and James Hogg, and he decided to devote himself to literary work. He published *Martzoufle, a Tragedy, with other Poems* (1826), a volume of essays, and a long narrative poem in several cantos, *The Captive of Fez* (1830). For a year he edited the *Edinburgh Weekly Journal*, and for twenty-eight years the *Dumfriesshire and Galloway Herald*. In 1848 he published a collected edition of his poems, which met with much favour. Carlyle said that he found in them "a healthy breath as of mountain breezes." Among Aird's other friends were De Quincey, Lockhart, Stanley (afterwards dean of Westminster) and Motherwell. He died at Dumfries on the 25th of April 1876.

AIRDRIE, a municipal and police burgh of Lanarkshire, Scotland. Pop. (1901) 22,228. It is situated 11 m. E. of Glasgow by the North British railway, and also communicates with Glasgow by the Monkland Canal (which passes within 1 m. of the town), as well as by the Caledonian railway via Coatbridge and Whifflet. The canal was constructed between 1761 and 1790, and connects with the Forth and Clyde Canal near Maryhill. Airdrie was a market town in 1695, but owes its prosperity to the great coal and iron beds in its vicinity. Other industries include iron and brass foundries, engineering, manufactures of woollens and calicoes, silk-weaving, paper-making, oil and fireclay. The public buildings comprise the town hall, county buildings, mechanics' institute, academy, two fever hospitals and free library, the burgh having been the first town in Scotland to adopt the Free Library Act. Airdrie unites with Falkirk, Hamilton, Lanark and Linlithgow in sending one member to parliament. The parish of New Monkland, in which Airdrie lies, was formed (with Old Monkland)in 1640 out of the ancient barony of Monkland, so named from the fact that it was part of the lands granted by Malcolm IV. to the monks of Newbattle.

AIRE, a town of south-western France, in the department of Landes, on the left bank of the Adour, 22 m. S.E. of Mont-de-Marsan on the Southern railway between Morcenx and Tarbes. Pop. (1906) 2283. It is the seat of a bishopric, and has a cathedral of the 12th century and an episcopal palace of the 11th, 17th and 18th centuries. Both have undergone frequent restoration. They are surpassed in interest by the church of St Quitterie in Mas d'Aire, the suburb south-west of the town. The latter is a brick building of the 13th and 14th centuries, with a choir in the Romanesque style, and a fine western portal which has been much disfigured. The crypt contains several Gallo-Roman tombs and the sarcophagus (5th century) of St Quitterie. Aire has two ecclesiastical seminaries.

Aire (*Atura, Vicus Julii*) was the residence of the kings of the Visigoths, one of whom, Alaric II. (*q.v.*), there drew up his famous code. The bishopric dates from the 5th century.

AIRE, a town of northern France, on the river Lys, in the department of Pas-de-Calais, 12 m. S.S.E. of St Omer by rail. Pop. (1906) 4258. The town lies in a low and marshy situation at the junction of three canals. The chief buildings are the church of St Pierre (15th and 16th centuries), which has an imposing tower and rich interior decoration; a hôtel de ville of the 18th century; and the Bailliage (16th century), a small building in the Renaissance style. Aire has flour-mills, leather and oil works, and nail manufactories, and trade in agricultural produce.

In the middle ages Aire belonged to the counts of Flanders, from whom in 1188 it received a charter, which is still extant. It was given to France by the peace of Utrecht 1713.

AIR-ENGINE, the name given to heat-engines which use air for their working substance, that is to say for the substance which is caused alternately to expand and contract by application and removal of heat, this process enabling a portion of the applied heat to be transformed into mechanical work. Just as the working substance which alternately takes in and gives out heat in the steam-engine is water (converted during a part of the action into steam), so in the air-engine it is air. The practical drawbacks to employing air as the working substance of a heat-engine are so great that its use has been very limited. Such attempts as have been made to design air-engines on a large scale have been practical failures, and are now interesting only as steps in the historical development of applied thermodynamics. In the form of motors for producing very small amounts of power air-engines have been found convenient, and within a restricted field they are still met with. But even in this field the competition of the oil-engine and the gas-engine is too formidable to leave to the air-engine more than a very narrow chance of employment.

One of the chief practical objections to air-engines is the great bulk of the working substance in relation to the amount of heat that is utilized in the working of the engine. To some extent this objection may be reduced by using the air in a state of compression, and therefore of greater density, throughout its operation. Even then, however, the amount of operative heat is very small in comparison with that which passes through the steam-engine, per cubic foot swept through by the piston, for the change of state which water undergoes in its transformation into steam involves the taking in of much more heat than can be communicated to air in changing its temperature within such a range as is practicable. Another and not less serious objection is the practical difficulty of getting heat into the working air through the walls of the containing vessel. The air receives heat from an external furnace just as water does in the boiler of a steam-engine, by contact with a heated metallic surface, but it takes up heat from such a surface with much less readiness than does water. The waste of heat in the chimney gases is accordingly greater; and further, the metallic shell is liable to be quickly burned away as a result of its contact at a high temperature with free oxygen. The temperature of the shell is much higher than that of a steam boiler, for in order to secure that the working air will take up a fair amount of heat, the upper limit to which its temperature is raised greatly exceeds that of even high-pressure steam. This objection to the air-engine arises from the fact that the heat comes to it from *external* combustion; it disappears when *internal* combustion is resorted to; that is to say, when the heat is generated within the envelope containing the working air, by the combustion there of gaseous or other fuel. Gas-engines and oil-engines and other types of engine employing internal combustion may be regarded as closely related to the air-engine. They differ from it, however, in the fact that their working substance is not air, but a mixture of gases—a necessary consequence of internal combustion. It is to internal combustion that they owe their success, for it enables them to get all the heat of combustion into the working substance, to use a relatively very high temperature at the top of the range, and at the same time to escape entirely the drawbacks that arise in the air-engine proper through the need of conveying heat to the air through a metallic shell.

A form of air-engine which was invented in 1816 by the Rev. R. Stirling is of special interest as embodying the earliest application of what is known as the "regenerative" principle, the principle namely that heat may be deposited by a substance at one stage of its action and taken up again at another stage with but little loss, and with a great resulting change in the substance's temperature at each of the two stages in the operation. The principle has since found wide application in metallurgical and other operations. In any heat-engine it is essential that the working substance should be at a high temperature while it is taking in heat, and at a relatively low temperature when it is rejecting heat. The highest thermodynamic efficiency will be reached when the working substance is at the top of its temperature range while any heat is being received and at the bottom while any heat is being rejected—as is the case in the cycle of operations of the theoretically imagined engine of Carnot. (See **Thermodynamics** and **Steam-Engine**.) In Carnot's cycle the substance takes in heat at its highest temperature, then passes by adiabatic expansion from the top to the bottom of its temperature range, then rejects heat at the bottom of the range, and is finally brought back by adiabatic compression to the highest temperature at which it again takes in heat, and so on. An air-engine working on this cycle would be intolerably bulky and mechanically inefficient. Stirling substituted for the two stages of adiabatic expansion and compression the passage of the air to and fro through a "regenerator," in which the air was alternately cooled by storing its heat in the material of the regenerator and reheated by picking the stored heat up again on the return journey. The essential parts of one form of Stirling's engine are shown in fig. 1. There A is the externally-fired heating vessel, the lower part of which contains hot air which is taking in heat from the furnace beneath. A pipe from the top of A leads to the working cylinder (B). At the top of A is a cooler (C) consisting of pipes through which cold water is made to circulate. In A there is a displacer (D) which is connected (by parts not shown) with the piston in such a manner that it moves down when the piston has moved up. The air-pressure is practically the same above and below D, for these spaces are in free communication with one another through the regenerator (E), which is an annular space stacked loosely with wire-gauze. When D moves down, the hot air is driven up through the regenerator to the upper part of the containing vessel. It deposits its heat in the wire-gauze, becoming lowered in temperature and consequently reduced in pressure. The piston (B) descends, and the air, now in contact with the cooling pipes (C), gives up heat to them. Then the displacer (D) is raised. The air passes down through its regenerator, picking up the heat deposited there, and thereby having its temperature restored and its pressure raised. It then takes in heat from the furnace, expanding in volume and forcing the piston (B) to rise, which completes the cycle. The engine was double-acting, another heating vessel like A being connected with the upper end of the working cylinder at F. The stages at which heat is taken from the furnace and rejected to the cooler (C) are approximately isothermal at the upper and lower limits of temperature respectively, and the cycle accordingly is approximately "perfect" in the thermodynamic sense. The theoretical indicator diagram is made up of two isothermal lines for the taking in and rejection of heat, and two lines of constant volume for the two passages through the regenerator. This engine was the subject of two patents (by R. and S. Stirling) in 1827 and 1840. A double-acting Stirling engine of 50 horse-power, using air which was maintained by a pump at a fairly high pressure throughout the operations, was used for some years in the Dundee Foundry, where it is credited with having consumed only 1·7 lb of coal per hour per indicated horse-power. The coal consumption per brake-horse-power was no doubt much greater. It was finally abandoned on account of the failure of the heating vessels.

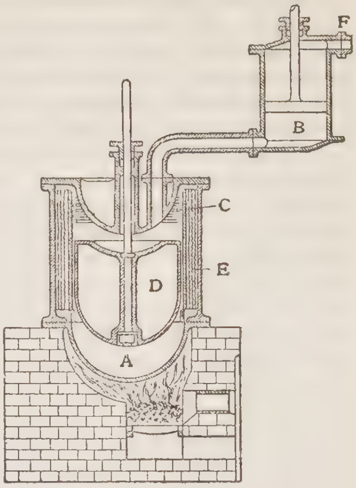

Fig. 1.—Stirling's Air-Engine.

The type survives in some small domestic motors, an example of which, manufactured under the patent of H. Robinson, is shown in fig. 2. In this there is no compressing pump, and the main pressure of the working air is simply that of the atmosphere. The whole range of pressure is so slight that no packing is required. Here A is the vessel in which the air is heated and within which the displacer works. It is heated by a small coke-fire or by a gas flame in C. It communicates through a passage

(D) with the working cylinder (B). The displacer (E), which takes its motion through a rod (I) from a rocking lever (F) connected by a short link to the crank-pin, is itself the regenerator, its construction being such that the air passes up and down through it as in one of the original Stirling forms. The cooler is a water vessel (G) through which water circulates from a tank (H). Messrs. Hayward and Tyler's "Rider" engine may be mentioned as another small hot-air motor which follows nearly the Stirling cycle of operations.

An attempt to develop a powerful air-engine was made in America about 1833 by John Ericsson, who applied it to marine propulsion in the ship "Caloric," but without permanent success. Like Stirling, Ericsson used a regenerator, but with this difference that the pressure instead of the volume of the air remained constant while it passed in each direction through the regenerator. Cold air was compressed by a pump into a receiver, where it was kept cool during compression and from which it passed through a regenerator into the working cylinder. In so passing it took up heat and expanded. It was then allowed to expand further, taking in heat from a furnace under the cylinder and falling in pressure. This expansion was continued till the pressure of the working air fell nearly to that of the atmosphere. It was then discharged through the regenerator, depositing heat for the next charge of air in turn to take up. The indicator diagram approximated to a form made up of two isothermal lines and two lines of constant pressure.

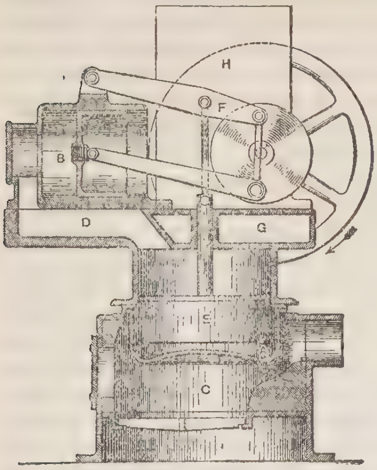

Fig. 2.—Robinson's form of Stirling's Engine.

In the transmission of power by compressed air (see Power Transmission) the air-driven motors are for the most part machines resembling steam-engines in the general features of their pistons, cylinders, valves and so forth. Such machines are not properly described as air-engines since their function is not the conversion of heat into work. Incidentally, however, they do in some cases partially discharge that function, namely, when what is called a "preheater" is used to warm up the compressed air before it enters in the motor cylinder. The object of this device is not, primarily, to produce work from heat, but to escape the inconveniences that would otherwise arise through extreme cooling of the air during its expansion. Without preheating the expanding air becomes so cold as to be liable to deposit snow from the moisture held in suspension, and thereby to clog the valves. With preheating this is avoided, and the amount of work done by a given quantity of air is increased by the conversion into work of a part of the supplementary energy which the preheater supplies in the form of heat. (J. A. E.)

AIREY, RICHARD AIREY, Baron (1803–1881), British general, was the son of Lieutenant-General Sir George Airey (1761–1833) and was born in 1803. He entered the army in 1821, became captain in 1825, and served on the staff of Sir Frederick Adam in the Ionian Islands (1827–1830) and on that of Lord Aylmer in North America (1830–1832). In 1838 Airey, then a lieutenant-colonel, went to the Horse Guards, where in 1852 he became military secretary to the commander-in-chief, Lord Hardinge. In 1854 he was given a brigade command in the army sent out to the East; from which, however, he was immediately transferred to the onerous and difficult post of quartermaster-general to Lord Raglan, in which capacity he served through the campaign in the Crimea. He was made a major-general in December 1854, and it was universally recognized in the army that he was the best soldier on Lord Raglan's staff. He was made a K.C.B., and was reported upon most favourably by his superiors, Lord Raglan and Sir J. Simpson. Airey was a quartermaster-general in the older sense of the word, *i.e.* a chief of the general staff, but a different view of the duties of the office was then becoming recognized. Public opinion held him and his department responsible for the failures and mismanagement of the commissariat. Airey demanded an inquiry on his return to England and cleared himself completely, but he never recovered from the effects of the unjust persecution of which he had been made the victim, though the popular view was not shared by his military superiors. He gave up his post at the front to become quartermaster-general to the forces at home. In 1862 he was promoted lieutenant-general, and from 1865 to 1870 he was governor of Gibraltar, receiving the G.C.B. in 1867. In 1870 he became adjutant-general at headquarters, and in 1871 attained the full rank of general. In 1876, on his retirement, he was created a peer, and in 1879–1880 he presided over the celebrated Airey commission on army reform. He died at the house of Lord Wolseley, at Leatherhead, on the 14th of September 1881.

AIR-GUN, a gun in which the force employed to propel the bullet is the elasticity of compressed atmospheric air. It has attached to it, or constructed in it, a reservoir of compressed air, a portion of which, liberated into the space behind the bullet, when the trigger is pulled, propels the bullet from the barrel by its expansion. The common forms of air-gun, which are merely toys, are charged by compressing a spiral spring, one end of which forms a piston working in a cylinder; when released by a pull on the trigger, this spring expands, and the air forced out in front of it propels the bullet. Air-guns of this kind are sometimes made to resemble walking-sticks and are then known as air-canes.

AIRY, SIR GEORGE BIDDELL (1801–1892), British Astronomer Royal, was born at Alnwick on the 27th of July 1801. He came of a long line of Airys who traced their descent back to a family of the same name residing at Kentmere, in Westmorland, in the 14th century; but the branch to which he belonged, having suffered in the civil wars, removed to Lincolnshire, where for several generations they lived as farmers. George Airy was educated first at elementary schools in Hereford, and afterwards at Colchester Grammar School. In 1819 he entered Trinity College, Cambridge, as a sizar. Here he had a brilliant career, and seems to have been almost immediately recognized as the leading man of his year. In 1822 he was elected scholar of Trinity, and in the following year he graduated as senior wrangler and obtained first Smith's prize. On the 1st of October 1824 he was elected fellow of Trinity, and in December 1826 was appointed Lucasian professor of mathematics in succession to Thomas Turton. This chair he held for little more than a year, being elected in February 1828 Plumian professor of astronomy and director of the new Cambridge observatory. Some idea of his activity as a writer on mathematical and physical subjects during these early years may be gathered from the fact that previous to this appointment he had contributed no less than three important memoirs to the *Philosophical Transactions of the Royal Society*, and eight to the Cambridge Philosophical Society. At the Cambridge observatory Airy soon gave evidence of his remarkable power of organization. The only telescope erected in the establishment when he took it in charge was the transit instrument, and to this he vigorously devoted himself. By the adoption of a regular system of work, and a careful plan of reduction, he was able to keep his observations reduced practically up to date, and published them annually with a degree of punctuality which astonished his contemporaries. Before long a mural circle was installed, and regular observations were instituted with it in 1833. In the same year the duke of Northumberland presented the Cambridge observatory with a fine object-glass of 12 in. aperture, which was mounted according to Airy's designs and under his superintendence, although the erection was not completed until after his removal to Greenwich in 1835. Airy's writings during this time are divided between mathematical physics and astronomy. The former are for the most part concerned with questions relating to the theory of light, arising out of his professorial lectures, among which may be specially mentioned his paper "On the Diffraction of an Object-Glass with Circular Aperture." In 1831 the Copley medal of the Royal Society was awarded to him for these researches. Of his astronomical writings during this period the most important are his investigation of the mass of Jupiter, his report to the British Association on the progress of astronomy during the 19th century, and his memoir *On an Inequality of Long Period in the Motions of the Earth and Venus.*

One of the sections of his able and instructive report was devoted to "A Comparison of the Progress of Astronomy in England with that in other Countries," very much to the disadvantage of England. This reproach was subsequently to a great extent removed by his own labours.

Airy's discovery of a new inequality in the motions of Venus and the earth is in some respects his most remarkable achievement. In correcting the elements of Delambre's solar tables he had been led to suspect an inequality overlooked by their constructor. The cause of this he did not long seek in vain. Eight times the mean motion of Venus is so nearly equal to thirteen times that of the earth that the difference amounts to only the $\frac{1}{240}$th of the earth's mean motion, and from the fact that the term depending on this difference, although very small in itself, receives in the integration of the differential equations a multiplier of about 2,200,000, Airy was led to infer the existence of a sensible inequality extending over 240 years (*Phil. Trans.* cxxii. 67). The investigation that brought about this result was probably the most laborious that had been made up to Airy's time in planetary theory, and represented the first specific improvement in the solar tables effected in England since the establishment of the theory of gravitation. In recognition of this work the medal of the Royal Astronomical Society was awarded to him in 1833.

In June 1835 Airy was appointed Astronomer Royal in succession to John Pond, and thus commenced that long career of wisely directed and vigorously sustained industry at the national observatory which, even more perhaps than his investigations in abstract science or theoretical astronomy, constitutes his chief title to fame. The condition of the observatory at the time of his appointment was such that Lord Auckland, the first lord of the Admiralty, considered that "it ought to be cleared out," while Airy admitted that "it was in a queer state." With his usual energy he set to work at once to reorganize the whole management. He remodelled the volumes of observations, put the library on a proper footing, mounted the new (Sheepshanks) equatorial and organized a new magnetic observatory. In 1847 an altazimuth was erected, designed by Airy to enable observations of the moon to be made not only on the meridian, but whenever she might be visible. In 1848 Airy invented the reflex zenith tube to replace the zenith sector previously employed. At the end of 1850 the great transit circle of 8 in. aperture and 11 ft. 6 in. focal length was erected, and is still the principal instrument of its class at the observatory. The mounting in 1859 of an equatorial of 13 in. aperture evoked the comment in his journal for that year, "There is not now a single person employed or instrument used in the observatory which was there in Mr Pond's time"; and the transformation was completed by the inauguration of spectroscopic work in 1868 and of the photographic registration of sun-spots in 1873.

The formidable undertaking of reducing the accumulated planetary observations made at Greenwich from 1750 to 1830 was already in progress under Airy's supervision when he became Astronomer Royal. Shortly afterwards he undertook the further laborious task of reducing the enormous mass of observations of the moon made at Greenwich during the same period under the direction, successively, of J. Bradley, N. Bliss, N. Maskelyne and John Pond, to defray the expense of which a large sum of money was allotted by the Treasury. As the result, no less than 8000 lunar observations were rescued from oblivion, and were, in 1846, placed at the disposal of astronomers in such a form that they could be used directly for comparison with the theory and for the improvement of the tables of the moon's motion. For this work Airy received in 1848 a testimonial from the Royal Astronomical Society, and it at once led to the discovery by P. A. Hansen of two new inequalities in the moon's motion. After completing these reductions, Airy made inquiries, before engaging in any theoretical investigation in connexion with them, whether any other mathematician was pursuing the subject, and learning that Hansen had taken it in hand under the patronage of the king of Denmark, but that, owing to the death of the king and the consequent lack of funds, there was danger of his being compelled to abandon it, he applied to the admiralty on Hansen's behalf for the necessary sum. His request was immediately granted, and thus it came about that Hansen's famous *Tables de la Lune* were dedicated to *La Haute Amirauté de sa Majesté la Reine de la Grande Bretagne et d'Irlande.*

One of the most remarkable of Airy's researches was his determination of the mean density of the earth. In 1826 the idea occurred to him of attacking this problem by means of pendulum experiments at the top and bottom of a deep mine. His first attempt, made in the same year, at the Dolcoath mine in Cornwall, failed in consequence of an accident to one of the pendulums; a second attempt in 1828 was defeated by a flooding of the mine, and many years elapsed before another opportunity presented itself. The experiments eventually took place at the Harton pit near South Shields in 1854. Their immediate result was to show that gravity at the bottom of the mine exceeded that at the top by $\frac{1}{19286}$th of its amount, the depth being 1256 ft. From this he was led to the final value of 6·566 for the mean density of the earth as compared with that of water (*Phil. Trans.* cxlvi. 342). This value, although considerably in excess of that previously found by different methods, was held by Airy, from the care and completeness with which the observations were carried out and discussed, to be "entitled to compete with the others on, at least, equal terms."

In 1872 Airy conceived the idea of treating the lunar theory in a new way, and at the age of seventy-one he embarked on the prodigious toil which this scheme entailed. A general description of his method will be found in the *Monthly Notices of the Royal Astronomical Society*, vol. xxxiv. No. 3. It consisted essentially in the adoption of Delauny's final numerical expressions for longitude, latitude and parallax, with a symbolic term attached to each number, the value of which was to be determined by substitution in the equations of motion. In this mode of treating the question the order of the terms is numerical, and though the amount of labour is such as might well have deterred a younger man, yet the details were easy, and a great part of it might be entrusted to a mere computer. The work was published in 1886, when its author was eighty-five years of age. For some little time previously he had been harassed by a suspicion that certain errors had crept into the computations, and accordingly he addressed himself to the task of revision. But his powers were no longer what they had been, and he was never able to examine sufficiently into the matter. In 1890 he tells us how a grievous error had been committed in one of the first steps, and pathetically adds, "My spirit in the work was broken, and I have never heartily proceeded with it since." In 1881 Sir George Airy resigned the office of Astronomer Royal and resided at the White House, Greenwich, not far from the Royal Observatory, until his death, which took place on the 2nd of January 1892.

A complete list of Airy's printed papers, numbering no less than 518, will be found in his *Autobiography*, edited in 1896 by his son, Wilfrid Airy, B. A., M. Inst.C.E. Amongst the most important of his works not already mentioned may be named the following:—*Mathematical Tracts* (1826) *on the Lunar Theory, Figure of the Earth, Precession and Nutation*, and *Calculus of Variations*, to which, in the second edition of 1828, were added tracts on the Planetary Theory and the Undulatory Theory of Light; *Experiments on Iron-built Ships, instituted for the purpose of discovering a correction for the deviation of the Compass produced by the Iron of the Ships* (1839); *On the Theoretical Explanation of* *an apparent new Polarity in Light* (1840); *Tides and Waves* (1842).

He was elected a fellow of the Royal Society in 1836, its president in 1871, and received both the Copley and Royal medals. He was five times president of the Royal Astronomical Society, was correspondent of the French Academy and belonged to many other foreign and American societies. He was D.C.L. of Oxford and LL.D. of Cambridge and Edinburgh. In 1872 he was made K.C.B. In the same year he was nominated a Grand Cross in the Imperial Order of the Rose of Brazil; he also held the Prussian Order "Pour le Mérite," and belonged to the Legion of Honour of France and to the Order of the North Star of Sweden and Norway.

See also *Proc. Roy. Society*, li. 1 (E. J. Routh); *Month. Notices Roy. Astr. Society*, lii. 212; *Observatory*, xv. 74 (E. Dunkin); *Nature*, 31st of Oct. 1878 (A. Winnecke), 7th of Jan. 1892; *The Times*, 5th of Jan. 1892; R. Grant's *Hist. of Phys. Astronomy*; R. P. Graves's *Life of Sir W. Rowan Hamilton*. (A. A. R.*)

AISLABIE, JOHN (1670–1742), English politician, was born at Goodramgate, York, on the 7th of December 1670. He was the fourth son of George Aislabie, principal registrar of the archiepiscopal court of York. In 1695 he was elected member of parliament for Ripon. In 1712 he was appointed one of the commissioners for executing the office of lord high admiral, and in 1714 became treasurer of the navy, being sworn in two years later as a member of the privy council. In March 1718 he became chancellor of the exchequer. The proposal of the South Sea Company to pay off the national debt was strenuously supported by Aislabie, and finally accepted in an amended form by the House of Commons. After the collapse of that company a secret committee of inquiry was appointed by the Commons, and Aislabie, who had in the meantime resigned the seals of his office, was declared guilty of having encouraged and promoted the South Sea scheme with a view to his own exorbitant profit, and expelled from the House. Though committed to the Tower he was soon released, and was allowed to retain the property he possessed before 1718, including his country estate, to which he retired to pass the rest of his days. He died in 1742.

AISLE (from Lat. *ala*, a wing), a term which in its primary sense means the wing of a house, but is generally applied in architecture to the lateral divisions of a church or large building. The earliest example is that found in the basilica of Trajan, which had double aisles on either side of the central area; the same number existed in the original church of St Peter's at Rome, in the basilica at Bethlehem, and according to Eusebius in the church of the Holy Sepulchre at Jerusalem. The aisles are divided from the nave or central area by colonnades or arcades, and may flank also the transept or choir, being distinguished as nave-aisles, transept-aisles or choir-aisles. If the choir is semi-circular, and the aisles, carried round, give access to a series of chapels, the whole arrangement is known as the chevet. As a rule in Great Britain there is only one aisle on each side of the nave, the only exceptions being Chichester and Elgin cathedrals, where there are two. Many European cathedrals have two aisles on each side, as those of Paris, Bourges, Amiens, Troyes, St Sernin, Toulouse, Cologne, Milan, Seville, Toledo; and in those of Paris, Chartres, Amiens and Bourges, Seville and Toledo, double aisles flank the choir on each side. The cathedral at Antwerp has three aisles on each side. In some of the churches in Germany the aisles are of the same height as the nave. These churches are known as *Hallenkirchen*, the principal examples being St Stephen's, Vienna, the Weissekirche at Soest, St Martin's, Landshut, Munich cathedral, and the Marienkirche at Danzig. (R. P. S.)

AISNE, a frontier department in the north-east of France, formed in 1790 from portions of the old provinces of Ile-de-France and Picardy. Area 2866 sq. m. Pop. (1906) 534,495. It is bounded N. by the department of Nord and the kingdom of Belgium, E. by the department of Ardennes, S.E. by that of Marne, S. by that of Seine-et-Marne, and W. by those of Oise and Somme. The surface of the department consists of undulating and well-wooded plains, intersected by numerous valleys, and diversified in the north-east by hilly ground which forms a part of the mountain system of the Ardennes. Its general slope is from north-east, where the culminating point (930 ft.) is found, to south-west, though altitudes exceeding 750 ft. are also found in the south. The chief rivers are the Somme, the Escaut and the Sambre, which have their sources in the north of the department; the Oise, traversing the north-west, with its tributaries the Serre and the Aisne, the latter of which joins it beyond the limits of the department; and the Marne and the Ourcq in the south. The climate is in general cold and humid, especially in the north-east. Agriculture is highly developed; cereals, principally wheat and oats, and beetroot are the chief crops; potatoes, flax, hemp, rape and hops are also grown. Pasturage is good, particularly in the north-east, where dairy-farming flourishes. Wine of medium quality is grown on the banks of the Marne and the Aisne. Bee-farming is of some importance. Large tracts of the department are under wood; the chief forests are those of Nouvion and St Michel in the north, Coucy and St Gobain in the centre, and Villers-Cotterets in the south. The osiers grown in the vicinity of St Quentin supply an active basket-making industry.

Though destitute of metals Aisne furnishes abundance of freestone, gypsum and clay. There are numerous tile and brick works in the department. Its most important industrial establishments are the mirror manufactory of St Gobain and the chemical works at Chauny, and the workshops and foundries of Guise, the property of an association of workpeople organized on socialistic lines and producing iron goods of various kinds. The manufacture of sugar is very important; brewing, distilling, flour-milling, iron-founding, the weaving and spinning of cotton, wool and silk, and the manufacture of iron goods, especially agricultural implements, are actively carried on. Aisne imports coal, iron, cotton and other raw material and machinery; it exports cereals, live-stock and agricultural products generally, and manufactured goods. The department is served chiefly by the lines of the Northern railway; in addition, the main line of the Eastern railway to Strassburg traverses the extreme south. The Oise, Aisne and Marne are navigable, and canals furnish 170 m. of waterway. Aisne is divided into five arrondissements—St Quentin and Vervins in the north, Laon in the centre, and Soissons and Château-Thierry in the south—and contains 37 cantons and 841 communes. It forms part of the educational division (*académie*) of Douai and of the region of the second army corps, its military centre being at Amiens, where also is its court of appeal. Laon is the capital, and Soissons the seat of a bishopric of the province of Reims. Other important places are Château-Thierry, St Quentin and Coucy-le-Château. La Ferté-Milon has remains of an imposing château of the 14th and 15th centuries with interesting fortifications. The ruined church at Longpont (13th century) is the relic of an important Cistercian abbey; Urcel and Mont-Notre-Dame have fine churches, the first entirely in the Romanesque style, the second dating from the 12th and 13th centuries, to which period the church at Braisne also belongs. At Prémontré the buildings of the abbey, which was the cradle of the Premonstratensian order, are occupied by a lunatic asylum.

AÏSSÉ [a corruption of HAIDÉE], MADEMOISELLE (*c.* 1694–1733), French letter-writer, was the daughter of a Circassian chief, and was born about 1694. Her father's palace was pillaged by the Turks, and as a child of four years old she was sold to the comte de Ferriol, the French ambassador at Constantinople. She was brought up in Paris by Ferriol's sister-in-law with her own sons, MM. d'Argental and Pont de Veyle. Her great beauty and romantic history made her the fashion, and she attracted the notice of the regent, Philip, duke of Orleans, whose offers she had the strength of mind to refuse. She formed a deep and lasting attachment to the Chevalier d'Aydie, by whom she had a daughter. She died in Paris on the 13th of March 1733. Her letters to her friend Madame Calandrini contain much interesting information with regard to contemporary celebrities, especially on Mme. du Deffand and Mme. de Tencin, but they are above all of interest in the picture they afford of the writer's own tenderness and fidelity. Her *Lettres* were edited by Voltaire (1787), by J. Ravenel, with a notice by Sainte-Beuve (1846) and by Eugène Asse (1873). Mlle. Aïssé has been the subject of three plays: by A. de Lavergne and P. Woucher (1854), by Louis Bouilhet (1872) and by Dejoux (1898).

See also Courteault, *Une Idylle au XVIIIe siècle, Mlle. Aïssé et le Chevalier d'Aydie* (Maçon, 1900); and notices prefixed to the editions of 1846 and 1873. There is an interesting essay by E. Gosse in his *French Profiles* (1905).

AITON, WILLIAM (1731–1793), Scottish botanist, was born near Hamilton in 1731. Having been regularly trained to the profession of a gardener, he travelled to London in 1754, and became assistant to Philip Miller, then superintendent of the Physic Garden at Chelsea. In 1759 he was appointed director of the newly established botanical garden at Kew, where he remained until his death on the 2nd of February 1793. He effected many improvements at the gardens, and in 1789 he published *Hortus Kewensis*, a catalogue of the plants there cultivated. A second and enlarged edition of the *Hortus* was brought out in 1810–1813 by his eldest son, WILLIAM TOWNSEND AITON (1766–1849), who succeeded him at Kew and was commissioned by George IV. to lay out the gardens at the Pavilion, Brighton.

AITZEMA, LIEUWE (LEO) **VAN** (1600–1669), Dutch historian and statesman, was born at Doccum, in Friesland, on the 19th of November 1600. In 1617 he published a volume of Latin poems under the title of *Poemata Juvenilia*, of which a copy is preserved in the British Museum. He made a special study of politics and political science and was for thirty years resident for the towns of the Hanseatic League at the Hague, where he died on the 23rd of February 1669. His most important work was the *Saken van Staet in Oorlogh in ende omtrent de Vereenigte Nederlanden* (14 vols. 4to, 1655–1671), embracing the period from 1621 to 1668. It contains a large number of state documents, and is an invaluable authority on one of the most eventful periods of Dutch history.

Four continuations of the history, by the poet and historian Lambert van den Bos, were published successively at Amsterdam in 1685, 1688, 1698 and 1699. The *Derde Vervolg Zijnde het vierde Stuck van het Vervolgh op de Historie, &c.*, brings the history down to 1697.

AIVALI (Gr. *Kydonia*), a prosperous town on the W. coast of Asia Minor, opposite the island of Mitylene. Pop. 21,000. It stands near the site of the Aeolian *Heraclea*, on rising ground at the end of a bay which is separated from the Gulf of Adramyttium, and protected from the prevailing winds by the Moschonisi Islands (*Hecatonnesoi*). In 1821 it was burned to the ground during a fight between the Turks and the Greeks, and a large number of its Greek population killed or enslaved. It is one of the most thriving towns in the Levant, with a purely Greek population distinguished for its commercial, industrial and maritime enterprise. The exports are olive oil, grain and wood, and a fleet of fishing-boats supplies Constantinople and Smyrna with fish; the exports in 1902 were valued at £987,070, and the imports at £336,693.

AIWAN, the reception-hall or throne-room of a Parthian or Sassanian palace.

AIX, a city of south-eastern France, capital of an arrondissement in the department of Bouches-du-Rhône, 18 m. N. of Marseilles by rail. Pop. (1906) 19,433. It is situated in a plain overlooking the Arc, about a mile from the right bank of the river. The Cours Mirabeau, a wide thoroughfare, planted with double rows of plane-trees, bordered by fine houses and decorated by three fountains, divides the town into two portions. The new town extends to the south, the old town with its wide but irregular streets and its old mansions dating from the 16th, 17th and 18th centuries lies to the north. Aix is an important educational centre, being the seat of the faculties of law and letters of the university of Aix-Marseille, and the north and east quarter of the town, where the schools and university buildings are situated, is comparable to the Latin Quarter of Paris. The cathedral of St Sauveur, which dates from the 11th, 12th and 13th centuries, is situated in this portion of Aix. It is preceded by a rich portal in the Gothic style with elaborately carved doors, and is flanked on the north by an uncompleted tower. The interior contains tapestry of the 16th century and other works of art. The archbishop's palace and a Romanesque cloister adjoin the cathedral on its south side. The church of St Jean de Malte, dating from the 13th century, contains some valuable pictures. The hôtel de ville, a building in the classical style of the middle of the 17th century, looks on to a picturesque square. It contains some fine wood-work and a large library which includes many valuable MSS. At its side rises a handsome clock-tower erected in 1505. Aix possesses many beautiful fountains, one of which in the Cours Mirabeau is surmounted by a statue of René, count of Provence, who held a brilliant court at Aix in the 15th century. Aix has thermal springs, remarkable for their heat and containing lime and carbonic acid. The bathing establishment was built in 1705 near the site of the ancient baths of Sextius, of which vestiges still remain. The town, which is the seat of an archbishop and court of appeal, and the centre of an *académie* (educational circumscription), numbers among its public institutions a court of assizes, tribunals of first instance and of commerce, and a chamber of arts and manufactures. It also has training-colleges, a lycée, a school of art and technics, museums of antiquities, natural history and painting, and several learned societies. The industries include flour-milling, the manufacture of confectionery, iron-ware and hats, and the distillation of olive-oil. Trade is in olive-oil, almonds and stone from the neighbouring quarries.

Aix (*Aquae Sextiae*) was founded in 123 B.C. by the Roman consul Sextius Calvinus, who gave his name to its springs. In 102 B.C. its neighbourhood was the scene of the defeat inflicted on the Cimbri and Teutones by Marius. In the 4th century it became the metropolis of Narbonensis Secunda. It was occupied by the Visigoths in 477, in the succeeding century was repeatedly plundered by the Franks and Lombards, and was occupied by the Saracens in 731. Aix, which during the middle ages was the capital of the county of Provence, did not reach its zenith until after the 12th century, when, under the houses of Aragon and Anjou, it became an artistic centre and seat of learning. With the rest of Provence, it passed to the crown of France in 1487, and in 1501 Louis XII. established there the *parlement* of Provence which existed till 1789. In the 17th and 18th centuries the town was the seat of the *intendance* of Provence.

AIX-LA-CHAPELLE (Ger. *Aachen*, Dutch *Aken*), a city and spa of Germany, in the kingdom of Prussia, situated in a pleasant valley, 44 m. W. of Cologne and contiguous to the Belgian and Dutch frontiers, to which its municipal boundaries extend. Pop. (1885) 95,725; (1905) including Burtscheid, 143,906. Its position, at the centre of direct railway communications with Cologne and Düsseldorf respectively on the E. and Liège–Brussels and Maestricht-Antwerp on the W., has favoured its rise to one of the most prosperous commerical towns of Germany. The city consists of the old inner town, the former ramparts of which have been converted into promenades, and the newer outer town and suburbs. Of the ancient gates but two remain, the Ponttor on the N.W. and the Marschiertor on the S. Its general appearance is that rather of a spacious modern, than of a medieval city full of historical associations.

Of the cluster of buildings in the centre, which are conspicuous from afar, the town hall (Rathaus) and the cathedral are specially noteworthy. The former, standing on the south side of the market square, is a Gothic structure, erected in 1353–1370 on the ruins of Charlemagne's palace. It contains the magnificent coronation hall of the emperors (143 ft. by 61 ft.), in which thirty-five German kings and eleven queens have banqueted after the coronation ceremony in the cathedral. The two ancient towers, the Granusturm to the W. and the Glockenturm to the E., both of which to a large extent had formed part of the Carolingian palace, were all but destroyed in the fire by which the Rathaus was seriously damaged in 1883. Their restoration was completed in 1902. Behind the Rathaus is the Grashaus, in which Richard of Cornwall, king of the Romans, is said to have held his court. It was restored in 1889 to accommodate the municipal archives. The cathedral is of great historic and architectural interest. Apart from the spire, which was rebuilt in 1884, it consists of two parts of different styles and date. The older portion, the *capella in palatio*, an octagonal building surmounted by a dome, was designed on the model of San Vitale at Ravenna by Udo of Metz, was begun under Charlemagne's auspices in 796 and consecrated by Pope Leo III. in 805. After being almost entirely wrecked by Norman raiders it was rebuilt, on the original lines, in 983, by the emperor Otto III. It is surrounded on the first story by a sixteen-sided gallery (the Hochmünster) adorned by antique marble and granite columns, of various sizes, brought by Charlemagne's orders from Rome, Ravenna and Trier. These were removed by Napoleon to Paris, but restored to their original positions after the peace of 1815. The mosaic representing Christ surrounded by "the four-and-twenty elders," which originally lined the cupola, had almost entirely perished by the 19th century, but was restored in 1882 from a copy made in the 17th century. Interesting too are the magnificent west doors, cast in bronze by native workmen in 804. Underneath the dome, according to tradition, was the tomb of Charlemagne, which, on being opened by Otto III. in 1000, disclosed the body of the emperor, vested in white coronation robes and seated on a marble chair. This chair, now placed in the gallery referred to, was used for centuries in the imperial coronation ceremonies. The site of the tomb is marked by a stone slab, with the inscription *Carlo Magno*, and above it hangs the famous bronze chandelier presented by the emperor Frederick I. (Barbarossa) in 1168. Charlemagne's bones are preserved in an ornate shrine in the Hungarian Chapel, lying to the north of the octagon. The casket was opened in 1906, at the instance of the emperor William II., and the draperies enclosing the body were temporarily removed to Berlin, with a view to the reproduction of similar cloth. The Gothic choir, forming the more modern portion of the cathedral, was added during the latter half of the 14th and the beginning of the 15th century, and contains the tomb of the emperor Otto III. The cathedral possesses many relics, the more sacred of which are exhibited only once every seven years, when they attract large crowds of worshippers.

Of the other thirty-three churches in the city those of St Foillan (founded in the 12th century, but twice rebuilt, in the 15th and 17th centuries, and restored in 1883) and St Paul, with its beautiful stained-glass windows, are remarkable. In addition to those already mentioned, Aix-la-Chapelle possesses several fine secular buildings: the Suermondt museum, containing besides other miscellaneous exhibits the fine collection of pictures by early German, Dutch and Flemish masters, presented to the town by Bartholomäus Suermondt (d. 1887); the public library; the theatre; the post-office; and the fine new central railway station. Among the schools may be mentioned the magnificently equipped Rhenish-Westphalian Polytechnic School (built 1865–1870) and the school of mining and electricity, founded in 1897.

There are many fine streets and squares and some handsome public monuments, notably among the last the fountain on the market square surmounted by a statue of Charlemagne, the bronze equestrian statue of the emperor William I. facing the theatre, the Kriegerdenkmal (a memorial to those who fell in the war of 1870) and the Kongress-Denkmal, a marble hall in antique style erected in 1844 on the Adalberts-Steinweg to commemorate the famous congress of 1818 (see below). Of the squares, the principal is the Friedrich-Wilhelmplatz, on which lies the Elisenbrunnen with its colonnade and garden, the chief resort of visitors taking the baths and waters.

The hot sulphur springs of Aix-la-Chapelle were known to the Romans and have been celebrated for centuries as specific in the cure of rheumatism, gout and scrofulous disorders. There are six in all, of which the Kaiserquelle, with a temperature of 136° F., is the chief. In the neighbouring Burtscheid (incorporated in 1897 with Aix-la-Chapelle) are also springs of far higher temperature, and this suburb, which has also a Kurgarten, is largely frequented during the season.

In respect of trade and industry Aix-la-Chapelle occupies a high place. Its cloth and silk manufactures are important, and owing to the opening up of extensive coalfields in the district almost every branch of iron industry is carried on. It has some large breweries and manufactories of chemicals, and does a considerable trade in cereals, leather, timber and wine. It is also an important banking centre and has several insurance societies of reputation.

The country immediately surrounding Aix-la-Chapelle presents many attractive features. From the Lousberg and the Salvatorberg to the north, the latter crowned by a chapel, magnificent views of the city are obtained; while covering the hills 2 m. west stretches the Stadtwald, a forest with charming walks and drives.

History.—Aix-la-Chapelle is the Aquisgranum of the Romans, named after Apollo Granus, who was worshipped in connexion with hot springs. As early as A.D. 765 King Pippin had a "palace" here, in which it is probable that Charlemagne was born. The greatness of Aix was due to the latter, who between 777 and 786 built a magnificent palace on the site of that of his father, raised the place to the rank of the second city of the empire, and made it for a while the centre of Western culture and learning. From the coronation of Louis the Pious in 813 until that of Ferdinand I. in 1531 the sacring of the German kings took place at Aix, and as many as thirty-two emperors and kings were here crowned. In 851, and again in 882, the place was ravaged by the Northmen in their raids up the Rhine. It was not, however, till late in the 12th century (1172–1176) that the city was surrounded with walls by order of the emperor Frederick I., to whom (in 1166) and to his grandson Frederick II. (in 1215) it owed its first important civic rights. These were still further extended in 1250 by the anti-Caesar William of Holland, who had made himself master of the place and of the imperial regalia, after a long siege, in 1248. The liberties of the burghers were, however, still restrained by the presence of a royal *advocatus* (*Vogt*) and bailiff. In 1300 the outer ring of walls was completed, the earlier circumvallation being marked by the limit of the Altstadt (old city). In the 14th century Aix, now a free city of the Holy Roman Empire, played a conspicuous part, especially in the league which, between 1351 and 1387, kept the peace between the Meuse and the Rhine. In 1450 an insurrection led to the admission of the gilds to a share in the municipal government. In the 16th century Aix began to decline in importance and prosperity. It lay too near the French frontier to be safe, and too remote from the centre of Germany to be convenient, as a capital; and in 1562 the election and coronation of Maximilian II. took place at Frankfort-on-Main, a precedent followed till the extinction of the Empire. The Reformation, too, brought its troubles. In 1580 Protestantism got the upper hand; the ban of the empire followed and was executed by Ernest of Bavaria, archbishop-elector of Cologne in 1598. A relapse of the city led to a new ban of the emperor Matthias in 1613, and in the following year Spinola's Spanish troops brought back the recalcitrant city to the Catholic fold. In 1656 a great fire completed the ruin wrought by the religious wars. By the treaty of Lunéville (1801) Aix was incorporated with France as chief town of the department of the Roer. By the congress of Vienna it was given to Prussia. The contrast between the new régime and the ancient tradition of the city was curiously illustrated in 1818 by a scene described in Metternich's *Memoirs*, when, before the opening of the congress, Francis I., emperor of Austria, regarded by all Germany as the successor of the Holy Roman emperors, knelt at the tomb of Charlemagne amid a worshipping crowd, while the Protestant Frederick William III. of Prussia, the new sovereign of the place, stood in the midst, "looking very uncomfortable."

See Quix, *Geschichte der Stadt Aachen* (1841); Pick, *Aus Aachens Vergangenheit* (Aachen, 1895); Bock, *Karls des grossen Pfalzkapelle* (Cologne, 1867); and Beissel, *Aachen als Kurort* (1889).

AIX-LA-CHAPELLE, CONGRESSES OF. Three congresses have been held at Aix-la-Chapelle: the first in 1668, the second in 1748, the third in 1818.

1. The treaty of the 2nd of May 1668, which put an end to the War of Devolution, was the outcome of that of St Germain

signed on the 15th of April by France and the representatives of the powers of the Triple Alliance. The treaty of Aix-la-Chapelle left to France all the conquests made in Flanders during the campaign of 1667, with all their "*appartenances, dépendances et annexes*," a vague provision of which, after the peace of Nijmwegen (1680), Louis XIV. took advantage to occupy a number of villages and towns adjudged to him by his *Chambres de réunion* as dependencies of the cities and territories acquired in 1668. On the other hand, France restored to Spain the cities of Cambrai, Aire and Saint-Omer, as well as the province of Franche Comté. The treaty of Aix-la-Chapelle was placed under the guarantee of Great Britain, Sweden and Holland, by a convention signed at the Hague on the 7th of May 1669, to which Spain acceded.

See Jean du Mont, baron de Carlscroon, *Corps universel diplomatique* (Amst., 1726–1731).

2. On the 24th of April 1748 a congress assembled at Aix-la-Chapelle for the purpose of bringing to a conclusion the struggle known as the War of Austrian Succession. Between the 30th of April and the 21st of May the preliminaries were agreed to between Great Britain, France and Holland, and to these Maria Theresa, queen of Bohemia and Hungary, the kings of Sardinia and Spain, the duke of Modena, and the republic of Genoa successively gave their adhesion. The definitive treaty was signed on the 18th of October, Sardinia alone refusing to accede, because the treaty of Worms was not guaranteed. Of the provisions of the treaty of Aix-la-Chapelle the most important were those stipulating for (1) a general restitution of conquests, including Cape Breton to France, Madras to England and the barrier towns to the Dutch; (2) the assignment to Don Philip of the duchies of Parma, Piacenza and Guastalla; (3) the restoration of the duke of Modena and the republic of Genoa to their former positions; (4) the renewal in favour of Great Britain of the Asiento contract of the 16th of March 1713, and of the right to send an annual vessel to the Spanish colonies; (5) the renewal of the article of the treaty of 1718 recognizing the Protestant succession in the English throne; (6) the recognition of the emperor Francis and the confirmation of the pragmatic sanction, *i.e.* of the right of Maria Theresa to the Habsburg succession; (7) the guarantee to Prussia of the duchy of Silesia and the county of Glatz.

Spain having raised objections to the Asiento clauses, the treaty of Aix-la-Chapelle was supplemented by that of Madrid (5th of October 1750), by which Great Britain surrendered her claims under those clauses in return for a sum of £100,000.

See A. J. H. de Clercq, *Recueil des traités de la France*; F. A. Wenk, *Corpus juris gentium recentissimi*, 1735–1772, vol. ii. (Leipzig, 1786), p. 337; Comte G. de Garden, *Hist. des traités de paix*, 1848-1887, iii. p. 373.

3. The congress or conference of Aix-la-Chapelle, held in the autumn of 1818, was primarily a meeting of the four allied powers—Great Britain, Austria, Prussia and Russia—to decide the question of the withdrawal of the army of occupation from France and the nature of the modifications to be introduced in consequence into the relations of the four powers towards each other, and collectively towards France. The congress, of which the first session was held on the 1st of October, was attended by the emperor Alexander I. of Russia, the emperor Francis I. of Austria, and Frederick William III. of Prussia, in person. Great Britain was represented by Lord Castlereagh and the duke of Wellington, Austria by Prince Metternich, Russia by Counts Capo d'Istria and Nesselrode, Prussia by Prince Hardenberg and Count Bernstorff. The duc de Richelieu, by favour of the allies, was present on behalf of France. The evacuation of France was agreed to in principle at the first session, the consequent treaty being signed on the 9th of October. The immediate object of the conference being thus readily disposed of, the time of the congress was mainly occupied in discussing the form to be taken by the European alliance, and the "military measures," if any, to be adopted as a precaution against a fresh outburst on the part of France. The proposal of the emperor Alexander I. to establish a "universal union of guarantee" on the broad basis of the Holy Alliance, after much debate, broke down on the uncompromising opposition of Great Britain; and the main outcome of the congress was the signature, on the 15th of November, of two instruments: (1) a secret protocol confirming and renewing the quadruple alliance established by the treaties of Chaumont and Paris (of the 20th of November 1815) against France; (2) a public "declaration" of the intention of the powers to maintain their intimate union, "strengthened by the ties of Christian brotherhood," of which the object was the preservation of peace on the basis of respect for treaties. The secret protocol was communicated in confidence to Richelieu; to the declaration France was invited publicly to adhere.

Besides these questions of general policy, the congress concerned itself with a number of subjects left unsettled in the hurried winding up of the congress of Vienna, or which had arisen since. Of these the most important were the questions as to the methods to be adopted for the suppression of the slave-trade and the Barbary pirates. In neither case was any decision arrived at, owing (1) to the refusal of the other powers to agree with the British proposal for a reciprocal right of search on the high seas; (2) to the objection of Great Britain to international action which would have involved the presence of a Russian squadron in the Mediterranean. In matters of less importance the congress was more unanimous. Thus, on the urgent appeal of the king of Denmark, the king of Sweden (Bernadotte) received a peremptory summons to carry out the terms of the treaty of Kiel; the petition of the elector of Hesse to be recognized as king was unanimously rejected; and measures were taken to redress the grievances of the German mediatized princes. The more important outstanding questions in Germany, *e.g.* the Baden succession, were after consideration reserved for a further conference to be called at Frankfort. In addition to these a great variety of questions were considered, from that of the treatment of Napoleon at St Helena, to the grievances of the people of Monaco against their prince and the position of the Jews in Austria and Prussia. An attempt made to introduce the subject of the Spanish colonies was defeated by the opposition of Great Britain. Lastly, certain vexatious questions of diplomatic etiquette were settled once for all (see DIPLOMACY). The congress, which broke up at the end of November, is of historical importance mainly as marking the highest point reached in the attempt to govern Europe by an international committee of the powers. The detailed study of its proceedings is highly instructive in revealing the almost insurmountable obstacles to any really effective international system.

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AIX-LES-BAINS, a town of France, in the department of Savoie, near the Lac du Bourget, and 9 m. by rail N. of Chambéry. Pop. (1901) 4741. It is 846 ft. above the level of the sea. It was a celebrated bathing-place, under the name of *Aquae Gratianae*, in the time of the Romans, and possesses numerous ancient remains. The hot springs, which are of sulphureous quality, and have a temperature of from 109° to 113° F., are still much frequented, attracting annually many thousands of visitors. They are used for drinking as well as for bathing purposes.

AIYAR, SIR SHESHADRI (1845–1901), native statesman of Mysore, India, was the son of a Brahman of Palghat in the district of Malabar. He was educated at the provincial school at Calicut and the presidency college in Madras, and entered the government service as a translator. In 1868 he was transferred to Mysore under Runga Charlu, and for thirteen years filled various offices in that state; but when Mysore was restored to native rule in 1881, he became personal assistant to Runga Charlu, whom he succeeded as diwan in 1885. For the next seventeen years he laboured assiduously to promote the economic and industrial development of the state, and proved an able assistant to the Maharaja Chamarajendra. By means of railway, irrigation and mining works, he added greatly to the wealth of the state, and put it on a sound financial footing. He retired in 1900, was made K.C.S.I. in 1893 and died on the 13th of September 1901.

AIYAR, SIR TIRUVARUR MUTUSWAMY (1832–1895), native Indian judge of the high court of Madras, was born of poor parents in the village of Vuchuwadi, near Tanjore, on the 28th of January 1832. His widowed mother was forced by poverty to remove with Mutuswamy and his brother to Tiruvarar, where the former learnt Tamil, and soon set to work under the village accountant at a monthly salary of one rupee. About this time he lost his mother, whose memory he cherished with reverence and affection to the last. His duty took him to the court-house of the tehsildar, Mr Naiken, who soon remarked his extraordinary intelligence and industry. There was an English school at Tiruvarar, where Mutuswamy managed to pick up an elementary knowledge of the English language. Mr Naiken then sent him to Sir Henry Montgomery's school at Madras, as a companion to his nephew, and there he won prizes and scholarships year after year. In 1854 he won a prize of 500 rupees offered to the students of the Madras presidency by the council of education for the best English essay. This success brought him to the notice of Sir Alexander Arbuthnot and Mr Justice Holloway. He was offered help to proceed to England and compete for the civil service, but being a Brahman and married, he declined to cross the ocean. Instead he entered the subordinate government service, and was employed in such various posts as school-teacher, record-keeper in Tanjore, and in 1856 deputy-inspector of schools. At this time the Madras authorities instituted the examination for the office of pleaders, and Mutuswamy came out first in the first examination, even beating Sir T. Madhavarao, his senior by many years. Mutuswamy was then appointed in succession district munsiff at Tranquebar, deputy-collector in Tanjore in 1859, sub-judge of south Kanara in 1865, and a magistrate of police at Madras in 1868. While serving in the last post he passed the examination for the degree of bachelor of laws of the local university. He was next employed as a judge of the Madras small causes court, until in 1878 he was raised to the bench of the high court, which office he occupied with ability and distinction for over fifteen years, sometimes acting as the chief justice. He attended by invitation of the viceroy the imperial assemblage at Delhi in 1877. In 1878 he received the honour of C.I.E. and in 1893 the K.C.I.E. was conferred on him. But he did not live long to enjoy this dignity, dying suddenly in 1895. Mutuswamy was too devoted to his offical work to give much time to other pursuits. Still he took his full share in the affairs of the Madras university, of which he was nominated a fellow in 1872 and a syndic in 1877, and was well acquainted with English law, literature and philosophy. He was through life a staunch Brahman, devout and amiable in character, with a taste for the ancient music of India and the study of the Vedas and other departments of Sanskrit literature.

AJACCIO, the capital of Corsica, on the west coast of the island, 210 m. S.E. of Marseilles. Pop. (1906) 19,021. Ajaccio occupies a sheltered position at the foot of wooded hills on the northern shore of the Gulf of Ajaccio. The harbour, lying to the east of the town, is protected on the south by a peninsula which carries the citadel and terminates in the Citadel jetty; to the south-west of this peninsula lies the Place Bonaparte, a quarter frequented chiefly by winter visitors attracted by the mild climate of the town. Apart from one or two fine thoroughfares converging to the Place Bonaparte, the streets are mean and narrow and the town has a deserted appearance. The house in which Napoleon I, was born in 1769 is preserved, and his associations with the town are everywhere emphasized by street-names and statues. The other buildings, including the cathedral of the 16th century, are of little interest. The town is the seat of a bishopric dating at least from the 7th century and of a prefect. It has tribunals of first instance and of commerce, training colleges, a communal college, a museum and a library; the three latter are established in the Palais Fesch, founded by Cardinal Fesch, who was born at Ajaccio in 1763. Ajaccio has small manufactures of cigars and macaroni and similar products, and carries on shipbuilding, sardine-fishing and coral-fishing. Its exports include timber, citrons, skins, chestnuts and gallic acid. The port is accessible by the largest ships, but its accommodation is indifferent. In 1904 there entered 603 vessels with a tonnage of 202,980, and cleared 608 vessels with a tonnage of 202,502. The present town of Ajaccio lies about two miles to the south of its original site, from which it was transferred by the Genoese in 1492. Occupied from 1553 to 1559 by the French, it again fell to the Genoese after the treaty of Cateau Cambrésis in the latter year. The town finally passed to the French in 1768. Since 1810 it has been capital of the department of Corsica.

AJAIGARH, or ADJYGURH, a native state of India, in Bundelkhand, under the Central India agency. It has an area of 771 sq. m., and a population in 1901 of 78,236. The chief, who is a Bundela Rajput, bears the title of sawai maharaja. He has an estimated revenue of about £15,000, and pays a tribute of £460. He resides at the town of Naushahr, at the foot of the hill-fortress of Ajaigarh, from which the state takes its name. This fort is situated on a very steep hill, more than 800 ft. above the town of the same name; and contains the ruins of temples adorned with elaborately carved sculptures. It was captured by the British in 1809. The town is subject to malaria. The state suffered severely from famine in 1868–1869, and again in 1896–1897.

AJANTA (more properly ĀJŪNTHĀ), a village in the dominions of the Nizam of Hyderabad in India (N. lat. 20° 32′ by E. long. 75° 48′), celebrated for its cave hermitages and halls. The caves are in a wooded and rugged ravine about 3½ m. from the village. Along the bottom of the ravine runs the river Wâgura, a mountain stream, which forces its way into the valley over a bluff on the east, and forms in its descent a beautiful waterfall, or rather series of waterfalls, 200 ft. high, the sound of which must have been constantly audible to the dwellers in the caves. These are about thirty in number, excavated in the south side of the precipitous bank of the ravine, and vary from 35 to 110 ft. in elevation above the bed of the torrent. The caves are of two kinds—dwelling-halls and meeting-halls. The former, as one enters from the pathway along the sides of the cliff, have a broad verandah, its roof supported by pillars, and giving towards the interior on to a hall averaging in size about 35 ft. by 20 ft. To left and right, and at the back, dormitories are excavated opening on to this hall, and in the centre of the back, facing the entrance, an image of the Buddha usually stands in a niche. The number of dormitories varies according to the size of the hall, and in the larger ones pillars support the roof on all three sides, forming a sort of cloister running round the hall. The meeting-halls go back into the rock about twice as far as the dwelling-halls; the largest of them being 94½ ft. from the verandah to the back, and 41¼ ft. across, including the cloister. They were used as chapter-houses for the meetings of the Buddhist Order. The caves are in three groups, the oldest group being of various dates from 200 B.C. to A.D. 200, the second group belonging, approximately, to the 6th, and the third group to the 7th century A.D. Most of the interior walls of the caves were covered with fresco paintings, of a considerable degree of merit, and somewhat in the style of the early Italian painters. When first discovered, in 1817, these frescoes were in a fair state of preservation, but they have since been allowed to go hopelessly to ruin. Fortunately, the school of art in Bombay, especially under the supervision of J. Griffiths, had copied in colours a number of them before the last vestiges had disappeared, and other copies of certain of the paintings have also been made. These copies are invaluable as being the only evidence we now have of pictorial art in India before the rise of Hinduism. The expression "Cave Temples" used by Anglo-Indians of such halls is inaccurate. Ajanta was a kind of college monastery Hsüan Tsang informs us that Dinnāga, the celebrated Buddhist philosopher and controversialist, author of well-known books on logic, resided there. In its prime the settlement must have afforded accommodation for several hundreds, teachers and pupils combined. Very few of the frescoes have been identified, but two are illustrations of stories in Ārya Sūra's *Jātaka Mālā*, as appears from verses in Buddhist Sanskrit painted beneath them.

See J. Burgess and Bhagwanlal Indraji, *Inscriptions from the Cave Temples of Western India* (Bombay, 1881); J. Fergusson and J. Burgess, *Cave Temples of India* (London, 1880); J. Griffiths, *Paintings in the Buddhist Cave Temples of Ajanta* (London, 2 vols., 1896–1897). (T. W. R. D.)

AJAX (Gr. *Αἴας*), a Greek hero, son of Oïleus, king of Locris, called the "lesser" or Locrian Ajax, to distinguish him from Ajax, son of Telamon. In spite of his small stature, he held his own amongst the other heroes before Troy; he was brave, next to Achilles in swiftness of foot and famous for throwing the spear. But he was boastful, arrogant and quarrelsome; like the Telamonian Ajax, he was the enemy of Odysseus, and in the end the victim of the vengeance of Athene, who wrecked his ship on his homeward voyage (*Odyssey*, iv. 499). A later story gives a more definite account of the offence of which he was guilty. It is said that, after the fall of Troy, he dragged Cassandra away by force from the statue of the goddess at which she had taken refuge as a suppliant, and even violated her (*Lycophron*, 360, Quintus Smyrnaeus xiii. 422). For this, his ship was wrecked in a storm on the coast of Euboea, and he himself was struck by lightning (Virgil, *Aen.* i. 40). He was said to have lived after his death in the island of Leukê. He was worshipped as a national hero by the Opuntian Locrians (on whose coins he appears), who always left a vacant place for him in the ranks of their army when drawn up in battle array. He was the subject of a lost tragedy by Sophocles. The rape of Cassandra by Ajax was frequently represented in Greek works of art, for instance on the chest of Cypselus described by Pausanias (v. 17) and in extant works.

AJAX, son of Telamon, king of Cyprus, a legendary hero of ancient Greece. To distinguish him from Ajax, son of Oïleus, he was called the "great" or Telamonian Ajax. In Homer's *Iliad* he is described as of great stature and colossal frame, second only to Achilles in strength and bravery, and the "bulwark of the Achaeans." He engaged Hector in single combat and, with the aid of Athene, rescued the body of Achilles from the hands of the Trojans. In the competition between him and Odysseus for the armour of Achilles, Agamemnon, at the instigation of Athene, awarded the prize to Odysseus. This so enraged Ajax that it caused his death (*Odyssey*, xi. 541). According to a later and more definite story, his disappointment drove him mad; he rushed out of his tent and fell upon the flocks of sheep in the camp under the impression that they were the enemy; on coming to his senses, he slew himself with the sword which he had received as a present from Hector. This is the account of his death given in the *Ajax* of Sophocles (Pindar, *Nemea*, 7; Ovid, *Met.* xiii. 1). From his blood sprang a red flower, as at the death of Hyacinthus, which bore on its leaves the initial letters of his name AI, also expressive of lament (Pausanias i. 35. 4). His ashes were deposited in a golden urn on the Rhoetean promontory at the entrance of the Hellespont. Like Achilles, he is represented as living after his death in the island of Leukê at the mouth of the Danube (Pausanias iii. 19. 11). Ajax, who in the post-Homeric legend is described as the grandson of Aeacus and the great-grandson of Zeus, was the tutelary hero of the island of Salamis, where he had a temple and an image, and where a festival called *Aianteia* was celebrated in his honour (Pausanias i. 35). At this festival a couch was set up, on which the panoply of the hero was placed, a practice which recalls the Roman *lectisternium*. The identification of Ajax with the family of Aeacus was chiefly a matter which concerned the Athenians, after Salamis had come into their possession, on which occasion Solon is said to have inserted a line in the *Iliad* (ii. 557 or 558), for the purpose of supporting the Athenian claim to the island. Ajax then became an Attic hero; he was worshipped at Athens, where he had a statue in the market-place, and the tribe Aiantis was called after his name. Many illustrious Athenians—Cimon, Miltiades, Alcibiades, the historian Thucydides—traced their descent from Ajax.

See D. Bassi, *La Leggenda di Aiace Telamonio* (1890); P. Girard, "Ajax, fils de Télamon," 1905, in *Revue des études grecques*, tome 18; J. Vürtheim, *De Ajacis Origine, Cultu, Patria* (Leiden, 1907), according to whom he and Ajax Oïleus, as depicted in epos, were originally one, a Locrian daemon somewhat resembling the giants. When this spirit put on human form and became known at the Saronic Gulf, he developed into the "greater" Ajax, while among the Locrians he remained the "lesser." In the article GREEK ART, fig. 13 (from a black-figured Corinthian vase) represents the suicide of Ajax.

AJMERE, or AJMER, a city of British India in Rajputana, which gives its name to a district and also to a petty province called Ajmere-Meirwara. It is situated in 26° 27′ N. lat. and 74° 44′ E. long., on the lower slopes of Taragarh hill, in the Aravalli mountains. To the north of the city is a large artificial lake called the Anasagar, whence the water supply of the place is derived.

The chief object of interest is the *darga*, or tomb of a famous Mahommedan saint named Mayud-uddin. It is situated at the foot of the Taragarh mountain, and consists of a block of white marble buildings without much pretension to architectural beauty. To this place the emperor Akbar, with his empress, performed a pilgrimage on foot from Agra in accordance with the terms of a vow he had made when praying for a son. The large pillars erected at intervals of two miles the whole way, to mark the daily halting-place of the imperial pilgrim, are still extant. An ancient Jain temple, now converted into a Mahommedan mosque, is situated on the lower slope of the Taragarh hill. With the exception of that part used as a mosque, nearly the whole of the ancient temple has fallen into ruins, but the relics are not excelled in beauty of architecture and sculpture by any remains of Hindu art. Forty columns support the roof, but no two are alike, and great fertility of invention is manifested in the execution of the ornaments. The summit of Taragarh hill, overhanging Ajmere, is crowned by a fort, the lofty thick battlements of which run along its brow and enclose the table-land. The walls are 2 m. in circumference, and the fort can only be approached by steep and very roughly paved planes, commanded by the fort and the outworks, and by the hill to the west. On coming into the hands of the English, the fort was dismantled by order of Lord William Bentinck, and is now converted into a sanatorium for the troops at Nasirabad. Ajmere was founded about the year 145 A.D. by Aji, a Chauhan, who established the dynasty which continued to rule the country (with many vicissitudes of fortune) while the repeated waves of Mahommedan invasion swept over India, until it eventually became an appanage of the crown of Delhi in 1193. Its internal government, however, was handed over to its ancient rulers upon the payment of a heavy tribute to the conquerors. It then remained feudatory to Delhi till 1365, when it was captured by the ruler of Mewar. In 1509 the place became a source of contention between the chiefs of Mewar and Marwar, and was ultimately conquered in 1532 by the latter prince, who in his turn in 1559 had to give way before the emperor Akbar. It continued in the hands of the Moguls, with occasional revolts, till 1770, when it was ceded to the Mahrattas, from which time up to 1818 the unhappy district was the scene of a continual struggle, being seized at different times by the Mewar and Marwar rajas, from whom it was as often retaken by the Mahrattas. In 1818 the latter ceded it to the British in return for a payment of 50,000 rupees. Since then the country has enjoyed unbroken peace and a stable government.

The modern city is an important station on the Rajputana railway, 615 m. from Bombay and 275 m. from Delhi, with a branch running due south to the Great Indian Peninsula main line. The city is well laid out with wide streets and handsome houses. The city trade chiefly consists of salt and opium. The former is imported in large quantities from the Sambar lake and Ramsur. Oil-making is also a profitable branch of trade. Cotton cloths are manufactured to some extent, for the dyeing of which the city has attained a high reputation. The educational institutions include the Mayo Rajkumar college, opened in 1875, for training the sons of the nobles of Rajputana, on the lines of an

English public school. Population (1901) 73,839, showing an increase of 10 % in the decade.

The DISTRICT OF AJMERE, which forms the largest part of the province of Ajmere-Merwara, has an area of 2069 sq. m. The eastern portion of the district is generally flat, broken only by gentle undulations, but the western parts, from north-west to south-west, are intersected by the great Aravalli range. Many of the valleys in this region are mere sandy deserts, with an occasional oasis of cultivation, but there are also some very fertile tracts; among these is the plain on which lies the town of Ajmere. This valley, however, is not only fortunate in possessing a noble artificial lake, but is protected by the massive walls of the Nagpathar range or Serpent rock, which forms a barrier against the sand. The only hills in the district are the Aravalli range and its offshoots. Ajmere is almost totally devoid of rivers, the Banas being the only stream which can be dignified with that name, and it only touches the south-eastern boundary of the district so as to irrigate the pargana of Samur. Four small streams—the Sagarmati, Saraswati, Khari and Dai—also intersect the district. In the dry weather they are little more than brooks. The population in 1901 was 7453, showing a decrease of 13 % in the decade. Besides the city of Ajmere, the district contains the military station of Nasirabad, with a population of 22,494.

AJMERE-MERWARA, a division or petty province of British India, in Rajputana, consisting of the two districts of Ajmere and Merwara, separated from each other and isolated amid native states. The administration is in the hands of a commissioner, subordinate to the governor-general's agent for Rajputana. The capital is Ajmere city. The area is 2710 sq. m. The plateau, on whose centre stands the town of Ajmere, may be considered as the highest point in the plains of Hindustan; from the circle of hills which hem it in, the country slopes away on every side—towards river valleys on the east, south, west and towards the desert region on the north. The Aravalli range is the distinguishing feature of the district. The range of hills which runs between Ajmere and Nasirabad marks the watershed of the continent of India. The rain which falls on one side drains into the Chambal, and so into the Bay of Bengal; that which falls on the other side into the Luni, which discharges itself into the Runn of Cutch. The province is on the border of what may be called the arid "zone"; it is the debatable land between the north-eastern and south-western monsoons, and beyond the influence of either. The south-west monsoon sweeps up the Nerbudda valley from Bombay and crossing the tableland at Neemuch gives copious supplies to Malwa, Jhalawar and Kotah and the countries which lie in the course of the Chambal river. The clouds which strike Kathiawar and Cutch are deprived of a great deal of their moisture by the hills in those countries, and the greater part of the remainder is deposited on Mount Abu and the higher slopes of the Aravalli mountains, leaving but little for Merwara, where the hills are lower, and still less for Ajmere. It is only when the monsoon is in considerable force that Merwara gets a plentiful supply from it. The north-eastern monsoon sweeps up the valley of the Ganges from the Bay of Bengal and waters the northern part of Rajputana, but hardly penetrates farther west than the longitude of Ajmere. On the varying strength of these two monsoons the rainfall of the district depends. The agriculturist in Ajmere-Merwara can never rely upon two good harvests in succession. A province subject to such conditions can hardly be free from famine or scarcity for any length of time; accordingly it was visited by two famines, one of unprecedented severity, and one scarcity, in the decade 1891–1901. In June 1900 the number of persons in receipt of relief was 143,000, being more than one-fourth of the total population.

In 1901 the population was 476,912, showing a decrease of 12% in the decade, due to the results of famine. Among Hindus, the Rajputs are land-holders, and the Jats and Gujars are cultivators. The Jains are traders and money-lenders. The aboriginal tribe of Mers are divided between Hindus and Mahommedans. The chief crops are millet, wheat, cotton and oil-seeds. There are several factories for ginning and pressing cotton, the chief trading centres being Beawar and Kekri.

AJODHYA, an ancient city of India, the prehistoric capital of Oudh, in the Fyzabad district of the United Provinces. It is situated on the right bank of the Gogra. In the present day the old city has almost entirely disappeared, and its site is marked only by a heap of ruins; but in remote antiquity Ajodhya was one of the largest and most magnificent of Indian cities. It is said to have covered an area of 96 m., and was the capital of the kingdom of Kosala, the court of the great king Dasaratha, the fifty-sixth monarch of the Solar line in descent from Raja Manu. The opening chapters of the *Ramayana* recount the magnificence of the city, the glories of the monarch and the virtues, wealth and loyalty of his people. Dasaratha was the father of Rama Chandra, the hero of the epic. A period of Buddhist supremacy followed the death of the last king of the Solar dynasty. On the revival of Brahmanism Ajodhya was restored by King Vikramaditya (*c.* 57 B.C.). Kosala is also famous as the early home of Buddhism, and of the kindred religion of Jainism, and claims to be the birthplace of the founders of both these faiths. The Chinese traveller, Hsüan Tsang, in the 7th century, found 20 Buddhist temples with 3000 monks at Ajodhya among a large Brahmanical population. The modern town of Ajodhya contains 96 Hindu temples and 36 Mussulman mosques. Little local trade is carried on, but the great fair of Ramnami held every year is attended by about 500,000 people.

AKABA, GULF OF, the Sinus Aelaniticus of antiquity, the eastern of the two divisions into which the Red Sea bifurcates near its northern extremity. It penetrates into Arabia Petraea in a N.N.E. direction, from 28° to 29° 32′ N., a distance of 100 m., and its breadth varies from 12 to 17 m. The entrance is contracted by Tiran and other islands, so that the passage is rendered somewhat difficult; and its navigation is dangerous on account of the numerous coral reefs, and the sudden squalls which sweep down from the adjacent mountains, many of which rise perpendicularly to a height of 2000 ft. The gulf is a continuation southward of the Jordan-'Araba depression. Raised beaches on the coast show that there has been a considerable elevation of the sea-bed. The only well-sheltered harbour is that of Dahab (the Golden Port) on its western shore, about 33 m. from the entrance and 29 m. E. of Mount Sinai. Near the head of the gulf is Jeziret Faraun (medieval *Graye*), a rocky islet with the ruins of a castle built by Baldwin I. (*c.* 1115).

About 2½ m. from the head of the gulf and on its eastern side is the TOWN OF AKABA, with a picturesque medieval castle, built for the protection of pilgrims on their way from Egypt to Mecca. In the neighbourhood are extensive groves of date palms, and there is an ample supply of good water. Akaba is of considerable historical interest and of great antiquity, being the Elath or Eloth of the Bible, and one of the ports whence Solomon's fleet sailed to Ophir. By the Romans, who made it a military post, it was called Aelana. It continued to be the seat of great commercial activity under the early Moslem caliphs, who corrupted the name to Haila or Ailat. In the 10th century an Arab geographer described it as the great port of Palestine and the emporium of the Hejaz. In the 12th century the town suffered at the hands of Saladin and thereafter fell into decay. In 1841 the town was recognized by Turkey, together with the Sinai peninsula, as part of Egypt. At that time Egyptian pilgrims frequented Akaba in large numbers. In 1892, on the accession of the khedive Abbas II., Turkey resumed possession of Akaba, the Egyptian pilgrims having deserted the land route to Mecca in favour of a sea passage. In 1906 the construction was begun of a branch line joining Akaba to the Mecca railway and thus giving through communication with Beirut. Early in the same year the Turks occupied Taba, a village at the mouth of a small stream 8 m. by land W. by S. of Akaba, near which is the site, not identified, of the Ezion-Geber of Scripture, another of the ports whence the argosies of the Israelites sailed. Taba being on the Egyptian side of the frontier, Great Britain intervened on behalf of Egypt, and in May 1906 secured the withdrawal of the Turks.

AKA HILLS, a tract of country on the north-east frontier of India, occupied by an independent tribe called the Akas. It lies north of the Darrang district of Eastern Bengal and Assam, and is bounded on the east by the Daphla Hills and on the west by independent Bhutia tribes. The Aka country is very difficult of access, the direct road from the plains leading along the precipitous channel of the Bhareli river, which divides the Aka from the Daphla country. The Akas are a brave people, and the men are strong and well-made. Their reputation as raiders is sufficiently shown in the division of the tribe into two clans, the Hazari-khoas or "eaters of a thousand hearths," and the Kapah-chors or "thieves that lurk in the cotton fields." In the early years of British occupation, about 1829, they gave much trouble; and in 1883 they broke out once more into their old habits. They raided into the British district of Darrang and carried off several native forest officers as hostages. An expedition was sent against them under General Sale Hill with 860 troops, which was completely successful. All its objects were satisfactorily accomplished, namely, the recovery of the captives, the surrender of all firearms, the payment of the fine inflicted by government, the complete submission of the tribe and the survey of the country.

AKALKOT, a native state of India, in the Deccan division of Bombay, ranking as one of the Satara Jagirs, situated between the British district of Sholapur and the nizam's dominions. It forms part of the Deccan table-land, and has a cool and agreeable climate. Area 498 sq. m.; pop. (1901) 82,047, showing an increase of 8 % in the decade. Estimated revenue, £26,586; the tribute is £1000. The chief, who is a Mahratta of the Bhonsla family, resides at Poona on a pension, while the state is under British management.

The town of Akalkot is situated near the Great Indian Peninsula railway, which traverses the state. Pop. 8348.

AKBAR, Akhbar or Akber, **JELLALADIN MAHOMMED** (1542–1605), one of the greatest and wisest of the Mogul emperors. He was born at Umarkot in Sind on the 14th of October 1542, his father, Humayun, having been driven from the throne a short time before by the usurper Sher Khan. After more than twelve years' exile, Humayun regained his sovereignty, which, however, he had held only for a few months when he died. Akbar succeeded his father in 1556 under the regency of Bairam Khan, a Turkoman noble, whose energy in repelling pretenders to the throne, and severity in maintaining the discipline of the army, tended greatly to the consolidation of the newly recovered empire. Bairam, however, was naturally despotic and cruel; and when order was somewhat restored, Akbar found it necessary to take the reins of government into his own hands, which he did by a proclamation issued in March 1560. The discarded regent lived for some time in rebellion, endeavouring to establish an independent principality in Malwa, but at last he was forced to cast himself on Akbar's mercy. The emperor not only freely pardoned him, but magnanimously offered him the choice of a high place in the army or a suitable escort for a pilgrimage to Mecca, and Bairam preferred the latter alternative. When Akbar ascended the throne, only a small portion of what had formerly been comprised within the Mogul empire owned his authority, and he devoted himself with great determination and success to the recovery of the revolted provinces. Over each of these, as it was restored, he placed a governor, whom he superintended with vigilance and wisdom. He tried by every means to develop and encourage commerce; he had the land accurately measured for the purpose of rightly adjusting taxation; he gave the strictest instructions to prevent extortion on the part of the taxgatherers, and in many other respects displayed an enlightened and equitable policy. Thus it happened that, in the fortieth year of Akbar's reign, the empire had more than regained all that it had lost, the recovered provinces being reduced, not to subjection only as before, but to a great degree of peace, order and contentment. Akbar's method of dealing with what must always be the chief difficulty of one who has to rule widely diverse races, affords perhaps the crowning evidence of his wisdom and moderation. In religion he was at first a Mussulman, but the intolerant exclusiveness of that creed was quite foreign to his character. Scepticism as to the divine origin of the Koran led him to seek the true religion in an eclectic system. He accordingly set himself to obtain information about other religions, sent to Goa, requesting that the Portuguese missionaries there should visit him, and listened to them with intelligent attention when they came. As the result of these inquiries, he adopted the creed of pure deism and a ritual based upon the system of Zoroaster. The religion thus founded, however, having no vital force, never spread beyond the limits of the court, and died with Akbar himself. But though his eclectic system failed, the spirit of toleration which originated it produced in other ways many important results, and, indeed, may be said to have done more to establish Akbar's power on a secure basis than all his economic and social reforms. He conciliated the Hindus by giving them freedom of worship; while at the same time he strictly prohibited certain barbarous Brahmanical practices, such as trial by ordeal and the burning of widows against their will. He also abolished all taxes upon pilgrims as an interference with the liberty of worship, and the capitation tax upon Hindus, probably upon similar grounds. Measures like these gained for him during his lifetime the title of "Guardian of Mankind," and caused him to be held up as a model to Indian princes of later times, who in the matter of religious toleration have only too seldom followed his example.

Akbar was a munificent patron of literature. He established schools throughout his empire for the education of both Hindus and Moslems, and he gathered round him many men of literary talent, among whom may be mentioned the brothers Feizi and Abul Fazl. The former was commissioned by Akbar to translate a number of Sanskrit scientific works into Persian; and the latter (see Abul Fazl) has left, in the *Akbar-Nameh*, an enduring record of the emperor's reign. It is also said that Akbar employed Jerome Xavier, a Jesuit missionary, to translate the four Gospels into Persian.

The closing years of Akbar's reign were rendered very unhappy by the misconduct of his sons. Two of them died in youth, the victims of intemperance; and the third, Salim, afterwards the emperor Jahangir, was frequently in rebellion against his father. These calamities were keenly felt by Akbar, and may even have tended to hasten his death, which occurred at Agra on the 15th of October 1605. His body was deposited in a magnificent mausoleum at Sikandra, near Agra.

See G. B. Malleson, *Akbar* ("Rulers of India" series), 1890.

AKCHA, a town and khanate of Afghan Turkestan. The town lies 42 m. westward of Balkh on the road to Andkhui. It is protected by a mud wall and a citadel. Estimated population 8000, chiefly Uzbegs. The khanate is small, but well watered and populous. The rivers rising in the southern mountains, which no longer reach the Oxus, terminate in vast swamps near Akcha, and into these the debris of such vegetation as yearly springs up on the slopes of the southern hills is washed down in time of flood.

AKEN, a town of Germany, in the kingdom of Prussia, on the Elbe, 25 m. E. S. E. of Magdeburg, with a branch line to Cöthen (8 m.). Pop. (1900) 7358. It has manufactures of cloth, leather, chemicals and optical instruments; large quantities of beetroot sugar are produced in the neighbourhood; and there is a considerable transit trade on the Elbe.

AKENSIDE, MARK (1721–1770), English poet and physician, was born at Newcastle-on-Tyne on the 9th of November 1721. He was the son of a butcher, and was slightly lame all his life from a wound he received as a child from his father's cleaver. All his relations were dissenters, and, after attending the free school of Newcastle, and a dissenting academy in the town, he was sent (1739) to Edinburgh to study theology with a view to becoming a minister, his expenses being paid from a special fund set aside by the dissenting community for the education of their pastors. He had already contributed "The Virtuoso, in imitation of Spenser's style and stanza" (1737) to the *Gentleman's Magazine*, and in 1738 "A British Philippic, occasioned by the Insults of the Spaniards, and the present Preparations for War" (also published separately). After he had spent one winter as a student of theology, he entered his name as a student of medicine. He repaid the money that had been advanced for his theological studies, and with this change of mind he seems to have drifted to a mild deism. His politics, says Dr Johnson, were characterized by an "impetuous eagerness to subvert and confound, with very little care what shall be established," and he is caricatured in the republican doctor of Smollett's *Peregrine Pickle*. He was elected a member of the Medical Society of Edinburgh in 1740. His ambitions already lay outside his profession, and his gifts as a speaker made him hope one day to enter parliament. In 1740 he printed his "Ode on the Winter Solstice" in a small volume of poems. In 1741 he left Edinburgh for Newcastle and began to call himself surgeon, though it is doubtful whether he practised, and from the next year dates his life-long friendship with Jeremiah Dyson (1722–1776). During a visit to Morpeth in 1738 he had conceived the idea of his didactic poem, "The Pleasures of the Imagination." He had already acquired a considerable literary reputation when he came to London about the end of 1743, and offered the work to Dodsley for £120. Dodsley thought the price exorbitant, and only accepted the terms after submitting the MS. to Pope, who assured him that this was "no everyday writer." The three books of this poem appeared in January 1744. His aim, Akenside tells us in the preface, was "not so much to give formal precepts, or enter into the way of direct argumentation, as, by exhibiting the most engaging prospects of nature, to enlarge and harmonize the imagination, and by that means insensibly dispose the minds of men to a similar taste and habit of thinking in religion, morals and civil life." Akenside's powers fell short of this lofty design; his imagination was not brilliant enough to surmount the difficulties inherent in a poem dealing so largely with abstractions; but the work was well received by the general public. His success was not unchallenged. Gray wrote to Thomas Wharton that it was "above the middling," but "often obscure and unintelligible and too much infected with the Hutchinson[1] jargon."

Into a note added by Akenside to the passage in the third book dealing with ridicule, William Warburton chose to read a reflexion on himself. Accordingly he attacked the author of the *Pleasures of the Imagination*—which was published anonymously—in a scathing preface to his *Remarks on Several Occasional Reflections, in answer to Dr Middleton . . .* (1744). This was answered, nominally by Dyson, in *An Epistle to the Rev. Mr Warburton*, in which Akenside no doubt had a hand. It was in the press when he left England in 1744 to secure a medical degree at Leiden. In little more than a month he had completed the necessary dissertation, *De ortu et incremento foetus humani*, and received his diploma. Returning to England he attempted without success to establish a practice in Northampton. In 1744 he published his *Epistle to Curio*, attacking William Pulteney (afterwards earl of Bath) for having abandoned his liberal principles to become a supporter of the government, and in the next year he produced a small volume of *Odes on Several Subjects*, in the preface to which he lays claim to correctness and a careful study of the best models. His friend Dyson had meanwhile left the bar, and had become, by purchase, clerk to the House of Commons. Akenside had come to London and was trying to make a practice at Hampstead. Dyson took a house there, and did all he could to further his friend's interest in the neighbourhood. But Akenside's arrogance and pedantry frustrated these efforts, and Dyson then took a house for him in Bloomsbury Square, making him independent of his profession by an allowance stated to have been £300 a year, but probably greater, for it is asserted that this income enabled him to "keep a chariot," and to live "incomparably well." In 1746 he wrote his much-praised "Hymn to the Naiads," and he also became a contributor to Dodsley's *Museum, or Literary and Historical Register*. He was now twenty-five years old, and began to devote himself almost exclusively to his profession. He was an acute and learned physician. He was admitted M.D. at Cambridge in 1753, fellow of the Royal College of Physicians in 1754, and fourth censor in 1755. In June 1755 he read the Gulstonian lectures before the College, in September 1756 the Croonian lectures, and in 1759 the Harveian oration. In January 1759 he was appointed assistant physician, and two months later principal physician to Christ's Hospital, but he was charged with harsh treatment of the poorer patients, and his unsympathetic character prevented the success to which his undeniable learning and ability entitled him. At the accession of George III. both Dyson and Akenside changed their political opinions, and Akenside's conversion to Tory principles was rewarded by the appointment of physician to the queen. Dyson became secretary to the treasury, lord of the treasury, and in 1774 privy councillor and cofferer to the household.

Akenside died on the 23rd of June 1770, at his house in Burlington Street, where the last ten years of his life had been spent. His friendship with Dyson puts his character in the most amiable light. Writing to his friend so early as 1744, Akenside said that the intimacy had "the force of an additional conscience, of a new principle of religion," and there seems to have been no break in their affection. He left all his effects and his literary remains to Dyson, who issued an edition of his poems in 1772. This included the revised version of the *Pleasures of Imagination*, on which the author was engaged at his death. The first book of this work defines the powers of imagination and discusses the various kinds of pleasure to be derived from the perception of beauty; the second distinguishes works of imagination from philosophy; the third describes the pleasure to be found in the study of man, the sources of ridicule, the operations of the mind, in producing works of imagination, and the influence of imagination on morals. The ideas were largely borrowed from Addison's essays on the imagination and from Lord Shaftesbury. Professor Dowden complains that "his tone is too high-pitched; his ideas are too much in the air; they do not nourish themselves in the common heart, the common life of man." Dr Johnson praised the blank verse of the poems, but found fault with the long and complicated periods. Akenside's verse was better when it was subjected to severer metrical rules. His odes are very few of them lyrical in the strict sense, but they are dignified and often musical, while the few "inscriptions" he has left are felicitous in the extreme.

The best edition of Akenside's *Poetical Works* is that prepared (1834) by Alexander Dyce for the *Aldine Edition of the British Poets*, and reprinted with small additions in subsequent issues of the series. See Dyce's *Life of Akenside* prefixed to his edition, also Johnson's *Lives of the Poets*, and the *Life, Writings and Genius of Akenside* (1832) by Charles Bucke.

AKERMAN, JOHN YONGE (1806–1873), English antiquarian, distinguished chiefly in the department of numismatics, was born in Wiltshire. He became early known in connexion with his favourite study, having initiated the *Numismatic Journal* in 1836. In the following year he became the secretary of the newly established Numismatic Society. In 1848 he was elected secretary to the Society of Antiquaries, an office which he was compelled to resign in 1860 on account of failing health. Akerman published a considerable number of works on his special subject, the more important being a *Catalogue of Roman Coins* (1839); a *Numismatic Manual* (1840); *Roman Coins relating to Britain* (1844); *Ancient Coins—Hispania, Gallia, Britannia* (1846); and *Numismatic Illustrations of the New Testament* (1846). He wrote also a *Glossary of Words used in Wiltshire* (1842); *Wiltshire Tales, illustrative of the Dialect* (1853); and *Remains of Pagan Saxondom* (1855).

AKHALTSIKH (Georgian *Akhaltsikhe*, "new fortress"), a fortified town of Russian Transcaucasia, government of Tiflis, 68 m. E. of Batum, in 41° 40′ N. lat., 43° 1′ E. long., on a tributary of the Kura, at an altitude of 3375 ft. The new town is on the right bank of the river, while the old town and the fortress are on the opposite bank. There is trade in silk, honey and wax, and brown coal is found in the neighbourhood. The silver filigree work is famous. Pop. (1897) 15,387, of whom many were Armenians, as against 15,977 in 1867. From 1579 to 1828 Akhaltsikh was the capital of Turkish Armenia. In the last-mentioned year it was captured by the Russians. The Turks invested it in 1853.

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[1] The reference is to Francis Hutcheson (1694–1746), author of an *Inquiry into the Original of our Ideas of Beauty and Virtue* (1725).

AK-HISSAR (anc. *Thyateira*, the "town of Thya"), a town situated in a fertile plain on the Gürdük Chai (*Lycus*), in the Aidin vilayet, 58 m. N.E. of Smyrna. Pop. about 20,000, Mussulmans forming two-thirds. Thyateira was an ancient town re-peopled with Macedonians by Seleucus about 290 B.C. It became an important station on the Roman road from Pergamum to Laodicea, and one of the "Seven Churches" of Asia (Rev. ii. 18), but was never a *metropolis* or honoured with a neocorate, though made the centre of a *conventus* by Caracalla. The modern town is connected with Smyrna by railway, and exports cotton, wool, opium, cocoons and cereals. The inhabitants are Greeks, Armenians and Turks. The Greeks are of an especially fine type, physical and moral, and noted all through Anatolia for energy and stability. W. M. Ramsay believes them to be direct descendants of the ancient Christian population; but there is reason to think they are partly sprung from more recent immigrants who moved in the 18th century from western Greece into the domain of the Karasmans of Manisa and Bergama, as recorded by W. M. Leake. Cotton of excellent quality is grown in the neighbourhood, and the place is celebrated for its scarlet dyes.

See W. M. Ramsay, *Letters to the Seven Churches* (1904); M. Clerc, *De rebus Thyatirenorum* (1893).

AKHMIM, or Ekhmim, a town of Upper Egypt, on the right bank of the Nile, 67 m. by river S. of Assiut, and 4 m. above Suhag, on the opposite side of the river, whence there is railway communication with Cairo and Assuan. It is the largest town on the east side of the Nile in Upper Egypt, having a population in 1907 of 23,795, of whom about a third were Copts. Akhmim has several mosques and two Coptic churches, maintains a weekly market, and manufactures cotton goods, notably the blue shirts and check shawls with silk fringes worn by the poorer classes of Egypt. Outside the walls are the scanty ruins of two ancient temples. In Abulfeda's days (13th century A.D.) a very imposing temple still stood here. Akhmim was the Egyptian Apu or Khen-min, in Coptic Shmin, known to the Greeks as Chemmis or Panopolis, capital of the 9th or Chemmite nome of Upper Egypt. The ithyphallic Min (Pan) was here worshipped as "the strong Horus." Herodotus mentions the temple dedicated to "Perseus" and asserts that Chemmis was remarkable for the celebration of games in honour of that hero, after the manner of the Greeks, at which prizes were given; as a matter of fact some representations are known of Nubians and people of Puoni (Somalic coast) clambering up poles before the god Min. Min was especially a god of the desert routes on the east of Egypt, and the trading tribes are likely to have gathered to his festivals for business and pleasure, at Coptos (which was really near to Neapolis, Kena) even more than at Akhmim. Herodotus perhaps confused Coptos with Chemmis. Strabo mentions linen-weaving as an ancient industry of Panopolis, and it is not altogether a coincidence that the cemetery of Akhmim is one of the chief sources of the beautiful textiles of Roman and Coptic age that are brought from Egypt. Monasteries abounded in this neighbourhood from a very early date; Shenout (Sinuthius), the fiery apostle and prophet of the Coptic national church, was a monk of Atrēpe (now Suhag), and led the populace to the destruction of the pagan edifices. He died in 451; some years earlier Nestorius, the ex-patriarch, had succumbed perhaps to his persecution and to old age, in the neighbourhood of Akhmim. Nonnus, the Greek poet, was born at Panopolis at the end of the 4th century. (F. Ll. G.)

AKHTAL [Ghiyāth ibn Ḥārith] (*c.* 640–710), one of the most famous Arabian poets of the Omayyad period, belonged to the tribe of Taghlib in Mesopotamia, and was, like his fellow-tribesmen, a Christian, enjoying the freedom of his religion, while not taking its duties very seriously. Of his private life few details are known, save that he was married and divorced, and that he spent part of his time in Damascus, part with his tribe in Mesopotamia. In the wars of the Taghlibites with the Qaisites he took part in the field, and by his satires. In the literary strife between his contemporaries Jarīr and Ferazdaq he was induced to support the latter poet. Akhtal, Jarir and Ferazdaq form a trio celebrated among the Arabs, but as to relative superiority there is dispute. In the 'Abbasid period there is no doubt that Akhtal's Christianity told against his reputation, but Abu 'Ubaida placed him highest of the three on the ground that amongst his poems there were ten flawless *qasidas* (elegies), and ten more nearly so, and that this could not be said of the other two. The chief material of his poems consists of panegyric of patrons and satire of rivals, the latter being, however, more restrained than was usual at the time.

The Poetry of al-Akhtal has been published at the Jesuit press in Beirūt, 1891. A full account of the poet and his times is given in H. Lammens' *Le chantre des Omiades* (Paris, 1895) (a reprint from the *Journal Asiatique* for 1894). (G. W. T.)

AKHTYRKA, a town of Russia, in the government of Kharkov, near the Vorskla river, connected by a branch (11 m.) with the railway from Kiev to Kharkov. It has a beautiful cathedral, built after a plan by Rastrelli in 1753, to which pilgrims resort to venerate an ikon of the Virgin. There are manufactures of light woollen stuffs and a trade in corn, cattle and the produce of domestic industries. The environs are fertile, the orchards producing excellent fruit. A fair is held on the 9th of May. The place was founded by the Poles in 1642. Pop. (1867) 17,411; (1900) 25,965.

AKKA (Tikki-Tikki), a race of African pygmies first seen by the traveller G. A. Schweinfurth in 1870, when he was in the Mangbettu country, N.W. of Albert Nyanza. The home of the Akka is the dense forest zone of the Aruwimi district of the Congo State. They form a branch of the primitive pygmy negroid race, and appear to be divided into groups, each with its own chief. Of all African "dwarfs" the Akka are believed the best representatives of the "little people" mentioned by Herodotus. Giovanni Miani, the Italian explorer who followed Schweinfurth, obtained two young Akka in exchange for a dog and a calf. These, sent to Italy in 1873, were respectively 4 ft. 4 in. and 4 ft. 8 in. high, while the tallest seen by Schweinfurth did not reach 5 ft. None of the four Akka brought to Europe in 1874 and 1876 exceeded 3 ft. 4 in. The average height of the race would seem to be somewhat under 4 ft., but sufficient measurements have not been taken to allow of a conclusive statement. Schweinfurth says the Akka have very large and almost spherical skulls (this last detail proves to be an exaggeration). They are of the colour of coffee slightly roasted, with hair almost the same colour, woolly and tufted; they have very projecting jaws, flat noses and protruding lips, which give them an "ape-like" appearance. Marked physical features are an abdominal protuberance which makes all Akka look like pot-bellied children, and a remarkable hollowing of the spine into a curve like an **S**. Investigation has shown that these are not true racial characteristics, but tend to disappear, the abdominal enlargement subsiding after some weeks of regular and wholesome diet. The upper limbs are long, and the hands, according to Schweinfurth, are singularly delicate. The lower limbs are short, relatively to the trunk, and curve in somewhat, the feet being bent in too, which gives the Akka a topheavy, tottering gait. There is a tendency to steatopygia among the women. The Akka are nomads, living in the forests, where they hunt game with poisoned arrows, with pitfalls and springs set everywhere, and with traps built like huts, the roofs of which, hung by tendrils only, fall in on the animal. They collect ivory and honey, manufacture poison, and bring these to market to exchange for cereals, tobacco and iron weapons. They are courageous hunters, and do not hesitate to attack even elephants, both sexes joining in the chase. They are very agile, and are said by the neighbouring negroes to leap about in the high grass like grasshoppers. They are timid as children before strangers, but are declared to be malevolent and treacherous fighters. In dress, weapons and utensils they are as the surrounding negroes. They build round huts of branches and leaves in the forest clearings. They seem in no way a degenerate race, but rather a people arrested in development by the forest environment.

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AKKAD (Gr. versions ἀρχαδ and ἀχαδ), a Hebrew name, mentioned only once in the Old Testament (Gen. x. 10), for one of the four chief cities, Akkad, Babel, Erech and Calneh, which constituted the nucleus of the kingdom of Nimrod in the land of Shinar or Babylonia. This Biblical city, Akkad, was most probably identical with the northern Babylonian city known to us as Agade (not Agane, as formerly read), which was the principal seat of the early Babylonian king Sargon I. (*Šargani-Šarāli*), whose date is given by Nabonidus, the last Semitic king of Babylonia (555–537 B.C.), as 3800 B.C., which is perhaps too old by 700 or 1000 years.[1] The probably non-Semitic name Agade occurs in a number of inscriptions[2] and is now well attested as having been the name of an important ancient capital. The later Assyro-Babylonian Semitic form *Akkadū* ("of or belonging to Akkad") is, in all likelihood, a Semitic loan form from the non-Semitic name Agade, and seems to be an additional demonstration of the identity of Agade and Akkad. The usual signs denoting *Akkadū* in the Semitic narrative inscriptions were read in the non-Semitic idiom *uri-ki* or *ur-ki*, "land of the city," which simply meant that *Akkadū* was the land of the city *par excellence*, *i.e.* of the city of Agade of Sargon I., which remained for a long period the leading city of Babylonia.[3]

It is quite probable that the non-Semitic name Agade may mean "crown (*aga*) of fire (*de*)"[4] in allusion to Ištar, "the brilliant goddess," the tutelar deity of the morning and evening star and the goddess of war and love, whose cult was observed in very early times in Agade. This fact is again attested by Nabonidus, whose record[5] mentions that the Ištar worship of Agade was later superseded by that of the goddess Anunit, another personification of the Ištar idea, whose shrine was at Sippar. It is significant in this connexion that there were two cities named Sippar, one under the protection of Shamash, the sun-god, and one under this Anunit, a fact which points strongly to the probable proximity of Sippar and Agade. In fact, it has been thought that Agade-Akkad was situated opposite Sippar on the left bank of the Euphrates, and was probably the oldest part of the city of Sippar.

In the Assyro-Babylonian literature the name *Akkadū* appears as part of the royal title in connexion with Sumer; viz. non-Semitic: *lugal Kēngi* (*ki*) *Uru* (*ki*) = *šar mât Šumeri u Akkadī*, "king of Sumer and Akkad," which appears to have meant simply "king of Babylonia." It is not likely, as many scholars have thought, that Akkad was ever used geographically as a distinctive appellation for northern Babylonia, or that the name Sumer (*q.v.*) denoted the southern part of the land, because kings who ruled only over Southern Babylonia used the double title "king of Sumer and Akkad," which was also employed by northern rulers who never established their sway farther south than Nippur, notably the great Assyrian conqueror Tiglath-pileser III. (745–727 B.C.). Professor McCurdy has very reasonably suggested[6] that the title "king of Sumer and Akkad" indicated merely a claim to the ancient territory and city of Akkad together with certain additional territory, but not necessarily all Babylonia, as was formerly believed.

A discussion of the interesting question relating to the non-Semitic so-called Sumero-Akkadian language and race will be found in the article SUMER.

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(J. D. PR.)

AKKERMAN (in old Slav. *Byelgorod*, "white town"), a town, formerly a fortress, of south-west Russia, in the government of Bessarabia, situated on the right bank of the estuary (*liman*) of the Dniester, 12 m. from the Black Sea. The town stands on the site of the ancient Milesian colony of Tyras. Centuries later it was rebuilt by the Genoese, who called it Mauro Castro. The Turks first acquired possession of it in 1484. It was taken by the Russians in 1770, 1774 and 1806, but each time returned to the Turks, and not definitely annexed to Russia until 1881. A treaty concluded here in 1826 between Russia and the Porte secured considerable advantages to the former. It was the non-observance of this treaty that led to the war of 1828. The harbour is too shallow to admit vessels of large size, but the proximity of the town to Odessa secures for it a thriving business in wine, salt, fish wool and tallow. The salt is obtained from the saline lakes (*limans*) in the neighbourhood. The town, with its suburbs, contains beautiful gardens and vineyards. It is surrounded by ramparts, and commanded by a citadel. Pop. (1900) 32,470.

AKMOLINSK, one of the governments belonging to the governor-generalship of the Steppes in Asiatic Russia, formerly known as the Kirghiz Steppe; bounded by the government of Turgai on the W., by that of Tobolsk on the N., of Semi-palatinsk on the E., and of Syr-darya on the S. Area 229,544 sq. m., of which 4535 are lakes. In the north the government is low and dotted with salt lakes, and is sandy on the banks of the Irtysh in the north-east. An undulating plateau stretches through the middle, watered by the Ishim and its tributary the Nura. The plains gradually rise southwards, where a broad spur of the Tarbagatai mountains stretches north-westwards, containing gold, copper and coal. Many lakes, of which the largest is Teniz, are scattered along the northern slope of these hills. Farther south, towards Lake Balkash, on the south-eastern frontier, is a wide waterless desert, Bek-pak-dala, or Famine Steppe. This section of the government is drained by the Sary-su and Chu, the latter on the southern boundary-line. The climate is continental and dry, the average temperatures at the town of Akmolinsk being for the year 35°, January 1·5°, July 70°; rainfall, only 9 in. The population, which was 686,863 in 1897 (324,587 women), consists chiefly of Russians in the northern and middle portions, and of Kirghiz (about 350,000), who breed cattle, horses and sheep. The urban population was only 74,069. Agriculture is successfully carried on in the north, the Siberian railway running between Petropavlovsk and Omsk through a very fertile, well-populated region. Steamers ply on the Irtysh. The government is divided into five districts, the chief towns of which are: Omsk (pop. 53,050 in 1900), formerly capital of West Siberia, now capital of this government and also of the governor-generalship of the Steppes; Akmolinsk, or Akmolly (9560 in 1897), on the Ishim, 260 m. S.S.W. of Omsk, and chief centre for the caravans coming from Tashkent and Bokhara; Atbasar (3030); Kokchetav (5000); and Petropavlovsk (21,769 in 1901).

AKOLA, a town and district of India, in Berar, otherwise known as the Hyderabad Assigned Districts. The town is on the Murna tributary of the Purna river, 930 ft. above the sea, Akola proper being on the west bank, and Tajnapeth, containing the government buildings and European residences, on the east bank. It is a station on the Nagpur branch of the Great Indian Peninsula railway and is 383 m. E.N.E. of Bombay. It had a population (1901) of 29,289. It is walled, and has a citadel built in the early years of the 19th century. Akola is one of the chief centres of the cotton trade in Berar, and has numerous ginning factories and cotton presses. Among the educational establishments are a government high school, and an industrial school supported by a Protestant mission.

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[1] Prince, *Nabonidus*, p. v.

[2] In the Sargon inscriptions; *Bab. Exped. of the Univ. of Penn.* i. pl. 1, nr. 1, line 6; pl. 2, nr. 2, line 5; pl. 3, nr. 3, line 3b; also xi. pl. 49, nr. 119 and in Nebuchadnezzar, col. ii. line 50 (Hilprecht, *Freibrief Neb.*); *Cun. Texts from Bab. Tablets*, pl. 1, nr. 91146, line 3.

[3] Rogers, *History of Babylonia and Assyria*, i. pp. 365, 373-374.

[4] Prince, "Materials for a Sumerian Lexicon," pp. 23, 73, *Journal of Biblical Literature*, 1906.

[5] I. Rawl. 69, col. ii. 48 and iii. 28.

[6] *History, Prophecy and the Monuments*, i. § 110.

The DISTRICT OF AKOLA as reconstituted in 1905 has an area of 4111 sq. m., the population of this area in 1901 being 754,804. (Before the alteration of the boundaries the area of the district was 2678 sq. m., and the population 582,540.) The surface of the country is generally flat, the greater part being situated in the central valley of Berar. On the north it is bounded by the Melghat hills. By the addition of Basim and Mangrul *taluks* in 1905, the district includes the eastern part of the Ajanta hills, with peaks rising to 2000 ft., and the tableland of Basim (*q.v.*). North of the Ajanta hills the country is drained eastward by the Purna affluent of the Tapti and its tributaries. None of the rivers is navigable. The climate resembles that of Berar generally, but the heat during April to mid-June, when the rains begin, is very great, the average temperature at the town of Akola in May for the twenty-five years ending 1901 being 94·4° F. But even during the hot season the nights are cool. The annual rainfall averages 34 in. In the Purna valley the soil is everywhere a rich black loam, and nearly the whole of the land is cultivated. Very little land is under irrigation. The principal crop is cotton, and the staple grain millet. Wheat and pulses are also grown. The history of Akola is not distinguished from that of the other portions of Berar. In 1317–1318 it was added to the Delhi empire, became independent under the Bahmani dynasty in 1348, and in 1596 again fell under the sway of the Moguls. In 1724 it came, with the rest of Berar, under the dominion of the nizam, being assigned to the British in 1853.

AKRON, a city and the county-seat of Summit county, Ohio, U.S.A., on the Little Cuyahoga river, about 35 m. S. by E. of Cleveland. Pop. (1890) 27,601; (1900) 42,728, of whom 7127 were foreign-born (3227 being German, 1104 English, and 641 Irish); (1910) 69,067. It is served by the Baltimore & Ohio, the Erie, the Northern Ohio, and the Cleveland, Akron & Columbus railways, by inter-urban electric lines and by the Ohio Canal. The city is situated in a region abounding in lakes, springs and hills; it is about 1000 ft. above sea-level, whence its name (from Gr. ἄκρον, height); and attracts many summer visitors. It is the seat of Buchtel College (co-educational; non-sectarian), which was founded by the Ohio Universalist Convention in 1870, was opened in 1872, and was named in honour of its most liberal benefactor, John R. Buchtel (1822–1892), a successful business man who did much to promote the industrial development of Akron. Buchtel College provides three courses leading to the degrees of A.B., Ph.B. and S.B.; it has a school of music, a school of art and an academy; in 1908 there were 267 students. Coal is mined in the neighbourhood. The river furnishes considerable water-power; and among the city's most important manufactures are rubber and elastic goods (value, 1905, $13,396,974; 83·9 % of the total of this industry in the state and 21·3 % of the total for the United States, Akron ranking first among the cities of the country in this industry), printing and publishing product (value, 1905, $2,834,639), foundry and machine-shop product (value, 1905, $2,367,764), and pottery, terra-cotta and fire-clay (value, 1905, $1,718,033; nearly twice the value of the output in 1900, Akron ranking fourth among the cities of the United States in this industry in 1905). Other important manufactures are food preparations (especially of oats) and flour and grist mill products. The value of the total manufactured products (under the "factory" system) in 1905 was $34,004,243, an increase in five years of 54·5 %. Akron was settled about 1825, was incorporated as a village in 1836, was made the county-seat in 1842, and in 1865 was chartered as a city.

See S. A. Lane, *Fifty Years and over of Akron and Summit County* (Akron, 1892).

AK-SHEHR (anc. *Philomelion*), a town in Asia Minor, in the Konia vilayet, situated at the edge of a fertile plain, on the north side of the Sultan Dagh. Philomelion was probably a Pergamenian foundation on the great Graeco-Roman highway from Ephesus to the east, and to its townsmen the Smyrniotes wrote the letter that describes the martyrdom of Polycarp. Cicero, on his way to Cilicia, dated some of his extant correspondence there; and the place played a considerable part in the frontier wars between the Byzantine emperors and the sultanate of Rum. It became an important Seljuk town, and late in the 14th century passed into Ottoman hands. There Bayezid Yilderim is said by Ali of Yezd to have died after his defeat at Angora. The place still enjoys much repute among Turks, as the burial-place of Nur-ed-din Khoja. The town has a station on the Anatolian railway, about 60 m. from Afium-Kara-Hissar and 100 m. from Konia.

AKSU (White Water), a town of the Chinese empire, Eastern Turkestan, in 41° 7′ N. and 79° 7′ E. of Uch-Turfan and 270 m. N.E. of Yarkand, near the left bank of the Aksu river, which takes its origin in the T'ien-shan (Tian-shan) mountains and joins the Tarim. It belongs to the series of oases (Uch-Turfan, Bai, Koucha, &c.) situated at the southern foot of the eastern T'ien-shan mountains. The town, which is supposed to have about 6000 houses, is enclosed by a wall. It is an important centre for caravan routes and has a considerable trade. There are some cotton manufactures; and the place is celebrated for its richly ornamented saddlery made from deerskin. A Chinese garrison is stationed here, and copper and iron are wrought in the neighbourhood by exiled Chinese criminals. Extensive cattle-breeding is carried on by the inhabitants.

AKYAB, a city and district in the Arakan division of Burma. The city is situated at the confluence of the three large rivers Myu, Koladaing and Lemyu, and is the most flourishing city in the Arakan division. Originally it was a mere fishing village, but when the British government in 1826 removed the restrictions on trade imposed by the Burmese, Akyab quickly grew into an important seat of maritime commerce. After the cession of Arakan by the treaty of Yandaboo in that year the old capital of Myohaung was abandoned as the seat of government, and Akyab on the sea-coast selected instead. During the first forty years of British rule it increased from a village to a town of 15,536 inhabitants, and now it is the third port of Burma, with a population in 1901 of 31,687. It contains the usual public buildings and several large rice mills. The chief exports are rice and oil.

The district lies along the north-eastern shores of the Bay of Bengal, with an area of 5136 sq. m. and a population in 1901 of 481,666. It forms the northernmost district of Lower Burma, and consists of the level tract lying between the sea and the Arakan Yoma mountains, and of the broken country formed by a portion of their western spurs and valleys. The forests form a most important feature of Akyab district and contain a valuable supply of timber of many kinds. The central part of the district consists of three fertile valleys, watered by the Myu, Koladaing and Lemyu These rivers approach each other at their mouths, and form a vast network of tidal channels, creeks and islands. Their alluvial valleys yield inexhaustible supplies of rice, which the abundant water carriage brings down to the port of Akyab at a very cheap rate. The four chief towns are Khumgchu in the extreme north-east of the district; Koladaing in the centre; Arakan, farther down the rivers; and Akyab on the coast, where their mouths converge. This district passed into the hands of the British, together with the rest of Arakan division, at the close of the first Burmese war of 1825–1826.

Akyab was the metropolitan province of the native kingdom of Arakan, and the history of that country centres in it. In 1871 the frontier or hill tracts of the district were placed under a special administration, with a view to the better government of the wild tribes which inhabit them. (J. G. Sc.)

ALA (from Lat. *ala*, a wing), a word used technically by analogy with its meaning of "wing." In physiology, it means any wing-like process, such as one of the lateral cartilages of the nose. In botany, one of the side petals of a papilionaceous corolla, &c. In architecture, a side apartment or recess of a Roman house (the origin of "aisle").

ALABAMA, a southern state of the American Union, situated between 84° 51′ and 88° 31′ W. long. and about 30° 13′ and 35° N. lat., bounded N. by Tennessee, E. by Georgia, S. by Florida and the Gulf of Mexico, and W. by Mississippi. Its total area is 51,998 sq. m., of which 719 are water surface.

Physical Features.—The surface of Alabama in the N. and N.E., embracing about two-fifths of its area, is diversified and picturesque; the remaining portion is occupied by a gently undulating plain having a general incline south-westward toward the Mississippi and the Gulf. Extending entirely across the state of Alabama for about 20 m. S. of its N. boundary, and in the middle stretching 60 m. farther S., is the Cumberland Plateau, or Tennessee Valley region, broken into broad table-lands by the dissection of rivers. In the N. part of this plateau, W. of Jackson county, there are about 1000 sq. m. of level highlands from 700 to 800 ft. above the sea. South of these highlands, occupying a narrow strip on each side of the Tennessee river, is a delightful country of gentle rolling lowlands varying in elevation from 500 to 800 ft. To the N.E. of these highlands and lowlands is a rugged section with steep mountain-sides, deep narrow coves and valleys, and flat mountain-tops. Its elevations range from 400 to 1800 ft. In the remainder of this region, the S. portion, the most prominent feature is Little Mountain, extending about 80 m. from E. to W. between two valleys, and rising precipitously on the N. side 500 ft. above them or 1000 ft. above the sea. Adjoining the Cumberland Plateau region on the S.E. is the Appalachian Valley (locally known as Coosa Valley) region, which is the S. extremity of the great Appalachian Mountain system, and occupies an area within the state of about 8000 sq. m. This is a limestone belt with parallel hard rock ridges left standing by erosion to form mountains. Although the general direction of the mountains, ridges and valleys is N.E. and S.W., irregularity is one of the most prominent characteristics. In the N.E. are several flat-topped mountains, of which Raccoon and Lookout are the most prominent, having a maximum elevation near the Georgia line of little more than 1800 ft. and gradually decreasing in height toward the S.W., where Sand Mountain is a continuation of Raccoon. South of these the mountains are marked by steep N.W. sides, sharp crests and gently sloping S.E. sides. South-east of the Appalachian Valley region, the Piedmont Plateau also crosses the Alabama border from the N.E. and occupies a small triangular-shaped section of which Randolph and Clay counties, together with the N. part of Tallapoosa and Chambers, form the principal portion. Its surface is gently undulating and has an elevation of about 1000 ft. above the sea. The Piedmont Plateau is a lowland worn down by erosion on hard crystalline rocks, then uplifted to form a plateau. The remainder of the state is occupied by the coastal plain. This is crossed by foot-hills and rolling prairies in the central part of the state, where it has a mean elevation of about 600 ft., becomes lower and more level toward the S.W., and in the extreme S. is flat and but slightly elevated above the sea. The Cumberland Plateau region is drained to the W.N.W. by the Tennessee river and its tributaries; all other parts of the state are drained to the S.W. In the Appalachian Valley region the Coosa is the principal river; and in the Piedmont Plateau, the Tallapoosa. In the Coastal Plain are the Tombigbee in the W., the Alabama (formed by the Coosa and Tallapoosa) in the W. central, and in the E. the Chattahoochee, which forms almost half of the Georgia boundary. The Tombigbee and Alabama unite near the S.W. corner of the state, their waters discharging into Mobile Bay by the Mobile and Tensas rivers. The Black Warrior is a considerable stream which joins the Tombigbee from the E. The valleys in the N. and N.E. are usually deep and narrow, but in the Coastal Plain they are broad and in most cases rise in three successive terraces above the stream. The harbour of Mobile was formed by the drowning of the lower part of the valley of the Alabama and Tombigbee rivers as a result of the sinking of the land here, such sinking having occurred on other parts of the Gulf coast.

The fauna and flora of Alabama are similar to those of the Gulf states in general and have no distinctive characteristics.

Climate and Soil.—The climate of Alabama is temperate and fairly uniform. The heat of summer is tempered in the S. by the winds from the Gulf of Mexico, and in the N. by the elevation above the sea. The average annual temperature is highest in the S.W. along the coast, and lowest in the N.E. among the highlands. Thus at Mobile the annual mean is 67° F., the mean for the summer 81°, and for the winter 52°; and at Valley Head, in De Kalb county, the annual mean is 59°, the mean for the summer 75°, and for the winter 41°. At Montgomery, in the central region, the average annual temperature is 66°, with a winter average of 49°, and a summer average of 81°. The average winter minimum for the entire state is 35°, and there is an average of 35 days in each year in which the thermometer falls below the freezing-point. At extremely rare intervals the thermometer has fallen below zero, as was the case in the remarkable cold wave of the 12th–13th of February 1899, when an absolute minimum of 17° was registered at Valley Head. The highest temperature ever recorded was 109° in Talladega county in 1902. The amount of precipitation is greatest along the coast (62 in.) and evenly distributed through the rest of the state (about 52 in.). During each winter there is usually one fall of snow in the S. and two in the N.; but the snow quickly disappears, and sometimes, during an entire winter, the ground is not covered with snow. Hail-storms occur in the spring and summer, but are seldom destructive. Heavy fogs are rare, and are confined chiefly to the coast. Thunderstorms occur throughout the year, but are most common in the summer. The prevailing winds are from the S. As regards its soil, Alabama may be divided into four regions. Extending from the Gulf northward for one hundred and fifty miles is the outer belt of the Coastal Plain, also called the "Timber Belt," whose soil is sandy and poor, but responds well to fertilization. North of this is the inner lowland of the Coastal Plain, or the "Black Prairie," which includes some 13,000 sq. m. and seventeen counties. It receives its name from its soil (weathered from the weak underlying limestone), which is black in colour, almost destitute of sand and loam, and rich in limestone and marl formations, especially adapted to the production of cotton; hence the region is also called the "Cotton Belt." Between the "Cotton Belt" and the Tennessee Valley is the mineral region, the "Old Land" area—"a region of resistant rocks"—whose soils, also derived from weathering *in situ*, are of varied fertility, the best coming from the granites, sandstones and limestones, the poorest from the gneisses, schists and slates. North of the mineral region is the "Cereal Belt," embracing the Tennessee Valley and the counties beyond, whose richest soils are the red clays and dark loams of the river valley; north of which are less fertile soils, produced by siliceous and sandstone formations.

Agriculture.—Agriculture is the principal occupation in Alabama, giving employment to 64·5% of the population. The farm acreage in 1900 was 20,685,427 acres (62% of the entire surface of the state), of which 8,654,991 acres (41·8%) were improved. Under the system of slave labour which existed before 1860, the average size of the plantations tended to increase, but since 1860 the reverse has been true, the average plantation in 1860 being 346 acres, and in 1900 92·7 acres. The average value per acre of farm land was $11·86 in 1860 and $8·67 in 1900. As to method of cultivation, 36·3 per cent of the farms were in 1900 managed by the owners, 33·3% by cash renters, 24·4% by share tenants, and the remaining 6% by other methods. The chief product is cotton, cultivated extensively in the "Black Belt" and less extensively in the other portions of the state. Cotton has always been the principal source of wealth, the amount of its exports at Mobile increasing from 7000 bales in 1818 to 25,000 bales in 1821, and the total product of the state in 1840 being double that of 1830. This was accompanied by an extensive employment of slave labour, and from 1820 until 1860 the rate of increase of the blacks was greater than that of the whites. The success of the economic system was such that in 1860 the cotton crop of Alabama was nearly 1,000,000 bales (989,955 bales), being 18·4% of the entire cotton product of the United States. The disorganization of labour resulting from the

Civil War and the emancipation of slaves, was the cause of a temporary decline in the cotton crop. In 1889 the crop again approximated to 1,000,000 bales (915,210 bales, being 12·2% of the entire crop of the United States), and in 1899 it exceeded that amount, Alabama being fourth among the states of the entire country. The total value of the farm products of Alabama in 1899 was $91,387,409; in 1889, $66,240,190; and in 1879, $56,872,994. The average yield per acre has also increased under the system of free labour. In recent years there has been a tendency to diversify crops, Indian corn, wheat and oats being raised extensively in the "Cereal Belt." In 1906, according to the *Year-Book* of the Department of Agriculture, the following were the acreages, yields and values of Alabama's more important crops (excepting cotton):—Indian corn, 2,990,387 acres, 47,849,392 bushels, $30,623,611; wheat, 98,639 acres, 1,085,029 bushels, $1,019,927; oats, 184,179 acres, 3,167,879 bushels, $1,615,618; hay, 56,350 acres, 109,882 tons, $1,461,431.

Minerals.—The chief feature of Alabama's industrial life since 1880 has been the exploitation of her iron and coal resources. The iron ore (found chiefly in the region of which Birmingham is the centre) is primarily red haematite and (much less important) brown haematite; though as regards the latter Alabama ranked first among the states of the Union in 1905 (with 781,561 tons). The total production of all classes of iron ores was 3,782,831 tons in 1905, Alabama ranking third in the Union in this respect. The production of bituminous coal has also increased very rapidly. Coal was first discovered in the state in 1834, and in 1840 the total production was 946 tons; in 1870 it was 13,200 short tons. The real development of the mines began in 1881 and 1882, and the product increased from 420,000 tons in 1881 to 1,568,000 in 1883. By 1890 it had increased to 4,090,409 tons, by 1900 to 8,394,275 tons, and by 1905 to 11,866,069 tons, valued at $14,387,721, making Alabama sixth of the coal-producing states. Nearly 85% of the coal is produced in three counties (Jefferson, Walker and Bibb), though the coal-bearing formations cover about 40% of the northern half of the state. Gold, silver, lead, copper, tin and bauxite have also been discovered, but the greater richness of the iron and coal deposits has prevented their development.

Manufactures.—The growth of manufactures in Alabama has been as remarkable as the revelation of mineral wealth. In 1880 the capital invested in manufactures was $9,668,008, little more than that ($9,098,181) in 1860; by 1890 it had increased to $46,122,571, or 377·1%; and in 1900 it amounted to $70,370,081, or 52·6% more than in 1890.[1] On account of the proximity of coal, iron and limestone, the manufactures of iron and steel are the most extensive. In 1895 it was demonstrated that Alabama pig-iron could be sent to Liverpool and sold cheaper than the English product, and Birmingham (Alabama) came consequently to rank next to Middlesborough and Glasgow among the world centres of the pig-iron trade. The pig-iron produced in the state in 1860 was valued at $64,590, in 1870 at $210,258, in 1880 at $1,405,356, in 1900 at $13,487,769, and in 1905 at $16,614,577. In the production of foundry pig-iron Alabama held first rank both in 1900 and in 1905. The manufacture of steel, though in its infancy, gave promise of equalling that of iron, and the coke industry is also of growing importance, the product of Alabama during the five years from 1896 to 1901 showing a greater increase, relatively, than that of the other states. In 1900 the state ranked sixth and in 1905 fifth among the states of the United States in the manufactures of iron and steel. In 1905 the value of the product was 2·7% of the value of the total iron and steel product of the country, and 22·6% of the value of all the state's factory products. In 1900 and in 1905 Alabama ranked second among the states of the Union in the production of coke, its product being more than one-tenth of that for the whole country, and more than one-twentieth (5·2% in 1900; 5·7% in 1905) of all the factory products of the state. The demand for coke is due to the rapidly growing iron and steel industry. Great possibilities were also shown for the production of lumber and naval stores. Approximately three-fourths of the total area of the state is woodland. In the "Timber Belt" the forests of long leaf pine have an estimated stand of 21,192 million ft.; and in 1905 the product of sawed lumber was valued at $13,563,815. Of this, yellow pine represented $11,320,909, oak $886,746, and poplar $627,686. In the decade 1890–1900 the number of turpentine factories increased from 7 to 152, and their product in 1900 and in 1905 ranked Alabama third among the states in that industry. The value of the turpentine and rosin products in 1905 was $2,434,365.

The manufacture of cotton goods has also developed rapidly. As late as 1890 there were only 13 cotton mills in Alabama, one more than the number in 1850; in 1900 there were 31, representing a capital of $11,638,757 and an annual product valued at $8,153,136, an increase of 272·2% over the product ($2,190,771) of 1890; in 1905 there were 46 establishments, representing a capital of $24,758,049 (an increase of 112·7% over that of 1900), and having a product (for the year) of $16,760,332, an increase of 105·6% over that for 1900. To encourage the establishment of cotton mills the legislature of 1896–1897 exempted from taxation during the succeeding ten years all capital that should be invested in the manufacture of cotton, provided that $50,000 or more be invested in buildings and machinery. Other industries of less importance are flour, fertilizers and tanned leather.

Communications.—The navigable mileage of the Alabama rivers is 2000 m., but obstructions often prevent the formation of a continuous route, notably the "Muscle Shoals" of the Tennessee, extending from a point 10 m. below Decatur to Florence, a distance of 38 m. To remove or circumvent these impediments, and to improve the Mobile harbour, the United States government spent, between 1870 and 1904, approximately $12,000,000. As the streams in the mineral region are not navigable, the railways are the carriers of its products.[2] Here all the large systems of the southern states find an entrance, the Mobile & Ohio, the Southern (Queen & Crescent Route), the Louisville & Nashville, and the 'Frisco system affording communication with the Mississippi and the west, and the Southern, Seaboard Air Line, Atlantic Coast Line, and the Central of Georgia forming connexions with northern and Atlantic states. Mobile, the only seaport of the state, has a channel 30 ft. deep, on which the national government spends large sums of money; yet an increasing amount of Alabama cotton is sent to New Orleans for shipment, and Pensacola, Florida, receives much of the lumber.

Population.—In 1880 the inhabitants of Alabama numbered 1,262,505; in 1890, 1,513,017, an increase of 17%; in 1900, 1,828,697, a further increase of 20%. This population is notable for its large proportion of negroes (45·23%), its insignificant foreign element (·08%), and the small percentage of urban inhabitants (10%). As regards church membership, the Baptists are much the most numerous, followed by the Methodists, the Roman Catholics and the Presbyterians. In 1900 there were 201 incorporated cities, towns and villages in the state, but of these only nine had a population in excess of 5000, and only three a population in excess of 25,000. These three were Mobile (38,469), Birmingham (38,415), and Montgomery (30,346), the capital of the state. Other important cities, with their populations, were Selma (8713), Anniston (9695), Huntsville (8068), Bessemer (6358), Tuscaloosa (5094), Talladega (5056), Eufaula (4532) and Tuskegee (2170). In 1910 the population was 2,138,093.

Government.—Alabama has been governed under five constitutions, the original constitution of 1819, the revision of 1865, the constitutions of 1868 and 1875, and the present constitution, which was framed in 1901. The last has a number of notable provisions. It lengthened the term of service of executive and legislative officials from two to four years, made that of the

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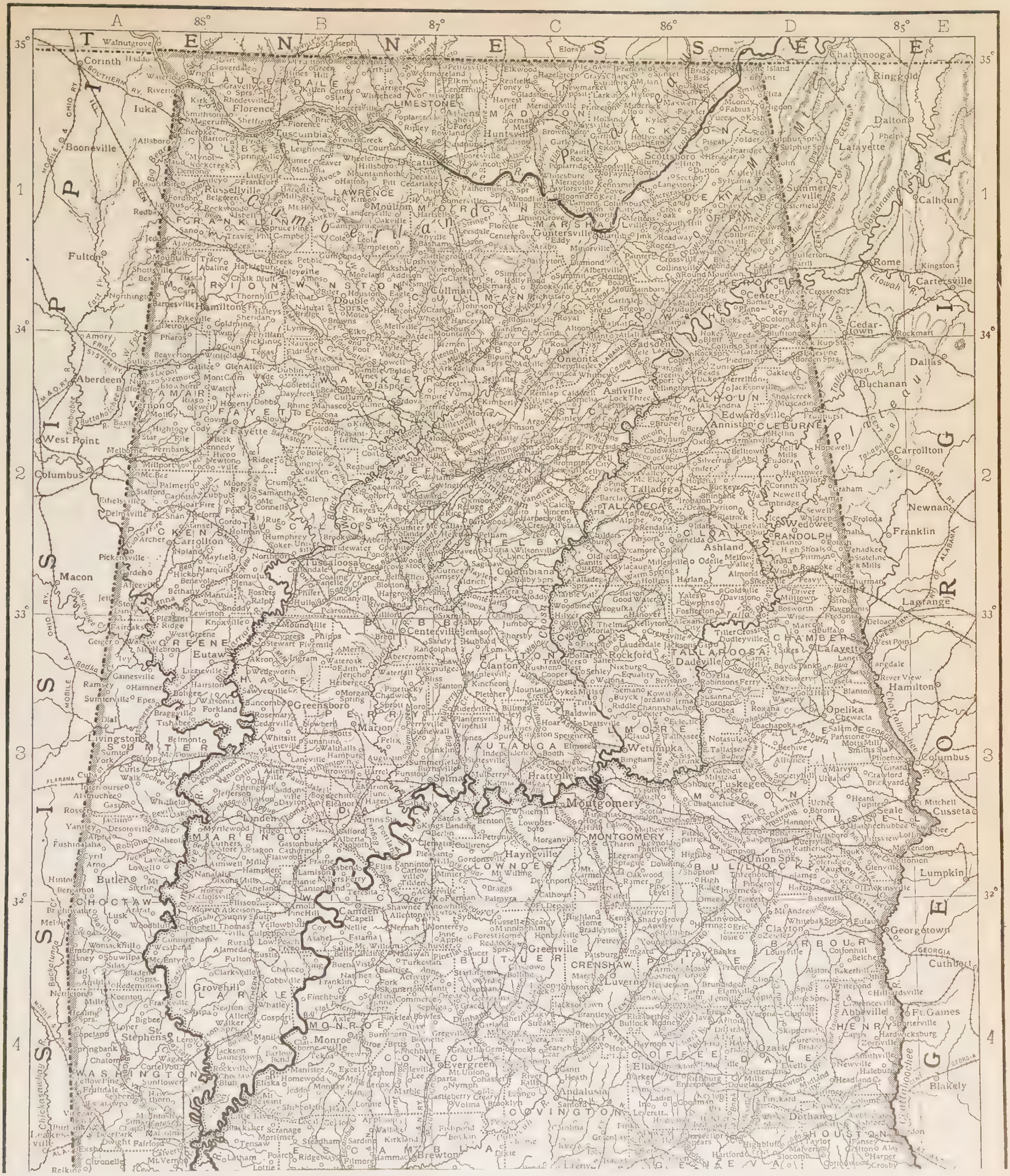
[1] The special census of manufactures taken in 1905 was confined to manufacturing establishments conducted under the so-called "factory system." According to this census the capital invested was $105,382,859, and the value of products was $109,169,922. The corresponding figures for 1900, if the same standard be taken for purposes of comparison, would be $60,165,904 and $72,109,929. During the five years, therefore, the capital invested in establishments under the factory system increased 75·2%, and the value of products 51·4%.

[2] The railway mileage of the state on the 31st of December 1906 was 4805·58 m.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FRANKLIN
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CULLMAN
BLOUNT
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CHEROKEE
LAMAR
FAYETTE
WALKER
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CALHOUN
CLEBURNE
PICKENS
TUSCALOOSA
JEFFERSON
SHELBY
TALLADEGA
CLAY
RANDOLPH
GREENE
HALE
BIBB
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COOSA
TALLAPOOSA
CHAMBERS
SUMTER
PERRY
AUTAUGA
ELMORE
LEE
MARENGO
DALLAS
LOWNDES
MONTGOMERY
MACON
RUSSELL
CHOCTAW
WILCOX
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BARBOUR
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COVINGTON
COFFEE
DALE
HENRY
WASHINGTON
ESCAMBIA
GENEVA
HOUSTON
Corinth
Iuka
Florence
Tuscumbia
Decatur
Huntsville
Scottsboro
Chattanooga
Guntersville
Fort Payne
Gadsden
Rome
Cullman
Jasper
Birmingham
Anniston
Talladega
Tuscaloosa
Columbus
Aberdeen
West Point
Macon
Eutaw
Greensboro
Selma
Montgomery
Tuskegee
Opelika
Lafayette
Dadeville
Wetumpka
Clanton
Centerville
Livingston
Demopolis
Linden
Camden
Greenville
Troy
Union Sprs.
Eufaula
Clayton
Abbeville
Ozark
Dothan
Andalusia
Evergreen
Brewton
Monroeville
Grovehill
St. Stephens
Butler
Hayneville
Lagrange
Columbus
Carrollton
Cedartown
Lumpkin
Georgetown
Cuthbert
Blakely
Chattahoochee R.
Tennessee R.
Tombigbee R.
Alabama R.
Coosa R.
Tallapoosa R.

judiciary six years, provided for quadrennial sessions of the legislature, and introduced the office of lieutenant-governor. The passage of local or special bills by the legislature was prohibited. A provision intended to prevent lobbying is that no one except legislators and the representatives of the press may be admitted to the floor of the House except by unanimous vote. No executive official can succeed himself in office, and the governor cannot be elected or appointed to the United States Senate, or to any state office during his term as governor, or within one year thereafter. Sheriffs whose prisoners suffer mob violence may be impeached. The constitution eliminated the negro from politics by a suffrage clause which went into effect in 1903. This limits the right to vote to those who can read and write any article of the constitution of the United States, and have worked or been regularly engaged in some lawful employment, business or occupation, trade or calling for the greater part of the twelve months next preceding the time they offer to register, unless prevented from labour or ability to read and write by physical disability, or who own property assessed at $300 upon which the taxes have been paid; but those who have served in the army or navy of the United States or of the Confederate States in time of war, their lawful descendants in every degree, and persons of good character "who understand the duties and obligations of citizenship under a republican form of government," are relieved from the operation of this law provided they registered prior to the 20th of December 1902. The second of these exceptions is known as the "Grandfather Clause." No man may vote in any election who has not by the 1st of February next preceding that election paid all poll taxes due from him to the state. In 1902 nine-tenths of the negroes in the state were disqualified from voting.[1] The constitution of 1901 (like that of 1867) and special statutes require separate schools for white and negro children. A "Jim Crow" law was enacted in 1891. Buying, selling or offering to buy or sell a vote has for penalty disfranchisement, and since 1891 the Australian ballot system has been used. The governor, auditor and attorney-general are required to prepare and present to each legislature a general revenue bill, and the secretary of state, with the last two officers, constitute a board of pardons who make recommendations to the governor, who, however, is not bound to follow their advice in the exercise of his pardoning power. State officials are forbidden to accept railway passes from railway companies, and individuals are forbidden to receive freight rebates. The constitution of 1901 exempted a homestead of 80 acres of farm land, or of a house and lot not exceeding $2000 in value, from liability for any debt contracted since the 30th of July 1868 except for a mortage on it to which the wife consented; personal property to the value of $1000 is exempted. Under the civil code of 1897 the earnings of a wife are her separate property, and it is provided that "no woman, nor any boy under age of twelve years, shall be employed to work or labour in or about any mine in this state." By acts of 1903 child labour under 12 years is forbidden in any factory unless for support of "a widowed mother or aged or disabled father," or unless the child is an indigent orphan; "no child under the age of ten years shall be so employed under any circumstances." Certificates of children's ages are necessary before a child is employed; false certification is forbidden under penalty of a fine of from $5 to $100 or hard labour not exceeding three months. No child under 13 may do night work at all. No child under 16 may do more than 48 hours a week of night work. No child of less than 12 is allowed to work more than 66 hours in any one week. An able-bodied parent who does not work when he has the opportunity, unless "idle under strike orders, or lock-outs," and who hires out his minor children, is declared a vagrant and may be fined $500 and imprisoned or sentenced to hard labour for not more than six months.

All amendments to the constitution must be approved by a three-fifths vote of each house of the legislature and then ratified by the people. The legislature of 1900–1901 established a department of archives and history whose aim is to preserve documents and historical records.

Education.—Public education for Mobile was authorized by the legislature of 1826, but it was not provided until 1852. Two years later (1854) a school system for the entire state was inaugurated. Its support was derived from public land given by the United States to the state of Alabama for educational purposes in 1819, and special taxes or tuition fixed by each township. The Civil War demoralized the nascent system. An important step in its revival seemed to be made in the constitution of 1868, which forbade any private recompense for instruction in the public schools and appropriated one-fifth of the state's revenue to common schools. But the attempt to teach whites and blacks in the same schools, and the corruption in the administration of funds, made the results unsatisfactory. The constitution of 1875 abolished the one-fifth revenue provision, made the support of the schools, except that derived from the land grant of 1819, and poll taxes, depend upon the appropriation of the legislature, and established separate schools for whites and blacks. Progress has been slow but steady. According to the constitution of 1901 the legislature is required to levy, in addition to the poll tax, an annual tax for education at the rate of 30 to 65 cents on the hundred dollars' worth of property, and practically every county in the state had made in 1906 an appropriation for its schools of a one mill tax on $100. The school fund in 1900 amounted to $1,000,000, an increase of 37 % over the average annual fund of the preceding decade; for the year ending the 30th of September 1907 the amount certified for apportionment by the state was $1,150,261·40, and the total annual expenditure was about $1,600,000; in 1906 the school census showed 697,465 children of school age. The legislature of 1907 voted an increase of $300,000 in the appropriation for the common school fund, and granted state-aid for rural school-houses; but its most important work probably was the establishment of county high schools. The rural schools have an annual term of five to seven months only. The percentage of illiterates declined from 50·97 % in 1880 to 41 % in 1890, and 34 % in 1900, when Alabama ranked third among the states in illiteracy.

There are also a number of institutions for higher education in Alabama. The most important of these are the university of Alabama (co-educational—opened in 1831), at Tuscaloosa, the institution being part of the public school system maintained by the state; the Alabama Polytechnic Institute at Auburn, a "state college for the benefit of agriculture and the mechanic arts," organized in 1872 according to the United States land grant act for the promotion of industrial education; the Southern University (incorporated 1856—Methodist Episcopal, South), at Greensboro; Howard College (Baptist), at East Lake (Birmingham); Spring Hill College (1830—Roman Catholic), near Mobile; Talladega College (for negroes), at Talladega; the Tuskegee Normal and Industrial Institute (for negroes), at Tuskegee; and state normal schools at Florence, Jacksonville, Troy and Livingston, and, for negroes, at Montgomery, Tuskegee and Normal.

Public Institutions.—Alabama supports various philanthropic and penal institutions: a home for Confederate veterans, at Mountain Creek; an institution for the deaf, an academy for the blind, and a school for the negro deaf, dumb and blind, all at Talladega; a hospital for the insane, opened in 1860, at Tuscaloosa; a penitentiary, established in 1839, at Wetumpka; and a state industrial school for white boys, at East Lake (Birmingham), and a state industrial school for white girls at Montevallo.

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[1] In Giles *v.* Harris, 189 U.S. 474, a negro asked that the defendant board of registry be required to enrol his name and the names of other negroes on the registration lists, and that certain sections of the constitution of Alabama be declared void as being contrary to the fourteenth and fifteenth amendments to the federal constitution. The Supreme Court dismissed the bill on the grounds that equity has no jurisdiction over political matters; that, assuming the fraudulent character of the objectionable constitutional provisions, the court was in effect asked to assist in administering a fraud; and that relief "must be given by them [the people of the state] or by the legislative and political departments of the government of the United States." The case attracted much attention; and it is often erroneously said that the court upheld the disfranchising clauses of the Alabama constitution.

These institutions are managed by trustees who are appointed by the governor. In addition to the usual method of employing convicts in the penitentiary or on state farms, Alabama, like other southern states, also hires its convicts to labour for private individuals. Reports of abuses under this system caused the legislature in 1901 to order a special investigation, the results of which led in 1903 to a new system of leasing to contractors, whereby the prisoners are kept under the direct supervision of state officials. In this same year a system of peonage that had grown up in the state attracted wide attention, and a Federal grand jury at a single term of court indicted a number of men for holding persons as "peons." Many similar cases were found later in other southern states, but those in Alabama being the first discovered attracted the most attention. The system came into existence in isolated communities through the connivance of justices of the peace with white farmers. The justices have jurisdiction over petty offences, of which negroes are usually the guilty parties, and the fines imposed would sometimes be paid by a white farmer, who would thus save the accused from imprisonment, but at the same time would require him to sign a contract to repay by his labour the sum advanced. By various devices the labourer would then be kept constantly in debt to his employer and be held in involuntary servitude for an indefinite time. The "peons" as a rule were negroes, but a few white ones were found; and in several instances negroes were found holding members of their own race in peonage. A law forbidding under severe penalties a labourer from hiring himself to a second employer without giving notice of a prior contract, and an employer from hiring a labourer known by him to be bound by such a contract, had aided in the development of the system, though it had been enacted for a different purpose. The Federal authorities, as soon as the existence of peonage became known, took active measures to stamp it out, and were supported by the press and by the leading citizens of the state. Up to 1907 the state licensed the sale of liquor, and liquor licence fees were partly turned over to the public school fund; there was a dispensary system in some counties; and in 1907 one-third of the counties of the state (22 out of 67) were "dry." Besides, saloons had been forbidden within 5 m. of certain churches and school-houses, so that liquor was sold scarcely at all except in incorporated towns, where in many cases local dispensaries were established. In the 1907 state legislature a county local option bill was passed in February, and immediately afterward the Sherrod anti-shipping bill was enacted forbidding the acceptance of liquors for shipment, transportation or delivery to prohibition districts, and penalising the soliciting of orders for liquor in "dry" districts with a punishment of $500 fine and six months' imprisonment with hard labour. In a special session of the legislature in November 1907 a law was passed forbidding the sale of liquor within the state, this prohibition to come into effect on the 1st of January 1909.

Finance.—One-half of the income of the state is derived from general taxes, the other sources of revenue being licences, a special school tax, poll tax and the lease of the convicts. The state debt, for which legislative corruption in the years 1868–1872 was largely responsible, amounted on the 1st of October 1906 to $9,057,000. Measures for its refunding, but not for its extinction, have been taken. The constitution of 1901 prohibits the increase of the debt for any other purposes than the suppression of insurrection or resistance to invasion, and the assumption of corporate debts by cities and towns is also restricted. All banks, except national banks, are subject to examination by a public official, and their charters expire within twenty years of their issue.

History.—The first Europeans to enter the limits of the present state of Alabama were Spaniards, who claimed this region as a part of Florida. It is possible that a member of Panfilo de Narvaez's expedition of 1528 entered what is now southern Alabama, but the first fully authenticated visit was that of Hernando de Soto, who made an arduous but fruitless journey along the Coosa, Alabama and Tombigbee rivers in 1539. The English, too, claimed the region north of the Gulf of Mexico, and the territory of modern Alabama was included in the province of Carolina, granted by Charles II. to certain of his favourites by the charters of 1663 and 1665. English traders of Carolina were frequenting the valley of the Alabama river as early as 1687. Disregarding these claims, however, the French in 1702 settled on the Mobile river and there erected Fort Louis, which for the next nine years was the seat of government of Louisiana. In 1711 Fort Louis was abandoned to the floods of the river, and on higher ground was built Fort Condé, the germ of the present city of Mobile, and the first permanent white settlement in Alabama. Later, on account of the intrigues of the English traders with the Indians, the French as a means of defence established the military posts of Fort Toulouse, near the junction of the Coosa and Tallapoosa rivers, and Fort Tombecbé on the Tombigbee river. The grant of Georgia to Oglethorpe and his associates in 1732 included a portion of what is now northern Alabama, and in 1739 Oglethorpe himself visited the Creek Indians west of the Chattahoochee river and made a treaty with them. The peace of Paris, in 1763, terminated the French occupation, and England came into undisputed possession of the region between the Chattahoochee and the Mississippi. The portion of Alabama below the 31st parallel then became a part of West Florida, and the portion north of this line a part of the "Illinois country," set apart, by royal proclamation, for the use of the Indians. In 1767 the province of West Florida was extended northward to 32° 28′ N. lat., and a few years later, during the War for Independence, this region fell into the hands of Spain. By the treaty of Versailles, on the 3rd of September 1783, England ceded West Florida to Spain; but by the treaty of Paris, signed the same day, she ceded to the United States all of this province north of 31°, and thus laid the foundation for a long controversy. By the treaty of Madrid, in 1795, Spain ceded to the United States her claims to the lands east of the Mississippi between 31° and 32° 28′; and three years later (1798) this district was organized by Congress as the Mississippi Territory. A strip of land 12 or 14 m. wide near the present northern boundary of Alabama and Mississippi was claimed by South Carolina; but in 1787 that state ceded this claim to the general government. Georgia likewise claimed all the lands between the 31st and 35th parallels from its present western boundary to the Mississippi river, and did not surrender its claim until 1802; two years later the boundaries of the Mississippi Territory were extended so as to include all of the Georgia cession. In 1812 Congress annexed to the Mississippi Territory the Mobile District of West Florida, claiming that it was included in the Louisiana Purchase; and in the following year General James Wilkinson occupied this district with a military force, the Spanish commandant offering no resistance. The whole area of the present state of Alabama then for the first time became subject to the jurisdiction of the United States. In 1817 the Mississippi Territory was divided; the western portion became the state of Mississippi, and the eastern the territory of Alabama, with St Stephens, on the Tombigbee river, as the temporary seat of government. In 1819 Alabama was regularly admitted to the Union as a state.

One of the first problems of the new commonwealth was that of finance. Since the amount of money in circulation was not sufficient to meet the demands of the increasing population, a system of state banks was instituted. State bonds were issued and public lands were sold to secure capital, and the notes of the banks, loaned on security, became a medium of exchange. Prospects of an income from the banks led the legislature of 1836 to abolish all taxation for state purposes. This was hardly done, however, before the panic of 1837 wiped out a large portion of the banks' assets; next came revelations of grossly careless and even of corrupt management, and in 1843 the banks were placed in liquidation. After disposing of all their available assets, the state assumed the remaining liabilities, for which it had pledged its faith and credit, and these form a part ($3,445,000) of its present indebtedness.

The Indian problem was important. With the encroachment of the white settlers upon their hunting-grounds the Creek

Indians began to grow restless, and the great Shawnee chief Tecumseh, who visited them in 1811, fomented their discontent. When the outbreak of the second war with Great Britain in 1812 gave the Creeks assurance of British aid they rose in arms, massacred several hundred settlers who had taken refuge in Fort Mims, near the junction of the Alabama and Tombigbee rivers, and in a short time no white family in the Creek country was safe outside a palisade. The Chickasaw and Choctaw Indians, however, remained the faithful allies of the whites, and volunteers from Georgia, South Carolina and Tennessee, and later United States troops, marched to the rescue of the threatened settlements. In the campaign that followed the most distinguished services were rendered by General Andrew Jackson, whose vigorous measures broke for ever the power of the Creek Confederacy. By the treaty of Fort Jackson (9th of August 1814) the Creeks ceded their claims to about one-half of the present state; and cessions by the Cherokees, Chickasaws and Choctaws in 1816 left only about one-fourth of Alabama to the Indians. In 1832 the national government provided for the removal of the Creeks; but before the terms of the contract were effected, the state legislature formed the Indian lands into counties, and settlers flocked in. This caused a disagreement between Alabama and the United States authorities; although it was amicably settled, it engendered a feeling that the policy of the national government might not be in harmony with the interests of the state—a feeling which, intensified by the slavery agitation, did much to cause secession in 1861.

The political history of Alabama may be divided into three periods, that prior to 1860, the years from 1860 to 1876, and the period from 1876 onwards.

The first of these is the only period of altogether healthy political life. Until 1832 there was only one party in the state, the Democratic, but the question of nullification caused a division that year into the (Jackson) Democratic party and the State's Rights (Calhoun Democratic) party; about the same time, also, there arose, chiefly in those counties where the proportion of slaves to freemen was greater and the freemen were most aristocratic, the Whig party. For some time the Whigs were nearly as numerous as the Democrats, but they never secured control of the state government. The State's Rights men were in a minority; nevertheless under their active and persistent leader, William L. Yancey (1814–1863), they prevailed upon the Democrats in 1848 to adopt their most radical views. During the agitation over the introduction of slavery into the territory acquired from Mexico, Yancey induced the Democratic State Convention of 1848 to adopt what is known as the "Alabama Platform," which declared in substance that neither Congress nor the government of a territory had the right to interfere with slavery in a territory, that those who held opposite views were not Democrats, and that the Democrats of Alabama would not support a candidate for the presidency if he did not agree with them on these questions. This platform was endorsed by conventions in Florida and Virginia and by the legislatures of Georgia and Alabama. Old party lines were broken by the Compromise of 1850. The State's Rights party, joined by many Democrats, founded the Southern Rights party, which demanded the repeal of the Compromise, advocated resistance to future encroachments and prepared for secession, while the Whigs, joined by the remaining Democrats, formed the party known as the "Unionists," which unwillingly accepted the Compromise and denied the "constitutional" right of secession. The "Unionists" were successful in the elections of 1851 and 1852, but the feeling of uncertainty engendered in the south by the passage of the Kansas-Nebraska Bill and the course of the slavery agitation after 1852 led the State Democratic convention of 1856 to revive the "Alabama Platform"; and when the "Alabama Platform" failed to secure the formal approval of the Democratic National convention at Charleston, South Carolina, in 1860, the Alabama delegates, followed by those of the other cotton "states," withdrew. Upon the election of Abraham Lincoln, Governor Andrew B. Moore, according to previous instructions of the legislature, called a state convention on the 7th of January 1861. After long debate this convention adopted on the 11th of January an ordinance of secession, and Alabama became one of the Confederate states of America, whose government was organized at Montgomery on the 4th of February 1861. Yet secession was opposed by many prominent men, and in North Alabama an attempt was made to organize a neutral state to be called Nickajack; but with President Lincoln's call to arms all opposition to secession ended.

In the early part of the Civil War Alabama was not the scene of military operations, yet the state contributed about 120,000 men to the Confederate service, practically all her white population capable of bearing arms, and thirty-nine of these attained the rank of general. In 1863 the Federal forces secured a foothold in northern Alabama in spite of the opposition of General Nathan B. Forrest, one of the ablest Confederate cavalry leaders. In 1864 the defences of Mobile were taken by a Federal fleet, but the city held out until April 1865; in the same month Selma also fell.

According to the presidential plan of reorganization, a provisional governor for Alabama was appointed in June 1865; a state convention met in September of the same year, and declared the ordinance of secession null and void and slavery abolished; a legislature and a governor were elected in November, the legislature was at once recognized by the National government, and the inauguration of the governor-elect was permitted after the legislature had, in December, ratified the thirteenth amendment. But the passage, by the legislature, of vagrancy and apprenticeship laws designed to control the negroes who were flocking from the plantations to the cities, and its rejection of the fourteenth amendment, so intensified the congressional hostility to the presidential plan that the Alabama senators and representatives were denied their seats in Congress. In 1867 the congressional plan of reconstruction was completed and Alabama was placed under military government. The negroes were now enrolled as voters and large numbers of white citizens were disfranchised.[1] A Black Man's Party, composed of negroes, and political adventurers known as "carpet-baggers," was formed, which co-operated with the Republican party. A constitutional convention, controlled by this element, met in November 1867, and framed a constitution which conferred suffrage on negroes and disfranchised a large class of whites. The Reconstruction Acts of Congress required every new constitution to be ratified by a majority of the legal voters of the state. The whites of Alabama therefore stayed away from the polls, and, after five days of voting, the constitution wanted 13,550 to secure a majority. Congress then enacted that a majority of the votes cast should be sufficient, and thus the constitution went into effect, the state was admitted to the Union in June 1868, and a new governor and legislature were elected.

The next two years are notable for legislative extravagance and corruption. The state endorsed railway bonds at the rate of $12,000 and $16,000 a mile until the state debt had increased from eight millions to seventeen millions of dollars, and similar corruption characterized local government. The native white people united, formed a Conservative party and elected a governor and a majority of the lower house of the legislature in 1870; but, as the new administration was largely a failure, in 1872 there was a reaction in favour of the Radicals, a local term applied to the Republican party, and affairs went from bad to worse. In 1874, however, the power of the Radicals was finally broken, the Conservative Democrats electing all state officials. A commission appointed to examine the state debt found it to be $25,503,000; by compromise it was reduced to $15,000,000. A new constitution was adopted in 1875, which omitted the guaranty of the previous constitution that no one should be denied suffrage on account of race, colour or previous condition of servitude, and forbade the state to engage in internal improvements or to give its credit to any private enterprise.

Since 1874 the Democratic party has had constant control of the state administration, the Republicans failing to make nominations for office in 1878 and 1880 and endorsing the ticket of the Greenback party in 1882. The development of mining and manufacturing was accompanied by economic distress among the farming classes, which found expression in the Jeffersonian Democratic party, organized in 1892. The regular Democratic ticket was elected and the new party was then merged into the Populist party. In 1894 the Republicans united with the Populists, elected three congressional representatives, secured control of many of the counties, but failed to carry the state, and continued their opposition with less success in the next campaigns. Partisanship became intense, and charges of corruption of the ignorant negro electorate were made. Consequently after division on the subject among the Democrats themselves, as well as opposition of Republicans and Populists, a new constitution with restrictions on suffrage was adopted in 1901.

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[1] The enrolment was 104,518 blacks and 61,295 whites.

The following is a list of the territorial and state governors of Alabama:—

Governor of the Territory.

William Wyatt Bibb	1817–1819	

Governors of the State.

William Wyatt Bibb	1819–1820	Democrat.
Thomas Bibb[1]	1820–1821	”
Israel Pickens	1821–1825	”
John Murphy	1825–1829	”
Gabriel Moore	1829–1831	”
Samuel B. Moore	1831	”
John Gayle	1831–1835	”
Clement C. Clay	1835–1837	”
Hugh M'Vay[2]	1837	”
Arthur P. Bagby	1837–1841	”
Benjamin Fitzpatrick[3]	1841–1845	”
Joshua L. Martin	1845–1847	”
Reuben Chapman	1847–1849	”
Henry W. Collier	1849–1853	”
John A. Winston	1853–1857	”
Andrew B. Moore	1857–1861	”
John Gill Shorter	1861–1863	”
Thomas H. Watts	1863–1865	”
Lewis E. Parsons	1865	Provisional Governor.
Robert M. Patton	1865–1867	Republican.
Wager Swayne	1867–1868	Military Governor.
William H. Smith	1868–1870	Republican.
Robert B. Lindsay	1870–1872	Democrat.
David P. Lewis	1872–1874	Republican.
George S. Houston	1874–1878	Democrat.
Rufus W. Cobb	1878–1882	”
Edward A. O'Neal	1882–1886	”
Thomas Seay	1886–1890	”
Thomas G. Jones	1890–1894	”
William C. Oates	1894–1896	”
Joseph F. Johnston	1896–1900	”
William J. Samford	1900–1901	”
William D. Jelks	1901–1907	”
B. B. Comer	1907	”

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In addition, W. G. Clark's *History of Education in Alabama* (Washington, 1889); W. E. Martin's *Internal Improvements in Alabama* (Baltimore, 1902; Johns Hopkins University Studies, series 20, No. 4); and W. L. Martin's *Code of Alabama* (2 vols., Atlanta, Ga., 1897) may be consulted.

Information concerning the aboriginal remains in the state may be found in two papers by Clarence B. Moore, "Certain Aboriginal Remains of the Tombigbee River" and "Certain Aboriginal Remains of the Alabama River," published in the *Journal of the Academy of Natural Sciences*, series 2, vol. ii. (Philadelphia, 1900).

"ALABAMA" ARBITRATION.—This is one of those arbitrations on pecuniary claims, made by one state, on behalf of its subjects, against another state, which are referred to in the article ARBITRATION, INTERNATIONAL. The case is important, both from a historical and a juridical point of view, and affords a conspicuous example of the value of arbitration as a means of averting war. The facts are as follows:—

In 1861 the Southern States of North America seceded from the rest on the slavery question and set up a separate government under President Jefferson Davis. Hostilities began with the capture of Fort Sumter by the Confederates on the 13th of April 1861. On the 19th of April President Abraham Lincoln declared a blockade of the southern ports. On the 14th of May the British government issued a proclamation of neutrality, by which the Confederates were recognized as belligerents. This example was followed shortly afterwards by France and other nations. The blockade of the southern ports was not at first effective, and blockade-running soon became an active industry. The Confederates established agencies in England for the purchase of arms, which they despatched in ordinary merchant vessels to the Bahamas, whence they were transhipped into fast steamers especially constructed for the purpose.

In June 1862 the vessel, the "Alabama," originally known as "No. 290," was being built by Messrs. Laird at Birkenhead. She was then nearly completed and was obviously intended for a man-of-war. On the 23rd of June Mr C. F. Adams forwarded to Earl Russell a letter from the United States consul at Liverpool giving certain particulars as to her character. This letter was laid before the law officers, who advised that, if these particulars were correct, the vessel ought to be detained. On the 21st of July sworn evidence, which was supplemented on the 23rd of July, was obtained and laid before the commissioners of customs (who were the proper authorities to enforce the provisions of the Foreign Enlistment Act of 1819), but they declined to move. On the 23rd of July the same evidence was laid before the law officers, who advised that there was sufficient ground for detention. By some accident, which has never been satisfactorily explained, but was probably connected with the severe illness of Sir John Harding, the queen's advocate, the papers were not returned till the 29th of July. Instructions were then issued to seize the vessel, but she had already sailed on the evening of the 28th. Although she remained for two days off the coast of Anglesey, there was no serious attempt at pursuit. She afterwards made her way to the Azores, where she received her armament, which was brought from Liverpool in two British ships. Captain Semmes there took command of her under a commission from the Confederate government. After a most destructive career she was sunk off Cherbourg by the "Kearsarge" on the 19th of June 1864.

On these facts the United States government alleged against Great Britain two grievances, or sets of grievances. The first was the recognition of the Southern States as belligerents and a general manifestation of unfriendliness in other ways. The second was in respect of breaches of neutrality in allowing the "Alabama," the "Florida" (originally the "Oreto"), the "Shenandoah" and other Confederate vessels to be built and equipped on British territory. Correspondence ensued extending over several years. At length in February 1871 a commission was appointed to sit at Washington in order, if possible, to arrive at some common understanding as to the mode in which the questions at issue might be settled. With respect to the "Alabama" claims the British commissioners suggested that they should be submitted to arbitration. The American commissioners refused "unless the principles which should govern the arbitrators in the consideration of the facts could be first agreed upon." After some discussion the British commissioners consented that the three following rules should apply. A neutral government is bound—(1) to use due diligence to prevent the fitting out, arming or equipping within its jurisdiction of any vessel, which it has reasonable ground to believe is intended to cruise or to carry on war against a power with which it is at peace, and also to use like diligence to prevent the departure from its jurisdiction of any vessel intended to cruise or carry on war as above, such vessel having been specially adapted, in whole or in part, within such jurisdiction, to warlike use; (2) not to permit or suffer either belligerent to make use of its ports or waters as the base of naval operations against the other, or for the purpose of the renewal or augmentation of military supplies or arms or the recruitment of men; (3) to exercise due diligence in its own ports and waters, and as to all persons within its jurisdiction to prevent any violation of the foregoing obligation and duties. The arrangements made by the commission were embodied in the treaty of Washington, which was signed on the 8th of May 1871, and approved by the Senate on the 24th of May. Article 1, after expressing the regret felt by Her Majesty's government for the escape, in whatever circumstances, of the "Alabama" and other vessels from British ports, and for the depredations committed by these vessels, provided that "the claims growing out of the acts of the said vessels, and generically known as the 'Alabama' claims" should be referred to a tribunal composed of five arbitrators, one to be named by each of the contracting parties and the remaining three by the king of Italy, the president of the Swiss Confederation and the emperor of Brazil respectively. By Article 2 all questions submitted were to be decided by a majority of the arbitrators, and each of the contracting parties was to name one person to attend as agent. Article 6 provided that the arbitrators should be governed by the three rules quoted above, and by such principles of international law not inconsistent therewith as the arbitrators should determine to be applicable to the case. By the same article the parties agreed to observe these rules as between themselves in future, and to bring them to the knowledge of other maritime powers. Article 7 provided that the decision should be made within three months from the close of the argument, and gave power to the arbitrators to award a sum in gross in the event of Great Britain being adjudged to be in the wrong.

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[1] William Wyatt Bibb died in 1820, and Thomas Bibb, then president of the state senate, filled the unexpired term of one year (1820).

[2] In 1837 Governor Clay was elected United States Senator, and Hugh M'Vay, the president of the state senate, filled the unexpired term.

[3] Until 1845 the term of state officials was one year; from then until 1901 it was two years; since 1901 it has been four years.

The treaty was, on the whole, welcomed in England. The United States appointed Mr C. F. Adams as arbitrator and Mr J. C. Bancroft Davis as agent. The British government appointed Sir Alexander Cockburn as arbitrator and Lord Tenterden as agent. The arbitrators appointed by the three neutral powers were Count Sclopis (Italy), M. Staempfli (Switzerland), Baron d'Itajuba (Brazil). The first meeting of the tribunal took place on the 15th of December 1871 in the Hôtel de Ville, Geneva. As soon as the cases had been formally presented, the tribunal adjourned till the following June. There followed immediately a controversy which threatened the collapse of the arbitration. It was found that in the American case damages were claimed not only for the property destroyed by the Confederate cruisers, but in respect of certain other matters known as "indirect losses," viz. the transference of the American marine to the British flag, the enhanced payments of insurance, the expenses of pursuit and the prolongation of the war. But this was not all. The American case revived the charges of "insincere neutrality" and "veiled hostility" which had figured in the diplomatic correspondence, and had been repudiated by Great Britain. It dwelt at length upon such topics as the premature recognition of belligerency, the unfriendly utterances of British politicians and the material assistance afforded to the Confederates by British traders. The inclusion of the indirect losses and the other matters just referred to caused great excitement in England. That they were within the treaty was disputed, and it was argued that, if they were, the treaty should be amended or denounced. In October 1872 Lord Granville notified to General Schenck, the United States minister, that the British government did not consider that the indirect losses were within the submission, and in April the British counter-case was filed without prejudice to this contention. On the 15th of June the tribunal reassembled and the American argument was filed. The British agent then applied for an adjournment of eight months, ostensibly in order that the two governments might conclude a supplemental convention, it having been meanwhile privately arranged between the arbitrators that an extra-judicial declaration should be obtained from the arbitrators on the subject of the direct claims. On the 19th of June Count Sclopis intimated on behalf of all his colleagues that, without intending to express any opinion upon the interpretation of the treaty, they had arrived at the conclusion that "the indirect claims did not constitute upon the principles of international law applicable to such cases a good foundation for an award or computation of damages between nations." In consequence of this intimation Mr Bancroft Davis informed the tribunal on the 25th of June that he was instructed not to press those claims; and accordingly on the 27th of June Lord Tenterden withdrew his application for an adjournment, and the arbitration was allowed to proceed. The discussion turned mainly on the question of the measure of "due diligence." The United States contended that it must be a diligence commensurate with the emergency or with the magnitude of the results of negligence. The British government maintained that while the measure of care which a government is bound to use in such cases must be dependent more or less upon circumstances, it would be unreasonable to require that it should exceed that which the governments of civilized states were accustomed to employ in matters concerning their own security or that of their citizens.

The tribunal adopted the view suggested by the United States. It found that Great Britain was legally responsible for all the depredations of the "Alabama" and "Florida" and for those committed by the "Shenandoah" after she left Melbourne. In the case of the "Alabama" the court was unanimous; in the case of the "Florida" Sir A. Cockburn alone, in that of the "Shenandoah" he and Baron d'Itajuba, dissented from the majority. In the cases of the other vessels the judgment was in favour of Great Britain. The tribunal decided to award a sum in gross, and (Sir A. Cockburn again dissenting) fixed the damages at $15,500,000 in gold. On the 14th of September the award was formally published, and signed by all the arbitrators except Sir A. Cockburn, who filed a lengthy statement of his reasons.

The stipulation that the three rules should be jointly submitted by the two powers to foreign nations has never been carried out. For this the British government has been blamed by some. But the general view of continental publicists is, that the language of the rules was not sufficiently precise to admit of their being generally accepted as a canon of neutral obligations. (M. H. C.)

ALABAMA RIVER, a river of Alabama, U.S.A., formed by the Tallapoosa and Coosa rivers, which unite about 6 m. above Montgomery. It flows W. as far as Selma, then S.W. until, about 45 m. from Mobile, it unites with the Tombigbee to form the Mobile and Tensas rivers, which discharge into Mobile Bay. The course of the Alabama is tortuous; its width varies from 200 to 300 yds., its depth from 3 to 7 ft.; its length by the United States Survey is 312 m., by steamboat measurement, 420 m. The river crosses the richest agricultural and timber districts of the state, and railways connect it with the mineral regions of north central Alabama. The principal tributary of the Alabama is the Cahaba (about 200 m. long), which enters it about 10 m. below Selma. Of the rivers which form the Alabama, the Coosa crosses the mineral region of Alabama, and is navigable for light-draft boats from Rome, Georgia (where it is formed by the junction of the Oostenaula and Etowah rivers), to about 117 m. above Wetumpka (about 192 m. below Rome and 26 m. below Greensport), and from Wetumpka to its junction with the Tallapoosa; the channel of the river has been considerably improved by the Federal government. The navigation of the Tallapoosa river (which has its source in Paulding county, Georgia, and is about 250 m. long) is prevented by shoals and a 60-ft. fall at Tallassee, a few miles N. of its junction with the Coosa. The Alabama is navigable throughout the year. In 1878 the Federal government undertook to make a channel the length of the Alabama 200 ft. wide and 4 ft. deep; an amendment in 1891 provided for a 6-ft. channel at low water, and in June 1907 this work was reported as "10% completed" at an expenditure of $303,659. The Mobile river is navigable for vessels of about 14 ft. draft. The Alabama is an important carrier of cotton, cotton seed, fertilizer, cereals, lumber, naval stores, &c.; and in the fiscal year 1906–1907 the freight tonnage was 417,041 tons.

ALABASTER, or ARBLASTIER, **WILLIAM** (1567–1640), English Latin poet and scholar, was born at Hadleigh, Suffolk, in 1567. He was, so Fuller states, a nephew by marriage of Dr John Still, bishop of Bath and Wells. His surname, sometimes written Arblastier, is one of the many variants of *arbalester*, a cross-bowman. Alabaster was educated at Westminster school, and entered Trinity College, Cambridge, in 1583. He became a fellow, and in 1592 was incorporated of the university of Oxford. About 1592 he produced at Trinity College his Latin tragedy of *Roxana*.[1] It is modelled on the tragedies of Seneca, and is a stiff and spiritless work. Fuller and Anthony à Wood bestowed exaggerated praise on it, while Samuel Johnson regarded it as the only Latin verse worthy of notice produced in England before Milton's elegies. *Roxana* is founded on the *La Dalida* (Venice, 1567) of Luigi Groto, known as Cieco di Hadria, and Hallam asserts that it is a plagiarism (*Literature of Europe*, iii. 54). A surreptitious edition in 1632 was followed by an authorized version *a plagiarii unguibus vindicata, aucta et agnita ab Authore, Gulielmo Alabastro*. One book of an epic poem in Latin hexameters, in honour of Queen Elizabeth, is preserved in MS. in the library of Emmanuel College, Cambridge. This poem, *Elisaeis, Apotheosis poetica*, Spenser highly esteemed. "Who lives that can match that heroick song?" he says in *Colin Clout's come home againe*, and begs "Cynthia" to withdraw the poet from his obscurity. In June 1596 Alabaster sailed with Robert Devereux, earl of Essex, on the expedition to Cadiz in the capacity of chaplain, and, while he was in Spain, he became a Roman Catholic. An account of his change of faith is given in an obscurely worded sonnet contained in a MS. copy of *Divine Meditations, by Mr Alabaster* (see J. P. Collier, *Hist. of Eng. Dram. Poetry*, ii. 341). He defended his conversion in a pamphlet, *Seven Motives*, of which no copy is extant. The proof of its publication only remains in two tracts, *A Booke of the Seuen Planets, or Seuen wandring motives of William Alablaster's* (*sic*) *wit* . . . , by John Racster (1598), and *An Answer to William Alabaster, his Motives*, by Roger Fenton (1599). From these it appears that Alabaster was imprisoned for his change of faith in the Tower of London during 1598 and 1599. In 1607 he published at Antwerp *Apparatus in Revelationem Jesu Christi*, in which his study of the Kabbalah was turned to account in a mystical interpretation of scripture which drew down the censure alike of Protestants and Catholics. The book was placed on the *Index librorum prohibitorum* at Rome early in 1610. Alabaster says in the preface to his *Ecce sponsus venit* (1633), a treatise on the time of the second advent of Christ, that he went to Rome and was there imprisoned by the Inquisition, but succeeded in escaping to England and again embraced the Protestant faith. He received a prebend in St Paul's cathedral, London, and the living of Therfield, Hertfordshire. He died in 1640. Alabaster's other cabalistic writings are *Commentarius de Bestia Apocalyptica* (1621) and *Spiraculum tubarum* . . . . (1633), a mystical interpretation of the Pentateuch. It was by these theological writings that he won the praise of Robert Herrick, who calls him "the triumph of the day" and the "one only glory of a million" ("To Doctor Alabaster" in *Hesperides*, 1648). He also published (1637) *Lexicon Pentaglotton, Hebraicum, Chaldaicum, Syriacum, Talmudico-Rabbinicon et Arabicum.*

See T. Fuller, *Worthies of England* (ii. 343); J. P. Collier, *Bibl. and Crit. Account of the Rarest Books in the English Language* (vol. i. 1865); Pierre Bayle, *Dictionary, Historical and Critical* (ed. London, 1734); also the *Athenaeum* (December 26, 1903), where Mr Bertram Dobell describes a MS. in his possession containing forty-three sonnets by Alabaster.

ALABASTER, a name applied to two distinct mineral substances, the one a hydrous sulphate of lime and the other a carbonate of lime. The former is the alabaster of the present day, the latter is generally the alabaster of the ancients. The two kinds are readily distinguished from each other by their relative hardness. The modern alabaster is so soft as to be readily scratched even by the finger-nail (hardness = 1·5 to 2), whilst the stone called alabaster by the ancients is too hard to be scratched in this way (hardness = 3), though it yields readily to a knife. Moreover, the ancient alabaster, being a carbonate, effervesces on being touched with hydrochloric acid, whereas the modern alabaster when so treated remains practically unaffected.

Ancient Alabaster.—This substance, the "alabaster" of scripture, is often termed Oriental alabaster, since the early examples came from the East. The Greek name ἀλαβαστρίτης is said to be derived from the town of Alabastron, in Egypt, where the stone was quarried, but the locality probably owed its name to the mineral; the origin of the mineral-name is obscure, and it has been suggested that it may have had an Arabic origin. The Oriental alabaster was highly esteemed for making small perfume-bottles or ointment vases called *alabastra*; and this has been conjectured to be a possible source of the name. Alabaster was also employed in Egypt for Canopic jars and various other sacred and sepulchral objects. A splendid sarcophagus, sculptured in a single block of translucent Oriental alabaster from Alabastron, is in the Soane Museum, London. This was discovered by Giovanni Belzoni, in 1817, in the tomb of Seti I., near Thebes, and was purchased by Sir John Soane, having previously been offered to the British Museum for £2000.

Oriental alabaster is either a stalagmitic deposit, from the floor and walls of limestone-caverns, or a kind of travertine, deposited from springs of calcareous water. Its deposition in successive layers gives rise to the banded appearance which the marble often shows on cross-section, whence it is known as onyx-marble or alabaster-onyx, or sometimes simply as onyx—a term which should, however, be restricted to a siliceous mineral. The Egyptian alabaster has been extensively worked near Suef and near Assiut; there are many ancient quarries in the hills overlooking the plain of Tell el Amarna. The Algerian onyx-marble has been largely quarried in the province of Oran. In Mexico there are famous deposits of a delicate green variety at La Pedrara, in the district of Tecali, near Puebla. Onyx-marble occurs also in the district of Tehuacan and at several localities in California, Arizona, Utah, Colorado and Virginia.

Modern Alabaster.—When the term "alabaster" is used without any qualification it invariably means, at the present day, a finely granular variety of gypsum (*q.v.*). This mineral, or alabaster proper, occurs in England in the Keuper marls of the Midlands, especially at Chellaston in Derbyshire, at Fauld in Staffordshire and near Newark in Nottinghamshire. At all these localities it has been extensively worked. It is also found, though in subordinate quantity, at Watchet in Somersetshire, near Penarth in Glamorganshire, and elsewhere. In Cumberland and Westmorland it occurs largely in the New Red rocks, but at a lower geological horizon. The alabaster of Nottinghamshire and Derbyshire is found in thick nodular beds or "floors," in spheroidal masses known as "balls" or "bowls," and in smaller lenticular masses termed "cakes." At Chellaston, where the alabaster is known as "Patrick," it has been worked into ornaments under the name of "Derbyshire spar"—a term applied also to fluor-spar. The finer kinds of alabaster are largely employed as an ornamental stone, especially for ecclesiastical decoration, and for the walls of staircases and halls. Its softness enables it to be readily carved into elaborate forms, but its solubility in water renders it inapplicable to outdoor work. The purest alabaster is a snow-white material of fine uniform grain, but it is often associated with oxide of iron, which produces brown clouding and veining in the stone. The coarser varieties of alabaster are converted by calcination into plaster of Paris, whence they are sometimes known as "plaster stone."

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[1] For an analysis of the play see an article on the Latin university plays in the *Jahrbuch der Deutschen Shakespeare Gesellschaft* (Weimar, 1898).

On the continent of Europe the centre of the alabaster trade is Florence. The Tuscan alabaster occurs in nodular masses, embedded in limestone, interstratified with marls of Miocene and Pliocene age. The mineral is largely worked, by means of underground galleries, in the district of Volterra. Several varieties are recognized—veined, spotted, clouded, agatiform, &c. The finest kind, obtained principally from Castellina, is sent to Florence for figure-sculpture, whilst the common kinds are carved locally, at a very cheap rate, into vases, clock-cases and various ornamental objects, in which a large trade is carried on, especially in Florence, Pisa and Leghorn. In order to diminish the translucency of the alabaster and to produce an opacity suggestive of true marble, the statues are immersed in a bath of water and gradually heated nearly to the boiling-point—an operation requiring great care, for if the temperature be not carefully regulated, the stone acquires a dead-white chalky appearance. The effect of heating appears to be a partial dehydration of the gypsum. If properly treated, it very closely resembles true marble, and is known as *marmo di Castellina.* It should be noted that sulphate of lime (gypsum) was used also by the ancients, and was employed, for instance, in Assyrian sculpture, so that some of the ancient alabaster is identical with the modern stone.

Alabaster may be stained by digesting it, after being heated, in various pigmentary solutions; and in this way a good imitation of coral has been produced (alabaster coral).

See M. Carmichael, *Report on the Volterra Alabaster Industry*, Foreign Office, Miscellaneous Series, No. 352 (London, 1895); A. T. Metcalfe, "The Gypsum Deposits of Nottingham and Derbyshire," *Transactions of the Federated Institution*, vol. xii. (1896), p. 107; J. G. Goodchild, "The Natural History of Gypsum," *Proceedings of the Geologists' Association*, vol. x. (1888), p. 425; George P. Merrill, "The Onyx Marbles," *Report of the U. S. National Museum for* 1893, p. 539. (F. W. R.*)

ALACOQUE, or Al Coq, **MARGUERITE MARIE** (1647–1690), French nun and mystic, was born at Lauthecourt, a village in the diocese of Autun, on the 22nd of July 1647. She would seem to have been from the first of a morbid and unhealthy temperament, and before the age of thirteen was the subject of a paralytic seizure. Having been cured of this, as she believed, by the intercession of the Holy Virgin, she changed her name to Marie and vowed to devote her life to her service. In May 1671 she entered the Visitation convent at Paray-le-Monial, in the diocese of Autun, and took the final vows in November 1672. Though her reading was confined to the lives of the saints, she taught in the school kept by the nuns for the girls of the neighbourhood, to whom she endeared herself by her kindly disposition. The appalling austerities, however, to which she was allowed to subject herself quickly affected her mental and bodily health. Hallucinations, to which she had been always subject, became more and more frequent. She conceived herself to be specially favoured by Christ, who appeared to her in the most extravagant forms. At last, by dint of fasting and lacerating her flesh, she succeeded in reducing herself to such a state of ecstatic suffering that she believed herself to be undergoing in her own person the Passion of the Lord. Her reward was the supreme vision in which Christ revealed to her His heart burning with divine love, and even, so she affirmed, exchanged it with hers, at the same time bidding her establish, on the Friday following, the feast of Corpus Christi, a festival in honour of His Sacred Heart. It was not till ten years later, in 1685, that the festival was first celebrated at Paray, and not till after the death of Marguerite, on the 17th of October 1690, that the cult of the Sacred Heart, fostered by the Jesuits and the subject of violent controversies within the church, spread throughout France and Christendom. (See Sacred Heart.)

Marguerite Alacoque was beatified by Pius IX. in 1864. Her short devotional writing, *La Dévotion au Sacré-Cœur de Jésus*, was published by J. Croiset in 1698, and is now very popular among Roman Catholics.

See Bishop Languet, *Vie de la vénérable Marguerite-Marie* (Paris, 1724), translated and edited by F. W. Faber (1847); Mgr. Bougaud, *Histoire de la bienheureuse Marguerite-Marie* (Paris, 1874); G. Tickell, S.J., *The Life of Blessed Margaret Mary Alacoque, with some account of the devotion to the Sacred Heart* (London, 1869); J. B. H. R. Capefigue, *Marie Marguerite Al-Coq* (Paris, 1866).

ALAGOAS, a maritime state of Brazil, bounded N. and W. by the state of Pernambuco, S. and W. by the state of Sergipe, and E. by the Atlantic. It has an area of 22,584 sq. m. A dry, semi-barren plateau, fit for grazing only, extends across the W. part of the state, breaking down into long fertile valleys and wooded ridges towards the coast, giving the country a mountainous character. The coastal plain is filled with lakes (*lagoas*), in some cases formed by the blocking up of river outlets by beach sands. The valleys and slopes are highly fertile and produce sugar, cotton, tobacco, Indian corn, rice, mandioca and fruits. Hides and skins, mangabeira rubber, cabinet woods, castor beans and rum are also exported. Cattle-raising was formerly a prominent industry, but it has greatly declined. Manufactures have been developed to a limited extent only, though protective tariff laws have been adopted for their encouragement. The climate is hot and humid, and fevers are prevalent in the hot season. The capital, Maceio, is the chief commercial city of the state, and its port (Jaragua) has a large foreign and coastwise trade. The principal towns are Alagoas, formerly the capital, picturesquely situated on Lake Manguaba, 15 m. S.W. of Maceio, and Penedo, a small port on the lower São Francisco, 26 m. above the river's mouth. Before 1817 Alagoas formed part of the capitania of Pernambuco, but in that year the district was rewarded with a separate government for refusing to join a revolution, and in 1823 became a province of the empire. The advent of the republic in 1889 changed the province into a state.

ALAIN DE LILLE [*Alanus de Insulis*] (*c.* 1128–1202), French theologian and poet, was born, probably at Lille, some years before 1128. Little is known of his life. He seems to have taught in the schools of Paris, and he attended the Lateran Council in 1179. He afterwards inhabited Montpellier (he is sometimes called *Alanus de Montepessulano*), lived for a time outside the walls of any cloister, and finally retired to Cîteaux, where he died in 1202. He had a very widespread reputation during his lifetime and his knowledge, more varied than profound, caused him to be called *Doctor universalis*. Among his very numerous works two poems entitle him to a distinguished place in the Latin literature of the middle ages; one of these, the *De planctu naturae*, is an ingenious satire on the vices of humanity; the other, the *Anticlaudianus*, a treatise on morals, the form of which recalls the pamphlet of Claudian against Rufinus, is agreeably versified and relatively pure in its latinity. As a theologian Alain de Lille shared in the mystic reaction of the second half of the 12th century against the scholastic philosophy. His mysticism, however, is far from being as absolute as that of the Victorines. In the *Anticlaudianus* he sums up as follows: Reason, guided by prudence, can unaided discover most of the truths of the physical order; for the apprehension of religious truths it must trust to faith. This rule is completed in his treatise, *Ars catholicae fidei*, as follows: Theology itself may be demonstrated by reason. Alain even ventures an immediate application of this principle, and tries to prove geometrically the dogmas defined in the Creed. This bold attempt is entirely factitious and verbal, and it is only his employment of various terms not generally used in such a connexion (axiom, theorem, corollary, etc.) that gives his treatise its apparent originality. Alain de Lille has often been confounded with other persons named Alain, in particular with Alain, archbishop of Auxerre, Alan, abbot of Tewkesbury, Alain de Podio, etc. Certain facts of their lives have been attributed to him, as well as some of their works: thus the *Life of St Bernard* should be ascribed to Alain of Auxerre and the *Commentary upon Merlin* to Alan of Tewkesbury. Neither is the philosopher of Lille the author of a *Memoriale rerum difficilium*, published under his name; and it is exceedingly doubtful whether the *Dicta*

Alani de lapide philosophico really issued from his pen. On the other hand, it now seems practically demonstrated that Alain de Lille was the author of the *Ars catholicae fidei* and the treatise *Contra haereticos.*

The works of Alain de Lille have been published by Migne, *Patrologia latina*, vol. ccx. A critical edition of the *Anticlaudianus* and of the *De planctu naturae* is given by Th. Wright in vol. ii. of the *Anglo-Latin Satirical Poets and Epigrammatists of the Twelfth Century* (London, 1872). See Hauréau, *Mémoire sur la vie et quelques œuvres d'Alain de Lille* (Paris, 1885); M. Baumgartner, *Die Philosophie des Alanus de Insulis* (Münster, 1896). (P. A.)

ALAIS, a town of southern France, capital of an arrondissement in the department of Gard, 25 m. N.N.W. of Nîmes on the Paris-Lyon railway, on which it is an important junction. Pop. (1906) 18,987. The town is situated at the foot of the Cévennes, on the left bank of the Gardon, which half surrounds it. The streets are wide and its promenades and fine plane-trees make the town attractive; but the public buildings, the chief of which are the church of St Jean, a heavy building of the 18th century, and the citadel, which serves as barracks and prison, are of small interest. Pasteur prosecuted his investigations into the silkworm disease at Alais, and the town has dedicated a bust to his memory. There is also a statue of the chemist J. B. Dumas. Alais has tribunals of first instance and of commerce, a board of trade-arbitrators, a lycée and a school of mines. The town is one of the most important markets for raw silk and cocoons in the south of France, and the Gardon supplies power to numerous silk-mills. It is also the centre of a mineral field, which yields large quantities of coal, iron, zinc and lead; its blast-furnaces, foundries, glass-works and engineering works afford employment to many workmen.

In the 16th century Alais was an important Huguenot centre. In 1629 the town was taken by Louis XIII., and by the peace of Alais the Huguenots gave up their right to *places de sûreté* (garrison towns) and other privileges. A bishopric was established there in 1694 but suppressed in 1790.

ALAJUELA, the capital of the province of Alajuela, in Costa Rica, Central America, on the transcontinental railway, 15 m. W. of San José. Pop. (1904) 4860. Alajuela is built at the southern base of the volcano of Poas (8895 ft.) and overlooks the fertile plateau of San José. Its central square, adorned with a handsome bronze fountain, contains the municipal buildings, and a large but unattractive cathedral. The town covers a considerable area; the detached white houses of its suburbs are surrounded by trees and flowering shrubs. Alajuela is the centre of the Costa Rican sugar trade, and an important market for coffee. Its products are exported from Puntarenas, on the Pacific Ocean, 32 m. W. The province of Alajuela includes the territory of the Guatusos Indians, along the northern frontier; the towns of Atenas, Grecia, Naranjo and San Ramon (all with less than 5000 inhabitants), and the gold-mines of Aguacate, a little north of Atenas.

ALAMANNI, or Allemanni, a German tribe, first mentioned by Dio Cassius, under the year 213. They apparently dwelt in the basin of the Maine, to the south of the Chatti. According to Asinius Quadratus their name indicates that they were a conglomeration of various tribes. There can be little doubt, however, that the ancient Hermunduri formed the preponderating element in the nation. Among the other elements may be mentioned the Juthungi, Bucinobantes, Lentienses, and perhaps the Armalausi. From the 4th century onwards we hear also of the Suebi or Suabi. The Hermunduri had apparently belonged to the Suebi, but it is likely enough that reinforcements from new Suebic tribes had now moved westward. In later times the names Alamanni and Suebi seem to be synonymous. The tribe was continually engaged in conflicts with the Romans, the most famous encounter being that at Strassburg, in which they were defeated by Julian, afterwards emperor, in the year 357, when their king Chonodomarius was taken prisoner. Early in the 5th century the Alamanni appear to have crossed the Rhine and conquered and settled Alsace and a large part of Switzerland. Their kingdom lasted until the year 495, when they were conquered by Clovis, from which time they formed part of the Frankish dominions. The Alamannic and Swabian dialects are now spoken in German Switzerland, the southern parts of Baden and Alsace, Württemberg and a small portion of Bavaria.

See Dio Cassius lxvii. ff.; Ammianus Marcellinus, *passim*; Gregory of Tours, *Historia Francorum*, book ii.; C. Zeuss, *Die Deutschen und die Nachbarstämme* (Munich, 1837), pp. 303 ff.; O. Bremer in H. Paul, *Grundriss der germanischen Philologie* (2nd ed., Strassburg, 1900), vol. iii. pp. 930 ff. (F. G. M. B.)

ALAMANNI, or Alemanni, **LUIGI** (1495–1556), Italian statesman and poet, was born at Florence. His father was a devoted adherent of the Medici party, but Luigi, smarting under a supposed injustice, joined with others in an unsuccessful conspiracy against Giulio de' Medici, afterwards Pope Clement VII. He was obliged in consequence to take refuge in Venice, and, on the accession of Clement, to flee to France. When Florence shook off the papal yoke in 1527, Alamanni returned, and took a prominent part in the management of the affairs of the republic. On the restoration of the Medici in 1530 he had again to take refuge in France, where he composed the greater part of his works. He was a favourite with Francis I., who sent him as ambassador to Charles V. after the peace of Crépy in 1544. As an instance of his tact in this capacity, it is related that, when Charles interrupted a complimentary address by quoting from a satirical poem of Alamanni's the words—

> "l' aquila grifagna,
> Che per più devorar, duoi rostri porta"
> (Two crooked bills the ravenous eagle bears,
> The better to devour),

the latter at once replied that he spoke them as a poet, who was permitted to use fictions, but that he spoke now as an ambassador, who was obliged to tell the truth. The ready reply pleased Charles, who added some complimentary words. After the death of Francis, Alamanni enjoyed the confidence of his successor Henry II., and in 1551 was sent by him as his ambassador to Genoa. He died at Amboise on the 18th of April 1556. He wrote a large number of poems, distinguished by the purity and excellence of their style. The best is a didactic poem, *La Coltivazione* (Paris, 1546), written in imitation of Virgil's *Georgics*. His *Opere Toscane* (Lyons, 1532) consists of satirical pieces written in blank verse. An unfinished poem, *Avarchide*, in imitation of the *Iliad*, was the work of his old age and has little merit. It has been said by some that Alamanni was the first to use blank verse in Italian poetry, but the distinction belongs rather to his contemporary Giangiorgio Trissino. He also wrote a poetical romance, *Girone il Cortese* (Paris, 1548); a tragedy, *Antigone*; a comedy, *Flora*; and other poems. His works were published, with a biography by P. Raffaelli, as *Versi e prose di Luigi Alamanni* (Florence, 1859).

See G. Naro, *Luigi Alamanni e la coltivazione* (Syracuse, 1897), and C. Corso, *Un decennio di patriottismo di Luigi Alamanni* (Palermo, 1898).

ALAMBAGH, or Alumbagh, the name of a large park or walled enclosure, containing a palace, a mosque and other buildings, as well as a beautiful garden, situated about 4 m. from Lucknow, near the Cawnpore road, in the United Provinces of India. It was converted into a fort by the mutineers in 1857, and after its capture by the British was of importance in connexion with the military operations around Lucknow. (See Indian Mutiny and Outram, Sir James.)

ALAMEDA, a residential city of Alameda county, California, U.S.A., on an artificial island about 5 m. long and 1 m. wide, on the E. side of San Francisco bay, opposite to and about 6 m. from San Francisco, and directly S. of Oakland, from which it is separated by a drainage canal, spanned by bridges. Included within the limits of the city is Bay Farm island, with an area of about 3 sq. m. Pop. (1870) 1557; (1880) 5708; (1890) 11,165; (1900) 16,464, of whom 4175 were foreign-born; (1910, census) 23,383. Alameda is served by the Southern Pacific railway, and is connected by an electric line with Oakland and Berkeley. Its site is low and level and its plan fairly regular. Among the city's manufactures are terra-cotta tiles, pottery, rugs, refrigerators and salt. The city owns and operates the electric-lighting plant; the water-works system is privately owned, and the water supply is obtained from deep wells at San Leandro. A settlement existed here before the end of the Mexican period. In 1854 it was incorporated as a town and in 1885 was chartered as a city. In 1906 the city adopted a freehold charter, centralizing power in the mayor and providing for a referendum. The county was organized in 1853.

ALAMOS DE BARRIENTOS, BALTASAR (1555–1640), Spanish scholar, was born at Medina del Campo in 1555. His friendship with Antonio Perez caused him to be arrested in 1590 and imprisoned for nearly thirteen years. His *Tácito español ilustrado con aforismos* (Madrid, 1614) is the only work which bears his name, but he is probably the author of the *Discurso del gobierno* ascribed to Perez. Through the influence of Lerma (to whom the *Tácito* is dedicated) and of Olivares, he subsequently attained high official position.

See *L'Art de gouverner*, ed. J. M. Guardia (Paris, 1867); P. J. Pidal, *Historia de las alteraciones de Aragon en el reinado de Felipe II.* (Madrid, 1862), vol. iii. pp. 29-30; A. Perez, *Relaciones* (Geneva, 1654), pp. 86-88.

ÅLAND ISLANDS, an archipelago at the entrance to the Gulf of Bothnia, about 25 m. from the coast of Sweden, and 15 from that of Finland. The group, which forms part of the Finnish province of Åbo-Björneborg, consists of nearly three hundred islands, of which about eighty are inhabited, the remainder being desolate rocks. These islands form a continuation of a dangerous granite reef extending along the south coast of Finland. They formerly belonged to Sweden, and in the neighbourhood the first victory of the Russian fleet over the Swedes was gained by Peter the Great in 1714. They were ceded to Russia in 1809. They occupy a total area of 1426 sq. km., and their present population is estimated at about 19,000. The majority of these occupy the island of Åland, upon which is situated the town of Mariehamn with a population of 1171. The inhabitants are mostly of Swedish descent, and are hardy seamen and fishermen. The surface of the islands is generally sandy, the soil thin and the climate keen; yet Scotch fir, spruce and birch are grown; and rye, barley, flax and vegetables are produced in sufficient quantity for the wants of the people. Great numbers of cattle are reared; and cheese, butter and hides, as well as salted meat and fish, are exported. There are several excellent harbours (notably that of Ytternäs), which were at one time of great importance to Russia from the fact that they are frozen up for a much briefer period than those on the coast of Finland.

The Åland Islands occupy a position of the greatest strategic importance, commanding as they do both the entrance to the port of Stockholm and the approaches to the Gulf of Bothnia, through which the greater part of the trade of Sweden is carried on. When, by the 4th article of the treaty of Fredrikshavn (Friedrichshamn), 5/17 September 1809, the islands were ceded to Russia, together with the territories forming the grand-duchy of Finland on the mainland, the Swedes were unable to secure a provision that the islands should not be fortified. The question was, however, a vital one not only for Sweden but for Great Britain, whose trade in the Baltic was threatened. In 1854, accordingly, during the Crimean War, an Anglo-French force attacked and destroyed the fortress of Bomersund, against the erection of which Palmerston had protested without effect some twenty years previously. By the "Åland Convention," concluded between Great Britain, France and Russia on the 30th of March 1856, it was stipulated that "the Åland Islands shall not be fortified, and that no military or naval establishments shall be maintained or created on them." By the 33rd article of the treaty of Paris (1856) this convention, annexed to the final act, was given "the same force and validity as if it formed part thereof," Palmerston declaring in the House of Commons (May 6) that it had "placed a barrier between Russia and the north of Europe." Some attention was attracted to this arrangement when in 1906 it was asserted that Russia, under pretext of stopping the smuggling of arms into Finland, was massing considerable naval and military forces at the islands. The question of the Åland Islands created some discussion in 1907 and 1908 in connexion with the new North Sea agreements, and undoubtedly Russia considered the convention of 1856 as rather humiliating. But it was plainly shown by other powers that they did not propose to regard it as modified or open to question, and the point was not definitely and officially raised.

See the article by Dr Verner Soderberg in the *National Review*, No. 392, for April 1908.

ALANI (Gr. Ἀλανοί, Ἀλαυνοί; Chinese *'O-lan-na*; since the 9th century A.D. they have been called *As*, Russ. *Jasy*, Georgian *Ossi*), the easternmost division of the Sarmatians (see SCYTHIA), Iranian nomads with some Altaic admixture. First met with north of the Caspian, and later (*c.* 1st century A.D.) spreading into the steppes of Russia, the Alans made incursions into both the Danubian and the Caucasian provinces of the Roman empire. By the Huns they were cut into two portions, of which the western joined the Germanic nations in their invasion of southern Europe, and, following the fortunes of the Vandals, disappeared in North Africa. Those of the eastern division, though dispersed about the steppes until late medieval times, were by fresh invading hordes forced into the Caucasus, where they remain as the Ossetes. At one time partially Christianized by Byzantine missionaries, they had almost relapsed into heathenism, but are now under Russian influence returning to Christianity. (E. H. M.)

ALARCÓN, HERNANDO DE, Spanish navigator of the 16th century, is known only in connexion with the expedition to the coast of California, of which he was leader. He set sail on the 9th of May 1540 with orders from the Spanish court to await at a certain point on the coast the arrival of an expedition by land under the command of Vasquez de Coronado. The junction was not effected, though Alarcón reached the appointed place and left letters, which were afterwards found by Diaz, another explorer. Alarcón was the first to determine with certainty that California was a peninsula and not an island, as had been supposed. He made a careful survey of the coast, ascended the Rio del Tizon or Rio de Buena Guia (Colorado) for 85 Spanish m., and was thus able on his return to New Spain in 1541 to construct an excellent map of California.

See Herrera, Decade VI. book ix. ch. 15; vol. vi. fol. 212 of Madrid edition of 1730.

ALARCÓN, JUAN RUIZ DE (1518?–1639), Spanish dramatist, was born about 1581 at Tlacho (Mexico), where his father was superintendent of mines. He came to Europe in 1600, studied law at Salamanca, and in 1608 went back to Mexico to compete for a professorial chair. Returning to Spain in 1611, he entered the household of the marquis de Salinas, became a successful dramatist, and was nominated a member of the council of the Indies in 1623. He died at Madrid on the 4th of August 1639. His plays were published in 1628 and 1634; the most famous of these is *La Verdad sospechosa*, which was adapted by Corneille as the *Menteur*. Alarcón had the misfortune to be a hunchback, to be embittered by his deformity, and to be constantly engaged in personal quarrels with his rivals; but his attitude in these polemics is always dignified, and his crushing retort to Lope de Vega in *Los pechos privilegiados* is an unsurpassable example of cold, scornful invective. More than any other Spanish dramatist, Alarcón is preoccupied with ethical aims, and his gift of dramatic presentation is as brilliant as his dialogue is natural and vivacious. It has been alleged that his foreign origin is noticeable in his plays, and there is some foundation for the criticism; but his workmanship is exceptionally conscientious, and in *El Tejedor de Segovia* he had produced a masterpiece of national art, national sentiment and national expression. (J. F.-K.)

ALARCÓN, PEDRO ANTONIO DE (1833–1891), Spanish writer, was born on the 10th of March 1833 at Guadix. He graduated at the university of Granada, studied law and theology privately, and made his first appearance as a dramatist before he was of age. Deciding to follow literature as a profession, he joined with Torcuato Tárrago y Mateos in editing a Cadiz newspaper entitled *El Eco de Occidente*. In 1853 he travelled to

Madrid in the hope of finding a publisher for his continuation of Espronceda's celebrated poem, *El Diablo Mundo*. Disappointed in his object, and finding no opening at the capital, he settled at Granada, became a radical journalist in that city, and showed so much ability that in 1854 he was appointed editor of a republican journal, *El Látigo*, published at Madrid. The extreme violence of his polemics led to a duel between him and the Byronic poet, José Heriberto Garcia Quevedo. The earliest of his novels, *El Final de Norma*, was published in 1855, and though its construction is feeble it brought the writer into notice as a master of elegant prose. A small anthology, called *Mañanas de Abril y Mayo* (1856), proves that Alarcón was recognized as a leader by young men of promise, for among the contributors were Castelar, Manuel del Palacio and Lopez de Ayala. A dramatic piece, *El Hijo prodigo*, was hissed off the stage in 1857, and the failure so stung Alarcón that he enlisted under O'Donnell's command as a volunteer for the war in Morocco. His *Diario de un testigo de la guerra de Africa* (1859) is a brilliant account of the expedition. The first edition, amounting to fifty thousand copies, was sold within a fortnight, and Alarcón's name became famous throughout the peninsula. The book is not in any sense a formal history; it is a series of picturesque impressions rendered with remarkable force. On his return from Africa Alarcón did the Liberal party much good service as editor of *La Politica*, but after his marriage in 1866 to a devout lady, Paulina Contrera y Reyes, he modified his political views considerably. On the overthrow of the monarchy in 1868, Alarcón advocated the claims of the duc de Montpensier, was neutral during the period of the republic, and declared himself a Conservative upon the restoration of the dynasty in December 1874. These political variations alienated Alarcón's old allies and failed to conciliate the royalists. But though his political influence was ruined, his success as a writer was greater than ever. The publication in the *Revista Europea* (1874) of a short story, *El Sombrero de tres picos*, a most ingenious resetting of an old popular tale, made him almost as well known out of Spain as in it. This remarkable triumph in the picturesque vein encouraged him to produce other works of the same kind; yet though his *Cuentos amatorios* (1881), his *Historietas nacionales* (1881) and his *Narraciones inverosimiles* (1882) are pleasing, they have not the delightful gaiety and charm of their predecessor. In a longer novel, *El Escándalo* (1875), Alarcón had appeared as a partisan of the neo-Catholic reaction, and this change of opinion brought upon him many attacks, mostly unjust. His usual bad fortune followed him, for while the Radicals denounced him as an apostate, the neo-Catholics alleged that *El Escándalo* was tainted with Jansenism. Of his later volumes, written in failing health and spirits, it is only necessary to mention *El Capitan Veneno* and the *Historia de mis libros*, both issued in 1881. Alarcón was elected a member of the Spanish Academy in 1875. He died at Madrid on the 20th of July 1891. His later novels and tales are disfigured by their didactic tendency, by feeble drawing of character, and even by certain gallicisms of style. But, at his best, Alarcón may be read with great pleasure. The *Diario de un testigo* is still unsurpassed as a picture of campaigning life, while *El Sombrero de tres picos* is a very perfect example of malicious wit and minute observation. (J. F.-K.)

ALARD, JEAN DELPHIN (1815–1888), French violinist and teacher, was born at Bayonne on the 8th of May 1815. From 1827 he was a pupil of F. A. Habeneck at the Paris Conservatoire, where he succeeded P. de Sales Baillot as professor in 1843, retaining the post till 1875. His playing was full of fire and point, and his compositions had a great success in France, while his violin school had a wider vogue and considerably greater value. Mention should also be made of his edition in 40 parts of a selection of violin compositions by the most eminent masters of the 18th century, *Les Maîtres classiques du violon* (Schott). Alard died in Paris on the 22nd of February 1888.

ALARIC (*Ala-reiks*, "All-ruler"), (*c.* 370–410), Gothic conqueror, the first Teutonic leader who stood as a conqueror in the city of Rome, was probably born about 370 in an island named Peucè (the Fir) at the mouth of the Danube. He was of noble descent, his father being a scion of the family of the Balthi or Bold-men, next in dignity among Gothic warriors to the Amals. He was a Goth and belonged to the western branch of that nation —sometimes called the Visigoths—who at the time of his birth were quartered in the region now known as Bulgaria, having taken refuge on the southern shore of the Danube from the pursuit of their enemies the Huns.

In the year 394 he served as a general of *foederati* (Gothic irregulars) under the emperor Theodosius in the campaign in which he crushed the usurper Eugenius. As the battle which terminated this campaign, the battle of the Frigidus, was fought near the passes of the Julian Alps, Alaric probably learnt at this time the weakness of the natural defences of Italy on her north-eastern frontier. The employment of barbarians as *foederati*, which became a common practice with the emperors in the 4th century, was both a symptom of disease in the body politic of the empire and a hastener of its impending ruin. The provincial population, crushed under a load of unjust taxation, could no longer furnish soldiers in the numbers required for the defence of the empire; and on the other hand, the emperors, ever fearful that a brilliantly successful general of Roman extraction might be proclaimed Augustus by his followers, preferred that high military command should be in the hands of a man to whom such an accession of dignity was as yet impossible. But there was obviously a danger that one day a barbarian leader of barbarian troops in the service of the empire might turn his armed force and the skill in war, which he had acquired in that service, against his trembling masters, and without caring to assume the title of Augustus might ravage and ruin the countries which he had undertaken to defend. This danger became a reality when in the year 395 the able and valiant Theodosius died, leaving the empire to be divided between his imbecile sons Arcadius and Honorius, the former taking the eastern and the latter the western portion, and each under the control of a minister who bitterly hated the minister of the other.

In the shifting of offices which took place at the beginning of the new reigns, Alaric apparently hoped that he would receive one of the great war ministries of the empire, and thus instead of being a mere commander of irregulars would have under his orders a large part of the imperial legions. This, however, was denied him, and he found that he was doomed to remain an officer of *foederati*. His disappointed ambition prompted him to take the step for which his countrymen were longing, for they too were grumbling at the withdrawal of the "presents," in other words the veiled ransom-money, which for many years they had been accustomed to receive. They raised him on a shield and acclaimed him as a king; leader and followers both resolving (says Jordanes the Gothic historian) "rather to seek new kingdoms by their own labour, than to slumber in peaceful subjection to the rule of others."

Alaric struck first at the eastern empire. He marched to the neighbourhood of Constantinople, but finding himself unable to undertake the siege of that superbly strong city, he retraced his steps westward and then marched southward through Thessaly and the unguarded pass of Thermopylae into Greece. The details of his campaign are not very clearly stated, and the story is further complicated by the plots and counterplots of Rufinus, chief minister of the eastern, and Stilicho, the virtual regent of the western empire, and the murder of the former by his rebellious soldiers. With these we have no present concern; it is sufficient to say that Alaric's invasion of Greece lasted two years (395–396), that he ravaged Attica but spared Athens, which at once capitulated to the conqueror, that he penetrated into Peloponnesus and captured its most famous cities, Corinth, Argos and Sparta, selling many of their inhabitants into slavery. Here, however, his victorious career ended. Stilicho, who had come a second time to the assistance of Arcadius and who was undoubtedly a skilful general, succeeded in shutting up the Goths in the mountains of Pholoe on the borders of Elis and Arcadia. From thence Alaric escaped with difficulty, and not without some suspicion of connivance on the part of Stilicho. He crossed the

Corinthian Gulf and marched with the plunder of Greece northwards to Epirus. Next came an astounding transformation. For some mysterious reason, probably connected with the increasing estrangement between the two sections of the empire, the ministers of Arcadius conferred upon Alaric the government of some part—it can hardly have been the whole—of the important prefecture of Illyricum. Here, ruling the Danubian provinces, he was on the confines of the two empires, and, in the words of the poet Claudian, he "sold his alternate oaths to either throne," and made the imperial arsenals prepare the weapons with which to arm his Gothic followers for the next campaign. It was probably in the year 400 (but the dates of these events are rather uncertain) that Alaric made his first invasion of Italy, co-operating with another Gothic chieftain named Radagaisus. Supernatural influences were not wanting to urge him to this great enterprise. Some lines of the Roman poet inform us that he heard a voice proceeding from a sacred grove, "Break off all delays, Alaric. This very year thou shalt force the Alpine barrier of Italy; thou shalt penetrate to the city." The prophecy was not at this time fulfilled. After spreading desolation through North Italy and striking terror into the citizens of Rome, Alaric was met by Stilicho at Pollentia (a Roman municipality in what is now Piedmont), and the battle which then followed on the 6th of April 402 (Easter-day) was a victory, though a costly one for Rome, and effectually barred the further progress of the barbarians. Alaric was an Arian Christian who trusted to the sanctity of Easter for immunity from attack, and the enemies of Stilicho reproached him for having gained his victory by taking an unfair advantage of the great Christian festival. The wife of Alaric is said to have been taken prisoner after this battle; and there is some reason to suppose that he was hampered in his movements by the presence with his forces of large numbers of women and children, having given to his invasion of Italy the character of a national migration. After another defeat before Verona, Alaric quitted Italy, probably in 403. He had not indeed "penetrated to the city," but his invasion of Italy had produced important results; it had caused the imperial residence to be transferred from Milan to Ravenna, it had necessitated the withdrawal of the Twentieth Legion from Britain, and it had probably facilitated the great invasion of Vandals, Suevi and Alani into Gaul, by which that province and Spain were lost to the empire. We next hear of Alaric as the friend and ally of his late opponent Stilicho. The estrangement between the eastern and western courts had in 407 become so bitter as to threaten civil war, and Stilicho was actually proposing to use the arms of Alaric in order to enforce the claims of Honorius to the prefecture of Illyricum. The death of Arcadius in May 408 caused milder counsels to prevail in the western cabinet, but Alaric, who had actually entered Epirus, demanded in a somewhat threatening manner that if he were thus suddenly bidden to desist from war, he should be paid handsomely for what in modern language would be called the expenses of mobilization. The sum which he named was a large one, 4000 pounds of gold (about £160,000 sterling), but under strong pressure from Stilicho the Roman senate consented to promise its payment.

Three months later Stilicho himself and the chief ministers of his party were treacherously slain in pursuance of an order extracted from the timid and jealous Honorius; and in the disturbances which followed the wives and children of the barbarian *foederati* throughout Italy were slain. The natural consequence was that these men to the number of 30,000 flocked to the camp of Alaric, clamouring to be led against their cowardly enemies. He accordingly crossed the Julian Alps, and in September 408 stood before the walls of Rome (now with no capable general like Stilicho to defend her) and began a strict blockade.

No blood was shed this time; hunger was the weapon on which Alaric relied. When the ambassadors of the senate in treating for peace tried to terrify him with their hints of what the despairing citizens might accomplish, he gave with a laugh his celebrated answer, "The thicker the hay, the easier mowed!" After much bargaining, the famine-stricken citizens agreed to pay a ransom of more than a quarter of a million sterling, besides precious garments of silk and leather and three thousand pounds of pepper. Thus ended Alaric's first siege of Rome.

At this time, and indeed throughout his career, the one dominant idea of Alaric was not to pull down the fabric of the empire but to secure for himself, by negotiation with its rulers, a regular and recognized position within its borders. His demands were certainly large—the concession of a block of territory 200 m. long by 150 wide between the Danube and the Gulf of Venice (to be held probably on some terms of nominal dependence on the empire), and the title of commander-in-chief of the imperial army. Yet large as the terms were, the emperor would probably have been well advised to grant them; but Honorius was one of those timid and feeble folk who are equally unable to make war or peace, and refused to look beyond the question of his own personal safety, guaranteed as it was by the dikes and marshes of Ravenna. As all attempts to conduct a satisfactory negotiation with this emperor failed before his impenetrable stupidity, Alaric, after instituting a second siege and blockade of Rome in 409, came to terms with the senate, and with their consent set up a rival emperor and invested the prefect of the city, a Greek named Attalus, with the diadem and the purple robe. He, however, proved quite unfit for his high position; he rejected the advice of Alaric and lost in consequence the province of Africa, the granary of Rome, which was defended by the partisans of Honorius. The weapon of famine, formerly in the hand of Alaric, was thus turned against him, and loud in consequence were the murmurs of the Roman populace. Honorius was also greatly strengthened by the arrival of six legions sent from Constantinople to his assistance by his nephew Theodosius II. Alaric therefore cashiered his puppet emperor Attalus after eleven months of ineffectual rule, and once more tried to reopen negotiations with Honorius. These negotiations would probably have succeeded but for the malign influence of another Goth, Sarus, the hereditary enemy of Alaric and his house. When Alaric found himself once more outwitted by the machinations of such a foe, he marched southward and began in deadly earnest his third, his ever-memorable siege of Rome. No defence apparently was possible; there are hints, not well substantiated, of treachery; there is greater probability of surprise. However this may be—for our information at this point of the story is miserably meagre—on the 24th of August 410 Alaric and his Goths burst in by the Salarian gate on the north-east of the city, and she who was of late the mistress of the world lay at the feet of the barbarians. The Goths showed themselves not absolutely ruthless conquerors. The contemporary ecclesiastics recorded with wonder many instances of their clemency: the Christian churches saved from ravage; protection granted to vast multitudes both of pagans and Christians who took refuge therein; vessels of gold and silver which were found in a private dwelling, spared because they "belonged to St. Peter"; at least one case in which a beautiful Roman matron appealed, not in vain, to the better feelings of the Gothic soldier who attempted her dishonour; but even these exceptional instances show that Rome was not entirely spared those scenes of horror which usually accompany the storming of a besieged city. We do not, however, hear of any damage wrought by fire, save in the case of Sallust's palace, which was situated close to the gate by which the Goths had made their entrance; nor is there any reason to attribute any extensive destruction of the buildings of the city to Alaric and his followers.

His work being done, his fated task, and Alaric having penetrated to the city, nothing remained for him but to die. He marched southwards into Calabria. He desired to invade Africa, which on account of its corn crops was now the key of the position; but his ships were dashed to pieces by a storm in which many of his soldiers perished. He died soon after, probably of fever, and his body was buried under the river-bed of the Busento, the stream being temporarily turned aside from its course while the grave was dug wherein the Gothic chief and some of his most precious spoils were interred. When the work was finished the river was turned back into its usual channel, and the captives by whose hands the labour had been accomplished were put to death that none might learn their secret. He was succeeded in the command of the Gothic army by his brother-in-law, Ataulphus.

Our chief authorities for the career of Alaric are the historian Orosius and the poet Claudian, both strictly contemporary; Zosimus, a somewhat prejudiced heathen historian, who lived probably about half a century after the death of Alaric; and Jordanes, a Goth who wrote the history of his nation in the year 551, basing his work on the earlier history of Cassiodorus (now lost), which was written about 520. (T. H.)

ALARIC II. (d. 507), eighth king of the Goths in Spain, succeeded his father Euric or Evaric in 485. His dominions not only included the whole of Spain except its north-western corner, but also Aquitaine and the greater part of Provence. In religion Alaric was an Arian, but he greatly mitigated the persecuting policy of his father Euric towards the Catholics and authorized them to hold in 506 the council of Agde. He displayed similar wisdom and liberality in political affairs by appointing a commission to prepare an abstract of the Roman laws and imperial decrees, which should form the authoritative code for his Roman subjects. This is generally known as the *Breviarium Alaricianum*, or *Breviary of Alaric* (*q.v.*). Alaric was of a peaceful disposition, and endeavoured strictly to maintain the treaty which his father had concluded with the Franks, whose king Clovis, however, desiring to obtain the Gothic province in Gaul, found a pretext for war in the Arianism of Alaric. The intervention of Theodoric, king of the Ostrogoths and father-in-law of Alaric, proved unavailing. The two armies met in 507 at the Campus Vogladensis, near Poitiers, where the Goths were defeated, and their king, who took to flight, was overtaken and slain, it is said, by Clovis himself.

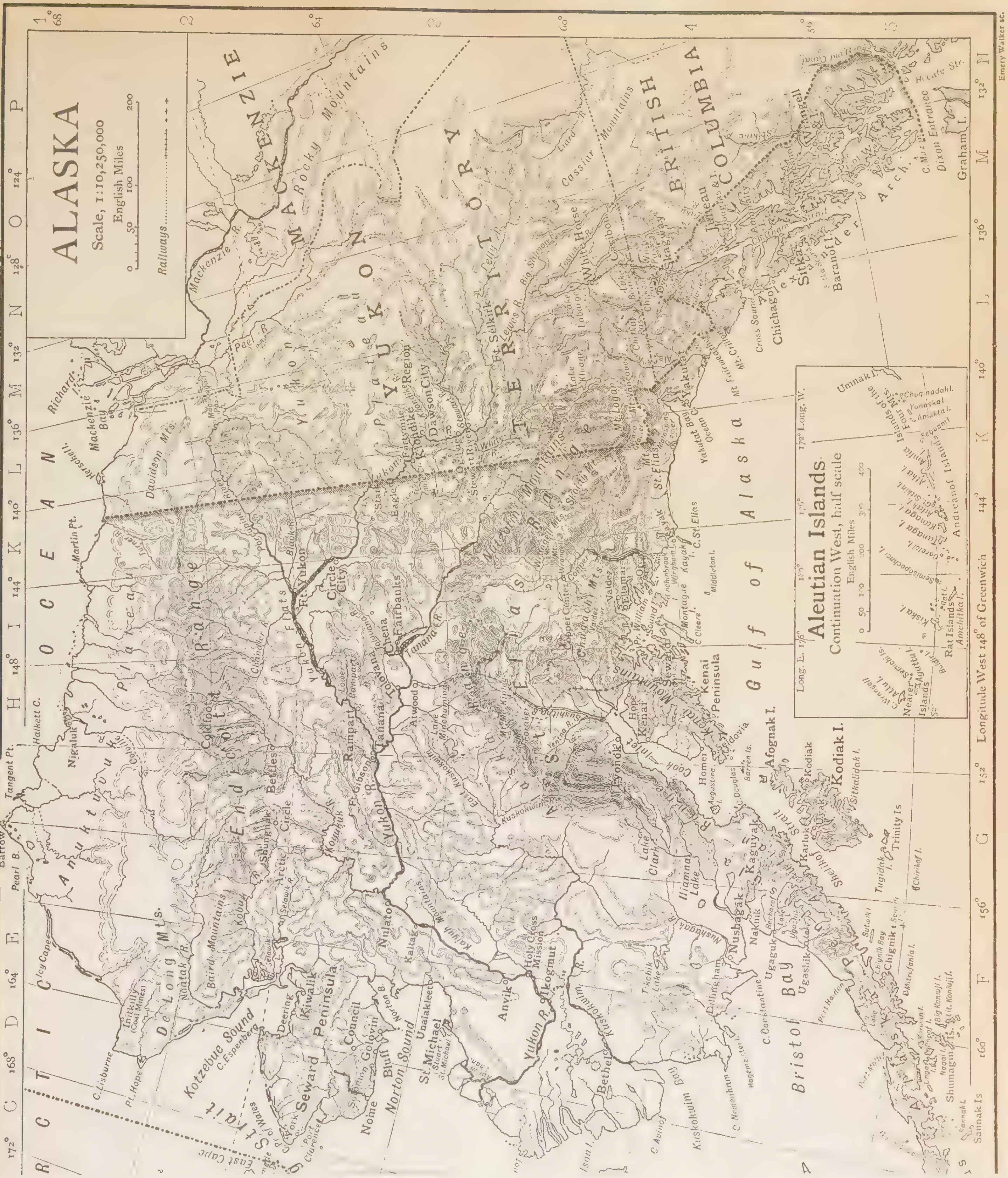
ALA-SHEHR (anc. *Philadelphia*), a town of Asia Minor, in the Aidin vilayet, situated in the valley of the Kuzu Chai (*Cogamus*), at the foot of the Boz Dagh (Mt. Tmolus) 83 m. E. of Smyrna (105 by railway). Pop. 22,000 (Moslems, 17,000; Christians, 5000). Philadelphia was founded by Attalus II. of Pergamum about 150 B.C., became one of the "Seven Churches" of Asia, and was called "Little Athens" on account of its festivals and temples. It was subject to frequent earthquakes. Philadelphia was an independent neutral city, under the influence of the Latin Knights of Rhodes, when taken in 1390 by Sultan Bayezid I. and an auxiliary Christian force under the emperor Manuel II. after a prolonged resistance, when all the other cities of Asia Minor had surrendered. Twelve years later it was captured by Timur, who built a wall with the corpses of his prisoners. A fragment of the ghastly structure is in the library of Lincoln cathedral. The town is connected by railway with Afium-Kara-Hissar and Smyrna. It is dirty and ill-built; but, standing on elevated ground and commanding the extensive and fertile plain of the Hermus, presents at a distance an imposing appearance. It is the seat of an archbishop and has several mosques and Christian churches. There are small industries and a fair trade. From one of the mineral springs comes a heavily charged water known in commerce as "Eau de Vals," and in great request in Smyrna.

See W. M. Ramsay, *Letters to the Seven Churches* (1904).

ALASKA, formerly called RUSSIAN AMERICA, a district of the United States of America, occupying the extreme north-western part of North America and the adjacent islands. The name is a corruption of a native word possibly meaning "mainland" or "peninsula." The district of Alaska comprises, first, all that part of the continent W. of the 141st meridian of W. longitude from Greenwich; secondly, the eastern Diomede island in Bering Strait, and all islands in Bering Sea and the Aleutian chain lying E. of a line drawn from the Diomedes to pass midway between Copper Island, off Kamchatka, and Attu Island of the Aleutians; thirdly, a narrow strip of coast and adjacent islands N. of a line drawn from Cape Muzon, in lat. 54° 40′ N., E. and N. up Portland Canal to its head, and thence, as defined in the treaty of cession to the United States, quoting a boundary treaty of 1825 between Great Britain and Russia, following "the summit of the mountains situated parallel to the coast" to the 141st meridian, provided that when such line runs more than ten marine leagues from the ocean the limit "shall be formed by a line parallel to the windings of the coast and which shall never exceed the distance of ten marine leagues therefrom." The international disputes connected with this description are referred to below.

Physical Features.—Alaska is bounded on the N. by the Arctic Ocean, on the W. by the Arctic Ocean and Bering Strait, on the S. and S.W. by the Gulf of Alaska and the Pacific Ocean, and on the E. by Yukon Territory and British Columbia. It consists of a compact central mass and two straggling appendages running from its S.W. and S.E. corners, and sweeping in a vast arc over 16 degrees of latitude and 58 degrees of longitude. These three parts will be referred to hereafter respectively, as Continental Alaska, Aleutian Alaska and the "Panhandle." The range of latitude from Point Barrow in the Arctic Ocean to Cape Muzon is almost 17 degrees—as great as from New Orleans to Duluth; the range of longitude from Attu Island to the head of Portland Canal is 58 degrees—considerably greater than from New York to San Francisco. The total area is about 586,400 sq. m. The general ocean-coast line is about 4750 m., and, including the islands, bays, inlets and rivers to the head of tide water, is about 26,000 m. in length (U.S. Coast Survey 1889). The entire southern coast is very irregular in outline; it is precipitous, with only very slight stretches of beach or plain. Its elevation gradually decreases as one travels W. toward the Aleutians. A great submarine platform extends throughout a large part of Bering Sea. The western and northern coasts are regular in outline with long straight beaches; and shallows are common in the seas that wash them. On the Arctic there is a broad coastal plain. Of the islands of Alaska the more important are: at the S.E. extremity and lying close inland, the Alexander Archipelago, whose principal islands from N.W. to S.E. are Chicagof, Baranof, Admiralty, Kupreanof, Kuiu, Prince of Wales (the largest of the archipelago and of all the islands about Alaska, measuring about 140 m. in length and 40 m. in width), Etolin and Revillagigedo; S.W. of the mainland, two groups—(1) Kodiak, whose largest island, of the same name, is 40 m. by 100 m., and may be considered a continuation of the Kenai Peninsula, and whose W. continuation, S. of Alaska Peninsula, consists of the Semidi, Shumagin and Sannak clusters; (2) the Aleutian Islands (*q.v.*) sweeping 1200 m. W.S.W. from the end of Alaska Peninsula, W. of the mainland, in Bering Sea, the Pribilof Islands, about 500 m. S. of Cape Prince of Wales, the small Hall and St Matthew Islands, about 170 m. S.W. of the same cape, St Lawrence Island (100 m. and 10 to 30 m. wide), which is about half way between the last mentioned pair of islets and Cape Prince of Wales and Nunivak Island, near the mainland and due E. of St Matthew; and in the middle of Bering Strait the Diomede Islands, which belong in part to Russia.

Very little was known about Alaska previous to 1896, when the gold discoveries in the Klondike stimulated public interest regarding it. Since 1895, however, the explorations of the United States Geological Survey and the Department of War, and other departments of the government, have fully established the main features of its physiography. It has mountains, plateaus and lowlands on a grand scale. "In a broad way, the larger features of topography correspond with those of the western states. There is a Pacific Mountain system, a Central Plateau region, a Rocky Mountain system, and a Great Plains region. These four divisions are well marked, and show the close geographic relation of this area to the southern part of the continent." The orographic features of the Pacific Mountain system trend parallel to the coast-line of the Gulf of Alaska, changing with this at the great bend beyond the N., and of the Panhandle from S.E. and N.W. to N.E. and S.W. and running through the Alaska Peninsula. The Pacific Mountain system includes four ranges. The Coast Range of the Panhandle attains a width of 100 m., but has no well-defined crest line. The range is characterized by the uniformity of summit levels between 5000 and 6000 ft. Continuing the Coast Range, with


ALASKA
Scale, 1:10,250,000
English Miles
0 50 100 200
Railways
Aleutian Islands
Continuation West, half scale
English Miles
0 50 100 200 300 400
Longitude West 148° of Greenwich
ARCTIC OCEAN
YUKON TERRITORY
MACKENZIE
BRITISH COLUMBIA
Gulf of Alaska
Bristol Bay
Bering Strait
Kotzebue Sound
Norton Sound
Seward Peninsula
Kenai Peninsula
Kodiak I.
Endicott Range
Alaska Range
Rocky Mountains
Fairbanks
Nome
Juneau
Sitka
Valdez
Emery Walker sc.

over these passes and the climate of

which it is closely associated—the Chilkat river lies between them—is the St Elias Range (a term now used to include not only the mountains between Cross Sound and Mt. St Elias, but the Chugach, Kenai, Skolai and Nutzotin mountains); among its peaks are: Mt. Crillon (15,900 ft.), Mt. Fairweather (15,290 ft.), Mt. Vancouver (15,666 ft.), Mt. Wrangell (17,500 ft., an active volcano) in the Nutzotin Mountains, Mt. St Elias (18,024 ft.) and, in Canadian territory, Mt. Logan (19,539 ft.). The Aleutian Range, of whose crest the Aleutian Islands are remnants, fills out the system near the coast. The Alaskan Range, connecting with the Nutzotin and Skolai branches of the St Elias Range, lies a little farther inland; it is splendidly marked by many snowy peaks, including Mt. Foraker (17,000 ft.) and Mt. McKinley. The latter, which on the W. rises abruptly out of a marshy country, offers the obstacles of magnificent, inaccessible granite cliffs and large glaciers to the mountaineer; it is the loftiest peak in North America (ca. 20,300 ft.). In the Alaskan Range and the Aleutian Range there are more than a dozen live volcanoes, several of them remarkable; the latter range is composed largely of volcanic material. Evidences of very recent volcanic activity are abundant about Cook Inlet. The Rocky Mountain system extends from Canada (the Yukon territory) into N.E. Alaska, which it crosses near the Arctic coast in a broad belt composed of several ranges about 6000 ft. in altitude. There is no well-defined crest line; the axis of the system is roughly parallel to the Pacific Mountain system, but runs more nearly E. and W. in Alaska. Between the Pacific Mountain and the Rocky Mountain systems lies the vast Central Plateau region, or Yukon plateau. Finally, between the Rocky Mountains and the Arctic Ocean is the Arctic Slope region, a sloping plain corresponding to the interior plains of the United States.

First Physiographic Region.—The Panhandle is remarkably picturesque. The maze of islands, hundreds in number, of the Alexander Archipelago (area about 13,000 sq. m.) are remnants of a submerged mountain system; the islands rise 3000 to 5000 ft. above the sea, with luxuriantly wooded tops and bald, sheer sides scarred with marks of glacial action; the beachless coast is only a narrow ledge between the mountains and the sea, and unlike the coast of Norway, to which in outline it is not dissimilar, is bold, steep and craggy. Through the inner channels, sheltered from the Pacific by the island rampart, runs the "inland passage," the tourist route northward from Seattle, Washington. The inter-insular straits are carried up into the shore as fjords heading in rivers and glaciers. Thus the Stikine river continues Sumner Strait and the Taku continues Cross Sound. The Stikine, Taku and Alsek rivers all cross the mountains in deep-cut canyons. Everywhere the evidences of glacial action abound. Most remarkable are the inlets known as Portland Canal and Lynn Canal (continuing Chatham Strait). The first is very deep, with precipitous shores and bordering mountains 5000 to 6000 ft. high; the second is a noble fjord 100 m. long and on an average 6 m. wide, with magnificent Alpine scenery. It is subject in winter to storms of extraordinary violence, but is never closed by ice. Both Portland Canal and Lynn Canal are of historical importance, as the question of the true location of the first and the commercial importance to Canada or to the United States of the possession of the second, were the crucial contentions in the disputes over the Alaska-Canadian boundary. At the head of Lynn Canal, the only place on the whole extent of the south-eastern Alaskan coast where a clear-cut water-parting is exhibited between the sea-board and interior drainage, the summits of the highest peaks in the Coast Range are 8000 to 9000 ft. above the sea. White Pass (2888 ft.) and Chilkoot Pass (3500 ft.), at the head of the Lynn Canal, are the gateway to the mining country of the Klondike and Upper Yukon. They are the highest points that one meets in travelling from Skagway along the course of the Yukon to Bering Sea.

Prior to the opening (in August 1900) of the railway between Skagway and White Horse, Canada (110 m.), by way of the White Pass, all transportation to the interior was effected by men and pack-animals (and for a time by a system of telpherage) over these passes and the Chilkat or Dalton trail; the building of the railway reduced carriage rates to less than a tenth of their former value, and the Chilkat and Chilkoot Passes were no longer used. The coast region above the Panhandle shows on a smaller and diminishing scale the same characteristic features, gradually running into those of the Aleutians. Out of the Alaska and Nutzotin mountains two great rivers flow southward: the Copper, practically unnavigable except for small boats, because of its turbulence and the discharge of glaciers into its waters; and the Susitna, also practically unnavigable. Both of these rivers have their sources in lofty mountain masses, and are swift and powerful streams carrying with them much silt; their passes over the water-parting N. of the Kenai Peninsula are through gorges from 4000 to 10,000 ft. in depth. The Copper, the Susitna and its tributary, the Yentna, as well as the Skwentna, a tributary of the Yentna from the west, all run through picturesque canyons, and their upper courses are characterized by glacial and torrential feeders. Their valleys are well timbered.

The glaciers of the Panhandle and throughout the rest of the Pacific region are most remarkable—extraordinary alike for their number and their size. They lie mainly between 56° and 61° N. lat., in a belt 1000 m. long, of which the central part, some 350 or 500 m. long and 80 m. to 100 m. wide, has been described as one great confluent névé field. Thousands of Alpine glaciers from one to fifteen miles long fill the upper valleys and canyons of the mountains. More than a hundred almost reach the sea, from which they are separated by detrital lowland or terminal moraines. Other glaciers are of the Piedmont type. Greatest of these and of Alaskan glaciers is the Malaspina, a vast elevated plateau of wasting ice, 1500 sq. m. in area (nearly a tenth the area of all Switzerland), touching the sea at only one point, though fronting it for 50 m. behind a fringing foreland of glacial debris. It is fed by Alpine glaciers, among them one of the grandest in Alaska, the Seward, which descends from Mt. Logan. It is more than 50 m. long, and more than 3 m. broad at its narrowest point, and several times in its course flows over cascades, falling hundreds of feet. Of tide-water glaciers the most remarkable is probably the Muir. It has an area of 350 sq. m.; the main trunk, which is 30 to 40 m. broad, is fed by 26 tributaries, 20 of which are each greater than the Mer de Glace, and pushes its bergs into the sea from ice cliffs almost 2 m. wide, standing 100 to 200 ft. above the water, and extending probably 700 to 1000 ft. beneath its surface. It has been calculated that the average daily discharge of the Muir in summer is 30,000,000 cubic ft. Its course, which is only about 13 m., has a slope of 100 ft. per mile, and the main current moves 7 ft. daily. The character of the Muir was greatly altered by an earthquake in 1899. There are some 30 tide-water glaciers—a considerable number of them very noteworthy. The Valdez is 30 m. long and 5000 ft. in altitude. Most of the Alaskan glaciers are receding, but not all of them; and at times there is a general advance. The Muir receded 1·6 m. from 1879–1890, the Childs about 600 yards in 17 years; others over 4, 7 or 10 m. in 20 years.

The Aleutian Islands (*q.v.*), like the Alexander Archipelago, are remnants of a submerged mountain system. Their only remarkable features are the volcanoes on the easterly islands, already mentioned.

Continental Alaska.—Continental Alaska in the interior is essentially a vast plateau. "The traveller between the main drainage areas of the interior is struck by the uniform elevation of the interfluminal areas. Rounded hills, level meads and persistent flat-topped ridges, composed of rocks of varying structure, rise to about the same level and give the impression that they are the remnants of a former continuous surface. Occasional limited areas of rugged mountains rise above this level, and innumerable stream valleys have been incised below it; but from the northern base of the St Elias and Alaskan ranges to the southern foothills of the Rocky Mountain system, and throughout their length, the remnants of this ancient level are to be seen. In height it varies from about 5000 ft. close to the bases of the mountain systems to less than 3000 ft. in the vicinity of the main lines of drainage, and slopes gradually towards the north." The Seward Peninsula is particularly rugged. This great plateau drains westward through broad, gently flowing streams, the network of whose tributary waters penetrates every corner of the interior and offers easy means of communication. Both the main streams and the smaller tributaries often flow through deep canyons. The Yukon is one of the great drainage systems of the world. The Yukon itself has a length of more than 2000 m. and bisects the country from E. to W. Behind the bluffs that form in large part its immediate border its basin is a rolling country, at times sinking into great dead levels like the Yukon flats between Circle City and the Lower Ramparts, some 30,000 sq. m. in area. Of the two great affluents of the Yukon, the Tanana is for the most part unnavigable, while the Koyukuk is navigable for more than 450 m. by river steamers, and for more than 500 m. above its mouth shows no appreciable diminution in volume. A low water-parting divides the Yukon valley from the Kuskokwim, the second river of Alaska in size, navigable by steamers for 600 m. Torrential near its source, it is already a broad, sluggish stream at its confluence with the East Kuskokwim. The tides rise 50 ft. near its mouth and the tide-head is 100 m. above the mouth.

Rocky Mountains.—The Rocky Mountain system in Alaska is higher and more complex than in Canada. About 100 m. wide at the international boundary, where the peaks of the British Mountains on the N. and of the Davidson Mountains on the S. are 7000 to 8000 ft. high, the system runs W.S.W. as the Endicott Mountains, two contiguous ranges of about 5000 to 6000 ft., and as these ranges separate, the northern becomes the De Long, the southern the Baird Mountains, whose elevation rapidly decreases toward the coast-line. The system is sharply defined on the north and less so on the south.

Arctic Slope Region.—The Arctic Slope region is divided into the Anuktuvuk Plateau about 80 m. wide, with a maximum altitude to the S. of 2500 ft., and between the plateau and the Arctic Ocean the Coastal Plain. Very little is known of either part of the region.

Climate.—From the foregoing description of the country it is evident that the range of climate must be considerable. That of the coast and that of the Yukon plateau are quite distinct. The Panhandle, along with the *lisière* (foreland), westward to Cook Inlet might be called temperate Alaska, its climate being similar to that of the N.W. coast of the United States; while to the westward and northward the winters become longer and more severe. The cause of the mild climate of the Panhandle, formerly supposed to be the Japanese current, or Kuro Shiwo, is now held to be the general eastward drift of the waters of the North Pacific in the direction of the prevalent winds. To the warmth and moisture brought by this means the coastal region owes its high equable temperature, its heavy rainfall (80–110 in.) and its superb vegetation. The mean annual temperature is from 54° to 60° F. Winter sets in about the 1st of December and the snow is gone save in the mountains by the 1st of May. The thermometer rarely registers below zero F. or above 75° F.; the difference between the midwinter and midsummer averages is seldom more than 25°. The summer is relatively dry, the autumn and winter wet. The vapour-laden sea air blowing landward against the girdle of snow and glaciers on the mountain barriers a few miles inland drains its moisture in excessive rain and snow upon the *lisière*, shrouding it in well-nigh unbroken fog and cloud-bank. Only some 60 to 100 days in the year are clear. In passing from the Sitkan district westward toward Kodiak and the Aleutians (*q.v.*) the climate becomes even more equable, the temperature a little lower and the rainfall somewhat less;[1] the fogs at first less dense, especially near Cook Inlet, where the climate is extremely local, but more and more persistent along the Aleutians. The clear days of a year at Unalaska can be counted on the fingers; five days in seven it actually rains or snows. Bering Sea is covered with almost eternal fog. Along the coast N. of Alaska Peninsula the rainfall diminishes to 10 in. or less within the Arctic circle; the summer temperature is quite endurable but the winters are exceedingly rigorous.[2] East of the mountains in south-eastern Alaska the atmosphere is dry and bracing, the temperature ranging from –14° to 92° F. In the farther interior, in the valleys of the Yukon, the Tanana, the Copper and the Sushitna the summers are much the same in character, the winters much more severe. On the Yukon at the international boundary the mean of the warmest month is higher than that of the warmest month at Sitka, 500 m. southward. At some points in the Upper Yukon valley the range of extreme temperatures is as great as from –75° to 90° F.[3] The mean heat of summer in the upper valley is about 60° to 70° F., and at some points in the middle and lower valley even higher.[4] By the middle of September snow flurries have announced the imminence of winter, the smaller streams congeal, the earth freezes, the miner perforce abandons his diggings, and navigation ceases even on the Yukon in October. All winter snows fall heavily. The air is dry and quiet, and the cold relatively uniform. In midwinter in the upper valley the sun rises only a few degrees above the horizon for from four to six hours a day, though very often quite obscured. In December, January, February and March the thermometer often registers lower than –50° F., and the mean temperature is –20°. In May the rivers open, the cleared land thaws out, and by June the miner is again at work. Summer is quickly in full ascendancy. In May and June the sun shines from eighteen to twenty hours and diffused twilight fills the rest of the day. The rainfall is light, from 10 to 25 in. according to the year or the locality. Dull weather is unknown. All nature responds in rich and rapid growth to the garish light and intense heat of the long, splendid days. But the Alaska summer is the uncertain season; at times the nights are cold into July, at times snow falls and there are frosts in mid-August; sometimes rain is heavy, or again there is a veritable drought. In the great river valleys S. of the Yukon basin climatic conditions are much less uniform.

Fauna and Flora.—The fauna of Alaska is very rich and surprisingly varied. The lists of insects, birds and mammals are especially noteworthy.[5] Of these three classes, and of other than purely zoological interest, are mosquitoes, which swarm in summer in the interior in vast numbers; sea fowl, which are remarkably abundant near the Aleutians; moose, and especially caribou, which in the past were very numerous in the interior and of extreme economic importance to the natives. The destruction of the wild caribou has threatened to expose the Indians to wholesale starvation, hence the effort which the United States government has made to stock the country with domestic reindeer from Siberia. This effort made under the direction of the Bureau of Education has been eminently successful, and in the future the reindeer seems certain to contribute very greatly to the food, clothing, means of shelter and miscellaneous industries of the natives; and not less to the solution of the problems of communication and transportation throughout the interior. It is, however, the fish and the fur-bearing animals of its rivers and surrounding seas that are economically most distinctive of and important to Alaska. The fishing grounds extend along the coast from the extreme south-east past the Aleutians into Bristol Bay. Herring are abundant, and cod especially so. There are probably more than 100,000 sq. m. of cod-banks from 22 to 90 fathoms deep in Bering Sea and E. of the Alaska Peninsula. Salmon are to be found in almost incredible numbers. Of marine mammals, whales are hunted far to the N. in Bering Sea and the Arctic Ocean, but are much less common than formerly, as are also the walrus, the sea otter and the fur seal. All these are disappearing before commercial greed. The walrus is now found mainly far N.; the sea otter, once fairly common throughout the Aleutian district, is now rarely found even on the remoter islands; the fur seal, whose habitat is the Pribilof Islands in Bering Sea, has been considerably reduced in numbers by pelagic hunting. There are half-a-dozen species of hair seals and sea-lions. The number of fur-bearing land animals is equally large. Sables, ermine, wolverines, minks, land otters, beavers and musk-rats have always been important items in the fur trade. There are black, grizzly and polar bears, and also two exclusively Alaskan species, the Kodiak and the glacier bear. The grey wolf is common; it is the basal stock of the Alaskan sledge-dog. The red fox is widely distributed, and the white or Arctic fox is very common along the eastern coast of Bering Sea; a blue fox, once wild, is now domesticated on Kodiak and the Aleutians, and on the southern continental coast, and a black fox, very rare, occurs in south-eastern Alaska; the silver fox is very rare.

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[1] At Kodiak, the monthly means range from 28° to 55° with a total range from –10° to 82° F., as against –3° to 87° F. at Sitka; the average temperature is 40·6° F., rainfall 59 in.

[2] At St Michael the mean annual temperature is about 26°, the monthly means run from about –2° to 54°, and the extreme recorded temperatures from about –55° to 77° F.; at Port Clarence the annual mean is 22°, monthly means –7° to 51° F.; extreme range of temperature, –38° to 77° F.; at Point Barrow the annual mean is 7·7° F., monthly means –18·6° to 38·1°F., extreme range of temperature –55° to 65° F.

[3] The mean annual temperature on the Yukon at the international line is about 21° F., the monthly means run from –17° to 60° F., the range of extreme temperatures from –80° to 90° F.

[4] At Fort Yukon five years' records showed mean seasonal temperatures of 14°, 60°, 17°, and –23·8° F. for spring, summer, autumn and winter respectively; at Holy Cross Mission 20°, 59°, 36° and 0·95°, at Nulato 29°, 60°, 36° and –14°.

[5] The Harriman expedition collected in two months 1000 species of insects, of which 344 species (and 6 genera) were new to science.

The Alaskan flora is less varied than the fauna. The forests of the coastal region eastward from Cook Inlet, and particularly in south-eastern Alaska, are of fair variety, and of great richness and value. The balsam fir and in the south the red cedar occur in scant quantities; more widely distributed, but growing only under marked local conditions, is the yellow or Alaska cedar, a very hard and durable wood of fine grain and pleasant odour. The Oregon alder is fairly common. Far the most abundant are coast and Alpine hemlocks and the tide-land or Sitka spruce. The last is not confined to this part of Alaska, but is the characteristic and universal tree. It is of primary economic importance to the natives, who use it for the most various purposes. On the islands of the Alexander Archipelago and on Prince William Sound it grows to gigantic size; even on the Koyukuk and the middle Yukon it attains in places a diameter of 2 ft. In 1902 a forest reservation comprising the largest part of the Alexander Archipelago was created by the United States government. The separation of the coast and interior floras is almost complete; only along the mountain passes and river valleys, and rarely there, is there an exchange of species. Timber, however, is fairly abundant along the entire course of the Yukon above Anvik (about 400 m. from the mouth), along the great tributaries of the Yukon, and, so far as explorations have revealed, along every stream in central Alaska; and the woods of the interior consist almost entirely of spruce. On the Yukon flats it grows in a vast forest impenetrably dense.[1] The timber line, which in the Panhandle and along the southern coast of the continental mass runs from 1800 to 2400 ft., frequently rises in the interior plateau even to 4000 ft. Next in importance after spruce, in the interior, is birch, and then balsam poplar. Thickets of alders and willows in wet places and new-made land, aspens and large cottonwoods west of the characteristic spruce area (as on Seward Peninsula), are also common. Toward the Arctic circle, the timber becomes, of course, sparse, low, gnarled and distorted. The willows in the Arctic drainage basin shrink to shrubs scarcely knee-high. Bushes are common in western Alaska, but undergrowth is very scanty in the forests. Grasses grow luxuriantly in the river bottoms and wherever the tundra moss is destroyed to give them footing. Most distinctive is the ubiquitous carpeting of mosses, varying in colours from the pure white and cream of the reindeer moss to the deep green and brown of the peat moss, all conspicuously spangled in the brief summer with bright flowers of the higher orders, heavy blossoms on stunted stalks. The thick peat moss or tundra of the undrained lowlands covers probably at least a quarter of Alaska; the reindeer moss grows both on the lowlands and the hills.[2] Sedges available for forage grow in the tundra. In August berries are fairly abundant over the interior; one of them, the salmon or cloud berry, preserved in seal oil for the winter, is an important food of the natives. The grasses are killed by the frosts in September. The western timber limit is on Kodiak Island. The Aleutian Islands (*q.v.*) are almost destitute of trees, but are covered with a luxuriant growth of herbage. Climatic differences cannot account for the treeless condition of the country W. of this point, and the true explanation lies probably in the fact that in winter, when the seeds of the coastal forests ripen and are released, the prevalent winds W. of Kodiak are damp and blow from the S. and S.W., while the spread of the seeds requires dry winds blowing from the N. and N.W. Such favourable conditions occur only rarely.

The *Soil* of Alaska seems to be in itself rich, and quite capable of agricultural development; the great impediment to this is in the briefness of the summer. Contrary, however, to the once universal belief, the experiments of the department of agriculture of the United States have definitely proved that hardy vegetables in great variety can readily be produced in the coastal region and at various stations in the Yukon valley; and presumably, therefore, all over the interior S. of the Arctic circle, save along Bering Sea; also that there is little doubt of the practicability of successfully cultivating buckwheat, barley and oats, and possibly also rye and wheat; that grasses for grazing grow generally and often in abundance; and in general that the possibilities of interior Alaska as a live-stock country are very considerable. It is calculated that a twentieth of south-eastern Alaska is available for agriculture, and that of the entire country 100,000 sq. m. are pasturable or tillable.

Industry.—The fur and fish resources of Alaska have until recently held first place in her industries. Herrings furnish oil and guano, and the young fish are packed as "sardines" at Juneau. Cod can be taken with comparatively little danger or hardship. During the Russian occupation a small amount was shipped to California and the Sandwich Islands. The take since 1879 has been practically constant. The take of halibut is increasing steadily. The salmon industry dates from 1878. The total output (in 1901, 100,000,000 ℔; in 1906, about 72,000,000 ℔), which since 1900 has been more than half the total salmon product of the United States, is more than ten times the product of all other fish.[3] On the Karluk river, Kodiak Island, is the greatest salmon fishery in the world. More than 3,000,000 salmon have been canned here in one season. The second salmon stream is the Nushagak, flowing into Bristol Bay; this bay is the richest fishing field of Alaska, furnishing in 1901, 35 % of the total production. The recklessly wasteful manner in which these fisheries are conducted, and the inadequate measures taken by the United States government for their protection, threaten the entire industry with destruction. From 1867 to 1902 the value of the total fishery product was estimated at $60,000,000. The fur-seal industry has been better protected but still unavailingly. (See SEAL FISHERIES and BERING SEA ARBITRATION.) The value of the fur seals taken from 1868 to 1902 was estimated at $35,000,000 and that of other furs at $17,000,000. The walrus, hunted for its ivory tusks, and the sea otter, rarest and most valuable of Alaskan fur animals, are near extermination; the blue fox is now bred for its pelt on the Aleutians and the southern continental coast; the skins of the black and silver fox are extremely rare, and in general the whole fur industry is discouragingly decadent. The whale fishery also has greatly fallen off; there is no profit on the oil and the whales are sought for the baleen alone; they are much less numerous too than they once were, and have to be sought farther and farther north.

Minerals.—The timber resources of Alaska are untouched and the serious exploitation of her minerals is very recent. As early as 1861 gold discoveries were made on the Stikine river; repeated discoveries, culminating in the Cassiar district "boom," were made in British Columbia from 1857 to 1874; colourings along the Yukon were reported in 1866–1867 and systematic prospecting of the upper river began about 1873. Juneau was founded in 1880; the same year the opposition of the Indians was withdrawn that had prevented the crossing of the mountain passes to the interior, and after 1880 repeated and scattered discoveries were made on the Lewes, Pelly, Stewart and other streams of the Upper Yukon country in Canada. As early as 1883–1885 there was a considerable mining excitement due to these discoveries, and a much greater one in 1887 after the discovery of coarse gold on Forty Mile Creek in American territory; but these were as nothing to the picturesque and feverish rush that followed the location of the first Klondike claim in Canadian territory in August 1896. (See Klondike.) The mines in American territory were temporarily deserted for the new diggings. Other gold districts are scattered over the whole interior of Alaska. Nome (*q.v.*) was the scene of a great gold mining stampede in 1900. The quartz mines near Juneau are among the greatest stamp mills of the world (See Juneau). The product of gold and silver (of the latter some 1.3 % of the total) from 1895 to 1901 was more than $32,000,000 from Alaska proper (not including that from the Canadian Yukon fields) as against a production of $5,000,000 in 1880–1896. The gold product of the Canadian Yukon territory from 1896–1903 was about $96,000,000, as estimated by the Canadian Geological Survey. In 1905 the product of gold from Alaska was valued at $15,630,000 (mines report); and from 1880 to 1906 the production of gold, according to the estimate of A. H. Brooks, was more than $100,000,000. The gravest problem of mining in the interior country, even graver than that presented by the climate, is transportation; in 1900 the Tanana fields, for example, were provisioned from Circle City, about 125 m. distant, at the rate of a cent per ℔ mile (*i.e.* $2000 for moving a ton 100 m.). Even higher rates prevailed in the copper country in 1902. Various other minerals in addition to gold have been discovered, and several of them, notably copper and silver (the latter appearing with the gold deposits), may probably be profitably exploited. In 1905 the product of copper was valued at $759,634, that of silver at $80,165 (mines report). Coal, and in much larger quantities lignite, have been found in many parts of Alaska. Most important, because of their location, are deposits along the Alaska Peninsula and between Circle City and Dawson. The latter furnishes fuel to the river steamboats, and it is hoped may eventually supply the surrounding mining region. There are valuable deposits of gypsum on Chicagof Island, and marble quarries are being developed on Prince of Wales Island.

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[1] The trees here grow as large as 10 in. in diameter and 40 or 50 ft. high; the branches do not spread, even where there is room, so that the tallest tree has a top only four or five feet broad; the roots, which cannot penetrate the shaded and frozen soil, spread over the ice or shallowly into the tundra carpeting, and often only by their matted network prevent the fall of the trees.

[2] 280 species of mosses proper, of which 46 were new to science, and 16 varieties of peat moss (*Sphagnum*) were listed by the Harriman expedition; and 74 species or varieties of ferns.

[3] The value of the total product of Alaska's fish canneries was in 1905 $7,735,782, or 29·3 % of the total for the United States; in 1900 it was 17·4 % of the country's total.

As against $7,200,000 paid for Alaska in 1867, the revenues returned to the United States in the years 1867–1903 totalled $9,555,909 (namely, rental for the Fox and Pribilof Islands, $999,200; special revenue tax on seal-skins, $7,597,351; Alaskan customs, $528,558; public lands, $28,928; other sources $401,872). It has been estimated that in the same period the United States drew from Alaska fish, furs and gold to the value of about $150,000,000; that up to 1903 the imports from the states aggregated $100,000,000; and that $25,000,000 of United States capital was invested in Alaska.

Since 1896 communication with the outer world has been greatly increased. Alaskan mails leave the states daily, many post-offices are maintained, mail is regularly delivered beyond the Arctic circle, all the more important towns have telegraphic communication with the states,[1] there is one railway in the interior through Canadian territory from Skagway, and other railways are planned. The total mileage in 1906 was 136 m. In that year the Alaskan Central Railroad (from Seward to Fairbanks, 463 m.) was chartered; 45 m. of this road were in operation in 1905. One long military road as an "All American" route from Valdez has long been built.

Population.—The population in 1867 at the time of the cession from Russia is estimated at 30,000, of which two-thirds were Eskimo and other Indians. Population returned in 1880, 33,426; in 1890, 32,052; in 1900, 63,592, of whom approximately 48 % were whites, 46 % natives and 6 % Japanese and Chinese; (1910 census) 64,356. The Asiatics are employed in the salmon canneries. The natives of Alaska fall under four ethnologic races: the Eskimo or Innuit—of these the Aleuts are an offshoot; the Haidas or Kaigani, found principally on Prince of Wales Island and thereabouts; the Thlinkits, rather widely distributed in the "Panhandle"; and the Tinnehs or Athapascans, the stock race of the great interior country. In 1890 the pure-blooded natives numbered 23,531, of whom 6000 were Haidas, Thlinkits or other natives of the coastal region, 1000 Aleuts, 3400 Athapascans and 13,100 Eskimo. The natives have adopted many customs of white civilization, and on the Aleutians, and in coastal Alaska, and in scattered regions in the interior acknowledge Christianity under the forms of the Orthodox Greek or other churches. The rapid exhaustion in late years of the caribou, seals and other animals, once the food or stock-in-trade of the Aleuts and other races, threatens more and more the swift depletion of the natives. They have also felt the fatal influence of the liquor traffic. From 1893 to 1895 the United States expended $55,000 to support the natives of the Fur Seal Islands. This policy threatens to become a continued necessity throughout much of Alaska. There is a small government Indian reservation on Afognak Island, near Kodiak. The white population is extremely mobile, and few towns have an assured or definite future. The prosperity of the mining towns of the interior is dependent on the fickle fortune of the gold-fields, for which they are the distributing points. Sitka, Juneau (the capital) and Douglas, both centres of a rich mining district, Skagway, shipping point for freight for the Klondike country (see these titles), and St Michael, the ocean port for freighting up the Yukon, are the only towns apparently assured of a prosperous future. Wrangell (formerly Fort St Dionysius, Fort Stikine and Fort Wrangell), founded in 1833, is a dilapidated and torpid little village, of some interest in Alaskan history, and of temporary importance from 1874 to 1877 as the gateway to the Cassiar mines in British Columbia. Its inhabitants are chiefly Thlinkit Indians.

Government.—Alaska, by an act of Congress approved the 7th of May 1906, received the power to elect a delegate to Congress. Before this act and the elections of August 1906 Alaska was a governmental district of the United States without a delegate in Congress. Its administration rests in the hands of the various executive departments, and is partly exercised by a governor and other resident officials appointed by the president. It is a military district, a customs district (since 1868), is organized into a land district, and constitutes three judicial divisions. In 1867–1877 the government was in the hands of the department of war, although the customs were from the beginning collected by the department of the treasury, with which the effective control rested from 1877 until the passage of the so-called Organic Act of 17th May 1884. This act extended over Alaska the laws of the state of Oregon so far as they should be applicable, created the judicial district and a land district, put in force the mining laws of the United States, and in general gave the administrative system the organization it retained up to the reforms of 1899–1900. The history of government and political agitation has centred since then in the demand for general land legislation and for an adequate civil and criminal law, in protests against the enforcement of a liquor prohibition law, and in agitation for an efficiently centralized administration. As the general land laws of the United States were not extended to Alaska in 1884, there was no means, generally speaking, of gaining title to any land other than a mining claim, and so far as any method did exist its cost was absolutely prohibitive. After partial and inadequate legislation in 1891 and 1898, the regular system of land surveys was made applicable to Alaska in 1899, and a generous homestead law was provided in 1903. An adequate code of civil and criminal law and provisions for civil government under improved conditions were provided by Congress in 1899 and 1900. The agitation over prohibition dates from 1868; the act of that year organizing a customs district forbade the importation and sale of firearms, ammunition and distilled spirits; the Organic Act of 1884 extended this prohibition to all intoxicating liquors. The coast of Alaska offers exceptional facilities for smuggling, and liquor has always been very plentiful; juries have steadily refused to convict offenders, and treasury officials have regularly collected revenue from saloons existing in defiance of law. The prohibition law is still upon the statute-books. The chief weaknesses in the colonial administration of the territory, particularly prior to 1900—but only to a slightly less extent since—have been decentralization and a lax civil service. The concomitants of these have been irresponsibility and inefficiency. The governor has represented the president without possessing much power; the department of war has had ill-defined duties; the department of justice has, in theory, had charge of the general law; the department of the interior has administered the land law; the agents of the bureau of education have superintended the stocking of Alaska with reindeer; the United States Fish Commission has investigated the condition of marine life without having powers to protect it. The treasury department has charted the coasts, sought to enforce the prohibition law, controlled and protected the fur seals and fisheries, and incidentally collected the customs. Since the creation of the department of commerce and labour (1903), it has taken over from other departments some of these scattered functions. All in all, the government has proved itself without power to protect the most valuable industries of the district, and for many years there has been talk of a regular territorial government. The paucity of permanent residents and the poverty of the local treasury seem to make such a solution an impossible one.

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[1] Seattle, Sitka and Valdez are connected by cable; telegraph lines run from the Panhandle inland to the Yukon and down its valley to Fort St Michael.

History.—The region now known as Alaska was first explored by the Russian officers Captain Vitus Bering and Chirikov in 1741. They visited parts of the coast between Dixon Entrance and Cape St Elias, and returned along the line of the Aleutians. Their expedition was followed by many private vessels manned by traders and trappers. Kodiak was discovered in 1763 and a settlement effected in 1784. Spanish expeditions in 1774 and 1775 visited the south-eastern coast and laid a foundation for subsequent territorial claims, one incident of which were the Nootka Sound seizures of 1789. Captain James Cook in 1778 made surveys from which the first approximately accurate chart of the coast was published; but it was reserved for Vancouver in 1793–1794 to make the first charts in the modern sense of the intricate south-eastern coast, which only in recent years have been superseded by new surveys. Owing to excesses committed by private traders and companies, who robbed, massacred and hideously abused the native Indians, the trade and regulation of the Russian possessions were in 1799 confided to a semi-official corporation called the Russian-American Company for a term of twenty years, afterwards twice renewed for similar periods. A monopoly of the American trade had previously been granted in 1788 to another private company, the Sholikof. Alexander Baranov (1747–1819); chief resident director of the American companies (1790–1819), one of the early administrators of the new company, became famous through the successes he achieved as governor. He founded Sitka (*q.v.*) in 1804 after the massacre by the natives of the inhabitants of an earlier settlement (1799) at an adjacent point. The headquarters of the company were at Kodiak until 1805, and thereafter at Sitka. In 1821 Russia attempted by *ukase* to exclude navigators from Bering Sea and the Pacific coast of her possessions, which led to immediate protest from the United States and Great Britain. This led to a treaty with the United States in 1824 and one with Great Britain in 1825, by which the excessive demands of Russia were relinquished and the boundaries of the Russian possessions were permanently fixed. The last charter of the Russian-American Company expired on the 31st of December 1861, and Prince Maksutov, an imperial governor, was appointed to administer the affairs of the territory. In 1864 authority was granted to an American company to make explorations for a proposed Russo-American company's telegraph line overland from the Amur river in Siberia to Bering Strait, and through Alaska to British Columbia. Work was begun on this scheme in 1865 and continued for nearly three years, when the success of the Atlantic cable rendered the construction of the line unnecessary and it was given up, but not until important explorations had been made. In 1854 a Californian company began importing ice from Alaska. Very soon thereafter the first official overtures by the United States for the purchase of Russian America were made during the presidency of James Buchanan. In 1867, by a treaty signed on the 30th of March, the purchase was consummated for the sum of $7,200,000, and on the 18th of October 1867 the formal transfer of the territory was made at Sitka.

Since its acquisition by the United States the history of Alaska has been mainly that of the evolution of its administrative system described above, and the varying fortunes of its fisheries and sealing industries. Since the gold discoveries a wonderful advance has been made in the exploration of the country. A military reservation has been created with Fort Michael as a centre. The two events of greatest general interest have been the Fur Seal Arbitration of 1893 (see BERING SEA ARBITRATION), and the Alaska-Canadian boundary dispute, settled by an international tribunal of British and American jurists in London in 1903. The boundary dispute involved the interpretation of the words, quoted above, in the treaties of 1825 and 1867 defining the boundary of the Russian (later American) possessions, and also the determining of the location of Portland Canal, and the question whether the coastal girdle should cross or pass around the heads of the fjords of the coast. The tribunal was an adjudication board and not an actual court of arbitration, since its function was not to decide the boundary but to settle the meaning of the Anglo-Russian treaty, which provided for an ideal (and not a physical) boundary. This boundary did not fit in with geographical facts; hence the adjudication was based upon the motive of the treaty and not upon the literal interpretation of such elastic terms as "ocean," "shore" and "coast-line." The award of the tribunal made in October 1903 was arrived at by the favourable vote of the three commissioners of the United States and of Lord Alverstone, whose action was bitterly resented by the two Canadian commissioners; it sustained in the main the claims of the United States.

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ALASSIO, a town of Liguria, Italy, on the N.W. coast of the Gulf of Genoa, in the province of Genoa, 57 m. S.W. of the town of the same name by rail. Pop. (1901) 5630. It is mainly noticeable as a health resort in winter and a bathing-place in summer, and has many hotels. The anchorage is safe, and the bay full of fish; the harbour has a certain amount of trade. The old town contains one or two interesting churches, and commands a fine view.

ALASTOR, in Greek mythology, the spirit of revenge, which prompts the members of a family to commit fresh crimes to obtain satisfaction. These crimes necessitate further acts of vengeance, and the curse is thus transmitted from generation to generation. The word is also used for a man's evil genius, which drives him to sin without any provocation; a man so driven is sometimes called *Alastor*. The epithet is applied to Zeus and the Erinyes as the deities of revenge and punishment.

ALA-TAU ("*Variegated Mountains*"), the name of six mountain ranges in Asiatic Russia. Three of these are in the government of Semiryechensk in Central Asia, all belonging to the Tian-shan system:—(1) the Terskei Ala-tau, south of and parallel to the lake of Issyk-kul; (2) the Kunghei Ala-tau, and (3) the Trans-Ili Ala-tau, both N. of and parallel to the same lake; and (4) the Dzungarian Ala-tau, lying N. of the Ili depression. The first three link together the Tian-shan and the Alexander Range. Their mean elevation is 6000–7000 ft.; their culminating point, Talgar, on a transverse ridge between (2) and (3), reaches 15,000 ft.; the limits of perpetual snow run at 11,000–11,700 ft. The Dzungarian Ala-tau reach a maximum altitude of 11,000 ft. and have a mean altitude of 6250 ft. From the middle of the Alexander Range another range (5) called Ala-tau, or Talastau, strikes west by south. The name Ala-tau also enters into the designation of (6), a range between the upper Yenisei and the upper Ob, in the government of Tomsk, namely, the Kuznetsk Ala-tau, forming an outlier of the Altai Mountains, and reaching 6000–7000 ft. in altitude.

ALAUNA, ALAUNUS, the Celtic names of two rivers, &c., in Roman Britain. Hence the modern Allan Water, river Alyn, &c.

ÁLAVA, DON MIGUEL RICARDO DE (1770–1843), Spanish general and statesman, was born at Vittoria in 1770. He served first in the navy, and had risen to be captain of a frigate when he exchanged into the army, receiving corresponding rank. He was present as a marine at the battle of Trafalgar on board the flagship of his uncle Admiral Álava. In politics he followed a very devious course. At the assembly of Bayonne in 1808 he was one of the most prominent of those who accepted the new constitution from Joseph Bonaparte as king of Spain. After the national rising against French aggression, and the defeat of General Dupont at Bailen in 1808, Álava joined the national independent party, who were fighting in alliance with the English. The Spanish Cortes appointed him commissary at the English headquarters, and the duke of Wellington, who regarded him with great favour, made him one of his aides-de-camp. Before the close of the campaign he had risen to the rank of brigadier-general. On the restoration of Ferdinand, Álava was cast into prison, but the influence of his uncle Ethenard, the inquisitor, and of Wellington secured his speedy release. He soon contrived to gain the favour of the king, who appointed him in 1815 ambassador to the Hague. It was therefore his remarkable fortune to be present at the battle of Waterloo with Wellington's staff. He is supposed to have been the only man who was present at both Waterloo and Trafalgar. Four years later he was recalled owing, it is said, to the marked kindness he had shown to his banished fellow-countrymen. On the breaking out of the revolution of 1820 he was chosen by the province of Álava to represent it in the Cortes, where he became conspicuous in the party of the *Exaltados*, and in 1822 was made president. In the latter year he fought with the militia under Francisco Ballesteros and Pablo Murillo to maintain the authority of the Cortes against the rebels. When the French invested Cadiz, Álava was commissioned by the Cortes to treat with the duc d'Angoulême, and the negotiations resulted in the restoration of Ferdinand, who pledged himself to a liberal policy. No sooner had he regained power, however, than he ceased to hold himself bound by his promises, and Álava found it necessary to retire first to Gibraltar and then to England. On the death of Ferdinand he returned to Spain, and espousing the cause of Maria Christina against Don Carlos was appointed ambassador to London in 1834 and to Paris in 1835. After the insurrection of La Granja he refused to sign the constitution of 1812, declaring himself tired of taking new oaths, and was consequently obliged to retire to France, where he died at Barèges in 1843.

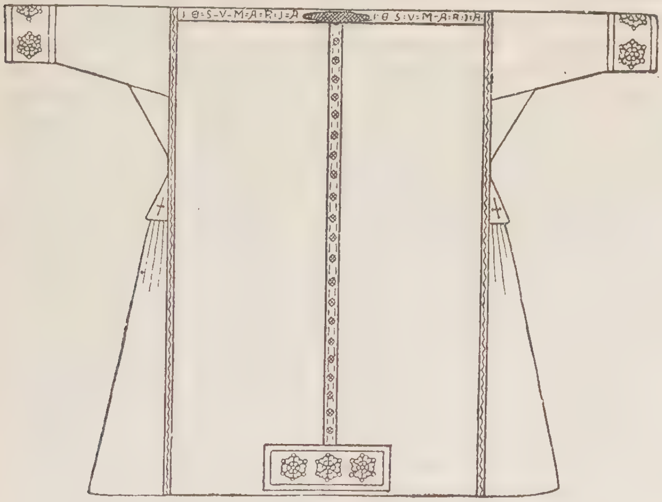
Frequent and honourable mention of Álava is made in Napier's *History of the Peninsular War*, and his name is often met both in lives of the duke of Wellington and in his correspondence.

ÁLAVA, one of the Basque Provinces of northern Spain; bounded on the N. by Biscay and Guipúzcoa, E. by Navarre, S. by Logroño, and W. by Burgos. Pop. (1900) 96,385; area 1175 sq. m. The countship of Trevino (190 sq. m.) in the centre of Álava belongs to the province of Burgos. The surface of Álava is very mountainous, especially on the north, where a part of the Pyrenees forms its natural boundary. It is separated from Logroño by the river Ebro, and its other rivers are the Zadorra and the Ayuda. The climate is mild in summer, fitful in autumn and spring, and very cold in winter, as even the plains are high and shut in on three sides by mountains snow-clad during several months. The soil in the valleys is fertile, yielding wheat, barley, maize, flax, hemp and fruits. Oil and a poor kind of wine called *chacoli* are also produced. Many of the mountains are clothed with forests of oak, chestnuts, beeches and other trees, and contain iron, copper, lead and marble. Salt is also found in large quantities; but mining and quarrying are not practised on a large scale; only lead, lignite and asphalt being worked. There are mineral waters in many places. Other local industries of some importance include smelting, and manufactures of beds, furniture, railway carriages, matches, paper, sweets and woollen and cotton goods. Bread-stuffs, colonial products and machinery are largely imported. Few provinces in Spain are inhabited by so laborious, active and well-to-do a population. The primary schools are numerously attended, and there are very good normal schools for teachers of both sexes, and a model agricultural farm. The public roads and other works of the province are excellent, and, like those of the rest of the Basque provinces, entirely kept up by local initiative and taxes. Railways from Madrid to the French frontier, and from Saragossa to Bilbao, cross the province. The capital is Vitoria (pop. 1900, 30,701), which is the only town with more than 3500 inhabitants.

For a fuller account of the history, people and customs of Álava, see BASQUES and BASQUE PROVINCES, with the works there cited. A very elaborate bibliography is given in the *Cátalogo de las obras referentes á las provincias de Álava y Navarra*, by A. A. Salazar (Madrid, 1887.) The following books by J. J. Landazuri y Romarate contain much material for a provincial history:—*Historia ecclesiastica, &c.* (Pamplona, 1797); *Historia civil, &c.* (Vitoria, 1798); *Compendios historicos de la ciudad y villas de . . . Álava, &c.* (Pamplona, 1798); *Suplemento á los cuatro libros de la historia de . . . Álava* (Vitoria, 1799); and *Los varones illustres Álavenses* (Vitoria, 1798). See also M. Risco in vol. 33 of *Hispania Sagrada*, by H. Florez, &c. (Madrid, 1754–1879).

ALB (Lat. *alba*, from *albus*, white), a liturgical vestment of the Catholic Church. It is a sack-like tunic of white linen, with narrow sleeves and a hole for the head to pass through, and when gathered up round the waist by the girdle (*cingulum*) just clears the ground. Albs were originally quite plain, but about the 10th century the custom arose of ornamenting the borders and the cuffs of the sleeves with strips of embroidery, and this became common in the 12th century. These at first encircled the whole border; but soon it became customary to substitute for them square patches of embroidery or precious fabrics. These "parures" "apparels" or "orphreys" (Lat. *parurae*, *grammata*, *aurifrisia*, &c.), were usually four in number, one being sewn on the back and another on the front of the vestment just above the lower hem, and one on each cuff. When, as occasionally happened, a fifth was added, this was placed on the breast just below the neck opening. These "apparelled albs" (*albae paratae*) continued in general use in the Western Church till the 16th century, when a tendency to dispense with the parures began, Rome itself setting the example.

The growth of the lace industry in the 17th century hastened the process by leading to the substitution of broad bands of lace as decoration; occasionally, as in a magnificent specimen preserved at South Kensington, nearly half the vestment is thus composed of lace. At the present time, so far as the Roman Catholic Church is concerned, apparelled albs are only in regular use at Milan (Ambrosian Rite), and, partially, in certain churches in Spain. The decree of the Congregation of Rites (May 18, 1819) says nothing about apparels, but only lays down that the alb must be of white linen or hemp cloth. There is no definite rule as to the material or character of the ornamentation, and attempts have been made, especially in England, to revive the use of the apparelled alb.



Apparelled Alb in the South Kensington Museum.
From Braun's *Liturgische Gewandung*.

In the Roman Church the alb is now reckoned as one of the vestments proper to the sacrifice of the Mass. It is worn by bishops, priests, deacons and subdeacons under the other eucharistic vestments, either at Mass or at functions connected with it. It is sometimes also worn by clerics in minor orders, whose proper vestment is, however, the surplice—itself a modification of the alb (see SURPLICE). The alb is supposed to be symbolical of purity, and the priest, when putting it on, prays: "Make me white and purify my heart, O Lord," &c. In the middle ages the parures, which originally had no mystic intention whatever, were taken to symbolize the wounds of Christ; whence probably is derived the custom surviving at the cathedral of Toledo, of the singers of the Passion on Good Friday being vested in apparelled albs.

In England at the Reformation the alb went out of use with the other "Mass vestments," and remained out of use in the Church of England until the ritual revival of the 19th century. It is now worn in a considerable number of churches not only by the clergy but by acolytes and servers at the Communion. Where the ritual, as in most cases, is a revival of pre-Reformation uses and not modelled on that of modern Rome, these albs are frequently apparelled. For the question of its legality see VESTMENTS.

Both the alb and its name are derived ultimately from the *tunica alba*, the white tunic, which formed part of the ordinary dress of Roman citizens under the Empire. As such it was worn both in and out of church, the few notices remaining which suggest a special tunic for ministers at the Eucharist merely implying that it was not fitting to use for so sacred a function a garment soiled by everyday wear. The date of its definite adoption as a liturgical vestment is uncertain; at Rome—where until the 13th century it was known as the *linea* or *camisia* (cf. the modern Italian *camice* for alb)—it seems to have been thus used as early as the 5th century. But as late as the 9th and 10th centuries the *alba* is still an everyday as well as a liturgical garment, and we find bishops and synods forbidding priests to sing mass in the *alba* worn by them in ordinary life (see Braun, p. 62). Throughout the middle ages, moreover, the word *alba* was somewhat loosely used. In the medieval inventories are sometimes found *albae*, described as red, blue or black; which has led to the belief that albs were sometimes not only made of stuffs other than linen, but were coloured. It is clear, however, from the descriptions of these vestments that in some cases they were actually tunicles, the confusion of terms arising from the similarity of shape (see DALMATIC); in other cases the colour applied to the parures, not to the albs as a whole. Silk albs appear in the inventories, but only very exceptionally.

The equivalent of the alb in the ancient Churches of the East is the sticharion (στιχάριον) of the Orthodox Church (Armenian *shapik*, Syrian *Kutina*, Coptic *stoicharion* or *tuniah*). It is worn girdled by bishops and priests in all rites, by subdeacons in the Greek and Coptic rites. By deacons and lectors it is worn ungirdled in all the rites. The colour of the vestment is usually white for bishops and priests (this is the rule in the Coptic Church); for the other orders there is no rule, and all colours, except black, may be used. Its material may be linen, wool, cotton or silk; but silk only is the rule for deacons. In the Armenian and Coptic rites the vestment is often elaborately embroidered; in the other rites the only ornament is a cross high in the middle of the back, save in the case of bishops of the Orthodox Church, whose sticharia are ornamented with two vertical red stripes (ποταμοί, "rivers"). In the East as in the West the vestment is specially associated with the ritual of the Eucharist.

The whole subject is exhaustively treated by Father Joseph Braun in *Die liturgische Gewandung* (Freiburg im Breisgau, 1907). See also bibliography to the article VESTMENTS.

ALBA, a town and episcopal see of Piedmont, Italy, on the river Tanaro, in the province of Cuneo. From the town of the same name it is 33 m. N.E. direct; it is 42 m. S.S.E. of Turin by rail. Pop. (1901) 13,900. It contains a fine cathedral, with a Gothic façade, reconstructed in 1486, and is an important commercial centre. It occupies the site of the ancient Alba Pompeia, probably founded by Pompeius Strabo (consul 89 B.C.) when he constructed the road from Aquae Statiellae (Acqui) to Augusta Taurinorum (Turin). Probably this was the road taken by Decimus Brutus when he succeeded, after the raising of the siege of Mutina in 43 B.C., in occupying Pollentia just before Mark Antony's cavalry came in sight. Alba was the birthplace of the emperor Pertinax. It became an episcopal see dependent on Milan in the 4th century. A small museum of local antiquities was established in 1897.

See F. Eusebio in *Atti del Congresso Internazionale di Scienze Storiche* (Rome, 1904), vol. v. p. 485.

ALBACETE, an inland province of south-eastern Spain, formed in 1833 out of the northern half of Murcia, and bounded on the N. by Cuenca, E. by Valencia and Alicante, S. by Murcia, and W. by Granada and Jaén. Pop. (1900) 237,877; area 5737 sq. m. The northern part of Albacete belongs to the high plains of New Castile, the southern is generally mountainous, traversed by low ranges or isolated groups of hills, which culminate in the Sierra de Alcaraz on the borders of Granada, where several summits reach 5000 ft. Besides many smaller streams, two large rivers water the province, the Segura in the south-west, and the Júcar in the north-east; both rising beyond the borders of Albacete, and ultimately flowing into the Mediterranean. The fertile glens of the Alcaraz district are richly wooded, and often, from their multitude of fruit trees, resemble the *huertas* or gardens of Alicante; but broad tracts of land are destitute of trees, and suitable only for pasture. These barren regions are thinly peopled; and for the whole of Albacete the density of population (41·3 per sq. m. in 1900) is lower than in any other Spanish province, except Soria.

The climate is generally mild and healthy, although, among the higher mountains, the snow lies for several months. Wheat and other cereals are cultivated, with fruits of many kinds, olives, and vines which yield a wine of fair quality; while saffron is largely produced, and some attention is given to the keeping of bees and silkworms. Stock-farming, for which the wide plains afford excellent opportunities, employs many of the peasantry; the bulls of Albacete are in demand for bull-fighting, and the horses for mounting the Spanish cavalry. There is also a good breed of mules. Sulphurous and other mineral springs, both hot and cold, exist in several districts, and deposits of silver, iron, copper, sulphur, coal and other minerals have been discovered; but the exploitation of these is retarded by lack of communications, and, apart from building materials, sulphur and salt, the actual output is insignificant. Manufactures are almost confined to the spinning of hemp, and the making of coarse cloth, porcelain, earthenware and cutlery. Brandy distilleries are numerous, and there is some trade in wood; but no local industry can rival agriculture and stock-breeding, which furnish the bulk of the exports. Albacete (pop. 1900, 21,512), the capital, and the other important towns of Almansa (11,180) and Hellín (12,558), are described under separate headings. Alcaraz, which gives its name to the mountain range already mentioned, is a picturesque old town with the ruins of a Moorish castle, and a fine Roman aqueduct; pop. (1900) 4501. Caudete (5913), Chinchilla, or Chinchilla de Monte-Aragon (6680), La Roda (7066), Tobarra (7787), Villarrobledo (10,125) and Yeste (6591) are important markets for the sale of agricultural produce. The railway from Madrid to Albacete passes south-westward to Chinchilla, where it bifurcates, one line going to Murcia, and the other to Alicante. A large part of the province is only accessible by road, and even the main highways maintained by the state are ill kept. Education is very backward even in the towns; many of the inhabitants carry arms; and crimes of violence are not infrequent.

ALBACETE, the capital of the above province, on the Madrid-Alicante railway, and at the confluence of the river Balazote with the canal of Maria Christina, which flows into the river Júcar, 16 m. N. Pop. (1900) 21,512. Albacete comprises the picturesque old upper town and the new or lower town, with law-courts, schools, barracks, hospitals, a council-hall, a bull-ring and other modern buildings, mostly erected after the city became a provincial capital in 1833. It is surrounded by a fertile plain, and has considerable trade in saffron and agricultural produce. A great market, chiefly for the sale of cattle, is held annually in September, and extends over several days. The manufacture of matches is aided by the existence of sulphur workings in the vicinity; and Albacete formerly had an extensive trade in cutlery, from which it was named the Sheffield of Spain. Despite the importation of cutlery from England and Germany, Albacete is still famous for its daggers, which are held in high repute by Spaniards. They are formidable weapons, of coarse manufacture, but with richly ornamented handles; and they frequently bear proverbial inscriptions suitable to their murderous appearance.

ALBA FUCENS (mod. *Albe*), an ancient Italian town occupying a lofty situation (3347 ft.) at the foot of the Monte Velino, 4 m. N. of Avezzano. It was originally a town of the Aequi, though on the frontier of the Marsi, but was occupied by a Roman colony (304 B.C.) owing to its strategic importance. It lay on a hill just to the north of the Via Valeria, which was probably prolonged beyond Tibur at this very period. In the Second Punic war Alba at first remained faithful, but afterwards refused to send contingents and was punished. After this it became a regular place of detention for important state prisoners, such as Syphax of Numidia, Perseus of Macedonia, Bituitus, king of the Arverni. It was attacked by the allies in the Social War, but remained faithful to Rome; and its strong position rendered it a place of some importance in the civil wars. Its prosperity, in the imperial period, can only be inferred from the number of inscriptions found there. It is chiefly remarkable for its finely preserved fortifications. The external walls, which have a circuit of about 2 m., are constructed of polygonal masonry; the blocks are carefully jointed, and the faces smoothed. With our present knowledge of such constructions, their date cannot certainly be determined. They are not preserved to any very considerable height; but the arrangement of the gates is clearly traceable; as a rule they come at the end of a long, straight stretch of wall, and are placed so as to leave the right side of any attacking force exposed. On the north there is, for a length of about 150 yds. a triple line of defences of later date (possibly added by the Roman colonists), inasmuch as both the city wall proper and the double wall thrown out in front of it are partly constructed of concrete, and faced with finer polygonal masonry (in which horizontal joints seem to be purposely avoided). A mile to the north of the city a huge mound with a ditch on each side of it (but at a considerable distance from it) may be traced for a couple of miles. Within the walls there are hardly any buildings of a later date. Excavations have only been made casually, though remains of buildings and of roads can be traced, and also an extensive system of underground passages perhaps connected with the defences of the place. The hill at the western extremity was occupied by a temple of the Tuscan order, into which was built the church of S. Pietro; this contains ancient columns, and some remarkably fine specimens of Cosmatesque work. It is the only monastic church in the Abruzzi in which the nave is separated from the aisles by ancient columns. The collegiate church of S. Nicola in the village contains a remarkable *staurotheca* of the 11th (?) century, and a wooden triptych in imitation of the Byzantine style with enamels of the 13th century.

A very good description of the site, with plans, is given by C. Promis, *L'Antichità di Alba Fucense* (Rome, 1836). (T. As.)

ALBA LONGA, an ancient city of Latium, situated on the western edge of the Albanus Lacus, about 12 m. S.E. of Rome. It was, according to tradition, founded by Ascanius, and was the oldest of all Latin cities—the mother indeed of Rome, by which, however, it was destroyed, it is said under Tullus Hostilius. By this act Rome succeeded to the hegemony of the Latin league. It has by many topographers been placed between the Albanus Mons and the Albanus Lacus, according to the indication given by Dionysius (i. 66), at the monastery of Palazzolo; but the position is quite unsuitable for an ancient city, and does not at all answer to Livy's description, *ab situ porrectae in dorso urbis Alba longa appellata*; and it is much more probable that its site is to be sought on the western side of the lake, where the modern Castel Gandolfo stands, immediately to the north of which the most important part of the archaic necropolis was situated. Confirmation of this may be found in Cicero's description (*Pro Milone*, 85) of the destruction of the shrines and sacred groves of Alba by the construction of Clodius's villa, in the local application of the adjective *Albanus*, and in the position of Castel Gandolfo itself, which exactly suits Livy's description. No traces of the ancient city, except of its necropolis, the tombs of which are overlaid with a stratum of peperino 3 ft. thick, are preserved. The view that the modern Albano occupies the site of Alba Longa was commonly held in the 15th and 16th centuries, but was disproved by P. Cluver (1624). But it is certain that no city took the place of Alba Longa until comparatively late times. The name *Albanum*, from about 150 B.C. till the time of Constantine, meant a villa in the Alban territory. The emperors formed a single estate out of a considerable part of this district, including apparently the whole of the lake, and Domitian was especially fond of residing here. The imperial villa occupied the site of the present Villa Barberini at Castel Gandolfo, and considerable remains of it still exist. To the south was a camp for the imperial bodyguard, with baths, an amphitheatre, a large water reservoir, &c. The first legion known to have been quartered there is the *II. Parthica*, founded by Septimius Severus; but it was probably constructed earlier. In some of the tombs of these legionaries coins of Maxentius have been found, while the *Liber Pontificalis* records that Constantine gave to the church of Albano "omnia scheneca deserta vel domos intra urbem Albanensem," which has generally been taken to refer to the abandoned camp. It was at this period, then, that the *civitas Albanensis* arose. The lapis Albanus is a green grey volcanic stone with black and white grains in it (hence the modern name, peperino), much used for building material.

See T. Ashby in *Journal of Philology*, xxvii., 1901, 37. (T. As.)

ALBAN, SAINT, usually styled the protomartyr of Britain, is said to have been born at Verulamium (the modern St Albans in Hertfordshire) towards the close of the 3rd century, and to have served for seven years in Rome in the army of the emperor Diocletian. On his return to Britain he settled at his native place and was put to death as a Christian during the persecution of Diocletian (*c.* 286–303). According to tradition, when peace was restored, great honours were paid to his tomb. A church was built on the spot, *c.* 793, by King Offa of Mercia. A monastery was subsequently added, and around it the present town of St Albans gradually grew up. Pope Adrian IV., who was born in the neighbourhood, conferred on the abbot of St Alban's the right of precedence over his fellow abbots, a right hitherto attached to the abbey of Glastonbury. St Alban is commemorated in the Roman martyrology on the 22nd of June; but it is impossible to determine with certainty whether he ever existed, as no mention of him occurs till the middle of the 6th century.

See U. Chevalier, *Répertoire des sources historiques* (1905), i. 95; D. Hardy, *Descriptive Catalogue* (1862), I. i. 3-34, ii. 688.

ALBANI, or ALBANO, **FRANCESCO** (1578–1660), Italian painter, was born at Bologna. His father was a silk merchant, and intended to bring up his son to the same occupation; but Albani was already, at the age of twelve, filled with so strong an inclination for painting, that on the death of his father he devoted himself entirely to art. His first master was Denis Calvert, with whom Guido Reni was at the same time a pupil. He was soon left by Calvert entirely to the care of Guido, and contracted with him a close friendship. He followed Guido to the school of the Caracci; but after this, owing to mutual rivalry, their friendship began gradually to cool. They kept up for a long time a keen competition, and their mutual emulation called forth some of their best productions. Notwithstanding this rivalry, they still spoke of each other with the highest esteem. Albani after having greatly improved himself in the school of the Caracci, went to Rome, where he opened an academy and resided for many years. Here he painted, after the designs of Annibal Caracci, the whole of the frescoes in the chapel of San Diego in the church of San Giacomo degli Spagnuoli. His best frescoes are those on mythological subjects, of which there is a large number in the Verospi, now Torlonia Palace. On the death of his wife he returned to Bologna, where he married a second time and resided till his death. His wife and children were very beautiful and served him for models. The learning displayed in the composition of his pictures, and their minute elaboration and exquisite finish, gave them great celebrity and entitle them to a distinctive place among the products of the Bolognese school. A number of his works are at Bologna, and others at Florence, the Louvre, Dresden and St Petersburg. Among the best of his sacred subjects are a "St Sebastian" and an "Assumption of the Virgin," both in the church of St Sebastian at Rome. He was among the first of the Italian painters to devote himself to the painting of cabinet pictures. A rare etching, the "Death of Dido," is attributed to him.

ALBANI, the stage name of MARIE LOUISE EMMA CECILE LAJEUNESSE (1847–), Canadian singer, who was born at Chambly, in the province of Quebec, on the 27th of September 1847. She made her first public appearance in Montreal, at the age of seven, and afterwards studied in the United States, Paris and Italy. In 1870 she made her first appearance at Messina, and after two successful seasons appeared in London in 1872 with the Royal Italian Opera. Later she abandoned opera for oratorio, and sang at all the principal festivals. She has made several tours of Canada and of the United States, and in 1886 sang at the opening of the Colonial and Indian Exhibition in London the ode written by Tennyson for the occasion. She frequently sang before Queen Victoria, the German emperor and others of the crowned heads of Europe, and received numerous marks of their esteem. In 1897 she was awarded the gold Beethoven medal by the London Philharmonic Society, "as a mark of appreciation of her exceptional genius and musical attainments, and of her generous and artistic nature." She married in 1878 Ernest Gye, the theatrical manager. Her stage name of Madame Albani was taken from that of an extinct Italian family.

See Morgan, *Canadian Men and Women of the Time* (1898).

ALBANIA, the ancient name of a district in the eastern Caucasus, consisting, according to Strabo (xi. 4. 1-8), of the valley of the Cyrus (Kur) and the land lying between it and the Caucasus range from Iberia to the Caspian Sea, *i. e.* the modern Shirvan. In reality the Albani inhabited also the mountain valleys and the land to the north towards Sarmatia, the modern Daghestan (Pliny vi. 39). Dionysius of Halicarnassus quotes a tradition that the name arose from the alleged fact that the people were the descendants of emigrants from Alba in Italy, but it would seem that the race was of Lesghian (not Georgian) descent. Strabo describes them as tall, well made, and in character simple and honest; he says that payment was in kind and that the people could not count beyond a hundred. They worshipped the sun, and more particularly the moon, the latter being perhaps identical with the great Nature Goddess of Asia Minor (see GREAT MOTHER OF THE GODS), and believed in soothsaying and the virtue of human sacrifice. Old age was held in high honour, but it was sacrilege to speak, or even to think, of the dead. The race was nomadic, and lived on the abundant natural fruits of the land. In Strabo's time they appear to have been ruled by a single king, though previously there were twenty-six, each one ruling over a community distinct only in point of language. The Albani became known to the Romans during Pompey's pursuit of Mithradates the Great (65 B.C.), against which they are said to have opposed a force of 60,000 foot and 20,000 cavalry. Pompey exacted from them a nominal submission, but their independence was not seriously affected by the Romans. In the reign of Hadrian their territory was invaded by the Alani (Th. Mommsen, *Provinces of the Roman Empire*, Eng. trans., 1886), and later they fell under the Sassanid rule. They were driven finally into Armenia by the Khazars, and ceased to exist as a separate people. The district subsequently suffered under the successive invasions of Huns, Varangians (who captured the chief town Barda in the 10th century) and Mongols. (See CAUCASIA, *History*; ARMENIA.)

ALBANIA, a portion of the Turkish empire extending along the western littoral of the Balkan Peninsula from the southern frontier of Montenegro to the northern confines of Greece. Albania is perhaps the least-known region in Europe; and though more than a hundred years have passed since Gibbon described it as "a country within sight of Italy, which is less known than the interior of America," but little progress has yet been made towards a scientific knowledge of this interesting land and its inhabitants. The wild and inaccessible character of the country, the fierce and lawless disposition of the people, the difficulties presented by their language and their complex social institutions, and the inability of the Turkish authorities to afford a safe conduct in the remoter districts, combine to render Albania almost unknown to the foreign traveller, and many of its geographical problems still remain unsolved. A portion of the Mirdite region, the Mat district, the neighbourhood of Dibra, Jakova and Ipek and other localities have never been thoroughly explored. The northern boundary of Albania underwent some alteration in consequence of the enlargement of Montenegro, sanctioned by the Berlin Treaty (July 13, 1878); owing to subsequent arrangements providing for the cession of Dulcigno to Montenegro (November 25, 1880) in exchange for the districts of Plava and Gusinye, restored to Turkey, the frontier-line (finally settled December 1884) now ascends the Boyana from its mouth to Lake Sass (Shas), thence passes northward, and crossing Lake Scutari separates the district of Kutch Kraïna on the N. from the territories of the Gruda, Hot and Klement tribes on the S.; leaving Gusinye and Plava to the S.E., it turns to the N.W. on reaching the Mokra Planina, and then follows the course of the Tara river. On the S., Albanian territory was curtailed owing to the acquisition of the Arta district by Greece (May 1881), the river Arta now forming the frontier. On the E. the chains of Shar, Grammos and Pindus constitute a kind of natural boundary, which does not, however, coincide with ethnical limits nor with the Turkish administrative divisions. North-eastern Albania forms part of the Turkish vilayet of Kossovo; the northern highlands are included in the vilayet of Shkodra (Scutari), the eastern portion of central Albania belongs to the vilayet of Monastir, and the southern districts are comprised in the vilayet of Iannina. The boundaries of the three last-named vilayets meet near Elbassan. The name Albania (in the Tosk dialect *Arberia*, in the Gheg *Arbenia*), like Albania in the Caucasus, Armenia, Albany in Britain, and Auvergne (*Arvenia*) in France, is probably connected with the root *alb*, *alp*, and signifies "the white or snowy uplands."

Physical Features.—The mountain system is extremely complex, especially that of the northern region. On the E. the great Shar range, extending in a south-westerly direction from the neighbourhood of Prishtina to that of Dibra, is continued towards the S. by the ranges of Grammos and Pindus; the entire chain, a prolongation of the Alpine systems of Bosnia and Dalmatia, may be described as the backbone of the peninsula; it forms the watershed between the Aegean and the Adriatic, and culminates in the lofty peak of Liubotrn, near Kalkandele, one of the highest summits in south-eastern Europe (8858 ft.). The country to the west of this natural barrier may be divided geographically into three districts—northern, central and southern Albania. The river Shkumb separates the northern from the central district, the Viossa the central from the southern. The highland region of northern Albania is divided into two portions by the lower course of the Drin; the mountains of the northern portion, the Bieska Malziis, extend in a confused and broken series of ridges from Scutari to the valleys of the Ibar and White Drin; they comprise the rocky group of the Prokletia, or Accursed Mountains, with their numerous ramifications, including Mount Velechik, inhabited by the Kastrat and Shkrel tribes, Bukovik by the Hot, Golesh by the Klement, Skulsen (7533 ft.), Baba Vrkh (about 7306 ft.), Maranay near Scutari, and the Bastrik range to the east. South of the Drin is another complex mountain system, including the highlands inhabited by the Mirdites and the Mat tribe; among the principal summits are Deia Mazzuklit, Mal-i Vels, Kraba, Toli and Mnela. Central Albania differs from the northern and southern regions in the more undulating and less rugged character of its surface; it contains considerable lowland tracts, such as the wide and fertile plain of Musseki, traversed by the river Simen. The principal summit is Tomor (7916 ft.), overhanging the town of Berat. Southern Albania, again, is almost wholly mountainous, with the exception of the plains of Iannina and Arta; the most noteworthy feature is the rugged range of the Tchika, or Khimara mountains, which skirt the sea-coast from south-west to north-east, terminating in the lofty promontory of Glossa (ancient *Acroceraunia*). Farther inland the Mishkeli range to the north-east of Lake Iannina and the Nemertzika mountains run in a parallel direction. In the extreme south, beyond the basin of the Kalamas, the mountains of Suli and Olyzika form a separate group. The rivers, as a rule, flow from east to west; owing to the rapidity of their descent none are navigable except the Boyana and Arta in their lower courses. The principal rivers are the Boyana, issuing from Lake Scutari, and consequently regarded as a continuation of the Montenegrin Moratcha, the Drin, formed by the confluence of the White and Black Drin, which, flowing respectively to the south and north through a long valley at the foot of the Shar range, take a westerly direction after their junction, the Matia, the Arzen, the Shkumb (ancient *Genusos*), the Simen (*Apsos*), formed by the junction of the Devol and Ergene, the Viossa (*Aöus*), which owing to the trend of the Khimara range takes a north-westerly direction, the Kalamas (*Thyamis*) and the Arta (*Arachthos*), flowing south into the Ambracian Gulf. A portion of the stream of the Drin has found its way into the Boyana channel; the result has been a rise in the level of Lake Scutari and the inundation of the adjacent lowlands. A proposal to confine the Drin to its former course by means of a dyke, and to ease the downflow of the Boyana by a canal opening navigation to Lake Scutari, has long been considered by the Turkish authorities. The great lakes of Scutari (135 sq. m.) and Ochrida (107 sq. m.) are among the most beautiful in Europe; the waters of Ochrida, which find an outlet in the Black Drin, are of marvellous clearness. Lake Malik, south by east of Ochrida, is drained by the Devol. The waters of the picturesque Lake Iannina (24 sq. m.) find an issue by *katabothra*, or underground channels, into the Ambracian Gulf. The lake of Butrinto (Buthrotum) is near the sea-coast opposite Corfu.

Climate.—The climate is healthy in the uplands, though subject to violent changes; in the valleys fever is very prevalent, especially in the basins of the Boyana, the lower Drin and the Simen. The winter is short, but exceedingly cold; snow remains on the Prokletia and other mountains till August, and sometimes throughout the year. The summer temperature in the plains is that of southern Italy; in the mountain districts it is high during the day, but falls almost to freezing-point at night. The sea-coast is exposed to the fierce *bora*, or north wind, during the spring.

Natural Products.—The mountains of Albania are said to be rich in minerals, but this source of wealth remains practically unexplored. Iron and coal are probably abundant, and silver-lead, copper and antimony are believed to exist. Gold mines were worked in antiquity in the Drin valley, and silver mines in the Mirdite region were known to the Venetians in the middle ages. At Selinitza, near Avlona, there is a remarkable deposit of mineral pitch which was extensively worked in Roman times; mining operations are still carried on here, but in a somewhat primitive fashion. The splendid forests, of which there are 70,000 acres in the vilayet of Scutari alone, are undergoing a rapid process of destruction, as in other lands under Turkish rule. The principal trees are the oak, the valonia oak, the beech, ash, elm, plane, celtis, poplar and walnut, which give way in the higher regions to the pine and fir. The oak forests near Dibra, where charcoal-making is a considerable industry, and the beech-woods of the Prishtina district, are especially remarkable. The sumach is largely grown in the Mirdite district; its leaves are exported to Trieste for use in tanneries and dyeworks. In 1898 the export of valonia was estimated at £11,200, of sumach at £2400. Of fruit-trees the white mulberry, cherry and wild pear are plentiful; the chestnut and walnut are sometimes met with, and the olive is grown in the lowland and maritime districts. The exportation of olive oil in 1898 was valued at £24,000. The greater part of the country is admirably suited to viticulture, and wine of tolerable quality is produced. Tobacco is grown extensively in southern Albania, especially near Berat and in the upper valley of the Viossa, but the quantity exported is small. The means of subsistence are mainly provided by the cultivation of grain and cattle-rearing. Notwithstanding the primitive condition of agriculture, the deficiency of communications and the damage caused by frequent inundations, Albania furnishes almost the entire corn supply of the Dalmatian coast and islands. Maize is the favourite grain for home consumption, but considerable quantities of this cereal, as well as barley, rye and oats are exported. The total export of cereals in 1898 was valued at £70,800. Sheep and goats form almost the only wealth of the mountaineers of northern Albania; large cattle are found only on the plains. The slopes of Pindus afford excellent pasture for the flocks of the Vlach shepherds. The export of raw hides and wool is considerable; in 1898 these commodities were valued respectively at £90,400 and £24,000. The lakes and rivers of Albania abound in fish. The *scoranze* (Alb. *seraga*), a kind of sardine, is taken in great quantities in Lake Scutari; it is salted and smoked for home consumption and exportation. Sea-fishing is almost wholly neglected. There are salines at Avlona and other places on the coast.

Commerce and Industries.—The exports in 1898 were estimated at £480,000, the imports at £1,360,000, the former comprising agricultural produce, live stock, hides, wool, cheese, eggs, poultry, olive oil, valonia, sumach leaves, timber, skins of wild animals, silk, tobacco and salted fish, the latter manufactured articles, cloth, hardware, furniture, firearms, gunpowder, sugar, coffee, &c. The monopoly of Albanian commerce formerly possessed by Venice has descended to Austria-Hungary; the trade with other countries, except Italy, is inconsiderable. Owing to the poverty of the people, cheap Austrian goods find a readier sale than the more expensive and solid British manufactures. The maritime traffic is largely conducted by the steamers of the subsidized Austrian-Lloyd company, Trieste being the principal commercial centre; the coasting trade is carried on by small Greek and Turkish sailing vessels. The trade of the northern and western districts has to some extent been diverted to Salonica since the opening of the railways from that town to Mitrovitza and Monastir. The development of commerce is retarded by lack of communications; the country possesses no railways and few roads. Several railway lines have been projected, but there is no great probability of their construction under existing political conditions. The Via Egnatia, the great Roman highway to the east, is still used; it runs from Durazzo (*Dyrrhachium*) to Elbassan and Ochrida. Iannina is connected by carriage-roads with Monastir, Agii Saranta and Preveza. As a rule, however, bridle-paths supply the only means of communication. The native industries are inconsiderable, and many of them are in a languishing condition. The manufacture of highly ornate firearms, yataghans and other weapons at Scutari, Jakova and Prizren has declined, owing to the importation of modern rifles and revolvers. Gold and silk embroidery, filigree work, morocco and richly-braided jackets are produced for home use and for sale in Bosnia, Macedonia and Montenegro.

Population.—The population of Albania may be estimated at between 1,600,000 and 1,500,000, of whom 1,200,000 or 1,100,000 are Albanians. Of the other races the Slavs (Serbs and Bulgars) are the most numerous, possibly numbering 250,000. Servian settlements exist in various parts of northern Albania; there is a strong Bulgarian colony in the neighbourhood of Dibra and Ochrida; farther south, Mount Zygos and the Pindus range—the "Great Walachia" of the middle ages—are inhabited by Vlachs or Tzintzars, who possibly number 70,000. Some Turkish colonies are also found in the south-eastern districts. There is a considerable Greek-speaking population in Epiros (including many Mahommedan Albanians), which must, however, be distinguished from the genuine Greeks of Iannina, Preveza and the extreme south; these may be estimated at 100,000. The population of the vilayet of Scutari is given as 237,000, that of the vilayet of Iannina as 552,000. The principal towns are Scutari (Albanian *Shkoder*, with the definite article *Shkodr-a*), the capital of the vilayet of that name, pop. 32,000; Prizren, 30,000; Iannina (often incorrectly written *Ioannina*), capital of the southern vilayet, 22,000; Jakova, 12,000; Dibra, 15,000; Prishtina, 11,000; Ipek (Slav. *Petch*), 15,000; Berat, 15,000; Ochrida, 11,000; Tirana, 12,000; Argyrokastro, 11,000; Kortcha (Slav. *Goritza*), 10,000; Elbassan (perhaps ancient *Albanopolis*), 8000; Metzovo, 7500; Preveza, 6500; Avlona, 6000; Durazzo, 5000; Parga, 5000; Butrinto, 2000; and Kroïa, the ancient fortress of Scanderbeg, 5000. All these, except Elbassan, Metzovo and Kroïa, are described in separate articles.

The Albanians are apparently the most ancient race in south-eastern Europe. History and legend afford no record of their arrival in the Balkan Peninsula. They are probably the descendants of the earliest Aryan immigrants, who were represented in historical times by the kindred Illyrians, Macedonians and Epirots; the Macedonians and Epirots are believed by Hahn to have formed the core of the pre-Hellenic Tyrrheno-Pelasgian population which inhabited the southern portion of the peninsula and extended its limits to Thrace and Italy. The Illyrians were also "Pelasgian," but in a wider sense. Of these cognate races, which are described by the Greek writers as barbarous or non-Hellenic, the Illyrians and Epirots, he thinks, were respectively the progenitors of the *Ghegs*, or northern, and the *Tosks*, or southern, Albanians. The Via Egnatia, which Strabo (vii. fragment 3) describes as forming the boundary between the Illyrians and Epirots, practically corresponds with the course of the Shkumb, which now separates the Ghegs and the Tosks. The same geographer (v. 2. 221) states that the Epirots were also called Pelasgians; the Pelasgian Zeus was worshipped at Dodona (Homer, *Il.* xvi. 234), and the neighbourhood of the sanctuary was called Pelasgia (Herodotus ii. 56). The meaning of the term "Pelasgian" is, however, too obscure to furnish a basis for ethnographical speculation; in the time of Herodotus it may have already come to denote a period rather than a race. The name *Tosk* is possibly identical with *Tuscus*, *Etruscus*, while the form *Tyrrhenus* perhaps survives in Tirana. The large number of Slavonic local names in Albania, even in districts where no trace of a Slavonic population exists, bears witness to the extensive Servian and Bulgarian immigrations in the early middle ages, but the original inhabitants gradually ousted or assimilated the invaders. The determination with which this remarkable race has maintained its mountain stronghold through a long series of ages has hitherto met with scant appreciation in the outside world. While the heroism of the Montenegrins has been lauded by writers of all countries, the Albanians—if we except Byron's eulogy of the Suloits—still remain unsung. Not less noticeable is the tenacity with which isolated fragments of the nation have preserved their peculiar characteristics, language, customs and traditions. The Albanians in Greece and Italy, though separated for six centuries from the parent stock, have not yet been absorbed by the surrounding populations.

The Albanians, both Ghegs and Tosks, call themselves *Shküpetar*, and their land *Shküpenia* or *Shküperia*, the former being the Gheg, the latter the Tosk form of the word. *Shküpetar* has been variously interpreted. According to Hahn it is a participial from *shkyipoij*, "I understand," signifying "he who knows" the native language; others interpret it with less probability as "the rock-dweller," from *shkep*, *shkip*, N. Alb. *shkamp*, "rock." The designations *Arber* (Gr. 'Αρβανίτης, Turk. *Arnaout*), denoting the people, and *Arbenia* or *Arberia*, the land, are also, though less frequently, used by the Albanians. A district near Kroïa is locally known as Arbenia; the Tosk form *Arberia* strictly applies only to the mountain region near Avlona. The region inhabited by a more or less homogeneous Albanian population may be roughly marked out by a line drawn from the Montenegrin frontier at Berane to Mitrovitza and the Servian frontier near Vranya; thence to Usküb, Prilep, Monastir, Florina, Kastoria, Iannina and Parga. These limits, however, are far from including all the members of a widely scattered race. The Albanians in Greece, whose settlements extend over Attica, Boeotia, the district of Corinth and the Argolid peninsula, as well as southern Euboea and the islands of Hydra, Spetzae, Poros and Salamis, descend from Tosk immigrants in the 14th century. They played a brilliant part in the War of Independence (1821–1829), and to-day supply the Greek army with its best soldiers. They were estimated by Leake at 200,000. A large number still speak the Albanian language; many of the older men, and a considerable proportion of the women, even in the neighbourhood of Athens, are ignorant of Greek. The Albanian settlements in southern Italy and Sicily were founded in 1444, 1464 and 1468; minor immigrations followed in the three succeeding centuries. In southern Italy there are 72 Albanian communes, with 154,674 inhabitants; in Sicily 7 communes, with 52,141 inhabitants. The Italian and Sicilian Albanians are of Tosk descent, and many of them still speak a variation of the Tosk dialect. There are also several Albanian settlements in European Turkey and Asia Minor, some founded by military colonists who received grants of land from successive sultans, others owing their origin to enforced migrations after insurrections in Albania. The only genuine division of the Albanian race is that of Ghegs and Tosks; the Liaps, who inhabit the district between the Viossa and the sea, and the Tshăms or Chăms, who occupy the coast-land south of the Kalamas, are subdivisions of the Tosk family. The name Gheg (*Gĕgĕ-a*) is not adopted by the Ghegs themselves, being regarded as a nickname; the designation Tosk (*Toskĕ-a*) is restricted by the Tosks to the inhabitants of a small region north of the lower Viossa (Toskería).

National Characteristics.—While the other primitive populations of the peninsula were either hellenized or latinized, or subsequently absorbed by the Slavonic immigration, the Albanians to a great extent remained unaffected by foreign influences. Retaining their original language and preserving the customs and institutions of remote antiquity, they present a distinct type, and differ in many essential particulars from the other nations of the peninsula. The Ghegs especially, notwithstanding their fierce and lawless character, their superstition, ignorance and predatory propensities, possess some noteworthy qualities rarely found in eastern Europe: simple, brave, faithful, and sometimes capable of devoted attachment, these wild mountaineers make excellent soldiers and trustworthy retainers; they have long furnished a bodyguard to the sultan and, like the Tosks, are much employed as kavasses and attendants at foreign embassies and consulates in the East. The native disposition of the Tosks has been modified by intercourse with the Greeks and Vlachs; while the Gheg devotes his attention exclusively to fighting, robbery and pastoral pursuits, the Tosk occasionally occupies himself with commercial, industrial or agricultural employments; the Gheg is stern, morose and haughty, the Tosk lively, talkative and affable. The natural antipathy between the two sections of the race, though less evident than in former times, is far from extinct. In all parts of Albania the vendetta (*gyăk, jăk*) or blood-feud, the primitive *lex talionis*, is an established usage; the duty of revenge is a sacred tradition handed down to successive generations in the family, the village and the tribe. A single case of homicide often leads to a series of similar crimes or to protracted warfare between neighbouring families and communities; the murderer, as a rule, takes refuge in the mountains from the avenger of blood, or remains for years shut up in his house. It is estimated that in consequence of these feuds scarcely 75% of the population in certain mountainous districts die a natural death. A truce (*bessa*, literally "faith," "pledge"), either temporary or permanent, is sometimes arranged by mediation, or among the Ghegs, by the intervention of the clergy; a general *bessa* has occasionally been proclaimed by special iradé of the sultan, the restoration of peace being celebrated with elaborate ceremonies. So stringent are the obligations of hospitality that a household is bound to exact reparation for any injury done to a guest as though he were a member of the family. No traveller can venture into the mountain districts without the *bessa* of one of the inhabitants; once this has been obtained he will be hospitably welcomed. In some districts there is a fixed price of blood; at Argyrokastro, for instance, the compensation paid by the homicide to the relatives of his victim is 1200 piastres (about £10), at Khimara 2000 piastres; once the debt has been acquitted amicable relations are restored. Notwithstanding their complete subjection, women are treated with a certain respect, and are often employed as intermediaries in the settlement of feuds; a woman may traverse a hostile district without fear of injury, and her *bessa* will protect the traveller or the stranger. Women accompany their male relatives to the battlefield for the purpose of tending the wounded and carrying away the dead. The bride brings no dowry to her husband; she is purchased at a stipulated price, and earnest-money is paid at the betrothal, which usually takes place while the contracting parties are still children. It is customary for young men who are attached to each other to swear eternal brotherhood (compare the Slavonic *pobratimstvo*); the contract is regarded as sacred, and no instance has been known of its violation. The costume of the Tosks differs from that of the Ghegs; its distinctive feature is the white plaited linen fustanella or petticoat, which has been adopted by the Greeks; the Ghegs wear trews of white or crimson native cloth adorned with black braid, and a short, close-fitting jacket, which in the case of wealthy persons is embellished with gold lace. The fez is worn by both races, and in the northern highlands yataghans and firearms are almost invariably carried. The costume of the Mirdite and Mat tribes is peculiar. It consists of a white felt cap, a long white tunic bound with a red girdle, white linen trousers and opinki, or sandals.

Tribal System.—The tribal organization in northern Albania is an interesting survival of the earliest form of social combination; it may be compared in many respects with that which existed in the Scottish highlands in the time of the Stuart kings. The practical autonomy which the Gheg mountaineers enjoy has been won by a prolonged and successful resistance to Turkish domination; as a rule they pay no taxes, they are exempt from the conscription, they know nothing of the Ottoman law, and the few Turkish officials established amongst them possess no real authority. Their only obligation to the Turkish government is to furnish a contingent in time of war; the only law they recognize is either traditional custom(*adĕt*) or the unwritten *Kanun-i Leks Dukajinit*, a civil and criminal code, so called from its author, Leka Dukajini, who is supposed to have lived in the 13th or 14th century. The tribe or *mal* ("mountain") is often composed of several clans (*phis-i, phárea*)or *baryaks* (literally "standards") each under a chief or *baryaktar* (standard-bearer), who is, strictly speaking, a military leader; there are in each clan a certain number of elders or voïvodes (Albanian *kru-ye*, pl. *krene-te*) who form a council and, like the baryaktar, hold their office by hereditary right; they preside over the assemblies of the tribesmen, which exercise the supreme legislative power. The clan is generally subdivided into smaller communities (*mahale*), each administered by a local notable or *jobar*. The jobars superintend the execution of the laws, collect fines and administer capital punishment; they are in contact with the *buluk-bashi*, or resident representative of the tribe at Scutari, who forms the only link between the mountaineers and the Turkish government. He communicates to the tribesmen the orders of the vali, which must be framed in accordance with their customs and institutions. The tribes of northern Albania, or Ghegería, may be classified in seven groups as follows:—(1) The Mirdites, who inhabit the alpine region around Orosh to the south-east of Scutari—the most important of all in respect of numbers (about 17,000) and political independence. A Roman Catholic tribe, occupying an inaccessible district, they have hitherto defeated every effort of the Turks to encroach on their autonomy. Their hereditary chiefs, or *capidans*, belong to the family known as *Dera e Jon Markut* (the house of John Marco), which has ruled for 200 years and is supposed to be descended from Scanderbeg. In 1868 the reigning chief, Bib Doda, died, and his son and successor Prenk was detained as a hostage by the Turks. The Mirdites consequently refused to contribute their customary contingent to the Turkish army, and eventually Prenk was restored. His ambiguous conduct, however, led to the despatch of two expeditions against the Mirdites and the devastation of their territory. In 1880 Prenk was kidnapped by the Turkish authorities and exiled to Anatolia; another member of the ruling family was appointed kaimakam, but the Mirdites refused to obey him, and their district has ever since been in a state of anarchy. No Moslem is allowed to remain in Mirdite territory. (2) The Mi-shkodrak (Upper Scutari) group or confederation, also known as the Malsia-Madhé (Great Highlands), is composed of the Klement, Grud-a, Hot, Kastrat and Shkrel tribes, which occupy the mountainous district north-east of Scutari. Owing to the proximity of the capital this group is comparatively subject to the Turkish power, and pays a small annual tribute; the chiefs, who assess and collect the tribute, form a kind of administrative council; the confederation has also an official representative council at Scutari, called the *Jibal*, under the presidency of a *Serkardê* or Moslem official. (3) The Dukajin, whose territory lies between that of the last-named group and the district of Jakova, include the Pulati, Shalla, Shoshi and other tribes; they are more independent and more savage than the Mi-shkodrak, and have never paid tribute from time immemorial. (4) The Puka group, known as "the Seven Baryaks of Puka," dwell on the south side of the river Drin; they are nominally administered by a Turkish kaimakam, who is a mere spectator of their proceedings. (5) The Malsia Jakovs, a group of two Catholic and three Moslem tribes, extend in the direction of Jakova, where they maintain an official representative; they are entirely exempt from taxation. (6,7) The Malsia-Lezhs, who occupy the Alessio highlands, and the Malsia Krues, who inhabit the region north of Kroïa, live in a state of extreme poverty and pay no tribute; the Malsia Krues are much addicted to brigandage. To these seven groups, which are included under the general appellation of *Malissori*, or "highlanders," may be added the Malsia of Dibra, who extend to the west and north of that town, and form a large separate group; they are notorious for their fierce lawless character, and maintain themselves by plundering the Bulgarian peasants in their neighbourhood. In general the attitude of the Albanians in the north-eastern districts towards the Slavonic peasantry may be compared with that of the Kurds towards the Armenians. In the region east of Kroïa the Mat tribe, which occupies the upper valley of the Matia, presents an entirely different organization; their district is governed by four wealthy families, possessing hereditary rank and influence. Towards the south the tribal organization becomes looser and is gradually supplanted by a kind of feudal system; among the powerful aristocratic houses may be mentioned the Vliores at Avlona, who are stated to own over 150 sq. m. of land, and the Toptans at Tirana. The principal landowners, who reside in fortified houses, are all Moslems; their estates are cultivated on the *mêtayer* system. Since the time of Ali Pasha, who broke the power of the local chieftains, southern Albania has been subject to the central Turkish power; before that period the mountaineers of Suli and Khimara enjoyed an independence similar to that of the Gheg tribes.

Religions.—The great majority of the Albanians, probably more than three-fifths, are Moslems. The conversion of the Christian population to Islam appears to have taken place during the 16th and 17th centuries. Like the Cretan Moslems and the Bulgarian Pomaks, the Albanian Mahommedans retain many Christian traditions and customs; it is said that many thousands of them secretly adhere to their original faith. In the vilayet of Scutari they form about 55% of the population; central Albania is almost entirely Moslem; in southern Albania, however, there is a considerable Christian population, whose limits practically coincide with those of the Greek-speaking districts. Of the Christian population (about 600,000), some 110,000 are Roman Catholic Ghegs, some 90,000 are Orthodox Tosks, and some 400,000 are Orthodox Slavs, Greeks and Vlachs. The Roman Catholic Ghegs appear to have abandoned the Eastern for the Western Church in the middle of the 13th century. Their bishops and priests, who wear the moustache in deference to popular prejudice, are typical specimens of the church militant. Some of the Gheg tribes, such as the Puka, Malsia Jakovs and Malsia Krues, are partly Roman Catholic, partly Moslem; among fellow-tribesmen the difference of religion counts for little. The Mirdites are exclusively Roman Catholic, the Mat-i exclusively Moslem. At the head of the Roman Catholic hierarchy are the archbishops of Scutari (with three suffragans), Prizren and Durazzo; the mitred abbot of St Alexander is the spiritual chief of the Mirdites. The Orthodox Church has metropolitans at Prizren, Durazzo, Berat, Iannina and Kortcha; the Bulgarian exarchate maintains a bishop at Dibra. Of the Albanians in Sicily the great majority (44,791) remain faithful to the Greek Church; in Italy 116,482 follow the Latin ritual, and 38,192 the Greek. All the Albanians in Greece belong to the Orthodox Church.

Education.—Education is almost non-existent, and the vast majority of the population, both Christian and Moslem, are totally illiterate. Instruction in the Albanian language is prohibited by the Turkish government for political reasons; a single exception has been made in the case of an American school for girls at Kortcha. There are Turkish primary and secondary schools in some of the towns; in the village mosques instruction in the Koran is given by the *imāms*, but neither reading nor writing is taught. The aristocratic Moslem families send their sons to be educated in Constantinople or Vienna. At Scutari a college and a seminary are maintained by the Jesuits, with the aid of the Austrian government; the Franciscans have several primary schools, and three lay schools are supported by the Italian government; in all these institutions Italian is the language of instruction. There are two Servian seminaries at Prizren. In southern Albania there are Greek schools in the towns and a large Greek gymnasium at Iannina. The priests of the Greek Church, on whom the rural population depend for instruction, are often deplorably ignorant. The merchant families of Iannina are well educated; the dialect spoken in that town is the purest specimen of colloquial Greek.

Language.—Albanian is peculiarly interesting as the only surviving representative of the so-called Thraco-Illyrian group of languages which formed the primitive speech of the peninsula. It has afforded an attractive study to philologists, amongst whom may be mentioned Malte-Brun, Leake, Xylander, Hahn, Miklosich and G. Meyer. The analysis of the language presents great difficulties, as, owing to the absence of literary monuments, no certainty can be arrived at with regard to its earlier forms and later development. The groundwork, so far as it can be ascertained, and the grammar are Indo-European, but a large number of words have been borrowed from the Latin or Italian and Greek, and it is not always easy to decide whether the mutilated and curtailed forms now in use represent adopted words or belong to the original vocabulary. There is also a considerable admixture of Turkish and Slavonic words. Notwithstanding certain points of resemblance in structure and phonetics, Albanian is entirely distinct from the neighbouring languages; in its relation to early Latin and Greek it may be regarded as a co-ordinate member of the Aryan stock. It possesses seven vowels; among the consonants are the aspirated *d* and *t*, as in Greek, and many other sounds, such as *b*, *d*, *sh*, *zh* (French *j*), and hard *g*, which are wanting in Greek, but exist in the Slavonic languages. There are three declensions, each with a definite and indefinite form; the genitive, dative and ablative are usually represented by a single termination; the vocative is formed by a final *o*, as *memmo* from *memme*, "mother." The neuter gender is absent. There are two conjugations; the passive formation, now wanting in most Indo-European languages, has been retained, as in Greek; thus *kerko-iy*, "I seek," forms *kerko-n-em*, "I am sought." The infinitive is not found; as in Greek, Rumanian and Bulgarian, it is replaced by the subjunctive with a particle. The two auxiliary verbs are *kăm*, "I have," and *yăm*, "I am." An interesting and characteristic feature of the language is the definite article, which is attached to the end of the word: *e.g. mik* ("friend," *amicus*), *mik-u* ("the friend"); *kien* ("dog"), *kien-i; Shkumb*, *Shkumb-i.* The suffix-article likewise appears in Rumanian and Bulgarian, but in no other Latin or Slavonic language; it is in each case a form of the demonstrative pronoun. Another remarkable analogy between the Albanian and the neighbouring languages is found in the formation of the future; the Albanian *do* (3rd pers. sing. of *dova*, "I will"), like the Greek *θὰ*, is prefixed without change to all persons of the verb: a similar usage in Servian and Bulgarian, as well as in Rumanian (especially the Macedonian dialect), is peculiar to these languages in the Slavonic and Latin groups. These and other points of similarity, possibly only accidental, have led to the conjecture that the primitive Illyrian language may have exerted some kind of influence on the other idioms of the peninsula. In the absence of literary culture the Albanian dialects, as might be expected, are widely divergent; the limits of the two principal dialects correspond with the racial boundaries of the Ghegs and Tosks, who understand each other with difficulty; the Albanians in Greece and Italy have also separate dialects. In writing Albanian the Latin character is employed by the Ghegs, the Greek by the Tosks; neither alphabet suffices to represent the manifold sounds of the language, and various supplementary letters or distinguishing signs are necessary. In the use of these no uniform system has yet been adopted. An alphabet of fifty-two letters, some presenting ancient Phoenician and Cretan forms, was found by Hahn in partial use at Elbassan and Tirana; its antiquity, however, has not been established. The Tosks generally use the Greek language for written communications. The native folklore and poetry of the Albanians can hardly compare with that of the neighbouring nations in originality and beauty. The earliest printed works in Albanian are those of the Catholic missionaries; the first book containing specimens of the language was the *Dictionarium Latino-Epiroticum* of Bianchi, printed in 1635. The literature of the last two centuries consists mainly of translations and religious works written by ecclesiastics, some of whom were natives of the Albanian colonies in Italy. The most noteworthy Albanian writer was Girolamo di Rada (b. 1815), a poet, philologist and collector of national folklore. Among his successors may be mentioned Vincenzo Dorsa and Demetrio Camarda.

Antiquities.—Albania abounds in ancient remains, which as yet have been little explored. Fragments of "Cyclopean" structures were discovered by Hahn at Kretzunista, Arinista, and other sites in the district of Argyrokastro; the walls, partly "Cyclopean," of an ancient city (perhaps *Bullis*) are visible at Gradisti on the Viossa. Masonry of this type, however, occurring in Illyria and Dalmatia (*e.g.* at Spalato and on the island of Lesina) has been shown by modern archaeologists to belong to the Roman period. In general, the remains of the classical epoch attest the influence of Roman rather than of Greek civilization. At Pollina, the ancient *Apollonia*, are the remnants of a Doric temple, of which a single column is still standing. A little north of Preveza are the considerable ruins of Nikopolis, founded by Octavian to commemorate the victory of Actium. At Khimara (anc. *Chimaera*) the remains of an old Greek city may still be seen; at Santi Quaranta (anc. *Onchesmos*) the walls and towers of a later town are in good preservation. Few traces remain of the once celebrated Dyrrhachium. The ruins of Pandosia, Ephyra, Elatea, Phoeniké, Buthrotum, Akrolissos and other towns may be identified. The most important and interesting remains, however, are those of Dodona (*q.v.*). Of the medieval ruins those of Kroïa, the stronghold of Scanderbeg, are the most interesting.

Medieval History.—After the division of the Roman empire, the lands inhabited by the Albanian race became provinces of the Byzantine empire; northern Albania from Scutari to Berat formed the *thema* or province of Dyrrachium (*Durazzo*, Albanian *Dourtz*), southern Albania and Epirus the *thema* of Nikopolis. The country was overrun by the Goths in the 4th and 5th centuries, but reconquered by Justinian in 535. In 640 northern Albania was invaded by the Serbo-Croats; it continued with interruptions under Servian rule till 1360. In 861 the Bulgarians conquered the southern portion of the country and Epirus as far as Khimara; under their powerful tsar Simeon (893–927), who defeated the Servians, they established their rule on the Adriatic littoral, except at Durazzo, which remained Byzantine, and colonized these regions in great numbers. A new Bulgarian dynasty, that of Shishman, was founded at Ochrida after the death of Simeon. Shishman's son Samuel (976–1014) captured Durazzo; he extended his sway over a great part of the Balkan Peninsula, but was eventually defeated in 1014 by the emperor Basil II., who put out the eyes of 15,000 Bulgarian prisoners. Southern Albania and Epirus fell once more under Byzantine rule, which, however, was shaken by numerous revolts. In 1081 the Normans under Robert Guiscard possessed themselves of Durazzo; Guiscard's son Bohemund defeated the Greeks in several battles and again (1107) laid siege to Durazzo, which had been surrendered to them by treachery; failing to take the city, he retired to Italy in 1109. Southern Albania and Epirus remained under Byzantine domination till 1204, when, after the capture of Constantinople by the crusaders, Michael Comnenus, a member of the imperial family, withdrew to Epirus and founded an independent sovereignty known as the *Despotate of Epirus* at Iannina; his realm included the whole of southern Albania, Acarnania and Aetolia. The despotate of Epirus was held by the Comnenus family till 1318, and by princes of the house of Orsini till 1358. Meanwhile Durazzo, with Berat and Central Albania, had passed into the hands of the Sicilian kings of the house of Anjou, who ruled these regions, which they styled the "Kingdom of Albania," from 1271 to 1368, maintaining a constant warfare with the Byzantine emperors. The Servians again installed themselves in Upper Albania about 1180, and the provinces of Scutari and Prizren were ruled by kings of the house of Nemanya till 1360; Stefan Dushan (1331–1358), the greatest of these monarchs, included all Albania in his extensive but short-lived empire, and took the title of *Imperator Romaniae Slavoniae et Albaniae* (emperor of the Greeks, Slavs and Albanians).

Period of Native Rule.—After the death of Dushan and the break-up of the Servian empire, a new epoch began when Albania fell under the rule of chieftains more or less of native origin. A portion of Upper Albania was ruled by the Balsha dynasty (1366–1421), which, though apparently Servian by descent, assimilated itself with its Albanian subjects and embraced the faith of Rome. Alessio and a tract of the interior in the direction of Ipek was governed by the Dukajin. The northern portion of the "kingdom of Albania," including Durazzo and Kroïa, was ruled by the family of Thopia (1359–1392) and afterwards by that of Kastriota, to which Scanderbeg belonged; the southern portion with Berat, by the Musaki (1368–1476). In the middle of the 14th century a great migration of Albanians from the mountainous districts of the north took place, under the chiefs Jin Bua Spata and Peter Liosha; they advanced southwards as far as Acarnania and Aetolia (1358), occupied the greater portion of the despotate of Epirus, and took Iannina and Arta. In the latter half of the century large colonies of Tosks were planted in the Morea by the despots of Mistra, and in Attica and Boeotia by Duke Nerio of Athens. As the power of the Balshas declined, the Venetians towards the close of the 14th century established themselves at Scutari, Budua, Antivari and elsewhere in northern Albania.

Period of Turkish Rule.—The advance of the Turks into Albania began with the capture of Iannina in 1431. For once in the history of the country the Albanian chiefs combined against the invader under a single leader, the celebrated George Kastriota (see SCANDERBEG), who fought thirteen campaigns in the period 1444–1466. In 1478 Kroïa, which the Venetians had occupied after Scanderbeg's death, surrendered to Mahommed II., and in 1479 Scutari, after a memorable defence by the Venetians and their Montenegrin allies, was reduced by blockade. Many of its native Christian defenders emigrated to Dalmatia and Italy; others took refuge in the mountains with the Roman Catholic Ghegs. In 1502 the Turks captured Durazzo, and in 1571 Antivari and Dulcigno, the last Venetian possessions in Albania. Notwithstanding the abandonment of Christianity by a large section of the population after the Turkish conquest, the authority of the sultans was never effectively established, and succeeding centuries present a record of interminable conflicts between the tribesmen and the Turks, between the Christians and the converts to Islam, or between all combined and the traditional Montenegrin enemy. The decline of the Ottoman power, which began towards the end of the 17th century, was marked by increasing anarchy and lawlessness in the outlying portions of the empire. About 1760 a Moslem chieftain, Mehemet of Bushat, after obtaining the pashalik of Scutari from the Porte, succeeded in establishing an almost independent sovereignty in Upper Albania, which remained hereditary in his family for some generations. In southern

Albania Ali Pasha of Tepelen (b. about 1750), an able, cruel and unscrupulous man, subdued the neighbouring pashas and chiefs, crushed the Suliotes and Khimarrhotes, and exercised a practically independent sovereignty from the Adriatic to the Aegean. He introduced comparative civilization at Iannina, his capital, and maintained direct relations with foreign powers. Eventually he renounced his allegiance to the sultan, but was overthrown by a Turkish army in 1822. Shortly afterwards the dynasty of Scutari came to an end with the surrender of Mustafa Pasha, the last of the house of Bushat, to the grand vizier Reshid Pasha, in 1831.

The opposition of the Albanians, Christian as well as Moslem, to the reforms introduced by the sultan Mahmūd II. led to the devastation of the country and the expatriation of thousands of its inhabitants. During the next half-century several local revolts occurred, but no movement of a strictly political character took place till after the Berlin Treaty (July 13, 1878), when some of the Moslems and Catholics combined to resist the stipulated transference of Albanian territory to Austria-Hungary, Servia and Montenegro, and the *Albanian League* was formed by an assemblage of chiefs at Prizren. The movement, which was instigated by the Porte with the object of evading the provisions of the treaty, was so far successful that the restoration of Plava and Gusinye to Albania was sanctioned by the powers, Montenegro receiving in exchange the town and district of Dulcigno. The Albanian leaders, however, soon displayed a spirit of independence, which proved embarrassing to Turkish diplomacy and caused alarm at Constantinople; their forces came into conflict with a Turkish army under Dervish Pasha near Dulcigno (November 1880), and eventually the league was suppressed. A similar agitation on a smaller scale was organized in southern Albania to resist the territorial concessions awarded by the powers to Greece. In the spring of 1903 serious disturbances took place in north-western Albania, but the Turks succeeded in pacifying the revolted tribesmen, partly by force and partly by concessions. These movements were far from displaying a genuinely national character. In recent years attempts have been made by Albanians resident abroad to propagate the national idea among their compatriots at home; committees have been formed at Brussels, Bucharest, Athens and elsewhere, and books, pamphlets and newspapers are surreptitiously sent into the country. Unity of aim and effort, however, seems foreign to the Albanians, except in defence of local or tribal privileges. The growth of a wider patriotic sentiment must depend on the spread of popular education; certainly up to 1908 no appreciable progress had been made in this direction.

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ALBANUS LACUS (mod. *Lago di Albano*), a lake about 12 m. S.E. of Rome. It is generally considered to have been formed by a volcanic explosion at the margin of the great crater of the Albanus Mons; it has the shape of a crater, the banks of which are over 400 ft. in height from the water-level, while the water is as much as 560 ft. deep in the S. portion. It is fed by subterranean springs. According to the legend, the *emissarium* (outlet) which still drains it was made in 398–397 B.C., the Delphic oracle having declared that Veii could only be taken when the waters of the lake reached the sea. It is over a mile in length, hewn in the rock, and about 6 ft. high and 4 ft. broad; it has vertical shafts at intervals, and a sluice chamber at its egress from the lake. In the time of Domitian the whole lake belonged to the imperial domain. (See ALBA LONGA.)

ALBANUS MONS (mod. *Monte Cavo*, from an early city of the name of Cabum? [1]), the highest point of the volcanic Alban hills, about 13 m. S.E. of Rome, 3115 ft. above sea-level. It is upon the line of the rim of the inner crater of the great volcano, while Tusculum and Algidus Mons mark the edge of the earlier outer crater, which was about 7 m. wide. The lakes of Albano and Nemi were probably formed by volcanic explosions at the margin of the great crater; though a view has also been expressed that the basins are the result of subsidence. The name Albanus Mons is also used generally of the Alban group of hills in which there seem to have been some remains of volcanic activity in early Roman times, which covered the early necropolis of Alba Longa, and occasionally produced showers of stones, *e.g.* in the time of Tullus Hostilius (Liv. i. 31), and perhaps much later. In 193 B.C. it is recorded (*ib.* xxxv. 9) that such a shower occurred at Aricia, Lanuvium and on the Aventine. Upon the Mons Albanus stood the temple of Jupiter Latiaris, where the annual festival of the Latin League was held. The foundations and some of the architectural fragments of the temple were still in existence until 1777, when they were used to build the Passionist monastery by Cardinal York. The road which ascended to the temple from the rim of the lake is still well preserved.

ALBANY, DUKES OF. The territorial designation of Albany was formerly given to those parts of Scotland to the north of the firths of Clyde and Forth. The title of duke of Albany was first bestowed in 1398 by King Robert III. on his brother, Robert Stewart, earl of Fife (see I. below); but in 1425 it became extinct. The dukedom was re-created, *c.* 1458, in favour of Alexander Stewart, "lord of Annandale and earl of March" (see II. below), whose son and successor (see III. below) left no legitimate heir. The title of duke of Albany was next bestowed upon Henry Stuart, commonly known as Lord Darnley, by Mary, queen of Scots, in 1565. From him the title passed to his son, James VI. of Scotland and I. of England. The title was by him given, at his birth, to Charles, his second son, afterwards King Charles I. By Charles II. it was again bestowed, in 1660, on James, duke of York, afterwards King James II. On the 5th of July 1716 Ernest Augustus, bishop of Osnaburgh [Osnabrück] (1715–1728), youngest brother of King George I., was created duke of York and Albany, the title becoming extinct on his death without heirs in 1728. On the 1st of April 1760 Prince Edward Augustus, younger brother of King George III., was created duke of York and Albany; he died without heirs on the 17th of September 1767. On the 29th of November 1784 the title of duke of York and Albany was again created in favour of Frederick, second son of George III., who died without heirs on the 5th of January 1827. The title of duke of Albany was bestowed on the 24th of May 1881 on Prince Leopold, youngest son of Queen Victoria (see IV. below).

I. ROBERT STEWART, duke of Albany (*c.* 1345–1420), regent of Scotland, was a son of King Robert II. by his mistress, Elizabeth Mure, and was legitimatized when his parents were married about 1349. In 1361 he married Margaret, countess of Menteith, and after his widowed sister-in-law, Isabel, countess of Fife, had recognized him as her heir, he was known as the earl of Fife and Menteith. Taking an active part in the government of the kingdom, the earl was made high chamberlain of Scotland in 1382, and gained military reputation by leading several plundering expeditions into England. In 1389 after his elder brother John, earl of Carrick, had been incapacitated by an accident, and when his father the king was old and infirm, he was chosen governor of Scotland by the estates; and he retained the control of affairs after his brother John became king as Robert III. in 1390. In April 1398 he was created duke of Albany;

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[1] See Th. Mommsen in *Bulletino dell' Istituto* (1861), 206; *Corpus Inscrip. Lat.* (Berlin, 1887), xiv. 2228.

but in the following year his nephew David, duke of Rothesay, the heir to the crown, succeeded him as governor, although the duke himself was a prominent member of the advising council. Uncle and nephew soon differed, and in March 1402 the latter died in prison at Falkland. It is not certain that Albany was responsible for the imprisonment and death of Rothesay, whom the parliament declared to have died from natural causes; but the scanty evidence points in the direction of his guilt. Restored to the office of governor, the duke was chosen regent of the kingdom after the death of Robert III. in 1406, as the new king, James I., was a prisoner in London; and he took vigorous steps to prosecute the war with England, which had been renewed a few years before. He was unable, or as some say unwilling, to effect the release of his royal nephew, and was soon faced by a formidable revolt led by Donald Macdonald, second lord of the Isles, who claimed the earldom of Ross and was in alliance with Henry IV. of England; but the defeat of Donald at Harlaw near Aberdeen in July 1411 freed him from this danger. Continuing alternately to fight and to negotiate with England, the duke died at Stirling Castle in September 1420, and was buried in Dunfermline Abbey. Albany, who was the ablest prince of his house, left by his first wife one son, Murdac (or Murdoch) Stewart, who succeeded him as duke of Albany and regent, but at whose execution in 1425 the dukedom became extinct.

See Andrew of Wyntoun, *The Orygynale Cronykil of Scotland*, edited by D. Laing (Edinburgh, 1872–1879); John of Fordun, *Scotichronicon*, continued by Walter Bower, edited by T. Hearne (Oxford, 1722); and P. F. Tytler, *History of Scotland* (Edinburgh, 1850). See also Sir W. Scott's *Fair Maid of Perth*.

II. **Alexander Stewart**, duke of Albany (*c.* 1454–1485), was the second son of James II., king of Scotland, by his wife, Mary, daughter of Arnold, duke of Gelderland. Created duke of Albany before 1458, he also received the lordship of the Isle of Man, and was afterwards captured by an English ship when journeying to Gelderland in 1468. He was soon released, and as he grew to manhood began to take part in the government and defence of Scotland, being appointed in quick succession high admiral, warden of the marches, governor of Berwick and lieutenant of the kingdom. Soon, however, he quarrelled with his brother, King James III. Some of his actions on the marches aroused suspicion, and in 1479 he was seized and imprisoned in Edinburgh Castle; but he soon made his escape, and reaching Paris in September 1479 was welcomed by King Louis XI. Louis, however, would not assist him to attack his brother the king, and crossing to England he made a treaty with King Edward IV. at Fotheringhay in June 1482. Like Edward Baliol, he promised to hold Scotland under English suzerainty in return for Edward's assistance, and with Richard, duke of Gloucester, afterwards King Richard III., he marched at the head of the English forces to Edinburgh. Meanwhile his supporters in Scotland had seized James, and professed their readiness to recognize Albany, declaring at the same time their distrust of Gloucester. A compromise, however, was arranged, and the restoration of his lands and offices was promised to Albany, who in turn agreed to be faithful to James; but about the same time the duke with remarkable duplicity had sworn he would keep the treaty with Edward. Again he was appointed lieutenant of the kingdom, a truce was made with the English, and James, released from custody, restored his brother and created him earl of Mar and Garioch. The fraternal peace was soon disturbed. Failing to obtain possession of the king's person, Albany renewed negotiations with Edward, and in February 1483 made a new treaty at Westminster on the lines of that of Fotheringhay. A fresh reconciliation followed between the brothers, but in July 1483, during Albany's absence in England, he was sentenced to death for treason. After making a raid on Lochmaben he went to France, where in 1485 he was accidentally killed. Albany's first wife was Catherine, daughter of William, third earl of Orkney and first earl of Caithness, who bore him three sons and a daughter. This marriage was dissolved in 1478, and as its issue was regarded as illegitimate the title of duke of Albany descended to John (see below), his only son by his second wife, Anne de la Tour d'Auvergne, daughter of Bertrand II., count of Auvergne and of Bouillon, whom he married in 1480.

III. **John Stewart**, duke of Albany (*c.* 1481–1536), regent of Scotland, was born about 1481. He was brought up in France, where he owned large estates, and held the office of admiral of France. In 1515, at the request of the Scottish parliament, and in spite of Henry VIII.'s efforts to prevent him, Albany came to Scotland, was inaugurated regent in July, and proceeded to organize resistance to the influence of England and of Margaret Tudor, the queen dowager, sister of Henry VIII. In August he seized the latter and her children at Stirling, and subsequently was occupied in suppressing the rebellion of the Homes, Angus (the second husband of Margaret), and James Hamilton, earl of Arran; Alexander, third Lord Home, being beheaded in October 1516. Albany was declared on the 12th of November heir to the throne, and on the 6th of June 1517 he returned to France. In August he concluded the treaty of Rouen, by which the alliance between France and Scotland was renewed and a daughter of Francis I. was to marry James V., and next year he obtained the relaxation of certain dues on Scottish imports into France. Meanwhile Margaret had returned immediately on Albany's departure, and disorders had broken out owing to the rivalry between Angus and Arran. Francis I. had secretly engaged himself to Henry VIII. not to allow Albany's departure from France, but he returned at the close of 1521 and immediately became the object of Henry VIII.'s and Wolsey's attacks. He reconciled himself temporarily with Margaret, supported her divorce from Angus, and was now accused by the English government, in all probability unjustly, of having seduced her and of harbouring schemes of marrying her himself, together with designs against the life of the young king. These accusations were repudiated by the Scots, and Henry's demand for the regent's dismissal refused. War broke out in 1522, and in September Albany advanced to within four miles of Carlisle with a large army. The Scots, however, showed unwillingness to fight outside their own frontiers, and Albany agreed to a truce and disbanded his troops. On the 25th of October he departed hastily to France, leaving the borders exposed to the enemy. On the 25th of September 1523 he once more landed in Scotland, bringing with him supplies from France and a considerable body of troops, and on the 3rd of November, after an unsuccessful attack on Wark, retreated hastily, and quitted Scotland finally on the 20th of May 1524. On the 30th of July his regency was terminated by the declaration of James V. as king. He accompanied Francis I. in his disastrous Italian campaign of 1525, being detached to make a diversion in Naples against the Spanish. Between 1530 and 1535 he acted as French ambassador in Rome, conducted Catherine de' Medici, his wife's niece, to Paris on her marriage to Henry (afterwards Henry II.) in 1534, and negotiated the marriage of James V.

The regent Albany was a singularly unfortunate commander in the field, but a successful ruler and administrator, and the Scottish court of session owed to him its institution. But he regarded himself more the subject of the king of France than of the king of Scotland, subordinated the interests of the latter state to the former, and disliked his official duties in Scotland, where the benefits of his administration were largely diminished by his want of perseverance and frequent absence. He appears to have been a man of honourable and straightforward conduct, whose character must be cleared from the aspersions of Wolsey and the English authorities. He married his cousin Anne de la Tour d'Auvergne, but left no legal issue, and all his honours became extinct at his death.

IV. **Leopold George Duncan Albert**, duke of Albany, eighth child and youngest son of Queen Victoria, was born on the 7th of April 1853. The delicacy of his health seemed to mark him out for a life of retirement, and as he grew older he evinced much of the love of knowledge, the capacity for study and the interest in philanthropic and ecclesiastical movements which had characterized his father, the prince consort. He matriculated at Christ Church, Oxford, in November 1872, living with his tutor at Wykeham House, St Giles's, and diligently pursued his favourite studies of science, art and the modern languages. In 1876 he left the university with the honorary degree of D.C.L., and resided at Boyton House, Wiltshire, and afterwards at Claremont. On coming of age in 1874, he had been made a privy councillor and granted an annuity of £15,000. He travelled on the continent, and in 1880 visited the United States and Canada. He was a trustee of the British Museum, a bencher of Lincoln's Inn, and continued to take an active part in the promotion of education and knowledge generally. Like his father and other members of his family he was an excellent public speaker. On the 24th of May 1881 he was created duke of Albany, earl of Clarence and Baron Arklow. On the 27th of April 1882 he married Hélène Frederica Augusta, princess of Waldeck-Pyrmont, and his income was raised by parliament to £25,000. Having gone to the south of France for his health in the spring of 1884, he was attacked by a fit, the cause or the consequence of a fall in a club-house at Cannes, on the 27th of March, and died very unexpectedly on the following morning. His death was universally regretted, from the gentleness and graciousness of his character, and the desire and ability he had shown to promote intellectual interests of every kind. He left a daughter, born in February 1883, and a posthumous son, Arthur Charles Edward, born on the 19th of July 1884, who succeeded to the dukedom of Albany, and who on the 30th of July 1900 became duke of Saxe-Coburg on the death of his uncle.

ALBANY, LOUISE MAXIMILIENNE CAROLINE, COUNTESS OF (1752–1824), eldest daughter of Prince Gustavus Adolphus of Stolberg-Gedern, was born at Mons on the 20th of September 1752. In her youth she was a canoness of Ste. Wandru at Mons, but in her twentieth year she was affianced, at the instigation of the duke of Berwick and with the secret connivance of the French Court, to Prince Charles Edward Stuart, "the Young Pretender," self-styled count of Albany. She was wedded to the prince at Macerata, near Ancona, on Good Friday 1774, and the married pair for over two years resided in the old Stuart palace at Rome. Pretty, intelligent, charming and witty, Louise fascinated Roman society, wherein she gained the nickname of "Queen of Hearts." The union, however, which was obviously intended to give an heir to the Stuart prince, proved childless, and Louise's married life became far from happy. In 1774 the pair moved to Florence, where in December 1780 Louise, terrified at her husband's violence and fearing for the safety of her life, fled to a neighbouring convent and threw herself on the protection of her brother-in-law, Henry Stuart, Cardinal York, who invited her to Rome. Louise had already in Florence formed the acquaintance of the great Italian tragic poet, Vittorio Alfieri, who had been captivated by her engaging manners, her youthful beauty and her literary powers. The poet now followed her to Rome, but the friendship between Alfieri and his sister-in-law does not seem to have aroused any suspicion in the mind of Cardinal York until 1783, when, after a visit to his brother in Florence, he suddenly requested Pope Pius VI. to banish Alfieri from papal territory. In 1784, however, a legal separation between the count and countess of Albany was arranged, and by Charles's death in 1788 Louise found herself freed from matrimonial bonds. In company with Alfieri (to whom rumour said she had been secretly married) she now visited Paris and London, and was cordially received at the English court, George III. granting her an annual pension of £1600 from the privy purse. Returning to Italy, Alfieri and the countess settled at Florence, where the poet died on the 9th of October 1803, and was buried in the church of Santa Croce beneath Canova's vast monument erected at Louise's expense. The countess continued to reside in the house on the Lung' Arno at Florence, patronising men of science and letters and holding nightly receptions, at which all visitors were expected to treat their hostess with the etiquette due to reigning royalty. She died on the 29th of January 1824 and was buried in Santa Croce, where in the south transept a marble monument by Giovannozzi and Santarelli commemorates her. By her will the countess bequeathed all her property, including many historic objects of art and documents, to the companion of her old age, the French painter, François Xavier Fabre, who ultimately gave the greater part of his legacy to the museum of his native town of Montpellier. Two excellent portraits of the countess of Albany and of Alfieri, painted by this artist, now hang in the Uffizi Gallery at Florence.

See Vernon Lee, *The Countess of Albany* (1884); Marchesa Vitelleschi, *A Court in Exile.* (H. M. V.)

ALBANY, a river of Canada, forming part of the boundary between the province of Ontario and the district of Keewatin. It rises in Lake St Joseph in 91° 25′ W. and 50° 55′ N., and flows E.N.E. into James Bay, its total length being over 400 m. It is navigable for nearly half its length, to Martin's Falls. There are four Hudson's Bay Company's posts on its banks, including Fort Albany at its mouth. The Ogoki and Kenogami rivers are the principal tributaries.

ALBANY, a city and the county-seat of Dougherty county, Georgia, U.S.A., at the mouth of the Kinchafoona Creek, and at the head of navigation on the Flint river, about 100 m. S.S.W. of Macon, about 200 m. S.W. of Savannah and about 203 m. N.E. of Pensacola. Pop. (1890) 4008; (1900) 4606 (2903 of negro descent); (1910) 8190. It is served by the Central of Georgia, the Georgia Northern, the Seaboard Air Line, the Albany & Northern and the Atlantic Coast Line railways, and by steamboats connecting it with Apalachicola at the mouth of the Apalachicola river. Its importance is largely due to these transportation facilities and to the resources of the surrounding country, which produces timber, lime, cotton, Indian corn, sugar-cane, wheat, oats, fruit, melons, hay and vegetables. Albany ships much cotton, and has a cotton compress, a cotton mill, cotton-seed oil and guano factories, brick yards, lumber mills and ice factories. It is a summer and winter resort and is the home of the Georgia Chautauqua. The city owns and operates the electric-lighting plant and artesian water-works. It was settled in 1836, was incorporated in 1838 and received its present city charter in 1907.

ALBANY, a city and the county-seat of Albany county, New York, U.S.A., and the capital of the state. It is situated on the W. bank of the Hudson river, just below the mouth of the Mohawk, 145 m. N. of New York City and 165 m. W. of Boston. Pop. (1880) 90,758; (1890) 94,923; (1900) 94,151, of whom 17,718 were foreign-born (6612 being Irish, 5903 German, 1361 English and 740 Russian) and 1178 were negroes; (1910) 100,253. Albany is a terminus of the New York Central & Hudson River, the Delaware & Hudson and the West Shore railways, and is also served by the Boston & Maine railway, by the Erie and Champlain canals (being a terminus of each), by steamboat lines on the Hudson river and by several inter-urban electric railways connecting with neighbouring cities.

Albany is attractively situated on a series of hills rising sharply from the river. The older portions of the city are reminiscent of Dutch colonial days, and some fine specimens of the Dutch and later colonial architecture are still standing. Perhaps the most famous of these is the Schuyler mansion (now St Francis de Sales Orphan Asylum), built in 1760–1761. The Van Rensselaer manor-house, built in 1765, was pulled down in 1893 and was reconstructed on the campus of Williams College, Williamstown, Massachusetts, where it is used as a fraternity club-house. Among the public buildings, the finest is the new State Capitol, one of the largest and most imposing in America. It occupies a commanding position in Capitol Square (7·84 acres), one of the highest points in the city. It is built of white Maine granite, and cost about $25,000,000. Its dimensions are 300×400 ft. The corner-stone was laid in 1871, and the building was completed, with the exception of the central tower and dome, in 1904. The legislature first met in it in 1879. The original designs were by Thomas Fuller, who also designed the parliamentary buildings at Ottawa; but the plans underwent many changes, Isaac Gale Perry, Leopold Eidlitz and H. H. Richardson being associated with the work before its completion.

The beautiful "western staircase" of red sandstone (from plans by Perry) and the senate chamber (designed by Richardson) are perhaps the most notable parts of the structure. The building houses the various executive departments, the legislature and the court of appeals. A large and handsome building of white granite was begun in 1908 directly opposite the Capitol to accommodate the department of education and the magnificent state library (about 450,000 volumes). Other important buildings are the old state hall, a handsome white marble building erected in 1842; the city hall, a beautiful French Gothic building of pink granite trimmed with red sandstone, designed by H. H. Richardson; the Federal Building; the State Museum of Natural History; the galleries of the Albany Institute and Historical and Art Society, in State Street, opposite the Capitol; Harmanus Bleecker Hall, a theatre since 1898; and the Ten Eyck and Kenmore hotels. Among the finest office buildings are the structures of the Albany City Savings Institution, National Commerical Bank, Union Trust Company, Albany Trust Company, the National Savings Bank, First National Bank, the New York State National Bank (1803, probably the oldest building in the United States used continuously for banking purposes) and the Albany Savings Bank. The Fort Orange Club, the Catholic Union, the Albany Club, the University Club, the City Club of Albany, the Country Club, the German Hall Association and the Adelphi Club are the chief social organizations. The principal church buildings are the Cathedral of the Immaculate Conception (Roman Catholic), a fine specimen of Gothic architecture, built of brownstone, with spires 210 ft. high; the cathedral of All Saints (Protestant Episcopal), an English Gothic structure of pink sandstone designed by R. W. Gibson and begun in 1883; St Peter's Episcopal Church (French Gothic), of Hudson River bluestone; Emmanuel Baptist Church, of white granite; the Madison Avenue Reformed Church; and St Joseph's (Roman Catholic), of bluestone and Caen stone with marble trimmings. Among the educational institutions are the Albany Medical College (1839) and the Albany Law School (1851), both incorporated since 1873 with the Union University, the Collegiate Department of which is at Schenectady; the Albany College of Pharmacy (1881), also part of Union University; the Albany Academy (1813), in which Joseph Henry, while a member of the faculty, perfected in 1826–1832 the electro-magnet and began his work on the electric telegraph; the Albany Academy for Girls, founded in 1814 as the Albany Female Academy (name changed in 1906); and a State Normal College (1890), with a Model School. The hospitals and charitable institutions include St Vincent's Orphan Asylum, the Lathrop Memorial (for children of working mothers), Albany City Hospital, the Homeopathic Hospital, St Peter's Hospital, the Albany City Orphan Asylum and the House of the Good Shepherd. There are a county penitentiary and a State armoury. The city has 95 acres of boulevards and avenues under park supervision and several fine parks (17, with 307 acres in 1907), notably Washington (containing Calverley's bronze statue of Robert Burns, and Rhind's "Moses at the Rock of Horeb"), Beaver and Dudley, in which is the old Dudley Observatory—the present Observatory building is in Lake Avenue, south-west of Washington Park, where is also the Albany Hospital. In the beautiful rural cemetery, north of the city, are the tombs of President Chester A. Arthur and General Philip Schuyler. The city owns a fine water-supply and a filtration plant covering 20 acres, with a capacity of 30,000,000 gallons daily and storage reservoirs with a capacity of 227,000,000 gallons.

The first newspaper in Albany was the *Gazette*, founded in 1771. The *Argus*, founded in 1813 by Jesse Buel (1778–1839) and edited from 1824 to 1854 by Edwin Croswell (1797–1871), was long the organ of the coterie of New York politicians known as the "Albany Regency," and was one of the most influential Democratic papers in the United States. Previously to their holding office, Daniel Manning (1831–1887), secretary of the treasury in President Cleveland's cabinet, was president of the *Argus* company, and Daniel Scott Lamont (1851–1905), secretary of war during President Cleveland's second administration, was managing editor of the newspaper. The *Evening Journal*, founded in 1830 as an anti-Masonic organ, and for thirty-five years edited by Thurlow Weed, was equally influential as an organ of the Whig and later of the Republican party.

Albany is an important railway and commercial centre, particularly as a distributing point for New England markets, as a lumber market and—though to a much less extent than formerly—as a depot for transhipment to the south and west. Among the city's manufactories are breweries, iron and brass foundries, stove factories, knitting mills, cotton mills, clothing factories, slaughtering and meat-packing establishments, cigar and cigarette factories, and manufactories of adhesive pastes, court plaster, spring beds, ribbed underwear, aniline dyes, chemicals, gas meters, fire-brick, and glazed paper and cardboard. The value of the total factory product in 1905 was $20,208,715, which was 17% greater than that for 1900.

History.—Albany was probably the second place to be permanently settled within the borders of the original Thirteen Colonies. It seems likely that French traders ascended the river as far as the site of the present city in the first half of the sixteenth century, and according to some writers a temporary trading post was established here about 1540. Albany's authentic history, however, may be dated from 1614, when Dutch traders built on Castle Island, opposite the city, a post which they named Fort Nassau. Three years later the fort was removed to the mainland, and near here in 1618 the Dutch made their first treaty with the Iroquois. In 1624 arrived eighteen families of Dutch Walloons, the first actual permanent settlers, as distinguished from traders. In that year, on a hill near the site of the present Capitol, Fort Orange was built, and around it, as a centre, the new town grew. At first it was known by the Dutch simply as the "fuyck" (hoop), from the curve in the river at this point, whence was soon derived the name Beverfuyck or Beverwyck. In 1629 the Dutch government granted to Killiaen van Rensselaer, an Amsterdam diamond merchant, land (ultimately 1093 sq. m.) centering at Fort Orange. Over this tract, the first patroonship granted in the colony, he had the usual powers and rights of a patroon. The grant was named Rensselaerwyck in his honour, became a "manor" in 1685, and remained in the family until 1853. The colonists whom he settled upon his grant (1630) were industrious, and "Beverwyck" became increasingly prosperous. From this time the town, on account of its favourable commercial and strategic position at the gateway of the Iroquois country and at the head of navigation on the Hudson river, was for a century and a half one of the most important places in the colonies. In 1664, with the transfer of New Netherlands to English control, the name "Beverwyck" was changed to "Albany"—one of the titles of the duke of York (afterward James II.). In 1673 the town was again for a short time under Dutch control. In 1686 Governor Dongan granted to Albany a city charter, which provided for an elected council. The first mayor appointed by the governor was Peter Schuyler (1657–1724). In 1689 was held here the first inter-colonial convention in America, when delegates from Massachusetts Bay, Plymouth, Connecticut and New York met to treat with representatives of the Five Nations and to plan a system of colonial defence. During the 18th century there was a great influx of English colonists, and in 1714 the first English church was erected. During the French and Indian wars Albany was a starting-point for expeditions against Canada and the Lake Champlain country. In June 1754, in pursuance of a recommendation of the Lords of Trade, a convention of representatives of Massachusetts, Rhode Island, New Hampshire, Connecticut, New York, Pennsylvania and Maryland met here for the purpose of confirming and establishing a closer league of friendship with the Iroquois and of arranging for a permanent union of the colonies. The Indian affairs having been satisfactorily adjusted, the convention, after considerable debate, in which Benjamin Franklin, Stephen Hopkins and Thomas Hutchinson took a leading part, adopted (July 11) a plan for a union of the colonies, which was in great part similar to one submitted to the convention by Franklin. This plan provided for a representative governing body to be known as the Grand Council, to which each colony should elect delegates (not more than seven or less than two) for a term of three years. This body was to have control of Indian affairs, impose taxes, nominate all civil officers, authorize the opening of new lands to settlement, and in general have charge of colonial defence, and of the enlistment, equipment and maintenance of an army. An executive or viceroy, to be known as the president-general, was to have the veto power over the acts of the Grand Council and the right of appointment of military officers. Finally, it was provided that the acts of the Grand Council should be valid unless vetoed by the crown within a period of three years. Neither the British government nor the growing party in the colonies which was clamouring for colonial rights received the plan with favour — the former holding that it gave the colonies too much independence, and the latter that it gave them too little. The strategic importance of Albany was fully recognized during the War of Independence, and it was against Albany that Burgoyne's expedition was directed. Albany became the permanent state capital in 1797. In 1839 it became the centre of the "Anti-Rent War," which was precipitated by the death of Stephen van Rensselaer (1764–1839), the last of the patroons; the attempt of his heirs to collect overdue rents resulting in disturbances which necessitated the calling out of the militia, spread into several counties where there were large landed estates, and were not entirely settled until 1847.

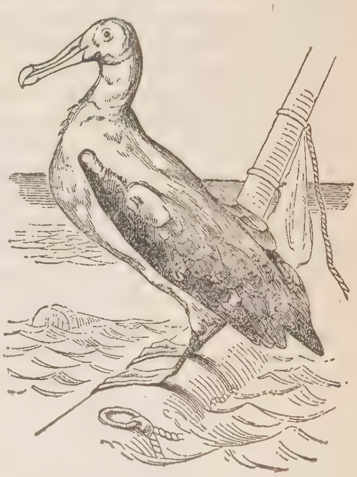
See William Barnes, *The Settlement and Early History of Albany* (Albany, 1864); J. Munsell, *The Annals of Albany* (10 vols., Albany, 1850–1859; 2nd ed., 4 vols., 1869–1871); E. B. O'Callaghan, *Documentary History of the State of New York*, vol. iii. (Albany, 1850); A. J. Weise, *The History of the City of Albany* (Albany, 1884); G. R. Howell and J. Tenney, *Bi-Centennial History of Albany* (New York, 1886); Amasa J. Parker, *Landmarks of Albany County* (Syracuse, 1897); and Cuyler Reynolds, *Albany Chronicles; or Albany Mayors and Contemporaneous Chronology* (Albany, 1907).

ALBANY, a municipal town in the county of Plantagenet, West Australia, on Princess Royal Harbour, a branch of King George Sound, 352 m. by rail and 254 m. directly S.S.E. of Perth. Pop. (1901) 3650. It is the chief health resort of the state, and its climate is one of the finest in Australia; it has a mean annual temperature of 58·6° F., and the summer heat is never excessive. One of the features of the town is the Marine Drive, some 5½ m. in circuit around the hills overlooking the harbour. Albany has several flourishing industries, of which the chief are brewing, coach-building, printing and tanning. In addition it has the finest harbour in West Australia. A pier extends for 1700 ft. into the sea, giving safe accommodation to the large steamers which call at the port. The Great Southern railway has a line to the seaward end of the pier, and affords direct communication with the interior of the colony. The harbour is protected by forts and there is a garrison in the town. King George Sound, of which Albany is the township, was first occupied in 1826 and a penal settlement was established. No attempt was made to colonize the locality until after this settlement was given up in 1831. Albany became a municipality in 1871.

ALBATEGNIUS (*c.* 850–929), an Arab prince and astronomer, correctly designated Mahommed ben Gebir al Batani, his surname being derived from his native town, Batan in Mesopotamia. From his observations at Aracte and Damascus, where he died, he was able to correct some of Ptolemy's results, previously taken on trust. He compiled new tables of the sun and moon, long accepted as authoritative, discovered the movement of the sun's apogee, and assigned to annual precession the improved value of 55″. Perhaps independently of Aryabhatta (born at Pātaliputra on the Ganges 476 A.D.), he introduced the use of sines in calculation, and partially that of tangents. His principal work, *De Motu Stellarum*, was published at Nuremberg in 1537 by Melanchthon, in a blundering Latin translation by Plato Tiburtinus (fl. 1116), annotated by Regiomontanus. A reprint appeared at Bologna in 1645. The original MS. is preserved at the Vatican; and the Escorial library possesses in MS. a treatise of some value by him on astronomical chronology. Albategnius takes the highest rank among Arab astronomers.

See Houzeau, *Bibliographie astronomique*, i. 467; M. Marie, *Histoire des sciences*, ii. 113; R. Wolf, *Geschichte der Astronomie*, p. 67; Delambre, *Hist. de l'astr. au moyen âge*, ch. ii.; *Phil. Trans.*, 1693 (913), where E. Halley supplies corrections to some of the observations recorded in *De Motu Stellarum*.

ALBATROSS (from the Port. *Alcatraz*, a pelican), the name of a genus of aquatic birds (*Diomedea*), closely allied to the petrels, and belonging, like them, to the order *Tubinares*. In the name *Diomedea*, assigned to them by Linnaeus, there is a reference to the mythical metamorphosis of the companions of the Greek warrior Diomedes into birds. The beak is large, strong and sharp-edged, the upper mandible terminating in a large hook; the wings are narrow and very long; the feet have no hind toe, and the three anterior toes are completely webbed. The best known is the common or wandering albatross (*D. exulans*), which occurs in all parts of the Southern Ocean. It is the largest and strongest of all sea-birds. The length of the body is stated at 4 ft., and the weight at from 15 to 25 lb. It sometimes measures as much as 17 ft. between the tips of the extended wings, averaging probably from 10 to 12 ft. Its strength of wing is very great. It often accompanies a ship for days—not merely following it, but wheeling in wide circles round it—without ever being observed to alight on the water, and continues its flight, apparently untired, in tempestuous as well as in moderate weather. It has even been said to sleep on the wing, and Moore alludes to this fanciful "cloud-rocked slumbering" in his *Fire Worshippers*. It feeds on small fish and on the animal refuse that floats on the sea, eating to such excess at times that it is unable to fly and rests helplessly on the water. The colour of the bird is white, the back being streaked transversely with black or brown bands, and the wings dark. Sailors capture the bird for its long wing-bones, which they manufacture into tobacco-pipe stems. The albatross lays one egg; it is white, with a few spots, and is about 4 in. long. In breeding-time the bird resorts to solitary island groups, like the Crozet Islands and the elevated Tristan da Cunha, where it has its nest—a natural hollow or a circle of earth roughly scraped together—on the open ground. The early explorers of the great Southern Sea cheered themselves with the companionship of the albatross in its dreary solitudes; and the evil hap of him who shot with his cross-bow the bird of good omen is familiar to readers of Coleridge's *Rime of the Ancient Mariner*. Several species of albatross are known; for the smaller forms see MALLEMUCK.



ALBAY, a city and the capital of the province of Albay, Luzon, Philippine Islands, near an inlet on the W. shore of the Gulf of Albay, 215 m. by wagon-road S.E. of Manila. Pop. (1903) 14,049; in October 1907 the towns of Daraga (pop. 1903, 18,695) and Legaspi (pop. 1903, 9206) were merged with Albay, making its total population, on the basis of the 1903 census, 41,950. Albay is one of the most important cities of the Philippine Islands. It is built on level ground near the S. base of Mount Mayón, a beautiful volcanic peak, 7916 ft. high, from which it is sheltered by the Linguin hills. The surrounding country is one of the most important hemp-producing districts in the Philippines; sinamay is woven here, and large quantities of hemp are shipped from here to Manila. Cocoa, copra, sugar and sweet potatoes are other important products of the district. The language is Bicol. The old town, called Cagsaua, which stood a short distance E.N.E. of the new, was completely destroyed by an eruption of the volcano in 1814 (about 1200 people being killed), and the new town was almost entirely destroyed by the insurgents in February 1900, an ancient stone church of much beauty (in what was formerly Daraga) being left standing on an elevated site commanding a view of the surrounding country. The town was rebuilt on a larger scale by Americans.

ALBEDO (from Lat. *albus*, white), "whiteness," a word used principally in astronomy for the degree of reflected light; the light of the sun which is reflected from the moon is called the albedo of the moon.

ALBEMARLE, EARLS AND DUKES OF. The name Albemarle, which now forms the title of the earldom held by the English family of Keppel, is an early variant of the French Aumale (Lat. *Alba Marla*), other forms being Aubemarle and Aumerle, and is described in the patent of nobility granted in 1696–1697 by William III. to Arnold Joost van Keppel as "a town and territory in the dukedom of Normandy."

The fief of Aumale (*q. v.*) was granted by the archbishop of Rouen to Odo of Champagne, brother-in-law of William the Conqueror, who erected it into a countship. On Odo's death his son Stephen succeeded not only to the countship of Aumale, but to the lordships of Holderness, of Bytham in Lincolnshire, &c., which were subsequently known as the "Fee and Honor of Albemarle." Stephen, who as a crusader had fought valiantly at Antioch, died about 1127, leaving by his wife Hawise, daughter of Ralph de Mortimer, a son—William of Blois, known as "le Gros." William, who distinguished himself at the battle of the Standard (1138), and shared with King Stephen in the defeat of Lincoln (1141), married Cicely, daughter of William Fitz-Duncan, grandson of Malcolm, king of Scotland, who as "lady of Harewood" brought him vast estates. He founded abbeys at Meaux in Holderness and at Thornton, and died in 1179. His elder daughter and heiress Hawise married (1) William de Mandeville, 3rd earl of Essex (d. 1189), (2) William de Fortibus (de Fors, de Fortz or des Forts[1]), (3) Baldwin de Betun or Béthune, all of whom bore the title of earls of Albemarle.

Soon after the death of Baldwin (October 13, 1213), William de Fortibus, Hawise's son by her second husband, was established by King John in the territories of the countship of Albemarle, and in 1215 the whole of his mother's estates were formally confirmed to him. He is described by Bishop Stubbs as "a feudal adventurer of the worst type," and for some time was actively engaged in the struggles of the Norman barons against John and Henry III. He was one of the twenty-five executors of the Great Charter; but in the war that followed sided with John, subsequently changing sides as often as it suited his policy. His object was to revive the independent power of the feudal barons, and he co-operated to this end with Falkes de Breauté (*q.v.*) and other foreign adventurers established in the country by John. This brought him into conflict with the great justiciar, Hubert de Burgh, and in 1219 he was declared a rebel and excommunicated for attending a forbidden tournament. In 1220 matters were brought to a crisis by his refusal to surrender the two royal castles of Rockingham and Sauvey of which he had been made constable in 1216. Henry III. marched against them in person, the garrisons fled, and they fell without a blow. In the following year, however, Albemarle, in face of further efforts to reduce his power, rose in revolt. He was now again excommunicated by the legate Pandulph at a solemn council held in St Paul's, and the whole force of the kingdom was set in motion against him, a special scutage—the "scutagium de Bihan"—being voted for this purpose by the Great Council. The capture of his castle of Bytham broke his power; he sought sanctuary and, at Pandulph's intercession, was pardoned on condition of going for six years to the Holy Land. He remained in England, however, and in 1223 was once more in revolt with Falkes de Breauté, the earl of Chester and other turbulent spirits. A reconciliation was once more patched up; but it was not until the fall of Falkes de Breauté that Albemarle finally settled down as an English noble. In 1225 he witnessed Henry's third re-issue of the Great Charter; in 1227 he went as ambassador to Antwerp; and in 1230 he accompanied Henry on his expedition to Brittany. In 1241 he set out for the Holy Land, but died at sea, on his way there, on the 26th of March 1242. By his wife Avelina of Montfichet, William left a son, also named William, who married (1) Christina (d. 1246), daughter and co-heiress of Alan, lord of Galloway, (2) in 1248 Isabella de Redvers (1237–1292-3), daughter of Baldwin de Redvers, earl of Devon and lord of the Isle of Wight. He played a conspicuous part in the reign of Henry III., notably in the Mad Parliament of 1258, and died at Amiens in 1260. His widow, Isabella, on the death of her brother Baldwin, 8th earl of Devon, in 1261, called herself countess of Devon. She had two children, Thomas, who died in 1269 unmarried, and Avelina, who married (1269) Edmund Plantagenet, earl of Lancaster, and died without issue in 1274. The "Honor of Albemarle" was claimed, in 1278, by John de Eston, or Aston, as heir of Amicia, younger daughter of William le Gros; but he released his right to the earldom of Albemarle to the crown in exchange for certain lands in Thornton.

The title of Albemarle, thus extinguished, was several times revived before it became attached to the family of its present holders. In 1385 Thomas of Woodstock, duke of Gloucester, was summoned to parliament as "duke of Albemarle," but he seems never subsequently to have used the title. In any case this creation became extinct with the death of his son Humphrey, duke of Gloucester, in 1399. In 1411 Thomas Plantagenet, second son of Henry IV., was created earl of Albemarle and duke of Clarence, but at his death at the battle of Beaugé (March 22, 1421) these honours became extinct. That of Albemarle was, however, soon revived (*c.* 1423) in favour of Richard de Beauchamp, earl of Warwick, whose title of earl of Aumerle, however, died with him.

In 1660 Charles II. bestowed the title of duke of Albemarle on General Monk (*q.v.*). Monk's hereditary claim to this semi-royal peerage was a very shadowy one, being based—as was also his subordinate style of Baron Beauchamp—on his descent from the youngest of the three co-heiresses of Richard, earl of Warwick, and, with yet more remote applicability, on that from Arthur Plantagenet, a natural son of Edward IV. The title became extinct in 1688, on the death of Christopher, 2nd duke of Albemarle.

Finally, as mentioned above, the title of earl of Albemarle was bestowed by William III., without any shadow of hereditary claim, on his Dutch favourite Arnold Joost van Keppel (see below), by whose descendants it is still held. The motive for choosing this title was probably that, apart from its dignified traditions, it avoided the difficulty created by the fact that the Keppels had as yet no territorial possessions in the British Islands.

ARNOLD JOOST VAN KEPPEL, 1st earl of Albemarle, and lord of Voorst in Gelderland (*c.* 1670–1718), son of Oswald van Keppel and his wife Anna Geertruid van Lintello, was born in Holland about 1670. He became page to William III., accompanied him to England in 1688, and was made groom of the bedchamber and master of the robes in 1695. On the 10th of February 1696/7 he was created earl of Albemarle, Viscount Bury and Baron Ashford. In 1700 William gave him lands of enormous extent in Ireland, but parliament obliged the king to cancel this grant, and William then bestowed on him £50,000. The same year he was made a knight of the Garter. Meanwhile he had served both with the English and Dutch troops, was major-general in 1697, colonel of several regiments and governor of Bois-le-Duc. Of handsome person and engaging disposition, he rivalled Portland, whose jealousy he aroused in the royal favour, possessed William's full confidence and accompanied him everywhere. In February 1702 he was sent by William, then prostrated with his last illness, to Holland to arrange the coming campaign, and only returned in time to receive William's last commissions on his deathbed. After the death of the latter, who bequeathed to him 200,000 guilders and some lands, he returned to Holland, took his seat as a noble in the states-general, and was made a general of horse in the Dutch army. He joined the forces of the allies in 1703, was present at Ramillies in 1706 and at Oudenarde in 1708, and distinguished himself at the siege of Lille. He commanded at the siege of Aire in 1710, led Marlborough's second line in 1711, and was general of the Dutch forces in 1712, being defeated at Denain after the withdrawal of Ormonde and the English forces and taken prisoner. He died on the 30th of May 1718, aged 48. He married Geertruid, daughter of Adam van der Denijn, by whom, besides a daughter, he had a son, William Anne, who succeeded him as 2nd earl of Albemarle.

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[1] The name was derived from Fors, a commune in the canton of Prahecq in Poitou. It is spelt Forz in a deed of 1233, and the best vernacular form is, according to Thomas Stapleton (Preface to the *Liber de Antiquitate*, Camden Soc., 1846, p. xxxiv. note), de Fortz.

Of the later earls mention need only be made of the sixth, GEORGE THOMAS KEPPEL (1799–1891), British general, second son of the fourth earl, born on the 13th of June 1799. Educated at Westminster School he entered the army as ensign, 14th Foot, in 1815. He joined his regiment in Belgium and took part in the Waterloo campaign and the march to Paris, joined the second battalion in Corfu, and was transferred to the 22nd Foot, with which he served in Mauritius and at the Cape, returning home in 1819, when he was appointed equerry to the duke of Sussex. Promoted to a lieutenancy in the 24th Foot, he was transferred to the 20th Foot, and went to India, where he was aide-de-camp to the marquess of Hastings until his resignation in 1823, when Keppel returned to England, travelling overland through Persia, Moscow and St Petersburg. He published in 1825 an account of his travels, entitled *Journey from India to England*. He was aide-de-camp to the Marquess Wellesley, lord-lieutenant of Ireland, for two years, was promoted captain in the 62nd Foot, studied in the senior department of the Royal Military College at Sandhurst, and in 1827 obtained a half-pay unattached majority. He did not again serve on full pay, but rose to be a general. In 1829 he visited the seat of the Russo-Turkish war and was with the British fleet in Turkish waters. In 1832 he was returned in the Whig interest to the first reformed parliament as member for East Norfolk and sat until 1835. He was private secretary to the premier, Lord John Russell, in 1846, and M.P. for Lymington from 1847 to 1849. He succeeded to the title on the death of his brother in 1851. He died in 1891 and was buried at Quidenham, Norfolk. He wrote an account of a *Journey across the Balkans*, *Memoirs of the Marquis of Rockingham*, and an autobiography entitled *Fifty Years of My Life*.

See G. E. C(ockayne), *Complete Peerage*, 8 vols. (London, 1887). For the two Williams de Fortibus, see *s.v.* Prof. T. F. Tout's articles in the *Dict. of Nat. Biog.*

ALBENGA, a town and episcopal see of Liguria, Italy, on the N.W. coast of the Gulf of Genoa, in the province of Genoa, 52½ m. S.W. of Genoa by rail. Pop. (1901) 6248. Albenga is the ancient *Album Ingaunum* or *Albingaunum*, the chief town of the Ingauni, one of the most important of the Ligurian tribes, whose territory reached as far as Genoa. Under the empire it was a *municipium*; an inscription records the restoration of the walls, forum, harbour, &c., by Constantius A.D. 354. A little way outside the town to the E. is a well-preserved Roman bridge nearly 500 ft. long and 11½ ft. wide, with 10 arches, each with a span of 37 ft. It belonged to the coast road and is now known as Ponte Lungo. To the S. of the town is a conspicuous monument, 27 ft. high, in the form of a rectangular pillar, resembling a tomb; but as there is no trace of a door to a sepulchral chamber it may be a shrine. In the town itself there are no Roman remains; but there is a good Gothic cathedral in brick, and an interesting octagonal baptistery, attributed to the 8th or 9th century, the arches being supported by ancient columns, and the vaulting decorated with mosaics. Some of the medieval palaces of Albenga have lofty brick towers.

See A. d'Andrade in *Relazione dell' Ufficio Regionale per la Conservazione dei monumenti del Piemonte e della Liguria* (Turin, 1899), 114 seq.

ALBERONI, GIULIO (1664–1752), Spanish–Italian cardinal and statesman, was born near Piacenza, probably at the village of Fiorenzuola, on the 31st of May 1664. His father was a gardener, and he himself became first connected with the church in the humble position of verger in the cathedral of Piacenza. Having gained the favour of Bishop Barni he took priest's orders, and afterwards accompanied the son of his patron to Rome. During the war of the Spanish succession Alberoni laid the foundation of his political success by the services he rendered to the duke of Vendôme, commander of the French forces in Italy; and when these forces were recalled in 1706 he accompanied the duke to Paris, where he was favourably received by Louis XIV. In 1711 he followed Vendôme into Spain as his secretary. Two years later, the duke having died in the interval, Alberoni was appointed consular agent for Parma at the court of Philip V. of Spain, being raised at the same time to the dignity of count. On his arrival at Madrid he found the princesse des Ursins all but omnipotent with the king, and for a time he judged it expedient to use her influence in carrying out his plans. In concert with her he arranged the king's marriage with Elizabeth Farnese of Parma. The influence of the new queen being actively exerted on Alberoni's behalf, he speedily rose to high position. He was made a member of the king's council, bishop of Malaga, and in 1715 prime minister, and was raised to the dignity of cardinal in 1717. His internal policy was exceedingly vigorous. The main purpose he put before himself was to produce an economic revival in Spain by abolishing internal custom-houses, throwing open the trade of the Indies and reorganizing the finances. With the resources thus gained he undertook to enable King Philip V. to carry out an ambitious policy both in Italy and in France. The impatience of the king and his wife gave the minister no time to mature his plans. By provoking England, France, Holland and the Empire at once it brought a flood of disaster on Spain for which Alberoni was held responsible. On the 5th of December 1719 he was ordered to leave Spain, Elizabeth herself having taken an active part in procuring the decree of banishment. He went to Italy, and there had to take refuge among the Apennines, Pope Clement XI., who was his bitter enemy, having given strict orders for his arrest. On the death of Clement, Alberoni boldly appeared at the Conclave, and took part in the election of Innocent XIII. (1721), after which he was for a short time imprisoned by the pontiff on the demand of Spain. At the next election (1724) he was himself proposed for the papal chair, and secured ten votes at the Conclave which elected Benedict XIII. Benedict's successor, Clement XII. (elected 1730), named him legate of Ravènna, in which capacity he incurred the pope's displeasure by the strong and unwarrantable measures he adopted to reduce the little republic of San Marino to subjection to Rome. He was consequently replaced by another legate in 1740, and soon after he retired to Piacenza. Clement XII. appointed him administrator of the hospital of San Lazzaro at Piacenza in 1730. The hospital was a medieval foundation for the benefit of lepers. The disease having disappeared from Italy, Alberoni obtained the consent of the pope to the suppression of the hospital, which had fallen into great disorder, and replaced it by a college for the education of seventy poor boys for the priesthood, under the name of the Collegio Alberoni, which it still bears. He died on the 16th of June 1752, leaving a sum of 600,000 ducats to endow the seminary he had founded, and the residue of the immense wealth he had acquired in Spain to his nephew. Alberoni left a large quantity of manuscripts; but the genuineness of the *Political Testament*, published in his name at Lausanne in 1753, has been questioned.

An *Histoire du Cardinal Alberoni* up to 1719 was published by Jean Rousset de Missy at the Hague in 1719. A laudatory life, *Storia del Cardinale Giulio Alberoni*, was published by Stefano Bersani, a priest educated at his college, at Piacenza, in 1861. *Giulio Alberoni e il suo secolo*, by Giovanni Bianchi (1901), is briefer and more critical. See also *Lettres intimes de J. Alberoni*, edited by M. E. Bourgeois (1892).

ALBERT (1522–1557), prince of Bayreuth, surnamed THE WARLIKE, and also ALCIBIADES, was a son of Casimir, prince of Bayreuth, and a member of the Franconian branch of the Hohenzollern family. Born at Ansbach on the 28th of March 1522, he lost his father in 1527 and came under the guardianship of his uncle George, prince of Ansbach, a strong adherent of the reformed doctrines. In 1541 he received Bayreuth as his share of the family lands, and as the chief town of his principality was Kulmbach he is sometimes referred to as the margrave of Brandenburg-Kulmbach. His restless and turbulent nature marked him out for a military career; and having collected a small band of soldiers, he assisted the emperor Charles V. in his war with France in 1543. The peace of Crépy in September 1544 deprived him of this employment, but he had won a considerable reputation, and when Charles was preparing to attack the league of Schmalkalden, he took pains to win Albert's assistance. Sharing in the attack on the Saxon electorate, Albert was taken prisoner at Rochlitz in March 1547 by John Frederick, elector of Saxony, but was released as a result of the emperor's victory at Mühlberg in the succeeding April. He then followed the fortunes of his friend Maurice, the new elector of Saxony, deserted Charles, and joined the league which proposed to overthrow the emperor by an alliance with Henry II. of France. He took part in the subsequent campaign, but when the treaty of Passau was signed in August 1552 he separated himself from his allies and began a crusade of plunder in Franconia. Having extorted a large sum of money from the burghers of Nuremberg, he quarrelled with his supporter, the French king, and offered his services to the emperor. Charles, anxious to secure such a famous fighter, gladly assented to Albert's demands and gave the imperial sanction to his possession of the lands taken from the bishops of Würzburg and Bamberg; and his conspicuous bravery was of great value to the emperor on the retreat from Metz in January 1553. When Charles left Germany a few weeks later, Albert renewed his depredations in Franconia. These soon became so serious that a league was formed to crush him, and Maurice of Saxony led an army against his former comrade. The rival forces met at Sievershausen on the 9th of July 1553, and after a combat of unusual ferocity Albert was put to flight. Henry II., duke of Brunswick, then took command of the troops of the league, and after Albert had been placed under the imperial ban in December 1553 he was defeated by Duke Henry, and compelled to fly to France. He there entered the service of Henry II., and had undertaken a campaign to regain his lands when he died at Pforzheim on the 8th of January 1557.

See J. Voigt, *Markgraf Albrecht Alcibiades von Brandenburg-Kulmbach* (Berlin, 1852).

ALBERT I. (*c.* 1100–1170), margrave of Brandenburg, surnamed THE BEAR, was the only son of Otto the Rich, count of Ballenstedt, and Eilika, daughter of Magnus Billung, duke of Saxony. He inherited the valuable Saxon estates of his father in 1123, and on his mother's death, in 1142, succeeded to one-half of the lands of the Billungs. About 1123 he received from Lothair, duke of Saxony, the margraviate of Lusatia, and, after Lothair became German king, accompanied him on the disastrous expedition to Bohemia in 1126, when he suffered a short imprisonment. In 1128 his brother-in-law, Henry II., margrave of the Saxon north mark, died, and Albert, disappointed at not receiving this fief, attacked Udo, the succeeding margrave, and was consequently deprived of Lusatia by Lothair. In spite of this, he went to Italy in 1132 in the train of the king, and his services there were rewarded, in 1134, by the investiture of the north mark, which was again without a ruler. For three years he was occupied in campaigns against the Wends, and by an arrangement made with Pribislaus, duke of Brandenburg, Albert secured this district when the duke died in 1150. Taking the title margrave of Brandenburg, he pressed the warfare against the Wends, extended the area of his mark, did much for the spread of Christianity and civilization therein, and so became the founder of the margraviate of Brandenburg. In 1137 his cousin, Henry the Proud, had been deprived by King Conrad III. of his Saxon duchy, which was given to Albert. After meeting with some success in his efforts to take possession, he was driven from Saxony, and also from his mark by Henry, and compelled to take refuge in South Germany, and when peace was made in 1142 he renounced the Saxon dukedom and received the counties of Weimar and Orlamünde. It was possibly at this time that Albert was made arch-chamberlain of the Empire, an office which afterwards gave the margraves of Brandenburg the rights of an elector. A feud with Henry the Lion, duke of Saxony, was followed, in 1158, by a pilgrimage to the Holy Land, and in 1162 Albert accompanied the emperor Frederick I. to Italy, and distinguished himself at the storming of Milan. In 1164 he joined a league of princes formed against Henry the Lion, and peace being made in 1169, Albert divided his territories among his six sons, and died on the 13th of November 1170, and was buried at Ballenstädt. His personal qualities won for him the surname of "the Bear," and he is also called by later writers "the Handsome."

See L. von Heinemann, *Albrecht der Bär* (Darmstadt, 1864).

ALBERT III. (1414–1486), elector of Brandenburg, surnamed ACHILLES because of his knightly qualities, was the third son of Frederick I. of Hohenzollern, elector of Brandenburg, and was born at Tangermünde on the 9th of November 1414. After passing some time at the court of the emperor Sigismund, he took part in the war against the Hussites, and afterwards distinguished himself whilst assisting the German king, Albert II., against the Poles. On the division of territory which followed his father's death in 1440, Albert received the principality of Ansbach; and although his resources were very meagre he soon took a leading place among the German princes, and was especially prominent in resisting the attempts of the towns to obtain self-government. In 1443 he formed a league directed mainly against Nuremberg, over which town members of his family had formerly exercised the rights of burgrave. It was not until 1448, however, that he found a pretext for attack, and the war which lasted until 1453 ended in a victory for the Nurembergers, and the recognition of their independence. He supported the emperor Frederick III. in his struggle with the princes who desired reforms in Germany, and in return for this loyalty received many marks of favour from Frederick, including extensive judicial rights which aroused considerable irritation among neighbouring rulers. In 1457 he arranged a marriage between his eldest son John, and Margaret, daughter of William III., landgrave of Thuringia, who inherited the claims upon Hungary and Bohemia of her mother, a granddaughter of the emperor Sigismund. The attempt to secure these thrones for the Hohenzollerns through this marriage failed, and a similar fate befell Albert's efforts to revive in his own favour the disused title of duke of Franconia. The sharp dissensions which existed among the princes over the question of reform culminated in open warfare in 1460, when Albert was confronted with a league under the leadership of the elector palatine, Frederick I., and Louis IX. (the Rich), duke of Bavaria-Landshut. Worsted in this struggle, which was concluded in 1462, Albert made an alliance with his former enemy, George Poděbrad, king of Bohemia, a step which caused Pope Paul II. to place him under the ban.

In 1470 Albert, who had inherited Bayreuth on the death of his brother John in 1464, became elector of Brandenburg owing to the abdication of his remaining brother, the elector Frederick II. He was soon actively engaged in its administration, and by the treaty of Prenzlau in 1472 he brought Pomerania also under his supremacy. Having established his right to levy a tonnage on wines in the mark, he issued in February 1473 the important *dispositio Achillea*, which decreed that the mark of Brandenburg should descend in its entirety to the eldest son, while the younger sons should receive the Franconian possessions of the family. After treating in vain for a marriage between one of his sons and Mary, daughter and heiress of Charles the Bold, duke of Burgundy, Albert handed over the government of Brandenburg to his eldest son John, and returned to his Franconian possessions. In 1474 he married his daughter Barbara to Henry XI., duke of Glogau, who left his possessions on his death in 1476 to his widow with reversion to her family, an arrangement which was resisted by Henry's kinsman, John II., duke of Sagan. Aided by Matthias Corvinus, king of Hungary, John invaded Brandenburg, and the Pomeranians seized the opportunity to revolt. Under these circumstances Albert returned to Brandenburg in 1478, compelled the Pomeranians to own his supremacy, and after a stubborn struggle secured a part of Duke Henry's lands for his daughter in 1482. His main attention was afterwards claimed by the business of the Empire, and soon after taking part in the election of Maximilian as king of the Romans he died at Frankfort on the 11th of March 1486. He left a considerable amount of treasure. His first wife was Margaret of Baden, by whom he had six children; and his second was Anne of Saxony, by whom he had thirteen.

Albert was a man of relentless energy and boundless ambition, who by reason of his physical and intellectual qualities was one of the most prominent princes of the 15th century.

See *Das kaiserliche Buch des Markgrafen Albrecht Achilles, Vorkurfürstliche Periode, 1440–1470*, edited by C. Höfler (Bayreuth, 1850); *Kurfürstliche Periode*, edited by J. von Minutoli (Berlin, 1850); *Quellensammlung zur Geschichte des Hauses Hohenzollern*, Band I., edited by C. A. H. Burkhardt (Jena, 1857); O. Franklin, *Albrecht Achilles und die Nuremberger, 1449–1453* (Berlin, 1866); *Politische Korrespondenz des Kurfürsten Albrecht Achilles, 1470–1486*, edited by F. Priebatsch (Leipzig, 1894–1898); J. G. Droysen, *Geschichte der preussischen Politik* (Berlin, 1855–1886).

ALBERT (FRANCIS CHARLES AUGUSTUS ALBERT EMMANUEL) (1819–1861), prince-consort of England, was born at Rosenau on the 26th of August 1819. He was the second son of the hereditary duke of Saxe-Coburg-Gotha (belonging to the Ernestine or elder branch of the royal family of Saxony) by his first wife, the princess Louise of Saxe-Gotha-Altenburg (*d.* 1831), from whom the duke was separated in 1824. His father's sister married the duke of Kent, and her daughter, afterwards Queen Victoria of England, Prince Albert's wife, was thus his first cousin. They were born in the same year. Albert and his elder brother, Ernest, were close companions in youth, and were educated under the care of Consistorialrath Florschütz, subsequently proceeding to the university of Bonn. There Prince Albert devoted himself especially to natural science, political economy and philosophy, having for teachers such men as Fichte, Schlegel and Perthes; he diligently cultivated music and painting, and excelled in gymnastic exercises, especially in fencing. The idea of a marriage between him and his cousin Victoria had always been cherished by their uncle, King Leopold I. of Belgium, and in May 1836 the duke of Saxe-Coburg-Gotha and his two sons paid a visit to Kensington Palace, where Princess Victoria, as she then was, lived, for the purpose of making acquaintance for the first time. The visit was by no means to the taste of King William IV., who disapproved of the match and favoured Prince Alexander of Orange. But Leopold's plan was known to Princess Victoria, and William's objections were fruitless. Princess Victoria, writing to her uncle Leopold (May 23, 1836), said that Albert was "extremely handsome"; and (June 7) thanked him for the "prospect of great happiness you have contributed to give me in the person of dear Albert. He possesses every quality that could be desired to render me perfectly happy." No formal engagement was entered into, but the situation was privately understood as one which in time would naturally develop. After the queen came to the throne, her letters show her interest in Albert's being educated for the part he would have to play. In the winter of 1838–1839 the prince travelled in Italy, accompanied by Baron Stockmar, formerly Leopold's doctor and private secretary, and now the queen's confidential adviser. On the 10th of October 1839 he and Ernest went again to England to visit the queen, with the object of finally settling the marriage. Mutual inclination and affection at once brought about the desired result. They became definitely engaged on the 15th of October, and on the 10th of February 1840 the marriage was celebrated at the chapel-royal, St James's.

The position in which the prince was placed by his marriage, while it was one of distinguished honour, was also one of considerable difficulty; and during his lifetime the tactful way in which he filled it was very inadequately appreciated. The public life of the prince-consort cannot be separated from that of the queen, and it is unnecessary here to repeat such details as are given in the article on her (see VICTORIA, QUEEN). The prejudice against him, on account of what was regarded as undue influence in politics, was never fully dissipated till after his death. His co-operation with the queen in dealing with the political responsibilities which devolved upon the sovereign represented an amount of conscientious and self-sacrificing labour which cannot easily be exaggerated; and his wisdom in council could only be realized, outside a very small circle, when in later years the materials for the history of that time became accessible. He was indeed a man of cultured and liberal ideas, well qualified to take the lead in many reforms which the England of that day sorely needed. He was specially interested in endeavours to secure the more perfect application of science and art to manufacturing industry. The Great Exhibition of 1851 originated in a suggestion he made at a meeting of the Society of Arts, and owed the greater part of its success to his intelligent and unwearied efforts. He had to work for its realization against an extraordinary outburst of angry expostulations. Every stage in his project was combated. In the House of Peers, Lord Brougham denied the right of the crown to hold the exhibition in Hyde Park; in the Commons, Colonel Sibthorp prophesied that England would be overrun with foreign rogues and revolutionists, who would subvert the morals of the people, filch their trade secrets from them, and destroy their faith and loyalty towards their religion and their sovereign. Prince Albert was president of the exhibition commission, and every post brought him abusive letters, accusing him, as a foreigner, of being intent upon the corruption of England. He was not the man to be balked by talk of this kind, but quietly persevered, looking always to the probability that the manufacturing power of Great Britain would be quickened by bringing the best manufactured products of foreign countries under the eyes of the mechanics and artisans. A sense of the artistic was at this time almost wholly wanting among the English people. One day the prince had a conversation with a great manufacturer of crockery, and sought to convert him to the idea of issuing something better than the eternal willow-pattern in white with gold, red or blue, which formed the staple of middle and lower class domestic china. The manufacturer held out that new shapes and designs would not be saleable; but he was induced to try, and he did so with such a rapid success that a revolution in the china cupboards of England was accomplished from that time. The exhibition was opened by the queen on the 1st of May 1851, and was a colossal success; and the realized surplus of £150,000 went to establish and endow the South Kensington Museum (afterwards renamed "Victoria and Albert") and to purchase land in that neighbourhood. Similar institutions, on a smaller scale but with a kindred aim, always found in him warm advocacy and substantial support. It was chiefly at meetings in connexion with these that he found occasion for the delivery of addresses characterized by profound thought and comprehensiveness of view, a collection of which was published in 1857. One of the most favourable specimens of his powers as a speaker is the inaugural address which he delivered as president of the British Association for the Advancement of Science when it met at Aberdeen in 1859. The education of his family and the management of his domestic affairs furnished the prince with another very important sphere of action, in which he employed himself with conscientious devotedness.

The estates of the duchy of Cornwall, the hereditary appanage of the prince of Wales, were so greatly improved under his father's management that the rent-roll rose from £11,000 to £50,000 a year. Prince Albert, indeed, had a peculiar talent for the management of landed estates. His model farm at Windsor was in every way worthy of the name; and the grounds at Balmoral and Osborne were laid out entirely in conformity with his designs.

A character so pure, and a life so useful and well-directed in all its aims, could scarcely fail to win respect among those who were acquainted with the facts. As the prince became better known, public mistrust began to give way. In 1847, but only after a significantly keen contest with Earl Powis, he was elected chancellor of the university of Cambridge; and he was afterwards appointed master of the Trinity House. In June 1857 the formal title of prince-consort was conferred upon him by letters patent, in order to settle certain difficulties as to precedence that had been raised at foreign courts.

But in the full career of his usefulness he was cut off. During the autumn of 1861 he was busy with the arrangements for the projected international exhibition, and it was just after returning from one of the meetings in connexion with it that he was seized with his last illness. Beginning at the end of November with what appeared to be influenza, it proved to be an attack of typhoid fever, and, congestion of the lungs supervening, he died on the 14th of December. The grief of the queen was overwhelming and the sympathy of the whole nation marked a revulsion of feeling about the prince himself which was not devoid of compunction for earlier want of appreciation. The magnificent mausoleum at Frogmore, in which his remains were finally deposited, was erected at the expense of the queen and the royal family; and many public monuments to "Albert the Good" were erected all over the country, the most notable being the Albert Hall (1867) and the Albert Memorial (1876) in London. His name was also commemorated in the queen's institution of the Albert medal (1866) in reward for gallantry in saving life, and of the order of Victoria and Albert (1862).

By the queen's authority, her secretary, General Grey, compiled *The Early Days of the Prince Consort*, published in 1867; and *The Life and Letters of the Prince Consort* (1st vol., 1874; 2nd, 1880) was similarly edited by Sir Theodore Martin. A volume of the *Principal Speeches and Addresses of Prince Albert*, with an introduction by Sir Arthur Helps, was published in 1862. See also the *Letters of Queen Victoria* (1907). (H. Ch.)

ALBERT I. (*c.* 1250–1308), German king, and duke of Austria, eldest son of King Rudolph I., the founder of the greatness of the house of Habsburg, was invested with the duchies of Austria and Styria, together with his brother Rudolph, in 1282. In 1283 his father entrusted him with their sole government, and he appears to have ruled them with conspicuous success. Rudolph was unable to secure the succession to the German throne for his son, and on his death in 1291, the princes, fearing Albert's power, chose Adolph of Nassau as king. A rising among his Swabian dependants compelled Albert to recognize the sovereignty of his rival, and to confine himself to the government of the Habsburg territories. He did not abandon his hopes of the throne, and, in 1298, was chosen German king by some of the princes, who were dissatisfied with Adolph. The armies of the rival kings met at Göllheim near Worms, where Adolph was defeated and slain, and Albert submitted to a fresh election. Having secured the support of several influential princes by extensive promises, he was chosen at Frankfort on the 27th of July 1298, and crowned at Aix-la-Chapelle on the 24th of August following. Albert sought to play an important part in European affairs. He seemed at first inclined to press a quarrel with France over the Burgundian frontier, but the refusal of Pope Boniface VIII. to recognize his election led him to change his policy, and, in 1299, a treaty was made between Albert and Philip IV., king of France, by which Rudolph, the son of the German king, was to marry Blanche, a daughter of the French king. He afterwards became estranged from Philip, and, in 1303, was recognized as German king and future emperor by Boniface, and, in return, admitted the right of the pope alone to bestow the imperial crown, and promised that none of his sons should be elected German king without the papal consent. Albert had failed in his attempt to seize Holland and Zealand, as vacant fiefs of the Empire, on the death of Count John I. in 1299, but in 1306 he secured the crown of Bohemia for his son Rudolph on the death of King Wenceslaus III. He also renewed the claim which had been made by his predecessor, Adolf, on Thuringia, and interfered in a quarrel over the succession to the Hungarian throne. His attack on Thuringia ended in his defeat at Lucka in 1307, and, in the same year, the death of his son Rudolph weakened his position in eastern Europe. His action in abolishing all tolls established on the Rhine since 1250, led to the formation of a league against him by the Rhenish archbishops and the count palatine of the Rhine; but aided by the towns, he soon crushed the rising. He was on the way to suppress a revolt in Swabia when he was murdered on the 1st of May 1308, at Windisch on the Reuss, by his nephew John, afterwards called "the Parricide," whom he had deprived of his inheritance. Albert married Elizabeth, daughter of Meinhard IV., count of Görz and Tirol, who bore him six sons and five daughters. Although a hard, stern man, he had a keen sense of justice when his selfish interests were not involved, and few of the German kings possessed so practical an intelligence. He encouraged the cities, and not content with issuing proclamations against private war, formed alliances with the princes in order to enforce his decrees. The serfs, whose wrongs seldom attracted notice in an age indifferent to the claims of common humanity, found a friend in this severe monarch, and he protected even the despised and persecuted Jews. The stories of his cruelty and oppression in the Swiss cantons first appear in the 16th century, and are now regarded as legendary.

See G. Droysen, *Albrechts I. Bemühungen um die Nachfolge im Reich* (Leipzig, 1862); J. F. A. Mücke, *Albrecht I. von Habsburg* (Gotha, 1866); A. L. J. Michelsen, *Die Landgrafschaft Thüringen unter den Königen Adolf, Albrecht, und Heinrich VII.* (Jena, 1860).

ALBERT II. (1397–1439), German king, king of Bohemia and Hungary, and (as Albert V.) duke of Austria, was born on the 10th of August 1397, the son of Albert IV. of Habsburg, duke of Austria. He succeeded to the duchy of Austria on his father's death in 1404. After receiving a good education, he undertook the government of Austria in 1411, and succeeded, with the aid of his advisers, in ridding the duchy of the evils which had arisen during his minority. He assisted the German king, Sigismund, in his campaigns against the Hussites, and in 1422 married Elizabeth, daughter and heiress of Sigismund, who designated him as his successor. When the German king died in 1437, Albert was crowned king of Hungary on the 1st of January 1438, and although crowned king of Bohemia six months later, he was unable to obtain possession of the country. He was engaged in warfare with the Bohemians and their Polish allies, when on the 18th of March 1438 he was chosen German king at Frankfort, an honour which he does not appear to have sought. Afterwards engaged in defending Hungary against the attacks of the Turks, he died on the 27th of October 1439 at Langendorf, and was buried at Stuhlweissenburg. Albert was an energetic and warlike prince, whose short reign gave great promise of usefulness for Germany.

See W. Altmann, *Die Wahl Albrecht II. zum römischen Könige* (Berlin, 1886).

ALBERT (1490–1545), elector and archbishop of Mainz, and archbishop of Magdeburg, was the younger son of John Cicero, elector of Brandenburg, and was born on the 28th of June 1490. Having studied at the university of Frankfort-on-the-Oder, he entered the ecclesiastical profession, and in 1513 became archbishop of Magdeburg and administrator of the diocese of Halberstadt. In 1514 he obtained the electorate of Mainz, and in 1518 was made a cardinal. Meanwhile to pay for the pallium of the see of Mainz and to discharge the other expenses of his elevation, Albert had borrowed a large sum of money from the Fuggers, and had obtained permission from Pope Leo X. to conduct the sale of indulgences in his diocese to obtain funds to repay this loan. For this work he procured the services of John Tetzel, and so indirectly exercised a potent influence on the course of the Reformation. When the imperial election of 1519 drew near, the elector's vote was eagerly solicited by the partisans of Charles (afterwards the emperor Charles V.) and by those of Francis I., king of France, and he appears to have received a large amount of money for the vote which he cast eventually for Charles. Albert's large and liberal ideas, his friendship with Ulrich von Hutten, and his political ambitions, appear to have raised hopes that he would be won over to the reformed faith; but after the Peasants' War of 1525 he ranged himself definitely among the supporters of Catholicism, and was among the princes who met to concert measures for its defence at Dessau in July 1525. His hostility towards the reformers, however, was not so extreme as that of his brother Joachim I., elector of Brandenburg; and he appears to have exerted himself in the interests of peace, although he was a member of the league of Nuremberg, which was formed in 1538 as a counterpoise to the league of Schmalkalden. The new doctrines nevertheless made considerable progress in his dominions, and he was compelled to grant religious liberty to the inhabitants of Magdeburg in return for 500,000 florins. During his latter years indeed he showed more intolerance towards the Protestants, and favoured the teaching of the Jesuits in his dominions. Albert adorned the *Stiftskirche* at Halle and the cathedral at Mainz in sumptuous fashion, and took as his motto the words *Domine, dilexi decorem domus tuae.* A generous patron of art and learning, he counted Erasmus among his friends. He died at Aschaffenburg on the 24th of September 1545.

See J. H. Hennes, *Albrecht von Brandenburg, Erzbischof von Mainz und Magdeburg* (Mainz, 1858); J. May, *Der Kurfürst, Kardinal, und Erzbischof Albrecht II. von Mainz und Magdeburg* (Munich, 1865–1875); W. Schum, *Kardinal Albrecht von Mainz und die Erfurter Kirchenreformation* (Halle, 1878); P. Redlich, *Kardinal Albrecht von Brandenburg, und das neue Stift zu Halle* (Mainz, 1900).

ALBERT (1490–1568), Grand Master of the Teutonic Order, and first duke of Prussia, was the third son of Frederick of Hohenzollern, prince of Ansbach and Bayreuth, and Sophia, daughter of Casimir IV., king of Poland. Born at Ansbach on the 16th of May 1490, he was intended for the church, and passed some time at the court of Hermann, elector of Cologne, who appointed him to a canonry in his cathedral. Turning to a more active life, he accompanied the emperor Maximilian I. to Italy in 1508, and after his return spent some time in Hungary. In December, Frederick, grand master of the Teutonic Order, died, and Albert, joining the order, was chosen as his successor early in 1511 in the hope that his relationship to Sigismund I., king of Poland, would facilitate a settlement of the disputes over east Prussia, which had been held by the order under Polish suzerainty since 1466. The new master, however, showed no desire to be conciliatory, and as war appeared inevitable, he made strenuous efforts to secure allies, and carried on tedious negotiations with the emperor Maximilian I. The ill-feeling, influenced by the ravages of members of the order in Poland, culminated in a struggle which began in December 1519. During the ensuing year Prussia was devastated, and Albert consented early in 1521 to a truce for four years. The dispute was referred to the emperor Charles V. and other princes, but as no settlement was reached the master continued his efforts to obtain help in view of a renewal of the war. For this purpose he visited Nuremberg in 1522, where he made the acquaintance of the reformer, Andreas Osiander, by whose influence he was won over to the side of the new faith. He then journeyed to Wittenberg, where he was advised by Martin Luther to cast aside the senseless rules of his order, to marry, and to convert Prussia into an hereditary duchy for himself. This proposal, which commended itself to Albert, had already been discussed by some of his relatives; but it was necessary to proceed cautiously, and he assured Pope Adrian VI. that he was anxious to reform the order and punish the knights who had adopted Lutheran doctrines. Luther for his part did not stop at the suggestion, but in order to facilitate the change made special efforts to spread his teaching among the Prussians, while Albert's brother, George, prince of Ansbach, laid the scheme before Sigismund of Poland. After some delay the king assented to it provided that Prussia were held as a Polish fief; and after this arrangement had been confirmed by a treaty made at Cracow, Albert was invested with the duchy by Sigismund for himself and his heirs on the 10th of February 1525. The estates of the land then met at Königsberg and took the oath of allegiance to the new duke, who used his full powers to forward the doctrines of Luther. This transition did not, however, take place without protest. Summoned before the imperial court of justice, Albert refused to appear and was placed under the ban; while the order, having deposed the grand master, made a feeble effort to recover Prussia. But as the German princes were either too busy or too indifferent to attack the duke, the agitation against him soon died away. In imperial politics Albert was fairly active. Joining the league of Torgau in 1526, he acted in unison with the Protestants, and was among the princes who banded themselves together to overthrow Charles V. after the issue of the *Interim* in May 1548. For various reasons, however, poverty and personal inclination among others, he did not take a prominent part in the military operations of this period. The early years of Albert's rule in Prussia were fairly prosperous. Although he had some trouble with the peasantry, the lands and treasures of the church enabled him to propitiate the nobles and for a time to provide for the expenses of the court. He did something for the furtherance of learning by establishing schools in every town and by giving privileges to serfs who adopted a scholastic life. In 1544, in spite of some opposition, he founded a university at Königsberg, where he appointed his friend Osiander to a professorship in 1549. This step was the beginning of the troubles which clouded the closing years of Albert's reign. Osiander's divergence from Luther's doctrine of justification by faith involved him in a violent quarrel with Melanchthon, who had adherents in Königsberg, and these theological disputes soon created an uproar in the town. The duke strenuously supported Osiander, and the area of the quarrel soon broadened. There were no longer church lands available with which to conciliate the nobles, the burden of taxation was heavy, and Albert's rule became unpopular. After Osiander's death in 1552 he favoured a preacher named John Funck, who, with an adventurer named Paul Scalich, exercised great influence over him and obtained considerable wealth at the public expense. The state of turmoil caused by these religious and political disputes was increased by the possibility of Albert's early death and the necessity in that event for a regency owing to the youth of his only son, Albert Frederick. The duke was consequently obliged to consent to a condemnation of the teaching of Osiander, and the climax came in 1566 when the estates appealed to Sigismund II., king of Poland, who sent a commission to Königsberg. Scalich saved his life by flight, but Funck was executed; the question of the regency was settled; and a form of Lutheranism was adopted, and declared binding on all teachers and preachers. Virtually deprived of power, the duke lived for two years longer, and died at Tapiau on the 20th of March 1568. In 1526 he had married Dorothea, daughter of Frederick I., king of Denmark, and after her death in 1547, Anna Maria, daughter of Eric I., duke of Brunswick. Albert was a voluminous letter-writer, and corresponded with many of the leading personages of the time. In 1891 a statue was erected to his memory at Königsberg.

See J. Voigt, *Briefwechsel der berühmtesten Gelehrten des Zeitalters der Reformation mit Herzog Albrecht von Preussen* (Königsberg, 1841); E. Joachim, *Die Politik des letzten Hochmeisters in Preussen, Albrecht von Brandenburg* (Leipzig, 1892); K. Lohmeyer, *Herzog Albrecht von Preussen* (Danzig, 1890).

ALBERT III. (1443–1500), duke of Saxony, surnamed ANIMOSUS or THE COURAGEOUS, younger son of Frederick II., the Mild, elector and duke of Saxony, was born on the 27th of January 1443, and after escaping from the hands of Kunz von Kaufungen, who had abducted him together with his brother Ernest, passed some time at the court of the emperor Frederick III. in Vienna. In 1464 he married Zedena, or Sidonia, daughter of George Poděbrad, king of Bohemia, but failed to obtain the Bohemian crown on the death of George in 1471. After the death of the elector Frederick in 1464, Albert and Ernest ruled their lands together, but in 1485 a division was made by the treaty of Leipzig, and Albert received Meissen, together with some adjoining districts, and founded the Albertine branch of the family of Wettin. Regarded as a capable soldier by the emperor, Albert, in 1475, took a prominent part in the campaign against Charles the Bold, duke of Burgundy, and in 1487 led an expedition against Matthias Corvinus, king of Hungary, which failed owing to lack of support on the part of the emperor. In 1488 he marched with the imperial forces to free the Roman king Maximilian from his imprisonment at Bruges, and when, in 1489, the king returned to Germany, Albert was left as his representative to prosecute the war against the rebels. He was successful in restoring the authority of Maximilian in Holland, Flanders and Brabant, but failed to obtain any repayment of the large sums of money which he had spent in these campaigns. His services were rewarded in 1498 when Maximilian bestowed upon him the title of hereditary governor (potestat) of Friesland, but he had to make good his claim by force of arms. He had to a great extent succeeded, and was paying a visit to Saxony, when he was recalled by news of a fresh rising. Groningen was captured, but soon afterwards the duke died at Emden, on the 12th of September 1500. He was buried at Meissen. Albert, who was a man of great strength and considerable skill in feats of arms, delighted in tournaments and knightly exercises. His loyalty to the emperor Frederick, and the expenses incurred in this connexion, aroused some irritation among his subjects, but his rule was a period of prosperity in Saxony.

See F. A. von Langenn, *Herzog Albrecht der Beherzte, Stammvater des königlichen Hauses Sachsen* (Leipzig, 1838); O. Sperling, *Herzog Albrecht der Beherzte von Sachsen als Gubernator Frieslands* (Leipzig, 1892).

ALBERT, FREDERICK AUGUSTUS, king of Saxony (1828–1902), was born on the 23rd of April 1828, being the eldest son of Prince John, who succeeded to the throne in 1854. His education was, as is usual with German princes, to a great extent military, but he attended lectures at the university of Bonn. His first experience of warfare was in 1849, when he served as a captain in the campaign of Schleswig-Holstein against the Danes. When the war of 1866 broke out, the crown-prince was placed in command of the Saxon forces opposing the Prussian army of Prince Frederick Charles. No attempt was made to defend Saxony; the Saxons fell back into Bohemia and effected a junction with the Austrians. They took a prominent part in the battles by which the Prussians forced the line of the Iser and in the battle of Gitchin. The crown-prince, however, succeeded in effecting the retreat in good order, and in the decisive battle of Königgrätz (see Seven Weeks' War) he held the extreme left of the Austrian position. The Saxons maintained their post with great tenacity, but were involved in the disastrous defeat of their allies. During these operations the crown-prince won the reputation of a thorough soldier; after peace was made and Saxony had entered the North German confederation, he was placed in command of the Saxon army, which had now become the XII. army corps of the North German army, and in this position carried out the necessary reorganization. He was a firm adherent of the Prussian alliance. On the outbreak of war in 1870 he again commanded the Saxons, who were included in the 2nd army under Prince Frederick Charles, his old opponent. At the battle of Gravelotte they formed the extreme left of the German army, and with the Prussian Guard carried out the attack on St Privat, the final and decisive action in the battle. In the reorganization of the army which accompanied the march towards Paris the crown-prince was given a separate command over the 4th army (army of the Meuse) consisting of the Saxons, the Prussian Guard corps and the IV. (Prussian Saxony) corps. He was succeeded in command of the XII. corps by his brother Prince George, who had served under him in Bohemia. He took a leading part in the operations which preceded the battle of Sedan, the 4th army being the pivot on which the whole army wheeled round in pursuit of MacMahon; and the actions of Buzancy and Beaumont on the 29th and 30th of August were fought under his direction; in the battle of Sedan itself, with the troops under his orders, he carried out the envelopment of the French on the east and north. His conduct in these engagements won for him the complete confidence of the army, and during the siege of Paris his troops formed the north-east section of the investing force. After the conclusion of the armistice he was left in command of the German army of occupation, a position which he held till the fall of the Commune. On the conclusion of peace he was made an inspector-general of the army and field-marshal. On the death of his father on the 29th of October 1873 he succeeded to the throne. His reign was uneventful, and he took little public part in politics, devoting himself to military affairs, in which his advice and experience were of the greatest value, not only to the Saxon corps but to the German army in general. In 1897 he was appointed arbitrator between the claimants for the principality of Lippe. King Albert married in 1853 Carola, daughter of Prince Gustavus of Vasa, and granddaughter of the last king of Sweden of the house of Holstein. He died on the 19th of June 1902.

ALBERT, surnamed the Degenerate (*c.* 1240–1314), landgrave of Thuringia, was the eldest son of Henry III., the Illustrious, margrave of Meissen. He married Margaret, daughter of the emperor Frederick II., in 1254, and in 1265 received from his father Thuringia and the Saxon palatinate. His infatuation for Kunigunde of Eisenberg caused his wife to leave him, and after her death in 1270 he married Kunigunde, who had already borne him a son, Apitz or Albert. He wished to make Apitz his successor in Thuringia, a plan which was resisted by his two elder sons, and a war broke out which lasted until 1307, when he abandoned Thuringia, in return for a yearly payment, but retained the title of landgrave (see Thuringia). Albert, who had married Elizabeth, daughter of Hermann III., count of Orlamünde, after the death of his second wife in 1286, died on the 13th of November 1314.

See F. X. Wegele, *Friedrich der Friedige, Markgraf von Meissen, und die Wettiner seiner Zeit* (Nördlingen, 1820); F. W. Tittmann, *Geschichte Heinrich des Erlauchten Markgraven zu Meissen* (Leipzig, 1863).

ALBERT (FRIEDRICH RUDOLF ALBRECHT), Archduke (1817–1895), Austrian field-marshal, was the eldest son of the archduke Charles (Karl Friedrich), and was born on the 3rd of August 1817 at Vienna. After being educated under the careful superintendence of his father, he entered the Austrian (*K.K.*) army as a colonel of infantry in 1837, and was transferred to the cavalry arm in 1839, becoming a major-general in 1840. A brief period of leave in this year he spent at the great manœuvres in Italy, to learn the art of troop-leading from the first soldier in Europe, Radetzky. He then took over the command of a brigade of all arms at Graz. In 1844 he married Princess Hildegarde of Bavaria. He had been made a lieutenant field-marshal in the previous year, and was now placed in command of the forces in Upper and Lower Austria. In this position he did much to maintain and improve the efficiency of the troops under his command, at a time when nearly all armies in Europe, with the exception of Radetzky's in Italy, had sunk to the lowest level. The influence of Radetzky over the young archduke was indeed remarkable. At this time the Austrian generals and staff officers had committed themselves blindly to the strategical method of the archduke Charles, the tradition of whose practical soldiership survived only in Radetzky and a few others. Albert chose to follow the latter, and was thus saved from the pseudo-scientific pedantry which brought defeat to the Austrian arms in 1859 and in 1866. His first serious service came in March 1848, when it became his duty, as district commander, to maintain order in Vienna by force, and at the outbreak of revolution in Vienna during the month of March he was in command of the troops who came into collision with the rioters. Owing to the collapse of the government it was impossible to repress the disturbances, and he was relieved from a post which brought much unpopularity and was not suitable to be held by a member of the imperial family. He went at once to the seat of war in Italy, and fought under Radetzky as a volunteer throughout the campaign of 1848, being present at the action of Pastrengo and the battles of Santa Lucia and Custozza. In the following campaign he applied for and obtained the command of a division in the II. corps (FZM. d'Aspre), though his previous grade had been that of a general commanding-in-chief. The splendid fighting of the corps at Novara was decisive of the war, and Radetzky named d'Aspre, Count Thurn, and the archduke as the general officers worthy of the greatest rewards. The field-marshal indeed recommended, and almost insisted, that Albert should receive the much-prized order of Maria Theresa. In 1850 he became a general of cavalry, and in 1851 military and civil governor of Hungary. In this important and difficult position he remained until 1860, when he was relieved at his own request. Shortly afterwards he was appointed to succeed Radetzky as commander-in-chief in Italy, and in 1863 he was promoted field-marshal. In the following year the archduke lost his wife, soon after the marriage of their elder daughter to Duke Philip of Württemberg. In 1859 and 1864 he was sent on important military and diplomatic missions to Berlin. When war became imminent in 1866, the archduke took command of the field army in Italy. The story of the campaign of 1866 in Italy will be found under ITALIAN WARS (1848–1870); the operations of the archduke, who disposed of greatly inferior forces, were crowned with success in the brilliant victory of Custozza (June 23), and his reputation as a general-in-chief was firmly established by only eight days of field operations, though it is possible that his chief of staff, Lieut. Field-Marshal von John, contributed not a little to the success of the Austrian arms. The result of Custozza was the retreat and complete immobilization of the whole Italian army, so that Albert was able to despatch the greater part of his troops to reinforce the Bohemian army, when, after being defeated by the Prussians, it fell back on Vienna. On the 10th of July the archduke was summoned to Vienna to take supreme command of the forces which were being collected to defend the capital, but peace was made before further hostilities took place. From this time, under various titles, he acted as inspector-general of the army. Like his father, and with better fortune, he was called upon to reorganize the military system of his country on an entirely new plan, learned, as before, by defeat. The principle of universal short service, and the theory of the armed nation, were necessarily the groundwork of the reforms, and the consequent preparation of all the national resources for their task in war, by the superintendence of peace administration, by the skilful conduct of manœuvres, was thenceforward the task of his lifetime. In 1870 he conducted the military negotiations preparatory to an alliance with France, which, however, was not concluded. The tragic death of his daughter, Princess Mathilde, in 1867, and the death of his brother, Archduke Karl Ferdinand, in 1874, narrowed still further his family circle, and impelled him to even greater activity in his military duties, and to effective participation in the work of many military charities. He retained personal control of the army until his last illness, which he contracted at the funeral of his nephew Francis, ex-king of Naples. His only remaining brother, the archduke Wilhelm, had died a few months before, as the result of an accident. He himself died on the 18th of February 1895. His only son died in childhood, and his nephew Archduke Frederick (born 1856) inherited his great possessions, including the Albertina, a famous collection of books, manuscripts, engravings and maps, founded by Duke Albert of Saxe-Teschen.

Amongst the military works of the Archduke Albert may be named *Über die Verantwortlichkeit im Kriege* (a work which created a great sensation, and was translated into English and French), *Gedanken über dem Militärgeist*, *Über die höhere Leitung im Kriege*, and *Kritische Betrachtungen über den Feldzug 1866 in Italien.* He also was the principal editor of the military works of his father.

See Duncker, *F. M. Erzherzog Albrecht* (Vienna and Prague, 1897); Mathes v. Bilabrück, "Gedenkrede auf Weiland Sr. K. u. K. H. Erzh. Albrecht," *Mil.-Wissenschaftl. Verein*, 1895; Teuber, *F. M. Erzh. Albrecht, ein Lebensbild* (Vienna, 1895).

ALBERT, MADAME (*c.* 1805–1846), French actress, whose maiden name was Thérèse Vernet, was born of a family of players. She first appeared in children's and *ingénue* parts, and in comic opera, and it was not until 1827, two years after her Paris *début*, that her great talents were seen and appreciated. In *Caleb Valentine*, *Henry V.*, *Madame Dubarry*, *Catherine II.*, *Leontine*, *Un duel sous le cardinal de Richelieu*, and many other plays, her grace, beauty and distinction of manner made her the idol of Paris, and her circle of admirers was widened by long tours of the provinces and abroad. Ill-health compelled her to retire in 1846. She was twice married, about 1825 to Albert Rodrigues, an actor who played under his Christian name, and in 1846 to Eugène Bignon (1812–1858), the actor and playwright.

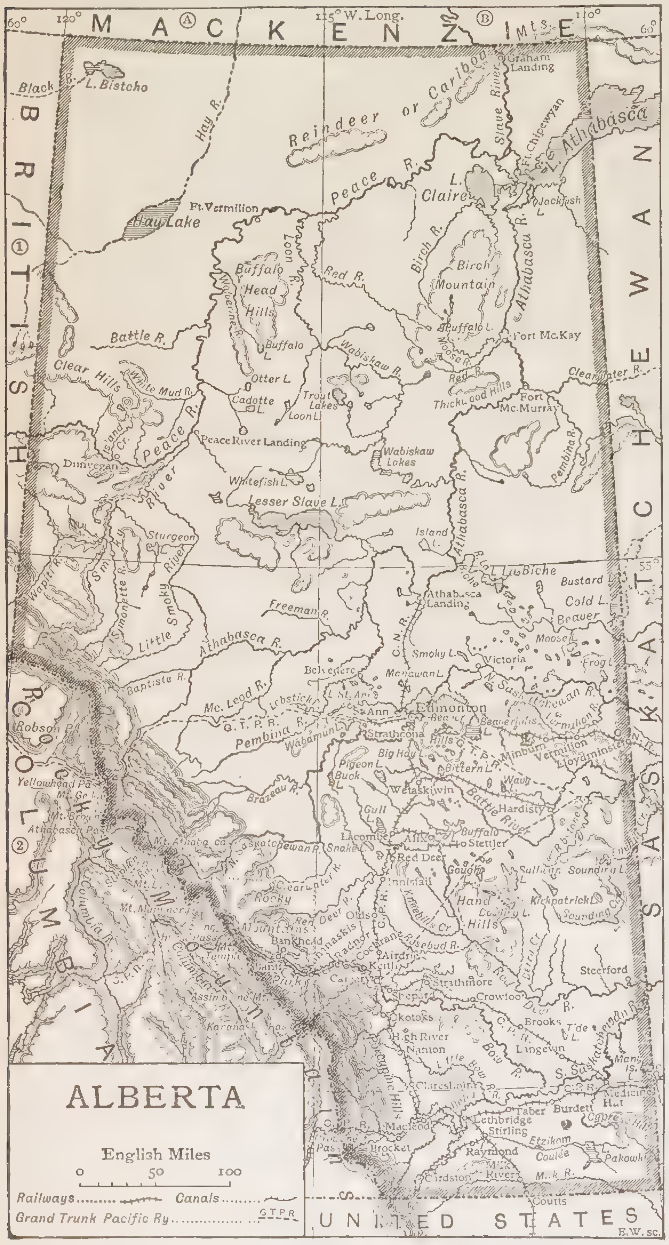
ALBERT OF AIX (fl. *c.* A.D. 1100), historian of the first crusade, was born during the later part of the 11th century, and afterwards became canon and *custos* of the church of Aix-la-Chapelle. Nothing else is known of his life except that he was the author of a *Historia Hierosolymitanae expeditionis*, or *Chronicon Hierosolymitanum de bello sacro*, a work in twelve books, written between 1125 and 1150. This history begins at the time of the council of Clermont, deals with the fortunes of the first crusade and the earlier history of the Latin kingdom of Jerusalem, and ends somewhat abruptly in 1121. It was well known during the middle ages, and was largely used by William, archbishop of Tyre, for the first six books of his *Belli sacri historia*. In modern times its historical value has been seriously impugned, but the verdict of the best scholarship seems to be that in general it forms a true record of the events of the first crusade, although containing some legendary matter. Albert never visited the Holy Land, but he appears to have had a considerable amount of intercourse with returned crusaders, and to have had access to valuable correspondence. The first edition of the history was published at Helmstadt in 1584, and a good edition is in the *Recueil des historiens des croisades*, tome iv. (Paris, 1841–1887).

See F. Krebs, *Zur Kritik Alberts von Aachen* (Münster, 1881); B. Kugler, *Albert von Aachen* (Stuttgart, 1885); M. Pigeonneau, *Le Cycle de la croisade et de la famille de Bouillon* (Paris, 1877); H. von Sybel, *Geschichte des ersten Kreuzzuges* (Leipzig, 1881); F. Vercruysse, *Essai critique sur la chronique d'Albert d'Aix* (Liége, 1889).

ALBERTA, a province of western Canada, established in 1905. Area 260,000 sq. m. It is bounded S. by the United States boundary line, 49° N.; E. by 110° W., which divides it from the province of Saskatchewan; N. by 60° N., which separates it from the North-West Territories; and W. by the line of peaks of the Rocky Mountains range, which runs north-westerly, and divides it from British Columbia. A fertile province, in the eastern and southern portions its surface consists chiefly of plains almost entirely treeless. As the slopes of the Rocky Mountains to the west are reached more trees are found, until in the foot-hills of the mountains bodies of forest timber occur. Trees become more numerous also northward in the province, until in the region north of the North Saskatchewan river forests are again met with. From the southern boundary line for two and a half degrees north the prairie is dry, but of good soil, which grows excellent crops when irrigated. North of this region the surface of the province is of most fertile soil, the ordinary rainfall sufficing for agriculture. The appearance of the prairie section of the province is that of undulating meadows, with rounded sloping ridges covered with shorter grasses, which serve for the support of great herds of cattle and horses. The wooded portions of the terrain are dotted with clumps and belts of trees of moderate size, giving them a park-like appearance. In winter the snowfall is very light, and even this is frequently removed by warm winds from the west. Within a hundred miles of the mountains there is constantly in view, in clear weather, the beautiful line of snowy peaks along the western horizon. This continues for hundreds of miles north-westward. The Rocky Mountains, which give its charm to Alberta, are ascended by a gradual approach from the east, but are exceedingly abrupt on their transalpine slope in British Columbia. The peaks of these mountains are majestic, many of them reaching a height of more than two miles above the sea. Among the more notable of these are Robson peak, 13,700 ft.; Athabasca, 13,700; Assiniboine, 11,830; Lyell, 12,000; Mummery, 12,000; Temple, 11,658; and Geikie, 11,000. Mt. Brown reaches 9050.

Through these Rocky Mountains the explorers and fur-traders, by ascending the streams running down the eastern declivities of the mountains, and crossing by short portages to the streams of the western slope, have succeeded in discovering passes by which the mountain chain can be crossed, the range rarely exceeding 60 m. in breadth. The most noted of the Alberta passes are (1) the Crow's Nest Pass, near the southern boundary line, through which a branch of the Canadian Pacific railway runs; (2) the Kicking Horse Pass, through which the main line of the Canadian Pacific railway is built; 40 m. from the eastern end of this pass is the Rocky Mountains Park, with the famous watering-place of Banff as its centre; (3) the Yellow Head Pass, running west from the northern branch of the Saskatchewan river; this pass was discovered by Capt. Palliser (1858), was crossed by Lord Milton and Dr W. B. Cheadle (1861), and by Sandford Fleming (1871–1872) in the Ocean to Ocean expedition; (4) Peace River Pass. By this pass Alexander Mackenzie made his celebrated voyage. There are other minor passes, and no doubt more to be discovered.

With the exception of the southern section, the province of Alberta may be said to be well watered. Rising from numerous valleys on the Alberta declivity of the Rocky Mountains between the international boundary line and 52° N. are streams which unite to form the Belly river, and farther north the Bow river. Running eastward these two rivers unite about 112° W., and flow on under the name of the South Saskatchewan river. North of 52° N. many small streams unite to form the Red Deer river, which flowing south-eastward joins the South Saskatchewan near 110° W. Between 52° and 53° N. rises the great river, the North Saskatchewan. It receives a southern tributary, the Battle river, which joins it about 108° W. Pursuing their courses eastward the North and South Saskatchewan rivers unite in the Saskatchewan (Cree, rapid-flowing river), which finds its way to Lake Winnipeg, and thence by way of Nelson river to Hudson Bay. It is one of the mightiest rivers of the continent.


MACKENZIE
BRITISH COLUMBIA
SASKATCHEWAN
UNITED STATES
115° W. Long.
120°
110°
60°
55°
L. Bistcho
Hay R.
Hay Lake
Ft. Vermilion
Reindeer or Caribou Mts.
Peace R.
Slave River
Graham Landing
Ft. Chipewyan
L. Athabasca
L. Claire
Jackfish L.
Birch R.
Birch Mountain
Athabasca R.
Buffalo Head Hills
Red R.
Loon R.
Buffalo L.
Fort McKay
Battle R.
Clear Hills
White Mud R.
Otter L.
Cadotte L.
Trout Lakes
Loon L.
Wabiskaw R.
Thickwood Hills
Fort McMurray
Clearwater R.
Peace River Landing
Wabiskaw Lakes
Pembina R.
Dunvegan
Whitefish L.
Lesser Slave L.
Island L.
Sturgeon
Smoky River
Wapiti R.
Freeman R.
La Biche
Bustard
Athabasca Landing
Cold L.
Beaver
Little Smoky
Athabasca R.
Smoky L.
Moose L.
Victoria
Frog L.
Belvedere
Manawan L.
Baptiste R.
Mc Leod R.
Lobstick
L. St. Ann
St. Ann
Edmonton
G.T.P.R.
Pembina R.
Wabamun
Strathcona
Beaver Hills
Vermilion
Lloydminster
Robson Pk.
Yellowhead Pass
Big Hay L.
Pigeon L.
Buck
Bittern L.
Minburn
Wetaskiwin
Battle River
Wavy
Hardisty
Gull
Lacombe
Alix
Buffalo
Stettler
Brazeau R.
Athabasca Pass
Mt. Athabasca
Saskatchewan R.
Snake
Red Deer
Sullivan
Sounding L.
Innisfail
Hand Hills
Kirkpatrick L.
Rocky Mts.
Red Deer R.
Olds
Banff
Bankhead
Rosebud R.
Airdrie
Calgary
Steerford
Strathmore
Crowfoot
Okotoks
Brooks
High River
Nanton
Bow R.
Langevin
S. Saskatchewan
Claresholm
Medicine Hat
Macleod
Lethbridge
Faber
Burdett
Stirling
Brocket
Crow's Nest Pass
Etzikom
Raymond
Coulee
Pakowki L.
Cardston
Milk R.
Coutts
Columbia R.
Kootenay
ALBERTA
English Miles
0 50 100
Railways
Canals
Grand Trunk Pacific Ry
G.T.P.R.
E.W. sc.

Between 53° and 54° N. begins the height of land running north-easterly, north of which all the waters of Alberta flow toward the Arctic Sea. In northern Alberta, on the northern slope, gathering its tributaries from rills in the Rocky Mountains, the river Athabasca runs north and empties into Lake Athabasca near 58° N. North of 56° N. flows through and from the Rocky Mountains the Peace river. After descending north-eastward to within a few miles of Lake Athabasca, it is met by a stream emerging from that lake. The united river carrying down the waters of the Athabasca slope is called the Slave river, which, passing through Great Slave Lake, emerges as the great Mackenzie river, which falls into the Arctic Sea. Alberta thus gives rise to the two great rivers Saskatchewan and Mackenzie. While a number of fresh-water, or in some cases brackish, lakes each less than 100 sq. m. in extent are situated in Alberta, two of more considerable size are found. These are Lake Athabasca, 3085 sq. m. in extent, of which a part is in the province of Saskatchewan, and the other Lesser Slave Lake some 600 sq. m. in area.

Climate.—As Alberta extends for 750 m. from north to south—as great a distance as from Land's End in England to the north of the Shetland Isles—it is natural that the climate should vary considerably between parallels of 49° and 60° N., and also between 110° and 120° W. It is also further influenced by the different altitudes above the sea of the several parts of the province. Dividing the province into three equal parts of 250 m. each from north to south, these may be called (A) the south, (B) the centre, (C) the north. The following data may be considered:—

CLIMATIC TABLE

Climate.	Places.	Above the Sea.	Mean Winter Temp.
(A) Moderate and changeable	Medicine Hat, lat. 50° N.	2171 ft.	14·3° F.
	Calgary, lat. 51°	3421 „	15·4° „
	Banff, lat. 51½°	4515 „	15·9° „
(B) Steady . .	Edmonton, lat. 53½°	2210 „	10·3° „
(C) Severe . .	Fort Chipewyan, lat. 59° N.	600 „	7·2° „

Climate (A) allows, in what is a great ranching district, cattle and horses to run at large through the whole winter. Through the mountain passes come at times dry winds from the Pacific coast, which lick up the snow in a few hours. These winds are known as Chinook winds. While elevating the temperature they bring more moisture into the air and produce a change not entirely desirable.

Climate (B) is the steady winter climate of Edmonton district. This while averaging a lower temperature than (A) is not so subject to change; it retains the snow for sleighing, which is a boon to the farmer. This climate is much less influenced by the Pacific winds than (A).

Climate (C), that of Fort Chipewyan, having a mean winter temperature of 22·6° lower than Calgary, is a decidedly sub-arctic climate. It is the region in winter of constant ice and snow, but its lower altitude gives it a summer climate with a mean temperature of only 1·6° less than Calgary, and 1·8° less than Edmonton. It will thus be seen that the agricultural capabilities of the Athabasca and Peace river districts, not yet fully known, are full of promise.

Fauna.—The three climatic regions of Alberta have naturally a varying fauna. The south and central region was the land of the bison, its grasses affording a great pasture ground for tens of thousands of "buffaloes." They were destroyed by whites and Indians in 1879–1882 on the approach of the Canadian Pacific railway. Grizzly, black and cinnamon bears are found in the mountains and wooded districts. The coyote or small wolf, here and there the grey wolf, the fox and the mountain lion (panther) occur. The moose and red deer are found in the wooded regions, and the jumping deer and antelope on the prairies. Wild sheep and goats live in the Rocky Mountains. The lynx, wolverine, porcupine, skunk, hare, squirrel and mouse are met. The gopher is a resident of the dry plains. District (C) is the fur-trader's paradise. The buffalo is replaced by the mountain buffaloes, of which a few survive. The musk-ox comes in thousands every year to the great northern lakes, while the mink, marten, beaver, otter, ermine and musk-rat are sought by the fur-trader. Fort Chipewyan was long known in Hudson's Bay Company history as the great depôt of the Mackenzie river district. Northern Alberta and the region farther north is the nesting-ground of the migratory birds. Here vast numbers of ducks, geese, swans and pelicans resort every year. Cranes, partridges and varieties of singing birds abound. The eagle, hawk, owl and crow are plentiful. Mosquitoes and flies are everywhere, and the wasp and wild bee also. In the rivers and lakes pike, pickerel, white fish and sturgeon supply food for the natives, and the brook trout is found in the small mountain streams. The turtle and frog also appear.

Flora.—In central and northern Alberta the opening spring brings in the prairie anemone, the avens and other early flowers. The advancing summer introduces many flowers of the sunflower family, until in August the plains are one blaze of yellow and purple. The southern part of Alberta is covered by a short grass, very nutritive, but drying up in the middle of summer until the whole prairie is brown and unattractive. The trees in the wooded sections of the province are seen in clumps and belts on the hill-sides. These are largely deciduous. On the north side of the Saskatchewan river forests prevail for scores and even hundreds of miles. They contain the poplar or aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera*), and paper or canoe birch (*Betula papyrifera*). The Coniferae are found northward and in the mountain valleys. Some of these are: Jack pine (*Pinus Banksiana*), Rocky Mountain pine (*Pinus flexilis*), black pine (*Pinus Murrayana*), white spruce (*Picea alba*), black spruce (*Picea nigra*), Engelman's spruce (*Picea Engelmanni*), mountain balsam (*Abies subalpina*), Douglas fir (*Pseudotsuga Douglasii*), mountain larch (*Larix Lyallis*).

Population.—By the census of 1906 the population of Alberta was found to be 185,412. It has grown from 73,022 in 1901 (the area of Alberta being then slightly different). The basis of the population is Canadian, and the immigration has been chiefly from (1) the British Isles, (2) United States, (3) continent of Europe (chiefly Austria, Hungary and Russia). Of the population in 1901, 17,245 had immigrated thither from the three mentioned sources. The following table shows the percentages of origins:—

	1901.
Canadian and native born	54 %
The British Isles	6·8 %
United States	16·6 %
Continent of Europe	24·4 %

Of the Indian and Indian half-breed population there were in 1901, 14,669 of the former and 11,635 of the latter. The Indians of central Alberta are chiefly plain Crees, a tribe of Algonquin stock. In southern Alberta are several thousands of Indians on reserves south and west of Calgary, consisting of the Blackfoots of Algonquin stock, Sarcees, Piegans and a few Assiniboins.

The chief cities and towns of Alberta are Edmonton (11,167), Calgary (11,967), Medicine Hat (3020), Lethbridge (2948) and Strathcona (2927).

Industries.— The chief industries of the people are farming and ranching. Cattle, horses and sheep are largely reared in the southern prairie region on ranches or smaller holdings. In this region irrigation is widely used. Red winter wheat is now produced to a considerable degree. In the town of Raymond is a large beet sugar manufactory, and in the vicinity great quantities of beets are grown by irrigation. In central Alberta coarse grains—oats and barley—and some wheat are grown, in conjunction with mixed farming. While washing out the sands of the North Saskatchewan for gold is still somewhat resorted to, the only real mining in Alberta is that for coal. Vast beds of coal are found extending for hundreds of miles, a short distance below the surface of the plains. The coal belongs to the Cretaceous beds, and while not so heavy as that of the Coal Measures is of excellent quality. In the valley of the Bow river, alongside the Canadian Pacific railway, valuable beds of anthracite coal are worked, and the coal is carried by railway as far east as Winnipeg. The usual coal deposits of Alberta are of bituminous or semi-bituminous coal. These are largely worked at Lethbridge in southern Alberta and Edmonton in the centre of the province. Many other parts of the province have pits for private use. The Athabasca river region, as well as localities far north on the Mackenzie river, has decided indications of petroleum, though it is not yet developed. Natural gas has been found at several points. The most notable gas discovery is that at Medicine Hat, which has wells with unlimited quantities. The gas is excellent, is used for lighting the town, supplies light and fuel for the people, and a number of industries are using the gas for manufacturing.

Communications.—For transportation the North Saskatchewan is to some extent depended on for carrying freight by steamboats, but railways are widespread in the province. The Canadian Pacific railway has its main line running from east to west chiefly between 50 and 51° N. Over this line passes an enormous trade from the Atlantic to the Pacific Ocean—the railway with its "Empress" steamers on the Pacific and also on the Atlantic Ocean claiming to have as its termini Liverpool and Yokohama. A branch line of the Canadian Pacific railway runs from Medicine Hat between 49° and 50° N., passing through the Crow's Nest Pass of the Rocky Mountains and carrying on trade with British Columbia. Another branch from Calgary runs southward to Macleod, and to Lethbridge there comes from the south a branch of the Great Northern railway of the United States, connecting with the state of Montana. From Calgary to Edmonton northward runs a line under the control of the Canadian Pacific railway. From this railway also run, eastward from Lacombe and Wetaskiwin, branch lines to complete the system. In 1906 the new line of the Canadian Northern railway was opened, connecting Winnipeg, 1000 m. to the east, along the North Saskatchewan river, with Edmonton. The Grand Trunk Pacific railway, backed by the Canadian government, forms a new transcontinental line; the prairie section from Winnipeg to Edmonton was in 1908 under contract.

Administration, &c.—The local government of Alberta is carried on by a provincial organization resembling that of the other Canadian provinces. The capital of the province is Edmonton, and here reside the lieutenant-governor and cabinet. The legislature consists of one house—the Legislative Assembly—of twenty-five members. Responsible government after the British model is followed, and the revenue is chiefly derived from grants from the Dominion government. Alberta has a system of municipal government similar to that of the other provinces.

Education is given by a public-school system, which, while nominally providing for separate schools for Catholics and Protestants, makes it practically impossible at most points to carry on such schools. A normal school is situated at Calgary. There is a college for secondary education in Calgary and another in Edmonton.

The following are the leading denominations in Alberta:—

	1901.
Roman Catholics	12,957
Presbyterians	10,655
Methodists	9,623
Church of England	8,888
Lutherans	5,810
Greek Church	4,618
Mormons	3,212
Baptists	2,722

The Mormons of Alberta are in the most southerly part of the province, and are a colony from the Mormon settlements in Utah, U.S. On coming to Canada they were given lands by the Dominion of Canada. The organization adopted in Utah among the Mormons is found also in Alberta, but the Canadian Mormons profess to have received a later revelation condemning polygamy.

History.—The present province of Alberta as far north as the height of land (53° N.) was from the time of the incorporation of the Hudson's Bay Company (1670) a part of Rupert's Land. After the discovery of the north-west by the French in 1731 and succeeding years the prairies of the west were occupied by them, and Fort La Jonquière was established near the present city of Calgary (1752). The North-West Company of Montreal occupied the northern part of Alberta district before the Hudson's Bay Company succeeded in coming from Hudson Bay to take possession of it. The first hold of the Athabasca region was gained by Peter Pond, who, on behalf of the North-West Company of Montreal, built Fort Athabasca on river La Biche in 1778. Roderick Mackenzie, cousin of Sir Alexander Mackenzie, built Fort Chipewyan on Lake Athabasca in 1788. By way of the North Saskatchewan river Alexander Mackenzie crossed the height of land, and proceeding northward discovered the river which bears his name, and also the Arctic Sea. Afterward going westward from Lake Athabasca and through the Peace river, he reached the Pacific Ocean, being the first white man to cross the North American continent, north of Mexico.

As part of the North-West Territories the district of Alberta was organized in 1875. Additional privileges and a local legislature were added from time to time. At length in 1905 the district of Alberta was enlarged and the present province formed by the Dominion parliament. (G. Br.)

ALBERT EDWARD NYANZA, a lake of Central Africa, the southern of the two western reservoirs of the Nile. It lies in the Albertine rift-valley between 0° 8′ and 0° 40′ S. and 29° 28′ and 29° 52′ E., at an elevation of 3004 ft. above the sea. It is roughly oval in shape and has no deep indentations. On its N.E. side it is connected by a winding channel, 25 m. long and from a quarter of a mile to a mile wide, flowing between high banks, with a smaller sheet of water, Lake Dweru, which extends north of the equator. Albert Edward Nyanza has a length of 44 m. and a breadth of 32 m. (maximum measurement). Dweru is about 20 m. long and 10 across at its widest part. The area of the two lakes is approximately 820 sq. m., or about the size of Leicestershire, England. A swampy plain, traversed by the Ruchuru and other rivers, extends south of the Nyanza and was once covered by its waters. The plain contains several salt-pans, and at the S.E. corner are numerous geysers. Along the eastern shore the low land extends to Kamarangu, a point about midway between the south and north ends of the lake, a considerable stretch of ground intervening between the wall of the rift-valley and the water, two terraces being clearly defined. The euphorbia trees and other vegetation on the lower terrace are of small size and apparently of recent origin. At some distance from the lake runs a belt of forest. North of Kamarangu the wall of the valley approaches the water in a series of bluffs some 300 to 350 ft. high. At the N.E. end the hills again recede and the plain widens to include Dweru. On the west side of the Nyanza the wall of the rift-valley runs close to the lake shore and at the N.W. corner the mountains close in on the water. North of the lake a high alluvial plain stretches to the southern slopes of the Ruwenzori mountains. From Ruwenzori a subsidiary range, known as the Kipura mountains, runs due south to the lake shore, where it ends in a low rounded hill. In general, the plain rises above the lake in a series of bold bluffs, a wide margin of swamp separating them from the water. The Semliki, the only outlet of the lake, issues from its N.W. end. Round the north-eastern shore of the lake are numerous crater lakes, many salt, the most remarkable being that of Katwe. This lake lies west of the Dweru channel and is separated from Albert Edward Nyanza by a ridge of land, not more than 160 ft. in breadth. The sides of this ridge run down steeply to the water on either side. The waters of the Katwe lake have a beautiful rose colour which becomes crimson in the shadows. The salt is highly prized and is exported to great distances.

The main feeder of Albert Edward Nyanza, and western head-stream of the Nile, the Ruchuru, rises on the north side of the volcanoes north of Lake Kivu (see Mfumbiro). On reaching the level plain 15 m. from the lake its waters become brackish, and the vegetation on its banks is scanty. The reedy marshes near its mouth form a retreat for a primitive race of fishermen. Lake Dweru, the shores of which are generally high, is fed by the streams from the eastern slopes of the Ruwenzori range. One of these, the Mpango, is a larger river than the Ruchuru. The outlet of the Nyanza, the Semliki, and the part played by the lake in the Nile system are described under Albert Nyanza.

A feature of Lake Albert Edward Nyanza is the thick haze which overhangs the water during the dry season, blotting out from view the mountains. In the rains, when the sky is clear, the magnificent panorama of hills encircling the lake on the west and north-west is revealed. The lake water is clear of a light green colour, and distinctly brackish. Fish abound, as do waterfowl, crocodiles and, in the southern swamps, hippopotami. In the rainy season the lake is subject to violent storms.

The entire area of Albert Edward Nyanza was found, by the work of the Anglo-German Boundary Commission of 1902–1904, to lie within the limits of the sphere of influence of the Congo Free State as defined in the agreement of the 12th of May 1894 between that state and Great Britain. Dweru was discovered in 1875 by H. M. Stanley, then travelling westward from Uganda, and by him was named Beatrice Gulf in the belief that it was part of Albert Nyanza. In 1888–1889 Stanley, approaching the Nile region from the west, traced the Semliki to its source in Albert Edward Nyanza, which lake he discovered, naming it after Albert Edward, prince of Wales, afterwards Edward VII. Stanley also discovered the connecting channel between the larger lake and Dweru. The accurate mapping of the lake was mainly the work of British officials and travellers, such as Scott Elliott, Sir F. D. Lugard, Ewart Grogan, J. E. Moore and Sir H. Johnston; while Emin Pasha and Franz Stuhlmann, deputy-governor (1891) of German East Africa, explored its southern shores. (See Albert Nyanza and Nile, and the authorities there quoted.) (W. E. G.; F. R. C.)

ALBERTI, DOMENICO (*c.* 1710–1740), Italian musician, is known in musical history as the writer of dozens of sonatas in which the melody is supported from beginning to end by an extremely familiar formula of arpeggio accompaniment, consequently known as the Alberti bass. He thus shows how advanced was the decay of polyphonic sensibility (as a negative preparation for the advent of the sonata-style) already during the lifetime of Bach. His works have no other special qualities, though it is probable that Mozart's first violin sonatas, written at the age of seven, were modelled on Alberti in spite of their superior cleverness.

ALBERTI, LEONE BATTISTA (1404–1472), Italian painter, poet, philosopher, musician and architect, was born in Venice on the 18th of February 1404. He was so skilled in Latin verse that a comedy he wrote in his twentieth year, entitled *Philodoxius*, deceived the younger Aldus, who edited and published it as the genuine work of Lepidus. In music he was reputed one of the first organists of the age. He held the appointment of canon in the metropolitan church of Florence, and thus had leisure to devote himself to his favourite art. He is generally regarded as one of the restorers of the ancient style of architecture. At Rome he was employed by Pope Nicholas V. in the restoration of the papal palace and of the foundation of Acqua Vergine, and in the ornamentation of the magnificent fountain of Trevi. At Mantua he designed the church of Sant' Andrea and at Rimini the celebrated church of San Francesco, which is generally esteemed his finest work. On a commission from Rucellai he designed the principal façade of the church of Santa Maria Novella in Florence, as well as the family palace in the Via della Scala, now known as the Palazzo Strozzi. Alberti wrote works on sculpture, *Della Statua*, and on painting, *De Pictura*, which are highly esteemed; but his most celebrated treatise is that on architecture, *De Re Aedificatoria*, which has been translated into Italian, French, Spanish and English. Alberti died at Rome in the April of 1472.

See Passerini, *Gli Alberti di Firenze* (1869, 1870); Mancini, *Vita di Alberti* (Firenze, 1882); V. Hoffmann, *Studien zu Leon Battista Alberti's zehn Büchern: De Re Aedificatoria* (Frankenberg, 1883).

ALBERTINELLI, MARIOTTO (1474–1515), Italian painter, was born in Florence, and was a fellow-pupil and partner of Fra Bartolommeo, with whom he painted many works. His chief paintings are in Florence, notably his masterpiece, the "Visitation of the Virgin" (1503) at the Uffizi.

ALBERTITE, a variety of asphalt found in Albert county, New Brunswick. It is of jet-black colour and brilliant pitch-like lustre. Its percentage chemical composition is:—

C.	H.	O.	N.	S.	Ash.
86·04	8·96	1·97	2·93	trace	0·10

It softens slightly in boiling water, but only fuses imperfectly when further heated, and it is less soluble than ordinary asphalt in oil of turpentine.

ALBERT LEA, a city and the county-seat of Freeborn county, Minnesota, U.S.A., about 97 m. S. of St Paul. Pop. (1890) 3305; (1900) 4500; (1905, state census) 5657, 1206 being foreign-born (461 Norwegians, 411 Danes, 98 Swedes); (1910, U.S. census) 6192. It is served by two branches of the Chicago, Milwaukee & St Paul, by the main line and one branch of the Chicago, Rock Island & Pacific, by the Illinois Central, by the Iowa Central, and by the Minneapolis & St Louis railways. It is attractively situated between Fountain Lake and Albert Lea Lake, and is a summer resort. It has a public library and the Freeborn County Court House, and is the seat of Albert Lea College (Presbyterian, for women), founded in 1884, and of Luther Academy (Norwegian Evangelical Lutheran), founded in 1888. Albert Lea is a railway and manufacturing centre of considerable importance, has grain elevators and foundries and machine shops, and manufactures bricks, tiles, carriages, wagons, flour, corsets, refrigerators and woollen goods. The city is also the centre of large dairy interests, and there are many creameries in the county. Numerous artesian wells furnish the city with an ample supply of water of unusual excellence. Albert Lea was settled in 1855 and received a city charter in 1878. The city and the lake were named in honour of Lieutenant Albert Miller Lea (1808–1891), a West Point graduate (1831) who, on behalf of the United States government, first surveyed the region and described it in a report published in 1836. He was a lieutenant-colonel of engineers in the Confederate army during the Civil War.

ALBERT NYANZA, a lake of Central Africa, the northern of the two western reservoirs of the Nile, lying in the western (Albertine) rift-valley, near its north end. The southern reservoir is Albert Edward Nyanza (*q.v.*). Lake Albert lies between 1° 9′ and 2° 17′ N. and 30° 30′ and 31° 35′ E., at an elevation of about 2000 ft. above the sea. Its greatest length is about 100 m., its greatest width 22 m., its area being approximately 1640 sq. m., about the size of Lancashire, England. South of the lake is a wide plain, traversed by the Semliki river, which enters the Nyanza through a swamp of tall weeds, chiefly ambach and papyrus. Both east and west the walls of the rift-valley are close to the lake, the water in many places washing the base of the cliffs. Elsewhere the narrow foreshore is thickly wooded. The ascent to the plateaus is generally by three tiers of hills rising one behind the other. On the west side the mountains present many pointed and conical summits; on the east the cliffs rise abruptly 1000 to 2000 ft. On either coast wild gorges and ravines, densely wooded, break the outline of the mountains. Through these gorges dash magnificent cascades, others leaping the escarpments of the plateaus in waterfalls of great volume and depth. Towards the north the hills recede from the coast and on both sides flats extend for distances varying from 5 to 15 m. On the eastern side, 92 m. from the southern end of the Nyanza, the Victoria Nile enters the lake, here not more than 6 m. across, through a wilderness of woods, the delta of the Nile extending over 4 m. The mouth of the main stream is obstructed by a bar of its own formation; the current is sluggish; there are many side channels, and the appearance of the lake gives no hint that a great river has joined its waters. For 5 or 6 m. north of the junction of the Victoria Nile the lake suffers no material diminution in width. Then, however, the eastern and western shores approach each other, and a current is perceptible flowing north. The lake has become the Bahr-el-Jebel, or Mountain river, as this section of the Nile is called. Throughout its extent Albert Nyanza is shallow; at its southern end the water for a considerable distance is not more than 3 ft. deep. The deepest soundings give only 50 to 55 ft., the average depth being 30 to 40 ft.

The Albertine Basin of the Nile.—Albert Nyanza receives the whole of the drainage of Albert Edward Nyanza and the Semliki river, and with them and its own basin forms the "Albertine" Nile system. Its waters, as stated above, mingle with those of the Victoria Nile, their united volume flowing north towards the Mediterranean. A study of the changes going on in the rift-valley in which the lakes lie leads, however, to the belief that the Albert Edward and Albert Nyanzas are drying up, a process which the nature of the drainage areas is helping to bring about. That the Albert Edward Nyanza once covered a much larger area than it does at present is certain. At that time, recent from a geological standpoint, the valley to the north, through which now flows the Semliki river, was blocked. The removal of the block led to the shrinkage of the lake and the formation of the Semliki, which found its way to the more northern lake—Albert Nyanza. Gradually the Semliki eroded its bed, and consequently the level of Albert Edward Nyanza continued to fall. The process continues but is checked by the existence of the rock barrier which stretches across the Semliki. This stream leaves Albert Edward Nyanza at its N.W. end in 0° 8′ 30″ S., and after a course of about 160 m. enters Albert Nyanza in 1° 9′ N. In its upper and in its lower course the river flows either through high alluvial plains, in which it has scored a deep channel, or across swamp land. In the middle section, which has a length of some 75 m., the river runs in a deep narrow valley covered with the densest forest. On the west this valley is bounded by the Congo mountains, which form the wall of the rift-valley, on the east by the mighty range of Ruwenzori, whose heights tower over 16,000 ft. above sea-level. In this length of 75 m. the river falls in cataracts and rapids over 800 ft. This rocky barrier acts as a regulator for the water received from Albert Edward Nyanza and, by checking the erosion of the river bed, tends to maintain the level of the lake. When this bar wears away Albert Edward Nyanza will, in all probability, disappear as a lake and will become a river, a continuation of its present most southern affluent, the Ruchuru.

Albert Nyanza, on the other hand, is threatened in the distant future with destruction from another cause—the filling of its bed by the alluvium poured into it by the Semliki, the Victoria Nile and, in a lesser degree, by other streams. The Semliki receives directly or indirectly the whole of the drainage of Ruwenzori, and also that of the eastern face of the Congo mountains as well as the drainage basin of Albert Edward Nyanza. The amount of alluvial matter carried is enormous; from Ruwenzori alone the detritus is very great. Charged with all this matter, the Semliki, as it emerges from the region of forest and cataracts (in which, often closely confined by its mountain barriers, the stream is deep and rapid), becomes sluggish, its slope flattens out, and its waters, unable to carry their burden, deposit much of it upon the land. This process, continually going on, has formed a large plain at the south end of Albert Nyanza, which has seriously encroached upon the lake. At the northern end of the lake the sediment brought down by the Victoria Nile is producing a similar effect. Albert Nyanza has indeed shrunk in its dimensions during the comparatively few years it has been known to Europeans. Thus at the S.W. end, Nyamsasi, which was an island in 1889, has become a peninsula. Islands which in 1876 were on the east coast no longer exist; they now form part of the foreshore. On the other hand, the shrinkage of the lake level caused the appearance in 1885 of an island where in 1879 there had been an expanse of shallow water. It seems probable that, in a period geologically not very remote, the "Albertine" system will consist of one great river, extending from the northern slopes of the Kivu range, where the Ruchuru has its rise, to the existing junction of the Victoria Nile with Albert Nyanza.

The combined drainage area, including the water surface of Albert Edward Nyanza, the Semliki and Albert Nyanza, is some

16,600 sq. m. Throughout this area the rainfall is heavy (40 to 60 in. or more per annum), the volume of water entering Albert Nyanza by the Semliki when in flood being not less than 700 cubic metres per second. Of the water received by Albert Nyanza annually (omitting the Victoria Nile from the calculation) between 50 and 60% is lost by evaporation, whilst 24,265,000,000 cubic metres are annually withdrawn by the Bahr-el-Jebel. The "Albertine" system plays a comparatively insignificant part in the annual flood rise of the White Nile, but to its waters are due the maintenance of a constant supply to this river throughout the year.

Discovery and Exploration.—Albert Nyanza was first reached by Sir Samuel Baker on the 14th of March 1864 near Vacovia, a small village of fishermen and salt-makers on the east coast. From a granitic cliff 1500 ft. above the water he looked out over a boundless horizon on the south and south-west, and towards the west descried at a distance of 50 or 60 m. mountains about 7000 ft. high. Albert Nyanza was consequently entered on his map as a vast lake extending about 380 m. But the circumnavigation of the lake by Gessi Pasha (1876), and by Emin Pasha in 1884, showed that Baker had been deceived as to the size of the lake. By the end of the 19th century the topography of the lake region was known with fair accuracy. The lake forms part of the (British) Uganda Protectorate, but the north-west shores were leased in 1894 to the Congo Free State during the sovereignty of king Leopold II. of Belgium. Of this leased area a strip 15 m. wide, giving the Congo State a passage way to the lake, was to remain in its possession after the determination of the lease.

See Nile; Sir W. Garstin's *Report upon the Basin of the Upper Nile* (Egypt, No. 2, 1904); Capt. H. G. Lyons' *The Physiography of the River Nile and its Basin* (Cairo, 1906), and the authorities quoted in those works. (W. E. G.; F. R. C.)

ALBERTUS MAGNUS (Albert of Cologne, ?1206–1280), count of Bollstädt, scholastic philosopher, was born of the noble family of Bollstädt at Lauingen in Suabia. The date of his birth, generally given as 1193, is more probably 1206. He was educated principally at Padua, where he received instruction in Aristotle's writings. In 1223 (or 1221) he became a member of the Dominican order, and studied theology under its rules at Bologna and elsewhere. Selected to fill the position of lecturer at Cologne, where the order had a house, he taught for several years there, at Regensburg, Freiburg, Strassburg and Hildesheim. In 1245 he went to Paris, received his doctorate and taught for some time, in accordance with the regulations, with great success. In 1254 he was made provincial of his order, and fulfilled the arduous duties of the office with great care and efficiency. During the time he held this office he publicly defended the Dominicans against the university of Paris, commented on St John, and answered the errors of the Arabian philosopher, Averroes. In 1260 the pope made him bishop of Regensburg, which office he resigned after three years. The remainder of his life he spent partly in preaching throughout Bavaria and the adjoining districts, partly in retirement in the various houses of his order; in 1270 he preached the eighth Crusade in Austria; almost the last of his labours was the defence of the orthodoxy of his former pupil, Thomas Aquinas. He died in 1280, aged seventy-four. He was beatified in 1622, and he is commemorated on the 16th of November. Albert's works (published in twenty-one folios by the Dominican Pierre Jammy in 1651, and reproduced by the Abbé Borgnet, Paris, 1890, 36 vols.) sufficiently attest his great activity. He was the most widely read and most learned man of his time. The whole of Aristotle's works, presented in the Latin translations and notes of the Arabian commentators, were by him digested, interpreted and systematized in accordance with church doctrine. Albert's activity, however, was rather philosophical than theological (see Scholasticism). The philosophical works, occupying the first six and the last of the twenty-one volumes, are generally divided according to the Aristotelian scheme of the sciences, and consist of interpretations and condensations of Aristotle's relative works, with supplementary discussions depending on the questions then agitated, and occasionally divergences from the opinions of the master. His principal theological works are a commentary in three volumes on the *Books of the Sentences* of Peter Lombard (*Magister Sententiarum*), and the *Summa Theologiae* in two volumes. This last is in substance a repetition of the first in a more didactic form. Albert's knowledge of physical science was considerable and for the age accurate. His industry in every department was great, and though we find in his system many of those gaps which are characteristic of scholastic philosophy, yet the protracted study of Aristotle gave him a great power of systematic thought and exposition, and the results of that study, as left to us, by no means warrant the contemptuous title sometimes given him—the "Ape of Aristotle." They rather lead us to appreciate the motives which caused his contemporaries to bestow on him the honourable surnames "The Great" and "Doctor Universalis." It must, however, be admitted that much of his knowledge was ill digested; it even appears that he regarded Plato and Speusippus as Stoics. Albertus is frequently mentioned by Dante, who made his doctrine of free-will the basis of his ethical system. Dante places him with his pupil Aquinas among the great lovers of wisdom (*Spiriti Sapienti*) in the Heaven of the Sun.

See Paget Toynbee, "Some Obligations of Dante to Albertus Magnus" in *Romania*, xxiv. 400-412, and the *Dante Dictionary* by the same author. For Albert's life see J. Sighart, *Albertus Magnus, sein Leben und seine Wissenschaft* (Regensburg, 1857; Eng. trans., Dixon, London, 1876); H. Finke, *Ungedrückte Dominikanerbriefe des 13. Jahrh.* (Paderborn, 1891). For his philosophy A. Stöckl, *Geschichte d. scholastischen Philosophie*; J. E. Erdmann, *Grundriss d. Ges. d. Phil.* vol. i. 8. The histories of Hauréau, Ritter, Prantl and Windelband may also be consulted. See also W. Feiler, *Die Moral d. A. M.* (Leipzig, 1891); M. Weiss, *Ueber mariologische Schriften des A. M.* (Paris, 1898); Jos. Bach, *Des A. M. Verhältniss zu d. Erkenntnisslehre d. Griechen, Römer, Araber u. Juden* (Vienna, 1881); Herzog-Hauck, *Realencyk.* (1897); Vacant, *Dict. Theol. Cathol.* (*s.v.*); Ch. Jourdain in *Dict. d. sciences philos.* (*s.v.*); M. Joel, *Das Verhältniss A. d. G. zu Moses Maimonides* (Breslau, 1863).

ALBERUS, ERASMUS (*c.* 1500–1553), German humanist, reformer and poet, was a native of the village of Sprendlingen near Frankfort-on-Main, where he was born about the year 1500. Although his father was a schoolmaster, his early education was neglected. Ultimately in 1518 he found his way to the university of Wittenberg, where he studied theology. He had here the good fortune to attract the attention of Luther and Melanchthon, and subsequently became one of Luther's most active helpers in the Reformation. Not merely did he fight for the Protestant cause as a preacher and theologian, but he was almost the only member of Luther's party who was able to confront the Roman Catholics with the weapon of literary satire. In 1542 he published a prose satire to which Luther wrote the preface, *Der Barfüsser Mönche Eulenspiegel und Alkoran*, an adaptation of the *Liber conformitatum* of the Franciscan Bartolommeo Albizzi of Pisa (Pisanus, d. 1401), in which the Franciscan order is held up to ridicule. Of higher literary value is the didactic and satirical *Buch von der Tugend und Weisheit* (1550), a collection of forty-nine fables in which Alberus embodies his views on the relations of Church and State. His satire is incisive, but in a scholarly and humanistic way; it does not appeal to popular passions with the fierce directness which enabled the master of Catholic satire, Thomas Murner, to inflict such telling blows. Several of Alberus's hymns, all of which show the influence of his master Luther, have been retained in the German Protestant hymnal. After Luther's death, Alberus was for a time *Diakonus* in Wittenberg; he became involved, however, in the political conflicts of the time, and was in Magdeburg in 1550–1551, while that town was besieged by Maurice of Saxony. In 1552 he was appointed *Generalsuperintendent* at Neubrandenburg in Mecklenburg, where he died on the 5th of May 1553.

Das Buch von der Tugend und Weisheit has been edited by W. Braune (1892); the sixteen *Geistliche Lieder* by C. W. Stromberger (1857). Alberus's prose writings have not been reprinted in recent times. See F. Schnorr von Carolsfeld, *Erasmus Alberus* (1894).

ALBERY, JAMES (1838–1889), English dramatist, was born in London on the 4th of May 1838. On leaving school he entered an architect's office, and started to write plays. After many failures he at last succeeded in getting an adaptation—*Dr Davy*

—produced at the Lyceum (1866). His most successful piece, *Two Roses*, a comedy, was produced at the Vaudeville in 1870, in which Sir Henry Irving made one of his earliest London successes as Digby Grant. He was the author of a large number of other plays and adaptations, including *Jingle* (a version of *Pickwick*), produced at the Lyceum in 1878, and *Pink Dominoes*, the latter being one of a series of adaptations from the French which he made for the Criterion theatre. At that house his wife, the well-known actress, Miss Mary Moore, played the leading parts. He died on the 15th of August 1889.

ALBI, a city of south-western France, capital of the department of Tarn, 48 m. N. E. of Toulouse, on a branch line of the Southern railway. Pop. (1906) 14,956. Albi occupies a commanding position on the left bank of the Tarn; it is united to its suburb of La Madeleine on the right bank by a medieval and a modern bridge. The old town forms a nucleus of narrow, winding streets surrounded by boulevards, beyond which lie modern quarters with regular thoroughfares and public gardens. The cathedral of Sainte Cécile, a fine fortress-church in the Gothic style, begun in 1277, finished in 1512, rises high above the rest of the town. The exterior, flanked at the western end by a lofty tower and pierced by high, narrow windows, is devoid of ornament. Its general plainness contrasts with the elaborate carving of the stone canopy which shelters the southern portal. In the interior, which is without transepts or aisles, the rood-screen and the choir-enclosure, which date from about 1500, are masterpieces of delicate sculpture; the vaulting and the walls are covered with paintings of the 15th and 16th centuries. The archbishop's palace to the north-east of the cathedral is a fortified building of the 14th century. St Salvi, the chief of the other churches of Albi, belongs to the 13th and 15th centuries. A statue of the sailor La Pérouse (1741–1788) stands in the square named after him.

Albi is the seat of an archbishop, a prefect and a court of assizes. It has tribunals of first instance and of commerce, a board of trade-arbitrators, a chamber of commerce, a *lycée* and training colleges. The industrial establishments of the town include dye-works, distilleries, tanneries, glass-works and important flour-mills. It is also a centre for hat-making, and produces cloth-fabrics, lace, umbrellas, casks, chairs, wooden shoes, candles and pastries. Trade is in wine and anise.

Albi (*Albiga*) was, in the Gallo-Roman period, capital of the Albigenses, and later of the viscounty of Albigeois, which was a fief of the counts of Toulouse. From the 12th century onwards, its bishops, the first of whom appears to have lived about the 3rd century, began to encroach on the authority of the viscounts; the latter, after the Albigensian war, lost their estates, which passed to Simon de Montfort and then to the crown of France. By a convention concluded in 1264 the chief temporal power in the city was granted to the bishops. The archbishopric dates from 1678.

ALBIAN (Fr. *Albien*, from Alba = Aube in France), in geology the term proposed in 1842 by A. d'Orbigny for that stage of the Cretaceous System which comes above the Aptian and below the Cenomanian (*Pal. France. Crét.* ii.). The precise limits of this stage are placed somewhat differently by English and continental geologists. In England it is usual to regard the Albian stage as equivalent to the Upper Greensand *plus* Gault, that is, to the "Selbornian" of Jukes-Browne. But A. de Lapparent would place most of the Upper Greensand in the Cenomanian. The English practice is to commence the *upper* Cretaceous with the Albian; on the other hand, this stage closes the *lower* Cretaceous according to continental usage. It is necessary therefore, when using the term Albian, to bear these differences in mind, and to ascertain the exact position of the strata by reference to the zonal fossils. These are, in descending order, *Pecten asper* and *Cardiaster fossarius*, *Schloenbachia rostrata*, *Hoplites lautus* and *H. interruptus*, *Douvilleiceras mammillatum*. In addition to the formations mentioned above, the following representatives of the Albian stage are worthy of notice: the gaize and phosphatic beds of Argonne and Bray in France; the Flammenmergel of North Germany; the lignites of Utrillas in Spain; the Upper Sandstones of Nubia, and the Fredericksburg beds of North America.

See GAULT, GREENSAND, and CRETACEOUS. (J. A. H.)

ALBIGENSES, the usual designation of the heretics—and more especially the Catharist heretics—of the south of France in the 12th and 13th centuries. This name appears to have been given to them at the end of the 12th century, and was used in 1181 by the chronicler Geoffroy de Vigeois. The designation is hardly exact, for the heretical centre was at Toulouse and in the neighbouring districts rather than at Albi (the ancient *Albiga*). The heresy, which had penetrated into these regions probably by trade routes, came originally from eastern Europe. The name of Bulgarians (*Bougres*) was often applied to the Albigenses, and they always kept up intercourse with the Bogomil sectaries of Thrace. Their dualist doctrines, as described by controversialists, present numerous resemblances to those of the Bogomils, and still more to those of the Paulicians, with whom they are sometimes connected. It is exceedingly difficult, however, to form any very precise idea of the Albigensian doctrines, as our knowledge of them is derived from their opponents, and the very rare texts emanating from the Albigenses which have come down to us (*e.g.* the *Rituel cathare de Lyon* and the *Nouveau Testament en provençal*) contain very inadequate information concerning their metaphysical principles and moral practice. What is certain is that, above all, they formed an anti-sacerdotal party in permanent opposition to the Roman church, and raised a continued protest against the corruption of the clergy of their time. The Albigensian theologians and ascetics, the Cathari or *perfecti*, known in the south of France as *bons hommes* or *bons chrêtiens*, were few in number; the mass of believers (*credentes*) were perhaps not initiated into the Catharist doctrine; at all events, they were free from all moral prohibition and all religious obligation, on condition that they promised by an act called *convenenza* to become "hereticized" by receiving the *consolamentum*, the baptism of the Spirit, before their death or even *in extremis*.

The first Catharist heretics appeared in Limousin between 1012 and 1020. Several were discovered and put to death at Toulouse in 1022; and the synod of Charroux (dep. of Vienne) in 1028, and that of Toulouse in 1056, condemned the growing sect. The preachers Raoul Ardent in 1101 and Robert of Arbrissel in 1114 were summoned to the districts of the Agenais and the Toulousain to combat the heretical propaganda. But, protected by William IX., duke of Aquitaine, and soon by a great part of the southern nobility, the heretics gained ground in the south, and in 1119 the council of Toulouse in vain ordered the secular powers to assist the ecclesiastical authority in quelling the heresy. The people were attached to the *bons hommes*, whose asceticism imposed upon the masses, and the anti-sacerdotal preaching of Peter of Bruys and Henry of Lausanne in Périgord, Languedoc and Provence, only facilitated the progress of Catharism in those regions. In 1147 Pope Eugenius III. sent the legate Alberic of Ostia and St Bernard to the affected district. The few isolated successes of the abbot of Clairvaux could not obscure the real results of this mission, and the meeting at Lombers in 1165 of a synod, where Catholic priests had to submit to a discussion with Catharist doctors, well shows the power of the sect in the south of France at that period. Moreover, two years afterwards a Catharist synod, in which heretics from Languedoc, Bulgaria and Italy took part, was held at St Félix de Caraman, near Toulouse, and their deliberations were undisturbed. The missions of Cardinal Peter (of St Chrysogonus), formerly bishop of Meaux, to Toulouse and the Toulousain in 1178, and of Henry, cardinal-bishop of Albano (formerly abbot of Clairvaux), in 1180–1181, obtained merely momentary successes. Henry of Albano attempted an armed expedition against the stronghold of heretics at Lavaur and against Raymond Roger, viscount of Béziers, their acknowledged protector. The taking of Lavaur and the submission of Raymond Roger in no way arrested the progress of the heresy. The persistent decisions of the councils against the heretics at this period—in particular, those of the council of Tours (1163) and of the oecumenical

Lateran council (1179)—had scarcely more effect. But on ascending the papal throne, Innocent III. resolved to suppress the Albigenses. At first he tried pacific conversion, and in 1198 and 1199 sent into the affected regions two Cistercian monks, Regnier and Guy, and in 1203 two monks of Fontfroide, Peter of Castelnau and Raoul (Ralph), with whom in 1204 he even associated the Cistercian abbot, Arnaud (Arnold). They had to contend not only with the heretics, the nobles who protected them, and the people who listened to them and venerated them, but also with the bishops of the district, who rejected the extraordinary authority which the pope had conferred upon his legates, the monks. In 1204 Innocent III. suspended the authority of the bishops of the south of France. Peter of Castelnau retaliated by excommunicating Raymond VI., count of Toulouse, as an abettor of heresy (1207), and kindled in the nobles of the south that animosity of which he was the first victim (1209). As soon as he heard of the murder of Peter of Castelnau, the pope ordered the Cistercians to preach the crusade against the Albigenses. This implacable war, which threw the whole of the nobility of the north of France against that of the south, and destroyed the brilliant Provençal civilization, ended, politically, in the treaty of Paris (1229), by which the king of France dispossessed the house of Toulouse of the greater part of its fiefs, and that of Béziers of the whole of its fiefs. The independence of the princes of the south was at an end, but, so far as the heresy was concerned, Albigensianism was not extinguished, in spite of the wholesale massacres of heretics during the war. Raymond VII. of Toulouse and the count of Foix gave asylum to the "faidits" (proscribed), and the people were averse from handing over the *bons hommes*. The Inquisition, however, operating unremittingly in the south at Toulouse, Albi, Carcassonne and other towns during the whole of the 13th century and a great part of the 14th, succeeded in crushing the heresy. There were indeed some outbursts of rebellion, some fomented by the nobles of Languedoc (1240–1242), and others emanating from the people of the towns, who were embittered by confiscations and religious persecutions (*e.g.* at Narbonne in 1234 and Toulouse in 1235), but the repressive measures were terrible. In 1245 the royal officers assisting the Inquisition seized the heretical citadel of Montségur, and 200 Cathari were burned in one day. Moreover, the church decreed severe chastisement against all laymen suspected of sympathy with the heretics (council of Narbonne, 1235; Bull *Ad extirpanda*, 1252).

Hunted down by the Inquisition and quickly abandoned by the nobles of the district, the Albigenses became more and more scattered, hiding in the forests and mountains, and only meeting surreptitiously. There were some recrudescences of heresy, such as that produced by the preaching (1298–1309) of the Catharist minister, Pierre Authier; the people, too, made some attempts to throw off the yoke of the Inquisition and the French,[1] and insurrections broke out under the leadership of Bernard of Foix, Aimery of Narbonne, and, especially, Bernard Delicieux at the beginning of the 14th century. But at this point vast inquests were set on foot by the Inquisition, which terrorized the district. Precise indications of these are found in the registers of the Inquisitors, Bernard of Caux, Jean de St Pierre, Geoffroy d'Ablis, and others. The sect, moreover, was exhausted and could find no more adepts in a district which, by fair means or foul, had arrived at a state of peace and political and religious unity. After 1330 the records of the Inquisition contain but few proceedings against Catharists. (See also under CATHARS.)

AUTHORITIES.—See C. Schmidt's *Histoire de la secte des Cathares ou Albigeois* (Paris, 1849), which is still the most important work on the subject. The following will be found useful: D. Vaissete, *Histoire de Languedoc*, vols. iii. iv. vii. viii. (new edition); Ch. Molinier, *L'Inquisition dans le Midi de la France* (Paris, 1880), and the other works by the same author; L. Tanon, *Histoire des tribunaux de l'Inquisition en France* (Paris, 1893). *Les Albigeois, leurs origines* (Paris, 1878), by Douais, should be read with caution. Of the sources, which are very numerous, may be mentioned: the *Liber Sententiarum* of the Inquisition of Carcassonne, published by Ph. van Limborch at the end of his *Historia Inquisitionis* (Amsterdam, 1692); other registers of the Inquisition analysed at length by Ch. Molinier, *op. cit.*, some published in vol. ii. of the *Documents pour l'histoire de l'Inquisition* (Paris, 1900), by C. Douais; numerous texts concerning the last days of Albigensianism, collected by M. Vidal, "Les derniers ministres albigeois,' in *Rev. de quest. histor.* (1906). See also the *Rituel cathare*, ed. by Cunitz (Jena, 1852); the *Nouveau Testament en provençal*, ed. by Clédat (Paris, 1887); and the very curious *Débat d'Yzarn et de Sicart de Figueiras*, ed. by P. Meyer (1880). On the ethics of the Catharists, see Jean Guiraud, *Questions d'histoire et d'archéologie chrétienne* (Paris, 1906); and P. Alphandéry, *Les idées morales chez les hétérodoxes latins au début du XIII^e siècle* (Paris, 1903). (P. A.)

ALBINO, a biological term (Lat. *albus*, white), in the usual acceptation, for a pigmentless individual of a normally pigmented race. Among some flowering plants, however, the character has become one of specific rank, and among animals we have in the polar bear and the Greenland hare instances where partial albinism—for in them the eyes are black and other parts may be pigmented—has also become a specific character.

A true or complete albino is altogether devoid of pigment. One result of this among the Vertebrata is that the eyeball is pink in colour, since the cornea, iris and retina being transparent, the red blood contained in the capillaries is unmasked by the absence of pigmentary material. In man, and doubtless also in lower forms, the absence of this pigment produces the well-marked albinotic facies. This is a condition in which the eyelids are brought into a nearly closed position accompanied by blinking movements and a general wrinkling of the skin around the immediate neighbourhood of the eyes. It is the result of the too great intensity of the light incident upon the retina, and which in normal eyeballs is adequately diminished by the absorptive power of the pigmentary material.

In a complete albino not only is all pigment absent in the skin, but also that which is normally present in deeper organs, such as the sympathetic nervous system and in the *substantia nigra* of the brain. There is some reason to believe that a peculiar condition found in the majority of human albinoes, and known as nystagmus, is correlated with the absence of pigment in the central nervous system. This condition is one marked by unsteadiness—a sort of flickering rolling—of the eyeballs, and it becomes more marked as they endeavour to adjust their accommodation to near objects. It is thought to depend upon some connexion, not yet anatomically demonstrated, between the third cranial nerve and its nucleus in the floor of the *iter* and the *substantia nigra*.

In addition to complete albinism, there exist, however, various albinotic conditions in which more or less pigment may be present. Familiar instances of this partial albinism is seen in the domestic breed of Himalayan rabbits. In these animals the eyeball and the fur of the body are unpigmented, but the tips of the ear pinnae and extremities of the fore and hind limbs, together with the tail, are marked by more or less well defined colour. One remarkable feature of these animals is that for a few months after birth they are complete albinoes. Occasionally, however, some are born with a grey colour and a few may be quite black, but ultimately they attain their characteristic coat. There is some reason to believe, as we shall see later, that in spite of the presence of a little pigment and of occasional wholly pigmented young ones, Himalayans must be regarded as true albinoes. Other individual rabbits, but belonging to no particular breed, are similarly marked, but in addition the eyeballs are black. Some domesticated mice are entirely white with the exception that they have black eyeballs; and individuals of this type are known in which there is a reduction of pigment in the eyeballs, and since the colour of the blood is then partially visible these appear of a reddish-black colour. Such cases are interesting as representing the last step in the graded series through which the condition of complete pigmentation passes into that of complete albinism.

There is evidence, as shown by G. M. Allen, that partial albinism is a condition in which pigment is reduced around definite body centres, so that unpigmented areas occur between the pigment patches or at their borders. In the mouse, ten such centres may be distinguished, arranged symmetrically five on either side of the median plane—a cheek patch, neck patch, shoulder patch, side patch and rump patch. Various degrees in the reduction of the pigment patches up to that of complete elimination may be traced.

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[1] These they often confounded, and a heretic is described as saying: "Clergy and French, they are one and the same thing."

Some animals are wholly pigmented during the summer and autumn, but through the winter and spring they are in the condition of extreme partial albinism and become almost complete albinoes. Such instances are found in the Scotch blue hare (*Lepus timidus*), in the Norway hare, in the North American hare (*L. americanus*), in the arctic fox (*Canis lagopus*), in the stoat and ermine, and among birds, in the ptarmigan, and some other species of *Lagopus*. How the change from the autumnal to the winter condition takes place appears not to be definitely settled in all cases, and accurate observations are much to be desired. In the case of the Norway hare, it has been stated that a general moult, including all the hairs and under fur, takes place and new white hairs are substituted. The process of moulting is said to begin in the middle of autumn and is completed before the end of December, by which time the fur is in its winter condition, and is closer, fuller and longer than in summer (*Naturalists' Library*, vol. vii.). On the other hand, it has been stated that during the whole of the transformation in the fur no hairs fall from the animal, and it is attributed to an actual change in the colour of the hair (*Edinburgh Philosophical Journal*, vol. xi. p. 191). In the case of the American hare, however, some very careful observations have been made by F. H. Welch. In this animal the long hairs (which form the pile) become white at their extremities, and in some of them this whiteness extends through their whole length. At the same time, new hairs begin to develop and to grow rapidly, and soon outstrip the hairs of the autumn pile. From their first appearance these new hairs are white and stiff, and they are confined to the sides and back of the body. It is not clear from Welch's account what is the cause of the whiteness of the tips of the hairs of the autumn coat, but his figures suggest that it is due to the development of gas in the interspaces between the keratin bridges and trabeculae of the hairs. There is nothing to show whether the pigment persists or is absorbed. Probably it persists. In this event, the whiteness of the tips will be due to the scattering or irregular reflexion of the incident rays of light from the surface of the numerous gas bubbles. In the case of the ptarmigan the evidence is clear that the existing autumnal feathers do change, more or less completely, to white. But the evidence is not conclusive as to whether any part of the winter condition is additionally produced by moulting.

The condition of albinism thus assumed as a seasonal variation is never complete, for the eyes at least retain their pigmented state. The reason of this is readily understood when it is borne in mind how disadvantageous to the function of sight is the unpigmented condition of an albino's eyeball; a disadvantage which would be probably much accentuated, in the cases now under consideration, by the bright glare from the surface of the snow, which forms the natural environment of these animals at the particular period of the year when the winter change occurs. In some cases, as in all the varying hares, in addition to the eyes retaining their normal pigmentation, areas similar in extent and situation to those on the Himalayan rabbits also retain their pigmentation; and in the ptarmigan there is a black band on each side of the head stretching forwards and backwards from the eyeball, and the outer tail feathers are black.

Albinism is restricted to no particular class of the animal kingdom; for partial albinism at least is known to occur in Coelentera, worms, Crustacea, Myriapoda, Coleoptera, Arachnida and fishes. The individuals in which this diminished pigmentation is found are for the most part those living in caves, and it is probable that their condition is not truly albinotic, but only temporary and due to the absence of the stimulus of light. This may be also true of some of those instances that have occurred among frogs, in *Proteus*, and with an axolotl once possessed by the present writer. This latter animal was quite white, with the exception of the black eyeballs. At the end of four weeks after it was first purchased the dorsal or upper surface of its external gills developed a small amount of dark pigment. Within the next few weeks this increased in quantity and the dorsal surface of the head and of the front end of the trunk began to be pigmented. The animal died at the end of the eighth week, but it is possible that had it lived it would have become wholly pigmented. But, apart from these instances, albinism is known, according to W. E. Castle, who cites it on the authority of Hugh M. Smith, to occur among a breed of albino trout, which breed true and are reared in the State fish-hatcheries of America. With birds and mammals, however, there is no doubt that complete albino individuals do occur; and among species which, like the jackdaw, certain deer and rabbits, are normally deeply pigmented.

Albinism occurs in all races of mankind, among mountainous as well as lowland dwellers. And, with man, as with other animals, it may be complete or partial. Instances of the latter condition are very common among the negroes of the United States and of South America, and in them assumes a piebald character, irregular white patches being scattered over the general black surface of the body. Occasionally the piebald patches tend to be symmetrically arranged, and sometimes the eyeballs are pigmentless (pink) and sometimes pigmented (black).

According to A. R. Gunn, of Edinburgh University, who has recently been investigating the subject of albinism in man, there is reason to believe that a condition of piebald albinism occurs also in Europeans (Scotsmen). He has examined subjects in which the whole of the hair of the body is white, but the eyeballs are pigmented, often deeply; and, conversely, he has seen cases in which the eyes are pink but the hair is pigmented. The hair and the eyes may be regarded as skin patches, in which sometimes the one and sometimes the other is pigmentless. He believes that, were it not for the generally very pale colour of white-skinned races, this piebald condition would be as manifest in them as in negroes, over the whole surface of the body.

In complete human albinoes, albinism is correlated, in addition to nystagmus, with a peculiar roughness of the skin, making it harsh to the touch. The skin is also milky-white in appearance.

According to C. J. Seligmann, there exists among the Papuans an albinotic race whose skin varies in colour from a pink-white to that of *café au lait;* the eyes are generally greenish, hazel or brown, and the hair is tow-coloured. The skin where unexposed is pinker than that of a normal North European. Like complete albinoes, this race suffers from photophobia, and is characterized by the albinotic facies.

Before we can inquire into the cause and meaning of albinism it will be necessary first to consider the nature of pigmentation. It has recently been ascertained that the coloration of certain sponges is due to the interaction of an oxydizing ferment, tyrosinase, upon certain colourless chromogenic substances. In 1901, Otto v. Furth and Hugo Schneider showed that a tyrosinase could be obtained from the blood of certain insects, and, acting upon a chromogen present in the blood, converted it into a pigmentary substance of melanin-like nature. Hans Przibram also extracted a tyrosinase from the ink-sac of *Sepia*, and, causing it to act upon a watery solution of tyrosin, obtained a black pigment. From the blood of *Bombyx mori*, V. von Ducceshi has also obtained a tyrosinase.

Subsequently (1903) L. Cuénot, in order to explain certain features in the hereditary transmission of coat colour in mice, postulated the hypothesis that the grey colour of the wild mouse (which is known to be a compound of black, chocolate and yellow pigments) may be due either to the interaction of a single ferment and three chromogens, or *vice versa*, to one chromogenic substance and three ferments.

Since then (1904) Miss Florence Durham has shown that if the skins of young or embryonic mammals (rats, rabbits and guinea-pigs) be ground up and extracted in water, and the expressed juice be then incubated with solid tyrosin for twenty-four hours, with the addition of a very small amount of ferrous sulphate to act as an activator, a pigmentary substance is thrown down. The colour of this substance is that of the pigment in the skin or hairs of the animal used. Miss Durham interprets her results as indicating that the skin of these pigmented animals normally secretes one or more tyrosinases. The same result was obtained from the skins of some unhatched chickens. The skins of albinoes gave no results.

Not only have such results been obtained with sponges, insects, cephalopods, birds and mammals, but Em. Bourquelot and G. Bertrand have shown that certain fungi, the tissues of which, when exposed to the air by injury, become immediately coloured, do so owing to the action of tyrosinase upon one or more chromogenous substances present in the plant. We may conceive, then, that a pigmented animal owes its colour to the power that certain tissues of its body possess to secrete both tyrosinases and chromogenic substances. And the period at which this process is most active is at birth, or preceding it or immediately succeeding it. In spite of the inquiry being only in its initial stages, there is already good evidence to believe that Cuénot's theory is correct, and that an albino is an individual whose skin lacks the power to secrete either the ferment or the chromogen. It forms one but not both of these substances.

A moment's consideration, however, will show that, while an albino may be an individual in which one or more of the complementary bodies of pigmentation are absent, a pigmented animal is something more than an individual which carries all the factors necessary for the development of colour. For it must be borne in mind that animals are not only coloured but the colour is arranged in a more or less definite pattern. The wild mouse, rat and rabbit are self-coloured, but the domesticated forms include various piebald patterns, such as spotted forms among mice, and the familiar black and white hooded and dorsal-striped pattern of some tame rats.

Colour, therefore, must be correlated with some determinant (determining factor) for pattern, and it cannot, therefore, exist alone in an animal's coat. And we must conceive that each kind of pattern—the self, the spotted, the striped, the hooded and all others—has its own special determinant. Given the presence of all the necessary determinants for the development of pigment in a mammal's coat, some or all of the hairs may bear this pigment according to the pattern determinants, or absence of pattern determinants, which the cells of the hair papillae carry. And this brings us to the question as to whether in a piebald animal the pigmented hairs are in any way different from the pigmentless or white hairs. No adequate investigation of this subject has yet been made, but some observations made by the author of this article, on the piebald black and white rat, show that differences connected with the microscopic structure exist.

There is thus evidence that colour is correlated with other factors which determine pattern. And this leads to the inquiry as to whether albinoes ever exhibit evidence that they carry the pattern determinants in the absence of those for pigmentation. For it is to be expected *a priori* that, since albinoes were derived from pigmented progenitors and may at any time appear, side by side with pigmented brothers, in a litter from pigmented parents, they would be carrying the pattern determinants of some one or other of their pigmented ancestors. Now we know, from the numerous experiments in heredity which have resulted since the rediscovery of Mendel's principles, that an individual may carry a character in one of two conditions. It may be carried as a somatic character, when it will be visible in the body tissues, or it may be carried as a gametic character, and its presence can only then be detected in subsequent generations, by adequately devised breeding tests.

With regard to pattern, the evidence is now clear that albinoes may carry the determinants in both these ways. So far as they are carried gametically, *i.e.* by the sex-cells, it has been shown by Cuénot and G. M. Allen for mice, by C. C. Hurst for rabbits, and by L. Doncaster and G. P. Mudge for rats, that in a cross between a coloured individual of known gametic purity and an albino, the individuals of the progeny in either the first or second, or both generations, may differ, and that the difference in some cases wholly depends upon the albino used. It has been shown that the individuals in such an offspring may bear patterns which never occurred in the ancestry of the coloured parent, but did in that of the albino; and, moreover, if the same coloured parent be mated with another individual, either albino or coloured, that their offspring may never contain members bearing such patterns. The particular pattern will only appear when the coloured parent is mated with the particular albino. And yet the albino itself shows no somatic pattern or pigment. So clear is the evidence on this point that any one adequately acquainted at first hand with the phenomena, by employing an albino of known gametic structure and mating it with a coloured individual, also of known gametic constitution, could predict the result.

With respect to albinoes carrying pattern as a visible somatic character, *i.e.* in the body cells, no definite evidence has as yet been published. But W. Haacke has described a single albino rat, in which he states that the hairs of the shoulder and mid-dorsal regions were of a different texture from those of the rest of the body. And it is possible that this albino, had it developed colour, would have been of the piebald pattern. But the author of this article has quite recently reared some albinoes in which the familiar shoulder hood and dorsal stripe of the piebald rat is perfectly obvious, in spite of the absence of the slightest pigmentation. The hairs which occupy the region which in the pigmented individual is black, are longer, thinner and more widely separated than those in the regions which are white. As a result of this, the pink skin is quite visible where these hairs occur, but elsewhere it is invisible. Thus these albinoes exhibit a pattern of pink skin similar in form with the black pattern of the piebald rat. Moreover, some of the albinoes possess these particular " pattern " hairs all over the body and obviously such individuals are carrying the self pattern. There are other details into which we cannot here enter, but which support the interpretation put upon these facts, *i.e.* that these particular albinoes are carrying in the soma the pattern determinants simultaneously with the absence of some of the factors for pigmentation.

Not only do albinoes thus carry the determinants for pattern, but it has been known for some time that they also carry gametically, but never visible somatically, the determinants for either the ferment or the chromogen for one or more colours. L. Cuénot was the first to show this for albino mice. He was able by appropriate experiments to demonstrate that when an albino is derived (extracted) from a coloured ancestry, and is then crossed with a coloured individual, both the colour of the pigmented parent and of the pigmented ancestry of the albino may appear among the individuals of the offspring.

Immediately subsequent to Cuénot, G. M. Allen in America demonstrated the same fact upon the same species of rodents. C. C. Hurst, more recently, has shown that albino rabbits, whether pure bred for eight generations at least, or extracted from pigmented parents, may carry the determinants for black or for black and grey. In this latter case the determinants for black are carried by separate gametes from those carrying grey, and the two kinds of sex-cells exist in approximately equal numbers. This is likewise true of albino mice when they carry the determinants for more than one colour.

Since Hurst's work, L. Doncaster and G. P. Mudge have both shown that albino rats also carry in a latent condition the determinants for black or grey. The experiments of the latter author show that, if a gametically pure black rat be crossed with an albino derived from a piebald black and white ancestry, all the offspring in successive litters will be black; but if the same black parent be crossed with albinoes extracted from parents of which one or both are grey, then both grey and black members will appear in the successive litters.

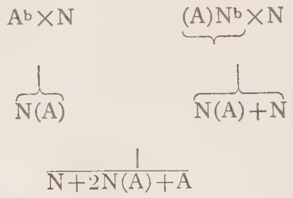
The proportions in which the various coloured individuals appear are approximately those demanded by the Mendelian principle of gametic purity and segregation. Cuénot and Hurst have also shown that when albinoes of one colour extraction are crossed with albinoes of another colour extraction the segregation of the colour determinants in the gametogenesis of the albinoes takes place in precisely the same way that it does in the gametogenesis of a pigmented individual; that is, in Mendelian fashion. Or, to express it otherwise, an albino extracted from yellow parents, bred with an albino extracted from black parents, will give an albino offspring whose gametes in equal numbers are bearers of the black and yellow determinants. And when one of these albinoes is bred with a pure coloured individual, a mixed offspring will appear in the first generation. Some of the individuals will be one or other of the two colours, the determinants of which were borne by the albino, and others the colour of the pigmented parent. But in such albino crosses the colour characters are latent because albinoes do not carry the whole of the complements for colour production. They carry only some determinant or determinants which are capable of developing colour when they interact with some other determinant or determinants carried alone by pigmented individuals. Whether albinoes carry the tyrosinase or other ferment, or whether they carry the chromogen or chromogens, is not yet settled. Miss Durham's work suggests that they carry the latter. But that they never bear both is proved by the fact that, when albinoes are crossed with each other, none but albinoes ever result in the offspring. One apparent exception to this rule only is known, and this almost certainly was due to error.

It is not only among albino animals that colour factors are carried in a latent condition, but also in white flowers. W. Bateson has shown this to be the case for the sweet-pea (*Lathyrus odoratus*), var. Emily Henderson, and for certain white and cream stocks (*Matthiola*). When white Emily Henderson (the race having round pollen grains) is crossed with a blue-flowered pea, purple offspring result. Similarly, when white Emily Henderson (long pollen grains) is crossed with white Emily Henderson (round pollen grains), the offspring wholly consists of the reversionary purple type, and sometimes wholly of a red bicolor form known as "Painted Lady." These two types never appear in the same family. With the stocks, when a white-flowered and hairless form is crossed with a cream-flowered and hairless one, all the offspring are purple and hairy. Bateson considers that the purple colour is due to the simultaneous existence in the plant of two colour factors which may be designated by C and R. If either one of these two is absent the plant is colourless. Cream-coloured flowers are regarded as white because cream is due to yellow plastids and not to sap colour. Thus the cream plant may carry C and the white one R. When they are crossed the two factors for colour production are brought together. Obviously, we may regard C as a tyrosinase and R as a chromogen, or *vice versa;* and in the case of the white sweet-pea crossed with a blue-flowered one, and producing purple offspring, we may imagine that the white flower brought in an additional tyrosinase or a chromogen not present in the blue flower, which, when combined or mixed with the chromogen or tyrosinase for blue, gave purple. A similar explanation may apply to C. Correns's experiment, in which he crossed white *Mirabilis jalapa* with a yellow form, and always obtained red-flowered offspring.

In heredity, complete albinism among animals is always recessive; and partial albinism (piebald) is always recessive to complete pigmentation (self-coloured). When an albino mouse, rat, guinea-pig or rabbit is crossed with either a pure self or pure pied-coloured form, the offspring are similar to, though not always exactly like, the coloured parent; provided, of course, that the albino is pure and is not carrying some colour or pattern determinant which is dominant to that of the coloured parent used. No albinoes, in such a case, will appear among the first generation, but if the individuals of this (F.1) generation are crossed *inter se* or back crossed with the albino parent, then albino individuals reappear among the offspring. In the former case they would form one-quarter of the individuals of this second (F.2) generation, and in the latter, one-half.

The recessive nature of albinism and its distribution in Mendelian fashion is almost certainly as true for man as for lower forms. This has been shown by W. C. Farabee for negroes in Coanoma county, Mississippi. The facts are as follows. An albino negro married a normal negress. They had three children, all males. All three sons married, and two of them had only normal children, judged of course by somatic characters. But the third son married twice, and by the first wife had five normal and one albino children, and by the second, six normal and three albino children. If we assume that the two negresses which the third son married were themselves carrying albinism recessive—an exceedingly probable condition considering that albino negroes are not uncommon—the result is accurately in accordance, as W. E. Castle has shown, with Mendelian expectation. For there is expected in the offspring of this third son coloured individuals and albinoes in the proportion of 3:1. There is actually 11:4, which is the nearest possible approximation with the number 15.

The operation of Mendelian processes in human heredity is further shown by the close relationship that exists between the appearance of albinoes and cousin marriages. An albino is a homozygote; that is, all its gametes are carrying the character of albinism and none of them bear the alternative character —the allelomorph—of pigmentation. By pigmentation is here meant all those factors which go to its production. Now such a gametic (egg or sperm) constitution can only result when two individuals, all or some of whose gametes are pure with regard to the character albinism, meet in fertilization. Hence it is readily seen that it is among cousin marriages that the greater probabilities exist that two individuals bearing identical characters will meet, than in the population at large. This can be illustrated in the following scheme. Let A stand for a pure albino and (A)N for a normal person, who nevertheless carries the character albinism (A) recessive. Then, in the scheme below, if A^b and $(A)N^b$ are two brothers who both marry normal wives N, their children N(A) in the first case will be all normal in appearance but will be carrying albinism recessive; and in the second case some will be pure normal individuals N, and some will be like the children of the first brother, *i.e.* N(A). Now, if one of these latter children of the second brother marries a cousin—a child of the first brother,—their offspring, if large enough, will consist of some pure normals N, impure normals N(A), and of albinoes A.



No other rational explanation of the close relationship between albinism and cousin marriages is at present forthcoming. And, when the whole facts are borne in mind, there can be no reasonable doubt that the Mendelian principles offer an intelligible solution of the problem.

A popular conception exists that albinoes are less constitutionally strong than the pigmented individuals of the same species. In support of this belief there is more or less scientifically ascertained evidence. Conversely, there is, however, conclusive evidence that in some instances and in respect of certain qualities the opposite belief is true.

To deal with the former belief first, we have the remarkable case cited by Charles Darwin on the authority of Professor I. J. Wyman. In Virginia the paint-root plant (*Lachnanthes tinctoria*) occurs abundantly, and Professor Wyman noticed that all the pigs in this district were black. Upon inquiry of the farmers he found that all the white pigs born in a litter were destroyed, because they could not be reared to maturity. The root of this plant, when eaten by white pigs, caused their bones to turn to a pink colour and their hoofs to fall off, but the black pigs could eat the same plant with impunity. Partial albinism in this case was undoubtedly correlated with some inherent constitutional defect, in virtue of which the individuals characterized by it were injuriously affected by the juices of a plant quite innocuous to their pigmented brethren. Heusinger has shown that white sheep and pigs are injured by the ingestion of certain plants, while the pigmented individuals may eat them without harm. In Devonshire and in parts of Kent the farmers entertain a marked prejudice against white pigs, because "the sun blisters their skin." More remarkable is the case of certain cattle, whose skin is piebald, marked by a general ground colour over which are scattered patches of unpigmented coat. In these animals, in certain inflammatory skin eruptions, caused by the ingestion of harmful plants, the albinotic areas are alone affected. And with certain cutaneous diseases accompanied by constitutional disturbances which afflict cattle, the affection in the skin appears on the patches bearing white hairs, the other parts remaining apparently healthy. Such cases suggest that we should be more correct in regarding, not albinism as correlated with constitutional defects, but rather pigmentation as correlated with powers of immunity or increased resistance against certain injurious processes. In the West Indies "the only horned cattle fit for work are those which have a good deal of black in them; the white are terribly tormented by the insects and they are weak and sluggish in proportion to the black."

Coming to man, it is known that some albino negroes are peculiarly sensitive to the bites of insects; and with Europeans it is a generally observed fact that the fairer individuals are more seriously affected by the bites of fleas and bugs than are darker ones. Dr Twining, in the *British Association Reports for 1845*, p. 79, cites some instances described by Humboldt, who says that the copper-coloured natives of the high plain of Bogoto, and at a lower level on the Magdalena river, were generally free from goitre. Professor Pöffig, also cited by Dr Twining, states that on the east side of the Andes in Chile, in some of the races which live there, he did not see a single case of goitre, and yet in the white inhabitants, who live exactly as the natives, it prevails in a great degree.

Turning now to instances of the opposite kind, it is known that silkworms which spin colourless cocoons are more resistant to the attacks of a certain deadly fungus than are those which spin the yellow ones. In some parts of North America it is found that the white peaches are much less liable to the attack of a disease known as the "yellows" than are the yellow-fleshed ones. In the region of the Mississippi, Farabee has observed that the albino negroes are taller and broader than the black-skinned individuals. We may assume that increased stature and breadth imply some sort of inherent physical superiority, and if such an assumption is valid we have in man evidence that albinism is correlated not with constitutional defectiveness but with greater perfectness.

But the question as to whether albinoes are more or less constitutionally vigorous than pigmented individuals of the same species may be tested by exact measurement. In 1893 W. D. Halliburton and T. G. Brodie, in ascertaining the physiological properties of nucleo-proteids, found that when they were intravascularly injected into pigmented rabbits, coagulation of the blood resulted, but of the eight albinoes which they used, none clotted. At a subsequent period (1897) Halliburton and J. W. Pickering showed that the three synthesized colloids of Grimaux in the same way produced coagulation in pigmented animals, but failed to do so in albinoes. Pickering, still later, showed, in the case of four Norway hares, two of which were injected while in their pigmented or summer coat, and two while in their albino or winter coat, that coagulation occurred in the former cases but not in the latter.

Quite recently, however, the author of this article has made a more detailed examination of the question, operating upon several hundreds of rabbits. And he found that all albinoes do not fail to clot when intravascularly injected with nucleo-proteids. Only about 9% of them thus failed absolutely to manifest any trace of coagulation. But about 7% showed an exceedingly limited coagulation, in which the clot was colourless and flocculent, and confined to the heart. The rest gave a typical and more or less wide-spread coagulation. Moreover, it was found that all the failures of coagulation occurred when the nucleo-proteid used was obtained from pigmented animals. When it was derived from albinoes no failures occurred. All pigmented animals clotted when the nucleo-proteid was derived from either source. The Himalayan rabbits reacted like complete albinoes, and 12% of them failed to clot when injected with nucleo-proteid extracted from pigmented animals.

The interesting fact was thus ascertained that all albinoes are not alike. To students of heredity this is precisely what would have been expected. For, as the facts above described show, albinoes, though apparently identical externally, are yet the carriers of different hereditary characters. Among albino rats, for instance, the author of this article has reason to believe, upon theoretical grounds resting on an experimental basis, that probably no less than thirteen types exist. With rabbits and mice there must be a still larger number.

In the intravascular coagulation experiments above described, all the rabbits were carefully weighed, and the amount of nucleo-proteid injected until coagulation occurred was measured. This would give for albinoes and pigmented individuals the amount per kilogramme of body-weight required to kill in each case, and would afford a measurement of the relative resistance of the two races. It was found that the resistance of albinoes towards the coagulative effects of injected nucleo-proteids was to that of pigmented individuals as 1·5 to 1·0. In this case, the greater constitutional vigour of the albino is thus accurately demonstrated. But it does not necessarily follow that with other materials and with other constitutional qualities the state of things would not be reversed.

One other feature remains to be mentioned. Albinism appears, in the processes of heredity, to be sometimes indissolubly correlated with certain peculiar traits. It is well known that the long-haired albino rabbit, called Angora, when at rest, has the habit of swaying its head sideways in a peculiar fashion. C. C. Hurst has shown that the long-haired and albino characters are always accompanied in heredity with the swaying habit. The Angora character never occurs without it.

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ALBINONI, TOMASSO (*c.* 1674–*c.* 1745), Italian musician, was born at Venice. He was a prolific composer of operas attracting contemporary attention for their originality, but is more remarkable as a composer of instrumental music, which greatly attracted the attention of Bach, who wrote at least two fugues on Albinoni's themes and constantly used his basses for harmony exercises for his pupils.

ALBINOVANUS PEDO, Roman poet, flourished during the Augustan age. He wrote a Theseis, referred to in a letter from his intimate friend Ovid (*Ex Ponto*, iv. 10), epigrams which are commended by Martial (ii. 77, v. 5) and an epic poem on the exploits of Germanicus. He had the reputation of being an excellent raconteur, and Quintilian (x. i. 90) awards him qualified praise as a writer of epics. All that remains of his works is a beautiful fragment, preserved in the *Suasoriae* (i. 15) of the rhetorician Seneca, from a description of the voyage of Germanicus (A.D. 16) through the river Ems to the Northern Ocean, when he was overtaken by the storm described by Tacitus (*Ann.* ii. 23). The cavalry commander spoken of by the historian is probably identical with the poet. Three elegies were formerly attributed to Pedo by Scaliger; two on the death of Maecenas (*In Obitum Maecenatis* and *De Verbis Maecenatis moribundi*), and one addressed to Livia to console her for the death of her son Drusus (*Consolatio ad Liviam de Morte Drusi* or *Epicēdion Drusi*, usually printed with Ovid's works); but it is now generally agreed that they are not by Pedo. The *Consolatio* has been put down as late as the 15th century as the work of an Italian imitator, there being no MSS. and no trace of the poem before the publication of the *editio princeps* of Ovid in 1471. There is an English verse translation of the elegies by Plumptre (1907).

See Bährens, *Poetae Latini Minores* (1879) and *Fragmenta Poetarum Latinorum* (1886); Haupt, *Opuscula*, i. (1875); Haube, *Beitrag zur Kenntnis des Albinovanus Pedo* (1880).

ALBINUS (originally WEISS), **BERNHARD SIEGFRIED** (1697–1770), German anatomist, was born on the 24th of February 1697, at Frankfort-on-Oder, where his father, Bernhard Albinus (1653–1721), was professor of the practice of medicine. In 1702 the latter was transferred to the chair of medicine at Leiden, and it was there that Bernhard Siegfried began his studies, having for his teachers such men as H. Boerhaave and Nikolaus Bidloo. Having finished his studies at Leiden, he went to Paris, where, under the instruction of Sébastien Vaillant (1669–1722), J. B. Winslow (1669–1760) and others, he devoted himself especially to anatomy and botany. After a year's absence he was, on the recommendation of Boerhaave, recalled in 1719 to Leiden to be a lecturer on anatomy and surgery. Two years later he succeeded his father in the professorship of these subjects, and speedily became one of the most famous teachers of anatomy in Europe, his class-room being resorted to not only by students but by many practising physicians. In 1745 Albinus was appointed professor of the practice of medicine, being succeeded in the anatomical chair by his brother Frederick Bernhard (1715–1778), who, as well as another brother, Christian Bernhard (1700–1752), attained considerable distinction. Bernhard Siegfried, who was twice rector of his university, died on the 9th of September 1770 at Leiden.

ALBION (in Ptolemy 'Αλουίων; Lat. *Albion*, Pliny 4.16[30],102), the most ancient name of the British Islands, though generally restricted to England. The name is perhaps of Celtic origin, but the Romans took it as connected with *albus*, white, in reference to the chalk-cliffs of Dover, and A. Holder (*Alt-Keltischer Sprachschatz*, 1896) unhesitatingly translates it *Weissland*, "white-land." The early writer (6th cent. B.C.) whose *periplus* is translated by Avienus (end of 4th cent. A.D.) does not use the name Britannia; he speaks of νῆσος Ἰέρνων καὶ Ἀλβιόνων ("island of the Ierni and the Albiones"). So Pytheas of Massilia (4th cent. B.C.) speaks of Ἄλβιον and Ἰέρνη. From the fact that there was a tribe called the Albiones on the north coast of Spain in Asturia, some scholars have placed Albion in that neighbourhood (see G. F. Unger, *Rhein. Mus.* xxxviii., 1883, pp. 156-196). The name Albion was taken by medieval writers from Pliny and Ptolemy.

ALBION, a city of Calhoun county, Michigan, U.S.A., on the Kalamazoo river, 21 m. W. of Jackson. Pop. (1890) 3763; (1900) 4519, of whom 622 were foreign-born; (1904) 4943; (1910) 5833. Albion is served by the Michigan Central and the Jackson division of the Lake Shore and Michigan Southern railways, and by an inter-urban electric line. The city has a public park and a public library. The W. part of the city has most of the factories; the principal manufactures are flour, agricultural implements, windmills, gasolene engines, harness and proprietary medicines. On a commanding site in the E. part of the city is Albion College (Methodist Episcopal; co-educational), embracing a College of Liberal Arts, a preparatory department, a conservatory of music, a school of art, a school of oratory, a normal course, and a commercial department. The college was incorporated in 1835 as Spring Arbor Seminary, and in 1839 by an amended charter was located at Albion, where it was first opened in 1843 under the name of the Wesleyan Seminary of Albion; in 1849 it became the Wesleyan Seminary and Female Collegiate Institute, with power to grant degrees to women only; but in 1861 the present name was adopted and the college was permitted to grant degrees to men and women. In 1906 it had a library of 16,500 volumes, a faculty of 19, and an enrolment of 483 (211 being women). The municipality owns and operates the water-works, the water-supply being obtained from artesian wells. Albion was settled in 1831, was incorporated as a village in 1866 and was chartered as a city in 1885.

ALBION, a village and the county-seat of Orleans county, New York, U.S.A., about 30 m. W.N.W. of Rochester. Pop. (1890) 4586; (1900) 4477, (984 being foreign-born and 43 negroes); (1905, state census) 5174; (1910) 5016. The village is served by the New York Central & Hudson River railway, by the Buffalo, Lockport & Rochester electric railway, and by the Erie Canal. In Albion are the Western House of Refuge for Women (a state institution established in 1890), a public park, the Swan Library, and the county buildings, including the court house, the jail and the surrogate's office; and about 2 m. to the S.E. is the beautiful Mount Albion Cemetery. Albion is the centre of the Medina sandstone industry, and lies in the midst of a good farming region, of which it is the principal shipping point, especially for apples, cabbages and beans. The village manufactures agricultural implements, vinegar, evaporated fruit, and canned fruit and vegetables, and has two large cold-storage houses. Albion was settled in 1812, was incorporated in 1823 and became the county-seat in 1825.

ALBITE, a mineral of the felspar group, belonging to the division of the *plagioclases* (*q.v.*). It is a sodium and aluminium silicate, $NaAlSi_3O_8$, and crystallizes in the anorthic system. Like all the felspars it possesses two cleavages, one perfect and the other less so, which are here inclined at an angle of 86° 24′. On the more perfect cleavage, which is parallel to the basal plane (P), is a system of fine striations, parallel to the second cleavage (M), due to twinning according to the "albite law" (figs. 1 and 2). The hardness is 6, and the specific gravity 2.63. The colour is usually pure white, hence the name (from the Lat. *albus*) for the species.

Albite forms an essential constituent of many acidic igneous and crystalline rocks; in granites, diorites, andesites, &c., it occurs as a primary mineral, whilst in crystalline schists, phyllites and crystalline limestones it is of secondary (metamorphic) origin. The beautifully developed crystals so abundant in crystal-lined crevices of Alpine granites and gneisses have been deposited, with other minerals, from solution; the crystals lining veins in the slates of Tintagel in Cornwall have the same origin.

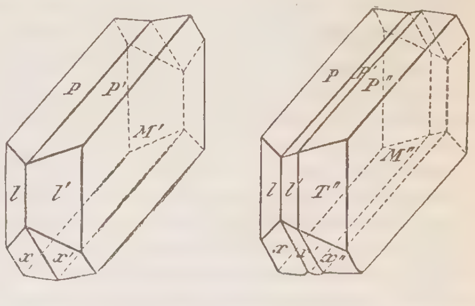

FIG. 1. FIG. 2.

Twinned crystals of Albite.

Several varieties of albite are distinguished, of which the following may be here specially mentioned. *Pericline* (from the Gr. περικλινής, "sloping") is the name given to large opaque white crystals from the chlorite-schists of the Alps; they are tabular parallel to the direction of perfect cleavage and are twinned according to the "pericline law." *Peristerite* (from the Gr. περιστερά, a dove) is characterized by a beautiful bluish sheen, somewhat resembling that seen on the neck of a pigeon; it is found mainly in Ontario. Aventurine and moonstone varieties occur, though these special appearances are more usually displayed by the oligoclase and orthoclase felspars respectively. (L. J. S.)

'ALBO, JOSEPH, a Spanish Jewish theologian of the 15th century. He was author of a very popular book on the philosophy of Judaism, entitled *'Iqqarim* or *Fundamentals*. Maimonides in the 12th century had formulated the principles of Judaism in thirteen articles; Albo reduced them to three: (i) The Existence of God, (ii) Revelation and (iii) Divine Retribution. Albo set the example of minimizing Messianism in the formulation of Jewish beliefs. Though he fully maintained the Mosaic authorship of the Law and the binding force of tradition, he discriminated between the essential and the non-essential in the practices and beliefs of Judaism. An English translation of the *'Iqqarim* appeared in the *Hebrew Review*, vols. i.-iii.

ALBOIN (d. 572 or 573), king of the Lombards, and conqueror of Italy, succeeded his father Audoin about 565. The Lombards were at that time dwelling in Noricum and Pannonia (archduchy of Austria, Styria and Hungary, west of the Danube). In alliance with the Avars, and Asiatic people who had invaded central Europe, Alboin defeated the Gepidae, a powerful nation on his eastern frontier, slew their king Cunimund, whose skull he fashioned into a drinking-cup, and whose daughter Rosamund he carried off and made his wife. Three years later (in 568), on the alleged invitation of Narses (*q.v.*), who was irritated by the treatment he had received from the emperor Justin II., Alboin invaded Italy, probably marching over the pass of the Predil. He overran Venetia and the wide district which we now call Lombardy, meeting with but feeble resistance till he came to the city of Ticinum (Pavia), which for three years (569–572) kept the Lombards at bay. While this siege was in progress Alboin was also engaged in other parts of Italy, and at its close he was probably master of Lombardy, Piedmont and Tuscany, as well as of the regions which afterwards went by the name of the duchies of Spoleto and Benevento. In 572 or 573, however, he was assassinated by his chamberlain Peredeo at the instigation of Queen Rosamund, whom Alboin had grievously insulted by forcing her to drink wine out of her father's skull. After his death and the short reign of his successor Cleph the Lombards remained for more than ten years in a state of anarchy.

The authorities for the history of Alboin are Procopius, Paulus Diaconus and Agnellus (in his history of the church of Ravenna).

ALBONI, MARIETTA (1823–1894), Italian opera-singer, was born at Cesena, Romagna, and was trained in music at Bologna, where she became a pupil of Rossini. She had a magnificent contralto voice, and in 1843 made her first appearance at La Scala, Milan, being recognized at once as a public favourite. In England her reputation was established by her appearance at Covent Garden in 1847, and she had brilliant success all over Europe in the leading operatic rôles; in 1853 she repeated these triumphs in the United States. Indeed, with the exception of Malibran, she had no compeer among the contraltos of the century, the old Italian school of singing finding in her a really great representative. She married first Count A. Pepoli, who died in 1866, and secondly (1877) a French officer, M. Zieger; she lived in Paris after her first marriage, and died at Ville d'Avray in 1894.

ALBORNOZ, GIL ALVAREZ DE, Spanish cardinal, was born at Cuenca early in the 14th century. He was the son of Gil Alvarez de Albornoz and of Doña Teresa de Luna, sister of Kimeno de Luna, archbishop of Toledo. He was educated at Saragosa, while his uncle was bishop of that see, and studied law at Toulouse. The powerful influence of his family opened him a public career early in life. He was made archdeacon of Calatrava, and became a member of the king's council while young. In 1337 he was chosen archbishop of Toledo in succession to his uncle by the favour of the king, Alphonso XI. At the battle of Tarifa he fought against a great invasion from Africa in 1340, and at the taking of Algeciras in 1344 he led the armed levy of his archbishopric. In 1343 he had been sent to Pope Clement VI. at Avignon to negotiate a grant of a tax on the revenues of the Church for the Crusade. His military and diplomatic ability became known to the pope, who made him a cardinal in 1350. Albornoz left Spain on the death of the king Alphonso XI. in that year, and never returned. It has been said, but not on contemporary evidence, that he fled from fear of Peter the Cruel. In 1353 Innocent VI. sent him as a legate into Italy, with a view to the restoration of the papal authority in the states of the Church. He was recalled in 1357, but was sent again to Italy after a brief interval, and in 1362 had paved the way for the return of Urban V. to Rome. As legate, Albornoz showed himself to be an astute manager of men and effective fighter. He began by making use of Rienzi, whose release from prison at Avignon he secured. After the murder of the tribune in 1354 Albornoz pursued his task of restoring the pope's authority by intrigue and force with remarkable success. As a mark of gratitude the pope appointed him legate at Bologna in 1367, but he died at Viterbo the same year. According to his own desire his remains were carried to Toledo, where Henry of Castile caused them to be entombed with almost royal honours. A work by Albornoz on the constitution of the Church of Rome, first printed at Jesi in 1473, is now very rare. The college of St Clement at Bologna was founded by Albornoz for the benefit of Spanish students.

See " De Vita et Rebus Gestis Aegidii Albornotii," in Sepulveda's *Opera Omnia*, vol. iv. (1780); *Cardenal Albornoz der zweite Begründer des Kirchenstaates*, by Dr H. J. Wurm (1892).

ALBRECHTSBERGER, JOHANN GEORG (1736–1809), Austrian musician, was born at Kloster-Neuburg, near Vienna, on the 3rd of February 1736. He studied musical composition under the court organist, Mann, and became one of the most learned and skilful contrapuntists of his age. After being employed as organist at Raab and Maria-Taferl, he was appointed in 1772 organist to the court of Vienna, and in 1792 *Kapellmeister* of St Stephen's cathedral. His fame as a theorist attracted to him in the Austrian capital a large number of pupils, some of whom afterwards became eminent musicians. Among these were Beethoven, Hummel, Moscheles and Josef Weigl (1766–1846). Albrechtsberger died in Vienna on the 7th of March 1809. His published compositions consist of preludes, fugues and sonatas for the piano and organ, string quartets, &c.; but the greater proportion of his works, vocal and instrumental, exists only in manuscript. They are in the library of the Vienna *Gesellschaft der Musikfreunde*. Probably the most valuable service he rendered to music was in his theoretical works. In 1790 he published at Leipzig a treatise on composition, of which a third edition appeared in 1821. A collection of his writings on harmony, in three volumes, was published under the care of his pupil Ignaz von Seyfried (1776–1841) in 1826. There is an English version of this published by Novello in 1855. Beethoven knew his own needs when he put himself under Albrechtsberger on finding that Haydn was not thoroughly disposed for the trouble of training him; and though Albrechtsberger could see nothing in him, and warned his other pupils against " that young man who would never turn out anything in good style," he justified Beethoven's confidence.

ALBRET. The lordship (seigneurie) of Albret (Labrit, Lebret), situated in the Landes, gave its name to one of the most powerful feudal families of France in the middle ages. Its members distinguished themselves in the local wars of that epoch; and during the 14th century they espoused the English cause for some time, afterwards transferring their support to the side of France. Arnaud Amanieu, lord of Albret, helped to take Guienne from the English. His son Charles became constable of France, and was killed at the battle of Agincourt in 1415. Alain the Great, lord of Albret (d. 1522), wished to marry Anne of Brittany, and to that end fought against Charles VIII.; but his hopes being defeated by the betrothal of Anne to Maximilian of Austria, he surrendered Nantes to the French in 1486. At that time the house of Albret had attained considerable territorial importance, due in great part to the liberal grants which it had obtained from successive kings of France. John of Albret, son of Alain, became king of Navarre by his marriage with Catherine of Foix. Their son Henry, king of Navarre, was created duke of Albret and peer of France in 1550. By his wife Margaret, sister of the French king, Francis I., he had a daughter, Jeanne d'Albret, queen of Navarre, who married Anthony de Bourbon, duke of Vendôme, and became the mother of Henry IV., king of France. The dukedom of Albret, united to the crown of France by the accession of this prince, was granted to the family of La Tour d'Auvergne in 1651, in exchange for Sedan and Raucourt.

To a younger branch of this house belonged Jean d'Albret, seigneur of Orval, count of Dreux and of Rethel, governor of Champagne (d. 1524), who was employed by Francis I. in many diplomatic negotiations, more particularly in his intrigues to get himself elected emperor in 1519. (M. P.*)

ALBRIGHT, JACOB (1759–1808), American clergyman, was born near Pottstown, Pennsylvania, on the 1st of May 1759. He was of "Pennsylvania-German" parentage, his name being originally Albrecht, and was educated in the Lutheran faith. At an early age he became a tile-burner. In 1790 he was converted to Methodism, and in 1796 determined to devote himself to preaching that faith among the Pennsylvania Germans. His efforts met with great success, and in 1800 he founded what was virtually a new and independent church organization on the Methodist system, of which he became the presiding elder, and eventually (1807) bishop. This church is officially the Evangelical Association, but its adherents have been variously known as "New Methodists." "Albrights," and "Albright Brethren." Albright died on the 18th of May 1808, atMühlbach, Pennsylvania.

ALBUERA, or ALBUHERA, **LA,** a small village of Spain, in the province of Badajoz, 13 m. S.E. of the town of that name. Pop. (1900) 820. Albuera is celebrated on account of the victory gained there on the 16th of May 1811 by the British, Portuguese and Spaniards, under Marshal Beresford, over the French army commanded by Marshal Soult. (See PENINSULAR WAR.)

ALBUFERA DE VALENCIA, a lagoon, 7 m. S. of Valencia in Spain, about 12 m. in length and 4 in breadth, 12 ft. being its greatest depth. It communicates with the sea by a narrow outlet, which can be opened or closed at pleasure. The lake is crown property, and is of great value from the fish and wildfowl with which it abounds. Rice is grown in large quantities by the inhabitants of the adjoining villages. In 1812 Marshal Suchet was created duke of Albufera by Napoleon for his conquest of Valencia, and invested with the domain; but the battle of Vittoria in 1813 deprived him of his possession, though he still retained the title. Subsequently the revenues of Albufera were conferred upon the duke of Wellington in token of the gratitude of the Spanish nation. (See PENINSULAR WAR.)

ALBULAE AQUAE, a group of springs, 4 m. W. of Tibur, the water of which is bluish, strongly impregnated with sulphur and carbonate of lime, and rises at a temperature of about 75° F. Remains of a Roman thermal establishment exist near the principal spring, the so-called Lago della Regina (which is continually diminishing in size owing to the deposit left by the water), and dedicatory inscriptions in honour of the waters have been found. The baths are still frequented by the Romans, though the modern establishment is about 1 m. S. on the high road.

See T. Ashby in *Papers of the British School at Rome*, iii. 117.

ALBULA PASS, now the principal route from the N. to the Upper Engadine in the Swiss canton of the Grisons. It was already frequented in the 13th century, while a carriage road (highest point, 7595 ft.) was constructed across it in 1865, but for a long time it was not as much used as the easier and more direct Julier Pass (7504 ft.), until the opening of the railway in 1903, which has vastly increased its practical importance. Starting from Coire the Rhine valley is followed to Reichenau (6¼ m.), and then that of the Hinter Rhine to Thusis (10½ m.). The line then runs through the grand Schyn gorge (cut by the Albula torrent) to Tiefenkastell (7½ m.), where it leaves the Julier road on the right (S.) and continues to follow the course of the Albula past Filisur and Bergün (12½ m.) to the mouth (5879 ft.) of the great tunnel (3¾ m. in length; highest point, 5987 ft.) which has been pierced below the pass. The descent lies through the Bevers glen to Bevers (2½ m.), where the Upper Engadine is reached, about 5 m. below St. Moritz, which is 56 m. from Coire by this route. (W. A. B. C.)

ALBUM (Lat. *albus*, white), in ancient Rome, a board chalked or painted white, on which decrees, edicts and other public notices were inscribed in black. The Annales Maximi of the Pontifex Maximus, the annual edicts of the praetor, the lists of Roman and municipal senators (*decuriones*) and jurors (*album indicum*) were exhibited in this manner. In medieval and modern times *album* denotes a book of blank pages in which verses, autographs, sketches, photographs and the like are collected. It is also applied to the official list of matriculated students in a university, and to the roll in which a bishop inscribes the names of his clergy. In law, the word is the equivalent of *mailles blanches*, for rent paid in silver ("white") money.

ALBUMAZAR, more properly ABU-MAASCHAR (805–885), Arab astronomer, was born at Balkh, flourished at Bagdad, and died at Wasid in Central Asia. His principal works are: *De Magnis Conjunctionibus* (Augsburg, 1489); *Introductorium in Astronomiam* (Venice, 1506); and *Flores Astrologici* (Augsburg, 1488). He maintained in the first that the world, created when the seven planets were in conjunction in the first degree of Aries, will come to an end at a like conjunction in the last degree of Pisces.

See *Biog. Universelle* (Jourdain); Lalande, *Bibliographie Astronomique*; Poggendorff, *Biog. literarisches Handwörterbuch*; Houzeau, *Bibl. Astronomique*.

ALBUMIN, or ALBUMEN (Lat. *albus*, white), an organic substance typical of a group of bodies (albumins or albuminates) of very complicated chemical composition. They are sometimes called the histogenetic bodies or proteids, because they are essential to the building up of the animal organism. The vegetable kingdom is the original source of albuminous substances, the albumins being found in greatest quantity in the seed. They also occur in the fluids of the living organism. The chemistry of the albumins is one of the most complicated and difficult in the whole domain of organic chemistry. It has attracted the attention of many workers, and has formed the subject of a huge literature. In this field Béchamp, Cohnheim, Albrecht Kossel, and, especially, Emil Fischer and his pupils have been extremely active. The general trend of these researches lies in the study of the decomposition or "breaking down" products of the albumin molecules; once these are accurately determined, the synthesis of an albumin is but a matter of time. Already we have proceeded far in our knowledge of the decomposition products, and certain simple proteids have been synthesized.

General characters.

The albumins contain in all cases the elements carbon, hydrogen, nitrogen, sulphur and oxygen; their composition, however, varies within certain limits: C=50-55 %, H=6·9-7·3 %, N=15-19 %, S=0·3-2·4 %, O=19-24 %, crystallized albumin is C=51·48 %, H=6·76 %, N=18·14%, S=0·96 %, O=22·66 %, which points to the formula $C_{720}H_{1134}N_{218}S_5O_{248}$, corresponding to the molecular weight 16,954. A high molecular weight characterizes these substances, but so far no definite value has been determined by either physical or chemical means; A. P. Sabanezhev obtained the value 15,000 by Raoult's method for purified egg albumin. All albumins are laevo-rotatory; and on incineration a small amount of inorganic ash is invariably left. They are usually insoluble in water, alcohol and ether; and their presence as solutes in vegetable and animal fluids is not yet perfectly understood, but it is probably to be connected with the presence of salts or other substances. A remarkable change occurs when many albumins are boiled with water, or treated with certain acids, their solubility and general characters being entirely altered, and the fluid becoming coagulated. This change is seen in the transformation of the "white" of an egg on boiling. Albumins are generally detected by taking advantage of this property, or of certain colour changes. The reagents in common use are: Millon's reagent, a solution of mercuric nitrate containing nitrous acid, this gives a violet-red coloration; nitric acid, which gives a yellow colour, turning to gold when treated with ammonia (xanthoproteic reaction); fuming sulphuric acid, which gives violet solutions; and caustic potash and copper sulphate, which, on warming, gives a red to violet coloration (biuret reaction).

Decomposition products.

Boiling with dilute mineral acids, or baryta water, decomposes albumins into carbon dioxide, ammonia and fatty amino- and other acids. These decomposition products include: glycocoll or aminoacetic acid, NH_2CH_2COOH, alanine or aminopropionic acid, $CH_3\cdot CH(NH_2)\cdot COOH$, α-aminobutyric acid, α-aminovalerianic acid, leucin or isobutyl-α-aminoacetic acid, $(CH_3)_2CH\cdot CH_2\cdot CH(NH_2)\cdot COOH$, isoleucin, probably β-aminocaproic acid, serin or α-amino-β-hydroxypropionic acid, $HO\cdot CH_2\cdot CH(NH_2)\cdot COOH$, aspartic acid or aminosuccinic acid, $HOOC\cdot CH_2\cdot CH(NH_2)\cdot COOH$, glutaminic acid or α-amino-*n*-glutaric acid, $HOOC\cdot (CH_2)_2\cdot CH(NH_2)\cdot COOH$, diaminoacetic acid, α-β-diaminopropionic acid, lysin. or α-ε-diamino-*n*-caproic acid, $NH_2(CH_2)_4\cdot CH(NH_2)\cdot COOH$, arginin or guanidine-α-amino-*n*-valerianic acid, $(NH)(NH_2)C\cdot NH\cdot (CH_2)_3\cdot CH(NH_2)\cdot COOH$, ornithin or αδ-diamino valerianic acid, $NH_2\cdot (CH_2)_3\cdot CH(NH_2)\cdot COOH$, histidin or α-amino-β-imidazol-propionic acid, $HOOC\cdot CH(NH_2)\cdot CH_2\cdot \overline{C:CH\cdot N:CH\cdot NH}$, proline or α-pyrrolidin carboxylic acid, $HOOC\cdot \overline{CH\cdot NH\cdot CH_2\cdot CH_2\cdot CH_2}$, hydroxyproline, phenyl alanine or phenyl-α-aminopropionic acid, $C_6H_5\cdot CH_2\cdot CH(NH_2)\cdot COOH$, tyrosine or p-hydroxyphenyl-α-aminopropionic acid, phenyl ethylamine, p-hydroxyphenyl ethylamine, tryptophane or indol aminopropionic acid, A. cystin (protein-cystin) or α-amino-β-thioglyceric acid "disulphide," $(S\cdot CH_2\cdot CH(NH_2)\cdot COOH)_2$, B. cystin (stone-cystin), or α-thio-β-aminoglyceric acid "disulphide," $(NH_2\cdot CH_2\cdot CH:S\cdot COOH)_2$. This list is not exhaustive; other products are given in Gustav Mann, *Chemistry of the Proteids* (1906), to which reference should be made for a complete account of this class of compounds.

Classification of albumins.

The complexity of composition militates in a great measure against a rational classification of albumins by purely chemical considerations. Such classifications have been attempted by A. Kossel and by W. Kühne and E. P. Pick; but in the present state of our knowledge, however, the older classification of E. Dreschel and F. Hoppe-Seyler, based primarily on solubilities and distribution, may be conveniently retained. This classification is with certain modifications as follows:—

I. *Albumins proper*: characterized by having colloidal solutions.
  (1) Albumins: serum-albumin, egg-albumin, lact-albumin.
  (2) Globulins: serum-globulin, egg-globulin, lacto-globulin, cell-globulins.
  (3) Plant-globulins and plant-vitellines.
  (4) Fibrinogen.
  (5) Myosin.
  (6) Phosphorus containing albumins (nucleo-albumins), caseins, vitellines, nucleo-albumins of the cell-protoplasm, mucoid nucleo-albumins.
  (7) Histones.
  (8) Protamines.
II. *Transformation products of the albumins proper.*
  (1) Acid-albumins, alkali albuminates.
  (2) Albumoses, peptones and peptides.
  (3) Halogen-albumins, oxyprotein, oxyprotsulphonic acid, &c.
III. *Proteids.*
  (1) Nucleo-proteids.
  (2) Haemoglobin and allied substances.
  (3) Glyco-proteids, mucins, mucoids, helico-proteid.
IV. *Albuminoids.*
  (1) Collagen.
  (2) Keratin.
  (3) Elastin.
  (4) Fibroin.
  (5) Spongin, &c.
  (6) Amyloid.
  (7) Albumoid.
  (8) Colouring matters derived from albumin.

Albumins proper.—Albumins (as classified above) are soluble in water, dilute acids and alkalies, and in saturated neutral salt solutions; they are coagulated by heat. "Serum-albumin," or "blood-albumin," possibly $C_{450}H_{720}N_{116}S_6O_{140}$, occurs in blood-serum, lymph, chyle, milk, &c.; its coagulation temperature is about 67°. It differs from egg-albumin in its specific rotation (−57° to −64°), and in being slowly coagulated by alcohol and ether. Egg-albumin is the chief constituent of the white of egg; this fluid also contains a globulin and a mucoid. It coagulates at about 56°, and its specific rotation is −30·70°. "Lact-albumin" occurs in all kinds of milk. The globulins are insoluble in water and in dilute acids, but soluble in alkalies and in neutral salt solutions; these solutions are coagulated on boiling. "Serum-globulin," also termed globulin or fibrino-plastic globulin, paraglobulin and paraglobin, occurs in blood serum; "cell-globulins" occur in many organs—liver, kidneys, pancreas and the thyroid gland, also in muscle-plasma; "crystalline," a globulin occurring in two forms α and β, is found in the lens of the eye; "egg-globulin" and "lacto-globulin" occur respectively in the white of egg and in milk. Plant albumins or phyto-albumins have been chiefly investigated in the case of those occurring in seeds; most are globulins, insoluble in pure water, but soluble in salt solutions; "edestin," a globulin of this class, is very widely distributed. Other varieties or classes of these compounds are: plant caseins, phyto-vitellines, legumins and conglutins. Fibrinogen occurs in the blood plasma, and is changed by a ferment into fibrin, to which the clotting of blood is due. Fibrinogen is insoluble in water, but soluble in salt solutions; it has three different coagulation temperatures, 56°, 67°, 75°. Fibrin, produced from fibrinogen by a ferment, is a jelly-like substance, coagulable by heat, alcohol, &c. The muscle-albumins include "myosin" or paramyosinogen, a globulin, which by coagulation induces *rigor mortis*, and the closely related "myosinogen" or myogen; myoglobulin and myoalbumin are also found in muscles. The nucleo-albumins or phospho-globulins are insoluble in water and acids, but soluble in alkalies, and have an acid reaction. "Caseinogen" (after W. D. Halliburton) is the chief albumin of milk; its composition varies with the animal. It is insoluble in water, while its salts are readily soluble. "Eucasein" is the ammonium salt; "nutrose" and "plasmon" are sodium salts. By the rennet ferment caseinogen is converted into casein, a substance resembling caseinogen in being soluble in water, but differing in having an insoluble calcium salt. The formation of casein involves the curdling of milk. Other phosphoglobulins are vitelline, found in the yolk of hens' eggs, and ichthulin, found in the eggs of fish. *Histones* are a class of albumins soluble in water and acids, but essentially basic in character; hence they are precipitated by alkalies. It is remarkable that many histones are soluble in an excess of alkali. They do not exist in a free state, but in combination with a "prosthetic group" (after A. Kossel) they give rise to important cell constituents—haemoglobin, nucleo-proteids, &c. "Thymus histone" occurs in the thymus gland; globin occurs in combination as haemoglobin; other histones have been extracted from the red blood corpuscles of the goose and the testes of fishes and other animals. The *protamines* are a well-characterized class of albumins found in the ripe spermatozoa of fishes.

Albumoses and Peptones.—The primary products of the dissociation of albumins are the albumoses, characterized by not being coagulable by heat, more soluble than the albumins, having a far less complex composition, and capable of being "salted out" by certain salts, and the peptones, similar to albumoses but not capable of being "salted out"; moreover, peptones are less complex than albumoses. By further decomposition peptones yield peptides, a certain number of which have been synthesized by Emil Fischer and his collaborators. Albumoses and peptones are white powders, readily soluble in water, with the exception of the hetero-albumoses—a subdivision of primary albumoses. They give the biuret and xanthoproteic reactions, and form salts with both acids and bases. Albumoses and peptones are obtained by peptic digestion, the latter being termed peptic-peptones; tryptic digestion also produces peptones. Acids and moist heat induce similar changes.

Proteids.—These substances are combinations of one or more albumins with a radical of an essentially different nature, termed by Kossel a "prosthetic group." It is convenient to classify proteids by those groups. "Nucleo-proteids," constituents of the cell-nucleus, are combinations of albumins and nucleic acid; they always contain iron. They are loose, white, non-hygroscopic powders, soluble in water and salt solutions, and have an acid reaction; they give the colour reactions of albumins. Nucleic acid is at present of unknown constitution; decomposition products are: phosphoric acid, uracil or 2.6-dioxy-pyrimidin,[1] cytosin or 2-oxy-6-amino-pyrimidin, thymin (nucleosin) or 2.6-dioxy-5-methyl pyrimidin hypoxanthin[1] or 6-oxypurin, xanthin or 2.6-dioxypurin, adenine or 6 amino-purin, guanine or 2-amino-6-oxypurin, pentoses (l-xylose), laevulinic acid, ammonia, etc. The nucleic acids vary with the source of the proteids, there being considerable differences in chemical composition. In general they are white, loose powders, slightly soluble in cold water, more soluble in hot water; they are precipitated by mineral acids, but dissolve in an excess. They are dextro-rotatory, and the specific rotation is numerically greater than that of albumin; hence the proteids are, in general, dextro-rotatory.

An important nucleo-proteid is haemoglobulin or haemoglobin, the colouring matter of the red blood corpuscles of vertebrates; a related substance, haemocyanin, in which the iron of haemoglobin is replaced by copper, occurs in the blood of cephalopods and crayfish. Haemoglobin is composed of a basic albumin and an acid substance haematin; it combines readily with oxygen, carbon dioxide and carbon monoxide to form loose compounds (see NUTRITION). It coagulates at 64°. By a dilute acid haemoglobin is decomposed into globin, and "haematin," a ferri-pyrrol derivative of the probable formula $C_{34}H_{34}N_4FeO_5$; under certain conditions the iron-free "haematoporphyrin" is obtained. This last substance may be reduced to mesoporphyrin, $C_{34}H_{38}O_4N_4$, which by further reduction gives haemopyrrol, $C_8H_{13}N$, possibly methyl-propyl-pyrrol or butyl-pyrrol. Other derivatives are haemin, haemochromogen and the haematinic acids.

"Glyco-proteids" differ from nucleo-proteids in containing a carbohydrate radical, which is liberated only by boiling with mineral acids or alkalies. The mucins and mucoids belong to this group; they are acid and contain no phosphorus; they give the albumin colour reactions but are not coagulated by heat. Mucins occur in most of the slimy fluids of the body; they vary in composition with their source. Mucoids resemble mucins in their composition and reactions, but differ, in general, in their physical properties. They occur in tendons, bones and cartilage. The "phospho-glyco-proteids" resemble the mucins and mucoids in containing a carbohydrate residue, but differ in containing phosphorus. Ichthulin (see above) may be placed in this group; "helico-proteid," found in the serous gland of *Helix pomatia*, the vineyard snail, also belongs here.

Albuminoids is the anatomical name given to albuminous substances forming the connective tissues. Chemically they resemble the albumins, being split up by acids or ferments into albumoses, peptones and amino-acids, forming salts, and giving the same colour reactions. They are quite insoluble in water and in salt solutions, and difficultly soluble in dilute acids and alkalies. Typical albuminoids are gelatin, keratin, elastin, fibroin, spongin and conchiolin.

"Collagen" (Gr. κόλλα, glue, and root γεν- of γεννάειν, to produce, γίγνεσθαι, to become), the ground-substance of bones and tissues, is decomposed by boiling water or on warming with acids into substances named gelatin, glutin or glue. Gelatin forms a white amorphous powder; the commercial product, however, generally forms glassy plates. The decomposition products are generally the same as with the general albumin; it gives the biuret reaction; forms salts with acids and alkalies, but is essentially acid in nature. Immersed in cold water gelatin does not dissolve but swells up; it dissolves readily in hot water, forming, according to the quantity present, a thick jelly which solidifies to a hard mass on cooling (the "glue" of the wood-worker), or a thin jelly (used in cookery). Gelatin occurs also in the cornea and the sclerotic coat of the eye; and in fish scales, the latter containing 80% of collagen, and 20% of ichthylepidin, a substance differing from gelatin in giving a well-marked Millon's reaction. Keratin (Gr. κέρας, a horn), the chief constituent of horny material, occurs in hair, nails, hoofs and feathers. It is quite insoluble in water, dilute acids and alkalies. Related to this substance are "neuro-keratin," found in the medullary sheath of nerves, and "gorgonin," the matrix of the axial skeleton of the coral *Gorgonia Cavolinii*. Elastin occurs either as thick strands or as membranes; it constitutes the "elastic tissue" of the anatomist. Its insolubility is much the same as keratin. "Fibroin" and silk-glue or sericin occur in natural silk fibres. Fibroin is insoluble in water, acids and alkalies; silk-glue resembles gelatin in its solubility, but it is less readily gelatinized. "Spongin," the matrix of bath-sponge, is insoluble in water and dilute acids, but soluble in concentrated mineral acids. "Conchiolin," the matrix of shells of the mollusca, is only slightly soluble in acids. "Cornein" forms the framework of corals. "Amyloid" occurs as a pathological product, and also in the healthy aorta and in old cartilage. It is an albumin, and not a carbohydrate as was formerly held; and gives most of the colour reactions of albumins. It forms shiny, homogeneous masses, quite insoluble in cold water and in salt solutions, but soluble in alkalies. The albumoids include, according to Cohnheim, substances which possess certain properties in common, but differ from the preceding groups. In general they resemble coagulated albumin, and also the gelatin-yielding tissues, but they themselves do not yield gelatin.

Colouring matters derived from albumins include the "melanins" (Gr. μέλας, black), substances which differ very considerably in composition, the sulphur and iron content being by no means constant; they do not give the reactions of albumins. The black colouring matter of hair, the skin of negroes, and of the ink bag of *Sepia* have been examined. Melanins obtained from tumours form black, shiny masses; they are insoluble in water, neutral salt solutions, dilute acids and in the common organic solvents.

ALBUMINURIA (Physiological or Functional), a term indicating the presence of albumin in the urine. This may depend on a number of morbid conditions, of which kidney troubles, acute illnesses and venous congestion are some of the commoner. But after exclusion of all known pathological causes, there still remains a large class of cases among subjects who appear to be in perfect health. This form has been called functional or physiological albuminuria, intermittent albuminuria, &c. Its recognition is of extreme importance, as it must be distinguished from the albuminuria due to Bright's disease and other troubles. The following are the main forms that have been described:—(1) Dietetic Albuminuria. This form affects some people after partaking of a meal consisting largely of albuminous foods, such as eggs. In others any extra indulgence in the pleasures of the table may give rise to it. (2) Cyclic Albuminuria. This name was first used by the physiologist Pavy, but other observers have called the same condition "postural albuminuria." It occurs in people enjoying perfect health, and is characterized by

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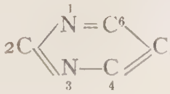
[1] The pyrimidin ring is numbered 

For the purin ring, see PURIN.

the presence of albumin in the urine at certain times of the day. It has been shown to depend entirely on the assumption of the erect position, and it disappears as a result of the recumbent position at night. (3) Albuminuria from exercise. This form affects some people after any unusual muscular exertion. (4) Prolonged mental strain or worry may give rise to a transient form of albuminuria. (5) Adolescent albuminuria is met with in some subjects, especially boys. The question of the real significance of "physiological" albuminuria is one about which there is much difference of opinion. But its importance and recognition—especially in questions of life insurance—admits of no question.

ALBUQUERQUE, ALPHONSO D' (in Old Port. AFFONSO D'ALBOQUERQUE) (1453–1515), surnamed THE GREAT, and THE PORTUGUESE MARS, was born in 1453 at Alexandria, near Lisbon. Through his father, Gonzalvo, who held an important position at court, he was connected by illegitimate descent with the royal family of Portugal. He was educated at the court of Alphonso V., and after the death of that monarch seems to have served for some time in Africa. On his return he was appointed *estribeiro-mor* (chief equerry) to John II. In 1503 he set out on his first expedition to the East, which was to be the scene of his future triumphs. In company with his kinsman Francisco he sailed round the Cape of Good Hope to India, and succeeded in establishing the king of Cochin securely on his throne, obtaining in return for this service permission to build a Portuguese fort at Cochin, and thus laying the foundation of his country's empire in the East. He returned home in July 1504, and was well received by King Emmanuel, who entrusted him with the command of a squadron of five vessels in the fleet of sixteen which sailed for India in 1506 under Tristan da Cunha. After a series of successful attacks on the Arab cities on the east coast of Africa, Albuquerque separated from Da Cunha, and sailed with his squadron against the island of Ormuz, in the Persian Gulf, which was then one of the chief centres of commerce in the East. He arrived on the 25th of September 1507, and soon obtained possession of the island, though he was unable long to maintain his position. With his squadron increased by three vessels, he reached the Malabar coast at the close of the year 1508, and immediately made known the commission he had received from the king empowering him to supersede the governor Francisco de Almeida. The latter, however, refused to recognize Albuquerque's credentials and cast him into prison, from which he was only released, after three months' confinement, on the arrival of the grand-marshal of Portugal with a large fleet. Almeida having returned home, Albuquerque speedily showed the energy and determination of his character. An unsuccessful attack upon Calicut in January 1510, in which the commander-in-chief received a severe wound, was immediately followed by the investment and capture of Goa. Albuquerque, finding himself unable to hold the town on his first occupation, abandoned it in August, to return with the reinforcements in November, when he obtained undisputed possession. He next directed his forces against Malacca, which he subdued after a severe struggle. He remained in the town nearly a year in order to strengthen the position of the Portuguese power. In 1512 he sailed for the coast of Malabar. On the voyage a violent storm arose, Albuquerque's vessel, the "Flor de la Mar," which carried the treasure he had amassed in his conquests, was wrecked, and he himself barely escaped with his life. In September of the same year he arrived at Goa, where he quickly suppressed a serious revolt headed by Idalcan, and took such measures for the security and peace of the town that it became the most flourishing of the Portuguese settlements in India. Albuquerque had been for some time under orders from the home government to undertake an expedition to the Red Sea, in order to secure that channel of communication exclusively to Portugal. He accordingly laid siege to Aden in 1513, but was repulsed; and a voyage into the Red Sea, the first ever made by a European fleet, led to no substantial results. In order to destroy the power of Egypt, he is said to have entertained the idea of diverting the course of the Nile and so rendering the whole country barren. His last warlike undertaking was a second attack upon Ormuz in 1515. The island yielded to him without resistance, and it remained in the possession of the Portuguese until 1622. Albuquerque's great career had a painful and ignominious close. He had several enemies at the Portuguese court who lost no opportunity of stirring up the jealousy of the king against him, and his own injudicious and arbitrary conduct on several occasions served their end only too well. On his return from Ormuz, at the entrance of the harbour of Goa, he met a vessel from Europe bearing despatches announcing that he was superseded by his personal enemy Soarez. The blow was too much for him and he died at sea on the 16th of December 1515. Before his death he wrote a letter to the king in dignified and affecting terms, vindicating his conduct and claiming for his son the honours and rewards that were justly due to himself. His body was buried at Goa in the Church of our Lady, and it is perhaps the most convincing proof possible of the justice of his administration that, many years after, Mussulmans and Hindus used to go to his tomb to invoke protection against the injustice of his successors. The king of Portugal was convinced too late of his fidelity, and endeavoured to atone for the ingratitude with which he had treated him by heaping honours upon his natural son Affonso. The latter published a selection from his father's papers under the title *Commentarios do Grande Affonso d'Alboquerque*.

See the *Cartas de Albuquerque*, published by the Lisbon Academy (vol. i., 1884); also Morse Stephens' *Life of Albuquerque*; an article in the *Bolitim* of the Lisbon Geographical Society (January to June 1902) on "O antigo Imperialismo portuguez, &c.," has especial reference to Albuquerque.

ALBUQUERQUE, a city and the county-seat of Bernalillo county, New Mexico, U. S. A., situated in the central part of the state, about 325 m. S. by W. of Denver, on the E. bank of the Rio Grande, at an altitude of 4950 ft. Pop. (1890) 3785; (1900) 6238 (956 foreign-born and 226 negroes); **(1910 census)** 11,020. In 1900 Albuquerque was the largest city in New Mexico. It is the connecting point of two main lines of the Atchison, Topeka & Santa Fé railway system. A short distance E. of the city is the university of New Mexico, under state control, founded in 1889 and opened in 1892; in 1908 it had a college of letters and science, a school of engineering, a school of education, a preparatory school and a commercial school. Albuquerque is also the seat of the Harwood Industrial School (Methodist) for Mexican girls, of the Menaul Mission School (Presbyterian) for Mexican boys, and of a government Indian training school (1881) for boys and girls. The city has a public library. The excellent climate has given Albuquerque and the surrounding country a reputation as a health resort. The city is an important railway centre, has extensive railway repair shops and stock-yards, and exports large quantities of live-stock, hides and wool. The largest industrial establishment is the American Lumber Company's plant, including a saw-mill, a sash, door and blind factory and a box factory. The timber used, chiefly white pine, is obtained from the Zuñi mountains. The city has also flour and woollen mills, breweries and ice factories. The old Spanish town of Albuquerque (pop. in 1900 about 1200) lies about 1 m. W. of the present city; it was founded in 1706, and was named in honour of the duke of Albuquerque, viceroy of New Spain from 1702 to 1710. During the Civil War it was occupied, late in February 1862, by Confederate troops under General Henry Hopkins Sibley (1816–1886), who soon afterwards advanced with his main body into northern New Mexico. In his retreat back into Texas he made a stand on the 8th of April 1862 at Albuquerque, where during the whole day there was a fight at long range and with few casualties against a detachment of Union soldiers commanded by Colonel Edward R. S. Canby (1819–1873). The modern city dates its origin from the completion of the first railway to Albuquerque in 1880.

ALBURNUM (sapwood), the outermost and youngest part of the wood of a tree, through which the sap rises. It is distinguished from the harder inner and older wood, the duramen or heart-wood.

ALBURY, a town in Goulburn county, New South Wales, Australia, 386 m. by rail W.S.W. of Sydney. Pop. (1901) 5821. It stands near the border of Victoria, on the right bank of the Murray river, here crossed by two bridges, one built of wood carrying a road, the other of iron bearing the railway. The Murray is navigable for small steamers from this town to its mouth, a distance of 1800 miles. Albury is the centre of a sheep-rearing and agricultural district; grapes, cereals and tobacco are largely grown, and the wine produced here is held in high repute throughout Australia. The tree under which the first explorers encamped here in November 1824 is still standing in an enclosed space. Albury became a municipality in 1859.

ALCAEUS (Alkaios), Greek lyric poet, an older contemporary of Sappho, was a native of Mytilene in Lesbos and flourished about 600 B.C. His life was greatly mixed up with the political disputes and internal feuds of his native city. He belonged to one of the noble families, and sided with his class against the "tyrants" who at that time set themselves up in Mytilene. He was in consequence obliged to leave his native country, and spent a considerable time in exile. He is said to have become reconciled to Pittacus, the ruler set up by the popular party, and to have returned to Lesbos. The date of his death is unknown. The subjects of his poems, which were composed in the Aeolic dialect, were of various kinds: some were hymns to the gods; others were of a martial or political character; others breathed an ardent love of liberty and hatred of tyrants; lastly, some were love-songs. Alcaeus was allotted the second place among the nine lyric poets in the Alexandrian canon. The considerable number of fragments extant, and the well-known imitations of Horace, who regarded Alcaeus as his great model, enable us to form a fair idea of the character of his poems. A new fragment has recently been discovered, together with some fragments of Sappho (*Classical Review*, May 1902).

See Bergk, *Poetae Lyrici Graeci* (1882); also *The Songs of Alcaeus*, by J. Easby-Smith (Washington, 1901); Plehn, *Lesbiacorum Liber* (1826); Flach, *Geschichte der griechischen Lyrik* (1883–1884); Farnell, *Greek Lyric Poets* (1891).

ALCAICS, in ancient poetry, a name given to several kinds of verse, from Alcaeus, their reputed inventor. The first kind consists of five feet, viz. a spondee or iambic, an iambic, a long syllable and two dactyles; the second of two dactyles and two trochees. Besides these, which are called *dactylic Alcaics*, there is another, simply styled *Alcaic*, consisting of an epitrite, two choriambi and a bacchius; thus—

Cur timet fla|vum Tiberim | tangere, cur | olivum?

The Alcaic ode is composed of several strophes, each consisting of four verses, the first two of which are always eleven-syllable alcaics of the first kind; the third verse is an iambic dimeter hypercatalectic consisting of nine syllables; and the fourth verse is a ten-syllable alcaic of the second kind. The following strophe is of this species, which Horace calls *Alcaei minaces camenae*—

Non possidentem multa vocaveris
Recte beatum; rectius occupat
Nomen beati, qui deorum
Muneribus sapienter uti.

There is also a decasyllabic variety of the Alcaic metre.

The Alcaic measure was one of the most splendid inventions of Greek metrical art. In its best examples it gives an impression of wonderful vigour and spontaneity. Tennyson has attempted to reproduce it in English in his

O mighty-mouthed inventor of harmonies,
O skilled to sing of time or eternity,
God-gifted organ-voice of England,
Milton, a name to resound for ages.

German is, however, the only modern literature in which alcaics have been written with much success. They were introduced by Klopstock, and used by Hölderlin, by Voss in his translations of Horace, by A. Kopisch and other modern German poets.

ALCALÁ (Moorish *al Kala*, the "Fortress" or "Castle"), the name of thirteen Spanish towns, all founded or named by the Moors. Alcalá de Henares (pop. (1900) 11,206) is separately described on account of its historical importance. Alcalá la Real (15,973), a picturesque town with a fine abbey, is situated in mountainous country in the extreme south-west of Jaén. Its distinctive name *la Real*, "the Royal," was conferred in memory of its capture by Alphonso XI. of Leon in 1340. In 1810 the French under Count Sebastiani here defeated the Spaniards. Alcalá de los Gazules (8877), on the river Barbate, in the province of Cadiz, has a thriving trade in cork and agricultural produce. Alcalá de Guadaira (8198), on the river Guadaira, near Seville, is popularly called Alcalá de los Panadores, or "Alcalá of the Bakers," because it supplies Seville with large quantities of bread. Alcalá de Chisbert (6293) is situated on the coast of Castellon de la Plana; Alcalá del Río (3006), on the Guadalquivir, 6 m. N. of Seville; Alcalá del Júcar (2968), on the Júcar, in Albacete; Alcalá de la Selva (1490), on the southern slopes of the Sierra del Gúdar, in Teruel; Alcalá de la Vega (712), on the river Cabriel, in Cuenca; Alcalá de Gurrea (632), on the river Seton, in Huesca; Alcalá del Obispo (432), in the same province; Alcalá de Ebro (388) and Alcalá de Moncayo (367), both in Saragossa.

ALCALÁ DE HENARES, a town of Spain, in the province of Madrid, 17 m. E.N.E. of Madrid, on the river Henares, and the Madrid-Saragossa railway. Pop. (1900) 11,206. Alcalá de Henares contains a military academy and various public institutions, but its commercial importance is slight and its main interest is historical. The town has been identified with the Roman *Complutum*, which was destroyed about the year 1000, and was rebuilt by the Moors in 1083. In later times it was renowned for its richly endowed university, founded by Cardinal Jimenes de Cisneros in 1510, which at the height of its prosperity numbered 12,000 students, and was second only to that of Salamanca. Here the famous edition of the Bible known as the *Complutensian Polyglot* was prepared from 1514 to 1517. The college of San Ildefonso, completed in 1583, was the chief university building. Its modernized Gothic church, the Colegiata, contains the 16th century marble monument of Jimenes (d. 1517) and a fine reredos. The greatest of Spanish writers, Cervantes, was born at Alcalá de Henares, and baptized in the otherwise insignificant church of S. Maria on the 9th of October 1547. A tablet, set up in 1840, marks the house in which he is said to have been born. Other illustrious natives of the town were the emperor Ferdinand I. (1503–1564) and the Spanish dramatist and historian Antonio de Solis (1610–1686). After the removal of the university to Madrid in 1836 the town rapidly declined, and the government turned most of the principal buildings erected by Cardinal Jimenes in the 16th century into a depot for the archives of various state departments. Here are kept very complete and curious documents of the Inquisition, showing all its workings from the 15th to the 19th century. One of the principal libraries is the former palace of the archbishops of Toledo.

For a fuller description of Alcalá see the *Guia del viajero en Alcalá de Henares*, by L. A. de la Torre (Alcalá, 1882). The following works are mainly of historical interest:—M. de Ayala and F. Sastre, *Alcalá de Henares* (Madrid, 1890); J. C. Garcia, *Ensayo de una Tipografia Complutense* (Madrid, 1889); M. Portilla y Esquivel, *Historia de la ciudad de Compluto* (Alcalá, 1725–1728); and the "Annales Complutenses" and "Chronicon Complutense" in *España Sagrada*, by H. Florez and others (Madrid, 1754–1879).

ALCALDE (from the Arab. *al-quadi*, the "*Cadi*" or "judge"), the title in Spanish for officials of somewhat varied functions, in which, however, there is always a judicial element. *Alcalde de corte* was a judge of the palace court, having jurisdiction in and about the residence of the king. But the mayor of a town or village who discharged the functions of a justice of the peace was also an *alcalde*. It is in this sense that the title is now exclusively used. He is subject to yearly election and the post has often been an undesirable one in Spain. The title of *alcalde* must be carefully distinguished from *alcaide*, which is derived from the Arabic *al-quāid*, a general, and means the governor of a fortress.

ALCAMENES, a Greek sculptor of Lemnos and Athens. He was a younger contemporary of Pheidias and noted for the delicacy and finish of his works, among which a Hephaestus and an Aphrodite "of the Gardens" were conspicuous. Pausanias says (v. 10. 8) that he was the author of one of the pediments of the temple of Zeus at Olympia (see Greek Art), but this seems a chronological and stylistic impossibility. At Pergamum there was discovered in 1903 a copy of the head of the Hermes "Propylaeus" of Alcamenes (*Athenische Mittheilungen*, 1904, p. 180). As, however, the deity is represented in an archaistic and conventional character, this copy cannot be relied on as giving us much information as to the usual style of Alcamenes, who was almost certainly a progressive and original artist. It is safer to judge him by the sculptural decoration of the Parthenon, in which he must almost certainly have taken a share under the direction of Pheidias.

ALCAMO, a town of Sicily, in the province of Trapani, 24 m. W.S.W. of Palermo direct (51½ m. by rail). Pop. (1881) 37,497; (1901) 51,809. It was founded in A.D. 828 by the Saracenic chief Al-Kamuk, who erected the castle (which still stands, though considerably altered), but was christianized by the emperor Frederick II. in 1233, who removed the site lower down. It possesses some medieval buildings of interest. The surrounding district is very fertile and the trade in agricultural products is considerable.

ALCANTARA, a small seaport of Brazil, in the state of Maranhão, on the W. shore of the bay of São Marcos, 16 m. from the city of Maranhão by water. It has a fairly good harbour, and excellent cotton and rice are grown in the vicinity and shipped thence.

ALCÁNTARA, a town of western Spain, in the province of Cáceres, situated on a rocky height on the left bank of the river Tagus, 7 m. from the Portuguese frontier. Pop. (1900) 3248. Alcántara (in Arab. "the bridge") owes its name to the magnificent Roman bridge which spans the Tagus on the north-west. This was originally built about A.D. 105, in honour of the Roman emperor Trajan and at the cost of eleven Lusitanian communities. It is entirely constructed of granite blocks, without cement, and consists of six arches of various sizes, with a total length of 616 feet and a height of about 190 ft. in the middle piers, which are surmounted by a fortified gateway. One of the arches was broken down in 1213 and rebuilt in 1553; another was blown up by the British troops in 1809, and, though temporarily reconstructed, was again destroyed in 1836, to prevent the passage of the Carlist forces. But in 1860 the whole was restored. A small Roman temple, dedicated to Trajan and other deified emperors, stood on the left bank, adjoining the bridge. It is doubtful, however, if Alcántara marks the site of any Roman town, though archaeologists have sometimes identified it either with *Norba Caesarea* or with *Interamnium*. It first became famous about 1215 as the stronghold of the knightly Order of Alcántara. Many of the grand masters of this order lie buried in the 13th-century Gothic church. The town possesses another interesting church built in 1506.

See *Antiguedades y santos de la muy noble villa de Alcántara*, by J. Arias de Quintanadueñas (Madrid, 1661); and *Retrato politico de Alcántara*, by L. Santibañez (Madrid, 1779).

ALCAVALA (Spanish, from Arab. *al-quabalah*, "tax," *quabala*, "to receive"; cf. Fr. *gabelle*), a duty formerly charged in Spain and its colonies on all transfers of property, whether public or private. Originally imposed in 1341 by Alphonso XI. to secure freedom from the Moors, it was an *ad valorem* tax of 10, increased afterwards to 14%, on the selling price of all commodities, whether raw or manufactured, chargeable as often as they were sold or exchanged. It subjected every farmer, manufacturer, merchant and shopkeeper to the continual visits and examination of the tax-gatherers, whose number was necessarily very great. This monstrous impost was permitted to ruin the industry and commerce of the greater part of the kingdom up to the time of the invasion of Napoleon. Catalonia and Aragon purchased from Philip V. an exemption from the alcavala, and, though still burdened with other heavy taxes, were in consequence in a comparatively flourishing state.

ALCÁZAR DE SAN JUAN, or Alcázar, a town of Spain, in the province of Ciudad Real, in the plain of La Mancha, at the junction of the Madrid-Manzanares and Madrid-Albacete railways. Pop. (1900) 11,499. Owing to its position on two important railways, Alcázar has a flourishing transit-trade in the wines of Estremadura and Andalusia; the soda and alkali of La Mancha are used in the manufacture of soap; and gunpowder, chocolate and inlaid daggers are also made here. Alcázar is sometimes identified with the Roman *Alce*, captured by Tiberius Sempronius Gracchus in 180 B.C. It derives its existing name from its medieval Moorish castle (*al-kasr*), which was afterwards garrisoned by the knights of St John. The townsfolk contend that the great Cervantes was a native of Alcázar; and, although this claim must be disallowed, much of the action of his masterpiece, *Don Quixote*, takes place in the neighbourhood. El Toboso, for instance, a village 12 m. E.N.E. [pop. (1900) 1895], was the home of the Lady Dulcinea del Toboso; Argamasilla de Alba (3505), 22 m. S.E., is declared by tradition to be the birthplace of Don Quixote himself. Local antiquaries even identify the knight with Don Rodrigo de Pacheco, whose portrait adorns the parish church; and the same authorities hold that part of the romance was written while Cervantes was a prisoner in their town. An edition of *Don Quixote* was published at Argamasilla in 1864.

ALCESTER, FREDERICK BEAUCHAMP PAGET SEYMOUR, Baron (1821–1895), British admiral, son of Colonel Sir Horace Beauchamp Seymour and cousin of Francis George Hugh Seymour, 5th marquess of Hertford, was born on the 12th of April 1821. Entering the navy in 1834, he served in the Mediterranean and the Pacific, was for three years flag-lieutenant to his uncle Sir George Seymour, and was promoted to be commander in 1847. He served in Burma as a volunteer in 1852, was made a captain in 1854, took the "Meteor" iron-clad battery out to the Black Sea and home again in 1856, was captain of the "Pelorus" on the Australian station from 1857 to 1863, and commanded the naval brigade in New Zealand during the Maori War, 1860–61, for which he was made a C.B. He became a rear-admiral in 1870; in 1871–1872 he commanded the flying squadron, was a lord of the admiralty in 1872–1874, and commanded the Channel fleet, 1874–1876. On the 31st of December 1876 he was made a vice-admiral, a K.C.B. on the 2nd of June 1877. In 1880–1883 he was commander-in-chief of the fleet in the Mediterranean, and in 1880 had also the chief command of the European squadron sent to the coast of Albania as a demonstration to compel the Porte to cede Dulcigno to Montenegro. On the 24th of May 1881 he was made a G.C.B., and on the 6th of May 1882 was promoted to the rank of admiral. In July 1882 he commanded at the bombardment of Alexandria and in the subsequent operations on the coast of Egypt, for which service he was raised to the peerage as Baron Alcester of Alcester in the county of Warwick, received a parliamentary grant of £25,000, the freedom of the city of London and a sword of honour. On his return from the Mediterranean he was for a couple of years again at the admiralty, and in 1886 he was placed on the retired list. For the next nine years he lived chiefly in London, but latterly his health was much broken, and he died on the 30th of March 1895. He was unmarried and the peerage became extinct.

ALCESTER [pronounced *Auster*], a market-town in the Stratford-on-Avon parliamentary division of Warwickshire, England, 16 m. W.S.W. from Warwick by the Great Western railway, served also by the Birmingham-Evesham branch of the Midland railway. Pop. (1901) 2303. It is pleasantly situated among low wooded hills at the junction of the small stream Alne with the Arrow, a northern tributary of the Avon. The church of St Nicholas, with the exception of the Decorated tower, is a reconstruction of 1734; among several monuments is a fine example of Chantrey's work, to the 2nd marquess of Hertford (d. 1822). There are a picturesque town hall (1641), raised on stone columns, and a free grammar school. The manufacture of needles is less important than formerly, having been absorbed into the centre of the industry at Redditch in the neighbouring county of Worcestershire. There are implement works and cycle works, and brewing is prosecuted.

The name (Alnecestre, Alyncester) signifies "the camp on the Alne." A small Romano-British town or village was situated here, on the road which runs from Derby and Wall, near Lichfield, to join the Fosse Way near Cirencester. Its name is not known. A relief figure in stone, some pavements, potsherds, coins and burials have been found, but nothing to indicate an important station. No written document relating to Alcester exists before the reign of Henry I. No mention occurs in Domesday, but it is given in a list of serjeanties of the reign of Henry III. as having been a royal borough in the time of Henry I., and in 1177 it rendered four marks' aid with the other boroughs of the county. However, there is no evidence of the grant of a royal charter, and the title of borough soon lapsed. In the reign of Henry III. a moiety of the manor was purchased by Sir Walter Beauchamp, who granted a charter to the inhabitants of the town establishing a Tuesday market for corn, cattle, and all kinds of merchandise, and also obtained grants of fairs at the feasts of St Giles (afterwards transferred to the feast of St Faith) and St Barnabas. In 1444 Sir John Beauchamp purchased the remaining moiety of the manor, and was granted an additional fair at the feast of St Dunstan. From this date the Beauchamps were lords of the whole manor until it passed by female descent to the Grevilles in the reign of Henry VIII. In 1140 a Benedictine monastery was founded here by Ralph Boteler of Oversley, and received the name of the Church of Our Lady of the Isle, owing to its insulation by a moat meeting the river Arrow. The monastery was suppressed among the smaller houses in 1536. Traces of the moat and the foundations are still to be seen in Priory Close. The ancient fairs survived to the end of the 19th century. In 1830 the needle-manufacture employed nearly a thousand hands.

ALCESTIS (Alkestis), in Greek legend the daughter of Pelias and Anaxibia, and wife of Admetus, king of Pherae in Thessaly. She consented to die in place of her husband, and was afterwards rescued by Heracles. This beautiful story of conjugal devotion forms the subject of the *Alcestis* of Euripides, which furnished the basis of Robert Browning's *Balaustion's Adventure*. Sophocles also wrote an *Alcestis*, of which only fragments remain.

See Dissel, *Der Mythos von Admetus und Alkestis*, 1882.

ALCHEMY. In the narrow sense of the word, alchemy is the pretended art of making gold and silver, or transmuting the base metals into the noble ones. The idea of such transmutation probably arose among the Alexandrian Greeks in the early centuries of the Christian era; thence it passed to the Arabs, by whom it was transmitted to western Europe, and its realization was a leading aim of chemical workers down to the time of Paracelsus and even later. But "alchemy" was something more than a particularly vain and deluded manifestation of the thirst for gold, as it is sometimes represented; in its wider and truer significance it stands for the chemistry of the middle ages. The idea of transmutation, in the country of its origin, had a philosophical basis, and was linked up with the Greek theories of matter there current; thus, by supplying a central philosophical principle, it to some extent unified and focussed chemical effort, which previously, so far as it existed at all, had been expended on acquiring empirical acquaintance with a mass of disconnected technical processes. Alchemy in this sense is merely an early phase of the development of systematic chemistry; in Liebig's words, it was "never at any time anything different from chemistry."

Regarding the derivation of the word, there are two main views which agree in holding that it has an Arabic descent, the prefix *al* being the Arabic article. But according to one, the second part of the word comes from the Greek *χυμεία*, pouring, infusion, used in connexion with the study of the juices of plants, and thence extended to chemical manipulations in general; this derivation accounts for the old-fashioned spellings "chymist" and "chymistry." The other view traces it to *khem* or *khamé*, hieroglyph *khmi*, which denotes black earth as opposed to barren sand, and occurs in Plutarch as *χυμεία*; on this derivation alchemy is explained as meaning the "Egyptian art." The first occurrence of the word is said to be in a treatise of Julius Firmicus, an astrological writer of the 4th century, but the prefix *al* there must be the addition of a later copyist. Among the Alexandrian writers alchemy was designated as *ἡ τῆς χρυσοῦ τε καὶ ἀργύρου ποιήσεως τέχνη θεία καὶ ἱερά* or *ἡ ἐπιστήμη ἱερά*. In English, *Piers Plowman* (1362) contains the phrase "experimentis of alconomye," with variants "alkenemye" and "alknamye." The prefix *al* begins to be dropped about the middle of the 16th century.

Origins of Alchemy.—Numerous legends cluster round the origin of alchemy. According to one story, it was founded by the Egyptian god Hermes (Thoth), the reputed inventor of the arts and sciences, to whom, under the appellation Hermes Trismegistus, Tertullian refers as the master of those who occupy themselves with nature; after him later alchemists called their work the "hermetic art," and the seal of Hermes, which they placed upon their vessels, is the origin of the common phrase "hermetically sealed." Another legend, given by Zosimus of Panopolis, an alchemistical writer said to date from the 3rd century, asserts that the fallen angels taught the arts to the women they married (cf. Genesis vi. 2), their instruction being recorded in a book called *Chemā*. A similar story appears in the Book of Enoch, and Tertullian has much to say about the wicked angels who revealed to men the knowledge of gold and silver, of lustrous stones, and of the power of herbs, and who introduced the arts of astrology and magic upon the earth. Again, the Arabic *Kitáb-al-Fihrist*, written by al-Nadím towards the end of the 10th century, says that the "people who practise alchemy," that is, who fabricate gold and silver from strange metals, state that the first to speak of the science of the work was Hermes the Wise, who was originally of Babylon, but who established himself in Egypt after the dispersion of the peoples from Babel." Another legend, also to be found in Arabic sources, asserts that alchemy was revealed by God to Moses and Aaron. But there is some evidence that, in accordance with the strong and constant tradition among the alchemists, the idea of transmutation did originate in Egypt with the Greeks of Alexandria. In the Leiden museum there are a number of papyri which were found in a tomb at Thebes, written probably in the 3rd century A.D., though their matter is older. Some are in Greek and demotic, and one, of peculiar interest from the chemical point of view, gives a number of receipts, in Greek, for the manipulation of base metals to form alloys which simulate gold and are intended to be used in the manufacture of imitation jewellery. Possibly this is one of the books about gold and silver of which Diocletian decreed the destruction about A.D. 290—an act which Gibbon styles the first authentic event in the history of alchemy (*Decline and Fall*, chap. xiii.). The author of these receipts is not under any delusion that he is transmuting metals; the MS. is merely a workshop manual in which are described processes in daily use for preparing metals for false jewellery, but it argues considerable knowledge of methods of making alloys and colouring metals. It has been suggested by M. P. E. Berthelot that the workers in these processes, which were a monopoly of the priestly caste and were kept strictly secret, though fully aware that their products were not truly gold, were in time led by their success in deceiving the public to deceive themselves also, and to come to believe that they actually had the power of making gold from substances which were not gold. Philosophical sanction and explanation of this belief was then found by bringing it into relation with the theory of the *prima materia*, which was identical in all bodies but received its actual form by the adjunction of qualities expressed by the Aristotelian elements—earth, air, fire and water. Some support for this view is gained from study of the alchemistical writings of the period. Thus, in the treatise known as *Physica et Mystica* and falsely ascribed to Democritus (such false attributions are a constant feature of the literature of alchemy), various receipts are given for colouring and gilding metals, but the conception of transmutation does not occur. This treatise was probably composed at a date not very different from that of the Leiden papyrus. Later, however, as in the *Commentary* on this work written by Synesius to Dioscorus, priest of Serapis at Alexandria, which probably dates from the end of the 4th century, a changed attitude becomes apparent; the more practical parts of the receipts are obscured or omitted, and the processes for preparing alloys and colouring metals, described in the older treatise, are by a mystical interpretation represented as resulting in real transmutation.

But while there are thus some grounds for supposing that the idea of transmutation grew out of the practical receipts of Alexandrian Egypt, the alchemy which embraced it as a leading principle was also strongly affected by Eastern influences such as magic and astrology. The earliest Greek alchemistical writings abound with references to Oriental authorities and traditions. Thus the pseudo-Democritus, who was reputed the author of the *Physica et Mystica*, which itself concludes each of its receipts with a magical formula, was believed to have travelled in Chaldaea, and to have had as his master Ostanes[1] the Mede, a name mentioned several times in the Leiden papyrus, and often by early Christian writers such as Tertullian, St Cyprian and St Augustine. The practices of the Persian adepts also are appealed to in the writings of the pseudo-Democritus, Zosimus and Synesius. The philosopher's egg, as a symbol of creation, is both Egyptian and Babylonian. In the Greek alchemists it appears as the symbol at once of the art and of the universe, enclosing within itself the four elements; and there is sometimes a play of words between τὸ ὄν and τὸ ᾠόν. The conception of man, the microcosm, containing in himself all the parts of the universe or macrocosm, is also Babylonian, as again probably is the famous identification of the metals with the planets. Even in the Leiden papyrus the astronomical symbols for the sun and moon are used to denote gold and silver, and in the *Meteorologica* of Olympiodorus lead is attributed to Saturn, iron to Mars, copper to Venus, tin to Hermes (Mercury) and electrum to Jupiter. Similar systems of symbols, but elaborated to include compounds, appear in Greek MSS. of the 10th century, preserved in the library of St Mark's at Venice. Subsequently electrum (an alloy of gold and silver) disappeared as a specific metal, and tin was ascribed to Jupiter instead, the sign of mercury becoming common to the metal and the planet. Thus we read in Chaucer (*Chanouns Yemannes Tale*):—

> The bodies sevene eek, lo! hem heer anoon:
> Sol gold is, and Luna silver we threpe,
> Mars yren, Mercurie quik-silver we clepe,
> Saturnus leed and Jupiter is tin,
> And Venus coper, by my fader kin!

Literature of Alchemy.— A considerable body of Greek chemical writings is contained in MSS. belonging to the various great libraries of Europe, the oldest being that at St Mark's, just mentioned. The contents of these MSS. are all of similar composition, and in Berthelot's opinion represent a collection of treatises made at Constantinople in the 8th or 9th century. The treatises are nearly all anterior to the 7th century, and most appear to belong to the 3rd and 4th centuries; some are the work of authentic authors like Zosimus and Synesius, while of others, such as profess to be written by Moses, Democritus, Ostanes, &c., the authorship is clearly fictitious. Some of the same names and the same works can be identified in the lists of the *Kitáb-al-Fihrist*. But the Arabs did not acquire their knowledge of this literature at first hand. The earliest Hellenic culture in the East was Syrian, and the Arabs made their first acquaintance with Greek chemistry, as with Greek philosophy, mathematics, medicine, &c., by the intermediary of Syriac translations. (See Arabian Philosophy and Syriac Literature.) Examples of such translations are preserved in MSS. at the British Museum, partly written in Syriac, partly in Arabic with Syriac characters. In Berthelot's opinion, the Syriac portions represent a compilation of receipts and processes undertaken in the Syrian school of medicine at Bagdad under the Abbasids in the 9th or 10th century, and to a large extent constituted by the earlier translations made by Sergius of Resaena in the 6th century. They contain, under the title *Doctrine of Democritus*, a fairly methodical treatise in ten books comprising the *Argyropoeia* and *Chrysopoeia* of the pseudo-Democritus, with many receipts for colouring metals, making artificial precious stones, effecting the *diplosis* or doubling of metals, &c. They give illustrations of the apparatus employed, and their close relationship to the Greek is attested by the frequent occurrence of Greek words and the fact that the signs and symbols of the Greek alchemists appear almost unchanged. The other portion seems of somewhat later date. Another Syriac MS., in the library of Cambridge University, contains a translation of a work by Zosimus which is so far unknown in the original Greek. Berthelot gives reproductions of the British Museum MSS. in vol. ii. of *La Chimie au moyen âge*.

Several alchemistical treatises, written in Arabic, exist in manuscript in the National Library at Paris and in the library of the university of Leiden, and have been reproduced by Berthelot, with translations, in vol. iii. of *La Chimie au moyen âge*. They fall into two groups: those in one are largely composed of compilations from Greek sources, while those in the other have rather the character of original compositions. Of the first group the most interesting and possibly the oldest is the *Book of Crates*; it is remarkable for containing some of the signs used for the metals by the Greek alchemists, and for giving figures of four pieces of apparatus which closely resemble those depicted in Greek MSS., the former being never, and the latter rarely, found in other Arabic MSS. Its concluding words suggest that its production was due to Khalid ben Yezid (died in 708), who was a pupil of the Syrian monk Marianus, and according to the *Kitáb-al-Fihrist* was the first Mussulman writer on alchemy. The second group consists of a number of treatises professing to be written by Jaber, celebrated in Latin alchemy as Geber (*q.v.*). Internal evidence suggests that they are not all from the same hand or of the same date, but probably they are not earlier than the 9th nor later than the 12th century. The Arabic chroniclers record the names of many other writers on alchemy, among the most famous being Rhazes and Avicenna.

But the further development of alchemy took place in the West rather than in the East. With the spread of their empire to Spain the Arabs took with them their knowledge of Greek medicine and science, including alchemy, and thence it passed, strengthened by the infusion of a certain Jewish element, to the nations of western Europe, through the medium of Latin translations. The making of these began about the 11th century, one of the earliest of the translators, Constantinus Africanus, wrote about 1075, and another, Gerard of Cremona, lived from 1114 to 1187. The *Liber de compositione alchemiae*, which professes to be by Morienus—perhaps the same as the Marianus who was the teacher of Khalid—was translated by Robertus Castrensis, who states that he finished the work in 1182, and speaks as if he were making a revelation—" Quid sit alchemia nondum cognovit vestra Latinitas." The earlier translations, such as the *Turba Philosophorum* and other works printed in collections like the *Artis auriferae quam chemiam vocant* (1572), *Theatrum chemicum* (1602), and J. J. Manget's *Bibliotheca chemica curiosa* (1702), are confused productions, written in an allegorical style, but full of phrases and even pages taken literally from the Greek alchemists, and citing by name various authorities of Greek alchemy. They were followed by treatises of a different character, clearer in matter, more systematic in arrangement, and reflecting the methods of the scholastic logic; these are farther from the Greek tradition, for although they contain sufficient traces of their ultimate Greek ancestry, their authors do not know the Greeks as masters and cite no Greek names. So far as they are Latin versions of Arabico-Greek treatises, they must have been much remodelled in the course of translation; but there is reason to suppose that many of them, even when pretending to be translations, are really original compositions. It is curious that although we possess a certain number of works on alchemy written in Arabic, and also many Latin treatises that profess to be translated from Arabic, yet in no case is the existence known of both the Arabic and the Latin version. The Arabic works of Jaber, as contained in MSS. at Paris and Leiden, are quite dissimilar from the Latin works attributed to Geber, and show few if any traces of the positive chemical knowledge, as of nitric acid (*aqua dissolutiva* or *fortis*) or of the mixture of nitric and hydrochloric acids known as *aqua regis* or *regia*, that appears in the latter. The treatises attributed to Geber, in fact, appear to be original works composed not earlier than the 13th century and fathered on Jaber in order to enhance their authority. If this view be accepted, an entirely new light is thrown on the achievements of the Arabs in the history of chemistry. Gibbon asserts that the Greeks were inattentive either to the use or to the abuse of chemistry (*Decline and Fall*, chap. xiii.), and gives the Arabs the credit of the origin and improvement of the science (chap. lii.).[1] But the chemical knowledge attributed to the Arabs has been so attributed largely on the basis of the contents of the Latin Geber, regarded as a translation from the Arabic Jaber. If, then, those contents do not represent the knowledge of Jaber, and if the contents of other Latin translations which there is reason to believe are really made from the Arabic, show little, if any, advance on the knowledge of the Alexandrian Greeks, evidently the part played by the Arabs must be less, and that of the Westerns greater, than Gibbon is prepared to admit.

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[1] An alchemistical work bearing the name of Ostanes speaks of a divine water which cures all maladies—an early appearance of the universal panacea or elixir of life.

The descent of alchemistical doctrine can thus be traced with fair continuity for a thousand years, from the Greeks of Alexandria down to the time when Latin alchemy was firmly established in the West, and began to be written of by historical authors like Albertus Magnus, Roger Bacon and Arnoldus Villanovanus in the 13th century. But side by side with this literary transmission Berthelot insists that there was another mode of transmission, by means of the knowledge of practical receipts and processes traditional among jewellers, painters, workers in glass and pottery, and other handicraftsmen. The chemical knowledge of Egyptian metallurgists and jewellers, he holds, was early transmitted to the artisans of Rome, and was preserved throughout the dark ages in the workshops of Italy and France until about the 13th century, when it was mingled with the theories of the Greek alchemists which reached the West by way of the Arabs. Receipts given in the Leiden papyrus reappear in the *Compositiones ad Tingenda* and the *Mappae Clavicula*, both workshop receipt books, one known in an 8th-century MS. at Lucca, and the other in a 10th-century MS. in the library of Schlettstadt; and again in such works as the *De Artibus Romanorum* of Eraclius and the *Schedula Diversarum Artium* of Theophilus, belonging to the 11th or 12th century.

Theory of Transmutation.—The fundamental theory of the transmutation of metals is to be found in the Greek alchemists, although in details it was modified and elaborated by the Arabs and the Latin alchemists. Regarding all substances as being composed of one primitive matter—the *prima materia*, and as owing their specific differences to the presence of different qualities imposed upon it, the alchemist hoped, by taking away these qualities, to obtain the *prima materia* itself, and then to get from it the particular substance he desired by the addition of the appropriate qualities. The *prima materia* was early identified with mercury, not ordinary mercury, but the "mercury of the philosophers," which was the essence or soul of mercury, freed from the four Aristotelian elements—earth, air, fire and water—or rather from the qualities which they represent. Thus the operator had to remove from ordinary mercury, earth or an earthy principle or quality, and water or a liquid principle, and to fix it by taking away air or a volatile principle. The *prima materia* thus obtained had to be treated with sulphur (or with sulphur and arsenic) to confer upon it the desired qualities that were missing. This sulphur again was not ordinary sulphur, but some principle derived from it, which constituted the philosopher's stone or elixir—white for silver and yellow or red for gold. This is briefly the doctrine that the metals are composed of mercury and sulphur, which persisted in one form or another down to the 17th century. Of course there were numerous variations and refinements. Thus in the *Speculum Naturale* of Vincent of Beauvais (*c.* 1250) it is said that there are four spirits—mercury, sulphur, arsenic and sal ammoniac—and six bodies—gold, silver, copper, tin, lead and iron.[2] Of these bodies the two first are pure, the four last impure. Pure white mercury, fixed by the virtue of white non-corrosive sulphur, engenders in mines a matter which fusion changes into silver, and united to pure clear red sulphur it forms gold, while with various kinds of impure mercury and sulphur the other bodies are produced. Vincent attributes to Rhazes the statement that copper is potentially silver, and any one who can eliminate the red colour will bring it to the state of silver, for it is copper in outward appearance, but in its inmost nature silver. This statement represents a doctrine widely held in the 13th century, and also to be found in the Greek alchemists, that everything endowed with a particular apparent quality possesses a hidden opposite quality, which can be rendered apparent by fire. Later, as in the works attributed to Basil Valentine, sulphur, mercury and salt are held to be the constituents of the metals.

It must be noted that the processes described by the alchemists of the 13th century are not put forward as being miraculous or supernatural; they rather represent the methods employed by nature, which it is the end of the alchemist's art to reproduce artificially in the laboratory. But even among the late Arabian alchemists it was doubted whether the resources of the art were adequate to the task; and in the West, Vincent of Beauvais remarks that success had not been achieved in making artificial metals identical with the natural ones. Thus he says that the silver which has been changed into gold by the projection of the red elixir is not rendered resistant to the agents which affect silver but not gold, and Albertus Magnus in his *De Mineralibus* —the *De Alchemia* attributed to him is spurious—states that alchemy cannot change species but merely imitates them—for instance, colours a metal white to make it resemble silver or yellow to give it the appearance of gold. He has, he adds, tested gold made by alchemists, and found that it will not withstand six or seven exposures to fire. But scepticism of this kind was not universal. Roger Bacon—or more probably some one who usurped his name—declared that with a certain amount of the philosopher's stone he could transmute a million times as much base metal into gold, and on Raimon Lull was fathered the boast, "Mare tingerem si mercurius esset." Numerous less distinguished adepts also practised the art, and sometimes were so successful in their deceptions that they gained the ear of kings, whose desire to profit by the achievements of science was in several instances rewarded by an abundant crop of counterfeit coins.

Later History of Alchemy.—In the earlier part of the 16th century Paracelsus gave a new direction to alchemy by declaring that its true object was not the making of gold but the preparation of medicines, and this union of chemistry with medicine was one characteristic of the iatrochemical school of which he was the precursor. Increasing attention was paid to the investigation of the properties of substances and of their effects on the human body, and chemistry profited by the fact that it passed into the hands of men who possessed the highest scientific culture of the time. Still, belief in the possibility of transmutation long remained orthodox, even among the most distinguished men of science. Thus it was accepted, at least academically, by Andreas Libavius (d. 1616); by F. de la Boë Sylvius (1614–1672), though not by his pupil Otto Tachenius, and by J. R. Glauber (1603–1668); by Robert Boyle (1627–1691) and, for a time at least, by Sir Isaac Newton and his rival and contemporary, G. W. Leibnitz (1646–1716); and by G. E. Stahl (1660–1734) and Hermann Boerhaave (1668–1738). Though an alchemist, Boyle, in his *Sceptical Chemist* (1661), cast doubts on the "experiments whereby vulgar Spagyrists are wont to endeavour to evince their salt, sulphur and mercury to be the true principles of things," and advanced towards the conception of chemical elements as those constituents of matter which cannot be further decomposed. With J. J. Becher (1635–1682) and G. E. Stahl, however, there was a reversion to earlier ideas. The former substituted for the salt, sulphur and mercury of Basil Valentine and Paracelsus three earths—the mercurial, the vitreous and the combustible—and he explained combustion as depending on the escape of this last combustible element; while Stahl's conception of phlogiston—not fire itself, but the principle of fire—by virtue of which combustible bodies burned, was a near relative of the mercury of the philosophers, the soul or essence of ordinary mercury.

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[1] "Some traditionary knowledge might be secreted in the temples and monasteries of Egypt; much useful experience might have been acquired in the practice of arts and manufactures, but the *science* of chemistry owes its origin and improvement to the industry of the Saracens. They first invented and named the alembic for the purposes of distillation, analyzed the substances of the three kingdoms of nature, tried the distinction and affinities of alkalis and acids, and converted the poisonous minerals into soft and salutary remedies. But the most eager search of Arabian chemistry was the transmutation of metals, and the elixir of immortal health: the reason and the fortunes of thousands were evaporated in the crucibles of alchemy, and the consummation of the great work was promoted by the worthy aid of mystery, fable and superstition." It may be noted that the word "alembic" is derived from the Greek ἄμβιξ, "cup," with the Arabic article prefixed, and that the instrument is figured in the MSS. of some of the Greek alchemists.

[2] Cf. Chaucer, *Chanouns Yemannes Tale*, where, however, mercury figures both as a spirit and a body:—

> "The firste spirit quik-silver called is,
> The second orpiment, the thridde ywis
> Sal armoniak, and the ferthe brimstoon."

Perhaps J. B. van Helmont (1577–1644) was the last distinguished investigator who professed actually to have changed mercury into gold, though impostors and mystics of various kinds continued to claim knowledge of the art long after his time. So late as 1782, James Price, an English physician, showed experiments with white and red powders, by the aid of which he was supposed to be able to transform fifty and sixty times as much mercury into silver and gold. The metals he produced are said to have proved genuine on assay; when, however, in the following year he was challenged to repeat the experiments he was unable to do so and committed suicide. In the course of the 19th century the idea that the different elements are constituted by different groupings or condensations of one primal matter—a speculation which, if proved to be well grounded, would imply the possibility of changing one element into another—found favour with more than one responsible chemist; but experimental research failed to yield any evidence that was generally regarded as offering any support to this hypothesis. About the beginning of the 20th century, however, the view was promulgated that the spontaneous production of helium from radium may be an instance of the transformation of one element into another. (See RADIOACTIVITY; also ELEMENT and MATTER.)

See M. P. E. Berthelot, *Les Origines de l'alchimie* (1885); *Collection des anciens alchimistes grecs* (text and translation, 3 vols., 1887–1888); *Introduction à l'étude de la chimie des anciens et du moyen âge* (1889); *La Chimie au moyen âge* (text and translation of Syriac and Arabic treatises on alchemy, 3 vols., 1893). Much bibliographical and other information about the later writers on alchemy is contained in *Bibliotheca Chemica* (2 vols., Glasgow, 1906), a catalogue by John Ferguson of the books in the collection of James Young of Kelly (printed for private distribution). (H. M. R.)

ALCIATI, ANDREA (1492–1550), Italian jurist, was born at Alzano, near Milan, on the 12th of January 1492. He displayed great literary skill in his exposition of the laws, and was one of the first to interpret the civil law by the history, languages and literature of antiquity, and to substitute original research for the servile interpretations of the glossators. He published many legal works, and some annotations on Tacitus. His *Emblems*, a collection of moral sayings in Latin verse, has been greatly admired, and translated into French, Italian and Spanish. Alciati's history of Milan, under the title *Rerum Patriae, seu Historiae Mediolanensis, Libri IV.*, was published posthumously at Milan in 1625. He died at Pavia in 1550.

ALCIBIADES (*c.* 450–404 B.C.), Athenian general and politician, was born at Athens. He was the son of Cleinias and Deinomache, who belonged to the family of the Alcmaeonidae. He was a near relative of Pericles, who, after the death of Cleinias at the battle of Coroneia (447), became his guardian. Thus early deprived of his father's control, possessed of great personal beauty and the heir to great wealth, which was increased by his marriage, he showed himself self-willed, capricious and passionate, and indulged in the wildest freaks and most insolent behaviour. Nor did the instructors of his early manhood supply the corrective which his boyhood lacked. From Protagoras, Prodicus and others he learnt to laugh at the common ideas of justice, temperance, holiness and patriotism. The laborious thought, the ascetic life of his master Socrates, he was able to admire, but not to imitate or practise. On the contrary, his ostentatious vanity, his amours, his debaucheries and his impious revels became notorious. But great as were his vices, his abilities were even greater.

He took part in the battle of Potidaea (432), where his life was saved by Socrates, a service which he repaid at the battle of Delium (424). As the reward of his bravery, the wealthy Hipponicus bestowed upon him the hand of his daughter. From this time he took a prominent part in Athenian politics during the Peloponnesian war. Originally friendly to Sparta, he subsequently became the leader of the war party in opposition to Nicias, and after the peace of 421 he succeeded by an unscrupulous trick in duping the Spartan ambassadors, and persuading the Athenians to conclude an alliance (420) with Argos, Elis and Mantineia (Thuc. v. 56, 76). On the failure of Nicias in Thrace (418–417) he became the chief advocate of the Sicilian expedition, seeing an opportunity for the realization of his ambitious projects, which included the conquest of Sicily, to be followed by that of Peloponnesus and possibly of Carthage (though this seems to have been an afterthought). The expedition was decided upon with great enthusiasm, and Alcibiades, Nicias and Lamachus were appointed joint commanders. But, on the day before the expedition sailed, there occurred the mysterious mutilation of the Hermae, and Alcibiades was accused not only of being the originator of the crime, but also of having profaned the Eleusinian mysteries. His request for an immediate investigation being refused, he was obliged to set sail with the charge still hanging over him. Almost as soon as he reached Sicily he was recalled to stand his trial, but he escaped on the journey home and made his way to Sparta. Learning that he had been condemned to death in his absence and his property confiscated, he openly joined the Spartans, and persuaded them to send Gylippus to assist the Syracusans and to fortify Decelea in Attica. He then passed over to Asia Minor, prevailed upon many of the Ionic allies of Athens to revolt, and concluded an alliance with the Persian satrap Tissaphernes. But in a few months he had lost the confidence of the Spartans, and at the instigation of Agis II., whose personal hostility he had excited, an order was sent for his execution. Receiving timely information of this order he crossed over to Tissaphernes (412), and persuaded him to adopt the negative policy of leaving Athens and Sparta to wear themselves out by their mutual struggles. Alcibiades was now bent on returning to Athens, and he used his supposed influence with Tissaphernes to effect his purpose. He entered into negotiations with the oligarch Peisander, but when these led to no result he attached himself to the fleet at Samos which remained loyal to the democracy, and was subsequently recalled by Thrasybulus, although he did not at once return to Athens. Being appointed commander in the neighbourhood of the Hellespont, he defeated the Spartan fleet at Abydos (411) and Cyzicus (410), and recovered Chalcedon and Byzantium. On his return to Athens after these successes he was welcomed with unexpected enthusiasm (407); all the proceedings against him were cancelled, and he was appointed general with full powers. His ill success, however, at Andros, and the defeat at Notium (407) of his lieutenant Antiochus, led the Athenians to dismiss him from his command. He thereupon retired to the Thracian Chersonesus. After the battle of Aegospotami, and the final defeat of Athens, he crossed the Hellespont and took refuge with Pharnabazus in Phrygia, with the object of securing the aid of Artaxerxes against Sparta. But the Spartans induced Pharnabazus to put him out of the way; as he was about to set out for the Persian court his residence was set on fire, and on rushing out on his assassins, dagger in hand, he was killed by a shower of arrows (404). There can be no doubt that his advice to Sparta in connexion with Syracuse and the fortification of Decelea was the real cause of his country's downfall, though it is only fair to him to add that had he been allowed to continue in command of the Sicilian expedition he would undoubtedly have overruled the fatal policy of Nicias and prevented the catastrophe of 413. His belated attempt to repair his fatal treachery only exposed the essential selfishness of his character. Though he must have known that his influence over the Persian satraps was slender in the extreme, he used it with the most flagrant dishonesty as a bait first to Sparta, then to the Athenian oligarchs, and finally to the democracy. Superficial and opportunist to the last, he owed the successes of his meteoric career purely to personal magnetism and an almost incredible capacity for deception.

There are lives of Alcibiades by Plutarch and Cornelius Nepos, and monographs by Hertzberg, *A. der Staatsmann und Feldherr* (1853), and Houssaye, *Histoire d'Alcibiade* (1873); but the best accounts will be found in the histories of Greece by G. Grote (also notes in abridged ed., 1907), Ed. Meyer, and works quoted under GREECE, *Ancient History*, sect. "Authorities"; also PELOPONNESIAN WAR.

ALCIDAMAS, of Elaea, in Aeolis, Greek sophist and rhetorician, flourished in the 4th century B.C. He was the pupil and successor of Gorgias and taught at Athens at the same time as Isocrates, whose rival and opponent he was. We possess two declamations under his name: Περὶ Σοφιστῶν, directed against Isocrates and setting forth the superiority of extempore over written speeches (a recently discovered fragment of another speech against Isocrates is probably of later date); Ὀδυσσεύς, in which Odysseus accuses Palamedes of treachery during the siege of Troy (this is generally considered spurious). According to Alcidamas, the highest aim of the orator was the power of speaking extempore on every conceivable subject. Aristotle (*Rhet.* iii. 3) criticizes his writings as characterized by pomposity of style and an extravagant use of poetical epithets and compounds and far-fetched metaphors. Of other works only fragments and the titles have survived: Μεσσηνιακός, advocating the freedom of the Messenians and containing the sentiment that "all are by nature free"; a *Eulogy of Death*, in consideration of the wide extent of human sufferings; a Τέχνη or instruction-book in the art of rhetoric; and a Φυσικὸς λόγος. Lastly, his Μουσεῖον (a word of doubtful meaning) contained the narrative of the contest between Homer and Hesiod, two fragments of which are found in the Ἀγὼν Ὁμήρου καὶ Ἡσιόδου, the work of a grammarian in the time of Hadrian. A 3rd-century papyrus (Flinders Petrie, *Papyri*, ed. Mahaffy, 1891, pl. xxv.) probably contains the actual remains of a description by Alcidamas.

See the edition by Blass, 1881; fragments in Müller, *Oratores Attici*, ii. (1858); Vahlen, *Der Rhetor Alkidamas* (1864); Blass, *Die attische Beredsamkeit.*

ALCINOUS (ALKINOÖS), in ancient Greek legend, king of the fabulous Phaeacians, in the island of Scheria, was the son of Nausithous and grandson of Poseidon. His reception and entertainment of Odysseus, who when cast by a storm on the shore of the island was relieved by the king's daughter, Nausicaä, is described in the *Odyssey* (vi.-xiii.). The gardens and palace of Alcinous and the wonderful ships of the Phaeacian mariners were famous in antiquity. Scheria was identified in very early times with Corcyra, where Alcinous was reverenced as a hero. In the Argonautic legend, his abode was the island of Drepane (Apoll. Rhodius iv. 990).

ALCINOUS, the Platonic philosopher, lived probably in the time of the Caesars. He was the author of an Ἐπιτομὴ τῶν Πλάτωνος δογμάτων, an analysis of Plato's philosophy according to later writers. It is rather in the manner of Aristotle, and freely attributes to Plato any ideas of other philosophers which appeared to contribute to the system. He produced in the end a synthesis of Plato and Aristotle with an admixture of Pythagorean or Oriental mysticism, and is closely allied to the Alexandrian school of thought. He recognized a God who is unknowable, and a series of beings (δαίμονες) who hold intercourse with men. He recognized also Ideas and Matter, and borrowed largely from Aristotle and the Stoics.

The Ἐπιτομή has been translated by Pierre Balbi (Rome, 1469) and by Marsilio Ficino; into French by J. J. Combes-Dounous (Paris, 1800), and into English by Thomas Stanley in his *History of Philosophy*. Editions: Heinsius (Leiden, 1630); Fischer (Leipzig, 1783); in Aldine Edition of Apuleius (Venice, 1521; Paris, 1532); Fell (Oxford, 1667). See Ritter, *Geschichte der Philosophie*, iv. 249

ALCIONIO, PIETRO, or PETRUS ALCYONIUS (*c.* 1487–1527), Italian classical scholar, was born at Venice. After having studied Greek under Marcus Musurus of Candia, he was employed for some time by Aldus Manutius as a corrector of the press, and in 1522 was appointed professor of Greek at Florence through the influence of Giulio de' Medici. When his patron became pope in 1523 under the title of Clement VII., Alcionio followed him to Rome and remained there until his death. Alcionio published at Venice, in 1521, a Latin translation of several of the works of Aristotle, which was shown by the Spanish scholar Sepulveda to be very incorrect. He wrote a dialogue entitled *Medices Legatus, sive de Exilio* (1522), in connexion with which he was charged with plagiarism by his personal enemy, Paulus Manutius. The accusation, which Tiraboschi has shown to be groundless, was that he had taken the finest passages in the work from Cicero's lost treatise *De Gloria*, and had then destroyed the only existing copy of the original in order to escape detection. His contemporaries speak very unfavourably of Alcionio, and accuse him of haughtiness, uncouth manners, vanity and licentiousness.

ALCIPHRON, Greek rhetorician, was probably a contemporary of Lucian (2nd century A.D.). He was the author of a collection of fictitious letters, of which 124 (118 complete and 6 fragments) have been published; they are written in the purest Attic dialect and are considered models of style. The scene is throughout at Athens; the imaginary writers are country people, fishermen, parasites and courtesans, who express their sentiments and opinions on familiar subjects in elegant language. The "courtesan" letters are especially valuable, the information contained in them being chiefly derived from the writers of the New Comedy, especially Menander.

EDITIONS.—*Editio princeps* (44 letters), 1499; Bergler (1715); Seiler (1856); Hercher (1873); Schepers (1905). English translation by Monro and Beloe (1791).

ALCIRA, a town of eastern Spain, in the province of Valencia; on the left bank of the river Júcar, and on the Valencia-Alicante railway. Pop. (1900) 20,572. Alcira is a walled town, surrounded by palm, orange and mulberry groves, and by low-lying rice-swamps, which render its neighbourhood somewhat unhealthy. Silk, fruit and rice are its chief products. It is sometimes identified with the Roman Saetabicula. In the middle ages it was a prosperous Moorish trading-station.

ALCMAEON, of Argos, in Greek legend, was the son of Amphiaraus and Eriphyle. When his father set out with the expedition of the Seven against Thebes, which he knew would be fatal to him, he enjoined upon his sons to avenge his death by slaying Eriphyle and undertaking a second expedition against Thebes. After the destruction of Thebes by the Epigoni, Alcmaeon carried out his father's injunctions by killing his mother, as a punishment for which he was driven mad and pursued by the Erinyes from place to place. On his arrival at Psophis in Arcadia, he was purified by its king Phegeus, whose daughter Arsinoe (or Alphesiboea) he married, making her a present of the fatal necklace and the peplus of Harmonia. But the land was cursed with barrenness, and the oracle declared that Alcmaeon would never find rest until he reached a spot on which the sun had never shone at the time he slew his mother. Such a spot he found at the mouth of the river Achelous, where an island had recently been formed by the alluvial deposit; here he settled and, forgetting his wife Arsinoe, married Callirrhoe, the daughter of the river-god. His new wife longed for the necklace and peplus, and Alcmaeon, returning to Psophis, obtained possession of them, on the pretence that he desired to dedicate them at Delphi. When the truth became known he was pursued and slain by Phegeus and his sons. After his death Alcmaeon was worshipped at Thebes; his tomb was at Psophis in a grove of cypresses. His story was the subject of an old epic and of several tragedies, but none of these has been preserved.

Homer, *Odyssey* xv. 248; Apollodorus iii. 7; Thucydides ii 68, 102; Pausanias viii. 24. x. 10; Ovid, *Metam.* ix. 400 *et seq.*

ALCMAEONIDAE, a noble Athenian family, claiming descent from Alcmaeon, the great-grandson of Nestor, who emigrated from Pylos to Athens at the time of the Dorian invasion of Peloponnesus. During the archonship of an Alcmaeonid Megacles (? 632 B.C.), Cylon, who had unsuccessfully attempted to make himself "tyrant," was treacherously murdered with his followers. The curse or pollution thus incurred was frequently in later years raked up for political reasons; the Spartans even demanded that Pericles should be expelled as accursed at the beginning of the Peloponnesian war. All the members of the family went into banishment, and having returned in the time of Solon (594) were again expelled (538) by Peisistratus (*q.v.*). Their great wealth enabled them during their exile to enhance their reputation and secure the favour of the Delphian Apollo by rebuilding the temple after its destruction by fire in 548. Their importance is shown by the fact that Cleisthenes, tyrant of Sicyon, gave his daughter Agariste in marriage to the Alcmaeonid Megacles in preference to all the assembled suitors after the undignified behaviour of Hippocleides. Under the statesman Cleisthenes (*q.v.*), the issue of this union, the Alcmaeonids became supreme in Athens about 510 B.C. To them was generally attributed (though Herodotus disbelieves the story—see Greece, *Ancient History*, sect. "Authorities," II.) the treacherous raising of the shield as a signal to the Persians at Marathon, but, whatever the truth of this may be, there can be little doubt that they were not the only one of the great Athenian families to make treasonable overtures to Persia. Pericles and Alcibiades were both connected with the Alcmaeonidae. Nothing is heard of them after the Peloponnesian war.

See Herodotus vi. 121-131.

ALCMAN, or Alcmaeon (the former being the Doric form of the name), the founder of Doric lyric poetry, to whom was assigned the first place among the nine lyric poets of Greece in the Alexandrian canon, flourished in the latter half of the 7th century B.C. He was a Lydian of Sardis, who came as a slave to Sparta, where he lived in the family of Agesidas, by whom he was emancipated. His mastery of Greek shows that he must have come very early to Sparta, where, after the close of the Messenian wars, the people were able to bestow their attention upon the arts of peace. Alcman composed various kinds of poems in various metres; Parthenia (maidens' songs), hymns, paeans, prosodia (processionals), and love-songs, of which he was considered the inventor. He was evidently fond of good living, and traces of Asiatic sensuousness seem out of place amidst Spartan simplicity. The fragments are scanty, the most considerable being part of a *Parthenion* found in 1855 on an Egyptian papyrus; some recently discovered hexameters are attributed to Alcman or Erinna (*Oxyrhynchus papyri*, i. 1898).

For general authorities see Alcaeus.

ALCMENE, in ancient Greek mythology, the daughter of Electryon, king of Mycenae, and wife of Amphitryon. She was the mother of Heracles by Zeus, who assumed the likeness of her husband during his absence, and of Iphicles by Amphitryon. She was regarded as the ancestress of the Heracleidae, and worshipped at Thebes and Athens.

See Winter, *Alkmene und Amphitryon* (1876).

ALCOBAÇA, a town of Portugal, in the district of Leiria, formerly included in the province of Estremadura, on the Alcoa and Baça rivers, from which it derives its name. Pop. (1900) 2309. Alcobaça is chiefly interesting for its Cistercian convent, now partly converted into schools and barracks. The monastic buildings, which form a square 725 ft. in diameter, with a huge conical chimney rising above them, were founded in 1148 and completed in 1222. During the middle ages it rivalled the greatest European abbeys in size and wealth. It was supplied with water by an affluent of the Alcoa, which still flows through the kitchen; its abbot ranked with the highest Portuguese nobles, and, according to tradition, 999 monks continued the celebration of mass without intermission throughout the year. The convent was partly burned by the French in 1810, secularized in 1834 and afterwards gradually restored. Portions of the library, which comprised over 100,000 volumes, including many precious MSS., were saved in 1810, and are preserved in the public libraries of Lisbon and Braga. The monastic church (1222) is a good example of early Gothic, somewhat defaced by Moorish and other additions. It contains a fine cloister and the tombs of Peter I. (1357–1367) and his wife, Iñez de Castro.

ALCOCK, JOHN (*c.* 1430–1500), English divine, was born at Beverley in Yorkshire and educated at Cambridge. In 1461 he was made dean of Westminster, and henceforward his promotion was rapid in church and state. In the following year he was made master of the rolls, and in 1470 was sent as ambassador to the court of Castile. He was consecrated bishop of Rochester in 1472 and was successively translated to the sees of Worcester (1476) and Ely (1486). He twice held the office of lord chancellor, and exhibited great ability in the negotiations with James III. of Scotland. He died at Wisbech Castle on the 1st of October 1500. Alcock was one of the most eminent pre-Reformation divines; he was a man of deep learning and also of great proficiency as an architect. Besides founding a charity at Beverley and a grammar school at Kingston-upon-Hull, he restored many churches and colleges; but his greatest enterprise was the erection of Jesus College, Cambridge, which he established on the site of the former convent of St Radigund.

Alcock's published writings, most of which are extremely rare, are: *Mons Perfectionis, or the Hill of Perfection* (London, 1497); *Gallicontus Johannis Alcock episcopi Eliensis ad frates suos curatos in sinodo apud Barnwell* (1498), a good specimen of early English printing and quaint illustrations; *The Castle of Labour*, translated from the French (1536), and various other tracts and homilies. See J. Bass Mullinger's *Hist. of the University of Cambridge*, vol. i.

ALCOCK, SIR RUTHERFORD (1809–1897), British consul and diplomatist, was the son of Dr Thomas Alcock, who practised at Ealing, near London, and himself followed the medical profession. In 1836 he became a surgeon in the marine brigade which took part in the Carlist war, and gaining distinction by his services was made deputy inspector-general of hospitals. He retired from this service in 1837, and seven years later was appointed consul at Fuchow in China, where, after a short official stay at Amoy, he performed the functions, as he himself expressed it, "of everything from a lord chancellor to a sheriff's officer." Fuchow was one of the ports opened to trade by the treaty of 1842, and Mr Alcock, as he then was, had to maintain an entirely new position with the Chinese authorities. In so doing he was eminently successful, and earned for himself promotion to the consulate at Shanghai. Thither he went in 1846 and made it an especial part of his duties to superintend the establishment and laying out of the British settlement, which has developed into such an important feature of British commercial life in China. In 1858 he was appointed consul-general in the newly opened empire of Japan, and in the following year was promoted to be minister plenipotentiary. In those days residence in Japan was surrounded with many dangers, and the people were intensely hostile to foreigners. In 1860 Mr Alcock's native interpreter was murdered at the gate of the legation, and in the following year the legation was stormed by a body of Ronins, whose attack was repulsed by Mr Alcock and his staff. Shortly after this event he returned to England on leave. Already he had been made a C.B. (1860); in 1862 he was made a K.C.B., and in 1863 hon. D.C.L. Oxon. In 1864 he returned to Japan, and after a year's further residence he was transferred to Pekin, where he represented the British government until 1871, when he retired. But though no longer in official life his leisure was fully occupied. He was for some years president of the Royal Geographical Society, and he served on many commissions. He was twice married, first in May 1841 to Henrietta Mary, daughter of Charles Bacon, who died in 1853, and secondly (July 8, 1862) to the widow of the Rev. John Lowder, who died on the 13th of March 1899. He was the author of several works, and was one of the first to awaken in England an interest in Japanese art; his best-known book is *The Capital of the Tycoon*, which appeared in 1863. He died in London on the 2nd of November 1897. (R. K. D.)

ALCOFORADO, MARIANNA (1640–1723), Portuguese authoress, writer of the *Letters of a Portuguese Nun*, was the daughter of a landed proprietor in Alemtejo. Beja, her birthplace, was the chief garrison town of that province, itself the principal theatre of the twenty-eight years' war with Spain that followed the Portuguese revolution of 1640, and her widowed father, occupied with administrative and military commissions, placed Marianna in her childhood in the wealthy convent of the Conception for security and education. She made her profession as a Franciscan nun at sixteen or earlier, without any real vocation, and lived a routine life in that somewhat relaxed house until her twenty-fifth year, when she met Noel Bouton. This man, afterwards marquis de Chamilly, and marshal of France, was one of the French officers who came to Portugal to serve under the great captain, Frederick, Count Schomberg, the re-organizer of the Portuguese army. During the years 1665–1667 Chamilly spent much of his time in and about Beja, and probably became acquainted with the Alcoforado family through Marianna's brother, who was a soldier. Custom then permitted religious to receive and entertain visitors, and Chamilly, aided by his military prestige and some flattery, found small difficulty in betraying the trustful nun. Before long their intrigue became known and caused a scandal, and to avoid the consequences Chamilly deserted Marianna and withdrew clandestinely to France. The letters to her lover which have earned her renown in literature were written between December 1667 and June 1668, and they described the successive stages of faith, doubt and despair through which she passed. As a piece of unconscious psychological self-analysis, they are unsurpassed; as a product of the Peninsular heart they are unrivalled. These five short letters written by Marianna to "expostulate her desertion" form one of the few documents of extreme human experience, and reveal a passion which in the course of two centuries has lost nothing of its heat. Perhaps their dominant note is reality, and, sad reading as they are from the moral standpoint, their absolute candour, exquisite tenderness and entire self-abandonment have excited the wonder and admiration of great men and women in every age, from Madame de Sevigné to W. E. Gladstone. There are signs in the fifth letter that Marianna had begun to conquer her passion, and after a life of rigid penance, accompanied by much suffering, she died at the age of eighty-three. The letters came into the possession of the comte de Guilleragues, director of the *Gazette de France*, who turned them into French, and they were published anonymously in Paris in January 1669. A Cologne edition of the same year stated that Chamilly was their addressee, which is confirmed by St Simon and Duclos, but the name of their authoress remained undivulged. In 1810, however, Boissonade discovered Marianna's name written in a copy of the first edition by a contemporary hand, and the veracity of this ascription has been placed beyond doubt by the recent investigations of Luciano Cordeiro, who found a tradition in Beja connecting the French captain and the Portuguese nun. The letters created a sensation on their first appearance, running through five editions in a year, and, to exploit their popularity, second parts, replies and new replies were issued from the press in quick succession. Notwithstanding that the Portuguese original of the five letters is lost, their genuineness is as patent as the spuriousness of their followers, and though Rousseau was ready to wager they were written by a man, the principal critics of Portugal and France have decided against him. It is now generally recognized that the letters are a verbatim translation from the Portuguese.

The foreign bibliography of the *Letters*, containing almost one hundred numbers, will be found in Cordeiro's admirable study, *Soror Marianna, A Friera Portugueza*, 2nd ed. (Lisbon, 1891). Besides the French editions, versions exist in Dutch, Danish, Italian and German; and the English bibliography is given by Edgar Prestage in his translation *The Letters of a Portuguese Nun* (*Marianna Alcoforado*), 3rd ed. (London, 1903). The French text of the *editio princeps* was printed in the first edition (1893) of this book. Edmund Gosse in the *Fortnightly Review*, vol. xlix. (old series) p. 506, shows the considerable influence exercised by the *Letters* on the sentimental literature of France and England. (E. Pr.)

ALCOHOL, in commerce, the name generally given to "spirits of wine"; in systematic organic chemistry it has a wider meaning, being the generic name of a class of compounds (hydroxy hydrocarbons) of which ordinary alcohol (specifically ethyl alcohol) is a typical member (see ALCOHOLS).

Etymology.

The word "alcohol" is of Arabic origin, being derived from the particle *al* and the word *kohl*, an impalpable powder used in the East for painting the eyebrows. For many centuries the word was used to designate any fine powder; its present-day application to the product of the distillation of wine is of comparatively recent date. Thus Paracelsus and Libavius both used the term to denote a fine powder, the latter speaking of an *alcohol* derived from antimony. At the same time Paracelsus uses the word for a volatile liquid; *alcool* or *alcool vini* occurs often in his writings, and once he adds "*id est vino ardente*." Other names have been in use among the earlier chemists for this same liquid. *Eau de vie* ("elixir of life") was in use during the 13th and 14th centuries; Arnoldus Villanovanus applied it to the product of distilled wine, though not as a specific name.

Ethyl alcohol.

Ordinary alcohol, which we shall frequently refer to by its specific name, ethyl alcohol, seldom occurs in the vegetable kingdom; the unripe seeds of *Heracleum giganteum* and *H. Sphondylium* contain it mixed with ethyl butyrate. In the animal kingdom it occurs in the urine of diabetic patients and of persons addicted to alcohol. Its important source lies in its formation by the "spirituous" or "alcoholic fermentation" of saccharine juices. The mechanism of alcoholic fermentation is discussed in the article FERMENTATION, and the manufacture of alcohol from fermented liquors in the article SPIRITS.

The qualitative composition of ethyl alcohol was ascertained by A. L. Lavoisier, and the quantitative by N. T. de Saussure in 1808. Sir Edward Frankland showed how it could be derived from, and converted into, ethane; and thus determined it to be ethane in which one hydrogen atom was replaced by a hydroxyl group. Its constitutional formula is therefore $CH_3 \cdot CH_2 \cdot OH$. It may be synthetically prepared by any of the general methods described in the article ALCOHOLS.

Pure ethyl alcohol is a colourless, mobile liquid of an agreeable odour. It boils at 78·3° C. (760 mm.); at −90° C. it is a thick liquid, and at −130° it solidifies to a white mass. Its high coefficient of thermal expansion, coupled with its low freezing point, renders it a valuable thermometric fluid, especially when the temperatures to be measured are below −39° C., for which the mercury thermometer cannot be used. It readily inflames, burning with a blue smokeless flame, and producing water and carbon dioxide, with the evolution of great heat; hence it receives considerable application as a fuel. It mixes with water in all proportions, the mixing being attended by a contraction in volume and a rise in temperature; the maximum contraction corresponds to a mixture of 3 molecules of alcohol and 1 of water. Commercial alcohol or "spirits of wine" contains about 90% of pure ethyl alcohol, the remainder being water. This water cannot be entirely removed by fractional distillation, and to prepare anhydrous or "absolute" alcohol the commercial product must be allowed to stand over some dehydrating agent, such as caustic lime, baryta, anhydrous copper sulphate, &c., and then distilled. Calcium chloride must not be used, since it forms a crystalline compound with alcohol. The quantity of alcohol present in an aqueous solution is determined by a comparison of its specific gravity with standard tables, or directly by the use of an alcoholometer, which is a hydrometer graduated so as to read per cents by weight (degrees according to Richter) or volume per cents (degrees according to Tralles). Other methods consist in determining the vapour tension by means of the vaporimeter of Geissler, or the boiling point by the ebullioscope. In the United Kingdom "proof spirit" is defined as having a specific gravity at 51° of 12/13 (·92308) compared with water at the same temperature. The "quantity at proof" is given by the formula:—

quantity of sample × (degrees over or under proof + 100) divided by 100.

The presence of water in alcohol may be detected in several ways. Aqueous alcohol becomes turbid when mixed with benzene, carbon disulphide or paraffin oil; when added to a solution of barium oxide in absolute alcohol, a white precipitate of barium hydroxide is formed. A more delicate method consists in adding a very little anthraquinone and sodium amalgam; absolute alcohol gives a green coloration, but in the presence of minute traces of water a red coloration appears. Traces of ethyl alcohol in solutions are detected and estimated by oxidation to acetaldehyde, or by conversion into iodoform by warming with iodine and potassium hydroxide. An alternative method consists in converting it into ethyl benzoate by shaking with benzoyl chloride and caustic soda.

Alcohol is extensively employed as a solvent; in fact, this constitutes one of its most important industrial applications. It dissolves most organic compounds, resins, hydrocarbons, fatty acids and many metallic salts, sometimes forming, in the latter case, crystalline compounds in which the ethyl alcohol plays a rôle similar to that of water of crystallization. This fact was first noticed by T. Graham, and, although it was at first contradicted, its truth was subsequently confirmed. In general, gases dissolve in it more readily than in water; 100 volumes of alcohol dissolve 7 volumes of hydrogen, 25 volumes of oxygen and 16 volumes of nitrogen.

Reactions.

Potassium and sodium readily dissolve in ethyl alcohol with the production of alcoholates of the formula $C_2H_5OK(Na)$. These are voluminous white powders. Sulphuric acid converts it into ethyl sulphuric acid (see ETHER), and sulphur trioxide gives carbyl sulphate. The phosphorous haloids give the corresponding ethyl haloid. Ethyl chloride (from the phosphorus chlorides and alcohol) is an ethereal liquid boiling at 12·5° C., soluble in alcohol, but sparingly so in water. Oxidation of ethyl alcohol gives acetaldehyde and acetic acid. Chlorine oxidizes it to acetaldehyde, and under certain conditions chloral (*q.v.*) is formed.

Industrial alcohol.

In almost all countries heavy taxes are levied on manufactured alcohol mainly as a source of revenue. In the United Kingdom the excise duty is eleven shillings per proof gallon of alcohol, while the customs duty is eleven shillings and fivepence; the magnitude of these imposts may be more readily understood when one remembers that the proof gallon costs only about sevenpence to manufacture. The great importance of alcohol in the arts has necessitated the introduction of a duty-free product which is suitable for most industrial purposes, and at the same time is perfectly unfit for beverages or internal application.

Methylated spirit.

In the United Kingdom this "denaturized" alcohol is known as methylated spirit as a distinction from pure alcohol or "spirits of wine." It was first enacted in 1855 that methylated spirit, a specific mixture of pure alcohol and wood-naphtha, should be duty-free; the present law is to be found in the Customs and Inland Revenue Act of 1890, and the Finance Act (sect. 8) of 1902. From 1858 to 1861 methylated spirit was duty-free when it was required for manufacturing processes, and the methylation or "denaturizing" was carried out in accordance with a prescribed process. During the next three decades (1861–1891) the law was extended, and methylated spirit was duty-free for all purposes except for use as beverages and internal medicinal applications. This spirit ("unmineralized methylated spirit") consisted of 90 parts of alcohol of 60–66 over-proof (91–95% of pure alcohol) and 10 parts of wood-naphtha. It was found, however, that certain classes were addicted to drinking this mixture, and since 1891 the sale of such spirit has been confined to manufacturers who must purchase it in bulk from the "methylators." For retail purposes the "ordinary" methylated spirit is mixed with ·357% of mineral naphtha, which has the effect of rendering it quite undrinkable. The Finance Act of 1902 allows a manufacturer to obtain a license which permits the use of duty-free alcohol, if he can show that such alcohol is absolutely essential for the success of his business, and that methylated spirit is unsuitable. Notwithstanding this permission there have been many agitations on the part of chemical manufacturers to obtain a less restricted use of absolute alcohol, and in 1905 an Industrial Alcohol Committee was appointed to receive evidence and report as to whether any modification of the present law was advisable. In the United States the same question was considered in 1896 by a Joint Select Committee on the use of alcohol in the manufactures and arts. Reference should be made to the reports of these committees for a full account of the use, manufacture and statistics of "denaturized" spirits in various European countries.

In Germany, the use of duty-free spirit is only allowed to state and municipal hospitals, and state scientific institutions, and for the manufacture of fulminates, fuzes and smokeless powders. The duty-free "denaturized" spirits may be divided into two groups—"completely denaturized" and "incompletely denaturized." In the first category there are two varieties:—(1) A mixture of 100 litres of spirit and 2½ litres of a mixture of 4 parts of wood-naphtha and 1 of pyridine bases; this spirit, the use of which is practically limited to heating and lighting purposes, may be mixed with 50 grs. of lavender or rosemary, in order to destroy the noxious odour of the pyridine bases. (2) A mixture of 100 litres of spirit, 1¼ litres of the naphtha-pyridine mixture described above, ¼ litre of methyl violet solution, and from 2 to 20 litres of benzol; this fluid is limited to combustion in motors and agricultural engines. The second category, or "incompletely denaturized" spirits, include numerous mixtures. The "general" mixture consists of 100 litres of spirit, and 5 litres of wood spirit or ½ litre of pyridine. Of the "particular" varieties, we can only notice those used in the colour industry. These consist of 100 litres of spirit mixed with either 10 litres of sulphuric ether, or 1 litre of benzol, or ½ litre of turpentine, or ·025 litre of animal oil.

The German regulations are apparently based on a keen appreciation of the fact that while one particular denaturizing agent may have little or no effect on one industry, yet it would be quite fatal to the success of another; there is consequently a great choice of denaturizing agents, and in certain cases it is sufficient to mix the alcohol with a reagent necessary for the purpose in hand, or even with a certain amount of the final product, it being only necessary to satisfy the state that the spirit is not available as a beverage.

In France, the general denaturizing agent is wood-spirit of at least 58 over-proof, and containing 25% of acetone and 2·5% of "*impurités pyrogenées*"; 10 litres of this spirit denaturizes 100 litres of alcohol. This mixture is supplied to manufacturers and corresponds to the British unmineralized methylated spirit; but the regulations are more stringent. When sold for lighting and heating purposes, it is further admixed with 0·5% of heavy benzene boiling at 150°–200° C. Provisions are also made for special denaturizing processes as in Germany.

In America the internal revenue tax on denaturized alcohol (formerly duty-free only to scientific institutions) was removed by Congress in 1906 (act of June 7th).

Pharmacology, Toxicology and Therapeutics of Alcohol.—Alcohol is of great medicinal value as a solvent, being used to form solutions of alkaloids, resins, volatile oils, iodoform, &c. In strength of about 10% and upwards it is an antiseptic. If applied to the skin it rapidly evaporates, thereby cooling the skin and diminishing the amount of sweat excreted. This refrigerant and anhidrotic action is employed to soothe many forms of headache by bathing the forehead with eau de Cologne. If, on the other hand, the alcohol be rubbed into the skin, or if its evaporation be prevented—as by a watch-glass—it absorbs water from the tissues and thus hardens them.

Thoroughly rubbed into the skin alcohol dilates the blood vessels and produces a mild counter-irritant effect. Many alcoholic liniments are therefore employed for the relief of pain, especially muscular pains, as in lumbago and other forms of so-called "muscular rheumatism." Given internally in small quantities and in sufficient dilution, alcohol causes dilatation of the gastric blood-vessels, increased secretion of gastric juice, and greater activity in the movements of the muscular layers in the wall of the stomach. It also tends to lessen the sensibility of the stomach and so may relieve gastric pain. In a 50 % solution or stronger—as when neat whisky is taken—alcohol precipitates the pepsin which is an essential of gastric digestion, and thereby arrests this process. The desirable effects produced by alcohol on the stomach are worth obtaining only in cases of acute diseases. In chronic disease and in health the use of alcohol as an aid to digestion is without the support of clinical or laboratory experience, the beneficial action being at least neutralized by undesirable effects produced elsewhere. The continued use of large doses of alcohol produces chronic gastritis, in which the continued irritation has led to overgrowth of connective tissue, atrophy of the gastric glands and permanent cessation of the gastric functions.

A single dose of concentrated alcohol (*e.g.* brandy) produces very valuable reflex effects, the heart beating more rapidly and forcibly, and the blood-pressure rising. Hence the immediately beneficial effect produced in the cases of "fainting" or syncope. After absorption, which is very rapid, alcohol exerts a marked action upon the blood. The oxygen contained in that fluid, and destined for consumption by the tissues, is retained by the influence of alcohol in its combination with the haemoglobin or colouring matter of the red blood corpuscles. Hence the diminished oxidation of the tissues, which leads to the accumulation of unused fat and so to the obesity which is so often seen in those who habitually take much alcohol. The drug exerts a noteworthy action upon the body-temperature. As it dilates the blood-vessels of the skin it increases the subjective sensation of warmth. The actual consequence, however, is that more heat than before is necessarily lost from the surface of the body. Alcohol also diminishes the oxidation which is the main source of the body-heat. It follows that the drug is an *antipyretic*, and it is hence largely used in fevers as a means of reducing the temperature. This reduction of the temperature, carried to an undesirable extreme, is the reason why the man who has copiously consumed spirits "to keep out the cold" is often visited with pneumonia. The largest amount of alcohol that can be burnt up within the healthy body in twenty-four hours is $1\frac{1}{2}$ oz., but it must be consumed in great dilution and divided into small doses taken every four hours. Otherwise the alcohol will for the most part leave the body unused in the urine and the expired air. In fever the case is different. The raised temperature appears to facilitate the oxidation of the substance, so that quantities may be taken and completely utilized which would completely intoxicate the individual had his temperature been normal. It follows that alcohol is a food in fever, and its value in this regard is greatly increased by the fact that it requires no primary digestion, but passes without changes, and without needing change, to the tissues which are to use it. According to Sir Thomas Fraser nothing else can compete with alcohol as a food in desperate febrile cases, and to this use must be added its antipyretic power already explained and its action as a soporific. During its administration in febrile cases the drug must be most carefully watched, as its action may prove deleterious to the nervous system and the circulation in certain classes of patient. The state of the pulse is the best criterion of the action of alcohol in any given case of fever. The toxicology of alcohol is treated in other articles. It includes acute alcoholism (*i.e.* intoxication), chronic alcoholism, delirium tremens, and all the countless pathological changes—extending to every tissue but the bones, and especially marked in the nervous system—which alcohol produces. (See DRUNKENNESS; DELIRIUM).

After death the presence of alcohol can be detected in all the body fluids. Its especial affinity for the nervous system is indicated by the fact that, when all traces of it have disappeared elsewhere, it can still be detected with ease in the cerebro-spinal fluid.

ALCOHOLS, in organic chemistry, a class of compounds which may be considered as derived from hydrocarbons by the replacement of one or more hydrogen atoms by hydroxyl groups. It is convenient to restrict the term to compounds in which the hydroxyl group is attached to an aliphatic residue; this excludes such compounds as the hydroxy-benzenes, naphthalenes, &c., which exhibit many differences from the compounds derived from the aliphatic alkyls.

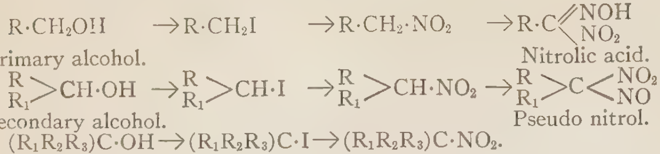
Alcohols are classified on two distinct principles, one depending upon the number of hydroxyl groups present, the other on the nature of the remaining groups attached to the carbon atom which carries the hydroxyl group. Monatomic or monohydric alcohols contain only one hydroxyl group; diatomic, two, known as glycols (*q.v.*); triatomic, three, known as glycerols (*q.v.*); and so on.

The second principle leads to alcohols of three distinct types, known as primary, secondary and tertiary. The genesis and formulation of these types may be readily understood by considering the relation which exists between the alcohols and the parent hydrocarbon. In methane, CH_4, the hydrogen atoms are of equal value, and hence only one alcohol, viz. CH_3OH, can be derived from it. This compound, methyl alcohol, is the simplest primary alcohol, and it is characterized by the grouping $\cdot CH_2OH$. Ethane, C_2H_6, in a similar manner, can only give rise to one alcohol, namely ethyl alcohol, CH_3CH_2OH, which is also primary. Propane, $CH_3CH_2CH_3$, can give rise to two alcohols—a primary alcohol, $CH_3CH_2CH_2OH$ (normal propyl alcohol), formed by replacing a hydrogen atom attached to a terminal carbon atom, and a secondary alcohol, $CH_3\cdot CH(OH)\cdot CH_3$ (isopropyl alcohol), when the substitution is effected on the middle carbon atom. The grouping $CH\cdot OH$ characterizes the secondary alcohols; isopropyl alcohol is the simplest member of this class. Butane, C_4H_{10}, exists in the two isomeric forms—normal butane, $CH_3\cdot CH_2\cdot CH_2\cdot CH_3$, and iso-butane, $CH(CH_3)_3$. Each of these hydro-carbons gives rise to two alcohols: *n*-butane gives a primary and a secondary; and iso-butane a primary, when the substitution takes place in one of the methyl groups, and a tertiary, when the hydrogen atom of the $\vdots CH$ group is substituted. Tertiary alcohols are thus seen to be characterized by the group $\vdots C\cdot OH$, in which the residual valencies of the carbon atom are attached to alkyl groups.

In 1860 Hermann Kolbe predicted the existence of secondary and tertiary alcohols from theoretical considerations. Regarding methyl alcohol, for which he proposed the name *carbinol*, as the simplest alcohol, he showed that by replacing one hydrogen atom of the methyl group by an alkyl residue, compounds of the general formula $R\cdot CH_2\cdot OH$ would result. These are the primary alcohols. By replacing two of the hydrogen atoms, either by the same or different alkyls, compounds of the formula $(R\cdot R_1)CH\cdot OH$ (*i.e.* secondary alcohols) would result; while the replacement of the three hydrogen atoms would generate alcohols of the general formula $(R\cdot R_1\cdot R_2)C\cdot OH$, *i.e.* tertiary alcohols. Furthermore, he exhibited a comparison between these three types of alcohols and the amines. Thus:—

$R\cdot NH_2$	$(R_1R_2)NH$	$(R_1R_2R_3)N$
$R\cdot CH_2OH$	$(R_1R_2)CH\cdot OH$	$(R_1R_2R_3)C\cdot OH$
Primary.	Secondary.	Tertiary.

To distinguish Primary, Secondary and Tertiary Alcohols.—Many reactions serve to distinguish these three types of alcohols. Of chief importance is their behaviour on oxidation. The primary alcohols are first oxidized to aldehydes (*q.v.*), which, on further oxidation, yield acids containing the same number of carbon atoms as in the original alcohol. Secondary alcohols yield ketones (*q.v.*), which are subsequently oxidized to a mixture of two acids. Tertiary alcohols yield neither aldehydes nor ketones, but a mixture of two or more acids. Another method is based upon the different behaviour of the corresponding nitro-alkyl with nitrous acid. The alcohol is first acted upon with phosphorus and iodine, and the resulting alkyl iodide is treated with silver nitrite, which gives the corresponding nitro-alkyl. The nitro-alkyl is then treated with potassium nitrite dissolved in concentrated potash, and sulphuric acid is added By this treatment a primary nitro-alkyl yields a nitrolic acid the potassium salt of which forms an intense red solution; a secondary nitro-alkyl forms a pseudo nitrol, which gives an intense blue solution, while the tertiary compound does not act with nitrous acid. The reactions outlined above may be thus represented:—



$$R\cdot CH_2OH \rightarrow R\cdot CH_2I \rightarrow R\cdot CH_2\cdot NO_2 \rightarrow R\cdot C{\lt}^{NOH}_{NO_2}$$

Primary alcohol. Nitrolic acid.

$${}^{R}_{R_1}{>}CH\cdot OH \rightarrow {}^{R}_{R_1}{>}CH\cdot I \rightarrow {}^{R}_{R_1}{>}CH\cdot NO_2 \rightarrow {}^{R}_{R_1}{>}C{\lt}^{NO_2}_{NO}$$

Secondary alcohol. Pseudo nitrol.

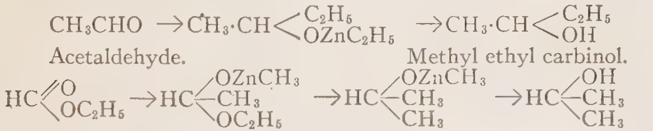
$$(R_1R_2R_3)C\cdot OH \rightarrow (R_1R_2R_3)C\cdot I \rightarrow (R_1R_2R_3)C\cdot NO_2.$$

Tertiary alcohol.

By heating to the boiling point of naphthalene (218°) tertiary alcohols are decomposed, while heating to the boiling point of anthracene (360°) suffices to decompose secondary alcohols, the primary remaining unaffected. These changes can be followed out by determinations of the vapour density, and so provide a method for characterizing alcohols (see *Compt. Rend.* 1904, 138, p. 984).

Preparation.

Alcohols may be readily prepared from the corresponding alkyl haloid by the action of moist silver oxide (which behaves as silver hydroxide); by the saponification of their esters; or by the reduction of polyhydric alcohols with hydriodic acid, and the subsequent conversion of the resulting alkyl iodide into the alcohol by moist silver oxide. Primary alcohols are obtained by decomposing their sulphuric acid esters (from sulphuric acid and the olefines) with boiling water; by the action of nitrous acid on primary amines; or by the reduction of aldehydes, acid chlorides or acid anhydrides. Secondary alcohols result from the reduction of ketones; and from the reaction of zinc alkyls on aldehydes or formic acid esters.



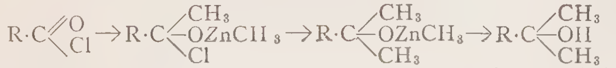
$$CH_3CHO \rightarrow CH_3\cdot CH{\lt}^{C_2H_5}_{OZnC_2H_5} \rightarrow CH_3\cdot CH{\lt}^{C_2H_5}_{OH}$$

Acetaldehyde. Methyl ethyl carbinol.

$$HC{\lt}^{O}_{OC_2H_5} \rightarrow HC\begin{smallmatrix}OZnCH_3\\ CH_3\\ OC_2H_5\end{smallmatrix} \rightarrow HC\begin{smallmatrix}OZnCH_3\\ CH_3\\ CH_3\end{smallmatrix} \rightarrow HC\begin{smallmatrix}OH\\ CH_3\\ CH_3\end{smallmatrix}$$

Formic ester. Isopropyl alcohol.

Tertiary alcohols may be synthesized by a method devised by A. Butlerow in 1864, who thus discovered the tertiary alcohols. By reacting with a zinc alkyl (methyl or ethyl) on an acid chloride, an addition compound is first formed, which decomposes with water to give a ketone. If, however, a second molecule of a zinc alkyl be allowed to react, a compound is formed which gives a tertiary alcohol when decomposed with water.



$$R\cdot C{\lt}^{O}_{Cl} \rightarrow R\cdot C\begin{smallmatrix}CH_3\\ OZnCH_3\\ Cl\end{smallmatrix} \rightarrow R\cdot C\begin{smallmatrix}CH_3\\ OZnCH_3\\ CH_3\end{smallmatrix} \rightarrow R\cdot C\begin{smallmatrix}CH_3\\ OH\\ CH_3\end{smallmatrix}$$

Acid chloride. Tertiary alcohol.

It is interesting to note that, whereas zinc methyl and ethyl give tertiary alcohols, zinc propyl only gives secondary alcohols. During recent years (1900 onwards) many brilliant syntheses have been effected by the aid of magnesium-alkyl-haloids.

Properties.

The alcohols are neutral in reaction, and the lower members possess the property of entering into combination with salts, in which the alcohol plays the rôle of water of crystallization. Sodium or potassium dissolves in them with the formation of alcoholates, the hydrogen of the hydroxyl group being replaced by the metal. With strong acids water is split off and esters are formed. The haloid esters of the paraffin alcohols formed by heating the alcohols with the halogen acids are the monohaloid derivatives of the paraffins, and are more conveniently prepared by the action of the phosphorous haloid on the alcohol. Energetic dehydration gives the olefine hydrocarbons, but under certain conditions ethers (see ETHER) are obtained.

The physical properties of the alcohols exhibit a gradation with the increase of molecular weight. The lower members are colourless mobile liquids, readily soluble in water and exhibiting a characteristic odour and taste. The solubility decreases as the carbon content rises. The normal alcohols containing 1 to 16 carbon atoms are liquids at the ordinary temperatures; the higher members are crystalline, odourless and tasteless solids, closely resembling the fats in appearance. The boiling points of the normal alcohols increase regularly about 10° for each CH_2 increment; this is characteristic of all homologous series of organic compounds. Of the primary, secondary and tertiary alcohols having the same empirical formula, the primary have the highest, and the tertiary the lowest boiling point; this is in accordance with the fairly general rule that a gain in symmetry is attended by a fall in the boiling point.

The following monatomic alcohols receive special treatment under their own headings:—ALCOHOL (ETHYL), ALLYL ALCOHOL, AMYL ALCOHOLS, BENZYL ALCOHOL, BUTYL ALCOHOLS, METHYL ALCOHOL, and PROPYL ALCOHOLS.

ALCOTT, AMOS BRONSON (1799–1888), American educationalist and writer, born on Spindle Hill, in the town of Wolcott, New Haven county, Connecticut, on the 29th of November 1799. His father, Joseph Chatfield Alcox, was a farmer and mechanic whose ancestors, then bearing the name of Alcocke, had settled in eastern Massachusetts in colonial days. The son adopted the spelling "Alcott" in his early youth. Self-educated and early thrown upon his own resources, he began in 1814 to earn his living by working in a clock factory in Plymouth, Conn., and for many years after 1815 he peddled books and merchandise, chiefly in the southern states. He began teaching in Bristol, Conn., in 1823, and subsequently conducted schools in Cheshire, Conn., in 1825–1827, again in Bristol in 1827–1828, in Boston in 1828–1830, in Germantown, now part of Philadelphia, in 1831–1833, and in Philadelphia in 1833. In 1830 he had married Abby May, the sister of Samuel J. May (1797–1871), the reformer and abolitionist. In 1834 he opened in Boston a school which became famous because of his original methods; his plan being to develop self-instruction on the basis of self-analysis, with an ever-present desire on his own part to stimulate the child's personality. The feature of his school which attracted most attention, perhaps, was his scheme for the teacher's receiving punishment, in certain circumstances, at the hands of an offending pupil, whereby the sense of shame might be quickened in the mind of the errant child. The school was denounced in the press, was not pecuniarily successful, and in 1839 was given up, although Alcott had won the affection of his pupils, and his educational experiments had challenged the attention of students of pedagogy. The school is perhaps best described in Miss E. P. Peabody's *A Record of Mr Alcott's School* (1835). In 1840 Alcott removed to Concord, Massachusetts. After a visit to England, in 1842, he started with two English associates, Charles Lane and Henry C. Wright, at "Fruitlands," in the town of Harvard, Massachusetts, a communistic experiment at farm-living and nature-meditation as tending to develop the best powers of body and soul. This speedily came to naught, and Alcott returned (1844) to his home near that of Emerson in Concord, removing to Boston four years later, and again living in Concord after 1857. He spoke, as opportunity offered, before the "lyceums" then common in various parts of the United States, or addressed groups of hearers as they invited him. These "conversations," as he called them, were more or less informal talks on a great range of topics, spiritual, aesthetic and practical, in which he emphasized the ideas of the school of American Transcendentalists led by Emerson, who was always his supporter and discreet admirer. He dwelt upon the illumination of the mind and soul by direct communion with the Creative Spirit; upon the spiritual and poetic monitions of external nature; and upon the benefit to man of a serene mood and a simple way of life. As regards the trend and results of Alcott's philosophic teaching, it must be said that, like Emerson, he was sometimes inconsistent, hazy or abrupt. But though he formulated no system of philosophy, and seemed to show the influence now of Plato, now of Kant, or of German thought as filtered through the brain of Coleridge, he was, like his American master, associate and friend, steadily optimistic, idealistic, individualistic. The teachings of William Ellery Channing a little before, as to the sacred inviolability of the human conscience—anticipating the later conclusions of Martineau—really lay at the basis of the work of most of the Concord transcendentalists and contributors to *The Dial*, of whom Alcott was one. In his last years, living in a serene and beautiful old age in his Concord home, the Orchard House, where every comfort was provided by his daughter Louisa (*q.v.*), Alcott was gratified at being able to become the nominal, and at times the actual, head of a Concord "Summer School of Philosophy and Literature," which had its first session in 1879, and in which—in a rudely fashioned building next his house—thoughtful listeners were addressed during a part of several successive summer seasons on many themes in philosophy, religion and letters. Of Alcott's published works the most important is *Tablets* (1868); next in order of merit is *Concord Days* (1872). His *Sonnets and Canzonets* (1882) are chiefly interesting as an old man's experiments in verse. He left a large collection of personal jottings and memorabilia, most of which remain unpublished. He died in Boston on the 4th of March 1888. Alcott was a Garrisonian abolitionist.

See *A. Bronson Alcott, His Life and Philosophy* (2 vols., Boston, 1893), by F. B. Sanborn and William T. Harris; *New Connecticut: an Autobiographical Poem* (Boston, 1887), edited by F. B. Sanborn; and Lowell's criticism in his *Fable for Critics*. (C. F. R.)

ALCOTT, LOUISA MAY (1832–1888), American author, was the daughter of Amos Bronson Alcott, and though of New England parentage and residence, was born in Germantown, now part of Philadelphia, Pennsylvania, on the 29th of November 1832. She began work at an early age as an occasional teacher and as a writer—her first book was *Flower Fables* (1854), tales originally written for Ellen, daughter of R. W. Emerson. In 1860 she began writing for the *Atlantic Monthly*, and she was nurse in the Union Hospital at Georgetown, D.C., for six weeks in 1862–1863. Her home letters, revised and published in the *Commonwealth* and collected as *Hospital Sketches* (1863, republished with additions in 1869), displayed some power of observation and record; and *Moods*, a novel (1864), despite its uncertainty of method and of touch, gave considerable promise. She soon turned, however, to the rapid production of stories for girls, and, with the exception of the cheery tale entitled *Work* (1873), and the anonymous novelette *A Modern Mephistopheles* (1877), which attracted little notice, she did not return to the more ambitious fields of the novelist. Her success dated from the appearance of the first series of *Little Women: or Meg, Jo, Beth and Amy* (1868), in which, with unfailing humour, freshness and lifelikeness, she put into story form many of the sayings and doings of herself and sisters. *Little Men* (1871) similarly treated the character and ways of her nephews in the Orchard House in Concord, Massachusetts, in which Miss Alcott's industry had now established her parents and other members of the Alcott family; but most of her later volumes, *An Old-Fashioned Girl* (1870), *Aunt Jo's Scrap Bag* (6 vols., 1871–1879), *Rose in Bloom* (1876), &c., followed in the line of *Little Women*, of which the author's large and loyal public never wearied. Her natural love of labour, her wide-reaching generosity, her quick perception and her fondness for sharing with her many readers that cheery humour which radiated from her personality and her books, led her to produce stories of a diminishing value, and at last she succumbed to overwork, dying in Boston on the 6th of March 1888, two days after the death of her father in the same city. Miss Alcott's early education had partly been given by the naturalist Thoreau, but had chiefly been in the hands of her father; and in her girlhood and early womanhood she had fully shared the trials and poverty incident to the life of a peripatetic idealist. In a newspaper sketch entitled "Transcendental Wild Oats," afterwards reprinted in the volume *Silver Pitchers* (1876), she narrated, with a delicate humour, which showed what her literary powers might have been if freed from drudgery, the experiences of her family during an experiment towards communistic "plain living and high thinking" at "Fruitlands," in the town of Harvard, Massachusetts, in 1843.

The story of her career has been fully and frankly told in Mrs Ednah D. Cheney's *Louisa May Alcott: Her Life, Letters and Journals* (Boston, 1889). (C. F. R.)

ALCOVE (through the Span. *alcova*, from the Arab. *al-*, the, and *quobbah*, a vault), an architectural term for a recess in a room usually screened off by pillars, balustrade or drapery.

ALCOY, a town of south-eastern Spain, in the province of Alicante, on the small river Sérpis, and at the terminus of a branch railway connected with the Barcelona-Valencia-Alicante line. Pop. (1900) 32,053. Alcoy is built on high ground at the entrance to a gorge in the Moncabrer range (4547 ft.). It is a thriving industrial town, devoid of any great antiquarian or architectural interest, though founded by the Moors. It owes its prosperity to its manufacture of linen, woolen goods and paper, especially cigarette paper. Many of the factories derive their motive power from the falls of a mountain torrent known as the Salto de las Aguas. Labour disturbances are frequent, for, like Barcelona, Alcoy has become one of the centres of socialistic and revolutionary agitation, while preserving many old-fashioned customs and traditions, such as the curious festival held annually in April in honour of St George, the patron saint of the town.

COCENTAINA (pop. 1900, 7093) is a picturesque and ancient town, 4 m. N.E. by rail. It is surrounded by Roman walls, which were partly rebuilt by the Moors, and it contains an interesting fortified palace, owned by the dukes of Medinaceli.

For an account of the festival of St George of Alcoy, see *Apuntes historicos acerca de las fiestas que celebra cada año la ciudad de Alcoy a su patron San Jorge*, by J. A. Llobet y Vallosera (Alcoy, 1853).

ALCUIN (ALCHUINE), a celebrated ecclesiastic and man of learning in the 8th century, who liked to be called by the Latin name of ALBINUS, and at the Academy of the palace took the surname of FLACCUS, was born at Eboracum (York) in 735. He was related to Willibrord, the first bishop of Utrecht, whose biography he afterwards wrote. He was educated at the cathedral school of York, under the celebrated master Ælbert, with whom he also went to Rome in search of manuscripts. When Ælbert was appointed archbishop of York in 766, Alcuin succeeded him in the headship of the episcopal school. He again went to Rome in 780, to fetch the *pallium* for Archbishop Eanbald, and at Parma met Charlemagne, who persuaded him to come to his court, and gave him the possession of the great abbeys of Ferrières and of Saint-Loup at Troyes. The king counted on him to accomplish the great work which was his dream, namely, to make the Franks familiar with the rules of the Latin language, to create schools and to revive learning. From 781 to 790 Alcuin was his sovereign's principal helper in this enterprise. He had as pupils the king of the Franks, the members of his family and the young clerics attached to the palace chapel; he was the life and soul of the Academy of the palace, and we have still, in the *Dialogue of Pepin* (son of Charlemagne) *and Alcuin*, a sample of the intellectual exercises in which they indulged. It was under his inspiration that Charles wrote his famous letter *de litteris colendis* (Boretius, *Capitularia*, i. p. 78), and it was he who founded a fine library in the palace. In 790 Alcuin returned to his own country, to which he had always been greatly attached, and stayed there some time; but Charlemagne needed him to combat the Adoptianist heresy, which was at that time making great progress in the marches of Spain. At the council of Frankfort in 794 Alcuin upheld the orthodox doctrine, and obtained the condemnation of the heresiarch Felix of Urgel. After this victory he again returned to his own land, but on account of the disturbances which broke out there, and which led to the death of King Æthelred (796), he bade farewell to it for ever. Charlemagne had just given him the great abbey of St Martin at Tours, and there, far from the disturbed life of the court, he passed his last years. He made the abbey school into a model of excellence, and many students flocked to it; he had numerous manuscripts copied, the calligraphy of which is of extraordinary beauty (*v.* Léopold Delisle in the *Mémoires de l'Académie des Inscriptions*, vol. xxxii., 1st part, 1885). He wrote numerous letters to his friends in England, to Arno, bishop of Salzburg, and above all to Charlemagne. These letters, of which 311 are extant, are filled chiefly with pious meditations, but they further form a mine of information as to the literary and social conditions of the time, and are the most reliable authority for the history of humanism in the Carolingian age. He also trained the numerous monks of the abbey in piety, and it was in the midst of these pursuits that he was struck down by death on the 19th of May 804.

Alcuin is the most prominent figure of the Carolingian Renaissance, in which have been distinguished three main periods: in the first of these, up to the arrival of Alcuin at the court, the Italians occupy the chief place; in the second, Alcuin and the Anglo-Saxons are dominant; in the third, which begins in 804, the influence of the Goth Theodulf is preponderant. Alcuin transmitted to the ignorant Franks the knowledge of Latin culture which had existed in England since the time of Bede. We still have a number of his works. His letters have already been mentioned; his poetry is equally interesting. Besides some graceful epistles in the style of Fortunatus, he wrote some long poems, and notably a whole history in verse of the church at York: *Versus de patribus, regibus et sanctis Eboracensis ecclesiae.* We owe to him, too, some manuals used in his educational work; a grammar and works on rhetoric and dialectics. They are written in the form of dialogues, and in the two last the interlocutors are King Charles and Alcuin. He wrote, finally, several theological treatises: a treatise *de Fide Trinitatis*, commentaries on the Bible, &c. The complete works of Alcuin have been edited by Froben: *Alcuini opera*, 1 vol. in 4 parts (Regensburg, 1777); this edition is reproduced in Migne's *Patrolog. lat.* vols. c. and ci. The letters have been published by Jaffé and Dümmler in Jaffé's *Bibliotheca rerum germanicarum*, vol. vi. pp. 132-897 (1873). E. Dümmler has also published an authoritative edition, *Epistolae aevi Carolini*, vol. ii. pp. 1-481, in the *Monumenta Germaniae*, and has edited the poems in the same collection: *Poetae latini aevi Carolini*, vol. i. pp. 169-341.

Authorities.—Monnier, *Alcuin et Charlemagne* (Paris, 1863); K. Werner, *Alkuin und sein Jahrhundert* (Paderborn, 1876); J. Bass Mullinger, *The Schools of Charles the Great and the Restoration of Education in the 9th Century* (London, 1877); Aug. Molinier, *Les Sources de l'histoire de France*, vol. i. p. 191; G. Monod, *Études critiques sur les sources de l'histoire carolingienne*, part i. (Paris, 1898); C. J. B. Gaskoin, *Alcuin: His Life and his Work* (London, 1903). See further U. Chevalier, *Répertoire des sources, &c., bio-bibliographie, s.v.* Alcuin; Wattenbach, *Deutschlands Geschichtsquellen* (Stuttgart and Berlin, 1904), i. p. 186. (C. Pf.)

ALCYONE, or Halcyone, in Greek mythology, daughter of Aeolus and wife of Ceyx. For their presumption in calling themselves Zeus and Hera they were changed into birds—Alcyone into a diver, Ceyx into a kingfisher. According to another story, Ceyx was drowned and his body cast on the shore. His wife found the body, and the gods, out of compassion, changed both her and her husband into kingfishers. By command of Zeus (or Aeolus) the winds ceased to blow during their brooding-time, for seven days before and after the shortest day, that their eggs might not be carried away by the sea. Hence the expression "halcyon days," used in ancient and modern times to denote a period of calm and tranquillity.

Apollonius Rhodius i. 1087; Ovid, *Metam.* xi. 410 et seq.; Hyginus, *Fabulae*, 65.

ALDABRA, the collective name of a group of islands in the Indian Ocean, forming part of the British colony of Seychelles. They lie in 9° 30′ S., 46° E., are 265 m. N.W. of the northern point of Madagascar and 690 m. S.W. of Mahé, the principal island of the Seychelles archipelago. The Comoro Islands lie 220 m. S. by W. of Aldabra. The Aldabra Islands constitute an atoll consisting of an oval ring of land, some 40 m. in circumference and about 1½ m. broad, enclosing a shallow lagoon. Channels divide the ring into four islands. Grande Terre or South Island forms three-fifths of the circumference. The other islands are West Island or Ile Picard, Polymnie and Middle Island. There are in addition several islets in the lagoon, the most important being Ile Michel. The total land area is estimated at about 60 sq. m., the lagoon, 16 m. long and 4 m. wide, covering a somewhat larger area. Pop. (1906) 127. The islands rise from 20 to 80 ft. above the sea, and consist of rugged coral rock and limestone, there being very little soil. The sea-face is generally overhanging cliff, but in a few places are sandy beaches and low sandhills. Dense scrub covers most of the land, but the inner (lagoon) shore is everywhere bounded by mangrove swamps. The flora and fauna of the islands present features of unusual interest. They are chiefly noted as the habitat of the gigantic land tortoise (*Testudo elephantina*), now carefully preserved, and of several rare and peculiar birds, including a rail (*Dryolimnas aldabranus*), an ibis (*Ibis abbottii*) and a dove (*Alectroenas sganzini*). Crustacea are abundant. They include oysters, crabs of great size, and a small mussel, found in enormous numbers. The flora includes mangroves, *Rubiaceae*, *Sapotaceae* and other forms requiring more than pure coralline material for their growth. Writing of the fauna and flora generally, Mr R. Dupont, curator of the Botanic station at Mahé, who visited Aldabra in 1906, says: "The specimens represented, besides being partly peculiar, mostly belong to the Mascarenes, Madagascar and Comoros species. Many species are also common to East Africa and to India. . . . The predominant species are Madagascar plants and birds, which are carried by the currents and the winds. . . . There are comparatively few (10) species of plants which are endemic as far as the flora has been investigated, and it is probable that most of them are also existing in the Comoros, where the flora is not well known. . . . Endemic inferior animals and mammals are practically non-existent, except two bats and one scorpion, which are allied to Madagascar species or introduced. The reptiles (tortoises) are also nearly allied to the Mascarenes and Madagascar species which once existed. With regard to birds and land shells the relation is much closer to the Comoros species, and the latter, of which I have collected seven species besides *Rachis aldabrae*, may serve to point out more than the birds the land connexion of Aldabra with the neighbouring countries." Aldabra, however, although situated in that region of the Indian Ocean which forms part of the site of the Indo-Madagascar continent of the Secondary period, is not a peak of the submerged land. It has been built up from the sunken remains of the old continent by a deposit, in the opinion of Professor A. Voeltzkow, of foraminiferal remains (mostly coccoliths and rhabdoliths). In any case, however Aldabra was formed, there can be no suggestion of its ever having been joined to any other land (Stanley Gardiner). Dupont states that at Aldabra the coral foundation is totally above water. The coral limestone of the atoll has a peculiar vitrified appearance and gives out a ringing sound when struck or simply walked on. The coral is generally reddish, but the colouring ranges from light yellow to chocolate-brown.

Aldabra was visited by Portuguese navigators in 1511. The islands were already known to the Arabs, from whom they get their name. They became in the middle of the 18th century dependencies of the French establishments at Bourbon (Réunion), whence expeditions were made for the capture of the giant tortoises. In 1810 with Mauritius, Bourbon, the Seychelles and other islands, Aldabra passed into the possession of Great Britain. The inhabitants are emigrants from the Seychelles. Goats are bred and coco-nuts cultivated, but fishing is the chief industry. With other outlying islands Aldabra is held under lease from the Seychelles government, the lessees having exclusive trading privileges.

See R. Dupont, *Report on a Visit of Investigation to . . . the Aldabra Group of the Seychelles Islands* (Seychelles, 1907); Dr Abbott in *Proceedings, United States National Museum* (Washington, 1894); A. Voeltzkow in *Abh. der Senckenbergischen Naturforschenden Ges.* vol. xxvi. part iv. (1901); J. S. Gardiner, "The Indian Ocean," *Geo. Journ.* Oct. 1906.

ALDBOROUGH, a village in the Ripon parliamentary division of the West Riding of Yorkshire, England, 16 m. W.N.W. of York, and 1 m. E. of the market town of Boroughbridge, which has a station on a branch of the North-Eastern railway. Aldborough formerly returned two members to parliament, but was disfranchised by the Reform Act of 1832. The place is remarkable from its numerous ancient remains. It was the *Isurium Brigantum* of the Romans, originally perhaps a capital of the Brigantes tribe, and afterwards a Romano-British town of considerable size. Inscriptions, beautiful mosaics and other traces of comfortable houses have been found, with many potsherds, coins and bronze, iron and other objects; and a large part of the town walls, several mosaics and parts of buildings, can be seen. A fine collection is kept in the Museum Isurianum in the grounds of the manor-house.

ALDEBURGH [ALDBOROUGH], a market town and municipal borough in the Eye parliamentary division of Suffolk, England, the terminus of a branch of the Great Eastern railway, $99\frac{1}{2}$ m. N.E. by E. from London. Area, 1629 acres. Pop. (1901) 2405. The surrounding district is open and somewhat bleak, but a fine stretch of sand fringes the shallow inlet of the North Sea known as Aldeburgh Bay. To the W. the river Alde broadens as if into an estuary, but its outflow is here prevented by the sand, and it runs south for nearly 10 m. parallel with the shore. The sandbanks have arrested the encroachments of the sea, which submerged a former site of Aldeburgh. The church of St Peter and St Paul is Perpendicular, largely restored, and contains a monument to the poet George Crabbe, born here on the 24th of December 1754. A small picturesque Moot Hall of the 16th century is used for corporation meetings. Slaughden Quay on the Alde admits small vessels, and fishing is carried on. Aldeburgh is governed by a mayor, 4 aldermen and 12 councillors.

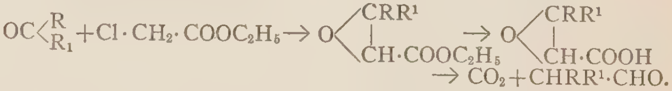
Aldeburgh (Aldburc) takes its name from the river Alde on which it stands. It is not mentioned in pre-Conquest records, but at the Domesday survey most of the land was held by Robert Malet, a Norman. In 1155 the manor was granted to the abbey of St John of Colchester, later to Cardinal Wolsey, and on his disgrace, to Thomas Howard, duke of Norfolk, to whom Elizabeth in 1567 granted a market on Saturday. In the 16th century Aldeburgh was a place of considerable commercial importance, due, no doubt, to its position on the sea-coast. Aldeburgh claims to be a borough by prescription: the earliest charter is that granted by Henry VIII. in 1529. Edward VI. in 1548 raised it to the rank of a free borough, granting a charter of incorporation and a market on Wednesday. Later charters were granted by Philip and Mary in 1553, by Elizabeth in 1558 and 1567, by James I. (who granted two annual fairs) in 1606, and by Charles I. in 1631 and 1637. The corporation included 2 bailiffs, 10 capital and 24 inferior burgesses, until the Municipal Corporations Act 1883. The fairs and markets became so unimportant that they were discontinued about the middle of the 19th century. The town returned two members to Elizabeth's parliament of 1572, and continued to be so represented till the Reform Bill of 1832 disfranchised it. Frequent disastrous incursions of the sea in the 18th century reduced Aldeburgh to a mere fishing village. In recent years it has grown as a seaside resort, with excellent golf-links.

See John Kirby, *The Suffolk Traveller* (2nd ed., 1764); N. F. Hele, *Notes about Aldeburgh* (1870); *Victoria County History—Suffolk.*

ALDEGREVER, or ALDEGRAF, **HEINRICH** (1502–1558), German painter and engraver, was born at Paderborn, from which he removed in early life to Soest, where he died. From the close resemblance of his style to that of Albrecht Dürer he has sometimes been called the Albert of Westphalia. His numerous engravings, chiefly from his own designs, are delicate and minute, though somewhat hard in style, and entitle him to a place in the front rank of the so-called "Little Masters." There is a good collection in the British Museum. Specimens of his painting are exceedingly rare. Five pictures are in continental galleries, but the genuineness of the works in the Vienna and Munich collections attributed to him is at least doubtful, the only unchallenged example being a portrait of Engelbert Therlaen (1551) in the Berlin Museum.

ALDEHYDES, a class of chemical compounds of the general formula R·CHO (R = an alkyl or an aryl group). The name is derived from *alcohol dehydrogenatum* in allusion to the fact that they may be prepared by the oxidation of alcohols. The lower members of the series are neutral liquids possessing a characteristic smell; they are soluble in water and are readily volatile (formaldehyde, however, is a gas at ordinary temperatures). As the carbon content of the molecule increases, they become less soluble in water, and their smell becomes less marked with the increase in boiling point, the highest members of the series being odourless solids, which can only be distilled without decomposition *in vacuo*.

The aldehydes may be prepared by the careful oxidation of primary alcohols with a mixture of potassium dichromate and sulphuric acid,—$3R{\cdot}CH_2OH + K_2Cr_2O7 + 4H_2SO_4 = K_2SO_4 + Cr_2(SO_4)_3 + 7H_2O + 3R{\cdot}CHO$; by distilling the calcium salts of the fatty acids with calcium formate; and by hydrolysis of the acetals. L. Bouveault (*Bull. soc. chim.*, 1904 [3], 31, p. 1306) prepares aldehydes by the gradual addition of disubstituted formamides (dissolved in anhydrous ether) to magnesium alkyl haloids, the best yields being obtained by the use of diethyl formamide. Secondary reactions take place at the same time, yielding more particularly hydrocarbons of the paraffin series. G. Darzens (*Comptes Rendus*, 1904, 139, p. 1214) prepares esters of disubstituted glycidic acids, by condensing the corresponding ketone with monochloracetic ester, in the presence of sodium ethylate. These esters on hydrolysis yield the free acids, which readily decompose, with loss of carbon dioxide and formation of an aldehyde,



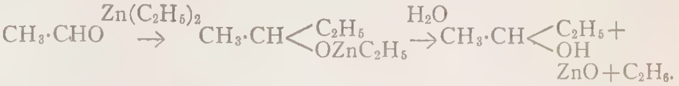
$$OC{<}^{R}_{R_1} + Cl{\cdot}CH_2{\cdot}COOC_2H_5 \rightarrow O{<}\begin{matrix}CRR^1\\ |\\ CH{\cdot}COOC_2H_5\end{matrix} \rightarrow O{<}\begin{matrix}CRR^1\\ |\\ CH{\cdot}COOH\end{matrix} \rightarrow CO_2 + CHRR^1{\cdot}CHO.$$

In the *German Patent* 157573 (1904) it is shown that by the action of at least two molecular proportions of an alkyl formate on two molecular proportions of a magnesium alkyl or aryl haloid, a complex addition compound is formed, which readily decomposes into a basic magnesium salt and an aldehyde,

$$C_6H_5MgBr + HCOOR \rightarrow RO{\cdot}CH{\cdot}C_6H_5{\cdot}OMgBr \rightarrow MgBr{\cdot}OR + C_6H_5CHO.$$

The aldehydes are characterized by their great chemical reactivity. They act as reducing agents, silver nitrate in the presence of ammonia being rapidly reduced to the condition of metallic silver. They are easily oxidized to the corresponding fatty acid, in many cases simply by exposure to air. Nascent hydrogen reduces them to primary alcohols, and phosphorus pentachloride replaces the carbonyl oxygen by chlorine. They form many addition compounds, combining with ammonia to form aldehyde ammonias of the type $R{\cdot}CH(OH){\cdot}NH_2$. These are colourless crystalline compounds, which are most readily prepared by passing ammonia gas into an ethereal solution of the aldehyde. With sodium bisulphite they form the so-called bisulphite compounds $R{\cdot}CH(OH){\cdot}SO_3Na$, which are readily resolved into their components by distillation with dilute acids, and are frequently used for the preparation of the pure aldehyde.

With hydrocyanic acid aldehydes form the cyanhydrins $R{\cdot}CH(OH){\cdot}CN$. They react with hydroxylamine and phenylhydrazine, with the formation of aldoximes and hydrazones. (For the isomerism of the aldoximes see OXIMES). The hydrazones are crystalline substances which are of value in the characterization of the aldehydes. Both oximes and hydrazones, on boiling with dilute acid, regenerate the parent aldehyde. The hydrazones are best prepared by mixing the aldehyde with phenylhydrazine in dilute acetic acid solution, in the absence of any free mineral acid. Semioxamazid, $NH_2{\cdot}CO{\cdot}CO{\cdot}NH{\cdot}NH_2$, has also been employed for the identification of aldehydes (W. Kerp and K. Unger, *Berichte*, 1897, 30. p. 585). Aldehydes are converted into resins by the action of caustic alkalies. On heating with alcohols to 100° C. they form acetals, and they also form condensation products with para-amido-di-methyl-aniline (A. Calm, *Berichte*, 1884, 17, p. 2939). They react with the zinc alkyls to form addition products, which are decomposed by water with formation of secondary alcohols (K. Thurnlach, *Annalen*, 1882, 213, p. 369) thus:—



$$CH_3{\cdot}CHO \xrightarrow{Zn(C_2H_5)_2} CH_3{\cdot}CH{<}^{C_2H_5}_{OZnC_2H_5} \xrightarrow{H_2O} CH_3{\cdot}CH{<}^{C_2H_5}_{OH} + ZnO + C_2H_6.$$

The reaction is a general one for all aldehydes with zinc methyl and zinc ethyl, but not with the higher zinc alkyls. V. Grignard (*Comptes Rendus*, 1900 et seq.) showed that aldehydes combine with magnesium alkyl iodides (in absolute ether solution) to form addition products, which are decomposed by water with the formation of secondary alcohols, thus from acetaldehyde and magnesium methyl iodide, isopropyl alcohol is obtained.

$$\mathrm{CH_3{\cdot}CHO+CH_3MgI \rightarrow CH_3{\cdot}CH}\left\langle\begin{matrix}\mathrm{CH_3}\\ \mathrm{OMgI}\end{matrix}\right. \xrightarrow{\mathrm{H_2O}} \mathrm{(CH_3)_2CH{\cdot}OH+MgI{\cdot}OH.}$$

The lower members of the aliphatic series are characterized by their power of polymerization (see FORMALIN, and the account of Acetaldehyde below), and also by the so-called "aldol" condensation, acetaldehyde in this way forming aldol, $\mathrm{CH_3{\cdot}CHOH{\cdot}CH_2{\cdot}CHO}$. These aldols generally lose the elements of water readily and pass into unsaturated compounds; aldol itself on distillation at ordinary atmospheric pressure gives crotonaldehyde, $\mathrm{CH_3{\cdot}CH : CH{\cdot}CHO}$.

Aldehydes are characterized by the reddish-violet colour which they give with a solution of fuchsine that has been decolorized by sulphurous acid (H. Schiff, *Ann.*, 1866, 140, p. 131). With diazobenzene sulphonic acid in the presence of alkali and a trace of sodium amalgam, a reddish-violet coloration is formed on standing (E. Fischer, *Ber.*, 1883, 16, p. 657). A. Angeli (*Gazz. chim. Ital.*, 1896, 22, ii. 17) has shown that aldehydes in the presence of nitrohydroxylaminic acid form hydroxamic acid. The aldehydes condense readily with acetoacetic ester in the presence of ammonia, to pyridines (see PYRIDINE), whilst O. Doebner and W. v. Miller (*Ber.*, 1892, 25, p. 2864; 1896, 29, p. 59) have shown that in the presence of aniline and sulphuric acid they give substituted quinolines. (See also C. Beyer, *Ber.*, 1887, 20, p. 1908). The chief aldehydes are shown in the following table:—

Name.	Formula.	Boiling Point.	Melting Point.
Formaldehyde	$\mathrm{H{\cdot}CHO}$	−21°	
Acetaldehyde	$\mathrm{CH_3{\cdot}CHO}$	20·8°	
Propyl aldehyde	$\mathrm{CH_3{\cdot}CH_2{\cdot}CHO}$	49°	
n-Butyl ,,	$\mathrm{CH_3{\cdot}(CH_2)_2{\cdot}CHO}$	75°	
iso- ,, ,,	$\mathrm{(CH_3)_2CH{\cdot}CHO}$	61°	
n-Valeryl ,,	$\mathrm{CH_3{\cdot}(CH_2)_3{\cdot}CHO}$	103°	
iso- ,, ,,	$\mathrm{C_4H_9{\cdot}CHO}$	92°	
Oenanthyl ,,	$\mathrm{CH_3{\cdot}(CH_2)_5{\cdot}CHO}$	155°	
Capric ,,	$\mathrm{CH_3{\cdot}(CH_2)_8{\cdot}CHO}$	121°	
Lauric ,,	$\mathrm{CH_3{\cdot}(CH_2)_{10}{\cdot}CHO}$		44·5°
Myristic ,,	$\mathrm{CH_3{\cdot}(CH_2)_{12}{\cdot}CHO}$		52·5°
Palmitic ,,	$\mathrm{CH_3{\cdot}(CH_2)_{14}{\cdot}CHO}$		58·5°
Stearic ,,	$\mathrm{CH_3{\cdot}(CH_2)_{16}{\cdot}CHO}$		63·5°
Acrolein, allyl aldehyde	$\mathrm{CH_2 : CH{\cdot}CHO}$	52°	
Crotonic ,,	$\mathrm{CH_3{\cdot}CH : CH{\cdot}CHO}$	104°	
Tiglic ,, (guaiacol)	$\mathrm{CH_3{\cdot}CH{:}C{\cdot}CH_3{\cdot}CHO}$	116°	
Propargylic A.	$\mathrm{CH : C{\cdot}CHO}$	59°	
Benzaldehyde	$\mathrm{C_6H_5{\cdot}CHO}$	179°	
Toluicaldehyde o		200°	
Toluicaldehyde m	$\mathrm{C_6H_4{\cdot}CH_3{\cdot}CHO}$	199°	
Toluicaldehyde p		204°	
Cumic ,,	$\mathrm{C_6H_4{\cdot}C_3H_7{\cdot}CHO}$	235°	
Cinnamic ,,	$\mathrm{C_6H_5{\cdot}CH : CH{\cdot}CHO}$	247°	

For formaldehyde see FORMALIN. *Acetaldehyde*, $\mathrm{CH_3{\cdot}CHO}$, was first noticed by C. Scheele in 1774 and isolated and investigated by J. v. Liebig (*Annalen*, 1835, 14, p. 133). It is prepared by oxidizing ethyl alcohol with dilute sulphuric acid and potassium bichromate, and is a colourless liquid of boiling point 20·8° C., possessing a peculiar characteristic smell. Its specific gravity is 0·8009 (0° C.). It is miscible in all proportions with alcohol, ether and water. It is readily polymerized, small quantities of hydrochloric acid, zinc chloride, carbonyl chloride, &c. converting it, at ordinary temperatures, into paraldehyde, $\mathrm{(C_2H_4O)_3}$, a liquid boiling at 124° C. and of specific gravity 0·998 (15° C.). Paraldehyde is moderately soluble in water, and when distilled with sulphuric acid is reconverted into the ordinary form. Metaldehyde, $\mathrm{(C_2H_4O)_3}$, is produced in a similar way to paraldehyde, but at lower temperatures (*e.g.* in presence of a freezing mixture). It is a crystalline solid, which sublimes at 112°–115° C. It is insoluble in water, and is only slightly soluble in alcohol and ether. When heated in a sealed tube at 120° C. it is completely converted into the ordinary form. Paraldehyde is oxidized by dilute nitric acid, with formation of much glyoxal, $\mathrm{(CHO)_2}$. (For trichloracetaldehyde see CHLORAL.)

By the action of acetaldehyde on alcohol at 100° C., acetal, $\mathrm{CH_3{\cdot}CH(OC_2H_5)_2}$, is produced. It may also be prepared by oxidizing ethyl alcohol with manganese dioxide and sulphuric acid (A. Wurtz). It is a colourless liquid of specific gravity 0·8314 (20°/4°) (J. W. Brühl) and boiling point 104° C. Dilute acids readily transform it into alcohol and aldehyde, and chromic acid oxidizes it to acetic acid. Chlor- and brom-acetals have been described.

Thioaldehydes are also known, and are obtained by leading sulphuretted hydrogen into an aqueous solution of acetaldehyde. By this means a mixture is obtained which by distillation or the action of hydrochloric acid yields trithioaldehyde, $\mathrm{(C_2H_4S)_3}$. For the constitution of these substances see E. Baumann and E. Fromm (*Berichte*, 1891, 24, p. 1426). Aldehyde ammonia, $\mathrm{CH_3{\cdot}CH(OH){\cdot}NH_2}$, is formed when dry ammonia gas is passed into an ethereal solution of acetaldehyde. It crystallizes in glistening rhombohedra, melting at 70°–80° C., and boiling at 100° C. It is completely resolved into its components when warmed with dilute acids.

The higher aldehydes of the series resemble acetaldehyde in their general behaviour. Unsaturated aldehydes are also known, corresponding to the olefine alcohols; they show the characteristic properties of the saturated aldehydes and can form additive compounds in virtue of their unsaturated nature. The simplest member of the series is acrolein, $\mathrm{C_3H_4O}$ or $\mathrm{CH_2 : CH{\cdot}CHO}$, which can be prepared by the oxidation of allyl alcohol, or by the abstraction of the elements of water from glycerin by heating it with anhydrous potassium bisulphate. It is also produced by the action of sodium on a mixture of epichlorhydrin and methyl iodide, $\mathrm{C_3H_5OCl+CH_3I+2Na=C_3H_4O+NaI+NaCl+CH_4}$. It is a colourless liquid, with a very pungent smell, and attacks the mucous membrane very rapidly. It boils at 52·4° C. and is soluble in water. It oxidizes readily: exposure to air giving acrylic acid, nitric acid giving oxalic acid, bichromate of potash and sulphuric acid giving carbon dioxide and formic acid. It combines with bromine to form a dibromide, from which E. Fischer, by the action of baryta water, obtained the synthetic sugars α- and β-acrose (*Berichte*, 1889, 22, p. 360). Metacrolein, $\mathrm{(C_3H_4O)_3}$, is a polymer of acrolein. By passing acrolein vapour into ammonia, acrolein ammonia, $\mathrm{C_6H_9NO}$, is obtained. It is a reddish amorphous mass, insoluble in alcohol, and when distilled yields picoline (methyl pyridine) (A. Baeyer, *Ann.*, 1870, 155, p. 283). Citronellal, rhodinal and geranial are also unsaturated aldehydes (see TERPENES).

The aromatic aldehydes resemble the aliphatic aldehydes in most respects, but in certain reactions they exhibit an entirely different behaviour. They do not polymerize, and in the presence of caustic alkalies do not resinify, but oxidize to alcohols and acids (see BENZALDEHYDE for Cannizzaro's reaction). When heated with alcoholic potassium cyanide they are converted into benzoins (*q.v.*). Vanillin does not give the Cannizzaro reaction, but with alcoholic potash forms vanillic acid, $\mathrm{HOOC(1){\cdot}C_6H_3{\cdot}OCH_3(3){\cdot}OH(4)}$, and vanilloin. With ammonia, benzaldehyde does not form an aldehyde ammonia, but condenses to hydrobenzamide, $\mathrm{(C_6H_5CH)_3N_2}$, with elimination of water. Cumic aldehyde (cuminol), $\mathrm{(CH_3)_2CH(1)C_6H_4{\cdot}CHO(4)}$, is found in Roman caraway oil and in oil of the water hemlock. It is a liquid, boiling at 235° C., and has a specific gravity of 0·973. On distillation with zinc dust it forms cymene (1·4 methyl isopropyl benzene).

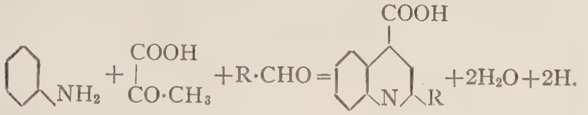
Salicylic aldehyde (ortho-hydroxybenzaldehyde), $\mathrm{HO(1){\cdot}C_6H_4{\cdot}CHO(2)}$, an aromatic oxyaldehyde, is a colourless liquid of boiling point 196° C. and specific gravity 1·172 (15°). It is found in the volatile oils of Spiraea, and can be obtained by the oxidation of the glucoside salicin, $\mathrm{(C_{13}H_{18}O_7)}$, which is found in willow bark. It is usually prepared by the so-called "Reimer" reaction (*Ber.*, 1876, 9, p. 1268), in which chloroform acts on phenol in the presence of a caustic alkali,

$$\mathrm{C_6H_5OH+CHCl_3+4KHO=3KCl+3H_2O+KO{\cdot}C_6H_4{\cdot}CHO,}$$

some para-oxybenaldehyde being formed at the same time. It is volatile (para-oxybenzaldehyde is not) and gives a violet coloration with ferric chloride. For dioxybenzaldehydes and their derivatives see PIPERONAL and VANILLIN.

Cinnamic aldehyde (β-phenyl acrolein), $C_6H_5\cdot CH:CH\cdot CHO$, an unsaturated aromatic aldehyde, is the chief constituent of cinnamon oil. It is prepared by oxidizing cinnamyl alcohol, or by the action of sodium ethylate on a mixture of benzaldehyde and acetaldehyde. It is a colourless aromatic-smelling oily liquid, which boils at 247° C. and readily oxidizes on exposure.

By condensation of aldehydes with pyruvic acid and naphthylamines, the α-alkyl-naphthoquinoline-γ-carboxylic acids are produced; the same reaction takes place with the aromatic amines generally (O. Doebner, *Ann.* 1894, 281, p. 1),



ALDEN, JOHN (1599?–1687), one of the "Pilgrims" who in 1620 emigrated to America on the "Mayflower" and founded the Plymouth Colony. According to William Bradford's *History of the Plimoth Plantation*, he was hired as a cooper at Southampton, "where the ship victuled," just before the voyage, "and being a hopfull yong man, was much desired." He was one of the first settlers of Duxbury, Massachusetts, where he lived during the greater part of his life, and from 1633 until 1675 he was an "Assistant" to the governor of the colony, frequently serving as acting governor. At the time of his death, at Duxbury, on the 12th of September 1687, he was the last male survivor of the signers of the "Mayflower Compact" of 1620, and with the exception of Mary Allerton was the last survivor of the "Mayflower" company. He is remembered chiefly because of a popular legend, put into verse as *The Courtship of Miles Standish* by Henry W. Longfellow, concerning his courtship of Priscilla Mullins, whom he married in 1623, after having wooed her first on behalf of his friend, Miles Standish.

ALDER, a genus of plants (*Alnus*) belonging to the order Betulaceae, the best-known of which is the common alder (*A. glutinosa*). The genus comprises a few species of shrubs or trees, seldom reaching a large size, distributed through the North Temperate zone, and in the New World passing along the Andes southwards to Chile. The British species *A. glutinosa* is confined to the Old World. This tree thrives best in moist soils, has a shrubby appearance, and grows under favourable circumstances to a height of 40 or 50 ft. It is characterized by its short-stalked roundish leaves, becoming wedge-shaped at the base and with a slightly toothed margin. When young they are somewhat glutinous, whence the specific name, becoming later a dark olive green. As with other plants growing near water it keeps its leaves longer than do trees in drier situations, and the glossy green foliage lasting after other trees have put on the red or brown of autumn renders it valuable for landscape effect. The stout cylindrical male catkins are pendulous, reddish in colour and 2 to 4 in. long; the female are smaller, less than an inch in length and reddish-brown in colour, suggesting young fir-cones. When the small winged fruits have been scattered the ripe, woody, blackish cones remain, often lasting through the winter. The alder is readily propagated by seeds, but throws up root-suckers abundantly. It is important as coppice-wood on marshy ground. The wood is soft, white when first cut and turning to pale red; the knots are beautifully mottled. Under water the wood is very durable, and it is therefore used for piles. The supports of the Rialto at Venice, and many buildings at Amsterdam, are of alder-wood. Furniture is sometimes made from the wood, and it supplies excellent charcoal for gunpowder. The bark is astringent; it is used for tanning and dyeing.

ALDER-FLY, the name given to neuropterous insects of the family *Sialidae*, related to the ant-lions, with long filamentous antennae and four large wings, of which the anterior pair is rather longer than the posterior. The females lay a vast number of eggs upon grass stems near water. The larvae are aquatic, active, armed with strong sharp mandibles, and breathe by means of seven pairs of abdominal branchial filaments. When full-sized they leave the water and spend a quiescent pupal stage on the land before metamorphosis into the sexually mature insect. *Sialis lutaria* is a well-known British example. In America there are two genera, *Corydalis* and *Chauliodes*, which are remarkable for their relatively gigantic size and for the immense length and sabre-like shape of the mandibles.

ALDERMAN (from A.-S. *ealdorman*, compounded of the comparative degree of the adjective *eald*, old, and *man*), a term implying the possession of an office of rank or dignity, and, in modern times, applied to an office-bearer in the municipal corporations and county councils of England and Wales, and in the municipal corporations of Ireland and the United States. Among the Anglo-Saxons, earls, governors of provinces and other persons of distinction received this title. Thus we read of the *aldermannus totius Angliae*, who seems to have corresponded to the officer afterwards styled *capitalis justiciarius Angliae*, or chief-justice of England; the *aldermannus regis*, probably an occasional magistrate, answering to the modern justice of assize, or perhaps an officer whose duty it was to prosecute for the crown; and *aldermannus comitatus*, a magistrate with a middle rank between what was afterwards called the *earl* and the *sheriff*, who sat at the trial of causes with the bishop and declared the common law, while the bishop proceeded according to ecclesiastical law. Besides these, we meet with the titles of *aldermannus civitatis, burgi, castelli, hundredi sive wapentachii*, &c. In England, before the passing of the Municipal Corporations Act, their functions varied according to the charters of the different boroughs. By the Municipal Corporations Act 1835, and other acts, consolidated by the Municipal Corporations Act 1882, the aldermen are elected by the councillors for six years, one-half going out every three years. The number of councillors in each borough varies according to its magnitude. One-fourth of the municipal council consists of aldermen and three-fourths of councillors. In the counties, too, the number of aldermen is one-third of the number of councillors, except in London, where it is one-sixth. In the municipal corporations of Scotland there is no such title as alderman, the office-bearers of corresponding rank there being termed bailies. The corporation of the city of London was not included in the Borough Reform Act, and the antiquated system remains there in full force. The court of aldermen consists of twenty-six, twenty-five of whom are elected for life by the freemen of the respective wards, who return two persons, one of whom the court of aldermen elect to supply the vacancy. The city is divided into twenty-six wards; twenty-four of these send up one alderman each, the other two combine to choose a twenty-fifth. The twenty-sixth alderman serves for the independent borough of Southwark (*q.v.*) and is appointed by the other aldermen, who generally select the senior from among themselves when a vacancy occurs. The lord mayor is elected from such of the aldermen as have served the office of sheriff; of these the Common Hall, which consists of the freemen of the different wards, select two, and the aldermen elect one of these to the mayoralty. The court of aldermen has the power of appointment to certain offices, exercises judicial functions in regard to licensing and in disputes connected with the ward election, has some power of disposal over the city cash and possesses magisterial control over the city, each alderman being a judge and magistrate for the whole city, and by virtue of his office exercising the functions of a justice of the peace. The aldermen are members of the court of common council, the legislative body of the corporation, which consists in all of 232 members, the remainder being elected annually by the freemen. In the United States aldermen form as a rule a legislative rather than a judicial body, although in some cities they hold courts and possess very considerable magisterial powers.

ALDERNEY (Fr. *Aurigny*), one of the Channel Islands, the northernmost of the principal members of the group, belonging to England. It lies in 49° 43′ N. and 2° 12′ W., 9 m. W. of Cape La Hague on the coast of Normandy. The harbour, on the north coast in the bay of Braye, is 25 m. from St Peter

Port, Guernsey, by way of which outer communications are principally carried on, and 55 m. S. by E. of Portland Bill, the nearest point of England. The length of the island from N. E. to S. W. is 3½ m., its average breadth 1 m., its area 1962 acres, and its population (1901) 2062.

The strait between the island and Cape La Hague, called the Race of Alderney (French *Raz Blanchard*), confined by numerous rocks and reefs off either coast, is rendered very dangerous in stormy weather by conflicting currents. Through this difficult channel the scattered remnant of the French fleet under Tourville escaped after the defeat of La Hogue in 1692. To the west is the narrower and also dangerous channel of the Swinge (*Singe*), between Alderney and the uninhabited islets of Burhou, Ortach and others. West of these again are the Casquets, a group of rocks to which attaches a long record of shipwreck. Rocks and reefs fringe all the coasts of Alderney. The island itself is a level open tableland, which on the south-west and south falls abruptly to the sea in a majestic series of cliffs. The greatest elevation of the land is about 300 ft. Towards the north-west, north and east the less rocky coast is indented by several bays, with open sandy shores, of which those of Crabby, Braye, Corblets and Longy are the most noteworthy. South-west of Longy Bay, where the coast rises boldly, there is a remarkable projecting block of sandstone, called La Roche Pendante (Hanging Rock) overhanging the cliff. Sandstone (mainly along the north-east coast), granite and porphyry are the chief geological formations. There are a few streams, but water is obtained mainly from wells. Trees are scarce. The town of St Anne stands almost in the centre of the island overlooking and extending towards the harbour. Here are the court-house, a gateway commemorating Albert, prince-consort, the clock tower, which belonged to the ancient parish church, and the modern church (1850), in Early English style, an excellent example of the work of Sir Gilbert Scott. The church is a memorial to the family of Le Mesurier, in which the hereditary governorship of the island was vested until the abolition of the office in 1825. There is a chain of forts round the north coast from Clanque Fort on the west to Fort Essex on the east; the largest is Fort Albert, above Braye Bay. In 1847 work was begun on a great breakwater west of the harbour, the intention being to provide a harbour of refuge, but although a sum exceeding one and a half million sterling was spent the scheme was unsuccessful. The soil of Alderney is light, fertile and well cultivated; grain and vegetables are grown and early potatoes are exported. A large part of the island is under grass, affording pasture for cattle. The well-known term "Alderney cattle," however, has lost in great measure its former signification of a distinctive breed. Alderney is included in the bailiwick of Guernsey. It has a court consisting of a judge and six jurats, attorney-general, *prêvot*, *greffierô* and *sergent;* but as a judicial court it is subordinate to that of Guernsey, and its administrative powers are limited to such matters as the upkeep of roads.

For its relations to the constitution of the bailiwick, and for the history of the island, see CHANNEL ISLANDS.

ALDERSHOT, an urban district in the Basingstoke parliamentary division of Hampshire, England, 34 m. S.W. by W. of London, on the London & South-Western and the South-Eastern & Chatham railways. It was a mere village till 1855, when Aldershot camp was established. Pop. (1891) 25,595; (1901) 30,974. Its germ is to be found in the temporary camp on Chobham Ridges, formed in 1853 by Lord Hardinge, the commander-in-chief, the success of which convinced him of the necessity of giving troops practical instruction in the field and affording the generals opportunities of manœuvring large bodies of the three arms. He therefore advised the purchase of a tract of waste land whereon a permanent camp might be established. His choice fell on Aldershot, a spot also recommended by strategic reasons, being situated on the flank of any army advancing upon London from the south. Nothing came of Lord Hardinge's proposal till the experience of the Crimean campaign fully endorsed his opinion. The lands at Aldershot, an extensive open heath country, sparsely dotted by fir-woods and intersected by the Basingstoke canal, were then acquired by the crown. Wooden huts were erected in 1855, and permanent buildings to replace them were begun in 1881. Under the Barracks Act 1890, and the Military Works Act of 1897 and 1899, large sums were provided for completing the work. The former division of North and South camps and permanent barracks no longer obtains. North camp is now named Marlborough Lines, with a field artillery barrack and five infantry barracks called after Marlborough's victories. South camp is now named Stanhope Lines, after Mr Stanhope, who was secretary of state for war when the Barracks Act 1890 was passed and the reconstruction commenced in earnest. They contain barracks for the Royal Engineers and Army Service Corps, the general parade, which stretches east and west, and five infantry barracks called after battles (other than those of Wellington), of the wars with France, 1793–1815. There are also barracks for the Royal Army Medical Corps. The old permanent barracks (which were built for the most part about 1857) have been renamed Wellington Lines, with cavalry and artillery barracks; and three infantry barracks called after Wellington's victories in the Peninsula. For the sick there are the Connaught Hospital in the Marlborough Lines, the Cambridge Hospital in Stanhope Lines, and the Union Hospital in Wellington Lines, besides the Louise Margaret Hospital for women and children and the isolated infection hospital.

The drainage of the station is all modern, and the sewage is disposed of on a sewage farm under the direction of the war department. The water supply is partly from the Aldershot Water Company, and partly from springs and reservoirs collecting water from a reserved area of war department property.

Most of the barracks can accommodate not only the units they are constructed for, but also detachments going through courses of instruction. The total of men, women and children for whom quarters are provided is at times as high as 24,000.

Besides the regimental buildings there are a large number of buildings for garrison purposes, such as quarters and offices for general, staff and departmental officers, with the warrant and non-commissioned officers employed under them; the supply depot with abattoir and bakery; the ordnance stores; barrack stores for furniture and bedding, shops and stores for R. E. services; the balloon establishment; the detention barracks; fire brigade stations; five churches; recreation grounds for officers and men; schools; and especially the military technical schools of army cooking, gymnastics, signalling, ballooning and of mounted infantry, Army Service Corps, Royal Army Medical Corps and veterinary duties. The work of these schools is, however, only a small part of the military training afforded at Aldershot; of greater importance is the field and musketry training, for the carrying out of which a considerable extent of land is essential. The land required for these purposes extends at present over an area about 9¼ m. in extreme length by 7¾ m. in extreme width. In addition to this there is the land at Sandhurst and the Staff College (Camberley) about 6½ m. distant, and at Woolmer Forest, 12 m. distant. The musketry practice of the troops at Aldershot is carried out at the Ash ranges, 2 m. east of the barracks, while the Pirbright ranges, alongside those of the National Rifle Association at Bisley, are utilized by the Household Cavalry and Guards, who are encamped there in succession. Suitable grounds in the vicinity of the barracks, of which Caesar's Camp, the Long Valley and Laffan's Plain are best known, are utilized for company, battalion and brigade training of infantry, while the mounted branches work over a wider area, and the engineers carry out their practices where most convenient. For the field-days of the combined arms, the whole of the war department property is available. Aldershot is the headquarters of the "Aldershot Army Corps," which is the largest organized force maintained in the United Kingdom.

Besides the troops in barracks, during the drill season there is often a considerable force in camp, both regular troops from other stations and militia and volunteer units, so that, including the regular garrison, sometimes as many as 40,000 troops have been concentrated at the station for training and manœuvres.

ALDHELM (*c.* 640–709), bishop of Sherborne, English scholar, was born before the middle of the 7th century. He is said to have been the son of Kenten, who was of the royal house of Wessex, but who was certainly not, as Aldhelm's early biographer Faritius asserts, the brother of King Ine. He received his first education in the school of an Irish scholar and monk, Maildulf, Mældubh or Meldun (d. *c.* 675), who had settled in the British stronghold of Bladon or Bladow on the site of the town called Mailduberi, Maldubesburg, Meldunesburg, &c., and finally Malmesbury,[1] after him. In 668 Pope Vitalian sent Theodore of Tarsus to be archbishop of Canterbury, and about the same time came the African scholar Hadrian, who became abbot of St Augustine's at Canterbury. Aldhelm was one of his disciples, for he addresses him as the "venerable preceptor of my rude childhood." He must, nevertheless, have been thirty years of age when he began to study with Hadrian. His studies included Roman law, astronomy, astrology, the art of reckoning and the difficulties of the calendar. He learned, according to the doubtful statements of the early lives, both Greek and Hebrew. He certainly introduces many Latinized Greek words into his works. Ill-health compelled him to leave Canterbury, and he returned to Malmesbury, where he was a monk under Maildulf for fourteen years, dating probably from 661, and including the period of his studies with Hadrian. When Maildulf died, Aldhelm was appointed in 675, according to a charter of doubtful authenticity cited by William of Malmesbury, by Leutherius, bishop of Dorchester from 671 to 676, to succeed to the direction of the monastery, of which he became the first abbot. He introduced the Benedictine rule, and secured the right of the election of the abbot to the monks themselves. The community at Malmesbury increased, and Aldhelm was able to found two other monasteries to be centres of learning at Frome and at Bradford on Avon. The little church of St Lawrence at Bradford dates back to his time and may safely be regarded as his. At Malmesbury he built a new church to replace Maildulf's modest building, and obtained considerable grants of land for the monastery. His fame as a scholar rapidly spread into other countries. Artwil, the son of an Irish king, submitted his writings for Aldhelm's approval, and Cellanus, an Irish monk from Peronne, was one of his correspondents. Aldhelm was the first Englishman, so far as we know, to write in Latin verse, and his letter to Acircius (Aldfrith or Eadfrith, king of Northumbria) is a treatise on Latin prosody for the use of his countrymen. In this work he included his most famous productions, 101 riddles in Latin hexameters. Each of them is a complete picture, and one of them runs to 83 lines. That his merits as a scholar were early recognized in his own country is shown by the encomium of Bede (*Eccl. Hist.* v. 18), who speaks of him as a wonder of erudition. His fame reached Italy, and at the request of Pope Sergius I. (687–701) he paid a visit to Rome, of which, however, there is no notice in his extant writings. On his return, bringing with him privileges for his monastery and a magnificent altar, he received a popular ovation. He was deputed by a synod of the church in Wessex to remonstrate with the Britons of Domnonia (Devon and Cornwall) on their differences from the Roman practice in the shape of the tonsure and the date of Easter. This he did in a long and rather acrimonious letter to their king Geraint (Geruntius), and their ultimate agreement with Rome is referred by William of Malmesbury to his efforts. In 705, or perhaps earlier, Hæddi, bishop of Winchester, died, and the diocese was divided into two parts. Sherborne was the new see, of which Aldhelm reluctantly became the first bishop. He wished to resign the abbey of Malmesbury which he had governed for thirty years, but yielding to the remonstrances of the monks he continued to direct it until his death. He was now an old man, but he showed great activity in his new functions. The cathedral church which he built at Sherborne, though replaced later by a Norman church, is described by William of Malmesbury. He was on his rounds in his diocese when he died in the church of Doulting on the 25th of May 709. The body was taken to Malmesbury, and crosses were set up by the pious care of his friend, Bishop Ecgwine of Worcester, at the various halting-places. He was buried in the church of St Michael. His biographers relate miracles due to his sanctity worked during his lifetime and at his shrine.

Aldhelm wrote poetry in Anglo-Saxon also, and set his own compositions to music, but none of his songs, which were still popular in the time of Alfred, have come down to us. Finding his people slow to come to church, he is said to have stood at the end of a bridge singing songs in the vernacular, thus collecting a crowd to listen to exhortations on sacred subjects. Aldhelm wrote in elaborate and grandiloquent Latin, which soon came to be regarded as barbarous. Much admired as he was by his contemporaries, his fame as a scholar therefore soon declined, but his reputation as a pioneer in Latin scholarship in England and as a teacher remains.

Aldhelm's works were collected in J. A. Giles's *Patres eccl. Angl.* (Oxford, 1844), and reprinted by J. P. Migne in his *Patrologiae Cursus*, vol. 89 (1850). The letter to Geraint, king of Domnonia, was supposed to have been destroyed by the Britons (W. of Malmesbury, *Gesta Pontificum*, p. 361), but was discovered with others of Aldhelm's in the correspondence of St Boniface, archbishop of Mainz. A long letter to Eahfrid, a scholar just returned from Ireland (first printed in *Usserii Veterum Epistt. Hiber. Sylloge*, 1632), is of interest as casting light on the relations between English and Irish scholars. Next to the riddles, Aldhelm's best-known work is *De Laude Virginitatis sive de Virginitate Sanctorum*, a Latin treatise addressed about 705 to the nuns of Barking,[2] in which he commemorates a great number of saints. This was afterwards turned by Aldhelm into Latin verse (printed by Delrio, Mainz, 1601). The chief source of his *Epistola ad Acircium sive liber de septenario, et de metris, aenigmatibus ac pedum regulis* (ed. A. Mai, *Class. Auct. vol.* v.) is Priscian. For the riddles included in it, his model was the collection known as *Symposii aenigmata*. The acrostic introduction gives the sentence, "Aldhelmus cecinit millenis versibus odas," whether read from the initial or final letters of the lines. His Latin poems include one on the dedication of a basilica built by Bugge (or Eadburga), a royal lady of the house of Wessex.

Authorities.—Faritius (d. 1117), an Italian monk of Malmesbury, afterwards abbot of Abingdon, wrote a *Vita S. Aldhelmi* (MS. Cotton, Faustina, B. 4), printed by Giles and Migne, also in *Original Lives of Anglo-Saxons* (Caxton Soc., 1854); but the best authority is William of Malmesbury, who in the fifth book, devoted to St Aldhelm, of the *Gesta Pontificum* proposes to fill up the outline of Faritius, using the church records, the traditions of Aldhelm's miracles preserved by the monks of Malmesbury, and the lost "Handboc" or commonplace book of King Alfred. His narrative is divided into four parts: the birth and attainments of Aldhelm, the religious houses he had established and endowed, the miracles recorded of him, and the history of the abbey down to the writer's own time (see *De Gestis Pontificum*, ed. N. E. S. A. Hamilton, 1870, for the Rolls Series, pp. 330-443). The life by John Capgrave in his *Legenda Nova* (1516) is chiefly an abridgment of Malmesbury's narrative. Consult also L. Bönhoff, *Aldhelm von Malmesbury* (Dresden, 1894); T. D. Hardy, *Descriptive Catalogue* (1862), vol. i. pp. 389-396; T. Wright, *Biog. Brit. Lit.* (A.-S. Period, 1842); G. F. Browne, bishop of Bristol, *St Aldhelm; his Life and Times* (1903); and W. B. Wildman, *Life of S. Ealdhelm, first Bishop of Sherborne* (1905), containing many interesting local details. For some poems attributed to Aldhelm, and printed in Dümmler's edition of the letters of St Boniface and Lul in *Monumenta Germaniae Historica* (epistt. tom. iii.), see H. Bradley in *Eng. Hist. Review*, xv. p. 291 (1900), where they are attributed to Aldhelm's disciple Æthilwald. The very varied sources and the chronology of Aldhelm's work are discussed in "Zu Aldhelm und Baeda," by Max Manitius, in *Sitzungsberichte der kaiserlichen Akad. der Wissenschaften* (Vienna, 1886).

An excellent account of his ecclesiastical importance is given by W. Bright in *Chapters on Early English Church History* (Oxford, 1878). For his position as a writer of Latin verse consult A. Ebert, *Allgemeine Geschichte d. Literatur des Mittelalters im Abendlande*, vol. i. new edition (1889); M. Manitius, *Geschichte der christlich-lateinischen Poesie &c.* (Stuttgart, 1891), pp. 487-496; also H. Hahn, *Bonifaz und Lul ihre angelsächsischen Korrespondenten*, chap. i. (Leipzig, 1883). The two last-named works contain many further bibliographical references.

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[1] For the disputed etymology of Malmesbury, which some connect with Aldhelm's name, see Bishop Browne, *St Aldhelm: his Life and Times*, p. 73.

[2] Cuthburga, sister of King Ine of Wessex, and therefore related to Aldhelm, left her husband Aldfrith, king of Northumbria, to enter the nunnery at Barking. She afterwards founded the nunnery of Wimborne, of which she became abbess.

ALDINE PRESS, the printing office started by Aldus Manutius at the end of the 15th century in Venice, from which were issued the celebrated Aldine editions of the classics of that time. (See MANUTIUS.) The Aldine Press is famous in the history of typography (*q.v.*), among other things, for the introduction of italics.

ALDINI, GIOVANNI (1762–1834), Italian physicist, born at Bologna on the 10th of April 1762, was a brother of the statesman Count Antonio Aldini (1756–1826) and nephew of L. Galvani, whose treatise on muscular electricity he edited with notes in 1791. He became professor of physics at Bologna in 1798, in succession to his teacher Sebastiano Canterzani (1734–1819). His scientific work was chiefly concerned with galvanism and its medical applications, with the construction and illumination of lighthouses, and with experiments for preserving human life and material objects from destruction by fire. He wrote in French and English in addition to his native Italian. In recognition of his merits, the emperor of Austria made him a knight of the Iron Crown and a councillor of state at Milan, where he died on the 17th of January 1834. He left by will a considerable sum to found a school of natural science for artisans at Bologna.

ALDRED, or EALDRED (d. 1069), English ecclesiastic, became abbot of Tavistock about 1027, in 1044 was made bishop of Worcester, and in 1060 archbishop of York. He had considerable influence over King Edward the Confessor, and as his interests were secular rather than religious he took a prominent part in affairs of state, and in 1046 led an unsuccessful expedition against the Welsh. In 1050 he was largely instrumental in restoring Sweyn, the son of Earl Godwin, to his earldom, and about the same time went to Rome "on the king's errand." In 1054 he was sent to the emperor Henry III. to obtain that monarch's influence in securing the return to England of Edward, son of Edmund Ironside, who was in Hungary with King Andrew I. In this mission he was successful and obtained some insight into the working of the German church during a stay of a year with Hermann II., archbishop of Cologne. After his return to England he took charge of the sees of Hereford and Ramsbury, although not appointed to these bishoprics; and in 1058 made a pilgrimage to Jerusalem, being the first English bishop to take this journey. Having previously given up Hereford and Ramsbury, Aldred was elected archbishop of York in 1060, and in 1061 he proceeded to Rome to receive the pallium. On his arrival there, however, various charges were brought against him by a synod, and Pope Nicholas II. not only refused his request but degraded him from the episcopate. The sentence was, however, subsequently reversed, and Aldred received the pallium and was restored to his former station. It is stated by Florence of Worcester that Aldred crowned King Harold II. in 1066, although the Norman authorities mention Stigand as the officiating prelate. After the battle of Hastings Aldred joined the party who sought to bestow the throne upon Edgar the Ætheling, but when these efforts appeared hopeless he was among those who submitted to William the Conqueror at Berkhampstead. Selected to crown the new king he performed the ceremony on Christmas Day 1066, and in 1068 performed the same office at the coronation of Matilda, the Conqueror's wife. But though often at court, he seems to have been no sympathiser with Norman oppression, and is even said to have bearded the king himself. He died at York on the 11th of September 1069 and was buried in his own cathedral. Aldred did much for the restoration of discipline in the monasteries and churches under his authority, and was liberal in his gifts for ecclesiastical purposes. He built the monastic church of St Peter at Gloucester, and rebuilt a large part of that of St John at Beverley. At his instigation, Folcard, a monk of Canterbury, wrote the *Life of St John of Beverley*.

See *The Anglo-Saxon Chronicle*, edited by C. Plummer (Oxford, 1892–1899); Florence of Worcester, *Chronicon ex Chronicis*, edited by B. Thorpe (London, 1848–1849); William of Malmesbury, *De Gestis Pontificum Anglorum*, edited by N. E. S. A. Hamilton (London, 1870); W. H. Dixon, *Fasti Eboracenses*, vol. i., edited by J. Raine (London, 1863); T. Stubbs, *Chronica Pontificum Ecclesiae Eboracensis*, edited by J. Raine (London, 1879–1894); E. A. Freeman, *History of the Norman Conquest*, vols. ii., iii., iv. (Oxford, 1867–1879).

ALDRICH, HENRY (1647–1710), English theologian and philosopher, was born in 1647 at Westminster, and was educated at the collegiate school there, under Dr Busby. In 1662 he entered Christ Church, Oxford, and in 1689 was made dean in succession to the Roman Catholic, John Massey, who had fled to the continent. In 1692 he was vice-chancellor of the University. In 1702 he was appointed rector of Wem in Shropshire, but continued to reside at Oxford, where he died on the 14th of December 1710. He was buried in the cathedral without any memorial at his own desire. Aldrich was a man of unusually varied gifts. A classical scholar of fair merits, he is best known as the author of a little book on logic (*Compendium Artis Logicae*), a work of little value in itself, but used at Oxford (in Mansel's revised edition) till long past the middle of the 19th century. Aldrich also composed a number of anthems and church services of high merit, and adapted much of the music of Palestrina and Carissimi to English words with great skill and judgment. To him we owe the well-known catch, "Hark, the bonny Christ Church bells." Evidence of his skill as an architect may be seen in the church and campanile of All Saints, Oxford, and in three sides of the so-called Peckwater Quadrangle of Christ Church, which were erected after his designs. He bore a great reputation for conviviality, and wrote a humorous Latin version of the popular ballad—

A soldier and a sailor,
A tinker and a tailor, &c.

Another specimen of his wit is furnished by the following epigram of the five reasons for drinking:—

Si bene quid memini, causae sunt quinque bibendi;
Hospitis adventus, praesens sitis atque futura,
Aut vini bonitas, aut quaelibet altera causa.

The translation runs:—

If on my theme I rightly think,
There are five reasons why men drink:—
Good wine; a friend; because I'm dry;
Or lest I should be by and by;
Or—any other reason why.

ALDRICH, NELSON WILMARTH (1841–), American politician, was born at Foster, Rhode Island, on the 6th of November 1841. His first political service was as a member (1869–1875) and president (1871–1872) of the Providence common council. He was a member of the lower house of the Rhode Island legislature in 1875 and 1876, and speaker in the latter year. By this time he had become a power in Republican state politics, and in 1878 and 1880 was elected to Congress. Early in his second term he was chosen United States senator, and was re-elected in 1886, 1892, 1898 and 1905. In the Senate he was looked upon as the special representative of the high protective industries and moneyed interests, and he took a prominent part in all legislation dealing with the tariff, banking and the merchant marine.

ALDRICH, THOMAS BAILEY (1836–1907), American author, was born in Portsmouth, New Hampshire, on the 11th of November 1836. When he was but a child his father moved to New Orleans, but after ten years the boy was sent back to Portsmouth—the "Rivermouth" of several of his stories—to prepare for college. This period of his life is partly described in his *Story of a Bad Boy* (1870), of which "Tom Bailey" is the juvenile hero.[1] His father's death in 1852 compelled Aldrich to abandon the idea of college and enter a business office in New York. Here he soon became a constant contributor to the newspapers and magazines, and the intimate friend of the young poets, artists and wits of the metropolitan Bohemia of the early 'sixties, among whom were E. C. Stedman, R. H. Stoddard, Bayard Taylor and Walt Whitman. From 1856 to 1859 he was on the staff of the *Home Journal*, then edited by N. P. Willis, while during the Civil War he was himself editor of the *New York Illustrated News*. In 1865 he moved to Boston and was editor for ten years for Ticknor and Fields—then at the height of their prestige—of the eclectic weekly *Every Saturday*, discontinued in 1875. From 1881 to 1890 he was editor of the *Atlantic Monthly*. Meanwhile Aldrich had written much, both in prose and verse. His genius was many-sided, and it is surprising that so busy an editor and so prolific a writer should have attained the perfection of form for which he was remarkable. His successive volumes of verse, chiefly *The Ballad of Babie Bell* (1856), *Pampinea, and Other Poems* (1861), *Cloth of Gold* (1874), *Flower and Thorn* (1876), *Friar Jerome's Beautiful Book* (1881), *Mercedes and Later Lyrics* (1883), *Wyndham Towers* (1889), and the collected editions of 1865, 1882, 1897 and 1900, showed him to be a poet of lyrical skill, dainty touch and felicitous conceit, the influence of Herrick being constantly apparent. He repeatedly essayed the long narrative or dramatic poem, but seldom with success, save in such earlier work as *Garnaut Hall*. But no American poet has shown more skill in describing some single picture, mood, conceit or episode. His best things are such lyrics as "Hesperides," "When the Sultan goes to Ispahan," "Before the Rain," "Nameless Pain," "The Tragedy," "Seadrift," "Tiger Lilies," "The One White Rose," "Palabras Cariñosas," "Destiny," or the eight-line poem "Identity," which did more to spread Aldrich's reputation than any of his writing after *Babie Bell*. Beginning with the collection of stories entitled *Marjorie Daw and Other People* (1873), Aldrich applied to his later prose work that minute care in composition which had previously characterized his verse—taking a near, new or salient situation, and setting it before the reader in a pretty combination of kindly realism and reticent humour. In the novels, *Prudence Palfrey* (1874), *The Queen of Sheba* (1877), and *The Stillwater Tragedy* (1880), there is more rapid action; but the Portsmouth pictures in the first are elaborated with the affectionate touch shown in the shorter humourous tale, *A Rivermouth Romance* (1877). In *An Old Town by the Sea* (1893) the author's birthplace was once more commemorated, while travel and description are the theme of *From Ponkapog to Pesth* (1883). Aldrich died at Boston on the 19th of March 1907.

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[1] This book has been translated into French as *Education et récréation*, and into German as a specimen of American humour.

His Life was written by Ferris Greenslet (1908).

ALDRINGER (Altringer, Aldringen), **JOHANN,** Count von (1588–1634), Austrian soldier, was born at Diedenhofen (Thionville) in Lorraine. After travelling as page to a nobleman in France, Italy and the Netherlands, he went to the university of Paris. In 1606 he entered the service of Spain, in which he remained until 1618, when he joined the imperial army. Here he distinguished himself in the field and in the cabinet. Made a colonel in 1622, two years later he was employed on the council of war and on diplomatic missions. At the bridge of Dessau in 1626 he performed very distinguished service against Ernst von Mansfeld. He and his constant comrade Matthias Gallas (*q.v.*) were ennobled on the same day, and in the course of the Italian campaign of 1630 the two officers married the two daughters of Count d'Arco. Aldringer served as Count Rambold Collalto's major-general in this campaign and was present at the taking of Mantua. The plunder of the duke of Mantua's treasures made Gallas and Aldringer wealthy men. Back in Germany in 1631, he served after Breitenfeld as Tilly's artillery commander, and, elevated to the dignity of count of the Empire, he was present at the battle of the Lech, where he was wounded. When Tilly died of his wounds Aldringer succeeded to the command. Made field-marshal after the assault of the Alte Veste near Nuremberg, at which he had been second in command under Wallenstein, duke of Friedland (with whom he was a great favourite), he was next placed at the head of the corps formed by Maximilian I. of Bavaria to support Wallenstein. In this post his tact and diplomatic ability were put to a severe test in the preservation of harmony between the two dukes. Finally Count Aldringer was won over by the court party which sought to displace the too successful duke of Friedland. After Wallenstein's death Aldringer commanded against the Swedes on the Danube, and at the defence of Landshut he fell (July 22, 1634). His great possessions descended to his sister, and thence to the family of Clary and Aldringen.

See Brohm, *Johann von Aldringen* (Halle, 1882), and Hermann Hallwich, *Johann von Aldringen* (Leipzig, 1885); also *Allgemeine Deutsche Biographie*, s.v. Gallas, correcting earlier biography of Aldringer in the same work.

ALDROVANDI, ULISSI (1522–1605), Italian naturalist, was born of noble parentage at Bologna on the 11th of September 1522. He was apprenticed to a merchant in Brescia, but a commercial career being distasteful to him, he turned his attention to law and medicine, studying first in his native town and afterwards at Padua. In 1550 he was accused of heresy, but succeeded in clearing himself before the Inquisition. In 1553 he took his doctor's degree in medicine at Bologna, and in the following year was appointed professor of philosophy and also lecturer on botany at the university. In 1560 he was transferred to the chair of natural history. At his instance the senate of Bologna established in 1568 a botanical garden, of which he was appointed the first director. About the same time he became inspector of drugs, and in that capacity published in 1574 a work entitled *Antidotarii Bononiensis Epitome*, which formed the model for many subsequent pharmacopoeias. He was also instrumental in founding the public museum of Bologna, which contains, especially in the natural history department, a large number of specimens collected by him. The results of his various researches were embodied in a *magnum opus*, which was designed to include everything that was known about natural history. The first three volumes, comprising his ornithology, were published in 1599, and a fourth, treating of insects, appeared in 1602. After his death a number of other volumes were compiled from his manuscript materials, under the editorship of several of his pupils, to whom the task was entrusted by the senate of Bologna. The work was enriched by a large number of illustrations prepared at great expense, the author having, it is said, employed several celebrated artists for thirty years. Among these were Lorenzo Benini of Florence and Christopher Coriolanus of Nuremberg. It has been said, indeed, that the cost of the undertaking was so great as to exhaust its author's means, and that he died penniless and blind in the public hospital of Bologna. This, however, is probably incorrect, at least as regards the allegation of poverty. Published records of the senate of Bologna show that it liberally supported Aldrovandi in his undertaking, doubling his salary soon after his appointment as professor, and bestowing on him from time to time sums amounting in all to 40,000 crowns. If, therefore, he died in the public hospital, he probably went there for the better treatment of his disease. His death occurred on the 10th of May 1605. Aldrovandi was chiefly remarkable for laborious and patient research. He seems to have been totally destitute of the critical faculty, and hardly any attempt is made in his great work to classify facts or to distinguish between the true and the fabulous, the important and the trivial. Much is thus included that is of no scientific value, but it also contains much information of very great interest to the naturalist.

ALE, an old word for a fermented liquor obtained chiefly from malt. In England "ale" is nowadays practically synonymous with "beer." Before the introduction of hops into England from Flanders in the 16th century ale was the name exclusively applied to malt liquor, the term beer being gradually introduced to describe liquor brewed with an infusion of hops. This distinction does not apply at the present time, except in so far as the term ale is not applied to black beers (stout and porter) nor to lager beer. In the United States, however, it is customary to confine the designation beer to the article obtained by the bottom fermentation process. In former times the Welsh and Scots had two distinct kinds of ale, called common and spiced ales, the relative values of which were appraised by law in the following terms: "If a farmer have no mead, he shall pay two casks of spiced ale, or four casks of common ale, for one cask of mead." There are numerous varieties of English ales, such as mild ale, which is a full, sweetish beer, of a dark colour and with relatively little hop; pale ale, which is relatively dry, of light colour and of a more pronounced hop flavour than the mild ale;

and bitter and stock ales, the latter term being generally reserved for superior beers, such as are used for bottling. The terms pale, bitter, stock, light, &c., are to be regarded as trade distinctions and not as exact definitions of quality or type. (See Beer and Brewing.)

Parish Ales.—In old England an "ale" was synonymous with a parish festival or merry-making at which ale was the chief drink. The word was generally used in composition. Thus there were leet-ales (that held on leet or manorial court day); lamb-ales (that held at lamb-shearing); Whitsun-ales, clerk-ales, church-ales and so on. The word *bridal* is really bride-ale, the wedding feast. Bid-ales, once very common throughout England, were "benefit" feasts to which a general invitation was given, and all the neighbours attending were expected to make some contribution to help the object of the "benefit." (See "Bidding-Weddings" under Bride.) These parish festivals were of much ecclesiastical and social importance in medieval England. The chief purpose of church-ales and clerk-ales, at least, was to facilitate the collection of parish-dues, or to make an actual profit for the church from the sale of the liquor by the church wardens. These profits kept the parish church in repair, or were distributed as alms to the poor. At Sygate, Norfolk, on the gallery of the church is inscribed—

> God speed the plough
> And give us good ale enow . . .
> Be merry and glade,
> With good ale was this work made.

On the beam of a screen in the church of Thorpe-le-Soken, Essex, is the following inscription in raised Gothic letters, on a scroll held by two angels—"This cost is the bachelers made by ales thesn be ther med." The date is about 1480. The feast was usually held in a barn near the church or in the churchyard. In Tudor times church-ales were held on Sundays. Gradually the parish-ales were limited to the Whitsun season, and these still have local survivals. The colleges of the universities used formerly to brew their own ales and hold festivals known as college-ales. Some of these ales are still brewed and famous, like "chancellor" at Queen's College, and "archdeacon" at Merton College, Oxford, and "audit ale" at Trinity, Cambridge.

See Brand's *Popular Antiquities of Great Britain* (Wm. Carew Hazlitt's edition, 1905).

ALEANDRO, GIROLAMO (Hieronymus Aleander) (1480–1542), Italian cardinal, was born at Motta, near Venice, on the 13th of February 1480. He studied at Venice, where he became acquainted with Erasmus and Aldus Manutius, and at an early age was reputed one of the most learned men of the time. In 1508 he went to Paris on the invitation of Louis XII. as professor of *belles lettres*, and held for a time the position of rector in the university. Entering the service of Eberhard, prince-bishop of Liége, he was sent by that prelate on a mission to Rome, where Pope Leo X. retained him, giving him (1519) the office of librarian of the Vatican. In the following year he went to Germany to be present as papal nuncio at the coronation of Charles V., and was also present at the diet of Worms, where he headed the opposition to Luther, advocating the most extreme measures to repress the doctrines of the reformer. His conduct evoked the fiercest denunciations of Luther, but it also displeased more moderate men and especially Erasmus. The edict against the reformer, which was finally adopted by the emperor and the diet, was drawn up and proposed by Aleandro. After the close of the diet the papal nuncio went to the Netherlands, where he kindled the flames of persecution, two monks of Antwerp, the first martyrs of the Reformation, being burnt in Brussels at his instigation. In 1523 Clement VII., having appointed him archbishop of Brindisi and Oria, sent him as nuncio to the court of Francis I. He was taken prisoner along with that monarch at the battle of Pavia (1525), and was released only on payment of a heavy ransom. He was subsequently employed on various papal missions, especially to Germany, but was unsuccessful in preventing the German princes from making a truce with the reformers, or in checking to any extent the progress of the new doctrines. He was created cardinal in 1536 by Paul III. (at the same time as Reginald Pole) and died at Rome on the 1st of February 1542.

Aleandro compiled a *Lexicon Graeco-Latinum* (Paris, 1512), and wrote Latin verse of considerable merit inserted in M. Tuscanus's *Carmina Illustrium Poetarum Italiorum.* The Vatican library contains a volume of manuscript letters and other documents written by him in connexion with his various missions against Luther. They were utilized by Pallavicino in his *Istoria del Concilio Tridentino* (i. 23-28), who gives a very partial account of the Worms conference.

Aleandro, who is sometimes called "the elder," must be distinguished from his grand-nephew, also called Girolamo Aleandro (1574–1629). The younger Aleandro was a very distinguished scholar, and wrote *Psalmi poenitentiales versibus elegiacis expressi* (Treves, 1593), *Gaii, veteris juris consulti Institutionum fragmenta, cum commentario* (Venice, 1600), *Explicatio veteris tabulae marmorcae solis effigie symbolisque exculptae* (Rome, 1616).

ALEARDI, ALEARDO, Count (1812–1878), Italian poet, was born at Verona on the 4th of November 1812, and thus soon after his birth became an Austrian subject. Inspired from his cradle with a hatred of the foreigner, he found himself disqualified for the position in the public service to which his rank would have entitled him, and unable to publish his patriotic verses. *Arnaldo da Rocca*, a narrative poem, nevertheless appeared in 1842, and the revolutionary year 1848 made an opening for his *Lettere a Maria.* He took an active part in the popular uprising, and was for some time imprisoned. In 1856 he produced the finest of his pieces, an ode to the maritime cities of Italy, and in 1858 a poem on his own misfortunes. After the expulsion of the Austrians from Lombardy he returned to Verona, published his poems in a collected edition (1862), became professor at the Academy of Fine Art, member of the Italian parliament and eventually senator. He died on the 17th of July 1878. Aleardi's warmth of patriotic feeling hardly finds adequate expression in his poetry; it is his merit to excel in description, but his fault to substitute description for action.

ALE-CONNER, an officer appointed yearly at the court-leet of ancient English manors for the assize of ale and ale-measures. The *gustatores cervisiae*—called in different localities by the different names "ale-tasters," "ale-founders," and "ale-conners"—were sworn to examine beer and ale, to take care that they were good and wholesome and were sold at proper prices. In London four ale-conners, whose duty it is to examine the measures used by beer and liquor sellers to guard against fraud, are still chosen annually by the liverymen in common hall assembled on Midsummer Day. Since ale and beer have become excisable commodities the custom of appointing ale-tasters has in most places fallen into disuse. (See also Adulteration.)

ALECSANDRI, or Alexandri, **VASILE** (1821–1890), Rumanian lyric poet, was born at Bacau in Moldavia on the 21st of July 1821. His father was the Spatar Alecsandri, of Jewish and Italian origin, who had settled in Moldavia in the 18th century. Vasile was educated first in Jassy and afterwards (1834–1839) in Paris. In 1839 he started on a long journey through the Carpathian Mountains, and was the first to collect Rumanian popular songs, no doubt influenced by Western examples. He first published his collection in 1844. His *Doine şi Lacrimioare*, lyrical poems, appeared at Paris in 1852, and in 1852–1853 he produced at Jassy a fuller collection of popular ballads and songs. He then adapted some French plays for the newly founded Rumanian theatre, and wrote some original pieces. His connexion with the revolutionary movement of 1848 compelled him to seek shelter in the west of Europe, and he visited England, where a beautifully illuminated edition of his poems was printed in the original Rumanian language. In 1867 he published some fugitive pieces, written in a lighter vein, and entitled *Pastele*; these were followed in 1871 by the *Legende* of similar character. More serious are his dramatic writings which began with *Despot Voda* and culminated in *Ovid.* In later life Alecsandri took an active part in politics; he became minister for foreign affairs from 1859 to 1860, and in 1885 was appointed Rumanian minister in Paris. He died on the 26th of August 1890 at his country seat, Mirceşti. His best title to fame consists in the fact that he gave the first impetus to the collection of Rumanian popular songs and first drew attention to their inimitable charm.

See L. Şainsanu, *Autorii Români moderni* (1891), pp. 90 and 318. A complete edition of Alecsandri's writings in nine volumes was published at Bucharest in 1875 seq. (M. G.)

ALEMAN, LOUIS (*c.* 1390–1450), French cardinal, was born of a noble family at the castle of Arbent near Bugey about the year 1390. He was successively bishop of Maguelonne (1418), archbishop of Arles (1423) and cardinal priest of St Cecilia (1426). He was a prominent member of the council of Basel, and, together with Cardinal Julian, led the party which maintained the supremacy of general councils over the pope's authority. In 1440 Aleman obtained the support of the emperor Sigismund and of the duke of Milan to his views, and proclaiming the deposition of Pope Eugenius IV., placed the tiara upon the head of Amadeus VIII., duke of Savoy (henceforward known as antipope Felix V.). Eugenius retorted by excommunicating the antipope and depriving Aleman of all his ecclesiastical dignities. In order to make an end of the schism, Felix V. finally abdicated on Aleman's advice, and Nicholas V., who had succeeded in 1447, restored the cardinal to all his honours and employed him as legate to Germany in 1449. On his return he retired to his diocese of Arles, where he devoted himself zealously to the instruction of his people. He died on the 16th of September 1450, and was beatified by Pope Clement VII. in 1527.

See U. Chevalier, *Répert. des sources hist.* (Paris, 1905), p. 130.

ALEMÁN, MATEO (1547–1609?), Spanish novelist and man of letters, was born at Seville in 1547. He graduated at Seville University in 1564, studied later at Salamanca and Alcalá, and from 1571 to 1588 held a post in the treasury; in 1594 he was arrested on suspicion of malversation, but was speedily released. In 1599 he published the first part of *Guzmán de Alfarache*, a celebrated picaresque novel which passed through not less than sixteen editions in five years; a spurious sequel was issued in 1602, but the authentic continuation did not appear till 1604. In 1608 Alemán emigrated to America, and is said to have carried on business as a printer in Mexico; his *Ortografia castellana* (1609), published in that city, contains ingenious and practical proposals for the reform of Spanish spelling. Nothing is recorded of Alemán after 1609, but it is sometimes asserted that he was still living in 1617. He married, unhappily, Catalina de Espinosa in 1571, and was constantly in money difficulties, being imprisoned for debt at Seville at the end of 1602. He is the author of a life (1604) of St Antony of Padua, and versions of two odes of Horace bear witness to his taste and metrical accomplishment. His chief title to remembrance, however, is *Guzmán de Alfarache*, which was translated into French in 1600, into English in 1623 and into Latin in 1623.

See J. Hazañas y la Rua, *Discursos leidos en la Real Academia Sevillana de Buenas letras el 25 de marzo de 1892* (Sevilla, 1892); J. Gestoso y Perez, *Nuevos datos para ilustrar las biografías del Maestro Juan de Malara y de Mateo Alemán* (Sevilla, 1896). (J. F.-K.)

ALEMBERT, JEAN LE ROND D' (1717–1783), French mathematician and philosopher, was born at Paris in November 1717. He was a foundling, having been exposed near the church of St Jean le Rond, Paris, where he was discovered on the 17th of November. It afterwards became known that he was the illegitimate son of the chevalier Destouches and Madame de Tencin. The infant was entrusted to the wife of a glazier named Rousseau who lived close by. He was called Jean le Rond from the church near which he was found; the surname Alembert was added by himself at a later period. His father, without disclosing himself, having settled an annuity on him, he was sent at four years of age to a boarding-school. In 1730 he entered the Mazarin College under the Jansenists, who soon perceived his exceptional talent, and, prompted perhaps by a commentary on the Epistle to the Romans which he produced in the first year of his philosophical course, sought to direct it to theology. His knowledge of the higher mathematics was acquired by his own unaided efforts after he had left the college. This fact naturally led to his crediting himself with many discoveries which he afterwards found had been already established, often by more direct and elegant processes than his own.

On leaving college he returned to the house of his foster-mother, where he continued to live for thirty years. Having studied law, he was admitted as an advocate in 1738, but did not enter upon practice. He next devoted himself to medicine, but his natural inclination proved too strong for him, and within a year he resolved to give his whole time to mathematics. In 1741 he received his first public distinction in being admitted a member of the Academy of Sciences, to which he had previously presented several papers, including a *Mémoire sur le calcul intégral* (1739). In his *Mémoire sur le réfraction des corps solides* (1741) he was the first to give a theoretical explanation of the phenomenon which is witnessed when a body passes from one fluid to another more dense in a direction not perpendicular to the surface which separates the two fluids. In 1743 he published his *Traité de dynamique*, a work famous as developing the mechanical principle, known as "Alembert's Principle," first enunciated in 1742 (see MECHANICS). In 1744 Alembert applied this principle to the theory of the equilibrium and the motion of fluids (*Traité de l'équilibre et du mouvement des fluides*), and all the problems before solved by geometricians became in some measure its corollaries. This discovery was followed by that of the calculus of partial differences, the first trials of which were published in his *Réflexion sur la cause générale des vents* (1747). This work was crowned by the Academy of Berlin, and was dedicated to Frederick the Great, who made several unsuccessful attempts to induce him to settle in Berlin. In 1763 he visited Berlin, and on that occasion finally refused the office of president of the Academy of Berlin, which had been already offered to him more than once. In 1747 he applied his new calculus to the problem of vibrating chords, the solution of which, as well as the theory of the oscillation of the air and the propagation of sound, had been given but incompletely by the geometricians who preceded him. In 1749 he furnished a method of applying his principles to the motion of any body of a given figure; and in 1754 he solved the problem of the precession of the equinoxes, determined its quantity and explained the phenomenon of the nutation of the earth's axis. In 1752 he published an *Essai d'une nouvelle théorie sur la résistance des fluides*, which contains a large number of original ideas and new observations. In 1746 and 1748 he published in the *Memoirs* of the Academy of Berlin "Recherches sur le calcul intégral," a branch of mathematical science which is greatly indebted to him. In his *Recherches sur différents points importants du systême du monde* (1754–1756) he perfected the solution of the problem of the perturbations of the planets, which he had presented to the academy some years before.

Alembert's association with Diderot in the preparation of the *Dictionnaire Encyclopédique* led him to take a somewhat wider range than that to which he had previously confined himself. He wrote for that work the *Discours préliminaire* on the rise, progress and affinities of the various sciences, which he read to the French Academy on the day of his admission as a member, the 18th of December 1754. He also wrote several literary articles for the first two volumes of the Encyclopaedia, and to the remaining volumes he contributed mathematical articles chiefly. One of the few exceptions was the article on "Geneva," which involved him in a somewhat keen controversy in regard to Calvinism and the suppression of theatrical performances within the town. During the time he was engaged on the Encyclopaedia he wrote a number of literary and philosophical works which extended his reputation and also exposed him to criticism and controversy, as in the case of his *Mélanges de Philosophie, d'Histoire, et de Littérature*. His *Essai sur la société des gens de lettres avec les grands* was a worthy vindication of the independence of literary men, and a thorough exposure of the evils of the system of patronage. He broke new ground and showed great skill as a translator in his *Traduction de quelques morceaux choisis de Tacite*. One of his most important works was the *Éléments de Philosophie* published in 1759, in which he discussed the principles and methods of the different sciences. He maintained that the laws of motion were necessary, not contingent. A treatise, *Sur la destruction des Jésuites* (1765), involved him in a fresh controversy, his own share in which was rendered very easy by the violence and extravagance of his adversaries. The list of his more noteworthy literary works is completed by the mention of the *Histoire des membres de l'Académie française*, containing biographical notices of all the members of the Academy who died between 1700 and 1772, the year in which he himself became secretary. Alembert was much interested in music both as a science and as an art, and wrote *Éléments de musique théorique et pratique* (1779), which was based upon the system of J. P. Rameau with important modifications and differences.

Alembert's fame spread rapidly throughout Europe and procured for him more than one opportunity of quitting the comparative retirement in which he lived in Paris for more lucrative and prominent positions. The offer of Frederick the Great has already been mentioned. In 1762 he was invited by Catherine of Russia to become tutor to her son at a yearly salary of 100,000 francs. On his refusal the offer was repeated with the additional inducement of accommodation for as many of his friends as he chose to bring with him to the Russian capital. Alembert persisted in his refusal, and the letter of Catherine was ordered to be engrossed in the minutes of the French Academy. In 1755, on the recommendation of Pope Benedict XIV., he was admitted a member of the Institute of Bologna. A legacy of £200 from David Hume showed the esteem in which he was held by that philosopher.

Alembert continued to the end to lead the quiet and frugal life dictated by his limited means as well as his simple tastes. His later years were saddened by circumstances connected with a romantic attachment he had formed for Mademoiselle de Lespinasse, whose acquaintance he made at the house of Madame du Deffand, a noted resort of literary men and savants. She nursed him assiduously during an illness he had in 1765, and from that period till her death in 1776 they lived in the same house without any scandal. On her part there seems to have been from first to last nothing more than warm friendship, but his feelings towards her were of a stronger kind and her death deeply affected him. He never recovered his elasticity of spirits, though he continued to occupy himself with his favourite pursuits, and to frequent the society of his brother philosophers. After the death of Voltaire (1778), whose friend and correspondent he had been for more than thirty years, he was regarded as the leader of the philosophical party in the Academy. He died at Paris on the 29th of October 1783.

The chief features of Alembert's character were benevolence, simplicity and independence. Though his income was never large, and during the greater part of his life was very meagre, he contrived to find means to support his foster-mother in her old age, to educate the children of his first teacher, and to help various deserving students during their college career. His cheerful conversation, his smart and lively sallies, a singular mixture of malice of speech with goodness of heart, and of delicacy of wit with simplicity of manners, rendered him a pleasing and interesting companion; and if his manner was sometimes plain almost to the extent of rudeness, it probably set all the better an example of a much-needed reform to the class to which he belonged. The controversy as to the nature of his religious opinions, arising as it did chiefly out of his connexion with the Encyclopaedia, has no longer any living interest now that the Encyclopaedists generally have ceased to be regarded with unqualified suspicion by those who count themselves orthodox. It is to be observed, moreover, that as Alembert confined himself chiefly to mathematical articles, his work laid him less open to charges of heresy and infidelity than that of some of his associates. The fullest revelation of his religious convictions is given in his correspondence with Voltaire, which was published along with that with Frederick the Great in Bossange's edition of his works.

The scientific works of Alembert have never been published in a collected form. The most important of them have been mentioned above, with the exception of the *Opuscules mathématiques* (1761–1780), 8 vols. 4to. His literary and philosophical works were collected and edited by Bastien (Paris, 1805, 18 vols. 8vo). A better edition by Bossange was published at Paris in 1821 (5 vols. 8vo). The best account of the life and writings of Alembert is contained in Condorcet's *Éloge*, presented to the Academy and published in 1784.

ALEMBIC (Arab. *al*, definite article, *anbiq*, a still; cognate to the Gr. ἄμβιξ, a cup), an apparatus for distillation, used chiefly by the alchemists, and now superseded by the retort and the worm-still. It varied considerably in form and construction, but consisted essentially of three parts—a vessel containing the material to be distilled and called, from its gourd-like shape, the cucurbit or mattrass; a vessel to receive and condense the vapour, called the head or capital; and a receiver for the spirit, connected by a pipe with the capital. The entire apparatus was sometimes constructed of glass, but it was more usual to make the cucurbit of copper or earthenware, and the capital alone of glass.

ALEMTEJO (*i.e.* "Beyond the Tagus"), an ancient province of central and southern Portugal; bounded on the N. by Beira, E. by Spanish Estremadura and Andalusia, S. by Algarve and W. by the Atlantic Ocean and Portuguese Estremadura. Pop. (1900) 416,105; area 9219 sq. m. Alemtejo is traversed by several mountain ranges, whose height does not generally rise much above 2000 ft. The low and sandy coast has a length of less than 25 m. and includes no harbour, except at the unimportant town of Villa Nova de Milfontes (pop. 1900, 825), which overlooks the Mira estuary. The principal rivers are the Tagus, which divides Alemtejo from Beira; its tributary the Zatas, or Sorraia, fed by a whole system of lesser affluents; the Guadiana, which, crossing the Spanish frontier, flows southwards through the province; the Sado, which rises in the Serra de Monchique, and flows to the north; and the Mira, which waters the valley between the Caldeirão and Monchique ranges. There are several extensive plains, notably those of Alemtejo, lying south-west of the Serra de Portalegre; of Beja, between the Sado and Guadiana; and of Ourique, farther south between the same rivers. Some portions of these plains are fruitful, others marshy, while large tracts are mere desolate wastes.

The climate in the lower parts of the country is exceedingly hot and is rendered unhealthy in summer by the stagnant marshes. Towards the Spanish frontier the soil is fertile, and in the south the country is covered by extensive forests of oak, pine, chestnut, cork and ilex, especially on the sides of the Mezquita and Caldeirão ranges. In the more fertile parts, grapes, figs, citrons, pomegranates and other fruits are produced. Wheat, maize and rice are grown, and some attention is given to the rearing of mules, asses, goats, cattle and sheep; while the Alter breed of horses, named after the villages of Alter do Chão and Alter Pedroso (3971), near Portalegre, is often accounted the best in the kingdom. Agriculture, however, is in a backward state, the sparse population being mostly concentrated in the towns, leaving extensive districts uncultivated and almost uninhabited. Droves of swine are fed on the waste lands, growing to a great size and affording excellent hams. The mineral wealth of Alemtejo is little exploited, although there are copper and iron mines and marble quarries. Medicinal springs exist at Aljustrel (3790), Castello de Vide (5192), Mértola (3873), Portalegre, Vimieiro (1838) and elsewhere. Chief among the local industries are the preparation of exceptionally fine olive oil, and the manufacture of cloth, pottery and leather. Alemtejo is traversed by three very important main lines of railway, the Madrid-Cáceres-Lisbon, Madrid-Badajoz-Lisbon and Lisbon-Faro; while the two last are connected by a branch line from Casa Branca to Evora and Elvas. For administrative purposes the province is divided into the districts of Portalegre in the north, Evora in the central region and Beja in the south; but the titles of these new districts have not superseded the ancient name of Alemtejo in ordinary usage. The chief towns Beja (8885), Elvas (13,981), Estremoz (7920), Evora (16,020) and Portalegre (11,820) are described in separate articles.

ALENÇON, COUNTS AND DUKES OF. The first line of the counts of Alençon was founded by Yves, lord of Bellesme, who in the middle of the 10th century possessed and fortified the town of Alençon. His successors, involved in all the wars of the kings of England in Normandy, were alternately deprived and repossessed of their domains, according to the fluctuations of fortune between the rival parties. Mabille, countess of Alençon and heiress of this family (d. 1082), married Roger of Montgomery, and from them descended a second house of Alençon which became extinct in the person of Robert IV.; the county of Alençon was then joined to the royal domain. It was successively granted as an appanage to Peter, son of St Louis (1268), and to Charles, count of Valois, brother of Philip the Fair (1293). The third house of Alençon sprang from Charles, second son of the count of Valois, who was killed at the battle of Crécy in 1346. The countship of Alençon was raised to a peerage in 1367 and into a dukedom in 1414. John, 1st duke of Alençon, was killed at Agincourt on the 25th of October 1415, after having with his own hand slain the duke of York. His son, also named John, was dispossessed of his duchy by the king of England, but reconquered it in 1449. In 1524 the dukedom of Alençon reverted to the crown, in consequence of the death of the duke Charles IV. without issue of his marriage with Margaret, sister of Francis I. It was given as a jointure to Catherine de' Medici in 1559, and as an appanage to her son Francis in 1566. It was pawned by Henry IV. to the duke of Württemberg, and subsequently it passed to Gaston, duke of Orleans, by grant of Louis XIII.; to Elizabeth of Orleans, duchess of Guise; to Charles, duke of Berry, grandson of Louis XIV. (1710); and to Monsieur (Louis XVIII.), brother of Louis XVI.

The title of duc d'Alençon was given to Ferdinand of Orleans, son of the duc de Nemours, and grandson of Louis-Philippe. (M. P.*)

ALENÇON, a town of north-western France, capital of the department of Orne, 36 m. N. of Le Mans on a branch line of the Western railway. Pop (1906) 14,378. Alençon, a clean, regularly built town with broad handsome streets, is situated in a wide and fertile plain, on the Sarthe at its confluence with the Briante. The only remains of the ancient castle of Alençon are two towers of the 15th century, which serve as a prison, and a third of the 14th century known as the Tour Couronnée, to which they are united. Notre-Dame, the chief church, dates from the 15th century. It is remarkable for a porch ornamented in the richest Gothic style, and for its stained windows of the 16th century. Alençon has a large circular corn-market and a cloth-market. The manufacture of the *point d'Alençon* lace has greatly diminished. The weaving and bleaching of cloth, which is of less importance than formerly, the manufacture of vehicles, and tanning are carried on; there is a large trade in the horses of the district, and granite is worked in the neighbourhood. Alençon is the seat of a prefect and a court of assizes. It has tribunals of first instance and of commerce, a board of trade-arbitrators, a lycée, training-colleges and a chamber of arts and manufactures.

ALENIO, GIULIO (1582–1649), Italian Jesuit missionary, was born at Brescia. He entered the Society of Jesus and was sent to the East. He landed at Macao in 1610, and while waiting a favourable opportunity to penetrate into China busied himself for three years in teaching mathematics. His thirty years' residence in China was marked by unceasing zeal and considerable success. He adopted the dress and manners of the country, was the first Christian missionary in Kiang-si, and built several churches in Fo-Kien. He wrote in Chinese a *Life of Christ* (Pekin, 1635-1637, 8 vols.; often reprinted, *e.g.* in 1887 in 3 vols., and used even by Protestant missionaries) and a cosmography (*Iche fang wai ki Hang-chow*, 1623, 6 vols.), which was translated into Manchu under the title *The True Origin of 10,000 Things*, a copy of which was sent from Pekin to Paris in 1789. Alenio died at Fu-chow in 1649.

For bibliography see de Backer and Sommervogel, *Bibl. de la Cie. de Jésus*, i. 158-160.

ALEPPO (native *Haleb*). (1) A vilayet of Asiatic Turkey, comprising N. Syria and N.W. Mesopotamia, with an extension N. of Taurus to the neighbourhood of Gorun. It comprises three sanjaks, Aleppo, Marash and Urfa. About half is mountain, but there are fertile plains of great extent N. of Antakia, S. of Marash and around the city of Aleppo (see below). The only seaport of importance is Alexandretta (*q.v.*). The exports are, on the average, over one million sterling, and imports about double in value. The settled population is barely a million; but there is a considerable unsettled element in the S.E. which cannot well be estimated. The Christians, mainly Jacobite Syrian, but including also Armenians of several denominations (*e.g.* those of Marash and Zeitun), Maronites and Greeks, form about one-fifth. There are some 20,000 Jews, resident chiefly in the provincial capital; and of the Moslem majority the bulk is Arab, Turkoman and Ansarieh. In the N.W. and N. is a considerable Kurdish population.

(2) The provincial capital (anc. *Khalep*; Gr. *Chalybon-Beroea*), situated on a plateau in the valley of the Kuwaik (anc. *Chalus*) about 10 m. above its dissipation in the great salt-marsh of Matkh. Pop. about 130,000, three-quarters Moslem. Aleppo is about midway between the sea and the Euphrates, a little nearer the latter.

The modern city stands on both banks of the Kuwaik, and the older portions are contained within a Saracenic wall, 3½ m. in circuit with seven gates. The European residents and Christians live outside in the Kitab and new Azizieh quarters, and the Jews in that of Bahsita. A modern citadel occupies the N.W., the medieval castle on its mound (partly artificial and not a strong position, according to Istakhri) being almost deserted but still forbidden to visitors. There are two mosques of special interest—the *Umawi* (or *Zakaria*) on the site of a church ascribed to the empress Helena and containing a tomb reputed to be that of the Baptist's father, and the *Kakun*. Many minor ones serve the needs of a population traditionally fanatical. Gardens extend for miles along the river, and the bazaars and khans are unusually large. The climate is cold, dry and healthy, despite the prevalence of the famous "Aleppo button," a swelling which appears either on the face or on the hands, and breaks into an ulcer which lasts a year and leaves a permanent scar. It has been ascribed to a fly, to the water and to other causes; but it is not peculiar to Aleppo, being rife also at Aintab, Bagdad, &c.

The attempt made by the British Euphrates expedition in 1841 to connect Aleppo with the sea by steamer through the nearest point on the Euphrates, Meskiné, failed owing to the obstructed state of the stream and the insecurity of the riparian districts. The latter drawback has been minimized by the continued success of the Aleppo administration in inducing the Anazeh Bedouins to become *fellahin*; but river traffic has not been resumed. A railway, however, connects southward with the Beirut-Damascus line at Rayak. Aleppo is an important consular station for all European powers, the residence of the Greek and Armenian Patriarchs of Antioch, and of Jacobite and Maronite bishops, and a station of Roman Catholic and Protestant missions. It is the emporium of N. Syria, and manufactures textiles in silk, cotton and wool, carpets and leather commodities, besides being the centre of a large district growing cereals, pistachios and fruit. The Turks regard it as one of the strongholds of their dominion and faith, and a future capital of their empire should they be forced into Asia. As a centre from which good natural roads lead N., N.E., W. and S., Aleppo would make a good capital.

History and Remains.—The site lies high (1400 ft.) on eight hillocks in a fertile oasis plain, beyond which stretch on the S. and S.E. grassy steppes merging ere long into desert, and on the other quarters rather sterile downs. It has superseded Antioch as the economic centre of N. Syria, and Palmyra as the great road-station for eastern caravans. But it is rather a revived than a new capital; *Khalep* was a very ancient Syrian and probably "Hittite" city of importance, known from Babylonian, Assyrian and Egyptian records. Seleucus Nicator gave it a Macedonian name, Beroea; but Chalcis, some distance S., was the capital of the province, Chalcidice (later, Kinnasrin), in which it lay, and the centre of that hellenized region, now a vast field of ruins, which stretches W. to the Orontes. Khalep-Beroea, we may infer, remained a native town and a focus of Aramaic influence, a fact which will explain the speedy oblivion of its Macedonian name and the permanent revival of its ancient title, even by Greeks.

As *Beroea* we hear of the place in Seleucid wars and dissensions. There Menelaus, the fomenter of war with the Asmoneans, was put to death by Lysias in 164 B.C., "as the manner is in that place" (*Macc.* ii. 13. 4), being thrown into a lofty tower full of cinders. There Heracleon, the court favourite and murderer of Antiochus Grypus, was born and made himself a principality (96 B.C.); and there the son of the latter king besieged his brother Philip in the last struggle for the heritage of Seleucus. As *Chalybon*, the town is called by Ptolemy head of a district, *Chalybonitis;* but we continue to hear of it as Beroea up to the Arab conquest, *e.g.* in the history of Julian's eastward march in A.D. 363, and in that of the Persian raid of 540. It was occupied in 611 by Chosroes II. Overwhelmed by the Saracen flood in A.D. 638, Beroea disappears, and as Moslem society settles down *Halep* emerges again as the great gathering-place of caravans passing from Asia Minor and Syria to Mesopotamia, Bagdad and the Persian and Indian kingdoms. Like Antioch it suffered from earthquakes, and late in the 12th century, after a terrible shock, had to be rebuilt by Nur ed-Din. But neither earthquakes nor the plague, to which it was also peculiarly liable, could divert trade and prosperity from it. It belonged to the Eastern Caliphate (the *Hamdanids*) until temporarily reoccupied by John Zimisces, emperor of Byzantium and a native of neighbouring Hierapolis (*q.v.*), A.D. 974, after an abortive attempt by Nicephorus thirteen years earlier. Thirteen years later it recognized and received the Fatimites, and passed under various Moslem dynasties, forming part of the Seljuk dominion from 1090 to 1117. The crusading princes of Antioch never held the place, though they attacked it in 1124; and Saladin, who took it in 1183, made it a stronghold against them and the northern capital of himself and his successors until the Tatar invasion of 1260. Thereafter the Mamelukes took and kept possession, despite the renewed Tatar inroad of 1401, until the final conquest by the Ottomans in 1517. Under the strong hand of the latter the trade of Aleppo with the East revived. One of the first provincial factories and consulates of the British Turkey (Levant) Company was established there in the reign of James I.; and a British agent had been in residence there even in Elizabeth's time. As the eastern outpost of the company's operations, it was connected with the western outpost of the East India Company in Bagdad by a private postal service, and its name became very familiar in England from the part that its merchants (largely Jewish) bore in the transmission of Eastern products to Europe (cf., *e.g.* Shakespeare, *Macb.* i. 3. 7; *Oth.* v. 2. 352). Through it passed the silks of Bambyce, called *bombazines*, the light textiles of Mosul (*mosulines—muslins*) and many other commodities for the wealthy and luxurious. The first blow was struck at this trade by the discovery of the Cape route to India; the second by the opening of a land route through Egypt to the Red Sea; the third and final one by the making of the Suez Canal. Long ere this last event, however, Aleppo had been declining from internal causes. In the latter part of the 18th century and the first years of the 19th it was constantly the scene of bloody dissensions between two rival parties, one led by the local janissaries, the other by the *sherifs* (religious); and the Ottoman governors took the side, now of one, now of the other, in order to plunder a distracted city, too far removed from the centre to be controlled by the sultans, and too near the rebellious *pashalik* of Acre and the unsettled district of Lebanon not to be affected by the disorders natural to a frontier province. This state of things led to the suspension of the British consulate by the Turkey Company in 1791; and it was not revived till 1800, after which date till 1825 it was maintained jointly by the East India Company. In 1803 Jezzar of Acre advanced as near as Hamah; but his death occurred in the following year; and after a sanguinary rising in 1805, Aleppo settled down, but was not at peace, even after a local janissary massacre in 1814, till Mahmud II. had dealt finally with the corps at headquarters (1826). Meanwhile there had been a frightful earthquake in 1822, and a visitation of cholera in the following year. More cholera in 1827 and 1832 and another earthquake in 1830 had left the place a wreck, with only half its former population, when Mehemet Ali of Cairo invaded and took Syria. Aleppo shared, and to some extent headed, the Syrian discontent with Egyptian rule, and was strongly held by troops whose huge barracks are still one of the sights of the city. Ready to rise behind Ibrahim Pasha in 1839, it was only prevented by the news of Nezib. Tumults and massacres of Christians occurred in 1850 and 1862, accompanied by great destruction of property; but on the whole, since the consolidation of Ottoman rule over Syria by Abdul Mejid's ministers, Aleppo has been reviving, although its trade is more local than of old.

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(D. G. H.)

ALES (ALESIUS), **ALEXANDER** (1500–1565), Scottish divine of the school of Augsburg, whose family name was ALANE, was born at Edinburgh on the 23rd of April 1500. He studied at St Andrews in the newly-founded college of St Leonard's, where he graduated in 1515. Some time afterwards he was appointed a canon of the collegiate church, and at first contended vigorously for the scholastic theology as against the doctrines of the Reformers. His views were entirely changed, however, on the execution of Patrick Hamilton, abbot of Fern, in 1528. He had been chosen to meet Hamilton in controversy, with a view to convincing him of his errors, but the arguments of the Scottish proto-martyr, and above all the spectacle of his heroism at the stake, impressed Alesius so powerfully that he was entirely won over to the cause of the Reformers. A sermon which he preached before the Synod at St Andrews against the dissoluteness of the clergy gave great offence to the provost, who cast him into prison, and might have carried his resentment to the extremest limit had not Alesius contrived to escape to Germany in 1532. After travelling in various countries of northern Europe, he settled down at Wittenberg, where he made the acquaintance of Luther and Melanchthon, and signed the Augsburg confession. Meanwhile he was tried in Scotland for heresy and condemned without a hearing. In 1533 a decree of the Scottish clergy, prohibiting the reading of the New Testament by the laity, drew from Alesius a defence of the right of the people, in the form of a letter to James V. A reply to this by John Cochlaeus, also addressed to the Scottish king, occasioned a second letter from Alesius, in which he not only amplifies his argument with great force, but enters into more general questions connected with the Reformation. In August 1534 he and a few others were excommunicated at Holyrood by the deputy of the archbishop of St Andrews. When Henry VIII. broke with the church of Rome Alesius was induced to go to England, where he was very cordially received (August 1535) by the king and his advisers Cranmer and Thomas Cromwell. After a short residence at Lambeth he was appointed, through the influence of Cromwell, then chancellor of the university, to lecture on theology at Cambridge; but when he had delivered a few expositions of the Hebrew psalms, he was compelled by the opposition of the papal party to desist. Returning to London he supported himself for some time by practising as a physician. In 1537 he attended a convocation of the clergy, and at the request of Cromwell conducted a controversy with Stokesley, bishop of London, on the nature of the sacraments. His argument was afterwards published under the title *Of the Auctorite of the Word of God concerning the number of the Sacraments.* In 1539 Alesius was compelled to flee for the second time to Germany, in consequence of the enactment of the statute of the Six Articles. He was appointed to a theological chair in the university of Frankfort-on-Oder, where he was the first professor who taught the reformed doctrines. In 1543 he quitted Frankfort for a similar position at Leipzig, his contention that it was the duty of the civil magistrate to punish fornication, and his sudden departure, having given offence to the authorities of the former university. He was in England again for a short time during Edward VI.'s reign, and was commissioned by Cranmer to make a Latin version of the First Prayer-Book (1549) for the information of Bucer, whose opinion was desired. He died at Leipzig on the 17th of March 1565.

Alesius was the author of a large number of exegetical, dogmatic and polemical works, of which over twenty are mentioned by Bale in his *List of English Writers*. (See also the British Museum catalogue.) In his controversial works he upholds the synergistic views of the Scottish theologian John Major. He displayed his interest in his native land by the publication of a *Cohortatio ad Concordiam Pietatis, missa in Patriam suam* (1544), which had the express approval of Luther, and a *Cohortatio ad Pietatis Concordiam ineundam* (1559).

The best early account of Alesius is the *Oratio de Alexandro Alesio* of Jacob Thomasius (April 1661), printed in the latter's *Orationes* (No. XIV., Leipzig, 1683): the best modern account is by Dr A. W. Ward in the *Dictionary of National Biography*. See also A. F. Mitchell's introduction to Gau's *Richt Vay* (Scottish Text Society, 1888).

ALESIA, the ancient name for a hill in central France, now Alise-Ste-Reine (department Côte d'Or), where in 52 B.C. Caesar besieged the Gaulish national leader Vercingetorix within enormous entrenchments, forced him to surrender, and thus practically ended his conquest of Gaul. The siege-works have been excavated by Napoleon III. and others, down to the present day. The site seems to have been inhabited also during the Roman empire, but its importance is limited to Caesar's siege.

ALESSANDRI, ALESSANDRO (Alexander ab Alexandro) (1461–1523), Italian jurist, was born at Naples about the year 1461. He studied law at Naples and Rome, and afterwards practised for a time as advocate in both cities. He is said to have been royal proto-notary at Naples in 1490. Dissatisfied, according to his own account, with the corrupt administration of justice, he at length quitted the bar and devoted himself entirely to literary pursuits, especially to the study of philology and antiquities. A sinecure appointment, which he owed to the favour of the pope, enabled him to lead a life of learned leisure at Rome, where he died on the 2nd of October 1523. His work entitled *Dies Geniales* appeared at Rome in 1522, and was constructed after the model of the *Noctes Atticae* of Aulus Gellius, and the *Saturnalia* of Macrobius. It consists of a confused mass of heterogeneous materials relating to philology, antiquities, law, dreams, spectres, &c., and is characterized by considerable credulity.

ALESSANDRIA, a city and episcopal see of Piedmont, Italy, capital of a province which bears its name, situated on the river Tanaro, 57 m. E. by S. of Turin by rail. Pop. (1901) 71,298, of which about half reside in the actual town: the rest are distributed over the suburbs. Alessandria was founded in 1168 by the inhabitants of the district in order to defend themselves against the marquis of Monferrato and the town of Pavia, at whose request it was besieged in 1174 by Frederick Barbarossa for six months, but without success. The Lombard League now included it among the allied cities and named it Alessandria, after Pope Alexander III. The traditional account of its foundation by the Lombard League has been disproved by F. Graf, *Die Gründung Alessandrias: ein Beitrag zur Geschichte des Lombardenbundes* (1888). After falling into various hands, it was ceded to Savoy by the peace of Utrecht in 1713, and its citadel was begun in 1728. During the French occupation (1800–1814), which began after the battle of Marengo, it was still more strongly fortified; the works were entirely destroyed by the Austrians in 1815, but were afterwards reconstructed, and Alessandria is still an important fortress and the headquarters of the second army corps. The citadel is on the left bank of the Tanaro, the town being on the right bank. It is regularly built and contains few buildings of architectural interest, but is a flourishing and important commercial town, not merely owing to its own manufactures (which are miscellaneous) but for the products of the district, and one of the greatest railway centres in Italy. Lines diverge from it to Turin via Asti, to Valenza (and thence to Vercelli, Mortara—for Novara or Milan—and Pavia), to Tortona, to Novi, to Acqui and to Brà.

ALESSI, GALEAZZO (1512–1572), Italian architect, was born at Perugia, and was probably a pupil of Caporali. He was an enthusiastic student of ancient architecture, and his style gained for him a European reputation. Genoa is indebted to him for a number of its most magnificent palaces, and specimens of his skill may be seen in the churches of San Paolo and Santa Vittoria at Milan, in certain parts of the Escurial, and in numerous churches and palaces throughout Sicily, Flanders and Germany.

See Rossi, *Di Galeazzo Alessi memorie* (Perugia, 1873).

ALETHIOLOGY (from the Gr. ἀλήθεια, truth), an uncommon expression for the doctrine of truth, used by Sir William Hamilton in his philosophic writings when treating of the rules for the discrimination of truth and error.

ALETRIUM (mod. *Alatri*), a town of the Hernici, about 6 m. due N. of Frusino, Italy, mentioned in 306 B.C. for its fidelity to Rome. In Cicero's time it was a *municipium*, and continued in this position throughout the imperial period. It is chiefly remarkable for its finely preserved fortifications constructed of tetrahedral and polygonal blocks of local limestone well jointed, with maximum dimensions of about 3 by $1\frac{1}{2}$ ft.; the outer circuit of the city wall measures about $2\frac{1}{2}$ m. It is almost entirely an embanking wall, as is the rule in the cities of this part of Italy, with a maximum height, probably, of about 30 ft. Two of the gates (of which there were perhaps five) are still to some extent preserved, and three posterns are to be found. In the centre of the city rises a hill (1647 ft.) which was adopted as the citadel. Remains of the fortifications of three successive periods can be traced, of which the last, perhaps a little more recent than that of the city wall, is the best preserved. In the first two periods the construction is rough, while in the third the blocks are very well and finely jointed, and the faces smoothed; they are mostly polygonal in form and are much larger (the maximum about 10 by 6 ft.) than those of the city wall. A flat surface was formed partly by smoothing off the rock and partly by the erection of huge terrace walls which rise to a height of over 50 ft., enclosing a roughly rectangular area of 235 by 115 yds. Two approaches to the citadel were constructed, both passing through the wall; the openings of both are rectangular. The architrave of the larger, known as Porta di Civita, measures about 17 ft. in length, 5 ft. in height, 6 ft. in thickness; while that of the smaller is decorated with three *phalli* in relief. Later, though probably in ancient times, a ramp was added on the northern side. In the centre of the *arx* was a building on the site of the present cathedral, of which only a small portion is preserved. Remains of a high-pressure aqueduct, which supplied the town with water and was constructed with other public buildings (*Corp. Inscr. Lat.* x., Berlin, 1883, p. 5807) by L. Betilienus Varus, may still be traced. A temple was excavated in 1889 about $\frac{1}{2}$ m. to the north of the town, and many fragments of the painted terra-cottas with which it was decorated were found. A reconstruction of it has been erected in the Museo di Villa Giulia at Rome. The present town (pop. in 1901, 15,322) has a picturesque aspect, and contains many buildings in the Gothic style.

See R. Bassel, *Centralblatt der Bauverwaltung*, 1881, 121, p. 134; H. Winnefeld, *Römische Mitteilungen*, 1889, 126; G. Fiorelli in *Notizie degli Scavi*, 1882, 417. (T. As.)

ALEURITES (Gr. ἀλευρίτης, pertaining to ἄλευρον, ground meal, from ἀλεῖν, to grind), a genus of trees belonging to the natural order Euphorbiaceae. *Aleurites moluccana*, or *triloba*, is widely cultivated throughout the tropical and sub-tropical parts of the world for its fruit, which is about the size of a walnut, and contains several seeds which are rich in oil. The oil is extracted and used for food and light; it is known in India as *kekuna*, and the tree as the "candle-nut." In the Sandwich Islands the nuts are strung upon strips of wood and used as torches. The oil is exported to Europe for candle-making. *A. cordata* flourishes in China, where it is known as the varnish-tree, on account of the lac contained in its seeds.

ALEUTIAN ISLANDS (possibly from Chukchi *aliat*, "island"), a chain of small islands situated in the Northern Pacific Ocean, and extending about 1200 m. westward from the extremity of the Alaskan peninsula toward the peninsula of Kamchatka; they constitute part of the District of Alaska, U.S.A. The islands, of which an alternative collective name is the Catherine Archipelago, comprise four groups—the Fox, Andreanof, Rat and Near Islands. They are all included between 52° and 55° N. lat. and 172° E. and 163° W. long.

The axis of the archipelago near the mainland of Alaska has a S.W. trend, but near the 129th meridian its direction changes to the N.W. This change of direction corresponds to a curve in the line of volcanic fissures which have contributed their products to the building of the islands. Such curved chains are repeated about the Pacific Ocean in the Kurile Islands, the Japanese chain, the Philippines, &c. The general elevation is greatest in the eastern islands and least in the western. The island chain is really a western continuation of the Aleutian Range on the mainland.

The great majority of the islands bear evident marks of volcanic origin, and there are numerous volcanic cones on the north side of the chain, some of them active; many of the islands, however, are not wholly volcanic, but contain crystalline or sedimentary rocks, and also amber and beds of lignite. The coasts are rocky and surf-worn and the approaches are exceedingly dangerous, the land rising immediately from the coasts to steep, bold mountains.

The climate of the islands is oceanic, with moderate and fairly uniform temperatures and heavy rainfall. Fogs are almost constant. The summers are much cooler than on the mainland at Sitka (*q.v.*), but the winter temperature of the islands and of south-eastern Alaska is very nearly the same. The mean annual temperature for Unalaska, the most important island of the group, is about 38° F. ; being about 30° for January and about 52° for August. The highest and lowest temperatures recorded on the islands are 78° and 5°. The average annual amount of rainfall is about 80 in., and Unalaska, with about 250 rainy days per year, is said to be the rainiest place within the territory of the United States. The growing season lasts about 135 days, from early in May till late in September, but agriculture is limited to the raising of a few vegetables. With the exception of some stunted willows the islands are practically destitute of trees, but are covered with a luxuriant growth of herbage, including grasses, sedges and many flowering plants. On the less mountainous islands the raising of sheep and reindeer is believed to be practicable. The principal occupations of the natives have always been fishing and hunting, and the women weave basketry of exquisite fineness. From the end of the 18th century the Russian fur traders had settlements here for the capture of the seal and the sea otter and the blue and the Arctic fox. Under the American régime seal fishing off the Aleutians save by the natives has never been legal, but the depletion of the Pribilof herd, the almost complete extinction of the sea otter, and the rapid decrease of the foxes and other fur animals, have threatened the Aleuts (as the natives are commonly called) with starvation. In recent years enterprising traders have raised foxes by culture and by especially protecting certain small islands, and this has furnished employment to whole communities of natives. Fish and sea-fowl are extremely abundant.

The natives are rather low in stature, but plump and well shaped, with short necks, swarthy faces, black eyes and long black hair. They are a branch of the Esquimauan family, but differ greatly from the Eskimo of the mainland in language, habits, disposition and mental ability. They were good fighters until they were cowed by the treatment of the Russians, who practically reduced them to slavery. Sporadic efforts to Christianize the Aleuts were made in the latter half of the 18th century, but little impression was made before the arrival in 1824 of Father Ivan Venyaminov, who in 1840 became the first Greek bishop of Alaska. While the missionaries of the Greek Church have nominally converted the natives to Christianity, white adventurers have more effectually converted them to various bad habits. In dress and mode of life they have adopted outwardly civilized customs. From the position of the Aleutian islands, stretching like a broken bridge from Asia to America, some ethnologists have supposed that by means of them America was first peopled. Raised shore-lines, occasional earthquakes, and slow measurable elevation of the land about active volcanoes, indicate that elevation is now in progress, but the geological evidence shows no sign of former submergence of a connecting isthmus. There is granite at the core of the Shaler range of mountains in southern Unalaska.

It is stated that before the advent of the Russians there were 25,000 Aleuts on the archipelago, but that the barbarities of the traders eventually reduced the population to one-tenth of this number. The number of Aleuts in 1890 was reported as 968; the total population of the archipelago in 1900 was 2000.

The principal settlements are on the Unalaska Island. Of these Iliuliuk (also called Unalaska), the oldest, settled in 1760–1775, has a custom house, a Russian-Greek Church, and a Methodist Mission and orphanage, and is the headquarters for a considerable fleet of United States revenue cutters which patrol the sealing grounds of the Pribilofs; adjacent is Dutch Harbor (so named, it is said, because a Dutch vessel was the first to enter it), which is an important port for Bering Sea commerce. The volcano Makushin (5691 ft.) is visible from Iliuliuk, and the volcanic islets Bogoslof and Grewingk, which rose from the sea in 1796 and 1883 respectively, lie about 30 m. W. of the bay. The latter is still active; in 1906 a new cone rose between the two earlier islets, and in 1907 still another: these were nearly demolished by an explosive eruption on the 1st of September 1907. The population of Unalaska Island in 1900 was 575 Aleuts and 66 whites. The Commander Islands group near the Asiatic coast is geographically, but since the acquisition of the Russian possessions in America not politically, a part of the Aleutian system.

In 1741 the Russian government sent out Vitus Bering, a Dane, and Alexei Chirikov, a Russian, in the ships "Saint Peter" and "Saint Paul" on a voyage of discovery in the Northern Pacific. After the ships were separated by a storm, Chirikov discovered several eastern islands of the Aleutian group, and Bering discovered several of the western islands, finally being wrecked and losing his life on the island of the Commander group that now bears his name. The survivors of Bering's party reached Kamchatka in a boat constructed from the wreckage of their ship, and reported that the islands were rich in fur-bearing animals. Siberian fur hunters at once flocked to the Commander Islands and gradually moved eastward across the Aleutian Islands to the mainland. In this manner Russia gained a foothold on the north-western coast of North America. The Aleutian Islands consequently belonged to Russia, until that country in 1867 transferred to the United States all its possessions in America. During his third and last voyage, in 1778, Captain James Cook surveyed the eastern portion of the Aleutian archipelago, accurately determined the position of some of the more important islands and corrected many errors of former navigators. Some preliminary surveys have been made by the United States government with a view to establishing a naval station on the island Kiska, in the western part of the Aleutian Chain.

ALEXANDER (Alexander of Battenberg) (1857–1893), first prince of Bulgaria, was the second son of Prince Alexander of Hesse and the Rhine by his morganatic marriage with Julia, countess von Hauke. The title of princess of Battenberg, derived from an old residence of the grand-dukes of Hesse, was conferred, with the prefix *Durchlaucht* or "Serene Highness," on the countess and her descendants in 1858. Prince Alexander, who was born on the 5th of April 1857, was nephew of the tsar Alexander II., who had married a sister of Prince Alexander of Hesse; his mother, a daughter of Count Moritz von Hauke, had been lady-in-waiting to the tsaritsa. In his boyhood and early youth he was frequently at St Petersburg, and he accompanied his uncle, who was much attached to him, during the Bulgarian campaign of 1877. When Bulgaria under the Berlin Treaty was constituted an autonomous principality under the suzerainty of Turkey, the tsar recommended his nephew to the Bulgarians as a candidate for the newly created throne, and

Prince Alexander was elected prince of Bulgaria by unanimous vote of the Grand Sobranye (April 29, 1879). He was at that time serving as a lieutenant in the Prussian life-guards at Potsdam. Before proceeding to Bulgaria, Prince Alexander paid visits to the tsar at Livadia, to the courts of the great powers and to the sultan; he was then conveyed on a Russian warship to Varna, and after taking the oath to the new constitution at Tirnova (July 8, 1879) he repaired to Sofia, being everywhere greeted with immense enthusiasm by the people. (For the political history of Prince Alexander's reign, see BULGARIA.) Without any previous training in the art of government, the young prince from the outset found himself confronted with difficulties which would have tried the sagacity of an experienced ruler. On the one hand he was exposed to numberless humiliations on the part of the representatives of official Russia, who made it clear to him that he was expected to play the part of a *roi fainéant*; on the other he was compelled to make terms with the Bulgarian politicians, who, intoxicated with newly won liberty, prosecuted their quarrels with a crude violence which threatened to subvert his authority and to plunge the nation in anarchy. After attempting to govern under these conditions for nearly two years, the prince, with the consent of the tsar Alexander III., assumed absolute power (May 9, 1881), and a suspension of the ultra-democratic constitution for a period of seven years was voted by a specially convened assembly (July 13). The experiment, however, proved unsuccessful; the Bulgarian Liberal and Radical politicians were infuriated, and the real power fell into the hands of two Russian generals, Sobolev and Kaulbars, who had been specially despatched from St Petersburg. The prince, after vainly endeavouring to obtain the recall of the generals, restored the constitution with the concurrence of all the Bulgarian political parties (September 18, 1883). A serious breach with Russia followed, which was widened by the part which the prince subsequently played in encouraging the national aspirations of the Bulgarians. The revolution of Philippopolis (September 18, 1885), which brought about the union of Eastern Rumelia with Bulgaria, was carried out with his consent, and he at once assumed the government of the revolted province. In the anxious year which followed, the prince gave evidence of considerable military and diplomatic ability. He rallied the Bulgarian army, now deprived of its Russian officers, to resist the Servian invasion, and after a brilliant victory at Slivnitza (November 19) pursued King Milan into Servian territory as far as Pirot, which he captured (November 27). Although Servia was protected from the consequences of defeat by the intervention of Austria, Prince Alexander's success sealed the union with Eastern Rumelia, and after long negotiations he was nominated governor-general of that province for five years by the sultan (April 5, 1886). This arrangement, however, cost him much of his popularity in Bulgaria, while discontent prevailed among a certain number of his officers, who considered themselves slighted in the distribution of rewards at the close of the campaign. A military conspiracy was formed, and on the night of the 20th of August the prince was seized in the palace at Sofia, and compelled to sign his abdication; he was then hurried to the Danube at Rakhovo, transported on his yacht to Reni, and handed over to Russian authorities, by whom he was allowed to proceed to Lemberg. He soon, however, returned to Bulgaria, owing to the success of the counter-revolution led by Stamboloff, which overthrew the provisional government set up by the Russian party at Sofia. But his position had become untenable, partly owing to an ill-considered telegram which he addressed to the tsar on his return; partly in consequence of the attitude of Prince Bismarck, who, in conjunction with the Russian and Austrian governments, forbade him to punish the leaders of the military conspiracy. He therefore issued a manifesto resigning the throne, and left Bulgaria on the 8th of September 1886. He now retired into private life. A few years later he married Fräulein Loisinger, an actress, and assumed the style of Count Hartenau (February 6, 1889). The last years of his life were spent principally at Gratz, where he held a local command in the Austrian army. Here, after a short illness, he died on the 23rd of October 1893. His remains were brought to Sofia, where they received a public funeral, and were eventually deposited in a mausoleum erected in his memory. Prince Alexander possessed much charm and amiability of manner; he was tall, dignified and strikingly handsome. His capabilities as a soldier have been generally recognized by competent authorities. As a ruler he committed some errors, but his youth and inexperience and the extreme difficulty of his position must be taken into consideration. He was not without aptitude for diplomacy, and his intuitive insight and perception of character sometimes enabled him to outwit the crafty politicians by whom he was surrounded. His principal fault was a want of tenacity and resolution; his tendency to unguarded language undoubtedly increased the number of his enemies.

See Drandar, *Le Prince Alexandre de Battenberg en Bulgarie* (Paris, 1884); Koch, *Fürst Alexander von Bulgarien* (Darmstadt, 1887); Matveyev, *Bulgarien nach dem Berliner Congress* (Petersburg, 1887); Bourchier, "Prince Alexander of Battenberg," in *Fortnightly Review*, January 1894. (J. D. B.)

ALEXANDER I., king of Epirus about 342 B.C., brother of Olympias the mother of Alexander the Great, and son-in-law of Philip of Macedon, whose daughter Cleopatra he married (336). In 332 he crossed over to Italy to assist the Tarentines against the Lucanians, Bruttians and Samnites. He gained considerable successes and made an arrangement with the Romans for a joint attack upon the Samnites; but the Tarentines, suspecting him of the design of founding an independent kingdom, turned against him. Although the advantage at first rested with Alexander, he gradually lost it, and his supporters dwindled away. In 330 (or earlier) he was defeated at Pandosia and slain by a Lucanian emigrant.

See Justin viii. 6, ix. 6, xii. 2; Livy viii. 3, 17, 24; Aulus Gellius xvii. 21; and article MACEDONIAN EMPIRE.

ALEXANDER II., king of Epirus, succeeded his father Pyrrhus, 272 B.C. He attacked Antigonus Gonatas and conquered the greater part of Macedonia, but was in turn driven out of both Epirus and Macedonia by Demetrius the son of Antigonus. He subsequently recovered his kingdom by the aid of the Acarnanians and Aetolians. He died about 260 (Polybius ii. 45, ix. 34; Plutarch, *Pyrrhus*, 9; Justin xviii. 1, xxvi. 2, xxviii. 1).

See Thirlwall, *History of Greece*, vol. viii.; Droysen, *Hellenismus*; B. Niese, *Gesch. d. griech. u. maked. Staaten*; J. Beloch, *Griech. Gesch.* vol. iii.

ALEXANDER III., known as THE GREAT[1] (356–323 B.C.), king of Macedon, was the son of Philip II. of Macedon, and Olympias, an Epirote princess. His father was pre-eminent for practical genius, his mother a woman of half-wild blood, weird, visionary and terrible; and Alexander himself is singular among men of action for the imaginative splendours which guided him, and among romantic dreamers for the things he achieved. He was born in 356 B.C., probably about October (Hogarth, pp. 284 ff.). The court at which he grew up was the focus of great activities, for Philip, by war and diplomacy, was raising Macedon to the headship of the Greek states, and the air was charged with great ideas. To unite the Greek race in a war against the Persian empire was set up as the ultimate mark for ambition, the theme of idealists. The great literary achievements of the Greeks in the 5th century lay already far enough behind to have become invested with a classical dignity; the meaning of Hellenic civilization had been made concrete in a way which might sustain enthusiasm for a body of ideal values, authoritative by tradition. And upon Alexander in his fourteenth year this sum of tradition was brought to bear through the person of the man who beyond all others had gathered it up into an organic whole: in 343–342 Aristotle (*q.v.*) came to Pella at Philip's bidding to direct the education of his son. We do not know what faculty the master-thinker may have had for captivating this ardent spirit; at any rate Alexander carried with him through life a

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[1] The use of the surname is proved as far back as the 1st century B.C. (Nepos, *De Reg.* 2).

passion for Homer, however he may have been disposed to greyer philosophic theory. But his education was not all from books. The coming and going of envoys from many states, Greek and Oriental, taught him something of the actual conditions of the world. He was early schooled in war. At the age of sixteen he commanded in Macedonia during Philip's absence and quelled a rising of the hill-tribes on the northern border; in the following year (338) he headed the charge which broke the Sacred Band at Chaeronea. Then came family dissensions such as usually vex the polygamous courts of the East. In 337 Philip repudiated Olympias for another wife, Cleopatra, Alexander went with his mother to her home in Epirus, and, though he soon returned and an outward reconciliation between father and son was contrived, their hearts were estranged. The king's new wife was with child; her kinsmen were in the ascendant; the succession of Alexander was imperilled. Some negotiations which Pixodarus, the satrap of Caria, opened with the Macedonian court with a view to effecting a marriage alliance between his house and Philip's, brought Alexander into fresh broils. In 336 Philip was suddenly assassinated whilst celebrating at Aegae the marriage of his daughter to Alexander I. of Epirus in the presence of a great concourse from all the Greek world. It is certain that the hand of the assassin was prompted by some one in the background; suspicion could not fail to fall upon Alexander among others. But guilt of that sort would hardly be consistent with his character as it appears in those early days.

Accession.

Leader of the Hellenes.

Alexander was not the only claimant to the vacant throne, but, recognized by the army, he soon swept all rivals from his path. The newly born son of Philip by Cleopatra, and Alexander's cousin Amyntas, were put to death, and Alexander took up the interrupted work of his father. That work was on the point of opening its most brilliant chapter by an invasion of the great king's dominions; the army was concentrated and certain forces had already been sent on to occupy the opposite shore of the Hellespont. The assassination of Philip delayed the blow, for it immediately made the base, Macedonia, insecure, and in such an enterprise, plunging into the vast territories of the Persian empire, a secure base was everything. Philip's removal had made all the hill-peoples of the north and west raise their heads and set the Greek states free from their fears. A demonstration in Greece, led by the new king of Macedonia, momentarily checked the agitation, and at the diet at Corinth Alexander was recognized as captain-general (ἡγεμὼν αὐτοκράτωρ) of the Hellenes against the barbarians, in the place of his father Philip. In the spring of 335 he went out from Macedonia northwards, struck across the Balkans, probably by the Shipka Pass, frustrating the mountain warfare of its tribes by a precision of discipline which, probably, no other army of the time could have approached, and traversed the land of the Triballians (Rumelia) to the Danube. To gratify his own imagination or strike the imagination of the world he took his army over the Danube and burnt a settlement of the Getae upon the other side. Meanwhile the Illyrians had seized Pelion (Pliassa), which commanded the passes on the west of Macedonia, and from the Danube Alexander marched straight thither over the hills. He had hardly restored Macedonian prestige in this quarter when he heard that Greece was aflame. Thebes had taken up arms. By a forced march he took the Thebans completely by surprise, and in a few days the city, which a generation before had won the headship of Greece, was taken. There were to be no half-measures now; the city was wiped out of existence with the exception of its temples and the house which had been Pindar's. Greece might now be trusted to lie quiet for some time to come. The Panhellenic alliance (from which Sparta still stood aloof) against the barbarians was renewed. Athens, although known to be hostile at heart to the cities of Macedonian power, Alexander treated all through with eager courtesy.

Invasion of Asia Minor.

Battle of Granicus.

In the spring of 334, Alexander crossed with an army of between 30,000 and 40,000 men, Macedonians, Illyrians, Thracians and the contingents of the Greek states, into Asia. The place of concentration was Arisbe on the Hellespont. Alexander himself first visited the site of Troy and there went through those dramatic acts of sacrifice to the Ilian Athena, assumption of the shield believed to be that of Achilles and offerings to the great Homeric dead, which are significant of the poetic glamour shed, in the young king's mind, over the whole enterprise, and which men will estimate differently according to the part they assign to imagination in human affairs. To meet the invader the great king had in Asia Minor an army slightly larger, it would seem, than Alexander's, gathered under the satraps of the western provinces at Zeleia. He had also, what was more serious, command of the Aegean. Alexander could communicate with his base only by the narrow line of the Hellespont, and ran the risk, if he went far from it, of being cut off altogether. To draw him after them, while avoiding a conflict, was sound strategy for the Persian generals. It was urged upon them by their colleague the Rhodian Memnon. But strategic considerations were cancelled by the Persian barons' code of chivalry, and Alexander found them waiting for him on the banks of the Granicus. It was a cavalry mêlée, in which the common code of honour caused Macedonian and Persian chieftains to engage hand to hand, and at the end of the day the relics of the Persian army were in flight, leaving the high-roads of Asia Minor clear for the invader. Alexander could now accomplish the first part of the task belonging to him as captain-general to the Hellenes, that liberation of the Greek cities of Asia Minor, for which Panhellenic enthusiasts had cried out so long. He first went to take possession of the old Lydian capital Sardis, the headquarters of the Persian government on this side of the Taurus, and the strong city surrendered without a blow. And now in all the Greek cities of Aeolis and Ionia the oligarchies or tyrants friendly to Persia fell, and democracies were established under the eye of Alexander's officers. Only where the cities were held by garrisons in the Persian service, garrisons composed mainly of Greek mercenaries, was the liberator likely to meet with any resistance. From Ephesus indeed the garrison fled upon the news of Granicus, but Miletus required a siege. The Persian fleet in vain endeavoured to relieve it, and Miletus did not long hold out against Alexander's attack. It was at Halicarnassus that Alexander first encountered stubborn resistance, at Halicarnassus where Memnon and the satraps of Caria had rallied what land-forces yet belonged to Persia in the west. When winter fell, Alexander had captured indeed the city itself, but the two citadels still held out against his blockade.

Meanwhile Alexander was making it plain that he had come not merely as captain-general for a war of reprisals, but to take the Persian's place as king of the land. The conquered provinces were organized under Macedonian governors and in Caria a dethroned princess of the native dynasty, Ada, was restored to power. In the winter, whilst Parmenio advanced upon the central plateau to make the occupation of Phrygia effective, Alexander himself passed along the coast to receive the submission of the Lycians and the adherence of the Greek cities of the Pamphylian sea-board. The hills inland were the domain of fighting tribes which the Persian government had never been able to subdue. To conquer them, indeed, Alexander had no time, but he stormed some of their fortresses to hold them in check, and marched through their territory when he turned north from Pamphylia into the interior. The point of concentration for next year's campaign had been fixed at Gordium, a meeting-place of roads in Northern Phrygia. The story of Alexander's cutting the fatal "Gordian knot" on the chariot of the ancient Phrygian king Gordius is connected with his stay in this place.

Extension of Alexander's power.

Whilst Alexander had been grounding his power in Asia Minor, he had run a narrow risk of losing his base in Europe. He had after the siege of Miletus disbanded the Graeco-Macedonian fleet, surrendering for the time all attempts to challenge the command of the Aegean. Memnon the Rhodian, now in supreme command of the Persian fleet, saw the European coasts exposed and set out to raise Greece, where discontent always smouldered in Alexander's rear. But Memnon died at the critical moment whilst laying siege to

Battle of Issus.

Mytilene and the great plan collapsed. A Persian fleet still held the sea, but it effected little, and presently fresh Graeco-Macedonian squadrons began to hold it in check. It was, however, the need to ensure command of the sea and free all lines of communication behind him that determined Alexander's plan for the next campaign. If he mastered the whole coast-line of the Levant, the enemy's fleet would find itself left in the air. The Syrian coast was accordingly his immediate objective when he broke up from Gordium for the campaign of 333. He was through the Cilician Gates before the Persian king, Darius III., had sent up a force adequate to hold them. His passage through Cilicia was marked by a violent fever that arrested him for a while in Tarsus, and meantime a great Persian army was waiting for him in northern Syria under the command of Darius himself. In the knot of mountains which close in about the head of the Gulf of Alexandretta, Alexander, following hard by the coast, marched past the Persian army encamped on the plains to the east. To cut Alexander's communications with the rear, Darius now committed the error of entangling his large force in the mountain defiles. Alexander turned, and near the town of Issus fought his second pitched battle, sending Darius and the relic of his army in wild flight back to the east.[1] It was an incident which did not modify Alexander's plan. He did not press the pursuit far, although the great king's camp with his harem fell into his hands. The chivalrous courtesy which he showed to the captive princesses was a favourite theme for later rhetoricians. He went on his way to occupy Syria and Phoenicia. It is now that we get definite evidence as to the reach of Alexander's designs; for Darius opened negotiations in which he ultimately went so far as to offer a partition of the empire, all west of the Euphrates, to be Alexander's. Alexander refused the bargain and definitely claimed the whole.[2] The conquest of the Phoenician coast was not to be altogether easy, for Tyre shut its gates and for seven months Alexander had to sit before it—one of those obstinate sieges which mark the history of the Semitic races. When it fell, Alexander had the old Tyrian people scattered to the winds, 30,000 sold as slaves. Gaza offered a resistance equally heroic, lasting two months, and here too the old population was dispersed. The occupation of the rest of Syria and Palestine proceeded smoothly, and after the fall of Gaza Alexander's way lay open into Egypt.[3] Egypt was the last of the Mediterranean provinces to be won, and here no defence was made. To the native Egyptians Alexander appeared as a deliverer from the Persian tyranny, and he sacrificed piously to the gods of Memphis. The winter (332–331) which Alexander spent in Egypt saw two memorable actions on his part. One was the expedition (problematic in its motive and details) to the oracle of Zeus Ammon (Oasis of Siwa), where Alexander was hailed by the priest as son of the god, a belief which the circle of Alexander, and perhaps Alexander himself, seem hereafter to have liked to play with in that sort of semi-serious vein which still allowed him in the moments of every-day commonplace to be the son of Philip. The other action was the foundation of Alexandria at the Canopic mouth of the Nile, the place destined to be a new commercial centre for the eastern Mediterranean world which Alexander had now taken in possession, to rise to an importance which the founder, although obviously acting with intention, can hardly have foreseen (E. Keller, *Alex. d. Grosse nach der Schlacht bei Issus*, 1904).

Invasion of Persia.

In the spring of 331 Alexander could at last leave the Mediterranean to strike into the heart of the Persian empire, for by his occupation of the coasts the Persian command of the sea had inevitably collapsed. Returning through Syria, and stopping at Tyre to make final arrangements for the conquered provinces, he traversed Mesopotamia and struck the Tigris some four marches above the site of Nineveh. It was near Nineveh that Darius was waiting with the immense host which a supreme effort could muster from all parts of the empire. The happy coincidence of a lunar eclipse gives us the 20th of September 331 as the exact day upon which the Macedonian army crossed the Tigris. Alexander came within sight of the Persian host without having met with any opposition since he quitted Tyre. He had now to settle the most serious problem which had yet faced him, for in the plains the Persian army was formidable by sheer bulk. But the day showed the Macedonian army equal to the task. The last army gathered by an Achaemenian king was shattered in the battle called popularly after the city of Arbela some 60 m. distant, or more precisely after the village of Gaugamela hard by. Darius fled eastwards into Media and again Alexander waited till he had secured the provinces to the south. He followed the Tigris into Babylonia, the central seat of the empire and its richest region, and from Babylon went on to seize the fabulous riches which the Persian kings had amassed in their spring residence, Susa. Thence he at last ascended upon the Iranian plateau. The mountain tribes on the road (the Oxii, Pers, Huzha), accustomed to exact blackmail even from the king's train, learnt by a bitter lesson that a stronger hand had come to wield the empire. Alexander entered Persis, the cradle of the Achaemenian house, and came upon fresh masses of treasure in the royal city, Persepolis. He destroyed the royal palace by fire, an act which has been variously estimated by historians. Ostensibly a solemn revenge for the burning of Greek temples by Xerxes, it has been justified as a symbolical act calculated to impress usefully the imagination of the East, and condemned as a senseless and vainglorious work of destruction.

Battle of Arbela.

With the spring of 330 Alexander was prepared for further pursuit. Darius fled northwards from Ecbatana upon his approach. At Ecbatana new masses of treasure were seized, but when once the necessary measures which its disposal and the occupation of the Median capital entailed were taken, Alexander continued the pursuit. It was an exciting chase of king by king, in which each covered the ground by incredible exertions, shedding their slower-going followers as they went, past Rhagae (Rai) and the Caspian gates, till early one morning Alexander came in sight of the broken train which still clung to the fallen king. He had become a puppet in the hands of his cousin Bessus and the Persian magnates with him (see DARIUS III.), and at this extremity they stabbed him and allowed Alexander to become master only of his corpse (summer 330).

The pursuit had brought Alexander into that region of mountains to the south of the Caspian which connects western Iran with the provinces to the east of the great central desert. To conquer this remaining portion of the empire, Alexander now went on through the mountain belt, teaching the power of his arms to the hillsmen, Tapyri and Mardi, till he came, passing through Zadracarta (Asterabad), to Parthia and thence to Arīa. In these further provinces of Iran the Macedonian invader had for the first time to encounter a serious national opposition, for in the west the Iranian rule had been merely the supremacy of an alien power over native populations indifferent or hostile. Here the ruling race was at home. In Asia Alexander learnt that Bessus had taken the diadem as Darius' successor in Bactria, but so soon as he marched against him Arīa rose in his rear, and Alexander had to return in all haste to bring the revolt under. Nor did he, when this was accomplished, again strike directly at Bactria, but made a wide turning movement through Seistan over Kandahar into the Kabul valley. It was on the way, in Seistan at Prophthasia (mod. *Farrah* ?), that the alienation between Alexander and his Macedonian followers, which becomes sensible in the latter part of his career, first showed itself in an ugly form. Alexander had come to merge the characters of Macedonian king and Hellenic captain-general, with which he had set out, in that of Oriental despot (Spieker. *Hof u. Hofordnung Al. d. Gr.*, 1904). He wore on occasions of state the Persian dress. (According to pseudo-Plutarch, *de fort. Al.* i. 8, it was the simpler *Persian* dress, not the Median.) A discontent began to work among the

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[1] See Bauer, "Die Schlacht bei Issus" in *Jahreshefte d. österr. archäol. Instit.* ii. pp. 105 f.; A. Janke. *Auf Alex. d. grossen Pfaden*; Gruhn, *Das Schlachtfeld von Issus*; Lammert in *Berl. Philol. Wochenschr.* (1905), col. 1596 f.

[2] Pridik, *De Alex. Mag. epist. commercio* (Dorpat, 1893); Schwartz, art. "Curtius" in Pauly-Wissowa, col. 1884.

[3] The story of Alexander's visit to Jerusalem rests on no better authority than a later Jewish romance.

Macedonians, and at Prophthasia the commander of the Macedonian cavalry Philotas, the son of Parmenio, and certain others were arraigned before the army on the charge of conspiring against the king's life. They were condemned and put to death. Not satisfied with procuring this, Alexander had Parmenio himself, who had been left in command in Media, put to death by secret orders. It is perhaps the worst crime, because the most cold-blooded and ungenerous, which can be laid to his charge. By the winter of 329–328 Alexander had reached the Kabul valley at the foot of the Paropamisadae (Hindu Kush).

The ordinarily received chronology makes Alexander reach the Kabul valley in the winter of 330–329. That to fit the actions and distances covered by Alexander into such a scheme, assuming that he went by Seistan and Kandahar, would involve physical impossibilities has been pointed out by Count Yorck v. Wartenburg and Mr D. G. Hogarth. Kaerst and Beloch continue to give the ordinary chronology untroubled.

Invasion of Northern India.

In the spring of 328 Alexander crossed the Hindu Kush into Bactria and followed the retreat of Bessus across the Oxus and into Sogdiana (Bokhara). Here Bessus was at last caught and treated with the barbaric cruelty which the rule of the old Persian monarchy prescribed for rebels. Till the spring of 327 Alexander was moving to and fro in Bactria and Sogdiana, beating down the recurrent rebellions and planting Greek cities. Just as in 335 he had crossed the Danube, so he now made one raid across the frontier river, the Jaxartes (Sir Daria), to teach the fear of his name to the outlying peoples of the steppe (summer 328). And meanwhile the rift between Alexander and his European followers continued to show itself in dark incidents—the murder of Clitus at Maracanda (Samarkand), when Alexander struck down an old friend, both being hot with wine; the claim that Alexander should be approached with prostration (*proskynesis*), urged in the spring of 327, and opposed boldly by the philosopher Callisthenes, Aristotle's nephew, who had come in the king's train; the conspiracy of the pages at Bactria, which was made an occasion for putting Callisthenes to death. It was now that Alexander completed the conquest of the provinces north of the Hindu Kush by the reduction of the last mountain strongholds of the native princes. In one of them he captured Roxana, the daughter of Oxyartes, whom he made his wife. Before the summer of 327 he had once more crossed the Hindu Kush on his way to India (for the campaigns in the N.E. see F. von Schwarz, *Alex. d. Grossen Feldzuge in Turkestan*, 1893, v.).

Whilst the heavier troops moved down the Kabul valley to Pencelaotis (Chārsadda) under Perdiccas and Hephaestion, Alexander with a body of lighter-armed troops and cavalry pushed up the valleys which join the Kabul from the north—through the regions now known as Bajour, Swat and Buner, inhabited by Indian hill peoples, as fierce then against the western intruder as their Pathan successors are against the British columns. The books give a number of their "cities" reduced by Alexander—walled mountain villages which can in some cases be identified more or less certainly with places where the clans are established to-day. The crowning exploit was the reduction of Aornus,[1] a stronghold perched on a precipitous summit above the Indus, which it was said that Heracles had failed to take. How much of the story of Alexander's discovery of the sacred mountain of the Nysa and the traces of Dionysus is due to the invention of Aristobulus and Clitarchus (Arrian did not find it in Ptolemy) we cannot say. Meantime Perdiccas and Hephaestion had built a bridge over the Indus, and by this in the spring of 326 Alexander passed into the Punjab (at Ohind, 16 m. above Attock, according to Foucher, *Notes sur la géogr. anc. du Gandhāra*, 1902). The country into which he came was dominated by three principalities, that of Ambhi (Gr. *Omphis*, Curt. viii. 12. 6) between the Indus and the Hydaspes (*Jhelum*, *Jehlam*), centred in the great city of Takkasila (Gr. *Taxila*), that of the Paurara rajah (Gr. *Porus*) between the Hydaspes and Acesines (*Chenab*), and that of Abhisara (Gr. *Abisares*) between the same two rivers higher up, on the confines of Kashmir (Stein, *Rajatarangini*, transl. bk. i. 180, v. 217). The kings of Taxila and Porus were at enmity, and for this cause the invader could reckon upon Omphis as a firm ally. Porus was prepared to contest the passage of the Hydaspes with all his strength. Abisares preferred to play a double game and wait upon events. Alexander reached the Hydaspes just as the rains broke, when the river was already swollen. Porus held the opposite bank with a powerful army, including 200 elephants. Alexander succeeded in taking a part of his forces across the river higher up during a night of torrential rain, and then he fought the fourth and last of his pitched battles in Asia, the one which put to proof more shrewdly than any of the others the quality of the Macedonian army as an instrument of war, and yet again emerged victorious. Porus fell sorely wounded into his hands.[2] Porus had saved his honour, and now Alexander tried, and not in vain, to gain him as a friend. When he continued his progress eastwards across the Acesines, Porus was an active ally. Alexander moved along close under the hills. After crossing the Hydraōtes (Rāvī) he once more came into contact with hostile tribes, and the work of storming petty towns began again. Then the Hyphasis (Beas) was reached, and here the Macedonian army refused to go any farther. It was a bitter mortification to Alexander, before whose imagination new vistas had just opened out eastwards, where there beckoned the unknown world of the Ganges and its splendid kings. For three days the will of king and people were locked in antagonism; then Alexander gave way; the long eastward movement was ended; the return began.

The return.

Alexander left the conquered portion of India east of the Indus to be governed under Porus, Omphis of Taxila, and Abisares, the country west of the Indus under Macedonian governors, and set out to explore the great river to its mouth (for the organization of the Indian provinces, see especially Niese, vol. i. pp. 500 f.). The fleet prepared on the Hydaspes sailed in October, while a land army moved along the bank. The confluence of the Hydaspes and Acesines passed, the Macedonians were once more in a region of hostile tribes with towns to be stormed. It was at one of these, a town of the Malli, that a memorable incident occurred, such as characterized the personality of Alexander for all succeeding time. He leapt from the wall with only three companions into the hostile town, and, before the army behind him could effect an entrance, lay wounded almost to death.[3] He recovered and beat down the resistance of the tribes, leaving them annexed to the Macedonian satrapy west of the Indus. Below the confluence of the Punjab rivers into the single stream of the Indus the territory of loose tribes was succeeded by another group of regular principalities, under the rajahs called by the Greeks Musicanus, Oxycanus and Sambus. These opposed a national resistance to the Macedonians, the fires of which were fanned by the Brahmins, but still the strong arm of the western people prevailed. The rajah of Patala at the apex of the Indus delta abandoned his country and fled. It was the high summer of 325 when Alexander reached Patala. From here he explored both arms of the delta to the ocean, now seen by the Macedonians for the first time. He had determined that the Indus fleet should be used to explore this new world and try to find a waterway between the Indus and the Persian Gulf. A great part of the land-forces had been already sent off under Craterus in the earlier summer to return west by Kandahar and Seistan; the fleet was to sail under the Greek Nearchus from the Indus mouth with the winter monsoon; Alexander himself with the rest of the land-forces set out in October to go by the coast of Baluchistan, through the appalling sand-wastes of the Mekran.[1]

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[1] The best opinion now confirms Abbott's identification of Aornus with Mahāban—Deane, *Journ. R. Asiat. Soc.* (Oct. 1896), p. 673; Stein, *Report of an Archaeological Tour with the Buner Field Force* (Lahore, 1898), pp. 45-48.

[2] Beside V. Smith (cited below) see Schubert, "Die Porusschlacht," in *Rhein. Mus.* lvi., 1901, p. 543.

[3] There seems nothing to fix the exact spot of this town; the common identification with Multan is, according to Raverty and V. Smith, certainly wrong.

He would seem to have kept down to the coast until the headland of Ras Malan was reached, scattering before him the bands of Arabitae and Oritae who were the inhabitants of this well-provisioned tract. For the 150 miles between Ras Malan and Pasni Alexander was compelled by the natural barriers to march inland, and it was here that his troops sank under the horrors of heat and thirst and sand. The coast once regained, the way was easy; no such desert had to be traversed, when Alexander again struck inland for the chief city of the Gedrosians (Pura), and thence made his way into Carmania. Here the spent troops rested; here the army of Craterus joined them, and Nearchus came to announce his safe arrival at the entrance of the Persian Gulf.[2]

Illness and death.

The machine of empire had not functioned altogether smoothly while the king had been absent, and on Alexander's re-appearance many incapables and rogues in high office had to be replaced by better men. In Carmania, in Persis, complaints from the provinces continued to reach him, as well as the news of disorders in Macedonia and Greece. New orders and appointments served to bring the empire into hand again, and at Susa in the spring of 324 Alexander rested, the task of conquering and compassing the Achaemenian realm achieved. The task of its internal reorganization now began to occupy him—changes, for instance, in the military system which tended to assimilate Macedonians and Orientals. The same policy of fusion was furthered by the great marriage festival at Susa, when Alexander took two more wives from the Persian royal house, married a number of his generals to Oriental princesses, and even induced as many as he could of the rank-and-file to take Asiatic wives. This policy did not allay the discontent of the Macedonian army, and when Alexander in the summer of 324 moved to the cooler region of Media, an actual mutiny of the Macedonians broke out on the way at Opis on the Tigris. It was occasioned by the discharge of the Macedonian veterans, and only the personal magnetism of Alexander and his threat to entrust himself altogether to the Orientals availed to quell it. At Ecbatana the death of Hephaestion for a time plunged Alexander into a passion of mourning. But by the winter (324–323) he was again active, bringing the hill-tribes on the S.W. border of Media, the Cossaei, into subjection. In the spring of 323 he moved down to Babylon, receiving on the way embassies from lands as far as the confines of the known world, for the eyes of all nations were now turned with fear or wonder to the figure which had appeared with so superhuman an effect upon the world's stage. The embassy from Rome, however, is almost certainly a later, and an inevitable, invention. The exploration of the waterways round about the empire was Alexander's immediate concern, the discovery of the presumed connexion of the Caspian with the Northern Ocean, the opening of a maritime route from Babylon to Egypt round Arabia. The latter enterprise Alexander designed to conduct in person; under his supervision was prepared in Babylon an immense fleet, a great basin dug out to contain 1000 ships, and the water-communications of Babylonia taken in hand. Innovations were carried out in the tactical system of the army which were to modify considerably the methods of future battle-fields. At last all was ready; the 20th of the month Daesius (? June 5) was fixed for the king's setting forth. On the 15th and 16th Alexander caroused deep into the night at the house of the favourite Medius. On the 17th he developed fever; for a time he treated it as a momentary impediment to the expedition; but on the 27th his speech was gone, and the Macedonian army were suffered to pass man by man through his chamber to bid him farewell. On the 28th (? June 13) Alexander died.[3]

His son by Roxana, the so-called ALEXANDER "AEGUS," was born a few months later. He and his uncle Philip, as joint kings, were placed under the guardianship of Perdiccas, Peithon and Antipater in succession. After the death of Antipater (319) Roxana fled with him to Epirus, and was afterwards taken back to Macedonia, together with Olympias, by Polyperchon. All three fell into the hands of Cassander; Alexander and his mother were in 310–309 put to death by order of Cassander (Justin xiv. 6, xv. 2). The meaningless surname of *Aegus*, still given in some books to this Alexander, is derived simply from a modern misreading of the text of the Astronomical Canon, ΑΙΓΟΥ for ΑΛΛΟΥ.

Character and policy.

Alexander the Great is one of the instances of the vanity of appealing from contemporary disputes to "the verdict of posterity"; his character and his policy are estimated to-day as variously as ever. Certain features—the high physical courage, the impulsive energy, the fervid imagination—stand out clear; beyond that disagreement begins. That he was a great master of war is admitted by most of those who judge his character unfavourably, but even this has been seriously questioned (*e.g.* by Beloch, *Griech. Gesch.* iii. (i.), p. 66). There is a dispute as to his real designs. That he aimed at conquering the whole world and demanded to be worshipped as a god is the traditional view. Droysen denies the former, and Niese maintains that his ambition was limited by the bounds of the Persian empire and that the claim to divine honours is fabulous (*Historische Zeitschr.* lxxix., 1897, 1 f.). It is true that our best authority, Arrian, fails to substantiate the traditional view satisfactorily; on the other hand those who maintain it urge that Arrian's interests were mainly military, and that the other authorities, if inferior in trustworthiness, are completer in range of vision. Of those, again, who maintain the traditional view, some, like Niebuhr and Grote, regard it as convicting Alexander of mad ambition and vainglory, whilst to Kaerst Alexander only incorporates ideas which were the timely fruit of a long historical development. The policy of fusing Greeks and Orientals again is diversely judged. To Droysen and Kaerst it accords with the historical conditions; to Grote and to Beloch it is a betrayal of the prerogative of Hellenism.

Some notion of the personal appearance of Alexander may be got from the literature and the surviving monuments. He is described as of an athletic frame, though not taller than the common, and a white and ruddy complexion. The expression of his eyes had something "liquid and melting" (*τῶν ὀμμάτων τὴν διάχυσιν καὶ ὑγρότητα*), and the hair which stood up over his forehead gave the suggestion of a lion. He had a way of carrying his head somewhat aslant. (See especially Plut. *Alex.* 4; *de Alex. fort.* ii. 2.) The greatest masters of the time executed portraits of him, Lysippus in sculpture, Apelles in painting and Pyrgoteles in graven gems. Among surviving monuments, we have no completely certified portraits except the Tivoli herm (now in the Louvre) and the coins struck by his successors. The herm is a dry work and the head upon the coins shows various degrees of idealization. There are, however, a considerable number of works which can make out a better or worse claim either to be portraits of Alexander or to reproduce his type, and a large field of discussion is therefore open as to their values and classification (F. Kopp, *Über das Bildnis Alexanders d. Grossen* (1892); K. J. Ujfalvy, *Le Type physique d'Alexandre le Grand* (1902); T. Schreiber, *Studien über das Bildnis Alexanders d. Grossen* (1903); J. J. Bernoulli, *Die erhaltenen Darstellungen Alexanders d. Grossen* (1905). Alexander shaved clean, and set the fashion in this respect for the Graeco-Roman world for the next 500 years.

BIBLIOGRAPHY.—The campaigns and life of Alexander did not lack contemporary historians, some of them eye-witnesses and even associates. They included the philosopher Callisthenes, put to death by Alexander in 327, whose history went up to the death of Darius, Alexander's general Ptolemy, afterwards king in Egypt, Nearchus who commanded the fleet that sailed from the Indus to the Persian Gulf, Onesicritus who served as pilot in the same fleet, Aristobulus who was with Alexander in India, Clitarchus, a contemporary, if not an eye-witness, important from the fact that his highly coloured version of the life of Alexander became the popular authority for the succeeding centuries. Besides the historical narrative, there were works mainly geographical or topographical left by persons like Baeton and Diognetus, whom Alexander had employed (as *βηματισταί*) to survey the roads over which he passed. All such original sources have now perished. The fragments are collected in the Didot edition of Arrian by Karl Müller. Not reckoning scattered notices, we depend principally upon five later compositions, Diodorus, book xvii. (*c.* 20 B.C.), the work of Quintus Curtius (*c.* A.D. 42), Plutarch's (*c.* 45–125 A.D.) *Life of Alexander*, Arrian's *Anabasis* and *Indica* (*c.* A.D. 150), and the relevant books of Justin's abridgment (2nd cent. A.D.) of the history of Trogus (*c.* 10 B.C.?). To these we may add the Latin *Itinerarium Alexandri*, a skeleton outline of Alexander's campaigns dedicated to the emperor Constantius (A.D. 324–361), printed at the end of the Didot edition of Arrian, and the *Epitome Rerum Gestarum Alexandri magni*, an abridgment made in the 4th or 5th century of a lost Latin work of uncertain date, combining history with elements taken from the *Romance* (edited by O. Wagner, Leipzig, 1900). The relation of these works to the various original sources constitutes the critical problem before the modern historian in reference to the history of Alexander. See Droysen vol. i. appendix i.; A. Schoene, *De rerum Alexandri Magni scriptorum imprimis Arriani & Plutarchi fontibus* (1870); Fraenkel, *Die Geschichtschreiber Alex. d. Grossen* (1883); O. Maas, *Kleitarch und Diodor* (Petersburg, 1894); Kaerst, *Forschungen zur Gesch. Alex. d. Grossen* (1887), and *Gesch. d. hellenist. Zeitalters* (vol. i., 1901), pp. 421 f.; F. L. Schoenle, *Diodorstudien* (1891); E. Schwartz, articles "Aristobulos (14)," "Arrianus," "Quintus Curtius," "Diodorus" in Pauly-Wissowa's *Realencyclopädie*.

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[1] For the Indian campaigns of Alexander see especially McCrindle, *Invasion of India by Alexander the Great* (1896); Vincent A. Smith, *Early History of India* (1904), and the references there given to the researches of Sir T. H. Holdich, Raverty and Foucher; A. Anspach, *De Alex. Magni exped. ind.* (1903).

[2] Tomaschek, "Topographische Erläuterung der Kustenfahrt Nearchs" in the *Sitzungsberichte der kaiserl. Akad. d. Wissensch.* of Vienna (*Philosoph.-histor. Klasse*, vol. cxxi.); Major P. M. Sykes, *Ten Thousand Miles in Persia* (1902), pp. 166 f.

[3] For Alexander's funeral, see F. Jacoby in *Rhein. Mus.* (1903), pp. 461 f.

For modern views of Alexander see Thirlwall, *History of Greece*; Niebuhr, *Lectures on Ancient History* (Eng. trans. rev. by author, 1852); Grote, *History of Greece*; Droysen, *Histoire de l'Hellénisme* (translation by Bouché-Leclerq); Ad. Holm, *History of Greece* (Eng. trans., 1898); B. Niese, *Gesch. der griech. u. maked. Staaten* (vol. i.); Kaerst, *Gesch. des hellenist. Zeitalters* (1901); J. Beloch, *Griechische Gesch.* (vol. iii., 1904); J. B. Bury, *History of Greece* (1902); A. von Gutschmid, *Geschichte Irans* (1888). Among the mass of monographs and special articles, reference may be made to Freeman, *Historical Essays*, 2nd series, pp. 182 f.; Dodge, *Alexander* (in a series called *Great Captains*) 1890; Mahaffy, *Problems in Greek History* (1892), ch. viii.; D. G. Hogarth, *Philip and Alexander of Macedon* (1897), a striking effort of historical imagination to reconstruct Alexander as a man of the real world; Benjamin I. Wheeler, *Alexander the Great* (1900) in the "Heroes of the Nations Series." The purely military aspect of Alexander's campaigns is treated in general histories of warfare (Rustow-Kochly, Bauer, Delbrück, Verdy du Vernois), and in special monographs by Hogarth, *Journ. of Philol.* vol. xvii., 1888, pp. 1 foll.; H. Droysen, *Untersuchungen über A. des Gr. Heerwesen* (1885), and Graf Yorck von Wartenburg, *Kurze Übersicht der Feldzüge A. de Gr.* (1897). For further references to the literature on Alexander, see Kaerst's article in Pauly-Wissowa's *Realencyclopädie* (1894). (E. R. B.)

The Romance of Alexander.

The figure of Alexander naturally impressed itself upon the imagination of the world which his career had shaken. Even in India we are told that he was held in honour by the native kings who took his farthest provinces in possession. But Eastern tradition, so tenacious of the old myths of primitive man, has a short memory for actual history, and five centuries later Alexander was only remembered in Irān as the accursed destroyer of the sacred books, whose wisdom he had at the same time pilfered by causing translations to be made into "Roman." That the East to-day has so much to tell about Alexander is only due to the fact that old mythical stories of gods or heroes who go travelling through lands of monsters and darkness, of magical fountains and unearthly oceans, became attached to his name in the popular literature of the Roman empire, and this mythical Alexander was reintroduced in the 7th century A.D. into the farther East, where the historical Alexander was almost forgotten. The romance of Alexander is found written in the languages of nearly all peoples from the Indian Ocean to the Atlantic, but all these versions are derived, mediately or immediately, from the Greek original which circulated under the false name of Callisthenes. The Greek pseudo-Callisthenes (otherwise Aisopos we possess in three recensions, based all upon a book produced in Egypt in the 2nd century A.D. But this book itself was a farrago of heterogeneous elements—pieces of genuine history, ancient stories once told in Babylon of Gilgamesh or Etanna, literary forgeries of the days soon after Alexander, like the oldest part of the "Testament of Alexander," variations due to Egyptian patriotic sentiment, like that which made Alexander the son of the last Pharaoh, Nectanebus. As the story was reproduced, variations were freely introduced according to the bent of different times and peoples; in the Persian version Alexander (Iskander) became a son of Darius; among the Mahommedans he turned into a prophet, hot against idols; the pen of Christian monks made him an ascetic saint.

The Alexander romance found its way into Europe through the medium of Latin, but originated mainly from the versions of the pseudo-Callisthenes, not from the more sober narrative of Quintus Curtius. The pseudo-Callisthenes, in a recension which has not been preserved, was translated into Latin by Julius Valerius about the end of the 3rd century, and an epitome of this translation, also in Latin, was made some time before the 9th century, and is introduced by Vincent de Beauvais into his *Speculum historiale*. Much of the legend is a running travesty of the true history of the conqueror. The first book deals with his birth and early exploits. The trace of Alexandrian influence is to be found in the pretence that his actual father was Nectanebus, a fugitive king of Egypt. The latter was a great magician, able, by operating upon waxen figures of the armies and ships of his enemies, to obtain complete power over their real actions. Obliged, however, to flee to Pella in Macedonia, he established himself as an astrologer, and as such was consulted by the childless Olympias. Having promised that Zeus Ammon would visit her in the form of a dragon, he himself assumed the disguise. In due course Alexander was born, and Philip's suspicions were overcome by a second appearance of the dragon, which was held to prove the divine fatherhood. The child was small and somewhat deformed, but of great courage and intelligence. When he was twelve years old he was instructed in starcraft by Nectanebus, who was killed by a fall into a pit, into which he had been playfully pushed by Alexander. The first book also relates his conquests in Italy, Africa, Syria and Asia Minor; his return to Macedonia and the submission of Greece. The second book continues the history of his conquests, and the third contains the victory over Porus, the relations with the Brahmins, the letter to Aristotle on the wonders of India, the histories of Candace and the Amazons, the letter to Olympias on the marvels of Farther Asia, and lastly the account of Alexander's death in Babylon.

The most wide-spread Latin version of the story, however, was the *Historia de proeliis*,[1] printed at Strassburg in 1486, which began to supersede the *Epitome* of Julius Valerius in general favour about the end of the 13th century. It is said to have been written by the Neapolitan arch-presbyter Leo, who was sent by Johannes and Marinus, dukes of Campania (941–965) to Constantinople, where he found his Greek original. Auxiliary sources for the medieval romance-writers were:—the opuscule (4th century) known as *Alexandri magni iter ad Paradisum*, a fable of Eastern origin directed against ambition; the *Itinerarium Alexandri* (340), based partly on Julius Valerius and dedicated to Constans, son of the emperor Constantine; the letter of Alexander to Aristotle (*Epist. de situ et mirabilibus Indiae*), and the correspondence between Alexander and the king of the Brahmins, Dindimus, both of which are often contained in MSS. of the *Epitome*; and the treatise (based on a lost history of Alexander by Onesicritus), *De gentibus Indiae et Bragmanibus*, ascribed without certainty to Palladius (d. *c.* 430), successively bishop of Helenopolis and Aspona.

The Ethiopic versions are of great interest as a striking example of literary "accommodation." Not only is the whole atmosphere Christian in colouring, but we actually find the Greek gods in the guise of Enoch, Elijah, &c., while Philip is a Christian martyr, and Alexander himself a great apostle, even a saint; quotations from the Bible are frequent. Syriac and Armenian versions were made in the 5th century. Persians and Arabs told the deeds of Iskander; and Firdousi made use of the story in the *Shâhnâma*. Another early Persian poet, Nizami, made the story specially his own. The crusaders brought back fresh developments; Gog and Magog (partly Arab and partly Greek) and some Jewish stories were then added. In the 11th century Simeon Seth, *protovestiarius* at the Byzantine court, translated the fabulous history from the Persian back into Greek.

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[1] *Nativitas et victoriae Alexandri magni regis* was the original title.

The Alexander legend was the theme of poetry in all European languages; six or seven German poets dealt with the subject, and it may be read in French, English, Spanish, Danish, Swedish, Icelandic, Flemish and Bohemian.

French.—The earliest known French romance of Alexander, by Alberic of Besançon (or more properly Briançon), was, until the discovery of a fragment of 100 lines at Florence in 1852, known only through the German adaptation by Lamprecht the preacher, who wrote towards the end of the 12th century, and by the version made by a Poitevin poet named Simon in decasyllabic lines. Alberic followed the epitome of Julius Valerius. He had some knowledge of authentic history, and rejected the more marvellous elements of the story. The French feudal romance, *Li Romans d'Alexandre*, was written in the 12th century by Lambert li Tors of Chateâudun, Alexandre de Bernai, surnamed de Paris, and others. It contained 20,000 lines, and was written in twelve-syllabled lines, whence the term "alexandrine" verse. The authors endowed Alexander with the fashionable virtues of the chivalric hero, making him especially the type of lavish generosity. They used as their sources Valerius, the letter to Aristotle and the *Iter ad Paradisum*, adding much of their own. Pierre de Saint Cloud, the writer of the fourth section of the romance, was evidently acquainted with the *Historia de proeliis*. The incident of the *Fuerre de Gadres* (Foray of Gaza), interpolated in the second section, is assigned to a certain Eustache. The redaction of the whole work is due to Alexandre de Bernai, who replaced the original assonance by rhyme. According to all the traditions of romance it was necessary to avenge the death of Alexander. At the end of the 12th century Gui de Cambrai and Jean le Nevelon (or Nevelaux or Venelais), each wrote a *Vengeance d'Alexandre*. Jean le Nevelon relates how Alior, the son of Alexander and Candace, avenged his father's death on Antipater and others. Between 1310 and 1315 Jacques de Longuyon (or Langhion) introduced into the account of the Indian war *Les Vœux du paon*, a romanesque and fantastic episode very loosely connected with Alexander. It is interesting for its connexion with the 15th-century romance of *Perceforest*, since in it Alexander visits Britain, where he bestows Scotland on Gadifer and England on Betis (otherwise Perceforest). *Les Vœux du paon* enjoyed great popularity, and had two sequels, *Le Restor du paon*, written before 1338 by Jean Brisebarre de Douai, and *Le Parfait du paon*, written in 1340 by Jean de la Mote. *Florimont*, a 12th-century poem by Aimon de Varenne, relates to a fictitious personage said to have been the grandfather of Alexander. This poem gave rise to two prose romances—*La Conqueste de Grece faicte par Philippe de Madien*, by Perrinet du Pin, first printed in 1527, and *Histoire du roi Florimond* (1528). Quintus Curtius was largely used for the *Alexandreis* (*c.* 1180) of Gaultier de Lille or de Châtillon (Galtherus ab Insulis or de Castellione). It is a Latin poem in ten books of hexameters, and contains a curious admixture of Biblical history. It was translated at the end of the next century into Flemish by J. van Maerlant and into German by Ulrich von Eschenbach.

Of the French prose versions of the *Historia de proeliis* may be noticed the late romance, *L'Histoire du noble et vaillant roy Alixandre le Grant* (1506). After an account of the ancient history of Macedonia and of the intrigue of Nectanebus we are told how Philip dies, and how Alexander subdues Rome and receives tribute from all European nations. He then makes his Persian expedition; the Indian campaign gives occasion for descriptions of all kinds of wonders. The conqueror visits a cannibal kingdom and finds many marvels in the palace of Porus, among them a vine with golden branches, emerald leaves and fruit of other precious stones. In one country he meets with women who, after the burial in the winter, become alive again in the spring full of youth and beauty. Having reached the ends of the earth and conquered all nations, he aspires to the dominion of the air. He obtains a magic glass cage, yoked with eight griffins, flies through the clouds, and, thanks to enchanters who know the language of birds, gets information as to their manners and customs, and ultimately receives their submission. The excessive heat of the upper regions compels him to descend, and he next visits the bottom of the sea in a kind of diving-bell. The fish crowd round him and pay homage. Alexander returns to Babylon, is crowned with much pomp and mass is celebrated. He dies by poison soon afterwards.

English Versions.—The Alexander cycle was no less popular in Great Britain. The letter from Alexander to Aristotle and his correspondence with Dindimus are found in Early English versions dating from the 11th century. These are printed by O. Cockayne in his *Narratiunculae Anglice conscriptae* (1861). The Monk (*De Cas. ill. vir.*) in Chaucer's *Canterbury Tales* prefaces his account of Alexander with the statement that his story is so common

> That every wight that hath discrecioun
> Hath herd somewhat or all of his fortune.

There are two considerable fragments of an English alliterative romance on the subject written in the west midland dialect, and dating from the second half of the 14th century. The first, *The Gestes of the Worthy King and Emperor Alisaunder of Macedoine* (ed. W. W. Skeat, E.E.T.S., 1877, with *William of Palerme*) contains an account of the wars of Philip, of Nectanebus and of the education of Alexander. A second fragment (ed. Skeat, E.E.T.S., 1878) contains Alexander's visit to the Gymnosophists and his correspondence with Dindimus. Another alliterative poem in the northern dialect, of 15th-century origin, is based on the *Historia de proeliis*, and was edited by Skeat for the E.E.T.S. (1886) as *The Wars of Alexander*. Earlier than any of these is the rhyming *Lyfe of Alisaunder* (*c.* 1330) which is printed in H. Weber's *Metrical Romances* (vol. i., 1810). It is written in unusually picturesque and vigorous language, and is based on the *Roman de toute chevalerie*, a French compilation made about 1250 by a certain Eustace or Thomas of Kent. Fragments of another rhyming poem (pr. *c.* 1550) are preserved in the British Museum. *The Scots Buik of the most noble and vailyzeand Conqueror Alexander the Great*, printed by Alexander Arbuthnot (d. 1585) about 1580, reprinted in 1831 for the Bannatyne Club, is not really a life. It contains three episodes of the cycle, the "Forray of Gadderis" (not taken from the *Fuerre de Gadres* but from the *Assaut de Tyr* in the *Romans d'Alixandre*), "The Avowes of Alexander," and "The Great Battel of Effesoun," taken from the *Vœux du paon*. Many passages in John Barbour's *Bruce* are almost identical with this book, and it is suggested by G. Neilson (*John Barbour, Poet and Translator*, London, 1900) that Barbour was the author, although the colophon states that it was written in 1438. Bruce at Bannockburn makes the same oration as Alexander at "Effesoun." *A Buke of the Conqueror Alexander the Great* by Sir Gilbert Hay (fl. 1456) is in MS. at Taymouth Castle.

BIBLIOGRAPHY.—The best sketch of the Alexander romance literature is by Paul Meyer, *Alexandre le grand dans la littérature française au moyen âge* (2 vols., Paris, 1886). The first volume contains some French texts, and the second a detailed discussion of the various versions from the pseudo-Callisthenes downwards. See also J Zacher, *Pseudo-Callisthenes*, *Forschungen zur . . . . Alexandersage* (Halle, 1867), and for Oriental versions, T. Nöldeke, "Beiträge zur Geschichte des Alexanderromans" (*Denkschriften der ksl. Akad. d. Wissenschaften, Phil.-hist. Klasse*, vol. 38: Vienna, 1890). For early printed versions see Brunet, *Manuel du libraire*, s.v. "*Alexandre.*"

The text of the pseudo-Callisthenes was edited by C. W. Muller from three MSS. in the Bibl. Nat. and printed in the Arrian of the Coll. Didot (Paris, 1846), and by H. Meusel (Leipzig, 1871) from a Leiden MS. A. Mai edited Julius Valerius (Milan, 1817) and the *Itinerarium Alexandri* (Class. Auct. vol. vii.; Milan, 1835); J. Zacher, the *Epitome* (Halle, 1867) and *Alex. iter ad Paradisum* (Regensburg, 1859); the Oxford MS. of the *Epitome* was edited by G. Cilli (Strassburg, 1905); G. Landgraf, *Die "Vita Alexandri" . . . des Archpresbyter Leo* (*Historia de proeliis*), (Erlangen, 1885); Alexander's letter to Aristotle and his correspondence with Dindimus are included in the Teubner edition of Julius Valerius (ed. B. Kübler, Leipzig, 1888). A newly discovered anonymous *Epitome* was edited by O. Wagner (Leipzig, 1900).

The fragment by Alberic was edited by P. Heyse (Berlin, 1856); Lamprecht's German text by H. Weismann (Frankfort, 1850) and by C. Kinzel (Halle, 1884); the *Alexandreis* of Gaultier de Lille, by F. A. W. Müldener (Leipzig, 1863); an Icelandic prose version (*c.* 1250) of the same, *Alexanders Saga*, by C. R. Unger (Christiania, 1848); *Li Romans d'Alixandre*, by H. Michelant (Stuttgart, 1846); the Ethiopic version by E. A. T. Wallis Budge (1896, 2 vols., with English translation); the Syriac text of pseudo-Callisthenes by Budge (Cambridge, 1889); cp. K. F. Weymann, *Die äthiopische und arabische Übersetzungen des Pseudo-Kallisthenes* (Kirchhain, 1901).

Besides the English editions quoted in the text, the alliterative English poems were partially edited by J. Stevenson for the Roxburghe Club (1849). There is a great deal of information on the various texts in H. L. Wood's *Catalogue of Romances in the British Museum* (1883, vol. i. pp. 94 et seq.). See also A. Hermann, *Untersuchungen über das Scottische Alexanderbuch* (1893); and *Unters. über das med. Gedicht, The Wars of Alexander* (Berlin, 1889). Among other works see E. Rohde, *Der griechische Roman* (2nd ed. Leipzig, 1900); B. Meissner, *Alexander u. Gilgamos* (Leipzig, 1894); F. Kampers, "Alex. d. Grosse und die Idee des Weltimperiums in Prophetie und Sage" (in H. Granert's *Studien*, &c., Freiburg, 1901); Adolf Ausfeld, *Der griechische Alexanderroman* (Leipzig, 1907), edited after the author's death by W. Kroll; Wilhelm Hertz, "Aristoteles in den Alex. Dichtungen d. Mittelalters" (*Kgl. Acad. d. Wissenschaften*, Munich, 1891); H. Becker, *Die Brahmanen in d. Alex. Sage* (Königsberg, 1889). (M. Br.)

ALEXANDER, tagus or despot of Pherae in Thessaly, ruled from 369 to 358 B.C. His tyranny caused the Aleuadae of Larissa to invoke the aid of Alexander II. of Macedon, whose intervention was successful, but after his withdrawal Alexander treated his subjects as cruelly as before. The Thessalians now applied to Thebes; Pelopidas, who was sent to their assistance, was treacherously seized and thrown into prison (368), and it was necessary to send Epaminondas with a large army to secure his release. Alexander's conduct caused renewed intervention; in 364 he was defeated at Cynoscephalae by the Thebans, although the victory was dearly bought by the loss of Pelopidas, who fell in the battle. Alexander was at last crushed by the Thebans, compelled to acknowledge the freedom of the Thessalian cities and to limit his rule to Pherae, and forced to join the Boeotian league. He was murdered by his wife's brother at her instigation. Ancient accounts agree in describing Alexander as a typically cruel and suspicious tyrant.

ALEXANDER (1461–1506), king of Poland and grand-duke of Lithuania, fourth son of Casimir IV., king of Poland, was elected grand-duke of Lithuania on the death of his father in 1492, and king of Poland on the death of his brother John Albert in 1501. His extreme impecuniosity made him from the first subservient to the Polish senate and nobles (*szlachta*), who deprived him of the control of the mint—then one of the most lucrative sources of revenue of the Polish kings—curtailed his prerogative, and generally endeavoured to reduce him to a subordinate position. This ill-timed parsimony reacted injuriously upon Polish politics. Thus, for want of funds, Alexander was unable to assist the Grand Master of the Order of the Sword against Muscovite aggression, or prevent Tsar Ivan III. from ravaging Lithuania with the Tatars. The utmost the king could do was to garrison Smolensk and other fortresses and employ his wife Helena, the tsar's daughter, to mediate a truce between his father-in-law and himself. During his reign Poland suffered much humiliation from the attempts of her subject principalities, Prussia and Moldavia, to throw off her yoke. Only the death of Stephen, the great hospodar of Moldavia, enabled Poland still to hold her own on the Danube; while the liberality of Pope Julius II., who issued no fewer than 29 bulls in favour of Poland and granted Alexander Peter's Pence and other financial help, enabled the Polish king to restrain somewhat the arrogance of the Teutonic Order. In Alexander the characteristic virtues of the Jagiellos, patience and generosity, degenerated into slothfulness and extravagance. Frequently he was too poor to pay the expenses of his own table. But he never felt at home in Poland, and bestowed his favour principally upon his fellow-countrymen, the most notable of whom was the wealthy Lithuanian magnate Michael Glinsky, who justified his master's confidence by his great victory over the Tatars at Kleck (August 5, 1506), the news of which was brought to Alexander on his deathbed.

See V. Czerny, *The Reigns of John Albert and Alexander Jagiello* (Pol.) (Cracow, 1882).

ALEXANDER, the name of eight popes:—

Alexander I. was bishop of Rome from about 106 to 115. He has been identified, without any foundation, with Alexander, a martyr of the Via Nomentana, whose day is the 3rd of May.

Alexander II. (Anselmo Baggio), pope from 1061 to 1073, was a native of Milan. As bishop of Lucca he had been an energetic coadjutor with Hildebrand in endeavouring to suppress simony, and to enforce the celibacy of the clergy. His election, which Hildebrand had arranged in conformity with the decree of 1059 (see Nicholas II.), was not sanctioned by the imperial court of Germany. This court, faithful to the practice observed by it in the preceding elections, nominated another candidate, Cadalus, bishop of Parma, who was proclaimed at the council of Basel under the name of Honorius II., marched to Rome, and for a long time jeopardized his rival's position. At length, however, he was abandoned by the Germanic court and deposed by a council held at Mantua; and Alexander's position remained unchallenged. Alexander was succeeded by his associate Hildebrand, who took the title of Gregory VII. (L. D.*)

Alexander III. (Orlando Bandinelli), pope from 1159 to 1181, was a Siennese, and as a teacher of canon law in Bologna composed the *Stroma* or the *Summa Magistri Rolandi*, one of the earliest commentaries on the Decretum Gratiani. In October 1150 Eugenius III. created him cardinal deacon SS. Cosmae and Damiani; later he became cardinal priest of St Mark's. Probably about this time he composed his *Sentences*, based on the *Introductio ad theologiam* of Abelard. In 1153 he became papal chancellor, and was the leader of the cardinals opposed to Frederick Barbarossa. On the 7th of September 1159 he was chosen the successor of Adrian IV., a minority of the cardinals, however, electing the cardinal priest Octavian, who assumed the name of Victor IV. This antipope, and his successors Paschal III. (1164–1168) and Calixtus III. (1168–1178), had the imperial support; but after the defeat of Legnano, Barbarossa finally (in the peace of Venice, 1177) recognized Alexander as pope. On the 12th of March 1178 Alexander returned to Rome, which he had been compelled to leave twice, namely, from 1162 until the 23rd of November 1165, and again in 1167. The first period he spent in France, the latter chiefly in Gaeta, Benevento, Anagni and Venice. In March 1179 Alexander held the third Lateran synod, a brilliant assemblage, reckoned by the Roman church as the eleventh oecumenical council; its acts embody several of the pope's proposals for the betterment of the condition of the church, among them the present law requiring that no one may be elected pope without the votes of two-thirds of the cardinals. This synod marks the summit of Alexander's power. Besides checkmating Barbarossa, he had humbled Henry II. of England in the affair of Thomas Becket, he had confirmed the right of Alphonso I. of Portugal to the crown, and even as a fugitive had enjoyed the favour and protection of Louis VII. of France. Nevertheless, soon after the close of the synod the Roman republic forced Alexander to leave the city, which he never re-entered; and on the 29th of September 1179 some nobles set up the antipope Innocent III. By the judicious use of money, however, Alexander got him into his power, so that he was deposed in January 1180. In 1181 Alexander excommunicated William the Lion of Scotland and put the kingdom under the interdict. The great pope died at Civita Castellana on the 30th of August 1181.

See Herzog-Hauck, *Realencyklopädie*, 3rd ed., i. 340-344; Wetzer and Welte, *Kirchenlexikon*, 2nd ed., 1481. The most elaborate biography is H. Reuter, *Geschichte Alexanders III. und der Kirche seiner Zeit* (3 vols., 2nd ed., Leipzig, 1860). (W. W. R.*)

Alexander IV. (Rinaldo), pope from 1254 to 1261, was, like Innocent III. and Gregory IX., a member of the family of the counts of Segni. His uncle Gregory IX. made him cardinal deacon in 1227 and cardinal bishop of Ostia in 1231. On the death of Innocent IV. he was elected pope at Naples on the 12th of December 1254. He is described as a stout man, kindly, cheerful, but of no great brilliancy. He succeeded Innocent IV. as guardian of Conradin, the last of the Hohenstaufen, promising him his benevolent protection; but in less than a fortnight he conspired against him and bitterly opposed Conradin's uncle Manfred. Alexander fulminated with excommunication and interdict against the party of Manfred, but in vain; nor could he enlist the kings of England and Norway in a crusade against the Hohenstaufen. Rome itself became too Ghibelline for the pope, who withdrew to Viterbo, where he died on the 25th of May 1261. His pontificate was signalized by efforts to unite the Greek and Latin churches, by the establishment of the Inquisition in France, by favours shown to the mendicant orders, and by an attempt to organize a crusade against the Tatars.

The registers of Alexander IV. are published by Bourel de la Roncière and others in the *Bibliothèque des Écoles françaises d'Athènes et de Rome*, Paris, 1895 ff. (W. W. R.*)

Alexander V. (Peter Philargès), pope 1409–1410, was born in Crete of unknown parents and entered the order of St Francis, for which, as for the other mendicant orders, he later manifested his affection in a striking manner. He was a member in turn of the universities of Oxford and Paris, and finally settled in Lombardy, where, thanks to the favour of Gian Galeazzo Visconti, he became bishop, first of Piacenza, then of Vincenza, then of Novara, and afterwards archbishop of Milan. On being created cardinal by Innocent VII. he devoted all his energies from 1408 onwards to the realization of the union of the church, in spite of the two rival popes. He was one of the promoters of the council of Pisa, and after that assembly had declared Gregory XII. and Benedict XIII. deposed, the cardinals assembled in conclave thought they could not do better than crown with the tiara this cosmopolitan prelate, who had an equal mastery of the Latin and Greek languages, and was renowned not only for his learning in theology but for his affability (June 26, 1409). As a matter of fact, the only effect of this election was to aggravate the schism by adding a third to the number of rival pontiffs. During his short reign of ten months Alexander V.'s aim was to extend his obedience with the assistance of France, and, notably, of the duke Louis II. of Anjou, upon whom he conferred the investiture of the kingdom of Sicily, together with the title of gonfalonier of the church. He proclaimed and promised rather than effected a certain number of reforms: the abandonment of the rights of "spoils" and "procurations," the re-establishment of the system of canonical election in the cathedral churches and principal monasteries, &c. But death came upon him almost without warning at Bologna, in the night of the 3rd-4th May 1410. A rumour went about that he had been poisoned by the cardinal Baldassare Cossa, impatient to be his successor, who succeeded him in fact under the name of John XXIII. The crime has, however, never been proved, though a Milanese physician, who performed the task of dissecting the corpse of Peter Philargès, seems to have thought that he found traces of poison. (N. V.)

Alexander VI. (Rodrigo Borgia) (1431–1503), pope from 1492 to his death, is the most memorable of the corrupt and secular popes of the Renaissance. He was born (January 1, 1431) at Xativa, near Valencia in Spain, and his father's surname was Lanzol or Llançol; that of his mother's family, Borgia or Borja, was assumed by him on the elevation of his maternal uncle to the papacy as Calixtus III. (April 8, 1455). He studied law at Bologna, and after his uncle's election he was created successively bishop, cardinal and vice-chancellor of the church, an act of nepotism characteristic of the age. He served in the Curia under five popes and acquired much administrative experience, influence and wealth, although no great power; he was economical in his habits; on occasion he displayed great splendour and lived in a fine palace. His manners were agreeable and his appearance fascinating, but, like many other prelates of the day, his morals were far from blameless, his two dominant passions being greed of gold and love of women, and he was devotedly fond of the children whom his mistresses bore him. Although ecclesiastical corruption was then at its height, his riotous mode of life called down upon him a very severe reprimand from Pope Pius II., who succeeded Calixtus III. in 1458. Of his many mistresses the one for whom his passion lasted longest was a certain Vannozza (Giovanna) dei Cattani, born in 1442, and wife of three successive husbands. The connexion began in 1470, and she bore him many children whom he openly acknowledged as his own: Giovanni, afterwards duke of Gandia (born 1474), Cesare (born 1476), Lucrezia (born 1480), and Goffredo or Giuffre (born 1481 or 1482). His other children—Girolamo, Isabella and Pier Luigi—were of uncertain parentage. Before his elevation to the papacy Cardinal Borgia's passion for Vannozza somewhat diminished, and she subsequently led a very retired life. Her place in his affections was filled by the beautiful Giulia Farnese (Giulia Bella), wife of an Orsini, but his love for his children by Vannozza remained as strong as ever and proved, indeed, the determining factor of his whole career. He lavished vast sums on them and loaded them with every honour. A characteristic instance of the corruption of the papal court is the fact that Borgia's daughter Lucrezia (see Borgia, Lucrezia) lived with his mistress Giulia, who bore him a daughter Laura in 1492.

On the death of Pope Innocent VIII. the three likely candidates for the Holy See were Cardinals Borgia, Ascanio Sforza and Giuliano della Rovere; at no previous or subsequent election were such immense sums of money spent on bribery, and Borgia by his great wealth succeeded in buying the largest number of votes, including that of Sforza, and to his intense joy he was elected on the 10th of August 1492, assuming the name of Alexander VI. Borgia's elevation did not at the time excite much alarm, except in some of the cardinals who knew him, and at first his reign was marked by a strict administration of justice and an orderly method of government in satisfactory contrast with the anarchy of the previous pontificate, as well as by great outward splendour. But it was not long before his unbridled passion for endowing his relatives at the expense of the church and of his neighbours became manifest. For this object he was ready to commit any crime and to plunge all Italy into war. Cesare, then a youth of sixteen and a student at Pisa, was made archbishop of Valencia, his nephew Giovanni received a cardinal's hat, and for the duke of Gandia and Giuffre the pope proposed to carve fiefs out of the papal states and the kingdom of Naples. Among the fiefs destined for the duke of Gandia were Cervetri and Anguillara, lately acquired by Virginio Orsini, head of that powerful and turbulent house, with the pecuniary help of Ferdinand of Aragon, king of Naples (Don Ferrante). This brought the latter into conflict with Alexander, who determined to revenge himself by making an alliance with the king's enemies, especially the Sforza family, lords of Milan. In this he was opposed by Cardinal della Rovere, whose candidature for the papacy had been backed by Ferdinand. Della Rovere, feeling that Rome was a dangerous place for him, fortified himself in his bishopric of Ostia at the Tiber's mouth, while Ferdinand allied himself with Florence, Milan, Venice, and the pope formed a league against Naples (April 25, 1493) and prepared for war. Ferdinand appealed to Spain for help; but Spain was anxious to be on good terms with the pope to obtain a title over the newly discovered continent of America and could not afford to quarrel with him.

Alexander meditated great marriages for his children. Lucrezia had been married to the Spaniard Don Gasparo de Procida, but on her father's elevation to the papacy the union was annulled, and in 1493 she was married to Giovanni Sforza, lord of Pesaro, the ceremony being celebrated at the Vatican with unparalleled magnificence. But in spite of the splendours of the court, the condition of Rome became every day more deplorable. The city swarmed with Spanish adventurers, assassins, prostitutes and informers; murder and robbery were committed with impunity, heretics and Jews were admitted to the city on payment of bribes, and the pope himself shamelessly cast aside all show of decorum, living a purely secular and immoral life, and indulging in the chase, dancing, stage plays and indecent orgies. One of his boon companions was Jem, the brother of the sultan Bayezid, detained as a hostage.

The general political outlook in Italy was of the gloomiest, and the country was on the eve of the catastrophe of foreign invasion. At Milan Lodovico Sforza (il Moro) ruled, nominally as regent for the youthful duke Gian Galeazzo, but really with a view to making himself master of the state. He made many alliances to secure his position, but fearing himself isolated he sought help from Charles VIII. of France, and as the king of Naples threatened to come to the aid of Gian Galeazzo, who had married his granddaughter, he encouraged the French king in his schemes for the conquest of Naples. Alexander carried on a double policy, always ready to seize opportunities to aggrandize his family. But through the intervention of the Spanish ambassador he made peace with Naples in July 1493 and also with the Orsini; the peace was cemented by a marriage between the pope's son Giuffre and Doña Sancha, Ferdinand's grand-daughter. In order to dominate the Sacred College more completely he created twelve new cardinals, among them his own son Cesare, then only eighteen years old, and Alessandro Farnese, the brother of Giulia Bella, one of the pope's mistresses, creations which caused much scandal. On the 25th of January 1494 Ferdinand died and was succeeded by his son Alphonso II. Charles of France now advanced formal claims on the kingdom, and Alexander drew him to his side and authorized him to pass through Rome ostensibly on a crusade against the Turks, without mentioning Naples. But when the French invasion became a reality he was alarmed, recognized Alphonso as king, and concluded an alliance with him in exchange for various fiefs to his sons (July 1494). Preparations for defence were made; a Neapolitan army was to advance through the Romagna and attack Milan, while the fleet was to seize Genoa; but both expeditions were badly conducted and failed, and on the 8th of September Charles crossed the Alps and joined Lodovico il Moro at Milan. The papal states were in a turmoil, and the powerful Colonna faction seized Ostia in the name of France. Charles rapidly advanced southward, and after a short stay in Florence set out for Rome (November 1494). Alexander appealed to Ascanio Sforza for help, and even to the sultan. He tried to collect troops and put Rome in a state of defence, but his position was most insecure, and the Orsini offered to admit the French to their castles. This defection decided the pope to come to terms, and on the 31st of December Charles entered Rome with his troops and the cardinals of the French faction. Alexander now feared that the king might depose him for simony and summon a council, but he won over the bishop of St Malo, who had much influence over the king, with a cardinal's hat, and agreed to send Cesare, as legate, to Naples with the French army, to deliver Jem to Charles and to give him Civitavecchia (January 16, 1495). On the 28th Charles departed for Naples with Jem and Cesare, but the latter escaped to Spoleto. Neapolitan resistance collapsed; Alphonso fled and abdicated in favour of his son Ferdinand II., who also had to fly abandoned by all, and the kingdom was conquered with surprising ease. But a reaction against Charles soon set in, for all the powers were alarmed at his success, and on the 31st of March a league between the pope, the emperor, Venice, Lodovico il Moro and Ferdinand of Spain was formed, ostensibly against the Turks, but in reality to expel the French from Italy. Charles had himself crowned king of Naples on the 12th of May, but a few days later began his retreat northward. He encountered the allies at Fornovo, and after a drawn battle cut his way through them and was back in France by November; Ferdinand II. with Spanish help was reinstated at Naples soon afterwards. The expedition, if it produced no material results, laid bare the weakness of the Italian political system and the country's incapacity for resistance.

Alexander availed himself of the defeat of the French to break the power of the Orsini, following the general tendency of all the princes of the day to crush the great feudatories and establish a centralized despotism. Virginio Orsini, who had been captured by the Spaniards, died a prisoner at Naples, and the pope confiscated his property. But the rest of the clan still held out, and the papal troops sent against them under Guidobaldo duke of Urbino and the duke of Gandia were defeated at Soriano (January 1497). Peace was made through Venetian mediation, the Orsini paying 50,000 ducats in exchange for their confiscated lands; the duke of Urbino, whom they had captured, was left by the pope to pay his own ransom. The Orsini still remained very powerful, and Alexander could count on none but his 3000 Spaniards. His only success had been the capture of Ostia and the submission of the Francophile cardinals Colonna and Savelli.

Now occurred the first of those ugly domestic tragedies for which the house of Borgia remained famous. On the 14th of June the duke of Gandia, lately created duke of Benevento, disappeared; the next day his corpse was found in the Tiber. Alexander, overwhelmed with grief, shut himself up in Castle St Angelo, and then declared that the reform of the church would be the sole object of his life henceforth—a resolution which he did not keep. Every effort was made to discover the assassin, and suspicion fell on various highly placed personages. Suddenly the rumour spread about that Cesare, the pope's second son, was the author of the deed, and although the inquiries then ceased and no conclusive evidence has yet come to light, there is every probability that the charge was well founded. No doubt Cesare, who contemplated quitting the church, was inspired by jealousy of Gandia's influence with the pope. Violent and revengeful, he now became the most powerful man in Rome, and even his father quailed before him. As he needed funds to carry out his various schemes, the pope began a series of confiscations, of which one of the victims was his own secretary, in order to enrich him. The process was a simple one: any cardinal, nobleman or official who was known to be rich would be accused of some offence; imprisonment and perhaps murder followed at once, and then the confiscation of his property. The disorganization of the Curia was appalling, the sale of offices became a veritable scandal, the least opposition to the Borgia was punished with death, and even in that corrupt age the state of things shocked public opinion. The story of Alexander's relations with Savonarola is narrated under the latter heading; it is sufficient to say here that the pope's hostility was due to the friar's outspoken invectives against papal corruption and to his appeals for a General Council. Alexander, although he could not get Savonarola into his own hands, browbeat the Florentine government into condemning the reformer to death (May 23, 1498). The pope was unable to maintain order in his own dominions; the houses of Colonna and Orsini were at open war with each other, but after much fighting they made peace on a basis of alliance against the pope. Thus further weakened, he felt more than ever that he had only his own kin to rely upon, and his thoughts were ever turned on family aggrandizement. He had annulled Lucrezia's marriage with Sforza in 1497, and, unable to arrange a union between Cesare and the daughter of Frederick, king of Naples (who had succeeded Ferdinand II. the previous year), he induced the latter by threats to agree to a marriage between the duke of Bisceglie, a natural son of Alphonso II., and Lucrezia. Cesare, who renounced his cardinalate, was sent on a mission to France at the end of the year, bearing a bull of divorce for the new king Louis XII., in exchange for which he obtained the duchy of Valentinois (hence his title of Duca Valentino) and a promise of material assistance in his schemes to subjugate the feudal princelings of Romagna; he married a princess of Navarre. Alexander hoped that Louis's help would be more profitable to his house than that of Charles had been and, in spite of the remonstrances of Spain and of the Sforza, he allied himself with France in January 1499 and was joined by Venice. By the autumn Louis was in Italy and expelled Lodovico Sforza from the Milanese. In order to consolidate his possessions still further, now that French success seemed assured, the pope determined to deal drastically with Romagna, which although nominally under papal rule was divided up into a number of practically independent lordships on which Venice, Milan and Florence cast hungry eyes. Cesare, nominated *gonfaloniere* of the Church, and strong in French favour, proceeded to attack the turbulent cities one by one (for detail see BORGIA, CESARE). But the expulsion of the French from Milan and the return of Lodovico Sforza interrupted his conquests, and he returned to Rome early in 1500. This year was a jubilee year, and crowds of pilgrims flocked to the city from all parts of the world bringing money for the purchase of indulgences, so that Alexander was able to furnish Cesare with funds for his enterprise. In the north the pendulum swung back once more and the French reoccupied Milan in April, causing the downfall of the Sforzas, much to Alexander's gratification. But there was no end to the Vatican tragedies, and in July the duke of Bisceglie, whose existence was no longer advantageous, was murdered by Cesare's orders; this left Lucrezia free to contract another marriage. The pope, ever in need of money, now created twelve new cardinals, from whom he received 120,000 ducats, and fresh conquests for Cesare were considered. But while a crusade was talked of, the real object was central Italy, and in the autumn Cesare, favoured by France and Venice, set forth with 10,000 men to complete his interrupted enterprise. The local despots of Romagna were dispossessed and an administration was set up, which, if tyrannical and cruel, was at least orderly and strong, and aroused the admiration of Machiavelli (*q.v.*). On his return to Rome (June 1501) he was created duke of Romagna. Louis XII., having succeeded in the north, determined to conquer southern Italy as well, and concluded a treaty with Spain for the division of the Neapolitan kingdom, which was ratified by the pope on the 25th of June, Frederick being formally deposed. The French army proceeded to invade Naples, and Alexander took the opportunity, with the help of the Orsini, to reduce the Colonna to obedience. In his absence he left Lucrezia as regent, offering the astounding spectacle of a pope's natural daughter in charge of the Holy See. Shortly afterwards he induced Alphonso d'Este, son of the duke of Ferrara, to marry her, thus establishing her as heiress to one of the most important principalities in Italy (January 1502). About this time a Borgia of doubtful parentage was born, Giovanni, described in some papal documents as Alexander's son and in others as Cesare's.

As France and Spain were quarrelling over the division of Naples and the Campagna barons were quiet, Cesare set out once more in search of conquests. In June he seized Camerino and Urbino, the news of which capture filled the pope with childish joy. But his military force was uncertain, for the *condottieri* were not to be trusted. His attempt to draw Florence into an alliance failed, but in July Louis of France again invaded Italy and was at once bombarded with complaints from the Borgia's enemies. Alexander's diplomacy, however, turned the tide, and Cesare, in exchange for promising to assist the French in the south, was given a free hand in central Italy. A new danger now arose in the shape of a conspiracy against him on the part of the deposed despots, the Orsini and some of his own *condottieri*. At first the papal troops were defeated and things looked black for the house of Borgia. But a promise of French help at once forced the confederates to come to terms, and Cesare by an act of treachery seized the ringleaders at Senigallia, and put Oliverotto da Fermo and Vitellozzo Vitelli to death (Dec. 31, 1502). As soon as Alexander heard the news he decoyed Cardinal Orsini to the Vatican and cast him into a dungeon, where he died. His goods were confiscated, his aged mother turned into the street and numbers of other members of the clan in Rome were arrested, while Giuffre Borgia led an expedition into the Campagna and seized their castles. Thus the two great houses of Orsini and Colonna, who had long fought for predominance in Rome and often flouted the pope's authority, were subjugated, and a great step achieved towards consolidating the Borgia's power. Cesare then returned to Rome, where his father wished him to assist Giuffre in reducing the last Orsini strongholds; this for some reason he was unwilling to do, much to Alexander's annoyance, but he eventually marched out, captured Ceri and made peace with Giulio Orsini, who surrendered Bracciano. Three more high personages fell victims to the Borgia's greed this year, viz. Cardinal Michiel, who was poisoned in April, J. da Santa Croce, who had helped to seize Cardinal Orsini, and Troches or Troccio, one of the family's most faithful assassins; all these murders brought immense sums to the pope. About Cardinal Ferrari's death there is more doubt; he probably died of fever, but the pope immediately confiscated his goods.

The war between France and Spain for the possession of Naples dragged on, and Alexander was ever intriguing, ready to ally himself with whichever power promised at the moment most advantageous terms. He offered to help Louis on condition that Sicily be given to Cesare, and then offered to help Spain in exchange for Siena, Pisa and Bologna. Cesare was preparing for another expedition into central Italy in July 1503, when, in the midst of all these projects and negotiations, both he and his father were taken ill with fever. The occurrence was of course attributed to poison, although quite without foundation, being merely due to malaria, at that time very prevalent in Rome. On the 18th of August Alexander died at the age of 72. His death was followed by scenes of wild disorder, and Cesare, being himself ill, could not attend to business, but sent Don Michelotto, his chief bravo, to seize the pope's treasures before the demise was publicly announced. When the body was exhibited to the people the next day it was in a shocking state of decomposition, which of course strengthened the suspicion of poison. At the funeral a brawl occurred between the soldiers and the priests, and the coffin having been made too short the body without the mitre was driven into it by main force and covered with an oil-cloth. Alexander's successor on the chair of St Peter was Francesco Todeschini-Piccolomini, who assumed the name of Pius III.

Alexander VI. has become almost a mythical character, and countless legends and traditions are attached to his name. As a matter of fact he cannot be regarded in any sense as a great man. His career shows no great political ideas, and none of his actions indicate genius. His one thought was family aggrandizement, and while it is unlikely that he meditated making the papacy hereditary in the house of Borgia, he certainly gave away its temporal estates to his children as though they belonged to him. The secularization of the church was carried to a pitch never before dreamed of, and it was clear to all Italy that he regarded the papacy as an instrument of worldly schemes with no thought of its religious aspect. During his pontificate the church was brought to its lowest level of degradation. The condition of his subjects was deplorable, and if Cesare's rule in Romagna was an improvement on that of the local tyrants, the people of Rome have seldom been more oppressed than under the Borgia. Alexander was not the only person responsible for the general unrest in Italy and the foreign invasions, but he was ever ready to profit by them. Even if we do not accept all the stories of his murders and poisonings and immoralities as true, there is no doubt that his greed for money and his essentially vicious nature led him to commit a great number of crimes. For many of his misdeeds his terrible son Cesare was responsible, but of others the pope cannot be acquitted. The one pleasing aspect of his life is his patronage of the arts, and in his days a new architectural era was initiated in Rome with the coming of Bramante. Raphael, Michelangelo and Pinturicchio all worked for him, and a curious contrast, characteristic of the age, is afforded by the fact that a family so steeped in vice and crime could take pleasure in the most exquisite works of art.

BIBLIOGRAPHY.—The chief contemporary authorities for this reign are: the diary of Alexander's master of ceremonies, Johannes Burchardus, edited by L. Thuasne (Paris, 1883–1884), which is characterized by accuracy and extraordinary candour often amounting to gross indecency; the despatches of Giustiniani, the Venetian ambassador, edited by P. Villari (Florence, 1876), which show great insight and are based on the most accurate information; and Paolo Cappelli's "Diarii" in E. Alberi's *Relazioni*, series ii., iii. Among modern works the most important are: F. Gregorovius's *Geschichte der Stadt Rom* (3rd ed., Stuttgart, 1881), a work of immense research and admirable synthesis, giving a very unfavourable view of the Borgia; A. von Reumont's *Geschichte der Stadt Rom* (Berlin, 1867–1870), also a valuable book; M. Creighton's *History of the Papacy* (London, 1897) is very learned and accurate, but the author is more lenient towards Alexander; F. Gregorovius's *Lucrezia Borgia* (Stuttgart, 1874) contains a great deal of information on the Borgia family; P. Villari's *Machiavelli* (English translation, new ed., 1892) deals with the subject at some length. Of the Catholic writers

L. Pastor, *Geschichte der Päpste* (Freiburg i. B, 1886) should be consulted, for although the author tries to extenuate the pope to some extent, on the whole he is fair. (L. V.*)

Alexander VII. (Fabio Chigi), pope from 1655 to 1667, was born at Siena on the 13th of February 1599. He was successively inquisitor at Malta, vice-legate at Ferrara and nuncio in Cologne (1639–1651). Though expected to take part in the negotiations which led in 1648 to the peace of Westphalia, he refused to deliberate with heretics, and protested against the treaties when completed. Innocent X. subsequently made him cardinal secretary of state. When Innocent died, Chigi, the candidate favoured by Spain, was elected pope on the 7th of April 1655. The conclave believed he was strongly opposed to the nepotism then prevalent. In the first year of his reign Alexander VII. forbade his relations even to visit Rome; but in 1656 he gave them the best-paid civil and ecclesiastical offices, also palaces and princely estates. Alexander disliked business of state, preferring literature and philosophy; a collection of his Latin poems appeared at Paris in 1656 under the title *Philomathi Labores Juveniles*. He also encouraged architecture, and in particular constructed the beautiful colonnade in the piazza of St Peter's. He favoured the Jesuits, especially in their conflict with the Jansenists, forbade in 1661 the translation of the Roman Missal into French, and in 1665 canonized Francis of Sales. His pontificate was marked by protracted controversies with France and Portugal. He died on the 22nd of May 1667. (W. W. R.*)

Alexander VIII. (Pietro Ottoboni), pope from 1689 to 1691, was born in 1610 of a noble Venetian family, was created cardinal, and then successively bishop of Brescia and datary. The ambassador of Louis XIV. succeeded in procuring his election on the 6th of October 1689 as successor to Innocent XI.; nevertheless, after months of negotiation Alexander finally condemned the declaration made in 1682 by the French clergy concerning the liberties of the Gallican church. Charities on a large scale and unbounded nepotism exhausted the papal treasury. He bought the books and manuscripts of Queen Christina of Sweden for the Vatican library. Alexander condemned in 1690 the doctrines of so-called philosophic sin, taught in the Jesuit schools. He died on the 1st of February 1691. (W. W. R.*)

ALEXANDER I. (Aleksander Pavlovich) (1777–1825), emperor of Russia, son of the grand-duke Paul Petrovich, afterwards Paul I., and Maria Fedorovna, daughter of Frederick Eugene of Württemberg, was born on the 28th of December 1777. The strange contradictions of his character make Alexander one of the most interesting as he is one of the most important figures in the history of the 19th century. Autocrat and "Jacobin," man of the world and mystic, he was to his contemporaries a riddle which each read according to his own temperament. Napoleon thought him a "shifty Byzantine," and called him the Talma of the North, as ready to play any conspicuous part. To Metternich he was a madman to be humoured. Castlereagh, writing of him to Lord Liverpool, gives him credit for "grand qualities," but adds that he is "suspicious and undecided." His complex nature was, in truth, the outcome of the complex character of his early environment and education. Reared in the free-thinking atmosphere of the court of Catherine II. he had imbibed from his Swiss tutor, Frédéric César de Laharpe, the principles of Rousseau's gospel of humanity; from his military governor, General Soltikov, the traditions of Russian autocracy; while his father had inspired him with his own passion of military parade, and taught him to combine a theoretical love of mankind with a practical contempt for men. These contradictory tendencies remained with him through life, revealed in the fluctuations of his policy and influencing through him the fate of the world. Another element in his character discovered itself when in 1801 he mounted the throne over the body of his murdered father: a mystic melancholy liable at any moment to issue in extravagant action. At first, indeed, this exercised but little influence on the emperor's life. Young, emotional, impressionable, well-meaning and egotistic, Alexander displayed from the first an intention of playing a great part on the world's stage, and plunged with all the ardour of youth into the task of realizing his political ideals. While retaining for a time the old ministers who had served and overthrown the emperor Paul, one of the first acts of his reign was to appoint a secret committee, called ironically the "Comité du salut public," consisting of young and enthusiastic friends of his own—Victor Gavovich Kochubey, Nikolai Nikolaevich Novosiltsov, Paul Alexandrovich Strogonov and Adam Czartoryski—to draw up a scheme of internal reform. Their aims, inspired by their admiration for English institutions, were far in advance of the possibilities of the time, and even after they had been raised to regular ministerial positions but little of their programme could be realized. For Russia was not ripe for liberty; and Alexander, the disciple of the revolutionist Laharpe, was—as he himself said—but "a happy accident" on the throne of the tsars. He spoke, indeed, bitterly of "the state of barbarism in which the country had been left by the traffic in men." "Under Paul," he said, "three thousand peasants had been given away like a bag of diamonds. If civilization were more advanced, I would abolish this slavery, if it cost me my head."[1] But the universal corruption, he complained, had left him no men; and the filling up of the government offices with Germans and other foreigners merely accentuated the sullen resistance of the "old Russians" to his reforms. That Alexander's reign, which began with so large a promise of amelioration, ended by riveting still tighter the chains of the Russian people was, however, due less to the corruption and backwardness of Russian life than to the defects of the tsar himself. His love of liberty, though sincere, was in fact unreal. It flattered his vanity to pose before the world as the dispenser of benefits; but his theoretical liberalism was mated with an autocratic will which brooked no contradiction. "You always want to instruct me!" he exlaimed to Derzhavin, the minister of justice, "but I am the autocratic emperor, and I will this, and nothing else!" "He would gladly have agreed," wrote Adam Czartoryski, "that every one should be free, if every one had freely done only what he wished." Moreover, with this masterful temper was joined an infirmity of purpose which ever let "I dare not wait upon I would," and which seized upon any excuse for postponing measures the principles of which he had publicly approved. The codification of the laws initiated in 1801 was never carried out during his reign; nothing was done to improve the intolerable status of the Russian peasantry; the constitution drawn up by Speranski, and passed by the emperor, remained unsigned. Alexander, in fact, who, without being consciously tyrannical, possessed in full measure the tyrant's characteristic distrust of men of ability and independent judgment, lacked also the first requisite for a reforming sovereign: confidence in his people; and it was this want that vitiated such reforms as were actually realized. He experimented in the outlying provinces of his empire; and the Russians noted with open murmurs that, not content with governing through foreign instruments, he was conferring on Poland, Finland and the Baltic provinces benefits denied to themselves. In Russia, too, certain reforms were carried out; but they could not survive the suspicious interference of the autocrat and his officials. The newly created council of ministers, and the senate, endowed for the first time with certain theoretical powers, became in the end but the slavish instruments of the tsar and his favourites of the moment. The elaborate system of education, culminating in the reconstituted, or new-founded, universities of Dorpat, Vilna, Kazan and Kharkov, was strangled in the supposed interests of "order" and of orthodox piety; while the military colonies which Alexander proclaimed as a blessing to both soldiers and state were forced on the unwilling peasantry and army with pitiless cruelty. Even the Bible Society, through which the emperor in his later mood of evangelical zeal proposed to bless his people, was conducted on the same ruthless lines. The Roman archbishop and the Orthodox metropolitans were forced to serve on its committee side by side with Protestant pastors; and village popes, trained to regard any tampering with the letter of the traditional documents of the church as mortal sin, became the unwilling instruments for the propagation of what they regarded as works of the devil.

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[1] Savary to Napoleon, Nov. 4, 1807. Tatischeff, p. 226.

Alexander's grandiose imagination was, however, more strongly attracted by the great questions of European politics than by attempts at domestic reform which, on the whole, wounded his pride by proving to him the narrow limits of absolute power. On the morrow of his accession he had reversed the policy of Paul, denounced the League of Neutrals, and made peace with England (April 1801), at the same time opening negotiations with Austria. Soon afterwards at Memel he entered into a close alliance with Prussia, not as he boasted from motives of policy, but in the spirit of true chivalry, out of friendship for the young king Frederick William and his beautiful wife. The development of this alliance was interrupted by the short-lived peace of October 1801; and for a while it seemed as though France and Russia might come to an understanding. Carried away by the enthusiasm of Laharpe, who had returned to Russia from Paris, Alexander began openly to proclaim his admiration for French institutions and for the person of Bonaparte. Soon, however, came a change. Laharpe, after a new visit to Paris, presented to the tsar his *Reflexions on the True Nature of the Consulship for Life*, which, as Alexander said, tore the veil from his eyes, and revealed Bonaparte "as not a true patriot," but only as "the most famous tyrant the world has produced." His disillusionment was completed by the murder of the duc d'Enghien. The Russian court went into mourning for the last of the Condés, and diplomatic relations with Paris were broken off.

The events of the war that followed belong to the general history of Europe; but the tsar's attitude throughout is personal to himself, though pregnant with issues momentous for the world. In opposing Napoleon, "the oppressor of Europe and the disturber of the world's peace," Alexander in fact already believed himself to be fulfilling a divine mission. In his instructions to Novosiltsov, his special envoy in London, the tsar elaborated the motives of his policy in language which appealed as little to the common sense of Pitt as did later the treaty of the Holy Alliance to that of Castlereagh. Yet the document is of great interest, as in it we find formulated for the first time in an official despatch those exalted ideals of international policy which were to play so conspicuous a part in the affairs of the world at the close of the revolutionary epoch, and issued at the end of the 19th century in the Rescript of Nicholas II.[1] and the conference of the Hague. The outcome of the war, Alexander argued, was not to be only the liberation of France, but the universal triumph of "the sacred rights of humanity." To attain this it would be necessary "after having attached the nations to their government by making these incapable of acting save in the greatest interests of their subjects, to fix the relations of the states amongst each other on more precise rules, and such as it is to their interest to respect." A general treaty was to become the basis of the relations of the states forming "the European Confederation"; and this, though "it was no question of realizing the dream of universal peace, would attain some of its results if, at the conclusion of the general war, it were possible to establish on clear principles the prescriptions of the rights of nations." "Why could not one submit to it," the tsar continued, "the positive rights of nations, assure the privilege of neutrality, insert the obligation of never beginning war until all the resources which the mediation of a third party could offer have been exhausted, having by this means brought to light the respective grievances, and tried to remove them? It is on such principles as these that one could proceed to a general pacification, and give birth to a league of which the stipulations would form, so to speak, a new code of the law of nations, which, sanctioned by the greater part of the nations of Europe, would without difficulty become the immutable rule of the cabinets, while those who should try to infringe it would risk bringing upon themselves the forces of the new union."[2]

Meanwhile Napoleon, little deterred by the Russian autocrat's youthful idealogy, never gave up hope of detaching him from the coalition. He had no sooner entered Vienna in triumph than he opened negotiations with him; he resumed them after Austerlitz. Russia and France, he urged, were "geographical allies"; there was, and could be, between them no true conflict of interests; together they might rule the world. But Alexander was still determined "to persist in the system of disinterestedness in respect of all the states of Europe which he had thus far followed," and he again allied himself with Prussia. The campaign of Jena and the battle of Eylau followed; and Napoleon, though still intent on the Russian alliance, stirred up Poles, Turks and Persians to break the obstinacy of the tsar. A party too in Russia itself, headed by the tsar's brother the grand-duke Constantine, was clamorous for peace; but Alexander, after a vain attempt to form a new coalition, summoned the Russian nation to a holy war against Napoleon as the enemy of the orthodox faith. The outcome was the rout of Friedland (June 13 and 14, 1807). Napoleon saw his chance and seized it. Instead of making heavy terms, he offered to the chastened autocrat his alliance, and a partnership in his glory.

The two emperors met at Tilsit on the 25th of June. Alexander, dazzled by Napoleon's genius and overwhelmed by his apparent generosity, was completely won. Napoleon knew well how to appeal to the exuberant imagination of his new-found friend. He would divide with Alexander the empire of the world; as a first step he would leave him in possession of the Danubian principalities and give him a free hand to deal with Finland; and, afterwards, the emperors of the East and West, when the time should be ripe, would drive the Turks from Europe and march across Asia to the conquest of India. A programme so stupendous awoke in Alexander's impressionable mind an ambition to which he had hitherto been a stranger. The interests of Europe were forgotten. "What is Europe?" he exclaimed to the French ambassador. "Where is it, if it is not you and we?"[3]

The brilliance of these new visions did not, however, blind Alexander to the obligations of friendship; and he refused to retain the Danubian principalities as the price for suffering a further dismemberment of Prussia. "We have made loyal war," he said, "we must make a loyal peace." It was not long before the first enthusiasm of Tilsit began to wane. Napoleon was prodigal of promises, but niggard of their fulfilment. The French remained in Prussia, the Russians on the Danube; and each accused the other of breach of faith. Meanwhile, however, the personal relations of Alexander and Napoleon were of the most cordial character; and it was hoped that a fresh meeting might adjust all differences between them. The meeting took place at Erfurt in October 1808, and resulted in a treaty which defined the common policy of the two emperors. But Alexander's relations with Napoleon none the less suffered a change. He realized that in Napoleon sentiment never got the better of reason, that as a matter of fact he had never intended his proposed "grand enterprise" seriously, and had only used it to preoccupy the mind of the tsar while he consolidated his own power in central Europe. From this moment the French alliance was for Alexander also not a fraternal agreement to rule the world, but an affair of pure policy. He used it, in the first instance, to remove "the geographical enemy" from the gates of St Petersburg by wresting Finland from the Swedes (1809); and he hoped by means of it to make the Danube the southern frontier of Russia. Events were in fact rapidly tending to the rupture of the Franco-Russian alliance. Alexander, indeed, assisted Napoleon in the war of 1809, but he declared plainly that he would not allow Austria to be crushed out of existence; and Napoleon complained bitterly of the inactivity of the Russian troops during the campaign. The tsar in his turn protested against Napoleon's encouragement of the Poles. In the matter of the French alliance he knew himself to be practically isolated in Russia, and he declared that he could not sacrifice the interest of his people and empire to his affection for Napoleon. "I don't want anything for myself," he said to the French ambassador, "therefore the world is *not* large enough to come to an understanding on the affairs of Poland, if it is a question of its restoration."[1] The treaty of Vienna, which added largely to the grand-duchy of Warsaw, he complained had "ill requited him for his loyalty," and he was only mollified for the time by Napoleon's public declaration that he had no intention of restoring Poland, and by a convention, signed on the 4th of January 1810 but not ratified, abolishing the Polish name and orders of chivalry.

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[1] Circular of Count Muraviev, Aug. 24, 1898.

[2] Instructions to M. Novosiltsov, Sept. 11, 1804. Tatischeff, p. 82.

[3] Savary to Napoleon, Nov. 18, 1807. Tatischeff, p. 232.

But if Alexander suspected Napoleon, Napoleon was no less suspicious of Alexander; and, partly to test his sincerity, he sent an almost peremptory request for the hand of the grand-duchess Anne, the tsar's youngest sister. After some little delay Alexander returned a polite refusal, on the plea of the princess's tender age and the objection of the dowager empress to the marriage. Napoleon's answer was to refuse to ratify the convention of the 4th of January, and to announce his engagement to the archduchess Marie Louise in such a way as to lead Alexander to suppose that the two marriage treaties had been negotiated simultaneously. From this time the relation between the two emperors gradually became more and more strained. The annexation of Oldenburg, of which the duke was the tsar's uncle, to France in December 1810, added another to the personal grievances of Alexander against Napoleon; while the ruinous reaction of "the continental system" on Russian trade made it impossible for the tsar to maintain a policy which was Napoleon's chief motive for the alliance. An acid correspondence followed, and ill-concealed armaments, which culminated in the summer of 1812 in Napoleon's invasion of Russia. Yet, even after the French had passed the frontier, Alexander still protested that his personal sentiments towards the emperor were unaltered; "but," he added, "God Himself cannot undo the past." It was the occupation of Moscow and the desecration of the Kremlin, the sacred centre of Holy Russia, that changed his sentiment for Napoleon into passionate hatred. In vain the French emperor, within eight days of his entry into Moscow, wrote to the tsar a letter, which was one long cry of distress, revealing the desperate straits of the Grand Army, and appealed to "any remnant of his former sentiments." Alexander returned no answer to these "fanfaronnades." "No more peace with Napoleon!" he cried, "He or I, I or He: we cannot longer reign together!"[2]

The campaign of 1812 was the turning-point of Alexander's life; and its horrors, for which his sensitive nature felt much of the responsibility, overset still more a mind never too well balanced. At the burning of Moscow, he declared afterwards, his own soul had found illumination, and he had realized once for all the divine revelation to him of his mission as the peacemaker of Europe. He tried to calm the unrest of his conscience by correspondence with the leaders of the evangelical revival on the continent, and sought for omens and supernatural guidance in texts and passages of scripture. It was not, however, according to his own account, till he met the Baroness de Krüdener—a religious adventuress who made the conversion of princes her special mission—at Basel, in the autumn of 1813, that his soul found peace. From this time a mystic pietism became the avowed force of his political, as of his private actions. Madame de Krüdener, and her colleague, the evangelist Empaytaz, became the confidants of the emperor's most secret thoughts; and during the campaign that ended in the occupation of Paris the imperial prayer-meetings were the oracle on whose revelations hung the fate of the world.

Such was Alexander's mood when the downfall of Napoleon left him the most powerful sovereign in Europe. With the memory of Tilsit still fresh in men's minds, it was not unnatural that to cynical men of the world like Metternich he merely seemed to be disguising "under the language of evangelical abnegation" vast and perilous schemes of ambition. The puzzled powers were, in fact, the more inclined to be suspicious in view of other, and seemingly inconsistent, tendencies of the emperor, which yet seemed all to point to a like disquieting conclusion. For Madame de Krüdener was not the only influence behind the throne; and, though Alexander had declared war against the Revolution, Laharpe was once more at his elbow, and the catchwords of the gospel of humanity were still on his lips. The very proclamations which denounced Napoleon as "the genius of evil," denounced him in the name of "liberty," and of "enlightenment." A monstrous intrigue was suspected for the alliance of the eastern autocrat with the Jacobinism of all Europe, which would have issued in the substitution of an all-powerful Russia for an all-powerful France. At the congress of Vienna Alexander's attitude accentuated this distrust. Castlereagh, whose single-minded aim was the restoration of "a just equilibrium" in Europe, reproached the tsar to his face for a "conscience" which suffered him to imperil the concert of the powers by keeping his hold on Poland in violation of his treaty obligation.[3]

Yet Alexander was sincere. Even the Holy Alliance, the pet offspring of his pietism, does not deserve the sinister reputation it has since obtained. To the other powers it seemed, at best "verbiage" and "exalted nonsense," at worst an effort of the tsar to establish the hegemony of Russia on the goodwill of the smaller signatory powers. To the Liberals, then and afterwards it was clearly a hypocritical conspiracy against freedom. Yet to Alexander himself it seemed the only means of placing the "confederation of Europe" on a firm basis of principle[4] and, so far from its being directed against liberty he declared roundly to all the signatory powers that "free constitutions were the logical outcome of its doctrines." Europe, in fact, owed much at this time to Alexander's exalted temper. During the period when his influence was supreme, the fateful years, that is, between the Moscow campaign and the close of the congress of Aix-la-Chapelle, it had been used largely in the interests of moderation and liberty. To him mainly it was due that France was saved from dismemberment, and received a constitution which, to use his own words, "united crown and representatives of the people in a sense of common interests."[5] By his wise intervention Switzerland was saved from violent reaction, and suffered to preserve the essential gains of the Revolution. To his protection it was due that the weak beginnings of constitutional freedom in Germany were able for a while to defy the hatred of Austria. Lastly, whatever its ultimate outcome, the constitution of Poland was, in its inception, a genuine effort to respond to the appeal of the Poles for a national existence.

From the end of the year 1818 Alexander's views began to change. A revolutionary conspiracy among the officers of the guard, and a foolish plot to kidnap him on his way to the congress of Aix-la-Chapelle (*q.v.*), are said to have shaken the foundations of his Liberalism. At Aix he came for the first time into intimate contact with Metternich, and the astute Austrian was swift to take advantage of the psychological moment. From this time dates the ascendancy of Metternich over the mind of the Russian emperor and in the councils of Europe. It was, however, no case of sudden conversion. Though alarmed by the revolutionary agitation in Germany, which culminated in the murder of his agent, the dramatist Kotzebue (*q.v.*), Alexander approved of Castlereagh's protest against Metternich's policy of "the governments contracting an alliance against the peoples," as formulated in the Carlsbad decrees, 1819, and deprecated any intervention of Europe to support "a league of which the sole object is the absurd pretensions of absolute power."[6] He still declared his belief in "free institutions, though not in such as are forced from feebleness, nor contracts ordered by popular leaders from their sovereigns, nor constitutions granted in difficult circumstances to tide over a crisis. "Liberty," he maintained, "should be confined within just limits. And the limits of liberty are the principles of order."[1]

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[1] Coulaincourt to Napoleon, 4th report, Aug. 3, 1809. Tatischeff, p. 496.

[2] Alexander speaking to Colonel Michaud. Tatischeff, p. 612.

[3] Castlereagh to Liverpool, Oct. 2, 1814. F.O. Papers. Vienna VII.

[4] Martens IV. part i. p. 49.

[5] *État des négociations actuelles*, &c., mem. prepared by order of the Tsar, July 16, 1815, enclosed in Castlereagh to Liverpool, F.O. Cont. papers. Congress Paris, Castlereagh, 22.

[6] Despatch of Lieven, Nov. 30 (Dec. 12), 1819, and Russ. Circular of Jan. 27, 1820. Martens IV. part i. p. 270.

It was the apparent triumph of the principles of disorder in the revolutions of Naples and Piedmont, combined with increasingly disquieting symptoms of discontent in France, Germany and among his own people, that completed Alexander's conversion. In the seclusion of the little town of Troppau, where in October of 1820 the powers met in conference, Metternich found an opportunity for cementing his influence over Alexander which had been wanting amid the turmoil and feminine intrigues of Vienna and Aix. Here, in confidence begotten of friendly chats over afternoon tea, the disillusioned autocrat confessed his mistake. "You have nothing to regret," he said sadly to the exultant chancellor, "but I have!"[2] The issue was momentous. In January Alexander had still upheld the ideal of a free confederation of the European states, symbolized by the Holy Alliance, against the policy of a dictatorship of the great powers, symbolized by the Quadruple Treaty; he had still protested against the claims of collective Europe to interfere in the internal concerns of the sovereign states. On the 19th of November he signed the Troppau Protocol, which consecrated the principle of intervention and wrecked the harmony of the concert. (See Troppau, Congress of.)

At Laibach, whither in the spring of 1821 the congress had been adjourned, Alexander first heard of the revolt of the Greeks. From this time until his death his mind was torn between his anxiety to realize his dream of a confederation of Europe and his traditional mission as leader of the Orthodox crusade against the Turks. At first, under the careful nursing of Metternich, the former motive prevailed. He struck the name of Alexander Ypsilanti from the Russian army list, and directed his foreign minister, Count Capo d'Istria, himself a Greek, to disavow all sympathy of Russia with his enterprise; and, next year, a deputation of the Greeks of the Morea on its way to the congress of Verona was turned back by his orders on the road. He made, indeed, some effort to reconcile the principles at conflict in his mind. He offered to surrender the claim, successfully asserted when the sultan had been excluded from the Holy Alliance and the affairs of the Ottoman empire from the deliberations of Vienna, that the affairs of the East were the "domestic concerns of Russia," and to march into Turkey, as Austria had marched into Naples, "as the mandatory of Europe."[3] Metternich's opposition to this, illogical, but natural from the Austrian point of view, first opened his eyes to the true character of Austria's attitude towards his ideals. Once more in Russia, far from the fascination of Metternich's personality, the immemorial spirit of his people drew him back into itself; and when, in the autumn of 1825, he took his dying empress for change of air to the south of Russia, in order—as all Europe supposed—to place himself at the head of the great army concentrated near the Ottoman frontiers, his language was no longer that of "the peace-maker of Europe," but of the Orthodox tsar determined to take the interests of his people and of his religion "into his own hands." Before the momentous issue could be decided, however, Alexander died at Taganrog on the 1st of December (November 18, O.S.) 1825, "crushed," to use his own words, "beneath the terrible burden of a crown" which he had more than once declared his intention of resigning. A report, current at the time and often revived, affirmed that he did not in fact die. By some it is supposed that a mysterious hermit named Fomich, who lived at Tomsk until 1870 and was treated with peculiar deference by successive tsars, was none other than Alexander.[4]

Modern history knows no more tragic figure than that of Alexander. The brilliant promise of his early years; the haunting memory of the crime by which he had obtained the power to realize his ideals; and, in the end, the terrible legacy he left to Russia: a principle of government which, under lofty pretensions, veiled a tyranny supported by spies and secret police; an uncertain succession; an army permeated by organized disaffection; an armed Poland, whose hunger for liberty the tsar had whetted but not satisfied; the quarrel with Turkey, with its alternative of war or humiliation for Russia; an educational system rotten with official hypocrisy; a Church in which conduct counted for nothing, orthodoxy and ceremonial observance for everything; economical and financial conditions scarce recovering from the verge of ruin; and lastly, that curse of Russia,—serfdom.

In private life Alexander displayed many lovable qualities. All authorities combine in praising his handsome presence and the affability and charm of his address, together with a certain simplicity of personal tastes, which led him in his intercourse with his friends or with the representatives of friendly powers to dispense with ceremonial and etiquette. His personal friendship, too, once bestowed, was never lightly withdrawn. By nature he was sociable and pleasure-loving, he proved himself a notable patron of the arts and he took a conspicuous part in all the gaieties of the congress of Vienna. In his later years, however, he fell into a mood of settled melancholy; and, though still accessible to all who chose to approach him with complaints or petitions, he withdrew from all but the most essential social functions, and lived a life of strenuous work and of Spartan simplicity. His gloom had been increased by domestic misfortune. He had been married, in 1793, without his wishes being consulted, to the beautiful and amiable Princess Maria Louisa of Baden (Elizabeth Feodorovna), a political match which, as he regretfully confessed to his friend Frederick William of Prussia, had proved the misfortune of both; and he consoled himself in the traditional manner. The only child of the marriage, a little grand-duchess, died on the 12th of May 1808; and their common sorrow drew husband and wife closer together. Towards the close of his life their reconciliation was completed by the wise charity of the empress in sympathizing deeply with him over the death of his beloved daughter by Madame Narishkine.

See also Europe; Russia; France; Turkey; Vienna, Congress of; Napoleon; Metternich; Capo d'Istria.

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Lives.—The principal life of Alexander I. is that, in Russian, by Nikolai Karlovich Schilder, *Imperator Aleksander, &c.* (4 vols., St Petersb., 1897, 1898). See also Bogdanovich, *History of the Government of the Emperor Alexander I.* (St Petersburg, 1869–1871, 6 vols.); Theodor Schiemann, *Geschichte Russlands unter Kaiser Nikolaus I.* Band i. *Kaiser Alexander I. und die Ergebnisse seiner Lebensarbeit* (Berl., 1904), a valuable study based upon much new material from the state archives of St Petersburg, Paris, Berlin and Vienna; A. Vandal, *Napoléon et Alexandre I.: l'alliance Russe sous le premier empire* (3 vols., Paris, 1891–1896); A. N. Pypin, *Political and Literary Movements under Alexander I.* (Russian, 2nd ed. St Petersburg, 1885; German, Berlin, 1894). Among the numerous less authoritative biographies may be mentioned Ivan Golovin, *Histoire d'Alexandre I.* (Leipzig, 1859), and C. Joyneville, *Life and Times of Alexander I.* (3 vols., 1875). This last contains much valuable information, but the references in footnotes are often wanting in precision, and it has no index. (W. A. P.)

ALEXANDER II. (1818–1881), emperor of Russia, eldest son of Nicholas I., was born on the 29th of April 1818. His early life gave little indication of his subsequent activity, and up to the moment of his accession in 1855 no one ever imagined that he would be known to posterity as a great reformer. In so far as he had any decided political convictions, he seemed to be animated with that reactionary spirit which was predominant in Europe at the time of his birth, and continued in Russia to the end of his father's reign. In the period of thirty years during which he was heir-apparent, the moral atmosphere of St Petersburg was very unfavourable to the development of any originality of thought or character. It was a time of government on martinet principles, under which all freedom of thought and all private initiative were as far as possible suppressed vigorously by the administration. Political topics were studiously avoided in general conversation, and books or newspapers in which the most keen-scented press-censor could detect the least odour of political or religious free-thinking were strictly prohibited. Criticism of existing authorities was regarded as a serious offence. The common policeman, the insignificant scribe in a public office, and even the actors in the "imperial" theatres, were protected against public censure as effectually as the government itself; for the whole administration was considered as one and indivisible, and an attack on the humblest representative of the imperial authority was looked on as an indirect attack on the fountain from which that authority flowed. Such was the moral atmosphere in which young Alexander Nicolaevich grew up to manhood. He received the education commonly given to young Russians of good family at that time—a smattering of a great many subjects, and a good practical acquaintance with the chief modern European languages. Like so many of his countryman he displayed great linguistic ability, and his quick ear caught up even peculiarities of dialect. His ordinary life was that of an officer of the Guards, modified by the ceremonial duties incumbent on him as heir to the throne. Nominally he held the post of director of the military schools, but he took little personal interest in military affairs. To the disappointment of his father, in whom the military instinct was ever predominant, he showed no love of soldiering, and gave evidence of a kindliness of disposition and a tender-heartedness which were considered out of place in one destined to become a military autocrat. These tendencies had been fostered by his tutor Zhukovsky, the amiable humanitarian poet, who had made the Russian public acquainted with the literature of the German romantic school, and they remained with him all through life, though they did not prevent him from being severe in his official position when he believed severity to be necessary. In 1841 he married the daughter of the grand-duke Louis II. of Hesse, Maximilienne Wilhelmine Marie, thenceforward known as Maria Alexandrovna, who bore him six sons and two daughters. He did not travel much abroad, for his father, in his desire to exclude from Holy Russia the subversive ideas current in Western Europe, disapproved foreign tours, and could not consistently encourage in his own family what he tried to prevent among the rest of his subjects. He visited England, however, in 1839, and in the years immediately preceding his accession he was entrusted with several missions to the courts of Berlin and Vienna. On the 2nd of March 1855, during the Crimean War, he succeeded to the throne on the death of his father.

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[1] *Aperçu des idées de l'Empereur*, Martens IV. part i. p. 269.

[2] Metternich *Mem.*

[3] Martens IV. part i. pp. 307, &c.

[4] See W. Gasiorowski, *Tragic Russia*, translated by Viscount de Busancy (London, 1908).

The first year of the new reign was devoted to the prosecution of the war, and after the fall of Sevastopol, to negotiations for peace. Then began a period of radical reforms, recommended by public opinion and carried out by the autocratic power. The rule of Nicholas, which had sacrificed all other interests to that of making Russia an irresistibly strong military power, had been tried by the Crimean War and found wanting. A new system must, therefore, be adopted. All who had any pretensions to enlightenment declared loudly that the country had been exhausted and humiliated by the war, and that the only way of restoring it to its proper position in Europe was to develop its natural resources and to reform thoroughly all branches of the administration. The government found, therefore, in the educated classes a new-born public spirit, anxious to assist it in any work of reform that it might think fit to undertake. Fortunately for Russia the autocratic power was now in the hands of a man who was impressionable enough to be deeply influenced by the spirit of the time, and who had sufficient prudence and practical common-sense to prevent his being carried away by the prevailing excitement into the dangerous region of Utopian dreaming. Unlike some of his predecessors, he had no grand, original schemes of his own to impose by force on unwilling subjects, and no pet crotchets to lead his judgment astray; and he instinctively looked with a suspicious, critical eye on the panaceas which more imaginative and less cautious people recommended. These traits of character, together with the peculiar circumstances in which he was placed, determined the part which he was to play. He moderated, guided and in great measure realized the reform aspirations of the educated classes. Though he carefully guarded his autocratic rights and privileges, and obstinately resisted all efforts to push him farther than he felt inclined to go he acted for several years somewhat like a constitutional sovereign of the continental type. At first he moved so slowly that many of the impatient, would-be reformers began to murmur at the unnecessary delay. In reality not much time was lost. Soon after the conclusion of peace important changes were made in the legislation concerning industry and commerce, and the new freedom thus accorded produced a large number of limited liability companies. At the same time plans were formed for constructing a great network of railways, partly for the purpose of developing the natural resources of the country, and partly for the purpose of increasing its powers of defence and attack. Then it was found that further progress was blocked by a great obstacle, the existence of serfage; and Alexander II. showed that, unlike his father, he meant to grapple boldly with the difficult and dangerous problem. Taking advantage of a petition presented by the Polish landed proprietors of the Lithuanian provinces, praying that their relations with the serfs might be regulated in a more satisfactory way—meaning in a way more satisfactory for the proprietors—he authorized the formation of committees "for ameliorating the condition of the peasants," and laid down the principles on which the amelioration was to be effected. This was a decided step and it was followed by one still more significant. Without consulting his ordinary advisers, his majesty ordered the minister of the interior to send a circular to the provincial governors of European Russia, containing a copy of the instructions forwarded to the governor-general of Lithuania, praising the supposed generous, patriotic intentions of the Lithuanian landed proprietors, and suggesting that perhaps the landed proprietors of other provinces might express a similar desire. The hint was taken, of course, and in all provinces where serfage existed emancipation committees were formed. The deliberations at once raised a host of important, thorny questions. The emancipation was not merely a humanitarian question capable of being solved instantaneously by imperial ukaz. It contained very complicated problems affecting deeply the economic, social and political future of the nation. Alexander II. had little of the special knowledge required for dealing successfully with such problems, and he had to restrict himself to choosing between the different measures recommended to him. The main point at issue was whether the serfs should become agricultural labourers dependent economically and administratively on the landlords, or should be transformed into a class of independent communal proprietors. The emperor gave his support to the latter project, and the Russian peasantry accordingly acquired rights and privileges such as are enjoyed by no other peasantry in Europe. In the numerous other questions submitted to him be began by consulting carefully the conflicting authorities, and while leaning as a rule rather to the side of those who were known as "Liberals," he never went so far as they desired, and always sought some middle course by which conflicting interests might be reconciled. On the 3rd of March 1861, the sixth anniversary of his accession, the emancipation law was signed and published. Other reforms followed in quick succession during the next five or six years: army and navy organization, a new judicial administration on the French model, a new penal code and a greatly simplified system of civil and criminal procedure, an elaborate scheme of local self-government for the rural districts and the large

Emancipation of the serfs.

towns, with elective assemblies possessing a restricted right of taxation, and a new rural and municipal police under the direction of the minister of the interior. These new institutions were incomparably better than the old ones which they replaced, but they did not work such miracles as inexperienced enthusiasts expected. Comparisons were made, not with the past, but with an ideal state of things which never existed in Russia or elsewhere. Hence arose a general feeling of disappointment, which acted on different natures in different ways. Some of the enthusiasts sank into a sceptical, reactionary frame of mind; while others, with deeper convictions or capable of more lasting excitement, attributed the failure to the fact that only half-measures and compromises had been adopted by the government. Thus appeared in the educated classes two extreme groups: on the one hand, the discontented Conservatives, who recommended a return to a more severe disciplinarian *régime*; and on the other, the discontented Radicals, who would have been satisfied with nothing less than the adoption of a throughgoing socialistic programme. Between the two extremes stood the discontented Moderates, who indulged freely in grumbling without knowing how the unsatisfactory state of things was to be remedied. For some years the emperor, with his sound common-sense and dislike of exaggeration, held the balance fairly between the two extremes; but long years of uninterrupted labour, anxiety and disappointment weakened his zeal for reform, and when radicalism assumed more and more the form of secret societies and revolutionary agitation, he felt constrained to adopt severe repressive measures.

Nihilism.

The revolutionary agitation was of a very peculiar kind. It was confined to a section of the educated classes, and emanated from the universities and higher technical schools. At the beginning of the reform period there had been much enthusiasm for scientific as opposed to classical education. Russia required, it was said, not classical scholars, but practical, scientific men, capable of developing her natural resources. The government, in accordance with this view, had encouraged scientific studies until it discovered to its astonishment that there was some mysterious connexion between natural science and revolutionary tendencies. Many of the young men and women, who were supposed to be qualifying as specialists in the various spheres of industrial and commercial enterprise, were in reality devoting their time to considering how human society in general, and Russian society in particular, could be reconstructed in accordance with the latest physiological, biological and sociological principles. Some of these young people wished to put their crude notions immediately into practice, and as their desire to make gigantic socialist experiments naturally alarmed the government, their activity was opposed by the police. Many of them were arrested and imprisoned or exiled to distant provinces, but the revolutionary work was continued with unabated zeal. Thus arose a struggle between the youthful, hot-headed partisans of revolutionary physical science and the zealous official guardians of political order—a struggle which has made the strange term Nihilism (*q.v.*) a familiar word not only in Russia but also in western Europe. The movement gradually assumed the form of terrorism, and aimed at the assassination of prominent officials, and even of the emperor himself, and the natural result was that the reactionary tendencies of the government were strengthened.

Foreign policy.

In foreign policy Alexander II. showed the same qualities of character as in internal affairs, ever trying prudently to steer a middle course. When he came to the throne a peace policy was imposed on him by circumstances. The Crimean War was still going on, but as there was no doubt as to the final issue, and the country was showing symptoms of exhaustion, he concluded peace with the allies as soon as he thought the national honour had been satisfied. Prince Gorchakov could then declare to Europe, "*La Russie ne boude pas; elle se recueille*"; and for fifteen years he avoided foreign complications, so that the internal strength of the country might be developed, while the national pride and ambition received a certain satisfaction by the expansion of Russian influence and domination in Asia. Twice, indeed, during that period the chancellor ran the risk of provoking war. The first occasion was in 1863, when the Western powers seemed inclined to interfere in the Polish question, and the Russian chancery declared categorically that no interference would be tolerated. The second occasion was during the Franco-German War of 1870–71, when the cabinet of St Petersburg boldly declared that it considered itself no longer bound by the Black Sea clause of the treaty of Paris. On both these occasions hostilities were averted. Not so on the next occasion, when Russia abandoned her attitude of *recueillement*. When the Eastern question was raised in 1875 by the insurrection of Herzegovina, Alexander II. had no intention or wish to provoke a great European war. No doubt he was waiting for an opportunity of recovering the portion of Bessarabia which had been ceded by the treaty of Paris, and he perceived in the disturbed state of Eastern Europe a possibility of obtaining the desired rectification of frontier, but he hoped to effect his purpose by diplomatic means in conjunction with Austria. At the same time he was anxious to obtain for the Christians of Turkey some amelioration of their condition, and to give thereby some satisfaction to his own subjects. As autocratic ruler of the nation which had long considered itself the defender of the Eastern Orthodox faith and the protector of the Slav nationalities, he could not remain inactive at such a crisis, and he gradually allowed himself to drift into a position from which he could not retreat without obtaining some tangible result. Supposing that the Porte would yield to diplomatic pressure and menace so far as to make some reasonable concessions, he delivered his famous Moscow speech, in which he declared that if Europe would not secure a better position for the oppressed Slavs he would act alone. The diplomatic pressure failed and war became inevitable. During the campaign he displayed the same perseverance and the same moderation that he had shown in the emancipation of the serfs. To those who began to despair of success, and advised him to conclude peace on almost any terms so as to avoid greater disasters, he turned a deaf ear, and brought the campaign to a successful conclusion; but when his more headstrong advisers urged him to insist on terms which would probably have produced a conflict with Great Britain and Austria, he resolved, after some hesitation, to make the requisite concessions. In this resolution he was influenced by the discovery that he could not rely on the expected support of Germany, and the discovery made him waver in his devotion to the German alliance, which had been the main pivot of his foreign policy; but his personal attachment to the emperor William prevented him from adopting a hostile attitude towards the empire he had helped to create.

The patriotic excitement produced by the war did not weaken the revolutionary agitation. The struggle between the Terrorists and the police authorities became more and more intense, and attempts at assassination became more and more frequent. Alexander II. succumbed by degrees to the mental depression produced originally by the disappointments which he experienced in his home and foreign policy; and in 1880, when he had reigned twenty-five years, he entrusted to Count Loris-Melikov a large share of the executive power. In that year the empress died, and a few weeks afterwards he married secretly a Princess Dolgoruki, with whom he had already entertained intimate relations for some years. Early in 1881, on the advice of Count Loris-Melikov, he determined to try the effect of some moderate liberal reforms on the revolutionary agitation, and for this purpose he caused a ukaz to be prepared creating special commissions, composed of high officials and private personages who should prepare reforms in various branches of the administration. On the very day on which this ukaz was signed—13th of March 1881—he fell a victim to a Nihilist plot. When driving in one of the central streets of St Petersburg, near the Winter Palace, he was mortally wounded by the explosion of some small bombs and died a few hours afterwards. (D. M. W.)

ALEXANDER III. (1845–1894), emperor of Russia, second son of Alexander II., was born on the 10th of March 1845. In natural disposition he bore little resemblance to his soft-hearted, liberal-minded father, and still less to his refined, philosophic, sentimental, chivalrous, yet cunning grand-uncle Alexander I., who coveted the title of "the first gentleman of Europe." With high culture, exquisite refinement and studied elegance he had no sympathy and never affected to have any. Indeed, he rather gloried in the idea of being of the same rough texture as the great majority of his subjects. His straightforward, abrupt manner savoured sometimes of gruffness, while his direct, unadorned method of expressing himself harmonized well with his rough-hewn, immobile features and somewhat sluggish movements. His education was not fitted to soften these peculiarities. During the first twenty years of his life he had no prospect of succeeding to the throne, because he had an elder brother, Nicholas, who seemed of a fairly robust constitution. Even when this elder brother showed symptoms of delicate health it was believed that his life might be indefinitely prolonged by proper care and attention, and precautions had been taken for the succession by his betrothal with Princess Dagmar of Denmark. Under these circumstances the greatest solicitude was devoted to the education of Nicholas as cesarevich, whereas Alexander received only the perfunctory and inadequate training of an ordinary grand-duke of that period, which did not go much beyond primary and secondary instruction, practical acquaintance with French, English and German, and a certain amount of drill. When he became heir-apparent by the death of his elder brother in 1865, he began to study the principles of law and administration under Professor Pobêdonostsef, who did not succeed in awakening in his pupil a love of abstract studies or prolonged intellectual exertion, but who influenced the character of his reign by instilling into his mind the belief that zeal for Eastern Orthodoxy ought, as an essential factor of Russian patriotism, to be specially cultivated by every right-minded tsar. His elder brother when on his deathbed had expressed a wish that his affianced bride, Princess Dagmar of Denmark, should marry his successor, and this wish was realized on the 9th of November 1866. The union proved a most happy one and remained unclouded to the end. During those years when he was heir-apparent—1865 to 1881—he did not play a prominent part in public affairs, but he allowed it to become known that he had certain ideas of his own which did not coincide with the principles of the existing government. He deprecated what he considered undue foreign influence in general, and German influence in particular, and he longed to see the adoption of genuine national principles in all spheres of official activity, with a view to realizing his ideal of a homogeneous Russia—homogeneous in language, administration and religion. With such ideas and aspirations he could hardly remain permanently in cordial agreement with his father, who, though a good patriot according to his lights, had strong German sympathies, often used the German language in his private relations, occasionally ridiculed the exaggerations and eccentricities of the Slavophils and based his foreign policy on the Prussian alliance. The antagonism first appeared publicly during the Franco-German War, when the tsar supported the cabinet of Berlin and the cesarevich did not conceal his sympathies with the French. It reappeared in an intermittent fashion during the years 1875–1879, when the Eastern question produced so much excitement in all ranks of Russian society. At first the cesarevich was more Slavophil than the government, but his phlegmatic nature preserved him from many of the exaggerations indulged in by others, and any of the prevalent popular illusions he may have imbibed were soon dispelled by personal observation in Bulgaria, where he commanded the left wing of the invading army. The Bulgarians had been represented in St Petersburg and Moscow not only as martyrs but also as saints, and a very little personal experience sufficed to correct the error. Like most of his brother officers he could not feel any very great affection for the "little brothers," as the Bulgarians were then commonly called, and he was constrained to admit that the Turks were by no means so black as they had been painted. He did not, however, scandalize the believers by any public expression of his opinions, and did not indeed make himself conspicuous in any way during the campaign. Never consulted on political questions, he confined himself to his military duties and fulfilled them in a conscientious and unobtrusive manner. After many mistakes and disappointments, the army reached Constantinople and the treaty of San Stefano was signed, but much that had been obtained by that important document had to be sacrificed at the congress of Berlin. Prince Bismarck failed to do what was confidently expected of him. In return for the Russian support, which had enabled him to create the German empire, it was thought that he would help Russia to solve the Eastern question in accordance with her own interests, but to the surprise and indignation of the cabinet of St Petersburg he confined himself to acting the part of "honest broker" at the congress, and shortly afterwards he ostentatiously contracted an alliance with Austria for the express purpose of counteracting Russian designs in Eastern Europe. The cesarevich could point to these results as confirming the views he had expressed during the Franco-German War, and he drew from them the practical conclusion that for Russia the best thing to do was to recover as quickly as possible from her temporary exhaustion and to prepare for future contingencies by a radical scheme of military and naval reorganization. In accordance with this conviction, he suggested that certain reforms should be introduced. During the campaign in Bulgaria he had found by painful experience that grave disorders and gross corruption existed in the military administration, and after his return to St Petersburg he had discovered that similar abuses existed in the naval department. For these abuses, several high-placed personages—among others two of the grand-dukes—were believed to be responsible, and he called his father's attention to the subject. His representations were not favourably received. Alexander II. had lost much of the reforming zeal which distinguished the first decade of his reign, and had no longer the energy required to undertake the task suggested to him. The consequence was that the relations between father and son became more strained. The latter must have felt that there would be no important reforms until he himself succeeded to the direction of affairs. That change was much nearer at hand than was commonly supposed. On the 13th of March 1881 Alexander II. was assassinated by a band of Nihilists, and the autocratic power passed to the hands of his son.

In the last years of his reign, Alexander II. had been much exercised by the spread of Nihilist doctrines and the increasing number of anarchist conspiracies, and for some time he had hesitated between strengthening the hands of the executive and making concessions to the widespread political aspirations of the educated classes. Finally he decided in favour of the latter course, and on the very day of his death he signed a ukaz, creating a number of consultative commissions which might have been easily transformed into an assembly of notables. Alexander III. determined to adopt the opposite policy. He at once cancelled the ukaz before it was published, and in the manifesto announcing his accession to the throne he let it be very clearly understood that he had no intention of limiting or weakening the autocratic power which he had inherited from his ancestors. Nor did he afterwards show any inclination to change his mind. All the internal reforms which he initiated were intended to correct what he considered as the too liberal tendencies of the previous reign, so that he left behind him the reputation of a sovereign of the retrograde type. In his opinion Russia was to be saved from anarchical disorders and revolutionary agitation, not by the parliamentary institutions and so-called liberalism of western Europe, but by the three principles which the elder generation of the Slavophils systematically recommended—nationality, Eastern Orthodoxy and autocracy. His political ideal was a nation containing only one nationality, one language, one religion and one form of administration; and he did his utmost to prepare for the realization of this ideal by imposing the Russian language and Russian schools on his German, Polish and Finnish subjects, by fostering Eastern Orthodoxy at the expense of other confessions, by persecuting the Jews and by destroying the remnants of German, Polish and Swedish institutions in the outlying provinces. In the other provinces he sought to counteract what he considered the excessive liberalism of his father's reign. For this purpose he clipped the feeble wings of the zemstvo, an elective local administration resembling the county and parish councils in England, and placed the autonomous administration of the peasant communes under the supervision of landed proprietors appointed by the government. At the same time he sought to strengthen and centralize the imperial administration, and to bring it more under his personal control. In foreign affairs he was emphatically a man of peace, but not at all a partisan of the doctrine of peace at any price, and he followed the principle that the best means of averting war is to be well prepared for it. Though indignant at the conduct of Prince Bismarck towards Russia, he avoided an open rupture with Germany, and even revived for a time the Three Emperors' Alliance. It was only in the last years of his reign, when M. Katkov had acquired a certain influence over him, that he adopted towards the cabinet of Berlin a more hostile attitude, and even then he confined himself to keeping a large quantity of troops near the German frontier, and establishing cordial relations with France. With regard to Bulgaria he exercised similar self-control. The efforts of Prince Alexander and afterwards of Stamboloff to destroy Russian influence in the principality excited his indignation, but he persistently vetoed all proposals to intervene by force of arms. In Central Asian affairs he followed the traditional policy of gradually extending Russian domination without provoking a conflict with Great Britain, and he never allowed the bellicose partisans of a forward policy to get out of hand. As a whole his reign cannot be regarded as one of the eventful periods of Russian history; but it must be admitted that under his hard unsympathetic rule the country made considerable progress. He died at Livadia on the 1st of November 1894, and was succeeded by his eldest son, Nicholas II. **(D. M. W.)**

ALEXANDER I. (*c.* 1078–1124), king of Scotland, was the fourth son of Malcolm Canmore by his wife (St) Margaret, grand-niece of Edward the Confessor. On the death of his brother Edgar in 1107 he succeeded to the Scottish crown; but, in accordance with Edgar's instructions, he inherited only a part of its possessions. By a partition, the motive of which is not quite certain, the districts south of the Forth and Clyde were erected into an earldom for Alexander's younger brother, David. Alexander, dissatisfied, sought to obtain the whole, but without success. A curious combination of the fierce warrior and the pious churchman, he manifested the one aspect of his character in his ruthless suppression of an insurrection in his northern dominion (thus gaining for himself the title of "the Fierce"), the other in his munificent foundation of bishoprics and abbeys. Among the latter were those of Scone and Inchcolm. His strong championship of the independence of the Scottish church involved him in struggles with both the English metropolitan sees. He died on the 27th of April 1124, and was succeeded by his brother, David I.

ALEXANDER II. (1198–1249), king of Scotland, son of William the Lion and Ermengarde of Beaumont, was born at Haddington in 1198, and succeeded to the kingdom on the death of his father in 1214. The year after his accession the clans MacWilliam and MacHeth, inveterate enemies of the Scottish crown, broke into revolt; but the insurrection was speedily quelled. In the same year Alexander joined the English barons in their struggle against John, and led an army into England in support of their cause; but on the conclusion of peace after John's death between his youthful son Henry III. and the French prince Louis, the Scottish king was included in the pacification. The reconciliation thus effected was further strengthened by the marriage of Alexander to Henry's sister Joanna in 1221. The next year was marked by the subjection of the hitherto semi-independent district of Argyll. A revolt in Galloway in 1235 was crushed without difficulty; nor did an invasion attempted soon afterwards by its exiled leaders meet with any better fortune. Soon afterwards a claim for homage from Henry of England drew forth from Alexander a counter-claim to the northern English counties. The dispute, however, was settled by a compromise in 1237. A threat of invasion by Henry in 1243 for a time interrupted the friendly relations between the two countries; but the prompt action of Alexander in anticipating his attack, and the disinclination of the English barons for war, compelled him to make peace next year at Newcastle. Alexander now turned his attention to securing the Western Isles, which still owned a nominal dependence on Norway. Negotiations and purchase were successively tried but without success. Alexander next attempted to seduce Ewen, the son of Duncan, lord of Argyll, from his allegiance to the Norwegian king. Ewen refused his overtures, and Alexander sailed forth to compel him. But on the way he was seized with fever at Kerrera, and died there on the 8th of July 1249.

ALEXANDER III. (1241–1285), king of Scotland, son of Alexander II. by his second wife Mary de Coucy, was born in 1241. At the age of eight years the death of his father called him to the throne. The years of his minority were marked by an embittered struggle for the control of affairs between two rival parties, the one led by Walter Comyn, earl of Menteith, the other by Alan Durward, the justiciar. The former was in the ascendant during the early years of the reign. At the marriage of Alexander to Margaret of England in 1251, Henry III. seized the opportunity to demand from his son-in-law homage for the Scottish kingdom, but the claim was refused. In 1255 an interview between the English and Scottish kings at Kelso resulted in the deposition of Menteith and his party in favour of their opponents. But though disgraced, they still retained great influence; and two years later, seizing the person of the king, they compelled their rivals to consent to the erection of a regency representative of both parties. On attaining his majority in 1262, Alexander declared his intention of resuming the projects on the Western Isles which had been cut short by the death of his father thirteen years before. A formal claim was laid before the Norwegian king Haakon. Not only was this unsuccessful, but next year Haakon replied by a formidable invasion. Sailing round the west coast of Scotland he halted off Arran, where negotiations were opened. These were artfully prolonged by Alexander until the autumn storms should begin. At length Haakon, weary of delay, attacked, only to encounter a terrific storm which greatly damaged his ships. The battle of Largs, fought next day, was indecisive. But even so Haakon's position was hopeless. Baffled he turned homewards, but died on the way. The Isles now lay at Alexander's feet, and in 1266 Haakon's successor concluded a treaty by which the Isle of Man and the Western Isles were ceded to Scotland in return for a money payment, Orkney and Shetland alone being retained. Towards the end of Alexander's reign, the death of all his three children within a few years made the question of the succession one of pressing importance. In 1284 he induced the Estates to recognize as his heir-presumptive his grand-daughter Margaret, the "Maid of Norway"; and next year the desire for a male heir led him to contract a second marriage. But all such hopes were defeated by the sudden death of the king, who was killed by a fall from his horse in the dark while riding to visit the queen at Kinghorn on the 16th of March 1285.

ALEXANDER (ALEXANDER OBRENOVICH) (1876–1903), king of Servia, was born on the 14th of August 1876. On the 6th of March 1889 his father, King Milan, abdicated and proclaimed him king of Servia under a regency until he should attain his majority at eighteen years of age. King Alexander, on the 13th of April 1893, being then in his seventeenth year, made his notable first *coup d'état*, proclaimed himself of full age, dismissed the regents and their government, and took the royal authority into his own hands. His action was popular, and was rendered still more so by his appointment of a radical ministry. In May 1894 King Alexander, by another *coup d'état*, abolished the liberal constitution of 1889 and restored the conservative one of 1869. His attitude during the Turco-Greek war of 1897 was one of strict neutrality. In 1898 he appointed his father commander-in-chief of the Servian army, and from that time, or rather from his return to Servia in 1894 until 1900, ex-king Milan was regarded as the *de facto* ruler of the country. But while, during the summer of 1900, Milan was away from Servia taking waters in Carlsbad, and making arrangements to secure the hand of a German princess for his son, and while the premier, Dr Vladan Dyorevich, was visiting the Paris Universal Exhibition, King Alexander suddenly announced to the people of Servia his engagement to Mme Draga Mashin, a widow, formerly a lady-in-waiting to Queen Natalie. The projected union aroused great opposition at first. Ex-King Milan resigned his post; so did the government; and King Alexander had great difficulty in forming a new cabinet. But the opposition subsided somewhat on the publication of Tsar Nicholas's congratulations to the king on his engagement and of his acceptance to act as the principal witness at the wedding. The marriage was then duly celebrated on the 5th of August 1900. Still this union was unpopular and weakened the position of King Alexander in the army and the country. He tried to reconcile political parties by granting from his own initiative a liberal constitution (April 6, 1901), introducing for the first time in the constitutional history of Servia the system of two chambers (skupshtina and senate). This did in a certain measure reconcile the political parties, but did not reconcile the army, which, already dissatisfied with the king's marriage, became still more so at the rumours that one of the two unpopular brothers of Queen Draga, Lieutenant Nicodiye, was to be proclaimed heir-apparent to the throne. Meanwhile the independence of the senate and of the council of state caused growing irritation to King Alexander, which led him to another *coup d'état*. He suspended (March 1903) the constitution for half an hour, time enough to publish the decrees by which the old senators and councillors of state were dismissed and replaced by new ones. This arbitrary act naturally increased the dissatisfaction in the country. The general impression was that inasmuch as the senate was packed with men devoted to the royal couple, and inasmuch as the government obtained a large majority at the general elections, King Alexander would not hesitate any longer to proclaim Queen Draga's brother as the heir to the throne. Apparently to prevent this, but in reality to replace Alexander Obrenovich by Peter Karageorgevich, a military conspiracy was organized. The conspirators penetrated into the palace and savagely murdered King Alexander and Queen Draga in the early morning of the 11th of June 1903. (C. Mi.)

ALEXANDER, son of Numenius, Greek rhetorician, flourished in the first half of the second century A.D. In addition to general treatises on rhetoric, he wrote a special work *Περὶ τῶν τῆς διανοίας καὶ τῆς λέξεως σχημάτων*, of which only an abridgment is extant; later epitomes were made in Latin by Aquila Romanus and Julius Rufinianus under the title *De Figuris Sententiarum et Elocutionis*. Another epitome was made in the fourth century by a Christian for use in Christian schools, containing additional examples from Gregory of Nazianzus.

Text in Spengel, *Rhetores Graeci* (1856).

ALEXANDER, ARCHIBALD (1772–1851), American Presbyterian divine, was born, of Scottish-Irish descent, in that part of Augusta county which is now Rockbridge county, Virginia, on the 17th of April 1772. After completing his preliminary education in the little school at Lexington, Virginia, which later developed into Washington and Lee University, he came under the influence of the religious movement known as the "great revival" (1789–1790) and devoted himself to the study of theology. Licensed to preach in 1791, he was engaged for several years as an itinerant Presbyterian preacher in his native state, and acquired during this period the facility in extemporaneous speaking for which he was remarkable. He was president of Hampden-Sidney College from 1796 to 1807, with a short intermission (in 1801–1802), and in 1807 became pastor of Pine Street Church, Philadelphia. In 1812 he became first professor in the newly established Presbyterian Theological Seminary at Princeton, New Jersey, where he remained until his death at Princeton on the 22nd of October 1851, filling successively the chairs of didactic and polemic theology (1812–1840), and pastoral and polemic theology (1840–1851). He married, in 1802, Janetta Waddel, the daughter of the celebrated blind preacher, James Waddel (1739–1805), whose eloquence was described in William Wirt's *Letters of a British Spy* (1803). Dr Alexander wrote a considerable number of theological works, which had a large circulation. Among these may be mentioned his *Brief Outline of the Evidences of the Christian Religion* (1825), which passed through several editions, and was translated into various languages; *The Canon of the Old and New Testament Ascertained; or the Bible Complete without the Apocrypha and Unwritten Traditions* (1826); *A History of the Israelitish Nation* (1852), and *Outlines of Moral Science* (1852), the last two being published posthumously.

See the biography (New York, 1854) by his son James W. Alexander.

ALEXANDER, FRANCIS (1800–1881), American portrait-painter, was born in Windham county, Connecticut, in February 1800. Brought up on a farm, he taught himself the use of colours, and in 1820 went to New York City and studied painting with Alexander Robertson. He spent the winters of 1831 and 1832 in Rome, and then for nearly a decade he lived in Boston, Massachusetts, where he had considerable vogue, and where in 1842 he painted a portrait of Charles Dickens. One of his best portraits is that of Mrs Fletcher Webster in the Boston Museum of Fine Arts. He died in 1881 in Florence.

ALEXANDER, GEORGE (1858–), English actor, whose family name was Samson, was born in Reading on the 19th of June 1858, the son of a Scottish manufacturer. He went into business in London after leaving school, but having acted as an amateur he determined to make the stage his profession. His first appearance was at Nottingham in 1879, and after some seasons of provincial experience he made his first London appearance as Caleb Deecie in *Two Roses* in 1881 with Irving at the Lyceum. He was selected by W. S. Gilbert to support Mary Anderson in *Comedy and Tragedy*, returned for a time to the Lyceum, where he was Irving's principal associate, especially as Faust (1886) and Macduff (1888); and, after starting successfully under his own management at the Avenue Theatre in 1890 with *Dr Bill*, in 1891 became manager of the St James's Theatre. There he produced a number of successful plays, notably Oscar Wilde's *Lady Windermere's Fan* and *The Importance of being Earnest*, Pinero's *Second Mrs Tanqueray*, *The Princess and the Butterfly*, *His House in Order* and *The Thunderbolt*; C. Haddon Chambers's *The Idler*; H. A. Jones's *Masqueraders*; Alfred Sutro's *John Glayde's Honour* and *The Builder of Bridges*; Carton's *Liberty Hall* and *The Tree of Knowledge*; Anthony Hope's *Prisoner of Zenda* and *Rupert of Hentzau*; and Stephen Phillips's *Paolo and Francesca*, himself playing the leading parts with great distinction. In 1907 he was elected a member of the London County Council as a municipal reformer, but continued to act regularly at the St James's.

ALEXANDER, SIR JAMES EDWARD (1803–1885), British soldier and traveller, was born on the 16th of October 1803. He joined the East India Company's army in 1820, transferring into the British army in 1825. As aide-de-camp to the British envoy to Persia, he was an eye-witness of the fighting in the war between Persia and Russia (1826), and in 1829 was present in the Balkans during the Russo-Turkish war. In 1832–1834 he was in Portugal during the Miguelete war, and in 1835 served in the Kaffir war in South Africa as aide-de-camp to Sir Benjamin D'Urban. Subsequently he conducted an exploring expedition into Namaqualand and Damaraland, and was knighted for his services (1838). From 1841 to 1855 he served in Canada, proceeding thence to the Crimea, and in 1862 held an important command in New Zealand during the Maori war. He retired from the service in 1877, and in 1881 was given the honorary rank of general. He was largely responsible for the preservation and transfer to England of Cleopatra's Needle in 1877. His varied experiences provided material for a large number of books, among which were *Travels from India to England* (1827); *Transatlantic Sketches* (1833); *An Expedition of Discovery into the Interior of Africa* (1838); *Passages in the Life of a Soldier* (1857); *Incidents of the Maori War* (1863). He was also the author of a *Life of Field-Marshal the Duke of Wellington* (1840). He died on the 2nd of April 1885.

ALEXANDER, JOHN WHITE (1856–), American painter, was born in Allegheny, Pennsylvania, on the 7th of October

1856. He was left an orphan when very young, became an illustrator for *Harper's Magazine*, studied in Europe, became a pupil of the Royal Academy at Munich, and also worked in Venice, in Holland and in Paris, where he attracted much attention by his exhibition at the Salon of two female portraits entitled "Gris" and "Noir." He became a member of the Société Nationale des Beaux Arts (Paris), of the National Academy of Design (New York), of the International Society (London), and of the Vienna and Munich Societies of Painters. In 1901 he was made a Chevalier of the Legion of Honour. He executed decorative panels for the Congressional Library, Washington, D.C., and a large decoration for the Carnegie Institute, Pittsburg, Pennsylvania; and his works include numerous portraits and subject pictures.

ALEXANDER, JOSEPH ADDISON (1809–1860), American biblical scholar, the third son of Archibald Alexander, was born in Philadelphia, Pennsylvania, on the 24th of April 1809. He graduated at the College of New Jersey (now Princeton University) in 1826, having devoted himself especially to the study of Hebrew and other oriental languages, and from 1830 to 1833 was adjunct professor of ancient languages and literature there. In 1834 he became an assistant to Dr Charles Hodge, professor of oriental and biblical literature in the Princeton Theological Seminary, and in 1838 became associate professor of oriental and biblical literature there, succeeding Dr Hodge in that chair in 1840 and being transferred in 1851 to the chair of biblical and ecclesiastical history, and in 1859 to that of Hellenistic and New Testament literature, which he occupied until his death at Princeton on the 28th of January 1860. Alexander was a remarkable linquist and exegete. He had been ordained as a Presbyterian minister in 1839, and was well known for his pulpit eloquence. He was the author of *The Earlier Prophecies of Isaiah* (1846), *The Later Prophecies of Isaiah* (1847), and an abbreviation of these two volumes, *Isaiah Illustrated and Explained* (2 vols., 1851), *The Psalms Translated and Explained* (3 vols., 1850), commentaries on *Acts* (2 vols., 1857), *Mark* (1858) and *Matthew* (1860), and two volumes of *Sermons* (1860).

See *The Life of Joseph A. Alexander* (2 vols., 2nd ed., New York, 1875) by his nephew, Henry C. Alexander.

His brother, JAMES WADDEL ALEXANDER (1804–1859), born in Louisa county, Virginia, on the 13th of March 1804, was a famous Presbyterian preacher. He graduated at the College of New Jersey in 1820, studied theology in the Princeton Seminary, and was pastor of a Presbyterian church in Charlotte county, Virginia, from 1826 to 1828, and of the First Presbyterian church in Trenton, New Jersey, in 1829–1832. From 1833 to 1844 he was professor of belles-lettres and Latin language and literature in the College of New Jersey, from 1844 to 1849 was pastor of the Duane Street Presbyterian church in New York City, from 1849 to 1851 was professor of ecclesiastical history, church government and sacred rhetoric in the Princeton Theological Seminary, and from 1851 until his death, at Red Sweet Springs, Virginia, on the 31st of July 1859, was pastor of the Fifth Avenue Presbyterian church in New York City. He wrote numerous magazine articles and published a number of books, including *The American Mechanic and Workingman* (2 vols., 1847, a collection of papers to mechanics first printed under the pseudonym of "Charles Quill"), *Thoughts on Family Worship* (1847), *Sacramental Addresses* (1854), *The Revival and its Lessons* (1859), *Thoughts on Preaching* (1861), *Faith* (1862), and many juvenile books for Sunday-school libraries.

See *Forty Years' Familiar Letters of James W. Alexander* (2 vols., New York, 1860), edited by Dr John Hall (1806–1894) of Trenton, N. J.

ALEXANDER, WILLIAM (1824–　　), Protestant archbishop of Armagh and primate of all Ireland, was born at Londonderry on the 13th of April 1824 and educated at Tonbridge Grammar School and Brasenose College, Oxford. After holding several livings in the north of Ireland he was made bishop of Derry and Raphoe in 1867, and was elevated to the primacy in 1896. He was Bampton lecturer in 1876. An eloquent preacher and the author of numerous theological works, he is best known to literature as a master of dignified and animated verse. His poems were collected in 1887 under the title of *St Augustine's Holiday, and other Poems*. His wife, Cecil Francis Humphreys (1818–1895), wrote some tracts in connexion with the Oxford movement, but is famous as the author of "Jesus calls us o'er the tumult," "There is a green hill far away" and other well-known hymns (nearly four hundred in all). A collection of her verse was published in 1896.

ALEXANDER, WILLIAM LINDSAY (1808–1884), Scottish divine, was born at Leith on the 24th of August 1808. He was educated at the universities of St Andrews and Edinburgh, where he gained a lasting reputation for classical scholarship. He entered Glasgow Theological Academy under Ralph Wardlaw in September 1827, but in December of the same year he left to become classical tutor at the Blackburn Theological Academy (afterwards the Lancashire Independent College). At Blackburn he stayed till 1831, lecturing on biblical literature, metaphysics, Greek and Latin. After short visits to Germany and London he was invited in November 1834 to become minister of North College Street church (afterwards Argyle Square), Edinburgh, an independent church which had arisen out of the evangelical movement associated with the Haldanes. He deliberately put aside the ambition to become a pulpit orator in favour of the practice of biblical exposition, which he invested with a singular charm and impressiveness. In 1836 he became one of the editors of the *Congregational Magazine*, to which he contributed articles on biblical literature and theology and on the "voluntary" controversy. In 1840 he delivered the Congregational Lecture in London on the "Connexion and Harmony of the Old and New Testaments."

Alexander took an active part in the "voluntary" controversy which ended in the Disruption, but he also maintained broad and catholic views of the spiritual relations between different sections of the Christian church. In 1845 he visited Switzerland with the special object of inquiring into the religious life of the churches there. He published an account of his journey in a book, *Switzerland and the Swiss Churches*, which led to an interchange of correspondence between the Swiss and Scottish churches. In 1845 he received the degree of D.D. from the university of St Andrews. In 1861 he undertook the editorship of the third edition of Kitto's *Biblical Encyclopaedia* with the understanding that the whole work should be thoroughly revised and brought up to date. In January 1870 he became one of the committee of Old Testament revisers, and by his thorough biblical scholarship rendered exceptional service to the board; he enjoyed the work and devoted much time to it for the next fourteen years. In 1877 he became principal of the Edinburgh Theological Hall, a position which he held, in spite of many tempting offers of preferment elsewhere, until his death on the 20th of December 1884.

See his *Life and Work* by James Ross (1887). (D. Mn.)

ALEXANDER AETOLUS, of Pleuron in Aetolia, Greek poet and man of letters, the only representative of Aetolian poetry, flourished about 280 B.C. When living in Alexandria he was commissioned by Ptolemy Philadelphus to arrange the tragedies and satyric dramas in the library; some ten years later he took up his residence at the court of Antigonus Gonatas, king of Macedonia. His reputation as a tragic poet was so high that he was allotted a place in the Alexandrian tragic Pleiad; we only know the title of one play (*Astragalistae*). He also wrote short epics, epigrams and elegies, the considerable fragments of which show learning and eloquence.

Meineke, *Analecta Alexandrina* (1853); Bergk, *Poetae Lyrici Graeci*; Couat, *La Poésie alexandrine* (1882).

ALEXANDER BALAS (*i.e.* "lord"), ruler of the Greek kingdom of Syria 150–146 B.C., was a native of Smyrna of humble origin, but gave himself out to be the son of Antiochus IV. Epiphanes and heir to the Syrian throne. His claims were recognized by the Roman senate, Ptolemy Philometor of Egypt and others. At first unsuccessful, he finally defeated the reigning king Demetrius Soter in 150 B.C. Being now undisputed master of Syria, he abandoned himself to a life of debauchery. Demetrius Soter's son profited by the opportunity to regain the throne. Ptolemy Philometor, who was Alexander's father-in-law, went over to his side, and Alexander was defeated in a pitched battle near Antioch in Syria. He fled for refuge to a Nabataean prince, who murdered him and sent his head to Ptolemy, who had been mortally wounded in the engagement.

See 1 Maccab. 10 ff.; Justin xxxv. 1 and 2; Josephus, *Antiq.* xiii. 2; Appian, *Syr.* 67; Polybius xxxiii. 14.

ALEXANDER CORNELIUS, Greek grammarian, surnamed POLYHISTOR from his great learning, born at Miletus or Myndus in Caria, flourished about 70 B.C. He was taken prisoner in the Mithridatic war by Sulla, from whom (or from Cornelius Lentulus) he received his freedom and assumed the name Cornelius. He accompanied Crassus on his Parthian campaigns, and perished at the destruction by fire of his house at Laurentum. He is said to have written "books without number," chiefly on historical and geographical subjects. Of the extant fragments (Müller, *Fragmenta Historicorum Graecorum*, iii.) those relating to the Jews are important as containing quotations from lost Jewish authors.

ALEXANDER JANNAEUS, king of the Jews, succeeded his brother Aristobulus in 103 B.C. and died in 76 B.C. His first act was the murder of one of his brothers who claimed the throne, and his reign was disgraced by the cruelties that he perpetrated in order to retain his position. (See JEWS and PHARISEES.)

ALEXANDER NEVSKY, SAINT (1220–1263), grand-duke of Vladimir, was the second son of the grand-duke Yaroslav. His childhood and youth were spent at Great Novgorod, whither his father sent him to rule (1228) with some guardian boyars. In 1239 he married Alexandra, daughter of Prince Bryachislav of Polotsk. At an early age he distinguished himself in constant warfare with the Germans, Swedes and Lithuanians, who tried to wrest Novgorod and Pskov from Russia while she was still suffering from the effects of the terrible Tatar invasion. The most notable of these battles, whereby he won his honorific epithet of Nevsky (*i.e.* of the Neva), was fought on the banks of the Neva (July 15, 1240) against the famous Swedish statesman, Birger Jarl, whom he utterly defeated, besides wounding him with his lance. In the following year the Teutonic Order, in conjunction with the Order of the Sword, succeeded in capturing Pskov; but Alexander recovered it in 1242, advanced into Livonia, and on the 5th of April defeated the knights on the ice of Lake Peipus and compelled them in the ensuing peace to renounce all their conquests. He also prevented the Swedes (in 1256) from settling in South Finland. On the death of his father (1246) Alexander and his younger brother Andrew went on a two years' journey into Mongolia to obtain their *yarluiki*, or letters of investiture, from the Grand Khan, who then disposed of the fate of all the Russian princes. He returned (1250) as grand-duke of Kiev and Novgorod, while to Andrew was given the far more important grand-duchy of Vladimir. In 1252, however, the Tatars themselves expelled Andrew and placed Alexander on the throne of Vladimir. Alexander henceforth did his best for his country by humbling himself before the Tatars so as to give them no pretext for ravaging the land again. Most of his spare money he devoted to the ransoming of the numerous Russian captives detained at the Golden Horde. But the men of Novgorod, in their semi-independent republic, continued (1255–1257) to give the grand-duke trouble, their chief grievance being the imposition of a Tatar tribute, which they only submitted to in 1259 on the rumour of an impending Tatar invasion. In 1262 the Tatar tribute was felt so grievously all over Russia that preparations were made for a general insurrection, and Alexander, who knew that an abortive rebellion would make the yoke heavier, was obliged to go to the Horde in person to prevent the Tatars from again attacking Russia. He stayed at Sarai, their Volgan capital, all the winter, and not only succeeded in obtaining a mitigation of the tribute, but also the abolition of the military service previously rendered by the Russians to the Tatars. This was his last service to his country. He died on his way home from the Horde, and in the words of his contemporary, the metropolitan Cyril, "with him the sun of Russia set." The Orthodox Church has canonized the ruler who gave his whole life for Russia and the Orthodox faith. His relics, discovered in 1380, were in 1724 translated by Peter the Great from Vladimir to St Petersburg.

See Sergyei Mikhailovich Solovev, *History of Russia* (Rus., 2nd ed., St Petersburg, 1897, vol. 3). (R. N. B.)

ALEXANDER OF APHRODISIAS, pupil of Aristocles of Messene, the most celebrated of the Greek commentators on the writings of Aristotle, and styled, by way of pre-eminence, ὁ ἐξηγητής ("the expositor"), was a native of Aphrodisias in Caria. He came to Athens towards the end of the 2nd century A.D., became head of the Lyceum and lectured on peripatetic philosophy. The object of his work was to free the doctrine from the syncretism of Ammonius and to reproduce the pure doctrine of Aristotle. Commentaries by Alexander on the following works of Aristotle are still extant:—the *Analytica Priora*, i.; the *Topica*; the *Meteorologica*; the *De Sensu*; and the *Metaphysica*, i.-v., together with an abridgment of what he wrote on the remaining books of the *Metaphysica*. His commentaries were greatly esteemed among the Arabians, who translated many of them. There are also several original writings by Alexander still extant. The most important of these are a work *On Fate*, in which he argues against the Stoic doctrine of necessity; and one *On the Soul*, in which he contends that the undeveloped reason in man is material (νοῦς ὑλικός) and inseparable from the body. He argued strongly against the doctrine of immortality. He identified the active intellect (νοῦς ποιητικός), through whose agency the potential intellect in man becomes actual, with God. Several of Alexander's works were published in the Aldine edition of Aristotle, Venice, 1495–1498; his *De Fato* and *De Anima* were printed along with the works of Themistius at Venice (1534); the former work, which has been translated into Latin by Grotius and also by Schulthess, was edited by J. C. Orelli, Zürich, 1824; and his commentaries on the *Metaphysica* by H. Bonitz, Berlin, 1847. J. Nourisson has treated of his doctrine of fate (*De la liberté et du hazard*, Paris, 1870). In the early Renaissance his doctrine of the soul's mortality was adopted by P. Pomponazzi against the Thomists and the Averroists.

See PERIPATETICS (*ad fin.*); ALEXANDRISTS; POMPONAZZI, PIETRO; also A. Apelt, "Die Schrift d. Alex. v. Aphr.," *Philologus*, xlv., 1886; C. Ruelle, "Alex. d'Aphr. et le prétendu Alex. d'Alexandrie," *Rev. des études grecques*, v., 1892; E. Zeller's *Outlines of Gk. Phil.* (Eng. trans., ed. 1905, p. 296).

ALEXANDER OF HALES (ALEXANDER HALENSIS), surnamed DOCTOR IRREFRAGABILIS, THEOLOGORUM MONARCHA and FONS VITAE, a celebrated English theologian of the 13th century, was born in Gloucestershire. Trained in the monastery of Hales he was early raised to an archdeaconry. He went, like most of the scholars of his day, to study at Paris, where he took the degree of doctor and became celebrated as a teacher. It is generally held that he taught Bonaventura, Duns Scotus and Thomas Aquinas, but a comparison of dates makes it clear that the two latter could not have been his pupils and that the statement about Bonaventura is open to doubt. In 1222 (or 1231, see Denifle, *Chartul. Univers. Paris*, Paris, 1889, i. 135) Alexander entered the order of Minorite Friars and thenceforward lived in strict seclusion. He refused, however, to renounce his degree of doctor, and was the first of his order who continued to bear that title after initiation. He died in 1245 and was buried in the convent of the Cordeliers at Paris. His most celebrated work was the *Summa Theologiae* (Nuremberg, 1452; Venice, 1576; Cologne, 1611), undertaken by the orders of Pope Innocent IV. and approved by Alexander IV., on the report of seventy learned theologians, as a system of instruction for all the schools in Christendom. The form is that of question and answer, and the method is rigidly scholastic. Of small intrinsic value, it is interesting partly as the first philosophical contribution of the Franciscans who were afterwards to take a prominent part in medieval thought (see SCHOLASTICISM), and partly as the first work based on a knowledge of the whole Aristotelian *corpus* and the Arabian commentators.

See Wadding, *Script. ord. minor.* (Rome, 1650); for his method

B. Hauréau, *Hist. de philos. scholast.* (Paris, 1880); F. Picavet, "Abélard et A. de H." in the *Bibliothèque de l'école des hautes-études* (2nd series, Paris, 1896, pp. 222-230); Schwane, *Dogmengesch.* (Freiburg, 1882); A. Harnack, *Dogmengesch.* (1890); J. Endres, "Des A. von H. Leben und psychol. Lehre" in *Philos. Jahrb.* (i. Fulda, 1888, pp. 24-55, 203-296); also Vacant's *Dict. de théologie catholique*, vol. i.

ALEXANDER OF TRALLES (ALEXANDER TRALLIANUS), Greek physician, born at Tralles in Lydia, lived probably about the middle of the 6th century and practised medicine with success at Rome. The Greek text of his *Βιβλία ἰατρικά* was printed at Paris in 1548 and his *De Lumbricis* at Venice in 1570.

See E. Milward, *Trallianus Reviviscens* (London, 1734).

ALEXANDER SEVERUS (MARCUS AURELIUS SEVERUS ALEXANDER) (208–235), Roman emperor from A.D. 222 to 235, was born at Arca Caesarea in Palestine on the 1st of October 208. His father, Gessius Marcianus, held office more than once as an imperial procurator; his mother, Julia Mamaea, was the daughter of Julia Maesa and the aunt of Heliogabalus. His original name was Bassianus, but he changed it in 221 when his grandmother, Maesa, persuaded the emperor Heliogabalus to adopt his cousin as successor and create him Caesar. In the next year, on the 11th of March, Heliogabalus was murdered, and Alexander was proclaimed emperor by the Praetorians and accepted by the senate. He was then a mere lad, amiable, well-meaning, but entirely under the dominion of his mother, a woman of many virtues, who surrounded him with wise counsellors, watched over the development of his character and improved the tone of the administration, but on the other hand was inordinately jealous, and alienated the army by extreme parsimony, while neither she nor her son had a strong enough hand to keep tight the reins of military discipline. Mutinies became frequent in all parts of the empire; to one of them the life of the jurist and praetorian praefect Ulpian was sacrificed; another compelled the retirement of Dio Cassius from his command. On the whole, however, the reign of Alexander was prosperous till he was summoned to the East to face the new power of the Sassanians (see PERSIA: *History*). Of the war that followed we have very various accounts; Mommsen leans to that which is least favourable to the Romans. According to Alexander's own despatch to the senate he gained great victories. At all events, though the Persians were checked for the time, the conduct of the Roman army showed an extraordinary lack of discipline. The emperor returned to Rome and celebrated a triumph (233), but next year he was called to face German invaders in Gaul, where he was slain (on the 18th or 19th of March 235), together with his mother, in a mutiny which was probably led by Maximinus, a Thracian legionary, and at any rate secured him the throne. Alexander was the last of the Syrian princes. During his reign, acting, as he did in most things, under the influence of his mother, he did much to improve the morals and condition of the people. His advisers were men like the famous jurist Ulpian, the historian Dio Cassius and a select board of sixteen senators; a municipal council of fourteen assisted the city praefect in administering the affairs of the fourteen districts of Rome. The luxury and extravagance that had formerly been so prevalent at the court were put down; the standard of the coinage was raised; taxes were lightened; literature, art and science were encouraged; the lot of the soldiers was improved; and, for the convenience of the people, loan offices were instituted for lending money at a moderate rate of interest. In religious matters Alexander preserved an open mind. In his private chapel he had busts of Orpheus, Abraham, Apollonius of Tyana and Jesus Christ. It is said that he was desirous of erecting a temple to the founder of Christianity, but was dissuaded by the pagan priests. There is no doubt that, had Alexander's many excellent qualities been supported by the energy and strength of will necessary for the government of a military empire, he would have been one of the greatest of the Roman emperors.

See Lampridius, *Alexander Severus*; Dio Cassius lxxviii. 30, lxxix. 17, lxxx. 1; Herodian vi. 1-18; Porrath, *Der Kaiser Alex. Sev.* (1876); Pauly-Wissowa, *Realencyclopädie*, ii. 2526 foll. (Groebe); monograph by R. V. Nind Hopkins, *Cambridge Historical Essays*, No. xiv. (1907).

ALEXANDER THE PAPHLAGONIAN, a celebrated impostor and worker of false oracles, was born at Abonouteichos (see INEBOLI) in Paphlagonia in the early part of the 2nd century A.D. The vivid narrative of his career given by Lucian might be taken as fictitious but for the corroboration of certain coins of the emperors Lucius Verus and Marcus Aurelius (J. H. Eckhel, *Doctrina Nummorum veterum*, ii. pp. 383, 384) and of a statue of Alexander, said by Athenagoras (*Apology*, c. 26) to have stood in the forum of Parium. After a period of instruction in medicine by a doctor who also, according to Lucian, was an impostor, he succeeded in establishing an oracle of Aesculapius at his native town. Having circulated a prophecy that the son of Apollo was to be born again, he contrived that there should be found in the foundations of the temple to Aesculapius, then in course of construction at Abonouteichos, an egg in which a small live snake had been placed. In an age of superstition no people had so great a reputation for credulity as the Paphlagonians, and Alexander had little difficulty in convincing them of the second coming of the god under the name of Glycon. A large tame snake with a false human head, wound round Alexander's body as he sat in a shrine in the temple, gave "autophones" or oracles unasked, but the usual methods practised were those of the numerous oracle-mongers of the time, of which Lucian gives a detailed account, the opening of sealed inquiries by heated needles, a neat plan of forging broken seals, and the giving of vague or meaningless replies to difficult questions, coupled with a lucrative blackmailing of those whose inquiries were compromising. The reputation of the oracle, which was in origin medical, spread, and with it grew Alexander's skilled plans of organized deception. He set up an "intelligence bureau" in Rome, instituted mysteries like those of Eleusis, from which his particular enemies the Christians and Epicureans were alike excluded as "profane," and celebrated a mystic marriage between himself and the moon. During the plague of A.D. 166 a verse from the oracle was used as an amulet and was inscribed over the doors of houses as a protection, and an oracle was sent, at Marcus Aurelius' request, by Alexander to the Roman army on the Danube during the war with the Marcomanni, declaring that victory would follow on the throwing of two lions alive into the river. The result was a great disaster, and Alexander had recourse to the old quibble of the Delphic oracle to Croesus for an explanation. Lucian's own close investigations into Alexander's methods of fraud led to a serious attempt on his life. The whole account gives a graphic description of the inner working of one among the many new oracles that were springing up at this period. Alexander had remarkable beauty and the striking personality of the successful charlatan, and must have been a man of considerable intellectual abilities and power of organization. His income is said by Lucian to have reached an enormous figure. He died of gangrene of the leg in his seventieth year.

See Lucian, *'Αλεξάνδρος ἢ ψευδόμαντις*; Samuel Dill, *Roman Society from Nero to Marcus Aurelius* (1904); and F. Gregorovius, *The Emperor Hadrian*, trans. by M. E. Robinson (1898).

ALEXANDERS (botanical name, *Smyrnium Olusatrum*, natural order Umbelliferae), a stout herbaceous plant with a furrowed, much-branched stem 1-3 ft. high, and large compound leaves with broad sheathing stalks, and broad, cut or lobed segments. The small yellow flowers are borne in compound umbels. The plant is a native of the Mediterranean region, and was formerly cultivated as a pot-herb. It is now found apparently wild in Great Britain and Ireland, growing in waste places, especially near the sea and amongst ruins.

In England the plant is sometimes popularly termed "alisander"; in North America *Thaspium aureum* is sometimes called "alexanders." "Alexander's foot," botanical name *Anacyclus Pyrethrum*, is the pellitory of Spain.

ALEXANDERSBAD, a watering-place of Germany, in the kingdom of Bavaria, romantically situated in the Fichtelgebirge, near Wunsiedel, at a height of 1900 ft. above the sea. Pop. 1200. Its waters, which are ferruginous and largely charged with carbonic acid gas, are of use in nervous and rheumatic disorders. In the neighbourhood is the Luisenburg (or Luxburg), so called after a visit paid by Queen Louise of Prussia in 1805, a hill covered by majestic granite rocks, commanding a grand view of the whole range of the Fichtelgebirge.

ALEXANDRE, NOËL (Natalis Alexander) (1639–1724), French theologian and ecclesiastical historian, was born at Rouen on the 19th of January 1639. In his 15th year he joined the Dominicans, and shortly after his ordination was appointed professor of philosophy at the convent of Saint-Jacques in Paris. The success of his subsequent lectures at the Sorbonne led to his selection by Colbert as tutor to his son, Jacques Nicolas Colbert, afterwards archbishop of Rouen. Alexandre obtained the degree of doctor in divinity from the Sorbonne in 1675 and for twelve years taught philosophy, theology and ecclesiastical law to the members of the Saint-Jacques community. He played a prominent part in ecclesiastical affairs and preached several times before Louis XIV., who granted him an annual pension of 800 livres, and in the general assemblies of the French bishops. He became provincial of his order in 1706, but was banished to Châtellerault in 1709 for having subscribed to the *Cas de conscience* (1703), and was deprived of his pension in 1713 on account of his opposition to the bull *Unigenitus*. He died in Paris on the 21st of August 1724, having lost his sight some time before owing to his strenuous literary activity. His numerous works are still much valued by ecclesiastical students.

His best-known work, the *Selecta historiae ecclesiasticae capita, et in loca ejusdem insignia dissertationes historicae, chronologicae, dogmaticae* (26 vols., Paris, 1676–1686), was placed on the Index by Innocent XI., on account of his bold defence of the Gallican claims. In 1689 he brought out at Paris his history of the Old Testament: *Selecta historiae Veteris Testamenti capita, &c., in* 6 vols. Of the numerous editions of Alexandre's ecclesiastical history the best is that of P. J. D. Mansi, which contains many valuable notes and additions (11 vols., Lucca, 1749) and has been frequently reprinted. Alexandre's principal contribution to theological literature is his *Theologia dogmatica et moralis secundum ordinem catechismi concilii Tridentini* (10 vols., Paris, 1694), in which he clearly shows himself a disciple of the Thomist school. His *Conformité des cérémonies chinoises avec l'idolâtrie grecque et romaine* and *Sept lettres sur les cérémonies de la Chine* (both published at Cologne in 1700) are interesting as they mark him out as a pioneer in the study of comparative religion.

See *Catalogue complet des œuvres du Père Alexandre* (Paris, 1716); Quétif-Echard, *Scriptores ordinis praedicatorum* (Paris, 1719–1721), t. ii. p. 810; and full bibliography in A. Vacant, *Dict. de théologie* (scholarly article by P. Mandounet, cols. 769-772).

ALEXANDRETTA, or Iskanderun (med. *Scanderoon*), a town of N. Syria, situated in the N.E. angle of the Levantine Mediterranean on the S.E. of the gulf to which it gives a title. Pop. about 10,000, two-thirds Moslem. Iskanderun preserves the name, but probably not the exact site, of *Alexandria ad Issum*, founded by Alexander in 333 B.C., about 23 m. S. of the scene of his victory, to supersede Myriandrus as key of the Syrian Gates (Beilan Pass). The importance of the place ever since has been derived from its relation to this pass, the easiest approach to the open ground of N. Syria of which Antioch and Aleppo have been the successive capitals; and this relation has prevailed over the extreme unhealthiness of the site, which lies on marshy deltaic ground, screened by the horseshoe of Elma Dagh from all purifying influences of N. and E. winds. As the main outlet for the overland trade from Bagdad and India, whose importance was great until the establishment of the Egyptian overland route, the place was a great resort, first of Genoese and Venetian merchants, then of those of West and North European nations. The British Levant (Turkey) Company maintained an agency and factory here for 200 years, till 1825, in spite of appalling mortality among its employés. Alexandretta is still the main port for the Aleppo district, to which a good *chaussée* leads over the Beilan Pass, and it has a considerable export trade in tobacco, silk, cereals, liquorice, textiles. The health of the place has improved with the draining of the marshes and the provision of a better supply of water, but still leaves much to be desired. The wealthier inhabitants have summer residences at Beilan near the summit of the pass, long a stronghold of freebooting Dere Beys and the scene of the victory won by Ibrahim Pasha in 1832, which opened Cilicia to his advance. There are resident consuls of all the principal powers, and the port is well served by coasting steamers under European and Ottoman flags. The distance by road to Aleppo has been shortened to about 70 m., and Antakia (Antioch) is about 45 m. distant by a branch of the same *chaussée*. (D. G. H.)

ALEXANDRIA (Arab. *Iskenderia*), a city and chief seaport of Egypt, and for over a thousand years from its foundation the capital of the country, situated on the Mediterranean in 31° 12′ N., 29° 15′ E., and 129 m. by rail N.W. of Cairo. The ancient Canopic mouth of the Nile (now dry) was 12 m. E.

I. *The Modern City.*—The city is built on the strip of land which separates the Mediterranean from Lake Mareotis (Mariut), and on a T-shaped peninsula which forms harbours east and west. The stem of the T was originally a mole leading to an island (Pharos) which formed the cross-piece. In the course of centuries this mole has been silted up and is now an isthmus half a mile wide. On it a part of the modern city is built. The cape at the western end of the peninsula is Ras et-Tin (Cape of Figs); the eastern cape is known as Pharos or Kait Bey. South of the town—between it and Lake Mareotis—runs the Mahmudiya canal, which enters the western harbour by a series of locks.

The customs house and chief warehouses are by the western harbour, but the principal buildings of the city are in the east and south-east quarters. From the landing-stage, by the customs house, roads lead to the Place Mehemet Ali, the centre of the life of the city and the starting-point of the electric tramways. The *place*, usually called the Grand Square, is an oblong open space, tree-lined, in the centre of which there is an equestrian statue of the prince after whom it is named. The square is faced with handsome buildings mainly in the Italian style. The most important are the law courts, exchange, Ottoman bank, English church and the Abbas Hilmi theatre. A number of short streets lead from the square to the eastern harbour. Here a sea wall, completed in 1905, provides a magnificent drive and promenade along the shore for a distance of about 3 m. In building this quay a considerable area of foreshore was reclaimed and an evil-smelling beach done away with. From the south end of the square the rue Sherif Pasha—in which are the principal shops—and the rue Tewfik Pasha lead to the boulevard, or rue, de Rosette, a long straight road with a general E. and W. direction. In it are the Zizinia theatre and the municipal palace (containing the public library); the museum lies up a short street to the N. Opened in 1895 this museum possesses an important collection of Egyptian, Greek and Roman antiquities, found not only in the city but in all Lower Egypt and the Fayum. The western end of the boulevard leads to the Place Ibrahim, often called Place Ste Cathérine, from the Roman Catholic church at its S.E. side. In a street running S. from the boulevard to the railway station is the mosque of Nebi Daniel, containing the tombs of Said Pasha and other members of the khedivial family. Immediately E. of the mosque is Kom ed-Dik, garrisoned by British troops, one of several forts built for the protection of the city. Except Kom ed-Dik the forts have not been repaired since the bombardment of 1882. Equally obsolete is the old line of fortifications which formerly marked the limits of the city south and east and has now been partly demolished. Throughout the central part of Alexandria the streets are paved with blocks of lava and lighted by electricity.

The north quarter is mainly occupied by natives and Levantines. The narrow winding streets and the Arab bazaars present an Oriental scene contrasting with the European aspect of the district already described. This Arab quarter is traversed by the rue Ras et-Tin, leading to the promontory of that name. Here, overlooking the harbour, is the khedivial yacht club (built 1903) and the palace, also called Ras et-Tin, built by Mehemet Ali, a large but not otherwise noteworthy building. In the district between the Grand Square and the western harbour, one of the poorest quarters of the city, is an open space with Fort Caffareli or Napoleon in the centre. This quarter has been pierced by several straight roads, one of which, crossing the Mahmudiya canal by the Pont Neuf, leads to Gabbari, the most westerly part of the city and an industrial and manufacturing region, possessing asphalt works and oil, rice and paper mills. On either side of the canal are the warehouses of wholesale dealers in cotton, wool, sugar, grain and other commodities. In the southern part of the city are the Arab cemetery, "Pompey's Pillar" and the catacombs. "Pompey's Pillar," which stands on the highest spot in Alexandria, is nearly 99 ft. high, including the pedestal. The shaft is of red granite and is beautifully polished. Nine feet in diameter at the base, it tapers to eight feet at the top. The catacombs, a short distance S.W. of the pillar, are hewn out of the rocky slope of a hill, and are an elaborate series of chambers adorned with pillars, statues, religious symbols and traces of painting (see below, *Ancient City*). Along the northern side of the Mahmudiya canal, which here passes a little S. of the catacombs, are many fine houses and gardens (Moharrem Bey quarter), stretching eastward for a considerable distance, favourite residences of wealthy citizens. A similar residential quarter has also grown up on the N.E., where the line of the old fortifications has become a boulevard. The district extending outside the E. fortifications, in the direction of Hadra, has been laid out with fine avenues, and contains numerous garden-cafés and pleasure resorts. Thence roads lead to the E. suburb known generally as Ramleh, which stretches along the coast, and is served by a local railway. It begins E. of the racecourse with Sidi Gabr, and does not end till the khedivial estates E. of San Stefano are reached, some 5 m. E. All this space is filled with villas, gardens and hotels, and is a favourite summer resort not only of Alexandrians but also of Cairenes.

The eastern bay is rocky, shallow and exposed, and is now used only by native craft. The harbour is on the W. of Pharos and partly formed by a breakwater (built 1871–1873 and prolonged 1906–1907), 2 m. long. The breakwater starts opposite the promontory of Ras et-Tin, on which is a lighthouse, 180 ft. above the sea, built by Mehemet Ali. Another breakwater starts from the Gabbari side, the opening between the two works being about half a mile. A number of scattered rocks lie across the entrance, but through them two fairways have been made, one 600 ft. wide and 35 ft. deep, the other 300 ft. wide and 30 ft. deep. The enclosed water is divided into an outer and inner harbour by a mole, 1000 yds. long, projecting N.W. from the southern shore. The inner harbour covers 464 acres. It is lined for 2½ m. by quays, affording accommodation for ships drawing up to 28 ft. The outer harbour (1400 acres water area) is furnished with a graving dock, completed in 1905, 520 ft. long, and with quays and jetties along the Gabbari foreshore. Their construction was begun in 1906.

Alexandria is linked by a network of railway and telegraph lines to the other towns of Egypt, and there is a trunk telephone line to Cairo. The city secured in 1906 a new and adequate water-supply, modern drainage works having been completed the previous year. Being the great *entrepôt* for the trade of Egypt, the city is the headquarters of the British chamber of commerce and of most of the merchants and companies engaged in the development of the Delta. About 90 % of the total exports and imports of the country pass through the port, though the completion, in 1904, of a broad-gauge railway connecting Cairo and Port Said deflected some of the cotton exports to the Suez Canal route. The staple export is raw cotton, the value of which is about 80 % of all the exports. The principal imports are manufactured cotton goods and other textiles, machinery, timber and coal. The value of the trade of the port increased from £30,000,000 in 1900 to £46,000,000 in 1906. In the same period the tonnage of the ships entering the harbour rose from 2,375,000 to 3,695,000. Of the total trade Great Britain supplies from 35 to 40 % of the imports and takes over 50 % of the exports. Among the exports sent to England are the great majority of the 80,000,000 eggs annually shipped (see also EGYPT: *Commerce*).

The population of the city (1907) was 332,246 or including the suburbs, about 400,000. The foreigners numbered over 90,000. The majority of these were Greeks, Italians, Syrians, Armenians and other Levantines, though almost every European and Oriental nation is represented. The predominant languages spoken, besides the Arabic of the natives, are Greek, French, English and Italian. The labouring population is mainly Egyptian; the Greeks and Levantines are usually shopkeepers or petty traders. In its social life Alexandria is the most progressive and occidental of all the cities of North Africa, with the possible exception of Algiers. (F. R. C.)

II. *The Ancient City.*—The Greek Alexandria was divided into three regions: (1) the Jews' quarter, forming the north-east portion of the city; (2) Rhacotis, on the west, occupied chiefly by Egyptians; (3) Brucheum, the Royal or Greek quarter, forming the most magnificent portion of the city. In Roman times Brucheum was enlarged by the addition of an official quarter, making up the number of four *regiones* in all. The city was laid out as a gridiron of parallel streets, each of which had an attendant subterranean canal. Two main streets, lined with colonnades and said to have been each about 200 ft. wide, intersected in the centre of the city, close to the point where rose the *Sema* (or *Soma*) of Alexander (*i.e.* his Mausoleum). This point is very near the present mosque of Nebi Daniel; and the line of the great east-west "Canopic" street only slightly diverged from that of the modern Boulevard de Rosette. Traces of its pavement and canal have been found near the Rosetta Gate; but better remains still of streets and canals were exposed in 1899 by the German excavators outside the E. fortifications, which lie well within the area of the ancient city.

Alexandria consisted originally of little more than the island of Pharos, which was joined to the mainland by a mole nearly a mile long and called the *Heptastadium.* The end of this abutted on the land at the head of the present Grand Square, where rose the "Moon Gate." All that now lies between that point and the modern Ras et-Tin quarter is built on the silt which gradually widened and obliterated this mole. The Ras et-Tin quarter represents all that is left of the island of Pharos, the site of the actual lighthouse having been weathered away by the sea. On the east of the mole was the Great Harbour, now an open bay; on the west lay the port of *Eunostos*, with its inner basin *Kibotos*, now vastly enlarged to form the modern harbour.

In Strabo's time, (latter half of 1st century B.C.) the principal buildings were as follows, enumerated as they were to be seen from a ship entering the Great Harbour. (1) *The Royal Palaces*, filling the N.E. angle of the town and occupying the promontory of Lochias, which shut in the Great Harbour on the east. Lochias, the modern *Pharillon*, has almost entirely disappeared into the sea, together with the palaces, the "Private Port" and the island of Antirrhodus. There has been a land subsidence here, as throughout the N. Delta and indeed all the N.E. coast of Africa; and on calm days the foundations of buildings may be seen, running out far under sea, near the Pharillon. Search was made for relics of these palaces by German explorers in 1898–1899, but without much success. (2) The Great Theatre, on the modern Hospital Hill near the Ramleh station. This was used by Caesar as a fortress, where he stood a siege from the city mob after the battle of Pharsalus. (3) The *Poseideion* or Temple of the Sea God, close to the theatre and in front of it. (4) The *Timonium* built by Antony. (5, 6, 7) The *Emporium* (Exchange), *Apostases* (Magazines) and *Navalia* (Docks), lying west of (4), along the sea-front as far as the mole. Behind the Emporium rose (8) the Great *Caesareum*, by which stood the two great obelisks, later known as "Cleopatra's Needles," and now removed to New York and London. This temple became in time the Patriarchal Church, some remains of which have been discovered: but the actual Caesareum, so far as not eroded by the waves, lies under the houses lining the new sea-wall. (9) The *Gymnasium* and (10) the *Palaestra* are both inland, near the great Canopic street (Boulevard de Rosette) in the eastern half of the town, but on sites not determined. (11) The *Temple of Saturn*: site unknown. (12) The Mausolea of Alexander (*Soma*) and the Ptolemies in one ring-fence, near the point of intersection of the two main streets. (13) The *Museum* with its library and theatre in the same region; but on a site not identified. (14) The *Serapeum*, the most famous of all Alexandrian temples. Strabo tells us that this stood in the west of the city; and recent discoveries go far to place it near "Pompey's Pillar" (see above), which, however, was an independent monument erected to commemorate Diocletian's siege of the city. We know the names of a few other public buildings on the mainland, but nothing as to their position. On the eastern point of the Pharos island stood the Great Lighthouse, one of the "Seven Wonders," reputed to be 400 ft. high. The first Ptolemy began it, and the second completed it, at a total cost of 800 talents. It is the prototype of all lighthouses (*q.v.*) in the world. A temple of Hephaestus also stood on Pharos at the head of the mole. In the Augustan age the population of Alexandria was estimated at 300,000 free folk, in addition to an immense number of slaves.

Ancient and medieval period.

III. *History.*—Founded in 332 B.C. by Alexander the Great, Alexandria was intended to supersede Naucratis (*q.v.*) as a Greek centre in Egypt, and to be the link between Macedonia and the rich Nile Valley. If such a city was to be on the Egyptian coast, there was only one possible site, behind the screen of the Pharos island and removed from the silt thrown out by Nile mouths. An Egyptian townlet, Rhacotis, already stood on the shore and was a resort of fishermen and pirates. Behind it (according to the Alexandrian treatise, known as pseudo-Callisthenes) were five native villages scattered along the strip between Lake Mareotis and the sea. Alexander occupied Pharos, and had a walled city marked out by Deinocrates on the mainland to include Rhacotis. A few months later he left Egypt for the East and never returned to his city; but his corpse was ultimately entombed there. His viceroy, Cleomenes, continued the creation of Alexandria. The Heptastadium, however, and the mainland quarters seem to have been mainly Ptolemaic work. Inheriting the trade of ruined Tyre and becoming the centre of the new commerce between Europe and the Arabian and Indian East, the city grew in less than a century to be larger than Carthage; and for some centuries more it had to acknowledge no superior but Rome. It was a centre not only of Hellenism but of Semitism, and the greatest Jewish city in the world. There the Septuagint was produced. The early Ptolemies kept it in order and fostered the development of its museum into the leading Greek university; but they were careful to maintain the distinction of its population into three nations, "Macedonian" (*i.e.* Greek), Jew and Egyptian. From this division arose much of the later turbulence which began to manifest itself under Ptolemy Philopater. Nominally a free Greek city, Alexandria retained its senate to Roman times; and indeed the judicial functions of that body were restored by Septimius Severus, after temporary abolition by Augustus. The city passed formally under Roman jurisdiction in 80 B.C., according to the will of Ptolemy Alexander; but it had been under Roman influence for more than a hundred years previously. There Julius Caesar dallied with Cleopatra in 47 B.C. and was mobbed by the rabble; there his example was followed by Antony, for whose favour the city paid dear to Octavian, who placed over it a prefect from the imperial household. Alexandria seems from this time to have regained its old prosperity, commanding, as it did, an important granary of Rome. This latter fact, doubtless, was one of the chief reasons which induced Augustus to place it directly under the imperial power. In A.D. 215 the emperor Caracalla visited the city; and, in order to repay some insulting satires that the inhabitants had made upon him, he commanded his troops to put to death all youths capable of bearing arms. This brutal order seems to have been carried out even beyond the letter, for a general massacre was the result. Notwithstanding this terrible disaster, Alexandria soon recovered its former splendour, and for some time longer was esteemed the first city of the world after Rome. Even as its main historical importance had formerly sprung from pagan learning, so now it acquired fresh importance as a centre of Christian theology and church government. There Arianism was formulated and there Athanasius, the great opponent of both heresy and pagan reaction, worked and triumphed. As native influences, however, began to reassert themselves in the Nile valley, Alexandria gradually became an alien city, more and more detached from Egypt; and, losing much of its commerce as the peace of the empire broke up during the 3rd century A.D., it declined fast in population and splendour. The Brucheum and Jewish quarters were desolate in the 5th century, and the central monuments, the *Soma* and Museum, fallen to ruin. On the mainland life seems to have centred in the vicinity of the Serapeum and Caesareum, both become Christian churches: but the Pharos and Heptastadium quarters remained populous and intact. In 616 it was taken by Chosroes, king of Persia; and in 640 by the Arabians, under ʽAmr, after a siege that lasted fourteen months, during which Heraclius, the emperor of Constantinople, did not send a single ship to its assistance. Notwithstanding the losses that the city had sustained, ʽAmr was able to write to his master, the caliph Omar, that he had taken a city containing "4000 palaces, 4000 baths, 12,000 dealers in fresh oil, 12,000 gardeners, 40,000 Jews who pay tribute, 400 theatres or places of amusement."

The story of the destruction of the library by the Arabs is first told by Bar-hebraeus (Abulfaragius), a Christian writer who lived six centuries later; and it is of very doubtful authority. It is highly improbable that many of the 700,000 volumes collected by the Ptolemies remained at the time of the Arab conquest, when the various calamities of Alexandria from the time of Caesar to that of Diocletian are considered, together with the disgraceful pillage of the library in A.D. 389 under the rule of the Christian bishop, Theophilus, acting on Theodosius' decree concerning pagan monuments (see LIBRARIES: *Ancient History*). The story of Abulfaragius runs as follows:—

> John the Grammarian, a famous Peripatetic philosopher, being in Alexandria at the time of its capture, and in high favour with ʽAmr, begged that he would give him the royal library. ʽAmr told him that it was not in his power to grant such a request, but promised to write to the caliph for his consent. Omar, on hearing the request of his general, is said to have replied that if those books contained the same doctrine with the Koran, they could be of no use, since the Koran contained all necessary truths; but if they contained anything contrary to that book, they ought to be destroyed; and therefore, whatever their contents were, he ordered them to be burnt. Pursuant to this order, they were distributed among the public baths, of which there was a large number in the city, where, for six months, they served to supply the fires.

Shortly after its capture Alexandria again fell into the hands of the Greeks, who took advantage of ʽAmr's absence with the greater portion of his army. On hearing what had happened, however, ʽAmr returned, and quickly regained possession of the city. About the year 646 ʽAmr was deprived of his government by the caliph Othman. The Egyptians, by whom ʽAmr was greatly beloved, were so much dissatisfied by this act, and even showed such a tendency to revolt, that the Greek emperor determined to make an effort to reduce Alexandria. The attempt proved perfectly successful. The caliph, perceiving his mistake, immediately restored ʽAmr, who, on his arrival in Egypt, drove the Greeks within the walls of Alexandria, but was only able to capture the city after a most obstinate resistance by the defenders. This so exasperated him that he completely demolished its fortifications, although he seems to have spared the lives of the inhabitants as far as lay in his power. Alexandria now rapidly declined in importance. The building of Cairo in 969, and, above all, the discovery of the route to the East by the Cape of Good Hope in 1498, nearly ruined its commerce; the canal, which supplied it with Nile water, became blocked; and although it remained a principal Egyptian port, at which most European visitors in the Mameluke and Ottoman periods landed, we hear little of it until about the beginning of the 19th century.

[Alexandria figured prominently in the military operations of Napoleon's Egyptian expedition of 1798. The French troops stormed the city on the 2nd of July 1798, and it remained in their hands until the arrival of the British expedition of 1801. The battle of Alexandria, fought on the 21st of March of that

Battle of 1801.

year, between the French army under General Menou and the British expeditionary corps under Sir Ralph Abercromby, took place near the ruins of Nicopolis, on the narrow spit of land between the sea and Lake Aboukir, along which the British troops had advanced towards Alexandria after the actions of Aboukir on the 8th and Mandora on the 13th. The British position on the night of the 20th extended across the isthmus, the right resting upon the ruins of Nicopolis and the sea, the left on the lake of Aboukir and the Alexandria canal. The line faced generally south-west towards the city, the reserve division under Major-General (Sir) John Moore on the right, the Guards brigade in the centre, and three other brigades on the left. In second line were two brigades and the cavalry (dismounted). On the 21st the troops were under arms at 3 A.M., and at 3.30 the French attacked and drove in the outposts. The French army now moved forward with great rapidity in their usual formation of columns. The brunt of the attack fell upon the command of Moore, and in particular upon the 28th (Gloucestershire Regiment). The first shock was repulsed, but a French column penetrated in the dark between two regiments of the British and a confused fight ensued in the ruins, in which the 42nd (Black Watch) captured a colour. The front and rear ranks of the 28th were simultaneously engaged, and the conduct of the regiment won for it the distinction of wearing badges both at the front and at the back of their head-dress. Other regiments which assisted in the overthrow of the French column were the 23rd, 40th and 58th. In a second attack the enemy's cavalry inflicted severe losses on the 42nd. Sir Ralph Abercromby was here engaged in personal conflict with some French dragoons, and about this time received a mortal wound, though he remained on the field and in command to the end. The attack on the centre was repulsed by the cool and steady fire of the Guards, and the left wing maintained its position with ease, but the French cavalry for the second time came to close quarters with the reserve. About half-past eight the combat began to wane, and the last shots were fired at ten. The real attack had been pressed home on the British right, and the *History* of the Queen's Royal West Surrey Regiment gives no undue praise to the regiments of the reserve in saying that "the determined attack would have been successful against almost any other troops." Technically, the details of the action show that, while not markedly better in a *mêlée* than the war-seasoned French, the British infantry had in its volleys a power which no other troops then existing possessed, and it was these volleys that decided the day even more than the individual stubbornness of the men. The 42nd, twice charged by cavalry, had but thirteen men wounded by the sabre. Part of the French losses, which were disproportionately heavy, were caused by the gunboats which lay close inshore and cannonaded the left flank of the French columns, and by a heavy naval gun which was placed in battery near the position of the 28th. The forces engaged on this day were approximately 14,000 British to about 20,000 French, and the losses were:—British, 1468 killed, wounded and missing, including Abercromby (who died on the 28th), Moore and three other generals wounded; French, 1160 killed and (?) 3000 wounded. The British subsequently advanced upon Alexandria, which surrendered on the 31st of August. (C. F. A.).]

Modern city.

During the anarchy which accompanied Ottoman rule in Egypt from first to last, Alexandria sank to a small town of about 4000 inhabitants; and it owed its modern renascence solely to Mehemet Ali, who wanted a deep port and naval station for his viceregal domain. He restored its water communication with the Nile by making the Mahmudiya canal, finished in 1820; and he established at Ras et-Tin his favourite residence. The old Eunostus harbour became the port, and a flourishing city arose on the old Pharos island and the Heptastadium district, with outlying suburbs and villa residences along the coast eastwards and the Mareotic shore. Being the starting-point of the "overland route" to India, and the residence of the chief foreign consuls, it quickly acquired a European character and attracted not only Frank residents, but great numbers of Greeks, Jews and Syrians. There most of the negotiations between the powers and Mehemet Ali were conducted; thence started the Egyptian naval expeditions to Crete, the Morea and Syria; and thither sailed the betrayed Ottoman fleet in 1839. It was twice threatened by hostile fleets, the Greek in 1827 and the combined British, French and Russian squadrons in 1828. The latter withdrew on the viceroy's promise that Ibrahim should evacuate the Morea. The fortifications were strengthened in 1841, and remained in an antiquated condition until 1882, when they were renovated by Arabi Pasha. Alexandria was connected with Cairo by railway in 1856. Much favoured by the earlier viceroys of Mehemet Ali's house, and removed from the Mameluke troubles, Alexandria was the real capital of Egypt till Said Pasha died there in 1863 and Ismail came into power. Though this prince continued to develop the city, giving it a municipality in 1866[1] and new harbour works in 1871–1878, he developed Cairo still more; and the centre of gravity definitely shifted to the inland capital.

Bombardment of 1882.

Fate, however, again brought Alexandria to the front. After a mutiny of soldiers there in 1881, the town was greatly excited by the arrival of an Anglo-French fleet in May 1882, and on the 11th of June a terrible riot and massacre took place, resulting in the death of four hundred Europeans. Since satisfaction was not given for this and the forts were being strengthened at the instigation of Arabi Pasha, the war minister, the British admiral, Sir Beauchamp Seymour (afterwards Lord Alcester), sent an ultimatum on the 10th of July and opened fire on the forts the next day. They were demolished, but as no troops were landed immediately a fresh riot and massacre ensued. As Arabi did not submit, a British military expedition landed at Alexandria on the 10th of August, the sequel being the British occupation of the whole country, the history of which is set forth under EGYPT.

Since the restoration of tranquillity and the establishment of sound political and economic conditions in the Nile valley, Alexandria has greatly expanded. As the British consular report for 1904 says, "Building . . . for residential and other purposes proceeds with almost feverish rapidity. The cost of living has doubled and the price of land has risen enormously." On the E. and S.E. a new town of handsome houses, gardens and boulevards has been called into existence, in the arrangement of which the controlling influence of the municipality is evident (see *Modern City* above).

IV. *Antiquities.*—Persistent efforts have been made to explore the antiquities of Alexandria. Encouragement and help have been given by the local Archaeological Society, and by many individuals, notably Greeks justly proud of a city which is one of the glories of their national story. The past and present directors of the museum have been enabled from time to time to carry out systematic excavations when opportunity offered; Mr D. G. Hogarth made tentative researches on behalf of the Egypt Exploration Fund and the Society for the Promotion of Hellenic Studies in 1895; and a German expedition worked for two years (1898–1899). But two difficulties face the would-be excavator in Alexandria. First, since the great and growing modern city stands right over the ancient one, it is almost impossible to find any considerable space in which to dig, except at enormous cost. Second, the general subsidence of the coast has sunk the lower-lying parts of the ancient town under water. Unfortunately the spaces still most open are the low grounds to N.E. and S.W., where it is practically impossible to get below the Roman strata.

The most important results were those achieved by Dr G. Botti, late director of the museum, in the neighbourhood of "Pompey's Pillar," where there is a good deal of open ground. Here substructures of a large building or group of buildings have been exposed, which are perhaps part of the Serapeum. Hard by immense catacombs and *columbaria* have been opened which may have been appendages of the temple. These contain one very remarkable vault with curious painted reliefs, now lighted by electricity and shown to visitors. The objects found in these researches are in the museum, the most notable being a great basalt bull, probably once an object of cult in the Serapeum. Other catacombs and tombs have been opened in Kom es-Shugafa Hadra (Roman) and Ras et-Tin (painted). The Germans found remains of a Ptolemaic colonnade and streets in the north-east of the city, but little else. Mr Hogarth explored part of an immense brick structure under the mound of Kom ed-Dik, which may have been part of the Paneum, the Mausolea or a Roman fortress. The making of the new foreshore led to the dredging up of remains of the Patriarchal Church; and the foundations of modern buildings are seldom laid without some objects of antiquity being discovered. The wealth underground is doubtless immense; but, despite all efforts, there is not much for antiquarians to see in Alexandria outside the museum and the neighbourhood of "Pompey's Pillar." The native tomb-robbers, well-sinkers, dredgers and the like, however, come upon valuable objects from time to time, which find their way into private collections.

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[1] This municipality was superseded by a new municipal body, with extensive powers, created in 1890.

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ALEXANDRIA, a city of Madison county, Indiana, U.S.A., about 46 m. N.E. of Indianapolis. Pop. (1890) 715; (1900) 7221 (1002 foreign-born); (1910) 5096. Alexandria is served by the Cleveland, Cincinnati, Chicago & St Louis, and the Lake Erie & Western railways, and by the Indiana Union Traction System (electric). In the city are a Carnegie library and Beulah Park (24 acres), the latter belonging to the Northern Indiana Holiness Association, which there holds summer camp-meetings. The city is in a rich farming country, which produces Indian corn, oats and wheat; and is in the Indiana natural gas region, to which fact it owes its rapid growth as a manufacturing centre. It is one of the principal seats of the glass industry in Indiana—plate glass, lamp chimneys, mirrors, &c., being manufactured here—and also has mineral wool factories and paper mills. The municipality owns and operates the water-works and the gas-lighting plant. Alexandria was founded in 1836 and was chartered as a city in 1893.

ALEXANDRIA, a city of Louisiana, U.S.A., capital of Rapides Parish, on the S. bank of the Red river in almost the exact geographical centre of the state. Pop. (1890) 2861; (1900) 5648 (3142 negroes); (1910) 11,213. The city is served by the Louisiana Railway & Navigation Company, the St Louis, Watkins & Gulf, the Texas & Pacific, the Louisiana & Arkansas, the Southern Pacific, the Chicago, Rock Island & Pacific, and the Missouri Pacific railways. The Red river is navigable to Alexandria during the entire year. Alexandria is on a level plain in the centre of the Louisiana long-leaf pine forests, in which pine is interspersed with various hardwoods. The forests stretch on all sides within a radius of 75 m. In the immediate vicinity of the city, on the Red river, cotton, sugar, alfalfa and garden vegetables are cultivated; south of the Red river is a peculiarly rich farming country watered by Bayou Rapides and Bayou Bœuf. Near the city is the Louisiana Asylum for the Insane. The principal industries are cotton-pressing and the manufacture of lumber and of cotton-seed products; sugar and molasses, artificial ice, mineral waters and brick are other manufactures. The city owns and operates the water-works and electric-lighting plant; the water-supply is derived from artesian wells. Alexandria was named in honour of Alexander Fulton, on whose grant from Spain the first settlement was made in 1785; it was first incorporated as a town in 1818 and received a city charter in 1882. In the spring of 1863 a Union fleet under Admiral David D. Porter, operating on the Red river, co-operated with land forces under General N. P. Banks in pushing the Confederates westward. Alexandria was occupied on the 7th of May 1863, but the troops were soon withdrawn for the Port Hudson attack. On the 19th of March 1864 it was again occupied by the Union forces, who made it the point of concentration for another land and naval expedition against E. Kirby Smith and Shreveport. After the check of this expedition and its abandonment, Alexandria was again vacated on the 12th-13th of May, when the city was almost entirely burned. The Union gunboats, which had passed up the river toward Shreveport at high water, were caught in its decline above the falls at Alexandria, but they were saved by a splendid piece of engineering (a dam at the falls), constructed by Lieutenant-Colonel Joseph Bailey (1827–1867), who for this service received the thanks of Congress and the brevet of brigadier-general of volunteers.

ALEXANDRIA, a town of Rumania, situated among the rich corn-lands of the Teleorman department, on the right bank of the river Vedea. Pop. (1900) 13,675. Its chief trade is in grain, despatched by rail to the Danubian port of Zimnicea, or by river to Giurgevo. Alexandria was named after its founder, Alexander John Cuza, prince of Rumania from 1859 to 1866.

ALEXANDRIA, a manufacturing town of Dumbartonshire, Scotland, situated on the right bank of the Leven about 3 m. north of Dumbarton, on the North British and Caledonian railways. It owes its origin almost entirely to the cotton printing and bleaching works of the vicinity, for which there is an abundant supply of excellent water, and contains one of the largest of the Turkey-red dyeing establishments in the Vale of Leven. The public buildings include a public hall, the mechanics' institute with library and lecture-hall, an institute for men, with library and recreation rooms, a similar institution for women, banks and other important commercial offices. Pop. (1891) 7796; (1901) 8007. Alexandria is connected with Bonhill, on the opposite bank of the river, by a bridge which replaced in 1898 one bought three years earlier by the county council from the Smollett family, who have been closely associated with the district since the time of Sir James Smollett, the novelist's grandfather. The industries of Bonhill centre in the calico printing, dyeing and bleaching which find their headquarters in the valley. Population (1891) 3843; (1901) 3333. Jamestown, about 1 m. to the north-east of Alexandria, with a station on the Forth & Clyde railway from Balloch to Stirling (North British), contains some of the largest cotton-printing works in Scotland. Population (1891) 1668; (1901) 2080.

ALEXANDRIA, a city and a port of entry of Alexandria county, Virginia, U.S.A., on the W. bank of the Potomac river, 6 m. below Washington, D.C., with which it is connected by a ferry. Pop. (1890) 14,339; (1900) 14,528, of whom 4533 were negroes; (1910, census), 15,329. Alexandria is served by the Baltimore & Ohio, the Chesapeake & Ohio, the Southern and the Washington Southern railways; by the Washington, Alexandria & Mount Vernon electric railway; and by several lines of river and coasting steamboats. It is a quaint, old-fashioned city, with quiet, shady streets, and a number of buildings dating back to the 18th century; of these the most interesting is the old Christ Church in which George Washington and Robert E. Lee worshipped. The city has a public library. About 2½ m. W. of Alexandria is the Protestant Episcopal Theological Seminary in Virginia, opened here in 1823 and chartered in 1854; in 1906–1907 the Seminary had a faculty of 7 and 46 students. Alexandria is a distributing and jobbing centre for the north-east counties of Virginia. Among its manufactures are fertilizers, bottles, carbonated beverages, flour, beer, shoes, silk thread, aprons, brooms, leather, bricks, and tiling and structural iron. The total value of its factory product in 1905 was $2,186,658. The municipality owns and operates its gas-lighting plant. Alexandria, first known as Belhaven, was named in honour of John Alexander, who in the last quarter of the 17th century had bought the land on which the city now stands from Robert Howison; the first settlement here was made in 1695. Alexandria was laid out in 1749 and was incorporated in 1779. From 1790 until 1846 Alexandria county was a part of the District of Columbia; at present the city, although within the limits of Alexandria county, is not administratively a part of it. The city was re-chartered in 1852. For some time Alexandria seemed destined to become an important commercial centre, but the rise of Washington created a rival that soon outstripped it, and since the Civil War the city's growth has been comparatively slight. At Alexandria in 1755 General Edward Braddock organized his fatal expedition against Fort Duquesne, and here, in April of the same year, the governors of Virginia, Massachusetts, New York, Pennsylvania and Maryland met (in a house still standing) to determine upon concerted action against the French in America. In March 1785 commissioners from Virginia and Maryland met here to discuss the commercial relations of the two states, finishing their business at Mount Vernon on the 28th with an agreement for freedom of trade and freedom of navigation of the Potomac. The Maryland legislature in ratifying this agreement on the 22nd of November proposed a conference between representatives from all the states to consider the adoption of definite commercial regulations. This led to the calling of the Annapolis convention of 1786, which in turn led to the calling of the Federal convention of 1787. In 1814 Alexandria was threatened by a British fleet, but bought immunity from attack by paying about $100,000. At the opening of the Civil War the city was occupied by Federal troops, and great excitement throughout the North was caused by the killing (May 24, 1861) of Colonel E. E. Ellsworth (1837–1861) by Captain James W. Jackson, a hotel proprietor, from whose building Ellsworth had removed a Confederate flag. After the erection of the state of West Virginia (1863), and until the close of the war, Alexandria was the seat of what was known as the "Alexandria Government" (see VIRGINIA).

ALEXANDRIAN SCHOOL. Under this title are generally included certain strongly marked tendencies in literature, science and art, which took their rise in the ancient Egyptian city of Alexandria. That city, founded by Alexander the Great about the time when Greece, in losing her national independence, lost also her intellectual supremacy, was in every way admirably adapted for becoming the new centre of the world's activity and thought. Its situation brought it into commercial relations with all the nations lying around the Mediterranean, and at the same time rendered it the one communicating link with the wealth and civilization of the East. The great natural advantages it thus enjoyed were artificially increased to an enormous extent by the care of the sovereigns of Egypt. Ptolemy Soter (reigned 323–285 B.C.), to whom, in the general distribution of Alexander's conquests, this kingdom had fallen, began to draw around him from various parts of Greece a circle of men eminent in literature and philosophy. To these he gave every facility for the prosecution of their learned researches. Under the inspiration of his friend Demetrius of Phalerum, the Athenian orator, statesman and philosopher, this Ptolemy laid the foundations of the great Alexandrian library and originated the keen search for all written works, which resulted in the formation of a collection such as the world has seldom seen. He also built, for the convenience of his men of letters, the Museum, in which, maintained by the royal bounty, they resided, studied and taught. This Museum, or academy of science, was in many respects not unlike a modern university. The work thus begun by Ptolemy Soter was carried on vigorously by his descendants, in particular by his two immediate successors, Ptolemy Philadelphus and Ptolemy Euergetes. Philadelphus (285–247), whose librarian was the celebrated Callimachus, bought up all Aristotle's collection of books, and also introduced a number of Jewish and Egyptian works. Among these appears to have been a portion of the Septuagint. Euergetes (247–222) largely increased the library by seizing on the original editions of the dramatists laid up in the Athenian archives, and by compelling all travellers who arrived in Alexandria to leave a copy of any work they possessed.

The intellectual movement so originated extended over a long period of years. If we date its rise from the 4th century B.C., at the time of the fall of Greece and the foundation of the Graeco-Macedonian empire, we must look for its final dissolution in the 7th century of the Christian era, at the time of the fall of Alexandria and the rise of the Mahommedan power. But this very long period falls into two divisions. The first, extending from about 306 to 30, includes the time from the foundation of the Ptolemaic dynasty to its final subjugation by the Romans; the second extends from 30 to A.D. 642, when Alexandria was destroyed by the Arabs. The characteristic features of these divisions are very clearly marked, and their difference affords an explanation of the variety and vagueness of meaning attaching to the term "Alexandrian School." In the first of the two periods the intellectual activity was of a purely literary and scientific nature. It was an attempt to continue and develop, under new conditions, the old Hellenic culture. This direction of effort was particularly noticeable under the early Ptolemies, Alexandria being then almost the only home in the world for pure literature. During the last century and a half before the Christian era, the school, as it might be called, began to break up and to lose its individuality. This was due partly to the state of government under some of the later Ptolemies, partly to the formation of new literary circles in Rhodes, Syria and elsewhere, whose supporters, though retaining the Alexandrian peculiarities, could scarcely be included in the Alexandrian school. The loss of active life, consequent on this gradual dissolution, was much increased when Alexandria fell under Roman sway. Then the influence of the school was extended over the whole known world, but men of letters began to concentrate at Rome rather than at Alexandria. In that city, however, there were new forces in operation which produced a second grand outburst of intellectual life. The new movement was not in the old direction—had, indeed, nothing in common with it. With its character largely determined by Jewish elements, and even more by contact with the dogmas of Christianity, this second Alexandrian school resulted in the speculative philosophy of the Neo-Platonists and the religious philosophy of the Gnostics and early church fathers.

There appear, therefore, to be at least two definite significations of the title Alexandrian School; or rather, there are two Alexandrian schools, distinct both chronologically and in substance. The one is the Alexandrian school of poetry and science, the other the Alexandrian school of philosophy. The term "school," however, has not the same meaning as when applied to the Academics or Peripatetics, the Stoics or Epicureans. These consisted of a company united by holding in common certain speculative principles, by having the same theory of things. There was nothing at all corresponding to this among the Alexandrians. In literature their activities were directed to the most diverse objects; they have only in common a certain spirit or form. There was among them no definite system of philosophy. Even in the later schools of philosophy proper there is found a community rather of tendency than of definite result or of fixed principles.

I. *Literature.*—The general character of the literature of the school appears as the necessary consequence of the state of affairs brought about by the fall of Greek nationality and independence. The great works of the Greek mind had formerly been the products of a fresh life of nature and perfect freedom of thought. All their hymns, epics and histories were bound up with their individuality as a free people. But the Macedonian conquest at Chaeroneia brought about a complete dissolution of this Greek life in all its relations, private and political. The full, genial spirit of Greek thought vanished when freedom, with which it was inseparably united, was lost. A substitute for this originality was found at Alexandria in learned research, extended and multifarious knowledge. Amply provided with means for acquiring information, and under the watchful care of a great monarch, the Alexandrians readily took this new direction in literature. With all the great objects removed which could excite a true spirit of poetry, they devoted themselves to minute researches in all sciences subordinate to literature proper. They studied criticism, grammar, prosody and metre, antiquities and mythology. The results of this study constantly appear in their productions. Their works are never national, never addressed to a people, but to a circle of learned men. Moreover, the very fact of being under the protection and, as it were, in the pay of an absolute monarch was damaging to the character of their literature. There was introduced into it a courtly element, clear traces of which, with all its accompaniments, are found in the extant works of the school. One other fact, not to be forgotten in forming a general estimate of the literary value of their productions, is, that the same writer was frequently or almost always distinguished in several special sciences. The most renowned poets were at the same time men of culture and science, critics, archaeologists, astronomers or physicians. To such writers the poetical form was merely a convenient vehicle for the exposition of science.

The forms of poetical composition chiefly cultivated by the Alexandrians were epic and lyric, or elegiac. Great epics are wanting; but in their place, as might almost have been expected, are found the historical and the didactic or expository epics. The subjects of the historical epics were generally some of the well-known myths, in the exposition of which the writer could exhibit the full extent of his learning and his perfect command of verse. These poems are in a sense valuable as repertoires of antiquities; but their style is on the whole bad, and infinite patience is required to clear up their numerous and obscure allusions. The best extant specimen is the *Argonautica* of Apollonius Rhodius; the most characteristic is the *Alexandra* or *Cassandra* of Lycophron, the obscurity of which is almost proverbial.

The subjects of didactic epics were very numerous; they seem to have depended on the special knowledge possessed by the writers, who used verse as a form for unfolding their information. Some, *e.g.* the lost poem of Callimachus, called *Αἴτια*, were on the origin of myths and religious observances; others were on special sciences. Thus we have two poems of Aratus, who, though not resident at Alexandria, was so thoroughly imbued with the Alexandrian spirit as to be with reason included in the school; the one is an essay on astronomy, the other an account of the signs of the weather. Nicander of Colophon has also left us two epics, one on remedies for poisons, the other on the bites of venomous beasts. Euphorion and Rhianus wrote mythological epics. The spirit of all their productions is the same, that of learned research. They are distinguished by artistic form, purity of expression and strict attention to the laws of metre and prosody, qualities which, however good in themselves, do not compensate for want of originality, freshness and power.

In their lyric and elegiac poetry there is much worthy of admiration. The specimens we possess are not devoid of talent or of a certain happy art of expression. Yet, for the most part, they either relate to objects thoroughly incapable of poetic treatment, where the writer's endeavour is rather to expound the matter fully than to render it poetically beautiful, or else expend themselves on short isolated subjects, generally myths, and are erotic in character. The earliest of the elegiac poets was Philetas, the sweet singer of Cos. But the most distinguished was Callimachus, undoubtedly the greatest of the Alexandrian poets. Of his numerous works there remain to us only a few hymns, epigrams and fragments of elegies.[1] Other lyric poets were Phanocles, Hermesianax, Alexander of Aetolia and Lycophron.

Some of the best productions of the school were their epigrams. Of these we have several specimens, and the art of composing them seems to have been assiduously cultivated, as might naturally be expected from the court life of the poets, and their constant endeavours after terseness and neatness of expression. Of kindred character were the parodies and satirical poems, of which the best examples were the *Silli* of Timon and the *Cinaedi* of Sotades.

Dramatic poetry appears to have flourished to some extent. There are still extant three or four varying lists of the seven great dramatists who composed the Pleiad of Alexandria. Their works, perhaps not unfortunately, have perished. A ruder kind of drama, the amoebaean verse, or bucolic mime, developed into the only pure stream of genial poetry found in the Alexandrian School, the *Idylls* of Theocritus. The name of these poems preserves their original idea; they were *pictures* of fresh country life.

The most interesting fact connected with this Alexandrian poetry is the powerful influence it exercised on Roman literature. That literature, especially in the Augustan age, is not to be thoroughly understood without due appreciation of the character of the Alexandrian school. The historians of this period were numerous and prolific. Many of them, *e.g.* Cleitarchus, devoted themselves to the life and achievements of Alexander the Great. The best-known names are those of Timaeus and Polybius.

Before the Alexandrians had begun to produce original works, their researches were directed towards the masterpieces of ancient Greek literature. If that literature was to be a power in the world, it must be handed down to posterity in a form capable of being understood. This was the task begun and carried out by the Alexandrian critics. These men did not merely collect works, but sought to arrange them, to subject the texts to criticism, and to explain any allusion or reference in them which at a later date might become obscure. The complete philological examination of any work consisted, according to them, of the following processes:—*διόρθωσις*, arrangement of the text; *ἀνάγνωσις*, settlement of accents; *τέχνη*, theory of forms, syntax; *ἐξήγησις*, explanation either of words or things; and finally, *κρίσις*, judgment on the author and his work, including all questions as to authenticity and integrity. To perform their task adequately required from the critics a wide circle of knowledge; and from this requirement sprang the sciences of grammar, prosody, lexicography, mythology and archaeology. The service rendered by these critics is invaluable. To them we owe not merely the possession of the greatest works of Greek intellect, but the possession of them in a readable state. The most celebrated critics were Zenodotus; Aristophanes of Byzantium, to whom we owe the theory of Greek accents; Crates of Mallus; and Aristarchus of Samothrace, confessedly the coryphaeus of criticism. Others were Lycophron, Callimachus, Eratosthenes and many of a later age, for the critical school long survived the literary. Dionysius Thrax, the author of the first scientific Greek grammar, may also be mentioned. These philological labours were of great indirect importance, for they led immediately to the study of the natural sciences, and in particular to a more accurate knowledge of geography and history. Considerable attention began to be paid to the ancient history of Greece, and to all the myths relating to the foundation of states and cities. A large collection of such curious information is contained in the *Bibliotheca* of Apollodorus, a pupil of Aristarchus who flourished in the 2nd century B.C. Eratosthenes was the first to write on mathematical and physical geography; he also first attempted to draw up a chronological table of the Egyptian kings and of the historical events of Greece. The sciences of mathematics, astronomy and medicine were also cultivated with assiduity and success at Alexandria, but they can scarcely be said to have their origin there, or in any strict sense to form a part of the peculiarly Alexandrian literature. The founder of the mathematical school was the celebrated Euclid (Eucleides); among its scholars were Archimedes; Apollonius of Perga, author of a treatise on *Conic Sections*; Eratosthenes, to whom we owe the first measurement of the earth; and Hipparchus, the founder of the epicyclical theory of the heavens, afterwards called the Ptolemaic system, from its most famous expositor, Claudius Ptolemaeus. Alexandria continued to be celebrated as a school of mathematics and science long after the Christian era. The science of medicine had distinguished representatives in Herophilus and Erasistratus, the two first great anatomists.

AUTHORITIES.—Müller and Donaldson, *History of the Literature of Ancient Greece*; W. Christ, *Geschichte der griechischen Litteratur*;

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[1] A considerable fragment of his epic *Hecalē* has been discovered in the Rainer papyrus.

Mahaffy, *Greek Life and Thought from the Age of Alexander to the Roman Empire*; Couat, *La Poésie alexandrine*; and especially Susemihl, *Geschichte der griechischen Litteratur in der Alexandrinerzeit.* Nicolai's *Griechische Literaturgeschichte*, though somewhat out of date, is useful for bibliography.

II. *Philosophy.*—Although it is not possible to divide literatures with absolute rigidity by centuries, and although the intellectual life of Alexandria, particularly as applied to science, long survived the Roman conquest, yet at that period the school, which for some time had been gradually breaking up, seems finally to have succumbed. The later productions in the field of pure literature bear the stamp of Rome rather than of Alexandria. But in that city for some time past there had been various forces secretly working, and these, coming in contact with great spiritual changes in the world around, produced a second outburst of intellectual activity, which is generally known as the Alexandrian school of philosophy. The doctrines of this school were a fusion of Eastern and Western thought, and combined in varying proportions the elements of Hellenistic and Jewish philosophy. Traces of this eclectic tendency are discoverable as far back as 280 B.C., but for practical purposes the dates of the school may be given as from about 30 B.C. to A.D. 529. The city of Alexandria had gradually become the neutral ground of Europe, Asia and Africa. Its population, then as at the present day, was a heterogeneous collection of all races. Alexander had planted a colony of Jews who had increased in number until at the beginning of the Christian era they occupied two-fifths of the city and held some of the highest offices. The contact of Jewish theology with Greek speculation became the great problem of thought. The Jewish ideas of divine authority and their transcendental theories of conduct were peculiarly attractive to the Greek thinkers who found no inspiration in the dry intellectualism into which they had fallen (see NEO-PYTHAGOREANISM). At the same time the Jews of the Dispersion had to some extent shaken off the exclusiveness of their old political relations and were prepared to compare and contrast their old territorial theology with cosmopolitan culture. Further, when the two sides came to consider the results of their intellectual inheritance they found that they had sufficient common ground for the initial compromise. Thus the Hellenistic doctrine of personal revelation could be combined with the Jewish tradition of a complete theology revealed to a special people. The result was the application of a purely philosophical system to the somewhat vague and unorganized corpus of Jewish theology. The matter was Jewish, the arrangement Greek. According to the relative predominance of these two elements arose Gnosticism, the Patristic theology, and the philosophical schools of Neo-Pythagoreanism, Neo-Platonism and eclectic Platonism.

The members of the school may be enumerated under three heads. (1) The beginnings of the eclectic spirit are, according to some authorities, discernible in the Septuagint (280 B.C.) (see Frankel, *Historisch-kritische Studien zur Septuaginta*, 1841), but the first concrete exemplification is found in Aristobulus (*c.* 160 B.C.). So far as the Jewish succession is concerned, the great name is that of Philo in the first century of our era. He took Greek metaphysical theories, and, by the allegorical method, interpreted them in accordance with the Jewish Revelation. He dealt with (*a*) human life as explained by the relative nature of Man and God, (*b*) the Divine nature and the existence of God, and, (*c*) the great *Logos* doctrine as the explanation of the relation between God and the material universe. From these three arguments he developed an elaborate theosophy which was a syncretism of oriental mysticism and pure Greek metaphysic, and may be regarded as representing the climax of Jewish philosophy. (2) The first purely philosophical phenomenon of the Alexandrian school was Neo-Pythagoreanism, the second and last Neo-Platonism. Leaving all detailed descriptions of these schools to special articles devoted to them, it is sufficient here to say that their doctrines were a synthesis of Platonism, Stoicism and the later Aristotelianism with a leaven of oriental mysticism which gradually became more and more important. The world to which they spoke had begun to demand a doctrine of salvation to satisfy the human soul. They endeavoured to deal with the problem of good and evil. They therefore devoted themselves to examining the nature of the soul, and taught that its freedom consists in communion with God, to be achieved by absorption in a sort of ecstatic trance. This doctrine reaches its height in Plotinus, after whom it degenerated into magic and theurgy in its unsuccessful combat with the victorious Christianity. Finally this pagan theosophy was driven from Alexandria back to Athens under Plutarch and Proclus, and occupied itself largely in purely historical work based mainly on the attempt to re-organize ancient philosophy in conformity with the system of Plotinus. This school ended under Damascius when Justinian closed the Athenian schools (A.D. 529). (3) The eddies of Neo-Platonism had a considerable effect on certain Christian thinkers about the beginning of the 3rd century. Among these the most important were Clement of Alexandria and Origen. Clement, as a scholar and a theologian, proposed to unite the mysticism of Neo-Platonism with the practical spirit of Christianity. He combined the principle of pure living with that of free thinking, and held that instruction must have regard to the mental capacity of the hearer. The compatibility of Christian and later Neo-Platonic ideas is evidenced by the writings of Synesius, bishop of Ptolemais, and though Neo-Platonism eventually succumbed to Christianity, it had the effect, through the writings of Clement and Origen, of modifying the tyrannical fanaticism and ultra-dogmatism of the early Christian writers.

AUTHORITIES.—Matter, *Histoire de l'école d'Alexandrie*, 2nd ed. (3 vols., 1840–1844); Simon, *Histoire de l'école d'Alexandrie* (2 vols., 1844–1845); Vacherot, *Histoire critique de l'école d'Alexandrie* (3 vols., 1846–1851); Kingsley, *Alexandria and her Schools* (1854); Gfrörer, *Philo und die Alexandrinische Theosophie* (1835); Dähne, *Geschicht. Darstellung der Jüdisch-Alexandrinischen Religionsphilosophie* (1834); *Histories of Philosophy* by Zeller, Ueberweg, Windelband, &c., and Bibliography of CHURCH HISTORY, &c.

ALEXANDRIA TROAS (mod. *Eski Stambul*), an ancient Greek city of the Troad, situated on the west coast at nearly its middle point, a little south of Tenedos. It was built by Antigonus, perhaps about 310 B.C., and was called by him Antigonia Troas. Early in the next century the name was changed by Lysimachus to Alexandria Troas, in honour of Alexander's memory. As the chief port of north-west Asia Minor, the place prospered greatly in Roman times, and the existing remains sufficiently attest its former importance. Thence St Paul sailed for Europe for the first time, and there occurred later the episode of the raising of Eutychus (Acts xx. 5-12). The site is now covered with valonia oaks, and has been much plundered, *e.g* by Mahommed IV., who took columns to adorn his new Valideh mosque in Stambul; but the circuit of the old walls can be traced, and in several places they are fairly well preserved. They had a circumference of about six English miles, and were fortified with towers at regular intervals. Remains of some ancient buildings, including a bath and gymnasium, can be traced within this area. Trajan built an aqueduct which can still be traced. The harbour had two large basins, now almost choked with sand. A Roman colony was sent to the place, as Strabo mentions, in the reign of Augustus. The abridged name "Troas" (Acts xvi. 8) was probably the current one in later Roman times. (D. G. H.)

ALEXANDRINE VERSE, a name given to the leading measure in French poetry. It is the heroic French verse, used in epic narrative, in tragedy and in the higher comedy. There is some doubt as to the origin of the name; but most probably it is derived from a collection of romances, collected in the 12th century, of which Alexander of Macedon was the hero, and in which he was represented, somewhat like the British Arthur, as the pride and crown of chivalry. Before the publication of this work most of the trouvère romances appeared in octosyllabic verse. There is also a theory that the form was invented by a poet named Alexander. The new work, which was henceforth to set the fashion to French literature, was written in lines of twelve syllables, but with a freedom of pause which was afterwards greatly curtailed. The new fashion, however, was not adopted all at once. The metre fell into disuse until the reign of Francis I., when it was revived by Jean Antoine de Baïf, one of the seven poets known as the Pleiades. Jodelle mingled episodical Alexandrines with the *vers communs* of his tragedies and so introduced them into drama. It was Ronsard, however, who made the verse popular, and gave it vogue in France. From his time it became the recognized vehicle for all great poetry, and the regulation of its pauses became more and more strict. The following is an example of the verse as used by Racine—

> Où suis-je ? qu'ai-je fait ? || que dois-je faire encore ?
> Quel transport me saisit ? || quel chagrin me dévore ?

Two inexorable laws came to be established with regard to the pauses. The first is, that each line should be divided into two equal parts, the sixth syllable always ending with a word. In the earlier use of this metre, on the contrary, it frequently happened that the sixth and seventh syllables belonged to the same word. The other is that, except under the most stringent conditions, there should be none of what the French critics call *enjambement*, that is, the overlapping of the sense from one line on to the next. Ronsard completely ignored this rule, which was after his time settled by the authority of Malherbe. The latest school of French prosody has given great attention to the breaking up of the Alexandrine, which no longer possesses the rigidity of authoritative form which it held until about 1880, but is often used with a licence no less than when Ronsard wrote.

Michael Drayton, who was twenty-two years of age when Ronsard died, seemed to think that the Alexandrine might be as pleasing to English as it was to French ears, and in this metre he wrote a long poem in twenty-four books called the *Polyolbion*. The metre, however, failed to catch the English ear. The principal English measure is a line of ten syllables, and the Alexandrine is used only occasionally to give it variety and weight. In ordinary English heroic verse it is but rarely introduced; but in the favourite narrative metre, known as the Spenserian, it comes in regularly as the concluding line of each stanza. In English usage, moreover, it is to be observed that there is no fixed rule as to the position of the pause, though it is true that most commonly the pause occurs at the end of the sixth syllable. Spenser is very free in shifting the pause about; and though the later poets who have used this stanza are not so free, yet, with the exception of Shenstone and of Byron, they do not scruple to obliterate all pause between the sixth and seventh syllables. Thus Thomson (*Castle of Indolence*, i. 42):—

> And music lent new gladness to the morning air.

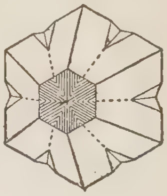
The danger in the use of the Alexandrine is that, in attempting to give dignity to his line, the poet may only produce heaviness, incurring the sneer of Pope—

> A needless Alexandrine ends the song,
> That, like a wounded snake, drags its slow length along.

The Alexandrine was the dominant metre in Dutch poetry from the 16th to the middle of the 19th century, and about the time of its introduction to Holland it was accepted in Germany by the school of Opitz. In the course of the 17th century, after being used without rhyme by Seckendorf and others, it formed a transitional station on the route to German blank verse, and has since then been rarely employed, except occasionally in rhymed comedy.

ALEXANDRISTS, the name given to those philosophers of the Renaissance, who, in the great controversy on the subject of personal immortality, adopted the explanation of the *De Anima* given by Alexander of Aphrodisias. According to the orthodox Thomism of the Roman Catholic Church, Aristotle rightly regarded reason as a faculty of the individual soul. Against this, the Averroists, led by Agostino Nifo (*q.v.*), introduced the modifying theory that universal reason in a sense individualizes itself in each soul and then absorbs the active reason into itself again. These two theories respectively evolved the doctrine of individual and universal immortality, or the absorption of the individual into the eternal One. The Alexandrists, led by Pietro Pomponazzi, boldly assailed these beliefs and denied that either was rightly attributed to Aristotle. They held that Aristotle considered the soul as a material and therefore a mortal entity which operates during life only under the authority of universal reason. Hence the Alexandrists denied the possibility of immortality in every shape or form. Since the soul is organically connected with the body, the dissolution of the latter involves the extinction of the former.

ALEXANDRITE, a variety of chrysoberyl (*q.v.*) discovered in the Urals in 1833, on the day set apart for celebrating the majority of the cesarevich, afterwards the tsar, Alexander II., in whose honour the stone was named by Nils Gustaf Nordenskiöld, of Helsingfors. It is remarkable for being strongly dichroic, generally appearing dark green by daylight and raspberry-red by candle-light, or by daylight transmitted through the stone. As red and green are the military colours of Russia, the mineral became highly popular as a gem-stone. The dark green crystals are usually cloudy and cracked, and grouped in triplets presenting a pseudo-hexagonal form. Alexandrite was found originally in the emerald-mine of Takovaya, east of Ekaterinburg in the Urals, and afterwards in the gold-bearing sands of the Sanarka in the southern Urals. Subsequently it was discovered in greater abundance in the gem-gravels of Ceylon. It has been found also in Tasmania. Some of the Ceylon alexandrite exhibits, when suitably cut, the Cat's-eye chatoyance, whence it has been called alexandrite cat's-eye. (F. W. R.*)



ALEXANDROPOL, or Alexandrapol (Turk. *Gumri*), a Russian town and fortified camp in Transcaucasia, government of Erivan, near the junction of the Arpa-chai with the Aras, 48 m. by rail E.N.E. of Kars. Altitude 5080 ft. It has a trade in silk. Here the Russians defeated the Turks in 1853. Pop. (1885) 22,670; (1897) 32,735.

ALEXANDROVSK. (1) A town of N. Russia, in the government of Archangel, on the harbour of Catherine (Ekaterininsk), on the Murman coast, 5 m. from the mouth of Kola Bay. It was opened in 1899 and is a naval station, being free from ice all the year round. It is also called Port Catherine. Pop. (1901) 300. (2) A town of S. Russia, 83 m. S. of Ekaterinoslav, on the railway to the Crimea, near the left bank of the Dnieper, below its rapids. Pop. (1897) 16,393. Opposite it is the island of Khortitsa, upon which was the *sich* (or *syech*) or camp of the Zaporozhian Cossacks. All its neighbourhood is strewn with *kurgans* (tumuli).

ALEXIS, Greek comic poet of the Middle Comedy, was born about 394 B.C. at Thurii and taken early to Athens, where he became a citizen. Plutarch says that he lived to the age of 106, and that he died on the stage while being crowned. According to Suidas, who calls him Menander's uncle, he wrote 245 comedies, of which some 130 titles are preserved. The fragments (about 1000 lines) attest the wit and refinement of the author (Koch, *Comicorum Atticorum Fragmenta*).

ALEXIS, WILLIBALD, the pseudonym of Georg Wilhelm Heinrich Häring (1798–1871), German historical novelist. He was born on the 29th of June 1798 at Breslau, where his father, who came of a French refugee family, named Hareng, held a high position in the war department. He attended the Werdersche Gymnasium in Berlin, and then, serving as a volunteer in the campaign of 1815, took part in the siege of the Ardenne fortresses. On his return he studied law at the universities of Berlin and Breslau and entered the legal profession, but he soon abandoned this career and devoted himself to literature. Settling in Berlin he edited, 1827–1835, the *Berliner Konversationsblatt*, in which for the first two years he was assisted by Friedrich Christoph Förster (1791–1868); and in 1828 was created a doctor of philosophy by the university of Halle. In 1852 he retired to Arnstadt in Thuringia, where after many years of broken health he died on the 16th of December 1871.

Häring made his name first known as a writer by an idyll in hexameters, *Die Treibjagd* (1820), and several short stories in which the influence of Tieck is observable; but his literary reputation was first established by the historical romance *Walladmor* (1823), which, published as being "freely translated from the English of Sir Walter Scott, with a preface by Willibald Alexis," so closely imitated the style of the famous Scotsman as really to deceive even Scott's admirers. The work became immediately popular and was translated into several languages, including English. It was followed by *Schloss Avalon* (1827), with regard to which the author adopted the same tactics and with equal success. These historical novels, however, were of considerable literary merit, and would doubtless have achieved popularity even without the borrowed plumage. Soon afterwards Häring published a number of successful short stories (*Gesammelte Novellen*, 4 vols., 1830–1831), some books of travel, and in the novels *Das Haus Dusterweg* (1835) and *Zwölf Nächte* (1838) showed for a while a leaning towards the "Young German" school. In *Cabanis* (1832), however, a story of the time of Frederick the Great, he entered the field of patriotic-historical romance, in which he so far excelled as to have earned the name of "der Märkische Walter Scott" (Walter Scott of the Mark). From 1840 onwards he published at short intervals a series of romances, each dealing with some epoch in the history of Brandenburg. Among them may be especially noted *Der Roland von Berlin* (1840), *Der falsche Woldemar* (1842), *Die Hosen des Herrn von Bredow* (1846–1848), *Ruhe ist die erste Bürgerpflicht* (1852), *Isegrimm* (1854) and *Dorothe* (1856). In all these the author shows himself as a keen observer of men and things; the characters, situations and natural surroundings are excellently delineated, and the patriotic feeling which pervades them is not overdone. Häring also made a name for himself in the field of criminology by commencing in 1842, in conjunction with the publicist, Julius Eduard Hitzig (1780–1849), the publication of *Der neue Pitaval* (continued by A. Vollert, 36 vols., Leipzig, 1842–1865; new edition, 24 vols., Leipzig, 1866–1891), a collection of criminal anecdotes culled from all nations and all times. This publication attained great popularity, and is to-day of psychological interest and value.

His *Gesammelte Werke* were published in 20 volumes (Berlin, 1874); the *Vaterländische Romane* separately in 8 volumes (Berlin, 1881, 1884), and, since the expiry of the copyright in 1901, in many cheap reprints. Cp. *W. Alexis' Erinnerungen*, edited by M. Ewert (1900), and essays by Julian Schmidt (*Neue Bilder aus dem geistigen Leben unsrer Zeit*, 1873), G. Freytag (*Werke*, vols. 16 and 23), A. Stern (*Zur Literatur der Gegenwart*, 1880) and T. Fontane (in *Bayreuther Blätter*, vi., 1883).

ALEXISBAD, a spa of Germany, in the duchy of Anhalt, lying under the Harz mountains, 1000 ft. above the sea, on the railway from Gernrode to Harzgerode. Pop. 1000. It is celebrated for its medicinal waters, of which the Alexisbrunnen, a ferruginous spring, is used for drinking, while the Selkebrunnen supplies the baths, which are of use in feminine disorders. The place was founded in 1810 by Duke Alexius of Anhalt-Bernburg.

ALEXIUS I. (1048–1118), emperor of the East, was the third son of John Comnenus, nephew of Isaac Comnenus, emperor 1057–1059. His father declined the throne on the abdication of Isaac, who was accordingly succeeded by four emperors of other families between that date and 1081. Under one of these emperors, Romanus Diogenes (1067-1071), he served with distinction against the Seljuk Turks. Under Michael Parapinaces (1071–1078) and Nicephorus Botaniates (1078–1081) he was also employed, along with his elder brother Isaac, against rebels in Asia Minor, Thrace and in Epirus (1071). The success of the Comneni roused the jealousy of Botaniates and his ministers, and the Comneni were almost compelled to take up arms in self-defence. Botaniates was forced to abdicate and retire to a monastery, and Isaac declined the crown in favour of his younger brother Alexius, who then became emperor in the 33rd year of his age. His long reign of nearly 37 years was full of difficulties (see ROMAN EMPIRE, LATER). At the very outset he had to meet the formidable attack of the Normans (Robert Guiscard and his son Bohemund), who took Dyrrhachium and Corfu, and laid siege to Larissa in Thessaly. The Norman danger ended for the time with Robert Guiscard's death (1085) and the conquests were recovered. He had next to repel the invasions of Patzinaks (Petchenegs) and Kumans in Thrace, with whom the Manichaean sects of the Paulicians and Bogomilians made common cause; and thirdly, he had to cope with the fast-growing power of the Turks in Asia Minor. Above all he had to meet the difficulties caused by the arrival of the warriors of the First Crusade, which had been in a great degree initiated owing to the representations of his own ambassadors, though the help which he wanted from the West was simply mercenary forces and not the immense hosts which arrived to his consternation and embarrassment. The first part, under Peter the Hermit, he got rid of by sending them on to Asia Minor, where they were massacred by the Turks (1096). The second and much more serious host of warriors, led by Godfrey of Bouillon, he conducted also into Asia, promising to supply them with provisions in return for an oath of homage, and by their victories recovered for the Empire a number of important cities and islands—Nicaea, Chios, Rhodes, Smyrna, Ephesus, Philadelphia, Sardis, and in fact most of Asia Minor (1097–1099). This is ascribed as a credit to his policy and diplomacy by his daughter, by the Latin historians of the crusade to his treachery and falseness, but during the last twenty years of his life he lost much of his popularity. They were marked by persecution of the followers of the Paulician and Bogomilian heresies (one of his last acts was to burn Basilius, a Bogomilian leader, with whom he had engaged in a theological controversy), by renewed struggles with the Turks (1110–1117), by anxieties as to the succession, which his wife Irene wished to alter in favour of her daughter Anne's husband, Nicephorus Bryennius for whose benefit the special title panhypersebastos (*i.e.* as it were *augustissimus si quis alius*) was created. This intrigue disturbed even his dying hours. He deserves the credit of having raised the Empire from a condition of anarchy and decay at a time when it was threatened on all sides by new dangers. No emperor devoted himself more laboriously or with a greater sense of duty to the task of ruling.

AUTHORITIES.—Zonaras xviii. 27-29; Anna Comnena's *Life*; see also Du Cange, *Familiae Byzantinae*; Friedrich Wilken, *Rerum ab Alexio I., Joanne, Manuele et Alexio II. Comnenis Romanorum, Byzantinorum imperatoribus gestarum, libri iv. Commentatio* (Heidelberg, 1811); Finlay, *History of Greece* (vol. iii., Oxford, 1877); Gibbon, *Decline and Fall of the Roman Empire*, edited with notes, &c., by Prof. J. B. Bury (London, 1898), where further authorities are cited; F. Chalandon, *Essai sur le règne d'Alexis I*^{er} *Comnène* (1900). (J. B. B.)

ALEXIUS II. (COMNENUS) (1167–1183), emperor of the East, was the son of Manuel Comnenus and Maria, daughter of Raymund, prince of Antioch, and was born at Constantinople on the 10th of September 1167. On Manuel's death, Maria, who had been immured in a convent under the name of Xene, had herself proclaimed regent (1179–1180), and handing over her son to evil counsellors, who encouraged him in every vice, supported the government of Alexius the protosebastos (nephew of Manuel), who was supposed to be her lover. The young Alexius and his friends now tried to form a party against the empress mother and the protosebastos; and his sister Maria, wife of Caesar John, stirred up riots in the streets of the capital. Their party was defeated (May 2, 1182), but Andronicus Comnenus took advantage of these disorders to aim at the crown, entered Constantinople, where he was received with almost divine honours, and overthrew the regents. His arrival was celebrated by a barbarous massacre of the Latins in Constantinople, which he made no attempt to stop. He allowed Alexius to be crowned, but forced him to consent to the death of all his friends, including his mother, his sister and the Caesar, and refused to allow him the smallest voice in public affairs. The betrothal in 1180 of Alexius with Agnes, daughter of Louis VII. of France, a child of nine, was quashed, and he was married to Irene, daughter of Andronicus. The latter was now formally proclaimed as co-emperor, and not long afterwards, on the pretext that divided rule was injurious to the Empire, he caused Alexius to be strangled with a bow-string (October 1183). (J. B. B.)

ALEXIUS III. (ANGELUS), emperor of the East, was the second son of Andronicus Angelus, nephew of Alexius I. In 1195, while his brother Isaac II. was away hunting in Thrace, he was proclaimed emperor by the troops; he captured Isaac at Stagira in Macedonia, put out his eyes, and kept him henceforth a close prisoner, though he had been redeemed by him from captivity at Antioch and loaded with honours. To compensate for this crime and to confirm his position as emperor, he had to scatter money so lavishly as to empty his treasury, and to allow such licence to the officers of the army as to leave the Empire practically defenceless. He consummated the financial ruin of the state. The empress Euphrosyne tried in vain to sustain his credit and his court; Vatatzes, the favourite instrument of her attempts at reform, was assassinated by the emperor's orders. Eastward the Empire was overrun by the Turks; from the north Bulgarians and Vlachs descended unchecked to ravage the plains of Macedonia and Thrace; while Alexius squandered the public treasure on his palaces and gardens. Soon he was threatened by a new and yet more formidable danger. In 1202 the Western princes assembled at Venice, bent on a new crusade. To them Alexius, son of the deposed Isaac, made appeal, promising as a crowning bribe to heal the schism of East and West if they would help him to depose his uncle. The crusaders, whose objective had been Egypt, were persuaded to set their course for Constantinople, before which they appeared in June 1203, proclaiming the emperor Alexius IV. and summoning the capital to depose his uncle. Alexius III., sunk in debauchery, took no efficient measures to resist. His son-in-law, Lascaris, who was the only one to do anything, was defeated at Scutari, and the siege of Constantinople began. On the 17th of July the crusaders, the aged doge Dandolo at their head, scaled the walls and took the city by storm. During the fighting and carnage that followed Alexius hid in the palace, and finally, with one of his daughters, Irene, and such treasures as he could collect, got into a boat and escaped to Develton in Thrace, leaving his wife, his other daughters and his Empire to the victors. Isaac, drawn from his prison and robed once more in the imperial purple, received his son in state.

Shortly afterwards Alexius made an effort in conjunction with Murtzuphlos (Alexius V.) to recover the throne. The attempt was unsuccessful and, after wandering about Greece, he surrendered with Euphrosyne, who had meanwhile joined him, to Boniface of Montferrat, then master of a great part of the Balkan peninsula. Leaving his protection he sought shelter with Michael, despot of Epirus, and then repaired to Asia Minor, where his son-in-law Lascaris was holding his own against the Latins. Alexius, joined by the sultan of Iconium (Konieh), now demanded the crown of Lascaris, and on his refusal marched against him. Lascaris, however, defeated and took him prisoner. Alexius was relegated to a monastery at Nicaea, where he died on some date unknown.

AUTHORITIES.—Nicetas Acominatus, George Acropolites, Nicephorus Gregoras; and the sources for the Fourth Crusade (see CRUSADES). (J. B. B.)

ALEXIUS V., eastern Roman emperor, was proclaimed emperor on the 5th of February 1204, during the siege of Constantinople by the Latins (Fourth Crusade). His name was Alexius Ducas Murtzuphlos, and he was a connexion of the imperial house of the Angeli. His elevation was the result of a revolution in the city against Isaac II. and Alexius IV. He conducted the defence with great bravery till it became hopeless (April 12), whereupon he fled. He would then have made common cause with Alexius III. against the Latins, but was blinded by that ex-monarch and fell into the hands of the crusaders, who put him to death by casting him from the top of the Pillar of Theodosius as the murderer of Alexius IV.

ALEXIUS MIKHAILOVICH (1629–1676), tsar of Muscovy, the son of Tsar Michael Romanov and Eudoxia Stryeshnevaya, was born on the 9th of March 1629. A youth at his father's death (1645), he was committed to the care of the *boyarin* Boris Ivanovich Morozov, a shrewd and sensible guardian, sufficiently enlightened to recognize the needs of his country, and by no means inaccessible to Western ideas. Morozov's foreign policy was pacificatory. He secured the truce with Poland and carefully avoided complications with the Porte. His domestic policy was severely equitable, and aimed at relieving the public burdens by limiting the privileges of foreign traders and abolishing a great many useless and expensive court offices. On the 17th of January 1648 he procured the marriage of the tsar with Maria Miloslavskaya, himself marrying her sister, Anna, ten days later. The Miloslavskis were typical self-seeking 17th century boyars, whose extortions made them generally detested. In May 1648 the people of Moscow rose against them, and the young tsar was compelled to dismiss both them and their patron Morozov. The successful issue of the Moscow riots was the occasion of disquieting disturbances all over the tsardom culminating in dangerous rebellions at Pskov and Great Novgorod, with which the government was so unable to cope that they surrendered, practically granting the malcontents their own terms. One man only had displayed equal tact and courage at Great Novgorod, the metropolitan Nikon (*q.v.*), who in consequence became in 1651 the tsar's chief minister. In 1653 the weakness and disorder of Poland, which had just emerged, bleeding at every pore, from the savage Cossack war, encouraged Alexius to attempt to recover from her secular rival the old Russian lands. On the 1st of October 1653 a national assembly met at Moscow to sanction the war and find the means of carrying it on, and in April 1654 the army was blessed by Nikon (now patriarch). The campaign of 1654 was an uninterrupted triumph, and scores of towns, including the important fortress of Smolensk, fell into the hands of the Muscovites. In January 1655 the rout of Ochmatov arrested their progress; but in the summer of the same year, the sudden invasion by Charles X. of Sweden for the moment swept the Polish state out of existence; the Muscovites, unopposed, quickly appropriated nearly everything which was not already occupied by the Swedes, and when at last the Poles offered to negotiate, the whole grand-duchy of Lithuania was the least of the demands of Alexius. Fortunately for Poland, the tsar and the king of Sweden now quarrelled over the apportionment of the spoil, and at the end of May 1656 Alexius, stimulated by the emperor and the other enemies of Sweden, declared war against her. Great things were expected of the Swedish war, but nothing came of it. Dorpat was taken, but countless multitudes were lost in vain before Riga. In the meantime Poland had so far recovered herself as to become a much more dangerous foe than Sweden, and, as it was impossible to wage war with both simultaneously, the tsar resolved to rid himself of the Swedes first. This he did by the peace of Kardis (July 2, 1661), whereby Muscovy retroceded all her conquests. The Polish war dragged on for six years longer and was then concluded by a truce, nominally for thirteen years, which proved the most durable of treaties. By the truce of Andrussowo (February 11, 1667) Vitebsk, Polotsk and Polish Livonia were restored to Poland, but the infinitely more important Smolensk and Kiev remained in the hands of the Muscovite together with the whole eastern bank of the Dnieper. This truce was the achievement of Athanasy Orduin-Nashchokin, the first Russian chancellor and diplomatist in the modern sense, who after the disgrace of Nikon became the tsar's first minister till 1670, when he was superseded by the equally able Artamon Matvyeev, whose beneficent influence prevailed to the end of the reign. It is the crowning merit of the ever amiable and courteous tsar Alexius that he discovered so many great men (like Nikon, Orduin, Matvyeev, the best of Peter's precursors) and suitably employed them. He was not a man of superior strength of character, or he would never have submitted to the dictation of Nikon. But, on the other hand, he was naturally, if timorously, progressive, or he would never have encouraged the great reforming *boyarin* Matvyeev. His education was necessarily narrow; yet he was learned in his way, wrote verses, and even began a history of his own times. His last years, notwithstanding the terrible rebellion of Stenka Razin, were deservedly tranquil. By his first consort he had thirteen children, of whom two sickly sons and eight healthy daughters survived him. By his second consort, Natalia Naruishkina, he had two children, the tsarevich Peter and the tsarevna Natalia.

See Robert Nisbet Bain, *The First Romanovs* (London, 1905). (R. N. B.)

ALEXIUS PETROVICH (1690–1718), Russian tsarevich, the sole surviving son of Peter I. and Eudoxia Lopukhina, was born on the 19th of February 1690. The young tsar married the *boyarinya* Lopukhina at his mother's command. We know nothing of the bride except that she was beautiful, modest and "brought up in the fear of the Lord." She would, doubtless, have made a model tsaritsa of the pre-Petrine period, but, unfortunately, she was no fit wife for such a vagabond of genius as Peter the Great. From the first her society bored Peter unspeakably, and, after the birth of their second short-lived son Alexander, on the 3rd of October 1691, he practically deserted her. The young Alexius was ignored by his father till he was nine years old. Peter was a rare and unwelcome guest in his own family, and a son who loved his mother could have little affection for a father who had ever been that mother's worst persecutor. From his sixth to his ninth year Alexius was educated by the diffuse and pedantic Vyazemsky, but after the removal of his mother to the Suzdal Prokovsky Monastery he was confided to the care of learned foreigners, who taught him history, geography, mathematics and French. In 1703 Alexius was ordered to follow the army to the field as a private in a bombardier regiment. In 1704 he was present at the capture of Narva. At this period the preceptors of the tsarevich had the highest opinion of his ability; but, unfortunately, it was not the sort of ability that his father could make use of. He was essentially a student, with strong leanings towards archaeology and ecclesiology. A monastic library was the proper place for this gentle emotional dreamer, who clung so fondly to the ancient traditions. To a prince of his temperament the vehement activity of his abnormally energetic father was very offensive. He liked neither the labour itself nor its object. Yet Peter, not unnaturally, wished his heir to dedicate himself to the service of new Russia, and demanded from him unceasing labour in order to maintain the brand-new state at the high level of greatness to which it had been raised. Painful relations between father and son, quite apart from the personal antipathies already existing, were therefore inevitable. It was an additional misfortune for Alexius that his father should have been too busy to attend to him just as he was growing up from boyhood to manhood. He was left in the hands of reactionary boyars and priests, who encouraged him to hate his father and wish for the death of the tsar-antichrist. His confessor, Yakov Ignatiev, whom he promised to obey as "an angel and apostle of God," was his chief counsellor in these days.

In 1708 Peter sent Alexius to Smolensk to collect provender and recruits, and thence to Moscow to fortify it against Charles XII. At the end of 1709 he went to Dresden for twelve months for finishing lessons in French and German, mathematics and fortification, and, his education completed, he was married, greatly against his will, to the princess Charlotte of Brunswick-Wolfenbüttel, whose sister espoused, almost simultaneously, the heir to the Austrian throne, the archduke Charles. The wedding was celebrated at Torgau on the 14th of October 1711, in the house of the queen of Poland, and three weeks later the bridegroom was hurried away by his father to Thorn to superintend the provisioning of the Russian troops in Poland. For the next twelve months Alexius was kept constantly on the move. His wife joined him at Thorn in December, but in April 1712 a peremptory ukaz ordered him off to the army in Pomerania, and in the autumn of the same year he was forced to accompany his father on a tour of inspection through Finland. Evidently Peter was determined to tear his son away from a life of indolent ease. Immediately on his return from Finland Alexius was despatched by his father to Staraya Rusya and Ladoga to see to the building of new ships. This was the last commission entrusted to him. On his return to the capital Peter, in order to see what progress his son had made in mechanics and mathematics, asked him to draw something of a technical nature for his inspection. Alexius, in order to escape such an ordeal, resorted to the abject expedient of disabling his right hand by a pistol-shot. In no other way could the tsarevich have offended his father so deeply. He had behaved like a cowardly recruit who mutilates himself to escape military service. After this, Peter seemed for a time to take no further interest in Alexius. He left him entirely to himself. He employed him no more. He no longer pressed him to attend public functions. Alexius rejoiced at this welcome change, but he had cause rather to fear it. It marked the deepening of a hatred which might have been overcome. Alexius was evidently consoling himself with the reflexion that the future belonged to him. He was well aware that the mass of the Russian nation was on his side. Nearly all the prelates were devoted to him. Equally friendly were the great boyar families. All Alexius had to do was to sit still, keep out of his father's way as much as possible and await the natural course of events. But with Peter the present was everything. He could not afford to leave anything to chance. All his life long he had been working incessantly with a single object—the regeneration of Russia. What if his successor refused to tread in his father's footsteps or, still worse, tried to destroy his father's work? By some such process of reasoning as this must the idea of changing the succession to the throne, by setting aside Alexius, have first occurred to the mind of Peter the Great. Nevertheless he made one last effort to reclaim his son. On the 22nd of October 1715 Alexius' consort, the princess Charlotte, died, after giving birth to a son, the grand-duke Peter, afterwards Peter II. On the day of the funeral Peter addressed to Alexius a stern letter of warning and remonstrance, urging him no longer to resemble the slothful servant in the parable, and threatening to cut him off, as though he were a gangrenous swelling, if he did not acquiesce in his father's plans. But it was now that Alexius showed what a poor creature he really was. He wrote a pitiful reply to his father, offering to renounce the succession in favour of his baby half-brother Peter, who had been born the day after the princess Charlotte's funeral. As if this were not enough, in January 1716 he wrote to his father for permission to become a monk. Still Peter did not despair. On the 26th of August 1716 he wrote to Alexius from abroad urging him, if he desired to remain tsarevich, to join him and the army without delay. Rather than face this ordeal Alexius fled to Vienna and placed himself under the protection of his brother-in-law, the emperor Charles VI., who sent him for safety first to the Tirolean fortress of Ahrenberg, and finally to the castle of San Elmo at Naples. He was accompanied throughout his journey by his mistress, the Finnish girl Afrosina. That the emperor sincerely sympathized with Alexius, and suspected Peter of harbouring murderous designs against his son, is plain from his confidential letter to George I. of England, whom he consulted on this delicate affair. Peter's agitation was extreme. The flight of the tsarevich to a foreign potentate was a reproach and a scandal. He must be recovered and brought back to Russia at all hazards. This difficult task was accomplished by Count Peter Tolstoi, the most subtle and unscrupulous of Peter's servants; but terrorized though he was, Alexius would only consent to return on his father solemnly swearing, "before God and His judgment seat," that if he came back he should not be punished in the least, but cherished as a son and allowed to live quietly on his estates and marry Afrosina. On the 31st of January 1718 the tsarevich reached Moscow. Peter had already determined to institute a most searching inquisition in order to get at the bottom of the mystery of the flight. On the 18th of February a "confession" was extorted from Alexius which implicated most of his friends, and he then publicly renounced the succession to the throne in favour of the baby grand-duke Peter Petrovich. A horrible reign of terror ensued, in the course of which the ex-tsaritsa Eudoxia was dragged from her monastery and publicly tried for alleged adultery, while all who had in any way befriended Alexius were impaled, broken on the wheel and otherwise lingeringly done to death. All this was done to terrorize the reactionaries and isolate the tsarevich. In April 1718 fresh confessions were extorted from Alexius, now utterly broken and half idiotic with fright. Yet even now there were no actual facts to go upon. Alexius' "evil designs" were still *in foro conscientiae*, and had not been, perhaps never would be, translated into practice. The worst that could be brought against him was that he had *wished* his father's death. In the eyes of Peter, his son was now a self-convicted and most dangerous traitor, whose life was forfeit. But there was no getting over the fact that his father had sworn "before the Almighty and His judgment seat" to pardon him and let him live in peace if he returned to Russia. From Peter's point of view the question was, did the enormity of the tsarevich's crime absolve the tsar from the oath which he had taken to spare the life of this prodigal son? This question was solemnly submitted to a grand council of prelates, senators, ministers and other dignitaries on the 13th of June 1718. The clergy left the matter to the tsar's own decision. The temporal dignitaries declared the evidence to be insufficient and suggested that Alexius should be examined by torture. Accordingly, on the 19th of June, the weak and ailing tsarevich received twenty-five strokes with the knout (as then administered nobody ever survived thirty), and on the 24th fifteen more. It was hardly possible that he could survive such treatment; the natural inference is that he was not intended to survive it. Anyway, he expired two days later in the guardhouse of the citadel of St Petersburg, two days after the senate had condemned him to death for *imagining* rebellion against his father, and for *hoping* for the co-operation of the common people and the armed intervention of his brother-in-law, the emperor. This shameful sentence was the outcome of mingled terror and obsequiousness. Abominable, unnatural as Peter's conduct to his unhappy and innocent son undoubtedly was, there is no reason to suppose that he ever regretted it. He argued that a single worthless life stood in Russia's way, and he therefore removed it. See R. N. Bain, *The First Ramonovs* (London, 1905). (R. N. B.)

ALFALFA, the name in America for the leguminous plant *Medicago sativa*, known elsewhere as lucerne (see LUCERNE).

ALFANI, DOMENICO, Italian painter, was born at Perugia towards the close of the 15th century. He was a contemporary of Raphael, with whom he studied in the school of Perugino. The two artists lived on terms of intimate friendship, and the influence of the more distinguished of the two is so clearly traceable in the works of the other, that these have frequently been attributed to Raphael. Towards the close of his life Alfani gradually changed his style and approximated to that of the later Florentine school. The date of his death, according to some, was 1540, while others say he was alive in 1553. Pictures by Alfani may be seen in collections at Florence and in several churches in Perugia.

ALFELD, a town of Germany, in the Prussian province of Hanover, 10 m. W. of Hildesheim, on the river Leine and the Hanover-Cassel main line of railway. Pop. (1900) 4900. It has a handsome church with twin spires, and training colleges for schoolmasters and theological candidates. Its industries are flourishing, and embrace paper-making, agricultural machine-works, iron-founding and flax-spinning.

ALFIERI, VITTORIO, COUNT (1749–1803), Italian dramatist, was born on the 17th of January 1749 at Asti in Piedmont. He lost his father in early infancy; but he continued to reside with his mother, who married a second time, till his tenth year, when he was placed at the academy of Turin. After he had passed a twelvemonth at the academy, he went on a short visit to a relation who dwelt at Coni; and during his stay there he made his first poetical attempt in a sonnet chiefly borrowed from lines in Ariosto and Metastasio, the only poets he had at that time read. When thirteen years of age he was induced to begin the study of civil and canonical law; but the attempt only served to disgust him with every species of application and to increase his relish for the perusal of French romances. By the death of his uncle, who had hitherto taken some charge of his education and conduct, he was left, at the age of fourteen, to enjoy without control his vast paternal inheritance, augmented by the recent accession of his uncle's fortune. He now began to attend the riding-school, where he acquired that rage for horses and equestrian exercise which continued to be one of his strongest passions till the close of his existence.

After some time spent in alternate fits of extravagant dissipation and ill-directed study, he was seized with a desire of travelling; and having obtained permission from the king, he departed in 1766, under the care of an English preceptor. Restless and unquiet, he posted with the utmost rapidity through the towns of Italy; and his improvement was such as was to be expected from his mode of travelling and his previous habits. Hoping to find in foreign countries some relief from the tedium and ennui with which he was oppressed, and being anxious to become acquainted with the French theatre, he proceeded to Paris. But he appears to have been completely dissatisfied with everything he witnessed in France and contracted a dislike to its people, which his intercourse in future years rather contributed to augment than diminish. In Holland he became deeply enamoured of a married lady, who returned his attachment, but who was soon obliged to accompany her husband to Switzerland. Alfieri, whose feelings were of the most impetuous description, was in despair at this separation, and returned to his own country in the utmost anguish and despondency of mind. While under this depression of spirits he was induced to seek alleviation from works of literature; and the perusal of Plutarch's *Lives*, which he read with profound emotion, inspired him with an enthusiastic passion for freedom and independence. Under the influence of this rage for liberty he recommenced his travels; and his only gratification, in the absence of freedom among the continental states, appears to have been derived from contemplating the wild and sterile regions of the north of Sweden, where gloomy forests, lakes and precipices conspired to excite those sublime and melancholy ideas which were congenial to his disposition. Everywhere his soul felt as if confined by the bonds of society; he panted for something more free in government, more elevated in sentiment, more devoted in love and more perfect in friendship. In search of this ideal world he posted through various countries more with the rapidity of a courier than of one who travels for amusement or instruction. During a journey to London he engaged in an intrigue with a married lady of high rank; and having been detected, the publicity of a rencounter with the injured husband, and of a divorce which followed, rendered it expedient and desirable for him to quit England. He then visited Spain and Portugal, where he became acquainted with the Abbé Caluso, who remained through life the most attached and estimable friend he ever possessed. In 1772 Alfieri returned to Turin. This time he became enamoured of the Marchesa Turinetti di Prie, whom he loved with his usual ardour, and who seems to have been as undeserving of a sincere attachment as those he had hitherto adored. In the course of a long attendance on his mistress, during a malady with which she was afflicted, he one day wrote a dialogue or scene of a drama, which he left at her house. On a difference taking place between them the piece was returned to him, and being retouched and extended to five acts, it was performed at Turin in 1775, under the title of *Cleopatra*.

From this moment Alfieri was seized with an insatiable thirst for theatrical fame, and the remainder of his life was devoted to its attainment. His first two tragedies, *Filippo* and *Polinice*, were originally written in French prose; and when he came to versify them in Italian, he found that, from his Lombard origin and long intercourse with foreigners, he expressed himself with feebleness and inaccuracy. Accordingly, with the view of improving his Italian style, he went to Tuscany and, during an alternate residence at Florence and Siena, he completed his *Filippo* and *Polinice*, and conceived the plan of various other dramas. While thus employed he became acquainted with the countess of Albany, who then resided with her husband at Florence. For her he formed an attachment which, if less violent than his former loves, appears to have been more permanent. With this motive to remain at Florence, he could not endure the chains by which his vast possessions bound him to Piedmont. He therefore resigned his whole property to his sister, the countess Cumiana, reserving an annuity which scarcely amounted to a half of his original revenues. At this period the countess of Albany, urged by the ill-treatment she received from her husband, sought refuge in Rome, where she at length received permission from the pope to live apart from her tormentor. Alfieri followed the countess to that capital, where he completed fourteen tragedies, four of which were now for the first time printed at Sienna.

At length, however, it was thought proper that, by leaving Rome, he should remove the aspersions which had been thrown on the object of his affections. During the year 1783 he therefore travelled through different states of Italy, and published six additional tragedies. The interests of his love and literary glory had not diminished his rage for horses, which seems to have been at least the third passion of his soul. He came to England solely for the purpose of purchasing a number of these animals, which he carried with him to Italy. On his return he learned that the countess of Albany had gone to Colmar in Alsace, where he joined her, and resided with her under the same roof during the rest of his life. They chiefly passed their time between Alsace and Paris, but at length took up their abode entirely in that metropolis. While here, Alfieri made arrangements with Didot for an edition of his tragedies, but was soon after forced to quit Paris by the storms of the Revolution. He recrossed the Alps with the countess, and finally settled at Florence. The last ten years of his life, which he spent in that city, seem to have been the happiest of his existence. During that long period his tranquillity was only interrupted by the entrance of the Revolutionary armies into Florence in 1799. Though an enemy of kings, the aristocratic feeling of Alfieri rendered him also a decided foe to the principles and leaders of the French Revolution; and he rejected with the utmost contempt those advances which were made with a view to bring him over to their cause. The concluding years of his life were laudably employed in the study of the Greek literature and in perfecting a series of comedies. His assiduous labour on this subject, which he pursued with his characteristic impetuosity, exhausted his strength, and brought on a malady for which he would not adopt the prescriptions of his physicians, but obstinately persisted in employing remedies of his own. His disorder rapidly increased, and he died on the 8th of October 1803.

The character of Alfieri may be best appreciated from the portrait which he has drawn of himself in his own *Memoirs of his Life*. He was evidently of an irritable, impetuous and almost ungovernable temper. Pride, which seems to have been a ruling sentiment, may account for many apparent inconsistencies of his character. But his less amiable qualities were greatly softened by the cultivation of literature. His application to study gradually tranquillized his temper and softened his manners, leaving him at the same time in perfect possession of those good qualities which he had inherited from nature—a warm and disinterested attachment to his family and friends, united to a generosity, vigour and elevation of character, which rendered him not unworthy to embody in his dramas the actions and sentiments of Grecian heroes.

It is to his dramas that Alfieri is chiefly indebted for the high reputation he has attained. Before his time the Italian language, so harmonious in the *Sonnets* of Petrarch and so energetic in the *Commedia* of Dante, had been invariably languid and prosaic in dramatic dialogue. The pedantic and inanimate tragedies of the 16th century were followed, during the iron age of Italian literature, by dramas of which extravagance in the sentiments and improbability in the action were the chief characteristics. The prodigious success of the *Merope* of Maffei, which appeared in the commencement of the 18th century, may be attributed more to a comparison with such productions than to intrinsic merit. In this degradation of tragic taste the appearance of the tragedies of Alfieri was perhaps the most important literary event that had occurred in Italy during the 18th century. On these tragedies it is difficult to pronounce a judgment, as the taste and system of the author underwent considerable change and modification during the intervals which elapsed between the three periods of their publication. An excessive harshness of style, an asperity of sentiment and total want of poetical ornament are the characteristics of his first four tragedies, *Filippo*, *Polinice*, *Antigone* and *Virginia*. These faults were in some measure corrected in the six tragedies which he gave to the world some years after, and in those which he published along with *Saul*, the drama which enjoyed the greatest success of all his productions—a popularity which may be partly attributed to the severe and unadorned manner of Alfieri being well adapted to the patriarchal simplicity of the age in which the scene of the tragedy is placed. But though there be a considerable difference in his dramas, there are certain observations applicable to them all. None of the plots are of his own invention. They are founded either on mythological fable or history; most of them had been previously treated by the Greek dramatists or by Seneca. *Rosmunda*, the only one which could be supposed of his own contrivance, and which is certainly the least happy effusion of his genius, is partly founded on the eighteenth novel of the third part of Bandello and partly on Prevost's *Mémoires d'un homme de qualité*. But whatever subject he chooses, his dramas are always formed on the Grecian model and breathe a freedom and independence worthy of an Athenian poet. Indeed, his *Agide* and *Bruto* may rather be considered oratorical declamations and dialogues on liberty than tragedies. The unities of time and place are not so scrupulously observed in his as in the ancient dramas; but he has rigidly adhered to a unity of action and interest. He occupies his scene with one great action and one ruling passion, and removes from it every accessory event or feeling. In this excessive zeal for the observance of unity he seems to have forgotten that its charm consists in producing a common relation between multiplied feelings, and not in the bare exhibition of one, divested of those various accompaniments which give harmony to the whole. Consistently with that austere and simple manner which he considered the chief excellence of dramatic composition, he excluded from his scene all *coups de théâtre*, all philosophical reflexions, and that highly ornamented versification which had been so assiduously cultivated by his predecessors. In his anxiety, however, to avoid all superfluous ornament, he has stripped his dramas of the embellishments of imagination; and for the harmony and flow of poetical language he has substituted, even in his best performances, a style which, though correct and pure, is generally harsh, elaborate and abrupt; often strained into unnatural energy or condensed into factitious conciseness. The chief excellence of Alfieri consists in powerful delineation of dramatic character. In his *Filippo* he has represented, almost with the masterly touches of Tacitus, the sombre character, the dark mysterious counsels, the *suspensa semper et obscura verba*, of the modern Tiberius. In *Polinice*, the characters of the rival brothers are beautifully contrasted; in *Maria Stuarda*, that unfortunate queen is represented unsuspicious, impatient of contradiction and violent in her attachments. In *Mirra*, the character of Ciniro is perfect as a father and king, and Cecri is a model of a wife and mother. In the representation of that species of mental alienation where the judgment has perished but traces of character still remain, he is peculiarly happy. The insanity of Saul is skilfully managed; and the horrid joy of Orestes in killing Aegisthus rises finely and naturally to madness in finding that, at the same time, he had inadvertently slain his mother.

Whatever may be the merits or defects of Alfieri, he may be considered as the founder of a new school in the Italian drama. His country hailed him as her sole tragic poet; and his successors in the same path of literature have regarded his bold, austere and rapid manner as the genuine model of tragic composition.

Besides his tragedies, Alfieri published during his life many sonnets, five odes on American independence and the poem of *Etruria*, founded on the assassination of Alexander I., duke of Florence. Of his prose works the most distinguished for animation and eloquence is the *Panegyric on Trajan*, composed in a transport of indignation at the supposed feebleness of Pliny's eulogium. The two books entitled *La Tirannide* and the *Essays on Literature and Government* are remarkable for elegance and vigour of style, but are too evidently imitations of the manner of Machiavel. His *Antigallican*, which was written at the same time with his *Defence of Louis XVI.*, comprehends an historical and satirical view of the French Revolution. The posthumous works of Alfieri consist of satires, six political comedies and the *Memoirs of his Life*—a work which will always be read with interest, in spite of the cold and languid gravity with which he delineates the most interesting adventures and the strongest passions of his agitated life.

See *Mem. di Vit. Alfieri*; Sismondi, *De la lit. du midi de l'Europe*; Walker's *Memoir on Italian Tragedy*; *Giorn. de Pisa*, tom. lviii.;

Life of Alfieri, by Centofanti (Florence, 1842); *Vita, Giornuli, Lettere di Alfieri*, by Teza (Florence, 1861); *Vittorio Alfieri*, by Antonini and Cognetti (Turin, 1898).

ALFORD, HENRY (1810–1871), English divine and scholar, was born in London on the 7th of October 1810. He came of a Somersetshire family, which had given five consecutive generations of clergymen to the Anglican church. Alford's early years were passed with his widowed father, who was curate of Steeple Ashton in Wiltshire. He was an extremely precocious lad, and before he was ten had written several Latin odes, a history of the Jews and a series of homiletic outlines. After a peripatetic school course he went up to Cambridge in 1827 as a scholar of Trinity. In 1832 he was 34th wrangler and 8th classic, and in 1834 was made fellow of Trinity. He had already taken orders, and in 1835 began his eighteen years' tenure of the vicarage of Wymeswold in Leicestershire, from which seclusion the twice-repeated offer of a colonial bishopric failed to draw him. He was Hulsean lecturer at Cambridge in 1841–1842, and steadily built up a reputation as scholar and preacher, which would have been enhanced but for his discursive ramblings in the fields of minor poetry and magazine editing. In September 1853 Alford removed to Quebec Chapel, London, where he had a large and cultured congregation. In March 1857 Viscount Palmerston advanced him to the deanery of Canterbury, where, till his death on the 12th of January 1871, he lived the same strenuous and diversified life that had always characterized him. The inscription on his tomb, chosen by himself, is "*Diversorium Viatoris Hierosolymam Proficiscentis.*"

Alford was a not inconsiderable artist, as his picture-book, *The Riviera* (1870), shows, and he had abundant musical and mechanical talent. Besides editing the works of John Donne, he published several volumes of his own verse, *The School of the Heart* (1835), *The Abbot of Muchelnaye* (1841), and a number of hymns, the best-known of which are "Forward! be our watchword," "Come, ye thankful people, come," and "Ten thousand times ten thousand." He translated the *Odyssey*, wrote a well-known manual of idiom, *A Plea for the Queen's English* (1863), and was the first editor of the *Contemporary Review* (1866–1870). His chief fame, however, rests upon his monumental edition of the New Testament in Greek (4 vols.), which occupied him from 1841 to 1861. In this work he first brought before English students a careful collation of the readings of the chief MSS. and the researches of the ripest continental scholarship of his day. Philological rather than theological in character, it marked an epochal change from the old homiletic commentary, and though more recent research, patristic and papyral, has largely changed the method of New Testament exegesis, Alford's work is still a quarry where the student can dig with a good deal of profit.

His *Life*, written by his widow, appeared in 1873 (Rivington).
(A. J. G.)

ALFRED, or ÆLFRED, known as THE GREAT (848–? 900), king of England, was born in 848 at Wantage, and was the fourth son of King Æthelwulf and his first wife (Osburh). He seems to have been a child of singular attractiveness and promise, and stories of his boyhood were remembered. At the age of five (853) he was sent to Rome, where he was confirmed by Leo IV., who is also stated to have "hallowed him as king." Later writers interpreted this as an anticipatory crowning in preparation for his ultimate succession to the throne of Wessex. That, however, could not have been foreseen in 853, as Alfred had three elder brothers living. It is probably to be understood either of investiture with the consular insignia, or possibly with some titular royalty such as that of the under-kingdom of Kent. In 855 Alfred again went to Rome with his father Æthelwulf, returning towards the end of 856. About two years later his father died. During the short reigns of his two eldest brothers, Æthelbald and Æthelberht, nothing is heard of Alfred. But with the accession of the third brother Æthelred (866) the public life of Alfred begins, and he enters on his great work of delivering England from the Danes. It is in this reign that Asser applies to Alfred the unique title of *secundarius*, which seems to indicate a position analogous to that of the Celtic *tanist*, a recognized successor, closely associated with the reigning prince. It is probable that this arrangement was definitely sanctioned by the witenagemot, to guard against the danger of a disputed succession should Æthelred fall in battle. In 868 Alfred married Ealhswith, daughter of Æthelred Mucill, who is called ealdorman of the Gaini, an unidentified district. The same year the two brothers made an unsuccessful attempt to relieve Mercia from the pressure of the Danes. For nearly two years Wessex had a respite. But at the end of 870 the storm burst; and the year which followed has been rightly called "Alfred's year of battles." Nine general engagements were fought with varying fortunes, though the place and date of two of them have not been recorded. A successful skirmish at Englefield, Berks (December 31, 870), was followed by a severe defeat at Reading (January 4, 871), and this, four days later, by the brilliant victory of Ashdown, near Compton Beauchamp in Shrivenham Hundred. On the 22nd of January the English were again defeated at Basing, and on the 22nd of March at Marton, Wilts, the two unidentified battles having perhaps occurred in the interval. In April Æthelred died, and Alfred succeeded to the whole burden of the contest. While he was busied with his brother's exequies, the Danes defeated the English in his absence at an unnamed spot, and once more in his presence at Wilton in May. After this peace was made, and for the next five years the Danes were occupied in other parts of England, Alfred merely keeping a force of observation on the frontier. But in 876 part of the Danes managed to slip past him and occupied Wareham; whence, early in 877, under cover of treacherous negotiations, they made a dash westwards and seized Exeter. Here Alfred blockaded them, and a relieving fleet having been scattered by a storm, the Danes had to submit and withdrew to Mercia. But in January 878 they made a sudden swoop on Chippenham, a royal vill in which Alfred had been keeping his Christmas, "and most of the people they reduced, except the King Alfred, and he with a little band made his way . . . by wood and swamp, and after Easter he . . . made a fort at Athelney, *and from that fort kept fighting against the foe*" (*Chron.*). The idea that Alfred, during his retreat at Athelney, was a helpless fugitive rests upon the foolish legend of the cakes. In reality he was organizing victory. By the middle of May his preparations were complete and he moved out of Athelney, being joined on the way by the levies of Somerset, Wilts and Hants. The Danes on their side moved out of Chippenham, and the two armies met at Edington in Wiltshire. The result was a decisive victory for Alfred. The Danes submitted. Guthrum, the Danish king, and twenty-nine of his chief men accepted baptism. By the next year (879) not only Wessex, but Mercia, west of Watling Street, was cleared of the invader. This is the arrangement known as the peace of Wedmore (878), though no document embodying its provisions is in existence. And though for the present the north-eastern half of England, including London, remained in the hands of the Danes, in reality the tide had turned, and western Europe was saved from the danger of becoming a heathen Scandinavian power. For the next few years there was peace, the Danes being kept busy on the continent. A landing in Kent in 884 or 885,[1] though successfully repelled, encouraged the East Anglian Danes to revolt. The measures taken by Alfred to repress this revolt culminated in the capture of London in 885 or 886, and the treaty known as Alfred and Guthrum's peace, whereby the boundaries of the treaty of Wedmore (with which this is often confused) were materially modified in Alfred's favour. Once more for a time there was a lull; but in the autumn of 892 (893) the final storm burst. The Danes, finding their position on the continent becoming more and more precarious, crossed to England in two divisions, amounting in the aggregate to 330 sail, and entrenched themselves, the larger body at Appledore and the lesser under Haesten at Milton in Kent. The fact that the new invaders brought their wives and children with them shows that this was no mere raid, but a deliberate attempt, in concert with the Northumbrian and East Anglian Danes, to conquer England. Alfred, 893 (894), took up a position whence he could observe both forces. While he was negotiating with Haesten the Danes at Appledore broke out and struck north-westwards, but were overtaken by Alfred's eldest son, Edward, and defeated in a general engagement at Farnham, and driven to take refuge in Thorney Island in the Hertfordshire Colne, where they were blockaded and ultimately compelled to submit. They then fell back on Essex, and after suffering another defeat at Benfleet coalesced with Haesten's force at Shoebury. Alfred had been on his way to relieve his son at Thorney when he heard that the Northumbrian and East Anglian Danes were besieging Exeter and an unnamed fort on the coast of North Devon. Alfred at once hurried westwards and raised the siege of Exeter; the fate of the other place is not recorded. Meanwhile the force under Haesten set out to march up the Thames valley, possibly with the idea of assisting their friends in the west. But they were met by a large force under the three great ealdormen of Mercia, Wilts and Somerset, and forced to head off to the north-west, being finally overtaken and blockaded at Buttington, which some identify with Buttington Tump at the mouth of the Wye, others with Buttington near Welshpool. An attempt to break through the English lines was defeated with loss; those who escaped retreated to Shoebury. Then after collecting reinforcements they made a sudden dash across England and occupied the ruined Roman walls of Chester. The English did not attempt a winter blockade, but contented themselves with destroying all the supplies in the neighbourhood. And early in 894 (895) want of food obliged the Danes to retire once more to Essex. At the end of this year and early in 895 (896) the Danes drew their ships up the Thames and Lea and fortified themselves twenty miles above London. A direct attack on the Danish lines failed, but later in the year Alfred saw a means of obstructing the river so as to prevent the egress of the Danish ships. The Danes realized that they were out-manœuvred. They struck off north-westwards and wintered at Bridgenorth. The next year, 896 (897), they abandoned the struggle. Some retired to Northumbria, some to East Anglia; those who had no connexions in England withdrew to the continent. The long campaign was over. The result testifies to the confidence inspired by Alfred's character and generalship, and to the efficacy of the military reforms initiated by him. These were (1) the division of the *fyrd* or national militia into two parts, relieving each other at fixed intervals, so as to ensure continuity in military operations; (2) the establishment of fortified posts (burgs) and garrisons at certain points; (3) the enforcement of the obligations of thanehood on all owners of five hides of land, thus giving the king a nucleus of highly equipped troops. After the final dispersal of the Danish invaders Alfred turned his attention to the increase of the navy, and ships were built according to the king's own designs, partly to repress the ravages of the Northumbrian and East Anglian Danes on the coasts of Wessex, partly to prevent the landing of fresh hordes. This is not, as often asserted, the beginning of the English navy. There had been earlier naval operations under Alfred. One naval engagement was certainly fought under Æthelwulf (851), and earlier ones, possibly in 833 and 840. Nor were the new ships a great success, as we hear of them grounding in action and foundering in a storm. Much, too, was needed in the way of civil re-organization, especially in the districts ravaged by the Danes. In the parts of Mercia acquired by Alfred, the shire system seems now to have been introduced for the first time. This is the one grain of truth in the legend that Alfred was the inventor of shires, hundreds and tithings. The finances also would need careful attention; but the subject is obscure, and we cannot accept Asser's description of Alfred's appropriation of his revenue as more than an ideal sketch. Alfred's care for the administration of justice is testified both by history and legend; and the title "protector of the poor" was his by unquestioned right. Of the action of the witenagemot we do not hear very much under Alfred. That he was anxious to respect its rights is conclusively proved, but both the circumstances of the time and the character of the king would tend to throw more power into his hands. The legislation of Alfred probably belongs to the later part of the reign, after the pressure of the Danes had relaxed. The details of it cannot be discussed here. Asser speaks grandiosely of Alfred's relations with foreign powers, but little definite information is available. He certainly corresponded with Elias III., the patriarch of Jerusalem, and probably sent a mission to India. Embassies to Rome conveying the English alms to the pope were fairly frequent; while Alfred's interest in foreign countries is shown by the insertions which he made in his translation of Orosius. His relations to the Celtic princes in the southern half of the island are clearer. Comparatively early in his reign the South Welsh princes, owing to the pressure on them of North Wales and Mercia, commended themselves to Alfred. Later in the reign the North Welsh followed their example, and the latter co-operated with the English in the campaign of 893 (894). The Celtic principality in Cornwall, which seems to have survived at least till 926, must long have been practically dependent on Wessex. That Alfred sent alms to Irish as well as to continental monasteries may be accepted on Asser's authority; the visit of the three pilgrim "Scots" (*i.e.* Irish) to Alfred in 891 is undoubtedly authentic; the story that he himself in his childhood was sent to Ireland to be healed by St Modwenna, though mythical, may point to Alfred's interest in that island. The history of the church under Alfred is most obscure. The Danish inroads had told heavily upon it; the monasteries had been special points of attack, and though Alfred founded two or three monasteries and imported foreign monks, there was no general revival of monasticism under him. To the ruin of learning and education wrought by the Danes, and the practical extinction of the knowledge of Latin even among the clergy, the preface to Alfred's translation of Gregory's *Pastoral Care* bears eloquent testimony. It was to remedy these evils that he established a court school, after the example of Charles the Great; for this he imported scholars like Grimbald and John the Saxon from the continent and Asser from South Wales; for this, above all, he put himself to school, and made the series of translations for the instruction of his clergy and people, most of which still survive. These belong unquestionably to the later part of his reign, not improbably to the last four years of it, during which the chronicles are almost silent. Apart from the lost *Handboc* or *Encheiridion*, which seems to have been merely a commonplace-book kept by the king, the earliest work to be translated was the *Dialogues of Gregory*, a book enormously popular in the middle ages. In this case the translation was made by Alfred's great friend Werferth, bishop of Worcester, the king merely furnishing a preface. The next work to be undertaken was Gregory's *Pastoral Care*, especially for the benefit of the clergy. In this Alfred keeps very close to his original; but the introduction which he prefixed to it is one of the most interesting documents of the reign, or indeed of English history. The next two works taken in hand were historical, the *Universal History* of Orosius and Bede's *Ecclesiastical History of the English People*. The priority should probably be assigned to the *Orosius*, but the point has been much debated. In the *Orosius*, by omissions and additions, Alfred so remodels his original as to produce an almost new work; in the *Bede* the author's text is closely adhered to, no additions being made, though most of the documents and some other less interesting matters are omitted. Of late years doubts have been raised as to Alfred's authorship of the *Bede* translation. But the sceptics cannot be regarded as having proved their point. We come now to what is in many ways the most interesting of Alfred's works, his translation of Boethius' *Consolation of Philosophy*, the most popular philosophical manual of the middle ages. Here again Alfred deals very freely with his original and though the late Dr G. Schepss showed that many of the additions to the text are to be traced not to Alfred himself, but to the glosses and commentaries which he used, still there is much in the work which is solely Alfred's and highly characteristic of his genius. It is in the *Boethius* that the oft-quoted sentence occurs: "My will was to live worthily as long as I lived, and after my life to leave to them that should come after, my memory in good works." The book has come down to us in two MSS. only. In one of these the poems with which the original is interspersed are rendered into prose, in the other into alliterating verse. The authorship of the latter has been much disputed; but probably they also are by Alfred. Of the authenticity of the work as a whole there has never been any doubt. The last of Alfred's works is one to which he gave the title *Blostman*, *i.e.* "Blooms" or Anthology. The first half is based mainly on the *Soliloquies* of St Augustine, the remainder is drawn from various sources, and contains much that is Alfred's own and highly characteristic of him. The last words of it may be quoted; they form a fitting epitaph for the noblest of English kings. "Therefore he seems to me a very foolish man, and very wretched, who will not increase his understanding while he is in the world, and ever wish and long to reach that endless life where all shall be made clear." Besides these works of Alfred's, the *Saxon Chronicle* almost certainly, and a Saxon *Martyrology*, of which fragments only exist, probably owe their inspiration to him. A prose version of the first fifty Psalms has been attributed to him; and the attribution, though not proved, is perfectly possible. How Alfred passed to "the life where all things are made clear" we do not know. The very year is uncertain. The arguments on the whole are in favour of 900. The day was the 26th of October. Alike for what he did and for what he was, there is none to equal Alfred in the whole line of English sovereigns; and no monarch in history ever deserved more truly the epithet of Great.

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[1] Where alternative dates are given the later date is that of the *Saxon Chronicle*. But the evidence of the Continental Chronicles makes it probable that the *Saxon Chronicle* is a year in advance of the true chronology in this part.

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ALFRED ERNEST ALBERT, duke of Saxe-Coburg and Gotha, and duke of Edinburgh (1844–1900), second son and fourth child of Queen Victoria, was born at Windsor Castle on the 6th of August 1844. In 1856 it was decided that the prince, in accordance with his own wishes, should enter the navy, and a separate establishment was accordingly assigned to him, with Lieutenant Sowell, R. E., as governor. He passed a most creditable examination for midshipman in August 1858, and being appointed to the "Euryalus," at once began to work hard at the practical part of his profession. In July 1860, while on this ship, he paid an official visit to the Cape, and made a very favourable impression both on the colonials and on the native chiefs. On the abdication of Otto, king of Greece, in 1862, Prince Alfred was chosen by the whole people to succeed him, but political conventions of long standing rendered it impossible for the British government to accede to their wishes. The prince therefore remained in the navy, and was promoted lieutenant on the 24th of February 1863 and captain on the 23rd of February 1866, being then appointed to the command of the "Galatea." On attaining his majority in 1865 the prince was created duke of Edinburgh and earl of Ulster, with an annuity of £15,000 granted by parliament. While still in command of the "Galatea" the duke started from Plymouth on the 24th of January 1867 for his voyage round the world. On the 11th of June 1867 he left Gibraltar and reached the Cape on the 24th of July, and landed at Glenelg, South Australia, on the 31st of October. Being the first English prince to visit Australia, the duke was received with the greatest enthusiasm. During his stay of nearly five months he visited Adelaide, Melbourne, Sydney, Brisbane and Tasmania; and it was on his second visit to Sydney that, while attending a public picnic at Clonfert in aid of the Sailors' Home, an Irishman named O'Farrell shot him in the back with a revolver. The wound was fortunately not dangerous, and within a month the duke was able to resume command of his ship and return home. He reached Spithead on the 26th of June 1868, after an absence of seventeen months. The duke's next voyage was to India, where he arrived in December 1869. Both there and at Hong Kong, which he visited on the way, he was the first British prince to set foot in the country. The native rulers of India vied with one another in the magnificence of their entertainments during the duke's stay of three months. On the 23rd of January 1874 the marriage of the duke to the grand-duchess Marie Alexandrovna, only daughter of Alexander II., emperor of Russia, was celebrated at St Petersburg, and the bride and bridegroom made their public entry into London on the 12th of March. The duke still devoted himself to his profession, showing complete mastery of his duties and unusual skill in naval tactics. He was promoted rear-admiral on the 30th of December 1878; vice-admiral, 10th of November 1882; admiral, 18th of October 1887; and received his baton as admiral of the Fleet, 3rd of June 1893. He commanded the Channel fleet, 1883–1884; the Mediterranean fleet, 1886–1889; and was commander-in-chief at Davenport, 1890–1893. He always paid the greatest attention to his official duties and was most efficient as an admiral.

On the death of his uncle, Ernest II., duke of Saxe-Coburg and Gotha, on the 22nd of August 1893, the vacant duchy fell to the duke of Edinburgh, for the prince of Wales had renounced his right to the succession. At first regarded with some coldness as a "foreigner," he gradually gained popularity, and by the time of his death, on the 30th of July 1900, he had completely won the good opinion of his subjects. The duke was exceedingly fond of music and an excellent violinist, and took a prominent part in establishing the Royal College of Music. He was also a keen collector of glass and ceramic ware, and his collection, valued at half a million of marks, was presented by his widow to the "Veste Coburg," near Coburg. When he became duke of Saxe-Coburg he surrendered his English allowance of £15,000 a year, but the £10,000 granted in addition by parliament on his marriage he retained in order to keep up Clarence House. The duke had one son, who died unmarried on the 6th of February 1899, and four daughters. The third daughter, Princess Alexandra Louisa Olga Victoria, married the hereditary prince Ernest of Hohenlohe-Langenburg, who became regent of the duchy of Coburg during the minority of the deceased duke's nephew, the young duke of Albany, to whom the succession fell. (G. F. B.)

ALFRED, a village in the township of Alfred, Allegany county, New York, U.S.A., about 75 m. S.W. of Buffalo. Pop. of the township, including the village (1900), 1615; (1910 U. S. census) 1590. Pop. of the village (1900) 756; (1910 U. S. census) 759. The township is served, at Alfred station, by the Erie railway. The village, which is connected by stage with the station, is situated at the junction of two valleys and commands delightful views of mountain scenery. On the west slope of Pine Hill is Alfred University (co-educational), which embraces a college (non-sectarian), an academy (non-sectarian) and a theological seminary (Seventh-Day Baptist). Closely associated with it also, and under the management of the university trustees, is the New York State School of Clay-Working and Ceramics (1900), one of the most efficient schools of the kind in the country. In 1908 the legislature of New York appropriated $80,000 for the establishment of a state school of agriculture in connexion with the university. The institution had its beginning in 1836 in a private school. This developed into an academy, which in 1843 was incorporated as Alfred Academy and Teachers' Seminary; in 1857 the university was chartered under its present name. The principal industry of the village is the manufacture of roofing tiles. The township of Alfred lies within the territory purchased by Robert Morris in 1791. He sold it in the same year to a company resident in London, England. Their agent sold most of it to settlers and, it is said, named the township, when it was organized in 1806, in honour of Alfred the Great. The first settlement within its present limits was made in 1807. For several years most of the settlers were Seventh-Day Baptists, and in 1812 they organized a church here. The village of Alfred was chartered in 1887.

J. S. Minard, *Allegany County and its People* (Alfred, 1896).

ALFRETON, a market town in the mid-parliamentary division of Derbyshire, England, 14 m. N. by E. of Derby, on the Midland railway. Pop. of urban district (1901) 17,505. It lies at a considerable elevation above the valley of a small stream tributary to the Derwent. The church of St Martin is Early English and later. The neighbourhood abounds in ironworks, collieries, quarries and potteries, and is thickly populated. To the north-east of Alfreton are South Normanton (pop. 5170), Blackwell (4144) and Tibshelf (3432); to the north Shirland (3929), to the south Ironville and other busy industrial villages. The foundation of Alfreton is traditionally ascribed to King Alfred.

ALFUROS (Alfures, Horaforas), a term of no ethnological value applied by the Malays to all the uncivilized non-Mahommedan peoples in the eastern portion of the Malay Archipelago. Its origin is uncertain, but its meaning is "wild" or "uncivilized." The term is not restricted to the aborigines, but is far more frequently used to describe the tribes of Malayan blood.

Classification.

ALGAE. The Latin word *alga* seems to have been the equivalent of the English word "seaweed" and probably stood for any or all of the species of plants which form the "wrack" of a seashore. When the word "Algae" came to be employed in botanical classification as the name of a class, an arbitrary limitation had to be set to its signification, and this was not always in keeping with its original meaning. The absence of differentiation into root, stem and leaf which prevails among seaweeds, seems, for example, to have led Linnaeus to employ the term in the *Genera Plantarum* for a sub-class of Cryptogamia, the members of which presented this character in a greater or less degree. Of the fifteen genera included by Linnaeus among algae, not more than six—viz. *Chara*, *Fucus*, *Ulva* and *Conferva*, and in part *Tremella* and *Byssus*—would to-day, in any sense in which the term is employed, be regarded as algae. The excluded genera are distributed among the liverworts, lichens and fungi; but notwithstanding the great advance in knowledge since the time of Linnaeus, the difficulty of deciding what limits to assign to the group to be designated *Algae* still remains. It arises from the fact that algae, as generally understood, do not constitute a homogeneous group, suggesting a descent from a common stock. Among them there exist, as will be seen hereafter, many well-marked but isolated natural groups, and their inclusion in the larger group is generally felt to be a matter of convenience rather than the expression of a belief in their close inter-relationship. Efforts are therefore continually being made by successive writers to exclude certain outlying sub-groups, and to reserve the term *Algae* for a central group reconstituted on a more natural basis within narrower limits.

It is perhaps desirable, in an article like this, to treat of algae in the widest possible sense in which the term may be used, an indication being at the same time given of the narrower senses in which it has been proposed to employ it. Interpreted in this way, the place of algae in the vegetable kingdom may be shown by means of a table:—

- The Vegetable Kingdom
  - Cryptogamia
    - Thallophyta
      - Myxomycetes
      - Fungi
      - Algae
    - Bryophyta
    - Pteridophyta
  - Phanerogamia
    - Gymnosperms
    - Angiosperms

Algae in this wide sense may be briefly described as the aggregate of those simpler forms of plant life usually devoid, like the rest of the Thallophyta, of differentiation into root, stem and leaf; but, unlike other Thallophyta, possessed of a colouring matter; by means of which they are enabled, in the presence of sunlight, to make use of the carbonic acid gas of the atmosphere as a source of carbon. It is true that certain Bryophyta (Marchantiaceae, Anthoceroteae) possess a thalloid structure similar to that of Thallophyta, and are at the same time possessed of the colouring matter of the Green Algae. Their life-cycle, however, the structure of the reproductive organs and their whole organization proclaim them to be Bryophyta (*q.v.*). On the other hand, certain undoubted animals (*Stentor*, *Hydra*, *Bonellia*) are provided with a green colouring matter by means of which they make use of atmospheric carbonic acid. A more important consideration is the occasional absence of this colour in species, or groups of species, with, in other respects, algal affinities. Such aberrant forms are to be regarded in the same light as Cuscuta and Orobanchaceae, for example, among Phanerogams. As these non-green plants do not cease to be classed with other Phanerogams, so must the forms in question be retained among algae. In all cases the loss of the colouring matter is associated with an incapacity to take up carbon from so simple a compound as carbonic acid

It might be mentioned here that the whole group of the Fungi (*q.v.*), with its many thousands of species, is now generally regarded as having been derived from algae, and the system of classification of fungi devised by Brefeld is based upon this belief. The similarity of the morphological characters of one group of fungi to those of certain algae has earned for it the name Phycomycetes or *alga-fungi*.

Further discussion of the general characters of algae will be deferred in order to take a brief survey of the subdivisions of the group. For this purpose there will be adopted the classification of algae into four sub-groups, founded on the nature of the colouring matters present in the plant:—

I. Cyanophyceae, or Blue-green Algae.
II. Chlorophyceae, or Green Algae.
III. Phaeophyceae, or Brown Algae.
IV. Rhodophyceae, or Red Algae.

The merits and demerits of this system will appear during the description of the characters of the members of the several subdivisions.

Sub-divisions.

I. Cyanophyceae.—This group derives its name from the circumstance that the cells contain in addition to the green colouring matter, chlorophyll, a blue-green colouring matter to which the term phycocyanin has been applied. To the eye, however, members of this group present a greater variety of colour than those of any other—yellow, brown, olive, red, purple, violet and variations of all these being known. They undoubtedly represent the lowest grade of algal life, and their distribution rivals that of the Green Algae. They occur in the sea, in fresh water, on moist earth, on damp rocks and on the bark of trees. Certain species are regularly found in the intercellular spaces of higher plants; such are species of *Nostoc* in the thallus of *Anthoceros*, the leaves of *Azolla* and the roots of Cycads. Many of them enter into the structure of the lichen-thallus, as the so-called gonidia. It is remarkable that species belonging to the Oscillatoriaceae are known to flourish in hot springs, the temperature of which rises as high as 85°C.

The thallus may be unicellular or multicellular. When unicellular, it may consist of isolated cells, but more commonly the cells are held together in a common jelly (Chroococcaceae) derived from the outer layers of the cell-wall. The multicellular species consist of filaments, branched or unbranched, which arise by the repeated divisions of the cells in parallel planes, no formation of mucilage occurring in the dividing walls. Such filaments may not give rise to mucilage on the lateral surface either, in which case they are said to be free; when mucilage does occur on the lateral wall, it appears as the sheath surrounding either the single filament, or a sheaf of filaments of common origin. The mucilage may also form an embedding substance similar to that of Chroococcaceae, in which the filaments lie parallel or radiate from a common centre (Rivulariaceae). The cells of the filament may be all alike, and growth may occur equally in all parts (Oscillatoriaceae); or certain cells (heterocysts) may become marked off by their larger size and the transparency of their contents; in which case growth may still be distributed equally throughout (*Nostoc*), or the filament may be attached where the heterocyst arises, and grow out at the opposite extremity into a fine hair (Rivulariaceae). An African form (*Camptothrix*), devoid of heterocysts and hair-like at both extremities, has recently been described. Branching has been described as "false" and "true." The former arises when a filament in a sheath, either in consequence of growth in length beyond the capacity of the sheath to accommodate it, or because of the decay of a cell, becomes interrupted by breaking, and the free ends slip past one another. "True" branching arises only by the longitudinal division of a cell of a filament and the lateral outgrowth of one of the cells resulting from the division (Sirosiphonaceae).

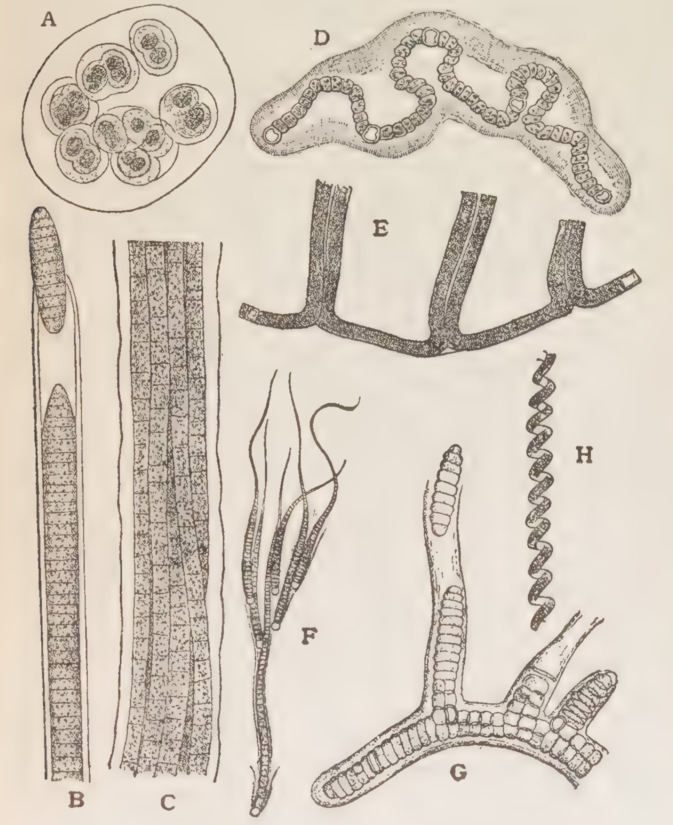


FIG. 1.—Cyanophyceae, variously magnified.

A. *Gloeocapsa sp.*, colony in mucilage.
B. *Phormidium sp.*, single filament with hormogonium.
C. *Microcoleus sp.*, several filaments in common sheath.
D. *Nostoc sp.*, young colony-filament with heterocysts.
E. *Scytonema sp.*, false branching.
F. *Rivularia sp.*
G. *Stigonema sp.*, with hormogonium and true branching.
H. *Spirulina sp.*

(From Engler and Prantl, *Pflanzenfamilien*, by permission of Wilhelm Engelmann.)

The nature of the contents of the cells of Cyanophyceae has given rise to considerable controversy. The cells are for the most part exceedingly minute, and are not easy to free from their colouring matters, so that investigation has been attended with great difficulty. Occupying as these algae do perhaps the lowest grade of plant life, it is a matter of interest to ascertain whether a nucleus or chromatophore is differentiated in their cells, or whether the functions and properties of these bodies are diffused through the whole protoplast. It is certain that the centre of the cell, which is usually non-vacuolated, is occupied by protoplasm of different properties from the peripheral region; and A. Fischer has further established the fact that the peripheral mass, which is a hollow sphere in spherical cells, and either a hollow cylinder or barrel-shaped body in filamentous forms, must be regarded as the single chromatophore of the Cyanophyceous cell. But what precisely is the nature of the central mass is still uncertain. Some investigators, such as R. Hegler, F. G. Kohl and E. W. Olive, claim that this body is a true nucleus comparable with that of the higher plants. It is said to undergo division by a mitosis essentially of the same character, with the formation of a spindle and the differentiation of chromosomes. It is further stated by Olive that the chromosomes undergo longitudinal fission, and that for the same species the same number of chromosomes appear at each division. H. Wager speaks with greater reserve, acknowledging, however, the central body to be a nucleus of a rudimentary type, but devoid of nuclear membrane and nucleolus. He thinks it may possibly originate in the vacuolization of the central region, and the accumulation of chromatin granules therein. He finds no spindle fibres or true chromosomes, and considers the division direct, not indirect. With reference to the existence of a chromatophore, he with others finds the colouring matter localized in granules in the peripheral region, but does not consider these individually or in the aggregate as chromatophores. Among other contents of the cell, fatty substances and tannin are known. A curious adaptation seems to occur in certain floating forms, in the presence of a gas-vacuole, which may be made to vary its volume with varying pressure. There is evidence that the dividing wall of filamentous forms is deeply pitted, as is found to be the case in red algae. Reproduction is chiefly effected by the vegetative method. Asexual reproductive cells are not infrequent, but sexual reproduction even in its initial stages is unknown. Nor is motility by means of cilia known in the group. In the unicellular forms, cell-division involves multiplication of the plant. In all the multicellular plants of this group which have been adequately investigated, vegetative multiplication by means of what are known as hormogonia has been found to occur. These are short segments of filaments consisting of a few cells which disengage themselves from the ambient jelly, if it be present, in virtue of a peculiar creeping movement which they possess at this stage. After a time they come to rest and give rise to new colonies. True reproduction of the asexual kind occurs, however, in the formation of sporangia, particularly in the Chamaesiphonaceae. Here the contents of certain cells break up endogenously into a great number of spores, which are distributed as a fine dust. Resting spores are also known. In these cases, certain cells of a colony of unicellular plants or of the filaments of multicellular plants enlarge greatly and thicken their wall. When unfavourable external conditions supervene and the ordinary cells become atrophied, these cells persist and reproduce the plant with the return of more favourable conditions. The Oscillatoriaceae are capable of a peculiar oscillatory movement, which has earned for them their name, and which enables them to move through considerable distances. It is not clear how the movement is effected, though it has frequently been the subject of careful investigation.

With the Cyanophyceae must be included, as their nearest allies, the Bacteriaceae (see BACTERIOLOGY). Notwithstanding the absence of chlorophyll, and the consequent parasitic or saprophytic habit, Bacteriaceae agree in so many morphological features with Cyanophyceae that the affinity can hardly be doubted.

A census of the Cyanophyceae with their two main groups is given below:—

1. Coccogoneae—2 families, 29 genera, 253 species.
2. Hormogoneae—6 families, 59 genera, 701 species.

(Engler and Prantl's *Pflanzenfamilien*, 1900.)

II. CHLOROPHYCEAE.—This group includes those algae in which the green colouring matter, chlorophyll, is not accompanied by a second colouring matter, as it is in other groups. It consists of three subdivisions—Conjugatae, Euchlorophyceae and Characeae. Of these the first and last are relatively small and sharply defined families, distinguished from the second family, which forms the bulk of the group, by characters so diverse that their inclusion with them in one larger group can only be justified on the ground of convenience. Chlorophyceae include both marine and freshwater plants.

Euchlorophyceae in their turn have been until recently regarded as made up of the three series of families—Protococcales, Confervales and Siphonales. As the result of recent investigations by two Swedish algologists, Bohlin and Luther, it has been proposed to make a re-classification of a far-reaching nature. Algae are withdrawn from each of the three series enumerated above and consolidated into an entirely new group. In these algae, the colouring matter is said to be yellowish-green, not strictly green, and contained in numerous small discoid chromatophores which are devoid of pyrenoids. The products of assimilation are stored up in the form of a fatty substance and not starch. A certain inequality in the character of the two cilia of the zoospores of some of the members of the group has earned for it the title Heterokontae, from the Greek κοντός, a punting-pole. In consonance with this name, its authors propose to re-name the Conjugatae; Akontae and Oedogoniaceae with a chaplet of cilia become Stephanokontae, and the algae remaining over in the three series from which the Heterokontae and Stephanokontae are withdrawn become Isokontae. Conjugatae, Protococcales and Characeae are exclusively freshwater; Confervales and Siphonales are both freshwater and marine, but the latter group attains its greatest development in the sea. Some Chlorophyceae are terrestrial in habit, usually growing on a damp substratum, however. *Trentepohlia* grows on rocks and can survive considerable desiccation. *Phycopeltis* grows on the surface of leaves, *Phyllobium* and *Phyllosiphon* in their tissues. *Gomontia* is a shell-boring alga,

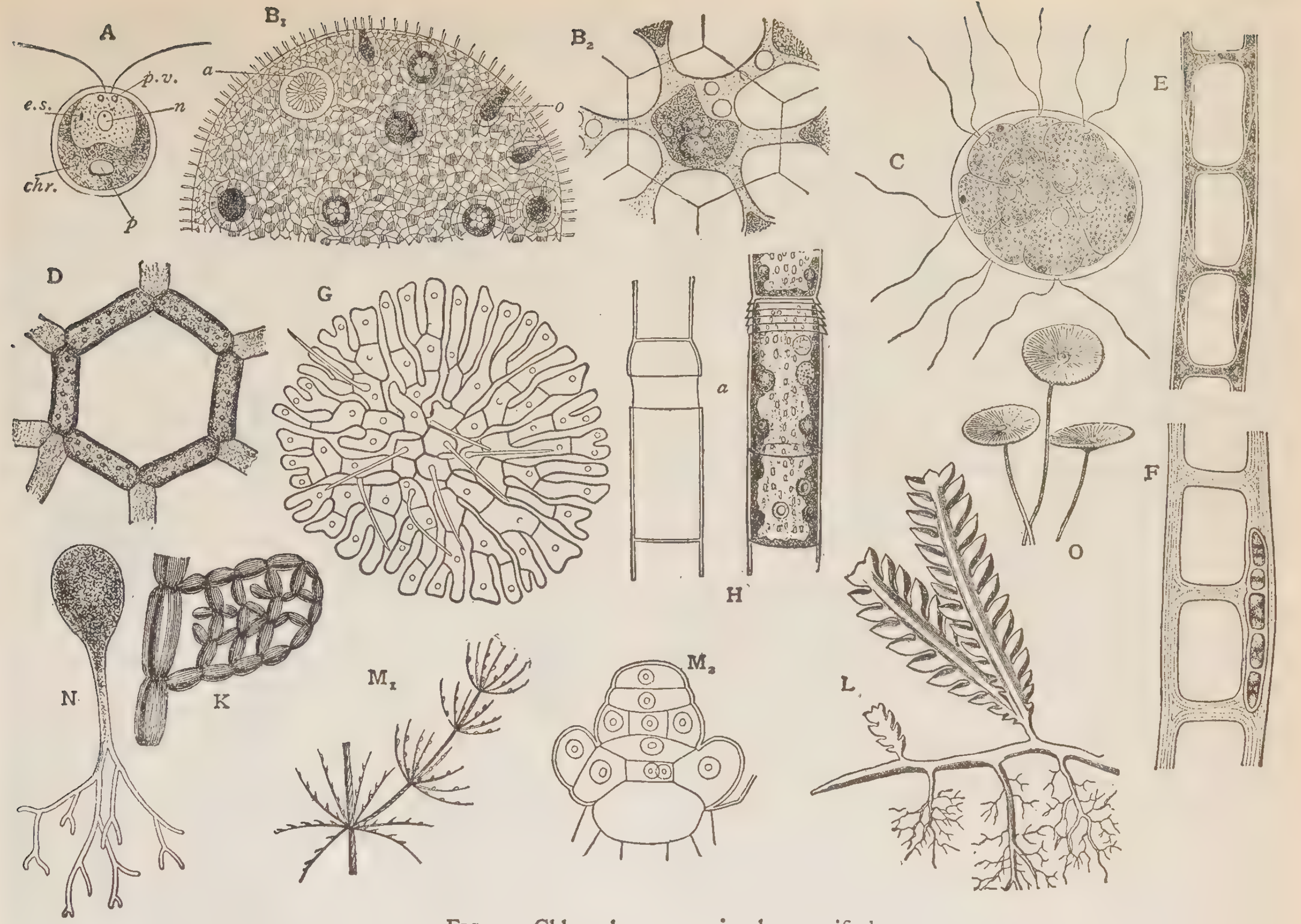


FIG. 2.—Chlorophyceae, variously magnified.

A. *Chlamydomonas sp.*, unicellular; *chr.*, chromatophore; *p.*, pyrenoid; *n.*, nucleus; *p.v.*, pulsating vacuoles; *e.s.*, eyespot.
B_1. *Volvox sp.*, with *a*, antheridia, and *o*, oogonia.
B_2. *Volvox sp.*, surface view of a single cell showing connexions.
C. *Pandorina sp.*, a 16-celled colony.
D. *Hydrodictyon*, a single mesh surrounded by 6 cells.
E. *Microspora sp.*, showing H-pieces in the wall.
F. *Entoderma sp.*, endophytic in *Ectocarpus*.
G. *Coleochaete sp.*, growing as a plate.
H. *Oedogonium sp.*, intercalated growth by insertion of new piece (*a*) leaving caps.
K. *Struvea sp.*, showing branches forming a net-work.
L. *Caulerpa sp.*, showing portion of axis with leaf-like and root-like appendages.
M_1. *Chara sp.*, axis with leaf-like appendages and a branch.
M_2. *Chara sp.*, apical region.
N. *Botrydium*, a simple siphonaceous alga with root-like attachment.
O. *Acetabularia Mediterranea*, mushroom-like calcareous siphonaceous alga.

(A, C, E, F, G, H, K, L, M_1, M_2 from Engler and Prantl, *Pflanzenfamilien*, by permission of Wilhelm Engelmann; B_1, N from Vines, *Students' Text Book of Botany*, by permission of Swan Sonnenschein and Co.; B_2, D, O from Oltmanns, *Morphologie u. Biologie der Algen*, by permission of Gustav Fischer.)

Dermatophyton grows on the carapace of the tortoise and *Trichophilus* in the hairs of the sloth. Certain Protococcales and Confervales exist as the gonidia of the lichenthallus.

The thallus is of more varied structure in this group than in any other. In the simplest case it may consist of a single cell, which may remain free during the whole of the greater part of its existence, or be loosely aggregated together within a common mucilage, or be held together by the adhesion of the cell-walls at the surface of contact. These aggregations or colonies, as they are termed, may assume the form of a plate, a ring, a solid sphere, a hollow sphere, a perforate sphere, a closed net, or a simple or branched filament. It is not easy in all cases to draw a distinction between a colony of plants and a multicellular individual. In a *Volvox* sphere, for example, there is a marked protoplasmic continuity between all the cells of the colony. The Ulvaceae, the thallus of which consists of laminae, one or more cells thick, or hollow tubes, probably represent a still more advanced stage in the passage of a colony into a multicellular plant. Here there is some amount of localization of growth and distinction of parts. It is only in such cases as *Volvox* and Ulvaceae that there is any pretension to the formation of a true parenchyma within the limits of the Chlorophyceae. In the whole series of the Confervales, the thallus consists of filaments branched or unbranched, attached at one extremity, and growing almost wholly at the free end. The branches end in fine hairs in Chaetophoraceae. In Coleochaetaceae the branches are often welded into a plate, simulating a parenchyma. In all Conjugatae and most Protococcales, and in the bulk of the Confervales, the thallus consists of a cell or cells, the protoplast of which contains a single nucleus. In Hydrodictyaceae, Cladophoraceae, Sphaeropleaceae and Gomontiaceae this is no longer the case. Instead of a single relatively large nucleus, each cell is found to contain many small nuclei, and is spoken of as a coenocyte. This character becomes still more pronounced in the large group of the Siphonales. Valoniaceae and Dasycladaceae are partially septate, but elsewhere no cellulose partitions occur, and the thallus is more or less the continuous tube from which the group is named. Yet the siphonaceous algae may assume great variety of form and reach a high degree of differentiation. *Protosiphon* and *Botrydium*, on the one hand, are minute vesicles attached to muddy surfaces by rhizoids; *Caulerpa*, on the other, presents a remarkable instance of the way in which much the same external morphology as that of cormophytes has been reached by a totally different internal structure. Many Siphonales are encrusted with lime like *Corallina* among Red Algae. *Penicillus* is brush-like, *Halimeda* and *Cymopolia* are jointed, *Acetabularia* has much the same external form as an expanded *Coprinus*, *Neomeris* simulates the fertile shoot of *Equisetum* with its densely packed whorled branches, and in *Microdictyon*, *Anadyomene*, *Struvea* and *Boodlea* the branches, spreading in one plane, become bound together in a more or less close network. Characeae are separated from other Chlorophyceae by a long interval, and present the highest degree of differentiation of parts known among Green Algae. Attached to the bottom of pools by means of rhizoids, the thallus of Characeae grows upwards by means of an apical cell, giving off whorled appendages at regular intervals. The appendages have a limited growth; but in connexion with each whorl there arise, singly or in pairs, branches which have the same unlimited growth as the main axis. There is thus a close approach to the external morphology of the higher plants. The streaming of the protoplasm, known elsewhere among Chlorophyceae, is a conspicuous feature of the cells of Characeae.

The Chlorophyceae excel all other groups of algae in the magnitude and variety of form of the chlorophyll-bodies. In *Ulva* and *Mesocarpus* the chromatophore is a single plate, which in the latter genus places its edge towards the incident light; in *Spirogyra* they are spiral bands embedded in the primordial utricle; in *Zygnema* they are a pair of stellate masses, the rays of which branch peripherally; in *Oedogonium* they are longitudinally-disposed anastomosing bands; in Desmids plates with irregular margins; in *Cladophora* polyhedral plates; in *Vaucheria* minute elliptical bodies occurring in immense numbers. Embedded in the chromatophore, much in the same way as the nucleus is embedded in the cytoplasm, are the pyrenoids. Unknown in Cyanophyceae and Phoeophyceae, known only in Bangiaceae and *Nemalion* among Rhodophyceae, they are of frequent occurrence among Chlorophyceae, excepting Characeae. Sometimes several pyrenoids occur in each chloroplast, as in *Mesocarpus* and *Spirogyra*; sometimes only an occasional chloroplast contains pyrenoid at all, as in *Cladophora*. The pyrenoid seems to be of proteid nature and gelatinous consistency, and to arise as a new formation or by division of pre-existing pyrenoids. When carbon-assimilation is active, starch-granules crowd upon the surface of the pyrenoid and completely obscure it from view.

Special provision for vegetative multiplication is not common among Chlorophyceae. *Valonia* and *Caulerpa* among Siphonales detach portions of their thallus, which are capable of independent growth. In *Caulerpa* no other means of multiplication is as yet known. In Characeae no fewer than four methods of vegetative reproduction have been described, and the facility with which buds and branches are in these cases detached has been adduced as an evidence of affinity with Bryophyta, which, as a class, are distinguished by their ready resort to vegetative reproduction.

With regard to true reproduction, which is characterized by the formation of special cells, the group Euchlorophyceae is characterized by the production of zoospores (Gr. ζῷον, animal, σπορά, seed); that is to say, cells capable of motility through the agency of cilia. Such ciliary motion is known in the adult condition of the cells of Volvocaceae, but where this is not the case the reproductive cells are endowed with motility for a brief period. The zoospore is usually a pyriform mass of naked protoplasm, the beaked end of which where the cilia arise is devoid of colouring matter. A reddish-brown body, known as the eyespot, is usually situated near the limits of the hyaline portion, and in the protoplasm contractile vacuoles similar to those of lower animals have been occasionally detected. The movement of the zoospore is effected by the lashing of the cilia and is in the direction of the beak, while the zoospore slowly rotates on its long axis at the same time. Usually two cilia are present; in *Botrydium* and *Hydrodictyon* only one is present; in certain species of *Cladophora* four; in *Dasycladus* a chaplet, and in *Oedogonium* a ring of many cilia. The so-called zoospore of *Vaucheria* is a coenocyte covered over with paired cilia corresponding in position to nuclei lying below. In all other cases, zoospores are uninucleate bodies. Zoospores arise in cells of ordinary size and form termed zoosporangia. In unicellular forms (*Sphaerella*) the thallus becomes transformed into a zoosporangium at the reproductive stage. In the zoosporangia of *Oedogonium*, *Tetraspora* and *Coleochaete* the contents become transformed into a single zoospore. In most cases repeated division seems to take place, and the final number is represented by some power of two. In coenocytic forms the zoospores would seem to arise simultaneously, probably because many nuclei are already present. The escape of zoospores is effected by the degeneration of the sporangial wall (*Chaetophora*), or by a pore (*Cladophora*), a slit (*Pediastrum*), or a circular fracture (*Oedogonium*). Zoospores are of two kinds: (1) Those which come to rest and germinate to form a new plant; these are asexual and are zoospores proper. (2) Those which are unable to germinate of themselves, but fuse with another cell, the product giving rise to a new individual; these are sexual and are zoogametes (Gr. ζῷον, animal, and γαμέτης, γαμετή, husband, wife). When two similar zoogametes fuse, the process is conjugation, and the product a zygospore (Gr. ζυγόν, yoke). Usually, however, only one of the fusing cells is a zoogamete, the other gamete being a much larger resting cell. In such a case the zoogamete is male, is called an antherozoid or spermatozoid, and arises in an antheridium; the larger gamete is an oosphere and arises in an oogonium. The fusion is now known as fertilization, and the product is an oospore. Reproduction by conjugation is also known as isogamy, by fertilization as oogamy. When zoospores come to rest, a new cell is formed and germination ensues at once. When zygospores and oospores are produced a new cell-wall is also formed, but a long period of rest ensues. All investigation goes to show that an essential part of sexual union is the fusion of the two nuclei concerned. It is interesting to know, on the authority of Oltmanns, that when the oosphere is forming in the oogonium of *Vaucheria*, there is a retrocession of all the included nuclei but one. That the antherozoid of *Vaucheria* contains a single nucleus had been inferred before.

From a comparison of those Euchlorophyceae which have been most closely investigated, it appears probable that sexual reproductive cells have in the course of evolution arisen as the result of specialization among asexual reproductive cells, and that in turn oogamous reproduction has arisen as the result of differentiation of the two conjugating cells into the smaller male gamete and the larger male gamete. It would further appear that oogamous reproduction has arisen independently in each of the three main groups of Euchlorophyceae, viz. Protococcales, Siphonales and Confervales. Thus among Volvocaceae, a family of Protococcales, while in some of the genera (*Chloraster*, *Sphondylomorum*) no sexual union has as yet been observed, in others (*Pandorina*, *Chlorogonium*, *Stephanosphaera*, *Sphaerella*) conjugation of similar gametes takes place, in others still (*Phacotus*, *Eudorina*, *Volvox*) the union is of the nature of fertilization. No other family of Protococcales has advanced beyond the stage of isogamous reproduction. Again, among Siphonales only one family (Vaucheriaceae) has reached the stage of oogamy, although an incipient heterogamy is said to occur in two other families (Codiaceae, Bryopsidaceae). Elsewhere among Siphonales, in those cases where reproductive cells are known, the reproduction is either isogamous or asexual. Among Confervales there is no family in which sexual reproduction—isogamy or oogamy—is not known to occur among some of the component species, and as many as four families (Cylindrocapsaceae, Sphaeropleaceae, Oedogoniaceae, Coleochaetaceae) are oogamous. On these, as well as other grounds, Confervales are regarded as having attained to the highest rank among Euchlorophyceae. Although the phenomena attending isogamous and oogamous reproduction respectively are essentially the same in all cases, slight variations in both instances appear in different families, attributable doubtless to the independent origin of the process in different groups. Thus, although isogamy consists in typical cases of a union of naked motile gametes by a fusion which begins at the beaked ends, and results in the formation of an immotile spherical zygote surrounded by a cell-wall, in *Leptosira* it is noticeable that the fusion begins at the blunt end; in a species of *Chlamydomonas* the two gametes are each included in a cell-wall before fusion; and in many cases the zygote retains for some time its motility with the double number of cilia. Again, in oogamous reproduction, while in general only one oosphere is differentiated in the oogonium, in *Sphaeroplea* several oospheres arise in each oogonium; and while the oospheres usually contract away from the oogonial wall, acquiring for themselves a new cell-wall after fertilization, in *Coleochaete* the oosphere remains throughout in contact with the oogonial wall. The oosphere is in all cases fertilized while still within the oogonium, the antherozoids being admitted by means of a pore. There is usually distinguishable upon the surface of the oosphere an area free from chlorophyll, known as the receptive spot, at which the fusion with the antherozoid takes place; and in many cases, before fertilization, a small mucilaginous mass has been observed to separate itself off from the oosphere at this point and to escape through the pore. In *Coleochaete* the oogonial wall is drawn out into a considerable tube, which is provided with an apical pore, and this tube has a somewhat similar appearance to the imperforate trichogyne of Florideae to be hereafter described. In certain species of *Oedogonium* minute male plantlets, known as dwarf males, become attached to the female plant in the neighbourhood of the oogonia, thus facilitating fertilization. Indeed the genus *Oedogonium* exhibits a high degree of specialization in its reproductive system, considering that its thallus has not advanced beyond the stage of an unbranched filament.

Many Euchlorophyceae are endowed with both asexual and sexual reproduction. Such are *Coleochaete*, *Oedogonium*, *Cylindrocapsa*, *Ulothrix*, *Vaucheria*, *Volvox*, &c. In others only the asexual method is yet known. When a species resorts to both methods, it is generally found that the asexual method prevails in the early part of the vegetative period and the sexual towards the close of that period. This is in consonance with the facts already mentioned that zoospores germinate forthwith, and that the sexually-produced cell or zygote enters upon a period of rest. It is known that zoogametes, which usually conjugate, may, when conjugation fails, germinate directly (*Sphaerella*). In rare cases the oosphere has been known to germinate without fertilization (*Oedogonium*, *Cylindrocapsa*). The germination of a zygospore or oospore is effected by the rupture of an outer cuticularized exosporium; then the cell may protrude an inner wall, the endosporium, and grow out into the new plant (*Vaucheria*), or the contents may break up into a first brood of zoospores. It is held that in *Coleochaete* a parenchyma results from the division of the oospore, from each cell of which a zoospore arises.

Reproduction is also effected among Euchlorophyceae by means of aplanospores and akinetes. Aplanospores would seem to represent zoospores arrested in their development; without reaching the stage of motility, they germinate within the sporangium. Akinetes are ordinary thallus cells, which on account of their acquisition of a thick wall are capable of surviving unfavourable conditions. Both aplanospores and akinetes may germinate with or without the formation of zoospores at the initial stage.

Among Conjugatae reproduction is effected solely by means of conjugation of what are literally aplanospores. Among those Desmidiaceae which live a free life, two plants become surrounded by a common mucilage, in which they lie either parallel (*Closterium*) or crosswise (*Cosmarium*). Gaps then appear in the apposed surfaces, usually at the isthmus; the entire protoplasts either pass out to melt into one another clear of the old walls, or partly pass out and fuse without complete detachment from the old walls. Among colonial Desmidiaceae, the break-up of the filament is a preliminary to this conjugation; otherwise the process is the same. The zygospore becomes surrounded with its own wall, consisting finally of three layers, the outer of which is furnished with spicular prominences of various forms. In Zygnemaceae there is no dissolution of the filaments, but the whole contents of one cell pass over by means of a conjugation-tube into the cavity of a cell of a neighbouring filament, where the zygospore is formed by the fusion of the two protoplasts. In these cases the activity of one of the gametes, and the passivity of the other, is regarded as evidence of incipient sex. In *Sirogonium* there is cell-division in the parent-cell prior to conjugation; and as two segments are cut off in the case of the active gamete, and only one in the case of the passive gamete, there is a corresponding difference of size, marking another step in the sexual differentiation. In *Zygogonium*, although no cell-division takes place, the gametes consist of a portion only of the contents of a cell, and this is regularly the case in Mesocarpaceae, which occupy the highest grade among Conjugatae. Some Zygnemaceae and Mesocarpaceae form either a short conjugating tube, or none at all, but the filaments approach each other by a knee-like bend, and the zygospore is formed at the point of contact, often being partially contained within the walls of the parent-cell. It would seem that in some cases the nuclei of the gametes remain distinct in the zygospore for a considerable time after conjugation. It is probable that in all cases nuclear fusion takes place sooner or later. In Zygnemaceae and Mesocarpaceae the zygospore, after a period of rest, germinates, to form a new filamentous colony; in Desmidiaceae its contents divide on germination, and thus give rise to two or more Desmids. Gametes which fail to conjugate sometimes assume the appearance of zygospores and germinate in due course. They are known as azygospores.

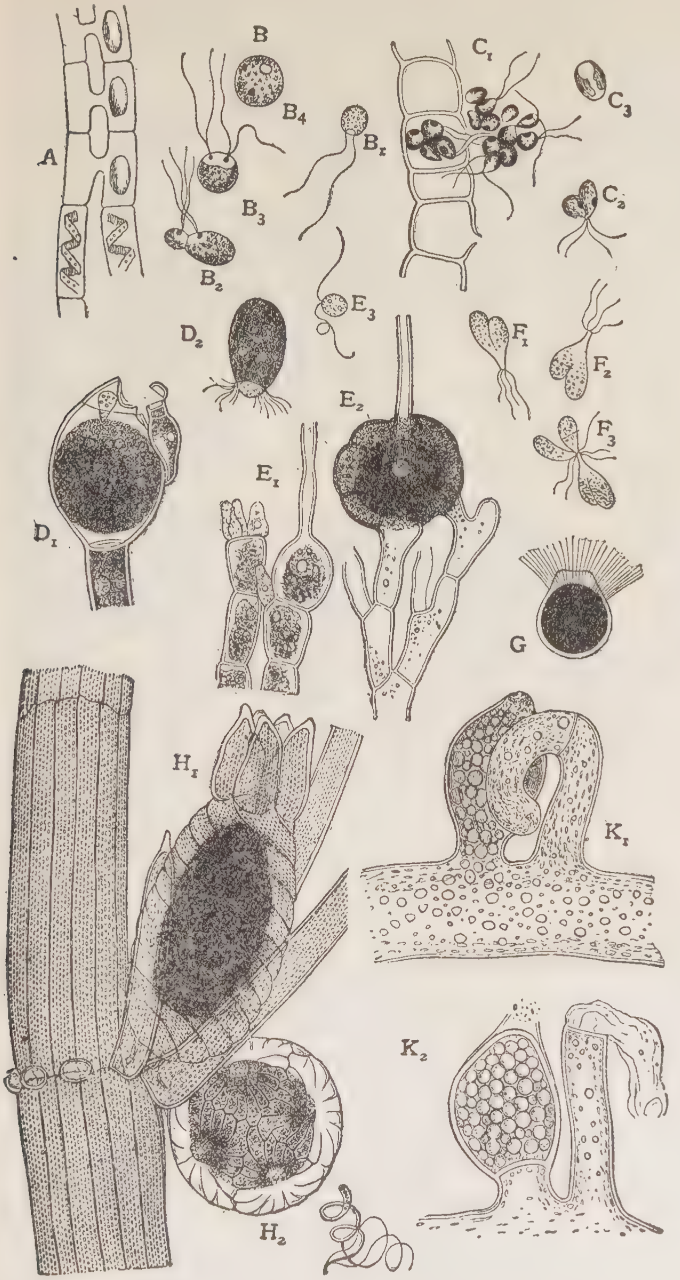


FIG. 3.—Chlorophyceae, variously magnified.

A. *Spirogyra sp.*, in conjugation.
B. Zoospore of *Pandorina*. $B_{2\,3\,4}$, stages of conjugation.
C. *Ulothrix sp.*, zoospores escaping. $C_{2\,3}$, stages of conjugation.
D_1. *Oedogonium sp.*, oogonium at moment of fertilization with dwarf male attached.
D_2. *Oedogonium sp.*, zoospore with crown of cilia.
E_1. *Coleochaete sp.*, with antheridia and an oogonium.
E_2. *Coleochaete sp.*, fertilized egg with investment of filaments.
E_3. *Coleochaete sp.*, zoospore.
$F_{1\,2\,3}$. *Protosiphon*, conjugation of zoogametes.
G. *Derbesia sp.*, zoospore with chaplet of cilia.
H_1. *Chara sp.*, oogonium and antheridium at a node on a lateral appendage.
H_2. *Chara sp.*, antherozoid.
K_1. *Vaucheria sp.*, oogonium and antheridium before fertilization.
K_2. *Vaucheria sp.*, after fertilization.

(A from Cooke, *British Freshwater Algae*, by permission of Kegan Paul, Trench, Trübner and Co.; C, E, F, G, H, K from Engler and Prantl, by permission of Wilhelm Engelmann; B_1 from Vines, by permission of Swan Sonnenschein and Co.; B_2, D from Oltmanns, by permission of Gustav Fischer.)

The reproduction of Characeae is characterized by a pronounced oogamy, the reproductive organs being the most highly differentiated among Chlorophyceae. The antheridia and oogonia are formed at the nodes of the appendages. The oogonium, seated on a stalk cell, is surrounded by an investment consisting of five spirally-wound cells, from the projecting ends of which segments are cut off, constituting the so-called stigma. The oosphere is not differentiated within the wall of the oogonium, but certain cells known as *wendungszellen*, the significance of which has given rise to much speculation, are cut off from the basal portion of the parent-cell during its development. The antheridia are spherical orange-coloured bodies of very complex structure. The antherozoid is a spirally-coiled thread of protoplasm, furnished at one end with a pair of cilia. It much more resembles the antherozoids of Bryophyta and certain Pteridophyta than any known among other algae. The fertilized egg charged with food reserves rests for a considerable period, surrounded by its cortex, the whole having assumed a reddish-brown colour. On germination it gives rise to a row of cells in which short (nodal) and long (internodal) cells alternate. From the first node arise rhizoids; from the second a lateral bud, which becomes the new plant. This peculiar product of germination, which intervenes between the oospore and the adult form, is the proembryo. It will be remembered that in Musci, the asexual spore somewhat similarly gives rise to a protonema, from which the adult plant is produced as a lateral bud. The proembryonic branches of Characeae, one of the means of vegetative reproduction already referred to, are so called because they repeat the characters of the proembryo.

Before leaving the Chlorophyceae, it should be mentioned that the genus *Volvox* has been included by some zoologists (Bütschli, for example) among Flagellata; on the other hand, certain green Flagellata, such as *Euglena*, are included by some botanists (for example, van Tieghem) among unicellular plants. A similar uncertainty exists with reference to certain groups of Phaeophyceae, and the matter will thus arise again.

A census of the Chlorophyceae is furnished below:—

1. Confervoideae—12 families, 77 genera, 1021 species.
2. Siphoneae—9 families, 26 genera, 271 species.
3. Protococcoideae—2 families, 90 genera, 342 species.
4. Conjugateae—2 families, 33 genera, 1296 species.
   (De Toni's *Sylloge Algarum*, 1889.)
5. Characeae—2 families, 6 genera, 181 species.
   (Engler and Prantl's *Pflanzenfamilien*, 1897.)

III. PHAEOPHYCEAE.—The Phaeophyceae are distinguished by the possession of a brown colouring matter, phycophaein, in addition to chlorophyll. They consist of the following groups:—Fucaceae, Phaeosporeae, Dictyotaceae, Cryptomonadaceae, Peridiniaceae and Diatomaceae. Of these the first three include multicellular plants, some of them of great size; the last three are unicellular organisms, with little in common with the rest excepting the possession of a brown colouring matter. Fucaceae and Phaeosporeae are doubtless closely allied, and to these Dictyotaceae may be joined, though the relationship is less close. They constitute the Euphaeophyceae, and will be dealt with in the first place.

Euphaeophyceae are almost exclusively marine, growing on rocks and stones on the coast, or epiphytic upon other algae. In tidal seas they range from the limits of high water to some distance beyond the low-water line. On the British coasts zones are observable in passing from high to low water mark, characterized by the prevalence of different species, thus:—*Pelvetia canaliculata*, *Fucus platycarpus*, *Fucus vesiculosus*, *Ascophyllum nodosum*, *Fucus serratus*, *Laminaria digitata*. Some species are minute filamentous plants, requiring the microscope for their detection; others, like *Lessonia*, are of considerable bulk, or, like *Macrocystis*, of enormous length. In Fucaceae, Dictyotacea, and in Laminariaceae and Sphacelariaceae, among Phaeosporeae, the thallus consists of a true parenchyma; elsewhere it consists of free filaments, or filaments so compacted together, as in Cutleriaceae and Desmarestiaceae, as to form a false parenchyma. In Fucaceae and Laminariaceae the inner tissue is differentiated into a conducting system. In Laminariaceae the inflation of the ends of conducting cells gives rise to the so-called trumpet-hyphae. In *Nereocystis* and *Macrocystis* a zone of tubes occurs, which present the appearance of sieve-tubes even to the eventual obliteration of the perforations by a callus. While there is a general tendency in the group to mucilaginous degeneration of the cell-wall, in *Laminaria digitata* there are also glands secreting a plentiful mucilage. Secondary growth in thickness is effected by the tangential division of superficial cells. The most fundamental external differentiation is into holdfast and shoot. In Laminariaceae secondary cylindrical props arise obliquely from the base of the thallus. In epiphytic forms the rhizoids of the epiphyte often penetrate into the tissue of the host, and certain epiphytes are not known to occur excepting in connexion with a certain host; but to what extent, if any, there is a partial parasitism in these cases has not been ascertained. In filamentous forms there is a differentiation into branches of limited and branches of unlimited growth (*Sphacelaria*). In Laminariaceae there is a distinction of stipe and blade. The blade is centrally-ribbed in *Alaria* and laterally-ribbed in *Macrocystis*. It is among the Sargassaceae that the greatest amount of external differentiation, rivalling that of the higher leafy plants, is reached. A characteristic feature of the more massive species is the occurrence of air-vesicles in their tissues. In *Fucus vesiculosus* they arise in lateral pairs; in *Ascophyllum* they are single and median; in *Macrocystis* one vesicle arises at the base of each thallus segment; in *Sargassum* and *Halidrys* the vesicles arise on special branches. They serve to buoy up the plant when attached to the sea-bottom, and thus light is admitted into the forest-like growths of the gregarious species. When such plants are detached they are enabled to float for great distances, and the great Sargasso Sea of the North Atlantic Ocean is probably only renewed by the constant addition of plants detached from the shores of the Caribbean Sea and Gulf of Mexico.

Growth in length is effected in a variety of ways. In *Dictyota*, Sphacelariaceae and Fucaceae there is a definite apical cell. In the first it is a biconvex lens, from which segments are continually cut off parallel to the posterior surface; and in the second an elongated dome, from which segments are cut off by a transverse wall. While, however, in *Dictyota* the product of the subsequent division in the segment enlarges with each subdivision, the divisions in the cylindrical segment of Sphacelariaceae are such that the whole product after subdivision, however many cells it may consist of, does not exceed in bulk the segment as cut off from the apical cell. In Dictyotaceae the apical cell occasionally divides longitudinally, and thus the dichotomous branching is provided for. In some Sphacelariaceae branches may appear at their inception as lateral protuberances of the apical cell itself. In Fucaceae an apical cell is situate at the surface of the thallus in a slit-like depression at the apex. From this cell segments are cut off in three or four lateral oblique planes.

A peculiar manner of growth in length is that to which the term trichothallic has been applied. It may readily be observed that in the hair-like branches of Ectocarpaceae, the point at which most rapid division occurs is situate near the base of the hair. In *Desmarestia* and *Arthrocladia*, for example, it is found that the thallus ends in a tuft of such hairs, each of them growing by means of an intercalated growing point. In these cases, however, the portions of the hairs behind the growing region become agglutinated together into a solid cylindrical pseudo-parenchymatous axis. In *Cutleria* the laminated thallus is formed in the same way. The intercalated growing region of *Laminaria* affords an example of another variety of growth in Phaeophyceae. While the laminated portion of the thallus is being gradually worn off in our latitudes during the autumnal storms, a vigorous new growth appears at the junction of the stipe and the blade, as the result of which a new piece is added to the stipe and the lamina entirely renovated.

Both asexual and sexual reproduction occur among Euphaeophyceae. Fucaceae are marked by an entire absence of the asexual method. The sexual organs—oogonia and antheridia—are borne on special portions of the thallus in cavities known as conceptacles. Both organs may occur in one conceptacle, as in *Pelvetia*, or each may be confined to one conceptacle or even one plant, as in *Fucus vesiculosus*. The oogonia arise on a stalk cell from the lining layer of the cavity, the contents dividing to form eight oospheres as in *Fucus*, four as in *Ascophyllum*, two as in *Pelvetia*, or one only as in *Halidrys*. It would seem that eight nuclei primarily arise in all Fucaceae, and that a number corresponding to the number of oospheres subsequently formed is reserved, the rest being discharged to the periphery, where they may be detected at a late stage. On the maturation of the oospheres the outer layer of the oogonial wall ruptures, and the oospheres, still surrounded by a middle and inner layer, pass out through the mouth of the conceptacle. Then usually these layers successively give way, and the spherical naked oospheres float free in the water. The antheridia, which arise in the conceptacular cavity as special cells of branched filaments, are similarly discharged whole, the antherozoids only escaping when the antheridia are clear of the conceptacle. The antherozoids are attracted to the oospheres, round each of which they swarm in great numbers. Suddenly the attraction ceases, and the oosphere is fertilized, probably at that moment, by the entry of a single antherozoid into the substance of the oosphere; a cell-wall is formed thereupon, in some cases in so short an interval as five minutes. Remarkable changes of size and outline of the oosphere have recently been described as accompanying fertilization in *Halidrys*. Probably the act of fertilization in plants has nowhere been observed in such detail as in Fucaceae. Dictyotaceae resemble Fucaceae in their pronounced oogamy. They differ, however, in being also asexually reproduced. The asexual cells are immotile spores arising in fours in sporangia from superficial cells of the thallus. In *Dictyota* the oospheres arise singly in oogonia, crowded together in sori on the surface of the female plant. The antheridia have a similar origin and grouping on the male plant. Until the recent discovery by Williams of motility, by means of a single cilium, of the antherozoids of *Dictyota* and *Taonia*, they were believed to be immotile bodies, like the male cells of red seaweeds. In *Dictyota* the unfertilized oosphere is found to be capable of undergoing a limited number of divisions, but the body thus formed appears to atrophy sooner or later.

Of the small family of the Tilopteridaceae our knowledge is as yet inadequate, but they probably present the only case of pronounced oogamy among Phaeosporeae. They are filamentous forms, exhibiting, however, a tendency to division in more than one plane, even in the vegetative parts. The discovery by Brebner of the specific identity of *Haplospora globosa* and *Scaphospora speciosa* marks an important step in the advance of our knowledge of the group. Three kinds of reproductive organs are known: first, sporangia, which each give rise to a single tetra-, or multi-nucleate non-motile, probably asexual spore; second, plurilocular sporangia, which are probably antheridia, generating antherozoids; and third, sporangia, which are probably oogonia, giving rise to single uninucleate non-motile oospheres. No process of fertilization has as yet been observed.

The Cutleriaceae exhibit a heterogamy in which the female sexual cell is not highly specialized, as it is in the groups already described. From each locule of a plurilocular sporangium there is set free an oosphere, which, being furnished with a pair of cilia, swarms for a time. In similar organs on separate plants the much smaller antherozoids arise. Fertilization has been observed at Naples; but it apparently depends on climatic conditions, as at Plymouth the oospheres have been observed to germinate parthenogenetically. The asexual organs in the case of *Cutleria multifida* arise on a crustaceous form, *Aglaozonia reptans*, formerly considered to be a distinct species. They are unilocular, each producing a small number of zoospores.

The possession of two kinds of reproductive organs, unilocular and plurilocular sporangia, is general among the rest of the Phaeosporeae. Bornet, however, called attention in 1871 to the fact that two kinds of plurilocular sporangia occurred in certain species of the genus *Ectocarpus*—somewhat transparent organs of an orange tint producing small zoospores, and also more opaque organs of a darker colour producing relatively larger zoospores. On the discovery of another such species by F. H. Buffham, Batters in 1892 separated the three species, *Ectocarpus secundus*, *E. fenestratus*, *E. Lebelii*, together with the new species, into a genus, *Giffordia*, characterized by the possession of two kinds of plurilocular sporangia. The suspicion that a distinction of sex accompanied this difference of structure has been justified by the discovery by Sauvageau of undoubted fertilization in *Giffordia secunda* and *G. fenestrata*. The conjugation of similar gametes, arising from distinct plurilocular sporangia, was observed by Berthold in *Ectocarpus siliculosus* and *Scytosiphon lomentarius* in 1880; and these observations have been recently confirmed in the case of the former species by Sauvageau, and in the case of the latter by Kuckuck. In these cases, however, the potential gametes may, failing conjugation, germinate directly, like the zoospores derived from unilocular sporangia. The assertion of Areschoug that conjugation occurs among zoospores derived from unilocular sporangia, in the case of *Dictyosiphon hippuroides*, is no doubt to be ascribed to error of observation. It would thus seem that the explanation of the existence of two kinds of sporangia, unilocular and plurilocular, among Phaeosporeae, lies in the fact that unilocular sporangia are for asexual reproduction, and that plurilocular sporangia are gametangia—potential or actual. It must, however, be remembered that so important a generalization is as yet supported upon a somewhat narrow base of observation. Moreover, for the important family of the Laminariaceae only unilocular sporangia are known to occur; and for many species of other families, only one or other kind, and in some cases neither kind, has hitherto been observed. The four species—*Ectocarpus siliculosus*, *Giffordia secunda*, *Cutleria multifida* and *Haplospora globosa*—may be taken to represent, within the Phaeosporeae, successive steps in the advance from isogamy to oogamy.

The Peridiniaceae have been included among Flagellata under the title of Dinoflagellata. The majority of the species belong to the sea, but many are found in fresh water. The thallus is somewhat spherical and unicellular, exhibiting a distinction between anterior and posterior extremities, and dorsal and ventral surfaces. The wall consists of a basis of cellulose, and in some cases readily breaks up into a definite number of plates, fitting into one another like the plates of the carapace of a tortoise; it is, moreover, often finely sculptured or coarsely ridged and flanged. Two grooves are a constant feature of the family, one running transversely and another longitudinally. In these grooves lie two cilia, attached at the point of meeting on the dorsal surface. The protoplast is uninucleate and vacuolate, and contains chromatophores of a brownish colour. It is not clear that

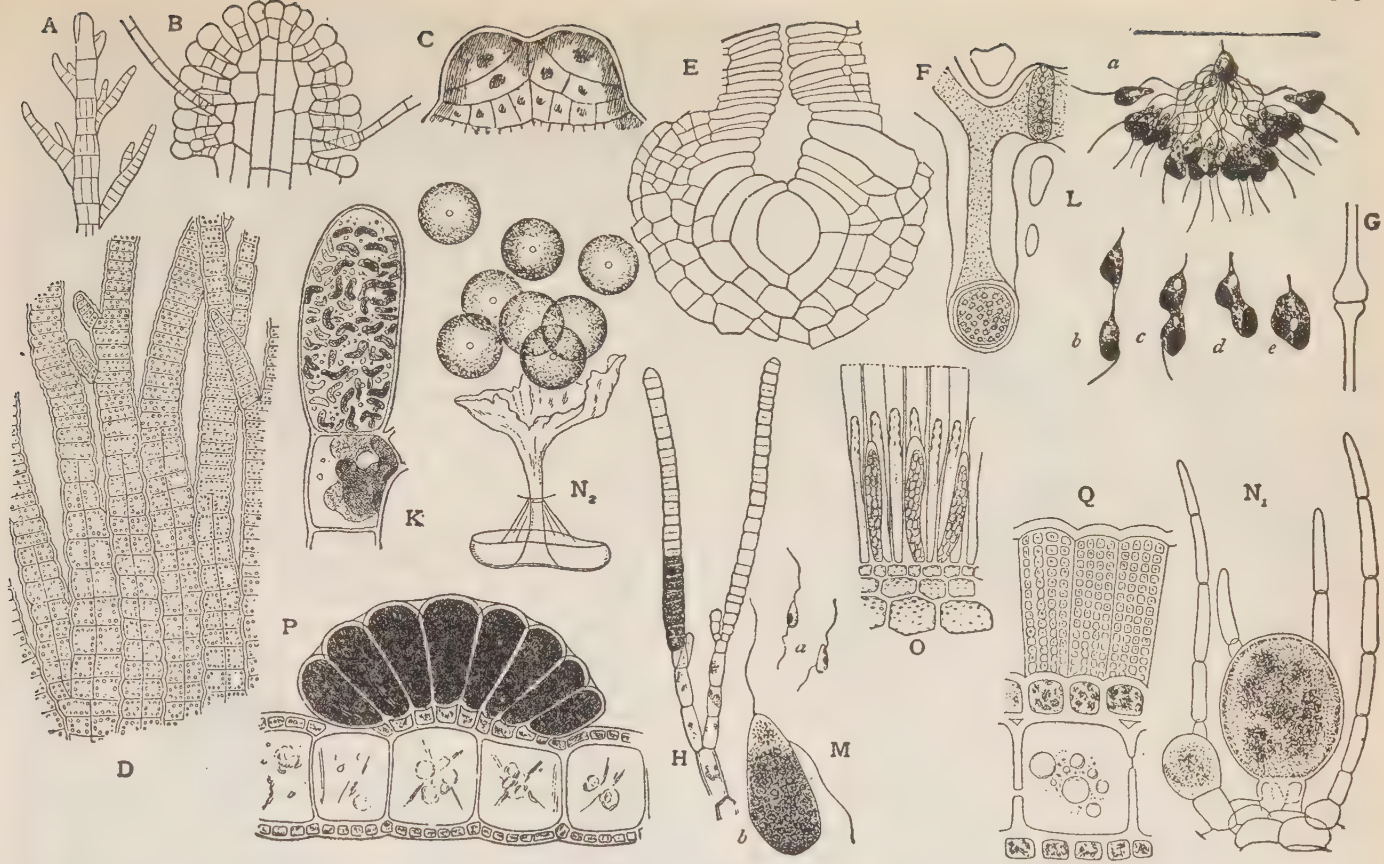


Fig. 4.—Phaeophyceae, variously magnified.

A. *Halopteris*, apical region.
B. *Chordaria sp.*, apical region showing so-called trichothallic growth.
C. *Dictyota sp.*, apical cells immediately after dichotomy.
D. *Cutleria sp.*, margin of thallus showing trichothallic growth.
E. *Halidrys*, apical depression with leading cell.
F. *Macrocystis sp.*, tubular elements from the medulla, with sieve-like transverse walls.
G. *Laminaria sp.*, hyphae with trumpet-like ends also from medulla.
H. *Elachistea sp.*, plurilocular sporanges.
K. *Ectocarpus sp.*, unilocular sporange.
L. *Ectocarpus siliculosus*, female gamete surrounded by male gametes. *a*, *b*, *c*, *d*, *e*, stages of conjugation.
M. *Cutleria multifida*. *a*, antherozoids, *b*, a female gamete.
N_1. *Fucus vesiculosus*, young oogonium.
N_2. *Fucus vesiculosus*, discharge of eight oospheres from oogonium.
O. *Laminaria sp.*, sporanges among paraphyses.
P. *Dictyota dichotoma*, a sorus of oogonia.
Q. *Dictyota dichotoma*, part of a sorus of antheridia.

(A, B, C, D, E, H, L, M, P, from Engler and Prantl, by permission of Wilhelm Engelmann; F, G, K, O, from Oltmanns, by permission of Gustav Fischer; Q, from *The Annals of Botany*, by permission of the Clarendon Press; N_1, N_2, from Hauck, *Meeresalgen*, by permission of Eduard Kummer.)

the brown colouring matter which is added to chlorophyll is identical with phycophaein; two varieties of it have been termed phycopyrrin and peridinine. Certain species, such as *Gymnodinium spirale*, are colourless and therefore saprophytic in their method of nutrition. Multiplication takes place in some cases by the endogenous formation of zoospores, the organism having come to rest; in others by longitudinal division, when the organism is still motile. No method of sexual reproduction is known with certainty.

The Cryptomonadaceae also are unicellular, and live free or in colonies. Each cell contains a flattened chromatophore of a brown or yellow colour. *Hydrurus* forms a branched gelatinous colony attached to stones in mountain streams. *Chromophyton* forms an eight-celled colony. Both plants multiply solely by means of zoospores. The Cryptomonadeae and Chromulineae are motile through the greater part of their life. *Cryptomonas*, when dividing in a mucilage after encystment, recalls the condition in *Gloeocystis*. In *Synura* and *Chromulina* the cells form a spherical motile colony, recalling Volvocaceae. *Chromulina* is uniciliate, and is contained in a hyaline capsule. Like the Peridiniaceae, the Cryptomonadaceae have been included among Flagellata. They have no close affinity with Euphaeophyceae. Such colonial forms as *Hydrurus* and *Phaeocystis* are supposed, however, to indicate a stage in the passage to the multicellular condition.

Diatomaceae have long been recognized as plants. Together with Peridiniaceae they constitute the bulk of marine plankton, and thus play an important part in the support of marine animal life. They exhibit striking adaptations in these circumstances to the floating habit. (See Diatomaceae.)

A census of Phaeophyceae is given below:—

(1) Cyclosporinae (Fucaceae)—4 families, 32 genera, 347 species.
(2) Tetrasporinae (Dictyotaceae)—1 family, 17 genera, 130 species.
(3) Phaeozoosporineae (Phaeosporeae)—24 families, 143 genera, 571 species.

(De Toni's *Sylloge Algarum*.)

(4) Peridiniales—3 families, 32 genera, 167 species.
(5) Cryptomonadaceae (including Chrysomonadaceae)—2 families, 28 genera, 50-60 species.
(6) Bacillariales (Diatomaceae)—about 150 genera and 5000 species, fossil and recent.

(Engler and Prantl's *Pflanzenfamilien*.)

IV. Rhodophyceae, or Florideae.—The members of this group are characterized by the possession of a red colouring matter, phycoerythrin, in addition to chlorophyll. There is, however, a considerable amount of difference in the shades of red which mark different species. The brightest belongs to those species which grow near low-water mark, or under the shade of larger algae at higher levels; species which grow near high-water mark are usually of so dark a hue that they are easily mistaken for brown seaweeds. Rhodophyceae are mostly marine, but not exclusively so. *Thorea*, *Lemanea*, *Tuomeya*, *Stenocladia*, *Batrachospermum*, *Balbiania* are genera belonging entirely to fresh water; and *Bangia*, *Chantransia*, *Caloglossa*, *Bostrychia* and *Delesseria* contain each one or more freshwater species. Most of the larger species of marine Rhodophyceae are attached by means of a disc to rocks, stones or shells. Many are epiphytic on other algae, more especially the larger Phaeophyceae and Rhodophyceae. As in the case of epiphytic brown seaweeds, the rhizoids of the epiphyte often penetrate the substance of the supporting alga. Some Red Algae find a home in the gelatinous substance of *Flustra*, *Alcyonidium* and other polyzoa, only emerging for the formation of the reproductive organs. Some are perforating algae and burrow into the substance of molluscan shells, in company with certain Green and Blue-green Algae. Some species belonging to the families Squamariaceae and Corallinaceae grow attached through their whole length and breadth, and are often encrusted with lime. The forms which grow away from the substratum vary greatly in external configuration. In point of size the largest cannot rival the larger Brown Algae, while the majority require the aid of the microscope for their investigation.

No unicellular Rhodophyceae are known, although a flagellate organism, *Rhodomonas*, has recently been described as possessed of the same red colouring matter. If the sub-group, Bangiaceae, be excluded, they may be said to consist exclusively of branched filaments. Growth in these cases takes place by means of an apical cell, from which successive segments are cut off by means of a transverse wall. The segment so cut off does not usually divide again by means of a transverse wall, nor indeed by a longitudinal wall which passes through the organic axis of the cell. New cells may be cut off laterally, which become the apical cells of branches. When the new cells grow no further, but constitute a palisading round the central cell covering its whole length, the condition is reached which characterizes the species of *Polysiphonia*, the "siphons" of which may be regarded as one-celled branches. To the law that no subsequent transverse division takes place in segments cut off from the apical cell, there seem to be two exceptions: first, the calcareous genus *Corallina*, in the pliable joints of which intercalated division occurs; and, second, the *Nitophylleae*, in which, moreover, median longitudinal division of axial cells is said to occur. Like the Fungi, therefore, the Red Algae consist for the most part of branched filaments, even where the thallus appears massive to the eye, and, as in the case of Fungi, this fact is not inconsistent with a great variety of external morphology. In the great majority the thallus is obviously filamentous, as in some species of *Callithamnion*. In other species of that genus an apparent cortication arises by the downward growth of rhizoids, which are retained within the gelatinous wall of the axial cells. In *Batrachospermum* the whole system of branches are retained within a diffluent gelatinous substance derived from the outer layers of the cell-walls. In other cases the mucilage is denser and the branches more closely compacted (*Helminthora*). In such cases as *Lemanea*, the terminal cells of the lateral branches form a superficial layer which has all the appearance of a parenchyma when viewed from the surface. In *Champia* and allied genera, the cylindrical axis is due not to the derivatives of one axial filament, but of several, the growth of which is co-ordinated to form a septated tube. The branching of the thallus, which meets the eye in all these cases, is due to the unlimited growth of a few branches. When such a lateral branch overtops the main axis whose growth has become limited, as in *Plocamium* and *Dasya*, a sympodium is formed. For the most part the branching is monopodial. Besides the differentiation into holdfast and shoot, and into branches of limited and branches of unlimited growth, there appear superficial structures of the nature of hairs. These are for the most part long, thin-walled, unicellular and colourless, and arise from the outer cells of the pseudo-cortex, or from the terminal cells of branches when the filaments are free. Among Rhodomelaceae, hair-like structures of a higher order are known. These arise from the axial cell, and are multicellular and branched. They soon fall off, and it is from the persistent basal cell that the branches of unlimited growth arise. Upon them also the reproductive organs arise in this family. It is not surprising, therefore, that they have been regarded as the rudiments of leaves. In *Iridaea* the thallus is an entire lamina; in *Callophyllis* a lobed lamina; in *Delesseria* it is provided with midrib and veins, simulating the appearance of a leaf of the higher plants; in *Constantinea* the axis remains cylindrical, and the lateral branches assume the form of leaves. In the compact thalli a secondary development often takes place by the growth of rhizoid-like internal filaments. They present a hypha-like appearance, running longitudinally for considerable distances. It is not difficult in such compact species to distinguish between superficial cells, whose chief function is assimilation, subjacent cells charged with reserve material, and a core of tissue engaged in the convection of elaborated material from part to part.

An interesting feature of the minute anatomy of Euflorideae, as the Red Algae, exclusive of the Bangiaceae, have been termed, is the existence of the so-called *Floridean pit*. When a cell divides it is found that there remains in the middle of the new wall a single large circular pit, which persists throughout the life of the cells, becoming more and more conspicuous with the progress of the thickening of the wall. These pits serve to indicate the genetic relationship of adjacent cells, when they form a compact pseudo-parenchyma, notwithstanding the fact that somewhat smaller secondary pits appear later between any contiguous cells. Protoplasmic continuity has been observed in the delicate membrane closing the pit.

Vegetative multiplication occurs only sparingly in Rhodophyceae. *Melobesia callithamnioides* gives rise to multicellular propagula; *Griffithsia corallina* is said to give rise to new individuals, by detaching portions of the thallus from the base of which new attachment organs have already arisen. The spores of *Monospora* are by some regarded as unicellular propagula. Reproduction is both asexual and sexual. It is noteworthy that although all the members of the group are aquatic no zoospores are produced, a negative character common to them and the Blue-green Algae. As a rule the asexual cells, and the male and female sexual cells arise upon different plants, so that the species may be said to be trioecious. Numerous exceptions, however, occur. Thus in Lemaneaceae asexual spores are unknown; in *Batracho-spermum*, *Bonnemaisonia* and *Polysiphonia byssoides* both kinds of sexual cells appear on the same plant; and in some cases the asexual cells may occur in conjunction with either the male or female sexual cells. The asexual cells are termed tetraspores on account of the usual occurrence of four in each sporangium. What may be termed monospores, bispores and octospores, however, are not unknown. The sporangia may be terminal or intercalated. When they are confined to special branches such branches are spoken of as stichidia. The tetraspores may arise by the simultaneous division of the contents of a sporangium, when they are arranged tetrahedrally, or they may arise by two successive divisions, in which case the arrangement may be zonate when the spores are in a row, or cruciate when the second divisions are at right angles to the first, or tetrahedral when the second divisions are at right angles to the first and also to one another. Tetraspores are at first naked, but soon acquire a cell-wall and germinate without a period of rest. The male sexual cells are produced singly in the terminal cells of branches. They are spoken of as spermatia. Great numbers of antheridia are usually crowded together, when the part is distinguishable by the absence of the usual red colour. In *Polysiphonia* they cover the joints of the so-called leaves; in *Chondria* they arise on flattened disks; in the more massive forms they arise in patches on the ordinary surface; in a few cases (*Gracilaria*, *Corallina*, *Galaxaura*) they line the walls of conceptacle-like depressions. The female sexual cell is represented by the contents of a cell which is terminal on ordinary or specialized branches. This is the carpogonium; it consists of a ventral portion which contains a nucleus, but in which no oosphere is differentiated, and an elongated tubular portion known as the trichogyne, into which the cytoplasm extends. Fertilization is effected by the passive convection of a spermatium from the antheridium to the trichogyne, to which it adheres, and to which it passes over its nucleus through an open communication set up at the point of contact. The nucleus then passes down the trichogyne and fuses with that of the egg. This fusion has been observed by Wille in *Nemalion multifidim*, and by Schmidle in *Batrachospermum*. It is singular that in the last-named species two nuclei occur regularly in the spermatium. The ventral portion of the carpogonium may be imbedded deep in the thallus in the massive species; the trichogyne, however, always reaches the surface. The first effect of fertilization is the occlusion of the trichogyne from the fertilized carpogonium. The subsequent course of development is characteristic of the Florideae. The carpogonium germinates forthwith, drawing its nourishment almost wholly from the parent plant. The ultimate product in all cases is a number of carpospores, but before this stage is reached the development is different in different sub-groups. In *Batrachospermum* filaments arise from the carpogonium on all sides; in *Chantransia* and *Scinaia* on one side only; in *Helminthora* the filaments are enclosed in a dense mucilage; in *Nemalion*, prior to the formation of the filaments, a sterile segment is cut off below. In all these cases, however, the end-cells of the filaments each give rise to a carpospore, and the aggregate of such sporiferous filaments is a cystocarp. Again, in the family of the Gelidiaceae, the single filament arising from the carpogonium grows back into the tissue and preys upon the cells of the axis and larger branches, after which the end-cells give rise to carpospores and a diffused cystocarp is formed. In the whole group of the Cryptonemiales the parasitism becomes more marked still. The filaments arising from the carpogonia grow into long thin tubes, which fuse with special cells rich in protoplasm contents; and from these points issue isolated tufts of sporogenous filaments, several of which may form the product of one fertilized female cell. In *Naccaria*, one of the Gelidiaceae, it is observable that the ooblastema filament, as the tube arising from the fertilized carpogonium has been called, fuses completely with a cell contiguous to the carpogonium before giving rise to the foraging filaments already referred to. This is also the case among Cryptonemiales. In a whole series of Red Algae, the existence of a highly specialized auxiliary cell in the neighbourhood of the carpogonium is a characteristic feature. In the Gigartinales it is already differentiated previous to fertilization; in Rhodymeniales it arises subsequent to fertilization. In the Gigartinales, the filaments which arise from the auxiliary cell may spread and give rise to isolated tufts of sporogenous filaments, as in the Cryptonemiales. In the Rhodymeniales a single tuft arises directly from the auxiliary cell. The carpospores are in all cases bright red naked masses of protoplasm when first discharged. They soon acquire a cell-wall, and germinate without a period of rest. When the cystocarps or segments of cystocarps are formed in the substance of a thallus, the site is marked merely by a swelling of the substance. When the cystocarp is produced externally, it may form a berry-like mass without an envelope, in which case it is known as a favella. In Rhodomelaceae there is a special urn-shaped envelope surrounding the sporogenous filaments. This is a ceramidium.

The attachment of the cell of an ooblastema filament to a cell of the thallus may be effected by means of a minute pore, or the two cells may fuse their contents into one protoplasmic mass. In the latter case, and especially where the union is with a special auxiliary cell, it is of importance to know what happens to the nuclei of the fusing cells. Schmitz was of opinion that in the cases of open union there occurred a fusion of nuclei similar to that which occurs in the sexual union of two cells. He founded his generalization to a large extent upon the observation that in *Gloeosiphonia capillaris* two cells completely fuse, and that only one nucleus can be detected in the fused mass. Oltmanns has recently re-investigated the phenomena in this plant, among others, and has shown that the nucleus of the cell which is being preyed upon recedes to the wall and gradually atrophies. The nucleus of the ooblastema filament dominates the

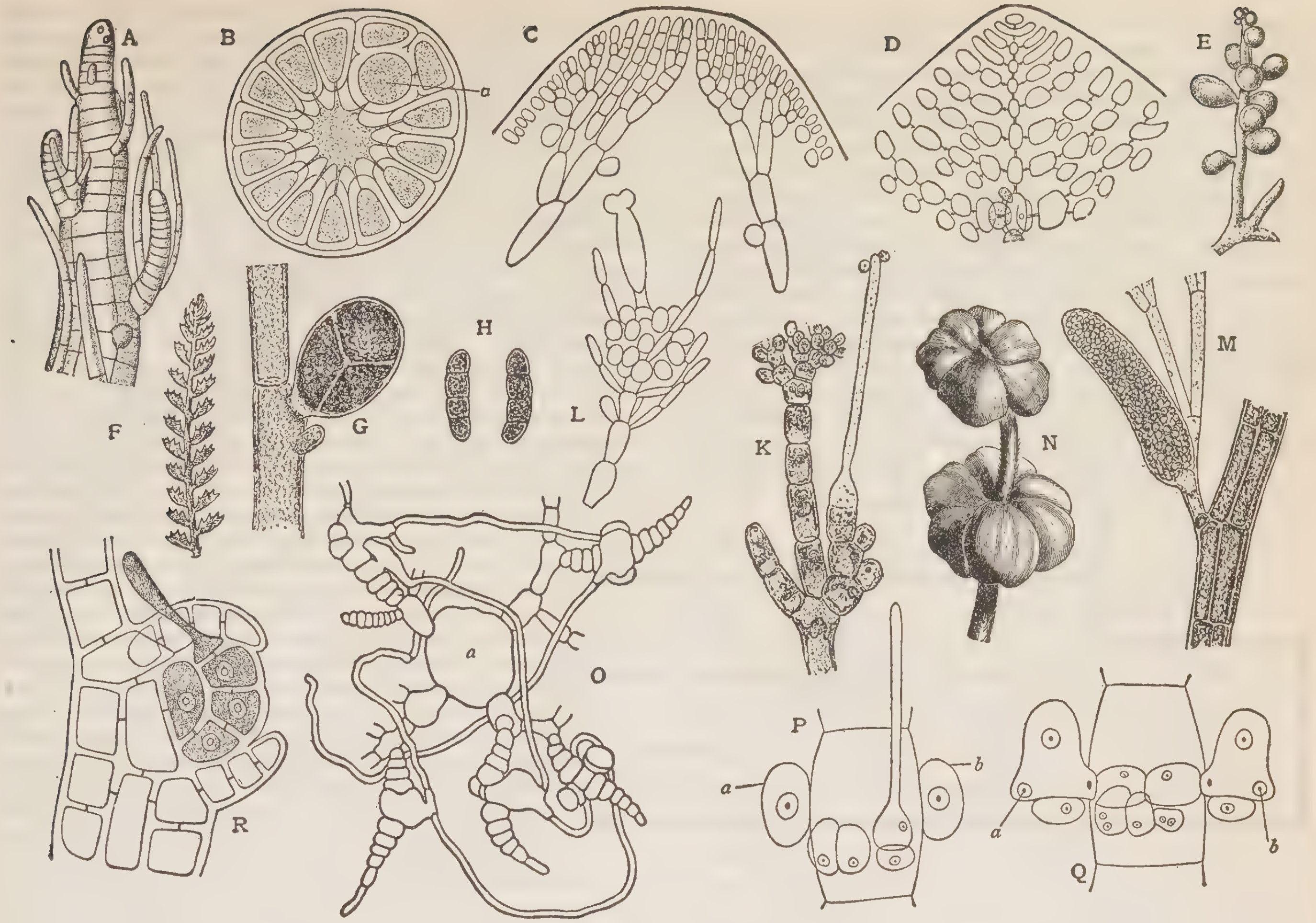


FIG. 5.—Rhodophyceae, variously magnified.

A. *Polysiphonia sp.*, apical region showing leading cell and cutting off of pericentral cell.
B. *Polysiphonia sp.*, transverse section through a branch, and at *a*, mother-cell of tetraspores.
C. *Lomentaria sp.*, apex showing growth in length through co-ordinated growth of many filaments.
D. *Delesseria sp.*, showing apical region with leading cell.
E. *Chrysymenia uvaria*, axis with swollen leaf-like appendages.
F. *Polyzonia sp.*, branch with leaf-like branches of limited growth.
G. *Callithamnion sp.*, tetrasporangium with spores arranged in a tetrad.
H. *Corallina sp.*, tetrasporangia with zonate arrangement of tetraspores.
K. *Nemalion sp.*, carpogonial and antheridial branches.
L. *Batrachospermum sp.*, trichogyne with spermatia attached; carpospores arising from fertilized carpogonium.
M. *Polysiphonia sp.*, antheridium.
N. *Constantinea sp.*, with flattened leaf-like appendages.
O. *Dudresnaya coccinea*, fusion of ooblastema filaments with auxiliary cells; *a* is an axial cell in transverse section with four appendages.
P. *Callithamnion corymbosum*, a joint cell with carpogonial branch and *a*, *b*, two auxiliary cells.
Q. *Callithamnion corymbosum*, fusion of products of fertilization with auxiliary cells, the nuclei of which *a* and *b* retire to the wall.
R. *Polysiphonia sp.*, section through young cystocarp.

(A, C, D, E, F, G, H, K, L, M, P, Q, from Oltmanns, by permission of Gustav Fischer; B, N, O, R, from Engler and Prantl, by permission of Wilhelm Engelmann.)

mass and from it all the nuclei of the carpospores are thus derived. There thus seems to be no justification for believing, as Schmitz taught, that a second sexual act occurs in the life-cycle of these Florideae.

The Bangiales are a relatively small group of Red Algae, to which much of the description now given does not apply. Structurally they are either a plate of cells, as in *Porphyra*, or filaments, as in *Bangia*. There is no exclusive apical growth, and the cells divide in all directions. The characteristic pit is also absent. Sexual and asexual reproduction prevail. The male cell is a spermatium, but the female cell bears no such receptive trichogyne as occurs in other Rhodophyceae. After fertilization the equivalent of the oospore divides directly to form a group of carpospores. There is thus a certain resemblance to Euflorideae, but sufficient difference to necessitate their being grouped apart. Fertilization by means of non-motile spermatia and a trichogyne are known among the Fungi in the families Collemaceae and Laboulbeniaceae.

A census of Rhodophyceae is furnished below: —

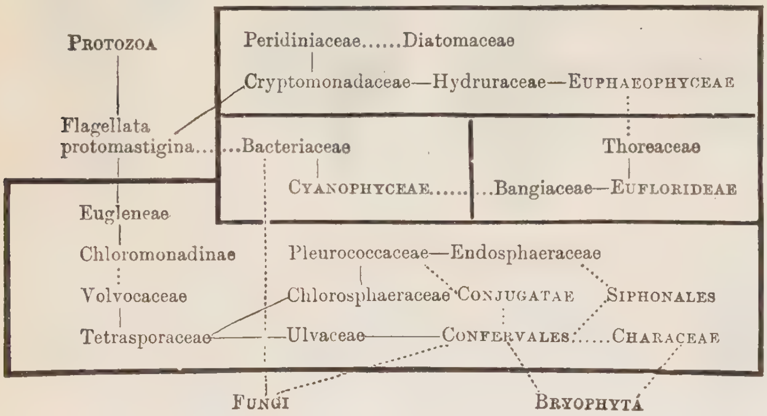
(1) Bangiaceae—4 families, 9 genera, 58 species.
(2) Nemalioninae—4 families, 33 genera, 343 species.
(3) Gigartininae—3 families, 54 genera, 409 species.
(4) Rhodymeninae—4 families, 92 genera, 602 species.
(De Toni's *Sylloge Algarum*, 1897.)

Limits of the algae.

After this survey of the four groups comprised under Algae it is easier to indicate the variations in the limits of the class as defined by different authorities. To consider the Cyanophyceae first, either the marked contrast in the method of nutrition of the generally colourless Bacteriaceae to that of the blue-green Cyanophyceae is regarded as sufficient ground for excluding Bacteriaceae from algae altogether, notwithstanding their acknowledged morphological affinity with Cyanophyceae, or, in recognition of the incongruity of effecting such a separation, the whole group of the Schizophyta —that is to say, the Cyanophyceae in the narrow sense, together with Bacteriaceae, is included or excluded together. Again, while Conjugatae may be shut out from Chlorophyceae as an independent group co-ordinate with them in rank, the Characeae constitute so aberrant a group that it has even been proposed to raise them as Charophyta to the dignity of a main division co-ordinate with Thallophyta. Similarly, while Diatomaceae may be excluded from among Phaeophyceae, though retained among algae, the Cryptomonadaceae and Peridiniaceae, like *Euglena* and other Chlorophyceae, may be excluded from Thallophyta and ranged among the flagellate Protozoa. It is doubtful, however, whether the conventional distinction between plants and animals will continue to be urged; and the suggestion of Haeckel that a class Protista should be established to receive the forms exhibiting both animal and plant affinities has much to recommend it on phylogenetic grounds. To adopt a figure, it is probable that the sources from which the two streams of life—animal and vegetable—spring may not be separable by a well-defined watershed at all, but consist of a great level upland, in which the waterways anastomose. Finally, while Chlorophyceae and Phaeophyceae exhibit important affinities, the Rhodophyceae are so distinct that the term "algae" cannot be made to include them, except when used in its widest sense.

Phylogeny.

It has been well said that the attempt to classify plants according to their natural affinities is an attempt to construct for them the genealogical tree by which their relationships can be traced. Algae are, however, so heterogeneous a class, of which the constituent groups are so inadequately known, that it is at present futile to endeavour thus to exhibit their pedigree. A synoptical representation of the present state of knowledge would be expressed by a network rather than by a tree. The following table is an adaptation of a scheme devised by Klebs, and indicates the inter-relationships of the various constituent groups. The area included in the thick boundary line represents algae in the widest sense in which the term is used, and the four included areas the four main subdivisions. A continuous line indicates a close affinity, and a dotted line a doubtful relationship.



Alternation of generations.

In comparing algae with the great archegoniate series which has doubtless sprung from them, it is natural to inquire to what extent, if any, they present evidence of the existence of the marked alternation of generations which dominates the life-history of the higher plants. Turning first to the Rhodophyceae, both on account of the high place which they occupy among algae and also the remarkable uniformity in their reproductive processes, it is clear that, as is the case among Archegoniatae, the product of the sexual act never germinates directly into a plant which gives rise to the sexual organs. Even among Bangiaceae the carpospores arise from the fertilized cell by division, while in all other Rhodophyceae the oospore, as it may be called, gives rise to a filamentous structure, varying greatly in its dimensions, epiphytic, and to a large extent parasitic upon the egg-bearing parent plant, and in the end giving rise to carpospores in the terminal cells of certain branches. There is here obviously a certain parallelism with the case of Bryophyta, where the sporogonium arising from the oospore is epiphytic and partially parasitic upon the female plant, and always culminates in the production of spores. Not even *Riccia*, with its rudimentary sporogonium, has so simple a corresponding stage as *Bangia*, for, while there is some amount of sterile tissue in *Riccia*, in *Bangia* the oospore completely divides to form carpospores. Excluding Bangiaceae, however, from consideration, the Eufloriodeae present in the product of the development of the oospore like Bryophyta a structure partly sterile and partly fertile. There is, nevertheless, this important difference between the two cases. While the spore of Bryophyta on germination gives rise to the sexual plant, the carpospore of the alga may give rise on germination to a plant bearing a second sort of asexual cells, viz. the tetraspores, and the sexual plant may only be reached after a series of such plants have been successively generated. It is possible, however, that the tetraspore formation should be regarded as comparable with the prolific vegetative reproduction of Bryophyta, and in favour of this view there is the fact that the tetraspores originate on the thallus in a different way from carpospores with which the spores of Bryophyta are in the first place to be compared; moreover, in certain Nemalionales the production of tetraspores does not occur, and the difficulty referred to does not arise in such cases. Altogether it is difficult on morphological grounds to resist the conclusion that Florideae present the same fundamental phenomenon of alternation of generations as prevails in the higher plants. It is by means of the cytological evidence, however, that this problem will finally be solved. As is well known, the dividing nuclei of the cells of the sporophyte generation of the higher plants exhibit a double number of chromosomes, while the dividing nuclei of the cells of the gametophyte generation exhibit the single number. In a fern-plant, for example, which is a sporophyte, every karyokinesis divulges the double number, while in the prothallium, which is the gametophyte generation, the single number appears. The doubling process is provided by the act of fertilization, where an antherozoid with the single number of chromosomes fuses with an oosphere also with the single number to provide a fertilized egg with the double number. The reduction stage, on the other hand, is the first division of the mother-cell of the spore. From egg to spore-mother-cell is sporophyte; from spore-mother-cell to egg is gametophyte. And since this rule has been found to hold good for all the archegoniate series and also for the flowering plants where, however, the gametophyte generation has become so extremely reduced as to be only with difficulty discerned, it is natural that when alternation of generation is stated to occur in any group of Thallophyta it should be required that the cytological evidence should support the view. The genus *Nemalion* has been recently investigated by Wolfe with the object of examining the cytological evidence. He finds that eight chromosomes appear in karyokinesis in the ordinary thallus cells, but sixteen in the gonimoblast filaments derived from the fertilized carpogonium. Eight chromosomes appear again in the ultimate divisions which give rise to the carpospores. Upon the evidence it would seem therefore that so far as *Nemalion* is concerned an alternation occurs comparable with that existing in the lower Bryophyta where the sporophyte is relatively small, being attached to and to some extent parasitic upon the gametophyte. *Nemalion* is, however, one of those Florideae in which tetraspores do not occur. What is the case with those Florideae which have been described as trioecious? If the sporophyte generation is confined to the cystocarp, is the tetrasporiferous plant, as has been suggested, merely a potential gametophyte reproducing by a process analogous to the bud-formation of the Bryophyta? In answer to this question a recent writer, Yamanouchi, states in a preliminary communication that he has found that in *Polysiphonia violacea* the germinating carpospores exhibit forty chromosomes, and the germinating tetraspores twenty chromosomes. From this it would seem that in this plant reduction takes place in the tetraspore mother-cell, and that the tetrasporiferous plants are sporophytes which alternate with sexual plants. Novel as this result may seem, the tetraspores of Florideae become hereby comparable with the tetraspores of *Dictyota*, to which reference will be made hereafter. But it is clear that it becomes on this view increasingly difficult to explain the occasional occurrence of tetraspores on male, female and monoecious plants or the rôle of the carpospores in the life-cycle of Florideae. The results of future research on the cytology of the group will be awaited with interest.

Among Phaeophyceae it is well known that the oospore of Fucaceae germinates directly into the sexual plant, and there is thus only one generation. Moreover, it is known that the reduction in the number of chromosomes which occurs at the initiation of the gametophyte generation in Pteridophyta occurs in the culminating stage of *Fucus*, where the oogonium is separated from the stalk-cell, so that unless it be contended that the *Fucus* is really a sporophyte which does not produce spores, and that the gametophyte is represented merely by the oogonium and antheridium, there is no semblance of alternation of generation in this case. The only case among Phaeophyceae which has been considered to point to the existence of such a phenomenon is *Cutleria*. Here the asexual cells are borne upon the so-called *Aglaozonia reptans* and the sexual cells upon the plants known as *Cutleria*. The spores of the *Aglaozonia* form are known to give rise to sexual plants, and the oospore of *Cutleria* has been observed to grow into rudimentary *Aglaozonia*. Latterly, however, as the result of the cytological investigations of Mottier and Lloyd Williams, great advance has been made in our knowledge of the conditions existing in *Dictyota*. Mottier first observed that a reduction in the number takes place in the mother-cells of the tetraspore. It will be remembered that, as in most Florideae, the male, female and asexual plants are distinct in this genus. Mottier's observation has been confirmed by Lloyd Williams, who has shown, moreover, that the single number occurs in germlings from the tetraspore, and also in the adult stages of all sexual plants, while the double number occurs in germlings from the oospore, and in adult stages of all asexual plants. It is probable, therefore, that we have here a sharp alternation of generations, both generations being, however, precisely similar to the eye up to point of reproduction. Among Chlorophyceae it is often the case that the oospore on germination divides up directly to form a brood of zoospores. In *Coleochaete* this seems to be preceded by the formation of a minute parenchymatous mass, in each cell of which a zoospore is produced. In *Sphaeroplea* it is only at this stage that zoospores are formed at all; but in most cases, such as *Oedogonium*, *Ulothrix*, *Coleochaete*, similar zoospores are produced again and again upon the thallus, and the product of the oospore may be regarded as merely a first brood of a series. It has been held by some, however, that the first brood corresponds to the sporophyte generation of the higher plants, and that the rest of the cycle is the gametophyte generation. Were the case of *Sphaeroplea* to stand alone, the phenomenon might perhaps be regarded as **an alternation of** generations, but still only comparable with the case of *Bangia*, and not the case of the Florideae. But it is difficult to apply such a term at all to those cases in which there intervene between the oospore and the next sexual stage a series of generations, the zoospores of which are all precisely similar.

Polymorphism.

The difficulty of tracing the relationships of algae is largely due to the inadequacy of our knowledge of the conditions under which they pass through the critical stages of their life-cycle. Of the thousands of species which have been distinguished, relatively few have been traced from spore to spore, as the flowering plants have been observed from seed to seed. The aquatic habit of most of the species and the minute size of many of them are difficulties which do not exist in the case of most seed-plants. From the analogy of the higher plants observers have justly argued that when they have seen and marked the characters of the reproductive organs they have found the plant at the stage when it exhibits its most noteworthy features, and they have named and classified the species in accordance with these observations. While even in such cases it is obvious that interesting stages in the life of the plant may escape notice altogether, in the cases of those plants the reproduction of which is unknown, and which have been named and placed on the analogy of the vegetative parts alone, there is considerable danger that a plant may be named as a distinct species which is only a stage in the life of another distinct and perhaps already known species. To take an example, *Lemanea* and *Batrachospermum* are Florideae which bear densely-whorled branches, but which, on the germination of the carpospore, give rise to a laxly-filamentous, somewhat irregularly-branched plant, from which the ordinary sexual plants arise at a later stage. This filamentous structure has been attributed to the genus *Chantransia*, which it greatly resembles, especially when, as is said to be the case in *Batrachospermum*, it bears similar monospores. The true *Chantransia*, however, bears its own sexual organs as well as monospores. To the specific identity of *Haplospora globosa* and *Scaphospora speciosa*, and of *Cutleria multifida* and *Aglaozonia reptans*, reference has already been made. Again, many Green Algae—some unicellular, like *Sphaerella* and *Chlamydomonas*; some colonial forms, like *Volvox* and *Hormotila*; some even filamentous forms, like *Ulothrix* and *Stigeoclonium*—are known to pass into a condition resembling that of a *Palmella*, and might escape identification on this account.

It is, on the other hand, a danger in the opposite sense to conclude that all *Chantransia* species are stages in the life-cycle of other plants, and, similarly, that all irregular colonial forms, like *Palmella*, represent phases in the life of other Green Algae. Long ago Kützing went so far as to express the belief that the lower algae were all capable of transformations into higher forms, even into moss-protonemata. Later writers have also thought that in all four groups of algae transformations of a most far-reaching character occur. Thus Borzi finds that *Protoderma viride* passes through a series of changes so varied that at different times it presents the characters of twelve different genera. Chodat does not find so general a polymorphism, but nevertheless holds that *Raphidium* passes through stages represented by *Protococcus*, *Characium*, *Dactylococcus* and *Sciadium*. Klebs has, however, recently canvassed the conclusions of both these investigators; and as the result of his own observations declares that algae, so far from being as polymorphic as they have been described, vary only within relatively narrow limits, and present on the whole as great fixity as the higher plants. It certainly supports his view to discover, on subjecting to a careful investigation *Botrydium granulatum*, a siphonaceous alga whose varied forms had been described by J. Rostafinski and M. Woronin, that these authors had included in the life-cycle stages of a second alga described previously by Kützing, and now described afresh by Klebs as *Protosiphon botryoides*. In *Botrydium* the chromatophores are small, without pyrenoids, and oil-drops are present; in *Protosiphon* the chromatophores form a net-work with pyrenoids, and the contents include starch. Klebs insists that the only solution of such problems is the subjection of the algae in question to a rigorous method of pure culture. It is interesting to learn that G. Senn, pursuing the methods described by Klebs, has confirmed Chodat's observation of the passage of *Raphidium* into a *Dactylococcus*-stage, although he was unable to observe further metamorphosis. He has also seen *Pleurococcus viridis* dividing so as to form a filament, but has not succeeded in seeing the formation of zoospores as described by Chodat. While, therefore, there is much evidence of a negative character against the existence of an extensive polymorphism among algae, some amount of metamorphosis is known to occur. But until the conditions under which a particular transformation takes place have been ascertained and described, so that the observation may be repeated by other investigators, scant credence is likely to be given to the more extreme polymorphistic views.

Physiology.

In comparison with the higher plants, algae exhibit so much simplicity of structure, while the conditions under which they grow are so much more readily controlled, that they have frequently been the subject of physiological investigation with a view chiefly to the application of the results to the study of the higher plants. (See PLANTS: *Physiology of*.) In the literature of vegetable physiology there has thus accumulated a great body of facts relating not only to the phenomena of reproduction, but also to the nutrition of algae. With reference to their chemical physiology, the gelatinization of the cell-wall, which is so marked a feature, is doubtless attributable to the occurrence along with cellulose of pectic compounds. There is, however, considerable variation in the nature of the membrane in different species; thus the cell-wall of *Oedogonium*, treated with sulphuric acid and iodine, turns a bright blue, while the colour is very faint in the case of *Spirogyra*, the wall of which is said to consist for the most part of pectose. While starch occurs commonly as a cell-content in the majority of the Green Algae no trace of it occurs in *Vaucheria* and some of its allies, nor is it known in the whole of the Phaeophyceae and Rhodophyceae. In certain Euphaeophyceae bodies built up of concentric layers, and attached to the chromatophores, were described by Schmitz as phaeophycean-starch; they do not, however, give the ordinary starch reaction. Other granules, easily mistaken for the "starch" granules, are also found in the cells of Phaeophyceae; these possess a power of movement apart from the protoplasm, and are considered to be vesicles and to contain phloroglucin. The colourless granules of Florideae, which are supposed to constitute the carbohydrate reserve material, have been called floridean-starch. A white efflorescence which appears on certain Brown Algae (*Saccorhiza bulbosa*, *Laminaria saccharina*), when they are dried in the air, is found to consist of mannite. Mucin is known in the cell-sap of *Acetabularia*. Some Siphonales (*Codium*) give rise to proteid crystalloids, and they are of constant occurrence among Florideae. The presence of tannin has been established in the case of a great number of freshwater algae.

Colouring matters.

By virtue of the possession of chlorophyll all algae are capable of utilizing carbonic acid gas as a source of carbon in the presence of sunlight. The presence of phycocyanin, phycophaein and phycoerythrin considerably modifies the absorption spectra for the plants in which they occur. Thus in the case of phycoerythrin the maximum absorption, apart from the great absorption at the blue end of the spectrum, is not, as in the case where chlorophyll occurs alone, near the Fraunhofer line B, but farther to the right beyond the line D. By an ingenious method devised by Engelmann, it may be shown that the greatest liberation of oxygen, and consequently the greatest assimilation of carbon, occurs in that region of the spectrum represented by the absorption bands. In this connexion Pfeffer points out that the penetrating power of light into a clear sea varies for light of different colours. Thus red light is reduced to such an extent as to be insufficient for growth at a depth of 34 metres, yellow light at a depth of 177 metres and green light at 322 metres. It is thus an obvious advantage to Red Algae, which flourish at considerable depths, to be able to utilize yellow light rather than the red, which is extinguished so much sooner. The experiment of Engelmann referred to deserves to be mentioned here, if only in illustration of the use to which algae have been put in the study of physiological problems. Engelmann observed that certain bacteria were motile only in the presence of oxygen, and that they retained their motility in a microscopic preparation in the neighbourhood of an algal filament when they had come to rest elsewhere on account of the exhaustion of oxygen. After the bacteria had all been brought to rest by being placed in the dark, he threw a spectrum upon the filament, and observed in what region the bacteria first regained their motility, owing to the liberation of oxygen in the process of carbon-assimilation. He found that these places corresponded closely with the region of the absorption band for the algae under experiment.

Although algae generally are able to use carbonic acid gas as a source of carbon, some algae, like certain of the higher plants, are capable of utilizing organic compounds for this purpose. Thus *Spirogyra* filaments, which have been denuded of starch by being placed in the dark, form starch in one day if they are placed in a 10 to 20% solution of dextrose. According to T. Bokorny, moreover, it appears that such filaments will yield starch from formaldehyde when they are supplied with sodium oxymethyl sulphonate, a salt which readily decomposes into formaldehyde and hydrogen sodium sulphite, an observation which has been taken to mean that formaldehyde is always a stage in the synthesis of starch. With reference to the assimilation of nitrogen, it would seem that algae, like other green plants, can best use it when it is presented to them in the form of a nitrate. Some algae, however, seem to flourish better in the presence of organic compounds. In the case of *Scenedesmus acutus* it is said that the alga is unable to take up nitrogen in the form of a nitrate or ammoniacal salt, and requires some such substance as an amide or a peptone. On the other hand, it has been held by Bernhard Frank and other observers that atmospheric nitrogen is fixed by the agency of Green Algae in the soil. (For the remarkable symbiotism between algae and fungi see FUNGI and LICHENS.)

Habitat.

Most algae, particularly Phaeophyceae and Rhodophyceae, spend the whole of the life-cycle immersed in water. In the case of the freshwater algae, however, belonging to the Chlorophyceae and Cyanophyceae, although they required to be immersed during the vegetative period, the reproductive cells are often capable of resisting a considerable degree of desiccation, and in this condition are dispersed through great distances by various agencies. Again, as is well known, many species of marine algae growing in the region between the limits of high and low water are so constituted that they are exposed to the air twice a day without injury. The occurrence of characteristic algae at different levels constituting the zones to which reference has already been made, is probably in part an expression of the fact that different species vary in the capacity to resist desiccation from exposure. Thus *Laminaria digitata*, which characterizes the lowest zone, is only occasionally exposed at all, and then only for short periods of time. On the other hand, *Pelvetia canaliculata*, which marks the upper belt, is exposed for longer periods, and during neap tides may not be reached by the water for many days. Algae of more delicate texture than either Fucaceae or Laminariaceae also occur in the region exposed by the ebb of the tide, but these secure their exemption from desiccation either by retaining water in their meshes by capillary attraction, as in the case of *Pilayella*, or by growing among the tangles of the larger Fucaceae, as in the case of *Polysiphonia fastigiata*, or by growing in dense masses on rocks, as in the case of *Laurencia pinnatifida*. Such a species as *Delesseria sanguinea* or *Callophyllis laciniata* would on the contrary run great risk by exposure for even a short period. A few algae approach the ordinary terrestrial plants in their capacity to live in a sub-aerial habitat subject only to such occasional supplies of water as is afforded by the rainfall. Of this nature are some of the species of *Vaucheria*. A very few species, like *Chroolepus*, which grows on rock surfaces, are comparable with the land plants which have been termed xerophilous.

Plankton.

The great majority of the aquatic algae, both freshwater and marine, are attached plants. Some, however, are wanderers, either swimming actively with the aid of cilia, or floating inertly as the result of a specific weight closely approaching that of the medium. To the aggregate of such forms, both animal and vegetable, the term *plankton* has been applied, and the investigation of the vegetable plankton, both freshwater and marine, has been pursued in recent times with energy and success. The German Plankton Expedition of 1889 added greatly to our knowledge of the floating vegetable life of the North Atlantic Ocean, while many laboratories established on the shores of inland seas and lakes have rendered a similar service in the case of our freshwater phyto-plankton. The quantitative estimate of the amount of this flora has revealed its enormous aggregate amount and therefore its great importance in the economy of oceanic and lacustrine animal life. The organisms constituting this plankton are mostly unicellular, often aggregated together in colonies, and the remarkable structure which they exhibit has added a new chapter to the story of adaptation to environment. The families Diatomaceae, Peridiniaceae and Protococcaceae are best represented in the pelagic plankton, while in addition the Volvocaceae are an important element in freshwater plankton.

Benthos.

The great majority of algae, however, grow like land-plants attached to a substratum, and to these the term *benthos* is now generally applied. While the root of land-plants serves for the double purpose of attachment and the supply of water, it is attachment only that is usually sought in the case of algae. Immersed as they usually are in a medium containing in solution the inorganic substances which they require for their nutrition, the absorption of these takes place throughout their whole extent. The elaborate provision for the conduct of water from part to part which has played so important a rôle in the morphological development of land plants is entirely wanting in algae, such conducting tissues as do exist in the larger Phaeophyceae and Rhodophyceae serving rather for the convection of elaborated organic substance, and being thus comparable with the phloem of the higher plants. The attachment organ of algae is thus more properly called a *holdfast*, and is found to be of very varied structure. It generally takes the form of a single flattened disc as in the Fucaceae, or a group of finger-like processes as in Laminariaceae, or a tuft of filaments as in many instances. When the attachment is in sand or mud, it often simulates the appearance of a true root as in *Chara* or *Caulerpa*. It is clear that where the bottom of a lake or sea consists of oozy mud or shifting sand, it is impossible for algae to secure a foothold. Thus a rock emerging from a sandy beach may often be observed to stand covered with vegetation like an oasis in a desert. The rapidity with which walls, piles and pontoons—stone, wood and iron—become covered with marine plants is well known, while the discovery of some effective means of preventing the fouling of the bottoms of ships by the growth of algae would be hailed as a boon by shipowners. While rocks and boulders are the favoured situation for the growth of marine algae, those which readily disintegrate, like the coarser sandstones, are naturally less favoured than the hard and resistant. A large number of algae again live as epiphytes or endophytes. In the case of the freshwater species the host-plants are mostly species of aquatic Graminaceae, Naiadaceae or Nymphaeaceae. In the case of marine algae, the hosts are chiefly the larger Phaeophyceae and Rhodophyceae. A bed of *Zostera* near the level of low water is, however, on the British coast a favourite collecting ground for the smaller red and brown epiphytes. Of endophytes a distinction must be made between those which occupy the cell-wall only and those which perforate the cells, bringing about their destruction. There can be little doubt that in some cases the epiphytism approaches parasitism. In one case described by Kuckuck the chromaphores of the infesting algae are absent, a circumstance which points to a complete parasitism. Allusion has already been made to the peculiar habit of the shell-boring algae.

Habit.

In many algae certain branches of limited growth bear a remarkable resemblance to leaves. The Characeae among freshwater algae and the Sargassaceae among marine algae might be cited as examples. Surveying the whole range of algae life, Oltmanns distinguishes bush-forms, whip-forms, net-forms, leaf-forms, sack-forms, dorsi-ventral forms, and cushions, plates and crusts. The similarity of outline in many species to that of trees and shrubs will strike any one who examines algae mounted for the herbarium. *Cladophora* and *Bryopsis* among monosiphonous forms, *Chara*, *Polysiphonia*, *Ceramium* and *Cystoseira* among larger algae, are illustrations of this. The whip-forms are represented by *Spirogyra*, *Chaetomorpha*, *Scytosiphon*, *Nemalion*, *Himanthalia* and *Chorda*. Net-forms are found in *Hydrodictyon* and *Microdictyon*. The leaf-forms are very varied and owe their existence to the advantage accruing from the exposure of a large surface to the influence of the light. In some cases such as *Delesseria*, *Neurymenia*, *Fucus*, *Alaria*, the leaf-like structure is provided with a strengthening mid-rib, and when as in *Delesseria* it is also richly veined the resemblance to the leaf of a flowering plant is striking. *Laminaria*, *Padina*, *Cutleria*, *Punctaria*, *Iridaea*, *Ulva*, *Porphyra*, are leaf-like with a rigidity varying from a fleshy lamina to the thin and pliable. *Agarum*, *Claudea* and *Struvea* are leaf-forms which are perforated like *Aldrovanda* among flowering plants. *Enteromorpha*, *Asperococcus* and *Adenocystis* are sack-forms. Dorsi-ventral algae are rare. *Leveillea jungermanneoides* bears a remarkable resemblance to a leafy liverwort. In the next group of forms the simplest are crusts attached to the substratum throughout their extent, and growing at the margin. Such are *Myrionema*, *Ralfsia*, *Melobesia* and *Hildebrandtia*. Others are attached throughout their extent, but also grow vertical filaments so as to form a velvety pile. Such are *Coleochaete*, *Ochlochaete*, *Elachistea*, *Ascocyclus* and *Rhododermis*. *Peysonellia squamaria*, *Melobesia lichenoides*, *Leathesia difformis* are forms which are not attached throughout but grow in plates like the foliaceous lichens.

Ecology.

When it is sought to consider algae with a view to the correlation of the external form to the conditions of life, a subject the study of which under the name of ecology has been latterly pursued with great success among land plants, it is difficult as yet to arrive at generalizations which are trustworthy. Among land plants, as is well known, similarity of environment has often called forth similar adaptations among plants of widely separated families. The similarity of certain xerophilous Euphorbiaceae to Cactaceae is a ready illustration of this phenomenon. From what has been already said it is evident that among algae also strikingly similar forms exist in widely different groups. Instances might be multiplied. Compare, for example, the blue-green *Gloeocapsa* with the green *Gloeocystis*, the red *Batrachospermum* with the green *Draparnaldia*, the red *Corallina* with the green *Cymopolia*, the green *Enteromorpha* with the brown *Asperococcus*, the green *Ulva* with the red *Porphyra*, the red *Nemalion* with the brown *Castagnea*, and so on. But on the one hand similar forms seem to grow often under different conditions, while on the other hand different forms flourish under the same conditions. The conceivable variations in the conditions which would count in algal life are variations in the chemical character of the water—whether fresh, brackish or salt; or in the rate of movement of the water, whether relatively quiet, or a stream or a surf; or in the degree of illumination with the depth and transparency of the water. But the laws which determine the associations of various algae under one environment are as yet little understood. The occurrence of a plentiful mucilage in many freshwater forms is, however, doubtless a provision against desiccation on exposure. The fine subdivision of filamentous and net-forms is similarly a provision for easy access of water and light to all parts. The calcareous deposits in Characeae, Corallinaceae and Siphonaceae are at once a protection against attack and a means of support. The whip-forms would seem to be designed to resist injury from surf or current. The vesicles of Fucaceae and Laminariaceae prevent the sinking of the bulkier forms. But why certain Fucaceae favour certain zones in the littoral region, why certain epiphytes are confined to certain hosts, why Red and Brown Algae are not better represented in fresh water or Green Algae in salt,—these are problems to which it is difficult to find a ready answer.

Uses.

Algae cannot be regarded as directly important in the industries. On the coasts of Europe marine algae detached by the autumnal gales are commonly carted on to the land as a convenient manure. *Porphyra laciniata* and *Rhodymenia palmata* are locally used as food, the latter being known as dulse. Agar-agar is a gelatinous substance derived from an eastern species of *Gracilaria*. The ash of seaweeds, known in Scotland as kelp, and in Brittany as varec, was formerly used as a source of iodine to a greater extent than is at present the case.

Occurrence in the rocks.

Excepting where the thallus is impregnated with silica, as in Diatomaceae, or carbonate of lime, as in Corallinaceae, Characeae and some Siphonales, it is perhaps not surprising that algae should not have been extensively preserved in the fossil form. Considering, however, that it is generally believed that Bryophyta and vascular plants are descended from an algal ancestry, it is natural to suppose that, prior to the luxuriant vegetable growths of the Carboniferous period, there must have existed an age of algae. It was doubtless this expectation that has led to the description of a number of Silurian and Devonian remains as algae upon what is now regarded as inadequate evidence. The geologic record is, as perhaps is to be expected, exceedingly poor, except as regards the calcareous Siphonales, which are well represented at various horizons, from the Silurian to the Tertiary; even the Diatomaceae, which are found in great quantities in the Tertiary deposits, do not occur at all earlier than the chalk. It is believed, however, that the Devonian fossil, *Nematophycus*, is a Laminarian alga, but it is not until the late Secondary and the Tertiary formations that fossil remains of algae become frequent. (See Palaeobotany.)

The subjoined list includes the larger standard works on algae, together with a number of papers to which reference is made in this article. For a detailed catalogue of Algological literature, see the "Bibliotheca Phycologica" in de Toni's *Syllope Algarum*, vol. i. (1889), with the addendum thereto in vol. iv. (1897) of the same work.

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(R. W. P.)

ALGARDI, ALESSANDRO (1602–1654), Italian sculptor, was born at Bologna in 1602. While he was attending the school of the Caracci his preference for the plastic art became evident, and he placed himself under the instruction of the sculptor Conventi. At the age of twenty he was brought under the notice of Duke Ferdinand of Mantua, who gave him several commissions. He was also much employed about the same period by jewellers and others in modelling in gold, silver and ivory. After a short residence in Venice he went to Rome in 1625 with an introduction from the duke of Mantua to the pope's nephew, Cardinal Ludovisi, who employed him for a time in the restoration of ancient statues. The death of the duke of Mantua left him to his own resources, and for several years he earned a precarious maintenance from these restorations and the commissions of goldsmiths and jewellers. In 1640 he executed for Pietro Buoncompagni his first work in marble, a colossal statue of San Filippo Neri, with kneeling angels. Immediately after, he produced a similar group, representing the execution of St Paul, for the church of the Barnabite Fathers in Bologna. These works, displaying great technical skill, though with considerable exaggeration of expression and attitude, at once established Algardi's reputation, and other commissions followed in rapid succession. The turning point in Algardi's fortune was the accession of Innocent X., of the Bolognese house of Panfili, to the papal throne in 1644. He was employed by Camillo Panfili, nephew of the pontiff, to design the Villa Doria Panfili outside the San Pancrazio gate. The most important of Algardi's other works were the monument of Leo XI., a bronze statue of Innocent X. for the capitol, and, above all, *La Fuega d'Attila*, the largest alto-relievo in the world, the two principal figures being about 10 ft. high. In 1650 Algardi met Velasquez, who obtained some interesting orders for his Italian companion in Spain. Thus there are four chimneys by Algardi in the palace of Aranjuez, where also the figures on the fountain of Neptune were executed by him. The Augustine monastery at Salamanca contains the tomb of the count and countess de Monterey, which was also the work of Algardi. From an artistic point of view, he was most successful in his portrait-statues and groups of children, where he was obliged to follow nature most closely. In his later years he became very avaricious and amassed a great fortune. He died in Rome on the 10th of June 1654.

See *Le arti di Bologna disegnate da A. Caracci ed intagliati da S. Giulini, con' assistenze d' Alessandrc A. Algardi* (1740).

ALGAROTH, POWDER OF, a basic chloride of antimony. It was known to Basil Valentine, and was used medicinally by the Veronese physician Victor Algarotus about the end of the 16th century. Its composition is probably $Sb_4O_5Cl_2$, and it may be prepared by the addition of much water to a solution of antimony chloride; a bulky amorphous precipitate being formed, which, on standing, gradually becomes crystalline. It is soluble in hydrochloric acid and tartaric acid, but insoluble in alcohol.

On its composition and preparation see E. Péligot, *Annalen*, 1847, lxiv. 280; L. Schäffer, *Annalen*, 1869, clii. 314; and R. W. E. MacIvor, *Chem. News*, 1875, xxxii. 229.

ALGAROTTI, FRANCESCO, Count (1712–1764), Italian philosopher and writer on art, was born on the 11th of December 1712 at Venice, and died at Pisa in 1764. He studied at Rome and Bologna, and at the age of twenty went to Paris, where he enjoyed the friendship of Voltaire and produced his great work *Neutonianismo per le dame*, a work on optics. Voltaire called him his *cher cygne de Padoue*. Returning from a journey to Russia, he met Frederick the Great who made him a count of Prussia (1740) and court chamberlain (1747). Augustus III. of Poland honoured him with the title of councillor. In 1754, after seven years' residence partly in Berlin and partly in Dresden, he returned to Italy, living at Venice and then at Pisa, where he died on the 3rd of May 1764. Frederick the Great erected to his memory a monument on the Campo Santo at Pisa. He was a man of wide knowledge, a connoisseur in art and music, and the friend of most of the leading authors of his time. His chief work on art is the *Saggi sopra le belle arti* (" Essays on the Fine Arts "). Among his other works may be mentioned *Poems, Travels in Russia, Essay on Painting, Correspondence.*

The best complete edition with biography was published by D. Michelessi (1791–1794).

ALGARVE, or Algarves, an ancient kingdom and province in the extreme S. of Portugal, corresponding with the modern administrative district of Faro, and bounded on the N. by Alemtejo, E. by the Spanish province of Huelva, and S. and W. by the Atlantic Ocean. Pop. (1900) 255,191; area, 1937 sq. m. The greatest length of the province is about 85 m. from E. to W.; its average breadth is about 22 m. from N. to S. The Serra de Malhão and the Serra de Monchique extend in the form of a crescent across the northern part of the province, and, sweeping to the south-west, terminate in the lofty promontory of Cape St Vincent, the south-west extremity of Europe. This headland is famous as the scene of many sea-fights, notably the defeat inflicted on the Spanish fleet in February 1797 by the British under Admiral Jervis, afterwards Earl St Vincent. Between the mountainous tracts in the north and the southern coast stretches a narrow plain, watered by numerous rivers flowing southward from the hills. The coast is fringed for 30 m. from Quarteira to Tavira, with long sandy islands, through which there are six passages, the most important being the Barra Nova, between Faro and Olhão. The navigable estuary of the Guadiana divides Algarve from Huelva, and its tributaries water the western districts. From the Serra de Malhão flow two streams, the Silves and Odelouca, which unite and enter the Atlantic below the town of Silves. In the hilly districts the roads are bad, the soil unsuited for cultivation, and the inhabitants few. Flocks of goats are reared on the mountain-sides. The level country along the southern coast is more fertile, and produces in abundance grapes, figs, oranges, lemons, olives, almonds, aloes, and even plantains and dates. The land is, however, not well suited for the production of cereals, which are mostly imported from Spain. On the coast the people gain their living in great measure from the fisheries, tunny and sardines being caught in considerable quantities. Salt is also made from sea-water. There is no manufacturing or mining industry of any importance. The harbours are bad, and almost the whole foreign trade is carried on by ships of other nations, although the inhabitants of Algarve are reputed to be the best seamen and fishermen of Portugal. The chief exports are dried fruit, wine, salt, tunny, sardines and anchovies. The only railway is the Lisbon-Faro main line, which passes north-eastward from Faro, between the Monchique and Malhão ranges. Faro (11,789), Lagos (8291), Loulé (22,478), Monchique (7345), Olhão (10,009), Silves (9687) and Tavira (12,175), the chief towns, are described in separate articles.

The name of Algarve is derived from the Arabic, and signifies a land lying to the west. The title " king of Algarve," held by the kings of Portugal, was first assumed by Alphonso III., who captured Algarve from the Moors in 1253.

ALGÄU, or Allgäu, the name now given to a comparatively small district forming the south-western corner of Bavaria, and belonging to the province of Swabia and Neuburg, but formerly applied to a much larger territory, which extended as far as the Danube on the N., the Inn on the S. and the Lech on the W. The Algäu Alps contain several lofty peaks, the highest of which is Mädelegabel (8681 ft.). The district is celebrated for its cattle, milk, butter and cheese.

ALGEBRA (from the Arab. *al-jebr wa'l-muqābala*, transposition and removal [of terms of an equation], the name of a treatise by Mahommed ben Musa al-Khwarizmi), a branch of mathematics which may be defined as the generalization and extension of arithmetic.

The subject-matter of algebra will be treated in the following article under three divisions:—A. Principles of ordinary algebra; B. Special kinds of algebra; C. History. Special phases of the subject are treated under their own headings, *e.g.* Algebraic Forms; Binomial; Combinatorial Analysis; Determinants; Equation; Continued Fraction; Function; Groups, Theory of; Logarithm; Number; Probability; Series.

A. Principles of Ordinary Algebra

1. The above definition gives only a partial view of the scope of algebra. It may be regarded as based on arithmetic, or as dealing in the first instance with formal results of the laws of arithmetical number; and in this sense Sir Isaac Newton gave the title *Universal Arithmetic* to a work on algebra. Any definition, however, must have reference to the state of development of the subject at the time when the definition is given.

2. The earliest algebra consists in the solution of equations. The distinction between algebraical and arithmetical reasoning then lies mainly in the fact that the former is in a more condensed form than the latter; an unknown quantity being represented by a special symbol, and other symbols being used as a kind of shorthand for verbal expressions. This form of algebra was extensively studied in ancient Egypt; but, in accordance with the practical tendency of the Egyptian mind, the study consisted largely in the treatment of particular cases, very few general rules being obtained.

3. For many centuries algebra was confined almost entirely to the solution of equations; one of the most important steps being the enunciation by Diophantus of Alexandria of the laws governing the use of the minus sign. The knowledge of these laws, however, does not imply the existence of a conception of negative quantities. The development of symbolic algebra by the use of general symbols to denote numbers is due to Franciscus Vieta (François Viète, 1540–1603). This led to the idea of algebra as generalized arithmetic.

4. The principal step in the modern development of algebra was the recognition of the meaning of negative quantities. This appears to have been due in the first instance to Albert Girard (1595–1632), who extended Vieta's results in various branches of mathematics. His work, however, was little known at the time, and later was overshadowed by the greater work of Descartes (1596–1650).

5. The main work of Descartes, so far as algebra was concerned, was the establishment of a relation between arithmetical and geometrical measurement. This involved not only the geometrical interpretation of negative quantities, but also the idea of continuity; this latter, which is the basis of modern analysis, leading to two separate but allied developments, viz. the theory of the function and the theory of limits.

6. The great development of all branches of mathematics in the two centuries following Descartes has led to the term algebra being used to cover a great variety of subjects, many of which are really only ramifications of arithmetic, dealt with by algebraical methods, while others, such as the theory of numbers and the general theory of series, are outgrowths of the application of algebra to arithmetic, which involve such special ideas that they must properly be regarded as distinct subjects. Some writers have attempted unification by treating algebra as concerned with functions, and Comte accordingly defined algebra as the *calculus of functions*, arithmetic being regarded as the *calculus of values*.

7. These attempts at the unification of algebra, and its separation from other branches of mathematics, have usually been accompanied by an attempt to base it, as a deductive science, on certain fundamental laws or general rules; and this has tended to increase its difficulty. In reality, the variety of algebra corresponds to the variety of phenomena. Neither

mathematics itself, nor any branch or set of branches of mathematics, can be regarded as an isolated science. While, therefore, the logical development of algebraic reasoning must depend on certain fundamental relations, it is important that in the early study of the subject these relations should be introduced gradually, and not until there is some empirical acquaintance with the phenomena with which they are concerned.

8. The extension of the range of subjects to which mathematical methods can be applied, accompanied as it is by an extension of the range of study which is useful to the ordinary worker, has led in the latter part of the 19th century to an important reaction against the specialization mentioned in the preceding paragraph. This reaction has taken the form of a return to the alliance between algebra and geometry (§5), on which modern analytical geometry is based; the alliance, however, being concerned with the application of graphical methods to particular cases rather than to general expressions. These applications are sometimes treated under arithmetic, sometimes under algebra; but it is more convenient to regard *graphics* as a separate subject, closely allied to arithmetic, algebra, mensuration and analytical geometry.

9. The association of algebra with arithmetic on the one hand, and with geometry on the other, presents difficulties, in that geometrical measurement is based essentially on the idea of continuity, while arithmetical measurement is based essentially on the idea of discontinuity; both ideas being equally matters of intuition. The difficulty first arises in elementary mensuration, where it is partly met by associating arithmetical and geometrical measurement with the cardinal and the ordinal aspects of number respectively (see ARITHMETIC). Later, the difficulty recurs in an acute form in reference to the continuous variation of a function. Reference to a geometrical interpretation seems at first sight to throw light on the meaning of a differential coefficient; but closer analysis reveals new difficulties, due to the geometrical interpretation itself. One of the most recent developments of algebra is the *algebraic theory of number*, which is devised with the view of removing these difficulties. The harmony between arithmetical and geometrical measurement, which was disturbed by the Greek geometers on the discovery of irrational numbers, is restored by an unlimited supply of the causes of disturbance.

10. Two other developments of algebra are of special importance. The theory of *sequences* and *series* is sometimes treated as a part of elementary algebra; but it is more convenient to regard the simpler cases as isolated examples, leading up to the general theory. The treatment of equations of the second and higher degrees introduces *imaginary* and *complex* numbers, the theory of which is a special subject.

11. One of the most difficult questions for the teacher of algebra is the stage at which, and the extent to which, the ideas of a negative number and of continuity may be introduced. On the one hand, the modern developments of algebra began with these ideas, and particularly with the idea of a negative number. On the other hand, the lateness of occurrence of any particular mathematical idea is usually closely correlated with its intrinsic difficulty. Moreover, the ideas which are usually formed on these points at an early stage are incomplete; and, if the incompleteness of an idea is not realized, operations in which it is implied are apt to be purely formal and mechanical. What are called negative numbers in arithmetic, for instance, are not really negative numbers but negative quantities (§ 27 (i.)); and the difficulties incident to the ideas of continuity have already been pointed out.

12. In the present article, therefore, the main portions of elementary algebra are treated in one section, without reference to these ideas, which are considered generally in two separate sections. These three sections may therefore be regarded as to a certain extent concurrent. They are preceded by two sections dealing with the introduction to algebra from the arithmetical and the graphical sides, and are followed by a section dealing briefly with the developments mentioned in §§ 9 and 10 above.

I. *Arithmetical Introduction to Algebra.*

13. *Order of Arithmetical Operations.*—It is important, before beginning the study of algebra, to have a clear idea as to the meanings of the symbols used to denote arithmetical operations.

(i.) Additions and subtractions are performed from left to right. Thus 3 ℔ + 5 ℔ − 7 ℔ + 2 ℔ means that 5 ℔ is to be added to 3 ℔, 7 ℔ subtracted from the result, and 2 ℔ added to the new result.

(ii.) The above operation is performed with 1 ℔ as the unit of counting, and the process would be the same with any other unit; *e.g.* we should perform the same process to find 3s. + 5s. − 7s. + 2s. Hence we can separate the numbers from the common unit, and replace 3 ℔ + 5 ℔ − 7 ℔ + 2 ℔ by (3 + 5 − 7 + 2) ℔, the additions and subtractions being then performed by means of an addition-table.

(iii.) Multiplications, represented by ×, are performed from right to left. Thus 5 × 3 × 7 × 1 ℔ means 5 times 3 times 7 times 1 ℔; *i.e.* it means that 1 ℔ is to be multiplied by 7, the result by 3, and the new result by 5. We may regard this as meaning the same as 5 × 3 × 7 ℔, since 7 ℔ itself means 7 × 1 ℔, and the ℔ is the unit in each case. But it does not mean the same as 5 × 21 ℔, though the two are equal, *i.e.* give the same result (see § 23).

This rule as to the meaning of × is important. If it is intended that the first number is to be multiplied by the second, a special sign such as ⋉ should be used.

(iv.) The sign ÷ means that the quantity or number preceding it is to be divided by the quantity or number following it.

(v.) The use of the *solidus* / separating two numbers is for convenience of printing fractions or fractional numbers. Thus $16/4$ does not mean $16 \div 4$, but $\frac{16}{4}$.

(vi.) Any compound operation not coming under the above descriptions is to have its meaning made clear by brackets, the use of a pair of brackets indicating that the expression between them is to be treated as a whole. Thus we should not write $8 \times 7 + 6$, but $(8 \times 7) + 6$, or $8 \times (7 + 6)$. The sign × coming immediately before, or immediately after, a bracket may be omitted; *e.g.* $8 \times (7 + 6)$ may be written $8(7 + 6)$.

This rule as to using brackets is not always observed, the convention sometimes adopted being that multiplications or divisions are to be performed before additions or subtractions. The convention is even pushed to such an extent as to make "$4\frac{1}{2} + 3\frac{2}{3}$ of $7 + 5$" mean "$4\frac{1}{2} + (3\frac{2}{3}$ of $7) + 5$"; though it is not clear what "Find the value of $4\frac{1}{2} + 3\frac{2}{3}$ times $7 + 5$" would then mean. There are grave objections to an arbitrary rule of this kind, the chief being the useless waste of mental energy in remembering it.

(vii.) The only exception that may be made to the above rule is that an expression involving multiplication-dots only, or a simple fraction written with the solidus, may have the brackets omitted for additions or subtractions, provided the figures are so spaced as to prevent misunderstanding. Thus $8 + (7 \times 6) + 3$ may be written $8 + 7.6 + 3$, and $8 + \frac{7}{6} + 3$ may be written $8 + 7/6 + 3$. But $\frac{3 \cdot 5}{2 \cdot 4}$ should be written $(3 \cdot 5)/(2 \cdot 4)$, not $3 \cdot 5/2 \cdot 4$.

14. *Latent Equations.*—The equation exists, without being shown as an equation, in all those elementary arithmetical processes which come under the head of *inverse operations*; *i.e.* processes which consist in obtaining an answer to the question "Upon what has a given operation to be performed in order to produce a given result?" or to the question "What operation of a given kind has to be performed on a given quantity or number in order to produce a given result?"

(i.) In the case of subtraction the second of these two questions is perhaps the simpler. Suppose, for instance, that we wish to know how much will be left out of 10s. after spending 3s., or how much has been spent out of 10s. if 3s. is left. In either case we may put the question in two ways:—(*a*) What must be added to 3s. in order to produce 10s., or (*b*) To what must 3s. be added in order to produce 10s. If the answer to the question is X, we have either (*a*) 10s. = 3s. + X, ∴ X = 10s. − 3s.
or (*b*) 10s. = X + 3s., ∴ X = 10s. − 3s.

(ii.) In the above case the two different kinds of statement lead to arithmetical formulae of the same kind. In the case of division we get two kinds of arithmetical formula, which, however, may be regarded as requiring a single kind of numerical process in order to determine the final result.

(*a*) If 24d. is divided into 4 equal portions, how much will each portion be?

Let the answer be X; then

$$24\text{d.} = 4 \times \text{X}, \therefore \text{X} = \tfrac{1}{4} \text{ of } 24\text{d.}$$

(*b*) Into how many equal portions of 6d. each may 24d. be divided?

Let the answer be x; then

$$24\text{d.} = x \times 6\text{d.}, \therefore x = 24\text{d.} \div 6\text{d.}$$

(iii.) Where the direct operation is evolution, for which there is no commutative law, the two inverse operations are different in kind.

(*a*) What would be the dimensions of a cubical vessel which would exactly hold 125 litres; a litre being a cubic decimetre?

Let the answer be X; then

$$125 \text{ c.dm.} = \text{X}^3, \therefore \text{X} = \sqrt[3]{125 \text{ c.dm.}} = \sqrt[3]{125} \text{ dm.}$$

(*b*) To what power must 5 be raised to produce 125?

Let the answer be x; then

$$125 = 5^x, \therefore x = \log_5 125.$$

15. With regard to the above, the following points should be noted.

(1) When what we require to know is a quantity, it is simplest to deal with this quantity as a whole. In (i.), for instance, we want to find the amount by which 10s. exceeds 3s., not the number of shillings in this amount. It is true that we obtain this result by subtracting 3 from 10 by means of a subtraction-table (concrete or ideal); but this table merely gives the generalized results of a number of operations of addition or subtraction performed with concrete units. We must count with something; and the successive somethings obtained by the addition of successive units are in fact numerical quantities, not numbers.

Whether this principle may legitimately be extended to the notation adopted in (iii.) (*a*) of § 14 is a moot point. But the present tendency is to regard the early association of arithmetic with linear measurement as important; and it seems to follow that we may properly (at any rate at an early stage of the subject) multiply a length by a length, and the product again by another length, the practice being dropped when it becomes necessary to give a strict definition of multiplication.

(2) The results may be stated briefly as follows, the more usual form being adopted under (iii.) (*a*):—

(i.) If $\text{A} = \text{B} + \text{X}$, or $= \text{X} + \text{B}$, then $\text{X} = \text{A} - \text{B}$.
(ii.) (*a*) If $\text{A} = m$ times X, then $\text{X} = \frac{1}{m}$ of A.
(*b*) If $\text{A} = x$ times M, then $x = \text{A} \div \text{M}$.
(iii.) (*a*) If $n = x^p$, then $x = \sqrt[p]{n}$.
(*b*) If $n = a^x$, then $x = \log_a n$.

The important thing to notice is that where, in any of these five cases, one statement is followed by another, the second is not to be regarded as obtained from the first by logical reasoning involving such general axioms as that "if equals are taken from equals the remainders are equal"; the fact being that the two statements are merely different ways of expressing the same relation. To say, for instance, that X is equal to $\text{A} - \text{B}$, is the same thing as to say that X is a quantity such that X and B, when added, make up A; and the above five statements of necessary connexion between two statements of equality are in fact nothing more than definitions of the symbols $-$, $\frac{1}{m}$ of, $\div$, $\sqrt[p]{}$, and $\log_a$.

An apparent difficulty is that we use a single symbol $-$ to denote the result of the two different statements in (i.) (*a*) and (i.) (*b*) of § 14. This is due to the fact that there are really two kinds of subtraction, respectively involving counting forwards (complementary addition) and counting backwards (ordinary subtraction); and it suggests that it may be wise not to use the one symbol $-$ to represent the result of both operations until the commutative law for addition has been fully grasped.

16. In the same way, a statement as to the result of an inverse operation is really, by the definition of the operation, a statement as to the result of a direct operation. If, for instance, we state that $\text{A} = \text{X} - \text{B}$, this is really a statement that $\text{X} = \text{A} + \text{B}$. Thus, corresponding to the results under § 15 (2), we have the following:—

(1) Where the inverse operation is performed on the unknown quantity or number:—

(i.) If $\text{A} = \text{X} - \text{B}$, then $\text{X} = \text{A} + \text{B}$.
(ii.) (*a*) If $\text{M} = \frac{1}{m}$ of X, then $\text{X} = m$ times M.
(*b*) If $m = \text{X} \div \text{M}$, then $\text{X} = m$ times M.
(iii.) (*a*) If $a = \sqrt[p]{x}$, then $x = a^p$.
(*b*) If $p = \log_a x$, then $x = a^p$.

(2) Where the inverse operation is performed with the unknown quantity or number:—

(i.) If $\text{B} = \text{A} - \text{X}$, then $\text{A} = \text{B} + \text{X}$.
(ii.) (*a*) If $m = \text{A} \div \text{X}$, then $\text{A} = m$ times X.
(*b*) If $\text{M} = \frac{1}{x}$ of A, then $\text{A} = x$ times M.
(iii.) (*a*) If $p = \log_x n$, then $n = x^p$.
(*b*) If $a = \sqrt[x]{n}$, then $n = a^x$.

In each of these cases, however, the reasoning which enables us to replace one statement by another is of a different kind from the reasoning in the corresponding cases of § 15. There we proceeded from the direct to the inverse operations; *i.e.* so far as the nature of arithmetical operations is concerned, we launched out on the unknown. In the present section, however, we return from the inverse operation to the direct; *i.e.* we rearrange our statement in its simplest form. The statement, for instance, that $32 - x = 25$, is really a statement that 32 is the sum of x and 25.

17. The five equalities which stand first in the five pairs of equalities in § 15 (2) may therefore be taken as the main types of a simple statement of equality. When we are familiar with the treatment of quantities by equations, we may ignore the units and deal solely with numbers; and (ii.) (*a*) and (ii.) (*b*) may then, by the commutative law for multiplication, be regarded as identical. The five processes of deduction then reduce to four, which may be described as (i.) subtraction, (ii.) division, (iii.) (*a*) taking a root, (iii.) (*b*) taking logarithms. It will be found that these (and particularly the first three) cover practically all the processes legitimately adopted in the elementary theory of the solution of equations; other processes being sometimes liable to introduce roots which do not satisfy the original equation.

18. It should be noticed that we are still dealing with the elementary processes of arithmetic, and that all the numbers contemplated in §§ 14-17 are supposed to be positive integers. If, for instance, we are told that $15 = \frac{3}{4}$ of $(x - 2)$, what is meant is that (1) there is a number u such that $x = u + 2$, (2) there is a number v such that $u = 4$ times v, and (3) $15 = 3$ times v. From these statements, working backwards, we find successively that $v = 5$, $u = 20$, $x = 22$. The deductions follow directly from the definitions, and such mechanical processes as "clearing of fractions" find no place (§ 21 (ii.)). The extension of the methods to fractional numbers is part of the establishment of the laws governing these numbers (§ 27 (ii.)).

19. *Expressed Equations.*—The simplest forms of arithmetical equation arise out of abbreviated solutions of particular problems. In accordance with § 15, it is desirable that our statements should be statements of equality of quantities rather than of numbers; and it is convenient in the early stages to have a distinctive notation, *e.g.* to represent the former by capital letters and the latter by small letters.

As an example, take the following. I buy 2 ℔ of tea, and have 6s. 8d. left out of 10s.; how much per ℔ did tea cost?

(1) In ordinary language we should say: Since 6s. 8d. was left, the amount spent was 10s. — 6s. 8d., *i.e.* was 3s. 4d. Therefore 2 ℔ of tea cost 3s. 4d. Therefore 1 ℔ of tea cost 1s. 8d.

(2) The first step towards arithmetical reasoning in such a case is the introduction of the sign of equality. Thus we say:—

Cost of 2 ℔ tea + 6s. 8d. = 10s.
∴ Cost of 2 ℔ tea = 10s. − 6s. 8d. = 3s. 4d.
∴ Cost of 1 ℔ tea = 1s. 8d

(3) The next step is to show more distinctly the unit we are dealing with (in addition to the money unit), viz. the cost of 1 ℔ tea. We write:—

$$(2\times\text{cost of 1 ℔ tea})+6\text{s. }8\text{d.}=10\text{s.}$$
$$\therefore\ 2\times\text{cost of 1 ℔ tea}=10\text{s.}-6\text{s. }8\text{d.}=3\text{s. }4\text{d.}$$
$$\therefore\ \text{Cost of 1 ℔ tea}=1\text{s. }8\text{d.}$$

(4) The stage which is introductory to algebra consists merely in replacing the unit "cost of 1 ℔ tea" by a symbol, which may be a letter or a mark such as the mark of interrogation, the asterisk, &c. If we denote this unit by X, we have

$$(2\times X)+6\text{s. }8\text{d.}=10\text{s.}$$
$$\therefore\ 2\times X=10\text{s.}-6\text{s. }8\text{d.}=3\text{s. }4\text{d.}$$
$$\therefore\ X=1\text{s. }8\text{d.}$$

20. *Notation of Multiples.*—The above is arithmetic. The only thing which it is necessary to import from algebra is the notation by which we write 2X instead of $2\times X$ or $2 . X$. This is rendered possible by the fact that we can use a single letter to represent a single number or numerical quantity, however many digits are contained in the number.

It must be remembered that, if a is a number, $3a$ means 3 times a, not a times 3; the latter must be represented by $a\times3$ or $a . 3$.

The number by which an algebraical expression is to be multiplied is called its *coefficient*. Thus in $3a$ the coefficient of a is 3. But in $3 . 4a$ the coefficient of $4a$ is 3, while the coefficient of a is $3 . 4$.

21. *Equations with Fractional Coefficients.*—As an example of a special form of equation we may take

$$\tfrac{1}{2}x+\tfrac{1}{3}x=10.$$

(i.) There are two ways of proceeding.

(*a*) The statement is that (1) there is a number u such that $x=2u$, (2) there is a number v such that $x=3v$, and (3) $u+v=10$. We may therefore conveniently take as our unit, in place of x, a number y such that $x=6y$.

We then have $3y+2y=10$,

whence $5y=10,\ y=2,\ x=6y=12$.

(*b*) We can *collect coefficients*, *i.e.* combine the separate quantities or numbers expressed in terms of x as unit into a single quantity or number so expressed, obtaining

$$\tfrac{5}{6}x=10.$$

By successive stages we obtain (§ 18) $\tfrac{1}{6}x=2$, $x=12$; or we may write at once $x=\dfrac{1}{5/6}$ of $10=\dfrac{6}{5}$ of $10=12$. The latter is the more advanced process, implying some knowledge of the laws of fractional numbers, as well as an application of the associative law (§ 26 (i.)).

(ii.) Perhaps the worst thing we can do, from the point of view of intelligibility, is to "clear of fractions" by multiplying both sides by 6. It is no doubt true that, if $\tfrac{1}{2}x+\tfrac{1}{3}x=10$, then $3x+2x=60$ (and similarly if $\tfrac{1}{2}x+\tfrac{1}{3}x+\tfrac{1}{6}x=10$, then $3x+2x+x=60$); but the fact, however interesting it may be, is of no importance for our present purpose. In the method (*a*) above there is indeed a multiplication by 6; but it is a multiplication arising out of subdivision, not out of repetition (see ARITHMETIC), so that the total (viz. 10) is unaltered.

22. *Arithmetical and Algebraical Treatment of Equations.*—The following will illustrate the passage from arithmetical to algebraical reasoning. "Coal costs 3s. a ton more this year than last year. If 4 tons last year cost 104s., how much does a ton cost this year?"

If we write X for the cost per ton this year, we have

$$4(X-3\text{s.})=104\text{s.}$$

From this we can deduce successively $X-3\text{s.}=26\text{s.}$, $X=29\text{s.}$ But, if we transform the equation into

$$4X-12\text{s.}=104\text{s.},$$

we make an essential alteration. The original statement was with regard to $X-3$s. as the unit; and from this, by the application of the distributive law (§ 26 (i.)), we have passed to a statement with regard to X as the unit. This is an algebraical process.

In the same way, the transition from $(x^2+4x+4)-4=21$ to $x^2+4x+4=25$, or from $(x+2)^2=25$ to $x+2=\sqrt{25}$, is arithmetical; but the transition from $x^2+4x+4=25$ to $(x+2)^2=25$ is algebraical, since it involves a change of the number we are thinking about.

Generally, we may say that algebraic reasoning in reference to equations consists in the alteration of the form of a statement rather than in the deduction of a new statement; *i.e.* it cannot be said that "If A=B, then E=F" is arithmetic, while "If C=D, then E=F" is algebra. Algebraic treatment consists in replacing either of the terms A or B by an expression which we know from the laws of arithmetic to be equivalent to it. The subsequent reasoning is arithmetical.

23. *Sign of Equality.*—The various meanings of the sign of equality (=) must be distinguished.

(i.) 4×3 ℔ $=12$ ℔.

This states that the *result* of the operation of multiplying 3 ℔ by 4 is 12 ℔.

(ii.) 4×3 ℔ $=3\times4$ ℔.

This states that the two operations give the same result; *i.e.* that they are *equivalent*.

(iii.) A's share = 5s., or
3 times A's share = 15s.

Either of these is a statement of fact with regard to a particular quantity; it is usually called an *equation*, but sometimes a *conditional equation*, the term "equation" being then extended to cover (i.) and (ii.).

(iv.) $x^3=x\times x\times x$.

This is a definition of x^3; the sign = is in such cases usually replaced by ≡.

(v.) 24d. = 2s.

This is usually regarded as being, like (ii.), a statement of equivalence. It is, however, only true if 1s. is equivalent to 12d., and the correct statement is then

$$\frac{1\text{s.}}{12\text{d.}}\times24\text{d.}=2\text{s.}$$

If the operator $\dfrac{1\text{s.}}{12\text{d.}}\times$ is omitted, the statement is really an equation, giving 1s. in terms of 1d. or *vice versa.*

The following statements should be compared:—

$$X=\text{A's share}=\tfrac{3}{2}\text{ of }£10=3\times£5=£15.$$
$$X=\text{A's share}=\tfrac{3}{2}\text{ of }£10=\tfrac{1}{2}\text{ of }£30=£15.$$

In each case, the first sign of equality comes under (iv.) above, the second under (iii.), and the fourth under (i.); but the third sign comes under (i.) in the first case (the statement being that $\tfrac{1}{2}$ of £10 = £5) and under (ii.) in the second.

It will be seen from § 22 that the application of algebra to equations consists in the interchange of equivalent expressions, and therefore comes under (i.) and (ii.). We replace $4(x-3)$, for instance, by $4x-4 . 3$, because we know that, whatever the value of x may be, the result of subtracting 3 from it and multiplying the remainder by 4 is the same as the result of finding $4x$ and $4 . 3$ separately and subtracting the latter from the former.

A statement such as (i.) or (ii.) is sometimes called an *identity*.

The two expressions whose equality is stated by an equation or an identity are its *members*.

24. *Use of Letters in General Reasoning.*—It may be assumed that the use of letters to denote quantities or numbers will first arise in dealing with equations, so that the letter used will in each case represent a definite quantity or number; such general statements as those of §§ 15 and 16 being deferred to a later stage. In addition to these, there are cases in which letters can usefully be employed for general arithmetical reasoning.

(i.) There are statements, such as A+B=B+A, which are particular cases of the laws of arithmetic, but need not be expressed as such. For multiplication, for instance, we have the statement that, if P and Q are two quantities, containing respectively p and q of a particular unit, then $p\times Q=q\times P$; or the more abstract statement that $p\times q=q\times p$.

(ii.) The general theory of ratio and proportion requires the use of general symbols.

(iii.) The general statement of the laws of operation of fractions is perhaps best deferred until we come to fractional numbers, when letters can be used to express the laws of multiplication and division of such numbers.

(iv.) *Variation* is generally included in text-books on algebra, but apparently only because the reasoning is general. It is part of the general theory of quantitative relation, and in its elementary stages is a suitable subject for graphical treatment (§ 31).

25. *Preparation for Algebra.*—The calculation of the values of simple algebraical expressions for particular values of letters involved is a useful exercise, but its tediousness is apt to make the subject repulsive.

What is more important is to verify particular examples of general formulae. These formulae are of two kinds:—(*a*) the general properties, such as $m(a+b)=ma+mb$, on which algebra is based, and (*b*) particular formulae such as $(x-a)(x+a)=x^2-a^2$. Such verifications are of value for two reasons. In the first place, they lead to an understanding of what is meant by the use of brackets and by such a statement as $3(7+2)=3.7+3.2$. This does not mean (cf. § 23) that the algebraic result of performing the operation $3(7+2)$ is $3.7+3.2$; it means that if we convert $7+2$ into the single number 9 and then multiply by 3 we get the same result as if we converted 3.7 and 3.2 into 21 and 6 respectively and added the results. In the second place, particular cases lay the foundation for the general formula.

Exercises in the collection of coefficients of various letters occurring in a complicated expression are usually performed mechanically, and are probably of very little value.

26. *General Arithmetical Theorems.*

(i.) The fundamental laws of arithmetic (*q.v.*) should be constantly borne in mind, though not necessarily stated. The following are some special points.

(*a*) The commutative law and the associative law are closely related, and it is best to establish each law for the case of two numbers before proceeding to the general case. In the case of addition, for instance, suppose that we are satisfied that in $a+b+c+d+e$ we may take any two, as b and c, together (association) and interchange them (commutation). Then we have $a+b+c+d+e=a+c+b+d+e$. Thus any pair of adjoining numbers can be interchanged, so that the numbers can be arranged in any order.

(*b*) The important form of the distributive law is $m(\mathrm{A}+\mathrm{B})=m\mathrm{A}+m\mathrm{B}$. The form $(m+n)\mathrm{A}=m\mathrm{A}+n\mathrm{A}$ follows at once from the fact that A is the unit with which we are dealing.

(*c*) The fundamental properties of subtraction and of division are that $\mathrm{A}-\mathrm{B}+\mathrm{B}=\mathrm{A}$ and $m\times\frac{1}{m}$ of $\mathrm{A}=\mathrm{A}$, since in each case the second operation restores the original quantity with which we started.

(ii.) The elements of the theory of numbers belong to arithmetic. In particular, the theorem that if n is a factor of a and of b it is also a factor of $pa\pm qb$, where p and q are any integers, is important in reference to the determination of greatest common divisor and to the elementary treatment of continued fractions. Graphic methods are useful here (§ 34 (iv.)). The law of relation of successive convergents to a continued fraction involves more advanced methods (see § 42 (iii.) and CONTINUED FRACTION).

(iii.) There are important theorems as to the relative value of fractions; *e.g.*

(*a*) If $\frac{a}{b}=\frac{c}{d}$, then each $=\frac{pa\pm qc}{pb\pm qd}$.

(*b*) $\frac{a+n}{b+n}$ is nearer to 1 than $\frac{a}{b}$ is; and, generally, if $\frac{a}{b}\neq\frac{c}{d}$, then $\frac{pa+qc}{pb+qd}$ lies between the two. (All the numbers are, of course, supposed to be positive.)

27. *Negative Quantities and Fractional Numbers.*—(i.) What are usually called "negative numbers" in arithmetic are in reality not negative numbers but *negative quantities.* If a person has to receive 7s. and pay 5s., with a net result of +2s., the order of the operations is immaterial. If he pays first, he then has −5s. This is sometimes treated as a debt of 5s.; an alternative method is to recognize that our zero is really arbitrary, and that in fact we shift it with every operation of addition or subtraction. But when we say "−5s." we mean "−(5s.)," not "(−5)s."; the idea of (−5) as a number with which we can perform such operations as multiplication comes later (§ 49).

(ii.) On the other hand, the conception of a *fractional number* follows directly from the use of fractions, involving the subdivision of a unit. We find that fractions follow certain laws corresponding exactly with those of integral multipliers, and we are therefore able to deal with the fractional numbers as if they were integers.

28. *Miscellaneous Developments in Arithmetic.*—The following are matters which really belong to arithmetic; they are usually placed under algebra, since the general formulae involve the use of letters.

(i.) *Arithmetical Progressions* such as 2, 5, 8, . . .—The formula for the rth term is easily obtained. The problem of finding the sum of r terms is aided by graphic representation, which shows that the terms may be taken in pairs, working from the outside to the middle; the two cases of an odd number of terms and an even number of terms may be treated separately at first, and then combined by the ordinary method, viz. writing the series backwards.

In this, as in almost all other cases, particular examples should be worked before obtaining a general formula.

(ii.) The law of *indices* (positive integral indices only) follows at once from the definition of a^2, a^3, a^4, . . . as abbreviations of $a.a$, $a.a.a$, $a.a.a.a$, . . ., or (by analogy with the definitions of 2, 3, 4, . . . themselves) of $a.a$, $a.a^2$, $a.a^3$, . . . successively. The treatment of roots and of logarithms (all being positive integers) belongs to this subject; $a=\sqrt[p]{n}$ and $p=\log_a n$ being the inverses of $n=a^p$ (cf. §§ 15, 16). The theory may be extended to the cases of $p=1$ and $p=0$; so that a^3 means $a.a.a.1$, a^2 means $a.a.1$, a^1 means $a.1$, and a^0 means 1 (there being then none of the multipliers a).

The terminology is sometimes confused. In $n=a^p$, a is the *root* or *base*, p is the *index* or *logarithm*, and n is the *power* or *antilogarithm.* Thus a, a^2, a^3, . . . are the first, second, third, . . . powers of a. But a^p is sometimes incorrectly described as "a to the power p"; the power being thus confused with the index or logarithm.

(iii.) *Scales of Notation* lead, by considering, *e.g.*, how to express in the scale of 10 a number whose expression in the scale of 8 is 2222222, to

(iv.) *Geometrical Progressions.*—It should be observed that the *radix* of the scale is exactly the same thing as the *root* mentioned under (ii.) above; and it is better to use the term "root" throughout. Denoting the root by a, and the number 2222222 in this scale by N, we have

$$\mathrm{N}=2222222.$$
$$a\mathrm{N}=22222220.$$

Thus by adding 2 to aN we can subtract N from $a\mathrm{N}+2$, obtaining 20000000, which is $=2\,.\,a^7$; and from this we easily pass to the general formula for the sum of a geometrical progression having a given number of terms.

(v.) *Permutations* and *Combinations* may be regarded as arithmetical recreations; they become important algebraically in reference to the binomial theorem (§§ 41, 44).

(vi.) *Surds and Approximate Logarithms.*—From the arithmetical point of view, surds present a greater difficulty than negative quantities and fractional numbers. We cannot solve the equation 7s.$+\mathrm{X}=$4s.; but we are accustomed to transactions of lending and borrowing, and we can therefore invent a negative quantity −3s. such that −3s.+3s.=0. We cannot solve the equation $7\mathrm{X}=$4s.; but we are accustomed to subdivision of units, and we can therefore give a meaning to X by inventing a unit $\frac{1}{7}$s. such that $7\times\frac{1}{7}$s$=1$s., and can thence pass to the idea of fractional numbers. When, however, we come to the equation $x^2=5$, where we are dealing with numbers, not with quantities, we have no concrete facts to assist us. We can, however, find a number whose square shall be as nearly equal to 5 as we please, and it is this number that we treat arithmetically as $\sqrt{5}$. We may take it to (say) 4 places of decimals; or we may suppose it to be taken to 1000 places. In actual practice, surds mainly arise out of mensuration; and we can then give an exact definition by graphical methods.

When, by practice with logarithms, we become familiar with the correspondence between additions of length on the logarithmic scale (on a slide-rule) and multiplication of numbers in the natural scale (including fractional numbers), $\sqrt{5}$ acquires a definite meaning as the number corresponding to the extremity of a length x, on the logarithmic scale, such that 5 corresponds to the extremity of $2x$. Thus the concrete fact required to enable us to pass arithmetically from the conception of a fractional number to the conception of a surd is the fact of performing calculations by means of logarithms.

In the same way we regard $\log_{10}2$, not as a new kind of number, but as an approximation.

(vii.) The use of *fractional indices* follows directly from this parallelism. We find that the product $a^m \times a^m \times a^m$ is equal to a^{3m}; and, by definition, the product $\sqrt[3]{a} \times \sqrt[3]{a} \times \sqrt[3]{a}$ is equal to a, which is a^1. This suggests that we should write $\sqrt[3]{a}$ as $a^{1/3}$; and we find that the use of fractional indices in this way satisfies the laws of integral indices. It should be observed that, by analogy with the definition of a fraction, $a^{p/q}$ mean $(a^{1/q})^p$, not $(a^p)^{1/q}$.

II. *Graphical Introduction to Algebra.*

29. The science of *graphics* is closely related to that of *mensuration.* While mensuration is concerned with the representation of geometrical magnitudes by numbers, graphics is concerned with the representation of numerical quantities by geometrical figures, and particularly by lengths. An important development, covering such diverse matters as the equilibrium of forces and the algebraic theory of complex numbers (§ 66), has relation to cases where the numerical quantity has direction as well as magnitude. There are also cases in which graphics and mensuration are used jointly; a variable numerical quantity is represented by a graph, and the principles of mensuration are then applied to determine related numerical quantities. General aspects of the subject are considered under MENSURATION; VECTOR ANALYSIS; INFINITESIMAL CALCULUS.

30. The elementary use of graphic methods is qualitative rather than quantitative; *i.e.* it is for purposes of illustration and suggestion rather than for purposes of deduction and exact calculation. We start with related facts, and adopt a particular method of visualizing the relation. One of the relations most commonly illustrated in this way is the time-relation; the passage of time being associated with the passage of a point along a straight line, so that equal intervals of time are represented by equal lengths.

31. It is important to begin the study of graphics with concrete cases rather than with tracing values of an algebraic function. Simple examples of the time-relation are—the number of scholars present in a class, the height of the barometer, and the reading of the thermometer, on successive days. Another useful set of graphs comprises those which give the relation between the expressions of a length, volume, &c., on different systems of measurement. Mechanical, commercial, economic and statistical facts (the latter usually involving the time-relation) afford numerous examples.

32. The ordinary method of representation is as follows. Let X and Y be the related quantities, their expressions in terms of selected units A and B being x and y, so that $X = x.A$, $Y = y\,.\,B$. For graphical representation we select units of length L and M, not necessarily identical. We take a fixed line OX, usually drawn horizontally; for each value of X we measure a length or *abscissa* ON equal to x.L, and draw an *ordinate* NP at right angles to OX and equal to the corresponding value of y . M. The assemblage of ordinates NP is then the *graph* of Y.

The series of values of X will in general be discontinuous, and the graph will then be made up of a succession of parallel and (usually) equidistant ordinates. When the series is theoretically continuous, the theoretical graph will be a continuous figure of which the lines actually drawn are ordinates. The upper boundary of this figure will be a line of some sort; it is this line, rather than the figure, that is sometimes called the "graph." It is better, however, to treat this as a secondary meaning. In particular, the equality or inequality of values of two functions is more readily grasped by comparison of the lengths of the ordinates of the graphs than by inspection of the relative positions of their bounding lines.

33. The importance of the bounding line of the graph lies in the fact that we can keep it unaltered while we alter the graph as a whole by moving OX up or down. We might, for instance, read temperature from 60° instead of from 0°. Thus we form the conception, not only of a zero, but also of the arbitrariness of position of this zero (cf. § 27 (i.)); and we are assisted to the conception of negative quantities. On the other hand, the alteration in the direction of the bounding line, due to alteration in the unit of measurement of Y, is useful in relation to geometrical projection.

This, however, applies mainly to the representation of values of Y. Y is represented by the length of the ordinate NP, so that the representation is cardinal; but this ordinate really corresponds to the point N, so that the representation of X is ordinal. It is therefore only in certain special cases, such as those of simple time-relations (*e.g.* "J is aged 40, and K is aged 26; when will J be twice as old as K?"), that the graphic method leads without arithmetical reasoning to the properties of negative values. In other cases the continuation of the graph may constitute a dangerous extrapolation.

34. Graphic representation thus rests on the principle that equal numerical quantities may be represented by equal lengths, and that a quantity mA may be represented by a length mL, where A and L are the respective units; and the science of graphics rests on the converse property that the quantity represented by pL is pA, *i.e.* that pA is determined by finding the number of times that L is contained in pL. The graphic method may therefore be used in arithmetic for comparing two particular magnitudes of the same kind by comparing the corresponding lengths P and Q measured along a single line OX from the same point O.

(i.) To divide P by Q, we cut off from P successive portions each equal to Q, till we have a piece R left which is less than Q. Thus $P = kQ + R$, where k is an integer.

(ii.) To continue the division we may take as our new unit a submultiple of Q, such as Q/r, where r is an integer, and repeat the process. We thus get $P = kQ + m.Q/r + S = (k + m/r)Q + S$, where S is less than Q/r. Proceeding in this way, we may be able to express $P \div Q$ as the sum of a finite number of terms $k + m/r + n/r^2 + \ . \ . \ .$; or, if r is not suitably chosen, we may not. If, *e.g.* $r = 10$, we get the ordinary expression of P/Q as an integer and a decimal; but, if P/Q were equal to 1/3, we could not express it as a decimal with a finite number of figures.

(iii.) In the above method the choice of r is arbitrary. We can avoid this arbitrariness by a different procedure. Having obtained R, which is less than Q, we now repeat with Q and R the process that we adopted with P and Q; *i.e.* we cut off from Q successive portions each equal to R. Suppose we find $Q = sR + T$, then we repeat the process with R and T; and so on. We thus express $P \div Q$ in the form of a *continued fraction*, $k + \cfrac{1}{s + \cfrac{1}{t + \&c.}}$, which is usually written, for conciseness, $k + \frac{1}{s+}\,\frac{1}{t+}\,\&c.$, or $k + \frac{1}{s} + \frac{1}{t} + \&c.$

(iv.) If P and Q can be expressed in the forms pL and qL, where p and q are integers, R will be equal to $(p - kq)$L, which is both less than pL and less than qL. Hence the successive remainders are successively smaller multiples of L, but still integral multiples, so that the series of quotients $k, s, t, \ . \ . \ .$ will ultimately come to an end. Moreover, if the last divisor is uL, then it follows from the theory of numbers (§ 26 (ii.)) that (a) u is a factor of p and of q, and (b) any number which is a factor of p and q is also a factor of u. Hence u is the greatest common measure of p and q.

35. In relation to algebra, the graphic method is mainly useful in connexion with the theory of limits (§§ 58, 61) and the functional treatment of equations (§ 60). As regards the latter, there are two classes of cases. In the first class come equations in a single unknown; here the function which is equated to zero is the Y whose values for different values of X are traced,

and the solution of the equation is the determination of the points where the ordinates of the graph are zero. The second class of cases comprises equations involving two unknowns; here we have to deal with two graphs, and the solution of the equation is the determination of their common ordinates.

Graphic methods also enter into the consideration of irrational numbers (§ 65).

III. *Elementary Algebra of Positive Numbers.*

36. *Monomials.*—(i.) An expression such as $a.2.a.a.b.c.3.a.a.c$, denoting that a series of multiplications is to be performed, is called a *monomial*; the numbers (arithmetical or algebraical) which are multiplied together being its *factors*. An expression denoting that two or more monomials are to be added or subtracted is a *multinomial* or *polynomial*, each of the monomials being a *term* of it. A multinomial consisting of two or of three terms is a *binomial* or a *trinomial*.

(ii.) By means of the commutative law we can collect like terms of a monomial, numbers being regarded as like terms. Thus the above expression is equal to $6a^5bc^2$, which is, of course, equal to other expressions, such as $6ba^5c^2$. The numerical factor 6 is called the *coefficient* of a^5bc^2 (§ 20); and, generally, the coefficient of any factor or of the product of any factors is the product of the remaining factors.

(iii.) The multiplication and division of monomials is effected by means of the law of indices. Thus $6a^5bc^2 \div 5a^2bc = \frac{6}{5}a^3c$, since $b^0 = 1$. It must, of course, be remembered (§ 23) that this is a statement of arithmetical equality; we call the statement an "identity," but we do not mean that the expressions are the same, but that, whatever the numerical values of a, b and c may be, the expressions give the same numerical result.

In order that a monomial containing a^m as a factor may be divisible by a monomial containing a^p as a factor, it is necessary that p should be not greater than m.

(iv.) In algebra we have a theory of *highest common factor* and *lowest common multiple*, but it is different from the arithmetical theory of greatest common divisor and least common multiple. We disregard numerical coefficients, so that by the H.C.F. or L.C.M. of $6a^5bc^2$ and $12a^4b^2cd$ we mean the H.C.F. or L.C.M. of a^5bc^2 and a^4b^2cd. The H.C.F. is then an expression of the form $a^pb^qc^rd^s$, where p, q, r, s have the greatest possible values consistent with the condition that each of the given expressions shall be divisible by $a^pb^qc^rd^s$. Similarly the L.C.M. is of the form $a^pb^qc^rd^s$, where p, q, r, s have the least possible values consistent with the condition that $a^pb^qc^rd^s$ shall be divisible by each of the given expressions. In the particular case it is clear that the H.C.F. is a^4bc and the L.C.M. is $a^5b^2c^2d$.

The extension to multinomials forms part of the theory of factors (§ 51).

37. *Products of Multinomials.*—(i.) Special arithmetical results may often be used to lead up to algebraical formulae. Thus a comparison of numbers occurring in a table of squares

$$\begin{array}{lcl} 1^2 = 1 & \qquad & 11^2 = 121 \\ 2^2 = 4 & & 12^2 = 144 \\ 3^2 = 9 & & 13^2 = 169 \\ \cdot & & \cdot \\ \cdot & & \cdot \end{array}$$

suggests the formula $(A+a)^2 = A^2 + 2Aa + a^2$. Similarly the equalities

$$\begin{array}{l} 99 \times 101 = 9999 = 10000 - 1 \\ 98 \times 102 = 9996 = 10000 - 4 \\ 97 \times 103 = 9991 = 10000 - 9 \\ \cdot \\ \cdot \end{array}$$

lead up to $(A-a)\ (A+a) = A^2 - a^2$. These, with $(A-a)^2 = A^2 - 2Aa + a^2$, are the most important in elementary work.

(ii.) These algebraical formulae involve not only the distributive law and the law of signs, but also the commutative law. Thus $(A+a)^2 = (A+a)(A+a) = A(A+a) + a(A+a) = AA + Aa + aA + aa$; and the grouping of the second and third terms as $2Aa$ involves treating Aa and aA as identical. This is important when we come to the binomial theorem (§ 41, and cf. § 54 (i.)).

(iii.) By writing $(A+a)^2 = A^2 + 2Aa + a^2$ in the form $(A+a)^2 = A^2 + (2A+a)a$, we obtain the rule for extracting the square root in arithmetic.

(iv.) When the terms of a multinomial contain various powers of x, and we are specially concerned with x, the terms are usually arranged in descending (or ascending) order of the indices; terms which contain the same power being grouped so as to give a single coefficient. Thus $2bx - 4x^2 + 6ab + 3ax$ would be written $-4x^2 + (3a+2b)x + 6ab$. It is not necessary to regard -4 here as a negative number; all that is meant is that $4x^2$ has to be subtracted.

(v.) When we have to multiply two multinomials arranged according to powers of x, the method of *detached coefficients* enables us to omit the powers of x during the multiplication. If any power is absent, we treat it as present, but with coefficient 0. Thus, to multiply $x^3 - 2x + 1$ by $2x^2 + 4$, we write the process

$$\begin{array}{rrrrrr} +1 & +0 & -2 & +1 & & \\ +2 & +0 & +4 & & & \\ \hline +2 & +0 & -4 & +2 & & \\ & +0 & +0 & -0 & +0 & \\ & & +4 & +0 & -8 & +4 \\ \hline +2 & +0 & +0 & +2 & -8 & +4 \end{array}$$

giving $2x^5 + 2x^2 - 8x + 4$ as the result.

38. *Construction and Transformation of Equations.*—(i.) The statement of problems in equational form should precede the solution of equations.

(ii.) The solution of equations is effected by transformation, which may be either arithmetical or algebraical. The principles of arithmetical transformation follow from those stated in §§ 15-18 by replacing X, A, B, m, M, x, n, a and p by any expressions involving or not involving the unknown quantity or number and representing positive numbers or (in the case of X, A, B and M) positive quantities. The principle of algebraic transformation has been stated in § 22; it is that, if A = B is an equation (*i.e.* if either or both of the expressions A and B involves x, and A is arithmetically equal to B for the particular value of x which we require), and if B = C is an identity (*i.e.* if B and C are expressions involving x which are different in form but are arithmetically equal for all values of x), then the statement A = C is an equation which is true for the same value of x for which A = B is true.

(iii.) A special rule of transformation is that any expression may be transposed from one side of an equation to the other, provided its sign is changed. This is the *rule of transposition*. Suppose, for instance, that $P+Q-R+S=T$. This may be written $(P+Q-R)+S=T$; and this statement, by definition of the sign $-$, is the same as the statement that $(P+Q-R) = T-S$. Similarly the statements $P+Q-R-S=T$ and $P+Q-R=T+S$ are the same. These transpositions are purely arithmetical. To transpose a term which is not the last term on either side we must first use the commutative law, which involves an algebraical transformation. Thus from the equation $P+Q-R+S=T$ and the identity $P+Q-R+S=P-R+S+Q$ we have the equation $P-R+S+Q=T$, which is the same statement as $P-R+S=T-Q$.

(iv.) The procedure is sometimes stated differently, the transposition being regarded as a corollary from a general theorem that the roots of an equation are not altered if the same expression is added to or subtracted from both members of the equation. The objection to this (cf. § 21 (ii.)) is that we do not need the general theorem, and that it is unwise to cultivate the habit of laying down a general law as a justification for an isolated action.

(v.) An alternative method of obtaining the rule of transposition is to change the zero from which we measure. Thus from $P+Q-R+S=T$ we deduce $P+(Q-R+S)=P+(T-P)$. If instead of measuring from zero we measure from P, we find $Q-R+S=T-P$. The difference between this and (iii.) is that we transpose the first term instead of the last; the two methods corresponding to the two cases under (i.) of § 15 (2).

(vi.) In the same way, we do not lay down a general rule that an equation is not altered by multiplying both members by the same number. Suppose, for instance, that $\frac{2}{5}(x+1)=\frac{4}{3}(x-2)$. Here each member is a number, and the equation may, by the commutative law for multiplication, be written $\frac{2(x+1)}{5}=\frac{4(x-2)}{3}$. This means that, whatever unit A we take, $\frac{2(x+1)}{5}$ A and $\frac{4(x-2)}{3}$ A are equal. We therefore take A to be 15, and find that $6(x+1)=20(x-2)$. Thus, if we have an equation $P=Q$, where P and Q are numbers involving fractions, we can clear of fractions, not by multiplying P and Q by a number m, but by applying the equal multiples P and Q to a number m as unit. If the P and Q of our equation were quantities expressed in terms of a unit A, we should restate the equation in terms of a unit A/m, as explained in §§ 18 and 21 (i.) (*a*).

(vii.) One result of the rule of transposition is that we can transpose all the terms in x to one side of equation, and all the terms not containing x to the other. An equation of the form $ax=b$, where a and b do not contain x, is the standard form of *simple equation.*

(viii.) The *quadratic equation* is the equation of two expressions, monomial or multinomial, none of the terms involving any power of x except x and x^2. The standard form is usually taken to be

$$ax^2+bx+c=0,$$

from which we find, by transformation,

$$(2\,ax+b)^2=b^2-4ac,$$

and thence

$$x=\frac{\sqrt{\{b^2-4ac\}}-b}{2a}.$$

This only gives one root. As to the other root, see § 47 (iii.).

39. *Fractional Expressions.*—An equation may involve a fraction of the form $\frac{P}{Q}$, where Q involves x.

(i.) If P and Q can (algebraically) be written in the forms RA and SA respectively, where A may or may not involve x, then $\frac{P}{Q}=\frac{RA}{SA}=\frac{R}{S}$, *provided A is not* $=0$.

(ii.) In an equation of the form $\frac{P}{Q}=\frac{U}{V}$, the expressions P, Q, U, V are usually numerical. We then have $\frac{P}{Q}\cdot QV.=\frac{U}{V}\cdot QV$, or $PV=UQ$, as in § 38 (vi.). This is the *rule of cross-multiplication.*

(iii.) The restriction in (i.) is important. Thus $\frac{x^2-1}{x^2+x-2}=\frac{(x-1)(x+1)}{(x-1)(x+2)}$ is equal to $\frac{x+1}{x+2}$, except when $x=1$. For this latter value it becomes $\frac{0}{0}$, which has no direct meaning, and requires interpretation (§ 61).

40. *Powers of a Binomial.*—We know that $(A+a)^2=A^2+2Aa+a^2$. Continuing to develop the successive powers of $A+a$ into multinomials, we find that $(A+a)^3=A^3+3A^2a+3Aa^2+a^3$, &c.; each power containing one more term than the preceding power, and the coefficients, when the terms are arranged in descending powers of A, being given by the following table:—

$$\begin{array}{lllllll}
1 \\
1 & 1 \\
1 & 2 & 1 \\
1 & 3 & 3 & 1 \\
1 & 4 & 6 & 4 & 1 \\
1 & 5 & 10 & 10 & 5 & 1 \\
1 & 6 & 15 & 20 & 15 & 6 & 1 \\
 & & \&c., & & & &
\end{array}$$

where the first line stands for $(A+a)^0=1.\,A^0a^0$, and the successive numbers in the $(n+1)$th line are the coefficients of A^na^0, $A^{n-1}a^1$, ... A^0a^n in the $n+1$ terms of the multinomial equivalent to $(A+a)^n$.

In the same way we have $(A-a)^2=A^2-2Aa+a^2$, $(A-a)^3=A^3-3A^2a+3Aa^2-a^3$, . . . , so that the multinomial equivalent to $(A-a)^n$ has the same coefficients as the multinomial equivalent to $(A+a)^n$, but with signs alternately + and −.

The multinomial which is equivalent to $(A\pm a)^n$, and has its terms arranged in ascending powers of a, is called the *expansion* of $(A\pm a)^n$.

41. The *binomial theorem* gives a formula for writing down the coefficient of any stated term in the expansion of any stated power of a given binomial.

(i.) For the general formula, we need only consider $(A+a)^n$. It is clear that, since the numerical coefficients of A and of a are each 1, the coefficients in the expansions arise from the grouping and addition of like terms (§ 37 (ii.)). We therefore determine the coefficients by counting the grouped terms individually, instead of adding them. To individualize the terms, we replace $(A+a)\,(A+a)\,(A+a)$ . . . by $(A+a)\,(B+b)\,(C+c)$ . . ., so that no two terms are the same; the "like"-ness which determines the placing of two terms in one group being the fact that they become equal (by the commutative law) when B, C, . . . and b, c, . . . are each replaced by A and a respectively.

Suppose, for instance, that $n=5$, so that we take five factors $(A+a)\,(B+b)\,(C+c)\,(D+d)\,(E+e)$ and find their product. The coefficient of A^2a^3 in the expansion of $(A+a)^5$ is then the number of terms such as AB*cde*, A*b*C*d*E, A*b*C*de*, . . . , in each of which there are two large and three small letters. The first term is ABCDE, in which all the letters are large; and the coefficient of A^2a^3 is therefore the number of terms which can be obtained from ABCDE by changing three, and three only, of the large letters into small ones.

We can begin with any one of the 5 letters, so that the first change can be made in 5 ways. There are then 4 letters left, and we can change any one of these. Then 3 letters are left, and we can change any one of these. Hence the change can be made in 3.4.5 ways.

If, however, the 3.4.5 results of making changes like this are written down, it will be seen that any one term in the required product is written down several times. Consider, for instance, the term A*bc*D*e*, in which the small letters are *bce*. Any one of these 3 might have appeared first, any one of the remaining 2 second, and the remaining 1 last. The term therefore occurs 1. 2. 3 times. This applies to each of the terms in which there are two large and three small letters. The total number of such terms in the multinomial equivalent to $(A+a)\,(B+b)\,(C+c)\,(D+d)\,(E+e)$ is therefore $(3.\,4.\,5)\div(1.\,2.\,3)$; and this is therefore the coefficient of A^2a^3 in the expansion of $(A+a)^5$.

The reasoning is quite general; and, in the same way, the coefficient of $A^{n-r}a^r$ in the expansion of $(A+a)^n$ is $\{(n-r+1)\,(n-r+2)\,.\,.\,.\,(n-1)n\}\div\{1.2.3\,.\,.\,.\,r\}$. It is usual to write this as a fraction, inverting the order of the factors in the numerator. Then, if we denote it by $n_{(r)}$, so that

$$n_{(r)}\equiv\frac{n\,(n-1)\ldots(n-r+1)}{1.\,2.\,3\ldots r} \qquad (1),$$

we have

$$(A+a)^n=n_{(0)}A^n+n_{(1)}A^{n-1}a+\ldots+n_{(r)}A^{n-r}a^r+\ldots+n_{(n)}a^n \qquad (2),$$

where $n_{(0)}$, introduced for consistency of notation, is defined by

$$n_{(0)}\equiv 1 \qquad (3).$$

This is the *binomial theorem* for a positive integral index.

(ii.) To verify this, let us denote the true coefficient of $A^{n-r}a^r$ by $\binom{n}{r}$, so that we have to prove that $\binom{n}{r}=n_{(r)}$, where $n_{(r)}$ is defined by (1); and let us inspect the actual process of multiplying the expansion of $(A+a)^{n-1}$ by $A+a$ in order to obtain that of $(A+a)^n$. Using detached coefficients (§ 37 (v.)), the multiplication is represented by the following:—

$$\begin{array}{ccccccccccc}
1 + & \binom{n-1}{1} & + & \binom{n-1}{2} & +\ldots+ & \binom{n-1}{r} & +\ldots+ & 1 & & & \\
 & 1 & + & \binom{n-1}{1} & +\ldots+ & \binom{n-1}{r-1} & +\ldots+ & \binom{n-1}{n-2} & +1 \\
\hline
1 + & \binom{n}{1} & + & \binom{n}{2} & +\ldots+ & \binom{n}{r} & +\ldots+ & \binom{n}{n-1} & +1,
\end{array}$$

so that

$$\binom{n}{r}=\binom{n-1}{r}+\binom{n-1}{r-1}.$$

Now suppose that the formula (2) has been established for every power of $A+a$ up to the $(n-1)$th inclusive, so that $\binom{n-1}{r}=(n-1)_{(r)}$, $\binom{n-1}{r-1}=(n-1)_{(r-1)}$. Then $\binom{n}{r}$, the coefficient of $A^{n-r}a^r$ in the expansion of $(A+a)^n$, is equal to $(n-1)_{(r)}+(n-1)_{(r-1)}$. But it may be shown that (r being >0)

$$n_{(r)}=(n-1)_{(r)}+(n-1)_{(r-1)} \qquad (4),$$

and therefore

$$\binom{n}{r}=n_{(r)}.$$

Hence the formula (2) is also true for the nth power of A+a. But it is true for the 1st and the 2nd powers; therefore it is true for the 3rd; therefore for the 4th; and so on. Hence it is true for all positive integral powers of n.

(iii.) The product 1. 2. 3 . . . r is denoted by $\underline{|r}$ or $r!$, and is called *factorial r*. The form $r!$ is better for printing, but the form $\underline{|r}$ is more convenient for ordinary use. If we denote $n(n-1)\ .\ .\ .\ (n-r+1)$ (r factors) by $n^{(r)}$, then $n_{(r)}\equiv n^{(r)}/r!$.

(iv.) We can write $n_{(r)}$ in the more symmetrical form

$$n_{(r)}=\frac{n\,!}{(n-r)\,!\ r\,!} \qquad (5),$$

which shows that

$$n_{(r)}=n_{(n-r)} \qquad (6).$$

We should have arrived at this form in (i.) by considering the selection of terms in which there are to be two large and three small letters, the large letters being written down first. The terms can be built up in 5! ways; but each will appear 2! 3! times.

(v.) Since $n_{(r)}$ is an integer, $n^{(r)}$ is divisible by $r!$; *i.e.* the *product of any r consecutive integers is divisible by r*! (see § 42 (ii.)).

(vi.) The product $r!$ arose in (i.) by the successive multiplication of $r, r-1, r-2,\ .\ .\ .\ 1$. In practice the successive factorials 1!, 2!, 3! . . . are supposed to be obtained successively by introduction of new factors, so that

$$r!=r.\ (r-1)! \qquad (7).$$

Thus in defining $r!$ as 1. 2. 3 . . . r we regard the multiplications as taking place from left to right; and similarly in $n^{(r)}$. A product in which multiplications are taken in this order is called a *continued product*.

(vii.) In order to make the formula (5) hold for the extreme values $n_{(0)}$ and $n_{(n)}$ we must adopt the convention that

$$0\,!=1 \qquad (8).$$

This is consistent with (7), which gives 1!=1.0!. It should be observed that, for $r=0$, (4) is replaced by

$$n_{(0)}=(n-1)_{(0)} \qquad (9),$$

and similarly, for the final terms, we should note that

$$p_{(q)}=0 \text{ if } q>p \qquad (10).$$

(viii.) If u_r denotes the term involving a^r in the expansion of $(\mathrm{A}+a)^n$, then $u_r/u_{r-1}=\{(n-r+1)/r\}.a/\mathrm{A}$. This decreases as r increases; its value ranging from na/A to $a/(n\mathrm{A})$. If $na<\mathrm{A}$, the terms will decrease from the beginning; if $n\,\mathrm{A}<a$, the terms will increase up to the end; if $na>\mathrm{A}$ and $n\mathrm{A}>a$, the terms will first increase up to a greatest term (or two consecutive equal greatest terms) and then decrease.

(ix.) The position of the greatest term will depend on the relative values of A and a; if a/A is small, it will be near the beginning. Advantage can be taken of this, when n is large, to make approximate calculations, by omitting terms that are negligible.

(*a*) Let S_r denote the sum $u_0+u_1+\ .\ .\ .\ +u_r$, this sum being taken so as to include the greatest term (or terms); and let $u_{r+1}/u_r=\theta$, so that $\theta<1$. Then the sum of the remaining terms $u_{r+1}+u_{r+2}+\ .\ .\ .+u_n$ is less than $(1+\theta+\theta^2+\ .\ .\ .\ +\theta^{n-r-1})u_{r+1}$, which is less than $u_{r+1}/(1-\theta)$; and therefore $(\mathrm{A}+a)^n$ lies between S_r and $\mathrm{S}_r+u_{r+1}/(1-\theta)$. We can therefore stop as soon as $u_{r+1}/(1-\theta)$ becomes negligible.

(*b*) In the same way, for the expansion of $(\mathrm{A}-a)^n$, let σ_r denote $u_0-u_1+\ .\ .\ .\ \pm u_r$. Then, provided σ_r includes the greatest term, it will be found that $(\mathrm{A}-a)^n$ lies between σ_r and σ_{r+1}.

For actual calculation it is most convenient to write the theorem in the form

$$(\mathrm{A}\pm a)^n=\mathrm{A}^n(1\pm x)^n=\mathrm{A}^n\pm\frac{n}{1}x.\mathrm{A}^n+\frac{n-1}{2}x.\frac{n}{1}x.\mathrm{A}^n\pm\ldots$$

where $x\equiv a/\mathrm{A}$; thus the successive terms are obtained by successive multiplication. To apply the method to the calculation of N^n, it is necessary that we should be able to express N in the form A+a or A−a, where a is small in comparison with A, A^n is easy to calculate and a/A is convenient as a multiplier.

42. The reasoning adopted in § 41 (ii.) illustrates two general methods of procedure. We know that $(\mathrm{A}+a)^n$ is equal to a multinomial of $n+1$ terms with unknown coefficients, and we require to find these coefficients. We therefore represent them by separate symbols, in the same way that we represent the unknown quantity in an equation by a symbol. This is the method of *undetermined coefficients*. We then obtain a set of equations, and by means of these equations we establish the required result by a process known as *mathematical induction*. This process consists in proving that a property involving p is true when p is any positive integer by proving (1) that it is true when $p=1$, and (2) that if it is true when $p=n$, where n is any positive integer, then it is true when $p=n+1$. The following are some further examples of mathematical induction.

(i.) By adding successively 1, 3, 5 . . . we obtain 1, 4, 9, . . . This suggests that, if u_n is the sum of the first n odd numbers, then $u_n=n^2$. Assume this true for $u_1,\ u_2,\ .\ .\ .,\ u_n$. Then $u_{n+1}=u_n+(2n+1)=n^2+(2n+1)=(n+1)^2$, so that it is true for u_{n+1}. But it is true for u_1. Therefore it is true generally.

(ii.) We can prove the theorem of § 41 (v.) by a double application of the method.

(*a*) It is clear that every integer is divisible by 1!.

(*b*) Let us assume that the product of every set of p consecutive integers is divisible by $p!$, and let us try to prove that the product of every set of $p+1$ consecutive integers is divisible by $(p+1)!$. Denote the product $n(n+1)\ .\ .\ .\ (n+r-1)$ by $n^{[r]}$. Then the assumption is that, whatever positive integral value n may have, $n^{[p]}$ is divisible by $p!$.

(1) $n^{[p+1]}-(n-1)^{[p+1]}=n(n+1)\ldots(n+p-1)(n+p)-(n-1)n\ .\ .\ .\ (n+p-1)=(p+1).\ n^{[p]}$. But, by hypothesis, $n^{[p]}$ is divisible by p!. Therefore $n^{[p+1]}-(n-1)^{[p+1]}$ is divisible by $p!$. Therefore, if $(n-1)^{[p+1]}$ is divisible by $(p+1)!$, $n^{[p+1]}$ is divisible by $(p+1)!$.

(2) But $1^{[p+1]}=(p+1)!$, which is divisible by $(p+1)!$.

(3) Therefore $n^{[p+1]}$ is divisible by $(p+1)!$, whatever positive integral value n may have.

(*c*) Thus, if the theorem of § 41 (v.) is true for $r=p$, it is true for $r=p+1$. But it is true for $r=1$. Therefore it is true generally.

(iii.) Another application of the method is to proving the law of formation of consecutive convergents to a continued fraction (see CONTINUED FRACTIONS).

43. *Binomial Coefficients.*—The numbers denoted by $n_{(r)}$ in § 41 are the *binomial coefficients* shown in the table in § 40; $n_{(r)}$ being the $(r+1)$th number in the $(n+1)$th row. They have arisen as the coefficients in the expansion of $(\mathrm{A}+a)^n$; but they may be considered independently as a system of numbers defined by (1) of § 41. The individual numbers are connected by various relations, some of which are considered in this section.

(i.) From (4) of § 41 we have

$$n_{(r)}-(n-1)_{(r)}=(n-1)_{(r-1)} \qquad (11).$$

Changing n into $n-1,\ n-2,\ .\ .\ .$, and adding the results,

$$n_{(r)}-(n-s)_{(r)}=(n-1)_{(r-1)}+(n-2)_{(r-1)}+\ldots+(n-s)_{(r-1)} \qquad (12).$$

In particular,

$$n_{(r)}=(n-1)_{(r-1)}+(n-2)_{(r-1)}+\ldots+(r-1)_{(r-1)} \qquad (13).$$

Similarly, by writing (4) in the form

$$n_{(r)}-(n-1)_{(r-1)}=(n-1)_{(r)} \qquad (14),$$

changing n and r into $n-1$ and $r-1$, repeating the process, and adding, we find, taking account of (9),

$$n_{(r)}=(n-1)_{(r)}+(n-2(_{(r-1)}+\ldots+(n-r-1)_0 \qquad (15).$$

(ii.) It is therefore more convenient to rearrange the table of § 40 as shown below, on the left; the table on the right giving the key to the arrangement.

$$\begin{array}{ccccccccc}
1 &&&&&&&& \\
& 1 &&&&&&& \\
1 && 1 &&&&&& \\
& 2 && 1 &&&&& \\
1 && 3 && 1 &&&& \\
& 3 && 4 && 1 &&& \\
1 && 6 && 5 && 1 && \\
& 4 && 10 && 6 && 1 & \\
1 && 10 && 15 && 7 && 1 \\
&& \&c. &&&&&&
\end{array}
\qquad
\begin{array}{ccccccccc}
0_{(0)} &&&&&&&& \\
& 1_{(1)} &&&&&&& \\
1_{(0)} && 2_{(2)} &&&&&& \\
& 2_{(1)} && 3_{(3)} &&&&& \\
2_{(0)} && 3_{(2)} && 4_{(4)} &&&& \\
& 3_{(1)} && 4_{(3)} && 5_{(5)} &&& \\
3_{(0)} && 4_{(2)} && 5_{(4)} && 6_{(6)} && \\
& 4_{(1)} && 5_{(3)} && 6_{(5)} && 7_{(7)} & \\
4_{(0)} && 5_{(2)} && 6_{(4)} && 7_{(6)} && 8_{(8)} \\
&&& \&c. &&&&&
\end{array}$$

Here we have introduced a number $0_{(0)}$ given by

$$0_{(0)}=1 \qquad (16),$$

which is consistent with the relations in (i.). In this table any number is equal to the sum of the numbers which lie horizontally above it in the preceding column, and the difference of any two numbers in a column is equal to the sum of the numbers horizontally between them in the preceding column.

The coefficients in the expansion of $(A+a)^n$ for any particular value of n are obtained by reading diagonally upwards from left to right from the $(n+1)$th number in the first column.

(iii.) The table might be regarded as constructed by successive applications of (9) and (4); the initial data being (16) and (10). Alternatively, we might consider that we start with the first diagonal row (downwards from the left) and construct the remaining diagonal rows by successive applications of (15). Constructed in this way, the successive diagonal rows, commencing with the first, give the *figurate* numbers of the first, second, third, . . . order. The $(r+1)$th figurate number of the nth order, *i.e.* the $(r+1)$th number in the nth diagonal row, is $n(n+1) \ldots (n+r-1)/r!=n^{[r]}/r!$; this may, by analogy with the notation of §41, be denoted by $n_{[r]}$. We then have

$$(n+1)_{[r]}=(r+1)_{[n]}=(n+r)!/(n!\,r!)=(n+r)_{(r)}=(n+r)_{(n)} \quad (17).$$

(iv.) By means of (17) the relations between the binomial coefficients in the form $p_{(q)}$ may be replaced by others with the coefficients expressed in the form $p_{[q]}$. The table in (ii.) may be written

$$\begin{array}{ccccccccc}
1_{[0]} &&&&&&&& \\
& 1_{[1]} &&&&&&& \\
2_{[0]} && 1_{[2]} &&&&&& \\
& 2_{[1]} && 1_{[3]} &&&&& \\
3_{[0]} && 2_{[2]} && 1_{[4]} &&&& \\
& 3_{[1]} && 2_{[3]} && 1_{[5]} &&& \\
4_{[0]} && 3_{[2]} && 2_{[4]} && 1_{[6]} && \\
& 4_{[1]} && 3_{[3]} && 2_{[5]} && 1_{[7]} & \\
5_{[0]} && 4_{[2]} && 3_{[4]} && 2_{[6]} && 1_{[8]} \\
&&& \&c. &&&&&
\end{array}$$

The most important relations are

$$n_{[r]}=n_{[r-1]}+(n-1)_{(r)} \qquad (18);$$

$$0_{[r]}=0 \qquad (19);$$

$$n_{[r]}-(n-s)_{[r]}=n_{[r-1]}+(n-1)_{[r-1]}+\ldots+(n-s+1)_{[r-1]} \quad (20);$$

$$n_{[r]}=n_{[r-1]}+(n-1)_{[r-1]}+\ldots+1_{[r-1]} \qquad (21).$$

(v.) It should be mentioned that the notation of the binomial coefficients, and of the continued products such as $n(n-1) \ldots (n-r+1)$, is not settled. Some writers, for instance, use the symbol n_r in place, in some cases, of $n_{(r)}$, and, in other cases, of $n^{(r)}$. It is convenient to retain x_r to denote $x^r/r!$, so that we have the consistent notation

$$x_r=x^r/r!,\ n_{(r)}=n^{(r)}/r!,\ n_{[r]}=n^{[r]}/r!.$$

The binomial theorem for positive integral index may then be written

$$(x+y)_n=x_n y_0+x_{n-1}y_1+\ldots+x_{n-r}y_r+\ldots+x_0 y_n.$$

This must not be confused with the use of suffixes to denote particular terms of a series or a progression (as in § 41 (viii.) and (ix.)).

44. *Permutations and Combinations.*—The discussion, in § 41 (i.), of the number of terms of a particular kind in a particular product, forms part of the theory of *combinatorial analysis* (*q.v.*), which deals with the grouping and arrangement of individuals taken from a defined stock. The following are some particular cases; the proof usually follows the lines already indicated. Certain of the individuals may be distinguishable from the remainder of the stock, but not from each other; these may be called a *type*.

(i.) A *permutation* is a linear arrangement, read in a definite direction of the line. The number $({}_nP_r)$ of permutations of r individuals out of a stock of n, all being distinguishable, is $n^{(r)}$. In particular, the number of permutations of the whole stock is $n!$.

If a of the stock are of one type, b of another, c of another, . . . the number of distinguishable permutations of the whole stock is $n!\div(a!b!c! \ldots)$.

(ii.) A *combination* is a group of individuals without regard to arrangement. The number $({}_nC_r)$ of combinations of r individuals out of a stock of n has in effect been proved in § 41 (i.) to be $n_{(r)}$. This property enables us to establish, by simple reasoning, certain relations between binomial coefficients. Thus (4) of § 41 (ii.) follows from the fact that, if A is any one of the n individuals, the ${}_nC_r$ groups of r consist of ${}_{n-1}C_{r-1}$ which contain A and ${}_{n-1}C_r$ which do not contain A. Similarly, considering the various ways in which a group of r may be obtained from two stocks, one containing m and the other containing n, we find that

$${}_{m+n}C_r={}_mC_r\cdot{}_nC_0+{}_mC_{r-1}\cdot{}_nC_1+\ldots+{}_mC_0\cdot{}_nC_r,$$

which gives

$$(m+n)_{(r)}=m_{(r)}.n_{(0)}+m_{(r-1)}.n_{(1)}+\ldots+m_{(0)}.n_{(r)} \qquad (22).$$

This may also be written

$$(m+n)^{(r)}=m^{(r)}.n^{(0)}+r_{(1)}.m^{(r-1)}.n^{(1)}+\ldots+r_{(r)}.m^{(0)}.n^{(r)} \quad (23).$$

If r is greater than m or n (though of course not greater than $m+n$), some of the terms in (22) and (23) will be zero.

(iii.) If there are n types, the number of individuals in each type being unlimited (or at any rate not less than r), the number $({}_nH_r)$ of distinguishable groups of r individuals out of the total stock is $n_{[r]}$. This is sometimes called the number of *homogeneous products of r dimensions* formed out of n letters; *i.e.* the number of products such as x^r, $x^{r-3}y^3$, $x^{r-2}z^2$, . . . that can be formed with positive integral indices out of n letters $x, y, z, \ldots$, the sum of the indices in each product being r.

(iv.) Other developments of the theory deal with *distributions*, *partitions*, &c. (see COMBINATORIAL ANALYSIS).

(v.) The theory of *probability* (*q.v.*) also comes under this head. Suppose that there are a number of arrangements of r terms or elements, the first of which a is always either A or not-A, the second b is B or not-B, the third c is C or not-C, and so on. If, out of every N cases, where N may be a very large number, a is A in pN cases and not-A in $(1-p)$N cases, where p is a fraction such that pN is an integer, then p is the *probability* or *frequency* of occurrence of A. We may consider that we are dealing always with a single arrangement abc . . . and that the number of times that a is made A bears to the number of times that a is made not-A the ratio of p to $1-p$; or we may consider that there are N individuals, for pN of which the *attribute* a is A, while for $(1-p)$N it is not-A. If, in this latter case, the proportion of cases in which b is B to cases in which b is not-B is the same for the group of pN individuals in which a is A as for the group of $(1-p)$N in which a is not-A, then the frequencies of A and of B are said to be *independent*; if this is not the case they are said to be *correlated*. The possibilities of a, instead of being A and not-A, may be $A_1, A_2, \ldots$, each of these having its own frequency; and similarly for $b, c, \ldots$ If the frequency of each A is independent of the frequency of each B, then the attributes a and b are independent; otherwise they are correlated.

45. *Application of Binomial Theorem to Rational Integral Functions.*—An expression of the form $c_0x^n+c_1x^{n-1}+\ldots+c_n$, where $c_0, c_1, \ldots$ do not involve x, and the indices of the powers of x are all positive integers, is called a *rational integral function* of x of *degree n*.

If we represent this expression by $f(x)$, the expression obtained by changing x into $x+h$ is $f(x+h)$; and each term of this may be expanded by the binomial theorem. Thus we have

$$\begin{aligned}
f(x+)h = {} & c_0x^n+nc_0x^{n-1}\frac{h}{1!}+n(n-1)c_0x^{n-2}\frac{h^2}{2!}+\ldots \\
& +c_1x^{n-1}+(n-1)c_1x^{n-2}\frac{h}{1!}+(n-1)(n-2)c_1x^{n-3}\frac{h^2}{2!}+\ldots \\
& +c_2x^{n-2}+(n-2)c_2x^{n-3}\frac{h}{1!}+(n-2)(n-3)c_2x^{n-4}\frac{h^2}{2!}+\ldots \\
& +\ \&c. \\
= {} & \{c_0x^n+c_1x^{n-1}+c_2x^{n-2}+\ldots\} \\
& +\left\{nc_0x^{n-1}+(n-1)c_1x^{n-2}+(n-2)c_2x^{n-3}+\ldots\right\}\frac{h}{1!} \\
& +\left\{n(n-1)c_0x^{n-2}+(n-1)(n-2)c_1x^{n-3}+\ldots\right\}\frac{h^2}{2!} \\
& +\ \&c.
\end{aligned}$$

It will be seen that the expression in curled brackets in each line after the first is obtained from the corresponding expression in the preceding line by a definite process; viz. x^r is replaced by

$r.x^{r-1}$, except for $r=0$, when x^0 is replaced by 0. The expressions obtained in this way are called the *first*, *second*, . . . *derived functions* of $f(x)$. If we denote these by $f_1(x), f_2(x), \ldots$, so that $f_s(x)$ is obtained from $f_{s-1}(x)$ by the above process, we have

$$f(x+h)=f(x)+f_1(x).h+f_2(x)h^2/2!+\ldots+f_r(x)h^r/r!+\ldots$$

This is a particular case of *Taylor's theorem* (see INFINITESIMAL CALCULUS).

46. *Relation of Binomial Coefficients to Summation of Series.*—(i.) The sum of the first n terms of an ordinary arithmetical progression $(a+b)$, $(a+2b)$, . . . $(a+nb)$ is (§ 28 (i.)) $\frac{1}{2}n\{(a+b)+(a+nb)\} = na+\frac{1}{2}n(n+1)b = n_{[1]}.a+n_{[2]}.b$. Comparing this with the table in §43 (iv.), and with formula (21), we see that the series expressing the sum may be regarded as consisting of two, viz. $a+a+\ldots$ and $b+2b+3b+\ldots$; for the first series we multiply the table (*i.e.* each number in the table) by a, and for the second series we multiply it by b, and the terms and their successive sums are given for the first series by the first and the second columns, and for the second series by the second and the third columns.

(ii.) In the same way, if we multiply the table by c, the sum of the first n numbers in any column is equal to the nth number in the next following column. Thus we get a formula for the sum of n terms of a series such as

$$2.4.6+4.6.8+\ldots, \text{ or } 6.8.10.12+8.10.12.14+\ldots$$

(iii.) Suppose we have such a series as $2.5+5.8+8.11+\ldots$ This cannot be summed directly by the above method. But the nth term is $(3n-1)(3n+2)=18n_{[2]}-6n_{[1]}-2$. The sum of n terms is therefore (§ 43 (iv.))

$$18n_{[3]}-6n_{[2]}-2n_{[1]}=3n^3+6n^2+n.$$

(iv.) Generally, let N be any rational integral function of n of degree r. Then, since $n_{[r]}$ is also a rational integral function of n of degree r, we can find a coefficient c_r, not containing n, and such as to make $N-c_r n_{[r]}$ contain no power of n higher than n^{r-1}. Proceeding in this way, we can express N in the form $c_r.n_{[r]}+c_{r-1}.n_{[r-1]}+\ldots$, where $c_r, c_{r-1}, c_{r-2}, \ldots$ do not contain n; and thence we can obtain the sum of the numbers found by putting $n=1, 2, 3, \ldots n$ successively in N. These numbers constitute an *arithmetical progression of the rth order*.

(v.) A particular case is that of the sum $1^r+2^r+3^r+\ldots+n^r$, where r is a positive integer. It can be shown by the above reasoning that this can be expressed as a series of terms containing descending powers of n, the first term being $n^{r+1}/(r+1)$. The most important cases are

$$1+2+3+\ldots+n=\tfrac{1}{2}n(n+1),$$
$$1^2+2^2+3^2+\ldots+n^2=\tfrac{1}{6}n(n+1)(2n+1),$$
$$1^3+2^3+3^3+\ldots+n^3=\tfrac{1}{4}n^2(n+1)^2=(1+2+\ldots+n)^2.$$

The general formula (which is established by more advanced methods) is

$$\tfrac{1}{2}.0^r+1^r+2^r+\ldots+(n-1)^r+\tfrac{1}{2}n^r$$
$$=\frac{1}{r+1}\left\{n^{r+1}+B_1(r+1)_{(2)}n^{r-1}-B_2(r+1)_{(4)}n^{r-3}+\ldots\right\},$$

where B_1, B_2, . . . are certain numbers known as *Bernoulli's numbers*, and the terms within the bracket, after the first, have signs alternately + and −. The values of the first ten of Bernoulli's numbers are

$$B_1=\tfrac{1}{6},\ B_2=\tfrac{1}{30},\ B_3=\tfrac{1}{42},\ B_4=\tfrac{1}{30},\ B_5=\tfrac{5}{66},\ B_6=\tfrac{691}{2730},\ B_7=\tfrac{7}{6},$$
$$B_8=\tfrac{3617}{510},\ B_9=\tfrac{43867}{798},\ B_{10}=\tfrac{174611}{330}.$$

IV. *Negative Numbers and Formal Algebra.*

47. Negative quantities will have arisen in various ways, *e.g.*

(i.) The logical result of the commutative law, applied to a succession of additions and subtractions, is to produce a negative quantity $-3s.$ such that $-3s.+3s.=0$ (§ 28 (vi.)).

(ii.) Simple equations, especially equations in which the unknown quantity is an interval of time, can often only be satisfied by a negative solution (§ 33).

(iii.) In solving a quadratic equation by the method of § 38 (viii.) we may be led to a result which is apparently absurd. If, for instance, we inquire as to the time taken to reach a given height by a body thrown upwards with a given velocity, we find that the time increases as the height decreases. Graphical representation shows that there are two solutions, and that an equation $X^2=9a^2$ may be taken to be satisfied not only by $X=3a$ but also by $X=-3a$.

48. The occurrence of negative quantities does not, however, involve the conception of negative numbers. In (iii.) of § 47, for instance, "$-3a$" does not mean that a is to be taken $(-3\cdot)$ times, but that a is to be taken 3 times, and the result treated as subtractive; *i.e.* $-3a$ means $-(3a)$, not $(-3)a$ (cf. § 27 (i.)).

In the graphic method of representation the sign − may be taken as denoting a reversal of direction, so that, if + 3 represents a length of 3 units measured in one direction, −3 represents a length of 3 units measured in the other direction. But even so there are two distinct operations concerned in the −3, viz. the multiplication by 3 and the reversal of direction. The graphic method, therefore, does not give any direct assistance towards the conception of negative numbers as operators, though it is useful for interpreting negative quantities as results.

49. In algebraical transformations, however, such as $(x-a)^2=x^2-2ax+a^2$, the arithmetical rule of signs enables us to combine the sign − with a number and to treat the result as a whole, subject to its own laws of operation. We see first that any operation with $4a-3b$ can be regarded as an operation with $(+)4a+(-)3b$, subject to the conditions (1) that the signs $(+)$ and $(-)$ obey the laws $(+)(+)=(+), (+)(-)=(-)(+)=(-), (-)(-)=(+)$, and (2) that, when processes of multiplication are completed, a quantity is to be added or subtracted according as it has the sign $(+)$ or $(-)$ prefixed. We are then able to combine any number with the + or the − sign inside the bracket, and to deal with this constructed symbol according to special laws; *i.e.* we can replace pr or $-pr$ by $(+p)r$ or $(-p)r$, subject to the conditions that $(+p).(+q)=(-p)(-q)=(+pq)$, $(+p)(-q)=(-p)(+q)=(-pq)$, and that $+(-s)$ means that s is to be subtracted.

These constructed symbols may be called *positive* and *negative coefficients*; or a symbol such as $(-p)$ may be called a *negative number*, in the same way that we call $\frac{2}{3}$ a fractional number.

This increases the extent of the numbers with which we have to deal; but it enables us to reduce the number of formulae. The binomial theorem may, for instance, be stated for $(x+a)^n$ alone; the formula for $(x-a)^n$ being obtained by writing it as $\{x+(-)a\}^n$ or $\{x+(-a)\}^n$, so that

$$(x-a)^n=x^n-n_{(1)}x^{n-1}a+\ldots+(-)^r n_{(r)}x^{n-r}a^r+\ldots,$$

where $+(-)^r$ means − or + according as r is odd or even.

The result of the extension is that the number or quantity represented by any symbol, such as P, may be either positive or negative. The numerical value is then represented by $|P|$; thus "$|x|<1$" means that x is between −1 and +1.

50. The use of negative coefficients leads to a difference between arithmetical division and *algebraical division* (by a multinomial), in that the latter may give rise to a quotient containing subtractive terms. The most important case is division by a binomial, as illustrated by the following examples:—

$$\begin{array}{lll} & (1) & \\ 2.10+1) & 6.100+5.10+1 & (3.10+1 \\ & \underline{6.100+3.10} & \\ & \qquad 2.10+1 & \\ & \qquad \underline{\underline{2.10+1}} & \end{array} \qquad \begin{array}{lll} & (2) & \\ 2.10+1) & 6.100+1.10-1 & (3.10-1 \\ & \underline{6.100+3.10} & \\ & \qquad -2.10-1 & \\ & \qquad \underline{\underline{-2.10-1}} & \end{array}$$

In (1) the division is both arithmetical and algebraical, while in (2) it is algebraical, the quotient for arithmetical division being $2.10+9$.

It may be necessary to introduce terms with zero coefficients. Thus, to divide 1 by $1+x$ algebraically, we may write it in the form $1+0.x+0.x^2+0.x^3+0.x^4$, and we then obtain

$$\frac{1}{1+x}=\frac{1+0.x+0.x^2+0.x^3+0.x^4}{1+x}=1-x+x^2-x^3+\frac{x^4}{1+x},$$

where the successive terms of the quotient are obtained by a process which is purely formal.

51. If we divide the sum of x^2 and a^2 by the sum of x and a, we get a quotient $x-a$ and remainder $2a^2$, or a quotient $a-x$ and remainder $2x^2$, according to the order in which we work Algebraical division therefore has no definite meaning unless

dividend and divisor are rational integral functions of some expression such as x which we regard as the root of the notation (§ 28 (iv.)), and are arranged in descending or ascending powers of x. If P and M are rational integral functions of x, arranged in descending powers of x, the division of P by M is complete when we obtain a remainder R whose degree (§ 45) is less than that of M. If $R=0$, then M is said to be a *factor* of P.

The *highest common factor* (or common factor of highest degree) of two rational integral functions of x is therefore found in the same way as the G.C.M. in arithmetic; numerical coefficients of the factor as a whole being ignored (cf. § 36 (iv.)).

52. *Relation between Roots and Factors.*—(i.) If we divide the multinomial

$$P \equiv p_0x^n + p_1x^{n-1} + \ldots + p_n$$

by $x-a$, according to algebraical division, the remainder is

$$R \equiv p_0a^n + p_1a^{n-1} + \ldots + p_n.$$

This is the *remainder-theorem*; it may be proved by induction.

(ii.) If $x=a$ satisfies the equation $P=0$, then $p_0a^n+p_1a^{n-1}+\ldots+p_n=0$; and therefore the remainder when P is divided by $x-a$ is 0, *i.e.* $x-a$ is a factor of P.

(iii.) Conversely, if $x-a$ is a factor of P, then $p_0a^n+p_1a^{n-1}+\ldots+p_n=0$; *i.e.* $x=a$ satisfies the equation $P=0$.

(iv.) Thus the problems of determining the roots of an equation $P=0$ and of finding the factors of P, when P is a rational integral function of x, are the same.

(v.) In particular, the equation $P=0$, where P has the value in (i.), cannot have more than n different roots.

The consideration of cases where two roots are equal belongs to the theory of equations (see EQUATION).

(vi.) It follows that, if two multinomials of the nth degree in x have equal values for more than n values of x, the corresponding coefficients are equal, so that the multinomials are equal for all values of x.

53. *Negative Indices and Logarithms.*—(i.) Applying the general principles of §§ 47-49 to indices, we find that we can interpret X^{-m} as being such that

$$X^m.X^{-m} = X^0 = 1; \text{ i.e. } X^{-m} = 1/X^m.$$

In the same way we interpret $X^{-p/q}$ as meaning $1/X^{p/q}$.

(ii.) This leads to negative logarithms (see LOGARITHM).

54. *Laws of Algebraic Form.*—(i.) The results of the addition, subtraction and multiplication of multinomials (including monomials as a particular case) are subject to certain laws which correspond with the laws of arithmetic (§ 26 (i.)) but differ from them in relating, not to arithmetical value, but to algebraic form. The commutative law in arithmetic, for instance, states that $a+b$ and $b+a$, or ab and ba, are equal. The corresponding law of form regards $a+b$ and $b+a$, or ab and ba, as being not only equal but identical (cf. § 37 (ii.)), and then says that $A+B$ and $B+A$, or AB and BA, are identical, where A and B are any multinomials. Thus $a(b+c)$ and $(b+c)a$ give the same result, though it may be written in various ways, such as $ab+ac$, $ca+ab$, &c. In the same way the associative law is that A(BC) and (AB)C give the same formal result.

These laws can be established either by tracing the individual terms in a sum or a product or by means of the general theorem in § 52 (vi.).

(ii.) One result of these laws is that, when we have obtained any formula involving a letter a, we can replace a by a multinomial. For instance, having found that $(x+a)^2=x^2+2ax+a^2$, we can deduce that $(x+b+c)^2=\{x+(b+c)\}^2=x^2+2(b+c)x+(b+c)^2$.

(iii.) Another result is that we can *equate* coefficients of like powers of x in two multinomials obtained from the same expression by different methods of expansion. For instance, by equating coefficients of x^r in the expansions of $(1+x)^{m+n}$ and of $(1+x)^m.(1+x)^n$ we obtain (22) of § 44 (ii.).

(iv.) On the other hand, the method of equating coefficients often applies without the assumption of these laws. In § 41 (ii.), for instance, the coefficient of $A^{n-r}a^r$ in the expansion of $(A+a)(A+a)^{n-1}$ has been called $\binom{n}{r}$; and it has then been shown that $\binom{n}{r}=\binom{n-1}{r}+\binom{n-1}{r-1}$. This does not involve any assumption of the identity of results obtained in different ways; for the expansions of $(A+a)^2$, $(A+a)^3$, ... are there supposed to be obtained in one way only, viz. by successive multiplications by $A+a$.

55. *Algebraical Division.*—In order to extend these laws so as to include division, we need a definition of algebraical division. The divisions in §§ 50-52 have been supposed to be performed by a process similar to the process of arithmetical division, viz. by a series of subtractions. This latter process, however, is itself based on a definition of division in terms of multiplication (§§ 15, 16). If, moreover, we examine the process of algebraical division as illustrated in § 50, we shall find that, just as arithmetical division is really the solution of an equation (§ 14), and involves the tacit use of a symbol to denote an unknown quantity or number, so algebraical division by a multinomial really implies the use of undetermined coefficients (§ 42). When, for instance, we find that the quotient, when $6+5x+7x^2+13x^3+5x^4$ is divided by $2+3x+x^2$, is made up of three terms $+3$, $-2x$, and $+5x^2$, we are really obtaining successively the values of c_0, c_1, and c_2 which satisfy the identity $6+5x+7x^2+13x^3+5x^4=(c_0+c_1x+c_2x^2)(2+3x+x^2)$; and we could equally obtain the result by expanding the right-hand side of this identity and equating coefficients in the first three terms, the coefficients in the remaining terms being then compared to see that there is no remainder. We therefore define algebraical division by means of algebraical multiplication, and say that, if P and M are multinomials, the statement "$P/M=Q$" means that Q is a multinomial such that MQ (or QM) and P are identical. In this sense, the laws mentioned in § 54 apply also to algebraical division.

56. *Extensions of the Binomial Theorem.*—It has been mentioned in § 41 (ix.) that the binomial theorem can be used for obtaining an approximate value for a power of a number; the most important terms only being taken into account. There are extensions of the binomial theorem, by means of which approximate calculations can be made of fractions, surds, and powers of fractions and of surds; the main difference being that the number of terms which can be taken into account is unlimited, so that, although we may approach nearer and nearer to the true value, we never attain it exactly. The argument involves the theorem that, if θ is a positive quantity less than 1, θ^t can be made as small as we please by taking t large enough; this follows from the fact that $t\log\theta$ can be made as large (numerically) as we please.

(i.) By algebraical division,

$$\frac{1}{1+x} = \frac{1+0.x+0.x^2+\ldots+0.x^{r+1}}{1+x}$$
$$= 1-x+x^2-\ldots+(-)^rx^r+(-)^{r+1}\frac{x^{r+1}}{1+x} \quad (24).$$

If, therefore, we take $1/(1+x)$ as equal to $1-x+x^2-\ldots+(-)^rx^r$, there is an error whose numerical magnitude is $|x^{r+1}/(1+x)|$; and, if $|x|<1$, this can be made as small as we please.

This is the foundation of the use of recurring decimals; thus we can replace $\frac{4}{11}\{=\frac{36}{99}=\frac{36}{100}/(1-\frac{1}{100})\}$ by $\cdot363636(=36/10^2+36/10^4+36/10^6)$, with an error (in defect) of only $36/(10^6\ .99)$.

(ii.) Repeated divisions of (24) by $1+x$, r being replaced by $r+1$ before each division, will give

$$(1+x)^{-2} = 1-2x+3x^2-4x^3+\ldots+(-)^r(r+1)x^r$$
$$+(-)^{r+1}x^{r+1}\{(r+1)(1+x)^{-1}+(1+x)^{-2}\},$$
$$(1+x)^{-3} = 1-3x+6x^2-10x^3+\ldots+(-)^r.\tfrac{1}{2}(r+1)(r+2)x^r$$
$$+(-)^{r+1}x^{r+1}\{\tfrac{1}{2}(r+1)(r+2)(1+x)^{-1}+(r+1)(1+x)^{-2}+(1+x)^{-3}\}, \&c.$$

Comparison with the table of binomial coefficients in § 43 suggests that, if m is any positive integer,

$$(1+x)^{-m} = S_r + R_r \quad (25),$$

where

$$S_r \equiv 1 - m_{[1]}x + m_{[2]}x^2 \ldots + (-)^r m_{[r]}x^r \quad (26),$$

$$R_r \equiv (-)^{r+1}x^{r+1}\{m_{[r]}(1+x)^{-1}+(m-1)_{[r]}(1+x)^{-2}+\ldots+1_{[r]}(1+x)^{-m}\} \quad (27).$$

This can be verified by induction. The same result would (§ 55) be obtained if we divided $1+0.x+0.x^2+\ldots$ at once by the expansion of $(1+x)^m$.

(iii.) From (21) of § 43 (iv.) we see that $|R_r|$ is less than $m_{[r+1]}x^{r+1}$ if x is positive, or than $|m_{[r+1]}x^{m+1}(1+x)^{-m}|$ if x is negative; and it can hence be shown that, if $|x|<1$, $|R_r|$ can be made as small as we please by taking r large enough, so that we can make S_r approximate as closely as we please to $(1+x)^{-m}$.

(iv.) To assimilate this to the binomial theorem, we extend the definition of $n_{(r)}$ in (1) of § 41 (i.) so as to cover negative integral values of n; and we then have

$$(-m)_{(r)}=\frac{(-m)(-m-1)\dots(-m-r+1)}{r!}=(-)^r m_{[r]} \quad (28),$$

so that, if $n\equiv -m$,

$$S_r\equiv 1+n_{(1)}x+n_{(2)}x^2+\dots+n_{(r)}x^r \quad (29).$$

(v.) The further extension to fractional values (positive or negative) of n depends in the first instance on the establishment of a method of algebraical evolution which bears the same relation to arithmetical evolution (calculation of a surd) that algebraical division bears to arithmetical division. In calculating $\sqrt{2}$, for instance, we proceed as if $2{\cdot}0000\dots$ were the exact square of some number of the form $c_0+c_1/10+c_2/10^2+\dots$

In the same way, to find $X^{1/q}$, where $X\equiv 1+a_1x+a_2x^2+\dots$ and q is a positive integer, we assume that $X^{1/q}=1+b_1x+b_2x^2\dots$, and we then (cf. § 55) determine $b_1, b_2, \dots$ in succession so that $(1+b_1x+b_2x^2+\dots)^q$ shall be identical with X.

The application of the method to the calculation of $(1+x)^n$, when $n=p/q$, q being a positive integer and p a positive or negative integer, involves, as in the case where n is a negative integer, the separate consideration of the form of the coefficients $b_1, b_2, \dots$ and of the numerical value of $1+b_1x+b_2x^2+\dots+b_rx^r$.

(vi.) The definition of $n_{(r)}$, which has already been extended in (iv.) above, has to be further extended so as to cover fractional values of n, positive or negative. Certain relations still hold, the most important being (22) of § 44 (ii.), which holds whatever the values of m and of n may be; r, of course, being a positive integer. This may be proved either by induction or by the method of § 52 (vi.). The relation, when written in the form (23), is known as *Vandermonde's theorem*. By means of this theorem it can be shown that, whatever the value of n may be,

$$\{1+(p/q)_{(1)}x+(p/q)_{(2)}x^2+\dots+(p/q)_{(r)}x^r\}^q=1+p_{(1)}x+p_{(2)}x^2+\dots+p_{(r)}x^r \\ +\text{terms in } x^{r+1}, x^{r+2},\dots x^{qr}.$$

(vii.) The comparison of the numerical value of $1+n_{(1)}x+n_{(2)}x^2+\dots+n_{(r)}x^r$, when n is fractional, with that of $(1+x)^n$, involves advanced methods (§ 64). It is found that this expression can be used for approximating to the value of $(1+x)^n$, provided that $|x|<1$; the results are as follows, where u_r denotes $n_{(r)}\,x^r$ and S_r denotes $u_0+u_1+u_2+\dots+u_r$.

(*a*) If $n>-1$, then, provided $r>n$,

(1) If $1>x>0$, $(1+x)^n$ lies between S_r and S_{r+1};
(2) If $0>x>-1$, $(1+x)^n$ lies between S_r and $S_r+u_{r+1}/(1+x)$.

(*b*) If $n<-1$, the successive terms will either constantly decrease (numerically) from the beginning or else increase up to a greatest term (or two equal consecutive greatest terms) and then constantly decrease. If S_r is taken so as to include the greatest term (or terms), then,

(1) If $1>x>0$, $(1+x)^n$ lies between S_r and S_{r+1};
(2) If $0>x>-1$, $(1+x)^n$ lies between S_r and $S_r+u_{r+1}/(1-u_{r+1}/u_r)$.

The results in (*b*) apply also if n is a negative integer.

(viii.) In applying the theorem to concrete cases, conversion of a number into a continued fraction is often useful. Suppose, for instance, that we require to calculate $(23/13)^{\frac{3}{2}}$. We want to express $(23/13)^3$ in the form a^2b, where b is nearly equal to 1. We find that $\frac{3}{2}\log_{10}(23/13)={\cdot}3716767=\log_{10}(2{\cdot}3533)=\log_{10}(40/17)$ nearly; and thence that $(23/13)^{\frac{3}{2}}=(40/17)\,(1+1063/3515200)^{\frac{1}{2}}$, which can be calculated without difficulty to a large number of significant figures.

(ix.) The extension of $n_{(r)}$, and therefore of $n_{[r]}$, to negative and fractional values of n, enables us to extend the applicability of the binomial coefficients to the summation of series (§ 46 (ii.)). Thus the nth term of the series $2.5+5.8+8.11+\dots$ in § 46 (iii.) is $18(n-\frac{1}{3})_{[2]}$; formula (20) of § 43 (iv.) holds for the extended coefficients, and therefore the sum of n terms of this series is $18.(n-\frac{1}{3})_{[3]}-18.\,(-\frac{1}{3})_{[3]}=3n^3+6n^2+n$. In this way we get the general rule that, to find the sum of n terms of a series, the rth term of which is $(a+rb)(a+\overline{r+1}\cdot b)\dots(a+\overline{r+p-1}\cdot b)$, we divide the product of the $p+1$ factors which occur either in the nth or in the $(n+1)$th term by $p+1$, and by the common difference of the factors, and add to a constant, whose value is found by putting $n=0$.

57. *Generating Functions.*—The series $1-m_{[1]}x+m_{[2]}x^2-\dots$ obtained by dividing $1+0.\,x+0.x^2+\dots$ by $(1+x)^n$, or the series $1+(p/q)_{(1)}x+(p/q)_{(2)}x^2+\dots$ obtained by taking the qth root of $1+p_{(1)}x+p_{(2)}x^2+\dots$, is an *infinite series*, *i.e.* a series whose successive terms correspond to the numbers 1, 2, 3, … It is often convenient, as in § 56 (ii.) and (vi.), to consider the mode of development of such a series, without regard to arithmetical calculation; *i.e.* to consider the relations between the coefficients of powers of x, rather than the values of the terms themselves. From this point of view, the function which, by algebraical operations on $1+0.x+0.x^2+\dots$, produces the series, is called its *generating function*. The generating functions of the two series, mentioned above, for example, are $(1+x)^{-m}$ and $(1+x)^{p/q}$. In the same way, the generating function of the series $1+2x+x^2+0.x^3+0.x^4+\dots$ is $(1+x)^2$.

Considered in this way, the relations between the coefficients of the powers of x in a series may sometimes be expressed by a formal equality involving the series as a whole. Thus (4) of § 41 (ii.) may be written in the form

$$1+n_{(1)}x+n_{(2)}x^2+\dots+n_{(r)}x^r+\dots\underset{f}{=}(1+x)\{1+(n-1)_{(1)}x+(n-1)_{(2)}x^2+\dots \\ +(n-1)_{(r)}x^r+\dots\};$$

the symbol "$\underset{f}{=}$" being used to indicate that the equality is only formal, not arithmetical.

This accounts for the fact that the same table of binomial coefficients serves for the expansions of positive powers of $1+x$ and of negative powers of $1-x$. For (4) may (§ 43 (iv.)) be written

$$(n-1)_{[r]}=n_{[r]}-n_{[r-1]},$$

and this leads to relations of the form

$$1+2x+3x^2+\dots\underset{f}{=}(1-x)(1+3x+6x^2+10x^3+\dots) \quad (30),$$

each set of coefficients being the numbers in a downward diagonal of the table. In the same way (21) of § 43 (iv.) leads to such relations as

$$1+3x+6x^2+\dots\underset{f}{=}(1+x+x^2+\dots)(1+2x+3x^2+\dots) \quad (31),$$

the relation of which to (30) is obvious.

An application of the method is to the summation of a *recurring series*, *i.e.* a series $c_0+c_1x+c_2x^2+\dots$ whose coefficients are connected by a relation of the form $p_0c_r+p_1c_{r-1}+\dots+p_kc_{r-k}=0$, where $p_0,p_1,\dots p_k$ are independent of x and of r.

58. *Approach to a Limit.*—There are two kinds of approach to a limit, which may be illustrated by the series forming the expansion of $(x+h)^n$, where n is a negative integer and $1>h/x>0$.

(i.) Denote $n_{(r)}x^{n-r}h^r$ by u_r, and $u_0+u_1+\dots+u_r$ by S_r. Then (§ 56 (iii.)) $(x+h)^n$ lies between S_r and S_{r+1}; and provided S_r includes the numerically greatest term, $|S_{r+1}-S_r|$ constantly decreases as r increases, and can be made as small as we please by taking r large enough. Thus by taking $r=0, 1, 2, \dots$ we have a *sequence* $S_0, S_1, S_2, \dots$ (*i.e.* a succession of numbers corresponding to the numbers 1, 2, 3, …) which possesses the property that, by starting far enough in the sequence, the range of variation of all subsequent terms can be made as small as we please, but $(x+h)^n$ always lies between the two values determining the range. This is expressed by saying that the sequence *converges* to $(x+h)^n$ as its *limit*; it may be stated concisely in any of the three ways,

$$(x+h)^n=\lim(x^n+n_{(1)}x^{n-1}h+\dots+n_{(r)}x^{n-r}h^r+\dots),\ (x+h)^n=\lim S_r, \\ S_r \doteq (x+h)^n.$$

It will be noticed that, although the differences between successive terms of the sequence will ultimately become indefinitely small, there will always be intermediate numbers that do not occur in the sequence. The approach to the limit will therefore be by a series of jumps, each of which, however small, will be finite; *i.e.* the approach will be discontinuous.

(ii.) Instead of examining what happens as r increases, let us examine what happens as h/x decreases, r remaining unaltered. Denote h/x by θ, where $1>\theta>0$; and suppose further that $\theta<|1/n|$, so that the first term of the series $u_0+u_1+u_2+\dots$ is the greatest (numerically). Then $\{(x+h)^n - S_r\}/h^{r+1}$ lies between $n_{(r+1)}x^{n-r-1}$ and $n_{(r+1)}x^{n-r-1}(1+\theta)^n$; and the difference between these can be made as small as we please by taking h small enough. Thus we can say that the limit of $\{(x+h)^n - S_r\}/h^{r+1}$ is $n_{(r+1)}x^{n-r-1}$; but the approach to this limit is of a different kind from that considered in (i.), and its investigation involves the idea of continuity.

V. *Continuity.*

59. The idea of continuity must in the first instance be introduced from the graphical point of view; arithmetical continuity being impossible without a considerable extension of the idea of number (§ 65). The idea is utilized in the elementary consideration of a differential coefficient; and its importation into the treatment of certain functions as continuous is therefore properly associated with the infinitesimal calculus.

60. The first step consists in the functional treatment of equations. Thus, to solve the equation $ax^2+bx+c=0$, we consider, not merely the value of x for which ax^2+bx+c is 0, but the value of ax^2+bx+c for every possible value of x. By graphical treatment we are able, not merely to see why the equation has usually two roots, and also to understand why there is in certain cases only one root (*i.e.* two equal roots) and in other cases no root, but also to see why there cannot be more than two roots.

Simultaneous equations in two unknowns x and y may be treated in the same way, except that each equation gives a functional relation between x and y. ("Indeterminate equations" belong properly to the theory of numbers.)

61. From treating an expression involving x as a function of x which may change continuously when x changes continuously, we are led to regard two functions x and y as changing together, so that (subject to certain qualifications) to any succession of values of x or of y there corresponds a succession of values of y or of x; and thence, if (x, y) and $(x+h, y+k)$ are pairs of corresponding values, we are led to consider the limit (§ 58 (ii.)) of the ratio k/h when h and k are made indefinitely small. Thus we arrive at the differential coefficient of $f(x)$ as the limit of the ratio of $f(x+\theta)-f(x)$ to θ when θ is made indefinitely small; and this gives an interpretation of nx^{n-1} as the derived function of x^n (§ 45).

This conception of a limit enables us to deal with algebraical expressions which assume such forms as $\frac{0}{0}$ for particular values of the variable (§ 39 (iii.)). We cannot, for instance, say that the fraction $\frac{x^2-1}{x-1}$ is arithmetically equal to $x+1$ when $x=1$, as well as for other values of x; but we can say that the limit of the ratio of x^2-1 to $x-1$ when x becomes indefinitely nearly equal to 1 is the same as the limit of $x+1$.

On the other hand, if $f(y)$ has a definite and finite value for $y=x$, it must not be supposed that this is necessarily the same as the limit which $f(y)$ approaches when y approaches the value x, though this is the case with the functions with which we are usually concerned.

62. The elementary idea of a differential coefficient is useful in reference to the *logarithmic* and *exponential* series. We know that $\log_{10}N(1+\theta)=\log_{10}N+\log_{10}(1+\theta)$, and inspection of a table of logarithms shows that, when θ is small, $\log_{10}(1+\theta)$ is approximately equal to $\lambda\theta$, where λ is a certain constant, whose value is ·434. . . If we took logarithms to base a, we should have

$$\log_a(1+\theta)=\log_a 10\times\lambda\theta,$$

approximately. If therefore we choose a quantity e such that

$$\log_e 10\times\lambda=1,\ \log_{10}e=\lambda,$$

which gives (by more accurate calculation)

$$e=2{\cdot}71828\ldots,$$

we shall have $$\lim\{\log_e(1+\theta))\}/\theta=1,$$

and conversely $$\lim\{e^{x+\phi}-e^x\}/\phi=e^x.$$

The deduction of the expansions

$$\log_e(1+x)=x-\tfrac{1}{2}x^2+\tfrac{1}{3}x^3-\ldots,$$
$$e^x=1+x+x^2/2!+x^3/3!+\ldots,$$

is then more simply obtained by the differential calculus than by ordinary algebraic methods.

63. The theory of *inequalities* is closely connected with that of maxima and minima, and therefore seems to come properly under this head. The more simple properties, however, only require the use of elementary methods. Thus to show that the arithmetic mean of n positive numbers is greater than their geometric mean (*i.e.* than the nth root of their product) we show that if any two are unequal their product may be increased, without altering their sum, by making them equal, and that if all the numbers are equal their arithmetic mean is equal to their geometric mean.

VI. *Special Developments.*

64. One case of convergence of a sequence has already been considered in § 58 (i.). The successive terms of the sequence in that case were formed by successive additions of terms of a series; the series is then also said to converge to the limit which is the limit of the sequence.

Another example of a sequence is afforded by the successive convergents to a continued fraction of the form $a_0+\frac{1}{a_1+}\frac{1}{a_2+}\ldots$, where $a_0, a_1, a_2, \ldots$ are integers. Denoting these convergents by P_0/Q_0, P_1/Q_1, P_2/Q_2, . . . they may be regarded as obtained from a series $\frac{P_0}{Q_0}+\left(\frac{P_1}{Q_1}-\frac{P_0}{Q_0}\right)+\left(\frac{P_2}{Q_2}-\frac{P_1}{Q_1}\right)+\ldots$; the successive terms of this series, after the first, are alternately positive and negative, and consist of fractions with numerators 1 and denominators continually increasing.

Another kind of sequence is that which is formed by introducing the successive factors of a continued product; *e.g.* the successive factors on the right-hand side of *Wallis's theorem*

$$\frac{\pi}{2}=\frac{2.2}{1{\cdot}3}\cdot\frac{4{\cdot}4}{3{\cdot}5}\cdot\frac{6.6}{5{\cdot}7}\ldots$$

A continued product of this kind can, by taking logarithms, be replaced by an infinite series.

In the particular case considered in § 58 (i.) we were able to examine the approach of the sequence $S_0, S_1, S_2, \ldots$ to its limit X by direct examination of the value of $X-S_r$. In most cases this is not possible; and we have first to consider the convergence of the sequence or of the series which it represents, and then to determine its limit by indirect methods. This constitutes the general theory of *convergence of series* (see SERIES).

The word "sequence," as defined in § 58 (i.), includes progressions such as the arithmetical and geometrical progressions, and, generally, the succession of terms of a series. It is usual, however, to confine it to those sequences (*e.g.* the sequence formed by taking successive sums of a series) which have to be considered in respect of their convergence or non-convergence.

In order that numerical results obtained by summing the first few terms of a series may be of any value, it is usually necessary that the series should converge to a limit; but there are exceptions to this rule. For instance, when n is large, $n!$ is approximately equal to $\sqrt{(2\pi n)}.(n/e)^n$; the approximation may be improved by *Stirling's theorem*

$$\log_e 2+\log_e 3+\ldots+\log_e(n-1)+\tfrac{1}{2}\log_e n=\tfrac{1}{2}\log_e(2\pi)+n\log_e n-n$$
$$+\frac{B_1}{1.2.n}-\frac{B_2}{3{\cdot}4{\cdot}n^3}+\ldots+\frac{(-)^{r-1}B_r}{(2r-1){\cdot}2r.n^{2r-1}}+\ldots,$$

where $B_1, B_2, \ldots$ are Bernoulli's numbers (§ 46 (v.)), although the series is not convergent.

65. Consideration of the binomial theorem for fractional index, or of the continued fraction representing a surd, or of theorems such as Wallis's theorem (§ 64), shows that a sequence, every term of which is rational, may have as its limit an *irrational number*, *i.e.* a number which cannot be expressed as the ratio of two integers.

These are isolated cases of irrational numbers. Other cases arise when we consider the continuity of a function. Suppose, for instance, that $y=x^2$; then to every rational value of x there corresponds a rational value of y, but the converse does not hold. Thus there appear to be discontinuities in the values of y.

The difficulty is due to the fact that number is naturally not continuous, so that continuity can only be achieved by an artificial development. The development is based on the necessity of being able to represent geometrical magnitude by arithmetical magnitude; and it may be regarded as consisting of three stages. Taking any number n to be represented by a point on a line at distance nL from a fixed point O, where L is a unit of length, we start with a series of points representing the integers 1, 2, 3, . . . This series is of course discontinuous. The next step is to suppose that fractional numbers are represented in the same way. This extension produces a change of character in the series of numbers. In the original integral series each number had a definite number next to it, on each side, except 1, which began the series. But in the new series there is no first number, and no number can be said to be next to any other number, since, whatever two numbers we take, others can be inserted between them. On the other hand, this new series is not continuous; for we know that there are some points on the line which represent surds and other irrational numbers, and these numbers are not contained in our series. We therefore take a third step, and obtain theoretical continuity by considering that every point on the line, if it does not represent a rational number, represents something which may be called an *irrational number*.

This insertion of irrational numbers (with corresponding negative numbers) requires for its exact treatment certain special methods, which form part of the *algebraic theory of number*, and are dealt with under NUMBER.

66. The development of the theory of equations leads to the amplification of real numbers, rational and irrational, positive and negative, by *imaginary* and *complex numbers*. The quadratic equation $x^2+b^2=0$, for instance, has no real root; but we may treat the roots as being $+b\sqrt{-1}$, and $-b\sqrt{-1}$, if $\sqrt{-1}$ is treated as something which obeys the laws of arithmetic and emerges into reality under the condition $\sqrt{-1}.\sqrt{-1}=-1$. Expressions of the form $b\sqrt{-1}$ and $a+b\sqrt{-1}$, where a and b are real numbers, are then described as *imaginary* and *complex* numbers respectively; the former being a particular case of the latter.

Complex numbers are conveniently treated in connexion not only with the theory of equations but also with analytical trigonometry, which suggests the graphic representation of $a+b\sqrt{-1}$ by a line of length $(a^2+b^2)^{\frac{1}{2}}$ drawn in a direction different from that of the line along which real numbers are represented.

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(W. F. SH.)

B. SPECIAL KINDS OF ALGEBRA

1. A *special* algebra is one which differs from ordinary algebra in the laws of equivalence which its symbols obey. Theoretically, no limit can be assigned to the number of possible algebras; the varieties actually known use, for the most part, the same signs of operation, and differ among themselves principally by their rules of multiplication.

2. Ordinary algebra developed very gradually as a kind of shorthand, devised to abbreviate the discussion of arithmetical problems and the statement of arithmetical facts. Although the distinction is one which cannot be ultimately maintained, it is convenient to classify the signs of algebra into symbols of quantity (usually figures or letters), symbols of operation, such as $+$, $\sqrt{}$, and symbols of distinction, such as brackets. Even when the formal evolution of the science was fairly complete, it was taken for granted that its symbols of quantity invariably stood for numbers, and that its symbols of operation were restricted to their ordinary arithmetical meanings. It could not escape notice that one and the same symbol, such as $\sqrt{(a-b)}$, or even $(a-b)$, sometimes did and sometimes did not admit of arithmetical interpretation, according to the values attributed to the letters involved. This led to a prolonged controversy on the nature of negative and imaginary quantities, which was ultimately settled in a very curious way. The progress of analytical geometry led to a geometrical interpretation both of negative and also of imaginary quantities; and when a "meaning" or, more properly, an interpretation, had thus been found for the symbols in question, a reconsideration of the old algebraic problem became inevitable, and the true solution, now so obvious, was eventually obtained. It was at last realized that the laws of algebra do not depend for their validity upon any particular interpretation, whether arithmetical, geometrical or other; the only question is whether these laws do or do not involve any logical contradiction. When this fundamental truth had been fully grasped, mathematicians began to inquire whether algebras might not be discovered which obeyed laws different from those obtained by the generalization of arithmetic. The answer to this question has been so manifold as to be almost embarrassing. All that can be done here is to give a sketch of the more important and independent special algebras at present known to exist.

3. Although the results of ordinary algebra will be taken for granted, it is convenient to give the principal rules upon which it is based. They are

$$\begin{array}{llll}
(a+b)+c=a+(b+c) & (\text{A}) & (a\times b)\times c=a\times(b\times c) & (\text{A}') \\
a+b=b+a & (\text{C}) & a\times b=b\times a & (\text{C}') \\
\multicolumn{4}{c}{a(b+c)=ab+ac \qquad (\text{D})} \\
(a-b)+b=a & (\text{I}) & (a\div b)\times b=a & (\text{I}')
\end{array}$$

These formulae express the *associative* and *commutative* laws of the operations $+$ and $\times$, the *distributive* law of $\times$, and the definitions of the *inverse* symbols $-$ and $\div$, which are assumed to be unambiguous. The special symbols 0 and 1 are used to denote $a-a$ and $a\div a$. They behave exactly like the corresponding symbols in arithmetic; and it follows from this that whatever "meaning" is attached to the symbols of quantity, ordinary algebra includes arithmetic, or at least an image of it. Every ordinary algebraic quantity may be regarded as of the form $\alpha+\beta\sqrt{-1}$, where α, β are "real"; that is to say, every algebraic equivalence remains valid when its symbols of quantity are interpreted as complex numbers of the type $\alpha+\beta\sqrt{-1}$ (cf. NUMBER). But the symbols of ordinary algebra do not necessarily denote numbers; they may, for instance, be interpreted as coplanar points or vectors. Evolution and involution are usually regarded as operations of ordinary algebra; this leads to a notation for powers and roots, and a theory of irrational algebraic quantities analogous to that of irrational numbers.

Non-numerical algebra.

4. The only known type of algebra which does not contain arithmetical elements is substantially due to George Boole. Although originally suggested by formal logic, it is most simply interpreted as an algebra of regions in space. Let i denote a definite region of space; and let a, b, &c., stand for definite parts of i. Let $a+b$ denote the region made up of a and b together (the common part, if any, being reckoned only once), and let $a\times b$ or ab mean the region common to a and b. Then $a+a=aa=a$; hence numerical coefficients and indices are not required. The inverse symbols $-$, $\div$ are ambiguous, and in fact are rarely used. Each symbol a is associated with its *supplement* $\bar{a}$ which satisfies the equivalences $a+\bar{a}=i$, $a\bar{a}=0$, the latter of which means that a and $\bar{a}$ have no region in common. Finally, there is a *law of absorption* expressed by $a+ab=a$. From every proposition in this algebra a reciprocal one may be deduced by interchanging $+$ and $\times$, and also the symbols 0 and i. For instance, $x+y=x+\bar{x}y$ and $xy=x(\bar{x}+y)$ are reciprocal. The operations $+$ and $\times$ obey all the ordinary laws A, C, D (§ 3).

Möbius's barycentric calculus.

5. A point A in space may be associated with a (real, positive, or negative) numerical quantity α, called its *weight*, and denoted by the symbol αA. The sum of two weighted points αA, βB is, by definition, the point $(\alpha+\beta)$G, where G divides AB so that AG: GB $=\beta:\alpha$. It can be proved by geometry that

$$(\alpha\mathrm{A}+\beta\mathrm{B})+\gamma\mathrm{C}=\alpha\mathrm{A}+(\beta\mathrm{B}+\gamma\mathrm{C})=(\alpha+\beta+\gamma)\mathrm{P},$$

where P is in fact the centroid of masses α, β, γ placed at A, B, C respectively. So, in general, if we put

$$\alpha\mathrm{A}+\beta\mathrm{B}+\gamma\mathrm{C}+\ldots+\lambda\mathrm{L}=(\alpha+\beta+\gamma+\ldots+\lambda)\mathrm{X}.$$

X is, in general, a determinate point, the *barycentre* of αA, βB, &c. (or of A, B, &c. for the weights α, β, &c.). If $(\alpha+\beta+\ldots+\lambda)$ happens to be zero, X lies at infinity in a determinate direction; unless $-\alpha$A is the barycentre of βB, γC, . . . λL, in which case $\alpha\mathrm{A}+\beta\mathrm{B}+\ldots+\lambda\mathrm{L}$ vanishes identically, and X is indeterminate. If ABCD is a tetrahedron of reference, any point P in space is determined by an equation of the form

$$(\alpha+\beta+\gamma+\delta)\mathrm{P}=\alpha\mathrm{A}+\beta\mathrm{B}+\gamma\mathrm{C}+\delta\mathrm{D}:$$

α, β, γ, δ are, in fact, equivalent to a set of homogeneous co-ordinates of P. For constructions in a fixed plane three points of reference are sufficient. It is remarkable that Möbius employs the symbols AB, ABC, ABCD in their ordinary geometrical sense as lengths, areas and volumes, except that he distinguishes their sign; thus AB $=-$BA, ABC $=-$ACB, and so on. If he had happened to think of them as "products," he might have anticipated Grassmann's discovery of the extensive calculus. From a merely formal point of view, we have in the barycentric calculus a set of "special symbols of quantity" or "extraordinaries" A, B, C, &c., which combine with each other by means of operations $+$ and $-$ which obey the ordinary rules, and with ordinary algebraic quantities by operations $\times$ and $\div$, also according to the ordinary rules, except that division by an extraordinary is not used.

Hamilton's quaternions.

6. A quaternion is best defined as a symbol of the type

$$q=\Sigma\alpha_s e_s=\alpha_0e_0+\alpha_1e_1=\alpha_2e_2+\alpha_3e_3,$$

where $e_0, \ldots e_3$ are independent extraordinaries and $\alpha_0, \ldots \alpha_3$ ordinary algebraic quantities, which may be called the co-ordinates of q. The sum and product of two quaternions are defined by the formulae

$$\Sigma\alpha_s e_s+\Sigma\beta_s e_s=\Sigma(\alpha_s+\beta_s)e_s$$
$$\Sigma\alpha_r e_r\times\Sigma\beta_s e_s=\Sigma\alpha_r\beta_s e_r e_s,$$

where the products $e_r e_s$ are further reduced according to the following multiplication table, in which, for example, the second line is to be read $e_1e_0=e_1$, $e_1^2=-e_0$, $e_1e_2=e_3$, $e_1e_3=-e_2$.

	e_0	e_1	e_2	e_3
e_0	e_0	e_1	e_2	e_3
e_1	e_1	$-e_0$	e_3	$-e_2$
e_2	e_2	$-e_3$	$-e_0$	e_1
e_3	e_3	e_2	$-e_1$	$-e_0$

The effect of these definitions is that the sum and the product of two quaternions are also quaternions; that addition is associative and commutative; and that multiplication is associative and distributive, but not commutative. Thus $e_1e_2=-e_2e_1$, and if q, q' are any two quaternions, qq' is generally different from $q'q$. The symbol e_0 behaves exactly like 1 in ordinary algebra; Hamilton writes 1, i, j, k instead of e_0, e_1, e_2, e_3, and in this notation all the special rules of operation may be summed up by the equalities

$$i^2=j^2=k^2=ijk=-1.$$

Putting $q=\alpha+\beta i+\gamma j+\delta k$, Hamilton calls α the *scalar part* of q, and denotes it by Sq; he also writes Vq for $\beta i+\gamma j+\delta k$, which is called the *vector part* of q. Thus every quaternion may be written in the form $q=\mathrm{S}q+\mathrm{V}q$, where either S$q$ or Vq may separately vanish; so that ordinary algebraic quantities (or *scalars*, as we shall call them) and pure vectors may each be regarded as special cases of quaternions.

The equations $q'+x=q$ and $y+q'=q$ are satisfied by the same quaternion, which is denoted by $q-q'$. On the other hand, the equations $q'x=q$ and $yq'=q$ have, in general, different solutions. It is the value of y which is generally denoted by $q\div q'$; a special symbol for x is desirable, but has not been established. If we put $q'_0=\mathrm{S}q'-\mathrm{V}q'$, then q'_0 is called the *conjugate* of q', and the scalar $q'q'_0=q'_0q'$ is called the *norm* of q' and written Nq'. With this notation the values of x and y may be expressed in the forms

$$x=q'_0q/\mathrm{N}q', \qquad y=qq'_0/\mathrm{N}q',$$

which are free from ambiguity, since scalars are commutative with quaternions. The values of x and y are different, unless $\mathrm{V}(qq'_0)=0$.

In the applications of the calculus the co-ordinates of a quaternion are usually assumed to be numerical; when they are complex, the quaternion is further distinguished by Hamilton as a *biquaternion.* Clifford's biquaternions are quantities $\xi q+\eta r$, where q, r are quaternions, and ξ, η are symbols (commutative with quaternions) obeying the laws $\xi^2=\xi$, $\eta^2=\eta$, $\xi\eta=\eta\xi=0$ (cf. QUATERNIONS).

Grassmann's extensive calculus.

7. In the extensive calculus of the nth category, we have, first of all, n independent "units," e_1, e_2, . . . e_n. From these are derived symbols of the type

$$\mathrm{A}_1=\alpha_1e_1+\alpha_2e_2+\ldots+\alpha_ne_n=\Sigma\alpha e,$$

which we shall call *extensive quantities of the first species* (and, when necessary, of the nth category). The *co-ordinates* $\alpha_1, \ldots \alpha_n$ are scalars, and in particular applications may be restricted to real or complex numerical values.

If $\mathrm{B}_1=\Sigma\beta e$, there is a law of addition expressed by

$$\mathrm{A}_1+\mathrm{B}_1=\Sigma(\alpha_i+\beta_i)e_i=\mathrm{B}_1+\mathrm{A}_1;$$

this law of addition is associative as well as commutative. The inverse operation is free from ambiguity, and, in fact,

$$\mathrm{A}_1-\mathrm{B}_1=\Sigma(\alpha_i-\beta_i)e_i.$$

To multiply A$_1$ by a scalar, we apply the rule

$$\xi\mathrm{A}_1=\mathrm{A}_1\xi=\Sigma(\xi\alpha_i)e_i,$$

and similarly for division by a scalar.

All this is analogous to the corresponding formulae in the barycentric calculus and in quaternions; it remains to consider the multiplication of two or more extensive quantities. The binary products of the units e_i are taken to satisfy the equalities

$$e_i^2=0, \quad e_ie_j=-e_je_i;$$

this reduces them to $\frac{1}{2}n(n-1)$ distinct values, exclusive of zero. These values are assumed to be independent, so we have $\frac{1}{2}n(n-1)$ *derived units of the second species or order.* Associated with these new units there is a system of extensive quantities of the second species, represented by symbols of the type

$$\mathrm{A}_2=\Sigma\alpha_i\mathrm{E}_i^{(2)} \qquad [i=1, 2, \ldots\tfrac{1}{2}n(n-1)],$$

where $\mathrm{E}_1^{(2)}$, $\mathrm{E}_2^{(2)}$, &c., are the derived units of the second species. If $\mathrm{A}_1=\Sigma\alpha_ie_i$, $\mathrm{B}_1=\Sigma\beta_ie_i$, the distributive law of multiplication is preserved by assuming

$$\mathrm{A}_1\mathrm{B}_1=\Sigma(\alpha_i\beta_j)e_ie_j;$$

it follows that $\mathrm{A}_1\mathrm{B}_1=-\mathrm{B}_1\mathrm{A}_1$, and that $\mathrm{A}_1^2=0$.

By assuming the truth of the associative law of multiplication, and taking account of the reducing formulae for binary products, we may construct derived units of the third, fourth ... nth species. Every unit of the rth species which does not vanish is the product of r different units of the first species; two such units are independent unless they are permutations of the same set of primary units e_i, in which case they are equal or opposite according to the usual rule employed in determinants. Thus, for instance—

$$e_1.e_2e_3 = e_1e_2.e_3 = e_1e_2e_3 = -e_2e_1e_3 = e_2e_3e_1;$$

and, in general, the number of distinct units of the rth species in the nth category ($r \leqslant n$) is $C_{n,r}$. Finally, it is assumed that (in the nth category) $e_1e_2e_3 \ldots e_n = 1$, the suffixes being in their natural order.

Let $A_r = \Sigma\alpha E^{(r)}$ and $B_s = \Sigma\beta E^{(s)}$ be two extensive quantities of species r and s; then if $r+s \leqslant n$, they may be multiplied by the rule

$$A_rB_s = \Sigma(\alpha\beta)E^{(r)}E^{(s)}$$

where the products $E^{(r)}E^{(s)}$ may be expressed as derived units of species $(r+s)$. The product B_sA_r is equal or opposite to A_rB_s, according as rs is even or odd. This process may be extended to the product of three or more factors such as $A_rB_sC_t \ldots$ provided that $r+s+t+ \ldots$ does not exceed n. The law is associative; thus, for instance, $(AB)C = A(BC)$. But the commutative law does not always hold; thus, indicating species, as before, by suffixes, $A_rB_sC_t = (-1)^{rs+st+tr}C_tB_sA_r$, with analogous rules for other cases.

If $r+s>n$, a product such as E_rE_s, worked out by the previous rules, comes out to be zero. A characteristic feature of the calculus is that a meaning can be attached to a symbol of this kind by adopting a new rule, called that of *regressive* multiplication, as distinguished from the foregoing, which is *progressive*. The new rule requires some preliminary explanation. If E is any extensive unit, there is one other unit E′, and only one, such that the (progressive) product $EE' = 1$. This unit is called the supplement of E, and denoted by $|E$. For example, when $n=4$,

$$|e_1 = e_2e_3e_4, \quad |e_1e_2 = e_3e_4, \quad |e_2e_3e_4 = -e_1,$$

and so on. Now when $r+s>n$, the product E_rE_s is defined to be that unit of which the supplement is the progressive product $|E_r|E_s$. For instance, if $n=4$, $E_r = e_1e_3$, $E_s = e_2e_3e_4$, we have

$$|E_r|E_s = (-e_2e_4)(-e_1) = e_1e_2e_4 = |e_3,$$

consequently, by the rule of regressive multiplication,

$$e_1e_3.e_2e_3e_4 = e_3.$$

Applying the distributive law, we obtain, when $r+s>n$,

$$A_rB_s = \Sigma\alpha E_r\Sigma\beta E_s = \Sigma(\alpha\beta)E_rE_s,$$

where the regressive products E_rE_s are to be reduced to units of species $(r+s-n)$ by the foregoing rule.

If $A = \Sigma\alpha E$, then, by definition, $|A = \Sigma\alpha|E$, and hence

$$A|(B+C) = A|B + A|C.$$

Now this is formally analogous to the distributive law of multiplication; and in fact we may look upon $A|B$ as a particular way of multiplying A and B (not A and B). The symbol AB, from this point of view, is called the *inner* product of A and B, as distinguished from the *outer* product $|AB$. An inner product may be either progressive or regressive. In the course of reducing such expressions as $(AB)C$, $(AB)\{C(DE)\}$ and the like, where a chain of multiplications has to be performed in a certain order, the multiplications may be all progressive, or all regressive, or partly, one, partly the other. In the first two cases the product is said to be *pure*, in the third case *mixed*. A pure product is associative; a mixed product, speaking generally, is not.

The outer and inner products of two extensive quantities A, B, are in many ways analogous to the quaternion symbols Vab and Sab respectively. As in quaternions, so in the extensive calculus, there are numerous formulae of transformation which enable us to deal with extensive quantities without expressing them in terms of the primary units. Only a few illustrations can be given here, Let a, b, c, d, e, f be quantities of the first species in the fourth category; A, B, C ... quantities of the third species in the same category. Then

$$\begin{aligned}(de)(abc) &= (abde)c + (cade)b + (bcde)a \\ &= (abce)d - (abcd)e,\end{aligned}$$

$$(ab)(AB) = (aA)(bB) - (aB)(bA)$$

$$ab|c = (a|c)b - (b|c)a, \quad (ab|cd) = (a|c)(b|d) - (a|d)(b|c).$$

These may be compared and contrasted with such quaternion formulae as

$$S(VabVcd) = SadSbc - SacSbd$$
$$dSabc = aSbcd - bScda + cSadb$$

where a, b, c, d denote arbitrary vectors.

Linear algebras.

8. An n-tuple linear algebra (also called a complex number system) deals with quantities of the type $A = \Sigma\alpha_ie_i$ derived from n special units $e_1, e_2 \ldots e_n$. The sum and product of two quantities are defined in the first instance by the formulae

$$\Sigma\alpha e + \Sigma\beta e = \Sigma(\alpha+\beta)e, \quad \Sigma\alpha_ie_i \times \Sigma\beta_je_j = \Sigma(\alpha_i\beta_j)e_ie_j,$$

so that the laws A, C, D of § 3 are satisfied. The binary products e_ie_j, however, are expressible as linear functions of the units e_i by means of a "multiplication table" which defines the special characteristics of the algebra in question. Multiplication may or may not be commutative, and in the same way it may or may not be associative. The types of linear associative algebras, not assumed to be commutative, have been enumerated (with some omissions) up to sextuple algebras inclusive by B. Peirce. Quaternions afford an example of a quadruple algebra of this kind; ordinary algebra is a special case of a duplex linear algebra. If, in the extensive calculus of the nth category, all the units (including 1 and the derived units E) are taken to be homologous instead of being distributed into species, we may regard it as a (2^n-1)-tuple linear algebra, which, however, is not wholly associative. It should be observed that while the use of special units, or extraordinaries, in a linear algebra is convenient, especially in applications, it is not indispensable. Any linear quantity may be denoted by a symbol $(\alpha_1, \alpha_2, \ldots \alpha_n)$ in which only its scalar coefficients occur; in fact, the special units only serve, in the algebra proper, as *umbrae* or regulators of certain operations on scalars (see NUMBER). This idea finds fuller expression in the algebra of matrices, as to which it must suffice to say that a matrix is a symbol consisting of a rectangular array of scalars, and that matrices may be combined by a rule of addition which obeys the usual laws, and a rule of multiplication which is distributive and associative, but not, in general, commutative. Various special algebras (for example, quaternions) may be expressed in the notation of the algebra of matrices.

9. In ordinary algebra we have the disjunctive law that if $ab=0$, then either $a=0$ or $b=0$. This applies also to quaternions, but not to extensive quantities, nor is it true for linear algebras in general. One of the most important questions in investigating a linear algebra is to decide the necessary relations between a and b in order that this product may be zero.

Subsidiary algebras.

10. The algebras discussed up to this point may be considered as independent in the sense that each of them deals with a class of symbols of quantity more or less homogeneous, and a set of operations applying to them all. But when an algebra is used with a particular interpretation, or even in the course of its formal development, it frequently happens that new symbols of operation are, so to speak, superposed upon the algebra, and are found to obey certain formal laws of combination of their own. For instance, there are the symbols Δ, D, E used in the calculus of finite differences; Aronhold's symbolical method in the calculus of invariants; and the like. In most cases these subsidiary algebras, as they may be called, are inseparable from the applications in which they are used; but in any attempt at a natural classification of algebra (at present a hopeless task), they would have to be taken into account. Even in ordinary algebra the notation for powers and roots disturbs the symmetry of the rational theory; and when a schoolboy illegitimately extends the distributive law by writing $\sqrt{(a+b)} = \sqrt{a} + \sqrt{b}$, he is unconsciously emphasizing this want of complete harmony.

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C. HISTORY

Etymology.

Various derivations of the word "algebra," which is of Arabian origin, have been given by different writers. The first mention of the word is to be found in the title of a work by Mahommed ben Musa al-Khwarizmi (Hovarezmi), who flourished about the beginning of the 9th century. The full title is *ilm al-jebr wa'l-muqābala*, which contains the ideas of restitution and comparison, or opposition and comparison, or resolution and equation, *jebr* being derived from the verb *jabara*, to reunite, and *muqābala*, from *gabala*, to make equal. (The root *jabara* is also met with in the word *algebrista*, which means a "bone-setter," and is still in common use in Spain.) The same derivation is given by Lucas Paciolus (Luca Pacioli), who reproduces the phrase in the transliterated form *alghebra e almucabala*, and ascribes the invention of the art to the Arabians.

Other writers have derived the word from the Arabic particle *al* (the definite article), and *geber*, meaning "man." Since, however, Geber happened to be the name of a celebrated Moorish philosopher who flourished in about the 11th or 12th century, it has been supposed that he was the founder of algebra, which has since perpetuated his name. The evidence of Peter Ramus (1515–1572) on this point is interesting, but he gives no authority for his singular statements. In the preface to his *Arithmeticae libri duo et totidem Algebrae* (1560) he says: "The name *Algebra* is Syriac, signifying the art or doctrine of an excellent man. For *Geber*, in Syriac, is a name applied to men, and is sometimes a term of honour, as master or doctor among us. There was a certain learned mathematician who sent his algebra, written in the Syriac language, to Alexander the Great, and he named it *almucabala*, that is, the book of dark or mysterious things, which others would rather call the doctrine of algebra. To this day the same book is in great estimation among the learned in the oriental nations, and by the Indians, who cultivate this art, it is called *aljabra* and *alboret*; though the name of the author himself is not known." The uncertain authority of these statements, and the plausibility of the preceding explanation, have caused philologists to accept the derivation from *al* and *jabara*. Robert Recorde in his *Whetstone of Witte* (1557) uses the variant *algeber*, while John Dee (1527–1608) affirms that *algiebar*, and not algebra, is the correct form, and appeals to the authority of the Arabian Avicenna.

Although the term "algebra" is now in universal use, various other appellations were used by the Italian mathematicians during the Renaissance. Thus we find Paciolus calling it *l'Arte Magiore; ditta dal vulgo la Regula de la Cosa over Alghebra e Almucabala*. The name *l'arte magiore*, the greater art, is designed to distinguish it from *l'arte minore*, the lesser art, a term which he applied to the modern arithmetic. His second variant, *la regula de la cosa*, the rule of the thing or unknown quantity, appears to have been in common use in Italy, and the word *cosa* was preserved for several centuries in the forms *coss* or algebra, *cossic* or algebraic, *cossist* or algebraist, &c. Other Italian writers termed it the *Regula rei et census*, the rule of the thing and the product, or the root and the square. The principle underlying this expression is probably to be found in the fact that it measured the limits of their attainments in algebra, for they were unable to solve equations of a higher degree than the quadratic or square.

Franciscus Vieta (François Viète) named it *Specious Arithmetic*, on account of the species of the quantities involved, which he represented symbolically by the various letters of the alphabet. Sir Isaac Newton introduced the term *Universal Arithmetic*, since it is concerned with the doctrine of operations, not affected on numbers, but on general symbols.

Notwithstanding these and other idiosyncratic appellations, European mathematicians have adhered to the older name, by which the subject is now universally known.

It is difficult to assign the invention of any art or science definitely to any particular age or race. The few fragmentary records, which have come down to us from past civilizations, must not be regarded as representing the totality of their knowledge, and the omission of a science or art does not necessarily imply that the science or art was unknown. It was formerly the custom to assign the invention of algebra to the Greeks, but since the decipherment of the *Rhind papyrus* by Eisenlohr this view has changed, for in this work there are distinct signs of an algebraic analysis. The particular problem—a heap (*hau*) and its seventh makes 19—is solved as we should now solve a simple equation; but Ahmes varies his methods in other similar problems. This discovery carries the invention of algebra back to about 1700 B.C., if not earlier.

Greek algebra.

It is probable that the algebra of the Egyptians was of a most rudimentary nature, for otherwise we should expect to find traces of it in the works of the Greek geometers, of whom Thales of Miletus (640–546 B.C.) was the first. Notwithstanding the prolixity of writers and the number of the writings, all attempts at extracting an algebraic analysis from their geometrical theorems and problems have been fruitless, and it is generally conceded that their analysis was geometrical and had little or no affinity to algebra. The first extant work which approaches to a treatise on algebra is by Diophantus (*q.v.*), an Alexandrian mathematician, who flourished about A.D. 350. The original, which consisted of a preface and thirteen books, is now lost, but we have a Latin translation of the first six books and a fragment of another on polygonal numbers by Xylander of Augsburg (1575), and Latin and Greek translations by Gaspar Bachet de Merizac (1621–1670). Other editions have been published, of which we may mention Pierre Fermat's (1670), T. L. Heath's (1885) and P. Tannery's (1893–1895). In the preface to this work, which is dedicated to one Dionysius, Diophantus explains his notation, naming the square, cube and fourth powers, *dynamis*, *cubus*, *dynamodinimus*, and so on, according to the sum in the indices. The unknown he terms *arithmos*, the number, and in solutions he marks it by the final ς; he explains the generation of powers, the rules for multiplication and division of simple quantities, but he does not treat of the addition, subtraction, multiplication and division of compound quantities. He then proceeds to discuss various artifices for the simplification of equations, giving methods which are still in common use. In the body of the work he displays considerable ingenuity in reducing his problems to simple equations, which admit either of direct solution, or fall into the class known as indeterminate equations. This latter class he discussed so assiduously that they are often known as *Diophantine problems*, and the methods of resolving them as the *Diophantine analysis* (see EQUATION, *Indeterminate*). It is difficult to believe that this work of Diophantus arose spontaneously in a period of general stagnation. It is more than likely that he was indebted to earlier writers, whom he omits to mention, and whose works are now lost; nevertheless, but for this work, we should be led to assume that algebra was almost, if not entirely, unknown to the Greeks.

The Romans, who succeeded the Greeks as the chief civilized power in Europe, failed to set store on their literary and scientific treasures; mathematics was all but neglected; and beyond a few improvements in arithmetical computations, there are no material advances to be recorded.

Indian algebra.

In the chronological development of our subject we have now to turn to the Orient. Investigation of the writings of Indian mathematicians has exhibited a fundamental distinction between the Greek and Indian mind, the former being pre-eminently geometrical and speculative, the latter arithmetical and mainly practical. We find that geometry was neglected except in so far as it was of service to astronomy; trigonometry was advanced, and algebra improved far beyond the attainments of Diophantus.

The earliest Indian mathematician of whom we have certain knowledge is Aryabhatta, who flourished about the beginning of the 6th century of our era. The fame of this astronomer and mathematician rests on his work, the *Aryabhattiyam*, the third chapter of which is devoted to mathematics. Ganessa, an eminent astronomer, mathematician and scholiast of Bhaskara, quotes this work and makes separate mention of the *cuttaca* ("pulveriser"), a device for effecting the solution of indeterminate equations. Henry Thomas Colebrooke, one of the earliest modern investigators of Hindu science, presumes that the treatise of Aryabhatta extended to determinate quadratic equations, indeterminate equations of the first degree, and probably of the second. An astronomical work, called the *Surya-siddhanta* ("knowledge of the Sun"), of uncertain authorship and probably belonging to the 4th or 5th century, was considered of great merit by the Hindus, who ranked it only second to the work of Brahmagupta, who flourished about a century later. It is of great interest to the historical student, for it exhibits the influence of Greek science upon Indian mathematics at a period prior to Aryabhatta. After an interval of about a century, during which mathematics attained its highest level, there flourished Brahmagupta (b. A.D. 598), whose work entitled *Brahma-sphuta-siddhanta* ("The revised system of Brahma") contains several chapters devoted to mathematics. Of other Indian writers mention may be made of Cridhara, the author of a *Ganita-sara* ("Quintessence of Calculation"), and Padmanabha, the author of an algebra.

A period of mathematical stagnation then appears to have possessed the Indian mind for an interval of several centuries, for the works of the next author of any moment stand but little in advance of Brahmagupta. We refer to Bhaskara Acarya, whose work the *Siddhanta-ciromani* ("Diadem of an Astronomical System"), written in 1150, contains two important chapters, the *Lilavati* ("the beautiful [science or art]") and *Viga-ganita* ("root-extraction"), which are given up to arithmetic and algebra.

English translations of the mathematical chapters of the *Brahma-siddhanta* and *Siddhanta-ciromani* by H. T. Colebrooke (1817), and of the *Surya-siddhanta* by E. Burgess, with annotations by W. D. Whitney (1860), may be consulted for details.

The question as to whether the Greeks borrowed their algebra from the Hindus or *vice versa* has been the subject of much discussion. There is no doubt that there was a constant traffic between Greece and India, and it is more than probable that an exchange of produce would be accompanied by a transference of ideas. Moritz Cantor suspects the influence of Diophantine methods, more particularly in the Hindu solutions of indeterminate equations, where certain technical terms are, in all probability, of Greek origin. However this may be, it is certain that the Hindu algebraists were far in advance of Diophantus. The deficiencies of the Greek symbolism were partially remedied; subtraction was denoted by placing a dot over the subtrahend; multiplication, by placing *bha* (an abbreviation of *bhavita*, the "product") after the factors; division, by placing the divisor under the dividend; and square root, by inserting *ka* (an abbreviation of *karana*, irrational) before the quantity. The unknown was called *yāvattāvat*, and if there were several, the first took this appellation, and the others were designated by the names of colours; for instance, x was denoted by *yā* and y by *kā* (from *kālaka*, black).

A notable improvement on the ideas of Diophantus is to be found in the fact that the Hindus recognized the existence of two roots of a quadratic equation, but the negative roots were considered to be inadequate, since no interpretation could be found for them. It is also supposed that they anticipated discoveries of the solutions of higher equations. Great advances were made in the study of indeterminate equations, a branch of analysis in which Diophantus excelled. But whereas Diophantus aimed at obtaining a single solution, the Hindus strove for a general method by which any indeterminate problem could be resolved. In this they were completely successful, for they obtained general solutions for the equations $ax \pm by = c$, $xy = ax + by + c$ (since rediscovered by Leonhard Euler) and $cy^2 = ax^2 + b$. A particular case of the last equation, namely, $y^2 = ax^2 + 1$, sorely taxed the resources of modern algebraists. It was proposed by Pierre de Fermat to Bernhard Frenicle de Bessy, and in 1657 to all mathematicians. John Wallis and Lord Brounker jointly obtained a tedious solution which was published in 1658, and afterwards in 1668 by John Pell in his *Algebra*. A solution was also given by Fermat in his *Relation*. Although Pell had nothing to do with the solution, posterity has termed the equation *Pell's Equation, or Problem*, when more rightly it should be the *Hindu Problem*, in recognition of the mathematical attainments of the Brahmans.

Hermann Hankel has pointed out the readiness with which the Hindus passed from number to magnitude and *vice versa*. Although this transition from the discontinuous to continuous is not truly scientific, yet it materially augmented the development of algebra, and Hankel affirms that if we define algebra as the application of arithmetical operations to both rational and irrational numbers or magnitudes, then the Brahmans are the real inventors of algebra.

Arabian algebra.

The integration of the scattered tribes of Arabia in the 7th century by the stirring religious propaganda of Mahomet was accompanied by a meteoric rise in the intellectual powers of a hitherto obscure race. The Arabs became the custodians of Indian and Greek science, whilst Europe was rent by internal dissensions. Under the rule of the Abbasids, Bagdad became the centre of scientific thought; physicians and astronomers from India and Syria flocked to their court; Greek and Indian manuscripts were translated (a work commenced by the Caliph Mamun (813–833) and ably continued by his successors); and in about a century the Arabs were placed in possession of the vast stores of Greek and Indian learning. Euclid's *Elements* were first translated in the reign of Harun-al-Rashid (786–809), and revised by the order of Mamun. But these translations were regarded as imperfect, and it remained for Tobit ben Korra (836–901) to produce a satisfactory edition. Ptolemy's *Almagest*, the works of Apollonius, Archimedes, Diophantus and portions of the Brahmasiddhanta, were also translated. The first notable Arabian mathematician was Mahommed ben Musa al-Khwarizmi, who flourished in the reign of Mamun. His treatise on algebra and arithmetic (the latter part of which is only extant in the form of a Latin translation, discovered in 1857) contains nothing that was unknown to the Greeks and Hindus; it exhibits methods allied to those of both races, with the Greek element predominating. The part devoted to algebra has the title *al-jebr wa'l-muqābala*, and the arithmetic begins with "Spoken has Algoritmi," the name Khwarizmi or Hovarezmi having passed into the word *Algoritmi*, which has been further transformed into the more modern words *algorism* and *algorithm*, signifying a method of computing.

Tobit ben Korra (836–901), born at Harran in Mesopotamia, an accomplished linguist, mathematician and astronomer, rendered conspicuous service by his translations of various Greek authors. His investigation of the properties of *amicable numbers* (*q.v.*) and of the problem of trisecting an angle, are of importance. The Arabians more closely resembled the Hindus than the Greeks in the choice of studies; their philosophers blended speculative dissertations with the more progressive study of medicine; their mathematicians neglected the subtleties of the conic sections and Diophantine analysis, and applied themselves more particularly to perfect the system of numerals (see NUMERAL), arithmetic and astronomy (*q.v.*). It thus came about that while some progress was made in algebra, the talents of the race were bestowed on astronomy and trigonometry (*q.v.*). Fahri des al Karhi, who flourished about the beginning of the 11th century, is the author of the most important Arabian work on algebra. He follows the methods of Diophantus; his work on indeterminate equations has no resemblance to the Indian methods, and contains nothing that cannot be gathered from Diophantus. He solved quadratic equations both geometrically and algebraically, and also equations of the form $x^{2n}+ax^n+b=0$; he also proved certain relations between the sum of the first n natural numbers, and the sums of their squares and cubes.

Cubic equations were solved geometrically by determining the intersections of conic sections. Archimedes' problem of dividing a sphere by a plane into two segments having a prescribed ratio, was first expressed as a cubic equation by Al Mahani, and the first solution was given by Abu Gafar al Hazin. The determination of the side of a regular heptagon which can be inscribed or circumscribed to a given circle was reduced to a more complicated equation which was first successfully resolved by Abul Gud. The method of solving equations geometrically was considerably developed by Omar Khayyam of Khorassan, who flourished in the 11th century. This author questioned the possibility of solving cubics by pure algebra, and biquadratics by geometry. His first contention was not disproved until the 15th century, but his second was disposed of by Abul Wefa (940–998), who succeeded in solving the forms $x^4=a$ and $x^4+ax^3=b$.

Although the foundations of the geometrical resolution of cubic equations are to be ascribed to the Greeks (for Eutocius assigns to Menaechmus two methods of solving the equation $x^3=a$ and $x^3=2a^3$), yet the subsequent development by the Arabs must be regarded as one of their most important achievements. The Greeks had succeeded in solving an isolated example; the Arabs accomplished the general solution of numerical equations.

Considerable attention has been directed to the different styles in which the Arabian authors have treated their subject. Moritz Cantor has suggested that at one time there existed two schools, one in sympathy with the Greeks, the other with the Hindus; and that, although the writings of the latter were first studied, they were rapidly discarded for the more perspicuous Grecian methods, so that, among the later Arabian writers, the Indian methods were practically forgotten and their mathematics became essentially Greek in character.

Turning to the Arabs in the West we find the same enlightened spirit; Cordova, the capital of the Moorish empire in Spain, was as much a centre of learning as Bagdad. The earliest known Spanish mathematician is Al Madshritti (d. 1007), whose fame rests on a dissertation on amicable numbers, and on the schools which were founded by his pupils at Cordova, Dania and Granada. Gabir ben Aflah of Sevilla, commonly called Geber, was a celebrated astronomer and apparently skilled in algebra, for it has been supposed that the word "algebra" is compounded from his name.

When the Moorish empire began to wane the brilliant intellectual gifts which they had so abundantly nourished during three or four centuries became enfeebled, and after that period they failed to produce an author comparable with those of the 7th to the 11th centuries.

Algebra in Europe.

Cubic equations.

In Europe the decline of Rome was succeeded by a period, lasting several centuries, during which the sciences and arts were all but neglected. Political and ecclesiastical dissensions occupied the greatest intellects, and the only progress to be recorded is in the art of computing or arithmetic, and the translation of Arabic manuscripts. The first successful attempt to revive the study of algebra in Christendom was due to Leonardo of Pisa, an Italian merchant trading in the Mediterranean. His travels and mercantile experience had led him to conclude that the Hindu methods of computing were in advance of those then in general use, and in 1202 he published his *Liber Abaci*, which treats of both algebra and arithmetic. In this work, which is of great historical interest, since it was published about two centuries before the art of printing was discovered, he adopts the Arabic notation for numbers, and solves many problems, both arithmetical and algebraical. But it contains little that is original, and although the work created a great sensation when it was first published, the effect soon passed away, and the book was practically forgotten. Mathematics was more or less ousted from the academic curricula by the philosophical inquiries of the schoolmen, and it was only after an interval of nearly three centuries that a worthy successor to Leonardo appeared. This was Lucas Paciolus (Lucas de Burgo), a Minorite friar, who, having previously written works on algebra, arithmetic and geometry, published, in 1494, his principal work, entitled *Summa de Arithmetica, Geometria, Proportioni et Proportionalita*. In it he mentions many earlier writers from whom he had learnt the science, and although it contains very little that cannot be found in Leonardo's work, yet it is especially noteworthy for the systematic employment of symbols, and the manner in which it reflects the state of mathematics in Europe during this period. These works are the earliest printed books on mathematics. The renaissance of mathematics was thus effected in Italy, and it is to that country that the leading developments of the following century were due. The first difficulty to be overcome was the algebraical solution of cubic equations, the *pons asinorum* of the earlier mathematicians. The first step in this direction was made by Scipio Ferro (d. 1526), who solved the equation $x^3+ax=b$. Of his discovery we know nothing except that he declared it to his pupil Antonio Marie Floridas. An imperfect solution of the equation $x^3+px^2=q$ was discovered by Nicholas Tartalea (Tartaglia) in 1530, and his pride in this achievement led him into conflict with Floridas, who proclaimed his own knowledge of the form resolved by Ferro. Mutual recriminations led to a public discussion in 1535, when Tartalea completely vindicated the general applicability of his methods and exhibited the inefficiencies of that of Floridas. This contest over, Tartalea redoubled his attempts to generalize his methods, and by 1541 he possessed the means for solving any form of cubic equation. His discoveries had made him famous all over Italy, and he was earnestly solicited to publish his methods; but he abstained from doing so, saying that he intended to embody them in a treatise on algebra which he was preparing. At last he succumbed to the repeated requests of Girolamo or Geronimo Cardano, who swore that he would regard them as an inviolable secret. Cardan or Cardano, who was at that time writing his great work, the *Ars Magna*, could not restrain the temptation of crowning his treatise with such important discoveries, and in 1545 he broke his oath and gave to the world Tartalea's rules for solving cubic equations. Tartalea, thus robbed of his most cherished possession, was in despair. Recriminations ensued until his death in 1557, and although he sustained his claim for priority, posterity has not conceded to him the honour of his discovery, for his solution is now known as *Cardan's Rule*.

Biquadratic equations.

Cubic equations having been solved, biquadratics soon followed suit. As early as 1539 Cardan had solved certain particular cases, but it remained for his pupil, Lewis (Ludovici) Ferrari, to devise a general method. His solution, which is sometimes erroneously ascribed to Rafael Bombelli, was published in the *Ars Magna*. In this work, which is one of the most valuable contributions to the literature of algebra, Cardan shows that he was familiar with both real positive and negative roots of equations whether rational or irrational, but of imaginary roots he was quite ignorant, and he admits his inability to resolve the so-called "irreducible case" (see Equation). Fundamental theorems in the theory of equations are to be found in the same work. Clearer ideas of imaginary quantities and the "irreducible case" were subsequently published by Bombelli, in a work of which the dedication is dated 1572, though the book was not published until 1579.

Contemporaneously with the remarkable discoveries of the Italian mathematicians, algebra was increasing in popularity in Germany, France and England. Michael Stifel and Johann Scheubelius (Scheybl) (1494–1570) flourished in Germany, and although unacquainted with the work of Cardan and Tartalea, their writings are noteworthy for their perspicuity and the introduction of a more complete symbolism for quantities and operations. Stifel introduced the sign (+) for addition or a positive quantity, which was previously denoted by *plus*, *piū*, or the letter *p*. Subtraction, previously written as *minus*, *mene* or the letter *m*, was symbolized by the sign (−) which is still in use. The square root he denoted by (√), whereas Paciolus, Cardan and others used the letter R.

The first treatise on algebra written in English was by Robert Recorde, who published his arithmetic in 1552, and his algebra entitled *The Whetstone of Witte, which is the second part of Arithmetik*, in 1557. This work, which is written in the form of a dialogue, closely resembles the works of Stifel and Scheubelius, the latter of whom he often quotes. It includes the properties of numbers; extraction of roots of arithmetical and algebraical quantities, solutions of simple and quadratic equations, and a fairly complete account of surds. He introduced the sign (=) for equality, and the terms *binomial* and *residual*. Of other writers who published works about the end of the 16th century, we may mention Jacques Peletier, or Jacobus Peletarius (*De occulta parte Numerorum, quam Algebram vocant*, 1558); Petrus Ramus (*Arithmeticae Libri duo et totidem Algebrae*, 1560), and Christoph Clavius, who wrote on algebra in 1580, though it was not published until 1608. At this time also flourished Simon Stevinus (Stevin) of Bruges, who published an arithmetic in 1585 and an algebra shortly afterwards. These works possess considerable originality, and contain many new improvements in algebraic notation; the unknown (*res*) is denoted by a small circle, in which he places an integer corresponding to the power. He introduced the terms *multinomial*, *trinomial*, *quadrinomial*, &c., and considerably simplified the notation for decimals.

About the beginning of the 17th century various mathematical works by Franciscus Vieta were published, which were afterwards collected by Franz van Schooten and republished in 1646 at Leiden. These works exhibit great originality and mark an important epoch in the history of algebra. Vieta, who does not avail himself of the discoveries of his predecessors—the negative roots of Cardan, the revised notation of Stifel and Stevin, &c.—introduced or popularized many new terms and symbols, some of which are still in use. He denotes quantities by the letters of the alphabet, retaining the vowels for the unknown and the consonants for the knowns; he introduced the *vinculum* and among others the terms *coefficient*, *affirmative*, *negative*, *pure* and *adfected* equations. He improved the methods for solving equations, and devised geometrical constructions with the aid of the conic sections. His method for determining approximate values of the roots of equations is far in advance of the Hindu method as applied by Cardan, and is identical in principle with the methods of Sir Isaac Newton and W. G. Horner.

We have next to consider the works of Albert Girard, a Flemish mathematician. This writer, after having published an edition of Stevin's works in 1625, published in 1629 at Amsterdam a small tract on algebra which shows a considerable advance on the work of Vieta. Girard is inconsistent in his notation, sometimes following Vieta, sometimes Stevin; he introduced the new symbols *ff* for *greater than* and § for *less than*; he follows Vieta in using the *plus* (+) for addition, he denotes subtraction by Recorde's symbol for equality (=), and he had no sign for equality but wrote the word out. He possessed clear ideas of indices and the generation of powers, of the negative roots of equations and their geometrical interpretation, and was the first to use the term *imaginary roots*. He also discovered how to sum the powers of the roots of an equation.

Passing over the invention of logarithms (*q.v.*) by John Napier, and their development by Henry Briggs and others, the next author of moment was an Englishman, Thomas Harriot, whose algebra (*Artis analyticae praxis*) was published posthumously by Walter Warner in 1631. Its great merit consists in the complete notation and symbolism, which avoided the cumbersome expressions of the earlier algebraists, and reduced the art to a form closely resembling that of to-day. He follows Vieta in assigning the vowels to the unknown quantities and the consonants to the knowns, but instead of using capitals, as with Vieta, he employed the small letters; equality he denoted by Recorde's symbol, and he introduced the signs > and < for *greater than* and *less than*. His principal discovery is concerned with equations, which he showed to be derived from the continued multiplication of as many simple factors as the highest power of the unknown, and he was thus enabled to deduce relations between the coefficients and various functions of the roots. Mention may also be made of his chapter on inequalities, in which he proves that the arithmetic mean is always greater than the geometric mean.

William Oughtred, a contemporary of Harriot, published an algebra, *Clavis mathematicae*, simultaneously with Harriot's treatise. His notation is based on that of Vieta, but he introduced the sign × for multiplication, ∺ for continued proportion, :: for proportion, and denoted ratio by one dot. This last character has since been entirely restricted to multiplication, and ratio is now denoted by two dots (:). His symbols for *greater than* and *less than* (⏋ and ⏌) have been completely superseded by Harriot's signs.

So far the development of algebra and geometry had been mutually independent, except for a few isolated applications of geometrical constructions to the solution of algebraical problems. Certain minds had long suspected the advantages which would accrue from the unrestricted application of algebra to geometry, but it was not until the advent of the philosopher Réné Descartes that the co-ordination was effected. In his famous *Geometria* (1637), which is really a treatise on the algebraic representation of geometric theorems, he founded the modern theory of analytical geometry (see Geometry), and at the same time he rendered signal service to algebra, more especially in the theory of equations. His notation is based primarily on that of Harriot; but he differs from that writer in retaining the first letters of the alphabet for the known quantities and the final letters for the unknowns.

The 17th century is a famous epoch in the progress of science, and the mathematics in no way lagged behind. The discoveries of Johann Kepler and Bonaventura Cavalieri were the foundation upon which Sir Isaac Newton and Gottfried Wilhelm Leibnitz erected that wonderful edifice, the Infinitesimal Calculus (*q.v.*). Many new fields were opened up, but there was still continual progress in pure algebra. Continued fractions, one of the earliest examples of which is Lord Brouncker's expression for the ratio of the circumference to the diameter of a circle (see Circle), were elaborately discussed by John Wallis and Leonhard Euler; the convergency of series treated by Newton, Euler and the Bernoullis; the binomial theorem, due originally to Newton and subsequently expanded by Euler and others, was used by Joseph Louis Lagrange as the basis of his *Calcul des Fonctions*. Diophantine problems were revived by Gaspar Bachet, Pierre Fermat and Euler; the modern theory of numbers was founded by Fermat and developed by Euler, Lagrange and others; and the theory of probability was attacked by Blaise Pascal and Fermat, their work being subsequently expanded by James Bernoulli, Abraham de Moivre, Pierre Simon Laplace and others. The germs of the theory of determinants are to be found in the works of Leibnitz; Étienne Bézout utilized them in 1764 for expressing the result obtained by the process of elimination known by his name, and since restated by Arthur Cayley.

In recent times many mathematicians have formulated other kinds of algebras, in which the operators do not obey the laws of ordinary algebra. This study was inaugurated by George Peacock, who was one of the earliest mathematicians to recognize the symbolic character of the fundamental principles of algebra. About the same time, D. F. Gregory published a paper "on the real nature of symbolical algebra." In Germany the work of Martin Ohm (*System der Mathematik*, 1822) marks a step forward. Notable service was also rendered by Augustus de Morgan, who applied logical analysis to the laws of mathematics.

The geometrical interpretation of imaginary quantities had a far-reaching influence on the development of symbolic algebras. The attempts to elucidate this question by H. Kühn (1750–1751) and Jean Robert Argand (1806) were completed by Karl Friedrich Gauss, and the formulation of various systems of vector analysis by Sir William Rowan Hamilton, Hermann Grassmann and others, followed. These algebras were essentially geometrical, and it remained, more or less, for the American mathematician Benjamin Peirce to devise systems of pure symbolic algebras; in this work he was ably seconded by his son Charles S. Peirce. In England, multiple algebra was developed by James Joseph Sylvester, who, in company with Arthur Cayley, expanded the theory of matrices, the germs of which are to be found in the writings of Hamilton (see above, under (B); and QUATERNIONS).

The preceding summary shows the specialized nature which algebra has assumed since the 17th century. To attempt a history of the development of the various topics in this article is inappropriate, and we refer the reader to the separate articles.

REFERENCES.—The history of algebra is treated in all historical works on mathematics in general (see MATHEMATICS: *References*). Greek algebra can be specially studied in T. L. Heath's *Diophantus*. See also John Wallis, *Opera Mathematica* (1693–1699), and Charles Hutton, *Mathematical and Philosophical Dictionary* (1815), article "Algebra." (C. E.*)

ALGEBRAIC FORMS. The subject-matter of algebraic forms is to a large extent connected with the linear transformation of algebraical polynomials which involve two or more variables. The theories of determinants and of symmetric functions and of the algebra of differential operations have an important bearing upon this comparatively new branch of mathematics. They are the chief instruments of research, and have themselves much benefited by being so employed. When a homogeneous polynomial is transformed by general linear substitutions as hereafter explained, and is then expressed in the original form with new coefficients affecting the new variables, certain functions of the new coefficients and variables are numerical multiples of the same functions of the original coefficients and variables. The investigation of the properties of these functions, as well for a single form as for a simultaneous set of forms, and as well for one as for many series of variables, is included in the theory of invariants. As far back as 1773 Joseph Louis Lagrange, and later Carl Friedrich Gauss, had met with simple cases of such functions, George Boole, in 1841 (*Camb. Math. Journ.* iii. pp. 1-20), made important steps, but it was not till 1845 that Arthur Cayley (*Coll. Math. Papers*, i. pp. 80-94, 95-112) showed by his calculus of hyper-determinants that an infinite series of such functions might be obtained systematically. The subject was carried on over a long series of years by himself, J. J. Sylvester, G. Salmon, L. O. Hesse, S. H. Aronhold, C. Hermite, Francesco Brioschi, R.F.A. Clebsch, P. Gordon, &c. The year 1868 saw a considerable enlargement of the field of operations. This arose from the study by Felix Klein and Sophus Lie of a new theory of groups of substitutions; it was shown that there exists an invariant theory connected with every group of linear substitutions. The invariant theory then existing was classified by them as appertaining to "finite continuous groups." Other "Galois" groups were defined whose substitution coefficients have fixed numerical values, and are particularly associated with the theory of equations. Arithmetical groups, connected with the theory of quadratic forms and other branches of the theory of numbers, which are termed "discontinuous," and infinite groups connected with differential forms and equations, came into existence, and also particular linear and higher transformations connected with analysis and geometry. The effect of this was to co-ordinate many branches of mathematics and greatly to increase the number of workers. The subject of transformation in general has been treated by Sophus Lie in the classical work *Theorie der Transformationsgruppen*. The present article is merely concerned with algebraical linear transformation. Two methods of treatment have been carried on in parallel lines, the unsymbolic and the symbolic; both of these originated with Cayley, but he with Sylvester and the English school have in the main confined themselves to the former, whilst Aronhold, Clebsch, Gordan, and the continental schools have principally restricted themselves to the latter. The two methods have been conducted so as to be in constant touch, though the nature of the results obtained by the one differs much from those which flow naturally from the other. Each has been singularly successful in discovering new lines of advance and in encouraging the other to renewed efforts. P. Gordan first proved that for any system of forms there exists a finite number of covariants, in terms of which all others are expressible as rational and integral functions. This enabled David Hilbert to produce a very simple unsymbolic proof of the same theorem. So the theory of the forms appertaining to a binary form of unrestricted order was first worked out by Cayley and P. A. MacMahon by unsymbolic methods, and later G. E. Stroh, from a knowledge of the results, was able to verify and extend the results by the symbolic method. The partition method of treating symmetrical algebra is one which has been singularly successful in indicating new paths of advance in the theory of invariants; the important theorem of expressibility is, directly we exclude unity from the partitions, a theorem concerning the expressibility of covariants, and involves the theory of the reducible forms and of the syzygies. The theory brought forward has not yet found a place in any systematic treatise in any language, so that it has been judged proper to give a fairly complete account of it.[1]

I. THE THEORY OF DETERMINANTS.[1]

Let there be given n^2 quantities

$$\begin{matrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2n} \\ a_{31} & a_{32} & a_{33} & \cdots & a_{3n} \\ . & . & . & \cdots & . \\ a_{n1} & a_{n2} & a_{n3} & \cdots & a_{nn} \end{matrix}$$

and form from them a product of n quantities

$$a_{1\alpha}\, a_{2\beta}\, a_{3\gamma} \ldots a_{n\nu},$$

where the first suffixes are the natural numbers 1, 2, 3, ...n taken in order, and $\alpha, \beta, \gamma, \ldots \nu$ is some permutation of these n numbers. This permutation by a transposition of two numbers, say α, β, becomes $\beta, \alpha, \gamma, \ldots \nu$, and by successively transposing pairs of letters the permutation can be reduced to the form 1, 2, 3, ...n. Let k such transpositions be necessary; then the expression

$$\Sigma(-)^k a_{1\alpha} a_{2\beta} a_{3\gamma} \ldots a_{n\nu},$$

the summation being for all permutations of the n numbers, is called the determinant of the n^2 quantities. The quantities $a_{1\alpha}$, $a_{2\beta}$ ... are called the elements of the determinant; the term $(-)^k a_{1\alpha} a_{2\beta} a_{3\gamma} \ldots a_{n\nu}$ is called a member of the determinant, and there are evidently $n!$ members corresponding to the $n!$ permutations of the n numbers 1, 2, 3, ... n. The determinant is usually written

$$\Delta = \begin{vmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2n} \\ a_{31} & a_{32} & a_{33} & \cdots & a_{3n} \\ . & . & . & \cdots & . \\ a_{n1} & a_{n2} & a_{n3} & \cdots & a_{nn} \end{vmatrix}$$

the square array being termed the *mairix* of the determinant. A matrix has in many parts of mathematics a signification apart from its evaluation as a determinant. A theory of matrices has been constructed by Cayley in connexion particularly with the theory of linear transformation. The matrix consists of n rows and n columns. Each row as well as each column supplies one and only one element to each member of the determinant. Consideration of the definition of the determinant shows that the value is unaltered when the suffixes in each element are transposed.

Theorem.—If the determinant is transformed so as to read by columns as it formerly did by rows its value is unchanged. The *leading member* of the determinant is $a_{11}a_{22}a_{33}\ldots a_{nn}$, and corresponds to the *principal diagonal* of the matrix.

We write frequently

$$\Delta = \Sigma \pm a_{11}a_{22}a_{33}\ldots a_{nn} = (a_{11}a_{22}a_{33}\ldots a_{nn}).$$

If the first two columns of the determinant be transposed the expression for the determinant becomes $\Sigma(-)^k a_{1\beta}a_{2a}a_{3\gamma}\dots a_{n\nu}$, viz. a and β are transposed, and it is clear that the number of transpositions necessary to convert the permutation $\beta a\gamma\dots\nu$ of the second suffixes to the natural order is changed by unity. Hence the transposition of columns merely changes the sign of the determinant. Similarly it is shown that the transposition of any two columns or of any two rows merely changes the sign of the determinant.

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[1] The elementary theory is given in the article DETERMINANT.

Theorem.—Interchange of any two rows or of any two columns merely changes the sign of the determinant.

Corollary.—If any two rows or any two columns of a determinant be identical the value of the determinant is zero.

Minors of a Determinant.—From the value of Δ we may separate those members which contain a particular element a_{ik} as a factor, and write the portion $a_{ik}\,A_{ik}$; A_k, the cofactor of a_{ik}, is called a minor of order $n-1$ of the determinant.

Now $a_{11}A_{11}=\Sigma\pm a_{11}a_{22}a_{33}\dots a_{nn}$, wherein a_{11} is not to be changed, but the second suffixes in the product $a_{22}a_{33}\dots a_{nn}$ assume all permutations, the number of transpositions necessary determining the sign to be affixed to the member.

Hence $a_{11}A_{11}=a_{11}\Sigma\pm a_{22}a_{33}\dots a_{nn}$, where the cofactor of a_{11} is clearly the determinant obtained by erasing the first row and the first column.

$$\text{Hence } A_{11}=\begin{vmatrix} a_{22} & a_{33} & \dots & a_{nn}\\ a_{32} & a_{33} & \dots & a_{3n}\\ . & . & \dots & .\\ a_{n2} & a_{n3} & \dots & a_{nn}\end{vmatrix}$$

Similarly A_{ik}, the cofactor of a_{ik}, is shown to be the product of $(-)^{i+k}$ and the determinant obtained by erasing from Δ the i^{th} row and k^{th} column. No member of a determinant can involve more than one element from the first row. Hence we have the development

$$\Delta=a_{11}A_{11}+a_{12}A_{12}+a_{13}A_{13}+\dots+a_{1n}A_{1n},$$

proceeding according to the elements of the first row and the corresponding minors.

Similarly we have a development proceeding according to the elements contained in any row or in any column, viz.

$$\left.\begin{aligned}\Delta&=a_{i1}A_{i1}+a_{i2}A_{i2}+a_{i3}A_{i3}+\dots+a_{in}A_{in}\\ \Delta&=a_{1k}A_{1k}+a_{2k}A_{2k}+a_{3k}A_{3k}+\dots+a_{nk}A_{nk}\end{aligned}\right\}\text{(A)}.$$

This theory enables the evaluation of a determinant by successive reduction of the orders of the determinants involved.

$$\textit{Ex. gr.}\begin{vmatrix}1 & 0 & 3\\ 2 & 1 & 6\\ 0 & -5 & 3\end{vmatrix}=1\begin{vmatrix}1 & 6\\ -5 & 3\end{vmatrix}-0\begin{vmatrix}2 & 6\\ 0 & 3\end{vmatrix}+3\begin{vmatrix}2 & 1\\ 0 & -5\end{vmatrix}$$
$$=1\,|\,3\,|-6\,|-5\,|+3.2\,|-5\,|-3.1\,|\,0\,|$$
$$=3+30-30-0=3.$$

Since the determinant

$$\begin{vmatrix} a_{21} & a_{22} & a_{23} & \dots & a_{2n}\\ a_{21} & a_{22} & a_{23} & \dots & a_{2n}\\ a_{31} & a_{32} & a_{33} & \dots & a_{3n}\\ . & . & . & \dots & .\\ a_{n1} & a_{n2} & a_{n3} & \dots & a_{nn}\end{vmatrix},\ \text{having two identical rows,}$$

vanishes identically; we have by development according to the elements of the first row

$$a_{21}A_{11}+a_{22}A_{12}+a_{23}A_{13}+\dots+a_{2n}A_{1n}=0;$$

and, in general, since

$$a_{i1}A_{i1}+a_{i2}A_{i2}+a_{i3}A_{i3}+\dots+a_{in}A_{in}=\Delta,$$

if we suppose the i^{th} and k^{th} rows identical

$$a_{k1}A_{i1}+a_{k2}A_{i2}+a_{k3}A_{i3}+\dots+a_{kn}A_{in}=0\quad(k\gtrless i);$$

and proceeding by columns instead of rows,

$$a_{1i}A_{1k}+a_{2i}A_{2k}+a_{3i}A_{3k}+\dots+a_{ni}A_{nk}=0\quad(k\gtrless i)$$

identical relations always satisfied by these minors.

If in the first relation of (A) we write $a_{is}=b_{is}+c_{is}+d_{is}+\dots$ we find that $\Sigma a_{is}A_{is}=\Sigma b_{is}A_{is}+\Sigma c_{is}A_{is}+\Sigma d_{is}A_{is}+\dots$ so that Δ breaks up into a sum of determinants, and we also obtain a theorem for the addition of determinants which have $n-1$ rows in common. If we multiply the elements of the second row by an arbitrary magnitude λ, and add to the corresponding elements of the first row, Δ becomes $\Sigma a_{1s}A_{1s}+\lambda\Sigma a_{2s}A_{1s}=\Sigma a_{1s}A_{1s}=\Delta$, showing that the value of the determinant is unchanged. In general we can prove in the same way the—

Theorem.—The value of a determinant is unchanged if we add to the elements of any row or column the corresponding elements of the other rows or other columns respectively each multiplied by an arbitrary magnitude, such magnitude remaining constant in respect of the elements in a particular row or a particular column.

Observation.—Every factor common to all the elements of a row or of a column is obviously a factor of the determinant, and may be taken outside the determinant brackets.

$$\textit{Ex. gr.}\begin{vmatrix}\alpha^2 & \beta^2 & \gamma^2\\ \alpha & \beta & \gamma\\ 1 & 1 & 1\end{vmatrix}=\begin{vmatrix}\alpha^2 & \beta^2-\alpha^2 & \gamma^2-\alpha^2\\ \alpha & \beta-\alpha & \gamma-\alpha\\ 1 & 0 & 0\end{vmatrix}=\begin{vmatrix}\beta^2-\alpha^2 & \gamma^2-\alpha^2\\ \beta-\alpha & \gamma-\alpha\end{vmatrix}$$
$$=(\beta-\alpha)(\gamma-\alpha)\begin{vmatrix}\beta+\alpha & \gamma+\alpha\\ 1 & 1\end{vmatrix}=(\beta-\gamma)(\gamma-\alpha)\begin{vmatrix}\beta-\gamma & \gamma+\alpha\\ 0 & 1\end{vmatrix}$$
$$=(\beta-\alpha)(\gamma-\alpha)(\beta-\gamma).$$

The minor A_{ik} is $\dfrac{\partial\Delta}{\partial a_{ik}}$, and is itself a determinant of order $n-1$. We may therefore differentiate again in regard to any element a_{rs} where $r\gtrless i$, $s\gtrless k$; we will thus obtain a minor of A_{ik}, which is a minor also of Δ of order $n-2$. It will be $A_{\substack{ik\\rs}}=\dfrac{\partial A_{ik}}{\partial a_{rs}}=\dfrac{\partial^2\Delta}{\partial a_{ik}\partial a_{rs}}$ and will be obtained by erasing from the determinant A_{ik} the row and column containing the element a_{rs}; this was originally the r^{th} row and s^{th} column of Δ; the r^{th} row of Δ is the r^{th} or $(r-1)^{th}$ row of A_{ik} according as $r\lesseqgtr i$ and the s^{th} column of Δ is the s^{th} or $(s-1)^{th}$ column of A_{ik} according as $s\gtrless k$. Hence, if T_{ri} denote the number of transpositions necessary to bring the succession ri into ascending order of magnitude, the sign to be attached to the determinant arrived at by erasing the i^{th} and r^{th} rows and the k^{th} and s^{th} columns from Δ in order produce $A_{\substack{ik\\rs}}$ will be -1 raised to the power of $T_{ri}+T_{ks}+i+k+r+s$.

Similarly proceeding to the minors of order $n-3$, we find that $A_{\substack{ik\\rs\\tu}}=\dfrac{\partial}{\partial a_{tu}}A_{\substack{ik\\rs}}=\dfrac{\partial^2}{\partial a_{rs}\partial a_{tu}}A_{ik}=\dfrac{\partial^3}{\partial a_{ik}\partial a_{rs}\partial a_{tu}}\Delta$ is obtained from Δ by erasing the i^{th}, r^{th}, t^{th} rows, the k^{th}, s^{th}, u^{th} columns, and multiplying the resulting determinant by -1 raised to the power $T_{tri}+T_{usk}+i+k+r+s+t+u$ and the general law is clear.

Corresponding Minors.—In obtaining the minor $A_{\substack{ik\\rs}}$ in the form of a determinant we erased certain rows and columns, and we would have erased in an exactly similar manner had we been forming the determinant associated with $A_{\substack{is\\rk}}$, since the deleting lines intersect in two pairs of points. In the latter case the sign is determined by -1 raised to the same power as before, with the exception that T_{uks} replaces T_{usk}; but if one of these numbers be even the other must be uneven; hence

$$A_{\substack{ik\\rs}}=-A_{\substack{is\\rk}}.$$

Moreover

$$a_{ik}a_{rs}A_{\substack{ik\\rs}}+a_{is}a_{rk}A_{\substack{is\\rk}}=\begin{vmatrix}a_{ik} & a_{is}\\ a_{ik} & a_{rs}\end{vmatrix}A_{\substack{ik\\rs}},$$

where the determinant factor is given by the four points in which the deleting lines intersect. This determinant and that associated with $A_{\substack{ik\\rs}}$ are termed corresponding determinants. Similarly p lines of deletion intersecting in p^2 points yield corresponding determinants of orders p and $n-p$ respectively. Recalling the formula

$$\Delta=a_{11}A_{11}+a_{12}A_{12}+a_{13}A_{13}+\dots+a_{1n}A_{1n}.$$

it will be seen that a_{1k} and A_{1k} involve corresponding determinants. Since A_{1k} is a determinant we similarly obtain

$$A_{1k}=a_{21}A_{\substack{1k\\21}}+\dots+a_{2,k-1}A_{\substack{1,k\\2,k-1}}+a_{2,k+1}A_{\substack{1,k\\2,k+1}}+\dots+a_{2,n}A_{\substack{1,k\\2,n}},$$

and thence

$$\Delta=\Sigma_{i,k}\,a_{1i}a_{2k}A_{\substack{1i\\2k}}\quad\text{where } i\gtrless k;$$

and as before

$$\Delta=\Sigma_{i,k}\begin{vmatrix}a_{1i} & a_{2i}\\ a_{1k} & a_{2k}\end{vmatrix}A_{\substack{1i\\2k}}\quad i>k,$$

an important expansion of Δ.

Similarly

$$\Delta=\Sigma_{i,k,r}\begin{vmatrix}a_{1i} & a_{2i} & a_{3i}\\ a_{1k} & a_{2k} & a_{3k}\\ a_{1r} & a_{2r} & a_{3r}\end{vmatrix}A_{\substack{1i\\2k\\3r}}\quad i>k>r,$$

and the general theorem is manifest, and yields a development in a sum of products of corresponding determinants. If the j^{th} column be identical with the i^{th} the determinant Δ vanishes identically; hence if j be not equal to i, k, or r,

$$0=\Sigma\begin{vmatrix}a_{1j} & a_{2j} & a_{3j}\\ a_{1k} & a_{2k} & a_{3k}\\ a_{1r} & a_{2r} & a_{3r}\end{vmatrix}A_{\substack{1i\\2k\\3r}}.$$

Similarly, by putting one or more of the deleted rows or columns equal to rows or columns which are not deleted, we obtain, with Laplace, a number of identities between products of determinants of complementary orders.

Multiplication.—From the theorem given above for the expansion of a determinant as a sum of products of pairs of corresponding determinants it will be plain that the product of $\Delta=(a_{11}, a_{22}, \dots a_{nn})$ and $D=(b_{11}, b_{22}, b_{nn})$ may be written as a determinant of order $2n$, viz.

$$\begin{vmatrix}
a_{11} & a_{21} & a_{31} & \dots & a_{n1} & -1 & 0 & 0 & \dots & 0\\
a_{12} & a_{22} & a_{32} & \dots & a_{n2} & 0 & -1 & 0 & \dots & 0\\
a_{13} & a_{23} & a_{33} & \dots & a_{n3} & 0 & 0 & -1 & \dots & 0\\
. & . & . & \dots & . & . & . & . & \dots & .\\
a_{1n} & a_{2n} & a_{3n} & \dots & a_{nn} & 0 & 0 & 0 & \dots & -1\\
0 & 0 & 0 & \dots & 0 & b_{11} & b_{12} & b_{13} & \dots & b_{1n}\\
0 & 0 & 0 & \dots & 0 & b_{21} & b_{22} & b_{23} & \dots & b_{2n}\\
0 & 0 & 0 & \dots & 0 & b_{31} & b_{32} & b_{33} & \dots & b_{3n}\\
. & . & . & \dots & . & . & . & . & \dots & .\\
0 & 0 & 0 & \dots & 0 & b_{n1} & b_{n2} & b_{n3} & \dots & b_{nn}
\end{vmatrix}=\begin{vmatrix}A & B\\ C & D\end{vmatrix}\ \text{for brevity.}$$

Multiply the 1st, 2nd, ... n^{th} rows by $b_{11}, b_{12}, \dots b_{1n}$ respectively, and add to the $(n+1)^{th}$ row; by $b_{21}, b_{22} \dots b_{2n}$, and add to the $(n+2)^{th}$ row; by $b_{31}, b_{32}, \dots b_{3n}$ and add to the $(n+3)^{rd}$ row, &c. C then becomes

$$\begin{vmatrix} a_{11}b_{11}+a_{12}b_{12}+\dots+a_{1n}b_{1n},\ a_{21}b_{11}+a_{22}b_{12}+\dots+a_{2n}b_{1n}, \\ \dots a_{n1}b_{11}+a_{n2}b_{12}+\dots+a_{nn}b_{1n} \\ a_{11}b_{21}+a_{12}b_{22}+\dots+a_{1n}b_{2n},\ a_{21}b_{21}+a_{22}b_{22}+\dots+a_{2n}b_{2n}, \\ \dots a_{n1}b_{21}+a_{n2}b_{22}+\dots+a_{nn}b_{2n} \\ a_{11}b_{31}+a_{12}b_{32}+\dots+a_{1n}b_{3n},\ a_{21}b_{31}+a_{22}b_{32}+\dots+a_{2n}b_{3n}, \\ \dots a_{n1}b_{31}+a_{n2}b_{32}+\dots+a_{nn}b_{2n} \\ \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \\ a_{11}b_{n1}+a_{12}b_{n2}+\dots+a_{1n}b_{nn},\ a_{21}b_{n1}+a_{22}b_{n2}+\dots+a_{2n}b_{nn}, \\ \dots a_{n1}b_{n1}+a_{n2}b_{n2}+\dots+a_{nn}b_{nn} \end{vmatrix}$$

and all the elements of D become zero. Now by the expansion theorem the determinant becomes

$$(-)^{1+2+3+\dots+2n}\mathrm{B.C} = (-1)^{n(2n+1)+n}\mathrm{C} = \mathrm{C}.$$

We thus obtain for the product a determinant of order n. We may say that, in the resulting determinant, the element in the i^{th} row and k^{th} column is obtained by multiplying the elements in the k^{th} row of the first determinant severally by the elements in the i^{th} row of the second, and has the expression

$$a_{k1}b_{i1}+a_{k2}b_{i2}+a_{k3}b_{i3}\dots+a_{kn}b_{in},$$

and we obtain other expressions by transforming either or both determinants so as to read by columns as they formerly did by rows.

Remark.—In particular the square of a determinant is a determinant of the same order $(b_{11}b_{22}b_{33}\dots b_{nn})$ such that $b_{ik}=b_{ki}$; it is for this reason termed symmetrical.

The Adjoint or Reciprocal Determinant arises from $\Delta=(a_{11}a_{22}a_{33}\dots a_{nn})$ by substituting for each element A_{ik} the corresponding minor A_{ik} so as to form $\mathrm{D}=(\mathrm{A}_{11}\mathrm{A}_{22}\mathrm{A}_{33}\dots A_{nn})$. If we form the product $\Delta.\mathrm{D}$ by the theorem for the multiplication of determinants we find that the element in the i^{th} row and k^{th} column of the product is

$$a_{k1}\mathrm{A}_{i1}+a_{k2}\mathrm{A}_{i2}+\dots+a_{kn}\mathrm{A}_{in},$$

the value of which is zero when k is different from i, whilst it has the value Δ when $k=i$. Hence the product determinant has the principal diagonal elements each equal to Δ and the remaining elements zero. Its value is therefore Δ^n and we have the identity

$$\mathrm{D}.\Delta=\Delta^n \text{ or } \mathrm{D}=\Delta^{n-1}.$$

It can now be proved that the first minor of the adjoint determinant, say B_{rs} is equal to $\Delta^{n-2}a_{rs}$.

From the equations

$$\begin{aligned} a_{11}x_1+a_{12}x_2+a_{13}x_3+\dots&=\xi_1, \\ a_{21}x_1+a_{22}x_2+a_{23}x_3+\dots&=\xi_2, \\ a_{31}x_1+a_{32}x_2+a_{33}x_3+\dots&=\xi_3, \\ \cdot \quad \cdot \quad \cdot \quad \dots &\quad \cdot \end{aligned}$$

we derive

$$\begin{aligned} \Delta x_1&=\mathrm{A}_{11}\xi_1+\mathrm{A}_{21}\xi_2+\mathrm{A}_{31}\xi_3+\dots, \\ \Delta x_2&=\mathrm{A}_{12}\xi_1+\mathrm{A}_{22}\xi_2+\mathrm{A}_{32}\xi_3+\dots, \\ \Delta x_3&=\mathrm{A}_{13}\xi_1+\mathrm{A}_{23}\xi_2+\mathrm{A}_{33}\xi_3+\dots, \\ \cdot \quad &\cdot \quad \cdot \quad \cdot \quad \dots, \end{aligned}$$

and thence

$$\begin{aligned} \Delta^{n-1}\xi_1&=\mathrm{B}_{11}\Delta x_1+\mathrm{B}_{12}\Delta x_2+\mathrm{B}_{13}\Delta x_3+\dots, \\ \Delta^{n-1}\xi_2&=\mathrm{B}_{21}\Delta x_1+\mathrm{B}_{22}\Delta x_2+\mathrm{B}_{23}\Delta x_3+\dots, \\ \Delta^{n-1}\xi_3&=\mathrm{B}_{31}\Delta x_1+\mathrm{B}_{32}\Delta x_2+\mathrm{B}_{33}\Delta x_3+\dots, \\ \cdot \quad &\cdot \quad \cdot \quad \cdot \quad \dots, \end{aligned}$$

and comparison of the first and third systems yields

$$\mathrm{B}_{rs}=\Delta^{n-2}a_{rs}.$$

In general it can be proved that any minor of order p of the adjoint is equal to the complementary of the corresponding minor of the original multiplied by the $(p-1)^{th}$ power of the original determinant.

Theorem.—The adjoint determinant is the $(n-1)^{th}$ power of the original determinant. The adjoint determinant will be seen subsequently to present itself in the theory of linear equations and in the theory of linear transformation.

Determinants of Special Forms.—It was observed above that the square of a determinant when expressed as a determinant of the same order is such that its elements have the property expressed by $a_{ik}=a_{ki}$. Such determinants are called *symmetrical*. It is easy to see that the adjoint determinant is also symmetrical, viz. such that $\mathrm{A}_{ik}=\mathrm{A}_{ki}$, for the determinant got by suppressing the i^{th} row and k^{th} column differs only by an interchange of rows and columns from that got by suppressing the k^{th} row and i^{th} column. If any symmetrical determinant vanish and be *bordered* as shown below

$$\begin{vmatrix} a_{11} & a_{12} & a_{13} & \lambda_1 \\ a_{12} & a_{22} & a_{23} & \lambda_2 \\ a_{13} & a_{23} & a_{33} & \lambda_3 \\ \lambda_1 & \lambda_2 & \lambda_3 & \cdot \end{vmatrix}$$

it is a perfect square when considered as a function of $\lambda_1, \lambda_2, \lambda_3$. For since $\mathrm{A}_{11}\mathrm{A}_{22}-\mathrm{A}_{12}^2=\Delta a_{33}$, with similar relations, we have a number of relations similar to $\mathrm{A}_{11}\mathrm{A}_{22}=\mathrm{A}_{12}^2$, and either $\mathrm{A}_{rs}=+\sqrt{(\mathrm{A}_{rr}\mathrm{A}_{ss})}$ or $-\sqrt{(\mathrm{A}_{rr}\mathrm{A}_{ss})}$ for all different values of r and s. Now the determinant has the value

$$-\{\lambda_1^2\mathrm{A}_{11}+\lambda_2^2\mathrm{A}_{22}+\lambda_3^2\mathrm{A}_{33}+2\lambda_2\lambda_3\mathrm{A}_{23}+2\lambda_3\lambda_1\mathrm{A}_{31}+2\lambda_1\lambda_2\mathrm{A}_{12}\}$$
$$=-\Sigma\lambda_r^2\mathrm{A}_{rr}-2\Sigma\lambda_r\lambda_s\mathrm{A}_{rs} \text{ in general, and hence by substitution}$$
$$\pm\{\lambda_1\sqrt{\mathrm{A}_{11}}+\lambda_2\sqrt{\mathrm{A}_{22}}+\dots+\lambda_n\sqrt{\mathrm{A}_{nn}}\}^2.$$

A *skew symmetric determinant* has $a_{rr}=0$ and $a_{rs}=-a_{sr}$ for all values of r and s. Such a determinant when of uneven degree vanishes, for if we multiply each row by -1 we multiply the determinant by $(-1)^n=-1$, and the effect of this is otherwise merely to transpose the determinant so that it reads by rows as it formerly did by columns, an operation which we know leaves the determinant unaltered. Hence $\Delta=-\Delta$ or $\Delta=0$. When a skew symmetric determinant is of even degree it is a perfect square. This theorem is due to Cayley, and reference may be made to Salmon's *Higher Algebra*, 4th ed. Art. 39. In the case of the determinant of order 4 the square root is

$$\mathrm{A}_{12}\mathrm{A}_{34}-\mathrm{A}_{13}\mathrm{A}_{24}+\mathrm{A}_{14}\mathrm{A}_{23}.$$

A *skew determinant* is one which is skew symmetric in all respects, except that the elements of the leading diagonal are not all zero. Such a determinant is of importance in the theory of orthogonal substitution. In the theory of surfaces we transform from one set of three rectangular axes to another by the substitutions

$$\begin{aligned} \mathrm{X}&=ax+by+cz, \\ \mathrm{Y}&=a'x+b'y+c'z, \\ \mathrm{Z}&=a''x+b''y+c''z, \end{aligned}$$

where $\mathrm{X}^2+\mathrm{Y}^2+\mathrm{Z}^2=x^2+y^2+z^2$. This relation implies six equations between the coefficients, so that only three of them are independent. Further we find

$$\begin{aligned} x&=a\mathrm{X}+a'\mathrm{Y}+a''\mathrm{Z}, \\ y&=b\mathrm{X}+b'\mathrm{Y}+b''\mathrm{Z}, \\ z&=c\mathrm{X}+c'\mathrm{Y}+c''\mathrm{Z}, \end{aligned}$$

and the problem is to express the nine coefficients in terms of three independent quantities.

In general in space of n dimensions we have n substitutions similar to

$$\mathrm{X}_1=a_{11}x_1+a_{12}x_2+\dots+a_{1n}x_n,$$

and we have to express the n^2 coefficients in terms of $\frac{1}{2}n(n-1)$ independent quantities; which must be possible, because

$$\mathrm{X}_1^2+\mathrm{X}_2^2+\dots+\mathrm{X}_n^2=x_1^2+x_2^2+x_3^2+\dots+x_n^2.$$

Let there be $2n$ equations

$$\begin{aligned} x_1&=b_{11}\xi_1+b_{12}\xi_2+b_{13}\xi_3+\dots, \\ x_2&=b_{21}\xi_1+b_{22}\xi_2+b_{23}\xi_3+\dots, \\ \cdot \quad &\cdot \quad \cdot \quad \cdot \quad \cdot \\ \mathrm{X}_1&=b_{11}\xi_1+b_{21}\xi_2+b_{31}\xi_3+\dots, \\ \mathrm{X}_2&=b_{12}\xi_1+b_{22}\xi_2+b_{32}\xi_3+\dots, \\ \cdot \quad &\cdot \quad \cdot \quad \cdot \quad \cdot \end{aligned}$$

where $b_{rr}=1$ and $b_{rs}=-b_{sr}$ for all values of r and s. There are then $\frac{1}{2}n(n-1)$ quantities b_{rs}. Let the determinant of the b's be Δ_b and B_{rs}, the minor corresponding to b_{rs}. We can eliminate the quantities $\xi_1, \xi_2, \dots \xi_n$ and obtain n relations

$$\begin{aligned} \Delta_b\mathrm{X}_1&=(2\mathrm{B}_{11}-\Delta_b)x_1+2\mathrm{B}_{21}x_2+2\mathrm{B}_{31}x_3+\dots, \\ \Delta_b\mathrm{X}_2&=2\mathrm{B}_{12}x_1+(2\mathrm{B}_{22}-\Delta_b)x_2+2\mathrm{B}_{32}x_3+\dots, \\ \cdot \quad &\cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \end{aligned}$$

and from these another equivalent set

$$\begin{aligned} \Delta_b x_1&=(2\mathrm{B}_{11}-\Delta_b)\mathrm{X}_1+2\mathrm{B}_{12}\mathrm{X}_2+2\mathrm{B}_{13}\mathrm{X}_3+\dots, \\ \Delta_b x_2&=2\mathrm{B}_{21}\mathrm{X}_1+(2\mathrm{B}_{22}-\Delta_b)\mathrm{X}_2+2\mathrm{B}_{23}\mathrm{X}_3+\dots, \\ \cdot \quad &\cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \end{aligned}$$

and now writing

$$\frac{2\mathrm{B}_{ii}-\Delta_b}{\Delta_b}=a_{ii}, \frac{2\mathrm{B}_{ik}}{\Delta_b}=a_{ik},$$

we have a transformation which is orthogonal, because $\Sigma\mathrm{X}^2=\Sigma x^2$ and the elements a_{ii}, a_{ik} are functions of the $\frac{1}{2}n(n-1)$ independent quantities b. We may therefore form an orthogonal transformation in association with every skew determinant which has its leading diagonal elements unity, for the $\frac{1}{2}n(n-1)$ quantities b are clearly arbitrary.

For the second order we may take

$$\Delta_b=\begin{vmatrix} 1, & \lambda \\ -\lambda, & 1 \end{vmatrix}=1+\lambda^2,$$

and the adjoint determinant is the same; hence

$$\begin{aligned} (1+\lambda^2)x_1&=(1-\lambda^2)\mathrm{X}_1+2\lambda\mathrm{X}_2, \\ (1+\lambda^2)x_2&=-2\lambda\mathrm{X}_1+(1-\lambda^2)\mathrm{X}_2. \end{aligned}$$

Similarly, for the order 3, we take

$$\Delta_b=\begin{vmatrix} 1 & \nu & -\mu \\ -\nu & 1 & \lambda \\ \mu & -\lambda & 1 \end{vmatrix}=1+\lambda^2+\mu^2+\nu^2,$$

and the adjoint is

$$\begin{vmatrix} 1+\lambda^2 & \nu+\lambda\mu & -\mu+\lambda\nu \\ -\nu+\lambda\mu & 1+\mu^2 & \lambda+\mu\nu \\ \mu+\lambda\nu & -\lambda+\mu\nu & 1+\nu^2 \end{vmatrix},$$

leading to the orthogonal substitution

$$\begin{aligned} \Delta_b x_1&=(1+\lambda^2-\mu^2-\nu^2)\mathrm{X}_1+2(\nu+\lambda\mu)\mathrm{X}_2+2(-\mu+\lambda\nu)\mathrm{X}_3 \\ \Delta_b x_2&=2(\lambda\mu-\nu)\mathrm{X}_1+(1+\mu^2-\lambda^2-\nu^2)\mathrm{X}_2+2(\mu\nu+\lambda)\mathrm{X}_3 \\ \Delta_b x_3&=2(\lambda\nu+\mu)\mathrm{X}_1+2(\mu\nu-\lambda)\mathrm{X}_2+(1+\nu^2-\lambda^2-\mu^2)\mathrm{X}_3. \end{aligned}$$

Functional determinants were first investigated by Jacobi in a work *De Determinantibus Functionalibus*. Suppose n dependent variables $y_1, y_2, \dots y_n$, each of which is a function of n independent variables $x_1, x_2, \dots x_n$, so that $y_s=f_s(x_1, x_2, \dots x_n)$. From the differential coefficients of the y's with regard to the x's we form the functional determinant

$$\mathrm{R} = \begin{vmatrix} \frac{\partial y_1}{\partial x_1} & \frac{\partial y_1}{\partial x_2} & \dots & \frac{\partial y_1}{\partial x_n} \\ \frac{\partial y_2}{\partial x_1} & \frac{\partial y_2}{\partial x_2} & \dots & \frac{\partial y_2}{\partial x_n} \\ \cdot & \cdot & \dots & \cdot \\ \frac{\partial y_n}{\partial x_1} & \frac{\partial y_n}{\partial x_2} & \dots & \frac{\partial y_n}{\partial x_n} \end{vmatrix} = \left(\begin{matrix} y_1, y_2, \dots y_n \\ x_1, x_2, \dots x_n \end{matrix}\right) \text{ for brevity.}$$

If we have new variables z such that $z_s = \phi_s(y_1, y_2, \dots y_n)$, we have also $z_s = \psi_s(x_1, x_2, \dots x_n)$, and we may consider the three determinants

$$\left(\begin{matrix} y_1, y_2, \dots y_n \\ x_1, x_2, \dots x_n \end{matrix}\right), \left(\begin{matrix} z_1, z_2 \dots z_n \\ y_1, y_2, \dots y_n \end{matrix}\right), \left(\begin{matrix} z_1, z_2, \dots z_n \\ x_1, x_2, \dots x_n \end{matrix}\right).$$

Forming the product of the first two by the product theorem, we obtain for the element in the i^{th} row and k^{th} column

$$\frac{\partial z_i}{\partial y_1}\frac{\partial y_1}{\partial x_k} + \frac{\partial z_i}{\partial y_2}\frac{\partial y_2}{\partial x_k} + \dots + \frac{\partial z_i}{\partial y_n}\frac{\partial y_n}{\partial x_k},$$

which is $\frac{\partial z_i}{\partial x_k}$, the partial differential coefficient of z_i with regard to x_k. Hence the product theorem

$$\left(\begin{matrix} z_1, z_2, \dots z_n \\ y_1, y_2, \dots y_n \end{matrix}\right) \left(\begin{matrix} y_1, y_2, \dots y_n \\ x_1, x_2, \dots x_n \end{matrix}\right) = \left(\begin{matrix} z_1, z_2, \dots z_n \\ x_1, x_2, \dots x_n \end{matrix}\right);$$

and as a particular case

$$\left(\begin{matrix} y_1, y_2, \dots y_n \\ x_1, x_2, \dots x_n \end{matrix}\right) \left(\begin{matrix} x_1, x_2, \dots x_n \\ y_1, y_2, \dots y_n \end{matrix}\right) = 1.$$

Theorem.—If the functions $y_1, y_2, \dots y_n$ be not independent of one another the functional determinant vanishes, and conversely if the determinant vanishes, $y_1, y_2, \dots y_n$ are not independent functions of $x_1, x_2, \dots x_n$.

Linear Equations.—It is of importance to study the application of the theory of determinants to the solution of a system of linear equations. Suppose given the n equations

$$\begin{aligned} f_1 &= a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n = 0, \\ f_2 &= a_{21}x_1 + a_{22}x_2 + \dots + a_{2n}x_n = 0, \\ &\cdot \quad \cdot \quad \dots \quad \cdot \\ f_n &= a_{n1}x_1 + a_{n2}x_2 + \dots + a_{nn}x_n = 0. \end{aligned}$$

Denote by Δ the determinant $(a_{11}a_{22} \dots a_{nn})$.

Multiplying the equations by the minors $\mathrm{A}_{1\mu}, \mathrm{A}_{2\mu}, \dots \mathrm{A}_{n\mu}$ respectively, and adding, we obtain

$$x_\mu(a_{1\mu}\mathrm{A}_{1\mu} + a_{2\mu}\mathrm{A}_{2\mu} + \dots + a_{n\mu}\mathrm{A}_{n\mu}) = x_\mu\Delta = 0,$$

since from results already given the remaining coefficients of $x_1, x_2, \dots x_{\mu-1}, x_{\mu+1}, \dots x_n$ vanish identically.

Hence if Δ does not vanish $x_1 = x_2 = \dots = x_n = 0$ is the only solution; but if Δ vanishes the equations can be satisfied by a system of values other than zeros. For in this case the n equations are not independent since identically

$$\mathrm{A}_{1\mu}f_1 + \mathrm{A}_{2\mu}f_2 + \dots + \mathrm{A}_{n\mu}f_n = 0,$$

and assuming that the minors do not all vanish the satisfaction of $n-1$ of the equations implies the satisfaction of the n^{th}.

Consider then the system of $n-1$ equations

$$\begin{aligned} a_{21}x_1 + a_{22}x_2 + \dots + a_{2n}x_n &= 0 \\ a_{31}x_1 + a_{32}x_2 + \dots + a_{3n}x_n &= 0 \\ \cdot \quad \cdot \quad \dots \quad & \cdot \\ a_{n1}x_1 + a_{n2}x_2 + \dots + a_{nn}x_n &= 0, \end{aligned}$$

which becomes on writing $\frac{x_s}{x_n} = y_s$,

$$\begin{aligned} a_{21}y_1 + a_{22}y_2 + \dots + a_{2,n-1}y_{n-1} + a_{2n} &= 0 \\ a_{31}y_1 + a_{32}y_2 + \dots + a_{3,n-1}y_{n-1} + a_{3n} &= 0 \\ \cdot \quad \cdot \quad \dots \quad & \cdot \\ a_{n1}y_1 + a_{n2}y_2 + \dots + a_{n,n-1}y_{n-1} + a_{nn} &= 0. \end{aligned}$$

We can solve these, assuming them independent, for the $n-1$ ratios $y_1, y_2, \dots y_{n-1}$.

Now

$$\begin{aligned} a_{21}\mathrm{A}_{11} + a_{22}\mathrm{A}_{12} + \dots + a_{2n}\mathrm{A}_{1n} &= 0 \\ a_{31}\mathrm{A}_{11} + a_{32}\mathrm{A}_{12} + \dots + a_{3n}\mathrm{A}_{1n} &= 0 \\ \cdot \quad \cdot \quad \dots \quad & \cdot \\ a_{n1}\mathrm{A}_{11} + a_{n2}\mathrm{A}_{12} + \dots + a_{nn}\mathrm{A}_{1n} &= 0, \end{aligned}$$

and therefore, by comparison with the given equations, $x_i = \rho\mathrm{A}_{1i}$, where ρ is an arbitrary factor which remains constant as i varies.

Hence $y_i = \frac{\mathrm{A}_{1i}}{\mathrm{A}_{1n}}$ where A_{1i} and A_{1n} are minors of the complete determinant $(a_{11}a_{22} \dots a_{nn})$.

$$\therefore y_i = (-)^{i+n} \frac{\begin{vmatrix} a_{21} & a_{22} & \dots a_{2,i-1} & a_{2,i+1} & \dots a_{2n} \\ a_{31} & a_{32} & \dots a_{3,i-1} & a_{3,i+1} & \dots a_{3n} \\ \cdot & \cdot & \dots & \cdot & \dots \cdot \\ a_{n1} & a_{n2} & \dots a_{n,i-1} & a_{n,i+1} & \dots a_{nn} \end{vmatrix}}{\begin{vmatrix} a_{21} & a_{22} & \dots a_{2,n-1} \\ a_{31} & a_{32} & \dots a_{3,n-1} \\ \cdot & \cdot & \dots \cdot \\ a_{n1} & a_{n2} & \dots a_{n,n-1} \end{vmatrix}},$$

or, in words, y_i is the quotient of the determinant obtained by erasing the i^{th} column by that obtained by erasing the n^{th} column, multiplied by $(-1)^{i+n}$. For further information concerning the compatibility and independence of a system of linear equations, see Gordon, *Vorlesungen über Invariantentheorie*, Bd. 1, § 8.

Resultants.—When we are given k homogeneous equations in k variables or k non-homogeneous equations in $k-1$ variables, the equations being independent, it is always possible to derive from them a single equation $\mathrm{R}=0$, where in R the variables do not appear. R is a function of the coefficients which is called the "resultant" or "eliminant" of the k equations, and the process by which it is obtained is termed "elimination." We cannot combine the equations so as to eliminate the variables unless on the supposition that the equations are simultaneous, *i.e.* each of them satisfied by a common system of values; hence the equation $\mathrm{R}=0$ is derived on this supposition, and the vanishing of R expresses the condition that the equations can be satisfied by a common system of values assigned to the variables.

Consider two binary equations of orders m and n respectively expressed in non-homogeneous form, viz.

$$\begin{aligned} f(x) &= f = a_0x^m - a_1x^{m-1} + a_2x^{m-2} - \dots = 0, \\ \phi(x) &= \phi = b_0x^n - b_1x^{n-1} + b_2x^{n-2} - \dots = 0. \end{aligned}$$

If $\alpha_1, \alpha_2, \dots \alpha_m$ be the roots of $f=0$, $\beta_1, \beta_2, \dots \beta_n$ the roots of $\phi = 0$, the condition that some root of $\phi=0$ may cause f to vanish is clearly

$$\mathrm{R}_{f,\phi} = f(\beta_1)f(\beta_2)\dots f(\beta_n) = 0;$$

so that $\mathrm{R}_{f,\phi}$ is the resultant of f and ϕ, and expressed as a function of the roots, it is of degree m in each root β, and of degree n in each root α, and also a symmetric function alike of the roots α and of the roots β; hence, expressed in terms of the coefficients, it is homogeneous and of degree n in the coefficients of f, and homogeneous and of degree m in the coefficients of ϕ.

Ex. gr.

$$f = a_0x^2 - a_1x + a_2 = 0,\ \phi = b_0x^2 - b_1x + b_2.$$

We have to multiply $a_0\beta_1^2 - a_1\beta_1 + a_2$ by $a_0\beta_2^2 - a_1\beta_2 + a_2$ and we obtain

$$a_0^2\beta_1^2\beta_2^2 - a_0a_1(\beta_1^2\beta_2 + \beta_1\beta_2^2) + a_0a_2(\beta_1^2 + \beta_2^2) + a_1^2\beta_1\beta_2 - a_1a_2(\beta_1 + \beta_2) + a_2^2,$$

where

$$\beta_1 + \beta_2 = \frac{b_1}{b_0},\ \beta_1\beta_2 = \frac{b_2}{b_0},\ \beta_1^2 + \beta_2^2 = \frac{b_1^2 - 2b_0b_2}{b_0^2},$$

and clearing of fractions

$$\mathrm{R}_{f,\phi} = (a_0b_2 - a_2b_0)^2 + (a_1b_0 - a_0b_1)(a_1b_2 - a_2b_1).$$

We may equally express the result as

$$\phi(\alpha_1)\phi(\alpha_2)\dots\phi(\alpha_m) = 0,$$

or as

$$\prod_{s,t}(\alpha_s - \beta_t) = 0.$$

This expression of R shows that, as will afterwards appear, the resultant is a simultaneous invariant of the two forms.

The resultant being a product of mn root differences, is of degree mn in the roots, and hence is of weight mn in the coefficients of the forms; *i.e.* the sum of the suffixes in each term of the resultant is equal to mn.

Resultant Expressible as a Determinant.—From the theory of linear equations it can be gathered that the condition that p linear equations in p variables (homogeneous and independent) may be simultaneously satisfied is expressible as a determinant, viz. if

$$\begin{aligned} a_{11}x_1 + a_{12}x_2 + \dots + a_{1p}x_p &= 0, \\ a_{21}x_1 + a_{22}x_2 + \dots + a_{2p}x_p &= 0, \\ \cdot \quad \cdot \quad \dots \quad & \cdot \\ a_{p1}x_1 + a_{p2}x_2 + \dots + a_{pp}x_p &= 0, \end{aligned}$$

be the system the condition is, in determinant form,

$$(a_{11}a_{22} \dots a_{pp}) = 0;$$

in fact the determinant is the resultant of the equations.

Now, suppose f and ϕ to have a common factor $x - \gamma$,

$$f(x) = f_1(x)(x-\gamma);\ \phi(x) = \phi_1(x)(x-\gamma),$$

f_1 and ϕ_1 being of degrees $m-1$ and $n-1$ respectively; we have the identity $\phi_1(x)f(x) = f_1(x)\phi(x)$ of degree $m+n-1$.

Assuming then ϕ_1 to have the coefficients $\mathrm{B}_1, \mathrm{B}_2, \dots \mathrm{B}_n$
and f_1 the coefficients $\mathrm{A}_1, \mathrm{A}_2, \dots \mathrm{A}_m$,
we may equate coefficients of like powers of x in the identity, and obtain $m+n$ homogeneous linear equations satisfied by the $m+n$ quantities $\mathrm{B}_1, \mathrm{B}_2, \dots \mathrm{B}_n, \mathrm{A}_1, \mathrm{A}_2, \dots \mathrm{A}_m$. Forming the resultant of these equations we evidently obtain the resultant of f and ϕ.

Thus to obtain the resultant of

$$f = a_0x^3 + a_1x^2 + a_2x + a_3,\ \phi = b_0x^2 + b_1x + b_2$$

we assume the identity

$$(\mathrm{B}_0x + \mathrm{B}_1)(a_0x^3 + a_1x^2 + a_2x + a_3) = (\mathrm{A}_0x^2 + \mathrm{A}_1x + \mathrm{A}_2)(b_0x^2 + b_1x + b_2).$$

and derive the linear equations

$$\begin{aligned} &\mathrm{B}_0a_0 && - \mathrm{A}_0b_0 && && = 0. \\ &\mathrm{B}_0a_1 + \mathrm{B}_1a_0 && - \mathrm{A}_0b_1 && - \mathrm{A}_1b_0 && = 0, \\ &\mathrm{B}_0a_2 + \mathrm{B}_1a_1 && - \mathrm{A}_0b_2 && - \mathrm{A}_1b_1 - \mathrm{A}_2b_0 && = 0, \\ &\mathrm{B}_0a_3 + \mathrm{B}_1a_2 && && - \mathrm{A}_1b_2 - \mathrm{A}_2b_1 && = 0, \\ &\qquad \mathrm{B}_1a && && - \mathrm{A}_2b_2 && = 0, \end{aligned}$$

and by elimination we obtain the resultant

$$\begin{vmatrix} a_0 & 0 & b_0 & 0 & 0 \\ a_1 & a_0 & b_1 & b_0 & 0 \\ a_2 & a_1 & b_2 & b_1 & b_0 \\ a_3 & a_2 & 0 & b_2 & b_1 \\ 0 & a_3 & 0 & 0 & b_2 \end{vmatrix} \quad \text{a numerical factor being disregarded.}$$

This is Euler's method. Sylvester's leads to the same expression, but in a simpler manner.

He forms n equations from f by separate multiplication by x^{n-1}, $x^{n-2}, \dots x$, 1, in succession, and similarly treats ϕ with m multipliers x^{m-1}, $x^{m-2}, \dots x$, 1. From these $m+n$ equations he eliminates the $m+n$ powers x^{m+n-1}, $x^{m+n-2}, \dots x$, 1, treating them as independent unknowns. Taking the same example as before the process leads to the system of equations

$$\begin{aligned} a_0x^4+a_1x^3+a_2x^2+a_3x \qquad &=0, \\ a_0x^3+a_1x^2+a_2x+a^3 &=0, \\ b_0x^4+b_1x^3+b_2x^2 \qquad &=0, \\ b_0x^3+b_1x^2+b_2x \qquad &=0, \\ b_0x^2+b_1x+b_2 &=0, \end{aligned}$$

whence by elimination the resultant

$$\begin{vmatrix} a_0 & a_1 & a_2 & a_3 & 0 \\ 0 & a_0 & a_1 & a_2 & a_3 \\ b_0 & b_1 & b_2 & 0 & 0 \\ 0 & b_0 & b_1 & b_2 & 0 \\ 0 & 0 & b_0 & b_1 & b_2 \end{vmatrix}$$

which reads by columns as the former determinant reads by rows, and is therefore identical with the former. E. Bézout's method gives the resultant in the form of a determinant of order m or n, according as m is $\gtrless n$. As modified by Cayley it takes a very simple form. He forms the equation

$$f(x)\phi(x')-f(x')\phi(x)=0,$$

which can be satisfied when f and ϕ possess a common factor. He first divides by the factor $x-x'$, reducing it to the degree $m-1$ in both x and x' where $m>n$; he then forms m equations by equating to zero the coefficients of the various powers of x'; these equations involve the m powers x^0, x, $x^2, \dots x^{m-1}$ of x, and regarding these as the unknowns of a system of linear equations the resultant is reached in the form of a determinant of order m. *Ex. gr.* Put

$$(a_0x^3+a_1x^2+a_2x+a_3)(b_0x'^2+b_1x'+b_2)-(a_0x'^3+a_1x'^2+a_2x'+a_3)(b_0x^2+b_1x+b_2)=0;$$

after division by $x-x'$ the three equations are formed

$$\begin{aligned} a_0b_0x^2+a_0b_1x+a_0b_2 \qquad\qquad &=0, \\ a_0b_1x^2+(a_0b_2+a_1b_1-a_2b_0)x+a_1b_2-a_3b_0 &=0, \\ a_0b_2x^2+(a_1b_2-a_3b_0)x+a_2b_2-a_3b_1 \qquad &=0 \end{aligned}$$

and thence the resultant

$$\begin{vmatrix} a_0b_0 & a_0b_1 & a_0b_2 \\ a_0b_1 & a_0b_2+a_1b_1-a_2b_0 & a_1b_2-a_3b_0 \\ a_0b_2 & a_1b_2-a_3b_0 & a_2b_2-a_3b_1 \end{vmatrix}$$

which is a symmetrical determinant.

Case of Three Variables.—In the next place we consider the resultants of three homogeneous polynomials in three variables. We can prove that if the three equations be satisfied by a system of values of the variable, the same system will also satisfy the Jacobian or functional determinant. For if u, v, w be the polynomials of orders m, n, p respectively, the Jacobian is $(u_1\ v_2\ w_3)$, and by Euler's theorem of homogeneous functions

$$\begin{aligned} xu_1+yu_2+zu_3 &= mu \\ xv_1+yv_2+zv_3 &= nv \\ xw_1+yw_2+zw_3 &= pw; \end{aligned}$$

denoting now the reciprocal determinant by $(\mathrm{U}_1\ \mathrm{V}_2\ \mathrm{W}_3)$ we obtain $\mathrm{J}x=mu\mathrm{U}_1+nv\mathrm{V}_1+pw\mathrm{W}_1$; $\mathrm{J}y=\dots$, $\mathrm{J}z=\dots$, and it appears that the vanishing of u, v, and w implies the vanishing of J. Further, if $m=n=p$, we obtain by differentiation

$$\mathrm{J}+x\frac{\partial \mathrm{J}}{\partial x}=m\left(u\frac{\partial \mathrm{U}_1}{\partial x}+v\frac{\partial \mathrm{V}_1}{\partial x}+w\frac{\partial \mathrm{W}_1}{\partial x}+u_1\mathrm{U}_1+v_1\mathrm{V}_1+w_1\mathrm{W}_1\right).$$

or

$$x\frac{\partial \mathrm{J}}{\partial x}=(m-1)\mathrm{J}+m\left(u\frac{\partial \mathrm{U}_1}{\partial x}+v\frac{\partial \mathrm{V}_1}{\partial x}+w\frac{\partial \mathrm{W}_1}{\partial x}\right).$$

Hence the system of values also causes $\frac{\partial \mathrm{J}}{\partial x}$ to vanish in this case; and by symmetry $\frac{\partial \mathrm{J}}{\partial y}$ and $\frac{\partial \mathrm{J}}{\partial z}$ also vanish.

The proof being of general application we may state that a system of values which causes the vanishing of k polynomials in k variables causes also the vanishing of the Jacobian, and in particular, when the forms are of the same degree, the vanishing also of the differential coefficients of the Jacobian in regard to each of the variables.

There is no difficulty in expressing the resultant by the method of symmetric functions. Taking two of the equations

$$\begin{aligned} ax^m+(by+cz)x^{m-1}+\dots &=0, \\ a'x^n+(b'y+c'z)x^{n-1}+\dots &=0, \end{aligned}$$

we find that, eliminating x, the resultant is a homogeneous function of y and z of degree mn; equating this to zero and solving for the ratio of y to z we obtain mn solutions; if values of y and z, given by any solution, be substituted in each of the two equations, they will possess a common factor which gives a value of x which, combined with the chosen values of y and z, yields a system of values which satisfies both equations. Hence in all there are mn such systems. If, therefore, we have a third equation, and we substitute each system of values in it successively and form the product of the mn expressions thus formed, we obtain a function which vanishes if any one system of values, common to the first two equations, also satisfies the third. Hence this product is the required resultant of the three equations.

Now by the theory of symmetric functions, any symmetric functions of the mn values which satisfy the two equations, can be expressed in terms of the coefficient of those equations. Hence, finally, the resultant is expressed in terms of the coefficients of the three equations, and since it is at once seen to be of degree mn in the coefficient of the third equation, by symmetry it must be of degrees np and pm in the coefficients of the first and second equations respectively. Its weight will be mnp (see Salmon's *Higher Algebra*, 4th ed. § 77). The general theory of the resultant of k homogeneous equations in k variables presents no further difficulties when viewed in this manner.

The expression in form of a determinant presents in general considerable difficulties. If three equations, each of the second degree, in three variables be given, we have merely to eliminate the six products x^2, y^2, z^2, yz, zx, xy from the six equations $u=v=w=\frac{\partial \mathrm{J}}{\partial x}=\frac{\partial \mathrm{J}}{\partial y}=\frac{\partial \mathrm{J}}{\partial z}=0$; if we apply the same process to these equations each of degree three, we obtain similarly a determinant of order 21, but thereafter the process fails. Cayley, however, has shown that, whatever be the degrees of the three equations, it is possible to represent the resultant as the quotient of two determinants (Salmon, *l.c.* p. 89).

Discriminants.—The discriminant of a homogeneous polynomial in k variables is the resultant of the k polynomials formed by differentiations in regard to each of the variables.

It is the resultant of k polynomials each of degree $m-1$, and thus contains the coefficients of each form to the degree $(m-1)^{k-1}$; hence the total degrees in the coefficients of the k forms is, by addition, $k(m-1)^{k-1}$; it may further be shown that the weight of each term of the resultant is constant and equal to $m(m-1)^{k-1}$ (Salmon, *l.c.* p. 100).

A binary form which has a square factor has its discriminant equal to zero. This can be seen at once because the factor in question being once repeated in both differentials, the resultant of the latter must vanish.

Similarly, if a form in k variables be expressible as a quadratic function of $k-1$, linear functions X_1, X_2, $\dots \mathrm{X}_{k-1}$, the coefficients being any polynomials, it is clear that the k differentials have, in common, the system of roots derived from $\mathrm{X}_1=\mathrm{X}_2=\dots=\mathrm{X}_{k-1}=0$, and have in consequence a vanishing resultant. This implies the vanishing of the discriminant of the original form.

Expression in Terms of Roots.—Since $x\frac{\partial f}{\partial x}+y\frac{\partial f}{\partial y}=mf$, if we take any root x_1, y_1, of $\frac{\partial f}{\partial x}$, and substitute in mf we must obtain $y_1\left(\frac{\partial f}{\partial y}\right)_{\substack{x=x_1 \\ y=y_1}}$; hence the resultant of $\frac{\partial f}{\partial x}$ and f is, disregarding numerical factors, $y_1y_2\dots y_{n-1}\times$discriminant of $f=a_0\times$disct. of f.

Now

$$\begin{aligned} f &= (xy_1-x_1y)(xy_2-x_2y)\dots(xy_m-x_my), \\ \frac{\partial f}{\partial x} &= \Sigma y_1(xy_2-x_2y)\dots(xy_m-x_my), \end{aligned}$$

and substituting in the latter any root of f and forming the product, we find the resultant of f and $\frac{\partial f}{\partial x}$, viz.

$$y_1y_2\dots y_m(x_1y_2-x_2y_1)^2(x_1y_3-x_3y_1)^2\dots(x_ry_s-x_sy_r)^2\dots$$

and, dividing by $y_1y_2\dots y_m$, the discriminant of f is seen to be equal to the product of the squares of all the differences of any two roots of the equation. The discriminant of the product of two forms is equal to the product of their discriminants multiplied by the square of their resultant. This follows at once from the fact that the discriminant is

$$\Pi(\alpha_r-\alpha_s)^2\Pi(\beta_r-\beta_s)^2\{\Pi(\alpha_r-\beta_s)\}^2.$$

REFERENCES FOR THE THEORY OF DETERMINANTS.—T. Muir's "List of Writings on Determinants," *Quarterly Journal of Mathematics.* vol. xviii. pp. 110-149, October 1881, is the most important bibliographical article on the subject in any language; it contains 589 entries, arranged in chronological order, the first date being 1693 and the last 1880. The bibliography has been continued, and published at various dates (vol. xxi. pp. 299-320; vol. xxxvi. pp. 171-267) in the same periodical. These lists contain 1740 entries. T. Muir, *History of the Theory of Determinants* (2nd ed., London, 1906). School treatises are those of Thomson, Mansion, Bartl, Mollame, in English, French, German and Italian respectively.—Advanced treatises are those of William Spottiswoode (1851), Francesco Brioschi (1854), Richard Baltzer (1857), George Salmon (1859), N. Trudi (1862), Giovanni Garbieri (1874), Siegmund Günther (1875), Georges J. Dostor (1877), Baraniecki (the most extensive of all) (1879), R. F. Scott (2nd ed., 1904), T. Muir (1881).

II. THE THEORY OF SYMMETRIC FUNCTIONS

Consider n quantities $\alpha_1, \alpha_2, \alpha_3, \dots \alpha_n$.

Every rational integral function of these quantities, which does not alter its value however the n suffixes 1, 2, 3, ... n be permuted, is a rational integral symmetric function of the quantities. If we write $(1+\alpha_1 x)(1+\alpha_2 x)\dots(1+\alpha_n x) = 1 + a_1 x + a_2 x^2 + \dots + a_n x^n$, $a_1, a_2, \dots a_n$ are called the elementary symmetric functions.

$$\begin{aligned} a_1 &= \alpha_1+\alpha_2+\dots+\alpha_n = \Sigma\alpha_1 \\ a_2 &= \alpha_1\alpha_2+\alpha_1\alpha_3+\alpha_2\alpha_3+\dots = \Sigma\alpha_1\alpha_2 \\ &\cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \\ a_n &= \alpha_1\alpha_2\alpha_3\dots\alpha_n. \end{aligned}$$

The general monomial symmetric function is

$$\Sigma\alpha_1^{p_1}\alpha_2^{p_2}\alpha_3^{p_3}\dots\alpha_n^{p_n},$$

the summation being for all permutations of the indices which result in different terms. The function is written

$$(p_1p_2p_3\dots p_n)$$

for brevity, and repetitions of numbers in the bracket are indicated by exponents, so that $(p_1p_1p_2)$ is written $(p_1^2p_2)$. The weight of the function is the sum of the numbers in the bracket, and the degree the highest of those numbers.

Ex. gr. The elementary functions are denoted by

$$(1),\ (1^2),\ (1^3),\ \dots\ (1^n),$$

are all of the first degree, and are of weights 1, 2, 3,...n respectively.

Remark.—In this notation $(0) = \Sigma\alpha_1^0 = \binom{n}{1}$; $(0^2) = \Sigma\alpha_1^0\alpha_2^0 = \binom{n}{2}$;...$(0^s) = \binom{n}{s}$, &c. The binomial coefficients appear, in fact, as symmetric functions, and this is frequently of importance.

The order of the numbers in the bracket $(p_1p_2\dots p_n)$ is immaterial; we may therefore always place them, as is most convenient, in descending order of magnitude; the numbers then constitute an ordered partition of the weight w, and the leading number denotes the degree.

The sum of the monomial functions of a given weight is called the *homogeneous-product-sum* or complete symmetric function of that weight; it is denoted by h_w; it is connected with the elementary functions by the formula

$$\frac{1}{1-a_1x+a_2x^2-a_3x^3+\dots} = 1+h_1x+h_2x^2+h_3x^3+\dots,$$

which remains true when the symbols a and h are interchanged, as is at once evident by writing $-x$ for x. This proves, also, that in *any* formula connecting $a_1, a_2, a_3, \dots$ with $h_1, h_2, h_3, \dots$ the symbols a and h may be interchanged.

Ex. gr. from $h_2 = a_1^2 - a_2$ we derive $a_2 = h_1^2 - h_2$.

The function $\Sigma\alpha_1^{p_1}\alpha_2^{p_2}\dots\alpha_n^{p_n}$ being as above denoted by a partition of the weight, viz. $(p_1p_2\dots p_n)$, it is necessary to bring under view other functions associated with the same series of numbers: such, for example, as

$$\Sigma\alpha_1^{p_1}\alpha_2^{p_3}\Sigma\alpha_1^{p_2}\alpha_2^{p_4}\dots\alpha_{n-2}^{p_{n-2}} = (p_1p_3)(p_2p_4\dots p_{n-2}).$$

The expression just written is in fact a partition of a partition, and to avoid confusion of language will be termed a *separation* of a partition. A partition is *separated* into *separates* so as to produce a separation of the partition by writing down a set of partitions, each separate partition in its own brackets, so that when all the parts of these partitions are reassembled in a single bracket the partition which is separated is reproduced. It is convenient to write the distinct partitions or separates in descending order as regards weight. If the successive weights of the separates $w_1, w_2, w_3, \dots$ be enclosed in a bracket we obtain a partition of the weight w which appertains to the separated partition. This partition is termed the *specification* of the separation. The degree of the separation is the sum of the degrees of the component separates. A separation is the symbolic representation of a product of monomial symmetric functions. A partition, $(p_1p_1p_1p_2p_2p_3) = (p_1^3p_2^2p_3)$, can be separated in the manner $(p_1p_2)(p_1p_2)(p_1p_3) = (p_1p_2)^2(p_1p_3)$, and we may take the general form of a partition to be $(p_1^{\pi_1}p_2^{\pi_2}p_3^{\pi_3}\dots)$ and that of a separation $(J_1)^{j_1}(J_2)^{j_2}(J_3)^{j_3}\dots$ when $J_1, J_2, J_3\dots$ denote the distinct separates involved.

Theorem.— The function symbolized by (n), viz. the sum of the n^{th} powers of the quantities, is expressible in terms of functions which are symbolized by separations of *any* partition $(n_1^{\nu_1}n_2^{\nu_2}n_3^{\nu_3}\dots)$ of the number n. The expression is—

$$(-)^{\nu_1+\nu_2+\nu_3+\dots}\frac{(\nu_1+\nu_2+\nu_3+\dots-1)!}{\nu_1!\nu_2!\nu_3!\dots}(n)$$
$$=\sum(-)^{j_1+j_2+j_3+\dots}\frac{(j_1+j_2+j_3+\dots-1)!}{j_1!j_2!j_3!\dots}(J_1)^{j_1}(J_2)^{j_2}(J_3)^{j_3}\dots,$$

$(J_1)^{j_1}(J_2)^{j_2}(J_3)^{j_3}\dots$ being a separation of $(n_1^{\nu_1}n_2^{\nu_2}n_3^{\nu_3}\dots)$ and the summation being in regard to all such separations. For the particular case $(n_1^{\nu_1}n_2^{\nu_2}n_3^{\nu_3}\dots) = (1^n)$

$$(-)^n\frac{1}{n}(n) = \sum(-)^{j_1+j_2+j_3+\dots}\frac{(j_1+j_2+j_3+\dots-1)!}{j_1!j_2!j_3!\dots}(1)^{j_1}(1^2)^{j_2}(1^3)^{j_3}\dots.$$

To establish this write—

$$1+\mu X_1+\mu^2X_2+\mu^3X_3+\dots = \prod_\alpha(1+\mu\alpha_1x_1+\mu^2\alpha_1^2x_2+\mu^3\alpha_1^3x_3+\dots),$$

the product on the right involving a factor for each of the quantities $\alpha_1, \alpha_2, \alpha_3\dots$, and μ being arbitrary.

Multiplying out the right-hand side and comparing coefficients

$$\begin{aligned} X_1 &= (1)x_1, \\ X_2 &= (2)x_2+(1^2)x_1^2, \\ X_3 &= (3)x_3+(21)x_2x_1+(1^3)x_1^3, \\ X_4 &= (4)x_4+(31)x_3x_1+(2^2)x_2^2+(21^2)x_2x_1^2+(1^4)x_1^4, \\ &\cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \\ X_m &= \Sigma(m_1^{\mu_1}m_2^{\mu_2}m_3^{\mu_3}\dots)x_{m_1}^{\mu_1}x_{m_2}^{\mu_2}x_{m_3}^{\mu_3}\dots, \end{aligned}$$

the summation being for all partitions of m.

Auxiliary Theorem.—The coefficient of $x_{l_1}^{\lambda_1}x_{l_2}^{\lambda_2}x_{l_3}^{\lambda_3}\dots$ in the product $\frac{X_{m_1}^{\mu_1}X_{m_2}^{\mu_2}X_{m_3}^{\mu_3}\dots}{\mu_1!\,\mu_2!\,\mu_3!\dots}$ is $\sum\frac{(J_1)^{j_1}(J_2)^{j_2}(J_3)^{j_3}\dots}{j_1!j_2!j_3!\dots}$ where $(J_1)^{j_1}(J_2)^{j_2}(J_3)^{j_3}\dots$ is a separation of $(l_1^{\lambda_1}l_2^{\lambda_2}l_3^{\lambda_3}\dots)$ of specification $(m_1^{\mu_1}m_2^{\mu_2}m_3^{\mu_3}\dots)$, and the sum is for all such separations.

To establish this observe the result.

$$\frac{1}{p!}X_s^p = \sum\frac{(3)^{\pi_1}(21)^{\pi_2}(1^3)^{\pi_3}}{\pi_1!\pi_2!\pi_3!}x_3^{\pi_1}x_2^{\pi_2}x_1^{\pi_2+3\pi_3}$$

and remark that $(3)^{\pi_1}(21)^{\pi_2}(1^3)^{\pi_3}$ is a separation of $(3^{\pi_1}2^{\pi_2}1^{\pi_2+3\pi_3})$ of specification (3^p). A similar remark may be made in respect of

$$\frac{1}{\mu_1!}X_{m_1}^{\mu_1},\ \frac{1}{\mu_2!}X_{m_2}^{\mu_2},\ \frac{1}{\mu_3!}X_{m_3}^{\mu_3},\dots$$

and therefore of the product of those expressions. Hence the theorem.

Now

$$\begin{aligned} &\log(1+\mu X_1+\mu^2X_2+\mu^3X_3+\dots) \\ &= \Sigma_\alpha\log(1+\mu\alpha_1x_1+\mu^2\alpha_1^2x_2+\mu^3\alpha_1^3x_3+\dots) \end{aligned}$$

whence, expanding by the exponential and multinomial theorems, a comparison of the coefficients of μ^n gives

$$(n)\sum(-)^{\nu_1+\nu_2+\nu_3+\dots-1}\frac{(\nu_1+\nu_2+\nu_3+\dots-1)!}{\nu_1!\nu_2!\nu_3!\dots}x_{n_1}^{\nu_1}x_{n_2}^{\nu_2}x_{n_3}^{\nu_3}\dots$$
$$=\sum(-)^{\nu_1+\nu_2+\nu_3+\dots-1}\frac{(\nu_1+\nu_2+\nu_3+\dots-1)!}{\nu_1!\nu_2!\nu_3!\dots}X_{n_1}^{\nu_1}X_{n_2}^{\nu_2}X_{n_3}^{\nu_3}\dots$$

and, by the auxiliary theorem, any term $X_{m_1}^{\mu_1}X_{m_2}^{\mu_2}X_{m_3}^{\mu_3}\dots$ on the right-hand side is such that the coefficient of $x_{n_1}^{\nu_1}x_{n_2}^{\nu_2}x_{n_3}^{\nu_3}\dots$ in $\frac{1}{\mu_1!\mu_2!\mu_3!\dots}X_{m_1}^{\mu_1}X_{m_2}^{\mu_2}X_{m_3}^{\mu_3}\dots$ is

$$\sum\frac{(J_1)^{j_1}(J_2)^{j_2}(J_3)^{j_3}\dots}{j_1!j_2!j_3!\dots},$$

where since $(m_1^{\mu_1}m_2^{\mu_2}m_3^{\mu_3}\dots)$ is the specification of $(J_1)^{j_1}(J_2)^{j_2}(J_3)^{j_3}\dots$, $\mu_1+\mu_2+\mu_3+\dots = j_1+j_2+j_3+\dots$. Comparison of the coefficients of $x_{n_1}^{\nu_1}x_{n_2}^{\nu_2}x_{n_3}^{\nu_3}\dots$ therefore yields the result

$$(-)^{\nu_1+\nu_2+\nu_3+\dots}\frac{(\nu_1+\nu_2+\nu_3+\dots-1)!}{\nu_1!\nu_2!\nu_3!\dots}(n)$$
$$=\sum(-)^{j_1+j_2+j_3+\dots}\frac{(j_1+j_2+j_3+\dots-1)!}{j_1!j_2!j_3!\dots}(J_1)^{j_1}(J_2)^{j_2}(J_3)^{j_3}\dots,$$

for the expression of $\Sigma\alpha^n$ in terms of products of symmetric functions symbolized by separations of $(n_1^{\nu_1}n_2^{\nu_2}n_3^{\nu_3}\dots)$.

Let $(n)_a, (n)_x, (n)_X$ denote the sums of the n^{th} powers of quantities whose elementary symmetric functions are $a_1, a_2, a_3, \dots$; $x_1, x_2, x_3, \dots$; $X_1, X_2, X_3, \dots$ respectively: then the result arrived at above from the logarithmic expansion may be written

$$(n)_a(n)_x = (n)_X,$$

exhibiting $(n)_X$ as an invariant of the transformation given by the expressions of $X_1, X_2, X_3\dots$ in terms of $x_1, x_2, x_3, \dots$.

The inverse question is the expression of any monomial symmetric function by means of the power functions $(r) = s_r$.

Theorem of Reciprocity.—If

$$X_{m_1}^{\mu_1}X_{m_2}^{\mu_2}X_{m_3}^{\mu_3}\dots = \dots+\theta(s_1^{\sigma_1}s_2^{\sigma_2}s_3^{\sigma_3}\dots)x_{l_1}^{\lambda_1}x_{l_2}^{\lambda_2}x_{l_3}^{\lambda_3}\dots+\dots,$$

where θ is a numerical coefficient, then also

$$X_{s_1}^{\sigma_1}X_{s_2}^{\sigma_2}X_{s_3}^{\sigma_3}\dots = \dots+\theta(m_1^{\mu_1}m_2^{\mu_2}m_3^{\mu_3}\dots)x_{l_1}^{\lambda_1}x_{l_2}^{\lambda_2}x_{l_3}^{\lambda_3}\dots+\dots.$$

We have found above that the coefficient of $(x_{l_1}^{\lambda_1}x_{l_2}^{\lambda_2}x_{l_3}^{\lambda_3}\dots)$ in the product $X_{m_1}^{\mu_1}X_{m_2}^{\mu_2}X_{m_3}^{\mu_3}\dots$ is

$$\mu_1!\mu_2!\mu_3!\dots\sum\frac{(J_1)^{j_1}(J_2)^{j_2}(J_3)^{j_3}\dots}{j_1!j_2!j_3!\dots},$$

the sum being for all separations of $l_1^{\lambda_1}l_2^{\lambda_2}l_3^{\lambda_3}\dots)$ which have the specification $(m_1^{\mu_1}m_2^{\mu_2}m_3^{\mu_3}\dots)$. We can multiply out this expression so as to obtain a series of monomials of the form $\theta(s_1^{\sigma_1}s_2^{\sigma_2}s_3^{\sigma_3}\dots)$. It can be shown that the number θ enumerates distributions of a certain nature defined by the partitions $(m_1^{\mu_1}m_2^{\mu_2}\dots)$, $(s_1^{\sigma_1}s_2^{\sigma_2}\dots)$,

$(l_1^{\lambda_1} l_2^{\lambda_2}\dots)$ and it is seen intuitively that the number θ remains unaltered when the first two of these partitions are interchanged (see COMBINATORIAL ANALYSIS). Hence the theorem is established.

Putting $x_1=1$ and $x_2=x_3=x_4=\dots=0$, we find a particular law of reciprocity given by Cayley and Betti,

$$(1^{m_1})^{\mu_1}(1^{m_2})^{\mu_2}(1^{m_3})^{\mu_3}\dots=\dots+\theta(s_1^{\sigma_1}s_2^{\sigma_2}s_3^{\sigma_3}\dots)+\dots,$$

$$(1^{s_1})^{\sigma_1}(1^{s_2})^{\sigma_2}(1^{s_3})^{\sigma_3}\dots=\dots+\theta(m_1^{\mu_1}m_2^{\mu_2}m_3^{\mu_3}\dots)+\dots;$$

and another by putting $x_1=x_2=x_3=\dots=1$, for then X_m becomes h_m, and we have

$$h_{m_1}^{\mu_1}h_{m_2}^{\mu_2}h_{m_3}^{\mu_3}\dots=\dots+\theta'(s_1^{\sigma_1}s_2^{\sigma_2}s_3^{\sigma_3}\dots)+\dots,$$

$$h_{s_1}^{\sigma_1}h_{s_2}^{\sigma_2}h_{s_3}^{\sigma_3}\dots=\dots+\theta'(m_1^{\mu_1}m_2^{\mu_2}m_3^{\mu_3}\dots)+\dots,$$

Theorem of Expressibility.—"If a symmetric function be symboilized by $(\lambda\mu\nu\dots)$ and $(\lambda_1\lambda_2\lambda_3\dots)$, $(\mu_1\mu_2\mu_3\dots)$, $(\nu_1\nu_2\nu_3\dots)\dots$ be any partitions of λ, μ, $\nu\dots$ respectively, the function $(\lambda\mu\nu\dots)$ is expressible by means of functions symbolized by separation of

$$(\lambda_1\lambda_2\lambda_3\dots\mu_1\mu_2\mu_3\dots\nu_1\nu_2\nu_3\dots)."$$

For, writing as before,

$$X_{m_1}^{\mu_1}X_{m_2}^{\mu_2}X_{m_3}^{\mu_3}\dots=\Sigma\Sigma\theta(s_1^{\sigma_1}s_2^{\sigma_2}s_3^{\sigma_3}\dots)x_{l_1}^{\lambda_1}x_{l_2}^{\lambda_2}x_{l_3}^{\lambda_3}\dots,$$
$$=\Sigma P x_{l_1}^{\lambda_1}x_{l_2}^{\lambda_2}x_{l_3}^{\lambda_3}\dots,$$

P is a linear function of separations of $(l_1^{\lambda_1}l_2^{\lambda_2}l_3^{\lambda_3}\dots)$ of specification $(m_1^{\mu_1}m_2^{\mu_2}m_3^{\mu_3}\dots)$, and if $X_{s_1}^{\sigma_1}X_{s_2}^{\sigma_2}X_{s_3}^{\sigma_3}\dots=\Sigma P' x_{l_1}^{\lambda_1}x_{l_2}^{\lambda_2}x_{l_3}^{\lambda_3}\dots$, P′ is a linear function of separations of $(l_1^{\lambda_1}l_2^{\lambda_2}l_3^{\lambda_3}\dots)$ of specification $(s_1^{\sigma_1}s_2^{\sigma_2}s_3^{\sigma_3}\dots)$. Suppose the separations of $(l_1^{\lambda_1}l_2^{\lambda_2}l_3^{\lambda_3}\dots)$ to involve k different specifications and form the k identities

$$X_{m_{1s}}^{\mu_{1s}}X_{m_{2s}}^{\mu_{2s}}X_{m_{3s}}^{\mu_{3s}}\dots=\Sigma P^{(s)}x_{l_1}^{\lambda_1}x_{l_2}^{\lambda_2}x_{l_3}^{\lambda_3}\dots(s=1,\ 2,\ \dots k),$$

where $(m_{1s}^{\mu_{1s}}m_{2s}^{\mu_{2s}}m_{3s}^{\mu_{3s}}\dots)$ is one of the k specifications.

The law of reciprocity shows that

$$P^{(s)}=\sum_{t=1}^{t=k}\theta_{st}(m_{1t}^{\mu_{1t}}m_{2t}^{\mu_{2t}}m_{3t}^{\mu_{3t}}\dots),$$

viz.: a linear function of symmetric functions symbolized by the k specifications; and that $\theta_{st}=\theta_{ts}$. A table may be formed expressing the k expressions $P^{(1)}$, $P^{(2)}$,…$P^{(k)}$ as linear functions of the k expressions $(m_{1s}^{\mu_{1s}}m_{2s}^{\mu_{2s}}m_{3s}^{\mu_{3s}}\dots)$, $s=1,\ 2,\ \dots k$, and the numbers θ_{st} occurring therein possess row and column symmetry. By solving k linear equations we similarly express the latter functions as linear functions of the former, and this table will also be symmetrical.

Theorem.—"The symmetric function $(m_{1s}^{\mu_{1s}}m_{2s}^{\mu_{2s}}m_{3s}^{\mu_{3s}}\dots)$ whose partition is a specification of a separation of the function symbolized by $(l_1^{\lambda_1}l_2^{\lambda_2}l_3^{\lambda_3}\dots)$ is expressible as a linear function of symmetric functions symbolized by separations of $(l_1^{\lambda_1}l_2^{\lambda_2}l_3^{\lambda_3}\dots)$ and a symmetrical table may be thus formed." It is now to be remarked that the partition $(l_1^{\lambda_1}l_2^{\lambda_2}l_3^{\lambda_3}\dots)$ can be derived from $(m_{1s}^{\mu_{1s}}m_{2s}^{\mu_{2s}}m_{3s}^{\mu_{3s}}\dots)$ by substituting for the numbers m_{1s}, m_{2s}, m_{3s},… certain partitions of those numbers (*vide* the definition of the specification of a separation).

Hence the theorem of expressibility enunciated above. A new statement of the law of reciprocity can be arrived at as follows:—Since.

$$P^{(s)}=\mu_{1s}!\mu_{2s}!\mu_{3s}!\dots\sum\frac{(J_1)^{j_1}(J_2)^{j_2}(J_3)^{j_3}\dots}{j_1!j_2!j_3!\dots},$$

where $(J_1)^{j_1}(J_2)^{j_2}(J_3)^{j_3}\dots$ is a separation of $(l_1^{\lambda_1}l_2^{\lambda_2}l_3^{\lambda_3}\dots)$ of specification $(m_{1s}^{\mu_{1s}}m_{2s}^{\mu_{2s}}m_{3s}^{\mu_{3s}}\dots)$, placing s under the summation sign to denote the specification involved,

$$\mu_{1s}!\mu_{2s}!\mu_{3s}\dots\sum_{s}\frac{(J_1)^{j_1}(J_2)^{j_2}(J_3)^{j_3}\dots}{j_1!j_2!j_3!\dots}=\sum_{t=1}^{t=k}\theta_{st}(m_{1t}^{\mu_{1t}}m_{2t}^{\mu_{2t}}m_{3t}^{\mu_{3t}}\dots),$$

$$\mu_{1t}!\mu_{2t}!\mu_{3t}!\dots\sum_{t}\frac{(J_1)^{j_1}(J_2)^{j_2}(J_3)^{j_3}\dots}{j_1!j_2!j_3\dots}=\sum_{s=1}^{s=k}\theta_{ts}(m_{1s}^{\mu_{1s}}m_{2s}^{\mu_{2s}}m_{3s}^{\mu_{3s}}\dots),$$

where $\theta_{st}=\theta_{ts}$.

Theorem of Symmetry.—If we form the separation function

$$\sum\frac{(J_1)^{j_1}(J_2)^{j_2}(J_3)^{j_3}\dots}{j_1!j_2!j_3!\dots}$$

appertaining to the function $(l_1^{\lambda_1}l_2^{\lambda_2}l_3^{\lambda_3}\dots)$, each separation having a specification $(m_{1s}^{\mu_{1s}}m_{2s}^{\mu_{2s}}m_{3s}^{\mu_{3s}}\dots)$, multiply by $\mu_{1s}!\,\mu_{2s}!\,\mu_{3s}!\dots$ and take therein the coefficient of the function $(m_{1t}^{\mu_{1t}}m_{2t}^{\mu_{2t}}m_{3t}^{\mu_{3t}}\dots)$, we obtain the same result as if we formed the separation function in regard to the specification $(m_{1t}^{\mu_{1t}}m_{t2}^{\mu_{2t}}m_{3t}^{\mu_{3t}}\dots)$, multiplied by $\mu_{1t}!\,\mu_{2t}!\,\mu_{3t}!\dots$ and took therein the coefficient of the function $(m_{1s}^{\mu_{1s}}m_{2s}^{\mu_{2s}}m_{3s}^{\mu_{3s}}\dots)$.

Ex.gr., take $(l_1^{\lambda_1}l_2^{\lambda_2}\dots)=(21^4)$; $(m_{1s}^{\mu_{1s}}m_{2s}^{\mu_{2s}}\dots)=(321)$; $(m_{1t}^{\mu_{1t}}m_{2t}^{\mu_{2t}}\dots)=(31_3)$; we find

$$(21)(1^2)(1)+(1^3)(2)(1)=\dots+13(31^3)+\dots$$
$$(21)(1)^3\quad\dots+13(321)+\dots$$

The Differential Operators.—Starting with the relation

$$(1+a_1x)(1+a_2x)\dots(1+a_nx)=1+a_1x+a_2x^2+\dots+a_nx^n$$

multiply each side by $1+\mu x$, thus introducing a new quantity μ; we obtain

$$(1+a_1x)(1+a_2x)\dots(1+a_nx)(1+\mu x)=1+(a_1+\mu)x+(a_2+\mu a_1)x^2+\dots$$

so that $f(a_1,\ a_2,\ a_3,\dots a_n)=f$, a rational integral function of the elementary functions, is converted into

$$f(a_1+\mu,\ a_2+\mu a_1,\dots a_n+\mu a_{n-1})=f+\mu d_1f+\frac{\mu^2}{2!}\overline{d_1^2}f+\frac{\mu^3}{3!}\overline{d_1^3}f+\dots$$

where

$$d_1=\frac{\partial}{\partial a_1}+a_1\frac{\partial}{\partial a_2}+a_2\frac{\partial}{\partial a_3}+\dots+a_{n-1}\frac{\partial}{\partial a_n}$$

and $\overline{d_1^s}$ denotes, not s successive operations of d_1, but the operator of order s obtained by raising d_1 to the s^{th} power symbolically as in Taylor's theorem in the Differential Calculus.

Write also $\frac{1}{s!}\overline{d_1^s}=D$, so that

$$f(a_1+\mu,\ a_2+\mu a_1,\ \dots a_n+\mu a_{n-1})=f+\mu D_1f+\mu^2D_2f+\mu^3D_3f+\dots.$$

The introduction of the quantity μ converts the symmetric function $(\lambda_1\lambda_2\lambda_3\dots)$ into

$$(\lambda_1\lambda_2\lambda_3+\dots)+\mu^{\lambda_1}(\lambda_2\lambda_3\dots)+\mu^{\lambda_2}(\lambda_1\lambda_3\dots)+\mu^{\lambda_3}(\lambda_1\lambda_2\dots)+\dots.$$

Hence, if $f(a_1,\ a_2,\ \dots a_n)=(\lambda_1\lambda_2\lambda_3\dots)$,

$$(\lambda_1\lambda_2\lambda_3\dots)+\mu^{\lambda_1}(\lambda_2\lambda_3\dots)+\mu^{\lambda_2}(\lambda_1\lambda_3\dots)+\mu^{\lambda_3}(\lambda_1\lambda_2\dots)+\dots$$
$$=(1+\mu D_1+\mu^2D_2+\mu^3D_3+\dots)(\lambda_1\lambda_2\lambda_3\dots).$$

Comparing coefficients of like powers of μ we obtain

$$D\lambda_1(\lambda_1\lambda_2\lambda_3\dots)=(\lambda_2\lambda_3\dots),$$

while $D_s(\lambda_1\lambda_2\lambda_3\dots)=0$ unless the partition $(\lambda_1\lambda_2\lambda_3\dots)$ contains a part s. Further, if $D_{\lambda_1}D_{\lambda_2}$ denote successive operations of D_{λ_1} and D_{λ_2},

$$D\lambda_1D\lambda_2(\lambda_1\lambda_2\lambda_2\dots)=(\lambda_3\dots),$$

and the operations are evidently commutative.

Also $D_{p1}^{\pi_1}D_{p2}^{\pi_2}D_{p3}^{\pi_3}\dots(p_1^{\pi_1}p_2^{\pi_2}p_3^{\pi_3}\dots)=1$, and the law of operation of the operators D upon a monomial symmetric function is clear.

We have obtained the equivalent operations

$$1+\mu D_1+\mu^2D_2+\mu^3D_3+\dots=\overline{exp}\,\mu d_1$$

where $\overline{exp}$ denotes (by the rule over *exp*) that the multiplication of operators is symbolic as in Taylor's theorem. d_1^s denotes, in fact, an operator of order s, but we may transform the right-hand side so that we are only concerned with the successive performance of linear operations. For this purpose write

$$a_s=\partial_{a_s}+a_1\partial_{a_{s+1}}+a_2\partial_{a_{s+2}}+\dots.$$

It has been shown (*vide* "Memoir on Symmetric Functions of the Roots of Systems of Equations," *Phil. Trans.* 1890, p. 490) that

$$\overline{exp}(m_1d_1+m_2d_2+m_3d_3+\dots)=exp(M_1d_1+M_2d_2+M_3d_3+\dots),$$

where now the multiplications on the dexter denote successive operations, provided that

$$exp(M_1\xi+M_2\xi^2+M_3\xi^3+\dots)=1+m_1\xi+m_2\xi^2+m_3\xi^3+\dots,$$

ξ being an undetermined algebraic quantity.

Hence we derive the particular cases

$$\overline{exp}\,d_1=exp(d_1-\tfrac{1}{2}d_2+\tfrac{1}{3}d_3-\dots);$$

$$\overline{exp}\,\mu d_1=exp(\mu d_1-\tfrac{1}{2}\mu^2d_2+\tfrac{1}{3}\mu^3d_3-\dots),$$

and we can express D_s in terms of d_1, d_2, d_3,…, products denoting successive operations, by the same law which expresses the elementary function a_s in terms of the sums of powers s_1, s_2, s_3,… Further, we can express d_s in terms of D_1, D_2, D_3, … by the same law which expresses the power function s, in terms of the elementary functions a_1, a_2, a_3,…

Operation of D_s *upon a Product of Symmetric Functions.*—Suppose f to be a product of symmetric functions $f_1f_2\dots f_m$. If in the identity $f=f_1f_2\dots f_m$ we introduce a new root μ we change a_s into $a_s+\mu a_{s-1}$, and we obtain

$$\begin{aligned}&(1+\mu D_1+\mu^2D_2+\dots+\mu^sD_s+\dots)f\\=&(1+\mu D_1+\mu^2D_2+\dots+\mu^sD_s+\dots)f_1\\\times&(1+\mu D_1+\mu^2D_2+\dots+\mu^sD_s+\dots)f_2\\\times&\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\\\times&(1+\mu D_1+\mu^2D_2+\dots+\mu^sD_s+\dots)f_m,\end{aligned}$$

and now expanding and equating coefficients of like powers of μ

$$\begin{aligned}D_1f&=\Sigma(D_1f_1)f_2f_3\dots f_m,\\D_2f&=\Sigma(D_2f_1)f_2f_3\dots f_m+\Sigma(D_1f_1)(D_1f_2)f_3\dots f_m,\\D_3f&=\Sigma(D_3f_1)f_2f_3\dots f_m+\Sigma(D_2f_1)(D_1f_2)f_3\dots f_m+\Sigma(D_3f_1)f_2f_3\dots f_m,\\&\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\end{aligned}$$

the summation in a term covering every distribution of the operators of the type presenting itself in the term.

Writing these results

$$\begin{aligned}D_1f&=D_{(1)}f,\\D_2f&=D_{(2)}f+D_{(1^2)}f.\\D_3f&=D_{(3)}f+D_{(21)}f+D_{(1^3)}f,\end{aligned}$$

we may write in general

$$D_s f = \Sigma D(p_1 p_2 p_3 \ldots) f,$$

the summation being for every partition $(p_1 p_2 p_3 \ldots)$ of s, and $D(p_1 p_2 p_3 \ldots) f$ being $= \Sigma (D p_1 f_1)(D p_2 f_2)(D p_3 f_3) f_4 \ldots f_m$.

Ex. gr. To operate with D_2 upon $(21^3)(21^4)(1^5)$, we have

$$D_{(2)} f = (1^3)(21^4)(1^5) + (21^3)(1^4)(1^5),$$
$$D_{(1^2)} f = (12^2)(21^3)(1^5) + (21^3)(21^3)(1^4) + (21^2)(21^4)(1^4),$$

and hence

$$D_2 f = (21^4)(1^5)(1^3) + (21^3)(1^5)(1^4) + (21^3)(21^2)(1^5) + (21^3)^2(1^4) + (21^4)(21^2)(1^4).$$

Application to Symmetric Function Multiplication.—An example will explain this. Suppose we wish to find the coefficient of $(52^4 1^3)$ in the product $(21^3)(21^4)(1^5)$.

Write

$$(21^3)(21^4)(1^5) = \ldots + A(52^4)(1^3) + \ldots;$$

then

$$D_5 D_2^4 D_1^3 (21^3)(21^4)(1^5) = A;$$

every other term disappearing by the fundamental property of D_s. Since

$$D_5 (21^3)(21^4)(1^5) = (1^3)(1^4)(1^4),$$

we have:—

$$D_2^4 D_1^3 (1^4)(1^4)(1^3) = A$$
$$D_2^3 D_1^3 \{(1^3)(1^3)(1^3) + 2(1^4)(1^3)(1^2)\} = A$$
$$D_2^2 D_1^3 \{5(1^3)(1^2)(1^2) + 2(1^4)(1^2)(1) + 2(1^3)(1^3)(1)\} = A$$
$$D_2 D_1^3 \{12(1^2)(1^2)(1) + 7(1^3)(1)(1) + 2(1^4)(1) + 6(1^3)(1^2)\} = A$$
$$D_1^3 12(1)^3 = A,$$

where ultimately disappearing terms have been struck out. Finally $A = 6 \cdot 12 = 72$.

The operator $d_1 = a_0 \partial a_1 + a_1 \partial a_2 + a_2 \partial a_3 + \ldots$ which is satisfied by every symmetric fraction whose partition contains no unit (called by Cayley *non-unitary symmetric functions*), is of particular importance in algebraic theories. This arises from the circumstance that the general operator

$$\lambda_0 a_0 \partial a_1 + \lambda_1 a_1 \partial a_2 + \lambda_2 a_2 \partial a_3 + \ldots$$

is transformed into the operator d_1 by the substitution

$$(a_0, a_1, a_2, \ldots a_s, \ldots) = (a_0, \lambda_0 a_1, \lambda_0 \lambda_1 a_2, \ldots, \lambda_0 \lambda_1 \ldots \lambda_{s-1} a_s, \ldots),$$

so that the theory of the general operator is coincident with that of the particular operator d_1. For example, the theory of invariants may be regarded as depending upon the consideration of the symmetric functions of the differences of the roots of the equation

$$a_0 x^n - \tbinom{n}{1} a_1 x^{n-1} + \tbinom{n}{2} a_2 x^{n-2} - \ldots = 0;$$

and such functions satisfy the differential equation

$$a_0 \partial a_1 + 2 a_1 \partial a_2 + 3 a_2 \partial a_3 + \ldots + n a_{n-1} \partial a_n = 0.$$

For such functions remain unaltered when each root receives the same infinitesimal increment h; but writing $x - h$ for x causes $a_0, a_1, a_2\ a_3, \ldots$ to become respectively $a_0, a_1 + h a_0, a_2 + 2 h a_1, a_3 + 3 h a_2, \ldots$ and $f(a_0, a_1, a_2, a_3, \ldots)$ becomes

$$f + h(a_0 \partial_{a_1} + 2 a_1 \partial_{a_2} + 3 a_2 \partial_{a_3} + \ldots) f,$$

and hence the functions satisfy the differential equation. The important result is that the theory of invariants is from a certain point of view coincident with the theory of non-unitary symmetric functions. On the one hand we may state that non-unitary symmetric functions of the roots of $a_0 x^n - a_1 x^{n-1} + a_2 x^{n-2} - \ldots = 0$, are symmetric functions of differences of the roots of

$$a_0 x^n - 1!\tbinom{n}{1} a_1 x^{n-1} + 2!\tbinom{n}{2} a_2 x^{n-2} - \ldots = 0;$$

and on the other hand that symmetric functions of the differences of the roots of

$$a_0 x^n - \tbinom{n}{1} a_1 x^{n-1} + \tbinom{n}{2} a_2 x^{n-2} - \ldots = 0,$$

are non-unitary symmetric functions of the roots of

$$a_0 x^n - \frac{a_1}{1!} x^{n-1} + \frac{a_2}{2!} x^{n-2} - \ldots = 0.$$

An important notion in the theory of linear operators in general is that of MacMahon's *multilinear operator* ("Theory of a Multilinear partial Differential Operator with Applications to the Theories of Invariants and Reciprocants," *Proc. Lond. Math. Soc.* t. xviii. (1886), pp. 61-88). It is defined as having four elements, and is written

$$\begin{aligned}(\mu, \nu; m, n) = \frac{1}{m}\Big[& \mu a_0^m \partial_{a_n} + (\mu + \nu) \frac{m!}{(m-1)!\,1!} a_0^{m-1} a_1 \partial_{a_{n+1}} \\ & + (\mu + 2\nu) \left\{ \frac{m!}{(m-1)!\,1!} a_0^{m-1} a_2 + \frac{m!}{(m-2)!\,2!} a_0^{m-2} a_1^2 \right\} \partial_{a_{n+2}} \\ & + (\mu + 3\nu) \left\{ \frac{m!}{(m-1)!\,1!} a_0^{m-1} a_3 + \frac{m!}{(m-2)!\,1!\,1!} a_0^{m-2} a_1 a_2 \right. \\ & \qquad \left. + \frac{m!}{(m-3)!\,3!} a_0^{m-3} a_0^3 \right\} \partial_{a_{n+3}} \\ & + \ldots \Big],\end{aligned}$$

the coefficient of $a_0^{k_0} a_1^{k_1} a_2^{k_2} \ldots$ being $\frac{m!}{k_0! k_1! k_2! \ldots}$. The operators $a_0 \partial_{a_1} + a_1 \partial_{a_2} + \ldots$, $a_0 \partial_{a_1} + 2 a_1 \partial_{a_2} + \ldots$ are seen to be $(1, 0; 1, 1)$ and $(1, 1; 1, 1)$ respectively. Also the operator of the Theory of Pure Reciprocants (see *Sylvester Lectures on the New Theory of Reciprocants*, Oxford, 1888) is

$$(4, 1; 2, 1) = \frac{1}{2} \left\{ 4 a_0^2 \partial_{a_1} + 10 a_0 a_1 \partial_{a_2} + 6(2 a_0 a_4 + a_1^2) \partial_{a_3} + \ldots \right\}.$$

It will be noticed that

$$(\mu, \nu; m, n) = \mu(1, 0; m, n) + \nu(0, 1; m, n).$$

The importance of the operator consists in the fact that taking any two operators of the system

$$(\mu, \nu; m, n); (\mu^1, \nu^1; m^1, n^1),$$

the operator equivalent to

$$(\mu, \nu; m, n)(\mu^1, \nu^1; m^1, n^1) - (\mu^1, \nu^1; m^1, n^1)(\mu, \nu; m, n),$$

known as the "alternant" of the two operators, is also an operator of the same system. We have the theorem

$$(\mu, \nu; m, n)(\mu^1, \nu^1; m^1, n^1) - (\mu^1, \nu^1; m^1, n^1)(\mu, \nu; m, n) = (\mu_1, \nu_1; m_1, n_1);$$

where

$$\mu_1 = (m^1 + m - 1) \left\{ \frac{\mu^1}{m^1}(\mu + n^1 \nu) - \frac{\mu}{m}(\mu^1 + n \nu^1) \right\},$$
$$\nu_1 = (n^1 - n) \nu^1 \nu + \frac{m-1}{m^1} \mu^1 \nu - \frac{m^1 - 1}{m} \mu \nu^1,$$
$$m_1 = m^1 + m - 1,$$
$$n_1 = n^1 + n,$$

and we conclude that *quâ* "alternation" the operators of the system form a "group." It is thus possible to study simultaneously all the theories which depend upon operations of the group.

Symbolic Representation of Symmetric Functions.—Denote the elementary symmetric function a_s by $\frac{\alpha_1^s}{s!}, \frac{\alpha_2^s}{s!}, \frac{\alpha_3^s}{s!}, \ldots$ at pleasure; then, taking n equal to ∞, we may write

$$1 + a_1 x + a_2 x^2 + \ldots = (1 + \rho_1 x)(1 + \rho_2 x) \ldots = e^{\alpha_1 x} = e^{\alpha_2 x} = e^{\alpha_3 x} = \ldots$$

where

$$a_s = \sum \rho_1 \rho_2 \ldots \rho_s = \frac{\alpha_1^s}{s!} = \frac{\alpha_2^s}{s!} = \frac{\alpha_3^s}{s!} = \ldots.$$

Further, let

$$1 + b_1 x + b_2 x^2 + \ldots + b_m x^m = (1 + \sigma_1 x)(1 + \sigma_2 x) \ldots (1 + \sigma_m x);$$

so that

$$1 + a_1 \sigma_1 + a_2 \sigma_1^2 + \ldots = (1 + \rho_1 \sigma_1)(1 + \rho_2 \sigma_1) \ldots = e^{\sigma_1 \alpha_1},$$
$$1 + a_1 \sigma_2 + a_2 \sigma_2^2 + \ldots = (1 + \rho_1 \sigma_2)(1 + \rho_2 \sigma_2) \ldots = e^{\sigma_2 \alpha_2},$$
$$\cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot$$
$$1 + a_1 \sigma_m + a_2 \sigma_m^2 + \ldots = (1 + \rho_1 \sigma_m)(1 + \rho_2 \sigma_m) \ldots = e^{\sigma_m \alpha_m};$$

and, by multiplication,

$$\prod_\sigma (1 + a_1 \sigma + a_2 \sigma^2 + \ldots) = \prod_\rho (1 + b_1 \rho + b_2 \rho^2 + \ldots + b_m \rho^m),$$
$$= e^{\sigma_1 \alpha_1 + \sigma_2 \alpha_2 + \ldots + \sigma_m \alpha_m}.$$

Denote by brackets ( ) and [ ] symmetric functions of the quantities ρ and σ respectively. Then

$$\begin{aligned} & 1 + a_1[1] + a_1^2[1^2] + a_2[2] + a_1^3[1^3] + a_1 a_2[21] + a_3[3] + \ldots \\ & \quad + a_{p_1} a_{p_2} a_{p_3} \ldots a_{p_m} [p_1 p_2 p_3 \ldots p_m] + \ldots \\ & = 1 + b_1(1) + b_1^2(1^2) + b_2(2) + b_1^3(1^3) + b_1 b_2(21) + b_3(3) + \ldots \\ & \quad + b_1^{q_1} b_2^{q_2} b_3^{q_3} \ldots b_m^{q_m} (m^{q_m} \overline{m-1}^{q_{m-1}} \ldots 2^{q_2} 1^{q_1}) + \ldots \\ & = e^{\sigma_1 \alpha_1 + \sigma_2 \alpha_2 + \ldots + \sigma_m \alpha_m}. \end{aligned}$$

Expanding the right-hand side by the exponential theorem, and then expressing the symmetric functions of $\sigma_1, \sigma_2, \ldots \sigma_m$, which arise, in terms of $b_1, b_2, \ldots b_m$, we obtain by comparison with the middle series the symbolical representation of all symmetric functions in brackets ( ) appertaining to the quantities $\rho_1, \rho_2, \rho_3, \ldots$ To obtain particular theorems the quantities $\sigma_1, \sigma_2, \sigma_3, \ldots \sigma_m$ are auxiliaries which are at our entire disposal. Thus to obtain *Stroh's theory of seminvariants* put

$$b_1 = \sigma_1 + \sigma_2 + \ldots + \sigma_m = [1] = 0;$$

we then obtain the expression of non-unitary symmetric functions of the quantities ρ as functions of differences of the symbols $\alpha_1, \alpha_2, \alpha_3, \ldots$

Ex. gr. $b_2^2(2^2)$ with $m = 2$ must be a term in

$$e^{\sigma_1 \alpha_1 + \sigma_2 \alpha_2} = e^{\sigma_1(\alpha_1 - \alpha_2)} = \ldots + \frac{1}{4!} \sigma_1^4 (\alpha_1 - \alpha_2)^4 + \ldots,$$

and since $b_2^2 = \sigma_1^4$ we must have

$$(2^2) = \frac{1}{24}(\alpha_1 - \alpha_2)^4 = \frac{1}{24}(\alpha_1^4 + \alpha_2^4) - \frac{1}{6}(\alpha_1^3 \alpha_2 + \alpha_1 \alpha_2^3) + \frac{1}{4} \alpha_1^2 \alpha_2^2$$
$$= 2a_4 - 2a_1 a_3 + a_2^2$$

as is well known.

Again, if $\sigma_1, \sigma_2, \sigma_3 \ldots \sigma_m$ be the m, m^{th} roots of -1, $b_1 = b_2 = \ldots = b_{m-1} = 0$ and $b_m = 1$, leading to

$$1 + (m) + (m^2) + (m^3) + \ldots = e^{\sigma_1 \alpha_1 + \sigma_2 \alpha_2 + \ldots + \sigma_m \alpha_m}$$

and

$$\therefore\ (m^s) = \frac{1}{ms!}(\sigma_1 \alpha_1 + \sigma_2 \alpha_2 + \ldots + \sigma_m \alpha_m)^{sm},$$

and we see further that $(\sigma_1 a_1+\sigma_2 a_2+\dots+\sigma_m a_m)^k$ vanishes identically unless $k\equiv 0 \pmod{m}$. If m be infinite and

$$1+b_1x+b_2x^2+\dots=(1+\sigma_1x)(1+\sigma_2x)\dots=e^{\beta_1x}=e^{\beta_2x}=\dots,$$

we have the symbolic identity

$$e^{\sigma_1a_1+\sigma_2a_2+\sigma_3a_3+\dots}=e^{\rho_1\beta_1+\rho_2\beta_2+\rho_3\beta_3+\dots},$$

and

$$(\sigma_1a_1+\sigma_2a_2+\sigma_3a_3+\dots)^p=(\rho_1\beta_1+\rho_2\beta_2+\rho_3\beta_3+\dots)^p.$$

Instead of the above symbols we may use equivalent differential operators. Thus let

$$\delta_a=a_1\partial_{a_0}+2a_2\partial_{a_1}+3a_3\partial_{a_2}+\dots$$

and let $a, b, c, \dots$ be equivalent quantities. Any function of differences of $\delta_a, \delta_b, \delta_c, \dots$ being formed, the expansion being carried out, an operand a_0 or b_0 or c_0 ... being taken and $b, c, \dots$ being subsequently put equal to a, a non-unitary symmetric function will be produced.

Ex. gr.

$$\begin{aligned}(\delta_a-\delta_b)^2(\delta_a-\delta_c)&=(\delta_a^2-2\delta_a\delta_b+\delta_b^2)(\delta_a-\delta_c)\\&=\delta_a^3-2\delta_a^2\delta_b+\delta_a\delta_b^2-\delta_a^2\delta_c+2\delta_a\delta_b\delta_c-\delta_b^2\delta_c\\&=6a_3-4a_2b_1+2a_1b_2-2a_2c_1+2a_1b_1c_1-2b_2c_1\\&=2(a_1^3-3a_1a_2+3a_3)=2(3).\end{aligned}$$

The whole theory of these forms is consequently contained implicitly in the operation δ.

Symmetric Functions of Several Systems of Quantities.—It will suffice to consider two systems of quantities as the corresponding theory for three or more systems is obtainable by an obvious enlargement of the nomenclature and notation.

Taking the systems of quantities to be

$$\alpha_1,\ \alpha_2,\ \alpha_3,\dots$$
$$\beta_1,\ \beta_2,\ \beta_3,\dots$$

we start with the fundamental relation

$$\begin{aligned}&(1+\alpha_1x+\beta_1y)(1+\alpha_2x+\beta_2y)(1+\alpha_3x+\beta_3y)\dots\\&=1+a_{10}x+a_{01}y+a_{20}x^2+a_{11}xy+a_{02}y^2+\dots+a_{pq}x^py^q+\dots\end{aligned}$$

As shown by L. Schläfli[1] this equation may be directly formed and exhibited as the resultant of two given equations, and an arbitrary linear non-homogeneous equation in two variables. The right-hand side may be also written

$$1+\Sigma\alpha_1x+\Sigma\beta_1y+\Sigma\alpha_1\alpha_2x^2+\Sigma\alpha_1\beta_2xy+\Sigma\beta_1\beta_2y^2+\dots$$

The most general symmetric function to be considered is

$$\Sigma\alpha_1^{p_1}\beta_1^{q_1}\alpha_2^{p_2}\beta_2^{q_2}\alpha_3^{p_3}\beta_3^{q_3}\dots$$

conveniently written in the symbolic form

$$(\overline{p_1q_1}\,\overline{p_2q_2}\,\overline{p_3q_3}\dots).$$

Observe that the summation is in regard to the expressions obtained by permuting the n suffixes 1, 2, 3, ...n. The weight of the function is bipartite and consists of the two numbers Σp and Σq; the symbolic expression of the symmetric function is a partition into biparts (multiparts) of the bipartite (multipartite) number $\overline{\Sigma p, \Sigma q}$. Each part of the partition is a bipartite number, and in representing the partition it is convenient to indicate repetitions of parts by power symbols. In this notation the fundamental relation is written

$$\begin{aligned}&(1+\alpha_1x+\beta_1y)(1+\alpha_2x+\beta_2y)(1+\alpha_3x+\beta_3y)\dots\\&=1+(\overline{10})x+(\overline{01})y+(\overline{10}^2)x^2+(\overline{10}\,\overline{01})xy+(\overline{01}^2)y^2\\&\quad+(\overline{10}^3)x^3+(\overline{10}^2\overline{01})x^2y+(\overline{10}\,\overline{01}^2)xy^2+(\overline{01}^3)y^3+\dots\end{aligned}$$

where in general $a_{pq}=(\overline{10}^p\,\overline{01}^q)$.

All symmetric functions are expressible in terms of the quantities a_{pq} in a rational integral form; from this property they are termed elementary functions; further they are said to be single-unitary since each part of the partition denoting a_{pq} involves but a single unit.

The number of partitions of a biweight $\overline{pq}$ into exactly μ biparts is given (after Euler) by the coefficient of $a^\mu x^py^q$ in the expansion of the generating function

$$\frac{1}{1-ax.\,1-ay.\,1-ax^2.\,1-axy.\,1-ay^2.\,1-ax^3.\,1-ax^2y.\,1-axy^2.\,1-ay^3\dots}$$

The partitions with one bipart correspond to the sums of powers in the single system or unipartite theory; they are readily expressed in terms of the elementary functions. For write $(\overline{pq})=s_{pq}$ and take logarithms of both sides of the fundamental relation; we obtain

$$s_{10}x+s_{01}y=\Sigma(\alpha_1x+\beta_1y)$$
$$s_{20}x^2+2s_{11}xy+s_{02}y^2=\Sigma(\alpha_1x+\beta_1y)^2,\ \&c.,$$

and

$$\begin{aligned}&s_{10}x+s_{01}y-\frac{1}{2}(s_{20}x^2+2s_{11}xy+s_{02}y^2)+\dots\\&=\log\,(1+a_{10}x+a_{01}y+\dots+a_{pq}x^py^q+\dots).\end{aligned}$$

From this formula we obtain by elementary algebra

$$(-)^{p+q-1}\frac{(p+q-1)!}{p!\,q!}s_{pq}=\sum_{\pi}(-)^{\Sigma\pi-1}\frac{(\Sigma\pi-1)!}{\pi_1!\,\pi_2!\dots}a_{p_1q_1}^{\pi_1}a_{p_2q_2}^{\pi_2}\dots$$

corresponding to Thomas Waring's formula for the single system. The analogous formula appertaining to n systems of quantities which expresses $s_{pqr\dots}$ in terms of elementary functions can be at once written down.

Ex. gr. We can verify the relations

$$s_{30}=a_{10}^3-3a_{20}a_{10}+3a_{30},$$
$$s_{21}=a_{10}^2a_{01}-a_{20}a_{01}-a_{11}a_{10}+a_{21}.$$

The formula actually gives the expression of $(\overline{pq})$ by means of separations of

$$(\overline{10}^p\overline{01}^q),$$

which is one of the partitions of $(\overline{pq})$. This is the true standpoint from which the theorem should be regarded. It is but a particular case of a general theory of expressibility.

To invert the formula we may write

$$\begin{aligned}&1+a_{10}x+a_{01}y+\dots+a_{pq}x^py^q+\dots\\&=exp\ \{(s_{10}x+s_{01}y)-\frac{1}{2}s_{20}x^2+2s_{11}xy+s_{02}y^2)+\dots\},\end{aligned}$$

and thence derive the formula—

$$\begin{aligned}&(-)^{p+q-1}a_{pq}\\&=\sum\left\{\frac{(p_1+q_1-1)!}{p_1!q_1!}\right\}^{\pi_1}\left\{\frac{(p_2+q_2-1)!}{p_2!q_2!}\right\}^{\pi_2}\dots\frac{(-)^{\Sigma\pi-1}}{\pi_1!\,\pi_2!\dots}s_{p_1q_1}^{\pi_1}s_{p_2q_2}^{\pi_2}\dots,\end{aligned}$$

which expresses the elementary functions in terms of the single bipart functions. The similar theorem for n systems of quantities can be at once written down.

It will be shown later that every rational integral symmetric function is similarly expressible.

The Function h_{pq}.—As the definition of h_{pq} we take

$$\begin{aligned}&1+n_{10}x+n_{01}y+\dots+n_{pq}x^py^q+\dots\\&=\frac{1}{(1-\alpha_1x-\beta_1y)(1-\alpha_2x-\beta_2y)\dots};\end{aligned}$$

and now expanding the right-hand side

$$h_{pq}=\sum\binom{p_1+q_1}{p_1}\binom{p_2+q_2}{p_2}\dots(\overline{p_1q_1}\,\overline{p_2q_2}\dots),$$

the summation being for all partitions of the biweight. Further writing

$$\begin{aligned}&1+h_{10}x+h_{01}y+\dots+h_{pq}x^py^q+\dots\\&=\frac{1}{1-a_{10}x-a_{01}y+\dots+(-)^{p+q}a_{pq}x^py^q+\dots},\end{aligned}$$

we find that the effect of changing the signs of both x and y is merely to interchange the symbols a and h; hence in any relation connecting the quantities h_{pq} with the quantities a_{pq} we are at liberty to interchange the symbols a and h. By the exponential and multinomial theorems we obtain the results—

$$(-)^{p+q-1}h_{pq}=\sum_{\pi}(-)^{\Sigma\pi-1}\frac{(\Sigma\pi)!}{\pi_1!\,\pi_2!\dots}a_{p_1q_1}^{\pi_1}a_{p_2q_2}^{\pi_2}\dots$$

and in this a and h are interchangeable.

$$\frac{(p+q-1)!}{p!\,q!}s_{pq}=\sum_{\pi}(-)^{\Sigma\pi-1}\frac{(\Sigma\pi-1)!}{\pi_1!\,\pi_2!\dots}h_{p_1q_1}^{\pi_1}h_{p_2q_2}^{\pi_2}\dots;$$

$$h_{pq}=\sum\left\{\frac{(p_1+q_1-1)!}{p_1!\,q_1!}\right\}^{\pi_1}\left\{\frac{(p_2+q_2-1)!}{p_2!\,q_2!\dots}\right\}^{\pi_2}\dots\frac{1}{\pi_1!\,\pi_2!\dots}s_{p_1q_1}^{\pi_1}s_{p_2q_2}^{\pi_2}\dots.$$

Differential Operations.—If, in the identity

$$\begin{aligned}&(1+\alpha_1x+\beta_1y)(1+\alpha_2x+\beta_2y)\dots(1+\alpha_nx+\beta_ny)\\&=1+a_{10}x+a_{01}y+a_{20}x^2+a_{11}xy+a_{02}y^2+\dots,\end{aligned}$$

we multiply each side by $(1+\mu x+\nu y)$, the right-hand side becomes

$$1+(a_{10}+\mu)x+(a_{01}+\nu)y+\dots+(a_{pq}+\mu a_{p-1,q}+\nu a_{p,q-1})x^py^q+\dots;$$

hence any rational integral function of the coefficients $a_{10}, a_{01}, \dots a_{pq}, \dots$ say $f(a_{10}, a_{01}, \dots)\equiv f$ is converted into

$$\overline{exp}(\mu d_{10}+\nu d_{01})f$$

$$\text{where } d_{10}=\sum a_{p-1,q}\frac{d}{da_{pq}},\ d_{01}=\sum a_{p,q-1}\frac{d}{da_{pq}}.$$

The rule over *exp* will serve to denote that $\mu d_{10}+\nu d_{01}$ is to be raised to the various powers symbolically as in Taylor's theorem.

Writing

$$D_{pq}=\frac{1}{p!\,q!}d_{10}^p d_{01}^q,$$

$$\overline{exp}(\mu d_{10}+\nu d_{01})=(1+\mu D_{10}+\nu D_{01}+\dots+\mu^p\nu^qD_{pq}+\dots)f;$$

now, since the introduction of the new quantities μ, ν results in the addition to the function $(\overline{p_1q_1}\overline{p_2q_2}\overline{p_3q_3}\dots)$ of the new terms

$$\mu^{p_1}\nu^{q_1}(\overline{p_2q_2}\overline{p_3q_3}\dots)+\mu^{p_2}\nu^{q_2}(\overline{p_1q_1}\overline{p_3q_3}\dots)+\mu^{p_3}\nu^{q_3}(\overline{p_1q_1}\overline{p_2q_2}\dots)+\dots,$$

we find

$$D_{p_1q_1}(\overline{p_1q_1}\overline{p_2q_2}\overline{p_3q_3}\dots)=(\overline{p_2q_2}\overline{p_3q_3}\dots);$$

and thence

$$D_{p_1q_1}D_{p_2q_2}D_{p_3q_3}\dots(\overline{p_1q_1}\overline{p_2q_2}\overline{p_3q_3}\dots)=1;$$

while $D_{rs}f=0$ unless the part $\overline{rs}$ is involved in f. We may then state that D_{pq} is an operation which obliterates one part $\overline{pq}$ when such part is present, but in the contrary case causes the function to vanish. From the above D_{pq} is an operator of order pq, but it is convenient for some purposes to obtain its expression in the form of a number of terms, each of which denotes pq successive linear operations; to accomplish this write

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[1] Vienna *Transactions*, t. iv. 1852.

$$d_{pq} = \sum a_{rs} \frac{d}{a_{p+r,q+s}}$$

and note the general result[1]

$$\overline{exp}\,(m_{10}d_{10}+m_{01}d_{01}+\ldots+m_{pq}d_{pq}+\ldots)$$
$$=exp\,(M_{10}d_{10}+M_{01}d_{01}+\ldots+M_{pq}d_{pq}+\ldots);$$

where the multiplications on the left- and right-hand sides of the equation are symbolic and unsymbolic respectively, provided that m_{pq}, M_{pq} are quantities which satisfy the relation

$$exp\,(M_{10}\xi+M_{01}\eta+\ldots+M_{pq}\xi^p\eta^p+\ldots)$$
$$=1+m_{10}\xi+m_{01}\eta+\ldots+m_{pq}\xi^p\eta^q+\ldots;$$

where ξ, η are undetermined algebraic quantities. In the present particular case putting $m_{10}=\mu$, $m_{01}=\nu$ and $m_{pq}=0$ otherwise

$$M_{10}\xi+M_{01}\eta+\ldots+M_{pq}\xi^p\eta^q+\ldots=\log\,(1+\mu\xi+\nu\eta)$$

or

$$M_{pq}=(-)^{p+q-1}\frac{(p+q-1)!}{p!q!}\mu^p\nu^q;$$

and the result is thus

$$\overline{exp}(\mu d_{10}+\nu d_{01})$$
$$=exp\{\mu d_{10}+\nu d_{01}-\frac{1}{2}(\mu^2d_{20}+2\mu\nu d_{11}+\nu^2d_{02})+\ldots\}$$
$$=1+\mu D_{10}+\nu D_{01}+\ldots+\mu^p\nu^q D_{pq}+\ldots;$$

and thence

$$\mu d_{10}+\nu d_{01}-\frac{1}{2}(\mu^2d_{20}+2\mu\nu d_{11}+\nu^2d_{02})+\ldots$$
$$=\ \log\,(1+\mu D_{10}+\nu D_{01}+\ldots+\mu^p\nu^q D_{pq}+\ldots).$$

From these formulae we derive two important relations, viz.

$$(-)^{p+q-1}\frac{(p+q-1)!}{p!q!}d_{pq}=\sum_{\pi}(-)^{\Sigma\pi-1}\frac{(\Sigma\pi-1)!}{\pi_1!\pi_2!\ldots}D^{\pi_1}_{p_1q_1}D^{\pi_2}_{p_2q_2}\ldots,$$

$$(-)^{p+q-1}D_{pq}=\sum_{\pi}\left\{\frac{(p_1+q_1-1)!}{p_1!q_1!}\right\}^{\pi_1}\left\{\frac{(p_2+q_2-1)!}{p_2!q_2!}\right\}^{\pi_2}\ldots$$
$$\ldots\quad\frac{(-)^{\Sigma\pi-1}}{\pi_1!\pi_2!\ldots}d^{\pi_1}_{p_1q_1}d^{\pi_2}_{p_2q_2}\ldots,$$

the last written relation having, in regard to each term **on the** right-hand side, to do with $\Sigma\pi$ successive linear operations. Recalling the formulae above which connect s_{pq} and a_{pq}, we see that d_{pq} and D_{pq} are in co-relation with these quantities respectively, and may be said to be operations which correspond to the partitions (pq), $(\overline{10}^p\overline{01}^q)$ respectively. We might conjecture from this observation that every partition is in correspondence with some operation; this is found to be the case, and it has been shown (*loc. cit.* p. 493) that the operation

$$\frac{1}{\pi_1!}\frac{1}{\pi_2!}\ldots d^{\pi_1}_{p_1q_1}d^{\pi_2}_{p_2q_2}\ldots\quad\text{(multiplication symbolic)}$$

corresponds to the partition $(\overline{p_1q_1}^{\pi_1}\,\overline{p_2q_2}^{\pi_2}\ldots)$. The partitions being taken as denoting symmetric functions we have complete correspondence between the algebras of quantity and operation, and from any algebraic formula we can at once write down an operation formula. This fact is of extreme importance in the theory of algebraic forms, and is easily representable whatever be the number of the systems of quantities.

We may remark the particular result

$$(-)^{p+q-1}\frac{(p+q-1)!}{p!q!}d_{pq}s_{pq}=D_{pq}(\overline{pq})=1;$$

d_{pq} causes every other single part function to vanish, and must cause any monomial function to vanish which does not comprise one of the partitions of the biweight $\overline{pq}$ amongst its parts.

Since

$$d_{pq}=(-)^{p+q-1}\frac{(p+q-1)!}{p!q!}\frac{d}{ds_{pq}},$$

the solutions of the partial differential equation $d_{pq}=0$ are the single bipart forms, omitting s_{pq}, and we have seen that the solutions of $D_{pq}=0$ are those monomial functions in which the part $\overline{pq}$ is absent.

One more relation is easily obtained, viz.

$$\frac{d}{da_{pq}}=d_{pq}-h_{10}d_{p+1,q}-h_{01}d_{p,q+1}+\ldots+(-)^{r+s}h_{rs}d_{p+r,q+s}+\ldots.$$

REFERENCES FOR SYMMETRIC FUNCTIONS.—Albert Girard, *Invention nouvelle en l'algèbre* (Amsterdam, 1629); Thomas Waring, *Meditationes Algebraicae* (London, 1782); Lagrange, *Mém. de l'acad. de Berlin* (1768); Meyer-Hirsch, *Sammlung von Aufgaben aus der Theorie der algebraischen Gleichungen* (Berlin, 1809); Serret, *Cours d'algèbre supérieure*, t. iii. (Paris, 1885); Unferdinger, *Sitzungsber. d. Acad. d. Wissensch. i. Wien*, Bd. lx. (Vienna, 1869); L. Schläfli, "Ueber die Resultante eines Systemes mehrerer algebraischen Gleichungen," *Vienna Transactions*, t. iv. 1852; MacMahon, "Memoirs on a New Theory of Symmetric Functions," *American Journal of Mathematics*, Baltimore, Md. 1888–1890; "Memoir on Symmetric Functions of Roots of Systems of Equations," *Phil. Trans.* 1890.

III. THE THEORY OF BINARY FORMS

A binary form of order n is a homogeneous polynomial of the *nth* degree in two variables. It may be written in the form

$$ax_1^n+bx_1^{n-1}x_2+cx_1^{n-2}x_2^2+\ldots;$$

or in the form

$$ax_1^n+\binom{n}{1}bx_1^{n-1}x_2+\binom{n}{2}cx_1^{n-2}x_2^2+\ldots,$$

which Cayley denotes by

$$(a,\ b,\ c,\ \ldots)(x_1,\ x_2)^n$$

$\binom{n}{1},\binom{n}{2}\ldots$ being a notation for the successive binomial coefficients n, $\frac{1}{2}n(n-1)$,.... Other forms are

$$ax_1^n+nbx_1^{n-1}x_2+n(n-1)cx_1^{n-2}x_2^2+\ldots,$$

the binomial coefficients $\binom{n}{s}$ being replaced by $s!\binom{n}{s}$, and

$$ax_1^n+\frac{1}{1!}bx_1^{n-1}x_2+\frac{1}{2!}cx_1^{n-2}x_2^2+\ldots,$$

the special convenience of which will appear later. For present purposes the form will be written

$$\overline{a}_0x_1^n+\binom{n}{1}\overline{a}_1x_1^{n-1}x_2+\binom{n}{2}\overline{a}_2x_1^{n-2}x_2^2+\ldots+\overline{a}_nx_2^n,$$

the notation adopted by German writers; the literal coefficients have a rule placed over them to distinguish them from umbral coefficients which are introduced almost at once. The coefficients $\overline{a}_0$, $\overline{a}_1$, $\overline{a}_2$,...$\overline{a}_n$, $n+1$ in number are arbitrary. If the form, sometimes termed a quantic, be equated to zero the $n+1$ coefficients are equivalent to but n, since one can be made unity by division and the equation is to be regarded as one for the determination of the ratio of the variables.

If the variables of the quantic $f(x_1,\ x_2)$ be subjected to the linear transformation

$$x_1=\alpha_{11}\xi_1+\alpha_{12}\xi_2,$$
$$x_2=\alpha_{21}\xi_1+\alpha_{22}\xi_2,$$

ξ_1, ξ_2 being new variables replacing x_1, x_2 and the coefficients α_{11}, α_{12}, α_{21}, α_{22}, termed the coefficients of substitution (or of transformation), being constants, we arrive at a transformed quantic

$$f(\xi_1,\xi_2)=\overline{a}'_0\xi_1^n+\binom{n}{1}\overline{a}'_1\xi_1^{n-1}\xi_2+\binom{n}{2}\overline{a}'_2\xi_1^{n-2}\xi_2+\ldots+\overline{a}'_n\xi_2^n$$

in the new variables which is of the same order as the original quantic; the new coefficients $\overline{a}'_0$, $\overline{a}'_1$, $\overline{a}'_2\ldots\overline{a}'_n$ are linear functions of the original coefficients, and also linear functions of products, of the coefficients of substitution, of the *nth* degree.

By solving the equations of transformation we obtain

$$r\xi_1=\quad\alpha_{22}x_1-\alpha_{12}x_2,$$
$$r\xi_2=-\alpha_{21}x_1+\alpha_{11}x_2,$$
$$\text{where } r=\begin{vmatrix}\alpha_{11}\alpha_{12}\\ \alpha_{21}\alpha_{22}\end{vmatrix}=\alpha_{11}\alpha_{12}-\alpha_{12}\alpha_{21};$$

r is termed the determinant of substitution or modulus of transformation; we assure x_1, x_2 to be independents, so that r must differ from zero.

In the theory of forms we seek functions of the coefficients and variables of the original quantic which, save as to a power of the modulus of transformation, are equal to the like functions of the coefficients and variables of the transformed quantic. We may have such a function which does not involve the variables, viz.

$$F(\overline{a}'_0,\ \overline{a}'_1,\ \overline{a}'_2,\ldots\overline{a}'_n)=r^{\lambda}F(\overline{a}_0,\ \overline{a}_1,\ \overline{a}_2,\ldots\overline{a}_n),$$

the function $F(\overline{a}_0,\ \overline{a}_1,\ \overline{a}_2,\ldots\overline{a}_n)$ is then said to be an *invariant* of the quantic *quâ* linear transformation. If, however, F involve as well the variables, viz.

$$F(\overline{a}'_0,\ \overline{a}'_1,\ \overline{a}'_2,\ldots;\xi_1,\ \xi_2)=r^{\lambda}F(\overline{a}_0,\ \overline{a}_1,\ \overline{a}_2,\ldots;\ x_1,\ x_2),$$

the function $F(\overline{a}_0,\ \overline{a}_1,\ \overline{a}_2,\ldots\ x_1,\ x_2)$ is said to be a *covariant* of the quantic. The expression "invariantive forms" includes both invariants and covariants, and frequently also other analogous forms which will be met with. Occasionally the word "invariants" includes covariants; when this is so it will be implied by the text. Invariantive forms will be found to be homogeneous functions alike of the coefficients and of the variables. Instead of a single quantic we may have several

$$f(\overline{a}_0,\ \overline{a}_1,\ \overline{a}_2\ldots;\ x_1,\ x_2),\ \phi(\overline{b}_0,\ \overline{b}_1,\ \overline{b}_2,\ldots;\ x_1,\ x_2),\ \ldots$$

which have different coefficients, the same variables, and are of the same or different degrees in the variables; we may transform them all by the same substitution, so that they become

$$f(\overline{a}'_0,\ \overline{a}'_1,\ \overline{a}'_2,\ldots;\ \xi_1,\ \xi_2),\ \phi(\overline{b}'_0,\ \overline{b}'_1,\ \overline{b}'_2,\ldots;\ \xi_1,\ \xi_2),\ldots.$$

If then we find

$$F(\overline{a}'_0,\ \overline{a}'_1,\ \overline{a}'_2,\ldots\overline{b}'_0,\ \overline{b}'_1,\ \overline{b}'_2,\ldots,\ldots;\ \xi_1,\ \xi_2),$$
$$=r^{\lambda}F(\overline{a}_0,\ \overline{a}_1,\ \overline{a}_2,\ldots\overline{b}_0,\ \overline{b}_1,\ \overline{b}_2,\ldots,\ldots;\ x_1,\ x_2),$$

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[1] *Phil. Trans.*, 1890, p. 490.

the function F, on the right which multiplies r, is said to be a *simultaneous invariant* or covariant of the system of quantics. This notion is fundamental in the present theory because we will find that one of the most valuable artifices for finding invariants of a single quantic is first to find simultaneous invariants of several different quantics, and subsequently to make all the quantics identical. Moreover, instead of having one pair of variables x_1, x_2 we may have several pairs y_1, y_2; z_1, z_2;... in addition, and transform each pair to a new pair by substitutions, having the same coefficients a_{11}, a_{12}, a_{21}, a_{22} and arrive at functions of the original coefficients and variables (of one or more quantics) which possess the above-defined invariant property. A particular quantic of the system may be of the same or different degrees in the pairs of variables which it involves, and these degrees may vary from quantic to quantic of the system. Such quantics have been termed by Cayley *multipartite.*

Symbolic Form.—Restricting consideration, for the present, to binary forms in a single pair of variables, we must introduce the symbolic form of Aronhold, Clebsch and Gordan; they write the form

$$(a_1x_1+a_2x_2)^n=a_1^nx_1^n+\binom{n}{1}a_1^{n-1}a_2x_1^{n-1}x_2+\ldots+a_2^nx_2^n=a_x^n$$

wherein a_1, a_2 are umbrae, such that

$$a_1^n,\ a_1^{n-1}a_2,\ldots a_1a_2^{n-1},\ a_2^n$$

are symbolical representations of the real coefficients $\overline{a}_0$, $\overline{a}_1$,... $\overline{a}_{n-1}$, $\overline{a}_n$, and in general $a_1^{n-k}a_2^k$ is the symbol for $\overline{a}_k$. If we restrict ourselves to this set of symbols we can uniquely pass from a product of real coefficients to the symbolic representations of such product, but we cannot, uniquely, from the symbols recover the real form. This is clear because we can write

$$\overline{a}_1\overline{a}_2=a_1^{n-1}a_2.\,a_1^{n-2}a_2^2=a_1^{2n-3}a_2^3$$

while the same product of umbrae arises from

$$\overline{a}_0\overline{a}_3=a_1^n.a_1^{n-3}a_2^3=a_1^{2n-3}a_2^3.$$

Hence it becomes necessary to have more than one set of umbrae, so that we may have more than one symbolical representation of the same real coefficients. We consider the quantic to have any number of equivalent representations $a_x^n\equiv b_x^n\equiv c_x^n\equiv\ldots.$ So that $a_1^{n-k}a_2^k\equiv b_1^{n-k}b_2^k\equiv c_1^{n-k}c_2^k\equiv\ldots=\bar{a}_k$; and if we wish to denote, by umbrae, a product of coefficients of degree s we employ s sets of umbrae.

Ex. gr. We write $\overline{a}_1\overline{a}_2=a_1^{n-1}a_2.b_1^{n-2}b_2^2$,

$$\overline{a_3^3}=a_1^{n-3}a_2^3.b_1^{n-3}b_2^3.c_1^{n-3}c_2^3,$$

and so on whenever we require to represent a product of real coefficients symbolically; we then have a one-to-one correspondence between the products of real coefficients and their symbolic forms. If we have a function of degree s in the coefficients, we may select any s sets of umbrae for use, and having made a selection we may when only one quantic is under consideration at any time permute the sets of umbrae in any manner without altering the real significance of the symbolism. *Ex. gr.* To express the function $\overline{a}_0\overline{a}_2-\overline{a}_1^2$, which is the discriminant of the binary quadratic $\overline{a}_0x_1^2+2\overline{a}_1x_1x_2+\overline{a}_2x_2^2=a_x^2=b_x^2$, in a symbolic form we have

$$2(a_0a_2-a_1^2)=\overline{a}_0\overline{a}_2+\overline{a}_0\overline{a}_2-2\overline{a}_1\,.\,\overline{a}_1=a_1^2b_2^2+a_2^2b_1^2-2a_1a_2b_1b_2$$
$$=(a_1b_2-a_2b_1)^2.$$

Such an expression as $a_1b_2-a_2b_1$, which is

$$\frac{\partial a_x}{\partial x_1}\frac{\partial b_x}{\partial x_2}-\frac{\partial a_x}{\partial x_2}\frac{\partial b_x}{\partial x_1},$$

is usually written (ab) for brevity; in the same notation the determinant, whose rows are a_1, a_2, a_3; b_1, b_2, b_3; c_1, c_2, c_3 respectively, is written (abc) and so on. It should be noticed that the real function denoted by $(ab)^2$ is not the square of a real function denoted by (ab). For a single quantic of the first order (ab) is the symbol of a function of the coefficients which vanishes identically; thus

$$(ab)=a_1b_2-a_2b_1=\overline{a}_0\overline{a}_1-\overline{a}_1\overline{a}_0=0$$

and, indeed, from a remark made above we see that (ab) remains unchanged by interchange of a and b; but $(ab)=-(ba)$, and these two facts necessitate $(ab)=0$.

To find the effect of linear transformation on the symbolic form of quantic we will disuse the coefficients a_{11}, a_{12}, a_{21}, a_{22}, and employ λ_1, μ_1, λ_2, μ_2. For the substitution

$$x_1=\lambda_1\xi_1+\mu_1\xi_2,\ x_2=\lambda_2\xi_1+\mu_2\xi_2,$$

$$\text{of modulus}\begin{vmatrix}\lambda_1 & \mu_1\\ \lambda_2 & \mu_2\end{vmatrix}=(\lambda_1\mu_2-\lambda_2\mu_1)=(\lambda\mu),$$

the quadratic form $\overline{a}_0x_1^2+2\overline{a}_1x_1x_2+\overline{a}_2x_2^2={}_x^2=f(x)$,

becomes

$$\overline{A}_0\xi_1^2+2\overline{A}_1\xi_1\xi_2+\overline{A}_2\xi_2^2=A_\xi^2=\phi(\xi),$$

where

$$\overline{A}_0=\overline{a}_0\lambda_1^2+2\overline{a}_1\lambda_1\lambda_2+\overline{a}_2\lambda_2^2,$$
$$\overline{A}_1=\overline{a}_0\lambda_1\mu_1+\overline{a}_1(\lambda_1\mu_2+\lambda_2\mu_1)+\overline{a}_2\lambda_2\mu_2,$$
$$\overline{A}_2=\overline{a}_0\mu_1^2+2\overline{a}_1\mu_1\mu_2+\overline{a}_2\mu_2^2.$$

We pass to the symbolic forms

$$a_x^2=(a_1x_1+a_2x_2)^2,\ A_\xi^2=(A_1\xi_1+A_2\xi_2)^2,$$

by writing for

$\overline{a}_0$, $\overline{a}_1$, $\overline{a}_2$ the symbols a_1^2, a_1a_2, a_2^2
$\overline{A}_0$, $\overline{A}_1$, $\overline{A}_2$,, A_1^2, A_1A_2, A_2^2

and then

$$\overline{A}_0=a_1^2\lambda_1^2+2a_1a_2\lambda_1\lambda_2+a_2^2\lambda_2^2=(a_1\lambda_1+a_2\lambda_2)^2=a_\lambda^2,$$
$$\overline{A}_1=(a_1\lambda_1+a_2\lambda_2)(a_1\mu_1+a_2\mu_2)=a_\lambda a_\mu,$$
$$\overline{A}_2=(a_1\mu_1+a_2\mu_2)^2=a_\mu^2;$$

so that

$$A_\xi^2=a_\lambda^2\xi_1^2+2a_\lambda a_\mu\xi_1\xi_2+a_\mu^2\xi_2^2=(a_\lambda\xi_1+a_\mu\xi_2)^2;$$

whence A_1, A_2 become a_λ, a_μ respectively and

$$\phi(\xi)=(a_\lambda\xi_1+a_\mu\xi_2)^2.$$

The practical result of the transformation is to change the umbrae a_1, a_2 into the umbrae

$$a_\lambda=a_1\lambda_1+a_2\lambda_2,\ a_\mu=a_1\mu_1+a_2\mu_2$$

respectively.

By similarly transforming the binary n^{ic} form a_x^n we find

$$\overline{A}_0=(a_1\lambda_1+a_2\lambda_2)^n=a_\lambda^n+A_1^n,$$
$$\overline{A}_1=(a_1\lambda_1+a_2\lambda_2)^{n-1}(a_1\mu_1+a_2\mu_2)=a_\lambda^{n-1}a_\mu=A_1^{n-1}A_2,$$
$$\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot$$
$$\overline{A}_k=(a_1\lambda_1+a_2\lambda_2)^{n-k}(a_1\mu_1+a_2\mu_2)^k=a_\lambda^{n-k}a_\mu^k=A_1^{n-k}A_2^k,$$

so that the umbrae A_1, A_2 are a_λ, a_μ respectively.

Theorem.—When the binary form

$$a_x^n=(a_1x_1+a_2x_2)^n$$

is transformed to

$$A_\xi^n=(A_1\xi_1+A_2\xi_2)^n$$

by the substitutions

$$x_1=\lambda_1\xi_1+\mu_1\xi_2,\ x_2=\lambda_2\xi_1+\mu_2\xi_2,$$

the umbrae A_1, A_2 are expressed in terms of the umbrae a_1, a_2 by the formulae

$$A_1=\lambda_1a_1+\lambda_2a_2,\ A_2=\mu_1a_1+\mu_2a_2.$$

We gather that A_1, A_2 are transformed to a_1, a_2 in such wise that the determinant of transformation reads by rows as the original determinant reads by columns, and that the modulus of the transformation is, as before, $(\lambda\mu)$. For this reason the umbrae A_1, A_2 are said to be *contragredient* to x_1, x_2. If we solve the equations connecting the original and transformed unbrae we find

$$(\lambda\mu)(-a_2)=\lambda_1(-A_2)+\mu_1A_1,$$
$$(\lambda\mu)a_1\qquad=\lambda_2(-A_2)+\mu_2A_1,$$

and we find that, except for the factor $(\lambda\mu)$, $-a_2$ and $+a_1$ are transformed to $-A_2$ and $+A_1$ by the same substitutions as x_1 and x_2 are transformed to ξ_1 and ξ_2. For this reason the umbrae $-a_2$, a_1 are said to be cogredient to x_1 and x_2. We frequently meet with cogredient and contragedient quantities, and we have in general the following definitions:—(1) "If two equally numerous sets of quantities x, y, z,... x', y', z',... are such that whenever one set x, y, z,... is expressed in terms of new quantities X, Y, Z, ... the second set x', y', z', ... is expressed in terms of other new quantities X′, Y′, Z′, ... , by the same scheme of linear substitution the two sets are said to be *cogredient* quantities." (2) "Two sets of quantities x, y, z, ...; ξ, η, ζ, ... are said to be *contragredient* when the linear substitutions for the first set are

$$x=\lambda_1X+\mu_1Y+\nu_1Z+\ldots,$$
$$y=\lambda_2X+\mu_2Y+\nu_2Z+\ldots,$$
$$z=\lambda_3X+\mu_3Y+\nu_3Z+\ldots,$$
$$\cdot\quad\cdot\quad\cdot\quad\cdot$$

and these are associated with the following formulae appertaining to the second set,

$$\Xi=\lambda_1\xi+\lambda_2\eta+\lambda_3\zeta+\ldots,$$
$$H=\mu_1\xi+\mu_2\eta+\mu_3\zeta+\ldots,$$
$$Z=\nu_1\xi+\nu_2\eta+\nu_3\zeta+\ldots,$$
$$\cdot\quad\cdot\quad\cdot\quad\cdot$$

wherein it should be noticed that *new* quantities are expressed in terms of the *old*, as regards the latter set, and not *vice versa.*"

Ex. gr. The symbols $\frac{d}{dx}$, $\frac{d}{dy}$, $\frac{d}{dz}$, ... are contragredient with the variables x, y, z, ... for when

$$(x,\ y,\ z,\ \ldots)=\begin{vmatrix}(\lambda_1, & \mu_1, & \nu_1, & \ldots)\\ \lambda_2, & \mu_2, & \nu_2, & \ldots\\ \lambda_3, & \mu_3, & \nu_3, & \ldots\\ \cdot & \cdot & \cdot & \cdot\end{vmatrix}(X,\ Y,\ Z,\ \ldots).$$

we find

$$\left(\frac{d}{dX}, \frac{d}{dY}, \frac{d}{dZ}, \dots\right) = \left|\begin{matrix}\lambda_1, & \lambda_2, & \lambda_3, & \dots \\ \mu_1, & \mu_2, & \mu_3, & \dots \\ \nu_1, & \nu_2, & \nu_3, & \dots \\ \cdot & \cdot & \cdot & \cdot\end{matrix}\right| \left(\frac{d}{dx}, \frac{d}{dy}, \frac{d}{dz}, \dots\right).$$

Observe the notation, which is that introduced by Cayley into the theory of matrices which he himself created.

Just as cogrediency leads to a theory of covariants, so contragrediency leads to a theory of contravariants. If u, a quantic in $x, y, z, \dots$, be expressed in terms of new variables X, Y, Z ...; and if $\xi, \eta, \zeta, \dots$, be quantities contragredient to $x, y, z, \dots$; there are found to exist functions of $\xi, \eta, \zeta, \dots$, and of the coefficients in u, which need, at most, be multiplied by powers of the modulus to be made equal to the same functions of Ξ, H, Z, ... of the transformed coefficients of u; such functions are called *contravariants* of u. There also exist functions, which involve both sets of variables as well as the coefficients of u, possessing a like property; such have been termed *mixed concomitants*, and they, like contravariants, may appertain as well to a system of forms as to a single form.

As between the original and transformed quantic we have the umbral relations

$$A_1=\lambda_1a_1+\lambda_2a_2,\ A_2=\mu_1a_1+\mu_2a_2,$$

and for a second form

$$B_1=\lambda_1b_1+\lambda_2b_2,\ B_2=\mu_1b_1+\mu_2b_2.$$

The original forms are a_x^n, b_x^n, and we may regard them *either* as *different* forms *or* as equivalent representations of the *same* form. In other words, B, b may be regarded as different or alternative symbols to A, a. In either case

$$(AB)=A_1B_2-A_2B_1=(\lambda\mu)(ab);$$

and, from the definition, (ab) possesses the invariant property. We cannot, however, say that it is an invariant unless it is expressible in terms of the real coefficients. Since $(ab)=a_1b_2-a_2b_1$, that this may be the case each form must be linear; and if the forms be different (ab) is an invariant (simultaneous) of the two forms, its real expression being $\bar{a}_0\bar{b}_1-\bar{a}_1\bar{b}_0$. This will be recognized as the resultant of the two linear forms. If the two linear forms be identical, the umbral sets a_1, a_2; b_1, b_2 are alternative, are ultimately put equal to one another and (ab) vanishes. A single linear form has, in fact, no invariant. When either of the forms is of an order higher than the first (ab), as not being expressible in terms of the actual coefficients of the forms, is not an invariant and has no significance. Introducing now other sets of symbols C, D, ...; $c, d, \dots$ we may write

$$(AB)^i(AC)^j(BC)^k\dots=(\lambda\mu)^{i+j+k+\dots}(ab)^i(ac)^j(bc)^k\dots,$$

so that the symbolic product

$$(ab)^i(ac)^j(bc)^k\dots,$$

possesses the invariant property. If the forms be all linear and different, the function is an invariant, viz. the i^{th} power of that appertaining to a_x and b_x multiplied by the j^{th} power of that appertaining to a_x and c_x multiplied by &c. If any two of the linear forms, say p_x, q_x, be supposed identical, any symbolic expression involving the factor (pq) is zero. Notice, therefore, that the symbolic product $(ab)^i(ac)^j(bc)^k\dots$ may be always viewed as a simultaneous invariant of a number of different linear forms $a_x, b_x, c_x, \dots$. In order that $(ab)^i(ac)^j(bc)^k\dots$ may be a simultaneous invariant of a number of different forms $a_x^{n_1}, b_x^{n_2}, c_x^{n_3}, \dots$, where $n_1, n_2, n_3, \dots$ may be the same or different, it is necessary that every product of umbrae which arises in the expansion of the symbolic product be of degree n_1 in a_1, a_2; in the case of b_1, b_2 of degree n_2; in the case of c_1, c_2 of degree n_3; and so on. For these only will the symbolic product be replaceable by a linear function of products of real coefficients. Hence the condition is

$$\begin{gathered} i+j+\dots=n_1, \\ i+k+\dots=n_2, \\ j+k+\dots=n_3, \\ \cdot \quad \cdot \quad \cdot \quad \cdot \end{gathered}$$

If the forms $a_x^n, b_x^n, c_x^n, \dots$ be identical the symbols are alternative, and provided that the form does not vanish it denotes an invariant of the single form a_x^n.

There may be a number of forms $a_x^n, b_x^n, c_x^n, \dots$ and we may suppose such identities between the symbols that on the whole only two, three, or more of the sets of umbrae are not equivalent; we will then obtain invariants of two, three, or more sets of binary forms. The symbolic expression of a covariant is equally simple, because we see at once that since $A_\xi, B_\xi, C_\xi, \dots$ are equal to $a_x, b_x, c_x, \dots$ respectively, the linear forms $a_x, b_x, c_x, \dots$ possess the invariant property, and we may write

$$(AB)^i(AC)^j(BC)^k\dots A_\xi^\rho B_\xi^\sigma C_\xi^\tau\dots \\ =(\lambda\mu)^{i+j+k+\dots}(ab)^i(ac)^j(bc)^k\dots a_x^\rho b_x^\sigma c_x^\tau\dots,$$

and assert that the symbolic product

$$(ab)^i(ac)^j(bc)^k\dots a_x^\rho b_x^\sigma c_x^\tau\dots$$

possesses the invariant property. It is always an invariant or covariant appertaining to a number of different linear forms, and as before it may vanish if two such linear forms be identical. In general it will be simultaneous covariant of the different forms $a_x^{n_1}, b_x^{n_2}, c_x^{n_3}, \dots$ if

$$\begin{gathered} i+j+\dots+\rho=n_1, \\ i+k+\dots+\sigma=n_2, \\ j+k+\dots+\tau=n_3, \\ \cdot \quad \cdot \quad \cdot \quad \cdot \end{gathered}$$

It will also be a covariant if the symbolic product be factorizable into portions each of which satisfies these conditions. If the forms be identical the sets of symbols are ultimately equated, and the form, provided it does not vanish, is a covariant of the form a_x^n.

The expression $(ab)^4$ properly appertains to a quartic; for a quadratic it may also be written $(ab)^2(cd)^2$, and would denote the square of the discriminant to a factor *près*. For the quartic

$$(ab)^4=(a_1b_2-a_2b_1)^4=a_1^4b_2^4-4a_1^3a_2b_1b_2^3+6a_1^2a_2^2b_1^2b_2^2 \\ -4a_1a_2^3b_1^3b_2+a_2^4b_1^4=\bar{a}_0\bar{a}_4-4\bar{a}_1\bar{a}_3+6\bar{a}_2^2-4\bar{a}_1\bar{a}_3+\bar{a}_0\bar{a}_4 \\ =2(\bar{a}_0\bar{a}_4-4\bar{a}_1\bar{a}_3+3\bar{a}_2^2),$$

one of the well-known invariants of the quartic.

For the cubic $(ab)^2a_xb_x$ is a covariant because each symbol a, b occurs three times; we can first of all find its real expression as a simultaneous covariant of two cubics, and then, by supposing the two cubics to merge into identity, find the expression of the quadratic covariant, of the single cubic, commonly known as the Hessian.

By simple multiplication

$$(a_1^3b_1b_2^2-2a_1^2a_2b_1^2b_2+a_1a_2^2b_1^3)x_1^2 \\ +(a_1^3b_2^3-a_1a_2^2b_1^2b_2-a_1^2a_2b_1b_2^2+a_2^3b_1^3)x_1x_2 \\ +(a_1^2a_2b_2^3-2a_1a_2^2b_1b_2^2+a_2^3b_1^2b_2)x_2^2;$$

and transforming to the real form,

$$(a_0b_2-2a_1b_1+a_2b_0)x_1^2+(a_0b_3-a_1b_2-a_2b_1+a_3b_0)x_1x_2 \\ +(a_1b_3-2a_2b_2+a_3b_1)x_2^2,$$

the simultaneous covariant; and now, putting $b=a$, we obtain twice the Hessian

$$(a_0a_2-a_1^2)x_1^2+(a_0a_3-a_1a_2)x_1x_2+(a_1a_3-a_2^2)x_2^2.$$

It will be shown later that all invariants, single or simultaneous, are expressible in terms of symbolic products. The degree of the covariant in the coefficients is equal to the number of different symbols $a, b, c, \dots$ that occur in the symbolic expression; the degree in the variables (*i.e.* the order of the covariant) is $\rho+\sigma+\tau+\dots$ and the weight[1] of the coefficient of the leading term $x_1^{\rho+\sigma+\tau+\dots}$ is equal to $i+j+k+\dots$. It will be apparent that there are four numbers associated with a covariant, viz. the orders of the quantic and covariant, and the degree and weight of the leading coefficient; calling these n, ϵ, θ, w respectively we can see that they are not independent integers, but that they are invariably connected by a certain relation $n\theta-2w=\epsilon$. For, if $\phi(\bar{a}_0,\dots x_1, x_2)$ be a covariant of order ϵ appertaining to a quantic of order n,

$$\phi(\bar{A}_0,\dots\xi_1\xi_2)=(\lambda\mu)^w\phi(\bar{a}_0,\dots\lambda_1\xi_1+\mu_1\xi_2,\lambda_2\xi_1+\mu_2\xi_2);$$

we find that the left- and right-hand sides are of degrees $n\theta$ and $2w+\epsilon$ respectively in $\lambda_1, \mu_1, \lambda_2, \mu_2$, and thence $n\theta=2w+\epsilon$.

Symbolic Identities.— For the purpose of manipulating symbolic expressions it is necessary to be in possession of certain simple identities which connect certain symbolic products. From the three equations

$$a_x=a_1x_1+a_2x_2,\ b_x=b_1x_1+b_2x_2,\ c_x=c_1x_1+c_2x_2,$$

we find by eliminating x_1 and x_2 the relation

$$a_x(bc)+b_x(ca)+c_x(ab)=0 \quad . \quad . \quad . \quad \text{(I.)}$$

Introduce now new umbrae d_1, d_2 and recall that $+d_2-d_1$ are cogredient with x_1 and x_2. We may in any relation substitute for any pair of quantities any other cogredient pair so that writing $+d_2$, $-d_1$ for x_1 and x_2, and noting that g_x then becomes (gd), the above-written identity becomes

$$(ad)(bc)+(bd)(ca)+(cd)(ab)=0 \quad . \quad . \quad . \quad \text{(II.)}$$

Similarly in (I.), writing for c_1, c_2 the cogredient pair $-y_2, +y_1$, we obtain

$$a_xb_y-a_yb_x=(ab)(xy). \quad . \quad . \quad . \quad . \quad \text{(III.)}$$

Again in (I.) transposing $a_x(bc)$ to the other side and squaring, we obtain

$$2(ac)(bc)a_xb_x=(bc)^2a_x^2+(ac)^2b_x-(ab)^2c_x^2 \quad . \quad \text{(IV.)}$$

and herein writing $d_2, -d_1$ for x_1, x_2,

$$2(ac)(bc)(ad)(bd)=(bc)^2(ad)^2+(ac)^2(bd)^2-(ab)^2(cd)^2. \quad \text{(V.)}$$

As an illustration multiply (IV.) throughout by $a_x^{n-2}b_x^{n-2}c_x^{n-2}$ so that each term may denote a covariant of an n^{ic}

$$2(ac)(bc)a_x^{n-1}b_x^{n-1}c_x^{n-1} \\ =(bc)^2a_x^nb_x^{n-2}c_x^{n-2}+(ac)^2a_x^{n-2}b_x^nc_x^{n-2}-(ab)^2a_x^{n-2}b_x^{n-2}c_x^n,$$

---

[1] The weight of a term $\bar{a}_0^{k_0}\bar{a}_1^{k_1}\dots\bar{a}_n^{k_n}$ is defined as being $k_1+2k_2+\dots+nk_n$.

Each term on the right-hand side may be shown by permutation of a, b, c to be the symbolical representation of the same covariant; they are equivalent symbolic products, and we may accordingly write

$$2(ac)(bc)a_x^{n-1}b_x^{n-1}c_x^{n-2}=(ab)^2a_x^{n-2}b_x^{n-2}c_x^n,$$

a relation which shows that the form on the left is the product of the two covariants

$$(ab)^2a_x^{n-2}b_x^{n-2} \text{ and } c_x^n.$$

The identities are, in particular, of service in reducing symbolic products to standard forms. A symbolical expression may be always so transformed that the power of any determinant factor (ab) is even. For we may in any product interchange a and b without altering its signification; therefore

$$(ab)^{2m+1}\phi_1=-(ab)^{2m+1}\phi_2,$$

where ϕ_1 becomes ϕ_2 by the interchange, and hence

$$(ab)^{2m+1}\phi_1=\frac{1}{2}(ab)^{2m+1}(\phi_1-\phi_2);$$

and identity (I.) will always result in transforming $\phi_1-\phi_2$ so as to make it divisible by (ab).

Ex. gr.

$$(ab)(ac)b_xc_x=-(ab)(bc)a_xc_x$$
$$=\frac{1}{2}(ab)c_x\{(ac)b_x-(bc)a_x\}=\frac{1}{2}(ab)^2c_x^2;$$

so that the covariant of the quadratic on the left is half the product of the quadratic itself and its only invariant. To obtain the corresponding theorem concerning the general form of even order we multiply throughout by $(ab)^{2m-2}c_x^{2m-2}$ and obtain

$$(ab)^{2m-1}(ac)b_xc_x^{2m-1}=\frac{1}{2}(ab)^{2m}c_x^{2m}.$$

Paying attention merely to the determinant factors there is no form with one factor since (ab) vanishes identically. For two factors the standard form is $(ab)^2$; for three factors $(ab)^2(ac)$; for four factors $(ab)^4$ and $(ab)^2(cd)^2$; for five factors $(ab)^4(ac)$ and $(ab)^2(ac)(de)^2$; for six factors $(ab)^6$, $(ab)^2(bc)^2(ca)^2$, and $(ab)^2(cd)^2(ef)^2$. It will be a useful exercise for the reader to interpret the corresponding covariants of the general quantic, to show that some of them are simple powers or products of other covariants of lower degrees and order.

The Polar Process.—The μ^{th} polar of a_x^n with regard to y is

$$a_x^{n-\mu}a_y^{\mu},$$

i.e. μ of the symbolic factors of the form are replaced by μ others in which new variables y_1, y_2 replace the old variables x_1, x_2. The operation of taking the polar results in a symbolic product, and the repetition of the process in regard to new cogredient sets of variables results in symbolic forms. It is therefore an invariant process. All the forms obtained are invariants in regard to linear transformations, in accordance with the same scheme of substitutions, of the several sets of variables.

An important associated operation is

$$\frac{\partial^2}{\partial x_1\partial y_2}-\frac{\partial^2}{\partial x_2\partial y_1},$$

which, operating upon any polar, causes it to vanish. Moreover, its operation upon any invariant form produces an invariant form.

Every symbolic product, involving several sets of cogredient variables, can be exhibited as a sum of terms, each of which is a polar multiplied by a product of powers of the determinant factors

$$(xy),\ (xz),\ (yz),\ldots$$

Transvection.—We have seen that (ab) is a simultaneous invariant of the two different linear forms a_x, b_x, and we observe that (ab) is equivalent to

$$\frac{\partial f}{\partial x_1}\frac{\partial \phi}{\partial x_2}-\frac{\partial f}{\partial x_2}\frac{\partial \phi}{\partial x_1}$$

where $f=a_x$, $\phi=b_x$.

If $f=a_x^m$, $\phi=b_x^n$ be any two binary forms, we generalize by forming the function

$$\frac{(m-k)!}{m!}\,\frac{(n-k)!}{n!}\left(\frac{\partial f}{\partial x_1}\frac{\partial \phi}{\partial x_2}-\frac{\partial f}{\partial x_2}\frac{\partial \phi}{\partial x_1}\right)^k.$$

This is called the k^{th} transvectant of f over ϕ; it may be conveniently denoted by

$$(f,\ \phi)^k.$$

Observing that

$$(a_x^m,\ b_x^n)^k=(ab)^ka^{m-k}b_x^{n-k},$$

it is clear that the k^{th} transvectant is a simultaneous covariant of the two forms.

It has been shown by Gordan that every symbolic product is expressible as a sum of transvectants.

If $m\geq n$ there are $n+1$ transvectants corresponding to the values 0, 1, 2,... n of k; if $k=0$ we have the product of the two forms, and for all values of $k>n$ the transvectants vanish. In general we may have any two forms

$$\phi_x^p=(\phi_1x_1+\phi_2x_2)^p,\ \psi_x^q=(\psi_1x_1+\psi_2x_2)^q,$$

ϕ_1, ϕ_2, ψ_1, ψ_2 being the umbrae, as usual, and for the k^{th} transvectant we have

$$(\phi_x^p,\ \psi_x^q)^k=(\phi\psi)^k\phi_x^{p-k}\psi_x^{q-k},$$

a simultaneous covariant of the two forms. We may suppose ϕ_x^p, ψ_x^q to be any two covariants appertaining to a system, and the process of transvection supplies a means of proceeding from them to other covariants.

The two forms a_x^m, b_x^n, or ϕ_x^p, ψ_x^q, may be identical; we then have the k^{th} transvectant of a form over itself which may, or may not, vanish identically; and, in the latter case, is a covariant of the single form. It is obvious that, when k is uneven, the k^{th} transvectant of a form over itself *does* vanish. We have seen that transvection is equivalent to the performance of partial differential operations upon the two forms, but, practically, we may regard the process as merely substituting $(ab)^k$, $(\phi\psi)^k$ for $a_x^kb_x^k$, $\phi_x^k\psi_x^k$ respectively in the symbolic product subjected to transvection. It is essentially an operation performed upon the product of two forms. If, then, we require the transvectants of the two forms $f+\lambda f'$, $\phi+\mu\phi'$, we take their product

$$f\phi+\lambda f'\phi+\mu f\phi'+\lambda\mu f'\phi',$$

and the k^{th} transvectant is simply obtained by operating upon each term separately, viz.

$$(f,\ \phi)^k+\lambda(f',\ \phi)^k+\mu(f,\ \phi')^k+\lambda\mu(f',\ \phi')^k;$$

and, moreover, if we require to find the k^{th} transvectant of one linear system of forms over another we have merely to multiply the two systems, and take the k^{th} transvectant of the separate products.

The process of transvection is connected with the operations Ω; for

$$\Omega^k(a_x^mb_y^n)=(ab)^ka_x^{m-k}b_y^{n-k};$$

or

$$\Omega^k(a_x^mb_y^n)_{y=x}=(f,\ \phi)^k;$$

so also is the polar process, for since

$$f_y^k=a_x^{m-k}b_y^k,\ \phi_y^k=b_x^{n-k}b_y^k,$$

if we take the k^{th} transvectant of f_y^k over ϕ_y^k, regarding y_1, y_2 as the variables,

$$(f_y^k,\ \phi_y^k)^k=(ab)^ka_x^{m-k}b_x^{n-k}=(f,\ \phi)^k;$$

or the k^{th} transvectant of the k^{th} polars, in regard to y, is equal to the k^{th} transvectant of the forms. Moreover, the k^{th} transvectant $(ab)^ka_x^{m-k}b_x^{n-k}$ is derivable from the k^{th} polar of a_x^m, viz. $a_x^{m-k}a_y^k$ by substituting for y_1, y_2 the cogredient quantities $b_2,-b_1$, and multiplying by b_x^{n-k}.

First and Second Transvectants.—A few words must be said about the first two transvectants as they are of exceptional interest. Since, if $f=a_n^m$, $\phi=b_x^n$,

$$(f,\ \phi)^1=\frac{1}{mn}\left(\frac{\partial f}{\partial x_1}\frac{\partial \phi}{\partial x_2}-\frac{\partial f}{\partial x_2}\frac{\partial \phi}{\partial x_1}\right)=(ab)a_x^{m-1}b_x^{n-1}=\mathrm{J},$$

the first transvectant differs but by a numerical factor from the Jacobian or functional determinant, of the two forms. We can find an expression for the first transvectant of $(f,\ \phi)^1$ over another form c^p.

For

$$(m+n)(f,\phi)_y^1=nf.\phi_y^1+mf_y^1.\phi,$$

and

$$f,\phi_y^1-f_y.\phi=(a_xb_y-a_yb_x)a_x^{m-1}b_x^{n-1}=(xy)(f,\phi)^1;$$
$$\therefore (f,\phi)^1=f_y^1.\phi+\frac{n}{m+n}(xy)(f,\phi)^1.$$

Put $m-1$ for m, $n-1$ for n, and multiply through by (ab); then

$$\{(f,\phi)\}_y^1=(ab)a_x^{m-2}a_yb_x^{n-1}+\frac{n-1}{m+n-2}(xy)(f,\phi)^2,$$
$$=(ab)a_x^{m-1}b_x^{n-2}b_y-\frac{m-1}{m+n-2}(xy)(f,\phi)^2.$$

Multiply by c_x^{p-1} and for y_1, y_2 write $c_2,-c_1$; then the right-hand side becomes

$$(ab)(bc)a_x^{m-1}b_x^{n-2}c_x^{p-1}+\frac{m-1}{m+n-2}c_x^p(f,\phi)^2,$$

of which the first term, writing $c_x^p=\psi$, is

$$a_x^{m-2}b_x^{n-2}c_x^{p-2}(ab)(bc)a_xc_x$$
$$=-\frac{1}{2}a_x^{m-2}b_x^{n-2}c_x^{p-2}\left\{(bc)^2a_x^2+(ab)^2c_x^2-(ac)^2b_x^2\right\}$$
$$=-\frac{1}{2}\left\{a_x^m(bc)^2b_x^{n-2}c_x^{p-2}+c_x^p(ab)^2a_x^{m-2}b_x^{n-2}-b_x^n(ac)^2a_x^{m-2}c_x^{p-2}\right\}$$
$$=-\frac{1}{2}\left\{(\phi,\psi)^2.f+(f,\phi)^2.\psi-(f,\psi)^2.\phi\right\};$$

and, if $(f,\phi)^1=k_x^{m+n-2}$,

$$\left\{(f,\phi)^1\right\}_y^1.c_x^{p-1}=k_x^{m+n-3}k_yc_x^{p-1};$$

and this, on writing $c_2, -c_1$ for y_1, y_2, becomes

$$(kc)k_x^{m+n-3}c_x^{p-1} = \Big\}(f,\phi)^1, \psi\Big\}^1;$$

$$\therefore \{(f,\phi)^1,\psi\}^1 = \frac{1}{2}\Big\}\frac{m-n}{m+n-2}(f,\phi)^2.\psi + (f,\psi)^2.\phi - (\phi,\psi)^2.f\Big\};$$

and thence it appears that the first transvectant of $(f, \phi)^1$ over ψ is always expressible by means of forms of lower degree in the coefficients wherever each of the forms f, ϕ, ψ is of higher degree than the first in x_1, x_2.

The second transvectant of a form over itself is called the Hessian of the form. It is

$$(f, f')^2 = (ab)^2 a_x^{m-2} b_x^{m-2} = \mathrm{H}_x^{2m-4} = \mathrm{H};$$

unsymbolically it is a numerical multiple of the determinant $\frac{\partial^2 f}{\partial x_1^2}\frac{\partial^2 f}{\partial x_2^2} - \left(\frac{\partial^2 f}{\partial x \partial x_2}\right)^2$. It is also the first transvectant of the differential coefficients of the form with regard to the variables, viz. $\left(\frac{\partial f}{\partial x_1}, \frac{\partial f}{\partial x_2}\right)^1$. For the quadratic it is the discriminant $(ab)^2$ and for the cubic the quadratic covariant $(ab)^2\, a_x b_x$.

In general for a form in n variables the Hessian is

$$\begin{vmatrix} \frac{\partial^2 f}{\partial x_1^2} & \frac{\partial^2 x}{\partial x_1 \partial x_2} \cdots & \frac{\partial^2 f}{\partial x_1 \partial x_n} \\ \frac{\partial^2 f}{\partial x_1 \partial x_2} & \frac{\partial^2 f}{\partial x_2^2} \cdots & \frac{\partial^2 f}{\partial x_2 \partial x_n} \\ \vdots & \vdots & \vdots \\ \frac{\partial^2 f}{\partial x_1 \partial x_n} & \frac{\partial^2 f}{\partial x_2 \partial x_n} \cdots & \frac{\partial^2 f}{\partial x_n^2} \end{vmatrix} = \mathrm{H}_x^{n(n-2)} = \mathrm{H};$$

and there is a remarkable theorem which states that if H=0 and $n=2$, 3, or 4 the original form can be exhibited as a form in 1, 2, 3 variables respectively.

The Form $f+\lambda\phi$.—An important method for the formation of covariants is connected with the form $f+\lambda\phi$, where f and ϕ are of the same order in the variables and λ is an arbitrary constant. If the invariants and covariants of this composite quantic be formed we obtain functions of λ such that the coefficients of the various powers of λ are simultaneous invariants of f and ϕ. In particular, when ϕ is a covariant of f, we obtain in this manner covariants of f.

The Partial Differential Equations.—It will be shown later that covariants may be studied by restricting attention to the leading coefficient, viz. that affecting x_1^ϵ where ϵ is the order of the covariant. An important fact, discovered by Cayley, is that these coefficients, and also the complete covariants, satisfy certain partial differential equations which suffice to determine them, and to ascertain many of their properties. These equations can be arrived at in many ways; the method here given is due to Gordan. λ_1, λ_2, μ_1, μ_2 being as usual the coefficients of substitution, let

$$\lambda_1\frac{\partial}{\partial\lambda_1} + \lambda_2\frac{\partial}{\partial\lambda_2} = \mathrm{D}_{\lambda\lambda},\ \lambda_1\frac{\partial}{\partial\mu_1} + \lambda_2\frac{\partial}{\partial\mu_2} = \mathrm{D}_{\lambda\mu},$$

$$\mu_1\frac{\partial}{\partial\lambda_1} + \mu_2\frac{\partial}{\partial\lambda_2} = \mathrm{D}_{\mu\lambda},\ \mu_1\frac{\partial}{\partial\mu_1} + \mu_2\frac{\partial}{\partial\mu_2} = \mathrm{D}_{\mu\mu},$$

be linear operators. Then if j, J be the original and transformed forms of an invariant

$$\mathrm{J} = (\lambda\mu)^w j,$$

w being the weight of the invariant.

Operation upon J results as follows:—

$$\mathrm{D}_{\lambda\lambda}\mathrm{J} = w\mathrm{J};\ \mathrm{D}_{\lambda\mu}\mathrm{J} = 0;$$

$$\mathrm{D}_{\mu\lambda}\mathrm{J} = 0; \mathrm{D}_{\mu\mu}\mathrm{J} = w\mathrm{J}.$$

The first and fourth of these indicate that $(\lambda\mu)^w$ is a homogeneous function of λ_1, λ_2, and of μ_1, μ_2 separately, and the second and third arise from the fact that $(\lambda\mu)$ is caused to vanish by both $\mathrm{D}_{\lambda\mu}$ and $\mathrm{D}_{\mu\lambda}$.

Since $\mathrm{J} = \mathrm{F}(\bar{\mathrm{A}}_0, \bar{\mathrm{A}}_1, \ldots \bar{\mathrm{A}}_k, \ldots)$, where $\overline{\mathrm{A}_k} = a_\lambda^{n-k} a_\mu^k$,
we find that the results are equivalent to

$$\sum_k (\mathrm{D}_{\lambda\lambda}\bar{\mathrm{A}}_k)\frac{\partial\mathrm{J}}{\partial\bar{\mathrm{A}}_k} = w\mathrm{J};\ \sum_k (\mathrm{D}_{\lambda\mu}\bar{\mathrm{A}}_k)\frac{\partial\mathrm{J}}{\partial\bar{\mathrm{A}}_k} = 0;$$

$$\sum_k (\mathrm{D}_{\mu\lambda}\bar{\mathrm{A}}_k)\frac{\partial\mathrm{J}}{\partial\bar{\mathrm{A}}_k} = 0;\ \sum_k (\mathrm{D}_{\mu\mu}\bar{\mathrm{A}}_k)\frac{\partial\mathrm{J}}{\partial\bar{\mathrm{A}}_k} = w\mathrm{J}.$$

According to the well-known law for the changes of independent variables. Now

$$\mathrm{D}_{\lambda\lambda}\bar{\mathrm{A}}_k = (n-k)\bar{\mathrm{A}}_k; \mathrm{D}_{\lambda\mu}\bar{\mathrm{A}}_k = k\bar{\mathrm{A}}_{k-1};$$

$$\mathrm{D}_{\mu\lambda}\bar{\mathrm{A}}_k = (n-k)\bar{\mathrm{A}}_{k+1}; \mathrm{D}_{\mu\mu}\bar{\mathrm{A}}_k = k\bar{\mathrm{A}}_k;$$

so we obtain

$$\sum_k (n-k)\bar{\mathrm{A}}_k\frac{\partial\mathrm{J}}{\partial\bar{\mathrm{A}}_k} = w\mathrm{J};\ \sum_k k\bar{\mathrm{A}}_{k-1}\frac{\partial\mathrm{J}}{\partial\bar{\mathrm{A}}_k} = 0;$$

$$\sum_k (n-k)\bar{\mathrm{A}}_{k+1}\frac{\partial\mathrm{J}}{\partial\bar{\mathrm{A}}_k} = 0;\ \sum_k k\bar{\mathrm{A}}_k\frac{\partial\mathrm{J}}{\partial\bar{\mathrm{A}}_k} = w\mathrm{J};$$

equations which are valid when λ_1, λ_2, μ_1, μ_2 have arbitrary values, and therefore when the values are such that $\mathrm{J}=j$, $\bar{\mathrm{A}}_k = \bar{a}_k$.

Hence

$$n\bar{a}_0\frac{\partial j}{\partial\bar{a}_0} + (n-1)\bar{a}_1\frac{\partial j}{\partial\bar{a}_1} + (n-2)\bar{a}_2\frac{\partial j}{\partial\bar{a}_2} + \ldots = wj,$$

$$\bar{a}_0\frac{\partial j}{\partial\bar{a}_1} + 2\bar{a}_1\frac{\partial j}{\partial\bar{a}_2} + 3\bar{a}_2\frac{\partial j}{\partial\bar{a}_3} + \ldots = 0,$$

$$n\bar{a}_1\frac{\partial j}{\partial\bar{a}_0} + (n-1)\bar{a}_2\frac{\partial j}{\partial\bar{a}_1} + (n-2)\bar{a}_3\frac{\partial j}{\partial\bar{a}_2} + \ldots = 0,$$

$$\bar{a}_1\frac{\partial j}{\partial\bar{a}_1} + 2\bar{a}_2\frac{\partial j}{\partial\bar{a}_2} + 3\bar{a}_3\frac{\partial j}{\partial\bar{a}_3} + \ldots = wj,$$

the complete system of equations satisfied by an invariant. The fourth shows that every term of the invariant is of the same weight. Moreover, if we add the first to the fourth we obtain

$$\sum_k \bar{a}_k\frac{\partial j}{\partial\bar{a}_k} = \frac{2w}{n}j = \theta j,$$

where θ is the degree of the invariant; this shows, as we have before observed, that for an invariant

$$w = \frac{1}{2}n\theta.$$

The second and third are those upon the solution of which the theory of the invariant may be said to depend. An instantaneous deduction from the relation $w = \frac{1}{2}n\theta$ is that forms of uneven orders possess only invariants of even degree in the coefficients. The two operators

$$\Omega = \bar{a}_0\frac{\partial}{\partial\bar{a}_1} + 2\bar{a}_1\frac{\partial}{\partial\bar{a}_2} + \ldots + n\bar{a}_{n-1}\frac{\partial}{\partial\bar{a}_n}$$

$$\mathrm{O} = n\bar{a}_1\frac{\partial}{\partial\bar{a}_0} + (n-1)\bar{a}_2\frac{\partial}{\partial\bar{a}_1} + \ldots + \bar{a}_n\frac{\partial}{\partial\bar{a}_{n-1}}$$

have been much studied by Sylvester, Hammond, Hilbert and Elliott (Elliott, *Algebra of Quantics*, ch. vi.). An important reference is "The Differential Equations satisfied by Concomitants of Quantics," by A. R. Forsyth, *Proc. Lond. Math. Soc.* vol. xix.

The Evectant Process.—If we have a symbolic product, which contains the symbol a only in determinant factors such as (ab), we may write $x_2, -x_1$ for a_1, a_2, and thus obtain a product in which (ab) is replaced by b_x, (ac) by c_x and so on. In particular, when the product denotes an invariant we may transform each of the symbols a, b,...to x in succession, and take the sum of the resultant products; we thus obtain a covariant which is called the first evectant of the original invariant. The second evectant is obtained by similarly operating upon all the symbols remaining which only occur in determinant factors, and so on for the higher evectants.

Ex. gr. From $(ac)^2(bd)^2(ad)(bc)$ we obtain

$$\begin{aligned} &(bd)^2(bc)c_x^2 d_x + (ac)^2(ad)c_x d_x^2 \\ &-(bd)^2(ad)a_x^2 b_x - (ac)^2(bc)a_x b_x^2 \\ &= 4(bd)^2(bc)c_x^2 d_x \text{ the first evectant;} \end{aligned}$$

and thence $4c_x^3 d_x^3$ the second evectant; in fact the two evectants are to numerical factors *près*, the cubic covariant Q, and the square of the original cubic.

If θ be the degree of an invariant j

$$\begin{aligned} \theta j &= \bar{a}_0\frac{\partial j}{\partial\bar{a}_0} + \bar{a}_1\frac{\partial j}{\partial\bar{a}_1} + \ldots + \bar{a}_n\frac{\partial j}{\partial\bar{a}_n} \\ &= a_1^n\frac{\partial j}{\partial\bar{a}_0} + a_1^{n-1}a_2\frac{\partial j}{\partial\bar{a}_1} + \ldots + a_2^n\frac{\partial j}{\partial\bar{a}_n} \end{aligned}$$

and, herein transforming from a to x, we obtain the first evectant

$$p_x^n = \sum_k (-)^k x_1^k x_2^{n-k}\frac{\partial j}{\partial\bar{a}_k}.$$

Combinants.—An important class of invariants, of several binary forms of the same order, was discovered by Sylvester. The invariants in question are invariants *quâ* linear transformation of the forms themselves as well as *quâ* linear transformation of the variables. If the forms be a_x^p, b_x^p, c_x^p,... the Aronhold process, given by the operation δ as between any two of the forms, causes such an invariant to vanish. Thus it has annihilators of the forms

$$\bar{a}_0\frac{d}{d\bar{b}_0} + \bar{a}_1\frac{d}{d\bar{b}_1} + \bar{a}_2\frac{d}{d\bar{b}_2} + \ldots$$

$$\bar{b}_0\frac{d}{d\bar{a}_0} + \bar{b}_1\frac{d}{d\bar{a}_1} + \bar{b}_2\frac{d}{d\bar{a}_2} + \ldots$$

and Gordan, in fact, takes the satisfaction of these conditions as defining those invariants which Sylvester termed "combinants." The existence of such forms seems to have been brought to Sylvester's notice by observation of the fact that the resultant of a_x^p and b_x^p must be a factor of the resultant of $\lambda a_x^p + \mu b_x^p$ and $\lambda' a_x^p + \mu' b_x^p$ for a common factor of the first pair must be also a common factor of the second pair; so that the condition for the existence of such common factor must be the same in the two cases. A leading proposition states that, if an invariant of λa_x^p and μb_x^p be considered as a form in the variables λ and μ, and an invariant of the latter be taken, the result will be a combinant of a_x^p and b_x^p. The idea can be generalized so as to have regard to ternary and higher forms each of the same order and of the same number of variables.

For further information see Gordan, *Vorlesungen über Invariantentheorie*, Bd. ii. § 6 (Leipzig, 1887); E. B. Elliott, *Algebra of Quantics*, Art. 264 (Oxford, 1895).

Associated Forms.—A system of forms, such that every form appertaining to the binary form is expressible as a rational and integral function of the members of the system, is difficult to obtain. If, however, we specify that all forms are to be rational, but not necessarily integral functions, a new system of forms arises which is easily obtainable. A binary form of order n contains n independent constants, three of which by linear transformation can be given determinate values; the remaining $n-3$ coefficients, together with the determinant of transformation, give us $n-2$ parameters, and in consequence one relation must exist between any $n-1$ invariants of the form, and fixing upon $n-2$ invariants every other invariant is a rational function of its members. Similarly regarding x_1, x_2 as additional parameters, we see that every covariant is expressible as a rational function of n fixed covariants. We can so determine these n covariants that every other covariant is expressed in terms of them by a fraction whose denominator is a power of the binary form.

First observe that with $f_x = a_x^n = b_x^n = \dots, f_1 = a_1 a_x^{n-1}, f_2 = a_2 a_x^{n-1}$, $f_x = f_1x_1 + f_2x_2$, we find

$$(ab) = \frac{(af)b_x - (bf)a_x}{f_x};$$

and that thence every symbolic product is equal to a rational function of covariants in the form of a fraction whose denominator is a power of f_x. Making the substitution in any symbolic product the only determinant factors that present themselves in the numerator are of the form (af), (bf), (cf),...and every symbol a finally appears in the form.

$$\psi_k = (af)^k a_x^{n-k}.$$

ψ_k has f as a factor, and may be written $f.\ u_k$; for observing that $\psi_0 = f.\ = f.\ u_0$; $\psi_1 = 0 = f.u_1$; where $u_0 = 1$, $u_1 = 0$,

assume that $\qquad \psi_k = (af)^k a_x^{n-k} = f.\ u_k = a_x^n . u_x^{k(n-2)}$.

Taking the first polar with regard to y

$$(n-k)(af)^k a_x^{n-k-1} a_y + k(af)^{k-1} a_x^{n-k} (ab)(n-1) b_x^{n-2} b_y$$
$$= k(n-2) a_x^n u_x^{kn-2k-1} u_y + n a_x^{n-1} a_y u_x^{k(n-2)},$$

and, writing f_2 and $-f_1$ for y_1 and y_2,

$$(n-k)(af)^{k+1} a_x^{n-k-1} + k(n-1)(ab)(af)^{k-1}(bf) a_x^{n-k} b_x^{n-2}$$
$$= k(n-2) f.\ (uf) u_x^{kn-2k-1}.$$

Moreover the second term on the left contains

$$(af)^{k-2} b_x^{k-2} = \frac{1}{2}\{(af)^{k-2} b_x^{k-2} - (bf)^{k-2} a_x^{k-2}\}.$$

if k be uneven, and

$$(af)^{k-1} b_x^{k-1} = \frac{1}{2}\{(af)^{k-1} b_x^{k-1} - (bf)^{k-1} a_x^{k-1}\},$$

if k be even; in either case the factor

$$(af)b_x - (bf)a_x = (ab)f,$$

and therefore

$$(n-k)\psi_{k+1} + \mathrm{M}.f = k(n-2)f.(uf)u_x^{kn-2k-1};$$

and ψ_{k+1} is seen to be of the form $f.\ u_{k+1}$.

We may write therefore

$$u_k = \frac{(af)^k a_x^{n-k}}{f}$$

These forms, n in number, are called "associated forms" of f ("Schwesterformen," "formes associées").

Every covariant is rationally expressible by means of the forms f, u_2, u_3,... u_n since, as we have seen $u_0 = 1$, $u_1 = 0$. It is easy to find the relations

$$u_2 = \frac{1}{2}(f, f')^2,$$
$$u_3 = ((f, f')^2, f'')$$
$$u_4 = \frac{1}{2}(f, f')^4 . f^2 - \frac{3}{4}\{(f, f')^2\}^2,$$

and so on.

To exhibit any covariant as a function of u_0, u_1, u_2,... take $a_y^n = (a_1y_1 + a_2y_2)^n$ and transform it by the substitution

$$f_1y_1 + f_2y_2 = \xi \text{ where } f_1 = a_1 a_x^{n-1}, f_2 = a_2 a_x^{n-1},$$
$$x_2y_1 - x_1y_2 = \eta \qquad f = f_1x_1 + f_2x_2;$$

thence

$$f.y_1 = x_1\xi + f_2\eta;\ f.y_2 = x_2\xi - f_1\eta,$$
$$f.a_y = a_x\xi + (af)\eta,$$

and

$$f^{n-1}.a_y^n = u_0\xi^n + \binom{n}{2}u_2\xi^{n-2}\eta^2 + \binom{n}{3}u_3\xi^{n-3}\eta^3 + \dots + u_n\eta^n.$$

Now a covariant of $a_x^n = f$ is obtained from the similar covariant of a_y^n by writing therein x_1, x_2, for y_1, y_2, and, since y_1, y_2 have been linearly transformed to ξ and η, it is merely necessary to form the covariants in respect of the form $(u_1\xi + u_2\eta)^n$, and then division, by the proper power of f, gives the covariant in question as a function of f, $u_0 = 1$, u_2, u_3,...u_n.

Summary of Results.—We will now give a short account of the results to which the foregoing processes lead. Of any form a_x^n there exists a finite number of invariants and covariants, in terms of which all other covariants are rational and integral functions (cf. Gordan, Bd. ii. § 21). This finite number of forms is said to constitute the complete system. Of two or more binary forms there are also complete systems containing a finite number of forms. There are also algebraic systems, as above mentioned, involving fewer covariants which are such that all other covariants are rationally expressible in terms of them; but these smaller systems do not possess the same mathematical interest as those first mentioned.

The Binary Quadratic.—The complete system consists of the form itself, a_x^2, and the discriminant, which is the second transvectant of the form upon itself, viz.: $(f, f')^2 = (ab)^2$; or, in real coefficients, $2(\bar{a}_0\bar{a}_2 - \bar{a}_1^2)$. The first transvectant, $(f, f')^1 = (ab)\ a_x b_x$, vanishes identically. Calling the discriminate D, the solution of the quadratic $a_x^2 = 0$ is given by the formula

$$a_x^2 = \frac{1}{\bar{a}_0}\left(\bar{a}_0x_1 + \bar{a}_1x_2 - x_2\sqrt{-\frac{\mathrm{D}}{2}}\right)\left(\bar{a}_0x_1 + \bar{a}_1x_2 + x_2\sqrt{-\frac{\mathrm{D}}{2}}\right).$$

If the form a_x^2 be written as the product of its linear factors $p_x q_x$, the discriminant takes the form $-\frac{1}{2}(pq)^2$. The vanishing of this invariant is the condition for equal roots. The simultaneous system of two quadratic forms a_x^2, a_x^2, say f and ϕ, consists of six forms, viz. the two quadratic forms f, ϕ; the two discriminants $(f, f')^2$, $(\phi, \phi')^2$, and the first and second transvectants of f upon ϕ, $(f, \phi)^1$ and $(f, \phi)^2$, which may be written $(a\alpha)a_x\alpha_x$ and $(a\alpha)^2$. These fundamental or ground forms are connected by the relation

$$-2\{(f, \phi)^1\}^2 = f^2(\phi, \phi')^2 - 2f\phi(f, \phi)^2 + \phi^2(f, f')^2.$$

If the covariant $(f, \phi)^1$ vanishes f and ϕ are clearly proportional, and if the second transvectant of $(f, \phi)^1$ upon itself vanishes, f and ϕ possess a common linear factor; and the condition is both necessary and sufficient. In this case $(f, \phi)^1$ is a perfect square, since its discriminant vanishes. If $(f, \phi)^1$ be not a perfect square, and r_x, s_x be its linear factors, it is possible to express f and ϕ in the canonical forms $\lambda_1(r_x)^2 + \lambda_2(s_x)^2$, $\mu_1(r_x)^2 + \mu_2(s_x)^2$ respectively. In fact, if f and ϕ have these forms, it is easy to verify that $(f, \phi)^1 = (\lambda\mu)(rs)r_xs_x$. The fundamental system connected with n quadratic forms consists of (i.) the n forms themselves f_1, f_2,...f_n, (ii.) the $\binom{n}{2}$ functional determinants $(f_i, f_k)^1$, (iii.) the $\binom{n+1}{2}$ invariants $(f_i, f_k)^2$, (iv.) the $\binom{n}{3}$ forms $(f_i, (f_k, f_m))^2$, each such form remaining unaltered for any permutations of i, k, m. Between these forms various relations exist (cf. Gordan, § 134).

The Binary Cubic.—The complete system consists of

$$f = a_x^3,\ (f, f')^2 = (ab)^2 a_x b_x = \Delta_x^2,\ (f, \Delta) = (ab)^2(ca)b_x c_x^2 = \mathrm{Q}_x^3,$$

and

$$(\Delta, \Delta')^2 = (ab)^2(cd)^2(ad)(bc) = \mathrm{R}.$$

To prove that this system is complete we have to consider

$$(f, \Delta)^2,\ (\Delta, \Delta')^1,\ (f, \mathrm{Q})^1,\ (f, \mathrm{Q})^2,\ (f, \mathrm{Q})^3,\ (\Delta, \mathrm{Q})^1,\ (\Delta, \mathrm{Q})^2,$$

and each of these can be shown either to be zero or to be a rational integral function of f, Δ Q and R. These forms are connected by the relation

$$2\mathrm{Q}^2 + \Delta^3 + \mathrm{R}f^2 = 0.$$

The discriminant of f is equal to the discriminant of Δ, and is therefore $(\Delta, \Delta')^2 = \mathrm{R}$; if it vanishes both f and Δ have two roots equal, Δ is a rational factor of f and Q is a perfect cube; the cube root being equal, to a numerical factor *près*, to the square root of Δ. The Hessian $\Delta = \Delta_x^2$ is such that $(f, \Delta)^2 = 0$, and if f is expressible in the form $\lambda(p_x)^3 + \mu(q_x)^3$, that is as the sum of two perfect cubes, we find that Δ_x^2 must be equal to $p_x q_x$ for then

$$\{\lambda(p_x)^3 + \mu(q_x)^3,\ p_x q_x\}^2 = 0.$$

Hence, if p_x, q_x be the linear factors of the Hessian Δ_x^2, the cubic can be put into the form $\lambda(p_x)^3 + \mu(q_x)^3$ and immediately solved. This method of solution fails when the discriminant R vanishes, for then the Hessian has equal roots, as also the cubic f. The Hessian in that case is a factor of f, and Q is the third power of the linear factor which occurs to the second power in f. If, moreover, Δ vanishes identically f is a perfect cube.

The Binary Quartic.—The fundamental system consists of five forms $a_x^4=f$; $(f,f')^2=(ab)^2a_x^2b_x^2=\Delta_x^4$; $(f,f')^4=(ab)^4=i$; $(f,\ \Delta)^1=(a\Delta)a_x^3\Delta_x^3=(ab)^2(cb)a_x^2b_xc_x^3=t$; $(f,\Delta)^4=(a\Delta)^4=(ab)^2(bc)^2(ca)^2=j$, viz. two invariants, two quartics and a sextic. They are connected by the relation

$$2t^2=\frac{1}{2}if^2\Delta-\Delta^3-\frac{1}{3}jf^3.$$

The discriminant, whose vanishing is the condition that f may possess two equal roots, has the expression $j^2-\frac{1}{6}i^3$; it is nine times the discriminant of the cubic resolvent $k^3-\frac{1}{2}ik-\frac{1}{3}j$, and has also the expression $4(t,t')^6$. The quartic has four equal roots, that is to say, is a perfect fourth power, when the Hessian vanishes identically; and conversely. This can be verified by equating to zero the five coefficients of the Hessian $(ab)^2a_x^2b_x^2$. Gordan has also shown that the vanishing of the Hessian of the binary n^{ic} is the necessary and sufficient condition to ensure the form being a perfect n^{th} power. The vanishing of the invariants i and j is the necessary and sufficient condition to ensure the quartic having three equal roots. On the one hand, assuming the quartic to have the form $4x_1^3x_2$, we find $i=j=0$, and on the other hand, assuming $i=j=0$, we find that the quartic must have the form $a_0x_1^4+4a_1x_1^3x_2$ which proves the proposition. The quartic will have two pairs of equal roots, that is, will be a perfect square, if it and its Hessian merely differ by a numerical factor. For it is easy to establish the formula $(yx)^2\Delta_x^4=2f.f_y^2-2(f_y^1)^2$ connecting the Hessian with the quartic and its first and second polars; now α, a root of f, is also a root of Δ_x^4, and consequently the first polar $f_y^1=y_1\frac{\partial f}{\partial x_1}+y_2\frac{\partial f}{\partial x_2}$ must also vanish for the root α, and thence $\frac{\partial f}{\partial x_1}$ and $\frac{\partial f}{\partial x_2}$ must also vanish for the same root; which proves that α is a double root of f, and f therefore a perfect square. When $f=6x_1^2x_2^2$ it will be found that $\Delta=-f$. The simplest form to which the quartic is in general reducible is $f=x_1^4+6mx_1^2x_2^2+x_2^4$, involving one parameter m; then $\Delta_x^4=2m(x_1^4+x_2^4)+2(1-3m^2)x_1^2x_2^2$; $i=2(1+3m^2)$; $j=6m(1-m)^2$; $t=(1-9m^2)(x_1^2-x_2^2)(x_1^2+x_2^2)x_1x_2$. The sextic covariant t is seen to be factorizable into three quadratic factors $\phi=x_1x_2$, $\psi=x_1^2+x_2^2$, $\psi=x_1^2-x_2^2$, which are such that the three mutual second transvectants vanish identically; they are for this reason termed conjugate quadratic factors. It is on a consideration of these factors of t that Cayley bases his solution of the quartic equation. For, since $-2t^2=\Delta^3-\frac{1}{2}if^2\Delta-\frac{1}{3}j(-f)^3$, he compares the right-hand side with the cubic resolvent $k^3-\frac{1}{2}i\lambda^2k-\frac{1}{3}j\lambda^3$, of $f=0$, and notices that they become identical on substituting Δ for k, and $-f$ for λ; hence, if k_1, k_2, k_3 be the roots of the resolvent

$$-2t^2=(\Delta+k_1f)(\Delta+k_2f)(\Delta+k_3f);$$

and now, if all the roots of f be different, so also are those of the resolvent, since the latter, and f, have practically the same discriminant; consequently each of the three factors, of $-2t^2$, must be perfect squares and taking the square root

$$t=\frac{1}{\sqrt{-2}}\phi.\chi.\psi;$$

and it can be shown that ϕ, χ, ψ are the three conjugate quadratic factors of t above mentioned. We have $\Delta+k_1f=\phi^2$, $\Delta+k_2f=\chi^2$, $\Delta+k_3f=\psi^2$, and Cayley shows that a root of the quartic can be expressed in the determinant form

$$\left|\begin{matrix} 1, k_1, \phi_y^1 \\ 1, k_2, \chi_y^1 \\ 1, k_3, \psi_y^1 \end{matrix}\right| \quad \begin{matrix} y_1=0 \\ y_2=1 \end{matrix}$$

the remaining roots being obtained by varying the signs which occur in the radicals ϕ_y^1, χ_y^1, ψ_y^1. The transformation to the normal form reduces the quartic to a quadratic. The new variables are the linear factors of ϕ. If $\phi=r_x.s_x$, the normal form of a_x^4, can be shown to be given by

$$(rs)^4.a_x^4=(ar)^4s_x^4+6(ar)^2(as)^2r_x^2s_x^2+(as)^4r_x^4;$$

ϕ is any one of the conjugate quadratic factors of t, so that, in determining r_x, s_x from $\sqrt{\Delta+k_1f}=0$, k_1 is any root of the resolvent. The transformation to the normal form, by the solution of a cubic and a quadratic, therefore, supplies a solution of the quartic. If $(\lambda\mu)$ is the modulus of the transformation by which a_x^4 is reduced to the normal form, i becomes $(\lambda\mu)^4i$, and j, $(\lambda\mu)^3j$; hence $\frac{i^3}{j^3}$ is absolutely unaltered by transformation, and is termed the absolute invariant. Since therefore $\frac{i^3}{j^2}=\frac{2}{9}\,\frac{(1+3m^2)^2}{m^2(1-m^2)^2}$ we have a cubic equation for determining m^2 as a function of the absolute invariant.

Remark.—Hermite has shown (*Crelle*, Bd. lii.) that the substitution, $z=\frac{i}{j}\,\frac{\Delta}{f}$, reduces $\frac{x_2\partial x_1-x_1\partial x_2}{\sqrt{j}}$ to the form

$$\frac{1}{2i}\sqrt{-\frac{j}{2}}\;\frac{\partial z}{\sqrt{\frac{1}{3}-\frac{1}{2}z+\frac{j^2}{i^3}z^3}}.$$

The Binary Quintic.—The complete system consists of 23 forms, of which the simplest are $f=a_x^5$; the Hessian $\mathrm{H}=(f,f')^2=(ab)^2a_x^3b_x^3$; the quadratic covariant $i=(f,f')^4=(ab)^4a_xb_x$; and the nonic covariant $\mathrm{T}=(f,(f',f'')^2)^1=(f,\mathrm{H})^1=(a\mathrm{H})a_x^4\mathrm{H}_x^5=(ab)^2(ca)a_x^2b_x^3c_x^4$; the remaining 19 are expressible as transvectants of compounds of these four.

There are four invariants $(i,i')^2$; $(i^3,\mathrm{H})^6$; $(f^2,i^5)^{10}$; $(ft,i^7)^{14}$
four linear forms $(f,i^2)^4$; $(f,i^3)^5$; $(i^4,\mathrm{T})^8$; $(i^5,\mathrm{T})^9$
three quadratic forms i; $(\mathrm{H},i^2)^4$; $(\mathrm{H},i^3)^5$
three cubic forms $(f,i)^2$; $(f,i^2)^3$; $(i^3,\mathrm{T})^6$
two quartic forms $(\mathrm{H},i)^2$; $(\mathrm{H},i^2)^3$.
three quintic forms f; $(f,i)^1$; $(i^2,\mathrm{T})^4$
two sextic forms H; $(\mathrm{H},i)^1$
one septic form $(i,\ \mathrm{T})^2$
one nonic form T.

We will write the cubic covariant $(f,i)^2=j$, and then remark that the result, $(f,j)^3=0$, can be readily established. The form j is completely defined by the relation $(f,j)^3=0$ as no other covariant possesses this property.

Certain convariants of the quintic involve the same determinant factors as appeared in the system of the quartic; these are f, H, i, T and j, and are of special importance. Further, it is convenient to have before us two other quadratic covariants, viz. $\tau=(j,j)^2j_xj_x$; $\theta=(i\tau)i_x\tau_x$; four other linear covariants, viz. $\alpha=-(ji)^2j_x$; $\beta=(i\alpha)i_x$; $\gamma=(\tau\alpha)\tau_x$: $\delta=(\tau\beta)\tau_x$. Further, in the case of invariants, we write $\mathrm{A}=(i,i')^2$ and take three new forms $\mathrm{B}=(i,\tau)^2$; $\mathrm{C}=(\tau,\tau')^2$; $\mathrm{R}=(\beta\gamma)$. Hermite expresses the quintic in a *forme-type* in which the constants are invariants and the variables linear covariants. If α, β be the linear forms, above defined, he raises the identity $a_x(\alpha\beta)=\alpha_x(a\beta)-\beta_x(a\alpha)$ to the fifth power (and in general to the power n) obtaining

$$(\alpha\beta)^5f=(a\beta)^5\alpha_x^5-5(a\beta)^4(a\alpha)\alpha_x^4\beta_x+\ldots-(a\alpha)^5\beta_x^5;$$

and then expresses the coefficients, on the right, in terms of the fundamental invariants. On this principle the covariant j is expressible in the form

$$\mathrm{R}^2j=\delta^3+\frac{3}{2}\mathrm{B}\delta^2\alpha+\frac{3}{4}\mathrm{AC}\delta\alpha^2+\frac{3}{8}\mathrm{C}(3\mathrm{AB}-4\mathrm{C})\alpha^3$$

when δ, α are the above defined linear forms.

Hence, solving the cubic,

$$\mathrm{R}^2j=(\delta-m_1\alpha)(\delta-m_2\alpha)(\delta-m_3\alpha)$$

wherein m_1 m_2, m_3 are invariants.

Sylvester showed that the quintic might, in general, be expressed as the sum of three fifth powers, viz. in the canonical form $f=k_1(p_x)^5+k_2(q_x)^5+k_3(r_x)^5$. Now, evidently, the third transvectant of f, expressed in this form, with the cubic $p_xq_xr_x$ is zero, and hence from a property of the covariant j we must have $j=p_xq_xr_x$; showing that the linear forms involved are the linear factors of j. We may therefore write

$$f=k_1(\delta-m_1\alpha)^5+k_2(\delta-m_2\alpha)^5+k_3(\delta-m_3\alpha)^5;$$

and we have merely to determine the constants k_1, k_2, k_3. To determine them notice that $\mathrm{R}=(\alpha\delta)$ and then

$$\begin{aligned}(f,\alpha^5)^5&=-\mathrm{R}^5(k_1+k_2+k_3),\\(f,\alpha^4\delta)^5&=-5\mathrm{R}^5(m_1k_1+m_2k_2+m_3k_3),\\(f,\alpha^3\delta^2)^5&=-10\mathrm{R}^5(m_1^2k_1+m_2^2k_2+m_3^2k_3),\end{aligned}$$

three equations for determining k_1, k_2, k_3. This canonical form depends upon j having three unequal linear factors. When C vanishes j has the form $j=p_x^2q_x$, and $(f,j)^3=(ap)^2(aq)a_x^2=0$. Hence, from the identity $a_x(pq)=p_x(aq)-q_x(ap)$, we obtain $(pq)^5f=(aq)^5p_x^5-5(ap)(aq)^4p_x^4q_x-(ap)^5q_x^5$, the required canonical form. Now, when $\mathrm{C}=0$, clearly (see *ante*) $\mathrm{R}^2j=\delta^2\rho$ where $\rho=\delta+\frac{3}{2}\mathrm{B}\alpha$; and Gordan then proves the relation

$$6\mathrm{R}^4.f=\mathrm{B}\delta^5+5\mathrm{B}\delta^4\rho-4\mathrm{A}^2\rho^5,$$

which is Bring's form of quintic at which we can always arrive, by linear transformation, whenever the invariant C vanishes.

Remark.—The invariant C is a numerical multiple of the resultant of the covariants i and j, and if $\mathrm{C}=0$, ρ is the common factor of i and j.

The discriminant is the resultant of $\frac{\partial f}{\partial x_1}$ and $\frac{\partial f}{\partial x_2}$ and of degree 8 in the coefficients; since it is a rational and integral function of the fundamental invariants it is expressible as a linear function of A^2 and B; it is independent of C, and is therefore unaltered when C vanishes; we may therefore take f in the canonical form

$$6\mathrm{R}^4f=\mathrm{B}\delta^5+5\mathrm{B}\delta^4\rho-4\mathrm{A}^2\rho^5.$$

The two equations

$$\frac{\partial f}{\partial \delta}=5\text{B}\delta^4+4\text{B}\delta^3\rho)=0,$$
$$\frac{\partial f}{\partial \rho}=5(\text{B}\delta^4-4\text{A}^2\rho^4)=0,$$

yield by elimination of δ and ρ the discriminant

$$\text{D}=64\text{B}-\text{A}^2.$$

The general equation of degree 5 cannot be solved algebraically, but the roots can be expressed by means of elliptic modular functions. For an algebraic solution the invariants must fulfil certain conditions. When $\text{R}=0$, and neither of the expressions $\text{AC}-\text{B}^2$, $2\text{AB}-3\text{C}$ vanishes, the covariant α_x is a linear factor of f; but, when $\text{R}=\text{AC}-\text{B}^2=2\text{AB}-3\text{C}=0$, α_x also vanishes, and then f is the product of the form j_x^3 and of the Hessian of j_x^3. When α_x and the invariants B and C all vanish, either A or j must vanish; in the former case j is a perfect cube, its Hessian vanishing, and further f contains j as a factor; in the latter case, if p_x, σ_x be the linear factors of i, f can be expressed as $(\rho\sigma)^5 f=c_1\rho_x^5+c_2\sigma_x^5$; if both A and j vanish i also vanishes identically, and so also does f. If, however, the condition be the vanishing of i, f contains a linear factor to the fourth power.

The Binary Sextic.—The complete system consists of 26 forms, of which the simplest are $f=a_x^6$; the Hessian $\text{H}=(ab)^2a_x^4b_x^4$; the quartic $i=(ab)^4a_x^2b_x^2$; the covariants $l=(ai)^4a_x^2$; $\text{T}=(ab)^2(cb)a_x^4b_x^3c_x^5$; and the invariants $\text{A}=(ab)^6$; $\text{B}=(ii')^4$. There are

5 invariants: $(a,b)^6$, $(i,i')^4$, $(l,l')^2$, $(f,l^3)^6$, $((f,i),l^4)^8$;
6 of order 2: l, $(i,l)^2$, $(f,l^2)^4$, $(i,l^2)^3$, $(f,l^3)^5$, $((f,i),l^3)^6$;
5 of order 4: i, $(f,l)^2$, (i,l), $(f,l^2)^3$, $((f,i),l^2)^4$;
5 of order 6: f, $p=(ai)^2a_x^4i_x^2$, (f,l), $((f,i),l)^2$, (p,l);
3 of order 8: H, (f,i), (H,l);
1 of order 10: (H,i);
1 of order 12: T.

For a further discussion of the binary sextic see Gordan, *loc. cit.*, Clebsch, *loc. cit.* The complete systems of the quintic and sextic were first obtained by Gordan in 1868 (*Journ. f. Math.* lxix. 323-354). August von Gall in 1880 obtained the complete system of the binary octavic (*Math. Ann.* xvii. 31-52, 139-152, 456); and, in 1888, that of the binary septimic, which proved to be much more complicated (*Math. Ann.* xxxi. 318-336). Single binary forms of higher and finite order have not been studied with complete success, but the system of the binary form of infinite order has been completely determined by Sylvester, Cayley, MacMahon and Stroh, each of whom contributed to the theory.

As regards simultaneous binary forms, the system of two quadratics, and of any number of quadratics, is alluded to above and has long been known. The system of the quadratic and cubic, consisting of 15 forms, and that of two cubics, consisting of 26 forms, were obtained by Salmon and Clebsch; that of the cubic and quartic we owe to Sigmund Gundelfinger (*Programm Stuttgart*, 1869, 1-43); that of the quadratic and quintic to Winter (*Programm Darmstadt*, 1880); that of the quadratic and sextic to von Gall (*Programm Lemgo*, 1873); that of two quartics to Gordan (*Math. Ann.* ii. 227-281, 1870); and to Eugenio Bertini (*Batt. Giorn.* xiv. 1-14, 1876; also *Math. Ann.* xi. 30-41, 1877). The system of four forms, of which two are linear and two quadratic, has been investigated by Perrin (*S. M. F. Bull.* xv. 45-61, 1887).

Ternary and Higher Forms.—The ternary form of order n is represented symbolically by

$$(a_1x_1+a_2x_2+a_3x_3)^n=a_x^n;$$

and, as usual, b, c, d,... are alternative symbols, so that

$$a_x^n=b_x^n=c_x^n=d_x^n=\dots.$$

To form an invariant or covariant we have merely to form a product of factors of two kinds, viz. determinant factors (abc), (abd), (bce), etc...., and other factors a_x, b_x, c_x,... in such manner, that each of the symbols a, b, c,... occurs n times. Such a symbolic product, if it does not vanish identically, denotes an invariant or a covariant, according as factors a_x, b_x, c_x,... do not or do appear. To obtain the real form we multiply out, and, in the result, substitute for the products of symbols the real coefficients which they denote.

For example, take the ternary quadratic

$$(a_1x_1+a_2x_2+a_3x_3)^2=a_x^2,$$

or in real form $ax_1^3+bx_2^3+cx_3^3+2fx_2x_3+2gx_3x_1+2hx_1x_2$. We can see that $(abc)a_xb_xc_x$ is not a covariant, because it vanishes identically, the interchange of a and b changing its sign instead of leaving it unchanged; but $(abc)^2$ is an invariant. If a_x^2, b_x^2, c_x^2 be different forms we obtain, after development of the squared determinant and conversion to the real form (employing single and double dashes to distinguish the real coefficients of b_x^2 and c_x^2),

$$\begin{aligned}&a(b'c''+b''c'-2f'f'')+b(c'a''+c''a'-2g'g'')\\&+c(a'b''+a''b'-2h'h'')+2f(g'h''+g''h'-a'f''-a''f')\\&+2g(h'f''+h''f'-b'g''-b''g')+2h(f'g''+f''g'-c'h''-c''h');\end{aligned}$$

a simultaneous invariant of the three forms, and now suppressing the dashes we obtain

$$6(abc+2fgh-af^2-bg^2-ch^2),$$

the expression in brackets being the well-known invariant of a_x^2, the vanishing of which expresses the condition that the form may break up into two linear factors, or, geometrically, that the conic may represent two right lines. The complete system consists of the form itself and this invariant.

The ternary cubic has been investigated by Cayley, Aronhold, Hermite, Brioschi and Gordan. The principal reference is to Gordan (*Math. Ann.* i. 90-128, 1869, and vi. 436-512, 1873). The complete covariant and contravariant system includes no fewer than 34 forms; from its complexity it is desirable to consider the cubic in a simple canonical form; that chosen by Cayley was $ax^3+by^3+cz^3+6dxyz$ (*Amer. J. Math.* iv. 1-16, 1881). Another form, associated with the theory of elliptic functions, has been considered by Dingeldey (*Math. Ann.* xxxi. 157-176, 1888), viz. $xy^2-4z^3+g_2x^2y+g_3x^3$, and also the special form axz^2-4by^3 of the cuspidal cubic. An investigation, by non-symbolic methods, is due to F. C. J. Mertens (*Wien. Ber.* xcv. 942-991, 1887). Hesse showed independently that the general ternary cubic can be reduced, by linear transformation, to the form

$$x^3+y^3+z^3+6mxyz,$$

a form which involves 9 independent constants, as should be the case; it must, however, be remarked that the counting of constants is not a sure guide to the existence of a conjectured canonical form. Thus the ternary quartic is not, in general, expressible as a sum of five 4th powers as the counting of constants might have led one to expect, a theorem due to Sylvester. Hesse's canonical form shows at once that there cannot be more than two independent invariants; for if there were three we could, by elimination of the modulus of transformation, obtain two functions of the coefficients equal to functions of m, and thus, by elimination of m, obtain a relation between the coefficients, showing them not to be independent, which is contrary to the hypothesis.

The simplest invariant is $\text{S}=(abc)(abd)(acd)(bcd)$ of degree 4, which for the canonical form of Hesse is $m(1-m^3)$; its vanishing indicates that the form is expressible as a sum of three cubes. The Hessian is symbolically $(abc)^2a_xb_xc_x=\text{H}_x^3$, and for the canonical form $(1+2m^3)xyz-m^2(x^3+y^3+z^3)$. By the process of Aronhold we can form the invariant S for the cubic $a_x^3+\lambda\text{H}_x^3$, and then the coefficient of λ is the second invariant T. Its symbolic expression, to a numerical factor *près*, is

$$(\text{H}bc)(\text{H}bd)(\text{H}cd)(bcd),$$

and it is clearly of degree 6.

One more covariant is requisite to make an *algebraically* complete set. This is of degree 8 in the coefficients, and degree 6 in the variables, and, for the canonical form, has the expression

$$\begin{aligned}&-9m^6(x^3+y^3+z^3)^2-(2m+5m^4+20m^7)(x^3+y^3+z^3)xyz\\&-(15m^2+78m^5-12m^8)x^2y^2z^2+(1+8m^3)^2(y^3z^3+z^3x^3+x^3y^3).\end{aligned}$$

Passing on to the ternary quartic we find that the number of ground forms is apparently very great. Gordan (*Math. Ann.* xvii. 217-233), limiting himself to a particular case of the form, has determined 54 ground forms, and G. Maisano (*Batt. G.* xix. 198-237, 1881) has determined all up to and including the 5th degree in the coefficients.

The system of two ternary quadratics consists of 20 forms; it has been investigated by Gordan (*Clebsch-Lindemann's Vorlesungen* i. 288, also *Math. Ann.* xix. 529-552); Perrin (*S. M. F. Bull.* xviii. 1-80, 1890); Rosanes (*Math. Ann.* vi. 264); and Gerbaldi (*Annali* (2), xvii. 161-196).

Ciamberlini has found a system of 127 forms appertaining to three ternary quadratics (*Batt. G.* xxiv. 141-157).

A. R. Forsyth has discussed the *algebraically* complete sets of ground forms of ternary and quaternary forms (see *Amer. J.* xii. 1-60, 115-160, and *Camb. Phil. Trans.* xiv. 409-466, 1889). He proves, by means of the six linear partial differential equations satisfied by the concomitants, that, if any concomitant be expanded in powers of x_1, x_2, x_3, the point variables—and of u_1, u_2, u_3, the contragredient line variables—it is completely determinate if its leading coefficient be known. For the unipartite ternary quantic of order n he finds that the fundamental system contains $\frac{1}{2}(n+4)(n-1)$ individuals. He successfully considers the systems of two and three simultaneous ternary quadratics. In Part III. of the Memoir he discusses bi-ternary quantics, and in particular those which are lineo-linear, quadrato-linear, cubo-linear, quadrato-quadratic, cubo-cubic, and the system of two lineo-linear quantics. He shows that the system of the bi-ternary $n^{o}m^{ic}$ comprises

$$\frac{1}{4}(n+1)(n+2)(m+1)(m+2)-3 \text{ individuals.}$$

Bibliographical references to ternary forms are given by Forsyth (*Amer. J.* xii. p. 16) and by Cayley (*Amer. J.* iv., 1881). Clebsch, in 1872, in papers in *Abh. d. K. Akad. d. U. zu Göttingen*, t. xvii. and *Math. Ann.* t. v., established the important result that in the case of a form in n variables, the concomitants of the form, or of a system of such forms, involve in the aggregate $n-l$ classes of variables. For instance, those of a ternary form involve two classes which may be geometrically interpreted as point and line co-ordinates in a plane; those of a quaternary form involve three classes which may be geometrically interpreted as point, line and plane co-ordinates in space.

IV. Enumerating Generating Functions

Professor Michael Roberts (*Quart. Math. J.* iv.) was the first to remark that the study of covariants may be reduced to the study of their leading coefficients, and that from any relations connecting the latter are immediately derivable the relations connecting the former. It has been shown above that a covariant, in general, satisfies four partial differential equations. Two of these show that the leading coefficient of any covariant is an isobaric and homogeneous function of the coefficients of the form; the remaining two may be regarded as operators which cause the vanishing of the covariant. These may be written, for the binary n^{ic},

$$\Sigma k a_{k-1}\frac{d}{da_k}-x_2\frac{d}{dx_1}=0;$$

$$\Sigma(n-k)a_{k+1}\frac{d}{da_k}-x_1\frac{d}{dx_2}=0;$$

or in the form

$$\Omega-x_2\frac{d}{dx_1}=0,\ O-x_1\frac{d}{dx_2}=0;$$

where

$$\Omega=a_0\frac{d}{da_1}+2a_1\frac{d}{da_2}+\ldots+na_{n-1}\frac{d}{da_n},$$

$$O=na_1\frac{d}{da_0}+(n-1)a_2\frac{d}{da_1}+\ldots+a_n\frac{d}{da_{n-1}}.$$

Let a covariant of degree ϵ in the variables, and of degree θ in the coefficients (the weight of the leading coefficient being w and $n\theta-2w=\epsilon$), be

$$C_0x_1^{\epsilon}+\epsilon c_1x_1^{\epsilon-1}x_2+\ldots.$$

Operating with $\Omega-x_2\frac{d}{dx_1}$ we find $\Omega C_0=0$; that is to say, C_0 satisfies *one* of the two partial differential equations satisfied by an invariant. It is for this reason called a seminvariant, and every seminvariant is the leading coefficient of a covariant. The whole theory of invariants of a binary form depends upon the solutions of the equation $\Omega=0$. Before discussing these it is best to transform the binary form by substituting $1!a_1$, $2!a_2$, $3!a_3,\ldots n!a_n$, for a_1, a_2, $a_3\ldots a_n$ respectively;
it then becomes

$$a_0x_1^n+na_1x_1^{n-1}x_2+n(n-1)a_2x_1^{n-2}x_2^2+\ldots+n!a_nx_2^n,$$

and Ω takes the simpler form

$$a_0\frac{d}{da_1}+a_1\frac{d}{da_2}+a_2\frac{d}{da_3}+\ldots+a_{n-1}\frac{d}{da_n}.$$

One advantage we have obtained is that, if we now write $a_0=0$, and substitute a_{s-1} for a_s, when $s>0$, we obtain

$$a_0\frac{d}{da_1}+a_1\frac{d}{da_2}+a_2\frac{d}{da_3}+\ldots+a_{n-2}\frac{d}{da_{n-1}}$$

which is the form of Ω for a binary $(n-1)^{ic}$.

Hence by merely diminishing each suffix in a seminvariant by unity, we obtain another seminvariant of the same degree, and of weight $w-\theta$, appertaining to the $(n-1)^{ic}$. Also, if we increase each suffix in a seminvariant, we obtain terms, free from a_0, of some seminvariant of degree θ and weight $w+\theta$. *Ex. gr.* from the invariant $a_2^2-2a_1a_3+2a_0a_4$ of the quartic the diminishing process yields $a_1^2-2a_0a_2$, the leading coefficient of the Hessian of the cubic, and the increasing process leads to $a_3^2-2a_2a_4+2a_1a_5$ which only requires the additional term $-2a_0a_6$ to become a seminvariant of the sextic. A more important advantage, springing from the new form of Ω, arises from the fact that if

$$x^n-a_1x^{n-1}+a_2x^{n-2}-\ldots(-)^na_n=(x-\alpha_1)(x-\alpha_2)\ldots(x-\alpha_n),$$

the sums of powers $\Sigma\alpha^2$, $\Sigma\alpha^3$, $\Sigma\alpha^4$, $\ldots\Sigma\alpha^n$ all satisfy the equation $\Omega=0$. Hence, excluding a_0, we may, in partition notation, write down the fundamental solutions of the equation, viz.—

$$(2),\ (3),\ (4),\ldots(n),$$

and say that with a_0, we have an *algebraically* complete system. Every symmetric function denoted by partitions, not involving the figure unity (say a non-unitary symmetric function), which remains unchanged by any increase of n, is also a seminvariant, and we may take if we please another fundamental system, viz.—

$$a_0,(2),(3),(22),(32),\ldots(2^{\frac{1}{2}n})\text{ or }(32^{\frac{1}{2}(n-3)}).$$

Observe that, if we subject any symmetric function $(p_1p_2p_3\ldots)$ to the diminishing process, it becomes $a_0^{p_1-p_2}(p_2p_3\ldots)$.

Next consider the solutions of $\Omega=0$ which are of degree θ and weight w. The general term in a solution involves the product $a_0^{\pi_0}a_1^{\pi_1}a_2^{\pi_2}\ldots a_n^{\pi_n}$ wherein $\Sigma\pi=\theta$, $\Sigma s\pi_s=w$; the number of such products that may appear depends upon the number of partitions of w into θ or fewer parts limited not to exceed n in magnitude. Let this number be denoted by $(w;\theta,n)$. In order to obtain the seminvariants we would write down the $(w;\theta,n)$ terms each associated with a literal coefficient; if we now operate with Ω we obtain a linear function of $(w-1;\theta,n)$ products, for the vanishing of which the literal coefficients must satisfy $(w-1;\theta,n)$ linear equations; hence $(w;\theta,n)-(w-1;\theta,n)$ of these coefficients may be assumed arbitrarily, and the number of linearly independent solutions of $\Omega=0$, of the given degree and weight, is precisely $(w;\theta,n)-(w-1;\theta,n)$. This theory is due to Cayley; its validity depends upon showing that the $(w-1;\theta,n)$ linear equations satisfied by the literal coefficients are independent; this has only recently been established by E. B. Elliott. These seminvariants are said to form an asyzygetic system. It is shown in the article on COMBINATORIAL ANALYSIS that $(w;\theta,n)$ is the coefficient of $a^\theta z^w$ in the ascending expansion of the fraction

$$\frac{1}{1-a.1-az.1-az^2.\ldots1-az^n}.$$

Hence $(w;\theta,n)-(w-1;\theta,n)$ is given by the coefficient of $a^\theta z^w$ in the fraction

$$\frac{1-z}{1-a.1-az.1-az^2.\ldots1-az^n},$$

the enumerating generating function of asyzygetic seminvariants. We may, by a well-known theorem, write the result as a coefficient of z^w in the expansion of

$$\frac{1-z^{n+1}.1-z^{n+2}.\ldots1-z^{n+\theta}}{1-z^2.1-z^3.\ldots1-z^\theta};$$

and since this expression is unaltered by the interchange of n and θ we prove Hermite's Law of Reciprocity, which states that the asyzygetic forms of degree θ for the n^{ic} are equinumerous with those of degree n for the θ^{ic}.

The degree of the covariant in the variables is $\epsilon=n\theta-2w$; consequently we are only concerned with positive terms in the developments and $(w,\theta,n)-(w-1;\theta,n)$ will be negative unless $n\theta-2w\geqq 0$. It is convenient to enumerate the seminvariants of degree θ and order $\epsilon=n\theta-2w$ by a generating function; so, in the first written generating function for seminvariants, write $\frac{1}{z^2}$ for z and az^n for a; we obtain

$$\frac{1-z^{-2}}{1-az^n.1-az^{n-2}.1-az^{n-4}.\ldots1-az^{-n+4}.1-az^{-n+2}.1-az^{-n}}$$

in which we have to take the coefficient of $a^\theta z^{n\theta-2w}$, the expansion being in ascending powers of a. As we have to do only with that part of the expansion which involves positive powers of z, we must try to isolate that portion, say $A_n(z)$. For $n=2$ we can prove that the complete function may be written

$$A_2(z)-\frac{1}{z^2}A_2\left(\frac{1}{z}\right),$$

where

$$A_2(z)=\frac{1}{1-az^2.1-a^2};$$

and this is the reduced generating function which tells us, by its denominator factors, that the complete system of the quadratic is composed of the form itself of degree order 1, 2 shown by az^2, and of the Hessian of degree order 2, 0 shown by a^2.

Again, for the cubic, we can find

$$A_3(z)=\frac{1-a^6z^6}{1-az^3.1-a^2z^2.1-a^3z^3.1-a^4},$$

where the ground forms are indicated by the denominator factors, viz.: these are the cubic itself of degree order 1, 3; the Hessian of degree order 2, 2; the cubi-covariant G of degree order 3, 3, and the quartic invariant of degree order 4, 0. Further, the numerator factor establishes that these are not all algebraically independent, but are connected by a syzygy of degree order 6, 6.

Similarly for the quartic

$$A_4(z)=\frac{1-a^6z^{12}}{1-az^4.1-a^2.1-a^2z^4.1-a^3.1-a^3z^6},$$

establishing the 5 ground forms and the syzygy which connects them.

The process is not applicable with complete success to quintic and higher ordered binary forms. This arises from the circumstance that the simple syzygies between the ground forms are not all independent, but are connected by second syzygies, and these again by third syzygies, and so on; this introduces new difficulties which have not been completely overcome. As regards invariants a little further progress has been made by Cayley, who established the two generating functions for the quintic

$$\frac{1-a^{36}}{1-a^4.1-a^8.1-a^{12}.1-a^{18}},$$

and for the sextic

$$\frac{1-a^{30}}{1-a^2.1-a^4.1-a^6.1-a^{10}.1-a^{15}}.$$

Accounts of further attempts in this direction will be found in Cayley's *Memoirs on Quantics* (Collected Papers), in the papers of Sylvester and Franklin (*Amer. J.* i.-iv.), and in Elliott's *Algebra of Quantics*, chap. viii.

Perpetuants.—Many difficulties, connected with binary forms of finite order, disappear altogether when we come to consider the form of infinite order. In this case the ground forms, called also perpetuants, have been enumerated and actual representative seminvariant forms established. Putting n equal to ∞, in a generating function obtained above, we find that the function, which enumerates the asyzygetic seminvariants of degree θ, is

$$\frac{1}{1-z^2.1-z^3.1-z^4....1-z^\theta}$$

that is to say, of the weight w, we have one form corresponding to each non-unitary partition of w into the parts 2, 3, 4,...θ. The extraordinary advantage of the transformation of Ω to association with non-unitary symmetric functions is now apparent; for we may take, as representative forms, the symmetric functions which are symbolically denoted by the partitions referred to. *Ex. gr.*, of degree 3 weight 8, we have the two forms $(3^2 2)$, $a(2^4)$. If we wish merely to enumerate those whose partitions contain the figure θ, and do not therefore contain any power of a as a factor, we have the generator

$$\frac{z^\theta}{1-z^2.1-z^3.1-z^4. ...1-z^\theta}.$$

If $\theta=2$, every form is obviously a ground form or perpetuant, and the series of forms is denoted by (2), (2^2), (2^3),...$(2^{\kappa+1})$.... Similarly, if $\theta=3$, every form $(3^{\kappa+1}2^\lambda)$ is a perpetuant. For these two cases the perpetuants are enumerated by

$$\frac{z^2}{1-z^2}, \text{ and } \frac{z^3}{1-z^2.1-z^3}$$

respectively.

When $\theta=4$ it is clear that no form, whose partition contains a part 3, can be reduced; but every form, whose partition is composed of the parts 4 and 2, is by elementary algebra reducible by means of perpetuants of degree 2. These latter forms are enumerated by $\frac{z^4}{1-z^2.1-z^4}$; hence the generator of quartic perpetuants must be

$$\frac{z^4}{1-z^2.1-z^3.1-z^4}-\frac{z^4}{1-z^2.1-z^4}=\frac{z^7}{1-z^2.1-z^3.1-z^4};$$

and the general form of perpetuants is $(4^{\kappa+1}\ 3^{\lambda+1}\ 2^\mu)$.

When $\theta\geqq 5$, the reducible forms are connected by syzygies which there is some difficulty in enumerating. Sylvester, Cayley and MacMahon succeeded, by a laborious process, in establishing the generators for $\theta=5$, and $\theta=6$, viz.:

$$\frac{z^{15}}{1-z^2.1-z^3.1-z^4.1-z^5}, \quad \frac{z^{31}}{1-z^2.1-z^3.1-z^4.1-z^5.1-z^6};$$

but the true method of procedure is that of Stroh which we are about to explain.

Method of Stroh.—In the section on "Symmetric **Functions,**" it was noted that Stroh considers

$$(\sigma_1 a_1+\sigma_2 a_2+...+\sigma_\theta a_\theta)^w,$$

where $\sigma_1+\sigma_2+...+\sigma_\theta=0$ and $\frac{a_1^s}{s!}=\frac{a_2^s}{s!}=...=\frac{a_\theta^s}{s!}=a_s$ symbolically, to be the fundamental form of seminvariant of degree θ and weight w; he observes that every form of this degree and weight is a linear function of such symbolic expressions. We may write

$$(1+\sigma_1\xi)(1+\sigma_2\xi)...(1+\sigma_\theta\xi)=1+A_2\xi^2+A_3\xi^3+...+A_\theta\xi^\theta.$$

If we expand the symbolic expression by the multinomial theorem, and remember that any symbolic product $a_1^{\pi 1}a_2^{\pi 2}a_3^{\pi 3}...$ retains the same value, however the suffixes be permuted, we shall obtain a sum of terms, such as $w!\frac{a_1^{\pi 1}}{\pi_1!}\frac{a_2^{\pi 2}}{\pi_2!}\frac{a_3^{\pi 3}}{\pi_3!}...\Sigma\sigma_1^{\pi 1}\sigma_2^{\pi 2}\sigma_3^{\pi 3}...$, which in real form is $w!\ a_{\pi 1}a_{\pi 2}a_{\pi 3}...\Sigma\sigma_1^{\pi 1}\sigma_2^{\pi 2}\sigma_3^{\pi 3}...$; and, if we express $\Sigma\sigma_1^{\pi 1}\sigma_2^{\pi 2}\sigma_3^{\pi 3}...$ in terms of A_2, A_3,..., and arrange the whole as a linear function of products of A_2, A_3,..., each coefficient will be a seminvariant, and the aggregate of the coefficients will give us the complete asyzygetic system of the given degree and weight.

When the proper degree θ is $< w$ a factor $a_0^{w-\theta}$ must be of course understood.

Ex. gr.

$$\frac{1}{2!}(\sigma_1 a_1+\sigma_2 a_2+\sigma_3 a_3+\sigma_4 a_4)^2=\frac{a_1^2}{2!}\Sigma\sigma_1^2+a_1 a_2\Sigma\sigma_1\sigma_2$$
$$=a_2(-2A_2)+a_1^2 A_2=(a_1^2-2a_2)A_2=(2)A_2\equiv a_0^2(2)A_2.$$

In general the coefficient, of any product $A_{\pi 1}A_{\pi 2}A_{\pi 3}...$, will have, as coefficient, a seminvariant which, when expressed by partitions, will have as leading partition (preceding in dictionary order all others) the partition $(\pi_1\pi_2\pi_3...)$. Now the symbolic expression of the seminvariant can be expanded by the binomial theorem so as to be exhibited as a sum of products of seminvariants, of lower degrees if $\sigma_1 a_1+\sigma_2 a_2+...+\sigma_\theta a_\theta$ can be broken up into any two portions

$$(\sigma_1 a_1+\sigma_2 a_2+...+\sigma_s a_s)+(\sigma_{s+1}a_{s+1}+\sigma_{s+2}a_{s+2}+...+\sigma_\theta a_\theta),$$

such that $\sigma_1+\sigma_2+...+\sigma_s=0$, for then

$$\sigma_{s+1}+\sigma_{s+2}+...+\sigma_\theta=0;$$

and each portion raised to any power denotes a seminvariant. Stroh assumes that every reducible seminvariant can in this way be reduced. The existence of such a relation, as $\sigma_1+\sigma_2+...+\sigma_2=0$, necessitates the vanishing of a certain function of the coefficients A_2, A_3,...A_θ, and as a consequence *one* product of these coefficients can be eliminated from the expanding form and no seminvariant, which appears as a coefficient to such a product (which may be the whole or only a part of the complete product, with which the seminvariant is associated), will be capable of reduction.

Ex. gr. for $\theta=2$, $(\sigma_1 a_1+\sigma_2 a_2)^w$; either σ_1 or σ_2 will vanish if $\sigma_1\sigma_2=A_2=0$; but every term, in the development, is of the form $(222...)A_2^{\frac{1}{2}w}$ and therefore vanishes; so that none are left to undergo reduction. Therefore every form of degree 2, except of course that one whose weight is zero, is a perpetuant. The generating function is $\frac{z^2}{1-z^2}$.

For $\theta=3$, $(\sigma_1 a_1+\sigma_2 a_2+\sigma_3 a_3)^w$; the condition is clearly $\sigma_1\sigma_2\sigma_3=A_3=0$, and since every seminvariant, of proper degree 3, is associated, as coefficient, with a product containing A_3, all such are perpetuants. The general form is $(3^\kappa 2^\lambda$ and the generating function $\frac{z^3}{1-z^2.1-z^3}$.

For $\theta=4$, $(\sigma_1 a_1+\sigma_2 a_2+\sigma_3 a_3+\sigma_4 a_4)^w$; the condition is

$$\sigma_1\sigma_2\sigma_3\sigma_4(\sigma_1+\sigma_2)(\sigma_1+\sigma_3)(\sigma_1+\sigma_4)=A_4 A_3=0.$$

Hence every product of A_1, A_2, A_3, A_4, which contains the product $A_4 A_3$ disappears *before* reduction; this means that every seminvariant, whose partition contains the parts 4, 3, is a perpetuant. The general form of perpetuant is $(4^\kappa 3^\lambda 2^\mu)$ and the generating function

$$\frac{z^7}{1-z^2.1-z^3.1-z^4}.$$

In general when θ is even and $=2\phi$, the condition is

$$\sigma_1\sigma_2...\sigma_{2\phi}\Pi(\sigma_1+\sigma_2)\Pi(\sigma_1+\sigma_2+\sigma_3)...\Pi(\sigma_1+\sigma_2+...+\sigma_\phi)=0;$$

and we can determine the lowest weight of a perpetuant; the degree in the quantities σ is

$$2\phi+\binom{2\phi}{2}+\binom{2\phi}{3}+...+\frac{1}{2}\binom{2\phi}{\phi}=2^{2\phi-1}-1=2^{\theta-1}-1.$$

Again, if θ is uneven $=2\phi+1$, the condition is

$$\sigma_1\sigma_2...\sigma_{2\phi+1}\Pi(\sigma_1+\sigma_2)\Pi(\sigma_1+\sigma_2+\sigma_3)...\Pi(\sigma_1+\sigma_2+...+\sigma\phi)=0;$$

and the degree, in the quantities σ, is

$$2\phi+1+\binom{2\phi+1}{2}+\binom{2\phi+1}{3}+...+\binom{2\phi+1}{\phi}$$
$$=2^{2\phi}-1=2^{\theta-1}-1.$$

Hence the lowest weight of a perpetuant is $2^{\theta-1}-1$, when θ is >2. The generating function is thus

$$\frac{z^{2^{\theta-1}-1}}{(1-z^2)(1-z^3)(1-z^4)...(1-z^\theta)}.$$

The actual form of a perpetuant of degree θ has been shown by MacMahon to be

$$(\theta^{\kappa_\theta+1}, \overline{\theta-1}^{\kappa_{\theta-1}+1}, \overline{\theta-2}^{\kappa_{\theta-2}+2}, \overline{\theta-3}^{\kappa_{\theta-3}+4}, ...3^{\kappa_3+2^{\theta-4}}, 2^{\kappa_2}),$$

$\kappa_\theta, \kappa_{\theta-1}, ...\kappa_2$ being given any zero or positive integer values.

Simultaneous Seminvariants of two Binary Forms.—Taking the two forms to be

$$a_0 x_1^p+pa_1 x_1^{p-1}x_2+p(p-1)a_2 x_1^{p-2}x_2^2+...+a_p x_2^p,$$
$$b_0 x_1^q+qb_1 x_1^{q-1}x_2+q(q-1)b_2 x_1^{q-2}x_2^2+...+b_q x_2^q,$$

every leading coefficient of a simultaneous covariant vanishes by the operation of

$$\Omega_a+\Omega_b=a_0\frac{d}{da_1}+a_1\frac{d}{da_2}+...+a_{p-1}\frac{d}{da_p}+b_0\frac{d}{db_1}+b_1\frac{d}{db_2}+...+b_{q-1}\frac{d}{db_q}.$$

Observe that we may employ the principle of suffix diminution to obtain from any seminvariant one appertaining to a $(p-1)^{ic}$ and a $q-1^{ic}$, and that suffix augmentation produces a portion of a higher seminvariant, the degree in each case remaining unaltered. Remark, too, that we are in association with non-unitary symmetric functions of two systems of quantities which will be denoted by partitions in brackets $(\ )_a$, $(\ )_b$ respectively. Solving the equation

$$(\Omega_a+\Omega_b)u=0,$$

by the ordinary theory of linear partial differential equations, we obtain $p+q+1$ independent solutions, of which p appertain to $\Omega_a u=0$, q to $\Omega_b u=0$; the remaining one is $J_{ab}=a_0 b_1-a_1 b_0$, the leading coefficient of the Jacobian of the two forms. This constitutes an algebraically complete system, and, in terms of its members, all seminvariants can be rationally expressed. A similar theorem holds in the case of any number of binary forms, the mixed seminvariants being derived from the Jacobians of the several pairs of forms. If the seminvariant be of degree θ, θ' in the coefficients, the forms of orders p, q respectively, and the weight w, the degree of the covariant in the variables will be $p\theta+q\theta'-2w=\epsilon$. an easy generalization of the theorem connected with a single form.

The general term of a seminvariant of degree θ, θ' and weight w will be

$$a_0^{\rho_0}a_1^{\rho_1}a_2^{\rho_2}\dots a_p^{\rho_p}b_0^{\sigma_0}b_1^{\sigma_1}b_2^{\sigma_2}\dots b_q^{\sigma_q}$$

where $\sum_1^p \rho_s=\theta$, $\sum_1^q \sigma_s=\theta'$ and $\sum_1^p s\rho_s+\sum_1^q s\sigma_s=w$.

The number of such terms is the number of partitions of w into $\theta+\theta'$ parts, the part magnitudes, in the two portions, being limited not to exceed p and q respectively. Denote this number by $(w;\theta,p;\theta'.q)$. The number of linearly independent seminvariants of the given type will then be denoted by

$$(w;\theta,p;\theta',q)-(w-1;\theta,p;\theta',q);$$

and will be given by the coefficient of $a^\theta b^{\theta'}z^w$ in

$$\frac{1-z}{1-a.\,1-az.\,1-az^2.\,\dots\,1-az^p.\,1-b.\,1-bz.\,1-bz^2\dots 1-bz^q};$$

that is, by the coefficient of z^w in

$$\frac{1-z^{p+1}.\,1-z^{p+2}.\,\dots\,1-z^{p+\theta}.\,1-z^{q+1}.\,1-z^{q+2}.\,\dots\,1-z^{q+\theta'}}{1-z.\,1-z^2.\,1-z^3.\,\dots\,1-z^\theta.\,1-z^2.\,1-z^3.\,\dots\,1-z^{\theta'}};$$

which preserves its expression when θ and p and θ' and q are separately or simultaneously interchanged.

Taking the first generating function, and writing az^p, bz^q, $\frac{1}{z^2}$ for a, b and z respectively, we obtain the coefficient of

$$a^\theta b^{\theta'}z^{p\theta+q\theta'-2w}.\text{ that is of }a^\theta b^{\theta'}z^\epsilon,\text{ in}$$

$$\frac{1-z^{-2}}{1-az^p.\,1-az^{p-2}.\dots1-az^{-p+2}.\,1-az^{-p}.\,1-bz^q.\,1-bz^{q-2}.\dots1-bz^{-q+2}.\,1-bz^{-q}};$$

the unreduced generating function which enumerates the covariants of degrees θ, θ' in the coefficients and order ϵ in the variables. Thus, for two linear forms, $p=q=1$, we find

$$\frac{1-z^{-2}}{1-az.\,1-az^{-1}.\,1-bz.\,1-bz^{-1}},$$

the positive part of which is

$$\frac{1}{1-az.\,1-bz.\,1-ab};$$

establishing the ground forms of degrees-order (1, 0; 1), (0, 1; 1), (1, 1; 0), viz:—the linear forms themselves and their Jacobian J_{ab}. Similarly, for a linear and a quadratic, $p=1$, $q=2$, and the reduced form is found to be

$$\frac{1-a^2b^2z^2}{1-az.\,1-bz^2.\,1-abz.\,1-b^2.\,1-a^2b},$$

where the denominator factors indicate the forms themselves, their Jacobian, the invariant of the quadratic and their resultant; connected, as shown by the numerator, by a syzygy of degrees-order (2, 2; 2).

The complete theory of the perpetuants appertaining to two or more forms of infinite order has not yet been established. For two forms the seminvariants of degrees 1, 1 are enumerated by $\frac{1}{1-z}$, and the only one which is reducible is a_0b_0 of weight zero; hence the perpetuants of degrees 1, 1 are enumerated by

$$\frac{1}{1-z}-1=\frac{z}{1-z};$$

and the series is evidently

$$a_0b_1-a_1b_0,$$
$$a_0b_2-a_1b_1+a_2b_0,$$
$$a_0b_3-a_1b_2+a_2b_1-a_3b_0,$$

one for each of the weights 1, 2, 3,..*ad infin.*

For the degrees 1, 2, the asyzygetic forms are enumerated by $\frac{1}{1-z.\,1-z^2}$, and the actual forms for the first three weights are

$$a_0b_0^2,$$
$$(a_0b_1-a_1b_0)b_0,$$
$$(a_0b_2-a_1b_1+a_2b_0)b_0,$$
$$a_0(b_1^2-2b_0b_2),$$
$$(a_0b_3-a_1b_2+a_2b_1-a_3b_0)b_0,$$
$$a_0(b_1b_2-3b_0b_3)-a_1(b_1^2-2b_0b_2);$$

amongst these forms are included all the asyzygetic forms of degrees 1, 1, multiplied by b_0, and also all the perpetuants of the second binary form multiplied by a_0; hence we have to subtract from the generating function $\frac{1}{1-z}$ and $\frac{z^2}{1-z^2}$, and obtain the generating function of perpetuants of degrees 1, 2.

$$\frac{1}{1-z.\,1-z^2}-\frac{1}{1-z}-\frac{z^2}{1-z^2}=\frac{z^3}{1-z.\,1-z^2}.$$

The first perpetuant is the last seminvariant written, viz.:—

$$a_0(b_0b_2-3b_0b_3)-a_1(b_1^2-2b_0b_2),$$

or, in partition notation,

$$a_0(21)_b-(1)_a(2)_b;$$

and, in this form, it is at once seen to satisfy the partial differential equation. It is important to notice that the expression

$$(\theta)_a(\theta'1^s)_b-(\theta1)_a(\theta'1^{s-1})_b+(\theta1^2)_a(\theta'1^{s-2})_b-\dots\pm(\theta1^s)_a(\theta')_b$$

denotes a seminvariant, if θ, θ', be neither of them unity, for, after operation, the terms destroy one another in pairs: when $\theta=0$, $(\theta)^a$ must be taken to denote a_0 and so for θ'. In general it is a seminvariant of degrees θ, θ', and weight $\theta+\theta'+s$; to this there is an exception, viz., when $\theta=0$, or when $\theta'=0$, the corresponding partial degrees are 1 and 1. When $\theta=\theta'=0$, we have the general perpetuant of degrees 1, 1. There is a still more general form of seminvariant; we may have instead of θ, θ' any collections of non-unitary integers not exceeding θ, θ' in magnitude respectively, *Ex. gr.*

$$(2^{\lambda_2}3^{\lambda_3}\dots\theta^{\lambda_\theta})_a(1^s2^{\mu_2}3^{\mu_3}\dots\theta'^{\mu_{\theta'}})_b$$
$$-(12^{\lambda_2}3^{\lambda_3}\dots\theta^{\lambda_\theta})_a(1^{s-1}2^{\mu_2}3^{\mu_3}\dots\theta'^{\mu_{\theta'}})_b$$
$$+(1^22^{\lambda_2}3^{\lambda_3}\dots\theta^{\lambda_\theta})_a(1^{s-2}2^{\mu_2}3^{\mu_3}\dots\theta'^{\mu_{\theta'}})_b$$
$$-\dots$$
$$(-)^s(1^s2^{\lambda_2}3^{\lambda_3}\dots\theta^{\lambda_\theta})_a(2^{\mu_2}3^{\mu_3}\dots\theta'^{\mu_{\theta'}})_b,$$

is a seminvariant; and since these forms are clearly enumerated by

$$\frac{1}{1-z.\,1-z^2.\,\dots\,1-z^\theta.\,1-z^2.\,1-z^3.\,\dots\,1-z^{\theta'}},$$

an expression which also enumerates the asyzygetic seminvariants, we may regard the form, written, as denoting the general form of asyzygetic seminvariant; a very important conclusion. For the case in hand, from the simplest perpetuant of degrees 1, 2, we derive the perpetuants of weight w,

$$a_0(21^{w-2})_b-a_1(21^{w-3})_b+a_2(21^{w-4})_b-\dots\pm a_{w-2}(2)_b,$$
$$a_0(2^21^{w-4})_b-a_1(2^21^{w-5})_b+a_2(2^21^{w-6})_b-\dots\pm a_{w-4}(2^2)_b,$$
$$a_0(2^31^{w-6})_b-a_1(2^31^{w-7})_b+a_2(2^31^{w-8})_b-\dots\pm a_{w-6}(2^3)_b,$$

a series of $\frac{1}{2}(w-2)$ or of $\frac{1}{2}(w-1)$ forms according as w is even or uneven. Their number for any weight w is the number of ways of composing $w-3$ with the parts 1, 2, and thus the generating function is verified. We cannot, by this method, easily discuss the perpetuants of degrees 2, 2, because a syzygy presents itself as early as weight 2. It is better now to proceed by the method of Stroh.

We have the symbolic expression of a seminvariant.

$$\frac{1}{w!}(\sigma_1\alpha_1+\sigma_2\alpha_2+\dots+\sigma_\theta\alpha_\theta+\tau_1\beta_1+\tau_2\beta_2+\dots+\tau_{\theta'}\beta_{\theta'})^w$$

where

$$\frac{\alpha_1^s}{s!}=\frac{\alpha_2^s}{s!}=\dots=a_s;\ \frac{\beta_1^s}{s!}=\frac{\beta_2^s}{s!}=\dots=b_s;$$

and $\sigma_1+\sigma_2+\dots+\sigma_\theta+\tau_1+\tau_2+\dots+\tau_\theta=0.$

Proceeding as we did in the case of the single binary form we find that for a given total degree $\theta+\theta'$, the condition which expresses reducibility is of total degree $2^{\theta+\theta'-1}-1$ in the coefficients σ and τ; combining this with the knowledge of the generating function of asyzygetic forms of degrees θ, θ', we find that the perpetuants of these degrees are enumerated by

$$\frac{z^{2^{\theta+\theta'-1}}-1}{1-z.\,1-z^2.\,1-z^3.\,\dots\,1-z^\theta.\,1-z^2.\,1-z^3.\,\dots\,1-z^{\theta'}},$$

and this is true for $\theta+\theta'=2$ as well as for other values of $\theta+\theta'$ (compare the case of the single binary form).

Observe that, if there be more than two binary forms, the weight of the simplest perpetuant of degrees θ, θ', θ'',... is $2^{\theta+\theta'+\theta''+\dots-1}-1$, as can be seen by reasoning of a similar kind.

To obtain information concerning the actual forms of the perpetuants, write

$$(1+\sigma_1x)(1+\sigma_2x)\dots(1+\sigma_\theta x)=1+A_1x+A_2x^2+\dots+A_\theta x^\theta$$
$$(1+\tau_1x)(1+\tau_2x)\dots(1+\tau_{\theta'}x)=1+B_1x+B_2x^2+\dots+B_{\theta'}x^{\theta'}$$

where $A_1+B_1=0.$

For the case $\theta=1$, $\theta'=1$, the condition is

$$\sigma_1\tau_1=A_1B_1=0,$$

which since $A_1+B_1=0$, is really a condition of weight unity. For $w=1$ the form is $A_1a_1+B_1b_1$, which we may write $a_0b_1-a_1b_0$ $a_0(1)_b-(1)_ab_0$; the remaining perpetuants, enumerated by $\frac{z}{1-z}$, have been set forth above.

For the case $\theta=1$, $\theta'=2$, the condition is $\sigma_1\tau_1\tau_2=A_1B_2=0$; and the simplest perpetuant, derived directly from the product A_1B_2, is $(1)_a(2)_b-(21)_b$; the remainder of those enumerated by $\frac{z^3}{1-z.\,1-z^2}$ may be represented by the form

$$(1^{\lambda_1+1})_a(2^{\mu_2+1})_b-(1^{\lambda_1})_a(2^{\mu_2+1}1)_b+\dots\pm(2^{\mu_2+1}1^{\lambda_1+1})_b;$$

λ_1 and μ_2 each assuming all integer (including zero) values. For the case $\theta=\theta'=2$, the condition is

$$\sigma_1\sigma_2\tau_1\tau_2(\sigma_1+\sigma_2)(\sigma_1+\tau_1)(\sigma_1+\tau_2)=-A_2^2B_1B_2-A_1A_2B_2^2=0.$$

To represent the simplest perpetuant, of weight 7, we may take as base either $A_2^2B_1B_2$ or $A_1A_2B_2^2$, and since $A_1+B_1=0$ the former is equivalent to $A_1A_2^2B_2$ and the latter to $A_2B_1B_2^2$; so that we have, apparently, a choice of four products. $A_2^2B_1B_2$ gives $(2^2)_a\ (21)_b-(2^21)_a(2)_b$, and $A_1A_2^2B_2$, $(2^21)_a(2)_b-(2^2)_a(21)_b$; these two merely differ in sign; and similarly $A_2B_1B_2^2$ yields $(2)_a(2^21)_b-(21)_a(2^2)_b$, and that due to $A_1A_2B_2^2$ merely differs from it in sign. We will choose from the forms in such manner that the product of letters A is either a power of A_1, or does not contain A_1; this rule leaves us with $A_2^2B_1B_2$ and $A_2B_1B_2^2$; of these forms we will choose that one which in letters B is earliest in ascending dictionary order; this is $A_2^2B_1B_2$, and our earliest perpetuant is

$$(2^2)_a(21)_b-(2^21)_a(2)_b,$$

and thence the general form enumerated by the generating function $\frac{z^7}{(1-z)(1-z^2)^2}$ is

$$(2^{\lambda_2+2})_a(2^{\mu_2+1}1^{\mu_1+1})_b-(2^{\lambda_2+2}1)_a(2^{\mu_2+1}1^{\mu_1})_b+\dots$$
$$\pm(2^{\lambda_2+2}1^{\mu_1+1})_a(2^{\mu_2+1})_b.$$

For the case $\theta=1$, $\theta'=3$, the condition is

$$\sigma_1\tau_1\tau_2\tau_3(\sigma_1+\tau_1)(\sigma_1+\tau_2)(\sigma_1+\tau_3)=A_1B_3^2+A_1^2B_2B_3=0.$$

By the rules adopted we take $A_1^2B_2B_3$, which gives

$$(1^2)_a(32)_b-(1)_a(321)_b+a_0(321^2)_b,$$

the simplest perpetuant of weight 7; and thence the general form enumerated by the generating function

$$\frac{z^7}{1-z.\,1-z^2.\,1-z^3},$$

viz:— $(1^{\lambda_1+2})_a(3^{\mu_3+1}2^{\mu_2+1})_b-\dots\pm a_0(3^{\mu_3+1}2^{\mu_2+1}1^{\lambda_1+2})_b$,

For the case $\theta=2$, $\theta'=3$, the condition is

$$\sigma_1\sigma_2\tau_1\tau_2\tau_3(\sigma_1+\sigma_2)(\sigma_1+\tau_1)(\sigma_1+\tau_2)(\sigma_1+\tau_3)(\sigma_2+\tau_1)(\sigma_2+\tau_2)(\sigma_2+\tau_3)$$
$$\times(\tau_1+\tau_2)(\tau_1+\tau_3)(\tau_2+\tau_3)=0.$$

The calculation results in

$$-A_2^4B_3B_2B_1^2+2A_2^3B_3B_2^2B_1^2-A_2^2B_3B_2^3B_1^2+A_2^4B_3^2B_1-2A_2^3B_3^2B_2B_1$$
$$-A_2^2B_3^2B_2B_1^3+A_2^2B_3^2B_2^2B_1+A_2B_3^2B_2^2B_1^3+A_2^2B_3^3B_1^2-2A_2B_3^3B_2B_1^2$$
$$+A_2B_3^4B_1=0.$$

By the rules we select the product $A_2^4B_3B_2B_1^2$, giving the simplest perpetuant of weight 15, viz:—

$$(2^4)_a(321^2)_b-(2^41)_a(321)_b+(2^41^2)_a(32)_b;$$

and thence the general form

$$(2^{\lambda_2+4})_a(3^{\mu_3+1}2^{\mu_2+1}1^{\mu_1+2})_b-\dots\pm(2^{\lambda_2+4}1^{\mu_1+2})_a(3^{\mu_3+1}2^{\mu_2+1})_b,$$

due to the generating function

$$\frac{z^{15}}{(1-z)(1-z^2)^2(1-z^3)}$$

For the case $\theta=1$, $\theta'=4$, the condition is

$$\sigma_1\tau_1\tau_2\tau_3\tau_4(\sigma_1+\tau_1)(\sigma_1+\tau_2)(\sigma_1+\tau_3)(\sigma_1+\tau_4)\Pi(\tau_s+\tau_t)=0;$$

the calculation gives

$$A_1B_4(A_1^2B_2+A_1B_3+B_4)(-B_3^2-A_1B_2B_3-A_1^2B_4)=0.$$

Selecting the product $A_1^4B_4B_3B_2^2$, we find the simplest perpetuant

$$(1^4)_a(432^2)_b-(1^3)_a(432^21)_b+(1^2)_a(432^21^2)_b-(1)_a(432^21^3)_b$$
$$+a_0(432^21^4)_b,$$

and thence the general form

$$(1^{\lambda_1+4})_a(4^{\mu_4+1}3^{\mu_3+1}2^{\mu_2+2})_b-\dots\pm a_0(4^{\mu_4+1}3^{\mu_3+1}2^{\mu_2+2}1^{\lambda_1+4})_b,$$

due to the generating function

$$\frac{z^{15}}{1-z.\,1-z^2.\,1-z^3.\,1-z^4}.$$

The series may be continued, but the calculations soon become very laborious.

V. RESTRICTED SUBSTITUTIONS

We may regard the factors of a binary n^{ic} equated to zero as denoting n straight lines through the origin, the co-ordinates being Cartesian and the axes inclined at any angle. Taking the variables to be x, y and effecting the linear transformation

$$x=\lambda_1X+\mu_1Y,$$
$$y=\lambda_2X+\mu_2Y,$$

so that

$$\frac{y}{x}=\frac{\lambda_2+\mu_2\frac{Y}{X}}{\lambda_1+\mu_1\frac{Y}{X}},\ \frac{Y}{X}=\frac{\lambda_1\frac{y}{x}-\lambda_2}{\mu_2-\mu_1\frac{y}{x}};$$

it is seen that the two lines, on which lie (x, y), (X, Y), have a definite projective correspondence. The linear transformation replaces points on lines through the origin by corresponding points on projectively corresponding lines through the origin; it therefore replaces a pencil of lines by another pencil, which corresponds projectively, and harmonic and other properties of pencils which are unaltered by linear transformation we may expect to find indicated in the invariant system. Or, instead of looking upon a linear substitution as replacing a pencil of lines by a projectively corresponding pencil retaining the same axes of co-ordinates, we may look upon the substitution as changing the axes of co-ordinates retaining the same pencil. Then a binary n^{ic}, equated to zero, represents n straight lines through the origin, and the x, y of any line through the origin are given constant multiples of the sines of the angles which that line makes with two fixed lines, the axes of co-ordinates. As new axes of co-ordinates we may take any other pair of lines through the origin, and for the X, Y corresponding to x, y any new constant multiples of the sines of the angles which the line makes with the new axes. The substitution for x, y in terms of X, Y is the most general linear substitution in virtue of the four degrees of arbitrariness introduced, viz. two by the choice of axes, two by the choice of multiples. If now the n^{ic} denote a given pencil of lines, an invariant is the criterion of the pencil possessing some particular property which is independent alike of the axes and of the multiples, and a covariant expresses that the pencil of lines which it denotes is a fixed pencil whatever be the axes or the multiples.

Besides the invariants and covariants, hitherto studied, there are others which appertain to particular cases of the general linear substitution. Thus what have been called seminvariants are not all of them invariants for the general substitution, but are invariants for the particular substitution

$$x_1=\lambda_1\xi_1+\mu_1\xi_2,$$
$$x_2=\qquad\ \mu_2\xi_2.$$

Again, in plane geometry, the most general equations of substitution which change from old axes inclined at ω to new axes inclined at $\omega'=\beta-\alpha$, and inclined at angles α, β to the old axis of x, without change of origin, are

$$x=\frac{\sin(\omega-\alpha)}{\sin\ \omega}X+\frac{\sin(\omega-\beta)}{\sin\ \omega}Y,$$
$$y=\frac{\sin\alpha}{\sin\omega}X\qquad+\frac{\sin\beta}{\sin\omega}Y,$$

a transformation of modulus

$$\frac{\sin\ \omega'}{\sin\ \omega}.$$

The theory of invariants originated in the discussion, by George Boole, of this system so important in geometry. Of the quadratic

$$ax^2+2bxy+cy^2,$$

he discovered the two invariants

$$ac-b^2,\ a-2b\cos\omega+c,$$

and it may be verified that, if the transformed of the quadratic be

$$AX^2\div2BXY+CY^2,$$
$$AC-B^2=\left(\frac{\sin\ \omega'}{\sin\ \omega}\right)^2(ac-b^2),$$
$$A-2B\cos\omega'+C=\left(\frac{\sin\ \omega'}{\sin\ \omega}\right)^2(a-2b\cos\omega+c).$$

The fundamental fact that he discovered was the invariance of $x^2+2\cos\omega\ xy+y^2$, viz.—

$$x^2+2\cos\omega\ xy+y^2=X^2+2\cos\omega'XY+Y^2,$$

from which it appears that the Boolian invariants of $ax^2+2bxy-y^2$ are nothing more than the full invariants of the simultaneous quadratics

$$ax^2+2bxy+y^2,\ x^2+2\cos\omega\,xy+y^2,$$

the word invariant including here covariant. In general the Boolian system, of the general n^{ic}, is coincident with the simultaneous system of the n^{ic} and the quadratic $x^2+2\cos\omega\ xy+y^2$.

Orthogonal System.—In particular, if we consider the transformation from one pair of rectangular axes to another pair of rectangular axes we obtain an orthogonal system which we will now briefly inquire into. We have $\cos\omega'=\cos\omega=0$ and the substitution

$$x_1=\cos\theta X_1-\sin\theta X_2$$
$$x_2=\sin\theta X_1+\cos\theta X_2,$$

with modulus unity. This is called the *direct* orthogonal substitution, because the sense of rotation from the axis of X_1 to the axis of X_2 is the same as that from that of x_1 to that of x_2. If the senses of rotation be opposite we have the skew orthogonal substitution

$$x_1=\cos\theta X_1+\sin\theta X_2,$$
$$x_2=\sin\theta X_1-\cos\theta X_2,$$

of modulus -1. In both cases $\frac{d}{dx_1}$ and $\frac{d}{dx_2}$ are cogredient with x_1 and x_2; for, in the case of direct substitution,

$$\frac{d}{dx_1}=\cos\theta\frac{d}{dX_1}-\sin\theta\frac{d}{dX_2},$$
$$\frac{d}{dx_2}=\sin\theta\frac{d}{dX_1}+\cos\theta\frac{d}{dX_2};$$

and for skew substitution

$$\frac{d}{dx_1}=\cos\theta\frac{d}{dX_1}+\sin\theta\frac{d}{dX_2},$$
$$\frac{d}{dx_2}=\sin\theta\frac{d}{dX_1}-\cos\theta\frac{d}{dX_2}.$$

Hence, in both cases, contragrediency and cogrediency are identical, and contravariants are included in covariants.

Consider the binary n^{ic}. $(a_1x_1+a_2x_2)^n=a_x^n$, and the direct substitution

$$x_1=\lambda X_1-\mu X_2,$$
$$x_2=\mu X_1+\lambda X_2,$$

where $\lambda^2+\mu^2=1$; λ, μ replacing $\cos\theta$, $\sin\theta$ respectively. In the notation

$$a_x=a_1x_1+a_2x_2,$$

observe that

$$a_a=a_1^2+a_2^2,$$
$$a_b=a_1b_1+a_2b_2.$$

Suppose that

$$a_x=b_x=c_x=\ldots$$

is transformed into

$$A_X=B_X=C_X=\ldots$$

then of course $(AB)=(ab)$ the fundamental fact which appertains to the theory of the general linear substitution; now here we have additional and equally fundamental facts; for since

$$\begin{aligned}
&A_1=\lambda a_1+\mu a_2,\ A_2=-\mu a_1+\lambda a_2,\\
&A_A=A_1^2+A_2^2=(\lambda^2+\mu^2)(a_1^2+a_2^2)=a_a;\\
&A_B=A_1B_1+A_2B_2=(\lambda^2+\mu^2)(a_1b_1+a_2b_2)=a_b;\\
&(XA)=X_1A_2-X_2A_1=(\lambda x_1+\mu x_2)(-\mu a_1+\lambda a_2)\\
&\qquad-(-\mu x_1+\lambda x_2)(\lambda a_1+\mu a_2)=(\lambda^2+\mu^2)(x_1a_2-x_2a_1)=(xa);
\end{aligned}$$

showing that, in the present theory, a_a, a_b, and (xa) possess the invariant property. Since $x_1^2+x_2^2=x_x$ we have six types of symbolic factors which may be used to form invariants and covariants, viz.—

$$(ab),\ a_a,\ a_b,\ (xa),\ a_x,\ x_x.$$

The general form of covariant is therefore

$$\begin{aligned}
&(ab)^{h_1}(ac)^{h_2}(bc)^{h_3}\ldots a_a^{i_1}b_b^{i_2}c_c^{i_3}\ldots a_b^{j_1}a_c^{j_2}b_c^{j_3}\ldots\\
&\times(xa)^{k_1}(xb)^{k_2}(xc)^{k_3}\ldots a_x^{l_1}b_x^{l_2}c_x^{l_3}\ldots x_x^m\\
&=(AB)^{h_1}(AC)^{h_2}(BC)^{k_3}\ldots A_A^{i_1}B_B^{i_2}C_C^{i_3}\ldots A_B^{j_1}A_C^{j_2}B_C^{j_3}\ldots\\
&\times(XA)^{k_1}(XB)^{k_2}(XC)^{k_3}\ldots A_X^{l_1}B_X^{l_2}C_X^{l_3}\ldots X_X^m.
\end{aligned}$$

If this be of order ϵ and appertain to an n^{ic}

$$\begin{aligned}
&\Sigma k+\Sigma l+2m=\epsilon,\\
&h_1+h_2+\ldots+2i_1+j_1+j_2+\ldots+k_1+l_1=n,\\
&h_1+h_3+\ldots+2i_2+j_1+j_3+\ldots+k_2+l_2=n,\\
&h_2+h_3+\ldots+2i_3+j_2+j_3+\ldots+k_3+l_3=n;\\
&\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot
\end{aligned}$$

viz., the symbols $a, b, c, \ldots$ must each occur n times. It may denote a simultaneous orthogonal invariant of forms of orders $n_1, n_2, n_3, \ldots$; the symbols must then present themselves $n_1, n_2, n_3\ldots$ times respectively. The number of different symbols $a, b, c, \ldots$ denotes the degree θ of the covariant in the coefficients. The coefficients of the covariants are homogeneous, but not in general isobaric functions, of the coefficients of the original form or forms. Of the above general form of covariant there are important transformations due to the symbolic identities:—

$$(ab)^2=a_ab_b-a_b^2;\quad (xa)^2=a_ax_x-a_x^2;$$

as a consequence any even power of a determinant factor may be expressed in terms of the other symbolic factors, and any uneven power may be expressed as the product of its first power and a function of the other symbolic factors. Hence in the above general form of covariant we may suppose the exponents

$$h_1,\ h_2,\ h_3, \ldots k_1,\ k_2,\ k_3, \ldots$$

if the determinant factors to be, each of them, either zero or unity. Or, if we please, we may leave the determinant factors untouched and consider the exponents $j_1, j_2, j_3, \ldots l_1, l_2, l_3, \ldots$ to be, each of them, either zero or unity. Or, lastly, we may leave the exponents h, k, j, l, untouched and consider the product

$$a_a^{i_1}b_b^{i_2}c_c^{i_3}\ldots x_x^m,$$

to be reduced either to the form g_g^i where g is a symbol of the series $a, b, c, \ldots$ or to a power of x_x. To assist us in handling the symbolic products we have not only the identity

$$(ab)c_x+(bc)a_x+(ca)b_x=0,$$

but also

$$(ab)x_x+(bx)a_x+(xa)b_x=0,$$
$$(ab)a_c+(bc)a_a+(ca)a_b=0,$$

and many others which may be derived from these in the manner which will be familiar to students of the works of Aronhold, Clebsch and Gordan. Previous to continuing the general discussion it is useful to have before us the orthogonal invariants and covariants of the binary linear and quadratic forms.

For the linear forms $\bar{a}_0x_1+\bar{a}_1x_2=a_x=b_x$ there are four fundamental forms

(i.) $a_x=\bar{a}_0x_1+\bar{a}_1x_2$	of degree-order	(1, 1),
(ii.) $x_x=x_1^2+x_2^2$	,,	(0, 2),
(iii.) $(xa)=\bar{a}_1x_1-\bar{a}_0x_2$	,,	(1, 1),
(iv.) $a_b=a_0^2+a_1^2$	,,	(2, 0),

(iii.) and (iv.) being the linear covariant and the quadrinvariant respectively. Every other concomitant is a rational integral function of these four forms. The linear covariant, obviously the Jacobian of a_x and x_x is the line perpendicular to a_x, and the vanishing of the quadrinvariant a_b is the condition that a_x passes through one of the circular points at infinity. In general any pencil of lines, connected with the line a_x by descriptive or metrical properties, has for its equation a rational integral function of the four forms equated to zero.

For the quadratic $\bar{a}_0x_1^2+2\bar{a}_1x_1x_2+\bar{a}_2x_2^2$, we have

$$\begin{aligned}
&\text{(i.)}\ a_x^2=\bar{a}_1x_1^2+2\bar{a}_1x_1x_2+\bar{a}_2x_2^2,\\
&\text{(ii.)}\ x_x=x_1^2+x_2^2,\\
&\text{(iii.)}\ (ab)^2=2(\bar{a}_0\bar{a}_2-\bar{a}_1^2),\\
&\text{(iv.)}\ a_a=\bar{a}_0+\bar{a}_2,\\
&\text{(v.)}\ (xa)a_x=\bar{a}_1x_1^2+(\bar{a}_2-\bar{a}_0)x_1x_2-\bar{a}_1x_2^2.
\end{aligned}$$

This is the fundamental system; we may, if we choose, replace $(ab)^2$ by $a_b^2=\bar{a}_0^2+2\bar{a}_1^2+\bar{a}_2^2$ since the identity $a_ab_b-a_b^2=(ab)^2$ shows the syzygetic relation

$$(\bar{a}_0+\bar{a}_2)^2-(\bar{a}_0^2+2\bar{a}_1^2+\bar{a}_2^2)=2(\bar{a}_0\bar{a}_2-\bar{a}_1^2).$$

There is no linear covariant, since it is impossible to form a symbolic product which will contain x once and at the same time appertain to a quadratic. (v.) is the Jacobian; geometrically it denotes the bisectors of the angles between the lines a_x^2, or, as we may say, the common harmonic conjugates of the lines a_x^2 and the lines x_x. The linear invariant a_a is such that, when equated to zero, it determines the lines a_x^2 as harmonically conjugate to the lines x_x; or, in other words, it is the condition that a_x^2 may denote lines at right angles.

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ALGECIRAS, or Algeziras, a seaport of southern Spain in the province of Cadiz, 6 m. W. of Gibraltar, on the opposite side of the Bay of Algeciras. Pop. (1900) 13,302. Algeciras stands at the head of a railway from Granada, but its only means of access to Gibraltar is by water. Its name, which signifies in Arabic the island, is derived from a small islet on one side of the harbour. It is supplied with water by means of a beautiful aqueduct. The fine winter climate of Algeciras attracts many invalid visitors, on whom the town largely depends for its prosperity. The harbour is bad, but at the beginning of the 20th century it became important as a fishing-station. Whiting, soles, bream, bass and other fish are caught in great quantities by the Algeciras steam-trawlers, which visit the Moroccan coast, as well as Spanish and neutral waters. There is also some trade in farm produce and building materials which supplies a fleet of small coasters with cargo.

Algeciras was perhaps the *Portus Albus* of the Romans, but it was probably refounded in 713 by the Moors, who retained possession of it until 1344. It was then taken by Alphonso XI. of Castile after a celebrated siege of twenty months, which attracted crusaders from all parts of Europe; among them being the English earl of Derby, grandson of Edward III. It is said that during this siege gunpowder was first used by the Moors in the wars of Europe. The Moorish city was destroyed by Alphonso; it was first reoccupied by Spanish colonists from Gibraltar in 1704; and the modern town was erected in 1760 by King Charles III. During the siege of Gibraltar in 1780–1782, Algeciras was the station of the Spanish fleet and floating batteries. On the 6th of July 1801 the English admiral Sir James Saumarez attacked a Franco-Spanish fleet off Algeciras, and sustained a reverse; but on the 12th he again attacked the enemy, whose fleet was double his own strength, and inflicted on them a complete defeat. The important international conference on Moroccan affairs, which resulted in an agreement between France and Germany, was held at Algeciras from the 16th of January to the 7th of April 1906. (See MOROCCO).

ALGER OF LIÉGE (d *c.* 1131), known also as ALGER OF CLUNY and ALGERUS MAGISTER, a learned French priest who lived in the first half of the 12th century. He was first a deacon of the church of St Bartholomew at Liége, his native town, and was then appointed (*c.* 1100) to the cathedral church of St Lambert. He declined many offers from German bishops and finally retired to the monastery of Cluny, where he died about 1131 at a great age and leaving a good reputation for piety and intelligence. His *History of the Church of Liége*, and many of his other works, are lost. The most important of those still extant are: 1. *De Misericordia et Justitia*, a collection of biblical and patristic extracts with a commentary (an important work for the history of church law and discipline), which is to be found in the *Anecdota* of Martène, vol. v. 2. *De Sacramentis Corporis et Sanguinis Domini*; a treatise, in three books, against the Berengarian heresy, highly commended by Peter of Cluny and Erasmus. 3. *De Gratia et Libero Arbitrio*; given in B. Pez's *Anecdota*, vol. iv. 4. *De Sacrificio Missae*; given in the *Collectio Scriptor. Vet.* of Angelo Mai, vol. ix. p. 371.

See Migne, *Patrol Ser. Lat.* vol. clxxx. pp. 739–972; Herzog-Hauck, *Realencyk. für prot. Theol.*, art. by S. M. Deutsch.

ALGER, RUSSELL ALEXANDER (1836–1907), American soldier and politician, was born in Lafayette township, Medina county, Ohio, on the 27th of February 1836. Left an orphan at an early age, he worked on a farm to pay his expenses at Richfield (Ohio) Academy, was a schoolmaster for two winters, and, having studied law in the meantime, was admitted to the bar in 1859. He began practice at Cleveland, Ohio, but early in 1860 he removed to Michigan, where he abandoned his profession and engaged in the lumber business. Enlisting in a Michigan cavalry regiment in September 1861, he rose from captain to colonel, distinguished himself in the Gettysburg campaign and under Sheridan in the Shenandoah Valley, and in 1864 and 1865 respectively received the brevets of brigadier-general and major-general of volunteers. After the war he invested extensively in pine lands in Michigan, and accumulated a large fortune in the lumber business. In 1884 he was elected governor of Michigan on the Republican ticket, serving from 1885 to 1887. In 1889–1890 he was commander-in-chief of the Grand Army of the Republic. From 1897 to 1899 he was secretary of war in President McKinley's cabinet. His administration of the war department during the Spanish-American War was severely criticized for extravagance in army contracts, for unpreparedness, and for general inefficiency, charges which he answered in his *The Spanish-American War* (1901). The extent of his personal responsibility is at least uncertain. In 1902 he was appointed by the governor of Michigan, and in 1903 was elected by the state legislature, as United States senator to complete the unexpired term of James McMillan (1838–1902). He died at Washington, D.C., on the 24th of January 1907.

ALGERIA (*Algérie*), a country of North Africa belonging to France, bounded N. by the Mediterranean, W. by Morocco, S. by the Sahara and E. by Tunisia. The boundaries, however, are in part not accurately determined. Algeria extends for about 650 m. along the coast, and stretches inland from 320 to 380 m., lying between 2° 10′ W. and 8° 50′ E., and 32° and 37° N. It is divided, politically, into three departments,—Oran in the west, Algiers in the centre and Constantine in the east. Its area is 184,474 sq. m., exclusive of the dependent Saharan regions, which have an area of some 750,000 sq. m. (see SAHARA, TUAT, &c.).

Physical Features.—The character of the Algerian coast is severe and inhospitable. The western half is bordered by a hilly rampart, broken only here and there, in the bays where the larger streams find their outlet, by flat and sandy plains. Between Dellys and Philippeville high mountains rise almost sheer from the sea, leaving only a narrow strip of beach. East of Philippeville the mountains recede from the coast, and the rampart of hills reappears. Only between Bona and La Calle is the general character of the sea-board low and sandy. Save near the towns and in the cultivated district of Kabylia, the coast is bare and uninhabited; and in spite of numerous indentations, of which the most important going from west to east are the Gulf of Oran, the Gulf of Arzeu, the Bay of Algiers, and the gulfs of Bougie, Stora and Bona, there are few good harbours. From time immemorial, indeed, this coast has had an evil reputation among mariners, quite apart from the pirates who for centuries made it the base of their depredations. A violent current, starting from the Straits of Gibraltar, rushes eastward along the shore, and, hurled back from the headlands, is deflected to the west. In summer the east wind brings dense and sudden fogs; while in winter the northerly gales blow straight into the mouths of the harbours. In these circumstances navigation is especially perilous for sailing craft. The terrors of this "savage sea and inhospitable shore," once described by Sallust, have, however, been greatly mitigated by the introduction of steam, the improvement of the harbours, and the establishment by the French government of an excellent system of lighthouses.

Southward from the sea the country falls naturally into three divisions, clearly distinguished by their broad physical characteristics. The healthy, and on the whole fertile coast region, from 50 to 100 m. in width, is known, as in Morocco and Tunisia. as the Tell (Arabic for "hill"). It is a mountainous country intersected with rocky cañons and fertile valleys, which occasionally broaden out into alluvial plains like that of the Shelif, or the Metija near Algiers, or those in the neighbourhood of Oran and Bona. Behind the Tell is a lofty table-land with an average elevation of 3000 ft., consisting of vast plains, for the most part arid or covered with esparto grass, in the depressions of which are great salt lakes and swamps (Arabic, *shats*) fed by streams which can find no outlet to the sea through the encircling hills. To the south this region is divided by the Great Atlas from the deserts of the Sahara, with its oases, in which the boundary of Algeria is lost.

The country is traversed by lofty ranges of the Atlas system, which run nearly parallel to the coast, and rise in places over 7000 ft. These are commonly divided into two leading chains, distinguished as the Great[1] and Little Atlas. The Great, or Saharan Atlas contains some of the highest points in the country. The chief ranges are Ksur and Amur in the west and the Aures in the east. The peak of Shellia, the highest point in Algeria, in the Aures range, has a height of 7611 ft. In the Amur are Jebel Ksel (6594 ft.) and Tuila Makna (6561 ft.). The Little Atlas, otherwise the Tell or Maritime Atlas, lies between the sea and the Saharan Atlas, and is composed of many distinct ranges, generally of no great elevation and connected by numerous transverse chains forming extensive table-lands and elevated valleys. The principal ranges of the Little Atlas—from west to east—are the Tlemçen (5500 ft.); the Warsenis (with Kef Sidi Omar, 6500 ft.); the Titeri (4900 ft.); the Jurjura, with the peak of Lalla Kedija (7542 ft.) and Mount Babor (6447 ft.); and the Mejerda (3700 ft.), which extends into Tunisia. The Jurjura range, forming the background of the plains between Algiers and Bougie, extends through the district of Kabylia, with which for grandeur of scenery no other part of Algeria can compare. South of the Jurjura and separated from it by the valley of the Sahel, is the Biban range with a famous double pass of the same name, through which alone access is gained to the highlands beyond. The Bibans or *Portes de fer* (Iron Gates) consist of two defiles with stupendous walls of rock, which by erosion have assumed the most fantastic shapes. In the case of the *Petite porte* the walls in some places are not more than twelve feet apart. The Dahra range (see MOSTAGANEM) overlooks the sea, and is separated from the Warsenis by the valley of the Shelif (see ATLAS MOUNTAINS, SAHARA and TUAT).

The rivers are numerous but the majority are short. Most

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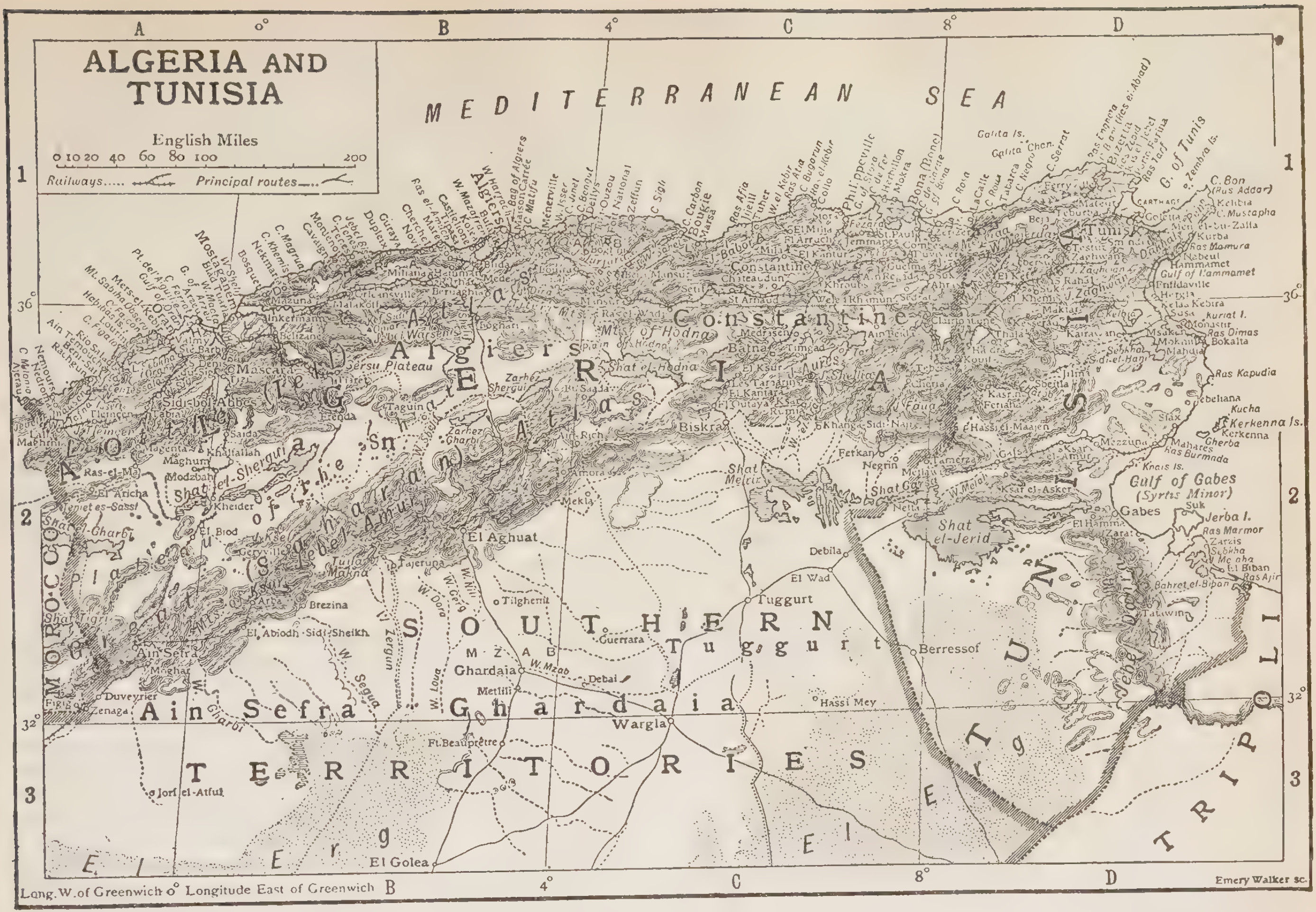
[1] The name "Great" Atlas is more correctly applied to the main range in Morocco.


ALGERIA AND TUNISIA
English Miles
0 10 20 40 60 80 100 200
Railways
Principal routes
MEDITERRANEAN SEA
Algiers
Oran
Constantine
TUNIS
MOROCCO
Ain Sefra
Ghardaia
Tuggurt
SOUTHERN TERRITORIES
TRIPOLI
Erg
El Erg
Gulf of Gabes (Syrtis Minor)
Gulf of Tunis
Gulf of Hammamet
Jerba I.
Kerkenna Is.
Shat el-Jerid
Shat Melrir
Shat el-Hodna
Shat el-Shergui
Shat el-Gharbi
Zarhez Shergui
Zarhez Gharbi
Biskra
Batna
Tebessa
Tlemçen
Sidi-bel-Abbes
Mascara
Saida
Tiaret
Medea
Miliana
Bona
Philippeville
Bougie
Setif
Guelma
Kairwan
Sfax
Susa
Bizerta
Gabes
El Aghuat
Wargla
El Golea
Metlili
Brezina
Geryville
Tilghemt
Guerrara
Debila
El Wad
Berressof
Hassi Mey
Ft. Beauprétre
Duveyrier
Figig
Jorf el-Atful
M Z A B
Mts. of Hodna
Aures
Tell
Atlas
Jebel Amur
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B
C
D
1
2
3
0°
4°
8°
36°
32°
Long. W. of Greenwich 0° Longitude East of Greenwich
Emery Walker sc.

of them rise in the mountains near the coast, and rush down through deep and rocky channels. During the rainy season they render communication between different parts of the country extremely difficult. The most important river, both from its length and volume, is the Shelif. It rises on the northern slopes of the Amur mountains and flows N.E. across the high plateau, piercing the little Atlas between the Warsenis and Titeri ranges. It then turns W. and reaches the Mediterranean at the eastern end of the Gulf of Arzeu. The Shelif, which has many tributaries, is about 430 m. long. The Seybuse (about 150 m. long), formed by the union of several small streams in the department of Constantine, runs through a fertile valley and reaches the Mediterranean near Bona. The Sahel (about 100 m. long), which contains the greatest body of water after the Shelif, rises in the department of Algiers near Aumâle, and flows for the most part N.E. to its mouth near Bougie. The Kebir or Rummel—the river is known by both names—is formed by the union of several small streams south of Constantine, and flows past that town N.W. 140 m. to the sea. Among the less important rivers which empty into the Mediterranean are the Macta, the Tafna, the Harrach and the Mazafran. The Macta, but 3 m. long, enters the sea in the Gulf of Arzeu, some 25 m. W. of the mouth of the Shelif. It is formed by the Habra (140 m.) and the Sig (130 m.), which rise in the Amur mountains and flowing north unite in a marshy plain, whence issues the Macta. On the lower courses of the Habra and the Sig, barrages have been built for irrigation purposes. The Habra barrage holds 38,000,000 cubic metres; that on the Sig 18,000,000. The Tafna (about 100 m.) rises in a large cavern in the mountains south of Tlemçen and flows N.E. to the sea at Rachgun. It has many affluents; the largest, the Isser (70 m.), joins it on the east bank about 30 m. above its mouth. The Harrach (40 m.), a picturesque stream, enters the Mediterranean in the Bay of Algiers. The Mazafran (50 m.) crosses the plains S.W of Algiers, reaching the sea N. of Kolea. The Mejerda and its affluent the Mellegue, rivers of Tunisia (*q.v.*), have their rise in Algeria, in the mountainous country east of Constantine. None of these rivers is navigable. Besides these there are a number of streams in the interior, but they are usually dry except in the rainy season.

Algeria abounds in extensive salt lakes and marshes. Of the lakes in the northern part of the country near the coast the principal are,—the Fezara, 14 m. S.W. of Bona; Sebkha and El Melah, south of Oran; and three small lakes in the immediate vicinity of La Calle. In the high plateaus are the Shat-el-Gharbi or Western Shat, the Shat-el-Shergui or Eastern Shat, the Zarhez-Gharbi and the Zarhez-Shergui, the Shat-el-Hodna and a number of others. South of the Jebel Aures is another series of salt lakes closely connected with the Shat-el-Jerid (of Tunisia). The chief of these is the Shat Melrir. There are a number of warm mineral springs, containing principally salts of lime, used with success by both Arabs and Europeans in several kinds of disease.

One of the most remarkable groups of springs is near Guelma, in the department of Constantine. There are two principal sources. Their waters unite in one stream whose course is marked by gigantic limestone cones, some of which are 36 ft. high. The water, which is at boiling point, falls into natural basins of a creamy white colour, formed by the deposit of carbonate of lime. The springs are known to the Arabs as Hammam Meskutin (the "accursed baths"). The name and the cones are accounted for by a legend which represents that at this spot lived a sheikh who, finding his sister too beautiful to be married to anyone else, determined to espouse her himself. Whilst the marriage festivities were being celebrated the judgment of Heaven descended on the guilty pair; fire came from below; the water became hot and the sheikh and his sister were turned into stone. Within a mile of Hammam Meskutin are ferruginous and sulphureous springs.

[*Geology.*—The geology of Algeria has been worked out in considerable detail by French geologists. Rocks of Archean and Palaeozoic ages contribute only a small share, but there is a very complete sequence of formations from the Lias to those of recent date. An interesting and orderly petrological sequence of Tertiary igneous rocks has been determined.

Archean rocks form the cores of the ancient crystalline masses within the littoral zone from Algiers to Bona. They consist of gneiss, mica-schist, quartzites, crystalline limestones and conglomerates. Primary deposits are doubtfully represented by the detached fragments of unfossiliferous strata of Traras, Blida and east of Orleansville. Carboniferous and Permian strata are possibly represented by some black and grey micaceous shales with beds of coal in the Jurjura. At Jebel-kahar and west of Traras, Pomel attributes certain conglomerates, red sandstones and purple and green shales to the Permian. The rocks of Secondary and Tertiary ages have been profoundly affected by the Alpine movements, and are thrown into a series of complex folds, so that in numerous instances their stratigraphy is imperfectly understood. The gypsiferous and saliferous marls of Shellata, Suk Ahras and Ain Nussi have yielded Triassic fossils. Triassic rocks are considered to be present in Constantine and in the Jurjura. Rhaetic beds (Infra Lias), consisting of dolomites and siliceous limestones, have been recognized at Saida. The lower and middle divisions of the Jurassic, composed of massive limestones more or less siliceous and overlain by the marls amd highly fossiliferous limestones of the Upper Lias, play an important part in the constitution of the chief mountains of the Tell. In south Oran they determine the principal axes of the mountain ranges. The Inferior Cretaceous rocks include the Neocomian and Gault (Albian and Aptian) subdivisions, and form the flanks of the mountains in the Tell. In the south the Albian subdivision of the Gault is alone represented. Rocks of Upper Cretaceous age are represented in all their stages. The Cenomanian presents two distinct facies. North of the Atlas it belongs to the European type, in the south it contains a fauna of oysters and sea-urchins belonging to the facies "africano-syrian" of Zittel. There is a continuous transition between the Senonian and Danian, proving that the Algerian region did not participate in the immersion which occurred in Provence and in the Corbières of southern France during the Danian epoch. The Lower Eocene rocks contain the chief phosphatic deposits of Algeria, those of the Tebessa region being the best known. Certain species of nummulites, which are very common, distinguish the various subdivisions of the Eocene. The highest beds, consisting of quartzites, shales, marls and sandstones with the remains of fucoids, are found in the Jurjura and Shellata. The Oligocene period consists of a marine phase confined to the littoral zone of Kabylia, and of a continental phase occupying vast areas composed of lacustrine, alluvial, gypsiferous marls, sandstones and conglomerates. The Miocene formation obtains its greatest development in Oran and is much expanded in the Tell. At the close of the Lower Miocene period (beds with *Ostrea crassissima*) great modifications in the relief and limits of the Algerian formations took place. Hitherto marine conditions were confined to the littoral; in Middle Miocene times (Helvetian) the sea broke in and spread in a south-east direction in the form of long ramified fjords but did not extend as far as the Sahara. To the Pliocene period the marine deposits of the Sahel of Algiers and of the Sahel Jijelli must be attributed; also the lacustrine marls and limestone of the basin of Constantine, and the ancient alluviums of the basins and depressions which bear no relation to the existing valleys. Among the Tertiary volcanic rocks those of acid types (granites, granulites) were the first to appear and are developed latitudinally; rocks of intermediate type (dacites, andesites) characterize the Miocene and early Pliocene periods; while the basic rocks (ophites, elaeolite syenites and basalts) attained their maximum in later Pliocene and Quaternary times. Their development, feeble as compared with the acid rocks, is meridional. The Quaternary period includes an older stage containing fragments of fossils from the underlying formations; a later stage containing the bones of *Hippopotamus*, *Elephas*, *Rhinoceros*, *Camelus*, *Equus*; and finally the vast accumulations of sand which began to be formed in prehistoric times. The broad platforms of the hamada are covered with Quaternary deposits. (W. G.*)]

Climate.—Although Algeria enjoys a warm climate, the temperature varies considerably in different parts, according to the elevation and configuration of the country. Along the coast the weather is very mild, the thermometer rarely falling to freezing-point even in winter. The coldest month is January, the hottest August. The mean annual temperature in the coast plains is 66° F. Heavy rains prevail from December to March, and rain is not uncommon during other months also, excepting June, July, August and September, which are very hot and rainless. The average annual fall is 29 in. On the mountains and the high plateaus the winter is often very severe; snow lies for six months on the higher peaks of the Kabyle mountains. On the plateaus the temperature passes from one extreme to the other, and rain seldom falls. (For the climate of the Saharan region see SAHARA.) Throughout Algeria, especially in the summer, there is a great difference between day and night temperature, notably in the inland districts. Between May and September the sirocco, or hot wind of the desert, sweeps at intervals over the country, impregnating the air with fine sand; but in general, with the exception of the vicinity of the marshes, the climate is healthy. Its salubrity has been increased by the draining of many marshes in the neighbourhood of the larger towns.

Fauna and Flora.—The fauna of Algeria resembles that of the Mediterranean system generally, though many animals once common to South Europe and North Africa—such as the lion, panther, hyena and jackal—are now extinct in Europe. Lions, formerly plentiful, have disappeared, and leopards and panthers are rare; but jackals, hyenas and Algerian apes are not uncommon. Wild boars are found in the oak forests, and brown bears in the uplands. In the south are various species of antelope and wild goat. Red deer (*Cervus elaphus barbarus*), which differ from the typical European species only in the fact that the second tine is absent from their antlers, a peculiarity which they share with the red deer of Spain and Corsica, are still found in the forest of Beni Saleh in the department of Constantine, but are being exterminated by forest fires and poaching Arabs. Of domestic animals the camel and sheep are the most important. The chief wealth of the Arab tribes of the plateaus consists in their immense flocks of sheep. The horses and mules of Algeria are noted; and the native cattle are an excellent stock on which to graft the better European varieties. Of birds, eagles, vultures, hawks, owls and quails are common; snipe, curlews, plovers, storks and herons frequent the marshy parts; and the ostrich the desert. Partridges and woodcocks are fairly common. Among the reptiles are various species of serpents, tortoises, turtles, lizards, &c. Locusts are common and sometimes do great damage. Scorpions are numerous in the arid regions. Algerian prawns, especially those of Bona, are large and of a delicate flavour. Of the twenty-one species of freshwater fish, five are peculiar to the country, but none is of much economic value save the barbel and eel. A species of trout is found in the streams near Collo, but in none of the other rivers.

The flora of Algeria consists of about 3000 species, of which some 450 are indigenous to the country, 100 being peculiar to the Sahara. The flora of the Tell is South European in character. The agave and prickly pear, the myrtle, the olive and the dwarf palm grow luxuriantly; and the fields are covered with narcissus, iris and other flowers of every hue. Roses, geraniums, and the like, bloom throughout the winter. The flora of the high plateaus consists chiefly of grasses, notably various kinds of alfa or esparto, and aromatic herbs. In the Saharan oases the characteristic tree is the date palm—"the king of the desert." Over 11,000 sq. m. of the mountainous country near the coast are covered with forests of various species of oak, pine, fir, cedar, elm, ash, maple, olive, many of them of gigantic size, and other trees; and on the slopes of the mountains up to 3800 ft. above the sea the fig is common. Its fruit forms one of the staple articles of food among the Kabyles. Cork and carob trees are also very common. A magnificent conifer, the Atlantic pinsapo (*Abies Pinsapo*), is found on the heights round Bougie. The forests suffer great damage from fires, occasioned in part by the custom of burning up the grass every autumn, and in part by incendiarism. In 1902 alone, according to the British consular report, "at a moderate estimate the number of trees damaged or destroyed might be put down at 6,000,000." Forestry is a state-protected industry, the government owning over 500,000 acres of forest. The chief tree which has commercial value is the cork, and the stripping of the bark is under official supervision. The first cork harvest was gathered in 1890, when 1474 cwt. were sold for £1361. Since that date the yield has been very great. Another tree of great commercial value is the soap tree (*Sapindus utilis*), introduced into the country in 1845 and grown extensively in low-lying lands near the coast.

Inhabitants.—Algeria had in 1906 a population of 5,231,850, consisting of a medley of European, Eastern and African races. The census showed that in addition to French settlers and their descendants (278,976) there were 117,475 Spaniards (most of whom are found in the department of Oran), 33,153 Italians (chiefly in the department of Constantine), 64,645 Jews, 6217 Maltese, and smaller communities of British, Germans, Levantines and Greeks. There were, moreover, 170,444 naturalized French citizens, mainly of Spanish and Italian origin. (These figures are exclusive of 73,799 persons counted apart, as not enjoying municipal rights. In the 73,799 the troops, French and native, are included). The total European population, in which category are reckoned the Jews, other than those of Mzab, was 680,263. Compared with the census of 1901 the figures of 1906 showed a decrease of 14,000 French, 36,000 Spaniards and 5000 Italians, but an increase of nearly 100,000 in the foreigners naturalized. Of other races: (1) The Berbers (*q.v.*) constitute 75 % of the entire population. The Kabyles (*q.v.*), a division of the Berbers, occupy chiefly the more mountainous parts of the Tell, but some live in the plains and valleys. (2) Arabs, a numerous class, are found principally in the south. (3) The so-called "Moors," generally of mixed blood, inhabit the towns and villages near the sea-coast. (4) Negroes, originally brought from the interior and sold as slaves, are now found chiefly in the towns, where they serve as labourers and domestic servants. (5) Mzabites (*q.v.*) or Beni-Mzab, a distinct branch of the Berber race, are for the most part engaged in petty trade, and are distinguished by their sleeveless coats of many colours. (6) A few Tuareg (*q.v.*), another division of the Berbers, are among the nomads found in the Algerian Sahara. The Kabyles, Mzabites, Tuareg, Arabs and Moors all profess Mahommedanism, though it is only among the Arabs that its tenets are held in any purity. The census of 1906 gave the number of the native population at 4,447,149. There were also 28,639 non-European foreigners in the country.

The Turks, though for a considerable period the dominant race, were never very numerous in Algeria. The majority of them were repatriated by the French. The Kuluglis, descendants of Turks by native women—once a distinct race noted for their energy, bravery and pride—have almost ceased to exist as a separate people, being merged in the Moors. Jews have long been settled in Algeria. Some are supposed to have fled thither when expelled from Cyrenaica in the reign of the emperor Hadrian, and others on their banishment from Italy in 1342. The purely "African" Jew is now found only in the oases in the extreme south of the country. In the towns the "native" Jews have intermarried with later arrivals from Europe. A remarkable feast is kept annually by the Algerian Jews to commemorate the defeat by the Turks of the emperor Charles V.'s attempt to capture Algiers (1541). The Jews, who enjoyed religious freedom under the Mahommedans, believed that the success of the Spaniards would but lead to their own persecution.

Chief Towns.—The chief towns are Algiers, the capital and principal seaport, with a population (1906), including Mustapha and other suburbs, of 154,049; Oran (100,499),[1] a western seaport and capital of the department of the same name, and Constantine (46,806), an inland town, capital of the department of Constantine. Besides Algiers and Oran the principal seaports are Bona (36,004), Mostaganem (19,528), Philippeville (16,539), Bougie (10,419), Cherchel (4733) and La Calle (2774). Inland, besides Constantine, are the important towns of Tlemçen (24,060), Sidi-bel-Abbes (24,494), Mascara (18,989) and Blida (16,866). In the Sahara are Biskra (4218), El Wad (7586), Tuggurt (2073) and Wargla (3579). All these places are separately noticed.

Nemours (1229) is a seaport near the Moroccan frontier, which formerly bore an Arabic name pregnant with its history —Jamaa-el-Ghazuat ("rendezvous of the pirates"). The surrounding country is rich in mineral wealth. Arzeu (3085) occupies a site on the western side of the gulf of the same name. It has a good harbour, is the outlet for the produce of several fertile valleys, and the starting-point of a railway which penetrates into the Sahara. This railway passes Saida (6256), 106 m. south of Arzeu, one of the capitals of Abd-el-Kader, and serves to bring down from the high plateaus their rich crops of esparto grass. Four miles S.E. of Arzeu is a Berber village, where are interesting ruins of a Roman settlement, identified by some authorities as the Portus Magnus of Pliny; other authorities claim Oran as occupying the site of Portus Magnus. In the vicinity are the famous quarries of Numidian marbles. Tenes (3176) is a seaport situated about 100 m. east of Arzeu on the site of the Phoenician town, afterwards the Roman colony, of Cartenna. Outside the town to the west is a public garden in which are several Roman tombs with inscriptions. Between Tenes and Algiers are Tipasa (*q.v.*) and Castiglione (1634), formerly called Bu-Ismail, both pleasant watering-places. Five miles inland west of Castiglione is Kolea (2932), a town dating from 1550 and originally peopled by Moslem refugees from Spain. It was destroyed by earthquake in 1825 and has been rebuilt largely in European style. It contains the *kubba* of a celebrated marabout, Sidi Embarek, who lived in the 17th century. Dellys (3275), 50 m. by sea E. of Algiers, has a small harbour sheltered from the W. and N.W. winds only. It is a walled town regularly laid out, built by the French on the site of the Roman Ruscurium, the western ramparts of which may still be seen. Jijelli (4878), on the eastern side of the Gulf of Bougie, occupies the site of the Roman colony of Igilgilis. The old town, built on a rocky peninsula, was completely destroyed by earthquake in 1856. A new town arose eastward of the former site, which is now restored as a citadel. Twenty miles by sea west of Philippeville is Collo (2258), a city of considerable importance during the Roman occupation. It was the Kollops Magnus of Ptolemy.

Twenty-three miles S.W. by rail from Algiers is Bufarik (the "hanging well"); pop. 5980. A thoroughly French town, it dates from 1835, when General Drouet d'Erlon established there an entrenched camp on a hillock in the midst of a pestilential swamp. Soon afterwards Marshal Clausel began to build a regular city, which was at first called Medina Clausel in his honour. The draining of the site and neighbourhood was a costly undertaking, and was only accomplished by the sacrifice of many lives. The town, surrounded by vast orchards and farms, is now one of the most flourishing in the country; and the most important market in the colony for the sale of cattle and agricultural produce is held there. Sixty-three miles S.W. of Algiers is Medea (4030)—supposed to stand on the site of a Roman town—finely situated on a plateau 3000 ft. above the sea. It is surrounded by a wall pierced by five gates. An ancient aqueduct is built into the eastern side of the wall. The town, which was chosen by the Turks as capital of the beylik of Titeri, is now French in character. Miliana (3991), which occupies the site of the Roman Milliana, lies about midway between Blida and Orleansville, is 2400 ft. above the sea, and is built on a plateau of the Zakkar mountains, commanding magnificent views of the valley of the Shelif. It possesses few remains of antiquity. An old Moorish minaret has been turned into a clock tower. The town, which is walled, has been rebuilt by the French. The chief streets are bordered by trees and have streams of water running down either side. Hammam R'Irha to the N.E. of Miliana, noted from the time of the Romans for its thermal springs, occupies a picturesque position 1800 ft. above the sea. Being the only place within easy distance of western Europe where patients can take with safety a course of baths during the winter months, it has become a resort of invalids. Orleansville (3510), on the extensive plain of the Shelif, 130 m. S.W. by rail from Algiers, and 132 m. N.E. from Oran, is an important military station. The basilica of St Reparatus, discovered in 1843, was allowed to be used as a public stable and has been completely destroyed. There was in it a beautiful mosaic of which, fortunately, drawings exist. From this it appears that the church was built in A.D. 324, and that St Reparatus, bishop of the diocese, was buried in it in 475. Orleansville occupies the site of the Roman Castellum Tingitanum.

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[1] The figures given are not those of the communes, but of the towns proper, certain classes of persons (such as troops, lunatics, convicts) excluded from the municipal franchise not being counted.

Ninety miles S.W. of Bougie is Aumâle (2350), a town and military post established by the French in 1846 on the site of the ancient Auzia. The Roman town was founded in the reign of Augustus, and it flourished for two centuries before it disappeared from history. Out of the materials of the ancient city the Turks built a fort, which at the time of the French occupation was itself a heap of ruins. Setif (12,261), the Sitifis Colonia of the Romans, is 50 m. S.E. of Bougie and 97 m. by rail W. of Constantine. It stands 3573 ft. above the sea, and is the junction of several great lines of communication. Its market is attended by Kabyles, Arabs of the plateaus and people from the Sahara. The town has been entirely rebuilt in the French style. Most of the Roman ruins, even those existing at the time of the French occupation (1839), have disappeared. The walls of the Roman city, restored probably by the Byzantines, have been incorporated in the French walls, which are pierced by four gates. Batna (5279), a walled town 3350 ft. above the sea, 50 m. S. of Constantine by the railway to Biskra, commands the passage of the Aures mountains by which the nomads of the Sahara were wont to enter the Tell. Its importance rests on its strategic position. On the railway between Constantine and Bona and 76 m. from the latter, is Guelma (6584), the Roman Kalama, finely situated on the right bank of the Seybuse. The French occupied the place in 1836 and built their town out of the Roman ruins. Thirty miles S.E. of Guelma is Suk Ahras (7602), a station on the railway to Tunis, identified with the Roman city Tagaste, the birthplace of St Augustine.

Towns in the Sahara.—On the southern slopes of the Great Atlas, 2437 ft. above the sea, looking out on the Saharan desert, and 200 m. in a straight line S.W. of Algiers, is the ancient town of El Aghuat (erroneously written Laghouat); pop. 5660. It formerly belonged to Morocco, by whom it was ceded to the Turks towards the close of the 17th century. It was stormed on the 4th of December 1852 by the French, who almost entirely destroyed the Arab town. The modern town contains little of interest, but is an important military station. One hundred and twelve miles S. of El Aghuat, and 36 m. W.N.W. of Wargla, is Ghardaia (pop. 7868), the capital of the Mzab country, annexed by France in 1882. This country consists of seven oases, five in close proximity and two isolated. The town of Ghardaia (in the local documents Taghardeit) is situated on a mosque-crowned hill in the middle of the Wadi Mzab, 1755 ft. above the sea. Ghardaia, which is divided by walls into three quarters, is built of limestone and the houses are in terraces one above the other. The central quarter is the home of the ruling tribe, the Beni-Mzab. The eastern quarter belongs to the Jews, of whom there are about 300 families; the western is occupied by the Medabia, Arabs from the Jebel Amur. The gardens belong exclusively to the Beni-Mzab. According to native accounts the town was founded about the middle of the 16th century. Aghrem Baba Saad, a small ruined town to the west of Ghardaia, is the fortified post in which the Beni-Mzab took refuge when the Turks under Salah Rais (about 1555) attempted unsuccessfully to subjugate the country. Next to Ghardaia the most important Mzabite town is Beni-Isguen (pop. 4016), an active trading centre. Guerrara, one of the two isolated oases, 37 m. N.E. of Ghardaia, contains a flourishing commercial town with 1012 inhabitants.

The caravan route south from Ghardaia brings the traveller, after a journey of 130 m., to the oasis and town of El Golea (pop. about 2500). The town consists of three portions—the citadel on a limestone hill, the upper and the lower town—separated by irregular plantations of date trees. The place is an important station for the caravan trade between Algeria and the countries to the south. It was occupied by the French under General Gallifet in 1873. El Golea was originally a settlement of the Zenata Berbers, by whom it was known as Taorert, and there is still a considerable Berber element in its population. The full Arab name is El Golea'a el Menia'a, or the "little fortress well defended."

Archaeology.—Algeria is rich in prehistoric memorials of man, especially in megalithic remains, of which nearly every known kind has been found in the country. Numerous flints of palaeolithic type have been discovered, notably at Tlemçen and Kolea. Near Jelfa, in the Great Atlas, and at Mechera-Sfa ("ford of the flat stones"), a peninsula in the valley of the river Mina not far from Tiaret in the department of Oran, are vast numbers of megalithic monuments. In the Kubr-er-Rumia—"grave of the Roman lady" (*Roman* being used by the Arabs to designate strangers of Christian origin)—the Medrassen and the Jedars, Algeria possesses a remarkable series of sepulchral monuments. The Kubr-er-Rumia—best known by its French name, *Tombeau de la Chrétienne*, tradition making it the burial-place of the beautiful and unfortunate daughter of Count Julian—is near Kolea, and is known to be the tomb of the Mauretanian king Juba II. and of his wife Cleopatra Selene, daughter of Cleopatra, queen of Egypt, and Mark Antony. It is built on a hill 756 ft. above the sea. Resting on a lower platform, 209 ft. square, is a circular stone building surmounted by a pyramid. Originally the monument was about 130 ft. in height, but it has been wantonly damaged. Its height is now 100 ft. 8 in.: the cylindrical portion 36 ft. 6 in., the pyramid 64 ft. 2 in. The base, 198 ft. in diameter, is ornamented with 60 engaged Ionic columns. The capitals of the columns have disappeared, but their design is preserved among the drawings of James Bruce, the African traveller. In the centre of the tomb are two vaulted chambers, reached by a spiral passage or gallery 6½ ft. broad, about the same height and 489 ft. long. The sepulchral chambers are separated by a short passage, and are cut off from the gallery by stone doors made of a single slab which can be moved up and down by levers, like a portcullis. The larger of the two chambers is 14½ ft. long by 11 ft. broad and 11 ft. high. The other chamber is somewhat smaller. The tomb was early violated, probably in search of treasure. In 1555 Salah Rais, pasha of Algiers, set men to work to pull it down, but the records say that the attempt was given up because big black wasps came from under the stones and stung them to death. At the end of the 18th century Baba Mahommed tried in vain to batter down the tomb with artillery. In 1866 it was explored by order of the emperor Napoleon III., the work being carried out by Adrian Berbrugger and Oscar MacCarthy.

The Medrassen is a monument similar to the Kubr-er-Rumia, but older. It was built about 150 B.C. as the burial-place of the Numidian kings, and is situated 35 m. S.W. of Constantine. The form is that of a truncated cone, placed on a cylindrical base, 196 ft. in diameter. It is 60 ft. high. The columns encircling the cylindrical portion are stunted and much broader at the base than the top; the capitals are Doric. Many of the columns, 60 in number, have been much damaged. When the sepulchral chamber was opened in 1873 by Bauchetet, a French engineer officer, clear evidence was found that at some remote period the tomb had been rifled and an attempt made to destroy it by fire.

The Jedars (Arab. "walls" or "buildings") are in the department of Oran. The name is given to a number of sepulchral monuments placed on hill-tops. A rectangular or square podium is in each case surmounted by a pyramid. The tombs date from the 5th to the 7th century of the Christian era, and lie in two distinct groups between Tiaret and Frenda, a distance of 35 m. Tiaret (pop. 5778), an ancient town modernized by the French, can be reached by railway from Mostaganem. Near

Frenda (2063), which has largely preserved its old Berber character, are numerous dolmens and prehistoric rock sculptures.

Algeria contains many Roman remains besides those mentioned and is also rich in monuments of Saracenic art. For a description of the chief antiquities see the separate town articles, including, besides those already cited, Lambessa, Tebessa, Tipasa and Timgad.

Agriculture.—Ever since the time of the Romans Algeria has been noted for the fertility of its soil. Over two-thirds of the inhabitants are engaged in agricultural pursuits. More than 7,500,000 acres are devoted to the cultivation of cereals. The Tell is the grain-growing land. Under French rule its productiveness has been largely increased by the sinking of artesian wells in districts which only required water to make them fertile. Of the crops raised, wheat, barley and oats are the principal cereals. A great variety of vegetables and of fruits, especially the orange, is exported. A considerable amount of cotton was grown during the American Civil War, but the industry afterwards declined. In the early years of the 20th century efforts to extend the cultivation of the plant were renewed. A small amount of cotton is also grown in the southern oases. Large quantities of *crin végétal* (vegetable horse-hair) an excellent fibre, are made from the leaves of the dwarf palm. The olive (both for its fruit and oil) and tobacco are cultivated with great success. The soil of Algeria everywhere favours the growth of the vine. The country, in the words of an expert sent to report on the subject by the French government, "can produce an infinite variety of wines suitable to every constitution and to every caprice of taste." The culture of the vine was early undertaken by the colonists, but it was not until vineyards in France were attacked by phylloxera that the export of wine from Algeria became considerable. Algerian vineyards were also attacked (1883) despite precautionary measures, but in the meantime the worth of their wines had been proved. In 1850 less than 2000 acres were devoted to the grape, but in 1878 this had increased to over 42,000 acres, which yielded 7,436,000 gallons of wine. Despite bad seasons and ravages of insects, cultivation extended, and in 1895 the vineyards covered 300,000 acres, the produce being 88,000,000 gallons. The area of cultivation in 1905 exceeded 400,000 acres, and in that year the amount of wine produced was 157,000,000 gallons. By that time the limits of profitable production had been reached in many parts of the country. Practically the only foreign market for Algerian wine is France, which in 1905 imported about 110,000,000 gallons.

Fishery is a flourishing but not a large industry. The fish caught are principally sardines, bonito, smelts and sprats. Fresh fish are exported to France, dried and preserved fish to Spain and Italy. Coral fisheries exist along the coast from Bona to Tunis.

Minerals.—Algeria is rich in minerals, found chiefly in the department of Constantine, where iron, lead and zinc, copper, calamine, antimony and mercury mines are worked. The most productive are those of iron and zinc. Lignite is found in the department of Algiers and petroleum in that of Oran. Immense phosphate beds were discovered near Tebessa in 1891. They yielded 313,500 tons in 1905. Phosphate beds are also worked near Setif, Guelma and Ain Beida. There are more than 300 quarries which produce, amongst other stones, onyx and beautiful white and red marbles. Algerian onyx from Ain Tekbalet was used by the Romans, and many ancient quarries have been found near Kleber in the department of Oran, some being certainly those from which the long-lost Numidian marbles were taken. Salt is collected on the margins of the *shats*.

Shipping and Commerce.—The carrying trade between Algeria and France is confined, by a law passed in 1889, to French bottoms. The largest port is Algiers, after which follow Oran, Philippeville and Bona. There is a considerable coasting trade. The average number of vessels entering and clearing Algerian ports each year has been, since 1900, about 4000, with a total tonnage of some 6,500,000. In the coasting trade some 12,000 small vessels are engaged.

Under French administration the commerce of Algeria has greatly developed. The total imports and exports at the time of the French occupation (1830) did not exceed £175,000. In 1850 the figures had reached £5,000,000; in 1868, £12,000,000; in 1880, £17,000,000; and in 1890, £20,000,000. From this point progress was slower and the figures varied considerably year by year. In 1905 the total value of the foreign trade was £24,500,000. About five-sixths of the trade is with or via France, into which country several Algerian goods have been admitted duty-free since 1851, and all since 1867. French goods, except sugar, have been admitted into Algeria without payment of duty since 1835. After the increase, in 1892, of the French minimum tariff, which applied to Algeria also, foreign trade greatly diminished.

The chief exports are sheep and oxen, most of which are raised in Morocco and Tunisia, and horses; animal products, such as wool and skins; wine, cereals (rye, barley, oats), vegetables, fruits (chiefly figs and grapes for the table) and seeds, esparto grass, oils and vegetable extracts (chiefly olive oil), iron ore, zinc, natural phosphates, timber, cork, *crin végétal* and tobacco. Of these France takes fully three-quarters. The import of wool exceeds the export. Sugar, coffee, machinery, metal work of all kinds, clothing and pottery are largely imported. Of these by far the greater part comes from France. The British imports consist chiefly of coal, cotton fabrics and machinery.

Communications.—Algeria possesses a railway system covering over 2000 m. A decree of 1857 granted to the Paris-Lyons Company the right to construct a line linking Algiers with Oran (266 m.) and Constantine (290 m.) and shorter lines joining the seaports to the trunk line, notably Philippeville to Constantine (54 m.). These lines were opened between 1862 and 1871, but it was not until 1879 that a general scheme for railway construction was adopted. A trunk line runs from the frontier of Morocco at Lalla Maghnia, 44 m. W. of Tlemçen, across the Tell to the Tunisian frontier, whence it is continued to the city of Tunis; while traverse railways connect the seaports with the trunk line and with towns to the south, the Philippeville line being continued to Biskra. From Arzeu a line goes south across the plateaus and crossing the Ksur range at a height of 4211 ft. enters the Sahara. Passing Ain Sefra and Figig (372 m. from Arzeu) the line is continued towards Tuat. The normal gauge of the railways is 4 ft. 8½ in.; a few "light lines" have a gauge of 3 ft. 3 in. Algeria is also traversed by a network of roads constructed by the French, of which the *routes nationales* alone are 2000 m. in length. There are complete postal and telegraphic facilities in all parts of the colony save the Saharan Territories, and cable communication with France.

Central Government.—By the Turks the country was divided into four provinces—Algiers and Titeri in the centre and south, Constantine in the east and Mascara or Oran in the west.[1] The last three were governed by beys dependent upon the representative of the Porte resident at Algiers. The Turkish governors were in the 17th century replaced by deys (see below, *History*). The French rule was at first (1830) purely military. In 1834 the post of governor-general was created. Under the direction of the ministry of war that official exercised nearly all the executive power. At the same time a civil administration and consultative council were formed. The principle of unity of authority was set aside by the second republic in 1848, when many of the public services were attached to the corresponding ministries in Paris, and the departments organized on the metropolitan model by division into arrondissements and communes and by placing a prefect at their head. Under Napoleon III. the governor-generalship was abolished, a minister of Algeria and the colonies created (24th of June 1858), and the whole administration conducted from Paris. At the same time the powers of the prefects were augmented and each department given a general council. This arrangement was not of long duration. By decree of the 24th of November 1860, the ministry of Algeria and the colonies was abolished and the office of governor general re-established with increased powers. This régime, strongly military in its type, ended with the fall of the second empire. After a brief transitional period, a decree of the 29th of March 1871 placed at the head of Algeria a civil governor-general and gave the control in Paris to the ministry of the interior. In 1876, on the initiative of General Chanzy, then governor-general, that official was accorded the right to correspond direct with all the ministers in Paris. This concession led, however, to the diminution of the authority of the governor-general, whose powers were, step by step, absorbed by the various ministries in France. It had its logical end in the system adopted in 1881 and known as the *rattachement*. Under this system the plan of 1848 was carried out more completely, every department of state being placed under one or other of the ministries in Paris, whilst the governor-general became little more than an ornamental personage. After lasting fifteen years the *rattachement* was, with the approval of the legislature, abrogated by decree dated the 31st of December 1896. The opposing principle, that of concentrating power in the hands of the governor-general, was re-affirmed, but in practice was modified by the retention of the direction from Paris of a few of the public services. The decree of 1896, which was of a provisional character, was replaced by another, dated the 23rd of August 1898, defining the powers of the governor-general under the new scheme. By a law of the 19th of December 1900, Algeria was constituted a legal personality, with power to own goods, contract loans, &c., and a decree of 1901 placed the customs department, until then directed from Paris, under the control of the governor-general, whose hands were also strengthened in various minor matters.

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[1] This western beylik corresponded roughly with the former sultanate of Tlemçen (*q.v.*).

It will be seen that the form of government is entirely dependent on the will of France. The French chambers alone possess the legislative power, though in the absence of express legislation decrees of the head of the state have the force of law. To the legislature in Paris Algeria elects three senators and six deputies (one senator and two deputies for each department). The franchise is confined to "citizens," in which category the native Jews are included by decree of the 24th of October 1870. The Mahommedans, who number nearly eight-ninths of the population, are not, however, "citizens" but "subjects," and consequently have not the vote. They can, however, acquire "citizenship" at their own request, by placing themselves absolutely under the civil and political laws of France (decree of 1865, confirmed in 1870). The number of Mahommedans who avail themselves of this rule is very small; naturalizations do not exceed an average of thirty persons a year. For certain specified objects, financial and municipal, Mahommedans are, however, permitted to exercise the franchise.

The actual form of government may be summarized thus:—At the head of the administration in Algeria is a governor-general, who exercises control over all branches, civil and military, of the administration, except the services of justice, public instruction and worship (as far as concerns Europeans) and the treasury. He corresponds directly with the other Barbary states; draws up the budget, and contracts loans on behalf of the colony. The governor-general is assisted by:—

(1) The Council of Government, a purely advisory body, composed entirely of high officials;

(2) A Superior Council, composed partly of elected and partly of nominated members, including representatives of the Mahommedans. Its duty is to deliberate upon all administrative matters, including the budget, and it possesses certain powers over the finances;

(3) The Financial Delegations (created by decree in 1898), an elective body whose duty is to investigate all matters affecting taxation and to vote the budget. The delegations consist of representatives of (*a*) "colonists," *i.e.* the *rural* community; (*b*) taxpayers, being citizens other than "colonists," *i.e.* the *urban* community; (*c*) the Mahommedan population. The last section is partly elective and partly nominated. A proportion of the members of the delegations are elected to the superior council.

Local Government.—The departments; presided over by prefects, are divided into *territoires civils* and *territoires du commandant*. In the regions under civil administration the local organization closely resembles that of France. The country is divided into arrondissements and communes, with most of the apparatus of self-government enjoyed by the corresponding units in France. The canton (in France a judicial area) has, however, no existence in Algeria. In the territoires du commandant, which are the districts farthest from the coast, and in which the European population is small, the prefect is replaced by a high military officer, who exercises all the functions of a prefect.

The prefect of each department is assisted by a general council, consisting of members elected by the citizens and of nominated representatives of the Mahommedan population. The powers of the council correspond to those of the councils in France. Communes are of three kinds: (1) those with full powers, (2) mixed, (3) native. In those of the first kind, modelled on the French communes, the Mahommedans possess the municipal franchise. The "mixed" communes are under an administrator nominated by the governor-general and assisted by a municipal council composed of Europeans and natives. These communes are large areas, each containing several towns or villages. In the territoires du commandant the mixed commune is presided over by a military officer who fulfils the duties of mayor. Native communes are organized on the same plan as those last mentioned. It will be seen that communes do not correspond with any natural unit. The unit among the Mahommedans is the *douar*, a tribal division administered by a cadi. The communes with full powers have each for centre a town with a considerable European population.

By decree of the 14th of August 1905, the frontier between Saharan territory dependent on Algeria and that attached to French West Africa was laid down. The Algerian Sahara was divided into four territories, officially named Tuggurt, Ghardaia, Ain Sefra and the Saharan Oases (Tuat, Gurara and Tidikelt). The governor-general represents the territories in civil affairs; the budget is distinct from that of Algeria and an annual subvention is provided by France.

Finance.—Revenue is derived chiefly from direct taxation, customs and monopolies. The heaviest item of expenditure chargeable on the Algerian budget is on public works, posts and telegraphs and agriculture. Algeria has had a budget distinct from that of France since 1901. This budget includes all the expenses of Algeria save the cost of the army (estimated at £2,000,000 yearly) and the guarantee of interest on the railways open before 1901. Both these items are borne by France. The Algerian budget for 1906 showed revenue and expenditure balancing at £3,820,000. The country has a debt (1905), including capital, annuities and interest, of some £3,400,000.

Defence.—The military force constitutes the XIX. army corps of the French army. There are in addition a territorial army reserve and a special body of troops, largely Arab, for the defence of the Saharan territory. The troops quartered in Algeria exceed 50,000. The defence of the coast is provided by the French navy.

Land Tenure.—The colonization of Algeria by the French has been greatly hampered by the system of land tenure which they found in force. Except among the Kabyles, private property in land was unknown. Amongst the Arabs, lands were either held in common by a whole tribe, under a tenure known as the *arch* or *sabegha*, or sometimes, especially in the towns, under a modified form of freehold (*melk*) by the family. At the same time the boundaries of property were ill defined and difficult to determine. This system made it impossible for French immigrants to obtain land by lawful transfer. The only lands at the outset available for settlement were, in fact, the confiscated domains of the dey. The obvious solution of the difficulty was to encourage the free movement of real estate by substituting private ownership for the traditional system. Before doing this, however, it was necessary to define the limits of tribal properties already existing—a work of great difficulty—with a view to their ultimate division, and at the same time to guard against any premature traffic in the rights of Arabs in the lands about to be divided. A *sénatus-consulte* of 1863 laid the basis for the change in the land system by providing (1) for the delimitation of the territory of each tribe, (2) for the repartition of the territory thus delimited among newly formed tribal divisions (douars or communes), and (3) for the recognition of private ownership by the issue of title deeds for such individual or family property (*melk*) as already existed. The purpose of this excellent law, which would have laid firmly the basis for gradual change, was defeated by the impatience of the French colonists. At the instance of their representatives in the chambers it was abandoned in 1870, and was not revived till seventeen years later. A law was passed in 1873, and amended in 1887, legalizing the immediate conversion of tribal and family property into private freehold. The result has been disappointing. For the most part, the Arab tribes have been reluctant to avail themselves of their new powers, and where they have done so the hasty reversal of the traditions of centuries has proved demoralizing to the natives, without any sufficient equivalent in the way of healthy French colonization. The main profit has been reaped by Jewish usurers.

The state domains were exhausted by 1870, but were again replenished by the large confiscations which followed the Arab revolt of 1871. Government lands were originally given free to applicants, but with a provisional and insecure title, which made it impossible for poor colonists to borrow money on their land. This was modified by a law of 1851. But ultimately, the results not being satisfactory, the precedent of Australia was followed, and by a law of 1860 domain lands were sold publicly at a fixed price. This had the effect of attracting more and a better class of immigrants, but was none the less reversed in 1881.

In September 1904, a new scheme, intended to attract more European settlers, was adopted. The lands of the state—other than woods and forests—but especially the barren lands and brushwoods situated in the plains, were offered for colonization, to be disposed of (1) by sale at a fixed price, (2) by auction, and (3), in certain cases, by agreement. Purchasers were to be Frenchmen, or Europeans naturalized as French citizens, who had never held "colonization lands"; and they were obliged, under pain of forfeiture, either to take up residence themselves on their property within six months and to live on it and exploit it for a period of ten years, or else to place on the land another family fulfilling the same conditions. If the purchaser farmed the land himself and made satisfactory progress, the period of obligatory residence was reduced to five years. When the interests of colonization required it, free gifts of land might be made; in which case the grantee must himself exploit his concession. In no case might land acquired under this scheme be let to natives until after the expiration of ten years.

For the purpose of creating villages, land was put at the disposition of societies or individuals, who undertook to people them with immigrants fulfilling the same conditions as independent settlers. Two-thirds of the villagers were to be French immigrants, the other third Frenchmen or naturalized Frenchmen already settled in Algeria. To favour the establishment of special industries, the governor-general was given power to authorize the introduction of foreign instead of French immigrants. The societies or individuals undertaking village settlements must do so from philanthropic motives, inasmuch as within two years of the founding of a village, the land, under pain of forfeiture to the state, must be transferred gratuitously to the villagers. As will be seen, settlement on the land by Europeans is hampered by official restrictions, especially by the stringent regulations as to residence.

Justice.—Two judicial systems exist in Algeria—native and French. Native courts decide suits between Mahommedans. From the decision of the cadis appeal lies to the French courts. The French system provides, for civil cases, a court of first instance in each of the sixteen arrondissements into which the country is divided. A court of appeal sits at Algiers. There are also tribunals of commerce and justices of the peace with extensive jurisdiction. The criminal courts are organized as in France. Trial by jury has been introduced; but as natives are not allowed to act as jurymen this has often led to serious miscarriages of justice and to excessive severities.

Whilst modifications of the law require special legislation or decree, it has been legally decided that all laws in force in France before the conquest of the country (*i.e.* those anterior to the 22nd of July 1834) are in force in Algeria. In practice the courts allow themselves wide latitude in applying this principle.

Education.—The system of education is complicated by the co-existence of Mahommedan and Christian communities. Before the arrival of the French two kinds of instruction were given, reading and writing being taught in the ordinary schools and higher education—largely theological—in *medressas* (colleges), usually attached to the chief mosques. Attempts by the French to improve the education of the natives were at first marked by hesitation and long periods in which little or nothing was done. The provision for the instruction of the European and Jewish population was also inadequate. In 1883 a law was passed for the reorganization of the systems in force, and primary instruction was made compulsory for Europeans and Jews, whilst in the case of Mahommedans discretion in the establishment of schools was vested in the governor-general.

Attempts are made to assimilate the Mahommedan population by means of Franco-Arab primary and secondary schools, which supplement the purely French and purely Arab establishments of the same character. These attempts meet with little success, owing in part to racial prejudice and in part to the indifference of the Arabs to education. Few Moslems attend the secondary schools. Purely Mahommedan higher schools exist at Algiers, Tlemçen and Constantine. From these establishments the ranks of native officials are recruited. There is one secondary school for Moslem girls. The education provided for Europeans resembles in most respects that given in France. (The *lycées* at Algiers, Oran and Constantine are open to Mahommedans, but few take advantage of them.) Besides the government schools there are establishments conducted by clerics and laymen. The best girls' schools are generally those kept by nuns. At Algiers there is an establishment with faculties of law, medicine and pharmacy, science and letters. At Oran is a college for European girls. The scholars attending primary schools number about 150,000 (over 100,000 being Europeans and some 15,000 Jewish) and those at secondary schools about 6000. (F. R. C.)

History

Africa Minor.

From a geographical point of view Algeria, together with Morocco and Tunisia, from which it is separated only by artificial and purely political frontiers, forms a distinct country, which it is convenient to designate by the name of *Africa Minor*. Both historically and geographically, Africa Minor belongs much more to the Mediterranean world than to the African. All the foreign invaders who successively established their dominion over this country either crossed the Mediterranean or followed its shores. The Phoenicians, the Romans, the Vandals, the Byzantines, the Arabs, the Turks and the French, all came from the east or from the north. The history of Africa Minor is the history of all those foreigners who have successively endeavoured to exploit this land, the history of their divers civilizations struggling against an ever-renascent barbarism.

The political divisions of Africa Minor have changed many times, for, as the country has no natural centre, many towns have aspired to play the rôle of capital. The rivalry of these towns is intimately connected with the struggles and insurrections which have stained the land with blood. The existing division—viz. Morocco, Algeria and Tunisia—dates back to the time of the Turkish dominion. It is since that time only that the expression Algeria has been in use.

At the beginning of the 16th century the native dynasties

Struggle with Spain.

which divided Africa Minor between them—the Marinides at Fez, the Abd el-Wahid at Tlemçen, and the Hafsides at Tunis—were without strength and without authority. Two nations, then at the height of their power, Spain and Turkey, disputed the empire of the Mediterranean. The Spaniards took Mers-el-Kebir (1505), Oran (1509), and Bougie and Tripoli (1510). Two Turkish corsairs, Arouj and his brother, Khair-ed-Din (otherwise known as Barbarossa), at first established in the island of Jerba and afterwards at Jijelli, disputed with the Spaniards the dominion of the country. Arouj seized Algiers (1516); Khair-ed-Din, succeeding him in 1518, did homage for his conquest to the sultan at Constantinople, who named him beylerbey and sent him soldiers (1519). Then began the struggle of the Turks with Spain. In 1541 the emperor Charles V. undertook a great expedition against Algiers. He succeeded in landing, and proceeded to attack the town. But during the night of the 26th of October a violent storm destroyed a great part of his fleet. His provisions and his ammunition were lost, his army was compelled to retreat with considerable loss, and the emperor had to re-embark with the remnant of his troops. This check completely discouraged the Spaniards and assured success to the Turks. The Spanish garrisons established in the coast towns, badly paid and left without reinforcements, had difficulty in defending themselves. In the end, the only towns the Spaniards retained on the Algerian coast were Oran and Mers-el-Kebir. These two towns, taken by the Turks in 1708 and retaken by the Spaniards in 1732, were finally abandoned in 1791.

Barbary corsairs.

Under the Turkish dominion Algeria had originally at its head a beylerbey resident at Algiers. He controlled three beys:—the bey of Titeri in the south, the bey of the east at Constantine, and the bey of the west who resided at Mascara and afterwards at Oran. These three beys existed till 1830. The beylerbeys were replaced in 1587 by pashas sent triennially by the Porte. But the authority of these pashas, strangers to the country, was always precarious. They found themselves, in fact, in conflict with two forces, which in principle were in their service, but which in reality held the power—the *taïffe des reis*, otherwise called the corporation of the corsairs (see BARBARY PIRATES), and the janissaries, a kind of military democracy in which each member was promoted according to seniority. In 1669 the corsairs drove out the pasha, and put into his place a dey elected by themselves. After some fruitless attempts Turkey ceased to send pashas to Algiers—where they were not allowed even to land—and thus recognized the *de facto* independence of this singular republic. The authority of the deys, moreover, was scarcely more solid than that of the pashas. They trembled before the janissaries, who from the 18th century elected and deposed them at their pleasure.

The relations which the European powers were able to maintain with northern Africa were at that time difficult and uncertain. Ships trading in the Mediterranean were seized by the corsairs, who pillaged the coasts of Europe, carried off their captives to Algiers, and destroyed the fishing and commercial settlements founded by the Marseillais on the shores of Africa. The Christian governments either uttered useless and impotent complaints at Constantinople, or endeavoured to negotiate directly with Algiers, as in the case of the negotiations of Sanson Napollon during the ministry of Richelieu. More rarely their patience became exhausted, and ships were sent to bombard this nest of pirates. Two naval demonstrations were made by France during the reign of Louis XIV., one by Abraham Duquesne in 1682, and the other by Marshal Jean d'Estrées in 1688, but these repressive measures were too intermittent to produce a durable effect.

In 1815 at the congress of Vienna, and in 1818 at the congress of Aix-la-Chapelle, the powers endeavoured to concert measures to put an end to the Barbary piracy. Nevertheless the naval demonstrations made by Lord Exmouth in 1816, and by a combined English and French squadron in 1819, remained equally fruitless. But the result which the European powers in concert had been unable to achieve, was brought about by the accidental circumstances which led France to undertake alone an expedition against Algiers.

French intervention.

Some difficulties had arisen between France and the dey of Algiers with reference to the debts contracted to Bacri and Busnach, two Algerine Jews who had supplied corn to the French government under the Directory. This question of interest would not have been sufficient in itself to bring about a rupture, but the situation became acute when the dey, Hussein, struck the French consul, Deval, on the face with his fly-flap (April 30, 1827). Thereupon the port of Algiers was blockaded. The minister of war, the duc de Clermont-Tonnerre, would have gone further, but the president of the council, the comte de Villèle, opposed the sending of an expedition, while in the Martignac ministry M. de la Ferronays, minister of foreign affairs, was bent upon negotiating. It needed a second insult—the firing on "La Provence," a vessel carrying a flag of truce, in the harbour of Algiers (August 3, 1829)—to spur the French government to further action than an ineffectual blockade. An expedition against Algiers was then decided upon, and Marshal de Bourmont, the minister of war, himself took the command. On the 14th of June 1830 the French troops landed at Sidi-Ferruch. On the 19th of June they beat the enemy at Staoueli. On the 4th of July the *fort de l'Empereur* was blown up. On the 5th of July Algiers capitulated. Some days later the dey was deported, as well as the greater part of the janissaries. Those who were not married were conveyed immediately to Asia Minor; the rest had permission to remain, but in fact they left the country soon afterwards.

Meanwhile the revolution of July 1830 had broken out in France. The new government found itself very much embarrassed by the situation bequeathed by the Restoration. The more serious section in parliament were frankly opposed to the idea of conquering or of colonizing Algeria; on the other hand, popular sentiment was hostile to evacuation. The French government—fearing to displease the other powers by following up its conquest, and hampered in particular by its engagements towards England, yet conscious that the only means of putting an end to the piracy was to remain—decided provisionally in favour of that intermediate system, called restricted occupation, which consisted in occupying merely the principal seaports and awaiting events. The Algerians extricated the government from its difficulty by attacking the French troops, who were obliged to defend themselves. The natives gained some successes, and it became necessary to avenge the honour of the flag. In this gradual manner were the French led to conquer Algeria.

General Bertrand Clausel, who succeeded Marshal de Bourmont, was one of the few men who at that period dreamed of conquering and colonizing Algeria. His enthusiastic confidence knew no obstacles. If the dey had left, the three beys remained. With the feeble resources at his disposal Clausel undertook an expedition against Bu-Meyrag, the bey of Titeri, took from him Blida and Medea, dismissed him, replaced him by a successor devoted to France, and returned to Algiers after having left a garrison in Medea. Then, not having the means of directly extending the rule of France to the east or west, Clausel devised a system of protectorates. He negotiated directly with the bey of Tunis with a view to installing as beys at Oran and Constantine Tunisian princes who recognized the authority of France. But the events which were taking place in Europe made it imperative to send home a part of the army of Africa, and Medea had to be evacuated. At the same time the negotiations set on foot with the bey of Tunis were censured by the government, and General Clausel was recalled (February 1831).

The period of uncertainty was prolonged under his successors, General Pierre Berthezène (February to December 1831); A. J. M. R. Savary, duc de Rovigo (December 1831 to March 1833), General Avizard (March to April 1833), and General Voirol (April 1833 to September 1834). The French, not yet certain whether or not they would retain Algeria, remained on the defensive. At the time they occupied only the three towns of Algiers, Bona and Oran, with their suburbs, where their situation was moreover singularly precarious. The Arabs would pillage the suburbs and run away. Sometimes they cut off supplies by ceasing to bring provisions to the market, but the French were not to be turned aside by such tactics.

At Algiers the energies of the French were devoted to protecting themselves against the incursions of the Hajutas. This was sufficient to absorb the attention of the general-in-chief, who left the guardianship of the east and west to the initiative of the generals established at Bona and Oran. At Bona, where General Monk d'Uzer was in command till 1836, things went fairly well. At once firm and conciliatory, he had been able to attach to the French cause the natives whom the cruelty of Ahmed, bey of Constantine, had alienated. The occupation of Bougie by General Camille Alphonse Trézel in October 1833 gave the French a footing at another point of this eastern province. But at Oran, where General Desmichels had succeeded General P. F. X. Boyer in the spring of 1833, their situation was much less favourable. There the French had found a redoubtable adversary in the young Abd-el-Kader, who had been proclaimed amir at Mascara in 1832.

Abd-el-Kader.

A man of rare intelligence, a fearless horseman and an eloquent orator, Abd-el-Kader had acquired a great reputation by his piety. He reunited under his sway the tribes that had hitherto been divided, and infused a unique spirit into their resistance. For fifteen years he held the French in check, treating on terms of equality with their government. Moreover, the treaty which General Desmichels had the weakness to sign with him on the 24th of February 1834 greatly improved his position. In pursuance of this treaty, French officers were to represent their country at the court of the amir; while the amir on his part was represented in the three French coast towns, Oran, Arzeu and Mostaganem, by vakils who immediately began to act as masters of the natives. Such was the situation at the period when, the French having at last resolved to keep Algeria, the ordinance of the 22nd of July 1834 laid down the bases of the political and administrative organization of the "French possessions in the north of Africa," at the head of which was placed a governor-general. But this date (July 22, 1834), very important from a judicial point of view, is much less so from a historical point of view. The position of the first governor-general, Jean Baptiste Drouet d'Erlon (1765–1844), remained fully as precarious as that of his predecessor. During this time the power of Abd-el-Kader increased. Master of the province of Oran, he crossed the Shelif at the appeal of the natives, the people flocking to witness his progress as that of an emperor. He entered Miliana and Medea, where he installed beys of his own choice. All the western part of Algeria belonged to him. General Trézel, who had succeeded General Desmichels at Oran, resolved to march against the amir, but was defeated on the banks of the Macta (June 1835). This defeat shook public opinion. Drouet d'Erlon was recalled and replaced by Marshal Clausel.

In short, five years after the capitulation of Algiers, the French dominion extended as yet over only six coast towns. Clausel, who returned with the same colonial ambitions as in 1830, resolved to conquer the interior of the country. He marched against the amir, defeated him and entered Mascara. Then he proceeded to deliver the inhabitants of Tlemçen, who had been attacked by Abd-el-Kader, and there he left a garrison. Turning towards the east, Clausel organized at Bona the first expedition against Constantine. This failed, and the only result of it was the occupation of Guelma. Clausel was recalled and replaced by General C. M. D. Damrémont (February 1837). The task of maintaining the position of France was then divided between Thomas Robert Bugeaud (1784–1849), acting independently in the west, and Damrémont, who directed all his efforts towards the east. By the signature of the celebrated treaty of the Tafna (June 1, 1837), Bugeaud made peace with Abd-el-Kader. In return for a vague recognition of the sovereignty of France in Africa, this treaty gave up to the amir the whole of western Algeria. France reserved to herself only Oran and its environs, Mazagran, Algiers and the Metija; she gave up Tlemçen and the Titeri beylik. This was a triumph for Abd-el-Kader, who regarded the peace as but a truce which would allow him time to gain strength to resume the war under more favourable conditions.

Damrémont, on his part, directed a second expedition on Constantine. The town was taken, but Damrémont was killed (October 1837). Marshal Sylvain Charles Valée (1773–1846), who replaced him, founded Philippeville to serve as a seaport for the region of Constantine, occupied Jijelli, and at the head of the expeditionary column returned from Constantine to Algiers by the interior, passing through Setif and les Portes de fer. Abd-el-Kader maintained that the French had thus violated the treaty of the Tafna, and began the war again. For two years his power had been increasing. A whole hierarchy of khalifas, aghas and caids obeyed him. He had a regular army of 8000 infantry and 2000 cavalry, without counting 50,000 *goums* (bodies of Arab horsemen) brought by the khalifas. He was well furnished with war material, possessing magazines and arsenals in the heart of the Tell. He had attacked and subjugated all who were not willing to recognize his authority. Under his influence old rivalries were effaced; at his voice all the tribes joined in the holy war. On the 18th of November 1839 he sent his declaration of war to Marshal Valée, but the impatient Hajutas had already devastated the Metija. Marshal Valée marched against Abd-el-Kader, and at first gained some successes: the French occupied Cherchel, Medea and Miliana. But at the end of 1840 Valée was recalled and replaced by Bugeaud, who adopted totally different tactics. The system of Marshal Valée had been the defensive: he multiplied the fortified posts in order to draw the enemy to a spot chosen beforehand. Bugeaud resolutely adopted the offensive, reduced the weight carried by the soldiers in order to increase the mobility of his troops, and carried the war into the province of Oran, from which Abd-el-Kader drew his principal resources. One after the other, all the magazines of the amir—those at Takdempt, Boghar, Taza, Saida and Sebdu—were taken and destroyed. In the spring of 1843 the duc d'Aumale had an opportunity of surprising the *smala* (camp) of Abd-el-Kader near Taguin. This was a serious blow for the amir, whose determination to continue the contest was, however, as strong as ever. He took refuge in Morocco, and induced that power to declare war on the French on the pretext that they would not give up the frontier post of Lalla-Maghnia. Morocco was soon vanquished. While François, prince de Joinville, was bombarding Tangier and Mogador, Bugeaud gained the victory of the Isly (August 1844). Morocco signed a treaty of peace at Tangier on the 10th of September 1844.

The struggle, however, was not ended. Islam made a supreme effort in Algeria. The Dahra and the Warsenis rose at the voice of a fanatic called Bu-Maza ("the goat man"), a *Khuan* of the order of the Mouley-Taïeb. Elsewhere other "masters of the hour," false Bu-Mazas, rose. Abd-el-Kader reappeared in Algeria, which he overran with a rapidity which baffled all pursuit. He beat the French at Sidi Brahim, raided the tribes of the Tell Oranais which had abandoned him, penetrated as far as the borders of the Metija, and reached the Jurjura, where he endeavoured to rouse the Kabyles. But his eloquence offended the narrow and cramped particularism of those little democratic cities, deaf to the sentiment of the common interest. From that time he played a losing game. He returned toward the west, penetrating farther and farther to the south. Badly received by the great aristocratic family of the Walid-sidi-Sheikh, he re-entered Morocco, but the emperor of that country, dreading his influence and fearing difficulties with the French, drove him out. This was the end. On the 23rd of December 1847 Abd-el-Kader surrendered to General Lamoricière in the plains of Sidi-Brahim. His adversary, Bugeaud, was there no longer. Having failed to persuade the French government to adopt his plans of military colonization, he had retired in June 1847 and had been replaced by the duc d'Aumale.

The surrender of Abd-el-Kader marks the end of the period of the conquest. It is true that Great Kabylia had to be subdued only ten years later, and that terrible insurrections still had to be quelled. But at the end of the reign of Louis Philippe the essential work was accomplished. All that remained was to complete and to secure it.

French progress.

Under the second republic Algeria was governed successively by Generals L. E. Cavaignac (February to April 1848), N. A. T. Changarnier (April to September 1848), V. Charon (September 1848 to October 1850), and A. H. d'Hautpoul (October 1850 to December 1851). The policy followed at this period consisted in assimilating Algeria to France. Important efforts were made to attract French colonists to the country, the colonization of Algeria appearing as a means towards the extinction of pauperism in the mother-country. This point of view suggested numerous projects, as chimerical as they were generous; two millions sterling (50 million francs) were expended with a view to installing Parisian unemployed workmen as colonists, but this attempt failed miserably. The most remarkable military events of this period were (1) the siege and destruction of the oasis of Zaatcha, where the inhabitants, displeased by an alteration in the tax on palms, rose at the voice of a fanatic named Bu-Zian; (2) the ineffectual campaign of Marshal Saint Arnaud in Little Kabylia, where the tribes rose at the instigation of Bu-Magla ("the mule man") in 1851.

Marshal J. L. C. A. Randon (1795–1871), named governor-general of Algeria after the *coup d'état*, had at first to repress in the south a rising of a new "master of the hour," Mahomet ben Abdallah, the sherif of Wargla. A column seized Laghouat (El Aghuat) in December 1852. Si-Hamza, leader of the Walid-sidi-Sheikh, an ally of France, indignant at the growing influence of a base-born agitator, pursued him and seized Wargla (1853). In 1854 General Desvaux entered Tuggurt. Henceforth matters remained quiet in the region of the Sahara, and Marshal Randon turned his efforts towards Kabylia. Neither the Romans nor the Turks had been able to subdue this square mountainous tract, of which Bougie, Setif, Aumâle and Dellys form the four corners. But in two months (May to June 1857) Marshal Randon made himself master of it, and built in the heart of this country Fort Napoleon (now Fort National), "the thorn in the side of Kabylia," whose batteries commanded all the Kabyle villages of the region.

In 1858 the creation of a "ministry of Algeria and of the colonies" brought about the resignation of Marshal Randon. The administrative headquarters of Algeria was then transferred from Algiers to Paris. The ministry of Algeria was entrusted first to Prince Napoleon, and afterwards to the marquis J. N. S. P. de Chasseloup-Laubat (1805–1873). But this office, created at the least prematurely, soon disappeared without causing any regrets. This ephemeral régime lasted from the 24th of June 1858 to the 24th of November 1860. The decree of the 24th of November 1860 transferred the services from Paris back to Algiers, and re-established the functions of governor-general, which were exercised at the end of the second empire first by Marshal Pélissier, duc de Malakoff (December 1860 to September 1864) and then by Marshal MacMahon, duc de Magenta (September 1864 to July 1870). At this period the conception of the *Arab kingdom* was prevalent. The emperor Napoleon III., in a celebrated letter, wrote that he was as much the emperor of the Arabs as the emperor of the French. Algeria was considered as a kind of great military fief, and the officers who ruled there commonly took the side of the native chieftains against the civil population. European colonization, hampered by the ill-will of the Arab bureaux, then made little progress.

Revolt of 1864-1871.

It was at this period that the great insurrection of the Walid-sidi-Sheikh broke out in the Sud Oranais. This powerful family had lived up to that time on a good understanding with France; Si-Hamza, chief of the elder branch, had remained until his death (1861) a faithful ally of France. Thanks to him, the security of the southern frontier was assured. But after his death his son, Si-Sliman, imbued with anti-French sentiments, revolted in 1864 and massacred the Beauprêtre column. Several years were occupied in quelling the insurrection. Compelled to guard themselves on the south against the Walid-sidi-Sheikh, the French realized how much they lost by not having the support of these great chieftains. They then accepted the services offered to them by Si-Sliman-ben-Kadour, chief of the younger branch of the Walid-sidi-Sheikh, who maintained tranquillity in the Sud Oranais during the great insurrection of Kabylia in 1871.

The causes of this insurrection were manifold, and, moreover, interdependent: the injury done to the military prestige of France by its defeats in Europe; the fall of the imperial government, in which, in the eyes of the natives, the authority of France was incarnate; and the insults offered with impunity in the streets by the civil population to the officers, who were loved and respected by the Arabs, at the same time that the decree of Adolphe Crémieux accorded to the Algerine Jews the rights of French citizens. The great native chiefs, bewildered and disquieted, thought themselves menaced. The insurrection was inevitable. Mokrani, bach-agha of the Mejana, whom the imperial government had loaded with honours, gave the signal. He had an interview with El Haddad, the sheikh of the *Khuans*, the religious confraternity of Sidi-Abd-er-Rahman, whose influence was great, and having secured his support in April 1871, Mokrani proclaimed the holy war. At the bidding of El Haddad the whole of Kabylia rose, and numbers of French colonists were massacred; the columns of Colonel Cérez and General F. G. Saussier had to engage in numerous fights. The death of the bach-agha at the battle of Suflat, the submission of the Sheikh El Haddad, and finally the arrest of Bu-Meyrag, brother of Mokrani, mark the declining stages of the insurrection, which was completely suppressed by August 1871. A heavy war contribution was imposed upon the rebels and their lands were sequestrated. The Beni-Manassir, who rose almost at the same time in the Dahra, were subdued soon after. Subsequently the native population of the Algerine Tell remained quiet, the massacre of the colonists at Margueritte many years later being a local and isolated movement.

Since 1870.

Under the third republic Algeria was governed successively by Admiral L. H. de Gueydon (March 1871 to June 1873), General A. E. A. Chanzy (June 1873 to February 1879), J. P. L. Albert Grévy (March 1879 to November 1881), Tirman (November 1881 to April 1891), Jules Cambon (April 1891 to September 1897), Louis Lépine (September 1897 to August 1898), E. J. Laferrière (August 1898 to October 1900), Charles Jonnart (October 1900 to June 1901), A. J. P. Révoil (June 1901 to April 1903), and again Jonnart. During the first years of the new régime a keen reaction was produced against the political system of the imperial government in Africa. The civil territory was considerably enlarged at the expense of the military. An effort was made to attract French colonists to Algeria by gratuitous concessions of land. Some lands were granted in particular to natives of Alsace-Lorraine, who preferred to retain French nationality after the war. Peasants from the south of France, whose vines had been destroyed by the phylloxera, crossed the Mediterranean and established in Algeria an important vineyard. This double current of immigration notably increased the French population of North Africa. The tendency then was to treat Algeria as a piece of France. This assimilative policy attained its culminating point in the so-called decrees of *rattachement* (1881), in pursuance of which each ministerial department in France was made responsible for Algerine affairs which came by their nature within its jurisdiction.

After a great inquiry held in 1892 by a senatorial committee a reaction was produced in France against this excessive assimilation. The system of *rattachement* was in great part abandoned, and decentralization was obtained by augmenting the powers of the governor-general, and by granting to Algeria legal personality and a special budget (see above, *Central Government*). These reforms appear to have given satisfaction to Algerian opinion. Profoundly troubled as Algeria was in the last years of the 19th century by the anti-Semitic agitation, which occasioned frequent changes of governors, it appears to-day to have turned aside from sterile political struggles to interest itself exclusively in the economic development of the country.

The movement of expansion towards the south was continued under the third republic. In 1873 General G. A. A. Gallifet entered El Golea. In 1882 the oasis of Mzab was annexed. In the Sud Oranais an insurrection, fomented by a marabout named Bu-Amama, broke out in 1881, and the insurgents massacred the European labourers engaged in the collection of alfa (or esparto) grass. But soon the French columns re-established peace, and Bu-Amama had to take refuge in Morocco. In 1883 Si-Hamza, chief of the elder branch of the Walid-sidi-Sheikh, made his submission, and since then that family has remained devoted to France.

The attempts at penetration into the extreme south, abandoned after the massacre by Tuareg of a mission sent in 1881, under Colonel Paul Flatters, to study the question of railway communication with Senegal, were begun again in 1890, in which year the British government recognized the western Sahara as within the French sphere. Since then military stations and scientific and commercial exploration have increased. But the results of these efforts remained inconsiderable until the spring of 1900, when the French authorities decided to occupy the oases of Gurara, Tuat and Tidikelt. This being accomplished by March 1901, the conquest of the Algerine Sahara was from that time completed, and nothing any longer hindered the attempts to join Algeria and the Sudan across the Sahara. (A. Gir.)

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The best general maps are those of the *Carte de l'Algérie*, in numerous sheets, on the scale of 1 : 50,000 (published by the *Service géographique de l'Armée*, Paris). (F. R. C.)

ALGHERO, a seaport and episcopal see on the W. coast of Sardinia, in the province of Sassari, 21 m. S.S.W. by rail from the town of Sassari. Pop. (1901) 10,779. The see was founded in 1503, but the cathedral itself dates from the 12th century, though it has been reconstructed. The town was strongly fortified by medieval walls, which have to some extent been demolished. It was originally founded by the Doria family of Genoa about 1102, but was occupied by the house of Aragon in 1354, who held it successfully against various attacks until it fell to the house of Savoy with the rest of Sardinia in 1720. Catalonian is still spoken here. Charles V. visited Alghero on his way to Africa in 1541. The coral and fishing industries are the most important in Alghero, but agriculture has made some progress in the district, which produces good wine. There is a large penal establishment containing over 700 convicts. Seven miles to the W.N.W. is the fine natural harbour of Porto Conte, secure in all weather, and on the W. of this harbour is the Capo Caccia, with two stalactite grottos, the finest of which, the Grotta di Nettuno, is accessible only from the sea. The important prehistoric necropolis of Anghelu Ruju was excavated in 1904 6½ m. N. of Alghero (*Notizie degli Scavi*, 1904, 301 seq.).

ALGIDUS MONS, a portion of the ridge forming the rim of the larger crater of the Alban volcano (see Albanus Mons) and more especially the eastern portion, traversed by a narrow opening (now called the Cava d'Aglio) of which the Via Latina took advantage, and which frequently appears in the early military history of Rome. That a distinct town existed (Dion. Halic. x. 21, xi. 3) on the mountain is improbable; there must have been a fortified post, but the extensive castle on the hill (Maschio d'Ariano) to the south of the Via Latina is entirely medieval, a fact which has not been recognized by some topographers.

ALGIERS (Fr. *Alger*, Arab. *Jezair*, *i.e.* The Islands), capital and largest city of Algeria, North Africa, seat of the governor-general, of a court of appeal, and of an archbishop, and station of the French XIX. *corps d'armée.* It is situated on the west side of a bay of the Mediterranean, to which it gives its name in 36° 47′ N., 3° 4′ E., and is built on the slopes of the Sahel, a chain of hills parallel to the coast. The view of the city from the sea is one of great beauty. Seen from a distance it appears like a succession of dazzling white terraces rising from the water's edge. The houses being seemingly embowered in the luxuriant verdure of the Sahel, the effect is imposing and picturesque, and has given rise to the Arab comparison of the town to a diamond set in an emerald frame. The city consists of two parts; the modern French town, built on the level ground by the seashore, and the ancient city of the deys, which climbs the steep hill behind the modern town and is crowned by the *kasbah* or citadel, 400 ft. above the sea. The kasbah forms the apex of a triangle of which the quays form the base.

Extending along the front of the town is the boulevard de la République, a fine road built by Sir Morton Peto on a series of arches, with a frontage of 3700 ft., and bordered on one side by handsome buildings, whilst a wide promenade overlooking the harbour runs along the other. Two inclined roads lead from the centre of the boulevard to the quay 40 ft. below. On the quay are the landing-stages, the custom-house and the railway station. At the southern end of the boulevard de la République is the square de la République, formerly the place Bresson, in which is the municipal theatre; at the other extremity of the boulevard is the place du Gouvernement, which is planted on three sides with a double row of plane trees and is the fashionable resort for evening promenade. The principal streets of the city meet in the place du Gouvernement: the rue Bab Azoun (Gate of Grief) which runs parallel to the boulevard de la République; the rue Bab-el-Oued (River Gate) which goes north to the site of the old arsenal demolished in 1900; the rue de la Marine which leads to the ancient harbour, and in which are the two principal mosques. A large part of the modern town lies south of the square de la République; in this quarter are the law courts, hôtel de ville, post office and other public buildings. The streets in the modern town are regularly laid out; several are arcaded on both sides.

The old town presents a strong contrast to the new town. The streets are narrow, tortuous and inaccessible to carriages. They often end in a *cul-de-sac*. The principal street is the rue de la Kasbah, which leads up to the citadel by 497 steps. The streets are joined by alleys just wide enough to pass through. The houses, built of stone and whitewashed, are square, substantial, flat-topped buildings, presenting to the street bare walls, with a few slits protected by iron gratings in place of windows. Each house has a quadrangle in the centre, into which it looks, and which is entered by a low, narrow doorway. Shops in the native quarter are simply chambers in the walls of the houses, and open at the front. In these shops the few Moorish industries are carried on, such as embroidery in gold and silver thread, the making of kid slippers of every kind and colour, the manufacture of gold and silver ornaments. To European eyes the native city, with its motley throng of Moors, Arabs, Jews and negroes, is the most interesting sight in Algiers. Various squares are set apart for markets, and here are to be witnessed scenes of the greatest animation.

The public buildings of chief interest are the kasbah, the government offices (formerly the British consulate), the palaces of the governor-general and the archbishop—all these are fine Moorish houses; the "Grand" and the "New" Mosques, the Roman Catholic cathedral of St Philippe, the church of the Holy Trinity (Church of England), and the Bibliothèque Nationale d'Alger—a Turkish palace built in 1799–1800. The kasbah was begun in 1516 on the site of an older building, and served as the palace of the deys until the French conquest. A road has been cut through the centre of the building, the mosque turned into barracks, and the hall of audience allowed to fall into ruin. There still remain a minaret and some marble arches and columns. Traces exist of the vaults in which were stored the treasures of the dey. The Grand Mosque (Jamaa-el-Kebir) is traditionally said to be the oldest mosque in Algiers. The pulpit (*mimbar*) bears an inscription showing that the building existed in 1018. The minaret was built by Abu Tachfin, sultan of Tlemçen, in 1324. The interior of the mosque is square and is divided into aisles by columns joined by Moorish arches. The principal façade, in the rue de la Marine, consists of a row of white marble columns supporting an arcade. The New Mosque (Jamaa-el-Jedid), dating from the 17th century, is in the form of a Greek cross, surmounted by a large white cupola, with four small cupolas at the corners. The minaret is 90 ft. high. The interior resembles that of the Grand Mosque. The church of the Holy Trinity (built in 1870) stands at the southern end of the rue d'Isly near the site of the demolished Fort Bab Azoun. The interior is richly decorated with various coloured marbles. Many of these marbles contain memorial inscriptions relating to the English residents (voluntary and involuntary) of Algiers from the time of John Tipton, British consul in 1580. One tablet records that in 1631 two Algerine pirate crews landed in Ireland, sacked Baltimore, and carried off its inhabitants to slavery; another recalls the romantic escape of Ida M‘Donnell, daughter of Admiral Ulric, consul-general of Denmark, and wife of the British consul. When Lord Exmouth was about to bombard the city in 1816, the British consul was thrown into prison and loaded with chains. Mrs. M‘Donnell—who was but sixteen—escaped to the British fleet disguised as a midshipman, carrying a basket of vegetables in which her baby was hidden. (Mrs. M‘Donnell subsequently married the duc de Talleyrand-Perigord and died at Florence in 1880). Among later residents commemorated is Edward Lloyd, who was the first person to show the value of esparto grass for the manufacture of paper, and thus started an industry which is one of the most important in Algeria.

The cathedral of St Philippe, built on the site of a mosque, is in the place Malakoff, next to the governor-general's palace. In its construction an attempt has been made to produce a building suitable for Christian worship whilst the architecture is Moorish in style. The principal entrance, reached by a flight of 23 steps, is ornamented with a portico supported by four black-veined marble columns. The roof of the nave is of Moorish plaster work. It rests on a series of arcades supported by white marble columns. Several of these columns belonged to the former mosque. In one of the chapels is a tomb containing the bones of San Geronimo. The finding of the remains of the saint in 1853 afforded striking confirmation of an incident recorded by a Spanish Benedictine named Haedo, who published a topography of Algeria in 1612. Haedo sets forth that a young Arab who had embraced Christianity and had been baptized with the name of Geronimo was captured by a Moorish corsair in 1569 and taken to Algiers. The Arabs endeavoured to induce Geronimo to renounce Christianity, but as he steadfastly refused to do so he was condemned to death. Bound hand and foot he was thrown alive into a mould in which a block of concrete was about to be made. The block containing his body was built into an angle of the Fort of the Twenty-four Hours, then under construction. In 1853 the Fort of the Twenty-four Hours was demolished, and in the angle specified by Haedo the skeleton of Geronimo was found. The bones were interred at St Philippe. Into the mould left by the saint's body liquid plaster of Paris was run, and a perfect model obtained, showing the features of the youth, the cords which bound him, and even the texture of his clothing. This model is now in the museum at Mustapha (see below).

Algiers possesses a college with schools of law, medicine, science and letters. The college buildings are large and handsome. There is also a lycée in which the instruction is similar to that given in France, and in which Christians, Jews and Mahommedans are educated together. The museum (a state institution), formerly housed in the same building as the library, was transferred in 1897 to a new building in the suburb of Mustapha Supérieur. In the museum are some of the ancient sculptures and mosaics discovered in Algeria, together with medals and Algerian money. New buildings, to contain specimens of Moslem art, were added in 1903.

The port of Algiers is sheltered from all winds. There are two harbours, both artificial—the old or northern harbour and the southern or Agha harbour. The northern harbour covers an area of 235 acres. The depth at the entrance is 72 to 108 ft., and in port from 36 to 66 ft. Two government dry docks are available for merchant vessels. The quays cover 18,000 sq. yds. There are three jetties, north, east and south. Within this harbour is the small harbour of the deys, now transformed into a wet dock. An opening in the south jetty affords an entrance into Agha harbour, constructed in Agha Bay. This harbour is formed by the projection of a mole, 2500 ft. in length, from the eastern jetty of the old harbour. It provides extensive quayage with a minimum depth of water of 28 ft. Agha harbour has also an independent entrance on its southern side. Algiers is the chief coaling station in the Mediterranean, having become so largely at the expense of Gibraltar. In other respects the trade resembles that of other Algerian ports. (For trade statistics see Algeria.) The inner harbour was begun in 1518 by Khair-ed-Din (see *History*, below), who, to accommodate his pirate vessels, caused the island on which was Fort Penon to be connected with the mainland by a mole. The lighthouse which occupies the site of Fort Penon was built in 1544. Work on the northern harbour was begun in 1836, on the southern in 1904. Algiers maintains communication with Marseilles by a quick service of steamers, which run the 497 miles across the Mediterranean in twenty-eight to thirty hours. The journey between Algiers and Paris, from which it is distant 1031 miles, is accomplished in about forty-five hours.

Algiers was a walled city from the time of the deys until the close of the 19th century. The French, after their occupation of the city (1830), built a rampart, parapet and ditch, with two terminal forts, Bab Azoun to the south and Bab-el-Oued to the north. The forts and part of the ramparts were demolished at the beginning of the 20th century, when a line of forts occupying the heights of Bu Zarea (at an elevation of 1300 ft. above the sea) took their place.

Owing to the mildness of its climate Algiers has become a favourite resort for those seeking to escape the rigours of a European winter. The city is well supplied with water and its sanitary state is good. The mistral of the Riviera is entirely absent from Algiers, but in summer the city occasionally suffers from the sirocco or desert wind. The environs of Algiers are noted for their beauty and healthiness. Of the suburbs the most picturesque is Mustapha Supérieur, about 2 m. from the centre of the city on the slopes of the hills to the south. Here are the summer palace of the governor-general, many fine Moorish and French villas and luxurious hotels, all surrounded by beautiful gardens. A numerous British colony resides at Mustapha, where there is an English club. Mustapha Inférieur is built on the lower slopes of the hills. Farther to the south is the large Jardin d'Essai, containing five avenues of palms, planes, bamboos and magnolias. Notre-Dame d'Afrique, a church built (1858–1872) in a mixture of the Roman and Byzantine styles, is conspicuously situated, overlooking the sea, on the shoulder of the Bu Zarea hills, 2 m. to the north of the city. Above the altar is a statue of the Virgin depicted as a black woman. The church also contains a solid silver statue of the archangel Michael, belonging to the confraternity of Neapolitan fishermen. Beyond Notre-Dame d'Afrique is the beautiful Valley of the Consuls, very little changed since the time of the deys. (The valley was in those days the favourite residence of the consuls.) At the Petit Séminaire, on the site of the old French consulate, Cardinal Lavigerie died (1892).

In 1906 the population of the commune of Algiers was 154,049; the *population municipale*, which excludes the garrison, prisoners, &c., was 145,280. Of this total 138,240 were living in the city proper or in Mustapha. Of the inhabitants 105,908 were Europeans. French residents numbered 50,996, naturalized Frenchmen 23,305, Spaniards 12,354, Italians 7368, Maltese 865, and other Europeans (chiefly British and Germans) 1652, besides 12,490 Jews. The remainder of the population—all Mahommedans—are Moors, Arabs, Berbers, Negroes, with a few Turks. The vast majority of the Europeans are Roman Catholics. Most of the naturalized French citizens are of Spanish or Italian origin.

History.—In Roman times a small town called Icosium existed on what is now the marine quarter of the city. The rue de la Marine follows the lines of a Roman street. Roman cemeteries existed near the rues Bab-el-Oued and Bab Azoun. Bishops of Icosium—which was created a Latin city by Vespasian—are mentioned as late as the 5th century. The present city was founded in 944 by Bulukkin b. Zeiri, the founder of the Zeirid-Sanhaja dynasty, which was overthrown by Roger II. of Sicily in 1148 (see FATIMITES). The Zeirids had before that date lost Algiers, which in 1159 was occupied by the Almohades, and in the 13th century came under the dominion of the Abd-el-Wahid, sultans of Tlemçen. Nominally part of the sultanate of Tlemçen, Algiers had a large measure of independence under amirs of its own, Oran being the chief seaport of the Abd-el-Wahid. The islet in front of the harbour, subsequently known as the Penon, had been occupied by the Spaniards as early as 1302. Thereafter a considerable trade grew up between Algiers and Spain. Algiers, however, continued of comparatively little importance until after the expulsion from Spain of the Moors, many of whom sought an asylum in the city. In 1510, following their occupation of Oran and other towns on the coast of Africa, the Spaniards fortified the Penon. In 1516 the amir of Algiers, Selim b. Teumi, invited the brothers Arouj and Khair-ed-Din (Barbarossa) to expel the Spaniards. Arouj came to Algiers, caused Selim to be assassinated, and seized the town. Khair-ed-Din, succeeding Arouj, drove the Spaniards from the Penon (1530) and was the founder of the pashalik, afterwards deylik, of Algeria. Algiers from this time became the chief seat of the Barbary pirates. In October 1541 the emperor Charles V. sought to capture the city, but a storm destroyed a great number of his ships, and his army of some 30,000, chiefly Spaniards, was defeated by the Algerians under their pasha, Hassan. Repeated attempts were made by various European nations to subdue the pirates, and in 1816 the city was bombarded by a British squadron under Lord Exmouth, assisted by Dutch men-of-war, and the corsair fleet burned. The piracy of the Algerians was renewed and continued until 1830. On the 4th of July in that year a French army under General de Bourmont attacked the city, which capitulated on the following day (see ALGERIA, *History*).

ALGOA BAY, a wide, shallow bay of South Africa, 436 m. E. from the Cape of Good Hope, bounded W. by Cape Recife, E. by Cape Padrone. St Croix Island in the bay is in 33° 47′ S. 25° 46′ E. On this island Bartholomew Diaz made his second landing in South Africa some time after the 3rd of February 1488, and from the cross which he is thought to have erected on it the island gets its name. Algoa Bay was the first landing-place of the British emigrants to the eastern province of Cape Colony in 1820. At a spot 6 m. N.E. of Cape Recife these emigrants founded a town, Port Elizabeth (*q.v.*), its harbour being sheltered from all winds save the S.E. By seafarers "Algoa Bay" is used as synonymous with Port Elizabeth.

ALGOL, the Arabic name (signifying "the Demon") of β Persei, a star of the second magnitude, noticed by G. Montanari in 1669 to fluctuate in brightness. John Goodricke established in 1782 the periodicity of its change in about $2^d\ 21^h$, and suggested their cause in recurring eclipses by a large dark satellite. Their intermittent character prompted the supposition. The light of Algol remains constant during close upon 56 hours; then declines in $6\frac{1}{2}$ hours (approximately) to nearly one-fourth its normal amount, and is restored by sensibly the same gradations. The amplitude of the phase is 1·1 magnitude; and the absence of any stationary interval at minimum proves the eclipse to be partial, not annular. Its conditions were investigated from photometric data, by Professor E. C. Pickering in 1880;[1] and their realization was finally demonstrated by Dr H. C. Vogel's spectroscopic measures in 1889.[2] Previously to each obscuration, the star was found to be moving rapidly away from the earth; its velocity then diminished to zero *pari passu* with the loss of light, and reversed its direction during the process of recovery. Algol, in fact, travels at the rate of 26·3 miles a second round the centre of gravity of the system which it forms with an invisible companion, while the two together approach the sun with an unvarying speed of 2·3 miles per second. The elements of this disparate pair, calculated by Dr Vogel on the somewhat precarious assumption that its dark and bright members are of equal mean density, are as follows:—

Diameter of Algol	1,061,000 English miles.
,, Satellite . . .	834,300 ,, ,,
Distance from centre to centre .	3,230,000 ,, ,,
Mass of Algol	$\frac{4}{9}$ solar mass.
,, Satellite	$\frac{2}{9}$,, ,,
Mean density	about $\frac{1}{4}$ solar.

The plane of the joint orbit, in which no deviation from circularity has yet been detected, nearly coincides with the line of sight. The period of Algol, as measured by its eclipses, is subject to complex irregularities. It shortened fitfully by eight seconds between 1790 and 1879; soon afterwards, restoration set in, and its exact length in 1903 was $2^d\ 20^h\ 48^m\ 56^s$, being only two seconds short of its original value. By an exhaustive discussion, Dr S. Chandler ascertained in 1888 the compensatory nature of these disturbances;[3] and he afterwards found the most important among several which probably conspire to produce the observed effects, to be comprised in a period of 15,000 light-cycles, equivalent to 118 years.[4] An explanatory hypothesis, propounded by him in 1892,[5] is still on its trial. The system of Algol, according to this view, is triple; it includes a large, obscure primary, round which the eclipsing pair revolves in an orbit somewhat smaller than that of Uranus, very slightly elliptical, and inclined 20° to the line of sight, the periodic time being 118 years. The alternate delay and acceleration of the eclipses are then merely apparent; they represent the changes in the length of the light-journey as the stars perform their wide circuit. If these suppositions have a basis of reality, the proper motion of Algol should be disturbed by a small, but measurable undulation, corresponding to the projection of its orbit upon the sky; and although certainty on the point cannot be attained for some years to come, Lewis Boss regarded the evidence available in 1895 as tending to confirm Dr Chandler's theory.[6]

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[1] *Proceedings Amer. Acad.* vol. xvi. p. 27.

[2] *Astr. Nach.* No. 2947.

[3] *Astr. Journal*, No. 165.

[4] *Ibid.* No. 509.

[5] *Ibid.* Nos. 255–256.

[6] *Ibid.* No. 343.

A rival interpretation of the phenomena it dealt with was put forward by F. Tisserand in 1895.[1] It involved the action of no third mass, but depended solely upon the progression of the line of apsides in a moderately elliptical orbit due to the spheroidal shape of the globes traversing it. Inequalities of the required sort in the returns of the eclipses would ensue; moreover, their duration should concomitantly vary with the varying distance from periastron at the times of their occurrence. It is a moot question whether changes of the latter kind actually occur. When they are proved to do so, Tisserand's hypothesis will hold the field.

Algol gives a helium-spectrum which undergoes no alteration at minimum. Hence the light from the marginal and central portions of the disc is identical in quality, and the limb can be little, if at all, darkened by the "smoke-veil" absorption conspicuous in the sun. The rays of this star spend close upon a century in travelling hither. Dr Chase's measures with the Yale heliometer indicated for it, in 1894, a parallax of about 0″·035;[2] and it must, accordingly, be of nearly four times the total brightness of Sirius, while its aerial lustre exceeds seventy-fold that of the solar photosphere. Variables of the Algol class are rendered difficult to discover by the incidental character of their fluctuations. At the end of 1905, however, about 37 had been certainly recognized, besides some outlying cases of indeterminate type, in which continuous occultations by two bright stars, revolving in virtual contact, are doubtfully supposed to be in progress. (A. M. C.)

ALGONQUIN, or ALGONKIN (a word formerly regarded as a French contraction of *Algomequin*, "those on the other side" of the river, viz. the St Lawrence, but now believed to be from the Micmac *algoomaking*—"at the place of spearing fish"), a collective term for a number of tribes of North American Indians dwelling in the valley of the Ottawa river and around the northern tributaries of the St Lawrence. The Algonquins allied themselves with the French against the Iroquois. Many were driven west by the latter and later became known as Ottawa. The French missionaries at work among the Algonquins early in the 17th century found their language to be the key to the many Indian dialects now included by philologists under the general term "Algonquian stock." The chief tribes included in this stock were the Algonquin, Malecite, Micmac, Nascapi, Pennacook, Fox, Kickapoo, Delaware, Cheyenne, Conoy, Cree, Mohican, Massachuset, Menominee, Miami, Misisaga, Mohegan, Nanticoke, Narraganset, Nipmuc, Ojibway, Ottawa, Pequot, Potawatami, Sac, Shawnee and Wampanoag. The Indians of Algonquian stock number between 80,000 and 90,000, of whom rather more than half are in the United States, the rest being in Canada. Of the Algonquins proper there remain about 1500 settled in the provinces of Quebec and Ontario.

For details see *Handbook of American Indians*, ed. F. W. Hodge, Washington, 1907.

ALGUAZIL, a Spanish title often to be met in stories and plays, derived from the Arabic "*visir*" and the article "*al*." The alguazil among the early Spaniards was a judge, and sometimes the governor of a town or fortress. In later times he has gradually sunk down to the rank of an officer of the court, who is trusted with the service of writs and certain police duties, but he is still of higher rank than the mere *corchete* or catch-poll. The title has also been given to inspectors of weights and measures in market-places, and similar officials.

ALGUM, or ALMUG TREE. The Hebrew words *Algummim* or *Almuggim* are translated Algum or Almug trees in the authorized version of the Bible (see 1 Kings x. 11, 12; 2 Chron. ii. 8, and ix. 10, 11); *almug* is an erroneous form (see Max Müller, *Science of Language*, vol. i.). The wood of the tree was very precious, and was brought from Ophir (probably some part of India), along with gold and precious stones, by Hiram, and was used in the formation of pillars for the temple at Jerusalem and for the king's house, also for the inlaying of stairs, as well as for harps and psalteries. It is probably the red sanders or red sandal-wood of India (*Pterocarpus santalinus*). This tree belongs to the natural order Leguminosae, sub-order Papilionaceae. The wood is hard, heavy, close-grained and of a fine red colour. It is different from the white fragrant sandal-wood, which is the produce of *Santalum album*, a tree belonging to a distinct natural order Santalaceae.

ALHAMA DE GRANADA, a town of southern Spain, in the province of Granada, 24 m. S.W. of Granada. Pop. (1900) 7679. Alhama is finely situated on a ledge of rock which overlooks a deep gorge traversed by the river Marchan or Alhama; while the rugged peaks of the Sierra de Alhama rise behind it to a height of 6800 ft. The town is largely modern; for over one thousand of its picturesque old Moorish houses, which formerly rose in terraces up the mountain side, were destroyed, together with five churches, the hospital, the theatre, the prison, and 800 of the inhabitants, in an earthquake which took place in 1884. Subscriptions were received from all parts of Spain, and the present town was built at a little distance from its predecessor. Few vestiges of antiquity survived, except the baths from which Alhama (in Arabic "the Bath") derives its name. These are situated near the river, and appear to have been used continuously since Roman times (*c.* 19 B.C.—A.D. 409). The temperature of the hot sulphurous springs is about 112° F.; and, as the waters are considered beneficial in cases of rheumatism and dyspepsia, many visitors come to Alhama in spring and autumn, attracted also by the fine scenery of the district. In the 15th century Alhama, and the neighbouring fortress of Loja (*q.v.*), were generally regarded as the keys of the kingdom of Granada, and their capture went far to insure the overthrow of the Moorish power. Alhama was taken by the Spanish marquis of Cadiz in 1482; and its fall is celebrated in an ancient ballad, *Ay de mi, Alhama*, which Byron translated into English.

ALHAMBRA, THE, an ancient palace and fortress of the Moorish monarchs of Granada, in southern Spain, occupying a hilly terrace on the south-eastern border of the city of Granada. This terrace or plateau, which measures about 2430 ft. in length by 674 ft. at its greatest width, extends from W.N.W. to E.S.E., and covers an area of about 35 acres. It is enclosed by a strongly fortified wall, which is flanked by thirteen towers. The river Darro, which foams through a deep ravine on the north, divides the plateau from the Albaicin district of Granada; the Assabica valley, containing the Alhambra Park, on the west and south, and beyond this valley the almost parallel ridge of Monte Mauror, separate it from the Antequeruela district.

The name *Alhambra*, signifying in Arabic "the red," is probably derived from the colour of the sun-dried *tapia*, or bricks made of fine gravel and clay, of which the outer walls are built. Some authorities, however, hold that it commemorates the red flare of the torches by whose light the work of construction was carried on nightly for many years; others associate it with the name of the founder, Mahomet Ibn Al Ahmar; and others derive it from the Arabic *Dar al Amra*, "House of the Master." (For an account of the period to which the Alhambra belongs, see GRANADA (city).) The palace was built chiefly between 1248 and 1354, in the reigns of Al Ahmar and his successors; but even the names of the principal artists employed are either unknown or doubtful. The splendid decorations of the interior are ascribed to Yusef I., who died in 1354. Immediately after the expulsion of the Moors in 1492, their conquerors began, by successive acts of vandalism, to spoil the marvellous beauty of the Alhambra. The open work was filled up with whitewash, the painting and gilding effaced, the furniture soiled, torn or removed. Charles V. (1516–1556) rebuilt portions in the modern style of the period, and destroyed the greater part of the winter palace to make room for a modern structure which has never been completed. Philip V. (1700–1746) Italianised the rooms, and completed the degradation by running up partitions which blocked up whole apartments, gems of taste and patient ingenuity. In subsequent centuries the carelessness of the Spanish authorities permitted this masterpiece of Moorish art to be still further defaced; and in 1812 some of the towers were blown up by the French under Count Sebastiani, while the whole buildings narrowly escaped the same fate. In

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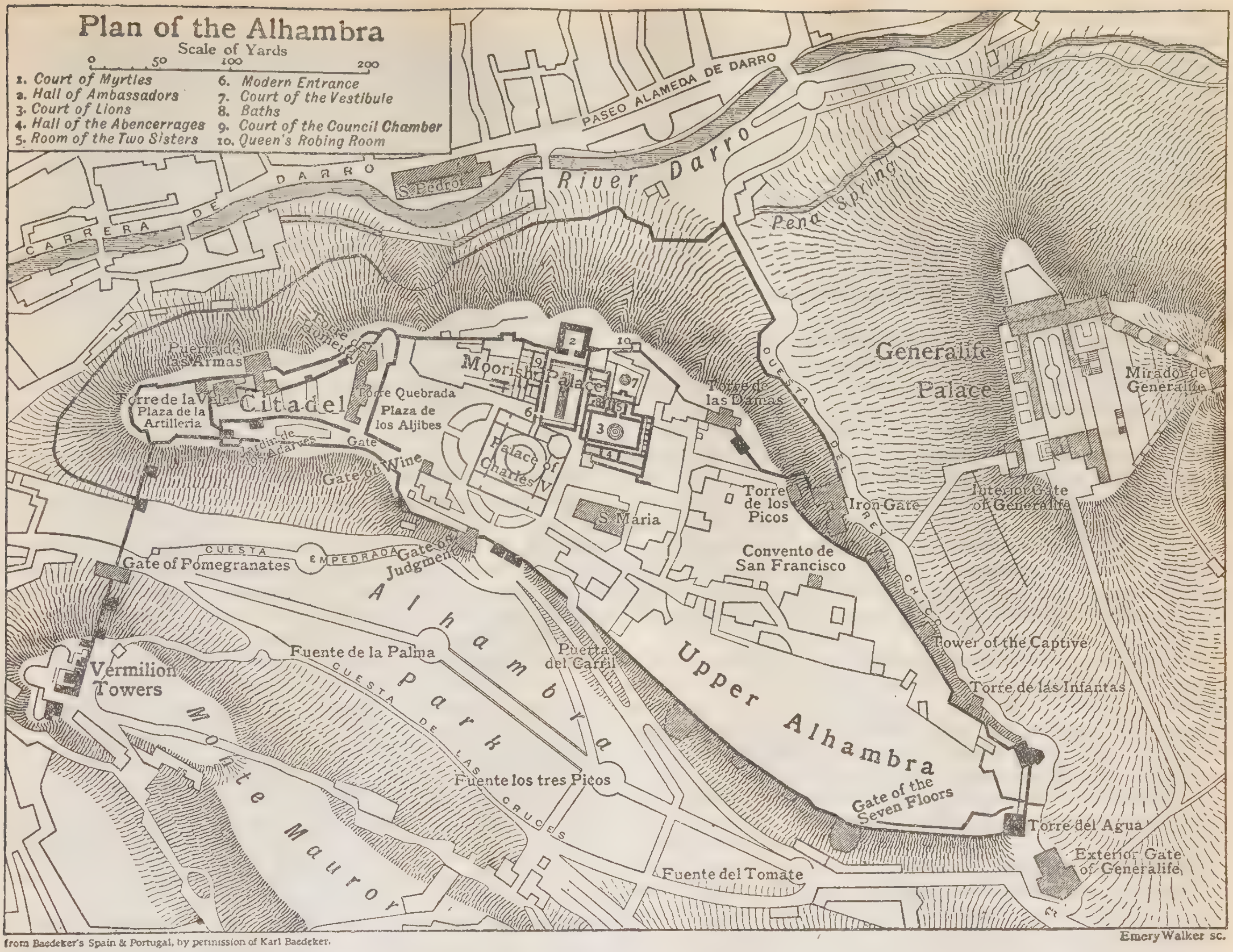
[1] *Comptes Rendus*, t. cxx. p. 125.

[2] *Astr. Jour.* No. 318.


Plan of the Alhambra
Scale of Yards
0 50 100 200
1. Court of Myrtles
2. Hall of Ambassadors
3. Court of Lions
4. Hall of the Abencerrages
5. Room of the Two Sisters
6. Modern Entrance
7. Court of the Vestibule
8. Baths
9. Court of the Council Chamber
10. Queen's Robing Room
PASEO ALAMEDA DE DARRO
River Darro
CARRERA DE DARRO
S. Pedro
Pena Spring
Generalife Palace
Mirador de Generalife
Cuesta del Rey Chico
Torre del Homenaje
Puerta de las Armas
Torre de la Vela
Plaza de la Artilleria
Citadel
Torre Quebrada
Plaza de los Aljibes
Jardin de los Adarves
Gate
Moorish Palace
Torre de las Damas
Palace of Charles V
Gate of Wine
S. Maria
Torre de los Picos
Iron Gate
Interior Gate of Generalife
Convento de San Francisco
Cuesta Empedrada
Gate of Pomegranates
Gate of Judgment
Alhambra Park
Upper Alhambra
Tower of the Captive
Torre de las Infantas
Vermilion Towers
Fuente de la Palma
Cuesta de las Cruces
Puerta del Carril
Monte Mauror
Fuente los tres Picos
Gate of the Seven Floors
Torre del Agua
Exterior Gate of Generalife
Fuente del Tomate

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Emery Walker sc.

1821 an earthquake caused further damage. The work of restoration undertaken in 1828 by the architect José Contreras was endowed in 1830 by Ferdinand VII.; and after the death of Contreras in 1847, it was continued with fair success by his son Rafael (d. 1890), and his grandson Mariano.

The situation of the Alhambra is one of rare natural beauty; the plateau commands a wide view of the city and plain of Granada, towards the west and north, and of the heights of the Sierra Nevada, towards the east and south. Moorish poets describe it as "a pearl set in emeralds," in allusion to the brilliant colour of its buildings, and the luxuriant woods round them. The park (Alameda de la Alhambra), which in spring is overgrown with wild-flowers and grass, was planted by the Moors with roses, oranges and myrtles; its most characteristic feature, however, is the dense wood of English elms brought hither in 1812 by the duke of Wellington. The park is celebrated for the multitude of its nightingales, and is usually filled with the sound of running water from several fountains and cascades. These are supplied through a conduit 5 m. long, which is connected with the Darro at the monastery of Jesus del Valle, above Granada.

The Moorish portion of the Alhambra resembles many medieval Christian strongholds in its threefold arrangement as a castle, a palace and a residential annexe for subordinates. The Alcazába or citadel, its oldest part, is built on the isolated and precipitous foreland which terminates the plateau on the north-west. Only its massive outer walls, towers and ramparts are left. On its watch-tower, the Torre de la Vela, 85 ft. high, the flag of Ferdinand and Isabella was first raised, in token of the Spanish conquest of Granada, on the 2nd of January 1492. A turret containing a huge bell was added in the 18th century, and restored after being injured by lightning in 1881. Beyond the Alcazába is the palace of the Moorish kings, or Alhambra properly so-called; and beyond this, again, is the Alhambra Alta (Upper Alhambra), originally tenanted by officials and courtiers.

In spite of the long neglect, wilful vandalism and ill-judged restoration which the Alhambra has endured, it remains the most perfect example of Moorish art in its final European development,—freed from the direct Byzantine influences which can be traced in the cathedral of Cordova, more elaborate and fantastic than the Giralda at Seville. The majority of the palace buildings are, in ground-plan, quadrangular, with all the rooms opening on to a central court; and the whole reached its present size simply by the gradual addition of new quadrangles, designed on the same principle, though varying in dimensions, and connected with each other by smaller rooms and passages. In every case the exterior is left plain and austere, as if the architect intended thus to heighten by contrast the splendour of the interior. Within, the palace is unsurpassed for the exquisite detail of its marble pillars and arches, its fretted ceilings and the veil-like transparency of its filigree work in stucco. Sun and wind are freely admitted, and the whole effect is one of the most airy lightness and grace. Blue, red, and a golden yellow, all somewhat faded through lapse of time and exposure, are the colours chiefly employed. The decoration consists, as a rule, of stiff, conventional foliage, Arabic inscriptions, and geometrical patterns wrought into arabesques of almost incredible intricacy and ingenuity. Painted tiles are largely used as panelling for the walls.

Access from the city to the Alhambra Park is afforded by the Puerta de las Granadas (Gate of Pomegranates), a massive triumphal arch dating from the 15th century. A steep ascent leads past the Pillar of Charles V., a fountain erected in 1554, to the main entrance of the Alhambra. This is the Puerta Judiciaria

(Gate of Judgment), a massive horseshoe archway, surmounted by a square tower, and used by the Moors as an informal court of justice. A hand, with fingers outstretched as a talisman against the evil eye, is carved above this gate on the exterior; a key, the symbol of authority, occupies the corresponding place on the interior. A narrow passage leads inward to the Plaza de los Aljibes (Place of the Cisterns), a broad open space which divides the Alcazába from the Moorish palace. To the left of the passage rises the Torre del Vino (Wine Tower), built in 1345, and used in the 16th century as a cellar. On the right is the palace of Charles V., a cold-looking but majestic Renaissance building, out of harmony with its surroundings, which it tends somewhat to dwarf by its superior size. Its construction, begun in 1526, was abandoned about 1650.

The present entrance to the Palacio Arabe, or Casa Real (Moorish palace), is by a small door from which a corridor conducts to the Patio de los Arrayanes (Court of the Myrtles), also called the Patio de la Alberca (Court of the Blessing or Court of the Pond), from the Moorish *birka*, "pond," or *berka*, "blessing." This court is 140 ft. long by 74 ft. broad; and in the centre there is a large pond set in the marble pavement, full of goldfish, and with myrtles growing along its sides. There are galleries on the north and south sides; that on the south 27 ft. high, and supported by a marble colonnade. Underneath it, to the right, was the principal entrance, and over it are three elegant windows with arches and miniature pillars. From this court the walls of the Torre de Comares are seen rising over the roof to the north, and reflected in the pond.

The Sala de los Ambajadores (Hall of the Ambassadors) is the largest in the Alhambra, and occupies all the Torre de Comares. It is a square room, the sides being 37 ft. in length, while the centre of the dome is 75 ft. high. This was the grand reception room, and the throne of the sultan was placed opposite the entrance. The tiles are nearly 4 ft. high all round, and the colours vary at intervals. Over them is a series of oval medallions with inscriptions, interwoven with flowers and leaves. There are nine windows, three on each façade, and the ceiling is admirably diversified with inlaid-work of white, blue and gold, in the shape of circles, crowns and stars—a kind of imitation of the vault of heaven. The walls are covered with varied stucco-work of most delicate pattern, surrounding many ancient escutcheons.

The celebrated Patio de los Leones (Court of the Lions) is an oblong court, 116 ft. in length by 66 ft. in breadth, surrounded by a low gallery supported on 124 white marble columns. A pavilion projects into the court at each extremity, with filigree walls and light domed roof, elaborately ornamented. The square is paved with coloured tiles, and the colonnade with white marble; while the walls are covered 5 ft. up from the ground with blue and yellow tiles, with a border above and below enamelled blue and gold. The columns supporting the roof and gallery are irregularly placed, with a view to artistic effect; and the general form of the piers, arches and pillars is most graceful. They are adorned by varieties of foliage, &c.; about each arch there is a large square of arabesques; and over the pillars is another square of exquisite filigree work. In the centre of the court is the celebrated Fountain of Lions, a magnificent alabaster basin supported by the figures of twelve lions in white marble, not designed with sculptural accuracy, but as emblems of strength and courage.

The Sala de los Abencerrajes (Hall of the Abencerrages) derives its name from a legend according to which Boabdil, the last king of Granada, having invited the chiefs of that illustrious line to a banquet, massacred them here. This room is a perfect square, with a lofty dome and trellised windows at its base. The roof is exquisitely decorated in blue, brown, red and gold, and the columns supporting it spring out into the arch form in a remarkably beautiful manner. Opposite to this hall is the Sala de las dos Hermanas (Hall of the two Sisters), so-called from two very beautiful white marble slabs laid as part of the pavement. These slabs measure 15 ft. by 7½ ft., and are without flaw or stain. There is a fountain in the middle of this hall, and the roof—a dome honeycombed with tiny cells, all different, and said to number 5000—is a magnificent example of the so-called "stalactite vaulting" of the Moors.

Among the other wonders of the Alhambra are the Sala de la Justicia (Hall of Justice), the Patio del Mexuar (Court of the Council Chamber), the Patio de Daraxa (Court of the Vestibule), and the Peinador de la Reina (Queen's Robing Room), in which are to be seen the same delicate and beautiful architecture, the same costly and elegant decorations. The palace and the Upper Alhambra also contain baths, ranges of bedrooms and summer-rooms, a whispering gallery and labyrinth, and vaulted sepulchres.

The original furniture of the palace is represented by the celebrated vase of the Alhambra, a splendid specimen of Moorish ceramic art, dating from 1320, and belonging to the first period of Moorish porcelain. It is 4 ft. 3 in. high; the ground is white, and the enamelling is blue, white and gold.

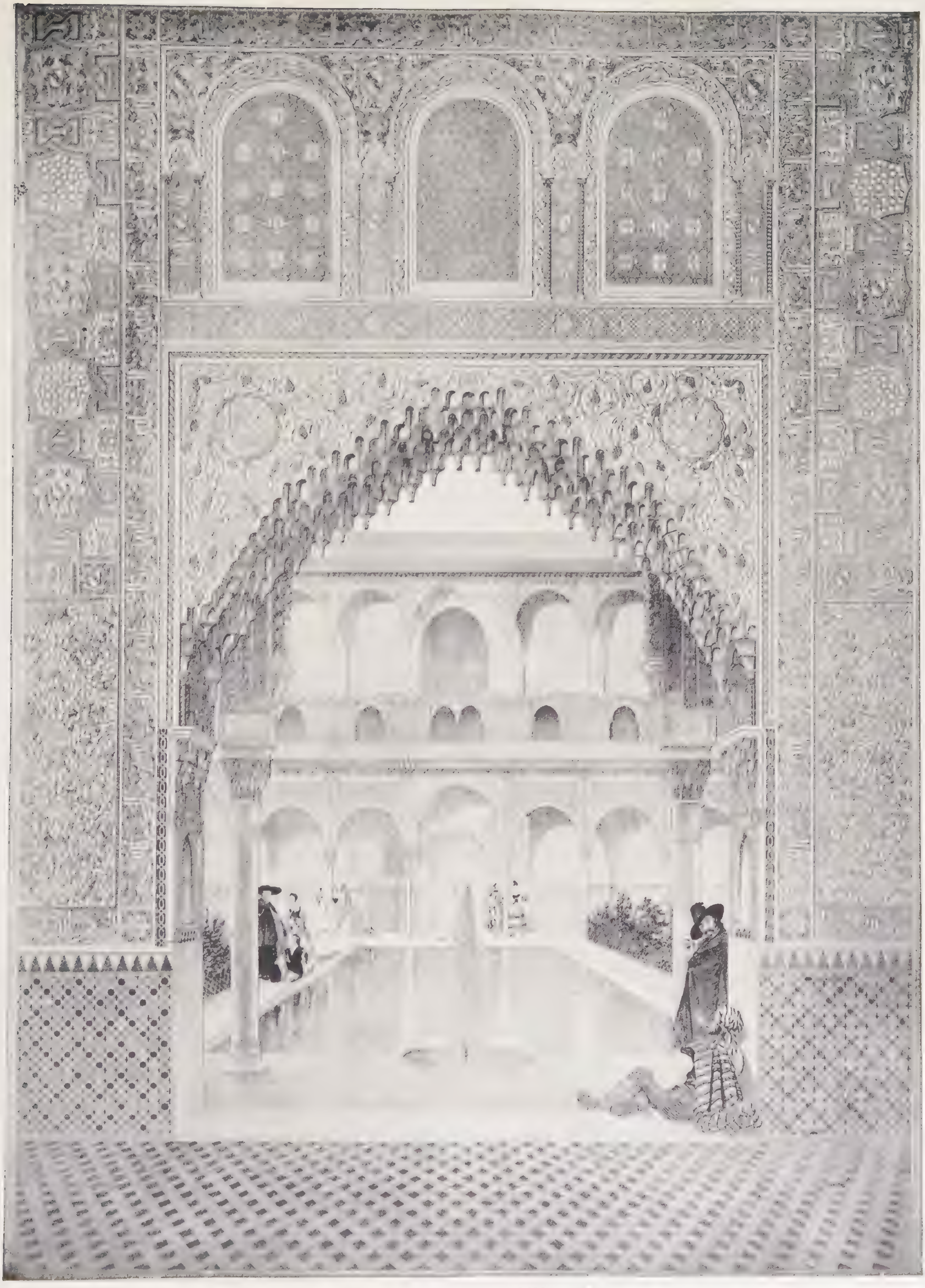
Of the outlying buildings in connexion with the Alhambra, the foremost in interest is the Palacio de Generalife or Gineralife (the Moorish *Jennat al Arif*, "Garden of Arif," or "Garden of the Architect"). This villa probably dates from the end of the 13th century, but has been several times restored. Its gardens, however, with their clipped hedges, grottos, fountains, and cypress avenues, are said to retain their original Moorish character. The Villa de los Martires (Martyrs' Villa), on the summit of Monte Mauror, commemorates by its name the Christian slaves who were employed to build the Alhambra, and confined here in subterranean cells. The Torres Bermejas (Vermilion Towers), also on Monte Mauror, are a well-preserved Moorish fortification, with underground cisterns, stables, and accommodation for a garrison of 200 men. Several Roman tombs were discovered in 1829 and 1857 at the base of Monte Mauror.

See *Plans, Elevations, Sections and Details of the Alhambra; from drawings taken on the spot by J. Goury and Owen Jones; with a complete translation of the Arabic inscriptions and a historical notice of the Kings of Granada, by P. de Gayangos*. These two magnificent folios, though first published in London between 1842 and 1845, give the best pictorial representation of the Alhambra. See also Rafael Contreras, *La Alhambra, El Alcázar, y la gran Mezquita de Occidente* (Madrid, 1885); *The Alhambra*, by Washington Irving, was written in 1832, and rewritten in 1857, when it had already become widely celebrated for its picturesque and humorous descriptions. A well-illustrated edition was published in London in 1896.

ALHAZEN (Abu Ali Al-Hasan Ibn Alhasan), Arabian mathematician of the 11th century, was born at Basra and died at Cairo in 1038. He is to be distinguished from another Alhazen who translated Ptolemy's *Almagest* in the 10th century. Having boasted that he could construct a machine for regulating the inundations of the Nile, he was summoned to Egypt by the caliph Hakim; but, aware of the impracticability of his scheme, and fearing the caliph's anger, he feigned madness until Hakim's death in 1021. Alhazen was, nevertheless, a diligent and successful student, being the first great discoverer in optics after the time of Ptolemy. According to Giovanni Battista della Porta, he first explained the apparent increase of heavenly bodies near the horizon, although Bacon gives the credit of this discovery to Ptolemy. He taught, previous to the Polish physicist Witelo, that vision does not result from the emission of rays from the eye, and wrote also on the refraction of light, especially on atmospheric refraction, showing, *e.g.* the cause of morning and evening twilight. He solved the problem of finding the point in a convex mirror at which a ray coming from one given point shall be reflected to another given point. His treatise on optics was translated into Latin by Witelo (1270), and afterwards published by F. Risner in 1572, with the title *Opticae thesaurus Alhazeni libri VII., cum ejusdem libro de crepusculis et nubium ascensionibus*. This work enjoyed a great reputation during the middle ages. Works on geometrical subjects were found in the *Bibliothèque nationale de Paris* in 1834 by E. A. Sédillot; other manuscripts are preserved in the Bodleian library at Oxford and in the library of Leiden.

See Casiri, *Bibl. Arab. Hisp. Escur.*; J. E. Montucla, *Histoire des mathématiques* (1758); and E. A. Sédillot, *Matériaux pour l'histoire des sciences mathématiques*.

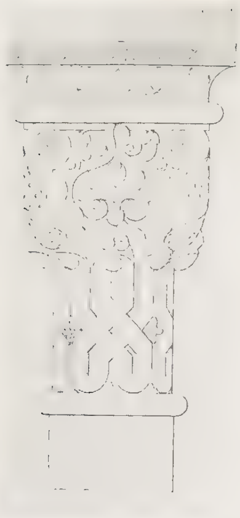
ALI, in full, ʽAli ben Abū Talib (*c.* 600–661), the fourth of the caliphs or successors of Mahomet, was born at Mecca about



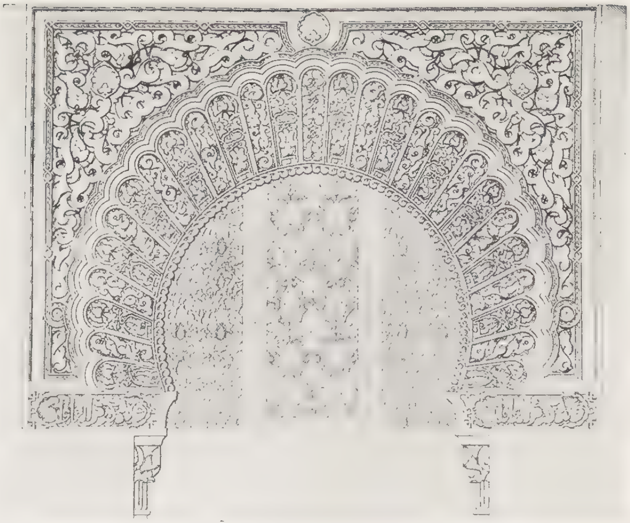
THE COURT OF THE MYRTLES.

From Gayangos and Owen Jones, *The Alhambra.*

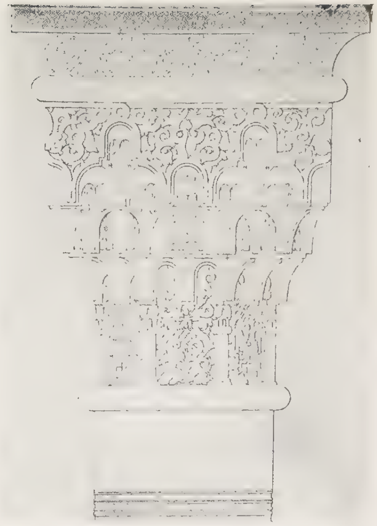
ALHAMBRA



CAPITAL IN THE COURT OF THE LIONS.



PRAYER NICHE.



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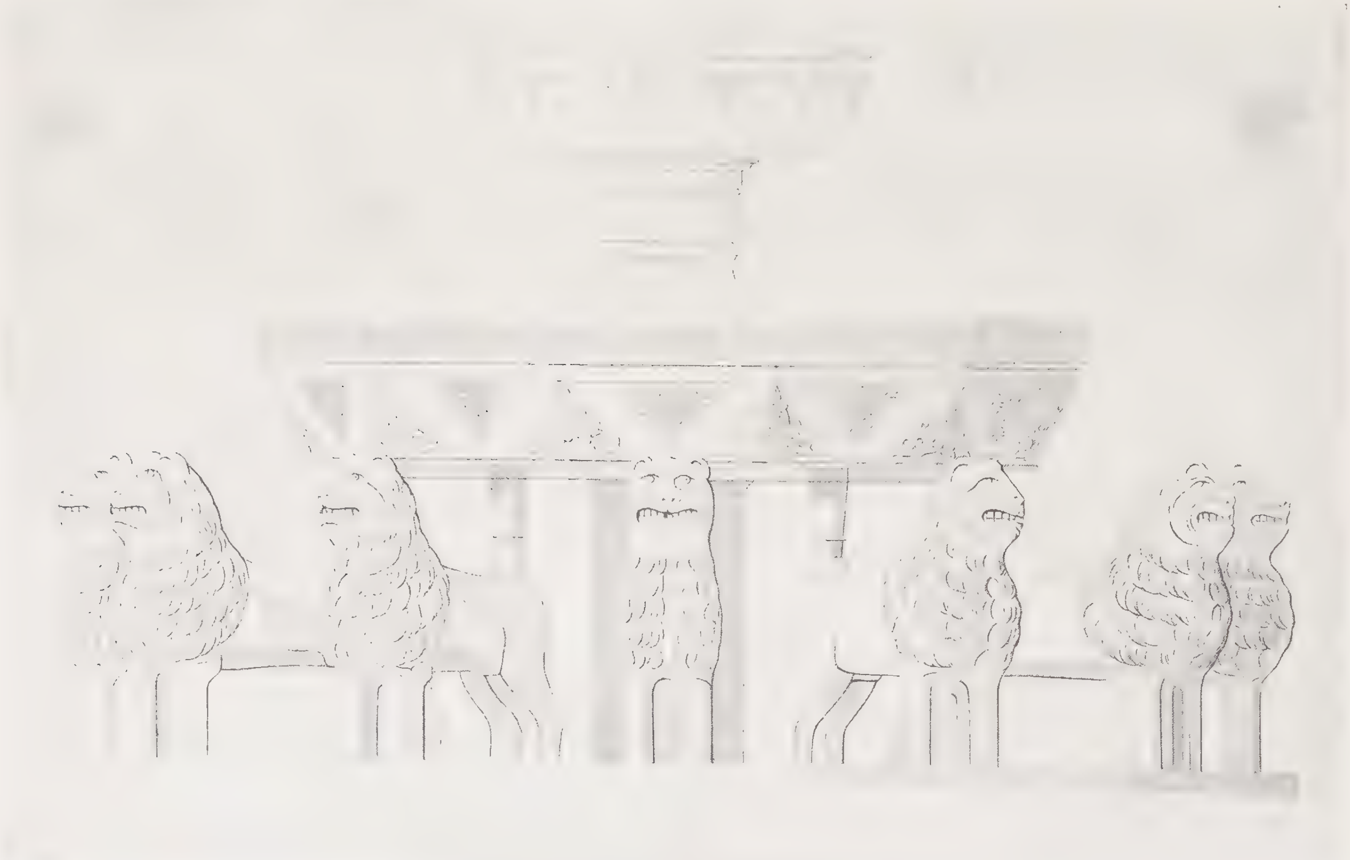
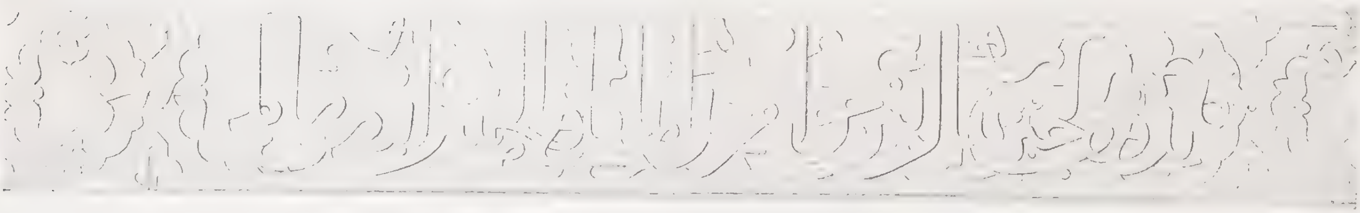


FOUNTAIN IN THE COURT OF THE LIONS.



DETAIL FROM THE FOUNTAIN (QUARTER-SIZE).

From Gayangos and Owen Jones, *The Alhambra.*

the year A.D. 600. His father, Abū Talib, was an uncle of the prophet, and Ali himself was adopted by Mahomet and educated under his care. As a mere boy he distinguished himself by being one of the first to declare his adhesion to the cause of Mahomet, who some years afterwards gave him his daughter Fatima in marriage. Ali proved himself to be a brave and faithful soldier, and when Mahomet died without male issue, a few emigrants thought him to have the best claim to succeed him. Abu Bekr, Omar and Othman, however, occupied this position before him, and it was not until 656, after the murder of Othman, that he assumed the title of caliph. The fact that he took no steps to prevent this murder is, perhaps, the only real blot upon his character. Almost the first act of his reign was the suppression of a rebellion under Talha and Zobair, who were instigated by Ayesha, Mahomet's widow, a bitter enemy of Ali, and one of the chief hindrances to his advancement to the caliphate. The rebel army was defeated at the "Battle of the Camel," near Bassorah (Basra), the two generals being killed, and Ayesha taken prisoner. Ali soon afterwards made Kufa his capital. His next care was to get rid of the opposition of Moawiya, who had established himself in Syria at the head of a numerous army. A prolonged battle took place in July 657 in the plain of Siffin (Suffein), near the Euphrates; the fighting was at first, it is said, in favour of Ali, when suddenly a number of the enemy, fixing copies of the Koran to the points of their spears, exclaimed that "the matter ought to be settled by reference to this book, which forbids Moslems to shed each other's blood." The superstitious soldiers of Ali refused to fight any longer, and demanded that the issue be referred to arbitration (see further CALIPHATE, section B. 1). Abu Musa was appointed umpire on the part of Ali, and ʽAmr-ibn-el-Ass, a veteran diplomatist, on the part of Moawiya. It is said that ʽAmr persuaded Abu Musa that it would be for the advantage of Islam that neither candidate should reign, and asked him to give his decision first. Abu Musa having proclaimed that he deposed both Ali and Moawiya, ʽAmr declared that he also deposed Ali, and announced further that he invested Moawiya with the caliphate. This treacherous decision (but see CALIPHATE, *ib.*) greatly injured the cause of Ali, which was still further weakened by the loss of Egypt. After much indecisive fighting, Ali found his position so unsatisfactory that according to some historians he made an agreement with Moawiya by which each retained his own dominions unmolested. It chanced, however—according to a legend, the details of which are quite uncertain—that three of the fanatic sect of the Kharijites had made an agreement to assassinate Ali, Moawiya and ʽAmr, as the authors of disastrous feuds among the faithful. The only victim of this plot was Ali, who died at Kufa in 661, of the wound inflicted by a poisoned weapon. A splendid mosque called Meshed Ali was afterwards erected near the city, but the place of his burial is unknown. He had eight wives after Fatima's death, and in all, it is said, thirty-three children, one of whom, Hassan, a son of Fatima, succeeded him in the caliphate. His descendants by Fatima are known as the Fatimites (*q.v.*; see also EGYPT: *History*, Mahommedan period). The question of Ali's right to succeed to the caliphate is an article of faith which divided the Mahommedan world into two great sects, the Sunnites and the Shiites, the former denying, and the latter affirming, his right. The Turks, consequently, hold his memory in abhorrence; whereas the Persians, who are generally Shiʽas, venerate him as second only to the prophet, call him the "Lion of God" (*Sher-i-Khudā*), and celebrate the anniversary of his martyrdom. Ali is described as a bold, noble and generous man, "the last and worthiest of the primitive Moslems, who imbibed his religious enthusiasm from companionship with the prophet himself, and who followed to the last the simplicity of his example." It is maintained, on the other hand, that his motives were throughout those of ambition rather than piety, and that, apart from the tragedy of his death, he would have been an insignificant figure in history. (See further CALIPHATE.)

In the eyes of the later Moslems he was remarkable for learning and wisdom, and there are extant collections (almost all certainly spurious) of proverbs and verses which bear his name: the *Sentences of Ali* (Eng. trans., William Yule, Edinburgh, 1832); H. L. Fleischer, *Alis hundert Sprüche* (Leipz. 1837); the *Divan*, by G. Kuypert (Leiden, 1745, and at Bulak, 1835); C. Brockelmann, *Gesch. d. arabisch. Lit.* (vol. i., Weimar, 1899).

ALI, known as ALI BEY (1766-1818), the assumed name of DOMINGO BADIA Y LEBLICH, a Spanish traveller, born in 1766. After receiving a liberal education he devoted particular attention to the Arabic language, and made a special study of the manners and customs of the East. Pretending to be a descendant of the Abbasids, Badia in 1803 set out on his travels. Under the name of Ali Bey el Abbassi, and in Mussulman costume, he visited Morocco, Tripoli, Egypt, Arabia and Syria, and was received as a person of high rank wherever he appeared. He made the pilgrimage to Mecca, at that time in the possession of the Wahabites. On his return to Spain in 1807 he declared himself a Bonapartist, and was made intendant first of Segovia and afterwards of Cordova. When the French were driven from Spain, Badia was compelled to take refuge in France, and there in 1814, published an account of his travels under the title of *Voyage d'Ali Bey en Asie et en Afrique, &c.* A few years later he set out again for Syria, under the assumed name of Ali Othman, and, it is said, accredited as a political agent by the French government. He reached Aleppo, and there died on the 30th of August 1818, not without suspicion of having been poisoned.

An account of his Eastern adventures was published in London in 1816, in two volumes, entitled *Travels in Morocco, Tripoli, Cyprus, Egypt, Arabia, Syria and Turkey, between the years 1803 and 1807.*

ALI, known as ALI PASHA (1741–1822), Turkish pasha of Iannina, surnamed *Arslan*, "the Lion," was born at Tepeleni, a village in Albania at the foot of the Klissura mountains. He was one of the Toske tribe, and his ancestors had for some time held the hereditary office of bey of Tepeleni. His father, a man of mild and peaceful disposition, was killed when Ali was fourteen years old by neighbouring chiefs who seized his territories. His mother Khamko, a woman of extraordinary character, thereupon herself formed and led a brigand band, and studied to inspire the boy with her own fierce and indomitable temper, with a view to revenge and the recovery of the lost property. In this wild school Ali proved an apt pupil. A hundred tales, for the most part probably mythical, are told of his powers and cunning during the years he spent among the mountains as a brigand leader. At last, by a picturesque stratagem, he gained possession of Tepeleni and took vengeance on his enemies. To secure himself from rivals in his own family, he is said to have murdered his brother and imprisoned his mother on a charge of attempting to poison him. With a view to establishing his authority he now made overtures to the Porte and was commissioned to chastise the rebellious pasha of Scutari, whom he defeated and killed. He also, on pretext of his disloyalty, put to death Selim, pasha of Delvinon. Ali was now confirmed in the possession of all his father's territory and was also appointed lieutenant to the derwend-pasha of Rumelia, whose duty it was to suppress brigandage and highway robbery. This gave him an opportunity for amassing wealth by sharing the booty of the robbers in return for leaving them alone. The disgrace that fell in consequence on his superior, Ali escaped by the use of lavish bribes at Constantinople. In 1787 he took part in the war with Russia, and was rewarded by being made pasha of Trikala in Thessaly and derwend-pasha of Rumelia. It now suited his policy to suppress the brigands, which he did by enlisting most of them under his own banner. His power was now already considerable; and in 1788 he added to it by securing his nomination to the pashalik of Iannina by a characteristic trick.

The illiterate brigand, whose boyish ambition had not looked beyond the recovery of his father's beylick, was now established as one of the most powerful viziers under the Ottoman government. Success only stimulated his insatiable ambition. He earned the confidence of the Porte by the cruel discipline he maintained in his own sanjak, and the regular flow of tribute and bribes which he directed to Constantinople; while he bent all his energies to extending his territories at the expense of his neighbours. The methods he adopted would have done credit to

Cesare Borgia; they may be studied in detail in the lurid pages of Pouqueville. Soon, by one means or another, his power was supreme in all central Albania. Two main barriers still obstructed the realization of his ambition, which now embraced Greece and Thessaly, as well as Albania, and the establishment in the Mediterranean of a sea-power which should rival that of the dey of Algiers. The first of these was the resistance of the little Christian hill community of Suli; the second the Venetian occupation of the coast, within a mile of which—by convention with the Porte—no Ottoman soldier might penetrate. It needed three several attacks before, in 1803, Ali conquered the Suliot stronghold. Events in western Europe gave him an earlier opportunity of becoming master of most of the coast towns. Ali had watched with interest the career of Bonaparte in Italy, and the treaty of Campo Formio (1797), which blotted the Venetian republic from the map of Europe, gave him the opportunity he desired. In response to his advances commissaries of the French republic visited him at Iannina and, affecting a sudden zeal for republican principles, he easily obtained permission to suppress the "aristocratic" tribes on the coast. His plans in Albania were interrupted by the war against Pasvan Oglu, the rebellious pasha of Widdin, in which Ali once more did good service. Meanwhile international politics had developed in a way that necessitated a change in Ali's attitude. Napoleon's occupation of the Ionian Islands and his relations with Ali had alarmed Russia, which feared that French influence would be substituted for her own in the Balkan peninsula; and on the 5th of September 1798 a formal alliance, to which Great Britain soon after acceded, was signed on behalf of the emperor Paul and the sultan. Once more Ali turned Turk and fought against his recent friends with such success that in the end he remained in possession of Butrinto, Prevesa and Vonitza on the coast, was created pasha "of three tails" by the sultan, and received the congratulations of Nelson. But the campaign of Austerlitz followed, then the peace of Pressburg which guaranteed to Napoleon the former dominions of Venice, and finally the treaty of Tilsit, which involved, among other things, the withdrawal of the Russians from the Ionian Islands and the Albanian coast.

Amid all the momentous changes the part of Ali was a difficult one. He had, moreover, to contend with domestic enemies, and with difficulty defeated a league formed against him by some Mussulman tribes, under Ibrahim of Berat and Mustapha of Delvinon, and the Suliots. He knew, however, how to retain the confidence of the sultan, who not only confirmed him in the possession of the whole of Albania from Epirus to Montenegro, but even in 1799 appointed him vali of Rumelia, an office which he held just long enough to enable him to return to Iannina laden with the spoils of Thessaly. He was now at the height of his power. In 1803 the Suliot stronghold fell; and he was undisputed master of Epirus, Albania and Thessaly, while the pashalik of the Morea was held by his son Veli, and that of Lepanto by his son Mukhtar. Only the little town of Parga held out against him on the coast; and in order to obtain this he once more in 1807 entered into an alliance with Napoleon. The French emperor, however, preferred to keep Parga, as a convenient gate into the Balkan peninsula, and it remained in French occupation until March 1814, when the Pargiots rose against the garrison and handed the fortress over to the British to save it from falling into the hands of Ali, who had bought the town from the French commander, Cozi Nikolo, and was closely investing it. The cordial relations between Napoleon and the pasha of Iannina had not long continued. Ali was angered by the refusal to surrender Parga and justly suspicious of the ambitions which this refusal implied; he could not feel himself secure with the Ionian Islands and the Dalmatian coast in the hands of a power whose plans in the East were notorious, and he was glad enough to avail himself of Napoleon's reverses in 1812 to help to rid himself of so dangerous a neighbor. His services to the allies received their reward. Still bent on obtaining Parga, he sent a special mission to London, backed by a letter from Sir Robert Liston, the British ambassador at Constantinople, calling the attention of the government to the pasha's supereminent qualities" and his services against the French. After some hesitation it was decided to evacuate Parga and hand it over to the Ottoman government, *i.e.* Ali Pasha. The convention by which this was effected was ultimately signed on the 17th of May 1817, being ratified by the sultan on the 24th of April 1819. By its terms the Pargiots were to receive an asylum in the islands, the Ottoman government undertaking to pay compensation for their property. Ali had no difficulty in finding the money; the garrison, as soon as it was received, marched out with the bulk of the inhabitants; and the last citadel of freedom in the Balkans fell to the tyrant of Iannina.[1]

Ali's authority in the great part of the peninsula subject to him now overshadowed that of the sultan; and Mahmud II., whose whole policy had been directed to destroying the overgrown power of the provincial pashas, began to seek a pretext for overthrowing the Lion of Iannina, whose all-devouring ambition seemed to threaten his own throne. The occasion came in 1820 when Ali, emboldened by impunity, violated the sanctity of Stamboul itself by attempting to procure the murder of his enemy Pacho Bey in the very precincts of the palace. A decree of disposition was now issued against the sacrilegious vali, who had dared "to fire shots in Constantinople, the residence of the caliph, and the centre of security." Its execution was entrusted to Khurshid Pasha, with the bulk of the Ottoman forces.

For two years Ali, now over eighty years of age, held his own, in spite of the defection of his vassals and even of his sons. At last, in the spring of 1822, after a prolonged siege in his island fortress at Iannina, which even the outbreak of the Greek revolt had not served to raise, the intrepid old man was forced to sue for terms. He asked and received an interview with Khurshid, was received courteously and dismissed with the most friendly assurances. As he turned to leave the grand vizier's tent he was stabbed in the back; his head was cut off and sent to Constantinople. Notwithstanding their treason to their father, his sons met with the same fate.

In spite of the ferocious characteristics which have been suggested in the above sketch, Ali Pasha is undoubtedly one of the most remarkable, as he is one of the most picturesque, figures in modern history; and as such he was recognized in his own day. His court at Iannina was the centre of a sort of barbarous culture, in which astrologers, alchemists and Greek poets played their part, and was often visited by travellers. Amongst others, Byron came, and has left a record of his impressions in "Childe Harold's Pilgrimage," less interesting and vivid than the prose accounts of Pouqueville, T. S. Hughes and William M. Leake. Leake (iii. 259) reports a reproof addressed by Ali to the French renegade Ibrahim Effendi, who had ventured to remonstrate against some particular act of ferocity: "At present you are too young at my court to know how to comport yourself. . . . You are not yet acquainted with the Greeks and Albanians: when I hang up one of these wretches on the plane-tree, brother robs brother under the very branches: if I burn one of them alive, the son is ready to steal his father's ashes to sell them for money. They are destined to be ruled by me; and no one but Ali is able to restrain their evil propensities." This is perhaps as good an apology as could be made for his character and methods. To the wild people over whom he ruled none was needed. He had their respect, if not their love; he is the hero of a thousand ballads; and his portrait still hangs among the *ikons* in the cottages of the Greek mountaineers. All accounts agree in describing him in later life as a man of handsome presence, with a venerable white beard, piercing black eyes and a benevolent cast of countenance, the effect of which was heightened in conversation by a voice of singular sweetness.

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[1] In his report on the Ionian Treaty presented to Lord Castlereagh at the congress of Vienna in December 1814, Sir Richard Church strongly advocated, not only the retention of Parga, but that Vonitza, Prevesa and Butrinto also should be taken from Ali Pasha and placed under British protection, a measure he considered necessary for the safety of the Ionian Islands. "Ali Pasha," he wrote, "is now busy building forts along his coast and strengthening his castles in the interior. In January 1814 he had 14,000 peasants at work on the castle of Argiro Castro, and about 1500 erecting a fort at Porto Palermo, nearly opposite Corfu." In 1810 he had erected a fort directly opposite Santa Maura commanding the harbour.

The fate of Parga created intense feeling at the time in England, and was cited by Liberals as a crowning instance of the perfidy of the government and of Castlereagh's subservience to reactionary tendencies abroad. The step, however, was not lightly taken. In occupying the town the British general had expressly refrained from pledging Great Britain to remain there; and the government held that any permanent occupation of a post on the mainland carried with it risks of complications out of all proportion to any possible benefit.

AUTHORITIES.—Apart from the scattered references in the published and unpublished diplomatic correspondence of the period, contemporary journals and books of travel contain much interesting material for the life of Ali. Of these may especially be mentioned François C. H. L. Pouqueville, *Voyage en Morée, à Constantinople, en Albanie, &c.* (3 vols., Paris, 1805), of which an English version by A. Plumptre was published in 1815; ib. *Voyage dans la Grèce* (5 vols., Paris, 1820, 1821). Pouqueville, who spent some time as French resident at Iannina, had special facilities for obtaining first-hand information, though his emotionalism makes his observations and deductions at times somewhat suspect. Very interesting also are Thomas Smart Hughes, *Travels in Greece and Albania* (2 vols., 2nd ed., Lond. 1830); John Cam Hobhouse (Lord Broughton), *A Journey through Albania, &c. . . . during the years 1809 and 1810* (Lond., 4to, 1813, a new ed., 2 vols., 1855); William Martin Leake, *Travels in Northern Greece* (4 vols., Lond. 1845). See also Pouqueville's *Hist. de la régénération de la Grèce*, 1740–1824 (4 vols., Paris, 1824, 3rd ed., Brussels, 1825); R. A. Davenport, *Life of Ali Pasha, vizier of Epirus* (1861). (W. A. P.)

ALIAGA, a town of the province of Nueva Ecija, Luzon, Philippine Islands, about 70 m. N. by W. of Manila. Pop. (1903) 11,950. It has a comparatively cool and healthful climate, and is pleasantly situated about midway between the Pampanga Grande and the Pampanga Chico rivers, and in a large and fertile valley of which the principal products are Indian corn, rice, sugar and tobacco. Tagalog is the most important language; Ilocano, Pampango and Pangasinan are also used.

ALIAS (Lat. for "at another time"), a term used to connect the different names of a person who has passed under more than one, in order to conceal his identity, or for other reasons; or, compendiously, to describe the adopted name. The expression *alias dictus* was formerly used in legal indictments, and pleadings where absolute precision was necessary in identifying the person to be charged, as "John Jones, *alias dictus* James Smith." The adoption of a name other than a man's baptismal or surname need not necessarily be for the purpose of deception or fraud; pseudonyms or nicknames fall thus under the description of an *alias*. Where a person is married under an *alias*, the marriage is void when both parties have knowingly and wilfully connived at the adoption of the *alias*, with a fraudulent intention. But if one of the parties to a marriage has acquired a new name by use and reputation, or if the true name of any one of the parties is not known to the other, the use of an *alias* in these cases will not affect the validity of the marriage.

ALIBI (Lat. for "elsewhere"), in law, the defence resorted to in criminal prosecutions, where the person charged alleges that he was so far distant at the time from the place where the crime was committed that he could not have been guilty. An alibi, if substantiated, is the most conclusive proof of innocence.

ALICANTE, a province of south-eastern Spain; bounded on the N. by Valencia, W. by Albacete and Murcia, S. by Murcia, and S.E. and E. by the Mediterranean Sea. Pop. (1900) 470,149; area, 2096 sq. m. Alicante was formed in 1833 of districts taken from the ancient provinces of Valencia and Murcia, Valencia contributing by far the larger portion. The surface of the province is extremely diversified. In the north and west there are extensive mountain ranges of calcareous formation, intersected by deep ravines; while farther south the land is more level, and there are many fertile valleys. On the Mediterranean coast, unhealthy salt marshes alternate with rich plains of pleasant and productive *huertas* or gardens, such as those of Alicante and Dénia. Apart from Segura, which flows from the highlands of Albacete through Murcia and Orihuela to the sea, there is no considerable river, but a few rivulets flow east into the Mediterranean. The climate is temperate, and the rainfall very slight. Despite the want of rivers and of rain, agriculture is in a flourishing condition. Many tracts, originally rocky and sterile, have been irrigated and converted into vineyards and plantations. Cereals are grown, but the inhabitants prefer to raise such articles of produce as are in demand for export, and consequently part of the grain supply has to be imported. Esparto grass, rice, olives, the sugar-cane, and tropical fruits and vegetables are largely produced. Great attention is given to the rearing of bees and silk-worms; and the wine of the province is held in high repute throughout Spain, while some inferior kinds are sent to France to be mixed with claret. There are iron and lignite mines, but the output is small. Mineral springs are found at various places. The manufactures consist of fine cloths, silk, cotton, woollen and linen fabrics, girdles and lace, paper, hats, leather, earthenware and soap. There are numerous oil mills and brandy distilleries. Many of the inhabitants are engaged in the carrying trade, while the fisheries on the coast are also actively prosecuted, tunny and anchovies being caught in great numbers. Barilla is obtained from the sea-weed on the shores, and some of the saline marshes, notably those near Torrevieja, yield large supplies of salt. The principal towns, which are separately described, include Alicante, the capital (pop. 1900, 50,142), Crevillente (10,726), Dénia (12,431), Elche (27,308), Novelda (11,388), Orihuela (28,530), and Villena (14,099). Other towns, of less importance, are Aspe (7927), Cocentaina (7093), Monóvar (10,601), Pinoso (7946), and Villajoyosa (8902).

ALICANTE, the capital of the Spanish province described above, and one of the principal seaports of the country. Pop. (1900) 50,142. It is situated in 38° 21′ N. and 0° 26′ W., on the Bay of Alicante, an inlet of the Mediterranean Sea. It is the termini of railways from Madrid and Murcia. From its harbour, the town presents a striking picture. Along the shore extends the Paseo de los Martires, a double avenue of palms; behind this, the white flat-roofed houses rise in the form of a crescent towards the low hills which surround the city, and terminate, on the right, in a bare rock, 400 ft. high, surmounted by an ancient citadel. Its dry and equable climate renders Alicante a popular health-resort. The city is an episcopal see, and contains a modern cathedral.

The bay affords good anchorage, but only small vessels can come up to the two moles. The harbour is fortified, and there is a small lighthouse on the eastern mole; important engineering works, subsidized by the state, were undertaken in 1902 to provide better accomodation. In the same year 1737 vessels of 939,789 tons entered the port. The trade of Alicante consists chiefly in the manufacture of cotton, linen and woollen goods, cigars and confectionery; the importation of coal, iron, machinery, manures, timber, oak staves and fish; and the exportation of lead, fruit, farm produce and red wines, which are sent to France for blending with better vintages. Fine marble is procured in the island of Plana near the coast.

Alicante was the Roman *Lucentum*; but, despite its antiquity, it has few Roman or Moorish remains. In 718, it was occupied by the Moors, who were only expelled in 1304, and made an unsuccessful attempt to recapture the city in 1331. Alicante was besieged by the French in 1709, and by the Federalists of Cartagena in 1873. For an account of the events which led up to these two sieges, see SPAIN.

For further details of the local history, see J. Pastor de la Roca, *Historia general de la ciudad y castillo de Alicante, &c.* (Alicante, 1854); and the *Ensayo biográfico bibliográfico de escritores de Alicante y de su provincia*, by M. R. Garcia and A. Montero y Perez (Alicante, 1890).

ALICE MAUD MARY, GRAND-DUCHESS OF HESSE-DARMSTADT (1843–1878), second daughter and third child of Queen Victoria, was born at Buckingham Palace, on the 25th of April 1843. A pretty, delicate-featured child—"cheerful, merry, full of fun and mischief," as her elder sister described her—fond of gymnastics, a good skater and an excellent horsewoman, she was a general favourite from her earliest days. Her first years were passed without particular incident in the home circle, where the training of their children was a matter of the greatest concern to the queen and the prince consort. Among other things, the royal children were encouraged to visit the poor, and the effect of this training was very noticeable in the later life of Princess Alice. After the marriage of the Princess Royal in 1858, the new responsibilities devolving upon Princess Alice, as the eldest daughter at home, called forth the higher traits of her character, and brought her into still closer relationship with her parents, and especially with her father. In the summer of 1860, at Windsor Castle, Princess Alice first met her future husband, Prince Louis of Hesse. An attachment quickly sprang up, and on the prince's second visit in November they were formally engaged. In the following year, on the announcement of the contemplated marriage, the House of Commons unanimously voted a dowry of £30,000 and an annuity of £6000 to the princess. In December 1861, while preparations were being made for the marriage, the prince consort was struck down with typhoid fever, and died on the 14th. Princess Alice nursed her father during his short illness with the utmost care, and after his death devoted herself to comforting her mother under this terrible blow. Her marriage took place at Osborne, on the 1st of July 1862. The princess unconsciously wrote her own biography from this period in her constant letters to Queen Victoria, a selection of which, edited by Dr. Carl Sell, were allowed to be printed in 1883. These letters give a complete picture of the daily life of the duke and duchess, and they also show the intense love of the latter for her husband, her mother and her native land. She managed to visit England every year, and it was at her special request that when she died her husband laid an English flag upon her coffin.

In the war between Austria and Prussia in 1866, Hesse-Darmstadt was upon the side of the Austrians; Prince Louis accompanied his troops to the front, and was duly appointed by the grand-duke to the command of the Hessian division. This was a time of intense trial to the princess, whose husband and brother-in-law, the crown prince of Prussia, were necessarily fighting upon opposite sides. The duke of Hesse also took part in the principal battles of the Franco-Prussian war, while the duchess was actively engaged in organizing hospitals for the relief of the sick and wounded. The death of the duke's father, Prince Charles of Hesse, on the 20th of March 1877, was followed by that of the grand-duke on the 13th of June, and Prince Louis succeeded to the throne as Grand Duke Louis IV. In the summer of 1878 the grand-duke and duchess, with their family, came again to England, and went to Eastbourne, where the duchess remained for some time. She returned to Darmstadt in the autumn, and on the 8th of November 1878 her daughter, Princess Victoria, was attacked by diphtheria. Three more of her children, as well as her husband, quickly caught the disease, and the youngest, "May," succumbed on the 16th. On the 7th of December the princess was herself attacked, and, being weakened by nursing and anxiety, had not strength to resist the disease, which proved fatal on the 14th of December, the seventeenth anniversary of her father's death. She left one son and four daughters.

See Carl Sell, *Alice: Mittheilungen aus ihrem Leben und Briefen, &c.* (Darmstadt, 1883), with English translation by the Princess Christian, *Alice: biographical sketch and letters* (1884). (G. F. B.)

ALIDADE (from the Arab.), the movable index of a graduated arc, used in the measurement of angles. The word is used also to designate the supporting frame or arms carrying the microscopes or verniers of a graduated circle.

ALIEN (Lat. *alienus*), the technical term applied by British constitutional law to anyone who does not enjoy the character of a British subject; in general, a foreigner who for the purposes of any state comes into certain domestic relations with it, other than those applying to native-born or naturalized citizens, but owns allegiance to a foreign sovereign.

English law, save with the special exceptions mentioned, admits to the character of subjects all who are born within the king's allegiance, that is, speaking generally, within the British dominions. In the celebrated question of the *post-nati* in the reign of James I. of England, it was found, after solemn trial, that natives of Scotland born before the union of the crowns were aliens in England, but that, since allegiance is to the person of the king, those born subsequently were English subjects. A child born abroad, whose father or whose grandfather on the father's side was a British subject, may claim the same character unless at the time of his birth his father was an attainted traitor, or in the service of a state engaged in war against the British empire (4th Geo. II. c. 21). Owing to this exceptional provision some sons of Jacobite refugees born abroad, who joined in the rebellion of 1745, were admitted to the privilege of prisoners of war.

It has been enacted in the United Kingdom with regard to the national status of women and children that a married woman is to be deemed a subject of the state of which her husband is for the time being a subject; that a natural-born British woman, having become an alien by marriage, and thereafter being a widow, may be rehabilitated under conditions slightly more favourable than are required for naturalization; that where a father or a widow becomes an alien, the children in infancy becoming resident in the country where the parent is naturalized, and being naturalized by the local law, are held to be subjects of that country; that those of a father or of a widow readmitted to British nationality or who obtains a certificate of naturalization, becoming during infancy resident with such parent in the British dominions in the former case or in the United Kingdom in the latter, become readmitted or naturalized (Naturalization Act 1870, s. 10). The nationality of children not covered by these enactments is not affected by the change of their parents' nationality. The same statute provides that a declaration of alienage before a justice of peace or other competent judge, having the effect of divesting the declarant of the character of a British subject, may be made by a naturalized British subject desiring to resume the nationality of the country to which he originally belonged, if there be a convention to that effect with that country; by natural-born subjects who were also born subjects of another state according to its law; or by persons born abroad having British fathers.

Naturalization, which means conferring the character of a subject, may now, under the act of 1870, be obtained by applying to the home secretary and producing evidence of having resided for not less than five years in the United Kingdom, or of having been in the service of the crown for not less than five years, and of intention to reside in the United Kingdom or serve under the crown. Such a certificate may be granted by the secretary of state to one naturalized previously to the passing of the act, or to a British subject as to whose nationality a doubt exists, or to a statutory alien, *i.e.* one who has become an alien by declaration in pursuance of the act of 1870.

In the United States the separate state laws largely determine the status of an alien, but subject to Federal treaties. (For further particulars see ALLEGIANCE and NATURALIZATION.)

Many of the disabilities to which aliens were subject in the United Kingdom, either by the common law or under various acts of parliament, have been repealed by the Naturalization Act 1870. It enables aliens to take, acquire, hold and dispose of real and personal property of every description, and to transmit a title to it, in all respects as natural-born British subjects. But the act expressly declares that this relaxation of the law does not qualify aliens for any office or any municipal, parliamentary or other franchise, or confer any right of a British subject other than those above expressed in regard to property, nor does it affect interests vested in possession or expectancy under dispositions made before the act, or by devolution of law on the death of any one dying before the act. A ship, any share in which is owned by an alien, shall not be deemed a British ship (Merchant Shipping Act 1894, s. 1). By the Juries Act 1870, s. 8, aliens who have been domiciled for ten years in England or Wales, if in other respects duly qualified, are liable to serve on juries or inquests in England or Wales; and by the Naturalization Act 1870, s. 5, the aliens' old privilege of being tried by a jury *de medietate linguae* (that is, of which half were foreigners), was abolished.

It seems to be a rule of general public law that an alien can be sent out of the realm by exercise of the crown's prerogative; but in modern English practice, whenever it seems necessary to expel foreigners (see EXPULSION), a special act of parliament has to be obtained for the purpose, unless the case falls within the extradition acts or the Aliens Act 1905. The latter prohibits the landing in the United Kingdom of undesirable alien steerage passengers, called in the act "immigrants," from ships carrying more than twenty alien steerage passengers, called in the act "immigrant ships"; nor can alien immigrants be landed except at certain ports at which there is an "immigrant officer," to whom power of prohibiting the landing is given, subject to a right of appeal to the immigration board of the port. The act contains a number of qualifications, and among these empowers the secretary of state to exempt any immigrant ship from its provisions if he is satisfied that a proper system is maintained to prevent the immigration of undesirable persons. The principal test of undesirableness is not having or being in a position to obtain the means of supporting one's self and one's dependents, or appearing likely from disease or infirmity to become a charge on the rates, provided that the immigrant is not seeking to avoid prosecution or punishment on religious or political grounds, or persecution, involving danger of imprisonment or danger to life or limb, on account of religious belief. Lunatics, idiots, persons who from disease or infirmity appear likely to become a detriment to the public otherwise than through the rates, and persons sentenced in a foreign country for crimes for which they could be surrendered to that country, are also enumerated as undesirable. Power is also given to the secretary of state to expel persons sentenced as just mentioned, or, if recommended by the court in which they have been convicted, persons convicted of felony or some offence for which the court has power to impose imprisonment without the option of a fine, or of certain offences against the police laws; and persons in receipt of any such parochial relief as disqualifies for the parliamentary franchise, or wandering without ostensible means of subsistence, or living under insanitary conditions due to overcrowding. (Jno. W.)

ALIENATION (from Lat. *alienus*, belonging to another), the act or fact of being estranged, set apart or separated. In law the word is used for the act of transfer of property by voluntary deed and not by inheritance. In regard to church property the word has come to mean, since the Reformation, a transfer from religious to secular ownership. "Alienation" is also used to denote a state of insanity (*q.v.*).

ALIEN-HOUSES, religious houses in England belonging to foreign ecclesiastics, or under their control. They generally were built where property had been left by the donors to foreign orders to pray for their souls. They were frequently regular "priories," but sometimes only "cells," and even "granges," with small chapels attached. Some, particularly in cities, seem to have been a sort of mission-houses. There were more than 100 in England. Many alien-houses were suppressed by Henry V. and the rest by Henry VIII.

ALIENIST (Lat. *alienus*, that which belongs to another, *i.e.* is external to one's self), one who specializes in the study of mental diseases, which are often included in the generic name "Alienation." (See Insanity.)

ALIGARH, a city and district of British India in the Meerut division of the United Provinces. The city, also known as Koil, was a station on the East Indian railway, 876 m. from Calcutta. Sir Sayad Ahmad Khan, K.C.S.I., who died in 1898, founded in 1864 the Aligarh Institute and Scientific Society for the translation into the vernacular of western literature; and afterwards the Mahommedan Anglo-Oriental college, under English professors, with an English school attached. The college meets with strong support from the enlightened portion of the Mussulman community, whose aim is to raise it to the status of a university, with the power of conferring degrees. The population (1901) 70,434, showed an increase of 14% in the decade. There are several flour-mills, cotton-presses and a dairy farm. Aligarh Fort, situated on the Grand Trunk road, consists of a regular polygon, surrounded by a very broad and deep ditch. It became a fortress of great importance under Sindhia in 1759, and was the depot where he drilled and organized his battalions in the European fashion with the aid of De Boigne. It was captured from the Mahrattas under the leadership of Perron, another French officer, by Lord Lake's army, in September 1803, since which time it has been much strengthened and improved. In the rebellion of 1857 the troops stationed at Aligarh mutinied, but abstained from murdering their officers, who, with the other residents and ladies and children, succeeded in reaching Hathras.

The district of Aligarh has an area of 1957 sq. m. It is nearly a level plain, but with a slight elevation in the centre, between the two great rivers the Ganges and Jumna. The only other important river is the Kali Nadi, which traverses the entire length of the district from north-east to south-west. The district is traversed by several railways and also by the Ganges canal, which is navigable. The chief trading centre is Hathras. In 1901 the population was 1,200,822, showing an increase of 15% in the decade, due to the extension of irrigation. There are several factories for ginning and pressing cotton.

ALIGNMENT (from Fr. *à* and *ligne*, the Lat. *linea*, a line), a setting in line, generally straight, or the way in which the line runs; an expression used in surveying, drawing, and in military arrangements, the alignment of a regiment or a camp meaning the situation when drawn up in line or the relative position of the tents. The alignment of a rifle has reference to the way of getting the sights into line with the object, so as to aim correctly.

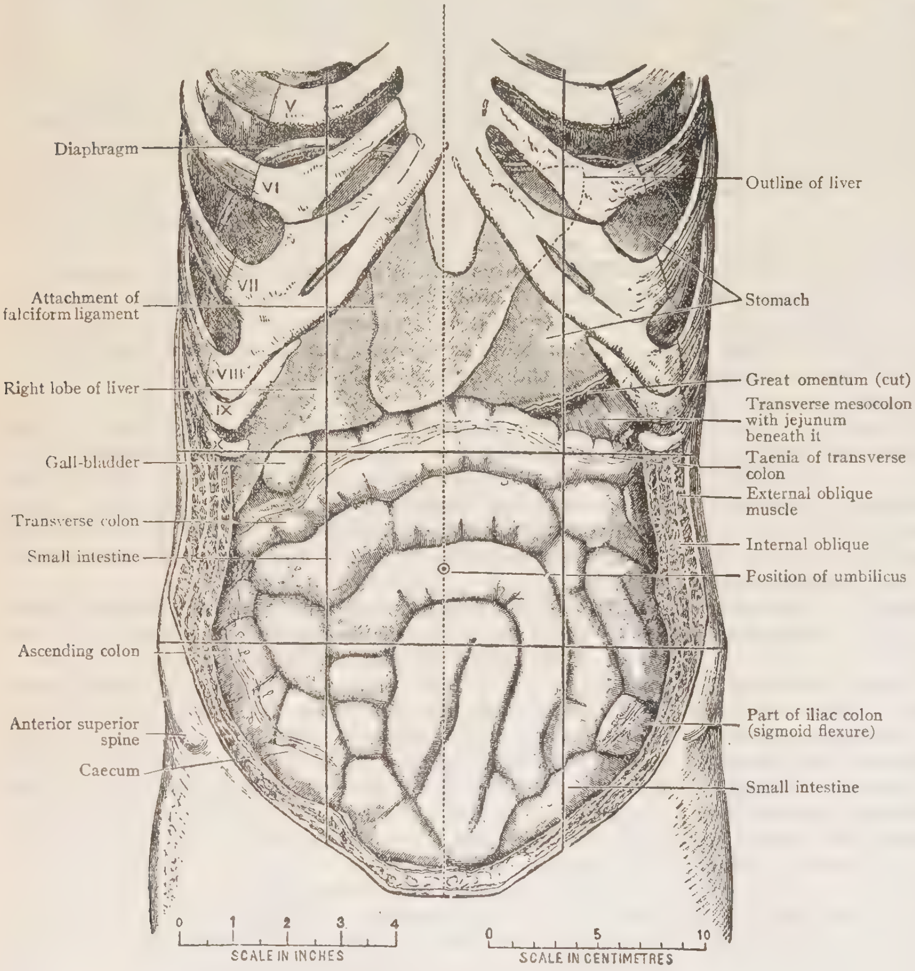
ALIMENT (from Lat. *aliment-um*, from *alere* to nourish), a synonym for "food," literally or metaphorically. The word has also been used in the same legal sense as Alimony (*q.v.*). Aliment, in Scots law, is the sum paid or allowance given in respect of the reciprocal obligation of parents and children, husband and wife, grandparents and grandchildren, to contribute to each other's maintenance. The term is also used in regard to a similar obligation of other parties, as of creditors to imprisoned debtors, the payments by parishes to paupers, &c. Alimentary funds, whether of the kind above mentioned, or set apart as such by the deed of a testator, are intended for the mere support of the recipient, and are not attachable by creditors.

ALIMENTARY CANAL, in anatomy. The alimentary canal, strictly speaking, is the whole digestive tract from the mouth to the anus. From the one orifice to the other the tube is some 25 to 30 ft. long, and the food, in its passage, passes through the following parts one after the other:—mouth, pharynx, oesophagus, stomach, small intestines, caecum, large intestines, rectum and anus. Into this tube at various points the salivary glands, liver and pancreas pour their secretions by special ducts. As the mouth (*q.v.*) and pharynx (*q.v.*) are separately described, the detailed description will here begin with the oesophagus or gullet.

The *oesophagus* (Gr. οἴσω, I will carry, and φαγεῖν, to eat), a muscular tube lined with mucous membrane, stretches from the lower limit of the pharynx, at the level of the cricoid cartilage, to the cardiac orifice of the stomach. It is about 10 in. long (25 cm.) and half to one inch in diameter. At first it lies in the lower part of the neck, then in the thorax, and lastly, for about an inch, in the abdomen. As far as the level of the fourth or fifth thoracic vertebra it lies behind the trachea, but when that tube ends, it is in close contact with the pericardium, and, at the level of the tenth thoracic vertebra, passes through the oesophageal opening of the diaphragm (*q.v.*), accompanied by the two vagi nerves, the left being in front of it and the right behind. In the abdomen it lies just behind the left lobe of the liver. Both in the upper and lower parts of its course it lies a little to the left of the mid line. Its mucous membrane is thrown into a number of longitudinal pleats to allow stretching.

The *stomach* (Gr. στόμαχος) is an irregularly pear-shaped bag, situated in the upper and left part of the abdomen. It is somewhat flattened from before backward and so has an anterior and posterior surface and an upper and lower border. When moderately distended the thick end of the pear or *fundus* bulges upward and to the left, while the narrow end is constricted to form the *pylorus*, by means of which the stomach communicates with the small intestine. The *cardiac orifice*, where the oesophagus enters, is placed about a third of the way along the upper border from the left end of the fundus, and, between it and the pylorus, the upper border is concave and is known as the *lesser curvature.* From the cardiac to the pyloric orifice, round the lower border, is the *greater curvature.* The stomach has in front of it the liver (see fig. 1), the diaphragm and the anterior abdominal wall, while behind it are the pancreas, left kidney, left adrenal, spleen, colon and mesocolon. These structures form what is known as the *stomach chamber.* When the stomach is empty it contracts into a tubular organ which is frequently sharply bent, and the transverse colon ascends to occupy the vacant part of the stomach chamber.

The last inch of the stomach before reaching the pylorus is usually tubular and is known as the *pyloric canal.* Before reaching this there is a bulging known as the *pyloric vestibule* (see D. J. Cunningham, *Tr. R. Soc. of Edinb.* vol. xlv. pt. 1, No. 2). The *pylorus* is an oval opening, averaging half an inch in its long axis but capable of considerable distension; it is formed by a special development of the circular muscle layer of the stomach, and during life is probably tightly closed. The mucous membrane of the stomach is thrown into pleats or rugae when the organ is not fully distended, while between these it has a mammillated appearance.



From A. Birmingham; Cunningham's *Text-Book of Anatomy.*

Fig. 1.—The Abdominal Viscera *in situ*, as seen when the abdomen is laid open and the great omentum removed (drawn to scale from a photograph of a male body aged 56, hardened by formalin injections).

The ribs on the right side are indicated by Roman numerals; it will be observed that the eighth costal cartilage articulated with the sternum on both sides. The subcostal, intertubercular, and right and left Poupart lines are drawn in black, and the mesial plane is indicated by a dotted line. The intercostal muscles and part of the diaphragm have been removed, to show the liver and stomach extending up beneath the ribs. The stomach is moderately distended, and the intestines are particularly regular in their arrangement.

Superficial to the mucous coat is a sub-mucous, consisting of loose connective tissue, while superficial to this are three coats of unstriped muscle, the inner oblique, the middle circular and the outer longitudinal. The peritoneal coat is described in the article on the coelom and serous membranes.

The *small intestine* is a tube, from 22 to 25 ft. long, beginning at the pylorus and ending at the *ileo-caecal valve;* it is divided into duodenum, jejunum and ileum.

The *duodenum* is from 9 to 11 in. long and forms a horseshoe or C-shaped curve, encircling the head of the pancreas. It differs from the rest of the gut in being retroperitoneal. Its first part is horizontal and lies behind the fundus of the gall-bladder, passing backward and to the right from the pylorus. The second part runs vertically downward in front of the hilum of the right kidney, and into this part the pancreatic and bile ducts open. The third part runs horizontally to the left in front of the aorta and vena cava, while the fourth part ascends to the left side of the second lumbar vertebra, after which it bends sharply downward and forward to form the *duodeno-jejunal* flexure.

The *jejunum* forms the upper two-fifths of the rest of the small intestine; it, like the ileum, is thrown into numerous convolutions and is attached by the mesentery to the posterior abdominal wall. (See Coelom and Serous Membranes.)

The *ileum* is the remaining three-fifths of the small intestine, though there is no absolute point at which the one ends and the other begins. Speaking broadly, the jejunum occupies the upper and left part of the abdomen below the subcostal plane (see Anatomy: *Superficial and Artistic*), the ileum the lower and right part. About 3 ft. from its termination a small pouch, known as *Meckel's diverticulum,* is very occasionally found. At its termination the ileum opens into the large intestine at the ileo-caecal valve.

The *caecum* is a blind sac occupying the right iliac fossa and extending down some two or three inches below the ileo-caecal junction. From its posterior and left surface the *vermiform appendix* protrudes, and usually is directed upward and to the left, though it not infrequently hangs down into the true pelvis. This worm-like tube is blind at its end and is usually 3 or 4 in. long, though it has been seen as long as 10. in. Its internal opening into the caecum is about 1 in. below that of the ileum. On transverse section it is seen to be composed of (1) an external muscular coat, (2) a sub-mucous coat, (3) a mass of lymphoid tissue, which appears after birth, and (4) mucous membrane. In many cases its lumen is wholly or partly obliterated, though this is probably due to disease (see R. Berry and L. Lack, *Journ. Anat. & Phys.* vol. xl. p. 247). Guarding the opening of the ileum into the caecum is the *ileo-caecal valve*, which consists of two cusps projecting into the caecum; of these the upper forms a horizontal shelf, while the lower slopes up to it obliquely. Complete absence of the valve has been noticed, and in one such case the writer found that no abdominal inconvenience had been recorded during life. The caecum is usually completely covered by peritoneum, three special pouches of which are often found in its neighbourhood; of these the ileo-colic is just above the point of junction of the ileum and caecum, the ileo-caecal just below that point, while the retro-caecal is behind the caecum. At birth the caecum is a cone, the apex of which is the appendix; it is bent upon itself to form a U, and sometimes this arrangement persists throughout life (see C. Toldt, "Die Formbildung d. menschl. Blinddarmes," *Sitz. der Wiener Akad.* Bd. ciii. Abteil. 3, p. 41).

The *ascending colon* runs up from the caecum at the level of the ileo-caecal valve to the hepatic flexure beneath and behind the right lobe of the liver; it is about 8 in. long and posteriorly is in contact with the abdominal wall and right kidney. It is covered by peritoneum except on its posterior surface (see fig. 1).

The *transverse colon* is variable in position, depending largely on the distension of the stomach, but usually corresponding to the subcostal plane (see ANATOMY: *Superficial and Artistic*). On the left side of the abdomen it ascends to the splenic flexure, which may make an impression on the spleen (see DUCTLESS GLANDS), and is bound to the diaphragm opposite the eleventh rib by a fold of peritoneum called the *phrenico-colic ligament*. The peritoneal relations of this part are discussed in the article on the coelom and serous membranes.

The *descending colon* passes down in front of the left kidney and left side of the posterior abdominal wall to the crest of the ilium; it is about 6 in. long and is usually empty and contracted while the rest of the colon is distended with gas; its peritoneal relations are the same as those of the ascending colon, but it is more likely to be completely surrounded.

The *iliac colon* stretches from the crest of the ilium to the inner border of the psoas muscle, lying in the left iliac fossa, just above and parallel to Poupart's ligament. Like the descending, it is usually uncovered by peritoneum on its posterior surface. It is about 6 in. in length.

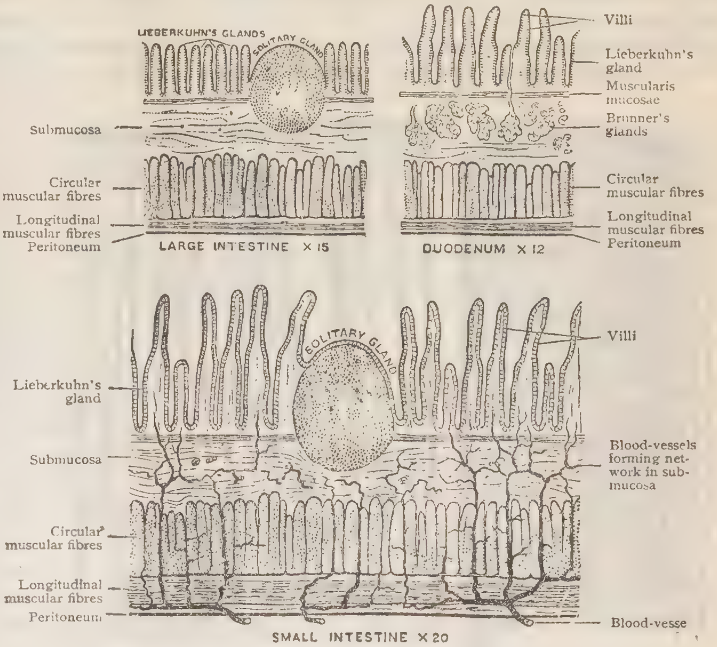
The *pelvic colon* lies in the true pelvis and forms a loop, the two limbs of which are superior and inferior while the convexity reaches across to the right side of the pelvis. In the foetus this loop occupies the right iliac fossa, but, as the caecum descends and enlarges and the pelvis widens, it is usually driven out of this region. The distal end of the loop turns sharply downward to reach the third piece of the sacrum, where it becomes the rectum. To this pelvic colon Sir F. Treves (*Anatomy of the Intestinal Canal*, London, 1885) has given the name of the *omega loop*. Formerly the iliac and pelvic colons were spoken of as the *sigmoid flexure*, but Treves and T. Jonnesco (*Le Colon pelvien pendant la vie intra-utérine*, Paris, 1892) have pointed out the inapplicability of the term, and to the latter author the modern description is due.

The *rectum*, according to modern ideas, begins in front of the third piece of the sacrum; formerly the last part of the Ω (or omega) loop was described as its first part. It ends in a dilatation or *rectal ampulla*, which is in contact with the back of the prostate in the male and of the vagina in the female and is in front of the tip of the coccyx. The rectum is not straight, as its name would imply, but has a concavity forward corresponding to that of the sacrum and coccyx.

When viewed from in front three bends are usually seen, the upper and lower of which are sharply concave to the left, the middle one to the right. At the end of the pelvic colon the mesocolon ceases, and the rectum is then only covered by peritoneum at its sides and in front; lower down the lateral covering is gradually reflected off and then only the front is covered. About the junction of the middle and lower thirds of the tube the anterior peritoneal covering is also reflected off on to the bladder or vagina, forming the *recto-vesical* pouch in the male and the *pouch of Douglas* in the female. This reflexion is usually about 3 in. above the anal aperture, but may be a good deal lower.

The *anal canal* is the termination of the alimentary tract, and runs downward and backward from the lower surface of the rectal ampulla between the levatores ani muscles. It is about an inch long and its lateral walls are in contact, so that in section it appears as an antero-posterior slit (see J. Symington, *Journ. Anat. and Phys.* vol. 23, 1888).

Structure of the Intestine.—The intestine has four coats: serous, muscular, submucous and mucous. The serous or peritoneal coat has already been described wherever it is present. The muscular coat consists of unstriped fibres arranged in two layers, the outer longitudinal and the inner circular (see fig. 2). In the large intestine the longitudinal fibres, instead of being arranged evenly round the tube as they are in the small, are gathered into three longitudinal bands called *taeniae* (see fig. 1); by the contraction of these the large intestine is thrown into a series of *sacculi* or slight pouches. The taeniae in the caecum all lead to the vermiform appendix, and form a useful guide to this structure. In the rectum the three taeniae once more become evenly arranged over the whole surface of the bowel, but more thickly on the anterior and posterior parts. The circular layer is always thicker than the longitudinal; in the small intestine it decreases in thickness from the duodenum to the ileum, but in the large it gradually increases again, so that it is thickest in the duodenum and rectum.



From A. Birmingham; Cunningham's *Text-Book of Anatomy.*

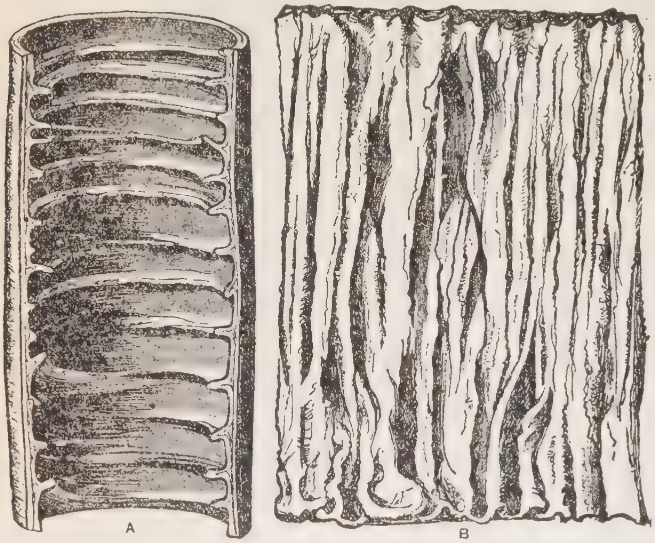
FIG. 2.—Diagram to show the structure of the small and large intestine and the duodenum.

The submucous coat is very strong and consists of loose areolar tissue in which the vessels break up.

The mucous coat is thick and vascular (see fig. 2); it consists of an epithelial layer most internally which forms the intestinal glands (see EPITHELIAL, ENDOTHELIAL AND GLANDULAR TISSUES). External to this is the *basement membrane*, outside which is a layer of retiform tissue, and this is separated from the submucous coat by a very thin layer of unstriped muscle called the *muscularis mucosae*. In the duodenum and jejunum the mucous membrane is thrown into a series of transverse pleats called *valvulae conniventes* (see fig. 3); these begin about an inch from the pylorus and gradually fade away as the ileum is reached. About 4 in. from the pylorus the common bile and pancreatic ducts form a papilla, above which one of the valvulae conniventes makes a hood and below which a vertical fold, the *frenulum*, runs downward. The surface of the mucous membrane of the whole of the small intestine has a velvety appearance, due to the presence of closely-set, minute, thread-like elevations called *villi* (see fig. 2). Throughout the whole length of the intestinal tract are minute masses of lymphoid tissue called *solitary glands* (see fig. 2); these are especially numerous in the caecum and appendix, while in the ileum they are collected into large oval patches, known as *agminated glands* or *Peyer's patches*, the long axes of which, from half an inch to 4 in. long, lie in the long axis of the bowel. They are always found in that part of the intestine which is farthest from the mesenteric attachment. In the interior of the rectum three shelf-like folds, one above the other, project into the cavity and correspond to the lateral concavities or kinks of the tube. They are not in the same line and the largest is usually on the right side. They are known as the *plicae recti* or *valves of Houston*. In the anal canal are four or five longitudinal folds called the *columns of Morgagni*. (For further details, see Quain's *Anatomy*, London, 1896; Gray's *Anatomy*, London, 1905; Cunningham's *Anatomy*, Edinburgh, 1906.)

Embryology.—The greater part of the alimentary canal is formed by the closing-in of the entoderm to make a longitudinal tube, ventral and parallel to the notochord. This tube is blind in front and behind (cephalad and caudad), but the middle part of its ventral wall is for some distance continuous with the wall of the yolk-sac, and this part of the canal, which at first opens into the yolk-sac by a very wide aperture, is called the *mid gut*. The part in front of it, which lies dorsal to the heart, is the *fore gut*, while the part behind the aperture of the yolk-sac is the *hind gut*.

The pharynx, oesophagus, stomach and part of the duodenum are developed from the fore gut, a good deal of the colon and the rectum from the hind gut, while the mid gut is responsible for the rest. The cephalic part of the fore gut forms the pharynx (*q.v.*), and about the fourth week the stomach appears as a fusiform dilatation in the straight tube. Between the two the oesophagus gradually forms as the embryo elongates. The opening into the yolk-sac, which at first is very wide, gradually narrows, as the ventral abdominal walls close in, until in the adult the only indication of the connexion between the gut and the yolk-sac is the very rare presence (about 2%) of Meckel's diverticulum already referred to. The stomach soon shows signs of the greater and lesser curvatures, the latter being ventral, but maintains its straight position. About the sixth week the caecum appears as a lateral diverticulum, and, until the third month, is of uniform calibre; after this period the terminal part ceases to grow at the same rate as the proximal, and so the vermiform appendix is formed. The mid gut forms a loop with its convexity toward the diminishing *vitelline duct*, or remains of the yolk-sac, and until the third month it protrudes into the umbilical cord. The greater curvature of the stomach grows more rapidly than the lesser, and the whole stomach turns over and becomes bent at right angles, so that what was its left surface becomes ventral. This turning over of the stomach throws the succeeding part of the intestine into a *duodenal loop*, which at first has a dorsal and ventral mesentery (see COELOM AND SEROUS MEMBRANES). The intestine now grows very rapidly and is thrown into a series of coils; the caecum ascends and passes to the right ventral to the duodenum, and presses it against the dorsal wall of the abdomen; then it descends toward its permanent position in the right iliac fossa.



From A. Birmingham; Cunningham's *Text-Book of Anatomy*.

FIG. 3.—*Valvulae Conniventes*.

A, As seen in a bit of jejunum which has been filled with alcohol and hardened.

B, A portion of fresh intestine spread out under water.

From the ventral surface on the hinder (caudal) closed end of the intestinal tube the *allantois* grows to form the placenta and bladder (see URINARY SYSTEM, REPRODUCTIVE SYSTEM and PLACENTA), and this region is the *cloaca* into which the alimentary, urinary and generative canals or ducts all open, but later two lateral folds appear which, by their union, divide the cloaca into a ventral and a dorsal part, the former being genito-urinary and the latter alimentary or intestinal. In this way the rectum or dorsal compartment is shut off from the genito-urinary. Later an ectodermal invagination at the hind end of the embryo develops and forms the anal canal; this is the *proctodaeum*, and for some time it is separated from the hind (caudal) end of the rectal part of the *mesodaeum* (or part of the intestinal canal formed from the mesoderm) by a membrane called the *anal membrane*. This is eventually absorbed and the digestive tract now communicates with the surface by the anus.

F. Wood Jones (*British Medical Journal*, 17th of December 1904) has given a somewhat different description of the development of the cloaca and anus, which better explains the various abnormalities met with in this region but requires further confirmation before it is generally accepted. For the development of the mouth, pharynx, lungs, liver and pancreas from the primitive alimentary canal, the reader is referred to the special articles on those structures. (For further details, see W. His, *Anatomie menschlicher Embryonen* (Leipzig, 1880–1885); C. S. Minot's *Embryology* (New York, 1897); and J. P. M‘Murrich, *Development of the Human Body* (London, 1906). (F. G. P.)

Comparative Anatomy.—The primitive condition of the vertebrate alimentary canal may be described as a straight, simple tube, consisting of an anterior portion, the *stomodaeum*, formed by an ectodermal invagination, the *mesenteron*, a long median portion lined by endoderm, and a short posterior portion, the *proctodaeum*, formed by ectodermal invagination. In the lower vertebrates the primitive tube subserved also the purpose of respiration, and traces of the double function remain in the adult structure of all vertebrates (see MOUTH, PHARYNX). In fish, the pharynx, or branchial region, suddenly becomes narrower, posterior to the gill-slits, to form the oesophagus; in higher animals the oesophagus, in the adult, is separated from the primitive pharyngeal region and lies dorsal to it. Probably, in the primitive vertebrata, the entire alimentary canal was lined with ciliated cells. Traces of this ciliation persist in many living forms. In the *Ammocoete*, the larval form of *Petromyzon* (see CYCLOSTOMATA), the whole canal is ciliated except the pharynx and the rectum; in the *Dipnoi* the epithelium of the stomach and the intestines is ciliated; in *Selachii* that of the posterior part of the gullet, and the spiral valve, is ciliated; extensive ciliation may occur in almost any region of the gut of the lower teleostomes, but in the higher forms (*Teleostei*) it is generally absent. In the latter, however, and in higher groups of vertebrates, a peculiar striated border on the columnar cells lining the intestinal tract has been held to be a final trace of ancestral ciliation.

The alimentary canal may be conveniently described in three divisions, the *oesophagus* or gullet, the passage by which food reaches the stomach, the *stomach*, typically an expanded region in which the food remains for a considerable time and is mechanically pulped, mixed with mucus and certain digestive juices (see NUTRITION) and partly macerated, the *intestinal tract* or gut, extending from the distal end of the stomach to the cloaca or anus, in which the food is subjected to further digestive action, but which is above all the region in which absorption of the products of digestion takes place, the refuse material together with quantities of waste matter entering the gut from the blood and liver being gradually passed towards the anus for discharge from the body.

The *oesophagus* is essentially merely a passage, as straight as may be, from the pharynx to the stomach, varying in length with the length of the neck and thoracic regions in different animals, and in calibre with the nature of the food. It is almost invariably lined with a many-layered epithelium, forming a tough coating, readily repaired and not easily damaged by hard food masses. It is occasionally separated from the stomach by a slight constriction which may be capable of contraction so as to prevent regurgitation. There are few exceptions to this structural and functional simplicity. In fishes (see ICHTHYOLOGY, *Anatomy*) the swim-bladder is developed as a dorsal outgrowth of the oesophagus and may remain in open connexion with it. In certain *Teleosteis* (*e.g. Lutodeira*) it is longer than the length it has to traverse and is thrown into convolutions. In many other fish, particularly *Selachiis*, a set of processes of the lining wall project into the cavity near the stomach and have been supposed to aid in preventing food particles, or living creatures swallowed without injury, escaping backwards into the mouth. In some egg-eating snakes the sharp tips of the ventral spines (hypapophyses) of the posterior cervical vertebrae penetrate the wall of the oesophagus and are used for breaking the shells of the eggs taken as food. In some aquatic *Chelonians*, the food of which consists chiefly of seaweeds, the lining membrane is produced into pointed processes backwardly directed. In birds this region frequently presents peculiarities. In *Opisthocomus* it forms an enormously wide double loop, hanging down over the breast-bone, which is peculiarly flattened and devoid of a keel in the anterior portion. In many birds part of the oesophagus may be temporarily dilated, forming a "crop," as for instance in birds of prey and humming birds. In the flamingo, many ducks, storks, and the cormorant the crop is a permanent although not a highly specialized enlargement. Finally, in the vast majority of seed-eating birds, in gallinaceous birds, pigeons, sandgrouse, parrots and many *Passeres*, particularly the finches, the crop is a permanent globular dilatation, in which the food is retained for a considerable time, mixed with a slight mucous secretion, and softened and partly macerated by the heat of the body. Many birds feed their young from the soft contents of the crop, and in pigeons, at the breeding season, the cells lining the crop proliferate rapidly and are discharged as a soft cheesy mass into the cavity, forming the substance known as pigeon's milk. Amongst *Mammalia*, in *Rodentia*, *Carnivora*, elephants and ruminants, the wall of the oesophagus contains a layer of voluntary muscle, by the contraction of which these animals induce anti-peristaltic movements and can so regurgitate food into the mouth.

Stomach.—Where the oesophagus passes into the stomach, the lining wall of the alimentary tract changes from a many-layered epithelium to a mucous epithelium, consisting of a single layer of endodermal cells, frequently thrown into pits or projecting as processes; from being chiefly protective, it has become secretory and absorbing, and maintains this character to the distal extremity where it passes into the epiblast of the proctodaeum. In most cases the course of the alimentary canal from the distal end of the oesophagus to the cloaca or anus is longer than the corresponding region of the body, and the canal is therefore thrown into folds. The fundamental form of the stomach is a sac-like enlargement of the canal, the proximal portion of which is continuous with the line of the oesophagus, but the distal portion of which is bent in the proximal portion, the whole forming an enlarged bent tube. At the distal end of the tube the intestinal tract proper begins, and the two regions are separated by a muscular constriction. In fishes the stomach is generally in one of two forms; it may be a simple bent tube, the proximal limb of which is almost invariably much wider than the distal, anteriorly directed limb; or the oesophagus may pass directly into an expanded, globular or elongated sac, from the anterior lateral wall of which, not far from the oesophageal opening, the duodenum arises. In *Batrachia* and *Reptilia* the stomach is in most cases a simple sac, marked off from the oesophagus only by increased calibre. In the *Crocodilia*, however, the anterior portion of the stomach is much enlarged and very highly muscular, the muscles radiating from a central tendinous area on each of the flattened sides. The cavity is lined by a hardened secretion and contains a quantity of pebbles and gravel which are used in the mechanical trituration of the food, so that the resemblance to the gizzard of birds is well marked. This muscular chamber leads by a small aperture into a distal, smaller and more glandular chamber. In birds the stomach exhibits two regions, an anterior glandular region, the proventriculus, the walls of which are relatively soft and contain enlarged digestive glands aggregated in patches (*e.g.* some *Steganopodes*), in rows (*e.g.* most birds of prey) or in a more or less regular band. The distal region is larger and is lined in most cases by a more or less permanent lining which is thick and tough in birds with a muscular gizzard, very slight in the others. In many birds, specially those feeding on fish, the two regions of the stomach are of equal width, and are indistinguishable until, on opening the cavity, the difference in the character of the lining membrane becomes visible. In other birds the proventriculus is separated by a well-marked constriction from the posterior and larger region. In graminiferous forms the latter becomes a thick-walled muscular gizzard, the muscles radiating from tendinous areas and the cavity containing pebbles or gravel.

In mammals, the primitive form of the stomach consists of a more or less globular or elongated expansion of the oesophageal region, forming the cardiac portion, and a forwardly curved, narrower pyloric portion, from which the duodenum arises. The whole wall is muscular, and the lining membrane is richly glandular. In the *Insectivora*, *Carnivora*, *Perissodactyla*, and in most *Edentata*, *Chiroptera*, *Rodentia* and *Primates*, this primitive disposition is retained, the difference consisting chiefly in the degrees of elongation of the stomach and the sharpness of the distal curvature. In other cases the cardiac portion may be prolonged into a caecal sac, a condition most highly differentiated in the blood-sucking bat, *Desmodeus*, where it is longer than the entire length of the body. There are two cardiac extensions in the hippopotamus and in the peccary. In many other mammals one, two or three protrusions of the cardiac region occur, whilst in the manatee and in some rodents the cardiac region is constricted off from the pyloric portion. In the *Artiodactyla* the stomach is always complex, the complexity reaching a maximum in ruminating forms. In the *Suidae* a cardiac diverticulum is partly constricted from the general cavity, forming an incipient condition of the rumen of true ruminants; the general cavity of the stomach shows an approach to the ruminant condition by the different characters of the lining wall in different areas. In the chevrotains, which in many other respects show conditions intermediate between non-ruminant artiodactyles and true ruminants, the oesophagus opens into a wide cardiac portion, incompletely divided into four chambers. Three of these, towards the cardiac extremity, are lined with villi and correspond to the *rumen* or paunch; the fourth, which lies between the opening of the oesophagus and the pyloric portion of the stomach, is the ruminant *reticulum* and its wall is lined with very shallow "cells." A groove runs along its dorsal wall from the oesophageal aperture to a very small cavity lined with low, longitudinally disposed folds, and forming a narrow passage between the cardiac and pyloric divisions; this is an early stage in the development of the *omasum*, *psalterium* or manyplies of the ruminant stomach. The fourth or true pyloric chamber is an elongated sac with smooth glandular walls and is the *abomasum*, or rennet sack. In the camel the rumen forms an enormous globular paunch with villous walls and internally showing a trace of division into two regions. It is well marked off from the reticulum, the "cells" of which are extremely deep, forming the well-known water-chambers. The psalterium is sharply constricted off from the reticulum and is an elongated chamber showing little trace of the longitudinal ridges characteristic of this region; it opens directly into the relatively small abomasum. In the true ruminants, the rumen forms a capacious, villous reservoir, nearly always partly sacculated, into which the food is passed rapidly as the animal grazes. The food is subjected to a rotary movement in the paunch, and is thus repeatedly subjected to moistening with the fluids secreted by the reticulum, as it is passed over the aperture of that cavity, and is formed into a rounded bolus. Most ruminants swallow masses of hairs, and these, by the rotary action of the paunch, are aggregated into peculiar dense, rounded balls which are occasionally discharged from the mouth and are known as "hair-balls" or "bezoars." The food bolus, when the animal is lying down after grazing, is passed into the oesophagus and reaches the mouth by anti-peristaltic contractions of the oesophagus. After prolonged mastication and mixing with saliva, it is again swallowed, but is now passed into the psalterium, which, in true ruminants, is a small chamber with conspicuous longitudinal folds. Finally it reaches the large abomasum where the last stages of gastric digestion occur.

In the *Cetacea* the stomach is different from that found in any other group of mammals. The oesophagus opens directly into a very large cardiac sac the distal extremity of which forms a long caecal pouch. At nearly the first third of its length this communicates by a narrow aperture into the elongated, relatively narrow pyloric portion. The latter is convoluted and constricted into a series of chambers that differ in different groups of *Cetacea*. In the *Sirenia* the stomach is divided by a constriction into a cardiac and a pyloric portion, and the latter has a pair of caeca. In most of the *Marsupialia* the stomach is relatively simple, forming a globular sac with the oesophageal and pyloric apertures closely approximated; in the kangaroos, on the other hand, the stomach is divided into a relatively small, caecal cardiac portion and an enormously long sacculated and convoluted pyloric region, the general arrangement of which closely recalls the large caecum of many mammals.

Intestinal Tract.—It is not yet possible to discuss the general morphology of this region in vertebrates as a group, as, whilst the modifications displayed in birds and mammals have been compared and studied in detail, those in the lower groups have not yet been systematically co-ordinated.

Fishes.—In the *Cyclostomata*, *Holocephali* and a few *Teleostei* the course of the gut is practically straight from the pyloric end of the stomach to the exterior, and there is no marked differentiation into regions. In the *Dipnoi*, a contracted sigmoid curve between the stomach and the dilated intestine is a simple beginning of the complexity found in other groups. In very many of the more specialized teleosteans, the gut is much convoluted, exhibiting a series of watchspring-like coils. In a number of different groups, increased surface for absorption is given, not by increase in length of the whole gut, but by the development of an internal fold known as the spiral valve. This was probably originally a longitudinal fold similar to the typhlosole of chaetopods. It forms a simple fold in the larval *Ammocoete*, and in its anterior region remains straight in some adult fish, *e.g. Polypterus*, but in the majority of cases it forms a complex spiral, wound round the inner wall of the expanded large intestine, the internal edge of the fold sometimes meeting to form a central column. It occurs in *Cyclostomata*, *Selachii*, *Holocephali*, *Chondrostei*, *Crossopterygii*, *Amiidae*, *Lepidosteidae* and *Dipnoi*. A set of organs peculiar to fish and known as the *pyloric caeca* are absent in *Cyclostomata* and *Dipnoi*, in most *Selachii* and in *Amia*, but present, in numbers ranging from one to nearly two hundred, in the vast majority of fish. These are outgrowths of the intestinal tract near the pyloric extremity of the stomach, and their function is partly glandular, partly absorbing. In a few *Teleostei* there is a single caecal diverticulum at the beginning of the "rectum," and in the same region a solid rectal gland occurs in most elasmobranchs, whilst, again, in the *Dipnoi* a similar structure opens into the cloaca. These caeca have been compared with the colic caeca of higher vertebrates, but there is yet no exact evidence for the homology.

In the *Batrachia* the course of the intestinal tract is nearly straight from the pyloric end of the stomach to the cloaca, in the case of the perennibranchiates there being no more than a few simple loops between the expanded "rectum" and the straight portion that leaves the stomach. In the *Caducibranchiata* the anterior end of the enlarged rectum lies very close to the distal extremity of the stomach, and the gut, between these two regions, is greatly lengthened, forming a loop with many minor loops borne at the periphery of an expanse of mesentery, recalling the Meckelian tract of birds and mammals. In the tadpole this region is spirally coiled and is still longer relatively to the length of the whole tract. In *Hyla* and *Pipa* there is a small caecum comparable with the colic caecum of birds and mammals.

In *Reptilia* the configuration of the intestinal tract does not differ much from that in *Batrachia*, the length and complexity of the minor coils apparently varying with the general configuration of the body, that is to say, in reptiles with a long, narrow, and snake-like body the minor loops of the gut are relatively short and unimportant, whilst in those with a more spacious cavity, such as chelonians, many lizards and crocodiles, the gut may be relatively long and disposed in many minor coils. There is comparatively little differentiation between the mid-gut and the gut in cases where the whole gut is long; in the others the hind-gut is generally marked by an increase of calibre. A short caecal diverticulum, comparable with the colic caecum of birds and mammals, is present in many snakes and lizards and in some chelonians.

In fishes, batrachians and reptiles the intestinal tract is swung from the dorsal wall of the abdominal cavity by a mesentery which is incomplete on account of secondary absorption in places, and which grows out with the minor loops of the gut. There are also traces, more abundant in the lower forms, of the still more primitive ventral mesentery.

Intestinal Tract in Birds and Mammals.—There is no doubt but that the similarity of the modes of disposition of the alimentary tract in birds and mammals points to the probability of the chief morphological features of this region in these animals having been laid down in some common ancestor, although we have not yet sufficient exact knowledge of the gut in *Pisces*, *Batrachia* and *Reptilia* to find amongst these with any certainty the most probable survival from the ancestral condition. The primitive gut must be supposed to have run backwards from the stomach to the cloaca suspended from the dorsal wall of the body-cavity by a dorsal mesentery. This tract, in the course of phylogeny of the common ancestors of birds and mammals, became longer than the straight length between its extreme points and, consequently, was thrown into a series of folds. The

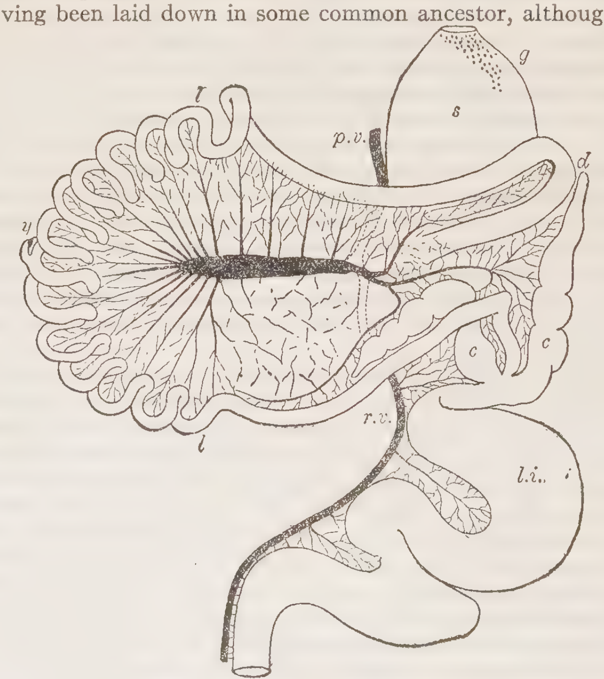


FIG. 4.—Intestinal Tract of *Chauna chavaria*.

c.c.	Colic caeca.	*p.v.*	Cut root of portal vein.
d.	Duodenum.	*r.v.*	Rectal vein.
g.	Glandular patch.	*s.*	Proventriculus.
l.l.	Meckel's tract.	*y.*	Meckel's diverticulum, or Yolk-sac vestige.
l.i.	Hind-gut.		

mesentery grew out with these folds, but the presence of adjacent organs, the disturbance due to the outgrowth of the liver, and the secondary relations brought about between different portions of the gut, as the out-growing loops invaded each other's localities, disturbed the primitive simplicity. Three definite regions of outgrowth, however, became conspicuous and are to be recognized in the actual disposition of the gut in existing birds and mammals. The first of these is the *duodenum*. In the vast majority of birds, and in some of the simpler mammals, the portion of the gut immediately distal of the stomach grows out into a long and narrow loop (fig. 4, *d*), the proximal and distal ends of which are close together, whilst the loop itself may remain long and narrow, or may develop minor loops on its course. In mammals generally, however, the duodenum is complex and is not so sharply marked off from the distal portion of the gut as in birds. The second portion is *Meckel's tract*. It consists of the part generally known as the small intestines, the *jejunum* and *ileum* of human anatomy, and stretches from the distal end of the duodenum to the caecum or caeca. It is the chief absorbing portion of the gut, and in nearly all birds and mammals is the longest portion. It represents, however, only a very small part of the primitive straight gut, corresponding to not more than two or three somites of the embryo. This narrow portion grows out to form the greater part of what is called the pendent loop in mammalian embryology. Its anterior or proximal end lies close to the approximated proximal and distal ends of the duodenal loop, whilst its distal end passes into the hind-gut at the colic caecum or caeca. In the embryos of all birds and mammals, the median point of Meckel's tract, the part of the loop which has grown out farthest from the dorsal edge of the mesentery, is marked by the *diverticulum caecum vitelli*, the primitive connexion of the cavity of the gut with the narrowing stalk of the yolk-sac (fig. 4, *y*). Naturally, in birds where the yolk-sac is of great functional importance this diverticulum is large, and in a majority of the families of birds persists throughout life, forming a convenient point of orientation. In mammals, no doubt in association with the functional reduction of the yolk-sac, this diverticulum, which is known as Meckel's diverticulum, has less importance, and whilst it has been observed in a small percentage of adult human subjects has not been recognized in the adult condition of any lower *Mammalia*.

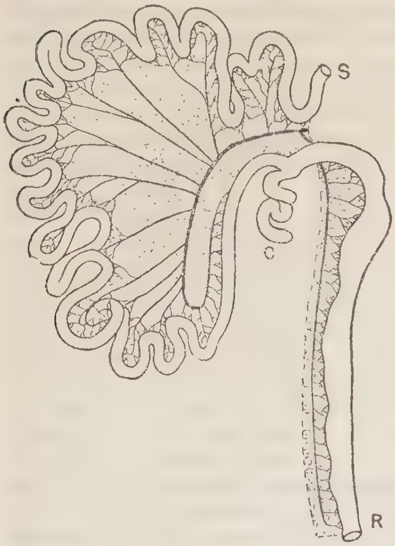


FIG. 5.—Intestinal Tract of *Canis vulpes*. *S*, cut end of duodenum; *C*, caecum; *R*, cut end of rectum.

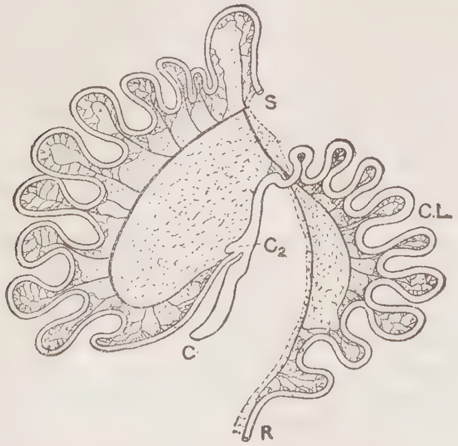


FIG. 6.—Intestinal Tract of *Macropus bennetti*. *S*, cut end of duodenum; *R*, cut end of rectum; *C*, caecum; C_2, accessory caecum; *C.L*, colic loop of hind-gut.

In birds, Meckel's tract falls into minor folds or loops, the disposition of which forms a series of patterns remarkable different in appearance and characteristic of different groups. In fig. 4 an extremely primitive type is represented. In mammals Meckel's tract remains much more uniform; it may be short, or increase enormously in length, but in either case it falls into a fairly symmetrical shape, suspended at the circumference of a nearly circular expanse of mesentery. Where it is short it is thrown into very simple minor loops (figs. 5, 6 and 7); where it is long, these minor loops form a convoluted mass (figs. 8 and 9).

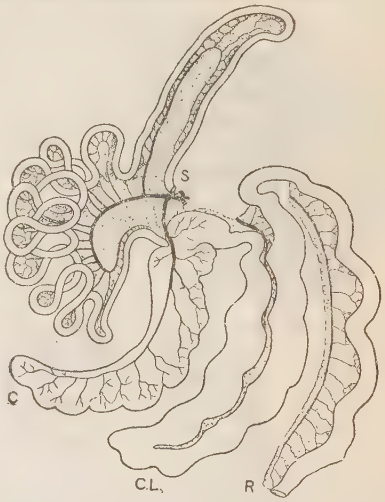


FIG. 7.—Intestinal Tract of Tapir. *S*, cut end of duodenum; *R*, cut end of rectum; *C*, caecum; *CL*, colon.

The third portion of the gut should be termed the *hind-gut* and lies between the caecum or caeca and the anus, corresponding to the large intestines, colon and rectum of human anatomy. It is formed from a much larger portion of the primitive straight gut than the duodenum and Meckel's tract together, and its proximal portion, in consequence, lies very close to the origin of the duodenum. In the vast majority of birds, the hind-gut in the adult is relatively extremely short, often being only from one-eighth to one-thirtieth of the whole length of the gut. A certain number of primitive birds, however, have retained a relatively long condition of the hind-gut (fig. 4), the greatest relative length occurring in struthious birds, and particularly in the ostrich, where the hind-gut exceeds in length the duodenum and Meckel's tract together. Mammals may be contrasted with birds as a group in which the hind-gut is always relatively long, sometimes extremely long, and in which, moreover, there is a strong tendency to differentiation of the hind-gut into regions

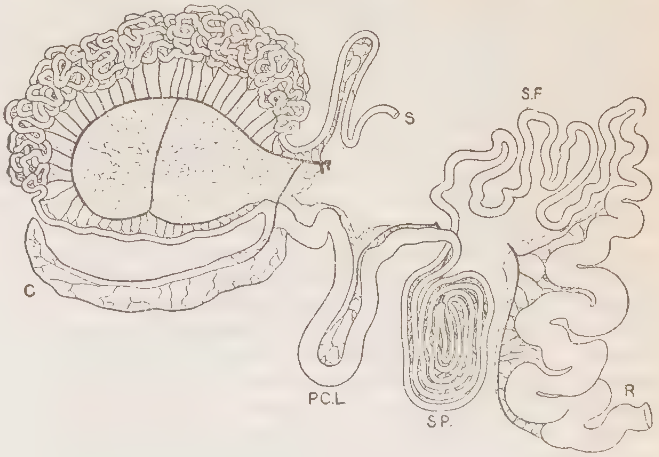


FIG. 8.—Intestinal Tract of Giraffe. *S*, cut end of duodenum; *R*, cut end of rectum; *C*, caecum; *P.C.L*, post-caecal loop; *S.P*, spiral loop; *SF*, third loop of hind-gut.

the characters of which are of systematic importance. The first region is the *colon*, which forms a very simple expansion in mammals such as *Carnivora* (fig. 5), where the whole hind-gut is relatively short, or a series of simple loops in mammals in which the whole gut has a primitive disposition (*e.g. Marsupialia*, fig. 6). In the odd-toed *Ungulata*, the colon (fig. 7) forms an enormously long loop, the two limbs of which are closely approximated and the calibre of which is very large. In *Ruminantia* (fig. 8) the colon is still more highly differentiated, displaying first a simple wide loop, then a complicated watchspring-like coil, and finally a very long, irregular portion. In the higher *Primates* (fig. 9) it forms one enormous very wide loop, corresponding to the ascending, transverse and descending colons of human anatomy, and a shorter distal loop, the omega loop of human anatomy. Other striking patterns are displayed in other mammalian groups.

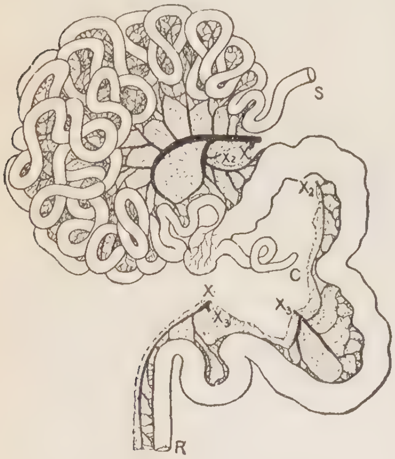


FIG. 9.—Intestinal Tract of Gorilla. *S*, cut end of duodenum; *R*, cut end of rectum; *C*, vermiform appendix of caecum; X, X_2, X_3, cut ends of factors of the portal vein.

The second region of the hind-gut is usually known as the *rectum*, and although it is sometimes lengthened it is typically little longer than the portion of the primitive straight gut that it represents.

Adaptations of the Intestinal Tract to Function.—The chief business of the gut is to provide a vascular surface to which the prepared food is applied so that the nutritive material may be absorbed into the system. Overlying and sometimes obscuring the morphological patterns of the gut, are many modifications correlated with the nature of the food and producing homoplastic resemblances independent of genetic affinity. Thus in birds and mammals alike there is a direct association of herbivorous habit with great relative length of gut. The explanation of this, no doubt, is simply that the vegetable matter which such creatures devour is in a form which requires not only prolonged digestive action, but, from the intimate admixture of indigestible material, a very large absorbing surface. In piscivorous birds and mammals, the gut **is** very long, with a thick wall and a relatively small calibre, whilst there is a general tendency for the regions of the gut to be slightly or not at all defined. Fish, as it is eaten by wild animals, contains a large bulk of indigestible matter, and so requires an extended absorbing surface; the thick wall and relatively small calibre are protections against wounding by fish bones. In frugivorous birds the gut is strikingly short, wide and simple, whilst a similar change has not taken place in frugivorous mammals. Carnivorous birds and mammals have a relatively short gut. In birds, generally, the relation of the length and calibre of the gut to the size of the whole creature is striking. If two birds of similar habit and of the same group be compared, it will be found that the gut of the larger bird is relatively longer rather than relatively wider. The same general rule applies to Meckel's tract in mammals, whereas in the case of the hind-gut increase of capacity is given by increase of calibre rather than by increased length.

The Colic Caeca.—These organs lie at the junction of the hind-gut with Meckel's tract and are homologous in birds and mammals although it happens that their apparent position differs in the majority of cases in the two groups. In most birds, the hind-gut is relatively very short, and the caecal position, accordingly, is at a very short distance from the posterior end of the body, whereas in most mammals the hind-gut is very long and the position of the caecum or caeca is relatively very **much farther** from the anus. Next, in most birds, the caeca when present are paired, whereas in most mammals there is only a single caecum. On the other hand, in certain birds (herons) as a normal occurrence, and in many birds as an individual variation, only a single caecum occurs. In some mammals, *e.g.* many armadillos, in *Hyrax* and the manatee, the caeca are normally paired; in many other (*e.g.* some rodents and marsupials) in addition to the normal caecum there is a reduced second caecum, whilst in quite a number of forms the relation of the caecum, ileum and colon at their junction is readily intelligible on the assumption that the caeca were originally paired. The origin and many of the peculiarities of the ileo-caecal valve find their best explanation on this hypothesis.

The caeca are hollow outgrowths of the wall of the gut, the blind ends being directed forwards. The caecal wall is in most cases highly glandular and contains masses of lymphoid tissue. In birds and in mammals this tissue may be so greatly increased as to transform the caecum into a solid or nearly solid sac, the calibre of which is for the most part smaller than that of the unmodified caecum. In some birds, the whole area of the caecum may be modified in this way; in mammals, it is generally the terminal portion, which then becomes the *vermiform appendix*, familiar in the anthropoid apes, in man and in some rodents. It is difficult to see in this modification merely a degeneration; not improbably it is the formation of a new glandular organ.

The caeca exhibit almost every gradation of development, from relatively enormous size to complete absence, and there is no definite, invariable connexion between the nature of the food and the degree of their development. In the case of birds, it may be said that on the whole the caeca are generally large in herbivorous forms and generally small in insectivorous, frugivorous, carnivorous and piscivorous forms, but there are many exceptions. Thus, owls and falcons have a diet that is closely similar, and yet owls have a pair of very long caeca, whilst in the *Falconidae* these organs are much reduced and apparently functionless. The insectivorous and omnivorous rollers, motmots and bee-eaters have a pair of large caeca, whilst in passerine birds of similar habit the caeca are vestigial glandular nipples. It is impossible to doubt that family history dominates in this matter. Certain families tend to retain the caeca, others to lose them, and direct adaptation to diet appears only to accelerate or retard these inherited tendencies. So also in mammals, no more than a general relation between diet and caecal development can be shown to exist, although the large size of the single caecum of mammals is more closely associated with a herbivorous as opposed to a carnivorous, frugivorous, piscivorous or omnivorous diet than is the case in birds. There is no relationship between diet and the complete or partial presence of both members of the primi-pair of caeca in mammals, the occurrence of the pair being rather an " accident " of inheritance than in any direct relation to function.

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(P. C. M.)

ALIMONY (from Lat. *alere*, to nourish), in law the allowance for maintenance to which a wife is entitled out of her husband's estate for her support on a decree for judicial separation or for the dissolution of the marriage. Though, as a rule, payable to a wife, it may, if the circumstances of the case warrant it, be payable by the wife to the husband. Alimony is of two kinds, (*a*) temporary (*pendente lite*), and (*b*) permanent. *Temporary* alimony, or alimony pending suit, is the provision made by the husband for the wife in causes between them to enable her to live during the progress of the suit, and is allowed whether the suit is by or against the husband and whatever the nature of the suit may be. The usual English practice is to allot as temporary alimony about one-fifth of the husband's net income; where it appears that the husband has no means or is in insolvent circumstances, the court will refuse to allot temporary alimony. So where the wife is supporting herself by her own earnings, this fact will be taken into consideration. And where the wife and husband have lived apart for many years before the institution of the suit, and she has supported herself during the separation, no alimony will be allotted. Nor will the wife be entitled to alimony where she has sufficient means of support independent of her husband. *Permanent* alimony is that which is allotted to the wife after final decree. By the Matrimonial Causes Act 1907, the court may, if it think fit, on any decree for dissolution or nullity of marriage, order that the husband shall, to the satisfaction of the court, secure to the wife such a gross sum of money or such annual sum of money for any term not exceeding her life, as having regard to her fortune (if any), to the ability of her husband, and to the conduct of the parties, it may deem reasonable. The court may suspend the pronouncing of its decree until a proper deed or instrument has been executed by all necessary parties. The court may also make an order on the husband for payment to the wife during their joint lives of a reasonable monthly or weekly sum for her maintenance; the court may also at any time discharge, modify, suspend or increase the order according to the altered means of the husband; the court has also power to make provision for children. Alimony is paid direct to the wife or to a trustee or trustees on her behalf, but the court may impose any restrictions which seem expedient. We may also describe as a kind of alimony the allowance of a reasonable weekly sum not exceeding £2 which in England, under the Summary Jurisdiction (Married Women) Act 1895, may be given to a married woman on applying to a court of summary jurisdiction if she has been forced by cruelty to leave her husband or has been deserted by him.

United States.—Alimony is granted by the courts of the several states on much the same principle as in England, though in many states the courts of equity as such may grant alimony without divorce or separation proceedings independently of any statute, on the ground that it is just that the husband should support his wife when she lives apart from him for his fault, and since the courts of common law provide no remedy the courts of equity will. This is so in Alabama (*Brady* v. *Brady*, 1905, 39 So. Rep. 237), Kentucky, North Carolina, Iowa, California, Ohio, Virginia, South Dakota and the District of Columbia. In other states alimony without such proceedings is allowed by statute, and such alimony is now very general throughout the United States. The usual grounds for the allowance of it are desertion and such conduct as would amount to legal cruelty. After divorce *a vinculo*, alimony or separate maintenance is sometimes granted on good reason. The marriage must be proven as a fact, but a "common law" marriage, *i.e.* one established by cohabitation and repute, is sufficient. In several states alimony or maintenance is by statute allowed to the husband in certain cases out of the wife's property. This is so in Massachusetts, Virginia, Rhode Island and Iowa. In Oregon he is entitled to one-third of his wife's real estate in addition to maintenance on divorce for her fault. The amount of alimony depends upon the circumstances of each case as in England. Permanent alimony is generally more than when *pendente lite*, and usually one-third the husband's income. It may generally be changed from time to time as the circumstances of the parties change. Judgment for alimony is considered a judgment *in personam* and not *in rem*, and can only be enforced outside the state where rendered in case the husband has been personally served with process within that state. The remarriage of the man is not sufficient ground for reducing the alimony (*Smith* v. *Smith*, 1905, 102 N.W. Rep. 631), but on remarriage of a woman to one able to support her, her former husband being in poor circumstances, it will be reduced (*Kiralfy* v. *Kiralfy*, 1901, 36 Wisc. N.S. 407).

ALIN, OSCAR JOSEF (1846–1900), Swedish historian and politician, was born at Falun on the 22nd of December 1846. In 1872 he became *docent*, and in 1882 professor of political economy at Upsala, of which university he was afterwards rector. In September 1888 he was elected a member of the first chamber of the *Riksdag*, where he attached himself to the conservative protectionist party, over which, from the first, he exercised great authority. But it is as a historian that Alin is most remarkable. Among his numerous works the following are especially worthy of note: *Bidrag till svenska rådets historia under medeltiden* (Upsala, 1872); *Sveriges Historia, 1511–1611* (Stockholm, 1878); *Bidrag till svenska statsrickets historia* (Stockholm, 1884–1887); *Den svensk-norsk Unionen* (Stockholm, 1889–1891), the best book on the Norwego-Swedish Union question from the Swedish point of view; *Fjerde Artiklen af Fredstraktaten i Kiel* (Stockholm, 1899); *Carl Johan och Sveriges yttre politik, 1810–1815* (Stockholm, 1899); *Carl XIV. och Rikets Ständer, 1840–1841* (Stockholm, 1893). He also edited *Svenska Riksdagsakter, 1521–1554* (Stockholm, 1887), in conjunction with E. Hildebrand, and *Sveriges Grundlagar* (Stockholm, 1892). He died at Upsala on the 31st of December 1900.

Obituary notice in *Sv. Hist. Tidssk.* (1901). (R. N. B.)

ALIPUR, a suburb of Calcutta, containing Belvedere House, the official residence of the lieutenant-governor of Bengal, and a number of handsome mansions. It lies within the limits of the south suburban municipality, and is a cantonment of native troops. On the Calcutta *maidan*, opposite Alipur Bridge, stood two trees under which duels were fought. It was here that the meeting in 1780 between Warren Hastings and Sir Philip Francis took place.

ALIQUOT (a Lat. word meaning "some," "so many"), a term generally occurring in the phrase "aliquot part," and meaning that one quantity is exactly divisible into another; thus 3 is an aliquot part of 6.

ALIRAJPUR, a native state of India, under the Bhopawar agency in Central India. It lies in Malwa, near the frontier of Bombay. It has an area of 836 sq. m.; and a population (1901) of 50,185. The country is hilly, and many of the inhabitants are aboriginal Bhils. It has from time to time been under British administration. The chief, whose title is Rana, is a Rahtor Rajput. He has an estimated revenue of £8700, and pays a tribute of £700. The Victoria bridge at Alirajpur was built to commemorate the Diamond Jubilee of 1897.

ALISMACEAE (from the Gr. ἄλισμα, a water-plant mentioned by Dioscorides), in botany, a natural order of monocotyledons belonging to the series Helobieae, and represented in Britain by the water plantain, *Alisma Plantago*, the arrow-head, *Sagittaria*, the star-fruit, *Damasonium*, and flowering rush, *Butomus* (from the Gr. βοῦς, ox, τέμνειν, to cut, in allusion to leaves cutting the tongues of oxen feeding on them). They are marsh- or water-plants with generally a stout stem (rhizome) creeping in the mud, radical leaves and a large, much branched inflorescence. The leaves show a great variety in shape, often on the same plant, according to their position in, on or above the water. The submerged leaves are long and grass-like, the floating leaves oblong or rounded, while the aerial leaves are borne on long, thin stalks above the water, and are often heart- or arrow-shaped at the base. The flower-bearing stem is tall; the flowers are borne in whorls on the axis as in arrow-head, on whorled branchlets as in water plantain or in an umbel as in *Butomus* (fig. 1). The flowers are regular and rather showy, generally with three greenish sepals, followed in regular succession by three white or purplish petals, six to indefinite stamens and six to indefinite free carpels. The floral

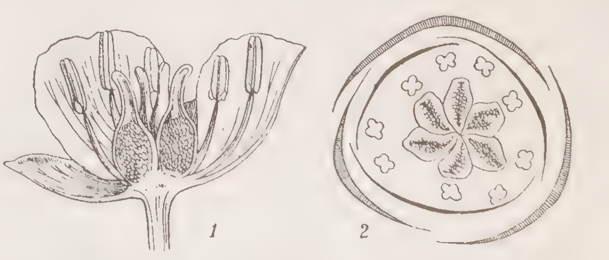


Fig. 1.—Flowering Rush (*Butomus umbellatus*). 1, Flower in vertical section; 2, horizontal plan of arrangement of flower.

arrangement thus recalls that of a buttercup, a resemblance which extends to the fruit, which is a head of achenes or follicles. The flowers contain honey, and attract flies, short-lipped bees or other small insects by the agency of which pollination is effected. The fruit of *Butomus* is of interest in having the seeds borne over the inner face of the wall of the leathery pod (follicle). *Damasonium* derives its popular name, star-fruit, from the fruits spreading when ripe in the form of a star. It is a western Mediterranean plant which spreads to the south of England, where it is sometimes found in gravelly ditches and pools. The order contains about fifty species in fourteen genera, and is widely distributed in temperate and warm zones. *Alisma Plantago* (fig. 2), a common plant in Britain (except in the north) in ditches and edges of streams, is widely distributed in the north temperate zone, and is found in the Himalayas, on the mountains of tropical Africa and in Australia.

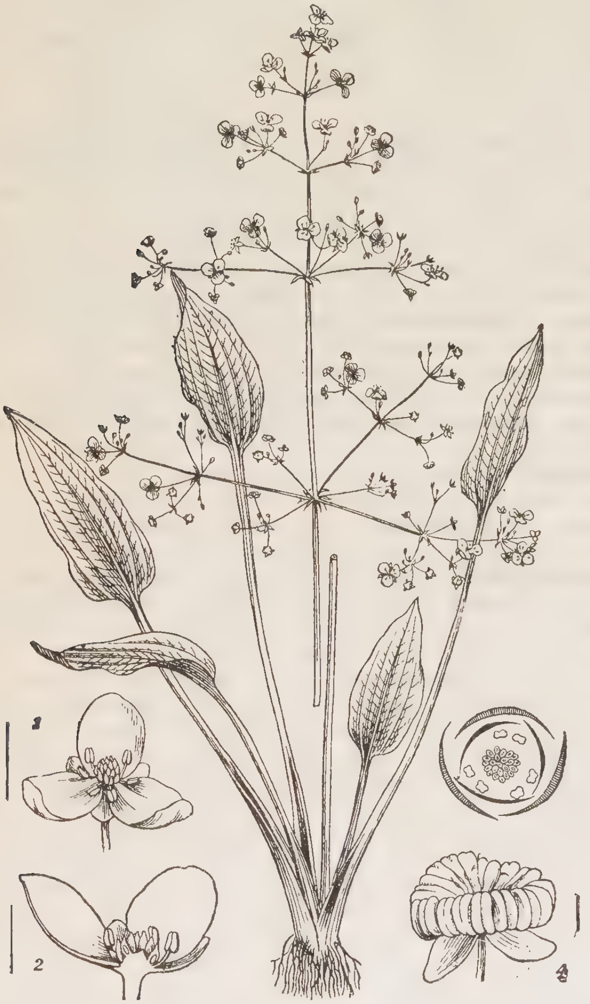


FIG. 2.—Water Plantain (*Alisma Plantago*). Plant about 3 ft. high. 1, Flower; 2, same in vertical section; 3, horizontal plan of flower; 4, mature fruit.

ALISON, ARCHIBALD (1757–1839), Scottish author, son of Patrick Alison, provost of Edinburgh, was born on the 13th of November 1757 at Edinburgh. After studying at the university of Glasgow and at Balliol College, Oxford, he took orders in the Church of England, and was appointed in 1778 to the curacy of Brancepeth, near Durham. In 1784 he married Dorothea, youngest daughter of Professor Gregory of Edinburgh. The next twenty years of his life were spent in Shropshire, where he held in succession the livings of High Ercall, Roddington and Kenley. In 1800 he removed to Edinburgh, having been appointed senior incumbent of St Paul's Chapel in the Cowgate. For thirty-four years he filled this position with much ability, his preaching attracting so many hearers that a new and larger church was built for him. His last years were spent at Colinton, near Edinburgh, where he died on the 17th of May 1839. Alison published, besides a *Life of Lord Woodhouselee*, a volume of sermons, which passed through several editions, and a work entitled *Essays on the Nature and Principles of Taste* (1790), based on the principle of association (see under AESTHETICS, p. 288). His elder son, Dr William Pulteney Alison (1790–1859), was a distinguished Edinburgh medical professor.

SIR ARCHIBALD ALISON, Bart. (1792–1867), the historian, was the younger son, and was born at Kenley, Shropshire, on the 29th of December 1792. He studied at the university of Edinburgh, distinguishing himself especially in Greek and mathematics. In 1814 he passed at the Scottish bar, but he did not at once practise. The close of the war had opened up the continent, and Alison set out in the autumn of 1814 for a lengthened tour in France. It was during this period that the idea of writing his history first occurred to him. A more immediate result of the tour was his first literary work of any importance, *Travels in France during the Years 1814–1815*, written in collaboration with his brother and A. F. Tytler, which appeared in the latter year. On his return to Edinburgh he practised at the bar for some years with very fair success. In 1822 he became one of the four advocates-depute for Scotland. As a result of the experience gained in this office, which he held until 1830, he wrote his *Principles of the Criminal Law of Scotland* (1832) and *Practice of the Criminal Law of Scotland* (1833), which in 1834 led to his appointment by Sir Robert Peel to the office of sheriff of Lanarkshire, which ranks next to a judgeship in the supreme court. The office, though by no means a sinecure, gave him time not only to make frequent contributions to periodical literature, but also to write the long-projected *History of Europe*, for which he had been collecting materials for more than fifteen years. The history of the period from the beginning of the French Revolution till the restoration of the Bourbons in 1815 was completed in ten volumes in 1842, and met with a success almost unexampled in works of its class. Within a few years it ran through ten editions, and was translated into many of the languages of Europe, as well as into Arabic and Hindustani. At the time of the author's death it was stated that 108,000 volumes of the library edition and 439,000 volumes of the popular edition had been sold. A popularity so widespread must have had some basis of merit, and the good qualities of Alison's work lie upon the surface. It brought together, though not always in a well-arranged form, an immense amount of information that had before been practically inaccessible to the general public. It at least made an attempt to show the organic connexion in the policy and progress of the different nations of Europe; and its descriptions of what may be called external history—of battles, sieges and state pageants—are spirited and interesting. On the other hand the faults of the work are numerous and glaring. The general style is prolix, involved and vicious; mistakes of fact and false deductions are to be found in almost every page; and the constant repetition of trite moral reflections and egotistical references seriously detracts from its dignity. A more grave defect resulted from the author's strong political partisanship, which entirely unfitted him for dealing with the problems of history in a philosophical spirit. His unbending Toryism made it impossible for him to give any satisfactory explanation of so complex a fact as the French Revolution, or accurately to estimate the forces that were to shape the Europe of the 19th century. A continuation of the History, embracing the period from 1815 to 1852, which was completed in four volumes in 1856, did not meet with the same success as the earlier work. The period being so near as to be almost contemporary, there was a stronger temptation, which he seems to have found it impossible to resist, to yield to political prejudice, while the materials necessary for a clear knowledge of the influences shaping European affairs were not as yet accessible. The book is now almost wholly out of date. In 1845 Alison was chosen rector of Marischal College, Aberdeen, and in 1851 of Glasgow University. In 1852 a baronetcy was conferred upon him, and in the following year he was made a D.C.L. of Oxford. His literary activity continued till within a short time of his death, the chief works he published in addition to his History being the *Principles of Population* (1840), in answer to Malthus; a *Life of Marlborough* (1847, 2nd edition greatly enlarged, 1852); and the *Lives of Lord Castlereagh and Sir C. Stewart* (1861.) This latter, based on MS. material preserved at Wynyard Park, is still of value, not only as the only available biography, but more especially because Alison's Tory sympathies enabled him to give a juster appreciation of the character and work of Castlereagh than the Liberal writers by whom for many years he was misjudged and condemned (see LONDONDERRY, Robert Stewart, 2nd marquess of). Three volumes of Alison's political, historical and miscellaneous essays were reprinted in 1850. He died at Possil House, Glasgow, on the 23rd of May 1867. His autobiography, *Some Account of my Life and Writings*, edited by his daughter-in-law, Lady Alison, was published in 1883 at Edinburgh. Sir Archibald Alison married in 1825 Elizabeth Glencairn, daughter of Colonel Tytler, by whom he had three children, Archibald, Frederick and Eliza Frances Catherine. Both sons became distinguished officers.

SIR ARCHIBALD ALISON, Bart. (1826–1907), the elder of the sons, entered the 72nd Highlanders in 1846. He served at the siege of Sevastopol; and during the Indian Mutiny he was military secretary to Sir Colin Campbell and was severely wounded at the relief of Lucknow, losing an arm. From 1862 to 1873 he was assistant adjutant-general at headquarters, Portsmouth and Aldershot. He was second in command of the Ashanti expedition 1873–1874, and was made a K.C.B. For three years Alison was deputy adjutant-general in Ireland, and then, for a few months, commandant of the Staff College. He was promoted to be major-general in 1877, and was head of the intelligence branch of the war office (1878–1882). He commanded the troops at Alexandria in 1882 until the arrival of Sir Garnet Wolseley, led the Highland brigade at the battle of Tel-el-Kebir, and remained in command of the army of occupation until 1883. He commanded at Aldershot 1883–1888, was for some months adjutant-general to the forces during Lord Wolseley's absence in Egypt, was made G.C.B. in 1887, was promoted general, and became a military member of the Council of India in 1889. He retired in 1893 and died in 1907.

ALIWAL, a village of British India, in the Ludhiana district of the Punjab, situated on the left bank of the Sutlej, and famous as the scene of one of the great battles of the 1st Sikh War. Late in January 1846 it was held by Ranjur Singh, who had crossed the river in force and threatened Ludhiana. On the 28th Sir Harry Smith, with a view to clearing the left or British bank, attacked him, and after a desperate struggle thrice pierced the Sikh troops with his cavalry, and pushed them into the river, where large numbers perished, leaving 67 guns to the victors. The consequence of the victory was the submission of the whole territory east of the Sutlej to the British.

ALIWAL NORTH, a town of South Africa, on the south bank of the Orange River, 4300 ft. above the sea, and 282 m. by rail N.W. by N. of the port of East London. Pop. (1904) 5566, of whom 1758 were whites. The town, a trading and agricultural centre for the N.E. part of the Cape and the neighbouring regions of Basutoland and Orange Free State, presents a pleasing appearance. It contains many fine stone buildings. The streets are lined with trees, and water from the neighbouring sulphur springs flows along them in open channels. The river, here the boundary between the Cape province and Orange Free State, is crossed by a stone bridge 860 ft. long. The sulphur springs, 1 m. from the town, which yield over 500,000 gallons daily, are resorted to for the cure of rheumatism and skin diseases. By reason of its dry and bracing climate, Aliwal North is also a favourite residence of sufferers from chest complaints. In the neighbourhood are stone quarries. Aliwal North is the capital of a division of the province of the same name, with an area of 1330 sq. m. and a pop. (1904) of 14,857, of whom 40% are whites.

Aliwal North was so called to distinguish it from Aliwal South, now Mossel Bay, the seaport of the pastoral Grasveld district, on the west side of Mossel Bay. Both places were named in honour of Sir Harry Smith, governor of Cape Colony 1847–1852, Aliwal (see above) being the village in the Punjab where in 1846 he gained a great victory over the Sikhs. Crossing the Orange River at this spot in September 1848, Sir Harry noted that it was "a beautiful site for a town," and in the May following the town was founded. In the early months of the Boer War of 1899–1902 Aliwal North was held by the Boers. It was reoccupied by the British in March 1900.

ALIZARIN, or 1·2 DIOXYANTHRAQUINONE,

$$C_6H_4\left<\begin{matrix}CO\\CO\end{matrix}\right>C_6H_2(OH)_2[1\cdot2],$$

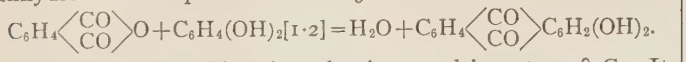
a vegetable dyestuff formerly prepared from madder root (*Rubia tinctorum*) which contains a glucoside ruberythric acid ($C_{26}H_{28}O_{14}$). This glucoside is readily hydrolysed by acids or ferments, breaking up into alizarin and glucose:

$$\begin{array}{c}C_{26}H_{28}O_{14}+2H_2O=2C_6H_{12}O_6+C_{14}H_8O_4\\ \text{Ruberythric acid}=\text{Glucose}+\text{Alizarin.}\end{array}$$

Alizarin was known to the ancients, and until 1868 was obtained entirely from madder root. The first step in the synthetical production of alizarin was the discovery in 1868 of C. Graebe and C. Liebermann that on heating with zinc dust, alizarin was converted into anthracene. In order to synthesize alizarin, they converted anthracene into anthraquinone and then brominated the quinone. The dibrominated product so obtained was then fused with caustic potash, the melt dissolved in water, and on the addition of hydrochloric acid to the solution, alizarin was precipitated. This process, owing to its expensive nature, was not in use very long, being superseded by another, discovered simultaneously by the above-named chemists and by Sir W. H. Perkin; the method being to sulphonate anthraquinone, and then to convert the sulphonic acid into its sodium salt and fuse this with caustic soda.

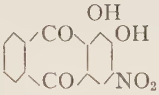
In practice, the crude anthracene is purified by solution in the higher pyridine bases, after which treatment it is frequently sublimed. It is then oxidized to anthraquinone by means of sodium dichromate and sulphuric acid in leaden vats, steam heated so that the mixture can be brought to the boil. When oxidation is complete the crude anthraquinone is separated in filter presses and heated with an excess of commercial oil of vitriol to 120° C., the various impurities present in the crude material being sulphonated and rendered soluble in water, whilst the anthraquinone is unaffected; it is then washed, to remove impurities, and dried. The anthraquinone so obtained is then heated for some hours at about 150-160° C. with fuming sulphuric acid (containing about 40-50 % SO_3), and by this treatment is converted into anthraquinone-β-monosulphonic acid. The solution is poured into water and sodium carbonate is added to neutralize the excess of acid, when the sodium salt of the monosulphonic acid (known as silver salt) separates out. This is filtered, washed, and then fused with caustic soda, when the sulpho-group is replaced by a hydroxyl group, and a second hydroxyl group is simultaneously formed; in order to render the formation of this second group easier, a little potassium chlorate or sodium nitrate is added to the reaction mixture. The melt is dissolved in water and the dyestuff is liberated from the sodium salt by hydrochloric or sulphuric acid, or is converted into the calcium salt by digestion with hot milk of lime, then filtered and the calcium salt decomposed by acid. The precipitated alizarin is then well washed and made into a paste with water, in which form it is put on to the market.

K. Lagodzinski (*Berichte*, 1895, 28, p. 1427) has synthesized alizarin by condensing hemipinic acid [$(CH_3O)_2C_6H_2(COOH)_2$] with benzene in the presence of aluminium chloride. The product on acidification gives a compound $C_{15}H_{12}O_5{\cdot}H_2O$ which is probably an oxy-methoxy-benzoyl benzoic acid. This is dissolved in cold concentrated sulphuric acid, in which it forms a yellowish red solution, but on heating to 100° C. the colour changes to red and violet, and on pouring out upon ice, the monomethyl ether of alizarin is precipitated. This compound is hydrolysed by hydriodic acid and alizarin is obtained. It can also be synthesized by heating catechol with phthalic anhydride and sulphuric acid at 150° C.

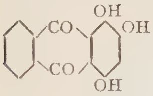


$$C_6H_4\left<\begin{matrix}CO\\CO\end{matrix}\right>O+C_6H_4(OH)_2[1\cdot2]=H_2O+C_6H_4\left<\begin{matrix}CO\\CO\end{matrix}\right>C_6H_2(OH)_2.$$

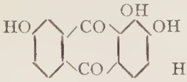
Pure alizarin crystallizes in red prisms melting at 290° C. It is insoluble in water, and not very soluble in alcohol. It dissolves readily in caustic alkalis on account of its phenolic character, and it forms a yellow-coloured di-acetate. Its value as a dyestuff depends on its power of forming insoluble compounds (lakes) with metallic oxides. It has no affinity for vegetable fibres, and consequently cotton goods must be mordanted before dyeing with it (see DYEING).

Numerous derivatives of alizarin are known. On solution in glacial acetic acid and addition of nitric acid, β-nitroalizarin (alizarin orange)  is produced, and this on heating with sulphuric acid and glycerin is converted into alizarin blue.

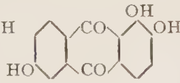
The trioxyanthraquinones—purpurin, anthrapurpurin, anthragallol and flavopurpurin—are also very valuable dyestuffs. These compounds may be represented by the following formulae:



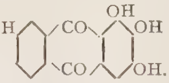
Purpurin.



Anthrapurpurin.

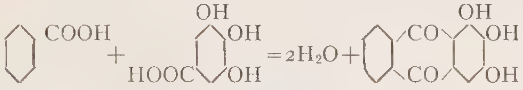


Flavopurpurin.



Anthragallol.

Purpurin (1·2·4 trioxyanthraquinone) is found with alizarin in madder root; it is now prepared synthetically by oxidizing alizarin with manganese dioxide and sulphuric acid. After the separation of the silver salt (see above) obtained on sulphonating anthraquinone, the remaining acid liquid gives on treatment with calcium carbonate the calcium salt of anthraquinone 2·6 disulphonic acid (anthraquinone-α-disulphonic acid). This is converted into the sodium salt by means of sodium carbonate, and on alkali fusion yields *flavopurpurin*. In a similar manner *anthrapurpurin* is prepared by alkali fusion of anthraquinone 2·8 disulphonic acid. *Anthragallol* is synthetically prepared by the condensation of benzoic and gallic acids with sulphuric acid



or from pyrogallol and phthalic anhydride in the presence of sulphuric acid or zinc chloride.

A. Baeyer in 1890, by heating alizarin with fuming sulphuric acid for 24-48 hours at 35-40° C., obtained a product, which after treatment with caustic soda gave a sulphuric acid ester of quinalizarin, and this after acidification and boiling was converted into quinalizarin (Alizarin Bordeaux) or 1·2·6·9 tetra-oxyanthraquinone. Penta-oxyanthraquinones have been obtained from purpurin and anthrapurpurin, while a hexa-oxyanthraquinone has been obtained from 1·5 dinitro-anthraquinone.

ALKAHEST (a pseudo-Arabic word believed to have been invented by Paracelsus), a liquid, much sought after by the alchemists, having the power of dissolving gold and every other substance, which it was supposed would possess invaluable medicinal qualities.

ALKALI, an Arabic term originally applied to the ashes of plants, from which by lixiviation carbonate of soda was obtained in the case of sea-plants and carbonate of potash in that of land-plants. The method of making these "mild" alkalis into "caustic" alkalis by treatment with lime was practised in the time of Pliny in connexion with the manufacture of soap, and it was also known that the ashes of shore-plants yielded a hard soap and those of land-plants a soft one. But the two substances were generally confounded as "fixed alkali" (carbonate of ammonia being "volatile alkali"), till Duhamel du Monceau in 1736 established the fact that common salt and the ashes of sea-plants contain the same base as is found in natural deposits of soda salts ("mineral alkali"), and that this body is different from the "vegetable alkali" obtained by incinerating land-plants or wood (pot-ashes). Later, Martin Heinrich Klaproth, finding vegetable alkali in certain minerals, such as leucite, proposed to distinguish it as potash, and at the same time assigned to the mineral alkali the name *natron*, which survives in the symbol, Na, now used for sodium. The word alkali supplied the symbol for potassium, K (*kalium*). In modern chemistry alkali is a general term used for compounds which have the property of neutralizing acids, and is applied more particularly to the highly soluble hydrates of sodium and potassium and of the three rarer "alkali metals," caesium, rubidium and lithium, also to aqueous ammonia. In a smaller degree these alkaline properties are shared by the less soluble hydrates of the "metals of the alkaline earths," calcium, barium and strontium, and by thallium hydrate. An alkali is distinguished from an acid or neutral substance by its action on litmus, turmeric and other indicators.

ALKALI MANUFACTURE. The word "alkali" denotes both soda and potash, but by "alkali manufacture" we understand merely the manufacture of sodium sulphate, carbonate and hydrate. The corresponding potash compounds are not manufactured in the United Kingdom, but exclusively in Germany (from potassium chloride and from the mother-liquor of the strontia process in the manufacture of beetroot sugar) and in France (from *vinasse*). The term *alkali* is employed in a technical sense for the carbonate and hydrate (of sodium), but since in the Leblanc process the manufacture of sodium sulphate necessarily precedes that of the carbonate, we include this as well as the manufacture of hydrochloric acid which is inseparable from it. We also treat of the utilization of hydrochloric acid for the manufacture of chlorine and its derivatives, which are usually comprised within the meaning of the term "alkali manufacture." A great many processes have been proposed for the manufacture of alkali from various materials, but none of these has become of any practical importance except those which start from sodium chloride (common salt); and among the latter again only three classes of processes are actually employed for manufacturing purposes, viz. the Leblanc, the ammonia-soda, and the electrolytic processes.

I. THE LEBLANC PROCESS

The *Leblanc process*, which was invented by Nicolas Leblanc (*q.v.*) about 1790, begins with the decomposition of sodium chloride by sulphuric acid, by which sodium sulphate and hydrochloric acid are produced. The sodium sulphate is afterwards fluxed with calcium carbonate and coal, and a mixture is thus obtained from which sodium carbonate can be extracted by exhausting it with water.

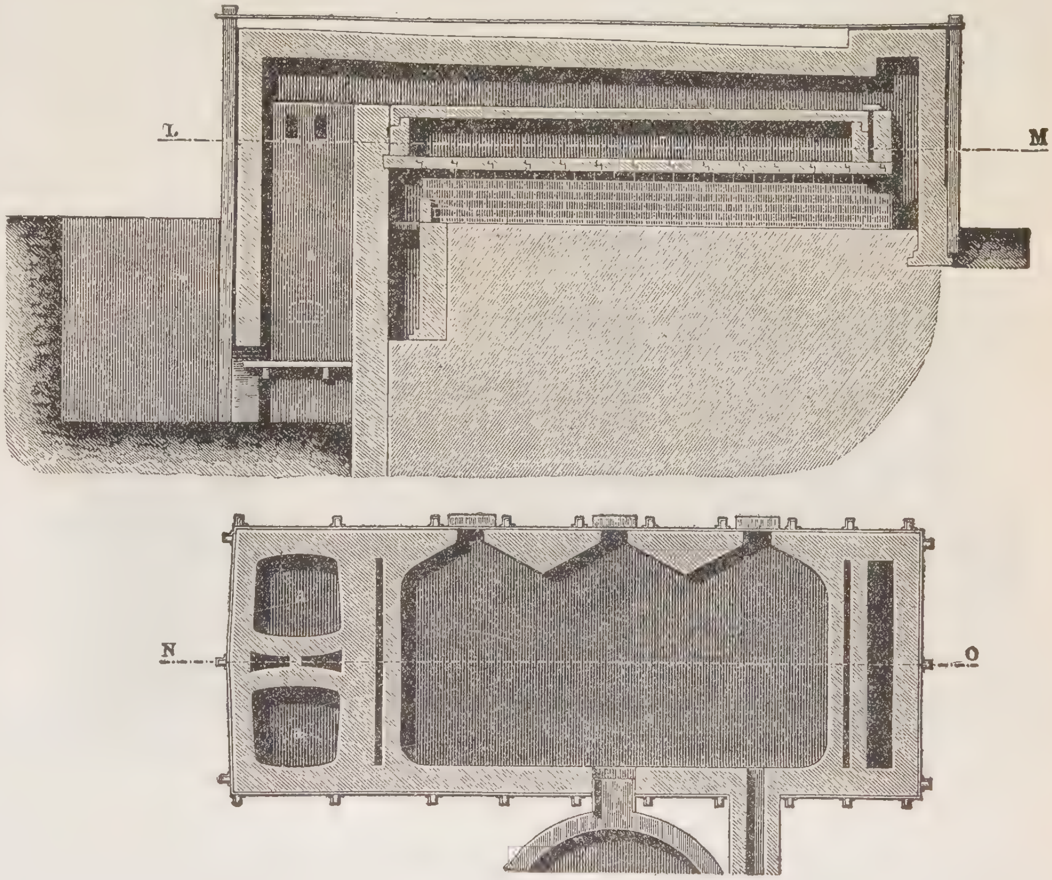
Leblanc himself for a time carried out his process on a manufacturing scale, but he was ruined in the political troubles of the time and died by his own hand in 1806. His invention was, however, at once utilized by others in France; and in Great Britain, after a few previous attempts on a small scale, it was definitely introduced by James Muspratt (*q.v.*) in 1823. From that time onward the Leblanc process spread more and more, and for a considerable period nearly all the alkali of commerce was made by it. The rise of the ammonia-soda process (since 1870) gradually told upon the Leblanc process, which in consequence has been greatly restricted in Great Britain and Germany, and has become practically extinct in all other countries, except as far as its first part, the manufacture of sodium sulphate and hydrochloric acid, is concerned.

The production of alkali in Great Britain, soon after the introduction of the Leblanc process, became the most extensive in the world, and outstripped that of all other countries put together. With the rise of the ammonia-soda process, for which the economic conditions are nearly as favourable in other countries, the predominance of Great Britain in that domain has become less, but even now that country produces more alkali than any other single country. Most of the British alkali works are situated in South Lancashire and the adjoining part of Cheshire, near the mouth of the Tyne and in the West of Scotland.

Various industries are carried on in Leblanc alkali works, as follows:—

1. Manufacture of sodium sulphate.
2. Manufacture of hydrochloric acid.
3. Preparation of chlorine.
4. Employment of chlorine for the manufacture of bleaching-powder and of chlorates.
5. Manufacture of ordinary alkali from sulphate of soda.
6. Manufacture of caustic soda.
7. Manufacture of soda crystals.
8. Recovery of sulphur from alkali waste.

1. *Manufacture of Sodium Sulphate.*—This is commercially known as *salt-cake*, and is made by decomposing common salt with sulphuric acid of about 80 %, the reaction being $2NaCl + H_2SO_4 = Na_2SO_4 + 2HCl$. This reaction proceeds in two stages. At first principally acid sodium sulphate, $NaHSO_4$, is formed together with some normal sulphate; later, when the temperature has risen, the $NaHSO_4$ acts with more NaCl so that nearly all of it is converted into Na_2SO_4. The gaseous hydrochloric acid evolved during all this time must be absorbed in water, unless it is directly converted into chlorine (see below, 2 and 3).



FIGS. 1 and 2.—Salt-cake Furnace. (Sectional Elevation and Plan.)

Figs. 1-9 from Lunge's *Handbuch der Soda-Industrie*, by permission of Friedr. Vieweg u. Sohn.

The process is carried out either in hand-wrought furnaces, or mechanical furnaces, both called "decomposing" or "salt-cake furnaces." In the former case, the first reaction is produced in cast-iron pans or "pots," very heavy castings of circular section, fired from below, either directly or by the waste heat from the muffle-furnace. The reaction is completed in a "roasting-furnace." The latter was formerly often constructed as a reverberatory furnace, which is easy to build and to work, but the hydrochloric acid given off here, being mixed with the products of the combustion of the fuel, cannot be condensed to strong acid and is partly, if not entirely, wasted. It is, therefore, decidedly preferable to employ "muffle-furnaces" in which the heating is performed from without, the fire-gases passing first over the arch and then under the bottom of the muffle. This requires more time and fuel than the work in "open" furnaces, but in the muffles the gaseous hydrochloric acid is separated from the fire-gases, just like that evolved in the pot, and can therefore be condensed into strong hydrochloric acid, like the pot-acid. This roaster-acid is, however, of less value than the pot-acid, as it contains more impurities.

It is not easy to keep the muffles permanently tight, and as soon as any leakages occur, either hydrochloric acid must escape into the fire-flue, or some fire-gases must enter into the muffle. The former is decidedly more objectionable than the latter, as it means that uncondensed hydrochloric acid is sent into the air. This drawback has been overcome by the construction of "plus-pressure" furnaces (figs. 1 and 2), where the fire-grate is placed 11 ft. below the top of the muffle. In consequence the fire-gases, when arriving there by the chimney shaft (*a*), have already a good upward draught, and when circulating round the muffle are at a lower pressure than the gases within the muffle, so that in case of any cracks being formed, no hydrochloric acid escapes into the fire-flues, but vice versa.

Since the work with ordinary hand-wrought salt-cake furnaces is disagreeable and costly, many attempts have been made to construct mechanical salt-cake furnaces. Of these J. Mactear's furnaces (fig. 3) have met with the greatest success. They consist of a horizontal pan, 17 ft. wide, which is made up of a central pan (*e*), and a series of concentric compartments (c^1), (c^2), (c^3), and which is supported on a frame (*d d*), revolving round a perpendicular axis on the wheels (*n n*). It is covered with an arch and heated on the top from one side (*l*), either by an ordinary coal-grate or by a gas-producer. A set of stirring blades carried in the frame (*b b*), and driven by gearing, passes through a gap in the arch in such a manner that the gases cannot escape outwards. The salt is conveyed to the furnace by a chain of buckets running on the pulley (*g*), and passing into the hopper (*h*), and through the pipe (*i*) is mixed with the proper amount of acid supplied by the pipe (*f*). The mixture is fed in continuously to the central pan (*e*), whence it overflows into the compartments (c^1), (c^2), (c^3) successively until it reaches the circumference, where it is discharged continously by *o* and *p* into the collecting-box (*q*), being now converted into salt-cake. This furnace acts very well, and has been widely introduced both in Great Britain and in other countries, but it has one great drawback, apart from its high cost, viz. that all the hydrochloric acid gas gets mixed with fire-gases, and consequently is condensed in a weaker and less pure form than from ordinary pots and muffles. This has led some factories which had introduced such furnaces to revert to hand-wrought muffle-furnaces.

Much was expected at one time from the "direct salt-cake process" of Hargreaves and Robinson, in which common salt is subjected in a series of large cast-iron cylinders to the action of pyrites-burner gases and steam at a low red heat. The reaction going on here is: $2NaCl+SO_2+O+H_2O=Na_2SO_4+2HCl$. This means that the previous manufacture of sulphuric acid in the vitriol-chambers is done away with, but this apparently great simplification is balanced by the great cost of the Hargreaves plant, and by the fact that the whole of the hydrochloric acid is mixed with nine or ten times its volume of inert gases. Owing to this, it is practically impossible to condense the gaseous hydrochloric acid into the commercial acid, although this acid may be obtained sufficiently strong to be worked up in the Weldon chlorine process (see below, 3). Therefore the Hargreaves process has been introduced only in a few places.

Although the consumption of salt-cake for the manufacture of alkali is now much less than formerly, since the Leblanc alkali process has been greatly restricted, yet it is largely made and will continue to be made for the use of glassmakers, who use it for the ordinary description of glass in the place of soda-ash. Nor must it be overlooked that salt-cake must be made as long as there is a sale for hydrochloric acid, or a consumption of the latter for the manufacture of chlorine.

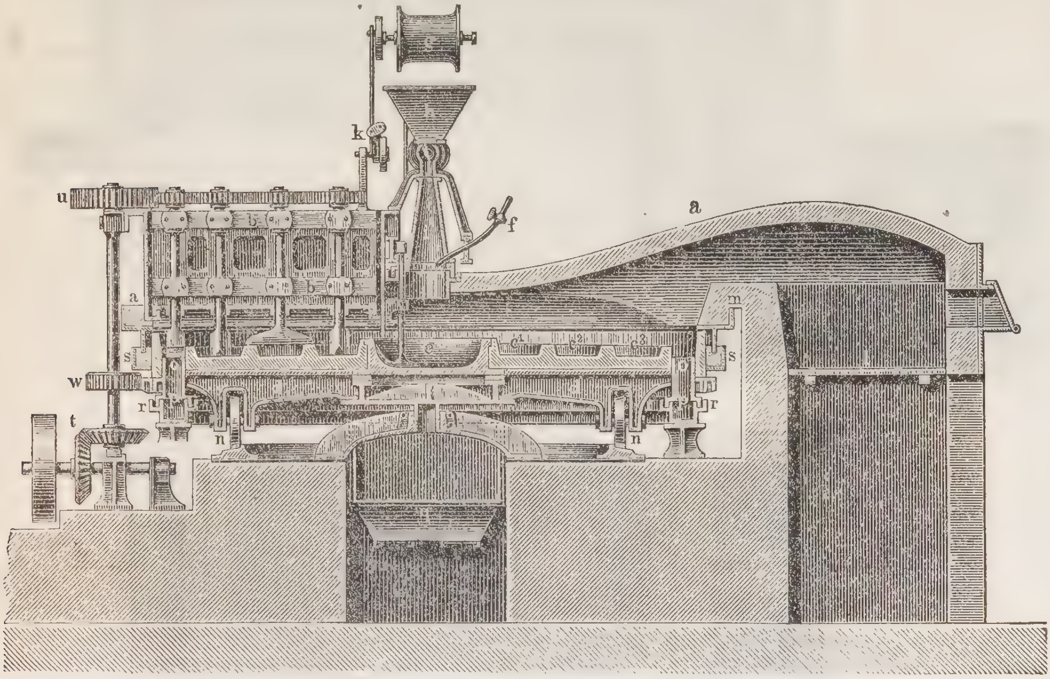


Fig. 3.—Mechanical Salt-cake Furnace. (Sectional Elevation.)

2. *Manufacture of Hydrochloric Acid* (commercially also known as "muriatic acid"). This unavoidable gaseous bye-product of the manufacture of salt-cake was, during the first part of the 19th century, simply sent into the air. When its deleterious effects upon vegetation, building materials, &c., became better known, and when at the same time an outlet had been found for moderate quantities of hydrochloric acid, most factories made more or less successful attempts to "condense" the gas by absorption in water. But this was hardly anywhere done to the fullest possible extent, and in those districts where a number of alkali works were located at no great distance from one another, their aggregate escapes of hydrochloric and other acids created an intolerable nuisance. This was most notably the case in South Lancashire, and it led to the passing of Lord Derby's "Alkali Act," in 1863, supplemented by further legislation in 1874, 1881 and later. There is hardly another example in the annals of legislative efforts equal to this, in respect of the real benefit conferred by it both on the general public and on the manufacturers themselves. This is principally the consequence of the exemplary way in which the duties of inspector under these acts were carried out by Dr R. Angus Smith (1817–1884) and his successors, who directed their efforts not merely to their primary duty of preventing nuisance, but quite as much to showing manufacturers how to make the most of the acid formerly wasted in one shape or another. Not merely Great Britain but all mankind has been immensely benefited by the labours of the British alkali inspectors, which were, of course, supplemented by the work of technical men in all the countries concerned. The scientific and technical principles of the condensation of hydrochloric acid are now thoroughly well understood, and it is possible to recover nearly the whole of it in the state of strong commercial acid, containing from 32 to 36 % of pure hydrochloric acid, although probably the majority of the manufacturers are still content to obtain part of the acid in a weaker state, merely to satisfy the requirements of the law prescribing the prevention of nuisance. The principles of the condensation, that is of converting the gaseous hydrochloric acid given off during the decomposition of common salt into a strong solution of this gas in water, can be summarized in a few words. The hydrochloric acid gas, which is always diluted with air, sometimes to a very great extent, must be brought into the most intimate contact possible with water, which greedily absorbs it, forming ordinary hydrochloric acid, and this process must be carried so far that scarcely any hydrochloric acid remains in the escaping gases. The maximum escape allowed by the Alkali Acts, viz. 5 % of the total hydrochloric acid, is far above that which is now practically attained. For a proper utilization of the condensed acid it is nearly always imperative that it should be as strong as possible, and this forms a second important consideration in the construction of the condensing apparatus. Since the solubility of hydrochloric acid in water decreases with the increase of the temperature, it is necessary to keep the latter down—a task which is rendered somewhat difficult both by the original heat retained by the gases on their escape from the decomposing apparatus, and by the heat given off through the reaction of hydrochloric acid upon water.

Very different methods have been employed to effect all the above purposes. In Great Britain Gay-Lussac's coke-towers, adapted by W. Gossage to the condensation of hydrochloric acid, are still nearly everywhere in use, frequently combined with a number of stone tanks through which the gas from the furnaces travels before entering the towers, meeting on its way the acid condensed in the tower. This process is excellent for effecting a complete condensation of the hydrochloric acid as prescribed by the Alkali Acts, and for recovering the bulk of the acid in a tolerably strong state, but less so for recovering nearly the whole of it in the most concentrated state, although even this is occasionally attained. On the continent of Europe, where the last-named requirement has been for a long time more urgent than in Great Britain, another system has been generally preferred, namely, passing the gas through a long series of stoneware receivers, and ultimately through a small tower packed with stoneware or coke, making the acid flow in the opposite direction to the gas. Great success has also been obtained by "plate-towers" made of stoneware, which allow both the coke-towers and most of the stoneware receivers to be dispensed with.

3. *Preparation of Chlorine.*—In this place we speak only of

the preparation of chlorine from hydrochloric acid by chemical processes; the electrolytic processes will be treated hereafter. It is clear that free chlorine must be prepared from hydrochloric acid by oxidizing the hydrogen. This can be done most easily by "active" oxygen, such as is present in the peroxides, in chromic or permanganic acid. Practically the only agent employed in this way, and that already by C. W. Scheele, the discoverer of chlorine, in 1774, is the peroxide of manganese (manganese dioxide), found in considerable quantities in nature as "manganese ore" (the purest of which is called pyrolusite), and also artificially regenerated from the waste liquors of a former operation. Even now, where chlorine is required for immediate use in some other chemical operations on a comparatively small scale, it is obtained by the action of hydrochloric acid on native manganese dioxide, according to the equation: $MnO_2+4HCl=MnCl_2+Cl_2+2H_2O$. This action must be promoted by heating the mixture, but even then nothing like all of the hydrochloric acid employed is made to act as above, because the attack on the manganese ore requires a certain minimum concentration of the acid. Formerly, instead of free hydrochloric acid a mixture of common salt and sulphuric acid was sometimes employed, but this is never done on a manufacturing scale now. Owing to the impossibility of employing any metal in contact with the acid, the "chlorine stills," where the above reaction is carried out, must be made of acid-proof stones or "chemical" stoneware. This process is very costly, as much of the acid and all of the manganese is wasted. Moreover it is of a most disagreeable kind, as the waste "still-liquor," containing very much free hydrochloric acid and even some free chlorine, forms a most deleterious impurity when finding its way into drains or watercourses, apart from the intolerable nuisance caused by the escapes of chlorine from the stills and otherwise, which cannot be at all times avoided.

Many endeavours were made to avoid the loss of the manganese in this operation, but with only partial or no success. The difficulty was only overcome by the *Weldon process*, being the inventions of Walter Weldon from 1866 onwards, and his process up to this day furnishes the greater proportion of chlorine manufactured in the world. It begins with "still-liquor," obtained in the old way from native manganese ore and hydrochloric acid. This liquor is first treated with carbonate of lime (ground chalk or limestone) in a "neutralizing-well," made of acid-proof material and provided with wooden stirring-gear. Here the free hydrochloric acid is converted into calcium chloride, and at the same time any ferric chloride present is converted into insoluble ferric hydroxide: $2FeCl_3+3CaCO_3+3H_2O=2Fe(OH)_3+3CaCl_2+3CO_2$. The sulphuric acid present is mostly precipitated as calcium sulphate. The mud thus formed is settled out, and the clear liquor, which is now quite neutral and contains both manganese and calcium chlorides, is mixed with cream of lime and treated by a strong current of air, produced by a blowing-engine. This is done in a tall iron cylinder, say 9 ft. wide and 30 ft. high, called the "oxidizer." The air-pipe goes right to the bottom of the cylinder and there branches out into perforated side-pipes, so that the mass is thoroughly stirred up all the time. The first action of the lime is to convert the manganese chloride into manganous hydrate ($Mn(OH)_2$) and calcium chloride; then more lime is added which greatly promotes and hastens the oxidizing process. The object of the latter is to convert the manganous hydroxide by the atmospheric oxygen into manganese dioxide, but this would take place much too slowly if there was not an excess of lime present ready to combine with the manganese dioxide to form a calcium manganite. Only so much lime is used that an acid manganite is formed corresponding to one molecule of calcium oxide to two of manganous oxide. This additional lime, which is called the "basis," certainly takes up hydrochloric acid in the next stage of the process, but that causes no more waste of acid than the incomplete action on native manganese ore, mentioned before. The product obtained, called "Weldon mud," is of such fine texture that it acts immediately with hydrochloric acid when mixed with it in the "Weldon stills" (fig. 4), and that this acid can be almost entirely neutralized thereby. The new still-liquor formed in this manner is treated as above, so that the manganese does its work over and over again. There is only a slight mechanical loss, which is reduced in the best managed works to about 2 parts of manganese dioxide to 100 of bleaching-powder. There are also other advantages of this process which explain its wide extension, in spite of the fact that only from 30 to 35 parts of the hydrochloric acid employed is converted into chlorine, the remainder ultimately leaving the factory in the shape of a harmless but useless solution of calcium chloride.

Weldon's later attempts at superseding his classical process by other inventions which utilize a larger proportion of the chlorine, introduced as hydrochloric acid, have not been successful in the long run, although some of them were aided by the great technical skill of A. R. Péchiney. But the *Deacon process*, the invention of Henry Deacon (who was greatly aided by his chemist Dr Ferdinand Hurter), carried out since 1868, has attained to better, although nothing like complete, success in that direction.

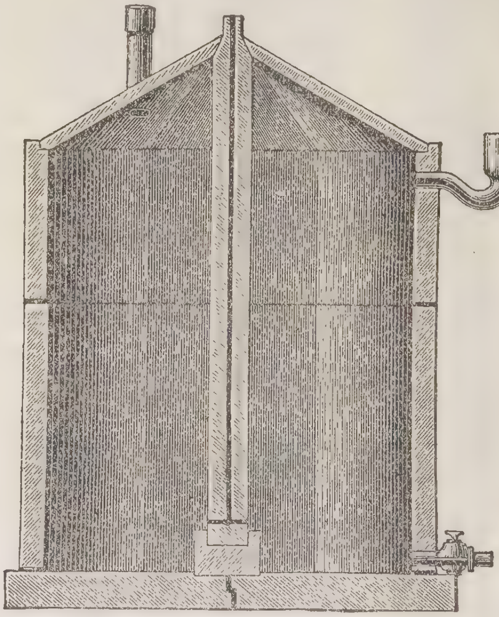


Fig. 4.—Weldon Chlorine Still. (Sectional Elevation.) *C*, Stone steam column resting in stone socket *K*.

The Deacon process, like the Weldon process, effects its object by the oxidizing action of atmospheric air, but in a very different manner. Weldon retained the principle of the Scheele process, by employing the active oxygen of manganese dioxide to convert hydrochloric acid into free chlorine, and he employed the atmospheric oxygen only indirectly, for the recovery of manganese dioxide from the manganese chloride formed. But Deacon worked on the direct reaction: $2HCl+O=H_2O+Cl_2$. This reaction in ordinary circumstances is so slow as to be practically useless. If, however, a "contact-substance" is employed and that at the proper temperature, the process goes on at an immensely quickened rate and can even be carried out as a continuous operation. The only substance which possesses sufficiently strong catalytic properties for the reaction is cupric chloride. If pieces of porous clay are soaked in a solution of this salt and dried and kept at a temperature of 450° C. (in practice it is necessary to go to a rather higher temperature), it is possible continuously to convert a united stream of hydrochloric acid and atmospheric air, passed through the contact-substance in a "decomposer" (fig. 5), to a larger extent into chlorine and water, of course mixed with the excess of oxygen and all the nitrogen of the air. On a small scale it is possible to push the decomposition as far as 90% of the hydrochloric acid, but on the large scale only at most 60% is reached. The mixture of hydrochloric acid and air is taken directly from the "decomposing-pan" of an ordinary salt-cake furnace, is first cooled down in pipes sufficiently to condense most of the moisture present (together with about 8% of the hydrochloric acid), and then passed through a cast-iron superheater and from this into the "decomposer." The gaseous mixture, issuing from the latter, is washed with water in the usual condensing apparatus, to remove the 40 or 50 parts of hydrochloric acid left unchanged, and can then be immediately employed for the manufacture of chlorate of potash.

Where (as is the more usual case) the chlorine has to serve for the manufacture of bleaching-powder, it must first be deprived of the great amount of moisture which it contains, by means of coke-towers fed with moderately strong sulphuric acid. As the gas issuing from these contains only about 5 volumes % of hydrochloric acid, it cannot be made to act upon lime in the ordinary bleaching-powder chambers, but specially constructed chambers must be provided (see fig. 4). The movement of the gases through all this complicated set of apparatus is produced by a Root's blower placed at the end of it all.

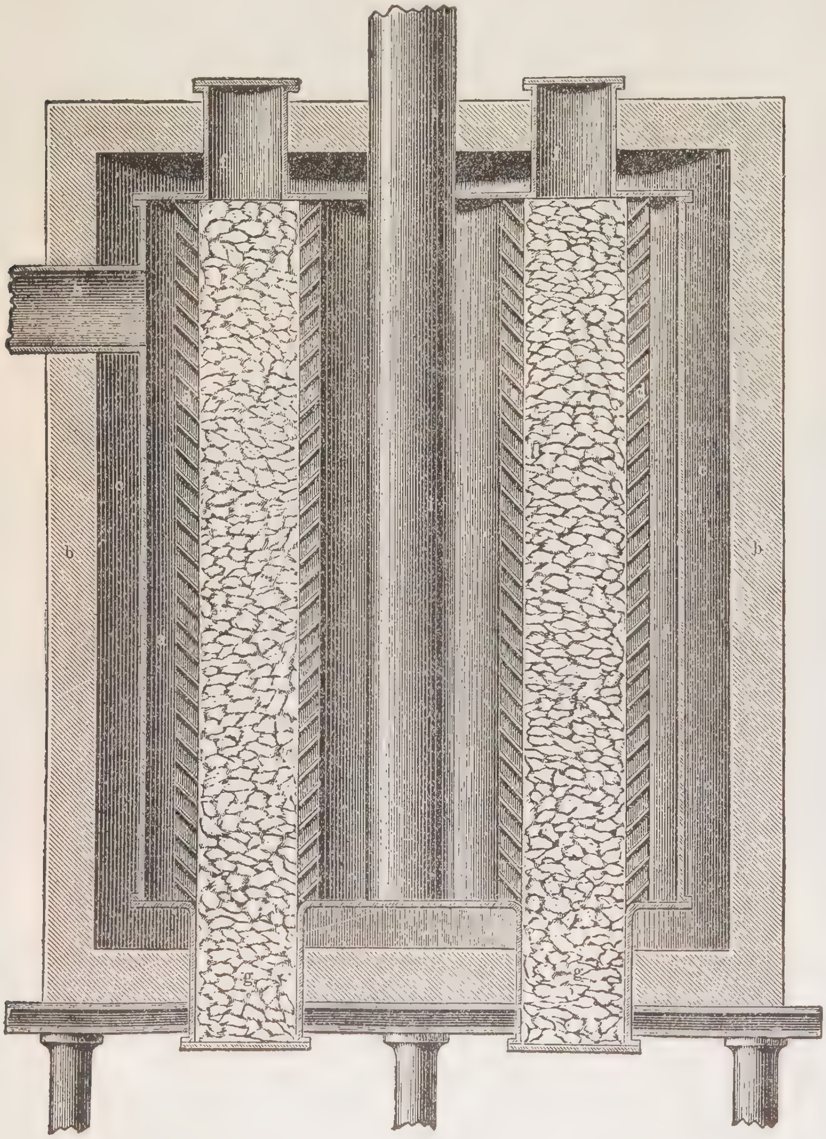


FIG. 5.—Deacon "Decomposer." (Sectional Elevation.) *a*, *a*, Upright cast-iron cylinders; *b*, *b*, brick jacket; *c*, *c*, flues; *d*, *e*, iron plates arranged like venetian blinds, between which the contact-substance is contained; *f*, charging hole; *g*, discharging hole; *h*, entrance pipe for gas; *i*, exit pipe for gas.

The Deacon process makes cheaper chlorine than the Weldon process, but the plant is complicated and costly and the working requires a great deal of attention. In skilled hands it has been proved to yield excellent results.

The hydrochloric acid from the calcining-furnaces or "roasters" cannot be employed immediately for the Deacon process, as the sulphuric acid always contained in the roaster gases soon "poisons" the contact-substance and renders it inoperative. This acid must, therefore, be condensed in the ordinary way into liquid hydrochloric acid and formerly could be worked up only by the Weldon process. R. Hasenclever has overcome this drawback by running this impure acid into moderately strong sulphuric acid (140° Twaddell), blowing in air at the same time. This produces a mixed current of pure hydrochloric acid gas and air, which is carried into a Deacon decomposer where it acts in the usual manner. The sulphuric acid, of which 6 or 7 parts are used to one of impure liquid hydrochloric acid, is always reserved for use in the same process, by driving off the excess of water in a lead pan, fired from the top, so that the principal expense of the process is that of the fuel required for the last operation.

4. *Applications of Chlorine.*—Some of the chlorine manufactured (practically only such as is obtained by the electrolysis of chlorides) is condensed by cold and pressure into *liquid chlorine*. If this is anhydrous, as it must be in any case for this purpose, it does not act upon the metal of the compressors, nor upon the iron bottles in which it is sent out. It may even be sent out in tank wagons, similar to those which are employed for carrying sulphuric acid, holding 10 tons each.

Sometimes the chlorine is employed directly for *bleaching purposes*, especially for some kinds of paper. A number of organic chlorinated products are also produced on a large scale. But most of the chlorine is utilized for the production of bleaching-powder, of bleach-liquor, and of chlorate of potash.

Bleaching-powder is a compound obtained by the action of free chlorine on hydrated lime, containing a slight excess of water at ordinary temperatures or slightly above these. Its composition approaches the formula $CaOCl_2$, and it is regarded as a double salt of calcium chloride and hypochlorite, which by the action of water splits up into a mixture of these salts. It always contains a certain quantity of chemically combined water and also an excess of lime. Usually this lime is regarded only as mechanically mixed with the bleaching-compound, $CaOCl_2$, but some chemists adopt formulae in which this lime is equally represented.

For the manufacture of bleaching-powder, limestone of high degree of purity (especially free from magnesia and iron) is carefully burned so as to drive out nearly all the carbon dioxide without overheating the lime. The quick-lime is then slaked with the requisite quantity of water; the product is passed through a fine-meshed wire sieve and is spread in layers of 2 or 3 in. at the bottom of large boxes, the "bleaching-powder chambers," made of lead, or sometimes of cast-iron protected by paint, of slate or even of tarred wood. Chlorine, generated in an ordinary or a Weldon still, is passed in and is rapidly absorbed. When the absorption becomes slow, the gas is cut off and the chamber is left to itself for twelve hours or more, when it will be found that all the chlorine has been taken up. Now the door of the chamber is opened, the powder lying at the bottom is turned over and the treatment with gas is repeated. Sometimes a third treatment is necessary in order to get the product up to the strength required in commerce, viz. 35% of "available" chlorine. The finished product is packed into wooden casks lined with brown paper. The work of packing is a most disagreeable and unhealthy operation which is best relieved by erecting the chambers at a higher level and placing the casks underneath, communication being made by means of traps in the chamber-bottom, so that the packers can do their work outside the chambers. The bleaching-powder casks must be kept in a dry place, as cool as possible, and never exposed to the direct rays of the sun, in order to prevent a decomposition which now and then has even led to explosions.

The weak chlorine from the Deacon process cannot be treated in this manner, as chambers of inpossibly large dimensions would be required. Originally the absorption of the Deacon chlorine took place in a set of chambers, constructed of large slabs of stone, containing a great many horizontal shelves superposed over one another. About sixteen such chambers were combined in such manner that the fresh gas passed into that chamber which had been the longest time at work and in which the bleaching-powder was nearly finished, and so forth until the gas, now all but entirely exhausted, reached the last-filled chamber in which it met with fresh lime and there gave up the last of the chlorine. These "Deacon chambers" occupied a large space, besides being expensive to build and difficult to keep in repair.

They are now mostly replaced by an apparatus, the invention of R. Hasenclever, consisting of four horizontal cast-iron cylinders with internal stirring-gear. The fresh lime is continually charged into the top cylinder, is gradually moved towards the other end, falls down into the next lower cylinder and thus gradually makes its way to the lowest cylinder. The weak chlorine gas from the Deacon apparatus travels precisely the opposite way, from the bottom upwards, the result being that finished bleaching-powder is continually discharged at the bottom and air free from chlorine leaves the apparatus at the top.

Bleaching-powder is manufactured to the extent of several hundred thousands of tons annually, almost entirely for the use of papermakers and cotton bleachers. Smaller quantities are used for disinfection and other purposes. It is usually sold in "tierces," that is, casks containing about 10 cwt.

Bleach-liquors.—If the chlorine is made to act on cream of lime, care being taken that the temperature does not rise above 35° and that the chlorine is not in excess, a solution is obtained containing a mixture of calcium chloride and hypochlorite which is a very convenient agent for bleachers, but which does not bear the expense of carriage over long distances. Similar liquids are obtained with a basis of sodium ("eau de Javel"), by passing chlorine into solutions of sodium carbonate. The former kind of bleach-liquor is mostly used in the industry of cotton, the latter in that of linen.

Chlorate of Potash.—Formerly all chlorate of potash, as some is still, was obtained by passing chlorine into milk of lime, allowing the temperature to rise almost to the boiling-point, and continuing until the bleaching-solution, originally formed, is converted into a mixture of calcium chlorate and chloride, the final reaction being $6Ca(OH)_2+6Cl_2=5CaCl_2+Ca(ClO_3)_2+6H_2O$. On adding to this solution, after settling out the mud, a quantity of potassium chloride equivalent to the calcium chlorate, the reaction $Ca(ClO_3)_2+2KCl=CaCl_2+2KClO_3$ is produced, the ultimate proportions thus being theoretically $2KClO_3$ to $6CaCl_2$, though in reality there is rather more calcium chloride present. When this solution is concentrated by evaporation and cooled down, about five-sixths of the chlorate of potash crystallizes out. It is purified by redissolving and crystallization, and is sold either in the state of crystals or finely ground. During these operations care must be taken lest a spark should produce the inflammation of the chlorate on contact with any organic substance. Large quantities of potassium chlorate exposed to strong heat in contact with the wood of casks or the timber of a roof have produced violent explosions.

Most of the chlorate of potash is now prepared by electrolysis of potassium chloride (see below). It is employed for fire-works, for some descriptions of explosives, for safety matches and as an oxidizer in some operations, especially in dyeing and tissue printing. For the last-named purpose it is sometimes replaced by sodium chlorate. The chlorates are usually sold in wooden kegs containing 1cwt. each.

5. *The Manufacture of Soda-ash from Salt-cake by the Leblanc process.*—This process consists in heating a mixture of commercial

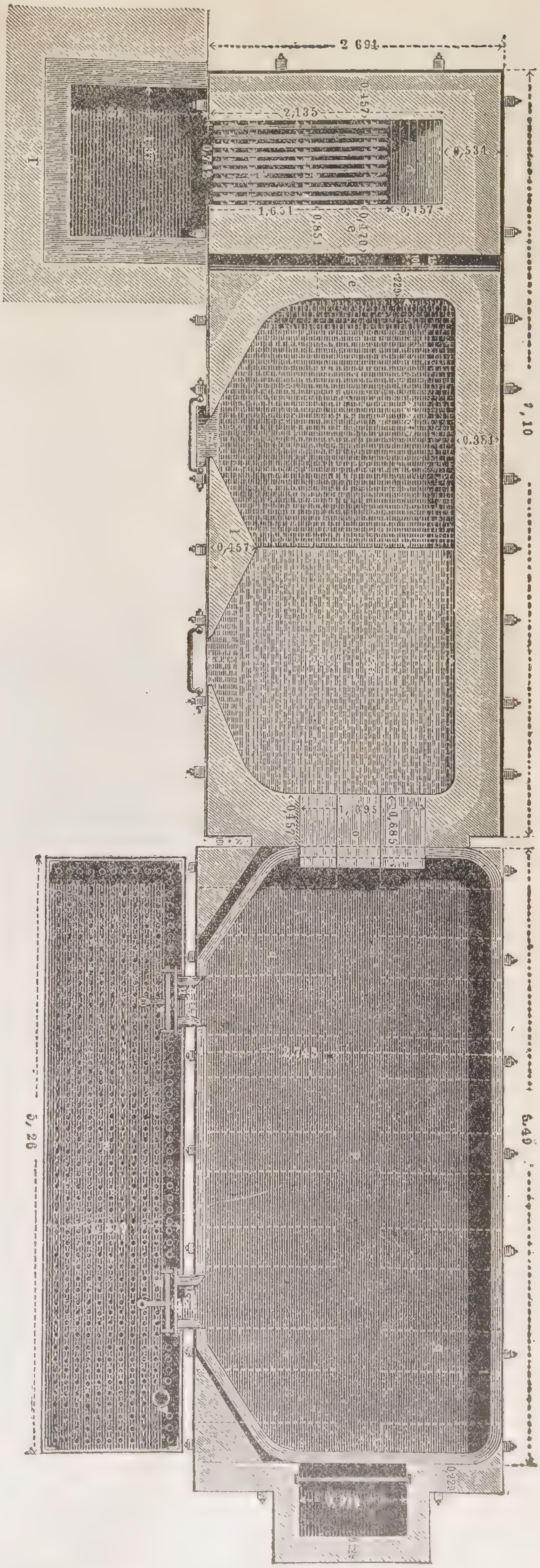


FIG. 6.—Black-ash Furnace and Boiling-down Pan.

sulphate of soda (salt-cake) with about the same weight of crushed limestone and half its weight of coal, until the materials are fluxed and a reaction has taken place, the principal phase of which is expressed by the equation $Na_2SO_4+CaCO_3+2C=2CO_2+Na_2CO_3+CaS$. A number of secondary reactions, however, occur, owing partly to the excess of calcium carbonate and coal and partly to the impurities present, so that the solid product of the process, which is called "black-ash," has a somewhat complicated composition. Its principal constituents are always sodium carbonate and calcium sulphide, which are separated by the action of water, the former being soluble and the latter insoluble.

The furnace in which the reaction takes place is shown in fig. 6 in a sectional plan. It is called a "black-ash" furnace, and belongs to the class of reverberatory furnaces. A large fire-grate (*ab*), having a cave (*c*) to facilitate stoking and stepped back at (*d*), is bounded on one side by a fire-bridge (*e*); on the other side of this, separated by an air-channel (*g*), there is first the proper fluxing bed (*h*), and behind this the "back-bed" (*i*) for pre-heating the charge. The flame issuing from the furnace by (*o*) is always further utilized for boiling down the liquors obtained in a later stage, either in a pan (*p*) fired from the top and supported on pillars (*qq*) as shown in the drawing, or in pans heated from below. The charge of salt-cake (generally 3 cwt.), limestone and coal is roughly mixed and put upon the back-bed; when the front-bed has become empty it is drawn forward and exposed to the full heat of the fire, with frequent stirring. After about three-quarters of an hour the substances are so far fluxed or softened that the reaction now sets in fully, as shown by the copious escape of gas. This is at first colourless carbon dioxide, but later on inflammable gases come out of the mass, which at this stage has turned into a thicker, pasty condition, showing that the end of the reaction is near. The inflammable gas is carbon monoxide, which, however, does not burn with its proper purple flame, but with a flame tinged bright yellow by the sodium present. This carbon monoxide is formed by the action of coal on the lime, formed at this stage from the original limestone. When the "candles" of carbon monoxide appear, the pasty mass is quickly drawn out of the furnace into iron "bogies," where it solidifies into a grey, porous mass, the "black-ash." Care must be taken to heat it no longer than necessary, as it otherwise turns red and yields bad soda.

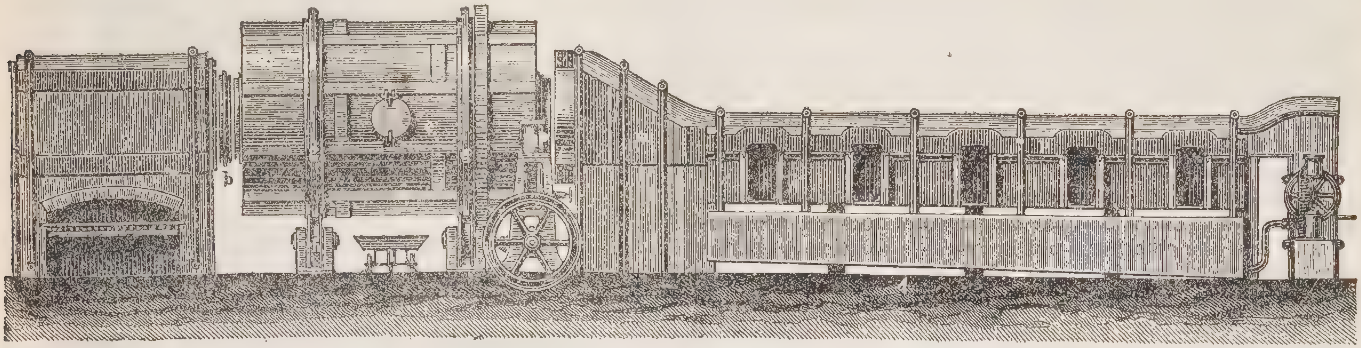


FIG. 7.—Revolving Black-ash Furnace. (Elevation.)

The hand-wrought black-ash furnace has been mostly superseded in the large factories by the revolving black-ash furnace, shown in fig. 7. These furnaces possess a large cylindrical shell (*e*), lined with fire-bricks, and made to revolve round its horizontal axis by means of a toothed wheel fixed on its exterior; (*ff*) are tire-seats holding tires (*gg*), which work in friction rollers (*h*). The flame of a fixed fireplace (*a*) enters through an "eye" (*b*) in the centre of the front end of the cylinder and issues in the centre of the back end, first into a large dust-chamber (*m*), and then over or under boiling-down pans (*p*). These mechanical furnaces do the work of from four to ten ordinary furnaces according to their size, with comparatively very little expense for labour, but they must be very carefully managed and the black-ash from them is more difficult to lixiviate than that from hand-wrought furnaces, because it is less porous. The lixiviation of the black-ash requires great care, as the calcium sulphide is liable to be changed into soluble calcium compounds, which immediately react with sodium carbonate and destroy a corresponding quantity of the latter, rendering the soda weaker and impure. This change of the calcium sulphide may be brought about either by the oxidizing action of the air or by "hydrolysis," produced by prolonged contact with hot water, the use of which, on the other hand, cannot be avoided in order to extract the sodium carbonate itself. The apparatus which has been found most suitable for the purpose was devised by Professor H. Buff of Giessen, and first practically carried out by Charles Dunlop at St Rollox. It consists of a number of tanks or "vats," placed at the same level and connected by pipes which reach nearly to the bottom of one tank and open out at the top into the next tank. The vats are also provided with false bottoms, outlet cocks, steam pipes and so forth. Tepid water is run in at one end of the series, where nearly exhausted black-ash is present; the weak liquor takes up more soda from the intermediate tanks and at last gets up to full strength in the last tank, charged with fresh black-ash and kept at a higher temperature, viz. 60° C. When the first tank has been quite exhausted, the water is turned on to the next, the first tank is emptied by discharging the "alkali-waste," and is filled with fresh black-ash, whereupon it becomes the last of the series. In spite of all precautions a certain quantity of impurities is always formed, but this should be kept down as much as possible by strictly watching the temperature in the vats and by taking care that the black-ash in the wet state is never exposed to the air. The unavoidable contamination with muddy particles of vat-waste is removed by allowing the vat-liquor to rest for some hours in a separate tank and settling out the mud.

The clear vat-liquor, if allowed to cool down to ordinary temperature, would separate out part of the sodium carbonate in the shape of decahydrated crystals. As these do not come out sufficiently pure, they would not be marketable and therefore they are not allowed to be formed, but the liquid, while still hot, is either run into the boiling-down pans, or submitted to one of the purifying operations to be described below. If it is boiled down without further purification, the resulting soda-ash is not of the first quality, but it is sufficiently pure for many purposes. The boiling down is most economically performed by means of large iron pans covered with a brick arch and heated from the top by the waste flame issuing from the black-ash furnaces (see figs. 6 and 7). It is continued until the contents of the pan have been converted into a thick paste of small crystals of monohydrated sodium carbonate, permeated by a mother-liquor which is removed by draining on perforated plates or by a centrifugal machine, and is always returned to the pans. The drained crystals are dried and heated to redness in a reverberatory furnace; when "finished," the mass is of an impure white or light yellow colour and is sold as ordinary "soda-ash." It is not easy to make it stronger than 92% of sodium carbonate, which is technically expressed as "52 degrees of available soda" (see next page). If purer and stronger soda-ash is wanted, the boiling down must be carried out in pans fired from below, and the crystals of monohydrated sodium carbonate "fished" out as they are formed, but this is mostly done after submitting the liquor to the purifying operations which we shall now describe.

The dried or "finished" soda-ash is ground to a pretty fine powder and is packed into wooden casks or "tierces," holding from 10 to about 20 cwt. each, according to the way of filling them.

The principal impurities of crude vat-liquor are sodium hydrate and sulphide, the latter of which always leads to the formation of soluble double sulphur salts of sodium and iron. The other impurities are of minor importance. The sulphides can be removed by "oxidizing" them into thiosulphates by means of atmospheric air, with or without the assistance of other agents, such as manganese peroxide; or by "carbonating" them with lime-kiln or other gases containing carbon dioxide; or by precipitating them with lead or zinc oxide. The last mentioned is the best but costliest method, and is employed only in the manufacture of the highest strengths of caustic soda. The most usual process, where soda-ash is to be made, is the "carbonating." This is usually effected either by forcing lime-kiln gas through the liquor, contained in a closed iron vessel, or by passing the gases through an iron tower filled with coke or other materials, suitable for subdividing the stream of the gases and that of the vat-liquor which trickles down in the tower. The same apparatus is used for "oxidizing" by means of atmospheric air passed through by means of an injector; sometimes both air and carbon dioxide are passed in at the same time. The operation is finished when all the sodium sulphide has been converted into normal sodium carbonate, partly also into acid sodium carbonate (bicarbonate) $NaHCO_3$; at the same time a precipitate is formed, consisting of ferrous sulphide, alumina and silica, which is removed by another settling tank, and the clear liquor is now ready either for boiling down in a "fishing-pan" for the manufacture of white soda-ash, or for the process of causticizing.

Soda-ash (as well as caustic soda) is sold by degrees of "available soda." This means that portion which neutralizes the acid employed for testing, and the degrees mean the percentage of Na_2O thus found, whether it be present as Na_2CO_3, NaOH, or sodium aluminate or silicate. The purest soda-ash, equal to 100% Na_2CO_3, would be 58½ degrees of available soda. The ordinary commercial strength of Leblanc soda-ash is from 52 to 54 degrees (in former times much was sold in the state of 48%).

6. *Manufacture of Caustic Soda.*—Most of the Leblanc liquor is nowadays converted into caustic soda, as white soda-ash is more easily and cheaply made by the ammonia-soda process. We shall therefore in this place describe the manufacture of caustic soda. This is always made from the carbonate by the action of slaked lime: $Na_2CO_3+Ca(OH)_2=CaCO_3+2NaOH$. The calcium carbonate, being insoluble, is easily separated from the caustic liquor by filtration. But as this reaction is reversible, we must observe the conditions necessary for directing it in the right sense. These are: diluting with water so as not to exceed 10% of sodium carbonate to 90% of water; boiling this mixture; and keeping it well agitated. At the best about 92% of the sodium carbonate can be converted into caustic soda, 8% remaining unchanged.

The operation is performed in iron cylinders, provided with an agitating arrangement. This may consist of a steam injector by means of which air is made to bubble through the liquid, which produces both the required agitation and the heating, and at the same time oxidizes at least part of the sulphides; but this method of agitation causes a great waste of steam and at the same time a further dilution of the liquor. Many, therefore, prefer mechanical stirring by means of paddles, fixed either to a vertical or to a horizontal shaft, and inject only sufficient steam to keep the mass at the proper temperature. Some heat is also gained by the slaking of the caustic lime within the liquor. After from half an hour to a whole hour the conversion of sodium carbonate into sodium hydrate is brought about as far as is practicable. The whole mass is now run into the *filters*, which are always constructed on the vacuum principle. They are iron boxes, in which a bed is made of bricks, above them gravel, and over this sand, covered on the top by iron grids. The space below the sieve thus formed is connected by means of an outlet tap with a closed tank, and this again communicates with a vacuum pump. By this means the filtration is quickened by the atmospheric pressure, and goes on very rapidly, as also does the subsequent washing. The filtered caustic liquor passes to the concentration plants; the washings are employed for diluting fresh vat-liquor for the next operation, or for dissolving solid soda-ash for the same purpose. The washed-out calcium carbonate, which always contains much calcium hydrate and 2 or 3% of soda in various forms, usually goes back to the black-ash furnaces, but it cannot be always used up in this way, and what remains is thrown upon a heap outside the works. Attempts have been made to use it in the manufacture of Portland cement, but without much success.

The clear caustic soda liquor must be concentrated in such a way that the caustic soda cannot to any great extent be reconverted into sodium carbonate, and that the "salts" which it contains, sodium carbonate, sulphate, chloride, &c., can be separated during the process. Formerly the most usual concentrating apparatus was the "boat-pan" (fig. 8). This is an oblong iron pan, the bottom of which slopes from both sides to a narrow channel. The latter rests on a brick pillar; the remaining part of the sloping bottom is heated, either by the waste fire from a black-ash furnace or by a special fireplace. This arrangement has the effect that the salts, as they separate out, slide down the sloping part and arrive in the central channel, which is not exposed to the fire-gases, so that they quietly settle there, without caking to the pan, until they are fished out by means of perforated ladles. These boat-pans were for many years almost everywhere employed, and did their work quite well, but rather expensively. At many works they have been replaced by either Thélen pans or vacuum pans.

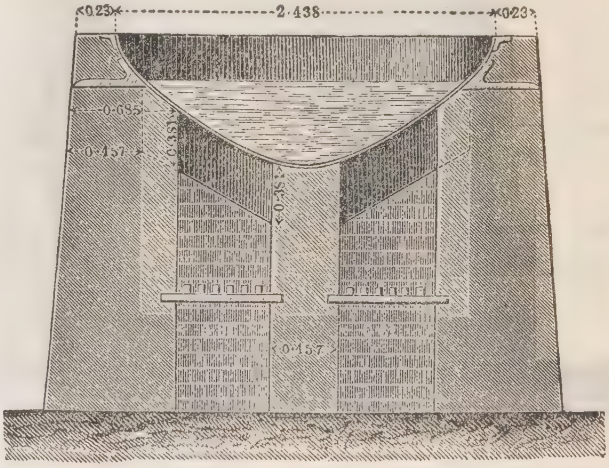


FIG. 8.—Caustic Soda Concentration Boat-pan. (Sectional Elevation.)

The "Thélen pan" (thus named from its inventor, a foreman at the Rhenania works near Aachen) is a mechanically worked fishing-pan, which requires considerably less labour and coal than ordinary boat-pans. It is a long trough, of nearly semicircular section, the whole bottom being exposed to the fire-gases. A horizontal shaft runs length-ways through the trough, and is provided with stirring blades, arranged in such a manner that they constantly scrape the bottom, so that the salts cannot burn fast upon it, and are at the same time moved forward towards one of the ends of the trough where they are automatically removed by means of a chain of buckets.

The most efficient evaporating apparatus, as far as economy of fuel is concerned, is the vacuum-pan, of which from two to five are combined to form a set, but it has the drawback that the removal of the salts is much more difficult than with the older pans, described above. In this apparatus only the first of the pans is heated directly, usually by means of ordinary boiler-steam circulating round a number of pipes, containing the liquid to be concentrated. The steam rising from the latter is passed into a similar pan, in which it circulates round another set of pipes, but as it could not bring the liquid in the latter to boil under ordinary conditions, the second pan is connected with a vacuum-pump so that the boiling-point of the liquid in this pan is lowered. This pan may be followed by a third pan, in which a stronger vacuum is maintained, and so forth. By this means the latent heat of the steam, issuing from all pans but the last, is utilized for evaporating purposes, and from half to three-fourths of the fuel is saved.

After being concentrated up to a certain point, and after the separation of nearly all the salts, the caustic liquor is transferred to cast-iron "finishing-pots" (fig. 9), holding from ten to twenty tons. Here it is further boiled down until the greater part or nearly all of the water has been removed, and until the salts on cooling would set to a solid mass. This requires ultimately a good red heat. Before the mass has reached that point the sulphides still present have been destroyed, either by the addition of solid nitrate of soda or by blowing air through the red-hot melt. Before finishing, the molten mass must be kept at a quiet heat for some hours in order to settle out the ferric oxide which it always contains, and which becomes insoluble (through the destruction of the sodium ferrite) only at high temperatures. When it has completely cleared, the liquid caustic is ladled or pumped out into sheet-iron drums, holding about 6 cwt. each, where it solidifies and forms the caustic soda known to commerce.

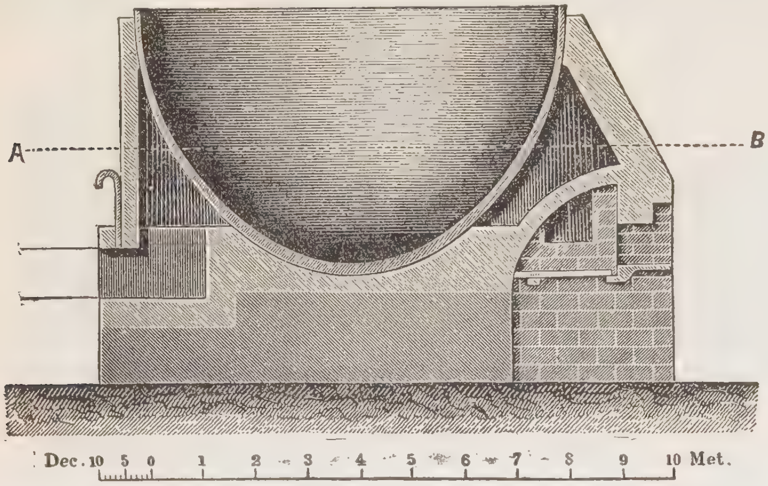


FIG. 9.—Caustic Soda "Finishing-pot." (Sectional Elevation.)

The best caustic soda tests from 75 to 76 degrees of "available soda"; this is only a few per cent removed from the composition of pure NaOH, which would be = 77·5 degrees Na_2O. Most of the caustic soda is sold at a strength of 70 degrees, sometimes as low as 60 degrees.

Caustic soda is used in very large quantities in the manufacture of soap, paper, textile fabrics, alizarin and other colouring matters, and for many other purposes.

7. *Soda-Crystals.*—Another product made in alkali works is soda-crystals. Their formula in Na_2CO_3, $10H_2O$, corresponding to 37 % of dry sodium carbonate. They are made by dissolving ordinary soda-ash in hot water, adding a small quantity of chloride of lime for the destruction of colouring matter and the oxidation of any ferrous salts present, carefully settling the solution, without allowing its temperature to fall below the point of maximum solubility (34° C.), and running the clarified liquid into cast-iron crystallizers or "cones," where, on cooling down, most of the sodium carbonate is separated in large crystals of the decahydrated form. This process lasts about a week in winter, and up to a fortnight in summer. In France the crystallization of soda is performed not in large tanks but in sheet-iron dishes holding only about ¼ cwt., and requires only from 27 to 48 hours in the cool season; it is not carried on at all in warmer climates during the summer months. The mother-liquor, drained from the soda-crystals, on boiling down to dryness yields a very white, but low-strength soda-ash, as the soluble impurities of the original soda-ash are nearly all collected here; it is called "mother-alkali."

Although the soda-crystals contain the alkali conbined with such a large quantity of water, they are made in large quantities, because their form, together with their complete freedom from caustic soda, makes them very suitable for domestic purposes. Hence they are best known as "washing-soda." Sometimes they are made, not from soda-ash, but from Leblanc soda-liquor before "finishing" the ash, or from the crude bicarbonate of the ammonia-soda process by prolonged boiling, until nearly half of the carbonic acid has been expelled.

Formerly *bicarbonate of soda* was made from Leblanc soda-crystals by the action of carbonic acid, but this article is now almost exclusively made in the ammonia-soda process.

8. *The Recovery of Sulphur from Alkali-waste.*—For many years all the sulphur used in the Leblanc process in the shape of sodium sulphate, and originally imported into the manufacture in the shape of brimstone or pyrites, was wasted in the crude calcium sulphide remaining from the lixiviation of black-ash. This "alkali-waste," also called tank-waste or vat-waste, was thrown into heaps where the calcium sulphide was gradually acted upon by the moisture and the oxygen of the air. The sulphur was by these converted partly into gaseous sulphuretted hydrogen, partly into soluble polysulphides, thiosulphates and other soluble compounds, and in all shapes caused a nuisance which became more and more intolerable as the number and size of alkali works increased. Both the air and the water in their neighbourhood were contaminated thereby.

Both this nuisance and the loss of the sulphur (whose cost sometimes amounted to more than half of the total cost of the soda-ash) led to many attempts at extracting the sulphur from the alkali-waste. This was first done with a certain amount of success by the processes of M. Schaffner (1861) and L. Mond (1862), but as these required the use of hydrochloric acid, and as they only recovered about half of the sulphur, they were superseded by another—a process which had been originally proposed by W. Gossage in 1837, but has been made practicable only by the inventions of C. F. Claus, in 1883, and from 1887 onward by the technical skill of Messrs Chance Brothers, of Oldbury. The Claus-Chance process, as it is called, comprises the following operations. The wet alkali-waste as it comes from the lixiviating vats, is transferred into upright iron cylinders in which it is systematically treated with lime-kiln gases until the whole of the calcium sulphide has been converted into calcium carbonate, the carbon dioxide of the lime-kiln gases being entirely exhausted. The sulphur issues as sulphuretted hydrogen, mixed with the nitrogen of the air. It is mixed with fresh air containing sufficient oxygen for the combustion of the hydrogen, and the mixture is passed through red-hot iron oxide (burnt pyrites) which by its catalytic action causes the reaction $H_2S+O=H_2O+S$ to take place. By cooling the vapours the sulphur is condensed in a very pure form, and about 85% of the whole of it is recovered, the remaining 15% escaping in the shape of sulphur dioxide (SO_2) and H_2S. Unfortunately it has been hitherto found impossible to deal with these gases in any profitable way.

It should be noted that this "recovered sulphur," which is equal in purity to the "refined brimstone" of commerce, has a far higher value than the sulphur contained in the originally employed pyrites, so that the recovery is a paying process, in spite of the somewhat considerable cost of the plant and of the working operations. It has been introduced at most large Leblanc alkali works, and has, so to say, given them a new lease of life.

II. THE AMMONIA-SODA PROCESS

In spite of the great improvements effected during recent times the Leblanc process cannot economically compete with the *ammonia-soda process*, principally for two reasons. The sodium in the latter costs next to nothing, being obtained from natural or artificial brine in which the sodium chloride possesses an extremely slight value. The fuel required is less than half the amount used in the Leblanc process. Moreover, the ammonia process has been gradually elaborated into a very complicated but perfectly regularly working scheme, in which the cost of labour and the loss of ammonia are reduced to a minimum. The only way in which the Leblanc process could still hold its own was by being turned in the direction of making caustic soda, to which it lends itself more easily than the ammonia-soda process; but the latter has invaded even this field. One advantage, however, still remained to the Leblanc process. All endeavours to obtain either hydrochloric acid or free chlorine in the ammonia-soda process have proved commercial failures, all the chlorine of the sodium chloride being ultimately lost in the shape of worthless calcium chloride. The Leblanc process thus remained the sole purveyor of chlorine in its active forms, and in this way the fact is accounted for that, at least in Great Britain, the Leblanc process still furnishes nearly half of all the alkali made, though in other countries its proportional share is very much less. The profit made upon the chlorine produced has to make up for the loss on the alkali.

The ammonia-soda process was first patented in 1838 by H. G. Dyar and J. Hemming, who carried it out on an experimental scale in Whitechapel. Many attempts were soon after made in the same direction, both in England and on the continent of Europe, the most remarkable of which was the ingenious combination of apparatus devised by J. J. T. Schloesing and E. Rolland. But a really economical solution of the problem was first definitely found in 1872 by Ernest Solvay, as the result of investigations begun about ten years previously. The greater portion of all the soda-ash of commerce is now made by Solvay's apparatus, which alone we shall describe in this place, although it should be borne in mind that the principles laid down by Dyar and Hemming have been and are still successfully carried out in a number of factories by an entirely different kind of apparatus.

The leading reaction of this process is the mutual decomposition of ammonium bicarbonate and sodium chloride: $NaCl+NH_4HCO_3=NaHCO_3+NH_4Cl$. It begins, however, not with ready-made ammonium bicarbonate, but with the substances from which it is formed—ammonia, water and carbon dioxide—which are made to act on sodium chloride. In practice the process is carried out as follows. A nearly saturated solution of sodium chloride is obtained by purifying natural or artificial brine, *i.e.* an impure solution of common salt, especially removing the alkaline earths and so forth by addition of sodium or ammonium carbonate and settling out the precipitate formed. This solution is saturated with ammonia, produced in the recovery plant (see below), in vessels provided with mechanical agitators and strongly cooled by coils of pipes through which cold water is made to flow. These vessels, as well as all others which are used in the process, are not open to the air, but communicate with it through washers in which fresh salt solution is employed for retaining any escaping vapours of ammonia. The ammoniacal salt solution is now saturated with carbon dioxide. This is employed in the shape of lime-kiln gases, obtained in a comparatively pure and strong form (up to 33 % CO_2), in very large kilns, charged with limestone and coke. The kilns are closed at the top, and the gases are drawn out by powerful air-pumps, washers being interposed between the kilns and the pumps for the purpose of purifying and cooling the gas. The heat evolved by the compression in the air-pumps (which rises to four atmospheres or upwards) is again removed by cooling, and the gas is now passed upwards in the "Solvay tower" (fig. 10). This is a tall iron erection, built up from superposed cylinders, which are separated from one another by perforated horizontal diaphragms, constructed in such a way that the gases are over and over again subdivided into many smaller streams and are thus thoroughly brought into contact with the ammoniacal salt solution with which the tower is about two-thirds filled. There the reaction mentioned above takes place, and owing to the concentration of the liquid the sodium bicarbonate formed is to a great extent precipitated in the shape of small crystals, forming with the mother-liquor a thin magma. This takes place with considerable evolution of heat which is removed by internal and external cooling with water. The temperature must not be allowed to rise beyond a certain point, for the reaction $NaCl+NH_4HCO_3=NaHCO_3+NH_4Cl$ is reversible, and at a temperature of about 60° or 70° C. it is in fact practically going the wrong way, viz. from right to left. On the other hand the cooling must not be carried too far, for in this case the crystals of sodium bicarbonate become so fine that the muddy mass is very difficult to filter. The best temperature seems to be about 30° C.

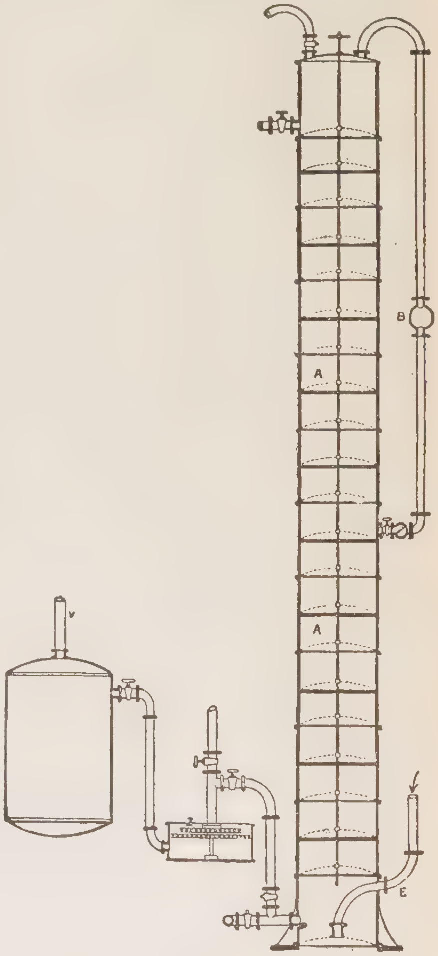


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FIG. 10.—Ammonia-soda Carbonating Towers and Filters. (Sectional Elevation.) *AA*, Tower: *B*, ammoniacal brine main; *E*, gas-inlet; *Z*, vacuum filter; *V*, pipe to air-pump.

Either at certain intervals, or continuously, a portion of the contents of the tower is withdrawn and fresh ammoniacal salt solution is introduced higher up. The muddy liquid running out is passed on to the vacuum filters (Z, fig. 10). Here a separation takes place between the crystals of sodium bicarbonate and the mother-liquor. The former are washed with water until the chlorides are nearly removed, and are then carried into the drying apparatus. This must be constructed in such a manner that the bicarbonate, which always contains some ammonium salts, is first freed from these by moderate heating (of course taking care that the ammonia is completely recovered), and later on, by raising the temperature, it is decomposed into solid sodium carbonate and gaseous carbon dioxide. The former needs only grinding to constitute the final product, ammonia-soda ash; the latter is again employed in the process of treating the ammoniacal salt solution with carbon dioxide. Various forms of apparatus are employed for this treatment of the crude bicarbonate—sometimes semi-circular troughs with mechanical agitators on the principle of the Thélen pan (see above)—all acting on the principle that the escaping ammonia and carbon dioxide must be fully utilized over again. The soda-ash obtained in the end is of a high degree of purity, testing from 98 to 99% Na_2CO_3, the remaining 1 or 2% consisting principally of NaCl.

A very important part of the process has still to be described, viz. the recovery of the ammonia from the mother-liquor coming from the vacuum filters and various washing liquors. Unless this recovery is carried out in the most efficient manner, the process cannot possibly pay; but so much progress has been made in this direction that the loss of ammonia is very slight indeed, merely a fraction per cent. The ammonia is for the major part found in the mother-liquor as ammonium chloride. A smaller but still considerable portion exists here and in the washings in the shape of ammonium carbonates. These compounds differ in their behaviour to heat. The ammonium carbonates are driven out from their solutions by mere prolonged boiling, being thereby decomposed into ammonia, carbon dioxide and water, but the ammonium chloride is not volatile under these conditions, and must be decomposed by milk of lime: $2NH_4Cl+Ca(OH)_2=2NH_3+CaCl_2+2H_2O$. The solution of calcium chloride is run to waste, the ammonia is re-introduced into the process.

Both these reactions are carried out in tall cylindrical columns or "stills," consisting of a number of superposed cylinders, having perforated horizontal partitions, and provided with a steam-heating arrangement in the enlarged bottom portion. The milk of lime is introduced at a certain distance from the bottom. The steam causes the action of the lime on the ammonium chloride to take place in this lower portion of the still, from which the steam, mixed with all the liberated ammonia, rises into the upper portion of the column where its heat serves to drive out the volatile ammonium carbonate. Just below the top there is a cooling arrangement, so that nearly all the water is condensed and runs back into the column, while the ammonia, with the carbon dioxide formerly combined with part of it, passes on first through an outside cooler where the remaining water is condensed, and afterwards into the vessels, already described, where the ammonia is absorbed by a solution of salt and thus again introduced into the process.

The reversible character of the principal reaction has the consequence that a considerable portion of the sodium chloride (up to 33%) is lost, being contained in the waste calcium chloride solution which issues from the ammonia stills. This is, however, not of much importance, as it had been introduced in the shape of a brine where its value is very slight (6d. per ton of NaCl). It is true that all the chlorine combined with the sodium is lost partly as NaCl and partly as $CaCl_2$; none of the innumerable attempts at recovering the chlorine from the waste liquor has been made to pay, and success is less likely than ever since the perfection of the electrolytic processes. (See CHLORINE.) For all that, especially in consequence of the small amount of fuel required, and the total absence of the necessity of employing sulphur compounds as an intermediary, the ammonia-soda process has supplanted the Leblanc process almost entirely on the continent of Europe and to a great extent in Great Britain.

III. ELECTROLITIC ALKALI MANUFACTURE

In theory by far the simplest process for making alkalis together with free chlorine is the electrolysis of sodium (or potassium) chloride. When this takes place in an aqueous solution, the alkaline metal at once reacts with the water, so that a solution of an alkaline hydrate is formed while hydrogen escapes. The reactions are therefore (we shall in this case speak only of the sodium compounds): (1) $NaCl=Na+Cl$, (2) $Na+H_2O=NaOH+H$.

The chlorine escapes at the anode, the hydrogen at the cathode. If the chlorine and the sodiun hydrate can act upon each other within the liquid, *bleach-liquors* are formed: $2NaOH+Cl_2=NaOCl+NaCl+H_2O$. The production of these for the use of papermakers and bleachers of textile fabrics has become an important industry, but does not enter into our province.

If, however, the action of the chlorine on the sodium hydrate is prevented, which can be done in various ways, they can both be collected in the isolated state and utilized as has been previously described, viz. the *chlorine* can be used for the manufacture of liquid chlorine, bleaching-powder or other bleaching compounds, or chlorates, and the solution of *sodium hydrate* can be sold as such, or converted into solid caustic soda. Precisely the same can be done in the electrolysis of potassium chloride.

There is a third way of conducting the action, viz. so that the chlorine can act upon the caustic soda or potash at a higher concentration and temperature, in which case *chlorates* are directly formed in the liquid: $KCl+3H_2O=KClO_3+3H_2$. This has indeed become the principal, because it is the cheapest, process for the manufacture of potassium and sodium chlorate. Perchlorates can also be made in this way.

In all these cases the chlorine, or the products made from it, really play a greater part than the alkali. From 58.5 parts by weight of NaCl we obtain theoretically $23Na=40NaOH=53Na_2CO_3$, together with 35.5 Cl, or 100 bleaching-powder. As the weight of bleaching-powder consumed in the world is at most one-fifth of that of alkali, calculated as Na_2CO_3, it follows that only about one-tenth of all the alkali required could be made by electrolysis, even supposing the Leblanc process to be entirely abolished. The remaining nine-tenths of alkali must be supplied from other sources, chiefly the ammonia-soda process. As long as the operation of the Leblanc process is continued, it will supply a certain share of both kinds of products. Trustworthy statistics on this point cannot be obtained, because most firms withhold any information as to the extent of their production from the public.

The first patents for the electrolysis of alkaline chlorides were taken out in 1851 and several others later on; but commercial success was utterly impossible until the invention of the dynamo machine allowed the production of the electric current at a sufficiently cheap rate. The first application of this machine for the present purpose seems to have been made in 1875 and the number of patents soon rapidly increased; but although a large amount of capital was invested and many very ingenious inventions made their appearance, it took nearly another twenty years before the manufacture of alkali in this way was carried out in a continuous way on a large scale and with profitable results. A little earlier the manufacture of *potassium chlorate* (on the large scale since 1890) had been brought to a definite success by H. Gall and the Vicomte A. de Montlaur; a few years later the processes worked out at the Griesheim alkali works (near Frankfort) for the manufacture of caustic potash and chlorine established definitely the success of electrolysis in the field of potash, but even then none of the various processes working with sodium chloride had emerged from the experimental stage. Only more recently the manufacture of caustic soda by electrolysis has also been established as a permanent and paying industry, but as the greatest secrecy is maintained in everything belonging to this domain, and as neither patent specifications nor the sanguine assertions and anticipations of interested persons throw much real light on the actual facts of the case, nothing certain can be said either in regard to the date at which the profitable manufacture of caustic soda was first carried out by electrolysis, or as to what extent this is the case at the present moment.

We shall here give merely an outline of those more important processes which are known to be at present working profitably on a large scale.

(1) The *Diaphragm process* is probably the only one employed at present for the decomposition of potassium chloride, and it is also used for sodium chloride. A hot, concentrated solution of the alkaline chloride is treated by the electric current in large iron tanks which at the same time serve as cathodes. The anodes are made of retort-carbon or other chlorine-resisting material, and they are mounted in cells which serve as diaphragms. The material of these cells is usually cement, mixed with certain soluble salts which impart sufficient porosity to the material. The electrolysis is carried on until about a quarter of the chloride has been transformed; it must be stopped at this stage lest the formation of hypochlorite and chlorate should set in. The alkaline liquid is now transferred to vacuum pans, constructed in such a manner that the unchanged chloride, which "salts out" during the concentration, can be removed without disturbing the vacuum, and here at last a concentrated pure

solution of KOH or NaOH is obtained which is sold in this state, or "finished" as solid caustic in the manner described in the section treating of the Leblanc soda.

(2) The *Castner-Kellner process* employs no diaphragm, but a mercurial cathode. The electrolysis takes place in the central compartment of a tripartite trough which can be made to rock slightly either to one side or the other. The bottom of the trough is covered with mercury. The sodium as it is formed at the cathode at once dissolves in the mercury which protects it against the action of the water as long as the percentage of sodium in the mercury does not exceed, say, 0·02%. When this percentage has been reached, the cell is rocked to the other side, so that the amalgam flows into one of the outer compartments where the sodium is converted by water into sodium hydrate. At the same time fresh mercury, from which the sodium had been previously extracted, flows from the other outside compartment into the central one. After a certain time the whole is rocked towards the other side, and the process is continued until the outer compartments contain a strong solution of caustic soda, free from chloride and hypochlorite.

(3) *Aussig process.*—Here the anode is fixed in a bell, mounted in a larger iron tank where the cathodes are placed. The whole is filled with a solution of common salt. As the electrolysis goes on, NaOH is formed at the cathodes and remains at the bottom. The intermediate layer of the salt solution, floating over the caustic soda solution, plays the part of a diaphragm, by preventing the chlorine evolved in the bell from acting on the sodium hydrate formed outside, and this solution offers much less resistance to the electric current than the ordinary diaphragms. This process therefore consumes less power than most others.

(4) The *Acker-Douglas process* electrolyses sodium chloride in the molten state, employing a cathode consisting of molten lead. The latter dissolves the sodium as it is formed and carries it to an outer compartment where by the action of water the sodium is converted into caustic soda, while the lead returns to the inner compartment. This process is carried on at Niagara Falls, but it is uncertain to what extent.

(5) The *Hargreaves-Bird process* avoids certain drawbacks attached to other processes, by employing a wire diaphragm and converting the caustic soda as it issues on the other side of this, by means of carbon dioxide, into a mixture of sodium carbonate and bicarbonate, which separates out in the solid state. This process is but little used.

It stands to reason that the electrolytic processes have been principally developed in localities where the electric current can be produced in the cheapest possible manner by means of water power, but this is not the only condition to be considered, as the question of freight to a centre of consumption and other circumstances may also play an important part. Where coal is very cheap indeed and the other conditions are favourable, it is possible to establish such an industry with a prospect of commercial success, even when the electric current is produced by means of steam-engines.

Natural Soda.—This is the term applied to certain deposits of alkaline salts, or their solutions, which occur, sometimes in very large quantities, in various parts of the world. The oldest and best known of these are the Natron lakes in Lower Egypt. The largest occurrence of natural soda hitherto known is that in Owen's Lake and other salt lakes situated in eastern California. The soda in all of these is present as "sesquicarbonate," in reality 4/3 carbonate: $NaHCO_3 \cdot Na_2CO_3 \cdot 2H_2O$, and is always mixed with large quantities of chloride and sulphate, which makes its extraction more difficult than would appear from the outset. Hence, although for many centuries (up to Leblanc's invention) hardly any soda was available except from this source, and although we now know that millions of tons of it exist, especially in the west of the United States, there is as yet very little of it practically employed, and that only locally.

References.—The principal work on the manufacture of alkali is G. Lunge's *Sulphuric Acid and Alkali* (2nd ed., vols. ii. and iii., 1895–1896). This work has also appeared in a German and a French edition. The same author wrote the articles on the manufacture of sodium and potassium compounds and on chlorine in Thorpe's *Dictionary of Applied Chemistry* (3 vols., 1890–1893). The subject is also treated, very much more briefly, in Sorel's *Industrie chimique minérale* (1902), and of course in every other general treatise on chemical technology. A special treatise on the manufacture of ammonia soda ash has been published in German by H. Schreib. Consult also the official *Annual Reports on Alkali*, &c., and, from 1864 onwards, *Journal of the Society of Chemical Industry*, *Fischers Jahresberichte der chemischen Technologie*, and *Zeitschrift für angewandte Chemie.* (G. L.)

ALKALINE EARTHS. The so-called alkaline earth-metals are the elements beryllium, magnesium, calcium, strontium and barium. By the early chemists, the term *earth* was used to denote those non-metallic substances which were insoluble in water and were unaffected by strong heating; and as some of these substances (*e.g.* lime) were found to be very similar in properties to those of the alkalis, they were called alkaline earths. The alkaline earths were assumed to be elements until 1807, when Sir H. Davy showed that they were oxides of various metals. The metals comprising this group are never found in the uncombined condition, but occur most often in the form of carbonates and sulphates; they form oxides of the type RO, and in the case of calcium, strontium and barium, of the type RO_2. The oxides of type RO are soluble in water, the solution possessing a strongly alkaline reaction and rapidly absorbing carbon dioxide on exposure; they are basic in character and dissolve readily in acids with the formation of the corresponding salts. As the atomic weight of the element increases, it is found that the solubility of the sulphates in water decreases.

Beryllium to a certain extent stands alone in many of its chemical properties, resembling to some extent the metal aluminium. Beryllium and magnesium are permanent in dry air; calcium, strontium and barium, however, oxidize rapidly on exposure. The salts of all the metals of this group usually crystallize well, the chlorides and nitrates dissolve readily in water, whilst the carbonates, phosphates and sulphates are either very sparingly soluble or are insoluble in water.

ALKALOID, in chemistry, a term originally applied to any organic base, *i.e.* a nitrogenous substance which forms salts with acids; now, however, it is usual to restrict the term to bases of vegetable origin and characterized by remarkable toxicological effects. Such bases occur almost exclusively in the dicotyledons, generally in combination with malic, citric, tartaric or similar plant-acids. They may be extracted by exhausting the plant-tissues with a dilute acid, and precipitating the bases with potash, soda, lime or magnesia. The separation of the mixed bases so obtained is effected by repeated fractional crystallization, or by taking advantage of certain properties of the constituents.

A chemical classification of alkaloids is difficult on account of their complex constitution. I. A. Wyschnegradsky, and afterwards W. Königs, expressed the opinion that the alkaloids were derivatives of pyridine or quinoline. This view has been fairly well supported by later discoveries; but, in addition to pyridine and quinoline nuclei, alkaloids derived from isoquinoline are known. The purely chemical literature on the alkaloids is especially voluminous; and from the assiduity with which the constitutions of these substances have been and are still being attacked, we may conclude that their synthesis is but a question of time. Piperine, conine, atropine, belladonine, cocaine, hyoscyamine and nicotine have been already synthesized; the constitution of several others requires confirmation, while there remain many important alkaloids—quinine, morphine, strychnine, &c.—whose constitution remains unknown.

The following classification is simple and convenient; the list of alkaloids makes no pretence at being exhaustive.

(1) Pyridine group. Piperine; conine; trigonelline; arecaidine; guvacine; pilocarpine; cytisine; nicotine; sparteine.

(2) Tropine group. Alkaloids characterized by containing the tropine (*q.v.*) nucleus. Atropine; cocaine; hygrine; ecgonine; pelletierine.

(3) Quinoline group. The alkaloids of the quina-barks:

quinine, &c.; the *strychnos* bases: strychnine, brucine; and the *veratrum* alkaloids: veratrine, cevadine, &c.

(4) Isoquinoline group. The opium alkaloids: morphine, codeine, thebaine, papaverine, narcotine, narceine, &c.; and the complicated substances hydrastine and berberine.

In addition to the above series there are a considerable number of compounds derived from purin which are by some writers classed with the alkaloids. These are treated in the article PURIN. There are also reasons for including such compounds as muscarine, choline, neurine and betaine in this group.

The greater number of these substances are of considerable medicinal value; this aspect is treated generally in the article PHARMACOLOGY. Reference should also be made to the articles on the individual alkaloids for further details as to their medicinal and chemical properties.

The chemistry of the alkaloids is treated in detail by Amé Pictet in his *La Constitution chimique des alcaloides végétaux* (Paris, 1897); enlarged and translated by H. C. Biddle with the title *The Vegetable Alkaloids* (New York, 1904); and by J. W. Bruhl, E. Hjelt, and O. Aschan: *Die Pflanzen-Alkaloide* (1900). A pamphlet, *Die Alkaloidchemie in den Jahren 1900–1904*, by Julius Schmidt, may also be consulted.

ALKAN, CHARLES HENRI VALENTIN MORHANGE (1813–1888), French musical composer, was born and died in Paris. Alkan was his *nom de guerre*. Admitted to the Conservatoire of Paris in his sixth year, he had a distinguished career there until 1830. He visited London in 1833, after which he settled in Paris as a pianoforte teacher till his death. He is important as the composer of a large number of pianoforte *études*, embodying the most extravagant technical difficulties. His invention was not modern enough to secure for these works that attention which they deserve as representing a pianoforte technique and sense of effect in some respects more advanced even than that of Liszt, though lacking Liszt's economy and tact.

ALKANET (dim. from Span. *alcaña*, Arab. *al-henna* = henna, Egyptian privet, or *Lawsonia inermis*), a plant, *Alkanna* or *Anchusa tinctoria*, of the order Boraginaceae, also known as orchanet, dyer's bugloss, Spanish bugloss or bugloss of Languedoc, which is grown in the south of France and on the shores of the Levant. Its root yields a fine red colouring matter which has been used to tint tinctures, oils, wines, varnishes, &c.

AL KASR AL KEBIR ("the great castle," in Span. ALCAZAR KEBIR, in Port. ALCAÇER QUIBIR), a town of Morocco, on the river Lekkus, 80 m. N.W. of Fez. Pop. about 10,000. Its mud and pantile dwellings are here and there relieved by a mosque tower, but the aspect of the town is far from inviting. It is frequently flooded in winter and in consequence fever is prevalent. The weekly market, held on Sundays in the centre of the town, gives to the place an appearance of bustle. A vice-governor is appointed for the town by the basha of Laraiche, one for the country round by the sultan of Morocco, a condition which causes much confusion on market-days. Al Kasr al Kebir was built, according to Leo Africanus, by Yakub el Mansur (1184–1199). Not far from the town, by the banks of the river Makhazan, is the site of the battle fought in 1578 between Dom Sebastian, king of Portugal, and the Moors under Abd el Malek, in which the Moors were victorious, though both kings perished, as well as the deposed Mahommed XI., who had called in the Portuguese to his aid against Abd el Malek.

ALKMAAR, a town in the province of North Holland, kingdom of Holland, 24½ m. by rail N.N.W. of Amsterdam, connected by steam-tramway with Haarlem and Amsterdam, and on the North Holland canal. Pop. (1900) 18,373. Alkmaar is a typical North Holland town, with tree-lined canals and brightly coloured 17th-century houses. The old city walls have been replaced by pleasant gardens and walks, and there is a park in which stands a fine monument (1876) by J. T. Stracké (1817–1891), symbolizing *Alcmaria victrix*, to commemorate the siege by the Spaniards in 1573. The Groote Kerk (1470–1498), dedicated to St Lawrence, is a handsome building and contains the tomb of Floris V., count of Holland (d. 1296), a brass of 1546, and some paintings (1507). In the town hall (1507) are the library and a small museum with two pictures by the 17th-century artist Caesar van Everdingen, who with his more celebrated brother Allart van Everdingen (*q.v.*) was a native of the town. The weigh-house (1582) is a picturesque building with quaint gable and tower. Just outside the town lies the Alkmaar wood, at the entrance to which stands the military cadet school which serves as a preparatory school for the royal military academy at Breda. Alkmaar derives its chief importance from being the centre of the flourishing butter and cheese trade of this region of Holland. It is also a considerable market for horses, cattle and grain, and there is a little boat-building and salt and sail-cloth manufacture. Tramways connect Alkmaar with Egmond and with the pretty summer resort of Bergen, which lies sheltered by woods and dunes.

The name of Alkmaar, which means "all sea," first occurs in the 10th century, and recalls its former situation in the midst of marshlands and lakes. It was probably originally a fishing-village, but with the reclamation of the surrounding morasses, *e.g.* that of the Schermer in 1685, and their conversion into rich meadow land, Alkmaar gradually acquired an important trade. In 1254 it received a charter from William II., count of Holland, similar to that of Haarlem, but in the 15th century duke Philip the Good of Burgundy made the impoverishment of the town, due to ill-government, the excuse for establishing an oligarchical régime, by charters of 1436 and 1437. As the capital of the ancient district of Kennemerland between den Helder and Haarlem, Alkmaar frequently suffered in the early wars between the Hollanders and the Frisians, and in 1517 was captured by the united Gelderlanders and Frisians. In 1573 it successfully sustained a seven-weeks' siege by 16,000 Spaniards under the duke of Alva. In 1799 Alkmaar gave its name to a convention signed by the duke of York and the French general Brune, in accordance with which the Russo-British army of 23,000 men, which was defeated at Bergen, evacuated Holland. A monument was erected in 1901 to commemorate the Russians who fell.

ALLACCI, LEONE [LEO ALLATIUS] (1586–1669), Greek scholar and theologian, was born in the island of Chios. His early years were passed in Calabria and at Rome, where he finally settled as teacher of Greek at the Greek college, at the same time devoting himself to the study of classics and theology. In 1622, after the capture of Heidelberg by Tilly, the elector Maximilian of Bavaria presented its splendid library composed of 196 cases of MSS. (*bibliotheca Palatina*) to Pope Gregory XV. Allacci was sent to superintend its removal to Rome, where it was incorporated with the Vatican library. On the death of Gregory, Allacci became librarian to Cardinal Berberini, and subsequently (1661) librarian of the Vatican, which post he held till his death on the 18th (or 19th) of January 1669. It is noteworthy that, although a Greek by birth, he became an ardent Roman Catholic and the bitter enemy of all heretics, including his own countrymen. Allacci was a very industrious and voluminous writer, but his works, although they bear ample testimony to his immense learning, show an absence of the true critical faculty, and are full of intolerance, especially on religious subjects. For a list of these, J. A. Fabricius's *Bibliotheca Graeca* (xi. 437) should be consulted, where they are divided into four classes: editions, translations and commentaries on ancient authors; works relating to the dogmas and institutions of the Greek and Roman Churches; historical works; miscellaneous works. The number of his unpublished writings is also very large; the majority of them are included in the MSS. of the Vallicellian library.

The main source of our knowledge of Allatius is the incomplete life by Stephanus Gradi, *Leonis Allatii vita*, published by Cardinal Mai, in *Nova Bibliotheca Patrum*. A complete enumeration of his works is contained in E. Legrand, *Bibliographie hellénique du XVII*$^{\text{ème}}$ *siècle* (Paris, 1895, iii. 435-471). The accounts of C. N. Sathas in Νεοελληνικὴ φιλολογία (Athens, 1868), and of the pseudo-prince Demetrius Rhodokanakis, *Leonis Allatii Hellas* (Athens, 1872), are inaccurate and untrustworthy. For a special account of his share in the foundation of the Vatican Library, see Curzio Mazzi, *Leone Allacci e la Palatina di Heidelberg* (Bologna, 1893). The theological aspect of his works is best treated by the Assumptionist Father L. Petit in A. Vacant's *Dictionnaire de théologie* (Paris, 1900, cols. 830-833).

ALLAH, the Arabic name used by Moslems of all nationalities for the one true God. It is compounded of *al*, the definite article, and *ilah*, meaning a god. The same word is found in Hebrew and Aramaic as well as in ancient Arabic (Sabaean). The meaning of the root from which it is derived is very doubtful; cf. Lane's

Arabic-English Lexicon, p. 82, and the Oxford *Hebrew and English Lexicon*, pp. 61 ff.

ALLAHABAD, a city of British India, the capital of the United Provinces of Agra and Oudh, giving its name to a district and a division. The city is situated at the confluence of the Ganges and the Jumna in 25°26′ N. lat. and 81°50′ E. long., 564 m. from Calcutta by rail. Its most conspicuous feature is the fort, which rises directly from the banks of the confluent rivers and completely commands the navigation of both streams. Within the fort are the remains of a splendid palace, erected by the Emperor Akbar, and once a favourite residence of his. A great portion of it has been destroyed, and its hall is converted into an arsenal. Outside the fort the places of most importance are the sarai and gardens of Khasru, the son of the Emperor Jehangir, and the Jama Masjid or Great Mosque. When the town first came into the hands of the English this mosque was used as a residence by the military officer commanding the station, and afterwards as an assembly room. Ultimately it was returned to its former owners, but the Mahommedans considered it desecrated, and it has never since been used as a place of worship. Allahabad (Illahabad) was the name given to the city when Akbar built the great fort. To the Hindus it is still known by its ancient name of Prag or Prayag ("place of sacrifice"), and it remains one of the most noted resorts of Hindu pilgrimage. It owes its sanctity to its being the reputed confluence of three sacred streams—the Ganges, the Jumna and the Saraswati. This last stream, however, actually loses itself in the sands of Sirhind, 400 m. north-west of Allahabad. The Hindus assert that the stream joins the other two rivers underground, and in a subterraneous temple below the fort a little moisture trickling from the rocky walls is pointed out as the waters of the Saraswati. An annual fair is held at Allahabad at the confluence of the streams on the occasion of the great bathing festival at the full moon of the Hindu month of Magh. It is known as the Magh-mela, lasts for a whole month, and is attended by as many as 250,000 persons in ordinary years, either for religious or commercial purposes. Every twelfth year there is a special occasion called the Kumbh-mela, which is attended by a million of devotees at one time. Allahabad was taken by the British in 1765 from the wazir of Oudh, and assigned as a residence to Shah Alam, the titular emperor of Delhi. Upon that prince throwing himself into the hands of the Mahrattas, the place was resumed by the British in 1771 and again transferred to the nawab of Oudh, by whom it was finally ceded together with the district to the British in 1801, in commutation of the subsidy which the wazir had agreed to pay for British protection. During the Mutiny of 1857, Allahabad became the scene of one of the most serious outbreaks and massacres which occurred in the North-Western Provinces. The fort was held by a little garrison of Europeans and loyal Sikhs, until it was relieved by General Neill on June 11th of that year.

The modern buildings of Allahabad include Government House, the High Court, the Mayo memorial and town hall, the Muir central college, the Thornhill and Mayne memorial library and museum, the Naini central jail, and the Anglican and Roman Catholic cathedrals. The Jumna is crossed by a railway bridge and there are two bridges of boats over the Ganges. The military cantonments contain accommodation for all three arms and are the headquarters of a brigade in the 8th division of the eastern army corps. At Allahabad is published the *Pioneer*, perhaps the best known English paper in India. There is an American mission college. Here is the junction of the great railway system which unites Bengal with Central India and Bombay, and is developing into a great centre of inland and export trade. The population in 1901 was 172,032.

The DISTRICT OF ALLAHABAD has an area of 2811 sq. m. In shape it is an irregular oblong, and it is very difficult to define its boundaries, as at one extremity it wanders into Oudh, while on the south the villages of the state of Rewa and those of this district are hopelessly intermingled. The Jumna and the Ganges enclose within their angle a fertile tract well irrigated with tanks and wells. The East Indian railway and the Grand Trunk road afford the principal means of land communication. In 1901 the population was 1,489,358, showing a decrease of 4% in the decade due to famine.

The division of Allahabad has an area of 17,270 sq. m. The population in 1901 was 5,540,702, showing a decrease of 4% in the decade due to the famine of 1896–1897, which was severely felt throughout the division. It comprises the seven districts of Cawnpore, Fatehpur, Banda, Hamirpur, Allahabad, Jhansi and Jalaun.

ALLAMANDA, named after J. N. S. Allamand (1713–1787), of Leiden, a genus of shrubby, evergreen climbers, belonging to the natural order Apocynaceae, and a native of tropical America. Several species are grown in hot-houses for the beauty of their foliage and flowers; the latter, borne in many-flowered panicles, have a funnel-shaped corolla with a narrow tube, and often yellow in colour. The plants are of comparatively easy culture, and very effective when trained to wires beneath the roof of the house.

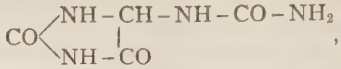
ALLAN, DAVID (1744–1796), Scottish historical painter, was born at Alloa. On leaving Foulis's academy of painting at Glasgow (1762), after seven years' successful study, he obtained the patronage of Lord Cathcart and of Erskine of Mar, on whose estate he had been born. The latter furnished him with the means of proceeding to Rome (1764), where he remained for a number of years engaged principally in copying the old masters. Among the original works which he then painted was the "Origin of Portraiture"—representing a Corinthian maid drawing her lover's shadow—well known through Domenico Cunego's excellent engraving. This gained for him the gold medal given by the Academy of St Luke in the year 1773 for the best specimen of historical composition. Returning from Rome in 1777, he resided for a time in London, and occupied himself in portrait-painting. In 1780 he removed to Edinburgh, where, on the death of Alexander Runciman in 1786, he was appointed director and master of the Academy of Arts. There he painted and etched in aquatint a variety of works, those by which he is best known—as the "Scotch Wedding," the "Highland Dance," the "Repentance Stool," and his "Illustrations of the Gentle Shepherd"—being remarkable for their comic humour. He was called the "Scottish Hogarth"; but his drolleries hardly entitle him to this comparison. Allan died at Edinburgh on the 6th of August 1796.

ALLAN, SIR HUGH (1810–1882), Canadian financier, was born on the 29th of September 1810, at Saltcoats, Ayrshire, Scotland, the son of Captain Alexander Allan, a shipmaster. He emigrated to Canada in 1826, and in 1831 entered the employ of the chief shipbuilding and grain-shipping firm of Montreal, of which he became a junior partner in 1835. In 1853 he organized the Allan Line of steamships, plying between Montreal, Liverpool and Glasgow; till his death he was closely associated with the commercial growth and prosperity of Canada, and in 1871 was knighted in recognition of his services. In 1872–1873 he obtained from the Canadian government a charter for building the Canadian Pacific railway, but the disclosures made with reference to his contributions to the funds of the Conservative party led to the Pacific scandal (see CANADA, *History*), and that company was soon afterwards dissolved. He died in Edinburgh on the 9th of December 1882.

See J. C. Dent, *Canadian Portrait Gallery* (1881).

ALLAN, SIR WILLIAM (1782–1850), Scottish painter, was born at Edinburgh, and at an early age entered as a pupil in the School of Design established in Edinburgh by the Board of Trustees for Arts and Manufactures, where he had as companions, John Wilkie, John Burnet the engraver, and others who afterward distinguished themselves as artists. Here Allan and Wilkie were placed at the same table, studied the same designs, and contracted a lifelong friendship. Allan continued his studies for some time in London; but his attempt to establish himself there was unsuccessful, and after exhibiting at the Royal Academy (1805) his first picture, "A Gipsy Boy and Ass," an imitation in style of Opie, he determined, in spite of his scanty resources, to seek his fortune abroad. He accordingly set out the same year for Russia, but was carried by stress of weather to Memel, where he remained for some time, supporting himself by his pencil. At last, however, he reached St Petersburg, where the kindness of Sir Alexander Crichton, the court physician, and other friends procured him abundant employment. By excursions into southern Russia, Turkey, the Crimea and Circassia, he filled his portfolio with vivid sketches, of which he made admirable use in his subsequent pictures. In 1814 he returned to Edinburgh, and in the two following years exhibited at the Royal Academy "The Circassian Captives" and "Bashkirs conducting Convicts to Siberia." The former picture remained so long unsold, that, thoroughly disheartened, he threatened to retire to Circassia when, through the kindness of Sir Walter Scott, a subscription of 1000 guineas was obtained for the picture, which fell by lot into the possession of the earl of Wemyss. About the same time the Grand Duke Nicholas, afterwards tsar of Russia, visited Edinburgh, and purchased his "Siberian Exiles" and "Haslan Gheray crossing the River Kuban," giving a very favourable turn to the fortunes of the painter, whose pictures were now sought for by collectors. From this time to 1834 he achieved his greatest success and firmly established his fame by the illustration of Scottish history. His most important works of this class were "Archbishop Sharpe on Magus Moor"; "John Knox admonishing Mary Queen of Scots" (1823), engraved by Burnet; "Mary Queen of Scots signing her Abdication" (1824); and "Regent Murray shot by Hamilton of Bothwellhaugh." The last procured his election as an associate of the Royal Academy (1825). Later Scottish subjects were "Lord Byron" (1831), portraits of Scott and "The Orphan" (1834), which represented Anne Scott seated near the chair of her deceased father. In 1830 he was compelled, on account of an attack of ophthalmia, to seek a milder climate, and visited Rome, Naples and Constantinople. He returned with a rich store of materials, of which he made excellent use in his "Constantinople Slave Market" and other productions. In 1834 he visited Spain and Morocco, and in 1841 went again to St Petersburg, when he undertook, at the request of the tsar, his "Peter the Great teaching his Subjects the Art of Shipbuilding," exhibited in London in 1845, and now in the Winter Palace of St Petersburg. His "Polish Exiles" and "Moorish Love-letter," &c., had secured his election as a Royal Academician in 1835; he was appointed president of the Royal Scottish Academy (1838), and royal limner for Scotland, after Wilkie's death (1841); and in 1842 received the honour of knighthood. His later years were occupied with battle-pieces, the last he finished being the second of his two companion pictures of the "Battle of Waterloo." He died on the 22nd of February 1850, leaving a large unfinished picture—"Bruce at Bannockburn."

ALLAN-DESPRÉAUX, LOUISE ROSALIE (1810–1856), French actress, was "discovered" by Talma at Brussels in 1820, when she played Joas with him in *Athalie*. At his suggestion she changed her surname, Ross, for her mother's maiden name, and, as Mlle. Despréaux, was engaged for children's parts at the Comédie Française. At the same time she studied at the Conservatoire. By 1825 she had taken the second prize for comedy, and was engaged to play *ingénue* parts at the Comédie Française, where her first appearance in this capacity was as Jenny in *L'Argent* on the 8th of December 1826. In 1831 the director of the Gymnase succeeded in persuading her to join his company. Her six years at this theatre, during which she married Allan, an actor in the company, were a succession of triumphs. She was then engaged at the French theatre at St Petersburg. Returning to Paris, she brought with her, as Legouvé says, a thing she had unearthed, through a Russian translation, a little comedy never acted till she took it up, a production half-forgotten, and esteemed by those who knew it as a pleasing piece of work in the Marivaux style—*Un Caprice* by Alfred de Musset, which she had played with success in St Petersburg. Her selection of this piece for her reappearance at the Théâtre Française (1847) laid the corner-stone of Musset's lasting fame as a dramatist. In the following year his comedy *Il ne faut jurer de rien* was acted at the same theatre, and thus led to the production of his finer plays. Among plays by other authors in which Mme. Allan won special laurels at the Théâtre Française, were *Par droit de conquête*, *Péril en la demeure*, *La joie fait peur*, and *Lady Tartuffe*. In the last, with a part of only fifty lines, and playing by the very side of the great Rachel, she yet held her own as an actress of the first rank. Mme. Allan died in Paris, in the height of her popularity, in March 1856.

ALLANTOIN, $C_4H_6N_4O_3$ or  $\mathrm{CO}\begin{matrix}\diagup \mathrm{NH-CH-NH-CO-NH_2}\\ \qquad\quad | \\ \diagdown \mathrm{NH-CO}\end{matrix}$, the diureide of glyoxylic acid. It is found in the allantoic liquid of the cow, and in the urine of sucking calves. It can be obtained by the oxidation of uric acid by means of lead dioxide, manganese dioxide, ozone or potassium permanganate:

$$C_5H_4N_4O_3 + H_2O + O = C_4H_6N_4O_3 + CO_2.$$

It has been synthesized by E. Grimaux by heating one part of glyoxylic acid with two parts of urea for ten hours at 100° C.: $2CO(NH_2)_2 + CH(OH)_2COOH = 3H_2O + C_4H_6N_4O_3$. It forms glancing prisms of neutral reaction slightly soluble in water. On standing with concentrated potassium hydroxide solution it gives potassium allantoate $C_4H_7N_4O_4K$. On heating with water it undergoes hydrolysis into urea and allanturic acid $C_3H_4O_3N_2$. It is reduced by sodium amalgam to glycouril $C_4H_6N_4O_2$, whilst with hydriodic acid it yields urea and hydantoin $C_3H_4N_2O_2$. Hot concentrated sulphuric acid also decomposes allantoin, with production of ammonia, and carbon monoxide and dioxide. By dry distillation it gives ammonium cyanide.

ALLEGHANY, or THE ALLEGHANIES (a spelling now more common than Allegheny), a name formerly used of all the Appalachian Mountains (*q.v.*), U.S.A., and now sometimes of all that system lying W. and S. of the Hudson river, being steep and narrow-crested in Pennsylvania (1500-1800 ft.), and in Maryland, Virginia and West Virginia higher (3000 ft.-4473 ft). and with broader crests. Another usage applies to the ridges ("the Alleghany Ridges") parallel to the Blue Ridge; the north-western part of this region is sometimes called the Alleghany Front or the Front of the Alleghany Plateau. The Alleghany Plateau is the north-westernmost division of the Appalachian system; it is an eroded mass of sedimentary rock sloping north-westward to the Prairie and Lake Plains and reaching south-west from the south-western part of New York state through Tennessee and into Alabama.

ALLEGHENY, formerly a city of Allegheny county, Pennsylvania, U.S.A., on the N. bank of the Allegheny and Ohio rivers, opposite Pittsburg; since 1907 a part of Pittsburg. Pop. (1890) 105,287; (1900) 129,896, of whom 30,216 were foreign-born and 3315 were negroes; of the foreign-born 12,022 were from Germany, 5070 from Ireland, 3929 from Austria, and 2177 from England; (1906, estimate) 145,240. Allegheny is served by the Baltimore & Ohio and the Pittsburg & Western railways, by the Pittsburg, Ft. Wayne & Chicago, the Western Pennsylvania, the Buffalo & Allegheny Valley, the Cleveland & Pittsburg, the Erie & Pittsburg, the Pittsburg, Youngstown & Ashtabula, and the Chautauqua divisions of the Pennsylvania railway system, and by Ohio river freight and passenger boats. Extending along the river fronts for about 6½ m. are numerous large manufactories and the headquarters of the shipping interests; farther back are the mercantile quarters and public buildings; and on the hills beyond are the residence districts, commanding extensive views of the valley. Two of the principal thoroughfares, Federal and Ohio streets, intersect at a central square, in which are the city hall, public library, post office and the market-place; and surrounding the main business section on the E., N. and W. is City Park of 100 acres, with lakes and fountains, and monuments to the memory of Alexander von Humboldt, George Washington and T. A. Armstrong. Farther out is Riverview Park (219 acres), in which is the Allegheny Astronomical Observatory, and elsewhere are a soldiers' monument and a monument (erected by Andrew Carnegie) in memory of Colonel Johnes Anderson. In Allegheny are the following institutions of higher learning:—the Allegheny Theological Seminary (United Presbyterian), opened in 1825; the Western Theological Seminary of the Presbyterian Church, opened in 1827; and the Theological Seminary of the Reformed Presbyterians, opened in 1856. There is a fine Carnegie library with a music-hall. Among penal and charitable institutions are the Riverside State Penitentiary, three hospitals, three homes for orphans, a home for the friendless and an industrial school. Six bridges spanning the river and electric lines crossing them have brought Allegheny into close industrial and social relations with the main part of Pittsburg, and on the hills of Allegheny are beautiful homes of wealthy men. As a manufacturing centre Allegheny was outranked in 1905 by only two cities in the state—Philadelphia and Pittsburg; among the more important of its large variety of manufactures are the products of slaughtering and meat-packing establishments, iron and steel rolling mills, the products of foundries and machine-shops, pickles, preserves and sauces, the products of railway-construction and repair shops, locomotives, structural iron and plumbers' supplies. In 1905 the total value of Allegheny's factory products was $45,830,272; this showed an apparent decrease (exceeded by one city only) of $7,365,106, from the product-value of 1900, but the decrease was partly due to the more careful census of 1905, in which there were not the duplications of certain items which occurred in the 1900 census. But in the five years there was a decrease of 3865 in the average number of wage-earners, and the iron and steel output was much less. In 1905 Allegheny ranked first among the cities of the United States in the manufacture of pickles, preserves and sauces, the product ($6,216,778) being 20·9% of that for the whole country. An important industry is the shipment of coal, especially on barges down the Ohio.

Allegheny was laid out in 1788 on a portion of a tract which the state had previously reserved opposite Pittsburg, with a view to bringing some valuable land into the market for the payment of its soldiers' claims. When ordered by the state to be laid out, it was also named as the site of the county-seat of the newly erected county of Allegheny, but the opposition of Pittsburg was so strong that by a supplementary act in the following year that town was made the county-seat. In 1828 Allegheny was incorporated as a borough and in 1840 it was chartered as a city. The city suffered severely in 1874 from a fire started by a fire-cracker on the 4th of July and from a flood caused by a great rain-storm on the 26th of the same month, but these calamities were followed by years of great prosperity and rapid growth. In 1906 the question of uniting Allegheny with Pittsburg under one municipal government was submitted to a joint vote of the electorate of the two cities, in accordance with an act of the state legislature, which had been passed in February of that year, and a large majority voted for the union; but there was determined opposition in Allegheny, every ward of the city voting in the negative; the constitutionality of the act was challenged; the supreme court of the state on the 11th of March 1907 declared the act valid, and on the 18th of November 1907 this decision was affirmed by the Supreme Court of the United States.

See J. E. Parke, *Recollections of Seventy Years and Historical Gleanings of Allegheny, Pennsylvania* (Boston, 1886).

ALLEGIANCE (Mid. Eng. *ligeaunce*; med. Lat. *ligeantia*, &c.; the *al-* was probably added through confusion with another legal term, *allegeance*, an allegation; the Fr. *allégeance* comes from the English; the word is formed from "liege," of which the derivation is given under that heading; the connexion with Lat. *ligare*, to bind, is erroneous), the duty which a subject or a citizen owes to the state or to the sovereign of the state to which he belongs. It is often used by English legal commentators in a larger sense, divided by them into natural and local, the latter applying to the deference which even a foreigner must pay to the institutions of the country in which he happens to live; but it is in its proper sense, in which it indicates national character and the subjection due to that character, that the word is important. In that sense it represents the feudal *liege homage*, which could be due only to one lord, while simple homage might be due to every lord under whom the person in question held land. The English doctrine, which was at one time adopted in the United States, asserted that allegiance was indelible:—*Nemo potest exuere patriam.* Accordingly, as the law stood before 1870, every person who by birth or naturalization satisfied the conditions described in the article Alien, though he should be removed in infancy to another country where his family resided, owed an allegiance to the British crown which he could never resign or lose, except by act of parliament or by the recognition of the independence or the cession of the portion of British territory in which he resided. By the Naturalization Act 1870, it was made possible for British subjects to renounce their nationality and allegiance, and the ways in which that nationality is lost are defined. So British subjects voluntarily naturalized in a foreign state are deemed aliens from the time of such naturalization, unless, in the case of persons naturalized before the passing of the act, they have declared their desire to remain British subjects within two years from the passing of the act. Persons who from having been born within British territory are British subjects, but who at birth became under the law of any foreign state subjects of such state, and also persons who though born abroad are British subjects by reason of parentage, may by declarations of alienage get rid of British nationality. Emigration to an uncivilized country leaves British nationality unaffected: indeed the right claimed by all states to follow with their authority their subjects so emigrating is one of the usual and recognized means of colonial expansion.

The doctrine that no man can cast off his native allegiance without the consent of his sovereign was early abandoned in the United States, and in 1868 congress declared that "the right of expatriation is a natural and inherent right of all people, indispensable to the enjoyment of the rights of life, liberty and the pursuit of happiness," and one of "the fundamental principles of the republic" (*United States Revised Statutes*, sec. 1999). Every citizen of a foreign state in America owes a double allegiance, one to it and one to the United States. He may be guilty of treason against one or both. If the demands of these two sovereigns upon his duty of allegiance come into conflict, those of the United States have the paramount authority in American law.

The oath of allegiance is an oath of fidelity to the sovereign taken by all persons holding important public office and as a condition of naturalization. By ancient common law it might be required of all persons above the age of twelve, and it was repeatedly used as a test for the disaffected. In England it was first imposed by statute in the reign of Elizabeth (1558) and its form has more than once been altered since. Up to the time of the revolution the promise was, "to be true and faithful to the king and his heirs, and truth and faith to bear of life and limb and terrene honour, and not to know or hear of any ill or damage intended him without defending him therefrom." This was thought to favour the doctrine of absolute non-resistance, and accordingly the convention parliament enacted the form that has been in use since that time—"I do sincerely promise and swear that I will be faithful and bear true allegiance to His Majesty . . ." (see Oath).

See also the articles Citizen, Naturalization: and Salmond on "Citizenship and Allegiance," in the *Law Quarterly Review* (July 1901, January 1902). (Jno. W.)

ALLEGORY (ἄλλος, other, and ἀγορεύειν, to speak), a figurative representation conveying a meaning *other* than and in addition to the literal. It is generally treated as a figure of rhetoric, but the medium of representation is not necessarily language. An allegory may be addressed to the eye, and is often embodied in painting, sculpture or some form of mimetic art. The etymological meaning of the word is wider than that which it bears in actual use. An allegory is distinguished from a *metaphor* by being longer sustained and more fully carried out in its details, and from an *analogy* by the fact that the one appeals to the imagination and the other to the reason. The fable or parable is a short allegory with one definite moral. The allegory has been a favourite form in the literature of nearly every nation. The Hebrew scriptures present frequent instances of it, one of the most beautiful being the comparison of the history of Israel to the growth of a vine in the 80th psalm. In classical literature one of the best known allegories is the story of the stomach and its members in the speech of Menenius Agrippa (Livy ii. 32); and several occur in Ovid's *Metamorphoses*. Perhaps the most elaborate and the most successful specimens of allegory are to be found in the works of English authors. Spenser's *Faerie Queene*, Swift's *Tale of a Tub*, Addison's *Vision of Mirza*, and, above all, Bunyan's *Pilgrim's Progress*, are examples that it would be impossible to match in elaboration, beauty and fitness, from the literature of any other nation.

ALLEGRI, GREGORIO, Italian priest and musical composer, probably of the Correggio family, was born at Rome either in 1560 or in 1585. He studied music under G. Maria Nanini, the intimate friend of Palestrina. Being intended for the church, he obtained a benefice in the cathedral of Fermo. Here he composed a large number of motets and sacred pieces, which, being brought under the notice of Pope Urban VIII., obtained for him an appointment in the choir of the Sistine Chapel at Rome. He held this from December 1629 till his death on the 18th of February 1652. His character seems to have been singularly pure and benevolent. Among the musical compositions of Allegri were two volumes of concerti, published in 1618 and 1619; two volumes of motets, published in 1620 and 1621; besides a number of works still in manuscript. He was one of the earliest composers for stringed instruments, and Kircher has given one specimen of this class of his works in the *Musurgia*. But the most celebrated composition of Allegri is the *Miserere*, still annually performed in the Sistine Chapel at Rome. It is written for two choirs, the one of five and the other of four voices, and has obtained a celebrity which, if not entirely factitious, is certainly not due to its intrinsic merits alone. The mystery in which the composition was long enshrouded, no single copy being allowed to reach the public, the place and circumstances of the performance, and the added embellishments of the singers, account to a great degree for much of the impressive effect of which all who have heard the music speak. This view is confirmed by the fact that, when the music was performed at Venice by permission of the pope, it produced so little effect that the emperor Leopold I., at whose request the manuscript had been sent, thought that something else had been substituted. In spite of the precautions of the popes, the *Miserere* has long been public property. In 1769 Mozart (*q.v.*) heard it and wrote it down, and in 1771 a copy was procured and published in England by Dr Burney. The entire music performed at Rome in Holy Week, Allegri's *Miserere* included, has been issued at Leipzig by Breitkopf and Härtel. Interesting accounts of the impression produced by the performance at Rome may be found in the first volume of Mendelssohn's letters and in Miss Taylor's *Letters from Italy*.

ALLEGRO (an Italian word, meaning "cheerful," as in Milton's poem), a term in music to indicate quick or lively time, coming between *andante* and *presto;* it is frequently modified by the addition of qualifying words. It is also used of a separate piece of music, or of a movement in a sonata, symphony, &c.

ALLEINE, JOSEPH (1634–1668), English Nonconformist divine, belonged to a family originally settled in Suffolk. As early as 1430 some of them—sprung of Alan, lord of Buckenhall—settled in the neighbourhood of Calne and Devizes, whence descended the immediate ancestors of "worthy Mr Tobie Alleine of Devizes," father of Joseph, who, the fourth of a large family, was born at Devizes early in 1634. 1645 is marked in the title-page of a quaint old tractate, by an eye-witness, as the year of his *setting forth in the Christian race*. His elder brother Edward had been a clergyman, but in this year died; and Joseph entreated his father that he might be educated to succeed his brother in the ministry. In April 1649 he entered Lincoln College, Oxford, and on the 3rd of November 1651 he became scholar of Corpus Christi College. On the 6th of July 1653 he took the degree of B.D., and became a tutor and chaplain of Corpus Christi, preferring this to a fellowship. In 1654 he had offers of high preferment in the state, which he declined; but in 1655 George Newton, of the great church of St Mary Magdalene, Taunton, sought him for assistant and Alleine accepted the invitation. Almost coincident with his ordination as associate pastor came his marriage with Theodosia Alleine, daughter of Richard Alleine. Friendships among "gentle and simple"—of the former, with Lady Farewell, grand-daughter of the protector Somerset—bear witness to the attraction of Alleine's private life. His public life was a model of pastoral devotion. This is all the more remarkable as he found time to continue his studies, one monument of which was his *Theologia Philosophica* (a lost MS.), a learned attempt to harmonize revelation and nature, which drew forth the wonder of Baxter. Alleine was no mere scholar or divine, but a man who associated on equal terms with the founders of the Royal Society. These scientific studies were, however, kept in subordination to his proper work. The extent of his influence was, in so young a man, unique, resting on the earnestness and force of his nature. The year 1662 found senior and junior pastors like-minded, and both were among the two thousand ejected ministers. Alleine, with John Wesley (grandfather of the celebrated John Wesley), also ejected, then travelled about, preaching wherever opportunity was found. For this he was cast into prison, indicted at sessions, bullied and fined. His *Letters from Prison* were an earlier *Cardiphonia* than John Newton's. He was released on the 26th of May 1664; and in spite of the Conventicle, or Five Mile Act, he resumed his preaching. He found himself again in prison, and again and again a sufferer. His remaining years were full of troubles and persecutions nobly borne, till at last, worn out by them, he died on the 17th of November 1668; and the mourners, remembering their beloved minister's words while yet with them, "If I should die fifty miles away, let me be buried at Taunton," found a grave for him in St Mary's chancel. No Puritan nonconformist name is so affectionately cherished as is that of Joseph Alleine. His chief literary work was *An Alarm to the Unconverted* (1672), otherwise known as *The Sure Guide to Heaven*, which had an enormous circulation. His *Remains* appeared in 1674.

See *Life*, edited by Baxter; *Joseph Alleine: his Companions and Times*, by Charles Stanford (1861); Wood's *Athenae*, iii. 819; Palmer's *Nonc. Mem.* iii. 208.

ALLEINE, RICHARD (1611–1681), English Puritan divine, was born at Ditcheat, Somerset, where his father was rector. He was a younger brother of William Alleine, the saintly vicar of Blandford. Richard was educated at St Alban's Hall, Oxford, where he was entered commoner in 1627, and whence, having taken the degree of B.A., he transferred himself to New Inn, continuing there until he proceeded M.A. On being ordained he became assistant to his father, and immediately stirred the entire county by his burning eloquence. In March 1641 he succeeded the many-sided Richard Bernard as rector of Batcomb (Somerset). He declared himself on the side of the Puritans by subscribing "The testimony of the ministers in Somersetshire to the truth of Jesus Christ" and "The Solemn League and Covenant," and assisted the commissioners of the parliament in their work of ejecting unsatisfactory ministers. Alleine continued for twenty years rector of Batcomb and was one of the two thousand ministers ejected in 1662. The Five Mile Act drove him to Frome Selwood, and in that neighbourhood he preached until his death on the 22nd of December 1681. His works are all of a deeply spiritual character. His *Vindiciae Pietatis* (which first appeared in 1660) was refused licence by Archbishop Sheldon, and was published, in common with other nonconformist books, without it. It was rapidly bought up and "did much to mend this bad world." Roger Norton, the king's printer, caused a large part of the first impression to be seized on the ground of its not being licensed and to be sent to the royal kitchen. Glancing over its pages, however, it seemed to him a sin that a book so holy—and so saleable—should be destroyed. He therefore bought back the sheets, says Calamy, for an old song, bound them and sold them in his own shop. This in turn was complained of, and he had to beg pardon on his knees before the council-table; and the remaining copies were sentenced to be "bisked," or rubbed over with an inky brush, and sent back to the kitchen for lighting fires. Such "bisked" copies occasionally occur still. The book was not killed. It was often reissued with additions, *The Godly Man's Portion* in 1663, *Heaven Opened* in 1666, *The World Conquered* in 1668. He also published a book of sermons.

Godly Fear, in 1664, and other less noticeable devotional compilations.

See Calamy, *s.v.*; Palmer's *Nonconf. Mem.* iii. 167-168; C. Stanford's *Joseph Alleine; Researches at Batcomb and Frome Selwood*; Wood's *Athenae* (Bliss), iv. 13.

ALLEMANDE (Fr. for *danse allemande*, or German dance), a name for two kinds of dance, one a German national dance, in 2-4 time, the other somewhat resembling a waltz. The movement in a suite following the prelude, and preceding the courante (*q.v.*), with which it is contrasted in rhythm, is also called an allemande, but has no connexion with the dance. The name, however, is given to pieces of music based on the dance movement, examples of which are found in Beethoven's German dances for the orchestra.

ALLEN, ETHAN (1739–1789), American soldier, was born at Litchfield, Connecticut, on the 10th of January 1739. He removed, probably in 1769, to the "New Hampshire Grants," where he took up lands, and eventually became a leader of those who refused to recognize the jurisdiction of New York, and contended for the organization of the "Grants" into a separate province. About 1771 he was placed at the head of the "Green Mountain Boys," an irregular force organized for resistance to the "Yorkers." On the 10th of May 1775, soon after the outbreak of the War of American Independence, in command of a force, which he had assisted some members of the Connecticut assembly to raise for the purpose, he captured Ticonderoga from its British garrison, calling upon its commanding officer—according to the unverified account of Allen himself—to surrender "in the name of the great Jehovah and the Continental Congress." Seth Warner being elected colonel of the "Green Mountain Boys" in July 1775, Allen, piqued, joined General Philip Schuyler, and later with a small command, but without rank, accompanied General Richard Montgomery's expedition against Canada. On the 25th of September 1775 near Montreal he was captured by the British, and until exchanged on the 6th of May 1778 remained a prisoner at Falmouth, England, at Halifax, Nova Scotia, and in New York. Upon his release he was brevetted colonel by the Continental Congress. He then, as brigadier-general of the militia of Vermont, resumed his opposition to New York, and from 1779 to 1783, acting with his brother, Ira Allen, and several others, carried on negotiations, indirectly, with Governor Frederick Haldimand of Canada, who hoped to win the Vermonters over to the British cause. He seems to have assured Haldimand's agent that "I shall do everything in my power to make this state a British province." In March 1781 he wrote to Congress, with characteristic bluster, "I am as resolutely determined to defend the independence of Vermont as congress that of the United States, and rather than fail will retire with the hardy Green Mountain Boys into the desolate caverns of the mountains and wage war with human nature at large." He removed to Burlington, Vermont, in 1787, and died there on the 11th of February 1789. He was, says Tyler, "a blustering frontier hero—an able-minded ignoramus of rough and ready humour, of boundless self-confidence, and of a shrewdness in thought and action equal to almost any emergency." Allen wrote a *Narrative of Colonel Ethan Allen's Captivity* (1779), the most celebrated book in the "prison literature" of the American revolution; *A Vindication of the Inhabitants of Vermont to the Government of New York and their Right to form an Independent State* (1779); and *Reason, the Only Oracle of Man; or A Compendious System of Natural Religion, Alternately adorned with Confutations of a Variety of Doctrines incompatible with it* (1784).

Ethan's youngest brother, Ira Allen (1751–1814), born on the 21st of April 1751 at Cornwall, Connecticut, also removed to the New Hampshire Grants, where he became one of the most influential political leaders. In 1775 he took part in the capture of Ticonderoga and the invasion of Canada. He was a member of the convention which met at Winchester, Vermont, and in January 1777 declared the independence of the New Hampshire Grants; served (1776–1786) as a member of the Vermont council of safety; conducted negotiations, on behalf of Vermont, for a truce with the British and for an exchange of prisoners, in 1781; served for eight terms in the general assembly, and was state treasurer from 1778 to 1786 and surveyor-general from 1778 to 1787. In 1789, by a gift of £4000, he made possible the establishment of the university of Vermont, of which institution, chartered in 1791 and built at Burlington in deference to his wishes, he was thus virtually the founder. In 1795, on behalf of the state, he purchased from the French government arms for the Vermont militia, of which he was then the ranking major-general, but he was captured by a British cruiser west of Ireland on his return journey, was charged with attempting to furnish insurrectionary Irish with arms, and after prolonged litigation in the British courts, the case not being finally decided until 1804, returned to Vermont in 1801. During his absence he had been dispossessed of his large holdings of land through the operation of tax laws, and to escape imprisonment for debt, he removed to Philadelphia, where on the 4th of January 1814 he died. He published a dull and biassed, but useful *Natural and Political History of Vermont* (1798), reissued (1870) in vol. i. of the *Collections* of the Vermont Historical Society.

There is no adequate biography of Ethan Allen, but Henry Hall's *Ethan Allen* (New York, 1892) may be consulted. The best literary estimate may be found in M. C. Tyler's *Literary History of the American Revolution* (2 vols., New York, 1897).

ALLEN, GRANT [Charles Grant Blairfindie], (1848–1899), English author, son of a clergyman of Irish descent, was born at Kingston, Ontario, Canada, on the 24th of February 1848. He was educated partly in America and France, and in England at King Edward's School, Birmingham, and afterwards at Merton, Oxford. He was for a few years a schoolmaster in Jamaica, but then made his home in England, where he became prominent as a writer. He died at his house on Hindhead, Haslemere, on the 24th of October 1899. Grant Allen was a voluminous author. He was full of interesting scientific knowledge and had a gift for expression both in biological exposition and in fiction. His more purely scientific books (such as *Physiological Aesthetics*, 1877; *The Evolutionist at Large*, 1881; *The Evolution of the Idea of God*, 1897) contain much original matter, popularly expressed, and he was a cultured exponent of the evolutionary idea in various aspects of biology and anthropology. He first attracted attention as a novelist with a sensational story, *The Devil's Die* (1888), though this was by no means his first attempt at fiction; and *The Woman who Did* (1895), which had a *succès de scandale* on account of its treatment of the sexual problem, had for the moment a number of cheap imitators. Other volumes flowed from his pen, and his name became well known in contemporary literature. But his reputation was essentially contemporary and characteristic of the vogue peculiar to the journalistic type.

ALLEN, JAMES LANE (1850–), American novelist, was born near Lexington, Kentucky, on the 21st of December 1850. He graduated at Kentucky University, Lexington, in 1872, taught at Fort Spring, Kentucky, at Richmond and at Lexington, Missouri, and from 1877 to 1879 at the academy of Kentucky University, where he was principal and taught modern languages; in 1880 he was professor of Latin and English at Bethany College, Bethany, West Virginia; and then became head of a private school at Lexington, Kentucky. Subsequently he gave up teaching, went to New York City, where he secured commissions for sketches of the "Blue Grass" region, and thereafter devoted himself to literature. His *Choir Invisible*, coming after other successful stories, made his name well known in England as well as America. His published works include: *With Flute and Violin* (1891), *The Blue Grass Region* (1892), *John Gray* (1893), *A Kentucky Cardinal* (1894), *Aftermath* (1895), *A Summer in Arcady* (1896), *The Choir Invisible* (1897), *The Reign of Law* (1900), *The Mettle of the Pasture* (1903), and *The Bride of the Mistletoe* (1909.)

ALLEN, JOHN (1476–1534), English divine, after studying at both Oxford and Cambridge, was sent by Archbishop Warham on an ecclesiastical mission to Rome. On his return he held a number of livings in succession, and in 1516 was rector of South Ockenden, Essex, and prebendary of Lincoln Cathedral. In the suppression of the minor monasteries in 1524–1525 he gave Wolsey much assistance, and became prebendary of Nottingham in 1526 and of St Paul's, London, in 1527. These prebends he resigned in 1528 on his election as archbishop of Dublin. For four years he was chancellor of Ireland but his career was full of trouble. In 1531 he was fined under the Statutes of Provisors and Praemunire, and in 1534 met a violent death at the hands of Lord Thomas Fitzgerald's followers.

ALLEN, or ALLEYN, **THOMAS** (1542–1632), English mathematician, was born at Uttoxeter in Staffordshire on the 21st of December 1542. He was admitted scholar of Trinity College, Oxford, in 1561; and graduated as M.A. in 1567. In 1580 he quitted his college and fellowship, retired to Gloucester Hall, and became famous for his knowledge of antiquity, philosophy and mathematics. Having received an invitation from Henry Percy, earl of Northumberland, a great friend and patron of men of science, he spent some time at the earl's house, where he became acquainted with Thomas Harriot, John Dee and other famous mathematicians. He was also intimate with Sir Robert Cotton, William Camden, and their antiquarian associates. Robert Dudley, earl of Leicester, had a particular esteem for Allen, and would have conferred a bishopric upon him, but his love of solitude made him decline the offer. His great skill in mathematics and astrology earned him the credit of being a magician; and the author of *Leicester's Commonwealth* accuses him of employing the art of "figuring" to further the earl of Leicester's unlawful designs, and of endeavouring by the black art to bring about a match between his patron and Queen Elizabeth. Allen was indefatigable in collecting scattered manuscripts relating to history, antiquity, astronomy, philosophy and mathematics. A considerable part of his collection was presented to the Bodleian library by Sir Kenelm Digby. He died on the 30th of September 1632 at Gloucester Hall. He published in Latin the second and third books of *Claudius Ptolemy of Pelusium, Concerning the Judgment of the Stars, or, as it is commonly called, of the Quadripartite Construction, with an Exposition.* He also wrote notes on John Bale's *De Scriptoribus M. Britanniae.*

ALLEN, WILLIAM (1532–1594), English cardinal, born at Rossall, Lancashire, went in 1547 to Oriel College, Oxford, and in 1556 became principal of St Mary Hall and proctor. According to Anthony Wood, he was appointed to a canonry at York in or about 1558; he therefore had already entered the clerical state by receiving the tonsure. On the accession of Elizabeth, he was deprived upon refusing the oath of supremacy, but remained in the university until 1561. His known opposition to the new learning in religion giving much offence, he escaped from England and went to Louvain, where were gathered many students who had left the English universities for conscience' sake. Here he continued his theological studies and began to write controversial treatises. In 1562, on account of health, he returned secretly to Lancashire and did much, by exhortation and private meetings, to restrain those Catholics who attended the new services in order to save their property from confiscation. His presence being known to the government, he left Lancashire and retired to the neighbourhood of Oxford, which he frequently visited, and where he influenced many of the students. After writing a treatise in defence of the priestly power to remit sins, he was obliged to leave and retired to Norfolk, leaving England soon after in 1565. He returned to Flanders, was ordained at Malines, and began to lecture in theology at the Benedictine college in that city. In 1567 he went to Rome for the first time, and there began his plan for establishing a college where English students could live together and finish their theological course. The idea subsequently developed into the establishing of a missionary college, or seminary, to keep up a supply of priests for England as long as the country remained separated from the Holy See. With the help of friends, and notably of the Benedictine abbots of the neighbouring monasteries, a college was established at Douai (September 29, 1568); and here Allen was joined by many of the English exiles. This college, the first of the seminaries ordered by the council of Trent, received the papal approval shortly after its establishment; the king of Spain took it under his protection and assigned it an annual grant. Allen continued his own theological studies and, after taking his doctorate, became regius professor at the university. Gregory XIII. in 1575 granted him a monthly pension of 100 golden crowns, and, as the number of students had now risen to one hundred and twenty, summoned him to Rome to undertake the establishing of a similar college in the papal city. By Allen's advice, the old English hospice was turned into a seminary and Jesuits were placed there to help Dr Maurice Clennock, the rector. The pope appointed Allen to a canonry in Courtrai and sent him back to Douai (July 1576); but here he had to face a new difficulty. Besides the reported plots to assassinate him by agents of the English government, the insurgents against Spain, urged on by Elizabeth's emissaries, expelled the students from Douai as being partisans of the enemy (March 1578). Allen moved his establishment to Reims under the protection of the house of Guise; and it was here that the English translation of the Scriptures, known as the Douai Version, was begun under his direction (see BIBLE, ENGLISH). In 1577 he began a correspondence with Robert Parsons (*q.v.*), the Jesuit, an intimacy that was fraught with disaster. He was summoned again to Rome in 1579 to quell the first of the many disturbances that befell the English college under the Jesuit influence. Brought now into personal contact with Parsons, Allen fell completely under the dominating personality of the redoubtable Jesuit, and gave himself up entirely to his influence. He arranged that the Society should take over the English college at Rome and should begin the Jesuit mission to England (1580). This short-sighted policy was the cause of much grave trouble in the near future. Returning to Reims he began to take a part in all the political intrigues which Parsons' fertile brain had hatched for the promotion of the Spanish interest in England. Allen's political career dates from this period. Parsons had already intended to remove Allen from the seminary at Reims, and for this purpose, as far back as the 6th of April 1581, had recommended him to Philip II. to be promoted to the cardinalate. In furtherance of the intrigues, Allen and Parsons went to Rome again in 1585 and there Allen was kept for the rest of his life. In 1587, during the time that he was being skilfully played with by Philip's agents, he wrote, helped by Parsons, a shameless defence of a shameful deed. Sir William Stanley, an English officer, had surrendered Deventer to the Spaniards; and Allen wrote a book in defence of Stanley, saying that all Englishmen were bound, under pain of damnation, to follow the traitorous example, as Elizabeth was no lawful queen. He shared in all the projects for the invasion of England, and was to have been archbishop of Canterbury and lord chancellor had they succeeded. Representing in reality only his own party, Allen had on the continent the position of the head of the Roman Catholics of England; and as such, just after the death of Mary, queen of Scots, he wrote to Philip II. (March 19, 1587) to exhort him to undertake the enterprise against England, and declared that the Catholics there were clamouring for the king to come and punish "this woman, hated by God and man." After much negotiation, he was made cardinal by Sixtus V. on the 7th of August 1587, nominally to supply the loss of the queen of Scotland, but in reality to ensure the success of the Armada. On his promotion Allen wrote to Reims that he owed the hat, under God, to Parsons. One of his first acts was to issue, under his own name, two violent works for the purpose of inciting the Catholics of England to rise against Elizabeth: "The Declaration of the Sentence of Sixtus V." a broadside, and a book, *An Admonition to the nobility and people of England* (Antwerp, 1588). On the failure of the Armada, Philip, to get rid of the burthen of supporting Allen as a cardinal, nominated him to the archbishopric of Malines, but the canonical appointment was never made. Gregory XIV. made him librarian at the Vatican; and he served on the commission for the revision of the Vulgate. He took part in four conclaves, but never had any real influence after the failure of the Armada. Before his death, which took place in Rome on the 16th of October 1594, he found reasons to change his mind concerning the wisdom of the Jesuit politics in Rome and England, and would have tried to curb their activities, had he been spared. The rift became so great that ten years after his death, Agazzari could write to Parsons: "So long as Allen walked in this matter (*the scheme for England*) in union with and fidelity to the Company, as he used to do, God preserved him, prospered and exalted him; but when he began to leave this path, in a manner, the threads of his plans and life were cut short together." As a cardinal Allen had lived in poverty and he died in debt.

While we cannot withhold a tribute of respect from Allen for his zeal and earnestness, and recognize that his foundation at Douai survives to-day in the two Catholic colleges at Ushaw and Ware, it is impossible to deny that he injured the work with which his name will ever be associated, by his disastrous intercourse with Father Parsons. Known as a sharer in that plotter's schemes, he gave a reasonable pretext to Elizabeth's government for regarding the seminaries as hotbeds of sedition. That they were not so is abundantly proved. The superiors kept their political actions secret from the students, and would not allow such matters even to be talked about or treated as theoretical abstractions in the schools. Dr Barrett, writing (April 14, 1583) to Parsons, makes open complaint of Allen's secrecy and refusal to communicate. How far Allen was really admitted to the full confidence of Parsons is a question; and his later attitude to the Society goes to prove that he at last realized that he had been tricked. Like James II. with Fr. Petre, Allen had been "bewitched" for a time and only recovered himself when too late.

Authorities.—T. F. Knox, *Letters and Memorials of Cardinal Allen* (London, 1882); A. Bellesheim, *Wilhelm Cardinal Allen und die englischen Seminare auf dem Festlande* (Mainz, 1885); *First and Second Diaries of the English College, Douai* (London, 1878); Nicholas Fitzherbert, *De Antiquitate et continuatione religionis in Anglia et de Alani Cardinalis vita libellus* (Rome, 1608); E. Taunton, *History of the Jesuits in England* (London, 1901); Teulet, vol. v.; the Spanish *State Papers* (Simancas), vols. iii. and iv.; a list of Allen's works is given in J. Gillow, *Biographical Dictionary of English Catholics*, vol. i., under his name. (E. Tn.)

ALLEN, WILLIAM FRANCIS (1830–1889), American classical scholar, was born at Northborough, Massachusetts, on the 5th of September 1830. He graduated at Harvard College in 1851 and subsequently devoted himself almost entirely to literary work and teaching. In 1867 he became professor of ancient languages and history (afterwards Latin language and Roman history) in the university of Wisconsin. He died in December 1889. His contributions to classical literature chiefly consist of schoolbooks published in the Allen (his brother) and Greenough series. The *Collection of Slave Songs* (1867), of which he was joint-editor, was the first work of the kind ever published.

ALLEN, BOG OF, the name given to a congeries of morasses in Kildare, King's County, Queen's County and Westmeath, Ireland. Clane Bog, the eastern extremity, is within 17 m. of Dublin, and the morasses extend westward almost to the Shannon. Their total area is about 238,500 acres. They do not form one continuous bog, the tract of the country to which the name is given being intersected by strips of dry cultivated land. The rivers Brosna, Barrow and Boyne take their rise in these morasses, and the Grand and Royal canals cross them. The Bog of Allen has a general elevation of 250 ft. above sea level, and the average thickness of the peat of which it consists is 25 ft. It rests on a subsoil of clay and marl.

ALLENSTEIN, a garrison town of Germany, in the province of East Prussia, on the river Alle, 100 m. by rail N.E. from Thorn, and 30 m. from the Russian frontier. Pop. (1900) 24,295. It has a medieval castle, several churches, a synagogue and various industries—iron-foundries, saw-mills, brick-works, and breweries; also an extensive trade in cereals and timber.

ALLENTOWN, a city and the county-seat of Lehigh county, Pennsylvania, U.S.A., on the Lehigh river, about 62 m. N.N.W. of Philadelphia. Pop. (1890) 25,228; (1900) 35,416, of whom 2994 were foreign-born, 1065 being of German birth; (1910) 51,913. It is served by the Central of New Jersey, the Lehigh Valley, the Perkiomen (of the Reading system) and the Philadelphia & Reading railways. The city is situated on high ground sloping gently towards the river and commanding diversified views of the surrounding country. Hamilton Street, the principal business thoroughfare, extends over 2 m. from E. to W., and in what was once the centre of the city is Centre Square, in which there is a monument to the memory of the soldiers and sailors who fell in the Civil War. Allentown is the seat of a state homoeopathic hospital for the insane, of the Allentown College for Women (Reformed Church, 1867), and of Muhlenberg College (1867), an Evangelical Lutheran institution which grew out of the Allentown Seminary (established in 1848 and incorporated as the "Allentown Collegiate Institute and Military Academy" in 1864); in 1907 the college had 191 students, of whom 109 were in the Allentown Preparatory School (1904), formerly the academic department of the college and still closely affiliated with it. The surrounding country is well adapted to agriculture, and slate, iron ore, cement rock and limestone are found in the vicinity. Allentown is an important manufacturing centre, and the value of its manufactured products increased 90·9 % from 1890 to 1900, and of its factory product 13·2 % between 1900 and 1905. In 1905 the city ranked sixth among the cities of the country in the manufacture of silk and silk goods, its most important industry. Other important manufactures are iron and steel, slaughtering and meat-packing products, boots and shoes, cigars, furniture, men's clothing, hosiery and knit goods, jute and jute goods, linen-thread, malt liquors, brick, cement, barbed wire, wire nails and planing-mill products. Allentown's total factory product in 1905 was valued at $16,966,550, of which $3,901,249, or 23 %, was the value of silk and silk goods. The municipality owns and operates its water-works. Allentown was first settled in 1751; in 1762 it was laid out as a town by James Allen, the son of a chief-justice of the province, in honour of whose family the city is named; in 1811 it was incorporated as a borough and its name was changed to Northampton; in 1812 it was made the county-seat; in 1838 the present name was again adopted; and in 1867 the first city charter was secured. The silk industry was introduced in 1881.

ALLEPPI, or Aulapalay, a seaport of southern India, in the state of Travancore, 33 m. south of Cochin, situated on a strip of coast between the sea and one of those backwaters that here form the chief means of inland communication. Pop. (1901) 24,918. There is a lighthouse, 85 ft. high, with a revolving white light visible 18 m. out at sea. Though the third town in the state in point of population, Alleppi is the first in commercial importance. It commands a fine harbour, affording safe anchorage for the greater part of the year. It was opened to foreign trade towards the latter end of the 18th century. The exports consist of coffee, pepper, cardamoms and coco-nuts. There are factories for coir-matting. The raja has a palace, and Protestant missionaries have a church.

ALLESTREE, or Allestry, **RICHARD** (1619–1681), royalist divine and provost of Eton College, son of Robert Allestree, and a descendant of an ancient Derbyshire family, was born at Uppington in Shropshire. He was educated at Coventry and later at Christ Church, Oxford, under Richard Busby. He entered as a commoner in 1636, was made student shortly afterwards, and took the degree of B.A. in 1640 and of M.A. in 1643. In 1642 he took up arms for the king under Sir John Biron. On the arrival of the parliamentary forces soon afterwards in Oxford he secreted the Christ Church valuables, and the soldiers found nothing in the treasury "except a single groat and a halter in the bottom of a large iron chest." He escaped severe punishment only by the hasty retirement of the army from the town. He was present at the battle of Edgehill in October 1642, after which, while hastening to Oxford to prepare for the king's visit to Christ Church, he was captured by a troop of Lord Say's soldiers from Broughton House, being soon afterwards set free on the surrender of the place to the king's forces. In 1643 he was again under arms, performing "all duties of a common soldier" and "frequently holding his musket in one hand and his book in the other." At the close of the Civil War, he returned to his studies, took holy orders, was made censor and became a "noted tutor." But he still remained an ardent royalist. He voted for the university decree against the Covenant, and, refusing submission to the parliamentary visitors in 1648, he was expelled. He found a retreat as chaplain in the house of the Hon. Francis Newport, afterwards Viscount Newport, in whose interests he undertook a journey to France. On his return he joined two of his friends, Dolben and Fell, afterwards respectively archbishop of York and bishop of Oxford, then resident at Oxford, and later joined the household of Sir Antony Cope of Hanwell, near Banbury. He was now frequently employed in carrying despatches between the king and the royalists in England. In May 1659 he brought a command from Charles in Brussels, directing the bishop of Salisbury to summon all those bishops, who were then alive, to consecrate clergymen to various sees "to secure a continuation of the order in the Church of England," then in danger of becoming extinct.[1] While returning from one of these missions, in the winter before the Restoration, he was arrested at Dover and committed a prisoner to Lambeth Palace, then used as a gaol for apprehended royalists, but was liberated after confinement of a few weeks at the instance, among others, of Lord Shaftesbury. At the Restoration he became canon of Christ Church, D.D. and city lecturer at Oxford. In 1663 he was made chaplain to the king and regius professor of divinity. In 1665 he was appointed provost of Eton College, and proved himself a capable administrator. He introduced order into the disorganized finances of the college and procured the confirmation of Laud's decree, which reserved five of the Eton fellowships for members of King's College. His additions to the college buildings were less successful; for the "Upper School," constructed by him at his own expense, was falling into ruin almost in his lifetime, and was replaced by the present structure in 1689. Allestree died on the 28th of January 1681, and was buried in the chapel at Eton College, where there is a Latin inscription to his memory. His writings are:—*The Privileges of the University of Oxford in point of Visitation* (1647)—a tract answered by Prynne in the *University of Oxford's Plea Rejected*; *18 sermons whereof 15 preached before the king* . . . (1669); *40 sermons whereof 21 are now first published* . . . (2 vols., 1684); sermons published separately including *A Sermon on Acts xiii. 2*, (1660); *A Paraphrase and Annotations upon all the Epistles of St Paul* (joint author with Abraham Woodhead and Obadiah Walker, 1675, see edition of 1853 and preface by W. Jacobson). In the *Cases of Conscience* by J. Barlow, Bishop of Lincoln (1692), Allestree's judgment on *Mr Cottington's Case of Divorce* is included. A share in the composition, if not the sole authorship, of the books published under the name of the author of the *Whole Duty of Man* has been attributed to Allestree (Nichols's *Anecdotes*, ii. 603), and the tendency of modern criticism is to regard him as the author. His lectures, with which he was dissatisfied, were not published. Allestree was a man of extensive learning, of moderate views and a fine preacher. He was generous and charitable, of "a solid and masculine kindness," and of a temper hot, but completely under control.

AUTHORITIES.—Wood's *Athenae Oxonienses* (edited by Bliss), iii. 1269; Wood's *Fasti*, i. 480, 514, ii. 57, 241, 370; *Richard Allestree, 40 sermons*, with biographical preface by Dr John Fell (2 vols., 1684); *Sufferings of the Clergy*, by John Walker; *Architectural History of Eton and Cambridge*, by R. Willis, i. 420; *Hist. of Eton College*, by Sir H. C. Maxwell-Lyte; *Hist. of Eton College*, by Lionel Cust (1899); *Egerton MSS.*, Brit. Mus. 2807 f. 197 b. For Allestree's authorship of the *Whole Duty of Man*, see Rev. F. Barham, *Journal of Sacred Literature*, July 1864, and C. E. Doble's articles in the *Academy*, November 1884. (P. C. Y.)

ALLEY (from the Fr. *allée*, a walk), a narrow passage-way between two buildings available only for foot passengers or hand-carts, sometimes entered only at one end and known as a "blind alley," or *cul-de-sac*. The name is also given to the long narrow enclosures where bowls or skittles are played.

ALLEYN, EDWARD (1566–1626), English actor and founder of Dulwich College, was born in London on the 1st of September 1566, the son of an innkeeper. It is not known at what date he began to act, but he certainly gained distinction in his calling while a young man, for in 1586 his name was on the list of the earl of Worcester's players, and he was eventually rated by common consent as the foremost actor of his time. Ben Jonson, a critic little prone to exalt the merits of men of mark among his contemporaries, bestowed unstinted praise on Alleyn's acting (*Epigrams*, No. 89). Nash expresses in prose, in *Pierce Penniless*, his admiration of him, while Heywood calls him "inimitable," "the best of actors," "Proteus for shapes and Roscius for a tongue." Alleyn inherited house property in Bishopsgate from his father. His marriage on the 22nd of October 1592 with Joan Woodward, stepdaughter of Philip Henslowe, brought him eventually more wealth. He became part owner in Henslowe's ventures, and in the end sole proprietor of several play-houses and other profitable pleasure resorts. Among these were the Rose Theatre at Bankside, the Paris Garden and the Fortune Theatre in St Luke's—the latter occupied by the earl of Nottingham's company, of which Alleyn was the head. He filled, too, in conjunction with Henslowe, the post of "master of the king's games of bears, bulls and dogs." On some occasions he directed the sport in person, and Stow in his *Chronicles* gives an account of how Alleyn baited a lion before James I. at the Tower.

Alleyn's connexion with Dulwich began in 1605, when he bought the manor of Dulwich from Sir Francis Calton. The landed property, of which the entire estate had not passed into Alleyn's hands earlier than 1614, stretched from the crest of that range of Surrey hills on whose summit now stands the Crystal Palace, to the crest of the parallel ridge, three miles nearer London, known in its several portions as Herne Hill, Denmark Hill and Champion Hill. Alleyn acquired this large property for little more than £10,000. He had barely got full possession, however, before the question how to dispose of it began to occupy him. He was still childless, after twenty years of wedded life. Then it was that the prosperous player—the man "so acting to the life that he made any part to become him" (Fuller, *Worthies*)—began the task of building and endowing in his own lifetime the College of God's Gift at Dulwich. All was completed in 1617 except the charter or deed of incorporation for setting his lands in mortmain. Tedious delays occurred in the Star Chamber, where Lord Chancellor Bacon was scheming to bring the pressure of kingly authority to bear on Alleyn with the aim of securing a large portion of the proposed endowment for the maintenance of lectureships at Oxford and Cambridge. Alleyn finally carried his point and the College of God's Gift at Dulwich was founded, and endowed under letters patent of James I., dated the 21st of June 1619. The building had been already begun in 1613 (see DULWICH). Alleyn was never a member of his own foundation, but he continued to the close of his life to guide and control its affairs under powers reserved to himself in the letters patent. His diary shows that he mixed much and intimately in the life of the college. Many of the jottings in that curious record of daily doings and incidents favour the inference that he was a genial, kind, amiable and religious man. His fondness for his old profession is indicated by the fact that he engaged the boys in occasional theatrical performances. At a festive gathering on the 6th of January 1622 "the boyes play'd a playe."

Alleyn's first wife died in 1623. The same year he married Constance, daughter of John Donne, the poet and dean of St Paul's. Alleyn died in November 1626 and was buried in the chapel of the college which he had founded. His gravestone fixes the day of his death as the 21st, but there are grounds for the belief that it was the 25th. A portrait of the actor is preserved at Dulwich. Alleyn was a member of the corporation of wardens of St Saviour's, Southwark, in 1610, and there is a memorial window to him in the cathedral.

ALL FOURS, a card game (known also in America as *Seven Up*, *Old Sledge* or *High-Low-Jack*) usually played by two players, though four may play. A full pack is used and each player receives seven counters. Four points can be scored, one each for *high*, the highest trump out, for *low*, the lowest trump dealt, for *Jack*, the knave of trumps, and for *game*, the majority of pips in the cards of the tricks that a player has won. Ace counts 4, King 3, Queen 2, Knave 1, and ten 10 points. *Low* is scored by the person to whom it is dealt; *High* of course wins a trick; *Jack* is scored by the player who finally has it among his tricks. If *Jack* is turned up the dealer scores the point. A player who plays a high or low trump is entitled to ask if they are *High* or *Low.* The game is 10 or 11 points. Six cards are dealt to each, the thirteenth being turned up for trumps. The non-dealer may *propose* or *beg* if he does not like his hand. If the dealer refuses the elder hand scores a point; if he consents he gives and takes three more cards, the seventh being turned up for trumps, which must be of a different suit from the original trump card; otherwise six more cards are dealt out, and so on till a fresh trump suit appears. The non-dealer then leads; the other must trump or follow suit, or forfeit a point. *Jack* may be played to any trick. Each pair of cards is a trick, and is collected by the winner. A fresh deal may be claimed if the dealer exposes one of his adversary's cards, or if he gives himself or his adversary too few or too many. In that case the error must be discovered before a card is played (see also Auction Pitch).

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[1] *Egerton MSS.*, Brit. Mus. 2807 f. 197 b; *Life of Dr John Barwick*, ed. by G. F. Barwick (1903), pp. 107, 129, 134.

ALLIA (mod. *Fosso Bettina*), a small tributary of the river Tiber, joining it on the left (east) bank, about 11 m. N. of Rome. It gave its name to the terrible defeat which the Romans suffered at the hands of the Gauls on the 18th of July 390 B.C. Livy (v. 37) and Diodorus (v. 114) differ with regard to the site of the battle, the former putting it on the left, the latter on the right bank of the Tiber. Mommsen and others support Diodorus, but the question still remains open.

See T. Ashby in *Papers of the British School at Rome*, iii. 24.

ALLIANCE, a city of Stark county, Ohio, U. S. A., on the Mahoning river, about 57 m. S.E. of Cleveland, about 1080 ft. above the sea, and about 505 ft. above the level of Lake Erie. Pop. (1890) 7607; (1900) 8974, of whom 1029 were foreign-born; (1910, census) 15,083. It is served by the Pennsylvania and the Lake Erie, Alliance & Wheeling railways, and by an electric line connecting with Canton and Salem. The city is the seat of Mount Union College (Methodist Episcopal), opened in 1846 as a preparatory school and having in 1907 a library of about 10,000 volumes, a collegiate department (opened in 1858), a normal department (1858), a school of music (1855), a commercial school (1868), a faculty of 29 teachers, and an enrolment of 524 students, of whom 274 were women. Among the manufactures of Alliance are structural iron, steel castings, pressed sheet steel, gun carriages, boilers, travelling cranes, pipe organs, street-car indicators, sashes and doors, and account registers and other material for file and cabinet-bookkeeping. The municipality owns and operates its water-works. Alliance was first settled in 1838, when it was laid out as a town and was named Freedom; it was named Alliance in 1851, was incorporated as a village in 1854, and became a city of the second class in 1888.

ALLIANCE, in international law, a league between independent states, defined by treaty, for the purpose of combined action, defensive or offensive, or both. Alliances have usually been directed to specific objects carefully defined in the treaties. Thus the Triple Alliance of 1688 between Great Britain, Sweden and the Netherlands, and the Grand Alliance of 1689 between the emperor, Holland, England, Spain and Saxony, were both directed against the power of Louis XIV. The Quadruple or Grand Alliance of 1814, defined in the treaty of Chaumont, between Great Britain, Austria, Russia and Prussia, had for its object the overthrow of Napoleon and his dynasty, and the confining of France within her traditional boundaries. The Triple Alliance of 1882 between Germany, Austria and Italy was ostensibly directed to the preservation of European peace against any possible aggressive action of France or Russia; and this led in turn, some ten years later, to the Dual Alliance between Russia and France, for mutual support in case of any hostile action of the other powers. Occasionally, however, attempts have been made to give alliances a more general character. Thus the "Holy Alliance" (*q.v.*) of the 26th of September 1815 was an attempt, inspired by the religious idealism of the emperor Alexander I. of Russia, to find in the "sacred precepts of the Gospel" a common basis for a general league of the European governments, its object being, primarily, the preservation of peace. So, too, by Article VI. of the Quadruple Treaty signed at Paris on the 20th of November 1815—which renewed that of Chaumont and was again renewed, in 1818, at Aix-la-Chapelle—the scope of the Grand Alliance was extended to objects of common interest not specifically defined in the treaties. The article runs:—"In order to consolidate the intimate tie which unites the four sovereigns for the happiness of the world, the High Contracting Powers have agreed to renew at fixed intervals, either under their own auspices or by their respective ministers, meetings consecrated to great common objects and to the examination of such measures as at each one of these epochs shall be judged most salutary for the peace and prosperity of the nations and the maintenance of the tranquillity of Europe."

It was this article of the treaty of the 20th of November 1815, rather than the "Holy Alliance," that formed the basis of the serious effort made by the great powers, between 1815 and 1822, to govern Europe in concert, which will be found outlined in the article on the history of Europe. In general it proved that an alliance, to be effective, must be clearly defined as to its objects, and that in the long run the treaty in which these objects are defined must—to quote Bismarck's somewhat cynical dictum—"be reinforced by the interests" of the parties concerned. Yet the "moral alliance" of Europe, as Count Nesselrode called it, though it failed to secure the permanent harmony of the powers, was an effective instrument for peace during the years immediately following the downfall of Napoleon; and it set the precedent for those periodical meetings of the representatives of the powers, for the discussion and settlement of questions of international importance, which, though cumbrous and inefficient for constructive work, have contributed much to the preservation of the general peace (see Europe: *History*). (W. A. P.)

ALLIARIA OFFICINALIS, also known botanically as *Sisymbrium Alliaria*, and popularly as garlic-mustard, Jack-by-the-hedge, or sauce-alone, a common hedge-bank plant belonging to the natural order Cruciferae. It is a rankly scented herb, 2 to 3 ft. high, with long-stalked, coarsely-toothed leaves, and small white flowers which are succeeded by stout long four-sided pods. It is widely spread through the north temperate region of the Old World.

ALLIBONE, SAMUEL AUSTIN (1816–1889), American author and bibliographer, was born in Philadelphia, Pennsylvania, on the 17th of April 1816, of French Huguenot and Quaker ancestry. He was privately educated and for many years was engaged in mercantile business in his native city. He, however, devoted himself chiefly to reading and to bibliographical research; acquired a very unusual knowledge of English and American literature, and is remembered as the compiler of the well-known *Critical Dictionary of English Literature and British and American Authors* (3 vols.: vol. i. 1854, vols. ii. and iii. 1871). To this, two supplementary volumes, edited by John Foster Kirk, were added in 1891. From 1867 to 1873, and again in 1877–1879, Allibone was book editor and corresponding secretary of the American Sunday School Union; and from 1879 to 1888 he was librarian of the Lenox Library, New York City. He died at Lucerne, Switzerland, on the 2nd of September 1889. In addition to his *Critical Dictionary* he published three large anthologies and several religious tracts.

See the "Memoir" by S. D. M'Connell, an address delivered before the Historical Society of Philadelphia (Philadelphia, 1890).

ALLIER (anc. *Elaver*), a river of central France flowing into the Loire. It rises in the department of Lozère, among the Margeride mountains, a few miles east of the town of Mende. The upper course of the Allier separates the mountains of the Margeride from those of the Velay and lies for the most part through deep gorges. The river then traverses the plains of Langeac and Brioude, and receives the waters of the Alagnon some miles above the town of Issoire. Swelled by torrents from the mountains of Dore and Dôme, it unites with the river Dore at its entrance to the department to which it gives its name. It then flows through a wide but shallow channel, joining the Sioule some distance above Moulins, the chief town on its banks. It soon after becomes the boundary line between the departments of Cher and Nièvre, and reaches the Loire 4 m. west of Nevers, after a course of 269 m. Its basin has an area of 6755 sq. m. The Allier is classed as navigable for the last 154 m. of its course, but there is little traffic on it.

ALLIER, a department of central France, formed in 1790 from the old province of Bourbonnais. Pop. (1906) 417,961. Area, 2849 sq. m. It is bounded N. by the department of Nièvre, E. by Saône-et-Loire, from which it is divided by the river Loire, S.E. by Loire, S. by Puy-de-Dôme, S.W. by Creuse and N.W. by Cher. Situated on the northern border of the Central Plateau, the department slopes from south to north. Its highest altitudes are found in the south-east, in the Bois-Noirs, where one point reaches 4239 ft., and in the Monts de la Madeleine. Plains alternating with forests occupy the northern zone of the department, while the central and western regions form an undulating and well-watered plateau. Entering the department in the south, and, like the other chief rivers, flowing almost due north, the Allier drains the central district, receiving on its left the Sioule. East of the Allier is the Bèbre, which joins the Loire within the limits of the department; and on the west the Cher, with its tributary the Aumance. Rigorous and rainy in the south-east, the climate elsewhere is milder though subject to sudden variations. Agriculturally the department is flourishing, the valleys of the Allier and the Sioule known as the Limagne Bourbonnaise comprising its most fertile portion. Wheat, oats, barley and other cereals are grown and exported, and owing to the abundance of pasture and forage, sheep and cattle-rearing are actively carried on. Potatoes and mangels yield good crops. Wines of fair quality are grown in the valley of the Sioule; walnuts, chestnuts, plums, apples and pears are principal fruits. Goats, from the milk of which choice cheese is made, and pigs are plentiful. A large area is under forests, the oak, beech, fir, birch and hornbeam being the principal trees. The mineral waters at Vichy (*q.v.*), Néris, Theneuille, Cusset and Bourbon l'Archambault are in much repute. The mineral wealth of the department is considerable, including coal as well as manganese and bituminous schist; plaster, building stone and hydraulic lime are also produced. Manufactories of porcelain, glass and earthenware are numerous. Montluçon and Commentry are iron-working centres. There are flour mills, breweries and saw-mills; and paper, chemicals, wooden shoes, wool and woollen goods are produced. Besides the products of the soil Allier exports coal, mineral waters and cattle for the Paris market. Building materials, brandy and coal are among the imports. The railways belong chiefly to the Orléans and Paris-Lyons-Mediterranean companies. The lateral canal of the Loire, the Berry Canal and the canal from Roanne to Digoin together traverse about 57 m. in the department. Allier is divided into the arrondissements of Moulins, Gannat, Lapalisse and Montluçon (29 cantons, 321 communes). It forms the diocese of Moulins and part of the ecclesiastical province of Bourges, and falls within the académie (educational division) of Clermont-Ferrand and the region of the XIII. army-corps. Its court of appeal is at Riom. Moulins, the capital, Montluçon and Vichy, are the principal towns. Souvigny possesses the church of a famous Cluniac priory dating from the 11th-12th and 15th centuries, and containing the splendid tombs (15th century) of Louis II. and Charles I. of Bourbon. At St Menoux, Ebreuil and Gannat there are fine Romanesque churches. Huriel has a church of the 11th century and a well-preserved keep, the chief survival of a medieval castle. St Pourçain-sur-Sioule has a large church, dating from the 11th to the 18th centuries. The castle of Bourbon l'Archambault, which belonged to the dukes of Bourbon, dates from the 13th and 15th centuries. The Romanesque churches of Veauce and Ygrande, and the châteaus of Veauce and Lapalisse, are also of interest, the latter belonging to the family of Chabannes.

ALLIES, THOMAS WILLIAM (1813–1903), English historical writer, was born at Midsomer Norton, near Bristol, on the 12th of February 1813. He was educated at Eton and at Wadham College, Oxford, of which he became a fellow in 1833. In 1840 Bishop Blomfield of London appointed him his examining chaplain and presented him to the rectory of Launton, Oxfordshire, which he resigned in 1850 on becoming a Roman Catholic. Allies was appointed secretary to the Catholic poor school committee in 1853, a position which he occupied till 1890. He died in London on the 17th of June 1903. Allies was one of the ablest of the English churchmen who joined the Church of Rome in the early period of the Oxford movement, his chief work, *The Formation of Christendom* (London, 8 vols., 1865–1895) showing much originality of thought and historical knowledge. His other writings: *St Peter, his Name and Office* (1852); *The See of St Peter, the Rock of the Church* (1850); *Per Crucem ad Lucem* (2 vols., 1879), have gone through many editions and been translated into several languages.

See his autobiography, *A Life's Decision* (1880); and the study by his daughter, Mary H. Allies, *Thomas Allies, the Story of a Mind* (London, 1906); which contains a full bibliography of his works.

ALLIFAE (mod. *Alife*), a town of the Samnites, 15 m. N.W. of Telesia, and 17 m. E.N.E. of Teanum. The site of the Samnite city, which in the 4th century B.C. had a coinage of its own, is not known; the Roman town lay in the valley of the Vulturnus, and its walls (4th century) enclose a circuit of 1½ m., in which are preserved remains of large baths (*Thermae Herculis*) and a theatre.

ALLIGATOR (Spanish *el lagarto*, "the lizard"), an animal so closely allied to the crocodile that some naturalists have classed them together as forming one genus. It differs from the true crocodile principally in having the head broader and shorter, and the snout more obtuse; in having the fourth, enlarged tooth of the under jaw received, not into an external notch, but into a pit formed for it within the upper one; in wanting a jagged fringe which appears on the hind legs and feet of the crocodile; and in having the toes of the hind feet webbed not more than half way to the tips. Alligators proper occur in the fluviatile deposits of the age of the Upper Chalk in Europe, where they did not die out until the Pliocene age; they are now restricted to two species, *A. mississippiensis* or *lucius* in the southern states of North America up to 12 ft. in length, and the small *A. sinensis* in the Yang-tse-kiang. In Central and South America alligators are represented by five species of the genus *Caiman*, which differs from *Alligator* by the absence of a bony septum between the nostrils, and the ventral armour is composed of overlapping bony scutes, each of which is formed of two parts united by a suture. *C. sclerops*, the spectacled alligator, has the widest distribution, from southern Mexico to the northern half of Argentina, and grows to a bulky size. The largest, attaining an enormous bulk and a length of 20 ft., is the *C. niger*, the *jacaré-assu* or large caiman of the Amazons. The names "alligator" and "crocodile" are often confounded in popular speech; and the structure and habits of the two animals are so similar that both are most conveniently considered under the heading Crocodile.

ALLINGHAM, WILLIAM (1824–1889), Irish man of letters and poet, was born at Ballyshannon, Donegal, on the 19th of March 1824 (or 1828, according to some authorities), and was the son of the manager of a local bank. He obtained a post in the custom-house of his native town and filled several similar situations in Ireland and England until 1870, when he had retired from the service, and became sub-editor of *Fraser's Magazine*, which he edited from 1874 to 1879. He had published a volume of *Poems* in 1850, followed by *Day and Night Songs*, a volume containing many charming lyrics, in 1855. Allingham was on terms of close friendship with D. G. Rossetti, who contributed to the illustration of the *Songs*. His *Letters to Allingham* (1854–1870) were edited by Dr Birkbeck Hill in 1897. *Lawrence Bloomfield*, a narrative poem illustrative of Irish social questions, appeared in 1864. Allingham married in 1874 Helen Paterson, known under her married name as a water-colour painter. He died at Hampstead on the 18th of November 1889. Though working on an unostentatious scale, Allingham produced much excellent lyrical and descriptive poetry, and the best of his pieces are thoroughly national in spirit and local colouring.

William Allingham: a Diary (1907), edited by Mrs Allingham and D. Radford, contains many interesting reminiscences of Tennyson, Carlyle and other famous contemporaries.

ALLISON, WILLIAM BOYD (1829–1908), American legislator, was born at Perry, Ohio, on the 2nd of March 1829. Educated at Allegheny and Western Reserve Colleges, he studied law, and practised in Ohio until 1857. In that year he settled in Dubuque, Iowa, where he took a prominent part in Republican politics;

and in 1860 he was a delegate to the national convention at Chicago which nominated Abraham Lincoln for the presidency. In 1861 he was appointed a member of the staff of Governor Samuel J. Kirkwood (1813–1894), and was of great service in the work of equipping and organizing the Iowa volunteers. From 1863 until 1871 he served with distinction in the House of Representatives; in 1873 he was elected to the United States Senate, and re-elected in 1878, 1884, 1890, 1896 and 1902. Here he became one of the highest authorities on questions connected with finance, and from 1877 he was a member of the Senate committee on finance. In 1881–1893, and again from 1895, he was chairman of the committee on appropriations, in which position he had great influence. He declined offers of the secretaryship of the treasury made to him by Presidents Garfield and Harrison. He was a prominent candidate for the presidential nomination in the Republican national conventions of 1888 and 1896. In 1892 he was chairman of the American delegation to the International Monetary Conference at Brussels. He died at Dubuque, Iowa, on the 4th of August 1908.

ALLITERATION (from Lat. *ad*, to, and *littera*, letter), the commencing of two or more words, in close juxtaposition, with the same sound. As Milton defined rhyme to be "the jingling sound of like endings," so alliteration is the jingle of like beginnings. All language has a tendency to jingle in both ways, even in prose. Thus in prose we speak of "near and dear," "high and dry," "health and wealth." But the initial form of jingle is much more common—"safe and sound," "thick and thin," "weal or woe," "fair or foul," "spick and span," "fish, flesh, or fowl," "kith and kin." The poets of nearly all times and tongues have not been slow to seize upon the emphasis which could thus be produced.

Although mainly Germanic in its character, alliteration was known to the Latins, especially in early times, and Cicero blames Ennius for writing "O Tite tute, Tati, tibi tanta, tyranne, tulisti." Lucretius did not disdain to employ it as an ornament. We read in Shakespeare:—

"Full fathom five thy father lies:
Of his bones are corals made."

In Pope:—

"Here files of pins extend their shining rows,
Puffs, powders, patches, bibles, billet-doux."

In Gray:—

"Weave the warp and weave the woof,
The winding-sheet of Edward's race."

In Coleridge:—

"The fair breeze blew, the white foam flew,
The furrow followed free;
We were the first that ever burst
Into that silent sea."

Churchill describes himself, in his *Prophecy of Famine*, as one

"Who often, but without success, had prayed
For apt alliteration's artful aid,"—

an example which is itself a proof of his failure; for alliteration is never effective unless it runs upon consonants.

As thus far considered, alliteration is a device wholly dependent on the poet's fancy. He may use it or not, or use it much or little, at his pleasure. But there is an extensive range of Teutonic poetry whose metrical laws are entirely based on alliteration. This, for example, is the principle on which Icelandic verse is founded; and we have a yet nearer interest in it, because it furnishes the key to Anglo-Saxon and a large portion of early English verse. For a specimen take the following lines, the spelling modernized, from the beginning of *Piers the Plowman*:—

"But in a *M*ay *m*orning | on *M*alvern hills,
Me be*f*el a *f*erly | of *f*airy methought;
I was *w*eary of *w*andering | and *w*ent me to rest
Under a *b*road *b*ank | *b*y a *b*urn-side;
And as I *l*ay and *l*eaned | and *l*ooked on the waters,
I *s*lumbered in a *s*leeping | it *s*ounded so merry."

The rule of this verse is indifferent as to the number of syllables it may contain, but imperative as to the number of accented ones. The line is divided in the middle by a pause, and each half ought to contain two accented syllables. Of the four accented syllables, the first three should begin with the same letter; the fourth is free and may start with any letter. Those who wish for a more minute analysis of the laws of alliterative verse, as practised by the Anglo-Saxon and early English poets, may consult an exhaustive essay on the subject by Professor W. W. Skeat, prefixed to vol. iii. of *Bishop Percy's Folio Manuscript*; only the reader must be on his guard against an error which pervades it, and which this able writer seems to have derived from Rask. The question arises—What is the nature of the cadence in alliterative verse? Now all metrical movement is of two kinds, according as the beat or emphasis begins the movement or ends it. If the beat is initial, we say in classical language that the movement is trochaic or dactylic, according to the number of its syllables; and if the beat is final, we in like manner say that the movement is iambic or anapaestic. Skeat and many others object with some reason to use the classical terms, and therefore brushing them aside, let us put the question in the simplest form—Has the movement of alliterative verse got the initial or the final beat? In the middle of the 18th century Bishop Percy decided this question with sufficient accuracy, though he mixed up his statement with a blunder which it is not easy to account for. He points out how the poets began to introduce rhyme into alliterative verse, until at length rhyme came to predominate over alliteration, and "thus was this kind of metre at length swallowed up and lost in the common burlesque Alexandrine or anapaestic verse, as

"A cobbler there was, and he lived in a stall."

Percy made a serious mistake when he gave the name of Alexandrine to anapaestic verse; but he is quite right in his general statement that alliterative verse became lost in a measure the movement of which had the final beat. Conybeare has stated the fact still more accurately. "In the Saxon poetry a trochaic character is predominant. In *Piers the Plowman* there is a prevailing tendency to an anapaestic cadence." It is the result of a change in the language—the loss of inflexion. Take the word *man*. The genitive in Saxon would be *mannes*, a trochee; in English, *of man*, an iambus. The tendency of the language was thus to pass from a metrical movement, in which the beat was initial, to one in which it was final. It may therefore be quite right to speak of Anglo-Saxon alliterative poetry as trochaic or dactylic, and quite wrong to apply the same terms to the cadence of our later alliterative verse. And this is precisely the error into which Skeat has fallen. He says—"Lines do not always begin with a loud syllable, but often one or two and sometimes (in early English especially) even three soft syllables precede it. These syllables are necessary to the sense, *but not to the scansion of the line*." That is just the point at issue. By leaving out of account the light syllable or syllables at the beginning of a line, and taking his start from the first syllable that has the alliterative beat, Skeat may certainly prove that all the later alliterative poetry has a movement of initial **beat**. But English ears will not submit to this rule. It is those light syllables of no account which have altered the rhythm of English descant from one of initial to one of final beat.

ALLIUM (Lat. for "garlic"), a genus of plants, natural order Liliaceae, with about 250 species (seven of which occur in Britain), found in Central and South Europe, North Africa, the dry country of West and Central Asia, and North and Central America. The plants are bulbous herbs, with flat or rounded radical leaves, and a central naked or leafy stem, bearing a head or umbel of small flowers, with a spreading or bell-shaped white, pink, red, yellow or blue perianth. Several species afford useful foods, such as onion (*Allium Cepa*), leek (*A. Porrum*), shallot or eschallot (*A. ascalonicum*), garlic (*A. sativum*), and chives (*A. schoenoprasum*). A few species are cultivated as border plants; such are *A. Moly*, an old garden plant with bright yellow flowers, and *A. neapolitanum*, the well-known white-flowered species, both natives of southern Europe.

ALLIX, PIERRE (1641–1717), French Protestant divine, was born at Alençon. He was pastor first at St Agobile in Champagne, and then at Charenton, near Paris. The revocation of the edict of Nantes in 1685 compelled him to take refuge in London, where, under the sanction of James II., he opened a church for the French exiles. His reputation for learning was such as to obtain for him, soon after his arrival, the degree of doctor of divinity from both universities, and in 1690 he received from Bishop Burnet the more substantial honour of the treasurership and a canonry in Salisbury Cathedral. He died at London in March 1717. The works of Allix, which are numerous, are chiefly of a controversial and apologetic character, and must be used with caution. In opposition to Bossuet he published *Some Remarks upon the Ecclesiastical History of the Ancient Churches of Piedmont* (1690), and *Remarks upon the Ecclesiastical History of the Ancient Churches of the Albigenses* (1692), with the idea of showing that the Albigenses were not Manichaeans, but historically identical with the Waldenses.

ALLMAN, GEORGE JAMES (1812–1898), British biologist, was born in Cork, Ireland, in 1812, and received his early education at the Royal Academical Institution, Belfast. For some time he studied for the Irish bar, but ultimately gave up law in favour of natural science. In 1843 he graduated in medicine at Dublin, and in the following year was appointed professor of botany in that university, succeeding his namesake, William Allman (1776–1846). This position he held for about twelve years until he removed to Edinburgh as regius professor of natural history. There he remained till 1870, when considerations of health induced him to resign his professorship and retire to Dorsetshire, where he devoted himself to his favourite pastime of horticulture. The scientific papers which came from his pen are very numerous. His most important work was upon the gymnoblastic hydrozoa, on which he published in 1871–1872, through the Ray Society, an exhaustive monograph, based largely on his own researches and illustrated with drawings of remarkable excellence from his own hand. Biological science is also indebted to him for several convenient terms which have come into daily use, *e.g. endoderm* and *ectoderm* for the two cellular layers of the body-wall in Coelenterata. He became a fellow of the Royal Society in 1854, and received a Royal medal in 1873. For several years he occupied the presidential chair of the Linnaean society, and in 1879 he presided over the Sheffield meeting of the British Association. He died on the 24th of November 1898 at Parkstone, Dorsetshire.

ALLOA, a municipal and police burgh and seaport of Clackmannanshire, Scotland. It is situated on the north bank of the Forth, 32 m. from Edinburgh by the North British railway via the Forth Bridge, and 28 m. from Leith by steamer. Pop. (1891) 12,643; (1901) 14,458. The Caledonian railway enters the town from the south-west by a bridge across the river, and also owns a ferry to South Alloa, on the opposite shore, in Stirlingshire. Between Alloa and Stirling the stream forms the famous "links," the course being so sinuous that whereas by road the two towns are but 6½ m. apart, the distance between them by river is nearly 12 m.

For its size and population the town enjoys unusual prosperity, in consequence of its several flourishing industries. Its manufactures of yarn are on the largest scale, the spinning mills often working night and day for many months together. There are also numerous breweries, and Alloa ale has always been famous. The great distillery at Carsebridge yields an immense supply of yeast as well as whisky. Other thriving trades include the glass-works on the shore, pottery-works in the "auld toon," dye-works and a factory for the making of electrical appliances. There is a good deal of shipbuilding, some ironfounding and a brass foundry. The chief article of export is coal from the neighbouring collieries, the other leading exports being ale, whisky, glass and manufactured goods. The imports comprise timber, grain, iron, linseed and flax. The docks, accessible only at high water, include a wet basin and a dry dock. Amongst the principal buildings are the fine Gothic parish church, with a spire 200 ft. high; the town hall, including the free public library, from designs by Alfred Waterhouse, R.A., the gift of Mr J. Thomson Paton; the county and municipal buildings; handsome public baths and gymnasium, presented to the town by Mr David Thomson; the accident hospital; the fever hospital; the museum of the Natural Science and Archaeological Society; the academy, the burgh school and a secondary school with the finest technical equipment in Scotland, given by Mr A. Forrester Paton. There is a public park, besides bowling-greens and cricket and football fields. The old burying-ground was the kirkyard of the former parish church, the tower of which still exists, but a modern cemetery has been formed in Sunnyside. The town owns the water-supply, gas-works and electric-lighting.

Alloa Park, the seat of the earl of Mar and Kellie, is in the immediate vicinity, and in its grounds stand the ruins of Alloa Tower, an ancient structure 89 ft. high, with walls 11 ft. thick, which was built about 1315, and was once the residence of the powerful family of Erskine, descendants of the earl of Mar. The earl who promoted the Jacobite rising in 1715 was born here. Many of the Scots princes received their education as wards of the Lords Erskine and the earls of Mar, the last to be thus educated being Henry, the eldest son of James VI.

ALLOBROGES (in Gr. usually 'Αλλόβριγες), a Celtic tribe in the north of Gallia Narbonensis, inhabiting the low ground called the "island" between the Rhodanus, the Isara and the Graian Alps, corresponding to the modern Dauphiné and Savoy. If the name is rightly interpreted as meaning "aliens," they would seem to have driven out the original inhabitants. Their chief towns were Vienna (Vienne), Genava (Geneva) and Cularo (afterwards Gratianopolis, whence Grenoble). The Allobroges first occur in history as taking part with Hannibal in the invasion of Italy. After the subjugation of the Salluvii (Salyes) by the Romans in 123 B.C., having given shelter to their king Tutomotulus and refused to surrender him, the Allobroges were attacked and finally defeated (August 8, 121) at the junction of the Rhodanus and Isara by Q. Fabius Maximus (afterwards Allobrogicus). But they still remained hostile to Rome, as is shown by the conduct of their ambassadors in the Catilinarian conspiracy (63; see Catiline); two years later a revolt under Catugnatus was put down by Gaius Pomptinus at Solonium. Under Augustus they were included in Gallia Narbonensis; later, in the Viennensis.

See A. Desjardins, *Géographie historique de la Gaule romaine*, ii. (1876–1893); E. Herzog, *Galliae Narbonensis Historia* (Leipzig, 1864); Mommsen, *Hist. of Rome* (Eng. trans.), bk. iii. ch. 4, iv. ch. 5; T. R. Holmes, *Caesar's Conquest of Gaul* (1899); G. Long in Smith's *Dict. of Greek and Roman Geography*; M. Ihm in Pauly-Wissowa's *Realencyclopädie*, i. 2 (1894); A. Holder, *Alt-celtischer Sprachschatz*; and bibliography in *La grande encyclopédie* (*s.v.*).

ALLOCATUR (from med. Lat. *allocatur*, it is allowed), in law, a certificate given by a taxing master, at the termination of an action, for the allowance of costs.

ALLOCUTION (Lat. *allocutio*, an address), a name given to the formal addresses made by the pope to the College of Cardinals and through them to the church generally. They are usually called forth by ecclesiastical or political circumstances, and aim at safeguarding papal principles and claims. They are published by being affixed to the door of St Peter's Church.

ALLODIUM, or Alodium, a legal term for lands which are the absolute property of their owner, and not subject to any service or acknowledgment to a superior. It is thus the opposite of *fe-odum* or fief. The proper derivation of the word has been much discussed and is still doubtful, though it is probably compounded of *all*, whole or entire, and *odh*, property. Allodial tenure seems to have been common throughout northern Europe. It exists in Orkney and Shetland, but is unknown in England, the feudal system having been made universal by William the Conqueror.

ALLOMEROUS (Gr. ἄλλος, other μέρος, part), the quality of bodies (*e.g.* mineral) by virtue of which they can change their elements and proportions while preserving their form.

ALLON, HENRY (1818–1892), English Nonconformist divine, was born on the 13th of October 1818 at Welton near Hull in Yorkshire. Under Methodist influence he decided to enter the ministry, but, developing Congregational ideas, was trained at Cheshunt College. In 1844 he became co-pastor with the Rev. Thomas Lewis of Union Chapel, Islington. In 1852, on the death of Lewis, Allon became sole pastor, and this position he held with increasing influence till his death in 1892. Union Chapel, originally founded by evangelical members of the Church of England and Nonconformists acting in harmony, became during Allon's co-pastorate definitely Congregational in principle and fellowship, and exercised an ever-expanding influence. His chief service to Nonconformity was in connexion with the improvement of congregational worship, and especially the service of praise. In 1852 Dr. H. J. Gauntlett became organist at Union Chapel and conductor of a psalmody class. To meet the wants of this class, Allon published the original edition of his well-known *Congregational Psalmist.* For many years his collection of hymns, chants and anthems was used in hundreds of churches throughout England. In 1860 Allon began to write, at first chiefly for the *Patriot*, then under the editorship of T. C. Turbeville. In 1864, at the age of forty-five, he was elected chairman of the Congregational Union, and in 1866 he undertook the editorship of the *British Quarterly Review* with H. R. Reynolds, the principal of Cheshunt. In 1877 he became sole editor, and in that capacity came into touch with such men as W. E. Gladstone, Matthew Arnold, F. D. Maurice and Dean Stanley. The magazine was discontinued in 1886. In 1871 he received the degree of D.D. from the university of Yale, U.S.A. In 1874 the congregation at Islington decided to erect new buildings. The church, which was built at a cost of £50,000, was specially adapted for congregational worship and was mentioned by an architectural journal as one of the hundred remarkable buildings of the century. The church had in its various departments about 300 teachers in charge of more than 3000 children, and was in its organization one of the earliest instances of the type known as the institutional church. In 1881, on the occasion of the jubilee of the Congregational Union of England and Wales, Allon was again elected chairman. In March 1892 he died suddenly from heart failure. His books were *A Memoir of James Sherman* (1863); the *Sermons of Thomas Binney*, with a biographical and critical sketch (1869); *The Vision of God and other sermons* (1876); *The Indwelling Christ* (1892). Allon was a man of sound judgment, strong will, great moral courage and personal kindness. His acquaintance with literature was wide, his own style lucid and decisive. In social and political affairs he was a convinced individualist. Both as leader of Union Chapel and in denominational affairs his courage and discretion, his simple faith, combined with a broad-minded sympathy with the intellectual movements of the time, made his ministry a widespread influence for good. (D. Mn.)

ALLONGE (from Fr. *allonger*, to draw out), a slip of paper affixed to a negotiable instrument, as a bill of exchange, for the purpose of receiving additional indorsements for which there may not be sufficient space on the bill itself. An indorsement written on the allonge is deemed to be written on the bill itself. An allonge is more usually met with in those countries where the Code Napoléon is in force, as the code requires every indorsement to express the consideration. Under English law, as the simple signature of the indorser on the bill, without additional words, is sufficient to operate as a negotiation, an allonge is seldom necessary.

ALLOPHANE, one of the few minerals known only in the amorphous state. It is a glassy substance, usually occurring as thin encrustations with a mammillary surface; occasionally, however, it is earthy and pulverulent. The colour varies considerably, from colourless to yellow, brown, blue or green. Specimens of a brilliant sky-blue colour, such as those found formerly in Wheal Hamblyn, near Bridestowe in Devonshire, and in Sardinia, are specially attractive in appearance; the colour is here due to the presence of the copper mineral chrysocolla. The hardness is 3, and the specific gravity 1·9. Chemically, it is a hydrous aluminium silicate, $Al_2SiO_5 . 5H_2O$. Allophane is always of secondary origin, resulting from the decomposition of various aluminous silicates, such as felspar. It is often found encrusting fissures and cavities in mines, especially those of copper and iron. It was first observed in 1809 in marl at Gräfenthal, near Saalfield in Thuringia; and has been found in some quantity in the chalk pits at Charlton in Kent, where it lines fissures and funnel-shaped cavities. The name allophane was given by F. Stromeyer in 1816, from the Gr. ἄλλος, another, and φαίνω, to appear, in allusion to the fact that the mineral crumbles and changes in appearance when heated before the blowpipe. Other names for the species are riemannite and elhuyarite, whilst closely allied minerals are carolathine, samoite and schrötterite (opal-allophane).

ALLORI, ALESSANDRO (1535–1607), Italian painter of the Florentine school, was brought up and trained in art by his uncle, Angelo Bronzino (*q.v.*) whose name he sometimes assumed in his pictures. Visiting Rome in his nineteenth year, he carefully studied the works of Michelangelo; but the influence of that great master can only be traced in the anatomical correctness of his drawing of nude figures. He was successful as a portrait painter. His son Cristofano Allori (1577–1621), born at Florence, received his first lessons in painting from his father, but becoming dissatisfied with the hard anatomical drawing and cold colouring of the latter, he entered the studio of Gregorio Pagani (1558–1605) who was one of the leaders of that later Florentine school which endeavoured to unite the rich colouring of the Venetians with the correct drawing of Michelangelo's disciples. Allori became one of the foremost of this school. His pictures are distinguished by their close adherence to nature and the delicacy and technical perfection of their execution. His technical skill is proved by the fact that several copies he made after Correggio have been taken to be duplicates by Correggio himself. His extreme fastidiousness limited his power of production, though the number of his works is not so small as is sometimes asserted. Several specimens are to be seen at Florence and elsewhere. The finest of all his works is his "Judith and Holofernes," in the Pitti Palace. The model for the Judith was his mistress, the beautiful Mazzafirra, who is also represented in his Magdalene; and the head of Holofernes is generally supposed to represent himself.

ALLOTMENT (from O. Fr. *à* and *loter*, to divide by lot), the act of allotting; a share or portion assigned. In England, the term denotes a portion of land assigned on partition or under an inclosure award (see Commons); also a division of land into small portions for cultivation by a labourer or artisan at a small rent (see Allotments and Small Holdings). In company law, "allotment" is the appropriation to an applicant by a resolution of the directors of a certain number of shares in response to an application. The document sent to such an applicant, which announces the number of shares assigned and concludes the contract, is called a *letter of allotment* or *allotment certificate.* A letter of allotment in England requires a sixpenny stamp if the value of the shares amounts to £5 or over, and a penny stamp if less than £5. (See Company.)

Allotment note is a writing by a seaman authorizing his employers to make an allotment of part of his wages, while he is on a voyage, in favour either of a "near" relative (wife, father, mother, grandfather, grandmother, child, grandchild, brother or sister of the seaman), or of a savings bank. Every allotment note must be in a form sanctioned by the Board of Trade.

ALLOTMENTS AND SMALL HOLDINGS. As the meaning of these terms in agricultural tenure varies in different localities, it may be as well to say at once that for the present purpose they are definable as pieces of land detached from cottages, and hired or owned by labouring men to supplement their main income. We do not include any farm, however small, from which the occupier derives his entire support by dairying, market-gardening, or other form of *la petite culture.* So, also, no account is taken of the tiny garden plot, used for growing vegetables for the table and simple flowers, which is properly an appurtenance of the cottage. Clearing away what is extraneous, the essential point round which much controversy has raged is the labourer's share in the land. The claim advanced depends upon tradition. In agriculture, the oldest of all industries, a cash payment is not even now regarded as discharging the obligations between master and servant. Mr Wilson Fox, in reporting to the Board of Trade on the earnings of agricultural labourers in Great Britain, gives, as a typical survival of an old custom, the case of a shepherd whose total income was calculated at £60 a year, but who got only £16 in money, the rest being made up by rights of grazing live-stock, growing crops on his master's land, and kindred privileges. That is exactly in the spirit that used to pervade agriculture, and doubtless had its origin in the manorial system. If we turn back to the 13th century, from Walter of Henley's *Husbandry* it will be seen that practically there were only two classes engaged in agriculture, and corresponding with them were two kinds of land. There were, on the one hand, the employer, the lord, and his demesne land; on the other, the villeins and the land held in villenage. Putting aside for the moment any discussion of the exact degree of servitude, it will be seen that the essence of the bargain was that the villein should be permitted to cultivate a virgate of land for his own use in return for service rendered on the home farm. This is not altered by the fact that the conditions approached those of slavery, that the villeins were *adscripti glebae*, that in some cases their wives and sons were bequeathed by deed to the service of religious houses, and that in many other respects their freedom was limited. Out of this, in the course of centuries, was developed the system prevailing to-day. Lammas lands are indeed a survival from it. There are in the valley of the Lea, and close to London, to take one example, lands allotted annually in little strips till the crops are carried, when, the day being fixed by a reeve, the land becomes a common pasture till the spring closing takes place once more. Perhaps the feature of this old system that bears most directly on the question of allotments was the treatment of the waste of the manor. The lord, like his tenants, was limited by custom as regards the number of beasts he could graze on it. After the havoc of the Black Death in 1349, many changes were necessitated by the scarcity and dearness of labour. It became less unusual for land to be let and for money payment to be accepted instead of services. There was a great demand for wool, and to conduct sheep-farming on a large scale necessitated a re-arrangement of the manor and the enclosure of many common fields under the statute of Merton and the statute of Westminster the Second. Nevertheless, up to the 18th century, a vast proportion of agricultural land was technically waste, on which rights of common were exercised by yeomen, some of whom had acquired holdings by the ordinary methods of purchase or inheritance, while others had merely squatted and built a house on the waste. It is to this period that belongs a certain injustice to which the peasantry were subject. No reasonable doubt can be entertained of the necessity of enclosure. Husbandry, after long stagnation, was making great advance; and among others, Arthur Young raised his voice against the clumsy inconvenient common fields that were the first to be enclosed. Between 1709 and 1797 no fewer than 3110 acts, affecting, as far as can be calculated, about 3,000,000 acres, were put into operation. They seem mostly to have been directed to the common fields. In the first half of the 19th century the movement went on apace. In a single year, 1801, no fewer than 119 acts were passed; and between 1801 and 1842 close on 2000 acts were passed—many of them expressly directed to the enclosure of wastes and commons. The same thing continued till 1869. It touched the peasant directly and indirectly. The enclosure of the common fields proved most hurtful to the small farmer; the enclosure of the waste injured the labourer by depriving him, without adequate compensation, of such useful privileges as the right to graze a cow, a pig, geese or other small animals. It also discouraged him by tending to the extinction of small tenancies and freeholds that were no longer workable at a profit when common rights ceased to go with them. The industrious labourer could previously nourish a hope of bettering his condition by obtaining a small holding. Yet though the labourer suffered, impartial study does not show any intentional injustice. He held a very weak position when those interested in a common affixed to the church door a notice that they intended to petition. As Mr Cowper (afterwards Lord Mount Temple) said in the House of Commons on the 13th of March 1844, "the course adopted had been to compensate the owner of the cottage to whom the common right belonged, forgetting the claims of the occupier by whom they were enjoyed"; and in the same debate Sir Robert Peel pointed out that not only the rights of the tenant, but those of his successors ought to have been studied. The course adopted divorced the labourer from the soil.

Parliament, as a matter of fact, had from a very early period recognized the wisdom of contenting the peasant. In the 14th century the labourer lived in rude abundance. Next century a rural exodus began, owing to the practice of enclosing the holdings and turning them into sheep walks. In 1487 an act was passed enjoining landlords to "keep up houses of husbandry," and attach convenient land to them. Within the next hundred years a number of similar attempts were made to control what we may call the sheep fever of the time. Then we arrive at the reign of Elizabeth and the famous Small Holdings Act passed in 1597—an anticipation of the three-acres-and-a-cow policy advocated towards the end of the 19th century. It required that no person shall "build, convert or ordain any cottage for habitation or dwelling for persons engaged in husbandry" unless the owner "do assign or lay to the same cottage or building four acres of ground at the least." It also provided against any "inmate or under-sitter" being admitted to what was sacred to one family. This measure was not conceived in the spirit of modern political economy, but it had the effect of staying the rural exodus. It was repealed in 1775 on the ground that it restricted the building of cottages. By that time the modern feeling in favour of allotments had begun to ripen, and it was contended that some compensation should be made to the labourers for depriving them of the advantages of the waste. Up to then the English labouring rustic had been very well off. Food was abundant and cheap, so were clothes and boots; he could graze his cow or pig on the common, and also obtain fuel from it. Now he fell on evil days. Prices rose, wages fell, privileges were lost, and in many cases he had to sell the patch of land whose possession made all the difference between hardship and comfort. All this was seen plainly enough both by statesmen and private philanthropists. One of the first experiments was described by Sir John Sinclair in a note to the report of a select committee of the House of Commons on waste lands in 1795. About 1772 the lord of the manor of some commonable lands near Tewkesbury had with great success set out 25 acres in allotments for the use of some of the poor. Sir John was very much struck with the result, and so heartily applauded the idea that the committee recommended that any general enclosure bill should have a clause in it providing for "the accommodation of land." Sir Thomas Bernard and W. Wilberforce took an active part in advocating the principle of allotments, on the ground, to summarize their argument in language employed later by a witness before the House of Commons, that "it keeps the cottagers buoyant and makes them industrious." In 1806, at the suggestion of the rector, a clause assigning an allotment of half an acre to every cottage was inserted in an enclosure bill then under consideration for the parish of Broad Somerford in Wiltshire. This was done, "and the example was followed by nearly every adjoining parish in that part of Wiltshire." Passing over several praiseworthy establishments of allotments by private persons, we come to 1819, when parliament passed an act akin in spirit to several that came into existence during the later portion of the Victorian era. It empowered the churchwardens and overseers of any parish, with the consent of the vestry, to purchase or hire land not exceeding 25 acres, and to let it in portions to "any poor and industrious inhabitant of the parish." This was amended in 1831 by an act extending the quantity of land to 50 acres, and also conveying an important new power to enable the same authorities to enclose from any waste or common, land not exceeding 50 acres to be devoted to the same purpose. This was followed next year by an act relating to fuel, and in 1834 the Poor Law Commissioners reported favourably on the principle of granting allotments. In 1843 an important inquiry into the subject was made by a committee of the House of Commons, which produced a number of valuable suggestions. One consequence was the bill of 1845, brought into parliament by Mr Cowper. It passed the House of Commons; and there Mr Bright made a remark that probably summarized a general opinion, since it never came to a third reading in the House of Lords. He said that "the voluntary system of arrangement would do all the good that was expected to accrue from the allotment system."

At this point in the history of the movement it may be as well to pause and ask what was the net result of so much legislation and benevolent action. Messrs Tremenheere and Tufnall, who prefixed an admirable epitome of what had been done to the report of the commission "appointed to inquire into the employment of women, young persons and children in agriculture" (1867), expressed considerable disappointment. Between 1710 and 1867, 7,660,413 statute acres were added to the cultivated area of England and Wales, or about one-third of the area in cultivation at the latter date; and of this total, 484,893 acres were enclosed between 1845 and 1867. Of the latter, only 2119 acres were assigned as public allotments for gardens to the labouring poor. It was found to be the case, as it is now, that land was taken up more readily when offered privately and voluntarily than when it came through official sources. Meanwhile competent and thoughtful men saw well that the sullen discontent of the peasantry continued, in Lord Bacon's phrase, to threaten "the might and manhood of the kingdom." It had existed since the beginning of the Napoleonic wars, and had become more articulate with the spread of education. We shall see a consciousness of its presence reflected in the minds of statesmen and politicians as we briefly examine the later phase of the movement. This found expression in the clauses against enclosure introduced by Lord Beaconsfield in 1876, and gave force to the three-acres-and-a-cow agitation, of which the more prominent leaders were Joseph Arch and Jesse Collings. In 1882 the Allotments Extension Act was passed, the object of which was to let the parishioners have charity land in allotments, provided it or the revenue from it was not used for apprenticeship, ecclesiastical or educational purposes. A committee of the House of Commons, appointed in 1885 to inquire into the housing of the working classes, reported strongly in favour of allotments, and this was followed in 1887 by the Allotments Act—the first measure in which the principle of compulsory acquisition was admitted in regard to other than charity lands. Its administration was first given to the sanitary authority, but passed to the district councils when these bodies were established in 1894. The local body is empowered to hire or purchase suitable land, and if they do not find any in the market they are to petition the county council, which after due inquiry may issue a provisional order compelling owners to sell land, and the Local Government Board may introduce a bill into parliament to confirm the order. It was found that the sanitary authority did not carry out the scheme, and in 1890 another act was passed for the purpose of allowing applicants for allotments, when the sanitary authority failed to provide land, to appeal to the county council. Judging from the evidence laid before the commission on agricultural depression (1894), the act of 1887 was not a conspicuous success. Most of the witnesses reported in such terms as these—"the Allotments Act has been quite inoperative in Cornwall"; "the act has been a dead letter in the district (Wigtownshire)"; "the Allotments Act has not been in operation in Flintshire"; "nothing has been done in the district of Pembrokeshire under the act." No evidence whatever was adduced to show that in a single district a different state of things had to be recorded. From a return presented by the Local Government Board to parliament in 1896 we learn that eighty-three rural sanitary authorities had acquired land for allotment prior to the 28th of December 1894, the date at which these authorities ceased to exist under the provisions of the Local Government Act 1894. Land was acquired by compulsory purchase in only one parish; by purchase or agreement in eighteen parishes; by hire by agreement in 132 parishes. The total acreage dealt with was 1836 acres 1 rood 34 poles, and the total number of tenants 4711. The number of county councils that up to the same date had acquired land was twelve, and they had done so by compulsory purchase in one parish, by purchase or agreement in five parishes, by hire by agreement in twenty-four parishes. The total area dealt with was only 413 acres 1 rood 5 poles, and the total number of tenants 825. The complete totals affected at the date of the return (August 21, 1895) by the acts, therefore, were 2249 acres 2 roods 29 poles, and 5536 tenants. A considerable extension has taken place since.

The Small Holdings Act introduced by Mr Henry Chaplin, and passed by parliament in 1892 was an attempt to appease the rural discontent that had been seething for some time past and was silently but most eloquently expressed in a steady migration from the villages. The object of this measure was to help the deserving labouring man to acquire a small holding, that is to say, a portion of land not less than one acre or more than fifty acres in extent and of an annual value not exceeding £50. It is not necessary here to describe the legal steps by which this was to be accomplished. The essence of the bargain was that a fifth of the purchase money should be paid down, and the remainder in half-yearly instalments spread over a period not exceeding fifty years. But if the local authority thought fit a portion of the purchase money, not exceeding one-fourth, might remain unpaid, and be secured by a perpetual rent charge upon the holding. It cannot be said that this act has attained the object for which it was drawn up. From a return made to the House of Commons in 1895 it was shown that eight county councils had acquired land under the Small Holdings Act, which amounted in the aggregate to 483 acres. A further return was made in 1903, which showed that the total quantity of land acquired from the commencement of the act up to the end of 1902 was only 652 acres.

It is, however, an English characteristic to prefer private to public arrangements, and probably a very great majority of the allotments and small holdings cultivated in 1907 were due to individual initiative. There are no means of arriving at the exact figures, but data exist whereby it is at least possible to form some rough idea of them. It is not the custom to give in the annual agricultural returns any statement of the manner in which land is held, and the information is to be found in the returns presented to parliament from time to time. From the following table, which includes both the holdings owned and tenanted, it will be seen that between 1895 and 1904 the tendency was for the holdings to decrease in number; while the holdings of from 50 to 300 acres slightly increased, those from 5 to 50 acres were almost stationary, and there was a decrease in those between 1 and 5 acres.

	1895.		1904.	
	Number.	Per cent.	Number.	Per cent.
1 to 5 acres	117,968	22·68	110,974	21·69
5 to 50 ,,	235,481	45·28	232,476	45·44
50 to 300 ,,	147,870	28·43	150,050	29·33
Above 300 ,,	18,787	3·61	18,084	3·54
Total .	520,106	100	511,584	100

These figures become doubly instructive when considered in connexion with the decline of the strictly rural population. It will, therefore, be useful to place beside them a summary published in a report on the decline of rural population in Great Britain issued by the Board of Agriculture and Fisheries in 1906.

Class.	1881.	1891.	1901.	Increase (+) or Decrease (−).	
				1881–1891.	1891–1901.
	No.	No.	No.	No.	No.
Farmers and Graziers .	279,126	277,943	277,694	−1,183	−249
Farm Bailiffs and Foremen	22,895	21,453	27,317	−1,442	+5,864
Shepherds .	33,125	31,686	35,022	−1,439	+3,336
Agricultural Labourers .	983,919	866,543	689,292	−117,376	−177,251

These figures must of course be approximate. The effect of recent development in methods of travelling and the growing custom for townsmen either to live wholly in the country or to take week-end cottages, has made it impossible to draw a strict line of demarcation between rural and urban populations. Still they are near enough for practical purposes, and they amply justify the efforts of those who are trying to stay the rural exodus.

While legislation had not, up to 1908, achieved any noteworthy result in the creation of small holdings, and still left doubts as to the practicability of re-creating the English yeoman by act of parliament, many successful efforts have been made by individuals. One of the most interesting is that of the earl of Carrington at Sleaford in Lincolnshire. In this case the most noteworthy feature is that between the landlord and the tenants there is a body called the South Lincolnshire Small Holdings Association, which took 650 acres from Lord Carrington on a twenty years' lease. These acres used to be let to four or five tenants. They were in 1905 divided among one hundred and seventy tenants. The Small Holders' Association guaranteed the rent, which works out at about 33s. per acre, to Lord Carrington. They let the men on yearly tenancy have it at about 40s. an acre, the difference being used to meet the expenses of dividing the lands into small holdings, maintaining drains, fences and roads connected with them, and other unavoidable outlays. In this way the landlord is assured of his rent, and the association has lost nothing, as the men were very punctual in their payments. But very great care was bestowed in choosing the men for the holdings. They were in a sense picked men, but men must be picked to work the business satisfactorily. Lincolnshire is pre-eminently a county of small holdings, and the labouring residents in it have been accustomed to the management of them from their infancy onwards. Here as elsewhere the provision of suitable houses formed a difficulty, some of the tenants having to walk several miles to their holdings. Lord Carrington availed himself as much as possible of the buildings that existed, dividing the old farm houses so as to make them suitable for the small tenants. At Cowbit farm, many of the ordinary labourers' cottages, which were put up at a cost of about £300 a pair, have by the addition of little dairies and other alterations been made suitable for the tenants. From facts collected on the spot we have come to the conclusion that on the small holdings a good tenant makes an average profit of about £4 an acre, but on an allotment cultivated by means of the spade it would probably be at the rate of over £6 an acre. Lord Carrington was also successful in establishing small holdings on the Humberston estate in North-Lincolnshire and on his Buckinghamshire estate, near Aylesbury. At Newport Pagnell the attempt failed because the demand was artificial, the ground arable, and the men not capable of dealing with it.

Other examples of the establishment of small holdings can only receive brief reference. The Norfolk Small Holdings Association acquired three farms at Whissonsett, Watton and Swaffham, which are broken up into small lots and let mostly to the village tradespeople. Sir Pearce Edgecumbe established small holdings at Rew, some of which have been purchased by the occupiers, and Mr A. B. Markham created similar ownerships at Twyford (Leicestershire). At Cudworth in Surrey a group was formed, but the owners were actuated more by the desire to lead a simple life than to prove the remunerative value of small holdings. Mr W. J. Harris created small holdings in Devon, each of which is let on a life tenancy. There the rural exodus has been more than arrested. Mr James Tomkinson established in Cheshire a number of graduated holdings, so contrived as to offer the successful holders a chance of stepping upwards.

The earl of Harrowby made an interesting experiment on his Sandon estate in Staffordshire in the midst of a pretty, broken and undulating country. The estate consists of about 6000 acres, one-third of which is laid out in small holdings. These fall naturally into three divisions. First, there are those which belong to men who have regular employment, and would therefore find it impossible to cultivate any great quantity of land. Many of that class are anxious to have a holding of some sort, as it lends a certain elasticity to their incomes and provides them with a never-failing interest. One who may be taken as typical hired six acres with a good cottage and a large garden, paying a rent of £20 a year. When this holding was created it had already a suitable cottage, but £100 was needed to provide outbuildings, and Lord Harrowby's custom is to charge 5% on outlay of this kind. This £5, however, is included in the total rent of £20 paid for cottage, land and garden. The man was not only content, but wished to get some more land. The next class consists of those who have not enough land to live on but eke out their livelihood by casual labour. Usually a man of this sort requires from 35 to 50 acres of land mostly pasture. He can attend to it and yet give a certain number of days to estate work. The third class is that of the small farmer who gains his entire livelihood from the land. The obstacle to breaking up large farms into small lies of course in the expense of providing the necessary equipment. It has been found here that a cottage suitable for a small farmer costs about £400 to build in a substantial manner, and the outbuildings about £200. This makes an addition therefore of about £30 to the rent of the land. The ardour with which these tenancies were sought when vacant formed the best testimony to the soundness of the principle applied by Lord Harrowby.

A nest of small holdings was created at Winterslow, near Salisbury, by Major R. M. Poore. The holders completed the purchase by 1906, and the work may be pronounced a complete success. Major Poore originally conceived the idea when land was cheap in 1892, owing to the depression in agriculture. He purchased an estate that came into the market at the time. The price came to an average of £10 an acre, and the men themselves made the average for selling it out again £15 on a principle of instalments. His object was not to make any profit from the transaction, and he formed what is termed a Landholders' Court, formed of the men themselves, every ten choosing one to represent them. This court was found to act well. It collected the instalments, which are paid in advance; and of course the members of it, down to the minutest detail, knew not only the circumstances but the character of every applicant for land. The result speaks for itself. The owners are, in the true sense of the word, peasants. They do not depend on the land for a living, but work in various callings—many being woodmen—for wages that average about 15s. a week. The holdings vary in size from less than an acre to ten acres, and are technically held on a lease of 1999 years, practically freehold, though by the adoption of a leasehold form a saving was effected in the cost of transfer. On the holdings most of the men have erected houses, using for the purpose chalk dug up from their gardens, it lying only a few inches below the surface. It is not rock, but soft chalk, so that they are practically mud walls; but being as a rule at least 18 inches thick, the houses are very cool in summer and warm in winter. Major Poore calculated that in seven years these poor people—there are not thirty of them altogether—managed to produce for their houses and land a gross sum of not less than £5000. This he attributed to the loyal manner in which even distant members of the family have helped.

The class of holding which owes its existence to the act of 1892 may be illustrated by the history of the Worcestershire small holdings. The inception of the scheme was due to the decline of the nail-making business, which caused a number of the inhabitants to be without occupation. Two candidates for election to the county council looking out for a popular cry found it in the demand for land. They promised to do their best in this direction, and thanks to the energetic action of Mr Willis Bund, the chairman, the act was put in force. Woodrow Farm, adjoining the village of Catshill in the neighbourhood of Birmingham, was purchased on terms that enabled the land to be sold to the peasant cultivator at £40 an acre. They were paying this back at the rate of 4% on the purchase money, a rate that included both interest and sinking fund, so that at the end of forty years they would own the small estates free from encumbrance. The huge population of Birmingham is close to the properties. The men turned their attention mostly to strawberries, to which many acres were devoted. Costermongers would come out from Birmingham and buy the fruit on the spot, selling part of it to the villas on the way back, and part in the Birmingham market. The experience gained in working the act enabled the committee on small holdings to make a number of practical suggestions for future legislation.

It remains to note the passing in 1907 of a new English Small Holdings and Allotments Act, experience of which is too recent for its provisions to be more than indicated here. The act transferred to the Board of Agriculture the duties generally of the Local Government Board, and transferred to parish councils or parish meetings the powers and duties of rural district councils; it required county councils to ascertain the demand for land without previous representation to them, and gave power for its compulsory acquisition; and the maximum holding of an allotment was raised from one acre to five. Both compulsory purchase and compulsory hiring (for not less than 14 nor more than 35 years) were authorized, value and compensation being decided by a single arbitrator. A coercive authority was applied to the county councils in the form of commissioners appointed by the Board of Agriculture, who were to hold inquiries independently and to take action themselves in case of a defaulting county council. They were to ascertain the local demand for small holdings, and to report to the Board, who might then require a county council to prepare a scheme, which, when approved, it was to carry out, the commissioners being empowered to do so in the alternative.

Foreign Countries.—It remains to give a brief outline of what small holdings are like outside Great Britain. From the results of the Belgian Agricultural Inquiry of 1895 the following table has been compiled, assuming that one hectare = 2½ acres:—

Size of Holding.	Occupied by Owner.		Occupied by Tenant.		Total.
	Whole.	More than half.	More than half.	Whole.	
	No.	No.	No.	No.	No.
1¼ acres and under	109,169	8,759	34,779	305,413	458,120
1¼ acres and under 5 acres . .	27,395	19,544	58,829	70,465	176,233
5 acres and under 10 acres . .	12,089	13,873	30,340	25,006	81,308
10 acres and under 50 acres . .	16,690	18,909	33,443	28,387	97,429
50 or 100 acres .	2,021	1,497	3,315	4,517	11,350
Over 100 ,, .	903	470	1,417	2,395	5,185
Total .	168,267	63,052	162,123	436,183	829,625

It will be seen from this table that Belgium is pre-eminently a country of small holdings, more than half of the total number being under 50 acres in extent. Of course it is largely a country of market gardens; but as the holdings are most numerous in Brabant, East and West Flanders and Hainault, the provinces showing the largest number of milch cows, it would seem that dairying and *la petite culture* go together.

There is a slight tendency for the holdings to decrease in number. In Germany the number of small holdings is proportionately much larger than in Great Britain. The returns collected in 1895 showed that there were 3,235,169, or 58·22 % of the total number of holdings under 5 acres in area; and of these no fewer than 11 % are held by servants as part of their wages. The table below compiled for the *Journal of the Board of Agriculture* enables us to compare the other holdings with those of Great Britain. Great Britain, it will be seen, has over 40 % of large farms of between 50 and 500 acres as compared with Germany's 12·6, while the latter has 86·8 of small holdings, compared with England's 58·6.

France also has a far larger proportion of small holdings than Great Britain; its cultivated area of 85,759,000 acres being divided into 5,618,000 separate holdings, of which the size averages a little over 15 acres as against 63 in Great Britain. Of the whole number, 4,190,795 are farmed by the owners, 934,338 are in métayage, and 1,078,184 by tenants. The leading feature is the peasant proprietary. Half of the arable, more than half of the pasture, six-sevenths of the vineyards and two-thirds of the garden lands are farmed by their owners. Comparison with Great Britain is difficult; but it would appear that, whereas only 11 % of British 520,000 agricultural holdings are farmed by the owners, the proportion in France is 75 %. A further point to be noted is that the average agricultural tenancy in France is just one-fourth of what it is in Great Britain, and the average owner-farmed estate only one-sixth.

Size of Holdings.	Germany.		Great Britain.	
	Number.	Per cent.	Number.	Per cent.
5 to 50 acres .	2,014,940	86·8	235,481	58·6
50 to 500 ,, .	292,982	12·6	161,438	40·1
Over 500 ,, .	13,809	0·6	5,219	1·3
Total . .	2,321,731	100	402,138	100

In France the tendency is for the very small holdings to increase in number owing to subdivision, with a consequent decrease of the size of the average holding. Between the years 1882 and 1892 there was a decrease of 138,237 in the total number of proprietors, the larger properties moving towards consolidation and those of the peasant proprietors towards subdivision.

Those interested in the formation of small holdings in Great Britain will find much to interest them in the history of Danish legislation. British policy for many generations was to preserve demesne land, and there are many devices for insuring that a spendthrift life-owner shall not be able to scatter the family inheritance; but as long ago as 1769 the Danish legislators set an exactly opposite example. They enacted that peasant land should not be incorporated or worked with estate land; it must always remain in the ownership and occupation of peasants. In this spirit all subsequent legislation was conceived, and the allotment law that came into force in October 1899 bears some resemblance to the English Small Holdings Act of 1892. It provides that labourers able to satisfy certain conditions as to character may obtain from the state a loan equal to nine-tenths of the purchase money of the land they wish to acquire. This land should be from 5 to 7 acres in extent and of medium quality, but the limits are from 2¾ to 10¾ acres in the case of better or poorer land. The total value should not exceed 4000 kr. (£222). The interest payable on the loan received from the state is 3 %. The loan itself is repayable after the first five years by annual instalments of 4 % until half is paid off; the remainder by instalments of 3½ %, including interest. Provision is, however, made for cases where the borrower desired to pay off the loan in larger sums. Regulations are laid down regarding the transfer of such properties and also their testamentary disposition. The Treasury was empowered to devote a sum of 2,000,000 kr. (£111,000) to this purpose for five years; after that the land is subject to revision.

Number and Size of Holdings in Denmark in 1901.

Groups.		Number.	Percentage of Number.	Acreage.	Percentage of Area.	Average size in Acres.
Tondeland.	Acres.					
Under 1 .	Under 1·36	68,380	27·3	23,455	·3	·34
1—3 . .	1·36—4	18,777	7·5	58,553	·7	3·12
3—27 . .	4—36·7	93,060	37·2	1,408,549	15·8	15·14
27—108 .	36·7—147	60,872	24·4	4,459,077	50·1	73·25
108—216 .	147—294	6,502	2·6	1,272,398	14·3	195·69
Over 216 .	Over 294	2,392	1·0	1,674,730	18·8	700·14
	Total.	249,983	100·0	8,896,762	100·0	35·59

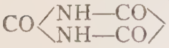
Even before this law was passed Denmark was a country of small holdings, the peasant farms amounting to 66 % of the whole, and the number is bound to increase, since the incorporation of farms is illegal, while there is no obstacle to their division. Between 1835 and 1885, the number of small holdings of less than one töndekarthorn increased from 24,800 to 92,856. What gives point to these remarks is, that Denmark seems in the way to arrest its rural exodus, and was one of the first countries to escape from the agricultural depression due to the extraordinary fall in grain prices. The distribution of land in Denmark may be gathered from a glance at the preceding table for the compilation of which we are indebted to Major Craigie.

Authorities.—Walter of Henley's *Husbandry*; *The English Village Community*, by Frederic Seebohm; *Annals of Agriculture*, by Arthur Young; *The Agricultural Labourer*, by T. E. Kebbel; *Report on the Employment of Women and Children in Agriculture*, 1867 (historical sketch by Messrs Tremenheere and Tufnall); *A Study of Small Holdings*, by W. E. Bear; *The Law and the Labourer*, by C. W. Stubbs; "Agricultural Holdings in England and Abroad," by Major Craigie (*Statistical Society's Journal*, vol. i.); *The Return to the Land*, by Senator Jules Méline; *Land Reform*, by the Right Hon. Jesse Collings, M.P.; *Report on the Decline in the Agricultural Population of Great Britain*, issued by the Board of Agriculture and Fisheries; *Report of the Departmental Committee appointed by the Board of Agriculture and Fisheries to enquire into and report upon the subject of Small Holdings in Great Britain.* (P. A. G.)

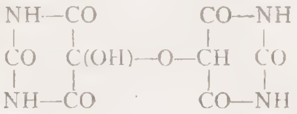
ALLOTROPY (Gr. ἄλλος, other, and τρόπος, manner), a name applied by J. J. Berzelius to the property possessed by certain substances of existing in different modifications. Custom has to some extent restricted its use to inorganic chemistry; the corresponding property of organic compounds being generally termed isomerism (*q.v.*). Conspicuous examples are afforded by oxygen, carbon, boron, silicon, phosphorus, mercuric oxide and iodide.

ALLOWANCE (from "allow," derived through O. Fr. *alouer* from the two Lat. origins *adlaudare*, to praise, and *allocare*, to assign a place; so that the English word combined the general idea of "assigning with approval"), the action of allowing, or the thing allowed; particularly, a certain limited apportionment of money or food and diet (see Dietary).

In commercial usage "allowance" signifies the deduction made from the gross weight of goods to make up for the weight of the box or package, waste, breakages, &c. Allowance, which is customary in most industries, varies according to the trade, district or country; *e.g.* in the coal trade it is customary for the merchant to receive from the pit 21 cwts. of coal for every ton purchased by him, the difference of 1 cwt. being the allowance for the purpose of making good the waste caused through transhipment, screening and cartage (see Tare and Tret.)

ALLOXAN, or Mesoxalyl Urea, $C_4H_2N_2O_4$ or  $CO\left\langle\begin{matrix}NH—CO\\NH—CO\end{matrix}\right\rangle CO$. an oxidation product of uric acid, being obtained from it by the action of cold nitric acid, $C_5H_4N_4O_3 + H_2O + O = C_4H_2N_2O_4 + CO(NH_2)_2$. It crystallizes from water in colourless rhombic prisms, containing four molecules of water of crystallization, and possesses a very acid reaction. It serves as the starting-point for the preparation of many related substances. Zinc and hydrochloric acid in the cold convert it into alloxantin (*q.v.*), hydroxylamine gives nitroso-barbituric acid, $C_4H_2N_2O_3{:}NOH$, baryta water gives alloxanic acid, $C_4H_4N_2O_5$, hot dilute nitric acid oxidizes it to parabanic acid (*q.v.*), hot potassium hydroxide solution hydrolyses it to urea and mesoxalic acid (*q.v.*) and zinc and hot hydrochloric acid convert it into dialuric acid, $C_4H_4N_2O_4$. M. Nencki has shown that alloxan combines with thiourea in alcoholic solution, in the presence of sulphur dioxide to form pseudothiouric acid, $C_5H_6N_4SO_3$. Methyl and dimethylalloxans are also known, the former being obtained on oxidation of methyl uric acid, and the latter on oxidation of caffeine (*q.v.*).

ALLOXANTIN, $C_8H_4N_4O_7 \cdot 3H_2O$, a product obtained by the combination of alloxan and dialuric acid, probably possessing the constitution

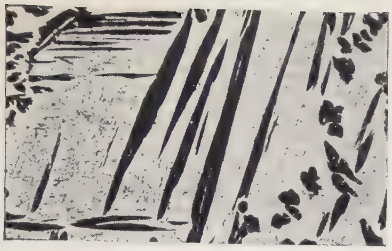


one of the three molecules of water being possibly constitutional. It forms small hard prisms which become red on exposure to air containing ammonia, owing to the formation of murexide (ammonium purpurate), $C_8H_4(NH_4)N_5O_6$. It may also be obtained by the action of sulphuretted hydrogen on alloxan. The tetramethyl derivative, amalic acid, $C_8(CH_3)_4N_4O_7$, has been prepared by oxidizing caffeine (*q.v.*) with chlorine water, and forms colourless crystals which are only slightly soluble in hot water. The formation of murexide is used as a test for the presence of uric acid, which on evaporation with dilute nitric acid gives alloxantin, and by the addition of ammonia to the residue the purple red colour of murexide becomes apparent.

ALLOYS (through the Fr. *aloyer*, from Lat. *alligare*, to combine), a term generally applied to the intimate mixtures obtained by melting together two or more metals, and allowing the mass to solidify. It may conveniently be extended to similar mixtures of sulphur and selenium or tellurium, of bismuth and sulphur, of copper and cuprous oxide, and of iron and carbon, in fact to all cases in which substances can be made to mix in varying proportions without very marked indication of chemical action. The term "alloy" does not necessarily imply obedience to the laws of definite and multiple proportion or even uniformity throughout the material; but some alloys are homogeneous and some are chemical compounds. In what follows we shall confine our attention principally to metallic alloys.

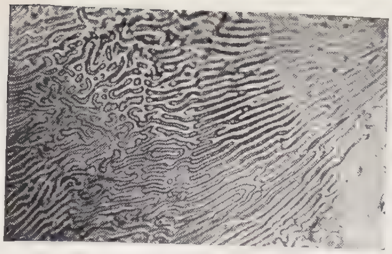
If we melt copper and add to it about 30 % of zinc, or 20 % of tin, we obtain uniform liquids which when solidified are the well-known substances brass and bell-metal. These substances are for all practical purposes new metals. The difference in the appearance of brass and copper is familiar to everyone; brass is also much harder than copper and much more suitable for being turned in a lathe. Similarly, bell-metal is harder, more sonorous and more brittle than either of its components. It is almost impossible by mechanical means to detect the separate ingredients in such an alloy; we may cut or file or polish it without discovering any lack of homogeneousness. But it is not permissible to call brass a chemical compound, for we can largely alter its percentage composition without the substance losing the properties characteristic of brass; the properties change more or less continuously, the colour, for example, becoming redder with decrease in the percentage of zinc, and a paler yellow when there is more zinc. The possibility of continuously varying the percentage composition suggests analogy between an alloy and a solution, and A. Matthiessen (*Phil. Trans.*, 1860) applied the term "solidified solutions" to alloys. Regarded as descriptive of the genesis of an alloy from a uniform liquid containing two or more metals, the term is not incorrect, and it may have acted as a signpost towards profitable methods of research. But modern work has shown that, although alloys sometimes contain *solid solutions*, the solid alloy as a whole is often far more like a conglomerate rock than a uniform solution. In fact the uniformity of brass and bell-metal is only superficial; if we adopt the methods described in the article Metallography, and if, after polishing a plane face on a bit of gun-metal, we etch away the surface layer and examine the new surface with a lens or a microscope, we find a complex pattern of at least two materials. Fig. 1 (Plate) is from a photograph of a bronze containing 23·3 % by weight of tin. The acid used to etch the surface has darkened the parts richest in copper, while those richest in tin remained white. The two ingredients revealed by this process are not pure copper and pure tin, but each material contains both metals. In this case the white tin-rich portions are themselves a complex that can be resolved into two substances by a higher magnification. The majority of alloys, when examined thus, prove to be complexes of two or more materials, and the patterns showing the distribution of these materials throughout the alloy are of a most varied character. It is certain that the structure existing in the alloy is closely connected with the mechanical properties, such as hardness, toughness, rigidity, and so on, that make particular alloys valuable in the arts, and many efforts have been made to trace this connexion. These efforts have, in some cases, been very

ALLOYS



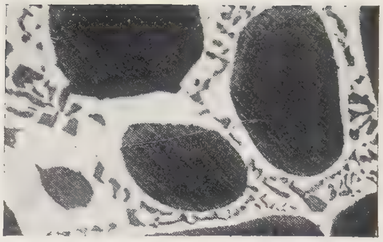
ALLOYS.

FIG. 1.—(Heycock & Neville, *Phil. Trans.*) Bronze containing 23·3% of tin. Slowly cooled. Magnified 18 diameters. Dark parts are rich in copper, light parts in tin.



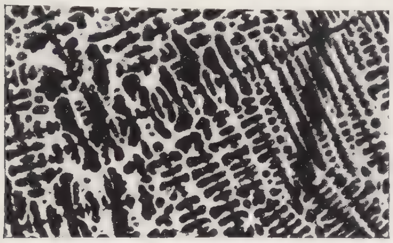
ALLOYS.

FIG. 2.—(Ewing & Rosenhain, *Phil. Trans.*) Lead-tin eutectic. Magnified 750 diameters.



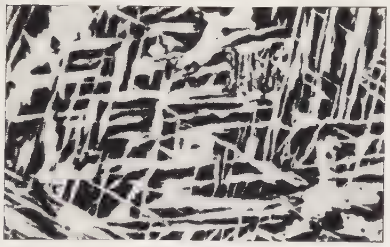
ALLOYS.

FIG. 3.—(F. Osmond.) Silver-copper [copper = 15%, silver = 85%] reheated to purple colour. Magnified 600 diameters.



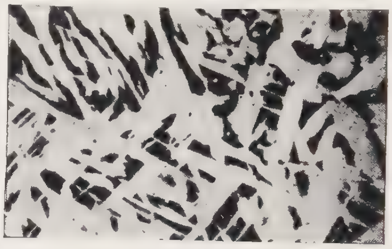
ALLOYS.

FIG. 4.—(Heycock & Neville, *Phil. Trans.*) Copper-tin [tin 27·7%] chilled at 731° C. before complete solidification. Magnified 18 diameters. Blacks rich, whites less rich in copper.



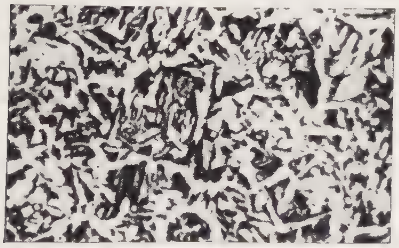
GUN-MAKING.

FIG. 5.—Gun steel, C. = 0·30%. From top of ingot as cast, magnified 29 diameters. Whites, ferrite; blacks, carbide.



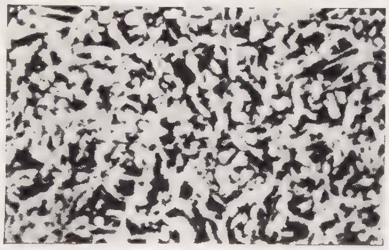
GUN-MAKING.

FIG. 6.—Gun steel, C. = 0·30%. From bottom of ingot as cast, magnified 29 diameters. Whites, ferrite; blacks, carbide.



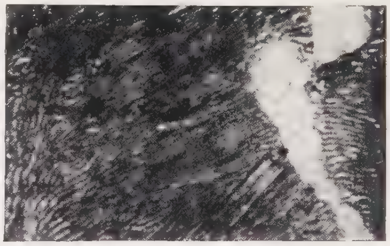
GUN-MAKING.

FIG. 7.—Gun steel, C. = 0·30%. Top of ingot, forged and annealed, magnified 29 diameters. Whites, ferrite; blacks, carbide.



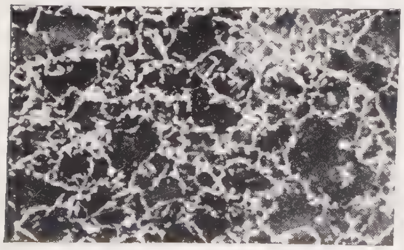
GUN-MAKING.

FIG. 8.—Gun steel, C. = 0·30%. Bottom of ingot, forged and annealed, magnified 29 diameters. Whites, ferrite; blacks, carbide.



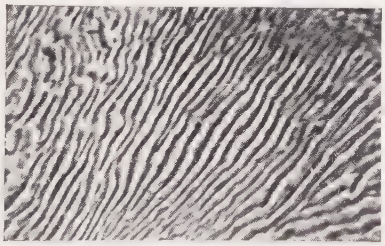
GUN-MAKING.

FIG. 9.—Gun steel, C. = 0·30%. Forged and annealed, magnified 1000 diameters, showing pearlite.



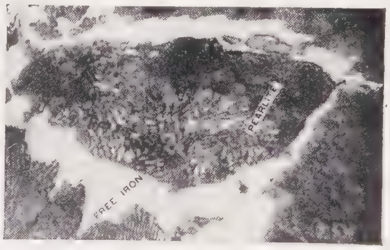
GUN-MAKING.

FIG. 10.—Gun steel, C. = 0·30%. Oil hardened and annealed, magnified 50 diameters.



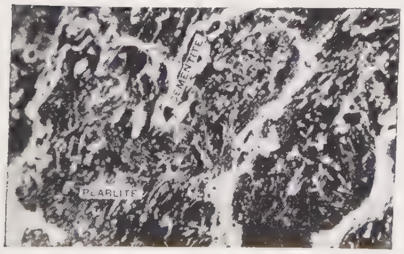
IRON AND STEEL.

FIG. 11.—(Osmond.) Pearlite, steel (carbon about 1%) forged and annealed at 800° C. Magnified 1000 diameters.



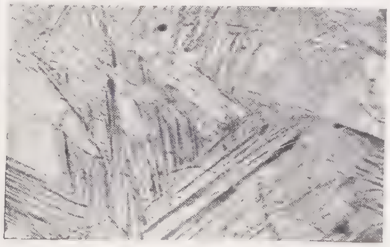
IRON AND STEEL.

FIG. 12.—(Stoughton.) Meshes of pearlite in a network of ferrite, from hypo-eutectoid steel. Magnified 250 diameters.



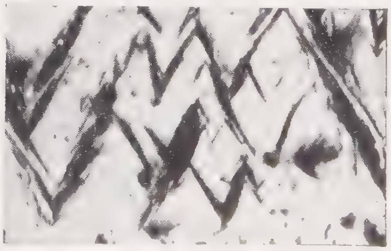
IRON AND STEEL.

FIG. 13.—(Stoughton.) Meshes of pearlite in a network of cementite from hyper-eutectoid steel. Magnified 250 diameters.



IRON AND STEEL.

FIG. 14.—(Osmond & Cartaud.) Martensite. Magnified 250 diameters.



IRON AND STEEL.

FIG. 15.—(Osmond.) Martensite (black) in austensite (white). Steel (carbon about 1·5%) quenched at 1050° C. in ice-cold water. Magnified 250 diameters.

PHOTOMICROGRAPHS OF ALLOYS AND METALS.

(See Articles METALLOGRAPHY, ALLOYS, GUN-MAKING, IRON and STEEL.)

successful; for example, in the case of steel, which is an alloy of iron and carbon, a microscopical examination gives valuable information concerning the suitability of a sample of steel for special purposes.

Mixture by fusion is the general method of producing an alloy, but it is not the only method possible. It would seem, indeed, that any process by which the particles of two metals are intimately mingled and brought into close contact, so that diffusion of one metal into the other can take place, is likely to result in the formation of an alloy. For example, if vapours of the volatile metals cadmium, zinc and magnesium are allowed to act on platinum or palladium, alloys are produced. The methods of manufacture of steel by cementation, case-hardening and the Harvey process are important operations which appear to depend on the diffusion of the carburetting material into the solid metal. When a solution of silver nitrate is poured on to metallic mercury, the mercury replaces the silver in the solution, forming nitrate of mercury, and the silver is precipitated; it does not, however, appear as pure metallic silver, but in the form of crystalline needles of an alloy of silver and mercury. F. B. Mylius and O. Fromm have shown that alloys may be precipitated from dilute solutions by zinc, cadmium, tin, lead and copper. Thus a strip of zinc plunged into a solution of silver sulphate, containing not more than 0·03 gramme of silver in the litre, becomes covered with a flocculent precipitate which is a true alloy of silver and zinc, and in the same way, when copper is precipitated from its sulphate by zinc, the alloy formed is brass. They have also formed in this way certain alloys of definite composition, such as $AuCd_3$, Cu_2Cd, and, more interesting still, Cu_3Sn. A very similar fact, that brass may be formed by electrodeposition from a solution containing zinc and copper, has long been known. W. V. Spring has shown that by compressing a finely divided mixture of 15 parts of bismuth, 8 parts of lead, 4 parts of tin and 3 parts of cadmium, an alloy is produced which melts at 100° C., that is, much below the melting-point of any of the four metals. But these methods of forming alloys, although they suggest questions of great interest, cannot receive further discussion here.

Our knowledge of the nature of solid alloys has been much enlarged by a careful study of the process of solidification. Let us suppose that a molten mixture of two substances A and B, which at a sufficiently high temperature form a uniform liquid, and which do not combine to form definite compounds, is slowly cooled until it becomes wholly solid. The phenomena which succeed each other are then very similar, whether A and B are two metals, such as lead and tin or silver and copper, or are a pair of fused salts, or are water and common salt. All these mixtures when solidified may fairly be termed alloys.[1] If a mixture of A and B be melted and then allowed to cool, a thermometer immersed in the mixture will indicate a gradually falling temperature. But when solidification commences, the thermometer will cease to fall, it may even rise slightly, and the temperature will remain almost constant for a short time. This halt in the cooling, due to the heat evolved in the solidification of the first crystals that form in the liquid, is called the freezing-point of the mixture; the freezing-point can generally be observed with considerable accuracy. In the case of a pure substance, and of a certain small class of mixtures, there is no further fall in temperature until the substance has become completely solid, but, in the case of most mixtures, after the freezing-point has been reached the temperature soon begins to fall again, and as the amount of solid increases the temperature becomes lower and lower. There may be other halts in the cooling, both before and after complete solidification, due to evolution of heat in the mixture. These halts in temperature that occur during the cooling of a mixture should be carefully noted, as they give valuable information concerning the physical and chemical changes that are taking place. If we determine the freezing-points of a number of mixtures varying in composition from pure A to pure B, we can plot the freezing-point curve. In such a curve the percentage composition can be plotted horizontally and the temperature of the freezing-point vertically, as in fig. 5. In such a diagram, a point P defines a particular mixture, both as to percentage, composition and temperature; a vertical line through P corresponds to the mixture at all possible temperatures, the point Q being its freezing-point. In the case of two substances which neither form compounds nor dissolve each other in the solid state, the complete freezing-point curve takes the form shown in fig. 5. It consists of two branches AC and BC, which meet in a lowest point C. It will be seen that as we increase the percentage of B from nothing up to that of the mixture C, the freezing-point becomes lower and lower, but that if we further increase the percentage of B in the mixture, the freezing-point rises. This agrees with the well-known fact that the presence of an impurity in a substance depresses its melting-point. The mixture C has a lower freezing or melting point than that of any other mixture; it is called the eutectic mixture. All the mixtures whose composition lies between that of A and C deposit crystals of pure A when they begin to solidify, while mixtures between C and B in composition deposit crystals of pure B. Let us consider a little more closely the solidification of the mixture represented by the vertical line PQRS. As it cools from P to Q the mixture remains wholly liquid, but when the temperature Q is reached there is a halt in the cooling, due to the formation of crystals of A. The cooling soon recommences and these crystals continue to form, but at lower and lower temperatures because the still liquid part is becoming richer in B. This process goes on until the state of the remaining liquid is represented by the point C. Now crystals of B begin to form, simultaneously with the A crystals, and the composition of the remaining liquid does not alter as the solidification progresses. Consequently the temperature does not change and there is another well-marked halt in the cooling, and this halt lasts until the mixture has become wholly solid. The corresponding changes in the case of the mixture TUVW are easily understood—the first halt at U, due to the crystallization of pure B, will probably occur at a different temperature, but the second halt, due to the simultaneous crystallization of A and B, will always occur at the same temperature whatever the composition of the mixture. It is evident that every mixture except the eutectic mixture C will have two halts in its cooling, and that its solidification will take place in two stages. Moreover, the three solids S, D and W will differ in minute structure and therefore, probably, in mechanical properties. All mixtures whose temperature lies above the line ACB are wholly liquid, hence this line is often called the "liquidus"; all mixtures at temperatures below that of the horizontal line through C are wholly solid, hence this line is sometimes called the "solidus," but in more complex cases the solidus is often curved. At temperatures between the solidus and the liquidus a mixture is partly solid and partly liquid. This general case has been discussed at length because a careful study of it will much facilitate the comprehension of the similar but more complicated cases that occur in the examination of alloys. A great many mixtures of metals have been examined in the above-mentioned way.

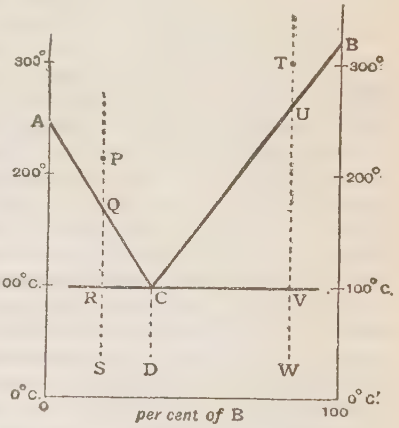


FIG. 5.

Fig. 6 gives the freezing-point diagram for alloys of lead and tin. We see in it exactly the features described above. The two sloping lines cutting at the eutectic point are the freezing-point curves of alloys that, when they begin to solidify, deposit crystals of lead and tin respectively. The horizontal line through the eutectic point gives the second halt in cooling, due to the simultaneous formation of lead crystals and tin crystals. In the case of this pair of metals, or indeed of any metallic alloy, we cannot see the crystals forming, nor can we easily filter them off and examine them apart from the liquid, although this has been done in a few cases. But if we polish the solid alloys, etch them if necessary, and examine them microscopically, we shall find that alloys on the *lead* side of the diagram consist of comparatively large crystals of lead embedded in a minute complex, which is due to the simultaneous crystallization of the two metals during the solidification at the eutectic temperature. If we examine alloys on the *tin* side we shall find large crystals of tin embedded in the same complex. The eutectic alloy itself, fig. 2 (Plate), shows the minute complex of the tin-lead eutectic, photographed by J. A. Ewing and W. Rosenhain, and fig. 3 (Plate), photographed by F. Osmond, shows the structure of a silver-copper alloy containing considerably more silver than the eutectic. Here, the large dark masses are the silver or silver-rich substance that crystallized above the eutectic temperature, and the more minute black and white complex represents the eutectic. It is not safe to assume that the two ingredients we see are pure silver and pure copper; on the contrary, there is reason to think that the crystals of silver contain some copper uniformly diffused through them, and vice versa. It is, however, not possible to detect the copper in the silver by means of the microscope. This uniform distribution of a solid substance throughout the mass of another, so as to form a homogeneous material, is called "solid solution," and we may say that solid silver can dissolve copper. Solid solutions are probably very common in alloys, so that when an alloy of two metals shows two constituents under the microscope it is never safe to infer, without further evidence, that these are the two pure metals. Sometimes the whole alloy is a uniform solid solution. This is the case with the copper-tin alloys containing less than 9% by weight of tin; a microscopic examination reveals only one material, a copper-like substance, the tin having disappeared, being in solution in the copper.

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[1] The instructive case of the solidification of a solution of common salt in water is discussed in the article FUSION.

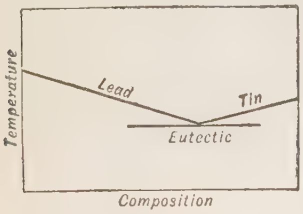

FIG. 6.

Much information as to the nature of an alloy can be obtained by placing several small ingots of the same alloy in a furnace which is above the melting-point of the alloy, and allowing the temperature to fall slowly and uniformly. We then extract one ingot after another at successively lower temperatures and chill each ingot by dropping it into water or by some other method of very rapid cooling. The chilling stereotypes the structure existing in the ingot at the moment it was withdrawn from the furnace, and we can afterwards study this structure by means of the microscope. We thus learn that the bronzes referred to above, although chemically uniform when solid, are not so when they begin to solidify, but that the liquid deposits crystals richer in copper than itself, and therefore that the residual liquid becomes richer in tin. Consequently, as the final solid is uniform, the crystals formed at first must change in composition at a later stage. We learn also that solid solutions which exist at high temperatures often break up into two materials as they cool; for example, the bronze of fig. 1, which in that figure shows two materials so plainly, if chilled at a somewhat higher temperature but when it was already solid, is found to consist of only one material; it is then a uniform solid solution. The difference between softness and hardness in ordinary steel is due to the permanence of a solid solution of carbon in iron if the steel has been chilled or very rapidly cooled, while if the steel is slowly cooled this solid solution breaks up into a minute complex of two substances which is called pearlite. The pearlite when highly magnified somewhat resembles the lead-tin eutectic of fig. 2 (Plate). In the case of steel (see IRON AND STEEL) the solid solution is very hard, while the pearlite complex is much softer. In the case of some bronzes, for example that with about 25% of tin, the solid solution is soft, and the complex into which it breaks up by slow cooling is much harder, so that the same process of heating and chilling which hardens steel will soften this bronze.

If we melt an alloy and chill it before it has wholly solidified, we often get evidence of the crystalline character of the solid matter which first forms. Fig. 4 (Plate) is the pattern found in a bronze containing 27·7% of tin when so treated. The dark, regularly oriented crystal skeletons were already solid at the moment of chilling; they are rich in copper. The lighter part surrounding them was liquid before the chill; it is rich in tin. This alloy, if allowed to solidify completely before chilling, turns into a uniform solid solution, and at still lower temperatures the solid solution breaks up into a pearlite complex. The analogy between the breaking up of a solid solution on cooling and the formation of a eutectic is obvious. Iron and phosphorus unite to form a solid solution which breaks up on cooling into a pearlite. Other cases could be quoted, but enough has been said to show the importance of solid solutions and their influence on the mechanical properties of alloys. These uniform solid solutions must not be mistaken for chemical compounds; they can, within limits, vary in composition like an ordinary liquid solution. But the occasional or indeed frequent existence of chemical compounds in alloys has now been placed beyond doubt.

We can sometimes obtain definite compounds in a pure state by the action of appropriate solvents which dissolve the rest of the alloy and do not attack the crystals of the compound. Thus, a number of copper-tin alloys when digested with hydrochloric acid leave the same crystalline residue, which on analysis proves to be the compound Cu_3Sn. The bodies $SbNa_3$, $BiNa_3$, $SnNa_4$, compounds of iron and molybdenum and many other substances, have also been isolated in this way. The freezing-point curve sometimes indicates the existence of chemical compounds. The simple type of curve, such as that of lead and tin, fig. 6, consisting of two downward sloping branches meeting in the eutectic point, and that of thallium and tin, the upper curve of fig. 7, certainly give no indication of chemical combination. But the curves are not always so simple as the above. The lower curve of fig. 7 gives the freezing-point curve of mercury and thallium; here A and E are the melting-points of pure mercury and pure thallium, and the branches AB and ED do not cut each other, but cut an intermediate rounded branch BCD. There are thus two eutectic alloys B and D, and the alloys with compositions between B and D have higher melting-points. The summit C of the branch BCD occurs at a percentage exactly corresponding to the formula Hg_2Tl. It is probable that all the alloys of compositions between B and D, when they begin to solidify, deposit crystals of the compound; the lower eutectic B probably corresponds to a solid complex of mercury and the compound. The point B is at – 60° C., the lowest temperature at which any metallic substance is known to exist in the liquid state. The higher eutectic D may correspond to a complex of solid thallium and the compound; but the possible existence of solid solutions makes further investigation necessary here. The curves of fig. 7 were determined by N. S. Kurnakow and N. A. Puschin. Sometimes a freezing-point curve contains more than one intermediate summit, so that more than one compound is indicated. For example, in the curve for gold-aluminium, ignoring minor singularities, we find two intermediate summits, one at the percentage Au_2Al, and another at the percentage $AuAl_2$. Microscopic examination fully confirms the existence of these compounds. The substance $AuAl_2$ is the most remarkable compound of two metals that has so far been discovered; although it contains so much aluminium its melting-point is as high as that of gold. It also possesses a splendid purple

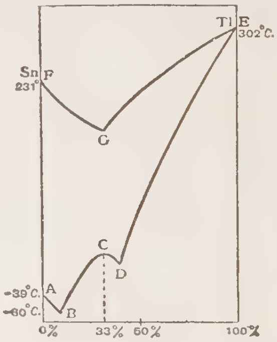

FIG. 7.

colour, more remarkable than that of any other metal or alloy. Many other inter-metallic compounds have been indicated by summits in freezing-point curves. For example, the system sodium-mercury has a remarkable summit at the composition $NaHg_2$. This compound melts at 350° C., a temperature far above the melting-point of either sodium or mercury. In the system potassium-mercury, the compound KHg_2 is similarly indicated. In the curve for sodium-cadmium, the compound $NaCd_2$ is plainly shown. These three examples are taken from the work of N. S. Kurnakow. Various compounds of the alkali metals with bismuth, antimony, tin and lead have been prepared in a pure state. Such are the compounds $SbNa_3$, $BiNa_3$, $PbNa_2$, $SnNa_4$. Of these, the first three are well indicated on the freezing-point curves. The intermediate summits occurring in the freezing-point curves of alloys are usually rounded; this feature is believed to be due to the partial decomposition of the compound which takes place when it melts. The formulae of the group of substances last mentioned are in harmony with the ordinary views of chemists as to valency, but the formulae $NaHg_2$, $NaCd_2$, $NaTl_2$, $AuAl_2$ are more surprising. They indicate the great gaps in our present knowledge of the subject of valency. We must not take it for granted, when the freezing-point curve gives no indication of the compound, that the compound does not exist in the solid alloy. For example, the compound Cu_3Sn is not indicated in the freezing-point curve, and indeed a liquid alloy of this percentage does not begin to solidify by the formation of crystals of Cu_3Sn; the liquid solidifies completely to a uniform solid solution, and only at a lower temperature does this change into crystals of the compound, the transformation being accompanied by a considerable evolution of heat. Until recently the vast subject of inter-metallic compounds has been an unopened book to chemists. But the subject is now being vigorously studied, and, apart from its importance as a branch of descriptive chemistry, it is throwing light, and promises to throw more, on obscure parts of chemical theory.

The graphical representation of the properties of alloys can be extended so as to record all the changes, thermal and chemical, which the alloy undergoes after, as well as before, solidification, including the formation and breaking up of solid solutions and compounds. For an example of such a diagram, see the Bakerian Lecture, 1903, *Phil. Trans.*, A. 346. The Phase Rule of Willard Gibbs, especially as developed by Bakhuis Roozeboom, is a most useful guide in such investigations.

So far we have been considering alloys containing two metals; the phenomena they present are by no means simple. But when three or more metals are present, as is often the case in useful alloys, the phenomena are much more complicated. With three component metals the complete diagram giving the variations in any property must be in three dimensions, although by the use of contour lines the essential facts can be represented in a plane diagram. The following method, depending on the constancy of the sum of the perpendiculars from any point on to the sides of an equilateral triangle, can be adopted:—Let ABC (fig. 8) be an equilateral triangle, the angular points corresponding to the three pure metals A, B, C. Then the composition of any alloy can be represented by a point P, so chosen that the perpendicular Pa on to the side BC gives the percentage of A in the alloy, and the perpendiculars Pb and Pc give the percentages of B and C respectively. Points on the side AB will correspond to binary alloys containing only A and B, and so on. If now we wish to represent the variations in some property, such as fusibility, we determine the freezing-points of a number of alloys distributed fairly uniformly over the area of the triangle, and, at each point corresponding to an alloy, we erect an ordinate at right angles to the plane of the paper and proportional in length to the freezing temperature of that alloy. We can then draw a continuous surface through the summits of all these ordinates, and so obtain a freezing-point surface, or liquidus; points above this surface will correspond to wholly liquid alloys. The ternary alloys containing bismuth, tin and lead have been studied in this way by F. Charpy and by E. S. Shepherd. We have here a comparatively simple case, as the metals do not form compounds. The solid alloy consists of crystals of pure tin in juxtaposition with crystals of almost pure lead and bismuth, these two metals dissolving each other in solid solution to the extent of a few per cent only. If now we cut the freezing-point surface by planes parallel to the base ABC we get curves giving us all the alloys whose freezing-point is the same; these isothermals can be projected on to the plane of the triangle and are seen as dotted lines in fig. 9. The freezing surface, in this case, consists of three sheets each starting from an angular point of the surface, that is, from the freezing-point of a pure metal. The sheets meet in pairs along three lines which themselves meet in a point. In fig. 9, due to F. Charpy, these lines are projected on to the plane of the triangle as Ee, E′e and E″e. The area of the triangle is thus divided into three regions. The region PbEeE′ contains all the alloys that commence their solidification by the crystallization of lead; similarly, the other two regions correspond to the initial crystallization of bismuth and tin respectively; these areas are the projections of the three sheets of the freezing-point surface. The points E, E′, E″ are the eutectics of binary alloys. Alloys represented by points on Ee, when they begin to solidify, deposit crystals of lead and bismuth simultaneously; Ee is a eutectic line, as also are E′e and E″e. The alloy of the point e is the ternary eutectic; it deposits the three metals simultaneously during the whole period of its solidfication and solidifies at a constant temperature. As the lines of the surface which correspond to Ee, &c., slope downwards to their common intersection it follows that the alloy e has the lowest freezing-point of any mixture of the three metals; this freezing-point is 96° C., and the alloy e contains about 32% of lead, 15·5% of tin and 52·5% of bismuth.

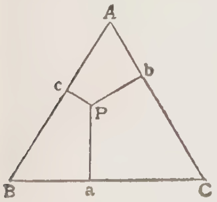

Fig. 8.

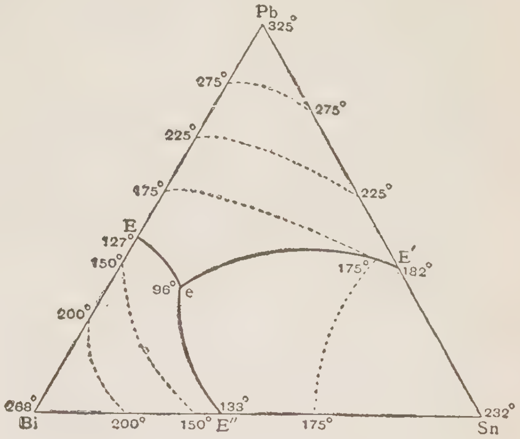

Fig. 9.

It is evident that any other property can be represented by similar diagrams. For example, we can construct the curve of conductivity of alloys of two metals or the surface of conductivity of ternary alloys, and so on for any measurable property.

The electrical conductivity of a metal is often very much decreased by alloying with it even small quantities of another metal. This is so when gold and silver are alloyed with each other, and is true in the case of alloys of copper. When a pure metal is cooled to a very low temperature its electrical conductivity is greatly increased, but this is not the case with an alloy. Lord Rayleigh has pointed out that the difference may arise from the heterogeneity of alloys. When a current is passed through a solid alloy, a series of Peltier effects, proportional to the current, are set up between the particles of the different metals, and these create an opposing electromotive force which is indistinguishable experimentally from a resistance. If the alloy were a true chemical compound the counteracting electromotive force should not occur; experiments in this direction are much needed.

Sir William Chandler Roberts-Austen has shown that in the case of molten alloys the conduction of electricity is apparently metallic, no transfer of matter attending the passage of the current. A group of bodies may, however, be yet discovered between alloys and electrolytes in which evidence may be found of some gradual change from wholly metallic to electrolytic conduction. A. P. Laurie has determined the electromotive force of a series of copper-zinc, copper-tin and gold-tin alloys, and as the result of his experiments he points to the existence of definite compounds. Explosive alloys have been formed by H. St Claire Deville and H. J. Debray in the case of rhodium, iridium and ruthenium, which evolve heat when they are dissolved in zinc. When the solution of the rhodium-zinc alloy is treated with hydrochloric acid, a residue is left which undergoes a change with explosive violence if it be heated *in vacuo* to 400°. The alloy is then insoluble in "aqua regia." The metals have therefore passed into an insoluble form by a comparatively slight elevation of temperature.

Surfusion.

Metals do not appear to have been studied from the point of view of surfusion until 1880, when A. D. van Riemsdijk showed that gold and silver would both pass below their actual freezing-points without becoming solid. Roberts-Austen pointed out that surfusion might be easily measured in metals and in alloys by the sensitive method of recording pyrometry perfected by him. He also showed that the crossing of curves of solubility, which had already been observed by H. le Chatelier and by A. C. A. Dahms in the case of salts, could be measured in the lead-tin alloys. The investigation of the mutual relations of partially miscible liquids, due to P. Alexejew, D. P. Konovalow, and to P. E. Duclaux, was extended to alloys by Alder Wright. The addition of a third metal will sometimes render the mixture of two other metals homogeneous. C. T. Heycock and F. H. Neville proved that when one metal is alloyed with a small quantity of some other metal, the solidification obeys the law of F. M. Raoult. Their experiments, although not conclusive, appear to indicate that the molecule of a metal when in dilute solution often consists of one atom. There are, however, numerous exceptions to this rule. In the cases of aluminium dissolved in tin and of mercury or bismuth in lead, it is at least probable that the molecules in solution are Al_2, Hg_2 and Bi_2 respectively, while tin in lead appears to form a molecule of the type Sn_4.

Industrial applications.

Since 1875 increased attention has been devoted to the applications of the rarer metals. Thus nickel, which was formerly used in the manufacture of "German silver" as a substitute for silver, is now widely employed in naval construction and in the manufacture of steel armour-plate and projectiles. Alloyed with copper, it is used for the envelopes of bullets. A nickel steel containing 36 % of nickel has the property of retaining an almost constant volume when heated or cooled through a considerable range of temperature; it is therefore useful for the construction of pendulums and for measures of length. Another steel containing 45 % of nickel has, like platinum, the same coefficient of expansion as glass. It can therefore be employed, instead of that costly metal, in the construction of incandescent lamps where a wire has to be fused into the glass to establish electric connexion between the inside and the outside of the bulb. Manganese not only forms with iron several alloys of great interest, but alloyed with copper it is used for electrical purposes, as an alloy can thus be obtained with an electrical resistance that does not alter with change of temperature; this alloy, called manganin, is used in the construction of resistance-boxes. Chromium also, in comparatively small quantities, is taking its place as a constituent of steel axles and tires, and in the manufacture of tool-steel. Steels containing as much as 12 % of tungsten are now used as a material for tools intended for turning and planing iron and steel. The peculiarity of these steels is that no quenching or tempering is required. They are normally hard and remain so, even at a faint red heat; much deeper cuts can therefore be taken at a high speed without blunting the tool. Vanadium, molybdenum and titanium may be expected soon to play an important part in the constitution of steel. Titanium is alloyed in small quantities with aluminium for use in naval architecture. Aluminium, when alloyed with a few per cent of magnesium, gains greatly in rigidity while remaining very light; this alloy, under the name of magnalium, is coming into use for small articles in which lightness and rigidity have to be combined. One of the most interesting amongst recent alloys is Conrad Heusler's alloy of copper, aluminium and manganese, which possesses magnetic properties far in excess of those of the constituent metals.

The importance is now widely recognized of considering the mechanical properties of alloys in connexion with the freezing-point curves to which reference has already been made, but the subject is a very complicated one, and all that need be said here, is that when considered in relation to their melting-points the pure metals are consistently weaker than alloys. The presence in an alloy of a eutectic which solidifies at a much lower temperature than the main mass, implies a great reduction in tenacity, especially if it is to be used above the ordinary temperature as in the case of pipes conveying super-heated steam. It has also been stated that alloys of metals with similar melting-points have higher tenacity when the atomic volumes of the constituent metals differ than when they are nearly the same.

REFERENCES.—Alloys have formed a subject of reports to several scientific societies. Sir W. C. Roberts-Austen's six *Reports* (1891 to 1904) to the Alloys Research Committee of the Institution of Mechanical Engineers, London, the last report being concluded by William Gowland; the *Cantor Lectures on Alloys delivered at the Society of Arts* and the *Contribution à l'étude des alliages* (1901), published by the *Société d'encouragement pour l'industrie nationale* under the direction of the *Commission des alliages* (1896–1900), should be consulted. The theoretical aspect is discussed in Léon Guillet's *Étude théorique des alliages métalliques* (1904). W. T. Brannt's *The Metallic Alloys* (1896); Roberts-Austen's *Introduction to the Study of Metallurgy* (1902); and R. G. Thurston's *Materials of Engineering*, should be consulted for the more practical details.

Recent progress is reported in the scientific periodicals, especially in *The Iron and Steel Metallurgist*, formerly *The Metallographist* (Boston, Mass.), and *Metallurgie* (Halle). Important memoirs by Ewing and Rosenhain, and by C. T. Heycock and F. H. Neville in the *Philosophical Transactions*, by N. S. Kurnakow in the *Zeitschrift für anorganische Chemie*, and by E. S. Shepherd in the *Journal of Physical Chemistry*, may also be consulted. (W. C. R.-A.; F. H. Ne.)

ALLPORT, SIR JAMES JOSEPH (1811–1892), English railway manager, born on the 27th of February 1811, was a son of William Allport, of Birmingham, and was associated with railways from an early period of his life. In 1843 he became general manager of the Birmingham and Derby railway, and in the following year succeeded to the same position on the Newcastle and Darlington line. Six years later he assumed the charge of the Manchester, Sheffield and Lincolnshire (now the Great Central) railway, and finally, in 1853, was appointed to the general managership of the Midland railway—an office which he held continuously, with the exception of a few years between 1857 and 1860, when he was managing director to Palmer's Shipbuilding Company at Jarrow, until his retirement in 1880, when he became a director. During these twenty-seven years the Midland grew to be one of the most important railway systems in England, partly by the absorption of smaller lines and partly by the construction of two main extensions—on the south to London and on the north to Carlisle—whereby it obtained an independent through-route between the metropolis and the north. In the railway world Sir James Allport was known as a keen tactician and a vigorous fighter, and he should be remembered as the pioneer of cheap and comfortable railway travelling. He was the first to appreciate the importance of the third-class passenger as a source of revenue, and accordingly, in 1872, he inaugurated the policy—subsequently adopted more or less completely by all the railways of Great Britain—of carrying third-class passengers in well-fitted carriages at the uniform rate of one penny a mile on all trains. The diminution in the receipts from second-class passengers, which was one of the results, was regarded by some authorities as a sign of the unwisdom of his action, but to him it appeared a sufficient reason for the abolition of second-class carriages, which therefore disappeared from the Midland system in 1875, the first-class fares being at the same time substantially reduced.

He was also the first to introduce the Pullman car on British railways. Allport received the honour of knighthood in 1884. He died in London on the 25th of April 1892.

ALLPORT, SAMUEL (1816–1897), English petrologist, brother of the above, was born in Birmingham on the 23rd of January 1816, and educated in that city. Although occupied in business during the greater portion of his life, his leisure was given to geological studies, and when residing for a short period in Bahia, S. America, he made observations on the geology, published by the Geological Society in 1860. His chief work was in microscopic petrology, to the study of which he was attracted by the investigations of Dr H. C. Sorby; and he became one of the pioneers of this branch of geology, preparing his own rock-sections with remarkable skill. The basalts of S. Staffordshire, the diorites of Warwickshire, the phonolite of the Wolf Rock (to which he first directed attention), the pitchstones of Arran and the altered igneous rocks near the Land's End were investigated and described by him during the years 1869–1879 in the *Quarterly Journal of the Geological Society* and in the *Geological Magazine*. In 1880 he was appointed librarian in Mason College, a post which he relinquished on account of ill-health in 1887. In that year the Lyell medal was awarded to him by the Geological Society. A few years later he retired to Cheltenham, where he died on the 7th of July 1897.

ALL-ROUND ATHLETICS. Specialization in athletic sports, although always existent, is to a great extent a modern product. In ancient times athletes were encouraged to excel in several branches of sport, often quite opposite in character. Thus the athlete held in highest honour at the Olympic Games (see GAMES, CLASSICAL) was the winner of the *pentathlon*, which consisted of running, jumping, throwing the javelin and the discus, and wrestling. All-round championships have existed for many years both in Scotland and Ireland, and in America there are both national and sectional championships. The American national championship was instituted in 1884, the winner being the athlete who succeeds in obtaining the highest marks in the following eleven events; 100 yards run; putting 16 ℔ shot; running high jump; half-mile walk; throwing 16 ℔ hammer; 120 yards hurdle race; pole vault; throwing 56 ℔ weight; one mile run; running broad jump; quarter-mile run. In each event 1000 points are allowed for equalling the "record," and an increasing number of points is taken off for performances below "record," down to a certain "standard," below which the competitor scores nothing. For example, in the 100 yards run the time of 9⅘ seconds represents 1000 points; that of 10 seconds scores 958, or 42 points less; 10⅕ seconds scores 916, &c.; and below 14⅕ seconds the competitor scores nothing. Should the record be broken 42 points are added for each ⅕ second. (See also ATHLETIC SPORTS.)

ALL SAINTS, FESTIVAL OF (*Festum omnium sanctorum*), also formerly known as ALL HALLOWS, or HALLOWMAS, a feast of the Catholic Church celebrated on the 1st of November in honour of all the saints, known or unknown. In the Roman Catholic Church it is a festival of the first rank, with a vigil and an octave. Common commemorations, by several churches, of the deaths of martyrs began to be celebrated in the 4th century. The first trace of a general celebration is in Antioch on the Sunday after Pentecost, and this custom is also referred to in the 74th homily of St Chrysostom (407). The origin of the festival of All Saints as celebrated in the West is, however, somewhat doubtful. In 609 or 610 Pope Boniface IV. consecrated the Pantheon at Rome to the Blessed Virgin and all the martyrs, and the feast of the *dedicatio Sanctae Mariae ad Martyres* has been celebrated at Rome ever since on the 13th of May. The idea, based on the medieval liturgiologists, that this festival was the origin of that of All Saints has now been abandoned. The latter is possibly traceable to the foundation by Gregory III. (731–741) of an oratory in St Peter's for the relics "of the holy apostles and of all saints, martyrs and confessors, of all the just made perfect who are at rest throughout the world." So far as the Western Church generally is concerned, though the festival was already widely celebrated in the days of Charlemagne, it was only made of obligation throughout the Frankish empire in 835 by a decree of Louis the Pious issued "at the instance of Pope Gregory IV. and with the assent of all the bishops," which fixed its celebration on the 1st of November. The festival was retained at the Reformation in the calendar of the Church of England, and also in that of many of the Lutheran churches. In the latter, in spite of attempts at revival, it has fallen into complete disuse.

ALL SOULS' DAY (*Commemoratio omnium fidelium defunctorum*), the day set apart in the Roman Catholic Church for the commemoration of the faithful departed. The celebration is based on the doctrine that the souls of the faithful which at death have not been cleansed from venial sins, or have not atoned for past transgressions, cannot attain the Beatific Vision, and that they may be helped to do so by prayer and by the sacrifice of the mass. The feast falls on the 2nd of November; or on the 3rd if the 2nd is a Sunday or a festival of the first class. The practice of setting apart a special day for intercession for certain of the faithful departed is of great antiquity; but the establishment of a feast of general intercession was in the first instance due to Odilo, abbot of Cluny (d. 1048). The legend connected with its foundation is given by Peter Damiani in his *Life of St Odilo*. According to this, a pilgrim returning from the Holy Land was cast by a storm on a desolate island where dwelt a hermit. From him he learned that amid the rocks was a chasm communicating with purgatory, from which rose perpetually the groans of tortured souls, the hermit asserting that he had also heard the demons complaining of the efficacy of the prayers of the faithful, and especially of the monks of Cluny, in rescuing their victims. On returning home the pilgrim hastened to inform the abbot of Cluny, who forthwith set apart the 2nd of November as a day of intercession on the part of his community for all the souls in purgatory. The decree ordaining the celebration is printed in the Bollandist *Acta Sanctorum* (*Saec. VI.*, pt. i. p. 585). From Cluny the custom spread to the other houses of the Cluniac order, was soon adopted in several dioceses in France, and spread thence throughout the Western Church. At the Reformation the celebration of All Souls' Day was abolished in the Church of England, though it has been renewed in certain churches in connexion with the "Catholic revival." Among continental Protestants its tradition has been more tenaciously maintained. Even Luther's influence was not sufficient to abolish its celebration in Saxony during his lifetime; and, though its ecclesiastical sanction lapsed before long even in the Lutheran Church, its memory survives strongly in popular custom. Just as it is the custom of French people, of all ranks and creeds, to decorate the graves of their dead on the *jour des morts*, so in Germany the people stream to the grave-yards once a year with offerings of flowers.

Certain popular beliefs connected with All Souls' Day are of pagan origin and immemorial antiquity. Thus the dead are believed by the peasantry of many Catholic countries to return to their former homes on All Souls' night and partake of the food of the living. In Tirol cakes are left for them on the table and the room kept warm for their comfort. In Brittany the people flock into the cemeteries at nightfall to kneel bare-headed at the graves of their loved ones, and to fill the hollow of the tombstone with holy water or to pour libations of milk upon it, and at bedtime the supper is left on the table for the soul's refreshment.

ALLSTON, WASHINGTON (1779–1843), American historical painter and poet, was born on the 5th of November 1779 at Waccamaw, South Carolina, where his father was a planter. He graduated at Harvard in 1800, and for a short time pursued his artistic studies at Charleston with Edward Greene Malbone (1777–1807) the miniature painter, and Charles Fraser (1782–1860). With the former, in 1801, he went to London, and entered the Royal Academy as a student of Benjamin West, with whom he formed a lifelong friendship. In 1804 he went to Paris, and, after a few months' residence there, to Rome, where he spent the greater part of the next four years. During this period he became intimate with Coleridge and Thorwaldsen. From 1809 to 1811 he resided in his native country, and from 1811 to 1817 he painted in England. After visiting Paris a second time, he returned to the United States, and practised his profession at Boston (1818–1830), and afterwards at Cambridge, Massachusetts, where he died on the 9th of July 1843. He was elected an associate of the Royal Academy in 1819. In colour and the management of light and shade Allston closely imitated the Venetian school, and he has hence been styled the "American Titian." Many of his pictures have Biblical subjects, and Allston himself had a profoundly religious nature. His first considerable painting, "The Dead Man Revived," executed shortly after his second visit to England, and now at the Pennsylvania Academy of Fine Arts in Philadelphia, gained a prize of 200 guineas. In England he also painted his "St Peter Liberated by the Angel," "Uriel in the Sun" (at Stafford House), "Jacob's Dream" (at Petworth) and "Elijah in the Wilderness." To the period of his residence in America belong "The Prophet Jeremiah" (at Yale), "Saul and the Witch of Endor," "Miriam," "Beatrice," "Rosalie," "Spalatro's Vision of the Bloody Hand," and the vast but unfinished "Belshazzar's Feast" (in the Boston Athenaeum), at which he was working at the time of his death. As a writer, Allston shows great facility of expression and imaginative power. His friend Coleridge (a portrait of whom by Allston is in the National Gallery) said of him that he was surpassed by no man of his age in artistic and poetic genius. His literary works are—*The Sylphs of the Seasons and other Poems* (1813), where he displays true sympathy with nature and deep knowledge of the human heart; *Monaldi* (1841), a tragical romance, the scene of which is laid in Italy; and *Lectures on Art*, edited by his brother-in-law, R. H. Dana the novelist (1850).

See J. B. Flagg's *Life and Letters of Washington Allston* (New York, 1892).

ALLUVION (Lat. *alluvio*, washing against), a word taken from Roman law, in which it was one of the examples of *accessio*, that is, acquisition of property without any act being done by the acquirer. It signifies the gradual accretion of land or formation of an island by imperceptible degrees. If the accretion or formation be by a torrent or flood, the property in the severed portion or new island continues with the original owner until the trees, if any, swept away with it take root in the ground. Alluvion never attached at all in the case of *agri limitati*, that is, lands belonging to the state and leased or sold in plots. Dig. xli. 1, 7, is the main authority. English law is in general agreement (except as to *agri limitati*) with Roman, as appears from the judgment in *Foster* v. *Wright*, 1878, 4 C.P.D. 438. The Scottish law, as laid down by the House of Lords in *Earl of Zetland* v. *Glover Incorporation*, 1872, L.R. 2 H.L., Sc., 70, is in accordance with the English. (See WATER RIGHTS.)

ALLUVIUM, soil or land deposited by running water. All streams, from the tiniest rill to the greatest river, are continually engaged in transporting downstream solid particles of rock, the product of weathering agencies in the area which they drain. Since the capacity of a stream to carry matter in suspension is proportional to its velocity, it follows that any circumstance tending to retard the rate of flow will induce deposition. Thus a fall in the gradient at any point in the course of a stream; any snag, projection or dam, impeding the current; the reduced velocity caused by the overflowing of streams in flood and the dissipation of their energy where they enter a lake or the sea, are all contributing causes to alluviation, or the deposition of stream-borne sediment. It is evident from the foregoing remarks, that while even the smallest stream may make deposits of alluvial character it is in the flood-plains and deltas of large rivers that the great alluvial deposits are to be found. The finer material constituting alluvium, often described as "silt," is sand and mud. Although it may be exceedingly fine-grained, there is usually very little clay in alluvium. The larger materials include gravel of all degrees of coarseness; carbonaceous matter is often an important element. The amount of solid matter borne by large streams is enormous; many rivers derive their names from the colour thereby imparted to the water, *e.g.* Hwang Ho = Yellow river, Missouri = Big Muddy, the Red river, &c. It has been estimated that the Mississippi annually carries 406¼ million tons of sediment to the sea; the Hwang Ho 796 million tons; the Po 67 million tons. Many shallow lakes have been completely filled with alluvium and their sites are now occupied by fertile plains; this process may be seen in operation almost anywhere; a good illustration is the delta of the Rhone in Lake Geneva. Alluvial deposits may be of great size. The flood-plain of the Mississippi has an area of 50,000 sq. m.; the great delta of the Ganges and Brahmaputra has an area of about 60,000 sq. m.; that of the Hwang Ho reaches out 300 m. into the sea and has a coastal border of about 400 m. Old alluvial deposits are left high above the existing level of many rivers, in the form of "terraces" of gravel and loam, the streams to which these owe their existence having modified their courses and cut deeper channels; such are the alluvial gravels and brick-earths upon which much of "greater London" is built. In some regions alluvial deposits are the resting places of gemstones and gold, platinum, &c.; it is from these deposits that the largest nuggets of gold have been obtained. Alluvial soils are almost invariably of great fertility; it is due to the alluvial mud annually deposited by the Nile that the dwellers in Egypt have been able to grow their crops for over 4000 years without artificial fertilization.

ALLYL ALCOHOL, C_3H_5OH or $CH_2{:}CH{\cdot}CH_2OH$, a compound which occurs in very small quantities in wood spirit. It may be prepared from allyl iodide by the action of moist silver oxide; by the reduction of acrolein; or by heating glycerin with oxalic acid and a little ammonium chloride to 260° C. In this last reaction glycerol monoformin is produced as an intermediate product, but is decomposed as the temperature rises:—

$$C_3H_5(OH)_3+H_2C_2O_4=\underset{\text{glycerol monoformin}}{C_3H_5(OH)_2{\cdot}O{\cdot}CHO}+CO_2+H_2O$$

$$C_3H_5(OH)_2{\cdot}O{\cdot}CHO=C_3H_5OH+CO_2+H_2O$$

It is a colourless mobile liquid of pungent smell, boiling at 97° C. Being an unsaturated compound it combines readily with the halogens. Oxidation by strong oxidizing agents converts it successively into its aldehyde, acrolein, and into acrylic acid. By gentle oxidation with potassium permanganate it may be converted into glycerin.

ALMA, a river of Russia, in the S.W. of the Crimea, entering the Black Sea 17 m. N. of Sevastopol. It gives its name to a famous victory gained over the Russians, on the 20th of September 1854, by the allied armies in the Crimean War (*q.v.*). The south bank of the river is bordered by a long ridge, which becomes steeper as it approaches the sea, and upon this the Russians, under Prince Menshikov, were drawn up, to bar the Sevastopol road to the allies, who under General Lord Raglan and Marshal St Arnaud approached from the north over an open plain. The Russian commander massed his troops in heavy columns after the fashion of 1813, and drew in his left wing so that it should as far as possible be out of range of the allied men-of-war, which were sailing down the coast in line with their land forces. The allied generals decided that the French (right wing) and the Turks should attack Menshikov's left, while the British, further inland, were to assault the front of the Russian position. The forces engaged are stated by Hamley (*War in the Crimea*) as, French and Turks, 35,000 infantry, with 68 guns; British, 23,000 infantry, 1000 cavalry and 60 guns; Russians, 33,000 infantry, 3800 cavalry and 120 guns; by the Austrian writer Berndt (*Zahl im Kriege*) the allied forces are reckoned at 57,000 men with 108 guns, and the Russians at 33,600 men with 96 guns. The French advance met at first with little opposition, and several divisions scaled the cliffs of the lower Alma without difficulty. Menshikov relied apparently on being able to detach his reserves to cope with them, but the assailants moved with a rapidity which he had not counted upon, and the Russians only came into action piecemeal in this quarter. Opposite the British, who as usual deployed at a distance and then advanced in long continuous lines, the Russians were posted on the crest of a long glacis-like slope, which offered but little dead ground to an assailant. The village of Burliuk, and the vineyards which bordered the river, were quickly cleared by the British skirmishers, and the line of battle behind them crossed, though with some difficulty. On emerging from the cover afforded by the river-bed the British divisions, now crowded together, but still preserving their general line, came under a terrible fire from heavy guns and musketry. The enemy's artillery was three hundred yards away, yet the British pressed on in spite of their losses, and as some of the Light Division troops reached the "Great Battery" the Russians hurried their guns away to safety. In the meantime, on both sides of this battery, the assailants had come to close quarters with the Russian columns, which were aided by their field guns. A brave counter-attack was made by the Russian Vladimir regiment, 3000 strong, against the troops which had stormed the great battery, and for want of support the British were driven out again. But they soon rallied, and now the second line had crossed and formed for attack. The Guards brigade attacked the Vladimir regiment, and on the left the Highland brigade and the cavalry moved forward also. Some of the field artillery, which had now crossed the Alma, fired steadily into the closed masses of the Russian reserve, and the Vladimir regiment lost half of its numbers under the volleys of the Guards. The French were now severely pressing the Russian left, and one-third of Menshikov's forces was drawn into the fight in that quarter. The success of the frontal assault had dispirited the remainder of the defenders, and Menshikov drew off his forces southwards. He had lost 5700 men (Berndt and Hamley). The British had about 2000 killed and wounded; the French stated their losses at 1340 men.

ALMACANTAR (from the Arabic for a sun-dial), an astronomical term for a small circle of the sphere parallel to the horizon; when two stars are in the same almacantar they have the same altitude. The term was also given (1880) to an instrument invented by S. C. Chandler to determine the latitude or correct the timepiece, of great value because of its freedom from instrumental errors.

ALMACK'S, formerly the name of a famous London club and assembly rooms. The founder, known as William Almack, is usually said to have been one Macall, or McCaul, of which name Almack is an anagram. In 1764 he founded a gentlemen's club in Pall Mall, where the present Marlborough Club stands. It was famous for its high play. In 1778 it was taken over by one Brooks, and established as Brooks's Club in St James's Street, where it still exists. In 1765 Almack built a suite of assembly rooms in King's Street, St James's. Here for a ten-guinea subscription a series of weekly balls was given for twelve weeks. They were managed by a committee of ladies of rank, and admission was exceedingly difficult. At Almack's death in 1781 they were left to his niece Mrs Willis. As "Willis's Rooms" they lasted till 1890, when they became a restaurant, but as "Almack's" they ceased in 1863. Several clubs, including a mixed club for ladies and gentlemen, held meetings at Almack's during the 18th and beginning of the 19th centuries. A new London social club (1904) has also adopted the name of Almack's.

ALMADÉN, or ALMADÉN DEL AZOGUE, a town of Spain, in the province of Ciudad Real; situated in mountainous country 55 m. W.S.W. of the city of Ciudad Real. Pop. (1900) 7375. Almadén, the *Sisapon* of the Romans, is celebrated for its mercury mines, which were extensively wrought by the Romans and Moors, and are still productive, the ore increasing in richness with the depth of the descent. The mines ranked with those of Adria, in South Austria, as the most valuable in the world, until the great development of the mercury deposits at New Almaden, in California, U.S.A., between 1853 and 1857. They were long worked by convict labour, owing to their unhealthy atmosphere; and exemption from military service is granted to miners who have worked at Almadén for two years. The annual yield is about 1,400,000 ℔. Lead and sulphur are obtained in the neighbourhood. The nearest railway station is that of Chillón, 3 m. S. on the Madrid-Badajoz-Lisbon line.

ALMAGRO, DIEGO DE (1475–1538), Spanish commander, the companion and rival of Pizarro (*q.v.*), was born at Aldea del Rey in 1475. According to another account he was a foundling in the village from which he derived his name. In 1525 he joined Pizarro and Hernando de Luque at Panama in a scheme for the conquest of Peru (see PERU: *History*). He was executed by order of Pizarro in 1538 in consequence of a dispute as to their respective territories.

ALMANAC, a book or table containing a calendar of the days, weeks and months of the year, a register of ecclesiastical festivals and saints' days, and a record of various astronomical phenomena &c. The derivation of the word is doubtful. The word almanac was used by Roger Bacon (*Opus Majus*, 1267) for tables of the apparent motions of the heavenly bodies. The Italian form is *almanacco*, French *almanach*, and the Spanish is *almanaque*; all of which, according to the *New English Dictionary*, are probably connected with the Arabic *al-manākh*, a combination of the definite article *al*, and *manākh*, a word of uncertain origin. An Arabic-Castilian vocabulary (1505) gives *manākh*, a calendar, and *manaḥ*, a sun-dial; *manākh* has also been connected with the Latin *manacus*, a sun-dial.

The attention given to astronomy by Eastern nations probably led to the early construction of such tables as are comprised in our almanacs; of these we know little or nothing. The *fasti* (*q.v.*) of the Romans are far better known and were similar to modern almanacs. Almanacs of a rude kind, known as *clogg almanacs*, consisting of square blocks of hard wood, about 8 in. in length, with notches along the four angles corresponding to the days of the year, were in use in some parts of England as late as the end of the 17th century. Dr Robert Plot (1640–1696), keeper of the Ashmolean Museum and professor of chemistry at Oxford, describes one of these in his *Natural History of Staffordshire* (Oxford, 1686); and another is represented in Gough's edition of Camden's *Britannia* (1806, vol. ii. p. 499).

The earliest almanac regarding which J. J. L. de Lalande (*Bibliographie astronomique*, Paris, 1803) could obtain any definite information belongs to the 12th century. Manuscript almanacs of considerable antiquity are preserved in the British Museum and in the libraries of Oxford and Cambridge. Of these the most remarkable are a calendar ascribed to Roger Bacon (1292), and those of Peter de Dacia (about 1300), Walter de Elvendene (1327) and John Somers (1380). It is to be remembered that early calendars (such as the *Kalendarium Lincolniense* of Bishop Robert Grosseteste) frequently bear the names, not of their compilers, but of the writers of the treatises on ecclesiastical computation on which the calendars are based. The earliest English calendar in the British Museum is one for the year 1431. The first printed almanac known was compiled by Pürbach, and appeared between the years 1450 and 1461; the first of importance is that of Regiomontanus, which appears to have been printed at Nuremberg in 1472. In this work the almanacs for the different months embrace three Metonic cycles, or the 57 years from 1475 to 1531 inclusive. The earliest almanac printed in England was *The Kalendar of Shepardes*, a translation from the French, printed by Richard Pynson about 1497.

Early almanacs had commonly the name of "prognostications" in addition, and what they professed to show may be gathered from titles like the following, which is quoted by J. O. Halliwell: "Pronostycacyon of Mayster John Thybault, medycyner and astronomer of the Emperyall Majestie, of the year of our Lorde God MCCCCCXXXIJ., comprehending the iiij. partes of this yere, and of the influence of the mone, of peas and warre, and of the sykenesses of this yere, with the constellacions of them that be under the vij. planettes, and the revolucions of kynges and princes, and of the eclipses and comets." Among almanacs of this class published in England, and principally by the Stationers' Company, are Leonard Digges's *Prognostication Everlasting of Right Good Effect*, for 1553, 1555, &c.; William Lilly's *Merlinus Anglicus Junior* for 1644, &c., and other almanacs and "*prognostications*"; John Booker's *Bloody Almanac* and *Bloody Irish Almanac* for 1643, 1647, &c.—the last attributed erroneously to Richard Napier; John Partridge's *Mercurius Coelestis* for 1681, *Merlinus Redivivus*, &c. The name of Partridge has been immortalized in Pope's *Rape of the Lock*; and his almanacs were very cleverly burlesqued by Swift, who predicted Partridge's own death, in genuine prognosticator's style. The most famous of all the Stationers' Company's predicting almanacs was the *Vox Stellarum* of Francis Moore (1657–1715?), the first number of which was completed in July 1700, and contained predictions for 1701.

Its publication has been continued under the title of *Old Moore's Almanac.* Of a different but not a better sort was *Poor Robin*, dating from 1663, and published by the company down to 1828, which abounded in coarse, sometimes extremely coarse, humour.

The exclusive right to sell "almanacs and prognostications" in England, enjoyed in the time of Elizabeth by two members of the Company of Stationers, was extended by James I. to the two universities and the Stationers' Company jointly; but the universities commuted their privilege for an annuity from the company. This monopoly was challenged by Thomas Carnan, a bookseller, who published an almanac for three successive years, after having been thrice imprisoned on that account by the company. The case came, in 1775, before the court of common pleas, and was decided in Carnan's favour, the question argued being, "Whether almanacs were such public ordinances, such matters of state, as belonged to the king by his prerogative, so as to enable him to communicate an exclusive right of printing them to a grantee of the crown?" In 1779 Lord North attempted to reverse this decision by a parliamentary enactment, but the bill was thrown out. In consequence of this the universities lost their title to their annuity, and in lieu of it they received a parliamentary grant. The company, however, virtually retained its monopoly for many years, by buying up as much as possible all the almanacs issued by other publishers, but in more recent times this power has altogether ceased, although a considerable proportion of the almanacs published in England still issue from the hall of the Stationers' Company. A description of "Almanac Day" at Stationers' Hall will be found in Knight's *Cyclopaedia of London* (1851), p. 588.

On the 1st of January 1828 the Society for the Diffusion of Useful Knowledge issued the *British Almanac* for that year—a publication greatly superior in every way to the almanacs of the time. The success of the *British Almanac*, with its valuable supplement, the *Companion to the Almanac*, led to a great improvement in this class of publications. The Stationers' Company issued the *Englishman's Almanac*, a work of a similar kind. The entire repeal in 1834, by the 3rd and 4th Will. IV. c. 57, of the heavy stamp duty, first imposed in 1710, on all almanacs of fifteenpence per copy, gave an additional stimulus to the publication of almanacs of a better class, and from that time the number has greatly increased. Since 1870, the *British Almanac* and *Companion* have been the principal almanacs published by the Stationers' Company. *Whitaker's Almanac*, commenced in 1868 by Joseph Whitaker (1820–1895), is perhaps the best known of modern almanacs.

In Scotland, almanacs containing much astrological matter appeared to have been published at about the beginning of the 16th century; and about a century later those published at Aberdeen enjoyed considerable reputation. In 1683, the *Edinburgh's True Almanack, or a New Prognostication*, appeared; a publication which improved with years and was issued after 1837 as *Oliver and Boyd's New Edinburgh Almanac*, a standard book of reference for Scottish affairs. *Thom's Irish Almanac* (since 1843) deals mainly with Ireland.

The earliest almanac published in the United States is probably to be ascribed to Bradford's press in Philadelphia, for the year 1687. *Poor Richard's Almanac*, commenced in 1732 by Benjamin Franklin under the pseudonym of "Richard Saunders," and continued by him for twenty-five years, gained a high reputation for its wise and witty sayings; it may have been suggested by a somewhat similar publication by Thomas, of Dedham, Massachusetts. *The American Almanac and Repository of Useful Knowledge* was published at Boston from 1828 to 1861; a continuation, *The National Almanac*, was published only twice, for 1863 and 1864. *The Old Farmer's Almanac* enjoys considerable popularity and has been published for many years. At the present time nearly every religious denomination, trade and newspaper have almanacs or year-books.

In France prophetic almanacs circulated very freely among the poorer and rural classes, although an *ordonnance* of Charles IX. required the seal of a diocesan bishop on all almanacs. In 1579 Henry III. prohibited the publication of predictions relating to political events, a prohibition renewed by Louis XIII. Of such almanacs, the most famous was the *Almanach Liégeois* first published in 1625 at Liége by Matthieu Laensbergh, a person of very problematic existence. Publications of this class subsequently increased in number to such an extent that, in 1852, their circulation was forcibly checked by the government. The most important French almanac is the *Almanach Royal*, afterwards *Impérial*, and now *National*, first published in 1679.

A number of publications, issued in Germany, from the middle of the 18th to the middle of the 19th century, under such titles as *Musenalmanach*, modelled on the *Almanach des Muses*, a contemporary almanac published at Paris, contain some of the best works of some of the most celebrated German poets. The *Almanach de Gotha*, which has existed since 1763, published since 1871 both in French and German, gives a particular account of all the royal and princely families of Europe, and ample details concerning the administration and the statistics of the different states of the world.

For the *Nautical Almanac* and similar publications, see EPHEMERIS.

ALMANDINE, or ALMANDITE, a name applied to certain kinds of precious garnet, being apparently a corruption of alabandicus, which is the name applied by Pliny to a stone found or worked at Alabanda, a town in Caria in Asia Minor. Almandine is an iron alumina garnet, of deep red colour inclining to purple. It is frequently cut with a convex face, or *en cabochon*, and is then known as carbuncle. Viewed through the spectroscope in a strong light, it generally shows three characteristic absorption bands, as first pointed out by Prof. A. H. Church.

Almandine occurs rather abundantly in the gem-gravels of Ceylon, whence it has sometimes been called Ceylon-ruby. When the colour inclines to a violet tint, the stone is often called Syrian garnet, a name said to be taken from Syriam, an ancient town of Pegu. Large deposits of fine almandine-garnets were found, some years ago, in the Northern Territory of South Australia, and were at first taken for rubies, whence they were known in trade for some time afterwards as Australian rubies.

Almandine is widely distributed. Fine rhombic dodecahedra occur in the schistose rocks of the Zillerthal, in Tyrol, and are sometimes cut and polished. An almandine in which the ferrous oxide is replaced partly by magnesia is found at Luisenfeld in German East Africa. In the United States there are many localities which yield almandine. Dr G. F. Kunz has figured a crystal of coarse almandine weighing 9⅔ ℔. from New York city. Fine crystals of almandine embedded in mica-schist occur near Fort Wrangell in Alaska. The coarse varieties of almandine are often crushed for use as an abrasive agent. (See GARNET.)

ALMANSA, or ALMANZA, a town of eastern Spain, in the province of Albacete; 35 m. E.S.E. of Albacete, on the Madrid-Alicante railway. Pop. (1900) 11,180. Almansa is built at the foot of a white limestone crag, which is surmounted by a Moorish castle, and rises abruptly in the midst of a fertile and irrigated plain. About 1 m. S. stands an obelisk commemorating the battle fought here on the 25th of April 1707, in which the French under the duke of Berwick, a natural son of James II. of Great Britain, routed the allied British, Portuguese and Spanish troops. (See SPANISH SUCCESSION, WAR OF THE.)

ALMA-TADEMA, SIR LAURENCE (LAURENS) (1836–), British artist, was born on the 8th of January 1836, at Dronrijp, a Frisian village near Leeuwarden, the son of Pieter Tadema, a notary, who died when he was four years old. Alma was the name of his godfather. His mother (d. 1863) was his father's second wife, and was left with a large family. It was designed that the boy should follow his father's profession; but he had so great a leaning towards art that he was eventually sent to Antwerp, where in 1852 he entered the academy under Gustav Wappers. Thence he passed to the *atelier* of Henri (afterwards Baron) Leys. In 1859 he assisted Leys in the latter's frescoes in the hall of the hôtel de ville at Antwerp. In the exhibition of Alma-Tadema's collected works at the Grosvenor Gallery in London in the winter of 1882–1883 were two pictures which may be said to mark the beginning and end of his first period. These were a portrait of himself, dated 1852, and "A Bargain," painted in 1860. His first great success was a picture of "The Education of the Children of Clovis" (1861), which was exhibited at Antwerp. In the following year he received his first gold medal at Amsterdam. The "Education of the Children of Clovis" (three young children of Clovis and Clotilde practising the art of hurling the axe in the presence of their widowed mother, who is training them to avenge the murder of their own parent) was one of a series of Merovingian pictures, of which the finest was the "Fredegonda" of 1878 (exhibited in 1880), where the dejected wife or mistress is watching from behind her curtain window the marriage of Chilperic I. with Galeswintha. It is perhaps in this series that we find the painter moved by the deepest feeling and the strongest spirit of romance. One of the most passionate of all is "Fredegonda at the Death-bed of Praetextatus," in which the bishop, stabbed by order of the queen, is cursing her from his dying bed. Another distinct series is designed to reproduce the life of ancient Egypt. One of the first of this series, "Egyptians 3000 Years Ago," was painted in 1863. A profound depth of pathos is sounded in "The Death of the Firstborn," painted in 1873. Among Alma-Tadema's other notable Egyptian pictures are "An Egyptian at his Doorway" (1865), "The Mummy" (1867), "The Chamberlain of Sesostris" (1869), "A Widow" (1873), and "Joseph, Overseer of Pharaoh's Granaries" (1874). On these scenes from Frankish and Egyptian life Alma-Tadema spent great energy and research; but his strongest art-impulse was towards the presentation of the life of ancient Greece and Rome, especially the latter. Amongst the best known of his earlier pictures of scenes from classical times are "Tarquinius Superbus" (1867), "Phidias and the Elgin Marbles" (1868), and "The Pyrrhic Dance" and "The Wine Shop" (1869). "The Pyrrhic Dance," though one of the simplest of his compositions, stands out distinctly from them all by reason of its striking movement. "Phidias and the Elgin Marbles" is the first of those glimpses of the art-life of classical times, of which "Hadrian in England," "The Sculpture Gallery," and "The Picture Gallery" are later examples. "The Wine Shop" is one of his many pictures of historical *genre*, but marked with a more robust humour than usual. In 1863 Alma-Tadema married a French lady, and lived at Brussels till 1869, when she died, leaving him a widower with two daughters, Laurence and Anna, both of whom afterwards made reputations—the former in literature, the latter in art. In 1869 he sent from Brussels to the Royal Academy two pictures, "Un Amateur romain" and "Une Danse pyrrhique," which were followed by three pictures, including "Un Jongleur," in 1870, when he came to London. By this time, besides his Dutch and Belgian distinctions, he had been awarded medals at the Paris Salon of 1864 and the Exposition Universelle of 1867. In 1871 he married Miss Laura Epps, an English lady of a talented family, who, under her married name, also won a high reputation as an artist. After his arrival in England Alma-Tadema's career was one of continued success. Amongst the most important of his pictures during this period were "The Vintage Festival" (1870), "The Picture Gallery" and "The Sculpture Gallery" (1875), "An Audience at Agrippa's" (1876), "The Seasons" (1877), "Sappho" (1881), "The Way to the Temple" (1883), his diploma work, "Hadrian in Britain" (1884), "The Apodyterium (1886), "The Woman of Amphissa" (1887), "The Roses of Heliogabalus" (1888), "An Earthly Paradise" (1891), and "Spring" (1895). Most of his other pictures have been small canvasses of exquisite finish, like the "Gold-fish" of 1900. These, as well as all his works, are remarkable for the way in which flowers, textures and hard reflecting substances, like metals, pottery, and especially marble, are painted. His work shows much of the fine execution and brilliant colour of the old Dutch masters. By the human interest with which he imbues all his scenes from ancient life he brings them within the scope of modern feeling, and charms us with gentle sentiment and playful humour. He also painted some fine portraits. Alma-Tadema became a naturalized British subject in 1873, and was knighted on the occasion of Queen Victoria's eighty-first birthday, 1899. He was made an associate of the Royal Academy in 1876, and a Royal Academician in 1879. In 1907 he was included in the Order of Merit. He became a knight of the order Pour le Mérite of Germany (Arts and Science Division); of Léopold, Belgium; of the Dutch Lion; of St Michael of Bavaria; of the Golden Lion of Nassau; and of the Crown of Prussia; an officer of the Legion of Honour, France; a member of the Royal Academies of Munich, Berlin, Madrid and Vienna. He received a gold medal at Berlin in 1872 and a grand medal at Berlin in 1874; a first class medal at the Paris International Exhibitions of 1889 and 1900. He also became a member of the Royal Society of Water-colours.

See also Georg Ebers, "Lorenz Alma-Tadema," *Westermann's Monatshefte*, November and December 1885, since republished in volume form; Helen Zimmern, "L. Alma-Tadema, his Life and Work," *Art Annual*, 1886; C. Monkhouse, *British Contemporary Artists* (London, 1899).

ALME or ALMAI (from *ālim*, wise, learned), the name of a class of singing girls in Egypt who are present at festivals and entertainments, and act as hired mourners at funerals. They are to be distinguished from the ghawazee, or dancing girls, who perform in the public streets and are of a lower order.

ALMEIDA, DOM FRANCISCO DE (*c.* 1450–1510), the first viceroy of Portuguese India, was born at Lisbon about the middle of the 15th century. He was the seventh son of the second count of Abrantes, and thus belonged to one of the most distinguished families in Portugal. In his youth he took part under Ferdinand of Aragon in the wars against the Moors (1485–1492). In March 1505, having received from Emmanuel I. the appointment of viceroy of the newly conquered territory in India, he set sail from Lisbon in command of a large and powerful fleet, and arrived in July at Quiloa (Kilwa), which yielded to him almost without a struggle. A much more vigorous resistance was offered by the Moors of Mombasa, but the town was taken and destroyed, and its large treasures went to strengthen the resources of Almeida. At other places on his way, such as the island of Angediva, near Goa, and Cannanore, he built forts, and adopted measures to secure the Portuguese supremacy. On his arrival in India he took up his residence at Cochin, where a Portuguese fort had been built by Alphonso d'Albuquerque in 1503. The most important events of Almeida's brief but vigorous administration were the conclusion of a commercial treaty with Malacca, and the discoveries made by his son Lorenzo, who acted as his lieutenant. Lorenzo was probably the first Portuguese who visited Ceylon, where he established a settlement, and Fernando Soares, a captain commanding a squadron of his fleet, appears to have been the first European to sight Madagascar. In 1508 he was killed at Dabul in a naval engagement with the Egyptians, who at this time endeavoured to dispute Portuguese supremacy in the Indian Ocean. His father was preparing to avenge his death when Albuquerque (*q.v.*) arrived in Cochin, and presented a commission empowering him to supersede Almeida in the government. It was probably Almeida's unwillingness to be thwarted in his scheme of vengeance that chiefly induced him to refuse to recognize Albuquerque's commission, and to cast him into prison. The punishment he inflicted on the Arabs and their Egyptian allies was speedy and terrible. Sailing along the coast he pillaged and burned various ports, including Goa and Dabul, and finally, encountering the enemy's combined fleet off Diu in February 1509, he completely destroyed it. Returning immediately to Cochin, he held out for a few months against the claims of Albuquerque, but in November 1509 he was compelled to yield. On the 1st of December he set sail for Europe with an escort of three vessels. On the voyage the fleet called at Table Bay, then known as Saldanha Bay, to procure water, and here Almeida was killed (on the 1st of March 1510) in an attack upon the Hottentot natives, during which he showed great personal courage. In this fight, which took place on the site of Cape Town, 65 Portuguese perished, including 12 captains. Almeida's body was recovered on the following day and buried on the spot where he fell.

ALMEIDA, a town of north-eastern Portugal, in the district of Guarda and formerly included in the province of Beira; situated in hilly country between the river Côa, a tributary of the Douro, and the river Turones, a branch of the Agueda. Pop. (1900) 2330. Almeida was long one of the principal frontier fortresses of Portugal. It was captured by the Spaniards in 1762. During the Peninsular War (*q.v.*), the country between the Côa and the Spanish fortress of Ciudad Rodrigo, 25 m. E.S.E., was the scene of hard fighting. Almeida was taken by the French in 1810, and its recapture, by the allied British and Portuguese forces under Lord Wellington, was only effected after a relieving force under Marshal Masséna had been defeated at Fuentes d'Onor (or Fuentes de Oñoro), 13 m. S.S.E. The battle was fought on the 5th of May 1811 and the fortress fell five days later.

ALMELO, a town in the province of Overysel, Holland, 12 m. by rail N.W. of Hengelo, at the junction of the Overysel and Almelo canals. Pop. (1900) 9957. It is a place of considerable antiquity, having been the seat of an independent lordship before the 14th century. But it first rose into importance in the second half of the 19th century owing to its share in the extraordinary industrial development of the Twente district, and now possesses numerous cotton and damask factories. Among the public buildings are a town hall, court house, corn exchange, and churches of various denominations, as well as a synagogue.

The lordship of Almelo belonged to the lords of Heeckeren, who acquired the barony of Rechteren by marriage in 1350 and the countship of Limpourg in 1711. The elder branch of the mediatized house of Rechteren-Limpourg is still established at Almelo; the younger, German branch, at Markt Einersheim in Bavaria.

ALMENDRALEJO, a town of western Spain, in the province of Badajoz; situated 27 m. E.S.E. of Badajoz, on the Merida-Seville railway. Pop. (1900) 12,587. Almendralejo is a thriving town, with broad streets and good modern houses; including the palace of the marquesses of Monsalúd, which contains a museum of Roman antiquities discovered in the neighbourhood. Local prosperity was greatly enhanced during the period 1875–1905 by the improvement of communications, which enabled the grain, fruit and wine of the Guadiana valley, on the north, and of the upland known as the Tierra de Barros, on the south, to be readily exported by the Merida-Seville railway. Brandy is produced in large quantities.

ALMERÍA, a maritime province of southern Spain, formed in 1833, and comprehending the eastern territories of the ancient kingdom of Granada. Pop. (1900) 359,013; area, 3360 sq. m. Almería is bounded on the N. by Granada and Murcia, E. and S. by Murcia and the Mediterranean Sea, and W. by Granada. It is traversed by mountain ridges, with peaks of 6000 to 8000 ft. in altitude; and it is seamed with valleys of great fertility. The chief *sierras*, or ranges, are those of Maria, in the north; Estancias and Oria, north of the Almanzora river; Filabres, in the middle of the province; Cabrera and Gata, along the south-east coast; Alhamilla, east of the city of Almería; Gádor in the south-west; and, in the west, some outlying ridges of the Sierra Nevada. Three small rivers, the Adra, or Río Grande de Adra, in the west, the Almería in the centre, and the Almanzora in the north and east, flow down from the mountains to the sea. On the south coast is the Gulf of Almería, 25 m. wide at its entrance, and terminating, on the east, in the Cabo de Gata, the southernmost point of eastern Spain. The climate is mild, except among the higher mountains. The valleys near the sea are well adapted for agriculture; oranges, lemons, almonds and other fruit trees thrive; silk is produced in the west; and the vine is extensively cultivated, less for the production of wine than to meet the foreign demand for white Almería grapes. Although the cost of transport is very heavy, the exportation of grapes is a flourishing industry, and more than 2,000,000 barrels are annually sent abroad. The cattle of the central districts are celebrated for size and quality. Almería is rich in minerals, especially iron and lead; silver, copper, mercury, zinc and sulphur are also obtained. At the beginning of the 20th century the mines at work numbered more than two hundred, and proved very attractive to foreign as well as native capitalists. Garnets are found in the Sierra de Gata and in the Sierra Nevada fine marble is quarried. The development of mining was facilitated by the extension of the railway system between 1895 and 1905. The main line from Madrid to Almería conveys much ore from Granada and Jaén to the sea; while the railway from Baza to Lorca skirts the Almanzora valley and transports the mineral products of eastern Almería by a branch line from Huércal-Overa to the Murcian port of Águilas. Light railways and aerial cables among the mountains supplement these lines. The chief imports comprise coal, timber, especially oak staves, and various manufactured goods. The exports are minerals, esparto, oil, grain, grapes and farm produce generally. The principal seaports are Almería, the capital, pop. (1900) 47,326, Adra (11,188), and Garrucha (4661), which, with Berja (13,224), Cuevas de Vera (20,562), Huércal-Overa (15,763) and Níjar (12,497), are described in separate articles. Other towns, important as mining or agricultural centres, are Albox (10,049), Dalías (7136), Lubrin (6593), Sorbas (7306), Tabernas (7629), Vélez Blanco (6825), Vélez Rubio (10,109) and Vera (8446). Education is backward and the standard of comfort low. A constant annual loss of 2000 or 3000 emigrants to Algeria and elsewhere prevents any rapid increase of population, despite the high birth-rate and low mortality.

ALMERÍA, the capital of the province of Almería, and one of the principal seaports on the Mediterranean coast of southern Spain; in 36° 5′ N. and 2° 32′ W., on the river Almería, at its outflow into the Gulf of Almería, and at the terminus of a railway from Madrid. Pop. (1900) 47,326. The city occupies part of a rich alluvial valley enclosed by hills. It is an episcopal see, and possesses a Gothic cathedral, dating from 1524, and constructed with massive embattled walls and belfry so as to resemble a fortress. A dismantled castle, the Castillo de San Cristobál, overlooks the city, which contains four Moorish towers rising conspicuously above its modern streets. Two long piers shelter the harbour, and vessels drawing 25 ft. can lie against the quays. About 1400 ships, of nearly 1,000,000 tons, enter the port every year, bringing fuel and timber, and taking cargoes of iron, lead, esparto and fruit. White grapes are exported in very large quantities.

Under its ancient name of Urci, Almería was one of the chief Spanish harbours after the final conquest of Spain by the Romans in 19 B.C. It reached the summit of its prosperity in the middle ages, as the foremost seaport of the Moorish kingdom of Granada. At this time its population numbered 150,000; its cruisers preyed upon the fleets of the neighbouring Christian states; and its merchant ships traded with countries as distant as Egypt and Syria. Almería was captured in 1147 by King Alphonso VII. of Castile and his Genoese troops, but speedily retaken and held by the Moors until 1489, when it was finally secured by the Spaniards.

See D. F. Margall, *Almería*, (Barcelona, 1886).

ALMERY, Aumery, Aumbrie, or Ambry (from the medieval form *almarium*, cf. Lat. *armarium*, a place for keeping tools; cf. O. Fr. *aumoire* and mod. *armoire*), in architecture, a recess in the wall of a church, sometimes square-headed, and sometimes arched over, and closed with a door like a cupboard—used to contain the chalices, basins, cruets, &c., for the use of the priest; many of them have stone shelves. They are sometimes near the piscina, but more often on the opposite side. The word also seems in medieval times to be used commonly for any closed cupboard and even bookcase.

ALMODÓVAR DEL CAMPO, or Almodóvar, a town of Spain, in the province of Ciudad Real, 18 m. S.S.W. of Ciudad Real, on the northern side of the Sierra de Alcúdia. Pop. (1900) 12,525. Almodóvar was a Moorish fortress in the middle ages, but contains little of antiquarian interest. It owes its modern prosperity to the nearness of the valuable Puertollano coal-field, 3 m. S. by a branch of the Madrid-Badajoz-Lisbon railway. Its manufactures are lace and linen and it has a brisk trade in live-stock, oil and wine. South of the Sierra lies the Alcúdia valley, owned by the crown, and used as pasture for immense flocks of sheep.

ALMOGÁVARES (from the Arab. *Al-Mugavari*, a scout), the name of a class of Spanish soldiers, well known during the

Christian reconquest of Spain, and much employed as mercenaries in Italy and the Levant, during the 13th and 14th centuries. The Almogávares (the plural of Almogávar) came originally from the Pyrenees, and were in later times recruited mainly in Navarre, Aragon and Catalonia. They were frontiersmen and foot-soldiers who wore no armour, dressed in skins, were shod with brogues (*abarcaș*), and carried the same arms as the Roman legionaries—two heavy javelins (Spanish *azagaya*, the Roman pilum), a short stabbing sword and a shield. They served the king, the nobles, the church or the towns for pay, and were professional soldiers. When Peter III. of Aragon made war on Charles of Anjou after the Sicilian Vespers—30th of March 1282—for the possession of Naples and Sicily, the Almogávares formed the most effective element of his army. Their discipline and ferocity, the force with which they hurled their javelins, and their activity, made them very formidable to the heavy cavalry of the Angevin armies. When the peace of Calatabellota in 1302 ended the war in southern Italy, the Almogávares followed Roger di Flor (Roger Blum) the unfrocked Templar, who entered the service of the emperor of the East, Andronicus, as condottieri to fight against the Turks. Their campaign in Asia Minor, 1303 and 1304, was a series of romantic victories, but their greed and violence made them intolerable to the Christian population. When Roger di Flor was assassinated by his Greek employer in 1305, they turned on the emperor, held Gallipoli and ravaged the neighbourhood of Constantinople. In 1310 they marched against the duke of Athens, of the French house of Brienne. Walter of Brienne was defeated and slain by them with all his knights at the battle of Cephissus, or Orchomenus, in Boeotia in March. They then divided the wives and possessions of the Frenchmen by lot and summoned a prince of the house of Aragon to rule over them. The foundation of the Aragonese duchy of Athens was the culmination of the achievements of the Almogávares. In the 16th century the name died out. It was, however, revived for a short time as a party nickname in the civil wars of the reign of Ferdinand VII.

Authorities.—The Almogávares are admirably described by one who fought with them, Ramon de Muntaner, whose *Chronicle* has been translated into French by J. A. Buchon, *Chroniques étrangères* (Paris, 1860). The original test was reprinted and edited by K. Lanz at Stuttgart, 1844. See also the *Expédition des “Almugávares” ou routiers catalans en orient, de l'an 1302 à l'an 1311*, by G. Schlumberger (Paris, 1902). (D. H.)

ALMOHADES (properly *Muwāḥḥadis*, *i.e.* “Unitarians,” the name being corrupted through the Spanish), a Mahommedan religious power which founded the fifth Moorish dynasty in the 12th century, and conquered all northern Africa as far as Egypt, together with Moslem Spain. It originated with Mahommed ibn Tūmart, a member of the Maṣmūda, a Berber tribe of the Atlas. Ibn Tūmart was the son of a lamplighter in a mosque and had been noted for his piety from his youth; he was small, ugly, and misshapen and lived the life of a devotee-beggar. As a youth he performed the pilgrimage to Mecca, whence he was expelled on account of his severe strictures on the laxity of others, and thence wandered to Bagdad, where he attached himself to the school of the orthodox doctor al Ashāri. But he made a system of his own by combining the teaching of his master with parts of the doctrines of others, and with mysticism imbibed from the great teacher Ghazāli. His main principle was a rigid unitarianism which denied the independent existence of the attributes of God, as being incompatible with his unity, and therefore a polytheistic idea. Mahommed in fact represented a revolt against the anthropomorphism of commonplace Mahommedan orthodoxy, but he was a rigid predestinarian and a strict observer of the law. After his return to Morocco at the age of twenty-eight, he began preaching and agitating, heading riotous attacks on wine-shops and on other manifestations of laxity. He even went so far as to assault the sister of the Murābṭi (Almoravide) amir ʽAli III., in the streets of Fez, because she was going about unveiled after the manner of Berber women. ʽAli, who was very deferential to any exhibition of piety, allowed him to escape unpunished.

Ibn Tūmart, who had been driven from several other towns for exhibitions of reforming zeal, now took refuge among his own people, the Maṣmūda, in the Atlas. It is highly probable that his influence would not have outlived him, if he had not found a lieutenant in ʽAbd-el-Mūmin el Kūmi, another Berber, from Algeria, who was undoubtedly a soldier and statesman of a high order. When Ibn Tūmart died in 1128 at the monastery or *ribāṭ* which he had founded in the Atlas at Tīnmāl, after suffering a severe defeat by the Murābṭis, ʽAbd-el-Mūmin kept his death secret for two years, till his own influence was established. He then came forward as the lieutenant of the Mahdi Ibn Tūmart. Between 1130 and his death in 1163, ʽAbd-el-Mūmin not only rooted out the Murābṭis, but extended his power over all northern Africa as far as Egypt, becoming amir of Morocco in 1149. Mahommedan Spain followed the fate of Africa, and in 1170 the Muwāḥḥadis transferred their capital to Seville, a step followed by the founding of the great mosque, now superseded by the cathedral, the tower of which they erected in 1184 to mark the accession of Yaʽḳūb el Manṣūr. From the time of Yūsef II., however, they governed their co-religionists in Spain and Central North Africa through lieutenants, their dominions outside Morocco being treated as provinces. When their amirs crossed the Straits it was to lead a *jehad* against the Christians and to return to their capital, Marrākesh.

The Muwāḥḥadi princes had a longer and a more distinguished career than the Murābṭis or “Almoravides” (*q.v.*). Yūsef II. or “Abu Yaʽḳub” (1163–1184), and Yaʽḳub I. or “El Manṣūr” (1184–1199), the successors of Abd-el-Mūmin, were both able men. They were fanatical, and their tyranny drove numbers of their Jewish and Christian subjects to take refuge in the growing Christian states of Portugal, Castile and Aragon. But in the end they became less fanatical than the Murābṭis, and Yaʽḳub el Manṣūr was a highly accomplished man, who wrote a good Arabic style and who protected the philosopher Averroes. His title of El Manṣur, “The Victorious,” was earned by the defeat he inflicted on Alphonso VIII. of Castile at Alarcos in 1195. But the Christian states in Spain were becoming too well organized to be overrun by the Mahommedans, and the Muwāḥḥadis made no permanent advance against them. In 1212 Mahommed III., “En-Nāṣir” (1199–1214), the successor of El Manṣūr, was utterly defeated by the allied five Christian princes of Spain, Navarre and Portugal, at Las Navas de Tolosa in the Sierra Morena. All the Moorish dominions in Spain were lost in the next few years, partly by the Christian conquest of Andalusia, and partly by the revolt of the Mahommedans of Granada, who put themselves under the protection of the Christian kings and became their vassals.

The fanaticism of the Muwāḥḥadis did not prevent them from encouraging the establishment of Christians even in Fez, and after the battle of Las Navas de Tolosa they occasionally entered into alliances with the kings of Castile. In Africa they were successful in expelling the garrisons placed in some of the coast towns by the Norman kings of Sicily. The history of their decline differs from that of the Murābṭis, whom they had displaced. They were not assailed by a great religious movement, but destroyed piecemeal by the revolt of tribes and districts. Their most effective enemies were the Beni Marīn (“Merinides”) who founded the next Moroccan dynasty, the sixth. The last representative of the line, Idrīs IV., “El Wāthik,” was reduced to the possession of Marrākesh, where he was murdered by a slave in 1269.

The amirs of the Muwāḥḥadi Dynasty were as follows:—ʽAbd-el-Mūmin (1145); Yūsef II., “Abu Yaʽḳūb” (1163); Yaʽḳūb I., “Abu Yūsef el Manṣūr” (1184); Mahommed III., “En-Nāṣir” (1199); Yūsef III., “Abu Yaʽḳub el Mustanṣir” (1214); ʽAbd-el-Wāhid, “El Makhlūwi” (1223); ʽAbd-Allah II., “Abu Mahommed” (1224); Yaḥya V., “El Muʽtāṣim” (1226); Idrīs III., “El Māmūn” (1229); Rashīd I., “ʽAbd-el-Wāhid II.” (1232); ʽAli IV., “Es-Saʽid el Mu tadīd” (1242); Omar I., “El Mortaḍa” (1248); Idrīs IV., “El Wāthik” (1266–1269). (B. M.*; D. H.)

ALMON, JOHN (1737–1805), English political pamphleteer and publisher, was born at Liverpool on the 17th of December

1737. In early life he was apprenticed to a printer in his native town, and he also spent two years at sea. He came to London in 1758 and at once began a career which, if not important in itself, had a very important influence on the political history of the country. The Whig opposition, hampered and harassed by the Government to an extent that threatened the total suppression of independent opinion, were in great need of a channel of communication with the public, and they found what they wanted in Almon. He had become personally known to the leaders through various publications of his own which had a great though transient popularity; the more important of these being *The Conduct of a late Noble Commander* [Lord George Sackville] *Examined* (1759); a *Review of his late Majesty's Reign* (1760); a *Review of Mr Pitt's Administration* (1761); and a number of letters on political subjects. The review of Pitt's administration passed through four editions, and secured for its author the friendship of Earl Temple, to whom it was dedicated. Brought thus into the counsels of the Whig party, he was persuaded in 1763 to open a bookseller's shop in Piccadilly, chiefly for the publication and sale of political pamphlets. This involved considerable personal risk, and though he generally received with every pamphlet a sum sufficient to secure him against all contingencies, he deserves the credit of having done much to secure the freedom of the press. The government strengthened his influence by their repressive measures. In 1765 the attorney-general moved to have him tried for the publication of the pamphlet entitled *Juries and Libels*, but the prosecution failed; and in 1770, for merely selling a copy of the *London Museum* containing Junius's celebrated "Letter to the King," he was sentenced by Lord Mansfield to pay a fine of ten marks and give security for his good behaviour. It was this trial that called forth the letter to Lord Mansfield, one of the bitterest of the Junius series. Almon himself published an account of the trial, and of course did not let slip the opportunity of reprinting the matter that had been the ground of indictment; but no further proceedings were taken against him. In 1774 Almon commenced the publication of his *Parliamentary Register*, a monthly report of the debates in parliament, and he also issued an abstract of the debates from 1742, when Richard Chandler's Reports ceased, to 1774. About the same time, having earned a competency, he retired to Boxmoor in Hertfordshire, though he still continued to write on political subjects. He became proprietor in 1784 of the *General Advertiser*, in the management of which he lost his fortune and was declared insolvent. To these calamities was added an imprisonment for libel. The claims of his creditors compelled him to leave the country, but after some years in France he was enabled to return to Boxmoor, where he continued a career of undiminished literary activity, publishing among other works an edition of Junius. His last work was an edition of Wilkes's correspondence, with a memoir (1805). He died on the 12th of December 1805. Almon's works, most of which appeared anonymously, have no great literary merit, but they are of very considerable value to the student of the political history of the period.

ALMOND (from the O. Fr. *almande* or *alemande*, late Lat. *amandola*, derived through a form *amingdola* from the Gr. ἀμυγδάλη, an almond; the *al-* for *a-* is probably due to a confusion with the Arabic article *al*, the word having first dropped the *a-* as in the Italian form *mandola*; the English pronunciation ā-mond and the modern French *amande* show the true form of the word). The almond is the fruit of *Amygdalus communis*, a plant belonging to the tribe Pruneae of the natural order Rosaceae. The genus *Amygdalus* is very closely allied to *Prunus* (Plum, Cherry), in which it is sometimes merged; the distinction lies in the fruit, the soft pulp attached to the stone in the plum being replaced by a leathery separable coat in the almond. The tree appears to be a native of western Asia, Barbary and Morocco; but it has been extensively distributed over the warm-temperate region of the Old World. It ripens its fruit in the south of England. It is a tree of moderate size; the leaves are lanceolate, and serrated at the edges; and it flowers early in spring. The fruit is a drupe, having a downy outer coat, called the epicarp, which encloses the reticulated hard stony shell or endocarp. The seed is the kernel which is contained within these coverings. The shell-almonds of trade consist of the endocarps enclosing the seeds. The tree grows in Syria and Palestine; and is referred to in the Bible under the name of *Shaked*, meaning "hasten." The word Luz, which occurs in Genesis xxx. 37, and which has been translated hazel, is supposed to be another name for the almond. In Palestine the tree flowers in January, and this hastening of the period of flowering seems to be alluded to in Jeremiah i. 11, 12, where the Lord asks the prophet, "What seest thou?" and he replies, "The rod of an almond-tree"; and the Lord says, "Thou hast well seen, for I will hasten my word to perform it." In Ecclesiastes xii. 5 it is said the "almond-tree shall flourish." This has often been supposed to refer to the resemblance of the hoary locks of age to the flowers of the almond; but this exposition is not borne out by the facts of the case, inasmuch as the flowers of the almond are not white but pink. The passage is more probably intended to allude to the hastening or rapid approach of old age. The application of Shaked or *hasten* to the almond is similar to the use of the name "May" for the hawthorn, which usually flowers in that month in Britain. The rod of Aaron, mentioned in Numbers xvii., was taken from an almond-tree; and the Jews still carry rods of almond-blossom to the synagogues on great festival days. The fruit of the almond supplied a model for certain kinds of ornamental carved work (Exodus xxv. 33, 34; xxxvii. 19, 20).

There are two forms of the plant, the one (with pink flowers) producing sweet, the other (with white flowers) bitter almonds. The kernel of the former contains a fixed oil and emulsin. It is used internally in medicine, and must not be adulterated with the bitter almond. The *Pulvis Amygdalae Compositus* of the British Pharmacopoeia consists of sweet almonds, sugar and gum acacia. It may be given in any dose. The *Mistura Amygdalae* contains one part of the above to eight of water; the dose is ½ to 1 oz.

The bitter almond is rather broader and shorter than the sweet almond and has a bitter taste. It contains about 50% of the fixed oil which also occurs in sweet almonds. It also contains a ferment *emulsin* which, in the presence of water, acts on a soluble glucoside, amygdalin, yielding glucose, prussic acid and the essential oil of bitter almonds or benzaldehyde (*q.v.*), which is not used in medicine. Bitter almonds may yield from 6 to 8% of prussic acid.

Oleum Amygdalae, the fixed oil, is prepared from either variety of almond. If intended for internal use, it must, however, be prepared only from sweet almonds. It is a glyceryl oleate, with slight odour and a nutty taste. It is almost insoluble in alcohol but readily soluble in chloroform or ether. It may be used as a pleasant substitute for olive oil. The pharmacopoeial preparations of the sweet almond are used only as vehicles for other drugs. The sweet almond itself, however, has a special dietetic value. It contains practically no starch and may therefore be made into flour for cakes and biscuits for patients suffering from *diabetes mellitus* or any other form of glycosuria. It is a nutritious and very pleasant food.

There are numerous commercial varieties of sweet almond, of which the most esteemed is the Jordan almond, imported from Malaga. Valentia almonds are also valued. Fresh sweet almonds are nutritive and demulcent, but as the outer brown skin sometimes causes irritation of the alimentary canal, they are blanched by removal of this skin when used at dessert.

ALMONER (from Lat. *eleemosynarius*, through med. Lat. *almosynarius*, *almonarius*, and Fr. *almosnier*, *aumosnier*, &c., mod. Fr. *aumônier*), in the primitive sense, an officer in religious houses to whom belonged the management and distribution of the alms of the house. By the ancient canons all monasteries were to spend at least a tenth part of their income in alms to the poor, and all bishops were required to keep almoners. Almoners, as distinct from chaplains, appear early as attached to the court of the kings of France; but the title of grand almoner of France first appears in the reign of Charles VIII.

He was an important court official whose duties comprised the superintendence of the Chapel Royal and all the religious ceremonies of the court. He was a director of the great hospital for the blind (*Quinze-Vingts*), and nominated the regius professors and readers in the Collège de France. The office was revived by Napoleon I., was abolished in 1830, and again created by Napoleon III.; it existed till 1870. In England, the royal almonry still forms a part of the sovereign's household, the officers being the hereditary grand almoner (the marquess of Exeter), the lord high almoner, the sub-almoner, and the secretary to the lord high almoner. The office of hereditary grand almoner is now merely titular. The lord high almoner is an ecclesiastical officer, usually a bishop, who had the rights to the forfeiture of all deodands (*q.v.*) and the goods of a *felo de se*, for distribution among the poor. He had also, by virtue of an ancient custom, the power of giving the first dish from the king's table to whatever poor person he pleased, or, instead of it, alms in money, which custom is kept up by the lord high almoner distributing as many silver pennies as the sovereign has years of age to poor men and women on Maundy Thursday (*q.v.*).

ALMONRY (Lat. *eleemosynarium*, Fr. *aumônerie*, Ger. *Almosenhaus*), the name for the place or chamber where alms were distributed to the poor in churches or other ecclesiastical buildings. At Bishopstone church, Wiltshire, it is a sort of covered porch attached to the south transept, but not communicating with the interior of the church. At Worcester Cathedral the alms are said to have been distributed on stone tables, on each side, within the great porch. In large monastic establishments, as at Westminster, it seems to have been a separate building of some importance, either joining the gatehouse or near it, that the establishment might be disturbed as little as possible.

ALMORA, a town and district of British India, the chief town and administrative headquarters of the Kumaon division of the United Provinces, situated on a mountain-ridge of the Himalayas 5494 ft. above the sea. Pop. (1901) 8596. The town has a college called after Sir Henry Ramsay; a government high school; a Christian girls' school; and a large cantonment. The town was captured by the Gurkhas in 1790, who constructed a fort on the eastern extremity of the ridge. Another citadel, Fort Moira, is situated on the other extremity of the ridge. Almora is also celebrated as the scene of the British victory which terminated the war with Nepal in April 1815, and which resulted in the evacuation of Kumaon by the Gurkhas and the annexation of the province by the British.

The DISTRICT OF ALMORA was constituted in 1891, together with Naini Tal, by a redistribution of the two former districts of Kumaon and the Tarai. It lies among the mountains of Kumaon, between the upper waters of the Ganges and the Gogra, here called the Kali. Area, 5419 sq. m.; pop. (1901) 465,893, showing an increase of 13% during the decade. Tea is grown in the district, which includes the military sanatorium of Ranikhet. The nearest railway via Naini Tal is the extension of the Oudh and Rohilkhand line from near Bareilly to Kathgodam.

ALMORAVIDES (properly *Murābṭis*, the name being corrupted through the Spanish), a Berber horde from the Sahara which, in the 11th century, founded the fourth dynasty in Morocco. By this dynasty the Moorish empire was extended over Tlemçen and a great part of Spain and Portugal. The name is derived from the Arab. *Murābit*, a religious ascetic (see MARABOUT). The most powerful of the invading tribes was the Lamtūna ("veiled men") from the upper Niger, whose best-known representatives now are the Tuareg. They had been converted to Mahommedanism in the early times of the Arab conquest, but their knowledge of Islām did not go much beyond the formula of the creed—"there is no god but God, and Mahomet is the apostle of God,"—and they were ignorant of the law. About the year 1040 or a little earlier, one of their chiefs, Yaḥya ibn Ibrāhīm, made the pilgrimage to Mecca. On his way home he attended the teachers of the mosque at Ḳairawān, in Tunisia, who soon learnt from him that his people knew little of the religion they were supposed to profess, and that though his will was good, his own ignorance was great. By the good offices of the theologians of Ḳairawān, one of whom was from Fez, Yaḥya was provided with a missionary, ʽAbd-Allah ibn Yāzīn, a zealous partisan of the Mālekis, one of the four orthodox sects of Islām. His preaching was for long rejected by the Lamtūnas, so on the advice of his patron Yaḥya, who accompanied him, he retired to an island in the Niger, where he founded a *ribāṭ* or Moslem monastery, from which as a centre his influence spread. There was no element of heresy in his creed, which was mainly distinguished by a rigid formalism and strict obedience to the letter of the Koran and the orthodox tradition or Sunna. ʽAbd-Allah imposed a penitential scourging on all converts as a purification, and enforced a regular system of discipline for every breach of the law, even on the chiefs. Under such directions the Murābṭis were brought to excellent order. Their first military leader, Yaḥya ibn Omar, gave them a good military organization. Their main force was infantry, armed with javelins in the front ranks and pikes behind, formed into a phalanx and supported by camelmen and horsemen on the flanks. From the year 1053 the Murābṭis began to impose their orthodox and puritanical religion on the Berber tribes of the desert, and on the pagan negroes. Yaḥya was killed in battle in 1056, but ʽAbd-Allah, whose influence as a religious teacher was paramount, named his brother Abu Bakr as chief. Under him the Murābṭis soon began to spread their power beyond the desert, and subjected the tribes of the Atlas. They then came in contact with the Berghwāta, a Berber people of central Morocco, who followed a heresy founded by Salaḥ ibn Tārīf 300 years previously. The Berghwāta made a fierce resistance, and it was in battle with them that ʽAbd-Allah ibn Yāzīn won the crown of martyrdom. They were, however, completely conquered by Abu Bakr, who espoused the defeated chief's widow, Zaïnāb.

In 1061 Abu Bakr made a division of the power he had established, handing over the more settled parts to his cousin Yūsef ibn Tashfīn, as viceroy, resigning to him also his favourite wife Zaïnāb, who had the reputation of a sorceress. For himself he reserved the task of suppressing the revolts which had broken out in the desert, but when he returned to resume control he found his cousin too powerful to be superseded, so he had to go back to the Sahara, where in 1087 he too attained martyrdom, having been wounded with a poisoned arrow in battle with the pagan negroes.

Ibn Tashfīn, who was largely guided by Zaïnāb, had in the meantime brought what is now known as Morocco to complete subjection, and in 1062 had founded the city of Marrākesh ("Morocco City"). He is distinguished as Yūsef I. In 1080 he conquered the kingdom of Tlemçen and founded the present city of that name, his rule extending as far east as Oran. In 1086 he was invited by the Mahommedan princes in Spain to defend them against Alphonso VI., king of Castile and Leon. In that year Yūsef passed the straits to Algeciras, and on the 23rd of October inflicted a severe defeat on the Christians at Sacralias, or in Arabic, Zallāka, near Badajoz. He was debarred from following up his victory by trouble in Africa which he had to settle in person. When he returned to Spain in 1090 it was avowedly for the purpose of deposing the Mahommedan princes and annexing their states. He had in his favour the mass of the inhabitants, who were worn out by the oppressive taxation imposed by their spendthrift rulers. Their religious teachers detested the native Mahommedan princes for their religious indifference, and gave Yūsef a *fetwa*—or legal opinion—to the effect that he had good moral and religious right to dethrone the heterodox rulers who did not scruple to seek help from the Christians whose bad habits they had adopted. By 1094 he had removed them all, and though he regained little from the Christians except Valencia, he reunited the Mahommedan power and gave a check to the reconquest of the country by the Christians. After friendly correspondence with the caliph at Bagdad, whom he acknowledged as Amīr el Mūminīn, "Prince of the Faithful," Yūsef in 1097 assumed the title of "Prince of the Resigned"—Amīr el Muslimīn. He died in 1106, when he was reputed to have reached the age of 100.

The Murābṭi power was at its height at Yūsef's death, and the Moorish empire then included all North-West Africa as far as Algiers, and all Spain south of the Tagus, with the east coast as far as the mouth of the Ebro, and the Balearic Islands. Three years afterwards, under Yūsef's son and successor, 'Ali III. of Morocco, Madrid, Lisbon and Oporto were added, and Spain was again invaded in 1119 and 1121, but the tide had turned, the French having assisted the Aragonese to recover Saragossa. In 1138 'Ali III. was defeated by Alphonso VII. of Castile and Leon, and in 1139 by Alphonso I. of Portugal, who thereby won his crown, and Lisbon was recovered by the Portuguese in 1147. 'Ali III. was a pious nonentity, who fasted and prayed while his empire fell to pieces under the combined action of his Christian foes in Spain and the agitation of the Muwāḥḥadis or "Almohades" (*q.v.*) in Morocco. After 'Ali's death in 1142, his son Tashfīn lost ground rapidly before the Muwāḥḥadis, and in 1145 he was killed by a fall from a precipice while endeavouring to escape after a defeat near Oran. His two successors Ibrāhīm and Isḥāk are mere names. The conquest of the city of Marrākesh by the Muwāḥḥadis in 1147 marked the fall of the dynasty, though fragments of the Murābṭis continued to struggle in the Balearic Islands, and finally in Tunisia.

The amirs of the Murābṭi dynasty were as follows:—Yūsef I., bin Tashfīn (1061); 'Ali III. (1106); Tashfīn I. (1143); Ibrāhim II. (1145); Isḥāk (1146).

See Budgett Meakin, *The Moorish Empire* (London, 1899); the anonymous *Raōḍ el Karṭāṣ* (Fez. 1326), translated by Baymier as *Roudh el-Kartas* (Paris, 1860); Ibn Khaldūn, *Kitāb el 'Aibr . . . fi Aīyām el Maghrib, &c.* (*cir.* 1405), partly translated by de Slane as *Histoire des Berbers*, vol. ii. (Algiers, 1852–1856); Makkāri, *History of the Mahommedan Dynasties in Spain*, translated by Gayangos (London, 1840); *Histoire des Mussulmans d'Espagne*, by R. Dozy, vol. iv. (Leiden, 1861). (B. M.*; D. H.)

ALMQVIST, KARL JONAS LUDWIG (1793–1866), Swedish writer, was born at Stockholm in 1793. He became a student at Upsala, where his father was professor of theology, in 1808, and took his degree in 1815. He began life under highly favourable auspices; but becoming tired of a university career, in 1823 he threw up the position he held in the capital to lead a colony of friends to the wilds of Wermland. This ideal Scandinavian life soon proved a failure; Almqvist found the pen easier to wield than the plough, and in 1828 he returned to Stockholm as a teacher in the new Elementary School there, of which he became rector in 1829. Now began his literary life; and after bringing out several educational works, he made himself suddenly famous by the publication of his great series of novels, called *The Book of the Thorn-Rose* (1832–1835). The career so begun developed with extraordinary rapidity; few writers have equalled Almqvist in productiveness and versatility; lyrical, epic and dramatic poems; romances; lectures; philosophical, aesthetical, moral, political and educational treatises; works of religious edification, studies in lexicography and history, in mathematics and philology, form the most prominent of his countless contributions to modern Swedish literature. So excellent was his style, that in this respect he has been considered the first of Swedish writers. His life was as varied as his work. Unsettled, unstable in all his doings, he passed from one lucrative post to another, at last subsisting entirely on the proceeds of literary and journalistic labour. More and more vehemently he espoused the cause of socialism in his brilliant novels and pamphlets; friends were beginning to leave him, foes beginning to triumph, when suddenly all minor criticism was silenced by the astounding news that Almqvist, convicted of forgery and charged with murder, had fled from Sweden. This occurred in 1851. For many years no more was heard of him; but it is now known that he went over to America and settled in St Louis. During a journey through Texas he was robbed of all his manuscripts, among which are believed to have been several unprinted novels. He is said to have appealed in person to President Lincoln, but the robbers could not be traced. The American adventures of Almqvist remain exceedingly obscure, and some of the most remarkable have been proved to be fabulous. In 1865 he returned to Europe, and his strange and sinister existence came to a close at Bremen on the 26th of September 1866. It is by his romances, undoubtedly the best in Swedish, that his literary fame will mainly be supported; but his singular history will always point him out as a remarkable figure even when his works are no longer read. He was another Eugene Aram, but of greater genius, and so far more successful that he escaped the judicial penalty of his crimes. (E. G.)

ALMS, the giving of relief, and the relief given, whether in goods or money, to the poor, particularly applied to the charity bestowed under a sense of religious obligation (see Charity and Charities). The word in O. Eng. was *aelmysse*, and is derived through the Teutonic adaptation (cf. the modern Ger. *almosen*) of the Latinized form of the Gr. ἐλεημοσύνη, compassion or mercy, from ἔλεος, pity. The English word "eleemosynary," that which is given in the way of alms, charitable, gratuitous, derives direct from the Greek. "Alms" is often, like "riches," wrongly taken as a plural word.

ALMSHOUSE, a house built and endowed by private charity for the residence of poor and usually aged people. The greater portion were built after the Reformation. Two interesting examples are the Hospital of St Cross, near Winchester, founded in 1136, and Coningsby Hospital at Hereford, founded in 1614.

ALMUCE, or Amice (O. Fr. *aumuce*, O. Eng. *aumuce*, *amys*, *amess*, &c., from late Lat. *almucia*, *almucium*, *armucia*, &c.), a hooded cape of fur, or fur-lined, worn as a choir vestment by certain dignitaries of the Western Church. The origin of the word *almucium* is a philological mystery. The *al-* is probably the Arabic article, since the word originated in the south (Sicilian *almuziu*, Prov. *almussa*, Span. *almucio*, &c.), but the derivation of the second part of the word from a supposed old Teutonic term for cap—Ger. *Mütze*, Dutch *Mutsche*, Scot. *mutch* (*New Eng. Dict. s.* "Amice"; Diez, *Wörterbuch der rom. Sprachen*)—is the exact reverse of the truth. The almuce was originally a head-covering only, worn by the clergy, but adopted also by the laity, and the German word *Mütze*, "cap," is later than the introduction of the almuce in church, and is derived from it (M. H. G., 13th century, *almutz*; 14th century, *armuz*, *aremuz*, &c.; 15th century, *mutz*, *mütze*, &c.). The word *mutzen*, to dock, cut off, which first appears in the 14th century, does not help much, though the name of another vestment akin to the almuce—the *mozzetta*—has been by some traced to it through the Ital. *mozzare* and *mozzo* (but see below).

In numerous documents from the 12th to the 15th century the *almucium* is mentioned, occasionally as identical with the hood, but more often as a sort of cap distinct from it, *e.g.* in the decrees of the council of Sens (1485)—*non caputia, sed almucia vel bireta tenentes in capite.* By the 14th century two types of *almucium* were distinguished: (1) a cap coming down just over the ears; (2) a hood-like cap falling over the back and shoulders. This latter was reserved for the more important canons, and was worn over surplice or rochet in choir. The introduction of the biretta (*q.v.*) in the 15th century tended to replace the use of the almuce as a head-covering, and the hood now became smaller, while the cape was enlarged till in some cases it fell below the elbows. Another form of almuce at this period covered the back, but was cut away at the shoulders so as to leave the arms free, while in front it was elongated into two stole-like ends. Almuces were occasionally made of silk or wool, but from the 13th century onward usually of fur, the hem being sometimes fringed with tails. Hence they were known in England as "grey amices" (from the ordinary colour of the fur), to distinguish them from the liturgical amice (*q.v.*). By the 16th century the almuce had become definitely established as the distinctive choir vestment of canons; but it had ceased to have any practical use, and was often only carried over the left arm as a symbol of office. The almuce has now been almost entirely superseded by the mozzetta, but it is still worn at some cathedrals in France, *e.g.* Amiens and Chartres, at three churches in Rome, and in certain cathedrals elsewhere in Italy. The "grey amice" of the canons of St Paul's at London was put down in 1549, the academic hood being substituted. It was again put down in 1559, and was finally forbidden to the clergy of the English Church by the unratified canons of 1571 (*Report* of the sub-committee of Convocation, 1908).

See du Cange, *Glossarium*, *s.* "Almucia"; Joseph Braun, *Die liturgische Gewandung*, p. 359, &c. (Freiburg im Breisgau, 1907); also the bibliography to the article VESTMENTS.

ALNAGE, or AULNAGE (from Fr. *aune*, ell), the official supervision of the shape and quality of manufactured woollen cloth. It was first ordered in the reign of Richard I. that "woollen cloths, wherever they are made, shall be of the same width, to wit, of two ells within the lists, and of the same goodness in the middle and sides." This ordinance is usually known as the Assize of Measures or the Assize of Cloth. Article 35 of Magna Carta re-enacted the Assize of Cloth, and in the reign of Edward I. an official called an "alnager" was appointed to enforce it. His duty was to measure each piece of cloth, and to affix a stamp to show that it was of the necessary size and quality. As, however, the diversity of the wool and the importation of cloths of various sizes from abroad made it impossible to maintain any specific standard of width, the rules as to size were repealed in 1353. The increased growth of the woollen trade, and the introduction of new and lighter drapery in the reign of Queen Elizabeth, compelled a revision of the old standards. A statute was passed in 1665 creating the office of alnager of the new drapery, and defining the sizes to which cloth should be woven. The object of the statute was to prevent people being deceived by buying spurious woollen cloth, and to provide against fraud and imposition. Owing to the introduction of the alternative standard, a distinction arose between "broadcloth" (cloth of two yards) and "streit" or "strait" (narrow cloth of one yard). The meaning now attached to broadcloth, however, is merely that of material of superior quality. Alnage duties and the office of alnager were abolished in 1699.

See W. J. Ashley, *Economic History*; and W. Cunningham, *Growth of English Industry and Commerce*.

ALNWICK, a market-town and the county-town of Northumberland, England, in the Berwick-upon-Tweed parliamentary division, 309 m. N. by W. from London, on a branch of the North Eastern railway. Pop. of urban district (1901) 6716. It is beautifully situated on the small river Aln, in a hilly district. Its history has left many marks. Dominating the town from an eminence above the south bank of the river stands the castle, held by the Percys since 1309, and long before this an important border stronghold. A gateway of *c.* 1350, a fine Norman arch of the middle of the 12th century, and the ancient well in the keep, are among noteworthy ancient portions; but the castle was extensively renovated and altered in the second half of the 18th century, while in 1854, when the lofty Prudhoe tower was built, a scheme of decoration in Italian style was adopted in the interior; so that the castle, though magnificent, has largely lost its historic character. It contains numerous fine examples of the works of Italian and other artists, and collections of British and Roman and Egyptian antiquities. In the beautiful park are a monument commemorating the capture of William the Lion of Scotland when besieging the town in 1174, two memorial towers, and a British stone chamber. Remains of the wall which formerly surrounded Alnwick are visible, and one of the four gates, the Bondgate, stands, dating from the early part of the 15th century. The church of St Michael has Norman remains, but is principally Perpendicular; it contains several ancient monuments and incised slabs. The modern church of St Paul has a fine east window of German stained glass. Within the confines of the park are ruins of two abbeys. Alnwick Abbey was a Premonstratensian foundation of 1147; only a gateway tower stands, but the ground-plan was excavated in 1884 and is outlined on the surface. At 3 m. from the town are more extensive remains of Hulne Abbey (1240), an early Carmelite monastery. The long narrow church remains unroofed; there are also a gateway tower, and portions of the chapter-house and cloisters. The Norman chapel of the hospital of St Leonard, which, as well as Alnwick Abbey, was founded by Eustace Fitz John, completes the series of antiquities in Alnwick. In this interesting locality, however, there must be mentioned the mansion of Howick, built in the 18th century, in a fine situation near the coast to the N.E. Not far from this, overlooking the sea from a rocky cliff pierced by deep gullies, are the ruins of Dunstanborough Castle; it dates from the 14th century, though the site was probably occupied as a stronghold from earlier times.

The chief industries are brewing, tobacco, snuff and fishing-tackle making, and corn milling. Alnwick is under an urban district council, but is a borough by prescription, and its freemen form a body corporate without authority over the affairs of the town. It is, however, required to pay, under an act of 1882, a sum not less than £500 out of the corporate property towards the upkeep of corporation schools. An ancient peculiar ceremony was attached until modern times to the making of freemen; those elected were required to ride in procession to a large pool called Freemen's Well and there rush through the water According to tradition the observance of this custom was enjoined by King John to punish the inhabitants, the king having lost his way and fallen into a bog owing to the neglected condition of the roads in the neighbourhood.

According to the Chronicle of Alnwick Abbey, the barony of Alnwick belonged before the Conquest to Gilbert Tyson, whose son and heir William was killed at Hastings, and whose estates with his daughter were granted by the king to Ivo de Vescy, although this theory does not seem probable since Gilbert Tyson was certainly not a Saxon. In 1297 William de Vescy, a descendant of Ivo, dying without issue, left the barony to the bishop of Durham, who in 1309 sold it to Sir Henry Percy, in whose family it still continues. The town evidently grew up round the castle, which is said to have been built by Eustace FitzJohn about 1140. Tradition states that it received its borough charter from King John. However, Alnwick is first definitely mentioned as a borough in a charter given by William de Vescy in the reign of Henry II., by which the burgesses were to have common of pasture on Haydon Moor and to hold of him "as freely and quietly as the burgesses of Newcastle hold of the king." This charter was confirmed by his grandson, William de Vescy, in an undated charter, and again by William, son of the latter William, in 1290. According to an inquiry of 1291 a market and fair were held in Alnwick from time immemorial. In 1297 Edward I., in addition, granted the bishop of Durham a market on Saturday, and a fair on the 17th of March and six following days. By charters of Henry VI. the burgesses received licence to enclose their town with a wall, to have a free port at Alnmouth, a market on Wednesday as well as Saturday, and two new fairs on the feasts of SS Philip and James and St Lucy, and eight days following each. Tanning and weaving were formerly the principal industries carried on in Alnwick, and in 1646 there were twenty-two tanneries there. Alnwick has never been represented in parliament.

See George Tate, *The History of the Borough, Castle, and Barony of Alnwick*, 2 vols. (Alnwick, 1866–1869); *Victoria County History, Northumberland*.

ALOE, a genus of plants belonging to the natural order Liliaceae, with about 90 species growing in the dry parts of Africa, especially Cape Colony, and in the mountains of tropical Africa. Members of the closely allied genera *Gasteria* and *Haworthia*, with a similar mode of growth, are also cultivated and popularly known as aloes. The plants are apparently stemless, bearing a rosette of large, thick, fleshy leaves, or have a shorter or longer (sometimes branched) stem, along which, or towards the end of which and its branches, the generally fleshy leaves are borne. They are much cultivated as ornamental plants, especially in public buildings and gardens, for their stiff, rugged habit. The leaves are generally lance-shaped with a sharp apex and a spiny margin; but vary in colour from grey to bright green, and are sometimes striped or mottled. The rather small tubular yellow or red flowers are borne on simple or branched leafless stems and are generally densely clustered. The juice of the leaves of certain species yields *aloes* (see below). In some cases, as in *Aloe venenosa*, the juice is poisonous. The plant called American aloe, *Agave americana* (*q.v.*), belongs to a different order, viz. Amaryllidaceae.

Aloes is a medicinal substance used as a purgative and produced from various species of aloe, such as *A. vera*, *vulgaris*, *socotrina*, *chinensis*, and *Perryi*. Several kinds of aloes are distinguished in commerce—Barbadoes, Socotrine, hepatic, Indian, and Cape aloes. The first two are those commonly used for medicinal purposes. Aloes is the expressed juice of the leaves of the plant. When the leaves are cut the juice flows out, and is collected and evaporated. After the juice has been obtained, the leaves are sometimes boiled, so as to yield an inferior kind of aloes.

From these plants active principles termed *aloins* are extracted by water. According to W. A. Shenstone, two classes are to be recognized: (1) Nataloins, which yield picric and oxalic acids with nitric acid, and do not give a red coloration with nitric acid; and (2) Barbaloins, which yield aloetic acid, $C_7H_2N_2O_5$, chrysammic acid, $C_7H_2N_2O_6$, picric and oxalic acids with nitric acid, being reddened by this reagent. This second group may be divided into α-Barbaloins, obtained from Barbadoes aloes, and reddened in the cold, and β-Barbaloins, obtained from Socotrine and Zanzibar aloes, reddened by ordinary nitric acid only when warmed, or by fuming acid in the cold. Nataloin, $2C_{17}H_{18}O_7 \cdot H_2O$, forms bright yellow scales, melting at 212°–222°; barbaloin, $C_{17}H_{18}O_7$, forms yellow prismatic crystals. Aloes also contain a trace of volatile oil, to which its odour is due.

The dose is 2 to 5 grains, that of aloin being ½ to 2 grains. Aloes can be absorbed from a broken surface and will then cause purging. When given internally it increases the actual amount as well as the rate of flow of the bile. It hardly affects the small intestine, but markedly stimulates the muscular coat of the large intestine, causing purging in about fifteen hours. There is hardly any increase in the intestinal secretion, the drug being emphatically not a hydragogue cathartic. There is no doubt that its habitual use may be a factor in the formation of haemorrhoids; as in the case of all drugs that act powerfully on the lower part of the intestine, without simultaneously lowering the venous pressure by causing increase of secretion from the bowel. Aloes also tends to increase the menstrual flow and therefore belongs to the group of emmenagogues. Aloin is preferable to aloes for therapeutic purposes, as it causes less, if any, pain. It is a valuable drug in many forms of constipation, as its continual use does not, as a rule, lead to the necessity of enlarging the dose. Its combined action on the bowel and the uterus is of especial value in chlorosis, of which amenorrhoea is an almost constant symptom. The drug is obviously contra-indicated in pregnancy and when haemorrhoids are already present. Many well-known patent medicines consist essentially of aloes.

The *lign-aloes* is quite different from the medicinal aloes. The word is used in the Bible (Numb. xxiv. 6), but as the trees usually supposed to be meant by this word are not native in Syria, it has been suggested that the LXX. reading in which the word does not occur is to be preferred. Lign-aloe is a corruption of the Lat. *lignum-aloe*, a wood, not a resin. Dioscorides refers to it as *agallochon*, a wood brought from Arabia or India, which was odoriferous but with an astringent and bitter taste. This may be *Aquilaria agallochum*, a native of East India and China, which supplies the so-called eagle-wood or aloes-wood, which contains much resin and oil.

ALŌÏDAE, or ALŌADAE, *i.e.* Otus and Ephialtes, in ancient Greek legend, the twin-sons of Poseidon by Iphimedeia, wife of Aloeus. They were celebrated for their extraordinary stature and strength. According to Homer (*Od.* xi. 305), they made war upon the Olympian gods and endeavoured to pile Pelion upon Ossa in order to storm heaven itself; had they reached the age of manhood, their attempt would have been successful, but Apollo destroyed them before their beards began to grow. In the *Iliad* (v. 365) Ares is imprisoned by them, but delivered by Hermes. Apollodorus says that they succeeded in piling Pelion upon Ossa. Another story is that they were presumptuous enough to seek Artemis and Hera in marriage, and that Artemis caused them to slay each other unintentionally on the island of Naxos, where they were afterwards worshipped as heroes. In punishment for their offences they were bound back to back with snakes to a pillar in the lower world (Hyginus, *Fab.* 28). The Alōïdae (here connected with ἀλωή, threshing-floor) represent the spirits of the fertile earth and agriculture, conceived of by the Greeks as engaged in combat with the Olympian gods. In contrast to these legends, Pausanias tells us that they were regarded as the first to worship the Muses on Mt. Helicon, while Diodorus represents them as historical personages, princes of Thessaly, who defeated the Thracians in Strongyle, *i.e.* Naxos, where they made themselves rulers, and subsequently slew one another in a quarrel.

ALOMPRA, ALOUNG P'HOURA (1711–1760), founder of the last Burmese dynasty, was born in 1711 at Mōtshobo, a small village 50 m. north-west of Ava. Of humble origin, he had risen to be chief of his native village when the invasion of Burma by the king of Pegu in 1752 gave him the opportunity of attaining to the highest distinction. The whole country had tamely submitted to the invader, and the leading chiefs had taken the oaths of allegiance. Alompra, however, with a more independent spirit, not only contrived to regain possession of his village, but was able to defeat a body of Peguan troops that had been sent to punish him. Upon this the Burmese, to the number of a thousand, rallied to his standard and marched with him upon Ava, which was recovered from the invaders before the close of 1753. For several years he prosecuted the war with uniform success. In 1754 the Peguans, to avenge themselves for a severe defeat at Keoum-nuoum, slew the king of Burma, who was their prisoner. The son of the latter claimed the throne, and was supported by the tribe of Quois; but Alompra resisted, being determined to maintain his own supremacy. In 1755 Alompra founded the city of Rangoon. In 1757 he had established his position as one of the most powerful monarchs of the East by the invasion and conquest of Pegu. Before a year elapsed the Peguans revolted; but Alompra, with his usual promptitude, at once quelled the insurrection. The Europeans were suspected of having instigated the rising, and the massacre of the English at Negrais in October 1759 is supposed to have been approved by Alompra after the event, though there is no evidence that he ordered it. Against the Siamese, who were also suspected of having abetted the Peguan rebels, he proceeded more openly and severely. Entering their territory, he was just about to invest the capital when he was seized with an illness which proved fatal on the 15th of May 1760. Alompra is one of the most remarkable figures in modern Oriental history. To undoubted military genius he added considerable political sagacity, and he deserves particular credit for his efforts to improve the administration of justice. His cruelty and deceitfulness were faults common to all Eastern despots.

ALONE. This adjective or adverb requires no definition for its meaning of "by oneself" or "solitary"; but its etymological history, as simply a combination of the words "all" and "one" is rather curious (compare the Ger. *allein*). "Lone" is merely a clipped form of the word, and so "lonely." The *New English Dictionary* traces the English word back to the year 1300.

ÁLORA, a town of southern Spain in the province of Málaga; 17 m. W.N.W. of Málaga, on the right bank of the river Guadalhorce, and on the Cordova-Málaga railway. Pop. (1900) 10,525. Álora, which is an ancient and picturesque town, with several Moorish ruins, occupies an outlying hill of the Sierra de Tolox, and overlooks a fertile valley where maize, sugar-cane and date-palms are cultivated. There are hot sulphurous springs in the town, which has also a fine climate; and many of the wealthy families from Málaga reside here in summer. Brandy distilling is, after agriculture, the chief local industry.

ALOST (Flem. *Aalst*), a town of Belgium, in the province of East Flanders, situated on the left bank of the Dender; the ancient capital of what was called Imperial Flanders. Pop. (1897) 28,771; (1904) 31,655. Flanders in the feudal period was a fief of the king of France—the count of Flanders being the first of the twelve peers of France; but there was a small strip extending from Alost to the isles of Zeeland, designated Imperial Flanders, of which the count was the vassal of the Holy Roman emperor. Attached to the hôtel de ville is a fine belfry of the 15th century, but unfortunately it was seriously damaged by fire in 1879. In the church of St Martin, dating from 1498 but unfinished, is a fine Rubens. The subject is St Roch, the patron saint of lepers, and the colouring of the scaly skin of the leper in the forefront of the picture is generally regarded as one of the master's most striking effects. The work was painted to the order of the Brewers' Gild in (it is said) eight days. It was outside Alost that William Clito, grandson of William the Conqueror, who was then endeavouring to establish his claims as count of Flanders, was mortally wounded in 1128. Of all the claims Alost possesses to fame perhaps the most remarkable is that Thierry Maartens (*c.* 1474) set up there one of the first printing presses in Europe. Alost is famous to-day for its hop gardens and linen-bleaching establishments. The meadows south of Alost are often covered with the linen undergoing the process of bleaching, which makes them assume the aspect of a whitish-blue carpet.

ALP. To the Swiss dwellers in the plains the term "the Alps" (*q.v.*) signifies the high snowy mountains which they see on the horizon, but to the dwellers in the valleys which nature has carved in the sides of those high mountains, the word alp means exclusively the summer pastures situated on the slopes above the valley, though below the snow-line. In fact such pastures are essential to the inhabitants of pastoral alpine districts, for the fodder to be obtained in the valley itself would not suffice to support the number of cattle which are required to afford sustenance to the inhabitants. Such mountain pastures, made use of only during the summer months, are of almost immemorial antiquity, cases occurring in 739, 868 and 999, while they are found in all parts of the Alpine chain. In France and Italy the system is badly managed, as also in Tirol (where the local name is *Almen*), where, too, these pastures have in the course of years been largely alienated by the valley inhabitants, and belong to large villages or small towns almost in the plains. But in Switzerland, and especially in the German-speaking mountain districts, the alps are the centre round which the entire pastoral life of the inhabitants turns. It is reckoned that in that country there are now about 4778 alps in all, the capital value of which is put at rather over £3,000,000. Of these alps about 45% are owned by the communes (exclusively or jointly) and 54% by individuals, the remaining 1% being the property of the state or a few great monasteries. In the case of the alps belonging to the Swiss communes, it must be borne in mind that "commune" here does not signify either *Einwohnergemeinden* or *Bürgergemeinden*, but a special class called *Alpgemeinden* (for instance in the well-known valley of Grindelwald there is one *Einwohnergemeinde*, but seven *Alpgemeinden*). These *Alpgemeinden* are composed of the persons who have a right to send cattle up to any particular alp in summer, this right being attached (in different places) either to certain plots of ground in the valley or certain houses in the village, or to certain persons. In any case the owners of an alp fix the greatest number of cows which it can support during the summer without being permanently damaged. The plot of ground which can support a single cow (or 2 heifers, 3 calves or sheep, 4 pigs or 8 goats) is called a *Kuhstoss* (of which there are 270,389 in Switzerland), and it is in these terms that the productiveness of the alp is reckoned. Sometimes a particular alp, or a portion of it, is reserved exclusively to heifers and calves, or to goats (in this case it is the loftier portion). On each alp there are several sets of huts wherein live the cow-herds and cheese-makers (the latter are called *Sennen* or *Fruitiers*), the cattle being generally left in the open. The cattle, with their attendants, shift from one to the other of these sets of huts, between the end of June and the end of September, making but one sojourn at the highest huts, but two at the lower. The proper name for these nuts is *Sennhütten* or *chalets*, but the latter term is incorrectly applied also to houses in the village below. The milk given each day by each cow is entered in a book, and then made into butter and cheese, the cow-herds and cheese-makers having the right to a certain proportion of milk, butter and cheese for their own sustenance, and receiving a small sum per head of cattle for looking after them. At the end of the season the net amount of cheese produced by milk from each cow is handed over to the owner of that particular cow, and is carried down by him to his home in the valley from the hut (a small building on four stone legs to secure the contents from mice) wherein the cheeses have been stored since they were made—this hut is called a *Speicher*. As the owners of *Kuhstössen* may exchange them provisionally for others on another alp, or may hire them out (they can only sell them with the plot or house to which they are attached), the persons who in any given summer actually send cows up to an alp (these form the *Besetzerschaft*) need not necessarily be absolutely identical with the true owners of these rights or *Besitzerschaft*. Hay is never mown on the true alps save in spots which are not easily accessible to cattle (in very high spots it belongs to the mower, and is then called *Wildheu*), but hay-crops are made on the Mayens or *Voralpen*, the lowest pastures, situated between the homesteads and the true alps; these *Voralpen* are individual (not communal) property, though probably in olden days cut out of the true *Alpen*. In the winter the cattle consume the hay mown on these *Voralpen* (which, to a certain extent, are grazed in late spring and early autumn, that is, before and after the summer sojourn on the alps), either living in the huts on the *Voralpen* while they consume it, or in the stable attached to the dwelling-houses in the village; in the barn is stored the hay mown on the homestead and on the meadows near the village, which may belong to the owner of the cattle. The whole system is well organized and is well understood by the natives, though not always by strangers who visit the Alps in summer.

See John Ball, *Hints and Notes for Travellers in the Alps* (article x., especially pp. lvii.-lxv.); new edition, London, 1899; Felix Anderegg, *Illustriertes Lehrbuch für die gesamte schweiz. Alpwirtschaft* (Bern, 1897–1898); the *Schweiz-Alpstatistik* (each volume devoted to the alps of a single Swiss canton); and A. v. Miaskowski's two books, *Die schweiz. Allmend* (Leipzig, 1879), and *Die Verfassung der Land-, Alpen- und Forstwirtschaft der Schweiz* (Basel, 1878). (W. A. B. C.)

ALPACA, one of two domesticated breeds of South American camel-like ungulates, derived from the wild huanaco or guanaco. Alpacas are kept in large flocks which graze on the level heights of the Andes of southern Peru and northern Bolivia, at an elevation of from 14,000 to 16,000 ft. above the sea-level, throughout the year. They are not used as beasts of burden like llamas, but are valued only for their wool, of which the Indian blankets and ponchos are made. The colour is usually dark brown or black and the coat of great length, reaching nearly to the ground. In stature the alpaca (*Lama huanacos pacos*) is considerably inferior to the llama, but has the same unpleasant habit of spitting.

In the textile industries "alpaca" is a name given to two distinct things. It is primarily a term applied to the wool, or rather hair, obtained from the Peruvian alpaca. It is, however, more broadly applied to a style of fabric originally made from the alpaca wool but now frequently made from an allied type of wool, viz. mohair, Iceland, or even from lustrous English wool. In the trade, distinctions are made between alpacas and the several styles of mohairs and lustres, but so far as the general purchaser is concerned little or no distinction is made.

The four species of indigenous South American wool-bearing animals are the llama, the alpaca, the guanaco and the vicuña. The llama and the alpaca are domesticated; the guanaco and the vicuña run wild. Of the four the alpaca and the vicuña are the most valuable wool-bearing animals: the alpaca on account of the quality and quantity, the vicuña on account of the softness, fineness and quality of its wool. In the early days of the 19th century, the usual length of alpaca staples appears to have been about 12 in., this being a three years' growth; but to-day the length is little more than about half this, *i.e.* a one to two years' growth, although from time to time longer staples are to be found. The fleeces are sorted for colour and quality by skilled native women. The colour of the greater proportion of alpaca imported into the United Kingdom is black and brown, but there is also a fair proportion of white, grey and fawn. It is customary to mix these colours together, thus producing a curious ginger-coloured yarn, which upon being dyed black in the piece takes a fuller and deeper shade than can be obtained by piece-dyeing a solid-coloured wool. In physical structure alpaca is somewhat akin to hair, being very glossy, but its softness and fineness enable the spinner to produce satisfactory yarns with comparative ease.

The history of the manufacture of this wool into cloth is one of the romances of commerce. Undoubtedly the Indians of Peru employed this fibre in the manufacture of many styles of fabrics for centuries before its introduction into Europe as a commercial product. The first European importations would naturally be into Spain. Spain, however, transferred the fibre to Germany and France. Apparently alpaca yarn was spun in England for the first time about the year 1808. It does not appear to have made any headway, however, and alpaca wool was condemned as an unworkable material. In 1830 Benjamin Outram, of Greetland, near Halifax, appears to have again attempted the spinning of this fibre, and for the second time alpaca was condemned. These two attempts to use alpaca were failures owing to the style of fabric into which the yarn was woven—a species of camlet. It was not until the introduction of cotton warps into the Bradford trade about 1836 that the true qualities of alpaca could be developed in the fabric. Where the cotton warp and mohair or alpaca weft plain-cloth came from is not known, but it was this simple yet ingenious structure which enabled Titus Salt (*q.v.*), then a young Bradford manufacturer, to utilize alpaca successfully. Bradford is still the great spinning and manufacturing centre for alpacas, large quantities of yarns and cloths being exported annually to the continent and to the United States, although the quantities naturally vary in accordance with the fashions in vogue, the typical "alpaca-fabric" being a very characteristic "dress-fabric."

The following statistics, taken from Hooper's *Statistics of the Woollen and Worsted Trades of the United Kingdom*, give an idea of the extent of the trade in yarns and fabrics of the alpaca type; unfortunately statistics for alpaca alone are not published.

Alpaca, Vicuña, and Llama Wool imported into the United Kingdom.

Year.	Peru.		Chile.[1]	
	lb	£	lb	£
1854	1,247,015	124,946	15,573	1,557
1860	2,334,048	263,635	520,402	58,443
1870	3,324,454	388,969	563,782	65,996
1880	1,412,365	98,644	890,627	64,621
1890	3,114,336	190,703	564,606	30,694
1900	4,236,566	205,839	1,148,694	51,116
1902	5,038,998	259,927	1,028,171	47,610
1905	2,301,522	119,321	2,302,650	112,367

Note.—In 1840 the imports into, exports from, and consumed in the United Kingdom of mohair, alpaca, vicuña, &c., amounted to £50,000.

Exports of Mohair and Alpaca Yarns for 1905.

Russia . . .	1,288,800 lb .	£168,596
Germany . . .	9,851,200 ,, .	1,145,795
Belgium . . .	316,400 ,, .	40,409
France . . .	2,006,700 ,, .	223,605

Exports of Alpaca from the United Kingdom to the United States.

1881 . .	£1,256	1900 . .	£30,631
1890 . .	—	1905 . .	4,954

Owing to the success in the manufacture of the various styles of alpaca cloths attained by Sir Titus Salt and other Bradford manufacturers, a great demand for alpaca wool arose, and this demand could not be met by the native product, for there never seems to have been any appreciable increase in the number of alpacas available. Unsuccessful attempts were made to acclimatize the alpaca goat in England, on the European continent and in Australia, and even to cross certain English breeds of sheep with the alpaca. There is, however, a cross between the alpaca and the llama—a true hybrid in every sense—producing a material placed upon the Liverpool market under the name "Huarizo." Crosses between the alpaca and vicuña have not proved satisfactory.

The preparing, combing, spinning, weaving and finishing of alpacas and mohairs are dealt with under WOOL. (A. F. B.)

ALP ARSLAN, or AXAN, **MAHOMMED BEN DA'UD** (1029–1072), the second sultan of the dynasty of Seljuk, in Persia, and great-grandson of Seljuk, the founder of the dynasty, was born in the year A.D. 1029 (421 of the Hegira). He assumed the name of Mahommed when he embraced the Mussulman faith; and on account of his military prowess he obtained the surname *Alp Arslan*, which signifies "a valiant lion." He succeeded his father Da'ud as ruler of Khorasan in 1059, and his uncle Togrul Bey as sultan of Oran in 1063, and thus became sole monarch of Persia from the river Oxus to the Tigris. In consolidating his empire and subduing contending factions he was ably assisted by Nizām ul-Mulk, his vizier, one of the most eminent statesmen in early Mahommedan history. Peace and security being established in his dominions, he convoked an assembly of the states and declared his son Malik Shah his heir and successor. With the hope of acquiring immense booty in the rich church of St Basil in Caesarea, the capital of Cappadocia, he placed himself at the head of the Turkish cavalry, crossed the Euphrates and entered and plundered that city. He then marched into Armenia and Georgia, which, in 1064, he finally subdued. In 1068 Alp Arslan invaded the Roman empire. The emperor Romanus Diogenes, assuming the command in person, met the invaders in Cilicia. In three arduous campaigns, the two first of which were conducted by the emperor himself while the third was directed by Manuel Comnenus, the Turks were defeated in detail and finally (1070) driven across the Euphrates. In 1071 Romanus again took the field and advanced with 100,000 men, including a contingent of the Turkish tribe of the Uzes and of the French and Normans, under Ursel of Baliol, into Armenia. At Manzikert, on the Murad Tchai, north of Lake Van, he was met by Alp Arslan; and the sultan having proposed terms of peace, which were scornfully rejected by the emperor, a battle took place in which the Greeks, after a terrible slaughter, were totally routed, a result due mainly to the rapid tactics of the Turkish cavalry. Romanus was taken prisoner and conducted into the presence of Alp Arslan, who treated him with generosity, and terms of peace having been agreed to, dismissed him, loaded with presents and respectfully attended by a military guard. The dominion of Alp Arslan now extended over the fairest part of Asia; 1200 princes or sons of princes surrounded his throne and 200,000 warriors were at his command. He now prepared to march to the conquest of Turkestan, the original seat of his ancestors. With a powerful army he advanced to the banks of the Oxus. Before he could pass the river with safety it was necessary to subdue certain fortresses, one of which was for several days vigorously defended by the governor, Yussuf Kothual, a Kharizmian. He was, however, obliged to surrender and was carried a prisoner before the sultan, who condemned him to a cruel death. Yussuf, in desperation, drew his dagger and rushed upon the sultan. Alp Arslan, the most skilful archer of his day, motioned to his guards not to interfere and drew his bow, but his foot slipped, the arrow glanced aside and he received the assassin's dagger in his breast. The wound proved mortal, and Alp Arslan expired a few hours after he received it, on the 15th of December 1072.

See Gibbon, *Decline and Fall of the Roman Empire*, edited by J. B. Bury (1898), vi. pp. 235 et seq., and authorities there cited.

ALPENA, a city and the county seat of Alpena county, Michigan, U.S.A., on Thunder Bay, a small arm of Lake Huron, at the mouth of Thunder Bay river, in the N.E. part of the lower peninsula. Pop. (1890) 11,283; (1900) 11,802, of whom 4193 were foreign-born; **(1910 census) 12,706.** It is served by the Detroit & Mackinac railway and by steamboat lines to Detroit and other ports. The city is built on sandy ground on both sides of the river and has a good harbour, which has been considerably improved by the Federal government; in 1907 the maximum draft that could be carried over the shallowest part of the channel was 14 ft. There is good farming land in the vicinity and Alpena has lumber and shingle mills, pulp works, Portland cement manufactories and tanneries; in 1905 the city's factory products were valued at $2,905,263. In 1906 the commerce of the port, chiefly in lumber, cement, coal, cedar posts and ties, fodder and general merchandise, was valued at $3,018,894. Alpena occupies the site of an Indian burying-ground. A trading-post was established here in 1835, but the permanent settlement dates from 1858; in 1871 Alpena was chartered as a city.

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[1] Grown in Peru but shipped from Valparaiso.

ALPENHORN, ALPHORN, a musical instrument, consisting of a natural wooden horn of conical bore, having a cup-shaped mouthpiece, used by mountaineers in Switzerland and elsewhere. The tube is made of thin strips of birchwood soaked in water until they have become quite pliable; they are then wound into a tube of conical form from 4 to 8 ft. long, and neatly covered with bark. A cup-shaped mouthpiece carved out of a block of hard wood is added and the instrument is complete. The alpenhorn has no lateral openings and therefore gives the pure natural harmonic series of the open pipe. The harmonics are the more readily obtained by reason of the small diameter of the bore in relation to the length. An alpenhorn made at Rigi-Kulm, Schwytz, and now in the South Kensington Museum, measures 8 ft. in length and has a straight tube. The well-known *Ranz des Vaches* is the traditional melody of the alpenhorn, which has been immortalized by Beethoven in the finale of the *Pastoral Symphony*, where the music is generally rendered by a *cor anglais* (*q.v.*). Rossini has introduced the melody into his opera *William Tell*. Wagner, in the third act of *Tristan and Isolde*, was not entirely satisfied with the tone quality of the *cor anglais* for representing the natural pipe of the peasant. Having in his mind the timbre of the alpenhorn, he had a wooden horn made for him with one valve only and a small pear-shaped bell, which is used at Bayreuth (see Holztrompete). The Swiss alpenhorn varies in shape according to the locality, being curved near the bell in the Bernese Oberland. Michael Praetorius mentions the alpenhorn under the name of *holzern trummet* in *Syntagma Musicum* (Wittenberg, 1615–1619). (K. S.)

ALPES MARITIMES, a department in the S.E. of France, formed in 1860 out of the county of Nice, to which were added the districts of Grasse (formerly in the department of the Var) and of Mentone (purchased from the prince of Monaco). Pop. (1906) 334,007. It is bounded N.E. and E. by Italy, S. by the Mediterranean Sea, and W. by the departments of the Var and the Basses Alpes, while its northern extremity forms a sharp angle between France and Italy. Its area is 1444 sq. m., its greatest length is 59 m. and its greatest breadth 48½ m. It is composed of the valley of the Var river (which is all but completely within this department), together with those of its chief affluents, the Tinée and the Vésubie. The region of Grasse is hilly, but the rest of the department is mountainous, its loftiest point being the Mont Tinibras (9948 ft.) at the head of the Tinée valley. Two singular features of the frontier of the department towards the east are only to be explained by historical reasons. One is that the central bit of the Roja valley is French, while the upper and lower bits of this valley are Italian; the reason is that those bits which are now Italian formed part of the county of Ventimiglia, and the central bit part of the county of Nice, which alone became French in 1860. The result is that the Italians are now unable to build a railway from Cuneo by the Col de Tenda and down the Roja valley direct to Ventimiglia. The other strange feature is that from near Isola in the upper Tinée valley southwards the political frontier does not coincide with the physical frontier, or the main watershed of the Alpine chain; the reason (it is said) is that in 1860 all the higher valleys of the Maritime Alps (on both sides of the watershed) were expressly excepted from the treaty of cession, in order that Victor Emmanuel II. might retain his right of chamois hunting in these parts. The department is divided into three arrondissements (Nice, Grasse and Puget Théniers), 27 cantons and 155 communes. It forms the bishopric of Nice (the first bishop certainly known is mentioned at the end of the 4th century), which till 1792 was in the ecclesiastical province of Embrun, then (1802) in that of Aix en Provence, next in that of Genoa (1814), and finally (1860) in that of Aix again. Its chief town is Nice. The broad-gauge railways in the department cover 56 m., including the line along the coast, while there are also 82 m. of narrow-gauge railways. The chief industries are distilleries for perfumes and manufacture of olive oil, of pottery and of tiles, besides a great commerce in cut flowers. To foreigners the department is best known for its health resorts, Nice, Cannes, Mentone, Antibes and Beaulieu, while other important towns are Grasse and Puget Théniers. (W. A. B. C.)

ALPHA and **OMEGA** (Α and Ω), the first and last letters of the Greek alphabet, corresponding to the *Aleph* and *Taw* of the Hebrew. They are used as a designation of Himself by the speaker in Rev. i. 8; xxi. 6; xxii. 13. The first and last letters of the Hebrew alphabet are used in Rabbinic writings in a similar way. We find also "the seal of God is Emeth," Emeth (truth) being composed of the first, middle and last letters of the Hebrew alphabet. God is thus represented as the beginning, middle and end of all things (see the *Jewish Encyclopaedia*, s.v.).

ALPHABET (see also Writing). By the word *alphabet*, derived from the Greek names for the first two letters—*alpha* and *beta*—of the Greek alphabet, is meant a series of conventional symbols each indicating a single sound or combination of sounds. The ideal alphabet would indicate one sound by one symbol, and not more than one sound by the same symbol. Symbols for a combination of sounds are not necessary, though they may be convenient as abbreviations. In the writing of some languages, *e.g.* Sanskrit, such abbreviations are carried to an extreme; in most Greek MSS. also they are of very frequent occurrence. These contractions, however, may prove too great a strain upon the eyesight or the memory, and thus become a hindrance instead of a help. This was apparently the case in Greek, for though the early printers cast types for all the contractions of the Greek MSS. these have now with one consent been given up. A consonant like *x* can only be regarded as an abbreviation; it expresses nothing that cannot as well be expressed by *ks* or *gz*, both of which combinations in different situations it may represent (see X). No alphabet corresponds exactly to the ideal which we have postulated, nor if it did, would it continue long so to do, as the sounds of most languages are continually changing. Hence in the case of dead languages or past forms of living languages, it is often very difficult to define with precision what the sounds of the past epoch were. The study of the history of English pronunciation occupied the late Dr A. J. Ellis for a large part of his life, and the results fill five large volumes. The sounds which are most difficult to define exactly are the vowels; a great variety may be indicated by the same symbol. In the New English Dictionary no fewer than thirteen different *nuances* of vowel sound are distinguished under the symbol A alone. In English, moreover, the vowel sounds tend to become diphthongs, so that the symbol for the simple sound tends to become the symbol for that combination which we call a diphthong. Thus the long *ī* in *ride, wine*, &c., has become the diphthong *ai*, and the name of the symbol I is itself so pronounced. In familiar, if vulgar, dialects, A tends in the same direction. In the "cockney" dialect, really the dialect of Essex but now no less familiar in Cambridge and Middlesex, the *ai* sound of *ī* is represented by *oi* as in *toime*, "time," while *ā* has become *ai* in *Kate, pane*, &c. In all southern English *ō* becomes more rounded while it is being pronounced, so that it ends with a slight *u* sound. In the vulgar dialect already mentioned, the sound begins as a more open sound than in the cultivated pronunciation, so that *no* is really pronounced as *naou*. It is clear, therefore, that the best alphabet would not long indicate very precisely the sounds which it was intended to represent. See Phonetics.

But the history of the alphabet shows that at no time has it represented any European language with much precision, because it was an importation adapted in a somewhat rough and ready fashion to represent sounds different from those which it represented outside Europe. Wherever the alphabet may have originated, there seems no doubt that its first importation in a form closely resembling that with which we are familiar in modern times was from the Phoenicians to the Greeks. The Phoenicians were certainly using it with freedom in the 9th century B.C.; with so much freedom, indeed, that they must have been in possession of it for a considerable time before we can trace it. With the materials available up to August 1910 it would be idle here to attempt to trace its earlier history. Great discoveries in Cappadocia, Assyria and Egypt were then only at their beginning, and any statement was liable to be quickly disproved by the appearance of new evidence. The prevalent theory, universally accepted till a few years ago, was that of Vicomte Emmanuel de Rougé, first propounded to the Académie des Inscriptions in 1859, but unnoticed by the world at large till republished, after de Rougé's death, by his son in 1874. According to this view the alphabet was borrowed by the Phoenicians from the cursive (hieratic) form of Egyptian hieroglyphics. The resemblances between some Egyptian symbols and some symbols of the Phoenician alphabet are striking; in other cases the differences are no less remarkable. As a matter of fact the Egyptians might have passed about thirty-five centuries B.C. from the picture writing of hieroglyphs to genuine alphabetic signs.[1] They did not, however, profit by their discovery, because, amongst the Egyptians, writing was clearly a mystery in both senses—only possible at that period for masters in the craft, and also something, like the writing of medical prescriptions at the present day in Latin, which was not to be made too easily intelligible to the common people. At all periods, moreover, hieroglyphic writing was a branch of decorative art, and it may have been that the ancient Egyptian, like the modern Turk, resented too much lucidity, and liked his literary compositions to be veiled in a certain obscurity. The alphabet devised by the Egyptians consisted of twenty-four letters. Egyptologists are at variance on the question whether this alphabet was the original, or had any influence upon the development of the Phoenician alphabet. "With the papyrus paper," says Professor Breasted,[2] "the hand customarily written upon it in Egypt now made its way into Phoenicia, where before the 10th century B.C. it developed into an alphabet of consonants, which was quickly transmitted to the Ionian Greeks and thence to Europe." On the other hand, Professor Spiegelberg,[3] writing soon after Professor Breasted, says that investigation has not as yet furnished proof that the Phoenician alphabet is of Egyptian origin, though he admits that in some respects the development of the two alphabets, both without vowel signs, is curiously parallel.

The most recent view is that of Dr A. J. Evans, who argues ingeniously that the alphabet was taken over from Crete by the "Cherethites and Pelethites" or Philistines, who established for themselves settlements on the coast of Palestine.[4] From them it passed to the Phoenicians, who were their near neighbours, if not their kinsfolk. Symbols like the letters of the alphabet have been found in European soil painted upon pebbles belonging to a stratum between the Palaeolithic and Neolithic age.[5] This was in France at Mas d'Azil on the left bank of the Arize. Elsewhere several series of such symbols resembling inscriptions have been found scratched on bones of the same period.[6] For the history of writing these may be important, but for the history of the alphabet, as we know it, they are not in question. The alphabet may have originated as Dr Evans thinks, but at present the proof is not conclusive. The Greek names of the letters, their forms, and the order of the symbols show that the Greek alphabet as we know it must have been imported by or from a Semitic people, and there is no evidence to contradict ancient tradition that this people was the Phoenicians. The view propounded by Deecke[7] in 1877, that the Phoenician alphabet had developed out of the late Assyrian cuneiform, never met with much acceptance and has really no evidence in its favour.

The earliest alphabetic document which can be dated with comparative certainty is the famous Moabite stone, which was discovered in 1868, and after a controversy between rival claimants which led to its being broken in pieces by the Arabs, ultimately reached the Louvre, where in a restored form it remains. The long inscription upon it celebrates the achievements of Mesha, king of Moab, who had been a tributary of Ahab, king of Israel, and rebelled after his death (1 Kings iii. 4, 5). Though the chronology of the period is somewhat uncertain, the date must be in the first half of the 9th century B.C. It is to be remembered, however, that important as this monument is for the development of the alphabet, and because it can be dated with tolerable accuracy, the dialect and alphabet of Moab are not in themselves proof for the Phoenician forms which influenced the peoples of the Aegean, and through them Western Europe. The fragment of a bronze bowl discovered in Cyprus in 1876, which bears round its edge an inscription dedicating it to Baal-Lebanon as a gift from a servant of Hiram, king of the Sidonians, is probably the oldest Phoenician document which we possess. This bowl, though perhaps a little earlier than the Moabite stone, in all probability is not more than a century older, while some authorities think it is even later. The earliest alphabet consisted of twenty-two letters, and bears a very close resemblance to the earliest Greek alphabet from A to T. The symbols in the Greek alphabet from Y to Ω, or in the numerical alphabet to ϡ, are not found in the Phoenician alphabet.

As already mentioned, the twenty-two symbols of the Phoenician alphabet indicate consonantal sounds only. Greek did not possess so many consonants. The Phoenician alphabet possessed many more aspirates than were required in Greek, which tended more and more to drop all its aspirates. Before history begins it had also lost, except sporadically in out-of-the-way dialects, the semi-vowel *i* (approximately English *y*). It therefore made the aspirates A, E, O and the semi-vowel I into vowels, and apparently converted the semi-vowel Y = *w* into the vowel Y = *u*, which it placed at the end of the alphabet and substituted for it as the sixth symbol of the alphabet the letter F with the old value of *w*. The superfluous sibilants were also adapted in various ways (see below).

Relationship of Greek to Phoenician.

The discovery of a large number of very archaic inscriptions in the island of Thera, which was made by Freiherr Hiller von Gärtringen in 1896, has shown that the earliest Greek alphabet was even more like the Phoenician than had been heretofore believed. The symbol for β in Thera (∂) is nearer than any previously known to the Semitic letter (𐤁) though, as not infrequently happens in the transference of a symbol from one people to another, its position is inverted—a fate which in this alphabet has befallen also λ (Semitic 𐤋, Thera ᒣ), and possibly σ (Semitic 𐤔, Thera M). The era of excavation initiated by Dr Schliemann on the grand scale has increased our knowledge of Greek inscriptions beyond anything that was earlier dreamt of. Besides the excavations of Athens, Delos, Epidaurus and Delphi, the results of which are most important for the 5th century B.C. and later, the exploration of the sites of Olympia, of the Heraeum near Argos, of Naucratis in Egypt, and of various Cretan towns (above all the ancient Gortyn), has revolutionized our knowledge of the archaic alphabets of Greece. We can now see how long and laborious was the process by which the Greeks attained to uniformity in writing and in numeration. In no field, perhaps, was the centrifugal tendency of the Greeks more persistent than in such matters. In numeration, indeed, uniformity was not attained till at least the 2nd century of the Christian era. The differentiation of the local alphabets is found from the very beginning of our records. Unfortunately, as yet no record is preserved which can with any probability be dated earlier than the 7th century B.C., and the Phoenician influence had by then nearly ceased. How long this influence lasted we cannot tell. If in Crete a system of writing of an entirely different nature had been developed seven or eight centuries before, there must have been some very important reason for the entire abandonment of the old method and the adoption of a new. In Crete, at least, the excavations show that the old civilization must have ended in a social and political cataclysm. The magnificent palace of Minos—there seems no reason to withhold from it the name of the great prince whom Thucydides recognized as the first to hold the empire of the sea—perished by the flames, and it evidently had been plundered beforehand of everything that a conqueror would regard as valuable. The only force in Greek history which we know that could have produced this change was that of the Dorian conquest. As everywhere in the Peloponnese, except at Argos, there seems to have been a sudden break with the earlier civilization, which can have been occasioned only by the semi-barbarous Dorian tribes, so the same result seems to have followed from the same cause in Thera. The Dorians apparently were without an alphabet, and consequently when Phoenician traders and pirates occupied the place left vacant by the downfall of Minos's empire, the people of the island, and of the sea coasts generally, adopted from them the Phoenician alphabet.[1] The Greeks who migrated to Cyprus, possibly as the result of the Dorian invasion, adopted a syllabary, not an alphabet (see Plate; also WRITING). That the alphabet was borrowed and adapted independently by different places not widely separated, and that the earliest Greek alphabets did not spread from one or a few centres in Greek lands, seem clear (*a*) from the different Greek sounds for which the Phoenician symbols were utilized; (*b*) from the different symbols which were employed to represent sounds which the Phoenicians did not possess, and for which, therefore, they had no symbols. The Phoenician alphabet was an alphabet of consonants only, but all Greek alphabets as yet known agree in employing A, E, I, O, Y as vowels. On the other hand, a table of Greek alphabets[2] will show how widely different the symbols for the same sound were. Except for a single Attic inscription (see Plate), the alphabets of Thera and of Corinth are the oldest Greek alphabets which we possess. Yet at Corinth alongside ΕƎ, which is found for the so-called spurious diphthong ει (*i.e.* the Attic ει, which does not represent an Indo-European ει, but arises by contraction, as in φιλεῖτε, or through the lengthening of the vowel sound as the result of the loss of a consonant, as in εἰρημένος for *FεFρημένος*) the short ε sound is represented by B; ι is found at Corinth in its oldest form Ƹ, and also as Σ, while in Thera it is ϟ. In Thera the *w* sound of digamma (*F*) was entirely lost, and therefore is not represented. Both Thera and Corinth employ in the earliest inscriptions 丰 for ζ, not ξ, though in both alphabets the ordinary use as ξ is adopted, no doubt through the influence of trade with other states. On the other hand, at Cleonae, which is distant not more than 8 or 9 m. from Corinth, an ancient inscription written βουστροφηδόν has recently been discovered, which shows that though Cleonae for B wrote ᑯ, like the Corinthian ᒍ, and, as at Corinth, wrote B for a vowel sound, the vowel thus represented was not short and long ε (ε and η) as at Corinth, but η only, as in ΧΡΒΜΑ, ΜΒ (χρῆμα μή). Here Ǝ represents ε, and the spurious diphthong is represented by ει, as in ЧƎMIƎ (εἶμεν, Doric infinitive = εἶναι), a form which shows that ι has at Cleonae the more modern form I as distinguished from the Corinthian Ƹ.[3]

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[1] Breasted, *History of Egypt* (1906), p. 45.

[2] *Op. cit.* p. 484.

[3] *Die Schrift und Sprache der alten Ägypter* (1907), p. 24.

[4] *Scripta Minoa*, i. (1909), § 10, pp. 77 ff.

[5] E. Piette, *L'Anthropologie*, vii. (1896) pp. 384 ff.

[6] E. Piette, *L'Anthropologie*, xvi. (1905) pp. 8-9. The apparent inscriptions of this period are conveniently collected and figured together in Dechelette's *Manuel d'archéologie préhistorique celtique et gallo-romaine*, i. (1908) p. 235.

[7] *Der Ursprung des alt-semitischen Alphabets aus der neu-assyrischen Keilschrift* (*ZDMG.* xxxi. pp. 102 ff.). A still more sweeping theory of the same nature is propounded by the Rev. C. J. Ball in the *Proceedings of the Society of Biblical Archaeology*, xv. (1893) pp. 392 ff.

Regarding three other questions controversy still rages. These are: (*a*) how Greek utilized the four sibilants (Shin, Samech, Zain and Zade), which it took over from the Phoenician; (*b*) what was the history of development in the symbols for φ, χ, ψ, ω (the history of ξ belongs to both heads); (*c*) the history of the symbol for the digamma *F*.

Greek use of Phoenician sibilants.

In the Phoenician alphabet Zain was the seventh letter, occupying the same position and having the same form approximately (I) as the early Greek Z, while in pronunciation it was a voiced *s*-sound; Samech (丰) followed the symbol for *n* and was the ordinary *s*-sound, though, as we have seen, it is in different Greek states at the earliest period ζ as well as ξ; after the symbol for *p* came Ẓade (ϻ), which was a strong palatal *s*, though in name it corresponds to the Greek ζῆτα; while lastly Shin (W) follows the symbol for *r*, and was an *sh*-sound. The Greek name for the sibilant (σίγμα) may simply mean the hissing letter and be a derivative from σίζω; many authorities, however, hold that it is a corruption of the Phoenician Samech. Unfortunately, it is not clear how many sibilants were distinguished in Greek pronunciation, nor over what areas a particular pronunciation extended. There is, however, considerable evidence in support of the view that Greek σσ representing the sound arising from *κy*, *χy*, *τy*, *θy* was pronounced as *sh* (*ṣ*), while ζ representing *gy*, *dy* was pronounced in some districts *zh* (*ẓ*).[4]

On an inscription of Halicarnassus, a town which stood in ancient Carian territory, the sound of σσ in Ἁλικαρνασσέων is represented by Ͳ, as it is also in the Carian name Panyassis (ΠανυάͲιος, genitive), though the ordinary ƸƸ is also found in the same inscription. The same variation occurs at the neighbouring Teos and at Ephesus, while the coins of Mesembria in Thrace show regularly ΜΕͲΑ and ΜΕͲΑΜΒΡΙΑΝΩΝ, where Ͳ represents the sound which resulted from the fusion of *θy*, and which appears in Homer as σσ in μέσσος, while in later Greek it becomes μέσος.[5] This symbol Ͳ is in all probability the early form of the letter which was known to the Greeks as San (σάν) and in modern times as Sampi, and which is utilized as the numeral for 900 in the shape ϡ. According to Herodotus (i. 139), San was only the Dorian name for the letter which the Ionians called Sigma. This would bring it into connexion with the Phoenician W (Shin), which, turned through a right angle, is possibly the Greek Σ, though some forms of Ẓade on old Hebrew coins and gems (Ʒ Σ) equally resemble the Greek letter. From other forms of Sade, however, the other early form of σ, viz. Ϻ, is probably derived. The confusion is thus extreme: the name Ẓade assimilated in Greek to the names ἦτα and θῆτα becomes ζῆτα, though the form is that of Zain; the name of Samech is possibly the origin of Sigma, while the form of Samech is that of Ξ which has not taken over a Phoenician name. It is probable that the form Ч is an abbreviation in writing from right to left of the earlier Ϻ, and ϟ of the four stroke Ƹ. That the confusion of the sibilants was not confined to the Greeks only, but that pronunciation varied within a small area even among the Semitic stock, is shown by the difficulty which the Ephraimites found in pronouncing "shibboleth" (Judges xii. 6).

History of the digamma.

For the history of the additional symbols which are not Phoenician, we must begin with Y. There is no Greek alphabet in which the symbol is not represented. But the Phoenician form corresponding to it is the consonant *w*, and occupies the position of the Greek digamma as sixth in the series. Whence did the Greeks obtain the digamma? The point is not clear, but probably the Greeks acted here as they did in the case of the vowel *i* and the consonant *y*, adopting the consonant symbol for the vowel sound. As, however, except in Cyprus, Pamphylia and Argos, the only *y* sound which survived in Greek—

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[1] In an excellent summary of the different views held as to the origin of the alphabet (*Journal of the American Oriental Society*, vol. xxii., first half, 1901), Dr J. P. Peters agrees (pp. 191 ff.) that the best test is the etymology of the names of the letters. He shows that "twelve of the letter-names are words with meanings [in the northern dialects of Semitic], all of them indicating simple objects, six of the twelve being parts of the body. The objects denoted by the other six names—ox, house, valve of a door, water, fish and mark or cross—clearly do not belong to any people in a nomadic state, but to a settled, town-abiding population. . . . Six of the letter-names are not words in any known tongue, and appear to be syllables only. Four letter-names are triliterals, and resemble in their form Semitic words." As 11 of the 12 which have meanings are to be found in the Assyrian-Babylonian syllabaries, he suggests a possible Babylonian origin. Different views with regard to some of these symbols are expressed by Lidzbarski, *Ephemeris für semitische Epigraphik*, ii. pp. 125 ff. (1906). The earliest tradition of the names is discussed by Nöldeke in his *Beiträge zur semitischen Sprachwissenschaft* (1904), pp. 124 ff.

[2] See, for example, the tables at the end of Roberts's *Introduction to Greek Epigraphy* (1887); or Kirchhoff's *Studien zur Geschichte des griechischen Alphabets* (4th ed. 1887); or Larfeld's *Handbuch der griechischen Epigraphik*, vol. i. (1907).

[3] Cp. Fränkel, *Corpus inscriptionum Graecarum Peloponnesi*, i., No. 1607.

[4] See Witton, in *American Journal of Philology*, xix. pp. 420 ff., and Lagercrantz, *Zur griechischen Lautgeschichte* (Upsala, 1898).

[5] See Foat, "Tsade and Sampi" (*Journal of Hellenic Studies*, xxv pp. 338 ff., xxvi. p. 286). A number of ingenious points often uncertain are raised by A. Gercke, "Zur Geschichte des ältesten griechischen Alphabets" (*Hermes*, xli., 1906, pp. 540 ff.).

the glide between *i* and another vowel as in *διά*=*diya*—is never represented, there was no occasion to use the Phoenician Jod in a double function. With Vau it was different; the *u*-sound existed in some form in all dialects, the *w*-sound survived in many far into historical times. The Phoenician symbol having been adopted for the vowel sound, whence came the new symbol Ϝ or Ⅽ for the digamma? Hitherto there have been two views. Most authorities have held that the new form was derived from E by dropping the lowermost crossbar; some have held that it developed out of the old Vau, a view which is not impossible in itself and has the similar development in Aramaic (Tema) in its favour. But as Dr Evans has found a form like the digamma among his most recent types of symbols, and as we have no intermediate forms which will prove the development of Ϝ from Y, though the form found at Oaxos in Crete, viz. N, shows a form sufficiently unlike Ϝ, it is necessary to suspend judgment.

Greek aspirates, &c.

The Greek aspirates were not the sounds which we represent by *ph*, *th*, *ch* (Scotch), but corresponded rather to the sound of the final consonants in such words as *lip*, *bit*, *lick*, the breath being audible after the formation of the consonant. It is not clear that Greek took over ⊘ with this value, for in one Theran inscription ⊖ ⊟ are found combined as equivalent to T—H, while the regular representation of φ and χ is Π ⊟ and K ⊟, or Φ (koppa) ⊟ respectively. In the great Gortyn inscription from Crete and occasionally in Thera, Π (in Crete in the form C) and K are used alone for φ and χ, just as conversely even in the 5th century the name of Themistocles has been found upon an *ostrakon* spelt Θεμισθοκλῆς. Such confusions show that even to Greek ears the distinction between the sounds was very small. To have recorded it in writing at all shows considerable progress in the observation of sounds. Such progress is more easily indicated by changes in the symbols among a people whose acquaintance with the art is not of long standing nor very familiar. English, though possessing sounds comparable to the Greek *θ*, *φ*, *χ*, has never made any attempt to represent them in writing. On the other hand, no doubt Athens in 403 B.C. officially adopted the Ionic alphabet and gave up the old Attic alphabet. The political situation in Athens, however, at this time was as exceptional as the French Revolution, and offered an opportunity not likely to recur for the adoption of a system in widely extended use which private individuals had been employing for a long time.

The history of the symbols φ and χ is altogether unknown. The very numerous theories on the subject have generally been founded on a principle which itself is in need of proof, viz. that these symbols must have arisen by differentiation from others already existing in the alphabet. The explanation is possible, but it is not easy to see why, for example, the symbol Ϙ or Φ=Koppa, the Latin Q, should have been utilized for a sound so different as *p-h*; nor, again, why the symbol for *θ* (⊕) by losing its cross stroke should become *φ*, seeing that the sounds of *θ* and *φ* outside Aeolic (a dialect which is not here in question) are never confused. On the other hand, if we remember the large number of symbols belonging to the prehistoric script, it will seem at least as easy to believe that the persons who, by adding new letters to the Phoenician alphabet, attempted to bring the symbols more into accordance with the sounds of the Greek language, may have borrowed from this older script. It is now generally admitted that the improvements of the alphabet were made by traders in the interests of commerce, and that these improvements began from the great Greek emporia of Asia Minor, above all from Miletus. Symbols exactly like *φ*, *χ*, and *ψ* (Φ, X, Ψ) are found in the Carian alphabet, and transliterated by Professor Sayce[1] as *v* (and *ü*), *h* and *kh* respectively. If the Carian alphabet goes back to the prehistoric script, why should not Miletus have borrowed them from it? We have already seen that, in the earliest alphabets of Thera and Corinth, the ordinary symbol for *ξ* in the Ionic alphabet was used for *ζ*. This usage brought in its train another—the use of Ψ, not for *ψ* as in Ionic, but for *ξ* in the name ΑΛΕΨΑ | CORA ='Αλεξαγόρα, and similarly in Melos, · PAΨ | IKVΔ | ECM = Πραξικύδεος.[2] This experiment, for it was no more, belongs apparently to the latter part of the 6th century, and was soon given up. As the Ionians kept the form Ξ, which the people of Thera used for *ζ*, in the same position in their alphabet as Samech occupied in the Phoenician alphabet, there can be no doubt as to its origin. The symbol + which the Chalcidian Greeks used in the 6th century B.C. for *ξ* may be derived, according to the most widely accepted theory, from a primitive form of Samech ⊞, which is recorded only in the *abecedaria* of the Chalcidian colonies in Italy. In this case the borrowing of the Greek alphabet must long precede any Phoenician record we possess. But it is not probable that the Ionic and Phoenician Ξ developed independently from the closed form. Kretschmer, however, in several publications[3] takes a different view. He thinks that the guttural element in *ξ* was a spirant, and therefore different from *χ*, which is an aspirate. He points out that in Naxos, in a 6th-century inscription,[4] *ξ* in Ναξίου, ἔξοχος and Φράξου is represented by □Σ, the first element in which he regards as a form of ⊟=*h*. As *χ* is found in the same inscription (in the form X), the guttural element must have been different, else *ξ* would have been spelt XΣ. Attica and most of the Cyclades kept X for the guttural element in *ξ* (written Xϟ or +ϟ) and for *χ* as well. On the west of the Aegean a new symbol Ψ was invented for the aspirate value, and this spread over the mainland and was carried by emigrants to Rhodes, Sicily and Italy. The sign X was kept in the western group for the guttural spirant in *ξ*, which was written XΣ; but, as this spirant occurred nowhere else, the combination was often abbreviated, and X was used for XΣ precisely as in the Italic alphabets we shall find that F=*f* develops out of a combination FH.

The development of symbols for the long vowels *η* and *ω* was also the work of the Ionians. The *h*-sound ceased at a very early period to exist in Ionic, and by 800 B.C. was ignored in writing. The symbol ⊟ or H was then employed for the long open *ē*-sound, a use suggested by the name of the letter, which, by the loss of the aspirate, had passed from Heta to Eta. About the same period, and probably as a sequel to this change, the Greeks of Miletus developed Ω for the long open *ō*-sound, a form which in all probability is differentiated out of O. Centuries passed, however, before this symbol was generally adopted, Athens using only O for *o*, *ω* and *ου*, the spurious diphthong, until the adoption of the whole Ionic alphabet in 403 B.C.[5]

Latin alphabet.

The discoveries of the last quarter of the 19th century carried back our knowledge of the Latin alphabet by at least two centuries, although the monuments of an early age which have been discovered are only three. (*a*) In 1880 was discovered between the Quirinal and Viminal hills a little earthenware pot of a curious shape, being, as it were, three vessels radiating from a centre, each with a separate mouth at the top.[6] Round the sides of the triangle formed by the three vessels and under the mouths runs an inscription of considerable length. The use for which the pot was intended and the purport of the inscription have been much disputed, there being at least as many interpretations as there are words in the inscription. The date is probably the early part of the 4th century B.C. Though found in Rome, the vessel is small enough to be easily portable, and might therefore have been brought from elsewhere in Italy. It is equally possible that the potter who inscribed the words upon it was not a native of Rome. One or two points in the inscription make it doubtful whether the Latin upon it is really the Latin of Rome.

The Dvenos inscription.

It is generally known as the Dvenos inscription, from the name of the maker who wrote on the vessel from right to left the inscription, part of which is DVENOS MED FECED (=*fecit*). (*b*) The second of these early records is the inscription on a gold fibula found at Praeneste and published in 1887. The inscription runs from right to left, and is in letters which show more clearly than ever that the Roman alphabet is borrowed from the alphabets of the Chalcidian Greek colonies in Italy. Its date cannot be later than the 5th and is possibly as early as the 6th century B.C. The words are MANIOS MED FHEFHAKED NVMASIOI, "Manius made me for Numasius." The symbol for M has still five strokes, *s* has the angular form ϟ, ϟ. The inscription is earlier than the Latin change of *s* between vowels into *r*, for *Numasioi* is the dative of the older form which corresponds to the later *Numerius*. The verb form

The Praeneste fibula.

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[1] See especially *Proceedings of the Society of Biblical Archaeology* for 1895, p. 40; cf. also Kalinka, *Neue Jahrbücher für Philologie*, iii. (1899), p. 683. Similar forms are also found in the Safa inscriptions (South Semitic) with similar values, and Praetorius argues (*Z.D.M.G.* lvi., 1902, pp. 677 ff., and again, lviii., 1904, pp. 725 f.) that these were somehow borrowed by Greek in the 8th century B.C., while in lxii. pp. 283 ff. he argues that the reason why the Greeks borrowed Θ for the aspirated *t* was its form, the cross in ⊗ being regarded as T and the surrounding circle as a variety of □ an occasional form of ⊟ the aspirate. Here also (p. 287) as in his *Ursprung des kanaanäischen Alphabets*, pp. 13 f., he argues that the two forms of the digamma F and Ⅽ, and also the South Semitic ⦶ = *ω*, could all have developed from the Cyprian I = *we*. But proof is impossible without evidence of the intermediate steps.

[2] *Inscriptiones Graecae*, xii., fasc. iii. Nos. 811. 1149.

[3] See especially *Athenische Mitteilungen*, xxi. p. 426.

[4] Figured in Roberts's *Introduction to Greek Epigraphy*, p. 65.

[5] Details of the history of the individual letters will be found in separate articles.

[6] It is figured most accessibly in Egbert's *Introduction to the Study of Latin Inscriptions*, p. 16.

is remarkable. In the Dvenos inscription the perfect of *facio* is *feced*; here it is a reduplicated form with the same vowel as the present. The spelling also is interesting. The symbol K is still in ordinary use, and not merely used for abbreviations as in the classical age. But most remarkable is the representation of Latin F by FH. The reason for this is clear. The value of F in the Greek alphabet is *w* and not *f* as in Latin. Greek had no sound corresponding to Latin F, consequently an attempt is made by combining F and H to indicate the difference of sound. Etruscan uses FH in the same way. As Latin, however, made the symbol V indicate not only the vowel sound *u*, but also the consonant sound *v* (*i.e.* English *w*), the sign for the digamma F was left unemployed, and as FH was a cumbrous method of representing a sound which did not exist in Greek, the second element came to be left out in writing. Thus F came to be the representative of the unvoiced labiodental spirant instead of that for the bilabial voiced spirant. Whether the form *fefaked* was ever good Latin in Rome may be doubted, for the Romans, in spite of the few miles that separate Praeneste from Rome, were inclined to sneer at the pronunciation and idiom of the Praenestines (cf. Plautus, *Trin.* 609, *Truc.* 691; Quintilian i. 5, 56). (*c*) The last, and in some respects the most important, of these records was found in 1899 under an ancient pavement in the *Comitium* at the north-west corner of the Roman Forum. It is engraved upon the four sides and one bevelled edge of a pillar, the top of which has been broken off. As the writing is βουστροφηδόν, beginning at the bottom of the pillar and running upwards and down again, no single line of the inscription is complete. Probably more than half the pillar is lost, so that it is not possible to make out the sense with certainty. The inscription is probably not older than that on the fibula from Praeneste, but has the additional interest of being undoubtedly couched in the Latin of Rome. The surviving portion of the inscription contains examples of all the letters of the early alphabet, though the forms of F and B are fragmentary and doubtful. As in the Praenestine inscription, the alphabet is still the western (Chalcidian) alphabet. K is still in use as an ordinary consonant, and not limited to a symbol for abbreviations as in the classical period. The rounded form of γ is found with the value of G in RECEI, which is probably the dative of *rex*. H has still the closed form ⊟, M has the five-stroke form, S is the three-stroke ᛊ, tending to become rounded. R appears in the Greek form without a tail, and V and Y are both found for the same sound. The manner of writing up and down instead of backwards and forwards across the stone is obviously appropriate to a surface which is of considerable length, but comparatively narrow, a connected sense being thus much easier to observe than in writing across a narrow surface where, as in the gravestones of Melos, three lines are required for a single word. The form of the monument corresponds to that which we are told was given to the revolving wooden pillars on which the laws of Solon were painted. That the writing of Solon's laws, which was βουστροφηδόν, was also vertical is rendered probable by the phrase ὁ κάτωθεν νόμος in Demosthenes' speech *Against Aristocrates*, § 28, for which Harpocration is unable to supply a satisfactory explanation.

Forum inscription.

The differentiation of the Roman alphabet from the Greek is brought about (*a*) by utilizing the digamma for the unvoiced labiodental spirant F; (*b*) by dropping out the aspirates θ, φ, χ (Ψ in the Chalcidian alphabet, whence the Roman is derived) from the alphabet proper and employing them only as numerals, θ (⊙) being gradually modified till it was identified with C as though the initial of *centum*, 100. Similarly ⦶ became in time identified with M as though the initial of *mille*, 1000, and the side strokes of χ in the above form were flattened out till it became ⊥, and ultimately L, 50. (*c*) After 350 B.C., at latest, there was in Latin no sound corresponding to Z, which was therefore dropped. In the Chalcidian alphabet the symbol for *x* was placed after the symbols common to all Greek alphabets, a position which X retains in the Latin (and also in the Faliscan) alphabet. K in time passed out of use except as an abbreviation, its place being taken by C, which, as we have seen, is in the earliest inscription still *g*. Three points here require explanation: (1) Why K fell into disuse; (2) why C took the place of K; (3) why the new symbol G was put in the place of the lost Z. It is clear that C must have become an equivalent of K before the latter fell out of use. There is some evidence which seems to point to a pronunciation of the voiced mutes which, like the South German pronunciation of *g*, *d*, *b*, but slightly differentiated them from the unvoiced mutes, so that confusion might easily arise. The Etruscans, who were separated from the Romans only by the Tiber, gradually lost the voiced mutes. But another cause was perhaps more potent. C and IC, as *k* was frequently written, would easily be confused in writing, and Professor Hempl (*Transactions of the American Philological Association* for 1899, pp. 24 ff.) shows that the Chalcidian form of ζ—I developed into shapes which might have partaken of the confusion. Owing to this confusion, the new symbol G, differentiated from C, took the place of the useless I. In abbreviations, however, C remained as before in the value of G, as in the names Gaius and Gnaeus. Y and Z were added in the last century of the republic for use in transliterating Greek words containing υ and ζ.[1]

Differentiation of Roman from Greek alphabet.

The dialect which was most closely akin to Latin was Faliscan. The men of Falerii, however, regularly took the side of the Etruscans in wars with Rome, and it is clear that the civilization of the old Falerii, destroyed for its rebellion in 241 B.C., was Etruscan and not Roman in character. Peculiar to this alphabet is the form for *f*—↑. Much more important than the scanty remains of Faliscan is the Oscan alphabet. The history of this alphabet is different from that of Rome. It is certain from the symbols which they develop or drop that the people of Campania and Samnium borrowed their alphabet from the Etruscans, who held dominion in Campania from the 8th to the 5th century B.C. Previous to the Punic wars Campania had reached a higher stage of civilization than Rome. Unfortunately, the remains of that civilization are very scanty, and our knowledge of the official alphabet outside Capua, and at a later period Pompeii, is practically confined to two important inscriptions, the tabula Agnonensis, now in the British Museum, and the Cippus Abellanus, which is now kept in the Episcopal Seminary at Nola. Of Etruscan origin also is the Umbrian alphabet, represented first and foremost in the bronze tablets from Gubbio (the ancient Iguvium). The Etruscan alphabet, like the Latin, was of Chalcidian origin. That it was borrowed at an early date is shown by the fact that most of its numerous inscriptions run from right to left, though some are written βουστροφηδόν. That it took over the whole Chalcidian alphabet is rendered probable by the survival in Umbrian and Oscan, its daughter alphabets, of forms which are not found in Etruscan itself. This mysterious language, despite the existence of more than 6000 inscriptions, and the publication in 1892 of a book written in the language and handed down to us by the accident of its use to pack an Egyptian mummy, remains as obscure as ever, but apparently it underwent very great phonetic changes at an early period, so that the voiced mutes B, D, G disappeared. Of the existence of the vowel O there is no evidence. If it ever existed in Etruscan, it had been lost before the Oscans and Umbrians borrowed their alphabets. On the other hand, both of their alphabets preserve B and Umbrian G in the form >. Etruscan also retained this symbol in the form Ↄ, and utilized it exactly as Latin did to replace ꓘ. Oscan, in order to represent D, introduced later a form Ꝗ, thus creating confusion between the symbols for *d* and for *r*. This form was adopted for *d* because ᗡ had already been borrowed from Etruscan as the symbol for *r*, although ᑫ is also found on Etruscan inscriptions. For the Greek digamma Etruscan used both Ɜ and ꟻ, but the former only was borrowed by the other languages. Etruscan, like Latin, used ⊟ꟻ (from right to left) to represent the sound of Latin F, but, unlike Latin, adopted ⊟ not ꟻ as the single symbol. This form it then wrote as two lozenges 8, whence developed a later sign, 8, which is used also in Umbrian and Oscan. As the old digamma was kept, this new sign was placed after those borrowed from the Chalcidian alphabet. Similarly it used ǂ and I for the Chalcidian ζ; Umbrian borrowed the first, Oscan the second form. The form for *h* was still closed ⊟, which Etruscan passed on to Oscan, while Umbrian modified it to ⦶. The form for *m* has five strokes; from a later form Ϻ the Oscan form was borrowed. Of the two sibilants, M and Ƨ or S, Oscan adopted only Ƨ, Umbrian both M and the rounded form S. ϙ is found on Etruscan inscriptions, but not in the alphabet series preserved; neither Umbrian nor Oscan has this form. T appears in Etruscan as Y, ✗, and X; of these Umbrian borrows the first two, while Oscan has a form T like Latin. Etruscan took over the three Greek aspirates, θ, φ, χ, in their Chalcidian forms; θ survives in Umbrian as ⊙, the others naturally disappear. Both Umbrian and Oscan devised two new symbols. Umbrian took over from Etruscan perhaps the sign q, but gave it the new value of a spirant which developed out of an earlier *d*-sound, but which is written in the Latin alphabet with *rs*. The second Umbrian symbol was d, which was the representative of an *s*-sound developed by palatalizing an earlier *k*. In Oscan, which had an *o*-sound, but no symbol for it, a new sign was invented by placing a dot between the legs of the symbol for *u*—V̇. This, however, is found only in the best-written documents, and on some materials the dot cannot be distinguished. The symbol ⊢ was invented for the open *ĭ*-sound and close *ē*-sound.[1] At a much later epoch it was introduced into the Latin alphabet by the emperor Claudius to represent *y*, and the sound which was written as *i* or *u* in *maximus*, *maxumus*, &c.

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[1] Gardthausen, "Ursprung und Entwickelung der griechisch-lateinischen Schrift" (*Germanisch-romanische Monatsschrift*, i. (1909), pp. 337 ff.) argues for a "proto-Tyrrhenian" alphabet from which Etruscan, Umbrian and Oscan descended as one group, and Faliscan and Latin as the other. Evidence in favour of such a position for the Latin alphabet is not forthcoming.

Besides the Italic alphabets already mentioned, which are all derived from the alphabet of the Chalcidian Greek colonists in Italy, there were at least four other alphabets in use in different parts of Italy: (1) the Messapian of the south-east part of the peninsula, in which the inscriptions of the Illyrian dialect in use there were written, an alphabet which, according to Pauli (*Alt-italische Forschungen*, iii. chap. ii.), was borrowed from the Locrian alphabet; (2) the Sabellic alphabet, derived from that of Corinth and Corcyra, and found in a few inscriptions of eastern-central Italy; (3) the alphabet of the Veneti of north-east Italy derived from the Elean; (4) the alphabet of Sondrio (between Lakes Como and Garda), which Pauli, on the insufficient ground that it possesses no symbols corresponding to ϕ and χ, derives from a source at the same stage of development as the oldest alphabets of Thera, Melos and Crete.

From the fact that upon the Galassi vase (unearthed at Cervetri, but probably a product of Caere), which is now in the Gregorian Museum of the Vatican, a syllabary is found along with one of the most archaic Greek alphabets, and that a similar combination was found upon the wall of a tomb at Colle, near Siena, it has been argued that syllabic preceded alphabetic writing in Italy. But a syllabary where each syllable is made by the combinations of a symbol for a consonant with that for a vowel can furnish no proof of the existence of a syllabary in the strict sense, where each symbol represents a syllable; it is rather evidence against the existence of such writing. The syllabary upon the Galassi vase indicates in all probability that the vase, which resembles an ink-bottle, belonged to a child, for whose edification the syllables *pa*, *pi*, *pe*, *pu* and the rest were intended. The evidence adduced from the Latin grammarians, and from abbreviations on Latin inscriptions like *lubs* for *lubens*, is not sufficient to establish the theory.

Teutonic runes.

It has been argued that the runes of the Teutonic peoples have been derived from a form of the Etruscan alphabet, inscriptions in which are spread over a great part of northern Italy, but of which the most characteristic are found in the neighbourhood of Lugano, and in Tirol near Innsbruck, Botzen and Trent. The Danish scholar L. F. A. Wimmer, in his great work *Die Runenschrift* (Berlin, 1887), contends that the resemblance, though striking, is superficial. Wimmer's own view is that the runes were developed from the Latin alphabet in use at the end of the 2nd century A.D. Wimmer supports his thesis with great learning and ingenuity, and when allowance is made for the fact that a script to be written upon wood, as the runes were, of necessity avoids horizontal lines which run along the fibres of the wood, and would therefore be indistinct, most of the runic signs thus receive a plausible explanation. The strongest argument for the derivation from the Latin alphabet is undoubtedly the value of *f* attaching to ᚠ; for, as we have seen, the Greek value of this symbol is *w*, and its value as *f* arises only by abbreviation from FH. On the other hand, several of Wimmer's equations are undoubtedly forced. Even if we grant that the Latin symbols were inverted or set at an angle (a proceeding which is paralleled by the treatment of the Phoenician signs in Greek hands), so that ᚢ represents Latin V, M Latin E, ᚳ Latin V, and ᚦ Latin D; while the symbol for the voiced spirant ð is ᚦ doubled, ᛞ, ᛞ, it is difficult to believe that the symbol for the spirant *g*, viz. X, represents a Latin K (which was of rare occurrence), or again ᚾ, ✕ a Latin N, or that the symbol for *ng*, ᛝ, represents < = *c* doubled. Moreover, the date of the borrowing seems too late. The runes are found in all Teutonic countries, and the Romans were in close contact with the Germans on the Rhine before the beginning of the Christian era. We hear of correspondence between the Romans and German chieftains in the early days of the empire. It is strange, therefore, if the Roman alphabet, which formed the model for the runes, was that of two whole centuries later, and even then the formal alphabet of inscriptions. By that time the Teutons were likely to have more convenient materials than wood whereon to write, so that the adaptation of the forms would not have been necessary. That the Germans were familiar with some sort of marks on wood at a much earlier period is shown by Tacitus's *Germania*, chap. x. There we are told that for purposes of divination certain signs were scratched on slips of wood from a fruit-bearing tree (including, no doubt, the beech; cp. *book*, German *Buch*, and *Buchstabe*, a letter of the alphabet); the slips were thrown down promiscuously on a white cloth, whence the expert picked them up at random and by them interpreted fate. In these slips we have the origin of the Norse *kefli*, the Scots *kaivel*, which were and are still used as lots. The fishermen of north-east Scotland, when they return after a successful haul, divide the spoil into as many shares as there are men in the boat, with one share more for the boat. Each man then procures a piece of wood or stone, on which he puts a private mark. These lots are put in a heap, and an outsider is called in who throws one lot or kaivel upon each heap of fish. Each fisherman then finds his kaivel, and the heap on which it lies is his. This system of "casting kaivels," as it is called, is certainly of great antiquity. But its existence will not help to prove an early knowledge of reading or writing, for in order that everything may be fair, it is clear that the umpire should not be able to identify the lot as belonging to a particular individual. It has, however, been contended that a system of primitive runes existed whence some at least of the later runes were borrowed, and the ownership marks of the Lapps, who have no knowledge of reading and writing, have been regarded as borrowed from these early Teutonic runes.[2] Be this as it may, the resemblances between the runic and the Mediterranean alphabets are too great to admit of denial that it is from a Greek alphabet, whether directly or indirectly, that the runes are derived. That Wimmer postdates the introduction of the runic alphabet seems clear from the archaic forms and method of writing. It is very unlikely that a people borrowing an alphabet which was uniformly written from left to right should have used it in order to write from right to left, or βουστροφηδόν. Hence Hempl contends[3] that Wimmer's view must be discarded, and that the runes were derived about 600 B.C. from a western Greek alphabet which closely resembled the Formello alphabet (one of the ancient Chalcidian *abecedaria*) and the Sabellic and North Etruscan alphabets. He thus fixes the date at the same period as Isaac Taylor had done in his *Greeks and Goths* and *The Alphabet*. Taylor, however, derived the runes from the alphabet of a Greek colony on the Black Sea. Hempl's initiative was followed by Professor Gundermann of Giessen, who announced in November 1897[4] that he had discovered the source of the runic alphabet, the introduction of which he declares preceded the first of the phonetic changes known as the "Teutonic sound-shifting," since < = *g* is used for *k*, X = χ for *g*, a Theta-like symbol for *d*, while *zd* is used for *st*. If this view (which is identical with Taylor's) be true, we have a parallel in the Armenian alphabet, which is similarly used for a new value of the sounds. Hempl, on the other hand, contends that the sound-shifting had already taken place, and, arguing that several of the symbols have changed places (*e.g.* ᚠ *f* and ᚨ *a*, ᚢ *u* and ᛒ *b*, because at this time *b* was a bilabial spirant and not a stop), ultimately obtains an order—a b d e f z *kgw* h i j ƕ p r s t u l m n ð o. As neither Gundermann nor Hempl has published the full evidence for his view, no definite conclusion at the moment is possible.

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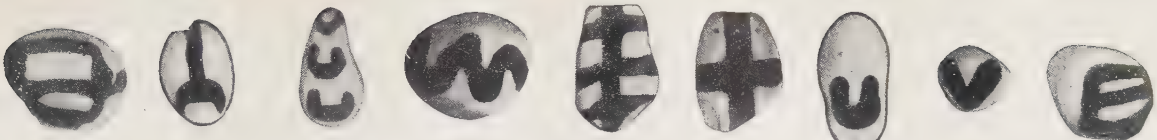
[1] For further details of these alphabets, see Conway, *The Italic Dialects*, ii. pp. 458 ff. The recent discovery by Keil and Premerstein (*Denkschriften der Wiener Akademie*, liii., 1908) of Lydian inscriptions containing the symbol 8 suggests that the old derivation of the Etruscans from Lydia may be true and that they brought this symbol with them (see article on *F*). But the inscriptions are not yet deciphered, so that conclusive proof is still wanting.

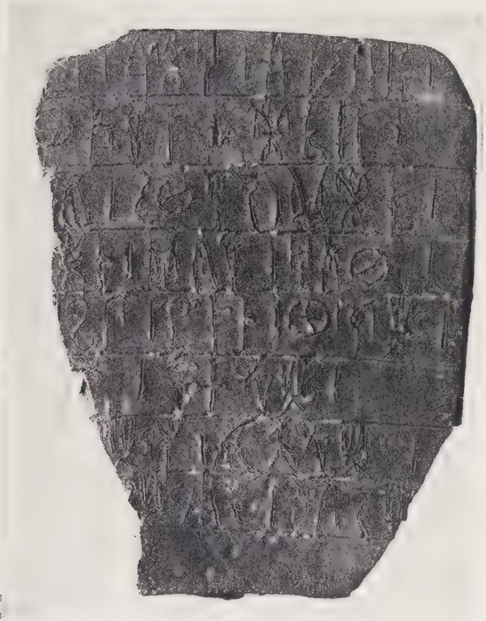
[2] R. M. Meyer, *Paul Braune und Sievers' Beiträge*, xxi. (1896), pp. 162 ff.

[3] In a paper published in the volume of *Philologische Studien*, presented as a "Festgabe" to Professor Sievers in 1896, and in a second paper in the *Journal of Germanic Philology*, ii. (1899), pp. 370 ff.

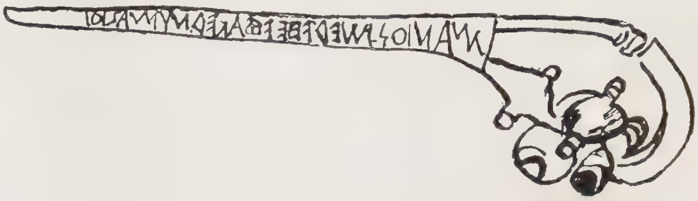
[4] See *Literaturblatt für germanische und romanische Philologie* for 1897, col. 429 f.



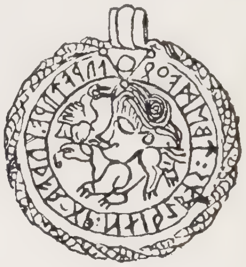
Inscribed Pebbles from Mas d'Azil.



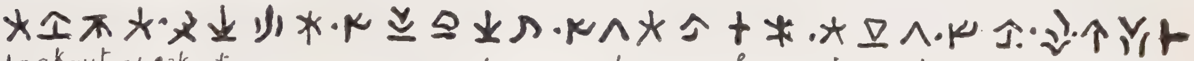
Prehistoric Linear Script from Crete.



Gold Fibula from Praeneste, with Early Latin Inscription. Right to left.



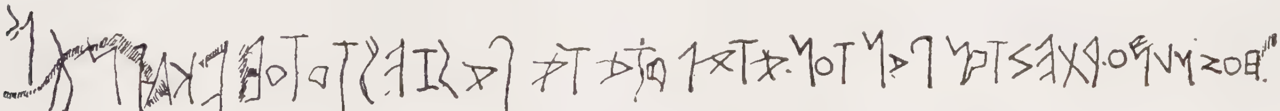
Vadstena Pendant, with Runic Alphabet; about A.D. 600.



i-ak-ut-i·ek-et-en-a·es-o-is-et-qu·es-ok-i-or-ol-e · i-ar-ok·es-ak·ur-iu-am-at

ι αχυτ[ν]ι·εκηθ εν α· ς ο ισιετ οπ·ς οκ ι οϝ ολ ε·ι αρ οκ· ς ακ·ιρ ταμαΔ

Cyprian Inscription (4th century B.C.) from Curium (*British Museum Excavations*, p. 64). Below are (1) the transliteration of the symbols; (2) the Greek words, both like the Cyprian reading from right to left.



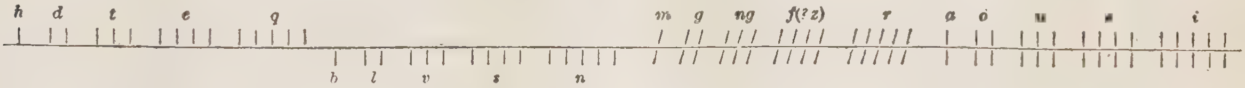
Ὅς. νῦν ὀρχηστῶν πάντων ἀταλώτατα παίζει το(ῦ)το δεκᾶ[ν]? μιν?

Oldest Attic Inscription. From a Dipylon Vase probably of 8th century B.C. Right to left.

Inscription on Buddha Vase, perhaps 4th century B.C.

Ogam writing. In one of the earliest runic records which we possess, the pendant found at Vadstena in Sweden in 1774, and dating from about A.D. 600 (see Plate), the signs are divided up into three series of eight (the twenty fourth, ⋈, being omitted for want of room). Upon the basis of this division a system of cryptography (in the sense that the symbols are unintelligible without knowledge of the runic alphabet) was developed, wherein the series and the position within the series of the letter indicated, were each represented by straight strokes, the strokes for the series being shorter than those for the runes, or the series being represented by strokes to the left, the runes by strokes to the right, of a medial line.[1] From this system probably developed the ogam writing employed among the Celtic peoples of Britain and Ireland. The ogam inscriptions in Wales are frequently accompanied by Latin legends, and they date probably as far back as the 5th and 6th centuries A.D. Hence the connexion between Celt and Teuton as regards writing must go back to a period preceding the Viking inroads of the 8th century. Taylor, however, conjectures (*The Alphabet*, ii. p. 227) that the ogams originated in Pembroke, "where there was a very ancient Teutonic settlement, possibly of Jutes, who, as is indicated by the evidence of runic inscriptions found in Kent, seem to have been the only Teutonic people of southern Britain who were acquainted with the Gothic Futhorc." However this may be, the ogam alphabet shows some knowledge of phonetics and some attempt to classify the sounds accordingly. The symbols are as follows[2]:—

Symbols of Ogam Alphabet.



The form of the ogam alphabet made it easy to carve hastily; hence in the old sagas, when a hero is killed we find the common formula, "His grave was dug and his stone was raised, and his name was written in ogam." According to Sophus Müller (*Nordische Altertumskunde*, ii. p. 264), it was from Britain that the use of runes upon gravestones was derived, a use which, to judge from the number of bilingual inscriptions in Britain, the Celts derived from the Romans.

The special forms of the alphabet—the Cyrillic and the Glagolitic—which have been adopted by certain of the Slavonic peoples are both sprung directly from the Greek alphabet of the ninth century A.D., with the considerable additions rendered necessary by the much greater variety of sounds in Slavonic as compared with Greek. Apart from other evidence, the use of B with the value of *v*, of H as well as I with the value of *ī*, of Φ with the value of *f*, and X with that of the Scotch *ch*, would be proof that the alphabet was not borrowed till long after the Greek classical period, for not till later did β, φ, χ become spirants and η become identified with ι. The confusion of β with *v* necessitated the invention of a new symbol Б in the Cyrillic, Ⰱ in the Glagolitic for *b*, while new symbols were also required for the sounds or combinations of sounds *ž* (*zh*), *dz*, *št* (*sht*), *c* (*ts*), *č* (*ch* in *church*), *š* (*sh*), *ŭ*, *ĭ*, *y* (*u* without protrusion of the lips), *ě* (a close long *e* sound), for the combination of *o*, *a* and *e* with consonantal I (English *y*) and for the nasalized vowels *ę*, *ǫ* (nasalized *o* in pronunciation) and the combinations ję and ją (English *yę*, *yą*). In all these matters Glagolitic differs very little from Cyrillic; it has only one symbol for *ja* (*ya*) and *ě* because both in this dialect were pronounced the same. It has also only one symbol for *e* and *je* (*ye*) for the phonetic reason that *je* always appears in the old ecclesiastical Slavonic, for which the alphabets were fashioned, at the beginning of words and after vowels: cp. the English use of the symbol *u* in *unspoken* and *uniform*. Glagolitic has a symbol for the palatalized *g* (Ʒ), but it is used only in the transcription of Greek words, γ having become *y* early between vowels in the popular dialects.

Such an elaborate alphabet could hardly have been invented except by a scholar, and tradition, probably rightly, has attached the credit for its invention to Cyril (originally Constantine), who along with his brother Methodius proceeded in A.D. 863 to Moravia from Constantinople, for the purpose of converting the Slavonic inhabitants to Christianity. The only question which concerns us here is which of the two alphabets was the earlier in use, and after much discussion authorities on Slavonic seem generally agreed that it was the Glagolitic (the name is derived from the Old Bulgarian, *i.e.* old ecclesiastical Slavonic *glagolŭ*, "word"). According to Professor Leskien (*Grammatik der altbulgarischen* (*altkirchenslavischen*) *Sprache*, Heidelberg, 1909, p. xxi.), Cyril had probably made a prolonged and careful study of Slavonic before proceeding on his missionary journey, and probably in the first instance with a view to preaching the Gospel to the Slavs of Macedonia and Bulgaria, who were much nearer his own home, Thessalonica, than were those of Moravia. The Glagolitic was founded upon the ordinary Greek minuscule writing of the period, as was shown by Dr Isaac Taylor,[3] though the writing of the letters separately without abbreviations and an obvious attempt at artistic effect has gradually differentiated it from Greek writing. This alphabet, which is much more difficult to read than the bolder Cyrillic founded on the Greek uncial, survived for ordinary purposes in Croatia and in the islands of the Quarnero till the 17th century. The Servians and Russians apparently always used the Cyrillic, and its advantages gradually ousted the Glagolitic elsewhere, though the service book in the old ecclesiastical language which is used by the Roman Catholic Croats is in Glagolitic.[4]

Phrygian. While the Carian and Lycian were probably independent of the Greek in origin, so, too, at the opposite end of the Mediterranean was the Iberian. On the other hand, the Phrygian was very closely akin to the Greek in alphabet as well as in linguistic character. The Greek alphabet, with which it was most closely connected, was the Western, for the evidence is strongly in favour of the form Ψ having the value of χ, not ψ, in Phrygian, as it certainly has in the Etruscan inscription found on Lemnos in 1886, which is in an alphabet practically identical.

Armenian. To a much later era belongs the Armenian alphabet, which, according to tradition, was revealed to Bishop Mesrob in a dream. The land might have been Grecized had it not, about A.D. 387, been divided between Persia and Byzantium, the greater part falling to the former, who discouraged Greek and favoured Syriac, which the Christian Armenians did not understand. As those within Persian territory were forbidden to learn Greek, an Armenian Christian literature became a necessity. Taylor contends that the alphabet is Iranian in origin, but the circumstances justify Gardthausen and Hübschmann in claiming it for Greek. That some symbols are like Persian only shows that Mesrob was not able to rid himself of the influences under which he lived.

Phoenician. Of the later development of Phoenician amongst Phoenician people little need be said here. It can be traced in the *graffiti* of the mercenaries of Psammetichus at Abu Simbel in Upper Egypt, where Greeks, Carians and Phoenicians all cut their names upon the legs of the colossal statues. Still later it is found on the stele of Byblos, and on the sarcophagus of Eshmunazar (about 300 B.C.). The most numerous inscriptions come from the excavations in Carthage, the ancient colony of Sidon. One general feature characterizes them all, though they differ somewhat in detail. The symbols become longer and thinner; in fact, cease to be the script of monuments and become the script of a busy trading people. While the Phoenician alphabet was thus fertile in developing daughter alphabets in the West, the progress of writing was no less great in the East, first among the Semitic peoples, and through them among other peoples still more remote. The carrying of the alphabet to the Greeks by the Phoenicians at an early period affords no clue to the period when Semitic ingenuity constructed an alphabet out of a heterogeneous multitude of signs. If it be possible to assign to some of the monuments discovered in Arabia by Glaser a date not later than 1500 B.C., the origin of the alphabet and its dissemination are carried back to a much earlier period than had hitherto been supposed. Next in date amongst Semitic records of the Phoenician type to the bowl of Baal-Lebanon and the Moabite stone comes the Hebrew inscription found in the tunnel at the Pool of Siloam in 1881, which possibly dates back to the reign of Hezekiah (700 B.C.). The only other early records are seals with Hebrew inscriptions and potters' marks upon clay vessels found in Lachish and other towns.[5]

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[1] A species of cryptography exactly like this, based upon the "abjad" order of the Arabic letters, is still in use among the Eastern Persians (E. G. Browne, *A Year amongst the Persians*, p. 391 f.).

[2] Cf. Rhŷs, *Outlines of Manx Phonology*, p. 73 (Publications of the Manx Society, vol. xxxiii.); Rhŷs and Brynmor Jones, *The Welsh People*, pp. 3, 502. An interpretation of the oldest ogam inscriptions is given by Whitley Stokes in *Bezzenberger's Beiträge*, xi (1886), p. 143 ff. Besides the collections of ogams by Brash (1879) and Ferguson (1887), a new collection by Mr R. A. S. Macalister is in course of publication (*Studies in Irish Epigraphy*, 1897, 1902, 1907). Professor Rhŷs, who at one time considered runes and ogam to be connected, now thinks that ogam was the invention of a grammarian in South Wales who was familiar with Latin letters.

[3] *Archiv für slavische Philologie*, v. 191 ff., where the Glagolitic and the cursive Greek, the Cyrillic and the Greek uncial are set side by side in facsimile.

[4] For further details and references to literature see the introduction to Leskien's *Grammatik* (not to be confused with his *Handbuch*), from which this is abbreviated.

[5] These are figured most accessibly in Lidzbarski's article on the alphabet in the *Jewish Encyclopaedia*, vol. i. (1901); see also his table of symbols added to the 27th edition of Gesenius' *Hebräischer Grammatik* (1902).

Like the Phoenician, these Hebrew signs are distinctly cursive in character, but, as the legend on the coins of the Maccabees shows, became stereotyped for monumental use, while the Jews after the exile gradually adopted the Aramaic writing, whence the square Hebrew script is descended. The Samaritans alone stuck fast to the old Hebrew as part of their contention that they, and not the Jews, were the true Hebrews.

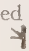
Aramaic.

The oldest records in Aramaic were found at Sindjirli, in the north of Syria, in 1890, and date to about 800 B.C. At this epoch the Aramaic alphabet, or at any rate the alphabet of these records, is but little different from that shown upon the Moabite stone. Either two sounds are confused under one symbol, or these records represent a dialect which, like Hebrew and Assyrian, shows *sh*, *z*, and *ç*, where the ordinary Aramaic representation is *ṭ*, *d*, and *ṭ*, the Arabic *tẖ*, *dh*, and *ṯh*. The Aramaic became in time by far the most important of the northern Semitic alphabets. Even while long and important documents in Assyria were still written on clay tablets, in cuneiform, a docket or précis of the contents was made upon the side in Aramaic, which thus became the alphabet of cursive writing—a fact which explains its later development. Two changes, the inception of which is early, but the completion of which belongs to the Persian period, gave the impulse which Aramaic obeyed in all its later developments. These were (*a*) the opening of the heads of letters, so that *beth* , *daleth* , and *resh* become respectively , , and , while O becomes first U and ultimately V. In the later development the heads tend to be reduced in size, and finally to disappear. (*b*) As was natural in cursive writing, angles tend to become rounded, and the tails of the letters, which in Phoenician are very long, are curved round in the middle of words so as to join on to the succeeding letter. These characteristics were naturally emphasized in the Aramaic writing on papyrus which, beginning about 500 B.C., during the Persian sovereignty in Egypt, lasted on there till about 200 B.C. The gradual development of this script into the square Hebrew, and the more ornamental writing of Palmyra, may be traced in the works of Berger and Lidzbarski.[1]

Arabic.

In the land of the Nabataeans, a people of Arabian origin, the Aramaic alphabet was employed in a form which ultimately developed into the modern Arabic alphabet. Probably the earliest example of the Aramaic script in Arabia is the stele of Tema, in north-western Arabia, in which is commemorated the establishment of a worship of an Aramaic divinity. This monument, now in the Louvre, is not later than the 5th century B.C. In it the writing preserves its ancient form, the heads of the closed letters being only very slightly opened. The Nabataean inscriptions belong to a different epoch and a different style. They were first discovered by Charles Doughty in 1876–1877, who was followed between 1880 and 1884 by Hüber and Euting, to whom a complete collection of these records is due. The records are fortunately dated, and belong to the period from 9 B.C. to A.D. 75. A further development can be traced in the *graffiti* with which pilgrims adorned the rocks of Mount Sinai down to the 2nd or 3rd century A.D. By the help of these inscriptions it is possible to trace the development of the modern Arabic where so many of the forms of the letters have become similar that diacritic points are essential to distinguish them, the original causes of confusion being the continuous development of cursive writing and the adoption of ligatures. Arabic writing, as known to us from documents of the early Mahommedan period, exhibits two principal types which are known respectively as the Cufic and the *nashki*. The former soon fell into disuse for ordinary purposes and was retained only for inscriptions, coins, &c.; the latter, which is more cursive in character, is the parent of the Arabic writing of the present day. Another form of the Aramaic alphabet, namely, the so-called Estrangela writing which was in use amongst the Christians of northern Syria, was carried by Nestorian missionaries into Central Asia and became the ancestor of a multitude of alphabets spreading through the Turkomans as far east as Manchuria.

South Semitic.

There still remains a branch of the Semitic languages which, except for one or two of the languages belonging to it, was practically unknown till recent years. This is the South Semitic. Till the 19th century the earliest form known of this alphabet was the Ethiopian or Geez, in which Christian documents have been preserved from the early centuries of our era, and which is still used by the Abyssinians for liturgical purposes. The travels of two English naval officers, Wellsted and Cruttenden, through Yemen in southern Arabia in 1835, first called attention to the earlier monuments of Arabia. Fulgence Fresnel first established the importance of the inscriptions discovered by these Englishmen, and in 1843, when French consul at Jeddah, obtained through a French traveller, François Arnaud, information about other monuments of the same kind. In 1869 Joseph Halévy brought back nearly seven hundred inscriptions from Yemen, and this number has been increased from other quarters by several thousands, through the energy of several adventurous scholars, but chiefly by Eduard Glaser's repeated journeys. The south Arabian inscriptions to which the terms Himyaritic and Sabaean are applied fall into two groups, the Sabaean proper and the Minaean. These are distinguished by differences in grammar and phraseology rather than in alphabet. The relative age of the Minaean and Sabaean monuments is a matter of dispute amongst Semitic scholars. Inscriptions in a kindred dialect were brought from El-Ola, in the north of the Hedjaz, by Professor Euting. To these D. H. Müller[2] gave the title of Lihyanite, from the name of the tribe (Liḥjān) to which they belong. Their date is supposed to be earlier than that of the Sabaean and Minaean. Minaean inscriptions were found at the same place, the Minaeans having had a trading station there. In 1893 J. Theodore Bent copied carefully at Yeha in Abyssinia a few inscriptions, some of which had been already copied in 1814 by the English traveller Salt. These inscriptions are of the greatest importance, because they demonstrate, according to D. H. Müller,[3] that the Sabaeans had colonized Abyssinia as early as 1000 B.C. Other inscriptions copied by Bent at Aksum belong to the 4th century A.D. and later. Two of the earliest are written in Sabaean characters, but in the language which is known as Geez or Ethiopic. From about A.D. 500 Ethiopic was written in an alphabet which according to Müller was no gradual growth but an ingenious device of a Greek scholar of this period at the court of Abyssinia. The Sabaean, like other Semitic, inscriptions are generally written from right to left, but a few are *βουστροφηδόν*; the Ethiopic is written from left to right, and makes a marked advance upon the ordinary Semitic manner of writing by indicating the vowels. This is done by varying the form of the consonant according to the vowel which follows it. The Ethiopic system is thus rather a syllabary than an alphabet. It is noticeable that the changes thus established were made upon the basis of the old Sabaean script, which in its oldest form is evidently closely related to the old Phoenician, though it would be premature to say that the Sabaean alphabet is derived from the Phoenician. It is as likely, considering the date of both, that they are equally descendants from an older source. The characteristics of the Sabaean are great squareness and boldness in outline. It has twenty-nine symbols, whereby it is enabled to differentiate certain sounds which are not distinguished from one another in the writing of the northern Semites. As we have seen, it is a tendency in northern Semitic to open the heads of letters, and therefore it is possible that the Sabaean form for Jod may be older[4] than the Phoenician . Similarly if *Pē* means *mouth*, Hommel is right in contending that the Sabaean is more like the object than the Phoenician , if we suppose the form, like or the Phoenician W and for the Phoenician , turned through an angle of 90°. So also if Kaf corresponds to the Babylonian *Kappu*, "hollow-hand," the Sabaean form which Hommel[5] interprets as the outline of the hand with the fingers turned in and the thumb raised is a better pictograph than the various meaningless forms of *k* (, &c.).

The rock inscriptions in the wild district of Safah near Damascus which have been collected by Halévy are also written in an Arabic dialect, but, owing chiefly to their careless execution, they are to a large extent unintelligible. The character appears to be akin to the Sabaean. It has been suggested that they were the work of Arabs who had wandered thus far from the south.

Persia.

There still remain for discussion the alphabets of the Indo-European peoples of Persia and India from which the other alphabets of the Farther East are descended. When Darius in 516 B.C. caused the great Behistun inscription to be engraved, it was the cuneiform writing, already long in use for the languages of Mesopotamia, that was adopted for this purpose. We have seen that at Babylon itself the Aramaic language and character were well known. It is probable therefore, a priori, that from the Aramaic alphabet the later writing of Persia should be developed. The conclusion is confirmed by the coins, the only records with Iranian script which go back so far; but the special form of Aramaic from which the Iranian alphabet is derived must at present be left undecided. The later developments of the Iranian alphabet are the Pahlavi and the Zend, in which the MSS. of the Avesta are written. Of these manuscripts none is older than the 13th century A.D. The Pahlavi is properly the alphabet of the Sassanid kings who ruled in Persia from A.D. 226 till the Arab conquest in the 7th century A.D. Under the Sassanids the old Persian worship, which had fallen with the Achaemenid dynasty in Alexander's time, and had been neglected by the subsequent Arsacid line, was revived and the remains of its liturgical literature collected. The name is, however, also applied to the alphabet on the coins of the Parthian or Arsacid dynasty, which in its beginnings was clearly under Greek influence; while later, when a knowledge of Greek had disappeared, the attempts to imitate the old legends are as grotesque as those in western Europe to copy the inscriptions on Roman coins. The relationship between the Pahlavi and the Aramaic is clearest in the records written in the "Chaldaco-Pahlavi" characters; the most important of these documents is the liturgical inscription of Hadji-abad, where the Arsacid and Sassanian alphabets are found side by side. Taylor (*The Alphabet*, ii. p. 248 f.) regards the former as probably derived from the "ancient alphabet of Eastern Iran, a sister alphabet of the Aramaean of the satrapies," while the Sassanian belongs to a later stage of Aramaic.

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[1] See Berger's *Histoire de l'écriture dans l'antiquité*, p. 252 ff.; Lidzbarski, *Nordsemitische Epigraphik*, p. 186 ff., from whom this summary is taken. Lidzbarski's second volume and G. A. Cooke's *Textbook of North-Semitic Inscriptions* (Oxford, 1903) contain the most convenient collections of Northern Semitic inscriptions for the student's purposes.

[2] Müller, *Epigraphische Denkmäler aus Arabien* (Vienna, 1889).

[3] *Epigraphische Denkmäler aus Abessinien* (Vienna, 1894). Praetorius (*Z.D.M.G.* lviii. p. 724) holds that the oldest Sabaean inscriptions may date from about 700 B.C., that the Lihyan inscriptions are at earliest of the Hellenistic period and the Safa inscriptions still later.

[4] Praetorius (*Z.D.M.G.* lviii. p. 461 f.) attempts to trace the development of the Sabaean form from the Phoenician.

[5] Hommel, *Süd-arabische Chrestomathie* (Munich, 1893), p. 5.

TABLE I.

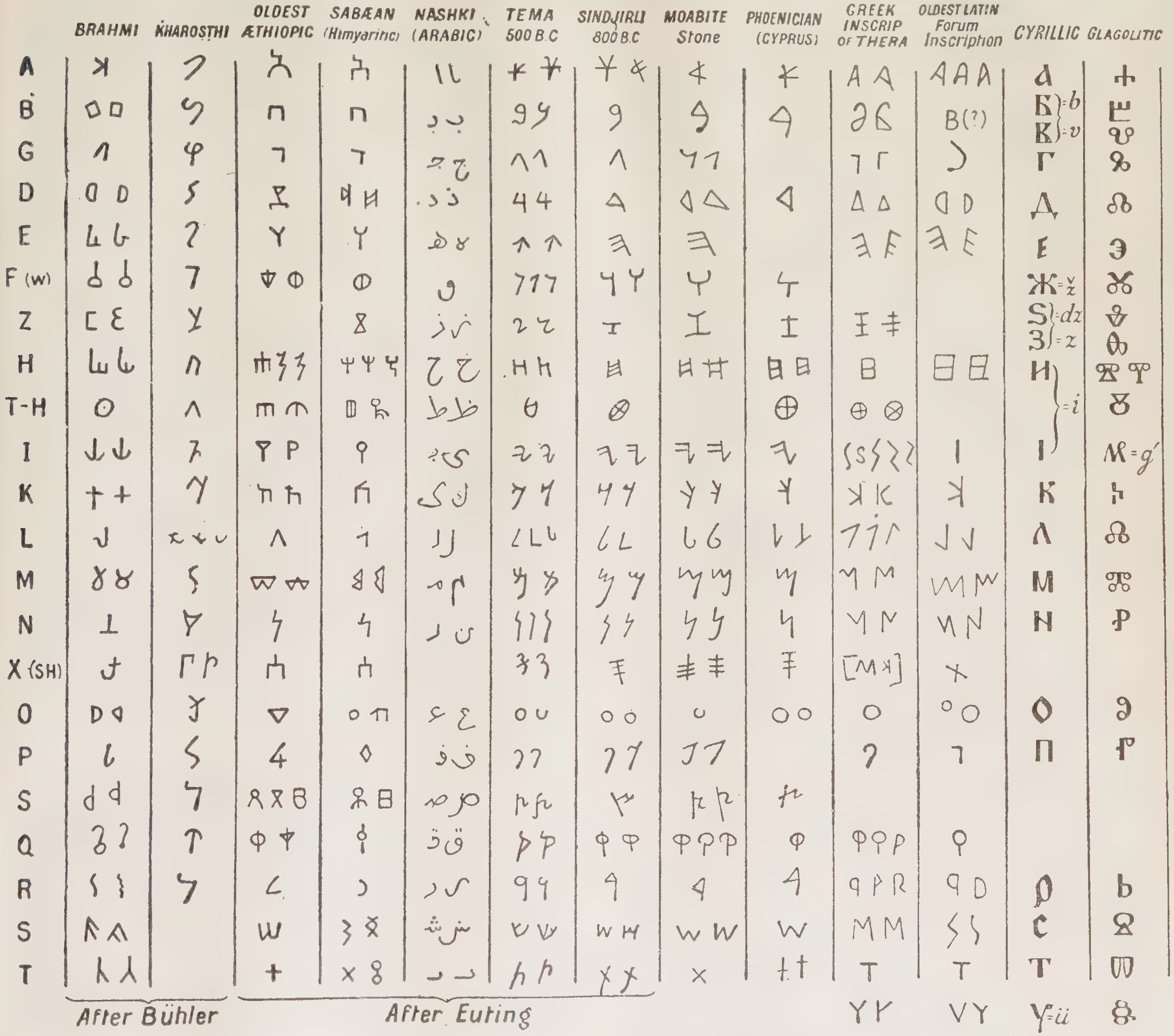
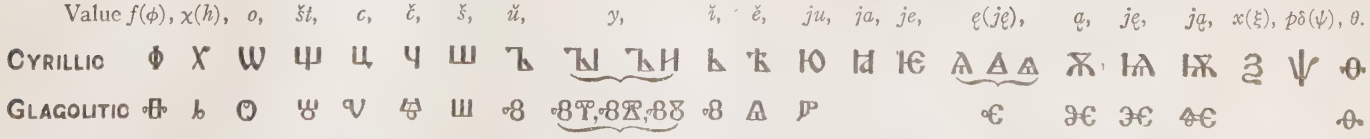

BRAHMI
KHAROṢTHI
OLDEST ÆTHIOPIC
SABÆAN (Himyaritic)
NASHKI (ARABIC)
TEMA 500 B.C
SINDJIRLI 800 B.C
MOABITE Stone
PHOENICIAN (CYPRUS)
GREEK INSCRIP OF THERA
OLDEST LATIN Forum Inscription
CYRILLIC
GLAGOLITIC
A
B
G
D
E
F (W)
Z
H
T-H
I
K
L
M
N
X (SH)
O
P
S
Q
R
S
T
=b
=v
=ž
=dz
=z
=i
=g′
=ü
After Bühler
After Euting

TABLE II.—*Cyrillic and Glagolitic Symbols not given above.*


Value f(φ), x(h), o, št, c, č, š, ŭ, y, ĭ, ´ ě, ju, ja, je, ę(ję), ą, ję, ją, x(ξ), pδ(ψ), θ.
CYRILLIC
GLAGOLITIC

India. The alphabets of India all spring from two sources: (*a*) the Kharoṣṭhī, (*b*) the Brāhmī alphabet. The history of the former is fairly clear. It was always a local alphabet, and never attained the importance of its rival. According to Bühler,[1] its range lay between 69° and 73° 30′ E. and 33° to 35° N., a conclusion which is not invalidated by the fact that some important modifications are found beyond this area, nor by Dr Stein's discovery of a great mass of documents in this alphabet at Khotan in Turkestan, for, according to tradition, the ancient inhabitants of Khotan were emigrants banished in the time of King Açoka from the area to which Bühler assigns this alphabet (see Stein's *Preliminary Report*, 1901, p. 51). Rapson[2] has pointed out that both Kharoṣṭhī and Brāhmī letters are found upon Persian silver *sigloi*, which were coined in the Punjab and belong to the period of the Achaemenid kings of Persia. As Bühler shows in detail, the Kharoṣṭhī alphabet is derived from the alphabet of the Aramaic inscriptions which date from the earlier part of the Achaemenid period. The Aramaic alphabet passed into India with the staff of subordinate officials by whom Darius organized his conquests there. The people of India already possessed their Brāhmī alphabet, but had this other alphabet forced upon them in their dealings with their rulers. The Kharoṣṭhī is then the gradual development under local conditions of the Aramaic alphabet of the Persian period. As Stein's explorations show, both alphabets may be found on opposite sides of the same piece of wood.

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[1] Bühler, *Indian Studies*, iii. (2nd ed., 1898), p. 93. The account of these alphabets is drawn from this work and from the same author's *Indische Paläographie* in the *Grundriss der indo-arischen Philologie*, to which is attached an atlas of plates (Strassburg, 1896), and in which a full bibliography is given.

[2] For a coin and a gild token with inscriptions see Rapson's *Indian Coins* (in *Grundriss d. ind.-ar. Phil.*), Plate I.

The history of the Brāhmī alphabet is more difficult. In its later forms it is so unlike other alphabets that many scholars have regarded it as an invention within India itself. The discovery of earlier inscriptions than were hitherto known has, however, caused this view to be discarded, and the problem is to decide from which form of the Semitic alphabet it is derived. Taylor (*The Alphabet*, ii. p. 314 ff.), following Weber, argues that it comes from the Sabaeans who were carrying on trade with India as early as 1000 B.C. Even if the alphabet had not reached India till the 6th century B.C., there would be time, he contends, for the peculiarities of the Indian form of it to develop before the period when records begin. The alphabet, according to Taylor, shows no resemblance to any northern Semitic script, while its stiff, straight lines and its forms seem like the Sabaean. Bühler, on the other hand, shows from literary evidence that writing was in common use in India in the 5th, possibly in the 6th, century B.C. The oldest alphabet must have been the *Brākmī lipi*, which is found all over India. But he rejects Taylor's derivation of this alphabet from the Sabaean script, and contends that it is borrowed from the North Semitic. To the pedantry of the Hindu he attributes its main characteristics, viz. (*a*) letters made as upright as possible, and with few exceptions equal in height; (*b*) the majority of the letters constructed of vertical lines, with appendages attached mostly at the foot, occasionally at the foot and at the top, or (rarely) in the middle, but never at the top alone; (*c*) at the tops of the characters the ends of vertical lines, less frequently straight horizontal lines, still more rarely curves or the points of angles opening downwards, and quite exceptionally, in the symbol *ma*, two lines rising upwards. A remarkable feature of the alphabet is that the letters are hung from and do not stand upon a line, a characteristic which, as Bühler notes (*Indian Studies*, iii. p. 57 *n.*), belongs even to the most ancient MSS., and to the Asoka inscriptions of the 3rd century B.C. When these specially Indian features have been allowed for, Bühler contends that the symbols borrowed from the Semitic alphabet can be carried back to the forms of the Phoenician and Moabite alphabets. The proof deals with each symbol separately; as might be expected of its author, it is both scholarly and ingenious, but, it must be admitted, not very convincing. Further evidence as to the early history of this alphabet must be discovered before we can definitely decide what its origin may be. That such evidence will be forthcoming there is little doubt. Even since Bühler wrote, the vase, the top of which is reproduced (see Plate), has been discovered on the borders of Nepal in a stupa where some of the relics of Buddha were kept. The inscription is of the same type as the Asoka inscriptions, but, in Bühler's opinion (*Journal of the Royal Asiatic Society*, xxx., 1898, p. 389), is older than Asoka's time. It reads as follows: *iyaṃ salilanidhane Budhasa bhagavate sakiyanaṃ sukitibhatinaṃ sabhaginikanaṃ saputadalanaṃ.* "This casket of relics of the blessed Buddha is the pious foundation (so Pischel, no doubt rightly, *Zeitsch. d. deutsch. morg. Gesell.* lvi. 158) of the Sākyas, their brothers and their sisters, together with children and wives."

How this alphabet was modified locally, and how it spread to other Eastern lands, must be sought in the specialist works to which reference has already been made. Its extension to new and hitherto unknown languages was in 1910 in process of being rapidly demonstrated by English and German expeditions in Chinese Turkestan.

AUTHORITIES.—Owing to the rapid increase of materials, all early works are out of date. The best general accounts, though already somewhat antiquated, are: (1) *The Alphabet* (2 vols., with references to earlier works), by Canon Isaac Taylor (1883), reprinted from the stereotyped plates with small necessary corrections (1899); and (2) *Histoire de l'écriture dans l'antiquité*, by M. Philippe Berger (Paris, 1891, 2nd ed. 1892). An excellent popular account is *The Story of the Alphabet*, by E. Clodd (no date, about 1900). Faulmann's *Illustrierte Geschichte der Schrift* (1880) is a popular work with good illustrations. For the beginnings of the alphabet, Dr A. J. Evans's *Scripta Minoa* (vol. i., 1909) is indispensable, whether his theories hold their ground or not. The Semitic alphabet is excellently treated by Lidzbarski in the *Jewish Encyclopaedia* (1901); his *Nordsemitische Epigraphik* (1898) has excellent facsimiles and tables of the alphabets, and there are many contributions to the history of the alphabet in the same writer's *Ephemeris für semitische Epigraphik* (Giessen, since 1900). See also "Writing" (by A. A. Bevan) in the *Encyclopaedia Biblica*, and "Alphabet" (by Isaac Taylor) in Hastings' *Dictionary of the Bible*. A very good article, now somewhat antiquated, is Schlottmann's "Schrift und Schriftzeichen" in Riehm's *Handwörterbuch des biblischen Altertums* (1884, reprinted 1894). For Greek epigraphy the fullest and also most recent work is W. Larfeld's *Handbuch der griechischen Epigraphik* (vol. ii., 1902; vol. i., 1907) (see especially *Herkunft und Alter des griechischen Alphabets*, i. 330 ff.). For the history of the Greek alphabet the fundamental work was A. Kirchhoff's *Studien zur Geschichte des griechischen Alphabets* (4th ed., 1887): his theories were adopted and worked out on a much larger scale in E. S. Roberts's *Introduction to Greek Epigraphy*, pt. i. "The Archaic Inscriptions and the Greek Alphabet" (1887), pt. ii. (with E. A. Gardner) "The Inscriptions of Attica" (1905). See also Salomon Reinach's *Traité d' épigraphie grecque* (1885). In Iwan von Müller's *Handbuch der klassischen Altertumswissenschaft* important articles on both Greek and Latin epigraphy and alphabets have appeared (Greek in edition 1 by G. Heinrichs, 1886; in edition 2 by W. Larfeld, 1892; Latin by Emil Hübner). See also "Alphabet," by W. Deecke, in Baumeister's *Denkmäler des klassischen Altertums* (1884), and by Szanto (Greek) and Joh. Schmidt (Italic) in Pauly's *Realencyclopädie* edited by Wissowa (1894). Mommsen's *Die unteritalischen Dialekte* (1850) is not without value even now. Other literature and references to fuller bibliographies in separate departments have been given in the notes. Elsewhere in this edition of the *Encyclopaedia Britannica* the articles on the various languages and under the headings INSCRIPTIONS, PALAEOGRAPHY, WRITING, &c., should be consulted, while separate articles are given on each letter of the English alphabet. The writer is indebted to Dr A. J. Evans for a photograph of the Cretan linear script, and to Professors A. A. Bevan and Rapson of Cambridge, and to Mr F. W. Thomas, librarian of the India Office, for help in their respective departments of Semitic and Indian languages. (P. GI.)

'AL-PHASI, ISAAC (1013–1103), Jewish rabbi and codifier, known as *Riph*, was born near Fez in 1013 and died at Lucena in 1103. 'Al-Phasi means the "man of Fez" (medieval Jews were often named after their birthplaces). He was forced to leave Fez when an old man of 75, being accused on some unknown political charge. He then settled in Spain where he was held in much esteem. His magnanimous character was illustrated by two incidents. When 'Al-phasi's opponent Isaac 'Albalia died, 'Al-phasi received 'Albalia's son with the greatest kindness and adopted him as a son. When, again, 'Al-phasi was himself on the point of death, he recommended as his successor in the Lucena rabbinate, not his own son, but his pupil Joseph ibn Migash. The latter became the teacher of Maimonides, and thus 'Al-phasi's teaching as well as his work must have directly influenced Maimonides. 'Al-phasi's fame rests on his Talmudical Digest called *Halakhoth* or *Decisions*. The Talmud was condensed by him with a special view to practical law. He omitted all the homiletical passages, and also excluded those parts of the Talmud which deal with religious duties practicable only in Palestine. 'Al-phasi thus occupies an important place in the development of the Spanish method of studying the Talmud. In contradistinction to the French rabbis, the Spanish sought to simplify the Talmud and free it from casuistical detail. 'Al-phasi succeeded in producing a Digest, which became the object of close study, and led in its turn to the great Codes of Maimonides and of Joseph Qaro.

ALPHEGE [ÆLFHEAH], **SAINT** (954–1023), archbishop of Canterbury, came of a noble family, but in early life gave up everything for religion. Having assumed the monastic habit in the monastery of Deerhurst, he pased thence to Bath, where he became an anchorite and ultimately abbot, distinguishing himself by his piety and the austerity of his life. In 984 he was appointed through Dunstan's influence to the bishopric of Winchester, and in 1006 he succeeded Ælfric as archbishop of Canterbury. At the sack of Canterbury by the Danes in 1011 Ælfheah was captured and kept in prison for seven months. Refusing to pay a ransom he was barbarously murdered at Greenwich on the 19th of April 1012. He was buried in St Paul's, whence his body was removed by Canute to Canterbury with all the ceremony of a great act of state in 1023.

Lives of St. Alphege in prose (which survives) and in verse were written by command of Lanfranc by the Canterbury monk Osbern (d. *c.* 1090), who says that his account of the solemn translation to Canterbury in 1023 was received from the dean, Godric, one of Alphege's own scholars.

ALPHEUS ('Αλφειός; mod. *Ruphia*), the chief river of Peloponnesus. Strictly Ruphia is the modern name for the ancient *Ladon*, a tributary which rises in N.E. Elis, but the name has been given to the whole river. The Alpheus proper rises near Asea; but its passage thither by subterranean channels from the Tegean plain and its union with the Eurotas are probably mythical (see W. Loring, in *Journ. Hell. Studies*, xv. p. 67). It consists for the most part of a shallow and rapid stream, occupying but a small part of its broad, stony bed. It empties itself into the Ionian sea. Pliny states that in ancient times it was navigable for six Roman miles from its mouth. Alpheus was recognized in cult and myth as the chief or typical river-god in the Peloponnesus, as was Achelous in northern Greece. His waters were said to pass beneath the sea and rise again in the fountain Arethusa at Syracuse; such is the earlier version from which later mythologists and poets evolved the familiar myth of the loves of Alpheus and Arethusa.

ALPHONSE I., Count of Toulouse (1103–1148), son of Count Raymond IV. by his third wife, Elvira of Castile, was born in 1103, in the castle of Mont-Pèlerin, Tripoli. He was surnamed Jourdain on account of his being baptized in the river Jordan. His father died when he was two years old and he remained under the guardianship of his cousin, Guillaume Jourdain, count of Cerdagne (d. 1109), until he was five. He was then taken to Europe and his brother Bertrand gave him the countship of Rouergue; in his tenth year, upon Bertrand's death (1112), he succeeded to the countship of Toulouse and marquisate of Provence, but Toulouse was taken from him by William IX., count of Poitiers, in 1114. He recovered a part in 1119, but continued to fight for his possessions until about 1123. When at last successful, he was excommunicated by Pope Calixtus II. for having expelled the monks of Saint-Gilles, who had aided his enemies. He next fought for the sovereignty of Provence against Raymond Berenger I., and not till September 1125 did the war end in an amicable agreement. Under it Jourdain became absolute master of the regions lying between the Pyrenees and the Alps, Auvergne and the sea. His ascendancy was an unmixed good to the country, for during a period of fourteen years art and industry flourished. About 1134 he seized the countship of Narbonne, only restoring it to the Viscountess Ermengarde (d. 1197) in 1143. Louis VII., for some reason which has not appeared, besieged Toulouse in 1141, but without result. Next year Jourdain again incurred the displeasure of the church by siding with the rebels of Montpellier against their lord. A second time he was excommunicated; but in 1146 he took the cross at the meeting of Vézelay called by Louis VII., and in August 1147 embarked for the East. He lingered on the way in Italy and probably in Constantinople; but in 1148 he had arrived at Acre. Among his companions he had made enemies and he was destined to take no share in the crusade he had joined. He was poisoned at Caesarea, either the wife of Louis or the mother of the king of Jerusalem suggesting the draught.

See the documentary *Histoire générale de Languedoc* by De Vie and Vaissette, vol. iii. (Toulouse, 1872).

ALPHONSE, Count of Toulouse and of Poitiers (1220–1271), the son of Louis VIII., king of France, and brother of St Louis, was born on the 11th of November 1220. He joined the county of Toulouse to his appanage of Poitou and Auvergne, on the death, in September 1249, of Raymond VII., whose daughter Jeanne he had married in 1237. He took the cross with his brother, St Louis, in 1248 and in 1270. In 1252, on the death of his mother, Blanche of Castile, he was joint regent with Charles of Anjou until the return of Louis IX., and took a great part in the negotiations which led to the treaties of Abbeville and of Paris (1258–1259). His main work was on his own estates. There he repaired the evils of the Albigensian war and made a first attempt at administrative centralization, thus preparing the way for union with the crown. The charter known as "Alphonsine," granted to the town of Riom, became the code of public law for Auvergne. Honest and moderate, protecting the middle classes against exactions of the nobles, he exercised a happy influence upon the south, in spite of his naturally despotic character and his continual and pressing need of money. He died without heirs on his return from the 8th crusade, in Italy, probably at Savona, on the 21st of August 1271.

See B. Ledain, *Histoire d'Alphonse, frère de S. Louis et du comté de Poitou sous son administration* (1241–1271) (Poitou, 1869); E. Boutaric, *Saint Louis et Alphonse de Poitiers* (Paris, 1870); A. Molinier, *Étude sur l'administration de S. Louis et d'Alphonse de Poitiers* (Toulouse, 1880); and also his edition of the *Correspondance administrative d'Alphonse de Poitiers* in the *Collection de documents inédits pour servir à l'histoire de France* (Paris, 1894 and 1895).

ALPHONSO, the common English spelling of Affonso, Alonso and Alfonso, which are respectively the Galician, the Leonese and the Castilian forms of Ildefonso (Ildefonsus), the name of a saint and archbishop of Toledo in the 7th century. The name has been borne by a number of Portuguese and Spanish kings, who are distinguished collectively below.

Kings of Portugal.

Portuguese Kings.—Alphonso I. (Affonso Henriques), son of Henry of Burgundy, count of Portugal, and Teresa of Castile, was born at Guimaraẽs in 1094. He succeeded his father in 1112, and was placed under the tutelage of his mother. When he came of age, he was obliged to wrest from her by force that power which her vices and incapacity had rendered disastrous to the state. Being proclaimed sole ruler of Portugal in 1128, he defeated his mother's troops near Guimaraẽs, making her at the same time his prisoner. He also vanquished Alphonso Raymond of Castile, his mother's ally, and thus freed Portugal from dependence on the crown of Leon. Next turning his arms against the Moors, he obtained, on the 26th July 1139, the famous victory of Ourique, and immediately after was proclaimed king by his soldiers. He assembled the Cortes of the kingdom at Lamego, where he received the crown from the archbishop of Braganza; the assembly also declaring that Portugal was no longer a dependency of Leon. Alphonso continued to distinguish himself by his exploits against the Moors, from whom he wrested Santarem in 1146 and Lisbon in 1147. Some years later he became involved in a war that had broken out among the kings of Spain; and in 1167, being disabled during an engagement near Badajoz by a fall from his horse, he was made prisoner by the soldiers of the king of Leon, and was obliged to surrender as his ransom almost all the conquests he had made in Galicia. In 1184, in spite of his great age, he had still sufficient energy to relieve his son Sancho, who was besieged in Santarem by the Moors. He died shortly after, in 1185. Alphonso was a man of gigantic stature, being 7 ft. high according to some authors. He is revered as a saint by the Portuguese, both on account of his personal character and as the founder of their kingdom.

Alphonso II., "the Fat," was born in 1185, and succeeded his father, Sancho I., in 1211. He was engaged in war with the Moors and gained a victory over them at Alcácer do Sal in 1217. He also endeavoured to weaken the power of the clergy and to apply a portion of their enormous revenues to purposes of national utility. Having been excommunicated for this by the pope (Honorius III.), he promised to make amends to the church; but he died in 1223 before doing anything to fulfil his engagement. He framed a code which introduced several beneficial changes into the laws of his kingdom.

Alphonso III., son of Alphonso II., was born in 1210, and succeeded his brother, Sancho II., in 1248. Besides making war upon the Moors, he was, like his father, frequently embroiled with the church. In his reign Algarve became part of Portugal. He died in 1279.

Alphonso IV. was born in 1290, and in 1325 succeeded his father, Dionis, whose death he had hastened by his intrigues and rebellions. Hostilities with the Castilians and with the Moors occupied many years of his reign, during which he gained some successes; but by consenting to the barbarous murder of Iñez de Castro, who was secretly espoused to his son Peter, he has fixed an indelible stain on his character. Enraged at this barbarous act, Peter put himself at the head of an army and devastated the whole of the country between the Douro and the Minho before he was reconciled to his father. Alphonso died almost immediately after, on the 12th of May 1357.

Alphonso V., "Africano," was born in 1432, and succeeded his father Edward in 1438. During his minority he was placed under the regency, first of his mother and latterly of his uncle, Dom Pedro. In 1448 he assumed the reins of government and at the same time married Isabella, Dom Pedro's daughter. In the following year, being led by what he afterwards discovered to be false representations, he declared Dom Pedro a rebel and defeated his army in a battle at Alfarrobeira, in which his uncle was slain. In 1458, and with more numerous forces in 1471, he invaded the territories of the Moors in Africa and by his successes there acquired his surname of "the African." On his return to Portugal in 1475 his ambition led him into Castile, where two princesses were disputing his succession to the throne. Having been affianced to the Princess Juana, Alphonso caused himself to be proclaimed king of Castile and Leon; but in the following year he was defeated at Toro by Ferdinand, the husband of Isabella of Castile. He went to France to obtain the assistance of Louis XI., but finding himself deceived by the French monarch, he abdicated in favour of his son John. When he returned to Portugal, however, he was compelled by his son to resume the sceptre, which he continued to wield for two years longer. After that he fell into a deep melancholy and retired into a monastery at Cintra, where he died in 1481.

Alphonso VI., the second king of the house of Braganza, was born in 1643 and succeeded his father in 1656. In 1667 he was compelled by his wife and brother to abdicate the throne and was banished to the island of Terceira. These acts, which the vices of Alphonso had rendered necessary, were sanctioned by the Cortes in 1668. He died at Cintra in 1675.

Spanish Kings.—From Alphonso I. (739–757) to Alphonso V. (999–1028) the personal history of the Spanish kings of this name is unknown and their very dates are disputed. Alphonso I. is said to have married Ormesinda, daughter of Pelayo, who was raised on the shield in Asturias as king of the Goths after the Arab conquest. He is also said to have been the son of Peter, duke of Cantabria. It is not improbable that he was in fact an hereditary chief of the Basques, but no contemporary records exist. His title of "the Catholic" itself may very well have been the invention of later chronicles. Alphonso II. (789–842), his reputed grandson, bears the name of "the Chaste." The Arab writers who speak of the Spanish kings of the north-west as the Beni-Alfons, appear to recognize them as a royal stock derived from Alphonso I. The events of his reign are in reality unknown. Poets of a later generation invented the story of the secret marriage of his sister Ximena with Sancho, count of Saldaña, and the feats of their son Bernardo del Carpio. Bernardo is the hero of a *cantar de gesta* (*chanson de geste*) written to please the anarchical spirit of the nobles.

Kings of medieval and modern Spain.

The first faint glimmerings of medieval Spanish history begin with Alphonso III. (866–914) surnamed "the Great." Of him also nothing is really known except the bare facts of his reign and of his comparative success in consolidating the kingdom known as "of Galicia" or "of Oviedo" during the weakness of the Omayyad princes of Cordova. Alphonso IV. (924–931) has a faint personality. He resigned the crown to his brother Ramiro and went into a religious house. A certain instability of character is revealed by the fact that he took up arms against Ramiro, having repented of his renunciation of the world. He was defeated, blinded and sent back to die in the cloister of Sahagun. It fell to Alphonso V. (999–1028) to begin the work of reorganizing the Christian kingdom of the north-west after a most disastrous period of civil war and Arab inroads. Enough is known of him to justify the belief that he had some of the qualities of a soldier and a statesman. His name, and that of his wife Geloria (Elvira), are associated with the grant of the first franchises of Leon. He was killed by an arrow while besieging the town of Viseu in northern Portugal, then held by the Mahommedans. (For all these kings see the article Spain: *History*.)

With Alphonso VI. (1065–1109) we come to a sovereign of strong personal character. Much romance has gathered round his name. In the *cantar de gesta* of the Cid he plays the part attributed by medieval poets to the greatest kings, to Charlemagne himself. He is alternately the oppressor and the victim of heroic and self-willed nobles—the idealized types of the patrons for whom the jongleurs and troubadours sang. (For the events of his reign see the article Spain: *History*.) He is the hero of a *cantar de gesta* which, like all but a very few of the early Spanish songs, like the *cantar* of Bernardo del Carpio and the *Infantes* of Lara, exists now only in the fragments incorporated in the chronicle of Alphonso the Wise or in ballad form. His flight from the monastery of Sahagun, where his brother Sancho endeavoured to imprison him, his chivalrous friendship for his host Almamun of Toledo, *caballero aunque mon*, a gentleman although a Moor, the passionate loyalty of his vassal Peranzules and his brotherly love for his sister Urraca of Zamora, may owe something to the poet who took him for hero. They are the answer to the poet of the nobles who represented the king as having submitted to take a degrading oath at the hands of Ruy Diaz of Bivar (the Cid), in the church of Santa Gadea at Burgos, and as having then persecuted the brave man who defied him. When every allowance is made, Alphonso VI. stands out as a strong man fighting for his own hand, which in his case was the hand of the king whose interest was law and order and who was the leader of the nation in the reconquest. On the Arabs he impressed himself as an enemy very fierce and astute, but as a keeper of his word. A story of Mahommedan origin, which is probably no more historical than the oath of Santa Gadea, tells of how he allowed himself to be tricked by Ibn Ammar, the favourite of Al Motamid, the king of Seville. They played chess for an extremely beautiful table and set of men, belonging to Ibn Ammar. Table and men were to go to the king if he won. If Ibn Ammar gained he was to name the stake. The latter did win and demanded that the Christian king should spare Seville. Alphonso kept his word. Whatever truth may lie behind the romantic tales of Christian and Mahommedan, we know that Alphonso represented in a remarkable way the two great influences then shaping the character and civilization of Spain. At the instigation, it is said, of his second wife, Constance of Burgundy, he brought the Cistercians into Spain, established them in Sahagun, chose a French Cistercian, Bernard, as the first archbishop of Toledo after the reconquest in 1085, married his daughters, legitimate and illegitimate, to French princes, and in every way forwarded the spread of French influence—then the greatest civilizing force in Europe. He also drew Spain nearer to the papacy, and it was his decision which established the Roman ritual in place of the old missal of Saint Isidore—the so-called Mozarabic. On the other hand he was very open to Arabic influence. He protected the Mahommedans among his subjects and struck coins with inscriptions in Arabic letters. After the death of Constance he perhaps married and he certainly lived with Zaida, said to have been a daughter of "Benabet" (Al Motamid), Mahommedan king of Seville. Zaida, who became a Christian under the name of Maria or Isabel, bore him the only son among his many children, Sancho, whom Alphonso designed to be his successor, but who was slain at the battle of Uclés in 1108. Women play a great part in Alphonso's life.

[Alphonso I., king of Aragon, "the Battler," who married Urraca, daughter of Alphonso VI. (1104–1134), is sometimes counted the VIIth in the line of the kings of Leon and Castile. A passionate fighting-man (he fought twenty-nine battles against Christian or Moor), he was married to Urraca, widow of Raymond of Burgundy, a very dissolute and passionate woman. The marriage had been arranged by Alphonso VI. in 1106 to unite the two chief Christian states against the Almoravides, and to supply them with a capable military leader. But Urraca was tenacious of her right as proprietary queen and had not learnt chastity in the polygamous household of her father. Husband and wife quarrelled with the brutality of the age and came to open war. Alphonso had the support of one section of the nobles who found their account in the confusion. Being a much better soldier than any of his opponents he gained victories at Sepúlveda and Fuente de la Culebra, but his only trustworthy supporters were his Aragonese, who were not numerous enough to keep down Castile and Leon. The marriage of Alphonso and Urraca was declared null by the pope, as they were third cousins. The king quarrelled with the church, and particularly the Cistercians, almost as violently as with his wife. As he beat her, so he drove Archbishop Bernard into exile and expelled the monks of Sahagun. He was finally compelled to give way in Castile and Leon to his stepson Alphonso, son of Urraca and her first husband. The intervention of Pope Calixtus II. brought about an arrangement between the old man and the young. Alphonso the Battler won his great successes in the middle Ebro, where he expelled the Moors from Saragossa; in the great raid of 1125, when he carried away a large part of the subject-Christians from Granada, and in the south-west of France, where he had rights as king of Navarre. Three years before his death he made a will leaving his kingdom to the Templars, the Hospitallers, and the Knights of the Sepulchre, which his subjects refused to carry out. He was a fierce, violent man, a soldier and nothing else, whose piety was wholly militant. Though he died in 1134 after an unsuccessful battle with the Moors at Braga, he has a great place in the reconquest.]

Alphonso VII., "the Emperor" (1126–1157), is a dignified and somewhat enigmatical figure. A vague tradition had always assigned the title of emperor to the sovereign who held Leon as the most direct representative of the Visigoth kings, who were themselves the representatives of the Roman empire. But though given in charters, and claimed by Alphonso VI. and the Battler, the title had been little more than a flourish of rhetoric. Alphonso VII. was crowned emperor in 1135 after the death of the Battler. The weakness of Aragon enabled him to make his superiority effective. He appears to have striven for the formation of a national unity, which Spain had never possessed since the fall of the Visigoth kingdom. The elements he had to deal with could not be welded together. Alphonso was at once a patron of the church, and a protector if not a favourer of the Mahommedans, who formed a large part of his subjects. His reign ended in an unsuccessful campaign against the rising power of the Almohades. Though he was not actually defeated, his death in the pass of Muradel in the Sierra Morena, while on his way back to Toledo, occurred in circumstances which showed that no man could be what he claimed to be—"king of the men of the two religions." His personal character does not stand out with the emphasis of those of Alphonso VI. or the Battler. Yet he was a great king, the type and to some extent the victim of the confusions of his age—Christian in creed and ambition, but more than half oriental in his household.

Alphonso VIII. (1158–1214), king of Castile only, and grandson of Alphonso VII., is a great name in Spanish history, for he led the coalition of Christian princes and foreign crusaders who broke the power of the Almohades at the battle of the Navas de Tolosa in 1212. The events of his reign are dealt with under Spain. His personal history is that of many medieval kings. He succeeded to the throne on the death of his father, Sancho, at the age of a year and a half. Though proclaimed king, he was regarded as a mere name by the unruly nobles to whom a minority was convenient. The devotion of a squire of his household, who carried him on the pommel of his saddle to the stronghold of San Esteban de Gormaz, saved him from falling into the hands of the contending factions of Castro and Lara, or of his uncle Ferdinand of Leon, who claimed the regency. The loyalty of the town of Avila protected his youth. He was barely fifteen when he came forth to do a man's work by restoring his kingdom to order. It was only by a surprise that he recovered his capital Toledo from the hands of the Laras. His marriage with Leonora of Aquitaine, daughter of Henry II. of England, brought him under the influence of the greatest governing intellect of his time. Alphonso VIII. was the founder of the first Spanish university, the *studium generale* of Palencia, which, however, did not survive him.

Alphonso IX. (1188–1230) of Leon, first cousin of Alphonso VIII. of Castile, and numbered next to him as being a junior member of the family (see the article Spain for the division of the kingdom and the relationship), is said by Ibn Khaldun to have been called the "Baboso" or Slobberer, because he was subject to fits of rage during which he foamed at the mouth. Though he took a part in the work of the reconquest, this king is chiefly remembered by the difficulties into which his successive marriages led him with the pope. He was first married to his cousin Teresa of Portugal, who bore him two daughters, and a son who died young. The marriage was declared null by the pope, to whom Alphonso paid no attention till he was presumably tired of his wife. It cannot have been his conscience which constrained him to leave Teresa, for his next step was to marry Berengaria of Castile, who was his second cousin. For this act of contumacy the king and kingdom were placed under interdict. The pope was, however, compelled to modify his measures by the threat that if the people could not obtain the services of religion they would not support the clergy, and that heresy would spread. The king was left under interdict personally, but to that he showed himself indifferent, and he had the support of his clergy. Berengaria left him after the birth of five children, and the king then returned to Teresa, to whose daughters he left his kingdom by will.

Alphonso X., *El Sabio*, or the learned (1252–1284), is perhaps the most interesting, though he was far from being the most capable, of the Spanish kings of the middle ages. (His merits as a writer are dealt with in the article Spain: *Literature*). His scientific fame is based mainly on his encouragement of astronomy. It may be pointed out, however, that the story which represents him as boasting of his ability to make a better world than this is of late authority. If he said so, he was speaking of the Ptolemaic cosmogony as known to him through the Arabs, and his vaunt was a humorous proof of his scientific instinct. As a ruler he showed legislative capacity, and a very commendable wish to provide his kingdoms with a code of laws and a consistent judicial system. The *Fuero Real* was undoubtedly his work, and he began the code called the *Siete Partidas*, which, however, was only promulgated by his great-grandson. Unhappily for himself and for Spain, he wanted the singleness of purpose required by a ruler who would devote himself to organization, and also the combination of firmness with temper needed for dealing with his nobles. His descent from the Hohenstaufen through his mother, a daughter of the emperor Philip, gave him claims to represent the Swabian line. The choice of the German electors, after the death of Conrad IV. in 1254, misled him into wild schemes which never took effect but caused immense expense. To obtain money he debased the coinage, and then endeavoured to prevent a rise in prices by an arbitrary tariff. The little trade of his dominions was ruined, and the burghers and peasants were deeply offended. His nobles, whom he tried to cow by sporadic acts of violence, rebelled against him. His second son, Sancho, enforced his claim to be heir, in preference to the children of Ferdinand de la Cerda, the elder brother who died in Alphonso's life. Son and nobles alike supported the Moors, when he tried to unite the nation in a crusade; and when he allied himself with the rulers of Morocco they denounced him as an enemy of the faith. A reaction in his favour was beginning in his later days, but he died defeated and deserted at Seville, leaving a will by which he endeavoured to exclude Sancho and a heritage of civil war.

Alphonso XI. (1312–1350) is variously known among Spanish kings as the Avenger or the Implacable, and as "he of the Rio Salado." The first two names he earned by the ferocity with which he repressed the disorder of the nobles after a long minority; the third by his victory over the last formidable African invasion of Spain in 1340. The chronicler who records his death prays that "God may be merciful to him, for he was a very great king." The mercy was needed. Alphonso XI. never went to the insane lengths of his son Peter the Cruel, but he could be abundantly sultanesque in his methods. He killed for reasons of state without form of trial, while his open neglect of his wife, Maria of Portugal, and his ostentatious passion for Leonora de Guzman, who bore him a large family of sons, set Peter an example which he did not fail to better. It may be that his early death, during the great plague of 1350, at the siege of Gibraltar, only averted a desperate struggle with his legitimate son, though it was a misfortune in that it removed a ruler of eminent capacity, who understood his subjects well enough not to go too far.

[Four other kings of Aragon, besides the Battler, bore the name of Alphonso. All these princes held territory in the south-east of France, and had a close connexion with Italy. Alphonso II. of Aragon (1162–1196) was the son of Raymond Berenger, count of Barcelona, and of Petronilla, niece of Alphonso the Battler, and daughter of Ramiro surnamed the Monk. He succeeded to the county of Barcelona in 1162 on the death of his father, at the age of eleven, and in 1164 his mother renounced her rights in Aragon in his favour. Though christened Ramon (Raymond), the favourite name of his line, he reigned as Alphonso out of a wish to please his Aragonese subjects, to whom the memory of the Battler was dear. As king of Aragon he took a share in the work of the reconquest, by helping his cousin Alphonso VIII. of Castile to conquer Cuenca, and to suppress one Pero Ruiz de Azagra, who was endeavouring to carve out a kingdom for himself in the debatable land between Christian and Mahommedan. But his double position as ruler both north and south of the eastern Pyrenees distracted his policy. In character and interests he was rather Provençal than Spanish, a favourer of the troubadours, no enemy of the Albigensian heretics, and himself a poet in the southern French dialect. Alphonso III. of Aragon (1285–1291), the insignificant son of the notable Peter III., succeeded to the Spanish and Provençal possessions of his father, but his short reign did not give him time even to marry. His inability to resist the demands of his nobles left a heritage of trouble in Aragon. By recognising their right to rebel in the articles called the Union he helped to make anarchy permanent. Alphonso IV. of Aragon (1327–1336) was a weak man whose reign was insignificant. Alphonso V. of Aragon (1416–1458), surnamed the Magnanimous, who represented the old line of the counts of Barcelona only through women, and was on his father's side descended from the Castilian house of Trastamara, is one of the most conspicuous figures of the early Renaissance. No man of his time had a larger share of the quality called by the Italians of the day "virtue." By hereditary right king of Sicily, by the will of Joanna II. and his own sword king of Naples, he fought and triumphed amid the exuberant development of individuality which accompanied the revival of learning and the birth of the modern world. When a prisoner in the hands of Filipo Maria Visconti, duke of Milan, in 1435, Alphonso persuaded his ferocious and crafty captor to let him go by making it plain that it was the interest of Milan not to prevent the victory of the Aragonese party in Naples. Like a true prince of the Renaissance he favoured men of letters whom he trusted to preserve his reputation to posterity. His devotion to the classics was exceptional even in that time. He halted his army in pious respect before the birthplace of a Latin writer, carried Livy or Caesar on his campaigns with him, and his panegyrist Panormita did not think it an incredible lie to say that the king was cured of an illness by having a few pages of Quintus Curtius read to him. The classics had not refined his taste, for he was amused by setting the wandering scholars, who swarmed to his court, to abuse one another in the indescribably filthy Latin scolding matches which were then the fashion. Alphonso founded nothing, and after his conquest of Naples in 1442 ruled by his mercenary soldiers, and no less mercenary men of letters. His Spanish possessions were ruled for him by his brother John. He left his conquest of Naples to his bastard son Ferdinand; his inherited lands, Sicily and Sardinia, going to his brother John who survived him.]

Alphonso XII. (1857–1885), king of modern Spain, son of Isabella II. and Maria Fernando Francisco de Assisi, eldest son of the duke of Cadiz, was born on the 28th of November 1857. When Queen Isabella and her husband were forced to leave Spain by the revolution of 1868 he accompanied them to Paris, and from thence he was sent to the Theresianum at Vienna to continue his studies. On the 25th of June 1870 he was recalled to Paris, where his mother abdicated in his favour, in the presence of a number of Spanish nobles who had followed the fortunes of the exiled queen. He assumed the title of Alphonso XII.; for although no king of *united* Spain had previously borne the name, the Spanish monarchy was regarded as continuous with the more ancient monarchy, represented by the eleven kings of Leon and Castile already referred to. Shortly afterwards he proceeded to Sandhurst to continue his military studies, and while there he issued, on the 1st of December 1874, in reply to a birthday greeting from his followers, a manifesto proclaiming himself the sole representative of the Spanish monarchy. At the end of the year, when Marshal Serrano left Madrid to take command of the northern army, General Martinez Campos, who had long been working more or less openly for the king, carried off some battalions of the central army to Sagunto, rallied to his own flag the troops sent against him, and entered Valencia in the king's name. Thereupon the president of the council resigned, and the power was transferred to the king's plenipotentiary and adviser, Canovas del Castillo. In the course of a few days the king arrived at Madrid, passing through Barcelona and Valencia, and was received everywhere with acclamation (1875). In 1876 a vigorous campaign against the Carlists, in which the young king took part, resulted in the defeat of Don Carlos and his abandonment of the struggle. Early in 1878 Alphonso married his cousin, Princess Maria de las Mercedes, daughter of the duc de Montpensier, but she died within six months of her marriage. Towards the end of the same year a young workman of Tarragona, Oliva Marcousi, fired at the king in Madrid. On the 29th of November 1879 he married a princess of Austria, Maria Christina, daughter of the Archduke Charles Ferdinand. During the honeymoon a pastrycook named Otero fired at the young sovereigns as they were driving in Madrid. The children of this marriage were Maria de las Mercedes, titular queen from the death of her father until the birth of her brother, born on the 11th of September 1880, married on the 14th of February 1901 to Prince Carlos of Bourbon, died on the 17th of October 1904; Maria Teresa, born on the 12th of November 1882, married to Prince Ferdinand of Bavaria on the 12th of January 1906; and Alphonso (see below). In 1881 the king refused to sanction the law by which the ministers were to remain in office for a fixed term of eighteen months, and upon the consequent resignation of Canovas del Castillo, he summoned Sagasta, the Liberal leader, to form a cabinet. Alphonso died of phthisis on the 24th of November 1885. Coming to the throne at such an early age, he had served no apprenticeship in the art of ruling, but he possessed great natural tact and a sound judgment ripened by the trials of exile. Benevolent and sympathetic in disposition, he won the affection of his people by fearlessly visiting the districts ravaged by cholera or devastated by earthquake in 1885. His capacity for dealing with men was considerable, and he never allowed himself to become the instrument of any particular party. In his short reign peace was established both at home and abroad, the finances were well regulated, and the various administrative services were placed on a basis that afterwards enabled Spain to pass through the disastrous war with the United States without even the threat of a revolution.

Alphonso XIII. (1886–), king of Spain, son of Alphonso XII., was born, after his father's death, on the 17th of May 1886. His mother, Queen Maria Christina, was appointed regent during his minority (see Spain: *History*). In 1902, on attaining his 16th year, the king assumed control of the government. On the 31st of May 1906 he married Princess Victoria Eugénie Julia Ena Maria Christina of Battenberg, niece of Edward VII. of England. As the king and queen were returning from the wedding they narrowly escaped assassination in a bomb explosion, which killed and injured many bystanders and members of the royal procession. An heir to the throne was born on the 10th of May 1907, and received the name of Alphonso.

Authorities.—The lives of all the early kings of Spain will be found in the general histories (see the article Spain: *Authorities*), of which the most trustworthy is the *Anales de la Corona de Aragon*, by Geronimo Zurita (Saragossa, 1610). See also the Chronicles of the Kings of Castile in the *Biblioteca de Autores Españoles de Riva deneyra* (Madrid, 1846–1880, vols. 66, 68, 70). (D. H.)

ALPHONSUS A SANCTA MARIA, or Alphonso de Cartagena (1396–1456), Spanish historian, was born at Carthagena, and succeeded his father, Paulus, as bishop of Burgos. In 1431 he was deputed by John II., king of Castile, to attend the council of Basel, in which he made himself conspicuous by his learning. He was the author of several works, the principal of which is entitled *Rerum Hispanorum Romanorum imperatorum, summorum pontificum, nec non regum Francorum anacephaleosis*

This is a history of Spain from the earliest times down to 1456, and was printed at Granada in 1545, and also in the *Rerum Hispanicarum Scriptores aliquot*, by R. Bel (Frankfort, 1579). Alphonsus died on the 12th of July 1456.

ALPINI, PROSPERO (Prosper Alpinus), 1553–1617, Italian physician and botanist, was born at Marostica, in the republic of Venice, on the 23rd of November 1553. In his youth he served for a time in the Milanese army, but in 1574 he went to study medicine at Padua. After taking his doctor's degree in 1578, he settled as a physician in Campo San Pietro, a small town in the Paduan territory. But his tastes were botanical, and to extend his knowledge of exotic plants he travelled to Egypt in 1580 as physician to George Emo or Hemi, the Venetian consul in Cairo. In Egypt he spent three years, and from a practice in the management of date-trees, which he observed in that country, he seems to have deduced the doctrine of the sexual difference of plants, which was adopted as the foundation of the Linnaean system. He says that "the female date-trees or palms do not bear fruit unless the branches of the male and female plants are mixed together; or, as is generally done, unless the dust found in the male sheath or male flowers is sprinkled over the female flowers." On his return, he resided for some time at Genoa as physician to Andrea Doria, and in 1593 he was appointed professor of botany at Padua, where he died on the 6th of February 1617. He was succeeded in the botanical chair by his son Alpino Alpini (d. 1637). His best-known work is *De Plantis Aegypti liber* (Venice, 1592). His *De Medicina Egyptiorum* (Venice, 1591) is said to contain the first account of the coffee plant published in Europe. The genus *Alpinia*, belonging to the order Zingiberaceae, was named after him by Linnaeus.

ALPS, the collective name for one of the great mountain systems of Europe.

1. *Position and Name.*—The continent of Europe is no more than a great peninsula extending westwards from the much vaster continent of Asia, while it is itself broken up by two inland seas into several smaller peninsulas—the Mediterranean forming the Iberian, the Italian and the Greek peninsulas, while the Baltic forms that of Scandinavia and the much smaller one of Denmark. Save the last-named, all these peninsulas of Europe are essentially mountain ranges. But in height and importance the ranges that rise therein are much surpassed by a great mountain-chain, stretching from south-eastern France to the borders of Hungary, as well as between the plains of northern Italy and of southern Germany. This chain is collectively known as the Alps, and is the most important physical feature of the European continent. The Alps, however, do not present so continuous a barrier as the Himalayas, the Andes or even the Pyrenees. They are formed of numerous ranges, divided by comparatively deep valleys, which, with many local exceptions, tend towards parallelism with the general direction of the whole mass. This, between the Dauphiné and the borders of Hungary, forms a broad band convex towards the north, while most of the valleys lie between the directions west to east and south-west to north-east. But in many parts deep transverse valleys intersect the prevailing direction of the ridges, and facilitate the passage of man, plants and animals, as well as of currents of air which mitigate the contrast that would otherwise be found between the climates of the opposite slopes.

The derivation of the name Alps is still very uncertain, some writers connecting it with a Celtic root *alb*, said to mean height, while others suggest the Latin adjective *albus* (white), referring to the colour of the snowy peaks. But in all parts of the great chain itself, the term *Alp* (or *Alm* in the Eastern Alps) is exclusively applied to the high mountain pastures (see Alp), and not to the peaks and ridges of the chain.

2. *Limits.*—These will depend on the meaning we attach to the word Alps as referring to the great mountain-chain of central Europe. If we merely desire to distinguish it from certain minor ranges (*e.g.* the Cévennes, the Jura, the hills of central Germany, the Carpathians, the Apennines), which are really independent ranges rather than offshoots of the main chain, the best limits are on the west (strictly speaking south), the Col d'Altare or di Cadibona (1624 ft.), leading from Turin to Savona and Genoa, and on the east the line of the railway over the Semmering Pass (3215 ft.) from Vienna to Marburg in the Mur valley, and on by Laibach to Trieste. But if we confine the meaning of the term Alps to those parts of the chain that are what is commonly called "Alpine," where the height is sufficient to support a considerable mass of perpetual snow, our boundaries to the west and to the east must be placed at spots other than those mentioned above. To the west the limit will then be the Col de Tenda (6145 ft.), leading from Cuneo (*Coni*) to Ventimiglia, while on the east our line will be the route over the Radstädter Tauern (5702 ft.) and the Katschberg (5384 ft.) from Salzburg to Villach in Carinthia, and thence by Klagenfurt to Marburg and so past Laibach in Carniola on to Trieste; from Villach the direct route to Trieste would be over the Predil Pass (3813 ft.) or the Pontebba or Saifnitz Pass (2615 ft.), more to the west, but in either case this would exclude the Terglou (9400 ft.), the highest summit of the entire South-Eastern Alps, as well as its lower neighbours.

On the northern side the Alps (in whichever sense we take this term) are definitely bounded by the course of the Rhine from Basel to the Lake of Constance, the plain of Bavaria, and the low region of foot-hills that extend from Salzburg to the neighbourhood of Vienna. One result of this limit, marked out by Nature herself, is that the waters which flow down the northern slope of the Alps find their way either into the North Sea through the Rhine, or into the Black Sea by means of the Danube, not a drop reaching the Baltic Sea. On the southern side the mountains extending from near Turin to near Trieste subside into the great plain of Piedmont, Lombardy and Venetia. But what properly forms the western bit of the Alps runs, from near Turin to the Col de Tenda, in a southerly direction, then bending eastwards to the Col d'Altare that divides it from the Apennines.

It should be borne in mind that the limits adopted above refer purely to the topographical aspect of the Alps as they exist at the present day. Naturalists will of course prefer other limits according as they are geologists, botanists or zoologists.

3. *Climate.*—It is well known that as we rise from the sea-level into the upper regions of the atmosphere the temperature decreases. The effect of mountain-chains on prevailing winds is to carry warm air belonging to the lower region into an upper zone, where it expands in volume at the cost of a proportionate loss of heat, often accompanied by the precipitation of moisture in the form of snow or rain. The position of the Alps about the centre of the European continent has profoundly modified the climate of all the surrounding regions. The accumulation of vast masses of snow, which have gradually been converted into permanent glaciers, maintains a gradation of very different climates within the narrow space that intervenes between the foot of the mountains and their upper ridges; it cools the breezes that are wafted to the plains on either side, but its most important function is to regulate the water-supply of that large region which is traversed by the streams of the Alps. Nearly all the moisture that is precipitated during six or seven months is stored up in the form of snow, and is gradually diffused in the course of the succeeding summer; even in the hottest and driest seasons the reserves accumulated during a long preceding period of years in the form of glaciers are available to maintain the regular flow of the greater streams. Nor is this all; the lakes that fill several of the main valleys on the southern side of the Alps are somewhat above the level of the plains of Lombardy and Venetia, and afford an inexhaustible supply of water, which, from a remote period, has been used for that system of irrigation to which they owe their proverbial fertility. Six regions or zones, which are best distinguished by their characteristic vegetation, are found in the Alps. It is an error to suppose that these are indicated by absolute height above the sea-level. Local conditions of exposure to the sun, protection from cold winds, or the reverse, are of primary importance in determining the climate and the corresponding vegetation.

Olive region.

The great plain of Upper Italy has a winter climate colder than that of the British Islands. The olive and the characteristic shrubs of the northern coasts of the Mediterranean do not thrive in the open air, but the former valuable tree ripens its fruit in sheltered places at the foot of the mountains, and penetrates along the deeper valleys and the shores of the Italian lakes. The evergreen oak is wild on the rocks about the Lake of Garda, and lemons are cultivated on a large scale, with partial protection in winter. The olive has been known to survive severe cold when of short duration, but it cannot be cultivated with success where frosts are prolonged, or where the mean winter temperature falls below 42° F.; and to produce fruit it requires a heat of at least 75° F. during the day, continued through four or five months of the summer and autumn.

Vine region.

The vine is far more tolerant of cold than the olive, but to produce tolerable wine it demands, at the season of ripening, a degree of heat not much less than that needed by the more delicate tree. These conditions are satisfied in the deeper valleys of the Alps, even in the interior of the chain, and up to a considerable height on slopes exposed to the sun. The protection afforded by winter snow enables the plant to resist severe and prolonged frosts, such as would be fatal in more exposed situations. Many wild plants characteristic of the warmer parts of middle Europe are seen to flourish along with the vine. A mean summer temperature of at least 68° F. is considered necessary to produce tolerable wine, but in ordinary seasons this is much exceeded in many of the great valleys of the Alps.

Mountain region, or region of deciduous trees.

Many writers take the growth of grain as the characteristic of the mountain region; but so many varieties of all the common species are in cultivation, and these have such different climatal requirements, that they do not afford a satisfactory criterion. A more natural limit is afforded by the presence of the chief deciduous trees—oak, beech, ash and sycamore. These do not reach exactly to the same elevation, nor are they often found growing together; but their upper limit corresponds accurately enough to the change from a temperate to a colder climate that is further proved by a change in the wild herbaceous vegetation. This limit usually lies about 4000 ft. above the sea on the north side of the Alps, but on the southern slopes it often rises to 5000 ft., sometimes even to 5500 ft. It must not be supposed that this region is always marked by the presence of the characteristic trees. The interference of man has in many districts almost extirpated them, and, excepting the beech forests of the Austrian Alps, a considerable wood of deciduous trees is scarcely anywhere to be found. In many districts where such woods once existed, their place has been occupied by the Scottish pine and spruce, which suffer less from the ravages of goats, the worst enemies of tree vegetation. The mean annual temperature of this region differs little from that of the British Islands; but the climatal conditions are widely different. Here snow usually lies for several months, till it gives place to a spring and summer considerably warmer than the average of British seasons.

Subalpine region, or region of coniferous trees.

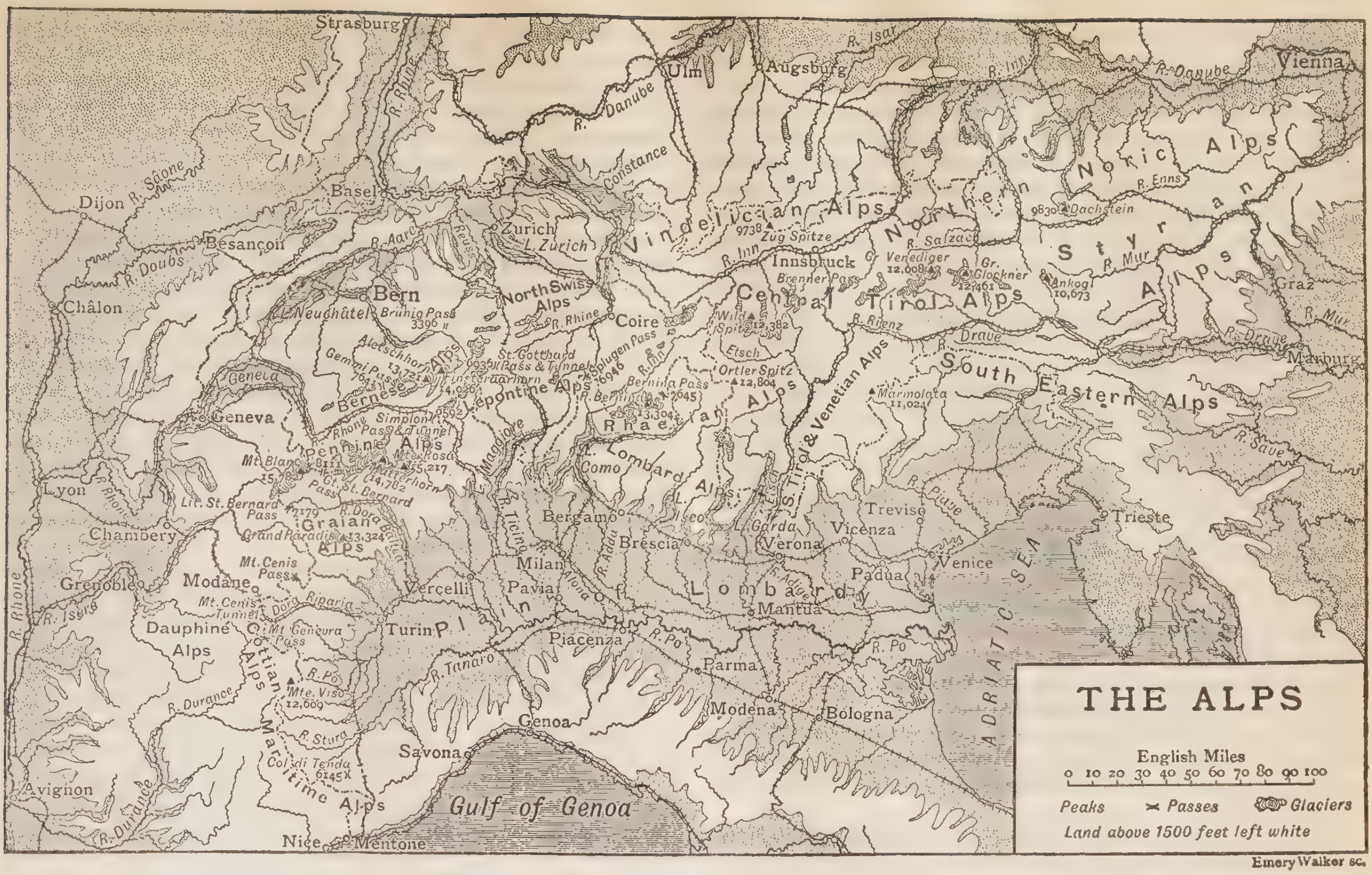
The Subalpine is the region which mainly determines the manner of life of the population of the Alps. On a rough estimate we may reckon that, of the space lying between the summits of the Alps and the low country on either side, one-quarter is available for cultivation, of which about one-half may be vineyards and corn-fields, while the remainder produces forage and grass. About another quarter is utterly barren, consisting of snow-fields, glaciers, bare rock, lakes and the beds of streams. There remains about one-half, which is divided between forest and pasture, and it is the produce of this half which mainly supports the relatively large population. For a quarter of the year the flocks and herds are fed on the upper pastures; but the true limit of the wealth of a district is the number of animals that can be supported during the long winter, and while one part of the population is engaged in tending the beasts and in making cheese and butter, the remainder is busy cutting hay and storing up winter food for the cattle. The larger villages are mostly in the mountain region, but in many parts of the Alps the villages stand in the subalpine region at heights varying from 4000 ft. to 5500 ft. above the sea, more rarely extending to about 6000 ft. The most characteristic feature of this region is the prevalence of coniferous trees, which, where they have not been artificially kept down, form vast forests that cover a large part of the surface. These play a most important part in the natural economy of the country. They protect the valleys from destructive avalanches, and, retaining the superficial soil by their roots, they mitigate the destructive effects of heavy rains. In valleys where they have been rashly cut away, and the waters pour down the slopes unchecked, every tiny rivulet becomes a raging torrent, that carries off the grassy slopes and devastates the floor of the valley, covering the soil with gravel and débris. In the pine forests of the Alps the prevailing species are the common spruce and the silver fir; on siliceous soil the larch flourishes, and surpasses every other European species in height. The Scottish pine is chiefly found at a lower level and rarely forms forests. The Siberian fir is found scattered at intervals throughout the Alps but is not common. The mughus, creeping pine, or *Krummholz* of the Germans, is common in the Eastern Alps, and sometimes forms on the higher mountains a distinct zone above the level of its congeners. In the Northern Alps the pine forests rarely surpass the limit of 6000 ft. above the sea, but on the south side they commonly attain 7000 ft., while the larch, Siberian fir and mughus often extend above that elevation.

Alpine region.

Throughout the Teutonic region of the Alps the word *Alp* is used specifically for the upper pastures where cattle are fed in summer, but this region is held to include the whole space between the uppermost limit of trees and the first appearance of permanent masses of snow. It is here that the characteristic vegetation of the Alps is developed in its full beauty and variety. Shrubs are not wanting. Three species of rhododendron vie with each other in the brilliancy of their masses of red or pink flowers; the common juniper rises higher still, along with three species of bilberry; and several dwarf willows attain nearly to the utmost limit of vegetation. The upper limit of this region coincides with the so-called limit of perpetual snow.

Glacial region.

On the higher parts of lofty mountains more snow falls in each year than is melted on the spot. A portion of this is carried away by the wind before it is consolidated; a larger portion accumulates in hollows and depressions of the surface, and is gradually converted into glacier-ice, which descends by a slow secular motion into the deeper valleys, where it goes to swell perennial streams. As on a mountain the snow does not lie in beds of uniform thickness, and some parts are more exposed to the sun and warm winds than others, we commonly find beds of snow alternating with exposed slopes covered with brilliant vegetation; and to the observer near at hand there is no appearance in the least corresponding to the term *limit of perpetual snow*, though the case is otherwise when a high mountain-chain is viewed from a distance. Similar conditions are repeated at many different points, so that the level at which large snow-beds show themselves along its flanks is approximately horizontal. But this holds good only so far as the conditions are similar. On the opposite sides of the same chain the exposure to the sun or to warm winds may cause a wide difference in the level of permanent snow; but in some cases the increased fall of snow on the side exposed to moist winds may more than compensate the increased influence of the sun's rays. Still, even with these reservations, the so-called line of perpetual snow is not fixed. The occurrence of favourable meteorological conditions during several successive seasons may and does increase the extent of the snow-fields, and lower the limit of seemingly permanent snow; while an opposite state of things may cause the limit to rise higher on the flanks of the mountains. Hence all attempts to fix accurately the level of perpetual snow in the Alps are fallacious, and can at the best approach only to local accuracy for a particular district. In some parts of the Alps the limit may be set at about 8000 ft. above the sea, while in others it cannot be placed much below 9500 ft.


THE ALPS
English Miles
0 10 20 30 40 50 60 70 80 90 100
Peaks
Passes
Glaciers
Land above 1500 feet left white
Strasburg
Ulm
Augsburg
Vienna
Dijon
Basel
Besançon
Zurich
Bern
Châlon
Geneva
Lyon
Chambery
Grenoble
Modane
Turin
Milan
Pavia
Vercelli
Bergamo
Brescia
Verona
Vicenza
Treviso
Padua
Venice
Trieste
Mantua
Piacenza
Parma
Modena
Bologna
Genoa
Savona
Nice
Mentone
Avignon
Innsbruck
Coire
Como
Graz
Marburg
Gulf of Genoa
Adriatic Sea
Vindelician Alps
Northern Noric Alps
Styrian Alps
Central Tirol Alps
South Eastern Alps
North Swiss Alps
Bernese Alps
Lepontine Alps
Pennine Alps
Graian Alps
Rhaetian Alps
Lombard Alps
Dauphiné Alps
Cottian Alps
Maritime Alps
Tirol & Venetian Alps
Lombardy
Plain
Mt. Blanc 15,782
Mte. Rosa 15,217
Matterhorn 14,782
Gr. Paradis 13,324
Mte. Viso 12,609
Ortler Spitz 12,804
Gr. Glockner 12,461
Zug Spitze 9738
Dachstein 9830
Marmolata 11,024
Col di Tenda 6145
Mt. Cenis Pass
Simplon Pass & Tunnel
St. Gotthard Pass & Tunnel
Brenner Pass
Little St. Bernard Pass
Gt. St. Bernard Pass
Bernina Pass
Splugen Pass
R. Danube
R. Rhine
R. Rhone
R. Po
R. Inn
R. Isar
R. Enns
R. Mur
R. Drave
R. Save
R. Piave
R. Adige
R. Ticino
R. Adda
R. Tanaro
R. Durance
R. Isère
R. Doubs
R. Saône
R. Aar
R. Salzach

Emery Walker sc.

As very little snow can rest on rocks that lie at an angle exceeding 60°, and this is soon removed by the wind, some steep masses of rock remain bare even near the summits of the highest peaks, but as almost every spot offering the least hold for vegetation is covered with snow, few flowering plants are seen above 11,000 ft. There is reason to think, however, that it is the want of soil rather than climatal conditions that checks the upward extension of the alpine flora. Increased direct effect of solar radiation compensates for the cold of the nights, and in the few spots where plants have been found in flower up to a height of 12,000 ft., nothing has indicated that the processes of vegetation were arrested by the severe cold which they must sometimes endure. The climate of the glacial region has often been compared to that of the polar regions, but they are widely different. Here, intense solar radiation by day, which raises the surface when dry to a temperature approaching 80° F., alternates with severe frost by night. There, a sun which never sets sends feeble rays that maintain a low equable temperature, rarely rising more than a few degrees above the freezing-point. Hence the upper region of the Alps sustains a far more varied and brilliant vegetation.

4. *Main Chain.*—In the case of every mountain system geographers are disposed to regard, as a general rule, the watershed (or boundary dividing the waters flowing towards opposite slopes of the range) as marking the main chain, and this usage is justified in that the highest peaks often rise on or very near the watershed. Yet, as a matter of fact, several important mountain groups are situated on one or other side of the watershed of the Alps, and form almost independent ranges, being only connected with the main chain by a kind of peninsula: such are the Dauphiné Alps, the Eastern and Western Graians, the entire Bernese Oberland, the Tödi, Albula and Silvretta groups, the Ortler and Adamello ranges, and the Dolomites of south Tirol, not to speak of the lower Alps of the Vorarlberg, Bavaria and Salzburg. Of course each of these semi-detached ranges has a watershed of its own, like the lateral ridges that branch off from the main watershed. Thus there are lofty ranges parallel to that which forms the main watershed. The Alps, therefore, are not composed of a single range (as shown on the old maps) but of a great "divide," flanked on either side by other important ranges, which, however, do not comprise such lofty peaks as the main watershed. In the following remarks we propose to follow the main watershed from one end of the Alps to the other.

Starting from the Col d'Altare or di Cadibona (west of Savona), the main chain extends first south-west, then north-west to the Col de Tenda, though nowhere rising much beyond the zone of coniferous trees. Beyond the Col de Tenda the direction is first roughly west, then north-west to the Rocher des Trois Évêques (9390 ft.), just south of the Mont Enchastraye (9695 ft.), several peaks of about 10,000 ft. rising on the watershed, though the highest of all, the Punta dell' Argentera (10,794 ft.) stands a little way to its north. From the Rocher des Trois Évêques the watershed runs due north for a long distance, though of the two loftiest peaks of this region one, the Aiguille de Chambeyron (11,155 ft.), is just to the west, and the other, the Monte Viso (12,609 ft.), is just to the east of the watershed. From the head of the Val Pellice the main chain runs north-west, and diminishes much in average height till it reaches the Mont Thabor (10,44 ft.), which forms the apex of a salient angle which the main chain here presents towards the west. Hence the main watershed extends eastwards, culminating in the Aiguille de Scolette (11,500 ft.), but makes a great curve to the north-west and back to the south-east before rising in the Rochemelon (11,605 ft.), which may be considered as a re-entering angle in the great rampart by which Italy is guarded from its neighbours. Thence the direction taken is north as far as the eastern summit (11,693 ft.) of the Levanna, the watershed rising in a series of snowy peaks, though the loftiest point of the region, the Pointe de Charbonel (12,336 ft.), stands a little to the west. Once more the chain bends to the north-west, rising in several lofty peaks (the highest is the Aiguille de la Grande Sassière, 12,323 ft.), before attaining the considerable depression of the Little St Bernard Pass. Thence for a short way the direction is north to the Col de la Seigne, and then north-east along the crest of the Mont Blanc chain, which culminates in the peak of Mont Blanc (15,782 ft.), the loftiest in the Alps. A number of high peaks crown our watershed before it attains the Mont Dolent (12,543 ft.). Thence after a short dip to the south-east, our chain takes near the Great St Bernard Pass the generally eastern direction that it maintains till it reaches Monte Rosa, whence it bends northwards, making one small dip to the east as far as the Simplon Pass. It is in the portion of the watershed between the Great St Bernard and the Simplon that the main chain maintains a greater average height than in any other part. But, though it rises in a number of lofty peaks, such as the Mont Vélan (12,353 ft.), the Matterhorn (14,782 ft.), the Lyskamm (14,889 ft.), the Nord End of Monte Rosa (15,132 ft.), and the Weissmies (13,226 ft.), yet many of the highest points of the region, such as the Grand Combin (14,164 ft.), the Dent Blanche (14,318 ft.), the Weisshorn (14,804 ft.), the true summit or Dufourspitze (15,217 ft.) of Monte Rosa itself, and the Dom (14,942 ft.), all rise on its northern slope and not on the main watershed. On the other hand the chain between the Great St Bernard and the Simplon sinks at barely half a dozen points below a level of 10,000 ft. The Simplon Pass corresponds to what may be called a dislocation of the main chain. Thence to the St Gotthard the divide runs north-east, all the higher summits (including the Monte Leone, 11,684 ft., and the Pizzo Rotondo, 10,489 ft.) rising on it, a curious contrast to the long stretch just described. From the St Gotthard to the Maloja the watershed between the basins of the Rhine and Po runs in an easterly direction as a whole, though making two great dips towards the south, first to near the Vogelberg (10,565 ft.) and again to near the Pizzo Gallegione (10,201 ft.), so that it presents a broken and irregular appearance. But all the loftiest peaks rise on it: Scopi (10,499 ft.), Piz Medel (10,509 ft.), the Rheinwaldhorn (11,149 ft.), the Tambohorn (10,749 ft.) and Piz Timun (10,502 ft.).

From the Maloja Pass the main watershed dips to the south-east for a short distance, and then runs eastwards and nearly over the highest summit of the Bernina group, the Piz Bernina (13,304 ft.), to the Bernina Pass. Thence to the Reschen Scheideck Pass the main chain is ill-defined, though on it rises the Corno di Campo (10,844 ft.), beyond which it runs slightly north-east past the sources of the Adda and the Fraële Pass, sinks to form the depression of the Ofen Pass, soon bends north and rises once more in the Piz Sesvenna (10,568 ft.).

The break in the continuity of the Alpine chain marked by the deep valley, the *Vintschgau*, of the upper Adige (Etsch) is one of the most remarkable features in the orography of the Alps. The little Reschen lake which forms the chief source of the Adige is only 13 ft. below the Reschen Scheideck Pass (4902 ft.), and by it is but 5 m. from the Inn valley. Eastward of this pass, the main chain runs north-east to the Brenner Pass along the snowy crest of the Oetzthal and Stubai Alps, the loftiest point on it being the Weisskugel (12,291 ft., Oetzthal), for the highest summits both of the Oetzthal and of the Stubai districts, the Wildspitze (12,382 ft.) and the Zuckerhütl (11,520 ft.) stand a little to the north.

The Brenner (4495 ft.) is almost the lowest of all the great carriage-road passes across the main chain, and has always been the chief means of communication between Germany and Italy. For some way beyond it the watershed runs eastwards over the highest crest of the Zillerthal Alps, which attains 11,559 ft. in the Hochfeiler. But, a little farther, at the Dreiherrenspitze (11,500 ft.) we have to choose between following the watershed southwards, or keeping due east along the highest crest of the Greater Tauern Alps. (*a*) The latter course is adopted by many geographers and has much in its favour. The eastward direction is maintained and the watershed (though not the chief Alpine watershed) continues through the Greater Tauern Alps, culminating in the Gross Venediger (12,008 ft.), for the Gross Glockner (12,461 ft.) rises to the south. Our chain bends north-east near the Radstädter Tauern Pass, and preserves that direction through the Lesser Tauern Alps to the Semmering Pass. (*b*) On the other hand, if from the Dreiherrenspitze we cleave to the true main watershed of the Alpine chain, we find that it dips south, passes over the Hochgall (11,287 ft.), the culminating point of the Rieserferner group, and then sinks to the Toblach Pass, but at a point a little east of the great Dolomite peak of the Drei Zinnen it bends east again, and rises in the Monte Coglians (9128 ft., the monarch of the Carnic Alps). Soon after our watershed makes a last bend to the south-east and culminates in the Terglou (9400 ft.), the highest point of the Julic Alps, though the Grintovc (8429 ft., the culminating point of the Karawankas Alps) stands more to the east. Finally our watershed turns south and ends near the great limestone plateau of the Birnbaumerwald, between Laibach and Görz.

As might be expected, the main chain boasts of more glaciers and eternal snow than the independent or external ranges. Yet it is a curious fact that the three longest glaciers in the Alps (the Great Aletsch, 16½ m., and the Unteraar and the Fiescher, each 10 m.) are all in the Bernese Oberland. In the main chain the two longest are both 9¼ m., the Mer de Glace at Chamonix and the Gorner at Zermatt. In the Eastern Alps the longest glacier is the Pasterze (rather over 6¼ m.), which is not near the true main watershed, though it clings to the slope of the Greater Tauern range, east of the Dreiherrenspitze. But the next two longest glaciers in the Eastern Alps (the Hintereis, 6¼ m., and the Gepatsch, 6 m.) are both in the Oetzthal Alps, and so close to the true main watershed.

The so-called alpine lakes are the sheets of water found at the foot of the Alps, on either slope, just where the rivers that form them issue into the plains. There are, however, alpine lakes higher up (*e.g.* the lake of Thun, and those in the Upper Engadine, in the heart of the mountains, though these are naturally smaller in extent, while the true lakes of the High Alps are represented by the glacier lakes of the Märjelensee (near the Great Aletsch glacier) and those on the northern slope of the Col de Fenêtre, between Aosta and the Val de Bagnes. The most singular, and probably the loftiest, lake in the Alps is the ever-frozen tarn that forms the summit of the Roccia Viva (11,976 ft.) in the Eastern Graians.

Among the great alpine rivers we may distinguish two classes: those which spring directly from glaciers and those which rise in lakes, these being fed by eternal snows or glaciers. In the former class are the Isère, the Rhone, the Aar, the Ticino, the Tosa, the Hinter (or main) Rhine and the Linth; while in the latter class we have the Durance, the Po, the Reuss, the Vorder and middle branches of the Rhine, the Inn, the Adda, the Oglio and the Adige. The Piave and the Drave seem to be outside either class.

5. *Principal Passes.*—Though the Alps form a barrier they have never formed an impassable barrier, since, from the earliest days onwards, they have been traversed first, perhaps, for purposes of war or commerce, and later by pilgrims, students and tourists. The spots at which they were crossed are called passes (this word is sometimes though rarely applied to gorges only), and are the points at which the great chain sinks to form depressions, up to which deep-cut valleys lead from the plains. Hence the oldest name for such passes is *Mont* (still retained in cases of the Mont Cenis and the Monte Moro), for it was many ages before this term was especially applied to the peaks of the Alps, which with a few very rare exceptions (*e.g.* the Monte Viso was known to the Romans as Vesulus) were long simply disregarded. The native inhabitants of the Alps were naturally the first to use the alpine passes. But to the outer world these passes first became known when the Romans traversed them in order to conquer the world beyond. In the one case we have no direct knowledge (though the Romans probably selected the passes pointed out to them by the natives as the easiest), while in the other we hear almost exclusively of the passes across the main chain or the principal passes of the Alps. For obvious reasons the Romans, having once found an easy direct pass across the main chain, did not trouble to seek for harder and more devious routes. Hence the passes that can be shown to have been certainly known to them are comparatively few in number: they are, in topographical order from west to east, the Col de l'Argentière, the Mont Genèvre, the two St Bernards, the Splügen, the Septimer, the Brenner, the Radstädter Tauern, the Sölkscharte, the Plöcken and the Pontebba (or Saifnitz). Of these the Mont Genèvre and the Brenner were the most frequented, while it will be noticed that in the Central Alps only

two passes (the Splügen and the Septimer) were certainly known to the Romans. In fact the central portion of the Alps was by far the least Romanised and least known till the early middle ages. Thus the Simplon is first certainly mentioned in 1235, the St Gotthard (without name) in 1236, the Lukmanier in 965, the San Bernardino in 941; of course they may have been known before, but authentic history is silent as regards them till the dates specified. Even the Mont Cenis (from the 15th to the 19th century the favourite pass for travellers going from France to Italy) is first heard of in 756 only. In the 13th century many hitherto unknown passes came into prominence, even some of the easy glacier passes. It should always be borne in mind that in the Western and Central Alps there is but one ridge to cross, to which access is gained by a deep-cut valley, though often it would be shorter to cross a second pass in order to gain the plains, *e.g.* the Mont Genèvre, that is most directly reached by the Col du Lautaret; and the Simplon, which is best gained by one of the lower passes over the western portion of the Bernese Oberland chain. On the other hand, in the Eastern Alps, it is generally necessary to cross three distinct ridges between the northern and southern plains, the central ridge being the highest and most difficult. Thus the passes which crossed a single ridge, and did not involve too great a detour through a long valley of approach, became the most important and the most popular, *e.g.* the Mont Cenis, the Great St Bernard, the St Gotthard, the Septimer and the Brenner. As time went on the travellers (with whatever object) who used the great alpine passes could not put up any longer with the bad old mule paths. A few passes (*e.g.* the Semmering, the Brenner, the Tenda and the Arlberg) can boast of carriage roads constructed before 1800, while those over the Umbrail and the Great St Bernard were not completed till the early years of the 20th century. Most of the carriage roads across the great alpine passes were thus constructed in the 19th century (particularly its first half), largely owing to the impetus given by Napoleon. As late as 1905, the highest pass over the main chain that had a carriage road was the Great St Bernard (8111 ft.), but three still higher passes over side ridges have roads—the Stelvio (9055 ft.), the Col du Galibier (8721 ft.), in the Dauphiné Alps, and the Umbrail Pass (8242 ft.). Still more recently the main alpine chain has been subjected to the further indignity of having railway lines carried over it or through it—the Brenner and the Pontebba lines being cases of the former, and the Col de Tenda, the Mont Cenis (though the tunnel is really 17 m. to the west), the Simplon and the St Gotthard, not to speak of the side passes of the Arlberg, Albula and Pyhrn of the latter. There are also schemes (more or less advanced) for piercing the Splügen and the Hohe Tauern, both on the main ridge, and the Lötschen Pass, on one of the external ranges. The numerous mountain railways, chiefly in Switzerland, up various peaks (*e.g.* the Rigi and Pilatus) and over various side passes (*e.g.* the Brünig and the Little Scheidegg) do not concern us here.

6. *Divisions.*—The Alps, within the limits indicated under (2) above, form a great range, consisting of a main chain, with ramifications, and of several parallel minor chains. They thus form a single connected whole as contrasted with the plains at their base, and nature has made no breaks therein, save at the spots where they sink to comparatively low depressions or passes. But for the sake of practical convenience it has long been usual to select certain of the best marked of these passes to serve as limits within the range, whether to distinguish several great divisions from each other, or to further break up each of these great divisions into smaller groups. As these divisions, great or small, are so to speak artificial, several systems have been proposed according to which the Alps may be divided. We give below that which seems to us to be the most satisfactory (based very largely on personal acquaintance with most parts of the range), considering, as in the case of the limits of the chain, only its topographical aspect, as it exists at the present day, while leaving it to geologists, botanists and zoologists to elaborate special divisions as required by these various sciences. Our selected divisions relate only to the High Alps between the Col de Tenda and the route over the Radstädter Tauern, while in each of the 18 subdivisions the less elevated outlying peaks are regarded as appendages of the higher group within the topographical limits of which they rise. No attempt, of course, has been made to give a complete catalogue of the peaks and passes of the Alps, while in the case of the peaks the culminating point of a lower half-detached group has been included rather than the loftier spurs of the higher and main group; in the case of the passes, the villages or valleys they connect have been indicated, and also the general character of the route over each pass.

As regards the main divisions, three are generally distinguished; the Western Alps (chiefly French and Italian, with a small bit of the Swiss Valais) being held to extend from the Col de Tenda to the Simplon Pass, the Central Alps (all but wholly Swiss and Italian) thence to the Reschen Scheideck Pass, and the Eastern Alps (wholly Austrian and Italian, save the small Bavarian bit at the north-west angle) thence to the Radstädter Tauern route, with a bend outwards towards the south-east, as explained under (2) in order to include the higher summits of the South-Eastern Alps. Strictly speaking, we should follow the Reschen Scheideck route down the Adige valley, but as this would include in the Central Alps the Ortler and some other of the highest Tirolese summits, it is best (remembering the artificial character of the division) to draw a line from Mals southwards either over the Umbrail Pass (the old historical pass) or the Stelvio (well-known only since the carriage road was built over it in the first quarter of the 19th century) to the head of the Valtellina, and then over the Aprica Pass (as the Bergamasque Alps properly belong to the Central Alps) to the Oglio valley or the Val Camonica, and down that valley to the Lake of Iseo and Brescia.

Assuming these three main divisions, we must now consider in detail the 18 sub-divisions which we distinguish; the first 5 forming the Western Alps, the next 7 the Central Alps, and the rest the Eastern Alps, the heights throughout being, of course, given in English feet and representing the latest measurements.

I. Western Alps

1. Maritime Alps (from the Col de Tenda to the Col de l'Argentière).

Chief Peaks of the Maritime Alps.

Punta dell' Argentera	10,794	Mont Tinibras	9,948
Cima dei Gelas	10,286	Mont Enchastraye	9,695
Monte Matto	10,128	Monte Bego	9,426
Mont Pelat	10,017	Mont Monnier	9,246
Mont Clapier	9,994	Rocca dell' Abisso	9,039

Chief Passes of the Maritime Alps.

Passo del Pagarin (Vésubie Valley to Valdieri), snow	9,236
Col di Fremamorta (Tinée Valley to the Baths of Valdieri), bridle path	8,688
Bassa di Druos (same to same), bridle path	8,629
Passo di Collalunga (Tinée Valley to Vinadio), bridle path	8,531
Coll dell' Agnel (Tenda to Valdieri), foot path	8,426
Col della Ciriegia (St Martin Vésubie to the Baths of Valdieri), bridle path	8,370
Col des Granges Communes (St Etienne de Tinée to Barcelonnette), bridle path	8,242
Col de Pourriac (Tinée Valley to Argentera), foot path	8,222
Col della Finestre (St Martin de Vésubie to Valdieri), bridle path	8,107
Col di Guercia (Tinée Valley to Vinadio), foot path	8,042
Col della Lombarda (same to same), bridle path	7,858
Col de la Cayolle (Var Valley to Barcelonnette), carriage road	7,717
Col di Santa Anna (Tinée Valley to Vinadio), bridle path	7,605
Col del Sabbione (Tenda to Valdieri), bridle path	7,428
Col d'Allos or de Valgelaye (Verdon Valley to Barcelonnette), carriage road	7,382
Col de l'Argentière (Barcelonnette to Cuneo), carriage road	6,545
Col de Tenda (Tenda to Cuneo), carriage road, railway beneath	6,145

2. Cottian Alps (from the Col de l'Argentière to the Mont Cenis and westwards to the Col du Galibier).

Chief Peaks of the Cottian Alps.

Monte Viso	12,609	Dents d'Ambin	11,096
Viso di Vallante	12,048	Mont d'Ambin	11,080
Aiguille de Scolette	11,500	Pointe de la Font Sancte	11,057
Aiguille de Chambeyron	11,155	Punta Ferrant	11,037
Grand Rubren	11,142	Visolotto	11,001
Brec de Chambeyron	11,116	Rochebrune	10,906
Rognosa d'Etache	11,106	Punta Sommeiller	10,896

Bric Froid	10,860	Tête des Toillies	10,430
Grand Glayza	10,781	Monte Granero	10,401
Rognosa di Sestrières	10,758	Mont Chaberton	10,286
Panestrel	10,673	Tête de Moyse	10,204
Roche du Grand Galibier	10,637	Monte Meidassa	10,187
Péou Roc	10,601	Pelvo d'Elva	10,053
Pic du Pelvat	10,558	Mont Politri	10,009
Pointe Haute de Mary	10,539	Mont Albergian	9,974
Pic du Thabor	10,516	Bric Bouchet	9,853
Mont Thabor	10,440	Punta Cournour	9,410
Pointe des Cerces	10,434		

Chief Passes in the Cottian Alps.

Col Sommeiller (Bardonnèche to Bramans), snow	9,718
Col de la Traversette (Crissolo to Abriès), mainly bridle path beneath pass tunnel made in 1478–1480	9,679
Col d'Ambin (Exilles to Bramans), snow	9,364
Col de St Véran (Val Varaita to the Queyras Valley), foot path	9,331
Col d'Etache (Bardonnèche to Bramans), bridle path	9,144
Col dell' Agnello (Val Varaita to the Queyras Valley), bridle path	9,003
Col Girardin (Ubaye Valley to the Queyras Valley), bridle path	8,855
Col de Sautron (Val Maira to Barcelonnette), bridle path	8,823
Col de Longet (Ubaye Valley to Val Varaita), bridle path	8,767
Col de Mary or de Maurin (Ubaye Valley to Val Maira), bridle path	8,708
Col d'Abriès or de Prali (Perosa to Abriès), bridle path	8,695
Col de la Roue (Bardonnèche to Modane), bridle path	8,419
Col de Fréjus (same to same), carriage road, beneath which is the so-called Mont Cenis railway tunnel	8,294
Col de Clapier (Bramans to Susa), bridle path	8,173
Col d'Izouard (Briançon to the Queyras Valley), carriage road	7,835
Col de la Croix (Torre Pellice to Abriès), bridle path	7,576
Petit Mont Cenis (Bramans to the Mont Cenis Plateau), bridle path	7,166
Col de Vars (Ubaye Valley to the Queyras Valley), carriage road	6,939
Mont Cenis (Lanslebourg to Susa), carriage road	6,893
Col de Sestrières (Pignerol to Césanne), carriage road	6,631
Mont Genèvre (Briançon to Césanne), carriage road	6,083
Col des Echelles de Planpinet (Briançon to Bardonnèche), partly carriage road	5,774

3. Dauphiné Alps (from the Col du Galibier, westwards and southwards).

Chief Peaks of the Dauphiné Alps.

Pointe des Écrins	13,462	Pic Félix Neff	10,571
Meije	13,081	Vieux Chaillol	10,378
Ailefroide	12,989	Tête de Vautisse	10,375
Mont Pelvoux	12,973	Grand Pinier	10,237
Pic Sans Nom	12,845	Pic de Parières	10,007
Pic Gaspard	12,730	Mourre Froid	9,830
Pic Coolidge	12,323	Belledonne (highest)	9,781
Grande Ruine	12,317	Rocher Blanc (Sept Laux)	9,617
Râteau	12,317	Taillefer	9,387
Montagne des Agneaux	12,008	Pic du Frêne	9,219
Les Bans	11,979	Tête de l'Obiou	9,164
Sommet des Rouies	11,923	Grand Ferrand	9,059
Aiguille du Plat	11,818	Pic de Bure (Aurouse)	8,898
Pic d'Olan	11,735	Grand Veymont	7,697
Pic Bonvoisin	11,680	Mont Aiguille	6,880
Aiguilles d'Arves (highest point)	11,529	Chamechaude	6,847
		Dent de Crolles	6,779
Grandes Rousses	11,395	Grand Som	6,670
Roche de la Muzelle	11,349	Mont Granier	6,358
Sirac	11,280	Dent du Chat	4,593

Chief Passes of the Dauphiné Alps.

Col de la Lauze (St Christophe to La Grave), snow	11,625
Col des Avalanches (La Bérarde to Vallouise), snow	11,520
Col de la Casse Déserte (La Bérarde to La Grave), snow	11,516
Col Émile Pic (La Grave to Vallouise), snow	11,490
Col des Écrins (La Bérarde to Vallouise), snow	11,205
Col du Glacier Blanc (La Grave to Vallouise), snow	10,854
Col du Sélé (La Bérarde to Vallouise), snow	10,834
Brèche de la Meije (La Bérarde to la Grave), snow	10,827
Col de la Temple (La Bérarde to Vallouise), snow	10,772
Col des Aiguilles d'Arves (Valloire to St Jean d'Arves), snow	10,335
Col du Says (La Bérarde to the Val Gaudemar), snow	10,289
Col du Clot des Cavales (La Bérarde to La Grave), snow	10,263
Col du Loup du Valgaudemar (Vallouise to the Val Gaudemar), snow	10,210
Col Lombard (La Grave to St Jean d'Arves), snow	10,171
Brèche des Grandes Rousses (Allemont to Clavans), snow	10,171
Col du Sellar (Vallouise to the Val Gaudemar), snow	10,063
Col de la Muande (St Christophe to the Val Gaudemar), snow	10,037
Col des Quirlies (St Jean d'Arves to Clavans), snow	9,679
Col du Goléon (La Grave to Valloire), foot path	9,449
Pas de la Cavale (Vallouise to Champoléon), carriage road	8,990
Col d'Orcières (Dormillouse to Orcières), bridle path	8,859
Col de l'Infernet (La Grave to St Jean d'Arves), foot path	8,826
Col du Galibier (Lautaret Hospice to St Michel de Maurienne), carriage road	8,721
Brèche de Valsenestre (Bourg d'Oisans to Valsenestre), foot path	8,642 8,642
Col de Vallonpierre (Val Gaudemar to Champoléon), foot path	8,596 8,596
Col de Val Estrète (same to same), foot path	8,596
Col de Vaurze (Val Gaudemar to Val Jouffrey), foot path	8,531
Col de Martignare (La Grave to St Jean d'Arves), foot path	8,531
Col des Tourettes (Orcières to Châteauroux), bridle path	8,465
Col de la Muzelle (St Christophe to Valsenestre), foot path	8,202
Col de l'Eychauda (Vallouise to Monestier), bridle path	7,970
Col d'Arsine (La Grave to Monestier), bridle path	7,874
Col des Prés Nouveaux (Le Freney to St Jean d'Arves), bridle path	7,523
Col des Sept Laux (Allevard to Bourg d'Oisans), bridle path	7,166
Col du Lautaret (Briançon to Bourg d'Oisans), carriage road	6,808
Col de la Croix de Fer (Bourg d'Oisans to St Jean d'Arves), carriage road	6,765
Col du Glandon (Bourg d'Oisans to La Chambre), carriage road	6,401
Col de l'Alpe de Vénosc (Vénosc to Le Freney), bridle path	5,446
Col d'Ornon (Bourg d'Oisans to La Mure), carriage road	4,462
Col Bayard (La Mure to Gap), carriage road	4,088
Col de la Croix Haute (Grenoble to Veynes and Gap), railway line over	3,829

4. Graian Alps (from the Mont Cenis to the Little St Bernard Pass). These are usually divided into three groups, the Central (the watershed between the two passes named), the Western or French, and the Eastern or Italian; in the following lists the initials "C," "W," and "E" show to which group each peak and pass belongs.

Chief Peaks of the Graian Alps.

Grand Paradis (E)	13,324	Grande Aiguille Rousse (C)	11,424
Grivola (E)	13,022		
Grande Casse (W)	12,668	Granta Parey (C)	11,395
Mont Pourri (W)	12,428	Roc du Mulinet (C)	11,382
Mont Herbetet (E)	12,396	Aiguille Pers (C)	11,323
Pointe de Charbonel (C)	12,336	Pointe de la Sana (W)	11,319
Aiguille de la Grande Sassière (C)	12,323	Cima dell' Auille (C)	11,306
		Pointe de l'Échelle (W)	11,260
Dent Parrachée (W)	12,179	Punta Fourà (E)	11,188
Tour du Grand St Pierre (E)	12,113	Pointe des Sengies (E)	11,182
		Pointe de la Glière (W)	11,109
Uja di Ciamarella (C)	12,061	Pointe de la Galise (C)	10,975
Cima di Charforon (E)	12,025	Pointe de la Traversière (C)	10,962
Grande Motte (W)	12,018		
Albaron (C)	12,015	Pointe de Méan Martin (W)	10,949
Roccia Viva (E)	11,976		
Levanna (C)	11,943	Punta Lavina (E)	10,854
Bessanese (C)	11,917	Ormelune (C)	10,771
Punta di Gaij (E)	11,887	Roche Chevrière (W)	10,768
Dôme de l'Arpont (W)	11,874	Signal du Mont Iseran (C)	10,634
Pointe de Ronce (C)	11,871	Pointe de la Rechasse (W)	10,575
Bec de l'Invergnan (C)	11,838	Grand Assaly (C)	10,414
Tsanteleina (C)	11,831	Roisebanque (E)	10,381
Dôme de Chasseforêt (W)	11,802	Becca di Nona (E)	10,309
Croce Rossa (C)	11,703	Torre d'Ovarda (C)	10,089
Aiguille de Péclet (W)	11,700	Pointe du Pousset (E)	9,994
Mont Emilius (E)	11,677	Dôme de Val d'Isère (C)	9,951
Punta d'Arnas (C)	11,615	Uja di Mondrone (C)	9,725
Aiguille de Polset (W)	11,608	Bellagarda (C)	9,643
Rochemelon (C)	11,605	Monte Marzo (E)	9,023
Mont Chalanson (C)	11,582	Petit Mont Blanc de Pralognan (W)	8,809
Tersiva (E)	11,526		
Grande Traversière (C)	11,467	Mont Jouvet (W)	8,409
Tête du Rutor (C)	11,438	Monte Civrari (C)	7,553

Chief Passes of the Graian Alps.

Col de la Grande Rousse (Rhèmes Valley to the Val Grisanche), snow (C)	11,483
Col de Gébroulaz (Arc Valley to Moûtiers Tarentaise), snow (W)	11,385
Col de Monei (Cogne to Locana), snow (E)	11,247
Col du Grand Paradis (Ceresole to the Val Savaranche), snow (E)	10,988
Col du Charforon (same to same), snow (E)	10,929
Col de Teleccio (Cogne to Locana), snow (E)	10,913
Col de Lauzon (Cogne to the Val Savaranche), bridle path (E)	10,831
Col du Bouquetin (Bonneval to Val d'Isère), snow (C)	10,827
Col de St Grat (Val Grisanche to La Thuille), snow (C)	10,827
Col de l'Herbetet (Cogne to the Val Savaranche), snow (E)	10,686
Col du Collerin (Bessans to Balme), snow (C)	10,506
Col du Grand Etret (Ceresole to the Val Savaranche), snow (E)	10,361

Col de Bassac (Rhèmes Valley to the Val Grisanche), snow (C)	10,345
Col du Carro (Bonneval to Ceresole), snow (C)	10,302
Col d'Arbole (Comboë to Brissógne), snow (E)	10,292
Col de la Goletta (Va ld'Isère to the Rhèmes Valley), snow (C)	10,237
Col de Rhèmes (same to same), snow (C)	10,174
Col de la Grande Casse (Pralognan to the Prémou Glen), snow (W)	10,171
Col de Sea (Bonneval to Forno Alpi Graie), snow (C)	10,115
Col de l'Autaret (Bessans to Usseglio), foot path (C)	10,073
Col de Girard (Bonneval to Forno Alpi Graie), snow (C)	9,987
Col Rosset (Val Savaranche to the Rhèmes Valley), bridle path (C)	9,922
Col d'Arnas (Bessans to Balme), snow (C)	9,889
Col de la Galise (Ceresole to Val d'Isère), snow (C)	9,836
Col de Sort (Val Savaranche to the Rhèmes Valley), partly bridle path (C)	9,735
Quecées de Tignes (Val d'Isère to Termignon), snow (W)	9,646
Col della Nouva (Cogne to Pont Canavese), partly bridle path (E)	9,623
Col de Garin (Aosta to Cogne), foot path (E)	9,411
Collarin d'Arnas (Balme to Usseglio), snow (C)	9,351
Finestra del Torrent (Rhèmes Valley to the Val Grisanche), foot path (C)	9,341
Fenêtre de Champorcher (Cogne to Champorcher), bridle path (E)	9,311
Col de Vaudet (Isère Valley to the Val Grisanche), foot path (C)	9,305
Col de Bardoney (Cogne to Pont Canavese), snow (E)	9,295
Col de Chavière (Modane to Pralognan), foot path (W)	9,206
Col de la Leisse (Tignes to Termignon), snow (W)	9,121
Col du Mont Iseran (Bonneval to Val d'Isère), bridle path (C)	9,085
Ghicet di Sea (Balme to Forno Alpi Graie), foot path (C)	8,973
Col de la Sachette (Tignes to Bourg St Maurice), foot path (W)	8,954
Col du Palet (Tignes to Moûtiers Tarentaise or Bourg St Maurice), bridle path (W)	8,721
Col du Mont (Ste Foy to the Val Grisanche), bridle path (C)	8,681
Col de la Croix de Nivolet (Ceresole to the Val Savaranche), bridle path (E)	8,665
Col della Crocetta (Ceresole to Forno Alpi Graie), bridle path (C)	8,649
Col de la Platière (St Jean de Maurienne to Moûtiers Tarentaise), partly bridle path (W)	8,531
Col de la Vanoise (Pralognan to Termignon), bridle path (W)	8,291
Col des Encombres (St Michel de Maurienne to Moûtiers Tarentaise), bridle path (W)	7,668
Little St Bernard (Aosta to Moûtiers Tarentaise), carriage road (C)	7,179
Col de la Madeleine (La Chambre to Moûtiers Tarentaise), bridle path (W)	6,509

5. Pennine Alps (from the Little St Bernard to the Simplon Pass). This range contains all the highest peaks in the Alps, save the Finsteraarhorn (14,026) in the Bernese Oberland.

Chief Peaks of the Pennine Alps.

Mont Blanc	15,782	Mont Blanc de Seilon	12,700
Monte Rosa (Dufourspitze)	15,217	Aiguille du Midi	12,609
Nord End (Monte Rosa)	15,132	Tour Noir	12,586
Dom (Mischabelhörner)	14,942	Aiguille des Glaciers	12,579
Lyskamm	14,889	Mont Dolent	12,543
Weisshorn	14,804	Aiguille du Chardonnet	12,540
Matterhorn	14,782	Cima di Jazzi	12,527
Täschhorn	14,758	Balfrin	12,474
Mont Maudit	14,669	Pigne d'Arolla	12,471
Dent Blanche	14,318	Mont Vélan	12,353
Dôme du Goûter	14,210	Aiguille du Dru	12,320
Grand Combin	14,164	Tête Blanche	12,304
Castor	13,879	L'Évêque	12,264
Zinal Rothhorn	13,856	Mont Pleureur	12,159
Alphubel	13,803	Dôme de Miage	12,100
Grandes Jorasses	13,797	Lo Besso	12,058
Rimpfischhorn	13,790	Aiguille de la Za	12,051
Strahlhorn	13,751	Mont Collon	11,956
Dent d'Hérens	13,715	Diablons	11,828
Zermatt Breithorn	13,685	Aiguille de Tour	11,615
Aiguille Verte	13,541	Mont Gelé	11,539
Ober Gabelhorn	13,364	Bec de Luseney	11,503
Aiguille de Bionnassay	13,341	Aiguille de Grépon	11,489
Allalinhorn	13,236	Château des Dames	11,447
Weissmies	13,226	Aiguille des Charmoz	11,293
Aiguille du Géant	13,170	Aiguille du Tacul	11,280
Laquinhorn	13,140	Grand Tournalin	11,086
Rossbodenhorn	13,128	Pointe de Rosa Blanche	10,985
Grand Cornier	13,022	Mont Avril	10,962
Aiguille de Trélatête	12,832	Grande Rochère	10,913
Aiguille d'Argentière	12,819	Corno Bianco	10,893
Ruinette	12,727	Grauhaupt	10,876
Aiguille de Triolet	12,717	Pointe d'Orny	10,742
		Dent du Midi	10,696
Mont Favre	10,693	Tagliaferro	9,725
Sasseneire	10,693	Riffelhorn	9,617
Grand Golliaz	10,630	Pointe Percée du Reposoir	9,029
Tour Sallières	10,588	Crammont	8,980
Pizzo Bianco	10,552	Pointe des Fours	8,921
Latelhorn	10,525	Pointe du Colloney	8,832
Schwarzhorn (Augstbord)	10,512	Catogne	8,527
Gornergrat	10,289	Monte Bò	8,386
Pointe de Léchaud	10,260	Mont Joly	8,291
Buet	10,201	Brévent	8,284
Mont Ruan	10,099	Pointe de Salles	8,183
Mont Néri	10,073	Aiguille de Varens	8,163
Bella Tola	9,935	Mont Chétif	7,687
Pointe de Tanneverge	9,784	Môle	6,132
Belvédère (Aigs. Rouges)	9,731	Salève (highest point)	4,528

Chief Passes of the Pennine Alps.

Sesiajoch (Zermatt to Alagna), snow	14,515
Col de la Brenva (Courmayeur to Chamonix), snow	14,217
Domjoch (Randa to Saas), snow	14,062
Lysjoch (Zermatt to Gressoney), snow	14,033
Mischabeljoch (Zermatt to Saas), snow	12,651
Alphubel Pass (same to same), snow	12,474
Adler Pass (same to same), snow	12,461
Moming Pass (Zermatt to Zinal), snow	12,287
Schwarzthor (Zermatt to Ayas), snow	12,274
Col de Triolet (Chamonix to Courmayeur), snow	12,110
Ried Pass (St Niklaus to Saas), snow	11,800
New Weissthor (Zermatt to Macugnaga), snow	11,746
Allalin Pass (Zermatt to Saas), snow	11,713
Col de Valpelline (Zermatt to Aosta), snow	11,687
Biesjoch (Randa to Turtmann), snow	11,644
Triftjoch (Zermatt to Zinal), snow	11,615
Col d'Argentière (Chamonix to Orsières), snow	11,536
Col du Sonadon (Bourg St Pierre to the Val de Bagnes), snow	11,447
Col de Talèfre (Chamonix to Courmayeur), snow	11,430
Col d'Hérens (Zermatt to Evolena), snow	11,418
Col Durand (Zermatt to Zinal), snow	11,398
Col des Maisons Blanches (Bourg St Pierre to the Val de Bagnes), snow	11,241
Col de Bertol (Arolla to the Col d'Hérens), snow	11,200
Col de Miage (Contamines to Courmayeur), snow	11,077
Col du Géant (Chamonix to Courmayeur), snow	11,060
Col du Mont Rouge (Val de Bagnes to the Val d'Hérémence), snow	10,962
Col du Chardonnet (Chamonix to Orsières), snow	10,909
Col de St Théodule (Zermatt to Châtillon), snow	10,899
Col du Tour (Chamonix to Orsières), snow	10,762
Fenêtre de Saleinaz (Saleinaz Glacier to Trient Glacier), snow	10,709
Col de Tracuit (Zinal to Turtmann), snow	10,670
Zwischbergen Pass (Saas to Gondo), snow	10,657
Col d'Oren (Val de Bagnes to the Valpelline), snow	10,637
Col de Seilon (Val de Bagnes to the Val d'Hérémence), snow	10,499
Col du Crêt (Val de Bagnes to the Val d'Hérémence), snow	10,329
Col de Valcóurnera (Val Tournanche to the Valpelline), snow	10,325
Col de Collon (Arolla to Aosta), snow	10,270
Col de Valsorey (Bourg St Pierre to Aosta), snow	10,214
Col de Chermontane (Val de Bagnes to Arolla), snow	10,119
Cimes Blanches (Val Tournanche to Ayas), bridle path	9,777
Col de Torrent (Evolena to the Val de Torrent), bridle path	9,593
Augstbord Pass (St Niklaus to Turtmann), bridle path	9,492
Col de Crête Sèche (Val de Bagnes to the Valpelline), snow	9,475
Col de Breuil (Bourg St Maurice to La Thuille), snow	9,446
Col d'Olen (Alagna to Gressoney), bridle path	9,420
Monte Moro (Saas to Macugnaga), partly bridle path	9,390
Pas de Chèvres (Arolla to the Val d'Hérémence), foot path	9,354
Antrona Pass (Saas to Antrona), partly bridle path	9,331
Col de Sorebois (Zinal to the Val de Torrent), bridle path	9,269
Col de Vessona (Valpelline to the St Barthélemy Glen), foot path	9,167
Col de Fenêtre (Val de Bagnes to Aosta), bridle path	9,141
Z'Meiden Pass (Zinal to Turtmann), bridle path	9,095
Turlo Pass (Alagna to Macugnaga), foot path	8,977
Col de Fenêtre (Great St Bernard to the Swiss Val Ferret), bridle path	8,855
Bettafurka (Ayas to Gressoney), bridle path	8,780
Col du Mont Tondu (Contamines to Courmayeur), snow	8,498
Col Serena (Great St Bernard to Courmayeur), foot path	8,327
Col Ferret (Courmayeur to Orsières), carriage road in progress	8,311
Col de la Seigne (Chapieux to Courmayeur) bridle path	8,242
Col de Susanfe (Champéry to Salvan), foot path	8,202
Col du Bonhomme (Contamines to Chapieux), bridle path	8,147
Col de Valdobbia (Gressoney to the Val Sesia), bridle path	8,134
Great St Bernard (Martigny to Aosta), carriage road	8,111
Col de Sagerou (Sixt to Champéry), foot path	7,917
Col de Moud (Alagna to Rima and Varallo), bridle path	7,622
Col d'Anterne (Sixt to Servos), bridle path	7,425

Col d'Egua (Rima to the Val Anzasca), bridle path	7,336
Col de Balme (Chamonix to the Trient Valley), bridle path	7,221
Simplon Pass (Brieg to Domo d'Ossola), carriage road over, railway tunnel beneath	6,592
Col de Chécouri (Courmayeur to the Lac de Combal), bridle path	6,431
Baranca Pass (Varallo to the Val Anzasca), bridle path	5,971
Col de Voza (Chamonix to Contamines), bridle path	5,496
Col de la Forclaz (Chamonix to St Gervais), bridle path	5,105
Col de la Forclaz (Trient Valley to Martigny), carriage road	4,987

II. CENTRAL ALPS

6. Bernese Oberland (from the Lake of Geneva to the Furka, the Reuss Valley and the Lake of Lucerne). This general name seems best to describe the range in question, though, of course, portions of it are in Cantons other than that of Berne, viz. Vaud, Fribourg, the Valais, Lucerne, Uri and Unterwalden.

Chief Peaks of the Bernese Oberland.

Finsteraarhorn	14,026	Wellhorn	10,486
Aletschhorn	13,721	Mettenberg	10,194
Jungfrau	13,669	Löffelhorn	10,165
Mönch	13,468	Grand Muveran	10,043
Gross Schreckhorn	13,386	Gross Wendenstock	9,987
Gross Fiescherhorn	13,285	Sparrhorn	9,928
Eiger	13,042	Torrenthorn	9,853
Bietschhorn	12,970	Grande Dent de Morcles	9,777
Gross Wannehorn	12,812	Schilthorn	9,754
Gross Nesthorn	12,533	Eggishorn	9,626
Lauterbrunnen Breithorn	12,399	Uri Rothstock	9,620
Balmhorn	12,176	Schwarzhorn (Grindelwald)	9,613
Wetterhorn (Mittelhorn)	12,166	Gross Siedelhorn	9,452
Wetterhorn (Hasli Jungfrau)	12,149	Albristhorn	9,069
		Röthihorn	9,052
Wetterhorn (Rosenhorn)	12,110	Faulhorn	8,803
Blümlisalphorn	12,044	Gummfluh	8,074
Gross Doldenhorn	11,966	Sulegg	7,914
Altels	11,930	Vanil Noir	7,858
Dammastock	11,920	Niesen	7,763
Galenstock	11,802	Brienzer Rothhorn	7,714
Sustenhorn	11,523	Tour d'Ai	7,658
Gspaltenhorn	11,293	Hohgant	7,225
Fleckistock	11,214	Stockhorn	7,192
Gross Hühnerstock	10,985	Kaiseregg	7,182
Ewigschneehorn	10,929	Pilatus (Tomlishorn)	6,995
Ritzlihorn	10,768	Chamossaire	6,943
Wildhorn	10,709	Gemmenalphorn	6,772
Wildstrubel	10,673	Rochers de Naye	6,710
Diablerets	10,650	Moléson	6,582
Titlis	10,627	Dent de Jaman	6,165
Gross Spannort	10,516	Napf	4,629

Chief Passes of the Bernese Oberland.

Lauithor (Lauterbrunnen to the Eggishorn), snow	12,140
Mönchjoch (Grindelwald to the Eggishorn), snow	11,680
Jungfraujoch (Wengern Alp to the Eggishorn), snow	11,385
Strahlegg Pass (Grindelwald to the Grimsel), snow	10,995
Grünhornlücke (Great Aletsch Glacier to the Fiescher Glacier), snow	10,844
Oberaarjoch (Grimsel to the Eggishorn), snow	10,607
Gauli Pass (Grimsel to Meiringen), snow	10,519
Petersgrat (Lauterbrunnen to the Lötschenthal), snow	10,516
Lötschenlücke (Lötschenthal to the Eggishorn), snow	10,512
Lauteraarsattel (Grindelwald to the Grimsel), snow	10,355
Beichgrat (Lötschenthal to the Bel Alp), snow	10,289
Lämmernjoch (Lenk to the Gemmi), snow	10,276
Triftlimmi (Rhone Glacier to the Gadmen Valley), snow	10,200
Sustenlimmi (Stein Alp to Goeschenen), snow	10,181
Gamchilücke (Kien Valley to Lauterbrunnen), snow	9,295
Tschingel Pass (Lauterbrunnen to Kandersteg), snow	9,265
Hohthürli Pass (Kandersteg to the Kien Valley), foot path	8,882
Lötschen Pass (Kandersteg to the Lötschenthal), snow	8,842
Sefinenfurka (Lauterbrunnen to the Kien Valley), foot path	8,583
Wendenjoch (Engelberg to the Gadmen Valley), snow	8,544
Furtwangsattel (Guttannen to the Gadmen Valley), foot path	8,393
Furka Pass (Rhone Glacier to Andermatt), carriage road	7,992
Rawil Pass (Sion to Lenk), bridle path	7,924
Gemmi Pass (Kandersteg to Leukerbad), bridle path	7,641
Surenen Pass (Engelberg to Altdorf), foot path	7,563
Susten Pass (Meiringen to Wassen), partly carriage road	7,422
Sanetsch Pass (Sion to Saanen), bridle path	7,331
Joch Pass (Meiringen to Engelberg), bridle path	7,267
Grimsel Pass (Meiringen to the Rhone Glacier), carriage road	7,100
Kleine Scheidegg (Grindelwald to Lauterbrunnen), railway over	6,772
Col de Cheville (Sion to Bex), bridle path	6,723
Grosse Scheidegg (Grindelwald to Meiringen), bridle path	6,434
Col de Jaman (Montreux to Montbovon), mule path over, railway tunnel beneath	4,974
Brünig Pass (Meiringen to Lucerne), railway over	3,396

7. Lepontine Alps (from the Simplon to the Splügen and south of the Furka and Oberalp Passes). The eastern portion of this range, from the St Gotthard Pass to the Splügen, is sometimes named the Adula Alps.

Chief Peaks of the Lepontine Alps.

Monte Leone	11,684	Piz Blas	9,918
Rheinwaldhorn	11,149	Monte Giove	9,876
Güferhorn	11,132	Pizzo Centrale	9,853
Blindenhorn	11,103	Pizzas d'Annarosa	9,850
Basodino	10,749	Piz Beverin	9,843
Tambohorn	10,749	Weisshorn (Splügen)	9,817
Helsenhorn	10,742	Pizzo Lucendro	9,708
Wasenhorn	10,680	Piz Tomül	9,676
Ofenhorn	10,637	Piz Cavel	9,659
Cherbadung	10,542	Bärenhorn	9,620
Piz Medel	10,509	Six Madun (Badus)	9,619
Scopi	10,499	Piz Muraun	9,512
Pizzo Rotondo	10,489	Zervreilerhorn	9,508
Pizzo dei Piani	10,361	Monte Cistella	9,353
Piz Terri	10,338	Piz Lukmanier	9,115
Piz Aul	10,250	Monte Prosa	8,983
Pizzo di Pesciora	10,247	Pizzo Columbè	8,363
Wyttenwasserstock	10,119	Monte Camoghè	7,303
Campo Tencia	10,089	Piz Mundaun	6,775
Leckihorn	10,069	Monte Generoso	5,591
Bruschghorn	10,020	Monte San Salvatore	3,004
Alperschellihorn	9,991		

Chief Passes of the Lepontine Alps.

Zapport Pass (Hinterrhein to Malvaglia and Biasca), snow	10,105
Güferlücke (Kanal Glen to the Lenta Glen), snow	9,777
Lentalücke (Hinterrhein to Vals Platz), snow	9,692
Hohsand Pass (Binn to Tosa Falls), snow	9,603
Lecki Pass (Wyttenwasser Glen to the Mutten Glen), snow	9,554
Passo Rotondo (Airolo to Oberwald), snow	9,449
Kaltwasser Pass (Simplon Hospice to Veglia Alp), snow	9,351
Scaradra Pass (Vals Platz to Olivone), foot path	9,088
Satteltelücke (Vals Platz to Vrin), foot path	9,082
Ritter Pass (Binn to Veglia Alp), snow	8,832
Cavanna Pass (Realp to the Val Bedretto), snow	8,566
Scatta Minoja (Devero to the Val Formazza), bridle path	8,521
Bocca di Cadlimo (Airolo to the Lukmanier Pass), foot path	8,340
Valserberg (Hinterrhein to Vals Platz), bridle path	8,225
Safierberg (Splügen to Safien Platz), bridle path	8,170
Geisspfad Pass (Binn to Devero), foot path	8,120
Gries Pass (Ulrichen to Tosa Falls), bridle path	8,098
Passo di Naret (Fusio to Airolo), bridle path	8,015
Nufenen Pass (Ulrichen to Airolo), bridle path	8,006
Diesrut Pass (Vrin to the Somvix Glen), bad bridle path	7,953
Albrun Pass (Binn to Devero and Baceno), bridle path	7,907
Greina Pass (Olivone to the Somvix Glen), bridle path	7,743
San Giacomo Pass (Airolo to Tosa Falls), bridle path	7,573
Passo di Buffalora (Val Mesocco to the Val Calanca), foot path	7,431
Passo dell' Uomo (Airolo to the Lukmanier Pass), bridle path	7,258
Splügen Pass (Thusis to Chiavenna), carriage road	6,946
St Gotthard Pass (Andermatt to Airolo), carriage road over, railway tunnel beneath	6,936
San Bernardino Pass (Thusis to Bellinzona), carriage road	6,769
Lukmanier Pass (Disentis to Olivone), carriage road	6,289

8. The Range of the Tödi (from the Oberalp Pass to the Klausen Pass).

Chief Peaks of the Range of the Tödi.

Tödi	11,887	Piz Segnes	10,178
Bifertenstock	11,241	Piz Giuf	10,165
Piz Urlaun	11,060	Crispalt	10,105
Oberalpstock	10,926	Bristenstock	10,086
Gross Scheerhorn	10,814	Selbsanft	9,938
Claridenstock	10,729	Vorab	9,925
Düssistock	10,703	Tschingelhörner (Elm)	9,351
Ringelspitz	10,667	Piz Sol (Grauehörner)	9,348
Brigelserhörner (highest)	10,663	Calanda	9,213
Grosse Windgälle	10,473	Kärpfstock	9,177
Hausstock	10,342	Mageren	8,294
Gross Ruchen	10,289	Mürtschenstock	8,012

Chief Passes of the Range of the Tödi.

Clariden Pass (Amsteg to Linththal), snow	9,741
Planura Pass (same to same), snow	9,646
Kammlilücke or Scheerjoch (Maderanerthal to Unterschächen), snow	9,344
Sardona Pass (Flims to Ragaz), snow	9,318
Sand Alp Pass (Disentis to Linththal), snow	9,121
Brunni Pass (Disentis to Amsteg), snow	8,977
Segnes Pass (Elm to Flims), foot path	8,613
Kisten Pass (Linththal to Ilanz), bad bridle path	8,203
Panixer Pass (Elm to Ilanz), bad bridle path	7,897
Krüzli Pass (Amsteg to Sedrun), foot path	7,710
Foo or Ramin Pass (Elm to Weisstannen), bridle path	7,290
Oberalp Pass (Andermatt to Disentis), carriage road	6,719
Klausen Pass (Altdorf to Linththal), carriage road	6,404

9. The Alps of North-Eastern Switzerland (north of the Klausen Pass).

Chief Peaks of the North-Eastern Swiss Alps.

Glärnisch (highest)	9,580
Böser Faulen	9,200
Säntis	8,216
Altmann	7,999
Faulfirst	7,925
Alvier	7,753
Kurfürsten (highest)	7,576
Speer	6,411
Gross Mythen	6,240
Rigikulm	5,906
Hoher Kasten	5,899
Rossberg	5,194
Zugerberg (Hochwacht)	3,255
Albis Hochwacht	2,887
Uetliberg	2,864

Chief Passes of the North-Eastern Swiss Alps.

Ruosalperkulm (Schächen Valley to the Muota Valley), foot path	7,126
Karren Alp Pass (Muota Valley to Linththal), foot path	6,877
Kinzigkulm Pass (Schächen Valley to the Muota Valley), foot path	6,811
Saasberg Pass (Einsiedeln to Glarus), foot path	6,227
Kamor Pass (Appenzell to Rüti), bridle path	5,512
Saxerlücke (Appenzell to Sax), foot path	5,417
Schwein Alp Pass (Wäggithal to the Klön Glen), bridle path	5,158
Pragel Pass (Muotathal to Glarus), carriage road in progress	5,099
Hacken Pass (Schwyz to Einsiedeln), foot path	4,649
Holzegg Pass (same to same), bridle path	4,616
Ibergeregg Pass (Schwyz to Iberg and Einsiedeln), carriage road	4,613
Kräzeren Pass (Nesslau to Urnäsch), bridle path	3,993

10. Bernina Alps (from the Maloja to the Reschen Scheideck and the Stelvio, south and east of the Val Bregaglia and of the Engadine and north of the Valtellina).

Chief Peaks of the Bernina Alps.

Piz Bernina	13,304
Piz Zupo	13,131
Monte di Scerscen	13,116
Piz Roseg	12,934
Piz Palü	12,835
Crast' Agüzza	12,704
Piz Morteratsch	12,317
Monte della Disgrazia	12,067
Pizzo di Verona	11,359
Cima di Piazzi	11,283
Cima di Castello	11,155
Cima Viola	11,103
Pizzo Cengalo	11,070
Cima di Rosso	11,060
Pizzo Scalino	10,903
Pizzo Badile	10,863
Corno di Campo	10,844
Pizzo di Dosdè	10,762
Cima di Saoseo	10,752
Piz Languard	10,716
Piz Sesvenna	10,568
Piz Pisoc	10,427
Piz Murtaröl	10,424
Piz Quatervals	10,358
Pizzo della Margna	10,355
Cima di Redascò	10,299
Piz Lischanna	10,204
Pizzo di Sena	10,099
Piz Casana	10,079
Monte Foscagno	10,010
Pizzo del Teo	10,007
Pizzo del Ferro	10,007
Piz Umbrail	9,955
Zwei Schwestern	9,784
Monte Braulio	9,777
Monte Spluga	9,321
Monte Massuccio	9,239
Mont la Schera	8,494

Chief Passes of the Bernina Alps.

Fuorcla Bellavista (Pontresina to Chiesa, in Val Malenco), snow	12,087
Fuorcla Crast' Agüzza (same to same), snow	11,805
Fuorcla Tschierva (same to same), snow	11,572
Fuorcla Sella (same to same), snow	10,840
Passo di Bondo (Bondo to the Baths of Masino), snow	10,227
Passo di Castello (Maloja to Morbegno), snow	10,171
Passo Tremoggia (Sils to Chiesa), snow	9,912
Passo di Mello (Chiareggio to Val Masino), snow	9,813
Diavolezza Pass (Bernina road to the Morteratsch Glen), snow	9,767
Passo di Dosdè (Val Grosina to Val Viola Bormina), foot path	9,351
Passo di Sacco (Bernina road to Grosio), foot path	9,026
Passo di Zocca (Vicosoprano to Val Masino), snow	9,000
Casana Pass (Scanfs to Livigno), bridle path	8,832
Muretto Pass (Maloja to Chiesa), partly snow	8,389
Umbrail Pass or Wörmserjoch (Münster Valley to the Stelvio road), carriage road	8,242
Passo di Val Viola (Bernina road to Bormio), bridle path	7,976
Giufplan Pass (Ofen road to Fraële), bridle path	7,723
Bernina Pass (Pontresina to Tirano), carriage road	7,645
Forcola di Livigno (Bernina Pass to Livigno), small carriage road	7,638
Cruschetta Pass (Schuls by Scarl to Taufers), bridle path	7,599
Passo di Verva (Bormio to Grosio), foot path	7,592
Sursass or Schlinig Pass (Remüs to Mals) foot path	7,540
Foscagno Pass (Bormio to Trepalle), bridle path	7,517
Alpisella Pass (Livigno to Fraële), bridle path	7,497
Scarl Pass (Scarl to Santa Maria Münster), carriage road	7,386
Dössradond Pass (Santa Maria Münster to Fraële), bridle path	7,349
Passo Dheira (Livigno to Trepalle) bridle path	7,248
Ofen Pass (Zernez to Mals), carriage road	7,071
Fraële Pass (Bormio to the Ofen road), partly bridle path	6,398
Scale di Fraële (Bormio to Fraële), bridle path	6,372
Maloja Pass (St Moritz to Chiavenna), carriage road	5,935

11. Albula Range (from the Splügen Pass to the Flüela Pass, north and west of the Val Bregaglia and of the Engadine).

Chief Peaks of the Albula Range.

Piz Kesch	11,228
Piz dellas Calderas	11,132
Piz Platta	11,109
Piz Julier	11,106
Piz d'Err	11,093
Piz d'Aela	10,959
Cima da Flex	10,785
Piz Uertsch	10,739
Piz Forbisch	10,689
Piz Ot	10,667
Gross Piz Vadret	10,584
Piz Timun or Emet	10,502
Tinzenhorn	10,430
Piz Michel	10,378
Pizzo Stella	10,375
Flüela Schwarzhorn	10,335
Pizzo della Duana	10,279
Pizzo Gallegione	10,201
Gletscherhorn	10,191
Cima di Lago	10,112
Hoch Ducan	10,060
Piz Grisch	10,000
Averser Weissberg	9,987
Surettahorn	9,971
Arosa Rothhorn	9,794
Piz Curver	9,761
Pizzo Lunghino	9,121
Stätzerhorn	8,450

Chief Passes of the Albula Range.

Fuorcla Calderas (Molins to Bevers), snow	10,270
Fuorcla d'Eschia (Madulein to Bergün), snow	9,869
Passo della Duana (Avers Valley to the Val Bregaglia), snow	9,187
Sertig Pass (Davos to Scanfs), foot path	9,062
Forcella di Prassignola (Avers Valley to Soglio), old paved cattle path	8,924
Tinzenthor (Bergün to Savognino), foot path	8,918
Forcella di Lago or Madris Pass (Avers Valley to Chiavenna), foot path	8,793
Forcellina (Avers Valley to the Septimer Pass), foot path	8,770
Ducan Pass (Davos to Bergün), foot path	8,763
Passo di Lei (Avers Valley to Chiavenna), foot path	8,724
Forcella di Lunghino (Maloja to the Septimer Pass), foot path	8,645
Scaletta Pass (Davos to Scanfs), bridle path	8,593
Suvretta Pass (St Moritz to Bevers), bridle path	8,590
Fuorcla d'Alp Fontauna (Bergün to Scanfs), foot path	8,580
Stallerberg (Avers Valley to Bivio-Stalla), foot path	8,478
Grialetsch Pass (Davos to Süs), foot path	8,353
Flüela Pass (Davos to Süs), carriage road	7,838
Strela Pass (Davos to Langwies), bridle path	7,799
Albula Pass (Bergün to Ponte), carriage road over, railway tunnel beneath	7,595
Septimer Pass (Bivio-Stalla to Casaccia), bridle path	7,582
Julier Pass (Thusis to Silvaplana), carriage road	7,504
Passo di Madesimo or d'Emet (Avers Valley to Madesimo), foot path	7,481

12. Silvretta and Rhätikon Ranges (from the Flüela Pass to the Reschen Scheideck and the Arlberg Pass).

Chief Peaks of the Silvretta and Rhätikon Ranges.

Piz Linard	11,201
Fluchthorn	11,165
Gross Piz Buin	10,880
Verstanklahorn	10,831
Muttler	10,821
Piz Fliana	10,775
Stammerspitze	10,689
Silvrettahorn	10,657
Augstenberg	10,611
Plattenhorn	10,568
Dreiländerspitze	10,539
Piz Tasna	10,443
Kuchenspitze	10,401
Hoher Riffler	10,368
Piz Mondin	10,325
Küchelspitze	10,315
Gross Seehorn	10,247
Vesilspitze	10,220
Gross Litzner	10,207
Vesulspitze	10,145
Flüela Weisshorn	10,132
Piz Minschun	10,079
Patteriol	10,037
Piz Faschalba	10,010
Hexenkopf	9,968
Gemsbleiskopf	9,899
Pischahorn	9,784
Scesaplana	9,741
Rothbleiskopf	9,640
Hohes Rad	9,554
Schiltfluh	9,482
Plattenpspitze	9,449
Madrishorn	9,285
Drusenfluh	9,282
Sulzfluh	9,252
Zimbaspitze	8,678
Naafkopf	8,445
Falknis	8,419

Chief Passes of the Silvretta and Rhätikon Ranges.

Jamjoch (Guarda to Galtür), snow	10,112
Fuorcla del Confin (Silvretta Pass to the Vermunt Glacier), snow	10,033
Buinlücke (Guarda to Patenen), snow	10,020
Silvretta Pass (Klosters to Lavin), snow	9,886
Zahnlücke (Jam Glen to the Fimber Glen), snow	9,712
Verstanklathor (Klosters to Lavin), snow	9,682
Fuorcla d'Urezzas (Ardez to Galtür); snow	9,564
Fuorcla Tasna (Ardez to Ischgl), snow	9,374
Fuorcla Maisas (Remüs to the Samnaun Glen), snow	9,357
Vermunt or Fermunt Pass (Guarda to Patenen), snow	9,193
Futschöl Pass (Ardez to Galtür), foot path	9,098
Fuorcla Zadrell or Vernela Pass (Klosters to Lavin), snow	9,033
Cuolm d'Alp bella or Vignitz Pass (Samnaun Glen to Kappl), foot path	8,852
Schafbücheljoch (Mathon to St Anton), foot path	8,685
Fimber Pass (Remüs to Ischgl), bridle path	8,570
Scheien Pass (Klosters to the See Glen), foot path	8,557
Vereina Pass or Pass da Val Torta (Klosters to Lavin), foot path	8,540

Zebles Pass (Ischgl to the Samnaun Glen), bridle path	8,350
Garnerajoch (Klosters to Gaschurn), foot path	8,153
Fless Pass (Klosters to Süs), foot path	8,045
St Antönien or Gargellenjoch (St Antönien to St Gallenkirch), foot path	7,792
Drusenthor (Schiers to Schruns), foot path	7,710
Verrajöchl (Lünersee to the Schweizerthor), foot path	7,648
Ofen Pass (Schweizerthor to Schruns), foot path	7,523
Cavelljoch (Bludenz and the Lünersee to Seewis), foot path	7,343
Gruben Pass (St Antönien to Schruns), foot path	7,333
Schlappinerjoch (Klosters to St Gallenkirch), bridle path	7,218
Schweizerthor (Schiers to Schruns), foot path	7,057
Bielerhöhe (Patenen to Galtür), bridle path	6,631
Zeinisjoch (Patenen to Galtür), bridle path	6,076
Arlberg Pass (Landeck to Bludenz), carriage road over, railway tunnel beneath	5,912

III. EASTERN ALPS

13. The Alps of Bavaria, the Vorarlberg and Salzburg (north of the Arlberg Pass, Innsbruck, the Pinzgau, and the Enns valley).

Chief Peaks of the Alps of Bavaria, the Vorarlberg and Salzburg.

Parseierspitze	9,968	Watzmann	8,901
Dachstein	9,830	Rothewandspitze	8,878
Zugspitze	9,738	Gross Krottenkopf (Allgäu)	8,718
Hochkönig	9,639	Selbhorn	8,711
Valluga	9,223	Hohes Licht	8,701
Rockspitze	9,059	Mädelegabel	8,681
E. Hohe Griesspitze	9,052	Hochvogel	8,511
Stanskogel	9,052		
Birkkarspitze (Karwendel)	9,042	Elmauer Haltsspitze (Kaisergebirge)	7,691

Chief Passes of the Alps of Bavaria, the Vorarlberg and Salzburg.

Gentschel Pass (Oberstdorf to Schröcken), bridle path	6,480
Schrofen Pass (Oberstdorf to Warth), foot path	5,538
Gerlos Pass (Zell to Mittersill), bridle path	4,876
Pass Thurn (Kitzbühel to Mittersill), carriage road	4,183
Fern Pass (Reutte to Nassereit), carriage road	4,026
Scharnitz or Seefeld Pass (Partenkirchen to Zirl), carriage road	3,874
Hirschbühel Pass (Berchtesgaden to Saalfelden), carriage road	3,858
Hochfilzen Pass (Saalfelden to Kitzbühel), railway over	3,173
Pyhrn Pass (Linz to Liezen), carriage road over, railway tunnel beneath	3,100
Wagreinstattel (Radstadt to St Johann in Pongau), carriage road	2,743

14. Central Tirol Alps (from the Brenner Pass to the Radstädter Tauern Pass, north of the Drave Valley and south of the Pinzgau and the Enns Valley). This division takes in the Zillerthal and Tauern Ranges.

Chief Peaks of the Central Tirol Alps.

Gross Glockner	12,461		
Gross Venediger	12,008	Ruthnerhorn (Rieserferner)	11,024
Gross Wiesbachhorn	11,713	Hochalmspitze	11,008
Hochfeiler (Zillerthal)	11,559	Reichenspitze (Z)	10,844
Dreiherrenspitze	11,500		
Mösele (Z)	11,438	Gross Rotherknopf (Schober)	10,814
Olperer (Z)	11,418	Gross Mörchner (Z)	10,785
Johannisberg	11,375	Hochnarr (Goldberg)	10,689
Hochgall (Rieserferner)	11,287	Ankogel	10,673
Thurnerkamp (Z)	11,228	Hochschober	10,663
Gross Löffler (Z)	11,096	Kitzsteinhorn	10,512
Fussstein (Z)	11,090	Sonnblick	10,196
Schwarzenstein (Z)	11,057	Zsigmondyspitze	10,122
Gross Geiger	11,041	Reckner (Tuxergebirge)	9,485

Chief Passes of the Central Tirol Alps.

Mitterbachjoch (Breitlahner to Taufers), snow (Z)	10,270
Trippachsattel (Floiten Valley to Taufers), snow (Z)	10,020
Riffelthor (Kaprun to Heiligenblut), snow	10,010
Bockkarscharte (Ferleiten to Heiligenblut), snow	9,994
Sonnblickscharte (Rauris to Heiligenblut), snow	9,774
Alpeinerscharte (Breitlahner to St Jodok am Brenner), foot path (Z)	9,712
Vorder Umbalthörl (Prägraten to Kasern), snow	9,607
Ober Sulzbachthörl (Prägraten to Wald), snow	9,600
Keilbachjoch (Mayrhofen to Steinhaus), foot path (Z)	9,410
Unter Sulzbachthörl (Wald to Gschlöss), snow	9,400
Schwarzkopfscharte (Bramberg to Gschlöss), snow	9,351
Prägraterthörl (Prägraten to the Defereggen Glen), foot path	9,338
Glödisthörl (Lienz to Kals), snow	9,292
Antholzerscharte (Rein Valley to the Antholz Valley), snow (Z)	9,252
Krimmlerthörl (Krimml Glen to the Obersulzbach Glen) snow	9,233
Goldzechscharte (Heiligenblut to Rauris), snow	9,220
Kalserthörl (Kals to Lienz), snow	9,197
Ober Tramerscharte (Rauris to Döllach), snow	9,193
Kleine Elendscharte (Gastein to Gmünd), snow	8,987
Kleine Zirknitzscharte (Döllach to Fragant or Rauris), snow	8,921
Dössener or Mallnitzerscharte (Mallnitz to Gmünd), snow	8,783
Grosse Elendscharte (Mallnitz to the Upper Malta Glen), snow	8,770
Unter Pfandlscharte (Ferleiten to Heiligenblut), snow	8,744
Heiliggeistjöchl (Mayrhofen to Kasern), foot path (Z)	8,721
Bergerthörl (Kals to Heiligenblut), foot path	8,695
Kaprunerthörl (upper Kaprun Glen to the upper Stubach Glen), snow	8,645
Krimmler Tauern (Krimml to Kasern), foot path	8,642
Virgner or Defereggerthörl (Defereggen Glen to Virgen and Prägraten), foot path	8,586
Backlenke or Trojerjoch (Prägraten to the Defereggen Glen), foot path	8,573
Hochthor or Heiligenbluter Tauern (Heiligenblut to Rauris), foot path	8,442
Hörndljöchl (Mayrhofen to Steinhaus), foot path (Z)	8,383
Velber Tauern (Windisch Matrei to Mittersill), bridle path	8,334
Kalser Tauern (Kals to Uttendorf), foot path	8,242
Hohe or Korn Tauern (Mallnitz to Gastein), bridle path over, railway tunnel beneath	8,081
Niedere or Mallnitzer Tauern (Mallnitz to Gastein), bridle path	7,920
Fuscherthörl (Ferleiten to the Seidlwinkel Glen), foot path	7,891
Lappacherjoch (Lappach to the Ahrn Valley), foot path (Z)	7,763
Tuxerjoch or Schmirnjoch (Mayrhofen to St Jodok am Brenner), foot path (Z)	7,697
Klammljoch (Taufers to the Defereggen Valley), bridle path	7,517
Arlscharte (St Johann in Pongau to Gmünd), foot path	7,386
Pfitscherjoch (Mayrhofen to Sterzing), foot path (Z)	7,376
Kals Matreierthörl (Kals to Windisch Matrei), bridle path	7,238
Die Stanz (Gastein to Rauris), foot path	6,900
Stallersattel (Defereggen Glen to the Antholz Glen), bridle path (R)	6,742
Radstädter Tauern (Radstadt to Mautendorf), carriage road	5,702

15. Ortler, Oetzthal and Stubai Ranges (from the Reschen Scheideck and the Stelvio to the Brenner Pass, south of the Inn Valley, and north of the Tonale Pass).

Chief Peaks of the Ortler, Oetzthal and Stubai Ranges.

Ortler	12,802	Zuckerhütl (Stubai)	11,520
Königsspitze	12,655	Schalfkogel	11,516
Monte Cevedale	12,382	Schrankogel	11,483
Wildspitze (Oetzthal)	12,382	Hochwildspitze	11,418
Weisskugel	12,291	Sonklarspitze	11,405
Monte Zebru	12,254	Tuckettspitze	11,346
Palon della Mare	12,156	Wilder Freiger	11,241
Punta San Matteo	12,113	Veneziaspitze	11,103
Thurwieserspitze	11,946	Tschengelser Hochwand	11,083
Hintere Schwärze	11,920	Monte Confinale	11,057
Similaun	11,821	Glockthurm	11,011
Pizzo Tresero	11,818	Fernerkogel	10,827
Gross Ramolkogel	11,651	Monte Sobretta	10,814
Vertainspitze	11,618	Habicht	10,758
Hochvernagtspitze	11,585	Pflerscher Tribulaun	10,178

Chief Passes of the Ortler, Oetzthal and Stubai Ranges.

Hochjoch (Sulden to the Zebru Glen), snow	11,602
Vioz Pass (Santa Caterina to Pejo), snow	10,949
Sonklarscharte (Sölden to Sterzing), snow	10,916
Königsjoch (Sulden to Santa Caterina), snow	10,811
Cevedale Pass (Santa Caterina to the Martell Glen), snow	10,732
Gepatschjoch (Vent to the Kauns Valley), snow	10,640
Ramoljoch (Vent to Gurgl), snow	10.479
Langtaufererjoch (Vent to the Reschen Scheideck Pass), snow	10,391
Bildstöckljoch (Sölden to Ranalt), snow	10,296
Gurgler Eisjoch (Gurgl to the Pfossen Glen), snow	10,292
Eissee Pass (Sulden to the Martell Glen), snow	10,279
Langthalerjoch (Gurgl to Pfelders), snow	10,033
Passo del Zebru (Santa Caterina to the Zebru Glen), snow	9,925
Sällentjoch (Martell Glen to Rabbi), snow	9,913
Niederjoch (Vent to the Schnals Valley), snow	9,899
Sforzellina Pass (Santa Caterina to Pejo), snow	9,859
Pitzthalerjöchl (Mittelberg to Sölden), snow	9,826
Eisjöchl am Bild (Pfelders to the Pfossen Glen), snow	9,541
Venter Hochjoch (Vent to the Schnals Valley), snow	9,465
Tabarettascharte (Sulden to Trafoi), foot path	9,459
Stelvio Pass (Trafoi to Bormio), carriage road	9,055
Gavia Pass (Santa Caterina to Ponte di Legno), foot path	8,651
Timmeljoch or Timblerjoch (Sölden to the Passeierthal and Meran), bridle path	8,232
Jaufen Pass (Sterzing to Meran), bridle path	6,870
Reschen Scheideck Pass (Landeck to Meran), carriage road	4,902
Brenner Pass (Innsbruck to Verona), railway over	4,495

16. Lombard Alps (from the Lake of Como to the Adige Valley, south of the Valtellina and the Aprica and Tonale Passes. This

division includes the Adamello, Presanella, Brenta and Bergamasque ranges.

Chief Peaks of the Lombard Alps.

Presanella	11,694	Pizzo del Diavolo	9,564
Adamello	11,661	Rè di Castello	9,482
Carè Alto	11,369	Recastello	9,475
Dosson di Genova	11,254	Monte Gleno	9,459
Crozzon di Lares	11,004	Monte Tornello	8,819
Corno di Baitone	10,929	Corno Stella	8,596
Busazza	10,922	Monte Legnone	8,563
Lobbia Alta	10,486	Pizzo dei Tre Signori	8,380
Cima Tosa (Brenta)	10,420	Pizzo di Presolana	8,239
Cima di Brenta	10,352	Grigna	7,907
Crozzon di Brenta	10,247	Monte Baldo	7,218
Pizzo di Coca (Bergamasque)	10,014	Monte Spinale	7,094
Pizzo di Scais	9,974	Monte Roën	6,939
Pizzo di Redorta	9,964	Monte Gazza	6,529
Pietra Grande	9,630	Monte Resegone	6,155

Chief Passes of the Lombard Alps.

Passo di Lares (Lares Glacier to the Lobbia Glacier), snow	10,483
Passo di Cercen (Val di Genova to Fucine), snow	9,984
Passo della Lobbia Alta (Lobbia Glacier to the Mandron Glacier), snow	9,961
Passo di Presena (Val di Genova to the Tonale Pass), snow	9,879
Pisgana Pass (Val di Genova to Ponte di Legno), snow	9,626
Bocca di Tuckett (Campiglio to Molveno), snow	8,714
Passo di Val Morta or del Diavolo (Val Seriana to Sondrio), foot path	8,534
Bocca di Brenta (Pinzolo or Campiglio to Molveno), snow	8,376
Passo del Grostè (Campiglio to Cles), foot path	8,006
Passo di Venina (Val Brembana to Sondrio), foot path	7,983
Passo del Salto (Val Seriana to Sondrio), foot path	7,937
Passo del Venerocolo (Val di Scalve to the Aprica road), bridle path	7,595
Passo della Forcellina or di Campo (Cedegolo to the Val di Fumo), foot path	7,507
Passo di Dordona (Val Brembana to Sondrio), foot path	6,824
Passo di San Marco (Bergamo to Morbegno), bridle path	6,513
Croce Domini Pass (Breno to Bagolino in Val Caffaro), bridle path	6,217
Tonale Pass (Trent to Edolo), carriage road	6,181
Passo di Zovetto (Val di Scalve to Edolo), bridle path	5,968
Colle Maniva (Val Trompia to Bagolino), bridle path	5,476
Campo or Ginevriè Pass (Dimaro by Campiglio to Pinzolo), carriage road	5,407
Gampenjoch (Cles to Meran), foot path	5,051
Mendel Pass (Botzen to Cles), railway on the E. slope	4,462
Passo di Castione or Presolana Pass (Clusone to the Val di Scalve), carriage road	4,219
Aprica Pass (Edolo to Tirano), carriage road	3,875

17. The Dolomites of South Tirol (from the Brenner Pass to the Monte Croce Pass, and south of the Pusterthal).

Chief Peaks of the Dolomites of South Tirol.

Marmolata	10,972	Pala di San Martino	9,831
Antelao	10,706	Rosengartenspitze	9,781
Tofana di Mezzo	10,633	Marmarole	9,715
Sorapiss	10,594	Cima di Fradusta	9,649
Monte Civetta	10,564	Fermedathurm	9,407
Vernel	10,519	Cima d'Asta	9,344
Monte Cristallo	10,496	Cima di Canali	9,338
Cima di Vezzana	10,470	Croda Grande	9,315
Cimon della Pala	10,453	Vajoletthurm (highest)	9,256
Langkofel	10,427	Sass Maor	9,239
Pelmo	10,397	Cima di Ball	9,131
Dreischusterspitze	10,375	Cima della Madonna (Sass Maor)	9,026
Boëspitze	10,342	Rosetta	8,993
Croda Rossa (Hoher Caisl)	10,329	Croda da Lago	8,911
Piz Popena	10,312	Central Grasleitenspitze	8,875
Elferkofel	10,220	Schlern	8,406
Grohmannspitze	10,207	Sasso di Mur	8,380
Zwölferkofel	10,142	Cima delle Dodici	7,671
Sass Rigais (Geislerspitzen)	9,932	Monte Pavione	7,664
Drei Zinnen	9,853	Cima di Posta	7,333
Kesselkogel (Rosengarten)	9,846	Monte Pasubio	7,323
Fünffingerspitze	9,833		

Chief Passes of the Dolomites of South Tirol.

Passo d' Ombretta (Campitello to Caprile), foot path	8,983
Langkofeljoch (Gröden Valley to Campitello), foot path	8,803
Tschagerjoch (Karersee to the Vajolet Glen), foot path	8,675
Grasleiten Pass (Vajolet Glen to the Grasleiten Glen), foot path	8,521
Passo di Pravitale (Rosetta Plateau to the Pravitale Glen), foot path	8,465
Passo delle Comelle (same to Cencenighe), foot path	8,462
Passo della Rosetta (San Martino di Castrozza to the great limestone Rosetta Plateau), foot path	8,442
Vajolet Pass (Tiers to the Vajolet Glen), foot path	8,363
Passo di Canali (Primiero to Agordo), foot path	8,193
Tiersalpljöchl (Campitello to Tiers), foot path	8,055
Passo di Ball (San Martino di Castrozza to the Pravitale Glen), foot path	8,038
Forcella di Giralba (Sexten to Auronzo), foot path	7,992
Col dei Bos (Falzarego Glen to the Travernanzes Glen), foot path	7,579
Forcella Grande (San Vito to Auronzo), foot path	7,422
Pordoi Pass (Caprile to Campitello), carriage road	7,382
Sellajoch (Gröden Glen to Campitello), bridle path	7,277
Tre Sassi Pass (Cortina to St Cassian), foot path	7,215
Mahlknechtjoch (Upper Duron Glen to the Seiser Alp), foot path	7,113
Grödenerjoch (Gröden Glen to Colfuschg), bridle path	7,011
Falzarego Pass (Caprile to Cortina), small carriage road	6,946
Fedaja Pass (Campitello to Caprile), bridle path	6,713
Passo di Valles (Paneveggio to Cencenighe), foot path	6,667
Rolle Pass (Predazzo to San Martino di Castrozza and Primiero), carriage road	6,509
Forcella Forada (Caprile to San Vito), bridle path	6,480
Passo di San Pellegrino (Moëna to Cencenighe), small carriage road	6,267
Forcella d'Alleghe (Alleghe to the Zoldo Glen), foot path	5,971
Tre Croci Pass (Cortina to Auronzo), carriage road	5,932
Karersee or Caressa Pass (Welschenofen to Vigo di Fassa), carriage road	5,715
Monte Croce Pass (Innichen and Sexten to the Piave Valley and Belluno), carriage road	5,374
Ampezzo Pass (Toblach to Cortina and Belluno), carriage road	5,066
Cereda Pass (Primiero to Agordo), bridle path	4,501
Toblach Pass (Bruneck to Lienz), railway over	3,967

18. South-Eastern Alps (east of the Monte Croce Pass). This division includes three small groups, the Julic, Carnic and Karawankas Alps—each peak and pass being distinguished by one of the initial letters "J," "C" or "K."

Chief Peaks of the South-Eastern Alps.

Terglou or Triglav (J)	9,400	Monte Cridola (C)	8,468
Monte Coglians (C)	9,128	Grintovc (K)	8,429
Kellerwand (C)	9,105	Prestrelenik (J)	8,202
Jof del Montasio (J)	9,039	Monte Cavallo (C)	7,386
Cima dei Preti (C)	8,868	Krn (J)	7,369
Monte Paralba (C)	8,829	Stou (K)	7,346
Manhart (J)	8,786	Dobratsch (C)	7,110
Jalouc (J)	8,711	Velka Kappa (K)	5,059
Monte Canin (J)	8,471		

Chief Passes of the South-Eastern Alps.

Oefnerjoch (Forno Avoltri to St Lorenzen in the Gail Valley), foot path (C)	7,550
Wolayer Pass (same to Mauthen), foot path (C)	6,506
Loibl Pass (Klagenfurt to Laibach), carriage road (K)	4,495
Plöcken Pass (Tolmezzo to Mauthen), bridle path (C)	4,462
Predil Pass (Villach by Tarvis and Flitsch to Görz), carriage road (J)	3,813
Birnbaumerwald (Laibach to Görz), carriage road (J)	2,897
Saifnitz or Pontebba Pass (Villach by Tarvis and Pontebba to Udine), railway	2,615

7. *Political History and Modern State of the Inhabitants of the Alps.*—We know practically nothing of the early dwellers in the Alps, save from the scanty accounts preserved to us by Roman and Greek historians and geographers. A few details have come down to us of the conquest of many of the Alpine tribes by Augustus, though not much more than their names. The successive emigrations and occupation of the Alpine region by divers Teutonic tribes from the 5th to the 6th centuries are, too, known to us only in outline, while to them, as to the Frankish kings and emperors, the Alps offered a route from one place to another rather than a permanent residence. It is not till the final break up of the Carolingian empire in the 10th and 11th centuries that it becomes possible to trace out the local history of different parts of the Alps.

In the case of the Western Alps (minus the bit from the chain of Mont Blanc to the Simplon, which followed the fortunes of the Valais), a prolonged struggle for the Alpine region took place between the feudal lords of Savoy, the Dauphiné and Provence. In 1349 the Dauphiné fell to France, while in 1388 the county of Nice passed from Provence to the house of Savoy, which too held Piedmont as well as other lands on the Italian side of the Alps. The struggle henceforth was limited to France and the house of Savoy, but little by little France succeeded in pushing back the house of Savoy across the Alps, thus forcing it to become a purely Italian power. One turning-point in the rivalry was the treaty of Utrecht (1713), by which France gave up to Savoy the districts (all forming part of the Dauphiné, and lying on the Italian slope of the Alps) of Exilles, Bardonnèche, Oulx, Fénestrelles, and Château Dauphin, while Savoy handed over to France the valley of Barcelonnette, situated on the western slope of the Alps and forming part of the county of Nice. The final act in the long-continued struggle took place in 1860, when France obtained by cession the rest of the county of Nice and also Savoy, thus remaining sole mistress on the western slope of the Alps.

In the Central Alps the chief event, on the northern side of the chain, is the gradual formation from 1291 to 1815 of the Swiss Confederation, at least so far as regards the mountain Cantons, and with especial reference to the independent confederations of the Grisons and the Valais, which only became full members of the Confederation in 1803 and 1815 respectively. The attraction of the south was too strong for both the Forest Cantons and the Grisons, so that both tried to secure, and actually did secure, various bits of the Milanese. The former, in the 15th century, won the Val Leventina (down which the St Gotthard train now thunders) as well as Bellinzona and the Val Blenio (though the Ossola Valley was held for a time only), while the latter added to the Val Bregaglia (which had been given to the bishop of Coire in 960 by the emperor Otto I.) the valleys of Mesocco and of Poschiavo. Further, in 1512, the Swiss Confederation as a whole won the valleys of Locarno with Lugano, which, combined with the 15th century conquests by the Forest Cantons, were formed in 1803 into the new Canton of Ticino or Tessin. On the other hand, the Grisons won in 1512 the Valtellina, with Bormio and Chiavenna, but in 1797 these regions were finally lost to it as well as to the Swiss Confederation, though the Grisons retained the valleys of Mesocco, Bregaglia and Poschiavo, while in 1762 it had bought the upper bit of the valley of Münster that lies on the southern slope of the Alps.

In the Eastern Alps the political history is almost monotonous, for it relates simply to the advance or retreat of the house of Habsburg, which still holds all but the whole of the northern portion (the exception is the small bit in the north-west that belongs to Bavaria) of that region. The Habsburgers, whose original home was in the lower valley of the Aar, where still stand the ruins of their ancestral castle, lost that district to the Swiss in 1415, as they had previously lost various other bits of what is now Switzerland. But they received a rich compensation in the Eastern Alps (not to speak of the imperial crown), for they there gathered in the harvest that numerous minor dynasties had prepared for them, albeit unconsciously. Thus they won the duchy of Austria with Styria in 1282, Carinthia and Carniola in 1335, Tirol in 1363, and the Vorarlberg in bits from 1375 to 1523, not to speak of minor "rectifications" of frontiers on the northern slope of the Alps. But on the other slope their progress was slower, and finally less successful. It is true that they early won Primiero (1373), as well as (1517) the Ampezzo Valley and several towns to the south of Trent. In 1797 they obtained Venetia proper, in 1803 the secularized bishoprics of Trent and Brixen (as well as that of Salzburg, more to the north), besides the Valtellina region, and in 1815 the Bergamasque valleys, while the Milanese had belonged to them since 1535. But, as is well known, in 1859 they lost to the house of Savoy both the Milanese and the Bergamasca, and in 1866 Venetia proper also, so that the Trentino is now their chief possession on the southern slope of the Alps. The gain of the Milanese in 1859 by the future king of Italy (1861) meant that Italy then won the valley of Livigno (between the Upper Engadine and Bormio), which is the only important bit it holds on the non-Italian slope of the Alps, besides the county of Tenda (obtained in 1575, and not lost in 1860), with the heads of certain glens in the Maritime Alps, reserved in 1860 for reasons connected with hunting. Thus the Alpine states (Italy, Switzerland and Austria), other than France and Bavaria, hold bits of territory on the slope of the Alps where one would not expect to find them. Roughly speaking, in each of these five lands the Alpine population speaks the tongue of the country, though in Italy there are a few French-speaking districts (the Waldensian valleys as well as the Aosta and Oulx valleys) as well as some German-speaking and Ladin-speaking settlements. In Switzerland there are Italian-speaking regions, as well as some spots (in the Grisons) where the old Romance dialect of Romansch or Ladin survives: while in Austria, besides German, Italian and Ladin, we have a Slavonic-speaking population in the South-Eastern Alps. The highest permanently inhabited village in the Alps is Juf, 6998 ft. (Grisons); while in the French Alps, L'Écot, 6713 ft. (Savoy), and St Véran, 6726 ft. (Dauphiné), are rivals; the Italian Alps boast of Trepalle, 6788 ft. (between Livigno and Bormio), and the Tirolese Alps of Ober Gurgl, 6322 ft., and Fend, 6211 ft. (both in the Oetzthal).

8. *Exploration of the High Alps.*—The higher region of the Alps were long left to the exclusive attention of the men of the adjoining valleys, even when Alpine travellers (as distinguished from Alpine climbers) began to visit these valleys. It is reckoned that about 20 glacier passes were certainly known before 1600, about 25 more before 1700, and yet another score before 1800; but though the attempt of P. A. Arnod (an official of the duchy of Aosta) in 1689 to "re-open" the Col du Géant may be counted as made by a non-native, we do not come upon another case of the kind till the last quarter of the 18th century. Nor did it fare much better with the high peaks, though the two earliest recorded ascents were due to non-natives, that of the Rochemelon in 1358 having been undertaken in fulfilment of a vow, and that of the Mont Aiguille in 1492 by order of Charles VIII. of France, in order to destroy its immense reputation for inaccessibility—in 1555 Conrad Gesner did not climb Pilatus proper, but only the grassy mound of the Gnepfstein, the lowest and the most westerly of the seven summits. The two first men who really systematically explored the regions of ice and snow were H. B. de Saussure (1740–1799), as regards the Pennine Alps, and the Benedictine monk of Disentis, Placidus à Spescha (1752–1833, most of whose ascents were made before 1806), in the valleys at the sources of the Rhine. In the early 19th century the Meyer family of Aarau conquered in person the Jungfrau (1811) and by deputy the Finsteraarhorn (1812), besides opening several glacier passes, their energy being entirely confined to the Bernese Oberland. Their pioneer work was continued in that district, as well as others, by a number of Swiss, pre-eminent among whom were Gottlieb Studer (1804–1890) of Bern, and Edouard Desor (1811–1882) of Neuchâtel. The first-known English climber in the Alps was Colonel Mark Beaufoy (1764–1827), who in 1787 made an ascent (the fourth) of Mont Blanc, a mountain to which his fellow-countrymen long exclusively devoted themselves, with a few noteworthy exceptions, such as Principal J. D. Forbes (1809–1868), A. T. Malkin (1803–1888), John Ball (1818–1889), and Sir Alfred Wills (b. 1828). Around Monte Rosa the Vincent family, Josef Zumstein (1783–1861), and Giovanni Gnifetti (1801–1867) did good work during the half century between 1778 and 1842, while in the Eastern Alps the Archduke John (1782–1859), Prince F. J. C. von Schwarzenberg, archbishop of Salzburg (1809–1885), Valentine Stanig (1774–1847), Adolf Schaubach (1800–1850), above all, P. J. Thurwieser (1789–1865), deserve to be recalled as pioneers in the first half of the 19th century. In the early fifties of the 19th century the taste for mountaineering rapidly developed for several very different reasons. A great stimulus was given to it by the foundation of the various Alpine clubs, each of which drew together the climbers who dwelt in the same country. The first was the English Alpine Club (founded in the winter of 1857–1858), followed in 1862 by the Austrian Alpine Club (which in 1873 was fused, under the name of the German and Austrian Alpine Club, with the German Alpine Club, founded in 1869), in 1863 by the Italian and Swiss Alpine Clubs, and in 1874 by the French Alpine Club, not to mention numerous minor societies of more local character. It was by the members of these clubs (and a few others) that the minute exploration (now all but complete)

of the High Alps was carried out, while much has been done in the way of building club huts, organizing and training guides, &c., to smooth the way for later comers, who benefit too by the detailed information published in the periodicals (the first dates from 1863 only) issued by these clubs. Limits of space forbid us to trace out in detail the history of the exploration of the High Alps, but the two sub-joined lists give the dates of the conquest of about fifty of the greater peaks (apart from the two climbed in 1358 and in 1492, see above), achieved before and after 1st January 1858. As a proof of the rapidly-growing activity of Englishmen, it may be pointed out that while before 1858 only four summits (the Mittelhorn, or central peak of the Wetterhörner, the highest point of Monte Rosa, Laquinhorn and Pelmo) were first ascended by Englishmen, in the case of the second list only five (Grand Combin, Wildspitze, Marmolata, Langkofel and Meije) were not so conquered (if the present writer, an American, be included among the English *pro hac vice*).

(1) Before 1st January 1858:—Titlis (1744), Ankogel (1762), Mont Vélan (1779), Mont Blanc (1786), Rheinwaldhorn (1789), Gross Glockner (1800), Ortler (1804), Jungfrau (1811), Finsteraarhorn (1812), Zumsteinspitze (1820), Tödi (1824), Altels (1834), Piz Linard (1835), Gross Venediger (1841), Signalkuppe (1842), Wetterhörner (1844–1845), Mont Pelvoux (1848), Diablerets and Piz Bernina (both in 1850), highest point of Monte Rosa (1855), Laquinhorn (1856) and Pelmo (1857).

(2) After 1st January 1858:—Dom (1858), Aletschhorn, Bietschhorn and Grand Combin (all in 1859), Grand Paradis and Grande Casse (both in 1860), Weisshorn, Monte Viso, Gross Schreckhorn, Lyskamm and Wildspitze (all in 1861), Dent Blanche, Monte della Disgrazia and Täschhorn (all in 1862), Marmolata, Presanella, Pointe des Ecrins and Zinal Rothhorn (all in 1864), Matterhorn, Ober Gabelhorn, Aiguille Verte and Piz Roseg (all in 1865), Langkofel (1869), Cimon della Pala (1870), Rosengarten (1872), Meije (1877), Aiguille du Dru (1878), Punta dell' Argentera (1879), Aiguille des Charmoz (1880), Aiguille de Grépon (1881) and Aiguille du Géant (1882).

9. General List of Books and Maps.—(1) *Books.*—For a longer list than we can give see John Ball's *Hints and Notes for Travellers in the Alps* (new ed., 1899) and also A. Wäber's *Landes- und Reisebeschreibungen der Schweiz* (1899, supplement in 1907). In general see J. Ball's *The Alpine Guide* (3 vols., new ed. of vol. i., 1898; last ed. of vol. ii., 1876, and of vol. iii., 1879); H. A. Berlepsch, *Die Alpen in Natur- und Lebensbildern* (last ed., 1885, Eng. trans., 1861); T. G. Bonney, *The Alpine Regions of Switzerland and the Neighbouring Countries* (1868); A. Civiale, *Les Alpes au point de vue de la géographie physique* (1882); Sir Martin Conway, *The Alps* (1904); W. A. B. Coolidge, *Swiss Travel and Swiss Guide-Books* (1889) and *The Alps* (1908); R. von Lendenfeld, *Aus den Alpen* (2 vols., 1896); C. Lenthéric, *L'Homme devant les Alpes* (1896); F. Umlauft, *Die Alpen* (1887, Eng. trans., 1889). On some special subjects see W. A. Baillie-Grohmann, *Sport in the Alps* (1896); A. Mossó, *Fisiologia dell' Uomo sulle Alpi* (1897, English trans., 1898); N. Zuntz and others, *Hohenklima und Bergwanderungen in ihrer Wirkungen auf den Menschen* (1906); G. Berndt, *Der Föhn* (1896, the south wind, so important in mountain districts); and the article on Glacier.

As to Alpine legends, consult Maria Savi-Lopez, *Leggende delle Alpi* (1889); M. Tscheinen, *Walliser-Sagen* (1872); Th. Vernaleken, *Alpensagen* (1858); and I. V. Zingerle, *Sagen aus Tirol* (1859); and as to Alpine poetry—J. Adam, *Der Natursinn in der deutschen Dichtung* (1906); E. A. Baker and F. E. Ross, *The Voice of the Mountains* (1905, an anthology in verse and prose); A. von Haller, *Die Alpen* (1732, best ed., 1882, illustrated ed., 1902); and H. E. Jenny, *Die Alpendichtung in der deutschen Schweiz* (1905).

As to Alpine dialects, consult J. Alton, *Die ladinischen Idiome in Ladinien, Gröden, Fassa, Buchenstein, Ampezzo* (1879); J. A. Chabrand and A. de Rochas d'Aiglun, *Patois des Alpes cottiennes* (1877); Z. and E. Pallioppi, *Dizionari dels Idioms Romauntschs d'Engiadina ota e bassa, &c.* (1895); A. Socin, *Schriftsprache und Dialekte im Deutschen* (1888); F. J. Stalder, *Die Landessprachen der Schweiz* (1819), and J. Zimmerli, *Die deutsch-französische Sprachgrenze in der Schweiz* (3 vols., 1891–1899); besides the great Swiss Dialect Dictionary (*Schweiz. Idiotikon*) in course of publication since 1881.

As to the history of the Alps, the following works touch on various aspects of the subject:—G. Allais, *Le Alpi Occidentali nell' Antichità* (1891); W. Brockedon, *Illustrations of the Passes of the Alps* (2 vols., 1828–1829); J. Grand-Carteret, *La Montagne à travers les ages* (2 vols., 1902–1904); G. Oberziner, *Le Guerre di Augusto contro i populi alpini* (1900); E. Oehlmann, *Die Alpenpässe im Mittelalter* (1878–1879); R. Reinhard, *Pässe und Strassen in den Schweizer Alpen* (1903); and L. Vaccarone, *Le Vie delle Alpi Occidentali negli antichi tempi* (1884); while W. A. B. Coolidge's *Josias Simler et les origines de l'alpinisme jusqu'en 1600* (1904) summarises our knowledge of the Alps up to 1600.

Among works of a more or less descriptive nature (based on actual travels), the following list includes all the standard works dated before 1855:—*Le Alpi che cingono l'Italia* (1845); J. G. Altmann, *Versuch einer hist. u. phys. Beschreibung der helvetischen Eisbergen* (1751); A. C. Bordier, *Voyage pittoresque aux glacières de Savoye* (1773); P. J. de Bourcet, *Mémoires militaires sur les frontières de la France, du Piémont, et de la Savoie* (1801); M. T. Bourrit, *Description des glacières, glaciers, et amas de glace du duché de Savoye* (1773, Eng. trans., 1775), *Description des Alpes pennines et rhétiennes* (2 vols., 1781, 3rd vol., 1785), and *Description des cols ou passages des Alpes* (2 vols., 1803); W. Brockedon, *Journals of Excursions in the Alps* (1833); U. Campell, *Raetiae alpestris topographica descriptio* (finished in 1572, but publ. only in 1884, with a supplement in 1900); J. A. Deluc and P. G. Dentan, *Relation de différents voyages dans les Alpes du Faucigny* (1776); E. Desor, *Excursions et séjours dans les glaciers* (2 series, 1844–1845); C. M. Engelhardt, *Naturschilderungen aus den höchsten Schweizer-Alpen* (1840), and *Das Monte-Rosa und Matterhorn-Gebirg* (1852); J. D. Forbes, *Travels through the Alps of Savoy* (1843, new ed., 1900); Sir John Forbes, *A Physician's Holiday* (1849); J. Fröbel, *Reise in die weniger bekannten Thäler auf der Nordseite der penninischen Alpen* (1840); G. Gnifetti, *Nozioni topografiche del Monte Rosa ed ascensioni su di esso* (1845, 2nd ed., 1858); G. S. Gruner, *Die Eisgebirge des Schweizerlandes* (3 vols., 1760); J. Hegetschweiler, *Reisen in den Gebirgsstock zwischen Glarus und Graubünden*, 1819–1822 (1825); G. Hoffmann, *Wanderungen in der Gletscherwelt* (1843); F. J. Hugi, *Naturhistorische Alpenreise* (1830); C. J. Latrobe, *The Alpenstock* (1829) and *The Pedestrian* (1832); J. R. and H. Meyer, *Reise auf den Jungfrau-Gletscher und Ersteigung seines Gipfels* (1811); De Montannel, *La Topographie militaire de la frontière des Alpes* (written in 1777, but publ. in 1875 only); *Opérations géodésiques et astronomiques pour la mesure d'un arc du parallèle moyen* (2 vols., 1825–1827); H. R. Rebmann, *Ein poëtisch Gastmal und Gespräch zweyer Bergen, nemlich des Niesens und Stockhorns* (1606); C. Rohrdorf, *Reise über die Grindelwald-Viescher-Gletscher und Ersteigung des Gletschers des Jungfrau-Berges* (1828); H. B. de Saussure, *Voyages dans les Alpes* (4 vols., 1779–1796); A. Schaubach, *Deutsche Alpen* (4 vols., 1845–1847); J. J. Scheuchzer, *Helvetiae Stoicheiographia, Orographia, et Oreographia* (1716), and *Itinera per Helvetiae alpinas regiones facta annis 1702–1711* (4 vols., 1723); J. Simler, *Vallesiae Descriptio et de Alpibus Commentarius* (1574, new ed. in 1904, see Coolidge above); Albert Smith, *The Story of Mont Blanc* (1853); G. Studer, *Topographische Mitteilungen aus dem Alpengebirge* (1843); R. Töpffer, *Voyages en zigzag* (2 series, 1844 and 1853); Aegid. Tschudi, *De priscâ ac verâ alpinâ Rhaetiâ* (1538, also in German, same date); and L. von Welden, *Der Monte Rosa* (1824).

As to works published after 1855 we can only give a short, though carefully selected, list. C. Aeby and others, *Das Hochgebirge von Grindelwald* (1865); W. A. Baillie-Grohmann, *Tyrol and the Tyrolese* (1876), and *Gaddings with a Primitive People* (2 vols., 1878); H. von Barth, *Aus den nördlichen Kalkalpen* (1874); L. Barth and L. Pfaundler, *Die Stubaiergebirgsgruppe* (1865); G. F. Browne, *Off the Mill* (1895); Mrs H. W. Cole, *A Lady's Tour round Monte Rosa* (1859); E. T. Coleman, *Scenes from the Snow Fields* (1859); Sir Martin Conway, *The Alps from End to End* (1895); A. Daudet, *Tartarin sur les Alpes* (1885, Eng. trans., same date); C. T. Dent, *Above the Snow Line* (1885); Miss A. B. Edwards, *Untrodden Peaks and Unfrequented Valleys* (1873, Dolomites); Max Förderreuther, *Die Allgäuer Alpen* (1906); D. W. Freshfield, *Across Country from Thonon to Trent* (1865), and *Italian Alps* (1875); Mrs Henry Freshfield, *Alpine Byways* (1861), and *A Summer Tour in the Grisons* (1862); H. B. George, *The Oberland and its Glaciers* (1866); J. Gilbert and G. C. Churchill, *The Dolomite Mountains* (1864); A. G. Girdlestone, *The High Alps without Guides* (1870); P. Grohmann, *Wanderungen in den Dolomiten* (1877); P. Güssfeldt, *In den Hochalpen* (1886), and *Der Montblanc* (1894); T. W. Hinchliff, *Summer Months among the Alps* (1857); C. Hudson and E. S. Kennedy, *Where there's a Will there's a Way* (1856); E. Javelle, *Souvenirs d' un Alpiniste* (1886, Eng. trans., 1899); S. W. King, *The Italian Valleys of the Pennine Alps* (1858); *Le Valli di Lanzo* (publ. by the Italian Alpine Club in 1899); A. Lorria and E. A. Martel, *Le Massif de la Bernina* (1894); J. Michelet, *La Montagne* (1868, Eng. trans., 1872); A. W. Moore, *The Alps in* 1864 (1867, publ. ed., 1902); A. F. Mummery, *My Climbs in the Alps* (1895); *Norman-Neruda, The Climbs of* (1899); *Peaks, Passes and Glaciers* (3 vols., 1859–1862); L. Purtscheller, *Über Fels und Firn* (1901); E. Rambert, *Ascensions et flâneries* (2 vols., 1888); G. Rey, *Il Monte Cervino* (1904); John Ruskin, vol. iv. (On Mountain Beauty) of *Modern Painters* (1856); A. von Ruthner, *Aus den Tauern* (1864) and *Aus Tirol* (1869); V. Sella and D. Vallino, *Monte Rosa e Gressoney* (1890); F. Simony, *Das Dachsteingebiet* (1889–1896); L. Sinigaglia, *Climbing Reminiscences of the Dolomites* (1896); K. von Sonklar, *Die Oetzthaler Gebirgsgruppe* (1860), and *Die Gebirgsgruppe der Hohen-Tauern* (1866); Sir L. Stephen, *The Playground of Europe* (1871); B. Studer, *Geschichte der physischen Geographie der Schweiz bis 1815* (1863);

G. Studer and others, *Berg- und Gletscherfahrten* (2 series, 1859 and 1863); G. Theobald, *Naturbilder aus den rhätischen Alpen* (1860), and *Das Bündner Oberland* (1861); F. F. Tuckett, *Hochalpenstudien* (2 vols., 1873–1874); Miss L. Tuckett, *How we Spent the Summer* (1864), *Pictures in Tyrol* (1867), and *Zigzagging amongst Dolomites* (1871); J. Tyndall, *The Glaciers of the Alps* (1860), *Mountaineering in 1861* (1862), and *Hours of Exercise in the Alps* (1871); J. J. Weilenmann, *Aus der Firnenwelt* (3 vols., 1872–1877); E. Whymper, *Scrambles amongst the Alps* (1871); Sir A. Wills, *Wanderings among the High Alps* (1856), and *The "Eagle's Nest" in the Valley of Sixt* (1860); G. Yeld, *Scrambles in the Eastern Graians* (1900); H. Zschokke, *Reise auf die Eisgebirge des Kantons Bern und Ersteigung ihrer höchsten Gipfel im Sommer von 1812* (1813); E. Zsigmondy, *Im Hochgebirge* (1889); M. Zurbriggen, *From the Alps to the Andes* (1899).

Many useful practical hints as to climbing are to be found in C. T. Dent and others, *Mountaineering* (1892, 3rd ed., 1900, "Badminton Library"); the *Manuel d'Alpinisme* (1904, publ. by the French Alpine Club); J. Meurer, *Handbuch der alpinen Sport* (1882), *Katechismus für Bergsteiger* (1892), and *Der Bergsteiger im Hochgebirge* (1893); and C. Wilson, *Mountaineering* (1893, "All England" series). As regards the dangers of Alpine climbing consult C. Fiorio and C. Ratti, *I Pericoli dell' Alpinismo* (1889), and E. Zsigmondy, *Die Gefahren der Alpen* (1885, Fr. trans., 1889). There are also special guide-books for the use of climbers in the Alps—the "Climbers' Guides" series, edited by Sir Martin Conway and W. A. B. Coolidge (10 vols., 1890–1904); W. A. B. Coolidge, H. Duhamel and F. Perrin, *Guide du Haut Dauphiné* (1887, with supplement in 1890, Eng. trans., 1892 and 1905); L. Purtscheller and H. Hess, *Der Hochtourist in den Ostalpen* (2 vols., 1894, 3 vols., 3rd ed., 1903); the 3 vols. publ. (1902–1905) by the Swiss Alpine Club under the name of *Clubführer* to the Alps of Glarus and Uri, and V. Wolf von Glanvell, *Dolomitenführer* (1898).

As regards the early history of Alpine exploration consult W. A. B. Coolidge, *Josias Simler et les origines de l'alpinisme jusqu'en 1600* (1904), and F. Gribble, *The Early Mountaineers* (1899). For the later period see, besides the more general works of travel mentioned above, the publications (that date from 1863) of the various Alpine Clubs—the *Alpine Journal* (English A. C.), the *Annuaire*, *Bulletin*, *La Montagne*, and *Revue alpine* (French A. C.), the *Jahrbuch*, *Mitteilungen*, *Verhandlungen*, and *Zeitschrift* (German and Austrian A. C.), the *Alpinista*, *Bollettino*, and *Rivista Mensile* (Italian A. C.), and the *Alpina*, *Écho des Alpes*, *Jahrbuch*, *Schweizer Alpen-Zeitung* (Swiss A. C.), besides those of the smaller societies, such as the *Österreichische Alpen-Zeitung* (Austrian A. C.), the *Annuaire* (Société des Touristes du Dauphiné), and the *Annuario* (Società degli Alpinisti Tridentini). Summaries of the Alpine history of the three great divisions of the Alps are given in (W. Alps) L. Vaccarone, *Statistica delle Prime Ascensioni nelle Alpi Occidentali* (3rd. ed., 1890—this work omits the Dauphiné Alps, as to which see the 1887 work or its Eng. version, 1905, mentioned above); (Central and Swiss Alps) G. Studer, *Über Eis und Schnee* (2nd ed. 3 vols., 1896–1899); and (E. Alps) G. Gröger and J. Rabl, *Die Entwickelung der Hochtouristik in den österreichischen Alpen* (1890), and E. Richter, *Die Erschliessung der Ostalpen* (3 vols., 1894). The detailed history of Mont Blanc has been written by Ch. Durier, *Le Mont Blanc* (1877, 4th ed., 1897), and C. E. Mathews, *The Annals of Mont Blanc* (1898). Lives of some of the most celebrated mountain guides have been written in C. D. Cunningham and W. de W. Abney, *Pioneers of the Alps* (2nd ed., 1888).

(2) *Maps.*—There is no good modern and fairly large-scale map of the entire chain of the Alps. But L. Ravenstein's maps (scale 1:250,000) of the Swiss Alps (2 sheets) and of the Eastern Alps (8 sheets) include the whole chain, save that portion south of the range of Mont Blanc.

All the countries which include Alpine districts have now issued official Government maps. The French map on a scale of 1:80,000 is clearer and more accurate than that on a scale of 1:100,000. The Italian Government has published maps on scales of 1:50,000 and 1:100,000, the Austrian on a scale of 1:75,000, and the Bavarian on a scale of 1:50,000. But the most splendid Government map of all is that put forth by the Swiss Federal Topographical Bureau, under the title of *Siegfried Atlas* (scale 1:50,000 for the Alpine districts), which has quite superseded the Dufour Map (scale 1:100,000), the history of which was published in 1896. For maps of the Swiss Alps and their neighbours, see J. H. Graf, *Literatur der Landesvermessung* (1896, with a supplement).

A few of the best special maps of certain districts may be mentioned—such as H. Duhamel's maps of the Dauphiné Alps (4 sheets on a scale of 1:100,000, 1889, 2nd ed., 1892), and that of the range of Mont Blanc (scale 1:50,000, 1896, 2nd ed., 1905), by X. Imfeld and L. Kurz. The German and Austrian Alpine Club is publishing a very fine set of maps (scale 1:50,000) of the Eastern Alps, which are clearer and better than the Austrian Government's *Topographische Detailkarten* (11 sheets, scale 1:50,000).

(W. A. B. C.)

10. *Geology.*—The Alps form but a small portion of a great zone of crumpling which stretches, in a series of curves, from the Atlas Mountains to the Himalayas. Within this zone the crust of the earth has been ridged up into a complex system of creases or folds, out of which the great mountain chains of southern Europe and Asia have been carved by atmospheric agencies. Superficially, the continuity of the zone is broken at intervals by gaps of greater or less extent; but these are due, in part at least, to the subsidence of portions of the folded belt and their subsequent burial by more recent accumulations. Such a gap is that between the Alps and the Carpathians, but a glance at a geological map of the region will show that the folding was probably at one time continuous. Leaving, however, the larger question of the connexion between the great mountain ranges of Europe and Asia, we find that the Alps are formed of a series of wrinkles or folds, one behind another, frequently arranged *en échelon*. The folds run, in general, in the direction of the chain, and together they form an arc around the plain of Lombardy and Piedmont. Outside this arc lies a depression along which the waters of the upper Danube and the lower Rhone find their way towards the sea; and beyond rise the ancient crystalline masses of Bohemia, the Black Forest and the central plateau of France, together with the intervening Mesozoic beds of southern Germany and the Jura. The depression is filled by Miocene and later beds, which for the most part lie flat and undisturbed as they were laid down. Beyond the depression also, excepting in the Jura Mountains, there is no sign of the folding which has raised the Alpine chain. Some of the older beds indeed are crumpled, but the folding is altogether different in age and in direction from that of the Alps.

To assist in forming a clear idea of the relations of the Alps to the surrounding regions, a simple illustration will suffice. Upon a table covered by a cloth lay two books in the relative positions shown in figure. The book A represents the central plateau of France and the book B represents the rocks of Bohemia and southern Germany. If the two hands be placed flat upon the table, in the angle between the two books, and the cloth pushed towards the corner, it will at once be rucked up into a fold which will follow a curve not unlike that of the Alps. The precise character and form of the folds produced will depend upon the nature of the cloth and other accidental circumstances; but with a little adjustment not only a representation of the chain of the Alps, but even a subsidiary fold in front in the position of the Jura Mountains may be obtained. Imperfect though this illustration may be, it will serve to explain the modern conception of the forces concerned in the formation of the Alps. Within the crust of the earth, whether by the contraction of the interior or in any other way, tangential pressures were set up. Since the crust is not of uniform strength throughout, only the weaker portions yielded to the pressure; and these were crumpled up against the more resisting portions and sometimes were pushed over them. In the case of the Alps it seems natural enough that the crystalline masses of Bohemia, the Black Forest and the central plateau of France should be firmer than the more modern sedimentary deposits; but it is not so easy to understand why the Mesozoic rocks of southern Germany resisted the folding, while those of the Jura yielded. It should, however, be borne in mind that the resisting mass is not necessarily at the surface. Such is in outline the process by which the Alps were elevated; but when the chain is examined in detail, it is found that its history has not been uniform throughout; and it will be convenient, for purposes of description, to divide it into three portions, which may be called the Eastern Alps, the Swiss Alps, and the Western Alps.

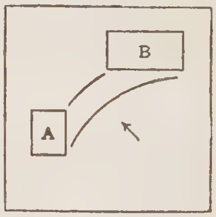


Fig. 1.—Looking down on the table.

Eastern Alps

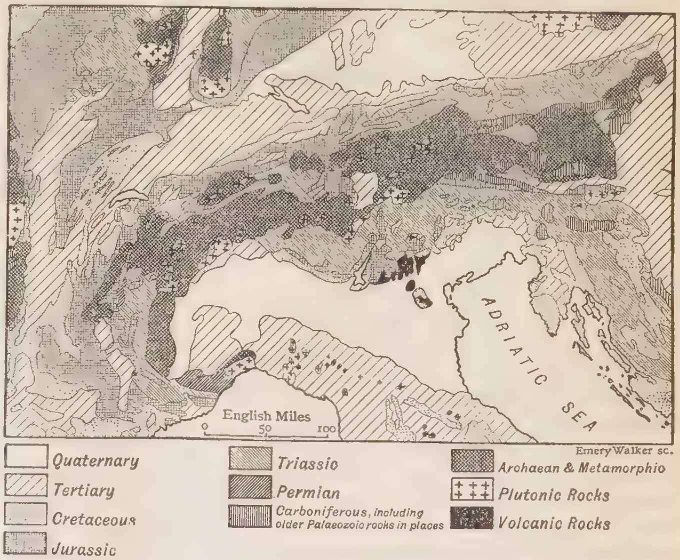
The Eastern Alps consist of a central mass of crystalline and schistose rocks flanked on each side by a zone of Mesozoic beds and on the north by an outer band of Tertiary deposits. On the Italian side there is usually no zone of folded Tertiaries and the Mesozoic band forms the southern border of the chain. Each of these zones is folded within itself, and the folding is more intense on the Bavarian side than on the Italian, the folds often leaning over towards the north. The Tertiary zone of the northern border is of especial significance and is remarkable for its extent and uniformity. It is divided longitudinally into an outer zone of *Molasse* and an inner zone of *Flysch*. The line of separation is very clearly defined; nowhere does the Molasse pass beyond it to the south and nowhere does the Flysch extend beyond it to the north. The Molasse, in the neighbourhood of the mountains, consists chiefly of conglomerates and sandstones, and the Flysch consists of sandstones and shales; but the Molasse is of Miocene and Oligocene age, while the Flysch is mainly Eocene. The relations of the two series are never normal. Along the line of contact, which is often a fault, the oldest beds of the Molasse crop out, and they are invariably overturned and plunge beneath the Flysch. A few miles farther north these same beds rise again to the surface at the summit of an anticlinal which runs parallel to the chain. Beyond this point all signs of folding gradually cease and the beds lie flat and undisturbed.

The Flysch is an extraordinarily thick and uniform mass of sandstones and shales with scarcely any fossils excepting fucoids. It is intensely folded and is constantly separated from the Mesozoic zone by a fault. Throughout the whole extent of the Eastern Alps it is strictly limited to the belt between this fault and the marginal zone of Molasse. Eocene beds, indeed, penetrate farther within the chain, but these are limestones with nummulites or lignite-bearing shales and have nothing in common with the Flysch. But although the Flysch is so uniform in character, and although it forms so well-defined a zone, it is not everywhere of the same age. In the west it seems to be entirely Eocene, but towards the east intercalated beds with *Inoceramus*, &c., indicate that it is partly of Cretaceous age. It is, in fact, a facies and nothing more. The most probable explanation is that the Flysch consists of the detritus washed down from the hills upon the flanks of which it was formed. It bears, indeed, very much the same relation to the Alps that the Siwalik beds of India bear to the Himalayas.

The Mesozoic belt of the Bavarian and Austrian Alps consists mainly of the Trias, Jurassic and Cretaceous beds playing a comparatively subordinate part. But between the Trias of the Eastern Alps and the Trias of the region beyond the Alpine folds there is a striking contrast. North of the Danube, in Germany as in England, red sandstones, shales and conglomerates predominate, together with beds of gypsum and salt. It was a continental formation, such as is now being formed within the desert belt of the globe. Only the Muschelkalk, which does not reach so far as England, and the uppermost beds, the Rhaetic, contain fossils in any abundance. The Trias of the Eastern Alps, on the other hand, consists chiefly of great masses of limestone with an abundant fauna, and is clearly of marine origin. The Jurassic and Cretaceous beds also differ, though in a less degree, from those of northern Europe. They consist largely of limestone; but marls and sandstones are by no means rare, and there are considerable gaps in the succession indicating that the region was not continuously beneath the sea. Tithonian fossils, characteristic of southern Europe, occur in the upper Jurassic, while the Gosau beds, belonging to the upper Cretaceous, contain many of the forms of the Hippuritic sea. Nevertheless, the difference between the deposits on the two sides of the chain shows that the central ridge was dry land during at least a part of the period.

The central zone of crystalline rock consists chiefly of gneisses and schists, but folded within it is a band of Palaeozoic rocks which divides it longitudinally into two parts. Palaeozoic beds also occur along the northern and southern margins of the crystalline zone. The age of a great part of the Palaeozoic belts is somewhat uncertain, but Permian, Carboniferous, Devonian and Silurian fossils have been found in various parts of the chain, and it is not unlikely that even the Cambrian may be represented.

The Mesozoic belt of the southern border of the chain extends from Lago Maggiore eastwards. Jurassic and Cretaceous beds play a larger part than on the northern border, but the Trias still predominates. On the west the belt is narrow, but towards the east it gradually widens, and north of Lago di Garda its northern boundary is suddenly deflected to the north and the zone spreads out so as to include the whole of the Dolomite mountains of Tirol. The sudden widening is due to the great Judicaria fault, which runs from Lago d'Idro to the neighbourhood of Meran, where it bends round to the east. The throw of this fault may be as much as 2000 metres, and the drop is on its south-east side, *i.e.* towards the Adriatic. It is probable, indeed, that the fault took a large share in the formation of the Adriatic depression. On the whole, the Mesozoic beds of the southern border of the Alps point to a deeper and less troubled sea than those of the north. Clastic sediments are less abundant and there are fewer breaks in the succession. The folding, moreover, is less intense; but in the Dolomites of Tirol there are great outbursts of igneous rock, and faulting has occurred on an extensive scale.

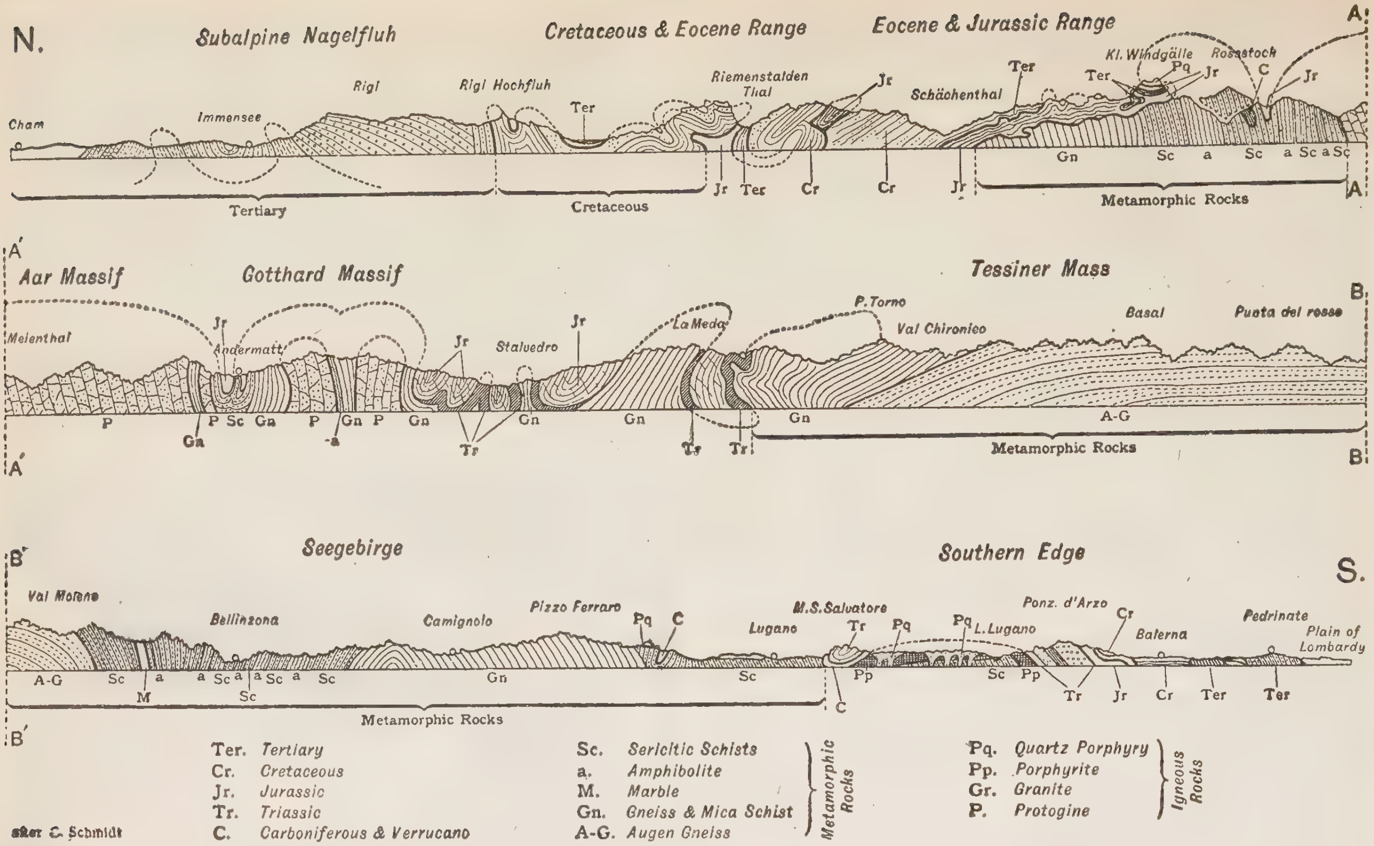


Emery Walker sc.

Swiss Alps.

West of a line which runs from Lake Constance to Lago Maggiore the zones already described do not continue with the same simplicity. The zone of the Molasse is little changed, but the Flysch is partly folded in the Mesozoic belt and no longer forms an absolutely independent band. The Trias has almost disappeared, and what remains is not of the marine type characteristic of the Eastern Alps but belongs rather to the continental facies which occurs in Germany and France. Jurassic and Cretaceous beds form the greater part of the Mesozoic band. On the southern side of the chain the Mesozoic zone disappears entirely a little west of Lago Maggiore and the crystalline rocks rise directly from the plain.

Perhaps the strangest problem in the whole of Switzerland is that presented by the so-called *Klippen*. Within the Alps, when normally developed, we may trace the individual folds for long distances and observe how they arise, increase and die out, to be replaced by others of similar direction. But at times, within or on the border of the northern Eocene trough, the continuity of the folds is suddenly broken by mountain masses of quite different constitution. These are the Klippen, and they are especially important in the Chablais and between the Lakes of Geneva and Thun. Not only is the folding of the Klippen wholly independent of that of the zone in which they lie, but the rocks which form them are of foreign facies. They consist chiefly of Jurassic and Triassic beds, but it is the Trias and the Jura of the Eastern Alps and not of Switzerland. Moreover, although they interrupt the folding of the zone in which they occur, they do not disturb it: they do not, in fact, rise through the zone, but lie upon it like unconformable masses—in other words, they rest upon a thrust-plane. Whence they have come into their present position is by no means clear; but the character of the beds which form them indicates a distant origin. It is interesting to note, in this


N.
Subalpine Nagelfluh
Cretaceous & Eocene Range
Eocene & Jurassic Range
A
Cham
Immensee
Rigi
Rigi Hochfluh
Ter
Riemenstalden Thal
Jr
Schächenthal
Ter
Kl. Windgälle
Rossstock
Pq
C
Gn
Sc
a
Jr
Tec
Cr
Tertiary
Cretaceous
Metamorphic Rocks
A'
Aar Massif
Gotthard Massif
Tessiner Mass
Melenthal
Andermatt
Staluedro
La Meda
P. Torno
Val Chironico
Basal
Punta del rosso
B
P
Ga
Tr
A-G
Seegebirge
Southern Edge
S.
Val Morene
Bellinzona
Camignolo
Pizzo Ferraro
M.S. Salvatore
Lugano
L. Lugano
Ponz. d'Arzo
Balerna
Pedrinate
Plain of Lombardy
M
Pp
Ter. Tertiary
Cr. Cretaceous
Jr. Jurassic
Tr. Triassic
C. Carboniferous & Verrucano
Sc. Sericitic Schists
a. Amphibolite
M. Marble
Gn. Gneiss & Mica Schist
A-G. Augen Gneiss
Metamorphic Rocks
Pq. Quartz Porphyry
Pp. Porphyrite
Gr. Granite
P. Protogine
Igneous Rocks

after C. Schmidt

connexion, that the pebbles of the Swiss Molasse are not generally such as would be derived from the neighbouring mountains, but resemble the rocks of the Eastern Alps. The Klippen are, no doubt, the remains of a much larger mass brought into the region upon a thrust-plane, and much of the Molasse has been derived from its destruction. Although the explanation here given of the origin of the Swiss Klippen is that which now is usually accepted, it should be mentioned that other theories have been proposed to account for their peculiarities.

Western Alps.

In the Western Alps the outer border of Molasse persists; but it no longer forms so well-defined a zone, and strips are infolded amongst the older rocks. The Eocene has altogether lost its independence as a band and occurs only in patches within the Mesozoic zone. The latter, on the other hand, assumes a greater importance and forms nearly the whole of the subalpine ranges. It consists almost entirely of Jurassic and Cretaceous beds, the Trias in these outer ranges being of very limited extent. The main chain is formed chiefly of crystalline and schistose rocks, which on the Italian side rise directly from the plain without any intervening zone of Mesozoic beds. But it is divided longitudinally by a well-marked belt of stratified deposits, known as the zone of the Briançonnais, composed chiefly of Carboniferous, Triassic and Jurassic beds. The origin of the schistose rocks has long been under discussion, and controversy has centred more particularly around the *schistes lustrés*, which are held by some to be of Triassic age and by others to be pre-Carboniferous and even, perhaps, Archaean. Partly in consequence of the uncertainty as to the age of these and other rocks, there is considerable difference of opinion as to the structure of the Western Alps. According to the view most widely accepted in France the main chain as a whole forms a fan, the folds on the eastern side leaning towards Italy and those on the western side towards France. The zone of the Briançonnais lies in the middle of the fan.

Asymmetry of the Alps.

From the above account it will at once appear that between the convex and the concave margins of the Alpine chain there is a striking difference. Upon the outer side of the arc the central zone of crystalline rocks is flanked by Mesozoic and Tertiary belts; towards the west, indeed, the individuality of these belts is lost, to a large extent, but the rocks remain. Upon the inner side the Tertiary band is found only in the eastern part of the chain, while towards the west, first the Tertiary and then the Mesozoic band disappears against the modern deposits of the low land. The appearance is strongly suggestive of faulting; and probably the southern margin of the chain lies buried beneath the plain of northern Italy.

Age of the Alps.

The chain of the Alps was not raised by a single movement nor in a single geological period. Its growth was gradual and has not been uniform throughout. In the Eastern Alps the central ridge seems to have been in existence at least as early as Triassic times, but it has since been subject to several oscillations. The most conspicuous folding, that of the Mesozoic and Tertiary belts, must have occurred in Tertiary times, and it was not completed till the Miocene period. The structure of the zones in the Bavarian Alps seems to suggest that the chain grew outwards in successive stages, each stage being marked by the formation of a boundary fault. A precisely similar structure is seen in the Himalayas.

Authorities.—The literature is very extensive. The following list includes a few selected works on each portion of the chain:—F. Frech, "Die karnischen Alpen," *Abh. naturf. Ges. Halle*, vol. xviii. (1892 and 1894); A. Rothpletz, *Ein geologischer Querschnitt durch die Ost-Alpen* (Stuttgart, 1894); C. Diener, "Bau und Bild der Ostalpen und des Karstgebietes," in *Bau und Bild Österreichs* (Vienna and Leipzig, 1903); *Livret-guide géologique dans le Jura et les Alpes de la Suisse* (Paris and Lausanne, 1894); A. Heim, *Mechanismus der Gebirgsbildung* (Basel, 1878); D. Zaccagna, "Riassunto di osservazioni geologiche fatte sul versante occidentale delle Alpi Graie," *Boll. R. Com. Geol. Ital.* vol. xxiii. (1892), pp. 175-244; C. Diener, *Der Gebirgsbau der West-Alpen* (1894); M. Bertrand, "Études dans les Alpes françaises," *Bull. Soc. Géol. France*, ser. 3, vol. xxii (1894), pp. 69-162; S. Franchi, "Sull' età mesozoica della zona delle pietri verdi nelle Alpi Occidentali," *Boll. R. Geol. Ital.* vol. xxix. (1898), pp. 173-247, 325-482, pts. v.-ix. For the broader question of the relation of the Alps to other regions, E. Suess, *Das Antlitz der Erde* (Vienna, 1885) (English translation, Oxford, 1904) should be consulted. The *Geologischer Führer durch die Alpen*, published by Borntraeger, Berlin, are handy guides. (P. La.)

11. *Flora.*—The Alps owe the richness and beauty of their plant life partly to their position as the natural boundary between the

"Baltic" flora on the north and the "Mediterranean" flora on the south, but chiefly to the presence on their heights of a third flora which has but little in common with either of the others. The stronghold of this last, the distinctively "Alpine" flora, is the region above the tree-limit. Its closest relationship is with the flora of the Pyrenees; but an alpine flora is characteristic of all the lofty mountains of central Europe. According to J. Ball, 2010 well-marked species of flowering plants occur within the limits of the Alps. If now we confine our attention to the alpine and higher regions of the Alps and exclude from our list all those plants which, however abundant in these regions, are not less so in the adjacent lowlands, we have left some 700 species (693, according to Dr Christ). We must observe, as regards the plants of the lower alpine region, that it is the actual presence of a forest vegetation, rather than the theoretical tree-limit, which affects their vertical distribution; so that, *e.g.* they overflow into the extensive clearings made by man in the primeval mountain forests. Indeed, an analysis of the composition of the alpine flora as a whole leads to the conclusion that the chief bond of union between its members consists in the treeless character of their habitat.

We may broadly distinguish two main geographical elements in the alpine flora, namely, the northern element and the endemic element. This division (which is not, however, strictly exhaustive) directs special attention to what is undoubtedly the most striking feature of the flora—namely, that of its 693 species no less than 271 reappear in the extreme north. This relation of the arctic to the alpine flora is all the more remarkable in view of the very important differences between the arctic and alpine climates. The following circumpolar species are common, and widely diffused throughout the whole of the Alps: *Silene acaulis*, *Dryas octopetala*, *Saxifraga oppositifolia*, *S. aizoides*, *S. stellaris*, *Erigeron alpinus*, *Azalea procumbens*, *Myosotis alpestris*, *Polygonum viviparum*, *Salix retusa*, *S. herbacea*, *Phleum alpinum*, *Juniperus nana*. The proportion of northern forms, as regards both species and individuals, increases as we ascend to the higher regions. In the highest vegetation-zone, the snow-region—*i.e.* on islands of rock above the snow-line—they attain to an equality with the endemic forms. As examples of northern flowers which are characteristic of the snow-region, we may mention *Silene acaulis*, *Eritrichium nanum* and *Arenaria ciliata*. On the other hand, typical endemic species of this highest zone are *Androsace helvetica*, *A. glacialis*, *Petrocallis pyrenaica* and *Cherleria sedoides*. All the plants just named, we may observe, are "cushion-plants." Their compact, moss-like growth and general structural peculiarities are not an expression of mutual affinity, but are in adaptation to the combined cold and dryness of their habitat. It is noteworthy that among the northern plants of the alpine zone, in the narrower sense of the term (*i.e.* of the region between the tree-limit and the snow-line), there is a marked predominance of species that affect moist localities; and conversely, the majority of alpine flowers of wet habitat are found also in the north. For example, in the genus *Primula*, a highly characteristic genus of the alpine flora, whose members are among the most striking ornaments of the rocks, the single northern species, *P. farinosa*, grows only in marshy meadows. On the whole, then, adaptation to cold and wet is the note of the northern element.

As for the explanation of the community between the alpine and arctic floras, all authorities are agreed that the key to the problem is furnished by the occurrence of the glacial period. In the ice-free belt, between the northern ice-sheet and the vastly extended glaciers of the Alps, the two floras must have found a common refuge and congenial conditions of existence; and this view is confirmed by direct palaeontological evidence. With the return of a milder climate, the so-called northern forms of the present alpine flora were split in two, one portion following close on the northern ice in its gradual retreat to the Arctic, the other following the shrinking glaciers till the plants were able to establish (or re-establish) themselves on the slopes of the Alps. The same explanation covers the case of the similarity of the flora (not merely as regards the northern element) on all the high mountains of central Europe. So much seems to be beyond reasonable doubt. But at this point disagreement begins between the most eminent writers on the subject. While some (*e.g.* Sir J. D. Hooker, Heer) regard the Arctic, and some (*e.g.* Wettstein) the Alps, as the original home of at least the bulk of the "northern" element, others (*e.g.* Ball, Christ) locate this in the highlands of temperate Asia. For it is a remarkable fact that, of the 230 northern species which are most typical of the far north, 182 are found also in the Altai (taking this as a collective name for the mountains that form the southern boundary of Siberia). In any case, however, the migration of these plants to the Alps must for the most part have taken place *via* the Arctic. The possibility of any extensive east to west migration having taken place direct from the Altai to the Alps seems excluded by the fact that 50% of the arctico-altaic alpine plants are absent from the Caucasus. A score of species, it is true—not such a number, be it observed, as was formerly supposed—are common to the Alps and Altai, but absent from the Arctic. But the species composing this Altaic element are not so numerous as the arctico-alpine species that are absent from the Altai. On the whole, a common origin in the north for at least the arctico-altaic group of alpine plants seems to be the most reasonable hypothesis.

Side by side with the northern element (which in some respects, we may observe to point the contrast, would be better named the tundra-element) we find a group of species usually spoken of as the xerothermic or meridional element. These do not, however, form an "element," in the strict geographical sense in which this term is otherwise used here. They are those species which, on general phyto-geographical grounds, must be regarded as having originated under steppe-like conditions. Their affinities are chiefly, though not exclusively, with the present Mediterranean flora—about fifty are of presumably Mediterranean origin—and a large proportion of them are restricted to the southern slopes of the Alps. The following, however, among others, are distributed throughout the whole, or a great part, of the range: *Colchicum alpinum*, *Crocus vernus*, *Orchis globosa*, *Petrocallis pyrenaica*, *Astragalus depressus*, *A. aristatus*, *Oxytropis Halleri*, *Eryngium alpinum*, *Erica carnea*, *Linaria alpina*, *Globularia nudicaulis*, *G. cordifolia*, *Leontopodium alpinum*. The last named (the well-known "edelweiss") is at the present day characteristic of the Siberian steppes. The presence of these plants among the alpine flora is traceable to the steppe-like conditions which prevailed in central Europe both during the warmer inter-glacial periods and (probably) for a time after the close of the ice-age. Subsequently, as the climate of the plains assumed a colder and more humid character, they retired before the invading forests to the high mountains. Here, in the intenser insolation which they enjoy on the alpine slopes, they seem to find a compensation for the drawbacks incidental to the altitude of their present station.

As regards now the endemic element as a whole, the question as to the time and place of its origin is of a highly complicated and controversial nature. The question, too, in the case of this element, is necessarily of genetic rather than purely geographical scope. It must suffice to say that the weight of scientific opinion inclines to the view that at least the majority of endemic species are of pre-glacial origin, and are either strictly indigenous or products of the neighbouring lowlands. About 40% of the endemic element in the alpine flora are endemic also in the narrower sense, *i.e.* they are confined to the Alps. Many of them are restricted to some one small portion of the chain; these occur chiefly in the southern and eastern Alps. It is an interesting fact that the centrally situated Bernese Alps produce hardly a single peculiar species. The greater richness of certain districts in the matter of species is partly due to the variety of soils encountered therein; but in part may be explained by the fact that these districts were the first to be freed from the ice-sheet at the end of the glacial period.

The following is a list of the most thoroughly characteristic alpine plants—all of them *ipso facto* members of the endemic element—which are at once peculiar to the Alps (or practically so) and widely distributed within the limits of the chain. These are: *Festuca pulchella, Carex microstyla, Salix caesia, Rumex nivalis, Alsine aretioides, Aquilegia alpina, Thlaspi rotundifolium, Saxifraga Seguieri, S. aphylla, Astragalus leontinus, Daphne striata, Eryngium alpinum, Bupleurum stellatum, Androsace helvetica, A. glacialis, Gentiana bavarica, Phyteuma humile, Campanula thyrsoidea, C. cenisia, Achillea atrata, Cirsium spinosissimum, Crepis Terglouensis.*

AUTHORITIES.—Among the voluminous literature on alpine flora, the following works are particularly noteworthy:—Ball, "On the Origin of the Flora of the European Alps," in *Proceed. of the Roy. Geog. Soc.*, 1879; Bennett, *The Flora of the Alps*, 2 vols. with 120 coloured plates (1896); Briquet, "Les Colonies végétales xérothermiques des alpes lémaniennes," in *Bull. d. l. Murithienne, soc. valaisienne des sciences nat.*, xxvii. and xxviii. (1898–1899); Alph. de Candolle, "Sur les causes de l'inégale distribution des plantes rares dans la chaîne des Alpes," *Extr. des Actes du Congrès botan. internat. de Florence* (1875); Chodat u. Pampanini, "Sur la distribution des plantes des alpes austro-orientales," *Extr. du Globe, organe de la soc. de géographie de Genève*, tome xli. (1902); H. Christ, *Das Pflanzenleben der Schweiz* (1882)—the chief classic on the subject; Engler, *Die Pflanzenformationen und die pflanzengeographische Gliederung der Alpenkette* (1901); Heer, *Ueber die nivale Flora der Schweiz* (1885); Jerosch, *Geschichte und Herkunft der schweizerischen Alpenflora; eine Übersicht über den gegenwärtigen Stand der Frage* (1903); Schröter, *Das Pflanzenleben der Alpen* (Zürich, 1908); R. von Wettstein, *Die Geschichte unserer Alpenflora* (1896). The best book of coloured plates is the *Atlas der Alpenflora*, in 5 vols., pub. by the Deutscher u. Oesterreichischer Alpenverein (2nd. ed., 1897).

12. *Fauna.*—The fauna of the lower zones in the Alps is, on the northern side of the chain, practically identical with that of central Europe, and on the southern side with that of the Mediterranean basin. But in the higher regions it presents many features of special interest alike to the zoologist and the traveller. It seems therefore best to treat here principally of the animal inhabitants of the high Alps.

Though among mammalia—as also in the case of the birds—there are but few forms peculiar to the Alps, many interesting animals have found in the high mountains at least a temporary refuge from man. The European bison, the urus, the elk and the wild swine have disappeared since Roman times. But the lynx (*Lynx vulgaris*) perhaps lingers in remote parts, and the brown bear (*Ursus arctos*) still survives in the dense forests of the Lower Engadine. The fox (*Canis vulpes*), the stonemarten (*Martes foina*) and the stoat or ermine (*Putorius erminea*) range in summer above the tree-limit. The Ungulata are represented by the chamois (*Rupicapra tragus*) and the bouquetin or steinbock (*Capra ibex*). The former—the sole representative, in western Europe, of the antelopes—is found elsewhere only in the Pyrenees, Carpathians, Caucasus and the mountains of eastern Turkey; the latter survives only in the eastern Graian Alps. Of the Rodentia the most interesting and conspicuous is the marmot (*Arctomys marmota*), which lives in colonies close to the snow-line. The snow-mouse (*Arvicola nivalis*) is confined to the alpine and snow regions, and is abundant at these levels throughout the whole chain of the Alps. The mountain hare (*Lepus variabilis* or *timidus*) replaces the common hare (*Lepus europaeus*) in the higher regions; though absent from the intervening plains it again appears in the north of Europe and in Scotland. Among the Insectivora, the alpine shrew (*Sorex alpinus*) is restricted to the Alps. Of the Cheiroptera (bats) only *Vesperugo maurus* is characteristically alpine.

The birds of the Alps are proportionately very numerous. The lammergeyer (*Gypaetus barbatus*), once common, is now extremely rare, even if it has not already become extinct in the Alps; but the golden eagle (*Aquila chrysaetos*) still holds its own. Some of the smaller birds of prey are not uncommon, but there is none that can be regarded as specially characteristic either of the Alps as a whole or of the alpine region. As characteristic birds of the snow-region may be mentioned the alpine chough (*Pyrrhocorax alpinus*), which is frequently seen at the summits even of the loftiest mountains, the alpine swift (*Cypselus melba*), the wall-creeper (*Tichodroma muraria*), snow-finch (*Montifringilla nivalis*) and ptarmigan (*Lagopus mutus*); the geographical distribution of this last being similar to that of the mountain hare. The black redstart (*Ruticilla titys*), though common in the lower regions, is also met with in fair numbers almost up to the snow-line. The raven (*Corvus corax*) is fairly common in the alpine and sub-alpine regions. On the highest pastures we find, further, the alpine accentor (*Accentor collaris*) and the alpine pipit (*Anthus spipoletta*). The crag-martin (*Cotyle rupestris*) haunts lofty cliffs in the alpine region. On the upper verge of the pine forests, or in the scrubby vegetation just beyond, the following are not uncommon—black woodpecker (*Picus martius*), ring-ousel (*Turdus torquatus*), Bonelli's warbler (*Phylloscopus Bonellii*), crested tit (*Parus cristatus*), citril finch (*Citrinella alpina*), siskin (*Chrysomitris spinus*), crossbill (*Loxia curvirostra*), nutcracker (*Nucifraga caryocatactes*), blackcock (*Tetrao tetrix*), and the alpine varieties of the marsh-tit (*Parus palustris, borealis*) and tree-creeper (*Certhia familiaris, costae*).

The remaining classes of Vertebrata are very sparsely represented in the high Alps; and what few species occur are mostly common to the plains as well. In fact, among the remaining land vertebrates, only the black salamander (*Salamandra atra*) is exclusively alpine. This interesting animal, though a member of the Amphibia, is terrestrial and viviparous.

The former connexion between the Arctic and the Alps, which has left such unmistakable traces in the present alpine flora, affords, as regards the fauna also, the only possible explanation of the present geographical distribution of many alpine forms; but it is chiefly among the Invertebrata that we find this collateral testimony to the influence of the glacial period. In this respect we may note that two small crustaceans, *Diaptomus bacillifer* and *D. denticornis*, swarm in the ice-cold waters of the highest alpine tarns throughout the entire chain; and the former of these is also a characteristic inhabitant of pools formed from melting snow in the extreme north. Among the remaining divisions of Invertebrata special mention may be made of the air-breathing Arthropoda—on the whole the most important and interesting group. About one-third of the animals belonging thereto that occur in the higher regions are exclusively alpine (or alpine and northern); these characteristically alpine forms being furnished chiefly by the spiders, beetles and butterflies. Most numerous are the beetles. Those of the highest zone are remarkable for the great predominance of predaceous species and of wingless forms. In this last respect they present a striking analogy with the endemic coleopterous fauna of oceanic islands. As for the butterflies, not more than one-third of the species found in the alpine region occur in the neighbouring lowlands. The relations between alpine butterflies and plants are especially interesting, as regards not only their bionomic interdependence but also the analogies of their geographical distribution. It should be noted that butterflies are the chief agents in securing the continued existence of such alpine flowers as depend on insect fertilization, the other insect fertilizers being mostly wanting at great heights.

The classic of alpine zoology is F. von Tschudi's *Das Tierleben der Alpenwelt* (11th ed., 1890). See also zoological section, by K. W. v. Dalla Torre, of *Anleitung zu wissenschaftlichen Beobachtungen auf Alpenreisen.* For the Vertebrata, see V. Fatio's *Faune des vertébrés de la Suisse* (5 vols., 1869–1904). *Die Tierwelt der Hochgebirgsseen*, by F. Zschokke (1900) is an important treatise on an interesting department of alpine natural history. C. Zeller's *Alpentiere im Wechsel der Zeit* (1892) gives a reliable account of the gradual disappearance of some of the larger forms of life from the Alps. For the inter-relations of alpine insects and flowers, see H. Müller's *Alpenblumen, ihre Befruchtung durch Insekten, und ihre Anpassung an dieselben* (1881). (H. V. K.)

ALPUJARRAS, or ALPUXARRAS, **THE** (Moorish *al Busherat*, "the grass-land"), a mountainous district of southern Spain, in the province of Granada, consisting principally of valleys which descend at right angles from the crest of the Sierra Nevada on the north, to the Sierras Almijara, Contraviesa and Gádor, which sever it from the Mediterranean Sea, on the south. These valleys are among the most beautiful and fertile in Spain. They contain a rich abundance of fruit trees, especially vines, oranges, lemons and figs, and in some parts present scenes of almost Alpine grandeur. The inhabitants are the descendants of the Moors, who, after the Spanish conquest of Granada in 1492, vainly sought to preserve the last relics of their independence in their mountain fastnesses. Many of the names of places in the

Alpujarras are of Moorish origin. The district contains many villages of 1000 to 4000 inhabitants, the four largest being Lanjaron, with its ruined castle and chalybeate baths, Orgiba, Trevelez and Ugijar; all situated at a considerable elevation. Trevelez, the highest, stands 5332 ft. above the sea.

'ALQAMA IBN 'ABADA, generally known as 'Alqama al-Fahl, an Arabian poet of the tribe Tamīm, who flourished in the second half of the 6th century. Of his life we know practically nothing except that his chief poem concerns an incident in the wars between the Lakhmids and the Ghassānids (see Arabia, *History*). Even the date of this is doubtful, but it is generally referred to the period after the middle of the 6th century. His poetic description of ostriches is said to have been famous among the Arabs. His diwān consists of three qasīdas (elegies) and eleven fragments. Asma' ī considered three of the poems genuine.

The poems were edited by A. Socin with Latin translation as *Die Gedichte des 'Alkama Alfahl* (Leipzig, 1867), and are contained in W. Ahlwardt's *The Diwans of the six ancient Arabic Poets* (Lond., 1870); cf. W. Ahlwardt's *Bemerkungen über die Aechtheit der alten arabischen Gedichte* (Greifswald, 1872), pp. 65-71 and 146-168. (G. W. T.)

ALQUIFOU (etymologically the same word as "alcohol"), a lead ore found in Cornwall, used by potters for its green glaze.

ALREDUS, Alured or Aluredus, **OF BEVERLEY,** was sacristan of the church of Beverley in the first half of the 12th century. He wrote, apparently about the year 1143, a chronicle entitled *Annales sive Historia de gestis regum Britanniae*, which begins with Brutus and carries the history of England down to 1129. This work was edited by T. Hearne (Oxford, 1716), and at one time enjoyed some reputation as an authority. It is, however, a mere compilation and of no value. Geoffrey of Monmouth and Simeon of Durham are Alured's chief sources. Among the Cottonian MSS. there is a collection of records relating to Beverley, *Libertates Ecclesiae S. Johannis de Beverlae,* which is attributed to Alured, but on no good authority. (H. W. C. D.)

ALSACE (Ger. *Elsass*), a former province of France, divided after the Revolution into the departments of Haut-Rhin and Bas-Rhin, and incorporated since the war of 1870 with the German empire (see Alsace-Lorraine). It is bounded on the north by the Rhenish Palatinate, on the east by the Rhine, on the south by Switzerland and on the west by the Vosges Mountains; and it comprises an area of 3344 English sq. m. The district possesses many natural attractions, and is one of the most fertile in central Europe. There are several ranges of hills, but no point within the province attains a great elevation. The only river of importance is the Ill, which falls into the Rhine after a course of more than 100 m., and is navigable below Colmar. The hills are generally richly wooded, chiefly with fir, beech and oak. The agricultural products are corn, flax, tobacco, grapes and various other fruits. The country has a great wealth of minerals, silver having been found, and copper, lead, iron, coal and rock-salt being wrought with profit. There are considerable manufactures, chiefly of cotton and linen. The chief towns are Mülhausen and Colmar in the upper district and Strassburg in the lower. The province is traversed from east to west by the railway from Strassburg to Nancy, and the main line north and south runs between Basel and Strassburg.

History.—From a very early period Alsace has been a disputed territory, and has suffered in the contentions of rival races. Inhabited by the Rauraci and the Sequani, it formed part of ancient Gaul, and was therefore included in the Roman empire in the provinces of Germania Superior and Maxima Sequanorum. The Romans held it nearly five hundred years, and on the dissolution of their power it passed under the sway of the Franks. In the Merovingian period it formed a duchy attached to the kingdom of Austrasia, and was governed by the descendants of duke Eticho, one of whom was St Odilia. After the death of Charlemagne, Alsace, like the rest of the empire, was divided into countships. But the duchy was re-established after the death of the German king Henry I., and became hereditary in the Hohenstaufen family, and then in the house of Austria, which succeeded in 1273 to the imperial dignity. In the beginning of the 12th century the country was divided between the two landgraviates of Upper and Lower Alsace, but to counteract the power of the nobles the emperors established in Alsace a great number of free towns. This state of things continued until 1648, when a large part of Alsace, comprising the two landgraviates of Upper and Lower Alsace and the prefecture of the ten free imperial towns, was ceded to France by the treaty of Westphalia. In the war which preceded this peace (generally known as the Thirty Years' War) Alsace had been so terribly devastated by the Swedes and the French that the German emperor found himself unable to hold it. The population was greatly reduced in numbers, and much of the land was left uncultivated. In the war between France and the Empire, arising out of the attempt of Louis XIV. to seize Holland, that part of Alsace which remained to Germany was again overrun by the French. Although this war was terminated in 1678 by the treaty of Nijmwegen, the French monarch was desirous of incorporating a still larger amount of Rhine territory; and accordingly in 1680 he laid claim to a number of territories, belonging to princes of the Empire, which he alleged had been dismembered from Alsace. It was ordered that these territories should be at once restored to that province under the crown of France, and several independent sovereigns were cited to appear before two chambers of inquiry, called *chambres de rêunion*, which Louis had established at Brisach and Metz. The princes appealed to the emperor and to the diet; but the previous wars had so exhausted the power of the former that nothing could be done to resist the aggression. In 1681 the French troops under Louvois seized Strassburg, aided by the treachery of the bishop and other great men of the city. A further war broke out, but by the treaty of Ratisbon (Regensburg) in 1684, Strassburg was secured to France. The war was renewed in 1688 and continued until 1697, when the peace of Ryswick confirmed definitively the annexation of Strassburg to France. Some remaining territories of small extent were acquired by the French after the revolution of 1789, including Mülhausen, which had been a republic allied to Switzerland.

Originally Celtic, the population was modified during the Roman period by the arrival of a Germanic people, the Triboci. In the 5th century came other German tribes, the Alamanni, and then the Franks, who drove the Alamanni into the south. Since that period the population has in the main been Teutonic; and the French conquests of the 17th century, while modifying this element, still left it predominant. The people continued to use a German dialect as their native tongue, though the educated classes also spoke French. Protestantism was professed by a large number of the inhabitants; and in many respects their characteristics identified them rather with the race to the east than that to the west of the Rhine. In process of time, however, they considered themselves French, and lost all desire for reannexation to any of the German states.

Alsace suffered a good deal in the war of 1870–71. The earlier battles of the campaign were fought there; Strassburg and other of its fortified towns were besieged and taken; and its people were compelled to submit to very severe exactions. The civil and military government of the province, as well as that of Lorraine, was assumed by the Germans as soon as they obtained possession of those parts of France, which was very shortly after the commencement of the war. The Alsatian railways were reorganized and provided with a staff of German officials. German stamps were introduced from Berlin; the occupied towns were garrisoned by the *Landwehr*; and requisitions on a large scale were demanded, and paid for in cheques which, at the close of the war, were to be honoured by whichever side should stand in the unpleasant position of the conquered. The people, notwithstanding their German origin, showed a very strong feeling against the invaders, and in no part of France was the enemy resisted with greater stubbornness. It was evident from an early period of the war, however, that Prussia was resolved to reannex Alsace to German territory. When the preliminaries of peace came to be discussed at Versailles in

February 1871, the cession of Alsace, together with what is called German Lorraine, was one of the earliest conditions laid down by Bismarck and accepted by Thiers. This sacrifice of territory was afterwards ratified by the National Assembly at Bordeaux, though not without a protest from the representatives of the departments about to be given up; and thus Alsace once more became German. By the bill for the incorporation of Alsace and German Lorraine, introduced into the German parliament in May 1871, it was provided that the sole and supreme control of the two provinces should be vested in the German emperor and the federal council until the 1st of January 1874, when the constitution of the German empire was established. Bismarck admitted the aversion of the population to Prussian rule, but said that everything would be done to conciliate the people. This policy appears really to have been carried out, and it was not long in bearing fruit. Many of the inhabitants of the conquered districts, however, still clung to the old connexion, and on the 30th of September 1872—the day by which the people were required to determine whether they would consider themselves German subjects and remain, or French subjects and transfer their domicile to France—45,000 elected to be still French, and sorrowfully took their departure. The German system of compulsory education of every child above the age of six was introduced directly after the annexation.

ALSACE-LORRAINE (Ger. *Elsass-Lothringen*), a German imperial territory (since 1871), consisting of the former French province Alsace (then divided into the departments of Haut-Rhin and Bas-Rhin), together with its capital Strassburg, and German Lorraine (which included the department of the Moselle and portions of the departments of Meurthe and Vosges), together with the capital and fortress of Metz. The imperial territory (*Reichsland*) is bounded S. by Switzerland; E. by Baden, from which it is separated by the Rhine; N.E. and N. by the Bavarian Palatinate, the Prussian Rhine Province and Luxemburg, and W. by France. Its area is 5601 sq. m. The maximum length from N. to S. is 145 m.; the maximum breadth E. to W. 105 m., and the minimum breadth, on a line drawn through Schlettstadt, 24 m. In respect of its physical features, Alsace-Lorraine falls into three parts—mountain land, plain and plateau. The first, practically co-extensive with the western half of Alsace, consists of the Vosges range, which running in a northerly direction from the deep gap or pass of Belfort (*trouée de Belfort*) forms in its highest ridges the natural frontier line between Germany and France. Between this mountain chain and its spurs, which fall steeply to the E., and the Rhine, stretches a fertile plain forming the eastern half of Alsace. In the N.W. a high and undulating plateau, which gently descends in the W. to the valley of the Moselle, occupies nearly the whole area of Lorraine. The drainage of the Vosges valleys and of the Rhine valley is collected and carried into the Rhine about 10 m. below Strassburg by the Ill, which has a course of more than 100 m. and is navigable below Colmar. With the exception of a few streams which run to the Rhone, all the waters of Alsace flow into the Rhine. The climate is on the whole temperate—warmest in the lowest districts (460 ft. above sea-level) of N. Alsace, and coldest on the summits of the Vosges, where snow lies six months in the year. The mean annual temperature at Strassburg is 49·8° F., at Metz 48·2°; the rainfall at Strassburg $26\frac{1}{4}$ in., and at Metz $27\frac{1}{2}$ in. The Rhine valley is in great part fertile, yielding good crops of potatoes, cereals (including maize), sugar beet, hops, tobacco, flax, hemp and products of oleaginous plants. But grapes and fruit are amongst the most valuable of the crops. The cereals chiefly grown are wheat, oats, barley and rye. Great quantities of hay are harvested. This description embraces also the production of Lorraine, where agriculture is less strenuously carried on, and the fertility of the soil is less. But Lorraine possesses, in compensation, greater riches *in* the earth, in coal and iron and salt mines. Cows are grazed on the S. Vosges in summer, and large quantities of cheese (Münster cheese) are made and exported. Total population (1905) 1,814,626.

The farms in Alsace are mostly small and are held partly as a private possession, partly on the communal system; in Lorraine there are some larger occupations. The manufacture of cottons, and on a smaller scale of woollens, is special to Alsace, the chief centres of the industry being Mülhausen, Colmar and the valleys of the Vosges. The territory has always been the centre of an active commerce, owing to its situation on the confines of Germany, France and Switzerland, and alongside the great highway of the Rhine. The communications embraced some 1249 m. of railway (1903), of which 1108 m. belonged to the state, a good system of roads, and several canals (notably the Rhine-Rhone, the Rhine-Marie and the Saar Canals), in addition to the rivers. Administratively the territory is divided into the following three districts, showing a density of population of about 316 to the sq. m.:—

Districts.	Area in sq. miles.	Population.	
		1885.	1905.
Upper Alsace . .	1354	462,549	512,709
Lower Alsace . .	1845	612,077	686,359
Lorraine . . .	2402	489,729	615,558

On the sex division, 935,305 were in 1905 males, and 879,321 females. The percentage of illegitimacy is about 7. The rural population embraces 51% of the whole, the urban population 48 %. The largest towns are Strassburg (the capital of the territory), Mülhausen, Metz, Colmar, all above 20,000 inhabitants each. Classified according to religion there were, in 1904, 372,078 Protestants, 1,310,391 Roman Catholics, and 32,379 Jews. Education is provided for at the university of Strassburg, in 21 classical and pro-classical schools, in 18 modern schools, and in nearly 4000 elementary schools. Over 85 % of the people speak German as their mother-tongue, the rest French, or a patois of French. The annual revenue and expenditure are each somewhat in excess of £3,000,000. Customs and indirect taxes yield more than three-fifths of the total revenue, and direct taxes less than one-fourth. The state forests give about one-ninth of the whole. The higher administration of justice is devolved upon six provincial courts and a supreme court, sitting at Colmar. Moreover, there are purely industrial tribunals at Mülhausen, Thann, Markirch, Strassburg and Metz. The fish-breeding establishment at Hüningen in Upper Alsace should be mentioned.

Constitution.—The sovereignty over the territory was by a law (*Reichsgesetz*) of the 9th of June 1871 vested in the German emperor, who, until the introduction of the imperial constitution on the 1st of January 1874, had, with the assent of the federal council (*Bundesrat*) and, in a few cases, that of the imperial diet (*Reichstag*), the sole right of initiating legislation. In October of this last year a committee (*Landesausschuss*) of the whole territory was appointed to deliberate on laws proposed to it before they received the final sanction of the emperor. On the 2nd of May 1877, the *Landesausschuss* was itself empowered to initiate legislation within the competence of the territory, and in 1879 the imperial viceroy (*Statthalter*), representing the imperial chancellor, who had until then been the responsible minister, took up his residence in Strassburg. He is assisted in the government by 4 ministers of departments, under the presidency of a secretary of state, and, when occasion demands the extraordinary discussion of legislative proposals, by a council of state (*Staatsrat*), consisting of the secretary of state, under secretaries, the president of the supreme court of justice of the territory and, as a rule, of 12 nominees of the emperor. The *Landesausschuss*, a constitutional body with parliamentary privileges, consists of 58 members, 34 being appointed out of their number by the various district councils (*Bezirkstage*), 4 by the large towns, and 20 by the rural districts. Alsace-Lorraine is represented in the Bundesrat by two commissioners, who have, however, but one voice; and the territory returns 15 members to the Reichstag.

See A. Schmidt, *Elsass und Lothringen* (Leip., 1859); Spach, *Histoire de la basse Alsace et de la ville de Strasbourg* (Stras., 1860); von Müllenheim Rechberg, *Die Annexion des Elsass durch*

Frankreich und Rückblick auf die Verwaltung des Landes, 1648–1697 (Stras., 1897); Du Prel, *Die deutsche Verwaltung in Elsass, 1870–1879* (Stras., 1879); L. Petersen, *Das Deutschtum in Elsass-Lothringen* (Munich, 1902). (P. A. A.)

ALSATIA (the old French province of Alsace), long a "debatable ground" between France and Germany, and hence a name applied in the 17th century to the district of Whitefriars, between the Thames and Fleet Street, in London, which afforded sanctuary (*q.v.*) to debtors and criminals. The privileges were abolished in 1697. The term is also used generally of any refuge for criminals.

ALSEN (Danish *Als*), an island in the Baltic, off the coast of Schleswig, in the Little Belt. It formerly belonged to Denmark, but, as a result of the Danish war of 1864, was incorporated with Germany. Its area is 105 sq. m.; the length nearly 20, and the breadth from 3 to 12 m. Pop. (1900) 25,000, most of whom speak Danish. The island is fertile, richly wooded, and yields grain and fruit. Sonderburg, the capital, with a good harbour and a considerable trade, is connected with the mainland by a pontoon bridge. Other places of note are Norburg and Augustenburg. On the peninsula Kekenis at the S.W. end of Alsen there is a lighthouse. Here, in 1848, the Danes directed their main attack against Field-marshal Wrangel's army. In 1864 the Prussians under Herwarth von Bittenfeld took Alsen, which was occupied by 9000 Danish troops under Steinmann, thus bringing the Danish war to a close. Since 1870 Alsen has been fortified.

'ALSHEKH, MOSES, Jewish rabbi in Safed (Palestine) in the later part of the 16th century. He was the author of many homiletical commentaries on the Hebrew Bible. His works still justly enjoy much popularity, largely because of their powerful influence as practical exhortations to virtuous life.

ALSIETINUS LACUS (mod. *Lago di Martignano*), a small lake in southern Etruria, 15 m. due N.N.W. of Rome, in an extinct crater. Augustus drew from it the Aqua Alsietina; the water was hardly fit to drink, and was mainly intended to supply his naumachia (lake made for a sham naval battle) at Rome, near S. Francesco a Ripa, on the right bank of the Tiber, where some traces of the aqueduct were perhaps found in 1720. The course of the aqueduct, which was mainly subterranean, is practically unknown: Frontinus tells us that it received a branch from the lake of Bracciano near Careiae (Galera): and an inscription relating to it was found in this district in 1887 (F. Barnabei, *Notizie degli Scavi*, 1887, 181).

ALSIUM (mod. *Palo*), an ancient town of Etruria, 29 m. W. by N. of Rome by rail, on the Via Aurelia, by which it is about 22 m. from Rome. It was one of the oldest cities of Etruria, but does not appear in history till the Roman colonization of 247 B.C., and was never of great importance, except as a resort of wealthy Romans, many of whom (Pompey, the Antonine emperors) had villas there. About 1½ m. N.E. of Palo is a row of large mounds called I Monteroni, which belong to tombs of the Etruscan cemetery. Considerable remains of ancient villas still exist along the low sandy coast, one of which, about 1 m. E. of Palo, occupies an area of some 400 by 250 yds. The medieval castle belongs to the Odescalchi family. Near Palo is the modern sea-bathing resort Ladispoli, founded by Prince Odescalchi.

See G. Dennis, *Cities and Cemeteries of Etruria*, i. 219.

ALSOP, VINCENT (*c.* 1630–1703), English Nonconformist divine, was of Northamptonshire origin and was educated at St John's College, Cambridge. He received deacon's orders from a bishop, whereupon he settled as assistant-master in the free school of Oakham, Rutland. He was reclaimed from indifferent courses and associates here by a very "painful" minister, the Rev. Benjamin King. Subsequently he married Mr King's daughter, and "becoming a convert to his principles, received ordination in the Presbyterian way, not being satisfied with that which he had from the bishop." He was presented to the living of Wilby in Northamptonshire; but was thence ejected under the act of Uniformity in 1662. After his ejection he preached privately at Oakham and Wellingborough, sharing the common pains and penalties of nonconformists,—*e.g.* he was imprisoned six months for praying with a sick person. A book against William Sherlock, dean of St Paul's, called *Antisozzo* (against Socinus), written in the vein of Andrew Marvell's *Rehearsal Transprosed*, procured him much celebrity as a wit. Dr Robert South, no friend to nonconformists, publicly pronounced that Alsop had the advantage of Sherlock in every way. Besides fame, *Antisozzo* procured for its author an invitation to succeed the venerable Thomas Cawton (the younger) as independent minister in Westminster. He accepted the call and drew great multitudes to his chapel. He published other books which showed a fecundity of wit, a playful strength of reasoning, and a provoking indomitableness of raillery. Even with Dr Goodman and Dr Stillingfleet for antagonists, he more than held his own. His *Mischief of Impositions* (1680) in answer to Stillingfleet's *Mischief of Separation*, and *Melius Inquirendum* (1679) in answer to Goodman's *Compassionate Inquiry*, remain historical landmarks in the history of nonconformity. Later on, from the entanglements of a son in alleged treasonable practices, he had to sue for and obtained pardon from King James II. This seems to have given a somewhat diplomatic character to his closing years, inasmuch as, while remaining a nonconformist, he had a good deal to do with proposed political-ecclesiastical compromises. He died on the 8th of May 1703, having preserved his "spirits and smartness" to the last.

See Wood's *Athenae* (Bliss) iv. 106; Calamy's *Life of Baxter*, ii. 487; Wilson's *History and Ant. of Dissenting Churches*, iv. 63-66. (A. J. G.)

ALSTED, JOHANN HEINRICH (1588–1638), German Protestant divine. He was some time professor of philosophy and theology at Herborn, in Nassau, and afterwards at Weissenburg in Transylvania, where he remained till his death in 1638. He was a marvellously prolific writer. His *Encyclopaedia* (1630), the most considerable of the earlier works of that class, was long held in high estimation.

ALSTON, CHARLES (1683–1760), Scottish botanist, was born at Eddlewood, near Hamilton, in 1683, and became lecturer in *materia medica* and botany at Edinburgh and also superintendent of the botanical gardens, of the plants in which he published a catalogue in 1740. He was a critic of Linnaeus's system of plant-classification (see BOTANY). He died on the 22nd of November 1760 at Edinburgh. His *Lectures on Materia Medica* were published posthumously in 1770.

ALSTON, a market-town in the Penrith parliamentary division of Cumberland, England, 29 m. by road E.S.E. of Carlisle, on a branch of the North-Eastern railway from Haltwhistle. Pop. (1901) 3133. It lies in the uppermost part of the valley of the South Tyne, among the high bleak moors of the Pennines. Copper and blende are found, and there are limestone quarries. The mines of argentiferous lead, belonging to Greenwich Hospital, London, were formerly of great value, and it was in order that royalties on the Alston lead mines and on those elsewhere in the county might be jointly collected that the parish was first included within the borders of Cumberland, in the 18th century. As many as 119 lead mines were worked in the parish in 1768, but the supply of metal has been almost exhausted. Coal is worked chiefly for lime-burning, and umber is prepared for the manufacture of colours. Thread and flannels are also made. Whitley Castle, 2 m. N., was a Roman fort, the original name of which is not known, guarding the road which ran along the South Tyne valley and over the Pennines. It has no connexion with Alston itself.

ALSTRÖMER, JONAS (1685–1761), Swedish industrial reformer, was born at Alingsås in Vestergötland, on the 7th of January 1685. He left his native village at an early age, and in 1707 became clerk to Alberg, a merchant of Stockholm, whom he accompanied to London. After carrying on business for three years, Alberg failed, and Alström (as his name was before his ennoblement) engaged in the business of shipbroker on his own account, and eventually proved very successful. After travelling for several years on the continent, he was seized with the patriotic desire to transplant to his native country some of the industries he had seen flourishing in Britain. He accordingly returned to Alingsås, and in 1724 established a woollen factory in the village. After preliminary difficulties it became a very profitable business. He next established a sugar refinery at Gothenburg, introduced improvements in the cultivation of potatoes and of plants suitable for dyeing, and directed attention to improved methods in shipbuilding, tanning and the manufacture of cutlery. But his most successful undertaking was the importation of sheep from England, Spain and Angora. He received many marks of distinction, was created (1748) knight of the order of the North Star, and a few years later received letters of nobility, with permission to change his name to Alströmer. He died on the 2nd of June 1761, leaving several works on practical industrial subjects. A statue was erected in his honour in the exchange at Stockholm. One of his sons, Clas (Claude) (1736–1794), was a naturalist of considerable eminence. During a voyage to Spain he noticed a native Peruvian plant known in Peru as the lily of the Incas, at the Swedish counsul's at Cadiz; he sent a few seeds to his master and friend, Linnaeus, who named the genus in his honour *Alströmeria*. He also wrote a work on sheep-breeding.

ALTAI (in Mongolian *Altain-ula*, the "Mountains of Gold"), a term used in Asiatic geography with various significations. The *Altai region*, in West Siberia and Mongolia, is similar in character to Switzerland, but covers a very much greater area. It extends from the river Irtysh and the Dzungarian depression (46°-47° N.) northwards to the Siberian railway and to the Sayan mountains. The backbone of the region is the Sailughem or Silyughema mountains, also known as Kolyvan Altai, which stretch north-eastwards from 49° N. and 86° E. towards the western extremity of the Sayan mountains in 51° 60′ N. and 89° E. Their mean elevation is 5000–5500 ft. The snow-line runs at 6700 ft. on the northern versant and at 7800 ft. on the southern, and above it the rugged peaks tower up some 3200 ft. more. Passes across the range are few and difficult, the chief being the Ulan-daban at 9275 ft. (9445 ft. according to Kozlov), and the Chapchan-daban, at 10,555 ft., in the south and north respectively. On the east and south-east this range is flanked by the great plateau of Mongolia, the transition being effected gradually by means of several minor plateaus, such as Ukök (7800 ft.), Chuya (6000 ft.), Kendykty (8200 ft.), Kak (8270 ft.), Suok (8500 ft.), and Juvlu-kul (7900 ft.). This region, which is not accurately known, is studded with large lakes, *i.e.* Ubsa-nor (2370 ft. above sea-level), Kirghiz-nor, Durga-nor and Kobdo-nor (3840 ft.), and traversed by various mountain ranges, of which the principal are the Tannu-ola, running roughly parallel with the Sayan mountains as far east as the Kosso-gol (100°–101° E. long.), and the Khan-khu mountains, also stretching west and east.

The range of the *Altai proper*, known also as the Ek-tagh, Mongolian Altai, Great Altai and Southern Altai, likewise extend in two twin parallel chains eastwards as far as 99°, if not farther. The Ek-tagh or Mongolian Altai, which separates the Kobdo basin on the north from the Irtysh basin on the south, is a true border-range, in that it rises in a steep and lofty escarpment from the Dzungarian depression (1550 to 3000 ft.), but descends on the north by a relatively short slope to the plateau (4000-5500 ft.) of north-western Mongolia. East of 94° the range is continued by a double series of mountain chains, all of which exhibit less sharply marked orographical features and are at considerably lower elevations. The southern chain bears the names of Kara-adzirga and Burkhan-ola, and terminates in about 99°; but the northern range, the principal names of which are Artsi-bogdo and Saikhat, extends probably most of the way to the great northward bend of the Hwang-ho or Yellow River round the desert of Ordos. Whereas the western Ek-tagh Altai rises above the snow-line and is destitute of timber, the eastern double ranges barely touch the snow-line and are clothed with thick forests up to an altitude of 6250 ft. The slopes of the constituent chains of the system are inhabited principally by nomad Kirghiz.

The north-western and northern slopes of the Sailughem mountains are extremely steep and very difficult of access. On this side lies the culminating summit of the range, the double-headed Byelukha (the Mont Blanc of the Altai), whose summits reach 14,890 and 14,560 ft. respectively,[1] and give origin to several glaciers (30 sq. m. in aggregate area). Here also are the Kuitun (12,000 ft.) and several other lofty peaks. Numerous spurs, striking in all directions from the Sailughem mountains, fill up the space between that range and the lowlands of Tomsk, but their mutual relations are far from being well known. Such are the Chuya Alps, having an average altitude of 9000 ft., with summits from 11,500 to 12,000 ft., and at least ten glaciers on their northern slope; the Katun Alps, which have a mean elevation of about 10,000 ft. and are mostly snow-clad; the Kholzun range; the Korgon (6300 to 7600 ft.), Talitsk and Selitsk ranges; the Tigeretsk Alps, and so on. Several secondary plateaus of lower altitude are also distinguished by geographers. The Katun valley begins as a wild gorge on the south-west slope of Byelukha; then, after a big bend, the river (400 m. long) pierces the Katun Alps, and enters a wider valley, lying at an altitude of from 2000 to 3500 ft., which it follows until it emerges from the Altai highlands to join the Biya in a most picturesque region. The Katun and the Biya together form the Ob. The next valley is that of the Charysh, which has the Korgon and Tigeretsk Alps on one side and the Talitsk and Bashalatsk Alps on the other. This, too, is very fertile. The Altai, seen from this valley, presents the most romantic scenes, including the small but deep Kolyvan lake (altitude, 1180 ft.), which is surrounded by fantastic granite domes and towers. Farther west the valleys of the Uba, the Ulba and the Bukhtarma open south-westwards towards the Irtysh. The lower part of the first, like the lower valley of the Charysh, is thickly populated; in the valley of the Ulba is the Riddersk mine, at the foot of the Ivanovsk peak (6770 ft.), clothed with beautiful alpine meadows. The valley of the Bukhtarma, which has a length of 200 m., also has its origin at the foot of the Byelukha and the Kuitun peaks, and as it falls some 5000 ft. in less than 200 m., from an alpine plateau at an elevation of 6200 ft. to the Bukhtarma fortress (1130 ft.), it offers the most striking contrasts of landscape and vegetation. Its upper parts abound in glaciers, the best known of which is the Berel, which comes down from the Byelukha. On the northern side of the range which separates the upper Bukhtarma from the upper Katun is the Katun glacier, which after two ice-falls widens out to 700-900 yards. From a grotto in this glacier bursts tumultuously the Katun river. The middle and lower parts of the Bukhtarma valley have been colonized since the 18th century by runaway Russian peasants—serfs and nonconformists (Raskolniks)—who created there a free republic on Chinese territory; and after this part of the valley was annexed to Russia in 1869, it was rapidly colonized. The high valleys farther north, on the same western face of the Sailughem range, are but little known, their only visitors being Kirghiz shepherds. Those of Bashkaus, Chulyshman, and Chulcha, all three leading to the beautiful alpine lake of Teletskoye (length, 48 m.; maximum width, 3 m.; altitude, 1700 ft.; area, 87 sq. m.; maximum depth, 1020 ft.; mean depth, 660 ft.), are only inhabited by nomad Telenghites or Teleuts. The shores of the lake—reminding a visitor somewhat of the Swiss lake of Lucerne—rise almost sheer to over 6000 ft. and are too wild to accommodate a numerous population. From this lake issues the Biya, which joins the Katun at Biysk, and then meanders through the beautiful prairies of the north-west of the Altai. Farther north the Altai highlands are continued in the Kuznetsk district, which has a slightly different geological aspect, but still belongs to the Altai system. But the Abakan river, which rises on the western shoulder of the Sayan mountains, belongs to the system of the Yenisei. The Kuznetsk Ala-tau range, on the left bank of the Abakan, runs north-east into the government of Yeniseisk, while a complexus of imperfectly mapped mountains (Chukchut, Salair, Abakan) fills up the country northwards towards the Siberian railway and westwards towards the Ob. The Tom and its numerous tributaries rise on the northern slopes of the Kuznetsk Ala-tau, and their fertile valleys are occupied by a dense Russian population, the centre of which is Kuznetsk, on the Tom.

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[1] Mr S. Turner estimates the culminating peak of Mt. Byelukha at 14,800 ft., but to Willer's Peak, a little to the N. W. of Byelukha, he assigns an altitude of 17,800 ft. (p. 205 of *Siberia*).

Geology.—Geologically the Altai mountains consist of two distinct elements which differ considerably from each other in composition and structure. The Russian Altai is composed mainly of mica and chlorite schists and slates, together with beds of limestone, and in the higher horizons Devonian and Carboniferous fossils occur in many places. There is no axial zone of gneiss, but intrusions of granite and other plutonic rocks occur, and the famous ore deposits are found chiefly near the contact of these intrusions with the schists. The strata are thrown into folds which run in the direction of the mountain ridges, forming a curve with the convexity facing the south-east. The Mongolian or Great Altai, on the other hand, consists mainly of gneiss and Archaean rocks. The strike of the rocks is independent of the direction of the chain, and the chain is bounded by faults. It is, in fact, a horst and not a zone of folding.

Flora.—The flora of the Altai, explored chiefly by Karl F. von Ledebour (1785–1851), is rich and very beautiful. Up to a level of 1000 ft. on the northern and 2000 ft. on the southern slopes, plant life belongs to the European flora, which extends into Siberia as far as the Yenisei. The steppe flora penetrates into the mountains, ascending some 1100-1200 ft., and in sheltered valleys even up to 5500 ft., when it of course comes into contact with the purely alpine flora. Tree vegetation, which reaches up as high as 6500 and 8150 ft., the latter limit on the north and west, consists of magnificent forests of birch, poplar, aspen, and Coniferae, such as *Pinus cembra*, *Abies sibirica*, *Larix sibirica*, *Picea obovata*, and so on, though the fir is not found above 2500 ft., while the meadows are abundantly clothed with brightly-coloured, typical assortments of herbaceous plants. The alpine meadows, which have many species in common with the European Alps, have also a number of their own peculiar Altaian species.

Mineral wealth.—The Altai proper is rich in silver, copper, lead and zinc ores, while in the Kuznetsk Ala-tau, gold, iron and coal are the chief mineral resources. The Kuznetsk Ala-tau mines are only now beginning to be explored, while the copper, and perhaps also the silver, ores of the Altai proper were worked by the mysterious prehistoric race of the Chudes at a time when the use of iron was not yet known. Russians began to mine in 1727 at Kolyvan, and in 1739 at Barnaul. Most of the Altai region, covering an area of some 170,000 sq. m. and including the Kuznetsk district, has since 1746 formed a domain of the imperial family under the name of the *Altai Mining District*. The ores of the Altai proper nearly always appear in irregular veins, containing silver, lead, copper and gold—sometimes all together,—and they are, or were, worked chiefly by Zmeinogorsk (or Zmeiev), Zyryanovsk, Ust-Kamenogorsk and Riddersk (abandoned in 1861). They offer, however, great difficulties, especially on account of their continually varying productivity and temperature of fusion. The beautiful varieties of porphyry—green, red, striped—which are obtained, often in big monoliths, near Kolyvan, are cut at the imperial stone-cutting factory into vases and other ornaments, familiar in the art galleries and palaces of Europe. Aquamarines of mediocre quality but enormous size (up to 3 in. in diameter) are found in the Korgon mine. The northern, or Salair, mining region is rich in silver ores, and the mine of this name used formerly to yield up to 93,300 oz. of silver in the year. But the chief wealth of the northern Altai is in the Kuznetsk coal-basin, also containing iron-ores, which fills up a valley between the Kuznetsk Ala-tau and the Salair range for a length of about 270 m., with a width of about 65 m. The coal is considered equal to the best coal of England and south Russia. The country is also covered with thick diluvial and alluvial deposits containing gold. However, all the mining is now on the decline.

Population.—The Russian population has rapidly increased since the fertile valleys belonging to the imperial family have been thrown open to settlement, and it has been estimated that in 1908 the population of the region (Biysk, Barnaul and Kuznetsk districts) reached about 800,000. Their chief occupations are agriculture (about 3,500,000 acres under culture), cattle-breeding, bee-keeping, mining, gathering of cedar-nuts and hunting. All this produce is exported partly to Tomsk and partly to Kobdo in Mongolia. The natives may represent a population of about 45,000. They are Altaians in the west and Telenghites or Teleuts in the east, with a few Kalmucks and Tatars. Although all are called Kalmucks by the Russians, they speak a Turkish language. Both the Telenghites and the Altaians are Shamanists in religion, but many of the former are already quite Russified. The virgin forests of the Kuznetsk Ala-tau—the Chern, or Black Forest of the Russians—are peopled by Tatars, who live in very small settlements, sometimes of the Russian type, but mostly in wooden *yurts* or huts of the Mongolian fashion. They can hardly keep any cattle, and lead the precarious life of forest-dwellers, living upon various wild roots when there is no grain in the spring. Hunting and fishing are resorted to, and the skins and furs are tanned.

Towns.—The capital of the Altai region is Barnaul, the centre of the mining administration and an animated commercial town; Biysk is the commercial centre; Kuznetsk, Ust-Kamenogorsk, and the mining towns of Kolyvan, Zmeinogorsk, Riddersk and Salairsk are the next largest places.

AUTHORITIES.—P. Semenov and G. N. Potanin, in supplementary vol. of Russian ed. of Ritter's *Asien* (1877); Ledebour, *Reise durch das Altaigebirge* (1829–1830); P. Chikhatchev, *Voyage scientifique dans l'Altai oriental* (1845); Gebler, *Übersicht des katunischen Gebirges* (1837); G. von Helmersen, *Reise nach dem Altai* (St Petersburg, 1848); T. W. Atkinson, *Oriental and Western Siberia* (1858); and Cotta, *Der Altai* (1871), are still worth consulting. Of modern works see Adrianov, "Journey to the Altai," in *Zapiski Russ. Geogr. Soc.* xi.; Yadrintsev, "Journey in West Siberia," in *Zapiski West Sib. Geogr. Soc.* ii.; Golubev, *Altai* (1890, Russian); Schmurlo, "Passes in S. Altai" (Sailughem), in *Izvestia Russ. Geogr. Soc.* (1898), xxxiv. 5; V. Saposhnikov, various articles in same periodical (1897), xxxiii. and (1899) xxxv., and, by the same, *Katun i yeya Istoki* (Tomsk, 1901); S. Turner, *Siberia* (1905); Deniker, on Kozlov's explorations, in *La Géographie* (1901, pp. 41, &c.); and P. Ignatov, in *Izvestia Russ. Geog. Soc.* (1902, No. 2). (P. A. K.; J. T. BE.)

ALTAMURA, a town of Apulia, Italy, in the province of Bari, 28 m. S.S.W. of the town of that name, and 56 m. by rail *via* Gioia del Colle. Pop. (1901) 22,729. It possesses a fine Romanesque cathedral begun in 1232 and restored in 1330 and 1531, the portal being especially remarkable. It is one of the four Palatine churches of Apulia. The surrounding territory is fertile. The medieval walls, erected by the emperor Frederick II., rest upon the walls of an ancient city of unknown name. These early walls are of rough blocks of stone without mortar. Ancient tombs with fragments of vases have also been found, and there are cases which have been used as primitive tombs or dwellings, and a group of some fifty tumuli near Altamura.

ALTAR (Lat. *altare*, from *altus*, high; some ancient etymological guesses are recorded by St Isidore of Seville in *Etymologiae* xv. 4), strictly a base or pedestal used for supplication and sacrifice to gods or to deified heroes. The necessity for such sacrificial furniture has been felt in most religions, and consequently we find its use widespread among races and nations which have no mutual connexion.

Mesopotamia.—Altars are found from the earliest times in the remains of Babylonian cities; the oldest are square erections of sun-dried bricks. In Assyrian mounds limestone and alabaster are the chief material. They are of varying form; an altar shown in a relief at Khorsabad is ornamented with stepped battlements, which are the equivalent of the familiar "altar-horns" in Hebrew ritual. An altar also from Khorsabad (now in the British Museum) has a circular table and a solid base triangular on plan, with pilasters ornamented with animals' paws at the angles. A third variety, of which an 8th century B.C. example from Nimrûd exists in the British Museum, is a rectangular block ornamented at the ends by cylindrical rolls. These altars are in height from 2 to 3 ft. According to Herodotus (i. 183) the great altars of Babylonia were made of gold.

Egypt.—In Egypt altars took the form of a truncated cone or of a cubical block of polished granite or of basalt, with one or more basin-like depressions in the upper surface for receiving fluid libations. These had channels whereby fluids poured into the receptacles could be drained off. The surface was plain, inscribed with dedicatory or other legends, or adorned with symbolical carving.

Palestine.—Recent excavations, especially at Gezer, have shown that the earliest altars, or rather sacrifice hearths, in Palestine were circular spaces marked out by small stones set on end. At Gezer a pre-Semitic place of worship was found in which three such hearths stood together, and drained into a cave which may reasonably be supposed to have been regarded as the residence of the divinity. These circular hearths persisted into the Canaanite period, but were ultimately superseded by the Semitic developments. To the primitive nomadic Semite the presence of the divinity was indicated by springs, shady trees, remarkable rocks and other landmarks; and from this earliest conception grew the theory that a *numen* might be induced to take up an abode in an artificial heap of stones, or a pillar set upright for the purpose. The blood of the victim was poured over the stone as an offering to the divinity dwelling within it; and from this conception of the stone arose the further and final view, that the stone was a table on which the victim was to be burned.

Very few specimens of early Palestinian altars remain. The megalithic structures common in the Hauran and Moab *may* be entirely sepulchral. At Gezer no definite altar was discovered in the great High Place; though it is possible that a bank of intensely hard compact earth, in which were embedded a large number of human skulls, took its place. A very remarkable altar, at present unique, was found at Taanach by the Austrian excavators. It is pyramidal in shape, and the surface is ornamented with human-headed animals in relief. This, like the earliest Babylonian altars, is of baked earth.

The Old Testament conception of the altar varies with the stage of religious development. In the pre-Deuteronomic period altars are erected in any place where there had appeared to be a manifestation of deity, or under any circumstance in which the aid of deity was invoked; not by heretical individuals, but by the acknowledged religious leaders, such as Noah at Ararat, Abraham at Shechem, Bethel &c., Isaac at Beersheba, Jacob at Bethel, Moses at Rephidim, Joshua at Ebal, Gideon at Ophrah, Samuel at Ramah, Elijah at Carmel, and others. These primitive altars were of the simplest possible description —in fact they were required to be so by the regulation affecting them, preserved in Exodus xx. 24, which prescribes that *in every place where Yahweh records his name* an altar of earth or of unhewn stone, without steps or other extraneous ornamentation, shall be erected.

The priestly regulations affecting altars are of a very elaborate nature, and are framed with a single eye to the essential theory of later Hebrew worship—the centralization of all worship at one shrine. These recognize two altars, which by the authors of this portion of the Pentateuch are placed from the first in the tabernacle in the wilderness—a theory which is inconsistent with the other evidences of the nature of the earlier Hebrew worship, to which we have just alluded.

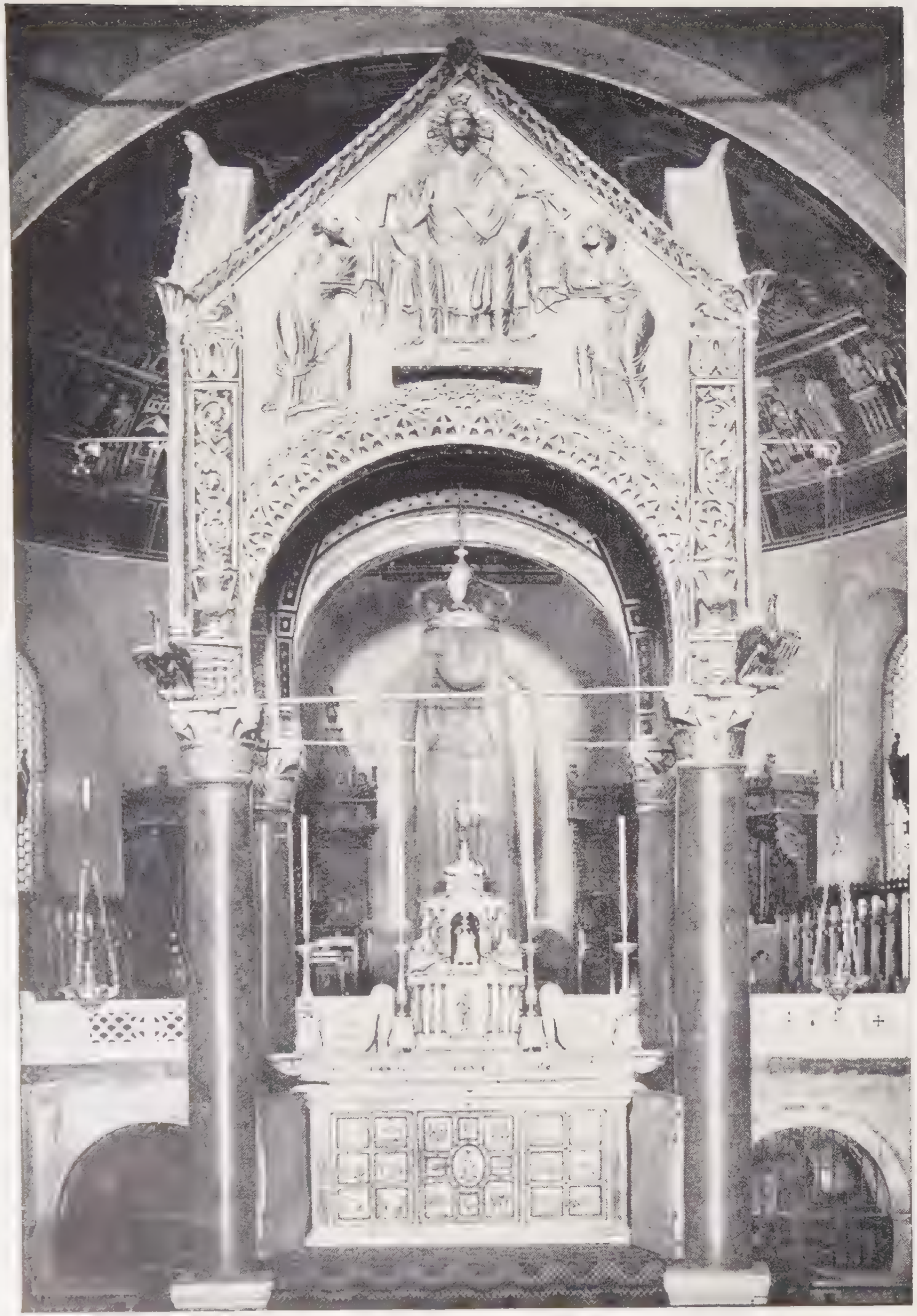
The first of these altars is that for burnt-offering. This altar was in the centre of the court of the tabernacle, of acacia wood, 3 cubits high and 5 square. It was covered with copper, was provided with "horns" at the corners (like those of Assyria), hollow in the middle, and with rings on the sides into which the staves for its transportation could be run (Ex. xxvii. 1-8). The altar of the Solomonic temple is on similar lines, but much larger. It is now generally recognized that the description of the tabernacle altar is intended to provide a precedent for this vast structure, which would otherwise be inconsistent with the traditional view of the simple Hebrew altars. In the second temple a new altar was built after the fashion of the former (1 Macc. iv. 47) of "whole stones from the mountain." In Herod's temple the altar was again built after the same model. It is described by Josephus (v. 5. 6) as 15 cubits high and 50 cubits square, with angle horns, and with an "insensible acclivity" leading up to it (a device to evade the pre-Deuteronomic regulation about steps). It was made without any use of iron, and no iron tool was ever allowed to touch it. The blood and refuse were discharged through a drain into the brook Kedron; this drain probably still remains, in the *Bīr el-Arwah*, under the "Dome of the Rock" in the mosque which covers the site of the temple.

The second altar was the altar of incense, which was in the holy place of the tabernacle. It was of similar construction to the altar of burnt-offering, but smaller, being 2 cubits high and 1 cubit square (Ex. xxx. 1-5). It was overlaid with gold. Solomon's altar of incense (1 K. vi. 20) is referred to in a problematical passage from which it would appear to have been of cedar. But the authenticity of the passages describing the altar of incense in the tabernacle, and the historicity of the corresponding altar in Solomon's temple, are matters of keen dispute among critics. The incense altar in the second temple was removed by Antiochus Epiphanes (1 Macc. i. 21) and restored by Judas Maccabaeus (1 Macc. iv. 49). That in the temple of Herod is referred to in Luke i. 11.

The ritual uses of these altars are sufficiently explained by their names. On the first was a fire continually burning, in which the burnt-offerings were consumed. On the second an offering of incense was made twice a day.

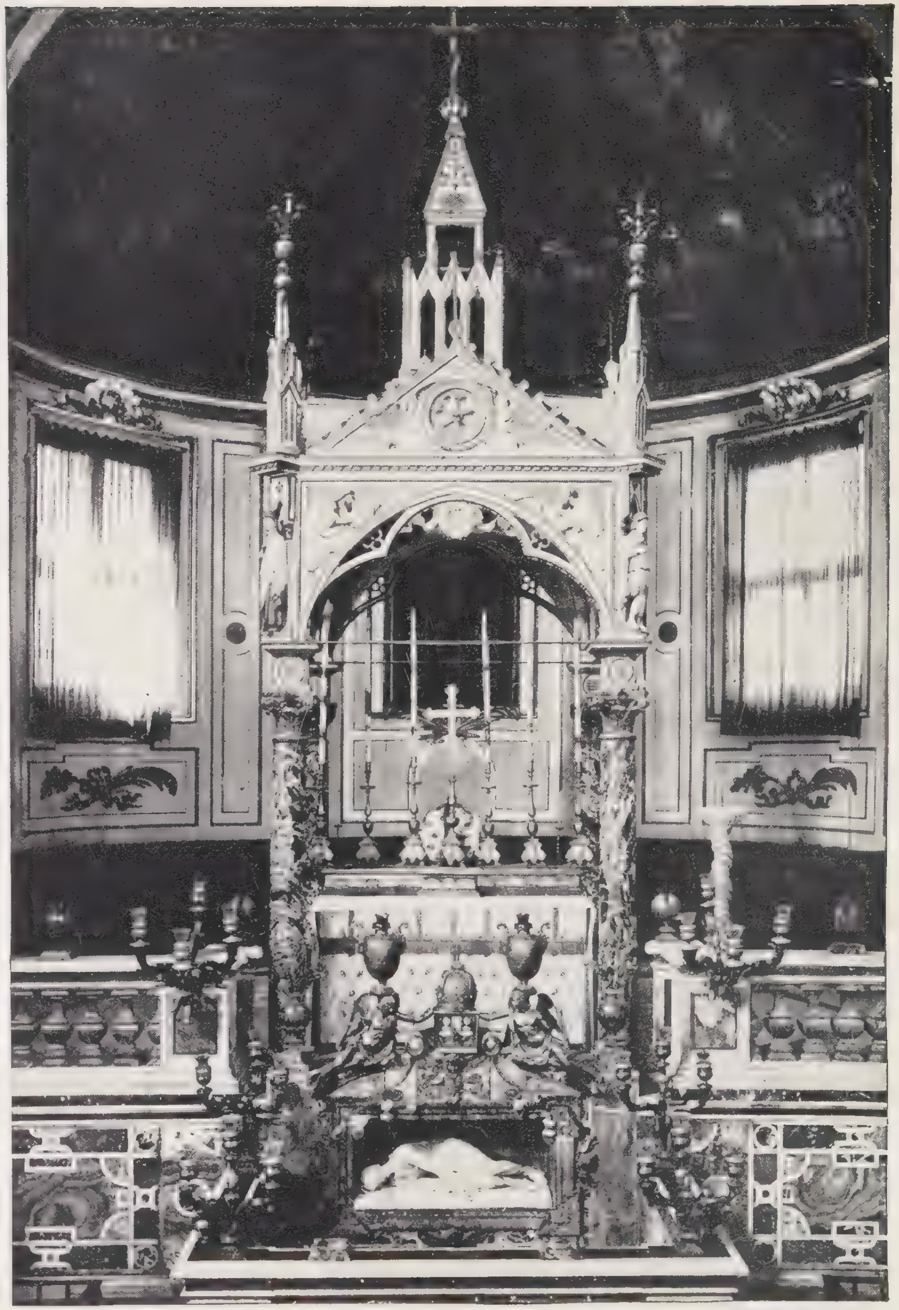
In the pre-Deuteronomic passage, Exodus xxi. 14, the use of the altar as an asylum is postulated, though denied to the wilful murderer. This is a survival of the ancient belief that the deity resided in the pillar or stone-heap, and that the fugitive was placing himself under the protection of the local *numen* by seeking sanctuary. From 1 Kings i. 50 it would appear that the suppliant caught hold of the altar-horns (compare 1 Kings ii. 28), as though special protective virtue resided in this important though obscure part of the structure.

Greece and Rome.—According to the difference in the service for which they were employed, altars fell into two classes. Those of the first class were pedestals, so small and low that the suppliant could kneel upon them; these stood inside the temples, in front of the sacred image. The second class consisted of larger tables destined for burnt sacrifice; these were placed in the open air, and, if connected with a temple, in front of the entrance. Possibly altars of the former class were in historical times substitutes for, and rendered the same service as, the bases of the sacred images within the temples in earlier ages. In this case the altar of Apollo at Delphi, upon which on the Greek vases Neoptolemus is frequently represented as taking refuge from Orestes, might be regarded as the pedestal of an invisible image of the god, and as fulfilling the same function as did the base of the actual image of Athene in Troy, towards which Cassandra fled from Ajax. The second class of altars, called *βωμοί* by the Greeks and *altaria* by the Romans, appears to have originated in temporary constructions such as heaps of earth, turf or stone, made for kindling a sacrificial fire as occasion required. But sacrifices to earth divinities were made on the earth itself, and those to the infernal deities in sunk hollows (*Odyss.* x. 25; Festus *s. v. Altaria*). The note of Eustathius (*Odyss.* xii. 252) perhaps indicates some customs reminiscent of a primitive antiquity in which the sacrifice was made without an altar at all. He says *ἀποβώμιά τινα ἱερὰ ὧν οὐκ ἐπὶ βωμοῦ ὁ καθαγισμὸς ἀλλ' ἐπὶ ἐδάφους*—"some holy places *away from altars*, whose offering is made not on an altar but on the floor." Pausanias (vi. 20. 7) speaks of an altar at Olympia made of unbaked bricks. In some primitive holy shrines the bones and ashes of the victims sacrificed were allowed to accumulate, and upon this new fires were kindled. Altars so raised were, like most religious survivals, considered as endowed with particular sanctity; the most remarkable recorded instances of such are the altars of Hera at Samos, and of Pan at Olympia (Paus. v. 14. 6; v. 15. 5), of Heracles at Thebes (Paus. ix. 11. 7), and of Zeus at Olympia (Paus. v. 13. 5). The last-mentioned stood on a platform (*πρόθυσις*) measuring 125 ft. in circumference, and led up to by steps, the altar itself being 22 ft. high. Women were excluded from the platform. Where hecatombs were sacrificed, the *πρόθυσις* necessarily assumed colossal proportions, as in the case of the altar at Parion, where it measured on each side 600 ft. The altar of Apollo at Delos (*ὁ κεράτινος βωμός*) was made



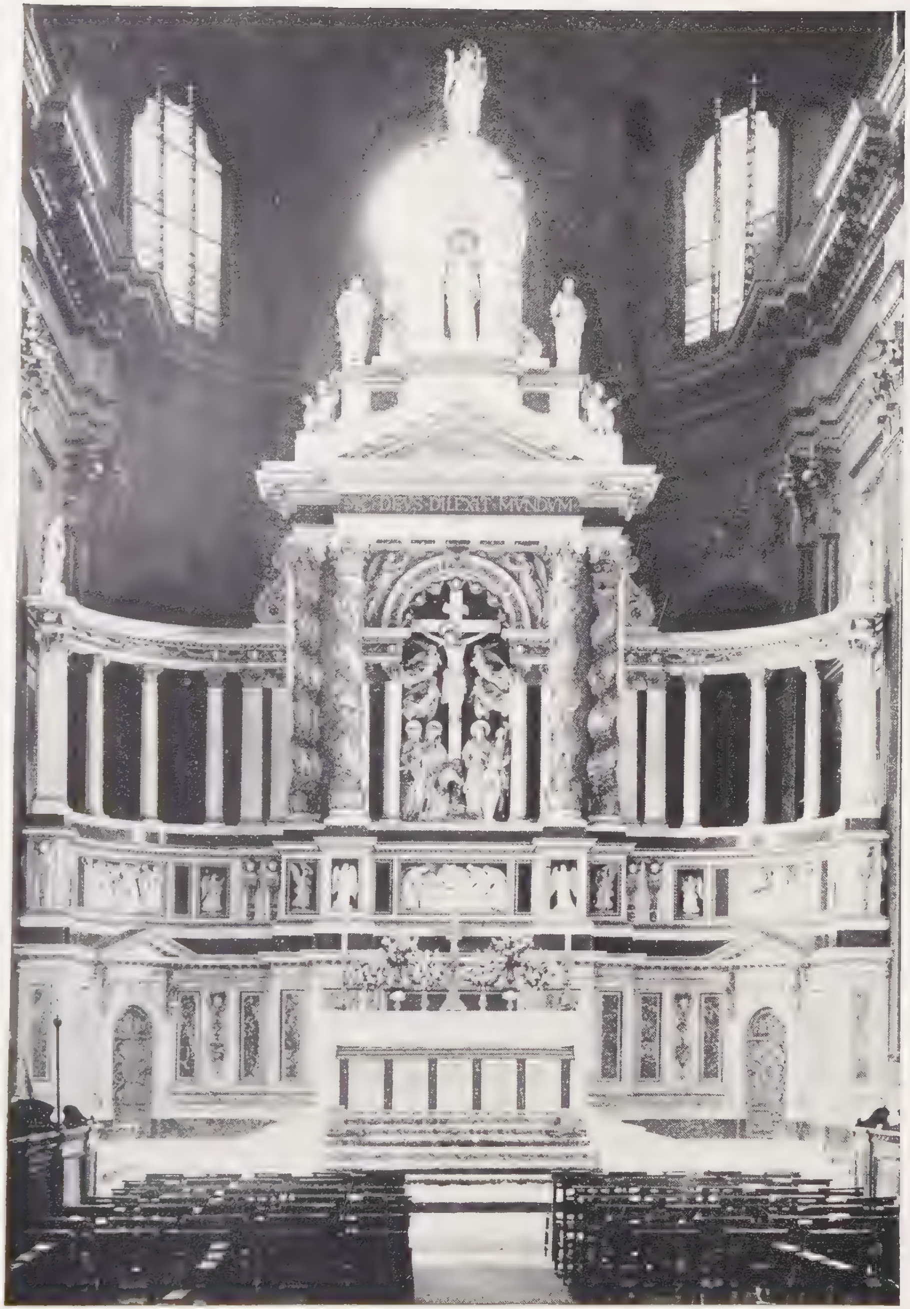
Photo, Brogi.

FIG. 1.—SANT' AMBROGIO, MILAN.



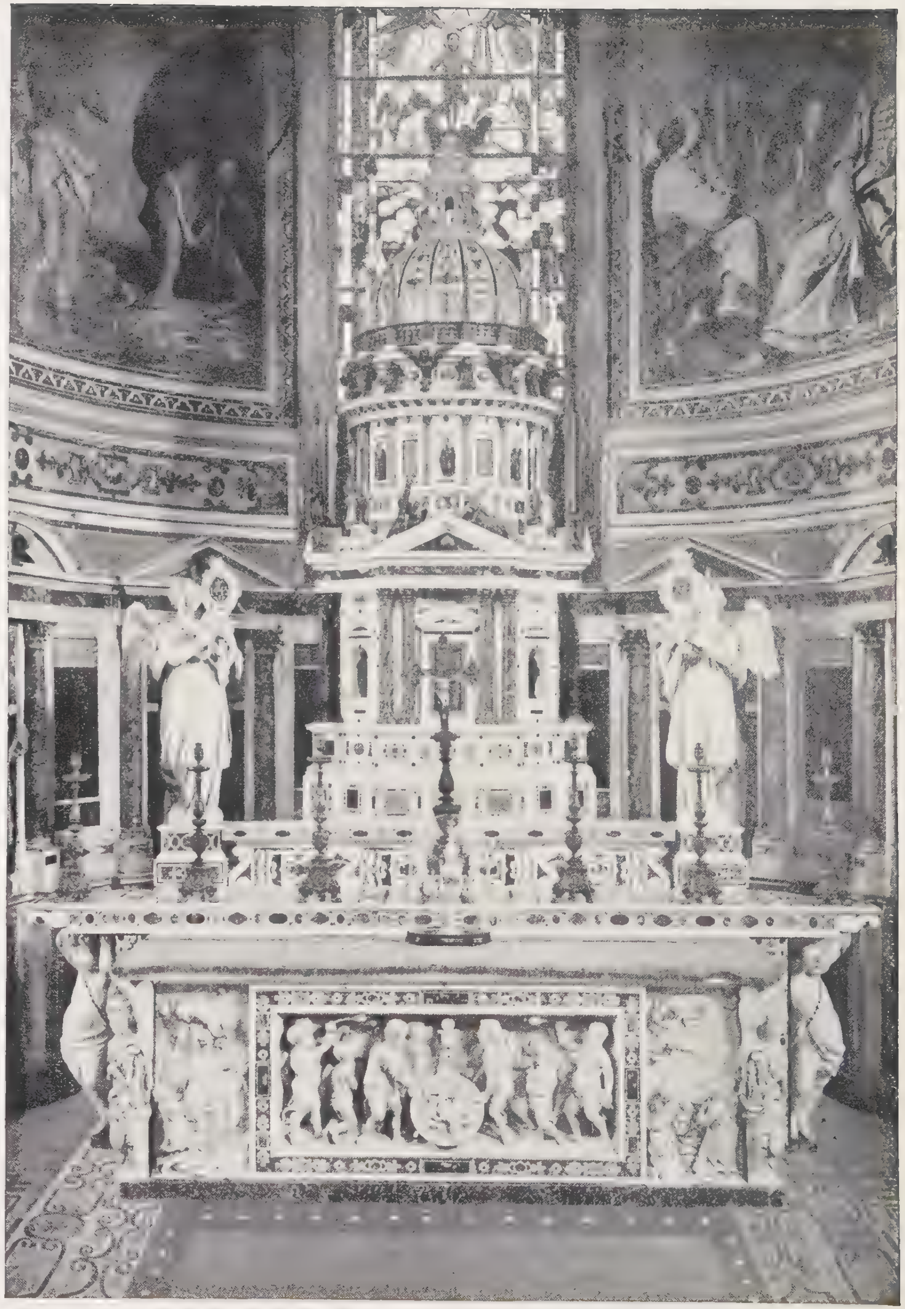
Photo, Alinari.

FIG. 2.—SANTA CECILIA, ROME.



Photo, O. W. Wilson & Co

FIG. 3.—ST PAUL'S, LONDON.



Photo, Brogi.

FIG. 4.—CERTOSA. PAVIA.

of the horns of goats believed to have been slain by Diana; while at Miletus was an altar composed of the blood of victims sacrificed (Paus. v. 13. 6). The altar at Phorae in Achaea was of unhewn stones (Paus. vii. 22. 3). The altar used at the festival in honour of Daedalus on Mt. Cithaeron was of wood, and was consumed along with the sacrifice (Paus. ix. 3. 4). Others of bronze are mentioned. But these were exceptional, the usual material of an altar was marble, and its form, both among the Greeks and Romans, was either square or round; polygonal altars, of which examples still exist, being exceptions. When sculptured decorations were added they frequently took the form of imitations of the actual festoons with which it was usual to ornament altars, or of symbols, such as crania and horns of oxen, referring to the victims sacrificed. As a rule, the altars which existed apart from temples bore the name of the person by whom they were dedicated and the names of the deities in whose service they were, or, if not the name, some obvious representation of the deity. Such, for example, is the purpose of the figures of the Muses on an altar dedicated to them, now to be seen in the British Museum. An altar was retained for the service of one particular god, except where through local tradition two or more deities had become intimately associated, as in the case of the altar at Olympia to Artemis and Alpheus jointly, or that of Poseidon and Erechtheus in the Erechtheum at Athens. The most remarkable instance of multiple dedication was, however, at Oropus, where the altar was divided into five parts, one dedicated to Heracles, Zeus and Paean Apollo, a second to heroes and their wives, a third to Hestia, Hermes, Amphiaraus and the children of Amphilochus, a fourth to Aphrodite Panacea, Jason, Health, and Healing Athene, and the fifth to the Nymphs, Pan, and the rivers Archelous and Cephissus (Paus. i. 34. 2). Such deities were styled σύμβωμοι, each having a separate part of the altar (Paus. i. 34. 2). Other terms are ἀγώνιοι, or ὁμοβώμιοι. Deities of an inferior order, who were conceived as working together—*e.g.* the wind gods—had an altar in common. In the same way, the "unknown gods" were regarded as a unit, and had in Athens and at Olympia one altar for all (Paus. i. 1. 4; v. 14. 5; cf. Acts of Apostles, xvii. 18). An altar to all the gods is mentioned by Aeschylus (*Suppl.* 222). Among the exceptional classes of altars are also to be mentioned those on which fire could not be kindled (βωμοὶ ἄπυροι), and those which were kept free from blood (βωμοὶ ἀναίμακτοι), of which in both respects the altar of Zeus Hypatos at Athens was an example. The ἑστία was a round altar; the ἐσχάρα, one employed apparently for sacrifice to inferior deities or heroes (but ἐσχάρα Φοίβου, Aesch. *Pers.* 205). In Rome an altar erected in front of a statue of a god was always required to be lower than the statue itself (Vitruvius iv. 9). Altars were always places of refuge, and even criminals and slaves were there safe, violence offered to them being insults to the gods whose suppliants the refugees were for the time being. They were also taken hold of by the Greeks when making their most solemn oaths.

Ancient America.—As a single specimen of an altar, wholly unrelated to any of the foregoing, we may cite the ancient Mexican example described by W. Bullock (*Six Months in Mexico*, London, 1824, p. 335). This was cylindrical, 25 ft. in circumference, with sculpture representing the conquests of the national warriors in fifteen different groups round the side.[1]

Portable altars and tables of offerings were used in pre-Christian as well as in Christian ritual. One such was discovered in the Gezer excavations, dating about 200 B.C. It was a slab of polished limestone about 6 in. square with five cups in its upper surface. Another from the same place was a small cubical block of limestone bearing a dedication to Heracles. They have also been found in Assyria. Pocket altars are still used in some forms of worship in India. See the *Journal of the Royal Asiatic Society*, 1852, p. 71.

Altars in the Christian Church

I. *The Early Church.*—The altar is spoken of by the early Greek and Latin ecclesiastical writers under a variety of names:—τράπεζα, the principal name in the Greek fathers and the liturgies; θυσιαστήριον (rarer; used in the Septuagint for Hebrew altars); ἱλαστήριον; βωμός (usually avoided, as it is a word with heathen associations); *mensa Domini*; *ara* (avoided like βωμός, and for the same reason); and, most regularly, *altare*. After the 4th century other names or expressions come into use, such as *mensa tremenda, sedes corporis et sanguinis Christi.*

The earliest Christians had no altars, and were taunted by the pagans for this. It is admitted by Origen in his reply to Celsus (p. 389), who has charged the Christians with being a secret society "because they forbid to build temples, to raise altars." "The altars," says Origen, "are the heart of every Christian." The same appears from a passage in Lactantius, *De Origine Erroris*, ii. 2. We gather from these passages that down to about A.D. 250, or perhaps a little later, the communion was administered on a movable wooden table. In the Catacombs, the *arcosolia* or bench-like tombs are said (though the statement is doubtful) to have been used to serve this purpose. The earliest church altars were certainly made of wood; and it would appear from a passage in William of Malmesbury (*De Gest. Pontif. Angl.* iii. 14) that English altars were of wood down to the middle of the 11th century, at least in the diocese of Worcester.

The cessation of persecution, and consequent gradual elaboration of church furniture and ritual, led to the employment of more costly materials for the altar as for the other fittings of ecclesiastical buildings. Already in the 4th century we find reference to stone altars in the writings of Gregory of Nyssa. In 517 the council of Epaone in Burgundy forbade any but stone pillars to be consecrated with chrism; but of course the decrees of this provincial council would not necessarily be received throughout the church.

Pope Felix I. (A.D. 269–274) decreed that "mass should be celebrated above the tombs of martyrs"—an observance probably suggested by the passage in Revelation vi. 9, "I saw under the altar the souls of them that were slain for the word of God." This practice developed into the medieval rule that no altar can be consecrated unless it contain a relic or relics.

The form of the altar was originally table-shaped, consisting of a plane surface supported by columns. There were usually four, but examples with one, two and five columns are also recorded. But the development of the relic-custom led to the adoption of another form, the square box shape of an "altar-tomb." Transitional examples, combining the box with the earlier table shape, are found dating about 450. Mention is made occasionally of silver and gold altars in the 5th to the 8th centuries. This means no doubt that gold and silver were copiously used in its decoration. Such an altar still remains in Sant' Ambrogio at Milan, dating from the 9th century (see fig. 1).

II. *The Medieval Church.*—It will be convenient now to pass to the fully-developed altar of the Western Church with its accessories, though the rudiments of most of the additional details are traceable in the earlier period.

In the Roman Catholic Church, which preserves in this respect the tradition that had become established during the middle ages, the component parts of a fixed altar in the liturgical sense are the table (*mensa*), or super-altar, consisting of a stone slab; the support (*stipes*), consisting either of a solid mass or of four or more columns; the *sepulchrum*, or altar-cavity, a small chamber for the reception of the relics of martyrs. The support, in the technical sense, must be of stone solidly joined to the table; but, if this support consist of columns, the intervals may be filled with other materials, *e.g.* brick or cement. The altar-slab or "table" alone is consecrated, and in sign of this are cut in its upper surface five Greek crosses, one in the centre and one in each corner. These crosses must have been anointed by the bishop with chrism in the ritual of consecration before the altar can be used. Crosses appear on the portable altar buried with

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[1] Bullock also says (p. 354) that the altar in the church of the Indian village of S. Miguel de los Ranchos which he visited was "of the same nature as those in use before the introduction of Christianity."

St Cuthbert (A.D. 687), but the history of the origin and development of this practice is not fully worked out.

According to the *Caeromoniale* (i. 12. 13) a canopy (*baldachinum*) should be suspended over the altar; this should be square, and of sufficient size to cover the altar and the *predella* on which the officiating priest stands. This baldachin, called liturgically the *ciborium*, is sometimes hung from the roof by chains in such a way that it can be lowered or raised; sometimes it is fixed to the wall or reredos; sometimes it is a solid structure of wood covered with metal or of marble supported on four columns. The latter form is, however, usual only in large churches, more especially of the basilica type, *e.g.* St Peter's at Rome or the Roman Catholic cathedral at Westminster. The origin of the *ciborium* is not certain, but it is represented in a mosaic at Thessalonica of a date not later than A.D. 500. Even at the present day, in spite of a decree of the Congregation of Rites (27th of May 1697) ordering it to be placed over all altars, it is—even at Rome itself—usually only found over the high altar and the altar of the Blessed Sacrament.

Multiplication of altars is another medieval characteristic. This also is probably a result of the edict of Pope Felix already mentioned. In a vault where more than one martyr was buried an altar might be erected for each. It is in the 6th century that we begin to find traces of the multiplication of altars. In the church of St Gall, Switzerland, in the 9th century there were seventeen. In the modern Latin Church almost every large church contains several altars—dedicated to certain saints, in private side chapels, established for masses for the repose of the founder's soul, &c. Archbishop Wulfred in 816 ordered that beside every altar there should be an inscription recording its dedication. This regulation fell into abeyance after the 12th century, and such inscriptions are very rare. One remains mutilated at Deerhurst (*Archaeologia*, vol. l. p. 69).

Where there is in a cathedral or church more than one altar, the principal one is called a "high altar." Where there is a second high altar, it is generally at the end of the choir or chancel. In monastic churches (*e.g.* formerly at St Albans) it sometimes stands at the end of the nave close to the choir screen.

Beside the altar was a drain (*piscina*) for pouring away the water in which the communion vessels were rinsed. This seems originally to have been under the altar, as it is still in the Eastern Church.

That the primitive communion table was covered with a communion-cloth is highly probable, and is mentioned by Optatus (*c.* A.D. 370), bishop of Milevis. This had developed by the 14th or 15th century into a cerecloth, or waxed cloth, on the table itself; and three linen coverings one above the other, two of about the size of the table and one rather wider than the altar, and long enough to hang down at each end. Five crosses are worked upon it, four in the corners and one in the middle, and there is an embroidered edging.[1] In front was often a hanging panel of embroidered cloth (the frontal; but frontals of wood, ornamented with carving or enamel, &c., are also to be found). These embroidered frontals are changeable, so that the principal colour in the pattern can accord with the liturgical colour of the day. Speaking broadly, red is the colour for feasts of martyrs, white for virgins, violet for penitential seasons, &c.; no less than sixty-three different uses differing in details have been enumerated. A similar panel of needlework (the dossal) is suspended behind the altar.

Portable altars have been used on occasion since the time of Bede. They are small slabs of hard stone, just large enough for the chalice and paten. They are consecrated and marked with the five incised crosses in the same way as the fixed altar, but they may be placed upon a support of any suitable material, whether wood or stone. They are used on a journey in a heretical or heathen country, or in private chapels. In the inventory of the field apparel of Henry, earl of Northumberland, A.D. 1513, is included "A coffer wyth ij liddes to serue for an Awter and ned be" (*Archaeologia*, xxvi. 403).

On the altar are placed a cross and candlesticks—six in number, and seven when a bishop celebrates in his cathedral; and over it is suspended or fixed a tabernacle or receptacle for the reservation of the Sacrament.

III. *Post-Reformation Altars.*—At the Reformation the altars in churches were looked upon as symbols of the unreformed doctrine, especially where the struggle lay between the Catholics and the Calvinists, who on this point were much more radical revolutionaries than the Lutherans. In England the name "altar"[2] was retained in the Communion Office in English, printed in 1549, and in the complete English Prayer-book of the following year, known to students as the First Book of Edward VI. But orders were given soon after that the altars should be destroyed, and replaced by movable wooden tables; while from the revised Prayer-book of 1552 the word "altar" was carefully expunged, "God's board" or "the table" being substituted. The short reign of Mary produced a temporary reaction, but the work of reformation was resumed on the accession of Elizabeth.

The name "altar" has been all along retained in the Coronation Office of the kings of England, where it occurs frequently. It was also recognized in the canons of 1640, but with the reservation that "it was an altar in the sense in which the primitive church called it an altar and in no other." In the same canons the rule for the position of the communion tables, which has been since regularly followed throughout the Church of England, was formulated. In the primitive church the altars seem to have been so placed that, like those of the Hebrews, they could be surrounded on all sides by the worshippers. The chair of the bishop or celebrant was on their east side, and the assistant clergy were ranged on each side of him. But in the middle ages the altars were placed against the east wall of the churches, or else against a *reredos* erected at the east side of the altar, so as to prevent all access to the table from that side; the celebrant was thus brought round to the west side and caused to stand between the people and the altar. On the north and south sides there were often curtains. When tables were substituted for altars in the English churches, these were not merely movable, but at the administration of the Lord's Supper were actually moved into the body of the church, and placed *table-wise*—that is, with the long sides turned to the north and south, and the narrow ends to the east and west,—the officiating clergyman standing at the north side. In the time of Archbishop Laud, however, the present practice of the Church of England was introduced. The communion table, though still of wood and movable, is, as a matter of fact, never moved; it is placed *altar-wise*—that is, with its longer axis running north and south, and close against the east wall. Often there is a reredos behind it; it is also fenced in by rails to preserve it from profanation of various kinds.

In 1841 the ancient church of the Holy Sepulchre at Cambridge was robbed of most of its interest by a calamitous "restoration" carried out under the superintendence and partly at the charge of the Camden Society. On this occasion a stone altar, consisting of a flat slab resting upon three other upright slabs, was presented to the parish, and was set up in the church at the east wall of the chancel. This was brought to the notice of the Court of Arches in 1845, and Sir H. Jenner Fust (*Faulkner* v. *Lichfield and Stearn*) ordered it to be removed, on the ground that a stone structure so weighty that it could not be carried about, and seeming to be a mass of solid masonry, was not a communion-table in the sense recognized by the Church of England.

BIBLIOGRAPHY.—For altars in the ancient East see M. Jastrow, *Religion of Assyria and Babylonia*; Perrot and Chipiez, *Art in Chaldea* (i. 143, 255); Sir J. Gardiner Wilkinson, *A Second Series of the Manners and Customs of the Ancient Egyptians*, ii. 387; Benzinger's and Nowack's works on *Hebräische Archäologie*. For classical altars, much information can be obtained from the notes in J. G. Frazer's *Pausanias*. See also Schömann, *Griechische Alterthümer*, vol. ii.; the volume on "Gottesdienstliche Alterthümer" in Hermann's *Lehrbuch der griechischen Antiquitäten*. On domestic altars and worship see Petersen, *Hausgottesdienst der Griechen* (Cassel, 1851).

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[1] In the Eastern Church four small pieces of cloth marked with the names of the Evangelists are placed on the four corners of the altar, and covered with three cloths, the uppermost (the corporal) being of smaller size.

[2] Except in one place where the term used is "God's board."

On plural dedications consult Maurer, *De aribus graecorum pluribus deis in commune positis* (Darmstadt, 1885). For Christian altars, reference is best made to the articles on the subject in the dictionaries of Christian and liturgical antiquities of Migne, Martigny, Smith and Cheetham, and Pugin, where practically all the available information is collected. See also Ciampinus, *Vetera Monumenta* (Rome, 1747), where numerous illustrations of altars are to be found; Martene, *De antiquis Ecclesiae ritibus*, iii. vi. (Rouen, 1700); Voigt, *Thysiasteriologia sive de altaribus veterum Christianorum* (Hamburg, 1709); and the liturgical works of Bona. Many articles on various sections of the subject have appeared in the journals of archaeological societies; we may mention Nesbitt on the churches of Rome earlier than 1150 (*Archaeologia*, xl. p. 210), Didron, "L'Autel chrétien" (*Annales archéologiques*, iv. p. 238), and a paper by Texier on enamelled altars in the same volume. (R. A. S. M.)

ALTDORF, the capital of the Swiss canton of Uri. It is built at a height of 1516 ft. above sea-level, a little above the right bank of the Reuss, not far above the point where this river is joined on the right by the Schächen torrent. In 1900 the population was 3117, all Romanists and German-speaking. Altdorf is 34 m. from Lucerne by the St Gotthard railway and 22 m. from Goeschenen. Its port on the Lake of Lucerne, Flüelen, is 2 m. distant. There is a stately parish church, while above the little town is the oldest Capuchin convent in Switzerland (1581). Altdorf is best known as the place where, according to the legend, William Tell shot the apple from his son's head. This act by tradition happened on the market-place, where in 1895, at the foot of an old tower (with rude frescoes commemorating the feat), there was set up a fine bronze statue (by Richard Kissling of Zürich) of Tell and his son. In 1899 a theatre was opened close to the town for the sole purpose of performing Schiller's play of *Wilhelm Tell*. The same year a new carriage-road was opened from Altdorf through the Schächen valley and over the Klausen Pass (6404 ft.) to the village of Linththal (30 m.) and so to Glarus. One and a half mile from Altdorf by the Klausen road is the village of Bürglen, where by tradition Tell was born; while he is also said to have lost his life, while saving that of a child, in the Schächen torrent that flows past the village. On the left bank of the Reuss, immediately opposite Altdorf, is Attinghausen, where the ruined castle (which belonged to one of the real founders of the Swiss Confederation) now houses the cantonal museum of antiquities. (W. A. B. C.)

ALTDORFER, ALBRECHT (? 1480–1538), German painter and engraver, was born at Regensburg (Ratisbon), where in 1505 he was enrolled a burgher, and described as "twenty-five years old." Soon afterwards he is known to have been prosperous, and as city architect he erected fortifications and a public slaughter-house. Altdorfer has been called the "Giorgione of the North." His paintings are remarkable for minute and careful finish, and for close study of nature. The most important of them are to be found in the Pinakothek at Munich. A representation of the battle of Arbela (1529), included in that collection, is usually considered his chief work. His engravings on wood and copper are very numerous, and rank next to those of Albrecht Dürer. The most important collection is at the Berlin museum. Albrecht's brother, Erhard Altdorfer, was also a painter and engraver, and a pupil of Lucas Cranach.

ALTEN, SIR CHARLES [Karl] (1764–1840), Hanoverian and British soldier, son of Baron Alten, a member of an old Hanoverian family, entered the service of the elector as a page at the age of twelve. In 1781 he received a commission in the Hanoverian guards, and as a captain took part in the campaigns of 1793–1795 in the Low Countries, distinguishing himself particularly on the Lys in command of light infantry. In 1803 the Hanoverian army was disbanded, and Alten took service with the King's German Legion in British pay. In command of the light infantry of this famous corps he took part with Lord Cathcart in the Hanoverian expedition of 1805 and in the siege of Copenhagen in 1807, and was with Moore in Sweden and Spain, as well as in the disastrous Walcheren expedition. He was soon employed once more in the Peninsula, and at Albuera commanded a brigade. In April 1813 Wellington placed him at the head of the famous "Light Division" (43rd, 52nd, 95th, and Caçadores), in which post he worthily continued the records of Moore and Robert Craufurd at Nivelle, Nive, Orthez and Toulouse. His officers presented him with a sword of honour as a token of their esteem. In 1815 Alten commanded Wellington's 3rd division and was severely wounded at Waterloo. His conduct won for him the rank of Count von Alten. When the King's German Legion ceased to exist, Alten was given the command of the Hanoverians in France, and in 1818 he returned to Hanover, where he became subsequently minister of war and foreign affairs, and rose to be field-marshal, being retained on the British Army list at the same time as Major-General Sir Charles Alten, G. C. B. He died in 1840. A memorial to Alten has been erected at Hanover.

See *Gentleman's Magazine*, 1840; N. L. Beamish, *Hist. of the King's German Legion*, 2 vols. (1832–1837).

ALTENA, a town of Germany, in the Prussian province of Westphalia, on the river Lenne, 38 m. S.S.E. from Dortmund. Pop. (1900) 12,769. It consists of a single street, winding up a deep valley for about 3 m. There are three churches, a museum, high grade and popular schools. Its hardware industries are important, and embrace iron rolling, the manufacture of fine wire, needles, springs and silver ornaments. On the neighbouring Schlossberg is the ancestral castle of the counts of La Marck, ancestors, on the female side, of the Prussian royal house.

ALTENBURG, a town of Germany, capital of the duchy of Saxe-Altenburg, situated near the river Pleisse, 23 m. S. of Leipzig, and at the junction of the Saxon state railways Leipzig-Hof and Altenburg-Zeitz. Pop. (1905) 38,811. The town from its hilly position is irregularly built, but many of its streets are wide, and contain a number of large and beautiful buildings. Its ancient castle is picturesquely situated on a lofty porphyry rock, and is memorable as the place from which, in 1455, Kunz von Kaufungen carried off the young princes Albert and Ernest, the founders of the present royal and ducal families of Saxony. Its beautiful picture gallery, containing portraits of several of the famous princes of the house of Wettin, was almost totally destroyed by fire in January 1905. Altenburg is the seat of the higher courts of the Saxon duchies, and possesses a cathedral and several churches, schools, a library, a gallery of pictures and a school of art, an infirmary and various learned societies. There is also a museum, with natural history, archaeological, and art collections, and among other buildings may be mentioned St Bartholomew's church (1089), the town hall (1562–1564), a lunatic asylum, teachers' seminary and an agricultural academy. There is considerable traffic in grain and cattle brought from the surrounding districts; and twice a year there are large horse fairs. Cigars, woollen goods, gloves, hats and porcelain are among the chief manufactures. There are lignite mines in the vicinity.

ALTENSTEIN, a castle upon a rocky mountain in Saxe-Meiningen, on the south-western slope of the Thüringerwald, not far from Eisenach. It is the summer residence of the dukes of Meiningen, and is surrounded by a noble park, which contains, among other objects of interest, a remarkable underground cavern, 500 ft. long, through which flows a large and rapid stream. Boniface, the apostle of the Germans, lived and preached at Altenstein in 724; and near by is the place where, in 1521, Luther was seized, by the order of the elector Frederick the Wise, to be carried off to the Wartburg. An old beech called "Luther's tree," which tradition connected with the reformer, was blown down in 1841, and a small monument now stands in its place.

ALTERNATION (from Lat. *alternare*, to do by turns), strictly, the process of "alternating," *i.e.* of two things following one another regularly by turns, as night alternates with day. A somewhat different sense is attached to some usages of the derivatives. Thus, in American political representative bodies and in the case of company directors, a substitute is sometimes called an "alternate." An "alternative" is that which is offered as a choice of two things, the acceptance of the one implying the rejection of the other. It is incorrect to speak of more than two alternatives, though Mr Gladstone wrote in 1857 of a fourth (*Oxf. Essays*, 26). When there is only one course open there is said to be no alternative.

ALTHAEA, in classical legend, daughter of Thestius, king of Aetolia, wife of Oeneus, king of Calydon, and mother of Meleager (*q.v.*).

ALTING, JOHANN HEINRICH (1583–1644), German divine, was born at Emden, where his father, Menso Alting (1541–1612), was minister. Johann studied with great success at the universities of Gröningen and Herborn. In 1608 he was appointed tutor of Frederick, afterwards elector-palatine, at Heidelberg, and in 1612 accompanied him to England. Returning in 1613 to Heidelberg, after the marriage of the elector with Princess Elizabeth of England, he was appointed professor of dogmatics, and in 1616 director of the theological department in the *Collegium Sapientiae*. In 1618, along with Abraham Scultetus, he represented the university in the synod of Dort. When Count Tilly took the city of Heidelberg (1622) and handed it over to plunder, Alting found great difficulty in escaping the fury of the soldiers. He first retired to Schorndorf; but, offended by the "semi-Pelagianism" of the Lutherans with whom he was brought in contact, he removed to Holland, where the unfortunate elector and "Winter King" Frederick, in exile after his brief reign in Bohemia, made him tutor to his eldest son. In 1627 Alting was appointed to the chair of theology at Gröningen, where he continued to lecture, with increasing reputation, until his death in 1644. Though an orthodox Calvinist, Alting laid little stress on the sterner side of his creed and, when at Dort he opposed the Remonstrants, he did so mainly on the ground that they were "innovators." Among his works are:—*Notae in Decadem Problematum Jacobi Behm* (Heidelberg, 1618); *Scripta Theologica Heidelbergensia* (Amst., 1662); *Exegesis Augustanae Confessionis* (Amst., 1647).

ALTINUM (mod. *Altino*), an ancient town of Venetia, 12 m. S.E. of Tarvisium (Treviso), on the edge of the lagoons. It was probably only a small fishing village until it became the point of junction of the Via Postumia and the Via Popillia (see AQUILEIA). At the end of the republic it was a *municipium*. Augustus and his successors brought it into further importance as a point on the route between Italy and the north-eastern portions of the empire. After the foundation of the naval station at Ravenna, it became the practice to take ship from there to Altinum, instead of following the Via Popillia round the coast, and thence to continue the journey by land. A new road, the Via Claudia Augusta, was constructed by the emperor Claudius from Altinum to the Danube, a distance of 350 m., apparently by way of the Lake of Constance. The place thus became of considerable strategic and commercial importance, and the comparatively mild climate (considering its northerly situation) led to the erection of villas which Martial (*Epigr.* iv. 25) compares with those of Baiae. It was destroyed by Attila in A.D. 452, and its inhabitants took refuge in the islands of the lagoons, forming settlements from which Venice eventually sprang.

ALTITUDE (Lat. *altitudo*, from *altus*, high), height or eminence, and particularly the height above the ground or above sea-level. In geometry, the altitude of a triangle is the length of the perpendicular from the vertex to the base. In astronomy, the altitude of a heavenly body is the apparent angular elevation of the body above the plane of the horizon (see ASTRONOMY: *Spherical*). *Apparent altitude* is the value which is directly observed; *true altitude* is deduced by correcting for astronomical refraction and dip of the horizon; *geocentric altitude* by correcting for parallax.

ALTMÜHL, a river of Germany, in the kingdom of Bavaria. It is an important left bank tributary of the Danube, rising in the Franconian plateau (Fränkische Terrasse), and after a tortuous course of 116 m., at times flowing through meadows and again in weird romantic gorges, joins the Danube at Kelheim. From its mouth it is navigable up to Dietfurt (18 m.), whence the Ludwigscanal (100 m. long) proceeds to Bamberg on the Regnitz, thus establishing communication between the Danube and the Rhine.

ALTO (Ital. for "high"), a musical term applied to the highest adult male voice or counter-tenor, and to the lower boy's or woman's (contralto) voice.

ALTON, a market-town in the Fareham parliamentary division of Hampshire, England, 46½ m. S.W. of London by the London & South-Western railway. Pop. of urban district (1901) 5479. It has a pleasant undulating site near the headwaters of the river Wey. Of the church of St Lawrence part, including the tower, is Norman; the building was the scene of a fierce conflict between the royalist and parliamentary troops in 1643. There is a museum of natural history; the collection is reminiscent of the famous naturalist Gilbert White, of Selborne in this vicinity. Large markets and fairs are held for corn, hops, cattle and sheep; and the town contains some highly reputed ale breweries, besides paper mills and iron foundries.

ALTON, a city of Madison county, Illinois, U.S.A., in the W. part of the state, on the Mississippi river, about 10 m. above the mouth of the Missouri, and about 25 m. N. of St Louis, Missouri. Pop. (1890) 10,294; (1900) 14,210, of whom 1638 were foreign-born; (1910) 17,528. Alton is served by the Chicago & Alton, the Chicago, Peoria & St Louis, the Cleveland, Cincinnati, Chicago & St Louis, and the Illinois Terminal railways. The river is here spanned by a bridge. The residential portion of the city lies on the river bluffs, some of which rise to a height of 250 ft. above the water level, and the business streets are on the bottom lands of the river. Alton has a public library and a public park. Upper Alton (pop. 2918 in 1910), about 1½ m. N.E. of Alton, is the seat of the Western Military Academy (founded in 1879 as Wyman Institute; chartered in 1892), and of Shurtleff College (Baptist, founded in 1827 at Rock Spring, removed to Upper Alton in 1831, and chartered in 1833), which has a college of liberal arts, a divinity school, an academy and a school of music; and the village of Godfrey, 5½ m. N. of Alton, is the seat of the Monticello Ladies' Seminary, founded by Benjamin Godfrey, opened in 1838, and chartered in 1841. Among the manufactures of Alton are iron and glass ware, miners' tools, shovels, coal-mine cars, flour, and agricultural implements; and there are a large oil refinery and a large lead smelter. The value of the city's factory products increased from $4,250,389 in 1900 to $8,696,814 in 1905, or 104·6 %.

The first settlement on the site of Alton was made in 1807, when a trading post was established by the French. The town was laid out in 1817, was first incorporated in 1821, and in 1827 was made the seat of a state penitentiary, which was later removed to Joliet, the last prisoners being transferred in 1860. Alton was first chartered as a city in 1837. In 1836 the Rev. Elijah P. Lovejoy (1802–1837), a native of Albion, Maine, removed the *Observer*, a religious (Presbyterian) periodical of which he was the editor, from St Louis to Alton. He had attracted considerable attention in St Louis by his criticisms of slavery, but though he believed in emancipation, he was not a radical abolitionist. After coming to Alton his anti-slavery views soon became more radical, and in a few months he was an avowed abolitionist. His views were shared by his brother, Owen Lovejoy (1811–1864), a Congregational minister, who also at that time lived in Alton, and who from 1857 until his death was an able anti-slavery member of Congress. Most of the people of southern Illinois were in sympathy with slavery, and consequently the Lovejoys became very unpopular. The press of the *Observer* was three time destroyed, and on the 7th of November 1837 E. P. Lovejoy was killed while attempting to defend against a mob a fourth press which he had recently obtained and which was stored in a warehouse in Alton. His death caused intense excitement throughout the country, and he was everywhere regarded by abolitionists as a martyr to their cause. In 1897 a monument, a granite column surmounted by a bronze statue of Victory, was erected in his honour by the citizens of Alton and by the state.

See Henry Tanner, *The Martyrdom of Lovejoy* (Chicago, 1881), and "The Alton Tragedy" in S. J. May's *Some Recollections of Our Anti-Slavery Conflict* (Boston, 1869).

ALTONA, a town of Germany, in the Prussian province of Schleswig-Holstein, on the right bank of the Elbe immediately west of Hamburg. Though administratively distinct, the two cities so closely adjoin as virtually to form one whole. Lying higher than Hamburg, Altona enjoys a purer and healthier atmosphere. It has spacious squares and streets, among the latter the Palmaille, a stately avenue ending on a terrace about 100 ft. above the Elbe, whence a fine view is obtained of the river and the lowlands beyond. Of the six Evangelical churches, the Hauptkirche (parish church), with a lofty steeple, is noteworthy. The main thoroughfares are embellished by several striking monuments, notably the memorials of the wars of 1864 and 1870, bronze statues of the emperor William I. and Bismarck and the column of Victory (*Siegessäule*). The museum (1901) is an imposing building in the German Renaissance style and contains, in addition to a valuable library, ethnographical and natural history collections. Its site is that formerly occupied by the terminus of the Schleswig-Holstein railways, but a handsome central station lying somewhat farther to the N., connected with Hamburg by an elevated railway, now accommodates all the traffic and provides through communication with the main Prussian railway systems. There are also fine municipal and judicial buildings, a theatre (under the same management as the Stadttheater in Hamburg), a gymnasium, technical schools, a school of navigation and a hospital. In respect of its local industries Altona has manufactures of tobacco and cigars, of machinery, woollens, cottons and chemicals. There are also extensive breweries, tanneries and soap and oil works. Altona carries on an extensive maritime trade with Great Britain, France and America, but it has by no means succeeded in depriving Hamburg of its commercial superiority—indeed, so dependent is it upon its rival that most of its business is transacted on the Hamburg exchange, while the magnificent warehouses on the Altona river bank are to a large extent occupied by the goods of Hamburg merchants. Since 1888, when Altona joined the imperial Zollverein, approximately half a million sterling has been spent upon harbour improvement works. The exports and imports resemble those of Hamburg. In the ten years 1871–1880, the port was entered on an average annually by 737 vessels of 67,735 tons, in 1881–1890 by 608 vessels of 154,713 tons, and in 1891–1898 by 839 vessels of 253,384 tons.

In 1890 the populous suburbs of Ottensen to the W., where the poet Gottlieb Klopstock lies buried, Bahrenfeld, Othmarschen and Övelgönne were incorporated. Without these suburbs the growth of the town may be seen from the following figures:—(1864, when it ceased to be Danish) 53,039; (1880) 91,049; (1885) 104,717; (1890) together with the four suburbs, 143,249; (1895) 148,944; (1900) 161,508; (1905) 168,301. Altona is the headquarters of the IX. German army corps.

The name Altona is said to be derived from *allzu-nah* ("all too near"), the Hamburgers' designation for an inn which in the middle of the 16th century lay too close to their territory. For a long time this was the only house in the locality. When in 1640 Altona passed to Denmark it was a small fishing village. Its rise to its present position is mainly due to the fostering care of the Danish kings who conferred certain customs privileges and exemptions upon it with a view to making it a formidable rival to Hamburg. In 1713 it was burnt by the Swedes, but rapidly recovered from this disaster, and despite the trials of the Napoleonic wars, gradually increased in prosperity. In 1853, owing to the withdrawal by Denmark of its customs privileges, its trade waned. In 1864 Altona was occupied in the name of the German Confederation, passed to Prussia after the war of 1866, and 1888 together with Hamburg joined the Zollverein, while retaining certain free trade rights over the *Freihafengebiet* which it shares with Hamburg and Wandsbek.

See Wichmann, *Geschichte Altonas* (2 vols., Alt., 1896); Ehrenberg & Stahl, *Altonas topographische Entwickelung* (Alt., 1894).

ALTOONA, a city of Blair county, Pennsylvania, U.S.A., about 117 m. E. by N. of Pittsburg. Pop. (1890) 30,337; (1900) 38,973, of whom 3301 were foreign-born, 1518 being German; (1910) 52,127. It lies in the upper end of Logan Valley at the base of the Alleghany mountains, about 1180 ft. above sea-level, and commands views of some of the most picturesque mountain scenery in the state. A short distance to the W. is the famous Horseshoe Bend of the Pennsylvania railway. Altoona is served by the Pennsylvania railway, and is one of the leading railway cities in the United States. Its freight yard is 7 m. long, and has 221 m. of tracks. Large numbers of eastbound coal trains from the mountains and westbound "empties" returning to the mines stop here; and the cars of these trains are classified here and new trains made up. Locomotives and cars are sent to Altoona to be repaired from all over the Pennsylvania railway system E. of Pittsburg, and cars and locomotives are built here; and in the south Altoona foundries car wheels and general castings for locomotives and cars are made. The several departments of railway work are used to give training in a sort of railway university. Graduates of technical schools are received as special apprentices and are directed in a course of four years through the erecting shops, vice shop, blacksmith shop, boiler shop, roundhouse, test department, machine shop, air-brake shop, iron foundry, car shop, work of firing on the road, office work in the motive power accounting department, and drawing room; the most competent may be admitted through the grades of inspector, in the office of the master mechanic or of the road foreman of engines, assistant master mechanic, assistant engineer of motive power, master mechanic and superintendent of motive power. The Pennsylvania railway, co-operating with the public school authorities, established at Altoona, in 1907, a railway high school, the first institution of the kind in the country. It has a well-equipped drawing room, carpenter shop, forging room, foundry, science laboratories and machinery department, in which expert instruction is given. In 1905 the city's factory products were valued at $14,349,963, and in this year the railway shops gave employment to 83·7 % of all wage-earners employed in manufacturing establishments. The manufacture of silk is the only other important industry in the city. The site of the city (formerly farming land) was purchased in 1849 by the Pennsylvania Railroad Company and was laid out as a town. It was incorporated as a borough in 1854 and was chartered as a city in 1868.

ALTO-RELIEVO (Ital. for "high relief"), the term applied to sculpture that projects from the plane to which it is attached to the extent of more than one-half the outline of the principal figures, which may be nearly or in parts entirely detached from the background. It is thus distinguished from *basso-relievo* (*q.v.*), in which there is a greater or less approximation in effect to the pictorial method, the figures being made to appear as projecting more than half their outline without actually doing so. At the same time it is not only the actual degree of relief which is implied by these two terms, but a resultant difference also of design and treatment necessitated by the contingent differences of light and shadow. (See RELIEF and SCULPTURE.)

ALTÖTTING, a town of Germany, in the kingdom of Bavaria, on the Mörren, not far from its junction with the Inn, and on the Mühldorf-Burghausen railway. Pop. (1900) 4344. It has long been a place of pilgrimage to which Roman Catholics, especially from Austria, Bavaria and Swabia resort in large numbers, on account of a celebrated image of the Virgin Mary in the Holy Chapel, which also contains the hearts of some Bavarian princes in silver caskets. In the church of St Peter and St Paul is the tomb of Tilly.

ALTRANSTÄDT, a village of Germany, in Prussian Saxony near Merseburg (*q.v.*), with (1900) 813 inhabitants. Altranstädt is famous in history for two treaties concluded here: (1) the peace which Augustus II., king of Poland and elector of Saxony, was forced to ratify, on the 24th of September 1706, with Charles XII. of Sweden, whereby the former renounced the throne of Poland in favour of Stanislaus Leszczynski—a treaty which Augustus declared null and void after Charles XII.'s defeat at Poltava (8th of July 1709); (2) the treaty of the 31st of August 1707, by which the emperor Joseph I. guaranteed to Charles XII. religious tolerance and liberty of conscience for the Silesian protestants.

ALTRINCHAM, or ALTRINGHAM (and so pronounced), a market-town in the Altrincham parliamentary division of Cheshire England, 8 m. S.W. by S. of Manchester, on the London

& North-Western, Manchester, South Junction & Altrincham and Cheshire Lines railways. Pop. of urban district (1901) 16,831. Many residences in the locality are occupied by those whose business lies in Manchester, who are attracted by the healthy climate and the vicinity of Bowdon Downs and Dunham Massey Woods. Market gardening is carried on, large quantities of fruit and flowers being grown for sale in Manchester. Cabinet-making is also practised; and there are sawmills, iron foundries, and manufactures of cotton, yarn and worsted.

Altrincham (Aldringham) was originally included in the barony of Dunham Massey, one of the eight baronies founded by Hugh, earl of Chester, after the Conquest. An undated charter from Hamo de Massey, lord of the barony, in the reign of Edward I., constituted Altrincham a free borough, with a gild merchant, the customs of Macclesfield, the right to elect reeves and bailiffs for the common council and other privileges. In 1290 the same Hamo obtained a grant of a Tuesday market and a three days' fair at the feast of the Assumption of the Virgin; but in 1319, by a charter from Edward II., the date of the fair was changed to the feast of St James the Apostle. A mayor of Altrincham is mentioned by name in 1452, but the office probably existed long before this date; it has now for centuries been a purely nominal appointment, the chief duty consisting in the opening of the annual fairs. The trade in worsted and woollen yarns, which formerly furnished employment to a large section of the population, has now completely declined, partly owing to the introduction of Irish worsted.

See *Victoria County History, Cheshire*; Alfred Ingham, *History of Altrincham and Bowdon* (Altrincham, 1879).

ALTRUISM (Fr. *autrui*, from Lat. *alter*, the other of two), a philosophical term used in ethics for that theory of conduct which regards the good of others as the end of moral action. It was invented by Auguste Comte and adopted by the English positivists as a convenient antithesis to egoism. According to Comte the only practical method of social regeneration is gradually to inculcate the true social feeling which subordinates itself to the welfare of others. The application to sociological problems of the physical theory of organic evolution further developed the altruistic theory. According to Herbert Spencer, the life of the individual in the perfect society is identical with that of the state: in other words, the first object of him who would live well must be to take his part in promoting the well-being of his fellows individually and collectively. Pure egoism and pure altruism are alike impracticable. For on the one hand unless the egoist's happiness is compatible to some extent with that of his fellows, their opposition will almost inevitably vitiate his perfect enjoyment; on the other hand, the altruist whose primary object is the good of others, must derive his own highest happiness—*i.e.* must realize himself most completely—in the fulfilment of this object. In fact, the altruistic idea, in itself and apart from a further definition of the good, is rather a method than an end.

The self-love theory of Hobbes, with its subtle perversions of the motives of ordinary humanity, led to a reaction which culminated in the utilitarianism of Bentham and the two Mills; but their theory, though superior to the extravagant egoism of Hobbes, had this main defect, according to Herbert Spencer, that it conceived the world as an aggregate of units, and was so far individualistic. Sir Leslie Stephen in his *Science of Ethics* insisted that the unit is the social organism, and therefore that the aim of moralists is not the "greatest happiness of the greatest number," but rather the "health of the organism." The socialistic tendencies of subsequent thinkers have emphasized the ethical importance of altruistic action, but it must be remembered always that it is ultimately only a form of action, that it may be commended in all types of ethical theory, and that it is a practical guide only when it is applied in accordance with a definite theory of "the good." Finally, he who devotes himself on principle to furthering the good of others as his highest moral obligation is from the highest point of view realizing, not sacrificing, himself.

See works of Comte, Spencer, Stephen, and text-books of ethics (cf. bibliography at end of article ETHICS).

ALTWASSER, a town of Germany, in the Prussian province of Silesia, 43 m. by rail S.W. from Breslau, and 3 m. N. from Waldenburg. It has factories for glass, porcelain, machinery, cotton-spinning, iron-foundries and coal-mines. Pop. (1900) 12,144.

ALTYN-TAGH, or ASTYN-TAGH, one of the chief constituent ranges of the Kuen-lun (*q.v.*) in Central Asia, separating Tibet from east Turkestan and the Desert of Gobi.

ALUM, in chemistry, a term given to the crystallized double sulphates of the typical formula $M_2SO_4 \cdot M_2^{III} \cdot (SO_4)_3 24H_2O$, where M is the sign of an alkali metal (potassium, sodium, rubidium, caesium), silver or ammonium, and M^{III} denotes one of the trivalent metals, aluminium, chromium or ferric iron. These salts are employed in dyeing and various other industrial processes. They are soluble in water, have an astringent, acid, and sweetish taste, react acid to litmus, and crystallize in regular octahedra. When heated they liquefy; and if the heating be continued, the water of crystallization is driven off, the salt froths and swells, and at last an amorphous powder remains.

Potash alum is the common alum of commerce, although both soda alum and ammonium alum are manufactured. The presence of sulphuric acid in potash alum was known to the alchemists. J. H. Pott and A. S. Marggraf demonstrated that alumina was another constituent. Pott in his *Lithogeognosia* showed that the precipitate obtained when an alkali is poured into a solution of alum is quite different from lime and chalk, with which it had been confounded by G. E. Stahl. Marggraf showed that alumina is one of the constituents of alum, but that this earth possesses peculiar properties, and is one of the ingredients in common clay (*Expériences faites sur la terre de l'alun*, Marggraf's *Opusc.* ii. 111). He also showed that crystals of alum cannot be obtained by dissolving alumina in sulphuric acid and evaporating the solutions, but when a solution of potash or ammonia is dropped into this liquid, it immediately deposits perfect crystals of alum (*Sur la régénération de l'alun*, Marggraf's *Opusc.* ii. 86).

T. O. Bergman also observed that the addition of potash or ammonia made the solution of alumina in sulphuric acid crystallize, but that the same effect was not produced by the addition of soda or of lime. (*De confectione aluminus*, Bergman's *Opusc.* i. 225), and that potassium sulphate is frequently found in alum.

After M. H. Klaproth had discovered the presence of potassium in leucite and lepidolite, it occurred to L. N. Vauquelin that it was probably an ingredient likewise in many other minerals. Knowing that alum cannot be obtained in crystals without the addition of potash, he began to suspect that this alkali constituted an essential ingredient in the salt, and in 1797 he published a dissertation demonstrating that alum is a double salt, composed of sulphuric acid, alumina and potash (*Annales de chimie*, xxii. 258). Soon after, J. A. Chaptal published the analysis of four different kinds of alum, namely, Roman alum, Levant alum, British alum and alum manufactured by himself. This analysis led to the same result as that of Vauquelin (*Ann. de chim.* xxii. 280).

The word *alumen*, which we translate *alum*, occurs in Pliny's *Natural History*. In the 15th chapter of his 35th book he gives a detailed description of it. By comparing this with the account of *στυπτηρία* given by Dioscorides in the 123rd chapter of his 5th book, it is obvious that the two are identical. Pliny informs us that alumen was found naturally in the earth. He calls it *salsugoterrae*. Different substances were distinguished by the name of "alumen"; but they were all characterized by a certain degree of astringency, and were all employed in dyeing and medicine, the light-coloured alumen being useful in brilliant dyes, the dark-coloured only in dyeing black or very dark colours. One species was a liquid, which was apt to be adulterated; but when pure it had the property of blackening when added to pomegranate juice. This property seems to characterize a solution of iron sulphate in water; a solution of ordinary (potash) alum would possess no such property. Pliny says that there is another kind of alum which the Greeks call *schistos*. It forms in white threads upon the surface of certain stones. From the name *schistos*, and the mode of formation, there can be little doubt that this species was the salt which forms spontaneously on certain slaty minerals, as alum slate and bituminous shale, and which consists chiefly of the sulphates of iron and aluminium. Possibly in certain places the iron sulphate may have been nearly wanting, and then the salt would be white, and would answer, as Pliny says it did, for dyeing bright colours. Several other species of alumen are described by Pliny, but we are unable to make out to what minerals he alludes.

The alumen of the ancients, then, was not the same with the alum of the moderns. It was most commonly an iron sulphate, sometimes probably an aluminium sulphate, and usually a mixture of the two. But the ancients were unacquainted with our alum. They were acquainted with a crystallized iron sulphate, and distinguished it by the names of *misy*, *sory*, *chalcanthum* (Pliny xxxiv. 12). As alum and green vitriol were applied to a variety of substances in common, and as both are distinguished by a sweetish and astringent taste, writers, even after the discovery of alum, do not seem to have discriminated the two salts accurately from each other. In the writings of the alchemists we find the words *misy, sory, chalcanthum* applied to alum as well as to iron sulphate; and the name *atramentum sutorium*, which ought to belong, one would suppose, exclusively to green vitriol, applied indifferently to both. Various minerals are employed in the manufacture of alum, the most important being alunite (*q.v.*) or alum-stone, alum schist, bauxite and cryolite.

In order to obtain alum from alunite, it is calcined and then exposed to the action of air for a considerable time. During this exposure it is kept continually moistened with water, so that it ultimately falls to a very fine powder. This powder is then lixiviated with hot water, the liquor decanted, and the alum allowed to crystallize. The alum schists employed in the manufacture of alum are mixtures of iron pyrites, aluminium silicate and various bituminous substances, and are found in upper Bavaria, Bohemia, Belgium and Scotland. These are either roasted or exposed to the weathering action of the air. In the roasting process, sulphuric acid is formed and acts on the clay to form aluminium sulphate, a similar condition of affairs being produced during weathering. The mass is now systematically extracted with water, and a solution of aluminium sulphate of specific gravity 1·16 is prepared. This solution is allowed to stand for some time (in order that any calcium sulphate and basic ferric sulphate may separate), and is then evaporated until ferrous sulphate crystallizes on cooling; it is then drawn off and evaporated until it attains a specific gravity of 1·40. It is now allowed to stand for some time, decanted from any sediment, and finally mixed with the calculated quantity of potassium sulphate (or if ammonium alum is required, with ammonium sulphate), well agitated, and the alum is thrown down as a finely-divided precipitate of alum meal. If much iron should be present in the shale then it is preferable to use potassium chloride in place of potassium sulphate.

In the preparation of alum from clays or from bauxite, the material is gently calcined, then mixed with sulphuric acid and heated gradually to boiling; it is allowed to stand for some time, the clear solution drawn off and mixed with acid potassium sulphate and allowed to crystallize. When cryolite is used for the preparation of alum, it is mixed with calcium carbonate and heated. By this means, sodium aluminate is formed; it is then extracted with water and precipitated either by sodium bicarbonate or by passing a current of carbon dioxide through the solution. The precipitate is then dissolved in sulphuric acid, the requisite amount of potassium sulphate added and the solution allowed to crystallize.

Potash alum, $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$, crystallizes in regular octahedra and is very soluble in water. The solution reddens litmus and is an astringent. When heated to nearly a red heat it gives a porous friable mass which is known as "burnt alum." It fuses at 92° C. in its own water of crystallization. "Neutral alum" is obtained by the addition of as much sodium carbonate to a solution of alum as will begin to cause the separation of alumina; it is much used in mordanting. Alum finds application as a mordant, in the preparation of lakes for sizing hand-made paper and in the clarifying of turbid liquids.

Sodium alum, $Na_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$, occurs in nature as the mineral mendozite. It is very soluble in water, and is extremely difficult to purify. In the preparation of this salt, it is preferable to mix the component solutions in the cold, and to evaporate them at a temperature not exceeding 60° C. 100 parts of water dissolve 110 parts of sodium alum at 0° C. (W. A. Tilden, *Jour. Chem. Soc.*, 1884, 45, p. 409), and 51 parts at 16° C. (E. Augé, *Comptes rendus*, 1890, 110, p. 1139).

Chrome alum, $K_2SO_4 \cdot Cr_2(SO_4)_3 \cdot 24H_2O$, appears chiefly as a by-product in the manufacture of alizarin, and as a product of the reaction in bichromate batteries.

The solubility of the various alums in water varies greatly, sodium alum being readily soluble in water, whilst caesium and rubidium alums are only sparingly soluble. The various solubilities are shown in the following table:—

Ammonium Alum.		Caesium Alum.		Potash Alum.		Rubidium Alum.	
t°C.	100 parts water dissolve.	t°C.	100 parts water dissolve.	t°C.	100 parts water dissolve.	t°C.	100 parts water dissolve.
0	2·62	0	0·19	0	3·9	0	0·71
10	4·5	10	0·29	10	9·52	10	1·09
50	15·9	50	1·235	50	44·11	50	4·98
80	35·2	80	5·29	80	134·47	80	21·60
100	70·83			100	357·48		
Poggiale *Ann. Chim. phys.* [3] 8, p. 467.		C. Setterberg *Ann.* 1882, 211, p. 104.		Poggiale		C. Setterberg	

ALUMINIUM (symbol *Al*; atomic weight 27·0), a metallic chemical element. Although never met with in the free state, aluminium is very widely distributed in combination, principally as silicates. The word is derived from the Lat. *alumen* (see ALUM), and is probably akin to the Gr. ἅλς (the root of *salt*, *halogen*, &c.). In 1722 F. Hoffmann announced the base of alum to be an individual substance; L. B. Guyton de Morveau suggested that this base should be called *alumine*, after *Sel alumineux*, the French name for alum; and about 1820 the word was changed into *alumina*. In 1760 the French chemist, T. Baron de Henouville, unsuccessfully attempted "to reduce the base of alum" to a metal, and shortly afterwards various other investigators essayed the problem in vain. In 1808 Sir Humphry Davy, fresh from the electrolytic isolation of potassium and sodium, attempted to decompose alumina by heating it with potash in a platinum crucible and submitting the mixture to a current of electricity; in 1809, with a more powerful battery, he raised iron wire to a red heat in contact with alumina, and obtained distinct evidence of the production of an iron-aluminium alloy. Naming the new metal in anticipation of its actual birth, he called it *alumium*; but for the sake of analogy he was soon persuaded to change the word to *aluminum*, in which form, alternately with *aluminium*, it occurs in chemical literature for some thirty years.

Preparation.

In the year 1824, endeavouring to prepare it by chemical means, H. C. Oersted heated its chloride with potassium amalgam, and failed in his object simply by reason of the mercury, so that when F. Wöhler repeated the experiment at Göttingen in 1827, employing potassium alone as the reducing agent, he obtained it in the metallic state for the first time. Contaminated as it was with potassium and with platinum from the crucible, the metal formed a grey powder and was far from pure; but in 1845 he improved his process and succeeded in producing metallic globules wherewith he examined its chief properties, and prepared several compounds hitherto unknown. Early in 1854, H. St Claire Deville, accidentally and in ignorance of Wöhler's later results, imitated the 1845 experiment. At once observing the reduction of the chloride, he realized the importance of his discovery and immediately began to study the commercial production of the metal. His attention was at first divided between two processes—the chemical method of reducing the chloride with potassium, and an electrolytic method of decomposing it with a carbon anode and a platinum cathode, which was simultaneously imagined by himself and R. Bunsen. Both schemes appeared practically impossible; potassium cost about £17 per ℔, gave a very small yield and was dangerous to manipulate, while on the other hand, the only source of electric current then available was the primary battery, and zinc as a store of industrial energy was utterly out of the question. Deville accordingly returned to pure chemistry and invented a practicable method of preparing sodium which, having a lower atomic weight than potassium, reduced a larger proportion. He next devised a plan for manufacturing pure alumina from the natural ores, and finally elaborated a process and plant which held the field for almost thirty years. Only the discovery of dynamo-electric machines and their application to metallurgical processes rendered it possible for E. H. and A. H. Cowles to remove the industry from the hands of chemists, till the time when P. T. L. Héroult and C. M. Hall, by devising the electrolytic method now in use, inaugurated the present era of industrial electrolysis.

Ores.

The chief natural compounds of aluminium are four in number: oxide, hydroxide (hydrated oxide), silicate and fluoride. *Corundum*, the only important native oxide (Al_2O_3), occurs in large deposits in southern India and the United States. Although it contains a higher percentage of metal (52·9 %) than any other natural compound, it is not at present employed as an ore, not only because it is so hard as to be crushed with difficulty, but also because its very hardness makes it valuable as an abrasive. *Cryolite* ($AlF_3\cdot5NaF$) is a double fluoride of aluminium and sodium, which is scarcely known except on the west coast of Greenland. Formerly it was used for the preparation of the metal, but the inaccessibility of its source, and the fact that it is not sufficiently pure to be employed without some preliminary treatment, caused it to be abandoned in favour of other salts. When required in the Héroult-Hall process as a solvent, it is sometimes made artificially. Aluminium silicate is the chemical body of which all clays are nominally composed. *Kaolin* or *China clay* is essentially a pure disilicate ($Al_2O_3\cdot2SiO_2\cdot2H_2O$), occurring in large beds almost throughout the world, and containing in its anhydrous state 24·4 % of the metal, which, however, in common clays is more or less replaced by calcium, magnesium, and the alkalis, the proportion of silica sometimes reaching 70 %. Kaolin thus seems to be the best ore, and it would undoubtedly be used were it not for the fatal objection that no satisfactory process has yet been discovered for preparing pure alumina from any mineral silicate. If, according to the present method of winning the metal, a bath containing silica as well as alumina is submitted to electrolysis, both oxides are dissociated, and as silicon is a very undesirable impurity, an alumina contaminated with silica is not suited for reduction. *Bauxite* is a hydrated oxide of aluminium of the ideal composition, $Al_2O_3\cdot2H_2O$. It is a somewhat widely distributed mineral, being met with in Styria, Austria, Hesse, French Guiana, India and Italy; but the most important beds are in the south of France, the north of Ireland, and in Alabama, Georgia and Arkansas in North America. The chief Irish deposits are in the neighbourhood of Glenravel, Co. Antrim, and have the advantage of being near the coast, so that the alumina can be transported by water-carriage. After being dried at 100° C., Antrim bauxite contains from 33 to 60 % of alumina, from 2 to 30% of ferric oxide, and from 7 to 24% of silica, the balance being titanic acid and water of combination. The American bauxites contain from 38 to 67 % of alumina, from 1 to 23 % of ferric oxide, and from 1 to 32 % of silica. The French bauxites are of fairly constant composition, containing usually from 58 to 70 % of alumina, 3 to 15 % of foreign matter, and 27 % made up of silica, iron oxide and water in proportions that vary with the colour and the situation of the beds.

Before the application of electricity, only two compounds were found suitable for reduction to the metallic state. Alumina itself is so refractory that it cannot be melted save by the oxy-hydrogen blowpipe or the electric arc, and except in the molten state it is not susceptible of decomposition by any chemical reagent. Deville first selected the chloride as his raw material, but observing it to be volatile and extremely deliquescent, he soon substituted in its place a double chloride of aluminium and sodium. Early in 1855 John Percy suggested that cryolite should be more convenient, as it was a natural mineral and might not require purification, and at the end of March in that year, Faraday exhibited before the Royal Institution samples of the metal reduced from its fluoride by Dick and Smith. H. Rose also carried out experiments on the decomposition of cryolite, and expressed an opinion that it was the best of all compounds for reduction; but, finding the yield of metal to be low, receiving a report of the difficulties experienced in mining the ore, and fearing to cripple his new industry by basing it upon the employment of a mineral of such uncertain supply, Deville decided to keep to his chlorides. With the advent of the dynamo, the position of affairs was wholly changed. The first successful idea of using electricity depended on the enormous heating powers of the arc. The infusibility of alumina was no longer prohibitive, for the molten oxide is easily reduced by carbon. Nevertheless, it was found impracticable to smelt alumina electrically except in presence of copper, so that the Cowles furnace yielded, not the pure metal, but an alloy. So long as the metal was principally regarded as a necessary ingredient of aluminium-bronze, the Cowles process was popular, but when the advantages of aluminium itself became more apparent, there arose a fresh demand for some chief method of obtaining it unalloyed. It was soon discovered that the faculty of inducing dissociation possessed by the current might now be utilized with some hope of pecuniary success, but as electrolytic currents are of lower voltage than those required in electric furnaces, molten alumina again became impossible. Many metals, of which copper, silver and nickel are types, can be readily won or purified by the electrolysis of aqueous solutions, and theoretically it may be feasible to treat aluminium in an identical manner. In practice, however, it cannot be thrown down electrolytically with a dissimilar anode so as to win the metal, and certain difficulties are still met with in the analogous operation of plating by means of a similar anode. Of the simple compounds, only the fluoride is amenable to electrolysis in the fused state, since the chloride begins to volatilize below its melting-point, and the latter is only 5° below its boiling-point. Cryolite is not a safe body to electrolyse, because the minimum voltage needed to break up the aluminium fluoride is 4·0, whereas the sodium fluoride requires only 4·7 volts; if, therefore, the current rises in tension, the alkali is reduced, and the final product consists of an alloy with sodium. The corresponding double chloride is a far better material; first, because it melts at about 180° C., and does not volatilize below a red heat, and second, because the voltage of aluminium chloride is 2·3 and that of sodium chloride 4·3, so that there is a much wider margin of safety to cover irregularities in the electric pressure. It has been found, however, that molten cryolite and the analogous double fluoride represented by the formula $Al_2F_6\cdot2NaF$ are very efficient solvents of alumina, and that these solutions can be easily electrolysed at about 800° C. by means of a current that completely decomposes the oxide but leaves the haloid salts unaffected. Molten cryolite dissolves roughly 30 % of its weight of pure alumina, so that when ready for treatment the solution contains about the same proportion of what may be termed "available" aluminium as does the fused double chloride of aluminium and sodium. The advantages lie with the oxide because of its easier preparation. Alumina dissolves readily enough in aqueous hydrochloric acid to yield a solution of the chloride, but neither this solution, nor that containing sodium chloride, can be evaporated to dryness without decomposition. To obtain the anhydrous single or double chloride, alumina must be ignited with carbon in a current of chlorine, and to exclude iron from the finished metal, either the alumina must be pure or the chloride be submitted to purification. This preparation of a chlorine compound suited for electrolysis becomes more costly and more troublesome than that of the oxide, and in addition four times as much raw material must be handled.

At different times propositions have been made to win the metal from its sulphide. This compound possesses a heat of formation so much lower that electrically it needs but a voltage of 0·9 to decompose it, and it is easily soluble in the fused sulphides of the alkali metals. It can also be reduced metallurgically by the action of molten iron. Various considerations, however, tend to show that there cannot be so much advantage in employing it as would appear at first sight. As it is easier to reduce than any other compound, so it is more difficult to produce. Therefore while less energy is absorbed in its final reduction, more is needed in its initial preparation, and it is questionable whether the economy possible in the second stage would not be neutralized by the greater cost of the first stage in the whole operation of winning the metal from bauxite with the sulphide as the intermediary.

Chemical reduction.

The Deville process as gradually elaborated between 1855 and 1859 exhibited three distinct phases:—Production of metallic sodium, formation of the pure double chloride of sodium and aluminium, and preparation of the metal by the interaction of the two former substances. To produce the alkali metal, a calcined mixture of sodium carbonate, coal and chalk was strongly ignited in flat retorts made of boiler-plate; the sodium distilled over into condensers and was preserved under heavy petroleum. In order to prepare pure alumina, bauxite and sodium carbonate were heated in a furnace until the reaction was complete; the product was then extracted with water to dissolve the sodium aluminate, the solution treated with carbon dioxide, and the precipitate removed and dried. This purified oxide, mixed with sodium chloride and coal tar, was carbonized at a red heat, and ignited in a current of dry chlorine as long as vapours of the double chloride were given off, these being condensed in suitable chambers. For the production of the final aluminium, 100 parts of the chloride and 45 parts of cryolite to serve as a flux were powdered together and mixed with 35 parts of sodium cut into small pieces. The whole was thrown in several portions on to the hearth of a furnace previously heated to low redness and was stirred at intervals for three hours. At length when the furnace was tapped a white slag was drawn off from the top, and the liquid metal beneath was received into a ladle and poured into cast-iron moulds. The process was worked out by Deville in his laboratory at the *École Normale* in Paris. Early in 1855 he conducted large-scale experiments at Javel in a factory lent him for the purpose, where he produced sufficient to show at the French Exhibition of 1855. In the spring of 1856 a complete plant was erected at La Glacière, a suburb of Paris, but becoming a nuisance to the neighbours, it was removed to Nanterre in the following year. Later it was again transferred to Salindres, where the manufacture was continued by Messrs. Péchiney till the advent of the present electrolytic process rendered it no longer profitable.

When Deville quitted the Javel works, two brothers C. and A. Tissier, formerly his assistants, who had devised an improved sodium furnace and had acquired a thorough knowledge of their leader's experiments, also left, and erected a factory at Amfreville, near Rouen, to work the cryolite process. It consisted simply in reducing cryolite with metallic sodium exactly as in Deville's chloride method, and it was claimed to possess various mythical advantages over its rival. Two grave disadvantages were soon obvious—the limited supply of ore, and, what was even more serious, the large proportion of silicon in the reduced metal. The Amfreville works existed some eight or ten years, but achieved no permanent prosperity. In 1858 or 1859 a small factory, the first in England, was built by F. W. Gerhard at Battersea, who also employed cryolite, made his own sodium, and was able to sell the product at 3s. 9d. per oz. This enterprise only lasted about four years. Between 1860 and 1874 Messrs Bell Brothers manufactured the metal at Washington, near Newcastle, under Deville's supervision, producing nearly 2 cwt. per year. They took part in the International Exhibition of 1862, quoting a price of 40s. per ℔ troy.

In 1881 J. Webster patented an improved process for making alumina, and the following year he organized the Aluminium Crown Metal Co. of Hollywood to exploit it in conjunction with Deville's method of reduction. Potash-alum and pitch were calcined together, and the mass was treated with hydrochloric acid; charcoal and water to form a paste were next added, and the whole was dried and ignited in a current of air and steam. The residue, consisting of alumina and potassium sulphate, was leached with water to separate the insoluble matter which was dried as usual. All the by-products, potassium sulphate, sulphur and aluminate of iron, were capable of recovery, and were claimed to reduce the cost of the oxide materially. From this alumina the double chloride was prepared in essentially the same manner as practised at Salindres, but sundry economies accrued in the process, owing to the larger scale of working and to the adoption of W. Weldon's method of regenerating the spent chlorine liquors. In 1886 H. Y. Castner's sodium patents appeared, and The Aluminium Co. of Oldbury was promoted to combine the advantages of Webster's alumina and Castner's sodium. Castner had long been interested in aluminium, and was desirous of lowering its price. Seeing that sodium was the only possible reducing agent, he set himself to cheapen its cost, and deliberately rejecting sodium carbonate for the more expensive sodium hydroxide (caustic soda), and replacing carbon by a mixture of iron and carbon—the so-called carbide of iron—he invented the highly scientific method of winning the alkali metal which has remained in existence almost to the present day. In 1872 sodium prepared by Deville's process cost about 4s. per ℔, the greater part of the expense being due to the constant failure of the retorts; in 1887 Castner's sodium cost less than 1s. per ℔, for his cast-iron pots survived 125 distillations.

In the same year L. Grabau patented a method of reducing the simple fluoride of aluminium with sodium, and his process was operated at Trotha in Germany. It was distinguished by the unusual purity of the metal obtained, some of his samples containing 99·5 to 99·8 %. In 1888 the Alliance Aluminium Co., organized to work certain patents for winning the metal from cryolite by means of sodium, erected plant in London, Hebburn and Wallsend, and by 1889 were selling the metal at 11s. to 15s. per ℔. The Aluminium Company's price in 1888 was 20s. per ℔ and the output about 250 ℔ per day. In 1889 the price was 16s., but by 1891 the electricians commenced to offer metal at 4s. per ℔, and aluminium reduced with sodium became a thing of the past.

Electrical reduction.

About 1879 dynamos began to be introduced into metallurgical practice, and from that date onwards numerous schemes for utilizing this cheaper source of energy were brought before the public. The first electrical method worthy of notice is that patented by E. H. and A. H. Cowles in 1885, which was worked both at Lockport, New York, U.S.A., and at Milton, Staffordshire. The furnace consisted of a flat, rectangular, firebrick box, packed with a layer of finely-powdered charcoal 2 in. thick. Through stuffing-boxes at the ends passed the two electrodes, made after the fashion of arc-light carbons, and capable of being approached together according to the requirements of the operation. The central space of the furnace was filled with a mixture of corundum, coarsely-powdered charcoal and copper; and an iron lid lined with firebrick was luted in its place to exclude air. The charge was reduced by means of a 50-volt current from a 300-kilowatt dynamo, which was passed through the furnace for 1½ hours till decomposition was complete. About 100 ℔ of bronze, containing from 15 to 20 ℔ of aluminium, were obtained from each run, the yield of the alloy being reported at about 1 ℔ per 18 e.h.p.-hours. The composition of the alloys thus produced could not be predetermined with exactitude; each batch was therefore analysed, a number of them were bulked together or mixed with copper in the necessary proportion, and melted in crucibles to give merchantable bronzes containing between $1\frac{1}{4}$ and 10 % of aluminium. Although the copper took no part in the reaction, its employment was found indispensable, as otherwise the aluminium partly volatilized, and partly combined with the carbon to form a carbide. It was also necessary to give the fine charcoal a thin coating of calcium oxide by soaking it in lime-water, for the temperature was so high that unless it was thus protected it was gradually converted into graphite, losing its insulating power and diffusing the current through the lining and walls of the furnace. That this process did not depend upon electrolysis, but was simply an instance of electrical smelting or the decomposition of an oxide by means of carbon at the temperature of the electric arc, is shown by the fact that the Cowles furnace would work with an alternating current.

In 1883 R. Crätzel patented a useless electrolytic process with fused cryolite or the double chloride as the raw material, and in 1886 Dr E. Kleiner propounded a cryolite method which was worked for a time by the Aluminium Syndicate at Tyldesley near Manchester, but was abandoned in 1890. In 1887 A. Minet took out patents for electrolysing a mixture of sodium chloride with aluminium fluoride, or with natural or artificial cryolite. The operation was continuous, the metal being regularly run off from the bottom of the bath, while fresh alumina and flouride were added as required. The process exhibited several disadvantages, the electrolyte had to be kept constant in composition lest either fluorine vapours should be evolved or sodium thrown down, and the raw materials had accordingly to be prepared in a pure state. After prolonged experiments in a factory owned by Messrs Bernard Frères at St Michel in Savoy, Minet's process was given up, and at the close of the 19th century the Héroult-Hall method was alone being employed in the manufacture of aluminium throughout the world.

The original Deville process for obtaining pure alumina from bauxite was greatly simplified in 1889 by K. T. Bayer, whose improved process is exploited at Larne in Ireland and at Gardanne in France. New works on the same process have recently been erected near Marseilles. Crude bauxite is ground, lightly calcined to destroy organic matter, and agitated under a pressure of 70 or 80 lb per sq. in. with a solution of sodium hydroxide having the specific gravity 1·45. After two or three hours the liquid is diluted till its density falls to 1.23, when it is passed through filter-presses to remove the insoluble ferric oxide and silica. The solution of sodium aluminate, containing aluminium oxide and sodium oxide in the molecular proportion of 6 to 1, is next agitated for thirty-six hours with a small quantity of hydrated alumina previously obtained, which causes the liquor to decompose, and some 70 % of the aluminium hydroxide to be thrown down. The filtrate, now containing roughly two molecules of alumina to one of soda, is concentrated to the original gravity of 1·45, and employed instead of fresh caustic for the attack of more bauxite; the precipitate is then collected, washed till free from soda, dried and ignited at about 1000° C. to convert it into a crystalline oxide which is less hygroscopic than the former amorphous variety.

The process of manufacture which now remains to be described was patented during 1886 and 1887 in the name of C. M. Hall in America, in that of P. T. L. Héroult in England and France. It would be idle to discuss to whom the credit of first imagining the method rightfully belongs, for probably this is only one of the many occasions when new ideas have been born in several brains at the same time. By 1888 Hall was at work on a commercial scale at Pittsburg, reducing German alumina; in 1891 the plant was removed to New Kensington for economy in fuel, and was gradually enlarged to 1500 h.p.; in 1894 a factory driven by water was erected at Niagara Falls, and subsequently works were established at Shawenegan in Canada and at Massena in the United States. In 1890 also the Hall process operated by steam power was installed at Patricroft, Lancashire, where the plant had a capacity of 300 lb per day, but by 1894 the turbines of the Swiss and French works ruined the enterprise. About 1897 the Bernard factory at St Michel passed into the hands of Messrs Péchiney, the machinery soon being increased, and there, under the control of a firm that has been concerned in the industry almost from its inception, aluminium is being manufactured by the Hall process on a large scale. In July 1888 the *Société Métallurgique Suisse* erected plant driven by a 500 h.p. turbine to carry out Héroult's alloy process, and at the end of that year the *Allgemeine Elektricitäts Gesellschaft* united with the Swiss firm in organizing the *Aluminium Industrie Actien Gesellschaft* of Neuhasen, which has factories in Switzerland, Germany and Austria. The *Société Electrométallurgique Française*, started under the direction of Héroult in 1888 for the production of aluminium in France, began operations on a small scale at Froges in Isère; but soon after large works were erected in Savoy at La Praz, near Modane, and in 1905 another large factory was started in Savoy at St Michel. In 1895 the British Aluminium Company was founded to mine bauxite and manufacture alumina in Ireland, to prepare the necessary electrodes at Greenock, to reduce the aluminium by the aid of water-power at the Falls of Foyers, and to refine and work up the metal into marketable shapes at the old Milton factory of the Cowles Syndicate, remodelled to suit modern requirements. In 1905 this company began works for the utilization of another water-power at Loch Leven.

In 1907 a new company, The Aluminium Corporation, was started in England to carry out the production of the metal by the Héroult process, and new factories were constructed near Conway in North Wales and at Wallsend-on-Tyne, quite close to where, twenty years before, the Alliance Aluminium Co. had their works.

The Héroult cell consists of a square iron or steel box lined with carbon rammed and baked into a solid mass; at the bottom is a cast-iron plate connected with the negative pole of the dynamo, but the actual working cathode is undoubtedly the layer of already reduced and molten metal that lies in the bath. The anode is formed of a bundle of carbon rods suspended from overhead so as to be capable of vertical adjustment. The cell is filled up with cryolite, and the current is turned on till this is melted; then the pure powdered alumina is fed in continuously as long as the operation proceeds. The current is supplied at a tension of 3 to 5 volts per cell, passing through 10 or 12 in series; and it performs two distinct functions:—(1) it overcomes the chemical affinity of the aluminium oxide, (2) it overcomes the resistance of the electrolyte, heating the liquid at the same time. As a part of the voltage is consumed in the latter duty, only the residue can be converted into chemical work, and as the theoretical voltage of the aluminium fluoride in the cryolite is 4·0, provided the bath is kept properly supplied with alumina, the fluorides are not attacked. It follows, therefore, except for mechanical losses, that one charge of cryolite lasts indefinitely, that the sodium and other impurities in it are not liable to contaminate the product, and that only the alumina itself need be carefully purified. The operation is essentially a dissociation of alumina into aluminium, which collects at the cathode, and into oxygen, which combines with the anodes to form carbon monoxide, the latter escaping and being burnt to carbon dioxide outside. Theoretically 36 parts by weight of carbon are oxidized in the production of 54 parts of aluminium; practically the anodes waste at the same rate at which metal is deposited. The current density is about 700 ampères per sq. ft. of cathode surface, and the number of rods in the anode is such that each delivers 6 or 7 ampères per sq. in. of cross-sectional area. The working temperature lies between 750° and 850° C., and the actual yield is 1 lb of metal per 12 e.h.p. hours. The bath is heated internally with the current rather than by means of external fuel, because this arrangement permits the vessel itself to be kept comparatively cool; if it were fired from without, it would be hotter than the electrolyte, and no material suitable for the construction of the cell is competent to withstand the attack of nascent aluminium at high temperatures. Aluminium is so light that it is a matter requiring some ingenuity to select a convenient solvent through which it shall sink quickly, for if it does not sink, it short-circuits the electrolyte. The molten metal has a specific gravity of 2·54, that of molten cryolite saturated with alumina is 2·35, and that of the fluoride Al_2F_6 2NaF saturated with alumina 1·97. The latter therefore appears the better material, and was originally preferred by Hall; cryolite, however, dissolves more alumina, and has been finally adopted by both inventors.

Properties. Aluminium is a white metal with a characteristic tint which most nearly resembles that of tin; when impure, or after prolonged exposure to air, it has a slight violet shade. Its atomic weight is 27 (26·77, H=1, according to J. Thomsen). It is trivalent. The specific gravity of cast metal is 2·583, and of rolled 2·688 at 4° C. It melts at 626° C. (freezing-point 654·5°, Heycock and Neville). It is the third most malleable and sixth most ductile metal, yielding sheets 0·000025 in. in thickness, and wires 0·004 in. in diameter. When quite pure it is somewhat harder than tin, and its hardness is considerably increased by rolling. It is not magnetic. It stands near the positive end of the list of elements arranged in electromotive series, being exceeded only by the alkalis and metals of the alkaline earths; it therefore combines eagerly, under suitable conditions, with oxygen and chlorine. Its coefficient of linear expansion by heat is 0·0000222 (Richards) or 0·0000231 (Roberts-Austen) per 1° C. Its mean specific heat between 0° and 100° is 0·227, and its latent heat of fusion 100 calories (Richards). Only silver, copper and gold surpass it as conductors of heat, its value being 31·33 (Ag=100, Roberts-Austen). Its electrical conductivity, determined on 99·6 % metal, is 60·5 % that of copper for equal volumes, or double that of copper for equal weights, and when chemically pure it exhibits a somewhat higher relative efficiency. The average strength of 98 % metal is approximately shown by the following table:—

	Elastic Limit, tons per sq. in.	Ultimate Strength, tons per sq. in.	Reduction of Area %
Cast . . .	3	7	15
Sheet . . .	5½	11	35
Bars . . .	6½	12	40
Wire . . .	7-13	13-29	60

Weight for weight, therefore, aluminium is only exceeded in tensile strength by the best cast steel, and its own alloy, aluminium bronze. An absolutely clean surface becomes tarnished in damp air, an almost invisible coating of oxide being produced, just as happens with zinc; but this film is very permanent and prevents further attack. Exposure to air and rain also causes slight corrosion, but to nothing like the same extent as occurs with iron, copper or brass. Commercial electrolytic aluminium of the best quality contains as the average of a large number of tests, 0·48 % of silicon and 0·46 % of iron, the residue being essentially aluminium itself. The metal in mass is not affected by hot or cold water, the foil is very slowly oxidized, while the amalgam decomposes rapidly. Sulphuretted hydrogen having no action upon it, articles made of it are not blackened in foggy weather or in rooms where crude coal gas is burnt. To inorganic acids, except hydrochloric, it is highly resistant, ranking well with tin in this respect; but alkalis dissolve it quickly. Organic acids such as vinegar, common salt, the natural ingredients of food, and the various extraneous substances used as food preservatives, alone or mixed together, dissolve traces of it if boiled for any length of time in a chemically-clean vessel; but when aluminium utensils are submitted to the ordinary routine of the kitchen, being used to heat or cook milk, coffee, vegetables, meat and even fruit, and are also cleaned frequently in the usual fashion, no appreciable quantity of metal passes into the food. Moreover, did it do so, the action upon the human system would be infinitely less harmful than similar doses of copper or of lead.

The highly electro-positive character of aluminium is most important. At elevated temperatures the metal decomposes nearly all other metallic oxides, wherefore it is most serviceable as a metallurgical reagent. In the casting of iron, steel and brass, the addition of a trifling proportion (0·005 %) removes oxide and renders the molten metal more fluid, causing the finished products to be more homogeneous, free from blow-holes and solid all through. On the other hand, its electro-positive nature necessitates some care in its utilization. If it be exposed to damp, to sea-water or to corrosive influences of any kind in contact with another metal, or if it be mixed with another metal so as to form an alloy which is not a true chemical compound, the other metal being highly negative to it, powerful galvanic action will be set up and the structure will quickly deteriorate. This explains the failure of boats built of commercially pure aluminium which have been put together with iron or copper rivets, and the decay of other boats built of a light alloy, in which the alloying metal (copper) has been injudiciously chosen. It also explains why aluminium is so difficult to join with low-temperature solders, for these mostly contain a large proportion of lead. This disadvantage, however, is often overestimated since in most cases other means of uniting two pieces are available.

Alloys. The metal produces an enormous number of useful alloys, some of which, containing only 1 or 2 % of other metals, combine the lightness of aluminium itself with far greater hardness and strength. Some with 90 to 99 % of other metals exhibit the general properties of those metals conspicuously improved. Among the heavy alloys, the aluminium bronzes (Cu, 90-97·5 %; Al, 10-2·5 %) occupy the most important position, showing mean tensile strengths increasing from 20 to 41 tons per sq. in. as the percentage of aluminium rises, and all strongly resisting corrosion in air or sea-water. The light copper alloys, in which the proportions just given are practically reversed, are of considerably less utility, for although they are fairly strong, they lack power to resist galvanic action. This subject is far from being exhausted, and it is not improbable that the alloy-producing capacity of aluminium may eventually prove its most valuable characteristic. In the meantime, ternary light alloys appear the most satisfactory, and tungsten and copper, or tungsten and nickel, seem to be the best substances to add.

Uses. The uses of aluminium are too numerous to mention. Probably the widest field is still in the purification of iron and steel. To the general public it appeals most strongly as a material for constructing cooking utensils. It is not brittle like porcelain and cast iron, not poisonous like lead-glazed earthenware and untinned copper, needs no enamel to chip off, does not rust and wear out like cheap tin-plate, and weighs but a fraction of other substances. It is largely replacing brass and copper in all departments of industry—especially where dead weight has to be moved about, and lightness is synonymous with economy—for instance, in bed-plates for torpedo-boat engines, internal fittings for ships instead of wood, complete boats for portage, motor-car parts and boiling-pans for confectionery and in chemical works. The British Admiralty employ it to save weight in the Navy, and the war-offices of the European powers equip their soldiers with it wherever possible. As a substitute for Solenhofen stone it is used in a modified form of lithography, which can be performed on rotary printing-machines at a high speed. With the increasing price of copper, it is coming into vogue as an electrical conductor for uncovered mains; it is found that an aluminium wire 0·126 in. in diameter will carry as much current as a copper wire 0·100 in. in diameter, while the former weighs about 79 ℔ and the latter 162 ℔ per mile. Assuming the materials to be of equal tensile strength per unit of area—hard-drawn copper is stronger, but has a lower conductivity—the adoption of aluminium thus leads to a reduction of 52 % in the weight, a gain of 60 % in the strength, and an increase of 26 % in the diameter of the conductor. Bare aluminium strip has recently been tried for winding-coils in electrical machines, the oxide of the metal acting as insulators between the layers. When the price of aluminium is less than double the price of copper aluminium is cheaper than copper per unit of electric current conveyed; but when insulation is necessary, the smaller size of the copper wire renders it more economical. Aluminium conductors have been employed on heavy work in many places, and for telegraphy and telephony they are in frequent demand and give perfect satisfaction. Difficulties were at first encountered in making the necessary joints, but these have been overcome by practice and experience.

Two points connected with this metal are of sufficient moment to demand a few words by way of conclusion. Its extraordinary lightness forms its chief claim to general adoption, yet is apt to cause mistakes when its price is mentioned. It is the weight of a mass of metal which governs its financial value; its industrial value, in the vast majority of cases, depends on the volume of that mass. Provided it be rigid, the bed-plate of an engine is no better for weighing 30 cwt. than for weighing 10 cwt. A saucepan is required to have a certain diameter and a certain depth in order that it may hold a certain bulk of liquid: its weight is merely an encumbrance. Copper being $3\frac{1}{3}$ times as heavy as aluminium, whenever the latter costs less than $3\frac{1}{3}$ times as much as copper it is actually cheaper. It must be remembered, too, that electrolytic aluminium only became known during the last decade of the 19th century. Samples dating from the old sodium days are still in existence, and when they exhibit unpleasant properties the defect is often ascribed to the metal instead of to the process by which it was won. Much has yet to be learnt about the practical qualities of the electrolytic product, and although every day's experience serves to place the metal in a firmer industrial position, a final verdict can only be passed after the lapse of time. The individual and collective influence of the several impurities which occur in the product of the Héroult cell is still to seek, and the importance of this inquiry will be seen when we consider that if cast iron, wrought iron and steel, the three totally distinct metals included in the generic name of "iron"—which are only distinguished one from another chemically by minute differences in the proportion of certain non-metallic ingredients—had only been in use for a comparatively few years, attempts might occasionally be made to forge cast iron, or to employ wrought iron in the manufacture of edge-tools. (E. J. R.)

Compounds of Aluminium.

Aluminium oxide or *alumina*, Al_2O_3, occurs in nature as the mineral corundum (*q.v.*), notable for its hardness and abrasive power (see Emery), and in well-crystallized forms it constitutes, when coloured by various metallic oxides, the gem-stones, sapphire, oriental topaz, oriental amethyst and oriental emerald. Alumina is obtained as a white amorphous powder by heating aluminium hydroxide. This powder, provided that it has not been too strongly ignited, is soluble in strong acids; by ignition it becomes denser and nearly as hard as corundum; it fuses in the oxyhydrogen flame or electric arc, and on cooling it assumes a crystalline form closely resembling the mineral species. Crystallized alumina is also obtained by heating the fluoride with boron trioxide; by fusing aluminium phosphate with sodium sulphate; by heating alumina to a dull redness in hydrochloric acid gas under pressure; and by heating alumina with lead oxide to a bright red heat. These reactions are of special interest, for they culminate in the production of artificial ruby and sapphire (see Gems, Artificial).

Aluminium Hydrates.—Several hydrated forms of aluminium oxide are known. Of these hydrargillite or gibbsite, $Al(OH)_3$, diaspore, $AlO(OH)$, and bauxite, $Al_2O(OH)_4$, occur in the mineral kingdom. Aluminium hydrate, $Al(OH)_3$, is obtained as a gelatinous white precipitate, soluble in potassium or sodium hydrate, but insoluble in ammonium chloride, by adding ammonia to a cold solution of an aluminium salt; from boiling solutions the precipitate is opaque. By drying at ordinary temperatures, the hydrate $Al(OH)_3 \cdot H_2O$ is obtained; at 300° this yields $AlO(OH)$, which on ignition gives alumina, Al_2O_3. Precipitated aluminium hydrate finds considerable application in dyeing. Soluble modifications were obtained by Walter Crum (*Journ. Chem. Soc.*, 1854, vi. 216), and Thomas Graham (*Phil. Trans.*, 1861, p. 163); the first named decomposing aluminium acetate (from lead acetate and aluminium sulphate) with boiling water, the latter dialysing a solution of the basic chloride (obtained by dissolving the hydroxide in a solution of the normal chloride). Both these soluble hydrates are readily coagulated by traces of a salt, acid or alkali; Crum's hydrate does not combine with dye-stuffs, neither is it soluble in excess of acid, while Graham's compound readily forms lakes, and readily dissolves when coagulated in acids.

In addition to behaving as a basic oxide, aluminium oxide (or hydrate) behaves as an acid oxide towards the strong bases with the formation of *aluminates*. Potassium aluminate, $K_2Al_2O_4$, is obtained in solution by dissolving aluminium hydrate in caustic potash; it is also obtained, as crystals containing three molecules of water, by fusing alumina with potash, exhausting with water, and crystallizing the solution *in vacuo*. Sodium aluminate is obtained in the manufacture of alumina; it is used as a mordant in dyeing, and has other commercial applications. Other aluminates (in particular, of iron and magnesium), are of frequent occurrence in the mineral kingdom, *e.g.* spinel, gahnite, &c.

Salts of Aluminium.—Aluminium forms one series of salts, derived from the trioxide, Al_2O_3. These exhibit, in certain cases, marked crystallographical and other analogies with the corresponding salts of chromium and ferric iron.

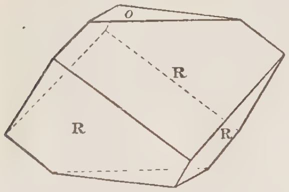
Aluminium fluoride, AlF_3, obtained by dissolving the metal in hydrofluoric acid, and subliming the residue in a current of hydrogen, forms transparent, very obtuse rhombohedra, which are insoluble in water. It forms a series of double fluorides, the most important of which is cryolite (*q.v.*); this mineral has been applied to the commercial preparation of the metal (see above). Aluminium chloride, $AlCl_3$, was first prepared by Oersted, who heated a mixture of carbon and alumina in a current of chlorine, a method subsequently improved by Wöhler, Bunsen, Deville and others. A purer product is obtained by heating aluminium turnings in a current of dry chlorine, when the chloride distils over. So obtained, it is a white crystalline solid, which slowly sublimes just below its melting point (194°). Its vapour density at temperatures above 750° corresponds to the formula $AlCl_3$; below this point the molecules are associated. It is very hygroscopic, absorbing water with the evolution of hydrochloric acid. It combines with ammonia to form $AlCl_3 \cdot 3NH_3$; and forms double compounds with phosphorus pentachloride, phosphorus oxychloride, selenium and tellurium chlorides, as well as with many metallic chlorides; sodium aluminium chloride, $AlCl_3 \cdot NaCl$, is used in the production of the metal. As a synthetical agent in organic chemistry, aluminium chloride has rendered possible more reactions than any other substance; here we can only mention the classic syntheses of benzene homologues. Aluminium bromide, $AlBr_3$, is prepared in the same manner as the chloride. It forms colourless crystals, melting at 90°, and boiling at 265°-270°. Aluminium iodide, AlI_3, results from the interaction of iodine and aluminium. It forms colourless crystals, melting at 185°, and boiling at 360°. Aluminium sulphide, Al_2S_3, results from the direct union of the metal with sulphur, or when carbon disulphide vapour is passed over strongly heated alumina. It forms a yellow fusible mass, which is decomposed by water into alumina and sulphuretted hydrogen. Aluminium sulphate $Al(SO_4)_3$, occurs in the mineral kingdom as keramohalite, $Al_2(SO_4)_3 \cdot 18H_2O$, found near volcanoes and in alum-shale; aluminite or websterite is a basic salt, $Al_2(SO_4)(OH)_4 \cdot 7H_2O$. Aluminium sulphate, known commercially as "concentrated alum" or "sulphate of alumina," is manufactured from kaolin or china clay, which, after roasting (in order to oxidize any iron present), is heated with sulphuric acid, the clear solution run off, and evaporated. "Alum cake" is an impure product. Aluminium sulphate crystallizes as $Al_2(SO_4)_3 \cdot 18H_2O$ in tablets belonging to the monoclinic system. It has a sweet astringent taste, very soluble in water, but scarcely soluble in alcohol. On heating, the crystals lose water, swell up, and give the anhydrous sulphate, which, on further heating, gives alumina. It forms double salts with the sulphates of the metals of the alkalis, known as the alums (see Alum).

Aluminium nitride (AlN) is obtained as small yellow crystals when aluminium is strongly heated in nitrogen. The nitrate, $Al(NO_3)_3$, is obtained as deliquescent crystals (with $8H_2O$)

by evaporating a solution of the hydroxide in nitric acid. Aluminium phosphates may be prepared by precipitating a soluble aluminium salt with sodium phosphate. Wavellite $Al_8(PO_4)_3(OH)_{15}\cdot 9H_2O$, is a naturally occurring basic phosphate, while the gem-stone turquoise (*q.v.*) is $Al(PO_4)(OH)_3\cdot H_2O$, coloured by traces of copper. Aluminium silicates are widely diffused in the mineral kingdom, being present in the commonest rock-forming minerals (felspars, &c.), and in the gem-stones, topaz, beryl, garnet, &c. It also constitutes with sodium silicate the mineral lapis-lazuli and the pigment ultramarine (*q.v.*). Forming the basis of all clays, aluminium silicates play a prominent part in the manufacture of pottery and porcelain.

BIBLIOGRAPHY.—The metallurgy and uses of aluminium are treated in detail in P. Moissonnier, *L'Aluminium* (Paris, 1903); in J. W. Richards, *Aluminium* (1896); and in A. Minet, *Production of Aluminium*, Eng. trans. by L. Waldo (1905); reference may also be made to treatises on general metallurgy, *e.g.* C. Schnabel, *Handbook of Metallurgy*, vol. ii. (1907). For the chemistry see Roscoe and Schlorlemmer, *Treatise on Inorganic Chemistry*, vol. ii. (1908); H. Moissan, *Traité de chimie minérale*; Abegg, *Handbuch der anorganischen Chemie*; and O. Dammer, *Handbuch der anorganischen Chemie*. Aluminium alloys have been studied in detail by Guillet.

ALUNITE, or ALUMSTONE, a mineral first observed in the 15th century at Tolfa, near Rome, where it is mined for the manufacture of alum. Extensive deposits are also worked in Tuscany and Hungary, and at Bulladelah in New South Wales. By repeatedly roasting and lixiviating the mineral, alum is obtained in solution, and this is crystallized out by evaporation. Alunite occurs as seams in trachytic and allied volcanic rocks, having been formed by the action of sulphureous vapours on these rocks. The white, finely granular masses somewhat resemble limestone in appearance, and the more compact kinds from Hungary are so hard and tough that they are used for millstones. Distinct crystals of alunite are rarely met with in cavities in the massive material; these are rhombohedra with interfacial angles of 90° 50′, so that they resemble cubes in appearance. Minute glistening crystals have also been found loose in cavities in altered rhyolite. The hardness is 4 and the specific gravity 2·6. The mineral is a hydrated basic aluminium and potassium sulphate, $KAl_3(SO_4)_2(OH)_6$. It is insoluble in water, but soluble in sulphuric acid. First called aluminilite by J. C. Delamétherie in 1797, this name was contracted by F. S. Beudant in 1824 to alunite. (L. J. S.)



ALUR (Lur, Luri, Lurem), a Negro people of the Nile valley, living on the north-west coast of Albert Nyanza. They are akin to the Acholi (*q.v.*), speaking practically the same language.

ALURE (O. Fr., from *aller*, to walk), an architectural term for an alley, passage, the water-way or flat gutter behind a parapet, the galleries of a clerestory, sometimes even the aisle itself of a church. The term is sometimes written *valure* or *valoring*.

ALVA, or ALBA, **FERNANDO ALVAREZ DE TOLEDO,** DUKE OF, (1508–1583), Spanish soldier, descended from one of the most illustrious families in Spain, was born in 1508. His grandfather, Ferdinand of Toledo, educated him in military science and politics; and he was engaged with distinction at the battle of Pavia while still a youth. Selected for a military command by Charles V., he took part in the siege of Tunis (1535), and successfully defended Perpignan against the dauphin of France. He was present at the battle of Mühlberg (1547), and the victory gained there over John of Saxony was due mainly to his exertions. He took part in the subsequent siege of Wittenberg, and presided at the court-martial which tried the elector and condemned him to death. In 1552 Alva was intrusted with the command of the army intended to invade France, and was engaged for several months in an unsuccessful siege of Metz. In consequence of the success of the French arms in Piedmont, he was made commander-in-chief of all the emperor's forces in Italy, and at the same time invested with unlimited power. Success did not, however, attend his first attempts, and after several unfortunate attacks he was obliged to retire into winter quarters. After the abdication of Charles he was continued in the command by Philip II., who, however, restrained him from extreme measures. Alva had subdued the whole Campagna and was at the gates of Rome, when he was compelled by Philip's orders to negotiate a peace. One of its terms was that the duke of Alva should in person ask forgiveness of the haughty pontiff whom he had conquered. Proud as the duke was by nature, and accustomed to treat with persons of the highest dignity, he confessed his voice failed him at the interview and his presence of mind forsook him. Not long after this (1559) he was sent at the head of a splendid embassy to Paris to espouse, in the name of his master, Elizabeth, daughter of Henry, king of France. In 1567, Philip, who was a bigoted Catholic, sent Alva into the Netherlands at the head of an army of 10,000 men, with unlimited powers for the extirpation of heretics. When he arrived he soon showed how much he merited the confidence which his master reposed in him, and instantly erected a tribunal which soon became known to its victims as the "Court of Blood," to try all persons who had been engaged in the late commotions which the civil and religious tyranny of Philip had excited. He imprisoned the counts Egmont and Horn, the two popular leaders of the Protestants, brought them to an unjust trial and condemned them to death. In a short time he totally annihilated every privilege of the people, and with unrelenting cruelty put multitudes of them to death. The executioner was employed in removing all those friends of freedom whom the sword had spared. In most of the considerable towns Alva built citadels. In the city of Antwerp he erected a statue of himself, which was a monument no less of his vanity than of his tyranny: he was figured trampling on the necks of two smaller statues, representing the two estates of the Low Countries. His attempt to raise money by imposing the Spanish *alcabala*, a tax of 5% on all sales, aroused the opposition of the Catholic Netherlands themselves. The exiles from the Low Countries, encouraged by the general resistance to his government, fitted out a fleet of privateers, and after strengthening themselves by successful depredations, ventured upon the bold exploit of seizing the town of Brielle. Thus Alva by his cruelty became the unwitting instrument of the future independence of the seven Dutch provinces. The fleet of the exiles, having met the Spanish fleet, totally defeated it, and reduced North Holland and Mons. Many cities hastened to throw off the yoke; while the states-general, assembling at Dordrecht, openly declared against Alva's government, and marshalled under the banners of the prince of Orange. Alva's preparations to oppose the gathering storm were made with his usual vigour, and he succeeded in recovering Mons, Mechlin and Zutphen, under the conduct of his son Frederick. With the exception of Zealand and Holland, he regained all the provinces; and at last his son stormed Naarden, and massacring its inhabitants, proceeded to invest the city of Haarlem, which, after standing an obstinate siege, was taken and pillaged. Their next attack was upon Alkmaar; but the spirit of desperate resistance was raised to such a height in the breasts of the Hollanders that the Spanish veterans were repulsed with great loss and Frederick constrained reluctantly to retire. Alva's feeble state of health and continued disasters induced him to solicit his recall from the government of the Low Countries; a measure which, in all probability, was not displeasing to Philip, who was now resolved to make trial of a milder administration. In December 1573 the much-oppressed country was relieved from the presence of the duke of Alva, who, returning home accompanied by his son, made the infamous boast that during the course of six years, besides the multitudes destroyed in battle and massacred after victory, he had consigned 18,000 persons to the executioner.

On his return he was treated for some time with great distinction by Philip. A tardy and imperfect justice, however, overtook him, when he was banished from court and confined in the castle of Uzeda for complicity in certain disgraceful conduct of his son. Here he had remained two years, when the success of Don Antonio in assuming the crown of Portugal determined Philip to turn his eyes towards Alva as the person in whose fidelity and abilities he could most confide. A secretary was instantly despatched to Alva to ascertain whether his health was sufficiently vigorous to enable him to undertake the command of an army. The aged chief returned an answer full of loyal zeal, and was immediately appointed to the supreme command in Portugal. It is a striking fact, however, that the liberation and elevation of Alva were not followed by forgiveness. In 1581 Alva entered Portugal, defeated Antonio, drove him from the kingdom, and soon reduced the whole under the subjection of Philip. Entering Lisbon he seized an immense treasure, and suffered his soldiers, with their accustomed violence and rapacity, to sack the suburbs and vicinity. It is reported that Alva, being requested to give an account of the money expended on that occasion, sternly replied, "If the king asks me for an account, I will make him a statement of kingdoms preserved or conquered, of signal victories, of successful sieges and of sixty years' service." Philip deemed it proper to make no further inquiries. Alva, however, did not enjoy the honours and rewards of his last expedition, for he died in January 1583 at the age of 74.

AUTHORITIES.—See the *Life*, by Rustant (Madrid, 1751). His correspondence during his Flemish government has been published by M. Gachard (Brussels, 1850). See also *Coleccion de documentos ineditos para la historia de España*, vols. iv., vii., viii., xiv., xxxii. and xxxv. (Madrid); and Motley's *Rise of the Dutch Republic* (1856).

ALVA, a police burgh of Clackmannanshire, Scotland, 3¼ m. N. of Alloa, terminus of a branch line of the North British railway. Pop. (1891) 5225; (1901) 4624. It is situated at the foot of three front peaks of the Ochils—West Hill (1682 ft.), Middle Hill (1436 ft.) and Wood Hill (1723 ft.). There are spinning-mills, and manufactures of tweeds, tartans and other woollen goods. Silver, lead and other metals have been found in the hills, but not in paying quantities. The glen to the east of the town, in which are abandoned workings, is called the Silver Glen. Alva House is the seat of the Johnstones, a family which has been intimately connected with the district since the latter half of the 18th century.

ALVARADO, PEDRO DE (1495–1541), one of the Spanish leaders in the discovery and conquest of America, was born at Badajoz about 1495. He held a command in the expedition sent from Cuba against Yucatan in the spring of 1518, and returned in a few months, bearing reports of the wealth and splendour of Montezuma's empire. In February 1519 he accompanied Hernando Cortes in the expedition for the conquest of Mexico, being appointed to the command of one of the eleven vessels of the fleet. He acted as Cortes's principal officer, and on the first occupation of the city of Mexico was left there in charge. When the Spaniards had temporarily to retire before the Mexican uprising, Alvarado led the rear-guard (1st of July 1520), and the *Salto de Alvarado*—a long leap with the use of his spear, by which he saved his life—became famous. He was engaged (1523–24) in the conquest of Guatemala, of which he was subsequently appointed governor by Charles V. In 1534 he attempted to bring the province of Quito under his power, but had to content himself with the exaction of a pecuniary indemnity for the expenses of the expedition. During a visit to Spain, three years later, he had the governorship of Honduras conferred upon him in addition to that of Guatemala. He died in Guatemala in 1541.

ALVAREZ, FRANCISCO (*c.* 1465–1541?), Portuguese missionary and explorer, was born at Coimbra. He was a chaplain-priest and almoner to Dom Manuel, king of Portugal, and was sent in 1515 as secretary to Duarte Galvão and Rodrigo da Lima on an embassy to the negūs of Abyssinia (Lebna Dengel Dawit (David) II.). The expedition having been delayed by the way, it was not until 1520 that he reached Abyssinia, where he remained six years, returning to Lisbon in 1526–1527. In 1533 he was sent to Rome on an embassy to Pope Clement VII. The precise date of his death, like that of his birth, is unknown, but it must have been later than 1540, in which year he published at Lisbon under the king's patronage an account of his travels in one volume folio, entitled *Verdadera Informaçam das terras do Preste Joam*. This curious work was translated into Italian (G. B. Ramusio, *Navagationi*, vol. i., Venice, 1550); into Spanish (*Historia de las Cosas de Etiopia*, by Fray Thomas de Padilla, Antwerp, 1557); into French (*Historiale Description de l'Ethiopie*, Christ. Plantin, Antwerp, 1558); into German (*Wahrhaftiger Bericht von . . . Ethiopien*, Eisleben, 1566); into English (Sam. Purchas, *Pilgrimes*, part ii., London, 1625). The information it contains must, however, be received with caution, as the author is prone to exaggerate, and does not confine himself to what came within his own observation.

ALVAREZ, DON JOSÉ (1768–1827), Spanish sculptor, was born at Priego, in the province of Cordova, in 1768. His full name was José Alvarez de Pereira y Cubero. Bred to his father's trade of a stone-mason, he devoted all his spare time to drawing and modelling. His education in art was due partly to the teaching of the French sculptor Verdiguier at Cordova, and partly to lessons at Madrid, where he attended the lectures of the academy of San Fernando. In 1799 he obtained from Charles IV. a pension of 12,000 reals to enable him to visit Paris and Rome. In the former city he executed in 1804 a statue of Ganymede, which placed him at once in the front rank of the sculptors of his time, and which is now in the sculpture gallery of the Prado. Shortly afterwards his pension was more than doubled, and he left Paris for Rome, where he remained till within a year of his death. He had married in Paris Elizabeth Bougel, by whom he had a son in 1805. This son, known as Don José Alvarez y Bougel, also distinguished himself as a sculptor and a painter, but he died at Burgos before he had reached the age of twenty-five, a little more than two years after his father's death in Madrid in 1827. One of the most successful works of the elder Alvarez was a group representing Antilochus and Memnon, which was commissioned in marble (1818) by Ferdinand VII., and secured for the artist the appointment of court-sculptor. It is now in the museum of Madrid. He also modelled a few portrait busts (Ferdinand VII., Rossini, the duchess of Alba), which are remarkable for their vigour and fidelity.

ALVAREZ, DON MANUEL (1727–1797), Spanish sculptor, was born at Salamanca. He followed classical models so closely that he was styled by his countrymen *El Griego*, "The Greek." His works, which are very numerous, are chiefly to be found at Madrid.

ALVARY, MAX (1858–1898), German singer, was born at Düsseldorf. Gifted with a fine tenor voice and handsome presence he speedily made a reputation in Germany in the leading rôles in Wagnerian opera, and from 1885 onwards appeared also in America and England. He was at his best in 1892, when his performances as Tristan and Siegfried at Covent Garden aroused great enthusiasm.

ALVEARY (from the Lat. *alvearium*), a beehive; used, like *apiarium* in the same sense, figuratively for a collection of hard-working people, or a scholarly work (*e.g.* dictionary) involving bee-like industry. By analogy the term is used for the hollow of the ear, where the wax collects.

ALVENSLEBEN, CONSTANTIN VON (1809–1892), Prussian general, was born on the 26th of August 1809 at Eichenbarleben in Prussian Saxony, and entered the Prussian guards from the cadet corps in 1827. He became first lieutenant in 1842, captain in 1849, and major on the Great General Staff in 1853, whence after seven years he went to the Ministry of War. He was soon afterwards promoted colonel, and commanded a regiment of Guard infantry up to 1864, when he became a major-general. In this rank he commanded a brigade of guards in the war of 1866. At the action of Soor (Bürkersdorf) on the 28th of June he distinguished himself very greatly, and at Königgrätz, where he led the advanced guard of the Guard corps, his energy and initiative were still more conspicuous. Soon afterwards he succeeded to the command of his division, General Hiller v. Gärtringen having fallen in the battle; he was promoted lieutenant-general, and retained this command after the conclusion of peace, receiving in addition the order *pour le mérite* for his services. In 1870, on the outbreak of war with France, von Alvensleben succeeded Prince Frederick Charles in command of the III army corps which formed part of the II German

Army commanded by the prince. Under their new general, the Brandenburg regiments forming the III corps proved themselves collectively the best in the whole German army, with the possible exception of the Prussian guards, and, if Prince Frederick Charles is entitled to the chief credit in training the III corps, Alvensleben had contributed in almost equal degree to the efficiency of the Guard infantry, while his actual leadership of the III corps in the battles of 1870 and 1871 showed him afresh as a fighting general of the very first rank. The battle of Spicheren, on the 6th of August, was initiated and practically directed throughout by him, and in the confusion which followed this victory, for which the superior commanders were not prepared, Alvensleben showed his energy and determination by resuming the advance on his own responsibility. This led to the great battles of the 14th, 16th and 18th of August around Metz, and again the III corps was destined, under its resolute leader, to win the chief credit. Crossing the Moselle the instant that he received permission from his army commander to do so, Alvensleben struck the flank of Bazaine's whole army (August 16th) in movement westward from Metz. The III corps attacked at once, and for many hours bore the whole brunt of the battle at Vionville. By the most resolute leading, and at the cost of very heavy losses, Alvensleben held the whole French army at bay while other corps of the I and II German Armies gradually closed up. In the battle of Gravelotte, on the 18th, the corps took little part. Its work was done, and it remained with the II Army before Metz until the surrender of Bazaine's army. Prince Frederick Charles then moved south-west to co-operate with the grand-duke of Mecklenburg on the Loire. At the battle of Beaune-la-Rolande, the corps, with its comrades of Vionville, the X corps under General v. Voigts-Rhetz, won new laurels, and it participated in the advance on Le Mans and the battle at that place on the 12th of January 1871. At the close of the war Alvensleben received the oak-leaves of the order *pour le mérite*, the first class of the Iron Cross and a grant of 100,000 thalers. He became full general of infantry in 1873 and retired immediately afterwards. In 1889 the emperor William II. ordered that the 52nd infantry regiment (one of the distinguished regiments of Vionville) should thereafter bear Alvensleben's name, and in 1892, on the anniversary of the battle of Le Mans, the old general received the order of the Black Eagle. He died on the 28th of March 1892 at Berlin.

His brother, Gustav von Alvensleben (1803–1881), Prussian general of infantry, was born at Eichenbarleben on the 30th of September 1803, entered the Guard infantry in 1821, and took part as a general staff officer in the suppression of the Baden insurrection of 1849. He became a major-general in 1858, aide-de-camp to the king in 1861, and lieutenant-general in 1863, and in the campaign of 1866 performed valuable military and political services. He was promoted general of infantry in 1868. In the war of 1870 he commanded the IV army corps, which took a conspicuous part in the action of Beaumont and afterwards served in the siege of Paris. He received the Iron Cross, the order *pour le mérite*, and a money grant, as a reward for his services, and retired in 1872. He died at Gernrode in the Harz on the 30th of June 1881.

Another brother, Albrecht, Count von Alvensleben (1794–1858), was a distinguished Prussian statesman.

ALVEOLATE (from Lat. *alveolus*), honeycombed, a word used technically in biology, &c., to mean pitted like a honeycomb.

ALVERSTONE, RICHARD EVERARD WEBSTER, 1st Baron (1842–), lord chief justice of England, was born on the 22nd of December 1842, being the second son of Thomas Webster, Q.C. He was educated at King's College and Charterhouse schools, and Trinity College, Cambridge; was called to the bar in 1868, and became Q.C. only ten years afterwards. His practice was chiefly in commercial, railway and patent cases until (June 1885) he was appointed attorney-general in the Conservative Government in the exceptional circumstances of never having been solicitor-general, and not at the time occupying a seat in parliament. He was elected for Launceston in the following month, and in November exchanged this seat for the Isle of Wight, which he continued to represent until his elevation to the House of Lords. Except under the brief Gladstone administration of 1886, and the Gladstone-Rosebery cabinet of 1892–1895, Sir Richard Webster was attorney-general from 1885 to 1900. In 1890 he was leading counsel for *The Times* in the Parnell inquiry; in 1893 he represented Great Britain in the Bering Sea arbitration; in 1898 he discharged the same function in the matter of the boundary between British Guiana and Venezuela; and in 1903 was one of the members of the Alaska Boundary Commission. He was well known as an athlete in his earlier years, having represented his university as a runner, and his interest in cricket and foot-racing was kept up in later life. In the House of Commons, and outside it, he was throughout his political career prominently associated with church work; and his speeches were distinguished for gravity and earnestness. In 1900 he succeeded Sir Nathaniel Lindley as Master of the Rolls, being raised to the peerage as Baron Alverstone, and in October of the same year he was elevated to the office of lord chief justice upon the death of Lord Russell of Killowen.

ALWAR, or Ulwar, a native state of India in the Rajputana agency. It is bounded on the E. by the state of Bharatpur and the British district of Gurgaon, on the N. by Gurgaon district and the state of Patiala, on the W. by the states of Nabha and Jaipur, and on the S. by the state of Jaipur. Its configuration is irregular, the greatest length from north to south being about 80 m., and breadth from east to west about 60 m., with a total area of 3141 sq. m. The eastern portion of the state is open and highly cultivated; the western is diversified by hills and peaks, which form a continuation of the Aravalli range, from 12 to 20 m. in breadth. These hills run in rocky and precipitous parallel ridges, in some places upwards of 2200 ft. in height. The Sabhi river flows through the north-western part of the state, the only other stream of importance being the Ruparel, which rises in the Alwar hills, and flows through the state into the Bharatpur territory. The population in 1901 was 828,487, showing an increase of 8% during the decade. When compared with a heavy decrease elsewhere throughout Rajputana, this increase may be attributed to the successful administration of famine relief, under British officials. The revenue is £185,000. The maharaja Jai Singh, who succeeded in 1892 at the age of ten, was educated at the Mayo college, where he excelled both in sports and in knowledge of English. He came of age in 1903, when he was invested by the viceroy with full ruling powers. Alwar was the first native state to accept a currency struck at the Calcutta mint, of the same weight and assay as the imperial rupee, with the head of the British sovereign on the obverse. Imperial service troops are maintained, consisting of both cavalry and infantry, with transport. The state is traversed by the Delhi branch of the Rajputana railway. A settlement of the land revenue has been carried out by an English civilian.

The state was founded by Pratap Singh (1740–1791), a Rajput of ancient lineage, and increased by his adopted son Bakhtawar Singh. The latter joined the British against the Mahrattas, and in 1803, after the battle of Laswari (Nov. 1), signed a treaty of offensive and defensive alliance with the British government. In 1811, owing to his armed intervention in Jaipur, a fresh engagement was made, prohibiting him from political intercourse with other states without British consent. In 1857 the raja Binni Singh sent a force of Mussulmans and Rajputs to relieve the British garrison in Agra; the Mussulmans, however, deserted, and the rest were defeated by the mutineers.

The City of Alwar has a railway station on the Rajputana line, 98 m. from Delhi; pop. (1901) 56,771, showing a steady increase. It stands in a valley overhung by a fortress 1000 ft. above. It is surrounded by a rampart and moat, with five gates, and contains fine palaces, temples and tombs. The water-supply is brought from a lake 9 m. distant. It has a high school, affiliated to the Allahabad university; and a school for the sons of nobles, founded to commemorate the Diamond Jubilee of Queen Victoria. The Lady Dufferin hospital is under the charge of an English lady doctor, with two female assistants.

ALYATTES, king of Lydia (609–560 B.C.), the real founder of the Lydian empire, was the son of Sadyattes, of the house of the Mermnadae. For several years he continued the war against Miletus begun by his father, but was obliged to turn his attention to the Medes and Babylonians. On the 28th of May 585, during a battle on the Halys between him and Cyaxares, king of Media, an eclipse of the sun took place; hostilities were suspended, peace concluded, and the Halys fixed as the boundary between the two kingdoms. Alyattes drove the Cimmerii (see SCYTHIA) from Asia, subdued the Carians, and took several Ionian cities (Smyrna, Colophon). He was succeeded by his son Croesus. His tomb still exists on the plateau between lake Gygaea and the river Hermus to the north of Sardis—a large mound of earth with a substructure of huge stones. It was excavated by Spiegelthal in 1854, who found that it covered a large vault of finely-cut marble blocks approached by a flat-roofed passage of the same stone from the south. The sarcophagus and its contents had been removed by early plunderers of the tomb, all that was left being some broken alabaster vases, pottery and charcoal. On the summit of the mound were large *phalli* of stone.

See A. von Ölfers, "Über die lydischen Königsgräber bei Sardes," *Abh. Berl. Ak.*, 1858.

ALYPIUS, a Greek writer on music whose works, with those of six others, were collected and published with a commentary and explanatory notes (*Antiquae Musicae Auctores Septem*, Amstel., 1652), by Mark Meibomius (1630–1711). He is said to have written before Euclid and Ptolemy; and Cassiodorus arranges his *Introduction to Music* between those of Nicomachus and Gaudentius. The work consists solely of a list of symbols of the various scales and modes, and is probably only a fragment.

ALYPIUS OF ANTIOCH, a geographer of the 4th century, who was sent by the emperor Julian into Britain as first prefect, and was afterwards commissioned to rebuild the temple of Jerusalem. Among the letters of Julian are two (29 and 30) addressed to Alypius; one inviting him to Rome, the other thanking him for a geographical treatise, which no longer exists.

See also Ammianus Marcellinus xxiii. 1, § 2.

ALYTES, the midwife toad, first discovered by P. Demours in 1741, on the border of a small pond in the Jardin des Plantes, in the very act of parturition which has rendered it famous, and described as *Petit crapaud mâle accoucheur de sa femelle. Alytes obstetricans* is of special interest as the first known example of paternal solicitude in Batrachians, and although many no less wonderful cases of nursing instinct have since been revealed to us, it remains the only one among European forms.

Alytes obstetricans is a small toad-like Batrachian, two inches in length, of dull greyish coloration, plump form with warty skin and large eyes with vertical pupils. Although toad-like it is not really related to the toads proper, but belongs to the family *Discoglossidae*, characterized by a circular, adherent tongue, teeth in the upper jaw and on the palate, short but distinct ribs on the anterior vertebrae, and convex-concave vertebrae. It inhabits France, Belgium, Switzerland, Western Germany (eastwards to the Weser), Spain and Portugal. A second species, *A. cisternasii*, occurs in Spain and Portugal.

Alytes is nocturnal and slow in its movements. It is thoroughly terrestrial, selecting for its retreat in the daytime holes made by small mammals, or interstices between stones. Towards evening it reveals its presence by a clear whistling note, which has often been compared to the sound of a little bell, or to a chime when produced by numerous individuals. The breeding season lasts throughout spring and summer, and the female is able to spawn two, three or even four times in the year. Pairing and oviposition take place on land; the male seizes the female round the waist. The eggs are large and yellow, and produced in two rosary-like strings, as if strung together by elastic filaments continuous with the gelatinous capsules. After impregnation, the male twists them round his legs and returns to his usual retreat, going about at night in order to feed himself and to keep up the moisture of the eggs, even resorting to a short immersion in the water during exceptionally dry nights. The development of the embryo within the egg takes about three weeks. When the time for eclosion has come, the male enters the water with his burden; the larvae, in the full tadpole condition, measuring 14 to 17 millimetres, bite their way through their tough envelope, which is not abandoned by the father until all the young are liberated, and complete in the ordinary way their metamorphosis. The tadpoles grow to a large size considering that of the adult, the body equalling in size a sparrow's or even a small pigeon's egg, and they often remain more than a year in that condition.

See A. de l'Isle, " Mémoire sur les mœurs et l'accouchement de l'Alytes obstetricans," *Ann. Sci. Nat.* (6) iii. 1876; G. A. Boulenger. *Tailless Batrachians of Europe* (Ray Society, 1897). (G. A. B.)

ALZEY, a town of Germany, in the grand duchy of Hesse-Darmstadt, 18 m. S. of Mainz by rail. Pop. (1900) 6893. There are a Roman Catholic and two Protestant churches, several high-grade schools and a teachers' seminary. Alzey has industries of dyeing and weaving, breweries, and does a considerable trade in wine. It is immortalized in the *Nibelungenlied* in the person of " Volkêr von Alzeie," the warrior who in the last part of the epic plays a part second only to that of Hagen, and who " was called the minstrel (*spilman*) because he could fiddle." It became an imperial city in 1277. In 1620 it was sacked by the Spaniards and in 1689 burnt by the French. Annexed to France during the Napoleonic wars, it passed in 1815 to the grand-duchy of Hesse-Darmstadt.

ALZOG, JOHANN BAPTIST (1808–1878), German theologian, was born at Ohlau, in Silesia, on the 29th of June 1808. He studied at Breslau and Bonn and was ordained priest at Cologne in 1834. In the following year he accepted the chairs of exegesis and church history at the seminary of Posen. He removed in 1844 to Hildesheim, where he had been appointed rector of the seminary. He became professor of church history at the university of Freiburg in the Breisgau in 1853 and held that post till his death on the 1st of March 1878. Together with Döllinger, Alzog was instrumental in convoking the famous Munich assembly of Catholic scholars in 1863. He also took part, with Bishops Hefele and Haseberg, in the preparatory work of the Vatican Council and voted in favour of the doctrine of papal infallibility but against the opportuneness of its promulgation. Alzog's fame rests mainly on his *Handbuch der Universal-Kirchengeschichte* (Mainz, 1841, often reprinted under various titles; Eng. trans. by Pabisch and Byrne, *A Manual of Church History*, 4 vols. Cincinnati, 1874). Based upon the foundations laid by Möhler, this manual was generally accepted as the best exposition of Catholic views, in opposition to the Protestant manual by C. A. Hase, and was translated into several languages. Besides a host of minor writings on ecclesiastical subjects, and an active collaboration in the great *Kirchenlexicon* of Wetzer and Welte, Alzog was also the author of *Grundriss der Patrologie* (Freiburg, 1866, 4th ed. 1888), a scholarly work, though now superseded by that of O. Bardenhewer.

A full list of Alzog's writings is given in H. Hurter's *Nomenclator literarius recentioris theologiae catholicae*, vol. iii. For an account of his life see the funeral oration by F. X. Kraus, entitled: *Gedächtnissrede auf Johannes Alzog* (Freiburg, 1879).

AMADÍS DE GAULA. This famous romance of chivalry survives only in a Castilian text, but it is claimed by Portugal as well as by Spain. The date of its composition, the name of its author, and the language in which it was originally written are not yet settled. It is not even certain when the romance was first printed, for though the oldest known edition (a unique copy of which is in the British Museum) appeared at Saragossa in 1508, it is highly probable that *Amadís* was in print before this date: an edition is reported to have been issued at Seville in 1496. As it exists in Spanish, *Amadís de Gaula* consists of four books, the last of which is generally believed to be by the *regidor* of Medina del Campo, Garci Rodriguez de Montalvo (whose name is given as Garci Ordoñez de Montalvo in all editions of *Amadís* later than that of 1508, and as Garci Gutiérrez de Montalvo in some editions of the *Sergas de Esplandián*). Montalvo alleges that the first three books were arranged and corrected by him from " the ancient originals," and a reference in the prologue to the siege of Granada points to the conclusion that the Spanish recast was made shortly after 1492; it is possible, however, that the prologue alone was written after 1492, and that the text itself is older. The number of these "ancient originals" is not stated, nor is there any mention of the language in which they were composed; Montalvo's silence on the latter point might be taken to imply that they were in Castilian, but any such inference would be hazardous. Three books of *Amadís de Gaula* are mentioned by Pero Ferrús who was living in 1379, and there is evidence that the romance was current in Castile more than a quarter of a century earlier; but again there is no information as to the language in which they were written. Gomes Eannes de Azurara, in his *Chronica de Conde D. Pedro de Menezes* (*c.* 1450), states that *Amadís de Gaula* was written by Vasco de Lobeira in the time of king Ferdinand of Portugal who died in 1383: as Vasco de Lobeira was knighted in 1385, it would follow that he wrote the elaborate romance in his earliest youth. This conclusion is untenable, and the suggestion that the author was Pedro de Lobeira (who flourished in the 15th century) involves a glaring anachronism. A further step was taken by the historian João de Barros, who maintained in an unpublished work dating between 1540 and 1550 that Vasco de Lobeira wrote *Amadís de Gaula* in Portuguese, and that his text was translated into Castilian; this is unsupported assertion. Towards the end of the 16th century Miguel Leite Ferreira, son of the Portuguese poet, Antonio Ferreira, declared that the original manuscript of *Amadís de Gaula* was then in the Aveiro archives, and an *Amadís de Gaula* in Portuguese, which is alleged to have existed in the conde de Vimeiro's library as late as 1586, had vanished before 1726. In the absence of corroboration, these dubious details must be received with extreme reserve. A stronger argument in favour of the Portuguese case is drawn from the existing Spanish text. In book I, chapters 40 and 42, it is recorded that the Infante Alphonso of Portugal suggested a radical change in the narrative of Briolanja's relations with Amadís. This prince has been identified as the Infante Alphonso who died in 1312, or as Alphonso IV. who ascended the Portuguese throne in 1325. Were either of these identifications established, the date of composition might be referred with certainty to the beginning of the 14th century or the end of the 13th. But both identifications are conjectural. Nevertheless the passage in the Spanish text undeniably lends some support to the Portuguese claim, and recent critics have inclined to the belief that *Amadís de Gaula* was written by João de Lobeira, a Galician knight who frequented the Portuguese court between 1258 and 1285, and to whom are ascribed two fragments of a poem in the Colocci-Brancuti *Canzoniere* (Nos. 240 and 240^b), which reappears with some unimportant variants in *Amadís de Gaula* (book II, chapter 11). The coincidence may be held to account in some measure for the traditional association of a Lobeira with the authorship of *Amadís de Gaula*; but, though curious, it warrants no definite conclusion being drawn from it. Against the Portuguese claim it is argued that the *Villancico* corresponding to João de Lobeiro's poem is an interpolation in the Spanish text, that Portuguese prose was in a rudimentary stage of development at the period when—*ex hypothesi*—the romance was composed, and that the book was very popular in Spain almost a century before it is even mentioned in Portugal. Lastly, there is the incontrovertible fact that *Amidís de Gaula* exists in Castilian, while it remains to be proved that it ever existed in Portuguese. As to its substance, it is beyond dispute that much of the text derives from the French romances of the Round Table; but the evidence does not enable us to say (1) whether it was pieced together from various French romances; (2) whether it was more or less literally translated from a lost French original; or (3) whether the first Peninsular adapter or translator was a Castilian or a Portuguese. On these points judgment must be suspended. There can, however, be no hesitation in accepting Cervantes' verdict on *Amadís de Gaula* as the "best of all the books of this kind that have ever been written." It is the prose epic of feudalism, and its romantic spirit, its high ideals, its fantastic gallantry, its ingenious adventures, its mechanism of symbolic wonders, and its flowing style have entranced readers of such various types as Francis I. and Charles V., Ariosto and Montaigne.

Bibliography.—Carolina Michaëlis de Vasconcellos and Gottfried Baist in the *Grundriss der romanischen Philologie* (Strassburg, 1897), ii. Band, 2. Abteilung, pp. 216-226 and 440-442; Ludwig Braunfels, *Kritischer Versuch über den Roman Amadis von Gallien* (Leipzig, 1876); Theophilo Braga, *Historia das novelas portuguezas de cavalleria* (Porto, 1873), *Curso de litteratura e arte portugueza* (Lisboa, 1881), and *Questões de litteratura e arte portugueza* (Lisboa, 1885); Marcelino Menéndez y Pelayo, *Origenes de la novela* (Madrid, 1905); Eugène Baret, *De l'Amadis de Gaule et de son influence sur les mœurs et la littérature au XVI^e et au XVII^e siècle* (Paris, 1873). (J. F. -K.)

AMADOU, a soft tough substance used as tinder, derived from *Polyporus fomentarius*, a fungus belonging to the group Basidiomycetes and somewhat resembling a mushroom in manner of growth. It grows upon old trees, especially the oak, ash, fir and cherry. The fungus is cut into slices and then steeped in a solution of nitre. Amadou is prepared on the continent of Europe, chiefly in Germany, but the fungus is a native of Britain. *Polyporus igniarius* and other species are also used, but yield an inferior product.

AMAKUSA, an island belonging to Japan, 26½ m. long and 13½ in extreme width, situated about 32° 20′ N., and 130° E. long., on the west of the province of Higo (island of Kiushiu), from which it is separated by the Yatsushiro-kai. It has no high mountains, but its surface being very hilly—four of the peaks rise to a height over 1500 ft.—the natives resort to the terrace system of cultivation with remarkable success. A number of the heads of the Christians executed in connexion with the Shimabara rebellion in the first half of the 17th century were buried in this island. Amakusa produces a little coal and fine kaolin, which was largely used in former times by the potters of Hirado and Satsuma.

AMAL, the name of the noblest family among the Ostrogoths, and that from which nearly all their kings were chosen.

AMALARIC (d. 531), king of the Visigoths, son of Alaric II., was a child when his father fell in battle against Clovis, king of the Franks (507). He was carried for safety into Spain, which country and Provence were thenceforth ruled by his maternal grandfather, Theodoric the Ostrogoth, acting through his vicegerent, an Ostrogothic nobleman named Theudis. In 522 the young Amalaric was proclaimed king, and four years later, on Theodoric's death, he assumed full royal power in Spain and a part of Languedoc, relinquishing Provence to his cousin Athalaric. He married Clotilda, daughter of Clovis; but his disputes with her, he being an Arian and she a Catholic, brought on him the penalty of a Frankish invasion, in which he lost his life in 531.

AMALASUNTHA or Amalasuentha, queen of the Ostrogoths (d. 535), daughter of Theodoric, king of the Ostrogoths, was married in 515 to Eutharic, an Ostrogoth of the old Amal line, who had previously been living in Spain. Her husband died, apparently in the early years of her marriage, leaving her with two children, Athalaric and Matasuentha. On the death of her father in 526, she succeeded him, acting as regent for her son, but being herself deeply imbued with the old Roman culture, she gave to that son's education a more refined and literary turn than suited the ideas of her Gothic subjects. Conscious of her unpopularity she banished, and afterwards put to death, three Gothic nobles whom she suspected of intriguing against her rule, and at the same time opened negotiations with the emperor Justinian with the view of removing herself and the Gothic treasure to Constantinople. Her son's death in 534 made but little change in the posture of affairs. Amalasuntha, now queen, with a view of strengthening her position, made her cousin Theodahad partner of her throne (not, as sometimes stated, her husband, for his wife was still living). The choice was unfortunate. Theodahad, notwithstanding a varnish of literary culture, was a coward and a scoundrel. He fostered the disaffection of the Goths, and either by his orders or with his permission, Amalasuntha was imprisoned on an island in the Tuscan lake of Bolsena, where in the spring of 535 she was murdered in her bath.

The letters of Cassiodorus, chief minister and literary adviser of Amalasuntha, and the histories of Procopius and Jordanes, give us our chief information as to the character of Amalasuntha.

AMALEKITES, an ancient tribe, or collection of tribes, in the south and south-east of Palestine, often mentioned in the Old Testament as foes of the Israelites. They were regarded as a branch of the Edomites (Gen. xxxvi. 12, see Edom), and appear to have numbered among their divisions the Kenites. When the Israelites were journeying from Egypt to the land of Canaan, the Amalekites are said to have taken advantage of their weak condition to harry the stragglers in the rear, and as a judgment for their hostility it was ordained that their memory should be blotted out from under heaven (Deut. xxv. 17-19). An allusion to this appears in the account of Israel's defeat on the occasion of the attempt to force a passage from Kadesh through Hormah, evidently into Palestine (Num. xiv. 43-45, cp. Deut. i. 44-46). The statements are obscure, and elsewhere Hormah is the scene of a victory over the Canaanites by Israel (Num. xxi. 1-3), or by the tribes Judah and Simeon (Judg. i. 17). The question is further complicated by the account of Joshua's overthrow of Amalek apparently in the Sinaitic peninsula. The event was commemorated by the erection of the altar "Yahweh-nissi" ("Yahweh my banner" or "memorial"), and rendered even more memorable by the utterance, "Yahweh hath sworn: Yahweh will have war with Amalek from generation to generation" (Ex. xvii. 8-16, on its present position, see Exodus [Book]). The same sentiment recurs in Yahweh's command to Saul to destroy Amalek utterly for its hostility to Israel (1 Sam. xv.), and in David's retaliatory expedition when he distributed among his friends the spoil of the "enemies of Yahweh" (xxx. 26). Saul himself, according to one tradition, was slain by an Amalekite (2 Sam. i., contrast 1 Sam. xxxi.). A similar spirit appears among the prophecies ascribed to Balaam: "Amalek, first (or chief) of nations, his latter end [will be] destruction" (Num. xxiv. 20).

The district of Amalek lay to the south of Judah (cp. 1 Chron. iv. 42 seq.), probably between Kadesh and Hormah (cp. Gen. xiv. 7; 1 Sam. xv. 7, xxvii. 8), and the interchange of the ethnic with "Canaanites" and "Amorites" suggests that the Amalekites are merely one of Israel's traditional enemies of the older period. Hence we find them taking part with Ammonites and Midianites (Judg. iii. 13, vi. 3), and their king Agag, slain by Samuel as a sacrificial offering (1 Sam. xv. 9), was a byword for old-time might and power (Num. xxiv. 7). Even in one of the Psalms (lxxxiii. 7) Amalek is mentioned among the enemies of Israel—just as Greek writers of the 6th century of this era applied the old term Scythians to the Goths (Nöldeke),—and the traditional hostility between Saul and Amalek is reflected still later in the book of Esther where Haman the Agagite is pitted against Mordecai the Benjamite.

Twice Amalek seems to be mentioned as occupying central Palestine (Judg. v. 14, xii. 15), but the passages are textually uncertain. The name is celebrated in Arabian tradition, but the statements regarding them are confused and conflicting, and for historical purposes are practically worthless, as has been proved by Th. Nöldeke (*Ueber die Amalekiter*, Göttingen, 1864). On the biblical data, see also E. Meyer, *Die Israeliten* (*Index*, *s.v.*).

(S. A. C.)

AMALFI, a town and archiepiscopal see of Campania, Italy, in the province of Salerno, from the town of which name it is distant 12 m. W.S.W. by road, on the N. coast of the Gulf of Salerno. Pop. (1901) 6681. It lies at the mouth of a deep ravine, in a sheltered situation, at the foot of Monte Cerreto (4314 ft.), in the centre of splendid coast scenery, and is in consequence much visited by foreigners. The cathedral of S. Andrea is a structure in the Lombard-Norman style, of the 11th century; the façade in black and white stone was well restored in 1891; the bronze doors were executed at Constantinople before 1066. The campanile dates from 1276. The interior is also fine, and contains ancient columns and sarcophagi. The conspicuous Capuchin monastery on the W. with fine cloisters (partly destroyed by a landslip in 1899) is now used as an hotel. Amalfi is first mentioned in the 6th century, and soon acquired importance as a naval power; in the 9th century it shared with Venice and Gaeta the Italian trade with the East, and in 848 its fleet went to the assistance of Pope Leo IV. against the Saracens. It was then an independent republic with a population of some 70,000, but in 1131 it was reduced by King Roger of Sicily. In 1135 and 1137 it was taken by the Pisans, and rapidly declined in importance, though its maritime code, known as the *Tavole Amalfitane*, was recognized in the Mediterranean until 1570. In 1343 a large part of the town was destroyed by an inundation, and its harbour is now of little importance. Its industries too, have largely disappeared, and the paper manufacture has lost ground since 1861.

AMALGAM, the name applied to alloys which contain mercury. It is said by Andreas Libavius to be a corruption of μάλαγμα; in the alchemists the form *algamala* is also found. Many amalgams are formed by the direct contact of a metal with mercury, sometimes with absorption, sometimes with evolution, of heat. Other methods are to place the metal and mercury together in dilute acid, to add mercury to the solution of a metallic salt, to place a metal in a solution of mercuric nitrate, or to electrolyse a metallic salt using mercury as the negative electrode. Some amalgams are liquids, especially when containing a large proportion of mercury; others assume a crystalline form. In some cases definite compounds have been isolated from amalgams which may be regarded as mixtures of one or more of such compounds with mercury in excess. In general these compounds are decomposable by heat, but some of them, such as those of gold, silver, copper and the alkali metals, even when heated above the boiling point of mercury retain mercury and leave residues of definite composition. Tin amalgam is used for "silvering" mirrors, gold and silver amalgam in gilding and silvering, cadmium and copper amalgam in dentistry, and an amalgam of zinc and tin for the rubbers of electrical machines; the zinc plates of electric batteries are amalgamated in order to reduce polarization.

AMALRIC, the name of two kings of Jerusalem.

Amalric I., king from 1162 to 1174, was the son of Fulk of Jerusalem, and the brother of Baldwin III. He was twice married: by his first wife, Agnes of Edessa, he had issue a son and a daughter, Baldwin IV. and Sibylla, while his second wife, Maria Comnena, bore him a daughter Isabella, who ultimately carried the crown of Jerusalem to her fourth husband, Amalric of Lusignan (Amalric II.). The reign of Amalric I. was occupied by the Egyptian problem. It became a question between Amalric and Nureddin, which of the two should control the discordant viziers, who vied with one another for the control of the decadent caliphs of Egypt. The acquisition of Egypt had been an object of the Franks since the days of Baldwin I. (and indeed of Godfrey himself, who had promised to cede Jerusalem to the patriarch Dagobert as soon as he should himself acquire Cairo). The capture of Ascalon by Baldwin III. in 1153 made this object more feasible; and we find the Hospitallers preparing sketch-maps of the routes best suited for an invasion of Egypt, in the style of a modern war office. On the other hand, it was natural for Nureddin to attempt to secure Egypt, both because it was the terminus of the trading route which ran from Damascus and because the acquisition of Egypt would enable him to surround the Latin kingdom. For some five years a contest was waged between Amalric and Shirguh (Shirkuh), the lieutenant of Nureddin, for the possession of Egypt. Thrice (1164, 1167, 1168) Amalric penetrated into Egypt: but the contest ended in the establishment of Saladin, the nephew of Shirguh, as vizier—a position which, on the death of the puppet caliph in 1171, was turned into that of sovereign. The extinction of the Latin kingdom might now seem imminent; and envoys were sent to the West with anxious appeals for assistance in 1169, 1171 and 1173. But though in 1170 Saladin attacked the kingdom, and captured Aila on the Red Sea, the danger was not so great as it seemed. Nureddin was jealous of his over-mighty subject, and his jealousy bound Saladin's hands. This was the position of affairs when Amalric died, in 1174; but, as Nureddin died in the same year, the position was soon altered and Saladin began the final attack on the kingdom. Amalric I., the second of the native kings of Jerusalem, had the qualities of his brother Baldwin III. (*q.v.*). He was something of a scholar, and it was he who set William of Tyre to work. He was perhaps still more of a lawyer: his delight was in knotty points of the law, and he knew the *Assises* better than any of his subjects. The Church had some doubts of him, and he laid his hands on the Church. William of Tyre was once astonished to find him questioning, on a bed of sickness, the resurrection of the body; and his taxation of clerical goods gave umbrage to the clergy generally. But he maintained the state of his kingdom with the resources which he owed to the Church; and he is the last in the fine list of the early kings of Jerusalem.

William of Tyre is our original authority: see xix. 2-3 for his sketch of Amalric. Röhricht narrates the reign of Amalric I., *Geschichte des Königreichs Jerusalem*, c. xvii.-xviii.

Amalric II., king from 1197 to 1205, was the brother of Guy of Lusignan. He had been constable of Jerusalem, but in 1194, on the death of his brother, he became king of Cyprus, as Amalric I. He married Isabella, the daughter of Amalric I, by his second marriage, and became king of Jerusalem in right of his wife in 1197. In 1198 he was able to procure a five years' truce with the Mahommedans, owing to the struggle between Saladin's brothers and his sons for the inheritance of his territories. The truce was disturbed by raids on both sides, but in 1204 it was renewed for six years. Amalric died in 1205, just after his son and just before his wife. The kingdom of Cyprus passed to Hugh, his son by an earlier marriage, while that of Jerusalem passed to Maria, the daughter of Isabella by her previous marriage with Conrad of Montferrat. (E. Br.)

AMALRIC (Fr. Amaury) **OF BENA** (d. *c.* 1204–1207), French theologian, was born in the latter part of the 12th century at Bena, a village in the diocese of Chartres. He taught philosophy and theology at the university of Paris and enjoyed a great reputation as a subtle dialectician; his lectures developing the philosophy of Aristotle attracted a large circle of hearers. In 1204 his doctrines were condemned by the university, and, on a personal appeal to Pope Innocent III., the sentence was ratified, Amalric being ordered to return to Paris and recant his errors. His death was caused, it is said, by grief at the humiliation to which he had been subjected. In 1209 ten of his followers were burnt before the gates of Paris, and Amalric's own body was exhumed and burnt and the ashes given to the winds. The doctrines of his followers, known as the Amalricians, were formally condemned by the fourth Lateran Council in 1215. Amalric appears to have derived his philosophical system from Erigena (*q.v.*), whose principles he developed in a one-sided and strongly pantheistic form. Three propositions only can with certainty be attributed to him: (1) that God is all; (2) that every Christian is bound to believe that he is a member of the body of Christ, and that this belief is necessary for salvation: (3) that he who remains in love of God can commit no sin. These three propositions were further developed by his followers, who maintained that God revealed Himself in a threefold revelation, the first in Abraham, marking the epoch of the Father; the second in Christ, who began the epoch of the Son; and the third in Amalric and his disciples, who inaugurated the era of the Holy Ghost. Under the pretext that a true believer could commit no sin, the Amalricians indulged in every excess, and the sect does not appear to have long survived the death of its founder.

See W. Preger, *Geschichte der deutschen Mystik im Mittelalter* (Leipzig, 1874, i. 167-173); Hauréau, *Hist. de la phil. scol.* (Paris, 1872); C. Schmidt, *Hist. de l'Église d'Occident pendant le moyen âge* (Paris, 1885); Hefele, *Conciliengesch.* (2nd ed., Freiburg, 1886).

AMALTEO, the name of an Italian family belonging to Oderzo, Treviso, several members of which were distinguished in literature. The best known are three brothers, Geronimo (1507–1574), Giambattista (1525–1573) and Cornelio (1530–1603), whose Latin poems were published in one collection under the title *Trium Fratrum Amaltheorum Carmina* (Venice, 1627; Amst., 1689). The eldest brother, Geronimo, was a celebrated physician; the second, Giambattista, accompanied a Venetian embassy to England in 1554, and was secretary to Pius IV. at the council of Trent; the third, Cornelio, was a physician and secretary to the republic of Ragusa.

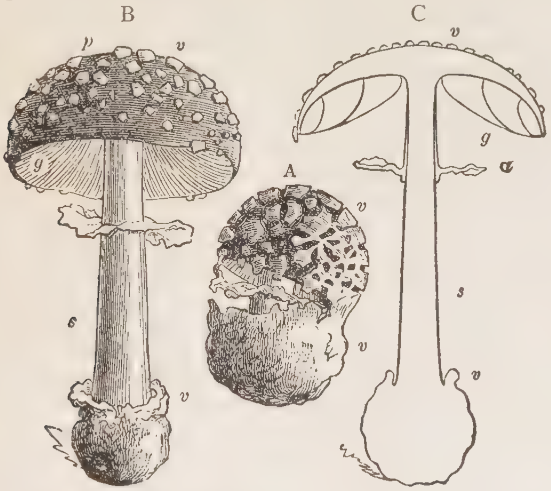
AMALTEO, POMPONIO (1505–1584), Italian painter of the Venetian school, was born at San Vito in Friuli. He was a pupil and son-in-law of Pordenone, whose style he closely imitated. His works consist chiefly of frescoes and altar-pieces and many of them (*e.g.* in the church of Santa Maria de' Battisti, at San Vito) have suffered greatly from the ravages of time.

AMALTHEIA, in Greek mythology, the foster-mother of Zeus. She is sometimes represented as the goat which suckled the infant-god in a cave in Crete, sometimes as a nymph of uncertain parentage (daughter of Oceanus, Haemonius, Olen, Melisseus), who brought him up on the milk of a goat. This goat having broken off one of its horns, Amaltheia filled it with flowers and fruits and presented it to Zeus, who placed it together with the goat amongst the stars. According to another story, Zeus himself broke off the horn and gave it to Amaltheia, promising that it would supply whatever she desired in abundance. Amaltheia gave it to Achelous (her reputed brother), who exchanged it for his own horn which had been broken off in his contest with Heracles for the possession of Deianeira. According to ancient mythology, the owners of the horn were many and various. Speaking generally, it was regarded as the symbol of inexhaustible riches and plenty, and became the attribute of various divinities (Hades, Gaea, Demeter, Cybele, Hermes), and of rivers (the Nile) as fertilizers of the land. The term "horn of Amaltheia" is applied to a fertile district, and an estate belonging to Titus Pomponius Atticus was called Amaltheum. Cretan coins represent the infant Zeus being suckled by the goat; other Greek coins exhibit him suspended from its teats or carried in the arms of a nymph (Ovid, *Fasti*, v. 115; *Metam.* ix. 87).

AMANA, a township in Iowa county, Iowa, U.S.A., 19 m. S.W. (by rail) of Cedar Rapids. Pop. (1900) 1748; (1910) 1729. It is served by the Chicago, Milwaukee & St Paul, and the Chicago, Rock Island & Pacific railways. The township is the home of a German religious communistic society, the Amana Society, formerly the True Inspiration Society (so called from its belief in the present inspiration of the truly godly and perfectly pious), whose members live in various villages near the Iowa river. These villages are named Amana, West Amana, South Amana, East Amana, Middle Amana, High Amana and Homestead. The houses are of brick or unpainted wood. The society has in all 26,000 acres of land, of which about 10,000 acres are covered with forests. The principal occupation of the members is farming, although they also have woollen mills (their woollens being of superior quality), a cotton print factory, flour mills, saw mills and dye shops. Each family has its own dwelling-place and a small garden; each member of a family has an annual allowance of credit at the common store and a room in the dwelling-house; and each group of families has a large garden, a common kitchen and a common dining-hall where men and women eat at separate tables. Between the ages of five and fourteen education is compulsory for the entire year. In the schools nature study and manual training are prominent; German is used throughout and English is taught in upper classes only. No man is permitted to marry until twenty-four years of age, and no woman until twenty. The society's views and practices are nearly related to the teachings of Schwenkfeld and Boehme. Baptism is not practised; the Lord's Supper is celebrated only once in two years; foot-washing is held as a sacrament. At an annual spiritual examination of the members, there are mutual criticisms and public confessions of sin. The Inspirationists are opposed to war and to taking of oaths. The Society became attached to the Separatist leader, Eberhard Ludwig Gruber (d. 1728) in Wetterau in 1714; in 1842–1844 about 600 members, led by Christian Metz, the "divine instrument" of the Society, emigrated from Germany to the United States and settled in a colony called Ebenezer, in Erie county, near Buffalo, N.Y.; in 1855 the colony began to remove to its present home, which it named from the mountain mentioned in the Song of Solomon, iv. 8, the Hebrew word meaning "remain true" (or, more probably, "fixed"), and in 1859 it was incorporated under the name of the Amana Society. Metz died in 1864 and was succeeded by Barbara Landmann, since whose death in 1884 the community has lacked an inspired leader. Amana was the strongest in numbers of the few sectarian communities in America which outlived the 19th century. A few new members have joined the community from Switzerland and Germany in recent years. In 1905 the community won a suit brought against it for its dissolution on the ground that, having been incorporated solely as a benevolent and religious body, it was illegally carrying on a general business.

See W. R. Perkins and B. L. Wick, *History of the Amana Society or Community of True Inspiration*, Historical Monograph, No. 1, in State University of Iowa publications (Iowa City, 1891); R. T. Ely, "Amana: A Study of Religious Communism," in *Harper's Magazine* for October 1902; and Bertha M. H. Shambaugh, *Amana, the Community of True Inspiration* (Iowa City, 1908).

AMANITA. The amanitas include some of the most showy representatives of the *Agaricineae* or mushroom order of fungi (*q.v.*). In the first stages of growth, they are completely enveloped by an outer covering called the veil. As the plant develops the veil is ruptured; the lower portion forms a sheath or volva round the base of the stem, while the upper portion persists as white patches or scales or warts on the surface of the cap. The stem usually bears an upper ring of tissue, the remains of an inner veil, that stretched from the stem to the edge of the cap and broke away from the cap as the latter expanded. The presence of the volva, and the clear white gills and spores, distinguish this genus from all other agarics. They are beautiful objects in the autumn woods; *Amanita muscaria*, the fly fungus, formerly known as *Agaricus muscarius*, being especially remarkable by its bright red cap covered with white warts. Others are pure white or of varying shades of yellow or green. There are sixteen British species of *Amanita*; they grow on the ground in or near woods. Several of the species are very poisonous.



Amanita muscaria.

A, the young plant.
B, the mature plant.
C, longitudinal section of mature plant.
p, the *pileus*.
g, the gills.
a, the *annulus*, or remnant of *velum partiale*.
v, remains of *volva* or *velum universale*.
s, the stalk.

AMANUENSIS (a Latin word, derived from the phrase *servus a manu*, slave of the hand, a secretary), one who writes, from dictation or otherwise, on behalf of another.

AMAPALA, the only port on the Pacific coast of Honduras, on the northern shore of Tigre island, in the Bay of Fonseca (*q.v.*); in 13° 3′ N., and 87° 9′ W. Pop. (1905) about 4000. Amapala was founded in 1838, and its port was opened and declared free in 1868. The roadstead is perfectly sheltered and so deep that the largest vessels can lie within a few yards of the shore. It is the natural outlet for the commerce of some of the richest parts of Honduras, Nicaragua and Salvador; and during the 19th century it exported large quantities of gold, silver and other ores, although its progress was retarded by the delay in constructing a transcontinental railway from Puerto Cortes. Its depots on the mainland, both about 30 m. distant, are La Brea, for the line to Puerto Cortes, and San Lorenzo, for Tegucigalpa. Silver is still exported, in addition to hides, timber, coffee and indigo, and there are valuable fisheries.

AMARANTH, or AMARANT (from the Gr. ἀμάραντος, unwithering), a name chiefly used in poetry, and applied to certain plants which, from not soon fading, typified immortality. Thus Milton (*Paradise Lost*, iii. 353):—

> "Immortal amarant, a flower which once
> In paradise, fast by the tree of life,
> Began to bloom; but soon for man's offence
> To heaven removed, where first it grew, there grows,
> And flowers aloft, shading the fount of life,
> And where the river of bliss through midst of heaven
> Rolls o'er elysian flowers her amber stream:
> With these that never fade the spirits elect
> Bind their resplendent locks."

It should be noted that the proper spelling of the word is amarant; the more common spelling seems to have come from a hazy notion that the final syllable is the Greek word ἄνθος, "flower," which enters into a vast number of botanical names.

The plant genus *Amarantus* (natural order Amarantaceae) contains several well-known garden plants, such as love-lies-bleeding (*A. caudatus*), a native of India, a vigorous hardy annual, with dark purplish flowers crowded in handsome drooping spikes. Another species *A. hypochondriacus*, is prince's feather, another Indian annual, with deeply-veined lance-shaped leaves, purple on the under face, and deep crimson flowers densely packed on erect spikes. "Globe amaranth" belongs to an allied genus, *Gomphrena*, and is also a native of India. It is an annual about 18 in. high, with solitary round heads of flowers; the heads are violet from the colour of the bracts which surround the small flowers.

In ancient Greece the amaranth (also called χρυσάνθεμον and ἑλίχρυσος) was sacred to Ephesian Artemis. It was supposed to have special healing properties, and as a symbol of immortality was used to decorate images of the gods and tombs. In legend, Amarynthus (a form of Amarantus) was a hunter of Artemis and king of Euboea; in a village of Amarynthus, of which he was the eponymous hero, there was a famous temple of Artemis Amarynthia or Amarysia (Strabo x. 448; Pausan. i. 31, p. 5).

See Lenz, *Botanik der alt. Griech. und Röm.* (1859); J. Murr, *Die Pflanzenwelt in der griech. Mythol.* (1890).

AMARAPURA ("the city of the gods"), formerly the capital of the Burmese kingdom, now a suburb of Mandalay, Burma, with a population in 1901 of 9103. The town was founded in 1783 to form a new capital about 6 m. to the north-east of Ava. It increased rapidly in size and population, and in 1810 was estimated to contain 170,000 inhabitants; but in that year the town was destroyed by fire, and this disaster, together with the removal of the native court to Ava in 1823, caused a decline in the prosperity of the place. In 1827 its population was estimated at only 30,000. It suffered severe calamity from an earthquake, which in 1839 destroyed the greater part of the city. It was finally abandoned in 1860, when king Mindon occupied Mandalay, 5 or 6 m. farther north. Amarapura was laid out on much the same plan as Ava. The ruins of the city wall, now overgrown with jungle, show it to have been a square with a side of about three-quarters of a mile in length. At each corner stood a solid brick pagoda about 100 ft. high. The most remarkable edifice was a celebrated temple, adorned with 250 lofty pillars of gilt wood, and containing a colossal bronze statue of Buddha. The remains of the former palace of the Burmese monarchs still survive in the centre of the town. During the time of its prosperity Amarapura was defended by a rampart and a large square citadel, with a broad moat, the walls being 7000 ft. long and 20 ft. high, with a bastion at each corner. The Burmans know it now as Myohaung, "the old city." It has a station on the Rangoon-Mandalay railway, and is the junction for the line to Maymyo and the Kunlong ferry and for the Sagaing-Myitkyina railway. The group of villages called Amarapura by Europeans is known to the Burmans as Taung-myo, "the southern city," as distinguished from Mandalay, the Myauk-myo, or "northern city," 3 m. distant.

AMARAR, a tribe of African "Arabs" inhabiting the mountainous country on the west side of the Red Sea from Suakin northwards towards Kosseir. Between them and the Nile are the Ababda and Bisharin tribes and to their south dwell the Hadendoa. The country of the Amarar is called the Etbai. Their headquarters are in the Ariab district. The tribe is divided into four great families: (1) Weled Gwilei, (2) Weled Aliab, (3) Weled Kurbab Wagadab, and (4) the Amarar proper of the Ariab district. They claim to be of Koreish blood and to be the descendants of an invading Arab army. Possibly some small bands of Koreish Arabs may have made an inroad and converted some of the Amarar to Islam. Further than this there is little to substantiate their claim.

See *Anglo-Egyptian Sudan*, edited by Count Gleichen (London, 1905); Sir F. R. Wingate, *Mahdism and the Egyptian Sudan* (London, 1891); A. H. Keane, *Ethnology of Egyptian Sudan* (London, 1884).

AMARA SINHA (*c.* A.D. 375), Sanskrit grammarian and poet, of whose personal history hardly anything is known. He is said to have been "one of the nine gems that adorned the throne of Vikramaditya," and according to the evidence of Hsüan Tsang, this is the Chandragupta Vikramaditya that flourished about A.D. 375. Amara seems to have been a Buddhist; and an early tradition asserts that his works, with one exception, were destroyed during the persecution carried on by the orthodox Brahmins in the 5th century. The exception is the celebrated *Amara-Kosha* (Treasury of Amara), a vocabulary of Sanskrit roots, in three books, and hence sometimes called *Trikanda* or the "Tripartite." It contains 10,000 words, and is arranged, like other works of its class, in metre, to aid the memory. The first chapter of the *Kosha* was printed at Rome in Tamil character in 1798. An edition of the entire work, with English notes and an index by H. T. Colebrooke, appeared at Serampore in 1808. The Sanskrit text was printed at Calcutta in 1831. A French translation by A. L. A. Loiseleur-Deslongchamps as published at Paris in 1839.

AMARI, MICHELE (1806–1889), Italian orientalist and patriot, was born at Palermo. From his earliest youth he imbibed liberal principles from his relatives, especially from his grandfather, and although at the age of fourteen he was appointed clerk in the Bourbon civil service, he joined the Carbonari like many other young Sicilians and actively sympathized with the revolution of 1820. The movement, which was separatist in its tendencies, was quickly suppressed, but the conspiracies continued, and Amari's father, implicated in that of 1822, was arrested and condemned to death together with many others; but his sentence was commuted to imprisonment, and in 1834 he was liberated. Michele Amari still held his clerkship, but he regarded the Neapolitan government with increasing hatred, and he led a life of active physical exercise to train himself for the day of revolution. He devoted much of his time to the study of English and of history; his first literary essay was a translation of Sir Walter Scott's *Marmion* (1832), and in 1839 he published a work on the Sicilian Vespers, entitled *Un Periodo delle storie Siciliane del XIII. secolo*, filled with political allusions reflecting unfavourably on the government. The book had an immediate success and went through many editions, but it brought the author under the suspicion of the authorities, and in 1842 he escaped from a boat just as he was about to be arrested. He settled in Paris, where he came in contact with a number of literary men, such as Michelet and Thierry, as well as with the Italian exiles. Having no private means he had to earn a precarious livelihood by literature. He was much struck with certain French translations of Arabic works on Sicily, which awoke in him a desire to read the authors in the original. With the assistance of Prof. Reinaud and Baron de Slane he soon acquired great proficiency in Arabic, and his translations and editions of oriental texts, as well as his historical essays, made him a reputation. In 1844 he began his great work *La Storia dei Musulmani in Sicilia*, but the revolution of 1848 plunged him into politics once more. His pamphlet, *Quelques Observations sur le droit public de la Sicile*, advocating the revival of the 1812 constitution for the island, met with great success, and on arriving at Palermo, whence the Bourbon government had been expelled, he was chosen member of the war committee and appointed professor of public law at the university. At the general elections Amari was returned for Palermo and became minister of finance in the Stabile cabinet. On its fall he was sent to Paris and London to try to obtain help for the struggling island; having failed in his mission he returned to Sicily in 1849, hoping to fight. But the Neapolitan troops had re-occupied the island, the Liberals were in disagreement among themselves, and Amari with several other notables with difficulty escaped to Malta. Characteristic of his scholarly nature is the fact that he delayed his flight to take the impress of an important Arabic inscription. He returned to Paris, sad and dejected at the collapse of the movement, and devoted himself once more to his Arabic studies. He published a work on the chronology of the Koran, for which he received a prize from the Académie des Inscriptions, edited the *Solwan el Mota* by Ibn Zafer (a curious collection of philosophical thoughts) and Ibn Haukal's *Description of Palermo*, and in 1854 the first volume of his history of the Mahommedans in Sicily appeared. He received a meagre stipend for cataloguing the Arabic MSS. in the Bibliothèque Nationale, and he contributed many articles to the reviews. Although a firm friend of Mazzini, he discouraged the latter's premature conspiracies. In 1859, after the expulsion of the central Italian despots, Amari was appointed professor of Arabic at Pisa and afterwards at Florence. But when Garibaldi and his thousand had conquered Sicily, Amari returned to his native island, and was given an appointment in the government. Although intensely Sicilian in sentiment, he became one of the staunchest advocates of the union of Sicily with Italy, and was subsequently made senator of the kingdom at Cavour's instance. He was minister of education in the Farini and Minghetti cabinets, but on the fall of the latter in 1864, he resumed his professorship at Florence and spent the rest of his life in study. His circle of acquaintances, both in Italy and abroad, was very large, and his sound scholarship was appreciated in all countries. He died in 1889, loaded with honours. The last volume of his *Storia dei Musulmani* appeared in 1873, and in addition to the above-mentioned works he published many others on oriental and historical subjects. His work on the Sicilian Vespers was re-written as *La Guerra del Vespro* (9th ed., Milan, 1886). He was the pioneer of Arabic studies in modern Italy, and he still remains the standard authority on the Mussulman domination in Sicily, though his judgment on religious questions is sometimes warped by a violently anti-clerical bias.

See A. D'Ancona, *Carteggio di Michele Amari coll' elogio di lui* (Turin, 1896); and Oreste Tommasini's essay in his *Scritti di storia e critica* (Rome, 1891). (L. V.*)

AMARYLLIS (the name of a girl in classical pastoral poetry), in botany, a genus of the natural order Amaryllidaceae, containing the belladonna lily (*Amaryllis Belladonna*), a native of South Africa, which was introduced into cultivation at the beginning of the 18th century. This is a half-hardy bulbous plant, producing in the spring a number of strap-shaped, dull green leaves, 1–1½ ft. long, arranged in two rows, and in autumn a solid stem, bearing at the top a cluster of 6–12 funnel-shaped flowers, of a rose colour and very fragrant. Several forms are known in cultivation. Most of the so-called Amaryllis of gardens belong to the allied genus *Hippeastrum* (*q.v.*).

AMASIA (anc. *Amasia*), the chief town of a sanjak in the Sivas vilayet of Asia Minor and an important trade centre on the Samsun-Sivas road, beautifully situated on the Yeshil Irmak (*Iris*). Pop. 30,000; Moslems about 20,000, of whom a large proportion are Kizilbash (Shia); Christians (mostly Armenians), 10,000. It was one of the chief towns of the kingdom of Trebizond and of the Seljuks, one of whose sultans, Kaikobad I., enriched it with fine buildings and restored the castle, which was thus enabled to stand a seven months' siege by Timur. It was also much favoured by the early Osmanli sultans, one of whom, Selim I., was born there. Bayezid II. built a fine mosque. The place was modernized about a generation ago by Zia Pasha, the poet, when governor, and is now an unusually well built Turkish town with good bazaar and khans and a fine clock-tower. The

Americans and the Jesuits have missionary schools for the Armenian population. Amasia has extensive orchards and fruit gardens still, as in Ibn Batuta's time, irrigated by water wheels turned by the current of the river; and there are steam flour-mills. Wheat, flour and silk are exported.

Ancient *Amasia* has left little trace of itself except on the castle rock, on the left of the river, where the acropolis walls and a number of splendid rock-cut tombs, described by Strabo as those of the kings of Pontus, can be seen. The cliff is cut away all round these immense sepulchres so that they stand free. The finest, known from its polished surfaces as the "Mirror Tomb," is about 2 m. from the modern city. Amasia rose into historical importance after the time of Alexander as the cradle of the power of Pontus; but the last king to reign there was the father of Mithradates Eupator "The Great." The latter, however, made it the base of his operations against the Romans in 89, 72 and 67 B.C. Pompey made it a free city in 65, after Mithradates' fall. It was the birthplace of Strabo. (D. G. H.)

AMASIS, or AMOSIS (the Greek forms of the Egyptian name *Ahmase*, *Ahmosi*, "the moon is born," often written *Aahmes* or *Ahmes* in modern works), the name of two kings of ancient Egypt.

AMASIS I., the founder of the XVIIIth dynasty, is famous for his successful wars against the Hyksos princes who still ruled in the north-east of the Delta (see EGYPT: *History*, sect. 1.)

AMASIS II. was the last great ruler of Egypt before the Persian conquest, 570–526 B.C. Most of our information about him is derived from Herodotus (ii. 161 et seq.) and can only be imperfectly controlled by monumental evidence. According to the Greek historian he was of mean origin. A revolt of the native soldiers gave him his opportunity. These troops, returning home from a disastrous expedition to Cyrene, suspected that they had been betrayed in order that Apries, the reigning king, might rule more absolutely by means of his mercenaries, and their friends in Egypt fully sympathized with them. Amasis, sent to meet them and quell the revolt, was proclaimed king by the rebels, and Apries, who had now to rely entirely on his mercenaries, was defeated and taken prisoner in the ensuing conflict at Momemphis; the usurper treated the captive prince with great lenity, but was eventually persuaded to give him up to the people, by whom he was strangled and buried in his ancestral tomb at Sais. An inscription confirms the fact of the struggle between the native and the foreign soldiery, and proves that Apries was killed and honourably buried in the 3rd year of Amasis. Although Amasis thus appears first as champion of the disparaged native, he had the good sense to cultivate the friendship of the Greek world, and brought Egypt into closer touch with it than ever before. Herodotus relates that under his prudent administration Egypt reached the highest pitch of prosperity; he adorned the temples of Lower Egypt especially with splendid monolithic shrines and other monuments (his activity here is proved by remains still existing). To the Greeks Amasis assigned the commercial colony of Naucratis on the Canopic branch of the Nile, and when the temple of Delphi was burnt he contributed 1000 talents to the rebuilding. He also married a Greek princess named Ladice, the daughter of Battus, king of Cyrene, and he made alliances with Polycrates of Samos and Croesus of Lydia. His kingdom consisted probably of Egypt only, as far as the First Cataract, but to this he added Cyprus, and his influence was great in Cyrene. At the beginning of his long reign, before the death of Apries, he appears to have sustained an attack by Nebuchadrezzar (568 B.C.). Cyrus left Egypt unmolested; but the last years of Amasis were disturbed by the threatened invasion of Cambyses and by the rupture of the alliance with Polycrates of Samos. The blow fell upon his son Psammetichus III., whom the Persian deprived of his kingdom after a reign of only six months.

See NAUCRATIS; also W. M. Flinders Petrie, *History*, vol. iii.; Breasted, *History* and *Historical Documents*, vol. iv. p. 509; Maspero, *Les Empires*. (F. LL. G.)

AMATEUR (Lat. *amator*, lover), a person who takes part in any art, craft, game or sport for the sake of the pleasure afforded by the occupation itself and not for pecuniary gain. Being thus a person for whom the pursuit in question is a recreation and not a business, and who therefore presumably devotes to it a portion only of his leisure and not his working hours, the average amateur possesses less skill than the average professional, whose livelihood and reputation depend on his proficiency, and who therefore concentrates all his energies on the task of attaining the greatest possible mastery in his chosen career. In the arts, such as music, painting and the drama, the best amateurs are outdistanced as executants not merely by the best professionals but by professionals far below the highest rank; and although the inferiority of the amateur is not perhaps so pronounced or so universal in the case of games and outdoor sports, the records of such pastimes as horse-racing, boxing, rowing, billiards, tennis and golf prove that here also the same contrast is generally to be found. Hence it has come about that the term "amateur," and more especially the adjectival derivative "amateurish," has acquired a secondary meaning, usually employed somewhat contemptuously, signifying inefficiency, unskilfulness, superficial knowledge or training.

The immense increase in popularity of athletic contests and games of all kinds in modern times, and especially the keen competition for "records" and championships, often of an international character, have made it a matter of importance to arrive at a clear and formal definition of the amateur as distinguished from the professional. The simple, straightforward definition of the amateur given above has been proved to be easily evaded. Many leading cricketers, for example, preserve their amateur status who, although they are not paid wages for each match they play like their professional colleagues, are provided with an annual income by their county or club under the guise of salary for performing the duties of "secretary" or some other office, leaving them free to play the game six days a week. Similarly, "gentlemen riders" are often presented with a cash payment described as a bet, or under some other pretext. Nor is the dividing-line between "out-of-pocket expenses" allowed to the amateur and the remuneration payable to the professional always strictly drawn. The various associations controlling the different branches of sport have therefore devised working regulations to be observed so far as their jurisdiction extends. Thus the Amateur Athletic Association of Great Britain defines an amateur as "one who has never competed for a money prize or staked bet, or with or against a professional for any prize, or who has never taught, pursued or assisted in the practice of athletic exercises as a means of obtaining a livelihood." The rules of the Amateur Rowing Association are stricter, denying amateur status to anyone who has ever steered or rowed in a race with a professional for any prize, or who is or has been by trade or employment for wages a mechanic, artisan or labourer, or engaged in any menial duty, besides insisting upon the usual restrictions in regard to taking money and competing with professionals. In association football the rules are much more lax, for although amateurs are clearly distinguished from professionals, an amateur may even become a regular member, though unsalaried, of a professional team without losing his amateur status. The Rugby game was, up to 1895, entirely controlled by the Rugby Football Union, which, by the strictness of its laws, effectually prevented the growth of professionalism, but there had been much dissatisfaction in the provinces with the Union's decision against reimbursing day-working players for "broken time," *i.e.* for that part of their wages which they lost by playing on working days, and this resulted in the formation (1895) of the Northern Union, which permits remuneration for "broken time," but allows no person who works for his living to play football unless regularly employed at his particular trade.

In America the amateur question is less complicated than in Great Britain; but the intensely business-like character of American ideas of sport has encouraged the modern spirit of professionalism. All important sports in America, except baseball, football, cricket, golf and rowing, are, however, under the control of the Amateur Athletic Union of the United States, the rules of which, so far as they relate to professionalism, are as follows. No person shall be eligible to compete in any athletic meeting, game or entertainment, given or sanctioned by this Union, who has (1) received or competed for compensation or reward in any form for the display, exercise or example of his skill or knowledge of any athletic exercise, or for rendering personal service of any kind to any athletic organization, or for becoming or continuing a member of any athletic organization; or (2) has entered any competition under a name other than his own, or from a club of which he was not at that time a member in good standing; or (3) has knowingly entered any competition open to any professional or professionals, or has knowingly competed with any professional for any prize or token; or (4) has issued or allowed to be issued in his behalf any challenge to compete against any professional or for money; or (5) has pawned, bartered or sold any prize won in athletic competition. It will be seen that by rule 3 the American Union enacts a standard for all athletes not much different from that of the British Amateur Rowing Association. The rules for the sports not within the Union's jurisdiction are practically the same, except that in baseball, cricket and golf amateurs may compete with professionals, though not for cash prizes. In the case of open golf competitions professional prize-winners receive cash, while amateurs are given plate to the value of their prizes as in Great Britain. There are practically no professional football players in America.

On both sides of the Atlantic the question of the employment of professional coaches has occasioned much discussion. In America it has been accepted as legal. In England the same is almost universally true, but there are certain exceptions, such as the decision of the Henley Regatta Committee, that no crew entering may be coached by a professional within two months of the race-day. Whether such a regulation be wise or the reverse is a question that depends upon the spirit in which games are regarded. Nobody wants to disparage proficiency; but if a game is conducted on business methods, the "game" element tends to be minimized, and if its object is pecuniary it ceases to be "sport" in the old sense, and the old idea of the "amateur" who indulges in it for love of the mere enjoyment tends to disappear.

AMATHUS, an ancient city of Cyprus, on the S. coast, about 24 m. W. of Larnaka and 6 m. E. of Limassol, among sandy hills and sand-dunes, which perhaps explain its name in Greek (ἄμαθος, sand). The earliest remains hitherto found on the site are tombs of the early Iron Age period of Graeco-Phoenician influences (1000–600 B.C.). Amathus is identified by some (E. Oberhummer, *Die Insel Cypern*, i., 1902, pp. 13-14; but see Citium) with *Kartihadasti* (Phoenician "New-Town") in the Cypriote tribute-list of Esarhaddon of Assyria (668 B.C.). It certainly maintained strong Phoenician sympathies, for it was its refusal to join the phil-Hellene league of Onesilas of Salamis which provoked the revolt of Cyprus from Persia in 500–494 B.C. (Herod. v. 105), when Amathus was besieged unsuccessfully and avenged itself by the capture and execution of Onesilas. The phil-Hellene Evagoras of Salamis was similarly opposed by Amathus about 385-380 B.C. in conjunction with Citium and Soli (Diod. Sic. xiv. 98); and even after Alexander the city resisted annexation, and was bound over to give hostages to Seleucus (Diod. Sic. xix. 62). Its political importance now ended, but its temple of Adonis and Aphrodite (*Venus Amathusia*) remained famous in Roman time.

The wealth of Amathus was derived partly from its corn (Strabo 340, quoting Hipponax, *fl.* 540 B.C.), partly from its copper mines (Ovid, *Met.* x. 220, 531), of which traces can be seen inland (G. Mariti, i. 187; L. Ross, *Inselreise*, iv. 195; W. H. Engel, *Kypros*, i. 111 ff.). Ovid also mentions its sheep (*Met.* x. 227); the epithet *Amathusia* in Roman poetry often means little more than "Cypriote," attesting however the fame of the city.

Amathus still flourished and produced a distinguished patriarch of Alexandria (Johannes Eleëmon), as late as 606–616, and a ruined Byzantine church marks the site; but it was already almost deserted when Richard Cœur de Lion won Cyprus by a victory there over Isaac Comnenus in 1191. The rich necropolis, already partly plundered then, has yielded valuable works of art to New York (L. P. di Cesnola, *Cyprus*, 1878 *passim*) and to the British Museum (*Excavations in Cyprus*, 1894 (1899) *passim*); but the city has vanished, except fragments of wall and of a great stone cistern on the acropolis. A similar vessel was transported to the Louvre in 1867. Two small sanctuaries, with terra-cotta votive offerings of Graeco-Phoenician age, lie not far off, but the great shrine of Adonis and Aphrodite has not been identified (M. Ohnefalsch-Richter, *Kypros*, i. ch.1). (J. L. M.)

AMATI, the name of a family of Italian violin-makers, who flourished at Cremona from about 1550 to 1692. According to Fétis, Andrea and Nicolo Amati, two brothers, were the first Italians who made violins. They were succeeded by Antonio and Geronimo, sons of Nicolo. Another Nicolo, son of Geronimo, was born on the 3rd of September 1596 and died on the 12th of August 1684. He was the most eminent of the family. He improved the model adopted by the rest of the Amatis and produced instruments capable of yielding greater power of tone. His pattern was usually small, but he also made the so-called "Grand Amatis." Of his pupils the most famous were Andrea Enamieri and Antonio Stradivari.

AMATITLÁN, or San Juan de Amatitlán, the capital of a department bearing the same name in Guatemala, on Lake Amatitlán, 15 m. S.W. of Guatemala city by the transcontinental railway from Puerto Barrios to San José. Pop. (1905) about 10,000. The town consists almost entirely of one-storeyed adobe huts inhabited by mulattoes and Indians, whose chief industry is the production of cochineal. In 1840 only a small Indian village marked its site, and its subsequent growth was due to the sugar plantations established by a Jesuit settlement. The wells of the town are strongly impregnated with salt and alum, and in the vicinity there are several hot springs. Lake Amatitlán, 9 m. long and 3 m. broad, lies on the northern side of the great Guatemalan Cordillera. Above it rises the four-cratered volcano of Pacaya (8390 ft.), which was in eruption in 1870. The outlet of the lake is a swift river 65 m. long, which cuts a way through the Cordillera, and enters the Pacific at Istapa, after forming at San Pedro a fine waterfall more than 200 ft. high.

AMAUROSIS (Gr. for "blinding,"), a term for "deprivation of sight," limited chiefly to those forms of defect or loss of vision which are caused by diseases not directly involving the eye.

AMAZON, the great river of South America. Before the conquest of South America, the *Rio de las Amazonas* had no general name; for, according to a common custom, each savage tribe gave a name only to the section of the river which it occupied—such as Paranáguazú, Guyermá, Solimões and others. In the year 1500, Vicente Yañez Pinzon, in command of a Spanish expedition, discovered and ascended the Amazon to a point about 50 m. from the sea. He called it the *Rio Santa Maria de la Mar Dulce*, which soon became abbreviated to *Mar Dulce*, and for some years, after 1502, it was known as the *Rio Grande*. The principal companions of Pinzon, in giving evidence in 1515, mention it as *El Ryo Marañon*. There is much controversy about the origin of the word *Marañon*. Peter Martyr in a letter to Lope Hurtado de Mendoza in 1513 is the first to state that it is of native origin. Ten years after the death of Pinzon, his friend Oviedo calls it the Marañon. Many writers believe that this was its Indian name. We are disposed to agree with the Brazilian historian Constancio that *Marañon* is derived from the Spanish word *maraña*, a tangle, a snarl, which well represents the bewildering difficulties which the earlier explorers met in navigating not only the entrance to the Amazon, but the whole island-bordered, river-cut and indented coast of the now Brazilian province of Maranhão.

The first descent of the mighty artery from the Andes to the sea was made by Orellana in 1541, and the name Amazonas arises from the battle which he had with a tribe of Tapuya savages where the women of the tribe fought alongside the men, as was the custom among all of the Tapuyas. Orellana, no doubt, derived the name *Amazonas* from the ancient Amazons (*q.v.*) of Asia and Africa described by Herodotus and Diodorus.

The first ascent of the river was made in 1638 by Pedro Texiera, a Portuguese, who reversed the route of Orellana and reached Quito by way of the Rio Napo. He returned in 1639 with the Jesuit fathers Acuña and Artieda, delegated by the viceroy of Peru to accompany him.

The river Amazon has a drainage area of 2,722,000 sq. m., if the Tocantins be included in its basin. It drains four-tenths of South America, and it gathers its waters from 5° N. to 20° S. latitude. Its most remote sources are found on the inter-Andean plateau, but a short distance from the Pacific Ocean; and, after a course of about 4000 m. through the interior of Peru and across Brazil, it enters the Atlantic Ocean on the equator. It is generally accepted by geographers that the Marañon, or Upper Amazon, rises in the little lake, Lauricocha, in 10° 30′ S. latitude, and 100 m. N.N.E. of Lima. They appear to have followed the account given by Padre Fritz which has since been found incorrect. According to Antonio Raimondi, it is the Rio de Nupe branch of the small stream which issues from the lake that has the longer course and the greater volume of water. The Nupe rises in the Cordillera de Huayhuath and is the true source of the Marañon. There is a difference among geographers as to where the Marañon ends and the Amazon begins, or whether both names apply to the same river. The Pongo de Manseriche, at the base of the Andes and the head of useful navigation, seems to be the natural terminus of the Marañon; and an examination of the hydrographic conditions of the great valley makes the convenience and accuracy of this apparent. Raimondi terminates the Marañon at the mouth of the Ucayali, Reclus the same, both following the missionary fathers of the colonial period. C. M. de la Condamine uses "Amazon" and "Marañon" indiscriminately and considers them one and the same. Smyth and Lowe give the mouth of the Javary as the eastern limit, as does d'Orbigny. Wolf, apparently uncertain, carries the "Marañon or Amazon" to the Peruvian frontier of Brazil at Tabatinga. Other travellers and explorers contribute to the confusion. This probably arises from the rivalry of the Spaniards and Portuguese. The former accepted the name Marañon in Peru, and as the missionaries penetrated the valley they extended the name until they reached the mouth of the Ucayali; while, as the Portuguese ascended the Amazon, they carried this name to the extent of their explorations. Beginning with the lower river we propose to notice, first, the great affluents which go to swell the volume of the main stream.

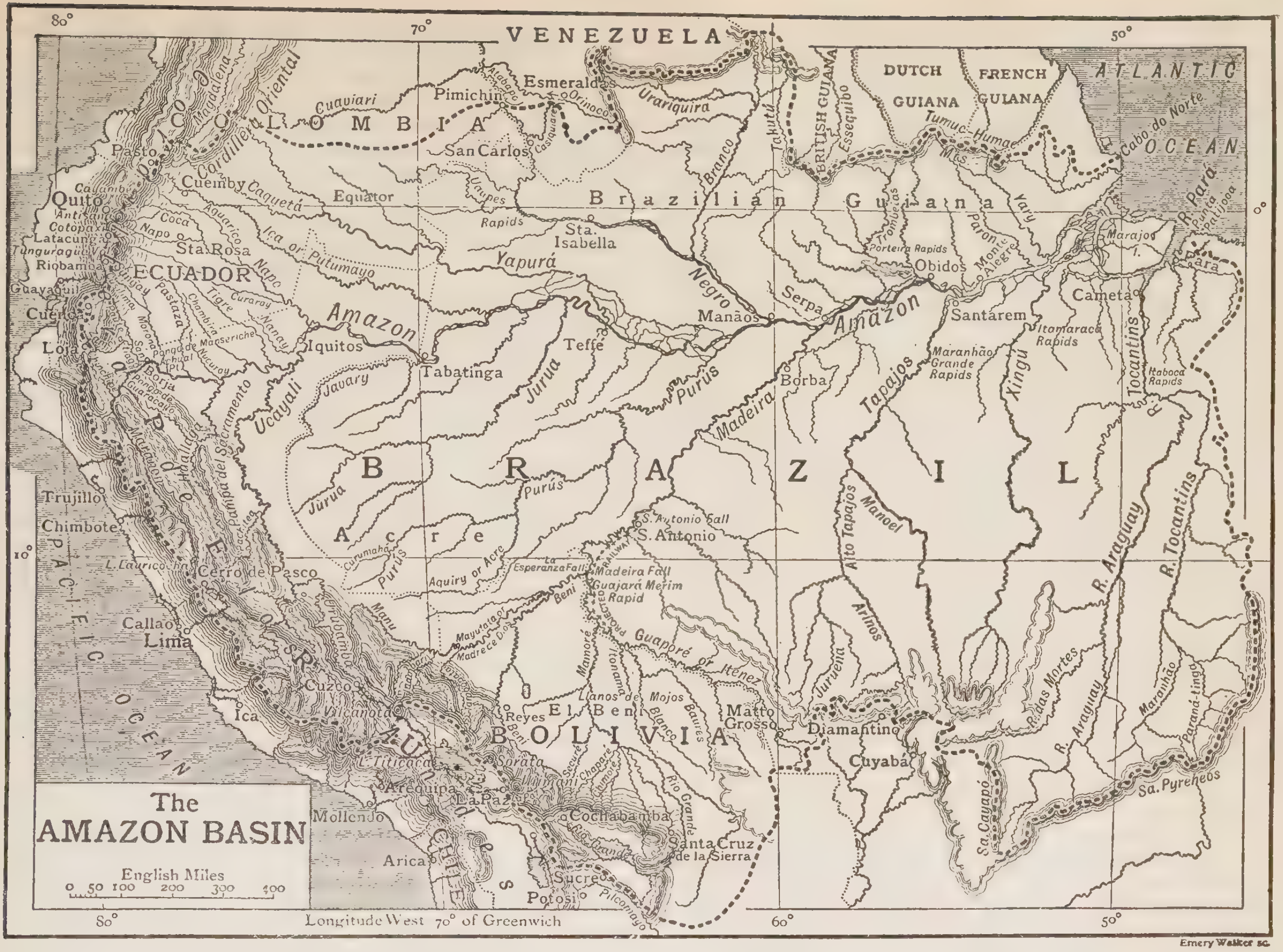
Tributaries.

The Tocantins is not really a branch of the Amazon, although usually so considered. It is the central fluvial artery of Brazil, running from south to north for a distance of about 1500 m. It rises in the mountainous district known as the Pyreneos; but its more ambitious western affluent, the Araguay, has its extreme southern headwaters on the slopes of the Serra Cayapó, and flows a distance of 1080 m. before its junction with the parent stream, which it appears almost to equal in volume. Besides its main tributary, the Rio das Mortes, it has twenty smaller branches, offering many miles of canoe navigation. In finding its way to the lowlands, it breaks frequently into falls and rapids, or winds violently through rocky gorges, until, at a point about 100 m. above its junction with the Tocantins, it saws its way across a rocky dyke for 12 m. in roaring cataracts. The tributaries of the Tocantins, called the Maranhão and Paraná-tinga, collect an immense volume of water from the highlands which surround them, especially on the south and south-east. Between the latter and the confluence with the Araguay, the Tocantins is occasionally obstructed by rocky barriers which cross it almost at a right angle. Through these, the river carves its channel, broken into cataracts and rapids, or *cachoeiras*, as they are called throughout Brazil. Its lowest one, the Itaboca cataract, is about 130 m. above its estuarine port of Cametá, for which distance the river is navigable; but above that it is useless as a commercial avenue, except for laborious and very costly transportation. The flat, broad valleys, composed of sand and clay, of both the Tocantins and its Araguay branch are overlooked by steep bluffs. They are the margins of the great sandstone plateaus, from 1000 to 2000 ft. elevation above sea-level, through which the rivers have eroded their deep beds. Around the estuary of the Tocantins the great plateau has disappeared, to give place to a part of the forest-covered, half submerged alluvial plain, which extends far to the north-east and west. The Pará river, generally called one of the mouths of the Amazon, is only the lower reach of the Tocantins. If any portion of the waters of the Amazon runs round the southern side of the large island of Marajo into the river Pará, it is only through tortuous, natural canals, which are in no sense outflow channels of the Amazon.

The Xingú, the next large river west of the Tocantins, is a true tributary of the Amazon. It was but little known until it was explored in 1884–1887 by Karl von den Steinen from Cuyabá. Travelling east, 240 m., he found the river Tamitatoaba, 180 ft. wide, flowing from a lake 25 m. in diameter. He descended this torrential stream to the river Romero, 1300 ft. wide, entering from the west, which receives the river Colisú. These three streams form the Xingú, or Paraná-xingú, which, from 73 m. lower down, bounds along a succession of rapids for 400 m. A little above the head of navigation, 105 m. from its mouth, the river makes a bend to the east to find its way across a rocky barrier. Here is the great cataract of Itamaracá, which rushes down an inclined plane for 3 m. and then gives a final leap, called the fall of Itamaracá. Near its mouth, the Xingú expands into an immense lake, and its waters then mingle with those of the Amazon through a labyrinth of *caños* (natural canals), winding in countless directions through a wooded archipelago.

The Tapajos, running through a humid, hot and unhealthy valley, pours into the Amazon 500 m. above Pará and is about 1200 m. long. It rises on the lofty Brazilian plateau near Diamantino in 14° 25′ S. lat. Near this place a number of streams unite to form the river Arinos, which at latitude 10° 25′ joins the Juruena to form the Alto Tapajos, so called as low down as the Rio Manoel, entering from the east. Thence to Santarem the stream is known as the Tapajos. The lower Arinos, the Alto Tapajos and the Tapajos to the last rapid, the Maranhão Grande, is a continuous series of formidable cataracts and rapids; but from the Maranhão Grande to its mouth, about 188 m., the river can be navigated by large vessels. For its last 100 m. it is from 4 to 9 m. wide and much of it very deep. The valley of the Tapajos is bordered on both sides by bluffs. They are from 300 to 400 ft. high along the lower river; but, a few miles above Santarem, they retire from the eastern side and only approach the Amazon flood-plain some miles below Santarem.

The Madeira has its junction with the Amazon 870 m. by river above Pará, and almost rivals it in the volume of its waters. It rises more than 50 ft. during the rainy season, and the largest ocean steamers may ascend it to the Fall of San Antonio, 663 m. above its mouth; but in the dry months, from June to November, it is only navigable for the same distance for craft drawing from 5 to 6 ft. of water. According to the treaty of San Ildefonso, the Madeira begins at the confluence of the Guaporé with the Mamoré. Both of these streams have their headwaters almost in contact with those of the river Paraguay. The idea of a connecting canal is based on ignorance of local conditions. San Antonic is the first of a formidable series of cataracts and rapids, nineteen in number, which, for a river distance of 263 m., obstruct the upper course of the Madeira until the last rapid called Guajará Merim (or Small Pebble), is reached, a little below the union of the Guaporé with the Mamoré. The junction of the great river Beni with the Madeira is at the Madeira Fall, a vast and grand display of reefs, whirlpools and boiling torrents. Between Guajará-Merim and this fall, inclusive, the Madeira receives the drainage of the north-eastern slopes of the Andes, from Santa Cruz de la Sierra to Cuzco, the whole of the south-western slope of Brazilian Matto Grosso, and the northern one of the Chiquitos sierras, an area about


The AMAZON BASIN
English Miles
0 50 100 200 300 400
Longitude West 70° of Greenwich
80°
70°
60°
50°
10°
0°
VENEZUELA
COLOMBIA
ECUADOR
B R A Z I L
BOLIVIA
Brazilian Guiana
DUTCH GUIANA
FRENCH GUIANA
BRITISH GUIANA
ATLANTIC OCEAN
PACIFIC OCEAN
Acre
Amazon
Yapurá
Negro
Purus
Juruá
Madeira
Tapajos
Xingu
Tocantins
R. Araguay
Ucayali
Javary
Napo
Putumayo
Caquetá
Branco
Trombetas
Mamoré
Guaporé or Itenez
Beni
Manu
Madre de Dios
Quito
Pasto
Guayaquil
Cuenca
Loja
Riobamba
Iquitos
Tabatinga
Teffe
Manãos
Serpa
Obidos
Monte Alegre
Santarem
Cameta
Pará
Marajó I.
Borba
S. Antonio Fall
S. Antonio
Madeira Fall
Guajará Merim Rapid
Esperanza Fall
Trujillo
Chimbote
Cerro de Pasco
Callao
Lima
Cuzco
Ica
L. Titicaca
Arequipa
Mollendo
Arica
La Paz
Sorata
Cochabamba
Santa Cruz de la Sierra
Sucre
Potosi
Reyes
Llanos de Mojos
Matto Grosso
Diamantino
Cuyabá
Sa. Cayapó
Sa. Pyreneos
R. das Mortes
Arinos
Alto Tapajos
San Carlos
Esmeraldas
Pimichin
Orinoco
Sta. Isabella
Sta. Rosa
Equator
Cordillera Oriental
Magdalena
Tumuc-Humac Mts.
Cabo do Norte
Itamaraca Rapids
Itaboca Rapids
Maranhão Grande Rapids
Porteira Rapids
Rapids
Pilcomayo
Rio Grande

Emery Walker sc.

equal to that of France and Spain. The waters find their way to the falls of the Madeira by many great rivers, the principal of which, if we enumerate them from east to west, are the Guaporé or Itenez, the Baures and Blanco, the Itonama or San Miguel, the Mamoré, Beni, and Mayutata or Madre de Dios, all of which are reinforced by numerous secondary but powerful affluents. The Guaporé presents many difficulties to continuous navigation; the Baures and Itonama offer hundreds of miles of navigable waters through beautiful plains; the Mamoré has been sounded by the writer in the driest month of the year for a distance of 500 m. above Guajará-Merim, who found never less than from 10 to 30 ft. of water, with a current of from 1 to 3 m. an hour. Its Rio Grande branch, explored under the writer's instructions, was found navigable for craft drawing 3 ft. of water to within 30 m. of Santa Cruz de la Sierra—a level sandy plain intervening. The Grande is a river of enormous length, rising in a great valley of the Andes between the important cities of Sucre and Cochabamba, and having its upper waters in close touch with those of the Pilcomayo branch of the river Paraguay. It makes a long curve through the mountains, and, after a course of about 800 m., joins the Mamoré near 15° S. lat. The Chaparé, Securé and Chimoré, tributaries of the Mamoré, are navigable for launches up to the base of the mountains, to within 130 m. of Cochabamba. The Beni has a 12-ft. fall 18 m. above its mouth called "La Esperanza"; beyond this, it is navigable for 217 m. to the port of Reyes for launches in the dry season and larger craft in the wet one. The extreme source of the Beni is the little river La Paz, which rises in the inter-Andean region, a few miles south-east of Lake Titicaca, and flows as a rivulet through the Bolivian city of La Paz. From this point to Reyes the river is a torrent. The principal affluent of the Beni, and one which exceeds it in volume, enters it 120 m. above its mouth, and is known to the Indians along its banks as the Mayutata, but the Peruvians call it the Madre de Dios. Its ramifications drain the slopes of the Andes between 12° and 15° of latitude. It is navigable in the wet season to within 180 m. of Cuzco. Its upper waters are separated by only a short transitable canoe portage of 7 m. in a straight line from those of the Ucayali. The portage on the eastern side terminates at the Cashpajali river 22 m. above its junction with the Manu. For the first 13 m. it is navigable all the year for craft drawing 18 in. of water, but the remaining 9 m. present many obstacles to navigation. At the Manu junction the elevation above sea-level is 1070 ft., the river width 300 ft., depth 8 ft., current $1\frac{1}{4}$ m. per hour. The general direction of the Manu is south-east for 158 m. as far as the Pilcopata river, where under the name of Madre de Dios it continues with a flow of 22,000 cubic metres per minute. Here its elevation is 718 ft. above the sea and its width 500 ft. During the above course of 158 m. the Manu receives 135 large and small affluents. Although the inclination of its bed is not great, the obstacles to free navigation are abundant, and consist of enormous trees and masses of tree-trunks which have filled the river during the period of freshets.

From the time it receives the Manu, the Madre de Dios carries its immense volume of waters 485 m. to the Beni over the extremely easy slope of a vast and fertile plain. Its banks are low, its bottom pebbly. A greater part of its course is filled with large and small islands some 63 in number. Its average width is about 1500 ft. Below the mouth of the Tambopata, the flow is estimated at 191,250 cubic metres per minute. The average current is $2\frac{1}{2}$ m. per hour. There are two important rapids and one cataract on the lower 300 m. of the river.

The Mayutata receives three principal tributaries from the south—the Tambopata, Inambari and Pilcopata.

The Peruvian government has sought to open a trade route between the Rio Ucayali and the rich rubber districts of the

Mayutata. All of the upper branches of the river Madeira find their way to the falls across the open, almost level Mojos and Beni plains, 35,000 sq. m. of which are yearly flooded to an average depth of about 3 ft. for a period of from three to four months. They rival if they do not exceed in fertility the valley of the Nile, and are the healthiest and most inviting agricultural and grazing region of the basin of the Amazon.

The Purús, a very sluggish river, enters the Amazon west of the Madeira, which it parallels as far south as the falls of the latter stream. It runs through a continuous forest at the bottom of the great depression lying between the Madeira river, which skirts the edge of the Brazilian sandstone plateau, and the Ucayali which hugs the base of the Andes. One of its marked features is the five parallel *furos*[1] which from the north-west at almost regular intervals the Amazon sends to the Purús; the most south-westerly one being about 150 m. above the mouth of the latter river. They cut a great area of very low-lying country into five islands. Farther down the Purús to the right three smaller *furos* also connect it with the Amazon. Chandless found its elevation above sea-level to be only 107 ft. 590 m. from its mouth. It is one of the most crooked streams in the world, and its length in a straight line is less than half that by its curves. It is practically only a drainage ditch for the half-submerged, lake-flooded district it traverses. Its width is very uniform for 1000 m. up, and for 800 m. its depth is never less than 45 ft. It is navigable by steamers for 1648 m. as far as the little stream, the Curumahá, but only by light-draft craft. Chandless ascended it 1866 m. At 1792 m. it forks into two small streams. Occasionally a cliff touches the river, but in general the lands are subject to yearly inundations throughout its course, the river rising at times above 50 ft., the numerous lakes to the right and left serving as reservoirs. Its main tributary, the Aquiry or Acre, enters from the right about 1104 m. from the Amazon. Its sources are near those of the Mayutata. It is navigable for a period of about five months of the year, when the Purús valley is inundated; and, for the remaining seven months, only canoes can ascend it sufficiently high to communicate overland with the settlements in the great india-rubber districts of the Mayutata and lower Beni; thus these regions are forced to seek a canoe outlet for their rich products by the very dangerous, costly and laborious route of the falls of the Madeira.

The Juruá is the next great southern affluent of the Amazon west of the Purús, sharing with this the bottom of the immense inland Amazon depression, and having all the characteristics of the Purús as regards curvature, sluggishness and general features of the low, half-flooded forest country it traverses. It rises among the Ucayali highlands, and is navigable and unobstructed for a distance of 1133 m. above its junction with the Amazon.

The Javary, the boundary line between Brazil and Peru, is another Amazon tributary of importance. It is supposed to be navigable by canoe for 900 m. above its mouth to its sources among the Ucayali highlands, but only 260 have been found suitable for steam navigation. The Brazilian Boundary Commission ascended it in 1866 to the junction of the Shino with its Jaquirana branch. The country it traverses in its extremely sinuous course is very level, similar in character to that of the Juruá, and is a fostered wilderness occupied by a few savage hordes.

The Ucayali, which rises only about 70 m. north of Lake Titicaca, is the most interesting branch of the Amazon next to the Madeira. The Ucayali was first called the San Miguel, then the Ucayali, Ucayare, Poro, Apu-Poro, Cocama and Rio de Cuzco. Peru has fitted out many costly and ably-conducted expeditions to explore it. One of them (1867) claimed to have reached within 240 m. of Lima, and the little steamer "Napo" forced its way up the violent currents for 77 m. above the junction with the Pachitea river as far as the river Tambo, 770 m. from the confluence of the Ucayali with the Amazon. The "Napo" then succeeded in ascending the Urubamba branch of the Ucayali 35 m. above its union with the Tambo, to a point 200 m. north of Cuzco. The remainder of the Urubamba, as shown by Bosquet in 1806 and Castelnau in 1846, is interrupted by cascades, reefs and numberless other obstacles to navigation. Señor Torres, who explored the Alto Ucayali for the Peruvian government, gives it a length of 186 m., counting from the mouth of the Pachitea to the junction of the Tambo and Urubamba. Its width varies from 1300 to 4000 ft., due to the great number of islands. The current runs from 3 to 4 m. an hour, and a channel from 60 to 150 ft. wide can always be found with a minimum depth of 5 ft. There are five bad passes, due to the accumulation of trees and rafts of timber. Sometimes enormous rocks have fallen from the mountains and spread over the river-bed causing huge whirlpools. "No greater difficulties present themselves to navigation by 10-knot steamers drawing 4 ft. of water."

The Tambo, which rises in the Vilcanota knot of mountains south of Cuzco, is a torrential stream valueless for commercial purposes. The banks of the Ucayali for 500 m. up are low, and in the rainy season extensively inundated.

The Huallaga (also known as the Guallaga and Rio de los Motilones), which joins the Amazon to the west of the Ucayali, rises high among the mountains, in about 10° 40′ S. lat., on the northern slopes of the celebrated Cerro de Pasco. For nearly its entire length it is an impetuous torrent running through a succession of gorges. It has forty-two rapids, its last obstruction being the Pongo de Aguirre, so called from the traitor Aguirre who passed there. To this point, 140 m. from the Amazon, the Huallaga can be ascended by large river steamers. Between the Huallaga and the Ucayali lies the famous "Pampa del Sacramento," a level region of stoneless alluvial lands covered with thick, dark forests, first entered by the missionaries in 1726. It is about 300 m. long, from north to south, and varies in width from 40 to 100 m. Many streams, navigable for canoes, penetrate this region from the Ucayali and the Huallaga. It is still occupied by savage tribes.

The river Marañon rises about 100 m. to the north-east of Lima. It flows through a deeply-eroded Andean valley in a north-west direction, along the eastern base of the Cordillera of the Andes, as far as 5° 36′ S. lat.; then it makes a great bend to the north-east, and with irresistible power cuts through the inland Andes, until at the Pongo de Manseriche[2] it victoriously breaks away from the mountains to flow onwards through the plains under the name of the Amazon. Barred by reefs, and full of rapids and impetuous currents, it cannot become a commercial avenue. At the point where it makes its great bend the river Chinchipe pours into it from southern Ecuador. Just below this the mountains close in on either side of the Marañon, forming narrows or *pongos* for a length of 35 m., where, besides numerous whirlpools, there are no less than thirty-five formidable rapids, the series concluding with three cataracts just before reaching the river Imasa or Chunchunga, near the mouth of which La Condamine embarked in the 18th century to descend the Amazon. Here the general level of the country begins to decrease in elevation, with only a few mountain spurs, which from time to time push as far as the river and form *pongos* of minor importance and less dangerous to descend. Finally, after passing the narrows of Guaracayo, the *cerros* gradually disappear, and for a distance of about 20 m. the river is full of islands, and there is nothing visible from its low banks but an immense forest-covered plain. But the last barrier has yet to be passed, the Pongo de Manseriche, 3 m. long, just below the mouth of the Rio Santiago, and between it and the old abandoned missionary station of Borja, in 38° 30′ S. lat. and 77° 30′ 40″ W. long. According to Captain Carbajal, who descended it in the little steamer "Napo" in 1868, it is a vast rent in the Andes about 2000 ft. deep, narrowing in places to a width of only 100 ft., the precipices "seeming to close in at the top." Through this dark cañon the Marañon leaps along, at times, at the rate of 12 m. an hour.[1] The Pongo de Manseriche was first discovered by the Adelantado Joan de Salinas. He fitted out an expedition at Loxa in Ecuador, descended the Rio Santiago to the Marañon, passed through the perilous Pongo in 1557 and invaded the country of the Maynas Indians. Later, the missionaries of Cuenca and Quito established many missions in the *Pais de los Maynas*, and made extensive use of the Pongo de Manseriche as an avenue of communication with their several convents on the Andean plateau. According to their accounts, the huge rent in the Andes, the Pongo, is about five or six m. long, and in places not more than 80 ft. wide, and is a frightful series of torrents and whirlpools interspersed with rocks. There is an ancient tradition of the savages of the vicinity that one of their gods descending the Marañon and another ascending the Amazon to communicate with him, they opened the pass called the Pongo de Manseriche. From the northern slope of its basin the Amazon receives many tributaries, but their combined volume of water is not nearly so great as that contributed to the parent stream by its affluents from the south. That part of Brazil lying between the Amazon and French, Dutch and British Guiana, and bounded on the west by the Rio Negro, is known as Brazilian Guiana. It is the southern watershed of a tortuous, low chain of mountains running, roughly, east and west. Their northern slope, which is occupied by the three Guianas first named, is saturated and river-torn; but their southern one, Brazilian Guiana, is in general thirsty and semi-barren, and the driest region of the Amazon valley. It is an area which has been left almost in the undisturbed possession of nomadic Indian tribes, whose scanty numbers find it difficult to solve the food problem. From the *divortium aquarum* between French Guiana and Brazil, known as the Tumuc-humac range of highlands, two minor streams, the Yary and the Parou, reach the Amazon across the intervening broken and barren tableland. They are full of rapids and reefs.

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[1] A *furo* is a natural canal—sometimes merely a deviation from the main channel, which it ultimately rejoins, sometimes a connexion across low flat country between two entirely separate streams.

[2] Pongo is a corruption of the Quichua *puncu* and the Aymará *ponco*, meaning a door. The Pongo de Manseriche was first named Marañon, then Santiago, and later Manseric, afterwards Mansariche and Manseriche, owing to the great numbers of parrakeets found on the rocks there.

The TROMBETAS is the first river of importance we meet on the northern side as we ascend the Amazon. Its confluence with this is just above the town of Obidos. It has its sources in the Guiana highlands, but its long course is frequently interrupted by violent currents, rocky barriers, and rapids. The inferior zone of the river, as far up as the first fall, the Porteira, has but little broken water and is low and swampy; but above the long series of cataracts and rapids the character and aspect of the valley completely change, and the climate is much better. The river is navigable for 135 m. above its mouth.

The NEGRO, the great northern tributary of the Amazon, has its sources along the watershed between the Orinoco and the Amazon basins, and also connects with the Orinoco by way of the Casiquiare canal. Its main affluent is the Uaupes, which disputes with the headwaters of the Guaviari branch of the Orinoco the drainage of the eastern slope of the "oriental" Andes of Colombia. The Negro is navigable for 450 m. above its mouth for 4 ft. of water in the dry season, but it has many sandbanks and minor difficulties. In the wet season, it overflows the country far and wide, sometimes to a breadth of 20 m., for long distances, and for 400 m. up, as far as Santa Isabella, is a succession of lagoons, full of long islands and intricate channels, and the slope of the country is so gentle that the river has almost no current. But just before reaching the Uaupes there is a long series of reefs, over which it violently flows in cataracts, rapids and whirlpools. The Uaupes is full of similar obstacles, some fifty rapids barring its navigation, although a long stretch of its upper course is said to be free from them, and to flow gently through a forested country. Despite the impediments, canoes ascend this stream to the Andes.

The Branco is the principal affluent of the Negro from the north; it is enriched by many streams from the sierras which separate Venezuela and British Guiana from Brazil. Its two upper main tributaries are the Urariquira and the Takutú. The latter almost links its sources with those of the Essequibo. The Branco flows nearly south, and finds its way into the Negro through several channels and a chain of lagoons similar to those of the latter river. It is 350 m. long, up to its Urariquira confluence. It has numerous islands, and, 235 m. above its mouth, it is broken by a bad series of rapids.

CASIQUIARE CANAL. In 1744 the Jesuit Father Roman, while ascending the Orinoco river, met some Portuguese slave-traders from the settlements on the Rio Negro. He accompanied them on their return, by way of the Casiquiare canal, and afterwards retraced his route to the Orinoco. La Condamine, seven months later, was able to give to the French Academy an account of Father Roman's extraordinary voyage, and thus confirm the existence of this wonderful waterway first reported by Father Acuña in 1639. But little credence was given to Father Roman's statement until it was verified, in 1756, by the Spanish Boundary-line Commission of Yturriaga y Solano. The actual elevation of the canal above sea-level is not known, but is of primary importance to the study of the hydrography of South America. Travellers in general give it at from 400 to 900 ft., but, after much study of the question of altitudes throughout South America, the writer believes that it does not exceed 300 ft. The canal connects the upper Orinoco, 9 m. below the mission of Esmeraldas, with the Rio Negro affluent of the Amazon near the town of San Carlos. The general course is south-west, and its length, including windings, is about 200 m. Its width, at its bifurcation with the Orinoco, is approximately 300 ft., with a current towards the Negro of three-quarters of a mile an hour; but as it gains in volume from the very numerous tributary streams, large and small, which it receives en route, its velocity increases, and in the wet season reaches 5 and even 8 m. an hour in certain stretches. It broadens considerably as it approaches its mouth, where it is about 1750 ft. in width. It will thus be seen that the volume of water it captures from the Orinoco is small in comparison to what it accumulates in its course. In flood-time it is said to have a second connexion with the Rio Negro by a branch which it throws off to the westward called the Itinivini, which leaves it at a point about 50 m. above its mouth. In the dry season it has shallows, and is obstructed by sandbanks, a few rapids and granite rocks. Its shores are densely wooded, and the soil more fertile than that along the Rio Negro. The general slope of the plains through which the canal runs is south-west, but those of the Rio Negro slope south-east. The whole line of the Casiquiare is infested with myriads of tormenting insects. A few miserable groups of Indians and half-breeds have their small villages along its southern portion. It is thus seen that this marvellous freak of nature is not, as is generally supposed, a sluggish canal on a flat tableland, but a great, rapid river which, if its upper waters had not found contact with the Orinoco, perhaps by cutting back, would belong entirely to the Negro branch of the Amazon. To the west of the Casiquiare there is a much shorter and more facile connexion between the Orinoco and Amazon basins, called the isthmus of Pimichin, which is reached by ascending the Terni branch of the Atabapo affluent of the Orinoco. Although the Terni is somewhat obstructed, it is believed that it could easily be made navigable for small craft. The isthmus is 10 m. across, with undulating ground, nowhere over 50 ft. high, with swamps and marshes. It is much used for the transit of large canoes, which are hauled across it from the Terni river, and which reach the Negro by the little stream called the Pimichin.

The YAPURÁ. West of the Negro the Amazon receives three more imposing streams from the north-west—the Yapurá, the Iça or Putumayo, and the Napo. The first was formerly known as the Hyapora, but its Brazilian part is now called the Yapurá, and its Colombian portion the Caquetá. Barão de Marajo gives it 600 m. of navigable stretches. Jules Crevaux, who descended it, describes it as full of obstacles to navigation, the current very strong and the stream frequently interrupted by rapids and cataracts. It rises in the Colombian Andes, nearly in touch with the sources of the Magdalena, and augments its volume from many branches as it courses through Colombia. It was long supposed to have eight mouths; but Ribeiro de Sampaio, in his voyage of 1774, determined that there was but one real mouth, and that the supposed others are all *furos* or *caños*.[1] In 1864–1868 the Brazilian government made a somewhat careful examination of the Brazilian part of the river, as far up as the rapid of Cupaty. Several very easy and almost complete water-routes exist between the Yapurá and Negro across the low, flat intervening country. Barão de Marajo says there are six of them, and one which connects the upper Yapurá with the Uaupes branch of the Negro; thus the Indian tribes of the respective valleys have facile contact with each other.

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[1] One of the most daring deeds of exploration ever known in South America was done by the engineer A. Wertheman. He fitted out three rafts, in August 1870, and descended this whole series of rapids and cascades from the Rio Chinchipe to Borja.

The Iça or Putumayo, west of and parallel to the Yapurá, was found more agreeable to navigate by Crevaux. He ascended it in a steamer drawing 6 ft. of water, and running day and night. He reached Cuemby, 800 m. above its mouth, without finding a single rapid. Cuemby is only 200 m. from the Pacific Ocean, in a straight line, passing through the town of Pasto in southern Colombia. There was not a stone to be seen up to the base of the Andes; the river banks were of argillaceous earth and the bottom of fine sand.

The Napo rises on the flanks of the volcanoes of Antisana, Sincholagua and Cotopaxi. Before it reaches the plains it receives a great number of small streams from impenetrable, saturated and much broken mountainous districts, where the dense and varied vegetation seems to fight for every square foot of ground. From the north it is joined by the river Coca, having its sources in the gorges of Cayambé on the equator, and also a powerful river, the Aguarico, having its headwaters between Cayambé and the Colombian frontier. From the west it receives a secondary tributary, the Curaray, from the Andean slopes, between Cotopaxi and the volcano of Tunguragua. From its Coca branch to the mouth of the Curaray the Napo is full of snags and shelving sandbanks, and throws out numerous caños among jungle-tangled islands, which in the wet season are flooded, giving the river an immense width. From the Coca to the Amazon it runs through a forested plain where not a hill is visible from the river—its uniformly level banks being only interrupted by swamps and lagoons. From the Amazon the Napo is navigable for river craft up to its Curaray branch, a distance of about 216 m., and perhaps a few miles farther; thence, by painful canoe navigation, its upper waters may be ascended as far as Santa Rosa, the usual point of embarkation for any venturesome traveller who descends from the Quito tableland. The Coca river may be penetrated as far up as its middle course, where it is jammed between two mountain walls, in a deep canyon, along which it dashes over high falls and numerous reefs. This is the stream made famous by the expedition of Gonzalo Pizarro.

The Nanay is the next Amazon tributary of importance west of the Napo. It belongs entirely to the lowlands, and is very crooked, has a slow current and divides much into caños and strings of lagoons which flood the flat, low areas of country on either side. It is simply the drainage ditch of districts which are extensively overflowed in the rainy season. Captain Butt ascended it 195 m., to near its source.

The Tigre is the next west of the Nanay, and is navigable for 125 m. from its confluence with the Amazon. Like the Nanay, it belongs wholly to the plains. Its mouth is 42 m. west of the junction of the Ucayali with the Amazon. Continuing west from the Tigre we have the Parinari, Chambira, and Nucuray, all short lowland streams, resembling the Nanay in character.

The Pastaza (the ancient river Sumatara) is the next large river we meet. It rises on the Ecuadorian tableland, where a branch from the valley of Riobamba unites with one from the Latacunga basin and breaks through the inland range of the Andes; and joined, afterwards, by several important tributaries, finds its way south-east among the gorges; thence it turns southward into the plains, and enters the Amazon at a point about 60 m. west of the mouth of the Huallaga. So far as known, it is a stream of no value except for canoe navigation. Its rise and fall are rapid and uncertain, and it is shallow and full of sandbanks and snags. It is a terrible river when in flood.

The Morona flows parallel to the Pastaza and immediately to the west of it, and is the last stream of any importance on the northern side of the Amazon before reaching the Pongo de Manseriche. It is formed from a multitude of water-courses which descend the slopes of the Ecuadorian Andes south of the gigantic volcano of Sangay; but it soon reaches the plain, which commences where it receives its Cusulima branch. The Morona is navigable for small craft for about 300 m. above its mouth, but it is extremely tortuous. Canoes may ascend many of its branches, especially the Cusulima and the Miazal, the latter almost to the base of Sangay. The Morona has been the scene of many rude explorations, with the hope of finding it serviceable as a commercial route between the inter-Andean tableland of Ecuador and the Amazon river. A river called the Paute dashes through the eastern Andes from the valley of Cuenca; and a second, the Zamora, has broken through the same range from the basin of Loja. Swollen by their many affluents, they reach the lowlands and unite their waters to form the Santiago, which flows into the Marañon at the head of the Pongo de Manseriche. There is but little known of a trustworthy character regarding this river, but Wolf says that it is probably navigable up to the junction of the Paute with the Zamora.

The Main River.

Physical characteristics.

The Amazon Main River is navigable for ocean steamers as far as Iquitos, 2300 m. from the sea, and 486 m. higher up for vessels drawing 14 ft. of water, as far as Achual Point. Beyond that, according to Tucker, confirmed by Wertheman, it is unsafe; but small steamers frequently ascend to the Pongo de Manseriche, just above Achual Point The average current of the Amazon is about 3 m. an hour; but, especially in flood, it dashes through some of its contracted channels at the rate of 5 m. The U.S. steamer "Wilmington" ascended it to Iquitos in 1899. Commander Todd reports that the average depth of the river in the height of the rainy season is 120 ft. It commences to rise in November, and increases in volume until June, and then falls until the end of October. The rise of the Negro branch is not synchronous; for the steady rains do not commence in its valley until February or March. By June it is full, and then it begins to fall with the Amazon. According to Bates, the Madeira "rises and sinks" two months earlier than the Amazon. The Amazon at times broadens to 4 and 6 m. Occasionally, for long distances, it divides into two main streams with inland, lateral channels, all connected by a complicated system of natural canals, cutting the low, flat *igapo* lands, which are never more than 15 ft. above low river, into almost numberless islands.[1] At the narrows of Obidos, 400 m. from the sea, it is compressed into a single bed a mile wide and over 200 ft. deep, through which the water rushes at the rate of 4 to 5 m. an hour. In the rainy season it inundates the country throughout its course to the extent of several hundred thousand square miles, covering the flood-plain, called *vargem*. The flood-levels are in places from 40 to 50 ft. high above low river. Taking four roughly equidistant places, the rise at Iquitos is 20 ft., at Teffé 45, near Obidos 35, and at Pará 12 ft.

The first high land met in ascending the river is on the north bank, opposite the mouth of the Xingú, and extends for about 150 m. up, as far as Monte Alegre. It is a series of steep, table-topped hills, cut down to a kind of terrace which lies between them and the river. Monte Alegre reaches an altitude of several hundred feet. On the south side, above the Xingú, a line of low bluffs extends, in a series of gentle curves with hardly any breaks nearly to Santarem, but a considerable distance inland, bordering the flood-plain, which is many miles wide. Then they bend to the south-west, and, abutting upon the lower Tapajos, merge into the bluffs which form the terrace margin of that river valley. The next high land on the north side is Obidos, a bluff, 56 ft. above the river, backed by low hills. From Serpa, nearly opposite the river Madeira, to near the mouth of the Rio Negro, the banks are low, until approaching Manãos, they are rolling hills; but from the Negro, for 600 m., as far up as the village of Canaria, at the great bend of the Amazon, only very low land is found, resembling that at the mouth of the river. Vast areas of it are submerged at high water, above which only the upper part of the trees of the sombre forests appear. At Canaria, the high land commences and continues as far as Tabatinga, and thence up stream.

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[1] A *caño*, like *furo*, is a kind of natural canal; it forms a lateral discharge for surplus water from a river.

[1] *Igapo* is thus the name given to the recent alluvial tracts along the margins of rivers, submerged by moderate floods, whereas *vargem* is the term used for land between the levels of moderate and high floods, while for land above this the people use the term *terra firma*.

On the south side, from the Tapajos to the river Madeira, the banks are usually low, although two or three hills break the general monotony. From the latter river, however, to the Ucayali, a distance of nearly 1500 m., the forested banks are just out of water, and are inundated long before the river attains its maximum flood-line. Thence to the Huallaga the elevation of the land is somewhat greater; but not until this river is passed, and the Pongo de Manseriche approached, does the swelling ground of the Andean foot-hills raise the country above flood-level.

The Amazon is not a continuous incline, but probably consists of long, level stretches connected by short inclined planes of extremely little fall, sufficient, however, owing to its great depth, to give the gigantic volume of water a continuous impulse towards the ocean. The lower Amazon presents every evidence of having once been an ocean gulf, the upper waters of which washed the cliffs near Obidos. Only about 10 % of the water discharged by the mighty stream enters it below Obidos, very little of which is from the northern slope of the valley. The drainage area of the Amazon basin above Obidos is about 1,945,000 sq. m., and, below, only about 423,000 sq. m., or say 20 %, exclusive of the 354,000 sq. m. of the Tocantins basin.

The width of the mouth of the monarch river is usually measured from Cabo do Norte to Punto Patijoca, a distance of 207 statute m.; but this includes the ocean outlet, 40 m. wide, of the Pará river, which should be deducted, as this stream is only the lower reach of the Tocantins. It also includes the ocean frontage of Marajo, an island about the size of the kingdom of Denmark lying in the mouth of the Amazon.

Following the coast, a little to the north of Cabo do Norte, and for 100 m. along its Guiana margin up the Amazon, is a belt of half-submerged islands and shallow sandbanks. Here the tidal phenomenon called the *bore*, or Pororoca, occurs, where the soundings are not over 4 fathoms. It commences with a roar, constantly increasing, and advances at the rate of from 10 to 15 m. an hour, with a breaking wall of water from 5 to 12 ft. high. Under such conditions of warfare between the ocean and the river, it is not surprising that the former is rapidly eating away the coast and that the vast volume of silt carried by the Amazon finds it impossible to build up a delta.

The Amazon is not so much a river as it is a gigantic reservoir, extending from the sea to the base of the Andes, and, in the wet season, varying in width from 5 to 400 m. Special attention has already been called to the fourteen great streams which discharge into this reservoir, but it receives a multitude of secondary rivers, which in any other part of the world would also be termed great.

Population, trade, &c.

For 350 years after the discovery of the Amazon, by Pinzon, the Portuguese portion of its basin remained almost an undisturbed wilderness, occupied by Indian tribes whom the food quest had split into countless fragments. It is doubtful if its indigenous inhabitants ever exceeded one to every 5 sq. m. of territory, this being the maximum it could support under the existing conditions of the period in question, and taking into account Indian methods of life. A few settlements on the banks of the main river and some of its tributaries, either for trade with the Indians or for evangelizing purposes, had been founded by the Portuguese pioneers of European civilization. The total population of the Brazilian portion of the Amazon basin in 1850 was perhaps 300,000, of whom about two-thirds were white and slaves, the latter numbering about 25,000. The principal commercial city, Pará, had from 10,000 to 12,000 inhabitants, including slaves. The town of Manãos, at the mouth of the Rio Negro, had from 1000 to 1500 population; but all the remaining villages, as far up as Tabatinga, on the Brazilian frontier of Peru, were wretched little groups of houses which appeared to have timidly effected a lodgment on the river bank, as if they feared to challenge the mysteries of the sombre and gigantic forests behind them. The value of the export and import trade of the whole valley in 1850 was but £500,000.

On the 6th of September 1850 the emperor, Dom Pedro II., sanctioned a law authorizing steam navigation on the Amazon, and confided to an illustrious Brazilian, Barão Mauá (Irineu Evangilista de Sousa), the task of carrying it into effect. He organized the "Compania de Navigação e Commercio do Amazonas" at Rio de Janeiro in 1852; and in the following year it commenced operations with three small steamers, the "Monarch," the "Marajo" and "Rio Negro." At first the navigation was principally confined to the main river; and even in 1857 a modification of the government contract only obliged the company to a monthly service between Pará and Manãos, with steamers of 200 tons cargo capacity, a second line to make six round voyages a year between Manãos and Tabatinga, and a third, two trips a month between Pará and Cametá. The government paid the company a subvention of £3935 monthly. Thus the first impulse of modern progress was given to the dormant valley. The success of the venture called attention to the unoccupied field; a second company soon opened commerce on the Madeira, Purús and Negro; a third established a line between Pará and Manãos; and a fourth found it profitable to navigate some of the smaller streams; while, in the interval, the Amazonas Company had largely increased its fine fleet. Meanwhile private individuals were building and running small steam craft of their own, not only upon the main river but upon many of its affluents. The government of Brazil, constantly pressed by the maritime powers and by the countries encircling the upper Amazon basin, decreed, on the 31st of July 1867, the opening of the Amazon to all flags; but limited this to certain defined points—Tabatinga, on the Amazon; Cameta, on the Tocantins; Santarem, on the Tapajos; Borba, on the Madeira; Manãos, on the Rio Negro; the decree to take effect on the 7th of September of the same year. Pará, Manãos and Iquitos are now thriving commercial centres. The first direct foreign trade with Manãos was commenced about 1874.

The local trade of the river is carried on by the English successors to the Amazonas Company—the Amazon Steam Navigation Company. In addition to its excellent fleet there are numerous small river steamers, belonging to companies and firms engaged in the rubber trade, navigating the Negro, Madeira, Purús and many other streams. The principal exports of the valley are india-rubber, cacao, Brazil nuts and a few other products of very minor importance. The finest quality of india-rubber comes from the Acre and Beni districts of Bolivia, especially from the valley of the Acre (or Aquiry) branch of the river Purús. Of the rubber production of the Amazon basin, the state of Pará gives about 35 %. The cacao tree is not cultivated, but grows wild in great abundance. There is but one railway in the whole valley; it is a short line from Pará towards the coast. The cities of Pará and Manãos have excellent tramways, many fine public buildings and private residences, gardens and public squares, all of which give evidence of artistic taste and great prosperity.

The number of inhabitants in the Brazilian Amazon basin (the states of Amazonas and Pará) is purely a matter of rough estimate. There may be 500,000 or 600,000, or more; for the immigration during recent years from the other parts of Brazil has been large, due to the rubber excitement. The influx from the state of Ceará alone, from 1892 to 1899 inclusive, reached 98,348.

As Commander Todd, in his report to the United States government, says: "The crying need of the Amazon valley is food for the people. . . . At the small towns along the river it is nearly impossible to obtain beef, vegetables, or fruit of any sort, and the inhabitants depend largely upon river fish, mandioc, and canned goods for their subsistence." Although more than four centuries have passed since the discovery of the Amazon river, there are probably not 25 sq. m. of its basin under cultivation, excluding the limited and rudely cultivated areas among the mountains at its extreme headwaters, which are inaccessible to commerce. The extensive exports of the mighty valley are almost entirely derived from the products of the forest. (G. E. C.)

AMAZONAS, the extreme north-western and largest state of Brazil, bounded N. by Colombia and Venezuela, E. by the state of Pará, S. by the state of Matto Grosso and Bolivia, and W. by Peru and Colombia. It embraces an area of 742,123 sq. m., wholly within the Amazon basin. A small part bordering the Venezuelan sierras is elevated and mountainous, but the greater part forms an immense alluvial plain, densely wooded, traversed by innumerable rivers, and subjected to extensive annual inundations. The climate is tropical and generally unfavourable to white settlement, the exceptions being the elevated localities on the Amazon exposed to the strong winds blowing up that river. The state is very sparsely populated; two-thirds of the inhabitants are Indians, forming small tribes, and subject only in small part to government control. The principal products are rubber, cacao and nuts; cattle are raised on the elevated plains of the north, while curing fish and collecting turtle eggs for their oil give occupation to many people on the rivers. Coffee, tobacco, rice and various fruits of superior quality are produced with ease, but agriculture is neglected and production is limited to domestic needs. The capital, Manãos, is the only city and port of general commercial importance in the state; other prominent towns are Serpa and Teffé on the Amazon, Borba and Crato on the Madeira, and Barcellos on the Rio Negro. Up to 1755 all the Portuguese territory on the Amazon formed part of the capitania of Pará. The upper districts were then organized into a separate capitania, called S. José do Rio Negro, to facilitate administration. When Brazil became independent in 1822, Rio Negro was overlooked in the reorganization into provinces and reverted, notwithstanding the protests and an attempted revolution (1832) of the people, to a state of dependence upon Pará. In 1850 autonomy was voted by the general assembly at Rio de Janeiro, and on the 1st of January 1852 the province of Amazonas was formally installed. In 1889 it became a federal state in the Brazilian republic.

AMAZONAS, a northern department of Peru, covering a mountainous district between the departments of Loreto and Cajamarca, with Ecuador on the N. The Marañon river forms the greater part of its W. boundary-line. Area, 13,943 sq. m.; pop. (1896) 70,676. The rainfall is abundant, and the soil of the heavily wooded valleys and lower mountain slopes is exceptionally fertile and productive. Its settlement and development is seriously impeded by the lack of transportation facilities. The capital, Chachapoyas, is a small town (pop. about 6000) situated on a tributary of the Marañon, 7600 ft. above sea-level. It is the seat of a bishopric, created in 1802, which covers the departments of Amazonas and Loreto, and one province of Libertad. It has an imposing cathedral and a university. The climate is equable and delightful, the mean temperature for the year being 62° F.

AMAZONAS, a territory belonging to Venezuela, and occupying the extreme southern part of that republic, adjoining the Brazilian state of Amazonas. It lies partly within the drainage basin of the Orinoco and partly within that of the Rio Negro, an affluent of the Amazon. The territory is covered with dense forests and is filled with intricate watercourses, one of which, the Casiquiare, forms an open communication between the Orinoco and the Rio Negro and is navigable for large canoes. The capital of the territory is Maroa, situated on the Guainia river, an affluent of the Rio Negro.

AMAZONS, an ancient legendary nation of female warriors. They were said to have lived in Pontus near the shore of the Euxine sea, where they formed an independent kingdom under the government of a queen, the capital being Themiscyra on the banks of the river Thermodon (Herodotus iv. 110-117). From this centre they made numerous warlike excursions—to Scythia, Thrace, the coasts of Asia Minor and the islands of the Aegean, even penetrating to Arabia, Syria and Egypt. They were supposed to have founded many towns, amongst them Smyrna, Ephesus, Sinope, Paphos. According to another account, they originally came to the Thermodon from the Palus Maeotis (Sea of Azov). No men were permitted to reside in their country; but once a year, in order to prevent their race from dying out, they visited the Gargareans, a neighbouring tribe. The male children who were the result of these visits were either put to death or sent back to their fathers; the female were kept and brought up by their mothers, and trained in agricultural pursuits, hunting, and the art of war (Strabo xi. p. 503). It is said that their right breast was cut off or burnt out, in order that they might be able to use the bow more freely; hence the ancient derivation of *’Αμάζονες* from *ἀ-μαζός*, "without breast." But there is no indication of this practice in works of art, in which the Amazons are always represented with both breasts, although the right is frequently covered. Other suggested derivations are: *ἀ* (intensive) and *μαζός*, breast, "full-breasted"; *ἀ* (privative) and *μάσσω*, touch, "not touching men"; *maza*, a Circassian word said to signify "moon," has suggested their connexion with the worship of a moon-goddess, perhaps the Asiatic representative of Artemis.

The Amazons appear in connexion with several Greek legends. They invaded Lycia, but were defeated by Bellerophon, who was sent out against them by Iobates, the king of that country, in the hope that he might meet his death at their hands (*Iliad*, vi. 186). They attacked the Phrygians, who were assisted by Priam, then a young man (*Iliad*, iii. 189), although in his later years, towards the end of the Trojan war, his old opponents took his side against the Greeks under their queen Penthesileia, who was slain by Achilles (Quint. Smyr. i.; Justin ii. 4; Virgil, *Aen.* i. 490). One of the tasks imposed upon Heracles by Eurystheus was to obtain possession of the girdle of the Amazonian queen Hippolyte (Apollodorus ii. 5). He was accompanied by his friend Theseus, who carried off the princess Antiope, sister of Hippolyte, an incident which led to a retaliatory invasion of Attica, in which Antiope perished fighting by the side of Theseus. The Amazons are also said to have undertaken an expedition against the island of Leuke, at the mouth of the Danube, where the ashes of Achilles had been deposited by Thetis. The ghost of the dead hero appeared and so terrified the horses, that they threw and trampled upon the invaders, who were forced to retire. They are heard of in the time of Alexander the Great, when their queen Thalestris visited him and became a mother by him, and Pompey is said to have found them in the army of Mithradates.

The origin of the story of the Amazons has been the subject of much discussion. While some regard them as a purely mythical people, others assume an historical foundation for them. The deities worshipped by them were Ares (who is consistently assigned to them as a god of war, and as a god of Thracian and generally northern origin) and Artemis, not the usual Greek goddess of that name, but an Asiatic deity in some respects her equivalent. It is conjectured that the Amazons were originally the temple-servants and priestesses (*hierodulae*) of this goddess; and that the removal of the breast corresponded with the self-mutilation of the *galli*, or priests, of Rhea Cybele. Another theory is that, as the knowledge of geography extended, travellers brought back reports of tribes ruled entirely by women, who carried out the duties which elsewhere were regarded as peculiar to man, in whom alone the rights of nobility and inheritance were vested, and who had the supreme control of affairs. Hence arose the belief in the Amazons as a nation of female warriors, organized and governed entirely by women. According to J. Vürtheim (*De Ajacis origine*, 1907), the Amazons were of Greek origin: "all the Amazons were Dianas, as Diana herself was an Amazon." It has been suggested that the fact of the conquest of the Amazons being assigned to the two famous heroes of Greek mythology, Heracles and Theseus—who in the tasks assigned to them were generally opposed to monsters and beings impossible in themselves, but possible as illustrations of permanent danger and damage,—shows that they were mythical illustrations of the dangers which beset the Greeks on the coasts of Asia Minor; rather perhaps, it may be intended to represent the conflict between the Greek culture of the colonies on the Euxine and the barbarism of the native inhabitants.

In works of art, combats between Amazons and Greeks are placed on the same level as and often associated with combats of Greeks and centaurs. The belief in their existence, however, having been once accepted and introduced into the national poetry and art, it became necessary to surround them as far as possible with the appearance of not unnatural beings. Their occupation was hunting and war; their arms the bow, spear, axe, a half shield, nearly in the shape of a crescent, called *pelta*, and in early art a helmet, the model before the Greek mind having apparently been the goddess Athena. In later art they approach the model of Artemis, wearing a thin dress, girt high for speed; while on the later painted vases their dress is often peculiarly Persian—that is, close-fitting trousers and a high cap called the *kidaris*. They were usually on horseback but sometimes on foot. The battle between Theseus and the Amazons is a favourite subject on the friezes of temples (*e.g.* the reliefs from the frieze of the temple of Apollo at Bassae, now in the British Museum), vases and sarcophagus reliefs; at Athens it was represented on the shield of the statue of Athena Parthenos, on wall-paintings in the Theseum and in the Poikile Stoa. Many of the sculptors of antiquity, including Pheidias, Polyclitus, Cresilas and Phradmon, executed statues of Amazons; and there are many existing reproductions of these.

The history of Bohemia affords a parallel to the Greek Amazons. During the 8th century a large band of women, under a certain Vlasta, carried on war against the duke of Bohemia, and enslaved or put to death all men who fell into their hands. In the 16th century the Spanish explorer Orellana asserted that he had come into conflict with fighting women in South America on the river Marañon, which was named after them the Amazon (*q.v.*) or river of the Amazons, although others derive its name from the Indian *amassona* (boat-destroyer), applied to the tidal phenomenon known as the "bore." The existence of "Amazons" (in the sense of fighting women) in the army of Dahomey in modern times is an undoubted fact, but they are said to have died out during the French protectorate. For notable cases of women who have become soldiers, reference may be made to Mary Anne Talbot and Hannah Snell.

See A. D. Mordtmann, *Die Amazonen* (1862); W. Stricker, *Die A. in Sage und Geschichte* (1868); A. Klügmann, *Die A. in der attischen Literatur und Kunst* (1875); H. L. Krause, *Die Amazonensage* (1893); F. G. Bergmann, *Les Amazones dans l'histoire et dans la fable* (1853); P. Lacour, *Les Amazones* (1901); articles in Pauly-Wissowa's *Realencyclopädie* and Roscher's *Lexikon der Mythologie*; Grote, *Hist. of Greece*, pt. i. ch. 11. In article Greek Art, fig. 40 represents three types of Amazons, and fig. 70 (pl. iv.) a battle between Amazons and Greeks.

AMAZON-STONE, or Amazonite, a green variety of microcline-felspar. The name is taken from that of the river Amazon, whence certain green stones were formerly obtained, but it is doubtful whether green felspar occurs in the Amazon district. The modern amazon-stone is a mineral of restricted occurrence. Formerly it was obtained almost exclusively from the neighbourhood of Miyask, in the Ilmen mountains, 50 m. S.W. of Cheliabinsk, Russia, where it occurs in granitic rocks. Of late years, magnificent crystals have been obtained from Pike's Peak, Colorado, where it is found associated with smoky quartz, orthoclase and albite in a coarse granite or pegmatite. Some other localities in the United States yield amazon-stone, and it is also found in pegmatite in Madagascar. On account of its lively green colour, it is cut and polished to a limited extent as an ornamental stone. The colour has been attributed to the presence of copper, but as it is discharged by heat it is likely to be due to some pigment of organic origin, and an organic salt of iron has been suggested. (See Microcline.)

AMBARVALIA, an annual festival of the ancient Romans, occurring in May, usually on the 29th, the object of which was to secure the growing crops against harm of all kinds. The priests were the Arval Brothers (*q.v.*), who conducted the victims—ox, sheep and pig (*suovetaurilia*)—in procession with prayer to Ceres round the boundaries of the *ager Romanus*. As the extent of Roman land increased, this could no longer be done, and in the Acta of the Fratres, which date from Augustus, we do not find this procession mentioned (Henzen, *Acta Fratrum Arvalium*, 1874); but there is a good description of this or a similar rite in Virgil, *Georg.* i. 338 ff., and in Cato's work *de Re Rustica* (141) we have full details and the text of the prayers used by the Latin farmer in thus "lustrating" his own land. In this last case the god invoked is Mars. The Christian festival which seems to have taken the place of these ceremonies is the Rogation or Gang week of the Roman Church. The perambulation or beating of bounds is probably a survival of the same type of rite.

See W. W. Fowler, *Roman Festivals* (1899), p. 124 ff.

(W. W. F.*)

AMBASSADOR (also Embassador, the form sometimes still used in America; from the Fr. *ambassadeur*, with which compare Ital. *ambasciatore* and Span. *embajador*, all variants of the Med. Lat. *ambasciator*, *ambassiator*, *ambasator*, &c., derived from Med. Lat. *ambasciare* or *ambactiare*, "to go on a mission, to do or say anything in another's name," from Lat. *ambactus*,[1] a vassal or servant; see Du Cange, *Glossarium*, s.v. *ambasciare*), a public minister of the first rank, accredited and sent by the head of a sovereign state as his personal representative to negotiate with a foreign government, and to watch over the interests of his own nation abroad. The power thus conferred is defined in the credentials or letters of credence of which the ambassador is the bearer, and in the instructions under the sign-manual delivered to him. The credentials consist of a sealed letter addressed by the sovereign whom the ambassador represents to the sovereign to whom he is accredited, and they embody a general assurance that the sovereign by whom the ambassador is sent will confirm whatever is done by the ambassador in his name. In Great Britain letters of credence are under the royal sign-manual, and are not countersigned by a minister. Ambassadors are distinguished as *ordinary* and *extraordinary*, which implied originally the difference between a permanent mission and one appointed to conduct a particular negotiation. The style of *ambassador extraordinary* is, however, now often given to a minister accredited to a court for an indefinite time and implies a somewhat more dignified rank.

By the protocol of the 19th of March 1815, afterwards embodied in the treaty of Vienna (1815) and confirmed by an instrument signed by the five great powers at Aix-la-Chapelle on the 21st of November 1818, it was finally determined that "ambassadors and papal legates and nuncios alone have a representative character," *i.e.* in the most exalted and peculiar sense, as representing the person of the sovereign, or the head of a republic, as well as the state to which they belong. It follows that only states enjoying "royal honours," *i.e.* empires, kingdoms, grand duchies, the great republics (*e.g.* France, Switzerland, the United States of America) and the Holy See, have the right to send or to receive ambassadors. By custom it has moreover been established that, as a general rule, only the greater "royal states" are represented by ambassadors, and then only when these are accredited to states esteemed, for one reason or another, to be of equal rank. Thus the promotion of the Japanese legations in Europe and the United States to the rank of embassies, and the corresponding change in the representation of the various powers at Tokio, marked in 1905 the definite recognition of Japan as a great power. To this rule the United States of America long remained an exception, and was content, in accordance with the tradition of republican simplicity, to be represented abroad only by ministers of the second rank. The subordinate position given to the representatives of so great a power, however, inevitably led to many inconveniences, and in 1893 an act of Congress empowered the president to accredit ambassadors to the great powers.

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[1] *Ambactus* is explained by Festus (*Paulus Diaconus ex Festo*, ed. C. O. Müller) as a Gallic word used by Ennius and meaning *servus*. Caesar (*De Bello Gallico*, vi. 15) says of the Gallic *equites*, "atque eorum ut quisque est genere copiisque amplissimus, plurimos circum se ambactos clientesque habent." Accepting the Celtic origin of the word, it has been connected with the Welsh *amaeth*, a tiller of the ground. A Teutonic origin has been suggested in the Old High Ger. *ambaht*, a retainer, which appears in a Scandinavian word *ambokt*, bondwoman or maid, in the *Ormulum* (*c.* 1200).

The distinction between an ambassador and ministers of the second rank is one rather of rank and dignity than of power or functions. His special immunities he shares with other diplomatic representatives of all classes. The peculiar privilege which he claims of free access to the sovereign has, in common practice, been reduced to the right of being received on presenting his credentials in public or private audience by the sovereign in person, it being obviously against public policy that a foreign representative should negotiate with the ruler otherwise than through his responsible ministers. In Great Britain the sovereign, when granting an audience to a foreign ambassador, is always attended by one or more ministers, and the same is usual in other states.

An ambassador, however, unless specially armed with plenary authority, cannot decide any questions beyond his instructions without reference to his government. Thus Lord Londonderry (Lord Stewart), who represented Great Britain at the conferences of Troppau in 1820 and Laibach in 1821, had not the same standing as the plenipotentiaries of the other powers present, and efforts were even made to exclude him from some of the more important discussions in consequence, not on the ground of inferior rank but of defective powers.

Socially, the position of an ambassador is one of great dignity. The pomp and magnificence which in earlier days characterized his progresses and his "entries" are indeed no longer observed. He is received, however, by the sovereign to whom he is accredited with elaborate state, of which every detail is minutely regulated, and ranks, as representing his own sovereign, next to the princes of the blood in the court where he resides. The controversies that once raged as to the order of precedence of the various ambassadors accredited to any one court were settled by the treaties already mentioned, it being decided that they should rank in order of seniority according to the date of the presentation of their credentials. In Roman Catholic countries, however—as in France before the abrogation of the concordat,—the position of *doyen* (dean) of the diplomatic body is given by courtesy to the nuncio of the pope.

The special immunities and privileges enjoyed by ambassadors are dealt with in the articles EXTERRITORIALITY and DIPLOMACY. See also the latter for the history of the subject.

The most authoritative modern hand-book on the subject is Charles de Martens, *Manuel diplomatique* (Paris, 1822; new ed., 1868). See also Henry Wheaton, *Hist. of the Law of Nations* (New York, 1845); L. Oppenheim, *International Law* (London, 1905); and the list of books attached to the article DIPLOMACY. (W. A. P.)

AMBATO, or ASIENTO DE AMBATO, an inland town of Ecuador, capital of the province of Tunguragua, 80 m. S. of Quito by the highway, and near the northern foot of Chimborazo. Pop. (est.) 10,000. The town stands in a bowl-like depression, 8606 ft. above sea-level, surrounded by steep, sandy, barren mountains, and has an equable climate, which has been likened to a perpetual autumn. The immediate environs are very fertile and produce a great variety of fruits, including many of the temperate zone, but the surrounding country is arid and sterile, producing scanty crops of barley, Indian corn and pease. The cochineal insect is found on the cactus which grows in abundance in the vicinity, and the town is known throughout Ecuador for its manufacture of boots and shoes, and for a cordage made from *cabuya*, the fibre of the agave plant. Ambato was destroyed by an eruption of Cotopaxi in 1698, and has been badly damaged two or three times by earthquakes.

AMBATO is also the name of a range of mountains in northern Argentina, being a spur of the Sierra de Aconquija crossing the province of Catamarca from north to south.

AMBER, a ruined city of India, the ancient capital of Jaipur state in the Rajputana agency. The name of Amber is first mentioned by Ptolemy. It was founded by the Minas and was still flourishing in A.D. 967. In 1037 it was taken by the Rajputs, who held it till it was deserted. In 1728 it was supplanted by the modern city of Jaipur, from which it is 5 m. distant. The picturesque situation of Amber at the mouth of a rocky mountain gorge, in which nestles a lovely lake, has attracted the admiration of all travellers, including Jacquemont and Heber. It is now only remarkable for its architecture. The old palace begun by Man Sing in 1600 ranks second only to Gwalior. The chief building is the Diwan-i-Khas built by Mirza Raja. "No sooner" (it is related) "had Mirza completed the Diwan-i-Khas than it came to the ears of the emperor Jehangir that his vassal had surpassed him in magnificence, and that this last great work quite eclipsed all the marvels of the imperial city; the columns of red sandstone having been particularly noticed as sculptured with exquisite taste and elaborate detail. In a fit of jealousy the emperor commanded that this masterpiece should be thrown down, and sent commissioners to Amber charged with the execution of this order; whereupon Mirza, in order to save the structure, had the columns plastered over with stucco, so that the messengers from Agra should have to acknowledge to the emperor that the magnificence, which had been so much talked of, was after all pure invention. Since then his apathetic successors have neglected to bring to light this splendid work; and it is only by knocking off some of the plaster that one can get a glimpse of the sculptures, which are perfect as on the day they were carved."

AMBER, a fossil resin much used for the manufacture of ornamental objects. The name comes from the Arab. *anbar*, probably through the Spanish, but this word referred originally to ambergris, which is an animal substance quite distinct from yellow amber. True amber has sometimes been called *karabe*, a word of oriental derivation signifying "that which attracts straw," in allusion to the power which amber possesses of acquiring an electric charge by friction. This property, first recorded by Thales of Miletus, suggested the word "electricity," from the Greek, ἤλεκτρον, a name applied, however, not only to amber but also to an alloy of gold and silver. By Latin writers amber is variously called *electrum*, *sucinum* (*succinum*), and *glaesum* or *glesum*. The Hebrew *ḥashmal* seems to have been amber.

Amber is not homogeneous in composition, but consists of several resinous bodies more or less soluble in alcohol, ether and chloroform, associated with an insoluble bituminous substance. The average composition of amber leads to the general formula $C_{10}H_{16}O$. Heated rather below 300° C. amber suffers decomposition, yielding an "oil of amber," and leaving a black residue which is known as "amber colophony," or "amber pitch"; this forms, when dissolved in oil of turpentine or in linseed oil, "amber varnish" or "amber lac."

True amber yields on dry distillation succinic acid, the proportion varying from about 3 to 8%, and being greatest in the pale opaque or "bony" varieties. The aromatic and irritating fumes emitted by burning amber are mainly due to this acid. True Baltic amber is distinguished by its yield of succinic acid, for many of the other fossil resins which are often termed amber contain either none of it, or only a very small proportion; hence the name "succinite" proposed by Professor J. D. Dana, and now commonly used in scientific writings as a specific term for the real Prussian amber. Succinite has a hardness between 2 and 3, which is rather greater than that of many other fossil resins. Its specific gravity varies from 1·05 to 1·10.

The Baltic amber or succinite is found as irregular nodules in a marine glauconitic sand, known as "blue earth," occurring in the Lower Oligocene strata of Samland in East Prussia, where it is now systematically mined. It appears, however, to have been partly derived from yet earlier Tertiary deposits (Eocene); and it occurs also as a derivative mineral in later formations, such as the drift. Relics of an abundant flora occur in association with the amber, suggesting relations with the flora of Eastern

Asia and the southern part of North America. H. R. Göppert named the common amber-yielding pine of the Baltic forests *Pinites succinifer*, but as the wood, according to some authorities, does not seem to differ from that of the existing genus it has been also called *Pinus succinifera*. It is improbable, however, that the production of amber was limited to a single species; and indeed a large number of conifers belonging to different genera are represented in the amber-flora. The resin contains, in addition to the beautifully preserved plant-structures, numerous remains of insects, spiders, annelids, crustaceans and other small organisms which became enveloped while the exudation was fluid. In most cases the organic structure has disappeared, leaving only a cavity, with perhaps a trace of chitin. Even hair and feathers have occasionally been represented among the enclosures. Fragments of wood not infrequently occur, with the tissues well-preserved by impregnation with the resin; while leaves, flowers and fruits are occasionally found in marvellous perfection. Sometimes the amber retains the form of drops and stalactites, just as it exuded from the ducts and receptacles of the injured trees. The abnormal development of resin has been called "succinosis." Impurities are often present, especially when the resin dropped on to the ground, so that the material may be useless except for varnish-making, whence the impure amber is called firniss. Enclosures of pyrites may give a bluish colour to amber. The so-called "black amber" is only a kind of jet. "Bony amber" owes its cloudy opacity to minute bubbles in the interior of the resin.

Although amber is found along the shores of a large part of the Baltic and the North Sea, the great amber-producing country is the promontory of Samland. Pieces of amber torn from the sea-floor are cast up by the waves, and collected at ebb-tide. Sometimes the searchers wade into the sea, furnished with nets at the end of long poles, by means of which they drag in the sea-weed containing entangled masses of amber; or they dredge from boats in shallow water and rake up amber from between the boulders. Divers have been employed to collect amber from the deeper waters. Systematic dredging on a large scale was at one time carried on in the Kurisches Haff by Messrs Stantien and Becker, the great amber merchants of Königsberg. At the present time extensive mining operations are conducted in quest of amber. The "pit amber" was formerly dug in open works, but is now also worked by underground galleries. The nodules from the "blue earth" have to be freed from matrix and divested of their opaque crust, which can be done in revolving barrels containing sand and water. The sea-worn amber has lost its crust, but has often acquired a dull rough surface by rolling in sand.

Amber is extensively used for beads and other trivial ornaments, and for cigar-holders and the mouth-pieces of pipes. It is regarded by the Turks as specially valuable, inasmuch as it is said to be incapable of transmitting infection as the pipe passes from mouth to mouth. The variety most valued in the East is the pale straw-coloured, slightly cloudy amber. Some of the best qualities are sent to Vienna for the manufacture of smoking appliances. In working amber, it is turned on the lathe and polished with whitening and water or with rotten stone and oil, the final lustre being given by friction with flannel. During the working much electricity is developed.

By gradually heating amber in an oil-bath it becomes soft and flexible. Two pieces of amber may be united by smearing the surfaces with linseed oil, heating them, and then pressing them together while hot. Cloudy amber may be clarified in an oil-bath, as the oil fills the numerous pores to which the turbidity is due. Small fragments, formerly thrown away or used only for varnish, are now utilized on a large scale in the formation of "ambroid" or "pressed amber." The pieces are carefully heated with exclusion of air and then compressed into a uniform mass by intense hydraulic pressure; the softened amber being forced through holes in a metal plate. The product is extensively used for the production of cheap jewellery and articles for smoking. This pressed amber yields brilliant interference colours in polarized light. Amber has often been imitated by other resins like copal and kauri, as well as by celluloid and even glass. True amber is sometimes coloured artificially.

Amber was much valued as an ornamental material in very early times. It has been found in Mycenaean tombs; it is known from lake-dwellings in Switzerland, and it occurs with neolithic remains in Denmark, whilst in England it is found with interments of the bronze age. A remarkably fine cup turned in amber from a bronze-age barrow at Hove is now in the Brighton Museum. Beads of amber occur with Anglo-Saxon relics in the south of England; and up to a comparatively recent period the material was valued as an amulet. It is still believed to possess certain medicinal virtue.

Rolled pieces of amber, usually small but occasionally of very large size, may be picked up on the east coast of England, having probably been washed up from deposits under the North Sea. Cromer is the best-known locality, but it occurs also on other parts of the Norfolk coast, as well as at Yarmouth, Southwold, Aldeburgh and Felixstowe in Suffolk, and as far south as Walton-on-the-Naze in Essex, whilst northwards it is not unknown in Yorkshire. On the other side of the North Sea, amber is found at various localities on the coast of Holland and Denmark. On the shores of the Baltic it occurs not only on the Prussian and Pomeranian coast but in the south of Sweden, in Bornholm and other islands, and in S. Finland. Amber has indeed a very wide distribution, extending over a large part of northern Europe and occurring as far east as the Urals. Some of the amber districts of the Baltic and North Sea were known in prehistoric times, and led to early trade with the south of Europe. Amber was carried to Olbia on the Black Sea, Massilia on the Mediterranean, and Hatria at the head of the Adriatic; and from these centres it was distributed over the Hellenic world.

Whilst succinite is the common variety of European amber, the following varieties also occur:—

Gedanite, or "brittle amber," closely resembling succinite, but much more brittle, not quite so hard, with a lower melting-point and containing no succinic acid. It is often covered with a white powder easily removed by wiping. The name comes from Gedanum, the Latin name of Danzig.

Stantienite, a brittle, deep brownish-black resin, destitute of succinic acid.

Beckerite, a rare amber in earthy-brown nodules, almost opaque, said to be related in properties to gutta-percha.

Glessite, a nearly opaque brown resin, with numerous microscopic cavities and dusty enclosures, named from *glesum*, an old name for amber.

Krantzite, a soft amber-like resin, found in the lignites of Saxony.

Allingite, a fossil resin allied to succinite, from Switzerland.

Roumanite, or Rumanian amber, a dark reddish resin, occurring with lignite in Tertiary deposits. The nodules are penetrated by cracks, but the material can be worked on the lathe. Sulphur is present to the extent of more than 1 %, whence the smell of sulphuretted hydrogen when the resin is heated. According to G. Murgoci the Rumanian amber is true succinite.

Simetite, or Sicilian amber, takes its name from the river Simeto or Giaretta. It occurs in Miocene deposits and is also found washed up by the sea near Catania. This beautiful material presents a great diversity of tints, but a rich hyacinth red is common. It is remarkable for its fluorescence, which in the opinion of some authorities adds to its beauty. Amber is also found in many localities in Emilia, especially near the sulphur-mines of Cesena. It has been conjectured that the ancient Etruscan ornaments in amber were wrought in the Italian material, but it seems that amber from the Baltic reached the Etruscans at Hatria. It has even been supposed that amber passed from Sicily to northern Europe in early times—a supposition said to receive some support from the fact that much of the amber dug up in Denmark is red; but it must not be forgotten that reddish amber is found also on the Baltic, though not being fashionable it is used rather for varnish-making than for ornaments. Moreover, yellow amber after long burial is apt to acquire a reddish colour. The amber of Sicily seems not to have been recognized in ancient times, for it is not mentioned by local authorities like Diodorus Siculus.

Burmite is the name under which the Burmese amber is now described. Until the British occupation of Burma but little was known as to its occurrence, though it had been worked for centuries and was highly valued by the natives and by the Chinese. It is found in flat rolled pieces, irregularly distributed through a blue clay probably of Miocene age. It occurs in the Hukawng valley, in the Nangotaimaw hills, where it is irregularly worked in shallow pits. The mines were visited some years ago by Dr Fritz Noetling, and the mineral has been described by Dr Otto Helm. The Burmese amber is yellow or reddish, some being of ruby tint, and like the Sicilian amber it is fluorescent. Burmite and simetite agree also in being destitute of succinic acid. Most of the Burmese amber is worked at Mandalay into rosary-beads and ear-cylinders.

Many other fossil resins more or less allied to amber have been described. Schraufite is a reddish resin from the Carpathian sandstone, and it occurs with jet in the cretaceous rocks of the Lebanon; ambrite is a resin found in many of the coals of New Zealand; retinite occurs in the lignite of Bovey Tracey in Devonshire and elsewhere; whilst copaline has been found in the London clay of Highgate in North London. Chemawinite or cedarite is an amber-like resin from the Saskatchewan river in Canada.

Amber and certain similar substances are found to a limited extent at several localities in the United States, as in the greensand of New Jersey, but they have little or no economic value. A fluorescent amber is said, however, to occur in some abundance in Southern Mexico. Amber is recorded also from the Dominican Republic.

References.—See, for Baltic amber, P. Dahms, "Ueber die Vorkommen und die Verwendung des Bernsteins," *Zeitsch. für praktische Geologie*, 1901, p. 201; H. Conwentz, *Monographie der baltischen Bernsteinbäume* (Danzig, 1890); R. Klebs, *Guide to Exhibit of the German Amber Industry at World's Fair* (St Louis, 1904); and abstract by G. F. Kunz in *Mineral Resources of the U. S.* (1904). For Sicilian amber, W. Arnold Buffum, *The Tears of the Heliades, or Amber as a Gem* (London, 1896). For Burmese amber, papers by Fritz Noetling and Otto Helm in *Records of Geol. Surv. of India*, vol. xxvi. (1893), pp. 31, 61. For British amber, Clement Reid in *Trans. Norfolk Nat. Soc.*, vol. iii. (1884) p. 601; vol. iv. (1886) p. 247; and H. Conwentz in *Natural Science*, vol. ix. (1896) pp. 99, 161. (F. W. R.*)

AMBERG, a town of Germany, in the kingdom of Bavaria, formerly the capital of the Upper Palatinate, situated on both sides of the Vils, 42 m. E. of Nuremberg by rail. Pop. 22,089. It has a town hall with handsome rooms, a library, a gymnasium, a lyceum, elementary schools, an arsenal, and eleven churches, the finest of which is St Martin's, of the 15th century, with many excellent paintings and a tower 300 ft. high. A former Jesuit monastery is now used for a grammar school and seminary. There are also a pilgrimage church on a hill 1621 ft. high, a large convict prison for men, an industrial, commercial and other schools. The principal manufactures are firearms, ironmongery, earthenware, woollen cloth, beer, stoneware, zinc goods, colours and salt; in the neighbourhood are iron and coal mines. The French under Jourdan were defeated by the Austrians under the Archduke Charles near Amberg in 1796.

AMBERGRIS (*Ambra grisea*, *Ambre gris*, or grey amber), a solid, fatty, inflammable substance of a dull grey or blackish colour, the shades being variegated like marble, possessing a peculiar sweet, earthy odour. It occurs as a biliary concretion in the intestines of the spermaceti whale (*Physeter macrocephalus*), and is found floating upon the sea, on the sea-coast, or in the sand near the sea-coast. It is met with in the Atlantic Ocean; on the coasts of Brazil and Madagascar; also on the coast of Africa, of the East Indies, China, Japan and the Molucca islands; but most of the ambergris which is brought to England comes from the Bahama Islands, Providence, &c. It is also sometimes found in the abdomen of whales, always in lumps of various shapes and sizes, weighing from ½ oz. to 100 or more pounds. Ambergris, when taken from the intestinal canal of the sperm whale, is of a deep grey colour, soft consistence and a disagreeable smell. On exposure to the air it gradually hardens, becomes pale and develops its peculiar sweet, earthy odour. In that condition its specific gravity ranges from 0·780 to 0·926. It melts at about 62° C. to a fatty, yellow resinous-like liquid; and at 100° C. it is volatilized into a white vapour. It is soluble in ether, and in volatile and fixed oils; it is only feebly acted on by acids. By digesting in hot alcohol, a substance termed *ambrein*, closely resembling cholesterin, is obtained, which separates in brilliant white crystals as the solution cools. The use of ambergris in Europe is now entirely confined to perfumery, though it formerly occupied no inconsiderable place in medicine. In minute quantities its alcoholic solution is much used for giving a "floral" fragrance to bouquets, washes and other preparations of the perfumer. It occupies a very important place in the perfumery of the East, and there it is also used in pharmacy and as a flavouring material in cookery. The high price it commands makes it peculiarly liable to adulteration, but its genuineness is easily tested by its solubility in hot alcohol, its fragrant odour, and its uniform fatty consistence on being penetrated by a hot wire.

AMBERT, a town of central France, capital of an arrondissement of the department of Puy-de-Dôme, on the Dore, 52 m. E.S.E. of Clermont-Ferrand by rail. Pop. (1906), town, 3889; commune, 7581. The town has a church of the 15th and 16th centuries and carries on the manufacture of paper, lace, ribbon, rosaries, &c., and trade in cheese. It is the seat of a sub-prefect, and the public institutions include tribunals of first instance and of commerce, a chamber of arts and manufactures, and a communal college.

AMBIENT (from Lat. *ambi*, on both sides, and *ire*, to go), surrounding; a word implying a moving rather than a stationary encircling. It is used mostly in the phrase the "ambient air," though Bacon applied it as an adjective to the clergy, suggesting "ambition." In astrology it means the sky.

AMBIGU, a French game of cards, composed of the characteristic elements of whist, bouillotte and piquet. A whist pack with the court cards deleted is used, and from two to six persons may play. Each player is given an equal number of counters, and a limit of betting is agreed upon. Two cards are dealt, one at a time, to each player, after each has placed two counters in a pool. Each player then either keeps his hand, saying "Enough," or takes one or two new cards from the top of the stock, after which the stock is reshuffled and cut, and each player receives two more cards, one at a time. The players then either "play" or "pass." If a person "plays," he bets a number of counters and the others may equal this bet or raise it. Should no player meet the first bet, the bettor takes back his bet, leaving the pool intact, and receives two counters from the last player who refuses to play. When two or more bet the same number, they again draw cards and "pass" or "play" as before. If all "pass," each pays a counter to the pool and a new deal ensues. The player betting more than the others call wins the pool. He then exposes his hand and is paid by each adversary according to its value. The hands rank as follows:—"Point," the number of pips on two or more cards of a suit (one counter). "Prime," four cards of different suits (two counters). "Grand Prime," the same with the number of pips over 30 (three counters). "Sequence," a hand containing three cards of the same suit in sequence (three counters). "*Tricon*," three of a kind (four counters). "Flush," four cards of the same suit (five counters). "Doublet," a hand containing two counting combinations at once, as 2, 3, 4 and 7 of spades, amounting to both a "sequence" and a "flush" (eight counters). "*Fredon*," four of a kind (the highest possible hand), ten or eleven counters, according to the number of pips. Ties are decided by the number of pips.

AMBIGUITY (Fr. *ambiguïté*, med. Lat. *ambiguitas*, from Lat. *ambiguus*, doubtful; *ambi*, both ways, *agere*, to drive), doubtfulness or uncertainty. In law an ambiguity as to the meaning of the words of a written instrument may be of considerable importance. Ambiguity, in law, is of two kinds, *patent* and *latent*. (1) Patent ambiguity is that ambiguity which is apparent on the face of an instrument to any one perusing it, even if he be unacquainted with the circumstances of the parties. In the case of a patent ambiguity parol evidence is admissible to explain only what has been written, not what it was intended to write. For example, in *Saunderson* v. *Piper*, 1839, 5 B.N.C. 425, where a bill was drawn in figures for £245 and in words for two hundred pounds, evidence that "and forty-five" had been omitted by mistake was rejected. But where it appears from the general context of the instrument what the parties really meant, the instrument will be construed as if there was no ambiguity, as in *Saye and Sele's* case, 10 Mod. 46, where the name of the grantor had been omitted in the operative part of a grant, but, as it was clear from another part of the grant who he was, the deed was held to be valid. (2) Latent ambiguity is where the wording of an instrument is on the face of it clear and intelligible, but may, at the same time, apply equally to two different things or subject matters, as where a legacy is given "to my nephew, John," and the testator is shown to have two nephews of that name. A latent ambiguity may be explained by parol evidence, for, as the ambiguity has been brought about by circumstances extraneous to the instrument, the explanation must necessarily be sought for from such circumstances. (See also EVIDENCE.)

AMBIORIX, prince of the Eburones, a tribe of Belgian Gaul. Although Caesar (*q.v.*) had freed him from paying tribute to the Aduatuci, he joined Catuvolcus (winter, 54 B.C.) in a rising against the Roman forces under Q. Titurius Sabinus and L. Aurunculeius Cotta, and almost annihilated them. An attack on Quintus Cicero (brother of the orator), then quartered with a legion in the territory of the Nervii, failed owing to the timely appearance of Caesar. Ambiorix is said to have found safety across the Rhine.

Caesar, *Bell. Gall.* v. 26-51, vi. 29-43, viii. 24; Dio Cassius xl. 7-11; Florus iii. 10.

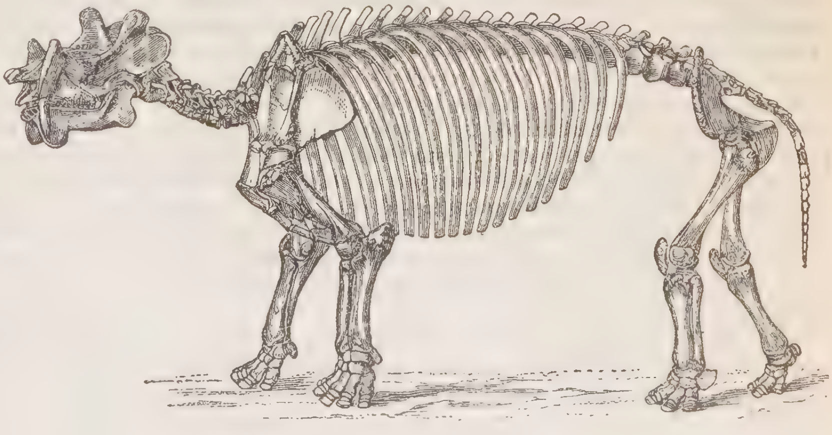
AMBLESIDE, a market-town in the Appleby parliamentary division of Westmorland, England, a mile from the head of Windermere. Pop. of urban district (1901) 2536. It is most beautifully situated, for though the lake is hardly visible from the town, the bare, sharply rising hills surrounding the richly wooded valley of the Rothay afford a series of exquisite views. The hills immediately above this part of the valley are Wansfell on the east, Loughrigg Fell on the west, and Rydal Fell and the ridge below Snarker Pike (2096 ft.) to the north. At the head of Windermere is Waterhead, the landing-stage of Ambleside, which is served by the lake steamers of the Furness Railway Company. The chief roads which centre upon Ambleside are—one from the town of Windermere, following the eastern shore of the lake; one from Ullswater, by Patterdale and Kirkstone Pass; one from Keswick, by Dunmail Raise and Grasmere, and the two lovely lakes of Grasmere and Rydal Water; and one from the Brathay valley and the Langdales to the west. Ambleside is thus much frequented by tourists. In its vicinity is Rydal Mount, for many years the residence of the poet Wordsworth. The town has some industry in bobbin-making, and there are slate quarries in the neighbourhood.

Close by the lake side the outlines are still visible of a Roman fort, the name of which is not known. It appears to have guarded a route over the hills by Hardknott and Wrynose Pass to Ravenglass on the coast of Cumberland.

AMBLYGONITE, a mineral usually found as cleavable or columnar, and compact masses; it is translucent and has a vitreous lustre, and the colour varies from white to pale shades of violet, grey, green or yellow. There are good cleavages in two directions. The hardness is 6 and the specific gravity 3·0. The mineral is thus not unlike felspar in general appearance, but it is readily distinguished from this by its chemical characters, being an aluminium and lithium fluophosphate, $Li(AlF)PO_4$, with part of the lithium replaced by sodium and part of the fluorine by hydroxyl. Crystals, which are rarely distinctly developed, belong to the anorthic system, and frequently show twin lamellae.

The mineral was first discovered in Saxony by A. Breithaupt in 1817, and named by him from the Greek ἀμβλύς, blunt, and γωνία, angle, because of the obtuse angle between the cleavages. Later it was found at Montebras, dep. Creuse, France, and at Hebron in Maine; and on account of slight differences in optical character and chemical composition the names montebrasite and hebronite have been applied to the mineral from these localities. Recently it has been discovered in considerable quantity at Pala in San Diego county, California, and at Cáceres in Spain. Amblygonite occurs with lepidolite, tourmaline and other lithia-bearing minerals in pegmatite-veins. It contains about 10% of lithia, and, since 1886, has been utilized as a source of lithium salts, the chief commercial sources being the Montebras deposits, and later the Californian. (L. J. S.)

AMBLYPODA, a suborder of primitive ungulate mammals, taking its name from the short and stumpy feet, which were furnished with five toes each, and supported massive pillar-like limbs. The brain-cavity was extremely small, and insignificant in comparison to the bodily bulk, which was equal to that of the largest rhinoceroses. These animals are, in fact, descendants of the small ancestral ungulates which have retained all the primitive characters of the latter accompanied by a huge increase in bodily size. They are confined to the Eocene period, and occur both in North America and Europe. The cheek teeth are short crowned (brachyodont), with the tubercles more or less completely fused into transverse ridges, or cross-crests (lophodont type); and the total number of teeth is in one case the typical 44, but in another is reduced below this. The vertebrae of the neck unite by nearly flat surfaces, the humerus has lost the foramen, or perforation, at the lower end, and the third trochanter to the femur may also be wanting. In the fore-limb the upper and lower series of carpal bones scarcely alternate, but in the hind-foot the astragalus overlaps the cuboid, while the fibula, which is quite distinct from the tibia (as is the radius from the ulna in the fore-limb), articulates with both astragalus and calcaneum. The most generalized type is *Coryphodon*, representing the family *Coryphodontidae*, from the lower Eocene of Europe and North America, in which there were 44 teeth, and no horn-like excrescences on the long skull, while the femur had a third trochanter. The canines are somewhat elongated, and were followed by a short gap in each jaw, and the cheek-teeth were adapted for succulent food. The length of the body reached about 6 ft. in some cases.



Restored skeleton of *Uintatherium* (*Dinoceras*) *mirabile*.
(After O. C. Marsh.)

In the middle Eocene formations of North America occurs the more specialized *Uintatherium* (or *Dinoceras*), typifying the family *Uintatheriidae*, which also contains species sometimes separated as *Tinoceras*. Uintatheres were huge creatures, with long narrow skulls, of which the elongated facial portion carried three pairs of bony horn-cores, probably covered with short horns in life, the hind-pair being much the largest. The dental formula is *i.* $\frac{0}{3}$, *c.* $\frac{1}{1}$, *p.* $\frac{3}{3\text{-}4}$, *m.* $\frac{3}{3}$; the upper canines being long sabre-like weapons, protected by a descending flange on each side of the front of the lower jaw.

In the basal Eocene of North America the Amblypoda were represented by extremely primitive, five-toed, small ungulates such as *Periptychus* and *Pantolambda*, each of these typifying a family. The full typical series of 44 teeth was developed in each, but whereas in the *Periptychidae* the upper molars were bunodont and tritubercular, in the *Pantolambdidae* they have assumed a selenodont structure. Creodont characters (see CREODONTA) are displayed in the skeleton.

See also H. F. Osborn, "Evolution of the Amblypoda," *Bull. Amer. Mus.* vol. x. p. 169. (R. L.*)

AMBO, or AMBON (Gr. ἄμβων, from ἀναβαίνειν, to walk up, the reading-desk of early Basilican churches, also called πύργος. Originally small and movable, it was afterwards made of large proportions and fixed in one place. In the Byzantine and early Romanesque periods it was an essential part of church furniture; but during the middle ages it was gradually superseded in the Western Church by the pulpit and lectern. The gospel and epistle are still read from the ambo in the Ambrosian rite at Milan. The position of the ambo was not absolutely uniform; sometimes in the central point between the sanctuary and the nave, sometimes in the middle of the church, and sometimes at one or both of the sides of the chancel. The normal ambo, when the church contained only one, had three stages or degrees, one above the other, and it was usually mounted by a flight of steps at each end. The uppermost stage was reserved for the deacon who sang the gospel (facing the congregation); for promulgating episcopal edicts; reciting the names inscribed on the diptychs (see DIPTYCH); announcing fasts, vigils and feasts; reading ecclesiastical letters or acts of the martyrs celebrated on that day; announcing new miracles for popular edification, professions by new converts or recantations by heretics; and (for priests and deacons) preaching sermons,—bishops as a general rule preaching from their own throne. The second stage was for the sub-deacon who read the epistle (facing the altar); and the third for the subordinate clergy who read other parts of scripture. The inconvenience of having a single ambo led to the substitution of two separate ambones, between which these various functions were divided, one on the south side of the chancel being for the reading of the gospel, and one on the north for reading the epistle. In the Russian Orthodox Church the term "ambo" is used of the semicircular steps leading to the platform in front of the iconostasis (*q.v.*), but in cathedrals the bishop has an ambo in the centre of the church. In the Greek Church the older form remains, usually placed at the side. In the Uniate Greek Catholic Church the "ambo" has become a table, on which are placed a crucifix and lights, before the doors of the iconostasis; here baptisms, marriages and confirmations take place.

Ambones were made of wood or else of costly marbles, and were decorated with mosaics, reliefs, gilding, &c.; sometimes also covered with canopies supported on columns. They were often of enormous size; that at St Sophia in Constantinople was large enough for the ceremonial of coronation.

The churches in Rome possess many fine examples of ambones in marble, of which the oldest is probably that in S. Clemente, reconstructed in the beginning of the 12th century. Those of slightly later date are enriched with marble mosaic known as Cosmati work, of which the examples in S. Maria-in-Ara-Coeli, S. Maria-in-Cosmedin and S. Lorenzo are those which are best known. Some early ambones are found in Ravenna, and in the south of Italy are many fine examples; the epistle ambo in the cathedral at Ravello (1130), which is perhaps the earliest, shows a Scandinavian influence in the design of its mosaic inlay, an influence which is found in Sicilian work and may be a Norman importation. The two ambones in the cathedral of Salerno, which are different in design, are magnificent in effect and are enriched with sculpture as well as with mosaic. In the gospel ambo in the cathedral of Ravello (1272), and also in that of the convent of the Trinita della Cava near Salerno, the spiral columns inlaid with mosaic stand on the backs of lions. In the epistle ambo at Salerno and the gospel ambones at Cava and San Giovanni del Toro in Ravello, the columns support segmental arches carrying the ambones; the epistle ambo at Ravello and all those in Rome are raised on solid marble bases.

See the liturgical and ecclesiastical dictionaries of Martigny, Migne, and Smith and Cheetham, *sub voce*, where all the scattered references are collected together and summarized. In Ciampinus, *Vetera Monumenta* (Rome, 1747), plates xii., xiii., are several illustrations of actual examples.

AMBOISE, GEORGES D' (1460–1510), French cardinal and minister of state, belonged to a noble family possessed of considerable influence. His father, Pierre d'Amboise, seigneur de Chaumont, was chamberlain to Charles VII. and Louis XI. and ambassador at Rome. His eldest brother, Charles d'Amboise, was governor of the Isle of France, Champagne and Burgundy, and councillor of Louis XI. Georges d'Amboise was only fourteen when his father procured for him the bishopric of Montauban, and Louis XI. appointed him one of his almoners. On arriving at manhood d'Amboise attached himself to the party of the duke of Orleans, in whose cause he suffered imprisonment, and on whose return to the royal favour he was elevated to the archbishopric of Narbonne, which after some time he changed for that of Rouen (1493). On the appointment of the duke of Orleans as governor of Normandy, d'Amboise became his lieutenant-general. In 1498 the duke of Orleans mounted the throne as Louis XII., and d'Amboise was suddenly raised to the high position of cardinal and prime minister. His administration was, in many respects, well-intentioned and useful. Having the good fortune to serve a king who was both economical and just, he was able to diminish the imposts, to introduce order among the soldiery, and above all, by the ordinances of 1499, to improve the organization of justice. He was also zealous for the reform of the church, and particularly for the reform of the monasteries; and it is greatly to his credit that he did not avail himself of the extremely favourable opportunities he possessed of becoming a pluralist. He regularly spent a large income in charity, and he laboured strenuously to stay the progress of the plague and famine which broke out in 1504. His foreign policy, less happy and less wise, was animated by two aims—to increase the French power in Italy and to seat himself on the papal throne; and these aims he sought to achieve by diplomacy, not by force. He, however, sympathized with, and took part in, the campaign which was begun in 1499 for the conquest of Milan. In 1500 he was named lieutenant-general in Italy and charged with the organization of the conquest. On the death of Alexander VI. he aspired to the papacy. He had French troops at the gates of Rome, by means of which he could easily have frightened the conclave and induced them to elect him; but he was persuaded to trust to his influence; the troops were dismissed, and an Italian was appointed as Pius III.; and again, on the death of Pius within the month, another Italian, Julius II., was chosen (1503). D'Amboise received in compensation the title of legate for life in France and in the Comtat Venaissin. He was one of the negotiators of the disastrous treaties of Blois (1504), and in 1508 of the League of Cambrai against Venice. In 1509 he again accompanied Louis XII. into Italy, but on his return he was seized at the city of Lyons with a fatal attack of gout in the stomach. He died there on the 25th of May 1510. His body was removed to Rouen, and a magnificent tomb, on which he is represented kneeling in the attitude of prayer, was erected to his memory in the cathedral of that town. Throughout his life he was an enlightened patron of letters and art, and it was at his orders that the château of Gaillon near Rouen was built.

See *Lettres du roi Louis XII. et du cardinal d'Amboise* (Brussels, 1712); L. Legendre, *Vie du cardinal d'Amboise* (Rouen, 1726); E. Lavisse, *Histoire de France* (vol. v. by H. Lemonnier, Paris, 1903);

J. A. Deville, *Tombeaux de la cathédrale de Rouen* (3rd ed., 1881). For a bibliography of the printed sources, see H. Hauser, *Les Sources de l'histoire de France, XVIe siècle*, vol. i. (1906). (J. I.)

AMBOISE, a town of central France in the department of Indre-et-Loire, on the left bank of the Loire, 12 m. E. of Tours by the Orléans railway. Pop. (1906) 4632. Amboise owes its celebrity to the imposing château which overlooks the Loire from the rocky eminence above the town. The Logis du Roi, the most important portion, was the work of Charles VIII.; the other wing was built under Louis XII. and Francis I. The ramparts are strengthened by two massive towers containing an inclined plane on which horses and carriages may ascend. The chapel of St Hubert, said to contain the remains of Leonardo da Vinci, who was summoned to Amboise by Francis I., king of France, and died there in 1519, is in the late Gothic style; a delicately carved relief over the doorway represents the conversion of St Hubert. The hôtel de ville is established in a mansion of Renaissance architecture; a town gateway of the 15th century, surmounted by a belfry, is also of architectural interest. Iron-founding, wool-weaving, and the manufacture of boots and farm implements are among the industries.

Amboise at the end of the 11th century was a lordship under the counts of Anjou, one of whom, Hugues I., rebuilt the ancient castle. Its territory was united to the domain of the crown of France by Charles VII. about the middle of the 15th century, and thenceforth the château became a favourite residence of the French kings. The discovery in 1560 of the "conspiracy of Amboise," a plot of the Huguenots to remove Francis II. from the influence of the house of Guise, was avenged by the death of 1200 members of that party. In 1563 Amboise gave its name to a royal edict allowing freedom of worship to the Huguenot nobility and gentry. After that period the château was frequently used as a state prison, and Abd-el-Kader was a captive there from 1848 to 1852. In 1872 it was restored by the National Assembly to the house of Orleans, to which it had come by inheritance from the duke of Penthièvre in the latter half of the 18th century.

AMBOYNA (Dutch *Ambon*), the name of a residency, its chief town, and the island on which the town is situated, in the Dutch East Indies.

The residency shares with that of Ternate the administration of the Moluccas, the previous government of which was abolished in 1867. It includes a mass of islands in the Banda Sea (2° 30′–8° 20′ S. and 125° 45′–135° E.), including the island-belt which surrounds the sea on the north, east and south; and is divided for administrative purposes into nine districts (*afdeelingen*): 1) Amboyna, the island of that name; (2) Saparua, with Oma and Nusa Laut; (3) Kajeli (Eastern Buru); (4) Masareti (Western Buru); (5) Kairatu (Western Ceram); (6) Wahai (the northern part of Mid-Ceram); (7) Amahai (the southern part of Mid-Ceram); (8) the Banda Isles, with East Ceram, Ceram Laut and Gorom; (9) the islands of Aru, Kei, Timor Laut or Tenimber, and the south-western islands. The total area of the residency is about 19,861 sq. m., and its population 296,000, including 2400 Europeans.

Amboyna Island lies off the south-west of Ceram, on the north side of the Banda Sea, being one of a series of volcanic isles in the inner circle round the sea. It is 32 m. in length, with an area of about 386 sq. m., and is of very irregular figure, being almost divided into two. The south-eastern and smaller portion (called Leitimor) is united to the northern (Hitoe) by a neck of land a few yards in breadth. The highest mountains, Wawani (3609 ft.) and Salhutu (4020 ft.), have hot springs and solfataras. They are considered to be volcanoes, and the mountains of the neighbouring Uliasser islands the remains of volcanoes. Granite and serpentine rocks predominate, but the shores of Amboyna Bay are of chalk, and contain stalactite caves. The surface is fertile, the rivers are small and not navigable, and the roads are mere footpaths. Cocoa is one of the products. The climate is comparatively pleasant and healthy; the average temperature is 80° F., rarely sinking below 72°. The rainfall, however, after the eastern monsoons, is very heavy, and the island is liable to violent hurricanes. It is remarkable that the dry season (October to April) is coincident with the period of the west monsoon. Indigenous mammals are poor in species as well as few in number; birds are more abundant, but of no greater variety. The entomology of the island, however, is very rich, particularly in respect of *Lepidoptera*. Shells are obtained in great numbers and variety. Turtle-shell is also largely exported. The vegetation is also rich, and Amboyna produces most of the common tropical fruits and vegetables, including the sago-palm, bread-fruit, cocoa-nut, sugar-cane, maize, coffee, pepper and cotton. Cloves, however, form its chief product, though the trade in them is less important than formerly, when the Dutch prohibited the rearing of the clove-tree in all the other islands subject to their rule, in order to secure the monopoly to Amboyna. Amboyna wood, of great value for ornamental work, is obtained from the hard knots which occur on certain trees in the forests of Ceram. The population (about 39,000) is divided into two classes—*orang burger* or citizens, and *orang negri* or villagers, the former being a class of native origin enjoying certain privileges conferred on their ancestors by the old Dutch East India Company. The natives are of mixed Malay-Papuan blood. They are mostly Christians or Mahommedans. There are also, besides the Dutch, some Arabs, Chinese and a few Portuguese settlers.

Amboyna, the chief town, and seat of the resident and military commander of the Moluccas, is protected by Fort Victoria, and is a clean little town with wide streets, well planted. Agriculture, fisheries and import and export trade furnish the chief means of subsistence. It lies on the north-west of the peninsula of Leitimor, and has a safe and commodious anchorage. Its population is about 8000.

The Portuguese were the first European nation to visit Amboyna (1511). They established a factory there in 1521, but did not obtain peaceable possession of it till 1580, and were dispossessed by the Dutch in 1609. About 1615 the British formed a settlement in the island, at Cambello, which they retained until 1623, when it was destroyed by the Dutch, and frightful tortures inflicted on the unfortunate persons connected with it. In 1654, after many fruitless negotiations, Cromwell compelled the United Provinces to give the sum of £300,000, together with a small island, as compensation to the descendants of those who suffered in the "Amboyna massacre." In 1673 the poet Dryden produced his tragedy of *Amboyna, or the Cruelties of the Dutch to the English Merchants.* In 1796 the British, under Admiral Rainier, captured Amboyna, but restored it to the Dutch at the peace of Amiens in 1802. It was retaken by the British in 1810, but once more restored to the Dutch in 1814.

AMBRACIA (more correctly AMPRACIA), an ancient Corinthian colony, situated about 7 m. from the Ambracian Gulf, on a bend of the navigable river Aracthus (or Aratthus), in the midst of a fertile wooded plain. It was founded between 650 and 625 B.C. by Gorgus, son of the Corinthian tyrant Cypselus. After the expulsion of Gorgus's son Periander its government developed into a strong democracy. The early policy of Ambracia was determined by its loyalty to Corinth (for which it probably served as an entrepôt in the Epirus trade), its consequent aversion to Corcyra, and its frontier disputes with the Amphilochians and Acarnanians. Hence it took a prominent part in the Peloponnesian War until the crushing defeat at Idomene (426) crippled its resources. In the 4th century it continued its traditional policy, but in 338 surrendered to Philip II. of Macedon. After forty-three years of autonomy under Macedonian suzerainty it became the capital of Pyrrhus, king of Epirus, who adorned it with palace, temples and theatres. In the wars of Philip V. of Macedon and the Epirotes against the Aetolian league (220–205) Ambracia passed from one alliance to the other, but ultimately joined the latter confederacy. During the struggle of the Aetolians against Rome it stood a stubborn siege. After its capture and plunder by M. Fulvius Nobilior in 189, it fell into insignificance. The foundation by Augustus of Nicopolis (*q.v.*). into which the remaining inhabitants were drafted, left the site desolate. In Byzantine times a new settlement took its place under the name of Arta (*q.v.*). Some fragmentary walls of large, well-dressed blocks near this latter town indicate the early prosperity of Ambracia.

AUTHORITIES.—Thucydides ii. 68–iii. 114; Aristotle, *Politics*, 1303a sqq.; Strabo p. 325; Polybius xxii. 9-13; Livy xxxviii. 3-9; G. Wolfe, *Journal of Geographical Society* (London), iii. (1833) pp. 77-94; E. Oberhummer, *Akarnanien, Ambrakien, &c. im Altertum* (Munich, 1887). (M. O. B. C.)

AMBRIZ, a West African seaport belonging to Portugal, at the mouth of the Loje River, in 7° 50′ S., 13° E., some 70 m. N. of Loanda. It forms a part of the province of Angola (*q.v.*). The town is within the free-trade area of the conventional basin of the Congo river. Its chief exports are rubber, gum, coffee and copper. Pop. about 2500. Ambriz was, previously to 1884, the northernmost point of Africa south of the equator acknowledged as Portuguese territory.

AMBROS, AUGUST WILHELM (1816–1876), Austrian composer and historian of music, was born at Mauth near Prague. His father was a cultured man, and his mother was the sister of R. G. Kiesewetter (1773–1850), the musical archaeologist and collector. Ambros was well educated in music and the arts, which were his abiding passion; but he was destined for the law and an official career in the Austrian civil service, and he occupied various important posts under the ministry of justice, music being the employment of his leisure. From 1850 onwards he became well known as a critic and essay-writer, and in 1860 he began working on his *magnum opus*, his *History of Music*, which was published at intervals from 1864 in five volumes, the last two (1878, 1882) being edited and completed by Otto Kade and Langhaus. Ambros became professor of the history of music at Prague in 1869. He was an excellent pianist, and the author of numerous compositions somewhat reminiscent of Mendelssohn. He died at Vienna on the 28th of June 1876.

AMBROSE (fl. 1190), Norman poet, and chronicler of the Third Crusade, author of a work called *L'Estoire de la guerre sainte*, which describes in rhyming French verse the adventures of Richard Cœur de Lion as a crusader. The poem is known to us only through one Vatican MS., and long escaped the notice of historians. The credit for detecting its value belongs to the late Gaston Paris, although his edition (1897) was partially anticipated by the editors of the *Monumenta Germaniae Historica*, who published some selections in the twenty-seventh volume of their *Scriptores* (1885). Ambrose followed Richard I. as a non-combatant, and not improbably as a court-minstrel. He speaks as an eye-witness of the king's doings at Messina, in Cyprus, at the siege of Acre, and in the abortive campaign which followed the capture of that city. Ambrose is surprisingly accurate in his chronology; though he did not complete his work before 1195, it is evidently founded upon notes which he had taken in the course of his pilgrimage. He shows no greater political insight than we should expect from his position; but relates what he had seen and heard with a naive vivacity which compels attention. He is prejudiced against the Saracens, against the French, and against all the rivals or enemies of his master; but he is never guilty of deliberate misrepresentation. He is rather to be treated as a biographer than as a historian of the Crusade in its broader aspects. None the less he is the chief authority for the events of the years 1190–1192, so far as these are connected with the Holy Land. The *Itinerarium Regis Ricardi* (formerly attributed to Geoffrey Vinsauf, but in reality the work of Richard, a canon of Holy Trinity, London) is little more than a free paraphrase of Ambrose. The first book of the *Itinerarium* contains some additional facts; and the whole of the Latin version is adorned with flowers of rhetoric which are foreign to the style of Ambrose. But it is no longer possible to regard the *Itinerarium* as a first-hand narrative. Stubbs's edition of the *Itinerarium* (Rolls Series, 1864), in which the contrary hypothesis is maintained, appeared before Gaston Paris published his discovery.

See the edition of *L'Estoire de la guerre sainte* by Gaston Paris in the *Collection des documents inédits sur l'histoire de France* (1897); the editor discusses in his introduction the biography of Ambrose, the value of the poem as a historical source, and its relation to the *Itinerarium*. R. Pauli's remarks (in *Monumenta Germaniae Historica. Scriptores*, xxvii.) also deserve attention. (H. W. C. D.)

AMBROSE, SAINT (*c.* 340–397), bishop of Milan, one of the most eminent fathers of the church in the 4th century, was a citizen of Rome, born about 337–340 in Trèves, where his father was prefect of Gallia Narbonensis. His mother was a woman of intellect and piety. Ambrose was early destined to follow his father's career, and was accordingly educated in Rome. He made such progress in literature, law and rhetoric, that the praetor Anicius Probus first gave him a place in the council and then made him consular prefect of Liguria and Emilia, with headquarters at Milan, where he made an excellent administrator. In 374 Auxentius, bishop of Milan, died, and the orthodox and Arian parties contended for the succession. An address delivered to them at this crisis by Ambrose led to his being acclaimed as the only competent occupant of the see; though hitherto only a catechumen, he was baptized, and a few days saw him duly installed as bishop of Milan. He immediately betook himself to the necessary studies, and acquitted himself in his new office with ability, boldness and integrity. Having apportioned his money among the poor, and settled his lands upon the church, with the exception of making his sister Marcellina tenant during life, and having committed the care of his family to his brother, he entered upon a regular course of theological study, under the care of Simplician, a presbyter of Rome, and devoted himself to the labours of the church, labours which were temporarily interrupted by an invasion of Goths, which compelled Ambrose and other churchmen to retire to Illyricum.

The eloquence of Ambrose soon found ample scope in the dispute between the Arians and the orthodox or Catholic party, whose cause the new bishop espoused. Gratian, the son of the elder Valentinian, took the same side; but the younger Valentinian, who had now become his colleague in the empire, adopted the opinions of the Arians, and all the arguments and eloquence of Ambrose could not reclaim the young prince to the orthodox faith. Theodosius, the emperor of the East, also professed the orthodox belief; but there were many adherents of Arius scattered throughout his dominions. In this distracted state of religious opinion, two leaders of the Arians, Palladius and Secundianus, confident of numbers, prevailed upon Gratian to call a general council from all parts of the empire. This request appeared so equitable that he complied without hesitation; but Ambrose, foreseeing the consequence, prevailed upon the emperor to have the matter determined by a council of the Western bishops. A synod, composed of thirty-two bishops, was accordingly held at Aquileia in the year 381. Ambrose was elected president; and Palladius, being called upon to defend his opinions, declined, insisting that the meeting was a partial one, and that, all the bishops of the empire not being present, the sense of the Christian church concerning the question in dispute could not be obtained. A vote was then taken, when Palladius and his associate Secundianus were deposed from the episcopal office.

Ambrose was equally zealous in combating the attempt made by the upholders of the old state religion to resist the enactments of Christian emperors. The pagan party was led by Quintus Aurelius Symmachus (*q.v.*), consul in 391, who presented to Valentinian II. a forcible but unsuccessful petition praying for the restoration of the altar of Victory to its ancient station in the hall of the senate, the proper support of seven vestal virgins, and the regular observance of the other pagan ceremonies. To this petition Ambrose replied in a letter to Valentinian, arguing that the devoted worshippers of idols had often been forsaken by their deities; that the native valour of the Roman soldiers had gained their victories, and not the pretended influence of pagan priests; that these idolatrous worshippers requested for themselves what they refused to Christians; that voluntary was more honourable than constrained virginity; that as the Christian ministers declined to receive temporal emoluments, they should also be denied to pagan priests; that it was absurd to suppose that God would inflict a famine upon the empire for neglecting to support a religious system contrary to His will as revealed in the Scriptures; that the whole process of nature encouraged innovations, and that all nations had permitted them, even in religion; that heathen sacrifices were offensive to Christians; and that it was the duty of a Christian prince to suppress pagan ceremonies. In the epistles of Symmachus and of Ambrose both the petition and the reply are preserved. They are a strange blend of sophistry, superstition, sound sense and solid argument.

The increasing strength of the Arians proved a formidable task for Ambrose. In 384 the young emperor and his mother Justina, along with a considerable number of clergy and laity professing the Arian faith, requested from the bishop the use of two churches, one in the city, the other in the suburbs of Milan. Ambrose refused, and was required to answer for his conduct before the council. He went, attended by a numerous crowd of people, whose impetuous zeal so overawed the ministers of Valentinian that he was permitted to retire without making the surrender of the churches. The day following, when he was performing divine service in the Basilica, the prefect of the city came to persuade him to give up at least the Portian church in the suburbs. As he still continued obstinate, the court proceeded to violent measures: the officers of the household were commanded to prepare the Basilica and the Portian churches to celebrate divine service upon the arrival of the emperor and his mother at the ensuing festival of Easter. Perceiving the growing strength of the prelate's interest, the court deemed it prudent to restrict its demand to the use of one of the churches. But all entreaties proved in vain, and drew forth the following characteristic declaration from the bishop:—"If you demand my person, I am ready to submit: carry me to prison or to death, I will not resist; but I will never betray the church of Christ. I will not call upon the people to succour me; I will die at the foot of the altar rather than desert it. The tumult of the people I will not encourage: but God alone can appease it."

Many circumstances in the history of Ambrose are strongly characteristic of the general spirit of the times. The chief causes of his victory over his opponents were his great popularity and the superstitious reverence paid to the episcopal character at that period. But it must also be noted that he used several indirect means to obtain and support his authority with the people. He was liberal to the poor; it was his custom to comment severely in his preaching on the public characters of his times; and he introduced popular reforms in the order and manner of public worship. It is alleged, too, that at a time when the influence of Ambrose required vigorous support, he was admonished in a dream to search for, and found under the pavement of the church, the remains of two martyrs, Gervasius and Protasius. The applause of the vulgar was mingled with the derision of the court party.

Although the court was displeased with the religious principles and conduct of Ambrose, it respected his great political talents; and when necessity required, his aid was solicited and generously granted. When Maximus usurped the supreme power in Gaul, and was meditating a descent upon Italy, Valentinian sent Ambrose to dissuade him from the undertaking, and the embassy was successful. On a second attempt of the same kind Ambrose was again employed; and although he was unsuccessful, it cannot be doubted that, if his advice had been followed, the schemes of the usurper would have proved abortive; but the enemy was permitted to enter Italy; and Milan was taken. Justina and her son fled; but Ambrose remained at his post, and did good service to many of the sufferers by causing the plate of the church to be melted for their relief. Theodosius, the emperor of the East, espoused the cause of Justina, and regained the kingdom. This Theodosius was sternly rebuked by Ambrose for the massacre of 7000 persons at Thessalonica in 390, and was bidden imitate David in his repentance as he had imitated him in guilt.

In 392, after the assassination of Valentinian and the usurpation of Eugenius, Ambrose fled from Milan; but when Theodosius was eventually victorious, he supplicated the emperor for the pardon of those who had supported Eugenius. Soon after acquiring the undisputed possession of the Roman empire, Theodosius died at Milan in 395, and two years later (4th April 397) Ambrose also passed away. He was succeeded by Simplician.

A man of pure character, vigorous mind, unwearying zeal and uncommon generosity, Ambrose ranks high among the fathers of the ancient church on many counts. His chief faults were ambition and bigotry. Though ranking with Augustine, Jerome, and Gregory the Great, as one of the Latin "doctors," he is most naturally compared with Hilary, whom he surpasses in administrative excellence as much as he falls below him in theological ability. Even here, however, his achievements are of no mean order, especially when we remember his juridical training and his comparatively late handling of Biblical and doctrinal subjects. In matters of exegesis he is, like Hilary, an Alexandrian; his chief productions are homiletic commentaries on the early Old Testament narratives, *e.g.* the Hexaëmeron (Creation) and Abraham, some of the Psalms, and the Gospel according to Luke. In dogmatic he follows Basil of Caesarea and other Greek authors, but nevertheless gives a distinctly Western cast to the speculations of which he treats. This is particularly manifest in the weightier emphasis which he lays upon human sin and divine grace, and in the place which he assigns to faith in the individual Christian life. His chief works in this field are *De fide ad Gratianum Augustum*, *De Spiritu Sancto*, *De incarnationis Dominicae sacramento*, *De mysteriis*. His great spiritual successor, Augustine, whose conversion was helped by Ambrose's sermons, owes more to him than to any writer except Paul. Ambrose's intense episcopal consciousness furthered the growing doctrine of the Church and its sacerdotal ministry, while the prevalent asceticism of the day, continuing the Stoic and Ciceronian training of his youth, enabled him to promulgate a lofty standard of Christian ethics. Thus we have the *De officiis ministrorum*, *De viduis*, *De virginitate* and *De paenitentia*.

Ambrose has also left several funeral orations and ninety-one letters, but it is as a hymn-writer that he perhaps deserves most honour. Catching the impulse from Hilary and confirmed in it by the success of Arian psalmody, Ambrose composed several hymns, marked by dignified simplicity, which were not only effective in themselves but served as a fruitful model for later times. We cannot certainly assign to him more than four or five (*Deus Creator Omnium*, *Aeterne rerum conditor*, *Jam surgit hora tertia*, and the Christmas hymn *Veni redemptor gentium*) of those that have come down to us. Each of these hymns has eight four-line stanzas and is written in strict iambic tetrameter.

On the Ambrosian ritual see LITURGY; on the Ambrosian library see LIBRARIES; on the church founded by him at Milan in 387 see MILAN. EDITIONS: The Benedictine (4 vols., Venice, 1748 ff.); Migne, *Patrol. Lat.* xiv.-xvii.; P. A. Ballerini (6 vols., Milan, 1875 ff.). LITERATURE: Th. Förster, *Ambrose, B. of Mailand* (Halle, 1884), and art. in Herzog-Hauck, *Realencyk.*, where the literature is cited in full; A. Ebert, *Gesch. der christlich-latein. Litt.* (2nd ed., 1889); O. Bardenhewer, *Patrologie* (2nd ed., 1891); A. Harnack, *Hist. of Dogma*, esp. vol. v.; W. Bright, *Age of the Fathers*. (A. J. G.)

AMBROSE (ANDREY SERTIS-KAMENSKIY) (1708–1771), archbishop of Moscow, was born at Nezhine in the government of Chernigov, and studied in the school of St Alexander Nevskiy, where he afterwards became a tutor. At the age of thirty-one he entered a monastery, where he took the name of Ambrose. Subsequently he was appointed archimandrite of the convent of New Jerusalem at Voznesensk. From this post he was transferred as bishop, first to the diocese of Pereyaslav, and afterwards to that of Krusitsy near Moscow, finally becoming archbishop of Moscow in 1761. He was famous not only for his interest in schemes for the alleviation of poverty in Moscow, but also as the founder of new churches and monasteries. A terrible outbreak of plague occurred in Moscow in 1771, and the populace began to throng round an image of the Virgin to which they attributed supernatural healing power. Ambrose, perceiving that this crowding together merely enabled the contagion to spread, had the image secretly removed. The mob, suspecting that he was responsible for its removal, attacked a monastery to which he had retired, dragged him away from the sanctuary, and, having given him time to receive the sacrament, strangled him. Ambrose's works include a liturgy and translations from the Fathers.

AMBROSE (Ambroise), **AUTPERT** (d. 778), French Benedictine monk. He became abbé of St Vincent on the Volturno "in the time of Desiderius, king of the Lombards." He wrote a considerable number of works on the Bible and religious subjects generally. Among these are commentaries on the Apocalypse (see *Bibl. Patrum*, xiii. 403), on the Psalms, on the Song of Solomon; *Lives of SS. Paldo, Tuto and Vaso* (according to Mabillon); *Assumption of the Virgin*; *Combat between the Virtues and the Vices*.

See Mabillon, *Acta sanct. Bolland.* III. ii. 259, 266; Georg Lommel, *Der ostfränkische Reformator Ambrosius* (Giessen, 1847); Bollandist *Bibl. hag. lat.* (1898), 61.

AMBROSE, ISAAC (1604–1663/4), English Puritan divine, was the son of Richard Ambrose, vicar of Ormskirk, and was probably descended from the Ambroses of Lowick in Furness, a well-known Catholic family. He entered Brazenose College, Oxford, in 1621, in his seventeenth year. Having graduated B.A. in 1624 and been ordained, he received in 1627 the little cure of Castleton in Derbyshire. By the influence of William Russell, earl of Bedford, he was appointed one of the king's itinerant preachers in Lancashire, and after living for a time in Garstang, he was selected by the Lady Margaret Hoghton as vicar of Preston. He associated himself with Presbyterianism, and was on the celebrated committee for the ejection of "scandalous and ignorant ministers and schoolmasters" during the Commonwealth. So long as Ambrose continued at Preston he was favoured with the warm friendship of the Hoghton family, their ancestral woods and the tower near Blackburn affording him sequestered places for those devout meditations and "experiences" that give such a charm to his diary, portions of which are quoted in his *Prima Media and Ultima* (1650, 1659). The immense auditory of his sermon (*Redeeming the Time*) at the funeral of Lady Hoghton was long a living tradition all over the county. On account of the feeling engendered by the civil war Ambrose left his great church of Preston in 1654, and became minister of Garstang, whence, however, in 1662 he was ejected with the two thousand ministers who refused to conform. His after years were passed among old friends and in quiet meditation at Preston. He died of apoplexy about the 20th of January 1663/4. As a religious writer Ambrose has a vividness and freshness of imagination possessed by scarcely any of the Puritan Nonconformists. Many who have no love for Puritan doctrine, nor sympathy with Puritan experience, have appreciated the pathos and beauty of his writings, and his *Looking to Jesus* long held its own in popular appreciation with the writings of John Bunyan.

AMBROSE THE CAMALDULIAN, the common name of Ambrogio Traversari (1386–1439), French ecclesiastic, born near Florence at the village of Portico. At the age of fourteen he entered the Camaldulian Order in the monastery of Sta Maria degli Angeli, and rapidly became a leading theologian and Hellenist. In Greek literature his master was Emmanuel Chrysoloras. He became general of the order in 1431, and was a leading advocate of the papacy. This attitude he showed clearly when he attended the council of Basel as legate of Eugenius IV. So strong was his hostility to some of the delegates that he described Basel as a western Babylon. He likewise supported the pope at Ferrara and Florence, and worked hard in the attempt to reconcile the Eastern and Western Churches. Though this cause was unsuccessful, Ambrose is interesting as typical of the new humanism which was growing up within the church. Voigt says that he was the first monk in Florence in whom the love of letters and art became predominant over his ecclesiastical views. Thus while among his own colleagues he seemed merely a hypocritical and arrogant priest, in his relations with his brother humanists, such as Cosimo de Medici, he appeared as the student of classical antiquities and especially of Greek theological authors. His chief works are:—*Hodoeporicon*, an account of a journey taken by the pope's command, during which he visited the monasteries of Italy; a translation of Palladius' *Life of Chrysostom*; of *Nineteen Sermons of Ephraem Syrus*; of the *Book of St Basil on Virginity*. A number of MSS. remain in the library of St Mark at Venice. He died on the 20th of October 1439.

See G. Voigt, *Die Wiederbelebung des klass. Altertums* (2 vols., 3rd ed., 1893); his *Epistolae* were published by Cannato (Florence, 1759) with a life by Mehus; Bollandist *Bibl. hag. lat.* (1898), 63; A. Masius, *Über die Stellung des Kamaldulensers Ambrogio Traversari zum Papst Eugen IV. und zum Basler Konzil* (Döbeln, 1888); Savigny, *Geschichte röm. Rechts, Mittel.* (1850), vi. 422-424.

AMBROSIA, in ancient mythology, sometimes the food, sometimes the drink of the gods. The word has generally been derived from Gr. ἀ-, not, and *μβρότος*, mortal; hence the food or drink of the immortals. A. W. Verrall, however, denies that there is any clear example in which the word ἀμβρόσιος necessarily means "immortal," and prefers to explain it as "fragrant," a sense which is always suitable; cf. W. Leaf, *Iliad* (2nd ed.), on the phrase ἀμβρόσιος ὕπνος (ii. 18). If so, the word may be derived from the Semitic *ambar* (ambergris) to which Eastern nations attribute miraculous properties. W. H. Roscher thinks that both nectar and ambrosia were kinds of honey, in which case their power of conferring immortality would be due to the supposed healing and cleansing power of honey (see further Nectar). Derivatively the word *Ambrosia* (neut. plur.) was given to certain festivals in honour of Dionysus, probably because of the predominance of feasting in connexion with them.

The name *Ambrosia* was also applied by Dioscorides and Pliny to certain herbs, and has been retained in modern botany for a genus of plants from which it has been extended to the group of dicotyledons called *Ambrosiaceae*, including *Ambrosia*, *Xanthium* and *Iva*, all annual herbaceous plants represented in America. *Ambrosia maritima* and some other species occur also in the Mediterranean region.

There is also an American beetle, the Ambrosia beetle, belonging to the family of Scolytidae, which derives its name from its curious cultivation of a succulent fungus, called ambrosia. Ambrosia beetles bore deep though minute galleries into trees and timber, and the wood-dust provides a bed for the growth of the fungus, on which the insects and larvae feed.

AMBROSIANS, the name given to several religious brotherhoods which at various times since the 14th century have sprung up in and around Milan; they have about as much connexion with St Ambrose as the "Jeromites" who were found chiefly in upper Italy and Spain have with their patron saint. Only the oldest of them, the *Fratres S. Ambrosii ad Nemus*, had anything more than a very local significance. This order is known from a bull of Gregory XI. addressed to the monks of the church of St Ambrose outside Milan. These monks, it would appear, though under the authority of a prior, had no rule. In response to the request of the archbishop, the pope had commanded them to follow the rule of Augustine and to be known by the above name. They were further to recite the Ambrosian office. Subsequently the order had a number of independent establishments in Italy which were united into one congregation by Eugenius IV., their headquarters being at Milan. Their discipline afterwards became so slack that an appeal was made to Cardinal Borromeo asking him to reform their houses. By Sixtus V. the order was amalgamated with the congregation of St Barnabas, but Innocent X. dissolved it in 1650.

The name Ambrosians is also given to a 16th-century Anabaptist sect, which laid claim to immediate communication with God through the Holy Ghost. Basing their theology upon the words of the Gospel of St John i. 9—"There was the true light which lighteth every man, coming into the world"—they denied the necessity of any priests or ministers to interpret the Bible. Their leader Ambrose went so far as to hold further that the revelation which was vouchsafed to him was a higher authority than the Scriptures. The doctrine of the Ambrosians, who belonged probably to that section of the Anabaptists known as *Pneumatici*, may be compared with the "Inner Light" doctrine of the Quakers.

See Herzog-Hauck's *Realencyklopädie*, i. 439.

AMBROSIASTER. A commentary on St Paul's epistles, "brief in words but weighty in matter," and valuable for the criticism of the Latin text of the New Testament, was long attributed to St Ambrose. Erasmus in 1527 threw doubt on the accuracy of this ascription, and the author is usually spoken of as Ambrosiaster or pseudo-Ambrose. Owing to the fact that Augustine cites part of the commentary on Romans as by "Sanctus Hilarius" it has been ascribed by various critics at different times to almost every known Hilary. Dom G. Morin (*Rev. d'hist. et de litt. religieuses*, tom. iv. 97 f.) broke new ground by suggesting in 1899 that the writer was Isaac, a converted Jew, writer of a tract on the Trinity and Incarnation, who was exiled to Spain in 378–380 and then relapsed to Judaism, but he afterwards abandoned this theory of the authorship in favour of Decimus Hilarianus Hilarius, proconsul of Africa in 377. With this attribution Professor Alex. Souter, in his *Study of Ambrosiaster* (Cambridge Univ. Press, 1905), agrees. There is scarcely anything to be said for the possibility of Ambrose having written the book before he became a bishop, and added to it in later years, incorporating remarks of Hilary of Poitiers on Romans. The best presentation of the case for Ambrose is by P. A. Ballerini in his complete edition of that father's works.

In the book cited above Professor Souter also discusses the authorship of the *Quaestiones Veteris et Novi Testamenti*, which the MSS. ascribe to Augustine. He concludes, on very thorough philological and other grounds, that this is with one possible slight exception the work of the same "Ambrosiaster." The same conclusion had been arrived at previously by Dom Morin.

AMBROSINI, BARTOLOMEO (1588–1657), Italian naturalist, was born and died at Bologna. He was a pupil of Aldrovandi, several of whose works he published, and whom he succeeded eventually as director of the university botanical garden. He studied at the university, and became successively professor of philosophy, of botany and of medicine; and during the plague of 1630 in Bologna he worked assiduously for the relief of the sufferers. He was the author of several medical works of some importance in their day.

His brother, GIACINTO AMBROSINI (1605–1672), was a distinguished botanist, who succeeded Bartolomeo as professor of botany and director of the university garden in 1657. He published a catalogue of its plants and also a botanical dictionary.

AMBROSIUS AURELIANUS, leader of the Britons against the Saxons in the 5th century, was, according to the legends preserved in Gildas and the *Historia Brittonum*, of Roman extraction. There are signs of the existence of two parties in the national opposition to the invaders, but as Pascent, son of Vortigern, is said by Nennius to have held his dominions in the west by leave of Ambrosius, the Roman element seems to have triumphed. Some measure of success appears to have attended the efforts of Ambrosius, and it has been suggested that Amesbury in Wiltshire is connected with Emrys, the Celtic form of his name.

See Bede, *Eccl. Hist.* (Plummer), i. 16; Nennius, *Hist. Britt.* § 31; Gildas, *De excidio Brittarum*, § 25; J. Rhys, *Celtic Britain* (1884), pp. 104, 105, 107.

AMBULANCE (from the Fr. *ambulance*, formerly *hôpital ambulant*, derived from the Lat. *ambulare*, to move about), a term generally applied in England and America to the wagon or other vehicle in which the wounded in battle, or those who have sustained injuries in civil life, are conveyed to hospital. More strictly, in military parlance, the term imports a hospital establishment moving with an army in the field, to provide for the collection, treatment and care of the wounded on the battlefield, and of the sick, until they can be removed to hospitals of a more stationary character. In 1905–1906 the term "field ambulance" was adopted in the British service to denote this organization, the former division of the ambulance service into "bearer companies" and "field hospitals" being done away with. The description of the British service given below applies generally to the system in vogue in the army after the experience gained in the South African War of 1899–1902; but in recent years the medical arrangements in connexion with the British army hospitals have been altered in various details, and the changes in progress showed no sign of absolute finality. Some of these, however, were rather of nomenclature than of substance, and hardly affect the principles as described below.

History.

The ambulance organization which, variously modified in details, now prevails in all civilized armies, only dates from the last decade of the 18th century. Before that time wounded soldiers were either carried to the rear by comrades or left unattended to and exposed until the fighting was over. Surgical assistance did not reach the battlefield till the day after the engagement, or even later; and for many of the wounded it was then too late. In 1792 Baron Dominique Jean Larrey (1766–1842) of the French army introduced his system of *ambulances volantes*, or flying field hospitals, capable of moving with speed from place to place, like the "flying artillery" of that time. They were adapted both for giving the necessary primary surgical treatment and for removing the wounded quickly from the sphere of fighting. Napoleon warmly supported Larrey in his efforts in this direction, and the system was soon brought to a high state of efficiency in the *Grande Armée*. About the same time another distinguished surgeon in the French army, Baron Pierre François Percy (1754–1825), organized a corps of *brancardiers*, or stretcher-bearers. These were soldiers trained and equipped for the duty of collecting the wounded while a battle was in progress, and carrying them to a place of safety, where their wounds and injuries could be attended to. An important step towards the amelioration of the condition of the wounded of armies in the field was the European Convention signed at Geneva in 1864, by the terms of which, subject to certain regulations, not only the wounded themselves but also the official staff of ambulances and their equipment were rendered neutral, the former therefore, not being liable to be retained as prisoners of war, nor the latter to be taken as prize of war. This convention has greatly favoured the development of ambulance establishments, but as all combatants have not the same knowledge of the conditions of this convention, or do not interpret them in the same way, charges of treachery and abuse of the Red Cross flag are but too common in modern warfare.

Geneva Convention.

The American Civil War marked the beginning of the modern ambulance system. The main feature, however, of the hospital organization throughout that war was the railway hospital service, which provided for the rapid conveyance of the sick and wounded to the rear of the contending armies. Hospital carriages, equipped with medical stores and appliances, for the transport of cases from the front to the base, were rapidly introduced into other armies, and played a great part in the ambulance service of the Franco-German War.

German system.

The German hospital service as existing at the time of the Franco-German War of 1870–71 was modified and extended by the *Kriegs Sanitäts Ordnung* of 1878 and the *Kriegs Etappen Ordnung* of 1887, which completed the organization by the addition in time of war of numerous subordinate offices and departments. The main divisions of the ambulance organization of the German army in the field fall into: (1) sanitary detachments, (2) field hospitals, (3) flying hospitals, (4) hospital reserve depots, (5) "committees for the transport of the sick," and (6) railway hospital trains. The whole administration of the ambulance service of the grand army in the field is in the hands of the chief of the ambulance sanitary staff, who is attached to headquarters. Next in command come surgeons-general of armies in the field, surgeons-general of army corps, and under them again surgeons-in-chief of divisions and regiments. Civil consulting surgeons of eminence, and professors from the universities, are also attached to the various armies and divisions to co-operate with and act as advisers to the surgeons of the standing military surgical staff. The hospital transport service on the lines of communication is highly organized and the hospital railway carriages are elaborately equipped. The French ambulance system, finally settled by the *règlement* of 1884, is organized on almost identical lines with the German; one of the principal peculiarities of the former being the *ambulances volantes* already referred to. The peace

French system.

organization of the German and French systems does not materially differ from that of the British service.

Japanese system.

In the Japanese army a special feature is the sanitary corps, whose duty is the prevention of disease among the troops; it has been brought to a great pitch of perfection, with the result that in the Russo-Japanese War (1904–1905) the immunity of the troops from all forms of preventable disease surpassed all previous experience. Not only was the army accompanied by sanitary experts who advised on all questions of camping grounds, water supply, &c., but before the war began the Intelligence Department collected information as to the diseases of the country likely to be the scene of operations, unhealthy places to be avoided, and precautions to be taken.

British army system.

Coming now to the ambulance system of the British army, in which are comprised the arrangements and organization of the medical department for the care and treatment of the sick and wounded from the time they are injured or taken ill, till they are able to return to duty or are invalided home, we will trace the progress of a wounded man from the field of battle to his home; remembering that, as British troops are usually engaged overseas, hospital ships as well as land transport are necessary.

First field dressing.

When a soldier falls wounded in action he is attended by the regimental surgeon and stretcher-bearers, who apply some extemporized method of stopping bleeding and dress the wounds with the "first field dressing"—a packet of antiseptic material which every officer and man on active service carries stitched to some part of his clothing, and which contains everything necessary for dressing an ordinary gunshot wound. Recent wars have demonstrated that in all uncomplicated cases it is better to leave this dressing undisturbed, as the wounds made by modern projectiles heal up at once if left alone, if air and dirt have been thus excluded.

Collecting station.

From the field he is carried on a stretcher by bearers (formerly of the "Bearer Companies") of the Royal Army Medical Corps to the collecting station, where he is placed on an ambulance wagon of the first line of assistance and taken to the dressing station. Here his wound will be examined if considered necessary, but as on the field the first medical officer who examined him has already attached a "specification tally" to the patient, giving particulars of the wound, it will probably not be disturbed unless complicated by bleeding, splintering of bone or some other condition requiring interference. Any operation, however, which is urgently called for will be here performed, nourishment, stimulants and opiates administered if required, and the patient moved to the field hospital in an ambulance wagon of the second line of assistance. From the field hospital he is transferred as soon as possible by the ambulance train to the general hospital at the advanced base of operations, and from there in due time in another train to the base of operations at the coast, from which he is ultimately either returned to duty or sent home in a hospital ship. The organization by which these requirements are fulfilled is the following:—Every regiment and fighting unit has posted to it, on proceeding on active service, a medical officer who looks after the health of the men and advises the commanding officer on sanitary matters.

Regimental arrangements.

When the regiment goes into action he takes command of the regimental stretcher-bearers who, to the number of two per company, have been in peace time instructed in first aid and in the carrying of the wounded on stretchers. These men leave their arms behind and wear the Red Cross armlets, to indicate their non-combatant functions, but in these days, when a battle is often fought at long ranges, it is not to be wondered at, or attributed to disregard of the red cross flag by the enemy, if medical officers and stretcher-bearers are hit. The bearer company into whose charge the wounded man next passes is composed of men of the Royal Army Medical Corps, with a detachment of the Army Service Corps for transport duties. In future, bearer sections of the Field Ambulances will perform the duties of the bearer company. Its function is to collect and succour the wounded on the battlefield and to hand them over to the field hospitals, with which these bearer companies are closely associated, though separately organized. In the Indian army the bearer company is provided from the *personnel* of the field hospital when there is a battle, and reverts to the hospital again after it is over. The war in South Africa of 1899–1902 clearly demonstrated the superiority of the Indian plan; for after the action the bearer company staff should be available to give the much-needed help in the field hospital, and some amalgamation of the two organizations, or something after the plan of the *ambulance volante* of the French, is necessary. The bearers afford the wounded any treatment required, supply water and sedatives, and then carry them back on stretchers to the collecting station in the rear, whence they are conveyed to the dressing station in the wagons or other form of transport.

At the dressing station, which ought to be out of range of the firing, and should have a good water supply, the patient is made as comfortable as possible, nourishment and stimulants are administered, and he is then taken to the field hospital. In times of great stress, when it is desirable to remove the wounded quickly from the field, and there are no roads or wheeled transport is not available, large numbers of bearers are employed to carry them on stretchers, &c. These men are engaged locally and are soon given the slight training necessary. This was done in Natal after the battles on the Tugela (1899), in which there were some thousands of wounded to be conveyed; also in Egypt, where the local troops not required for the fighting line were requisitioned; the Japanese in Mongolia employed hundreds of Chinese coolies for this purpose, the general use of sedan-chairs in China having accustomed the poorer class of natives to this kind of labour.

Indian bearers.

In India, the rank and file of the Royal Army Medical Corps not being employed, the bearer work is carried out by natives specially enlisted and organized into a corps. These men are bearers by caste—a reminiscence of the system which prevailed generally a hundred years ago, and is still met with in out-of-the-way places, of conveyance of travellers in dhoolies, which are closed wooden carriages fixed on long poles and carried on men's shoulders. The bearers convey the wounded in dandies, similar to dhoolies, but made mostly of canvas, so that they are much lighter. The courage of these bearers on the battlefield has often been praised. The old bearer caste is, however, rapidly dying out owing to the general discontinuance of the use of dhoolies. Thus the ambulance organization in India is entirely different from that in other parts of the British empire. The rank and file of the Royal Army Medical Corps are not employed there, although the medical officers are. The warrant and non-commissioned ranks are replaced by a most useful body of men of Anglo-Indian or Eurasian (half caste) birth, called the Subordinate Medical Department, the members of which, now called assistant surgeons (formerly apothecaries), receive a three years' training in medical work at the Indian medical schools and are competent to perform the compounding of medicines and to deal with all but the most serious cases of injury and illness. In the hospitals the men of the Royal Army Medical Corps are replaced by the Native Army Hospital Corps, subdivided into ward-servants, cooks, water-carriers, sweepers and washermen. The caste system necessitates this division of labour, and the men are not so efficient or trustworthy as the white soldiers whose places they take. The bearers of the wounded are a separate and distinct class, partly attached to regiments, &c., as part of the regimental transport, and partly organized into bearer companies, attached to field hospitals. The dandies in which they carry the wounded are much more comfortable than stretchers, being fitted with roofs and sides of canvas to keep off sun and rain, thus being collapsible so that the dandy is quite flat when not in use. Still they are heavy, clumsy, and cannot be folded up into a small compass for transport like a stretcher; they also take up a good deal of room in wagons and can scarcely be carried on the backs of animals owing to the length of the pole. Hence riding ponies and mules are much used in Indian warfare, especially in the mountains, for the carriage of less seriously wounded men. In India separate hospitals are necessary for white and native troops, and the latter have accommodation for the large numbers of non-combatant camp-followers, mule-drivers, cooks, officers' servants, &c., &c., which constitute one of the most remarkable features of the Indian army organization.

Field hospitals.

Field hospitals, under the new scheme furnished by tent sections of the Field Ambulances, are each supposed to provide accommodation for 100 patients, who live on their field rations suitably cooked and supplemented by various medical comforts. The patients are not supplied with hospital clothing, nor do they have beds, but lie on straw, which is spread on the ground and covered with waterproof sheets and blankets; of these latter a considerable reserve is carried. These hospitals can and must at times accommodate more than the regulation number of patients, but in the South African War their resources were at times considerably overtaxed, with consequent discomfort and hardship to the patients, the medical equipment proving insufficient for unexpectedly heavy calls upon its resources. These hospitals are supposed to move with the army, and therefore it is imperative to pass the wounded quickly back from these to the stationary hospitals on the lines of communication (which vary according to the length of these lines) and thence to the general hospitals at the base. The size of the lines of communication hospitals varies according to circumstances, and they are as a rule "dieted," that is to say, proper hospital diets and not field rations are issued to the patients, who also are supplied with beds and proper hospital clothing. In these hospitals also there may be nursing sisters, who of course are unsuited for the rough work and life nearer the front. Sisters are also employed on the hospital trains, which were found most useful and brought to great perfection in the South African War, being fitted with beds, kitchens, dispensaries, &c., so that patients were moved long distances in comfort.

Hospitals on the lines of communication.

General hospitals.

Arrived at the base of operations the wounded are admitted to the general hospitals, of which the numbers and situation vary with circumstances, but each is supposed to have an officers' ward. In the South African War, owing to the inability of the comparatively small Royal Army Medical Corps to meet all the requirements of the enormous force which was ultimately employed, many of the doctors were drawn from the civil profession, and the rank and file from the St John's Ambulance Association and the Volunteer Medical Staff Corps, while many nursing sisters belonged to the Army Nursing Reserve, ordinarily employed in civil hospitals but liable to be drafted out during war. In the South African War the patriotism and liberality of the British public furnished several large general hospitals, perfectly equipped, and officered by some of the most eminent members of the medical profession in the United Kingdom. Among others may be mentioned the Princess Christian, the Imperial Yeomanry (both field and general hospitals), the Langman, the Portland, the Scottish, Irish and Welsh hospitals. These were staffed entirely by civilians, except that an officer of the Royal Army Medical Corps was attached to each as administrator and organizer; and their *personnel* was made up of physicians, surgeons, nurses, dressers (medical students and in some cases fully qualified surgeons) and servants; the numbers, of course, varying with the size of the hospitals. In addition to the staff of these hospitals several eminent civil surgeons, including Sir William MacCormac and Sir F. Treves, went out to the seat of war as consultants: an innovation in the British service, but in accordance with the system long in vogue in Germany.

Civil general hospitals.

To the Army Medical organization is affiliated in war time that of the Red Cross Society and other charitable associations, which during the South African War aided the Army Medical Service greatly by gifts of clothing, money and numerous luxuries for the sick and wounded.

Hospital ships.

Lastly, the wounded man is transferred to a hospital ship, which is fitted up with comfortable swinging cots in airy wards, with refrigerators for preserving provisions and the supply of ice, punkahs for hot weather, &c. Each division of an army corps is supposed to have one such ship, with from 200 to 250 beds and the same staff of doctors, nurses, &c., as a hospital of similar size on shore, when necessary.

Red Cross societies.

Different regulations are made by various powers as to the work of the Red Cross societies under the Geneva flag. Whereas in Germany and France such aid is officially recognized and placed under direct military control, the English Red Cross societies have acted side by side with, but independently of, the military ambulance organization. In the South African War (1899–1902), however, the bonds of union were drawn considerably closer, and cordial co-operation was brought about to prevent overlapping and waste of money. In Germany the volunteer organization is presided over by an imperial commission or inspector-general appointed in peace time, who in time of war is attached to the headquarters staff. His functions are to control the relations of the various Red Cross societies and secure harmonious co-operation. Delegates appointed by him are attached to the various corps and transport commissions. No volunteer assistance can be utilized which is not entirely subordinate to the military control, and has not already in peace time received official recognition and been organized on a skeleton footing. Moreover, only persons of German nationality can be employed under it with the armies in the field. In case of base hospitals situated in Germany itself, the services of foreigners may be employed when specially authorized by the war office. In France, in the main, the same rules obtain in the case of volunteer hospital service.

St. John's Ambulance Association.

Great attention has been paid to civil ambulance organization in England. In 1878 the British ambulance association of St John of Jerusalem was founded. Its object was to render first aid to persons injured in accidents on the road, railway, or in any of the occupations of civil life. As the result of the initiative taken by this society, ambulance corps have been formed in most large towns of the United Kingdom; and police, railway servants and workmen have been instructed how to render first aid pending the arrival of a doctor. This samaritan work has been further developed and extended to most parts of the British empire, notably Canada, Australia and India, and there is no doubt that many lives are saved annually by the knowledge, diffused by this association, as to how to stop bleeding, resuscitate the apparently drowned, &c. Moreover, during the South African War this association provided a most valuable reserve for the Royal Army Medical Corps, and drafted out some hundreds of partially trained men whose assistance was most valuable to the Army Medical Service in dealing with the enormous numbers of sick and wounded who came upon their hands.

Civil ambulance in America.

In America each city has its own system and organization of civil ambulance service. In some, as in Boston, the service is worked by the police; in others, notably New York, by the hospitals, while Chicago has an admirable service under municipal control. In most of the capitals of Europe similar systems prevail.

Ambulance wagons.

British ambulance wagons are built very strongly to stand rough roads, and are of several patterns; those used in the war in South Africa were reported on as heavy, uncomfortable, and so unwieldy as to be incapable very often of keeping up with the troops; but a new and more mobile vehicle, to convey four patients lying down as well as six seated, or fourteen all seated (whereas the old pattern wagons only accommodated two lying-down cases), has been introduced. All patterns of wagons weigh from 17½ to 18½ cwt., while the Boers and the British Colonial auxiliaries used much lighter carts, which were taken at a gallop over almost any country. The Indian ambulances are small two-wheeled carts, called *tongas*, drawn by two bullocks or mules; very strongly made, they are capable of holding two men lying down, or four sitting up, besides the native driver.

Various other forms of transport are found, such as mule litters in mountainous districts, where wheeled carriages cannot go, camel litters in the Sudan, dhoolies in India, hammocks on the west coast of Africa, or sedan-chairs in China. In the Russo-Japanese War an ingenious form of mule litter for serious cases was made by fixing the ends of two long springy poles about 15 ft. long into each side of the pack saddles of two mules, one in front of the other, so as to support a bed for the patient between them; the length and resiliency of the poles prevented jolting of the wounded man, and the mules were able to carry him long distances over any kind of ground. The ordinary mule or camel litter provides for a wounded man (lying down) being carried on a sort of stretcher on either side of the animal, or in cacolets in which the less serious cases are slung in seats (one on each side of the animal), sitting up.

Mobilization. In Great Britain, the material and equipment required are stored in times of peace at the various headquarters stations and carefully examined twice a year; and on orders for mobilization being issued, the doctors and various ranks of attendants, who have previously been told off to each unit, repair to the allotted station, draw the equipment and transport, and embark with the brigade to which they are attached. The tendency of the present day is towards reduction in bulk and concentration of strength of drugs, points which simplify the question of transport of ambulance material. As the fighting man can carry concentrated nourishment enough for thirty-six hours, in the form of an emergency ration, in a tin the size of an ordinary cigar-case, and enough sweetening material in the form of saccharine to last a fortnight in a bottle smaller than an ordinary watch, so the medical department can take their drugs in the form of compressed tabloids, each the correct dose, and each occupying about one-tenth of the space the drug ordinarily would; while the medical officers can carry hypodermic cases, not so large as an ordinary cigarette-case, containing a syringe and hundreds of doses of highly concentrated remedies. Again, the traction engines which now accompany an army can also supply electricity for X-ray work, electric-lighting, ice-making, &c. (J. R. D.)

AMBULATORY (Med. Lat. *ambulatorium*, a place for walking, from *ambulare*, to walk), the covered passage round a cloister; a term applied sometimes to the procession way round the east end of a cathedral or large church and behind the high altar.

AMBUSH (older form, "embush," O. Fr. *embusche*, from the Ital. *imboscata*, *in* and *bosco*, a wood), the hiding of troops, primarily in a wood, and so any concealment for the purpose of a sudden attack.

AMEDEO FERDINANDO MARIA DI SAVOIA, duke of Aosta (1845–1890), third son of Victor Emmanuel II., king of Italy, and of Adelaide, archduchess of Austria, was born at Turin on the 30th of May 1845. Entering the army as captain in 1859 he fought through the campaign of 1866 with the rank of major-general, leading his brigade into action at Custozza and being wounded at Monte Torre. In May 1867 he married the princess Maria Carlotta del Pozzo della Cisterna. In 1868 he was created vice-admiral of the Italian navy, but, two years later, left Italy to ascend the Spanish throne, his reluctance to accept the invitation of the Cortes having been overridden by the Italian cabinet. On the 16th of November 1870 he was proclaimed king of Spain by the Cortes; but, before he could arrive at Madrid, Marshal Prim, chief promoter of his candidature, was assassinated. Undeterred by rumours of a plot against his own life, Amedeo entered Madrid alone, riding at some distance from his suite to the church where Marshal Prim's body lay in state. His efforts as constitutional king were paralysed by the rivalry between the various Spanish factions, but with the approval of his father he rejected all idea of a *coup d'état*. Though warned of a plot against his life (August 18, 1872) he refused to take precautions, and, while returning from Buen Retiro to Madrid in company with the queen, was repeatedly shot at in Via Avenal. The royal carriage was struck by several revolver and rifle bullets, the horses wounded, but its occupants escaped unhurt. A period of calm followed the outrage. On the 11th of February 1873, however, Amedeo, abandoned by his partisans and attacked more fiercely than ever by his opponents, signed his abdication. Upon returning to Italy he was cordially welcomed and reinstated in his former position. His consort, whose health had been undermined by anxiety in Spain, died on the 3rd of November 1876. Not until the 11th of September 1888 did Amedeo contract his second marriage, with his niece Princess Letitia Bonaparte. Less than two years later (January 18, 1890) he died at Turin in the arms of his elder brother, King Humbert I., leaving four children—the duke of Aosta, the count of Turin, the duke of the Abruzzi (issue of his first marriage), and the count of Salemi. (H. W. S.)

AMÉLIE-LES-BAINS, a watering-place of south-western France, in the department of Pyrénées-Orientales, at the junction of the Mondony with the Tech, 28½ m. S.S.W. of Perpignan by rail. Pop. (1906) 1247. It has numerous sulphur springs (68°–145° F.) used as baths by sufferers from rheumatism and maladies of the lungs. The town is situated at a height of 770 ft. and has both a winter and summer season. There are two bathing establishments, one of which preserves remains of Roman baths, and a large military thermal hospital. The town, formerly called Arles-les-Bains, is named after Queen Amelia, wife of Louis Philippe.

AMELOT DE LA HOUSSAYE, ABRAHAM NICOLAS (1634–1706), French historian and publicist, was born at Orleans in February 1634, and died at Paris on the 8th of December 1706. Little is known of his personal history beyond the fact that he was secretary to an embassy from the French court to the republic of Venice. In his *Histoire du gouvernement de Venise* he undertook to explain, and above all to criticize, the administration of that republic, and to expose the causes of its decadence. The work was printed by the king's printer and dedicated to Louvois, which points to the probability that the government did not disapprove of it. It appeared in March 1676, and provoked a warm protest from the Venetian ambassador, Giustiniani. The author was sent to the Bastille, where he remained, however, only six weeks (*Archives de la Bastille*, vol. viii. pp. 93 and 94). A second edition with a supplement, published immediately after, drew forth fresh protestations, and the edition was suppressed. This persecution gave the book an extraordinary vogue, and it passed through twenty-two editions in three years, besides being translated into several languages; there is an English translation by Lord Falconbridge, son-in-law of Oliver Cromwell. Amelot next published in 1683 a translation of Fra Paolo Sarpi's *History of the Council of Trent*. This work, and especially certain notes added by the translator, gave great offence to the advocates of unlimited papal authority, and three separate memorials were presented asking for its repression. Under the pseudonym of La Motte Josseval, Amelot subsequently published a *Discours politique sur Tacite*, in which he analysed the character of Tiberius.

AMEN, a Hebrew word, of which the root meaning is "stability," generally adopted in Christian worship as a concluding formula for prayers and hymns. Three distinct biblical usages may be noted. (*a*) Initial Amen, referring back to words of another speaker, *e.g.* 1 Kings i. 36; Rev. xxii. 20. (*b*) Detached Amen, the complementary sentence being suppressed, *e.g.* Neh. v. 13; Rev. v. 14 (cf. 1 Cor. xiv. 16). (*c*) Final Amen, with no change of speaker, as in the subscription to the first three divisions of the Psalter and in the frequent doxologies of the New Testament Epistles. The uses of amen ("verily") in the Gospels form a peculiar class; they are initial, but often lack any backward reference. Jesus used the word to affirm his own utterances, not those of another person, and this usage was adopted by the church. The liturgical use of the word in apostolic times is attested by the passage from 1 Cor. cited above, and Justin Martyr (*c.* A.D. 150) describes the congregation as responding "amen" to the benediction after the celebration of the Eucharist. Its introduction into the baptismal formula (in the Greek Church it is pronounced after the name of each person of the Trinity) is probably later. Among certain Gnostic sects Amen became the name of an angel, and in post-biblical Jewish works exaggerated statements are multiplied as to the right method and the bliss of pronouncing it. It is still used in the service of the synagogue, and the Mahommedans not only add it after reciting the first *Sura* of the Koran, but also when writing letters, &c., and repeat it three times, often with the word *Qimtīr*, as a kind of talisman.

AMENDMENT (through the O. Fr. *amender*, to correct, from Lat. *mendum*, a fault), an improvement, correction or alteration (nominally at least) for the better. The word is used either of moral character or, more especially, in connexion with "amending" a bill or motion in parliament or resolution at a meeting; and in law it signifies the correction of any defect or error in the record of a civil action or on a criminal indictment. All written constitutions also usually contain a clause providing for the method by which they may be amended. Another noun, in the plural form of "amends," is restricted in its meaning to that of the penalty paid for a fault or wrong committed. In its French form the *amende*, or *amende honorable*, once a public confession and apology when the offender passed to the seat of justice barefoot and bareheaded, now signifies in the English phrase a spontaneous and satisfactory rectification of an error.

AMENTIFERAE, or AMENTACEAE, a name which has been used to include in one class several natural orders of plants which bear their flowers in catkins (*amenta*). They are trees and shrubs chiefly of temperate climates, and include many common British trees. It comprised the following orders:—*Salicaceae*, willows and poplars; *Corylaceae*, hazel, hornbeam; *Betulaceae*, birch, alder; *Fagaceae*, oak, beech, chestnut; *Casuarinaceae*, *Casuarina* (beefwood); *Platanaceae*, plane; *Juglandaceae*, walnut; *Myricaceae*, bog myrtle. This class is not retained in the most modern systems of classification.

AMERCEMENT, or AMERCIAMENT (derived, through the Fr. *à merci*, from Lat. *merces*, pay), in English law, an arbitrary pecuniary penalty, inflicted in old days on an offender by the peers or equals of the party amerced. The word has in modern times become practically a poetical synonym for fine or deprivation. But an amercement differed from a fixed fine, prescribed by statute, by reason of its arbitrary nature; it represented a commutation of a sentence of forfeiture of goods, while a fine was originally a composition agreed upon between the judge and the prisoner to avoid imprisonment. The fixing or assessment of an amercement was termed an *affeerment*. In the lower courts the amercement was offered by a jury of the offender's neighbours (*affeerors*); in the superior courts by the coroner, except in the case of officers of the court, when the amount was affeered by the judges themselves. All judgments were entered on the court roll as "in mercy" (*sit in misericordia*), and the word *misericordia*, or some contracted form of it, was written on the margin. Articles twenty to twenty-two of Magna Carta regulated the assessment of amercements.

See Stephen, *History of Criminal Law*; Pollock and Maitland, *History of English Law*; W. S. McKechnie, *Magna Carta* (1905).

AMERIA (mod. *Amelia*), a city of Umbria, situated about 65 m. N. of Rome on the Via Amerina (which approached it from the S. starting from Falerii and passing through Castellum Amerinum, probably mod. Orte, where it crossed the Tiber). It has a fine position, 1332 ft. above sea-level, and still retains considerable remains of the city wall, built in polygonal masonry of carefully jointed blocks of limestone, some 12 ft. in total thickness, and showing traces of reconstruction at different periods. Various remains of the Roman period exist between the walls, including a large water reservoir divided into ten chambers. The lofty campanile of the cathedral was erected in 1050 with fragments of Roman buildings. Ameria is not mentioned in the history of the Roman conquest of Umbria, but is alluded to as a flourishing place, with a fertile territory extending to the Tiber, by Cicero in his speech in defence of Sextus Roscius Amerinus, and its fruit is often extolled by Roman writers. Augustus divided its lands among his veterans, but did not plant a colony here. The bishopric of Ameria was founded in the middle of the 4th century.

AMERICA. I. *Physical Geography*.—The accidental use of a single name, America, for the pair of continents that has a greater extension from north to south than any other continuous land area of the globe, has had some recent justification, since the small body of geological opinion has turned in favour of the theory of the tetrahedral deformation of the earth's crust as affording explanation of the grouping of continents and oceans. America, broadening in the north as if to span the oceans by reaching to its neighbours on the east and west, tapering between vast oceans far to the south where the nearest land is in the little-known Antarctic regions, roughly presents the triangular outline that is to be expected from tetrahedral warping; and although greatly broken in the middle, and standing with the northern and southern parts out of a meridian line, America is nevertheless the best witness among the continents of to-day to the tetrahedral theory. There seems to be, however, not a unity but a duality in its plan of construction, for the two parts, North and South America, resemble each other not only in outline but, roughly speaking, in geological evolution also; and the resemblances thus discovered are the more remarkable when it is considered how extremely small is the probability that among all the possible combinations of ancient mountain systems, modern mountain systems and plains, two continents out of five should present so many points of correspondence. Thus regarded, it becomes reasonable to suppose that North and South America have in a broad way been developed under a succession of somewhat similar strains in the earth's crust, and that they are, in so far, favourable witnesses to the theory that there is something individual in the plan of continental growth. The chief points of correspondence between these two great land masses, besides the southward tapering, are as follows:—(1) The areas of ancient fundamental rocks of the north-east (Laurentian highlands of North America, uplands of Guiana in South America), which have remained without significant deformation, although suffering various oscillations of level, since ancient geological times; (2) the highlands of the south-east (Appalachians and Brazilian highlands) with a north-east south-west crystalline axis near the ocean, followed by a belt of deformed and metamorphosed early Palaeozoic strata, and adjoined farther inland by a dissected plateau of nearly horizontal later Palaeozoic formations—all greatly denuded since the ancient deformation of the mountain axis, and seeming to owe their present altitude to broad uplifts of comparatively modern geological date; (3) the complex of younger mountains along the western side of the continents (Western highlands, or Cordilleras, of North America; Andean Cordilleras of South America) of geologically modern deformation and upheaval, with enclosed basins and abundant volcanic action, but each a system in itself, disconnected and not standing in alignment; (4) confluent lower lands between the highlands, giving river drainage to the north (Mackenzie, Orinoco), east (St Lawrence, Amazon), and south (Mississippi, La Plata). Differences of dimension and detail are numerous, but they do not suffice to mask what seems to be a resemblance in general plan. Indeed, some of the chief contrasts of the two continents arise not so much from geological unlikeness as from their unsymmetrical situation with respect to the equator, whereby the northern one lies mostly in the temperate zone, while the southern one lies mostly in the torrid zone. North America is bathed in frigid waters around its broad northern shores; its mountains bear huge glaciers in the north-west; the outlying area of Greenland in the north-east is shrouded with ice; and in geologically recent times a vast ice-sheet has spread over its north-eastern third; while warm waters bring corals to its southern shores. South America has warm waters and corals on the north-east, and cold waters and glaciers only on its narrowing southern end. If the symmetry that is so noticeable in geological history had extended to climate as well, many geographical features might now present likenesses instead of contrasts.

The relation of the Americas to each other and to the rest of the world, as the home of plants and animals, is greatly affected by the breadth of the adjacent oceans, and also by the geologically recent changes of altitude whereby the breadth of the narrower parts of the lands and the oceans has been significantly altered. Between the parallels of 60° and 70° N. the east and west widening of North America forms more than a third of the almost continuous land ring around a zone of sub-Arctic climate, through the middle of which runs the Arctic circle. As a result there is a remarkable community of resemblance of plant and animal life in the high northern latitudes of North America and Eurasia. In strong contrast with this relation of close fellowship is the exceptional isolation of far southern South America. Excepting the barren lands of the Antarctic regions, with which Patagonia is somewhat associated by a broken string of islands, the nearest continental lands of a more habitable kind are South Africa and New Zealand. In contrast to the sub-Arctic land ring, here is a sub-Antarctic ocean ring, and as a result the land flora and fauna of South America to-day are strongly unlike the life forms of the other south-ending continents.

For further treatment of the physical geography of the American continents, see North America, South America.

(W. M. D.)

II. *General Historical Sketch.*— The name America was derived from that of Amerigo Vespucci (*q.v.*). In Waldseemüller's map of 1507 the name is given to a body of land roughly corresponding to the continent of South America. As discovery revealed the existence of another vast domain to the north, the name spread to the whole of the pair of continents by customary use, in spite of the protests of the Spaniards, by whom it was not officially used of North America till the 18th century.

The discovery of America is justly dated on the 12th (N.S. 21st) of October 1492, when Christopher Columbus (*q.v.*), the Genoese, made his landfall on the island of Guanahani, now identified with Watling Island in the Bahamas. In the 10th and 11th centuries Norse sea-rovers, starting from Iceland, had made small settlements in Greenland and had pushed as far as the coast of New England (or possibly Nova Scotia) in transient visits (see Vinland and Leif Ericsson). But the Greenland colony was obscure, the country was believed to form part of Europe, and the records of the farther explorations were contained in sagas which were only rediscovered by modern scholarship. Throughout the middle ages, legendary tales of mythical lands lying in the western ocean—the Isle of St Brandan, of Brazil and Antilia—had been handed down. Scholars, guessing from isolated passages in classic writers, or arguing on general principles, had held that the "Indies" could be reached by sailing due west. But the venture was beyond the resources of the ships and the seamanship of the time. The opinions of scholars, and the fantasies of poets, became an enthusiastic belief in the mind of Columbus. After many disappointments he persuaded the Catholic sovereigns Ferdinand and Isabella of Spain to furnish him with a squadron of three small vessels. With it he sailed from Palos in Andalusia on the 3rd of August 1492, reached Guanahani on the 12th of October, touched on the coast of Cuba and Hispaniola, established a small post on the latter, and returned to Lisbon on the 4th of March 1493, and thence to Spain.

It was the belief of Columbus and his contemporaries that he had reached the islands described by Marco Polo as forming the eastern extremity of Asia. Hence he spoke of the "Indies," and "las Indias" continued to be the official name given to their American possessions by the Spaniards for many generations. His feat produced a diplomatic controversy with Portugal which was destined to have important political consequences. In 1454 Pope Nicholas V. had given the Portuguese the exclusive right of exploration and conquest on the road to the Indies. His bull contemplated only the use of the route by the coast of Africa to the south and east. In 1488 the Portuguese Bartholomeu Diaz had rounded the Cape of Good Hope. After the return of Columbus and his supposed demonstration that the Indies could be reached by sailing west, disputes might obviously arise between the two powers as to their respective "spheres of influence." The Catholic sovereigns applied to Pope Alexander VI., a Spaniard, for a confirmation of their rights. The pope drew a line from north to south one hundred leagues west of the Azores and Cape Verde Islands, and gave the Spaniards the claim to all to the west (May 4, 1493). The Portuguese thought the division unfair to them, and protested. A conference was held between the two powers at Tordesillas in 1494, and by common consent the line was shifted to three hundred and seventy leagues west of the Cape Verde Islands. The boundary line corresponded to the 50th[1] degree of longitude west of Greenwich, which strikes the mainland of South America about the mouth of the Amazon. Thenceforward the Spaniards claimed the right to exclude all other peoples from trade or settlement "beyond the line."

Between September 1493 and the time of his last voyage (May 1502 to November 1504), Columbus explored the West Indies, reached the mainland of South America at the mouth of the Orinoco and sailed along the coast of Central America from Cape Honduras to Nombre de Dios (near Colon). Henry VII. of England allowed the Bristol merchants to fit out a western voyage under the command of another Genoese, John Cabot (*q.v.*), in 1497. The history of the venture is very obscure, but Cabot is thought to have reached Newfoundland and the mainland. Between 1500 and 1503 a Portuguese family of the name of Cortereal carried out voyages of exploration on the eastern coast of North America, with the consent of their government, and with little regard for the treaty of Tordesillas. In 1500 the Portuguese Pedro Alvarez Cabral, while on his way to the East Indies, sighted the coast of Brazil at Monte Pascoal in the Aimores, and took formal possession. The belief that the eastern extremity of Asia had been reached died slowly, and the great object of exploration in America continued for some years to be the discovery of a passage through to the Spice Islands, in order to compete with the Portuguese, who had reached them by the Cape route. The first Spanish settlement in Hispaniola spread to the mainland by the adventure of Alonso de Ojeda and Diego de Nicuesa in Darien in 1509. Cuba was occupied by Diego de Velazquez in 1511. In 1512 (or 1513) Juan Ponce de Leon made the first recorded exploration of the coast of Florida and the Bahama Channel. In 1513, Vasco Nuñez de Balboa crossed the isthmus of Darien and saw the South Sea (Pacific). The hope that a passage through to the Spice Islands would be found near existing Spanish settlements was now given up. One was sought farther south, and in November 1520 Ferdinand Magellan (*q.v.*) passed through the strait which bears his name and sailed across the Pacific. At last the existence of a continent divided by a vast stretch of ocean from Asia, and mostly lying within the sphere of influence assigned to Spain by the pope, was revealed to the world.

The first aim of the Spaniards had been trade with the Indies. The *Casa de Contratacion*, a committee for the regulation of trade, was established at Seville in 1503. European plants and animals were introduced into Hispaniola and Cuba, and sugar plantations were set up. But the main object of the Spaniards, who could not labour in the tropics even if they had wished to do so, was always gold, to be won by slave labour. As the surface gold of the islands was exhausted, and the feeble island races perished before the invaders, the Spaniards were driven to go farther afield. In 1519 Pedrarias Davila transferred the Darien settlement to Panama. In that and the following year the coasts of Yucatan and of the Gulf of Mexico were explored successively by Francisco Hernandez Córdova and Juan de Grijalva, who both sailed from Cuba. From Cuba it was that Hernan Cortes (*q.v.*) sailed on the 10th (or 18th) of February 1519 for the conquest of Mexico. Hitherto the Spaniards had met only the weak islanders, or the more robust cannibal Caribs, both alike pure savages. In Mexico they found "pueblo" or town Indians who possessed an organized government and had made some progress in civilization. The hegemony of the Aztecs, who dominated the other tribes from the central valley of Mexico, was oppressive. Cortes, the most accomplished and statesmanlike of the Spanish conquerors, raised the subject peoples against them. His conquest was effected by 1521. His example stimulated the settlers at Panama, who had heard of a great people owning vast quantities of gold to the south of them. Between 1524 and 1535 Francisco Pizarro (*q.v.*) and Diego de Almagro had completed the conquest of Peru, which was followed, however, by a long period of strife among the Spaniards, and of rebellions. The country between Peru and Panama was subdued before 1537 by the conquest of Quito by Sebastian de Benalcazar and of New Granada by Jimenez de Quesada. From Peru the Spaniards advanced southwards to Chile, which was first unsuccessfully invaded (1535–37) by Diego de Almagro, and afterwards occupied (1540–53) by Pedro de Valdivia. Their advance to the south was checked by the indomitable opposition of the Araucanians, but from the southern Andes the Spaniards overflowed on to the great plains which now form the interior of the Argentine Republic. The first permanent settlement at the mouth of the river Plate at Buenos Aires dates from 1580. In its main lines the Spanish conquest was complete by 1550. What the Spaniards had then overrun from Mexico to Chile is still Spanish America. Brazil, after a period of exploration which began in 1510, was gradually settled by the Portuguese, though its bounds on the south remained a subject of dispute with the Spaniards till the 18th century.

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[1] The exact position has been disputed. According to John Fiske, the line would be between 41° and 44° long.

The vast territories acquired by Spain in this brief period were held to be, by virtue of the pope's bull, the peculiar property of the sovereign. When the wide and dangerous powers granted to Columbus by his patent were confiscated, Ferdinand first imposed Bishop Fonseca on him as a check. In 1509 the council of the Indies was established, but it did not take its final form till 1524. It consisted of a president, with a board of advisers, who possessed legislative and administrative powers, and who varied in number at different times. There was an appeal to it from all colonial governors and courts. The *Casa de Contratacion*, another board, regulated the trade. In America the crown was represented by governors. After the preliminary period of conquest the whole of the Spanish possessions were divided into the two "kingdoms" of New Spain,—consisting of Venezuela and the Spanish possessions north of the isthmus—and of New Castile, a title soon changed to Peru, which included the Central American isthmus and all of South America except Venezuela and Brazil. Each was ruled by a viceroy. As the Spanish dominions became more settled, the viceroyalty of Peru was found to be unwieldy. New Granada (which included the present republics of Venezuela, Colombia and Ecuador) was created a viceroyalty in 1718 (soon abolished, but re-created in 1740). A fourth viceroyalty for the river Plate was formed in 1778. Other governments known as captain-generalships were cut out of the viceroyalties at different periods—Guatemala in 1527, Venezuela in 1773, Cuba in 1777 and Chile in 1778. The captains-general corresponded directly with the council of the Indies, and were independent of the viceroys except in war time. The administrative powers of the viceroys were very great. They were, however, checked by the *audiencias*, or law courts, of which there were eleven from the reign of Philip IV.—Santo Domingo, Mexico, Panama, Lima, Guatemala, Guadalajara, Bogota, La Plata, Quito, Chile, Buenos Aires. They acted as councils to the governors, and had civil and criminal jurisdiction with an appeal to the council of the Indies at Seville. The towns had municipal franchises, exercised by a governing body comprised of Spaniards, either immigrants from Old Spain, or Creoles, *i.e.* descendants of Spanish settlers. The places were often sold, and were objects of ambition to the richer merchants. In practice the selling of a seat in the town councils, or *cabildos*, did not have the bad consequences which might have appeared inevitable. In the earlier stages of Spanish colonial history meetings of delegates (procurators) of the town councils, in imitation of the national cortes of Spain, were not uncommon. The kings of Spain had obtained from the popes Alexander VI. and Julius II. the right of levying the tithe, and of naming the holders of all ecclesiastical benefices. These immense concessions, made when the development of the Spanish settlements could not be foreseen, were regretted by later popes, but the crown adhered firmly to its regalities.

The government of Spain administered its dominions from the beginning in the strictest spirit of the "colonial system." The Indies were expected to supply precious metals and raw materials, and to take all manufactures from the mother country. In order to facilitate the regulation of the trade by the *Casa de Contratacion*, it was concentrated first in Seville, and when the Guadalquivir was found to be becoming too shallow for the growing tonnage of ships, at Cadiz. Merchant vessels were required for their protection to sail in convoy. The convoys or *flotas* sailed in October first to Cartagena in South America, and from thence to Nombre de Dios or, in later times, Porto Bello. The yearly fairs at these places received the imports from Europe and the colonial trade of the Pacific coast, first collected at Panama and then carried over the isthmus. From Nombre de Dios or Porto Bello the convoys went to La Vera Cruz for the trade of New Spain, and returned home in July by the Florida straits. One-fifth of the produce of the mines belonged to the crown. The collection of this bullion was at all times a main object with the Spanish government, and more especially so after the discovery of the great silver deposits of Potosi in Bolivia. Forced labour was required to work them and the natives were driven to the toil. The excesses of the earliest Spanish settlers have become a commonplace, largely through the passionate eloquence of Bartolomé de Las Casas (see Las Casas). The Spanish government made strenuous attempts to regulate forced labour by limiting the rights of the masters. An *encomienda* was required by anyone who wished to exact labour, *i.e.* the Indians of a district were given to him "*in commendam*" with the power to demand a *corvée* from them and a small yearly payment per head. The laws endeavoured to check abuses, but there can be no doubt that they were often defeated by the greed of the colonists—more especially in the viceroyalty of Peru, which was always less well governed than Mexico. But the bulk of the inhabitants of the Spanish possessions were of pure or mixed Indian blood, and many Indians were prosperous as traders, manufacturers, farmers and artisans.

The Portuguese settlement in Brazil was more purely colonial than the Spanish possessions. Until 1534 little was done to regulate the activity of private adventures. In that year the coast was divided into captaincies, which were united under a single governor-general in 1549. Between 1555 and 1567 the Portuguese had to contend with the French Huguenot invaders who seized Rio, and whom they expelled. Between 1572 and 1576 there were in Brazil the two governments of Rio de Janeiro and Bahia, but its history is of little importance till the occupation of Portugal by Philip II. drew the country into the wars of the Spanish monarchy.

The claim of the Peninsula powers to divide the American continent between them, based as it was on an award given in entire ignorance of the facts, would in no case have been respected. In the great upheaval of the Renaissance and the Reformation it was certain to be defied. As England was in general alliance with the sovereigns of Spain during the early 16th century, Englishmen turned their attention at first towards the discovery of a route to the Spice Islands round the north of Asia. But the rivalry of Francis I. and Charles V. gave France a strong motive for assailing the Spaniards in the New World now revealed to the ambition of Europe. King Francis encouraged the ill-recorded and disputed voyages of the Florentine Giovanni da Verrazano in 1524, and the undoubted explorations of Jacques Cartier. Between 1534 and 1542 this seaman, a native of St Malo, explored the Strait of Belle Isle and the Gulf of St Lawrence, and visited the Indian village of Hochelaga, now Montreal. The claims of France to the possession of a great part of the northern half of America were based on the voyages of Verrazano and Cartier. The death of King Francis, and the beginning of the wars of religion, suspended colonial enterprise under royal direction. But the Huguenots, under the inspiration of Coligny, made three attempts to found colonies to the south—at Rio de Janeiro in 1555–1567, near the present Beaufort, South Carolina, in 1562, and in Florida in 1565. These ventures were ruined partly by the hostility of the Spaniards and Portuguese, partly by the dissensions of the colonists. Meanwhile French corsairs from St Malo and Dieppe had been active in infesting the West Indies and the trade route followed by the Spanish convoys. After the accession of Queen Elizabeth, and the beginning of the breach between England and Spain, they were joined by English sea-rovers. The English claimed the right to trade with all Spanish possessions in or out of Europe by virtue of their treaty of trade and amity made in the reign of Charles V. The Spaniards disputed this interpretation of the treaty, and maintained that there was "no peace beyond the line," *i.e.* Pope Alexander's line as finally fixed by the conference at Tordesillas. The English retaliated by armed smuggling voyages.

It was, however, not till late that they attempted to found permanent settlements. In 1578 Sir Humphrey Gilbert obtained a patent for discovery and settlement. In 1583 he perished in an effort to establish a colony in Newfoundland. His work was taken up by his half-brother Sir Walter Raleigh in 1584. Between 1586 and 1603 Sir Walter made successive efforts to settle a colony in the wide territory called Virginia, in honour of Queen Elizabeth, a name of much wider significance then than in later days. His colony at Roanoke, in what is now the state of North Carolina, was unsuccessful, and after his fall his patent reverted to the crown, but the new Virginia Company carried on his schemes. In 1607 the first lasting settlement was made in Virginia, and after a period of struggle began to flourish by the cultivation of tobacco.

In 1620 another settlement was made. A small body of religious dissentients, one hundred and one men, women and children, including some who had fled to Holland to escape the discipline of the church of England, secured leave from the Virginia Company to plant themselves within its bounds. They sailed in a single ship, the "Mayflower," and landed near Cape Cod, where they founded the colony of Plymouth, afterwards (1621) obtaining a patent from the council for New England. From these two centres, and from later settlements, arose the "Plantations" of the English, which gradually increased to the number of thirteen and were destined to become the United States of America. Two strongly contrasted types were found among them. The Virginian or southern type, which may be said to have prevailed from Maryland southward, were for the most part planters producing tobacco, Indian corn, rice, indigo and cotton, largely by the labour of negro slaves. They had no very pronounced religious leaning, though Maryland was founded as a Roman Catholic refuge, but they had a prevailing leaning to the church of England. The northern or New England element began by endeavouring to establish a Puritan theocracy which broke down. But the tendency was towards "Independency," and the New Englanders were farmers tilling their own land, traders and seafaring men. In the middle region between them religion had a large share in promoting the formation of Pennsylvania, which was founded by the Quaker William Penn.

The English colonies, though divided by interest or character, were all alike jealous to defend, and eager to extend, their freedom of self-government, based on charters granted by, or extorted from, the crown. The settlers by degrees threw off the control of the proprietors who had received grants from the crown and had promoted the first settlements. It was a marked characteristic of the English colonists, and a strong element in their prosperity, that they were hospitable in welcoming men of other races,—Germans from the Palatinate, and French Huguenots driven out by persecution who brought with them some capital, more intelligence and an enduring hatred of Roman Catholic France. Though the British government gave, more or less unwillingly, a large measure of self-government to the Plantations, it was no less intent than the Spanish crown on retaining the whole colonial trade in British hands, and on excluding foreigners. Like the Spaniards it held that this trade should be confined to an exchange of colonial raw produce for home manufactures. Two foreign settlements within the English sphere—the Dutch colony of New Netherland, now New York, and the Swedish settlement on the Delaware—were absorbed by the growing English element.

While the English plantations were striking root along the coast, by somewhat prosaic but fruitful industry, and were growing in population with rapid strides, two other movements were in progress. To the south, the English, French and Dutch, though often in rivalry with one another, combined to break in on the monopoly of the Spaniards. They turned the maxim that "there is no peace beyond the line" against its inventors. They invaded the West Indies, seized one island after another, and formed the freebooting communities known as the Brethren of the Coast and the Buccaneers (*q.v.*). After the renewal of the war between Spain and Holland in 1621, the Dutch invaded the Portuguese colony of Brazil, and seized Bahia. A long period of struggle followed, but, after the declaration of Portuguese independence in 1640, local opposition, and the support given to the Portuguese by the French, led to the retreat of the Dutch.

To the north, to the west and to the south of the English settlements on the mainland, a most characteristic French colonial policy was being carried out. No sooner were the wars of religion over than the French again set about making good their claim to Canada, and to whatever they could represent as arising naturally out of Canada. In 1599, under the encouragement of Henry IV., speculators began to frequent the St Lawrence in pursuit of the fur trade. Their settlements were mainly trading posts. Their colonists were not farmers but trappers, woodrangers, *coureurs du bois*, who married Indian women, and formed a mixed race known as the *bois brulés*. Not a few of the leaders, notably Samuel de Champlain (*q.v.*), who founded Quebec in 1608, were brave ingenious men, but the population provided no basis for a lasting colony. It was adventurous, small, scattered and unstable. The religious impulse which was so strong both in the Spanish and the English colonies was prominent in the French, but in the most fatal form. Pious people were eager to bring about the conversion of the Indians, and were zealously served by missionaries. The Jesuits, whose first appearance in New France dates from 1611, were active and devoted. Their aim was to reduce the fierce Red men to a state of childlike docility to priests, and they discouraged all colonization in their neighbourhood. It was true that the most active French colonial element, the trappers, were barbarized by the natives, and that the pursuit of the fur trade and other causes had brought the French into sharp collision with the most formidable of the native races, the confederation known as the Five (or Six) Nations. During the reign of Louis XIV., after 1660, the French government paid great attention to Canada, but not in a way capable of leading to the formation of a colony. The king was as intent as the rulers of Spain had been to keep the American possessions free from all taint of heresy. Therefore he carried on the policy of excluding the Huguenots—the only colonizing element among his subjects,—and drove them into the English plantations. A small handful of obedient peasants, priest-ridden and over-administered, formed the basis of the colony. On this narrow foundation was raised a vast superstructure, ecclesiastical, administrative and military. His priests, and his officials civil and military, gave the French king many daring explorers. While the English colonies were slowly digging their way, taking firm hold of the soil, and growing in numbers, from the sea to the Alleghanies, French missionaries and explorers had ranged far and wide. In 1682 Robert Cavelier, sieur de la Salle, who had already explored the Ohio, sailed down the Mississippi and took possession of the region at the mouth by the name of Louisiana.

The problem which was to be settled by a century of strife was now posed. On the one hand were the English plantations, populated, cultivated, profitable, stretching along the east coast of North America; on the other were the Canadian settlements, poverty-stricken, empty, over-officialled, a cause of constant expense to the home government, and, at a vast distance, those of Louisiana, struggling and bankrupt. The French remedy for an unsuccessful colony has always been to annex more territory, and forestall a possible rival. Therefore the French government strove to unite the beggarly settlements in Canada and Louisiana by setting up posts all along the Ohio and the Mississippi, in order to confine the English between the Alleghanies and the sea.

The political history of North America till 1763 is mainly the story of the pressure of the English colonies on this paper barrier. As regards Spanish America, England was content to profit by the *Asiento* (*q.v.*) treaty, which gave her the monopoly of slave-hunting for the Spanish colonies and an opening for contraband trade. In the river Plate region, where the dissensions of Spaniards and Portuguese afforded another opening, English traders smuggled. The Spaniards, with monstrous fatuity, refused to make use of the superb waterways provided by the Paraná and Paraguay, and endeavoured to stifle all trade. England's main struggle was with France. It was prolonged by her entanglement in European disputes and by political causes, by the want of co-operation among the English colonies and their jealousy of control by the home government. The organization of the French colonies, though industrially ruinous, gave them

AMERICA

Illustrations representative of the primitive cultures of Central America, Mexico and Peru (*q.q.v.*) selected and arranged by Dr Walter Lehmann of the Royal Ethnographical Museum, Munich.

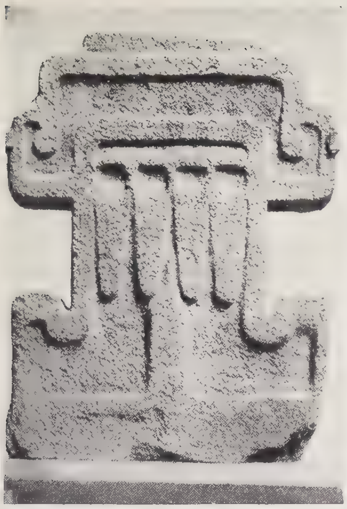


FIG. 1.—Stone Sculpture, from Teotihuacan, Mexico. Prae-Mexican culture (? Totonacan).

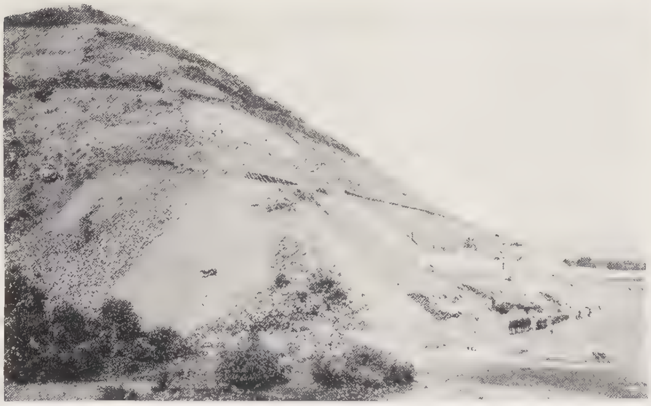


FIG. 2.—View of the Giant Pyramid of the Sun, Teotihuacan. Plateau region, Mexico. Prae-Mexican culture (? Totonacan).

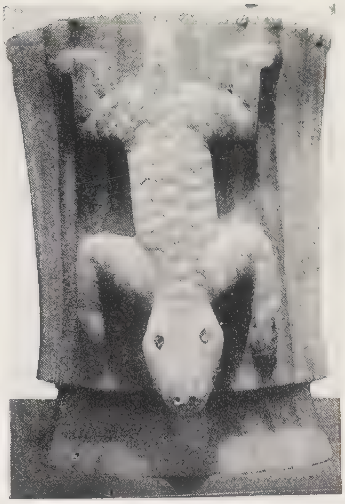


FIG. 3.—Alabaster Vessel, with carved lizard as handle. Teotihuacan, Mexico. Proto-Mexican culture.

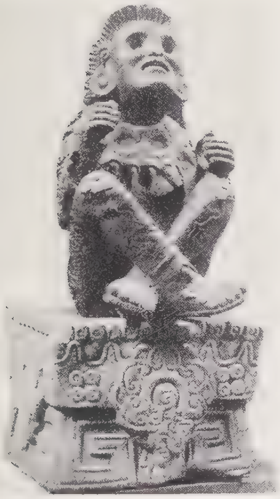


FIG. 5.—Carved Stone Figure of the god of sports and dancing (Xochipilli-Miacuilxochitl, "five flowers"), squatting on a stool, decorated with flowers and tonallo emblems. Plateau region, Mexico. Mexican culture.

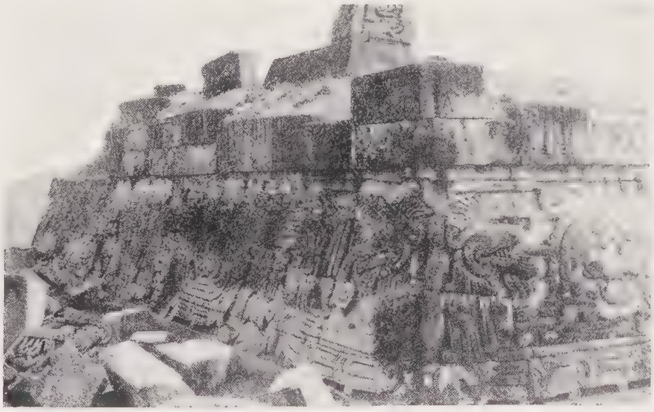


FIG. 6.—Sculptured Frieze of the Temple of Xochicalco. Plateau region, Mexico. Mexican culture with Mayan influence.

(*Figs. 2 and 6 from photos by Waite, Mexico.*)

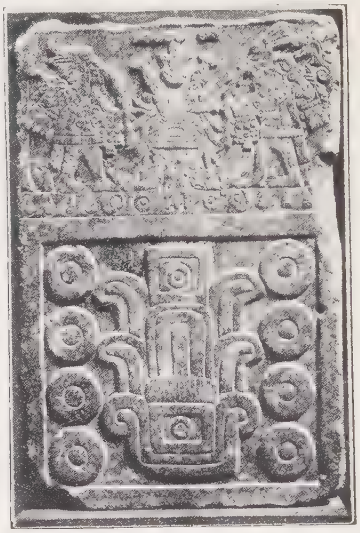


FIG. 7.—Stone Tablet in memory of the year *chicuei-acatl* ("8 reeds"), A.D. 1487, when the Great Temple in Mexico was consecrated; above are the figures of the Kings Tiçoc and Ahuitzotl, sacrificing, with the date of the beginning of the rebuilding, *chicome-acatl* ("7 reeds"), A.D. 1447. Mexico City. Mexican culture.

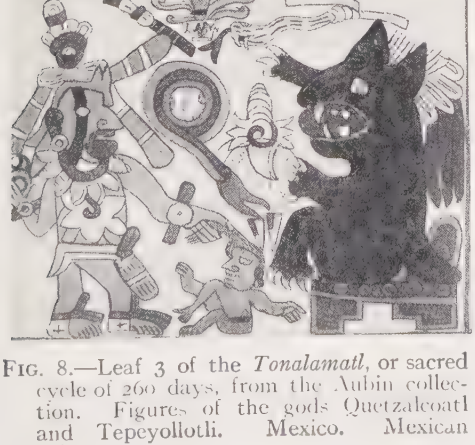


FIG. 8.—Leaf 3 of the *Tonalamatl*, or sacred cycle of 260 days, from the Aubin collection. Figures of the gods Quetzalcoatl and Tepeyollotli. Mexico. Mexican culture.

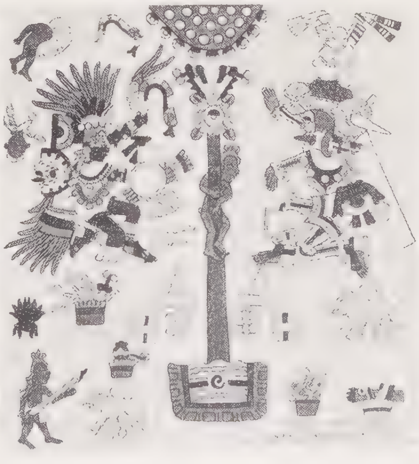


FIG. 9.—Leaf 10 of *Codex Borbonicus*, with figure of the god of the underworld (Mictlantecutli) as regent of the tenth of the 20 sections, each of 13 days of the *tonalamatl*, which begins with "one flint" (*ce tepcatl*). Mexico. Mexican culture.

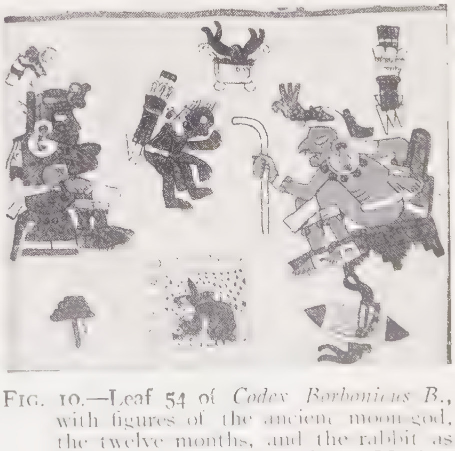


FIG. 10.—Leaf 54 of *Codex Borbonicus B.*, with figures of the ancient moon-god, the twelve months, and the rabbit as the animal moon-emblem. Mexico. Mexican culture.

(*Figs. 8-10 from the publications of the duke of Loubat.*)

AMERICA

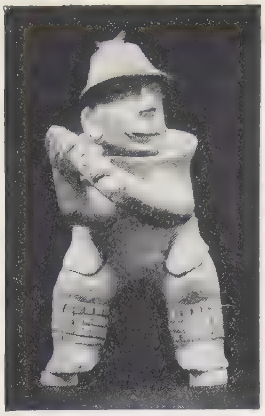


FIG. 1.—Male Clay Figure, holding weapon (?). From near Tzintzuntzan Michoacan, Mexico. (?) Tarascan culture.

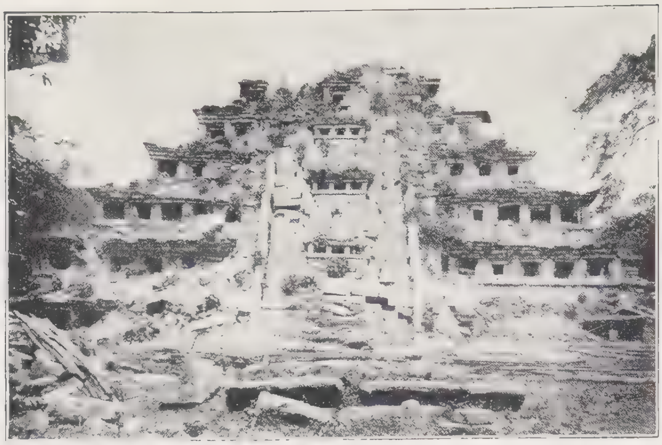


FIG. 2.—View of the Ruins of the Pyramid Temple of Papantla, near Vera Cruz, Mexico. Totonacan culture.

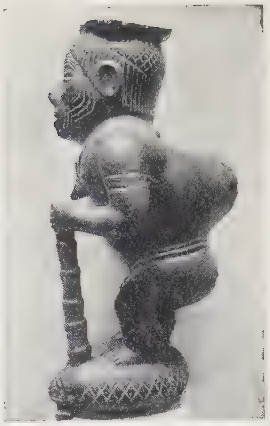


FIG. 3.—Hump-Backed Clay Figure, standing on a fish; a reed staff in one hand, and incised lines on face. From Tzintzuntzan. (?) Tarascan culture.

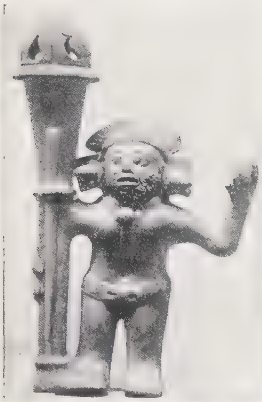


FIG. 4.—Human Figure, with a rattle-stick in the right hand. From near Alvarado, Vera Cruz, Mexico. Totonacan culture.

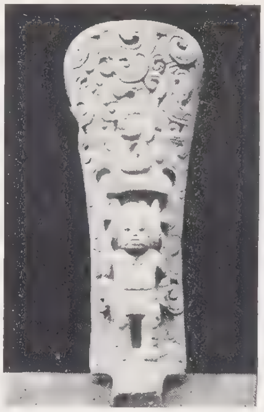


FIG. 5.—Stone Carving, deeply undercut, of the so-called Palma type. From Coatepec, Canton Falapa, Vera Cruz, Mexico. Totonacan culture.

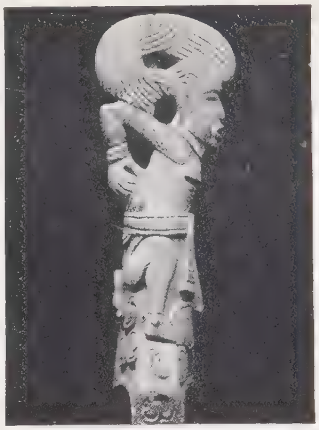


FIG. 6.—Similar Carving, with human figure. From Coatepec. Totonacan culture.

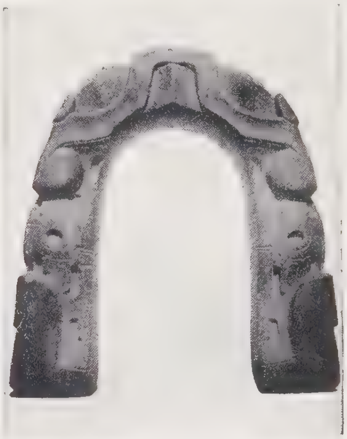


FIG. 7.—Stone Yoke, carved in the so-called frog-type. Vera Cruz, Mexico. Totonacan culture.

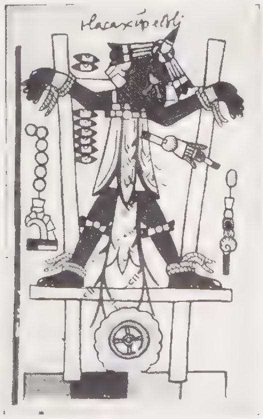


FIG. 8.—Crucified Figure, pierced with arrows, of the victim at the festival of the god Xipe (Mexican Tlacaxipenaliztli), with the symbols of the god. Culture of the Mayan transitional peoples of the Atlantic coast of the Gulf of Mexico. Totonacan culture.

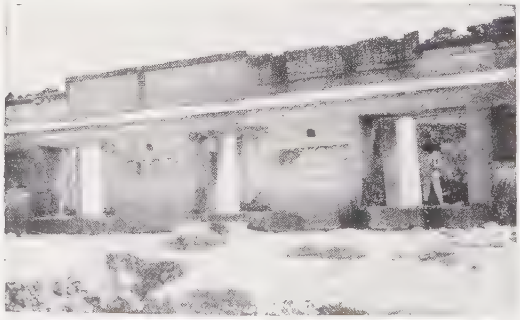


FIG. 9. — Temple Chambers, with stone pillars, from the ruins of Mitla, Oaxaca, with wall mosaic of joined stones. Zapotecan culture with proto-Mexican influence.

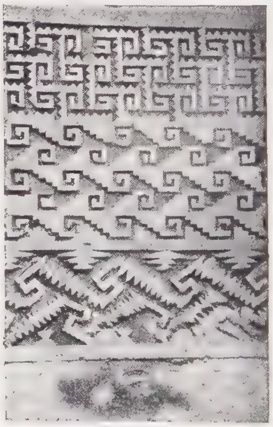


FIG. 10.—Wall Mosaic of joined Stone from the ruins of Mitla. Zapotecan culture with proto-Mexican influence.

(*Figs. 2, 9 and 10 are from photos by Waite, Mexico; Fig. 8, from the "Codex Nuttall," publications of the Peabody Museum.*)

the command of more available military forces than were at the disposal of the English. Thus the fight dragged on, and was constantly maintained in Acadia, where the sovereignty had been early disputed, and the border never properly settled. At last, when under the leadership of the elder Pitt (see CHATHAM, EARL OF) England set to work resolutely to force a final settlement, the end came. The British navy cut off the French from all help from home, and after a gallant struggle, their dominion in Canada was conquered, and the French retired from the North American continent. They surrendered Louisiana to Spain, which had suffered much in an attempt to help them, and their possessions in America were reduced to their islands in the West Indies and French Guiana.

The fall of the French dominion on the continent of North America was practically the beginning of the existence of independent nations of European origin in the New World. The causes which led to the revolt of the Plantations, the political and military history of the War of Independence, are dealt with under the heading of UNITED STATES (*History*) and AMERICAN WAR OF INDEPENDENCE. The significance of these great events in the general history of America is that from 1783 onwards there was, in the New World, an autonomous community not wholly unified at once, nor without strife, but self-governing and self-subsisting, in entire separation from European control. Such a polity, surrounded as it was by territory dependent on European sovereigns, could not be without a profound influence on its neighbours. Of deliberate direct action there was not much, nor was it needed. The peoples of the thirteen states which had secured emancipation from British sovereignty were wisely intent on framing their own Federal Union, and in taking effective possession of the vast territories in the Ohio region and beyond the Mississippi. But their example worked. Their independence tempted, their prosperity stimulated. From the freedom of the United States came the revolt of Spanish America, and the grant by Great Britain to Canada of the amplest rights of self-government.

The effect which the establishment of the great northern republic was bound to have on their own colonies was not unknown to the wiser among the rulers of Spain. They took, however, few and weak steps to counteract the visible peril. During the later 17th century and the whole of the 18th, the history of the Spanish colonies and of the Portuguese in Brazil, was not, as has often been said, one of pure stagnation. Apart from such a peculiar development as the rise, formation and fall of the Jesuit missions in Paraguay, there was growth and change. The Creole population increased and was steadily recruited from home. Apart from settlers who came for trade, the flow of government officials, and soldiers, both officers and men, ended generally in recruiting the Creole element. The newcomers married in the country, and died there, leaving their families to grow up Americans. San Martin, the military leader of Buenos Aires in the revolt, was the son of a Spanish army officer and a Creole mother, and he is quoted as the example of thousands. He was educated in Spain, and began as an officer in the Spanish army. Increasing numbers of Creoles came home for education, and though they rarely went beyond Spain, yet Spain itself was being permeated by the influence of French philosophic and economic writers. The Creoles brought back new ideas. Slow as the Spanish government was to move, and obstinately as it clung to old ways, it was forced to remove restrictions on trade, largely by the discovery that it could not prevent smuggling, which was, in fact, carried on with the connivance of its own corrupt officials. The attempt to prevent all trade on the river Plate was given up, and a vigorous commercial community arose. A revolt of the Indians in Peru in 1780, which was savagely suppressed, forced the government to take note of the abuses of its colonial administration. Many reforms were introduced. Spanish America was never so well governed as at the end of the 18th century, and was on the whole prosperous. But the reforms and concessions of Spain came too late. In commerce it had to compete with the highly developed maritime industry of Great Britain. In government it had to meet with the growing discontent of the Creoles, who found themselves treated as children, and their country looked on as a milch cow. The wars of the French Revolution and of the emperor Napoleon, in which Spain was entangled, interrupted its communications with its colonies, and weakened its hold on them. The defeat, in 1806 and 1807, of two British expeditions to Buenos Aires and Montevideo, resulting in the capitulation of the English force, gave a great impulse to the self-reliance of the colonists, to whom the credit of the victory entirely belonged. When the intervention of Napoleon in Spain plunged the mother country into anarchy, the colonists began to act for themselves. They were still loyal, but they were no longer passive. The brutality of some Spanish governors on the spot provoked anger. The cortes assembled in Cadiz, being under the influence of the merchants and mob, could make no concessions, and all Spanish America flamed into revolt. For the details of the struggle the reader must refer to the articles ARGENTINA, BOLIVIA, CHILE, COLOMBIA, ECUADOR, PANAMA, PERU, PARAGUAY, URUGUAY, VENEZUELA. Brazil followed the same course in a milder way and a little later. The struggle of Spanish America for independence lasted from 1810 to 1826.

This vast extension of the area of independence in America could not but have its proportionate effect on the general balance of power among nations. So long as Spain retained her colonies on the mainland, while England held Canada, and the English, Dutch and French had possessions in Guiana, the New World must have remained in political dependence on the Old. When the Spanish colonies secured effective independence, and even before their freedom was formally recognized, foreign sovereignty became at once the exception in America. The change thus established *de facto* owed its first diplomatic consecration to the developments of international politics in the Old World. The committee of the great powers which, since the downfall of Napoleon, had succeeded to the authority which he had usurped in Europe (see EUROPE: *History*), was for the few years of its unbroken existence fully occupied with the task of preserving the "European Confederation" from the peril to its peace of renewed revolutionary outbreaks. As early as the congress of Aix-la-Chapelle (1818), however, the question of the relations of Spain and her colonies had been brought up and the suggestion made of concerted intervention, to put an end to a state of things scandalous in itself and dangerous, if only by force of example, to the monarchical principle. The proposal came to nothing, and fared no better when revived at subsequent conferences, owing to the opposition of Great Britain and of Spain herself. Spanish pride resented the interference of an alliance in which Spain had no part; Great Britain could not afford to allow any action to be taken which might end in the re-establishment of the old Spanish colonial system and the destruction of the considerable British trade, still nominally contraband, which had grown up with the colonies during the troubles. Had the Spanish government frankly accepted the situation and acknowledged the trade as legitimate, England would have had no objection to the re-establishment of the Spanish sovereignty in America. But the stubborn blindness of Ferdinand VII. and his ministers made any such solution impossible, and, before the meeting of the congress of Verona, in 1822, Castlereagh had realized the eventual necessity of recognizing the independence of the South American states. Matters were brought to a crisis by the outcome of the Verona conferences (see VERONA, CONGRESS OF), and the re-establishment, in 1823, of the absolute power of the king in Spain by French arms and under French influence, the logical consequence of which seemed to be the reconquest, with the aid of France, of the Spanish colonies. Great Britain could not afford to stand aside and watch the accomplishment of an ambition to prevent which she had, at immense sacrifice of blood and treasure, overthrown the power of Louis XIV. and of Napoleon. She had exhausted every art of diplomatic obstruction to the aggressive action of France; her counterstroke to the unexpectedly easy victory of the French arms was the formal recognition of the revolted colonies as independent states. "If France has Spain," cried Canning in parliament, "at least it shall be Spain without the Indies. We have called a New World into existence to redress the balance of the Old."

On the 23rd of July 1824, a commercial treaty was signed between Great Britain and Brazil; Colombia and Mexico were acknowledged in December of the same year; and the recognition of the other states followed, as each was able to give guarantees of stable government. Meanwhile the United States, acting in harmony, but not in formal co-operation, with England, had taken decisive action. President Monroe, in his message to Congress on the 2nd of December 1823, laid down the rule that no part of America was any longer *res nullius*, or open to colonial settlement. Though the vast ultimate consequences of this sudden appearance of the great western republic in the arena of international politics were not realized even by those in sympathy with Monroe's action, the weight of the United States thrown into the scale on the side of Great Britain made any effective protest by the European powers impossible; Russia, Austria and Prussia contented themselves with joining in a mild expression of regret that the action of Great Britain "tended to encourage that revolutionary spirit it had been found so difficult to control in Europe." Great Britain and the United States were, indeed, not in complete agreement as to the legitimacy of fresh colonial settlements in the New World, but they were practically resolved that nobody should make any new settlements except themselves. From President Monroe's declaration has grown up what is now known as the Monroe Doctrine (*q.v.*), which, in substance, insists that America forms a separate system apart from Europe, wherein still existing European possessions may be tolerated, but on the understanding that no extension of them, and no establishment of European control over a nominally independent American state, will be allowed.

The Monroe Doctrine is indeed the recognition, rather than the cause, of undeniable fact. Europe is still possessed of some measure of sovereign power in the New World, in Canada, in Guiana and in the West Indian islands. But Canada is bound only by a voluntary allegiance, Guiana is unimportant, and in the West Indian islands, where the independence of Hayti and the loss of Cuba and Porto Rico by Spain have diminished the European sphere, European dominion is only a survival of the colonial epoch. America, North and South, does form a separate system. Within that system power is divided as it has not been in Europe since the fall of the Roman empire. On the one hand are the United States and Canada. On the other are all the states formed out of the colonial empires of Spain and Portugal. The states of the American Union are non-tropical, adapted to the development of European races, not mixed with Indian blood, and possessed by long inheritance of the machinery needed for the successful conduct of self-government. They grew during the 19th century in population and wealth at a rate that placed them far ahead of the Spanish and Portuguese states, which in the year 1800 were the richer and the more populous. The Spanish and Portuguese states of America are mainly tropical, and therefore ill adapted to the health of a white race. Their population is divided between a white minority, among whom there are to be found strains of Indian blood, and a coloured majority, sometimes docile and industrious, sometimes mere savages. They inherited no machinery of self-government. Townships governed by close corporations, and all embedded in the despotic power of the crown, presented none of the elements out of which a commonwealth could be formed. It was inevitable that in the early stages of their history, the so-called Latin communities should fall under the control of "the single person," and no less inevitable that he should be a soldier. The sword and military discipline supplied the only effective instruments of government. It would have been a miracle if the first generation of Mexican and South American history had not been anarchical. And though in recent years Spanish America has seemingly settled down, and republican institutions have followed upon long periods of continual revolution, yet over the American continent as a whole there is an overwhelming predominance, material and intellectual, of the communities of English speech and politically of English origin.

AUTHORITIES.—Separate bibliographies will be found under the headings of the separate states. Amid the plethora of books, the reader cannot do better than consult the *Narrative and Critical History of America*, edited by Justin Winsor (1886–1889), in eight large octavo volumes, in which all the chapters are supplied with copious and carefully compiled bibliographies. (D. H.)

The American aborigines.

III. *Ethnology and Archaeology.*—A summary account is here given of the American aborigines, who are discussed in more detail under INDIANS, NORTH AMERICAN. Whether with Payne it is assumed that in some remote time a speechless anthropoid passed over a land bridge, now the Bering Sea, which then sank behind him; or with W. Boyd Dawkins and Brinton, that the French cave man came hither by way of Iceland; or with Keane, that two subvarieties, the long-headed Eskimo-Botocudo type and the Mexican round-headed type, prior to all cultural developments, reached the New World, one by Iceland, the other by Bering Sea; or that Malayoid wanderers were stranded on the coast of South America; or that no breach of continuity has occurred since first the march of tribes began this way—ethnologists agree that the aborigines of the western came from the eastern hemisphere, and there is lacking any biological evidence of Caucasoid or Negroid blood flowing in the veins of Americans before the invasions of historic times. The time question is one of geology.

Following *Notes and Queries on Anthropology*, published by the British Association for the Advancement of Science, the study of the American aborigines divides itself into two parts: that relating to their biology, and that relating to their culture. In the four subdivisions of humanity based on the hair, the Americans are straight-haired or Mongoloid. But it will free this account of them from embarrassments if they be looked upon as a distinct subspecies of *Homo sapiens*. Occupying 135 degrees of latitude, living on the shores of frozen or of tropical waters; at altitudes varying from sea-level to several thousands of feet; in forests, grassy prairies or deserts; here starved, there in plenty; with a night here of six months' duration, there twelve hours long; here among health-giving winds, and there cursed with malaria—this brown man became, in different culture provinces, brunette or black, tall or short, long-headed or short-headed, and developed on his own hemisphere variations from an average type.

Since the tribes practised far more in-breeding than out-breeding, the tendency was toward forming not only verbal linguistic groups, but biological varieties; the weaker the tribe, the fewer the captures, the greater the isolation and harder the conditions—producing dolichocephaly, dwarfism and other retrogressive characteristics. The student will find differences among anthropologists in the interpretation of these marks—some averring that comparative anatomy is worthless as a means of subdividing the American subspecies, others that biological variations point to different Old World origins, a third class believing these structural variations to be of the soil. The high cheek-bone and the hawk's-bill nose are universally distributed in the two Americas; so also are proportions between parts of the body, and the frequency of certain abnormalities of the skull, the hyoid bone, the humerus and the tibia. Viability, by which are meant fecundity, longevity and vigour, was low in average. The death-rate was high, through lack of proper weaning foods, and hard life. The readiness with which the American Indian succumbed to disease is well known. For these reasons there was not, outside of southern Mexico, northern Central America and Peru, a dense population. In the whole hemisphere there were not over ten million souls.

The materials for studying the American man biologically are abundant in the United States National Museum in Washington; the Peabody Museum, at Cambridge, Massachusetts; the American Museum of Natural History, New York; the Academy of Sciences and the Free Museum of Arts and Sciences, Philadelphia, Pennsylvania; the Field Museum in Chicago; the National Museum, city of Mexico, and the Museum of La Plata. In Europe there are excellent collections in London, Cambridge, Paris, Berlin, St Petersburg and Prague.

Professor Putnam measured for the World's Columbian Exposition 1700 living Indians, and the results have been summed up by Boas. The breadth of the Indian face is one centimetre more than that of the whites, and the half-breeds are nearer the Indian standard; this last is true also of colour in the skin, eyes and hair. In stature, the tall tribes exceed 170 cm.; middle stature ranges between 166 and 170; and short tribes are under 166 cm. The Indians are on the whole a tall people. Tribes that have changed residence have changed stature. The tallest statures are on the plains in both Americas. The mountains of the south-east and of the west reveal the shortest statures. The whole Mississippi valley was occupied by tall peoples. The Athapascans of New Mexico are of middle stature, the Pueblo peoples are short. The Shoshoni, Shahaptin and Salish tribes are of middle stature; on the coast of British Columbia, Puget Sound, in Oregon, and northern California, are the shortest of all the North Americans save the Eskimo, while among them, on the Columbia, are taller tribes. The comparison of cranial indexes is rendered difficult by intentional flattening of the forehead and undesigned flattening of the occiput by the hard cradle-board. The Mississippi valley tribes are nearly brachycephalic; the index increases around the Great Lakes, and lessens farther east. The eastern Eskimo are dolichocephalic, the western are less so, and the Aleuts brachycephalic. On the North Pacific coast, and in spots down to the Rio Grande, are short heads, but scattered among these are long heads, frequent in southern California, but seen northward to Oregon, as well as in Sonora and some Rio Grande pueblos.

The same variety of index exists in South America. In the regions of greatest linguistic mixture is the greatest heterogeneity of cephalic index.

Classification.

The concepts on which the peoples of the Old World have been classified, such as stature, colour, skeletal measurements, nationality, and so on, cannot as yet be used in America with success. The only basis of division practicable is language, which must be kept separate in the mind from the others. However, before the conquest, in no other part of the globe did language tally so nearly with kinship. Marriage was exogamic among clans in a tribe, but practically, though not wholly, endogamic as between tribes, wife and slave capture being common in places. In his family tree of *Homo Americanus* Keane follows out such a plan, placing the chief linguistic family names on the main limbs, North American on one side, and South American on the other. Deniker groups mankind into twenty-nine races and sub-races. Americans are numbered thus:—21, South American sub-race; Palaeo-Americans and South Americans. 22, North American sub-race; tall, mesocephalic. 23, Central American race; short, brachycephalic. 24, Patagonian race; tall, brachycephalic. 25, Eskimo race; short, dolichocephalic.

Farrand speaks of physical, linguistic, geographic, and cultural criteria, the first two the more exact, the latter more convenient and sometimes the only feasible bases.

Culture provinces.

Zoologists divide the earth into biological areas or regions, so both archaeologists and ethnologists may find it convenient to have in mind some such scheme of provinces as the following, named partly after the dominant ethnic groups:—Eskimo, on Arctic shores; Déné (Tinneh), in north-western Canada; Algonquin-Iroquois, Canada and eastern United States; Sioux, plains of the west; Muskhogee, Gulf States; Tlinkit-Haida, North Pacific coast; Salish-Chinook, Fraser-Columbia coasts and basins; Shoshoni, interior basin; California-Oregon, mixed tribes; Pueblo province, south-western United States and northern Mexico; Nahuatla-Maya, southern Mexico and Central America; Chibcha-Kechua, the Cordilleras of South America; Carib-Arawak, about Caribbean Sea; Tupi-Guarani, Amazon drainage; Araucanian, Pampas; Patagonian, peninsula; Fuegian, Magellan Strait. It is necessary to use geographical terms in the case of California and the North Pacific, the Caucasus or *cloaca gentium* of the western hemisphere, where were pocketed forty out of one hundred or more families of native tribes. The same is true in a limited sense of Matto Grosso. That these areas had deep significance for the native races is shown by the results, both in biology and culture. The presence or absence of useful minerals, plants and animals rendered some congenial, others unfriendly; some areas were the patrons of virile occupations, others of feminine pursuits.

Language.

Among the languages of America great differences exist in the sounds used. A collection of all the phonetic elements exhausts the standard alphabets and calls for new letters. A comparison of one family with another shows also that some are vocalic and soft, others wide in the range of sounds, while a third set are harsh and guttural, the speaking of them (according to Payne) resembling coughing, barking and sneezing. Powell also thinks that man lived in America before he acquired articulate speech. The utterance of these speech elements in definite order constitutes the roots and sentences of the various tongues. From the manner of assemblage, all American languages are agglutinative, or holophrastic, but they should not be called polysynthetic or incorporative or inflexional. They were more or less on the way to such organized forms, in which the world's literatures are preserved. As in all other languages, so in those of aboriginal America, the sentence is the unit. Words and phrases are the organic parts of the sentence, on which, therefore, the languages are classified. It is on this basis of sentential elements that Powell has arranged the linguistic families of North America. He has brought together, in the Bureau of American Ethnology in Washington, many hundreds of manuscripts, written by travellers, traders, missionaries, and scholars; and, better still, in response to circulars, carefully prepared vocabularies, texts and long native stories have been written out by trained collectors. A corps of specialists—Boas, Dall, Dorsey, Gatschet, Hewitt, Mooney, Pilling, J. R. Swanton—have studied many of these languages analytically and comparatively. Other institutional investigations have been prosecuted, the result of all which will be an intelligent comprehension of the philology of a primitive race.

Linguistic families.

Attention is frequently called to the large number of linguistic families in America, nearly 200 having been named, embracing over 1000 languages and dialects. A few of them, however, occupied the greater part of lands both north and south of Panama; the others were encysted in the territory of the prevailing families, or concealed in *culs-de-sac* of the mountains. They are, through poverty of material, unclassed languages, merely outstanding phenomena. Factions separated from the parent body developed dialects or languages by contact, intermarriage and incorporation with foreign tribes. To the old-time belief that languages multiplied by splitting and colonizing, must be added the theory that languages were formerly more numerous, and that those of the Americans were formed by combining.

The families of North America, Middle America and South America are here given in alphabetical order, the prevailing ones in small capitals:—

North America.

ALGONQUIN, E. Can., N. Atlantic States, middle States, middle western States; ATHAPASCAN, N.W. Can., Alaska, Wash., Or., Cal., Ariz., Mex.; Attacapan, La.; Beothukan, Nova Scotia; CADDOAN, Tex., Neb., Dak.; Chimakuan, Wash.; Chimarikan, N. Cal.; CHIMMESYAN, Brit. Col.; CHINOOKAN, Or.; Chitimachan, La.; Chumashan, S. Cal.; Coahuiltecan, Tex.; Copehan, N. Cal.; Costanoan, Cal.; ESKIMAUAN, Arctic province; Esselenian, Cal.; IROQUOIAN, N.Y., N.C.; Kalapooian, Or.; Karankawan, Tex.; KERESAN, N. Mex.; KIOWAN, Neb.; KITUNAHAN, Brit. Col.; KOLUSCHAN, S. Alaska; KULANAPAN, Cal.; Kusan, Cal.; Lutuamian, Or.; Mariposan, Cal.; Moquelumnan, Cal.; MUSKHOGEAN, Gulf States; NATCHESAN, Miss.; Palaihnihan, Cal.; PIMAN, Ariz.; Pujunan, Cal.; Quoratean, Or.; Salinan, Cal.; SALISHAN, Brit. Col.; Sastean, Or.; SHAHAPTIAN, Or.; SHOSHONEAN, Interior Basin; SIOUAN, Mo. Valley; SKITTAGETAN, Brit. Col.; Takilman, Or.; TANYOAN, Mex.; Timuquanan, Fla.; Tonikan, Miss.; Tonkawan, Tex.; Uchean, Ga.; Waiilatpuan, Or.; WAKASHAN, Vancouver I.; Washoan, Nev.; Weitspekan, Or.; Wishoskan, Cal.; Yakonan, Or.; Yanan, Or.; Yukian, Cal.; Yuman, L. Cal.; ZUNYAN, N. Mex.

Middle America.

CHAPANECAN, Chi.; Chinantecan, Oax.; Chontalan, S. Mex.; Huatusan, Nic.; Huavean, Tehuant.; Lencan, Hon.; MAYAN, Yuc. and Guat.; NAHUATLAN, Mex.; OTOMITLAN, Cen. Mex.; Raman, Hond.; Serian, Tiburon I.; Subtiaban, Nic.; TARASCAN, Mich.; Tehuantepecan, Isthmus; Tequistlatecan, Oax.; TOTONACAN, Mex.; Triquian, S. Mex.; Ulvan, Nic.; Xicaquean, Hond.; ZAPOTECAN, Oax.; ZOQUEAN, Tehuant.

South America.

Alikulufan, T. del Fuego; Arauan, R. Purús; ARAWAKIAN, E. Andes; Atacamenyan, S. Peru; ARAUCANIAN, Pampas; AYMARAN, Peru; Barbacoan, Colombia; Betoyan, Bogota; Canichanan, Bolivia; Carahan, S. Brazil; CARIBIAN, around Caribbean Sea; Catamarenyan, Chaco; Changuinan, Panama; Charruan, Paraná R.; CHIBCHAN, Colombia; Churoyan, Orinoco R.; Coconucan, Colombia; Cunan, Panama; GUAYCURUAN.

Paraguay R.; JIVAROAN, Ecuador; KECHUAN, Peru; Laman, N.E. Peru; Lulean, Vermejo R.; Mainan, S. Ecuador; Matacoan, Vermejo R.; Mocoan, Colombia; Mosetenan, E. Bolivia; ONAN, T. del Fuego; Paniquitan, Colombia; Panoan, Ucayali R., Peru; Payaguan, Chaco; Puquinan, Titicaca L.; Samucan, Bolivia; Tacanan, N. Bolivia; TAPUYAN, Brazil; Timotean, Venezuela; TUPIAN, Amazon R.; TZONECAN, Patagonia; YAHGAN, T. del Fuego; Yuncan, Truxillo, Peru; Yurucarian, E. Bolivia; ZAPAROAN, Ecuador.

Written language was largely hierographic and heroic. The drama, the cult image, the pictograph, the synecdochic picture, the ideaglyph, were steps in a progress without a break. The warrior painted the story of conflicts on his robe only in part, to help him recount the history of his life; the Eskimo etched the prompters of his legend on ivory; the Tlinkit carved them on his totem post; the women fixed them in pottery, basketry, or blankets. At last, the central advanced tribes made the names of the abbreviated pictures useful in other connexions, and were far on the way to a syllabary. Intertribal communication was through gestures; it may be, survivals of a primordial speech, antedating the differentiated spoken languages. See publications of the *Bureau of American Ethnology*, by F. W. Hodge (1906); Farrand, *Basis of Am. History*, chap. xviii.; and Orozco y Berra, *Geografia de las lenguas, &c.* (Mexico, 1868).

Technology.

To supply their wants the Americans invented modifications in natural materials, the working of which was their industries. The vast collections in richly endowed European and American museums are the witnesses and types of these. There is danger of confounding the products of native industries. The following classes must be carefully discriminated:—(*a*) pre-Columbian, (*b*) Columbian, (*c*) pre-contact, (*d*) first contact, (*e*) post-contact, (*f*) present, and (*g*) spurious. Pre-Columbian or pre-historic material is further classified into that which had been used by Indians before the discovery, and such as is claimed to be of a prior geological period. Columbian, or 15th-century material, still exists in museums of Europe and America, and good descriptions are to be found in the writings of contemporary historians. Pre-contact material is such as continued to exist in any tribe down to the time when they were touched by the presence of the trade of the whites. In some tribes this would bring the student very near to the present time; for example, before Steinen, the Indians in Matto Grosso were in the pre-contact period. Post-contact material is genuine Indian work more or less influenced by acculturation. It is interesting in this connexion to study also first contact in its lists of articles, and the effects produced upon aboriginal minds and methods. For example, a tribe that would jump at iron arrow-heads stoutly declined to modify the shafts. Present material is such as the Indian tribes of the two Americas are making to-day. Spurious material includes all that mass of objects made by whites and sold as of Indian manufacture; some of it follows native models and methods; the rest is fraudulent and pernicious. The question whether similarities in technology argue for contact of tribes, or whether they merely show corresponding states of culture, with modifications produced by environment, divides ethnologists. (See Farrand, chap. xviii.)

Aboriginal mechanics.

The study of mechanics involves materials, tools, processes and products. No iron tools existed in America before the invasion of the whites. Mineral, vegetable and animal substances, soft and hard, were wrought into the supply of wants by means of tools and apparatus of stone, wood and bone—tools for cutting, or edged tools; tools for abrading and smoothing the surfaces of substances, like planes, rasps and sand-paper; tools for striking, that is, pounding for the sake of pounding, or for crushing and fracturing violently; perforating tools; devices for grasping and holding firmly. These varied in the different culture provinces according to the natural supply, and the presence or absence of good tool material counted for as much as the presence or absence of good substances on which to work. As a means of grading progress among the various tribes, the tool is valuable both in its working part and its hafting, or manual part. Fire drills were universal.

Besides chipped stone knives, the teeth of rodents, sharks, and other animals served an excellent purpose. In north-west America and in the Caribbean area the adze was highly developed. In Mexico, Colombia and Peru the cutting of friable stone with tough volcanic hammers and chisels, as well as rude metallurgy, obtained, but the evidences of smelting are not convincing. Engineering devices were almost wanting. The Eskimo lifted his weighted boat with sheer-legs made of two paddles; he also had a tackle without sheaves, formed by reaving a greased thong through slits cut in the hide of a walrus. The north-west coast Indians hoisted the logs that formed the plates of their house frames into position with skids and parbuckles of rope. The architectural Mexicans, Central Americans, and especially the Peruvians, had no derricks or other hoisting devices, but rolled great stones into place along prepared ways and up inclined planes of earth, which were afterwards removed. In building the fortress of Sacsahuaman, heights had to be scaled; in Tiahuanaco stones weighing 400 tons were carried seventeen miles; in the edifices of Ollantaytambo not only were large stones hauled up an ascent, but were fitted perfectly. The moving of vast objects by these simple processes shows what great numbers of men could be enlisted in a single effort, and how high a grade of government it was which could hold them together and feed them. In Arizona, Mexico and Peru, reservoirs and aqueducts prove that hydrotechny was understood. (Hodge, *Am. Anthrop.* vi. 323.)

Time-keeping devices were not common. Sun-dials and calendar monuments were known among the more advanced tribes. Fractional portions of time were gauged by shadows, and time of day indicated by the position of the sun with reference to natural features. No standards of weighing or measuring were known, but the parts of the body were the units, and money consisted in rare and durable vegetable and animal substances, which scarcely reached the dignity of a mechanism of exchange. If the interpretation of the Maya calculiform glyphs be trustworthy, these people had carried their numeral system into the hundreds of thousands and devised symbols for recording such high numbers. (See *Bulletin* 28, *Bur. Am. Ethnol.*)

Food.

The Americans were, in most places, flesh-eaters. The air, the waters and the land were their base of supplies, and cannibalism, it is admitted, was widespread. With this animal diet everywhere vegetable substances were mixed, even in the boreal regions. Where the temperature allowed, vegetable diet increased, and fruits, seeds and roots were laid under tribute. Storage was common, and also the drying of ripened fruits. The most favoured areas were those where corn and other plants could be artificially produced, and there barbaric cultures were elaborated. This farming was of the rudest kind. Plots of ground were burned over, trees were girdled, and seeds were planted by means of sharpened sticks. The first year the crop would be free from weeds, the second year only those grew whose seeds were wafted or carried by birds, the third year the crop required hoeing, which was done with sticks, and then the space was abandoned for new ground. Irrigation and terrace culture were practised at several points on the Pacific slope from Arizona to Peru. The steps along which plant and animal domestication passed upwards in artificiality are graphically illustrated in the aboriginal food quest.

Clothing and adornment.

Except in the boreal areas the breech-clout was nearly universal with men, and the cincture or short petticoat with women. Even in Mexican and Mayan sculptures the gods are arrayed in gorgeous breech-clouts. The foot-gear in the tropics was the sandal, and, passing northward, the moccasin, becoming the long boot in the Arctic. Trousers and the blouse were known only among the Eskimo, and it is difficult to say how much these have been modified by contact. Leggings and skin robes took their place southward, giving way at last to the nearly nude. Head coverings also were gradually tabooed south of the 49th parallel. Tattooing and painting the body were well-nigh universal. Labrets, *i.e.* pieces of bone, stone, shell, &c., were worn as ornaments in the lip (Latin, *labrum*) or cheek by Eskimo, Tlinkit, Nahuatlas and tribes on the Brazilian coast. For ceremonial purposes all American tribes were expert in the masquerade and dramatic apparel. A study of these in the

AMERICA

PLATE III.

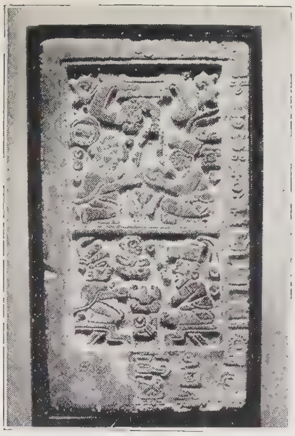
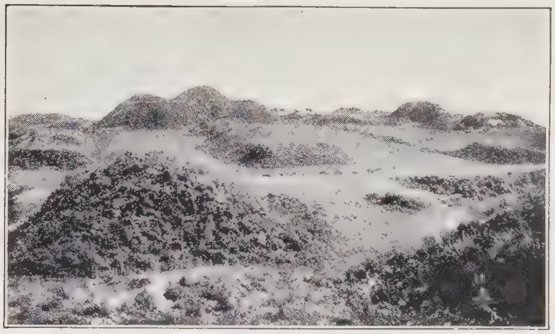


FIG. 1.—Stone Tablet with seated figures, and characteristic hieroglyphs (undeciphered). From Monte Alban, Oaxaca. Zapotecan culture.



Photo, Waite, Mexico

FIG. 2.—General View of the Ruins of Monte Alban, Oaxaca, with terraced pyramids. Zapotecan culture.

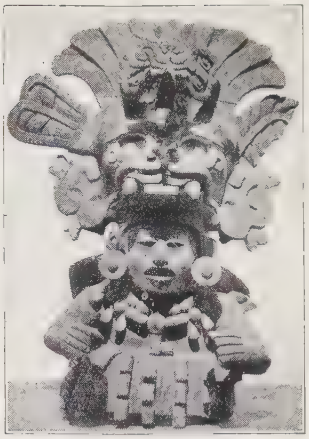


FIG. 3.—Sepulchral Clay Urn, with beast mask and rich head ornament. Oaxaca. Zapotecan culture.

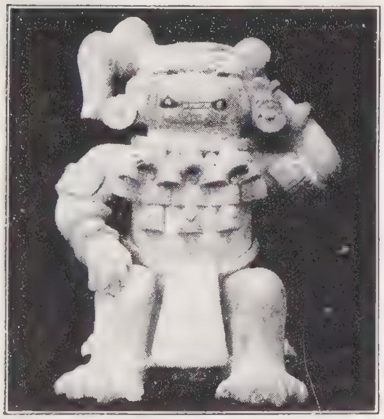


FIG. 4.—Sepulchral Clay Urn, in the form of a jaguar-like human figure, with shell ornament and loin-cloth. Oaxaca. Zapotecan culture.

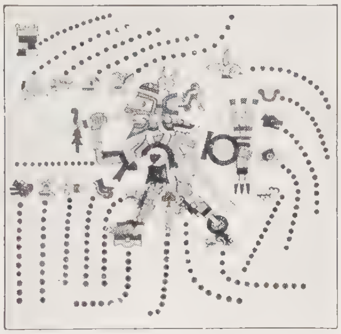


FIG. 5.—Leaf 44 of *Codex Fejerváry Mayer.* Figure of the god Tezcatlipoca, surrounded by the 20 day symbols of the sacred cycle of 260 days, *tonalamatl.* Mexican culture with Mayan influence.
(*From publications of the Duke of Loubat.*)

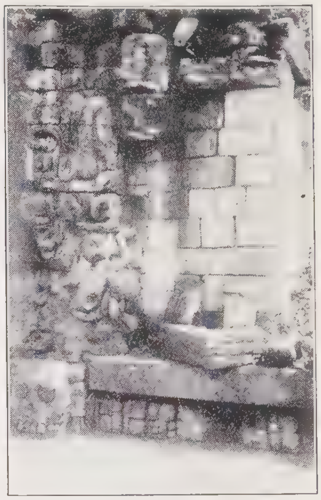


FIG. 6.—Temple Chamber, with richly carved wall facing and hieroglyph groups beneath the plinth. Copan, Honduras. Mayan culture.

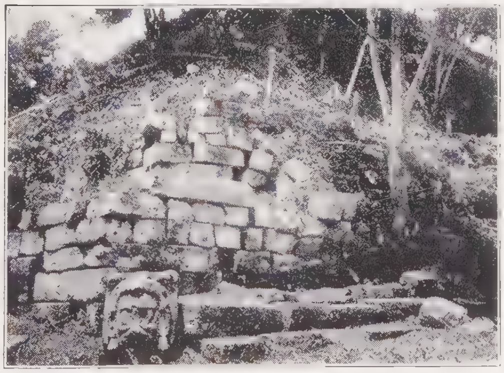
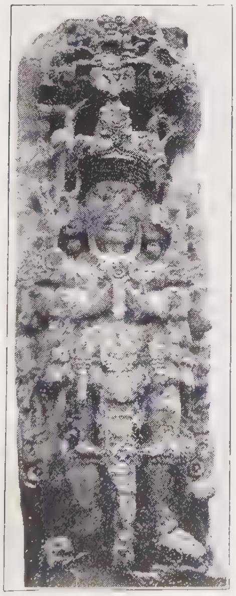


FIG. 7.—Temple Pyramid, with sculptured cornerstone at base. Copan, Honduras. Mayan culture.



G. 8.—Stone Stele, with richly decorated human figure, the hands meeting across the breast. Copan, Honduras. Mayan culture.

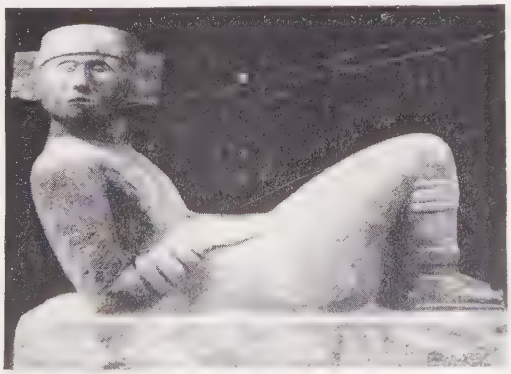


FIG. 9.—Stone Figure of the so-called Chac̄-Mol type, with round vessel resting on the body and characteristic breastplate. Chi-chen-itza, Yucatan. Proto-Mexican culture.

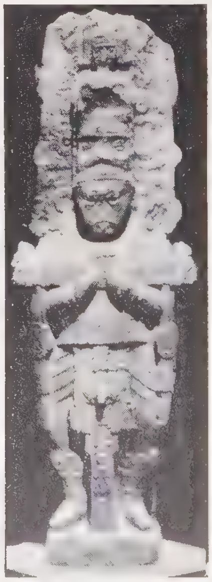


FIG. 10.—Stone Stele with human figure Chiapas, Mexico. Mayan culture.

PLATE IV.

AMERICA

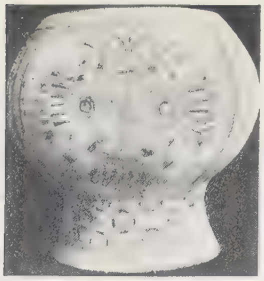


FIG. 1.—Polychrome Clay Bowl, with incised curves and figure of the earth monster. Necropolis of Santa Barbara, Guanacaste, Costa Rica. Mexican culture.

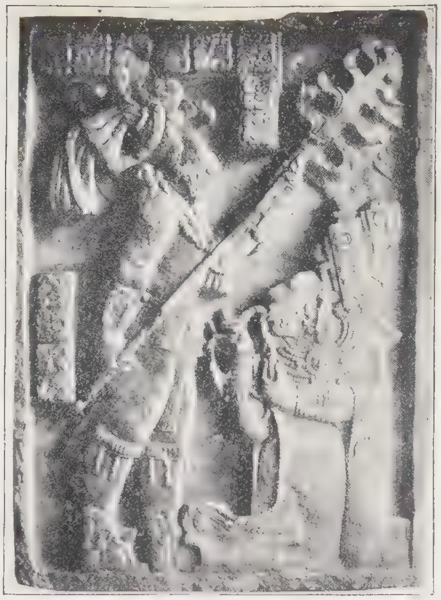


FIG. 2.—Stone Relief, with figure of a penitent (*çaca-quixtiani*) passing through his tonguea thong studded with thorns. It is accompanied by two groups of hieroglyphs. Lorillard City, Chiapas, Mexico. Mayan culture.

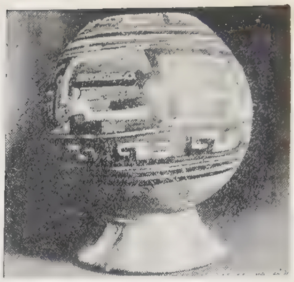


FIG. 3.—Polychrome Clay Bowl, with maeander border and stencilled figures in three fields. Santa Barbara Necropolis. Guanacaste. Chorotega culture.

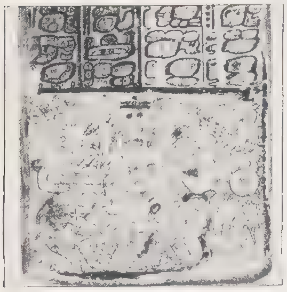


FIG. 4.—Lower Portion of Leaf 60 of *Codex Dresdensis*, with figures of four deities and groups of hieroglyphs on Agave paper. Mayan culture.
From E. Färstmann, 1892.

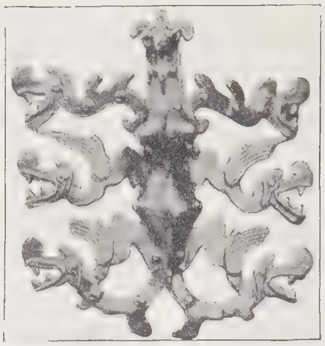


FIG. 5.—Gold Breast Ornament from the grave of a chief, in the form of a crocodile with three reptiles on each side. S. E. Costa Rica (El General), Central America. Culture of the Coto and Quepo.

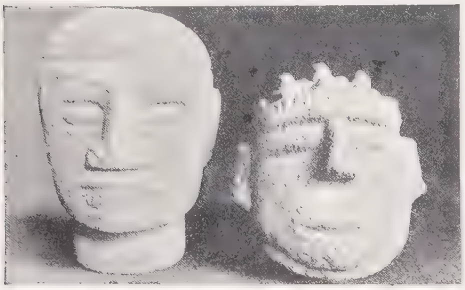


FIG. 6.—Two Typical Stone Sculptures in the form of human heads, with characteristic ornaments. Interior of Costa Rica, Central America. Culture of the Guëtar.

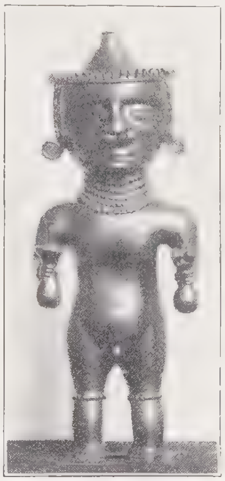


FIG. 7.—Large Gold Human Figure, with a gold coco-flask in each hand; gold diadem, nose and ear ornaments, and chains on neck and legs. Antioquia, Columbia. Chibcha culture.

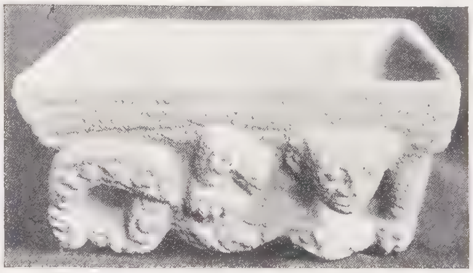


FIG. 8.—Stone Vessel supported by prone Human Figure. Interior of Costa Rica, Central America. Culture of the Guëtar.

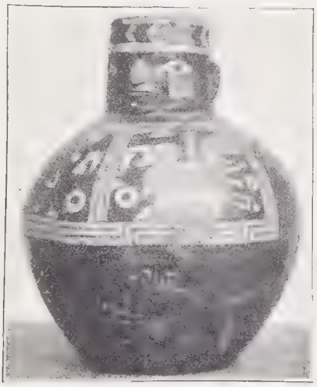


FIG. 9.—Painted Clay Vessel in polychrome, with neck in form of a human face with tear marks. Beneath a stencilled bird resembling a condor. Tiahuanaco style. Pachacamac, Peru. Pre-Inca culture.

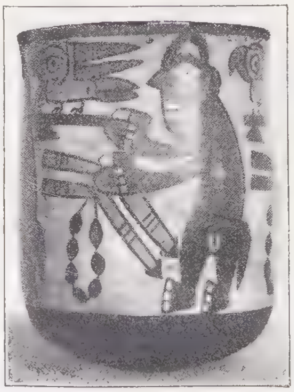


FIG. 10.—Painted Clay Vessel in polychrome on white stucco ground. A human figure with pearl chain and arrows in left hand, and parrot on a wooden stick in the right. Nasca style. Nasca, Peru. Pre-Inca culture.

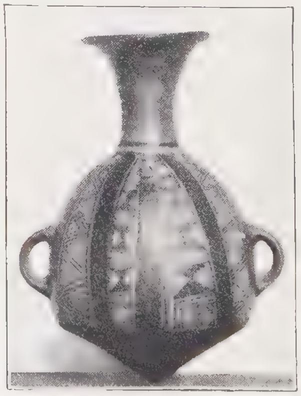


FIG. 11.—Typical painted Clay Vessel, with geometric pattern, standing on a conical point. Cuzco style. Cuzco, Peru.

historic tribes makes plain the motives in gorgeous Mexican sculptures.

Habitation.

The tribal system of family organization, universal in America, dominated the dwelling. The Eskimo underground houses of sod and snow, the Déné (Tinneh) and Sioux bunch of bark or skin wigwams, the Pawnee earth lodge, the Iroquois long house, the Tlinkit great plank house, the Pueblo with its honeycomb of chambers, the small groups of thatched houses in tropical America and the Patagonian toldos of skin are examples. The Indian habitation was made up of this composite abode, with whatever out-structures and garden plots were needed. A group of abodes, however joined together, constituted the village or home of the tribe, and there was added to these a town hall or large assembly structure where men gathered and gossiped, and where all dramatic and religious ceremonies were held. Powell contends that in a proper sense none of the Indian tribes was nomadic, but that, governed by water-supply, bad seasons and superstition (and discomfort from vermin must be added), even the Pueblo tribes often tore down and rebuilt their domiciles. The fur trade, the horse, the gun, disturbed the sedentary habit of American tribes. Little attention was paid to furniture. In the smoke-infested wigwam and hut the ground was the best place for sitting or sleeping. The communal houses of the Pacific coast had bunks. The hammock was universal in the tropics, and chairs of wood or stone. Eating was from the pot, with the hand or spoon. Tables, knives, forks and other prandial apparatus were as lacking as they were in the palaces of kings a few centuries before. (Morgan, *Houses and House Life*; Farrand, p. 286.)

Stone-working.

Stone-working was universal in America. The tribes quarried by means of crowbars and picks of wood and bone. They split the silicious rocks with stone hammers, and then chipped them into shape with bone tools. Soapstone for pottery was partly cut into the desired shape in the native ledge, broken or prised loose, and afterwards scraped into form. Paint was excavated with the ubiquitous digging-stick, and rubbed fine on stones with water or grease. For polished stonework the material was pecked by blows, ground with other stones, and smoothed with fine material. Sawing was done by means of sand or with a thin piece of harder stuff. Boring was effected with the sand-drill; the hardest rocks may have been pierced with specially hard sand. At any rate stones were sawed, shaped, polished, carved and perforated, not only by the Mexicans, but among other tribes. For building purposes stones were got out, dressed, carved and sculptured with stone hammers and chisels made of hard and tenacious rock. Stone-cutters' tools of metal are not known to have existed, and they were not needed. Their quarrying and stone-working were most wasteful. Those localities where chipping was done reveal hundreds of tons of splinters and failures, and these are often counted as ruder implements of an earlier time. The dressed stones for great buildings were pecked out of the ledges, and broken off with levers in pieces much too large for their needs. (McGuire, "The Stone Hammer," *Am. Anthrop.* iv., 1891; Holmes, *Archaeological Studies*; see Hodge's List, *Bur. Am. Ethnol.*, 1906, and *Handbook.*)

Metallurgy.

Metals were treated as malleable stones by the American aborigines. No evidence of smelting ores with fluxes is offered, but casting from metal melted in open fires is assumed. Gold, silver, copper, pure or mixed with tin or silver, are to be found here and there in both continents, and nuggets were objects of worship. Tools and appliances for working metals were of the rudest kind, and if moulds for casting were employed these were broken up; at least no museum contains samples of them, and the processes are not described. In the Arctic and Pacific coast provinces, about Lake Superior, in Virginia and North Carolina, as well as in ruder parts of Mexico and South America, metals were cold-hammered into plates, weapons, rods and wire, ground and polished, fashioned into carved blocks of hard, tenacious stone by pressure or blow, overlaid, cold-welded and plated. Soldering, brazing and the blowpipe in the Cordilleran provinces are suspected, but the evidence of their existence must be further examined. A deal of study has been devoted to the cunning Tubal Cains, the surprising productions of whose handiwork have been recovered in the art provinces of Mexico and the Cordilleras, especially in Chiriqui, between Costa Rica and Colombia. It must be admitted, however, that both the tools and the processes have escaped the archaeologist, as they did "the ablest goldsmiths in Spain, for they never could conceive how they had been made, there being no sign of a hammer or an engraver or any other instrument used by them, the Indians having none such" (Herrera).

Pottery.

The potter's wheel did not exist in the western world, but it was almost invented. Time and muscle, knack and touch, a trained eye and brain and an unlimited array of patterns hanging on fancy's walls, aided by a box of dry sand, were competent to give the charming results. No more striking contrast can be found between forlorn conditions and refined art products. Art in clay was far from universal in the two Americas. The Eskimo on Bering Sea had learned to model shallow bowls for lamps. No pottery existed in Athapascan boundaries. Algonquin-Iroquois tribes made creditable ware in Canada and eastern United States. Muskhogean tribes were potters, but Siouan tribes, as a rule, in all the Mississippi drainage were not. In their area, however, dwelt clay-working tribes, and the Mandans had the art. Moreover, the mound-builders in the eastern half of this vast plain, being sedentary, were excellent potters. The efflorescence of aboriginal pottery is to be found in the Pueblo region of south-western United States, in Mexico, Central America, Caribbean Islands, Colombia, Ecuador, Peru and restricted areas of eastern Brazil. (The literature on this subject is extensive. See Cushing, Fewkes, Holmes, Hough, Stevenson.) On the Pacific side of the continent not one of the forty linguistic families made pottery. The only workers in clay west of the Rockies and north of the Pueblo country belonged to the Shoshonean family of the Interior Basin.

Textile industries.

The study of Indian textiles includes an account of their fibres, tools, processes, products, ornaments and uses. The fibres were either animal or vegetable; animal fibres were hair, fur on the skin, feathers, hide, sinew and intestines; vegetable fibres were stalks of small trees, brush, straw, cotton, bast, bark, leaves and seed vessels in great variety as one passes from the north southward through all the culture provinces. The products of the textile industry in America were bark cloth, wattling for walls, fences and weirs, paper, basketry, matting, loom products, needle or point work, net-work, lacework and embroidery. In the manufacture of these the substances were reduced to the form of slender filaments, shreds, rods, splints, yarn, twine and sennit or braid. All textile work was done by hand; the only devices known were the bark peeler and beater, the shredder, the flint-knife, the spindle, the rope-twister, the bodkin, the warp-beam and the most primitive harness. The processes involved were gathering the raw material, shredding, splitting, gauging, wrapping, twining, spinning and braiding. Twining and spinning were done with the fingers of both hands, with the palm on the thigh, with the spindle and with the twister. Ornamentation was in form, colour, technical processes and dyes. The uses to which the textiles were put were for clothing, furniture for the house, utensils for a thousand industries, fine arts, social functions and worship.

In order to comprehend the more intricate processes of the higher peoples it is necessary to examine the textile industry in all of the culture areas. It is essentially woman's work, though among the Pueblos, strangely enough, men are weavers.

The Eskimo woman did not weave, but was expert in sewing and embroidering with sinew thread by means of a bodkin. The Déné (Tinneh) peoples used strips of hide for snowshoes and game-bags, sewed their deerskin clothing with sinew thread, and embroidered in split quill. Their basketry, both in Canada and in Arizona, was coiled work. The northern Algonquin and Iroquoian tribes practised similar arts, and in the Atlantic states wove robes of animal and bird skins by cutting the latter into long strips, winding these strips on twine of hemp, and weaving them by the same processes employed in their basketry. Textile work in the Sioux province was chiefly the making of skin garments with sinew thread, but in the Gulf states the existence of excellent cane and grasses gave opportunity for several varieties of weaving. On the Pacific coast of America the efflorescence of basketry in every form of technic was known. This art reached down to the borders of Mexico. Loom-weaving in its simplest form began with the Chilkats of Alaska, who hung the warp over a long pole, and wrought mythological figures into their gorgeous blankets by a process resembling tapestry work. The forming of bird skins, rabbit skins and feathers into robes, and all basketry technic, existed from Vancouver Island to Central America. In northern Mexico net-work, rude lace-work in twine, are followed farther south, where finer material existed, by figured weaving of most intricate type and pattern; warps were crossed and wrapped, wefts were omitted and texture changed, so as to produce marvellous effects upon the surface. This composite art reached its climax in Peru, the llama wool affording the finest staple on the whole hemisphere. Textile work in other parts of South America did not differ from that of the Southern states of the Union. The addition of brilliant ornamentation in shell, teeth, feathers, wings of insects and dyed fibres completed the round of the textile art. A peculiar type of coiled basketry is found at the Strait of Magellan, but the motives are not American. (Consult the works of Boas, Dixon, G. T. Emmons, Holmes, Otis T. Mason, Matthews, John Murdoch, E. W. Nelson, A. P. Niblack, Lucien M. Turner.)

Zootechny.

Since most American tribes lived upon flesh, the activities of life were associated with the animal world. These activities were not confined to the land, but had to do also with those littoral meadows where invertebrate and vertebrate marine animals fed in unlimited numbers. An account of savage life, therefore, includes the knowledge of the animal life of America and its distribution, regarding the continent, not only as a whole, but in those natural history provinces and migrations which governed and characterized the activities of the peoples. This study would include industries connected with capture, those that worked up into products the results of capture, the social organizations and labours which were involved in pursuit of animals, the language, skill, inventions and knowledge resulting therefrom, and, finally, the religious conception united with the animal world, which has been named zootheism. In the capture of animals would be involved the pedagogic influence of animal life; the engineering embraced in taking them in large numbers; the cunning and strategy necessary to hunters so poorly armed giving rise to disguises and lures of many kinds. Capture begins among the lower tribes with the hand, without devices, developing knack and skill in seizing, pursuing, climbing, swimming, and maiming without weapons; and proceeds to gathering with devices that take the place of the hand in dipping, digging, hooking and grasping; weapons for striking, whether clubs, missiles or projectiles; edged weapons of capture, which were rare in America; piercing devices for capture, in lances, barbed spears, harpoons and arrows; traps for enclosing, arresting and killing, such as pens, cages, pits, pen-falls, nets, hooks, nooses, clutches, adhesives, deadfalls, impalers, knife traps and poisons; animals consciously and unconsciously aiding in capture; fire in the form of torches, beacons, burning out and smoking out; poisons and asphyxiators; the accessories to hunting, including such changes in food, dress, shelter, travelling, packing, mechanical tools and intellectual apparatus as demanded by these arts. Finally, in this connexion, the first steps in domestication, beginning with the improvement of natural corrals or spawning ground, and hunting with trained dogs and animals. Zootechnic products include food, clothing, ornaments, habitations, weapons, industrial tools, textiles, money, &c.

In sociology the dependence of the American tribes upon the animal world becomes most apparent. A great majority of all the family names in America were from animal totems. The division of labour among the sexes was based on zootechny. Labour organizations for hunting, communal hunt and migrations had to do with the animal world.

In the duel between the hunter and the beast-mind the intellectual powers of perception, memory, reason and will were developed; experience and knowledge by experience were enlarged, language and the graphic arts were fostered, the inventive faculty was evoked and developed, and primitive science was fostered in the unfolding of numbers, metrics, clocks, astronomy, history and the philosophy of causation. Beliefs and practices with reference to the heavenly world were inspired by zoic activities; its location, scenery and environment were the homes of beast gods. It was largely a zoopantheon; thus zootheism influenced the organization of tribes and societies in the tribes. The place, furniture, liturgies and apparatus of worship were hereby suggested. Myths, folk-lore, hunting charms, fetishes, superstitions and customs were based on the same idea. (For life zones, see C. H. Merriam, *Biol. Survey, U. S. Dept. of Agriculture.*)

Travel.

Excepting for extensive and rapid travel over the snow in the Arctic regions by means of dog sleds, the extremely limited transportation by dog travail (or sledge) in the Sioux province, and the use of the llama as a beast of burden throughout the Peruvian highlands, land travel was on foot, and land transportation on the backs of men and women. One of the most interesting topics of study is the trails along which the seasonal and annual migrations of tribes occurred, becoming in Peru the paved road, with suspension bridges and wayside inns, or tambos. In Mexico, and in Peru especially, the human back was utilized to its utmost extent, and in most parts of America harness adapted for carrying was made and frequently decorated with the best art. In the Mexican codices pictures of men and women carrying are plentiful. Travelling on the water was an important activity in aboriginal times. Hundreds of thousands of miles of inland waters and archipelagoes were traversed. Commencing in the Arctic region, the Eskimo in his kayak, consisting of a framework of driftwood or bone covered with dressed sealskin, could paddle down east Greenland, up the west shore to Smith Sound, along Baffin Land and Labrador, and the shores of Hudson Bay throughout insular Canada and the Alaskan coast, around to Mount St Elias, and for many miles on the eastern shore of Asia. In addition to this most delicate and rapid craft, he had his umiak or freight boat, sometimes called woman's boat. The Athapascan covered all north-western Canada with his open and portable birch-bark canoe, somewhat resembling the kayak in finish. The Algonquin-Iroquois took up the journey at Bear Lake and its tributaries, and by means of paddling and portages traversed the area of middle and eastern Canada, including the entire St Lawrence drainage. The absence of good bark, dugout timber, and chisels of stone deprived the whole Mississippi valley of creditable water-craft, and reduced the natives to the clumsy trough for a dugout and miserable bull-boat, made by stretching dressed buffalo hide over a crate. On the Atlantic coast of the United States the dugout was improved in form where the waters were more disturbed. John Smith's Indians had a fleet of dugouts. The same may be said of the Gulf states tribes, although they added rafts made of reed. Along the archipelagoes of the North Pacific coast, from Mount St Elias to the Columbia river, the dugout attained its best. The Columbia river canoe resembled that of the Amur, the bow and stern being pointed at the water-line. Poor dugouts and rafts, made by tying reeds together, constituted the water-craft of California and Mexico until Central America is reached.

The Caribs were the Haidas of the Caribbean Sea and northern South America. Their craft would vie in form, in size, and seaworthiness with those of the North Pacific coast. The catamaran and the reed boat were known to the Peruvians. The tribes of Venezuela and Guiana, according to Im Thurn, had both the dugout and the built-up hull. The simplest form of navigation in Brazil was the woodskin, a piece of bark stripped from a tree and crimped at the ends. The sangada, with its platform and sail, belonging to the Brazilian coast, is spoken of as a good seaworthy craft. Finally, the Fuegian bark canoe, made in three pieces so that it can be taken apart and transported over hills and sewed together, ends the series. The American craft was propelled by poling, paddling, rowing, and by rude sails of matting.

Fine art.

The aesthetic arts of the American aborigines cannot be studied apart from their languages, industries, social organizations, lore and worships. Art was limited most of all by poverty in technical appliances. There were just as good materials and inspirations, but what could the best of them do without metal tools? One and all skilful to a surpassing degree —weavers, embroiderers, potters, painters, engravers, carvers, sculptors and jewellers,—they were wearied by drudgery and overpowered by a never-absent, weird and grotesque theology. The Eskimo engraved poorly, the Déné (Tinneh) embroidered in quill, the North Pacific tribes carved skilfully in horn, slate and cedar, the California tribes had nimble fingers for basketry, the Sioux gloried in feathers and painted parfleche. The mound builders, Pueblo tribes, middle Americans and Peruvians, were potters of many schools; gorgeous colour fascinated the Amazonians, the Patagonians delighted in skins, and even the Fuegians saw beauty in the pretty snail shells of their desolate island shores. Of the Mexican and Central American sculpture and architecture a competent judge says that Yucatan and the southern states of Mexico are not rich in sculptures, apart from architecture; but in the valley of Mexico the human figure, animal forms, fanciful life motives in endless variety, were embodied in masks, yokes, tablets, calendars, cylinders, disks, boxes, vases and ornaments. The Nahuatl lapidaries had at hand many varieties of workable and beautiful stone—onyx, marble, limestone, quartz and quartz crystal, granite, syenite, basalt, trachyte, rhyolite, diorite and obsidian, the best of material prepared for them by nature; while the Mayas had only limestone, and hard, tenacious rock with which to work it, and timber for burning lime. However, looking over the whole field of North American achievement, architectural and non-architectural, composite and monolithic, the palm for boldness, magnitude of proportions and infinity of labour, must go to the sculptured mosaics of Yucatan. Maya architecture is the best remaining index of the art achievements of the American race. The construction of such buildings as the palace at Uxmal and the castillo at Chichen (Chichenitza) indicates a mastery in architectural design. There is lack of unity in plan and grouping, and an enormous waste of material as compared with available room. At Uxmal the mass of masonry is to chamber space about as forty to one. The builders were "ignorant of some of the most essential principles of construction, and are to be regarded as hardly more than novices in the art" (Holmes, *Archaeological Studies*, &c.). As for the marvels of Peru, the walls of the temple of the sun in Cuzco, with their circular form and curve inward, from the ground upward, are most imposing. Some of the gates without lintels are beautiful, and the geometric patterns in the walls extremely effective. The same objection to over-massiveness might not apply here as in Mexico, owing to volcanic activity.

Sociology.

Institutions in Europe and America have gathered abundant material for an intelligent comprehension of American Indian sociology. The British Association had a committee reporting during many years on the tribes of north-west Canada. The American Museum in New York has prepared a series of monographs on the tribes of the North Pacific coast, of northern Mexico, and of the Cordilleras of South America. The reports of the Bureau of American Ethnology in Washington cover the Eskimo, east and west, and all the tribes of the United States. In Mexico the former labours of Pimentel and Orozco y Berra are supplemented by those of Bandelier, Peñafiel, Herrera and Alfredo Chavero. Otto Stoll's studies in Guatemala, Berendt's in Central America, Ernst's in Venezuela, Im Thurn's in Guiana, those of Ehrenreich, von den Steinen, Meyer in Brazil, or of Bandelier, Bastian, Brühl, Middendorf, von Tschudi in Peru, afford the historian of comparative sociology ample groundwork for a comprehensive grasp of South American tribes. In all parts of the western hemisphere society was organized on cognate kinship, real or artificial, the unit being the clan. There were tribes where the basis of kinship was agnate, but these were the exceptions. The headship of the clan was sometimes hereditary, sometimes elective, but each clan had a totemic name, and the clans together constituted the tribe, the bond being not land, but blood. Women could adopt prisoners of war, in which case the latter became their younger sons. When a confederacy was organized under a council, intermarriage between tribes sometimes occurred; an artificial kinship thus arose, in which event the council established the rank of the tribes as elder and younger brother, grandfather, father and sons, rendering the relationship and its vocabulary most intricate, but necessary in a social system in which age was the predominant consideration and etiquette most exacting. (See Morgan, *Tables of Consanguinity*, Smithsonian Contributions, xvii.)

The Eskimo have a regular system of animal totem marks and corresponding gentes. Powell sets forth the laws of real and artificial kinship among the North American tribes, as well as tribal organization and government, the formation of confederacies, and the intricate rules of artificial kinship by which rank and courtesy were established. (Many papers in *Reports of Bur. Am. Ethnol.*) Bandelier declares that in Mexico existed neither state nor nation, nor political society of any kind, but tribes representing dialects, and autonomous in matters of government, and forming confederacies for the purposes of self-defence and conquest. The ancient Mexican tribe was composed of twenty autonomous kins. According to Brinton the social organization of ancient Peru was a government by a council of the gentes. The Inca was a war chief elected by the council to carry out its commands. Among the Caribs a like social order prevailed; indeed, their family system is identical with the totem system of North American Indians. Dominated by the rule of blood relationship, the Indians regulated all co-operative activities on this basis. Not only marriage, but speech and common industries, such as rowing a boat or chasing a buffalo, were under its sway. It obtrudes itself in fine art, behaviour, law-making, lore and religion. In larger or smaller numbers of cognate kindred, for shorter or longer periods of time, near or far from home, the aborigines developed their legislatures, courts, armies, secret societies and priesthoods.

Art of war.

In organization, engineering, strategy, offence and defence, the art of war was in the barbarous and the savage status or grade. One competent to judge asserts that peace, not war, was the normal intertribal habit. They held frequent intercourse, gave feasts and presents, and practised unbounded hospitality. Through this traffic objects travelled far from home, and now come forth out of the tombs to perplex archaeologists. Remembering the organization of the tribe everywhere prevalent, it is not difficult to understand that the army, or horde, that stands for the idea, was assembled on the clan basis. The number of men arrayed under one banner, the time during which they might cohere, the distances from home they could march, their ability to hold permanently what they had gained, together form an excellent metric scale of the culture grade in the several American provinces, and nowhere, even in the most favoured, is this mark high. With the Mexicans war was a passion, but warfare was little above the raid (Bandelier; Farrand). The lower tribes hunted their enemies as they hunted animals. In their war dances, which were only rehearsals, they disguised themselves as animals, and the pantomime was a mimic hunt. They had striking, slashing and piercing weapons held in the hand, fastened to a shaft or thong, hurled from the hand, from a sling, from an atlatl or throwing-stick, or shot from a bow. Their weapons were all individual, not one co-operative device of offence being known among them, although they understood fortification.

The term "slavery" is often applied to the aboriginal American tribes. The truth of this depends upon the definition of the word "slave." If it means the capture of men, and especially of women, and adoption into the tribe, this existed everywhere; but if subjection to a personal owner, who may compel service, sell or put to death the individual, slavery was far from universal. Nieboer finds it only on the North Pacific coast as far south as Oregon, among the Navajo and the Cibola pueblos, and in a few tribes of Middle and South America.

The thought life of the American aborigines is expressed in their practical knowledge and their lore. The fascination which hangs around the latter has well-nigh obscured the former. As in medicine theory is one thing and practice another, so among these savages must the two be carefully discriminated. **Lore.** Dorsey, again, draws a distinction between lore narratives, which can be rehearsed without fasting or prayer, and rituals which require the most rigid preparation. In each culture province the Indians studied the heavenly bodies. The Arctic peoples regulated their lives by the long day and night in the year; among the tribes in the arid region the place of sunrise was marked on the horizon for each day; the tropical Indians were not so observant, but they worshipped the sun-god above all. The Mayas had a calendar of 360 days, with intercalary days; this solar year was intersected by their sacred year of twenty weeks of thirteen days each, and these assembled in bewildering cycles. Their knowledge of the air and its properties was no less profound. Heat and cold, rain and drought, the winds in relation to the points of the compass, were nearest their wants and supplies, and were never out of their thoughts. In each province they had found the best springs, beds of clay, paint, soapstone, flinty rock, friable stone for sculpture and hard, tenacious stone for tools, and used ashes for salt. The vegetal kingdom was no less familiar to them. Edible plants, and those for dyes and medicines, were on their lists, as well as wood for tools, utensils and weapons, and fibres for textiles. They knew poisonous plants, and could eliminate noxious properties. The universal reliance on animal life stimulated the study of the animal kingdom. Everywhere there were names for a large number of species; industries and fine arts were developed through animal substances. Society was organized in most cases on animal clans, and religion was largely zoomorphic. The hunting tribes knew well the nature and habits of animals, their anatomy, their migrations, and could interpret their voices. Out of this practical knowledge, coupled with the belief in personeity, grew a folk-lore so vast that if it were written down the world would not contain the books.

The religion of the American aborigines, so far as it can be made a subject of investigation, consisted (1) in what the tribes believed about spirits, or shades, and the spirit world—its organization, place, activities and relation to our world; **Religion.** and (2) in what they did in response to these beliefs. The former was their creeds, the latter their cults or worships. In these worships, social organization, religious dramas and paraphernalia, amusement and gambling, and private religion or fetichism, found place. In order to obtain an intelligent grasp of the religion of tribes in their several culture provinces, it must be understood: (1) That the form of belief called *animism* by Tylor (more correctly speaking, *personeity*), was universal; everything was somebody, alive, sentient, thoughtful, wilful. This personeity lifts the majority of earthly phenomena out of the merely physical world and places them in the spirit world. Theology and science are one. All is supernatural, *wakañ*. (2) That there existed more than one self or soul or shade in any one of these personalities, and these shades had the power not only to go away, but to transform their bodily tenements at will; a bird, by raising its head, could become a man; the latter, by going on all fours, could become a deer. (3) That the regulative side of the spirit world was the natural outcome of the clan social system and the tribal government in each tribe. Even one's personal name had reference to the world of ghosts. The affirmation that American aborigines believed in an all-pervading, omnipotent Spirit is entirely inconsistent with the very nature of the case. (4) Worship was everywhere dramatic. Only here and there among the higher tribes were bloody sacrifices in vogue, and prayers were in pantomime.

In the culture areas the environment gave specific characters to the religion. In the Arctic province the overpowering influence of meteorological phenomena manifested itself both in the doctrine of shades and in their shamanistic practices. The raven created the world. The Déné (Tinneh) myths resembled those of the Eskimo, and all the hunting tribes of eastern Canada and United States and the Mississippi valley have a mythology based upon their zootechny and their totemism. The religious conceptions of the fishing tribes on the Pacific coast between Mount St Elias and the Columbia river are worked out by Boas; the transformation from the hunting to the agricultural mode of life was accompanied by changes in belief and worship quite as radical. These have been carefully studied by Cushing, Stevenson and Fewkes. The pompous ceremonials of the civilized tribes of Mexico and the Cordilleras in South America, when analysed, reveal only a higher grade of the prevailing idea. Im Thurn says of the Carib: "All objects, animate and inanimate, seem exactly of the same nature, except that they differ in the accident of bodily form." These mythological ideas and symbols of the American aborigines were woven in their textiles, painted on their robes and furniture, burned into their pottery, drawn in sand mosaics on deserts, and perpetuated in the only sculptures worthy of the name, in wood and stone. They are inseparable from industry; language, social organization and custom wait upon them: they explain the universe in the savage mind.

The archaeology of the western hemisphere should be divided as follows: (1) that of Indian activities; (2) the question of man's existence in a prior geological period. There is no dividing line between first-contact ethnology and **Archaeology.** pre-contact archaeology. Historians of this time, both north and south of Panama, described tools and products of activities similar to those taken from beneath the soil near by. The archaeologist recovers his specimens from waste places, cave deposits, abandoned villages, caches, shell-heaps, refuse-heaps, enclosures, mounds, hut rings, earthworks, garden beds, quarries and workshops, petroglyphs, trails, graves and cemeteries, cliff and cavate dwellings, ancient pueblos, ruined stone dwellings, forts and temples, canals or reservoirs. The relics found in these places are material records of language, industries, fine arts, social life, lore and religion.

Here and there in the Arctic province remains of old village sites have been examined, and collections brought away by whalers and exploring expeditions. Two facts are established—namely, that the Eskimo lived formerly farther south on the Atlantic coast, and that, aboriginally, they were not specially adept in carving and etching. The old apparatus of hunting and fishing is quite primitive. The Déné (Tinneh) province in Alaska and north-western Canada yields nothing to the spade. Algonquin-Iroquois Canada, thanks to the Geological Survey and the Department of Education in Ontario, has revealed old Indian camps, mounds and earthworks along the northern drainage of Lakes Erie and Ontario, and pottery in a curved line from Montreal to Lake of the Woods. Throughout eastern United States shell-heaps, quarries, workshops and camp sites are in abundance. The Sioux and the Muskhogee province is the mound area, which extends also into Canada along the Red river. The forms of these are earth-heaps, conical mounds, walls of earth, rectangular pyramids and effigies (Putnam). Thomas sums up the work of the Bureau of American Ethnology upon the structure, contents and distribution of these earth monuments, over a vast area from which adobe, building stone and stone-working material were absent. (See Hodge's *List of Pubs. of the Bur. Am. Ethnol.*) No writings have been recovered, the artisans shaping small objects in stone were specially gifted, the potters in only a few places approached those of the Pueblos, the fine art was poor, and relics found in the mounds do not indicate in their makers a grade of culture above that of the Indian tribes near by. The archaeology of the Pacific coast, from the Aleutian Islands, is written in shell-heaps, village sites, caves, and burial-places (Dall, Harlan I. Smith, Schumacher). The relics of bone, antler, stone, shell and copper are of yesterday. Even the Calaveras man is no exception, since his skull and his polished conical pestle, the latter made of stone more recent than the auriferous gravels, show him to have been of Digger Indian type. In Utah begin the ruins of the Pueblo culture. These cover Arizona and New Mexico, with extensions into Colorado on the north and Mexico on the south. The reports of work done in this province for several years past form a library of text and illustration. Cliff dwellings, cavate houses, pueblos and casas are all brought into a series without a break by Bandelier, Cushing, Fewkes, Holmes, Hough,

AMERICA

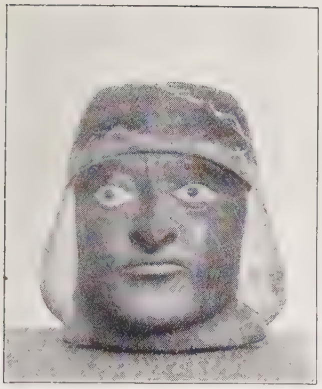


FIG. 1.—Reddish Brown Clay Vessel, in the form of a human head (portrait). Trujillo style. Chimboto, Peru. Inca culture.

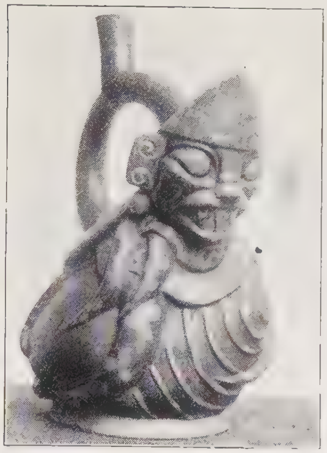


FIG. 2.—Red Clay Vessel, in the form of a demon shaped like a crab upon a mussel. Trujillo style. Chimboto, Peru. Inca culture.

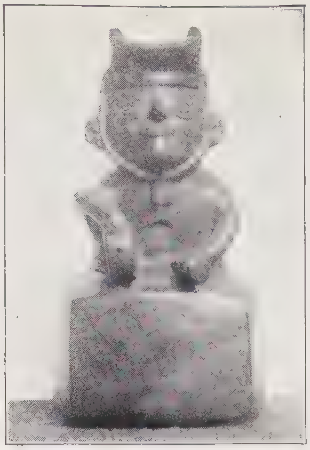


FIG. 3.—Black Clay Vessel, in the form of a human figure, with peculiar head-gear. Trujillo, Peru. Inca culture.

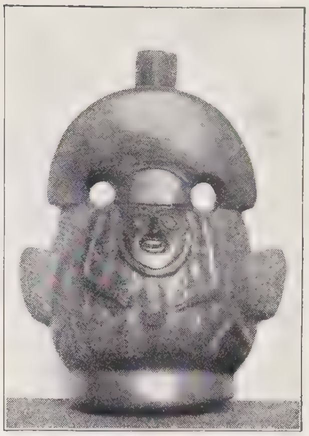


FIG. 4.—Black Clay Vessel, in the form of a human figure, with large head-gear and ornamentation of maize-cobs. Trujillo, Peru. Inca culture.

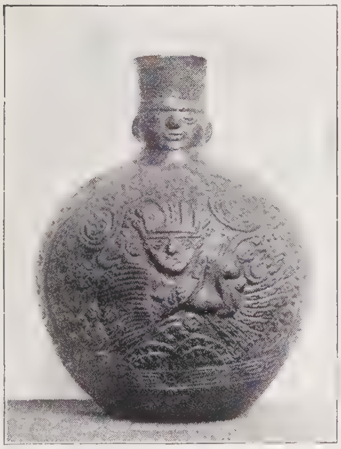


FIG. 5.—Red-Brown Clay Flask, with impressed relief representing a mythological scene. Supe, Peru.

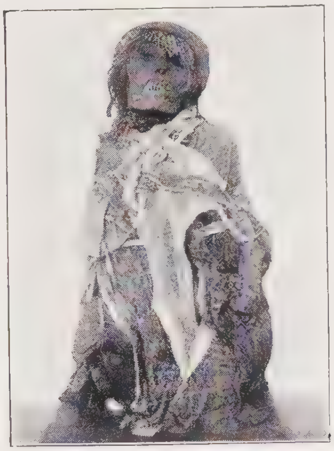


FIG. 6.—Female Mummy, with mantle of feathered mosaic; neckband, shawls, hair-net, head-wrap over tassels of parrot feathers. Peru. Inca culture.

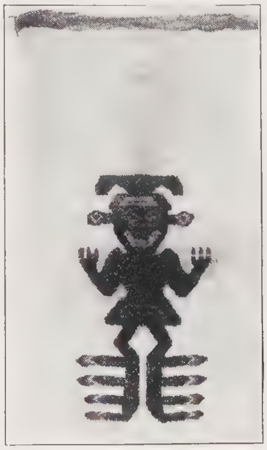


FIG. 7.—Textile Fabric, with stencilled human figure; colours, black, red-brown and yellow. Peru. Inca culture.

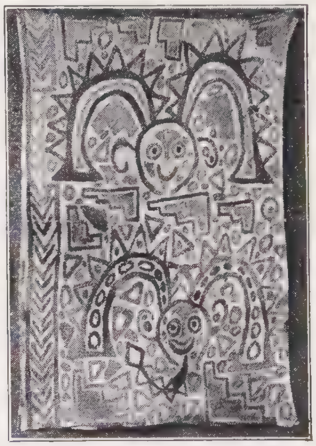


FIG. 8.—Coloured Textile Fabric, with picture writing. Peru.

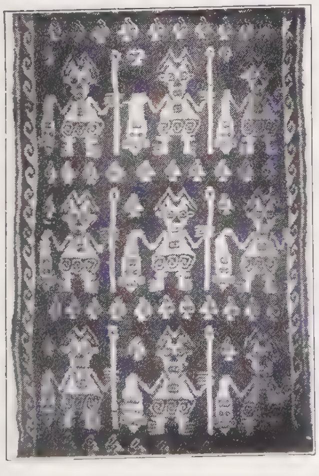


FIG. 9.—Textile Fabric in brown and yellowish white, with figures of birds and men holding staves and head trophies. Inca style. Peru.

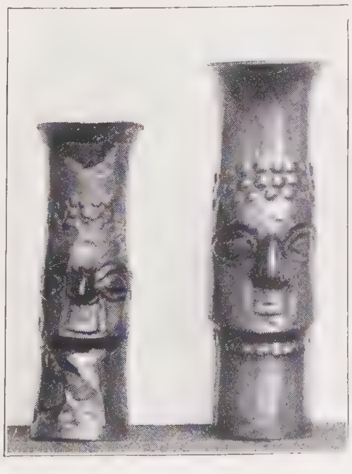


FIG. 10.—Two Gold Beakers, with human faces. Peru. Inca culture.

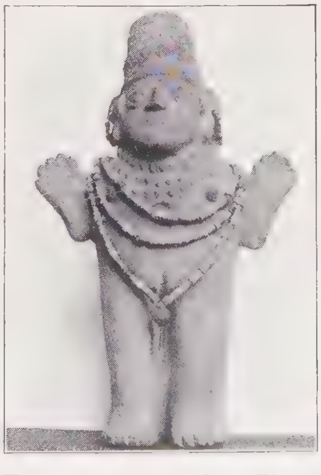


FIG. 11.—Human Clay Figure, with bead chain of mussel shells and of Venetian glass in the ears and on the neck; 1st period of Spanish conquest. Chancay, Peru.

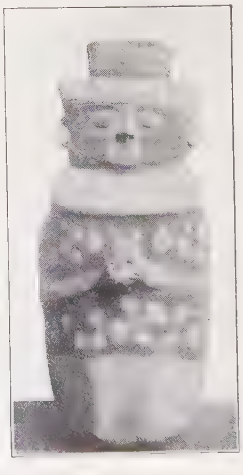


FIG. 12.—Black-Painted Clay Vessel, in form of a human figure holding a mussel. Chancay, Peru.

Mindeleff, Nordenskjöld, Powell and Stevenson. From Casa Grande, in Chihuahua, to Quemada, in Zacatecas, Carl S. Lumholtz found survivals of the cliff dwellers. Between Quemada and Copan, in Honduras, is an unbroken series of mural structures. The traditions agree with the monuments, whatever may be objected to assigning any one ruin to the Toltec, the Chichimec or the Nahuatl, that there are distinct varieties in ground-plan, motives, stone-craft, wall decorations and sculptures. Among these splendours in stone the following recent explorers must be the student's guide:—Bowditch, Charnay, Förstemann, F. T. Goodman, Gordon, Holmes, Maudslay, Mercer, Putnam, Sapper, Marshall H. Saville, Seler, Cyrus Thomas, Thompson. A list of the ruins, printed in the handbook on Mexico published by the Department of State in Washington, covers several pages. The special characteristics of each are to be seen partly in the skill and genius of their makers, and partly in the exigencies of the site and the available materials. A fascinating study in this connexion is that of the water-supply. The cenotes or underground reservoirs were the important factors in locating the ruins of northern Yucatan. From Honduras to Panama the urn burials, the pottery, the rude carved images and, above all, the grotesque jewellery, absorb the archaeologist's attention. (*Publications of Peabody Museum.*)

Beyond Chiriqui southward is El Dorado. Here also bewildering products of ancient metallurgy tax the imagination as to the processes involved, and questions of acculturation also interfere with true scientific results. The fact remains, however, that the curious metal-craft of the narrow strip along the Pacific from Mexico to Titicaca is the greatest of archaeological enigmas. Bandelier, Dorsey, Holmes, Seler and Uhle have taken up the questions anew. Beyond Colombia are Ecuador and Peru, where, in the widening of the continent, architecture, stone-working, pottery, metallurgy, textiles are again exalted. Among the Cordilleras in their western and interior drainages, over a space covering more than twenty degrees of latitude, the student comes again upon massive ruins. The materials on the coast were clay and gravel wrought into concrete, sun-dried bricks and pisé, or rammed work, cut stalks of plants formed with clay a kind of staff, and lintels were made by burying stems of caña brava (*Gynerium saccharoides*) in blocks of pisé. On the uplands structures were of stone laid up in a dozen ways. Walls for buildings, garden terraces and aqueducts were straight or sloping. Doorways were usually square, but corbelled archways and gateways surmounted with sculptures were not uncommon. Ornamentation was in carving and in colour, the latter far more effectively used than in Middle America. A glance at the exquisite textiles reveals at once the inspiration of mural decorations. The most prolific source of Peruvian relics is the sepulchres or huacas, the same materials being used in their construction as in building the houses. Here, owing to a dry climate, are the dead, clad and surrounded with food, vessels, tools and art products, as in life. The textiles and the pottery can only be mentioned; their quality and endless varieties astonish the technologist. In the Carib province there are no mural remains, but the pottery, with its excessive onlaying, recalls Mexico and the jewellers of Chiriqui. The polished stone work is superb, finding its climax in Porto Rico, which seems to have been the sacred island of the Caribs. For the coasts of South America the vast shell-heaps are the repositories of ancient history.

Palaeolithic man.

Since 1880 organized institutions of anthropology have taken the spade out of the hands of individual explorers in order to know the truth concerning Glacial or Pleistocene man. The geologist and the trained archaeologist are associated. In North America the sites have been examined by the Peabody Museum, the Bureau of American Ethnology, and others, with the result that only the Trenton gravels have any standing. The so-called palaeolithic implements are everywhere. The question is one of geology, simply to decide whether those recovered at Trenton are ancient. Putnam and George Frederick Wright maintain that they are ancient, Alex. Francis Chamberlain and Holmes that they are post-Glacial and comparatively recent (*Am. Anthrop.*, N.S. i. pp. 107, 614). Elsewhere in the United States fossilized bones, crania of a low order, association of human remains with those of fossil animals are not necessarily evidence of vast antiquity. In South America the shell-heaps, of enormous size, are supposed to show that the animals have undergone changes in size and that such vast masses require untold ages to accumulate. The first is a biological problem. As for the second, the elements of savage voracity and wastefulness, of uncertainty as to cubical contents on uneven surface, and of the number of mouths to fill, make it hazardous to construct a chronological table on a shell-heap. Hudson's village sites in Patagonia contain pottery, and that brings them all into the territory of Indian archaeology. Ameghino refers deposits in Patagonia, from which undoubted human bones and relics have been exhumed, to the Miocene. The question is of the age of the sediments from which these were taken. The bones of other associated animals, says John B. Hatcher, demonstrate the Pleistocene nature of the deposits, by which is not necessarily meant older Quaternary, for their horizons have not been differentiated and correlated in South America. Hatcher believes that "there is no good evidence in favour of a great antiquity for man in Patagonia." In a cave near Consuelo Cove, southern Patagonia, have been found fragments of the skin and bones of a large ground-sloth, *Grypotherium* (*Neomylodon*) *listai*, associated with human remains. Ameghino argues that this creature is still living, while Dr Moreno advances the theory that the animal has been extinct for a long period, and that it was domesticated by a people of great antiquity, who dwelt there prior to the Indians. Rodolfo Hauthal, Walter E. Roth and Dr R. Lehmann Nitsche review their work with the conclusion, not unanimously held by them, that man co-existed here with all the other animals whose remains were found during an inter-Glacial period. Arthur Smith Woodward sums up the question in *Proceedings of the Zoological Society of London*, closing with this sentence: "If we accept the confirmatory evidence afforded by Mr Spencer Moore, we can hardly refuse to believe that this ground-sloth was kept and fed by an early race of men." These are individual opinions, subject to revision by that court of appeals, the institutional judgment. (Summary in H. Hesketh Prichard, *Through the Heart of Patagonia* (1902), Appendix A.)

AUTHORITIES.—A valuable endowment of research in specimens, literature and pictures, deposited in libraries, museums and galleries since 1880, will keep ethnologists and archaeologists employed for many years to come. The scientific inquirer will find a mass of material in the papers and reports contributed to the numerous societies and institutions which are devoted to anthropological research. Museums of aboriginal culture are without number; in Washington the Smithsonian Institution, the National Museum, the Bureau of American Ethnology and the American Anthropologist issue publications on every division of the subject, lists of their publications and general bibliographies. Also the Peabody Museum, Cambridge; the American Museum of Natural History, New York; the Academy of Natural Sciences, Philadelphia; the Field Museum, Chicago; the California Academy and the California University, San Francisco; and the Canadian Institute, Toronto, publish monographs and lists. The most comprehensive work on North America is the *Handbook of American Indians* (prepared by the Bureau of American Ethnology, under W. H. Holmes, and edited by F. Webb Hodge).

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AMERICA ISLANDS, a name given to Christmas, Fanning, Palmyra and attendant islets, belonging to Great Britain, in the Central Pacific Ocean, between the equator and 6° N., and about 160° W. They are so named because frequented for their guano by traders from the United States. Christmas Island is probably the largest atoll in the Pacific (it is about 90 m. in circuit), and was discovered by Captain Cook in 1777. The islands were annexed by Great Britain in 1888 in view of the laying of the Pacific cable, of which Fanning Island is a station. Guano and mother-of-pearl shells are the principal articles of export; the population of the islands is about 300.

AMERICAN CIVIL WAR (1861–1865). 1. The Civil War between the northern and southern sections of the United States, which began with the bombardment of Fort Sumter on the 12th of April 1861, and came to an end, in the last days of April 1865, with the surrender of the Confederates, was in its scope one of the greatest struggles known to history. Its operations were spread over thousands of miles, vast numbers of men were employed, and both sides fought with an even more relentless determination than is usual when "armed nations" meet in battle. The duration of the war was due to the nature of the country and the enormous distances to be traversed, not to any want of energy, for the armies were in deadly earnest and their battles and combats (of which two thousand four hundred can be named) sterner than those of almost any war in modern history. The political history of the war, its antecedents and its consequences, are dealt with in the articles UNITED STATES (*History*) and CONFEDERATE STATES. For the purposes of the military narrative it is sufficient to say that eleven southern states seceded from the Union and formed the Confederate States of America. Jefferson Davis was chosen president of this confederacy, and an energetic government prepared to repel the expected attack of the "Union" states. The "resumption" by the seceding states of the coast defences (built on land ceded by the various states to the Federal government, and, it was argued, withdrawn therefore by the act of secession) brought on the war.

2. *Bombardment of Fort Sumter.*—South Carolina, finding other means of seizing or regaining Fort Sumter at Charleston ineffectual, ushered in the great struggle by the bombardment of the 12th of April 1861. Against overwhelming odds the United States troops held out until honour was satisfied; they then surrendered the ruins of the fort and were conveyed by warships to the north. At once the war spirit was aroused. President Lincoln called out 75,000 men. The few southern states which had not yet seceded, refused their contingents and promptly joined the "rebels," but there was no hesitation in the people of the North, and the state troops volunteered in far greater numbers than had been demanded. Nearly the whole of the nation had now definitely taken sides in the quarrel. The Confederacy consisted of eleven states (Virginia, North and South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, Arkansas and Tennessee). All the remaining states and territories stood by the Union, except Missouri, Kentucky and Maryland, in which public opinion was divided. But the first operations of the war brought about the willing or unwilling adhesion of these border states to the Federal cause. Citizens of these states served on either side in the war. The small, but highly efficient, regular army stood by the president, though large numbers of the officers, amongst them many of the best in the service, left it when their states seceded. The navy likewise remained national, and of its officers very few went with their states, for the foreign relations of the navy tended to produce a sentiment wider than local. But the Federal armaments were not on such a scale as to enable the government to cope with a "nation in arms," and the first call for volunteers was followed by more and more, until in the end the Federals had more than a million men under arms. At first the troops on both sides were voluntarily enlisted, but the South quickly, the North later, put in force conscription acts. Reducing the figures to a three years' average, the North furnished about 45 % of her military population, the South not less than 90 % for that term. Even so the Confederacy was numerically, as in every other respect, far weaker, and rarely, after the second year, opposed equal numbers to the troops of the Union. Throughout the critical period of the war, that is, from the beginning of 1862 up to the day of Chattanooga, three distinct campaigns were always in progress. Virginia, separating the two hostile capitals, Richmond and Washington, was the theatre of the great campaigns of the east, where the flower of both armies fought. In the centre, the valleys of the Ohio, the Cumberland and the Tennessee were the battle-ground of large armies attacking and defending the south and south-eastern states of the Confederacy, while on and beyond the great waterway of the Mississippi was carried on the struggle for those interests, vital to either party, which depended on the mighty river and its affluents. Until the end of 1863 the events in these three regions remain distinct episodes; after that the whole theatre of war is comprised in the "anaconda policy," which concentrated irresistible masses of troops from all sides on the heroic remnants of the Confederacy. In Virginia and the east, Washington, situated on the outpost line of the Union, and separated by the "border" state of Maryland from Pennsylvania and the North, was for some time in great peril. Virginia, and with it the Federal navy yard at Norfolk and the arsenal at Harper's Ferry, was controlled by the rebels. Baltimore was the scene of a bloody riot as the first Northern regiment

(6th Mass.) passed through on its way to Washington on the 19th of April, and, until troops could be spared to protect the railway through Maryland, all reinforcements for the national capital had to be brought up to Annapolis by sea. When that state was reduced to order, the Potomac became the front, and, later, the base, of the Northern armies.

3. *Missouri and West Virginia.*—Missouri, at the other flank of the line, contained an even stronger Confederate element, and it was not without a severe struggle that the energy of Mr (afterwards General) F. P. Blair, and of Nathaniel Lyon, the Unionist military commander, prevailed over the party of secession. In Kentucky the Unionist victory was secured almost without a blow, and, even at the end of 1861, the Confederate outposts west of the Alleghenies lay no farther north than the line Columbus—Bowling Green—Cumberland Gap, though southern Missouri was still a contested ground. Between the Mississippi and the mountains the whole of the year was spent by both sides in preparing for the contest. In the east hostilities began in earnest in western Virginia. This part of the state, strongly Unionist, had striven to prevent secession, and soon became itself a state of the Union (1863). A force under General G. B. McClellan advanced from the Ohio in June and captured Philippi. This promptitude was not only dictated by the necessity of preserving West Virginia, but imposed by the necessity of holding the Baltimore & Ohio railway, which, as the great link between east and west, was essential to the Federal armies. A month later, an easy triumph was obtained by McClellan and Rosecrans against the Confederates of Virginia at Rich Mountain.

4. *First Bull Run.*—The opposing forces now in the field numbered 190,000 Unionists and half that number of Confederates; sixty-nine warships flew the Stars and Stripes and a number of improvised ironclads and gunboats the rival "Stars and Bars." On the 10th of June a Federal force was defeated at Big Bethel (near Fortress Monroe), and soon afterwards the main Virginian campaign began. On the Potomac the Unionist generals McDowell and Patterson commanded respectively the forces at Washington and Harper's Ferry, opposed by the Confederates under Generals J. E. Johnston and Beauregard at Winchester and at Manassas. The forces of these four commanders were raw but eager, and the people behind them clamoured for a decision. Much against his own judgment, Lieutenant-General Winfield Scott, the Federal general-in-chief, a veteran of the second war with England and of the war with Mexico, felt constrained to order an advance against Beauregard, while Patterson was to hold Johnston in check on the Shenandoah. On the 21st of July took place the first battle of Bull Run (*q.v.*) between McDowell and Beauregard, fought by the raw troops of both sides with an obstinacy that foreboded the desperate battles of subsequent campaigns. The arrival of Johnston on the previous evening and his lieutenant Kirby Smith at the crisis of the battle (for Patterson's part in the plan had completely failed), turned the scale, and the Federals, not yet disciplined to bear the strain of a great battle, broke and fled in wild rout. The equally raw Confederates were in no condition to pursue. A desultory duel between the forces of Rosecrans and Robert E. Lee in West Virginia, which ended in the withdrawal of the Confederates, and a few combats on the Potomac (Ball's Bluff or Leesburg, October 21; Dranesville, December 20), brought to a close the first campaign in the east.

5. *Close of the First Year.*—In the end Bull Run did more harm to the victors than to the conquered. The Southerners undeniably rested on their laurels, and enabled McClellan, who was now called to the chief military command at Washington, to raise, organize and train the famous Army of the Potomac, which, in defeat and victory, won its reputation as one of the finest armies of modern history. Johnston meanwhile was similarly employed in fashioning the equally famous Army of northern Virginia, which for three years carried the Confederacy on its bayonets. It was not until the people was stung by the humiliation of Bull Run that the unorganized enthusiasm of the North settled down into an invincible determination to crush the rebellion at all costs. The men of the South were not less in earnest, and the most highly individualized people in the world was thus found ready to accept a rigorous discipline as the only way to success. In the autumn, a spirited attempt was made by the Arkansas Confederates to reoccupy Missouri. Frémont, the Federal commander, proved quite unable to deal with this, and the gallant Lyon was defeated and killed at Wilson's Creek (August 10). Soon afterwards, after a steady resistance, the Unionist garrison of Lexington surrendered to Sterling Price. But the work of Blair and Lyon had not been in vain, and the mere menace of Frémont's advance sufficed to clear the state, while General John Pope, by vigorous action in the field and able civil administration, restored order and quiet in the northern part of the state. In the central theatre (Kentucky), the only event of importance was a daring reconnaissance of the Confederate fort at Columbus on the Mississippi by a small force under Brigadier-General U. S. Grant (action of Belmont, November 7).

6. *The Blockade.*—Meanwhile the Federal navy had settled down to its fourfold task of blockading the enemy's coast against the export of cotton and the import of war material, protecting the Union commerce afloat, hindering the creation of a Confederate navy and co-operating with the land forces. From the first months of the war the sea power of the Federals was practically unchallenged, and the whole length of the hostile coast-line was open to invasion. But the blockade of 3000 miles of coast was a far more formidable task, and international law required it to be effective in order to be respected. Nevertheless along the whole line some kind of surveillance was established long before the close of 1861, and, in proportion as the number of vessels available increased, the blockade became more and more stringent, until at last it was practically unbreakable at any point save by the fastest steamers working under unusually favourable conditions of wind and weather. As against the civilian enemy the navy strangled commerce; its military preponderance nipped in the bud every successive attempt of the Confederates to create a fleet (for each new vessel as it emerged from the estuary or harbour in which it had been built, was destroyed or driven back), while at any given point a secure base was available for the far-ranging operations of the Union armies. Two hundred and twelve warships or converted merchantmen were in commission on the 1st of January 1862. There had been several coastal successes in 1861, notably the occupation of Hatteras Inlet, North Carolina, by Commodore S. H. Stringham and General B. F. Butler (August 28–29, 1861), and the bombardment and capture of Forts Beauregard and Walker at Port Royal, South Carolina, by the fleet under Commodore S. F. duPont and the forces of General T. W. Sherman (November 7, 1861). Early in 1862 a large expedition under General A. E. Burnside and Commodore L. M. Goldsborough captured Roanoke Island, and the troops penetrated inland as far as Newbern (actions of February 8 and March 14). About the same time Fort Pulaski (the main defence of Savannah, Georgia) was invested and captured. But the greatest and most important enterprise was the capture of New Orleans (*q.v.*) by Flag-Officer D. G. Farragut and General Butler (April 18–25, 1862). This success opened up the lower Mississippi at the same time as the armies of the west began to move down that river under Grant, who was always accompanied by the gunboat flotilla which had been created on the upper waters in 1861. A slight campaign in New Mexico took place in February 1862, in which several brilliant tactical successes were won by the Texan forces, but no permanent foothold was secured by them.

7. *Fort Donelson.*—In the early months of 1862 preparations on a gigantic scale were made for the conquest of the South. McClellan and the Army of the Potomac faced Johnston, who with the Army of northern Virginia lay at Manassas, exercising and training his men with no less care than his opponent. Major-General D. C. Buell in Kentucky had likewise drilled his troops to a high state of efficiency and was preparing to move against the Confederate general Albert Sidney Johnston, whose reputation was that of being the foremost soldier on either side. Farther west the troops on both sides were by no means so well trained,

yet active operations began on the Tennessee. Here Fort Donelson on the Cumberland, Fort Henry on the Tennessee and Columbus on the Mississippi guarded the left of the Southern line, Sidney Johnston himself maintaining a precarious advanced position at Bowling Green, with his lieutenants, Zollicoffer and Crittenden, farther east at Mill Springs, and a small force under General Marshall in the mountains of eastern Kentucky. The last-named was soon defeated by General James A. Garfield at Prestonburg, and a few days later General G. H. Thomas won his first victory at Mill Springs (Logan's Cross Roads). Zollicoffer was killed and his army forced to make a disastrous retreat (January 19–20, 1862). The centre of Johnston's line (Forts Henry and Donelson) was next attacked by General Grant and Flag-Officer A. H. Foote. On the 6th of February Fort Henry fell to Foote's gunboat flotilla, and Grant then moved overland to Donelson. His troops were raw and possessed no decisive superiority in numbers, and sharp fighting took place when the garrison of Donelson tried to cut its way out. The attempt failed when almost on the point of success, and the Federals, under the excellent leadership of Generals C. F. Smith, Lew Wallace and McClernand, effected a lodgment in the works. The Confederate commanders proved themselves quite unequal to the crisis, and 15,000 men surrendered with the fort on the 16th of February.

8. *Island No. 10 and Pea Ridge.*—This very considerable success thrust back Johnston's whole line to New Madrid, Corinth and the Memphis & Charleston railway. The left flank, even after the evacuation of Columbus, was exposed, and the Missouri divisions under Pope quickly seized New Madrid. The adjoining river defences of Island No. 10 in the Mississippi proved more formidable. Foote's gunboats could, and did, run the gauntlet, but a canal had to be cut right round the batteries for the transports, before the land forces could cross the river and attack the works in rear; when this was accomplished, by the skill and energy of all concerned, the place with its garrison of 7000 men surrendered at once (April 8, 1862). Meanwhile, in the Missouri theatre, the Federal general Curtis, outnumbered and outmanœuvred by the forces of Price and Van Dorn, fought, and by his magnificent tenacity won, the battle of Pea Ridge (March 7–8), which put an end to the war in this quarter. On the whole, the first part of the western campaign was uniformly a brilliant success for the Federal arms. General H. W. Halleck, who was here in control of all the operations of the Federals, had meanwhile ordered Grant's force to ascend the Tennessee river and operate against Corinth; Buell's well-disciplined forces were to march overland from Nashville to join him, and General O. M. Mitchel with a division was sent straight southwards from the same place to cut the Memphis & Charleston line. The latter mission, brilliantly as it was executed, failed, through want of support, to secure a foothold. Had Halleck reinforced Mitchel, that officer might perhaps have forestalled the later victories of Grant and Sherman. As it was, the enterprise became a mere diversion.

9. *Shiloh.*—Meanwhile Grant was encamped at Pittsburg Landing on the Tennessee with an army of 45,000 men, and Buell with 37,000 men about two marches away. Early on the 6th of April A. S. Johnston and Beauregard completely surprised the camps of Grant's divisions. The battle of Shiloh (*q.v.*) was a savage scuffle between two half-disciplined hosts, contested with a fury rare even in this war. On the 6th the Unionists, scattered and unable to combine, were driven from point to point, and at nightfall barely held their ground on the banks of the river. The losses were enormous on both sides, Johnston himself being amongst the killed. The arrival of Buell enabled the Federals to take the offensive next morning along the whole line, and by sunset on the 7th, after another sanguinary battle, Beauregard was in full retreat. Some weeks afterwards, Halleck with the combined armies of Grant, Buell and Pope began the siege of Corinth, which Beauregard ultimately evacuated a month later. Thus the first campaign of the western armies, completed by the victory of the gunboat flotilla at Memphis (June 6), cleared the Mississippi as far down as Vicksburg, and compelled the Confederates to evacuate the Cumberland and a large portion of the Tennessee basins.

10. *The Peninsula.*—Many schemes were discussed between McClellan and President Lincoln before the Army of the Potomac finally took the offensive in Virginia. It was eventually decided that General Banks was to oppose "Stonewall" Jackson in the Shenandoah Valley, Frémont to hold western Virginia against the same general's enterprise, and McDowell with a strong corps to advance overland to meet McClellan, who, with the main army, was to proceed by sea to Fortress Monroe and thence to advance on Richmond. The James river, afterwards so much used for the Federal operations, was not yet clear, and it was here, in Hampton Roads, that the famous fight took place between the ironclads "Merrimac" (or "Virginia") and "Monitor" (March 8–9, 1862). McClellan's advance was opposed by a small force of Confederates under General Magruder, which, gradually reinforced, held the historic position of Yorktown for a whole month, and only evacuated it on the 3rd of May. Two days later McClellan's advanced troops fought a sharp combat at Williamsburg and the Army of the Potomac rendezvoused on the Chickahominy with its base at White House on the Pamunkey (May 7). J. E. Johnston had, long ere this, fallen back from Manassas towards Richmond, and the two armies were in touch when a serious check was given to McClellan by the brilliant successes of Jackson in the Shenandoah Valley.

11. *Jackson's Valley Campaign.*—The "Valley of Virginia," called also the "Granary of the Confederacy," was cut into long parallel strips by ridges and rivers, across which passages were rare, and along which the Confederates could, with little fear of interruption from the east, debouch into Maryland and approach Washington itself. Here Stonewall Jackson lay with a small force, and in front of him at the outlet of the valley was Banks, while Frémont threatened him from West Virginia. Jackson had already fought a winter campaign which ended in his defeat at the hands of General Shields at Kernstown (March 23). Banks's main army, early in May, lay far down the Valley at Strasburg and Front Royal, Frémont at the town of McDowell. Jackson's first blow fell on part of Frémont's corps, which was sharply attacked and driven into the mountains (McDowell, May 8). The victor quickly turned upon Banks, destroyed his garrison of Front Royal and nearly surrounded his main body; barely escaping, Banks was again defeated at Winchester and driven back to the Maryland border (May 23–25). These rapid successes paralysed the Federal offensive. McDowell, instead of marching to join McClellan, was ordered to the Valley to assist in "trapping Jackson," an operation which, at one critical moment very near success, ended in the defeat of Frémont at Cross Keys and of McDowell's advanced troops at Port Republic (June 8–9) and the escape of the daring Confederates with trifling loss. McClellan, deprived of McDowell's corps, felt himself reduced to impotence, and three Federal armies were vainly marching up and down the Valley when Johnston fell with all his forces upon the Army of the Potomac. The Federals lay on both sides of the Chickahominy river, and at this moment Johnston heard that McDowell's arrival need not be feared. The course of the battle of Seven Pines or Fair Oaks (*q.v.*) bore some resemblance to that of Shiloh; a sharp attack found the Unionists unprepared, and only after severe losses and many partial defeats could McClellan check the rebel advance. Here also fortune was against the Confederates. J. E. Johnston fell severely wounded, and in the end a properly connected and combined advance of the Army of the Potomac drove back his successor into the lines of Richmond (May 31–June 1).

12. *The Seven Days.*—Bad weather and skilful defence completely checked the assailants for another three weeks, and the situation was now materially altered. Jackson with the Valley troops had stealthily left Harrisonburg by rail on the 17th of June, and was now at Ashland in McClellan's rear. General Lee, who had succeeded Johnston in the command of the Army of northern Virginia, proposed to attack the Federals in their line of communication with White House, and passed most of his forces round to the aid of Jackson. The Seven Days' Battle (*q.v.*)

opened with the combat of Mechanicsville on the 26th of June, and the battle of Gaines' Mill on the 27th. Lee soon cut the communication with White House, but McClellan changed his base and retreated towards Harrison's Landing on the James river. It was some time before Lee realized this. In the end the Federals were sharply pursued, but McClellan had gained a long start and, fighting victoriously almost every day, at length placed himself in a secure position on the James, which was now patrolled by the Federal warships (June 26–July 1). But the second advance on Richmond was clearly a strategical failure.

13. *The Campaign of Perryville.*—After the capture of Corinth Halleck had suspended the Federal advance all along the line in the west, and many changes took place about this time. Halleck went to Washington as general-in-chief, Pope was transferred to Virginia, Grant, with his own Army of the Tennessee and Rosecrans's (lately Pope's) Army of the Mississippi, was entrusted with operations on the latter river, while Buell's Army of the Ohio was ordered to east Tennessee to relieve the inhabitants of that district, who, as Unionist sympathizers, were receiving harsh treatment from the Confederate and state authorities. Late in July Braxton Bragg, who had succeeded Beauregard in command of the Confederates, transferred his forces to the neighbourhood of Chattanooga. Tennessee was thenceforward to be the central theatre of war, and too late it was recognized that Mitchel should have been supported in the spring. The forces left south of Corinth were enough to occupy the attention of Grant and Rosecrans, and almost contemporaneously with Lee's advance on Washington (see below), Price and Bragg took the offensive against Grant and Buell respectively. The latter early in August lay near Murfreesboro, covering Nashville, but the Confederate general did not intend to threaten that place. The valleys and ridges of eastern Tennessee screened him as he rapidly marched on Louisville and Cincinnati. The whole of the Southern army in the west swung round on its left wing as the pivot, and Buell only just reached Louisville before his opponent. The Washington authorities, thoroughly dissatisfied, ordered him to turn over the command to General Thomas, but the latter magnanimously declined the offer, and Buell on the 8th of October fought the sanguinary and indecisive battle of Perryville, in consequence of which Bragg retired to Chattanooga.

14. *The Western Campaign.*—The Union leader was now ordered once more to east Tennessee, but he protested that want of supplies made such a move impossible. Rosecrans, the victor of Corinth and Iuka (see below), was thereupon ordered to replace him. Buell's failure to appreciate political considerations as a part of strategy justified his recall, but the value of his work, like that of McClellan, can hardly be measured by marches and victories. The disgraced general was not again employed, but the men of the Army of the Ohio retained throughout, as did those of the Army of the Potomac, the impress of their first general's discipline and training. Sterling Price in the meanwhile had been ordered forward against Grant and Rosecrans, and Van Dorn promised his assistance. Before the latter could come up, however, Rosecrans defeated Price at Iuka (September 19). The Confederates, not dismayed thereby, effected their junction and moved on Corinth, which was defended by Rosecrans and 23,000 Federal troops. Grant's other forces were split up into detachments, and when Van Dorn, boldly marching right round Rosecrans, descended upon Corinth from the north, Grant could hardly stir to help his subordinate. Rosecrans, however, won the battle of Corinth (October 3–4), though on the evening of the 3rd he had been in a perilous position. The Confederates fell back to the southward, escaping Grant once more, and thus ended the Confederate advance in the West.

15. *Pope's Campaign in Virginia.*—The Army of Virginia under Pope was composed of the troops lately chasing Jackson in the Valley—Frémont's (now Sigel's), Banks's and McDowell's corps. Halleck (at the Washington headquarters) began by withdrawing McClellan from the James to assist Pope in central Virginia; Lee, thus released from any fear for the safety of Richmond, turned swiftly upon Pope. That officer desired to concentrate his command on Gordonsville, but Jackson was before him at that place, and he fell back on Culpeper. On the 9th of August Banks and Jackson joined battle once more at Cedar Mountain (or Cedar Run); the Federals, though greatly inferior in numbers, attacked with much vigour. Banks was eventually beaten, but he had come very near to success, and Jackson soon retired across the Rapidan, where (the Army of the Potomac having now begun to leave the James) Lee joined him (August 17) with the corps of Longstreet. Pope now fell back behind the Rappahannock without showing fight. Here Halleck's orders bade him cover both Washington and Aquia Creek (whence the Army of the Potomac was to join him), orders almost impossible of execution, as any serious change of position necessarily uncovered one of these lines. The leading troops of the Army of the Potomac were now landed, and set out to join Pope's army, which faced Longstreet and Jackson on the Rappahannock between Bealton and Waterloo. On the 24th of August Lee ordered Jackson to march round Pope's right wing and descend on his rear through Thoroughfare Gap on Manassas and the old battle-ground of 1861. Pope was at this moment about to take the offensive, when a violent storm swelled the rivers and put an end to all movement. On the 26th of August the daring flank march of Jackson's corps ended at Manassas Station (see BULL RUN). Longstreet followed Jackson, and Lee's army was reunited on the battlefield. By the 1st of September the campaign of "Second Manassas" was over. Pope's army and such of the troops of the Army of the Potomac as had been involved in the catastrophe were driven, tired and disheartened, into the Washington lines. The Confederates were once more masters of eastern Virginia.

16. *Antietam.*—It was at this moment that Bragg was in the full tide of his temporary success in Tennessee and Kentucky, and, after his great victory of Second Bull Run, Lee naturally invaded Maryland, which, it was assumed, had not forgotten its Southern sympathies. But Lee received no real accession of strength, and when McClellan with all available forces moved out of Washington to encounter the Army of northern Virginia, the Confederates were still but a few marches from the point where they had crossed the Potomac. Lee had again divided his army. On the 13th of September Jackson was besieging 11,000 Federals in Harper's Ferry, Longstreet was at Hagerstown, Stuart's cavalry holding the passes of the South Mountain, while McClellan's whole army lay at Frederick. Here extraordinary good fortune put into the enemy's hands a copy of Lee's orders, from which it was clear that the Confederates were dangerously dispersed. Had McClellan moved at once he could have seized the passes without difficulty, as he was aware that he had only cavalry to oppose him. But the 13th was spent in idleness, and stubborn infantry now held the passes. A serious and costly action had to be fought before the way was cleared (battle of South Mountain, September 14). On the following day Harper's Ferry capitulated after a weak defence. Jackson thereupon swiftly rejoined Lee, leaving only a division to carry out the capitulation. On the 16th McClellan found Lee in position behind the Antietam Creek, and on the 17th was fought the sanguinary and obstinately contested battle of Antietam (*q.v.*) or Sharpsburg. At the price of enormous losses both sides escaped defeat in the field, but Lee's offensive was at an end and he retired into Virginia. Thenceforward the Confederacy was purely on the defensive. Only twice more did the forces of the South strike out (Gettysburg, 1863; Nashville, 1864), and then the offensive was more of a counter-attack than an advance.

17. *Vicksburg in 1862.*—The Confederate failures of Corinth, Perryville and Antietam were followed by a general advance by the Federals. It is about this time that Vicksburg becomes a place of importance. Farragut from New Orleans, and the gunboat flotilla from the upper waters, had engaged the batteries in June and July, but had returned to their respective stations, while a Federal force under General Williams, which had appeared before the fortress, retired to Baton Rouge. Early in August, Van Dorn, now in command of the place, sent a force to attack Williams, and on the 5th a hard-fought action took place at Baton Rouge, in which Williams was killed but his troops held

their own. At this time the minor fortress of Port Hudson was established to guard the rear of Vicksburg. In November Grant, with 57,000 men, began to move down from the north against General J. C. Pemberton, who had superseded the talented Van Dorn. A converging movement made by Grant from Grand Junction, W. T. Sherman from Memphis, and a force from Helena on the Arkansas side, failed, owing to Pemberton's prompt retirement to Oxford, Mississippi, and complications brought about by the intrigues of an able but intractable subordinate, McClernand, induced Grant to make a complete change of plan. Sherman was to proceed down the great river, and join the ships from the Gulf before Vicksburg, while Grant himself drove Pemberton southwards along the Mississippi Central railway. This double plan failed. Grant, as he pushed Pemberton before him to Granada, lengthened day by day his line of communication, and when Van Dorn, ever enterprising, raided the great Federal depot of Holly Springs the game was up. Grant retired hastily, for starvation was imminent, and Pemberton, thus freed, turned upon Sherman, and inflicted a severe defeat on that general at Chickasaw Bayou near Vicksburg (December 29). McClernand now assumed command, and on the 11th of January 1863 captured Fort Hindman near Arkansas Post. This was the solitary gain of the whole operation. Meanwhile Vicksburg was steadily becoming stronger and more formidable.

18. *Fredericksburg.*—McClellan, after the battle of the Antietam, paused for some time to reorganize his forces, some of which had barely recovered from the effects of Pope's unlucky campaign. He then slowly moved down the east side of the Blue Ridge, while Lee retired up the Valley on the west side of the same range. On the 6th of November the Army of the Potomac was at Warrenton, Lee at Culpeper, and Jackson in the Valley. When on the point of resuming the offensive, McClellan was suddenly superseded by Burnside, one of his corps commanders. Like Buell, McClellan had tempered the tools with which others were to strike; he was not again employed, and in his fall was involved his most brilliant subordinate, Fitz John Porter (*q.v.*). Burnside was by no means the equal of his predecessor, though a capable subordinate, and indeed only accepted the chief command with reluctance. He began his campaign by cancelling McClellan's operation, and, his own plan being to strike at Richmond from Fredericksburg, he moved the now augmented army to Falmouth opposite that place, hoping to surprise the crossing of the Rappahannock. Delays and neglect, not only at the front, but on the part of the headquarters staff at Washington, permitted Lee to seize the heights of the southern bank in time. When Burnside fought his battle of Fredericksburg (*q.v.*) an appalling reverse was the result, the more terrible as it was absolutely useless (December 13).

19. *Closing Operations of 1862.*—Chickasaw Bayou and Fredericksburg ended the Federal initiative in the west and the east; the Army of the Cumberland under Rosecrans alone could claim a victory. Buell's successor retained the positions about Nashville, whilst a new Army of the Ohio prepared to operate in east Tennessee. Bragg lay at Murfreesboro (see STONE RIVER), where Rosecrans attacked him on the 31st of December 1862. A very obstinate and bloody two days' battle ended in Bragg's retirement towards Chattanooga. During these campaigns the United States navy had not been idle. The part played by the gunboats on the upper Mississippi had been most conspicuous, as had been the operations of Farragut's heavier ships in the lower waters of the same river. The work of Du Pont and Goldsborough on the Atlantic coast has been alluded to above. Charleston was attacked without success in 1862, but from June to August 1863 it was besieged by General Gillmore and Admiral Dahlgren, and under great difficulties the Federals secured a lodgment, though it was not until Sherman appeared on the land side early in 1865 that the Confederate defence collapsed. Fort Fisher near Wilmington also underwent a memorable siege by land and sea. Certain incursions were from time to time made at different points along the whole sea-board. Minor operations moreover, especially in Arkansas and southern Missouri, were continually undertaken by both sides during 1862–1863, of which the battle of Prairie Grove, Arkansas (December 7, 1862), was the most notable incident. Meanwhile the blockade had become so stringent that few ordinary vessels could expect to break through, and a special type of steamer came into vogue for the purpose.

20. *Capture of Vicksburg.*—In 1863 the campaigns once more divided themselves accurately into those of east, centre and west. This year saw the greatest successes and the heaviest reverses of the Union army, Gettysburg and Vicksburg and Chattanooga against Chancellorsville and Chickamauga. Operations began in the west with the second advance upon Vicksburg. One corps of the Army of the Tennessee was detached to cover the Memphis & Charleston railway. Grant, with the other three under Sherman, McClernand and McPherson, moved by water to the neighbourhood of the fortress. Many weeks passed without any success to the Union arms. Vicksburg and its long line of fortifications stood on high bluffs, all else was swampy lowland and intricate waterways. As Sherman in 1862, so now Grant was unable to obtain any foothold on the high ground, and no effective attack was possible until this had been gained. At last, after many trials and failures, Grant took a daring step. The troops with their supplies marched round through a network of lakes and streams to a point south of Vicksburg; Admiral Porter's gunboats and the transports along with them "ran" the batteries. At Bruinsburg, beyond Pemberton's reach, a landing was made on the eastern bank and, without any base of supplies or line of retreat, Grant embarked upon a campaign which made him in the end master of the prize. On the 4th of July Pemberton surrendered the fortress and 37,000 men. Grant's endurance and daring had won what was perhaps the greatest success of the war. General Joseph Johnston with a small relieving army had appeared at Jackson, Mississippi, but had been held in check by General F. P. Blair and a force from the Army of the Tennessee; when Vicksburg surrendered a larger force was at once sent against him, whereupon he retired. In the meanwhile Banks had moved upstream from New Orleans, and laid siege to Port Hudson. Operations were pressed with vigour, and the place surrendered four days after Vicksburg. A Confederate attack on the post of Helena, Arkansas, was the last serious fight on the great river, and before the end of July the first merchant steamer from St Louis discharged her cargo at New Orleans.

21. *Chancellorsville and Gettysburg.*—In Virginia Burnside had made, in January 1863, an attempt to gain by manœuvre what he had missed in battle. The sudden swelling of rivers and downpour of rain stopped all movement at once, and the "Mud March" came to an end. A Federal general could retain his hold on the men after a reverse, but not after a farce: Burnside was replaced by General Joseph Hooker, who had a splendid reputation as a subordinate leader. The new commander displayed great energy in reorganizing the Army of the Potomac, the discipline of which had not come unscathed through a career of failure. Lee still held the battlefield of Fredericksburg and had not attempted the offensive, and in April he was much weakened by the detachment of Longstreet's corps to a minor theatre of operations. Hooker's operations began well, Lee was outmanœuvred and threatened in flank and rear, but the Federals were in the end involved in the confused and disastrous battle of Chancellorsville (*q.v.*). Stonewall Jackson was mortally wounded, but his men and those of Longstreet's who had remained with Lee defeated Hooker and forced him to retire again beyond the Rappahannock, though he had double Lee's force. But Hooker could at least make himself obeyed, and when Lee initiated his second invasion of the North a month after the battle of Chancellorsville, the Army of the Potomac was as resolute as ever. On the 9th of June the cavalry combat of Brandy Station made it clear to the Federal staff that Lee was about to use the Valley once more to screen an invasion of Maryland. Longstreet, A. P. Hill and Ewell (who were now Lee's corps commanders) were at one time scattered from Strasburg in the Valley to Fredericksburg, and Hooker earnestly begged to be allowed to attack them in detail. Success was certain, but the scheme was

vetoed by the Federal headquarters and government, whose first and ruling idea was to keep the Army of the Potomac between Lee and Washington. Hooker was thus compelled to follow Lee's movements. Ewell's men were raiding unchecked as far north as the Susquehanna, while Hooker was compelled to inactivity before the forces of Hill and Longstreet. The Federal general, within his limitations, acted prudently and skilfully. The Army of the Potomac crossed that river only one day later than Lee, and concentrated at Frederick. But Hooker was no longer trusted by the Washington authorities, and his dispositions were interfered with. Not allowed to control the operations of his own men, the unfortunate general resigned his command on the 28th. He was succeeded by General G. G. Meade, who, besides steadiness and ability, possessed the confidence of Lincoln and Halleck which Hooker had lacked. Meade was thus able to move promptly, Lee was compelled to meet him, and the Army of the Potomac began to take up its position on Pipe Creek, screened by Generals Reynolds and Buford at Gettysburg (*q.v.*). On the 1st of July the heads of Lee's columns engaged Buford's cavalry outposts, and the conflict began. All troops on both sides hurried to the unexpected battlefield, and after a great three days' battle, the Army of the Potomac emerged at last with a decisive victory. On the 4th, as Pemberton surrendered at Vicksburg, Lee drew off his shattered forces. One third of the Army of northern Virginia and one quarter of the Army of the Potomac remained on the field. Pursuit was not seriously undertaken, and the armies manœuvred back to the old battle-grounds of the Rapidan and the Rappahannock. A war of manœuvre followed, each side being reduced in turn by successive detachments sent to aid Rosecrans and Bragg in the struggle for Tennessee. In October Lee attempted a third Bull Run campaign on the same lines as the second, but Meade's steadiness foiled him, and he retired to the Rapidan again, where he in turn repulsed Meade's attempt to surprise him (Mine Run, November 26–28, 1863).

22. *Chickamauga.*—In the centre Rosecrans and Bragg spent the first six months of the year, as it were glaring at each other. Nothing was done by the main armies, but the far-ranging cavalry raids of the Confederates under J. H. Morgan and other leaders created much excitement, especially "Morgan's Raid" (June 27–July 26), through Indiana, Kentucky and Ohio, which states had hitherto little or no experience of the war on their own soil. At last the Army of the Cumberland advanced. Rosecrans manœuvred his opponent out of one position after another until Bragg was driven back into Chattanooga. These operations were very skilfully conducted by Rosecrans and his second-in-command, Thomas, and, at a trifling cost, advanced the Union outposts to the borders of Georgia. Burnside and the new Army of the Ohio had now cleared east Tennessee and occupied Knoxville (September 2), and meanwhile Rosecrans by a brilliant movement, in which he displayed no less daring in execution than skill in planning, once more manœuvred Bragg out of his position and occupied Chattanooga. But he had to fight to maintain his prize, and in the desperate battle of Chickamauga (*q.v.*) on the 19th and 20th of September, Bragg, reinforced by Longstreet from Virginia, won a complete victory. Thomas's defence won him the popular title of the "Rock of Chickamauga" and enabled Rosecrans to draw off his men, but the critical position of the Army of the Cumberland in Chattanooga aroused great alarm.

23. *Chattanooga.*—Grant was now given supreme command in the west, and the Army of the Tennessee (now under Sherman) and two corps from Virginia under Hooker were hurried by rail to Tennessee. In spite of his good record Rosecrans was deprived of his command. But Thomas, his successor, was one of the greatest soldiers of the war, and Grant's three generals, all men of great ability, set to work promptly. Hooker defeated Longstreet at Wauhatchie and revictualled Chattanooga (*q.v.*), and on the 23rd, 24th and 25th of November the three armies attacked Bragg's position. On the left Sherman made little progress; on the right, however, Hooker and the men from the Potomac army fought and won the extraordinary "Battle above the Clouds" on Lookout Mountain, and on the 25th the Confederate centre on Missionary Ridge was brilliantly stormed by Thomas and the Army of the Cumberland. Grant's triumph was decisive of the war in the west, and with Burnside's victory over Longstreet at Knoxville, the struggle for Tennessee was over. Vicksburg, Gettysburg and Chattanooga ended the crisis of the war, which had been at its worst for the Union in this year. Henceforth the South was fighting a hopeless battle.

24. *Plan of Campaign for 1864.*—Grant, now the foremost soldier in the Federal army, was on the 9th of March 1864 commissioned lieutenant-general and appointed general-in-chief. Halleck, Lincoln and Stanton, the intractable, if energetic, war secretary, now stood aside, and the efforts of the whole vast army were to be directed and co-ordinated by one supreme military authority. Sherman was to command in the west, Grant's headquarters accompanied Meade and the Army of the Potomac. The general plan was simple and comprehensive. Meade was to "hammer" Lee, and Sherman, at the head of the armies which had been engaged at Chattanooga and Knoxville, was to deal with the other great field army of Confederates under Johnston, and as far as possible gain ground for the Union in the south-east. Sherman's own plans went farther still, and included an eventual invasion of Virginia itself from the south, but this was not contemplated as part of the immediate programme. Butler with the new Army of the James was to move up that river towards Richmond and Petersburg. Subsidiary forces were to operate on the sea-board, in the Shenandoah Valley and elsewhere. At this time took place the Red River Expedition, which was intended for the subjugation of western Louisiana. The troops of General Banks and the war vessels under Admiral Porter moved up the Red river, and on the 16th of March 1864 reached Alexandria. Skirmishing constantly with the Confederates under Kirby Smith and Taylor, the Federals eventually on the 8th and 9th of April suffered serious reverses at Sabine Cross Roads and Pleasant Hill. Banks thereupon retreated, and, high water in the river having come to an end, the fleet was in the gravest danger of being cut off, until Colonel Bailey suggested, and rapidly carried out, the construction of a dam and weir over which the ships ran down to the lower waters. Eventually the various forces retired to the places whence they had come.

25. *The Wilderness Campaign.*—Virginia was now destined to be the scene of the bloodiest fighting of the whole war. Grant and Meade, reinforced by Burnside's IX. Corps to a strength of 120,000 men, crossed the Rapidan on the 4th of May with the intention of attacking Lee's inner flank, that nearer Richmond. With a bare 70,000 men the Confederate general struck at the flank of Grant's marching columns in that same Wilderness where Jackson had won his last battle twelve months before. The battle of the Wilderness (*q.v.*) went on for two days, with little advantage to either side. On his part Grant had lost 18,000 men. Lee had lost fewer, but could ill spare them, and Longstreet had been severely wounded (May 5–6). Grant, astonished perhaps, but here as always resolute, tried again to reach Lee's right wing, and on the 8th another desperate battle began at Spottsylvania (*q.v.*) Court House. The fighting on this field lasted ten days, at the end of which Grant had doubled his losses and was as far as ever from success. On the 21st of May, with extraordinary pertinacity, he sent Meade and Burnside once more against the inner flank of the Army of northern Virginia. The action of North Anna ended like the rest, though on this occasion the loss was small. A week later the Federals, again moving to their left, arrived upon the ground on which McClellan had fought two years before, and at Cold Harbor (Porter's battlefield of Gaines' Mill) the leading troops of the Army of the James joined the lieutenant-general. Meanwhile the minor armies had come to close quarters all along the line. The Army of the James moved towards Richmond on the same day on which the Army of the Potomac crossed the Rapidan. On the 16th of May Butler fought the indecisive battle of Drury's Bluff against Beauregard, in consequence of which he had to retire to Bermuda Hundred, whence most of his troops were sent to join Grant. At the same time the Union troops under Sigel in the Shenandoah Valley were defeated at New Market (May 15). General Hunter, who

replaced Sigel, won a combat at Piedmont, and marched on the 8th of June towards Lynchburg. The danger threatening this important point caused Lee to send thither General Early with the remnants of Jackson's old Valley troops. Hunter's assault (June 18) failed, and the Federals, unable to hold their ground, had to make a circuitous retreat to the Potomac by way of West Virginia.

26. *Cold Harbor.*—On the 3rd of June at Cold Harbor (*q.v.*) took place the last of Grant's "hammering" battles in the open fields. The attack of the Federals failed utterly; not even Fredericksburg was so disastrous a defeat. Six thousand men fell in one hour's fighting, and the total losses on this field, where skirmishing went on for many days, were 13,000. But Grant was as resolute as ever. His forces once more manœuvred against Lee's inner flank, still found no weak spot, and eventually arrived upon the James. The river was crossed, Lee as usual conforming to the movement, and on the 15th of June the Federals appeared before the works of Petersburg (*q.v.*). Here, and in the narrow neck of land between the Appomattox and the James, was the ganglion of the Confederacy, and the struggle for its possession was perhaps the greatest of modern history. A first assault made at once (June 15–18) failed with a loss of 8150 men. Two sharp combats followed on the 22nd of June and the 2nd of July, as Grant once more began to feel Lee's right. But the anniversary of Gettysburg saw Lee's works still intact, and 72,000 men of the Army of the Potomac and the Army of the James had fallen since the campaign had opened two months before. History has few examples to show comparable to this terrible campaign in Virginia. The ruthless determination of the superior leaders had been answered splendidly by the devotion of the troops, but the men of Chancellorsville and Gettysburg were mostly dead or wounded, and the recruits attracted by bounties or compelled by the "draft," which had at last been enforced in the North, proved far inferior soldiers to the gallant veterans whom they replaced.

27. *Petersburg.*—There was no formal siege of Lee's position. A vast network of fortifications covered the front of both armies, whose flank extended far to the south-west, Grant seeking to capture, Lee to defend, the Danville railway by which the Confederates received their supplies. Richmond, though no longer of paramount importance, was no less firmly held than Petersburg, and along the whole long line fighting went on with little interruption. On the 30th of July the Federal engineers exploded a mine under the hostile works, and Burnside's corps rushed to the assault. But the attempt ended in failure—the first defeat of the Army of the Potomac which could fairly be called discreditable. Still, Lee was losing men, few it is true, but most precious, since it was impossible to replace them, while the North poured unlimited numbers into the Federal camps. The policy of "attrition" upon which Grant had embarked, and which he was carrying through regardless of his losses, was having its effect. About this time Early, freed from the opposition of Hunter's forces, made a bold stroke upon Washington. Crossing the Potomac, he marched eastward, and, defeating a motley force (action of the Monocacy) which General Lew Wallace had collected to oppose him, appeared before the lines of Washington. The Federal capital was at the moment almost denuded of troops, and forces hastily despatched from the James only arrived just in time to save it. Thereupon the Confederates retired, narrowly escaping Hunter, and the brief campaign came to an end with an engagement at Kernstown. Early had been nearer to the immediate success than Lee had been in 1862 and 1863, but he had failed utterly to relax Grant's hold on Petersburg, which was becoming daily more crushing.

On the decisive theatre the Federals made their way, little by little and at a heavy cost, to the Weldon railway, and beyond it to the westward. Lee's lines were becoming dangerously extended, but he could not allow the enemy to cut him off from the west. On the 25th of August there was a battle at Reams Station, in which the Federals were forced back, and the famous II. Corps under Hancock was for the first time routed. But Grant was tireless, and five days later another battle was fought, at Peebles Farm, in which the lost ground was regained. Butler and the Army of the James at the same time won some successes in front of the Richmond works. One more attempt to outflank Lee to the westward was made by Grant without success, before winter came on, and the campaign closed with an expedition, under the direction of General Warren, which destroyed the Weldon line. Grant had not reached Lee's flank at any point, and his casualties from first to last had been unprecedentedly heavy, but "hammering" was steadily prevailing where skill and valour had failed.

28. *Sheridan's Valley Campaign.*—In the closing months of the year Grant's brilliant cavalry commander Sheridan had been put in command of an army to operate against Early in the Valley. The Federals in this quarter had hitherto suffered from want of unity in the command (*e.g.* Banks, Frémont and McDowell in 1862). The Army of the Shenandoah would not be thus handicapped, for Sheridan was a leader of exceptional character. The first encounter took place on the Opequan near Winchester. Early was defeated, but not routed (September 19), and another battle took place near Strasburg (Fisher's Hill) on the 22nd. Always disposing of superior numbers, Sheridan on this occasion won an important victory without much loss. A combat which took place, at Mount Jackson, during the pursuit, again ended successfully, and the triumphant Federals retired down the Valley, ruthlessly destroying everything which might be of the slightest value to the enemy. Early sharply followed them up, his men infuriated by the devastation of the "Granary of the Confederacy." At Cedar Creek (*q.v.*), during a momentary absence of the Federal commander, his camps were surprised by Early (October 19). The Army of the Shenandoah was routed and driven towards the Potomac. But the gallant stand of the old Potomac troops of the VI. Corps checked the Confederates. Sheridan arrived on the scene to find a new battle in progress. He was at his best at such a moment, and the rallied Federals under his command swept all before them. The victory was decisive, and, the country being now bare of supplies, the Army of the Shenandoah was sent to reinforce Grant, while the remnant of Early's forces also went to Petersburg. Sheridan's campaign was a famous episode of the war. It was conducted with skill, though, with twice the numbers of the enemy at his command, Sheridan's victory was a foregone conclusion. But he had at least shown that he possessed to an unusual degree the real attribute of a great captain—power over men.

29. *Sherman and Johnston.*—Meanwhile Sherman had fought his Atlanta campaign. General Johnston opposed him almost on the old Chickamauga battle-ground, where the Federal commander, after a brief campaign in Mississippi and Alabama, the result of which was to clear his right flank (February 3–March 6, 1864), collected his armies—the Army of the Tennessee under McPherson, the Army of the Cumberland under Thomas (Hooker's troops had now become part of this army) and the Army of the Ohio under Schofield. In the celebrated campaign of Atlanta the highest manœuvring skill was displayed by both the famous commanders. Whilst Grant, with his avowed object of crushing Lee's army, lost no opportunity of fighting a battle *coûte que coûte*, Sherman, intent rather on the conquest of territory, acted on different lines. Johnston, than whom there was no better soldier in the Confederate service when a careful defence was required, disposed of sensibly inferior forces, and it was to be expected that the 18th-century methods of making war by manœuvring and by combats, not battles, would receive a modern illustration in Georgia. Operations began early in May 1864, and five days of manœuvring and skirmishing about Resaca and Rocky Face ended in Johnston's retirement to Resaca. A fortnight later the same manœuvres, combined with constant "tapping" at the Confederate defences, caused him to fall back again. At Adairsville the same process was gone through, and Johnston retired to Cassville, where he offered battle. Sherman was far too wary to be drawn into an action under unfavourable conditions. If each general had been able to obtain a great battle upon his own terms, each would have fought most willingly, for neither desired a useless prolongation of the war. As it was, both declined to risk a

decision. Johnston's inferiority in numbers was now becoming lessened as Sherman had to detach more and more troops to his ever-lengthening communications with Chattanooga. Another manœuvre brought about a heavy combat near Dallas (Pickett's Mills and New Hope Church, May 25–27). After a time Johnston fell back, and on the 6th of June the Federals appeared before Marietta (*q.v.*). Hitherto neither leader had offered a weak spot to his opponent, though the constant skirmishing had caused a loss of 9000 men to Sherman and about two-thirds of that number to the Confederates. At this moment Sherman suddenly changed his policy and sent his troops straight against the hostile entrenchments. The neighbourhood of Marietta witnessed for the next fortnight very heavy fighting, notably at Pine Mountain on the 14th and Kenesaw on the 27th, both actions being frontal assaults gallantly pushed home and as gallantly repulsed. Sherman acted thus in order to teach his own men and the enemy that he was not "afraid," and the lesson was not valueless. He then resumed his manœuvring, which was now facilitated by improved weather and better roads.

30. *Atlanta.*—Johnston in due time evacuated the Marietta lines. On the 7th of July his fortifications on the Chattahoochee river were turned, and he fell back into the Atlanta (*q.v.*) position, which was carefully prepared, like all the others, beforehand. Here Johnston was deprived of his command. His campaign had not been unsuccessful, for Sherman had never succeeded in taking him at a disadvantage, but the whole of the South, including President Davis and his chief of staff General Bragg, clamoured for a more "energetic" policy, and General J. B. Hood was put in command on the understanding that he should "fight." The new general, whose bold and skilful leading had been conspicuous on most of the Virginia battlefields, promptly did so. At first successful, the Confederates had in the end to retire. A few days after this battle (called Peach Tree Creek) took place the battle of Atlanta, which was fiercely contested by the veterans of both sides, and in which McPherson, one of the best generals in the Union army, was killed. Still, Hood was again beaten. The Army of the Tennessee, under its new commander General O. O. Howard, fought and won the battle of Ezra Church on the 28th of July, and, Atlanta being now nearly surrounded, Hood was compelled to adopt the Fabian methods of his predecessor, and fell back to the southward. An attack on the Army of the Ohio near Jonesboro concluded the Atlanta campaign, which left Sherman in control of Atlanta, but hampered by the necessity of preserving his communications with Chattanooga and weakened by a total loss of 30,000 men. In this celebrated campaign the American generals rivalled if they did not excel the exploits of Marlborough, Eugene and Villars, under allied conditions.

31. *The March to the Sea.*—Although General Canby, with a Federal force in the south, had been ordered to capture Mobile early in the year—after which he was to operate towards Atlanta—Mobile still flew the Confederate flag, and Hood, about to resume the offensive, was thus able to base himself on Montgomery in order to attack Sherman in flank and rear. But the Federal commander was not to be shaken off from his prize. He held firmly to Atlanta, clearing the city of non-combatants and in other ways making ready for a stubborn defence. Thomas and the Army of the Cumberland were sent back to guard Tennessee. A heavy attack on the post of Allatoona (to the garrison of which Sherman sent the famous message, "Hold the fort, for I am coming") was repulsed (October 5). The main armies quickly regained contact, each edging away northwestwards towards the Tennessee and coming into contact at Gaylesville, Alabama, and again at Decatur. General Slocum with Hooker's old Potomac troops garrisoned Atlanta, and every important post along the railway to Chattanooga was held in force. Sherman had now resolved to execute his plan of a march through Georgia to the sea and thence through the Carolinas towards Virginia, destroying everything of military value *en route*. With the provisos that if Lee turned upon Sherman, Grant must follow him up sharply, and that Thomas could be left to deal with Hood (both of which could be, and were, done), the scheme might well be decisive of the war. Preparations were carefully made. Fifty thousand picked men were to march through Georgia with Sherman, and Thomas was to be reinforced by all other forces available. There was no force to oppose the "March to the Sea." Hood was far away on the Tennessee, which he crossed on the 29th of October at Tuscumbia, making for Nashville. Want of supplies checked the Confederates after a few marches, while Schofield was pressing forward to meet them at Pulaski and Thomas was gathering, at Nashville, a motley army drawn from all parts of the west. It was at this same time that Sherman broke up his railway communication, destroying Atlanta as a place of arms, and set out on his adventurous expedition. There was little in his path. Skirmishes at Macon and Milledgeville alone varied the daily routine of railway-breaking and supply-finding, in which a belt of country 60 m. wide was absolutely cleared. On the 10th of December the army, thoroughly invigorated by its march, appeared before the defences of Savannah. On the 13th of December a division stormed Fort McAllister, and communication was opened with the Federal fleet. The march concluded with the occupation of Savannah on the 20th.

32. *Nashville.*—Hood, at a loss to divine Sherman's purpose, hastened on into Tennessee amidst weather which would have stopped most troops. Schofield met him on the Duck river, while Thomas was shaping his army in rear. Hood manœuvred Schofield out of his lines and pushed on once more. At Franklin Schofield had to accept battle, and thirteen distinct assaults on his works were made, all pushed with extraordinary fury and lasting far into the night. Thomas ordered his lieutenant to retire on Nashville, Hood following him up, impressing recruits, transports and supplies, and generally repeating the scenes of Bragg's march of 1862. The civil authorities and the lieutenant-general also urgently demanded that Thomas should advance. Constancy of purpose was the salient feature of Thomas's military character. He would not fight till he was ready. But this last great counterstroke of the Confederacy alarmed the whole North. So great was the tension that Grant finally sent General J. A. Logan to take command. But before Logan arrived, Thomas had on the 15th and 16th of December fought and won the battle of Nashville (*q.v.*), the most crushing victory of the whole war. Hood's army was absolutely ruined. Only a remnant of it reassembled beyond the Tennessee.

33. *The Carolinas.*—From Savannah, Sherman started on his final march through the Carolinas. Columbia, his first objective, was reached on the 17th of February 1865. As usual, all that could be of possible value to the enemy was destroyed and, by some accident, the town itself was burned. Sherman, like Sheridan, was much criticized for his methods of reducing opposition, but it does not seem that his "bummers" were guilty of wanton cruelty and destructiveness, at least in general, though the cavalry naturally gave more ground for the accusation than the main body of the army. And the methods of the Confederates had on occasion been somewhat similar. The Confederate general Hardee managed to gather some force (chiefly from the evacuated coast towns) wherewith to oppose the onward progress of the Federals. As commander-in-chief, Lee now reappointed Johnston to command, and the latter soon attacked and very nearly defeated his old opponent at Bentonville (March 19–20). But the "bummers" were no mere marauders, but picked men from the armies that had won Vicksburg and Chattanooga, and, though surrounded, held their ground stoutly and successfully. Advancing once more, they were joined at Goldsboro by the forces lately besieging Fort Fisher (see below), and nearly 90,000 men marched northward towards Virginia, pushing Johnston's weak army before them. Meanwhile the bulk of the forces at Nashville had been sent to the north-east to close Lee's escape to the mountains, and in March the final campaign had opened at Petersburg.

34. *The Final Campaign.*—At last Lee's men had lost heart in the unequal struggle. Sheridan raided the upper James and destroyed all supplies. Grant lay in front of the Army of northern Virginia with 125,000 men, and when active operations

began Lee had no resource but to try and escape to the southwest in order to join Johnston. The western movement was covered by a furious sortie from the lines of Petersburg, which was repulsed with heavy loss. Grant felt that this was a mere feint to screen some other move, and instantly carried the Army of the Potomac to the westward, leaving a bare screen of troops in his lines. On the 29th of March the movement began, followed in rapid succession by the combats of White Oak Road and Dinwiddie Court House and Sheridan's great victory of Five Forks. At the same time the VI. Corps at last carried the Petersburg lines by storm. Thereupon Lee and Longstreet evacuated the Petersburg and Richmond lines and began their retreat. Their men were practically starving, though their rearguard showed a brave front. The remnant of Ewell's corps was cut off at Sailor's Creek, and when Sheridan got ahead of the Confederates while Grant furiously pressed them in the rear, surrender was inevitable (April 8). On the 9th the gallant remnant of the Army of northern Virginia laid down its arms at Appomattox Court House, and the Confederacy came to an end. Johnston surrendered to Sherman at Durham Station on the 26th, and soon afterwards all the remaining Confederate soldiers followed their example. So ended the gigantic struggle, as to the conduct of which it is only necessary to quote, with a more general application, the *envoi* of a Federal historian, "It has not seemed necessary to me to attempt a eulogy of the Army of the Potomac or the Army of northern Virginia." The general terms of surrender were that the Confederates should give up all material, and sign a parole not to take up arms again. There were no manifestations of triumph or exultation on the part of the victors, the lot of the vanquished was made as easy as possible, and after a short time the armies melted into the mass of the people without disturbance or disorder. A general amnesty proclaimed by the president of the United States on the 29th of May was the formal ending of the Civil War.

35. *Character of the War.*—No undisciplined levies could have fought as did the armies on both sides. Grave faults the men had, from the regular's point of view. They required humouring, and their march discipline was very elastic. But in battle the "thinking bayonets" resolutely obeyed orders, even though it were to attack a Marye's Hill, or a "Bloody Angle," for they had undertaken their task and would carry it through unflinchingly. So much may be said of both armies. The great advantage of the Confederate—an advantage which he had in a less degree as against the hardier and country-bred Federal of the west—was that he was a hunter and rider born and bred, an excellent shot, and still not infrequently settled his quarrels by the duel. The town-bred soldier of the eastern states was a thoughtful citizen who was determined to do his duty, but he had far less natural aptitude for war than his enemy from the Carolinas or his comrade from Illinois or Kansas. At the same time the more varied conditions of urban life made him more adaptable to changes of climate and of occupation than the "Southron." Irish brigades served on both sides and shot each other to pieces as at Fredericksburg. They had the reputation of being excellent soldiers. The German divisions, on the other hand, were rarely as good as the rest. The leading of these men was in the hands, as a rule, of regular or ex-regular officers, who made many mistakes in their handling of large masses, but had been taught at West Point and on the Indian frontier to command men in danger, and administer them in camp. The volunteer officers rarely led more than a division. When given high command at once they usually failed, but the best of them rose gradually to the superior ranks; Logan, for instance, became an army commander, Sickles, Terry and others corps commanders. Cleburne, one of the best division commanders of the South, had been a corporal in the British army. Meagher, the leader of the "Irish brigade" at Fredericksburg, was the young orator of the "United Irishmen." But Lee, the Johnstons, McClellan, Grant and Sherman had all served in the old army. Most of them were young men in 1861. Stuart was twenty-eight, Sheridan thirty, Grant and Jackson under forty, while some of the subordinate generals were actually fresh from West Point.

36. *Strategy and Tactics.*—The roughness of much of the country gave a peculiar tone to the strategy of the combatants. Roads were untrustworthy, rivers swelled suddenly, advance and retreat were conditioned and compelled, especially in the case of the ill-equipped Confederates, by the exigencies of food supply. Long forward strides of the Napoleonic type were rarely attempted; "changes of base" were indeed made across country, and over considerable distances, as by Sherman in 1864, but ordinarily either the base and the objective were connected by rail or water, or else every forward step was, after the manner of Marlborough's time, organized as a separate campaign. Hence field fortifications played an unusually prominent part, time and material being available as a rule for works of solid construction. In isolated instances of more rapid campaigning—*e.g.* Antietam and Gettysburg—they were of subordinate importance. The attack and defence of these entrenchments led to tactical phenomena of unusual interest. Cavalry could not bring about the decision in such country, and sought a field for its restless activity elsewhere. Artillery had fallen, technically, far behind the infantry arm, and in face of long-range rifle fire could not annihilate the hostile line with case-shot fire as in the days of Napoleon. In a battle such as Chancellorsville or the Wilderness guns were almost valueless, since there was little open space in which they might be used. It thus fell to the infantry to attack and defend with its own weapons, and the defence was, locally, almost inexpugnable behind its tall breastworks. One line of works could be stormed, but there were almost always two or three retrenchments behind. The attacking infantry, who found it necessary to cross a fire-swept zone 1000 yds. broad, had to be used resolutely in masses, line following line, and each carrying forward the wrecks of its predecessor. Partial attacks were invariably costly failures. The use of masses was never put in practice more sternly than by Grant in 1864. At the same time, as has been said, the cavalry arm found plenty of work. The horses were not trained for European shock-tactics, nor did the country offer charging room, and though mêlées of mounted men engaging with sword and pistol were not infrequent, the usual method of fighting was dismounted fire action, which was practised with uncommon skill by the troopers on both sides. The far-ranging strategic "raid" was a notable feature of the war; freely employed by both sides, it was sometimes harmful, more usually profitable, especially to the South, by reason of the captures in material, the information acquired and the alarm and confusion created. These raids, and the more ordinary screening work, were never executed more brilliantly than by Lee's great cavalry general, "Jeb" Stuart, in Virginia, but the Federal generals, Pleasonton and Sheridan, did excellent work in the east, as also Wheeler and Forrest on the Confederate, Wilson and Grierson on the Federal, side in the west. The technical services, in which the mechanical skill and ingenuity of the American had full play, developed remarkable efficiency. Whether it was desired to build a railway bridge, disable a locomotive or cut a canal, the engineers were always ready with some happy expedient. On one occasion an *infantry* division of 8000 men repaired 102 miles of railway and built 182 bridges in 40 days, forging their own tools and using local resources. Many novelties, too, such as the field telegraph, balloons and signalling, were employed.

37. *The Union and Confederate Navies.*—The naval war had been likewise fruitful of lessons for the future. Though wooden ships were still largely employed, the ironclad even then had begun to take a commanding place, and the sailing ship at last disappeared from naval warfare. Mines, torpedoes and submarines were all employed, and with the "Monitor" may fairly be said to have begun the application of mechanical science to the uses of naval war. The Federal navy was enormously expanded. Three hundred and thirteen steamers were brought into the service. Sloops of an excellent type were built for work on the high seas, of which the celebrated "Kearsarge" was one. Gunboats were constructed so fast that they were called "ninety-day gunboats." Special reversible paddle steamers (called double-enders) were designed for service in the inlets and estuaries, and sixty-six ironclads were built and employed during the four

years. Mississippi river steamers were armed with heavy guns and protected by armour, boiler-plates, cotton bales, &c., and some fast cruisers were constructed for ocean work, one of them actually reaching the high speed of 17·75 m. per hour. The existing Federal navy of 1861 already included some large and powerful modern vessels, such as the "Minnesota" and "Powhatan." To oppose them the Confederates, limited as they were for means, managed to construct various ironclads, and to improvise a considerable fleet of minor vessels, and, though a fighting navy never assembled under a Confederate flag-officer, the Southern warships found another more damaging and more profitable scope for their activity. It has been said that the blockade of the Confederate coast became in the end practically impenetrable, and that every attempt of the Confederate naval forces to break out was checked at once by crushing numerical preponderance. The exciting and profitable occupation of blockade-running led to countless small fights off the various harbours, and sometimes the United States navy had to fight a more serious action when some new "rebel" ironclad emerged from her harbour, inlet or sound.

38. *Fort Fisher.*—Many of the greater combats in which the navy was engaged on the coast and inland have been referred to above, and the fighting before Charleston, New Orleans, Mobile and Vicksburg is described in separate articles. One of the heaviest of the battles was fought at Fort Fisher in 1864. This place guarded the approaches to Wilmington, North Carolina. Troops under Butler and a large fleet under Admiral Porter were destined for this enterprise. An incendiary vessel was exploded close to the works without effect on the 23rd–24th of December, and the ships engaged on the 24th. The next day the troops were disembarked, only to be called off after a partial assault. Butler then withdrew, and Porter was informed on the 31st that "a competent force properly commanded" would be sent out. On the 8th of January 1865 General Terry arrived with the land forces, and the armada arrived off Fisher on the 12th. On the 13th, 6000 men were landed, covered by the guns of the fleet, and, after Porter had subjected the works to a terrific bombardment, Fisher was brilliantly carried by storm on the 15th. Reinforcements arriving, the whole force then marched inland to meet Sherman.

39. *Other Naval Actions.*—Apart from this, and other actions referred to, two incidents of the coast war call for notice—the career of the "Albemarle" and the duel between the "Atlanta" and the "Weehawken." The ironclad ram "Albemarle," built at Edwards' Ferry on the Roanoke river, had done considerable damage to the Federal vessels which, since Burnside's expedition to Newberne, had cruised in Albemarle Sound, and in 1864 a force of double-enders and gunboats, under Captain Melancton Smith, U.S.N., was given the special task of destroying the rebel ram. A naval battle was fought on the 5th of May 1864, in which the double-ender "Sassacus" most gallantly rammed the "Albemarle" and was disabled alongside her, and Smith's vessel and others, unarmoured as they were, fought the ram at close quarters. After this the ironclad retired upstream, where she was eventually destroyed in the most daring manner by a boat's crew under Lieutenant W. B. Cushing. Making his way up the Roanoke as far as Plymouth he there sank the ironclad at her wharf by exploding a spar-torpedo (October 27). On the 17th of June 1863 after a brief action the monitor "Weehawken" captured the Confederate ironclad "Atlanta" in Wassaw Sound, South Carolina. This duel resembled in its attendant circumstances the famous fight of the "Chesapeake" and the "Shannon." Captain John Rodgers, like Broke, was one of the best officers, and the "Weehawken," like the "Shannon," was known as one of the smartest ships in the service. Five heavy accurate shots from the Federal's turret guns crushed the enemy in a few minutes.

40. *The Commerce-Destroyers.*—Letters of marque were issued to Confederate privateers as early as April 1861, and Federal commerce at once began to suffer. When, however, surveillance became blockade, prizes could only with difficulty be brought into port, and, since the parties interested gained nothing by burning merchantmen, privateering soon died out, and was replaced by commerce-destroying pure and simple, carried out by commissioned vessels of the Confederate navy. Captain Raphael Semmes of the C.S.S. "Sumter" made a successful cruise on the high seas, and before she was abandoned at Gibraltar had made seventeen prizes. Unable to build at home, the Confederates sought warships abroad, evading the obligations of neutrality by various ingenious expedients. The "Florida" (built at Liverpool in 1861–1862) crossed the Atlantic, refitted at Mobile, escaped the blockaders, and fulfilled the instructions which, as her captain said, "left much to the discretion but more to the torch." She was captured by the U.S.S. "Wachusett" in the neutral harbour of Bahia (October 7, 1862). The most successful of the foreign-built cruisers was the famous "Alabama," commanded by Semmes and built at Liverpool. In the course of her career she burned or brought into port seventy prizes, fought and sank the U.S.S. "Hatteras" off Galveston, and was finally sunk by the U.S.S. "Kearsarge," Captain Winslow, off Cherbourg (June 19, 1864). The career of another promising cruiser, the "Nashville," was summarily ended by the Federal monitor "Montauk" (February 28, 1863). The "Shenandoah" was burning Union whalers in the Bering Sea when the war came to an end. None of the various "rams" built abroad for the "rebel" government ever came into action. The difficulties of coaling and the obligations of neutrality hampered these commerce-destroyers as much as the Federal vessels that were chasing them, but, in spite of drawbacks, the *guerre de course* was the most successful warlike operation undertaken by the Confederacy. The mercantile marine of the United States was almost driven off the high seas by the terror of these destructive cruisers.

41. *Cost of the War.*—The total loss of life in the Union forces during the four years of war was 359,528, and of the many thousands discharged from the services as disabled or otherwise unfit, a large number died in consequence of injuries or disease incurred in the army. The estimate of 500,000 in all may be taken as approximately correct. The same number is given as that of the Southern losses, which of course fell upon a much smaller population. The war expenditure of the Federal government has been estimated at $3,400,000,000; the very large sums devoted to the pensions of widows, disabled men, &c., are not included in this amount (Dodge). In 1879 an estimate made of all Federal war expenses up to that date, including pension charges, interest on loans, &c., showed a total of $6,190,000,000 (Dewey, *Financial History of the United States*).

Bibliography.—The United States government's *Official Records of the Union and Confederate Armies* (70 vols., most of which are divided into two or three "parts," and atlas, 1880–1900) include every important official document of either side that it was possible to obtain in the course of many years' work. A similar but less voluminous work is the *Records of the Union and Confederate Navies* (1894–); *The Rebellion Record* (1862–1868), edited by F. W. Moore, a contemporary collection, has been superseded to a great extent by the official records, but is still valuable as a collection of unofficial documents of all kinds. *Battles and Leaders of the Civil War* (1887–1889) is a series of papers, covering the whole war, written by the prominent commanders of both sides. The sixteen volumes of the *Campaigns of the Civil War* (1881–1882) and the *Navy in the Civil War* (1883) (written by various authors) are of very unequal merit, but several of the volumes are indispensable to the study of the Civil War. Of general works the following are the best:—Comte de Paris, *History of the Civil War in America*, translated from the French (1875–1888); Horace Greeley, *The American Conflict* (1864–1866); J. Scheibert, *Der Bürgerkrieg i. d. Nordam. Freistaaten* (Berlin, 1874); Wood and Edmonds, *Civil War in the United States* (London, 1905); T. A. Dodge, *Bird's Eye View of our Civil War* (revised edition, 1887); E. A. Pollard, *A Southern History of the War* (1866). The contemporary accounts mentioned should be studied with caution. Of critical works, J. C. Ropes, *The Story of the Civil War* (1894–1898); G. F. R. Henderson, *Stonewall Jackson and the American Civil War* (London, 1898) and *The Science of War*, chapters viii. and ix. (London, 1905); C. C. Chesney, *Essays in Military Biography* (1874); Freytag-Loringhoven, *Studien über Kriegführung, 1861–1865* (Berlin, 1901–1903), are the most important. Publications of the Military Historical Society of Massachusetts (vols. i.-x., 1881 onwards) also comprise critical accounts of nearly all the important campaigns. A critical account of the Virginian operations and the Chickamauga campaign is Gen. E. P. Alexander's *Military Memoirs of a Confederate* (1906). C. R. Cooper, *Chronological and Alphabetical Record of the Great Civil War* (Milwaukee, 1904) may be mentioned as a work of reference.

A fairly complete bibliography will be found in J. N. Larned, *Literature of American History* (Boston, 1902), and useful lists in Ropes, *op. cit.*, and in the *Cambridge Modern History*, vol. vii. p. 812. For biographies, memoirs and general works, see the lists appended to the various biographical articles and to the articles UNITED STATES and CONFEDERATE STATES. (C. F. A.)

AMERICAN LAW. The laws of the various states and territories of the United States rest at bottom on the same foundation as those of England, namely, the English common law as it existed at the beginning of the 17th century. (See ENGLISH LAW.) The only exceptions worth noting are to be found in the state of Louisiana, the territory of New Mexico, and the acquisitions following the Spanish war of 1898. Those derive most of their law from France or Spain, and thus remotely from the principles of Roman jurisprudence. A part also, but comparatively a small part, of the law of Texas, Missouri, Arizona and the Pacific states comes from similar sources. The United States as a whole has no common law, except so far as its courts have followed the rules of English common-law procedure in determining their own. Most of the positive law of the United States comes from the several states. It is the right of each state to regulate at its pleasure the general relations of persons within its territory to each other, as well as all rights to property subject to its jurisdiction. Each state has also its own system of adjective law. The trial courts of the United States of original jurisdiction follow in general the practice of the state in which they sit as to procedure in cases of common-law character. As to that in equity, or what means the same thing, chancery causes, they follow in general the practice of the English court of chancery as it existed towards the close of the 18th century, when the original Judiciary Act of the United States was adopted. The public statutes of the United States are to be found in the *Revised Statutes* of 1873, and in the succeeding volumes of the *Statutes at Large*, enacted by each Congress. Those of each state and territory are printed annually or biennially as they are enacted by each legislature, and are commonly revised every fifteen or twenty years, the revision taking the place of all former public statutes, and being entitled *Revised Statutes*, *General Statutes*, or *Public Laws*. The private or special laws of each state, so far as such legislation is permitted by its constitution, are in some states published separately, and made the subject of similar compilations or revisions; in others they are printed with the public session laws. American courts are often given power by statute to make rules of procedure which have the force of laws. Municipal subdivisions of a state generally have authority from the legislature to make ordinances or by-laws on certain subjects, having the character of a local law, with appropriate sanctions, commonly by fine or forfeiture.

The XIVth Amendment.

Law in the United States has been greatly affected by the results of the Civil War. During its course (1861–1865) the powers of the president of the United States may be said to have been re-defined by the courts. It was its first civil war, and thus for the first time the exercise of the military authority of the United States within a state which had not sought its aid became frequent and necessary. Next followed the amendments of the Constitution of the United States having for their special purpose the securing beyond question of the permanent abolition of slavery and the civil and political rights of the coloured race. At the outset the Supreme Court of the United States was inclined to treat them as having a very limited operation in other directions. One of the provisions of the XIVth Amendment is that no state shall deny to any person within its jurisdiction the equal protection of the laws. The benefit of this guarantee was claimed by the butchers of New Orleans, in contending against a monopoly in respect of the slaughter of cattle granted by the state of Louisiana to a single corporation. Their suit was dismissed by the Supreme Court in 1873, with the expression of a doubt whether any action of a state not directed by way of discrimination against the negroes as a class, or on account of their race, would ever be held to come within the purview of the provision in question.[1] The chief justice and three of his associates dissented from the judgment, holding that the XIVth Amendment did protect the citizens of the United States against the deprivation of their common rights by state legislation.[2] Public sentiment supported the view of the minority, and it was not long before changes in the *personnel* of the court, occurring in common course, led it to the same conclusions. The protection of the XIVth Amendment is now invoked before it more frequently than is that afforded by any other article of the Constitution. In one of its recent terms twenty-one cases of this nature were decided.[3] Very few of them related to the negro. Since the decision in the Slaughter-House Cases, the controversies as to the constitutional rights of the negro have been comparatively infrequent, but there has been a great and steadily increasing number in all the courts in the country, involving questions of discrimination in favour of or against particular individuals, or of changes affecting the rights of parties in the accustomed forms of judicial procedure.

Down to 1868, when this amendment was adopted, it was, as to most matters, for the state alone to settle the civil rights and immunities of those subject to its jurisdiction. If they were to be free from arbitrary arrests, secure in liberty and property, equal in privilege and entitled to an impartial administration, it was because the constitution of the state so declared. Now they have the guarantee of the United States that the state shall never recede from these obligations. This has readjusted and reset the whole system of the American law of personal rights.[4]

The Supreme Court of the United States has used the great power thus confided to it with moderation. Its general rules of decision are well stated in these words of Mr Justice Brown, found in one of its recent opinions:—

> "In passing upon the validity of legislation, attacked as contrary to the XIVth Amendment, it has not failed to recognize the fact that the law is, to a certain extent, a progressive science; that in some of the states methods of procedure, which at the time the constitution was adopted were deemed essential to the protection and safety of the people or to the liberty of the citizen, have been found to be no longer necessary; that restrictions which had formerly been laid upon the conduct of individuals, or of classes of individuals, had proved detrimental to their interests; while, upon the other hand, certain other classes of persons, particularly those engaged in dangerous or unhealthful employments, have been found to be in need of additional protection. Even before the adoption of the constitution, much had been done toward mitigating the severity of the common law, particularly in the administration of its criminal branch. The number of capital crimes, in this country at least, had been largely decreased. Trial by ordeal and by battle had never existed here, and had fallen into disuse in England. The earlier practice of the common law, which denied the benefit of witnesses to a person accused of felony, had been abolished by statute, though, so far as it deprived him of the assistance of counsel and compulsory process for the attendance of his witnesses, it had not been changed in England. But, to the credit of her American colonies, let it be said that so oppressive a doctrine had never obtained a foothold there. The 19th century originated legal reforms of no less importance. The whole fabric of special pleading, once thought to be necessary to the elimination of the real issue between the parties, has crumbled to pieces. The ancient tenures of real estate have been largely swept away, and land is now transferred almost as easily and cheaply as personal property. Married women have been emancipated from the control of their husbands, and placed upon a practical equality with them with respect to the acquisition, possession and transmission of property. Imprisonment for debt has been abolished. Exemptions from executions have been largely added to, and in most of the states homesteads are rendered incapable of seizure and sale upon forced process. Witnesses are no longer incompetent by reason of interest, even though they be parties to the litigation. Indictments have been simplified, and an indictment for the most serious of crimes is now the simplest of all. In several of the states grand juries, formerly the only safeguard against a malicious prosecution, have been largely abolished, and in others the rule of unanimity, so far as applied to civil cases, has given way to verdicts rendered by a three-fourths majority. This case does not call for an expression of opinion as to the wisdom of these changes, or their validity under the XIVth Amendment, although the substitution of prosecution by information in lieu of indictment was recognized as valid in *Hurtado* v. *California*, 110 U.S. 516. They are mentioned only for the purpose of calling attention to the probability that other changes of no less importance may be made in the future, and that while the cardinal principles of justice are immutable, the methods by which justice

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[1] The Slaughter-House Cases, 16 Wallace's Reports, 36, 81.

[2] *Ibid.* 89, 111, 129.

[3] *Guthrie on the Fourteenth Amendment*, 27.

[4] Baldwin's *Modern Political Institutions*, 111, 112.

is administered are subject to constant fluctuation, and that the Constitution of the United States, which is necessarily and to a large extent inflexible and exceedingly difficult of amendment, should not be so construed as to deprive the states of the power to amend their laws so as to make them conform to the wishes of the citizens as they may deem best for the public welfare without bringing them into conflict with the supreme law of the land. Of course, it is impossible to forecast the character or extent of these changes, but in view of the fact that from the day Magna Carta was signed to the present moment, amendments to the structure of the law have been made with increasing frequency, it is impossible to suppose that they will not continue, and the law be forced to adapt itself to new conditions of society, and particularly to the new relations between employers and employees, as they arise."[1]

The Civil War deeply affected also the course of judicial decision in the southern states. During its progress it engaged the attention of a very large part of the population, and the business of the courts necessarily was greatly lessened. Upon its close political power passed, for a time, into new hands, and many from the northern and western states took prominent positions both at the bar and on the bench. The very basis of society was changed by the abolition of slavery. New state constitutions were adopted, inspired or dictated by the ideas of the North. The transport system was greatly extended, and commerce by land took to a large extent the place formerly filled by commerce by navigation. Manufacturing came in to supplement agricultural industry. Cities grew and assumed a new importance. Northern capital sought investment in every state. It was a natural consequence of all these things that the jurisprudence of the South should come to lose whatever had been its distinctive character. The unification of the nation inevitably tended to unify its law.

The Bar Association.

An important contribution towards this result was made by the organization of the American Bar Association in 1878. Of the fourteen signers of the call for the preliminary conference, five were from the southern states. Its declared objects were "to advance the science of jurisprudence, promote the administration of justice and uniformity of legislation throughout the Union, uphold the honour of the profession of the law, and encourage cordial intercourse among the members of the American Bar."

Law schools.

Largely through its efforts, the American law schools have taken on a new character. The course of study has been both broadened and prolonged, and the attendance of students has increased in full proportion to the additions to the facilities for obtaining a more thorough training in the profession. When the association commenced its labours, those studying law in the offices of practising lawyers very largely outnumbered those found in the law school. The proportion is now reversed. During the year 1900, for instance, the state board of law examiners in New York examined 899 applicants for admission to the bar of that state. Of these all but 157 had received their legal education wholly or in part at a law school.[2] In 1878 few law schools had adopted any system of examination for those desiring to enter them. Such a requirement for admission is now common. In only one school were opportunities then afforded for advanced studies by graduate students with a view to attaining the doctorate in law. Courses of this description are now offered by several of the university schools.

Reports.

A more scientific character has thus been taken on by American law. It is noticeable both in legal text-books and in the opinions of the courts of last resort. In the latter precision of statement and method in discussion are invited by the uniform practice of preparing written opinions. The original practice of reading these from the bench has been generally discontinued. They are simply handed down to an official reporter for publication, which is done at the expense of the government by which the court is commissioned. With the judicial reports of each state the lawyers of that state are required to be familiar; and this is rendered possible, even in the larger ones, by state digests, prepared every few years by private enterprise. Outside of the state their circulation is comparatively limited, though sets of all are generally found in each state library, and of many in the Bar libraries at the principal county seats. The private libraries of lawyers in large practice also often contain the reports of adjoining and sometimes those of distant states as well as those of their own and of the Supreme Court of the United States. The decisions of one state, however, are now best known in others through unofficial reports. One large publishing concern prints every case decided in the courts of last resort. They are published in several distinct series, those, for instance, coming from the northern Atlantic states being grouped together as the *Atlantic Reporter*, and those from the states on the Pacific coast as the *Pacific Reporter*. Another house has published a compilation professing to give all the leading American cases from the first to the latest volume of reports. Another makes a similar selection from the decisions of each year as they appear, and publishes them with critical annotations. There are also annual digests of a national character, comprehending substantially all American cases and the leading English cases reported during the preceding year.

These various publications are widely diffused, and so the American lawyer is enabled, in preparing for the argument of any cause involving questions of difficulty, to inform himself with ease of such precedents as may apply. A court in Texas is thus as likely to be made acquainted with a decision in Maine or Oregon as with one in any nearer state, and in the development of American law all American courts are brought in close touch with each other.

English and American law.

This tendency has been advanced by the steady growth of codification. That is beginning also to serve to bring English and American law nearer together in certain directions. A Negotiable Instruments Act, promoted by the American Bar Association, and prepared by a conference of commissioners appointed by the several states to concert measures of uniform legislation, has been adopted in the leading commercial states. It is founded upon the English "Chalmers's Act," and the English decisions giving a construction to that have become of special importance. The acts of parliament known as the Employers' Liability Act and the Railway and Canal Traffic Act have also served as the foundation of similar legislation in the United States, and with the same result. Modern English decisions are, however, cited less frequently in American courts than the older ones; and the older ones themselves are cited far less frequently than they once were. In the development of their legislation, England and the United States have been in general harmony so far as matters of large commercial importance are concerned, but as to many others they have since 1850 drawn apart. Statutes, at one point or another, probably now affect the disposition of most litigated causes in both countries. Their application, therefore, must serve more or less to obscure or displace general principles, which might otherwise control the decision and make it a source of authority in foreign tribunals. The movement of the judicial mind in the United States, and also its modes and form of expression, have a different measure from that which characterizes what comes from the English bench. American judges are so numerous, and (except as to the Supreme Court of the United States) the extent of their territorial jurisdiction so limited, that they can give more time to the careful investigation of points of difficulty, and also to the methodical statement of their conclusions. Whatever they decide upon appeal being announced in writing, and destined to form part of the permanent published records of the state, they are expected and endeavour to study their words and frame opinions not only sound in law but unobjectionable as literary compositions.

The choice of American judges, particularly in the older states, has been not uninfluenced by these considerations. Marshall, Bushrod Washington, Story, Kent, Ware, Bradley, and many of their contemporaries and successors, were put upon the bench in part because of their legal scholarship and their power of felicitous expression. Hence the better American opinions have more elaboration and finish than many which come from the English courts, and are more readily accepted as authorities by American judges. But the great multiplication of reports has so widened the field of citation as in effect to reduce it. Each of the larger and older states has now a settled body of legal precedent of its own, beyond which its judges in most cases do not look. If a prior decision applies, it is controlling. If there be none, they prefer to decide the case, if possible, on principle rather than authority.

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[1] *Holden* v. *Hardy*, 169 United States Reports, 336, 385-387.

[2] *Columbia Law Review*, i. 99.

While the state courts are bound to accept the construction placed upon the Constitution and laws of the United States by the Supreme Court of the United States, and thus uniformity of decision is secured in that regard, the courts of the United States, on the other hand, are as a rule obliged to accept in all other particulars the construction placed by the courts of each state on its constitution and laws. This often gives a seeming incongruity to the decisions of the Supreme Court of the United States. A point in a case coming up from one judicial circuit may be determined in a way wholly different from that followed in a previous judgment in a cause turning upon the same point, but appealed from another circuit, because of a departure from the common law in one state which has not been made in another. In view of this, a doctrine originally proposed by Mr Justice Story in 1842[1] has not been infrequently invoked of late years, which rests upon the assumed existence of a distinctive federal jurisprudence of paramount authority as to certain matters of general concern, as for example those intimately affecting commerce between the states or with foreign nations. The consequence is that a case involving such questions may be differently adjudged, according as it is brought in a state or in a federal court.[2]

The divergences now most noticeable between English and American law are in respect of public control over personal liberty and private property, criminal procedure and the scope of the powers of municipal corporations.

Under the constitutional provision that no one shall be deprived of life, liberty or property without due process of law, American courts frequently declare void statutes which in England would be within the acknowledged powers of parliament. These provisions are liberally expounded in favour of the individual, and liberty is held to include liberty of contract as well as of person. Criminal procedure is hedged about with more refinements and safeguards to the accused than are found in England, and on the other hand, prosecutions are more certain to follow the offence, because they are universally brought by a public officer at public expense. The artificiality of the proceedings is fostered by a general right of appeal on points of law to the court of last resort. It is in criminal causes involving questions of common-law liability and procedure[3] that English law-books and reports are now most frequently cited. American municipal corporations are confined within much narrower limits than those of England, and their powers more strictly construed.

Trial by jury.

Trial by jury in civil causes seems to be declining in public esteem. The expenses necessarily incident to it are naturally increasing, and the delays are greater also from a general tendency, especially in cities, where most judicial business is transacted, to reduce the number of hours a day during which the court is in session. The requirement of unanimity is dispensed with in a few states, and it has been thus left without what many deem one of its essential features. The judge interposes his authority to direct and expedite the progress of the trial less frequently and less peremptorily than in England. A jury is waived more often than formerly, and there is a growing conviction that, with a capable and independent judiciary, justice can be looked for more confidently from one man than from thirteen.

The United States entered on the work of simplifying the forms of pleading earlier than England, but has not carried it so far. Demurrers have not been abandoned, and in some states little has been done except to replace one system of formality by another hardly less rigid. The general plan has been to codify the laws of pleading by statute. In a few states they have proceeded more nearly in accordance with the principles of the English Judicature Act, and left details to be worked out by the judges, through rules of court.[4]

The legislature and the courts.

Most of the state constitutions assume that the powers of government can be divided into three distinct departments, executive, legislative and judicial; and direct such a distribution. In thus ignoring the administrative functions of the state, they have left a difficult question for the courts, upon which the legislature often seeks in part to cast them. The general tendency has been to construe, in such circumstances, the judicial power broadly, and hold that it may thus be extended over much which is rather to be called quasi-judicial.[5] A distinction is taken between entrusting jurisdiction of this character to the courts, and imposing it upon them. Where the statute can be construed as simply permissive, the authority may be exercised as a matter of grace, when it would be peremptorily declined, were the meaning of the legislature that it must be accepted.[6] The courts, for similar reasons, have generally declined (in the absence of any constitutional requirement to that effect) to advise the legislature, at its request, whether a proposed statute, if enacted, would be valid. While its validity, were it to be enacted, might become the subject of a judicial decision, it is thought for that reason, if for no other, to be improper to prejudge the point, without a hearing of parties interested. The constitutions of several states provide for such a proceeding, and in these the Supreme Court is not infrequently called upon in this way, and gives responses which are always considered decisive of legislative action, but would not be treated as conclusive in any subsequent litigation that might arise.

Police power of states.

The general trend of opinion in the Supreme Court of the United States since 1870, upon questions other than those arising under the XIVth Amendment, has been towards recognizing the police power of the several states as entitled to a broad scope. Even, for instance, in such a matter as the regulation of commerce between different states, it has been upheld as justifying a prohibition against running any goods trains on a Sunday, and a requirement that all railway cars must be heated by steam.[7] In the "Granger Cases,"[8] the right of the state to fix the rate of charges for the use of a grain elevator for railway purposes, and for general railway services of transportation, was supported, and although the second of these was afterwards overruled,[9] the principle upon which it was originally rested was not shaken.

On the other hand, reasons of practical convenience have necessarily favoured the substantial obliteration of state lines as to the enforcement of statutory private rights. Massachusetts in 1840, six years before the passage of Lord Campbell's Act, provided a remedy by indictment for the negligent killing of a man by a railway company, a pecuniary penalty being fixed which the state was to collect for the benefit of his family. In most of the other states by later statutes a similar result has been reached through a civil action brought by the executor or administrator as an agent of the law. In some, however, the state must be the plaintiff; in others the widow, if any there be. The accident resulting in death often occurs in a state where the man who was killed does not reside, or in which the railway company does not have its principal seat. It may therefore be desirable to sue in one state for an injury in another. Notwithstanding such an action is unknown to the common law, and rests solely on a local statute, the American courts uniformly hold that, when civil in form, it can be brought under such statutes in any state the public policy of which is not clearly opposed to such a remedy. In like manner, the responsibilities of stockholders and directors of a moneyed corporation, under the laws of the state from which the charter is derived, are enforced in any other states in which they may be found. Thus a double liability of stockholders to creditors, in case of the insolvency of the company, or a full liability to creditors of directors who have made false reports or certificates regarding its financial condition, is treated as of a contractual nature, and not penal in the international sense of that term.[1] As a judgment of one state has equal force in another, so far as the principle of *res adjudicata* is concerned, the orders of a court in a state to which a corporation owes its charter, made in proceedings for winding it up, may be enforced to a large extent in any other. The shareholders are regarded as parties by representation to the winding-up proceedings, and so bound by decrees which are incidental to it.[2]

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[1] *Swift* v. *Tyson*, 16 Peters' Reports, 1, 19.

[2] See *Forepaugh* v. *Delaware, Lackawanna & Western Railroad Company*, 128 Pennsylvania State Reports, 267; *Faulkner* v. *Hart*, 82 New York Reports, 313; and *Lake Shore & Michigan Southern Railway Company* v. *Prentice*, 147 United States Reports, 101.

[3] See, as examples, *Commonwealth* v. *Rubin*, 165 Massachusetts Reports, 453, in which Holmes, C.J., traces the rule that, if a man abuse an authority given him by the law, he becomes a trespasser *ab initio*, back to the Year Books; and *Commonwealth* v. *Cleary*, 172 Massachusetts Reports, 175, in which the same judge refers to Glanville and Fleta as authority for the proposition that the admission in evidence, in cases of rape, of complaints made by the woman soon after the commission of the offence is a perverted survival of the old rule that she could not bring an appeal unless she had made prompt hue and cry.

[4] This has been carried furthest in Connecticut. See *Botsford* v. *Wallace*, 72 Connecticut Reports, 195.

[5] Norwalk Street Railway Company's Appeal, 69 Connecticut Reports, 576; 38 *Atlantic Reporter*, 708.

[6] *Zanesville* v. *Zanesville Telephone Company*, 63 Ohio State Reports, 442; 59 *North-Eastern Reporter*, 109.

[7] *New York Railroad* v. *New York*, 165 United States Reports, 628.

[8] *Munn* v. *Illinois*, 94 United States Reports, 113; *Chicago Railroad Company* v. *Iowa*, ibid. 155.

[9] *Wabash Railway Company* v. *Illinois*, 118 United States Reports, 557; *Reagan* v. *Farmers' Loan and Trust Company*, 154 United States Reports, 362.

The provisions of the United States law on different subjects and the literature concerning them are given in the separate articles. See the bibliography to the article LAW; also Cooley on *The Constitutional Limitations which rest upon the Legislative Power of the States of the American Union;* Andrews on *American Law*; and Russell on *The Police Power of the State, and Decisions thereon as illustrating the Development and Value of Case Law.* (S. E. B.)

Beginnings.

AMERICAN LITERATURE. The earliest books which are commonly described as the beginnings of American literature were written by men born and bred in England; they were published there; they were, in fact, an undivided part of English literature, belonging to the province of exploration and geographical description and entirely similar in matter and style to other works of voyagers and colonizers that illustrate the expansion of England. They contain the materials of history in a form of good Elizabethan narrative, always vigorous in language, often vivid and picturesque. John Smith (1579–1631) wrote the first of these, *A True Relation of such Occurrences and Accidents of Note as hath happened in Virginia* (1608), and he later added other accounts of the country to the north. William Strachey, a Virginian official of whom little is known biographically, described (1610) the shipwreck of Sir Thomas Gates on the Bermudas, which is believed to have yielded Shakespeare suggestions for *The Tempest.* Colonel Henry Norwood (d. 1689), hitherto unidentified, of Leckhampton, Gloucestershire, a person eminent for loyalty in the reign of Charles I. and distinguished in the civil wars, later governor of Tangiers and a member of parliament for Gloucester, wrote an account of his voyage to Virginia as an adventurer, in 1649. These are characteristic works of the earliest period, and illustrate variously the literature of exploration which exists in numerous examples and is preserved for historical reasons. The settlement of the colonies was, in general, attended by such narratives of adventure or by accounts of the state of the country or by documentary record of events. Thus George Alsop (b. 1638) wrote the *Character of the Province of Maryland* (1666), and Daniel Denton a *Brief Description of New York* (1670), and in Virginia the progress of affairs was dealt with by William Stith (1689–1755), Robert Beverly (f. 1700), and William Byrd (1674–1744). Each settlement in turn, as it came into prominence or provoked curiosity, found its geographer and annalist, and here and there sporadic pens essayed some practical topic. The product, however, is now an indistinguishable mass, and titles and authors alike are found only in antiquarian lore. The distribution of literary activity was very uneven along the sea-board; it was naturally greatest in the more thriving and important colonies, and bore some relation to their commercial prosperity and political activity and to the closeness of the connexion with the home culture of England. From the beginning New England, owing to the character of its people and its ecclesiastical rule, was the chief seat of the early literature, and held a position apart from the other colonies as a community characterized by an intellectual life. There the first printing press was set up, the first college founded, and an abundant literature was produced.

The characteristic fact in the Puritan colonies is that literature there was in the hands of its leading citizens and was a chief concern in their minds. There were books of exploration and description as in the other colonies, such as William Wood's (d. 1639) *New England's Prospect* (1634), and John Josselin's *New England's Rarities* (1672), and tales of adventure in the wilderness and on the sea, most commonly described as "remarkable providences," in the vigorous Elizabethan narrative; but besides all this the magistracy and the clergy normally set themselves to the labour of history, controversy and counsel, and especially to the care of religion. The governors, beginning with William Bradford (1590–1657) of Plymouth, and John Winthrop (1588–1649) of Massachusetts Bay, wrote the annals of their times, and the line of historians was continued by Winslow, Nathaniel Morton, Prince, Hubbard and Hutchinson. The clergy, headed by John Cotton (1585–1652), Thomas Hooker (1586?–1647), Nathaniel Ward (1579?–1652), Roger Williams (1600–1683), Richard Mather (1596–1669), John Eliot (1604–1690), produced sermons, platforms, catechisms, theological dissertations, tracts of all sorts, and their line also was continued by Shepard, Norton, Wise, the later Mathers and scores of other ministers. The older clergy were not inferior in power or learning to the leaders of their own communion in England, and they commanded the same prose that characterizes the Puritan tracts of the mother country; nor did the kind of writing deteriorate in their successors. This body of divines in successive generations gave to early New England literature its overwhelming ecclesiastical character; it was in the main a church literature, and its secular books also were controlled and coloured by the Puritan spirit. The pervasiveness of religion is well illustrated by the three books which formed through the entire colonial period the most popular domestic reading of the Puritan home. These were *The Bay Psalm Book* (1640), which was the first book published in America; Michael Wigglesworth's (1631–1705) *Day of Doom* (1662), a doggerel poem; and the *New England Primer* (c. 1690), called "the Little Bible." The sole voice heard in opposition was Thomas Morton's satirical *New English Canaan* (1637), whose author was sent out of the colony for the scandal of Merrymount, but satire itself remained religious in Ward's *Simple Cobbler of Agawam* (1647). Poetry was represented in Anne Bradstreet's (1612–1672) *The Tenth Muse lately sprung up in America* (1650), and was continued by a succession of doggerel writers, mostly ministers or schoolmasters, Noyes, Oakes, Folger, Tompson, Byles and others. The world of books also included a good proportion of Indian war narratives and treatises relating to the aborigines. The close of the 17th century shows literature, however, still unchanged in its main position as the special concern of the leaders of the state. It is Chief-Justice Samuel Sewall's (1652–1730) *Diary* (which remained in manuscript until 1878) that affords the most intimate view of the culture and habits of the community; and he was known to his contemporaries by several publications, one of which, *The Selling of Joseph* (1700), was the first American anti-slavery tract.

Puritanism.

The literature of the first century, exemplified by these few titles, is considerable in bulk, and like colonial literature elsewhere is preserved for historical reasons. In general, it records the political progress and social conditions of the Puritan state, and the contents of the Puritan mind. The development of the original settlement took place without any violent check. Though the colony was continually recruited by fresh immigration, the original 20,000 who arrived before 1640 had established the principles of the state, and their will and ideas remained dominant after the Restoration as before. It was a theocratic state controlled by the clergy, and yet containing the principle of liberty. The second and third generations born on the soil, nevertheless, showed some decadence; notwithstanding the effort to provide against intellectual isolation and mental poverty by the foundation of Harvard College, they felt the effects of their situation across the sea and on the borders of a wilderness. The people were a hard-faring folk and engaged in a material struggle to establish the plantations and develop commerce on the sea; their other life was in religion soberly practised and intensely felt. They were a people of one book, in the true sense,—the Bible; it was the organ of their mental life as well as of their spiritual feelings. For them, it was in the place of the higher literature. But long resident there in the strip between the sea and the forest, cut off from the world and consigned to hard labour and to spiritual ardours, they developed a fanatical temper; their religious life hardened and darkened; intolerance and superstition grew. Time, nevertheless, ripened new changes, and the colony was to be brought back from its religious seclusion into the normal paths of modern development. The sign was contained, perhaps, most clearly in the change effected in the new charter granted by King William which made property the basis of the franchise in place of church-membership, and thus set the state upon an economic instead of a religious foundation. It is rather by men than by books that these times are remembered, but it is by the men who were writers of books. In general, the career of the three Mathers coincides with the history of the older Puritanism, and their personal characteristics reflect its stages as their writings contain its successive traits. Richard Mather, the emigrant, had been joint author in the composition of *The Bay Psalm Book*, and served the colony among the first of its leaders. It was in his son, Increase Mather (1639–1723), that the theocracy, properly speaking, culminated. He was not only a divine, president of Harvard College and a prolific writer; but he was dominant in the state, the chief man of affairs. It was he who, sent to represent the colony in England, received from King William the new charter. His son, Cotton Mather (1663–1728), succeeded to his father's distinction; but the changed condition is reflected in his non-participation in affairs; he was a man of the study and led there a narrower life than his father's had been. He was, nevertheless, the most broadly characteristic figure of the Puritan of his time. He was able and learned, abnormally laborious, leaving over 400 titles attributed to him; and at the same time he was an ascetic and visionary. The work by which he is best remembered, the *Magnalia Christi Americana, or the Ecclesiastical History of New England from its First Planting in the Year 1620, unto the Year of our Lord 1698* (1702), is the chief historical monument of the period, and the most considerable literary work done in America up to that time. It is encyclopaedic in scope, and contains an immense accumulation of materials relating to life and events in the colony. There the New England of the 17th century is displayed. His numerous other works still further amplify the period, and taken all together his writings best illustrate the contents of Puritanism in New England. The power of the clergy was waning, but even in the political sphere it was far from extinction, and it continued under its scheme of church government to guard jealously the principles of liberty. In John Wise's (1652–1725) *Vindication of the Government of New England Churches* (1717) a precursor of the Revolution is felt. It was in another sphere, however, that Puritanism in New England was to reach its height, intellectually and spiritually alike, in the brilliant personality of Jonathan Edwards (1703–1758), its last great product. He was free of affairs, and lived essentially the private life of a thinker. He displayed in youth extraordinary precocity and varied intellectual curiosity, and showed at the same early time a temperament of spirtual sensitiveness and religious ideality which suggests the youth of a poet rather than of a logician. It was not without a struggle that he embraced sincerely the Calvinistic scheme of divine rule, but he was able to reconcile the doctrine in its most fearful forms with the serenity and warmth of his own spirit; for his soul at all times seems as lucid as his mind, and his affections were singularly tender and refined. He served as minister to the church at Northampton; and, driven from that post, he was for eight years a missionary to the Indians at Stockbridge; finally he was made president of Princeton College, where after a few weeks' incumbency he died. The works upon which his fame is founded are *Treatise concerning the Religious Affections* (1746), *On the Freedom of the Will* (1754), *Treatise on Original Sin* (1758). They exhibit extraordinary reasoning powers and place him among the most eminent theologians. He contributed by his preaching great inspiring force to the revival, known as "the Great Awakening," which swept over the dry and formal Puritanism of the age and was its last great flame. In him New England idealism had come to the birth. He illustrates, better than all others, the power of Puritanism as a spiritual force; and in him only did that power reach intellectual expression in a memorable way for the larger world. The ecclesiastical literature of Puritanism, abundant as it was, produced no other work of power; nor did the Puritan patronage of literature prove fruitful in other fields. If Puritanism was thus infertile, it nevertheless prepared the soil. It impressed upon New England the stamp of the mind; the entire community was by its means intellectually as well as morally bred; and to its training and the predisposition it established in the genius of the people may be ascribed the respect for the book which has always characterized that section, the serious temper and elevation of its later literature and the spiritual quality of the imagination which is so marked a quality of its authors.

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[1] *Huntington* v. *Attrill*, 146 United States Reports, 657.

[2] *Great Western Telegraph Company* v. *Purdy*, 162 United States Reports, 329; *Fish* v. *Smith*, 73 Connecticut Reports, 377; 47 *Atlantic Reporter*, 710.

Franklin.

The secularization of life in New England, which went on concurrently with the decline of the clergy in social power, was incidental to colonial growth. The practical force of the people had always been strong; material prosperity increased and a powerful class of merchants grew up; public questions multiplied in variety and gained in importance. The affairs of the world had definitely obtained the upper hand. The new spirit found its representative in the great figure of Benjamin Franklin (1706–1790), who, born in Boston, early emigrated to Philadelphia, an act which in itself may be thought to forecast the transfer of the centre of interest to the west and south and specifically to that city where the congress was to sit. Franklin was a printer, and the books he circulated are an index to the uses of reading in his generation. Practical works, such as almanacs, were plentiful, and it is characteristic that Franklin's name is, in literature, first associated with *Poor Richard's Almanack* (1732). The literature of the 18th century outside of New England continued to be constituted of works of exploration, description, colonial affairs, with some sprinkling of crude science and doctrines of wealth; but it yields no distinguished names or remembered titles. Franklin's character subsumes the spirit of it. In him thrift and benevolence were main constituents; scientific curiosity of a useful sort and invention distinguished him; after he had secured a competence, public interests filled his mature years. In him was the focus of the federating impulses of the time, and as the representative of the colonies in England and during the Revolution in France, he was in his proper place as the greatest citizen of his country. He was, first of men, broadly interested in all the colonies, and in his mind the future began to be comprehended in its true perspective and scale; and for these reasons to him properly belongs the title of "the first American." The type of his character set forth in the *Autobiography* (1817) was profoundly American and prophetic of the plain people's ideal of success in a democracy. It is by his character and career rather than by his works or even by his great public services that he is remembered; he is a type of the citizen-man. Older than his companions, and plain while they were of an aristocratic stamp, he greatens over them in the popular mind as age greatens over youth; but it was these companions who were to lay the foundations of the political literature of America. With the increasing political life lawyers as a class had naturally come into prominence as spokesmen and debaters. A young generation of orators sprang up, of whom James Otis (1725–1783) in the north, and Patrick Henry (1736–1799) in the south, were the most brilliant; and a group of statesmen, of whom the most notable were Thomas Jefferson (1743–1826), James Madison (1751–1836), and Alexander Hamilton (1757–1804), held the political direction of the times; in the speeches and state-papers of these orators and statesmen and their fellows the political literature of the colonies came to hold the first place. The chief memorials of this literature are *The Declaration of Independence* (1776), *The Federalist* (1788), a treatise on the principles of free government, and Washington's *Addresses* (1789–1793–1796). Thus politics became, in succession to exploration and religion, the most important literary element in the latter half of the 18th century.

18th-century poetry and fiction.

The more refined forms of literature also began to receive intelligent attention towards the close of the period. The Revolution in passing struck out some sparks of balladry and song, but the inspiration of the spirit of nationality was first felt in poetry by Philip Freneau (1752–1832), whose *Poems* (1786) marked the best poetical achievement up to his time. Patriotism was also a ruling motive in the works of the three poets associated with Yale College, John Trumbull (1750–1831), Timothy Dwight (1752–1817), and Joel Barlow (1754–1812), authors respectively of *McFingal* (1782), a Hudibrastic satire of the Revolution, *The Conquest of Canaan* (1785), an epic, and *The Vision of Columbus* (1787), later remade into *The Columbiad*, also an epic. These poets gathered about them a less talented company, and all were denominated in common the "Hartford Wits," by which name rather than by their works they are remembered. The national hymn, "Hail Columbia," was composed by Joseph Hopkinson (1770–1842) in 1798. Fiction, in turn, was first cultivated by Charles Brockden Brown (1771–1810), a Philadelphian, who wrote six romantic novels (1798–1801) after the style of Godwin, but set in the conditions of the new world and mixing local description and observation with the material of mystery and terror. Fiction had been earlier attempted by Mrs Susanna Haswell Rowson, whose *Charlotte Temple* (1790) is remembered, and contemporaneously by Mrs Hannah Webster Foster in *The Coquette* (1797) and by Royall Tyler (1758–1826) in *The Algerian Captive* (1799); but to Brown properly belongs the title of the first American novelist, nor are his works without invention and intensity and a certain distinction that secure for them permanent remembrance. The drama formally began its career on a regular stage and with an established company, in 1786 at New York, with the acting of Royall Tyler's comedy *The Contrast*; but the earliest American play was Thomas Godfrey's (1736–1763) tragedy, *The Prince of Parthia*, acted in Philadelphia in 1767. William Dunlap (1766–1839) is, however, credited with being the father of the American theatre on the New York stage, where his plays were produced. One other earlier book deserves mention, John Woolman's (1720–1772) *Journal* (1775), an autobiography with much charm. With these various attempts the 18th century was brought to an end. In 200 years no literary classic had been produced in America.

The new nation.

The new nation, which with the 19th century began its integral career, still retained the great disparities which originally existed between the diverse colonies. Political unity, the simplest of the social unities, had been achieved; "a more perfect union," in the language of the founders, had been formed; but even in the political sphere the new state bore in its bosom disuniting forces which again and again threatened to rive it apart until they were dissipated in the Civil War; and in the other spheres of its existence, intellectually, morally, socially, its unity was far from being accomplished. The expansion of its territory over the continental area brought new local diversity and prolonged the contrasts of border conditions with those of the long-settled communities. This state of affairs was reflected in the capital fact that there was no metropolitan centre in which the tradition and forces of the nation were concentrated. Washington was a centre of political administration; but that was all. The nation grew slowly, indeed, into consciousness of its own existence; but it was without united history, without national traditions of civilization and culture, and it was committed to the untried idea of democracy. It was founded in a new faith; yet at the moment that it proclaimed the equality of men, its own social structure and habit north and south contradicted the declaration, not merely by the fact of slavery, but by the life of its classes. The south long remained oligarchic; in the north aristocracy slowly melted away. The coincidence of an economic opportunity with a philosophic principle is the secret of the career of American democracy in its first century. The vast resources of an undeveloped country gave this opportunity to the individual, while the nation was pledged by its fundamental idea to material prosperity for the masses, popular education and the common welfare, as the supreme test of government. In this labour, subduing the new world to agriculture, trade and manufactures, the forces of the nation were spent, under the complication of maintaining the will of the people as the directing power; the subjugation of the soil and experience in popular government are the main facts of American history. In the course of this task the practice of the fine arts was hardly more than an incident. When anyone thinks of Greece, he thinks first of her arts; when anyone thinks of America, he thinks of her arts last. Literature, in the sense of the printed word, has had a great career in America; as the vehicle of use, books, journals, literary communication, educational works and libraries have filled the land; nowhere has the power of the printed word ever been so great, nowhere has the man of literary genius ever had so broad an opportunity to affect the minds of men contemporaneously. But, in the artistic sense, literature, at most, has been locally illustrated by a few eminent names.

The most obvious fact with regard to this literature is that—to adopt a convenient word—it has been regional. It has flourished in parts of the country, very distinctly marked, and is in each case affected by its environment and local culture; if it incorporates national elements at times, it seems to graft them on its own stock. The growth of literature in these favoured soils was slow and humble. There was no outburst of genius, no sudden movement, no renaissance; but very gradually a step was taken in advance of the last generation, as that had advanced upon its forefathers. The first books of true excellence were experiments; they seem almost accidents. The cities of Boston, New York and Philadelphia were lettered communities; they possessed imported books, professional classes, men of education and taste. The tradition of literature was strong, especially in New England; there were readers used to the polite letters of the past. It was, however, in the main the past of Puritanism, both in England and at home, and of the 18th century in general, on which they were bred, with a touch ever growing stronger of the new European romanticism. All the philosophic ideas of the 18th century were current. What was most lacking was a standard self-applied by original writers; and in the absence of a great national centre of standards and traditions, and amid the poverty of such small local centres as the writers were bred in, they sought what they desired, not in England, not in any one country nor in any one literature, but in the solidarity of literature itself, in the republic of letters, the world-state itself,—the master-works of all European lands; they became either actual pilgrims on foreign soil or pilgrims of the mind in fireside travels. The foreign influences that thus entered into American literature are obvious and make a large part of its history; but the fact here brought out is that European literature and experience stood to American writers in lieu of a national centre; it was there that both standard and tradition were found.

Early 19th-century classics.

American literature first began to exist for the larger world in the persons of Washington Irving (1785–1859) and James Fenimore Cooper (1789–1851). Their recognition was almost contemporaneous. *The Sketch Book* (1819) was the first American book to win a great reputation in England, and *The Spy* (1821) was the first to obtain a similar vogue on the continent. The fame of both authors is associated with New York, and that city took the first place as the centre of the literature of the period. It was not that New York was more intellectual than other parts of the country; but it was a highly prosperous community, where a mercantile society flourished and consequently a certain degree of culture obtained. The first American literature was not the product of a raw democracy nor of the new nationality in any sense; there was nothing sudden or vehement in its generation; but, as always, it was the product of older elements in the society where it arose and flourished under the conditions of precedent culture. The family of Irving were in trade. Cooper's father was in the law. A third writer, William Cullen Bryant (1794–1878), is associated with them, and though he announced his poetic talent precociously by *Thanatopsis* (1807), his *Poems* (1832), immediately republished in London, were the basis of his true fame. Born in Massachusetts, he lived his long life in New York, and was there a distinguished citizen. His father was a physician. All three men were not supremely endowed; they do not show the passion of genius for its work which marks the great writers; they were, like most American writers, men with the literary temperament, characteristically gentlemen, who essayed literature with varying power. If the quality of this early literature is to be appreciated truly, the fact of its provenance from a society whose cultivation was simple and normal, a provincial bourgeois society of a prosperous democracy, must be borne in mind. It came, not from the people, but from the best classes developed under preceding conditions.

Irving.

Irving all his life was in the eyes of his countrymen, whatever their pride might be in him, more a travelled gentleman than one of themselves. He had come home to end his days at Sunnyside by the Hudson, but he had won his fame in foreign fields. In his youth the beginnings of his literary work were most humble—light contributions to the press. He was of a most social nature, warm, refined, humorous, a man belonging to the town. He was not seriously disposed, idled much, and surprised his fellow-citizens suddenly by a grotesque *History of New York* (1809), an extravaganza satirizing the Dutch element of the province. He discovered in writing this work his talent for humour and also one part of his literary theme, the Dutch tradition; but he did not so convince himself of his powers as to continue, and it was only after the failure of his commercial interests that, being thrown on himself for support, he published in London ten years later, at the age of thirty-six, the volume of sketches which by its success committed him to a literary career. In that work he found himself; sentiment and distinction of style characterized it, and these were his main traits. He remained abroad, always favoured in society and living in diplomatic posts in Spain and England, for seventeen years, and he later spent four years in Spain as minister. Spain gave him a larger opportunity than England for the cultivation of romantic sentiment, and he found there his best themes in Moorish legend and history. On his return to America he added to his subjects the exploration of the west; and he wrote, besides, biographies of Goldsmith and Washington. He was, as it turned out, a voluminous writer; yet his books successively seem the accident of his situation. The excellence of his work lies rather in the treatment than the substance; primarily, there is the pellucid style, which he drew from his love of Goldsmith, and the charm of his personality shown in his romantic interest, his pathos and humour ever growing in delicacy, and his familiar touch with humanity. He made his name American mainly by creating the legend of the Hudson, and he alone has linked his memory locally with his country so that it hangs over the landscape and blends with it for ever; he owned his nativity, too, by his pictures of the prairie and the fur-trade and by his life of Washington, who had laid his hand upon his head; but he had spent half his life abroad, in the temperamental enjoyment of the romantic suggestion of the old world, and by his writings he gave this expansion of sympathy and sentiment to his countrymen. If his temperament was native-born and his literary taste home-bred, and if his affections gave a legend to the countryside and his feelings expanded with the view of prairie and wilderness, and if he sought to honour with his pen the historic associations and memory of the land which had honoured him, it was, nevertheless, the trans-Atlantic touch that had loosed his genius and mainly fed it, and this fact was prophetic of the immediate course of American literature and the most significant in his career.

Cooper.

Cooper's initiation into literature was similar to that of Irving. He had received, perhaps, something more of scanty formal education, since he attended Yale College for a season, but he early took to the sea and was a midshipman. He was thirty years old before he began to write, and it was almost an accident that after the failure of his first novel he finished *The Spy*, so deterring was the prejudice that no American book could succeed. He was, however, a man of great energy of life, great force of will; it was his nature to persist. The way once opened, he wrote voluminously and with great unevenness. His literary defects, both of surface and construction, are patent. It was not by style nor by any detail of plot or character that he excelled; but whatever imperfections there might be, his work was alive; it had body, motion, fire. He chose his subjects from aspects of life familiar to him in the woods or on the sea or from patriotic memories near to him in the fields of the Revolution. He thus established a vital connexion with his own country, and in so far he is the most national by his themes of any of the American writers. What he gave was the scene of the new world, both in the forest and by the fires of the Revolution and on the swift and daring American ships; but it was especially by his power to give the sense of the primitive wilderness and the ocean weather, and adventure there, that he won success. In France, where he was popular, this came as an echo out of the real world of the west to the dream of nature that had lately grown up in French literature; and, besides, of all the springs of interest native to men in every land adventure in the wild is, perhaps, the easiest to touch, the quickest and most inflaming to respond. Cooper stood for a true element in American experience and conditions, for the romance in the mere presence of primeval things of nature newly found by man and opening to his coming; this was an imaginative moment, and Cooper seized it by his imagination. He especially did so in the Indian elements of his tale, and gave permanent ideality to the Indian type. The trait of loftiness which he thus incorporated belongs with the impression of the virgin forest and prairie, the breadth, the silence and the music of universal nature. The distinction of his work is to open so great a scene worthily, to give it human dignity in rough and primitive characters seen in the simplicity of their being, and to fill it with peril, resourcefulness and hardihood. It is the only brave picture of life in the broad from an American pen. Scott, in inventing the romantic treatment of history in fiction, was the leader of the historical novel; but Cooper, except in so far as he employed the form, was not in a true sense an imitator of Scott; he did not create, nor think, nor feel, in Scott's way, and he came far short of the deep human power of Scott's genius. He was not great in character; but he was great in adventure, manly spirit and the atmosphere of the natural world, an Odysseyan writer, who caught the moment of the American planting in vivid and characteristic traits.

Bryant.

This same spirit, but limited to nature in her most elemental forms and having the simplest generic relations to human life, characterizes Bryant. He, too, had slender academic training, and came from the same social origins as Irving and Cooper; but, owing to his extraordinary boyish precocity, the family influences upon him and the kind of home he was bred in are more clearly seen. He framed his art in his boyhood on the model of 18th-century verse, and though he felt the liberalizing influences of Wordsworth later there always remained in his verse a sense of form that suggests a severer school than that of his English contemporaries. He lived the life of a journalist and public man in New York, but the poet in him was a man apart and he jealously guarded his talent in seclusion. Though he was at times abroad, he resembled Cooper in being unaffected by foreign residence; he remained home-bred. He wrote a considerable quantity of verse; but it is by a quality in it rather than by its contents that his poetry is recalled, and this quality exists most highly in the few pieces that are well known. To no verse is the phrase "native wood-notes wild" more properly applied. His poetry gives this deep impression of privacy; high, clear, brief in voice, and yet, as it were, as of something hidden in the sky or grove or brook, or as if the rock spoke, it is nature in her haunts; it is the voice of the peak, the forests, the cataracts, the smile of the blue gentian, the distant rosy flight of the water-fowl,—with no human element less simple than piety, death or the secular changes of time. It is, too, an expression of something so purely American that it seems that it must be as uncomprehended by one not familiar with the scene as the beauty of Greece or Italian glows; it is poetry locked in its own land. This presence of the pure, the pristine, the virginal in the verse, this luminousness, spaciousness, serenity in the land, this immemorialness of natural things, is the body and spirit of the true wild, such as Bryant's eyes had seen it and as it had possessed his soul. In no other American poet is there this nearness to original awe in the presence of nature; nowhere is nature so slightly humanized, so cosmically felt, and yet poetized. Poetry of this sort must be small in amount; a few hundred lines contain it all; but they alone shrine the original grandeur, not so much of the American landscape, as of wild nature when first felt in the primitive American world.

American romanticism thus began with these three writers, who gave it characterization after all by only a few simple traits. There was in it no profound passion nor philosophy nor revolt; especially there was no morbidness. It was sprung from a new soil. The breath of the early American world was in Bryant's poetry; he had freed from the landscape a Druidical nature-worship of singular purity, simple and grand, unbound by any conventional formulas of thought or feeling but deeply spiritual. The new life of the land filled the scene of Cooper; prairie, forest and sea, Indians, backwoodsmen and sailors, the human struggle of all kinds, gave it diversity and detail; but its life was the American spirit, the epic action of a people taking primitive possession, battling with its various foes, making its world. Irving, more brooding and reminiscent, gave legend to the landscape, transformed rudeness with humour and brought elements of picturesqueness into play; and in him, in whom the new race was more mature, was first shown that nostalgia for the past, which is everywhere a romantic trait but was peculiarly strong under American conditions. He was consequently more free in imagination than the others, and first dealt with other than American subjects, emancipating literature from provinciality of theme, while the modes of his romantic treatment, the way he felt about his subjects, still owed much to his American birth. In all this literature by the three writers there was little complexity, and there was no strangeness in their personalities. Irving was more genially human, Cooper more vitally intense; Bryant was the more careful artist in the severe limits of his art, which was simple and plain. Simplicity and plainness characterize all three; they were, in truth, simple American gentlemen, of the breeding and tastes that a plain democracy produced as its best, who, giving themselves to literature for a career, developed a native romanticism, which, however obvious and uncomplicated with philosophy, passion or moods, represented the first stage of American life with freshness of power, an element of ideal loftiness and much literary charm.

General progress.

Though Irving, Cooper and Bryant were associated with New York, there was something sporadic in their germination. They have no common source; they stood apart; and their work neither overlapped nor blended, but remained self-isolated. None of them can be said to have founded a school, but Irving left a literary tradition and Cooper had followers in the field of historical fiction. The literary product up to the middle of the century presents generally from its early years the appearance of an indistinguishable mass, as in colonial days, in which neither titles nor authors are eminent. The association of American literature with the periodical press is, perhaps, the most important trait to be observed. New York and Philadelphia were book-markets, and local presses had long been at work issuing many reprints. Magazines in various degrees of importance sprang up in succession to the earlier imitations of English 18th-century periodicals, which abounded at the beginning of the century; and as time went on these were accompanied by a host of annuals of the English *Keepsake* variety. Philadelphia was especially distinguished by an early fertility in magazines, which later reached a great circulation, as in the case of *Godey's* and *Graham's*; the *Knickerbocker* became prominent in New York from 1833, when it was founded; Richmond had in *The Southern Literary Messenger* the chief patron of southern writers from 1834, and there were abortive ventures still farther south in Charleston. These various periodicals and like publications were the literary arena, the place of ambition for young and old, for known and unknown, and there literary fame and what little money came of its pursuit were found. Minor poetry flourished in it; sketches, tales, essays, every sort of writing in prose multiplied there. A change in the atmosphere of letters is also to be noted. The 18th century was fairly left behind. The Philadelphian reprint of Galignani's Paris edition of Keats, Shelley and Coleridge had brought in the new romantic poetry with wide effect; and Disraeli, Bulwer and, later, Dickens are felt in the prose; in verse, especially by women, Mrs Hemans and Mrs Browning ruled the moment. The product was large. In poetry it was displayed on the most comprehensive scale in Rufus Wilmot Griswold's (1815–1857) collections of American verse, made in the middle of the century. Mrs Lydia Sigourney (1791–1865), a prolific writer, and Mrs Maria Gowan Brooks (1795–1845), known as Southey's "Maria del Occidente," a more ambitious aspirant, the "Davidson sisters" (1808–1825: 1823–1838), and Alice (1820–1871) and Phoebe Cary (1824–1871) illustrate the work of the women; and Richard Henry Wilde (1789–1847), George Pope Morris (1802–1864), Charles Fenno Hoffman (1806–1884) and Willis Gaylord Clark (1810–1841) may serve for that of men. In this verse, and in the abundant prose as well, the sentimentality of the period is strongly marked; it continued to the times of the Civil War. Two poets of a better type, Joseph Rodman Drake (1795–1820), distinguished by delicacy of fancy, and Fitz-Greene Halleck (1790–1867), who showed ardour and a real power of phrase, are remembered from an earlier time for their brotherhood in verse, but Drake died young and Halleck was soon sterilized, so that the talents of both proved abortive. The characteristic figure that really exemplifies this secondary literature at its best is Nathaniel Parker Willis (1806–1867) who, though born in Portland, Maine, was the chief *littérateur* of the Knickerbocker period. He wrote abundantly in both verse and prose, and was the first of the journalist type of authors, a social adventurer with facile powers of literary entertainment, a man of the town and immensely popular. He was the sentimentalist by profession, and his work, transitory as it proved, was typical of a large share of the taste, talent and ambition of the contemporary crowd of writers. Neighbouring him in time and place are the authors of various stripe, known as "the Literati," whom Poe described in his critical papers, which, in connexion with Griswold's collections mentioned above, are the principal current source of information concerning the bulk of American literature in that period.

Poe.

This world of the magazines, the Literati and sentimentalism, was the true *milieu* of Edgar Allan Poe (1809–1849). Born in Boston, his mother a pleasing English actress and his father a dissipated stage-struck youth of a Baltimore family, left an orphan in childhood, he was reared in the Virginian home of John Allan, a merchant of Scottish extraction; he received there the stamp of southern character. He was all his life characteristically a southerner, with southern ideals of character and conduct, southern manners towards both men and women and southern passions. He showed precocity in verse, but made his real *début* in prose as editor of *The Southern Literary Messenger* at Richmond in 1835. He was by his talents committed to a literary career, and being usually without definite means of support he followed the literary market, first to Philadelphia and later to New York. He was continuously associated with magazines as editor, reviewer or contributor; they were his means of sustenance; and, whether as cause or effect, this mode of life fell in with the nature of his mind, which was a contemporary mind. He was perhaps better acquainted with contemporary work in literature than any of his associates; he took his first cues from Disraeli and Bulwer and Moore, and he was earliest to recognize Tennyson and Mrs Browning; his principal reading was always in the magazines. He was, however, more than a man of literary temperament like Irving and Cooper; he was a child of genius. As in their case, there was something sporadic in his appearance on the scene. He had no American origins, but only American conditions of life. In fact he bore little relation to his period, and so far as he was influenced, it was for the worse; he transcended the period, essentially, in all his creative work. He chose for a form of expression the sketch, tale or short story, and he developed it in various ways. From the start there was a melodramatic element in him, itself a southern trait and developed by the literary influence of Disraeli and Bulwer on his mind. He took the tale of mystery as his special province; and receiving it as a mystery that was to be explained, after the recent masters of it, he saw its fruitful lines of development in the fact that science had succeeded to superstition as the source of wonder, and also in the use of ratiocination as a mode of disentanglement in the detective story. Brilliant as his success was in these lines, his great power lay in the tale of psychological states as a mode of impressing the mind with the thrill of terror, the thrall of fascination, the sense of mystery. It is by his tales in these several sorts that he won, more slowly than Irving or Cooper and effectually only after his death, continental reputation; at present no American author is so securely settled in the recognition of the world at large, and he owes this, similarly to Cooper, to the power of mystery over the human mind universally; that is, he owes it to his theme, seconded by a marvellous power to develop it by the methods of art. He thus added new traits to American romanticism, but as in the case of Irving's Spanish studies there is no American element in the theme; he is detached from his local world, and works in the sphere of universal human nature, nor in his treatment is there any trace of his American birth. He is a world author more purely than any other American writer. Though it is on his tales that his continental reputation necessarily rests, his temperament is more subtly expressed in his verse, in which that *fond* of which his tales are the logical and intelligible growth gives out images and rhythms, the issue of morbid states, which affect the mind rather as a form of music than of thought. Emotion was, in art, his constant aim, though it might be only so simple a thing as the emotion of colour as in his landscape studies; and in his verse, by an unconscious integration and flow of elements within him it must be thought, he obtained emotional effects by images which have no intellectual value, and which float in rhythms so as to act musically on the mind and arouse pure moods of feeling absolutely free of any other contents. Such poems must be an enigma to most men, but others are accessible to them, and derive from them an original and unique pleasure; they belong outside of the intellectual sphere. It is by virtue of this musical quality and immediacy that his poetry is characterized by genius; in proportion as it has meaning of an intelligible sort it begins to fade and lower; so far as "Lenore" and "Annie" and "Annabel Lee" are human, they are feeble ghosts of that sentimentality which was so rife in Poe's time and so maudlin in his own personal relations; and except for a half-dozen pieces, in which his quality of rhythmical fascination is supreme, his verse as a whole is inferior to the point of being commonplace. Small as the quantity of his true verse is, it more sustains his peculiar genius in American eyes than does his prose; and this is because it is so unique. He stands absolutely alone as a poet with none like him; in his tales, as an artist, he is hardly less solitary, but he has some ties of connexion or likeness with the other masters of mystery. Poe lived in poverty and died in misery; but without him romanticism in America would lose its most romantic figure, and American literature the artist who, most of all its writers, had the passion of genius for its work.

Poe left even less trace of himself in the work of others than did Irving, Cooper and Bryant. He stands in succession to them, and closed the period so far as it contributed to American romanticism anything distinguished, original or permanent. The ways already opened had, however, been trod, and most notably in fiction. The treatment of manners and customs, essentially in Irving's vein, was pleasingly cultivated in Maryland by John Pendleton Kennedy (1795–1870) in *Swallow Barn* (1832) and similar tales of Old Dominion life. In Virginia, Beverly Tucker (1784–1851) in *The Partisan Leader* (1836), noticeable for its prophecy of secession, and John Esten Cooke (1830–1886) in *The Virginia Comedians* (1854), also won a passing reputation. The champion in the south, however, was William Gilmore Simms (1806–1870), born in Charleston, a voluminous writer of both prose and verse, who undertook to depict, on the same scale as Cooper and in his manner, the settlement of the southern territory and its Indian and revolutionary history; but of his many novels, of which the characteristic examples are *The Yemassee* (1835), *The Partisan* (1835) and *Beauchampe* (1842), none attained literary distinction. The sea-novel was developed by Herman Melville (1819–1891) in *Typee* (1846) and its successors, but these tales, in spite of their being highly commended by lovers of adventure, have taken no more hold than the work of Simms. Single novels of wide popularity appeared from time to time, of which a typical instance was *The Wide, Wide World* (1850) by Susan Warner (1819–1885). The grade of excellence was best illustrated, perhaps, for the best current fiction which was not to be incorporated in literature, by the novels of Catharine Maria Sedgwick (1789–1867), of a western Massachusetts family, in *Hope Leslie* (1827) and its successors. The distinct Knickerbocker strain was best preserved by James Kirke Paulding (1778–1860) among the direct imitators of Irving; but the better part of the Irving tradition, its sentiment, social grace and literary flavour, was not noticeable until it awoke in George William Curtis (1824–1892), born a New Englander but, like Bryant, a journalist and public man of New York, whose novels, notes of travel and casual brief social essays brought that urbane style to an end, as in Donald Grant Mitchell (born 1822) the school of sentiment, descended from the same source, died not unbecomingly in the *Reveries of a Bachelor* (1850) and *Dream Life* (1851). Two poets, just subsequent to Poe, George Henry Boker (1823–1890) and Thomas Buchanan Read (1822–1872), won a certain distinction, the former especially in the drama, in the Philadelphia group. The single popular songs, "The Star-Spangled Banner" (1813), by Francis Scott Key (1779–1843) of Maryland, "America" (1832) by Samuel Francis Smith (1808–1895) of Massachusetts, and "Home, Sweet Home" (1823) by John Howard Payne (1792–1852) of New York, may also be appropriately recorded here. The last distinct literary personality to emerge from the miscellany of talent in the middle of the century, in the middle Atlantic states, was James Bayard Taylor (1825–1878), who, characteristically a journalist, gained reputation by his travels, poems and novels, but in spite of brilliant versatility and a high ambition failed to obtain permanent distinction. His translation of *Faust* (1870) is his chief title to remembrance; but the later cultivation of the oriental motive in American lyrical poetry owes something to his example.

New England scholarship.

In New England, which succeeded to New York as the chief source of literature of high distinction, the progress of culture in the post-Revolutionary period was as normal and gradual as elsewhere in the country; there was no violence of development, no sudden break, but the growth of knowledge and taste went slowly on in conjunction with the softening of the Puritan foundation of thought, belief and practice. What most distinguished literature in New England from that to the west and south was its connexion with religion and scholarship, neither of which elements was strong in the literature that has been described. The neighbourhood of Harvard College to Boston was a powerful influence in the field of knowledge and critical culture. The most significant fact in respect to scholarship, however, was the residence abroad of George Ticknor (1791–1871), author of *The History of Spanish Literature* (1849), of Edward Everett (1794–1865), the orator, and of George Bancroft (1800–1891), author of the *History of the United States* (1834–1874), who as young men brought back new ideals of learning. The social connexion of Boston, not only with

England but with the continent, was more constant, varied and intimate than fell to the fortune of any other city, and owing to the serious temper of the community the intellectual commerce with the outer world through books was more profound. Coleridge was early deeply influential on the thought of the cultivated class, and to him Carlyle, who found his first sincere welcome and effectual power there, succeeded. The influence of both combined to introduce, and to secure attention for, German writers. Translation, as time went on, followed, and German thought was also further sustained and advanced in the community by Frederick Henry Hedge (1805–1890), a philosophical theologian, who conducted a propaganda of German ideas. The activity of the group about him is significantly marked by the issue of the series of *Specimens of Foreign Standard Literature* (1838), edited by George Ripley (1802–1880), the critic, which was the first of its kind in America. French ideas, as time went on, were also current, and the field of research extended to the Orient, the writings of which were brought forward especially in connexion with the Transcendental Movement to which all these foreign studies contributed. In New England, in other words, a close, serious and vital connexion was made, for the first time, with the philosophic thought of the world and with its tradition even in the remote past. Unitarianism, which was the form in which the old Puritanism dissolved in the cultivated class, came in with the beginning of the century, and found its representative in the gentle character, refined intelligence and liberal humanity of William Ellery Channing (1780–1842), who has remained its chief apostle. It was the expression of a moral maturing and intellectual enlightenment that took place with as little disturbance as ever marked religious evolution in any community. The people at large remained evangelical, but they also felt in a less degree the softening and liberalizing tendency; nevertheless it was mainly in the field of Unitarianism that literature flourished, as was natural, and Transcendentalism was a phenomenon that grew out of Unitarianism, being indeed the excess of the movement of enlightenment and the extreme limit of intuitionalism, individualism and private judgment. These two factors, religion and scholarship, gave to New England literature its serious stamp and academic quality; but the preparatory stage being longer, it was slower to emerge than the literature of the rest of the country.

The first stirrings of romanticism in New England were felt, as in the country to the south, by men of literary temperament in a sympathetic enjoyment and feeble imitation of the contemporary English romantic school of fiction exemplified by Mrs Radcliffe, Lewis and Godwin. Washington Allston (1779–1843), the painter, born in South Carolina but by education and adoption a citizen of Cambridge, showed the taste in *Monaldi* (1841), and Richard Henry Dana (1787–1879) in *Paul Felton* (1833); in his poem of the same date, "The Buccaneer," the pseudo-Byronic element, which belongs to the conception of character and passion in this school of fiction, appears. These elder writers illustrate rather the stage of imaginative culture at the period, and show by their other works also—Allston by his poems "The Sylphs of the Seasons" (1813), and Dana by his abortive periodical *The Idle Man* (1821) issued at New York—their essential sympathy with the literary conditions reigning before the time of Irving. They both were post-Revolutionary, and advanced American culture in other fields rather than imagination, Allston in art and Dana in criticism, as editor of *The North American Review*, which was founded in 1815, and was long the chief organ of serious thought and critical learning, influential in the dissemination of ideas and in the maintenance of the intellectual life. The influence of their personality in the community, like that of Channing, with whom they were closely connected, was of more importance than any of their works.

Emerson: Hawthorne: Longfellow.

The definite moment of the appearance of New England in literature in the true sense was marked by Ralph Waldo Emerson's (1803–1882) *Nature* (1836), Nathaniel Hawthorne's (1804–1864) *Twice-Told Tales* (1837) and Henry Wadsworth Longfellow's (1807–1882) *Voices of the Night* (1839). Of this group of men Longfellow is the most national figure, and from the point of view of literary history the most significant by virtue of what he contributed to American romanticism in the large. He felt the conscious desire of the people for an American literature, and he obeyed it in the choice of his subjects. He took national themes, and his work is in this respect the counterpart in poetry to that of Cooper in prose. In *Hiawatha* (1855) he poetized the Indian life; and, though the scene and figures of the poem are no more localized than the happy hunting-grounds, the ideal of the life of the aborigines in the wilderness is given with freshness and primitive charm and with effect on the imagination. It is the sole survivor of many poetic attempts to naturalize the Indian in literature, and will remain the classic Indian poem. In *Evangeline* (1847), *The Courtship of Miles Standish* (1858) and *The New England Tragedies* (1868), he depicted colonial life. As he thus embodied national tradition in one portion of his work, he rendered national character in another, and with more spontaneity, in those domestic poems of childhood and the affections, simple moods of the heart in the common lot, which most endeared him as the poet of the household. These are American poems as truly as his historical verse, though they are also universal for the English race. In another large portion of his work he brought back from the romantic tradition of Europe, after Irving's manner, motives which he treated for their pure poetic quality, detached from anything American, and he also translated much foreign verse from the north and the south of Europe, including Dante's *Divine Comedy* (1867). He has, more than any other single writer, reunited America with the poetic past of Europe, particularly in its romance. The same serenity of disposition that marked Irving and Bryant characterized his life; and his art, more varied than Bryant's or Irving's, has the same refinement, being simple and so limpid as to deceive the reader into an oblivion of its quality and sometimes into an unwitting disparagement of what seems so plain and natural as to be commonplace. In Longfellow, as in Irving, one is struck by that quietude, which is so prevailing a characteristic of American literature, and which proceeds from its steady and even flow from sources that never knew any disturbance or perturbation. The life, the art, the moods are all calm; deep passion is absent.

Hawthorne was endowed with a soul of more intense brooding, but he remained within the circle of this peace. He developed in solitude exquisite grace of language, and in other respects was an artist, the mate of Poe in the tale and exceeding Poe in significance since he used symbolism for effects of truth. He, like Longfellow, embodied the national tradition, in this case the Puritan past; but he seized the subject, not in its historical aspects and diversity of character and event, but psychologically in its moral passion in *The Scarlet Letter* (1850), and less abstractly, more picturesquely, more humanly, in its blood tradition, in *The House of the Seven Gables*. In his earlier work, as an artist, he shows the paucity of the materials in the environment, especially in his tales; but when his residence in Italy and England gave into his hands larger opportunity, he did not succeed so well in welding Italy with America in *The Marble Faun* (1860), or England with America in his experimental attempts at the work which he left uncompleted, as he had done in the Puritan romances. He had, however, added a new domain to American romanticism; and, most of all these writers, he blended moral truth with fiction; he, indeed, spiritualized romance, and without loss of human reality,—a rare thing in any literature. Both Longfellow and Hawthorne were happy in reconciling their art with their country: both, not less than Poe, were universal artists, but they incorporated the national past in their art and were thereby more profoundly American.

Emerson, whose work lay in the religious sphere, not unlike Jonathan Edwards at an earlier time of climax but in a different way, marked the issue of Puritanism in pure idealism, and was more contemporaneously associated with life in the times than were the purely imaginative writers. He was the central figure of Transcendentalism, and apart from his specific teachings stood for the American spirit, disengaged from authority, independent, personal, responsible only to himself. He reached a revolutionary extreme, but he had not arrived at it by revolutionary means; without storm or stress, with characteristic peacefulness, he came to the great denials, and without much concerning himself with them turned to his own affirmations of spiritual reality, methods of life and personal results. Serenity was his peculiar trait; amid all the agitation about him he was entirely unmoved, lived calmly and wrote with placid power, concentrating into the slowly wrought sentences of his *Essays* (1841–1875) the spiritual essence and moral metal of a life lived to God, to himself and to his fellow-men. He, more than any other single writer, reunited American thought with the philosophy of the world; more than all others, he opened the ways of liberalism, wherever they may lead. He was an emancipator of the mind. In his *Poems* (1847–1867), though the abstract and the concrete often find themselves awkward mates, his philosophic ideas are put forth under forms of imagination and his personal life is expressed with nobility; his poetic originality, though so different in kind, is as unique as Poe's, and reaches a height of imaginative faculty not elsewhere found in American verse. His poetry belongs more peculiarly to universal art, so pure in general is its philosophic content and so free from any temporal trait is the style; but it is as distinguished for the laconic expression of American ideas, minted with one blow, as his prose is for the constant breathing of the American spirit. It is the less possible to define the American traits in Emerson, because they constituted the man. He was as purely an American type as Lincoln. The grain of the man is in his work also; and the best that his prose and verse contain is his personal force. In him alone is genius felt as power; in the others it impresses one primarily as culture, modes of artistic faculty, phases of temperament. In this, too, he brings to mind Jonathan Edwards, the other climax of the religious spirit in New England; in Edwards it was intellectual power, in Emerson it was moral power; in both it was indigenous, power springing from what was most profound in the historic life of the community.

Whittier: Holmes: Lowell.

Three other names, John Greenleaf Whittier (1807–1892), Oliver Wendell Holmes (1809–1894), James Russell Lowell (1819–1891), complete the group of the greater writers of New England. Holmes was a more local figure, by his humour and wit and his mental acuteness a Yankee and having the flavour of race, but neither in his verse nor his novels reaching a high degree of excellence and best known by *The Autocrat of the Breakfast Table* (1858), which is the Yankee prose classic. His contemporary reputation was largely social and owed much to the length of his life, but his actual hold on literature already seems slight and his work of little permanent value. Whittier stands somewhat apart as the poet of the soil and also because of his Quakerism; he was first eminent as the poet of the anti-slavery movement, to which he contributed much stirring verse, and later secured a broader fame by *Snowbound* (1866) and his religious poems of simple piety, welcome to every faith; he was also a balladist of local legends. In general he is the voice of the plain people without the medium of academic culture, and his verse though of low flight is near to their life and faith. Lowell first won distinction by *The Biglow Papers* (1848), which with the second series (1886) is the Yankee classic in verse, and is second only to his patriotic odes in maintaining his poetic reputation; his other verse, variously romantic in theme and feeling, and latterly more kindred to English classic style, shows little originality and was never popularly received; it is rather the fruit of great talent working in close literary sympathy with other poets whom from time to time he valued. His prose consists in the main of literary studies in criticism, a field in which he held the first rank. Together with Holmes and Whittier he gives greater body, diversity and illustration to the literature of New England; but in the work of none of these is there the initiative or the presence of single genius that characterize Emerson, Hawthorne and Longfellow. Lowell was a scholar with academic ties, a patriot above party, master of prose and verse highly developed and finished, and at times of a lofty strain owing to his moral enthusiasm; Whittier was a Quaker priest, vigorous in a great cause of humanity, with fluent power to express in poetry the life of the farm, the roadside and the legends that were like folklore in the memory of the settlement; Holmes was a town wit and master of occasional verse, with notes here and there of a higher strain in single rare poems.

Transcendentalism.

The secondary literature that accompanied the work of these writers was abundant. It was largely the product of Transcendentalism and much of it gathered about Emerson. In *The Dial* (1840), the organ of Transcendentalism, he introduced to the public his young friend, Henry David Thoreau (1817–1862), author of *Walden* (1854) and the father of the nature-writers, who as a hermit-type has had some European vogue and shows an increasing hold as an exception among men, but whose work has little literary distinction; and together with him, his companion, William Ellery Channing (1818-1901), a poet who has significance only in the transcendentalist group. With them should be named Emerson's coeval, Amos Bronson Alcott (1799–1888), the patriarch of the so-called Concord philosophers, better esteemed for his powers of monologue than as a writer in either prose or verse. Emerson's associate-editor in *The Dial* was Sarah Margaret Fuller, afterwards Marchioness d'Ossoli (1810–1850), a woman of extraordinary qualities and much usefulness, who is best remembered by her *Woman in the Nineteenth Century* (1844), but contributed no permanent work to literature. She was a leading figure at Brook Farm, the socialistic community founded by members of the group, and especially by Ripley, who like her afterwards emigrated to New York and together with her began a distinguished critical career in connexion with *The New York Tribune*. Transcendentalism produced also its peculiar poet in Jones Very (1813–1881), whose *Poems* (1839) have original quality though slight merit, and its novelist in Sylvester Judd (1813–1853), whose *Margaret* (1845) is a unique work in American fiction. Other transcendentalist poets were Christopher Pearse Cranch (1813–1892), and Charles Timothy Brooks (1813–1883), who translated *Faust* (1856), besides a score of minor names. Outside of this group Thomas William Parsons (1819–1892), who translated Dante's *Inferno* (1843), was a poet of greater distinction, but his product was slight. The prose of the movement, though abundant, yielded nothing that is remembered.

History.

Oratory.

Fiction.

The literary life of Boston was, however, by no means confined within this circle of thought. It was most distinguished in the field of history, where indeed the writers rivalled the imaginative authors in public fame. They were, besides George Bancroft already mentioned, John Gorham Palfrey(1796–1881), author of *The History of New England*(1858), William Hickling Prescott (1796–1859), whose field was Spanish and Spanish-American history, John Lothrop Motley (1814–1877), whose attention was given to Dutch history, and Jared Sparks (1789–1866), whose work lay in biography. In the writings of Prescott and Motley the romanticism of the period is clearly felt, and they attained the highest distinction in the literary school of history of the period. Oratory also flourished in Daniel Webster (1782–1852), Edward Everett (1794–1865), Rufus Choate (1799–1859), Wendell Phillips (1811–1884), Charles Sumner (1811–1874), and Robert Charles Winthrop (1809–1894), the last survivor of a long line of fiery or classic oratory in which New England was especially distinguished and had rivalry only from Henry Clay (1777–1852) of Virginia, and John Caldwell Calhoun (1782–1850) of South Carolina. The church also produced two powerful speakers in Theodore Parker (1810–1860), the protagonist of the liberals in Boston, and Henry Ward Beecher, (1813–1887), who sustained a liberal form of New England congregationalism in Brooklyn, New York, where he made Plymouth Church a national pulpit. The single memorable novel of the period was Mrs Harriet Beecher Stowe's (1811–1896) *Uncle Tom's Cabin* (1852), which had a world-wide vogue; it is the chief contribution of the anti-slavery movement to American literature and stands for plantation life in the old south. Another female writer, Mrs Lydia Maria Child (1802–1880), remembered by her *Philothea* (1836), deserves mention in the line of notable American women who served their generation in literary ways and by devotion to public causes. Criticism was served excellently by Edwin Percy Whipple (1819–

Scholarship.

1885), and less eminently by Henry Theodore Tuckerman (1813–1871), who emigrated to New York; but scholarship in general flourished under the protection of Harvard College, where Ticknor, Longfellow and Lowell maintained a high ideal of literary knowledge and judgment in the chair they successively filled, and were accompanied in English by Francis James Child (1825–1896), whose *English and Scottish Ballads*, first issued in 1858, was brought to its final and monumental form in 1892. Cornelius Conway Felton (1807–1862), president of Harvard College, stood for Greek culture, but the classical influence was little in evidence. Elsewhere in New England George Perkins Marsh (1801–1882) of Vermont, long minister to Italy, and William Dwight Whitney (1827–1894) of Yale, were linguistic scholars of high distinction. The development of the colleges into universities was already prophesied in the presence and work of these men. Outside of New England scholarship had been illustrated in New York by Charles Anthon (1797–1867), the classical editor, by the Duyckincks, Evert Augustus (1816–1878) and George Long (1823–1863), editors of the *Cyclopaedia of American Literature* (1855), and by Giulian Crommelin Verplanck (1786–1870), editor of *Shakespeare* (1846).

Characteristics of New England literature.

New England thus, standing somewhat apart, produced a characteristic literature, more deeply rooted in the community than was the case elsewhere; and this literature, blending with what was produced to the south and west, became a predominant share of what has been nationally accepted as standard American literature. It is also the more profound and scholarly share; and if quantity as well as quality be counted, and, as is proper, Bryant be included as the product of Puritan culture, it is the more artistic share. American standard literature, so constituted, belongs to romanticism, and is a phase of the romanticism which was then the general mood of literature; but it is a native product, with traits of its own and inward development from local conditions, not only apparent by its themes, but by its distinct evolution. Though it owed much to contact with Europe through its travelled scholars and its intellectual commerce by means of translations and imported books, and often dealt with matter detached from America both in prose and poetry, it was essentially self-contained. It was, in a marked way, free from the passions whose source was the French Revolution and its after-throes from 1789 to 1848; it is by this fact that it differs most from European romanticism. Just as the Puritan Rebellion in England left the colonies untouched to their own development, the political revolutions in Europe left the new nation unaffected to its normal evolution. There was never any revolution, in the French sense, in America, whether social, political, religious or literary; its great historical changes, such as the termination of English rule, the passing away of Puritanism, the abolition of slavery with the consequent destruction of the old South, were in a true sense conservative changes, normal phases of new life. In literature this state of things is reflected in the absence in it of any disturbance, its serenity of mood, its air of quiet studies. It is shown especially in its lack of passion. The only ardours displayed by its writers are moral, patriotic or religious, and in none of them is there any sense of conflict. The life which they knew was wholesome, regular, still free from urban corruption, the experience of a plain, prosperous and law-abiding people. None of these writers, though like Hawthorne they might deal with sin or like Poe with horror and a lover's despair at death, struck any tragic note. No tragedy was written, no love-poetry, no novel of passion. No literature is so maiden-pure. It is by refinement rather than power that it is most distinguished, by taste and cultivation, by conscientiousness in art, in poetic and stylistic craft; it is romance retrospectively seen in the national past, or conjured out of foreign lands by reminiscent imagination, or symbolically created out of fantasy; and this is supplemented by poetry of the domestic affections, the simple sorrows, all "that has been and may be again" in daily human lives, and by prose similarly related to a well-ordered life. If it is undistinguished by any work of supreme genius, it reflects broadly and happily and in enduring forms the national tradition and character of the land in its dawning century.

The original impulse of this literature had spent its force by 1861—that is, before the Civil War. The greater writers had, in general, already done their characteristic work, and though the survivors continued to produce till toward the close of the century, their works contained no new element and were at most mellow fruits of age. The war itself, like the Revolution, left little trace in literature beyond a few popular songs and those occasional poems which the older poets wrote in the course of the conflict. Their attitude toward it and (with the exception of Whittier and Lowell) toward the anti-slavery movement which led up to it was rather that of citizens than of poets, though in the verse of Longfellow and Emerson there is the noble stamp of the hour, the impress of liberty, bravery and sorrow. Lowell is the exception; he found in the *Commemoration Ode* (1865) his loftiest subject and most enduring fame. The work began to fall into new hands, and a literature since the war grew up, which was, however, especially in poetry, a continuation of romanticism and contained its declining force. It was contributed to from all parts of the older country, and also from the west, and a generation has now added its completed work to the sum. No author, in this late period, has received the national welcome to the same degree as the men of the elder time; none has had such personal distinction, eminence or public affection; and none has found such honourable favour abroad, either in England or on the continent. Poetry has felt the presence of the art of Tennyson, which has maintained an extreme sensitiveness among the poets to artistic requirements of both material and technique; and it also has taken colour from the later English schools. It has, however, yielded its pre-eminent position to prose. The novel has displaced romance as the highest form of fiction, and the essay has succeeded the review as the form of criticism. The older colleges have grown into universities, and public libraries have multiplied throughout the north and west. The literature of information, meant for the popularization of knowledge of all kinds, has been put forth in great quantity, and the annual increase in the production of books keeps pace with the general growth of the country. Literature of distinction, however, makes but a small part of this large mass.

Later writers.

In poetry the literary tradition was continued in Boston by Thomas Bailey Aldrich (1836–1907), essentially a stylist in verse, brief, definite, delicate, who carried the lighter graces of the art, refinement, wit, polish, to a high point of excellence. His artistic consanguinity is with Herrick and Landor, and he takes motive and colour for his verse from every land, as his predecessors had done, but with effects less rich. He divided attention between drama and lyric, but as his dramas look strictly to the stage, it is on the lyrics that his reputation rests. He was master also of an excellent prose and wrote novels, sketches of travel, and especially stories, strongly marked by humour, surprise and literary distinction. In New York, Edmund Clarence Stedman (1833–1908) became the chief representative of the literary profession. He was both poet and critic, and won reputation in the former and the first rank in the latter field. His *Victorian Poets* (1875) and *Poets of America* (1885), followed by comprehensive anthologies (1894–1900), together with *The Nature and Elements of Poetry* (1892), are the principal critical work of his generation, and indeed the sole work that is eminent. His verse, less practised as time went on, was well wrought and often distinguished by flashes of spirited song and balladry. With him is associated his elder friend, Richard Henry Stoddard (1825–1903), who made his appearance before the Civil War, and whose verse belongs in general character to the style of that earlier period and is as rapidly forgotten. Both Stedman and Stoddard were of New England birth, as was also the third to be mentioned, William Winter (born 1836), better known as the lifelong dramatic critic of the metropolis. The last of the New York poets of established reputation, Richard Watson Gilder (b. 1844 in New Jersey; d. 1909), was at first affiliated with the school of Rossetti, and his work in general, *Five Books of Song* (1894), strongly marked by artistic susceptibility, is in a high degree refined and delicate. In the country at large popular success, in England as well as in America, was won by Charles Godfrey Leland (1824–1903), in *Hans Breitmann's Ballads* (1871), humorous poems in the Pennsylvania Dutch dialect. Born in Philadelphia, he spent the greater part of his mature life abroad and wrote numerous works on diverse topics, but his reputation is chiefly connected with his books on gypsy life and lore. Another foreign resident who deserves mention was William Wetmore Story (1819–1895), the sculptor, of Massachusetts, connected with the Boston group, whose verse and prose gave him the rank of a *littérateur*. The South again entered into literature with the work of Sidney Lanier (1842–1881), in succession to Henry Timrod (1829–1867) and Paul Hamilton Hayne (1830–1886), who find a place rather by the affection in which they are held at the South than by positive merit. Lanier showed originality and a true poetic gift, but his talents were little effectual. From the West humorous poetry was produced by Francis Bret Harte (1839–1902), born in Albany, in *The Heathen Chinee* (1870) and similar verse, but he is better remembered as the artistic narrator of western mining life in his numerous stories and novels. Verse of a similar kind also first brought into literary notice John Hay (1838–1905), in *Pike County Ballads* (1871), who also wrote in prose; but his reputation was rather won as a statesman in the closing years of his life. Minor poets of less distinction but with a vein superior to that of the earlier period, more excellent in workmanship and more coloured with imagination and mood, arose in all parts, of whom the most notable are Julia Ward Howe (born 1819), in Boston, the venerable friend of many good causes, Henry Howard Brownell (1820–1872) of Rhode Island, author of the most vigorous and realistic poetry of the Civil War, *War Lyrics* (1866), Edward Rowland Sill (1841–1887), born in Connecticut but associated with California, Henry Van Dyke (born 1852), in New York, better known by his prose in tale and essay, Silas Weir Mitchell (born 1830), in Philadelphia, whose repute as a novelist has overshadowed his admirable verse, Eugene Field (1850–1895) of Chicago, James Whitcomb Riley (born 1853) of Indiana, both distinguished for their humorous and childhood verse, and Joaquin Miller (born 1841) of Oregon, whose first work, *Songs of the Sierras* (1871), had in it much of the spirit of the wild land, the colour of the desert, the free, adventurous character of the filibuster, all strangely mixed with pseudo-Byronic passions.

Whitman.

Apart from all these, whether minor or major poets, stands Walt Whitman (1819–1892), whose *Leaves of Grass* (1855) first appeared before the war, but whose fame is associated rather with its successive editions and its companion volumes, and definitely dated, perhaps, from 1867. He received attention in England, as did Miller, on an assumption that his works expressed the new and original America, the unknown democracy, and he has had some vogue in Germany mainly owing to his naturalism. His own countrymen, however, steadily refuse to accept him as representative of themselves, and his naturalism is uninteresting to them, while on the other hand a group apparently increasing in critical authority treat his work as significant. It is, in general, only by those few fine lyrics which have found a place in all anthologies of American verse that he is well known and highly valued in his own land.

The later novel.

The chief field of literary activity has been found in the novel, and nowhere has the change been so marked as here. The romantic treatment of the novel practically disappeared, and in its place came the realistic or analytic treatment, rendering manners by minute strokes of observation or dissecting motives psychologically. This amounted to a substitution of the French art of fiction, in some of its forms, for the English tradition of broad ideality and historical picturesqueness. The protagonist of the reform was William Dean Howells (born 1837), a cultivated literary scholar, and a various writer of essays, travel sketches, poetry and plays, editor of many magazines and books, whose career in letters has been more laborious and miscellaneous than any other contemporary, but whose main work has been the long series of novels that he has put forth almost annually throughout the period. He not only wrote fiction, but he endeavoured to make known to Americans fiction as it was practised in other lands, Russia, Italy, Spain, and to bring the art that was dearest to him into line with the standard of the European world. He was an apostle of the realistic school, and directed his teaching to the advocacy of the novel of observation, which records life in its conditions and attempts to realize what is in the daily lives and experience of man rather than what belongs to adventure, imagination or the dreaming part of life. Of his works, *The Lady of the Aroostook* (1879), *The Rise of Silas Lapham* (1885), *A Hazard of New Fortunes* (1889), are characteristic examples. He won a popular vogue, and if it is now less than it was, it is because after a score of years tastes and fashions change. The conscientiousness of his art continues the tradition of American writers in that respect, and he is master of an affable style. His work, including all its phases, is the most important body of work done in his generation. Henry James (born 1843), who mainly resided abroad, is his compeer, and in a similar way has followed French initiative. He also has been a various writer of criticism and travel and the occasional essay; but his equally long series of novels sustains his reputation. He has developed the psychological treatment of fiction, and of his work *The Portrait of a Lady* (1881), *The Princess Casamassima* (1886) and *The Tragic Muse* (1890) are characteristic. He has had less vogue owing to both matter and style, but in certain respects his power, more intellectual than that of Howells, has greater artistic elements, while the society with which he deals is more complex. He is really a cosmopolitan writer and has no other connexion with America than the accident of birth. A third novelist, also a foreign resident, Francis Marion Crawford (1854–1909), falls into the same category. A prolific novelist, in the beaten track of story-telling, he has always a story to tell and excellent narrative power. The work regarded as most important from his hand is *Saracinesca* (1887) and its sequels; but his subjects are cosmopolitan, his talent is personal, and he has no effectual connexion with his own country. The romantic tradition of the older time was continued by Lew Wallace (1827–1905) of Indiana, a distinguished general and diplomat, in his Mexican tale, *The Fair God* (1873), and his oriental romances, *Ben Hur* (1880), one of the most widely circulated of American books, and *The Prince of India* (1893). A mode of the novel which was wholly unique was practised by Francis Richard Stockton (1834–1902) in his droll tales, of which *Rudder Grange* (1879) is the best known.

The principal minor product of the novel lay in the provincial tale. The new methods easily lent themselves to the portraiture of local conditions, types and colour. Every part of the country had its writers who recorded its traits in this way. For New England Mrs Harriet Beecher Stowe described the older life in *Old Town Folks* (1869), and was succeeded by Sarah Orne Jewett (1849–1909) and Mary Eleanor Wilkins (born 1862). The West was notably treated by Edward Eggleston (1837–1902) in *The Hoosier School Master* (1871), Mary Hallock Foote (born 1847) in *Led-Horse Claim* (1883) and Hamlin Garland (born 1860) in *Main Travelled Roads* (1891). The South was represented by Mary Noailles Murfree ["Charles Egbert Craddock"] (born 1850) in *In the Tennessee Mountains* (1884) and its successors, by Thomas Nelson Page (born 1853) in *Marse Chan* (1887) and other tales of the reconstruction in Virginia, and with most literary grace by George Washington Cable (born 1844), whose novels of Louisiana are remarkable for their poetic charm. The list is sufficiently illustrative of the general movement, which made what was called the dialect novel supreme for the season. This was succeeded by a revival of the historical novel in local fields, of which Winston Churchill (born 1871) in *Richard Carvel* (1899) is the leading exponent, and together with it the sword and dagger tale of the Dumas type, the special contemporary plot invented by Anthony Hope, and romance in its utmost forms of adventure and extravagance, came in like a flood at the close of the Spanish War. There were during the period from 1870 to 1900 many other writers of fiction, who often proceeded in conventional and time-honoured ways to tell their tale, but none of them is especially significant for the general view or as showing any tendencies of an original sort. The pietistic novel, for example, was produced with immense popularity by Edward Payson Roe (1838–1888), who shared the same vogue as Josiah Gilbert Holland (1819–1881), and both fell heir to the same audience which in the earlier period had welcomed *The Wide, Wide World* with the same broad acceptance.

Essayists.

The essay, and the miscellaneous work which may be classed with it, was cultivated with most distinction by Thomas Wentworth Higginson (born 1823), one of the Boston group, a writer of the greatest versatility, as in his life he followed many employments, from that of preaching in a Unitarian pulpit to that of commanding a negro regiment in the Civil War. He has written good verse and excellent prose, and his familiar style, often brilliant with life and wit, especially becomes the social essay or reminiscent paper in which he excelled, and gives agreeableness to his writings in every form. *Atlantic Essays* (1871) is a characteristic book; and, in general, in his volumes is to be found a valuable fund of reminiscence about the literature and the times of his long life, not elsewhere so abundant or entertaining. Charles Dudley Warner (1829–1900) of Hartford, also in close touch in the later years with the Boston group, was more gifted with gentle humour and of a literary temperament that made the social essay his natural expression. He won popularity by *My Summer in a Garden* (1870), and was the author of many volumes of travel and several novels, but the familiar essay, lighted with humour and touched with a reminiscence of the Irving quality in sentiment, was his distinctive work. The long life of Edward Everett Hale (1822–1909), minister at Boston, was fruitful in many miscellaneous volumes, including fiction of note, *The Man Without a Country* (1868), but the most useful writing from his pen falls into prose resembling the essay in its form and manner of address, though cousin, too, to the sermon. John Burroughs (b. 1837) of New York carried on in essay form the nature tradition of Thoreau, touched with Emersonianism in the thought, and after his example books of mingled observation, sentiment and literary quality, with an out-of-door atmosphere, have multiplied.

Humour.

American humour often cultivates a form akin to the essay, but it also falls into the mould of the tale or scene from life. In the period before the Civil War, to sum up the whole subject in this place, it had the traits which it has since maintained, as its local tang, of burlesque, extravaganza, violence, but it recorded better an actual state of manners and scene of life in raw aspects. Its noteworthy writers were Seba Smith (1792–1868) of Maine, author of the *Letters of Major Jack Downing*, which began to appear in the press in 1830; Augustus Baldwin Longstreet of Georgia in *Georgia Scenes* (1835); William Tappan Thompson (1812–1882), born in Ohio but associated with the South by descent and residence, in *Major Jones' Courtship* (1840), a Georgian publication; Joseph G. Baldwin (1815–1864) in *Flush Times in Alabama and Mississippi* (1853); and Benjamin Penhallow Shillaber (1814–1890) in *Life and Sayings of Mrs Partington* (1854). A fresh form, attended by whimsicality, appears in George Horatio Derby's (1823–1861) *Phoenixiana* (1855). In the war-times Robert Henry Newell (1836–1901) and David Ross Locke (1833–1888), respectively known as "Orpheus C. Kerr" and "Petroleum V. Nasby" cultivated grotesque orthography in a characteristic vein of wit; and with more quaintness and drollery Henry Wheeler Shaw (1818–1885) and Charles Farrar Browne (1834–1867), known as "Josh Billings" and "Artemus Ward," won immense popularity which extended to England. These latter writers were men of Northern birth, but of Western and wandering journalistic experience as a rule. Their works make up a body of what is known as "American humour," a characteristic native product of social conditions and home talent. One poet, John Godfrey Saxe (1816–1887) of Vermont, attempted something similar in literary verse after the style of Tom Hood. The heir to this tradition of farce, drollery and joke was Samuel Langhorne Clemens (1835–1910), known as "Mark Twain," born in Missouri, who raised it to an extraordinary height of success and won world-wide reputation as a great and original humorist. His works, however, include a broader compass of fiction, greater humanity and reality, and ally him to the masters of humorous creation. Joel Chandler Harris (1848–1908) of Georgia introduced a new variety in *Nights with Uncle Remus* (1883), which is literary negro folklore, and Finley Peter Dunne (born 1857) of Chicago, the creator of "Mr Dooley," continues the older American style in its original traits.

History.

History was represented in this period with a distinction not inferior to that of the elder group by Francis Parkman (1823–1893) of Boston, who, however, really belongs with the preceding age by his affiliations; his series of histories fell after the Civil War by their dates of publication, but they began with *History of the Conspiracy of Pontiac* (1851); he was the contemporary of Lowell and differed from the other members of the elder group, who survived, only by the fact of the later maturing of his work. He was not less eminent than Motley and Prescott and his history is of a more modern type. In the next generation the field of American history was cultivated by many scholars, and a large part of local history and of national biography was for the first time recorded. James Ford Rhodes's (1848) *History of the United States* (1892) holds standard rank; the various writings of John Fiske (1842–1901), distinguished also as a philosophical writer, in the colonial and revolutionary periods are valued both for scholarship and for excellent literary style; and Theodore Roosevelt's (born 1858) *The Winning of the West* (1889) and his several biographical studies deserve mention by their merit as well as for his eminent position. The historians, however, have seldom sought literary excellence, and their works belong rather to learning than to literature. The same statement is true of the scholarship of the universities in general, where the spirit of literary study has changed. In the department of scholarship little requires mention beyond Horace Howard Furness's (born 1833) lifelong work on his *Variorum Edition of Shakespeare*, the Shakespearian labours of Henry Norman Hudson (1814–1886) and Richard Grant White (1821–1885), the Chaucerian studies of Thomas Raynesford Lounsbury (born 1838) of Yale, and the translations of Dante (1867, 1892) by Charles Eliot Norton (1827–1908) of Harvard.

Modern ideas.

The period has been one of great literary activity, effort and ambition, but it affects one by its mass rather than its details; it presents few eminent names. The romantic motives fixed in early colonizing history as a taking possession of the land by a race of Puritans, pioneers, river-voyagers, backwoodsmen, argonauts, have been exhausted; and no new motives have been found. The national tradition has been absorbed and incorporated, so far as literature was able to accomplish this. The national character on the other hand has been expressed rather in local types, the colour of isolated communities and provincial conditions for their picturesque value and human truth, and in commonplace characters of average life; but no broadly ideal types of the old English tradition have been created, and the great scene of life has not been staged after the manner of the imaginative masters of the past. There has been no product of ideas since Emerson; he was, indeed, the sole author who received and fertilized ideas as such, and he has had no successor. America is, in truth, perhaps intellectually more remote from Europe than in its earlier days. The contact of its romanticism with that of Europe was, as has been seen, imperfect, but its touch with the later developments and reactions of the movement in Europe is far more imperfect. With Tolstoy, Ibsen, d'Annunzio, Zola, Nietzsche, Maeterlinck, Sudermann, the American people can have no effectual touch; their social tradition and culture make them impenetrable to the present ideas of Europe as they are current in literary forms. Nor has anything been developed from within that is fertile in literature. The political unity of the nation is achieved, but it is not an integral people in other respects. It has not the unity of England or France or even of the general European mind; it rather contains such disparate elements as characterize the Roman or the Turkish empire. It is cleft by political tradition and in social moral conviction, north and south, and by intellectual strata of culture east and west; it is still a people in the making. Its literature has been regional, as was said, centred in New England, New York, Philadelphia, contributed to sporadically from the

South, growing up in Western districts like Indiana or germinating in Louisville in Kentucky, abundant in California, but always much dependent on the culture of its localities; it blends to some extent in the mind of the national reading public, but not very perfectly. The universities have not, on the whole, been its sources or fosterers, and they are now filled with research, useful for learning but impotent for literature. The intellectual life is now rather to be found in social, political and natural science than elsewhere; the imaginative life is feeble, and when felt is crude; the poetic pulse is imperceptible.

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AMERICAN WAR OF INDEPENDENCE (1775–1781). This war, by which the United States definitely separated themselves from the British connexion, began with the affair of Lexington in Massachusetts, on the 19th of April 1775, and was virtually ended by the capitulation of Cornwallis at Yorktown, Virginia, on the 19th of October 1781. In this article the progress of the war itself is alone considered, its political side being treated under United States: *History*. From a military standpoint as well as politically it was a conspicuous and instructive conflict,—conspicuous, or even unique, as being the most famous struggle in history where colonial dependencies defeated their powerful parent state, and instructive as presenting exceptional conditions and consequent errors in the attempt to break down the revolt. The reasons for Great Britain's failure appear in the progress of the war, which assumed two distinct stages, operations in the north followed by operations in the south. In point of time and energy military activity was about equally divided between these two fields. As the naval operations in connexion with the war have a European interest as well, they are dealt with in a separate section.

Land operations.

To strike at the rebellion first in the north was natural and inevitable. To King George and his ministry, Massachusetts was the hotbed of disloyalty, the head and front of opposition to their colonial policy, and there coercion should begin. It was also a convenient point for a prompt display of authority, as the town of Boston was the headquarters of General Gage, recently appointed royal governor of Massachusetts and commander of the king's troops in North America. He had with him four regiments of regulars, the initial force with which to overawe the restless and defiant population in his vicinity. While Gage is to be credited with advising his government that not less than 20,000 men would be necessary for the work in hand, he proceeded at once to suppress demonstrations around Boston. His principal expedition brought about the skirmish of the 19th of April 1775 (see Lexington), in which a detachment sent to seize some military stores collected at Concord suffered heavily at Lexington, Concord and other places, at the hands of the surrounding militia. This encounter roused the New England colonies, and in a few days some 16,000 of their townsmen marched in small bands upon Boston to protest against and resist further similar incursions; and in this irregular body we have the nucleus of the colonial forces which carried the war through. A noteworthy incident of the Concord affair, and characteristic of the attitude which the provincials had maintained and continued to maintain for another year, was the official representation to the king by the Massachusetts people that the regulars were the first to fire upon them, and that they returned the fire and fought through the day in strict defence of their rights and homes as Englishmen. They repeated their professions of loyalty to his majesty and the principles of the English Constitution. Conscious, nevertheless, that a struggle impended, they instantly sent word to all the other colonies, whose whig elements sympathetically responded to the alarm. The war had opened.

Bunker Hill.

The home government extended its precautions and preparations. General (Sir) William Howe, who succeeded Gage in the chief command in October, and Generals (Sir) Henry Clinton and John Burgoyne were sent out at once with reinforcements. Cornwallis followed a year later. These four generals were identified with the conduct of the principal operations on the side of the British. The force at Boston was increased to 10,000 men. The American Congress at Philadelphia, acting for all the thirteen colonies, voted general defensive measures, called out troops and appointed George Washington of Virginia commander-in-chief. Before he reached the camp forming around Boston, a second and more important collision took place. On the 17th of June 1775 occurred the battle of Bunker Hill (*q.v.*), in which, although victorious, the British suffered heavily, losing one-third of their force in storming the hastily constructed lines of the "rebels." The latter's most serious loss was that of General Joseph Warren, one of the prominent leaders of the revolutionary movement in Massachusetts. In moral effect the battle proved anything but a defeat to the Americans, who now drew a cordon of works around Boston, hemming Howe's army in a contracted, and, as it proved, untenable, position. On the 3rd of July Washington took command of the American army at Cambridge and proceeded with what is known as the "siege of Boston," which was marked by no special incident, and closed with the evacuation of the town by the British on the 17th of March 1776, Howe sailing away to Halifax, Nova Scotia. While the main interest centred at this point, the year 1775 was marked by two enterprises elsewhere. Fort Ticonderoga, the key to the passage of Lakes George and Champlain to Canada, was surprised and taken on the 10th of May by a small band under Colonel Ethan Allen, while Colonel Benedict Arnold headed an expedition through the Maine woods to effect the capture of Quebec, where Sir Guy Carleton commanded. Arnold joined General Richard Montgomery, who was already near the city, and the combined force assaulted Quebec on the 31st of December, only to meet with complete defeat. Montgomery was killed and many of his men taken prisoners. Demonstrations against Canada were soon discontinued, Arnold drawing off the remnant of his army in May 1776.

The events of 1775, though favourable to America, were but a prelude to the real struggle to come. For the campaign of 1776 both sides made extensive preparations. To the home government the purely military problem, although assuming larger dimensions and more difficulties, still seemed to admit of a simple solution, namely, to strike hard where the rebellion was most active and capable of the longest resistance. Defeated there, it would quickly dissipate in all quarters. As much more than one-half of the population and resources of the colonists lay north of Chesapeake Bay—New England alone having an estimated population of over 700,000 persons—it was only a question as to what point in this area should be made the future base of operations. Largely upon the representations of Howe, Burgoyne and others, it was determined to shift the field from Boston to New York city, from there to hold the line of the Hudson river in co-operation with a force to move down from Canada under Carleton and Burgoyne, and thus effectually to isolate New England.

Long Island.

Fort Washington.

Upon this plan the new campaign opened in June 1776. Howe, heavily reinforced from home, sailed on the 10th from Halifax to New York and on the 5th of July encamped on Staten Island. Washington, anticipating this move, had already marched from Boston and fortified the city. His left flank was thrown across the East river beyond the village of Brooklyn, while his front and right on the harbour and North or Hudson river were open to a combined naval and military attack. The position proved untenable. Howe drove Washington out of it, and forced the abandonment of the whole of Manhattan Island by three well-directed movements upon the American left. On the 22nd of August he crossed the Narrows to the Long Island shore with 15,000 troops, increasing the number to 20,000 on the 25th, and on the 27th surprised the Americans, driving them into their Brooklyn works and inflicting a loss of about 1400 men. Among the prisoners were Generals J. Sullivan and W. Alexander, *soi-disant* earl of Stirling. (See LONG ISLAND.) Howe has been criticized, rightly or wrongly, for failing to make full use of his victory. Washington skilfully evacuated his Brooklyn lines on the night of the 29th, and in a measure relieved the depression which the defeat had produced in his army. On the 15th of September Howe crossed the East river above the city, captured 300 of the militia defending the lines and occupied the city. Washington had withdrawn his main army to the upper part of the island. A skirmish, fought the next day, opposite the west front of the present Columbia University, and known as the affair of Harlem Heights, cost the British a loss of seventy of their light infantry. Delaying until the 12th of October, Howe again moved forward by water into Westchester county, and marching toward White Plains forced another retreat on Washington. In the fight on Chatterton Hill at the Plains, on the 28th of October, an American brigade was defeated. Instead of pressing Washington further, Howe then returned to Manhattan Island, and on the 16th of November captured Fort Washington with nearly 3000 prisoners. This was the heaviest blow to the Americans throughout the war in the north. The British then pushed down through New Jersey with designs on Philadelphia. Washington, still retreating with a constantly diminishing force, suddenly turned upon Lieutenant-Colonel Rall's advanced corps of Hessians at Trenton on the 26th of December and captured nearly 1000 prisoners. This brilliant exploit was followed by another on the 3rd of January, when Washington, again crossing the Delaware, outmarched Cornwallis at Trenton, and marching to his rear defeated three British regiments and three companies of light cavalry at Princeton, New Jersey. Marching on to Morristown, Washington encamped there on the flank of the British advance in New Jersey, thus ending the first campaign fought on the new issue of American Independence, which had been declared on the 4th of July 1776.

Brandywine.

While these closing successes inspirited the Americans, it was undeniable that the campaign had gone heavily against them. Having raised a permanent force for the war called the Continental Line, they awaited further operations of the enemy. Following up the occupation of New York, Howe proceeded in 1777 to capture Philadelphia. Complete success again crowned his movements. Taking his army by sea from New York to the head of the Chesapeake, he marched up into Pennsylvania, whither Washington had repaired to watch him, and on the 26th of September entered the city. The Americans attempted to check the advance of the British at the river Brandywine, where an action occurred on the 11th, resulting in their defeat (see BRANDYWINE); and on the 4th of October Washington directed a well-planned attack upon the enemy's camp at Germantown on the outskirts of the city, but failed of success. (See GERMANTOWN.)

Saratoga.

Howe's victorious progress in Pennsylvania was neutralized by disasters farther north. Burgoyne marched from Canada in June 1777, with a strong expeditionary force, to occupy Albany and put himself in touch with Howe at the other end of the Hudson. Driving the Americans under General Arthur St Clair out of Ticonderoga, and making his way through the deep woods with difficulty, he reached the Hudson at Fort Edward on the 30th of July. General Philip Schuyler, commanding the Americans in that quarter, retreated to Stillwater, 30 m. above Albany, barricading the roads and impeding Burgoyne's progress. Dissatisfaction with his conduct led Congress to replace him in command by General Gates. On the 13th of August Burgoyne despatched a force to Bennington, Vermont, under the German colonel Friedrich Baum, to capture stores and overawe the country. On the 16th Baum was attacked by General John Stark with the militia from the surrounding country, and was overwhelmed. Colonel Breyman, marching to his relief, was also routed. The misfortune cost the British 1000 men. Equally unfortunate was the fate of an expedition sent under Colonel Barry St Leger to co-operate with Burgoyne by way of the Mohawk Valley. On the 6th of August he was met at Oriskany by General Nicholas Herkimer and forced to retreat. Despite these disasters Burgoyne pushed south to Stillwater, where he was defeated by Gates's improvised army of continentals and militia in two battles on the 19th of September (Freeman's Farm) and the 7th of October (Bemis's Height). On the 17th he was forced to surrender. (See SARATOGA, BATTLE OF.) This disaster was followed by the alliance between America and France in 1778, and later by the addition of Spain to England's enemies—events of far-reaching importance.

A movement of importance, in 1778–79, was the expedition of George Rogers Clark, under the authority of the state of Virginia, against the British posts in the north-west. With a company of volunteers Clark captured Kaskaskia, the chief post in the Illinois country, on the 4th of July 1778, and later secured the submission of Vincennes, which, however, was recaptured by General Henry Hamilton, the British commander at Detroit. In the spring of 1779 Clark raised another force, and recaptured Vincennes from Hamilton. This expedition did much to free the frontier from Indian raids, gave the Americans a hold upon the north-west, of which their diplomats duly took advantage in the peace negotiations, and later, by giving the states a community of interest in the western lands, greatly promoted the idea of union.

In 1778 Sir Henry Clinton succeeded Howe in the chief command in America. With fewer resources than his predecessor had disposed of, he could accomplish practically nothing in the north. In June 1778 he evacuated Philadelphia, with the intention of concentrating his force at New York. Washington, who had passed the winter at Valley Forge, overtook him at Monmouth, N.J., and in an action on the 28th of June both armies suffered about equal loss. Thereafter (except in the winter of 1779, at Morristown) Washington made West Point on the Hudson the headquarters of his army, but Clinton avowed himself too weak to attack him there. In 1779 he attempted to draw Washington out of the Highlands, with the result that in the manœuvres he lost the garrison at Stony Point, 700 strong, the position being stormed by Wayne with the American light infantry on the 16th of July. During the summer General John Sullivan marched with a large force against the Indians (all the Iroquois tribes except the Oneidas and part of the Tuscaroras siding with the British during the war) and against the Loyalists of western New York, who had been committing great depredations along the frontier; and on the 29th of August he inflicted a crushing defeat upon them at Newtown, on the site of the present Elmira. In addition several Indian villages and the crops of the Indians were destroyed in the lake region of western New York.

Meanwhile the co-operation of the French became active. In July Count Rochambeau arrived at Newport, Rhode Island. That place had been occupied by the British from 1776 to the close of 1779. An unsuccessful attempt was made to drive them out in 1778 by the Americans assisted by the French admiral d'Estaing and a French corps. The year 1780 is also marked by the treason of General Benedict Arnold (*q.v.*), and the consequent execution of Major André. Minor battles and skirmishes occurred until in August 1781 Washington conceived the project of a combined American-French attack on Cornwallis at Yorktown, Va., the success of which was decisive of the war (see below).

Campaign in Georgia.

The inadequate results of the British campaigns against the northern colonies in 1776 and 1777 led the home government to turn its attention to the weaker colonies in the south. Operations in the north were not to cease, but a powerful diversion was now to be undertaken in the south with a view to the complete conquest of that section. Success there would facilitate further movements in the north. An isolated attack on Charleston, South Carolina, had been made by Sir Henry Clinton and Sir Peter Parker as early as June 1776, but this was foiled by the spirited resistance of General William Moultrie; after 1778 the southern attempts, stimulated in part by the activity of the French in the West Indies, were vigorously sustained. On the 29th of December of this year Colonel Archibald Campbell (1739–1791) with an expeditionary corps of 3500 men from Clinton's army in New York, captured Savannah, Georgia, defeating the American force under General Robert Howe. In the following month he pushed into the interior and occupied Augusta. General Benjamin Lincoln, succeeding Howe, undertook to drive the British out of Georgia, but General Augustine Prevost, who had commanded in Florida, moved up and compelled Lincoln to retire to Charleston. Prevost, making Savannah his headquarters, controlled Georgia. In September 1779 he was besieged by Lincoln in conjunction with a French naval and military force under Admiral d'Estaing, but successfully repelled an assault (October 9), and Lincoln again fell back to Charleston. In this assault Count Casimir Pulaski, on the American side, was mortally wounded.

Charleston.

The prestige thus won by the British in the south in 1779 was immensely increased in the following year, when they victoriously swept up through South and North Carolina. Failing, as stated, to achieve any advantage in the north in 1779, Sir Henry Clinton, under instructions from government, himself headed a combined military and naval expedition southward. He evacuated Newport, R.I. (October 25), left New York in command of the German general Wilhelm von Knyphausen, and in December sailed with 8500 men to join Prevost at Savannah. Cornwallis accompanied him, and later Lord Rawdon joined him with an additional force. Marching upon Charleston, Clinton cut off the city from relief, and after a brief siege compelled Lincoln to surrender on the 12th of May. (See CHARLESTON.) The loss of this place and of the 5000 troops included in the surrender was a serious blow to the American cause. The apparent submission of South Carolina followed. In June Clinton returned to New York, leaving Cornwallis in command, with instructions to reduce North Carolina also. Meanwhile an active and bitter partisan warfare opened. The British advance had been marked by more than the usual destruction of war; the Loyalists rose to arms; the whig population scattered and without much organization formed groups of riflemen and mounted troopers to harass the enemy. Little mercy was shown on either side. The dashing rider, Colonel Banastre Tarleton, cut to pieces (April 14, 1780) a detachment of Lincoln's cavalry, and followed it up by practically destroying Buford's Virginia regiment near the North Carolina border. On the other hand, daring and skilful leaders such as Francis Marion and Thomas Sumter kept the spirit of resistance alive by their sudden attacks and surprises of British outposts. Hanging Rock, Ninety-Six, Rocky Mount and other affairs brought their prowess and devotion into notice. By the month of August 1780, with the main British force encamped near the North Carolina line, the field seemed clear for the next advance.

Camden.

Guilford Court House.

The threatening situation in the Carolinas alarmed Congress and Washington and measures were taken to protect the distressed section. Before Cornwallis could be brought to bay he was faced successively by four antagonists—Generals Gates, Greene, Lafayette and Washington. They found in him the most capable and dangerous opponent of the war. Greene called him " the modern Hannibal." With Lincoln's surrender of nearly all the continental soldiers in the south, a new force had to be supplied to meet the British veterans. Two thousand men, mainly the Maryland line, were hurried down from Washington's camp under Johann de Kalb; Virginia and North Carolina put new men into the field, and the entire force was placed under command of General Gates. Gates marched towards Camden, S.C., and on the 16th of August encountered Cornwallis near that place. Each army by a night march attempted a surprise of the other, but the British tactics prevailed, and Gates was utterly routed. The reputation he had won at Saratoga was ruined on the occasion by over-confidence and incompetence. De Kalb was killed in the action. General Greene, standing next to Washington as the ablest and most trusted officer of the Revolution, succeeded Gates. Cornwallis marched leisurely into North Carolina, but before meeting Greene some months later he suffered the loss of two detachments sent at intervals to disperse various partisan corps of the Americans. On the 7th of October 1780 a force of 1100 men under Major Patrick Ferguson was surrounded at King's Mountain, S. C., near the North Carolina line, by bands of riflemen under Colonels Isaac Shelby, James Williams, William Campbell and others, and after a desperate fight on the wooded and rocky slopes, surrendered. Ferguson himself was killed. On the 17th of January 1781 General Daniel Morgan was attacked at Cowpens, south-west of King's Mountain, by Colonel Tarleton with his legion. Both were leaders of repute, and a most stirring action occurred in which Morgan, with Colonel William Washington leading his cavalry, practically destroyed Tarleton's corps. Despite the weakening his army suffered by these losses, Cornwallis marched rapidly through North Carolina, giving Greene a hard chase nearly to the Virginia line. On the 15th of March the two armies met at Guilford Court House (near the present Greensboro, N.C.), and a virtually drawn battle was fought. The British, by holding their ground with their accustomed tenacity when engaged with superior numbers, were tactically victors, but were further weakened by a loss of nearly 600 men. Greene, cautiously avoiding another Camden, retreated with his forces intact. With his small army, less than 2000 strong, Cornwallis declined to follow Greene into the back country, and retiring to Hillsborough, N.C., raised the royal standard, offered protection to the inhabitants, and for the moment appeared to be master of Georgia and the two Carolinas. In a few weeks, however, he abandoned the heart of the state and marched to the coast at Wilmington, N.C., to recruit and refit his command.

At Wilmington the British general faced a serious problem, the solution of which upon his own responsibility unexpectedly led to the close of the war within seven months. Instead of remaining in Carolina he determined to march into Virginia, justifying the move on the ground that until Virginia was reduced he could not firmly hold the more southern states he had just overrun. This decision was subsequently sharply criticized by Clinton as unmilitary, and as having been made contrary to his instructions. To Cornwallis he wrote in May: " Had you intimated the probability of your intention, I should certainly have endeavoured to stop you, as I did then as well as now consider such a move likely to be dangerous to our interests in the Southern Colonies." The danger lay in the suddenly changed situation in that direction; as General Greene, instead of following Cornwallis to the coast, boldly pushed down towards Camden and Charleston, S.C., with a view to drawing his antagonist after him to the points where he was the year before, as well as to driving back Lord Rawdon, whom Cornwallis had left in that field. In his main object, the recovery of the southern states, Greene succeeded by the close of the year; but not without hard fighting and repeated reverses. " We fight, get beaten, and fight again," were his words. On the 25th of April 1781 he was surprised in his camp at Hobkirk's Hill, near Camden, by Lord Rawdon and defeated, both sides suffering about an equal loss. On the 22nd of May he attempted to storm the strong British post at Ninety-Six but was repulsed;

and finally on the 8th of September he fought the last battle of the war in the lower southern states at Eutaw Springs, S.C. ***Eutaw Springs.*** In the first part of the action Greene was successful after a desperate conflict; in the pursuit, however, the Americans failed to dislodge the British from a stone house which they held, and their severe loss in both engagements was over 500 men. The British lost about 1000, one-half of whom were prisoners. Better success attended the American partisan operations directed by Greene and conducted by Marion, Sumter, Andrew Pickens, Henry Lee and William Washington. They fell upon isolated British posts established to protect the Loyalist population, and generally captured or broke them up. Rawdon found himself unable with his diminishing force to cover the country beyond Charleston; and he fell back to that place, leaving the situation in the south as it had been in the early part of 1780. On the American side, Greene was hailed as the deliverer of that section.

Virginia campaign.

Cornwallis, meantime, pursued his Virginia project. Leaving Wilmington, N.C., on the 25th of April 1781, he reached Petersburg on the 20th of May. There he found British detachments, 2000 strong, composed of troops whom Clinton had sent down separately under Generals Benedict Arnold and William Phillips to establish a base in the Chesapeake, as a diversion in favour of the operations of Cornwallis in the Carolinas. Virginia at the moment presented a clear field to the British, and they overran the state as far north as Fredericksburg and west to Charlottesville. At the latter place Jefferson, governor of the state, barely escaped capture by Tarleton's men. A small American force under Lafayette, whom Wayne reinforced during the summer, partially checked the enemy. At Green Spring, near Jamestown Island, Lafayette boldly attacked his antagonist on the 6th of July, but had to save himself by a hasty retreat. Early in August Cornwallis retired to Yorktown to rest and await developments. There he fortified himself, and remained until the American-French military and naval combination, referred to above, appeared and compelled his surrender. (See YORKTOWN.)

With this event war operations ceased. Preliminary articles of peace, signed on the 30th of November 1782, were followed by a definitive treaty concluded on the 3rd of September 1783. Charleston, S.C., was evacuated late in 1782; New York on the 25th of November 1783. The reasons of Great Britain's misfortunes and failure may be summarized as follows:—Misconception by the home government of the temper and reserve strength of her colonists, a population mainly of good English blood and instincts; disbelief at the outset in the probability of a protracted struggle covering the immense territory in America; consequent failure to despatch sufficient forces to the field; the safe and Fabian generalship of Washington; and finally, the French alliance and European combinations by which at the close of the conflict England was without a friend or ally on the continent.

BIBLIOGRAPHY.—The most exhaustive reference work for this period is vol. vi. of Winsor's *Narrative and Critical History of America* (Boston, 1887). Its nine chapters, prepared by different writers, give a complete review of the struggle, both military and naval, and each closes with numerous illustrative notes, editorial criticisms and a full list of authorities. The volume is interspersed, far more extensively and richly than any other treatise on the war, with reproductions of contemporary plans, maps, documents, portraits and prints. Supplementing Winsor and bringing the material down to recent date is Prof. C. H. Van Tyne's *American Revolution* (Harper's "Am. Nation" Series, New York, 1905), chap. xviii., on bibliographical aids and authorities. General histories of the war are mainly of American authorship, such as: George Bancroft's *History of the United States* (Boston, 1883–1885) which, in spite of minor errors of fact and judgment, will remain standard; J. Fiske's *American Revolution* (2 vols., Boston, 1891); Carrington's *Battles of the American Revolution* (New York, 1876) is a critical study by a military officer; B. J. Lossing's *Pictorial Field Book of the Revolution* (2 vols., New York, 1850–1859), not always accurate, but preserves local traditions and details. Monographs on single events or campaigns abound: Dawson's papers on Ticonderoga, "Storming of Stony Point," &c. (New York, 1866–); Johnston's "Campaign of 1776 around New York" (L. I. Hist. Soc., 1877), "Yorktown Campaign" (New York, 1881), &c.; Sargent's *Life of Major John André* (Boston, 1861), one of the best of Revolutionary biographies; Gen. William Stryker's *Battles of Trenton and Princeton* (Boston, 1898); and others mentioned in Winsor and Van Tyne.

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Effect of sea-power.

The naval operations of the War of Independence divide themselves naturally into two periods. (1) From 1775 till the summer of 1778 the British navy was engaged in co-operating with the troops employed against the insurgents, on the coasts, rivers and lakes of North America, or in endeavouring to protect British commerce against the enterprise of American privateers. (2) During the second period the successive interventions of France, Spain and Holland extended the naval war till it ranged from the West Indies to the Bay of Bengal. This second period lasted from the summer of 1778 to the middle of 1783, and it included both such operations as had already been in progress in America, or for the protection of commerce, and naval campaigns on a great scale carried out by the fleets of the maritime powers.

First Period.—The history of the naval war from 1775 to 1778 was made up of many small operations. The naval force at the disposal of the admirals commanding on the station, who until Lord Howe took up the command on the 12th of July 1776 were Samuel Graves and Molyneux Shuldham, was insufficient to patrol the long line of coast. A large part of such squadrons as there were was necessarily limited to aiding General Gage and Sir W. Howe at Boston, in seeking stores for the army and in supplying naval brigades. At other points of the coast the British navy was employed in punitive expeditions against the coast towns—as for example the burning of Falmouth (now Portland, Maine) in October 1775—which served to exasperate, rather than to weaken the enemy, or the unsuccessful attack on Charleston, S.C., in June 1776. It was wholly unequal to the task of blockading the many towns from which privateers could be fitted out. British commerce therefore suffered severely, even as far off as the Irish coasts, where it was found necessary to supply convoy to the Belfast linen trade. The Americans were not yet in a position to provide a fleet. On the 23rd of March 1776 Congress did indeed issue letters of marque and reprisal, and efforts were made to fit out a national force. But the so-called "continental" vessels which sailed with the commission of the Congress hardly differed in character, or in the nature of their operations, from the privateers. The British navy was able to cover the retreat of the army from Boston to Halifax in April 1776, and to convey it to New York in June. It assisted in the expedition to Philadelphia in July 1777. On the St Lawrence and the Lakes it was able to play a more aggressive part. The relief of Quebec by Captain—afterwards Sir Charles—Douglas in May 1776 forced the American general Arnold to retreat. The destruction of his squadron on Lake Champlain in October covered the frontier of Canada, and supplied a basis for the march of General Burgoyne in 1777 which ended in the surrender at Saratoga.

Second Period.—The disaster at Saratoga was followed in 1778 by war with France, which had already given much private help to the American privateers and to their forces in the field. The rupture came in March when the British ambassador, Lord Stormont, was recalled from Paris, but as neither fleet was ready for service, actual conflict did not take place till July. The French government was somewhat more ready than the British. On the 13th of April it despatched a squadron of twelve sail of the line and four frigates from Toulon to America under the command of the Count d'Estaing. As no attempt was made to stop him in the Straits of Gibraltar, he passed them on the 16th of May, and though the rawness of his crews and his own error in wasting time in pursuit of prizes delayed his passage, he reached the mouth of the Delaware on the 8th of July unopposed. The French government, which by the fault of the British administration was allowed to take the offensive, had three objects in view—to help the Americans, to expel the British from the West Indies and to occupy the main strength of the naval forces of Great Britain in the Channel. Therefore a second and more powerful fleet was fitted out at Brest under the command of the Count d'Orvilliers. The British government, having neglected to occupy the Straits of Gibraltar in time, despatched Admiral Byron from Plymouth on the 9th of June with thirteen sail of the line to join Admiral (Lord) Howe, Sir William's brother, in America, and collected a strong force at home, called the Western Squadron, under Viscount Keppel. Keppel, after a preliminary cruise in June, brought d'Orvilliers to action off Brest on the 27th of July. The fleets were equal and the action was indecisive,—as the two forces merely passed one another, cannonading. A violent quarrel exacerbated by political differences broke out among the British commands, which led to two courts-martial and to the resignation of Keppel, and did great injury to the discipline of the navy. No further event of note occurred in European waters. On the coast of America the news of the approach of d'Estaing compelled the British commanders to evacuate Philadelphia on the 18th of June. Howe then concentrated his force of nine small line-of-battle ships at Sandy Hook on the 29th of June, and on the 11th of July he learnt that d'Estaing was approaching. The French admiral did not venture to make an attack, and on the 22nd of July sailed to co-operate with the Americans in an endeavour to expel the British garrison from Rhode Island. Howe, who had received a small reinforcement, followed. The French admiral, who had anchored above Newport, R.I., came to sea to meet him, but both fleets were scattered by storms. D'Estaing sailed to Boston on the 21st of August. Howe received no help from Byron, whose badly appointed fleet was damaged and scattered by a gale on the 3rd of July in mid-Atlantic. His ships dropped in by degrees during September. Howe resigned on the 25th of that month, and was succeeded by Byron. The approach of winter made a naval campaign on the coast of North America dangerous. The operations of naval forces in the New World were largely dictated by the facts that from June to October are the hurricane months in the West Indies, while from October to June includes the stormy winter of the northern coast. On the 4th of November d'Estaing sailed for the West Indies, on the very day that Commodore William Hotham was despatched from New York to reinforce the British fleet in those waters. On the 7th of September the French governor of Martinique, the marquis de Bouillé, had surprised the British island of Dominica. Admiral Samuel Barrington, the British admiral in the Leeward Islands, had retaliated by seizing Santa Lucia on the 13th and 14th of December after the arrival of Hotham from North America. D'Estaing, who followed Hotham closely, was beaten off in two feeble attacks on Barrington at the Cul-de-Sac of Santa Lucia on the 15th of December. On the 6th of January 1779 Admiral Byron reached the West Indies. During the early part of this year the naval forces in the West Indies were mainly employed in watching one another. But in June, while Byron had gone to Antigua to guard the trade convoy on its way home, d'Estaing first captured St Vincent, and then on the 4th of July Grenada. Admiral Byron, who had returned, sailed in hopes of saving the island, but arrived too late. An indecisive action was fought off Grenada on the 6th of July. The war now died down in the West Indies. Byron returned home in August. D'Estaing, after co-operating unsuccessfully with the Americans in an attack on Savannah, in September also returned to Europe. In European waters the Channel had been invaded by a combined French and Spanish fleet of sixty-six sail of the line, Spain having now joined the coalition against Great Britain. Only thirty-five sail of the line could be collected against them under the command of Sir Charles Hardy. But they came late and did nothing. The allies retired early in September and were not even able to molest the British trade convoys. In the meantime the Spaniards had formed the siege of Gibraltar.

So far the British navy had stood on the defensive, without material loss except in the West Indies, but without triumph. The operations of 1780 went on much the same lines. The British government, not feeling strong enough to blockade Brest and the Spanish ports, was compelled to regulate its movements by those of its opponents. In the Channel it was saved from disaster by the ineptitude of the French and Spanish fleets. The only real success achieved by this numerically imposing force was the capture on the 8th and 9th of August of a large British convoy of ships bound for the East and West Indies carrying troops. But on the American coast and in the West Indies more vigour was displayed. Early in the year Admiral Marriot Arbuthnot was sent to take command in North America. On the French side the count de Guichen was sent with reinforcements to the West Indies to take command of the ships left in the previous year by d'Estaing. He arrived in March, and was able to confine the small British force under Sir Hyde Parker at Gros Islet Bay in Santa Lucia. In May M. d'Arzac de Ternay was sent from Brest with seven line-of-battle ships, and a convoy carrying 6000 French troops to act with the Americans. He had a brush with a small British force under Cornwallis near Bermuda on the 20th of June, and reached Rhode Island on the 11th of July. During the rest of the year, and part of the next, the British and French naval forces in North American waters remained at their respective headquarters, New York and Newport, watching one another. The West Indies was again the scene of the most important operations of the year. In February and March a Spanish force from New Orleans, under Don Bernardo de Galvez, invaded West Florida with success. But the allies made no further progress. At the close of 1779 Sir George Rodney had been appointed to command a large naval force which was to relieve Gibraltar, then closely blockaded, and send stores to Minorca. Rodney was to go on to the West Indies with part of the fleet. He sailed on the 29th of December 1779 with the trade for the West Indies under his protection, captured a Spanish convoy on his way off Finisterre on the 8th of January, defeated a smaller Spanish force near Cape St Vincent on the 16th, relieved Gibraltar on the 19th, and left for the West Indies on the 13th of February. On the 27th of March he joined Sir Hyde Parker at Santa Lucia, and Guichen retired to Fort Royal in Martinique. Until July the fleets of Rodney and Guichen, of equal strength, were engaged in operations round the island of Martinique. The British admiral endeavoured to force on a close engagement. But in the first encounter on the 17th of April to leeward of the island, Rodney's orders were not executed by his captains, and the action was indecisive. He wished to concentrate on the rear of the enemy's line, but his captains scattered themselves along the French formation. In two subsequent actions, on the 15th and 19th of May, to windward of Martinique, the French admiral would not be brought to close action. The arrival of a Spanish squadron of twelve ships of the line in June gave a great numerical superiority to the allies, and Rodney retired to Gros Islet Bay in Santa Lucia. But nothing decisive occurred. The Spanish fleet was in bad health, the French much worn-out. The first went on to Havana, the second to San Domingo. In July, on the approach of the dangerous hurricane season, Rodney sailed for North America, reaching New York on the 14th of September. Guichen returned home with the most worn-out of his ships. On the 6th of December Rodney was back at Barbadoes from the North American station, where he was not able to effect anything against the French in Narragansett Bay.

The rambling operations of the naval war till the close of 1780 —directed by the allies to such secondary objects as the capture of West Indian islands, or of Minorca and Gibraltar, and by Great Britain to defensive movements—began to assume a degree of coherence in 1781. Holland having now joined the allies, the British government was compelled to withdraw part of its fleet from other purposes to protect the North Sea trade. A desperate battle was fought on the Dogger Bank on the 5th of August between Sir Hyde Parker and the Dutch admiral Zoutman, both being engaged in protecting trade; but Holland did not affect the general course of the war. The allies again failed to make a vigorous attack on the British forces in the Channel. They could not even prevent Admiral George Darby from relieving Gibraltar and Minorca in April. The second of these places was closely invested later on, and was compelled to surrender on the 5th of February 1782. But a vigorous policy was carried out by France in the West Indies and America, while she began a most resolute attack on the British position in the East Indies.

In the West Indies Rodney, having received news of the breach with Holland early in the year, took the island of St Eustatius, which had been a great depot of contraband of war, on the 3rd of February. The British admiral was accused of applying himself so entirely to seizing and selling his booty that he would not allow his second in command, Sir Samuel Hood, who had recently joined him, to take proper measures to impede the arrival of French forces known to be on their way to Martinique. The French admiral, the count de Grasse, reached the island with reinforcements in April. Until July he was engaged in a series of skilful operations directed to menacing the British islands while he avoided being brought to battle by Rodney. In July he sailed for the coast of North America, whither he was followed in August by Sir S. Hood, Rodney having been compelled to return home in ill-health.

On the coast of North America the war came to its crisis. In the earlier part of the year the British at New York and the French at Newport continued to watch one another. In April the British admiral Arbuthnot did indeed succeed in baffling an attempt of the French to carry reinforcements to the American cause in Virginia. The action he fought off the capes of Virginia on the 16th of April was ill conducted, but his main purpose was achieved. Washington, who was wisely anxious to concentrate attack on one or other of the centres of British power in Virginia or New York, had to wait till the arrival of Grasse before he could see his ideas applied. The French admiral gave the allies a superiority of naval strength on the coast of Virginia, and Lord Cornwallis, the British commander, was beleaguered in Yorktown. Admiral Thomas Graves, Arbuthnot's successor, who had been joined by Hood from the West Indies, endeavoured to drive off the French fleet. But the feeble battle he fought on the 5th of September failed to shake the French hold on the Chesapeake, and Grasse having been reinforced, Graves sailed away. Yorktown fell on the 19th of October, and the war was settled as far as the coast of North America was concerned.

The French admiral, having rendered this vital service to his ally, now returned to the West Indies, whither he was followed by Hood, and resumed the attacks on the British islands. In January and February 1782 he conquered St Christopher, in spite of the most determined opposition of Hood, who with a much inferior force first drove him from his anchorage at Basseterre, and then repulsed his repeated attacks. The next purpose of the French was to combine with the Spaniards for an attack on Jamaica. Sir George Rodney, having returned to his command with reinforcements, baffled this plan by the series of operations which culminated in the battle of the 12th of April 1782. (See SAINTS, BATTLE OF.) No further operations of note occurred in the West Indies. At home Howe relieved Gibraltar for the last time in September and October 1782.

The war in the East Indies formed a separate series of episodes. In 1778 the British authorities had little difficulty in seizing the French settlement of Pondicherry. A naval engagement of a very feeble kind took place on the 10th of August in the Bay of Bengal, between the British naval officer in command and M. de Tronjoly. But the French were too weak in these seas for offensive movements, and therefore remained quiescent at Bourbon and Mauritius till the beginning of 1782. In the spring of 1781 the bailli de Suffren was sent to the East with a small squadron; on his way he fell upon a British force which had been sent to take the Cape from the Dutch, and which he found in the Portuguese anchorage of Porto Praya, on the 16th of April. Having provided for the security of the Cape, Suffren went on to the French islands. He sailed from them early in 1782 to carry out a vehement attack on the British forces in the Bay of Bengal. From the 17th of February 1782 to the 20th of June 1783 he fought a series of fine actions against Sir Edward Hughes, by which he secured a marked superiority on the water. Though he had no port in which to refit and no ally save Hyder Ali, he kept the sea and did not even return to the French islands during the north-easterly monsoon. Suffren failed in his main purpose, which was to make such a capture as would put his government in a strong position during the negotiations for peace. But his capture of Trincomalee in July 1782 in spite of Sir Edward Hughes, and the heavy loss he inflicted on the British fleet in several of the actions he fought, constitute the most honourable part of the French naval operations in the war.

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AMERICAN WAR OF 1812. The war between the United States and Great Britain, commonly known as "of 1812," began by the American declaration of war on the 18th of June of that year, and lasted till the beginning of 1815. The treaty of peace signed at Ghent on the 24th of December 1814 was ratified by the president of the United States on the 17th of February 1815. These two years and a half of conflict were filled with isolated encounters which can hardly be reduced to coherent and ordered operations. Although the outbreak of war had been preceded by years of angry diplomatic dispute, the United States were absolutely unready, while Great Britain was still hard pressed by the hostility of Napoleon, and was compelled to retain the greater part of her forces and her best crews in European waters, till the ruin of the *Grande Armée* in Russia and the rising of Germany left her free to send an overwhelming force of ships to American waters.

The forces actually available on the American side when the war began consisted of a small squadron of very fine frigates and sloops in an efficient state. Twenty-two was the extreme limit of the naval force the States were able to commission. The paper strength of the army was 35,000, but the service was voluntary and unpopular, while there was an almost total want of trained and experienced officers. The available strength was a bare third of the nominal. The militia, called in to aid the regulars, proved untrustworthy. They objected to serve beyond the limits of their states, were not amenable to discipline, and behaved as a rule very ill in the presence of the enemy. On the British side, the naval force in American waters under Sir John Borlase Warren, who took up the general command on the 26th of September 1812, consisted of ninety-seven vessels in all, of which eleven were of the line and thirty-four were frigates, a power much greater than the national navy of America, but inadequate to the blockade of the long coast from New Brunswick to Florida. The total number of British troops present in Canada in July 1812 was officially stated to be 5004, consisting in part of Canadians.

The scene of operations naturally divided into three sections:—(1) the ocean; (2) the Canadian frontier, from Lake Huron, by Lakes Erie and Ontario, the course of the St Lawrence and Lake Champlain; (3) the coast of the United States. As the operations on these three fields had little interaction on one another, it will be more convenient to take them separately than to follow the confusing chronological order.

Operations on the Ocean.—These cover all cruises of sea-going ships, even when they did not go far from the coast. They again subdivide into the actions of national vessels, and the raids of the privateers. The first gave to the United States the most brilliant successes of the war. When it began two small squadrons were getting ready for sea at New York; the frigate "President" (44) and sloop "Hornet" (18), under Commodore John Rodgers, who had also the general command; and the frigates "United States" (44) and "Congress" (38), with the brig "Argus" (16) to which two guns were afterwards added, under Captain Stephen Decatur. Rodgers would have preferred to keep his command together, and to strike with it at the main course of British commerce, but he was overruled. He sailed on the 21st of June, and after chasing the British frigate "Belvidera" (36), which escaped into Halifax by throwing boats, &c., overboard, stood across the North Atlantic in search of a West Indian convoy, which he failed to sight, returning by the 31st of August to Boston. While he was absent, Captain Isaac Hull, commanding the "Constitution" (44), sailed from the Chesapeake, and after a narrow escape from a British squadron, which pursued him from the 18th to the 20th of July, reached Boston. Going to sea again on the 2nd of August he captured and burned the British frigate "Guerrière" (38). On the 8th of October Rodgers and Decatur sailed—the first on a cruise to the east, the second to the south. Commodore Rodgers met with no marked success, but on the 25th of October Captain Decatur in the "United States" captured the British frigate "Macedonian" (38), which he carried back to port. At the close of the month Captain Bainbridge sailed with the "Constitution," "Essex" (32) and "Hornet" (18) on a southerly cruise. On the 29th of December, when off Bahia, he fell in with the British frigate "Java" (38), which was carrying General Hislop, the governor of Bombay, to India, and took her after a sharp action. The "Essex" and "Hornet" were not in company. The first, under the command of Captain David Porter, went on to the Pacific, where she did great injury to British trade, till she was captured off Valparaiso by the British frigate "Phoebe" (38) and the sloop "Cherub" (24) on the 28th of March 1814. In these actions, except the last, the Americans had the advantage of greater size and a heavier broadside, but they showed excellent seamanship and gunnery. The capture of three British frigates one after another caused a painful impression in Great Britain and stimulated her to greater exertions. Vessels were accumulated on the American sea-board, and the watch became more strict. On the 1st of June 1813 the capture of the U.S. frigate "Chesapeake" (38), by the British frigate "Shannon" (38), a vessel of equal force, counterbalanced the moral effect of previous disasters. The blockade of American ports was already so close that the United States ships found it continually more difficult to get to sea, or to keep the sea without meeting forces of irresistibly superior strength.

The operations of American privateers were too numerous and far-ranging to be told in detail. They continued active till the close of the war, and were only partially baffled by the strict enforcement of convoy by the British authorities. A signal instance of the audacity of the American cruisers was the capture of the U.S. sloop "Argus" (20) by the British sloop "Pelican" (18) so far from home as St David's Head in Wales on the 14th of August 1813. The "Pelican's" guns were heavier than those of the "Argus."

Operations on the Lakes.—The American people, who had expected little from their diminutive navy, had calculated with confidence on being able to overrun Canada. As, however, they had taken no effectual measures to provide a mobile force they were disappointed. The British general, Sir George Prevost, was neither able nor energetic, but his subordinate, Major-General Isaac Brock, was both. In July, before the Americans were ready, Brock seized Mackinac at the head of Lake Huron; and on the 16th of August Detroit in the channel between Huron and Erie was surrendered. Kingston was held at the east end of Ontario. Montreal on the St Lawrence was a strong position on the British side to which, however, the Americans had an easy road of approach by Lake Champlain. Sound reasoning would have led the Americans to direct their chief attacks on Kingston and Montreal, since success at those points would have isolated the British posts on Lakes Ontario, Erie and Huron. But they were much influenced by fear of the Indians, who had been won over to the British side by the energy of Brock. They therefore looked more carefully to the lakes than to the course of the St Lawrence, and it may be added that their leaders showed an utter want of capacity for the intelligent conduct of war.

The impracticable character of the communications by land made it absolutely necessary for both parties to obtain control of the water. Neither had made any preparations, and the war largely resolved itself into a race of shipbuilding. The Americans, who had far greater facilities for building than the British, allowed themselves to be forestalled. In the second half of 1812 the British general, Sir Isaac Brock, lieutenant-governor of Upper Canada, adopted measures for opposing the Americans on the frontier line, between Huron and Erie. The American brigadier-general William Hull invaded Canada on the 12th of July from Detroit, just below the small Lake of St Clair between Huron and Erie. His army was mainly composed of militiamen, who behaved very badly, and his papers having been captured in a boat, his plans were revealed. General Brock drove him back and forced him to surrender at Detroit on the 16th of August. Brock now promptly transferred himself to the western end of Erie, where the American general Henry Dearborn was attempting another invasion. Brock fell in action on the 13th of October, while repulsing Dearborn's subordinate Van Rensselaer, a politician named to command by favour, and ignorant of a soldier's business. The Americans were driven back. In this field also their militia behaved detestably. The Canadians on the other hand, both the French who were traditionally amenable to authority and those of English descent, who being largely sons of loyalists of the War of Independence had a bitter hatred of the Americans, did excellent service. The discontent of New England with the war both hampered the American generals and also aided the British, who drew their supplies to a great extent from United States territory. On the 22nd of January 1813, at Frenchtown, the American troops under Winchester surrendered to a British and Indian force under Procter.

During the winter both sides were busy in building ships. On Ontario the Americans pushed on their preparations at Sackett's Harbour under Isaac Chauncey; the English were similarly engaged at Kingston. Sir James Lucas Yeo took command on the 15th of May 1813. On Erie the American headquarters were at Presqu' Isle, now the city of Erie; the English at Fort Malden. The American commander was Captain Oliver Perry, the British commander, Captain Robert Barclay. On Lake Ontario Yeo formed a more mobile though less powerful force than Chauncey's, and therefore manœuvred to avoid being brought to close action. Three engagements, on the 10th of August, 11th of September and 28th of September, led to no decisive result. By the close of the war Yeo had constructed a ship of 102 guns which gave him the superiority, and the British became masters of Lake Ontario. On Lake Erie the energy of Captain Perry, aided by what appears to have been the misjudgment of Barclay, enabled him to get a superior force by the 4th of August, and on the 10th of September he fought a successful action which left the Americans masters of Lake Erie. The military operations were subordinate to the naval. In April 1813 the Americans took York (now Toronto), and in May moved on Fort George; but a counter-attack by Yeo and Prevost on Sackett's Harbour, on the 29th of May, having made the Americans anxious about the safety of their base, naval support failed the American generals, and they were paralysed. A success was gained by them (October 5) at the Thames, where the Indian chief Tecumseh fell, but they made no serious progress. The Americans turned to the east of Ontario, intending to assail Montreal by the St Lawrence in combination with their forces at Lake Champlain. But the combination failed; they were severely harassed on the St Lawrence, and the invasion was given up.

The operations of 1814 bear a close resemblance to those of

1813, with, however, one important difference. The American generals, having by this time brought their troops to order, were able to fight with much better effect. Their attack on the Niagara peninsula led to hot fighting at Chippewa (July 5) and Lundy's Lane (July 25), the first a success for the Americans, the second a drawn battle. The fall of Napoleon having now freed the British government from the obligation to retain its army in Europe, troops from Spain began to pour in. But on the Canadian frontier they made little difference. In August 1814 Sir George Prevost attacked the American forces at Champlain. But his naval support, ill prepared, was hurried into action by him at Plattsburg on the 11th of September, and defeated. Prevost then retired. His management of the war, more especially on Lake Champlain, was severely criticized, and he was threatened with a court-martial, but died before the trial came on. A British occupation of part of the coast of Maine proved to be mere demonstration.

Operations on the American Coast.—When the war began the British naval forces were unequal to the work of blockading the whole coast. They were also much engaged in seeking for the American cruisers under Rodgers, Decatur and Bainbridge. The British government, having need of American foodstuffs for its army in Spain, was willing to benefit by the discontent of the New Englanders. No blockade of New England was at first attempted. The Delaware and Chesapeake were declared in a state of blockade on the 26th of December 1812. This was extended to the whole coast south of Narragansett by November 1813, and to the whole American coast on the 31st of May 1814. In the meantime much illicit trade was carried on by collusive captures arranged between American traders and British officers. American ships were fraudulently transferred to neutral flags. Eventually the United States government was driven to issue orders for the purpose of stopping illicit trading, and the commerce of the country was ruined. The now overpowering strength of the British fleet enabled it to occupy the Chesapeake and to execute innumerable attacks of a destructive character on docks and harbours. The burning by the American general McClure, on the 10th of December 1813, of Newark (Niagara on the Lake), for which severe retaliation was taken at Buffalo, was made the excuse for much destruction. The most famous of these destructive raids was the burning of the public buildings at Washington by Sir Alexander Cochrane, who succeeded Warren in April in the naval command, and General Robert Ross. The expedition was carried out between the 19th and 29th of August 1814, and was well organized and vigorously executed.[1] On the 24th the American militia, collected at Bladensburg to protect the capital, fled almost before they were attacked. A subsequent attack on Baltimore, in which General Ross was killed (September 12, 1814), was a failure. The expedition to New Orleans (*q.v.*) is separately dealt with.

AUTHORITIES.—In his *Sea Power in its Relations to the War of 1812* Captain Mahan has given a careful account of the war by land and sea with reference to services. *The Naval War of 1812*, by Theodore Roosevelt (New York, 1882), is lively but somewhat passionate, and not free from prejudice. A vehement statement of the Canadian side will be found in *How Canada was held for the Empire*, by James Hannay (London, Edinburgh, Toronto, 1905). See also *The Canadian War of 1812*, by Charles P. Lucas (Oxford, 1906). (D. H.)

AMERICUS, a city and the county-seat of Sumter county, Georgia, U.S.A., about 71 m. S.S.W. of Macon. Pop. (1880) 3635; (1890) 6398; (1900) 7674 (4661 of negro descent); (1910) 8063. It is served by the Central of Georgia and the Seaboard Air Line railways, and is the seat of the Third Congressional District Agricultural High School, a branch of the state university of Georgia. The city is in a rich sugar-cane and fruit country, is a large cotton and mule and horse market, and has division shops of the Seaboard Air Line railway. Among the city's manufactures are cotton-seed oil, fertilizers, chemicals, iron, carriages and wagons and harness (especially horse collars). The city owns the waterworks; the water-supply is obtained from artesian wells. Americus was settled in 1832, and was first chartered as a city in 1855.

AMERSFOORT, a town in the province of Utrecht, Holland, on the navigable Eem, and a junction station 14 m. by rail N.E. by E. of Utrecht. Pop. (1900) 19,089. It is situated in the midst of picturesque and undulating country, consisting of wide sandy heaths and woods, and dotted with many fine country houses. One of the most interesting of its few historic monuments is the Koppelpoort, an old gateway situated at the end of a fine avenue of trees bordering the canal. Close by is a lofty Gothic tower (1500), which belonged to the ancient church of St Mary, which was wrecked by an explosion of gunpowder in 1787. The large plain church of St George dates from the first half of the 13th century. There is also a Jansenist church, to which a seminary is attached. Besides these there are a town hall, a court of primary jurisdiction, industrial and other schools. Amersfoort has a large garrison, consisting chiefly of artillery, and manufactures woollen goods, cotton, silk, glass and brandy. It has also a considerable trade in tobacco, grown in the neighbourhood, and in corn and fish.

AMERSHAM, a market town in the Wycombe parliamentary division of Buckinghamshire, England, 24 m. W.N.W. of London by the Metropolitan railway. Pop. (1901) 2674. It is pleasantly situated in the narrow valley of the Misbourne stream, which is flanked by the well-wooded slopes of the Chiltern Hills. The church of St Mary is almost entirely Perpendicular, and has a beautiful south porch, brasses of the 15th, 16th and 17th centuries and numerous monuments, several of which, in a chantry, commemorate members of the family of Drake, lords of the manor. The town hall was built by Sir William Drake in 1642. At Coleshill, near Amersham, Edmund Waller the poet was born in 1606; he sat in parliament for the former borough of Amersham. The town has flour mills and breweries, and some straw-plaiting and lace-making are carried on in the vicinity. The district is one of the most beautiful near London; the village of Chenies, overlooking the valley of the Chess, is especially picturesque.

Amersham (Elmodesham, Agmondesham, Hagmondesham, Aumundesham, Homersham) at the time of the Domesday Survey was divided into no less than six holdings. The manor, or chief of them, was held by Geoffrey de Mandeville. At the time of Edward the Confessor it was held by Queen Edith. The manor afterwards descended to the families of Fitz Piers, Bohun and Strafford, and was granted by Henry VIII. to Sir John Russell, ancestor of the earls of Bedford. In 1638 Francis, earl of Bedford, conveyed it to William Drake, by whose descendants it is still held. The north chapel in the church of St Michael, Chenies, has been the burial-place of the Russell family since its erection in 1556, and contains a number of fine memorials, notably that of Anne, countess of Bedford (d. 1558), who founded the chapel. Amersham was formerly a parliamentary borough by prescription, and returned two members in 1300, 1306, 1307 and 1309. In 1623 this privilege was restored, and was only annulled by the Reform Bill of 1832. The annual fair, in September, is held under a charter secured by Geoffrey Fitz Peter, earl of Essex, in 1200, that on Whit Monday under a charter of 1614, secured by Edward, earl of Bedford, which transferred the Friday market, also granted under the earlier charter, to Tuesday.

AMES, FISHER (1758–1808), American statesman, orator and political writer, son of Nathaniel Ames, a physician, was born at Dedham, Massachusetts, on the 9th of April 1758. He graduated at Harvard College in 1774, and began the practice of the law at Dedham in 1781, but eventually abandoned that profession for the more congenial pursuit of politics. He was a prominent member of the Massachusetts convention which (February 1788) ratified for that state the Federal Constitution, and in the same year, having entered the lower house in the state legislature, he distinguished himself greatly by his eloquence and readiness in debate. During the eight years of Washington's administration (1789–1797) he was a prominent Federalist member of the national House of Representatives. On the 28th of April 1796, when the Republicans, hostile to the Jay Treaty, were on the point of holding up the appropriation necessary for its execution, Ames, who had just arisen from a sick-bed, made what has been considered the greatest speech of his life; before the delivery of his speech his opponents had claimed a majority of six, but the appropriation was finally passed, in the committee of the whole, by the casting vote of the chairman. When Washington retired from the presidency, Congress voted him an address and chose Ames to deliver it. In 1797 he returned to Dedham to resume the practice of the law, which the state of his health after a few years obliged him to relinquish. He published numerous essays, chiefly in relation to the contest between Great Britain and revolutionary France, as it might affect the liberty and prosperity of America. Ames was one of the group of New England ultra-Federalists known as the "Essex Junto," who opposed the French policy of President John Adams in 1798, and were conspicuous for their British sympathies. Four years before his death he was chosen president of Harvard College, an honour which his broken state of health obliged him to decline. He died on the 4th of July 1808.

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[1] The burning of Washington was an act of vandalism by no means approved of by many of the British officers who were compelled to take part in it. (See SMITH. SIR HENRY GEORGE WAKELYN.)

His writings and speeches, which abound in sparkling passages, displaying great fertility of imagination, were collected and published, with a memoir of the author, in 1809, by the Rev. Dr J. T. Kirkland, in one large octavo volume. A more complete edition in two volumes was published by his son, Seth Ames, at Boston, Mass., in 1854.

AMES, JOSEPH (1689–1759), English author, was born at Yarmouth on the 23rd of January 1689. He wrote an account of printing in England from 1471 to 1600, *Typographical Antiquities* (1749). Ames sent out circular letters with a list of two hundred and fifteen English printers with whose works he intended to deal, asking for any available information. He earned the gratitude of subsequent bibliographers by disregarding printed lists and consulting the title-pages of the books themselves. An interleaved copy of the work with many notes in the author's hand is now in the British Museum. Editions of his works were published with added information by William Herbert (3 vols., 1785–1790), and T. F. Dibdin (4 vols., 1810–1819). Ames's occupation is variously given. It is uncertain whether he was a ship-chandler, a patten-maker, a plane-iron maker or an ironmonger; but he led a prosperous life at Wapping, and amassed valuable collections of antiquities. He died on the 7th of October 1759. His other works are catalogues of English printers, of the collection of coins which belonged to the earl of Pembroke, of some two thousand English portraits, and *Parentalia* (1750), a memoir of the Wrens, undertaken in conjunction with Sir Christopher Wren's grandson, Stephen Wren. Part of his correspondence in bibliography is included in Nichols's *Literary Anecdotes and Illustrations.*

AMES, OAKES (1804–1873), American manufacturer, capitalist and politician, was born in Easton, Massachusetts, on the 10th of January 1804. As a manufacturer of shovels, in association with his father and his brother Oliver (1807–1877), he amassed a large fortune. In 1860 he became a member of the executive council of Massachusetts, and from 1863 to 1873 was a republican member of the national House of Representatives. As a member of the committee on railroads he became interested in the project, greatly aided by the government, to build a trans-continental railway, connecting the eastern states with California. Others having failed, he was induced in 1865 to assume the direction of the work, and to him more than to any other one man the credit for the construction of the Union Pacific railway was due. The execution was effected largely through a construction company, the Crédit Mobilier Company of America. In disposing of some of the stock of this company, Ames in 1867–1871 sold a number of shares to members of Congress at a price much below what these shares eventually proved to be worth. This, on becoming known, gave rise in 1872–1873 to a great congressional scandal. After an investigation by a committee of the House, which recommended the expulsion of Ames, a resolution was passed on the 28th of February 1873, "that the House absolutely condemns the conduct of Oakes Ames . . . in seeking to secure congressional attention to the affairs of a corporation in which he was interested, and whose interest directly depended upon the legislation of Congress, by inducing members of Congress to invest in the stocks of said corporation." Many have since attributed this resolution to partisanship, and the influence of popular clamour, and in 1883 the legislature of Massachusetts passed a resolution vindicating Ames. He died at North Easton, Mass., on the 8th of May 1873. His son, OLIVER AMES (1831–1895), was lieutenant-governor of Massachusetts from 1883 until 1887, and governor from 1887 to 1890.

See CRÉDIT MOBILIER OF AMERICA and the references there given. For a defence of Oakes Ames, see *Oakes Ames, A Memorial Volume* (Cambridge, Mass., 1884).

AMES, WILLIAM (1576–1633), English Puritan divine, better known, especially in Europe, as Amesius, was born of an ancient family at Ipswich, Suffolk, in 1576, and was educated at the local grammar school and at Christ's College, Cambridge, where, as throughout his life, he was an omnivorous student. He was considerably influenced by his tutor, the celebrated William Perkins, and by his successor, a man of kindred intellect and fervour, Paul Bayne. He graduated B.A. and M.A. in due course, and was chosen to a fellowship in Christ's College. He was universally beloved in the university. His own college (Christ's) would have chosen him for the mastership; but a party opposition led to the election of Valentine Cary, who had already quarrelled with Ames for disapproving of the surplice and other outward symbols. One of Ames's sermons became historical in the Puritan controversies. It was delivered on St Thomas's day (1609) before the feast of Christ's nativity, and in it he rebuked sharply "lusory lotts" and the "heathenish debauchery" of the students during the twelve days ensuing. The scathing vehemence of his denunciations led to his being summoned before the vice-chancellor, who suspended him "from the exercise of his ecclesiastical function and from all degrees taken or to be taken." After Cary's election he left the university and would have accepted the great church of Colchester, but the bishop of London refused to grant institution and induction. Like persecution awaited him elsewhere, and at last he passed over to Holland, being aided by certain wealthy English merchants who wished him to controvert the supporters of the English church in Leiden. At Rotterdam, clad in the fisherman's habit donned for the passage, he opposed Grevinchovius (Nicholas Grevinckhoven, d. 1632), minister of the Arminian or Remonstrant church, and overwhelmed him with his logical reasoning from Phil. ii. 13, "It is God that worketh in us both to will and to do." The fisherman-controversialist made a great stir, and from that day became known and honoured in the Low Countries. Subsequently Ames entered into a controversy in print with Grevinchovius on universal redemption and election, and cognate problems. He brought together all he had maintained in his *Coronis ad Collationem Hagiensem*—his most masterful book, which figures largely in Dutch church history. At Leiden, Ames became intimate with the venerable Mr Goodyear, pastor of the English church there. While thus resident in comparative privacy he was sent for to the Hague by Sir Horatio Vere, the English governor of Brill, who appointed him a minister in the army of the states-general, and of the English soldiers in their service, a post held by some of the greatest of England's exiled Puritans. He married a daughter of Dr Burgess, who was Vere's chaplain, and, on his father-in-law's return to England, succeeded to his place.

It was at this time he began his memorable controversy with Episcopius, who, in attacking the *Coronis*, railed against the author as having been "a disturber of the public peace in his native country, so that the English magistrates had banished him thence; and now, by his late printed *Coronis*, he was raising new disturbances in the peaceable Netherlands." It was a miserable libel and was at once rebutted by Goodyear. The *Coronis* had been primarily prepared for the synod of Dort, which sat from November 1618 until May 1619. At this celebrated synod the position of Ames was a peculiar one. The High Church party in England had induced Vere to dismiss him from the chaplaincy; but he was still held, deservedly, in such reverence, that it was arranged he should attend the synod, and accordingly he was retained by the Calvinist party at four florins a day to watch the proceedings on their behalf and advise them when necessary. A proposal to make him principal of a theological college at Leiden was frustrated by Archbishop Abbot; and when later invited by the state of Friesland to a professoriate at Franeker, the opposition was renewed, but this time abortively. He was installed at Franeker on the 7th of May 1622, and delivered a most learned discourse on the occasion on "Urim and Thummin." He soon brought renown to Franeker as professor, preacher, pastor and theological writer. He prepared his *Medulla Theologiae*, a manual of Calvinistic doctrine, for his students. His *De Conscientia, ejus Jure et Casibus* (1632), an attempt to bring Christian ethics into clear relation with particular cases of conduct and of conscience, was a new thing in Protestantism. Having continued twelve years at Franeker (where he was rector in 1626), his health gave way, and he contemplated removal to New England. But another door was opened for him. He yearned for more frequent opportunities of preaching to his fellow-countrymen, and an invitation to Rotterdam gave him such opportunity. His friends at Franeker were passionately opposed to the transference, but ultimately acquiesced. At Rotterdam he drew all hearts to him by his eloquence and fervour in the pulpit, and his irrepressible activity as a pastor. Home-controversy engaged him again, and he prepared his *Fresh Suit against Ceremonies*—the book which made Richard Baxter a Nonconformist. It ably sums up the issues between the Puritan school and that of Hooker. It was posthumously published. He did not long survive his removal to Rotterdam. Having caught a cold from a flood which inundated his house, he died in November 1633, at the age of fifty-seven, apparently in needy circumstances. He left, by a second wife, a son and a daughter. His valuable library found a home in New England.

Few Englishmen have exercised so formative and controlling an influence on European thought and opinion as Ames. He was a master in theological controversy, shunning not to cross swords with the formidable Bellarmine. He was a scholar among scholars, being furnished with extraordinary resources of learning. His works, which even the *Biographia Britannica* (1778) testifies were famous over Europe, were collected at Amsterdam in 5 vols. 4to. Only a very small proportion was translated into his mother tongue. His *Lectiones in omnes Psalmos Davidis* (1635) is exceedingly suggestive and terse in its style, reminding of Bengel's *Gnomon*, as does also his *Commentarius utriusque Epist. S. Petri.* His "Replies" to Bishop Morton and Dr Burgess on "Ceremonies" tell us that even kinship could not prevent him from "contending earnestly for the faith."

See John Quick's MS. *Icones Sacrae Anglicanae*, which gives the fisherman anecdote on the personal authority of one who was present; *Life* by Nethenus prefixed to collected edition of Latin works (5 vols., Amsterdam, 1658); Winwood's *Memorials*, vol. iii. pp. 346–347; Neal's *Puritans*, i. 532; Fuller's *Cambridge* (*Christ's College*); Hanbury's *Hist. Memorials*, i. 533; *Collections of the Massachusetts Historical Society*, vol. vi., fourth series, 1863, pp. 576–577.

AMES, a city of Story county, Iowa, U.S.A., about 35 m. N. of Des Moines, at the intersection of two lines of the Chicago & North-Western railway. Pop. (1890) 1276; (1900) 2422; (1910 U. S. census) 4223. The city is the seat of the state college of agriculture and mechanic arts; this institution, opened in 1869, has for its use about 1175 acres of land, on which the state has erected, at a cost of $1,200,000, thirty-two college buildings, besides dwelling-houses and buildings for farm purposes. On the college campus are beautiful groves containing several hundred varieties of trees, and in a central position stands a campanile with excellent chimes. The college offers four-year courses in agronomy, animal husbandry, dairying, domestic economy, general science, veterinary medicine, and civil, mechanical, electrical and mining engineering. In 1909–1910 it had an enrollment of 2631 students (including 796 in the winter short course) and a library of 23,000 volumes. The cost of instruction and experimentation is met by the income from national grants (under the Morrill Acts of 1862 and 1882) and by state appropriations. Ames has a Carnegie library, and owns and operates its electric-lighting plant and waterworks. It was laid out as a town in 1864 and was named in honour of Oakes Ames, at the time one of the proprietors of the Cedar Rapids & Missouri River railway (now part of the Chicago & North-Western); five years later it was incorporated.

AMESBURY, a small town in the Wilton parliamentary division of Wiltshire, England, 8 m. N. of Salisbury, on the London & South-Western railway. Pop. (1901) 1143. It stands on a wooded upland, amid the chalk downs of Salisbury Plain. The church of St Mary is cruciform, with a low square tower, and is largely Early English, with some richly decorated windows in the chancel. A curious two-storeyed building which adjoins the north transept consists of a chapel with a piscina below and a priest's chamber above. Amesbury Abbey, a beautiful house built by Inigo Jones for the dukes of Queensberry, stands close to the village, in a park watered by the river Avon, here famous for its trout. Stonehenge (*q.v.*), the greatest surviving megalithic work in the British Isles, is a mile and a half distant; and on a hill near the village is Vespasian's Camp or the Ramparts, a large earthwork, which is undoubtedly of British, not Roman, origin.

At Amesbury (Ambresberia, Aumbresbery) a witenagemot was held in 932, while about 980 Ælfthryth (Ethelfrida), queen-dowager of Edgar, erected here a nunnery in expiation of the murder of her stepson. The house afterwards acquired such ill repute that in 1177 the nuns were dispersed and the house was attached to the abbey of Fontevrault, by whom it was re-established. From this date, by a succession of royal charters and private gifts, the nunnery amassed vast wealth and privileges, and became a fashionable retreat for ladies of high rank, among whose number were Eleanor, widow of Henry III., and Mary, daughter of Edward I. After the dissolution in 1540 the site was granted to Edward, earl of Hertford, afterwards duke of Somerset and protector of the kingdom. It subsequently passed to the duke of Queensberry. According to the Domesday, Amesbury was a royal manor and did not pay geld, but was under the obligation of providing one night's entertainment for the king. In 1317 the prioress obtained a Saturday market and a three days' fair at the feast of St Melor (Meliorus). The market was subsequently changed to Friday, and three additional fairs were granted. Pipe-clay abounds in the neighbourhood, and in the 17th century Amesbury was famous for the best pipes in England, many of which are preserved in Salisbury museum.

See *Victoria County History—Wiltshire*; Sir Richard Colt Hoare, *History of Modern Wiltshire* (1822–1844).

AMESBURY, a township of Essex county, in N.E. Massachusetts, U.S.A., situated on the Merrimac river, about 6 m. above its mouth. Pop. (1890) 9798; (1900) 9473, of whom 2448 were foreign-born; (1910, U. S. census), 9894. Amesbury is served by two divisions of the Boston & Maine railway, and is connected by electric line with Haverhill and Newburyport, Mass., and with Hampton Beach, New Hampshire, and Salisbury Beach, Mass., two summer resorts. The township covers a land area of about 13 sq. m. The surface is hilly. The Powow river, a small stream, passes through the centre of the township. There is a public library. Among Amesbury's manufactures are hats, cotton goods, carriages, automobile bodies, carriage and automobile lamps, thermometers, brass castings and motor boats. In 1905 the factory products were valued at $3,614,692. Amesbury was settled about 1644 as a separate part of Salisbury, and in 1654, by mutual agreement of the old and new "towns," became practically independent, although not legally a township until 1666 (named Amesbury, from the English town in Wilts, in 1667). It suffered repeatedly in the course of the colonial Indian wars. Quakers settled here as early as 1701. Josiah Bartlett (1729–1795), a signer of the Declaration of Independence, was born here, and is commemorated by a statue (1888) by Karl Gerhardt. Shipbuilding was an important industry in the 18th and especially the first quarter of the 19th century, and the U.S. frigate "Alliance" was built at Salisburypoint in 1778. A nail factory, one of the earliest in the country, was built on the Powow in 1796. The manufacture of iron began about 1710, of hats in 1769, of carriages in 1800 and of cotton goods in 1812. Paul Moody, who with F. C. Lowell constructed in 1814 at Waltham the first successful power-loom in America, was engaged in the manufacture of cotton goods in Amesbury. The township was the home of John G. Whittier from 1836 to 1892; here were written most of the poems of his middle and later life, many of which describe the surrounding country. In 1876 Merrimac township was created out of the territory of Amesbury; in 1886 the west part of the old township of Salisbury was united to Amesbury.

See Joseph Merrill, *History of Amesbury* (Haverhill, 1880); S. T. Pickard, *Whittier-land, A Handbook of North Essex* (Boston, New York, 1904).

AMETHYST, a violet or purple variety of quartz used as an ornamental stone. The name is generally said to be derived from the Gr. ἀ, "not," and μεθύσκειν, "to intoxicate," expressing the old belief that the stone protected its owner from strong drink. It was held that wine drunk out of a cup of amethyst would not intoxicate. According, however, to the Rev. C. W. King, the word may probably be a corruption of an Eastern name for the stone.

The colour of amethyst is usually attributed to the presence of manganese, but as it is capable of being much altered and even discharged by heat it has been referred by some authorities to an organic source. Ferric thiocyanate has been suggested, and sulphur is said to have been detected in the mineral. On exposure to heat, amethyst generally becomes yellow, and much of the cairngorm or yellow quartz of jewellery is said to be merely "burnt amethyst." Veins of amethystine quartz are apt to lose their colour on the exposed outcrop.

Amethyst is composed of an irregular superposition of alternate lamellae of right-handed and left-handed quartz. (See Quartz.) It has been shown by Prof. J. W. Judd that this structure may be due to mechanical stresses. In consequence of this composite formation, amethyst is apt to break with a rippled fracture, or to show "thumb markings," and the intersection of two sets of curved ripples may produce on the fractured surface a pattern something like that of "engine turning." Some mineralogists, following Sir D. Brewster, apply the name of amethyst to all quartz which exhibits this structure, regardless of its colour.

The amethyst was used as a gem-stone by the ancient Egyptians, and was largely employed in antiquity for intaglios. Beads of amethyst are found in Anglo-Saxon graves in England. Amethyst is a very widely distributed mineral, but fine clear specimens fit for cutting as ornamental stones are confined to comparatively few localities. Such crystals occur either in cavities in mineral-veins and in granitic rocks, or as a lining in agate geodes. A huge geode, or "amethyst-grotto," from near Santa Cruz in southern Brazil, was exhibited at the Düsseldorf Exhibition of 1902. Many of the hollow agates of Brazil and Uruguay contain a crop of amethyst-crystals in the interior. Much fine amethyst comes from Russia, especially from near Mursinka in the Ekaterinburg district, where it occurs in drusy cavities in granitic rocks. Many localities in India yield amethyst; and it is found also in Ceylon, chiefly as pebbles.

Purple corundum, or sapphire of amethystine tint, is called *Oriental amethyst*, but this expression is often applied by jewellers to fine examples of the ordinary amethystine quartz, even when not derived from Eastern sources.

Amethyst occurs at many localities in the United States, but rarely fine enough for use in jewellery. Among these may be mentioned Amethyst Mountain, Texas; Yellowstone National Park; Delaware Co., Pennsylvania; Haywood Co., North Carolina; Deer Hill, and Stow, Maine. It is found also in the Lake Superior district. See G. F. Kunz, *Gems &c. of North America* (1890), and *Report for 12th Census* (vol. "Mines and Quarries"). (F.W.R.*)

AMHARA, the central province of Abyssinia. The chief town, Gondar (*q.v.*), by which name the province is also known, was the residence of the negus negusti, or emperor, of Abyssinia from the middle ages up to 1854. The speech of the inhabitants, Amharic, which differs in several features from the dialects spoken in Tigré and Shoa, is the official language of Abyssinia.

AMHERST, JEFFREY AMHERST, Baron (1717–1797), British soldier, was the son of Jeffrey Amherst of Riverhead, Kent, and by the interest of the duke of Dorset obtained an ensigncy in the Guards in 1731. He served in Germany and the Low Countries as aide-de-camp to General (Lord) Ligonier, and was present at Dettingen, Fontenoy and Roucoux. He then served on Cumberland's staff, and took part with the duke in the later campaigns of the Austrian Succession war, in the battle of Val, and the North German campaign of 1757, including the battle of Hastenbeck. A year previously he had been promoted to a lieutenant-colonelcy. In 1758 William Pitt caused Amherst to be made a major-general, and gave him command of an expedition to attack the French in North America. For the great plan of conquering Canada, Pitt chose young and ardent officers, with Amherst, distinguished for steadiness and self-control, as their commander-in-chief. The first victory of the expedition, the capture of Louisburg (July 26, 1758), was soon followed by other successes, and Amherst was given the chief command of all the forces in the theatre of war. In the campaign of 1759 Amherst's own share was the capture of Ticonderoga and Crown Point, while Fort Niagara fell to another column, and Quebec was taken by Wolfe. In 1760 a concentric march on Montreal was carried out with complete success. Amherst was immediately appointed governor-general of British North America, and in the following year was made a K.B. His conduct of the operations against the Indians under Pontiac was, however, far from being as successful as his generalship against regular troops; and he returned to England in 1763, being made governor of Virginia and colonel of the 60th regiment in the same year. In 1768 the king, who had had a quarrel with Amherst, made amends by giving him another colonelcy; in 1770 he was made governor of Guernsey; and two years later, though not yet a full general, he was made lieutenant-general of the ordnance and acting commander-in-chief of the forces. In this capacity he was the chief adviser at headquarters during the American War of Independence. He was created a peer in 1776, was promoted general in 1778 and became colonel of the 2nd Horse Grenadiers (2nd Life Guards) two years later. He aided in suppressing the Gordon riots of 1780. The rest of his active life, with a short interval in 1782–1783, he spent at the Horse Guards as commander-in-chief, but he was no longer capable of good service, and in 1795 he was succeeded by the duke of York. In 1796 Lord Amherst was made field-marshal; and he died on the 3rd of August 1797 at "Montreal," his residence in Kent.

AMHERST, WILLIAM PITT AMHERST, Earl (1773–1857), governor-general of India, was the nephew of Jeffrey, Baron Amherst, and succeeded to his title in 1797 by the remainder provided when the patent of nobility was renewed in 1788. In 1816 he was sent as ambassador extraordinary to the court of China, with a view of establishing more satisfactory commercial relations between that country and Great Britain. On arriving in the Peiho he was given to understand that he could only be admitted to the emperor's presence on condition of performing the *ko-tou* (kow-tow), a ceremony which Western nations consider degrading, and which is, indeed, a homage exacted by a Chinese sovereign from his tributaries. To this Lord Amherst, following the advice of Sir George T. Staunton, who accompanied him as second commissioner, refused to consent, as Lord Macartney had done in 1793, unless the admission was made that his sovereign was entitled to the same show of reverence from a mandarin of his rank. In consequence of this he was not allowed to enter Pekin, and the object of his mission was frustrated. His ship, the "Alceste," after a cruise along the coast of Korea and to the Loo-Choo Islands, on proceeding homewards was totally wrecked on a sunken rock in Gaspar Strait. Lord Amherst and part of his shipwrecked companions escaped in the ship's boats to Batavia, whence relief was sent to the rest. The ship in which he returned to England in 1817 having touched at St Helena, he had several interviews with the emperor Napoleon (see Ellis's *Proceedings of the Late Embassy to China*, 1817; M'Leod's *Narrative of a Voyage in H.M.S. "Alceste,"* 1817). Lord Amherst held the office of governor-general of India from August 1823 to February 1828. The principal event of his government was the first Burmese war of 1824, resulting in the cession of Arakan and Tenasserim to Great Britain. He was created Earl Amherst of Arakan in 1826. On his return to England he lived in retirement till his death in March 1857.

See A. Thackeray and R. Evans, *Lord Amherst* ("Rulers of India" series), 1894.

AMHERST, a town and district in the Tenasserim division of Lower Burma. The town is situated about 30 m. S. of Moulmein. It was founded by the British in 1826 on the restoration of the town of Martaban to the Burmese, and named in compliment to the governor-general of India of that day; but in 1827 the headquarters were transferred to Moulmein. Amherst has been eclipsed in prosperity by the latter city, and is now merely a bathing-place for Moulmein.

The district forms a narrow strip of land between the Indian Ocean and the mountains which separate it from the independent kingdom of Siam. It has an area of 7062 sq. m. and had a population in 1901 of 300,173; it consists partly of fertile valleys formed by spurs of mountain system which divides it from Siam, and partly of a rich alluvial tract created by the great rivers which issue from them. The most important of these are the Salween and the Gyaing, formed by the junction of the Hlaingbwè and Haungtharaw rivers. The river highways bring down inexhaustible supplies of rice to Moulmein, the chief town of the district, as also of the province of Tenasserim. The district is subject to very heavy rainfall approaching 150 in. in the year, and has a uniform temperature of about 80° F. throughout the twelvemonth.

AMHERST, a village of Amherst township, Hampshire county, Massachusetts, U.S.A., in the central part of the state, about 7 m. N.E. of Northampton. Pop. of the township (1890) 4512; (1900) 5028; **(1910, U. S. census) 5112. It** is served by the Boston & Maine and the Central Vermont railways, and by interurban electric railways to Northampton, Holyoke, Sunderland and Pelham. The village is picturesquely situated on a plateau within a rampart of hills on the E. side of the Connecticut river valley. About 3 m. to the S. are the Holyoke Mountains (so called), while on the three remaining sides the land slopes to meadows, beyond which rise on the W. the Hampshire and Berkshire Hills, on the N. the Sugar Loaf Mountains and Mt. Toby, and on the E. the Pelham Hills, including Mt Lincoln (1246 ft.). Two small rivers (Mill and Fort) flow through the township. Amherst is a quiet, pleasing, academic village of attractive homes. It is noteworthy as the seat of Amherst College, one of the best known of the smaller colleges of the United States. Amherst Academy (opened about 1814, chartered 1816), a co-educational school at which Mary Lyon, the founder of Mt. Holyoke College, was educated, preceded the college (not co-educational), which was opened in 1821 and was chartered in 1825. It was originally a collegiate charitable institution, its basis being a fund for the schooling of ministers, and the charity element has remained very large relatively to other colleges. The principal college buildings are College Hall (1828); College Chapel (1828); the Henry T. Morgan Library; Williston Hall, containing the Mather Art Museum, the rooms of the Young Men's Christian Association, and several lecture-rooms; Walker Hall, with college offices and lecture-rooms; Hitchcock Hall; Barrett Hall (1859), the first college gymnasium built in the United States, now used as a lecture hall; the Pratt Gymnasium and Natatorium and the Pratt Health Cottage, whose donors also gave to the college the Pratt Field; an astronomical observatory; and the two dormitories, North College and South College, supplemented by several fraternity houses. The natural history collections (including the very large ichnological collection of President Hitchcock, and Audubon's collection of birds) are of exceptional richness. At Amherst is also the Massachusetts Agricultural College (co-educational; 1867) and experiment station (1887). Among the presidents of Amherst College have been in 1845–1854 and in 1876–1890 respectively—Edward Hitchcock, the famous geologist, and the Rev. Julius H. Seelye (1824–1895), a well-known educationalist. The township seems to have been first settled in 1731; it was incorporated in 1759 as a "district" (*i.e.* having all the rights of a township save corporate representation in the legislature) and in 1776 as a "town" (township). It was originally part of Hadley. Its name was given to it in honour of General Jeffrey Amherst (1717–1797). During the Shays' Rebellion Amherst was a centre of disaffection and a rallying-point of the insurgents. Noah Webster lived in the village from 1812 to 1822, when working on his *Dictionary*; and Emily Dickinson and Helen M. Fiske (later Helen Hunt-Jackson, "H. H.") were born here.

See William Seymour Tyler, *A History of Amherst College* (New York, 1896), and Carpenter and Morehouse, *The History of the Town of Amherst* (New York, 1896).

AMHERST, the county town of Cumberland county, and port of entry in Novia Scotia, Canada, at the head of Chignecto Bay and on the Intercolonial railway, 138 m. from Halifax. Pop. (1901) 4964. It is situated in a rich agricultural and mining district, and contains county and railway buildings and numerous mills and factories. It is the distributing centre for the surrounding district, and exports railway carriages, engines, boilers, stoves, &c.

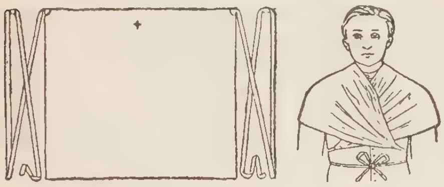
AMHURST, NICHOLAS (1697–1742), English poet and political writer, was born at Marden, Kent, on the 16th of October 1697. He was educated at the Merchant Taylors' School, and received an exhibition (1716) to St John's College, Oxford. In 1719 he was expelled from the university, ostensibly for his irregularities of conduct, but in reality, according to his own account, because of his whig principles, which were sufficiently evident in a congratulatory epistle to Addison, in *Protestant Popery; or the Convocation* (1718), an attack on the opponents of Bishop Hoadly, and in *The Protestant Session . . . by a member of the Constitution Club at Oxford* (1719), addressed to James, first Earl Stanhope, and printed anonymously, but doubtless by Amhurst. He had satirized Oxford morals in *Strephon's Revenge; a Satire on the Oxford Toasts* (1718), and he attacked from time to time the administration of the university and its principal members. An old Oxford custom on public occasions permitted some person to deliver from the rostrum a humorous, satirical speech, full of university scandal. This orator was known as *Terrae filius.* In 1721 Amhurst produced a series of bi-weekly satirical papers under this name, which ran for seven months and incidentally provides much curious information. These publications were reprinted in 1726 in two volumes as *Terrae Filius; or the secret history of the University of Oxford; in several essays. . . .* He collected his poems in 1720, and wrote another university satire, *Oculus Britanniae*, in 1724. On leaving Oxford for London he became a prominent pamphleteer on the opposition side. On the 5th of December 1726 he issued the first number of the *Craftsman*, a weekly periodical, which he conducted under the pseudonym of Caleb D'Anvers. The paper contributed largely to the final overthrow of Sir Robert Walpole's government, and reached a circulation of 10,000 copies. For this success Amhurst's editorship was not perhaps chiefly responsible. It was the organ of Lord Bolingbroke and William Pulteney, the latter of whom was a frequent and caustic contributor. In 1737 an imaginary letter from Colley Cibber was inserted, in which he was made to suggest that many plays by Shakespeare and the older dramatists contained passages which might be regarded as seditious. He therefore desired to be appointed censor of all plays brought on the stage. This was regarded as a "suspected" libel, and a warrant was issued for the arrest of the printer. Amhurst surrendered himself instead, and suffered a short imprisonment. On the overthrow of the government in 1742 the opposition leaders did nothing for the useful editor of the *Craftsman*, and this neglect is said to have hastened Amhurst's death, which took place at Twickenham on the 27th of April 1742.

AMIANTHUS, a corruption of *amiantus* (Gr. ἀμίαντος, undefiled), a name applied to the finer kinds of asbestos (*q.v.*), in consequence, it is said, of the mineral being unaffected by fire. Some of the finest amianthus, with long silky flexible fibres, occurs in the district of the Tarentaise in Savoy. According to Dr J. W. Evans, the ancient amianthus, derived mostly from Karystos in Euboea and from Cyprus, was probably a fibrous serpentine, or chrysotile (now called locally παμπακόπετρα, or cotton-stone).

See *Mineralogical Mag.* (London) vol. xiv. no. 65 (1906), art. by J. W. Evans.

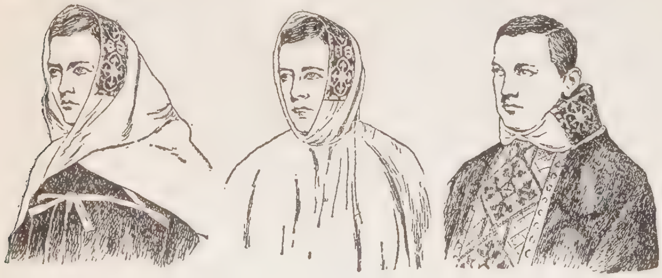
AMICABLE NUMBERS, two numbers so related that the sum of the factors of the one is equal to the other, unity being considered as a factor. Such a pair are 220 and 284; for the factors of 220 are 1,2,4,5,10,11,20,22,44,55 and 110, of which the sum is 284; and the factors of 284 are 1,2,4,71, and 142, of which the sum is 220. Amicable numbers were known to the Pythagoreans, who accredited them with many mystical properties. A general formula by which these numbers could be derived was invented by the Arabian astronomer Tobit ben Korra (836-901): if $p=3\cdot2^m-1$, $q=3\cdot2^{m-1}-1$ and $r=9\cdot2^{2m-1}-1$, where m is an integer and p,q,r prime numbers, then $2^m pq$ and $2^m r$ are a pair of amicable numbers. This formula gives the pairs 220 and 284, 17,296 and 18,416, 9,463,584 and 9,437,056. The pair 6232 and 6368 are amicable, but they cannot be derived from this formula. Amicable numbers have been studied by Al Madshritti (d. 1007), René Descartes, to whom the formula of Tobit ben Korra is sometimes ascribed, C. Rudolphus and others.

AMICE (earlier forms: *amyt*, *amys*, O. Fr. *amit*, Lat. *amictus*, from *amicire*, to throw or wrap round, the change of *t* to *s* being probably due to an early confusion with the *aumuce*: see Almuce), a liturgical vestment of the Western Church. It is a rectangular piece of cloth which is wrapped round the neck, shoulders and breast. Sometimes, more particularly in Germany, it is called the *humerale* (from *humerus*, shoulder). According to modern Roman use, laid down by the decree of the Congregation of Rites in 1819, the amice must be of linen or of a hempen material, not wool; and, as directed by the new Roman Missal (1570), a small cross must be sewn or embroidered in the middle of it. In putting it on it is first laid on the head, then allowed to fall on the shoulders, and finally folded round the chest and tied with the strings attached for that purpose (see fig. 1). The amice is now worn under the alb, except at Milan and Lyons, where it is put on over it. The vestment was at first a perfectly plain white cloth, but in the 12th century the custom arose of decorating the upper border with a band of embroidery, the parure (*parura*) or "apparel." This was abandoned at Rome about the end of the 15th century and is not prescribed in the Missal; it survived, however, in many parts of Europe till much later. This apparel, when the vestment has been adjusted, forms a sort of stiff collar which appears above the chasuble or dalmatic (see fig. 2). In some exceptional cases, as at Milan, it has become detached from the amice and is fixed like a collar to the chasuble.



From Braun, *Liturgische Gewandung*, by permission of the publisher, B. Herder.

Fig. 1.—Amice of the Present Day.



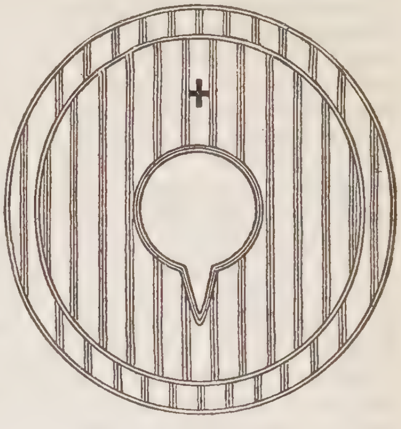
Redrawn from Braun, *Liturgische Gewandung*.

Fig. 2.—Medieval Method of putting on the Amice.

The Latin word *amictus* was applied to any wrap-like garment, and, according to Father Braun, the liturgical amice originated in the ordinary neck-cloth worn by all classes of Romans. It had at the outset no liturgical significance whatever, and was simply adopted by the clergy for the same reason that the clergy of the 18th century wore wigs—because it was part of the full dress of ordinary life. The first record of its ecclesiastical use is at Rome in the 8th century, when it was worn only with the dalmatic and was known as the *anabolagium* (*anagolaium*, *anagolagium*, from Gr. ἀναβόλαιον), a name it continued to bear at Rome till the 13th century. In the 9th century it spread to the other countries that adopted the Roman use: it is mentioned in an inventory of vestments given by Abbot Angilbert (d. 814) to the monastery at Centula (St Riguier) and in the *de clericorum institutione* of Hrabanus Maurus (*c.* 820). The amice was worn first simply as a shoulder-cloth, but at the end of the 9th century the custom grew up of putting it on over the head and of wearing it as a hood, either while the other vestments were being put on or, according to the various uses of local churches, during part of the Mass, though never during the canon. This ceased at Rome at the same time as the apparel disappeared; but two relics of it survive—(1) in the directions of the Missal for putting on the amice, (2) in the ordination of subdeacons, when the bishop lays the vestment on the ordinand's head with the words, "Take the amice, which symbolizes discipline over the tongue, &c." The priest too in putting it on prays, "Place on my head the helmet of salvation, &c."

The amice, whatever its origin or symbolism, became specifically a vestment associated with the sacrifice of the Mass, and as such it was rejected with the other "Mass vestments" in England at the Reformation. Its use has, however, been revived in many Anglican churches, the favourite form being the medieval apparelled amice. (See Vestments.) A vestment akin to the amice is also worn in the Armenian and some other oriental churches, but it is unknown to the Orthodox Eastern Church.

Akin to the amice is a vestment peculiar to the popes, the *fanone* (Med. Lat. *fano*, "cloth," Goth. *fana*, "cloth," Mod. Ger. *Fahne*, "a flag"), also called the *orale* (from *ora*, an edge, border). This is at present a circular broad collar of two thicknesses of silk, ornamented with gold stripes and a gold-embroidered cross (see fig. 3). It is put on after the alb, &c., and under the tunicle, dalmatic and chasuble, but then drawn up so as to fall over the latter like a collar. The fanone was originally a cloth like the amice and was wrapped round neck and shoulders; until the 15th century, moreover, it was not worn with the amice. Since then, however, both vestments have been worn, one under, the other over, the alb. It is worn by the popes only on certain special days or occasions, and forms part of the vestments in which they are buried.



From Braun, *Liturgische Gewandung*.

Fig. 3.—The Papal Fanone.

See Joseph Braun, S. J., *Die liturgische Gewandung*, pp. 21-56 (Freiburg im Breisgau, 1907), and bibliography to the article Vestments.

AMICI, GIOVANNI BATTISTA (1786–1863), Italian astronomer and microscopist, was born on the 25th of March 1786 at Modena. After studying at Bologna, he became professor of mathematics at Modena, and in 1831 was appointed inspector-general of studies in the duchy. A few years later he was chosen director of the observatory at Florence, where he also lectured at the museum of natural history. He died at Florence on the 10th of April 1863. His name is best known for the improvements he effected in the mirrors of reflecting telescopes and especially in the construction of the microscope. He was also a diligent and skilful observer, and busied himself not only with astronomical subjects, such as the double stars, the satellites of Jupiter and the measurement of the polar and equatorial diameters of the sun, but also with biological studies of the circulation of the sap in plants, the fructification of plants, infusoria, &c.

AMICIS, EDMONDO DE (1846–1908), Italian writer, was born at Oneglia, in Liguria, on the 21st of October 1846. After some schooling at Cuneo and Turin, he was sent to the Military School at Modena, from which he was appointed to a lieutenancy in the 3rd regiment of the line in 1865. He fought at the battle of Custozza in 1866. In 1867 he became director of the *Italia*

Militare, Florence. In the following year he published his first book, *La Vita Militare*, which consisted of sketches of military life, and attained wide popularity. After the overthrow of the pope's temporal power in 1870, De Amicis retired from the army and devoted himself to literature, making his headquarters at Turin. Always a traveller by inclination, he found opportunity for this in his new leisure, and some of his most popular books have been the product of his wanderings. Several of these have been translated into English and the other principal languages of Europe. The most important of these are his descriptions of Spain (1873), Holland (1874), Constantinople (1877) and Morocco (1879). These gained him a well-deserved reputation as a brilliant depicter of scenery and the external aspects of life; solid information is not within their sphere; and much of their success is owing to the opportunities they afford for spirited illustration. Subsequently De Amicis greatly extended his fame as a writer of fiction, especially by *Il Romanzo d' un Maestro*, and the widely read *Il Cuore* (translated into English as *An Italian Schoolboy's Journal*); later volumes from his pen being *La Carozza di tutti* (centring round an electric tram), *Memorie, Speranze e glorie, Ricordi d' infanzia è di scuola, L' Idioma gentile*, and a volume of short stories, *Nel Regno dell' Amore*. He died suddenly of heart disease at Bordighera on the 12th of March 1908.

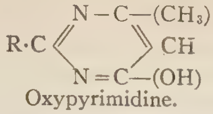
AMICUS CURIAE (Lat. for "a friend of the court"), a term used primarily in law, signifying a person (usually a member of the bar) who, having special knowledge but not being engaged in the suit, intervenes during its hearing to give information for the assistance of the court, either upon some fact relevant to the issue or upon a point of law, such as the hearing of a local custom, the precedent of some decided case, &c.

AMIDINES, in organic chemistry, the name given to compounds of general formula $R\cdot C:(NH)\cdot NH_2$, which may be considered as derived from the acid-amides by replacement of oxygen by the divalent imino ($=NH$) group. They may be prepared by the action of ammonia or amines on imide chorides, or on thiamides (O. Wallach, A. Bernthsen); by the action of ammonium chloride or hydrochlorides of amines on nitriles; by condensing amines and amides in presence of phosphorus trichloride; by the action of hydrochloric acid on acid-amides (O. Wallach, *Ber.*, 1882, 15, p. 208); and by the action of ammonia or amines on imino-ethers (A. Pinner, *Ber.*, 1883, 16, p. 1647; 1884, 17, p. 179). They are monacid bases, which are not very stable; they readily take up the elements of water (when boiled with acids or alkalies), yielding amides and ammonia. On dry distillation they yield nitriles and ammonia. When warmed with sulphuretted hydrogen they yield thiamides, $R\cdot C:(NH)\cdot NHR+H_2S=R\cdot C(NH_2)(SH)NHR=R\cdot CSNH_2+NH_2\cdot R$ or $RCS\cdot NHR+NH_3$. With β-ketonic esters, $HO(CH_3)C:CH\cdot CO_2R$, they yield oxy-pyrimidines (A. Pinner, *Ber.*, 1890, 23, p. 3820).

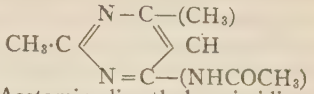
Formamidine, $HC:(NH)NH_2$, is only known in the form of its salts, the hydrochloride being obtained by the action of ammonia on the hydrochloride of formimido-ethyl ether (A. Pinner, *Ber.*, 1883, 16, p. 357). *Acetamidine*, $CH_3C:(NH)\cdot NH_2$, is alkaline in reaction, and readily splits up into acetic acid and ammonia when warmed with acids. Its hydrochloride melts at 163° C., and crystallizes from alcohol in colourless deliquescent prisms. Acetic anhydride converts the base into an acetamino-dimethyl pyrimidine, acetic acid and acetamide being also formed.

Benzamidine, $C_6H_5\cdot C:(NH)NH_2$, forms colourless crystals which melt at 75–80° C. When warmed it breaks down into ammonia and cyanphenine (s-triphenyl triazine). It condenses with acetic anhydride to form a methyldiphenyl triazine, acetamide being also formed; with acetyl-acetone to form dimethyl-phenyl pyrimidine (A. Pinner, *Ber.*, 1893, 26, p. 2125); and with trimethylene bromide to form a phenyl tetrahydropyrimidine (Pinner). H. v. Pechmann (*Ber.*, 1895, 28, p. 2362) has shown that amidines of the type $R\cdot C:(NY)\cdot NHZ$ sometimes react as if they possessed the constitution $R\cdot C:(NZ)\cdot NHY$; but this only appears to occur when Y and Z are groups which function in the same way. If Y and Z are groups which behave very differently, then there is apparently no tautomerism and a definite formula can be given to the compound.

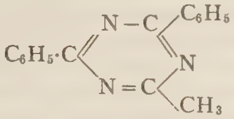
The formulae of the ringed compounds mentioned above are here shown:



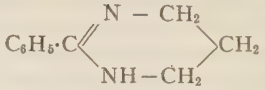
Oxypyrimidine.



Acetaminodimethyl pyrimidine.



Methyldiphenyl triazine.



Phenyl tetrahydropyrimidine.

AMIEL, HENRI FRÉDÉRIC (1821–1881), Swiss philosopher and critic, was born at Geneva on the 27th of September 1821. He was descended from a Huguenot family driven to Switzerland by the revocation of the edict of Nantes. Losing his parents at an early age, he travelled widely, became intimate with the intellectual leaders of Europe and made a special study of German philosophy in Berlin. In 1849 he was appointed professor of aesthetics at the academy of Geneva, and in 1854 became professor of moral philosophy. These appointments, conferred by the democratic party, deprived him of the support of the aristocratic party; which comprised nearly all the culture of the city. This isolation inspired the one book by which Amiel lives, the *Journal Intime*, which, published after his death, obtained a European reputation. It was translated into English by Mrs Humphry Ward. Although second-rate as regards productive power, Amiel's mind was of no inferior quality, and his journal gained a sympathy which the author had failed to obtain in his life. In addition to the *Journal*, he produced several volumes of poetry and wrote studies on Erasmus, Madame de Staël and other writers. He died in Geneva on the 11th of March 1881. His chief poetical works are *Grains de mil, Il penseroso, Part du rêve, Les Etrangères, Charles le Têméraire, Romancero historique, Jour à jour.*

See *Life of Amiel* by Mdlle Berthe Vadier (Paris, 1885); Paul Bourget, *Nouveaux essais* (Paris, 1885); E. Scherer, introd. to the *Journal* and in *Études sur la litt. contemp.* (vol. viii.).

AMIENS, a city of northern France, capital of the department of Somme, on the left bank of the Somme, 81 m. N. of Paris on the Northern railway to Calais. Pop. (1906) 78,407. Amiens was once a place of great strength, and still possesses a citadel of the end of the 16th century, but the ramparts which surrounded it have been replaced by boulevards, bordered by handsome residences. Suburbs, themselves bounded by another line of boulevards, have arisen beyond these limits, and the city also extends to the right bank of the Somme. The busy quarter of Amiens lies between the river and the railway, which for some distance follows the inner line of boulevards. The older and more picturesque quarter is situated directly on the Somme; its narrow and irregular streets are intersected by the eleven arms of the river and it is skirted on the north by the canal derived therefrom. Besides its boulevards Amiens has the ample park or Promenade de la Hotoie to the west and several fine squares, notably the Place Longueville and the Place St Denis, in which stands the statue of the famous 17th-century scholar Charles Ducange. The cathedral (see ARCHITECTURE: *Romanesque and Gothic Architecture in France*; and CATHEDRAL), which is perhaps the finest church of Gothic architecture in France, far exceeds the other buildings of the town in importance. Erected on the plans of Robert de Luzarches, chiefly between 1220 and 1288, it consists of a nave, nearly 140 ft. in height, with aisles and lateral chapels, a transept with aisles, and a choir (with deambulatory) ending in an apse surrounded by chapels. The total length is 469 ft., the breadth 216 ft. The façade, which is flanked by two square towers without spires, has three portals decorated with a profusion of statuary, the central portal having a remarkable statue of Christ of the 13th century; they are surmounted by two galleries, the upper one containing twenty-two statues of the kings of Judah in its arcades, and by a fine rose-window. A slender spire rises above the crossing. The southern portal is remarkable for a figure of the Virgin and other statuary. In the interior, which contains beautifully carved stalls, a choir-screen in the flamboyant style and many other works of art, the most striking features are the height of the nave and the boldness of the columns supporting the vaulting. The chief of the other churches of Amiens is St Germain (15th century), which has some good stained glass. The hôtel de ville, begun in 1550, a belfry of the 14th and 18th centuries and several old mansions are of interest. Amiens has a rich library and admirable collections of paintings, sculptures and antiquities in the museum of Picardy. Its learned associations include the Société des Antiquaires de Picardie, by whom the museum was built in 1854–1864. The city is the seat of a bishop, a prefect, a court of appeal and a court of assizes, and headquarters of the II. Army Corps. There are also tribunals of first instance and of commerce, a board of trade-arbitrators, a chamber of commerce and a branch of the Bank of France. The educational institutions include lycées for boys and girls, training-colleges for teachers, a preparatory school of medicine, a school of music and a school of iron-working and wood-working. The textile industries for which Amiens has been celebrated since the middle ages include manufactures of velvet, cotton-, wool-, silk-, hemp- and flax-spinning, and the weaving of hosiery and a variety of mixed fabrics. Manufactures of machinery, chemicals, blacking, polish and sugar, and printing, dyeing and iron-founding are also carried on. Market gardens, known as *hortillonnages*, intersected by small canals derived from the Somme and Avre, cover a considerable area to the north-east of Amiens; and the city has trade in vegetables, as well as in grain, sugar, wool, oil-seeds and the duck-pasties and macaroons for which it is renowned.

Amiens occupies the site of the ancient *Samarobriva*, capital of the Ambiani, from whom it probably derives its name. At the beginning of the 4th century Christianity was preached there by St Firmin, its first bishop. During the middle ages its territory formed the countship of Amiénois. The authority of the counts was, however, balanced by that of the bishops, and early in the 12th century the citizens, profiting by this rivalry, gained a charter of enfranchisement. The fief became for the first time a dependency of the French crown in 1185, when Philip of Alsace, count of Flanders, ceded it to Philip Augustus. It more than once passed out of the power of the French kings, notably in 1435, when, by the treaty of Arras, it came into the possession of the dukes of Burgundy, to whom it belonged till 1477. Surprised by the Spaniards in 1597, the city was recaptured from them after a long siege by Henry IV. Till 1790 it was the capital of the *gouvernement* of Picardy (*q.v.*). The famous treaty between Great Britain, France, Spain and Holland which took its name from Amiens was signed in the hôtel de ville on the 25th of March 1802. During the war between France and Germany, Amiens, after an important action, fell into the hands of the Prussians on the 28th of November 1870. (See FRANCO-GERMAN WAR.)

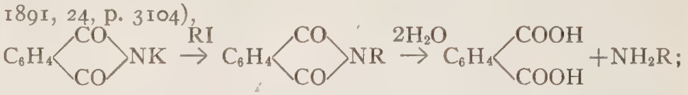
See A. de Calonne, *Histoire de la ville d'Amiens* (1900); John Ruskin, *The Bible of Amiens* (1881); *La Picardie historique et monumentale*, tome i., published by the Société des Antiquaires de Picardie (1893).

AMINES, in chemistry, derivatives of ammonia in which one or more of the hydrogen atoms are replaced by alkyl or aryl groups. The replacement of one hydrogen atom by one alkyl or aryl group gives rise to primary amines; of two hydrogen atoms by two groups, to secondary amines; of three hydrogen atoms by three groups, to tertiary amines. The tertiary amines possess the power of combining with one molecular proportion of an alkyl iodide to form quaternary ammonium salts. The structural relations of these compounds may be shown thus:

NH_3;	NH_2R;	NHR_2;	NR_3;	NR_4I.
Ammonia;	primary amine;	secondary amine;	tertiary amine;	quaternary ammonium iodide.

Aliphatic amines.—These compounds possess properties very similar to those of ammonia, the lowest members of the series being combustible gases readily soluble in water. The next higher members of the series are liquids of low boiling point also readily soluble in water, the solubility and volatility, however, decreasing with the increasing carbon content of the molecule, until the highest members of the series are odourless solids of high boiling point and are insoluble in water. They are all strong bases, readily forming salts with the mineral acids and double salts with the chlorides of gold, platinum and mercury. They are ionized in aqueous solution to a much greater extent than ammonia, the quaternary ammonium bases being the most ionized, and the secondary bases being more strongly ionized than the primary or tertiary bases. For data concerning the conductivity of the organic bases see G. Bredig (*Zeit. für phys. Chem.*, 1894, 13, p. 289).

Many methods have been devised for the preparation of the amines, the first amine having been isolated in 1849 by A. Wurtz on boiling methyl isocyanate with caustic potash, $CON{\cdot}CH_3 + 2KHO = CH_3NH_2 + K_2CO_3$. The primary amines may also be prepared by heating the alkyl iodides with ammonia (A. W. Hofmann); by the reduction of nitriles with alcohol and sodium (A. Ladenburg, *Ber.*, 1886, 19, p. 783); by heating the esters of nitric acid with alcoholic ammonia at 100° C. (O. Wallach, *Ber.*, 1881, 14, p. 421); by the action of reducing agents on nitro-paraffins; by the action of zinc and hydrochloric acid on aldehyde ammonias (German Patent 73,812); by the reduction of the phenylhydrazones and oximes of aldehydes and ketones with sodium amalgam in the presence of alcohol and sodium acetate (J. Tafel, *Ber.*, 1886, 19, p. 1925; 1889, 22, p. 1854; H. Goldschmidt, *Ber.*, 1886, 19, p. 3232); by the action of dilute hydrochloric acid on the isonitriles, $R{\cdot}NC + 2H_2O = R{\cdot}NH_2 + H_2CO_2$; by heating the mustard oils with a mineral acid, by the hydrolysis of the alkyl phthalimides (S. Gabriel, *Ber.*, 1887, 20, p. 2224; 1891, 24, p. 3104),



$$C_6H_4\left\langle\begin{matrix}CO\\CO\end{matrix}\right\rangle NK \xrightarrow{RI} C_6H_4\left\langle\begin{matrix}CO\\CO\end{matrix}\right\rangle NR \xrightarrow{2H_2O} C_6H_4\left\langle\begin{matrix}COOH\\COOH\end{matrix}\right. + NH_2R;$$

by distilling the amino-acids with baryta; by the action of bromine and caustic potash on the acid-amides (A. W. Hofmann, *Ber.*, 1885, 18, p. 2734; 1886, 19, p. 1822);

$$CH_3CONH_2 \rightarrow CH_3CONHBr \rightarrow CH_3CONKBr \rightarrow CH_3NCO \rightarrow CH_3NH_2;$$

and by the hydrolysis of substituted urethanes (Th. Curtius, *Ber.*, 1894, 27, p. 779; 1896, 29, p. 1166),

$$\underset{\text{acid}}{R{\cdot}COOH} \rightarrow \underset{\text{ester}}{R{\cdot}COOR^1} \xrightarrow{N_2H_4{\cdot}H_2O}\rightarrow \underset{\text{hydrazide}}{R{\cdot}CONH{\cdot}NH_2} \xrightarrow{HONO}$$
$$\underset{\text{azide}}{R{\cdot}CON_3} \xrightarrow{C_2H_5OH} \underset{\text{urethane}}{R{\cdot}NH{\cdot}CO_2C_2H_5} \xrightarrow{HCl} R{\cdot}NH_2$$

The secondary amines are prepared, together with the primary and tertiary, by the action of ammonia on the alkyl iodides (see below), or by the hydrolysis of para-nitroso derivatives of tertiary aromatic amines, such as para-nitrosodimethylaniline, thus: $NO{\cdot}C_6H_4{\cdot}N(CH_3)_2 + H_2O = NO{\cdot}C_6H_4{\cdot}OH + NH(CH_3)_2$. By the action of ammonia on the alkyl iodides a complex mixture of primary, secondary and tertiary amines, along with a quaternary ammonium salt, is obtained, the separation of which is difficult. The method worked out by A. W. Hofmann is as follows:—the mixture is distilled with caustic potash, when the primary, secondary and tertiary amines distil over, and the quaternary ammonium salt remains behind unaffected. The aqueous solution of the amines is now shaken up with diethyl oxalate, when the primary amine forms a crystalline dialkyl oxamide and the secondary amine an insoluble liquid, which is an ethyl dialkyl oxamate, the tertiary amine not reacting: $(CO_2C_2H_5)_2 + 2NH_2R = (CO{\cdot}NHR)_2 + 2C_2H_5OH$; $(CO_2C_2H_5)_2 + NHR_2 = C_2H_5O_2C{\cdot}CONR_2 + C_2H_5OH$. The tertiary amine is then distilled off, the residual products separated by filtration and finally hydrolysed by a caustic alkali.

The primary, secondary and tertiary amines may be readily distinguished by their behaviour with various reagents. Primary amines when heated with alcoholic potash and chloroform yield isonitriles, which are readily detected by their offensive smell. The secondary and tertiary amines do not give this reaction. With nitrous acid, the primary amines yield alcohols, the secondary amines yield nitrosamines and the tertiary amines do not react: $R{\cdot}NH_2 + ONOH = R{\cdot}OH + N_2 + H_2O$; $R_2NH + ONOH = R_2N{\cdot}NO + H_2O$. With benzene sulphochloride in the presence of alkali, the primary amines yield compounds of the type $C_6H_5SO_2NHR$, soluble in alkalies, whilst the secondary amines yield compounds of the type $C_6H_5SO_2NR_2$, insoluble in alkalies (O. Hinsberg, *Ber.*, 1890, 23, p. 2963). Primary amines heated with carbon bisulphide in alcoholic solution are converted into mustard oils, when the dithiocarbamate first produced is heated with a solution of mercuric chloride.

Methylamine, CH_3NH_2, occurs in *Mercurialis perennis*, in bone-oil, and herring brine. It is also a decomposition product of many alkaloids. At ordinary temperatures it is a gas, but may be condensed to a liquid which boils at − 6° C. It has a strong ammoniacal smell, burns readily and is exceedingly soluble in water. Its critical temperature is 155° C. and critical pressure 72 atmos. (C. Vincent, J. Chappuis, *Jahresb.*, 1886, p. 202). Dimethylamine, $(CH_3)_2NH$, is found in Peruvian guano. It is a heavy vapour which condenses at 7° C. to a liquid, having a pronounced fish-like smell. Trimethylamine, $(CH_3)_3N$, is very similar to dimethylamine, and condenses to a liquid which boils at 3·2–3·8° C. It is usually obtained from "vinasses," the residue obtained from the distillation of beet sugar alcohol, and is used in the manufacture of potassium bicarbonate by the Solvay process, since its hydrochloride is much more soluble than potassium carbonate. Tetramethylammonium iodide, $N(CH_3)_4I$, is the chief product obtained by the action of methyl iodide on ammonia (Hofmann). It crystallizes in quadratic prisms and has a bitter taste. By warming its aqueous solution with an excess of silver oxide it is converted into tetramethylammonium hydroxide, $N(CH_3)_4OH$, which crystallizes in hygroscopic needles, and has a very alkaline reaction. It forms many crystalline salts and absorbs carbon dioxide. It precipitates many metallic hydroxides. On dry distillation it is resolved into trimethylamine and methyl alcohol. If the nitrogen atom in the quaternary ammonium salts be in combination with four different groups, then the molecule is asymmetrical, and the salt can be resolved into optically active enantiamorphous isomerides. W. J. Pope (*Jour. Chem. Soc.*, 1901, 79, p. 828) has resolved benzyl-allyl-phenyl-methylamine iodide by boiling with silver *d*-camphorsulphonate in a nearly anhydrous mixture of acetone and ethyl acetate. The silver iodide is separated and the solvent distilled off. The residue crystallizes slowly, and the crystalline product is almost wholly *d*-benzyl-allyl-phenyl-ammonium-*d*-sulphonate, the corresponding *l*-compound remaining as a syrupy residue. The corresponding iodides are obtained by the addition of potassium iodide to solutions of the sulphonates, and are optically active antipodes.

Diamines.—The diamines contain two amino groups and bear the same relation to the glycols that the primary monamines bear to the primary alcohols. They are of importance, since the higher homologues are identical in many cases with the ptomaines produced by the putrefactive action of some bacteria on albumen and other related substances. Ethylene diamine, $C_2H_4(NH_2)_2$, may be prepared by heating ethylene dibromide with alcoholic ammonia to 100° C. (F. S. Cloez, *Jahresb.*, 1853, p. 468); or by the action of tin and hydrochloric acid on cyanogen (T. Fairley, *Ann. Suppl.*, 3, 1864, p. 372). It is an alkaline liquid, which when anhydrous boils at 116·5° C. Nitrous acid converts it into ethylene oxide. It combines directly with many metallic salts. (See S. F. Jörgensen, *Jour. pr. Chem.*, 1889 (2), 39, p. 8.) Trimethylene diamine, $NH_2\cdot(CH_2)_3\cdot NH_2$, is prepared by the action of ammonia on trimethylene bromide (E. Fischer, *Ber.*, 1884, 17, p. 1799). It is a liquid which boils at 135–136° C., and is readily soluble in alcohol, ether, chloroform and benzene. Tetramethylene diamine (putrescine), $NH_2\cdot(CH_2)_4\cdot NH_2$, is prepared by reducing ethylene dicyanide (succinonitrile) with sodium in absolute alcoholic solution (A. Ladenburg, *Ber.*, 1886, 19, p. 780). It melts at 27° C., and is easily soluble in water. Pentamethylene diamine (cadaverine), $NH_2\cdot(CH_2)_5\cdot NH_2$, is prepared by reducing trimethylene cyanide in ether solution by zinc and hydrochloric acid (A. Ladenburg, *Ber.*, 1883, 16, p. 1151). J. v. Braun (*Ber.*, 1904, 37, p. 3583) has prepared pentamethylene derivatives from piperidine by the action of phosphorus pentachloride. On heating piperidine with phosphorus pentachloride to 200°C. in a sealed tube pentamethylene dichloride is obtained, and this on treatment with potassium phthalimide gives a condensation product of composition, $C_6H_4[CO]_2N(CH_2)_5N[CO]_2C_6H_4$, which is finally hydrolysed by hydrochloric acid. Cadaverine is a syrup at ordinary temperatures, and boils at 178–179° C. It is readily soluble in water and alcohol, but only slightly soluble in ether.

Aromatic Amines.—The aromatic amines in some respects resemble the aliphatic amines, since they form salts with acids, and double salts with platinum chloride, and they also distil without decomposition. On the other hand, they are much weaker bases than the aliphatic amines, their salts undergoing hydrolytic dissociation in aqueous solution. The primary aromatic amines may be prepared by the reduction of the nitro-hydrocarbons, the reducing agents used being either alcoholic-ammonium sulphide (N. Zinin), zinc and hydrochloric acid (A. W. Hofmann), an alcoholic solution of stannous chloride (containing hydrochloric acid) (R. Anschutz, *Ber.*, 1886, 19, p. 2161), tin and hydrochloric acid, or, on the manufacturing scale, iron and hydrochloric acid. They may also be obtained by the reduction of nitroso compounds and of hydrazo compounds and of hydrazones (J. Tafel, *Ber.*, 1886, 19, p. 1924), by distilling the amido-acids with lime, by heating phenols with zinc chloride ammonia (V. Merz, *Ber.*, 1880, 13, p. 1298), and by heating the secondary and tertiary bases with concentrated hydrochloric acid to about 180° C.

At a temperature of about 300–400° C. the alkyl chloride formed in this reaction attacks the benzene nucleus and replaces hydrogen by an alkyl group or groups, forming primary amines homologous with the original amine; thus methylaniline hydrochloride is converted into para- and ortho-toluidine hydrochloride, and trimethyl phenyl ammonium iodide is converted into mesidine hydriodide. It is to be noted that only traces of the aromatic amines are produced by heating the halogen substituted benzenes with ammonia, unless the amino group be situated in the side chain, as in the case of benzylamine.

The primary amines are colourless liquids or crystalline solids, which are insoluble in water, but readily soluble in the common organic solvents. When heated with alkyl or aryl iodides, they are converted into secondary and tertiary amines. Concentrated nitric acid attacks them violently, producing various oxidation products, but if the amino group be "protected" by being previously acetylated, then nitro derivatives are obtained. When heated with concentrated sulphuric acid for some time, they are sulphonated. They form condensation products with aldehydes, benzaldehyde and aniline forming benzylidene aniline, $C_6H_5N:CHC_6H_5$, and when heated with acids they form anilides. They give the isonitrile reaction (see above) when warmed with chloroform and a caustic alkali, and form alkyl thioureas when heated with an alcoholic solution of carbon bisulphide. When warmed with a solution of nitrous acid, they are converted into phenols; if, however, nitrous acid be added to an ice-cold solution of a primary amine in excess of mineral acid, a diazonium salt is formed (see Azo Compounds and Diazo Compounds), or in absence of excess of acid, a diazoamine is produced.

The secondary amines may be of two types—namely, the purely aromatic amines, and the mixed secondary amines, which contain an aromatic residue and an alkyl group. The purely aromatic amines result upon heating the primary amines with their hydrochlorides, and, in some cases, by heating a phenol with a primary amine and anhydrous zinc chloride. The mixed secondary amines are prepared by the action of alkyl iodides on the primary amines, or by heating salts of the primary amine with alcohols under pressure. The mixed secondary amines have basic properties, but the purely aromatic secondary amines are only very feeble bases. Both classes readily exchange the imide hydrogen for acid radicals, and give nitrosamines with nitrous acid. The secondary amines do not give the isonitrile reaction.

The tertiary amines may also be of two types, the purely aromatic and the mixed type. The mixed tertiary amines are produced by the action of alkyl halides on the primary amines. The simplest aromatic tertiary amine, triphenylamine, is prepared by the action of brombenzene on sodium diphenylamine (C. Heydrich, *Ber.*, 1885, 18, p. 2156). The simplest aromatic monamine is aniline (*q.v.*), and the simplest mixed amines are mono- and di-methyl aniline. These substances are treated in the article ANILINE.

The aromatic amine resembling the aliphatic amines is benzylamine, $C_6H_5 \cdot CH_2 \cdot NH_2$, which may be prepared by reducing benzonitrile in alcoholic solution by means of zinc and acetic acid (O. Mendius, *Ann.* 1862, 121, p. 144), or by metallic sodium (E. Bamberger, *Ber.*, 1887, 20, p. 1709). It can also be obtained by the action of ammonia on benzyl chloride (S. Cannizzaro, *Ann.*, 1865, 134, p. 128), but di- and tri-benzylamines are simultaneously formed. It is a liquid, which boils at 183° C., and is miscible in all proportions with water, alcohol and ether. It is basic in character, and has a strongly alkaline reaction. Diphenylamine, $(C_6H_5)_2NH$, is the simplest representative of the true aromatic secondary amines. It is prepared by heating aniline and aniline hydrochloride for some hours to 210–240° C, (Ch. Girard and G. de Laire, *Zeit für. Chem.*, 1866, p. 438). It crystallizes in white plates, which melt at 45° C. and boil at 302° C. It is almost insoluble in water, but readily volatilizes in steam. When heated with monobasic saturated acids and zinc chloride it yields acridines.

Aromatic Diamines.—The diamines are prepared by reducing the nitranilines or the dinitrohydrocarbons. They crystallize in plates, and for the most part distil without decomposition. Orthophenylene diamine, $C_6H_4(NH_2)_2$, crystallizes from water in plates, which melt at 102–103° C. and boil at 256–258° C. When heated with 10% hydrochloric acid to 180° C. it yields pyrocatechin (Jacob Meyer, *Ber.*, 1897, 30, p. 2569). The orthodiamines are characterized by the large number of condensation products they form. (See IMIDAZOLES, QUINOXALINES, &c.). Metaphenylene diamine crystallizes in rhombic plates which melt at 63° C. and boil at 287° C. It is easily soluble in water and alcohol. When heated with 10% hydrochloric acid to 180° C. it yields resorcin (J. Meyer). Paraphenylene diamine may be prepared as above, and also by the reduction of amidoazobenzene. It crystallizes in tables which melt at 140° C. and boil at 267° C. When heated with 10% hydrochloric acid to 180° C. it yields hydroquinone (J. Meyer). Manganese dioxide and dilute sulphuric acid oxidize it to quinone. The three classes of diamines may be distinguished by their behaviour towards nitrous acid. The ortho-compounds condense to azimido benzenes, the meta-compounds yield azo-dyestuffs, and the para-compounds yield bis-diazo compounds of the type $XN_2 \cdot C_6H_4 \cdot N_2X$.

AMIOT, JEAN JOSEPH MARIE (1718–1793), French Jesuit missionary, was born at Toulon in February 1718. He entered the Society of Jesus in 1737 and was sent in 1750 as a missionary to China. He soon won the confidence of the emperor Kien-lung and spent the remainder of his life at Pekin, where he died on the 9th of October 1793. Amiot was eminently fitted to make good use of the advantages which his situation afforded, and his works did more than had ever been done before to make known to the Western world the thought and life of the Far East. His *Dictionnaire tatare-mantchou-français* (Paris, 1789) was a work of great value, the language having been previously quite unknown in Europe. His other writings are to be found chiefly in the *Mémoires concernant l'histoire, les sciences et les arts de Chinois* (15 vols., Paris, 1776–1791). The *Vie de Confucius*, the twelfth volume of that collection, is complete and accurate.

For full bibliography see De Backer and C. Sommervogel, *Bibliothèque de la Cie. de Jésus*, i. 294-303; for his works on Chinese music see F. J. Fétis, *Biog. univers. des musiciens* (Brussels, 1837–1844).

AMIR, or AMEER (an Arabic word meaning "commander," from the root *amr*, "commanding"), a title common in the Mahommedan East. The form *emir* is also commonly employed in English. The word originally signified a military commander, but very early came to be extended to anyone bearing rule, Mahomet himself being styled by the pagan Arabs amir of Mecca. Thus the term gradually came to be applied to any high office-bearer, or to any lord or chief. The caliph has the style of *Amir ul Omara*, "lord of lords." The title *Amir ul Muminim*, or "commander of the faithful," now borne by the sultan of Turkey, was first assumed by Abu Bekr, and was taken by most of the various dynasties which claimed the caliphate, including the Fatimites, the Spanish Omayyads and the Almohades. The Almoravides and the Merinides assumed the style of *Amir ul Muslimin*, "commander of the Mussulmans."

The use of the word is, in fact, closely akin to that of the English "lord," sometimes connoting office, as in *Amir ul-aḫghal* (minister of finance) under the Almohades (*cf.* "lord of the treasury"), sometimes mere dignity, as in the case of the title of honour borne by all descendants of the Prophet, or of the title *Mir* assumed by men of great rank in the Far East. Sometimes it implies a temporary office of dignity and command—*e.g.* the *Amir ul-haj*, "commander of the pilgrimage" (to Mecca). Sometimes again it connotes the meaning of "sovereign lord," in which sense it was early assumed by the princes of Sind and by the rulers of Afghanistan and Bokhara, the title implying a lesser dignity than that of sultan. Thus too it is very generally applied in the East to the chiefs of independent or semi-independent tribes. In the Lebanon both the Christian clans and the Druses are ruled by hereditary *amirs.* Finally the word (confused not unnaturally with the particle usually attached to it) was borrowed by the West, and is the origin of the English "admiral."

AMIS ET AMILES, the title of an old French romance based on a widespread legend of friendship and sacrifice. In its earlier and simpler form it is the story of two friends, one of whom, Amis, was smitten with leprosy because he had committed perjury to save his friend. A vision informed him that he could only be cured by bathing in the blood of Amiles's children. When Amiles learnt this he killed the children, who were, however, miraculously restored to life after the cure of Amis. The tale was probably of Oriental origin, and introduced to the West by way of Byzantium. It found its way into French literature through the medium of Latin, as the names Amicus and Amelius indicate, and was eventually attached to the Carolingian cycle in the 12th-century *chanson de geste* of *Amis et Amiles.* This poem is written in decasyllabic assonanced verse, each stanza being terminated by a short line. It belongs to the heroic period of French epic, containing some passages of great beauty, notably the episode of the slaying of the children, and maintains a high level of poetry throughout. Amis has married Lubias and become count of Blaives (Blaye), while Amiles has become seneschal at the court of Charlemagne, and is seduced by the emperor's daughter, Bellisant. The lovers are betrayed, and Amiles is unable to find the necessary supporters to enable him to clear himself by the ordeal of single combat, and fears, moreover, to fight in a false cause. He is granted a reprieve, and goes in search of Amis, who engages to personate him in the combat. He thus saves his friend, but in so doing perjures himself. Then follows the leprosy of Amis, and, after a lapse of years, his discovery of Amiles and cure. There are obvious reminiscences in this story of Damon and Pythias, and of the classical instances of sacrifice at the divine command. The legend of Amis and Amiles occurs in many forms with slight variations, the names and positions of the friends being sometimes reversed. The crown of martyrdom was not lacking, for Amis and Amiles were slain by Ogier the Dane at Novara on their way home from a pilgrimage to the Holy Land. *Jourdain de Blaives*, a *chanson de geste* which partly reproduces the story of *Apollonius of Tyre*, was attached to the *geste* of Amis by making Jourdain his grandson.

The versions of *Amis and Amiles* include—(*a*) numerous Latin recensions in prose and verse, notably that given by Vincent de Beauvais in his *Speculum historiale* (lib. xxiii. cap. 162-166 and 169); (*b*) an Anglo-Norman version in short rhymed couplets, which is not attached to the Charlemagne legend and agrees fairly closely with the English *Amis and Amiloun* (Midland dialect, 13th century); these with the old Norse version are printed by E. Kölbing, *Altengl. Bibl.* vol. ii. (1889), and the English romance also in H. Weber, *Metrical Romances*, vol. ii. (1810); (*c*) the 12th-century French *chanson de geste* analysed by P. Paris in *Hist. litt. de la France* (vol. xxii.), and edited by K. Hofmann (Erlangen, 1882) with the addition of *Jourdain de Blaives*; (*d*) the Latin *Vita Sanct. Amici et Amelii* (pr. by Kölbing, *op. cit.*) and its Old-French translation, *Li amitiez de Ami et Amile*, ed. L. Moland and C. d'Héricault in *Nouvelles* . . .

du xiii^e siècle (Paris, 1856); (*e*) a 14th-century drama, *Un Miracle de Notre Dame d'Amis et Amile*, ed. L. J. N. Monmerqué and F. Michel in *Théâtre fr. au moyen âge* (1839); (*f*) old Norse, Icelandic, Danish versions, &c. (see K. Hofmann, *op. cit.*); (*g*) an imitation which under the name of *Oliver and Artus* was current in many languages and was the subject of Hans Sachs's comedy, *Die treuen Gesellen* (1556); (*h*) *Engelhart und Engeltrut*, by the minnesinger Conrad von Würzburg (ed. M. Haupt, Leipzig, 1844, 2nd ed., 1900); (*i*) the late prose romances, with many changes and additions, *Milles et Amys*, printed by A. Verard (Paris, *c.* 1503), &c., for which see G. Brunet, *Manuel du libraire*, s.v. "Milles." A different version of the legend is inserted at considerable length in *L'Ystoire des sept sages* (ed. G. Paris, *Soc. des anc. textes fr.*, 1876), in which the friends are called Alexandre and Louis, and Bellisant Florentine. For a further bibliography see L. Gautier, *Bibl. des chansons de geste* (Paris, 1897). William Morris's version of the French romance was printed at the Kelmscott Press in 1894. See also the essay by W. Pater in *The Renaissance*, 1893.

AMITERNUM, an ancient town of the Sabines, situated about 5 m. N. of Aquila, in the broad valley of the Aternus, from which, according to Varro, it took its name. It was stormed by the Romans in 293 B.C., and though it suffered from the wars of the Republican period, it seems to have risen to renewed prosperity under the empire. This it owed largely to its position. It lay at the point of junction of four roads—the Via Caecilia, the Via Claudia Nova and two branches of the Via Salaria, which joined it at the 64th and 89th miles respectively. The fertility of its territory was also praised by ancient authors. There are considerable remains of an aqueduct, an amphitheatre and a theatre (the latter excavated in 1880—see *Notizie degli scavi*, 1880, 290, 350, 379), all of which belong to the imperial period, while in the hill on which the village of S. Vittorino is built are some Christian catacombs. Amiternum was the birthplace of the historian Sallust. In a gorge 1½ m. east are massive remains of cyclopean walls (*i.e.* in rough blocks), probably intended to regulate the flow of the stream (N. Persichetti in *Römische Mitteilungen*, 1902, 134 *seq.*).

AMLWCH (*llwch*= "lake"), a market town of Anglesey, North Wales, situated on slightly rising ground on the N. coast of the island, 15 m. N.W. of Beaumaris and 262 m. from London, by the London & North-Western railway. Pop. of urban district (1901) 2994. Originally it owed its whole importance to the copper mines of the Parys (probably, Parry's) mountain, as, before ore was discovered in March 1768, it was a small hamlet of fishermen. The mines once produced 3000 tons of metal annually, copper smelting being largely carried on, but have now almost ceased working. Though apparently not mentioned by Ptolemy, they were perhaps Roman. Robert Parys, chamberlain of North Wales under Henry IV., is often given as their godfather. The poor harbour called the "port," protected by a breakwater, has been cut out of the rock (shingle). Amlwch is the terminus of the branch railway from Gaerwen to Amlwch, formerly the Anglesey Central Railway Company. Porthllechog, or Bull Bay (so called from the Bull Rock), at a mile's distance, is a small but favourite watering-place. Beyond, on the coast, some 3 m. distant, are the remains of a British fort and of the Llanllaianau monastery, opposite the Middle Mouse islet and close to Llanbadrig old church and Cemmaes. Industries include slate quarrying, shipbuilding, iron and brass foundries, alum, vitriol, manure, guano and tobacco works. At Llanllaianau was found, in 1841, a stone coffin, holding a well-preserved skeleton of 7½ ft. in length. The coffin was apparently of Aberdovey (Aberdyfi) limestone, much corroded. At Llangefni, not far from Amlwch, in 1829, and at Llangristiolus, 3 m. distant from Llangefni, about 1770, were found human bones of a high antiquity, between Glan Hwfa and Fron, and at Capel, respectively. The town has an old Anglican church (St Eleth's).

AMMAN, JOHANN CONRAD (1669–*c.*1730), Swiss physician, was born at Schaffhausen in 1669. After graduating at Basel in 1687 he began to practise at Amsterdam, where he gained a great reputation. He was one of the earliest writers on the instruction of the deaf and dumb, and first called attention to his method in his *Surdus loquens* (Amsterdam, 1692), which was often reprinted, and was reproduced by John Wallis in the *Philosophical Transactions* (1698). His process consisted principally in exciting the attention of his pupils to the motions of his lips and larynx while he spoke, and then inducing them to imitate these movements, till he brought them to repeat distinctly letters, syllables and words. The edition of Caelius Aurelianus, which was undertaken by the Wetsteins in 1709, was superintended by Amman. He died about 1730 at Warmoud, near Leiden.

AMMAN, JOST (1539–1591), Swiss artist, celebrated chiefly for his engravings on wood, was born at Zürich. Of his personal history little is known beyond the fact that he removed in 1560 to Nuremberg, where he continued to reside until his death in March 1591. His productiveness was very remarkable, as may be gathered from the statement of one of his pupils, that the drawings he made during a period of four years would have filled a hay wagon. A large number of his original drawings are contained in the Berlin collection of engravings. The genuineness of not a few of the specimens to be seen elsewhere is at least questionable. A series of copperplate engravings by Amman of the kings of France, with short biographies, appeared at Frankfort in 1576. He also executed many of the woodcut illustrations for the Bible published at Frankfort by Sigismund Feierabend. Another serial work, the *Panoplia Omnium Liberalium Mechanicarum et Sedentariarum Artium Genera Continens*, containing 115 plates, is of great value. Amman's drawing is correct and spirited, and his delineation of the details of costume, &c., is minute and accurate. He executed too much, however, to permit of his reaching the highest style of art. Paintings in oil and on glass are attributed to him, but no specimen of these is known to exist.

AMMAN, PAUL (1634–1691), German physician and botanist, was born at Breslau in 1634. In 1662 he received the degree of doctor of physic from the university of Leipzig, and in 1664 was admitted a member of the society *Naturae Curiosorum*, under the name of Dryander. Shortly afterwards he was chosen extraordinary professor of medicine in the above-mentioned university; and in 1674 he was promoted to the botanical chair, which he again in 1682 exchanged for the physiological. He died at Leipzig in 1691. He seems to have been a man of critical mind and extensive learning. His principal works were: *Medicina Critica* (1670); *Paraenesis ad Docentes occupata circa Institutionum Medicarum Emendationem* (1673); *Irenicum Numae Pompilii cum Hippocrate* (1689); *Supellex Botanica* (1675); and *Character Naturalis Plantarum* (1676).

AMMANATI, BARTOLOMEO (1511–1592), Florentine architect and sculptor. He studied under Bandinelli and Jacopo Sansovino, and closely imitated the style of Michelangelo. He was more distinguished in architecture than in sculpture. He designed many buildings in Rome, Lucca and Florence, an addition to the Pitti Palace in the last-named city being one of his most celebrated works. He was also employed in 1569 to build the beautiful bridge over the Arno, known as Ponte della Trinita—one of his celebrated works. The three arches are elliptic, and though very light and elegant, have resisted the fury of the river, which has swept away several other bridges at different times. Another of his most important works was the fountain for the Piazza della Signoria. In 1550 Ammanati married Laura Battiferri, an elegant poet and an accomplished woman.

AMMIANUS, MARCELLINUS, the last Roman historian of importance, was born about A.D. 325–330 at Antioch; the date of his death is unknown, but he must have lived till 391, as he mentions Aurelius Victor as the city prefect for that year. He was a Greek, and his enrolment among the *protectores domestici* (household guards) shows that he was of noble birth. He entered the army at an early age, when Constantius II. was emperor of the East, and was sent to serve under Ursicinus, governor of Nisibis and *magister militiae*. He returned to Italy with Ursicinus, when he was recalled by Constantius, and accompanied him on the expedition against Silvanus the Frank, who had been forced by the unjust accusations of his enemies into proclaiming himself emperor in Gaul. With Ursicinus he went twice to the East, and barely escaped with his life from Amida or Amid (mod. Diarbekr), when it was taken by the Persian king Shapur (Sapor) II. When Ursicinus lost his office and the favour of Constantius, Ammianus seems to have shared his downfall; but under Julian, Constantius's successor, he regained his position. He accompanied this emperor, for whom he expresses enthusiastic admiration, in his campaigns against the Alamanni and the Persians; after his death he took part in the retreat of Jovian as far as Antioch, where he was residing when the conspiracy of Theodorus (371) was discovered and cruelly put down. Eventually he settled in Rome, where, at an advanced age, he wrote (in Latin) a history of the Roman empire from the accession of Nerva to the death of Valens (96–378), thus forming a continuation of the work of Tacitus. This history (*Rerum Gestarum Libri XXXI.*) was originally in thirty-one books; of these the first thirteen are lost, the eighteen which remain cover the period from 353 to 378. As a whole it is extremely valuable, being a clear, comprehensive and impartial account of events by a contemporary of soldierly honesty, independent judgment and wide reading. "Ammianus is an accurate and faithful guide, who composed the history of his own times without indulging the prejudices and passions which usually affect the mind of a contemporary" (Gibbon). Although Ammianus was no doubt a heathen, his attitude towards Christianity is that of a man of the world, free from prejudices in favour of any form of belief. If anything he himself inclined to neo-Platonism. His style is generally harsh, often pompous and extremely obscure, occasionally even journalistic in tone, but the author's foreign origin and his military life and training partially explain this. Further, the work being intended for public recitation, some rhetorical embellishment was necessary, even at the cost of simplicity. It is a striking fact that Ammianus, though a professional soldier, gives excellent pictures of social and economic problems, and in his attitude to the non-Roman peoples of the empire he is far more broad-minded than writers like Livy and Tacitus; his digressions on the various countries he had visited are peculiarly interesting. In his description of the empire—the exhaustion produced by excessive taxation, the financial ruin of the middle classes, the progressive decline in the morale of the army—we find the explanation of its fall before the Goths twenty years after his death.

The work was discovered by Poggio, who copied the original MS. *Editio princeps* (bks. 14-26) by Sabinus, 1474; completed by Accursius, 1533; with variorum notes, by Wagner-Erfurdt, 1808; latest edition of text, Gardthausen, 1874-1875. English translations by P. Holland, 1609; Yonge (Bohn's Classical Library), 1862; also Max Büdinger, *Ammianus Marcellinus und die Eigenart seines Geschichtswerkes* (1895); F. Liesenberg, *Die Sprache des Ammianus Marcellinus* (1888–1890); T. R. Glover, *Life and Letters in the Fourth Century* (1901); Abbé Gimazane, *Ammianus Marcellinus, sa vie et son œuvre* (Toulouse, 1889), a work containing a number of very doubtful theories. For a criticism of his views on Roman society see S. Dill, *Roman Society in the Last Century of the Western Empire* (London, 1898).

AMMIRATO, SCIPIONE (1531–1601), Italian historian, born at Lecce, in the kingdom of Naples. His father, intending him for the profession of law, sent him to study at Naples, but his own decided preference for literature prevented him from fulfilling his father's wishes. Entering the church, he resided for a time at Venice, and afterwards engaged in the service of Pope Pius IV. In 1569 he went to Florence, where he was fortunate in securing the patronage and support of Duke Cosimo I., who gave him a residence at the Medici Palace and the Villa Zopaja on the understanding that he should write his *Istorie Fiorentine* (1600), the work by which he is best known. In 1595 he was made a canon of the cathedral of Florence. He died in 1601. Among the other works of Ammirato, some of which were first published after his death, may be mentioned discourses on Tacitus and genealogies of the families of Naples and Florence.

AMMON, the Graecized name of an Egyptian deity, in the native language Amūn, connected by the priests with a root meaning "conceal." He was, to begin with, the local deity of Thebes, when it was an unimportant town on the east bank of the river, about the region now occupied by the temple of Karnak. The XIth dynasty sprang from a family in the Hermonthite nome or perhaps at Thebes itself, and adorned the temple of Karnak with statues. Amenemhē, the name of the founder of the XIIth dynasty, was compounded with that of Amūn and was borne by three of his successors. Several Theban kings of the later part of the Middle Kingdom adopted the same name; and when the Theban family of the XVIIth dynasty drove out the Hyksos, Ammon, as the god of the royal city, was again prominent. It was not, however, until the rulers of the XVIIIth dynasty carried their victorious arms beyond the Egyptian frontiers in every direction that Ammon began to assume the proportions of a universal god for the Egyptians, eclipsing all their other deities and asserting his power over the gods of all foreign lands. To Ammon the Pharaohs attributed all their successful enterprises, and on his temples they lavished their wealth and captured spoil.

Ammon is figured of human form, wearing on his head a plain deep circlet from which rise two straight parallel plumes, perhaps representing the tail feathers of a hawk. Two main types are seen: in the one he is seated on a throne, in the other he is standing, ithyphallic, holding a scourge, precisely like Min, the god of Coptos and Chemmis (Akhmim). The latter may be his original form, as a god of fertility, before whom the king ceremoniously breaks up the ground for sowing or cuts the ripe corn. His consort was sometimes called Amaune (feminine of Amūn), but more usually Mūt, "mother": she was human-headed, wearing the double crown of Upper and Lower Egypt, and their son was Khons (Chon or Chons), a lunar god, represented as a youth wearing the crescent and disk of the moon. A great temple was built to Mūt at Karnak not later than the XVIIIth dynasty, and another to Khons not later than the XXth dynasty.

The name of Rē, the sun-god, was generally joined to Ammon, especially in his title as "king of the gods": the rule of heaven belonged to the sun-god in the Egyptian cosmos, and this identification with Rē was only logical for a supreme deity. Ammon was entitled "lord of the thrones of the two lands," or, more proudly still, "king of the gods." Such indeed was his unquestioned position when suddenly he was overthrown and his worship proscribed. Not even a henotheist fervently worshipping one of many gods, Amenophis (Amenhotp) IV. of the XVIIIth dynasty became the monotheist Akhenaton; discarding all the gods of Egypt, and especially persecuting Ammon the arch-god, he devoted himself to the purer and more sublime worship of Aton, the sun. But he failed to win the permanent adhesion of the people to his reform, or to conciliate or entirely crush the enormously powerful priesthood of Ammon. A few years after the reformer's death, the old cults were re-established and the monuments of Aton studiously defaced. Hymns were then addressed to Amen-rē, which are almost monotheistic in expression. The cult of the supreme god spread throughout Egypt and was carried by the Egyptian conquerors into other lands, Syria, Ethiopia and Libya, and was accepted by the natives both in Ethiopia and in the Libyan cases, where civilization was low and Egyptian influence permanent. After the XXth dynasty the centre of power was removed from Thebes, and the authority of Ammon began to wane. In the XXIst dynasty the secondary line of priest kings of Thebes upheld his dignity to the best of their power, and the XXIInd dynasty favoured Thebes: but as the sovereignty weakened the division between Upper and Lower Egypt asserted itself, and thereafter Thebes would have rapidly decayed had it not been for the piety of the kings of Ethiopia towards Ammon, whose worship had long prevailed in their country. Thebes was at first their Egyptian capital, and they honoured Ammon greatly, although their wealth and culture were not sufficient to effect much. Ammon (Zeus) continued to be the great god of Thebes in its decay, and notwithstanding that a nome-capital in the north of the Delta and many lesser temples, from El Hibeh in Middle Egypt to Canopus on the sea, acknowledged Ammon as their supreme divinity, he probably in some degree represented the national aspirations of Upper Egypt as opposed to Middle and Lower Egypt: he also remained the national god of Ethiopia, where his name was pronounced Amane. The priests of Amane at Meroe and Napata, in fact, regulated through his oracle the whole government of the country, choosing the king, directing his military expeditions (and even compelling him to commit suicide, according to Diodorus) until in the 3rd century B.C. Arkamane (Ergamenes) broke through the bondage and slew the priests. Ammon had yet another outburst of glory. There was an oracle of Ammon established for some centuries in Libya, in the distant oasis of Siwa. Such was its reputation among the Greeks that Alexander journeyed thither, after the battle of Issus, and during his occupation of Egypt, in order to be acknowledged the son of the god. The Egyptian Pharaohs of the XVIIIth dynasty had likewise been proclaimed mystically sons of this god, who, it was asserted, had impregnated the queen-mother; and on occasion wore the ram's horns of Ammon, even as Alexander is represented with them on coins.

The Egyptian goose (*chenalopex*) is figured in the XVIIIth dynasty as sacred to Ammon; but his most frequent and celebrated incarnation was the woolly sheep with curved ("Ammon") horns (as opposed to the oldest native breed with long horizontal twisted horns and hairy coat, sacred to Khnum or Chnumis). It is found as representing Ammon from the time of Amenophis III. onwards.

As king of the gods Ammon was identified by the Greeks with Zeus and his consort Mūt with Hera. Khnum was likewise identified with Zeus probably through his similarity to Ammon; his proper animal having early become extinct, Ammon horns in course of time were attributed to this god also.

See Erman, *Handbook of Egyptian Religion* (London, 1907); Ed. Meyer, art. "Ammon" in Roscher's *Lexikon der griechischen und römischen Mythologie*; Pietschmann, arts. "Ammon," "Ammoneion" in Pauly-Wissowa, *Realencyclopädie*; and works on Egyptian religion quoted under EGYPT, section *Religion*. (F. LL. G.)

AMMON, CHRISTOPH FRIEDRICH VON (1766–1850), German theological writer and preacher, was born at Baireuth. He studied at Erlangen, held various professorships in the philosophical and theological faculties of Erlangen and Göttingen, succeeded Franz Reinhard (1753–1812) in 1813 as court preacher and member of the consistorial court at Dresden, retired from these offices in 1849, and died on the 21st of May 1850. Seeking to establish for himself a middle position between rationalism and supernaturalism, he declared for a "rational supernaturalism," and contended that there must be a gradual development of Christian doctrine corresponding to the advance of knowledge and science. But at the same time he sought, like other representatives of this school of thought, such as K. G. Bretschneider and Julius Wegscheider, to keep in close touch with the historical theology of the Protestant churches. He was a man of great versatility and extensive learning, a philologist and philosopher as well as a theologian, and a very voluminous author. His principal theological work was the *Fortbildung des Christenthums zur Weltreligion*, in 4 volumes (Leipzig, 1833–1840). *Entwurf einer reinbiblischen Theologie* appeared in 1792 (2nd ed., 1801), *Summa Theologiae Christianae* in 1803 (other editions, 1808, 1816, 1830); *Das Leben Jesu* in 1842, and *Die wahre und falsche Orthodoxie* in 1849. Von Ammon's style in preaching was terse and lively, and some of his discourses are regarded as models of pulpit treatment of political questions.

See Herzog-Hauck, *Realencyklopädie*; Otto Pfleiderer, *The Development of Theology in Germany since Kant*, pp. 89 ff.

AMMONIA (NH_3). Salts of ammonia have been known from very early times; thus the term *Hammoniacus sal* appears in the writings of Pliny (*Nat. Hist.* xxxi. 39), although it is not known whether the term is identical with the more modern sal-ammoniac (*q.v.*). In the form of sal-ammoniac, ammonia was known, however, to the alchemists as early as the 13th century, being mentioned by Albertus Magnus, whilst in the 15th century Basil Valentine showed that ammonia could be obtained by the action of alkalies on sal-ammoniac. At a later period when sal-ammoniac was obtained by distilling the hoofs and horns of oxen, and neutralizing the resulting carbonate with hydrochloric acid, the name spirits of hartshorn was applied to ammonia. Gaseous ammonia was first isolated by J. Priestley in 1774 and was termed by him "alkaline air." In 1777 K. W. Scheele showed that it contained nitrogen, and C. L. Berthollet, in about 1785, ascertained its composition.

Ammonia is found in small quantities as the carbonate in the atmosphere, being produced from the putrefaction of nitrogenous animal and vegetable matter; ammonium salts are also found in small quantities in rain-water, whilst ammonium chloride (sal-ammoniac) and ammonium sulphate are found in volcanic districts; and crystals of ammonium bicarbonate have been found in Patagonian guano. Ammonium salts too are found distributed through all fertile soil, in sea-water, and in most plant and animal liquids, and also in urine.

Ammonia can be synthesized by submitting a mixture of nitrogen and hydrogen to the action of the silent electric discharge, the combination, however, being very imperfect. It is obtained by the dry distillation of nitrogenous vegetable and animal products; by the reduction of nitrous acid and nitrites with nascent hydrogen; and also by the decomposition of ammonium salts by alkaline hydroxides or by slaked lime, the salt most generally used being the chloride (*sal-ammoniac*, *q.v.*) thus $2NH_4Cl + Ca(OH)_2 = CaCl_2 + 2H_2O + 2NH_3$. It also results on decomposing magnesium nitride (Mg_3N_2) with water, $Mg_3N_2 + 6H_2O = 3Mg(OH)_2 + 2NH_3$. Large quantities of ammonia and ammonium salts are now obtained from the ammoniacal liquor of gas-works.

Ammonia is a colourless gas possessing a characteristic pungent smell and a strongly alkaline reaction; it is lighter than air, its specific gravity being 0·589 (air = 1). It is easily liquefied and the liquid boils at −33·7° C., and solidifies at −75° C. to a mass of white crystals. It is extremely soluble in water, one volume of water at 0° C. and normal pressure absorbs 1148 volumes of ammonia (Roscoe and W. Dittmar). All the ammonia contained in an aqueous solution of the gas may be expelled by boiling. It does not support combustion; and it does not burn readily unless mixed with oxygen, when it burns with a pale yellowish-green flame. Ammonia gas has the power of combining with many substances, particularly with metallic halides; thus with calcium chloride it forms the compound $CaCl_2\cdot 8NH_3$, and consequently calcium chloride cannot be used for drying the gas. With silver chloride it forms two compounds (F. Isambert, *Comptes rendus*, 1868, lxvi. p. 1259)—one, $AgCl\cdot 3NH_3$ at temperatures below 15° C.; the other, $2AgCl\cdot 3NH_3$ at temperatures above 20° C. On heating these substances, ammonia is liberated and the metallic chloride remains. It was by the use of silver chloride ammonia compounds that in 1823 M. Faraday was first able to liquefy ammonia. It can be shown by Isambert's results that the compound $AgCl\cdot 3NH_3$ cannot be formed above 20° C., by the action of ammonia on silver chloride at atmospheric pressure; whilst $2AgCl\cdot 3NH_3$, under similar conditions, cannot be formed above about 68° C. Liquid ammonia is used for the artificial preparation of ice. It readily dissolves sodium and potassium, giving in each case a dark blue solution. At a red heat ammonia is easily decomposed into its constituent elements, a similar decomposition being brought about by the passage of electric sparks through the gas. Chlorine takes fire when passed into ammonia, nitrogen and hydrochloric acid being formed, and unless the ammonia be present in excess, the highly explosive nitrogen chloride NCl_3 is also produced. With iodine it reacts to form *nitrogen iodide*. This compound was discovered in 1812 by Bernard Courtois, and was originally supposed to contain nitrogen and iodine only, but in 1840 R. F. Marchand showed that it contained hydrogen, whilst R. Bunsen showed that no oxygen was present. As regards its constitution, it has been given at different times the formulae NI_3, NHI_2, NH_2I, $N_2H_3I_3$, &c., these varying results being due to the impurities in the substance, owing to the different investigators working under unsuitable conditions, and also to the decomposing action of light. F. D. Chattaway determined its composition as $N_2H_3I_3$, by the addition of excess of standard sodium sulphite solution, in the dark, and subsequent titration of the excess of the sulphite with standard iodine. The constitution has been definitely determined by O. Silberrad (*Jour. of Chem. Soc.*, 1905, lxxxvii. p. 55) by the interaction of nitrogen iodide with zinc ethyl, the products of the reaction being triethylamine and ammonia; the ammonia liberated was absorbed in hydrochloric acid, and 95% of the theoretical amount of the ammonium chloride was obtained. On these grounds O. Silberrad assigns the formula $NH_3\cdot NI_3$ to the compound and explains the decomposition as taking place, $2NH_3 \cdot NI_3 + 6Zn(C_2H_5)_2 = 6ZnC_2H_5 \cdot I + 2NH_3 + 2N(C_2H_5)_3$. The hydrogen in ammonia is capable of replacement by metals, thus magnesium burns in the gas with the formation of magnesium nitride Mg_3N_2, and when the gas is passed over heated sodium or potassium, sodamide, $NaNH_2$, and potassamide, KNH_2, are formed.

One of the most characteristic properties of ammonia is its power of combining directly with acids to form salts; thus with hydrochloric acid it forms ammonium chloride (sal-ammoniac); with nitric acid, ammonium nitrate, &c. It is to be noted that H. B. Baker (*Journal of Chem. Soc.*, 1894, lxv. p. 612) has shown that perfectly dry ammonia will not combine with perfectly dry hydrochloric acid, moisture being necessary to bring about the reaction. The aqueous solution of ammonia is very basic in its reactions, and since it is a weak electrolyte, one must assume the solution to contain a certain amount of ammonium hydroxide NH_4OH, although it is probably chiefly composed of a solution of ammonia in water. (On the constitution of aqueous ammonia solutions see also Carl Frenzel, *Zeit für angew. Chemie*, xxxii. 3, p. 319.) Ammonia finds a wide application in organic chemistry as a synthetic reagent; it reacts with alkyl iodides to form amines (*q.v.*), with esters to form acid amides (*q.v.*), with halogen fatty acids to form amino-acids; while it also combines with isocyanic esters to form alkyl ureas and with the mustard oils to form alkyl thioureas. Aldehydes also combine directly with ammonia.

Liquid ammonia possesses strong ionizing powers, and solutions of salts in liquid ammonia have been much studied. For details see E. C. Franklin and C. A. Kraus, *Amer. Chem. Jour.*, 1899, xxi. p. 8; 1900, xxiv. p. 83; 1902, xxviii. p. 277; also Carl Frenzel, *Zeits für Elektrochemie*, 1900, vi. p. 477.

The salts produced by the action of ammonia on acids are known as the ammonium salts and all contain the compound radical ammonium (NH_4). Numerous attempts have been made to isolate this radical, but so far none have been successful. By the addition of sodium amalgam to a concentrated solution of ammonium chloride, the so-called ammonium amalgam is obtained as a spongy mass which floats on the surface of the liquid; it decomposes readily at ordinary temperatures into ammonia and hydrogen; it does not reduce silver and gold salts, a behaviour which distinguishes it from the amalgams of the alkali metals, and for this reason it is regarded by some chemists as being merely mercury inflated by gaseous ammonia and hydrogen. M. le Blanc has shown, however, that the effect of ammonium amalgam on the magnitude of polarization of a battery is comparable with that of the amalgams of the alkali metals.

Many of the ammonium salts are made from the ammoniacal liquor of gas-works, by heating it with milk of lime and then absorbing the gas so liberated in a suitable acid. (See GAS: *Manufacture*.)

Ammonium bromide, NH_4Br, can be prepared by the direct action of bromine on ammonia. It crystallizes in colourless prisms, possessing a saline taste; it sublimes on heating and is easily soluble in water. On exposure to air it gradually assumes a yellow colour and becomes acid in its reaction.

Ammonium chloride, NH_4Cl. (See SAL-AMMONIAC.)

Ammonium fluoride, NH_4F, may be obtained by neutralizing ammonia with hydrofluoric acid. It crystallizes in small prisms, having a sharp saline taste, and is exceedingly soluble in water. It decomposes silicates on being heated with them.

Ammonium iodide, NH_4I, can be prepared by the action of hydriodic acid on ammonia. It is easily soluble in water, from which it crystallizes in cubes, and also in alcohol. It gradually turns yellow on standing in moist air, owing to decomposition with liberation of iodine.

Ammonium chlorate, NH_4ClO_3, is obtained by neutralizing chloric acid with either ammonia or ammonium carbonate, or by precipitating barium, strontium or calcium chlorates with ammonium carbonate. It crystallizes in small needles, which are readily soluble in water, and on heating, decompose at about 102° C., with liberation of nitrogen, chlorine and oxygen. It is soluble in dilute aqueous alcohol, but insoluble in strong alcohol.

Ammonium carbonates. The commercial salt is known as sal-volatile or salt of hartshorn and was formerly obtained by the dry distillation of nitrogenous organic matter such as hair, horn, decomposed urine, &c., but is now obtained by heating a mixture of sal-ammoniac, or ammonium sulphate and chalk, to redness in iron retorts, the vapours being condensed in leaden receivers. The crude product is refined by sublimation, when it is obtained as a white fibrous mass, which consists of a mixture of hydrogen ammonium carbonate, $NH_4 \cdot HCO_3$, and ammonium carbamate, NH_2COONH_4, in molecular proportions; on account of its possessing this constitution it is sometimes called ammonium sesquicarbonate. It possesses a strong ammoniacal smell, and on digestion with alcohol the carbamate is dissolved and a residue of ammonium bicarbonate is left; a similar decomposition taking place when the sesquicarbonate is exposed to air. Ammonia gas passed into a strong aqueous solution of the sesquicarbonate converts it into normal ammonium carbonate, $(NH_4)_2CO_3$, which can be obtained in the crystalline condition from a solution prepared at about 30° C. This compound on exposure to air gives off ammonia and passes back to ammonium bicarbonate.

Ammonium bicarbonate, $NH_4 \cdot HCO_3$, is formed as shown above and also by passing carbon dioxide through a solution of the normal compound, when it is deposited as a white powder, which has no smell and is only slightly soluble in water. The aqueous solution of this salt liberates carbon dioxide on exposure to air or on heating, and becomes alkaline in reaction. The aqueous solutions of all the carbonates when boiled undergo decomposition with liberation of ammonia and of carbon dioxide.

Ammonium nitrate, NH_4NO_3, is prepared by neutralizing nitric acid with ammonia, or ammonium carbonate, or by double decomposition between potassium nitrate and ammonium sulphate. It can be obtained in three different crystalline forms, the transition points of which are 35° C., 83° C. and 125° C. It is easily soluble in water, a considerable lowering of temperature taking place during the operation; on this account it is sometimes used in the preparation of freezing mixtures. On gentle heating, it is decomposed into water and nitrous oxide. P. E. M. Berthelot in 1883 showed that if ammonium nitrate be rapidly heated the following reaction takes place with explosive violence:—$2NH_4NO_3 = 4H_2O + 2N_2 + O_2$.

Ammonium nitrite, NH_4NO_2, is formed by oxidizing ammonia with ozone or hydrogen peroxide; by precipitating barium or lead nitrites with ammonium sulphate, or silver nitrite with ammonium chloride. The precipitate is filtered off and the solution concentrated. It forms colourless crystals which are soluble in water and decompose on heating, with the formation of nitrogen.

Ammonium phosphates. The normal phosphate, $(NH_4)_3PO_4$, is obtained as a crystalline powder, on mixing concentrated solutions of ammonia and phosphoric acid, or on the addition of excess of ammonia to the acid phosphate $(NH_4)_2HPO_4$. It is soluble in water, and the aqueous solution on boiling loses ammonia and the acid phosphate $NH_4H_2PO_4$ is formed. Diammonium hydrogen phosphate, $(NH_4)_2HPO_4$, is formed by evaporating a solution of phosphoric acid with excess of ammonia. It crystallizes in large transparent prisms, which melt on heating and decompose, leaving a residue of metaphosphoric acid, (HPO_3). Ammonium dihydrogen phosphate, $NH_4 \cdot H_2PO_4$, is formed when a solution of phosphoric acid is added to ammonia until the solution is distinctly acid. It crystallizes in quadratic prisms.

Ammonium sodium hydrogen phosphate, $NH_4 \cdot NaHPO_4 \cdot 4H_2O$. (See MICROCOSMIC SALT.)

Ammonium sulphate $(NH_4)_2SO_4$ is prepared commercially from the ammoniacal liquor of gas-works (see GAS: *Manufacture*) and is purified by recrystallization. It forms large rhombic prisms, has a somewhat saline taste and is easily soluble in water. The aqueous solution on boiling loses some ammonia and forms an acid sulphate. It is used largely as an artificial manure, and also for the preparation of other ammonium salts.

Ammonium persulphate $(NH_4)_2S_2O_8$ has been prepared by H. Marshall (*Jour. of Chem. Soc.*, 1891, lix. p. 777) by the method used for the preparation of the corresponding potassium salt (see SULPHUR). Pure specimens are difficult to obtain. It is very soluble in cold water, a large fall of temperature accompanying solution.

Ammonium sulphide, $(NH_4)_2S$, is obtained, in the form of micaceous crystals, by passing sulphuretted hydrogen mixed with a slight excess of ammonia through a well-cooled vessel; the hydrosulphide $NH_4 \cdot HS$ is formed at the same time. It dissolves readily in water, but is probably partially dissociated in solution. The *hydrosulphide* $NH_4 \cdot HS$ can be obtained as a white solid, by mixing well-cooled ammonia with a slight excess of sulphuretted hydrogen. According to W. P. Bloxam (*Jour. of Chem. Soc.*, 1895, lxvii. p. 283), if sulphuretted hydrogen is passed into strong aqueous ammonia at ordinary temperature, the compound $(NH_4)_2S \cdot 2NH_4HS$ is obtained, which, on cooling to 0° C. and passing more sulphuretted hydrogen, forms the compound $(NH_4)_2S \cdot 12NH_4HS$. An ice-cold solution of this substance kept at 0° C. and having sulphuretted hydrogen continually passed through it gives the hydrosulphide. Several complex polysulphides of ammonium have been isolated, for details of which see Bloxam's paper quoted above. Compounds are known which may be looked upon as derived from ammonia by the replacement of its hydrogen by the sulpho-group (HSO_3); thus potassium ammon-trisulphonate, $N(SO_3K)_3 \cdot 2H_2O$, is obtained as a crystalline precipitate on the addition of excess of potassium sulphite to a solution of potassium nitrite, $KNO_2 + 3K_2SO_3 + 2H_2O = N(SO_3K)_3 + 4KHO$. It can be recrystallized by solution in alkalies. On boiling with water, it is converted, first into the disulphonate $NH(SO_3K)_2$ thus, $N(SO_3K)_3 + H_2O = NH(SO_3K)_2 + KHSO_4$, and ultimately into the monosulphonate $NH_2 \cdot SO_3K$. The disulphonate is more readily obtained by moistening the nitrilosulphonate with dilute sulphuric acid and letting it stand for twenty-four hours, after which it is recrystallized from dilute ammonia. It forms monosymmetric crystals which by boiling with water yield amidosulphonic acid. (See also E. Divers, *Jour. of Chem. Soc.*, 1892, lxi. p. 943.) Amidosulphonic acid crystallizes in prisms, slightly soluble in water, and is a stable compound.

Ammonia and ammonium salts can be readily detected, in very minute traces, by the addition of *Nessler's solution*, which gives a distinct yellow coloration in the presence of the least trace of ammonia or ammonium salts. Larger quantities can be detected by warming the salts with a caustic alkali or with quicklime, when the characteristic smell of ammonia will be at once apparent. The amount of ammonia in ammonium salts can be estimated quantitatively by distillation of the salts with sodium or potassium hydroxide, the ammonia evolved being absorbed in a known volume of standard sulphuric acid and the excess of acid then determined volumetrically; or the ammonia may be absorbed in hydrochloric acid and the ammonium chloride so formed precipitated as ammonium chlorplatinate, $(NH_4)_2PtCl_6$.

AMMONIACUM, or GUM AMMONIAC, a gum-resin exuded from the stem of a perennial herb (*Dorema ammoniacum*), natural order Umbelliferae. The plant grows to the height of 8 or 9 ft., and its whole stem is pervaded with a milky juice, which oozes out on an incision being made at any part. This juice quickly hardens into round tears, forming the "tear ammoniacum" of commerce. "Lump ammoniacum," the other form in which the substance is met with, consists of aggregations of tears, frequently incorporating fragments of the plant itself, as well as other foreign bodies. Ammoniacum has a faintly fetid, unpleasant odour, which becomes more distinct on heating; externally it possesses a reddish-yellow appearance, and when the tears or lumps are freshly fractured they exhibit a waxy lustre. It is chiefly collected in central Persia, and comes to the European market by way of Bombay. Ammoniacum is closely related to asafetida and galbanum (from which, however, it differs in yielding no umbelliferone) both in regard to the plant which yields it and its therapeutical effects. Internally it is used in conjunction with squills in bronchial affections; and in asthma and chronic colds it is found useful, but it has no advantages over a number of other substances of more constant and active properties (Sir Thomas Fraser). Only the "tear ammoniacum" is official.

African ammoniacum is the product of a plant said to be *Ferula tingitana*, which grows in North Africa; it is a dark coloured gum-resin, possessed of a very weak odour and a persistent acrid taste.

AMMONITES, or the "children of Ammon," a people of east Palestine who, like the Moabites, traced their origin to Lot, the nephew of the patriarch Abraham, and must have been regarded, therefore, as closely related to the Israelites and Edomites. Both the Ammonites and Moabites are sometimes spoken of under the common name of the children of Lot (Deut. ii. 19; Ps. lxxxiii. 8); and the whole history shows that they preserved throughout the course of their national existence a sense of the closest brotherhood. According to the traditions, the original territory of the two tribes was the country lying immediately on the east of the Dead Sea, and of the lower half of the Jordan, having the Jabbok for its northern boundary; and of this tract the Ammonites laid claim to the northern portion between the Arnon and the Jabbok, out of which they had expelled the Zamzummim (Judg. xi. 13; Deut. ii. 20 sqq.; cf. Gen. xiv. 5), though apparently it had been held, in part at least, conjointly with the Moabites, or perhaps under their supremacy (Num. xxi. 26, xxii. 1; Josh. xiii. 32). From this their original territory they had been in their turn expelled by Sihon, king of the Amorites, who was said to have been found by the Israelites, after their deliverance from Egypt, in possession of both Gilead and Bashan, that is, of the whole country on the left bank of the Jordan, lying to the north of the Arnon (Num. xxi. 13). By this invasion, as the Moabites were driven to the south of the Arnon, which formed their northern boundary from that time, so the Ammonites were driven out of Gilead across the upper waters of the Jabbok where it flows from south to north, which henceforth continued to be their western boundary (Num. xxi. 24; Deut. ii. 37, iii. 16). The other limits of the *Ammonitis*, or country of the Ammonites (Ἀμμανῖτις χῶρα, 2 Mac. iv. 26), there are no means of exactly defining. On the south it probably adjoined the land of Moab; on the north it may have met that of the king of Geshur (Josh. xii. 5); and on the east it probably melted away into the desert peopled by Amalekites and other nomadic races.

The chief city of the country, called Rabbah, or Rabbath of the children of Ammon, *i.e.* the metropolis of the Ammonites (Deut. iii. 11), and Rabbathammana by the later Greeks (Polyb, v. 7. 4), whose name was changed into Philadelphia by Ptolemy Philadelphus, a large and strong city with an acropolis, was situated on both sides of a branch of the Jabbok, bearing at the present day the name of Nahr 'Ammān, the river of Ammon, whence the designation "city of waters" (2 Sam. xii. 27; see *Survey of E. Pal* (Pal. Explor. Fund), pp. 19 sqq. The ruins called Ammān by the natives are extensive and imposing. The country to the south and east of Ammān is distinguished by its fertility; and ruined towns are scattered thickly over it, attesting that it was once occupied by a population which, however fierce, was settled and industrious, a fact indicated also by the tribute of corn paid annually to Jotham (2 Chron. xxvii. 5).

The traditional history of Ammon as related in the Old Testament is not free from obscurity, due to the uncertain date of the various references and to the doubt whether the individual details belong to the particular period to which each is ascribed. (See further MOAB.) From the Assyrian inscriptions we learn that the Ammonite king *Ba'sa* (Baasha) (son) of Ruhubi, with 1000 men joined Ahab and the Syrian allies against Shalmaneser II. at the battle of Karkar in 854. In 734 their king Sanip(b)u was a vassal of Tiglathpileser IV., and his successor, P(b)udu-ilu, held the same position under Sennacherib and Esarhaddon. Somewhat later, their king Amminadab was among the tributaries who suffered in the course of the great Arabian campaign of Assurbanipal. With the neighbouring tribes, the Ammonites helped the Babylonian monarch Nebuchadrezzar against Jehoiakim (2 Kings xxiv. 2); and if they joined Zedekiah's conspiracy (Jer. xxvii. 3), and were threatened by the Babylonian army (Ezek. xxi. 20 sqq.), they do not appear to have suffered punishment at that period, perhaps on account of a timely submission. When, after the destruction of Jerusalem, the fugitive Jews were again gathered together, it was at the instigation of Baalis, king of Ammon, that Gedaliah, the ruler whom Nebuchadrezzar had appointed over them, was murdered, and new calamities were incurred (Jer. xl. 14); and when Nehemiah prepared to rebuild the walls of Jerusalem an Ammonite was foremost in opposition (Neh. ii. 10,19, iv. 1-3).[1] True to their antecedents, the Ammonites, with some of the neighbouring tribes, did their utmost to resist and check the revival of the Jewish power under Judas Maccabaeus (1 Macc. v. 6; cf. Jos. *Ant. Jud.* xii. 8. 1.). The last notice of them is in Justin Martyr (*Dial. cum Tryph.* § 119), where it is affirmed that they were still a numerous people. The few Ammonite names that have been preserved (Nahash, Hanun, and those mentioned above, Zelek in 2 Sam. xxiii. 37 is textually uncertain) testify, in harmony with other considerations, that their language was Semitic, closely allied to Hebrew and to the language of the Moabites. Their national deity was Molech or Milcon. (See MOLOCH.) (S. A. C.)

AMMONIUS GRAMMATICUS, the supposed author of a treatise entitled *Περὶ ὁμοίων καὶ διαφόρων λέξεων* (*On the Differences of Synonymous Expressions*), of whom nothing is known. He was formerly identified with an Egyptian priest who, after the destruction of the pagan temple at Alexandria (389), fled to Constantinople, where he became the tutor of the ecclesiastical historian Socrates. But it seems more probable that the real author was Herennius Philo of Byblus, who was born during the reign of Nero and lived till the reign of Hadrian, and that the treatise in its present form is a revision prepared by a later Byzantine editor, whose name may have been Ammonius.

Text by Valckenaer, 1739, Schäfer, 1822; Kopp, *De Ammonii . . . Distinctionibus Synonymicis*, 1883.

AMMONIUS HERMIAE (5th century A.D.), Greek philosopher, the son of Hermias or Hermeias, a fellow-pupil of Proclus. He taught at Alexandria, and had among his scholars Asclepius, John Philoponus, Damascius and Simplicius. His commentaries on Plato and Ptolemy are lost. Those on Aristotle are all that remain of his reputedly numerous writings. Of the commentaries we have—(1) one on the *Isagoge* of Porphyry (Venice, 1500 fol.); (2) one on the *Categories* (Venice, 1503 fol.), the authenticity of which is doubted by Brandis; (3) one on the *De Interpretatione* (Venice, 1503 fol.). They are printed in Brandis's scholia to Aristotle, forming the fourth volume of the Berlin *Aristotle*; they are also edited (1891–1899) in A. Busse's *Commentaria in Aristot. Graeca*. The special section on fate was published separately by J. C. Orelli, *Alex. Aphrod., Ammonii, et aliorum de Fato quae supersunt* (Zürich, 1824). A life of Aristotle, ascribed to Ammonius, but with more accuracy to John Philoponus, is often prefixed to editions of Aristotle. It has been printed separately, with Latin translation and scholia, at Leiden, 1621, at Helmstadt, 1666, and at Paris, 1850. Other commentaries on the *Topics* and the first six books of the *Metaphysics* still exist in manuscript. Of the value of the logical writings of Ammonius there are various opinions. K. Prantl speaks of them with great, but hardly merited, contempt.

For a list of his works see J. A. Fabricius, *Bibliotheca Graeca*, v. 704-707; C. A. Brandis, *Über d. Reihenf. d. Bücher d. Aristot. Org.*, 283 f.; K. Prantl, *Gesch. d. Logik*, i. 642.

AMMONIUS SACCAS (3rd century A.D.), Greek philosopher of Alexandria, often called the founder of the neo-Platonic school. Of humble origin, he appears to have earned a livelihood as a porter; hence his nickname of "Sack-bearer" (*Σακκᾶς*, for *σακκοφόρος*). The details of his life are unknown, insomuch that he has frequently been confused with a Christian philosopher of the same name. Eusebius (*Church History*, vi. 19), who is followed by Jerome, asserts that he was born a Christian, remained faithful to Christianity throughout his life, and even produced two works called *The Harmony of Moses and Jesus* and *The Diatessaron, or Harmony of the Four Gospels*, which is said by some to exist in a Latin version by Victor, bishop of Capua. Porphyry, quoted by Eusebius, *ib.* vi. 19. 6, however, says that he apostatized in later life and left no writings behind him. There seems no reason, therefore, to doubt that Eusebius is here referring to the Christian philosopher. After long study and meditation, Ammonius opened a school of philosophy in Alexandria. His principal pupils were Herennius, the two Origens, Cassius Longinus and Plotinus. As he designedly wrote nothing, and, with the aid of his pupils, kept his views secret, after the manner of the Pythagoreans, his philosophy must be inferred mainly from the writings of Plotinus. As Zeller points out, however, there is reason to think that his doctrines were rather those of the earlier Platonists than those of Plotinus. Hierocles, writing in the 5th century A.D., states that his fundamental doctrine was an eclecticism, derived from a critical study of Plato and Aristotle. His admirers credited him with having reconciled the quarrels of the two great schools. His death is variously given between A.D. 240 and 245. See NEO-PLATONISM ORIGEN.

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AMMUNITION, a military term (derived, through the French, from Lat. *munire*, to provide), for consumable stores used in attack or defence, such as rifle cartridges, cartridges, projectiles, igniting tubes and primers for ordnance, &c.

The components of ammunition intended for rifles and ordnance may be divided into (*a*) explosives and propellants (see EXPLOSIVES and GUNPOWDER), (*b*) projectiles of all kinds, and (*c*) cartridges. The military classification of explosives differs somewhat from that of the Explosives Act 1875, but, broadly speaking, they are divided into two groups. The first of these comprises explosives in bulk, made-up cartridges for cannon, and filled quick-firing cartridges; Group II. contains small-arm cartridges, fuzes, primers, tubes, filled shells (fuzed or unfuzed), &c. Each group is subdivided, and arrangements are made for storing certain divisions of Group I. in a magazine in separate compartments. All the divisions of Group II. are, and the remaining divisions of Group I. (comprising wet gun-cotton, picric acid and Q.F. cartridges) may be, stored in ammunition stores.

These general conditions apply to the *storage of ammunition in fortresses*. Here the positions for the magazine and ammunition stores are so chosen as to afford the best means of protection from an enemy's fire. Huge earth parapets cover these buildings, which are further strengthened, where possible, by traverses protecting the entrances. For the purpose of filling, emptying and examining cannon cartridges and shell, a laboratory is generally provided at some distance from the magazine. The various stores for explosives are classified into those under magazine conditions (viz. magazines, laboratories and cartridge stores) and those with which these restrictions need not be observed (viz. ammunition and shell stores). The interior walls of a magazine are lined and the floors laid so that there may be no exposed iron or steel. At the entrance there is a lobby or barrier, inside which persons about to enter the magazine change their clothes for a special suit, and their boots for a pair made without nails. In an ammunition or shell store these precautions need not be taken except where the shell store and the adjacent cartridge store have a common entrance; persons entering may do so in their ordinary clothes. A large work may have a main magazine and several subsidiary magazines, from which the stock of cartridges is renewed in the cartridge stores attached to each group of guns or in the expense cartridge stores and cartridge recesses. The same applies to main ammunition stores which supply the shell stores, expense stores and recesses.

The supply of ammunition may be divided roughly into (*a*) that for guns forming the movable armament, (*b*) that for guns placed in permanent positions. The movable armament will consist of guns and howitzers of small and medium calibre, and it is necessary to arrange suitable expense cartridge stores and shell stores in close proximity to the available positions. They can generally be constructed to form part of the permanent work in the projected face of traverses or other strong formations, and should be arranged for a twenty-four hours' supply of ammunition. These stores are refilled from the main magazine every night under cover of darkness. Light railways join the various positions. The guns mounted in permanent emplacements are divided into groups of two or three guns each, and usually each group will require but one calibre of ammunition. A cartridge store, shell store and a general store, all well ventilated, are arranged for the especial service of such a group of guns. In the cartridge store the cylinders containing the cartridges are so placed and labelled that the required charge, whether reduced or full, can be immediately selected. In the shell store also for the same reason the common shell are separated from the armour-piercing or shrapnel. Each nature of projectile is painted in a distinctive manner to render identification easy. The fuzes, tubes, &c., are placed in the general store with the tools and accessories belonging to the guns. The gun group is distinguished by some letter and the guns of the group by numerals; thus, $\frac{A}{1}$ is No. 1 gun of group A. The magazine and shell stores are also indicated by the group letter, and so that mistakes, even by those unaccustomed to the fort, may be avoided, the passages are pointed out by finger posts and direction boards. For the immediate service of each gun a few cartridges and projectiles are stored in small receptacles—called cartridge and shell recesses respectively—built in the parapet as near the gun position as practicable. In some cases a limited number of projectiles may be placed close underneath the parapet if this is conveniently situated near the breech of the gun and not exposed to hostile fire.

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[1] The allusions in Jer. xlix. 1-6; Zeph. ii. 8-11; Ezek. xxi. 28-32; Judg. xi. 12-28, have been taken to refer to an Ammonite occupation of Israelite territory after the deportation of the east Jordanic Israelites in 734, but more probably belong to a later event. The name Chephar-Ammoni (in Benjamin; Josh. xviii. 24) seems to imply that the "village" became a settlement of "Ammonites." Some light is thrown upon the obscure history of the post-exile period by the references to the mixed marriages which aroused the reforming zeal of Ezra and culminated in the exclusion of Ammon and Moab from the religious community—on the ground of incidents which were ascribed to the time of the "exodus" (Deut. xxiii. 3 sqq.; Ezr. ix. 1 sqq.; Neh. xiii. 1 sqq.).

In order to supply the ammunition sufficiently rapidly for the efficient service of modern guns, hydraulic, electric or hand-power hoists are employed to raise the cartridges and shell from the cartridge store and shell store to the gun floor, whence they are transferred to a derrick or loading tray attached to the mounting for loading the gun.

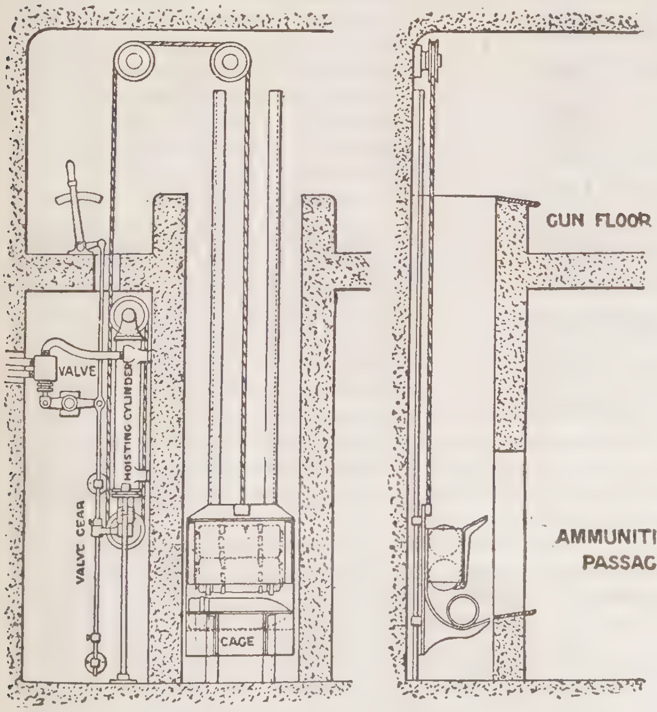

FIG. 1.—Ammunition Hoist.

Projectiles for B.L. guns above 6-in. calibre are stored in shell stores ready filled and fuzed standing on their bases, except shrapnel and high-explosive shell, which are fuzed only when about to be used. Smaller sizes of shells are laid on their sides in layers, each layer pointing in the opposite direction to the one below to prevent injury to the driving bands. Cartridges are stored in brass corrugated cases or in zinc cylinders. The corrugated cases are stacked in layers in the magazine with the mouth of the case towards a passage between the stacks, so that it can be opened and the cartridges removed and transferred to a leather case when required for transport to the gun. Cylinders are stacked, when possible, vertically one above the other. The charges are sent to the gun in these cylinders, and provision is made for the rapid removal of the empty cylinders.

The number and nature of rounds allotted to any fortress depends on questions of policy and location, the degrees of resistance the nature of the works and *personnel* could reasonably be expected to give, and finally on the nature of the armament. That is to say, for guns of large calibre three hundred to four hundred rounds per gun might be sufficient, while for light Q.F. guns it might amount to one thousand or more rounds per gun. (A. G. H.)

Supply of ammunition in the field.

With every successive improvement in military arms there has necessarily been a corresponding modification in the method of supplying ammunition and in the quantity required to be supplied. When hand-to-hand weapons were the principal implements of battle, there was, of course, no such need, but even in the middle ages the archers and crossbowmen had to replenish the shafts and bolts expended in action, and during a siege stone bullets of great size, as well as heavy arrows, were freely used. The missiles of those days were, however, interchangeable, and at the battle of Towton (1461) the commander of the Yorkist archers, by inducing the enemy to waste his arrows, secured a double supply of ammunition for his own men. This interchangeability of war material was even possible for many centuries after the invention of firearms. At the battle of Liegnitz (1760) a general officer was specially commissioned by Frederick the Great to pack up and send away, for Prussian use, all the muskets and ammunition left on the field of battle by the defeated Austrians. Captured material is, of course, utilized whenever possible, at the present time, and in the Chino-Japanese War the Japanese went so far as to prepare beforehand spare parts for the Chinese guns they expected to capture (Wei-Hai-Wei, 1895), but it is rare to find a modern army trusting to captures for arms and ammunition; almost the only instance of the practice is that of the Chilean civil war of 1891, in which the army of one belligerent was almost totally dependent upon this means of replenishing stores of arms and cartridges. But what was possible with weapons of comparatively rough make is no longer to be thought of in the case of modern arms. The Lee-Metford bullet of ·303 in. diameter can scarcely be used in a rifle of smaller calibre, and in general the minute accuracy of parts in modern weapons makes interchangeability almost impossible. Further, owing to the rapidity with which, in modern arms, ammunition is expended, and the fact that, as battles are fought at longer ranges than formerly, more shots have to be fired in order to inflict heavy losses, it is necessary that the reserves of ammunition should be as close as possible to the troops who have to use them. This was always the case even with the older firearms, as, owing to the great weight of the ammunition, the soldier could carry but few rounds on his person. Nevertheless it is only within the past seventy years that there has grown up the elaborate system of ammunition supply which now prevails in all regularly organized armies. That which is described in the present article is the British, as laid down in the official *Combined Training* (1905) and other manuals. The new system designed for stronger divisions, and others, vary only in details and nomenclature.

Infantry.—The infantry soldier generally carries, in pouches, bandoliers, &c., one hundred rounds of small-arms ammunition (S.A.A.), and it is usual to supplement this, when an action is imminent, from the regimental reserve (see below). It is to be noticed that every reduction in the calibre of the rifle means an increase in the number of rounds carried. One hundred rounds of the Martini-Henry ammunition weighed 10lb 10 oz.; the same weight gives 155 with ·303 ammunition (incl. charges), and if a ·256 calibre is adopted the number of rounds will be still greater. It is, relatively, a matter of indifference that the reserves of ammunition include more rounds than formerly; it is of the highest importance that the soldier should, as far as possible, be independent of fresh supplies, because the bringing up of ammunition to troops closely engaged is laborious and costly in lives. The *regimental reserves* are carried in S.A.A. carts and on pack animals. Of the former each battalion has six, of the latter eight. The six carts are distributed, one as reserve to the machine gun, three as reserve to the battalion itself, and two as part of the *brigade reserve*, which consists therefore of eight carts. The brigade reserve communicates directly with the brigade ammunition columns of the artillery (see below). The eight pack animals follow the eight companies of their battalion. These, with two out of the three battalion carts, endeavour to keep close to the firing line, the remaining cart being with the reserve companies. Men also are employed as carriers, and this duty is so onerous that picked men only are detailed. Gallantry displayed in bringing up ammunition is considered indeed to justify special rewards. The amount of S.A.A. in regimental charge is 100 rounds in the possession of each soldier, 2000 to 2200 on each pack animal, and 16,000 to 17,600 in each of four carts, with, in addition, about 4000 rounds with the machine gun and 16,000 more in the fifth cart.

Artillery.—The many vehicles which accompany batteries (see ARTILLERY) carry a large quantity of ammunition, and with the contents of two wagons and the limber each gun may be considered as well supplied, more especially as fresh rounds can be brought up with relatively small risk, owing to the long range at which artillery fights and the use of cover. Each brigade of artillery has its own *ammunition column*, from which it draws its reserve in the first instance.

Ammunition Columns.—An ammunition column consists of military vehicles carrying gun and S.A. ammunition for the combatant unit to which the column belongs. Thus the ammunition columns of a division, forming part of the brigades of field artillery, carry reserve ammunition for the guns, the machine guns of the infantry and the rifles of all arms. Generally speaking, the ammunition column of each of the artillery brigades furnishes spare ammunition for its own batteries and for one of the brigades of infantry. All ammunition columns are officered and manned by the Royal Artillery. They are not reserved exclusively to their own brigades, divisions, &c., but may be called upon to furnish ammunition to any unit requiring it during an action. The officers and men of the R.A. employed with the ammunition column are, as a matter of course, immediately available to replace casualties in the batteries. Teams, wagons and *matériel* generally are also available for the same purpose. The horse artillery, howitzer and heavy brigades of artillery have each their own ammunition columns, organized in much the same way and performing similar duties. The ammunition column of the heavy brigade is divisible into three sections, so that the three batteries, if operating independently, have each a section at hand to replenish the ammunition expended. The horse artillery brigade ammunition columns carry, besides S.A.A. for all corps troops other than artillery, the reserve of pom-pom ammunition. In action these columns are on the battlefield itself. Some miles to the rear are the divisional and corps troops columns, which on the one hand replenish the empty wagons of the columns in front, and on the other draw fresh supplies from the depots on the line of communication. These also are in artillery charge; a divisional column is detailed to each division (*i.e.* to replenish each set of brigade ammunition columns), and the corps troops column supplies the columns attached to the heavy, howitzer and horse artillery brigades. The ammunition thus carried includes ordinarily seven or eight kinds at least. S.A.A., field, horse, howitzer and heavy gun shrapnel, howitzer and heavy gun lyddite shells, cartridges for the four different guns employed and pom-pom cartridges for the cavalry,—in all twelve distinct types of stores would be carried for a complete army corps. Consequently the rounds of each kind in charge of each ammunition column must vary in accordance with the work expected of the combatant unit to which it belongs. Thus pom-pom ammunition is out of place in the brigade ammunition columns of field artillery, and S.A.A. is relatively unnecessary in that attached to a heavy artillery brigade. Under these circumstances a column may be unable to meet the particular wants of troops engaged in the vicinity; for instance, a cavalry regiment would send in vain to a heavy artillery ammunition section for pom-pom cartridges. The point to be observed in this is that the fewer the natures of weapons used, the more certain is the ammunition supply. (C. F. A.)

Shot.

The first projectiles fired from cannon were the darts and stone shot which had been in use with older weapons. These darts ("garros") had iron heads or were of iron wrapped with leather to fit the bore of small guns, and continued in use up to nearly the end of the 16th century. Spherical stone shot were chosen on account of cheapness; forged iron, bronze and lead balls were tried, but the expense prevented their general adoption. Further, as the heavy metal shot necessitated the use of a correspondingly large propelling charge, too great a demand was made on the strength of the feeble guns of the period. Stone shot being one-third the weight of those of iron the powder charge was reduced in proportion, and this also effected an economy. Both iron and stone shot were occasionally covered with lead, probably to preserve the interior of the bore of the gun. Cast iron, while known in the 14th century, was not sufficiently common to be much used for the manufacture of shot, although small ones were made about that time. They were used more frequently at the latter part of the following century. Towards the end of the 16th century nearly all shot were of iron, but stone shot were still used with guns called Petrieroes (hence the name) or Patararoes, for attacking weak targets like ships at short range.

Case shot are very nearly as ancient as spherical shot. They can be traced back to the early part of the 15th century, and they have practically retained their original form up to the present date. They are intended for use at close quarters when a volley of small shot is required. With field guns they are not of much use at ranges exceeding about four hundred yards; those for heavy guns are effective up to one thousand yards. In the earlier forms lead or iron shot were packed in wood casks or in canvas bags tied up with twine like the later quilted shot. In the present (fig. 2) type small shot are placed in a cylindrical case of sheet iron, with iron ends, one end being provided with handles. For small guns the bullets are made of lead and antimony—like shrapnel bullets—while for larger calibres they are of cast iron weighing from two ounces to three and a half pounds each.

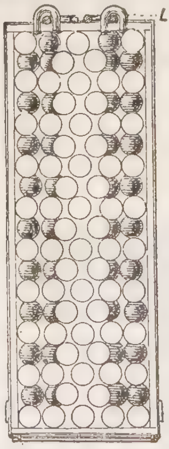

FIG. 2.—Case Shot.

Grape shot is now obsolete. It consisted generally of three tiers of cast-iron balls separated by iron plates and held in place by an iron bolt which passed through the centre of the plates.

There was also another type called *quilted shot* which consisted of a number of small shot in a canvas covering tied up by rope. *Chain shot*, in the days of sailing ships, was much in favour as a means of destroying rigging. Two spherical shot were fastened together by a short length of chain. On leaving the gun they began gyrating around each other and made a formidable missile.

Red-hot shot were invented in 1579 by Stephen Batory, king of Poland. They were used with great effect by the English during the siege of Gibraltar, especially on the 13th of September 1782, when the French floating batteries were destroyed, together with a large part of the Spanish fleet. *Martin's shell* was a modified form; here a cast-iron shell was filled with molten cast iron and immediately fired. On striking the side of a ship the shell broke up, freeing the still molten iron, which set fire to the vessel.

Rotation.—Projectiles intended for R.M.L. guns were at first fitted with a number of gun-metal studs arranged around them in a spiral manner corresponding to the twist of rifling. This was defective, as it allowed, as in the old smooth-bore guns, the powder gas to escape by the clearance (called "windage") between the projectile and the bore, with a consequent loss of efficiency; it also quickly eroded the bore of the larger guns. Later the rotation was effected by a cupped copper disc called a "gas check" attached to the base end of the projectile. The powder gas pressure expanded the rim of the gas check into the rifling grooves and prevented the escape of gas; it also firmly fixed the gas check to the projectile, thus causing it to rotate. A more regular and efficient action of the powder gas was thus ensured, with a corresponding greater range and an improvement in accuracy. With the earlier Armstrong (R.B.L.) guns the projectiles were coated with lead (the late Lord Armstrong's system), the lead being forced through the rifling grooves by the pressure of the exploded powder gas. The lead coating is, however, too soft with the higher velocities of modern B.L. guns. Mr Vavasseur, C.B., devised the plan of fitting by hydraulic pressure a copper "driving band" into a groove cut around the body of the projectile. This is now universal. It not only fulfils the purpose of rotating the projectile, but renders possible the use of large charges of slow-burning explosive. The copper band, on being forced through the gun, gives rise to considerable resistance, which allows the propelling charge to burn properly and thus to exert its enormous force on the projectile.

The laws which govern the designs of projectiles are not well defined. Certain formulae are used which give the thickness of the walls of the shell for a known chamber pressure in the gun, and for a particular stress on the material of the shell. The exact proportions of the shell depend, however, greatly on experimental knowledge.

Armour-piercing Shot and Shell.—On the introduction of iron ships it was found that the ordinary cast-iron projectile readily pierced the thin plating, and in order to protect the vital parts of the vessel wrought-iron armour of considerable thickness was placed on the sides. It then became necessary to produce a projectile which would pierce this armour. This was effected by Sir W. Palliser, who invented a method of hardening the head of the pointed cast-iron shot. By casting the projectile point downwards and forming the head in an iron mould, the hot metal was suddenly chilled and became intensely hard, while the remainder of the mould being formed of sand allowed the metal to cool slowly and the body of the shot to be made tough.

These shot proved very effective against wrought-iron armour, but were not serviceable against compound and steel armour. A new departure had, therefore, to be made, and forged steel shot with points hardened by water, &c., took the place of the Palliser shot. At first these forged steel shot were made of ordinary carbon steel, but as armour improved in quality the projectiles followed suit, and, for the attack of the latest type of cemented steel armour, the projectile is formed of steel—either forged or cast—containing both nickel and chromium. Tungsten steel has also been used with success.

Armour-piercing shot or shell are generally cast from a special mixture of chrome steel melted in pots; they are afterwards forged into shape. The shell is then thoroughly annealed, the core bored and the exterior turned up in the lathe. The shell is finished in a similar manner to others described below. The final or tempering treatment is very important, but details are kept strictly secret. It consists in hardening the head of the projectile and tempering it in a special manner, the rear portion being reduced in hardness so as to render it tough. The cavity of these projectiles is capable of receiving a small bursting charge of about 2 % of the weight of the complete projectile, and when this is used the projectile is called an *armour-piercing shell.* The shell, whether fuzed or unfuzed, will burst on striking a medium thickness of armour. Armour-piercing shells, having a bursting charge of about 3 % of the weight of the complete projectile, are now often fitted with a soft steel cap (fig. 3) for the perforation of hard steel armour. For the theory of the action of the cap see Armour Plates.

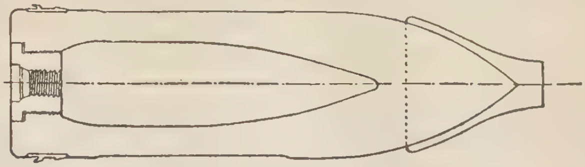

Fig. 3.—Capped A.P. Shell.

Even with these improvements the projectile cannot, with a reasonable velocity, be relied upon to pierce one calibre in thickness of modern cemented steel armour.

Shell.

Explosive shells do not appear to have been in general use before the middle of the 16th century. About that time hollow balls of stone or cast iron were fired from mortars. The balls were nearly filled with gunpowder and the remaining space with a slow-burning composition. This plan was unsatisfactory, as the composition was not always ignited by the flash from the discharge of the gun, and moreover the amount of composition to burn a stipulated time could not easily be gauged. The shell was, therefore, fitted with a hollow forged iron or copper plug, filled with slow-burning powder. It was impossible to ignite with certainty this primitive fuze simply by firing the gun; the fuze was consequently first ignited and the gun fired immediately afterwards. This entailed the use of a mortar or a very short piece, so that the fuze could be easily reached from the muzzle without unduly endangering the gunner. Cast-iron spherical common shell (fig. 4) were in use up to 1871. For guns they were latterly fitted with a wooden disc called a *sabot*, attached by a copper rivet, intended to keep the fuze central when loading. They were also supposed to reduce the rebounding tendency of the shell as it travelled along the bore on discharge. Mortar shell (fig. 5) were not fitted with sabots.

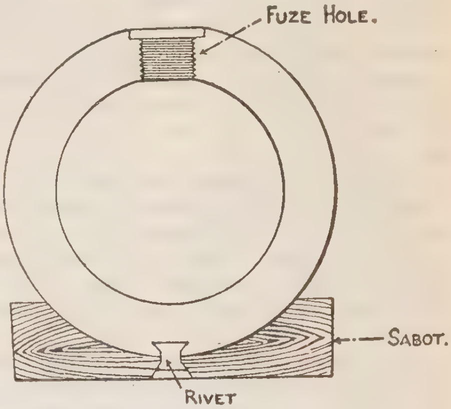

Fig. 4.—Spherical Common Shell.

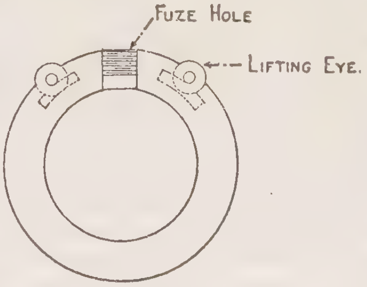

Fig. 5.—Mortar Shell.

Cast iron held its own as the most convenient material for projectiles up to recent years, steel supplanting it, first for projectiles intended for piercing armour, and afterwards for common shell for high-velocity guns where the shock of discharge has been found too severe for cast iron.

Common shell is essentially a material destructor. Filled with ordinary gunpowder, the larger natures are formidable projectiles for the attack of fortifications and the unarmoured portions of warships. On bursting they break up into somewhat large pieces, which carry destruction forward to some distance from the point of burst. For the attack of buildings common shell are superior to shrapnel and they are used to attack troops posted behind cover where it is impossible for shrapnel to reach them; their effect against troops is, however, generally insignificant. When filled with lyddite, melinite, &c., they are called high-explosive (H.E.) shell (see below). Common shell for modern high-velocity guns may be made of cast steel or forged steel; those made of cast iron are now generally made for practice, as they are found to break up on impact, even against earthworks, before the fuze has time to act; the bursting charge is, therefore, not ignited or only ignited after the shell has broken up, the effect of the bursting charge being lost in either case. So long as the shell is strong enough to resist the shocks of discharge and impact against earth or thin steel plates, it should be designed to contain as large a bursting charge as possible and to break up into a large number of medium-sized pieces. Their effect between decks is generally more far-reaching than lyddite shell, but the purely local effect is less. Light structures, which, at a short distance from the point of burst, successfully resist lyddite shell and confine the effect of the explosion, may be destroyed by the shower of heavy pieces produced by the burst of a large common shell.

To prevent the premature explosion of the shell, by the friction of the grains of powder on discharge, it is heated and coated internally with a thick lacquer, which on cooling presents a smooth surface. Besides this the bursting charge of all shell of 4-in. calibre and upwards (also with all other natures except shrapnel) is contained in a flannel or canvas bag. The bag is inserted through the fuze hole and the bursting charge of pebble and fine grain powder gradually poured in. The shell is tapped on the outside by a wood mallet to settle the powder down. When all the powder has been got in, the neck of the bag is tied and pushed through the fuze hole. A few small shalloon primer bags, filled with seven drams of fine grain powder, are then inserted to fill up the shell and carry the flash from the fuze through the burster bag.

In the United States specially long common shell called *torpedo shell*, about 4·7 calibres in length, are employed with the coast artillery 12-in. mortars. They were made of cast steel, but owing to a premature explosion in a mortar, supposed to be due to weakness of the shell, they are now made of forged steel. The weight of the usual projectile for this mortar is 850 ℔. The torpedo shell, however, weighs 1000 ℔ and contains 137 ℔ of high explosive; it is not intended for piercing armour but for producing a powerful explosion on the armoured deck of a warship. The compression, and consequent generation of heat on discharge of the charge in these long shell, render them liable to premature explosion if fired with high velocities. Some inventors have, therefore, sought to overcome this by dividing the shell transversely into compartments and so making each portion of the charge comparatively short.

Cast-steel common shell (fig. 6) are cast in sand moulds head downwards from steel of the required composition to give the proper tenacity. A large head, which is subsequently removed, is cast on the base to give solidity and soundness to the castings. The castings are annealed by placing them in a furnace or oven until red hot, then allowing them to cool gradually. The process of casting is very similar to that for the old cast-iron common shell, which, however, were cast base downwards. The steel castings after being annealed are dressed and carefully examined for defects. The exterior of the body is generally ground by an emery wheel or turned in a lathe; the groove for the driving band is also turned and the fuze hole fitted with a gun-metal bush. Forged-steel common shell are made from solid steel billets. These are heated to redness and shaped by a series of punches which force the heated metal through steel dies by hydraulic pressure. If the shell is intended for a nose fuze the base end is shaped by the press and the head subsequently formed by a properly shaped die, or, in the case of small shell, the head can, when red hot, be spun up in a lathe by a properly formed tool. For a base fuze shell the head is produced by the punches and dies, and the base is subsequently formed by pressing in the metal to the desired shape. The shell is then completed as described above.

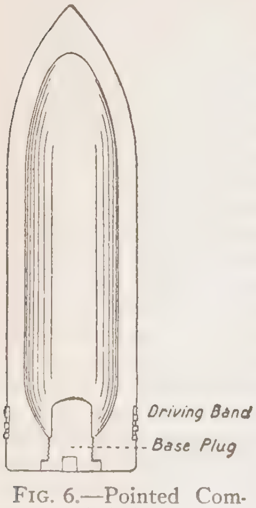

FIG. 6.—Pointed Common Shell (cast steel).

High-explosive shell (fig. 7), as used in the English service, are simply forged-steel common shell filled with lyddite and having a special nose fuze and exploder. The base end of lyddite shell is made solid to prevent the possibility of the gas pressure in the gun producing a premature explosion. In filling the shell great precautions are necessary to prevent the melted lyddite (picric acid) from coming in contact with certain materials such as combinations of lead, soda, &c., which produce sensitive picrates. The shell are consequently painted externally with a special non-lead paint and lacquered inside with special lacquer. The picric acid is melted in an oven, the temperature being carefully limited. The melted material is poured into the shell by means of a bronze funnel, which also forms the space for the exploder of picric powder. On cooling, the material solidifies into a dense, hard mass (density 1·6), in which state it is called *lyddite*. The fuze on striking ignites the exploder and in turn the lyddite. When properly detonated a dense black smoke is produced and the projectile is broken up into small pieces, some of which are almost of the fineness of grains of sand. The radius of the explosion is about 25 yds., but the local effect is intense, and hence on light structures in a confined space the destruction is complete. The shell is only of use against thin plates; against modern armour it is ineffective. When detonation has not been complete, as sometimes happens with small shells, the smoke is yellowish and the pieces of the exploded shell are as large as when a powder burster is used.

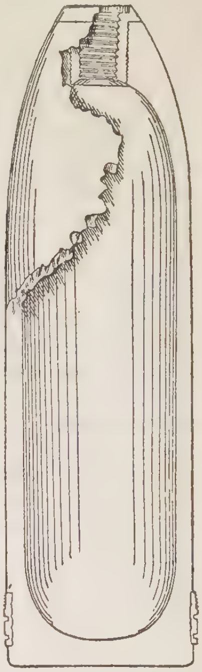

FIG. 7.—Lyddite Shell (forged steel).

The French high-explosive shell *obus torpille* or *obus à mélinite* was adopted in 1886. The *mélinite* was originally filled into the ordinary cast-iron common shell (*obus ordinaire*) with thick walls, but soon afterwards a forged-steel thin-walled shell (*obus allongé*) was introduced. To explode the shell a steel receptacle (called a *gaîne*) is screwed into the nose of the shell. It is filled with explosive and fitted with a detonator which is exploded by a percussion fuze. Except for the means adopted to ensure detonation this shell is practically the same as the lyddite shell.

Picric acid in some form or other is used in nearly all countries for filling high-explosive shell. In some the explosive is melted and poured into cardboard cases instead of being poured directly into the shell. The cases are placed in the shell either by the head of the shell unscrewing from the body or by a removable base plug. The French *mélinite* and the Italian *pertite* are believed to be forms of picric acid. Russia and the United States use compressed wet gun-cotton (density 1·2) as the charge for their high-explosive shell. The gun-cotton is packed in a thin zinc or copper case and is placed in the shell either by the head or base of the shell being removable. The gun-cotton is detonated by a powerful exploder, the form of which differs in each country. Ammonal is also used in high-explosive shell, but owing to its light density it is not in great favour. For field-gun and other small high-explosive shells, ordinary smokeless powder is often used.

Double shell is a term given to a common shell which was made abnormally long, so as to receive a large bursting charge. They were intended to be fired with a reduced charge at short range. They are now practically obsolete; their place with modern B.L. guns has been taken by high-explosive shell. *Star shell* are intended for illuminating the enemy's position. They are very similar to shrapnel shell, composition stars made up in cylindrical paper cases taking the place of the bullets. The shell on bursting, blows off the head and scatters the ignited stars. This shell is only supplied to mountain guns and howitzers, and takes the place of the older types of illuminating shell, viz. the *ground light ball* and the *parachute light ball.*

Hand grenades were used at the assault of entrenchments or in boat attacks. Although generally regarded as obsolete, they were much used by the Japanese at the siege of Port Arthur, 1904. In the British service they were small, thin, spherical common shell weighing 3 ℔ for land service and 6 ℔ for sea service, filled with powder. They were fitted with a small wood time fuze to burn 7·5 seconds. The grenade was held in the hand and the fuze lighted by a port-fire. It was then thrown some 20 to 30 yds. at the enemy's works or boats. Sometimes a number were fired from a mortar at an elevation of about 30° so that none should strike the ground too near the mortar. New types of grenades filled with high explosives detonated by a percussion fuze have been produced of late years, and it is probable that they will be again introduced into most countries.

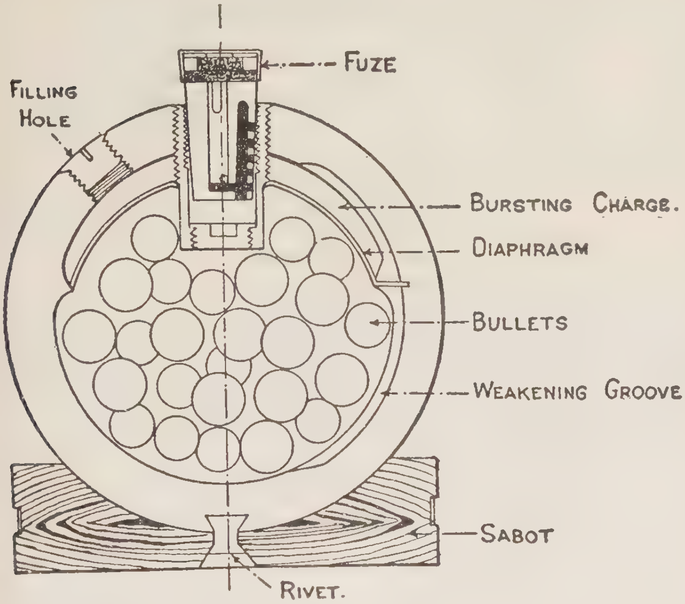

Fig. 8.—Boxer Shrapnel.

Shrapnel shell were invented by Lieutenant (afterwards Lieutenant-General) Henry Shrapnel, R.A. (1761–1842), in 1784. They were spherical common shell with lead bullets mixed with the bursting charge. Although far superior to common shell in man-killing effect, their action was not altogether satisfactory, as the shell on bursting projected the bullets in all directions, and there was a liability of premature explosion. In order to overcome these defects Colonel Boxer, R.A., separated the bullets from the bursting charge by a sheet-iron diaphragm—hence the name of "diaphragm shell" (fig. 8). The bullets were hardened by the addition of antimony, and, as the bursting charge was small, the shell was weakened by four grooves made inside the shell extending from the fuze hole to the opposite side.

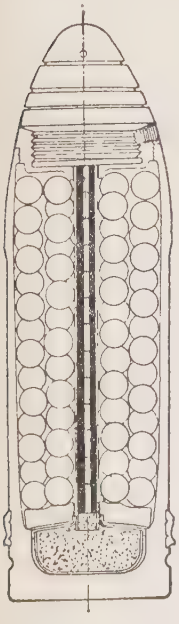

Fig. 9.—Shrapnel Shell.

With rifled guns the form of the shell altered, but its character remained. The body of the shell was still made of cast iron with a cavity at the base for the bursting charge; on this was placed a thick steel diaphragm with a hollow brass tube which communicated the flash from the nose fuze to the bursting charge. The body was filled with hard lead bullets, and a wood head covered with sheet iron or steel surmounted it and carried the fuze. By making the body of toughened steel (fig. 9) and by slightly reducing the diameter of the bullets, the number of bullets contained was much increased. In the older field shrapnel, bullets of 18 and 34 to the ℔ were used; for later patterns see table in Ordnance: *Field Equipments.* Thus with the cast-iron body the percentage of useful weight, *i.e.* the proportion of the weight of the bullets to the total weight of the shell, was from 26 to 28 %, while with modern steel shell it is from 47 to 53 %. The limit of the forward effect of shrapnel at effective range is about 300 yds. and the extent of front covered 25 yds.

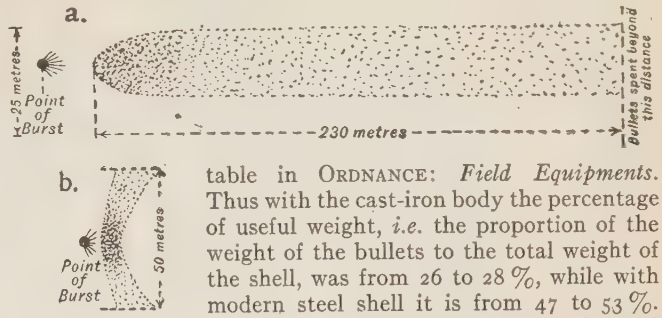

Fig. 10.

[Fig. 10 shows in plan the different effects of (*a*) shrapnel and of (*b*) high-explosive, burst in the air with a time fuze in the usual way. It will be seen that the shrapnel bullets sweep an area of about 250 yds. by 30 yds., half the bullets falling on the first 50 yds. of the beaten zone. With the high-explosive shell, however, the fragments strike the ground closer to the point of burst and beat a shallow, but broad, area of ground (about 7 yds. by 55 yds.). These areas show the calculated performance of the German field gun (96 N.A.), firing at a range of 3300 yds. In the case of the high-explosive shell, the concussion of the burst is highly dangerous, quite apart from the actual distribution of the fragments of the shell.]

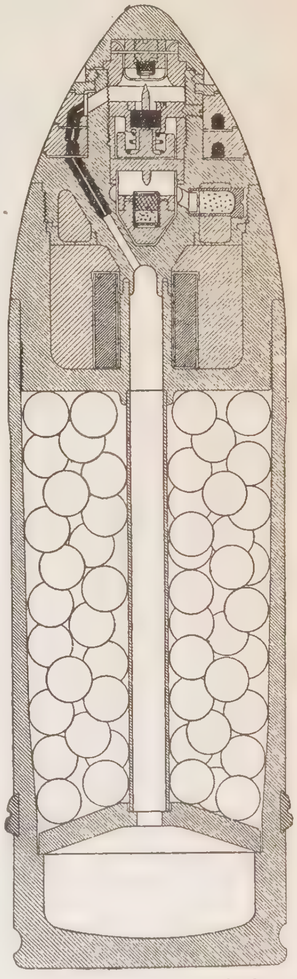

Fig. 11.—High-Explosive Shrapnel (Ehrhardt).

The term "*shooting shrapnel*" is given to certain howitzer shrapnel, which are designed to contain a large bursting charge for the purpose of considerably augmenting the velocity of the bullets when the shell bursts.

High-explosive shell of a compound type have also lately appeared. Messrs Krupp have made a kind of ring shell with a steel body; a central tube conveys the flash from the fuze to a base magazine containing a smoke-producing charge, while surrounding the central tube is a bursting charge of ordinary smokeless nitro-powder. A shrapnel on somewhat similar lines has been made by Ehrhardt; in form (fig. 11) it is an ordinary shrapnel with base burster, but near the head is a second magazine filled with a high-explosive charge; this is attached to the end of the fuze and is so arranged that when the shell is burst as time shrapnel the flash from the fuze passes clear of the high-explosive magazine and ignites only the base magazine, the bullets being blown out in the usual manner. When, however, the fuze acts on graze, the percussion part detonates the high-explosive charge and the bullets are blown out sideways and thus reach men behind shields, &c. (fig. 10). There is some loss of bullet capacity in this shell, and it appears likely that the bullets will be materially deformed when detonation occurs; the advantages may, however, counterbalance their objections.

Segment and *ring shell* are varieties of shrapnel, the interior of the shell being built up of cast-iron segments or rings (which break up into segments) about a tinned-iron cylinder which formed the magazine of the shell. The shell was completed by a cast-iron body formed around the segments or rings. The German army in 1870 employed ring shell almost exclusively against the French. The French found that common shell (*obus ordinaire*) when made of cast iron broke up on bursting into a small number of irregularly shaped pieces, and in order to obtain a systematic fragmentation for small shells they adopted a variety of projectiles of the segment and shrapnel types. With the improvements made latterly these have become obsolete, and the French system does not now materially differ from that employed in England and other countries. The old shell are, however, of sufficient interest to be enumerated; thus the "double-walled shell" (*obus à double paroi*) was built up of two shells, the internal portion had a cylindrical chamber for the bursting charge, but on the outside it was so shaped as to break up into well-defined pieces; the external portion of the shell was cast around the internal part, and also broke up into a number of pieces; this shell was liable to premature explosion. The *obus à couronnes de balles* (1879) was practically a segment shell with cast-iron balls in lieu of segments; thin iron partitions separated each layer, and the balls were flattened where they came in contact with the plates. The *obus à balles libres*, adopted in 1880, were of the same type, but there were no separating plates. The *obus à anneaux* was simply a ring shell of the same type as used in England. The *obus à mitraille* adopted in 1883 for field and siege guns had a cast-iron disc for its base with the body built up of segments and steel balls; a hollow ogival head surmounted this and a thin steel envelope bound all together. The head was filled with powder and fitted with a fuze; on explosion the head burst and rupturing the envelope set free the balls and segments.

It is of importance in firing shrapnel shell that the position of the burst shall be plainly seen. With the larger patterns of shell this presents no difficulty, but with the shrapnel for field guns which contain a small bursting charge only, and at long range in certain states of the atmosphere, the difficulty becomes pronounced. The problem has been solved in some cases by packing the bullets in fine grain black powder (instead of resin) and compressing both bullets and powder in order to prevent the generation of heat when the bullets set back on the discharge of the gun. In Germany a mixture of red amorphous phosphorus and fine grain powder is used for the same purpose and produces a dense white cloud of smoke. In Russia a mixture of magnesium and antimony sulphide is used.

Fuzes.—The fuzes first used were short iron or copper tubes filled with slow-burning composition. They were roughly screwed on the exterior to fit a similar thread in the fuze hole of the shell. There was no means of regulating the length of time of burning, but later, about the end of the 17th century, the fuze case was made of paper or wood, so that, by boring a hole through the outer casing into the composition, the fuze could be made to burn approximately for a given time before exploding the shell—or the fuze could be cut to the correct length for the same purpose.

Early attempts to produce percussion fuzes were unsuccessful, but the discovery of fulminate of mercury in 1799 finally afforded the means of attaining this object. Some fifty years, however, elapsed before a satisfactory fuze was made. This was the Pettman fuze, in which a roughened ball covered with detonating composition was released by the discharge of the gun. When the shell hit any object, the ball struck against the interior walls of the fuze, the composition was exploded and thence the bursting charge of the shell. At present there are three types of percussion fuzes—(1) those which depend on the gas pressure in the gun setting the pellet of the fuze free—this type is necessarily a base fuze; (2) those which rely on the shock of discharge or the rotation of the shell setting the pellet free, as in various kinds of nose and base fuzes; (3) those relying on direct impact with the object.

The British base percussion fuze (fig. 12) illustrates type (1). In this, before firing, the needle pellet is held back by a central spindle with a pressure plate attached to its rear end. For additional safety a centrifugal bolt is added which is released by the rotation of the shell. On discharge, the gas pressure pushes the pressure plate in, the central spindle is carried forward with it and unlocks the centrifugal bolt; this is withdrawn by the rotation of the shell, and the needle pellet is then free to move forward and explode the detonating cap when the shell strikes.

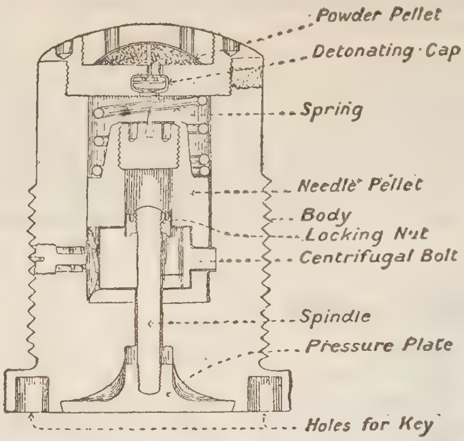

FIG. 12.—Base Percussion Fuze.

Type (2) is that usually adopted in small base fuzes and in the percussion part of "time and percussion" fuzes. Here the ferrule, on shock of discharge, moves back relatively to the percussion pellet by collapsing the stirrup spring; this leaves the pellet free to move forward, on the shell striking, and its detonator to strike the needle fixed in the fuze body. A spiral spring prevents any movement of the pellet during flight.

The direct-action or impact fuzes of type (3) are very simple (see fig. 13 of direct-action fuze). They are made of such a strength that during discharge nothing happens, but on striking an object the needle disc is crushed in and the needle explodes the detonating composition and thence the powder.

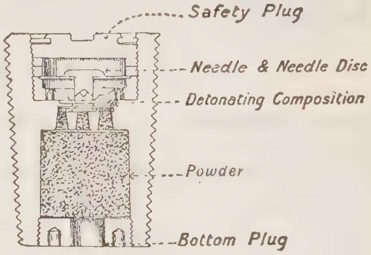

FIG. 13.—Direct-Action Percussion Fuze.

The action of all time fuzes is started by the discharge of the gun. By this the pellet strikes the detonator and so ignites a length of slow-burning composition which is pressed into a wood tube or into a channel formed in a metal ring. To regulate the time of burning of the wood fuze, a hole is bored through into the composition as before stated, so that when it has burnt down to this hole one of the side channels filled with powder is ignited and explodes the shell. Wood fuzes are now only used for R.M.L. guns.

With modern long-burning fuzes (fig. 14), two composition time rings are used. The lower of these rings is made movable so that it can be turned to bring any desired place over a hole in the body of the fuze, which is filled with powder and communicates with the magazine. On the gun being fired the detonator is exploded and its flash ignites the upper time ring. This burns round to a passage made in the lower ring, when the lower ring begins to burn and continues to do so until the channel to the magazine is reached. The gases from the ignited composition escape from an external hole made in each time ring.

Mechanical time fuzes depending on the rotation of the shell to give a regular motion to clockwork have been tried, but so far no practicable form of these fuzes has been found.

It is important that all fuzes should be rigidly guarded against dampness, which tends to lengthen their time of burning; hence they are protected either by being kept in hermetically sealed tins holding one or more fuzes, or by some similar means.

Tubes and Primers.—In ancient times various devices were adopted to ignite the charge. Small guns were fired by thrusting a hot wire down the vent into the charge, or slow-burning powder was poured down the vent and ignited by a hot wire.

Later the priming powder was ignited by a piece of slow match held in a lint-stock (often called linstock). About A.D. 1700 this was effected by means of a port-fire (this was a paper case about 16 in. long filled with slow-burning composition which burnt rather more than 1 in. per minute). Later again the charge was exploded by paper tubes (sometimes called Dutch tubes) filled with powder and placed in the vent and ignited by a port-fire. In comparatively modern times friction tubes have been used, while in the latest patterns percussion or electric tubes are employed.

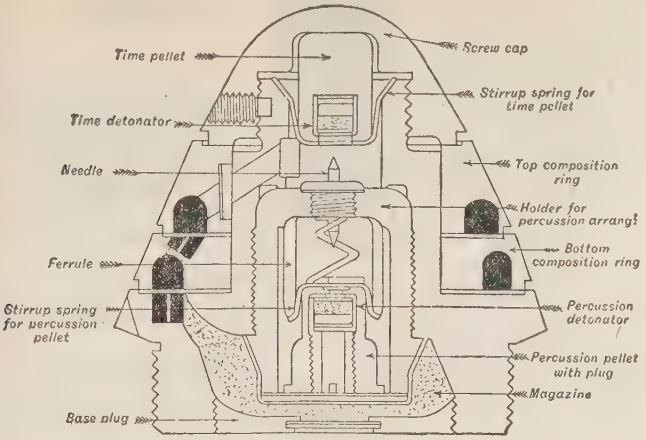
Time pellet
Screw cap
Stirrup spring for time pellet
Time detonator
Needle
Top composition ring
Holder for percussion arrangt
Bottom composition ring
Ferrule
Stirrup spring for percussion pellet
Percussion detonator
Percussion pellet with plug
Magazine
Base plug

Fig. 14.—Fuze, Time and Percussion, No. 80, Mk. I.

In most B.L. guns it is essential to stop the erosion of the metal of the vent by preventing the escape of gas through it when the gun is fired. For this purpose the charges in such guns are ignited by "vent-sealing tubes." For M.L. guns and small B.L. guns radially vented, especially those using black powder, the amount of erosion in the vent is not so serious. The charge is fired by ordinary friction tubes, which are blown away by the escape of gas through the vent. In all guns axially vented, vent-sealing tubes, which are not blown out, must be employed so that the men serving the gun may not be injured.

The common friction tube is a copper tube, driven with powder, having at the upper end a short branch (called a nib piece) at right angles. This branch is filled with friction composition in which a friction bar is embedded. On the friction bar being sharply pulled out, by means of a lanyard, the composition is ignited and sets fire to the powder in the long tube; the flash is conveyed through the vent and explodes the gun charge. For naval purposes, in order that the sailors should not be cut about the face or hurt their feet, tubes of quill instead of copper were used. If friction tubes are employed when cordite or other smokeless powder charges are used, the erosion of the vent is very rapid unless the escape of the gas is prevented; in this case T-headed tubes (fig. 15) are used. They are similar in action to the ordinary type, but are fixed to the vent by the head fitting a bayonet joint formed with the vent. The explosion blows a small ball upwards and blocks the coned hole at the top of the tube and so prevents any rush of gas.

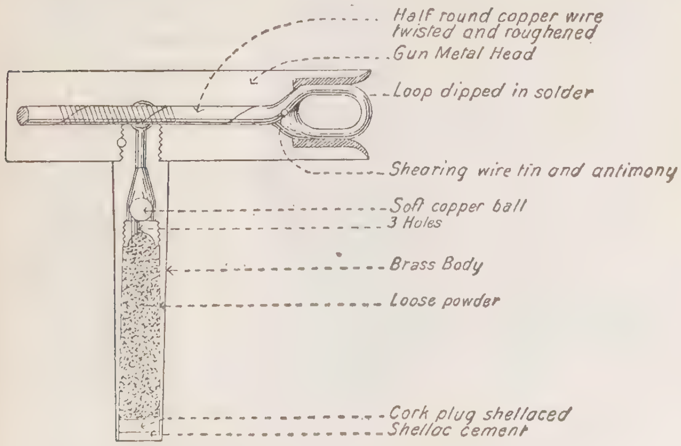
Half round copper wire twisted and roughened
Gun Metal Head
Loop dipped in solder
Shearing wire tin and antimony
Soft copper ball
3 Holes
Brass Body
Loose powder
Cork plug shellaced
Shellac cement

Fig. 15.—T-headed Friction Tube.

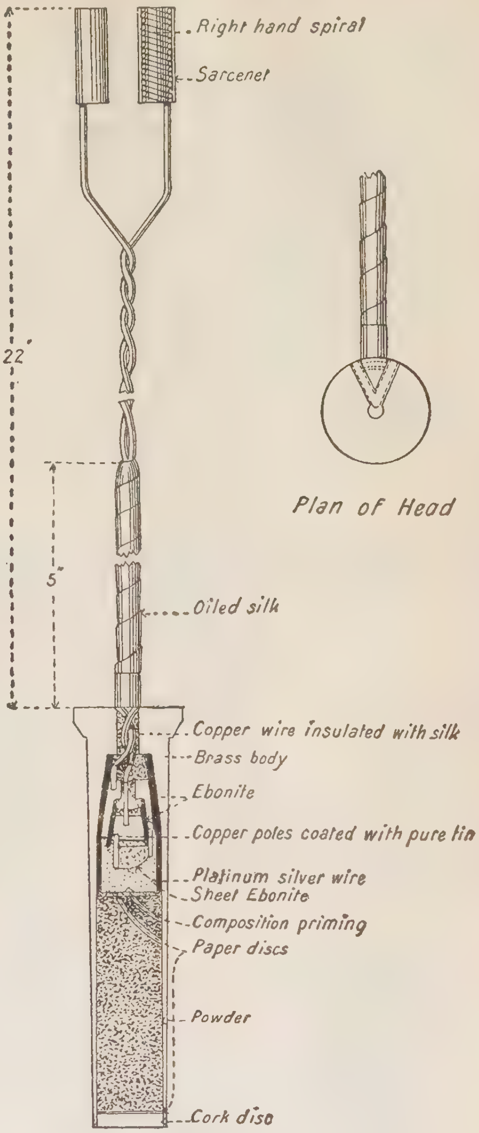
Right hand spiral
Sarcenet
22"
5"
Plan of Head
Oiled silk
Copper wire insulated with silk
Brass body
Ebonite
Copper poles coated with pure tin
Platinum silver wire
Sheet Ebonite
Composition priming
Paper discs
Powder
Cork disc

Fig. 16.—Electric Tube.

The vent-sealing tube accurately fits into a chamber formed at the end of the vent, and is held in place by the gun lock or some similar means. The force of the explosion expands the tube against the walls of its chamber, while the internal structure of the tube renders it gas-tight, any escape of gas through the vent being thus prevented.

In the English service electric tubes (in the United States called "primers") are mostly used, but percussion or friction tubes are in most favour on the continent, and electric tubes are seldom or never used. There are two types of electric tube, one with long wires (fig. 16) for joining up with the electric circuit and the other without external wires. The first type has two insulated wires led into the interior and attached to two insulated

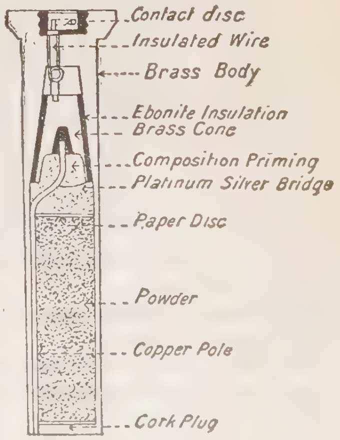
Contact disc
Insulated Wire
Brass Body
Ebonite Insulation
Brass Cone
Composition Priming
Platinum Silver Bridge
Paper Disc
Powder
Copper Pole
Cork Plug

Fig. 17.—Wireless Tube.

brass cones which are connected by a wire "bridge" of platinum silver. This bridge is surrounded by a priming composition of gun-cotton dust and mealed powder and the remainder of the tube is filled with powder. On an electric current passing, the bridge is heated to incandescence and ignites the priming composition.

In the wireless tube (fig. 17) the lock of the gun makes the electric contact with an insulated disc in the head of the tube. This disc is connected by an insulated wire to a brass cone, also insulated, the bridge being formed from an edge of the cone to a brass wire which is soldered to the mouth of the tube. Priming composition surrounds the bridge and the tube is filled with powder. The electric circuit passes from the gun lock to the disc, thence through the bridge to the body of the tube, returning through the metal of the gun and mounting.

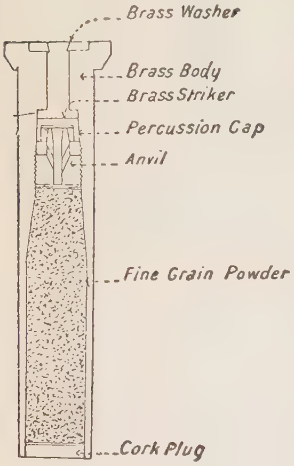
Brass Washer
Brass Body
Brass Striker
Percussion Cap
Anvil
Fine Grain Powder
Cork Plug

FIG. 18.—Primer.

The percussion tube (fig. 18) has a similarly shaped body to the wireless electric tube, but the internal construction differs; it is fitted with a striker, below which is a percussion cap on a hollow brass anvil, and the tube is filled with powder.

With Q.F. guns (that is, strictly, those using metallic cartridge cases) the case itself is fitted with the igniting medium; in England these are called primers. For small guns the case contains a percussion primer, usually a copper cap filled with a chlorate mixture and resting against an anvil. The striker of the gun strikes the cap and fires the mixture. For larger guns an electric primer (fig. 19) is used, the internal construction and action of which are precisely similar to the wireless tube already described; the exterior is screwed for the case. For percussion firing an ordinary percussion tube is placed in an adapter screwed into the case. In some foreign services a combined electric and percussion primer is used; the action of this will be understood from fig. 20.

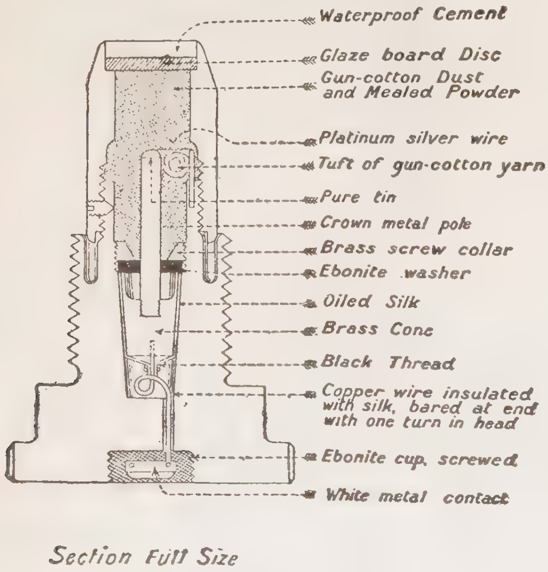
Waterproof Cement
Glaze board Disc
Gun-cotton Dust and Mealed Powder
Platinum silver wire
Tuft of gun-cotton yarn
Pure tin
Crown metal pole
Brass screw collar
Ebonite washer
Oiled Silk
Brass Cone
Black Thread
Copper wire insulated with silk, bared at end with one turn in head
Ebonite cup, screwed
White metal contact
Section Full Size

FIG. 19.—Electric Primer.

Cartridges.

The first cartridges for cannon were made up of gunpowder packed in a paper bag or case. For many years after the introduction of cannon the powder was introduced into the bore by means of a scoop-shaped ladle fixed to the end of a long stave. The ladle was made of the same diameter as the shot, and it had a definite length so that it was filled once for the charging of small guns but for larger guns the ladle had to be filled twice or even thrice. The rule was to make the powder charge the same weight as that of the shot.

Cartridges made up in paper or canvas bags were afterwards used in forts at night-time or on board ship, so that the guns could be more rapidly loaded and with less risk than by using a ladle. Before loading, a piece of the paper or canvas covering had to be cut open immediately under the vent; after the shot had been rammed home the vent was filled with powder from a priming horn, and the gun was then fired by means of a hot iron, quick match or port-fire.

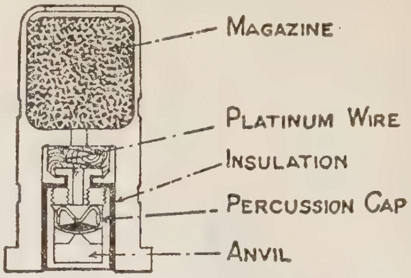
Magazine
Platinum Wire
Insulation
Percussion Cap
Anvil

FIG. 20.—Combined Primer.

The ancient breech-loading guns were not so difficult to load, as the powder chamber of the gun was removable and was charged by simply filling it up with powder and ramming a wad on top to prevent the escape of the powder.

Paper, canvas and similar materials are particularly liable to smoulder after the gun has been fired, hence the necessity of well sponging the piece. Even with this precaution accidents often occurred owing to a cartridge being ignited by the still glowing débris of the previous round. In order to prevent this, bags of non-smouldering material, such as flannel, serge or silk cloth are used; combustible material such as woven gun-cotton cloth has also been tried, but there are certain disadvantages attending this.

All smokeless powders are somewhat difficult to ignite in a gun, so that in order to prevent hang-fires every cartridge has a primer or igniter, of ordinary fine grain gunpowder, placed so as to intercept the flash from the tube; the outside of the bag containing this igniter is made of shalloon, to allow the flash to penetrate with ease. The charge for heavy guns (above 6 in.) is made up in separate cartridges containing half and quarter charges, both for convenience of handling, and to allow of a reduced charge being used.

The cartridges are made of a bundle of cordite, or other smokeless powder, tightly tied with silk, placed in a silk cloth bag with the primer or igniter stitched on the unclosed end; the exterior is taped with silk cloth tape so as to form a stiff cartridge. For some of the longer guns, the exterior of the cartridge is conveniently made of a coned shape, the coned form being produced by building up layers outside a cylindrical core. In these large cartridges a silk cord becket runs up the centre with a loop at the top for handling (fig. 21).

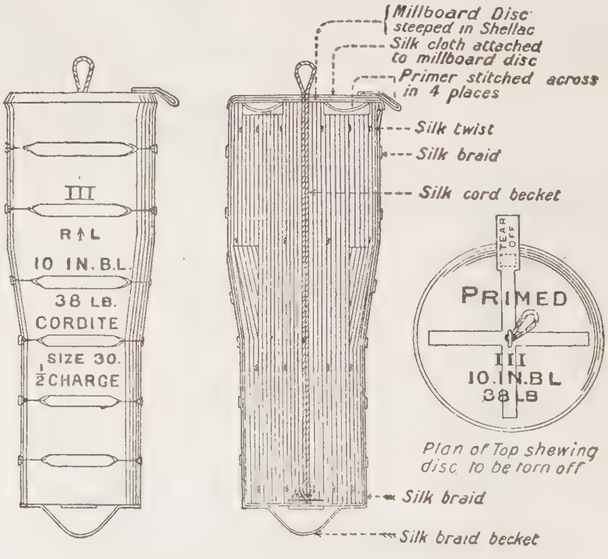
Millboard Disc steeped in Shellac
Silk cloth attached to millboard disc
Primer stitched across in 4 places
Silk twist
Silk braid
Silk cord becket
III
R↑L
10 IN.B.L.
38 LB.
CORDITE
SIZE 30.
½ CHARGE
TEAR OFF
PRIMED
III
10.IN.B.L
38 LB
Plan of Top shewing disc to be torn off
Silk braid
Silk braid becket

FIG. 21.—10-inch B.L. Gun Cartridge.

For howitzers, variable charges are used, and are made up so that the weight can be readily altered. The following typical instance (fig. 22) will serve to show the general method of making up such charges, whether for B.L. or Q.F. howitzers. Small size cordite is used, and the charge is formed of a mushroom-shaped core, made up in a shalloon bag; on the stalk, so as to be easily removed, three rings of cordite are placed. The bottom of the core contains the primer, and the rings can be attached to the core by two silk braids. The weight of the rings is graduated so that by detaching one or more the varying charges required can be obtained.

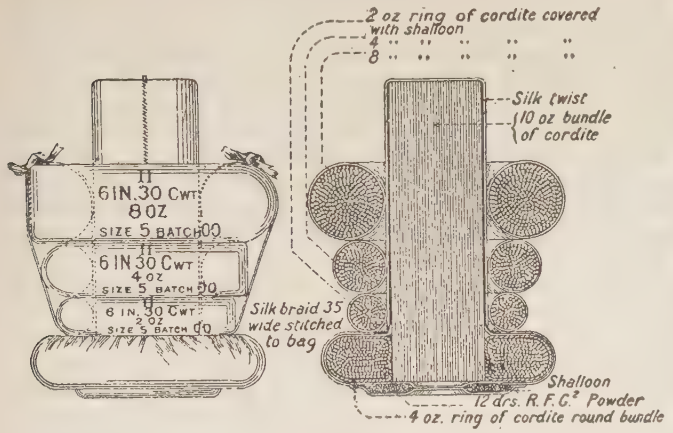
2 oz ring of cordite covered with shalloon
4 " " " "
8 " " " "
Silk twist
10 oz bundle of cordite
6 IN. 30 CWT. 8 OZ SIZE 5 BATCH 00
6 IN 30 CWT 4 oz SIZE 5 BATCH 00
6 IN. 30 CWT 2 OZ SIZE 5 BATCH 00
Silk braid 35 wide stitched to bag
Shalloon
12 drs. R.F.G.² Powder
4 oz. ring of cordite round bundle

Fig. 22.—6-inch B.L. Howitzer Cartridge.

For quick-firing guns the charge is contained in a brass case to which is fitted a primer for igniting the charge. This case is inserted into the gun, and when fired slightly expands and tightly fits the chamber of the gun, thus acting as an obturator and preventing any escape of gas from the breech. This class of ammunition is especially useful for the smaller calibres of guns, such as 3-pr., 6-pr. and field guns, but Messrs Krupp also employ metallic cartridge cases for the largest type of gun, probably on account of the known difficulty of ensuring trustworthy obturation by any other means practicable with sliding wedge guns.

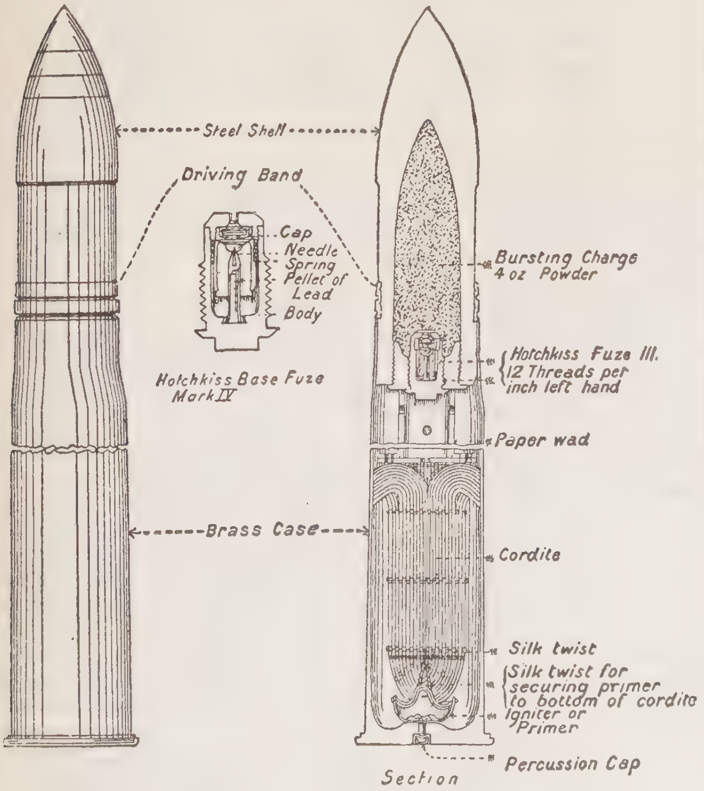
Steel Shell
Driving Band
Cap
Needle
Spring
Pellet of Lead
Body
Hotchkiss Base Fuze Mark IV
Bursting Charge 4 oz Powder
Hotchkiss Fuze III. 12 Threads per inch left hand
Paper wad
Brass Case
Cordite
Silk twist
Silk twist for securing primer to bottom of cordite
Igniter or Primer
Percussion Cap
Section

Fig. 23.—6-pr. Q.F. Cartridge.

The charges for these cases are made up in a very similar manner to those already described for B.L. guns. Where necessary, distance pieces formed of *papier-mâché* tubes and felt wads are used to fill up the space in the case and so prevent any movement of the charge. The mouth of the case is closed either by the base end of the projectile (fig. 23), in which case it is called "fixed ammunition" or "simultaneous loading ammunition," or by a metallic cap (fig. 24), when it is called "separate loading ammunition," the projectile and charge being thus loaded by separate operations. (A. G. H.)

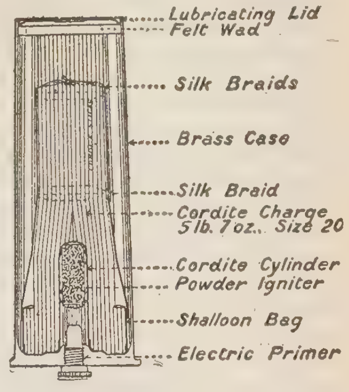
Lubricating Lid
Felt Wad
Silk Braids
Brass Case
Silk Braid
Cordite Charge 5 lb. 7 oz. Size 20
Cordite Cylinder
Powder Igniter
Shalloon Bag
Electric Primer

Fig. 24.—4·7-inch Q.F. Cartridge (greatly reduced scale).

Small-arms ammunition.

The Bullet.—The original musket bullet was a spherical leaden ball two sizes smaller than the bore, wrapped in a loosely fitting paper patch which formed the cartridge. The loading was, therefore, easy with the old smooth-bore Brown Bess and similar military muskets. The original muzzle-loading rifle, on the other hand, with a closely fitting ball to take the grooves, was loaded with difficulty, particularly when foul, and for this reason was not generally used for military purposes.

In 1826 Delirque, a French infantry officer, invented a breech with abrupt shoulders on which the spherical bullet was rammed down until it expanded and filled the grooves. The objection in this case was that the deformed bullet had an erratic flight. The Brunswick rifle, introduced into the British army in the reign of William IV., fired a spherical bullet weighing 557 grs. with a belt to fit the grooves. The rifle was not easily loaded, and soon fouled. In 1835 W. Greener produced a new expansive bullet, an oval ball, a diameter and a half in length, with a flat end, perforated, in which a cast metallic taper plug was inserted. The explosion of the charge drove the plug home, expanded the bullet, filled the grooves and prevented windage. A trial of the Greener bullet in August 1835, at Tynemouth, by a party of the 60th (now King's Royal) Rifles, proved successful. The range and accuracy of the rifle were retained, while the loading proved as easy as with a smooth-bore musket. The invention was, however, rejected by the military authorities on the ground that the bullet was a compound one. In 1852 the government awarded Minié, a Frenchman, £20,000 for a bullet of the same principle, adopted into the British service. Subsequently, in 1857, Greener was also awarded £1000 for "the first public suggestion of the principle of expansion, commonly called the Minié principle, in 1836." The Minié bullet contained an iron cup in a cavity in the base of the bullet. The form of the bullet was subsequently changed from conoidal to cylindro-conoidal, with a hemispherical iron cup. This bullet was used in the Enfield rifle introduced into the British army in 1855. It weighed 530 grs., and was made up into cartridges and lubricated as for the Minié rifle. A boxwood plug to the bullet was also used. The bullet used in the breech-loading Martini-Henry rifle, adopted by the British government in 1871 in succession to the Snider-Enfield rifle, weighed 480 grs., and was fired from an Eley-Boxer cartridge-case with a wad of wax lubrication at the base of the bullet.

Between 1854 and 1857 Sir Joseph Whitworth conducted a long series of rifle experiments, and proved, among other points, the advantages of a smaller bore and, in particular, of an elongated bullet. The Whitworth bullet was made to fit the grooves of the rifle mechanically. The Whitworth rifle was never adopted by the government, although it was used extensively for match purposes and target practice between 1857 and 1866, when it was gradually superseded by Metford's system mentioned below.

The next important change in the history of the rifle bullet occurred in 1883, when Major Rubin, director of the Swiss Laboratory at Thun, invented the small-calibre rifle, one of whose essential features was the employment of an elongated compound bullet, with a leaden core in a copper envelope. About 1862 and later, W. E. Metford had carried out an exhaustive series of experiments on bullets and rifling, and had invented the important system of light rifling with increasing spiral, and a hardened bullet. The combined result of the above inventions was that in December 1888 the Lee-Metford small-bore ·303 rifle, Mark I., was finally adopted for the British army. The latest development of this rifle is now known as the ·303 Lee-Enfield, which fires a long, thin, nickel-covered, leaden-cored bullet 1·25 in. long, weighing only 215 grs., while the Martini-Henry bullet, 1·27 in. in length and ·45 in. in diameter, weighed 480 grs.

The adoption of the smaller elongated bullet, necessitated by the smaller calibre of the rifle, entailed some definite disadvantages. The lighter bullet is more affected by wind. Its greater relative length to diameter necessitates a sharper pitch of rifling in order properly to revolve the bullet (one turn in 10 in. for the ·303 rifle as compared with one turn in 22 in. for the Martini-Henry). This, in its turn, necessitates a hard nickel envelope for the leaden bullet in order to prevent its "stripping," or being forced through the barrel without rotation. The general result is that, while the enveloped bullet has a much higher penetrative power than one of lead only, it does not usually inflict so severe a wound, nor has it such a stunning effect as the old lead bullet. It cuts a small clean hole, but does not deform. This fact is of some military importance, as, for example, in warfare with savages, in which the chief danger is usually a rush of large numbers at close quarters. The advantages, however, of the smaller calibre and the lighter bullet and ammunition are considered to outweigh the disadvantages, and they have been universally adopted for all military rifles.

Bullets for target and sporting-rifles have, in the main, followed, or occasionally preceded, the line of progress of military rifle bullets. In 1861 Henry introduced a modification of the grooving of the cylindrical Whitworth bullet, and in 1864 and 1865 the Rigby mechanically fitting bullet was used with success at the National Rifle Association meeting, and in the second stage of the Queen's prize. The bullets of sporting rifles, and particularly those of Express rifles, are often lighter than military bullets, and made with hollow points to ensure the expansion of the projectile on or after impact. The size and shape of the hollow in the point vary according to the purpose required and the nature of the game hunted. If greater penetration is needed, the leaden bullet is hardened with mercury or tin, or the military nickel-coated bullet is used with the small-bore, smokeless-powder rifles. Explosive bullets filled with detonating powder were at one time used in Express and large-bore rifles for large game. The use of these bullets is now practically abandoned owing to their uncertainty of action and the danger involved in handling them. Their use in warfare is prohibited by international law.

The nickel-covered bullet, when used in a modern small-bore rifle for sporting purposes, is made into an expanding bullet, either by leaving the leaden core uncovered at the nose of the bullet, with or without a hollow point, or by cutting transverse or longitudinal nicks of varying depth in the point or circumference of the bullet.

A cone-shaped sharp-pointed bullet, named the Spitzer bullet, has been tried in the United States under the auspices of the Ordnance Department, in a Springfield rifle, which is practically identical with the British service ·303 Lee-Enfield. This bullet is lighter than the Lee-Enfield bullet (150 grs. as against 215 grs.), and when fired with a heavier charge of powder (51 grs. as against 31 grs.) gives, it is claimed, better results in muzzle-velocity, trajectory, deflexion from wind and wear and tear of rifling, than the present universally used cylinder-shaped bullet. In 1906 details of its prototype, the German "S" bullet (*Spitzgeschoss*), and of the French "D" bullet, were published.

The Cartridge.—The original cartridge for military small arms dates from 1586. It consisted of a charge of powder and a bullet in a paper envelope. This cartridge was used with the muzzle-loading military firearm, the base of the cartridge being ripped or bitten off by the soldier, the powder poured into the barrel, and the bullet then rammed home. Before the invention of the fire-lock or flint-lock, about 1635, the priming was originally put into the pan of the wheel-lock and snaphance muskets from a flask containing a fine-grained powder called serpentine powder. Later the pan was filled from the cartridge above described before loading. The mechanism of the flint-lock musket, in which the pan was covered by the furrowed steel struck by the flint, rendered this method of priming unnecessary, as, in loading, a portion of the charge of powder passed from the barrel through the vent into the pan, where it was held by the cover and hammer.

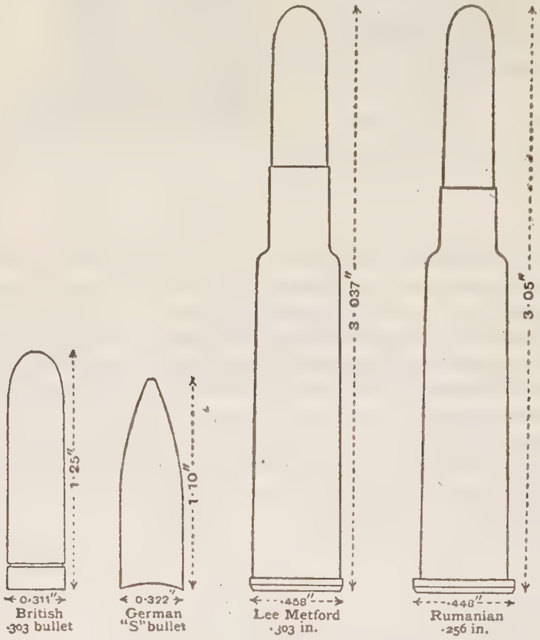

FIG. 25.

The next important advance in the method of ignition was the introduction of the copper percussion cap. This was only generally applied to the British military musket (the Brown Bess) in 1842, a quarter of a century after the invention of percussion powder and after an elaborate government test at Woolwich in 1834. The invention which made the percussion cap possible was patented by the Rev. A. J. Forsyth in 1807, and consisted of priming with a fulminating powder made of chlorate of potash, sulphur and charcoal, which exploded by concussion. This invention was gradually developed, and used, first in a steel cap, and then in a copper cap, by various gunmakers and private individuals before coming into general military use nearly thirty years later. The alteration of the military flint-lock to the percussion musket was easily accomplished by replacing the powder pan by a perforated nipple, and by replacing the cock or hammer which held the flint by a smaller hammer with a hollow to fit on the nipple when released by the trigger. On the nipple was placed the copper cap containing the detonating composition, now made of three parts of chlorate of potash, two of fulminate of mercury and one of powdered glass. The detonating cap thus invented and adopted, brought about the invention of the modern cartridge case, and rendered possible the general adoption of the breech-loading principle for all varieties of rifles, shot guns and pistols. Probably no invention connected with firearms has wrought such changes in the principle of gun construction as those effected by the expansive cartridge case. This invention has completely revolutionized the art of gunmaking, has been successfully applied to all descriptions of firearms, and has produced a new and important industry—that of cartridge manufacture.

Its essential feature is the prevention of all escape of gas at the breech when the weapon is fired, by means of an expansive cartridge case containing its own means of ignition. Previous to this invention shot guns and sporting rifles were loaded by means of powder flasks and shot flasks, bullets, wads and copper caps, all carried separately. The earliest efficient modern cartridge case was the pin-fire, patented, according to some authorities, by Houiller, a Paris gunsmith, in 1847; and, according to others, by Lefaucheux, also a Paris gunsmith, in or about 1850. It consisted of thin weak shell made of brass and paper which expanded by the force of the explosion, fitted perfectly into the barrel, and thus formed an efficient gas check. A small percussion cap was placed in the middle of the base of the cartridge, and was exploded by means of a brass pin projecting from the side and struck by the hammer. This pin also afforded the means of extracting the cartridge case. This cartridge was introduced in England by Lang, of Cockspur Street, London, about 1855.

The central-fire cartridge was introduced into England in 1861 by Daw. It is said to have been the invention of Pottet of Paris, improved upon by Schneider, and gave rise to much litigation in respect of its patent rights. Daw was subsequently defeated in his control of the patents by Eley Bros. In this cartridge the cap in the centre of the cartridge base is detonated by a striker passing through the standing breech to the inner face, the cartridge case being withdrawn, or, in the most modern weapons, ejected by a sliding extractor fitted to the breech end of the barrel, which catches the rim of the base of the cartridge.

This is practically the modern cartridge case now in universal use. In the case of shot guns it has been gradually inproved in small details. The cases are made either of paper of various qualities with brass bases, or entirely of thin brass. The wadding between powder and shot has been thickened and improved in quality; and the end of the cartridge case is now made to fit more perfectly into the breech chamber. These cartridges vary in size from 32 bore up to 4 bore for shoulder guns. They are also made as small as ·410 and ·360 gauge: their length varies from 1¾ in. to 4 in. Cartridges for punt guns are usually 1½ in. in diameter and 9¾ in. in length.

In the case of military rifles the breech-loading cartridge case was first adopted in principle by the Prussians about 1841 in the needle-gun (*q.v.*) breech-loader. In this a conical bullet rested on a thick wad, behind which was the powder, the whole being enclosed in strong lubricated paper. The detonator was in the hinder surface of the wad, and fired by a needle driven forward from the breech, through the base of the cartridge and through the powder, by the action of a spiral spring set free by the pulling of the trigger.

In 1867 the British war office adopted the Eley-Boxer metallic central-fire cartridge case in the Enfield rifles, which were converted to breech-loaders on the Snider principle. This consisted of a block opening on a hinge, thus forming a false breech against which the cartridge rested. The detonating cap was in the base of the cartridge, and was exploded by a striker passing through the breech block. Other European powers adopted breech-loading military rifles from 1866 to 1868, with paper instead of metallic cartridge cases. The original Eley-Boxer cartridge case was made of thin coiled brass. Later the solid-drawn, central-fire cartridge case, made of one entire solid piece of tough hard metal, an alloy of copper, &c., with a solid head of thicker metal, has been generally substituted.

Central-fire cartridges with solid-drawn metallic cases containing their own means of ignition are now universally used in all modern varieties of military and sporting rifles and pistols. There is great variety in the length and diameter of cartridges for the different kinds and calibres of rifles and pistols. Those for military rifles vary from 2·2 in. to 2·25 in. in length, and from ·256 to ·315 gauge. For sporting rifles from 2¼ in. to 3½ in. in length, and through numerous gauges from ·256 in. to ·600 in. For revolvers, pistols, rook and rabbit rifles, and for Morris tubes, cartridges vary from ·22 in. to ·301 in. in gauge. All miniature cartridges with light charges are made for breech adapters to enable ·303 military rifles to be used on miniature rifle ranges. All the above cartridges are central-fire. Rim-fire cartridges for rifles, revolvers and pistols vary from ·22 in. to ·56 in. gauge according to the weapon for which they are required. The cartridge for the British war office miniature rifle is ·22 calibre, with 5 grs. of powder and a bullet weighing 40 grs. Most modern military rifles are supplied with clip or charger loading arrangements, whereby the magazine is filled with the required number of cartridges in one motion. A clip is simply a case of cartridges which is dropped into the magazine; a charger is a strip of metal holding the bases of the cartridges, and is placed over the magazine, the cartridges being pressed out into the latter. Both clips and chargers, being consumable stores, may be considered as ammunition. (H. S.-K.)

AMNESTY (from the Gr. ἀμνηστία, oblivion), an act of grace by which the supreme power in a state restores those who may have been guilty of any offence against it to the position of innocent persons. It includes more than pardon, inasmuch as it obliterates all legal remembrance of the offence. Amnesties, which may be granted by the crown alone, or by act of parliament, were formerly usual on coronations and similar occasions, but are chiefly exercised towards associations of political criminals, and are sometimes granted absolutely, though more frequently there are certain specified exceptions. Thus, in the case of the earliest recorded amnesty, that of Thrasybulus at Athens, the thirty tyrants and a few others were expressly excluded from its operation; and the amnesty proclaimed on the restoration of Charles II. did not extend to those who had taken part in the execution of his father. Other celebrated amnesties are that proclaimed by Napoleon on the 13th of March 1815, from which thirteen eminent persons, including Talleyrand, were excepted; the Prussian amnesty of the 10th of August 1840; the general amnesty proclaimed by the emperor Francis Joseph of Austria in 1857; the general amnesty granted by President Johnson after the Civil War in 1868; and the French amnesty of 1905. The last act of amnesty passed in Great Britain was that of 1747, which proclaimed a pardon to those who had taken part in the second Jacobite rebellion.

AMOEBA, the Greek equivalent of the name "Amibe" given by Bery St Vincent to the Proteus animalcule of earlier naturalists, used as a quasi-popular term for any simple naked protist the sole external organs of which are pseudopodia, *i.e.* temporary outgrowths of the clearer outer layer of the soft protoplasmic body. It is also used as a generic name, and in its present limitations by E. Penard includes only those the pseudopodia of which are constantly changing, blunt outgrowths. In the former wider sense, amoebae are found in sluggish waters, fresh and salt, all over the world; they readily make their appearance in infusions putrefying after infection from aerially carried germs, and the leucocytes or colourless blood corpuscles of Metazoa are essentially amoebae in their structure and behaviour. The protoplasm of the individual is divided into a centrally placed body, the nucleus, of relatively stable shape, and the cytoplasm, itself divided into an outer, clearer ectoplasm ("ectosarc") and an inner, more granular endoplasm ("endosarc"), passing into one another. The movements of amoebae are of several kinds. (1) The amoeba may grow out irregularly into blunt lobes, the pseudopodia, some being emitted while others are retracted, and so may advance in any direction by the emission of pseudopodia thitherward, and the enlargement of these by the passage of the organism into them. (2) Again, it may advance by a sort of rolling: the lower surface, or that in contact with the substratum over or under which it is passing, is viscid and adheres to the substratum, the superficial dorsal layer passing forward and bending over to the ventral side; whilst the converse action takes place at the hinder end; (3) or again, the pseudopodia, when long, well marked and relatively permanent, may serve as actual limbs on which the body is supported and on which it moves. In the outgrowth of a pseudopod the process may take place gradually, the ectoplasm growing as it stretches, or it may take place by the limiting layer of the ectosarc bursting, as it were, and a rounded prominence of the endosarc protruding and at once forming a new "skin" or pellicle. This last mode, termed "eruptive," is common in the case of the enormous, multinucleate amoeba termed *Pelomyxa palustris*, which attains a diameter when contracted and spherical of as much as a line (over 2 mm.). From the ease with which amoebae are obtained and kept alive under the microscope, as well as from their identity in structure with the primitive elements of Metazoa, they have always been favourite objects of study for protoplasmic physiology under its simplest conditions. Among the investigators of protoplasmic movements we may cite F. Dujardin, O. Bütschli, L. Rhumbler and H. S. Jennings. The opening to the exterior of the contractile vesicle has been found here. *Pelomyxa* has yielded to A. E. Dixon and M. Hartog a peptic ferment, such as has been extracted by C. F. W. Krukenberg from the Myxomycete *Fuligo* (Flowers of Tan), which is the largest known naked mass of protoplasm without cellular differentiation.

Amoeba shows also the multiplication by fission, so characteristic of the cell: for the study of other modes of reproduction, spore formation and syngamic (or so-called fertilization) processes, fresh-water or salt-water amoebae are ill suited, and up to this date we do not know the life cycle of any free-living naked amoeba, though that of some parasitic forms and shell-bearers have been fully made out. Some amoebae are certainly young states of Myxomycetes. Encystment, the excretion of a membrane around the cell to tide over unfavourable circumstances, has been noted in almost all species.

Amoeba coli and *A. histolytica* are parasites in the gut of man, the former relatively harmless, the latter the cause of severe dysentery and hepatic abscess, common in India.

H. S. Jennings has recently made a full study of the movements of *Amoeba*, and of its general behaviour, and found therein many indications that these are on the whole such as we should expect of an organism working by "trial and error" rather than the uniform modes of non-living beings. Thus the operations of an amoeba ingesting a round, encysted *Euglena* are summed up thus: "One seems to see that the amoeba is trying to obtain this cyst for food, that it shows remarkable pertinacity in continuing its attempts to put forth efforts to accomplish this in various ways, and that it shows remarkable pertinacity in continuing its attempts to ingest the food when it meets with difficulties. Indeed the scene could be described in a much more vivid and interesting way by the use of terms still more anthropomorphic in tendency." (M. Ha.)

AMOL, or Amul, a town of Persia, in the province of Mazandaran, 23 m. W. of Barfurush, in 36° 28′ N. Lat. and 52° 23′ E. long. Pop. about 10,000. It is situated on both banks of the Heraz, or Herhaz river, which is crossed here by a very narrow stone bridge of twelve arches and flows into the Caspian Sea 12 m. lower down. Amol is not walled and is now a place of little importance, but in and around it there are ruins and ancient buildings which bear witness to its former greatness. Of these the most conspicuous is the mausoleum of Seyed Kavvam ud-din, king of Mazandaran, who died in 1379, and one old mosque dates from A.D. 793. The town has spacious and well-supplied bazaars and post and telegraph offices.

AMONTONS, GUILLAUME (1663–1705), French experimental philosopher, the son of an advocate who had left his native province of Normandy and established himself at Paris, was born in that city on the 31st of August 1663. He devoted himself particularly to the improvement of instruments employed in physical experiments. In 1687 he presented to the Academy of Sciences an hygrometer of his own invention, and in 1695 he published his only book, *Remarques et expériences physiques sur la construction d'une nouvelle clepsydre, sur les baromètres, les thermomètres et les hygromètres*. In 1699 he published some investigations on friction, and in 1702–1703 two noteworthy papers on thermometry. He experimented with an air-thermometer, in which the temperature was defined by measurement of the length of a column of mercury; and he pointed out that the extreme cold of such a thermometer would be that which reduced the "spring" of the air to nothing, thus being the first to recognize that the use of air as a thermometric substance led to the inference of the existence of a zero of temperature. In 1704 he noted that barometers are affected by heat as well as by the weight of the atmosphere, and in the following year he described barometers without mercury, for use at sea. Amontons, who through disease was rendered almost completely deaf in early youth, died at Paris on the 11th of October 1705.

'AMORA (Hebrew for "speaker" or "discourser"), a title applied to the rabbis of the 2nd to 5th centuries, *i.e.* to the compilers of the Talmud. Each *tana*—or rabbi of the earlier period—had a spokesman, who repeated to large audiences the discourses of the tana. But the 'amora soon ceased to be a mere repeater, and developed into an original expounder of scripture and tradition.

AMORITES, the name given by the Israelites to the earlier inhabitants of Palestine. They are regarded as a powerful people, giants in stature "like the height of the cedars," who had occupied the land east and west of the Jordan. The Biblical usage appears to show that the terms "Canaanites" and "Amorites" were used synonymously, the former being characteristic of Judaean, the latter of Ephraimite and Deuteronomic writers. A distinction is sometimes maintained, however, when the Amorites are spoken of as the people of the past, whereas the Canaanites are referred to as still surviving. The old name is an ethnic term, evidently to be connected with the terms Amurru and Amar, used by Assyria and Egypt respectively. In the spelling Mar-tu, the name is as old as the first Babylonian dynasty, but from the 15th century B.C. and downwards its syllabic equivalent Amurru is applied primarily to the land extending northwards of Palestine as far as Kadesh on the Orontes. The term "Canaan," on the other hand, is confined more especially to the southern district (from Gebal to the south of Palestine). But it is possible that the terms at an early date were interchangeable, Canaan being geographical and Amorite ethnical. The wider extension of the use of Amurru by the Babylonians and Assyrians is complicated by the fact that it was even applied to a district in the neighbourhood of Babylonia. If the people of the first Babylonian dynasty (about 21st century B.C.) called themselves "Amorites," as Ranke seems to have shown, it is possible that some feeling of common origin was recognized at that early date.

See Ranke, *Bab. Exped. Pennsylvania*, series D, iii. 33 sqq.; and for general information, W. M. Müller, *Asien u. Europa*, 217 sqq.; Pinches, *Old Testament*, Index (*s.v.*). The people of Amar are represented on the Egyptian monuments with yellow skin, blue eyes, red eyebrows and beard, whence it has been conjectured that they were akin to the Libyans (Sayce, *Expositor*, July 1888). Senir, the "Amorite" name of Hermon (Deut. iii. 9), appears to be identical with Saniru in the Lebanon, mentioned by Shalmaneser II. In the Old Testament the chief references may be classified as follows:—primitive inhabitants generally, Is. xvii. 9 (on text see comm.), Ezek. xvi. 3; a people W. of Jordan, Josh. x. 5; Judg. i. 34-36; Deut. i. 7, 44; Gen. xiv. 7, xlviii. 22; E. of Jordan, Num. xxi. 13, 21 sqq.; Josh. ii. 10, xxiv. 8; Judg. x. 8. See further Canaan, Palestine.

AMORPHISM (from α, privative, and μορφή, form), a term used in chemistry and mineralogy to denote the absence of regular or crystalline structure in a body; the adjective "amorphous," formless or of irregular shape, being also used technically in biology, &c.

AMORT, EUSEBIUS (1692–1775), German Catholic theologian, was born at Bibermühle, near Tölz, in Upper Bavaria, on the 15th of November 1692. He studied at Munich, and at an early age joined the Canons Regular at Polling, where, shortly after his ordination in 1717, he taught theology and philosophy. In 1733 he went to Rome as theologian to Cardinal Niccolo Maria Lercari (d. 1757). He returned to Polling in 1735 and devoted the rest of his life to the revival of learning in Bavaria. He died at Polling on the 5th of February 1775. Amort, who had the reputation of being the most learned man of his age, was a voluminous writer on every conceivable subject, from poetry to astronomy, from dogmatic theology to mysticism. His best known works are: a manual of theology in 4 vols., *Theologia* *eclectica, moralis et scholastica* (Augsburg, 1752; revised by Benedict XIV. for the 1753 edition published at Bologna); a defence of Catholic doctrine, entitled *Demonstratio critica religionis Catholicae* (Augsburg, 1751); a work on indulgences, which has often been criticized by Protestant writers, *De Origine, Progressu, Valore, et Fructu Indulgentiorum* (Augsburg, 1735); a treatise on mysticism, *De Revelationibus et Visionibus*, &c. (2 vols., 1744); and the astronomical work *Nova philosophiae planetarum et artis criticae systemata* (Nuremberg, 1723). The list of his other works, including his three erudite contributions to the question of authorship of the *Imitatio Christi*, will be found in C. Toussaint's scholarly article in A. Vacant's *Dict. de théologie* (1900, cols. 1115–1117).

AMORTIZATION (derived through the French from Lat. *ad*, and *mortem*, to death), literally an extinction or doing to death, a word formerly used of alienating lands in mortmain, and now for the paying off of a debt, particularly by means of a regular sinking-fund; thus "amortization" and "amortization fund" generally refer to the latter method of extinguishing some pecuniary liability.

AMORY, THOMAS (*c.* 1691–1788), British author, was born about 1691, his father being the secretary for the forfeited estates in Ireland. He was an eccentric character and seems to have lived a very secluded life. He published *Memoirs; containing the lives of several Ladies of Great Britain; a History of Antiquities &c.* (1755) and *Life of John Buncle Esq.* (1756 and 1766). Both books are an extraordinary mixture of fiction, autobiography, scenic description and theological discussion. Amory died on the 25th of November 1788.

AMOS, in the Bible, an Israelitish prophet of the 8th century B.C. He was a native of Tekoa, *i.e.* as most suppose, a place which still bears the same name 6 m. S. of Bethlehem. He was a shepherd, or perhaps a sheep-breeder, but combined this occupation with that of a tender of sycomore figs. It is true, the Tekoa just mentioned lies too high for sycomores; so it has been almost too ingeniously supposed that Amos may have owned a plantation of sycomores in the hill country leading down to Philistia, technically called the Shephēlah (*R.V.*, "lowland"). Here there were sycomores in abundance (1 Kings x. 27). That this was his usual occupation we learn from a better source than the heading (i. 1), viz. a narrative (vii. 10, 17), evidently of early origin, which interrupts the series of prophetic visions on the fall of the kingdom of Israel. Amos, it appears, though himself a Judahite, had been prophesying in the northern kingdom, when his activity was brought to an abrupt close by the head priest of the royal sanctuary at Bethel, Amaziah, who bade him escape to the land of Judah and get his living there. The reply of Amos is full of instruction. "No prophet am I; no prophet's son am I; a shepherd am I, and one who tends sycomore-figs. And Yahweh took me from behind the flock; and Yahweh said to me, Go, prophesy against my people Israel." The following words show that a prophet in ancient Israel had the utmost freedom of speech. It was far otherwise in the period of the fall of Judah. (See Jeremiah.)

But what had Amos said that appeared so dangerous to the head priest? Amaziah summarizes it thus, "Jeroboam shall die by the sword, and Israel shall go away into captivity from his own land" (vii. 11; cf. vii. 9b, v. 27, vi. 7). He omits all the reasons for this stern prophecy. The reasons are that the good old Israelitish virtue of brotherliness is dying away, that oppression and injustice are rampant (ii. 6-8, iii. 9, 10, iv. 1, v. 11, 12, viii. 4-6), and that rites are practised in the name of religion which are abhorrent to Yahweh, because they either have no moral meaning at all, and are mere forms (v. 21-23), or else, judged from Amos's purified point of view, are absolutely immoral (ii. 7; cf. viii. 14). On the details of the captivity Amos preserves a mysterious vagueness. The fact, however, he puts forward with the confidence of one who is intimate with his God (iii. 7), and most probably it was at some great festival that he spoke the words which so perturbed Amaziah. The priest may not indeed himself have believed them, but he probably feared their effect on the moral courage of the people. And it is perhaps not arbitrary to suppose that the splendour of the ritual in Amos's time implies a tremulous anxiety that Israel's seeming prosperity under Jeroboam II. (see Jews) may not be as secure as could be wished. For Amos cannot have been quite alone either in Israel or in Judah; there must have been a little flock of those who felt with Amos that there was small reason indeed to "desire the day of Yahweh" (v. 18; see Harper's note).

But why did Amos so emphatically decline to be called a prophet? A prophet in some true sense he certainly was, a prophet who, within his own range, has not been surpassed. He means this—that he is no mere ecstatic enthusiast or "dervish," whose primary aim is to keep up the warlike spirit of the people, taking for granted that Yahweh is on the people's side, and that he is perfectly free from the taint of selfishness, not having to support himself by his prophesying. He could not indeed tell Amaziah this, but it is nevertheless true that he was the founder, or one of the founders, of a new type of prophet. He was also either the first, or one of the first, to write down, or to get written down, the substance of his spoken prophecies, and perhaps also prophecies which he never delivered at all. This was the consequence of his ill success as a public preacher. The other prophets of the same order may be presumed to have been hardly less unsuccessful. Hence the new phenomenon of written prophecies. The literary skill of Amos leads one to suppose that he had prepared in advance for this, perhaps we may say, not altogether unfortunate necessity.

That there are many hard problems connected with the fascinating book of Amos cannot be denied. The one point on which we have indicated a doubt, viz. as to the situation of Tekoa, ought strictly to be accompanied by others. For instance, how came Amos to transfer himself to northern Israel? How hard it must have been to obtain a footing there while he was a mere student and observer! And how came he by his wide knowledge of people outside the limits of Israel? The most recent and elaborate commentator even calls him an "ethnologist." And lastly, whence came his mastery of the poetical and literary arts? Is he really the Columbus of written prophecy? And behind these questions is the fundamental problem of the text, which has been somewhat too slightly treated. The text of Hosea may be in a much worse condition, but a keen scrutiny discloses many an uncertainty, not to say impossibility, in the traditional form of Amos. That the text has been much adapted and altered is certain; not less obvious are the corruptions due to carelessness and accident.

The main divisions of the book are plain, viz. chaps. i.–ii., chaps. iii.–vi., and chaps. vii.–ix. This arrangement, however, is probably not due to Amos himself, or to his immediate disciples, but to some later redactor. A number of passages seem to have been inserted subsequently to the time of Amos, on which see *Ency. Bib.*, "Amos," and the introduction to Robertson Smith's *Prophets of Israel* (^{2}), though in some cases the final decision will have to be preceded by a more thorough examination of the traditional text. The most obvious non-Amosian passage in the book is the concluding passage, ix. 8-15, which has evidently supplanted the original close of the section. The meaning of the phrase "the tabernacle (booth) of David that is fallen" (ver. 11) is not perfectly clear. Beyond reasonable doubt, however, the writer seeks to take out the sting of the preceding passage in which Israel is devoted to utter destruction. The penitent and God-fearing Jews of the post-exilic age needed some softening appendix, and this the editor provided.

English readers are now well supplied with books on Amos. Driver's *Joel and Amos* (see Joel) (1897) and G. A. Smith's *Twelve Prophets*, vol. i. (1896), supplement and illustrate each other. Harper's *Amos and Hosea* (see Hosea) (1905) gives the cream of all the good things that have been said before, with a generally sound judgment; it is addressed to advanced students, and is perhaps less cautious than the two former. The German commentaries on the Minor Prophets by Nowack (2nd ed., 1903) and (especially) Marti (1904) must not, however, be neglected. Wellhausen's briefer work (3rd ed., 1898) is especially suggestive for textual criticism. Cheyne's *Critica Biblica* (1904), cf. his review of Harper in *Hibbert Journal*, iii. 824 ff., breaks new ground. (T. K. C.)

AMOS, SHELDON (1835–1886), English jurist, was educated at Clare College, Cambridge, and was called to the bar as a member of the Middle Temple in 1862. In 1869 he was appointed to the chair of jurisprudence in University College, London, and in 1872 became reader under the council of legal education and examiner in constitutional law and history to the university of London. Failing health led to his resignation of those offices, and he took a voyage to the South Seas. He resided for a short time at Sydney, and finally settled in Egypt, where he practised as an advocate. After the bombardment of Alexandria, and the reorganization of the Egyptian judicature, he was appointed judge of the court of appeal, but being without any previous experience of administrative work he found the strain too great for his health. He came to England on leave in the autumn of 1885, and on his return to Egypt he died suddenly at Alexandria on the 3rd of January 1886. His principal publications are: *Systematic View of the Science of Jurisprudence* (1872); *Lectures on International Law* (1873); *Science of Law* (1874); *Science of Politics* (1883); *History and Principles of the Civil Law of Rome as Aid to the Study of Scientific and Comparative Jurisprudence* (1883), and numerous pamphlets. His wife, Mrs Sheldon Amos (Sarah Maclardie Bunting), took a prominent part in Liberal Nonconformist politics and in movements connected with the position of women. She died at Cairo on the 21st of January 1908.

AMOY, a city and treaty-port in the province of Fuh-kien, China, situated on the slope of a hill, on the south coast of a small and barren island named Hiamen, in 24° 28′ N. and 118° 10′ E. It is a large and exceedingly dirty place, about 9 m. in circumference, and is divided into two portions, an inner and an outer town, which are separated from each other by a ridge of hills, on which a citadel of considerable strength has been built. Each of these divisions of the city possesses a large and commodious harbour, that of the inner town, or city proper, being protected by strong fortifications. There are dry-docks and an excellent anchorage. Amoy may be regarded as the port of the inland city of Chang-chow, with which it has river communication, and its trade, both foreign and coastwise, is extensive and valuable. The chief articles imported are sugar, rice, raw cotton and opium, as well as cotton cloths, iron goods and other European manufactures. The chief exports are tea, porcelain and paper. The trade carried on by means of Chinese junks is said to be large, and the native merchants are considered to be among the wealthiest and most enterprising in China. By other vessels the trade in 1870 was:—imports, £1,915,427; exports, £1,440,000. In 1904 the figures were:—imports, £2,081,494; exports, £384,494. The falling off of exports is due to the decreased demand for China tea, for which Amoy was one of the chief centres. The native population is now estimated at 300,000, and the foreign residents number about 280. A large part of the trade is that carried on with the neighbouring Japanese island of Formosa. The province of Fuh-kien is claimed by the Japanese as their particular sphere of influence. Amoy was captured by the British in 1841, after a determined resistance, and is one of the five ports that were opened to British commerce by the treaty of 1842; it is now open to the ships of all nations.

AMPELIUS, LUCIUS, possibly a tutor or schoolmaster, and author of an extremely concise summary—a kind of index—of universal history (*Liber Memorialis*) from the earliest times to the reign of Trajan. Its object and scope are sufficiently indicated in the dedication to a certain Macrinus: "Since you desire to know everything, I have written this 'book of notes,' that you may learn of what the universe and its elements consist, what the world contains, and what the human race has done." It seems to have been intended as a text-book to be learnt by heart. The little work, in fifty chapters, gives a sketch of cosmography, geography, mythology (chaps. i.–x.), and history (chap. x.–end). The historical portion, dealing mainly with the republican period, is untrustworthy, and the text in many places corrupt; the earlier chapters are more valuable, and contain some interesting information. In chap. viii. (*Miracula Mundi*) occurs the only reference in an ancient writer to the famous sculptures of Pergamum, discovered in 1871, excavated in 1878 and now at Berlin: "At Pergamum there is a great marble altar, 40 ft. high, with colossal sculptures, representing a battle of the giants." Nothing is known of the author or of the date at which he lived: the times of Trajan, Hadrian, Antoninus Pius, the beginning of the 3rd century, and the age of Diocletian and Constantine have all been suggested. The Macrinus to whom the work is dedicated may have been the emperor, who reigned 217–218, but the name is not uncommon, and it seems more likely that he was a young man with a thirst for universal knowledge, which the *Liber Memorialis* was compiled to satisfy.

There is no English edition or translation. The first edition of Ampelius was published in 1638 by Salmasius (Saumaise) from the Dijon MS., now lost, together with the Epitome of Florus; the latest edition is by Wölfflin (1854), based on Salmasius's copy of the lost codex.

See Gläser, *Rheinisches Museum*, ii. (1843); Zink, *Eos*, ii. (1866); Wölfflin, *De L. Ampelii Libro Memoriali* (1854).

AMPELOPSIS (from Gr. ἄμπελος, vine, and ὄψις, appearance, as it resembles the grape-vine in habit), a genus of the vine order *Ampelideae* and nearly allied to the grape-vine. The plants are rapidly-growing, hardy, ornamental climbers, which flourish in common garden soil, and are readily propagated by cuttings. They climb by means of tendrils. *A. quinquefolia*, Virginian creeper, a native of North America, introduced to Europe early in the 17th century, has palmately compound leaves with three to five leaflets. *A. tricuspidata*, better known as *A. Veitchii*, a more recent introduction (1868) from Japan, has smaller leaves very variable in shape; it clings readily to stone or brick work by means of suckers at the ends of the branched tendrils.

AMPÈRE, ANDRÉ MARIE (1775–1836), French physicist, was born at Polémieux, near Lyons, on the 22nd of January 1775. He took a passionate delight in the pursuit of knowledge from his very infancy, and is reported to have worked out long arithmetical sums by means of pebbles and biscuit crumbs before he knew the figures. His father began to teach him Latin, but ceased on discovering the boy's greater inclination and aptitude for mathematical studies. The young Ampère, however, soon resumed his Latin lessons, to enable him to master the works of Euler and Bernouilli. In later life he was accustomed to say that he knew as much about mathematics when he was eighteen as ever he knew; but his reading embraced nearly the whole round of knowledge—history, travels, poetry, philosophy and the natural sciences. When Lyons was taken by the army of the Convention in 1793, the father of Ampère, who, holding the office of *juge de paix*, had stood out resolutely against the previous revolutionary excesses, was at once thrown into prison, and soon after perished on the scaffold. This event produced a profound impression on his susceptible mind, and for more than a year he remained sunk in apathy. Then his interest was aroused by some letters on botany which fell into his hands, and from botany he turned to the study of the classic poets, and to the writing of verses himself. In 1796 he met Julie Carron, and an attachment sprang up between them, the progress of which he naïvely recorded in a journal (*Amorum*). In 1799 they were married. From about 1796 Ampère gave private lessons at Lyons in mathematics, chemistry and languages; and in 1801 he removed to Bourg, as professor of physics and chemistry, leaving his ailing wife and infant son at Lyons. She died in 1804, and he never recovered from the blow. In the same year he was appointed professor of mathematics at the lycée of Lyons. His small treatise, *Considérations sur la théorie mathématique du jeu*, which demonstrated that the chances of play are decidedly against the habitual gambler, published in 1802, brought him under the notice of J. B. J. Delambre, whose recommendation obtained for him the Lyons appointment, and afterwards (1804) a subordinate position in the polytechnic school at Paris, where he was elected professor of mathematics in 1809. Here he continued to prosecute his scientific researches and his multifarious studies with unabated diligence. He was admitted a member of the Institute in 1814. It is on the service that he rendered to science in establishing the relations between electricity and magnetism, and in developing the science of electromagnetism, or, as he called it, electrodynamics, that Ampère's fame mainly rests. On the 11th of September 1820 he heard of H. C. Oersted's discovery that a magnetic needle is acted on by a voltaic current. On the 18th of the same month he presented a paper to the Academy, containing a far more complete exposition of that and kindred phenomena. (See ELECTROKINETICS.) The whole field thus opened up he explored with characteristic industry and care, and developed a mathematical theory which not only explained the electromagnetic phenomena already observed but also predicted many new ones. His original memoirs on this subject may be found in the *Ann. Chim. Phys.* between 1820 and 1828. Late in life he prepared a remarkable *Essai sur la philosophie des sciences*. In addition, he wrote a number of scientific memoirs and papers, including two on the integration of partial differential equations (*Jour. École Polytechn.* x., xi.). He died at Marseilles on the 10th of June 1836. The great amiability and childlike simplicity of Ampère's character are well brought out in his *Journal et correspondance* (Paris, 1872).

AMPÈRE, JEAN JACQUES (1800–1864), French philologist and man of letters, only son of André Marie Ampère, was born at Lyons on the 12th of August 1800. He studied the folk-songs and popular poetry of the Scandinavian countries in an extended tour in northern Europe. Returning to France, he delivered in 1830 a series of lectures on Scandinavian and early German poetry at the Athenaeum in Marseilles. The first of these was printed as *De l'Histoire de la poésie* (1830), and was practically the first introduction of the French public to the Scandinavian and German epics. In Paris he taught at the Sorbonne, and became professor of the history of French literature at the Collège de France. A journey in northern Africa (1841) was followed by a tour in Greece and Italy, in company with Prosper Mérimée and others. This bore fruit in his *Voyage dantesque* (printed in his *Grèce, Rome et Dante*, 1848), which did much to popularize the study of Dante in France. In 1848 he became a member of the French Academy, and in 1851 he visited America. From this time he was occupied with his chief work, *L'Histoire romaine à Rome* (4 vols., 1861–1864), until his death at Pau on the 27th of March 1864.

The *Correspondance et souvenirs* (2 vols.) of A. M. and J. J. Ampère (1805–1854) was published in 1875. Notices of J. J. Ampère are to be found in Sainte-Beuve's *Portraits littéraires*, vol. iv., and *Nouveaux Lundis*, vol. xiii.; and in P. Mérimée's *Portraits historiques et littéraires* (2nd ed., 1875).

AMPEREMETER, or AMMETER, an instrument for the measurement of electric currents in terms of the unit called the ampere. (See ELECTROKINETICS; CONDUCTION, ELECTRIC; and UNITS, PHYSICAL.) Since electric currents may be either continuous, *i.e.* unidirectional, or alternating, and the latter of high or of low frequency, amperemeters may first be divided into those (1) for continuous or direct currents, (2) for low frequency alternating currents, and (3) for high frequency alternating currents. A continuous electric current of one ampere is defined to be one which deposits electrolytically 0·001118 of a gramme of silver per second from a neutral solution of silver nitrate.[1] An alternating current of one ampere is defined to be one which produces the same heat in a second in a wire as the unit continuous current defined as above to be one ampere. These definitions provide a basis on which the calibration of amperemeters can be conducted. Amperemeters may then be classified according to the physical principle on which they are constructed. An electric current in a conductor is recognized by its ability (*a*) to create heat in a wire through which it passes, (*b*) to produce a magnetic field round the conductor or wire. The heat makes itself evident by raising the temperature and therefore elongating the wire, whilst the magnetic field creates mechanical forces which act on pieces of iron or other conductors conveying electric currents when placed in proximity to the conductor in question. Hence we may classify ammeters into (1) Thermal; (2) Electromagnetic, and (3) Electrodynamic instruments.

1. *Thermal Ammeters.*—These instruments are also called hot-wire ammeters. In their simplest form they consist of a wire through which passes the current to be measured, some arrangement being provided for measuring the small expansion produced by the heat generated in the wire. This may consist simply in attaching one end of the wire to an index lever and the other to a fixed support, or the elongation of the wire may cause a rotation in a mirror from which a ray of light is reflected, and the movement of this ray over a scale will then provide the necessary means of indication. It is found most convenient to make use of the sag of the wire produced when it is stretched between two fixed points (K_1K_2, fig. 1) and then heated. To render the elongation evident, another wire is attached to its centre S_2, this last having a thread fixed to its middle of which the other end is twisted round the shaft of an index needle or in some way connected to it through a multiplying gear. The expansion of the working wire when it is heated will then increase or create a sag in it owing to its increase in length, and this is multiplied and rendered evident by the movement of the index needle. In order that this may take place, the heated wire must be flexible and must therefore be a single fine wire or a bundle of fine wires. In ammeters for small currents it is customary to pass the whole current through the heating wire. In instruments for larger currents the main current passes through a metallic strip acting as a bye-pass or shunt, and to the ends of this shunt are attached the ends of the working wire. A known fraction of the current is then indicated and measured. This shunt is generally a strip of platinoid or constantin, and the working wire itself is of the same metal. There is therefore a certain ratio in which any current passing through the ammeter is divided between the shunt and the working wire.

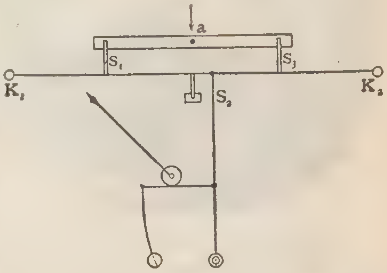

FIG. 1.—Diagram showing the arrangements of Hartmann and Braun's Hot-wire Ammeter.

Thermal ammeters recommend themselves for the following reasons:—(1) the same instrument can be used for continuous currents and for alternating currents of low frequency; (2) there is no temperature correction; (3) if used with alternating currents no correction is necessary for frequency, unless that frequency is very high. It is, however, requisite to make provision for the effect of changes in atmospheric temperature. This is done by mounting the working wire on a metal plate made of the same metal as the working wire itself; thus if the working wire is of platinoid it must be mounted on a platinoid bar, the supports which carry the ends of the working wire being insulated from this bar by being bushed with ivory or porcelain. Then no changes of external temperature can affect the sag of the wire, and the only thing which can alter its length relatively to the supporting bar is the passage of a current through it. Hot-wire ammeters are, however, liable to a shift of zero, and means are always provided by some adjusting screw for slightly altering the sag of the wire and so adjusting the index needle to the zero of the scale. Hot-wire ammeters are open to the following objections:—The scale divisions for equal increments of current are not equal in length, being generally much closer together in the lower parts of the scale. The reason is that the heat produced in a given time in a wire is proportional to the square of the strength of the current passing through it, and hence the rate at which the heat is produced in the wire, and therefore its temperature, increases much faster than the current itself increases. From this it follows that hot-wire ammeters are generally not capable of giving visible indications below a certain minimum current for each instrument. The instrument therefore does not begin to read from zero current, but from some higher limit which, generally speaking, is about one-tenth of the maximum, so that an ammeter reading up to 10 amperes will not give much visible indication below 1 ampere. On the other hand, hot-wire instruments are very "dead-beat," that is to say, the needle does not move much for the small fluctuations in the current, and this quality is generally increased by affixing to the index needle a small copper plate which is made to move in a strong magnetic field (see fig. 2). Hot-wire instruments working on the sag principle can be used in any position if properly constructed, and are very portable. In the construction of such an instrument it is essential that the wire should be subjected to a process of preparation or "ageing," which consists in passing through it a fairly strong current, at least the maximum that it will ever have to carry, and starting and stopping this current frequently. The wire ought to be so treated for many hours before it is placed in the instrument. It is also necessary to notice that shunt instruments cannot be used for high frequencies, as then the relative inductance of the shunt and wire becomes important and affects the ratio in which the current is divided, whereas for low frequency currents the inductance is unimportant. In constructing a hot-wire instrument for the measurement of high frequency currents it is necessary to make the working wire of a number of fine wires placed in parallel and slightly separated from one another, and to pass the whole of the current to be measured through this strand.

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[1] See J. A. Fleming, *A Handbook for the Electrical Laboratory and Testing Room*, vol. i. p. 341 (1901), also A. Gray, *Absolute Measurements in Electricity and Magnetism*, vol. ii. pt. ii. p. 412 (1893).

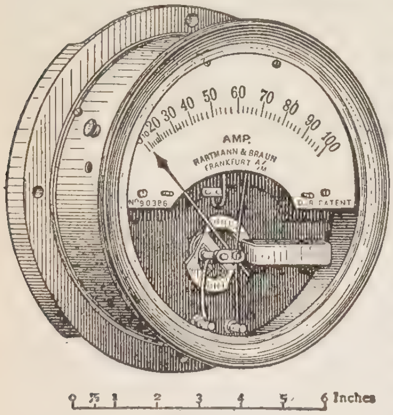

FIG. 2.—Hot-wire Ammeter.

In certain forms, hot-wire instruments are well adapted for the measurement of very small alternating currents. One useful form has been made as follows:—Two fine wires of diameter not greater than ·001 in. are stretched parallel to one another and 2 or 3 mm. apart. At the middle of these parallel wires, which are preferably about 1 m. in length, rests a very light metallic bridge to which a mirror is attached, the mirror reflecting a ray of light from a lamp upon a screen. If a small alternating current is passed through one wire, it sags down, the mirror is tilted, and the spot of light on the screen is displaced. Changes of atmospheric temperature affect both wires equally and do not tilt the mirror. The instrument can be calibrated by a continuous current. Another form of hot-wire ammeter is a modification of the electric thermometer originally invented by Sir W. Snow Harris. It consists of a glass bulb, in which there is a loop of fine wire, and to the bulb is attached a U-tube in which there is some liquid. When a current is passed through the wire, continuous or alternating, it creates heat, which expands the air in the bulb and forces the liquid up one side of the U-tube to a certain position in which the rate of loss of heat by the air is equal to the rate at which it is gaining heat. The instrument can be calibrated by continuous currents and may then be used for high frequency alternating currents.

2. *Electromagnetic Ammeters.*—Another large class of ammeters depend for their action upon the fact that an electric current creates an electric field round its conductor, which varies in strength from point to point, but is otherwise proportional to the current. A small piece of iron placed in this field tends to move from weak to strong places in the field with a force depending on the strength of the field and the rate at which the field varies. In its simplest form an electromagnetic ammeter consists of a circular coil of wire in which is pivoted eccentrically an index needle carrying at its lower end a small mass of iron. The needle is balanced so that gravity compels it to take a certain position in which the fragment of iron occupies a position in the centre of the field of the coil where it is weakest. When a current is passed through the coil the iron tends to move nearer to the coil of the wire where the field is stronger and so displaces the index needle over the scale. Such an instrument is called a soft-iron gravity ammeter. Another type of similar instrument consists of a coil of wire having a fragment of iron wire suspended from one arm of an index needle near the mouth of a coil. When a current is passed through the wire forming the coil, the fragment of iron is drawn more into the aperture of the coil where the field is stronger and so displaces an index needle over a scale. In the construction of this soft-iron instrument it is essential that the fragment of iron should be as small and as well annealed as possible and not touched with tools after annealing; also it should be preferably not too elongated in shape so that it may not acquire permanent magnetization but that its magnetic condition may follow the changes of the current in the coil. If these conditions are not fulfilled sufficiently, the ammeter will not give the same indications for the same current if that current has been reached (*a*) by increasing from a smaller current, or (*b*) by decreasing from a larger current. In this case there is said to be hysteresis in the readings. Although therefore most simple and cheap to construct, such soft-iron instruments are not well adapted for accurate work. A much better form of electromagnetic ammeter can be constructed on a principle now extensively employed, which consists in pivoting in the strong field of a permanent magnet a small coil through which a part of the current to be measured is sent. Such an instrument is called a shunted movable coil ammeter, and is represented by a type of instrument shown in fig. 3. The construction of this instrument is as follows:—Within the instrument is a horseshoe magnet having soft-iron pole pieces so arranged as to produce a uniform magnetic field. In this magnetic field is pivoted a small circular or rectangular coil carried in jewelled bearings, the current being passed into and out of the movable coil by fine flexible conductors. The coil carries an index needle moving over a scale, and there is generally an iron core in the interior of the coil but fixed and independent of it. The coil is so situated that, in its zero position when no current is passing through it, the plane of the coil is parallel to the direction of the lines of force of the field. When a current is passed through the coil it rotates in the field and displaces the index over the scale against the control of a spiral spring like the hairspring of a watch. Such instruments can be made to have equidivisional scales and to read from zero upwards. It is essential that the permanent magnet should be subjected to a process of ageing so that its field may not be liable to change subsequently with time.

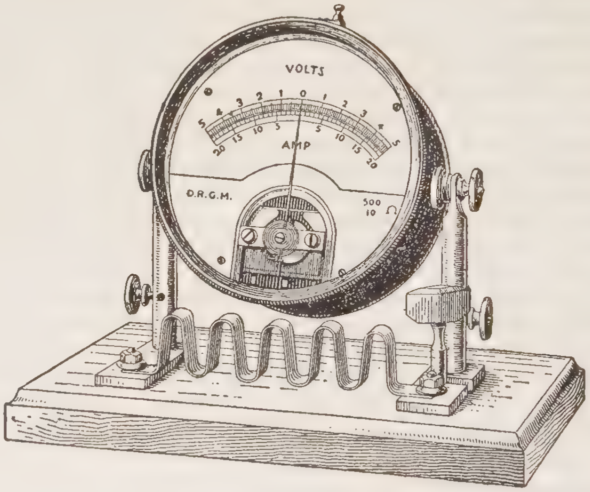

FIG. 3.—Shunted Movable Coil Ammeter, Isenthal & Co.

In the case of ammeters intended for very small currents, the whole current can be sent through the coil, but for larger currents it is necessary to provide in the instrument a shunt which carries the main current, the movable coil being connected to the ends of this shunt so that it takes a definite small fraction of the current passed through the instrument. Instruments of this type with a permanent magnetic field are only available for the measurement of continuous currents, but soft-iron instruments of the above-described gravity type can be employed with certain restrictions for the measurement of alternating currents. Direct reading equidivisional movable coil ammeters can be made in various portable forms, and are very much employed as laboratory instruments and also as ammeters for the measurement of large electric currents in electric generating stations. In this last case the shunt need not be contained in the instrument itself but may be at a considerable distance, wires being brought from the shunt which carries the main current to the movable coil ammeter itself, which performs the function simply of an indicator,

3. *Electrodynamic Ammeters.*—Instruments of the third class depend for their action on the fact discovered by Ampère, that mechanical forces exist between conductors carrying electric currents when those conductors occupy certain relative positions. If there be two parallel wires through which currents are passing, then these wires are drawn together if the currents are in the same direction and pressed apart if they are in opposite directions. (See ELECTROKINETICS.) Instruments of this type are called Electrodynamometers, and have been employed both as laboratory research instruments and for technical purposes. In one well-known form, called a Siemens Electrodynamometer, there is a fixed coil (fig. 4), which is surrounded by another coil having its axis at right angles to that of the fixed coil. This second coil is suspended by a number of silk fibres, and to the coil is also attached a spiral spring the other end of which is fastened to a torsion head. If then the torsion head is twisted, the suspended coil experiences a torque and is displaced through an angle equal to that of the torsion head. The current can be passed into and out of the movable coil by permitting the ends of the coil to dip into two mercury cups. If a current is passed through the fixed coil and movable coil in series with one another, the movable coil tends to displace itself so as to bring the axes of the coils, which are normally at right angles, more into the same direction. This tendency can be resisted by giving a twist to the torsion head and so applying to the movable coil through the spring a restoring torque, which opposes the torque due to the dynamic action of the currents. If then the torsion head is provided with an index needle, and also if the movable coil is provided with an indicating point, it is possible to measure the torsional angle through which the head must be twisted to bring the movable coil back to its zero position. In these circumstances the torsional angle becomes a measure of the torque and therefore of the product of the strengths of the currents in the two coils, that is to say, of the square of the strength of the current passing through the two coils if they are joined up in series. The instrument can therefore be graduated by passing through it known and measured continuous currents, and it then becomes available for use with either continuous or alternating currents. The instrument can be provided with a curve or table showing the current corresponding to each angular displacement of the torsion head. It has the disadvantage of not being direct reading when made in the usual form, but can easily be converted into a direct reading instrument by appropriately dividing the scale over which the index of the torsion head moves.

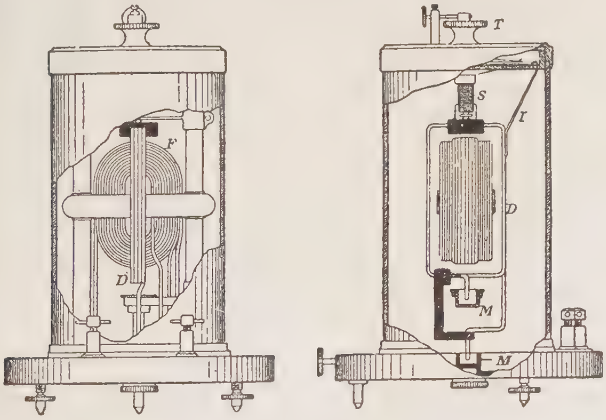

FIG. 4.—Siemens Electrodynamometer.
F, Fixed coil; *D*, Movable coil; *S*, Spiral spring; *T*, Torsion head; *MM*, Mercury cups; *I*, Index needle.

Ampere Balance.—Very convenient and accurate instruments based on the above principles have been devised by Lord Kelvin, and a large variety of these ampere balances, as they are called, suitable for measuring currents from a fraction of an ampere up to many thousands of amperes, have been constructed by that illustrious inventor. The difficulty which has generally presented itself to those who have tried to design instruments on the electrodynamometer principle for use with large currents has been that of getting the current into and out of the movable conductor, and yet permitting that conductor to remain free to move under very small force. The use of mercury cups is open to many objections on account of the fact that the mercury becomes oxidized, and such instruments are not very convenient for transportation. The great novelty in the ampere balances of Lord Kelvin was a joint or electric coupling, which is at once exceedingly flexible and yet capable of being constructed to carry with safety any desired current. This he achieved by the introduction of a device which is called a metallic ligament. The general principle of its construction is as follows:—Let +A, −A (fig. 5), be a pair of semi-cylindrical fixed trunnions which are carried on a supporting frame and held with flat sides downwards. Let + B, −B, be two smaller trunnions which project out from the sides of the two strips connecting together a pair of rings CC. The rings and the connecting strips constitute the circuit which is to be rendered movable. A current entering by the trunnion + B flows round the two halves of the circuit, as shown by the arrows, and comes out at the trunnion −B. In fig. 5 the current is shown dividing round the two rings; but in all the balances, except those intended for the largest currents, the current really circulates first round one ring and then round the other. To make the ligament, a very large number of exceedingly fine copper wires laid close together are soldered to the upper surface of the upper trunnion. The movable circuit CC thus hangs by two ligaments which are formed of very fine copper wires. This mode of suspension enables the conductor CC to vibrate freely like a balance, but at the same time very large currents can easily be passed through this perfectly flexible joint.

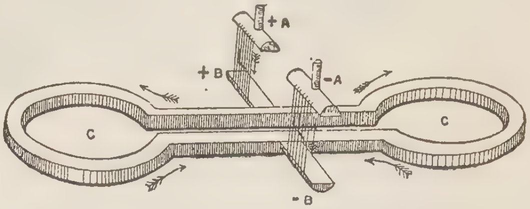

FIG. 5.—Kelvin Flexible Metallic Ligament.

Above and below these movable coils, which form as it were the two scale-pans of a balance, are fixed other stationary coils, and the connexions of all these six coils (shown in fig. 6) are such that when a current is passed through the whole of the coils in series, forces of attraction and repulsion are brought into existence which tend to force one movable coil upwards and the other movable coil downwards. This tendency is resisted by the weight of a mass of metal, which can be caused to slide along a tray attached to the movable coils. The appearance of the complete instrument is shown by fig. 7. When a current is passed through the instrument it causes one end of the movable system to tilt downwards, and the other end upwards; the sliding weight is then moved along the tray by means of a silk cord until equilibrium is again established. The value of the current in amperes is then

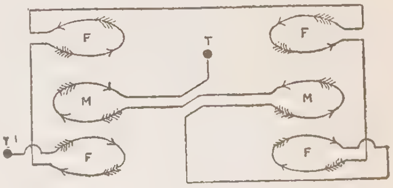

FIG. 6.—Connexions of Kelvin Ampere Balance.

obtained approximately by observing the position of the weight on the scale, or it may be obtained more accurately in the following manner:—The upper edge of the shelf on which the weights slide (see fig. 8) is graduated into equal divisions, and the weight is provided with a sharp tongue of metal in order that its position on the shelf may be accurately determined. Since the current passing through the balance when equilibrium is obtained with a given weight is proportional to the square root of the couple due to this weight, it follows that the current strength when equilibrium is obtained is proportional to the product of the square root of the weight used and the square root of the displacement distance of this weight from its zero position. Each instrument is accompanied by a pair of weights and by a square root table, so that the product of the square root of the number corresponding to the position of the sliding weight and the ascertained constant for each weight, gives at once the value of the current in amperes. Each of these balances is made to cover a certain range of reading. Thus the centi-ampere balance ranges from 1 to 100 centi-amperes, the deci-ampere balance from 1 to 100 deci-amperes, the ampere balance from 1 to 100 amperes, the deka-ampere balance from 1 to 100 amperes, the hecto-ampere balance from 6 to 600 amperes, and the kilo-ampere balance from 100 to 2500 amperes. They are constructed for the measurement not only of continuous or unvarying but also of alternating currents. In those intended for alternating currents, the main current through the movable coil, whether consisting of one turn or more than one turn, is carried by a wire rope, of which each component strand is insulated by silk covering, to prevent the inductive action from altering the distribution of the current across the transverse section of the conductor. To avoid the creation of induced currents, the coil frames and the base boards are constructed of slate. Kelvin ampere balances are made in two types—(1) a variable weight type suitable for obtaining the ampere value of any current within their range; and (2) a fixed weight type intended to indicate when a current which can be varied at pleasure has a certain fixed value. An instrument of the latter type of considerable accuracy was designed by Lord Kelvin for the British Board of Trade Electrical Laboratory, and it is there used as the principal standard ampere balance. A fixed weight is placed on one coil and the current is varied gradually until the balance is just in equilibrium. In these circumstances the current is known to have a fixed value in amperes determined by the weight attached to the instrument.

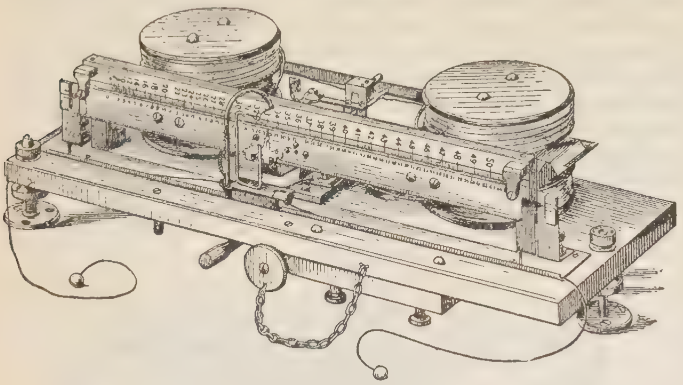

Fig. 7.—Lord Kelvin's Ampere Balance.

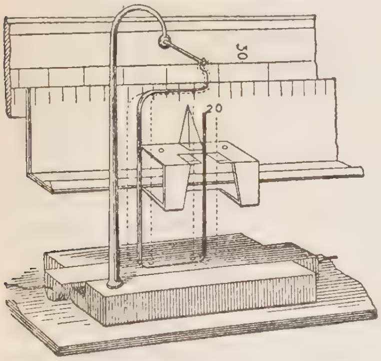

Fig. 8.—Slider of Kelvin Ampere Balance.

Calibration.—The calibration of ammeters is best conducted by means of a series of standard low resistances and of a potentiometer (*q.v.*). The ammeter to be calibrated is placed in series with a suitable low resistance which may be ·1 ohm, ·01 ohm, ·001 ohm or more as the case may be. A steady continuous current is then passed through the ammeter and low resistance, placed in series with one another and adjusted so as to give any required scale reading on the ammeter. The potential difference of the ends of the low resistance is at the same time measured on the potentiometer, and the quotient of this potential difference by the known value of the low resistance gives the true value of the current passing through the ammeter. This can be then compared with the observed scale reading and the error of the ammeter noted.[1]

A good ammeter should comply with the following qualifications:—(1) its readings should be the same for the same current whether reached by increasing from a lower current or decreasing from a higher current; (2) if used for alternating currents its indications should not vary with the frequency within the range of frequency for which it is likely to be used; (3) it should not be disturbed by external magnetic fields; (4) the scale divisions should, if possible, be equal in length and there should be no dead part in the scale. In the use of ammeters in which the control is the gravity of a weight, such as the Kelvin ampere balances and other instruments, it should be noted that the scale reading or indication of the instrument will vary with the latitude and with the height of the instrument above the mean sea-level. Since the difference between the acceleration of gravity at the pole and at the equator is about $\frac{1}{2}$ %, the correction for latitude will be quite sensible in an instrument which might be used at various times in high and low latitudes. If G is the acceleration of gravity at the equator and g that at any latitude λ, then $g=G(1+0{\cdot}00513\sin^2\lambda)$. In the case of an instrument with gravity control, the latitude at which it is calibrated should therefore be stated.

Switchboard Ammeters.—For switchboard use in electric supply stations where space is valuable, instruments of the type called edgewise ammeters are much employed. In these the indicating needle moves over a graduated cylindrically shaped scale, and they are for the most part electromagnetic instruments (see fig. 9).

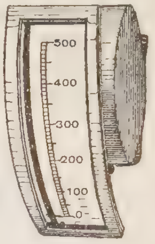

Fig. 9.—Edgewise Switchboard Ammeter, Kelvin & James White Ltd.

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AMPERSAND (a corruption of the mixed English and Latin phrase, "and *per se* and," of which there are many dialect forms, as "ampussyand," or "amperseand"), the name of the sign *&* or &, which is a combination of the letters *e*, *t*, of the Lat. *et*= and. The sign is now usually called "short and." In old-fashioned primers and nursery books the name and sign were always added at the end of the alphabet.

AMPHIARAUS, in Greek mythology, a celebrated seer and prince of Argos, son of Oïcles (or Apollo) and Hypermestra, and through his father descended from the prophet Melampus (*Odyssey*, xv. 244). He took part in the voyage of the Argonauts and in the chase of the Calydonian boar; but his chief fame is in connexion with the expedition of the Seven against Thebes, organized by Adrastus, the brother of his wife Eriphyle, for the purpose of restoring Polyneices to the throne. Amphiaraus, foreseeing the disastrous issue of the war, at first refused to share in it; he had, however, promised Eriphyle when he married her that, in the event of any dispute arising between her brother and himself, she should decide between them; and now Eriphyle, bribed by Polyneices with the fatal necklace given by Cadmus to Harmonia, persuaded him against his better judgment to set out on the expedition. Knowing his doom, he bade his sons, Alcmaeon and Amphilochus, avenge his death upon their mother, upon whom, as he stepped into his chariot, he turned a look of anger. This scene was represented upon the chest of Cypselus described by Pausanias (v. 17).

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[1] See "The Electrolysis of Copper Sulphate in Standardizing Electrical Instruments," by A. W. Meikle, read before the Physical Society of Glasgow University on the 27th of January 1888, or J. A. Fleming, *A Handbook for the Electrical Laboratory and Testing Room*, vol. i. p. 343.

The assault on Thebes was disastrous for the Seven; and Amphiaraus, pursued by Periclymenus, would have been slain with his spear, had not Zeus with a thunderbolt opened a chasm into which the seer, with his chariot, horses and charioteer, disappeared. Henceforth he was numbered with the immortals and worshipped as a god. Near Oropus, on the supposed site of his passing, his sanctuary arose, with healing springs, and an oracle famous for its interpretation of dreams (Pausanias i. 34). The ruins of this temple, with inscriptions which identify it, have been discovered and preserved at Mavrodilisi, in the provinces of Boeotia and Attica. There was another temple dedicated to him on the road from Thebes to Potniae, and here was the oracle of Amphiaraus consulted by Croesus and Mardonius.

Homer, *Odyssey*, xi. 326; Herodotus viii. 134; Pindar, *Olympia*, vi., *Nemea*, ix.; Apollodorus iii. 6.

AMPHIBIA, a zoological term originally employed by Linnaeus to denote a class of the Animal Kingdom comprising crocodiles, lizards and salamanders, snakes and *Caeciliae*, tortoises and turtles and frogs; to which, in the later editions of the *Systema Naturae* he added some groups of fishes. In the *Tableau Elêmentaire*, published in 1795, Cuvier adopts Linnaeus's term in its earlier sense, but uses the French word "Reptiles," already brought into use by Brisson, as the equivalent of *Amphibia*. In addition Cuvier accepts the Linnaean subdivisions of *Amphibia-Reptilia* for the tortoises, lizards (including crocodiles), salamanders and frogs; and *Amphibia-Serpentes* for the snakes, apodal lizards and *Caeciliae*.

In 1799[1] Alexandre Brongniart pointed out the wide differences which separate the frogs and salamanders (which he terms *Batrachia*) from the other reptiles; and in 1804 P. A. Latreille,[2] rightly estimating the value of these differences, though he was not an original worker in the field of vertebrate zoology, proposed to separate Brongniart's *Batrachia* from the class of *Reptilia* proper, as a group of equal value, for which he retained the Linnaean name of *Amphibia*.

Cuvier went no further than Brongniart, and, in the *Règne Animal*, he dropped the term *Amphibia*, and substituted *Reptilia* for it. J. F. Meckel,[3] on the other hand, while equally accepting Brongniart's classification, retained the term *Amphibia* in its earlier Linnaean sense; and his example has been generally followed by German writers, as, for instance, by H. Stannius, in that remarkable monument of accurate and extensive research, the *Handbuch der Zootomie* (2nd ed., 1856).

In 1816, de Blainville,[4] adopting Latreille's view, divided the Linnaean *Amphibia* into *Squamifêres* and *Nudipellifêres*, or *Amphibiens*; though he offered an alternative arrangement, in which the class *Reptiles* is preserved and divided into two sub-classes, the *Ornithoides* and the *Ichthyoides*. The latter are Brongniart's *Batrachia*, *plus* the *Caeciliae*, whose true affinities had, in the meanwhile, been shown by A. M. C. Duméril; and, in this arrangement, the name *Amphibiens* is restricted to *Proteus* and *Siren*.

B. Merrem's *Pholidota* and *Batrachia* (1820), F. S. Leuckart's *Monopnoa* and *Dipnoa* (1821), J. Müller's *Squamata* and *Nuda* (1832), are merely new names for de Blainville's *Ornithoides* and *Ichthyoides*, though Müller gave far better anatomical characters of the two groups than had previously been put forward. Moreover, following the indications already given by K. E. von Baer in 1828,[5] Müller calls the attention of naturalists to the important fact, that while all the *Squamata* possess an amnion and an allantois, these structures are absent in the embryos of all the *Nuda*. An appeal made by Müller for observations on the development of the *Caeciliae*, and of those *Amphibia* which retain gills or gill-clefts throughout life, has unfortunately yielded no fruits.

In 1825 P. A. Latreille[6] published a new classification of the *Vertebrata*, which are primarily divided into *Haematherma*, containing the three classes of *Mammifera*, *Monotremata* and *Aves*; and *Haemacryma*, also containing three classes—*Reptilia*, *Amphibia* and *Pisces*. This division of the *Vertebrata* into hot and cold blooded is a curiously retrograde step, only intelligible when we reflect that the excellent entomologist had no real comprehension of vertebrate morphology; but he makes some atonement for the blunder by steadily upholding the class distinctness of the *Amphibia*. In this he was followed by Dr J. E. Gray; but Duméril and Bibron in their great work,[7] and Dr Günther in his *Catalogue*, in substance, adopted Brongniart's arrangement, the *Batrachia* being simply one of the four orders of the class *Reptilia*. Huxley adopted Latreille's view of the distinctness of the *Amphibia*, as a class of the *Vertebrata*, co-ordinate with the *Mammalia*, *Aves*, *Reptilia* and *Pisces*; and the same arrangement was accepted by Gegenbaur and Haeckel. In the Hunterian lectures delivered at the Royal College of Surgeons in 1863, Huxley divided the *Vertebrata* into Mammals, Sauroids and Ichthyoids, the latter division containing the *Amphibia* and *Pisces*. Subsequently he proposed the names of *Sauropsida* and *Ichthyopsida* for the Sauroids and Ichthyoids respectively.

Sir Richard Owen, in his work on *The Anatomy of Vertebrates*, followed Latreille in dividing the *Vertebrata* into *Haematotherma* and *Haematocrya*, and adopted Leuckart's term of *Dipnoa* for the *Amphibia*. T. H. Huxley, in the ninth edition of this *Encyclopaedia*, treated of Brongniart's *Batrachia*, under the designation Amphibia, but this use of the word has not been generally accepted. (See BATRACHIA.) (T. H. H.; P. C. M.)

AMPHIBOLE, an important group of rock-forming minerals, very similar in chemical composition and general characters to the pyroxenes, and like them falling into three series according to the system of crystallization. They differ from the pyroxenes, however, in having an angle between the prismatic cleavage of 56° instead of 87°; they are specifically lighter than the corresponding pyroxenes; and, in their optical characters, they are distinguished by their stronger pleochroism and by the wider angle of extinction on the plane of symmetry.

They are minerals of either original or secondary origin; in the former case occurring as constituents (hornblende) of igneous rocks, such as granite, diorite, andesite, &c. Those of secondary origin have either been developed (tremolite) in limestones by contact-metamorphism, or have resulted (actinolite) by the alteration of augite by dynamo-metamorphism. Pseudomorphs of amphibole after pyroxene are known as uralite.

The name amphibole (from the Gr. ἀμφίβολος, ambiguous) was used by R. J. Haüy to include tremolite, actinolite and hornblende; this term has since been applied to the whole group. Numerous sub-species and varieties are distinguished, the more important of which are tabulated below in three series. The formulae of each will be seen to conform to the general metasilicate formula $R''SiO_3$.

	ORTHORHOMBIC SERIES.
Anthophyllite . .	$(Mg,Fe)SiO_3$.
	MONOCLINIC SERIES.
Tremolite . .	$CaMg_3(SiO_3)_4$.
Actinolite . .	$Ca(Mg,Fe)_3(SiO_3)_4$.
Cummingtonite .	$(Fe,Mg)SiO_3$.
Richterite . .	$(K_2,Na_2,Mg,Ca,Mn)SiO_3$.
Hornblende . .	$Ca(Mg,Fe)_3(SiO_3)_4$ with $NaAl(SiO_3)_2$ and $(Mg,Fe)\ (Al,Fe)_2SiO_6$.

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[1] Brongniart's *Essai d'une classification naturelle des reptiles* was not published in full till 1803. It appears in the volume of the *Mémoires présentés à l'Institut par divers savans* for 1805.

[2] *Nouveau dictionnaire d'histoire naturelle*, xxiv., cited in Latreille's *Familles naturelles du règne animal*.

[3] *System der vergleichenden Anatomie* (1821).

[4] "Prodrome d'une Nouvelle Distribution du Règne Animal," *Bulletin des sciences par la Société Philomatique de Paris* (1816), p. 113.

[5] *Entwickelungs-Geschichte der Thiere*, p. 262.

[6] *Familles naturelles du règne animal*.

[7] *Erpétologie générale, ou histoire naturelle complète des reptiles* (1836).

MONOCLINIC SERIES—*continued.*

Glaucophane	$NaAl(SiO_3)_2 \cdot (Fe,Mg)SiO_3$.
Crocidolite	$NaFe(SiO_3)_2 \cdot FeSiO_3$.
Riebeckite	$2NaFe(SiO_3)_2 \cdot FeSiO_3$.
Arfvedsonite	$Na_8(Ca,Mg)_3(Fe,Mn)_{14}(Al,Fe)_2Si_{21}O_{45}$.

ANORTHIC SERIES.

Aenigmatite	$Na_4Fe''_9Al\,Fe'''(Si,Ti)_{12}O_{38}$.

Of these, tremolite, hornblende and crocidolite, as well as the important varieties, asbestos and jade, are treated under their own headings. Brief mention only need be here made of some of the others. Naturally, on account of the wide variations in chemical composition, the different members vary considerably in characters and general appearance; the specific gravity, for example, varies from 2·9 in tremolite to 3·8 in aenigmatite.

Anthophyllite occurs as brownish, fibrous or lamellar masses with hornblende in mica-schist at Kongsberg in Norway and some other localities. An aluminous variety is known as gedrite, and a deep green, Russian variety containing little iron as kupfferite.

Actinolite is an important member of the monoclinic series, forming radiating groups of acicular crystals of a bright green or greyish-green colour. It occurs frequently as a constituent of crystalline schists. The name (from ἀκτίς, a ray, and λίθος, a stone) is a translation of the old German word *Strahlstein,* radiated stone.

Glaucophane, crocidolite, riebeckite and arfvedsonite form a somewhat special group of alkali-amphiboles. The two former are blue fibrous minerals occurring in crystalline schists, and are the result of dynamo-metamorphic processes; the two latter are dark green minerals which occur as original constituents of igneous rocks rich in soda, such as nepheline-syenite and phonolite.

Aenigmatite and its variety cossyrite are rare minerals forming constituents of igneous rocks of the nepheline-syenite and phonolite groups. (L. J. S.)

AMPHIBOLITE, the name given to a rock consisting mainly of amphibole (hornblende), the use of the term being restricted, however, to metamorphic rocks. Holocrystalline plutonic igneous rocks composed essentially of hornblende are known as hornblendites. As is the case with most petrological terms the exact connotation is not very strictly defined; most authors allow that accessory minerals such as felspar, garnet, augite and quartz may be present in variable and often considerable amount. A foliated or schistose structure, though often developed in these rocks, is not universal. The hornblende is usually dark green (actinolite) but may be nearly black in the hand specimen; in the microscopic slide it is commonly green of various shades, but may be brown, blue or nearly colourless. It frequently occurs in elongated bladed prisms, but rarely shows good crystal faces. The term hornblende-schist is employed by many writers as nearly synonymous with amphibolite; most hornblende-schists contain felspar and iron oxides, while sphene, rutile, quartz and apatite are rarely absent. Reddish garnets are often conspicuous in the rocks of this group (garnet-amphibolites), and when in addition a green-coloured augite occurs the rocks are intimately allied to the hornblende-eclogites. Epidote also, in yellow grains, is common (epidote-amphibolites), and in these rocks the hornblende may be of the blue and richly pleochroic variety known as glaucophane (glaucophane-epidote-schists). Hornblende-schists containing dark green ferriferous hornblende (grünerite-schists) are abundant in some parts of North America. Tremolite-schists consist essentially of white or very pale green amphibole; occasionally they are black from the presence of numerous minute grains of iron oxide or of graphite. Many tremolite-schists contain much talc and chlorite, and as these rocks have been derived from peridotites they not infrequently show residual grains of olivine. Nephrite (Gr. νεφρός, a kidney) is a very compact, hardly schistose amphibolite, consisting of fine interwoven fibres of hornblende. Among other accessory minerals biotite, chlorite, talc, scapolite and tourmaline may be mentioned; if abundant they give rise to special varieties such as biotite-amphibolite, &c.

The amphibolites are typical rocks of the metamorphic group and as such attain a large development in all regions of crystalline schists and gneisses such as the Alps, Ardennes, Harz, Scottish Highlands, and the Lakes district of North America. They occur in two ways, viz. as large circular or elliptical areas which mark the site of old plutonic stocks or bosses of basic rock, and as long narrow strips intercalated among outcrops of other metamorphic rocks. Regarded from the point of view of their origin they fall into two groups, the ortho-amphibolites, which are modified igneous rocks, and the para-amphibolites, which are altered sediments. The former are far the more common. Igneous rocks which contain much augite (*e.g.* dolerites, gabbros, diabases, pyroxenites and many peridotites) are usually converted into amphibolites when they are subjected to pressure and interstitial movements during earth-folding. If felspar be present also, epidote may form, while part of the felspar recrystallizes as a species of the same mineral richer in alkalies or as mica. Olivine and ilmenite, the other common constituents of these rocks, may, alone or in conjunction with the above-named minerals, yield garnet, talc, sphene, rutile, &c. There is little or no alteration in the bulk composition of the rock, but its component elements enter into new combinations. Chemical analysis, accordingly, will often enable us to identify an igneous rock (diabase, &c.) under the guise of an amphibolite. The transformation of the rock may be complete, so that no trace is left of the original structures or minerals. Very often, however, it is only partial, and by obtaining a sufficiently large number of specimens a series of intermediate or transitional stages may be studied; these prove conclusively the nature of the process, though its causes are less clearly understood. Green hornblende may be seen gradually replacing augite, at first in needle-like crystals, for which gradually more compact masses are substituted. The felspar breaks up into a mosaic in which albite, epidote or zoisite, quartz and garnet may often be identified. Biotite and primary hornblende suffer comparatively little change; olivine disappears, and garnet, talc and tremolite or anthophyllite take its place. The original structures of this group of rocks (ophitic, porphyritic, poikilitic, vesicular, &c.) gradually fade away, and merge into those of the metamorphic amphibolites. Even when the greater part of the rock mass has suffered complete reconstruction, kernels or phacoids may remain, showing the old igneous structures, though the minerals are greatly altered. The transitional stages from gabbro or diabase to amphibolite are so common that they form a widespread and important group of rocks, which have been described under the names greenstone, greenstone-schist, flaser-gabbro, saussurite-gabbro, meta-diabase, &c. The ortho-amphibolites also include a small group of igneous rocks, which have a foliated or banded structure due to movements and pressure during consolidation, *e.g.* foliated diorite or diorite-schist.

The sedimentary amphibolites or para-amphibolites, less common than those above described, are frequent in some districts, such as the northern Alps, southern highlands of Scotland, Green Mountains, U.S.A. Many of them have been ash-beds, and their conversion into hornblende-schists follows exactly similar stages to those exemplified by basic crystalline igneous rocks. Others have been greywackes of varied composition with epidote, chlorite, felspar, quartz, iron oxides, &c., and may have been mixed with volcanic materials, or may be partly derived from the disintegration of basic rocks. When they are most metamorphosed they are often very hard to distinguish from igneous hornblende-schists; yet they rarely fail to reveal signs of bedding, pebbly structure, sedimentary banding and gradual transition into undoubtedly sedimentary types of gneiss and schist. Deposits containing dolomite and siderite also readily yield amphibolites (tremolite-schists, grünerite-schists, &c.) especially where there has been a certain amount of contact metamorphism by adjacent granitic masses. (J. S. F.)

AMPHIBOLOGY, or AMPHIBOLY (Gr. ἀμφιβολία), in logic, a verbal fallacy arising from ambiguity in the grammatical structure of a sentence (Aristot., *Organon, Soph., El.,* chap. iv.)

It occurs frequently in poetry, owing to the alteration for metrical reasons of the natural order of words; Jevons quotes as an example Shakespeare, *Henry VI.*: "The duke yet lives that Henry shall depose."

AMPHICTYONY (Gr. *ἀμφικτυονία*, *i.e.* a body composed of *ἀμφικτίονες*, *ἀμφικτύονες*, "dwellers around"), an association of ancient Greek communities centring in a shrine. As the extant sources do not define the term, and as they apply it to but five or six associations, the majority of which are little known, modern scholars are in doubt as to the essential character of the institution, and hesitate therefore to extend the name beyond this limited list. The word itself indicates that the association primarily comprised neighbours, though the Delphic amphictyony came in time to include relatively distant communities (Strabo ix. 3, 7). For the origin of the institution it is safe to assume that neighbouring communities, whether tribes (*ἔθνη*) or cities, desiring friendly intercourse with one another chose the sanctuary of some deity conveniently situated, at which to hold their periodical festival for worship and their fair for the interchange of goods. If the limited use of the word according to our sources is not purely accidental, at all events there were many Greek leagues, not expressly termed amphictyonies, which had the characteristics here stated.

The Delian amphictyony probably reached the height of its splendour early in the 7th century B.C. The *Hymn to the Delian Apollo*, composed about that time, celebrates the gathering of the Ionians with their wives and children at the shrine of their god on the island of Delos, to worship him with music, dancing and gymnastic contests (vv. 146-164; cf. Thuc. iii. 104). The later misfortunes of the Ionians caused a decline of the festival. Peisistratus, taking possession of Delos, seems to have used the sanctuary as a means of extending his political influence. When after the great war with Persia the Aegean cities under the leadership of Athens united in a political league (477 B.C.), they chose as its centre the temple of the Delian Apollo, doubtless through a desire to connect the new alliance with the associations of the old amphictyony. How far the council and other institutions of the Delian confederacy were based upon the amphictyonic organization cannot be determined. The removal of the treasury to Athens in 454 B.C. deprived Delos of political importance, though the amphictyony continued. The council gradually dwindled, and probably came to an end without formal abolition. In 426 B.C. the Athenians purified the island and instituted a great festival to be held under their presidency every four years (Thuc. iii. 104). In 422 they expelled the Delians (Thuc. v. 1). At the end of the Peloponnesian War Athens was deprived of Delos along with her other possessions, but she appears to have regained control of the island after the victory of Cnidus (394). An inscription of 390 B.C. proves that at this date Athenian authority had been restored. The affairs of the temple were managed by a board of five Athenian amphictyons, assisted by some Delian officials (inscrr. in *Bull. Hell.* viii. 284, 304, 307 f.); and in the 4th century we again hear of a council in addition to the board (*CIG.* i. 158). At this time the amphictyony is known to have embraced both the Athenians and the inhabitants of the Cyclades; but a strong Delian party bitterly opposed Athenian rule (cf. inscr. in *Bull. Hell.* iii. 473 f.), which came to an end with the supremacy of Macedon. The dissolution of the amphictyony soon followed.

Far more famous is the Delphic, or more strictly, the Pylaeic-Delphic, amphictyony. It was originally composed of twelve tribes dwelling round Thermopylae—the Thessalians, Boeotians, Dorians, Ionians, Perrhaebians, Magnetes, Locrians, Oetaeans, Phthiotes, Malians, Phocians (Aeschin. ii. 116), and Dolopians (Paus. x. 8. 2). The name of the council (*pylaea*) and of one set of deputies (*pylagori*), together with the important place held in the amphictyony by the temple of Demeter at Anthela, near Thermopylae, suggests that this shrine was the original centre of the association. How and when Delphi became a second centre is quite uncertain. The council of the league included deputies of two different kinds—*pylagori* and *hieromnemones*. The latter were twenty-four in number, two from each tribe. As the league was originally made up of neighbours, the Dorian tribe must have comprised simply the inhabitants of Doris; the Locrians were probably the eastern (Opuntian) branch; and the Ionians were doubtless limited to the adjacent island of Euboea. Afterwards, by affiliating themselves to Doris, the Peloponnesian Dorians gained admission, and Athens must have entered as an Ionian city before the first Sacred War. Henceforth Athens monopolized one of the two Ionian votes, while the other passed in rotation among the remaining Ionic, perhaps only among the Euboeic, cities. In the same way Doris held one Dorian vote and the other passed in rotation among the Dorian cities of Peloponnesus; and the east and west Locrians came to have one each. When after the second Sacred War the Phocians were expelled, Macedon received their two votes (346 B.C.). About the same time the Perrhaebians and the Dolopians were deprived of half their representation, and the two votes were transferred to the Delphians (inscrr. in *N. Jahrb. f. cl. Philol.* clv. 742, cf. 743, 753; *Bull. Hell.* xxi. 322, cf. 325; Bourguet, *Sanct. Pyth.* 145, 147). In the following century the Aetolians gained such dominance in the amphictyony as to convert the council into an organ of their league. Recent research has made it appear certain (cf. Pomptow, *ib.* 754 ff.) that they were never formally admitted to membership, but that they maintained their supremacy in the council (Livy xxxi. 32. 3; Polyb. iv. 25. 8) by controlling the votes of their allies, who—called Aetolians in the inscriptions—were often in the majority. They made no material change in its composition, which, accordingly, after the dissolution of their league by the Romans is found to be nearly as it was after the second Sacred War. A few minor changes came in under the supremacy of the Roman republic; and finally Augustus increased the number of votes to thirty, and distributed them according to his pleasure. In the age of the Antonines the association was still in existence (Paus. x. 8. 4 f.).

Although the hieromnemones of the Thessalians, who held the presidency, and perhaps of a few other communities, must have been elected, the office was ordinarily, as at Athens, filled by lot. As a rule they were renewed annually (Aristoph. *Clouds*, 623 f.; Foucart, in *Bull. Hell.* vii. 411, 413 f.). Each hieromnemon was accompanied by two pylagori, elected semi-annually (Demosth. xviii. 149; Aeschin. iii. 115; Tim. *Lex. Plat.*, *s.v.* Ἀμφικτύονες), and representing the same tribe, though not necessarily the same city. On one occasion Athens is known to have sent three. The hieromnemones were formally superior, but because of the method of appointment they were necessarily men of mediocre ability, inexperienced in speaking and public business, and for that reason they readily became the tools of the pylagori, who were orators and statesmen. In the literary sources, accordingly, the latter are rightly given credit for the acts of the council; it was the pylagori who set a price on the head of the traitor Ephialtes (Herod. vii. 213), and who on the motion of Themistocles rejected the proposition of Lacedaemon for the expulsion of the states which had sided with Persia (Plut. *Them.* 20). The pylagori had a right to propose measures and to take part in the deliberations; they as well as the hieromnemones were required to take the juror's oath; and the acts of the council were inscribed officially as resolutions of the hieromnemones and pylagori conjointly. The hieromnemon, however, cast the vote of his community, though in the record his two pylagori were made equally responsible for it. The necessary inference from these facts is that the vote was determined by a majority of the three deputies (inscr. in *Bull. Hell.* xxvii. 106-111, A 20-33; B 1-10). The council decided all questions which fell within its competence. Matters of greater importance, as the levy of an extraordinary fine on a state or the declaration of a sacred war, it presented in the form of a resolution to an assembly (*ἐκκλησία*), composed of the deputies, the amphictyonic priests, and any other citizens of the league who chanced to be present (Aeschin. iii. 124; cf. Hyp. iv. 7, 26 f.). This assembly was relatively unimportant, however, and is mentioned only by the two authorities here cited.

It is now well established by epigraphic evidence (*Bull. Hell.*

vii. 412 f., 417; Pomptow, in *N. Jahrb. f. cl. Philol.* cxlix. 826-829) that the amphictyons met both in the spring and in the autumn at Delphi, and the literary sources should alone be sufficient authority for meetings in the same seasons at Thermopylae (Hyp. iv. 7, 25 ff.; Strabo ix. 3, 7, 4, 17; Harpocration, *s.v.* Πύλαι). It is known, too, that the meeting at Thermopylae followed that at Delphi (inscr. in *Bull. Hell.* xxiv. 136 f.).

The primary function of the council was to administer the temporal affairs of the two shrines, of which the sanctuary of Apollo at Delphi claimed by far the greater share of attention. The hieromnemones were required periodically to inspect the lands belonging to this god, to punish those who encroached, and to see that the tenants rendered their quota of produce; and the council held the states responsible for the right performance of such duties by their respective deputies (*CIA.* ii. 545; inscr. in *Bull. Hell.* vii. 428 f.). Another task of the council was to supervise the treasury, to protect it from thieves, and by investments to increase the capital (Strabo ix. 3, 7; Isoc. xv. 232; Demosth. xxi. 144; Plut. *Sull.* 12). Naturally, too, it controlled the expenditure. We find it, accordingly, in the 6th century B.C. contracting for the rebuilding of the Delphic temple after it had been destroyed by fire (Herod. v. 62; Paus. x. 5. 13), and in the 4th century creating an Hellenic college of temple-builders for the purpose (inscrr. in *Bull. Hell.* xx. 202 f., 206, xxi. 478, xxiv. 464), adorning the interior with statues and pictures (Diod. xvi. 33), inscribing the proverbs of the Seven Sages on the walls (Paus. x. 24. 1), bestowing crowns on benefactors of the god (*CIG.* i. 1689 *b*), preparing for the Pythian games, awarding the prizes (Pind. *Pyth.* iv. 66, x. 8 f.), instituting a board of treasurers (inscr. in Bourguet, *Sanct. Pyth.* 175 ff.) and issuing coins. It was also in the material interest of Apollo that the council passed a law which forbade the Greeks to levy tolls on pilgrims to the shrine (Aeschin. iii. 107; Strabo ix. 3, 4), and another requiring the amphictyonic states to keep in repair their own roads which led towards Delphi (*CIA.* ii. 545). A law of great interest, dating from the beginning of the institution, imposed an oath upon the members of the league not to destroy an amphictyonic city or to cut it off from running water in war or peace; but to wage war upon those who transgressed this ordinance, to destroy their cities, and to punish any others who by theft or plotting sought to injure the god (Aeschin. ii. 115). In this regulation, which was intended to mitigate the usages of war amongst the members of the league, we have one of the origins of Greek interstate law. Though other regulations were made to secure peace at the time of the festival (Dion. Hal. iv. 25. 3), and though occasionally the council was called upon to arbitrate in a dispute (cf. Demosth. xviii. 135), no provision was made to compel arbitration.

For the enforcement of such laws and for administrative efficiency in general it was necessary that the council should have judicial power. As jurors the deputies took an oath to decide according to written law, or in cases not covered by law, according to their best will and judgment (*CIA.* ii. 545). The earliest known amphictyonic penalty was the destruction of Crisa for having levied tolls on pilgrims (Aeschin. iii. 107; Strabo ix. 3, 4; cf. Paus. x. 37. 5-8). This offence was the cause of the first Sacred War. The second and third Sacred Wars, fought in the 4th century B.C., were waged by the amphictyons against the Phocians and the Amphissaeans respectively for alleged trespassing on the sacred lands (Aeschin. iii. 124, 128; Diod. xvi. 23, 31 f.). In the 5th century the council fined the Dolopians for having disturbed commerce by their piracy (Plut. *Cim.* 8), and in the 4th century the Lacedaemonians for having occupied the citadel of Thebes in time of peace (Diod. xvi. 23, 29).

The judgments of the council were sometimes considered unfair, and were occasionally defied by the states affected. The Lacedaemonians refused to pay the fine above mentioned; the Athenians protested against the treatment of Amphissa, and were slow in accepting the decisions given under the influence of Macedon. The inability of the council to enforce its resolutions was chiefly due to its composition; the majority of the communities represented were even in combination no match for individual cities like Athens, Sparta or Thebes. The council was a power in politics only when manipulated by a great state, as Thebes, Macedon or Aetolia, and in such a case its decrees were most likely to give offence by their partisanship. Although the council sometimes championed the Hellenic cause, as could any association or individual, it never acquired a recognized authority over all Greece; and notwithstanding its frequent participation in political affairs, it remained essentially a religious convocation.

In addition to the three associations thus far mentioned there was an amphictyony of Onchestus (Strabo ix. 2, 33). It may be inferred from a comparison of Paus. iv. 5. 2 with Herod. vi. 92 that there was an amphictyony of Argos of which Epidaurus and Aegina were members. An amphictyony of Corinth has, with less justification, been assumed on the strength of a passage in Pindar (*Nem. Od.* vi. 40-42).

Authorities.—Foucart, "Amphictyones," in Daremberg and Saglio, *Dict. d. antiq. grecq. et rom.* (1873) i. 235-238; F. Cauer, "Amphiktyonia," in Pauly-Wissowa, *Realencycl. d. cl. Altertumswiss.* (1894) i. 1904–1935; Pomptow, *Fasti Delphici*, ii. in *Neue Jahrb. f. cl. Philol.* (1894) cxlix. 497-558, clv. (1897) 737-765, 785-848; E. A. Freeman, *History of Federal Government in Greece and Italy* (2nd ed., London and New York, 1895), 95-111; W. S. Ferguson, "Delian Amphictyony," in *Classical Review* (1901), xv. 38-40; Schömann-Lipsius, *Griechische Alterthümer* (1902), ii. 29-44; E. Bourguet, *L'Administration financière du sanctuaire pythique au IV^e siècle avant J.-C.* (Paris, 1905). The earlier literature has been deprived of a great part of its value by recent discoveries of inscriptions, many of which may be found in the *Bulletin de correspondance hellénique*, iii. vii. viii. x. xx. xxi. xxiv. xxvi. xxvii., edited with commentary chiefly by Bourguet, Colin, Foucart and Homolle. See also H. Collitz, *Sammlung d. griech. Dialekt-Inschriften*, ii. p. 643 ff. and Nos. 2508 ff., edited by Baunack. (G. W. B.)

AMPHILOCHUS, in Greek legend, a famous seer, son of Amphiaraus and Eriphyle and brother of Alcmaeon. According to some he assisted in the murder of Eriphyle, which, according to others, was carried out by Alcmaeon alone (Apollodorus iii. 6, 7). He took part in the expedition of the Epigoni against Thebes and in the Trojan War. After the fall of Troy he founded, in conjunction with Mopsus, another famous seer, the oracle of Mallos in Cilicia. The two seers afterwards fought for its possession, and both were slain in the combat. Amphilochus is also said to have been killed by Apollo (Strabo xiv. 675, 676). According to another story, he returned to Argos from Troy, but, being dissatisfied with the condition of things there, left it for Acarnania, where he founded Amphilochian Argos on the Ambracian gulf. He was worshipped at Oropus, Athens and Sparta.

Strabo xiv. pp. 675, 676; Thucydides ii. 68; Pausanias i. 34, iii. 15.

AMPHION and ZETHUS, in ancient Greek mythology, the twin sons of Zeus by Antiope. When children, they were exposed on Mount Cithaeron, but were found and brought up by a shepherd. Amphion became a great singer and musician, Zethus a hunter and herdsman (Apollodorus iii. 5). After punishing Lycus and Dirce for cruel treatment of Antiope (*q.v.*), they built and fortified Thebes, huge blocks of stone forming themselves into walls at the sound of Amphion's lyre (Horace, *Odes*, iii. 11). Amphion married Niobe, and killed himself after the loss of his wife and children (Ovid, *Metam.* vi. 270). The brothers were buried in one grave and worshipped as the Dioscuri "with white horses" (Eurip. *Phoen.* 609).

AMPHIOXUS, or Lancelet, the name of small, fish-like, marine creatures, forming the class Cephalochorda, of the phylum Vertebrata. Lancelets are found in brackish or salt water, generally near the coast, and have been referred to several genera and many species. They were first discovered by P. S. Pallas in 1778, who took them to be slugs and described them under the name *Limax lanceolatus*. The true position in the animal kingdom was first recognized in 1834 by O. G. Costa, who named the genus *Branchiostoma*, and it has since been dealt with by many writers.

The theoretical interest of Amphioxus depends upon a variety of circumstances. In its manner of development from the egg, and in the constitution of its digestive, vascular, respiratory (branchial), excretory, skeletal, nervous and muscular systems it exhibits what appears to be a primordial condition of vertebrate organization, a condition which is, in fact, partly recapitulated in the course of the embryonic stages of craniate vertebrates. In comparative morphology it provides many illustrations of important biological principles (such, for example, as substitution and change of function of organs), and throws new light upon, or at least points the way to new ideas of, the primitive relations of different organic systems in respect of their function and topography. One of the most puzzling features in its structure, and, at the same time, one of the greatest obstacles to the view that it is essentially primitive and not merely a degenerate creature, is the entire absence of the paired organs of special sense, olfactory, optic and auditory, which are so characteristic of the higher vertebrates. Although it is true that there is a certain amount of gradation in the degree of development to which these organs have attained in the various orders, yet it is hardly sufficient to enable the imagination to bridge over the gap which separates Amphioxus from the lowest fishes in regard to this feature of organization.

Classification.—On account of the absence of anything in the nature of a skull, Amphioxus has been regarded as the type of a division, Acrania, in contrast with the Craniata which comprise all the higher Chordata. The ordinal name for the genera and species of Amphioxus is Cephalochorda, the term referring to the extension of the primary backbone or *notochord* to the anterior extremity of the body; the family name is *Branchiostomidae.* The amount of generic divergence exhibited by the members of this family is not great in the mass, but is of singular interest in detail. There are two principal genera—1. *Branchiostoma* Costa, having paired sexual organs (gonadic pouches); 2. *Heteropleuron* Kirkaldy, with unilateral gonads. Of these, the former includes two subgenera, *Amphioxus* (s. str.) Yarrell and *Dolichorhynchus* Willey. The species belonging to the genus *Heteropleuron* are divided among the three subgenera *Paramphioxus* Haeckel, *Epigonichthys* Peters, and *Asymmetron* Andrews. The generic characters are based upon definite modifications of form which affect the entire facies of the animals, while the specific diagnoses depend upon minor characters, such as the number of *myotomes* or muscle-segments.

Habits and Distribution.—With regard to its habits, all that need be said here is that while Amphioxus is an expert swimmer when occasion requires, yet it spends most of its time burrowing in the sand, in which, when at rest, it lies buried with head protruding and mouth wide agape. Its food consists of microscopic organisms and organic particles; these are drawn into the mouth together with currents of water induced by the action of the vibratile cilia which are abundant along special tracts on the sides and roof of the vestibule of the mouth and in the walls of the perforated pharynx ("ciliary ingestion"). Amphioxus favours a littoral habitat, and rarely if ever descends below the 50-fathom line. Species occur in all seas of the temperate, tropical and subtropical zones. The European species, *A. lanceolatus*, is found in the Black and Mediterranean Seas, and on the coasts of France, Great Britain and Scandinavia, while a closely allied species or subspecies, *A. caribaeus*, frequents the Caribbean region from Chesapeake to La Plata. *A. californiensis* occurs on the coast of California, and *A. belcheri* extends its area of distribution from Queensland through Singapore to Japan. A recently described species, *Dolichorhynchus indicus*, characterized by the great length of the praeoral lobe or snout, has been dredged in the Indian Ocean. *Paramphioxus bassanus* occurs on the coast of Australia from Port Phillip to Port Jackson; *P. cingalensis* at Ceylon. *Epigonichthys cultellus* (fig. 1) inhabits Torres Strait, and has also been

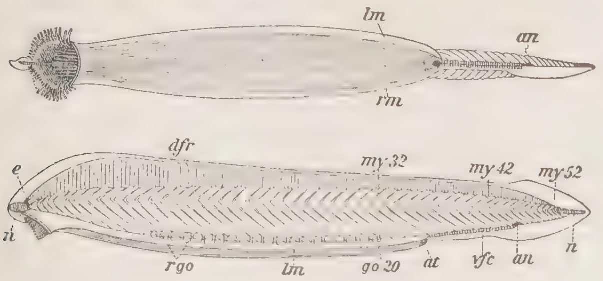

FIG. 1.—*Epigonichthys cultellus* from below and from the left side. (Slightly altered from Kirkaldy.) *rm* and *lm*, Right and left metapleur; *at*, atriopore; *an*, anus; *e*, "eyespot" at anterior end of neurochord projecting beyond the myotomes (*my*); *n*, notochord; *rgo*, gonads of right side only showing through by transparency; *go* 20, the last gonad; *dfr*, dorsal fin with fin chambers and fin rays; *vfc*, ventral fin chambers.

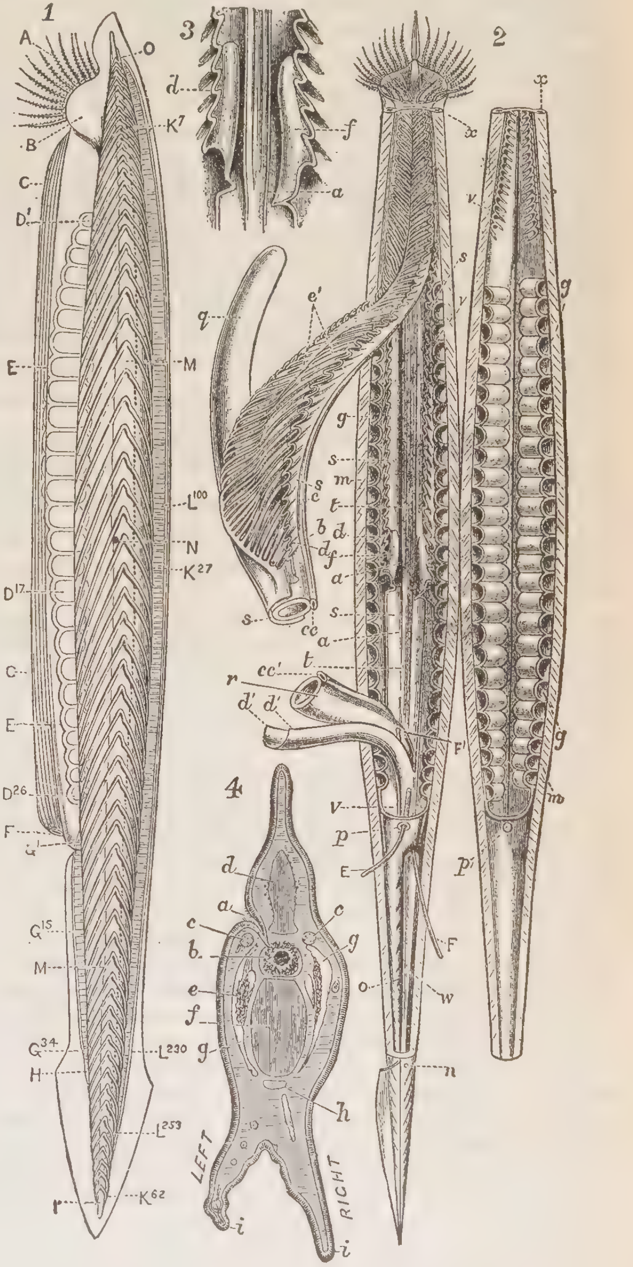

FIG. 2.—*Amphioxus lanceolatus*, Yarrell (*Branchiostoma lubricum*, Coste). (From Ray Lankester.) (1) Lateral view of adult, to show general form, the myomeres, fin rays and gonads. A, Oral tentacles (28 to 32 in full-grown animals, 20 to 24 in half-grown specimens); B, praeoral hood or praeoral epipleur; C, plicated ventral surface of atrial chamber; D^1, D^{17}, D^{26}, gonads, twenty-six pairs, coincident with myotomes 10 to 36; E, metapleur or lateral ridge on atrial epipleur; F, atripore, coincident with myotome 36; G^1, G^{15}, G^{34}, double ventral fin rays, extending from myotomes 37 to 52, but having no numerical relation to them; H, position of anus, between myotomes 51 and 52; I, notochord, projecting beyond myotomes; K^7, K^{27}, K^{62}, myotomes or muscular segments of body-wall, 62 in number; L^{100}, L^{230}, L^{253}, dorsal fin rays, about 250 in number, the hard substance of the ray being absent at the extreme ends of the

body (these have no constant numerical relation to the myomeres); M, notochord as seen through the transparent myotomes, the thin double-lined spaces being the connective-tissue septa and the broader spaces the muscular tissue of the myotomes; N, position of brown funnel of left side (atrio-coelomic canal); O, nerve tube resting on notochord.

(2) Dissection of *Amphioxus.* By a horizontal incision on each side of the body a large ventral area has been separated and turned over, as it were on a hinge, to the animal's left side. The perforated pharyngeal region has then been detached from the adherent epipleura or opercular folds (wall of atrial or branchial chamber) by cutting the fluted pharyngo-pleural membrane *d*, and separated by a vertical cut from the intestinal region. *a*, Edge of groove formed by adhesion of median dorsal surface of alimentary canal to sheath of notochord; *b*, median dorsal surface of alimentary canal; *c*, left dorsal aorta; *cc*, single dorsal aorta, formed by union of the two anterior vessels; *cc′*, same vessel resting on intestine; *d*, cut edge of pharyngo-pleural folds of atrial tunic, really the original outer body-wall before the downgrowth of epipleura; *d′*, atrial tunic (original body-wall) at non-perforate region, cut and turned back so as to expose peri-enteric coelom and intestine *r*; *e′*, upstanding folds of body-wall (pharyngo-pleural folds) on alternate bars of perforate region of body; *f*, atrio-coelomic canals or brown funnels (collar-pores of *Balanoglossus*); *g*, cavity of a gonad-sac; *m*, cut musculature of body-wall; *n*, anus; *o*, post-atrioporal extension of atrial chamber in form of a tubular caecum; *p*, atriopore; *q*, hepatic caecum; *r*, intestine; *s*, coelom; *t*, area of adhesion between alimentary canal and sheath of notochord; *v*, atrial chamber or branchial cavity; *w*, post-atrioporal portion of intestine; *x*, canals of metapleura exposed by cutting; E, probe passing through atriopore into atrial or branchial chamber; FF′, probe passing from coelom, where it expands behind the atriopore, into narrower peri-enteric coelom of praeatrioporal region.

(3) Portion of (2) enlarged to show atrio-coelomic canals ("brown funnels" of Lankester). Lettering as in (2).

(4) Section taken transversely through praeoral region near termination of nerve tube. *a*, Olfactory ciliated pit on animal's left side, its wall confluent with substance of nerve tube; *b*, pigment spot (rudimentary eye) on anterior termination of nerve tube; *c*, first pair of nerves in section; *d*, fin ray; *e*, myotome; *f*, notochord; *g*, space round myotome (?artifact or coelom); *h*, subchordal canal (? blood-vessel); *i*, a symmetrical epipleura of praeoral hood.

found at Ternate. *Asymmetron lucayanum* is the Bahaman representative of the family, with a subspecies, *A. caudatum*, in the South Pacific from New Guinea to the Loyalty Islands. The Peruvian species, *Branchiostoma elongatum*, with nearly eighty myotomes, cannot at present be assigned to its proper subgenus.

External Form.—The following description, unless otherwise stated, refers to *A. lanceolatus.* Amphioxus is a small fish-like creature attaining a maximum length of about 3 in., semi-transparent in appearance, showing iridescent play of colour. The body is narrow, laterally compressed and pointed at both ends. The main musculature can be seen through the thin skin to be divided into about sixty pairs of muscle-segments (myotomes) by means of comma-shaped dissepiments, the myocommas, which stretch between the skin and the central skeletal axis of the body. These myotomes enable it to swim rapidly with characteristic serpentine undulations of the body, the movements being effected by the alternate contraction and relaxation of the longitudinal muscles on both sides. Apparently correlated with this peculiar locomotion is the anatomical fact of the alteration of the myotomes on the two sides. Symmetrical at their first appearance in the embryo, the somites (from which the myotomes are derived) early undergo a certain distortion, the effect of which is to carry the somites of the left side forwards through the length of one half-segment. For example, the twenty-seventh myotome of the left side is placed opposite to the twenty-sixth myocomma of the right side. The back of the body is occupied by a crest, called the dorsal fin, consisting of a hollow ridge, the cavity of which is divided into about 250 compartments or fin chambers, into each of which, with the exception of those near the anterior and posterior end of the body, projects a stout pillar composed of characteristic laminar tissue, the fin ray. The dorsal crest is continued round both extremities, becoming expanded to form the rostral fin in front and the caudal fin behind. Even in external view, careful inspection will show that the body is divisible into four regions, namely, cephalic, atrial, abdominal and caudal. The cephalic region includes the rostrum or praeoral

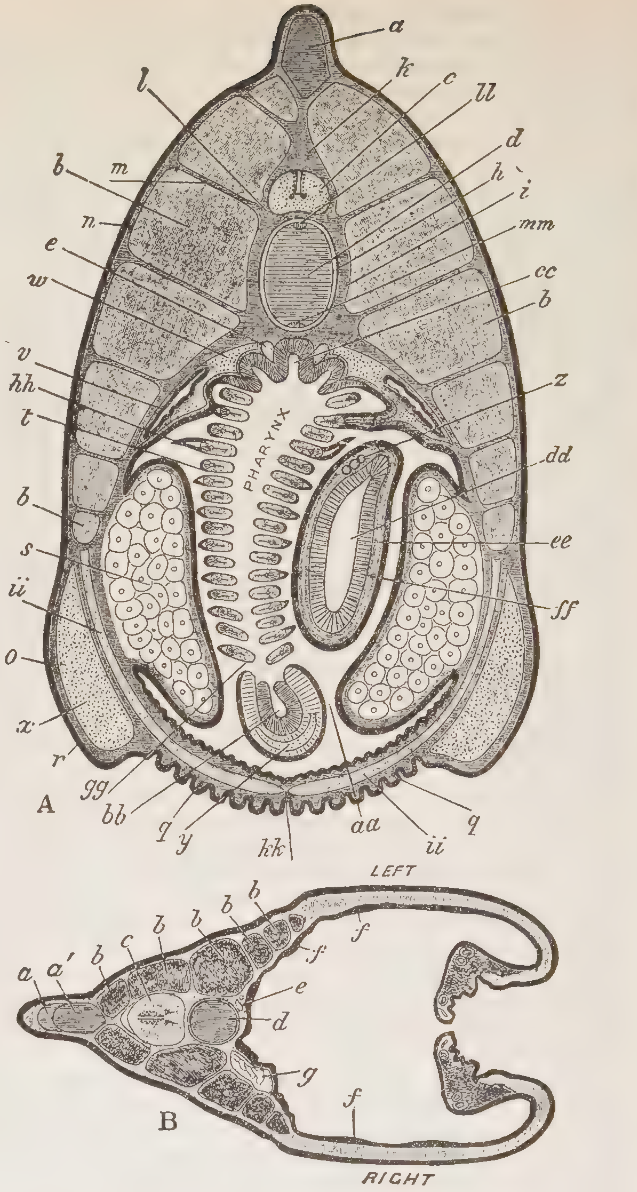

Fig. 3.—Transverse sections of *Amphioxus.* (From Lankester.) A. Section through region of atrio-coelomic canals, *v*. B. Section in front of mouth; the right and left sides are transposed. *a*, Cavity surrounding fin ray; *a′*, fin ray; *b*, muscular tissue of myotome; *c*, nerve-cord; *d*, notochord; *c*, left aorta; *f*, thickened ridges of epithelium of praeoral chamber (Rader organ); *g*, coiled tube lying in a coelomic space on right side of praeoral hood, apparently an artery; *h*, cuticle of notochord; *i*, connective-tissue sheath of notochord; *k*, median ridge of skeletal canal of nerve-cord; *l*, skeletal canal protecting nerve-cord; *m*, inter-segmental skeletal septum of myotome; *n*, subcutaneous skeletal connective tissue; *o*, ditto of metapleur (this should be relatively thicker than it is); *q*, subcutaneous connective tissue of ventral surface of atrial wall (not a canal, as supposed by Stieda and others); *r*, epiblastic epithelium; *s*, gonad-sac containing ova; *t*, pharyngeal bar in section, one of the "tongue" bars alternating with the main bars and devoid of pharyngo-pleural fold and coelom; *v*, atrio-coelomic funnel; *w*, so-called "dorsal" coelom; *x*, lymphatic space or canal of metapleur; *y*, sub-pharyngeal vascular trunk; *z*, blood-vessel (portal vein) on wall of hepatic caecum; *aa*, space of atrial or branchial chamber; *bb*, ventral groove of pharynx (anteriorly this takes the form of a ridge); *cc*, hyperbranchial groove of pharynx; *dd*, lumen or space of hepatic caecum; *ee*, narrow coelomic space surrounding hepatic caecum; *ff*, lining cell-layer of hepatic caecum; *gg*, inner face of a pharyngeal bar clothed with hypoblast, the outer face covered with epiblast (represented black); *hh*, a main pharyngeal bar with projecting pharyngeal fold (on which the reference line rests) in section, showing coelomic space beneath the black epiblast; *ii*, transverse ventral muscle of epipleura; *kk*, raphe or plane of fusion of two down-grown epipleura; *ll*, space and nucleated cells on dorsal face of notochord; *mm*, similar space and cells on its ventral face.

lobe and the mouth. As already stated, the notochord extends beyond the mouth to the tip of the rostrum. The mouth consists of two portions, an outer vestibule and an inner *apertura oris*; the latter is surrounded by a sphincter muscle, which forms the so-called *velum*. The vestibule of the mouth is the space bounded by the oral hood; this arises by secondary downgrowth of lid-like folds over the true oral aperture, and is provided with a fringe of tentacular cirri, each of which is supported by a solid skeletal axis. The oral hood with its cirri has a special nerve supply and musculature by which the cirri can be either spread out, or bent inwards so that those of one side may interdigitate with those of the other, thus completely closing the entrance to the mouth. The velum is also provided with a circlet of twelve tantacles (in some species sixteen) which hang backwards into the pharynx; these are the velar tentacles. The atrial region extends from the mouth over about two-thirds of the length of the body, terminating at a large median ventral aperture, the atriopore; this is the excurrent orifice for the respiratory current of water and also serves for the evacuation of the generative products. This region is really the branchiogenital region, although the fact is not apparent in external view. The ventral side of the body in the atrial region is broad and convex, so that the body presents the appearance of a spherical triangle in transverse section, the apex being formed by the dorsal fin and the angles bordered by two hollow folds, the metapleural folds, each of which contains a continuous longitudinal lymph-space, the metapleural canal. In the genus *Branchiostoma* the metapleural folds terminate symmetrically shortly behind the atriopore, but in *Heteropleuron* the right metapleur passes uninterruptedly into the median crest of the ventral fin (fig. 1). In this connexion it may also be mentioned that in all cases the right half of the oral hood is directly continuous with the rostral fin (fig. 2). The abdominal region comprises a short stretch of body between atriopore and anus, the termination of the alimentary canal. It is characterized by the presence of a special development of the lophioderm or median fin-system, namely, the ventral fin, which is composed of two portions, a lower keel-like portion, which underlies an upper chambered portion, each chamber containing typically a pair of gelatinous fin rays. Finally, the caudal region comprises the post-anal division of the trunk. The keel of the ventral fin is continued past the anus into the expanded caudal fin, and so it happens that the anal opening is displaced from the middle line to the left side of the fin. In *Asymmetron* the caudal region is remarkable for the curious elongation of the notochord, which is produced far beyond the last of the myotomes.

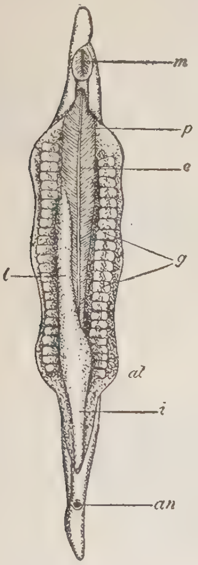

FIG. 4.—*Amphioxus lanceolatus* laid open ventrally. (After Rathke, slightly altered.) *m*, Mouth appearing as an elongated slit when relaxed (as in the lamprey); *p*, perforated pharynx; *e*, endostyle; *g*, gonads; *l*, liver; *at*, level of atriopore; *i*, intestine; *an*, anus. In this species the atrium is produced as an asymmetrical blind pouch behind the atriopore as far as the anus.

Alimentary, Respiratory and Excretory Systems.—Although the function of the two latter systems of organs is the purification of the blood, they are not usually considered together, and it is therefore the more remarkable that their close association in *Amphioxus* renders it necessary to treat them in common. The alimentary canal is a perfectly straight tube lined throughout by ciliated epithelium. As food particles pass in through the mouth they become enveloped in a slimy substance (secreted by the endostyle) and conveyed down the gut by the action of the vibratile cilia as a continuous food-rope, the peristaltic movements of the gut-wall being very feeble. The first part of the alimentary canal consists of the pharynx or branchial sac, the side walls of which are perforated by upwards of sixty pairs of elongated slits, the gill-clefts. Each primary gill-cleft becomes divided into two by a tongue-bar which grows down secondarily from the upper wall of the cleft and fuses with the ventral wall. New clefts continue to form at the posterior end of the pharynx during the adult life of the animal. The gill-clefts open directly from the cavity of the pharynx into that of the atrium, and so give egress to the respiratory current which enters the mouth with the food (fig. 4). The atrium or atrial chamber is a peripharyngeal cavity of secondary origin effecting the enclosure of the gill-clefts, which in the larva opened directly to the exterior. The atrium is thus analogous to the opercular cavity of fishes and tadpoles, and, as stated above, remains in communication with the exterior by means of the atriopore. The primary and secondary bars which separate and divide the successive gill-clefts from one another are traversed by blood-vessels which run from a simple tubular contractile ventral branchial vessel along the bars into a dorsal aorta. The ventral branchial vessel lies below the hypobranchial groove or endostyle, and is the representative of a heart. As water for respiration streams through the clefts, gaseous interchange takes place between the circulating colourless blood and the percolating water. The pharynx projects freely into the atrium; it is surrounded at the sides and below by the continuous atrial cavity, but dorsally it is held in position in two ways. First, its dorsal wall (which is grooved to form the hyperpharyngeal groove) is closely adherent to the sheath of the notochord; and secondly, the pharynx is attached through the intermediation of the primary bars. These are suspended to the muscular body-wall by a double membrane, called the *ligamentum denticulatum*, which forms at once the roof of the atrial chamber and the floor of a persistent portion of the original body-cavity or coelom (the dorsal coelomic canal on each side of the pharynx). The *ligamentum denticulatum* is thus lined on one side by the epiblastic atrial epithelium, and on the other by mesoblastic coelomic epithelium. Now this ligament is inserted into the primary bars some distance below the upper limits of the gill-clefts, and it therefore follows that, corresponding with each tongue-bar, the atrial cavity is produced upward beyond the insertion of the ligament into a series of bags or pockets, which may be called the atrial pouches. At the top of each of these pouches there is a minute orifice, the aperture of a small tubule lying above each pouch in the dorsal coelom. These tubules are the excretory tubules or nephridia. They communicate with the coelom by several openings or nephrostomes, and with the atrium by a single opening in each case, the nephridiopore. It is important to emphasize the fact that in Amphioxus the excretory tubules are co-extensive with the gill-clefts. The perforated pharynx terminates some distance in front of the atriopore. At the level of its posterior end a pair of funnel-shaped pouches of the atrium are produced forwards into the dorsal coelom. These are the atrial coelomic funnels or brown funnels, so called on account of the characteristic pigmentation of their walls. There are reasons for supposing that these funnels are vestiges of an ancient excretory system, which has given way by substitution to the excretory tubules described above. In the same region of the body, namely, close behind the pharynx, a large diverticulum is given off from the ventral side of the gut. This is the hepatic caecum (fig. 2, 2, *q*, fig. 4, *l*), which is quite median at its first origin, but, as it grows in length, comes to lie against the right wall of the pharynx. Although within the atrial cavity, it is separated from the latter by a narrow coelomic space, bounded towards the atrium by coelomic and atrial epithelium. No food passes into the hepatic caecum, which has been definitely shown on embryological and physiological grounds to be the simplest persistent form of the vertebrate liver.

Nervous System.—As has already been indicated, a solid sub-cylindrical elastic rod, the notochord, surrounded by a sheath of laminar connective tissue, the cordal sheath, lies above the alimentary canal in contact with its dorsal wall, and extends beyond it both in front and behind to the obtusely pointed extremities of the body. This notochord represents the persistent primordial skeletal axis which, in the higher Craniata (though not so in the lower), gives way by substitution to the segmented vertebral column. Immediately above the notochord there lies another subcylindrical cord, also surrounded by a sheath of connective tissue. This cord is neither elastic nor solid, but consists of nerve tissue, fibres and ganglion cells, surrounding a small central canal. For the sake of uniformity in nomenclature this nerve-cord may be called the neurochord. It is the central nervous system, and contains within itself the elements of the brain and spinal marrow of higher forms. The neurochord tapers towards its posterior end, where it is coextensive with the notochord, but ends abruptly in front, some distance behind the tip of the snout. The neurochord attains its greatest thickness not at its anterior end but some way behind this region; but the central canal dilates at the anterior extremity to form a thin-walled cerebral vesicle, in the front wall of which there is an aggregation of dark pigment cells constituting an eyespot, visible through the transparent skin (fig. 1). There are two pairs of specialized cerebral nerves innervating the praeoral lobe, and provided with peripheral ganglia placed near the termination of the smaller branches. Corresponding with each pair of myotomes, and subject to the same alternation, two pairs of spinal nerves arise from the neurochord, namely, a right and left pair of compact dorsal sensory roots without ganglionic enlargement, and a right and left pair of ventral motor roots composed of loose fibres issuing separately from the neurochord and passing directly to their termination on the muscle-plates of the myotomes. The first dorsal spinal nerve coincides in position with the myocomma which separates the first myotome from the second on each side, and thereafter the successive dorsal roots pass through the substance of the myocommata on their way to the skin; they are therefore septal or intersegmental in position. The ventral roots, on the contrary, are myal or segmental in position. In addition to the cerebral eyespot there are large numbers of minute black pigmented bodies beside and below the central canal of the neurochord, commencing from the level of the third myotome. It has been determined that these bodies are of the nature of eyes (*Becheraugen*, R. Hesse), each consisting of two cells, a cup-shaped pigment cell and a triangular retinal cell. These may be called the spinal eyes, and it is said that they are disposed in such a way as to receive illumination preferentially from the right side, although this fact has no relation with the side upon which *Amphioxus* may lie upon the sand. When kept in captivity the animal often lies upon one side on the surface of the sand, but on either side indifferently. Over the cerebral eye there is a small orifice placed to the left of the base of the cephalic fin, leading into a pit which extends from the surface of the body to the surface of the cerebral vesicle; this is known as A. von Kölliker's olfactory pit.

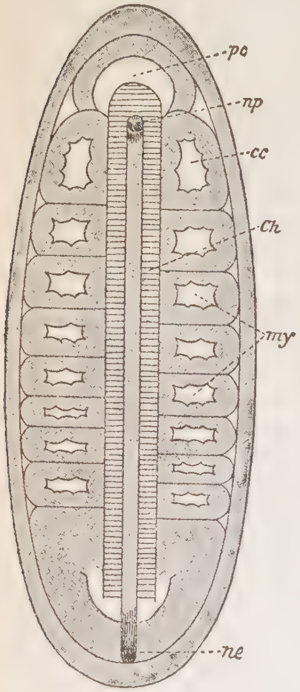

FIG. 5.—Diagram of embryo of *Amphioxus* seen from above in optical section. (Adapted from Hatschek.) *pc*, Praechordal head-cavity of embryo; *cc*, collar-cavity (first somite); *my*, mesodermic somites (myocoelomic or archenteric pouches); *ch*, notochord with the neural tube (neurochord) lying upon it; *np*, anterior neuropore; *ne*, position of posterior neurenteric canal.

Reproductive System.—The sexes are separate, and the male or female gonads, which are exactly similar in outward appearance, occur as a series of gonadic pouches projecting into the atrial cavity at the base of the myotomes (figs. 2, 3, 4). At the breeding season the walls of the pouches burst and the sexual elements pass into the atrium, whence they are discharged through the atriopore into the water, where fertilization takes place.

Development.—The development of *Amphioxus* possesses many features of interest, and cannot fail to retain its importance as an introduction to the study of embryology. The four principal phases in the development are: (1) Blastula, (2) Gastrula, (3) Flagellate Embryo, (4) Larva. The segmentation or cleavage of the ovum which follows upon fertilization terminates in the achievement of the blastula form, a minute sphere of cells surrounding a central cavity. Then follows the phenomenon of gastrulation, by which one-half of the blastula is invaginated into the other, so as to obliterate the segmentation cavity. The embryo now consists of two layers of cells, epiblast and hypoblast, surrounding a cavity, the archenteron, which opens to the exterior by the orifice of invagination or blastopore. One important fact should be noted with regard to the gastrula, in which it seems to differ from the gastrulae of invertebrata. After invagination is completed, the embryo begins to elongate, the blastopore becomes narrower, and the dorsal wall of the gastrula loses its convexity, and becomes flattened to form the dorsal plate, the outer layer of which is the primordium of the neurochord and the inner layer the primordium of the notochord. While still within the egg-membrane the epiblastic cells become flagellated, and the gastrula rotates within the membrane. About the eighth hour after commencement of development the membrane ruptures and the oval embryo escapes, swimming by means of its flagella at the surface of the sea for another twenty-four hours, during which the principal organs are laid down, although the mouth does not open until the close of this period. The primordium of the neurochord (neural or medullary plate) referred to above becomes closed in from the surface by the overgrowth of surrounding epiblast, and its edges also bend up, meet, and finally fuse to form a tube, the medullary or neural tube. An important fact to note is that the blastopore is included in this overgrowth of epiblast, so that the neural tube remains for some time in open communication with the archenteron by means of a posterior neurenteric canal. It is still longer before the neural tube completes its closure in front, exhibiting a small orifice at the surface, the anterior neuropore. It is thus possible that the neurenteric canal is due to the conjunction of a posterior neuropore with the blastopore, *i.e.* it is a complex and not a simple structure. Paired archenteric pouches

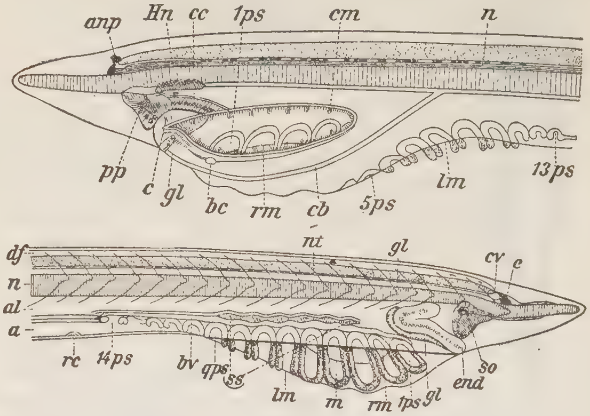

FIG. 6.—Anterior region of two pelagic larvae of *A. lanceolatus* obtained by the tow-net in 8–10 fathoms, showing the asymmetry of the large lateral sinistral mouth with its ciliated margin *cm* and the dextral series of simple primary gill-slits (1*ps*-14*ps*). The larvae swim normally like the adult or suspend themselves by their flagella (not shown in the figures) vertically in mid-water. There is nothing in their mode of life which will afford an explanation of the asymmetry which is a developmental phenomenon. *Lettering of upper figure.*—*anp*, Anterior neural pore; *bc*, rudiment of buccal skeleton; *c*, cilia; *cb*, ciliated band; *cc*, ciliated groove; *cm*, cilia at margin of mouth; *gl*, external opening of club-shaped gland; *Hn*, Hatschek's nephridium; *lm*, left metapleur; *n*, notochord; *pp*, praeoral pit; *ps*, primary gill-slits, 1, 5, and 13; *rm*, right metapleur showing through. *Lettering of lower figure.*—*a*, Atrium; *al*, alimentary canal; *bv*, blood-vessel; *cv*, cerebral vesicle; *df*, dorsal section of myocoel (=fin spaces); *e*, "eyespot"; *end*, endostyle; *gl*, club-shaped gland; *lm*, edge of left metapleur; *m*, lower edge of mouth; *n*, notochord; *nt*, pigmented nerve tube; *ps*, primary gill-slits, 1, 9, and 14; *rc*, renal cells on atrial floor; *rm*, edge of right metapleur; *so*, sense organ opening into praeoral pit; *ss*, thickenings, the rudiments of the row of secondary gill-slits.

meanwhile appear at the sides of the axial notochordal tract, the mesoblastic somites. The first of these differs in several respects from those which succeed, and has been called the collar cavity (MacBride). In front of the latter there remains a portion of the archenteron, which becomes constricted off as the head cavity. This becomes divided into two, the right half forming the cavity of the rostrum, while the left acquires an opening to the exterior, and forms the praeoral pit of the larva, which subsequently gives rise to special ciliated tracts in the vestibule of the mouth mentioned above. The larval period commences at about the thirty-sixth hour with the perforation of the mouth, first gill-cleft and anus. The larva is curiously asymmetrical, as many as fourteen gill-clefts appearing in an unpaired series on the right side, while the mouth is a large orifice on the left side, the anus being median. The adult form is achieved by metamorphosis, which cannot be further described here. One point must not be omitted, namely, the homogeny of the endostyle of Amphioxus and the thyroid gland of Craniata.

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AMPHIPOLIS (mod. *Yeni Keui*), an ancient city of Macedonia, on the east bank of the river Strymon, where it emerges from Lake Cercinitis, about 3 m. from the sea. Originally a Thracian town, known as 'Εννέα 'Οδοί ("Nine Roads"), it was colonized by Athenians with other Greeks under Hagnon in 437 B.C., previous attempts—in 497, 476 (Schol. Aesch. *De fals. leg.* 31) and 465—having been unsuccessful. In 424 B.C. it surrendered to the Spartan Brasidas without resistance, owing to the gross negligence of the historian Thucydides, who was with the fleet at Thasos. In 422 B.C. Cleon led an unsuccessful expedition to recover it, in which both he and Brasidas were slain. The importance of Amphipolis in ancient times was due to the fact that it commanded the bridge over the Strymon, and consequently the route from northern Greece to the Hellespont; it was important also as a depot for the gold and silver mines of the district, and for timber, which was largely used in shipbuilding. This importance is shown by the fact that, in the peace of Nicias (421 B.C.), its restoration to Athens is made the subject of a special provision, and that about 417, this provision not having been observed, at least one expedition was made by Nicias with a view to its recovery. Philip of Macedon made a special point of occupying it (357), and under the early empire it became the headquarters of the Roman propraetor, though it was recognized as independent. Many inscriptions, coins, &c., have been found here, and traces of the ancient fortifications and of a Roman aqueduct are visible.

AMPHIPROSTYLE (from the Gr. ἀμφί, on both sides, and πρόστυλος, a portico), the term for a temple (*q.v.*) with a portico both in the front and in the rear.

AMPHISBAENA (a Greek word, from ἀμφίς, both ways, and βαίνειν, to go), a serpent in ancient mythology, beginning or ending at both head and tail alike. Its fabled existence has been utilized by the poets, such as Milton, Pope and Tennyson. In modern zoology it is the name given to the main genus of a family of worm-shaped lizards, most of which inhabit the tropical parts of America, the West Indies and Africa. The commonest species in South America and the Antilles is the sooty or dusky *A. fuliginosa.* The body of the amphisbaena, from 18 to 20 in. long, is of nearly the same thickness throughout. The head is small, and there can scarcely be said to be a tail, the vent being close to the extremity of the body. The animal lives mostly underground, burrowing in soft earth, and feeds on ants and other small animals. From its appearance, and the ease with which it moves backwards, has arisen the popular belief that the amphisbaena has two heads, and that when the body is cut in two the parts seek each other out and reunite. From this has arisen another popular error, which attributes extraordinary curative properties to its flesh when dried and pulverized.

AMPHITHEATRE (Gr. ἀμφί, around, and θέατρον, a place for spectators), a building in which the seats for spectators surround the scene of the performance. The word was doubtless coined by the Greeks of Campania, since it was here that the gladiatorial shows for which the amphitheatre was primarily used were first organized as public spectacles. The earliest building of the kind still extant is that at Pompeii, built after 80 B.C. It is called *spectacula* in a contemporary inscription. The word *amphitheatrum* is first found in writers of the Augustan age.

In Italy, combats of gladiators at first took place in the forums, where temporary wooden scaffoldings were erected for the spectators; and Vitruvius gives this as the reason why in that country the forums were in the shape of a parallelogram instead of being squares as in Greece. Wild beasts were also hunted in the circus. But towards the end of the Roman republic, when the shows increased both in frequency and in costliness, special buildings began to be provided for them.

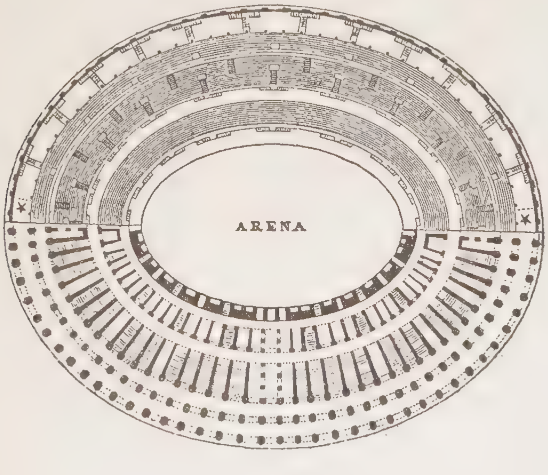
The first amphitheatre at Rome was that constructed, 59 B.C., by C. Scribonius Curio. Pliny tells us that Curio built two wooden theatres, which were placed back to back, and that after the dramatic representations were finished, they were turned round, with all the spectators in them, so as to make one circular theatre, in the centre of which gladiators fought; but the story is incredible, and must have arisen from the false translation of ἀμφιθέατρον by "double theatre." It is uncertain whether Caesar, in 46 B.C., constructed a temporary amphitheatre of wood for his shows of wild beasts; at any rate, the first permanent amphitheatre was built by C. Statilius Taurus in 29 B.C. Probably the shell only was of stone. It was burnt in the great fire of A.D. 64.

We hear of an amphitheatre begun by Caligula and of a wooden structure raised in the year A.D. 57 by Nero; but these were superseded by the *Amphitheatrum Flavium* (known at least since the 8th century as the Colosseum, from its colossal size), which was begun by Vespasian on the site of an artificial lake included in the Golden House of Nero, and inaugurated by Titus in A.D. 80 with shows lasting one hundred days. It was several times restored by the emperors, having been twice struck by lightning in the 3rd century and twice damaged by earthquake in the 5th. Gladiatorial shows were suppressed by Honorius in A.D. 404, and wild beast shows are not recorded after the reign of Theodoric (d. A.D. 526). In the 8th century Bede wrote *Quamdiu stabit Coliseus, stabit et Roma; quando cadet Coliseus, cadet et Roma.* A large part of the western arcades seem to have collapsed in the earthquake of A.D. 1349, and their remains were used in the Renaissance as a quarry for building materials (*e.g.* for the Palazzo di Venezia, the Cancelleria and the Palazzo Farnese).

Rome possesses the remains of a second amphitheatre on the Esquiline, called by the chronologist of A.D. 354 *Amphitheatrum Castrense*, which probably means the "court" or "imperial" amphitheatre. Its fine brickwork seems to date from Trajan's reign. It was included by Aurelian in the circuit of his wall. The remains of numerous amphitheatres exist in the various provinces of the empire. The finest are—in Italy, those of Verona (probably of the Flavian period), Capua (built under Hadrian) and Pozzuoli; in France, at Nîmes, Arles and Fréjus; in Spain, at Italica (near Seville); in Tunisia, at Thysdrus (El-Jem); and at Pola, in Dalmatia. The builders often took advantage of natural features, such as a depression between hills; and ruder structures, mainly consisting of banked-up earth, are found, *e.g.* at Silchester (Calleva). The amphitheatre at Pompeii (length 444 ft., breadth 342 ft., seating capacity 20,000) is formed by a huge embankment of earth supported by a retaining wall and high buttresses carrying arches. The stone seats (of which there are thirty-five rows in three divisions) were only gradually constructed as the means of the community allowed. Access to the highest seats was given by external staircases, and there was no system of underground chambers for wild beasts, combatants, &c.

In contrast to this simple structure the Colosseum represents the most elaborate type of amphitheatre created by the architects of the empire. Its external elevation consisted of four storeys. The three lowest had arcades whose piers were adorned with engaged columns of the three Greek orders. The arches numbered eighty. Those of the basement storey served as entrances; seventy-six were numbered and allotted to the general body of spectators, those at the extremities of the major axis led into the arena, and the boxes reserved for the emperor and the presiding magistrate were approached from the extremities of the minor axis. The higher arcades had a low parapet with (apparently) a statue in each arch, and gave light and air to the passages which surrounded the building. The openings of the arcades above the principal entrances were larger than the rest, and were adorned with figures of chariots. The highest stage was composed of a continuous wall of masonry, pierced by forty small square windows, and adorned with Corinthian pilasters. There was also a series of brackets to support the poles on which the awning was stretched.

The interior may be naturally divided into the *arena* and the *cavea* (see annexed plan, which shows the Colosseum at two different levels).



The *arena* was the portion assigned to the combatants, and derived its name from the sand with which it was strewn, to absorb the blood and prevent it from becoming slippery. Some of the emperors showed their prodigality by substituting precious powders, and even gold dust, for sand. The *arena* was generally of the same shape as the amphitheatre itself, and was separated from the spectators by a wall built perfectly smooth, that the wild beasts might not by any possibility climb it. At Rome it was faced inside with polished marble, but at Pompeii it was simply painted. For further security, it was surrounded by a metal railing or network, and the arena was sometimes surrounded also by a ditch (*euripus*), especially on account of the elephants. Below the arena were subterranean chambers and passages, from which wild beasts and gladiators were raised on movable platforms (*pegmata*) through trap-doors. Such chambers have been found in the amphitheatres of Capua and Pozzuoli as well as in the Colosseum. Means were also provided by which the arena could be flooded when a sea-fight (*naumachia*) was exhibited, as was done by Titus at the inauguration of the Colosseum.

The part assigned to the spectators was called *cavea*. It was divided into several galleries (*maeniana*) concentric with the outer walls, and therefore, like them, of an elliptical form. The place of honour was the lowest of these, nearest to the arena, and called the *podium*. The divisions in it were larger, so as to be able to contain movable seats. At Rome it was here that the emperor sat, his box bearing the name of *suggestus*, *cubiculum* or *pulvinar*. The senators, principal magistrates, vestal virgins, the provider (*editor*) of the show, and other persons of note, occupied the rest of the *podium*. At Nîmes, besides the high officials of the town, the *podium* had places assigned to the principal gilds, whose names are still seen inscribed upon it, with the number of places reserved for each. In the Colosseum there were three *maeniana* above the *podium*, separated from each other by terraces (*praecinctiones*) and walls (*baltei*), and divided vertically into wedge-shaped blocks (*cunei*) by stairs. The lowest was appropriated to the equestrian order, the highest was covered in with a portico, whose roof formed a terrace on which spectators found standing room. Numerous passages (*vomitoria*) and small stairs gave access to them; while long covered corridors, behind and below them, served for shelter in the event of rain. At Pompeii each place was numbered, and elsewhere their extent is defined by little marks cut in the stone. The spectators were admitted by tickets (*tesserae*), and order preserved by a staff of officers appointed for the purpose.

The height of the Colosseum is about 160 ft.; but the fourth storey in its present form is not earlier in date than the 3rd century A.D. It seems to have been originally of wood, since an inscription of the year A.D. 80 mentions the *summum maenianum in ligneis*. It is stated in the *Notitia Urbis Romae* (4th century) that the Colosseum contained 87,000 places; but Huelsen calculates that the seats would accommodate 45,000 persons at most, besides whom 5000 could find standing room. The exaggerated estimate is due to the fact that space was allotted to corporate bodies, whose numbers were taken as data. The greatest length is about 615 ft., and the length of the shorter axis of the ellipse about 510 ft. The dimensions of the arena were 281 ft. by 177 ft.

The following table, giving the dimensions of some of the principal amphitheatres, is based mainly on the figures given by Friedländer (*l.c.*):—

	ENTIRE BUILDING.		ARENA.	
	Greater Axis.	Shorter Axis.	Greater Axis.	Shorter Axis.
Rome (Colosseum)	615	510½	281	177
Capua	557	458	250	148
Julia Caesarea	551	289	459	197
Italica (Seville)	514	439½	. .	. .
Verona	502½	403	248	145½
Thysdrus	488	406	308	197
Tarraco	486	390	277	181
Pozzuoli	482	383	236½	137¾
Tours	472	406	223	98½
Pola	449½	367½	230	144½
Arles	448	352	229	129
Pompeii	444	342	218½	115
Nîmes	440	336	227	126½

BIBLIOGRAPHY.—Arts. "Amphitheatrum" in Smith's *Dictionary of Greek and Roman Antiquities* (3rd ed., 1890), and in Daremberg and Saglio's *Dictionnaire des antiquités*; Friedländer, *Darstellungen aus der Sittengeschichte Roms* (6th ed., 1888–1890), vol. ii. pp. 551-620; Durm, *Geschichte der Baukunst*, II.² (1905), 360 ff. Of older works, J. Lipsius, *De Amphitheatris* (1585); Carlo Fontana, *L'Anfiteatro Flavio* (1725); and Maffei, *Verona Illustrata*, vol. ii. (1826), are worthy of mention. For the amphitheatre at Pompeii, see Mau-Kelsey.

FIG. 1. "WIDE WORLD" FIG. 2. TAKEN BY THE "DAILY SKETCH," AND SUPPLIED BY THE WIDE WORLD AGENCY [illegible]

The last few years have been marked by the construction of many giant "stadia," and by the revival of great athletic competitions. (See articles FOOTBALL, Vol. 30; OLYMPIC GAMES, Vol. 30, etc.) FIG. 1. University of California Memorial Stadium. FIG. 2. Aerial view of the Football Cup Final at Wembley, England.

Pompeii, its Life and Art (2nd ed. 1904), chap. 30; for the Colosseum, Middleton, *Remains of Ancient Rome*, ii. pp. 78-110, and Huelsen's art. "Flavium Amphitheatrum" in Pauly-Wissowa, *Realencyclopädie*. (H. S. J.)

AMPHITRITE, in ancient Greek mythology, a sea-goddess, daughter of Nereus (or Oceanus) and wife of Poseidon. She was so entirely confined in her authority to the sea and the creatures in it, that she was never associated with her husband either for purposes of worship or in works of art, except when he was to be distinctly regarded as the god who controlled the sea. She was one of the Nereids, and distinguishable from the others only by her queenly attributes. It was said that Poseidon saw her first dancing at Naxos among the other Nereids, and carried her off (Schol. on *Od.* iii. 91). But in another version of the myth, she then fled from him to the farthest ends of the sea, where the dolphin of Poseidon found her, and was rewarded by being placed among the stars (Eratosthenes, *Catast.* 31). In works of art she is represented either enthroned beside him, or driving with him in a chariot drawn by sea-horses or other fabulous creatures of the deep, and attended by Tritons and Nereids. In poetry her name is often used for the sea.

AMPHITRYON, in Greek mythology, son of Alcaeus, king of Tiryns in Argolis. Having accidentally killed his uncle Electryon, king of Mycenae, he was driven out by another uncle, Sthenelus. He fled with Alcmene, Electryon's daughter, to Thebes, where he was cleansed from the guilt of blood by Creon, his maternal uncle, king of Thebes. Alcmene, who had been betrothed to Amphitryon by her father, refused to marry him until he had avenged the death of her brothers, all of whom except one had fallen in battle against the Taphians. It was on his return from this expedition that Electryon had been killed. Amphitryon accordingly took the field against the Taphians, accompanied by Creon, who had agreed to assist him on condition that he slew the Teumessian fox which had been sent by Dionysus to ravage the country. The Taphians, however, remained invincible until Comaetho, the king's daughter, out of love for Amphitryon cut off her father's golden hair, the possession of which rendered him immortal. Having defeated the enemy, Amphitryon put Comaetho to death and handed over the kingdom of the Taphians to Cephalus. On his return to Thebes he married Alcmene, who gave birth to twin sons, Iphicles being the son of Amphitryon, Heracles of Zeus, who had visited her during Amphitryon's absence. He fell in battle against the Minyans, against whom he had undertaken an expedition, accompanied by the youthful Heracles, to deliver Thebes from a disgraceful tribute. According to Euripides (*Hercules Furens*) he survived this expedition, and was slain by his son in his madness. Amphitryon was the title of a lost tragedy of Sophocles; the episode of Zeus and Alcmene forms the subject of comedies by Plautus and Molière. From Molière's line "Le véritable Amphitryon est l'Amphitryon où l'on dîne" (*Amphitryon*, iii. 5), the name Amphitryon has come to be used in the sense of a generous entertainer, a good host.

Apollodorus ii. 4; Herodotus v. 59; Pausanias viii. 14, ix, 10, 11, 17; Hesiod, *Shield*, 1-56; Pindar, *Pythia*, ix. 81.

AMPHORA (a Latin word from Gr. ἀμφορεύς, derived from ἀμφὶ, on both sides, and φέρειν, to bear), a large big-bellied vessel used by the ancient Greeks and Romans for preserving wine, oil, honey, and fruits; and in later times as a cinerary urn. It was so named from usually having an ear or handle on each side of the neck (*diōta*). It was commonly made of earthenware, but sometimes of stone, glass or even more costly materials. Amphorae either rested on a foot, or ended in a point so that they had to be fixed in the ground. The older amphorae were oval-shaped, such as the vases filled with oil for prizes at the Panathenaic festival, having on one side a figure of Athena, on the other a representation of the contest; the latter were tall and slender, with voluted handles. The first class exhibits black figures on a reddish background, the second red figures on a black ground. The amphora was a standard measure of capacity among both Greeks and Romans, the Attic containing nearly nine gallons, and the Roman about six. In modern botany it is a technical term sometimes denoting the lower part of the capsule called pyxidium, attached to the flower stalk in the form of an urn.

AMPLIATIVE (from Lat. *ampliare*, to enlarge), an adjective used mainly in logic, meaning "extending" or "adding to that which is already known." In Norman law an "ampliation" was a postponement of a sentence in order to obtain further evidence.

AMPLITUDE (from Lat. *amplus*, large), in astronomy, the angular distance of the rising or setting sun, or other heavenly body, from the east or west point of the horizon; used mostly by navigators in finding the variation of the compass by the setting sun. In algebra, if a be a real positive quantity and ω a root of unity, then a is the *amplitude* of the product $a\omega$. In elliptic integrals, the amplitude is the limit of integration when the integral is expressed in the form $\int_o^\phi \sqrt{1-\mathrm{N}^2 \sin^2 \phi}\, d\phi$. The *hyperbolic* or *Gudermannian* amplitude of the quantity x is $\overset{-1}{\tan}$ (sinh x). In mechanics, the amplitude of a wave is the maximum ordinate. (See WAVE.)

AMPSANCTUS, or AMSANCTUS (mod. *Sorgente Mefita*), a small lake in the territory of the Hirpini, 10 m. S.E. of Aeclanum, close to the Via Appia. There are now two small pools which exhale carbonic acid gas and sulphuretted hydrogen. Close by was a temple of the goddess Mephitis, with a cave from which suffocating vapours rose, and for this reason the place was brought into connexion with the legends of the infernal regions. Virgil's description (*Aeneid*, vii. 563) is not, however, very accurate.

AMPTHILL, ODO WILLIAM LEOPOLD RUSSELL, 1ST BARON (1829–1884), British diplomatist and ambassador, was born in Florence on the 20th of February 1829. He was the son of Major-General Lord George William Russell, by Elizabeth Ann, niece of the marquess of Hastings, who was governor-general of India during the final struggle with the Mahrattas. His education, like that of his two brothers—Hastings, who became eventually 9th duke of Bedford, and Arthur, who sat for a generation in the House of Commons as member for Tavistock—was carried on entirely at home, under the general direction of his mother, whose beauty was celebrated by Byron in *Beppo*. Lady William Russell was as strong-willed as she was beautiful, and certainly deserved to be described as she was by Disraeli, who said in conversation, "I think she is the most fortunate woman in England, for she has the three nicest sons." If it had not been for her strong will it is as likely as not that all the three would have gone through the usual mill of a public school, and have lost half their very peculiar charm. In March 1849 Odo was appointed by Lord Malmesbury attaché at Vienna. From 1850 to 1852 he was temporarily employed in the foreign office, whence he passed to Paris. He remained there, however, only about two months, when he was transferred to Vienna. In 1853 he became second paid attaché at Paris, and in August 1854 he was transferred as first paid attaché to Constantinople, where he served under Lord Stratford de Redcliffe. He had charge of the embassy during his chief's two visits to the Crimea in 1855, but left the East to work under Lord Napier at Washington in 1857. In the following year he became secretary of legation at Florence, but was detached from that place to reside in Rome, where he remained for twelve years, till August 1870. During all that period he was the real though unofficial representative of England at the Vatican, and his consummate tact enabled him to do all, and more than all, that an ordinary man could have done in a stronger position. A reference, however, to his evidence before a committee of the House of Commons in 1871 will make it clear to any unprejudiced reader that those were right who, during the early 'fifties, urged so strongly the importance of having a duly accredited agent at the papal court. The line taken by him during the Vatican council has been criticized, but no fault can justly be found with it. Abreast as he was of the best thought of his time—the brother of Arthur Russell, who, more perhaps than any other man, was its most ideal representative in London society—he sympathized strongly with the views of those who laboured to prevent the extreme partisans of papal infallibility from having everything their own way. But in his capacity of clear-headed observer, whose business it was to reflect the actual truth upon the mind of his government, he was obliged to make it quite clear that they had no chance whatever, and in conversing with those whose opinions were quite unlike his own, such as Cardinal Manning, he seems to have shown that he had no illusions about the result of the long debate. In 1868 Odo Russell married Lady Emily Theresa Villiers, the daughter of Lord Clarendon. In 1870 he was appointed assistant under-secretary at the foreign office, and in November of that year was sent on a special mission to the headquarters of the German army, where he remained till 1871.

It was in connexion with this mission that an episode occurred which at the time threw much discredit upon Gladstone's government. Russia had taken advantage of the collapse of France and her own cordial relations with Prussia to denounce the Black Sea clauses of the treaty of Paris of 1856. Russell, in an interview with Bismarck, pointed out that unless Russia withdrew from an attitude which involved the destruction of a treaty solemnly guaranteed by the powers, Great Britain would be forced to go to war "with or without allies." This strong attitude was effective, and the question was ultimately referred to and settled by the conference which met at London in 1871. Though the result was to score a distinct diplomatic success for the Liberal government, the bellicose method employed wounded Liberal sentiment and threatened to create trouble for the ministry in parliament. On the 16th of February 1871, accordingly, Gladstone, in answer to a question, said that "the argument used by Mr Odo Russell was not one which had been directed by her Majesty's government," that it was used by him "without any specific instructions or authority from the government," but that, at the same time, no blame was to be attached to him, as it was "perfectly well known that the duty of diplomatic agents requires them to express themselves in that mode in which they think they can best support and recommend the propositions of which they wish to procure acceptance." This Gladstonian explanation was widely criticized as an illegitimate attack on Russell. What is certain is that the foreign office and the country profited by Russell's firmness. (See Morley's *Gladstone*, ii. 534.)

A little later in the same year he received the well-deserved reward of his labours by being made ambassador at Berlin.

During the months he passed at the foreign office he was examined before the committee of the House of Commons, already alluded to, and had an opportunity of stating very distinctly in public some of his views with regard to his profession. "If you could only organize diplomacy properly," he said, "you would create a body of men who might influence the destinies of mankind and ensure the peace of the world." In these words we have the key to the thought and habitual action of one of the best and wisest public servants of the time.

Russell remained at Berlin, with only brief intervals of absence, from the 16th of October 1871 till his death at Potsdam on the 25th of August 1884. He was third plenipotentiary at the Berlin congress, and is generally credited with having prevented, by his tact and good sense, the British prime minister from making a speech in French, which he knew very imperfectly and pronounced abominably. In 1874 Odo Russell received a patent of precedence raising him to the rank of a duke's son, and after the congress of Berlin he was offered a peerage by the Conservative government. This he naturally declined, but accepted the honour in 1881 when it was offered by the Liberals, taking the title of Baron Ampthill. He became a privy councillor in 1872 and was made a G.C.B. somewhat later. At the conference about the Greek frontier, which followed the congress of Berlin, he was the only British representative. During all his long sojourn in the Prussian capital, he did everything that in him lay to bring about close and friendly relations between Great Britain and Germany. He kept on the best of terms with Bismarck, carefully avoiding everything that could give any cause of offence to that most jealous and most unscrupulous minister, whom he, however, did not hesitate to withstand when his unscrupulousness went the length of deliberately attempting to deceive.

He was succeeded as 2nd baron by his son, ARTHUR OLIVER VILLIERS RUSSELL (b. 1869), who rowed in the Oxford eight (1889, 1890, 1891) and became a prominent Unionist politician. He was private secretary to Mr Chamberlain, 1895–1897, and governor of Madras, 1899–1906. In 1904 he acted temporarily as Viceroy of India. (M. G. D.)

AMPTHILL, a market town in the northern parliamentary division of Bedfordshire, England, 44 m. N.N.W. of London by the Midland railway. Pop. of urban district (1901) 2177. It lies on the southern slope of a low range of hills, in a well-wooded district. The church of St Andrew ranges in date from Early English to Perpendicular. It contains a monument to Richard Nicolls (1624–1672), who, under the patronage of the duke of York, brother to Charles II., to whom the king had granted the Dutch North American colony of New Netherland, received the submission of its chief town, New Amsterdam, in 1664, and became its first English governor, the town taking the name of New York. Nicolls perished in the action between the English and Dutch fleets at Solebay, and the ball which killed him is preserved on his tomb. Houghton Park, in the vicinity, contains the ruins of Houghton House, built by Mary, countess of Pembroke, in the time of James I. To this countess Sir Philip Sidney dedicated the *Arcadia*. Ampthill Park became in 1818 the seat of that Lord Holland in whose time Holland House, in Kensington, London, became famous as a resort of the most distinguished intellectual society. In the park a cross marks the site of Ampthill Castle, the residence of Catherine of Aragon while her divorce from Henry VIII. was pending. A commemorative inscription on the cross was written by Horace Walpole. Brewing, straw-plaiting and lace-making are carried on in Ampthill.

AMPULLA (either a diminutive of *amphora*, or from Lat. *ambo*, both, and *olla*, a pot), a small, narrow-necked, round-bodied vase for holding liquids, especially oil and perfumes. It is the Latin term equivalent to the Greek λήκυθος. It was used in ancient times for toilet purposes and anointing the bodies of the dead, being then buried with them. Gildas mentions the use of *ampullae* as established among the Britons in his time, and St Columba is said to have employed one in the coronation of King Aidan. Both the name and the function of the ampulla have survived in the Western Church, where it still signifies the vessel containing the oil consecrated by the bishop for ritual uses, especially in the sacraments of Confirmation, Orders and Extreme Unction. The word occurs repeatedly in the service of coronation of the English sovereign in connexion with the ancient ceremony of anointing by the archbishop of Canterbury, which is still observed. The ampulla of the regalia of England takes the form of a golden eagle with outspread wings. The most celebrated ampulla in history was that known as *la sainte ampoule*, in the abbey of St Remi at Reims, from which the kings of France were anointed. According to the legend it had been brought from heaven by a dove for the coronation of Clovis, and at one period the kings of France claimed precedence over all other sovereigns on account of it. It was destroyed at the Revolution. The word "ampulla" is used in biology, by analogy from the shape, for a certain portion of the anatomy of a plant or animal.

AMRAM (d. 875), a famous *gaon* or head of the Jewish Academy of Sura (Persia) in the 9th century. He was author of many "Responsa," but his chief work was liturgical. He was the first to arrange a complete liturgy for the synagogue, and his Prayer-Book (*Siddur Rab ʿAmram*) was the foundation of most of the extant rites in use among the Jews. The *Siddur* was published in Warsaw in two parts (1865).

AMRAOTI, or UMRAWATTEE, a town and district of India, in Berar, Central Provinces. The district was reconstituted in 1905, when that of Ellichpur was incorporated with it. The town has a station 6 m. from Badnera junction on the Great Indian Peninsula line. Pop. (1901) 34,216, showing an increase of 22% in the decade. It is the richest town of Berar, with the most numerous and substantial commercial population. It possesses a branch of the Bank of Bombay, and has the largest cotton mart, where an average of 80,593 *bojas* of cotton are bought and sold annually. It has also a large grain market, cotton presses, ginning factories and oil mills. Amraoti raw cotton is quoted on the Liverpool Exchange.

The district of Amraoti has an area of 4754 sq. m. In 1901 the population was 630,245, showing a decrease of 4% in the decade; on the area as now constituted it was 809,499. The district is an extensive plain, about 800 ft. above sea-level, the general flatness being only broken by a small chain of hills, running in a north-westerly direction between Amraoti and Chandor, with an average height from 400 to 500 ft. above the lowlands. The principal towns, besides Amraoti, are Karinja, Kolapur, and Badnera, which lies on the Great Indian Peninsula railway, the main line of which crosses the district. Severe drought visited Amraoti in 1899–1900.

AMRAVATI, or AMARAVATI, a ruined city of India in the Guntur district of the Madras presidency, on the south bank of the Kistna river, 62 m. from its mouth. The town is of great interest for the antiquary as one of the chief centres of the Buddhist kingdom of Vengi, and for its *stupa* (sepulchral monument). Amravati has been identified with Hsüan Tsang's To-na-kie-tse-kia and with the Rahmi of Arab geographers. Subsequent to the disappearance of Buddhism from this region the town became a centre of the Sivaite faith. When Hsüan Tsang visited Amravati in A.D. 639 it had already been deserted for a century, but he speaks in glowing terms of its magnificence and beauty. Very careful and artistic representations of the *stupa* with its *daghoba* and interesting rail, pillars and sculptures will be found in Fergusson's *Tree and Serpent Worship*, and in his *History of Indian Architecture* (1876). Its elaborate carvings illustrate the life of Buddha. Some are preserved in the British Museum; others in the museum at Madras.

An account by Dr James Burgess was published in 1877 as one of the volumes of the Archaeological Survey of Southern India.

‘AMR-IBN-EL-ASS, or ‘AMR (strictly ‘AMR B. ‘ĀS), one of the most famous of the first race of the Saracen leaders, was of the tribe of Koreish (Qureish). In his youth he was an antagonist of Mahomet. His zeal prompted him to undertake an embassy to the king of Ethiopia, in order to stimulate him against the converts whom he had taken under his protection, but he returned a convert to the Mahommedan faith and joined the fugitive prophet at Medina. When Abu Bekr resolved to invade Syria, he entrusted ‘Amr with a high command. ‘Amr soon perceived that his troops were not sufficient for a serious battle. Reinforced by Khālid b. al-Walīd, whom Abu Bekr sent in all haste from Irak to Syria, he defeated the imperial troops, commanded by Theodorus, the brother of Heraclius, not far from Ramleh in Palestine, on the 31st of July 634. When Omar became caliph he made Khālid chief commander of the Syrian armies, ‘Amr remaining in Palestine to complete the submission of that province. It is not certain that ‘Amr assisted Khālid in the siege of Damascus, but very probable that he took part in the decisive battle of Yarmūk, 20th of August 636. After this battle he laid siege to Jerusalem, in which enterprise he was seconded a year later by Abu Obeida, then chief commander. After the surrender of Jerusalem ‘Amr began the siege of Caesarea, which, however, was brought to a successful end in September or October 640 by Moawiya, ‘Amr having obtained Omar's sanction for an expedition against Egypt. Towards the end of 639 he led an army of 4000 Arabs into that country. During his march a messenger from Omar arrived with a letter containing directions to return if he should have received it in Syria, but if in Egypt to advance, in which case all needful assistance would be instantly sent to him. The contents of the letter were not made known to his officers until he was assured that the army was on Egyptian soil, so that the expedition might be continued under the sanction of Omar's orders. Having taken Farama (Pelusium), he advanced to Misr, north of the ancient Memphis, and besieged it and the strong fortress of Babylon for seven months. Although numerous reinforcements arrived, he would have found it very difficult to storm the place previous to the inundation of the Nile but for treachery within the citadel; the Greeks who remained there were either made prisoners or put to the sword. On the same spot ‘Amr built a city named Fostat ("the encampment"), the ruins of which are known by the name of Old Cairo. The mosque which he erected and called by his own name is described in *Asiatic Journal* (1890), p. 759. ‘Amr pursued the Greeks to Alexandria, but finding that it was impossible to take the place by storm, he contented himself with blockading it with the greater part of his army, and reducing the Delta to submission with the rest. At the end of twelve months Alexandria sued for peace, and a treaty was signed on the 8th of November 641. To ‘Amr acting on Omar's command has been attributed the burning of the famous Alexandrian library. (See LIBRARIES and ALEXANDRIA.) Not only is this act of barbarism inconsistent with the characters of Omar and his general, but the earliest authority for the story is Abulfaragius (Barhebraeus), a Christian writer, who lived six centuries later. After the conquest of Egypt ‘Amr carried his conquests eastward along the North African coast as far as Barca and even Tripolis. His administration of Egypt was moderate and statesmanlike, and under his rule the produce of the Nile Valley was a constant source of supply to the cities of Arabia. He even reopened a canal at least 80 m. long from the Nile to the Red Sea with the object of renewing communication by sea. Removed from his office by Othman in 647, who replaced him by Ibn abi Sarh, he sided with Moawiya in the contest for the caliphate, and was largely responsible for the deposition of Ali (*q.v.*) and the establishment of the Omayyad dynasty. (See CALIPHATE, section B.) In 658 he reconquered Egypt in Moawiya's interest, and governed it till his death on the 6th of January 664. In a pathetic speech to his children on his deathbed, he bitterly lamented his youthful offence in opposing the prophet, although Mahomet had forgiven him and had frequently affirmed that "there was no Mussulman more sincere and steadfast in the faith than ‘Amr."

Sir W. Muir, *The Caliphate* (London, 1891); E. Gibbon's *Decline and Fall*; M. J. de Goeje, *Mémoire sur la conquête de la Syrie* (Leiden, 1900); Butler, *Arab Conquest of Egypt* (Oxford, 1902); art. EGYPT, *History*, Mahommedan Period.

‘AMR IBN KULTHŪM, Arabian poet, author of one of the Mo‘allaḳāt. Little or nothing is known of his life save that he was a member of the tribe of Taghlib and that he is said to have died of excessive wine-drinking. Some stories of him are told in the *Book of Songs* (see ABULFARAJ), vol. ix. pp. 181-185.

AMRITSAR, or UMRITSAR, a city and district of British India, in the Lahore division of the Punjab. The city has a station on the North Western railway 32 m. E. of Lahore, its position on which has greatly assisted its development. Amritsar is chiefly notable as the centre of the Sikh religion and the site of the Golden Temple, the chief worshipping place of the Sikhs. Ram Das, the fourth *guru*, laid the foundations of the city upon a site granted by the emperor Akbar. He also excavated the holy tank from which the town derives its name of Amrita Turas, or Pool of Immortality. It is upon a small island in the middle of this tank that the Golden Temple is now situated. About two centuries afterwards, in the course of the struggle between the Sikhs and the Mahommedans, Ahmad Shah Durani routed the Sikhs at the great battle of Panipat, and on his homeward march he destroyed the town of Amritsar, blew up the temple with gunpowder, filled in the sacred tank with mud, and defiled the holy place by the slaughter of cows. But when Ahmad Shah returned to Kabul the Sikhs rose once more and re-established their religion. Finally the city and surrounding district fell under the sway of Ranjit Singh at Lahore, and passed with the rest of the Punjab into the possession of the British after the second Sikh war. The Golden Temple is so called on account of its copper dome, covered with gold foil, which shines brilliantly in the rays of the Indian sun, and is reflected back from the waters of the lake; but the building as a whole is too squat to have much architectural merit apart from its ornamentation. Marble terraces and balustrades surround the tank, and a marble causeway leads across the water to the temple, whose gilded walls, roof, dome and cupolas, with vivid touches of red curtains, are reflected in the still water. The temple was considerably enriched by the spoils taken by Ranjit Singh in his conquests. The population of Amritsar in 1901 was 162,429. A Sikh college for university education was opened in 1897. The other public buildings include two churches, a town hall and a hospital. Amritsar is famous for its carpet-weaving industry. It was the first mission station of the church of England in the Punjab.

The district is bounded on the N.W. by the river Ravi, on the S.E. by the river Beas, on the N.E. by the district of Gurdaspur, and on the S.W. by the district of Lahore. Amritsar district is a nearly level plain, with a very slight slope from east to west. The banks of the Beas are high, and on this side of the district well-water is not found except at 50 ft. below the surface; while towards the Ravi wells are less than 20 ft. in depth. The only stream passing through the district is the Kirni or Saki, which takes its rise in a marsh in the Gurdaspur district, and after traversing part of the district empties itself into the Ravi. Numerous canals intersect the district, affording ample means of irrigation. The Sind, Punjab and Delhi railway (North Western) and Grand Trunk road, which runs parallel with it, afford the principal means of land communication and traffic. The area of the district is 1601 sq. m.; pop. (1901) 1,023,828, showing an increase of 3% on the previous decade. It is the headquarters of the Sikh religion, containing 264,329 Sikhs as against 280,985 Hindus and 474,976 Mahommedans. The principal crops are wheat, pulse, maize, millet, with some cotton and sugar-cane. There are factories for ginning and pressing cotton.

AMROHA, a town of British India, in the Moradabad district of the United Provinces. It contains the tomb of a Mahommedan saint, Shaikh Saddu, and has been for many centuries a Mahommedan centre. Pop. (1901) 40,077.

AMRUM, or AMROM, a German island in the North Sea, off the coast of Schleswig-Holstein to the south of Sylt. Pop. (1900) 900. It is 6 m. long and 3 m. broad, with an area of 10½ sq. m., and is reached from the mainland by a regular steamboat service to Wittdün, a favourite sea-bathing resort; or at low water by carriage from Föhr. The larger part of Amrum consists of a treeless sandy expanse, but a fringe of rich marshes affords good pasture-land. The principal place is Nebel, connected by a light railway with Wittdün. (See also FRISIAN ISLANDS.)

AMRU'-UL-QAIS, or IMRU'-UL QAIS, **IBN HUJR,** Arabian poet of the 6th century, the author of one of the Moʻallaḳāt (*q.v.*), was regarded by Mahomet and others as the most distinguished poet of pre-Islamic times. He was of the kingly family of Kinda, and his mother was of the tribe of Taghlib. While he was still young, his father was killed by the Bani Asad. After this his life was devoted to the attempt to avenge his father's death. He wandered from tribe to tribe to gain assistance, but his attempts were always foiled by the persistent following of the messengers of Mundhir of Hira (Ḥīra). At last he went to the Jewish Arabian prince, Samuʻāl, left his daughter and treasure with him, and by means of Hārith of Ghassān procured an introduction to the Byzantine emperor Justinian. After a long stay in Constantinople he was named phylarch of Palestine, and received a body of troops from Justin II. With these he started on his way to Arabia. It is said that a man of Asad, who had followed him to Constantinople, charged him before the emperor with the seduction of a princess, and that Justin sent him a poisoned cloak, which caused his death at Ancyra.

His poems are contained in W. Ahlwardt's *The Divans of the six ancient Arabic Poets* (London, 1870), and have been published separately in M'G. de Slane's *Le Diwan d'Amro'lkais* (Paris, 1837); a German version with life and notes in F. Rückert's *Amrilkais der Dichter und König* (Stuttgart, 1843). Many stories of his life are told in the *Kitāb ul-Aghāni*, vol. viii. pp. 62-77. (G. W. T.)

AMSDORF, NICOLAUS VON (1483–1565), German Protestant reformer, was born on the 3rd of December 1483 at Torgau, on the Elbe. He was educated at Leipzig, and then at Wittenberg, where he was one of the first who matriculated (1502) in the recently founded university. He soon obtained various academical honours, and became professor of theology in 1511. Like Andreas Carlstadt, he was at first a leading exponent of the older type of scholastic theology, but under the influence of Luther abandoned his Aristotelian positions for a theology based on the Augustinian doctrine of grace. Throughout his life he remained one of Luther's most determined supporters; was with him at the Leipzig conference (1519), and the diet of Worms (1521); and was in the secret of his Wartburg seclusion. He assisted the first efforts of the Reformation at Magdeburg (1524), at Goslar (1531) and at Einbeck (1534); took an active part in the debates at Schmalkalden (1537), where he defended the use of the sacrament by the unbelieving; and (1539) spoke out strongly against the bigamy of the landgrave of Hesse. After the death of the count palatine, bishop of Naumburg-Zeitz, he was installed there (January 20, 1542), though in opposition to the chapter, by the elector of Saxony and Luther. His position was a painful one, and he longed to get back to Magdeburg, but was persuaded by Luther to stay. After Luther's death (1546) and the battle of Mühlberg (1547) he had to yield to his rival, Julius von Pflug, and retire to the protection of the young duke of Weimar. Here he took part in founding Jena University (1548); opposed the "Augsburg Interim" (1548); superintended the publication of the Jena edition of Luther's works; and debated on the freedom of the will, original sin, and, more noticeably, on the Christian value of good works, in regard to which he held that they were not only useless, but prejudicial. He urged the separation of the High Lutheran party from Melanchthon (1557), got the Saxon dukes to oppose the Frankfort Recess (1558) and continued to fight for the purity of Lutheran doctrine. He died at Eisenach on the 14th of May 1565, and was buried in the church of St George there, where his effigy shows a well-knit frame and sharp-cut features. He was a man of strong will, of great aptitude for controversy, and considerable learning, and thus exercised a decided influence on the Reformation. Many letters and other short productions of his pen are extant in MS., especially five thick volumes of *Amsdorfiana*, in the Weimar library. They are a valuable source for our knowledge of Luther. A small sect, which adopted his opinion on good works, was called after him; but it is now of mere historical interest.

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AMSLER, SAMUEL (1791–1849), Swiss engraver, was born at Schinznach, in the canton of Aargau. He studied his art under Johan Heinrich Lips (1758–1817) and Karl Ernst Hess, at Munich, and from 1816 pursued it in Italy, and chiefly at Rome, till in 1829 he succeeded his former master Hess as professor of copper engraving in the Munich academy. The works he designed and engraved are remarkable for the grace of the figures, and for the wonderful skill with which he retains and expresses the characteristics of the original paintings and statues. He was a passionate admirer of Raphael, and had great success in reproducing his works. Amsler's principal engravings are: "The Triumphal March of Alexander the Great," and a full-length "Christ," after the sculptures of Thorwaldsen and Dannecker; the "Entombment of Christ," and two "Madonnas" after Raphael; and the "Union between Religion and the Arts," after Overbeck, his last work, on which he spent six years.

AMSTERDAM, the chief city of Holland, in the province of North Holland, on the south side of the Y or Ij, an arm of the Zuider Zee, in 52° 22′ N. and 4° 53′ E. Pop. (1900) 523,557. It has communication by railway and canal in every direction; steam-tramways connect it with Edam, Purmerend, Alkmaar and Hilversum, and electric railways with Haarlem and the seaside resort of Zandvoort. Amsterdam, the "dam or dyke of the Amstel," is so called from the Amstel, the canalized river which passes through the city to the Y. Towards the land the city is surrounded by a semicircular fosse or canal, and was at one time regularly fortified; but the ramparts have been demolished and are replaced by fine gardens and houses, and only one gateway, the Muiderpoort, is still standing. Within the city are four similar canals (*grachten*) with their ends resting on the Y, extending in the form of polygonal crescents nearly parallel to each other and to the outer canal. Each of these canals marks the line of the city walls and moat at different periods. Lesser canals intersect the others radially, thus virtually dividing the city into a number of islands; whence it has been compared with Venice. The nucleus of the town lies within the innermost crescent canal, and, with the large square, the Dam, in the centre, represents the area of Amsterdam about the middle of the 14th century. At one extremity of the enclosing canal is the Schreijerstoren (1482) or "Weepers' Tower," so called on account of its being at the head of the ancient harbour, and the scene in former days of sorrowful leave-takings. Between this and the next crescent of the Heeren Gracht sprang up, on the east, the labyrinthine quarter where for more than three centuries the large Jewish population has been located, and in the middle of which the painter Rembrandt lived (1640–1656) and the philosopher Spinoza was born (1632). Beyond the Heeren Gracht lie the Keizers Gracht and the Prinsen Gracht respectively, and these three celebrated canals, with their tree-bordered quays and plain but stately old-fashioned houses, form the principal thoroughfares of the city. West of the Prinsen Gracht lies the region called De Jordaan, a corruption of Le Jardin, the name which it acquired from the fact of its streets being called after various flowers. It was formed by the settlement of French refugees here after the revocation of the edict of Nantes. The outermost crescent canal is called the Singel Gracht (girdle canal), and marks the boundary of the city at the end of the 17th century. The streets in the oldest part of Amsterdam are often narrow and irregular, and the sky-line is picturesquely broken by fantastic gables, roofs and towers. The site of the city being originally a peat bog, the foundations of the houses have to be secured by driving long piles (4–20 yds.) into the firm clay below, the palace on the Dam being supported on nearly 14,000 piles. As late as 1822, however, an overladen corn magazine sank into the mud. Modern Amsterdam extends southward beyond the Singel Gracht, and here the houses are often very handsome, while the broad streets are planted with rows of large trees. In the middle of this new region lies the Vondel Park, named after the great national poet Joost van den Vondel (d. 1679), whose statue stands in the park. The Willems Park adjoining was added in later times. In the older part of the town the chief open space is the Zoological Gardens in the north-eastern corner. They belong to a private society called *Natura Artis Magistra*, and came into existence in 1838. They have, however, been much enlarged since then, and bear a high reputation. In connexion with the gardens there are an aquarium (1882), a library, and an ethnographical and natural history museum. Concerts are given here in summer as well as in the Vondel Park. Close to the Zoological Gardens are the Botanical Gardens, and a small park, also the property of a private society, in which there is a variety theatre. The public squares of the city include the Sophiaplein, with the picturesque old mint-tower; the Rembrandtplein, with a monument (1852) to the painter by Lodswyk Royer; the Thorbeckeplein, with a monument to the statesman, J. R. Thorbecke (1798–1872), and the Leidscheplein, with the large town theatre, rebuilt in 1890–1894 after a fire.

Buildings and Institutions.—The Dam is the vital centre of Amsterdam. All the tramways meet here, and some of the busiest streets, and here too are situated the Nieuwe Kerk and the palace. In the middle of the Dam stands a monument to those who fell in the Belgian revolution of 1830–1831, and called the Metal Cross after the war medals struck at that time. The palace is an imposing building in the classical style, originally built as a town-hall in 1648–1655 by the architect Jacob van Kempen. It was first given up to royalty on the occasion of the visit of the Stadtholder William V. in 1768, and forty years later was appropriated as a royal palace by Louis Bonaparte, king of Holland. But King William I. afterwards formally returned the palace to the city, and the sovereign is therefore actually the city's guest when residing in it. Beautifully decorated on the exterior with gable reliefs by Artus Quellinus (1609–1668) of Antwerp, its great external defect is the absence of a grand entrance. The architectural and ornamental sculpture of the interior is mostly by the same artist, and there are a few interesting pictures, as well as some realistic wall paintings by the 18th-century artist Jacob de Wit similar to those in the Huis ten Bosch near the Hague. The great hall is one of the most splendid of its kind in Europe. Like most of the lesser apartments, it is lined with white Italian marble, and in spite of its enormous dimensions the roof is unsupported by pillars. Ancient flags captured in war decorate the walls, and in the middle of the marble floor is a representation of the firmament inlaid in copper. The Nieuwe Kerk (St Catherine's), in which the sovereigns of Holland are crowned, is a fine Gothic building dating from 1408. Internally it is remarkable for its remains of ancient stained glass, fine carvings and interesting monuments, including one to the famous Admiral de Ruyter (d. 1676). A large stained-glass window commemorates the taking of the oath by Queen Wilhelmina in 1898. The new exchange (1901) is a striking building in red brick and stone, and lies a short distance away between the Dam and the fine central station (1889). The Oude Kerk (St Nicholaas), so called, was built about the year 1300, and contains some beautiful stained glass of the 16th and 17th centuries, by Pieter Aertsen of Amsterdam (1508–1575) and others. One window contains the arms of the burgomasters of Amsterdam from 1578 to 1767. Among the monuments are those to various naval heroes, including Admirals van Heemskerk (d. 1607), Sweers (d. 1673) and van der Hulst (d. 1666). The North Church was the last work of the architect Hendrik de Keyser (1565–1621) of Utrecht. The Roman Catholic church of St Nicholaas (1886) was built to replace the accommodation previously afforded by a common dwelling-house, now the Museum Amstelkring of ecclesiastical antiquities. Among the numerous Jewish synagogues, the largest is that of the Portuguese Jews (1670), which is said to be an imitation of the temple of Solomon. Other buildings of interest are the St Antonieswaag, built as a town gate in 1488–1585, and now containing the city archives; the Trippenhuis, built as a private house in 1662, and now the home of the Royal Society of Science, Letters and Fine Arts; the Netherlands Bank (1865–1869), built by the architect W. A. Froger; the new building (1860) of the Seamen's Institute, founded in 1785; the cellular prison; and the so-called Paleis van Volksvlijt, an immense building of iron and glass with a fine garden, built by Dr Samuel Sarphati, and used for industrial exhibitions, the performance of operas, &c. The museums and picture galleries of Amsterdam are of great interest. The Ryks Museum, or state museum, is the first in Holland. It is a large, handsome and finely situated building designed by Dr P. J. H. Cuyper in the Dutch Renaissance style, and erected in 1876–1885. The exterior is decorated with sculptures and tile-work, and internally it is divided, broadly speaking, into a museum of general antiquities below, and the large gallery of pictures of the Dutch and Flemish schools above. The nucleus of this unsurpassed national collection of pictures was formed out of the collections removed hither from the Pavilion at Haarlem, consisting of modern paintings, and from the town-hall, the van der Hoop Museum and the Trippenhuis in Amsterdam. The important van der Hoop collection arose out of bequests by Adrian van der Hoop and his widow in 1854 and 1880; but the most famous pictures in the Ryks Museum are perhaps the three which come from the Trippenhuis, namely, the so-called "Nightwatch" and the "Syndics of the Cloth Hall" by Rembrandt, and the "Banquet of the Civic Guard," by van der Helst. The Trippenhuis gallery consisted of the pictures brought from the Hague by Louis Bonaparte, king of Holland, and belonging to the collection of the Orange family dispersed during the Napoleonic period. The municipal museum contains a collection of furniture, paintings, &c., bequeathed by Sophia Lopez-Suasso (1890), a medico-pharmaceutical collection, and the National Guard Museum. The Joseph Fodor Museum (1860) contains modern French and Dutch pictures. The private collection founded by Burgomaster Jan Six (d. 1702), the friend and patron of Rembrandt, was sold to the state in 1907; the pictures, except the family Rembrandts, are in the Ryks Museum. Close to this is the Willet-Holthuysen Museum (1895) of furniture, porcelain, &c.

Education and Charities.—There are two universities in Amsterdam: the Free University (1880), and the more ancient state university of Amsterdam, originally founded in 1632, but reconstructed in 1887. In addition to the numerous science laboratories the state university possesses a very fine library of about 100,000 volumes, including the Rosenthal collection of over 8000 books on Jewish literature. Modern educational institutions include a school of engineering (1879), a school for teachers (1878) and a school of industrial art (1879). Amsterdam is also remarkable for the number and high character of its benevolent institutions, which are to a large extent supported by voluntary contributions. Among others may be mentioned hospitals for the sick, the aged, the infirm, the blind, the deaf, the dumb, the insane, and homes for widows, orphans, foundlings and sailors. The costumes of the children educated at the different orphanages are varied and picturesque, those of the municipal orphanage being dressed in the city colours of red and black. In the Walloon orphanage are some interesting pictures by van der Helst and others. The Society for Public Welfare (*Maatschappij tot nut van het Algemeen*), founded in 1785, has for its object the promotion of the education and improvement of all classes, and has branches in every part of Holland. Among other Amsterdam societies are the *Felix Meritis* (1776), and the *Arti et Amicitiae* (1839), whose art exhibitions are of a high order.

Harbour and Commerce.—The first attempt which the city of Amsterdam made to overcome the evils wrought to its trade by the slow formation of the Pampus sandbank at the entrance to the Y from the Zuider Zee, was the construction of the North Holland canal to the Helder in 1825. But the route was too long and too intricate, and in 1876 a much larger and more direct ship canal was built across the isthmus to the North Sea at Ymuiden. The serious rivalry of Rotterdam, especially with regard to the transit trade, and the inadequacy of the Keulsche Vaart, which connected the city with the Rhine, led to the construction in 1892 of the Merwede canal to Gorinchem. Meanwhile a complete transformation took place on the Y to suit the new requirements of the city's trade. The three islands built out into the river serve to carry the railway across the front of the city, and form a long series of quays. On either side are the large East and West docks (1825–1834), and beyond these stretch the long quays at which the American and East Indian liners are berthed. On the west of the West dock is the timber dock, and east of the East dock is another series of islands joined together so as to form basins and quays, one of which is the State Marine dock (1790–1795) with the arsenal and admiralty offices. Opening out of one of the crescent canals which penetrate the city from the Y is the State Entrepôt dock (1900), the free harbour of Amsterdam, where the produce from the Dutch East Indies is stored. On the north side of the Y are the dry docks and the petroleum dock (1880–1890). The principal imports are timber, coal, grain, ore, petroleum and colonial produce. Under the last head fall tobacco, tea, coffee, cocoa, sugar, Peruvian bark and other drugs. Diamond-cutting has long been practised by the Jews and forms one of the most characteristic industries of the city. Other industries include sugar refineries, soap, oil, glass, iron, dye and chemical works; distilleries, breweries, tanneries; tobacco and snuff factories; shipbuilding and the manufacture of machinery and stearine candles. Although no longer the centre of the banking transactions of the world, the Amsterdam exchange is still of considerable importance in this respect. The celebrated Bank of Amsterdam, founded in 1609, was dissolved in 1796, and the present Bank of the Netherlands was established in 1814 on the model of the Bank of England. The money market is the headquarters of companies formed to promote the cultivation of colonial produce.

History.—In 1204, when Giesebrecht II. of Amstel built a castle there, Amsterdam was a fishing hamlet held in fee by the lords of Amstel of the bishops of Utrecht, for whom they acted as bailiffs. In 1240 Giesebrecht III., son of the builder of the castle, constructed a dam to keep out the sea. To these two, then, the origin of the city may be ascribed. The first mention of the town is in 1275, in a charter of Floris IV., count of Holland, exempting it from certain taxes.

In 1296 the place passed out of the hands of the lords of Amstel, owing to the part taken by Giesebrecht IV. in the murder of Count Floris V. of Holland. Count John (d. 1304), after coming to an understanding with the bishop of Utrecht, bestowed the fief on his brother, Guy of Hainaut. Guy gave the town its first charter in 1300. It established the usual type of government under a bailiff (*schout*) and judicial assessors (*scabini*, or *schoppenen*), the overlord's supremacy being guarded, and an appeal lying from the court of the *scabini*, in case of their disagreement, to Utrecht. In 1342 more extensive privileges were granted by Count William IV., including freedom from tolls by land and water in return for certain annual dues. In 1482 the town was surrounded with walls; and in the 16th century, during the religious troubles, it received a great increase of prosperity owing to the influx of refugees from Antwerp and Brabant. Amsterdam, influenced by its trading interests, did not join the other towns in revolt against Spain until 1578. In 1587 the earl of Leicester made an unsuccessful attempt to seize it. The great development of Amsterdam was due, however, to the treaty of Westphalia in 1648, by which its rival, Antwerp, was ruined, owing to the closing of the Scheldt. The city held out obstinately against the pretensions of the stadtholders, and in 1650 opened the dykes in order to prevent William II. from seizing it. The same device was successful against Louis XIV. in 1672; and Amsterdam, now reconciled with the stadtholder, was one of the staunchest supporters of William III. against France. After the revocation of the edict of Nantes in 1685 it opened its gates to numerous French refugees; but this hardly compensated it for its losses during the war. In 1787 Amsterdam was occupied by the Prussians, and in 1795 by the French under Pichegru. It was now made the capital of the Batavian Republic and afterwards of the kingdom of Holland. When, in 1810, this was united with the French empire, Amsterdam was recognized officially as the third town of the empire, ranking next after Paris and Rome.

See J. ter Gouw, *Geschiedeniss van Amsterdam* (3 vols., Amsterdam, 1879–1881), a full history with documents.

AMSTERDAM (New Amsterdam), an uninhabited and almost inaccessible island in the Indian Ocean, in 37° 47′ S., and 77° 34′ E., about 60 m. N. of St Paul Island, and nearly midway between the Cape of Good Hope and Tasmania. It is an extinct volcano, rising 2989 ft. from the sea. It was discovered by Anthony van Diemen in 1633, and annexed by France in 1893. It may have been sighted by the companions of Magellan returning to Europe in 1522, and by a Dutch vessel, the "Zeewolf," in 1617. In 1871 the British frigate "Megaera" was wrecked here, and most of the 400 persons on board had to remain upwards of three months on the island. The *Mémoires* of a Frenchman, Captain François Péron (Paris, 1824), who was marooned three years on the island (1792–1795), are of much interest.

AMSTERDAM, a city of Montgomery county, New York, U.S.A., on the north bank of the Mohawk river, about 33 m. N.W. of Albany. Pop. (1890) 17,336; (1900) 20,929, of whom 5575 were foreign-born; (1910) 31,267. It is served by the New York Central & Hudson River and the West Shore railways, and by the Erie Canal. Hills on both sides of the river command fine views of the Mohawk Valley. Amsterdam has two hospitals, a free public library and St Mary's Institute (Roman Catholic). Manufacturing is the most important industry, and carpets and rugs, hosiery and knit goods are the most important products. In 1905 the city's factory products were valued at $15,007,276 (an increase of 41 % over their value in 1900); carpets and rugs being valued at $5,667,742, and hosiery and knit goods (in the manufacture of which Amsterdam ranked third among the cities of the country) at $4,667,022, or 3·4 % of the total product of the United States. Among the other manufactures are brushes, brooms, buttons, silk gloves, paper boxes, electrical supplies, dyeing machines, cigars, and wagon and carriage springs. Amsterdam was settled about 1775, and was called Veedersburg until 1804, when its present name was adopted. It was incorporated as a village in 1830, and was chartered as a city in 1885.

AMUCK, RUNNING (or more properly AMOK), the native term for the homicidal mania which attacks Malays. A Malay will suddenly and apparently without reason rush into the street armed with a kris or other weapon, and slash and cut at everybody he meets till he is killed. These frenzies were formerly regarded as due to sudden insanity. It is now, however, certain that the typical *amok* is the result of circumstances, such as domestic jealousy or gambling losses, which render a Malay desperate and weary of his life. It is, in fact, the Malay equivalent of suicide. "The act of running *amuck* is probably due to causes over which the culprit has some amount of control, as the custom has now died out in the British possessions in the peninsula, the offenders probably objecting to being caught and tried in cold blood" (W. W. Skeat).

Though so intimately associated with the Malay there is some ground for believing the word to have an Indian origin, and the act is certainly far from unknown in Indian history. Some notable cases have occurred among the Rajputs. Thus, in 1634, the eldest son of the raja of Jodhpur ran amuck at the court of Shah Jahan, failing in his attack on the emperor, but killing five of his officials. During the 18th century, again, at Hyderabad (Sind), two envoys, sent by the Jodhpur chief in regard to a quarrel between the two states, stabbed the prince and twenty-six of his suite before they themselves fell.

In Malabar there were certain professional assassins known to old travellers as *Amouchi* or *Amuco*. The nearest modern equivalent to these words would seem to be the Malayalim *Amar-khan*, "a warrior" (from *amar*, "fight"). The Malayalim term *chaver* applied to these ruffians meant literally those "who devote themselves to death." In Malabar was a custom by which the zamorin or king of Calicut had to cut his throat in public when he had reigned twelve years. In the 17th century a variation in his fate was made. He had to take his seat, after a great feast lasting twelve days, at a national assembly, surrounded by his armed suite, and it was lawful for anyone to attack him, and if he succeeded in killing him the murderer himself became zamorin (see Alex. Hamilton, "A new Account of the East Indies," in Pinkerton's *Voyages and Travels*, viii. 374). In 1600 thirty would-be assassins were killed in their attempts. These men were called *Amar-khan*, and it has been suggested that their action was "running amuck" in the true Malay sense. Another proposed derivation for *amouchi* is Sanskrit *amokshya*, "that cannot be loosed," suggesting that the murderer was bound by a vow, an explanation more than once advanced for the Malay *amuck*; but *amokshya* in such a sense is unknown in Malayalim.

See Sir F. A. Swettenham, *Malay Sketches* (1895); H. Clifford, *Studies in Brown Humanity* (1898).

AMULET (Late Lat. *amuletum*, origin unknown; falsely connected with the Arab. *ḥimālah*, a cord used to suspend a small Koran from the neck), a charm, generally, but not invariably, hung from the neck, to protect the wearer against witchcraft, sickness, accidents, &c. Amulets have been of many different kinds, and formed of different substances,—stones, metals, and strips of parchment being the most common, with or without characters or legends engraved or written on them. Gems have often been employed and greatly prized, serving for ornaments as well as for charms. Certain herbs, too, and animal preparations have been used in the same way. In setting them apart to their use as amulets, great precautions have been taken that fitting times be selected, stellar and other magic influences propitious, and everything avoided that might be supposed to destroy or weaken the force of the charm. From the earliest ages the Oriental races have had a firm belief in the prevalence of occult evil influences, and a superstitious trust in amulets and similar preservatives against them. There are references to, and apparently correctives of, these customs in the Mosaic injunctions to bind portions of the law upon the hand and as frontlets between the eyes, as well as write them upon the door-posts and the gates; but, among the later Jews especially, the original design and meaning of these usages were lost sight of; and though it has been said that the phylacteries were not strictly amulets, there is no doubt that they were held in superstitious regard. Amulets were much used by the ancient Egyptians, and also among the Greeks and Romans. We find traces of them too in the early Christian church, in the emphatic protests of Chrysostom, Augustine and others against them. The fish was a favourite symbol on these charms, from the word ἰχθύς being the initials of Ἰησοῦς Χριστὸς Θεοῦ υἱὸς σωτήρ. A firm faith in amulets still prevails widely among Asiatic nations. *Talisman*, also from the Arabic, is a word of similar meaning and use, but some distinguish it as importing a more powerful charm. A talisman, whose "virtues are still applied to for stopping blood and in cases of canine madness," figures prominently in, and gives name to, one of Sir Walter Scott's novels.

See also Arpe, *De Prodigiis Naturae et Artis Operibus Talismanes et Amuleta dictis* (Hamburg, 1717); Ewele, *Ueber Amulete* (1827); and Koop's *Palaeographica Critica*, vols. iii. and iv. (1829).

AMUR (known also as the *Sakhalin-ula*), a river of eastern Asia, formed by the confluence of the Argun and the Shilka, at Ust-Stryelka, in 53° 19′ N. lat. and 120° 30′ E. long. Both these rivers come from the south-west: the Argun, or Kerulen as it is called above Lake Kulun (Dalai-nor), through which it flows about half way between its source and Ust-Stryelka, rises in 49° N. lat. and 109° E. long.; the Shilka is formed by the union of the Onon and the Ingoda, both of which have their sources a little farther north-east than the Kerulen (Argun). The Amur proper flows at first in a south-easterly direction for about 800 m., as far as long. 132′ E., separating Manchuria from the Amur government; it then turns to the north-east, cuts its way through the Little Khingan mountains in a gorge 2000 ft. wide and 140 m. long, and after a total course of over 1700 m. discharges into the Sea of Okhotsk, opposite to the island of Sakhalin. It is estimated to drain an area of 772,000 sq. m. Its principal tributaries from the south are the Sungari, which the Chinese consider to be the true head-river of the Amur, and the Usuri; from the north it receives the Oldoi, Zeya, Bureya, Kur, Gorin and Amgun. As the mouth is choked with sandbanks, goods are disembarked at Mariinsk and carried by train (9 m.) to Alexandrovsk at the head of the Gulf of Tartary. Navigation on the river is open from April to early in November.

See T. W. Atkinson, *Travels in the Region of the Amoor* (1860); Collins, *Exploration of the Amoor* (ed. 1864) and *Voyage down the Amoor* (1866); Andree, *Das Amurgebiet* (ed. 1876); and Grum-Grshimaylo, *Account of the Amur* (Russian, 1894).

AMUR, a government of East Siberia, stretching from the Stanovoi (Yablonoi) mountains southwards to the left bank of the Amur river. It includes the basins of the Oldoi, Zeya and Bureya, left-bank tributaries of the river Amur, and has the governments of Transbaikalia on the W., Irkutsk and Yakutsk on the N., the Maritime province on the E., and Manchuria on the S.W. and S. Area, 172,848 sq. m. Immense districts are quite uninhabited. All the north-western part is occupied by a high plateau, bordered by the Great Khingan range, whose exact position in the region is not yet definitely settled. Next comes a belt of fertile plateaus bounded on the east by the Little Khingan, or Dusse-alin, a picturesque well-wooded range, which stretches in a north-easterly direction from Kirin across Manchuria, is pierced by the Amur, and continues on its left bank, separating the Bureya from the Amgun. To the east of it stretches in the same direction a strip of marshy lowlands. In the ranges which rise above the high plateau in the north-west, in the vicinity of the Stanovoi watershed, gold mines of great richness are worked. Coal of inferior quality is known to exist on the Oldoi, Zeya and Bureya. The Russians are represented by the Amur Cossacks, whose villages, *e.g.* Albazin, Kumara, Ekaterino-Nikolsk and Mikhailo-Semenovsk, are strung at intervals of 17 to 20 m. along the whole course of the river; by peasant immigrants, chiefly nonconformists, who are the wealthiest part of the population; and by a floating population of gold miners. Nomadic Tungus (Orochons), Manegres and Golds hunt and fish along the rivers. Steamers ply regularly along the Amur for 6½ months, from Khabarovsk to Stryetensk, on the Shilka terminus of the Trans-Siberian railway; but only light steamers with 2 to 3 ft. draught can navigate the upper Amur and Shilka. In the winter the frozen river is the usual highway. Rough roads and bridle-paths only are found in the interior. The great engineering difficulties in building a railway along the Amur induced the Russian government to obtain from China permission to build a railway through Manchuria, but the project for a railway from Khabarovsk to Stryetensk received imperial sanction in the summer of 1906. The Amur government has a continental climate, the yearly average at Blagovyeshchensk (50° N. lat.) being 30° Fahr. (January, 17°; July, 70°). It benefits from the influence of the monsoons. Cold north-west winds prevail from October to March, while in July and August torrential rains fall, resulting in a sudden and very considerable rise in the Amur and its right-bank tributaries. The only town is Blagovyeshchensk, but the centre of the administration is Khabarovsk in the Maritime province. The settled population in 1897 was 119,909, of whom 31,515 lived in towns.

The governor-generalship of Amur includes this government and the Maritime province, the total area being 888,830 sq. m., and the total population in 1897, 339,127. This region became known to the Russians in 1639. In 1649–1651 a party of Cossacks, under Khabarov, built a fort at Albazin on the Amur river, but in 1689 they withdrew in favour of the Chinese. From 1847 onwards they once more turned their attention to this region, and began to make settlements, especially after 1854, when a powerful flotilla sailed from Ust-Stryelka down to the mouth of the river. Four years later China ceded to Russia the whole left bank of the Amur, and also the right bank below the confluence of the Ussuri, and in 1860 all the territory between the Ussuri and the Eastern Sea. (P. A. K.)

AMYGDALIN (from the Gr. ἀμυγδάλη, almond), $C_{20}H_{27}NO_{11}$, a glucoside isolated from bitter almonds by H. E. Robiquet and A. F. Boutron-Charlard in 1830, and subsequently investigated by Liebig and Wöhler, and others. It is extracted from almond cake by boiling alcohol; on evaporation of the solution and the addition of ether, amygdalin is precipitated as white minute crystals. Sulphuric acid decomposes it into *d*-glucose, benzaldehyde and prussic acid; while hydrochloric acid gives mandelic acid, *d*-glucose and ammonia. The decomposition induced by enzymes may occur in two ways. Maltase partially decomposes it, giving *d*-glucose and mandelic nitrile glucoside, $C_6H_5CH(CN)O\cdot C_6H_{11}O_5$; this compound is isomeric with sambunigrin, a glucoside found by E. E. Bourquelot and Danjou in the berries of the common elder, *Sambucus nigra*. Emulsin, on the other hand, decomposes it into benzaldehyde, prussic acid, and two molecules of glucose; this enzyme occurs in the bitter almond, and consequently the seeds invariably contain free prussic acid and benzaldehyde. An "amorphous amygdalin" is said to occur in the cherry-laurel. Closely related to these glucosides is dhurrin, $C_{14}H_{17}O_7N$, isolated by W. Dunstan and T. A. Henry from the common sorghum or "great millet," *Sorghum vulgare*; this substance is decomposed by emulsin or hydrochloric acid into *d*-glucose, prussic acid, and *p*-hydroxybenzaldehyde.

AMYGDALOID, a term meaning "almond-shaped," used in anatomy and geology.

AMYL ALCOHOLS ($C_5H_{11}OH$). Eight amyl alcohols are known: normal amyl alcohol $CH_3\cdot(CH_2)_4\cdot OH$, isobutyl carbinol or isoamyl alcohol $(CH_3)_2\cdot CH\cdot CH_2\cdot CH_2OH$, active amyl alcohol $(CH_3)(C_2H_5):CH\cdot CH_2OH$, tertiary butyl carbinol $(CH_3)_3C\cdot CH_2OH$, diethyl carbinol $(C_2H_5)_2CH\cdot OH$, methyl (n) propyl carbinol $(CH_3\cdot CH_2\cdot CH_2)(CH_3):CH:OH$, methyl isopropyl carbinol $(CH_3)_2:CH(CH_3):CHOH$, and dimethyl ethyl carbinol $(CH_3)_2\cdot(C_2H_5)\vdots C\cdot OH$. Of these alcohols, the first four are primary, the last one a tertiary, the other three secondary alcohols; three of them, viz. active amyl alcohol, methyl (n) propyl carbinol, and methyl isopropyl carbinol, contain an asymmetric carbon atom and can consequently each exist in two optically active, and one optically inactive form.

The most important is isobutyl carbinol, this being the chief constituent of fermentation amyl alcohol, and consequently a constituent of fusel (*q.v.*) oil. It may be separated from fusel oil by shaking with strong brine solution, separating the oily layer from the brine layer and distilling it, the portion boiling between 125° and 140°C. being collected. For further purification it may be shaken with hot milk of lime, the oily layer separated, dried with calcium chloride and fractionated, the fraction boiling between 128° and 132°C. only being collected. It may be synthetically prepared from isobutyl alcohol by conversion into isovaleryl-aldehyde, which is subsequently reduced to isobutyl carbinol by means of sodium amalgam.

It is a colourless liquid of specific gravity 0·8248 (0°C.), boiling at 131·6°C., slightly soluble in water, easily soluble in alcohol, ether, chloroform and benzene. It possesses a characteristic strong smell and a sharp burning taste. When perfectly pure, it is not a poison, although the impure product is. On passing its vapour through a red-hot tube, it undergoes decomposition with production of acetylene, ethylene, propylene, &c. It is oxidized by chromic acid mixture to isovaleryl-aldehyde; and it forms crystalline addition compounds with calcium and stannic chlorides.

The other amyl alcohols may be obtained synthetically. Of these, tertiary butyl carbinol has been the most difficult to obtain, its synthesis having only been accomplished in 1891, by L. Tissier (*Comptes Rendus*, 1891, 112, p. 1065) by the reduction of a mixture of trimethyl acetic acid and trimethylacetyl chloride with sodium amalgam. It is a solid which melts at 48°–50° C. and boils at 112·3° C.

AMYL NITRITE (isoamyl nitrite), $C_5H_{11}\cdot ONO$, a liquid prepared by passing nitrous fumes (from starch and concentrated nitric acid) into warm isoamyl alcohol; or by distilling a mixture of 26 parts of potassium nitrite in 15 parts of water with 30 parts of isoamyl alcohol in 30 parts of sulphuric acid (Renard, *Jahresb.*, 1874, p. 352). It is a yellow-coloured liquid of specific gravity 0·877, boiling at about 95°–96° C. It has a characteristic penetrating odour, and produces marked effects on the system when its vapour is inhaled. It is insoluble in water, but dissolves readily in alcohol, ether, glacial acetic acid, chloroform and benzene. On heating with methyl alcohol it is converted into isoamyl alcohol, methyl nitrite being produced at the same time; a similar reaction takes place with ethyl alcohol, but the change is less complete. It is readily decomposed by nascent hydrogen, with the formation of ammonia and isoamyl alcohol; and on hydrolysis with caustic potash it forms potassium nitrite and isoamyl alcohol. When the liquid is dropped on to fused caustic potash, it forms potassium valerate. Amyl nitrite finds application in medicine, and in the preparation of anhydrous diazonium salts (E. Knoevenagel, *Berichte*, 1890, 23, p. 2094).

AMYMONE, in ancient Greek legend, daughter of Danaüs. With her sisters, she had been sent to look for water, the district of Argos being then parched through the anger of Poseidon. Amymone having thrown her spear at a stag, missed it, but hit a satyr asleep in the brake. The satyr pursued her, and she called for help on Poseidon, who appeared, and for love of her beauty caused a spring to well up, which received her name. Aeschylus wrote a satyric drama on the subject. By the god Amymone became the mother of Nauplius, the wrecker. Her meeting with Poseidon at the spring is frequently represented on ancient coins and gems.

Apollodorus ii. 1, 4; Hyginus, *Fab.* 169; Propertius ii. 26.

AMYNTAS I., king of Macedonia (*c.* 540–498 B.C.), was a tributary vassal of Darius Hystaspes. With him the history of Macedonia may be said to begin. He was the first of its rulers to have relations with other countries; he entered into an alliance with the Peisistratidae, and when Hippias was driven out of Athens he offered him the territory of Anthemus on the Thermaïc Gulf, with the object of turning the Greek party feuds to his own advantage (Herodotus v. 17, 94; Justin vii. 2; Thucydides ii. 100; Pausanias ix. 40). See MACEDONIAN EMPIRE.

AMYNTAS II. (or **III.**), son of Arrhidaeus, great-grandson of Alexander I., king of Macedonia from 393 (or 389) to 369 B.C.

He came to the throne after the ten years of confusion which followed the death of Archelaus, the patron of art and literature, and showed the same taste for Greek culture and its representatives. But he had many enemies at home; in 383 he was driven out by the Illyrians, but in the following year, with the aid of the Thessalians, he recovered his kingdom. He concluded a treaty with the Spartans, who assisted him to reduce Olynthus (379). He also entered into a league with Jason of Pherae, and assiduously cultivated the friendship of Athens. By his wife, Eurydice, he had three sons, the youngest of whom was the famous Philip of Macedon.

Diodorus xiv. 89, xv. 19, 60; Xenophon, *Hellenica*, v. 2; Justin vii. 4.

AMYOT, JACQUES (1513–1593), French writer, was born of poor parents, at Melun, on the 30th of October 1513. He found his way to the university of Paris, where he supported himself by serving some of the richer students. He was nineteen when he became M.A. at Paris, and later he graduated doctor of civil law at Bourges. Through Jacques Colure (or Colin), abbot of St Ambrose in Bourges, he obtained a tutorship in the family of a secretary of state. By the secretary he was recommended to Marguerite de Valois, and through her influence was made professor of Greek and Latin at Bourges. Here he translated *Théagène et Chariclée* from Heliodorus (1547 fol.), for which he was rewarded by Francis I. with the abbey of Bellozane. He was thus enabled to go to Italy to study the Vatican text of Plutarch, on the translation on whose *Lives* (1559; 1565) he had been some time engaged. On the way he turned aside on a mission to the council of Trent. Returning home, he was appointed tutor to the sons of Henry II., by one of whom (Charles IX.) he was afterwards made grand almoner (1561) and by the other (Henry III.) was appointed, in spite of his plebeian origin, commander of the order of the Holy Ghost. Pius I. promoted him to the bishopric of Auxerre, and here he continued to live in comparative quiet, repairing his cathedral and perfecting his translations, for the rest of his days, though troubled towards the close by the insubordination and revolts of his clergy. He was a devout and conscientious churchman, and had the courage to stand by his principles. It is said that he advised the chaplain of Henry III. to refuse absolution to the king after the murder of the Guise princes. He was, nevertheless, suspected of approving the crime. His house was plundered, and he was compelled to leave Auxerre for some time. He died on the 6th of February 1593, bequeathing, it is said, 1200 crowns to the hospital at Orleans for the twelve " deniers " he received there when " poor and naked " on his way to Paris. He translated seven books of Diodorus (1554), the *Daphnis et Chloe* of Longus (1559) and the *Opera Moralia* of Plutarch (1572). His vigorous and idiomatic version of Plutarch, *Vies des hommes illustres*, was translated into English by Sir Thomas North, and supplied Shakespeare with materials for his Roman plays. Montaigne said of him," I give the palm to Jacques Amyot over all our French writers, not only for the simplicity and purity of his language in which he surpasses all others, nor for his constancy to so long an undertaking, nor for his profound learning . . . but I am grateful to him especially for his wisdom in choosing so valuable a work." It was indeed to Plutarch that Amyot devoted his attention. His other translations were subsidiary. The version of Diodorus he did not publish, although the manuscript had been discovered by himself. Amyot took great pains to find and interpret correctly the best authorities, but the interest of his books to-day lies in the style. His translation reads like an original work. The personal method of Plutarch appealed to a generation addicted to memoirs and incapable of any general theory of history. Amyot's book, therefore, obtained an immense popularity, and exercised great influence over successive generations of French writers.

There is a good edition of the works of Amyot from the firm of Didot (25 vols., 1818–1821). See also Auguste de Blignières, *Essai sur Amyot et les traducteurs français au xvi^e^ siècle* (Paris, 1851).

AMYRAUT, MOSES (1596–1664), also known as AMYRALDUS, French Protestant theologian and metaphysician, was born at Bourgueil, in the valley of Anjou, in 1596. His father was a lawyer, and, designing Moses for his own profession, sent him on the completion of his study of the humanities at Orleans to the university of Poitiers. Here he took the degree of licentiate (B.A.) of laws. On his way home from the university he passed through Saumur, and, having visited the pastor of the Protestant church there, was introduced by him to Philippe de Mornay, governor of the city. Struck with young Amyraut's ability and culture, they both urged him to change from law to theology. His father advised him to revise his philological and philosophical studies, and read over Calvin's *Institutions*, before finally determining. He did so, and decided for theology. He thereupon removed to Saumur—destined to be for ever associated with his name—and studied under J. Cameron, who ultimately regarded him as his greatest scholar. He had a brilliant course, and was in due time licensed as a minister of the French Protestant Church. The contemporary civil wars and excitements hindered his advancement. His first church was in St Aignan, in the province of Maine. There he remained two years. The eminent theologian, Jean Daillé, being then removed to Paris, advised the church at Saumur to secure Amyraut as his successor, praising him " as above himself." The university of Saumur at the same time had fixed its eyes on him as professor of theology. The great churches of Paris and Rouen also contended for him, and to win him sent their deputies to the provincial synod of Anjou. Amyraut had left the choice to the synod. He was appointed to Saumur in 1633, and to the professor's chair along with the pastorate. On the occasion of his inauguration he maintained for thesis *De Sacerdotio Christi*. His co-professors were Louis Cappel and Josué de la Place, who also were Cameron's pupils. Very beautiful was the lifelong friendship of these three remarkable men, who collaborated in the *Theses Salmurienses*, a collection of theses propounded by candidates in theology prefaced by the inaugural addresses of the three professors. Full of energy, Amyraut very speedily gave to French Protestantism a new force. In 1631 he published his *Traité des religions*, a book that still lives; and from this year onward he was a foremost man in the church. Chosen to represent the provincial synod of Anjou, Touraine and Maine at the national synod held in 1631 at Charenton, he was appointed as orator to present to the king " The Copy of their Complaints and Grievances for the Infractions and Violations of the Edict of Nantes." Previous deputies had addressed the king on their bended knees, whereas the representatives of the Catholics had been permitted to stand. Amyraut consented to be orator only if the assembly authorized him to stand. There was intense resistance. Cardinal Richelieu himself, preceded by lesser dignitaries, condescended to visit Amyraut privately, to persuade him to kneel; but Amyraut held resolutely to his point and carried it. His " oration " on this occasion, which was immediately published in the French *Mercury*, remains a striking landmark in the history of French Protestantism. During his absence on this matter the assembly debated " Whether the Lutherans who desired it, might be admitted into communion with the Reformed Churches of France at the Lord's Table." It was decided in the affirmative previous to his return; but he approved with astonishing eloquence, and thereafter was ever in the front rank in maintaining intercommunication between all churches holding the main doctrines of the Reformation. P. Bayle recounts the title-pages of no fewer than thirty-two books of which Amyraut was the author. These show that he took part in all the great controversies on predestination and Arminianism which then so agitated and harassed all Europe. Substantially he held fast the Calvinism of his preceptor Cameron; but, like Richard Baxter in England, by his breadth and charity he exposed himself to all manner of misconstruction. In 1634 he published his *Traité de la prédestination*, in which he tried to mitigate the harsh features of predestination by his " Universalismus hypotheticus." God, he taught, predestines all men to happiness on condition of their having faith. This gave rise to a charge of heresy, of which he was acquitted at the national synod held at Alençon in 1637, and presided over by Benjamin Basnage (1580–1652). The charge was brought up again at the national synod of Charenton in 1644, when he was again acquitted. A third attack at the synod of Loudun in 1659 met with no better success. The university of Saumur became the university of French Protestantism. Amyraut had as many as a hundred students in attendance upon his prelections. Another historic part filled by Amyraut was in the negotiations originated by Pierre le Gouz de la Berchère (1600–1653), first president of the parlement of Grenoble, when exiled to Saumur, for a reconciliation and reunion of the Catholics of France with the French Protestants. Very large were the concessions made by Richelieu in his personal interviews with Amyraut; but, as with the Worcester House negotiations in England between the Church of England and nonconformists, they inevitably fell through. On all sides the statesmanship and eloquence of Amyraut were conceded. His *De l'élévation de la foy et de l'abaissement de la raison en la créance des mystères de la religion* (1641) gave him early a high place as a metaphysician. Exclusive of his controversial writings, he left behind him a very voluminous series of practical evangelical books, which have long remained the fireside favourites of the peasantry of French Protestantism. Amongst these are *Estat des fidèles après la mort*; *Sur l'oraison dominicale*; *Du mérite des œuvres*; *Traité de la justification*; and paraphrases of books of the Old and New Testament. His closing years were weakened by a severe fall he met with in 1657. He died on the 18th of January 1664.

See Edm. Saigey, *Moses Amyraut, sa vie et ses écrits* (1849); Alex. Schweizer in *Tüb. theol. Jahrbb.*, 1852, pp. 41 ff. 155 ff., *Protestant. Central-Dogmen*(1854 ff.), ii. 225 ff., and in Herzog-Hauck, *Realencyklopädie*; Bayle, *s.v.*; *Biog. Univ.*, s.v.; John Quick's *Synod. in Gall. Reform.* pp. 352-357; Ibid. MS. *Icones Sacrae Gallicanae*; *Life of Cameron.*

ANA, a Latin neuter plural termination appropriated to various collections of the observations and criticisms of eminent men, delivered in conversation and recorded by their friends, or discovered among their papers after their decease. Though the term Ana is of comparatively modern origin, the introduction of this species of composition is not of recent date. It appears, from d'Herbelot's *Bibliothèque Orientale*, that from the earliest periods the Eastern nations were in the habit of preserving the maxims of their sages. From them the practice passed to the Greeks and Romans. Plato and Xenophon treasured up and recorded the sayings of their master Socrates; and Arrian, in the concluding books of his *Enchiridion*, now lost, collected the casual observations of Epictetus. The numerous apophthegms scattered in Plutarch, Diogenes Laertius and other writers, show that it was customary in Greece to preserve the colloquially expressed ideas of illustrious men. It appears that Julius Caesar compiled a book of apophthegms, in which he related the *bons mots* of Cicero; and Quintilian informs us that a freedman of that celebrated wit and orator composed three books of a work entitled *De Jocis Ciceronis*. We are told by Suetonius that Caius Melissus, originally the slave but afterwards the freedman and librarian of Maecenas, collected the sayings of his master; and Aulus Gellius has filled his *Noctes Atticae* with anecdotes which he heard from the eminent scholars and critics whose society he frequented in Rome.

But though vestiges of Ana may be traced in the classical ages, it is only in modern times that they have come to be regarded as constituting a distinct species of composition, comprising literary anecdotes, critical reflexions, and historical incidents, mingled with the detail of *bons mots* and ludicrous tales. The term Ana seems to have been applied to such collections as far back as the beginning of the 15th century. Francesco Barbaro, in a letter to Poggio, says that the information and anecdotes which Poggio and Bartolommeo of Montepulciano had picked up during a literary excursion through Germany will be called *Ana*: "Quemadmodum mala ab Appio e Claudia gente *Appiana*, et pira a Mallio *Malliana* cognominata sunt, sic haec literarum quae vestra ope et opera Germania in Italiam deferentur, aliquando et *Poggiana* et *Montepolitiana* vocabuntur."

Poggio Bracciolini, to whom this letter is addressed, and to whom the world is indebted for the preservation of so many classical remains, is the first eminent person of modern times whose jests and opinions have been transmitted to posterity. Poggio was secretary to five successive popes. During the pontificate of Martin V., who was chosen in 1417, Poggio and other members of the Roman chancery were in the habit of assembling in a common hall adjoining the Vatican, in order to converse freely on all subjects. Being more studious of wit than of truth, they termed this apartment *Buggiale*, a word which Poggio himself interprets *Mendaciorum Officina*. Here Poggio and his friends discussed the news and scandal of the day; communicated entertaining anecdotes; attacked what they did not approve (and they approved of little); and indulged in the utmost latitude of satiric remark, not sparing even the pope and cardinals. The jests and stories which occurred in these unrestrained conversations were collected by Poggio, and formed the chief materials of his *Facetiae*, first printed, according to de Bure, in 1470. This collection, which forms a principal part of the *Poggiana*, is chiefly valuable as recording interesting anecdotes of eminent men of the 14th and 15th centuries. It also contains a number of quibbles or *jeux de mots*, and a still greater number of *facetiae*, idle and licentious stories. These *Facetiae* form, upon the whole, the most amusing and interesting part of the *Poggiana* printed at Amsterdam in 1720; but this collection also comprehends additional anecdotes of Poggio's life, and a few extracts from his graver compositions.

Though Poggio was the first person whose remarks and *bons mots* were collected under the name of Ana, the *Scaligerana*, which contains the opinions of Joseph Scaliger, was the first worked *published* under that appellation, and accordingly may be regarded as having led the way to that class of publications. There are two collections of Scaligerana—the *Prima* and *Secunda*. The first was compiled by a physician named Francois Vertunien, sieur de Lavau, who attended a family with whom Joseph Scaliger resided. He, in consequence, had frequent opportunities of meeting the celebrated critic, and was in the custom of committing to writing the observations which dropped from him in the course of conversation, to which he occasionally added remarks of his own. This collection, which was chiefly Latin, remained in manuscript many years after the death of the compiler. It was at length purchased by M. de Sigogne, who published it in 1669, under the title of *Prima Scaligerana, nusquam antehac edita*, calling it *prima* in order to preserve its claim of priority over another *Scaligerana*, which, though published three years before, had been more recently compiled. This second work, known as *Secunda Scaligerana*, was collected by two brothers of the name of Vassan, students of the university of Leiden, of which Scaliger was one of the professors. Being particularly recommended to Scaliger, they were received in his house, and enjoyed his conversation. Writing down what they had heard, particularly on historical and critical subjects, they soon made up a large manuscript volume, in which, however, there was neither connexion nor arrangement of any description. After passing through various hands this manuscript came into the possession of M. Daillé, who for his own use arranged in alphabetical order the articles which it contained. Isaac Vossius, obtaining the manuscript in loan from M. Daillé, transcribed it, and afterwards published it at the Hague, under the title of *Scaligerana, sive Excerpta ex Ore Josephi Scaligeri*. This edition was full of inaccuracies and blunders, and a more correct impression was afterwards published by M. Daillé, with a preface complaining of the use that Vossius had made of the manuscript, which he declares was never intended for publication, and was not of a nature to be given to the world. Indeed, most literary men in that age conceived that the *Scaligerana*, particularly the *second*, detracted considerably from the reputation of the great scholar. Joseph Scaliger, with more extensive erudition, but, as some think, less genius than his father Julius Caesar Scaliger, had inherited his vanity and dogmatical spirit. Conversing with two young students, he would probably be but little cautious in the opinions he expressed, as his literary errors could not be detected or exposed. Unfortunately the blind admiration of his pupils led them to regard his opinions as the responses of an oracle, and his most unmerited censures as just condemnations. The *Scaligerana*, accordingly, contains many falsehoods, with much unworthy personal abuse of the most distinguished characters of the age.

In imitation of the *Scaligerana*, a prodigious number of similar works appeared in France towards the end of the 17th and beginning of the 18th century. At first these collections were confined to what had fallen from eminent men in conversation; but they were afterwards made to embrace fragments found among their papers, and even passages extracted from their works and correspondence. Of those which merely record the conversations of eminent men, the best known and most valuable is the *Menagiana*. Gilles Ménage was a person of good sense, of various and extensive information and of a most communicative disposition. A collection of his oral opinions was published in 1693, soon after his death; and this collection, which was entitled *Menagiana*, was afterwards corrected and enlarged by Bernard de la Monnoye, in an edition published by him in 1715.

The *Perroniana*, which exhibits the opinions of Cardinal du Perron, was compiled from his conversation by C. Dupuy, and published by Vossius in 1666, by the same contrivance which put him in possession of the *Scaligerana*. The *Thuana*, or observations of the president de Thou, have usually been published along with the *Perroniana*, but first appeared in 1669.

The *Valesiana* is a collection of the literary opinions of the historiographer Adrien de Valois, published by his son. M. de Valois was a great student of history, and the *Valesiana* accordingly comprehends many valuable historical observations, particularly on the works of du Cange.

The *Fureteriana* (1696) contains the *bons mots* of Antoine Furetière, the Academician, the stories which he was in the habit of telling, and a number of anecdotes and remarks found in his papers after his decease.

The *Chevraeana* (1697), so called from Urbain Chevreau, is more scholarly than most works of a similar description, and probably more accurate, as it differs from the Ana proper, of which the works described above are instances, in having been published during the life of the author and revised by himself.

Parrhasiana (1699–1701) is the work of Jean le Clerc, a professor of Amsterdam, who bestowed this appellation on his miscellaneous productions with the view of discussing various topics of philosophy and politics with more freedom than he could have employed under his own name.

The *Huetiana* contains the detached thoughts and criticisms of P. D. Huet, bishop of Avranches, which he himself committed to writing when he was far advanced in life. Huet was born in 1630, and in 1712 he was attacked by a malady which impaired his memory, and rendered him incapable of the sustained attention necessary for the completion of a long or laborious work. In this situation he employed himself in putting his detached observations on paper. These were published by the Abbé d'Olivet the year after his death (1722).

The *Casauboniana* presents us with the miscellaneous observations, chiefly philological, of the celebrated Isaac Casaubon. During the course of a long life that eminent commentator was in the daily practice of committing to paper anything remarkable which he heard in conversation with his friends, especially if it bore on the studies in which he was engaged. He also made annotations from day to day on the works he read, with which he connected his judgments concerning the authors and their writings. This compilation was styled *Ephemerides*. His *Adversaria*, and materials amassed for a refutation of the *Ecclesiastical Annals of Baronius*, were bequeathed by his son Meric Casaubon to the Bodleian Library at Oxford. These were shown to J. C. Wolf during a visit which he paid to that university; and having been transcribed by him, were published in 1710 under the title of *Casauboniana*.

Besides the above a great many works under the title of Ana appeared in France about the same period. Thus, the opinions and conversation of Charpentier, Colomesius and St Evremond were recorded in the *Carpenteriana*, *Colomesiana* and *St Evremoniana*; and those of Segrais in the *Segraisiana*,—a collection formed by a person stationed behind the tapestry in a house where Segrais was accustomed to visit, of which Voltaire declared, "que de tous les Ana c'est celui qui mérite le plus d'être mis au rang des mensonges imprimés, et surtout des mensonges insipides." The Ana, indeed, from the popularity which they now enjoyed, were compiled in such numbers and with so little care that they became almost proverbial for inaccuracy.

In 1743 the Abbé d'Olivet spoke indignantly of "ces ana, dont le nombre se multiple impunément tous les jours à la honte de notre siècle." About the middle of the 18th century, too, they were sometimes made the vehicles of revolutionary and heretical opinions. Thus the evil naturally began to cure itself, and by a reaction the French Ana sank in public esteem as much below their intrinsic value as they had formerly been exalted above it.

Of the examples England has produced of this species of composition, perhaps the most interesting is the *Walpoliana*, a transcript of the literary conversation of Horace Walpole, earl of Orford. Most other works which in England have been published under the name of *Ana*, as *Baconiana*, *Atterburyana*, &c., are rather extracts from the writings and correspondence of eminent men than memorials of their conversation.

There are some works which, though they do not bear the title, belong more strictly to the class of Ana than many of the collections which are known under that appellation. Such are the *Mélanges d'histoire et de littérature*, published under the name of *Vigneul Marville*, though the work of a Benedictine, d'Argonne; and the *Locorum Communium Collectanea, ex Lectionibus Philippi Melanchthonis*,—a work of considerable reputation on account of its theological learning, and the information it communicates concerning the early state of the Reformed Church. But of those productions which belong to the class, though they do not bear the name, of Ana, the most celebrated are the *Colloquia Mensalia* of Luther and Selden's *Table-Talk*. The former, which comprehends the conversation of Luther with his friends and coadjutors in the great work of the Reformation, was first published in 1566. Captain H. Bell, who translated it into English in the time of the Commonwealth, informs us that, an edict having been promulgated commanding the works of Luther to be destroyed, it was for some time supposed that all the copies of the *Colloquia Mensalia* had been burned; but in 1626, on the foundation of a house being removed, a printed copy was found lying in a deep hole and wrapped up in a linen cloth. The book, translated by Bell, and again by the younger Hazlitt in 1847, was originally collected by Dr Anton Lauterbach (1502–1569) "out of the holy mouth of Luther." It consists chiefly of observations and discussions on idolatry, auricular confession, the mass, excommunication, clerical jurisdiction, general councils, and all the points agitated by the reformed church in those early periods. The *Table-Talk* of Selden contains a more genuine and undisguised expression of the sentiments of that eminent man than we find in his more studied productions. It was published after his death by Richard Milward, his amanuensis, who affirms that for twenty years he enjoyed the opportunity of daily hearing his discourse, and made it his practice faithfully to commit to writing "the excellent things that usually fell from him."

The most remarkable collection of Ana in the English language—and, indeed, in any language—is to be found in a work which does not correspond to the normal type either in name or in form. In his *Life of Samuel Johnson, LL.D.*, Boswell relates that to his remark, *à propos* of French literature, "Their Ana are good," Johnson replied, "A few of them are good; but we have one book of that kind better than any of them—Selden's *Table-Talk*." Boswell's own work, however, is incomparably superior to all.

J. C. Wolf has given a history of the Ana in a preliminary discourse to his edition of the *Casauboniana*, published in 1710. In the *Répertoire de bibliographies spéciales, curieuses, et instructives*, by Peignot, there is a *Notice bibliographique* of these collections; but many of the books there enumerated consist of mere extracts from the writings of popular authors.

ANABAPTISTS ("re-baptizers," from Gr. ἀνά and βαπτίζω), a name given by their enemies to various sects which on the occasion of Luther's revolt from Romanism denied the validity of infant baptism, and therefore baptized those whom they quite logically regarded as not having received any Christian initiation at all.

On the 27th of December 1521 three "prophets" appeared in Wittenberg from Zwickau, Thomas Münzer, Nicolas Storch and Mark Thomas Stübner. Luther's reform was not thorough enough for them. He professed to rest all upon Scripture, yet accepted from the Babylon of Rome a baptism neither scriptural nor primitive, nor fulfilling the chief conditions of admission into a visible brotherhood of saints, to wit, repentance, faith, spiritual illumination and free surrender of self to Christ. Melanchthon, powerless against the enthusiasts with whom his co-reformer Carlstadt sympathized, appealed to Luther, still concealed in the Wartburg. He had written to the Waldenses that it is better not to baptize at all than to baptize little children; now he was cautious, would not condemn the new prophecy off-hand; but advised Melanchthon to treat them gently and to prove their spirits, less they be of God. There was confusion in Wittenberg, where schools and university sided with the "prophets" and were closed. Hence the charge that Anabaptists were enemies of learning, which is sufficiently rebutted by the fact that the first German translation of the Hebrew prophets was made and printed by two of them, Hetzer and Denk, in 1527. The first leaders of the movement in Zürich—Grebel, Manz, Blaurock, Hubmaier—were men learned in Greek, Latin and Hebrew. On the 6th of March Luther returned, interviewed the prophets, scorned their "spirits," forbade them the city, and had their adherents ejected from Zwickau and Erfurt. Denied access to the churches, the latter preached and celebrated the sacrament in private houses. Driven from the cities they swarmed over the countryside. Compelled to leave Zwickau, Münzer visited Bohemia, resided two years at Alltstedt in Thuringia, and in 1524 spent some time in Switzerland. During this period he proclaimed his revolutionary doctrines in religion and politics with growing vehemence, and, so far as the lower orders were concerned, with growing success. The crisis came in the so-called Peasants' War in South Germany in 1525. In its origin a revolt against feudal oppression, it became, under the leadership of Münzer, a war against all constituted authorities, and an attempt to establish by force his ideal Christian commonwealth, with absolute equality and the community of goods. The total defeat of the insurgents at Frankenhausen (May 15, 1525), followed as it was by the execution of Münzer and several other leaders, proved only a temporary check to the Anabaptist movement. Here and there throughout Germany, Switzerland and the Netherlands there were zealous propagandists, through whose teaching many were prepared to follow as soon as another leader should arise. A second and more determined attempt to establish a theocracy was made at Münster, in Westphalia (1532–1535). Here the sect had gained considerable influence, through the adhesion of Rothmann, the Lutheran pastor, and several prominent citizens; and the leaders, Johann Matthyszoon or Matthiesen, a baker of Haarlem, and Johann Bockholdt, a tailor of Leiden, had little difficulty in obtaining possession of the town and deposing the magistrates. Vigorous preparations were at once made, not only to hold what had been gained, but to proceed from Münster as a centre to the conquest of the world. The town being besieged by Francis of Waldeck, its expelled bishop (April 1534), Matthiesen, who was first in command, made a sally with only thirty followers, under the fanatical idea that he was a second Gideon, and was cut off with his entire band. Bockholdt, better known in history as John of Leiden, was now supreme. Giving himself out as the successor of David, he claimed royal honours and absolute power in the new "Zion." He justified the most arbitrary and extravagant measures by the authority of visions from heaven, as others have done in similar circumstances. With this pretended sanction he legalized polygamy, and himself took four wives, one of whom he beheaded with his own hand in the market-place in a fit of frenzy. As a natural consequence of such licence, Münster was for twelve months a scene of unbridled profligacy. After an obstinate resistance the town was taken by the besiegers on the 24th of June 1535, and in January 1536 Bockholdt and some of his more prominent followers, after being cruelly tortured, were executed in the market-place. The outbreak at Münster was the crisis of the Anabaptist movement. It never again had the opportunity of assuming political importance, the civil powers naturally adopting the most stringent measures to suppress an agitation whose avowed object was to suppress them. It is difficult to trace the subsequent history of the sect as a religious body. The fact that, after the Münster insurrection the very name Anabaptist was proscribed in Europe, is a source of twofold confusion. The enforced adoption of new names makes it easy to lose the historical identity of many who really belonged to the Münster Anabaptists, and, on the other hand, has led to the classification of many with the Münster sect who had no real connexion with it. The latter mistake, it is to be noted, has been much more common than the former. The Mennonites, for example, have been identified with the earlier Anabaptists, on the ground that they included among their number many of the fanatics of Münster. But the continuity of a sect is to be traced in its principles, and not in its adherents, and it must be remembered that Menno and his followers expressly repudiated the distinctive doctrines of the Münster Anabaptists. They have never aimed at any social or political revolution, and have been as remarkable for sobriety of conduct as the Münster sect was for its fanaticism (see MENNONITES). In English history frequent reference is made to the Anabaptists during the 16th and 17th centuries, but there is no evidence that any considerable number of native Englishmen ever adopted the principles of the Münster sect. Many of the followers of Münzer and Bockholdt seem to have fled from persecution in Germany and the Netherlands to be subjected to a persecution scarcely less severe in England. The mildest measure adopted towards these refugees was banishment from the kingdom, and a large number suffered at the stake. It was easier to burn Anabaptists than to refute their arguments, and contemporary writers were struck with the intrepidity and number of their martyrs. Thus Stanislaus Hosius (1504–1579), a Polish cardinal and bishop of Warmie, wrote (*Opera*, Venice, 1573, p. 202):—

> "They are far readier than followers of Luther and Zwingli to meet death, and bear the harshest tortures for their faith. For they run to suffer punishments, no matter how horrible, as if to a banquet; so that if you take that as a test either of the truth of doctrine or of their certitude of grace, you would easily conclude that in no other sect is to be found a faith so true or grace so certain. But as Paul wrote: 'Even if I give my body up to be burned and have not charity, it avails me naught.' But he has not charity who divides the unity. . . . He cannot be a martyr who is not in the Church."

The excesses of John of Leiden, the Brigham Young of that age, cast an unjust stigma on the Baptists, of whom the vast majority were good, quiet people who merely carried out in practice the early Christian ideals of which their persecutors prated. They have been reckoned an extreme left wing of the Reformation, because for a time they followed Luther and Zwingli. Yet their Christology and negative attitude towards the state rather indicate, as in the case of Wicklif, Hus and the Fraticelli, an affinity to the Cathari and other medieval sects. But this affiliation is hard to establish. The earliest Anabaptists of Zürich allowed that the Picardi or Waldensians had, in contrast with Rome and the Reformers, truth on their side, yet did not claim to be in their succession; nor can it be shown that their adult baptism derived from any of the older Baptist sects, which undoubtedly lingered in parts of Europe. Later on Hermann Schyn claimed descent for the peaceful Baptists from the Waldensians, who certainly, as the records of the Flemish inquisition, collected by P. Fredericq, prove, were wide-spread during the 15th century over north France and Flanders. It would appear from the way in which Anabaptism sprang up everywhere independently, as if more than one ancient sect took in and through it a new lease of life. Ritschl discerned in it the leaven of the Fraticelli or Franciscan Tertiaries. In Moravia, if what Alex. Rost related be true, namely that they called themselves

Apostolici, and went barefooted healing the sick, they must have at least absorbed into themselves a sect of whom we hear in the 12th century in the north of Europe as deferring baptism to the age of 30, and rejecting oaths, prayers for the dead, relics and invocation of saints. The Moravian Anabaptists, says Rost, went bare-footed, washed each other's feet (like the Fraticelli), had all goods in common, worked everyone at a handicraft, had a spiritual father who prayed with them every morning and taught them, dressed in black and had long graces before and after meals. Zeiler also in his German *Itinerary* (1618) describes their way of life. The Lord's Supper, or bread-breaking, was a commemoration of the Passion, held once a year. They sat at long tables, the elders read the words of institution and prayed, and passed a loaf round from which each broke off a bit and ate, the wine being handed round in flagons. Children in their colonies were separated from the parents, and lived in the school, each having his bed and blanket. They were taught reading, writing and summing, cleanliness, truthfulness and industry, and the girls married the men chosen for them. In the following points Anabaptists resembled the medieval dissenters:—(1) They taught that Jesus did not take the flesh from his mother, but either brought his body from heaven or had one made for him by the Word. Some even said that he passed through his mother, as water through a pipe, into the world. In pictures and sculptures of the 15th century and earlier, we often find represented this idea, originated by Marcion in the 2nd century. The Anabaptists were accused of denying the Incarnation of Christ: they did, but not in the sense that he was not divine; they rather denied him to be human. (2) They condemned oaths, and also the reference of disputes between believers to law-courts. (3) The believer must not bear arms or offer forcible resistance to wrongdoers, nor wield the sword. No Christian has the *jus gladii*. (4) Civil government belongs to the world, is Caesar. The believer who belongs to God's kingdom must not fill any office, nor hold any rank under government, which is to be passively obeyed. (5) Sinners or unfaithful ones are to be excommunicated, and excluded from the sacraments and from intercourse with believers unless they repent, according to Matt. xviii. 15 *seq.* But no force is to be used towards them.

Some sects calling themselves *Spirituales* or *Perfecti* also held that the baptized cannot sin, a very ancient tenet.

They seem to have preserved among them the primitive manual called the *Teaching of the Apostles*, for Bishop Longland in England condemned an Anabaptist for repeating one of its maxims "that alms should not be given before they did sweat in a man's hand." This was between 1518 and 1521.

On the 12th of April 1549, certain London Anabaptists brought before a commission of bishops asserted.—

> "That a man regenerate could not sin; that though the outward man sinned, the inward man sinned not; that there was no Trinity of Persons; that Christ was only a holy prophet and not at all God; that all we had by Christ was that he taught us the way to heaven; that he took no flesh of the Virgin, and that the baptism of infants was not profitable."

The Anabaptists were great readers of Revelation and of the Epistle of James, the latter perhaps by way of counteracting Luther's one-sided teaching of justification by faith alone. Luther feebly rejected this scripture as "a right strawy epistle." English Anabaptists often knew it by heart. Excessive reading of Revelation seems to have been the chief cause of the aberrations of the Münster fanatics.

In Poland and Holland certain of the Baptists denied the Trinity, hence the saying that a Socinian was a learned Baptist (see SOCINUS). With these Menno and his followers refused to hold communion.

One of the most notable features of the early Anabaptists is that they regarded any true religious reform as involving social amelioration. The socialism of the 16th century was necessarily Christian and Anabaptist. Lutheranism was more attractive to grand-ducal patriots and well-to-do burghers than to the poor and oppressed and disinherited. The Lutherans and Zwinglians never converted the Anabaptists. Those who yielded to stress of persecution fell back into Papalism and went to swell the tide of the Catholic reaction.

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ANABASIS (*ἀνάβασις*, a march up country), the title given by Xenophon (*q.v.*) to his narrative of the expedition of Cyrus the younger against his brother, Artaxerxes of Persia, 401 B.C., and adopted by Arrian for his history of the expedition of Alexander the Great.

ANABOLISM (Gr. ἀνά, up, βολή, a throw), the biological term for the building up in an organism of more complex from simpler substances, constructive metabolism. (See PHYSIOLOGY.)

ANACHARSIS, a Scythian philosopher, who lived about 600 B.C. He was the son of Gnurus, chief of a nomadic tribe of the Euxine shores, and a Greek woman. Instructed in the Greek language by his mother, he prevailed upon the king to entrust him with an embassy to Athens about 589 B.C. He became acquainted with Solon, from whom he rapidly acquired a knowledge of the wisdom and learning of Greece, and by whose influence he was introduced to the principal persons in Athens. He was the first stranger who received the privileges of citizenship. He was reckoned one of the Seven Sages, and it is said that he was initiated into the Eleusinian mysteries. After he had resided several years at Athens, he travelled through different countries in quest of knowledge, and returned home filled with the desire of instructing his countrymen in the laws and the religion of the Greeks. According to Herodotus he was killed by his brother Saulius while he was performing sacrifice to the goddess Cybele. It was he who compared laws to spiders' webs, which catch small flies and allow bigger ones to escape. His simple and forcible mode of expressing himself gave birth to the proverbial expression "Scythian eloquence," but his epigrams are as unauthentic as the letters which are often attributed to him. According to Strabo he was the first to invent an anchor with two flukes. Barthélémy borrows his name as the title for his *Anacharsis en Grèce*.

Herodotus iv. 76; Lucian, *Scytha*; Cicero, *Tusc. Disp.* v. 32; Diog. Laert. i. 101.

ANACHRONISM (from ἀνά, back, and χρόνος, time), a neglect or falsification, whether wilful or undesigned, of chronological relation. Its commonest use restricts it to the ante-dating of events, circumstances or customs; in other words, to the introduction, especially in works of imagination that rest on a historical basis, of details borrowed from a later age. Anachronisms may be committed in many ways, originating, for instance, in disregard of the different modes of life and thought that characterize different periods, or in ignorance of the progress of the arts and sciences and the other ascertained facts of history, and may vary from glaring inconsistency to scarcely perceptible misrepresentation. Much of the thought entertained about the past is so deficient in historical perspective as to be little better than a continuous anachronism. It is only since the close of the 18th century that this kind of untruthfulness has jarred on the general intelligence. Anachronisms abound in the works of Raphael and Shakespeare, as well as in those of the meanest daubers and playwrights of earlier times. In particular, the artists, on the stage and on the canvas, in story and in song, assimilated their *dramatis personae* to their own nationality and their own time. The Virgin was represented here as an Italian contadina, and there as a Flemish frow; Alexander the Great appeared on the French stage in the full costume of Louis XIV. down to the time of Voltaire; and in England the contemporaries of Addison could behold, without any suspicion of burlesque,

> "Cato's long wig, flower'd gown, and lacquer'd chair."

Modern realism, the progress of archaeological research, and the more scientific spirit of history, have made an anachronism an offence, where our ancestors saw none.

ANACOLUTHON (Gr. for "not following on"), a grammatical term, given to a defectively constructed sentence which does not run on as a continuous whole; this may occur either, in a text, by some corruption, or, in the case of a writer or speaker, simply through his forgetting the way in which he started. In the case of a man who is full of his subject, or who is carried along by the passion of the moment, such inconsequents are very apt to occur. Of Niebuhr it is told that his oral lectures consisted almost entirely of anacoluthic constructions. To this kind of licence some languages, as Greek and English, readily lend themselves; while the grammatical rigidity of others, as Latin and French, admits of it but sparingly. In Herodotus, Thucydides, Aeschylus, Pindar and Plato, abundant specimens are to be found; and the same is true of the writers of the Elizabethan age in English. The following is an example:—"And he charged him to tell no man; *but go show thyself*," &c. (Luke v. 14).

ANACONDA, a city and the county-seat of Deer Lodge county, Montana, U.S.A., situated in the mountains on the W. side of Deer Lodge Valley, in the S.W. part of the state, about 26 m. N.W. of Butte, and at an altitude of about 5300 ft. Pop. (1890) 3975; (1900) 9453, of whom 3478 were foreign-born; (1910, census) 10,134. It is connected with Butte by the **Butte**, Anaconda & Pacific railroad. Among its public buildings are the county court-house and the Hearst free public library (1898). Industrially, Anaconda is essentially a smelting camp for the copper ores from the Butte mines, probably the largest copper-smelter in the world being located here; the principal copper-mine at Butte—one of the most famous copper-mines in the world—is called the Anaconda. In 1905 the capital invested in manufacturing was $13,728,456, and the factory product was valued at $28,581,530. Electric power generated at the Helena Power Transmission Company's plant on the Missouri river, 18 m. from Helena, comes to Anaconda over 110 m. of wire at 70,000 voltage. Anaconda is to a large degree the market and trading-place of the Big Hole Basin cattle country in the north-western part of Beaverhead county; with Wisdom, in the Big Hole Basin, it was connected in 1905 by a 65 m. telephone line. Anaconda was first settled in 1884 and was chartered as a city in 1888.

ANACONDA, an aquatic boa, inhabiting the swamps and rivers of the dense forests of tropical South America. It is the largest of all modern snakes, said to attain over 30 ft. in length. The *Eunectes murinus* (formerly called *Boa murina*) differs from *Boa* by the snout being covered with shields instead of small scales, the inner of the three nasal shields being in contact with that of the other side. The general colour is dark olive-brown, with large oval black spots arranged in two alternating rows along the back, and with smaller white-eyed spots along the sides. The belly is whitish, spotted with black. The anaconda combines an arboreal with an aquatic life, and feeds chiefly upon birds and mammals, mostly during the night. It lies submerged in the water, with only a small part of its head above the surface, waiting for any suitable prey, or it establishes itself upon the branches of a tree which overhangs the water or the track of game. Being eminently aquatic this snake is viviparous. It is the only large boa which is decidedly ill-tempered.

ANACREON, Greek lyric poet, was born about 560 B.C., at Teos, an Ionian city on the coast of Asia Minor. Little is known of his life, except a few scattered notices, not in all cases certainly authentic. He probably shared the voluntary exile of the mass of his fellow-townsmen, who, when Cyrus the Great was besieging the Greek cities of Asia (545), rather than surrender their city to his general Harpagus, sailed to Abdera in Thrace, where they founded a colony. Anacreon seems to have taken part in the fighting, in which, on his own admission, he did not distinguish himself, but, like Alcaeus and Horace, threw away his shield and fled. From Thrace he removed to the court of Polycrates of Samos, one of the best of those old "tyrants," who by no means deserved the name in its worst sense. He is said to have acted as tutor to Polycrates; that he enjoyed the tyrant's confidence we learn on the authority of Herodotus (iii. 121), who represents the poet as sitting in the royal chamber when audience was given to the Persian herald. In return for his favour and protection, Anacreon wrote many complimentary odes upon his patron. Like his fellow-lyrist, Horace, who was one of his great admirers, and in many respects of a kindred spirit, Anacreon seems to have been made for the society of courts. On the death of Polycrates, Hipparchus, who was then in power at Athens and inherited the literary tastes of his father Peisistratus, sent a special embassy to fetch the popular poet to Athens in a galley of fifty oars. Here he became acquainted with the poet Simonides, and other members of the brilliant circle which had gathered round Hipparchus. When this circle was broken up by the assassination of Hipparchus, Anacreon seems to have returned to his native town of Teos, where, according to a metrical epitaph ascribed to his friend Simonides, he died and was buried. According to others, before returning to Teos, he accompanied Simonides to the court of Echecrates, a Thessalian dynast of the house of the Aleuadae. Lucian mentions Anacreon amongst his instances of the longevity of eminent men, as having completed eighty-five years. If an anecdote given by Pliny (*Nat. Hist.* vii. 7) is to be trusted, he was choked at last by a grape-stone, but the story has an air of mythical adaptation to the poet's habits, which makes it somewhat apocryphal. Anacreon was for a long time popular at Athens, where his statue was to be seen on the Acropolis, together with that of his friend Xanthippus, the father of Pericles. On several coins of Teos he is represented, holding a lyre in his hand, sometimes sitting, sometimes standing. A marble statue found in 1835 in the Sabine district, and now in the Villa Borghese, is said to represent Anacreon. Anacreon had a reputation as a composer of hymns, as well as of those bacchanalian and amatory lyrics which are commonly associated with his name. Two short hymns to Artemis and Dionysus, consisting of eight and eleven lines respectively, stand first amongst his few undisputed remains, as printed by recent editors. But pagan hymns, especially when addressed to such deities as Aphrodite, Eros and Dionysus, are not so very unlike what we call "Anacreontic" poetry as to make the contrast of style as great as the word might seem to imply. The tone of Anacreon's lyric effusions has probably led to an unjust estimate, by both ancients and moderns, of the poet's personal character. The "triple worship" of the Muses, Wine and Love, ascribed to him as his religion in an old Greek epigram (*Anthol.* iii. 25,51), may have been as purely professional in the two last cases as in the first, and his private character on such points was probably neither much better nor worse than that of his contemporaries. Athenaeus remarks acutely that he seems at least to have been sober when he wrote; and he himself strongly repudiates, as Horace does, the brutal characteristics of intoxication as fit only for barbarians and Scythians (*Fr.* 64). Of the five books of lyrical pieces by Anacreon which Suidas and Athenaeus mention as extant in their time, we have now but the merest fragments, collected from the citations of later writers. Those graceful little poems (most of them first printed from the MSS. by Henry Stephens in 1554), which long passed among the learned for the songs of Anacreon, and which are well-known to many English readers in the translations of Cowley and Moore, are really of much later date, though possibly here and there genuine fragments of the poet are included. Modern critics, however, regard the entire collection as imitations belonging to different periods—the oldest probably to Alexandrian times, the most recent to the last days of paganism. They will always retain a certain popularity from their lightness and elegance, and some of them are fair copies of Anacreon's style, which would lend itself readily enough to a clever imitator. A strong argument against their genuineness lies in the fact that the peculiar forms of the Ionic Greek, in which Anacreon wrote, are not to be found in these reputed odes, while the fragments of his poems quoted by ancient writers are full of Ionicisms. Again, only one of the quotations from Anacreon in ancient writers is to be found in these poems, which further contain no references to contemporaries, whereas Strabo (xiv. p. 638) expressly states that Anacreon's poems included numerous allusions to Polycrates. The character of Love as a mischievous little boy is quite different from that given by Anacreon, who describes him as "striking with a mighty axe, like a smith," and is more akin to the conceptions of later literature.

The best edition of the genuine fragments of Anacreon, as well as of the Anacreontea, is by Bergk (*Poetae lyrici graeci*, 1882). He includes in an appendix a similar collection of imitations from the *Anecdota graeca* of P. Matranga (1850), which had their origin in the beginning of the middle ages, and resemble the Christian anacreontics of Sophronius.

ANACREONTICS (from the name of the Greek poet Anacreon), the title given to short lyrical pieces, of an easy kind, dealing with love and wine. The English word appears to have been first used in 1656 by Abraham Cowley, who called a section of his poems "anacreontiques," because they were paraphrased out of the so-called writings of Anacreon into a familiar measure which was supposed to represent the metre of the Greek. Half a century later, when the form had been much cultivated, John Phillips (1631–1706) laid down the arbitrary rule that an anacreontic line "consists of seven syllables, without being tied to any certain law of quantity." In the 18th century, the antiquary William Oldys (1696–1761) was the author of a little piece which is the perfect type of an anacreontic: this begins:—

> "Busy, curious, thirsty fly,
> Drink with me, and drink as I;
> Freely welcome to my cup,
> Could'st thou sip and sip it up.
> Make the most of life you may;
> Life is short and wears away."

In 1800 Tom Moore published a collection of erotic anacreontics which are also typical in form; Moore speaks of the necessity of catching "the careless facility with which Anacreon appears to have trifled," as a reason why anacreontics are often tame and worthless. He dwells, moreover, on the absurdity of writing "pious anacreontics," a feat, however, which was performed by several of the Greek Christian poets, and in particular by Gregory of Nazianzus and John of Damascus. (E. G.)

ANADYOMENE (Ἀναδυομένη), an epithet of Aphrodite (Venus), expressive of her having sprung from the foam of the sea. In a famous picture by Apelles she was represented under this title as if just emerged from the sea and in the act of wringing her tresses. This painting was executed for the temple of Asclepius at Cos, from which it was taken to Rome by Augustus in part payment of tribute, and set up in the temple of Caesar. In the time of Nero, owing to its dilapidated condition, it was replaced by a copy made by the painter Dorotheus (Pliny, *Nat. Hist.* xxxv. 36). There are several epigrams on it in the Greek anthology.

ANADYR, (1) a gulf, and (2) a river, in the extreme N.E. of Siberia, in the Maritime Province. The gulf extends from Cape Chukchi on the north to Cape Navarin on the south, forming part of the Bering Sea. The river, taking its rise in the Stanovoi mountains as the Ivashki or Ivachno, about 67° N. lat. and 173° E. long., flows through the Chukchi country, at first south-west and then east, and enters the Gulf of Anadyr after a course of about 500 m. The country through which it passes is thinly populated, barren and desolate. For nine months of the year the ground is covered with snow. Reindeer, upon which the inhabitants subsist, are found in considerable numbers.

ANAEMIA (from Gr. ἀν-, privative, and αἷμα, blood), literally "want of blood," a word used as a generic term for various forms of disease characterized by a defective constitution of the blood. For different types of anaemia see the article BLOOD, section *Pathology*.

ANAESTHESIA and **ANAESTHETICS** (Gr. ἀναισθησία, from ἀν-, privative, and αἴσθησις, sensation), terms used in medicine to describe a state of local or general insensibility to external impressions, and the substances used for inducing this state. In diseases of the brain or spinal cord anaesthesia is an occasional symptom, but in such cases it is usually limited in extent, involving a limb or a definite area of the body's surface. Complete anaesthesia occurs in a state of catalepsy or trance—conditions associated with no definite lesion of the nervous system.

The artificial induction of anaesthesia has come to occupy a foremost place in modern medicine, but there is abundant evidence to show that it is a practice of great antiquity. Besides the mention by Homer of the anaesthetic effects of nepenthe, and the reference by Herodotus to the practice of the Scythians of inhaling the vapours of a certain kind of hemp to produce intoxication, the employment of anaesthetics in surgery by the use of mandragora is particularly alluded to by Dioscorides and Pliny. It also appears, from an old Chinese manuscript laid before the French Academy by Stanislas Julien, that a physician named Hoa-tho, who lived in the 3rd century, gave his patients a preparation of hemp, whereby they were rendered insensible during the performance of surgical operations. Mandragora was extensively used as an anaesthetic by Hugo de Lucca, who practised in the 13th century. The soporific effects of mandrake are alluded to by Shakespeare, who also makes frequent mention of anaesthetizing draughts, the composition of which is not specified.

In the *Medical Gazette*, vol. xii. p. 515, Dr Sylvester, quoting from a German work by Meissner, published in 1782, mentions the case of Augustus, king of Poland, who underwent amputation while rendered insensible by a narcotic. But the practice of anaesthesia never became general, and surgeons appear to have usually regarded it with disfavour. When, towards the close of the 18th century, the discoveries of Priestley gave an impetus to chemical research, the properties of gases and vapours began to be more closely investigated, and the belief was then entertained that many of them would become of great medicinal value. In 1800, Sir Humphry Davy, experimenting on nitrous oxide (the so-called "laughing gas"), discovered its anaesthetic properties, and described the effects it had on himself when inhaled with the view of relieving local pain. He suggested its employment in surgery in the following words:—"As nitrous oxide, in its extensive operation, seems capable of destroying physical pain, it may probably be used with advantage in surgical operations in which no great effusion of blood takes place." His suggestion, however, remained unheeded for nearly half a century. The inhalation of sulphuric ether for the relief of asthma and other lung affections had been employed by Dr Pearson of Birmingham as early as 1785; and in 1805 Dr J. C. Warren of Boston, U.S.A., used this treatment in the later stages of pulmonary consumption.

In 1818 Faraday showed that the inhalation of the vapour of ether produced anaesthetic effects similar to those of nitrous oxide; and this property of ether was also shown by the American physicians, John D. Godman (1822), James Jackson (1833), Wood and Bache (1834).

These observations, however, appear to have been regarded in the light of mere scientific curiosities and subjects for lecture-room experiment, rather than as facts capable of being applied practically in the treatment of disease, till December 1844, when Dr Horace Wells, a dentist of Hartford, Connecticut, underwent in his own person the operation of tooth-extraction while rendered insensible by nitrous oxide. Satisfied, from further experience, that teeth could be extracted in this way without pain, Dr Wells proposed to establish the practice of painless dentistry under the influence of the gas; but in consequence of an unfortunate failure in an experiment at Boston he abandoned the project. On the 30th of September 1846 Dr W. T. G. Morton, a dentist of Boston, employed the vapour of ether to procure general anaesthesia in a case of tooth-extraction, and thereafter administered it in cases requiring surgical operation with complete success. This great achievement marked a new era in surgery. Operations were performed in America in numerous instances under ether inhalation, the result being only to establish more firmly its value as a successful anaesthetic. The news of the discovery reached England on the 17th of December 1846. On the 19th of December Mr Robinson, a dentist in London, and on the 21st Robert Liston, the eminent surgeon, operated on patients anaesthetized by ether; and the practice soon became general both in Great Britain and on the continent.

Sir James Simpson was the first to apply anaesthesia by ether to midwifery practice; this he did in 1847, and found that the pains of labour could be abolished without interference with uterine contractions or injury to the child. On the 8th of March 1847 M. J. P. Flourens read a paper before the Académie des Sciences on the effect of chloroform on the lower animals, but no notice was taken of what has since proved to be a discovery of epoch-making importance. In November of the same year Simpson announced his discovery of the anaesthetic properties of chloroform, the trial of which had been suggested to him by Waldie, a chemist of Liverpool. As the result, chloroform came to be widely used instead of ether, though it was found by several casualties that it was not the absolutely safe anaesthetic that had at first been hoped. It, however, remained the drug that was chiefly used till Dr J. T. Clover (1825–1882) of London introduced his regulating ether-inhaler in 1876, embodying a new principle—that of limiting the quantity of air during etherization and regulating the strength of the vapour.

During the intervening period, as the results of the labours of John Snow, Sir Benjamin Ward Richardson, Thomas Nunnely, and Colton amongst others, several drugs were found to possess anaesthetic properties. Of these one, ethyl chloride, which was speedily given up, has come into deserved prominence at the present time; and another, nitrous oxide, which had been lost sight of since Wells's failure at Boston, was reintroduced, and it became and has remained the most popular anaesthetic in dental practice.

Since 1876 no new drugs have been introduced; the progress has been in the direction of improvements in the technique of anaesthetization. The most important of these is the administration of oxygen with nitrous oxide, resulting from the recognition of the fact that this drug does not owe its anaesthetic properties to partial asphyxia, as was thought till the contrary was shown by Edmund Andrews of Chicago in 1868. It was not till twenty years later that this knowledge was put to practical use, when F. W. Hewett introduced his regulating stopcock, which enabled the anaesthetist to exhibit the nitrous oxide and oxygen in such proportions as were demanded by the patient's condition. At the present time the anaesthetics in common use are the following:—

(1) Nitrous oxide gas, or laughing gas, N_2O. This is a colourless, odourless gas, which for convenience is carried about in liquid form in iron cylinders. When about to be used, it is allowed to escape into a large rubber bag, connected with a closely-fitting face-piece, which covers up the nose and mouth, and allows of inspiration only from the bag of gas, expiration being into the air. When thus given the patient is exposed to a certain degree of asphyxia. This asphyxia is not only not necessary but is harmful, and may be obviated by giving oxygen in small amounts simultaneously by means of Hewett's regulating stopcock. This drug is used chiefly for dental operations, and for minor surgery where absolute muscular relaxation is not required. When mixed with oxygen, it can be given if necessary for an hour or longer. It has an induction period of a few breaths only, and the recovery is as a rule unaccompanied by excitement or nausea. It is also used as a preliminary to ether; the gas is given till unconsciousness is reached, the unpleasant taste of the ether being thus avoided and the induction period shortened. The mortality from nitrous oxide is small, and from the gas and oxygen in expert hands nil.

(2) Ethyl chloride, C_2H_5Cl, a colourless liquid of a pleasant odour, boiling at 12.5° C. It is used in the same class of operations as the last anaesthetic. It is best given in an apparatus that consists of a mask closely adapted to the face, and a rubber bag of small capacity, with which is connected the bottle containing the ethyl chloride. The vapour supplied from the bottle is breathed backwards and forwards from the bag, fresh air being admitted in small quantities only. The period of induction is shorter than in the case of nitrous oxide, the patient losing consciousness in two or three breaths; the stage of recovery is not so uniformly pleasant, headache, nausea and vomiting occurring not infrequently. It is difficult at present to estimate the mortality, as it has only recently come into general use, but it seems to occupy an intermediate position between ether and chloroform.

(3) Ether, or ethyl oxide, $(C_2H_5)_2O$, a colourless, volatile liquid, boiling at 36.5° C. It has a pungent odour. It is best administered, as in the case of ethyl chloride, by limiting the amount of air during inhalation. The induction is much slower than in the case of the last two drugs, and it is accompanied by a feeling of suffocation, owing to the pungent odour of the ether. On that account the anaesthetic is best started with nitrous oxide or ethyl chloride. The recovery is always marked by some nausea and very frequently by vomiting. The mortality is small during the actual operation, but fatalities from respiratory complications later on are not uncommon.

(4) Chloroform, $CHCl_3$, a colourless liquid of a penetrating odour, boiling at 63° C. It is administered in such a way as to ensure the free admixture of air. To secure this the face-piece must be loosely-fitting, and the strength of the vapour so gradually increased that the patient is never inconvenienced or impelled to hold the breath. The induction is slow, occupying two or more minutes, but it is not at all unpleasant; nausea and vomiting during recovery are rarer than in the case of ether, but if they do occur they last longer. The mortality on the table is about 1 in 2500.

The question as to which is the better anaesthetic, ether or chloroform, for long operations, is a moot point. In the hands of an experienced anaesthetist there is probably nothing to choose as regards safety, and the anaesthetic advantages of the latter are incontestable. In the hands of the less-experienced anaesthetist, ether is the more suitable drug. At the extremes of life, chloroform is well taken, as it is also by women in labour, and it is indicated where there has been recent inflammation of the air passages. In operations, too, about the mouth, chloroform must be the drug used, as a closely-fitting mask is obviously impossible.

The introduction by inhalation of any of the above drugs into the organism produces an anaesthesia, the degree of which at any moment varies directly as the amount or tension of the vapour in the blood, and therefore also as the tension of the vapour in the inspired air. The organism in this case may be compared to an electric lamp, of which the voltage is, say 100, a current of any less voltage will only produce a red heat, however many amperes are forced through; with the voltage at 100 the filament will be white hot, at over 100 the filament will fuse. So with these drugs: with the vapour at a low tension a certain low depth of anaesthesia is obtained; if the administrator increases the tension, true surgical anaesthesia is produced; if he increases it again, the filament fuses and the patient dies. This is the principle which guides the anaesthetist; it is the quality of the vapour that decides the depth of the anaesthesia, not the quantity. An infinite quantity of chloroform may be absorbed with impunity if the tension be low, but a few drops will kill if the tension be high. For practical purposes four degrees of anaesthesia are described, through which a patient passes from unconsciousness to (in the last resort) death:—

(1) A state of disordered consciousness, with analgesia; the patient's ideas are confused, the special senses are disturbed, and though the application of stimuli to the skin causes no mental impression, yet in response to them there may be what look like purposeful movements.

(2) In the second stage there is complete loss of consciousness, and though the reflexes persist, the movements in response to the stimuli are purposeless. The muscles generally act strongly.

(3) The stage of surgical anaesthesia; there is a general muscular relaxation, with the loss of many of the reflexes, *i.e.* an operation may be performed without evoking any movement on the part of the patient, while the vital reflexes and the vital centres in the medulla are still active, and the heart muscle is not paralysed.

(4) Finally, the stage of paralysis of the medulla, when the respiratory and circulatory centres are paralysed, and the heart muscle itself is poisoned and death ensues.

The aim of the anaesthetist is to keep the patient in the third degree of anaesthesia, thus avoiding the movements of the second and the dangers of the fourth; he therefore keeps the patient under close observation, and by watching the respiration, pulse and facial aspect, is able to judge the condition of the respiration and circulation. He has a further guide in the lid-reflex, *i.e.* the movement of the eyelid when the globe is touched; this and the size of the pupil tell him to what extent the central nervous system is depressed and complete the information he requires.

It will have been observed that the administration of the above drugs is by inhalation, and has to be continued throughout the operation, the reason being that all the drugs are as rapidly excreted as they are absorbed, especially by the lungs, and therefore no other method would be of any avail. That there are drugs which are sufficiently slowly eliminated to allow of an operation being performed between the moment of induction and that of recovery, cannot be doubted, and their discovery and use can only be a matter of time. Even at the present time there is one, urethane, which, if injected with a hypodermic needle, soon produces a profound general anaesthesia. It has only been used on the lower animals, as its depressing effect on the respiratory centre contra-indicates its use in human beings.

Local Anaesthesia.—Much attention has recently been devoted to the discovery of methods by which the insensibility may be confined to the area of operation and the loss of consciousness avoided. Such a procedure has been common for many years for small operations, but it is only lately that it has been successfully applied to the severer ones. It is very doubtful whether local anaesthesia will ever replace general in the latter class. Though the preliminary starvation is avoided, and the patient has the shock of operation alone to recover from, without the cardiac depression resulting from the anaesthetic during the operation, the patient, unless of a very apathetic temperament, is in that state of severe nervous strain, when any unexpected movement or remark, or sight of a soiled instrument, may produce an alarming or fatal syncope. The earliest local anaesthetic was cold, produced by a mixture of ice and salt. In place of this cumbersome method, the skin is now frozen by means of a fine spray of ether or ethyl chloride directed upon it. The spraying is discontinued when the skin becomes white, and it is then allowed to regain its colour. The moment this occurs the incision is made and will be quite painless. The recovery, like that from any other frost-bite, is very painful, and the time during which an operation can be done is very short; consequently this method has been very largely superseded by the use of drugs. The drugs chiefly used are cocaine and its derivatives. Cocaine has by far the highest anaesthetic properties; it is, however, in certain individuals a most powerful cardiac depressant and has caused numerous fatalities, and further, it cannot be sterilized by heat, as it undergoes decomposition. Eucaine has now largely taken its place, though its anaesthetic properties are less; it is, however, less toxic, and can be sterilized by heat. In combination with these drugs there is usually given some of the extract of the suprarenal body of the sheep; this substance increases and prolongs the anaesthetic effect by constricting the blood-vessels, the result of which is to reduce the haemorrhage, and also to prevent the too rapid absorption of the drug into the general system, confining it to the area of operation.

The chief methods of bringing about local anaesthesia are as follows:—

(1) Painting or spraying a solution of the drugs on to the area on which it is proposed to operate.

(2) Injection by means of a needle of the solution into the skin and the deeper structures.

(3) Spinal analgesia. The method of inducing analgesia by injecting solutions into the sheath surrounding the spinal cord was devised by Bier in 1898, and for the purpose he employed a solution of cocaine. It was found, however, that there was considerable danger with this drug, so the method was not adopted to any great extent, until Fourneau discovered *stovaine* in 1904.

The principle involved in spinal anaesthesia is this: that a substance in solution is injected into the sac containing the spinal cord in the lumbar region. The spinal cord as such ends at the level of the first lumbar vertebra in a leash of nerves termed the *cauda equina*. When giving an injection there is little danger of injuring these nerves because in this situation there is a space filled with fluid between the wall of the sac and the nerves. The substances injected, by virtue of their specific action on nervous tissues, cause loss of painful sensations in the lower limbs and for a variable distance up the trunk. It has been found that the specific gravity of the solution injected has some influence on the height to which the analgesia will extend up the trunk, and this distance can also be controlled by altering the position of the patient. The canal in which the cord is situated is not a straight tube, but is curved backwards in the sacral and upper dorsal regions, and forwards in the lower dorsal and lumbar regions. Therefore with the patient lying on his back, any solution injected that has a greater specific gravity than that of the cerebrospinal fluid which bathes the cord, tends to gravitate towards the sacral and upper dorsal regions; and, conversely, any solution of lower specific gravity than that of the cerebrospinal fluid tends to rise and produce analgesia at a still higher level. In this way the situation of the fluid producing analgesia can be controlled to some extent. It has been found that a very serious danger exists if the solution passes up to the brain, or even if it passes higher than the sixth cervical nerve. It is important that the osmotic pressure of the solutions employed should be as nearly as possible that of the cerebrospinal fluid, that is to say, the nearer the solution is isotonic with the cerebrospinal fluid, the better will be the analgesia, and the less will be the harmful effects. At present it has not been found possible to separate in any of the substances employed the radicle which produces motor effects from that which blocks the advent of sensory stimuli. Although both effects last only a short time there seems to be a certain risk due to the temporary muscular paralysis, and in a patient with a tendency to bronchitis this is a matter of considerable moment.

The fluid is injected in the following manner. A puncture is made with a special trocar and canula in the lumbar region between the second and third or third and fourth lumbar spines. The sheath of the sac having been entered, as is evidenced by the loss of resistance to the point of the trocar, and by the fact that cerebrospinal fluid escapes when the trocar is withdrawn, the dose of the fluid selected is injected through the canula, which is then withdrawn. An important point is that the operation must be absolutely aseptic; great care is taken to sterilize thoroughly the instruments, site of operation and fluid used. The patient is placed in that position which will yield the best and safest analgesia for the operation; it is essential, however, that the patient's head be raised well above the level of the spine. The injection is followed very quickly, generally within three to five minutes, by the production of analgesia, which lasts for a period varying from half an hour to two hours. Various substances have been used for the injection, of which the following are the chief —tropacocaine, stovaine, novocaine, cocaine, eucaine and alypin. All of these have been combined with adrenalin hydrochloride with a view to limiting their action in one degree or another; and also with other inert substances in such quantity as will produce isotonic solutions of relatively high specific gravity.

The points in favour of this method of producing analgesia are as follows: (*a*) The patient is not rendered unconscious, and is often able to assist at his own operation, such as by coughing or moving his limbs in any way as may be desired. (*b*) There are no troublesome after-effects, such as nausea, vomiting and thirst. (*c*) The formation of haematoma is less frequent. (*d*) Surgical shock is considerably lessened, especially in such operations as amputations and severe abdominal emergencies. (*e*) The risk attending a general anaesthetic is avoided.

The disadvantages at present attending the method are: (*a*) A severe form of headache may sometimes follow, but this has seemed to depend on the kind of fluid injected, and in the recent cases has not been so frequent as in the early ones. (*b*) The paralysis of muscles. In a very few cases this has been permanent. The temporary paralysis of the muscles of respiration is apt to be a serious matter. (*c*) Occasionally incontinence of urine and faeces occurs; this, however, has not been permanent except in a few of the earlier cases. (*d*) The uncertainty of the method, so that the analgesia is not always as complete as is desirable. (*e*) The analgesia for safety must be limited to a line below the level of the second rib in front. (*f*) The use of the Trendelenburg position is impossible, or indeed the use of any position which involves lowering the patient's head.

It would appear that the method undoubtedly has its uses, and that it will take its place in surgery and find its proper level. A large amount of work is being done on the subject, with a view of determining the limitations and possibilities of the method, the best kind of substance to use and the proper dose to employ.

Finally, a large number of operations have been performed under a local anaesthesia produced by hypnotism (*q.v.*), but this is a method that can only be used on selected cases. (H. C. C.)

ANAGNIA [mod. *Anagni*; pop. (1901) 10,059], an ancient town of the Hernici, situated on a hill (1558 ft.) above the valley of the Trerus and the Via Labicana (the post-station 3 m. below the town, from which a branch road ascended to it, was *Compitum Anagninum*, which was 40 m. E.S.E. of Rome: see T. Ashby, in *Papers of the British School at Rome*, i. 215). In 1880 a pre-Aryan grave was found between the town and the river, with a skeleton painted red, stone implements and a bronze dagger. After the Italian immigration, its position in a fertile district soon gave it importance, and it became the seat of the assembly of the Hernican towns. In the war of 306 B.C. it was conquered by Q. Marcius Tremulus and lost its independence. Its inhabitants had certainly acquired Roman citizenship before the Social War and it continued to be a *municipium* throughout the Roman period. It was besieged by the Saracens in 877, but in the 11th century was a place of considerable importance, the Conti and Gaetani being the chief families; Pope Boniface VIII., a member of the latter, was there made prisoner in 1303. The ancient city walls are in some points still existing, in others they have been much restored; they are built of rectangular blocks of porous limestone about 1½ft. high. On the north of the town they are especially well-preserved, and at one point the area within them is slightly extended by a terrace supported by three lofty pillars. Within the city there are no ancient remains, except some massive substruction walls which supported buildings on the hillside. The present town still preserves in parts its medieval aspect. The cathedral, constructed in 1074 at the summit of the hill, is externally plain; it has a fine Gothic interior, somewhat spoilt by restoration, with a good Cosmati pavement, and a canopy and paschal candlestick in the same style. The crypt contains frescoes of the 13th century, and in the treasury are valuable vestments. Lower down is the Palazzo Civico, belonging to the 11th or early 12th century, which is supported on arches of a single span, under which the road passes. Its posterior façade is fine. Pope Adrian IV. (Nicholas Breakspeare) died here, and there is a chapel of St Thomas Becket in the crypt of the cathedral.

See L. Pigorini, in *Bullettino di Paletnologia Italiana* (1880, 8 seq.); J. Kulakowski, in *Atti del Congresso Internazionale di Scienze Storiche* (Rome, 1904), v. 673 seq. (T. As.)

ANAGRAM (Gr. *ἀνὰ*, back, and *γράφειν*, to write), the result of transposing the letters of a word or words in such a manner as to produce other words that possess meaning. The construction of anagrams is an amusement of great antiquity, its invention being ascribed without authority to the Jews, probably because the later Hebrew writers, particularly the Kabbalists, were fond of it, asserting that "secret mysteries are woven in the numbers of letters." Anagrams were known to the Greeks and also to the Romans, although the known Latin examples of words of more than one syllable are nearly all imperfect. They were popular throughout Europe during the middle ages and later, particularly in France, where a certain Thomas Billon was appointed "anagrammatist to the king" by Louis XIII. W. Camden (*Remains*, 7th ed., 1674) defines "Anagrammatisme" as "a dissolution of a name truly written into his letters, as his elements, and a new connection of it by artificial transposition, without addition, subtraction or change of any letter, into different words, making some perfect sence applyable to the person named." Dryden disdainfully called the pastime the "torturing of one poor word ten thousand ways," but many men and women of note have found amusement in it. A well-known anagram is the change of *Ave Maria, gratia plena, Dominus tecum* into *Virgo serena, pia, munda et immaculata.* Among others are the anagrammatic answer to Pilate's question, "*Quid est veritas?*"—namely, "*Est vir qui adest*"; and the transposition of "Horatio Nelson" into "*Honor est a Nilo*"; and of "Florence Nightingale" into "Flit on, cheering angel." James I.'s courtiers discovered in "James Stuart" "A just master," and converted "Charles James Stuart" into "Claimes Arthur's seat." "Eleanor Audeley," wife of Sir John Davies, is said to have been brought before the High Commission in 1634 for extravagances, stimulated by the discovery that her name could be transposed to "Reveale, O Daniel," and to have been laughed out of court by another anagram submitted by the dean of the Arches, "Dame Eleanor Davies," "Never soe mad a ladie." There must be few names that could furnish so many anagrams as that of "Augustus de Morgan," who tells that a friend had constructed about 800 on his name, specimens of which are given in his *Budget of Paradoxes*, p. 82. The pseudonyms adopted by authors are often transposed forms, more or less exact, of their names; thus "Calvinus" becomes "Alcuinus"; "François Rabelais," "Alcofribas Nasier"; "Bryan Waller Proctor," "Barry Cornwall, poet"; "Henry Rogers," "R. E. H. Greyson," &c. It is to be noted that the last two are impure anagrams, an "r" being left out in both cases. "Telliamed," a simple reversal, is the *title* of a well-known work by "De Maillet." The most remarkable pseudonym of this class is the name "Voltaire," which the celebrated philosopher assumed instead of his family name, "François Marie Arouet," and which is now generally allowed to be an anagram of "Arouet, l.j.," that is, Arouet the younger. Perhaps the only practical use to which anagrams have been turned is to be found in the transpositions in which some of the astronomers of the 17th century embodied their discoveries with the design apparently of avoiding the risk that, while they were engaged in further verification, the credit of what they had found out might be claimed by others. Thus Galileo announced his discovery that Venus had phases like the moon in the form, "*Haec immatura a me jam frustra leguntur—oy*," that is, "*Cynthiae figuras aemulatur Mater Amorum.*"

Another species of anagram, called "palindrome" (Gr. *πάλιν*, back, and *δρόμος*, running), is a word or sentence which may be read backwards as well as forwards, letter by letter, while preserving the same meaning; for example, the words "Anna," "noon," "tenet," or the sentence with which Adam is humorously supposed to have greeted Eve: "Madam, I'm Adam!"

A still more complicated variety is the "logogram" (Gr. *λόγος*, word), a versified puzzle containing several words derived from recombining the letters of the original word, the difficulty lying in the fact that synonyms of the derived words may be used. Thus, if the original word be "curtain," the word "dog" may be used instead of "cur."

ANAH, or ʽĀNA, a town on the Euphrates, about mid-way between the Gulf of Alexandretta and the Persian Gulf. It is called Ḫanat in a Babylonian letter (about 2200 B.C.), and An-at by the scribe of Assur-naṣir-pal (879 B.C.), Ἀναθω (Isidore Charax), Anatha (Ammianus Marcellinus) by Greek and Latin writers in the early Christian centuries, ʽĀNA (sometimes, as if plural, ʽĀnāt) by Arabic writers. The name has been connected with that of the deity Anat. Whilst ʽĀna has thus retained its name for forty-one centuries the site is variously described. Most early writers concur in placing it on an island; so Assur-naṣir-pal, Isidore, Ammianus Marcellinus, Ibn Serapion, al-ʽIstakri, Abulfeda and al-Ḳaramāni. Ammianus (*lib.* 24, *c.* 2) calls it a *munimentum*, Theophylactus Simocatta (iv. 10, v. 1, 2) *τὸ Ἀναθων φρούριον*, Zosimus (iii. 14) a *φρούριον*, opp. Φαθυσαι, which may be the Βεθ(θ)ινα of Ptolemy (v. 19).[1] Leonhart Rauwolff, in A.D. 1574, found it "divided . . . into two towns," the one "Turkish," "so surrounded by the river, that you cannot go into it but by boats," the other, much larger, on the Arabian side of the river.[2] G. A. Olivier in the beginning of the 19th century describes it as a long street (5 or 6 m. long), parallel to the right bank of the Euphrates—some 100 yards from the water's edge and 300 to 400 paces from the rocky barrier of the Arabian desert—with, over against its lower part, an island bearing at its north end the ruins of a fortress (p. 451).

This southernmost town of Mesopotamia proper (*Gezīra*) must have shared the chequered history of that land (see MESOPOTAMIA). Of ʽĀna's fortunes under the early Babylonian empire the records have not yet been unearthed; but in a letter dating from the third millennium B.C., six men of Hanat (Ha-na-at^{KI}) are mentioned in a statement as to certain disturbances which had occurred in the sphere of the Babylonian Resident of Suḫi, which would include the district of ʽĀna. How ʽĀna fared at the hands of the Mitanni and others is unknown. The suggestion that Amenophis (Amenḥotep) I. (16th century B.C.) refers to it is improbable; but we seem to be justified in holding ʽĀna to be the town "in the middle of the Euphrates" opposite (*ina put*) to which Assur-naṣir-pal halted in his campaign of 879 B.C. The supposed reference to ʽĀna in the speech put into the mouth of Sennacherib's messengers to Hezekiah (2 Kings xix. 13, Is. xxxvii. 13) is exceedingly improbable. The town may be mentioned, however, in four 7th century documents edited by C. H. W. Johns.[3] It was at ʽĀna that the emperor Julian met the first opposition on his disastrous expedition against Persia (363), when he got possession of the place and transported the people; and there that Ziyād and Shureiḥ with the advanced guard of ʽAli's army were refused passage across the Euphrates (36/657) to join ʽAli in Mesopotamia (Ṭabari i. 3261). Later ʽĀna was the place of exile of the caliph Qaim (al-Qāim bi-amr-illāh) when Basīsīri was in power (450/1058). In the 14th century ʽĀna was the seat of a Catholicos, primate of the Persians (Marin Sanuto). In 1610 Della Valle found a Scot, George Strachan, resident at ʽĀna (to study Arabic) as physician to the amīr (i. 671–681). In 1835 the steamer "Tigris" of the English Euphrates expedition went down in a hurricane just above ʽĀna, near where Julian's force had suffered from a similar storm. Della Valle described ʽĀna as the chief Arab town on the Euphrates, an importance which it owes to its position on one of the routes from the west to Bagdād; Texeira said that the power of its amīr extended to Palmyra (early 17th century); but Olivier found the ruling prince with only twenty-five men in his service, the town becoming more depopulated every day from lack of protection from the Arabs of the desert. Von Oppenheim (1893) reported that Turkish troops having been recently stationed at the place, it had no longer to pay blackmail (*ḫuwwa*) to the Arabs. F. R. Chesney reported some 1800 houses, 2 mosques and 16 water-wheels; W. F. Ainsworth (1835) reported the Arabs as inhabiting the N.W. part of the town, the Christians the centre, and the Jews the S.E.; Della Valle (1610) found some sun-worshippers still there.

Modern ʽĀna lies from W. to E. on the right bank along a bend of the river just before it turns S. towards Hīt, and presents an attractive appearance. It extends, chiefly as a single street, for several miles along a narrow strip of land between the river and a ridge of rocky hills. The houses are separated from one another by fruit gardens. ʽĀna marks the boundary between the olive (N.) and the date (S.). Arab poets celebrated its wine (Yāqūt, iii. 593 f.), and Mustaufi (8/14th century) tells of the fame of its palm-groves. In the river, facing the town, is a succession of equally productive islands. The most easterly contains the ruins of the old castle, whilst the remains of the ancient Anatho extend from this island for about 2 m. down the left bank. Coarse cloth is almost the only manufacture.

BIBLIOGRAPHY.—In addition to the authorities cited above may be mentioned: G. A. Olivier, *Voyage dans l'empire othoman, &c.*, iii. 450-459 (1807); Carl Ritter, *Erdkunde von Asien*, vii. b., pp. 716-726 (1844); W. F. Ainsworth, *Euphrates Expedition*, i. 401-418 (1888). For a map see sheet 5 of the atlas accompanying Chesney's work. (H. W. H.)

ANAHEIM, a city of Orange county, California, U.S.A., about 24 m. S.E. of Los Angeles, about 12 m. from the Pacific Ocean, and about 3 m. from the Santa Ana river. (1900) 1456; (1910) 2628. It is served by the Atchison, Topeka & Santa Fé, and the Southern Pacific railways. It lies in a fine fruit region, in which oranges, lemons, apricots, grapes and walnuts are raised. The plain on which it is laid out, now fertile and well-watered, was originally an arid waste. Water for irrigation is obtained from the Santa Ana river, about 15 m. above the nearest point along the river to the city. The city itself has an area of only 1½ sq. m., and in 1908 the population of the district, including that of the city, was estimated at 5000. The principal manufactures are dried and canned fruits, wine, beer, and agricultural implements. Anaheim is of particular interest as the earliest of various settlements in southern California in which co-operation has made possible the establishment of intensive fruit culture in semi-desert regions. In 1857 fifty Germans (mostly mechanics) organized in San Francisco the Los Angeles Vineyard Association and bought 1165 acres of land here which could be irrigated from the Santa Ana river; each member took possession of a 20 acre share only when gradual improvement had made everything ready for occupancy and the tracts had been distributed by lot, with bonuses or rebates to equalize them in value to the drawers. This ended the co-operative feature of the enterprise, which was never communistic except that its irrigating canal remained common property. The settlement was uninterruptedly successful, and was influential as a pioneer experiment. Anaheim was incorporated as a town in 1870; this incorporation was revoked in 1872; in 1878 the town was incorporated again; and in 1888 Anaheim received a city charter.

ANÁHUAC, a geographical district of Mexico, limited by the traditional and vaguely defined boundaries of an ancient Indian empire or confederation of that name previous to the Spanish conquest. The word is said to signify "country by the waters" in the old Aztec language; hence the theory that Anáhuac was located on the sea coast. One of the theories relating to the location of Anáhuac describes it as all the plateau region of Mexico, with an area equal to three-fourths of the republic, and extending between the eastern and western coast ranges from Rio Grande to the isthmus of Tehuantepec. A more exact description, however, limits it to the great plateau valley in which the city of Mexico is located, between 18° 40′ and 20° 30′ N. lat., about 200 m. long by 75 m. wide, with an average elevation of 7500 ft., and a mean temperature of 62°. The accepted meaning of the name fits this region as well as any on the sea coast, as the lakes of this valley formerly covered one-tenth of its area. The existence of the name in southern Utah, United States, and on the gulf coast of Mexico, has given rise to theories of other locations and wider bounds for the old Indian empire

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[1] Steph. Byz. (*sub* Τύρος) says that Arrian calls Anatha Τύρος.

[2] Texeira (1610) says that "Anna" lay on both banks of the river, and so Della Valle (i. 671).

[3] *Ass. Deeds and Doc.* nos. 23, 168, 228, 385. The characters used are DIŠ TU, which may mean Ana-tu.

ANALCITE, a commonly occurring mineral of the zeolite group. It crystallizes in the cubic system, the common form being the icositetrahedron (211), either alone (fig. 1) or in combination with the cube (100); sometimes the faces of the cube predominate in size, and its corners are each replaced by three small triangular faces representing the icositetrahedron (fig. 2). Although cubic in form, analcite usually shows feeble double refraction, and is thus optically anomalous. This feature of analcite has been much studied, Sir David Brewster in 1826 being the earliest investigator. Crystals of analcite are often perfectly colourless and transparent with a brilliant glassy lustre, but some are opaque and white or pinkish-white. The hardness of the mineral is 5 to 5½, and its specific gravity is 2·25. Chemically, analcite is a hydrated sodium and aluminium silicate, $NaAlSi_2O_6+H_2O$; small amounts of the sodium being sometimes replaced by calcium or by potassium. The water of crystallization is readily expelled by heat, with modification of the optical characters of the crystals. Before the blowpipe the mineral readily fuses with intumescence to a colourless glass. It is decomposed by acids with separation of gelatinous silica.

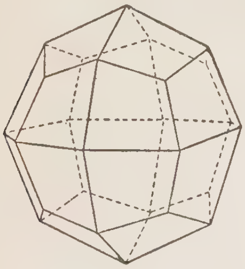
FIG. 1.

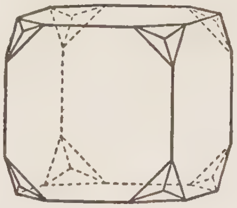
FIG. 2.

Analcite usually occurs, associated with other zeolitic minerals, lining amygdaloidal cavities in basic volcanic rocks such as basalt and melaphyre, and especially in such as have undergone alteration by weathering; the Tertiary basalts of the north of Ireland frequently contain cavities lined with small brilliant crystals of analcite. Larger crystals of the same kind are found in the basalt of the Cyclopean Islands (Scogli de' Ciclopi or Faraglioni) N.E. of Catania, Sicily. Large opaque crystals of the pinkish-white colour are found in cavities in melaphyre at the Seisser Alpe near Schlern in southern Tirol. In all such cases the mineral is clearly of secondary origin, but of late years another mode of occurrence has been recognized, analcite having been found as a primary constituent of certain igneous rocks such as monchiquite and some basalts. The irregular grains, of which it has the form, had previously been mistaken for glass.

Owing to the fact that analcite often crystallizes in cubes, it was long known as cubic zeolite or as cuboite. The name now in use was proposed in 1797 in the form analcime, by R. J. Haüy, in allusion to the weak (ἄναλκις) electrification of the mineral produced by friction. Euthallite is a compact, greenish analcite, produced by the alteration of elaeolite at various localities in the Langesund-fjord in southern Norway. Eudnophite, from the same region, was originally described as an orthorhombic mineral dimorphous with analcite, but has since been found to be identical with it. Cluthalite, from the Clyde (Clutha) valley, is an altered form of the mineral. (L. J. S.)

ANALOGY (Gr. ἀναλογία, proportion), a term signifying, (1) in general, resemblance which falls short of absolute similarity or identity. Thus by analogy, the word "loud," originally applied to sounds, is used of garments which obtrude themselves on the attention; all metaphor is thus a kind of analogy. (2) Euclid used the term for proportionate equality; but in mathematics it is now obsolete except in the phrase, "Napier's Analogies" in spherical trigonometry (see NAPIER, JOHN). (3) In grammar, it signifies similarity in the dominant characteristics of a language, derivation, orthography and so on. (4) In logic, it is used of arguments by inference from resemblances between known particulars to other particulars which are not observed. Under the name of "example" (παράδειγμα) the process is explained by Aristotle (*Prior Anal.* ii. 4) as an inference which differs from induction (*q.v.*) in having a particular, not a general, conclusion; *i.e.* if A is demonstrably like B in certain respects, it may be assumed to be like it in another, though the latter is not demonstrated. Kant and his followers state the distinction otherwise, *i.e.* induction argues from the possession of an attribute by many members of a class that all members of the class possess it, while analogy argues that, because A has some of B's qualities, it must have them all (cf. Sir Wm. Hamilton, *Lectures on Logic*, ii. 165-174, for a slight modification of this view). J. S. Mill very properly rejects this artificial distinction, which is in practice no distinction at all; he regards induction and analogy as generically the same, though differing in the demonstrative validity of their evidence, *i.e.* induction proceeds on the basis of scientific, causal connexion, while analogy, in absence of proof, temporarily accepts a probable hypothesis. In this sense, analogy may obviously have a universal conclusion. This type of inference is of the greates value in physical science, which has frequently and quite legitimately used such conclusions until a negative instance has disproved or further evidence confirmed them (for a list of typical cases see T. Fowler's edition of Bacon's *Nov. Org.* Aph. ii. 27 note). The value of such inferences depends on the nature of the resemblances on which they are based and on that of the differences which they disregard. If the resemblances are small and unimportant and the differences great and fundamental, the argument is known as "False Analogy." The subject is dealt with in Francis Bacon's *Novum Organum*, especially ii. 27 (see T. H. Fowler's notes) under the head of *Instantiae conformes sive proportionatae*. Strictly the argument by analogy is based on similarity of relations between things, not on the similarity of things, though it is, in general, extended to cover the latter. See works on Logic, *e.g.* J. S. Mill, T. H. Fowler, W. S. Jevons. For Butler's *Analogy* and its method see BUTLER, JOSEPH.

The term was used in a special sense by Kant in his phrase, "Analogies of Experience," the third and most important group in his classification of the *a priori* elements of knowledge. By it he understood the fundamental laws of pure natural science under the three heads, substantiality, causality, reciprocity (see F. Paulsen, *I. Kant*, Eng. trans. 1902, pp. 188 ff.).

ANALYSIS (Gr. ἀνὰ and λύειν, to break up into parts), in general, the resolution of a whole into its component elements; opposed to synthesis, the combining of separate elements or minor wholes into an inclusive unity. It differs from mere "disintegration" in proceeding on a definite scientific plan. In grammar, analysis is the breaking up of a sentence into subject, predicate, object, &c. (an exercise introduced into English schools by J. D. Morell about 1852); so the analysis of a book or a lecture is a synopsis of the main points. The chief technical uses of the word, which retains practically the same meaning in all the sciences, are in (1) philosophy, (2) mathematics, (3) chemistry.

(1) Logical analysis is the process of examining into the connotation of a concept or idea, and separating the attributes from the whole and each other. It, therefore, does not increase knowledge, but merely clarifies and tests it. In this sense Kant distinguished an analytic from a synthetic judgment, as one in which the predicate is involved in the essence of the subject. Such judgments are also known as verbal, as opposed to real or ampliative judgments. The processes of synthesis and analysis though formally contradictory are practically supplementary; thus to analyse the connotation is to synthesize the denotation of a term, and vice versa; the process of knowledge involves the two methods, analysis being the corrective of synthetic empiricism. In a wider sense the whole of formal logic is precisely the analysis of the laws of thought. Analytical psychology is distinguished from genetic and empirical psychology inasmuch as it proceeds by the method of introspective investigation of mental phenomena instead of by physiological or psycho-physical experiment. For the relation between analysis and synthesis on the one hand, and deduction and induction on the other, see INDUCTION.

(2) In mathematics, analysis has two distinct meanings, conveniently termed ancient and modern. Ancient analysis,

as described by Pappus, related chiefly to geometrical problems, and is the method of reasoning from the solution, as taken for granted, to consequences which are known to be true, whereas synthesis reasons from known data to the solution. (See Geometry.)

Modern analysis is practically coeval with Descartes, the founder of "analytical geometry," although the calculus of general quantities had previously been termed analysis. Many mathematical subjects are now included under this name, and are treated in the following articles:—Geometry, Analytical; Infinitesimal Calculus; Differential Equation; Variations, Calculus of; Curve; Surface; Function; Spherical Harmonics; Series; Fourier's Series; Groups, Theory of; Probability.

(3) In Chemistry, the word analysis was introduced by Robert Boyle to denote the determination of the composition of substances. (See Chemistry, *Analytical*).

ANALYST, in modern times, a person professionally skilled in chemical analysis. He may be called upon, in the discharge of his profession, to analyse a wide range of substances. Apart from private practitioners and those engaged in large manufacturing concerns, analysts employed by public bodies are termed public analysts. In most large manufacturing establishments there is usually a staff of analysts, whose duty it is primarily to exercise constant watchfulness over the processes of manufacture, to test the purity of the substances used, as well as that of the final products. The services of analysts are constantly required in judicial enquiries, sometimes in purely criminal cases, sometimes in civil proceedings, such as offences against the customs or excise or under the various British Food and Drugs Acts. In the case of criminal proceedings, the services of the official analyst attached to the British Home Office are employed. The inland revenue department has a laboratory at Somerset House, with a staff of analysts, who are engaged in analysing for excise and other purposes. Under the Fertilizers and Feeding Stuffs Act 1893, the Board of Agriculture employs an agricultural chemist, whose duty is the analysis of fertilizers and feeding stuffs.

A "public analyst" is an analyst appointed by a local authority for the purposes of the Sale of Food and Drugs Acts. He must be possessed of competent medical, chemical and microscopical knowledge to analyse all articles of food and drink (see Adulteration).

ANALYTIC (the adjective of "analysis," *q.v.*), according with, or consisting in, the method of separating a whole into its parts, the opposite of synthetic. For analytic *chemistry*, analytic *language*, &c., see the articles under the noun-headings. The title of ἀναλυτικά or *Analytics* was given by Aristotle to his treatises on logic.

ANAMALAI HILLS, a range of mountains in southern India, in the Coimbatore district of Madras, lying between 10° 13′ and 10° 31′ N. lat., and between 76° 52′ and 77° 23′ E. long., forming a portion of the Western Ghats, after this range has been broken by the Palghat Pass, south of the Nilgiris. They really consist of a forest-clad and grassy tableland, with summits rising about 8000 ft.; the Anaimudi mountain, which is the highest in southern India, having an altitude of 8850 ft. Their geological formation is metamorphic gneiss, veined with felspar and quartz, and interspersed with reddish porphyrite. The lower slopes yield valuable teak and other timber; and some land has been taken up for coffee planting. The only inhabitants are a few wild tribes who live by hunting and collecting jungle produce.

ANAMORPHOSIS (a Gr. word, derived from ἀνά, back, and μορφή, form: the second *o* in the Greek is long, but in English the pronunciation varies), a deformation or distortion of appearance; in drawing, the representation of an object as seen, for instance, altered by reflexion in a mirror; in botany, *e.g.* in the case of fungi or lichens, an abnormal change giving the appearance of a different species.

'ANAN BEN DAVID, a Persian Jew of the 8th century, and founder within Judaism of the sect of Qaraites (Karaites) which set itself in opposition to the rabbinic tradition. 'Anan was an unsuccessful candidate for the dignity of Exilarch, and thus his opposition to the rabbanite Jews was political as well as theological. His secession occurred at a moment when the time was ripe for a reaction against rabbinism, and 'Anan became the rallying point for many opponents of tradition. (See Qaraites.)

ĀNANDA, one of the principal disciples of the Buddha (*q.v.*). He has been called the beloved disciple of the Buddhist story. He was the first cousin of the Buddha, and was devotedly attached to him. Ānanda entered the Order in the second year of the Buddha's ministry, and became one of his personal attendants, accompanying him on most of his wanderings and being the interlocutor in many of the recorded dialogues. He is the subject of a special panegyric delivered by the Buddha just before his death (*Book of the Great Decease*, v. 38); but it is the panegyric of an unselfish man, kindly, thoughtful for others and popular; not of the intellectual man, versed in the theory and practice of the Buddhist system of self-culture. So in the long list of the disciples given in the *Anguttara* (i. xiv.) where each of them is declared to be the chief in some gift, Ānanda is mentioned five times (which is more often than any other), but it is as chief in conduct and in service to others and in power of memory, not in any of the intellectual powers so highly prized in the community. This explains why he had not attained to arahatship; and in the earliest account of the convocation said to have been held by five hundred of the principal disciples immediately after the Buddha's death, he was the only one who was not an arahat (*Cullavagga*, book xi.). In later accounts this incident is explained away. Thirty-three verses ascribed to Ānanda are preserved in a collection of lyrics by the principal male and female members of the order (*Thera Gāthā*, 1017–1050). They show a gentle and reverent but simple spirit. (T. W. R. D.)

ANANIAS, the Gr. form of Hananiah, or Ananiah, a name occurring several times in the Old Testament and Apocrypha (Neh. iii. 23, 1 Ch. xxv. 23, Tob. v. 12. &c.), and three times in the New Testament. Special mention need be made only of the bearers of the name in the New Testament. (1) A member of the first Christian community, who, with his wife Sapphira, was miraculously punished by Peter with sudden death for hypocrisy and falsehood (Acts v. 1–10; cf. Josh. vii. 1 ff.). (2) A disciple at Damascus who figures in the story of the conversion and baptism of Paul (Acts ix. 10–17, xxii. 12–16). (3) Son of Nedebaios (Jos. *Ant.* xx. 5. 2), a high priest who presided during the trial of Paul at Jerusalem and Caesarea (Acts xxiii. 2, xxiv. 1-5). He officiated as high priest from about A.D. 47 to 59. Quadratus, governor of Syria, accused him of being responsible for acts of violence. He was sent to Rome for trial (A.D. 52), but was acquitted by the emperor Claudius. Being a friend of the Romans, he was murdered by the people at the beginning of the Jewish war.

ANANTAPUR, a town and district of India, in the Madras presidency. The town has a station on the Madras railway, 62 m. S.E. from Bellary. Pop. (1901) 7938.

The district of Anantapur was constituted in 1882 out of the unwieldy district of Bellary. It has an area of 5557 sq. m., and in its northern and central portions is a high plateau, generally undulating, with large granite rocks or low hill ranges rising here and there above its surface. In the southern portion of the district the surface is more hilly, the plateau there rising to 2600 ft. above the sea. There is a remarkable fortress rock at Gooty, 2171 ft. above the sea, and a similar but larger rock at Penukonda, with an elevation equal to that of Bangalore, about 3100 ft. Gooty fortress was a stronghold of the Mahrattas, but was taken from them by Hyder Ali. In 1789 it was ceded by Tippoo to the nizam, and in 1800 the nizam ceded the district of Anantapur with others to the British in payment for a subsidiary British force. The population in 1901 was 788,254, showing an increase of 8 % in the decade. The principal crops are millet, rice, other food grains, pulse, oil seeds and cotton. There are several steam factories for pressing cotton. Two railways traverse the district.

ANAPA, a seaport town of Russia, in the government of Kuban, on the N. coast of the Black Sea, 45 m. S.E. from the Strait of Yenikale or Kerch, giving access to the Sea of Azov. It was originally built in 1781 as a frontier fortress of the Turks against Russia. Three times captured by the Russians, in 1791, 1807 and 1828, and twice restored by them, in 1792 and 1812, it was finally left in their hands by the treaty of Adrianople in 1829. During the Crimean War its fortifications were destroyed (1855) by the Russians themselves. Pop. (1897) 6676.

ANAPAEST (from Gr. *ἀνάπαιστος*, reversed), a metrical foot consisting of three syllables, the first two short and the third long and accented; so called as the reverse of a dactyl, which has the first a long syllable, followed by two short ones. An anapaestic verse is one which only contains, or is mostly made up of, anapaestic feet.

ANARCHISM (from the Gr. *ἀν-*, and *ἀρχή*, contrary to authority), the name given to a principle or theory of life and conduct under which society is conceived without government—harmony in such a society being obtained, not by submission to law, or by obedience to any authority, but by free agreements concluded between the various groups, territorial and professional, freely constituted for the sake of production and consumption, as also for the satisfaction of the infinite variety of needs and aspirations of a civilized being. In a society developed on these lines, the voluntary associations which already now begin to cover all the fields of human activity would take a still greater extension so as to substitute themselves for the state in all its functions. They would represent an interwoven network, composed of an infinite variety of groups and federations of all sizes and degrees, local, regional, national and international—temporary or more or less permanent—for all possible purposes: production, consumption and exchange, communications, sanitary arrangements, education, mutual protection, defence of the territory, and so on; and, on the other side, for the satisfaction of an ever-increasing number of scientific, artistic, literary and sociable needs. Moreover, such a society would represent nothing immutable. On the contrary—as is seen in organic life at large—harmony would (it is contended) result from an ever-changing adjustment and readjustment of equilibrium between the multitudes of forces and influences, and this adjustment would be the easier to obtain as none of the forces would enjoy a special protection from the state.

If, it is contended, society were organized on these principles, man would not be limited in the free exercise of his powers in productive work by a capitalist monopoly, maintained by the state; nor would he be limited in the exercise of his will by a fear of punishment, or by obedience towards individuals or metaphysical entities, which both lead to depression of initiative and servility of mind. He would be guided in his actions by his own understanding, which necessarily would bear the impression of a free action and reaction between his own self and the ethical conceptions of his surroundings. Man would thus be enabled to obtain the full development of all his faculties, intellectual, artistic and moral, without being hampered by overwork for the monopolists, or by the servility and inertia of mind of the great number. He would thus be able to reach full *individualization*, which is not possible either under the present system of *individualism*, or under any system of state-socialism in the so-called *Volkstaat* (popular state).

The Anarchist writers consider, moreover, that their conception is not a Utopia, constructed on the *a priori* method, after a few desiderata have been taken as postulates. It is derived, they maintain, from an *analysis of tendencies* that are at work already, even though state socialism may find a temporary favour with the reformers. The progress of modern technics, which wonderfully simplifies the production of all the necessaries of life; the growing spirit of independence, and the rapid spread of free initiative and free understanding in all branches of activity—including those which formerly were considered as the proper attribution of church and state—are steadily reinforcing the no-government tendency.

As to their economical conceptions, the Anarchists, in common with all Socialists, of whom they constitute the left wing, maintain that the now prevailing system of private ownership in land, and our capitalist production for the sake of profits, represent a monopoly which runs against both the principles of justice and the dictates of utility. They are the main obstacle which prevents the successes of modern technics from being brought into the service of all, so as to produce general well-being. The Anarchists consider the wage-system and capitalist production altogether as an obstacle to progress. But they point out also that the state was, and continues to be, the chief instrument for permitting the few to monopolize the land, and the capitalists to appropriate for themselves a quite disproportionate share of the yearly accumulated surplus of production. Consequently, while combating the present monopolization of land, and capitalism altogether, the Anarchists combat with the same energy the state, as the main support of that system. Not this or that special form, but the state altogether, whether it be a monarchy or even a republic governed by means of the *referendum*.

The state organization, having always been, both in ancient and modern history (Macedonian empire, Roman empire, modern European states grown up on the ruins of the autonomous cities), the instrument for establishing monopolies in favour of the ruling minorities, cannot be made to work for the destruction of these monopolies. The Anarchists consider, therefore, that to hand over to the state all the main sources of economical life—the land, the mines, the railways, banking, insurance, and so on—as also the management of all the main branches of industry, in addition to all the functions already accumulated in its hands (education, state-supported religions, defence of the territory, &c.), would mean to create a new instrument of tyranny. State capitalism would only increase the powers of bureaucracy and capitalism. True progress lies in the direction of decentralization, both *territorial* and *functional*, in the development of the spirit of local and personal initiative, and of free federation from the simple to the compound, *in lieu* of the present hierarchy from the centre to the periphery.

In common with most Socialists, the Anarchists recognize that, like all evolution in nature, the slow evolution of society is followed from time to time by periods of accelerated evolution which are called revolutions; and they think that the era of revolutions is not yet closed. Periods of rapid changes will follow the periods of slow evolution, and these periods must be taken advantage of—not for increasing and widening the powers of the state, but for reducing them, through the organization in every township or commune of the local groups of producers and consumers, as also the regional, and eventually the international, federations of these groups.

In virtue of the above principles the Anarchists refuse to be party to the present state organization and to support it by infusing fresh blood into it. They do not seek to constitute, and invite the working men not to constitute, political parties in the parliaments. Accordingly, since the foundation of the International Working Men's Association in 1864–1866, they have endeavoured to promote their ideas directly amongst the labour organizations and to induce those unions to a direct struggle against capital, without placing their faith in parliamentary legislation.

The Historical Development of Anarchism.—The conception of society just sketched, and the tendency which is its dynamic expression, have always existed in mankind, in opposition to the governing hierarchic conception and tendency—now the one and now the other taking the upper hand at different periods of history. To the former tendency we owe the evolution, by the masses themselves, of those institutions—the clan, the village community, the gild, the free medieval city—by means of which the masses resisted the encroachments of the conquerors and the power-seeking minorities. The same tendency asserted itself with great energy in the great religious movements of medieval times, especially in the early movements of the reform and its forerunners. At the same time it evidently found its expression in the writings of some thinkers, since the times of Lao-tsze, although, owing to its non-scholastic and popular origin, it obviously found less sympathy among the scholars than the opposed tendency.

As has been pointed out by Prof. Adler in his *Geschichte des*

Sozialismus und Kommunismus, Aristippus (b. *c.* 430 B.C.), one of the founders of the Cyrenaic school, already taught that the wise must not give up their liberty to the state, and in reply to a question by Socrates he said that he did not desire to belong either to the governing or the governed class. Such an attitude, however, seems to have been dictated merely by an Epicurean attitude towards the life of the masses.

The best exponent of Anarchist philosophy in ancient Greece was Zeno (342–267 or 270 B.C.), from Crete, the founder of the Stoic philosophy, who distinctly opposed his conception of a free community without government to the state-Utopia of Plato. He repudiated the omnipotence of the state, its intervention and regimentation, and proclaimed the sovereignty of the moral law of the individual—remarking already that, while the necessary instinct of self-preservation leads man to egotism, nature has supplied a corrective to it by providing man with another instinct—that of sociability. When men are reasonable enough to follow their natural instincts, they will unite across the frontiers and constitute the Cosmos. They will have no need of law-courts or police, will have no temples and no public worship, and use no money—free gifts taking the place of the exchanges. Unfortunately, the writings of Zeno have not reached us and are only known through fragmentary quotations. However, the fact that his very wording is similar to the wording now in use, shows how deeply is laid the tendency of human nature of which he was the mouth-piece.

In medieval times we find the same views on the state expressed by the illustrious bishop of Alba, Marco Girolamo Vida, in his first dialogue *De dignitate reipublicae* (Ferd. Cavalli, in *Mem. dell' Istituto Veneto*, xiii.; Dr E. Nys, *Researches in the History of Economics*). But it is especially in several early Christian movements, beginning with the 9th century in Armenia, and in the preachings of the early Hussites, particularly Chojecki, and the early Anabaptists, especially Hans Denk (cf. Keller, *Ein Apostel der Wiedertäufer*), that one finds the same ideas forcibly expressed—special stress being laid of course on their moral aspects.

Rabelais and Fénelon, in their Utopias, have also expressed similar ideas, and they were also current in the 18th century amongst the French Encyclopaedists, as may be concluded from separate expressions occasionally met with in the writings of Rousseau, from Diderot's *Preface* to the *Voyage* of Bougainville, and so on. However, in all probability such ideas could not be developed then, owing to the rigorous censorship of the Roman Catholic Church.

These ideas found their expression later during the great French Revolution. While the Jacobins did all in their power to centralize everything in the hands of the government, it appears now, from recently published documents, that the masses of the people, in their municipalities and "sections," accomplished a considerable constructive work. They appropriated for themselves the election of the judges, the organization of supplies and equipment for the army, as also for the large cities, work for the unemployed, the management of charities, and so on. They even tried to establish a direct correspondence between the 36,000 communes of France through the intermediary of a special board, outside the National Assembly (cf. Sigismund Lacroix, *Actes de la commune de Paris*).

It was Godwin, in his *Enquiry concerning Political Justice* (2 vols., 1793), who was the first to formulate the political and economical conceptions of Anarchism, even though he did not give that name to the ideas developed in his remarkable work. Laws, he wrote, are not a product of the wisdom of our ancestors: they are the product of their passions, their timidity, their jealousies and their ambition. The remedy they offer is worse than the evils they pretend to cure. If and only if all laws and courts were abolished, and the decisions in the arising contests were left to reasonable men chosen for that purpose, real justice would gradually be evolved. As to the state, Godwin frankly claimed its abolition. A society, he wrote, can perfectly well exist without any government: only the communities should be small and perfectly autonomous. Speaking of property, he stated that the rights of every one "to every substance capable of contributing to the benefit of a human being" must be regulated by justice alone: the substance must go "to him who most wants it." His conclusion was Communism. Godwin, however, had not the courage to maintain his opinions. He entirely rewrote later on his chapter on property and mitigated his Communist views in the second edition of *Political Justice* (8vo, 1796).

Proudhon was the first to use, in 1840 (*Qu'est-ce que la propriété?* first memoir), the name of Anarchy with application to the no-government state of society. The name of "Anarchists" had been freely applied during the French Revolution by the Girondists to those revolutionaries who did not consider that the task of the Revolution was accomplished with the overthrow of Louis XVI., and insisted upon a series of economical measures being taken (the abolition of feudal rights without redemption, the return to the village communities of the communal lands enclosed since 1669, the limitation of landed property to 120 acres, progressive income-tax, the national organization of exchanges on a just value basis, which already received a beginning of practical realization, and so on).

Now Proudhon advocated a society without government, and used the word Anarchy to describe it. Proudhon repudiated, as is known, all schemes of Communism, according to which mankind would be driven into communistic monasteries or barracks, as also all the schemes of state or state-aided Socialism which were advocated by Louis Blanc and the Collectivists. When he proclaimed in his first memoir on property that "Property is theft," he meant only property in its present, Roman-law, sense of "right of use and abuse"; in property-rights, on the other hand, understood in the limited sense of *possession*, he saw the best protection against the encroachments of the state. At the same time he did not want violently to dispossess the present owners of land, dwelling-houses, mines, factories and so on. He preferred to attain the same end by rendering capital incapable of earning interest; and this he proposed to obtain by means of a national bank, based on the mutual confidence of all those who are engaged in production, who would agree to exchange among themselves their produces at cost-value, by means of labour cheques representing the hours of labour required to produce every given commodity. Under such a system, which Proudhon described as "Mutuellisme," all the exchanges of services would be strictly equivalent. Besides, such a bank would be enabled to lend money without interest, levying only something like 1 %, or even less, for covering the cost of administration. Every one being thus enabled to borrow the money that would be required to buy a house, nobody would agree to pay any more a yearly rent for the use of it. A general "social liquidation" would thus be rendered easy, without violent expropriation. The same applied to mines, railways, factories and so on.

In a society of this type the state would be useless. The chief relations between citizens would be based on free agreement and regulated by mere account keeping. The contests might be settled by arbitration. A penetrating criticism of the state and all possible forms of government, and a deep insight into all economic problems, were well-known characteristics of Proudhon's work.

It is worth noticing that French mutualism had its precursor in England, in William Thompson, who began by mutualism before he became a Communist, and in his followers John Gray (*A Lecture on Human Happiness*, 1825; *The Social System*, 1831) and J. F. Bray (*Labour's Wrongs and Labour's Remedy*, 1839). It had also its precursor in America. Josiah Warren, who was born in 1798 (cf. W. Bailie, *Josiah Warren, the First American Anarchist*, Boston, 1900), and belonged to Owen's "New Harmony," considered that the failure of this enterprise was chiefly due to the suppression of individuality and the lack of initiative and responsibility. These defects, he taught, were inherent to every scheme based upon authority and the community of goods. He advocated, therefore, complete individual liberty. In 1827 he opened in Cincinnati a little country store which was the first "Equity Store," and which the people called

"Time Store," because it was based on labour being exchanged hour for hour in all sorts of produce. "Cost—the limit of price," and consequently "no interest," was the motto of his store, and later on of his "Equity Village," near New York, which was still in existence in 1865. Mr Keith's "House of Equity" at Boston, founded in 1855, is also worthy of notice.

While the economical, and especially the mutual-banking, ideas of Proudhon found supporters and even a practical application in the United States, his political conception of Anarchy found but little echo in France, where the Christian Socialism of Lamennais and the Fourierists, and the State Socialism of Louis Blanc and the followers of Saint-Simon, were dominating. These ideas found, however, some temporary support among the left-wing Hegelians in Germany, Moses Hess in 1843, and Karl Grün in 1845, who advocated Anarchism. Besides, the authoritarian Communism of Wilhelm Weitling having given origin to opposition amongst the Swiss working men, Wilhelm Marr gave expression to it in the 'forties.

On the other side, Individualist Anarchism found, also in Germany, its fullest expression in Max Stirner (Kaspar Schmidt), whose remarkable works (*Der Einzige und sein Eigenthum* and articles contributed to the *Rheinische Zeitung*) remained quite overlooked until they were brought into prominence by John Henry Mackay.

Prof. V. Basch, in a very able introduction to his interesting book, *L'Individualisme anarchiste*: *Max Stirner* (1904), has shown how the development of the German philosophy from Kant to Hegel, and "the absolute" of Schelling and the *Geist* of Hegel, necessarily provoked, when the anti-Hegelian revolt began, the preaching of the same "absolute" in the camp of the rebels. This was done by Stirner, who advocated, not only a complete revolt against the state and against the servitude which authoritarian Communism would impose upon men, but also the full liberation of the individual from all social and moral bonds—the rehabilitation of the "I," the supremacy of the individual, complete "a-moralism," and the "association of the egotists." The final conclusion of that sort of Individual Anarchism has been indicated by Prof. Basch. It maintains that the aim of all superior civilization is, not to permit *all* members of the community to develop in a normal way, but to permit certain better endowed individuals "fully to develop," even at the cost of the happiness and the very existence of the mass of mankind. It is thus a return towards the most common individualism, advocated by all the would-be superior minorities, to which indeed man owes in his history precisely the state and the rest, which these individualists combat. Their individualism goes so far as to end in a negation of their own starting-point,—to say nothing of the impossibility for the individual to attain a really full development in the conditions of oppression of the masses by the "beautiful aristocracies." His development would remain uni-lateral. This is why this direction of thought, notwithstanding its undoubtedly correct and useful advocacy of the full development of each individuality, finds a hearing only in limited artistic and literary circles.

Anarchism in the International Working Men's Association.—A general depression in the propaganda of all fractions of Socialism followed, as is known, after the defeat of the uprising of the Paris working men in June 1848 and the fall of the Republic. All the Socialist press was gagged during the reaction period, which lasted fully twenty years. Nevertheless, even Anarchist thought began to make some progress, namely in the writings of Bellegarrique (*Cœurderoy*), and especially Joseph Déjacque (*Les Lazaréennes*, *L'Humanisphère*, an Anarchist-Communist Utopia, lately discovered and reprinted). The Socialist movement revived only after 1864, when some French working men, all "mutualists," meeting in London during the Universal Exhibition with English followers of Robert Owen, founded the International Working Men's Association. This association developed very rapidly and adopted a policy of direct economical struggle against capitalism, without interfering in the political parliamentary agitation, and this policy was followed until 1871. However, after the Franco-German War, when the International Association was prohibited in France after the uprising of the Commune, the German working men, who had received manhood suffrage for elections to the newly constituted imperial parliament, insisted upon modifying the tactics of the International, and began to build up a Social-Democratic political party. This soon led to a division in the Working Men's Association, and the Latin federations, Spanish, Italian, Belgian and Jurassic (France could not be represented), constituted among themselves a Federal union which broke entirely with the Marxist general council of the International. Within these federations developed now what may be described as *modern Anarchism*. After the names of "Federalists" and "Anti-authoritarians" had been used for some time by these federations the name of "Anarchists," which their adversaries insisted upon applying to them, prevailed, and finally it was revindicated.

Bakunin (*q.v.*) soon became the leading spirit among these Latin federations for the development of the principles of Anarchism, which he did in a number of writings, pamphlets and letters. He demanded the complete abolition of the state, which—he wrote—is a product of religion, belongs to a lower state of civilization, represents the negation of liberty, and spoils even that which it undertakes to do for the sake of general well-being. The state was an historically necessary evil, but its complete extinction will be, sooner or later, equally necessary. Repudiating all legislation, even when issuing from universal suffrage, Bakunin claimed for each nation, each region and each commune, full autonomy, so long as it is not a menace to its neighbours, and full independence for the individual, adding that one becomes really free only when, and in proportion as, all others are free. Free federations of the communes would constitute free nations.

As to his economical conceptions, Bakunin described himself, in common with his Federalist comrades of the International (César De Paepe, James Guillaume Schwitzguébel), a "Collectivist Anarchist"—not in the sense of Vidal and Pecqueur in the 'forties, or of their modern Social-Democratic followers, but to express a state of things in which all necessaries for production are owned in common by the Labour groups and the free communes, while the ways of retribution of labour, Communist or otherwise, would be settled by each group for itself. Social revolution, the near approach of which was foretold at that time by all Socialists, would be the means of bringing into life the new conditions.

The Jurassic, the Spanish, and the Italian federations and sections of the International Working Men's Association, as also the French, the German and the American Anarchist groups, were for the next years the chief centres of Anarchist thought and propaganda. They refrained from any participation in parliamentary politics, and always kept in close contact with the Labour organizations. However, in the second half of the 'eighties and the early 'nineties of the 19th century, when the influence of the Anarchists began to be felt in strikes, in the 1st of May demonstrations, where they promoted the idea of a general strike for an eight hours' day, and in the anti-militarist propaganda in the army, violent prosecutions were directed against them, especially in the Latin countries (including physical torture in the Barcelona Castle) and the United States (the execution of five Chicago Anarchists in 1887). Against these prosecutions the Anarchists retaliated by acts of violence which in their turn were followed by more executions from above, and new acts of revenge from below. This created in the general public the impression that violence is the substance of Anarchism, a view repudiated by its supporters, who hold that in reality violence is resorted to by all parties in proportion as their open action is obstructed by repression, and exceptional laws render them outlaws. (Cf. *Anarchism and Outrage*, by C. M. Wilson, and *Report of the Spanish Atrocities Committee*, in "Freedom Pamphlets"; *A Concise History of the Great Trial of the Chicago Anarchists*, by Dyer Lum (New York, 1886); *The Chicago Martyrs: Speeches*, &c.).[1]

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[1] It is important to remember that the term "Anarchist" is inevitably rather loosely used in public, in connexion with the authors

Anarchism continued to develop, partly in the direction of Proudhonian "Mutuellisme," but chiefly as Communist-Anarchism, to which a third direction, Christian-Anarchism, was added by Leo Tolstoy, and a fourth, which might be ascribed as literary-Anarchism, began amongst some prominent modern writers.

The ideas of Proudhon, especially as regards mutual banking, corresponding with those of Josiah Warren, found a considerable following in the United States, creating quite a school, of which the main writers are Stephen Pearl Andrews, William Grene, Lysander Spooner (who began to write in 1850, and whose unfinished work, *Natural Law*, was full of promise), and several others, whose names will be found in Dr Nettlan's *Bibliographie de l'anarchie*.

A prominent position among the Individualist Anarchists in America has been occupied by Benjamin R. Tucker, whose journal *Liberty* was started in 1881 and whose conceptions are a combination of those of Proudhon with those of Herbert Spencer. Starting from the statement that Anarchists are egotists, strictly speaking, and that every group of individuals, be it a secret league of a few persons, or the Congress of the United States, has the right to oppress all mankind, provided it has the power to do so, that equal liberty for all and absolute equality ought to be the law, and "mind every one your own business" is the unique moral law of Anarchism, Tucker goes on to prove that a general and thorough application of these principles would be beneficial and would offer no danger, because the powers of every individual would be limited by the exercise of the equal rights of all others. He further indicated (following H. Spencer) the difference which exists between the encroachment on somebody's rights and resistance to such an encroachment; between domination and defence: the former being equally condemnable, whether it be encroachment of a criminal upon an individual, or the encroachment of one upon all others, or of all others upon one; while resistance to encroachment is defensible and necessary. For their self-defence, both the citizen and the group have the right to any violence, including capital punishment. Violence is also justified for enforcing the duty of keeping an agreement. Tucker thus follows Spencer, and, like him, opens (in the present writer's opinion) the way for reconstituting under the heading of "defence" all the functions of the state. His criticism of the present state is very searching, and his defence of the rights of the individual very powerful. As regards his economical views B. R. Tucker follows Proudhon.

The Individualist Anarchism of the American Proudhonians finds, however, but little sympathy amongst the working masses. Those who profess it—they are chiefly "intellectuals"—soon realize that the *individualization* they so highly praise is not attainable by individual efforts, and either abandon the ranks of the Anarchists, and are driven into the Liberal individualism of the classical economists, or they retire into a sort of Epicurean a-moralism, or super-man-theory, similar to that of Stirner and Nietzsche. The great bulk of the Anarchist working men prefer the Anarchist-Communist ideas which have gradually evolved out of the Anarchist Collectivism of the International Working Men's Association. To this direction belong—to name only the better

of a certain class of murderous outrages, and that the same looseness of definition often applies to the professions of "Anarchism" made by such persons. As stated above, a philosophic Anarchist would repudiate the connexion. And the general public view which regards Anarchist doctrines indiscriminately is to that extent a confusion of terms. But the following *résumé* of the chief modern so-called "Anarchist" incidents is appended for convenience in stating the facts under the heading where a reader would expect to find them.

Between 1882 and 1886, in France, Prince Kropotkin, Louise Michel and others were imprisoned. In England, Most, one of the German Anarchist leaders, founded *Die Freiheit*, and, for defending in it the assassination of Alexander II. at St Petersburg, was sentenced to eighteen months' imprisonment with hard labour. After this he moved to the United States, and re-established his paper there in New York, in May 1886. During this period there were several Anarchist congresses in the United States. In one at Albany, in 1878, the revolutionary element, led by Justus Schwab, broke away from the others; at Allegheny City, in 1879, again there was a rupture between the peaceful and the revolutionary sections. *The Voice of the People* at St Louis, the *Arbeiter Zeitung* at Chicago, and the *Anarchist* at Boston, were the organs of the revolutionary element. In 1883, at Pittsburg, a congress of twenty-eight delegates, representing twenty-two towns, drew up an address to the working men of America. The programme it proposed was as follows:—

First, Destruction of the existing class rule by all means, *i.e.* energetic, relentless, revolutionary and international action.

Second, Establishment of a free society, based upon co-operative organization of production.

Third, Free exchange of equivalent products by and between the productive organizations, without commerce and profit-mongery.

Fourth, Organization of education on a secular, scientific and equal basis for both sexes.

Fifth, Equal rights for all, without distinction of sex or race.

Sixth, Regulation of all public affairs by free contracts between the autonomous (independent) communes and associations, resting on a federalistic basis.

This, together with an appeal to the working men to organize, was published in Chicago, November 1883, by a local committee of four, representing French, Bohemian, German and English sections, the head of the last being August Spies, who was hanged in 1887 for participation in the Haymarket affair in Chicago, 4th May 1886. This affair was the culmination of a series of encounters between the Chicago working men and the police, which had covered several years. The meeting of 4th May was called by Spies and others to protest against the action of the police, by whom several working men had been killed in collisions growing out of the efforts to introduce the eight hours' day. The mayor of the city attended the meeting, but, finding it peaceful, went home. The meeting was subsequently entered by the police and commanded to disperse. A bomb was thrown, several policemen being killed and a number wounded For this crime eight men were tried in one panel and condemned seven—Spies, Parsons, Engel, Fischer, Fielden, Schwab, and Ling—to death, and one—Neebe—to imprisonment for fifteen years. The sentences on Fielden and Schwab were commuted by Governor Oglesby to imprisonment for life, on the recommendation of the presiding judge and the prosecuting attorney. Ling committed suicide in jail, and Spies, Parsons, Engel and Fischer were hanged, 11th November 1887. On 26th June 1893 an unconditional pardon was granted the survivors, Fielden, Schwab and Neebe, by Governor Altgeld. The reasons for the pardon were stated by the governor to be that, upon an examination of the records he found that the jury had not been drawn in the usual manner, but by a special bailiff, who made his own selection and had summoned a "prejudiced jury"; that the "state had never discovered who it was that threw the bomb which killed the policemen, and the evidence does not show any connexion whatever between the defendants and the man who did throw it," . . . or that this man "ever heard or read a word coming from the defendants, and consequently fails to show that he acted on any advice given by them." Judge Gary, the judge at the trial, published a defence of its procedure in the *Century Magazine*, vol. xxiii p. 803.

A number of outbreaks in later years were attributed to the propaganda of reform by revolution, like those in Spain and France in 1892, in which Ravachol was a prominent figure. In 1893 a bomb was exploded in the French Chamber of Deputies by Vaillant. The spirit of these men is well illustrated by the reply which Vaillant made to the judge who reproached him for endangering the lives of innocent men and women: "There can be no innocent bourgeois." In 1894 there was an explosion in a Parisian café, and another in a theatre at Barcelona. For the latter outrage six men were executed. President Carnot of the French Republic was assassinated by an Italian at Lyons in the same year. The empress Elizabeth of Austria was assassinated in September 1898. These events, all associated by the public with "Anarchism," led to the passage by the United States Congress of a law, in 1894, to keep out foreign Anarchists, and to deport any who might be found in the country, and also to the assemblage of an international conference in Rome, in 1898, to agree upon some plan for dealing with these revolutionists. It was proposed that their offences should no longer be classed as political, but as common-law crimes, and be made subject to extradition. The suppression of the revolutionary press and the international co-operation of the police were also suggested. The results of the conference were not, however, published; and the question of how to deal with the campaign against society fell for a while into abeyance. The attempt made by the youth Sipido on the (then) prince of Wales at Brussels in 1900 recalled attention to the subject. The acquittal of Sipido, and the failure of the Belgian government to see that justice was done in an affair of such international importance, excited considerable feeling in England, and was the occasion of a strongly-worded note from the British to the Belgian government. The murder of King Humbert of Italy in July 1900 renewed the outcry against Italian Anarchists. Even greater horror and indignation were excited by the assassination of President McKinley by Czolgoscz on the 6th of September 1901, at Buffalo, U.S.A. And a particularly dastardly attempt was made to blow up the young king and queen of Spain on their wedding-day in 1906. (Ed. *E.B.*)

known exponents of Anarchism—Elisée Reclus, Jean Grave, Sebastien Faure, Emile Pouget in France; Enrico Malatesta and Covelli in Italy; R. Mella, A. Lorenzo, and the mostly unknown authors of many excellent manifestos in Spain; John Most amongst the Germans; Spies, Parsons and their followers in the United States, and so on; while Domela Nieuwenhuis occupies an intermediate position in Holland. The chief Anarchist papers which have been published since 1880 also belong to that direction; while a number of Anarchists of this direction have joined the so-called Syndicalist movement—the French name for the non-political Labour movement, devoted to direct struggle with capitalism, which has lately become so prominent in Europe.

As one of the Anarchist-Communist direction, the present writer for many years endeavoured to develop the following ideas: to show the intimate, logical connexion which exists between the modern philosophy of natural sciences and Anarchism; to put Anarchism on a scientific basis by the study of the tendencies that are apparent now in society and may indicate its further evolution; and to work out the basis of Anarchist ethics. As regards the substance of Anarchism itself, it was Kropotkin's aim to prove that Communism—at least partial—has more chances of being established than Collectivism, especially in communes taking the lead, and that Free, or Anarchist-Communism is the only form of Communism that has any chance of being accepted in civilized societies; Communism and Anarchy are therefore two terms of evolution which complete each other, the one rendering the other possible and acceptable. He has tried, moreover, to indicate how, during a revolutionary period, a large city—if its inhabitants have accepted the idea—could organize itself on the lines of Free Communism; the city guaranteeing to every inhabitant dwelling, food and clothing to an extent corresponding to the comfort now available to the middle classes only, in exchange for a half-day's, or a five-hours' work; and how all those things which would be considered as luxuries might be obtained by every one if he joins for the other half of the day all sorts of free associations pursuing all possible aims—educational, literary, scientific, artistic, sports and so on. In order to prove the first of these assertions he has analysed the possibilities of agriculture and industrial work, both being combined with brain work. And in order to elucidate the main factors of human evolution, he has analysed the part played in history by the popular constructive agencies of mutual aid and the historical rôle of the state.

Without naming himself an Anarchist, Leo Tolstoy, like his predecessors in the popular religious movements of the 15th and 16th centuries, Chojecki, Denk and many others, took the Anarchist position as regards the state and property rights, deducing his conclusions from the general spirit of the teachings of the Christ and from the necessary dictates of reason. With all the might of his talent he made (especially in *The Kingdom of God in Yourselves*) a powerful criticism of the church, the state and law altogether, and especially of the present property laws. He describes the state as the domination of the wicked ones, supported by brutal force. Robbers, he says, are far less dangerous than a well-organized government. He makes a searching criticism of the prejudices which are current now concerning the benefits conferred upon men by the church, the state and the existing distribution of property, and from the teachings of the Christ he deduces the rule of non-resistance and the absolute condemnation of all wars. His religious arguments are, however, so well combined with arguments borrowed from a dispassionate observation of the present evils, that the anarchist portions of his works appeal to the religious and the non-religious reader alike.

It would be impossible to represent here, in a short sketch, the penetration, on the one hand, of Anarchist ideas into modern literature, and the influence, on the other hand, which the libertarian ideas of the best comtemporary writers have exercised upon the development of Anarchism. One ought to consult the ten big volumes of the *Supplement littéraire* to the paper *La révolte* and later the *Temps nouveaux*, which contain reproductions from the works of hundreds of modern authors expressing Anarchist ideas, in order to realize how closely Anarchism is connected with all the intellectual movement of our own times. J. S. Mill's *Liberty*, Spencer's *Individual versus The State*, Marc Guyau's *Morality without Obligation or Sanction*, and Fouillée's *La morale, l'art et la religion*, the works of Multatuli (E. Douwes Dekker), Richard Wagner's *Art and Revolution*, the works of Nietzsche, Emerson, W. Lloyd Garrison, Thoreau, Alexander Herzen, Edward Carpenter and so on; and in the domain of fiction, the dramas of Ibsen, the poetry of Walt Whitman, Tolstoy's *War and Peace*, Zola's *Paris and Le travail*, the latest works of Merezhkovsky, and an infinity of works of less known authors,—are full of ideas which show how closely Anarchism is interwoven with the work that is going on in modern thought in the same direction of enfranchisement of man from the bonds of the state as well as from those of capitalism.

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MODERN ANARCHISM.—The best sources are the collections of newspapers which, although compelled sometimes to change their names, were run for considerable lengths of time and are appearing still: J. Most, *Freiheit*, since 1878; *Le Révolté—La Révolte—Temps nouveaux*, since 1878; Domela Nieuwenhuis, *Recht voor Allen*, since 1878; *Freedom*, since 1886; *Le Libertaire*; Pouget's *Père Pèsuard; Réveil-Risveglio*; see Nettlan's *Bibliographie.* These papers and a great number of pamphlets are indispensable for those who intend to know anarchism, as the works published in book form are not numerous. Of the latter only a few will be mentioned:—Elisée Reclus, *Evolution and Revolution*, many editions in all languages; "Anarchy by an Anarchist," in *Contemp. Review* (May, 1884); *The Ideal and Youth* (1895); Jean Grave, *La Société au lendemain de la révolution*, many editions since 1882; *La Société mourante et l'anarchie* (1893); *L'Autonomie selon la science* (1882); *La Société future* (1895); *L'Anarchie, son but, ses moyens*; Sébastien Faure, *La Douleur universelle* (1892); A. Hamon, *Les Hommes et les théories de l'anarchie* (1893); *Psychologie de l'anarchiste-socialiste* (1895); Enrico Malatesta, *Fra Contadini*, transl. in all languages—Eng. trans. *A Talk about Anarchist Communism*, in "Freedom Pamphlets" (1891); *Anarchy* (do. 1892); *Au café*; and many other Italian pamphlets, as also several papers started at various times in Italy under different names: F. S. Merlino, *Socialismo o Monopolismo?* (1887). Pamphlets, reviews and papers by P. Gori L. Molinari, E. Covelli, &c. The manifestos of the Spanish Federations contain excellent expositions of Anarchism; cf. also, many books, pamphlets and papers by J. Lluñas y Pujals, J. Serrano y Oteiza, Ricardo Mella, A. Lorenzo, &c. John Most, the paper

Freiheit, of which a few articles only have been reprinted as pamphlets in the *Internationale Bibliothek* (" The Deistic Pestilence," " The Beast of Property " in English); *Memoiren*, 3 *fascicules*. F. Domela Nieuwenhuis, *Le Socialisme en danger* (1895); C. Malato, *Philosophie de l'anarchie* (1890); Charlotte Wilson, *Anarchism* (" Fabian Tracts," 4); *Anarchism and Violence* (" Freedom Pamphlets "); Albert Parsons, *Anarchism, its Philosophy and Scientific Basis* (Chicago, 1888); *The Chicago Martyrs: Speeches in Court*; P. Kropotkin, *Paroles d'un révolté* (1884); *Conquest of Bread* (1906) (1st French ed. in 1890); *Anarchist Morality*; *Anarchy, its Philosophy and Ideals*; *Anarchist Communism*; *The State, its Historic Rôle*; and other " Freedom Pamphlets "; *Fields, Factories and Workshops* (5th popular edition, 1807); *Mutual Aid: a Factor of Evolution* (1904). Modern Individualist Anarchists:—B. Tucker, the paper *Liberty* (1892 sqq.); *Instead of a Book, by one too busy to write one* (Boston, 1893); Dyer Lum, *Social Problems* (1883); Lysander Spooner, *Natural Law, or the Science of Justice* (Boston, 1891). Religious Anarchists:—Leo Tolstoy, *The Kingdom of God in Yourselves*; *My Faith*; *Confession*; *&c.*

The best work on Anarchism, and in fact the only one written with full knowledge of the Anarchist literature, and quite fairly, is by a German judge Dr Paul Eltzbacher, *Anarchismus* (transl. in all chief European languages, except English). Prof. Adler's article " Anarchismus " in Conrad's *Handwörterbuch der Staatswissenschaften*, vol. i., is less accurate for modern times than for the earlier periods. G. v. Zenker, *Der Anarchismus* (1895); and Prof. Edmund Bernatzik, " Der Anarchismus," in Schmoller's *Jahrbuch*, may also be mentioned—the remainder being written with absolute want of knowledge of the subject.

A most important work is the reasoned *Bibliographie de l'anarchie*, by Dr M. Nettlan (Brussels, 1897, 8vo, 294 ff.), written with a full knowledge of the subject and its immense literature. (P. A. K.)

ANASTASIUS, the name of four popes.

ANASTASIUS I., pope from 399–401. He it was who condemned the writings of Origen shortly after their translation into Latin.

ANASTASIUS II., pope from 496–498. He lived in the time of the schism of Acacius of Constantinople. He showed some tendency towards conciliation, and thus brought upon himself the lively reproaches of the author of the *Liber pontificalis*. On the strength of this tradition, Dante has placed this pope in hell.

ANASTASIUS III., pope from 911–913, was a Roman by birth. Practically nothing is recorded of him, his pontificate falling in the period when Rome was in the power of the Roman nobles.

ANASTASIUS IV. was pope from 1153 to 1154. He was a Roman named Conrad, son of Benedictus, and at the time of his election, on the 9th of July 1153, was cardinal bishop of Sabina. He had taken part in the double election of 1130, had been one of the most determined opponents of Anacletus II. and, when Innocent II. fled to France, had been left behind as his vicar in Italy. During his short pontificate, however, he played the part of a peacemaker; he came to terms with the emperor Frederick I. in the vexed question of the appointment to the see of Magdeburg and closed the long quarrel, which had raged through four pontificates, about the appointment of William Fitzherbert (d. 1154)—commonly known as St William of York—to the see of York, by sending him the pallium, in spite of the continued opposition of the powerful Cistercian order. Anastasius died on the 3rd of December 1154, and was succeeded by Cardinal Nicholas of Albano as Adrian IV.

ANASTASIUS I. (*c.* 430–518), Roman emperor, was born at Dyrrhachium not later than A.D. 430. At the time of the death of Zeno (491), Anastasius, a palace official (*silentiarius*), held a very high character, and was raised to the throne of the Roman empire of the East, through the choice of Ariadne, Zeno's widow, who married him shortly after his accession. His reign, though afterwards disturbed by foreign and intestine wars and religious distractions, commenced auspiciously. He gained the popular favour by a judicious remission of taxation, and displayed great vigour and energy in administering the affairs of the empire. The principal wars in which Anastasius was engaged were those known as the Isaurian and the Persian. The former (492–496) was stirred up by the supporters of Longinus, the brother of Zeno. The victory of Cotyaeum in 493 " broke the back " of the revolt, but a guerilla warfare continued in the Isaurian mountains for some years longer. In the war with Persia (502–505), Theodosiopolis and Amida were captured by the enemy, but the Persian provinces also suffered severely and the Romans recovered Amida. Both adversaries were exhausted when peace was made (506) on the basis of *status quo*. Anastasius afterwards built the strong fortress of Daras to hold Nisibis in check. The Balkan provinces were devastated by invasions of Slavs and Bulgarians; to protect Constantinople and its vicinity against them he built the " Anastasian wall," extending from the Propontis to the Euxine. The emperor was a convinced Monophysite, but his ecclesiastical policy was moderate; he endeavoured to maintain the principle of the *Henotikon* of Zeno and the peace of the church. It was the uncompromising attitude of the orthodox extremists, and the rebellious demonstrations of the Byzantine populace, that drove him in 512 to abandon this policy and adopt a monophysitic programme. His consequent unpopularity in the European provinces was utilized by an ambitious man, named Vitalian, to organize a dangerous rebellion, in which he was assisted by a horde of " Huns " (514–515); it was finally suppressed by a naval victory won by the general Marinus. The financial policy of Anastasius was so prudent and economical that it gained him a reputation for avarice and contributed to his unpopularity. He died in 518.

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ANASTASIUS II. (d. 721), Roman emperor in the East, whose original name was Artemius, was raised to the throne of Constantinople by the voice of the senate and people in A.D. 713, on the deposition of Philippicus, whom he had served in the capacity of secretary. The empire was threatened by the Saracens both by land and sea, and Anastasius sent an army under Leo the Isaurian, afterwards emperor, to defend Syria; adopted wise and resolute measures for the defence of his capital; attempted to reorganize the discipline of the army; and equipped and despatched to Rhodes a formidable naval force, with orders not only to resist the approach of the enemy, but to destroy their naval stores. The troops of the Opsikian province, resenting the emperor's strict measures, mutinied, slew the admiral, and proclaimed Theodosius, a person of low extraction, emperor. After a six months' siege, Constantinople was taken by Theodosius; and Anastasius, who had fled to Nicaea, was compelled to submit to the new emperor, and, retiring to Thessalonica, became a monk (716). In 721 he headed a revolt against Leo, who had succeeded Theodosius, and receiving a considerable amount of support, laid siege to Constantinople; but the enterprise failed, and Anastasius, falling into Leo's hands, was put to death by his orders.

AUTHORITIES.—Sources: Theophanes, *Chronicle*; Nicephorus Patriarches, *Breviarium*. Modern works: Gibbon, *Decline and Fall*, vol. v. (ed. Bury); Bury, *Later Roman Empire*, vol. ii.

ANASTOMOSIS (a Greek word in which the second *o* is long, from ἀναστομοῦν, to furnish with a mouth or outlet), the intercommunication between two vessels; a word used in vegetable and animal anatomy for the communication between channels (arteries and veins) containing fluid, and also for the crossing between the veins or branches of leaves, trees, insect-wings or river-connexions, and by analogy in art-design.

ANATASE, one of the three mineral forms of titanium dioxide. It is always found as small, isolated and sharply developed crystals, and like rutile, a more commonly occurring modification of titanium dioxide, it crystallizes in the tetragonal system; but, although the degree of symmetry is the same for both, there is no relation between the interfacial angles of the two minerals, except, of course, in the prism-zone of 45° and 90°. The common pyramid {111} (fig. 1) of anatase,[1] parallel to the faces of which there are perfect cleavages, has an angle over the polar edge of 82° 9′, the corresponding angle $(111):(\bar{1}11)$ of rutile being 56° 52½′. It was on account of this steeper pyramid of anatase that the mineral was named, by R. J. Haüy in 1801, from the Gr. ἀνάτασις, " extension," the vertical axis of the crystals being longer than in rutile. There are also important differences between the physical characters of anatase and rutile; the former is not quite so hard ($H=5\frac{1}{2}$-6) or dense (sp. gr.=3·9); it is optically negative, rutile being positive; and its lustre is even more strongly adamantine or metallic-adamantine than that of rutile.

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[1] For the notation see CRYSTALLOGRAPHY.

Two types or habits of anatase crystals may be distinguished. The commoner occurs as simple acute double pyramids {111} (fig. 1) with an indigo-blue to black colour and steely lustre. Crystals of this kind are abundant at Le Bourg d'Oisans in Dauphiné, where they are associated with rock-crystal, felspar and axinite in crevices in granite and mica-schist. Similar crystals, but of microscopic size, are widely distributed in sedimentary rocks, such as sandstones, clays and slates, from which they may be separated by washing away the lighter constituents of the powdered rock. Crystals of the second type have numerous pyramidal faces developed, and they are usually flatter or sometimes prismatic in habit (fig. 2); the colour is honey-yellow to brown. Such crystals closely resemble xenotime in appearance and, indeed, were for a long time supposed to belong to this species, the special name wiserine being applied to them. They occur attached to the walls of crevices in the gneisses of the Alps, the Binnenthal near Brieg in canton Valais, Switzerland, being a well-known locality.

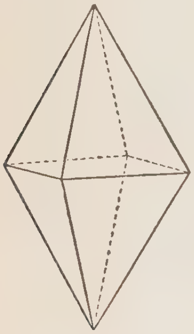
FIG. 1.

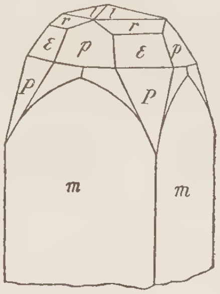

FIG. 2.

When strongly heated, anatase is converted into rutile, changing in specific gravity to 4·1; naturally occurring pseudomorphs of rutile after anatase are also known. Crystals of anatase have been artificially prepared by several methods; for instance, by the interaction of steam and titanium chloride or fluoride.

Another name commonly in use for this mineral is octahedrite, a name which, indeed, is earlier than anatase, and given because of the common (acute) octahedral habit of the crystals. Other names, now obsolete, are oisanite and dauphinite, from the well-known French locality. (L. J. S.)

ANATHEMA (from Gr. ἀνατιθέναι, to lift up), literally an offering, a thing set aside. The classical Greek form ἀνάθημα (Lat. *anathēma*) was the technical term for a gift (cf. *donarium*, *oblatio*) made to a god either in gratitude or with a view to propitiation. Thus at Athens the Thesmothetae (perhaps all the archons) made a vow that, should they break any law, they would dedicate a life-size gilt statue in the temple at Delphi. Similarly, of spoils taken in war, a part, generally a tenth, was dedicated to the god of the city (*e.g.* to Athena); to this class probably belong the trophies erected by the victors on the field of battle; sometimes a captured ship was placed upon a hill as an offering to Poseidon (Neptune). Persons who had recovered from an illness offered *anathemata* in the temples of Asclepius (Aesculapius); those who had escaped from shipwreck offered their clothes, or, if these had been lost, a lock of hair, to Neptune (Hor. *Odes*, i. 5. 13; Virg. *Aeneid*, xii. 768). The latter offering was very commonly made by young men and girls, especially young brides. Works of art of all kinds and the implements of a craftsman giving up his work were likewise dedicated. Such presents were far more common, as also more valuable, among the Greeks than among the Romans. Similar practices were prevalent, to an extent hardly realized, among the Christians up to the middle ages and even later. Just as the ancients hung their offerings on trees, temple columns and the images of the gods, so offerings were made to the Cross, to the Virgin Mary and on altars generally.

In the form *anathĕma*, the word is used in the Septuagint, the New Testament and ecclesiastical writers as the equivalent of the Hebrew *ḥerem*, which is commonly translated "accursed thing" (A.V.) or "devoted thing" (R.V.; cf. the Roman *devotio*). In Hebrew the root *ḥ-r-m* means to "set apart," "devote to Yahweh," for destruction; but in Arabic it means simply to separate or seclude (cf. "harem"). The idea of destruction or perdition is thus a secondary meaning of the word, which gradually lost its primary sense of consecration. In the New Testament, though it is used in the sense of "offering" (Luke xxi. 5), it generally signifies "separated" from the church, *i.e.* "accursed" (cf. Gal. i. 8 ff.; 1 Cor. xvi. 22), and it became the regular formula of excommunication from the time of the council of Chalcedon in 451, especially against heretics, *e.g.* in the canons of the council of Trent and those of the Vatican council of 1870. See EXCOMMUNICATION; PENANCE. The expression *maranatha* ("the Lord cometh"), which follows *anathema* in 1 Cor. xvi. 22, is often erroneously quoted as though it were an amplification of the curse.

ANATOLI, JACOB (*c.* 1194–1256), Hebrew translator from the Arabic. He was invited to Naples by the enlightened ruler Frederick II., and under this royal patronage and in association with Michael Scot, made Arabic learning accessible to Western readers. Among his most important services were translations of works by Averroes.

ANATOLIA (Gr. ἀνατολή, sunrise, *i.e.* eastern land), in ancient geography, the country east of the Aegean, *i.e.* Asia Minor. It was the name of one of the three themes (provinces) into which Phrygia was divided in the military reorganization of the East Roman empire. It is now used (by the Turks in the form (*Anadŏli*) to denote a division of the Turkish empire, practically coincident with Asia Minor (*q.v.*).

ANATOMY (Gr. ἀνατομή, from ἀνα-τέμνειν, to cut up), literally dissection or cutting asunder, a term always used to denote the study of the structure of living things; thus there is *animal anatomy* (zootomy) and *vegetable anatomy* (phytotomy). Animal anatomy may include the study of the structure of different animals, when it is called *comparative anatomy* or *animal morphology*, or it may be limited to one animal only, in which case it is spoken of as *special anatomy*. From a utilitarian point of view the study of Man is the most important division of special anatomy, and this *human anatomy* may be approached from different points of view. From that of the medical man it consists of a knowledge of the exact form, position, size and relationship of the various structures of the human body in health, and to this study the term *descriptive* or *topographical human anatomy* is given, though it is often, less happily, spoken of as *Anthropotomy*. An accurate knowledge of all the details of the human body takes years of patient observation to gain and is possessed by only a few. So intricate is man's body that only a small number of professional human anatomists are complete masters of all its details, and most of them specialize on certain parts, such as the brain, viscera, &c.; contenting themselves with a good working knowledge of the rest. Topographical anatomy must be learned by each person for himself by the repeated dissection and inspection of the dead human body. It is no more a science than a pilot's knowledge is, and, like that knowledge, must be exact and available in moments of emergency.

From the morphological point of view, however, human anatomy is a scientific and fascinating study, having for its object the discovery of the causes which have brought about the existing structure of Man, and needing a knowledge of the allied sciences of embryology or ontogeny, phylogeny and histology.

Pathological or morbid anatomy is the study of diseased organs, while sections of normal anatomy, applied to various purposes, receive special names such as medical, surgical, gynaecological, artistic and superficial anatomy. The comparison of the anatomy of different races of mankind is part of the science of physical anthropology or anthropological anatomy. In the present edition of this work the subject of anatomy is treated systematically rather than topographically. Each anatomical article contains first a description of the structures of an organ or system (such as nerves, arteries, heart, &c.), as it is found in Man; and this is followed by an account of the development or embryology and comparative anatomy or morphology, as far as vertebrate animals are concerned; but only those parts of the lower animals which are of interest in explaining Man's structure are here dealt with. The articles have a twofold purpose; first, to give enough details of man's structure to make the articles on physiology, surgery, medicine and pathology intelligible; and, secondly, to give the non-expert inquirer, or the worker in some other branch of science, the chief theories on which the modern scientific groundwork of anatomy is built.

The following separate anatomical articles will be found under their own headings:—

Alimentary canal.
Arteries.
Brain.
Coelom and serous membranes.
Connective tissues.
Diaphragm.
Ductless glands.
Ear.
Epithelial, endothelial and glandular tissues.
Eye.
Heart.
Joints.
Liver.
Lymphatic system.
Mammary gland.
Mouth and salivary glands.
Muscular system.
Nervous system.
Nerve.
Olfactory system.
Pharynx.
Pancreas.
Placenta.
Reproductive system.
Respiratory system.
Scalp.
Skeleton.
Skin and Exoskeleton.
Skull.
Spinal cord.
Teeth.
Tongue.
Urinary system.
Vascular system.
Veins.

HISTORY OF ANATOMY[1]

In tracing the history of the origin of anatomy, it may be justly said that more learning than judgment has been displayed. Some writers claim for it the highest antiquity, and pretend to find its first rudiments alternately in the animal sacrifices of the shepherd kings, the Jews and other ancient nations, and in the art of embalming as practised by the Egyptian priests.[2] Even the descriptions of wounds in the *Iliad* have been supposed adequate to prove that in the time of Homer mankind had distinct notions of the structure of the human body. Of the first it may be said that the rude information obtained by the slaughter of animals for sacrifice does not imply profound anatomical knowledge; and those who adduce the second as evidence are deceived by the language of the poet of the Trojan War, which, distinguishing certain parts by their ordinary Greek epithets, as afterwards used by Hippocrates, Galen and all anatomists, has been rather too easily supposed to prove that the poet had studied systematically the structure of the human frame.

Hippocrates.

With not much greater justice has the cultivation of anatomical knowledge been ascribed to Hippocrates, who, because he is universally allowed to be the father of medicine, has also been thought to be the creator of the science of anatomy. Of the seven individuals of the family of the Heracleidae who bore this celebrated name, the second, who was the son of Heraclides and Phenarita, and grandson of the first Hippocrates, was indeed distinguished as a physician of great observation and experience, and the first who appreciated the value of studying accurately the phenomena, effects and terminations of disease. It does not appear, however, notwithstanding the vague and general panegyrics of J. Riolan, Bartholin, D. le Clerc, and A. Portal, that the anatomical knowledge of this illustrious person was either accurate or profound. Of the works ascribed to Hippocrates, five only are genuine. Most of them were written either by subsequent authors of the same name, or by one or other of the numerous impostors who took advantage of the zealous munificence of the Ptolemies, by fabricating works under that illustrious name. Of the few which are genuine, there is none expressly devoted to anatomy; and of his knowledge on this subject the only proofs are to be found in the exposition of his physiological opinions, and his medical or surgical instructions. From these it appears that Hippocrates had some accurate notions on osteology, but that of the structure of the human body in general his ideas were at once superficial and erroneous. In his book on injuries of the head, and in that on fractures, he shows that he knew the sutures of the cranium and the relative situation of the bones, and that he had some notion of the shape of the bones in general and of their mutual connexions. Of the muscles, of the soft parts in general, and of the internal organs, his ideas are confused, indistinct and erroneous. The term φλέψ he seems, in imitation of the colloquial Greek, to have used generally to signify a blood-vessel, without being aware of the distinction of vein and artery; and the term ἀρτηρία, or air-holder, is restricted to the windpipe. He appears to have been unaware of the existence of the nervous chords; and the term *nerve* is used by him, as by Grecian authors in general, to signify a *sinew* or *tendon*. On other points his views are so much combined with peculiar physiological doctrines, that it is impossible to assign them the character of anatomical facts; and even the works in which these doctrines are contained are with little probability to be ascribed to the second Hippocrates. If, however, we overlook this difficulty, and admit what is contained in the genuine Hippocratic writings to represent at least the sum of knowledge possessed by Hippocrates and his immediate descendants, we find that he represents the brain as a gland, from which exudes a viscid fluid; that the heart is muscular and of pyramidal shape, and has two ventricles separated by a partition, the fountains of life—and two auricles, receptacles of air; that the lungs consist of five ash-coloured lobes, the substance of which is cellular and spongy, naturally dry, but refreshed by the air; and that the kidneys are glands, but possess an attractive faculty, by virtue of which the moisture of the drink is separated and descends into the bladder. He distinguishes the bowels into colon and rectum (ὁ ἀρχός).

The knowledge possessed by the second Hippocrates was transmitted in various degrees of purity to the descendants and pupils, chiefly of the family of the Heracleidae, who succeeded him. Several of these, with feelings of grateful affection, appear to have studied to preserve the written memory of his instructions, and in this manner to have contributed to form part of that collection of treatises which have long been known to the learned world under the general name of the *Hippocratic writings.* Though composed, like the genuine remains of the physician of Cos, in the Ionian dialect, all of them differ from these in being more diffuse in style, more elaborate in form, and in studying to invest their anatomical and medical matter with the fanciful ornaments of the Platonic philosophy. Hippocrates had the merit of early recognizing the value of facts apart from opinions, and of those facts especially which lead to general results; and in the few genuine writings which are now extant it is easy to perceive that he has recourse to the simplest language, expresses himself in terms which, though short and pithy, are always precise and perspicuous, and is averse to the introduction of philosophical dogmas. Of the greater part of the writings collected under his name, on the contrary the general character is verboseness, prolixity and a great tendency to speculative opinions. For these reasons, as well as for others derived from internal evidence, while the Aphorisms, the Epidemics and the works above mentioned, bear distinct marks of being the genuine remains of Hippocrates, it is impossible to regard the book Περὶ φύσιος ἀνθρώπου as entirely the composition of that physician; and it appears more reasonable to view it as the work of some one of the numerous disciples to whom the author had communicated the results of his observation, which they unwisely attempted to combine with the philosophy of the Platonic school and their own mysterious opinions.

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[1] The article in the 9th edition of this Encyclopaedia, dealing with the history of anatomy, and written by the late Dr Craigie of Edinburgh, has gained such a just reputation as the classical work on the subject in the English language that it is substantially reproduced. Here and there points of special or biographical interest are drawn attention to in the shape of footnotes, but any reader interested in the subject would do well to consult, with this article, the work of R. R. von Toply, *Studien zur Geschichte der Anatomie im Mittelalter* (Leipzig, 1898). In addition to this Professor A. Macalister has published a series of articles, under the head of "Archaeologia Anatomica," in the *Journal of Anatomy and Physiology*. These are written from a structural rather than a bibliographical point of view, and will be found under the following headings: "Atlas and Epistropheus," *J. Anat.* vol. xxxiii. p. 204; "Veins of Forearm," vol. xxxiii. p. 343; "Poupart's Ligament," vol. xxxiii. p. 493; "Tendo-Achillis," vol. xxxiii. p. 676; "Parotid," vol. xxxv. p. 117; "Trochanter," vol. xxxv. p. 269.

[2] The oldest anatomical treatise extant is an Egyptian papyrus probably written sixteen centuries before our era. It shows that the heart, vessels, liver, spleen, kidneys, ureters and bladder were recognized, and that the blood-vessels were known to come from the heart. Other vessels are described, some carrying air, some mucus, while two to the right ear are said to carry the breath of life, and two to the left ear the breath of death. See A. Macalister, "Archaeologia Anatomica," *J. Anat. and Phys.* vol. xxxii. p. 775. But see also the article OMEN.

Polybus.

Among those who aimed at this distinction, the most fortunate in the preservation of his name is Polybus, the son-in-law of the physician of Cos. This person, who must not be confounded with the monarch of Corinth, immortalized by Sophocles in the tragic story of Oedipus, is represented as a recluse, severed from the world and its enjoyments, and devoting himself to the study of anatomy and physiology, and to the composition of works on these subjects. To him has been ascribed the whole of the book on the *Nature of the Child* and most of that *On Man*; both physiological treatises interspersed with anatomical sketches. His anatomical information, with which we are specially concerned, appears to have been rude and inaccurate, like that of his preceptor. He represents the large vessels of the body as consisting of four pairs; the first proceeding from the head by the back of the neck and spinal cord to the hips, lower extremities and outer ankle; the second, consisting of the jugular vessels (αἱ σφαγίτιδες), proceeding to the loins, thighs, hams and inner ankle; the third proceeding from the temples by the neck to the *scapula* and lungs, and thence by mutual intercrossings to the spleen and left kidney, and the liver and right kidney, and finally to the rectum; and the fourth from the fore-part of the neck to the upper extremities, the fore-part of the trunk, and the organs of generation.

This specimen of the anatomical knowledge of one of the most illustrious of the Hippocratic disciples differs not essentially from that of Syennesis, the physician of Cyprus, and Diogenes, the philosopher of Apollonia, two authors for the preservation of whose opinions we are indebted to Aristotle. They may be admitted as representing the state of anatomical knowledge among the most enlightened men at that time, and they only show how rude and erroneous were their ideas on the structure of the animal body. It may indeed, without injustice, be said that the anatomy of the Hippocratic school is not only erroneous, but fanciful and imaginary in often substituting mere supposition and assertion for what ought to be matter of fact. From this censure it is impossible to exempt even the name of Plato himself, for whom some notices in the *Timaeus* on the structure of the animal body, as taught by Hippocrates and Polybus, have procured a place in the history of the science.

Aristotle.

Amidst the general obscurity in which the early history of anatomy is involved, only two leading facts may be admitted with certainty. The first is, that previous to the time of Aristotle there was no accurate knowledge of anatomy; and the second, that all that was known was derived from the dissection of the lower animals only. By the appearance of Aristotle this species of knowledge, which was hitherto acquired in a desultory and irregular manner, began to be cultivated systematically and with a definite object; and among the services which the philosopher of Stagira rendered to mankind, one of the greatest and most substantial is, that he was the founder of Comparative Anatomy, and was the first to apply its facts to the elucidation of zoology. The works of this ardent and original naturalist show that his zootomical knowledge was extensive and often accurate; and from several of his descriptions it is impossible to doubt that they were derived from frequent personal dissection. Aristotle, who was born 384 years before the Christian era, or in the first year of the 99th Olympiad, was at the age of thirty-nine requested by Philip to undertake the education of his son Alexander. During this period it is said he composed several works on anatomy, which, however, are now lost. The military expedition of his royal pupil into Asia, by laying open the animal stores of that vast and little-known continent, furnished Aristotle with the means of extending his knowledge, not only of the animal tribes, but of their structure, and of communicating more accurate and distinct notions than were yet accessible to the world. A sum of 800 talents, and the concurrent aid of numerous intelligent assistants in Greece and Asia, were intended to facilitate his researches in composing a system of zoological knowledge; but it has been observed that the number of instances in which he was thus compelled to trust to the testimony of other observers led him to commit errors in description which personal observation might have enabled him to avoid.

The first three books of the *History of Animals*, a treatise consisting of ten books, and the four books on the *Parts of Animals*, constitute the great monument of the *Aristotelian Anatomy*. From these we find that Aristotle was the first who corrected the erroneous statements of Polybus, Syennesis and Diogenes regarding the blood-vessels, which they made, as we have seen, to arise from the head and brain. These he represents to be two in number, placed before the spinal column, the larger on the right, the smaller on the left, which, he also remarks, is by some called *aorta* (ἀορτή), the first time we observe that this epithet occurs in the history. Both he represents to arise from the heart, the larger from the largest upper cavity, the smaller or aorta from the middle cavity, but in a different manner and forming a narrower canal. He also distinguishes the thick, firm and more tendinous structure of the aorta from the thin and membranous structure of vein. In describing the distribution of the latter, however, he confounds the *vena cava* and pulmonary artery, and, as might be expected, he confounds the ramifications of the former with those of the arterial tubes in general. While he represents the lung to be liberally supplied with blood, he describes the brain as an organ almost destitute of this fluid. His account of the distribution of the aorta is wonderfully correct. Though he does not notice the coeliac, and remarks that the aorta sends no direct branches to the liver and spleen, he had observed the mesenteric, the renal and the common iliac arteries. It is nevertheless singular that though he remarks particularly that the renal branches of the aorta go to the substance and not the *pelvis* (κοιλία) of the kidney, he appears to mistake the ureters for branches of the aorta. Of the nerves (νευρά) he appears to have the most confused notions. Making them arise from the heart, which he says has nerves (tendons) in its largest cavity, he represents the aorta to be a nervous or tendinous vein (νευρώδης φλέψ). By and by, afterwards saying that all the articulated bones are connected by nerves, he makes them the same as ligaments.

He distinguishes the windpipe or air-holder (ἀρτηρία) from the oesophagus, because it is placed before the latter, because food or drink passing into it causes distressing cough and suffocation, and because there is no passage from the lung to the stomach. He knew the situation and use of the epiglottis, seems to have had some indistinct notions of the larynx, represents the windpipe to be necessary to convey air to and from the lungs, and appears to have a tolerable understanding of the structure of the lungs. He repeatedly represents the heart, the shape and site of which he describes accurately, to be the origin of the blood-vessels, in opposition to those who made them descend from the head; yet, though he represents it as full of blood and the source and fountain of that fluid, and even speaks of the blood flowing from the heart to the veins, and thence to every part of the body, he says nothing of the circular motion of the blood. The diaphragm he distinguishes by the name διάζωμα, and ὑπόζωμα. With the liver and spleen, and the whole alimentary canal, he seems well acquainted. The several parts of the quadruple stomach of the ruminating animals are distinguished and named; and he even traces the relations between the teeth and the several forms of stomach, and the length or brevity, the simplicity or complication of the intestinal tube. Upon the same principle he distinguishes the *jejunum* (ἡ νῆστις), or the empty portion of the small intestines in animals (τὸ ἔντερον λεπτόν), the *caecum* (τυφλόν τι καὶ ὄγκωδες), the colon (τὸ κῶλον), and the sigmoid flexure (*στενώτερον καὶ εἱλιγμένον*). The modern epithet of *rectum* is the literal translation of his description of the straight progress (*εὐθύ*) of the bowel to the anus (*πρωκτός*). He knew the nasal cavities and the passage from the tympanal cavity of the ear to the palate, afterwards described by B. Eustachius. He distinguishes as "partes similares" those structures, such as bone, cartilage, vessels, sinews, blood, lymph, fat, flesh, which, not confined to one locality, but distributed throughout the body generally, we now term the tissues or textures, whilst he applies the term "partes dissimilares" to the regions of the head, neck, trunk and extremities.

Next to Aristotle occur the names of Diocles of Carystus and Praxagoras of Cos, the last of the family of the Asclepiadae. The latter is remarkable for being the first who distinguished the arteries from the veins, and the author of the opinion that the former were air-vessels.

Alexandrian school.

Hitherto anatomical inquiry was confined to the examination of the bodies of brute animals. We have, indeed, no testimony of the human body being submitted to examination previous to the time of Erasistratus and Herophilus; and it is vain to look for authentic facts on this point before the foundation of the Ptolemaic dynasty of sovereigns in Egypt. This event, which, as is generally known, succeeded the death of Alexander, 320 years before the Christian era, collected into one spot the scattered embers of literature and science, which were beginning to languish in Greece under a weak and distracted government and an unsettled state of society. The children of her divided states, whom domestic discord and the uncertainties of war rendered unhappy at home, wandered into Egypt, and found, under the fostering hand of the Alexandrian monarchs, the means of cultivating the sciences, and repaying with interest to the country of Thoth and Osiris the benefits which had been conferred on the infancy of Greece by Thales and Pythagoras. Alexandria became in this manner the repository of all the learning and knowledge of the civilized world; and while other nations were sinking under the effects of internal animosities and mutual dissensions, or ravaging the earth with the evils of war, the Egyptian Greeks kept alive the sacred flame of science, and preserved mankind from relapsing into their original barbarism. These happy effects are to be ascribed in an eminent degree to the enlightened government and liberal opinions of Ptolemy Soter, and his immediate successors Philadelphus and Euergetes. The two latter princes, whose authority was equalled only by the zeal with which they patronized science and its professors, were the first who enabled physicians to dissect the human body, and prevented the prejudices of ignorance and superstition from compromising the welfare of the human race. To this happy circumstance Herophilus and Erasistratus are indebted for the distinction of being known to posterity as the first anatomists who dissected and described the parts of the human body. Both these physicians flourished under Ptolemy Soter, and probably Ptolemy Philadelphus, and were indeed the principal supports of what has been named in medical history the Alexandrian School, to which their reputation seems to have attracted numerous pupils. But though the concurrent testimony of antiquity assigns to these physicians the merit of dissecting the human body, time, which wages endless war with the vanity and ambition of man, has dealt hardly with the monuments of their labours. As the works of neither have been preserved, great uncertainty prevails as to the respective merits of these ancient anatomists; and all that is now known of their anatomical researches is obtained from the occasional notices of Galen, Oribasius and some other writers. From these it appears that Erasistratus recognized the valves of the heart, and distinguished them by the names of *tricuspid* and *sigmoid*; that he studied particularly the shape and structure of the brain, and its divisions, and cavities, and membranes, and likened the convolutions to the folds of the jejunum; that he first formed a distinct idea of the nature of the nerves, which he made issue from the brain; and that he discovered lymphatic vessels in the mesentery, first in brute animals, and afterwards, it is said, in man. He appears also to have distinguished the nerves into those of sensation and those of motion.

Erasistratus.

Herophilus.

Of Herophilus it is said that he had extensive anatomical knowledge, acquired by dissecting not only brutes but human bodies. Of these he probably dissected more than any of his predecessors or contemporaries. Devoted to the assiduous cultivation of anatomy, he appears to have studied with particular attention those parts which were least understood. He recognized the nature of the pulmonary artery, which he denominates *arterious vein*; he knew the vessels of the mesentery, and showed that they did not go to the *vena portae*, but to certain glandular bodies; and he first applied the name of *twelve-inch* or *duodenum* (*δωδεκαδάκτυλος*) to that part of the alimentary canal which is next to the stomach. Like Erasistratus, he appears to have studied carefully the configuration of the brain; and though, like him, he distinguishes the nerves into those of sensation and those of voluntary motion, he adds to them the ligaments and tendons. A tolerable description of the liver by this anatomist is preserved in the writings of Galen. He first applied the name of choroid or vascular membrane to that which is found in the cerebral ventricles; he knew the straight venous sinus which still bears his name; and to him the linear furrow at the bottom of the fourth ventricle is indebted for its name of *calamus scriptorius*.

The celebrity of these two great anatomists appears to have thrown into the shade for a long period the names of all other inquirers; for, among their numerous and rather celebrated successors in the Alexandrian school, it is impossible to recognize a name which is entitled to distinction in the history of anatomy. In a chasm so wide it is not uninteresting to find, in one who combined the characters of the greatest orator and philosopher of Rome, the most distinct traces of attention to anatomical knowledge. Cicero, in his treatise *De Natura Deorum*, in a short sketch of physiology, such as it was taught by Aristotle and his disciples, introduces various anatomical notices, from which the classical reader may form some idea of the state of anatomy at that time. The Roman orator appears to have formed a pretty distinct idea of the shape and connexions of the windpipe and lungs; and though he informs his readers that he knows the alimentary canal, he omits the details through motives of delicacy. In imitation of Aristotle, he talks of the blood being conveyed by the veins (*venae*), that is, blood-vessels, through the body at large; and, like Praxagoras, of the air inhaled by the lungs being conveyed through the arteries.

Aretaeus, though chiefly known as a medical author, makes some observations on the lung and the pleura, maintains the glandular structure of the kidney, and describes the anastomoses or communications of the capillary extremities of the *vena cava* with those of the portal vein.

Celsus.

The most valuable depository of the anatomical knowledge of these times is the work of Celsus, one of the most judicious medical authors of antiquity. He left, indeed, no express anatomical treatise; but from the introductions to the 4th and 8th books of his work, *De Medicina*, with incidental remarks in the 7th, the modern reader may form very just ideas of his anatomical attainments. From these it appears that Celsus was well acquainted with the windpipe and lungs and the heart; with the difference between the windpipe and oesophagus (*stomachus*), which leads to the stomach (*ventriculus*); and with the shape, situation and relations of the diaphragm. He enumerates also the principal facts relating to the situation of the liver, the spleen, the kidneys and the stomach. He appears, however, to have been unaware of the distinction of *duodenum* or twelve-inch bowel, already admitted by Herophilus, and represents the stomach as directly connected by means of the *pylorus* with the *jejunum* or upper part of the small intestine.

The 7th and 8th books, which are devoted to the consideration of those diseases which are treated by manual operation, contain sundry anatomical notices necessary to explain the nature of the diseases or mode of treatment. Of these, indeed, the merit is unequal; and it is not wonderful that the ignorance of the day prevented Celsus from understanding rightly the mechanism of the pathology of hernia. He appears, however, to have formed a tolerably just idea of the mode of cutting into the urinary bladder; and even his obstetrical instructions show that his knowledge of the uterus, vagina and appendages was not contemptible. It is in osteology, however, that the information of Celsus is chiefly conspicuous. He enumerates the sutures and several of the holes of the cranium, and describes at great length the superior and inferior maxillary bones and the teeth. With a good deal of care he describes the vertebrae and the ribs, and gives very briefly the situation and shape of the *scapula, humerus, radius* and *ulna*, and even of the carpal and metacarpal bones, and then of the different bones of the pelvis and lower extremities. He had formed a just idea of the articular connexions, and is desirous to impress the fact that none is formed without cartilage. From his mention of many minute holes (*multa et tenuia foramina*) in the recess of the nasal cavities, it is evident that he was acquainted with the perforated plate of the ethmoid bone; and from saying that the straight part of the auditory canal becomes flexuous and terminates in numerous minute cavities (*multa et tenuia foramina diducitur*), it is inferred by Portal that he knew the semicircular canals.

Though the writings of Celsus show that he cultivated anatomical knowledge, it does not appear that the science was much studied by the Romans; and there is reason to believe that, after the decay of the school of Alexandria, it languished in neglect and obscurity. It is at least certain that the appearance of Marinus during the reign of Nero is mentioned by authors as an era remarkable for anatomical inquiry, and that this person is distinguished by Galen as the restorer of a branch of knowledge which had been before him suffered to fall into undeserved neglect. From Galen also we learn that Marinus gave an accurate account of the muscles, that he studied particularly the glands, and that he discovered those of the mesentery. He fixed the number of nerves at seven; he observed the palatine nerves, which he rated as the fourth pair; and described as the fifth the auditory and facial, which he regards as one pair, and the hypoglossal as the sixth.

Rufus.

Not long after Marinus appeared Rufus (or Ruffus) of Ephesus, a Greek physician, who in the reign of Trajan was much attached to physiology, and as a means of cultivating this science studied Comparative Anatomy and made sundry experiments on living animals. Of the anatomical writings of this author there remains only a list or catalogue of names of different regions and parts of the animal body. He appears, however, to have directed attention particularly to the tortuous course of the uterine vessels, and to have recognized even at this early period the Fallopian tube. He distinguishes the nerves into those of sensation and those of motion. He knew the recurrent nerve. His name is further associated with the ancient experiment of compressing in the situation of the carotid arteries the pneumogastric nerve, and thereby inducing insensibility and loss of voice.

Galen.

Of all the authors of antiquity, however, none possesses so just a claim to the title of anatomist as Claudius Galenus, the celebrated physician of Pergamum, who was born about the 130th year of the Christian era, and lived under the reigns of Hadrian, the Antonines, Commodus and Severus. He was trained by his father Nicon (whose memory he embalms as an eminent mathematician, architect and astronomer) in all the learning of the day, and initiated particularly into the mysteries of the Aristotelian philosophy. In an order somewhat whimsical he afterwards studied philosophy successively in the schools of the Stoics, the Academics, the Peripatetics and the Epicureans. When he was seventeen years of age, his father, he informs us, was admonished by a dream to devote his son to the study of medicine; but it was fully two years after that Galen entered on this pursuit, under the auspices of an instructor whose name he has thought proper to conceal. Shortly after he betook himself to the study of anatomy under Satyrus, a pupil of Quintus, and of medicine under Stratonicus, a Hippocratic physician, and Aeschrion, an empiric. He had scarcely attained the age of twenty when he had occasion to deplore the loss of the first and most affectionate guide of his studies; and soon after he proceeded to Smyrna to obtain the anatomical instructions of Pelops, who, though mystified by some of the errors of Hippocrates, is commemorated by his pupil as a skilful anatomist. After this he appears to have visited various cities distinguished for philosophical or medical teachers; and, finally, to have gone to Alexandria with the view of cultivating more accurately and intimately the study of anatomy under Heraclianus. Here he remained till his twenty-eighth year, when he regarded himself as possessed of all the knowledge then attainable through the medium of teachers. He now returned to Pergamum to exercise the art which he had so anxiously studied, and received, in his twenty-ninth year, an unequivocal testimony of the confidence which his fellow-citizens reposed in his skill, by being intrusted with the treatment of the wounded gladiators; and in this capacity he is said to have treated wounds with success which were fatal under former treatment. A seditious tumult appears to have caused him to form the resolution of quitting Pergamum and proceeding to Rome at the age of thirty-two. Here, however, he remained only five years; and returning once more to Pergamum, after travelling for some time, finally settled in Rome as physician to the emperor Commodus. The anatomical writings ascribed to Galen, which are numerous, are to be viewed not merely as the result of personal research and information, but as the common depository of the anatomical knowledge of the day, and as combining all that he had learnt from the several teachers under whom he successively studied with whatever personal investigation enabled him to acquire. It is on this account not always easy to distinguish what Galen had himself ascertained by personal research from that which was known by other anatomists. This, however, though of moment to the history of Galen as an anatomist, is of little consequence to the science itself; and from the anatomical remains of this author a pretty just idea may be formed both of the progress and of the actual state of the science at that time.

The osteology of Galen is undoubtedly the most perfect of the departments of the anatomy of the ancients. He names and distinguishes the bones and sutures of the cranium nearly in the same manner as at present. Thus, he notices the quadrilateral shape of the parietal bones; he distinguishes the squamous, the styloid, the mastoid and the petrous portions of the temporal bones; and he remarks the peculiar situation and shape of the sphenoid bone. Of the ethmoid, which he omits at first, he afterwards speaks more at large in another treatise. The malar he notices under the name of zygomatic bone; and he describes at length the upper maxillary and nasal bones, and the connexion of the former with the sphenoid. He gives the first clear account of the number and situation of the vertebrae, which he divides into *cervical*, *dorsal* and *lumbar*, and distinguishes from the sacrum and coccyx. Under the head *Bones of the Thorax*, he enumerates the sternum, the ribs (*αἱ πλευραί*), and the dorsal vertebrae, the connexion of which with the former he designates as a variety of *diarthrosis*. The description of the bones of the extremities and their articulations concludes the treatise.

Though in myology Galen appears to less advantage than in osteology, he nevertheless had carried this part of anatomical knowledge to greater perfection than any of his predecessors. He describes a frontal muscle, the six muscles of the eye and a seventh proper to animals; a muscle to each *ala nasi*, four muscles of the lips, the thin cutaneous muscle of the neck, which he first termed *platysma myoides* or muscular expansion, two muscles of the eyelids, and four pairs of muscles of the lower jaw—the temporal to raise, the masseter to draw to one side, and two depressors, corresponding to the digastric and internal pterygoid muscles. After speaking of the muscles which move the head and the scapula, he adverts to those by which the windpipe is opened and shut, and the intrinsic or proper muscles of the larynx and hyoid bone. Then follow those of the tongue, pharynx and neck, those of the upper extremities, the trunk and the lower extremities successively; and in the course of this description he swerves so little from the actual facts that most of the names by which he distinguishes the principal muscles have been retained by the best modern anatomists. It is chiefly in the minute account of these organs, and especially in reference to the minuter muscles, that he appears inferior to the moderns.

The angiological knowledge of Galen, though vitiated by the erroneous physiology of the times and ignorance of the separate uses of arteries and veins, exhibits, nevertheless, some accurate facts which show the diligence of the author in dissection. Though, in opposition to the opinions of Praxagoras and Erasistratus, he proved that the arteries in the living animal contain not air but blood, it does not appear to have occurred to him to determine in what direction the blood flows, or whether it was movable or stationary. Representing the left ventricle of the heart as the common origin of all the arteries, though he is misled by the pulmonary artery, he nevertheless traces the distribution of the branches of the aorta with some accuracy. The *vena azygos* also, and the jugular veins, have contributed to add to the confusion of his description, and to render his angiology the most imperfect of his works.

In neurology we find him to be the author of the dogma that the brain is the origin of the nerves of sensation, and the spinal cord of those of motion; and he distinguishes the former from the latter by their greater softness or less consistence. Though he admits only seven cerebral pairs, he has the merit of distinguishing and tracing the distribution of the greater part of both classes of nerves with great accuracy. His description of the brain is derived from dissection of the lower animals, and his distinctions of the several parts of the organ have been retained by modern anatomists. His mode of demonstrating this organ, which indeed is clearly described, consists of five different steps. In the first the bisecting membrane—*i.e.* the falx (*μῆνιγξ διχοτομοῦσα*)—and the connecting blood-vessels are removed; and the dissector, commencing at the anterior extremity of the great fissure, separates the hemispheres gently as far as the *torcular*, and exposes a smooth surface (*τὴν χώραν τυλώδη πως οὖσαν*), the mesolobe of the moderns, or the middle band. In the second he exposes by successive sections the ventricles, the choroid plexus and the middle partition. The third exhibits the pineal body (*σῶμα κωνοειδές*) or conarium, concealed by a membrane with numerous veins, meaning that part of the plexus which is now known by the name of *velum interpositum*, and a complete view of the ventricles. The fourth unfolds the third ventricle (*τὶς ἄλλη τρίτη κοιλία*), the communication between the two lateral ones, the arch-like body (*σῶμα ψαλιδοειδές*) *fornix*, and the passage from the third to the fourth ventricle. In the fifth he gives an accurate description of the relations of the third and fourth ventricle, of the situation of the two pairs of eminences, *nates* (*γλουτά*) and *testes* (*διδυμία* or *ὄρχεις*), the scolecoid or worm-like process, anterior and posterior, and lastly the linear furrow, called by Herophilus *calamus scriptorius*.

In the account of the thoracic organs equal accuracy may be recognized. He distinguishes the *pleura* by the name of inclosing membrane (*ὑμὴν ὑπεζωκώς*, *membrana succingens*), and remarks its similitude in structure to that of the peritoneum, and the covering which it affords to all the organs. The pericardium also he describes as a membranous sac with a circular basis corresponding to the base of the heart and a conical apex; and after an account of the tunics of the arteries and veins, he speaks shortly of the lung, and more at length of the heart, which, however, he takes some pains to prove not to be muscular, because it is harder, its fibres are differently arranged, and its action is incessant, whereas that of muscle alternates with the state of rest; he gives a good account of the valves and of the vessels; and notices especially the bony ring formed in the heart of the horse, elephant and other large animals.

The description of the abdominal organs, and of the kidneys and urinary apparatus, is still more minute, and in general accurate. Our limits, however, do not permit us to give any abstract of them; and it is sufficient in general to say that Galen gives correct views of the arrangement of the peritoneum and omentum, and distinguishes accurately the several divisions of the alimentary canal and its component tissues. In the liver, which he allows to receive an envelope from the peritoneum, he admits, in imitation of Erasistratus, a proper substance or *parenchyma*, interposed between the vessels, and capable of removal by suitable dissection. His description of the organs of generation is rather brief, and is, like most of his anatomical sketches, too much blended with physiological dogmas.

This short sketch may communicate some idea of the condition of anatomical knowledge in the days of Galen, who indeed is justly entitled to the character of rectifying and digesting, if not of creating, the science of anatomy among the ancients. Though evidently confined, perhaps entirely by the circumstances of the times, to the dissection of brute animals, so indefatigable and judicious was he in the mode of acquiring knowledge, that many of his names and distinctions are still retained with advantage in the writings of the moderns. Galen was a practical anatomist, and not only describes the organs of the animal body from actual dissection, but gives ample instructions for the proper mode of exposition. His language is in general clear, his style as correct as in most of the authors of the same period, and his manner is animated. Few passages in early science are indeed so interesting as the description of the process for demonstrating the brain and other internal organs which is given by this patient and enthusiastic observer of nature. To some it may appear absurd to speak of anything like good anatomical description in an author who writes in the Greek language, or anything like an interesting and correct manner in a writer who flourished at a period when taste was depraved or extinct and literature corrupted—when the philosophy of Antoninus and the mild virtues of Aurelius could do little to soften the iron sway of Lucius Verus and Commodus; but the habit of faithful observation in Galen seems to have been so powerful that in the description of material objects, his genius invariably rises above the circumstances of his age. Though not so directly connected with this subject, it is nevertheless proper to mention that he appears to have been the first anatomist who can be said, on authentic grounds, to have attempted to discover the uses of organs by vivisection and experiments on living animals. In this manner he ascertained the position and demonstrated the action of the heart; and he mentions two instances in which, in consequence of disease or injury, he had an opportunity of observing the motions of this organ in the human body. In short, without eulogizing an ancient author at the expense of critical justice, or commending his anatomical descriptions as superior to those of the moderns, it must be admitted that the anatomical writings of the physician of Pergamum form a remarkable era in the history of the science; and that by diligence in dissection and accuracy in description he gave the science a degree of importance and stability which it has retained through a lapse of many centuries.

The death of Galen, which took place at Pergamum in the seventieth year of his age and the 200th of the Christian era, may be regarded as the downfall of anatomy in ancient times. After this period we recognize only two names of any celebrity in the history of the science—those of Soranus and Oribasius, with the more obscure ones of Meletius and Theophilus, the latter the chief of the imperial guard of Heraclius.

Soranus, who was an Ephesian, and flourished under the emperors Trajan and Hadrian, distinguished himself by his researches on the female organs of generation. He appears to have dissected the human subject; and this perhaps is one reason why his descriptions of these parts are more copious and more accurate than those of Galen, who derived his knowledge from the bodies of the lower animals. He denies the existence of the hymen, but describes accurately the clitoris. Soranus the anatomist must be distinguished from the physician of that name, who was also a native of Ephesus.

Oribasius.

Oribasius, who was born at Pergamum, is said to have been at once the friend and physician of the emperor Julian, and to have contributed to the elevation of that apostate to the imperial throne. For this he appears to have suffered the punishment of a temporary exile under Valens and Valentinian; but was soon recalled, and lived in great honour till the period of his death (387). By le Clerc, Oribasius is regarded as a compiler; and indeed his anatomical writings bear so close a correspondence with those of Galen that the character is not altogether groundless. In various points, nevertheless, he has rendered the Galenian anatomy more accurate; and he has distinguished himself by a good account of the salivary glands, which were overlooked by Galen.

To the same period generally is referred the Anatomical Introduction of an anonymous author, first published in 1618 by Lauremberg, and afterwards by C. Bernard. It is to be regarded as a compilation formed on the model of Galen and Oribasius. The same character is applicable to the treatises of Meletius and Theophilus.

The decline indicated by these languid efforts soon sank into a state of total inactivity; and the unsettled state of society during the latter ages of the Roman empire was extremely unfavourable to the successful cultivation of science. The sanguinary conflicts in which the southern countries of Europe were repeatedly engaged with their northern neighbours between the 2nd and 8th centuries tended gradually to estrange their minds from scientific pursuits; and the hordes of barbarians by which the Roman empire was latterly overrun, while they urged them to the necessity of making hostile resistance, and adopting means of self-defence, introduced such habits of ignorance and barbarism, that science was almost universally forgotten. While the art of healing was professed only by some few ecclesiastics or by itinerant practitioners, anatomy was utterly neglected; and no name of anatomical celebrity occurs to diversify the long and uninteresting period commonly distinguished as the dark ages.

Arabian Physicians.

Anatomical learning, thus neglected by European nations, is believed to have received a temporary cultivation from the Asiatics. Of these, several nomadic tribes, known to Europeans under the general denomination of Arabs and Saracens, had gradually coalesced under various leaders; and by their habits of endurance, as well as of enthusiastic valour in successive expeditions against the eastern division of the Roman empire, had acquired such military reputation as to render them formidable wherever they appeared. After a century and a half of foreign warfare or internal animosity, under the successive dynasties of the Omayyads and Abbasids, in which the propagation of Islam was the pretext for the extinction of learning and civilization, and the most remorseless system of rapine and destruction, the Saracens began, under the latter dynasty of princes, to recognize the value of science, and especially of that which prolongs life, heals disease and alleviates the pain of wounds and injuries. The caliph Mansur combined with his official knowledge of Moslem law the successful cultivation of astronomy; but to his grandson Mamun, the seventh prince of the line of the Abbasids, belongs the merit of undertaking to render his subjects philosophers and physicians. By the directions of this prince the works of the Greek and Roman authors were translated into Arabic; and the favour and munificence with which literature and its professors were patronized speedily raised a succession of learned Arabians. The residue of the rival family of the Omayyads, already settled in Spain, was prompted by motives of rivalry or honourable ambition to adopt the same course; and while the academy, hospitals and library of Bagdad bore testimony to the zeal and liberality of the Abbasids, the munificence of the Omayyads was not less conspicuous in the literary institutions of Cordova, Seville and Toledo.

Notwithstanding the efforts of the Arabian princes, however, and the diligence of the Arabian physicians, little was done for anatomy, and the science made no substantial acquisition. The Koran denounces as unclean the person who touches a corpse; the rules of Islam forbid dissection; and whatever their instructors taught was borrowed from the Greeks. Abu-Bekr Al-Rasi, Abu-Ali Ibn-Sina, Abul-Qasim and Abul Walid ibn Rushd, the Rhazes, Avicenna, Abulcasis and Averroes of European authors, are their most celebrated names in medicine; yet to none of these can the historian with justice ascribe any anatomical merit. Rhazes has indeed left descriptions of the eye, of the ear and its *meatus*, and of the heart; and Avicenna, Abul-Qasim and Averroes give anatomical descriptions of the parts of the human body. But of these the general character is, that they are copies from Galen, sometimes not very just, and in all instances mystified with a large proportion of the fanciful and absurd imagery and inflated style of the Arabian writers. The chief reason of their obtaining a place in anatomical history is, that by the influence which their medical authority enabled them to exercise in the European schools, the nomenclature which they employed was adopted by European anatomists, and continued till the revival of ancient learning restored the original nomenclature of the Greek physicians. Thus, the *cervix*, or nape of the neck, is *nucha*; the oesophagus is *meri*; the umbilical region is *sumen* or *sumac*; the abdomen is *myrach*; the peritoneum is *siphac*; and the omentum, *zirbus*.

From the general character now given justice requires that we except Abdallatif, the annalist of Egyptian affairs. This author, who maintains that it is impossible to learn anatomy from books, and that the authority of Galen must yield to personal inspection, informs us that the Moslem doctors did not neglect opportunities of studying the bones of the human body in cemeteries; and that he himself, by once examining a collection of bones in this manner, ascertained that the lower jaw is formed of one piece; that the sacrum, though sometimes composed of several, is most generally of one; and that Galen is mistaken when he asserts that these bones are not single.

School of Bologna.

The era of Saracen learning extends to the 13th century; and after this we begin to approach happier times. The university of Bologna, which, as a school of literature and law, was already celebrated in the 12th century, became, in the course of the following one, not less distinguished for its medical teachers. Though the misgovernment of the municipal rulers of Bologna had disgusted both teachers and students, and given rise to the foundation of similar institutions in Padua and Naples,—and though the school of Salerno, in the territory of the latter, was still in high repute,—it appears, from the testimony of M. Sarti, that medicine was in the highest esteem in Bologna, and that it was in such perfection as to require a division of its professors into physicians, surgeons, physicians for wounds, barber-surgeons, oculists and even some others. Notwithstanding these indications of refinement, however, anatomy was manifestly cultivated rather as an appendage of surgery than a branch of medical science; and according to the testimony of Guy de Chauliac, the cultivation of anatomical knowledge was confined to Roger of Parma, Roland, Jamerio, Bruno, and Lanfranc or Lanfranchi of Milan; and this they borrowed chiefly from Galen.

Mondino.

In this state matters appear to have proceeded with the medical school of Bologna till the commencement of the 14th century, when the circumstance of possessing a teacher of originality enabled this university to be the agent of as great an improvement in medical science as she had already effected in jurisprudence. This era, indeed, is distinguished for the appearance of Mondino (Mundinus), under whose zealous cultivation the science first began to rise from the ashes in which it had been buried. This father of modern anatomy, who taught in Bologna about the year 1315, quickly drew the curiosity of the medical profession by well-ordered demonstrations of the different parts of the human body. In 1315 he dissected and demonstrated the parts of the human body in two female subjects; and in the course of the following year he accomplished the same task on the person of a single female. But while he seems to have had sufficient original force of intellect to direct his own route, J. Riolan accuses him of copying Galen; and it is certain that his descriptions are corrupted by the barbarous leaven of the Arabian schools, and his Latin defaced by the exotic nomenclature of Avicenna and Rhazes. He died, according to G. Tiraboschi, in 1325.

Mondino divides the body into three cavities (*ventres*), the upper containing the animal members, as the head, the lower containing the natural members, and the middle containing the spiritual members. He first describes the anatomy of the lower cavity or the abdomen, then proceeds to the middle or thoracic organs, and concludes with the upper, comprising the head and its contents and appendages. His general manner is to notice shortly the situation and shape or distribution of textures or membranes, and then to mention the disorders to which they are subject. The peritoneum he describes under the name of *siphac*, in imitation of the Arabians, the omentum under that of *zirbus*, and the mesentery or *eucharus* as distinct from both. In speaking of the intestines he treats first of the rectum, then the colon, the left or sigmoid flexure of which, as well as the transverse arch and its connexion with the stomach, he particularly remarks; then the caecum or *monoculus*, after this the small intestines in general under the heads of ileum and jejunum, and latterly the duodenum, making in all six bowels. The liver and its vessels are minutely, if not accurately, examined; and the *cava*, under the name *chilis*, a corruption from the Greek κοίλη, is treated at length, with the emulgents and kidneys. His anatomy of the heart is wonderfully accurate; and it is a remarkable fact, which seems to be omitted by all subsequent authors, that his description contains the rudiments of the circulation of the blood. "Postea vero versus pulmonem est aliud orificium venae arterialis, quae *portat* sanguinem ad pulmonem a corde; quia cum pulmo deserviat cordi secundum modum dictum, ut ei recompenset, cor ei *transmittit* sanguinem per hanc venam, quae vocatur vena arterialis; est vena, quia portat sanguinem, et arterialis, quia habet duas tunicas; et habet duas tunicas, primo quia vadit ad membrum quod existit in continuo motu, et secundo quia portat sanguinem valde subtilem et cholericum." The merit of these distinctions, however, he afterwards destroys by repeating the old assertion that the left ventricle ought to contain spirit or air, which it generates from the blood. His osteology of the skull is erroneous. In his account of the cerebral membranes, though short, he notices the principal characters of the *dura mater*. He describes shortly the lateral ventricles, with their anterior and posterior *cornua*, and the choroid plexus as a blood-red substance like a long worm. He then speaks of the third or middle ventricle, and one posterior, which seems to correspond with the fourth; and describes the infundibulum under the names of *lacuna* and *emboton*. In the base of the organ he remarks, first, two mammillary caruncles, the optic nerves, which he reckons the first pair; the oculomuscular, which he accounts the second; the third, which appears to be sixth of the moderns; the fourth; the fifth, evidently the seventh; a sixth, the *nervus vagus*; and a seventh, which is the ninth of the moderns. Notwithstanding the misrepresentations into which this early anatomist was betrayed, his book is valuable, and has been illustrated by the successive commentaries of Alessandro Achillini, Jacopo Berengario and Johann Dryander (1500–1560).

Matthew de Gradibus, a native of Gradi, a town in Friuli, near Milan, distinguished himself by composing a series of treatises on the anatomy of various parts of the human body (1480). He is the first who represents the ovaries of the female in the correct light in which they were subsequently regarded by Nicolas Steno or Stensen (1638–1687).

Objections similar to those already urged in speaking of Mondino apply to another eminent anatomist of those times. Gabriel de Zerbis, who flourished at Verona towards the conclusion of the 15th century, is celebrated as the author of a system in which he is obviously more anxious to astonish his readers by the wonders of a verbose and complicated style than to instruct by precise and faithful description. In the vanity of his heart he assumed the title of *Medicus Theoricus*; but though, like Mondino, he derived his information from the dissection of the human subject, he is not entitled to the merit either of describing truly or of adding to the knowledge previously acquired. He is superior to Mondino, however, in knowing the olfactory nerves.

Achillini.

Eminent in the history of the science, and more distinguished than any of this age in the history of cerebral anatomy, Achillini of Bologna (1463–1512), the pupil and commentator of Mondino, appeared at the close of the 15th century. Though a follower of the Arabian school, the assiduity with which he cultivated anatomy has rescued his name from the inglorious obscurity in which the Arabian doctors have in general slumbered. He is known in the history of anatomical discovery as the first who described the two tympanal bones, termed *malleus* and *incus*. In 1503 he showed that the tarsus consists of seven bones; he rediscovered the fornix and the infundibulum; and he was fortunate enough to observe the course of the cerebral cavities into the inferior *cornua*, and to remark peculiarities to which the anatomists of a future age did not advert. He mentions the orifices of the ducts, afterwards described by Thomas Wharton (1610–1673). He knew the ileo-caecal valve; and his description of the duodenum, ileum and colon shows that he was better acquainted with the site and disposition of these bowels than any of his predecessors or contemporaries.

Berenger.

Not long after, the science boasts of one of its most distinguished founders. Berengario, commonly called Berenger of Carpi, in the Modenese territory, flourished at Bologna at the beginning of the 16th century. In the annals of medicine his name will be remembered not only as the most zealous and eminent in cultivating the anatomy of the human body, but as the first physician who was fortunate enough to calm the alarms of Europe, suffering under the ravages of syphilis, then raging with uncontrollable virulence. In the former character he surpassed both predecessors and contemporaries; and it was long before the anatomists of the following age could boast of equalling him. His assiduity was indefatigable; and he declares that he dissected above one hundred human bodies. He is the author of a compendium, of several treatises which he names Introductions (*Isagogae*), and of commentaries on the treatise of Mondino, in which he not only rectifies the mistakes of that anatomist, but gives minute and in general accurate anatomical descriptions.

He is the first who undertakes a systematic view of the several textures of which the human body is composed; and in a preliminary commentary he treats successively of the anatomical characters and properties of fat, of membrane in general (*panniculus*), of flesh, of nerve, of *villus* or fibre (*filum*), of ligament, of sinew or tendon, and of muscle in general. He then proceeds to describe with considerable precision the muscles of the abdomen, and illustrates their site and connexions by woodcuts which, though rude, are spirited, and show that anatomical drawing was in that early age beginning to be understood. In his account of the peritoneum he admits only the intestinal division of that membrane, and is at some pains to prove that Gentilis Fulgineus, who justly admits the muscular division also, is in error. In his account of the intestines he is the first who mentions the vermiform process of the caecum; he remarks the yellow tint communicated to the duodenum by the gall-bladder; and he recognizes the opening of the common biliary duct into the duodenum (*quidam porus portans choleram*). In the account of the stomach he describes the several tissues of which that organ is composed, and which he represents to be three, and a fourth from the peritoneum; and afterwards notices the *rugae* of its villous surface. He is at considerable pains to explain the organs of generation in both sexes, and gives a long account of the anatomy of the foetus. He was the first who recognized the larger proportional size of the chest in the male than in the female, and conversely the greater capacity of the female than of the male pelvis. In the larynx he discovered the two arytenoid cartilages. He gives the first good description of the thymus; distinguishes the oblique situation of the heart; describes the pericardium, and maintains the uniform presence of pericardial liquor. He then describes the cavities of the heart; but perplexes himself, as did all the anatomists of that age, about the spirit supposed to be contained. The aorta he properly makes to arise from the left ventricle; but confuses himself with the *arteria venalis*, the pulmonary vein, and the *vena arterialis*, the pulmonary artery. His account of the brain is better. He gives a minute and clear account of the ventricles, remarks the *corpus striatum*, and has the sagacity to perceive that the choroid plexus consists of veins and arteries; he then describes the middle or third ventricle, the infundibulum or *lacuna* of Mondino, and the pituitary gland; and lastly, the passage to the fourth ventricle, the *conarium* or pineal gland, and the fourth or posterior ventricle itself, the relations of which he had studied accurately. He rectifies the mistake of Mondino as to the olfactory or first pair of nerves, gives a good account of the optic and others, and is entitled to the praise of originality in being the first observer who contradicts the fiction of the wonderful net and indicates the principal divisions of the carotid arteries. He enumerates the tunics and humours of the eye, and gives an account of the internal ear, in which he notices the *malleus* and *incus*.

French school.

Italy long retained the distinction of giving birth to the first eminent anatomists in Europe, and the glory she acquired in the names of Mondino, Achillini, Berenger and N. Massa, was destined to become more conspicuous in the labours of R. Columbus, G. Fallopius and Eustachius. While Italy, however, was thus advancing the progress of science, the other nations of Europe were either in profound ignorance or in the most supine indifference to the brilliant career of their zealous neighbours. The 16th century had commenced before France began to acquire anatomical distinction in the names of Jacques Dubois, Jean Fernel and Charles Etienne; and even these celebrated teachers were less solicitous in the personal study of the animal body than in the faithful explanation of the anatomical writings of Galen. The infancy of the French school had to contend with other difficulties. The small portion of knowledge which had been hitherto diffused in the country was so inadequate to eradicate the prejudices of ignorance, that it was either difficult or absolutely impossible to procure human bodies for the purposes of science; and we are assured, on the testimony of A. Vesalius and other competent authorities, that the practical part of anatomical instruction was obtained entirely from the bodies of the lower animals. The works of the Italian anatomists were unknown; and it is a proof of the tardy communication of knowledge that, while the structure of the human body had been taught in Italy for more than a century by Mondino and his followers, these anatomists are never mentioned by Etienne, who flourished long after.

Dubois.

Such was the aspect of the times at the appearance of Jacques Dubois (1478–1555), who, under the Romanized name of Jacobus Sylvius, according to the fashion of the day, has been fortunate in acquiring a reputation to which his researches do not entitle him. For the name of Dubois the history of anatomy, it is said, is indebted to his inordinate love of money. At the instance of his brother Francis, who was professor of eloquence in the college of Tournay at Paris, he devoted himself to the study of the learned languages and mathematics; but discovering that these elegant accomplishments do not invariably reward their cultivators with the goods of fortune, Dubois betook himself to medicine. After the acquisition of a medical degree in the university of Montpellier, at the ripe age of fifty-one Dubois returned to Paris to resume a course of anatomical instruction. Here he taught anatomy to a numerous audience in the college of Trinquet; and on the departure of Vidus Vidius for Italy was appointed to succeed that physician as professor of surgery to the Royal College. His character is easily estimated. With greater coarseness in his manners and language than even the rude state of society in his times can palliate, with much varied learning and considerable eloquence, he was a blind, indiscriminate and irrational admirer of Galen, and interpreted the anatomical and physiological writings of that author in preference to giving demonstrations from the subject. Without talent for original research or discovery himself, his envy and jealousy made him detest every one who gave proofs of either. We are assured by Vesalius, who was some time his pupil, that his manner of teaching was calculated neither to advance the science nor to rectify the mistakes of his predecessors. A human body was never seen in the theatre of Dubois; the carcases of dogs and other animals were the materials from which he taught; and so difficult even was it to obtain human bones, that unless Vesalius and his fellow-students had collected assiduously from the Innocents and other cemeteries, they must have committed numerous errors in acquiring the first principles. This assertion, however, is contradicted by J. Riolan, and afterwards by K. P. J. Sprengel and T. Lauth, the last of whom decidedly censures Vesalius for this ungrateful treatment of his instructor. It is certain that opportunities of inspecting the human body were by no means so frequent as to facilitate the study of the science. Though his mention of injections has led some to suppose him the discoverer of that art, he appears to have made no substantial addition to the information already acquired; and the first acknowledged professor of anatomy to the university of Paris appears in history as one who lived without true honour and died without just celebrity. He must not be confounded with Franciscus Sylvius (de le Boe), who is mentioned by F. Ruysch and M. V. G. Malacarne as the author of a particular method of demonstrating the brain.

Etienne.

Almost coeval may be placed Charles Etienne (1503–1564), a younger brother of the celebrated printers, and son to Henry, who Hellenized the family name by the classical appellation of Stephen (Στέφανος). It is uncertain whether he taught publicly. But his tranquillity was disturbed, and his pursuits interrupted, by the oppressive persecutions in which their religious opinions involved the family; and Charles Etienne drew the last breath of a miserable life in a dungeon in 1564. Etienne, though sprung of a family whose classical taste has been their principal glory, does not betray the same servile imitation of the Galenian anatomy with which Dubois is charged. He appears to have been the first to detect valves in the orifice of the hepatic veins. He was ignorant, however, of the researches of the Italian anatomists; and his description of the brain is inferior to that given sixty years before by Achillini. His comparison of the cerebral cavities to the human ear has persuaded F. Portal that he knew the inferior *cornua*, the *hippocampus* and its prolongations; but this is no reason for giving him that honour to the detriment of the reputation of Achillini, to whom, so far as historical testimony goes, the first knowledge of this fact is due. The researches of Etienne into the structure of the nervous system are, however, neither useless nor inglorious; and the circumstance of demonstrating a canal through the entire length of the spinal cord, which had neither been suspected by contemporaries nor noticed by successors till J. B. Senac (1693–1770) made it known, is sufficient to place him high in the rank of anatomical discoverers.

Vesalius.

The French anatomy of the 16th century was distinguished by two circumstances unfavourable to the advancement of the science —extravagant admiration of antiquity, with excessive confidence in the writings of Galen, and the general practice of dissecting principally the bodies of the lower animals. Both these errors were much amended, if not entirely removed, by the exertions of a young Fleming, whose appearance forms a conspicuous era in the history of anatomy. Andreas Vesalius, (1514–1564), a native of Brussels, after acquiring at Louvain the ordinary classical attainments of the day, began at the age of fourteen to study anatomy under the auspices of Dubois. Though the originality of his mind soon led him to abandon the prejudices by which he was environed, and take the most direct course for attaining a knowledge of the structure of the human frame, he neither underrated the Galenian anatomy nor was indolent in the dissection of brute animals. The difficulties, however, with which the practical pursuit of human anatomy was beset in France, and the dangers with which he had to contend, made him look to Italy as a suitable field for the cultivation of the science; and in 1536 we find him at Venice, at once pursuing the study of human anatomy with the utmost zeal, and requested, ere he had attained his twenty-second year, to demonstrate publicly in the university of Padua. After remaining here about seven years, Vesalius went by express invitation to Bologna, and shortly afterwards to Pisa; and thus professor in three universities, he appears to have carried on his anatomical investigations and instructions alternately at Padua, Bologna and Pisa, in the course of the same winter. It is on this account that Vesalius, though a Fleming by birth and trained originally in the French school, belongs, as an anatomist, to the Italian, and may be viewed as the first of an illustrious line of teachers by whom the anatomical reputation of that country was in the course of the 16th century raised to the greatest eminence.

Vesalius is known as the first author of a comprehensive and systematic view of human anatomy. The knowledge with which his dissections had furnished him proved how many errors were daily taught and learned under the broad mantle of Galenian authority; and he perceived the necessity of a new system of anatomical instruction, divested of the omissions of ignorance and the misrepresentations of prejudice and fancy. The early age at which he effected this object has been to his biographers the theme of boundless commendation; and we are told that he began at the age of twenty-five to arrange the materials he had collected, and accomplished his task ere he had completed his 28th year.

Soon after this period we find him invited as imperial physician to the court of Charles V., where he was occupied in the duties of practice and answering the various charges which were unceasingly brought against him by the disciples of Galen. After the abdication of Charles he continued at court in great favour with his son Philip II. To this he seems to have been led principally by the troublesome controversies in which his anatomical writings had involved him. It is painful to think, however, that even imperial patronage bestowed on eminent talents does not ensure immunity from popular prejudice; and the fate of Vesalius will be a lasting example of the barbarism of the times, and of the precarious tenure of the safety even of a great physician. On the preliminary circumstances authors are not agreed; but the most general account states that when Vesalius was dissecting, with the consent of his kinsmen, the body of a Spanish grandee, it was observed that the heart still gave some feeble palpitations when divided by the knife. The immediate effects of this outrage to human feelings were the denunciation of the anatomist to the Inquisition; and Vesalius escaped the severe treatment of that tribunal only by the influence of the king, and by promising to perform a pilgrimage to the Holy Land. He forthwith proceeded to Venice, from which he sailed with the Venetian fleet, under James Malatesta, for Cyprus. When he reached Jerusalem, he received from the Venetian senate a message requesting him again to accept the Paduan professorship, which had become vacant by the death of his friend and pupil Fallopius. His destiny, however, which pursued him fast, suffered him not again to breathe the Italian air. After struggling for many days with the adverse winds in the Ionian Sea, he was wrecked on the island of Zante, where he quickly breathed his last in such penury that unless a liberal goldsmith had defrayed the funeral charges, his remains must have been devoured by beasts of prey. At the time of his death he was scarcely fifty years of age.

To form a correct estimate of the character and merits of Vesalius, we must not compare him, in the spirit of modern perfection, with the anatomical authors either of later times or of the present day. Whoever would frame a just idea of this anatomist must imagine, not a bold innovator without academical learning, not a genius coming from a foreign country, unused to the forms and habits of Catholic Europe, nor a wild reformer, blaming indiscriminately everything which accorded not with his opinion; but a young student scarcely emancipated from the authority of instructors, whose intellect was still influenced by the doctrines with which it had been originally imbued,—a scholar strictly trained in the opinions of the time, living amidst men who venerated Galen as the oracle of anatomy and the divinity of medicine,—exercising his reason to estimate the soundness of the instructions then in use, and proceeding, in the way least likely to offend authority and wound prejudice, to rectify errors, and to establish on the solid basis of observation the true elements of anatomical science. Vesalius has been denominated the founder of human anatomy; and though we have seen that in this career he was preceded with honour by Mondino and Berenger, still the small proportion of correct observation which their reverence for Galen and Arabian doctrines allowed them to communicate, will not in a material degree impair the original merits of Vesalius. The errors which he rectified and the additions which he made are so numerous, that it is impossible, in such a sketch as the present, to communicate a just idea of them.

Besides the first good description of the sphenoid bone, he showed that the sternum consists of three portions and the sacrum of five or six; and described accurately the vestibule in the interior of the temporal bone. He not only verified the observation of Etienne on the valves of the hepatic veins, but he described well the *vena azygos*, and discovered the canal which passes in the foetus between the umbilical vein and the *vena cava*, since named *ductus venosus*. He described the omentum, and its connexions with the stomach, the spleen and the colon; gave the first correct views of the structure of the pylorus; remarked the small size of the caecal appendix in man; gave the first good account of the mediastinum and pleura and the fullest description of the anatomy of the brain yet advanced. He appears, however, not to have understood well the inferior recesses; and his account of the nerves is confused by regarding the optic as the first pair, the third as the fifth and the fifth as the seventh.

The labours of Vesalius were not limited to the immediate effect produced by his own writings. His instructions and examples produced a multitude of anatomical inquirers of different characters and varied celebrity, by whom the science was extended and rectified. Of these we cannot speak in detail; but historical justice requires us to notice shortly those to whose exertions the science of anatomy has been most indebted.

Eustachius.

The first that claims attention on this account is Bartolomeo Eustachi of San Severino, near Salerno, who though greatly less fortunate in reputation than his contemporary Vesalius, divides with him the merit of creating the science of human anatomy. He extended the knowledge of the internal ear by rediscovering and describing correctly the tube which bears his name; and if we admit that G. F. Ingrassias anticipated him in the knowledge of the third bone of the tympanal cavity, the *stapes*, he is still the first who described the internal and anterior muscles of the *malleus*, as also the *stapedius*, and the complicated figure of the *cochlea*. He is the first who studied accurately the anatomy of the teeth, and the phenomena of the first and second dentition. The work, however, which demonstrates at once the great merit and the unhappy fate of Eustachius is his *Anatomical Engravings*, which, though completed in 1552, nine years after the impression of the work of Vesalius, the author was unable to publish. First communicated to the world in 1714 by G. M. Lancisi, afterwards in 1744 by Cajetan Petrioli, again in 1744 by B. S. Albinus, and subsequently at Bonn in 1790, the engravings show that Eustachius had dissected with the greatest care and diligence, and taken the utmost pains to give just views of the shape, size and relative position of the organs of the human body.

The first seven plates illustrate the history of the kidneys and some of the facts relating to the structure of the ear. The eighth represents the heart, the ramifications of the *vena azygos*, and the valve of the *vena cava*, named from the author. In the seven subsequent plates is given a succession of different views of the viscera of the chest and abdomen. The seventeenth contains the brain and spinal cord; and the eighteenth more accurate views of the origin, course and distribution of the nerves than had been given before. Fourteen plates are devoted to the muscles.

Eustachius did not confine his researches to the study of relative anatomy. He investigated the intimate structure of organs with assiduity and success. What was too minute for unassisted vision he inspected by means of glasses. Structure which could not be understood in the recent state, he unfolded by maceration in different fluids, or rendered more distinct by injection and exsiccation. The facts unfolded in these figures are so important that it is justly remarked by Lauth, that if the author himself had been fortunate enough to publish them, anatomy would have attained the perfection of the 18th century two centuries earlier at least. Their seclusion for that period in the papal library has given celebrity to many names which would have been known only in the verification of the discoveries of Eustachius.

Columbus.

M. R. Columbus and G. Fallopius were pupils of Vesalius. Columbus, as his immediate successor in Padua, and afterwards as professor at Rome, distinguished himself by rectifying and improving the anatomy of the bones; by giving correct accounts of the shape and cavities of the heart, of the pulmonary artery and aorta and their valves, and tracing the course of the blood from the right to the left side of the heart; by a good description of the brain and its vessels, and by correct understanding of the internal ear, and the first good account of the ventricles of the larynx.

Fallopius.

Fallopius, who, after being professor at Pisa in 1548, and at Padua in 1551, died at the age of forty, studied the general anatomy of the bones; described better than heretofore the internal ear, especially the tympanum and its osseous ring, the two *fenestrae* and their communication with the vestibule and cochlea; and gave the first good account of the stylo-mastoid hole and canal, of the ethmoid bone and cells, and of the lacrymal passages. In myology he rectified several mistakes of Vesalius. He also devoted attention to the organs of generation in both sexes, and discovered the utero-peritoneal canal which still bears his name.

Ingrassias.

Osteology nearly at the same time found an assiduous cultivator in Giovanni Filippo Ingrassias (1545–1580), a learned Sicilian physician, who, in a skilful commentary on the osteology of Galen, corrected numerous mistakes. He gave the first distinct account of the true configuration of the sphenoid and ethmoid bones, and has the merit of first describing (1546) the third bone of the tympanum, called *stapes*, though this is also claimed by Eustachius and Fallopius.

Aranzi.

The anatomical descriptions of Vesalius underwent the scrutiny of various inquirers. Those most distinguished by the importance and accuracy of their researches, as well as the temperate tone of their observations, were Julius Caesar Aranzi (1530–1589), anatomical professor for thirty-two years in the university of Bologna, and Constantio Varoli, physician to Pope Gregory XIII. To the former we are indebted for the first correct account of the anatomical peculiarities of the foetus, and he was the first to show that the muscles of the eye do not, as was falsely imagined, arise from the *dura mater* but from the margin of the optic hole. He also, after considering the anatomical relations of the cavities of the heart, the valves and the great vessels, corroborates the views of Columbus regarding the course which the blood follows in passing from the right to the left side of the heart. Aranzi is the first anatomist who describes distinctly the inferior cornua of the ventricles of the cerebrum, who recognizes the objects by which they are distinguished, and who gives them the name by which they are still known (*hippocampus*); and his account is more minute and perspicuous than that of the authors of the subsequent century. He speaks at large of the choroid plexus, and gives a particular description of the fourth ventricle, under the name of *cistern of the cerebellum*, as a discovery of his own.

Varolius.

Italy, though rich in anatomical talent, has probably few greater names than that of Constantio Varoli (b. 1543) of Bologna. Though he died at the early age of thirty-two, he acquired a reputation not inferior to that of the most eminent of his contemporaries. He is now known chiefly as the author of an epistle, inscribed to Hieronymo Mercuriali, on the optic nerves, in which he describes a new method of dissecting the brain, and communicates many interesting particulars relating to the anatomy of the organ. He observes the threefold division of the inferior surface or base, defines the limits of the anterior, middle and posterior eminences, as marked by the compartments of the skull, and justly remarks that the cerebral cavities are capacious, communicate with each other, extending first backward and then forward, near the angle of the pyramidal portion of the temporal bone, and that they are folded on themselves, and finally lost above the middle and inferior eminence of the brain. He appears to have been aware that at this point they communicate with the exterior or convoluted surface. He recognized the impropriety of the term *corpus callosum*, seems to have known the communication called afterwards *foramen Monroianum*, and describes the *hippocampus* more minutely than had been previously done.

Among the anatomists of the Italian school, as a pupil of Fallopius, Eustachius and U. Aldrovandus, is generally enumerated Volcher Coiter (b. 1534) of Groningen. He distinguished himself by accurate researches on the cartilages, the bones and the nerves, recognized the value of morbid anatomy, and made experiments on living animals to ascertain the action of the heart and the influence of the brain.

The *Fruitefull and Necessary Briefe Worke* of John Halle[1] (1565) and *The Englisheman's Treasure* by Master Thomas Vicary (1586),[2] English works published at this time, are tolerable compilations from former authors, much tinged by Galenian and Arabian distinctions. A more valuable compendium than either is, however, that of John Banister (1578), entitled *The Historie of Man, from the most approved Anathomistes in this Present Age.*

Fabricius.

The celebrity of the anatomical school of Italy was worthily maintained by Hieronymo Fabricio of Acquapendente, who, in imitation of his master Fallopius, laboured to render anatomical knowledge more precise by repeated dissections, and to illustrate the obscure by researches on the structure of animals in general. In this manner he investigated the formation of the foetus, the structure of the oesophagus, stomach and bowels, and the peculiarities of the eye, the ear and the larynx. The discovery, however, on which his surest claims to eminence rest is that of the membranous folds, which he names *valves*, in the interior of veins. Several of these folds had been observed by Fernel, Sylvius and Vesalius; and in 1547 G. B. Canani observed those of the *vena azygos;* but no one appears to have offered any rational conjecture on their use, or to have traced them through the venous system at large, until Fabricius in 1574, upon this hypothesis, demonstrated the presence of these valvular folds in all the veins of the extremities.

Fabricius, though succeeded by his pupil Julius Casserius of Placenza, may be regarded as the last of that illustrious line of anatomical teachers by whom the science was so successfully studied and taught in the universities of Italy. The discoveries which each made, and the errors which their successive labours rectified, tended gradually to give anatomy the character of a useful as well as an accurate science, and to pave the way for a discovery which, though not anatomical but physiological, is so intimately connected with correct knowledge of the shape and situation of parts, that it exercised the most powerful influence on the future progress of anatomical inquiry. This was the knowledge of the circular motion of the blood—a fact which though obscurely conjectured by Aristotle, Nemesius, Mondino and Berenger, and partially taught by Servetus, Columbus, Andreas Caesalpinus and Fabricius, it was nevertheless reserved to William Harvey fully and satisfactorily to demonstrate.

Servetus.

Mondino believed that the blood proceeds from the heart to the lungs through the *vena arterialis* or pulmonary artery, and that the aorta conveys the spirit into the blood through all parts of the body. This doctrine was adopted with little modification by Berenger, who further demonstrated the existence and operation of the tricuspid valves in the right ventricle, and of the sigmoid valves at the beginning of the pulmonary artery and aorta, and that there were only two ventricles separated by a solid impervious septum. These were afterwards described in greater detail by Vesalius, who nevertheless appears not to have been aware of the important use which might be made of this knowledge. It was the Spaniard Michael Servet or Servetus (born in 1509, burnt in 1553) who in his treatise *De Trinitatis Erroribus*, published at Haguenau in 1531, first maintained the imperviousness of the septum, and the transition of the blood by what he terms an unknown route, namely, from the right ventricle by the *vena arteriosa* (pulmonary artery) to the lungs, and thence into the *arteria venosa* or pulmonary vein and left auricle and ventricle, from which, he adds afterwards, it is conveyed by the aorta to all parts of the body.[1]

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[1] An interesting article on the character and work of the Maidstone surgeon, John Halle, by E. Barclay Smith, will be found in the *J. Anat. and Phys.* vol. xxxiv. p. 275.

[2] It has been pointed out by Dr J. F. Payne that Vicary's work is merely an abridged copy of an unpublished English anatomical treatise of the 14th century. The name of the author is unknown, but internal evidence shows that he was a London surgeon. The manuscript was written in English in 1392. See *British Medical Journal*, January 25, 1896.

Though the leading outlines, not only of the pulmonary or small but even of the great circulation, were sketched thus early by one who, though a philosopher, was attached to the church, it was only in his work *De Re Anatomica*, published at Venice in 1559, that Columbus formally and distinctly announced the circular course of the blood as a discovery of his own; and maintained, in addition to the imperviousness of the septum, the fact that the *arteria venalis* (pulmonary vein) contains, not air, but blood mixed with air brought from the lungs to the left ventricle of the heart, to be distributed through the body at large.

Caesalpinus.

Soon after, views still more complete of the small or pulmonary circulation were given by Andreas Caesalpinus (1519–1603) of Arezzo, who not only maintained the analogy between the structure of the arterious vein or pulmonary artery and the aorta, and that between the venous artery or pulmonary veins and veins in general, but was the first to remark the swelling of veins below ligatures, and to infer from it a refluent motion of blood in these vessels. The discoveries of Aranzi and Eustachius in the vessels of the foetus tended at first to perplex and afterwards to elucidate some of these notions.

Harvey.

At length it happened that, between the years 1598 and 1600, a young Englishman, William Harvey, pursuing his anatomical studies at Padua under Fabricius, learnt from that anatomist the existence of the valves in the veins of the extremities, and undertook to ascertain the use of these valves by experimental inquiry. It is uncertain whether he learnt from the writings of Caesalpinus the fact observed by that author of the tumescence of a vein below the ligature, but he could not fail to be aware, and indeed he shows that he was aware, of the small circulation as taught by Servetus and Columbus. Combining these facts already known, he, by a series of well-executed experiments, demonstrated clearly the existence, not only of the small, but of a general circulation from the left side of the heart by the aorta and its subdivisions, to the right side by the veins. This memorable truth was first announced in the year 1619.

It is unnecessary here to consider the arguments and facts by which Harvey defended his theory, or to notice the numerous assaults to which he was exposed, and the controversies in which his opponents wished to involve him. It is sufficient to say that, after the temporary ebullitions of spleen and envy had subsided, the doctrine of the circular motion of the blood was admitted by all enlightened and unprejudiced persons, and finally was universally adopted as affording the most satisfactory explanation of many facts in anatomical structure which were either misunderstood or entirely overlooked. The inquiries to which the investigation of the doctrine gave rise produced numerous researches on the shape and structure of the heart and its divisions, of the lungs, and of the blood-vessels and their distribution. Of this description were the researches of Nicolas Steno on the structure of the heart, the classical work of Richard Lower, the dissertation of J. N. Pechlin, the treatise of Raymond Vieussens, the work of Marcello Malpighi on the structure of the lungs, several sketches in the writings of John Mayow, and other treatises of less moment. Systematic treatises of anatomy began to assume a more instructive form, and to breathe a more philosophical spirit. The great work of Adrian Spigelius, which appeared in 1627, two years after the death of the author, contains indeed no proof that he was aware of the valuable generalization of Harvey; but in the institutions of Caspar Bartholinus, as republished and improved by his son Thomas in 1651, the anatomical descriptions and explanations are given with reference to the new doctrine. A still more unequivocal proof of the progress of correct anatomical knowledge was given in the lectures delivered by Peter Dionis, at the Jardin Royal of Paris, in 1673 and the seven following years, in which that intelligent surgeon gave most accurate demonstrations of all the parts composing the human frame, and especially of the heart, its auricles, ventricles and valves, and the large vessels connected with it and the lungs. These demonstrations, first published in 1690, were so much esteemed that they passed through seven editions in the space of thirty years, and were translated into English.

Aselli.

The progress of anatomical discovery continued in the meantime to advance. In the course of the 16th century Eustachius, in studying minutely the structure of the vena azygos, had recognized in the horse a white vessel full of watery fluid, connected with the internal jugular vein, on the left side of the vertebral column, corresponding accurately with the vessel since named *thoracic duct.* Fallopius also described vessels belonging to the liver distinct from arteries and veins; and similar vessels appear to have been noticed by Nicolaus Massa (1499–1569). The nature and properties of these vessels were, however, entirely unknown. On the 23rd of July 1622 Gaspar Aselli, professor of anatomy at Pavia, while engaged in demonstrating the recurrent nerves in a living dog, first observed numerous white delicate filaments crossing the mesentery in all directions; and though he took them at first for nerves, the opaque white fluid which they shed quickly convinced him that they were a new order of vessels. The repetition of the experiment the following day showed that these vessels were best seen in animals recently fed; and as he traced them from the villous membrane of the intestines, and observed the valves with which they were liberally supplied, he inferred that they were genuine chyliferous vessels. By confounding them with the lymphatics, he made them proceed to the pancreas and liver—a mistake which appears to have been first rectified by Francis de le Boe. The discovery of Aselli was announced in 1627; and the following year, by means of the zealous efforts of Nicolas Peiresc, a liberal senator of Aix, the vessels were seen in the person of a felon who had eaten copiously before execution, and whose body was inspected an hour and a half after. In 1629 they were publicly demonstrated at Copenhagen by Simon Pauli, and the same year the thoracic duct was observed by Jacques Mentel (1599–1670) for the first time since it was described by Eustachius. Five years after (1634), John Wesling, professor of anatomy and surgery at Venice, gave the first delineation of the lacteals from the human subject, and evinced more accurate knowledge than his predecessors of the thoracic duct and the lymphatics. Nathaniel Highmore[1] in 1637 demonstrated unequivocally the difference between the lacteals and the mesenteric veins; and though some perplexity was occasioned by the discovery of the pancreatic duct by Christopher Wirsung, this mistake was corrected by Thomas Bartholinus; and the discovery by Jean Pecquet in 1647 of the common trunk of the lacteals and lymphatics, and of the course which the chyle follows to reach the blood, may be regarded as the last of the series of isolated facts by the generalization of which the extent, distribution and uses of the most important organs of the animal body were at length developed.

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[1] The passage of Servetus is so interesting that our readers may feel some curiosity in perusing it in the language of the author; and it is not unimportant to remark that Servetus appears to have been led to think of the course of the blood by the desire of explaining the manner in which the animal spirits were supposed to be generated:—"Vitalis spiritus in sinistro cordis ventriculo suam originem habet, juvantibus maxime pulmonibus ad ipsius perfectionem. Est spiritus tenuis, caloris vi elaboratus, flavo colore, ignea potentia, ut sit quasi ex puriore sanguine lucens, vapor substantiam continens aquae, aeris, et ignis. Generatur ex facta in pulmone commixtione inspirati aeris cum elaborato subtili sanguine, quem dexter ventriculus sinistro communicat. Fit autem communicatio haec, non per parietem cordis medium, ut vulgo creditur, sed magno artificio a dextro cordis ventriculo, longo per pulmones ductu agitatur sanguis subtilis; a pulmonibus praeparatur, flavus efficitur, et a vena arteriosa in arteriam venosam transfunditur. Deinde in ipsa arteria venosa, inspirato aeri miscetur et exspiratione a fuligine expurgatur; atque ita tandem a sinistro cordis ventriculo totum mixtum per diastolen attrahitur, apta supellex, ut fiat spiritus vitalis. Quod ita per pulmones fiat communicatio et praeparatio, docet conjunctio varia, et communicatio venae arteriosae cum arteria venosa in pulmonibus. Confirmat hoc magnitudo insignis venae arteriosae, quae nec talis nec tanta esset facta, nec tantam a corde ipso vim purissimi sanguinis in pulmones emitteret, ob solum eorum nutrimentum; nec cor pulmonibus hac ratione serviret, cum praesertim antea in embryone solerent pulmones ipsi aliunde nutriri, ob membranulas illas seu valvulas cordis, usque ad horum nativitatem; ut docet Galenus, &c. Itaque ille spiritus a sinistro cordis ventriculo arterias totius corporis deinde transfunditur, ita ut qui tenuior est, superiora petit, ubi magis elaboratur, praecipue in plexu retiformi, sub basi cerebri sito, ubi ex vitali fieri incipit animalis, ad propriam rationalis animae rationem accedens."—*De Trinitate*, lib. v.

[1] Highmore was a physician practising at Sherborne all his life (1613–1685).

Joyliffe.

To complete the history of this part of anatomical science one step yet remained—the distinction between the lacteals and lymphatics, and the discovery of the termination of the latter order of vessels. The honour of this discovery is divided between George Joyliffe (1621–1658), an English anatomist, and Olaus Rudbeck (1630–1702), a young Swede. The former, according to the testimony of Francis Glisson and Thomas Wharton, was aware of the distinct existence of the lymphatics in 1650, and demonstrated them as such in 1652. It is nevertheless doubtful whether he knew them much before the latter period; and it is certain that Rudbeck observed the lymphatics of the large intestines, and traced them to glands, on the 27th of January 1651, after he had, in the course of 1650, made various erroneous conjectures regarding them, and, like others, attempted to trace them to the liver. The following year he demonstrated them in presence of Queen Christina, and traced them to the thoracic duct, and the latter to the subclavian vein. Their course and distribution were still more fully investigated by Thomas Bartholinus, Wharton, J. Swammerdam and G. Blaes, the last two of whom recognized the existence of valves; while Antony Nuck of Leiden, by rectifying various errors of his predecessors, and adding several new and valuable observations, rendered this part of anatomy much more precise than formerly.

Willis.

After this period anatomists began to study more minutely the organs and textures. Francis Glisson[1] distinguished himself by a minute description of the liver (1654), and a clearer account of the stomach and intestines, than had yet been given. Thomas Wharton[2] investigated the structure of the glands with particular care; and though rather prone to indulge in fanciful generalization, he developed some interesting views of these organs; while Walter Charleton (1619–1707), who appears to have been a person of great genius, though addicted to hypothesis, made some good remarks on the communication of the arteries with the veins, the foetal circulation and the course of the lymphatics. But the circumstance which chiefly distinguished the history of anatomy at the beginning of the 17th century was the appearance of Thomas Willis[3] (1621–1675), who rendered himself eminent not only by good researches on the brain and nerves, but by many judicious observations on the structure of the lungs, the intestines, the blood-vessels and the glands. His anatomy of the brain and nerves is so minute and elaborate, and abounds so much in new information, that the reader is struck by the immense chasm between the vague and meagre notices of his predecessors and the ample and correct descriptions of Willis. This excellent work, however, is not the result of his own personal and unaided exertions; and the character of Willis derives additional lustre from the candid avowal of his obligations to Sir Christopher Wren and Thomas Millington, and, above all, to the diligent researches of his fellow-anatomist Richard Lower.

Willis was the first who numbered the cranial nerves in the order in which they are now usually enumerated by anatomists. His observation of the connexion of the eighth pair with the slender nerve which issues from the beginning of the spinal cord is known to all. He remarked the parallel lines of the mesolobe, afterwards minutely described by Felix Vicq d'Azyr (1748–1794). He seems to have recognized the communication of the convoluted surface of the brain and that between the lateral cavities beneath the fornix. He described the *corpora striata* and *optic thalami*; the four orbicular eminences, with the bridge, which he first named *annular protuberance*; and the white mammillary eminences, behind the infundibulum. In the cerebellum he remarks the arborescent arrangement of the white and grey matter, and gives a good account of the internal carotids, and the communications which they make with the branches of the basilar artery.

Malpighi.

About the middle of the 17th century R. Hooke and Nehemiah Grew employed the simple microscope in the minute examination of plants and animals; and the Dutch philosopher A. Leeuwenhoek with great acuteness examined microscopically the solids and fluids of the body, recognized the presence of scales in the cuticle, and discovered the corpuscles in the blood and milk, and the spermatozoa in the seminal fluid. The researches of Malpighi also tended greatly to improve the knowledge of minute structure. He gave the first distinct ideas on the organization of the lung, and the mode in which the bronchial tubes and vessels terminate in that organ. By the microscope he traced the transition of the arteries into the veins, and saw the movements of the blood corpuscles in the capillaries. He endeavoured to unfold, by dissection and microscopic observation, the minute structure of the brain. He studied the structure of bone, he traced the formation and explained the structure of the teeth; and his name is to this day associated with the discovery of the deeper layer of the cuticle and the Malpighian bodies in the spleen and kidney. In these difficult inquiries the observations of Malpighi are in general faithful, and he may be regarded as the founder of histological anatomy.

Nicolas Steno, or Stensen, described with accuracy (1660) the lacrymal gland and passages, and rediscovered the parotid duct. L. Bellini studied the structure of the kidneys, and described the tongue and tonsils with some care; and Charles Drelincourt laboured to investigate the changes effected on the uterus by impregnation, and to elucidate the formation of the foetus. The science might have derived still greater advantages from the genius of Regnier de Graaf, who investigated with accuracy the structure of the pancreas and of the organs of generation in both sexes, had he not been cut off at the early age of thirty-two. Lastly, Wepfer, though more devoted to morbid anatomy, made, nevertheless, some just observations on the anatomical disposition of the cerebral vessels, the glandular structure of the liver, and the termination of the common duct in the duodenum.

Ruysch.

The appearance of Frederic Ruysch, who was born in 1638, became professor of anatomy at Amsterdam in 1665 and died in that city in 1731, gave a new impulse to anatomical research, and tended not only to give the science greater precision, but to extend its limits in every direction. The talents of Ruysch are said to have been developed by accident. To repel the audacious and calumnious aspersions with which Louis de Bils attacked de le Boe and van Horne, Ruysch published his tract on the valves of the lymphatics, which completely established his character as an anatomist of originality and research. This, however, is the smallest of his services to the science. The art of injecting, which had been originally attempted by Eustachi and Varoli, and was afterwards rudely practised by Glisson, Bellini and Willis, was at length carried to greater perfection by de Graaf and Swammerdam, the former of whom injected the spermatic vessels with mercury and variously coloured liquors; while the latter, by employing melted wax with other ingredients, made the first approach to the refinements of modern anatomy. By improving this idea of using substances which, though solid, may be rendered fluid at the period of injecting, Ruysch carried this art to the highest perfection.

By the application of this happy contrivance he was enabled to demonstrate the arrangement of minute vessels in the interior of organs which had escaped the scrutiny of previous anatomists. Scarcely a part of the human body eluded the penetration of his syringe; and his discoveries were proportionally great. His account of the valves of the lymphatics, of the vessels of the lungs, and their minute structure; his researches on the vascular structure of the skin, of the bones, and their epiphyses, and their mode of growth and union; his observations on the spleen, the glans penis, the clitoris, and the womb impregnated and unimpregnated, were but a limited part of his anatomical labours. He studied the minute structure of the brain; he demonstrated the organization of the choroid plexus; he described the state of the hair when affected with Polish plait; he proved the vascular structure of the teeth; he injected the dura mater, the pleura, the pericardium and peritoneum; he unfolded the minute structure of the conglomerate glands; he investigated that of the synovial apparatus placed in the interior of the joints; and he discovered several curious particulars relating to the lacteals, the lymphatics and the lymphatic glands.

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[1] Glisson was for forty years professor of physic at Cambridge.

[2] Wharton was a graduate both of Oxford and Cambridge, and physician to St Thomas's Hospital.

[3] Willis was Sedleian professor of natural philosophy in Oxford in 1660. Later he practised in London.

Meanwhile, H. Meibomius rediscovered (1670) the palpebral glands, which were known to Casserius; Swammerdam studied the action of the lungs, described the structure of the human uterus, and made numerous valuable observations on the coeca and pancreatoid organs of fishes; and Th. Kerckring laid the foundation of a knowledge of the process of ossification. John Conrad Brunner, in the course of experiments on the pancreas, discovered (1687) the glands of the duodenum named after him, and J. Conrad Peyer (1677–1681) described the solitary and agminated glands of the intestinal canal. Leonard Tassin, distinguished for original observation, rendered the anatomical history of the brain more accurate than heretofore, and gave particular accounts of the intestinal tube, the pancreatic duct and the hepatic ligaments (1678).

Duverney.

That France might not be without participation in the glory of advancing the progress of anatomical knowledge, the names of Joseph Guichard Duverney and Vieussens are commemorated with distinction. Duverney, born in 1648, and first introduced into public life in 1676 in the Royal Academy of Sciences, decorated with the honorary title of professor of anatomy to the dauphin, and appointed in 1679 professor at the Jardin Royal, distinguished himself by the first accurate account of the organ of hearing, and by his dissections of several animals at the academy supplied valuable materials for the anatomical details of the natural history of animals published by that learned body. He appears to have been the first who demonstrated the fact that the cerebral sinuses open into the jugular veins, and to have been aware that the former receives the veins of the brain and are the venous receptacles of the organ. He understood the cerebral cavities and their mode of communication; distinguishes the posterior pillars of the vault from the pedes hippocampi; recognizes the two plates of the septum lucidum; and, what is still more remarkable, he first indicates distinctly the discussation of the anterior pyramids of the medulla oblongata—a fact afterwards verified by the researches of Mistichelli, F. P. du Petit and G.D. Santorini. He studied the ganglions attentively, and gives the first distinct account of the formation, connexions and distribution of the intercostal nerves. It is interesting to remark that his statement that the veins or sinuses of the spinal cord terminate in the vena azygos was verified by the subsequent researches of G. Dupuytren (1777–1835) and G. Breschet (1784–1845), which showed that the vertebral veins communicate by means of the intercostal and superior lumbar veins with the azygos and hemi-azygos. His account of the structure of bones and of the progress of ossification is valuable. He recognized the vascular structure of the spleen, and described the excretory ducts of the prostate gland, the verumontanum, and the anteprostates.

One of the circumstances which at this time tended considerably to the improvement of anatomical science was the attention with which Comparative Anatomy was beginning to be cultivated. In ancient times, and at the revival of letters, the dissection of the lower animals was substituted for that of the human body; and the descriptions of the organs of the latter were too often derived from the former. The obloquy and contempt in which this abuse involved the study of animal anatomy caused it to be neglected, or pursued with indifference, for more than two centuries, during which anatomists confined their descriptions, at least very much, to the parts of the human body. At this period, however, the prejudice against Comparative Anatomy began to subside; and animal dissection, though not substituted for that of the human body, was employed, as it ought always to have been, to illustrate obscurities, to determine doubts and to explain difficulties, and, in short, to enlarge and rectify the knowledge of the structure of animal bodies generally.

Collins.

For this revolution in its favour, Comparative Anatomy was in a great measure indebted to the learned societies which were established about this time in the different countries of Europe. Among these, the Royal Society of London, embodied by charter by Charles II. in 1662, and the Academy of Sciences of Paris, founded in 1666 by J. B. Colbert, are undoubtedly entitled to the first rank. Though later in establishment, the latter institution was distinguished by making the first great efforts in favour of Comparative Anatomy; and Claude Perrault, Pecquet, Duverney and Jean Méry, by the dissections of rare animals obtained from the royal menagerie, speedily supplied valuable materials for the anatomical naturalist. In England, Nehemiah Grew, Edward Tyson[1] and Samuel Collins[2] cultivated the same department with diligence and success. Grew has left an interesting account of the anatomical peculiarities of the intestinal canal in various animals; Tyson, in the dissection of a porpoise, an opossum and an orang outang, adduces some valuable illustrations of the comparative differences between the structure of the human body and that of the lower animals; Collins has the merit of conceiving, and executing on an enlarged plan, a comprehensive system, embodying all the information then extant (1685). With the aid of Tyson and his own researches, which were both extensive and accurate, he composed a system of anatomical knowledge in which he not only gives ample and accurate descriptions of the structure of the human body, and the various morbid changes to which the organs are liable, but illustrates the whole by accurate and interesting sketches of the peculiarities of the lower animals. The matter of this work is so excellent that it can only be ascribed to ignorance that it has received so little attention. Though regarded as a compilation, and though indeed much of the human anatomy is derived from Vesalius, it has the advantage of the works published on the continent at that time, that it embodies most of the valuable facts derived from Malpighi, Willis and Vieussens. The Comparative Anatomy is almost all original, the result of personal research and dissection; and the pathological observations, though occasionally tinged with the spirit of the times, show the author to have been endowed with the powers of observation and judicious reflexion in no ordinary degree.

About this time also we recognize the first attempts to study the minute constitution of the tissues, by the combination of the microscope and the effects of chemical agents. Bone furnished the first instance in which this method was put in use; and though Gagliardi, who undertook the inquiry, had fallen into some mistakes which it required the observation of Malpighi to rectify, this did not deter Clopton Havers[3] and Nesbitt,[4] in England, and Courtial, H. L. Duhamel-Dumonceau and Delasone, and afterwards Herissant, in France, from resuming the same train of investigation. The mistakes into which these anatomists fell belong to the imperfect method of inquiry. The facts which they ascertained have been verified by recent experiment, and constitute no unessential part of our knowledge of the structure of bone.

Ten years after the publication of the work of Collins, Ridley,[5] another English anatomist, distinguished himself by a monograph (1695) on the brain, which, though not free from errors, contains, nevertheless, some valuable observations. Ridley is the first who distinguishes by name the restiform processes, or the posterior pyramidal eminences. He recognized the figure of the four eminences in the human subject; he remarked the mammillary bodies; and he discovered the sinus which passes under his name.

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[1] Tyson was a graduate both of Oxford and Cambridge. He was reader of anatomy at Surgeons' Hall, London.

[2] Collins was an M. D. of Padua, Oxford and Cambridge. He was physician in ordinary to Charles II.

[3] Havers was a London physician, and died in 1702.

[4] Robert Nesbitt (d. 1761) studied at Leiden and practised as a physician in London.

[5] Humphrey Ridley (1653–1708) was a London physician who studied at Leiden.

Vieussens.

Raymond Vieussens, by the publication of his great work on neurography in 1684, threw new light on the configuration and structure of the brain, the spinal cord and the nerves; and gave a description of the arrangement and distribution of the latter more precise than heretofore. Of the formation and connexions of the sympathetic nerve especially he gave views which have been generally adopted by subsequent anatomists. His new arrangement of the vessels, published in 1705, contains several curious opinions. His observations on the structure of the heart, published in 1706, and enlarged in 1715, exhibit the first correct views of the intimate structure of an organ which afterwards was most fully developed by the labours of G. M. Lancisi and J. B. Senac.

To the same period (1685–1697) belong the rival publications of G. Bidloo[1] and William Cowper, the latter of whom, however, stained a reputation otherwise good by publishing as his own the engravings of the former. Cowper further distinguished himself by a minute account of the urethral glands, already known to Columbus and Méry; by a good description of the intestinal glands, discovered by Brunner and Peyer; and by demonstrating the communication of the arteries and veins of the mesentery.

Santorini.

The anatomical genius of Italy, which had slumbered since the death of Malpighi, was destined once more to revive in Lancisi, A. M. Valsalva, and his illustrious pupils G. D. Santorini and J. B. Morgagni. Valsalva especially distinguished himself by his description of the structure of the ear, which, in possessing still greater precision and minuteness than that of Duverney, is valuable in setting the example of rendering anatomy altogether a science of description. Santorini, who was professor at Venice, was no unworthy friend of Valsalva and Morgagni. His anatomical observations, which relate to the muscles of the face, the brain and several of the nerves, the ducts of the lachrymal gland, the nose and its cavities, the larynx, the viscera of the chest and belly, and the organs of generation in the two sexes, furnish beautiful models of essays, distinguished for perspicuity, precision and novelty, above anything which had then appeared. These observations, indeed, which bear the impress of accurate observation and clear conception, may be safely compared with any anatomical writings which have appeared since. Those on the brain are particularly interesting.

Morgagni.

Morgagni, though chiefly known as a pathological anatomist, did not neglect the healthy structure. His *Adversaria*, which appeared between 1706 and 1719, and his *Epistles*, published in 1728, contain a series of observations to rectify the mistakes of previous anatomists, and to determine the characters of the healthy structure of many parts of the human body. Many parts he describes anew, and indicates facts not previously observed. All his remarks show how well he knew what true anatomical description ought to be. In this respect, indeed, the three anatomists now mentioned may be said to have anticipated their contemporaries nearly a century; for, while other authors were satisfied with giving loose and inaccurate or meagre notices of parts, with much fanciful supposition, Valsalva, Santorini and Morgagni laboured to determine with precision the anatomical characters of the parts which they describe.

Winslow.

The same character is due to J. B. Winslow (1669–1760), a native of Denmark, but, as pupil and successor of Duverney, as well as a convert to Catholicism, naturalized in France, and finally professor of anatomy at the Royal Gardens. His exposition of the structure of the human body is distinguished for being not only the first treatise of descriptive anatomy, divested of physiological details and hypothetical explanations foreign to the subject, but for being a close description derived from actual objects, without reference to the writings of previous anatomists. About the same time W. Cheselden in London, the first Alexander Monro in Edinburgh, and B. S. Albinus in Leiden, contributed by their several treatises to render anatomy still more precise as a descriptive science. The *Osteographia* of the first-mentioned was of much use in directing attention to the study of the skeleton and the morbid changes to which it is liable. This work, however, magnificent as it was, was excelled by that of Albinus, who in 1747 published engravings, executed by Jan Wandelaar (1691–1759), of the bones and muscles, which had never been surpassed in accuracy of outline or beauty of execution. The several labours of Albinus, indeed, constitute an important era in the history of the science. He was the first who classified and exhibited the muscles in a proper arrangement, and applied to them a nomenclature which is still retained by the consent of the best anatomists. He gives a luminous account of the arteries and veins of the intestines, represents with singular fidelity and beauty the bones of the foetus, inquires into the structure of the skin and the cause of its colour in different races; represents the changes incident to the womb in different periods of pregnancy, and describes the relations of the thoracic duct and the vena azygos with the contiguous parts. Besides these large and magnificent works, illustrated by the most beautiful engravings, six books of Academical Annotations were the fruits of his long and assiduous cultivation of anatomy. These contain valuable remarks on the second structure and morbid deviations of numerous parts of the human body.

Albinus.

Haller.

Albinus found a worthy successor in his pupil Albert von Haller (1708–1777), who, with a mind imbued with every department of literature and science, directed his chief attention, nevertheless, to the cultivation of anatomical and physiological knowledge. Having undertaken at an early age (twenty-one) to illustrate, with commentaries, the physiological prelections of his preceptor H. Boerhaave, he devoted himself assiduously to the perusal of every work which could tend to facilitate his purpose; and, as he found numerous erroneous or imperfect statements, and many deficiencies to supply, he undertook an extensive course of dissection of human and animal bodies to obtain the requisite information. During the seventeen years he was professor at Göttingen, he dissected 400 bodies, and inspected their organs with the utmost care. The result of these assiduous labours appeared at intervals in the form of dissertations by himself, or under the name of some one of his pupils, finally published in a collected shape between 1746 and 1751 (*Disputationes Anatomicae Selectiores*), and in eight numbers of most accurate and beautiful engravings, representing the most important parts of the human body, *e.g.* the diaphragm, the uterus, ovaries and vagina, the arteries of the different regions and organs, with learned and critical explanatory observations. He verified the observations that in the foetus the testicles lie in the abdomen, and showed that their descent into the scrotum may be complicated with the formation of congenital hernia. Some years after, when he had retired from his academical duties at Göttingen, he published between 1757 and 1765 the large and elaborate work which, with singular modesty, he styled *Elements of Physiology*. This work, though professedly devoted to physiology, rendered, nevertheless, the most essentially services to anatomy. Haller, drawing an accurate line of distinction between the two, gave the most clear, precise and complete descriptions of the situation, position, figure, component parts and minute structure of the different organs and their appendages. The results of previous and coeval inquiry, obtained by extensive reading, he sedulously verified by personal observation; and though he never rejected facts stated on credible authorities, he in all cases laboured to ascertain their real value by experiment. The anatomical descriptions are on this account not only the most valuable part of his work, but the most valuable that had then or for a long time after appeared. It is painful, nevertheless, to think that the very form in which this work is composed, with copious and scrupulous reference to authorities, made it be regarded as a compilation only; and that the author was compelled to show, by a list of his personal researches, that the most learned work ever given to the physiologist was also the most abundant in original information.

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[1] Bidloo was a Dutch anatomist and Cowper a London surgeon.

With the researches of Haller it is proper to notice those of his contemporaries, John Frederick Meckel, J. N. Lieberkühn, and his pupil John Godfrey Zinn. The first, who was professor of anatomy at Berlin, described the Casserian ganglion, the first pair of nerves and its distribution and that of the facial nerves generally, and discovered the spheno-palatine ganglion (1748–1751). He made some original and judicious observations on the tissue of the skin and the mucous net (1753–1757); and above all, he recognized the connexion of the lymphatic vessels with the veins—a doctrine which, after long neglect, was revived by Vincent Fohmann (1794–1837) and Lippi. He also collected several valuable observations on the morbid states of the heart and brain. Lieberkühn published in 1745 a dissertation on the villi and glands of the small intestines. Zinn, who was professor of medicine at Göttingen, published a classical treatise on the eye (1755), which demonstrated at once the defects of previous inquiries, and how much it was possible to elucidate, by accurate research and precise description, the structure of one of the most important organs of the human frame. It was republished after his death by H. A. Wrisberg (1780). About the same time J. Weitbrecht gave a copious and minute account of the ligaments, and J. Lieutaud (1703–1780), who had already laboured to rectify many errors in anatomy, described with care the structure and relations of the heart and its cavities, and rendered the anatomy of the bladder very precise, by describing the triangular space and the mammillary eminence at its neck.

The study of the minute anatomy of the tissues, which had originally been commenced by Leeuwenhoek, Malpighi and Ruysch, began at this period to attract more general attention. Karl August von Bergen had already demonstrated (1732) the general distribution of cellular membrane, and showed that it not only incloses every part of the animal frame, but forms the basis of every organ—a doctrine which was adopted and still more fully expanded (1757) by his friend Haller, in opposition to what was asserted by Albinus, who maintains that each part has a proper tissue. ***W. Hunter.*** William Hunter at the same time gave a clear and ingenious statement of the difference between cellular membrane and adipose tissue (1757), in which he maintained the general distribution of the former, and represented it as forming the serous membranes, and regulating their physiological and pathological properties—doctrines which were afterwards confirmed by his brother John Hunter. A few years after, the department of general anatomy first assumed a substantial form in the systematic view of the membranes and their mutual connexions traced by Andrew Bonn of Amsterdam. ***A. Bonn.*** In his inaugural dissertation *De Continuationibus Membranarum*, published at Leiden in 1763, this author, after some preliminary observations on membranes in general and their structure, and an exposition of that of the skin, traces its transition into the mucous membranes and their several divisions. He then explains the distribution of the cellular membrane, the aponeurotic expansions, and the periosteum and perichondrium, by either of which, he shows, every bone of the skeleton is invested and connected. He finally gives a very distinct view of the arrangement of the internal membranes of cavities, those named serous and fibro-serous, and the manner of their distribution over the contained organs. This essay, which is a happy example of generalization, is remarkable for the interesting general views of the structure of the animal body which it exhibits; and to Bonn belongs the merit of sketching the first outlines of that system which it was reserved for the genius of M. F. X. Bichat to complete and embellish. Lastly, T. de Bordeu, in an elaborate essay (1767) on the mucous tissue, or cellular organ, as he terms it, brought forward some interesting views of the constitution, nature and extent of the cellular membrane.

Though anatomy was hitherto cultivated with much success as illustrating the natural history and morbid states of the human body, yet little had been done for the elucidation of local diseases, and the surgical means by which they may be successfully treated. The idea of applying anatomical knowledge directly to this purpose appears to have originated with Bernardin Genga, a Roman surgeon, who published in 1672, at Rome, a work entitled *Surgical Anatomy, or the Anatomical History of the Bones and Muscles of the Human Body, with the Description of the Blood-vessels.* This work, which reached a second edition in 1687, is highly creditable to the author, who appears to have studied intimately the mutual relations of different parts. It is not improbable that the example of Genga led J. Palfyn, a surgeon at Ghent, to undertake a similar task about thirty years after (1718–1726). For this, however, he was by no means well qualified; and the work of Palfyn, though bearing the name of *Surgical Anatomy*, is a miserable compilation, meagre in details, inaccurate in description, and altogether unworthy of the honour of being republished, as it afterwards was by Antony Petit.

While these two authors, however, were usefully employed in showing what was wanted for the surgeon, others were occupied in the collection of new and more accurate facts. Albinus, indeed, ever assiduous, had, in his account of the operations of Rau, given some good sketches of the relative anatomy of the bladder and urethra; and Cheselden had already, in his mode of cutting into the urinary bladder, shown the necessity of an exact knowledge of the relations of contiguous parts. The first decided application, however, of this species of anatomical research it was reserved for a Dutch anatomist of the 18th century to make. ***Camper.*** Peter Camper, professor of anatomy at Amsterdam, published in 1760 and 1762 his anatomico-pathological demonstrations of the parts of the human arm and pelvis, of the diseases incident to them, and the mode of relieving them by operation, and explained with great clearness the situation of the blood-vessels, nerves and important muscles. His remarks on the lateral operation of lithotomy, which contain all that was then known on the subject, are exceedingly interesting and valuable to the surgeon. It appears, further, that he was the first who examined anatomically the mechanism of ruptures, his delineations of which were published in 1801 by S. T. Sömmerring. Camper also wrote some important memoirs on Comparative Anatomy, and he was the author of a well-known work on the *Relations of Anatomy to the Fine Arts.*

The attention of anatomists was now directed to the elucidation of the most obscure and least explored parts of the human frame—the lymphatic vessels and the nerves. Although, since the first discovery of the former by Aselli, Rudbeck and Pecquet, much had been done, especially by Ruysch, Nuck, Meckel and Haller, many points, notwithstanding, relating to their origin and distribution in particular organs, and in the several classes of animals, were imperfectly ascertained or entirely unknown. ***W. and J. Hunter.*** William Hunter investigated their arrangement, and proposed the doctrine that they are absorbents; and John Hunter, who undertook to demonstrate the truth of this hypothesis by experiment, discovered, in 1758, lymphatics in the neck in birds. ***Hewson.*** As the doctrine required the existence of this order of vessels, not only in quadrupeds and birds but in reptiles and fishes, the inquiry attracted attention among the pupils of Hunter; and William Hewson[1] at length communicated, in December 1768, to the Royal Society of London an account of the lacteals and lymphatics in birds, fishes and reptiles, as he had discovered and demonstrated them. The subject was about the same time investigated by the second Alexander Monro, who indeed claimed the merit of discovering these vessels in the classes of animals now mentioned. But whatever researches this anatomist may have instituted, Hewson, by communicating his observations to the Royal Society, must be allowed to possess the strongest as well as the clearest claim to discovery. The same author, in 1774, gave the first complete account of the anatomical peculiarities of the lymphatic system in man and other animals, and thereby supplied an important gap in this department. Hewson is the first who distinguishes the lymphatics into two orders—the superficial and the deep—both in the extremities and in the internal organs. He also studied the structure of the intestinal villi, in which he verified the observations of Lieberkühn; and he made many important observations on the corpuscles of the lymph and blood. He finally applied his anatomical discoveries to explain many of the physiological and pathological phenomena of the animal body. Ten years after, John Sheldon, another pupil of Hunter, gave a second history and description of the lymphatics, which, though divested of the charm of novelty, contains many interesting anatomical facts. He also examined the structure of the villi.

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[1] Hewson was a partner with William Hunter in the Windmill Street School of Anatomy.

Cruikshank.

Lastly, Cruikshank,[1] in 1786, published a valuable history of the anatomy of the lymphatic system, in which he maintains the accuracy of the Hunterian doctrine, that the lymphatics are the only absorbents; gave a more minute account than heretofore of these vessels, of their coats and valves; and explained the structure of the lymphatic glands. He also injected the villi, and examined them microscopically, verifying most of the observations of Lieberkühn. The origin of the lymphatics he maintains rather by inference than direct demonstration. To these three works, though in other respects very excellent, it is a considerable objection that the anatomical descriptions are much mixed with hypothetical speculation and reasonings on properties, and that the facts are by no means always distinguished from mere matters of opinion. At the same time J. G. Haase published an account of the lymphatics of the skin and intestines, and the plexiform nets of the pelvis.

Mascagni.

To complete this sketch of the history of the anatomy of the lymphatic system, it may be added that Paolo Mascagni, who had been engaged from the year 1777 to 1781 in the same train of investigation, first demonstrated to his pupils several curious facts relating to the anatomy of the lymphatic system. When at Florence in 1782 he made several preparations, at the request of Peter Leopold, grand duke of Tuscany; and when the Royal Academy of Sciences at Paris announced the anatomy of this system for their prize essay appointed for March 1784, Mascagni resolved on communicating to the public the results of his researches—the first part of his commentary, with four engravings. Anxiety, however, to complete his preparations detained him at Florence till the close of 1785; and from these causes his work did not appear till 1787. These delays, however, unfavourable as they were to his claims of priority to Sheldon and Cruikshank, were on the whole advantageous to the perfection of his work, which is not only the most magnificent, but also the most complete that ever was published on the lymphatics. In his account of the vessels and their valves he confirms some of Hewson's observations and rectifies others. Their origin he proves by inference much in the same manner as Cruikshank; but he anticipates this author in the account of the glands, and he gives the most minute description of the superficial and deep lymphatics, both in the members and in the internal organs.

General accounts of the nerves had been given with various degrees of accuracy by Willis, Vieussens, Winslow, and the first Monro; and the subject had been much rectified and improved by the indefatigable Haller. The first example of minute descriptive neurography was given in 1748 by John Frederick Meckel, whose account of the fifth pair and of the nerves of the face will long remain a lasting proof of accuracy and research. The same subject was investigated in 1765 by Hirsch and in 1777 by Wrisberg. In 1766 Metzger examined the origin, distribution and termination of the first pair—a point which was afterwards very minutely treated by A. Scarpa[2] in his anatomical disquisitions, published in 1780; and the internal nerves of the nostrils were examined in 1791 by Haase. The optic nerve, which had been studied originally by Varoli, and afterwards by Méry, Duverney, J. F. Henkel, Moeller, Hein and Kaldschmid, was examined with extreme accuracy, with the other nerves of the organ of vision, by Zinn in his elaborate treatise. The phrenic nerves and the oesophageal branches of the vagus were studied by Haase; the phrenic, the abdominal and the pharyngeal nerves, by Wrisberg; those of the heart most minutely by Andersch; and the origins, formation and distribution of the intercostal nerves, by Iwanov, C. G. Ludwig, and Girardi. The labours of these anatomists, however, were eclipsed by the splendid works of Walter (1783) on the nerves of the chest and belly; and those of Scarpa (1794) on the distribution of the eighth pair and splanchnic nerves in general. In minuteness of description and in beauty of engraving these works have not yet been equalled, and will never perhaps be surpassed. About the same time, Scarpa, so distinguished in every branch of anatomical research, investigated the minute structure of the ganglions and plexuses. The anatomy of the brain itself was also studied (1780) with great attention by the second Monro, M. V. G. Malacarne and Vicq d'Azyr.

Lastly, the anatomy of the gravid uterus, which had been originally studied by Albinus, Roederer and Smellie, was again illustrated (1774) most completely by William Hunter, whose engravings will remain a lasting memorial of scientific zeal and artistic talent.

19th century.

The perfection which anatomical science attained in the last ten years of the 18th and during the 19th century is evinced not only in the improved character of the systems published by anatomists, but in the enormous advance which has taken place in the knowledge of the minute structure of the animal tissues, of the development of the tissues and organs, and of the modifications in form and structure exhibited by various groups of animals.

Sömmerring.

The first who gave a good modern system was R. B. Sabatier; but his work was speedily eclipsed by the superior merits of the treatises of Sömmerring, Bichat and Portal. The excellent work by Samuel Thomas Sömmerring, originally published in the German language, between the years 1791 and 1796; then in the Latin language, between the years 1794 and 1800; and in a second edition in the German language in 1800 and 1801, maintaining the high character which it first possessed for clear arrangement, accurate description and general precision, was, between the years 1841 and 1844, republished in eight volumes at Leipzig by Th. L. W. Bischoff, F. G. J. Henle, E. H. Huschke, Theile, G. G. Valentin, Vogel, and R. Wagner, with suitable additions, and a large amount of new and accurate information. In this edition Rudolph Wagner gives, in the first division of the first volume, the life, correspondence and literary writings of Sömmerring; and in the second volume the anatomy of the bones and ligaments. The third volume contains the anatomy of the muscles and the vascular system by Theile. G. G. Valentin devotes one volume, the fourth, to the minute anatomy of the nervous system and its parts, as disclosed by careful examination by the microscope; and it must be allowed that the author has been at great pains to present just views of the true anatomy of the brain, the spinal cord, the nervous branches and the ganglia. In the fifth volume, E. H. Huschke of Jena gives the anatomical history of the viscera and the organs of the senses, a department which had been left in some degree incomplete in the original, but for one division of which the author had left useful materials in his large figures already mentioned. In the sixth volume, an entire and complete system of general anatomy, deduced from personal observation and that of other careful observers, the materials being in general new, and in all instances confirmed and rectified is given by F. G. J. Henle. The seventh volume contains the history of the process of development in mammalia and man, by Th. L. W. Bischoff. The eighth volume treats of the pathological anatomy of the human body, by Julius Vogel, but contains only the first division, relating to the generalities of the subject. This, which is probably the most accurate as it is the most elaborate system of anatomical knowledge up to the date of its publication in 1844, was translated into the French language by Jourdan, and published in 1846 under the name of *Encyclopédie anatomique*. The eighth volume was translated into English in the year 1847.

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[1] W. Cruikshank followed W. Hunter as lecturer at the Windmill Street school.

[2] Scarpa was professor of anatomy at Modena and Pavia.

Bichat.

French systematic anatomists.

The *Anatomie générale* of M. F. X. Bichat is a monument of his philosophical genius which will last as long as the structure and functions of the human body are objects of interest. His *Anatomie descriptive* is distinguished by clear and natural arrangement, precise and accurate description, and the general ingenuity with which the subject is treated. The physiological observations are in general correct, often novel, and always highly interesting. It is unfortunate, however, that the ingenious author was cut off prematurely during the preparation of the third volume. The later volumes are, however, pervaded with the general spirit by which the others are impressed, and are highly creditable to the learning, the judgment and the diligence of P. J. Roux and M. F. R. Buisson. The system of A. Portal is a valuable and correct digest of anatomical and pathological knowledge, which, in exact literary information, is worthy of the author of the *Histoire de l'anatomie et de la chirurgie*, and, in accuracy of descriptive details, shows that Portal trusted not to the labours of his predecessors only. A. Boyer published in 1803 a complete treatise on descriptive anatomy. H. Cloquet formed, on the model of the *Anatomie descriptive* of Bichat, a system in which he avails himself of the literature and precision of Sömmerring and the details of Portal. An English translation of this work was prepared by Dr Robert Knox. Jean Cruveilhier published in 1834–1835 a good general treatise on descriptive anatomy, which was translated into English, and published as a part of *The Library of Medicine*. Cruveilhier's treatise has passed through several editions. The most elaborate work of the French school is the great treatise of M. J. Bourgery, consisting of four divisions, on descriptive, general, surgical and philosophical anatomy (1832–1854). These are beautifully illustrated.

Modern Human Anatomy (*Anthropotomy*)

The history of modern human anatomy in Great Britain begins with the time at which the dissection of the human body became part of the training of students of medicine, and this is one of the greatest debts, though by no means the best recognized, of the many which medical science owes to that remarkable man William Hunter. Before his time the anatomy professors of the most celebrated schools both at home and abroad used one or at most two subjects to illustrate their courses of lectures, and were in the habit of demonstrating the performance of surgical operations not on human bodies but on those of lower animals. Few students dissected the human body, because for such dissection they had no opportunities. The English law, since the time of Henry VIII., allowed only the bodies of persons executed for murder to be dissected, and the supply seems to have been sufficient for the humble needs of the time. The reformation of this antiquated and imperfect system took place in 1747, when Hunter established complete courses of anatomical lectures and opened a school for dissection. The practice of dissection grew so rapidly that by about 1793 there were 200 regular anatomy students in London, while in 1823 their number was computed at about 1000. Of course the supply of murderers was not enough for all these students, and the very fact that only murderers were allowed for this purpose made people bitterly hostile to the bodies of their relations and friends being dissected. In accounting for the great aversion which there has always been from dissection in England, it should be remembered that, although capital punishment was the penalty for very many offences at the beginning of the 19th century, only the bodies of murderers were handed over to the anatomists.

When once the absolute necessity of a surgeon's having a good knowledge of anatomy was realized, bodies had to be procured at any hazard, and the chief method was to dig them up as soon as possible after their burial. This practice of exhumation or "body-snatching" on a large scale seems to have been peculiar to Great Britain and America, and not to have been needed on the continent of Europe. In France, Italy, Portugal and Austria no popular objection was raised to the bodies of friendless people, who died in hospitals, or of those whose burial was paid for by the state, being dissected, provided a proper religious service was held over them. In Germany it was obligatory that the bodies of all people unable to pay for their burials, all dying in prisons, all suicides and public women should be given up. In all these countries the supply was most ample, exhumation was unknown, and the cost of learning anatomy to the students was very moderate. In Great Britain the earlier exhumations seem to have caused very little popular concern; Hunter, it is said, could manage to get the body of any person he wanted, were it that of giant, dwarf, hunchback or lord, but later, when the number of students increased very rapidly, the trade of "resurrection man" became commoner, and attracted the lowest dregs of the vicious classes. It is computed that in 1828 about 200 people were engaged in it in London alone, though only a few gained their entire livelihood by it. In the first half of the 18th century, and for some time afterwards, the few dissections which were undertaken were carried out in the private houses of medical men. In 1702 a rule was passed at St Thomas's Hospital preventing the surgeons or pupils from dissecting bodies there without the express permission of the treasurer, but by 1780 this rule seems to have lapsed, and a definite dissecting-room was established, an example which was soon followed by Guy's and St Bartholomew's.

In the early years of the 19th century the number of students increased so rapidly that a good many private anatomy schools grew up, and in 1828 we find that the total list of London dissecting rooms comprised those of Guy's, London, St Bartholomew's and St Thomas's hospitals, the Webb Street school of Mr Grainger, the Aldersgate school of Mr Tyrrell, the Windmill Street school where Caesar Hawkins and Herbert Mayo lectured, and the schools of Messrs. Bennett, Carpue, Dermott and Sleigh. These schools needed and, it seems, obtained nearly 800 bodies a year in the years about 1823, when there were nearly 1000 students in London, and it is recorded that bodies were even sent to Edinburgh and Oxford.

When it is realized that the greater number of these were exhumed, it is easy to understand how hostile the public feeling became to the body-snatchers or "resurrection men," and also in a modified form to the teachers of anatomy and medical students. This was increased by the fact that it soon became well known that many of the so-called resurrection men only used their calling as a cloak for robbery, because, if they were stopped with a horse and cart by the watch at night, the presence of a body on the top of stolen goods was sufficient to avert suspicion and search. It is in many places suggested, though not definitely stated, that the Home Office authorities understood how absolutely necessary it was that medical students should learn the details of the human body, on which they would be called to operate, and that the police had instructions not to interfere more than was necessary with the only method by which that education could be supplied, however unlawful it might be. So emboldened and careless did these body-snatchers become, and so great was the demand for bodies, that they no longer confined themselves to pauper graves, but took the remains of the wealthier classes, who were in a position to resent it more effectually; often they did not even take the trouble to fill in the graves after rifling their contents, and, in consequence, many sextons, who no doubt had been bribed, lost their posts, and men armed with firearms watched the London burial-places at night. The result of this was that the "resurrection men" had to go farther afield, and their occupation was attended with considerable danger, so that the price of a body gradually rose from £2 to about £14, which seems the maximum ever paid. In addition to this heavy sum the anatomical teachers had to pay the fines of the exhumers when they were caught, or to support their families when they were imprisoned. By 1828 the annual supply of bodies had dropped to about 450, and about 200 English students were forced each year to go to Paris for their anatomical instruction. There they could get a body for about seven francs and could also be taught by English anatomists who settled in that city for the purpose.

As early as about 1810 an anatomical society was formed, to impress on the government the necessity for an alteration in the law, and among the members we find the names of John Abernethy, Charles Bell, Everard Home, Benjamin Brodie, Astley Cooper and Henry Cline. It was owing to the exertions of this body that in 1828 a select committee was appointed by the government to report on the whole question, and to the minutes of evidence taken before this body the reader is referred for further details.

The report of this committee led to the Anatomy Act of 1832, but there can be little doubt that its passage through the House was expedited by the recent discovery and arrest of the infamous William Burke and William Hare, who, owing to the extreme difficulty of procuring subjects for dissection in Edinburgh and the high price paid for them, had made a practice of enticing men to their lodgings and then drugging and suffocating them in order to sell their bodies to Dr Knox. Hare turned king's evidence but Burke was executed. (See MacGregor's *History of Burke and Hare*, 1884, Lonsdale's *Life and Writings of Robert Knox*, 1870. Many further details connected with the condition of anatomy, especially in Dublin, before the passing of the Anatomy Act, will be found in *Memoirs of James Macartney* by Professor A. Macalister, F.R.S.) The bill to legalize and regulate the supply of subjects for dissection did not pass without considerable opposition. In 1829 the College of Surgeons petitioned against it, and it was withdrawn in the House of Lords owing to the opposition of the archbishop of Canterbury, but in 1832 a new Anatomy Bill was introduced, which, though violently opposed by Messrs Hunt, Sadler and Vyvyan, was supported by Macaulay and O'Connell, and finally passed the House of Lords on the 19th of July 1832.

This is the act which governs the practice of anatomy in the British Isles up to the present day, and which has only been slightly modified as to the time during which bodies may be kept unburied in the schools. It provides that any one intending to practise anatomy must obtain a licence from the home secretary. As a matter of fact only one or two teachers in each institution take out this licence and are known as licensed teachers, but they accept the whole responsibility for the proper treatment of all bodies dissected in the building for which their licence is granted. Watching over these licensed teachers, and receiving constant reports from them, are four inspectors of anatomy, one each for England, Scotland, Ireland and London, who report to the home secretary and know the whereabouts of every body which is being dissected. The main clause of the act is the seventh, which says that a person having lawful possession of a body may permit it to undergo anatomical examination provided no relative objects; the other clauses are subsidiary and detail the methods of carrying this into effect. In clause 16, however, the old act of Henry VIII. is repealed and the bodies of murderers are no longer to be given up for dissection after execution.

There can be little doubt that this act has worked well and with a minimum of friction; it at once did away with body-snatching and crimes like those of Burke and Hare. No licensed teacher now could or would receive a body without a medical certificate and a warrant from the inspector of anatomy, and, when the bodies are buried, a proper religious service, according to the creed professed during life, is provided. The great majority of bodies are those of unclaimed poor in the workhouse infirmaries, but a few are obtained each year from the general hospitals. Occasionally a well-to-do person, following the example of Jeremy Bentham, leaves his body for the advancement of science, but even then, if his relatives object, it is not received.

The ample supply of subjects obtained by legitimate means which the anatomy act provided was followed by the opening of anatomical schools at all the great London hospitals and the universities, with the result that anatomical research was stimulated and text-books embodying the latest discoveries were brought out. It is wonderful, however, how much descriptive anatomy was taught in the days before text-books were common and how much of what is essential to the study of surgery and medicine the students knew. In looking through an old book of anatomical questions and answers dated 1812, one is struck by the fact that any one working through them with the body would probably pass an average modern anatomical examination to-day.

The various phases which anatomy in the British Isles has passed through have also been experienced in America, though it is difficult to compare the two countries owing to the fact that each state in the Union makes its own laws as to dissection, and that these vary considerably. The first anatomy act worthy of the name was that of Massachusetts, and was passed in 1831, one year before the British act. There is reason to believe, however, that, in some states, all the evils of body-snatching existed up to the end of the 19th century. In some more enlightened states, such as Pennsylvania and Massachusetts, the modern acts are in advance of the British in that they are mandatory instead of permissive, and their compulsory nature is found rather to reduce than to increase public opposition to dissection. A study of the history of anatomy in the United States during the 19th century furnishes an instructive lesson on the futility of attempting to suppress dissection by legislation and on the serious and sometimes terrible crimes to which any such attempt naturally leads. It also teaches that, when unclaimed bodies *must* be given up and *must* be treated reverently and buried decently, there is less friction than when public boards have the right of arbitrarily refusing to allow their unclaimed dead to be used for the service of the living.

In all the important countries of Europe, with the exception of Russia and Turkey, anatomy acts exist. They almost all differ from the British act in being mandatory instead of permissive; in other words, certain unclaimed bodies must be given up to the schools of anatomy. As a rule these come from the general hospitals, but sometimes, as in Germany, Austria and Sweden, suicides are received and form a considerable part of the whole number. Even where executed criminals are available they nowadays form a negligible contribution, but the unclaimed bodies of people dying in prison are provided for in the French, Belgian, Norwegian, Swedish, German and Italian regulations, and in Paris they form an important element of the supply. In Russia several attempts to gain an anatomy act have been made, but have always been opposed by those in authority, and there is good reason to believe that bodies are procured by bribing hospital and mortuary attendants. It is said that the army contributes a large percentage of the total number. In Turkey no facilities for dissecting the dead body exist, as the practice is against the Mahommedan religion; the German pathologists in Turkey, however, insist on making *post mortem* examinations. In the British colonies anatomical regulations vary a good deal; sometimes, as in New South Wales, the act is founded on that of Great Britain and is permissive, but in Victoria the minister may authorize the medical officer of any public institution supported wholly or in part by funds from the general revenue to permit unclaimed bodies to be dissected, provided the persons, during life had not expressed a wish against it. This act in its working is equivalent to a mandatory one, since the power of refusing bodies is not left in the hands of, in this respect, uneducated poor law guardians.

In the early years of the 19th century Sir Charles Bell's work on human anatomy is by far the most important in the British Isles. He wrote the article on the nerves in his brother John Bell's work on the anatomy of the human body, as well as his own classical works on the anatomy of expression, the hand and the arteries; but his chief work was the discovery of the difference between motor and sensory nerves. Sir Astley Cooper brought out his beautifully illustrated monograph on hernia in 1807. Besides these, the Edinburgh school had contributed the systematic treatises of Andrew Fyfe, John Bell, the third Monro and John Gordon. In 1828 appeared the first edition of Quain's *Anatomy*, written by Jones Quain. This monumental work, which is still among the very first of English text-books, has run through ten editions, and is of even greater value to the teacher and researcher than to the medical student, because of its excellent bibliographies and the way in which it has been kept abreast of modern morphological knowledge by its various editors. Hardly any of the original work now remains. In 1858 another famous text-book on systematic anatomy appeared, written by Henry Gray, and this has always been particularly popular with students both in Great Britain and in America; it pays more attention to the surgical applications of anatomy than to the scientific and morphological side, and has reached its sixteenth edition.

The *Cyclopedia of Anatomy and Physiology*, edited by Dr Robert Todd from 1835 to 1859, which contained articles on both human and comparative anatomy, is now somewhat out of date, but did much for the advancement of the science when it appeared.

In 1893 a text-book written by several authors and edited by Henry Morris appeared. It has run through three editions and is especially popular in America. The latest English systematic work of first-rate importance is the splendid compilation edited by D. J. Cunningham (1902) and written, with one or two exceptions, by pupils of the veteran anatomist Sir William Turner. It is dedicated to him and will long serve as a memento of the work which he has done in training anatomists for the whole of the British empire. Besides these systematic treatises, many dissecting manuals have been published. The earliest were the *Dublin Dissector* and the *London Dissector*; others still in use are those of G. V. Ellis, C. Heath, D. J. Cunningham, and J. Cleland and J. Mackay. In 1889 Professor A. Macalister published a book on anatomy, which combined the advantages of a text-book with those of a dissecting guide.

In America the English text-books are largely used in addition to that edited by F. H. Gerrish. There is a special American edition of Gray.

Many systematic works on modern anatomy have come from Germany. J. F. Meckel, J. C. Rosenmüller, C. F. Krause, G. F. Hildebrandt, J. Hyrtl, H. Luschka and A. Meyer have all published works which have made their mark, but by far the most important, and, as some consider, still the best of all anatomical text-books, is that of F. G. J. Henle, professor of anatomy in Göttingen, which was completed in 1873. The beautiful illustrations of frozen specimens of the body brought out by W. Braune added a great deal to the student's opportunities of learning the relations of the various structures, and are largely used all over the world. Rudinger's *Anatomy* also contains many plates showing various sections, but the most complete text-book in the German language is that by Prof. Karl von Bardeleben of Jena; this is in eight volumes and contains notices of the latest literature on descriptive and morphological anatomy by the most prominent German anatomists. In addition to these W. Spalteholz and C. Toldt have brought out valuable atlases. In France J. Testut's and Poirier's anatomies, both of great excellence and beautifully illustrated, are the ones in common use.

There are two epoch-making dates in the history of modern English anatomy besides that of the passing of the Anatomy Act in 1832. The first of these is 1867, when the first volume of the *Journal of Anatomy and Physiology* appeared. This afforded a medium for English anatomists to publish their original work, besides containing valuable reviews and notices of books and work published abroad; it has appeared quarterly without a break since that time, and was long under the immediate direction of Sir William Turner.

The second date is 1887, when the Anatomical Society of Great Britain and Ireland was founded through the exertions of Mr C. B. Lockwood. It meets three times a year in London and once, in the summer, at some provincial school. It numbers some one hundred and fifty members, and enables anatomists from the whole British empire to meet one another and discuss subjects of common interest. Its first president was Prof. Murray Humphry of Cambridge, and its official organ is the *Journal of Anatomy and Physiology*.

No account of modern anatomical work would be complete without drawing attention to the great mass of special periodical literature containing the records of original work which are being published. It is said that some three or four thousand articles on anatomy appear in six hundred journals each year. To mention a few of these, in addition to the British *Journal of Anatomy and Physiology* there is an American *Journal of Anatomy*, the French *Bulletin et mêmoires de la société anatomique*, and *La journal de l'anatomie et de la physiologie*, and the German *Internationale Monatschrift für Anatomie und Physiologie*, *Anatomischer Anzeiger*, Waldeyer's *Archiv für Anatomie und Physiologie*, Schwalbe's *Zeitschrift für Morphologie und Anthropologie*, Gegenbaur's *Morphologisches Jahrbuch*, edited by Ruge, and Merkel's *Anatomische Hefte*.

Unfortunately the outlook of anatomy in Great Britain is not altogether satisfactory. The number of subjects for dissection has since 1895 been steadily diminishing, especially in London. This is due partly to the modern system of insuring lives for small sums and so decreasing the number of unclaimed bodies, and partly to the fact that, owing to the permissive nature of the British Anatomy Act, several boards of guardians will not allow even unclaimed bodies to be used for dissection and for the teaching of operative surgery. It is not popularly understood that a dearth of bodies means not only a check to abstract science, but a serious handicap to medical education, which must react more upon the poor than upon the rich, since the latter can afford to pay for the services of medical men educated abroad, where no difficulties are placed in the way of their learning fully the structure of the body they have to treat in disease. (F. G. P.)

Anatomy—Superficial and Artistic

The objects of the study of superficial anatomy are to show, first, the form and proportions of the human body and, second, the surface landmarks which correspond to deeper structures hidden from view. This study blends imperceptibly with others, such as physical anthropology, physiognomy, phrenology and palmistry, but whereas these deal chiefly with variations, superficial anatomy is concerned with the type.

With regard to the proportions of the body the artist and anatomist approach the subject from a slightly different point of view. The former, by a process of artistic selection, seeks the ideal and adopts the proportions which give the most pleasing effect, while the latter desires to know only the mean of a large series of measurements.

The scheme which Dr Paul Richer suggests (*Anatomie artistique*, Paris, 1890), and Professor Arthur Thomson approves (*Anatomy for Art Students*, 1896), is to divide the whole body into head-lengths, of which seven and a half make up the stature. Four of these are above the fork and three and a half below (see figs. 1 and 2). Of the four above, one forms the head and face, the second reaches from the chin to the level of the nipples, the third from the nipples to the navel, and the fourth from there to the fork. By dividing these into half-heads other points can be determined; for instance the middle of the first head-length corresponds to the eyes, the middle of the second to the shoulder, of the fourth to the top of the hip-joint, and of the fifth to the knee-joint.

The elbow-joint, when the arms are by the side, is a little above the lower limit of the third head-length, whilst the wrist is opposite the very centre of the stature, three head-lengths and three-quarters from the crown or the soles. The tips of the fingers reach a little below the middle of the fifth head-length. (In fig. 1 the fingers are bent.) By making the stature eight head-lengths instead of seven and a half the artistic effect is increased, as it is also by slightly lengthening the legs in proportion to the body. Approximate average breadth measurements are two heads for the greatest width of the shoulders, one and a half for the greatest width of the hips, one for the narrowest part of the waist, and three-quarters for the breadth of the head on a level with the eyes.

The relation of superficial landmarks to deep structures cannot be treated here in full detail, but the chief points may be indicated. Certain parts of the head may easily be felt through the skin. If the finger is run along the upper margin of the orbit, the notch for the supraorbital nerve may usually be felt at the junction of the inner and middle thirds. At the outer end of the margin is its junction with the malar bone, and this easily felt point is known as the external angular process. The junction of the frontal and nasal bones at the root of the nose is the nasion, while at the back of the skull the external occipital protuberance or inion is felt and marks the position of the torcular Herophili, where the venous sinuses meet. The zygoma may be felt running back from the malar bone to just in front of the ear, and two fingers' breadth above the middle of it marks the pterion, a very important point in the localization of intracranial structures. It corresponds to the anterior branch of the middle meningeal artery, to the Sylvian point where the three limbs of the fissure of Sylvius diverge, to the middle cerebral artery, the central lobe of the brain or island of Reil, and the anterior part of the corpus striatum. The fissure of Sylvius can be marked out by drawing a line from the external angular process back through the Sylvian point to the lower part of the parietal eminence.

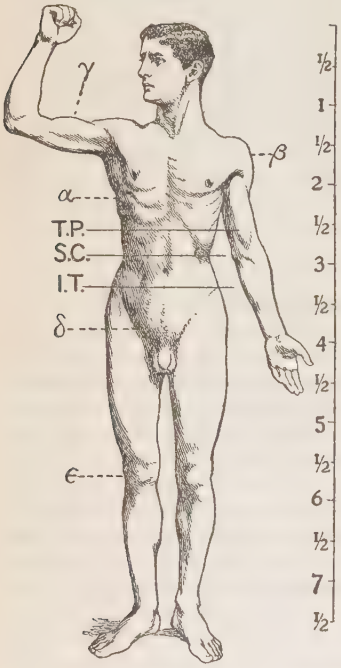

FIG. 1.

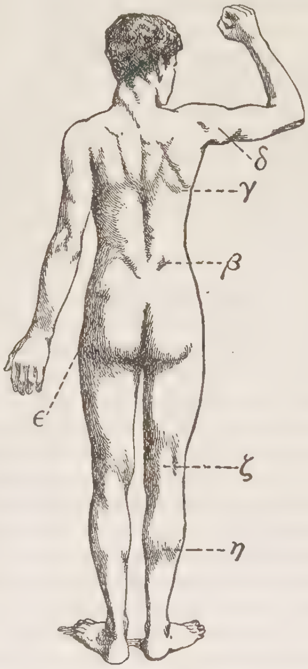

FIG. 2.

α, Serratus magnus.
β, Deltoid.
γ, Biceps.
δ, Poupart's ligament.
ε, Patella.
T.P. Transpyloric plane.
S.C. Subcostal plane.
I.T. Intertubercular plane.

β, Dimple over posterior superior spine of ilium.
γ, Lower angle of scapula.
δ, External head of triceps.
ε, Depression over great trochanter.
ζ, Popliteal space.
η, Gastrocnemius.

The scale between the figures represents head-lengths.

The position of the sulcus of Rolando is important because of the numerous cortical centres which lie close to it. For practical purposes it may be mapped out by taking the superior Rolandic point, ½ in. behind the bisection of a line drawn from the nasion to the inion over the vault of the skull, and joining that to the inferior Rolandic point, which is just above the line of the fissure of Sylvius and 1 in. behind the Sylvian point. The external parieto-occipital fissure, which forms the boundary between the parietal and occipital lobes of the brain, is situated practically at the lambda, which is a hand's breadth (2¾ in.) above the inion. The lateral sinus can be mapped out by joining the inion to the asterion, a point two-thirds of the distance from the lambda to the tip of the mastoid process; thence the sinus curves downward and forward toward the tip of the mastoid process. A point 1 in. horizontally backward from the top of the external auditory meatus will always strike it.

Cranio-cerebral topography has been dealt with by Broca, Bischoff, Turner, Feré, Pozzi, Giacomini, Ecker, Hefftler and Hare. Among the more recent papers are those of R. W. Reid (*Lancet*, 27th September 1884), W. Anderson and G. Makins (*Lancet*, 13th July 1889), Prof. Chiene (detailed in Cunningham's *Text-Book of Anatomy*), V. Horsley (*Am. Journal Med. Sci.*, 1887), G. Thane and R. Godlee (Quain's *Anatomy*—appendix to 10th edition). D. J. Cunningham discusses the whole question in his "Contribution to the Surface Anatomy of the Cerebral Hemispheres" (Cunningham *Memoirs*, No. vii. R. Irish Academy, Dublin, 1892), and he has prepared a series of casts to illustrate it.

The Face.—On the front of the face a line drawn down from the supraorbital notch between the bicuspid teeth to the side of the chin will cut the exit of the second division of the fifth nerve from the infraorbital foramen, a quarter of an inch below the infraorbital margin, and also the exit of the third division of the fifth at the mental foramen, midway between the upper and lower margins of the body of the jaw. In practice it will be found that the angle of the mouth at rest usually corresponds to the interval between the bicuspid teeth. The skin of the eyelids is very thin, and is separated from the subjacent fibrous tarsal plates by the orbicularis palpebrarum muscle. On everting the lids the delicate conjunctival membrane is seen, and between this and the tarsal plates lie the meibomian glands, which can be faintly seen as yellowish streaks. From the free edges of the eyelids come the eyelashes, between which many large sweat-glands open, and when one of these is inflamed it causes a "stye." Internally the two eyelids form a little recess called the internal canthus, occupied by a small red eminence, the caruncula lachrymalis, just external to which a small vertical fold of conjunctiva may often be seen, called the plica semilunaris, representing the third eyelid of birds and many mammals. By gently drawing down the lower eyelid the lower punctum may be seen close to the caruncula; it is the pinhole opening into the lower of the two canaliculi which carry away the tears to the lachrymal sac and duct. On the side of the face the facial artery may be felt pulsating about an inch in front of the angle of the jaw; it runs a tortuous course to near the angle of the mouth, the angle of the nose and the inner angle of the eye; in the greater part of its course its vein lies some distance behind it. The parotid gland lies between the ramus of the jaw and the mastoid process; anteriorly it overlaps the masseter to form the socia parotidis, and just below this its duct, the duct of Stensen, runs forward to pierce the buccinator and open into the mouth opposite the second upper molar tooth. The line of this duct may be marked out by joining the lower margin of the tragus to a point midway between the lower limit of the nose and the mouth. The facial or seventh nerve emerges from the skull at the stylomastoid foramen just in front of the root of the mastoid process; in the parotid gland it forms a network called the pes anserinus, after which it divides into six branches which radiate over the face to supply the muscles of expression.

The Neck.—In the middle line below the chin can be felt the body of the hyoid bone, just below which is the prominence of the thyroid cartilage called "Adam's apple," better marked in men than in women. Still lower the cricoid cartilage is easily felt, while between this and the suprasternal notch the trachea and isthmus of the thyroid gland may be made out. At the side the outline of the sterno-mastoid muscle is the most striking mark; it divides the anterior triangle of the neck from the posterior. The upper part of the former contains the submaxillary gland, which lies just below the posterior half of the body of the jaw. The line of the common and the external carotid arteries may be marked by joining the sterno-clavicular articulation to the angle of the jaw. The eleventh or spinal accessory nerve corresponds to a line drawn from a point midway between the angle of the jaw and the mastoid process to the middle of the posterior border of the sterno-mastoid muscle and thence across the posterior triangle to the deep surface of the trapezius. The external jugular vein can usually be seen through the skin; it runs in a line drawn from the angle of the jaw to the middle of the clavicle, and close to it are some small lymphatic glands. The anterior jugular vein is smaller, and runs down about half an inch from the middle line of the neck. The clavicle or collar-bone forms the lower limit of the neck, and laterally the outward slope of the neck to the shoulder is caused by the trapezius muscle.

The Chest.—It is important to realize that the shape of the chest does not correspond to that of the bony thorax which encloses the heart and lungs; all the breadth of the shoulders is due to the shoulder girdle, and contains the axilla and the head of the humerus. In the middle line the suprasternal notch is seen above, while about three fingers' breadth below it a transverse ridge can be felt, which is known as Ludovic's angle and marks the junction between the manubrium and gladiolus of the sternum. Level with this line the second ribs join the sternum, and when these are found the lower ribs may be easily counted in a moderately thin subject. At the lower part of the sternum, where the seventh or last true ribs join it, the ensiform cartilage begins, and over this there is often a depression popularly known as the pit of the stomach. The nipple in the male is situated in front of the fourth rib or a little below; vertically it lies a little external to a line drawn down from the middle of the clavicle; in the female it is not so constant. A little below it the lower limit of the great pectoral muscle is seen running upward and outward to the axilla; in the female this is obscured by the breast, which extends from the second to the sixth rib vertically and from the edge of the sternum to the mid-axillary line laterally. The female nipple is surrounded for half an inch by a more or less pigmented disc, the areola. The apex of a normal heart is in the fifth left intercostal space, three and a half inches from the mid-line.

The Abdomen.—In the mid-line a slight furrow extends from the ensiform cartilage above to the symphysis pubis below; this marks the linea alba in the abdominal wall, and about its middle point is the umbilicus or navel. On each side of it the broad recti muscles can be seen in muscular people. The outline of these muscles is interrupted by three or more transverse depressions indicating the lineae transversae in the recti; there is usually one about the ensiform cartilage, one at the umbilicus, and one between; sometimes a fourth is present below the umbilicus. The upper lateral limit of the abdomen is the subcostal margin formed by the cartilages of the false ribs (8, 9, 10) joining one another; the lower lateral limit is the anterior part of the crest of the ilium and Poupart's ligament running from the anterior superior spine of the ilium to the spine of the pubis (see fig. 1, δ); these lower limits are marked by definite grooves. Just above the pubic spine is the external abdominal ring, an opening in the muscular wall of the abdomen for the spermatic cord to emerge in the male. The most modern method of marking out the abdominal contents is to draw three horizontal and two vertical lines; the highest of the former is the transpyloric line of C. Addison (fig. 1, T.P.), which is situated half-way between the suprasternal notch and the top of the symphysis pubis; it often cuts the pyloric opening of the stomach an inch to the right of the mid-line. The hilum of each kidney is a little below it, while its left end approximately touches the lower limit of the spleen. It corresponds to the first lumbar vertebra behind. The second line is the subcostal (fig. 1, S.C.), drawn from the lowest point of the subcostal arch (tenth rib); it corresponds to the upper part of the third lumbar vertebra, and is an inch or so above the umbilicus; it indicates roughly the transverse colon, the lower ends of the kidneys, and the upper limit of the transverse (3rd) part of the duodenum. The third line is called the intertubercular (fig. 1, I.T.), and runs across between the two rough tubercles, which can be felt on the outer lip of the crest of the ilium about two and a half inches from the anterior superior spine. This line corresponds to the body of the fifth lumbar vertebra, and passes through or just above the ileo-caecal valve where the small intestine joins the large. The two vertical or mid-Poupart lines are drawn from the point midway between the anterior superior spine and the pubic symphysis on each side vertically upward to the costal margin. The right one is the most valuable, as the ileo-caecal valve is situated where it cuts the intertubercular line, while the orifice of the vermiform appendix is an inch lower down. At its upper part it meets the transpyloric line at the lower margin of the ribs, usually the ninth, and here the gall-bladder is situated. The left mid-Poupart line corresponds in its upper three-quarters to the inner edge of the descending colon. The right subcostal margin corresponds to the lower limit of the liver, while the right nipple is about half an inch above the upper limit of this viscus.

The Back.—There is a well-marked furrow stretching all the way down the middle line of the back from the external occipital protuberance to the cleft of the buttocks. In this the spinous processes of the vertebrae can be felt, especially if the model bend forward. The cervical spines are difficult to feel, except the seventh and sometimes the second, and although the former is called the vertebra prominens, its spine is less easily felt than is that of the first thoracic. In practice it is not very easy to identify any one spine with certainty: one method is to start from the prominent first thoracic and to count down; another is to join the lower angles of the two scapulae (fig. 2, γ) when the arms are hanging down, and to take the spine through which the line passes as the seventh.

The spinal furrow is caused by the prominence of the erector spinae muscles on each side; these become less well marked as they run upward. The outlines of the scapulae can be well seen; they cover the ribs from the second to the seventh inclusive. The scapular spine is quite subcutaneous, and can be followed upward and outward from the level of the third thoracic spine to the acromion, and so to the outer end of the clavicle. On the lower margin of the acromion is a little tubercle known as the metacromial process or acromial angle, which is very useful for taking measurements from. The tip of the twelfth rib may usually be felt about two inches above the middle of the iliac crest, but this rib is very variable in length. The highest point of the iliac crest corresponds to the fourth lumbar spine, while the posterior superior iliac spine is on a level with the second sacral vertebra. This posterior superior spine is not easily felt, owing to the ligaments attached to it, but there is usually a little dimple in the skin over it (fig. 2, β). By drawing horizontal lines through the 1st, 3rd and 5th lumbar spines, the transpyloric, subcostal and intertubercular lines or planes may be reproduced behind and the same viscera localized.

The Arm.—Running downward and outward from the inner half of the clavicle, where that bone is convex forward, is the clavicular part of the pectoralis major, while from the outer third of the bone, where it is concave forward, is the clavicular part of the deltoid; between these two muscles is an elongated triangular gap with its base at the clavicle, and here the skin is somewhat depressed, while the cephalic vein sinks between the two muscles to join the axillary vein. The tip of the coracoid process is situated just under cover of the inner edge of the deltoid, one inch below the junction between the outer and middle thirds of the clavicle. The deltoid muscle (fig. 1, β) forms the prominence of the shoulder, and its convex outline is due to the presence of the head of the humerus deep to it; when this is dislocated the shoulder becomes flattened. The pectoralis major forms the anterior fold of the axilla or armpit, the posterior being formed by the latissimus dorsi and teres major muscles. The skin of the floor of this space is covered with hair in the adult, and contains many large sweat glands. The axillary vessels and brachial plexus of nerves lie in the outer wall, while on the inner wall are the serrations of the serratus magnus muscle, the outlines of some of which are seen on the side of the thorax, through the skin, when the arm is raised (fig. 1, α). Below the edge of the pectoralis major, the swelling of the biceps (fig. 1, γ) begins to be visible, and this can easily be traced into its tendon of insertion, which reaches below the level of the elbow joint. On each side of the biceps is the external and internal bicipital furrow, in the latter of which the brachial artery may be felt and compressed. The median nerve is here in close relation to the artery. At the bend of the elbow the two condyles of the humerus may be felt; the inner one projects beneath the skin, but the outer one is obscured by the rounded outline of the brachio-radialis muscle. The superficial veins at the bend of the elbow are very conspicuous; they vary a good deal, but the typical arrangement is an M, of which the radial and ulnar veins form the uprights, while the outer oblique bar is the median cephalic and the inner oblique the median basilic vein. At the divergence of these two the median vein comes up from the front of the forearm, while the two vertical limbs are continued up the arm as the cephalic and basilic, the former on the outer side, the latter on the inner. On the back of the arm the three heads of the triceps are distinguishable, the external forming a marked oblique swelling when the forearm is forcibly extended and internally rotated (fig. 2, δ). In the upper part of the front of the forearm the antecubital fossa or triangle is seen; its outer boundary is the brachio-radialis, its inner the pronator radii teres, and where these two join below is the apex. In this space are three vertical structures—externally the tendon of the biceps, just internal to this the brachial artery, and still more internally the median nerve. Coming from the inner side of the biceps tendon the semi-lunar fascia may be felt; it passes deep to the median basilic vein and superficial to the brachial artery, and in former days was a valuable protection to the artery when unskilful operators were bleeding from the median basilic vein. About the middle of the forearm the fleshy parts of the superficial flexor muscles cease, and only the tendons remain, so that the limb narrows rapidly. In front of the wrist there is a superficial plexus of veins, while deep to this two tendons can usually be made to start up if the wrist be forcibly flexed; the outer of these is the flexor carpi radialis, which is the physician's guide to the radial artery where the pulse is felt. If the finger is slipped to the outer side of this tendon, the artery, which here is very superficial, can be felt beating. The inner of the two tendons is the palmaris longus, though it is not always present. On cutting down between these two the median nerve is reached.

The wrist joint may be marked out by feeling the styloid process of the radius on the outer side, and the styloid process of the ulna on the inner side behind, and joining these two by a line convex upward. The superficial appearance of the palm of the hand is described in the article on Palmistry; with regard to anatomical landmarks the superficial palmar arterial arch is situated in the line of the abducted thumb, while the deep arch is an inch nearer the wrist. The digital nerves correspond to lines drawn from the clefts of the fingers toward the wrist. On the back of the forearm the olecranon process of the ulna is quite subcutaneous, and during extension of the elbow is in a line with the two condyles, while between it and the inner condyle lies the ulnar nerve, here known popularly as the "funny bone." From the olecranon process the finger may be run down the posterior border of the ulna, which is subcutaneous as far as the styloid process at the lower end. On the dorsum of the hand is a plexus of veins, deep to which the extensor tendons are seen on extending the fingers. When the thumb is extended, two tendons stand out very prominently, and enclose a triangular space between them which is sometimes known as the "anatomical snuff box"; the outer of these is the tendon of the extensor brevis, the inner of the extensor longus pollicis. Situated deeply in the space is the radial artery, covered by the radial vein. On the dorsum of the hand there is a plexus of veins, and deep to these the tendons of the extensor longus digitorum stand out when the wrist and fingers are extended.

The Leg.—Just below Poupart's ligament (fig. 1, δ), a triangular depression with its apex downward may be seen in muscular subjects; it corresponds to Scarpa's triangle, and its inner border is the tendon of the adductor longus, which is easily felt if the model forcibly adducts the thigh. In this triangle the superficial inguinal glands may be made out. The head of the femur lies just below the centre of Poupart's ligament. The sartorius muscle forms the outer boundary of the triangle, and may be traced from the anterior superior spine obliquely downward and inward, across the front of the thigh, to the inner side of the knee. The two vasti muscles are well marked, the internal being the lower and forming with the sartorius the rounded bulging above the inner side of the knee. The internal saphenous vein runs superficially up the inner side of the thigh from behind the internal condyle to the femur to the saphenous opening in the deep fascia, the top of which is an inch horizontally outward from the spine of the pubis. On the other side of the thigh a groove runs down which corresponds to the ilio-tibial band, a thickening of the fascia lata or deep fascia; the lower end of this leads to the head of the fibula. On the front of the thigh, below the sartorius, the rectus muscle makes a prominence which leads down to the patella, the outlines of which bone are very evident (fig. 1, ε). The only part of the femur besides the great trochanter which is superficial is the lower end, and this forms the two condyles for articulation with the tibia. If the posterior part of the inner condyle be joined to the mid-point between the anterior superior spine and the symphysis pubis, when the thigh is externally rotated, the line will correspond in its upper two-thirds to that of the common and superficial femoral arteries, the former occupying the upper inch and a half. The common femoral vein lies just internal to its artery, while the anterior crural nerve is a quarter of an inch external to the latter. The rounded mass of the buttock is formed by the gluteus maximus muscle covered by fat; the lower horizontal boundary is called the fold of the nates, and does not correspond exactly to the lower edge of the muscle. At the side of the buttock is a depression (fig. 2, ε) where the great trochanter of the femur can be felt; a line, named after Nelaton, drawn from the anterior superior spine to the tuberosity of the ischium, passes through the top of this. On the back of the thigh the hamstrings form a distinct swelling; below the middle these separate to enclose the diamond-shaped popliteal space (fig. 2, ζ), the outer hamstrings or biceps being specially evident, while, on the inner side, the tendons of the semi-tendinosus and semi-membranosus can be distinguished. The external popliteal nerve may be felt just behind the biceps tendon above the head of the fibula.

On the front of the leg, below the knee, the ligamentum patellae is evident, leading down from the patella (fig. 1, ε) to the tubercle of the tibia. From this point downward the anterior border of the tibia or shin is subcutaneous, as is also the internal surface of the tibia. Internal to the skin is the fleshy mass made by the tibialis anticus and extensor longus digitorum muscles. At the inner side of the ankle the internal malleolus is subcutaneous, while on the outer side the tip of the external malleolus is rather lower and farther back. Both this malleolus and the lower quarter of the shaft of the fibula are subcutaneous, and this area, if traced upward, is continuous with a furrow on the outer side of the leg which separates the anterior tibial from the peroneal groups of muscles, and eventually leads to the subcutaneous head of the fibula. At the back of the leg the two heads of the gastrocnemius form the calf, the inner one (fig. 2, η) being larger than the outer. Between the two, in the mid-line of the calf, the external saphenous vein and nerve lie, while lower down they pass behind the external malleolus to the outer side of the foot. The internal saphenous vein and nerve lie just behind the internal border of the tibia, and below pass in front of the internal malleolus. At the level of the ankle-joint the tibialis posticus and flexor longus digitorum tendons lie just behind the internal malleolus, while the peroneus longus and brevis are behind the external. Running down to the heel is the tendo Achillis with the plantaris on its inner side. On the dorsum of the foot the musculo-cutaneous nerve may be seen through the skin in thin people when the toes are depressed; it runs from the anterior peroneal furrow, already described, to all the toes, except the cleft between the two inner ones. There is also a venous arch to be seen, the two extremities of which pass respectively into the external and internal saphenous veins. The long axis of the great toe, even in races unaccustomed to boots, runs forward and outward, away from the mid-line between the two feet, so that perfectly straight inner sides to boots are not really anatomical. The second toe in classical statues is often longer than the first, but this is seldom seen in Englishmen. On the outer side of the sole the skin is often in contact with the ground all along, but on the inner side the arch is more marked, and, except in flat-footed people, there is an area in which the sole does not touch the ground at all.

For further details of surface anatomy see *Anatomy for Art Students*, by A. Thomson (Oxford, 1896); Harold Stiles's article in Cunningham's *Text-Book of Anatomy* (Young J. Pentland, 1902); G. Thane and R. Godlee's Appendix to *Quain's Anatomy* (Longmans, Green & Co., 1896); *Surface Anatomy*, by B. Windle and Manners Smith (H. K. Lewis, 1896); *Landmarks and Surface Markings of* *the Human Body*, by L. B. Rawling (H. K. Lewis, 1906); *Surface Anatomy*, by T. G. Moorhead (Baillière, Tindall & Cox, 1905). No one interested in the subject should omit to read an article on "Art in its relation to Anatomy," by W. Anderson, *British Medical Journal*, 10th August 1895. (F. G. P.)

ANATTO (possibly a native American name, with many variants such as *annatto*, *arnotto*), a colouring matter produced from the seeds of *Bixa orellana* (natural order *Flacourtiaceae*), a small tree which grows in Central and South America. The seeds are surrounded with a thin coating of a waxy pulp, which is separated from them by washing in water, passing the liquid through a sieve and allowing the suspended pulp to deposit. The water is then drained away and the paste dried, till it is a thick, stiff, unctuous mass. In this state it has a dark orange-red colour and is known as "roll" or "flag" arnotto, according to the form in which it is put up, but when further dried it is called "cake" arnotto. Arnotto is much used by South American Indians for painting their bodies; among civilized communities its principal use is for colouring butter, cheese and varnishes. It yields a fugitive bright orange colour, and is to some extent used alone, or in conjunction with other dyes, in the dyeing of silks and in calico printing. It contains a yellow colouring matter, bixin, $C_{16}H_{26}O_2$.

ANAXAGORAS, Greek philosopher, was born probably about the year 500 B.C. (Apollodorus *ap.* Diog. Laert. ii. 7.) At his native town of Clazomenae in Asia Minor, he had, it appears, some amount of property and prospects of political influence, both of which he surrendered, from a fear that they would hinder his search after knowledge. Nothing is known of his teachers; there is no reason for the theory that he studied under Hermotimus of Clazomenae, the ancient miracle-worker. In early manhood (*c.* 464–462 B.C.) he went to Athens, which was rapidly becoming the headquarters of Greek culture. There he is said to have remained for thirty years. Pericles learned to love and admire him and the poet Euripides derived from him an enthusiasm for science and humanity. Some authorities assert that even Socrates was among his disciples. His influence was due partly to his astronomical and mathematical eminence, but still more to the ascetic dignity of his nature and his superiority to ordinary weaknesses—traits which legend has embalmed. It was he who brought philosophy and the spirit of scientific inquiry from Ionia to Athens. His observations of the celestial bodies led him to form new theories of the universal order, and brought him into collision with the popular faith. He attempted, not without success, to give a scientific account of eclipses, meteors, rainbows and the sun, which he described as a mass of blazing metal, larger than the Peloponnesus; the heavenly bodies were masses of stone torn from the earth and ignited by rapid rotation. The ignorant polytheism of the time could not tolerate such explanation, and the enemies of Pericles used the superstitions of their countrymen as a means of attacking him in the person of his friend.

Anaxagoras was arrested on a charge of contravening the established dogmas of religion (some say the charge was one of Medism), and it required all the eloquence of Pericles to secure his acquittal. Even so he was forced to retire from Athens to Lampsacus (434–433 B.C.), where he died about 428 B.C., honoured and respected by the whole city.

It is difficult to present the cosmical theory of Anaxagoras in an intelligible scheme. All things have existed in a sort of way from the beginning. But originally they existed in infinitesimally small fragments of themselves, endless in number and inextricably combined throughout the universe. All things existed in this mass, but in a confused and indistinguishable form. There were the seeds (*σπέρματα*) or miniatures of corn and flesh and gold in the primitive mixture; but these parts, of like nature with their wholes (the *ὁμοιομερῆ* of Aristotle), had to be eliminated from the complex mass before they could receive a definite name and character. The existing species of things having thus been transferred, with all their specialities, to the prehistoric stage, they were multiplied endlessly in number, by reducing their size through continued subdivision; at the same time each one thing is so indissolubly connected with every other that the keenest analysis can never completely sever them. The work of arrangement, the segregation of like from unlike and the summation of the *ὁμοιομερῆ* into totals of the same name, was the work of Mind or Reason; *πάντα χρήματα ἦν ὁμοῦ · εἶτα νοῦς ἐλθὼν αὐτὰ διεκόσμησε.* This peculiar thing, called Mind (*νοῦς*), was no less illimitable than the chaotic mass, but, unlike the Intelligence of Heraclitus (*q.v.*), it stood pure and independent (*μοῦνος ἐφ' ἑωυτοῦ*), a thing of finer texture, alike in all its manifestations and everywhere the same. This subtle agent, possessed of all knowledge and power, is especially seen ruling in all the forms of life. Its first appearance, and the only manifestation of it which Anaxagoras describes, is Motion. It originated a rotatory movement in the mass (a movement far exceeding the most rapid in the world as we know it), which, arising in one corner or point, gradually extended till it gave distinctness and reality to the aggregates of like parts. But even after it has done its best, the original intermixture of things is not wholly overcome. No one thing in the world is ever abruptly separated, as by the blow of an axe, from the rest of things. The name given to it signifies merely that in that congeries of fragments the particular "seed" is preponderant. Every *a* of this present universe is only *a* by a majority, and is also in lesser number *b*, *c*, *d*. It is noteworthy that Aristotle accuses Anaxagoras of failing to differentiate between *νοῦς* and *ψυχή*, while Socrates (Plato, *Phaedo*, 98 B) objects that his *νοῦς* is merely a *deus ex machina* to which he refuses to attribute design and knowledge.

Anaxagoras proceeded to give some account of the stages in the process from original chaos to present arrangements. The division into cold mist and warm ether first broke the spell of confusion. With increasing cold, the former gave rise to water, earth and stones. The seeds of life which continued floating in the air were carried down with the rains and produced vegetation. Animals, including man, sprang from the warm and moist clay. If these things be so, then the evidence of the senses must be held in slight esteem. We seem to see things coming into being and passing from it; but reflection tells us that decease and growth only mean a new aggregation (*σύγκρισις*) and disruption (*διάκρισις*). Thus Anaxagoras distrusted the senses, and gave the preference to the conclusions of reflection. Thus he maintained that there must be blackness as well as whiteness in snow; how otherwise could it be turned into dark water?

Anaxagoras marks a turning-point in the history of philosophy. With him speculation passed from the colonies of Greece to settle at Athens. By the theory of minute constituents of things, and his emphasis on mechanical processes in the formation of order, he paved the way for the atomic theory. By his enunciation of the order that comes from reason, on the other hand, he suggested, though he seems not to have stated explicitly, the theory that nature is the work of design. The conception of reason in the world passed from him to Aristotle, to whom it seemed the dawn of sober thought after a night of disordered dreams. From Aristotle it descended to his commentators, and under the influence of Averroes became the engrossing topic of speculation.

AUTHORITIES.—The fragments of Anaxagoras have been collected by E. Schaubach (Leipzig, 1827), and W. Schorn (Bonn, 1829); see also F. W. A. Mullach, *Fragmenta Philos. Graec.* i. 243-252; A. Fairbanks, *The First Philosophers of Greece* (1898). For criticism see T. Gomperz, *Greek Thinkers* (Eng. trans., L. Magnus, 1901), bk. ii. chap. 4; E. Bersot, *De controversis quibusdam Anaxagorae doctrinis* (Paris, 1844); E. Zeller, *Die Philosophie der Griechen* (Eng. trans., S. F. Alleyne, 2 vols., London, 1881); J. M. Robertson, *Short History of Freethought* (London, 1906); W. Windelband, *History of Philosophy* (Eng. trans., J. H. Tufts, 1893); J. I. Beare, *Greek Theories of Elementary Cognition* (1906); L. Parmentier, *Euripide et Anaxagore* (1892); F. Lortzing, "Bericht über die griechischen Philosophen vor Sokrates" (for the years 1876–1897) in Bursian's *Jahresbericht über die Fortschritte der classischen Altertumswissenschaft*, cxvi. (1904), with references to important articles in periodicals.

(W. W.; J. M. M.)

ANAXARCHUS (*c.* 340 B.C.), a Greek philosopher of the school of Democritus, was born at Abdera. He was the companion and friend of Alexander in his Asiatic campaigns. He checked the vainglory of Alexander, when he aspired to the honours of divinity, by pointing to his wounded finger, saying, "See the blood of a mortal, not of a god." The story that at Bactra in 327 B.C. in a public speech he advised all to worship Alexander as a god even during his lifetime, is with greater probability attributed to the Sicilian Cleon. It is said that Nicocreon, tyrant of Cyprus, commanded him to be pounded to death in a mortar, and that he endured this torture with fortitude; but the story is doubtful, having no earlier authority than Cicero. His philosophical doctrines are not known, though some have inferred from the epithet εὐδαιμονικός ("fortunate"), usually applied to him, that he held the end of life to be εὐδαιμονία.

ANAXILAUS, of Larissa, a physician and Pythagorean philosopher, who was banished from Rome by Augustus, B.C. 28, on the charge of practising the magic art. This accusation appears to have originated in his superior skill in natural philosophy, by which he produced effects that the ignorant attributed to magic.

Euseb., *Chron. ad Olymp.* clxxxviii.; St Iren. i. 13; Pliny xix. 4, xxv. 95, xxviii. 49, xxxii. 52, xxxv. 50.

ANAXIMANDER, the second of the physical philosophers of Ionia, was a citizen of Miletus and a companion or pupil of Thales. Little is known of his life. Aelian makes him the leader of the Milesian colony to Amphipolis, and hence some have inferred that he was a prominent citizen. The computations of Apollodorus have fixed his birth in 611, and his death shortly after 547 B.C. Tradition, probably correct in its general estimate, represents him as a successful student of astronomy and geography, and as one of the pioneers of exact science among the Greeks. He taught, if he did not discover, the obliquity of the ecliptic, is said to have introduced into Greece the gnomon (for determining the solstices) and the sundial, and to have invented some kind of geographical map. But his reputation is due mainly to his work on nature, few words of which remain. From these fragments we learn that the beginning or first principle (ἀρχή, a word which, it is said, he was the first to use) was an endless, unlimited mass (ἄπειρον), subject to neither old age nor decay, and perpetually yielding fresh materials for the series of beings which issued from it. He never defined this principle precisely, and it has generally (*e.g.* by Aristotle and Augustine) been understood as a sort of primal chaos. It embraced everything, and directed the movement of things, by which there grew up a host of shapes and differences. Out of the vague and limitless body there sprung a central mass,—this earth of ours, cylindrical in shape, poised equidistant from surrounding orbs of fire, which had originally clung to it like the bark round a tree, until their continuity was severed, and they parted into several wheel-shaped and fire-filled bubbles of air. Man himself and the animals had come into being by like transmutations. Mankind was supposed by Anaximander to have sprung from some other species of animals, probably aquatic. But as the measureless and endless had been the prime cause of the motion into separate existences and individual forms, so also, according to the just award of destiny, these forms would at an appointed season suffer the vengeance due to their earlier act of separation, and return into the vague immensity whence they had issued. Thus the world, and all definite existences contained in it, would lose their independence and disappear in the "indeterminate." The blazing orbs, which have drawn off from the cold earth and water, are the temporary gods of the world, clustering round the earth, which, to the ancient thinker, is the central figure.

See Histories of the Ionian School by Ritten, Mallet; Schleiermacher, "Dissert. sur la philosophie d'Anaximandre," in the *Mémoires de l'acad. des sciences de Berlin* (1815); J. Burnet, *Early Greek Philosophy* (Lond. 1892); A. W. Benn, *Greek Philosophers* (Lond. 1883 foll.); A. Fairbanks, *First Philosophers of Greece* (Lond. 1898); Ritter and Preller, *Historia Phil.* §§ 17-22; Mullach, *Fragmenta Phil. Graec.* i. 237-240, and Ionian School of Philosophy.

ANAXIMENES, of Lampsacus (*fl.* 380–320 B.C.), Greek rhetorician and historian, was a favourite of Alexander the Great, whom he accompanied in his Persian campaigns. He wrote histories of Greece and of Philip, and an epic on Alexander (fragments in Müller, *Scriptores Rerum Alexandri Magni*). As a rhetorician, he was a determined opponent of Isocrates and his school. The *Rhetorica ad Alexandrum*, usually included among the works of Aristotle, is now generally admitted to be by Anaximenes, although some consider it a much later production (edition by Spengel, 1847).

See P. Wendland, *Anax. von Lampsakos* (1905); also Rhetoric.

ANAXIMENES, of Miletus, Greek philosopher in the latter half of the 6th century, was probably a younger contemporary of Anaximander, whose pupil or friend he is said to have been. He held that the air, with its variety of contents, its universal presence, its vague associations in popular fancy with the phenomena of life and growth, is the source of all that exists. Everything is air at different degrees of density, and under the influence of heat, which expands, and of cold, which contracts its volume, it gives rise to the several phases of existence. The process is gradual, and takes place in two directions, as heat or cold predominates. In this way was formed a broad disk of earth, floating on the circumambient air. Similar condensations produced the sun and stars; and the flaming state of these bodies is due to the velocity of their motions.

See Schmidt, *Dissertatio de Anaximensis psychologia* (Jena, 1869); Ritter and Preller, *Historia Phil.* §§ 23-27; A. Fairbanks, *First Philosophers of Greece* (1898); Mullach, *Fragmenta Phil. Graec.* i. 241-243; also Ionian School of Philosophy; Evolution.

ANAZARBUS (med. *Ain Zarba*; mod. *Navarza*), an ancient Cilician city, situated in the Aleian plain about 10 m. W. of the main stream of the Pyramus (Jihun) and near its tributary the Sempas Su. A lofty isolated ridge formed its acropolis. Though some of the masonry in the ruins is certainly pre-Roman, Suidas's identification of it with *Cyinda*, famous as a treasure city in the wars of Eumenes of Cardia, cannot be accepted in the face of Strabo's express location of Cyinda in *western* Cilicia. Under the early Roman empire the place was known as *Caesarea*, and was the metropolis of Cilicia Secunda. Rebuilt by the emperor Justin after an earthquake, it became *Justinopolis* (A.D. 525); but the old native name persisted, and when Thoros I., king of Lesser Armenia, made it his capital early in the 12th century, it was known as Anazarva. Its great natural strength and situation, not far from the mouth of the Sis pass, and near the great road which debouched from the Cilician gates, made Anazarbus play a considerable part in the struggles between the Byzantine empire and the early Moslem invaders. It had been rebuilt by Harun al-Rashid in 796 A.D., refortified at great expense by Saif addaula, the Hamdanid (10th century) and Saiked, and ruined by the crusaders.

The present wall of the lower city is of late construction, probably Armenian. It encloses a mass of ruins conspicuous in which are a fine triumphal arch, the colonnades of two streets, a gymnasium, &c. A stadium and a theatre lie outside on the south. The remains of the acropolis fortifications are very interesting, including roads and ditches hewn in the rock; but beyond ruins of two churches and a fine tower built by Thoros I. there are no notable structures in the upper town. For picturesqueness the site is not equalled in Cilicia, and it is worth while to trace the three fine aqueducts to their sources. (D. G. H.)

ANBAR, originally called Firuz Shapur, or Perisapora, a town founded about A.D. 350 by Shapur (Sapor) II. Sassanid, king of Persia, on the east bank of the Euphrates, just south of the Nahr Isa, or Sakhlawieh canal, the northernmost of the canals connecting that river with the Tigris, in lat. 33° 22′ N., long. 43° 49′ E. It was captured and destroyed by the emperor Julian in A.D. 363, but speedily rebuilt. It became a refuge for the Christian and Jewish colonies of that region, and there are said to have been 90,000 Jews in the place at the time of its capture by Ali in 657. The Arabs changed the name of the town to Anbar ("granaries"). Abū 'l-'Abbās as-Saffāḥ, the founder of the Abbasid caliphate, made it his capital, and such it remained until the founding of Bagdad in 762. It continued to be a place of much importance throughout the Abbasid period. It is now entirely deserted. The site is occupied only by ruin mounds, as yet unexplored. Their great extent indicates the former importance of the city.

(J. P. Pe.)

ANCACHS, a coast province of central Peru, lying between the departments of Lima and Libertad, and W. of the Marañon river. Area, 16,562 sq. m.; pop. (1896) 428,703. The department was created in 1835, and received its present name in 1839, and its last accession of territory in 1861. Lying partly on the arid coast, partly in the high Cordilleras and partly in the valley of the Marañon, it has every variety of climate and productions. Rice, cotton, sugar-cane, yucas (*Manihot aipi*) and tropical fruits are produced in the irrigated valleys of the coast, and wheat, Indian corn, barley, potatoes, coffee, coca, &c., in the upland regions. Cattle and sheep are also raised for the coast markets. Mining is likewise an important industry. The capital, Huaráz (est. pop. 8000 in 1896), on the Rio Santa or Huaráz, is a large mining centre in the sierras, 9931 ft. above sea-level, from which a railway runs to the small seaports of Santa and Chimbote, 172 m. distant. Other noteworthy towns are Caraz (6000) and Carhuaz (5000) in the sierra region, and Huarmey (1500) on the coast.

ANCAEUS, in Greek legend, son of Zeus or Poseidon, king of the Leleges of Samos. In the Argonautic expedition, after the death of Tiphys, helmsman of the "Argo," he took his place. It is said that, while planting a vineyard, he was told by a soothsayer that he would never drink of its wine. As soon as the grapes were ripe, he squeezed the juice into a cup, and, raising it to his lips, mocked the seer, who retorted with the words, *Πολλὰ μεταξὺ πέλει κύλικος καὶ χείλεος ἀκροῦ* ("there is many a slip between the cup and the lip"). At that moment it was announced that a wild boar was ravaging the land. Ancaeus set down the cup, leaving the wine untasted, hurried out, and was killed by the boar.

Apollonius Rhodius, i. 188 (and Scholiast), ii. 867-900.

ANCASTER AND KESTEVEN, DUKE OF, an English title borne by the well-known Lincolnshire family of Bertie from 1715 to 1809. ROBERT BERTIE (1660–1723), son and heir of Robert, third earl of Lindsey (d. 1701), who succeeded his father as lord great chamberlain of England, was created marquess of Lindsey in 1706, being made duke of Ancaster and Kesteven in July 1715. His eldest surviving son, PEREGRINE (1686–1742), who had been a member of parliament for Lincolnshire from 1708 to 1714, succeeded to the dukedom and also to the lord-lieutenancy of Lincolnshire, which had been held by his father. His son and successor, PEREGRINE (1714–1778), who was also lord great chamberlain and lord-lieutenant of Lincolnshire, attained the rank of general in the British army. The fourth duke was ROBERT (1756–1779), son of the third duke, who died in July 1779, when his barony of Willoughby de Eresby and the hereditary office of lord great chamberlain fell into abeyance until 1780. The dukedom, however, and other honours came to his uncle BROWNLOW (1729–1809), on whose death in February 1809 the dukedom of Ancaster and Kesteven became extinct; but the earldom of Lindsey descended to a distant kinsman, Albemarle Bertie (1744–1818). After a second period of abeyance the barony of Willoughby de Eresby was revived in 1871 in favour of Clementina Elizabeth (d. 1888), a descendant of the Berties, who was the widow of Gilbert John Heathcote, 1st Baron Aveland (d. 1867). Her son and successor, GILBERT HENRY HEATHCOTE-DRUMMOND-WILLOUGHBY (b. 1830), 23rd Baron Willoughby de Eresby, and joint hereditary lord great chamberlain, was created earl of Ancaster in 1898.

ANCELOT, JACQUES ARSÈNE FRANÇOIS POLYCARPE (1794–1854), French dramatist and *littérateur*, was born at Havre, on the 9th of February 1794. He became a clerk in the admiralty, and retained his position until the revolution of 1830. In 1816 his play *Warwick* was accepted by the Théâtre Français, but never produced, and three years later a five-act tragedy, *Louis IX.*, was staged. Three editions of the play were speedily exhausted; it had a run of fifty representations, and brought him a pension of 2000 francs from Louis XVIII. His next work, *Le Maire du palais*, was played in 1825 with less success; but for it he received the cross of the legion of honour. In 1824 he produced *Fiesque*, a clever adaptation of Schiller's *Fiesco*. In 1828 appeared *Olga, ou l'orpheline russe*, the plot of which had been inspired by a voyage he made to Russia in 1826. About the same period he produced in succession *Marie de Brabant* (1825), a poem in six cantos; *L'Homme du monde* (1827), a novel in four volumes, afterwards dramatized with success; and in 1829 a play, *Elisabeth d'Angleterre*. By the revolution of July 1830 he lost at once his royal pension and his office as librarian at Meudon; and he was chiefly employed during the next ten years in writing vaudevilles and light dramas and comedies. A tragedy, *Maria Padilla* (1838), gained him admission to the French Academy in 1841. Ancelot was sent by the French government in 1849 to Turin, Florence, Brussels and other capitals, to negotiate on the subject of international copyright; and the treaties which were concluded soon after were the result, in a great measure, of his tact and intelligence.

ANCESTOR-WORSHIP, a general name for the cult of deceased parents and forefathers. Aristotle in his *Ethics* stigmatizes as "extremely unloving" (*λίαν ἄφιλον*) the denial that ancestors are interested in or affected by the fortunes of their descendants; and in effect ancestor-worship is the staple of most religions, ancient or modern, civilized or savage. The ancient Jews were a striking exception; for though the frequent mention of ancestral graves on hilltops or in caves, and in connexion with sacred trees and pillars, and the resemblance of the "elohim" in Exod. xxi. 4-6 to household gods, may suggest that cults of the dead preceded that of Yahweh, nevertheless in the classical age of their religion (see HEBREW RELIGION) as reflected in the Old Testament, ancestor-worship has already vanished. "The Semitic nomads," remarks Renan in his *History of Israel* (*tome* 1, p. 50), "were the religious race *par excellence*, because in fact they were the least superstitious of the families of mankind, the least duped by the dream of a beyond, by the phantasmagory of a double or a shadow surviving in the nether regions. . . . They suppressed the chimeras which went with belief in a complete survival after death, chimeras which were homicidal at the time, in so far as they robbed man of the true notion of death and led him to multiply murders."

Renan here refers to the burial rite of an ancient Scythian king (as described by Herodotus, iv. 71), at whose tomb were strangled his concubine, cup-bearer, cook, groom, lackey, envoy, and several of his horses. Such cruel customs were, of course, and still are associated in many lands with the cult of the dead; but, on the other hand, there are gentler and more beneficial aspects observable to-day in China and Japan. There the mighty dead are present with the living, protect them and their houses and crops, are their strength in battle, and teach their hands to war and their fingers to fight. In the Russo-Japanese War in 1904–5 the greatest incentive to deeds of patriotic valour was for Japanese soldiers the belief that the spirits of their ancestors were watching them; and in China it is not the man himself that is ennobled for his philanthropic virtues or learning, but his ancestor. No more solemn duty weighs upon the Chinaman than that of tending the spirits of his dead forefathers. Confucius, it is recorded, sacrificed to the dead, as if they were present, and to the spirits, as if they were there. In view of such Chinese sacrifices the names of the dead are inscribed on wooden plaques called spirit-tablets, into which the spirits are during the ceremony supposed to enter, having quitted the very heaven and presence of God in order to commune with posterity. Twice a year, in spring and autumn,[1] a Chinese ruler goes in state to the imperial college in Pekin, and presents the appointed offerings before the spirit-tablets of Confucius and of the worthies who have been associated with him in his temples. He greets the sage's spirit with this prayer:—"This year, in this month, on this day, I, the emperor, offer sacrifice to the philosopher K'ung, the ancient teacher, the perfect sage, and say, O teacher, in virtue equal to heaven and earth. . . Now in this second month of spring, in reverent observance of the old statutes, with victims, silks, spirits, and fruits, I offer sacrifice to thee."

In ancient Rome painted wax images of ancestors who had served the state in its highest offices were preserved in the *atria* or halls of their descendants, inscribed, like the Chinese tablets, with titles recording their dignity and exploits. Whether the departed spirits tenanted them according to the Chinese belief is not recorded; though it probably was so, for at funerals they might be carried, like the images of the gods in *Lectisternia* (see IMAGE WORSHIP), on couches before the corpse. Oftener, however, they were mere masques worn at funerals by men who personated the ancestors and wore their robes of office. Perhaps the vulgar regarded these men as temporary reincarnations of those whom they thus represented.

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[1] Prof. J. Legge, in *Religious Systems of the World*, London, 1892, p. 72.

The word *Manes* signified the friendly ancestral ghosts of a Roman household. To them, under the name of *Lares*, it was the solemn preoccupation of male descendants to offer food and sacrifice and to keep alight the hearth fire which cooked the offerings. Small waxen images of the Manes called *Lares*, clothed in dogskin, and on feast days crowned with garlands, stood round the family hearth of which they were the unseen guardians (but see LARES). To lack such care and tendance was —along with want of regular burial—the most dreadful fate that could overtake an ancient; and a Roman, like a Hindu, in case he was childless, adopted a male child whose duty it would be, as if his own son, to continue after his death the family rites or *sacra*. On this side the ancestor-worship of the Aryans has been productive of the most important institutions of adoption and will or testament. Sir Henry Maine (*Ancient Law*, ch. v.) has justly observed that “the history of political ideas begins with the assumption that kinship in blood is the sole possible ground of community in political functions,” and that in early commonwealths “citizens considered all the groups in which they claimed membership to be founded on common lineage.” A man only shared in house, tribe and state, so far as he was descended from particular ancestors and eponymous heroes, and due cult of these illustrious dead was the condition of his enjoying any rights or inheriting any property. Yet if society was to grow, men of alien descent had to be admitted into the original brotherhood and amalgamated therewith. “Adverting to Rome singly,” adds the same author, “we perceive that the primary group, the family, was being constantly adulterated by the practice of adoption.” Thus transition was made possible from an agnatic society based on blood ties to one based on contiguity.

In the worship of the Lares the head of a Roman household commemorated and reinforced the blood tie which made one flesh of all its members living and dead. The *gens* in turn was regarded as an expansion of the family, as was the state of the *gens*; and members of these larger units by worship of common ancestors—usually mythical—kept alive the feeling that they were a single organic whole animated by a common soul and joined in consanguinity. Outcasts alone, the offspring of irregular unions, could be ignorant of the blood which ran in their veins, of the unseen ancestors to be fed and tended in family and gentile rites.[1] Such considerations help us to understand the enormous importance attached in ancient societies to the right of intermarriage, as also to grasp the origin of wills and testaments. For a will was to begin with but a mode of indicating (not necessarily in writing) on whom devolved the duty of conducting a parent's funeral, and together with that duty the right of inheriting his property. The due performance of funeral rites re-created the blood tie and renewed the kinship of living and dead at the moment when death seemed specially to endanger it by removal of that representative of the household whose special duty it had been to keep up the family *sacra*. In Hindostan, as Maine remarks (*op. cit. ch.* vi.), we have a parallel to the Roman system; for there “the right to inherit a dead man's property is exactly co-extensive with the duty of performing his obsequies. If the rites are not properly performed or not performed by the proper person, no relation is considered as established between the deceased and anybody surviving him; the law of succession does not apply, and nobody can inherit the property. Every great event in the life of a Hindu seems to be regarded as leading up to and bearing on these solemnities. If he marries, it is to have children who may celebrate them after his death; if he has no children, he lies under the strongest obligation to adopt them from another family, ‘with a view,’ writes the Hindu doctor, ‘to the funeral cake, the water and the solemn sacrifice.’” “May there be born in our lineage,” so the Indian Manes are supposed to say, “a man to offer to us, on the thirteenth day of the moon, rice boiled in milk, honey and ghee.”[2]

It is then in connexion with the history of inheritance and adoption, and of the gradual evolution from societies held together only by blood-kinship to societies consolidated on other bases, especially on that of local contiguity, that ancestor-worship chiefly calls for investigation.

We must now pass on to other aspects of it less important for the student of ancient law, but interesting to the folklorist.

In ancient Rome the *Di manes*, or as we should say the blessed dead, who reposed in their necropolis outside the walls, were specially commemorated on the *dies parentales* or days of placating them (*placandis Manibus*). These began on the 13th of February and ended on the 22nd with the *Caristia* or feast of *Cara Cognatio*. The family have on the preceding days solemnly visited the grave, and offered to the shades gifts of water, wine, milk, honey, oil, and the blood of black victims; they have decked the tomb with flowers, have renewed the feast and farewell of the funeral, and have prayed to the ancestors to watch over their welfare. Now the survivors return home and hold a love-feast, in which all quarrels are healed, all trespasses forgiven. The Lares are brought out to preside over this solemn feast, and for the occasion are *incincti* or clothed in tunics girt at the loins.

It is doubtful whether we should dignify by the name of ancestor-worship the older Roman festival of the *Lemuria*, which was held on the 9th, 11th and 13th of May. For the *lemures* were, like our unlaid ghosts, unburied, mischievous or inimical spirits, and these three days were *nefasti* or unlucky, because their malign influence was abroad. The ghosts had to be driven out of the house, and Ovid (*Fasti*, v. 432) relates how the head of the family arose at midnight, and with feet unfettered by shoon or sandals, and with washen hands traversed his house beckoning against the ghosts with fingers joined to thumb. Nine times with averted glance he spat a black bean out of his mouth and cried: “With these I redeem me and mine.” The ghosts followed and picked up, or perhaps entered into the beans. Then he washed afresh, and rattled his brass vessels, and nine times over bade them begone with the polite formula, *Manes exite paterni*, “Go forth, O paternal manes.”

The gesture described was probably the same as that with which a Christian priest averts demonic influences from the heads of his congregation in the act of blessing them. The many hands of Zeus Sabazios turned up in ancient excavations observe a similar gesture. All over the earth we meet with such periodically recurrent ceremonies of expelling demons and ghosts, who usually are given a meal before being hunted back into their graves. But an account of such ceremonies belongs rather to demonology than to the history of the worship of Manes, which are peaceful, well-conducted and beneficent beings, endowed and, so to speak on the foundation, like the Christian souls for whose masses money has been left. Ancestor-worship has its parallels in Christian cults of the dead and of the saints; it must be remembered, however, that a saint is not as a rule an ancestor, and that his cult is not based upon family feeling and love of kinsmen, nor tends to stimulate and encourage the same. Such cults have never prevented those who participated in them from fighting one another. Ancestor-worship on this side is also in strong contrast with the teaching of the Gospel, for it is an apotheosis of family affections and supplies a real cement wherewith to bind society together; whereas the Christian Messiah taught that, “If any cometh to me, and hateth not his father and his mother, and his wife and his children, and his brethren and his sister, yea, and his own life also, he cannot be my disciple." To the ordinary good citizen of antiquity, whose religion was the consecration of family ties, such a precept was no less scandalous than it is to a Chinaman or Hindu of to-day. Was not the duty of following the Messiah to supersede even that of burying one's parents, the most sacred of all ancient obligations? The Church when it had once conquered the world allowed such precepts to lapse and fall into the background, and no one save monks or Manichaean heretics remembered them any more; indeed modern divines affect to believe that marriage rites and family ties were the peculiar concern of the Church from the very first; and few moderns will fail to sympathize with the misgivings of the barbarian chief who, having been converted and being about to receive Christian baptism, paused as he stepped down into the font, and asked the priests if in the heaven to which their rites admitted him he would meet and converse with his pagan ancestors. On being assured that he would not, he stepped out again and declined their methods of salvation.

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[1] Livy iv. 2:—“Quam enim aliam vim connubia promiscua habere, nisi ut ferarum prope ritu vulgentur concubitus plebis Patrumque? ut qui natus sit, ignoret, cujus sanguinis, quorum sacrorum sit.”

[2] E. B. Tylor, *Primitive Culture*, ii. p. 119.

In the above paragraphs we have drawn examples only from races organized on a patriarchal basis among whom the headship passes from father to son. But many primitive societies do not trace descent through males and yet may be said to worship ancestors. The aborigines of Australia furnish an example. The Aruntas among them are said to have no idea of paternity, but believe that local spirits of tree, rock or stream enter women as they pass by their haunts. In doing so they drop a wooden soul-token called a *Churinga*. This the elders of the tribe pick up or pretend to find, and carefully store up in a cleft of the hills or in a cave which no woman may approach. The souls of members of the tribe who have died survive in these slips of wood, which are treasured up for long generations and repaired if they decay. They are carried into battle to assist the tribe, are regularly anointed, fondled and invoked; for it is believed that the souls present in them are powerful to work weal and woe to friend and enemy respectively. They thus resemble the Chinese spirit tablet.

Reference has been made above to the possibility that the Roman *imago* of an ancestor actually embodied his ghost, at least on solemn occasions. The custom of providing a material abode or *nidus* for the ghost is found all over the earth; *e.g.* in New Ireland a carved chalk figure of the deceased, indicating the sex, is procured, and entrusted to the chief of a village, who sets it up in a funeral hut in the middle of a large *taboo* house adorned with plants. The survivors believe that the ghostly ogre, being so well provided for, will abstain from haunting them.

The Romans, as we remarked above, distinguished between the *Lemures* or wandering mischievous ghosts and the *Manes* snugly interred and tended in the cemetery which was part of every Italian settlement. The distinction, however, is one for which survivors alone are responsible and not one inherent in the nature of ghosts. No race at all, it would seem, except the Jews, has ever been able to regard a man's death as the end of him; and except in the higher forms of Christianity the dead are everywhere supposed to need the same sort of food, equipment, tenement and gear which they enjoyed in life, and to molest the living unless they obtain it. It may be affection, or it may be fear, which prompts the survivor to feed and tend his dead; in general no doubt it is a mixture of both feelings.

In Africa and other savage countries a third motive sometimes operates, namely the desire to consult the dead—as Odysseus, anxious about his return home, was constrained to do—or to use them against the living; for negro magicians are reputed even to murder remarkable individuals in order to possess themselves of their power and to be able to use them as familiar spirits.

The question has often been raised, what is the relation of private cults of ancestors to public religion? Do men after death become gods? Euhemerus of Messenia tried of old to rationalize the Greek myths by supposing that the Olympian gods were deified men. Such a theory, like its modern rival of the sun-myth, may of course be pushed till it becomes absurd; yet in India critical observers, like Sir Alfred C. Lyall, attest innumerable examples of the gradual elevation into gods of human beings, the process even beginning in their lifetime. There a man wins local fame as an ascetic with abnormal powers, or a wife, because Alcestis-like she sacrificed herself for her husband and immolated herself on his pyre. Miracles occur at their shrines, and the surviving relatives who guard them wax rich off the offerings brought. "In the course of a very few years, as the recollection of the man's personality becomes misty, his origin grows mysterious, his career takes a legendary hue, his birth and death were both supernatural; in the next generation the names of the elder gods get introduced into the story, and so the marvellous tradition works itself into a myth, until nothing but a personal incarnation can account for such a series of prodigies. The man was an *Avatár* of Vishnu or Siva; his supreme apotheosis is now complete, and the Brahmins feel warranted in providing for him a niche in the orthodox pantheon."[1]

AUTHORITIES.—H. S. Maine, *Ancient Law* (London, 1906); E. B. Tylor, *Primitive Culture* (London, 1903); and article on the "Matriarchal Family System," in the *Nineteenth Century*, xl. 81 (1896); W. W. Fowler, *The Roman Calendar* (London, 1906); Fustel de Coulanges, *La Cité antique* (17th ed., 1900); L. André, *Le Culte des morts chez les Hébreux* (1895); C. Grüneisen, *Der Ahnenkultus und die Urreligion Israels* (Halle, 1900); Grant Allen, *The Evolution of the Idea of God* (London, 1897); F. B. Jevons, *Introduction to the History of Religion* (London, 1896); Sir A. C. Lyall, *Asiatic Studies* (London, 1899 and 1907); D. G. Brinton, *Religions of Primitive Peoples* (New York, 1897); H. Oldenberg, *Die Religion des Veda* (Berlin, 1894). (F. C. C.)

ANCHISES, in Greek legend, Trojan hero, son of Capys and Themis, grandson (according to Hyginus, son) of Assaracus, connected on both sides with the royal family of Troy, was king of Dardanus on Mt. Ida. Here Aphrodite met him and, enamoured of his beauty, bore him Aeneas. For revealing the name of the child's mother, in spite of the warnings of the goddess, he was killed or struck blind by lightning (Hyginus, *Fab.* 94). In the more recent legend, adopted by Virgil in the *Aeneid*, he was conveyed out of Troy on the shoulders of his son Aeneas, whose wanderings he followed as far as Sicily, where he died and was buried on Mt. Eryx. On the other hand, there was a grave on Mt. Ida at Troy pointed out as his. From the name Assaracus, from the intercourse between the Phoenicians and the early inhabitants of the Troad, and from the connexion of Aphrodite, the protecting goddess of the Phoenicians, with Anchises, it has been inferred that his family was originally of Assyrian origin. His flight on the shoulders of Aeneas is frequently represented on engraved gems of the Roman period; and his visit from Aphrodite is rendered in a beautiful bronze relief, engraved in Millingen's *Unedited Gems*.

ANCHOR (from the Greek ἄγκυρα, which Vossius considers is from ὄγκη, a crook or hook), an instrument of iron or other heavy material used for holding ships or boats in any locality required, and preventing them from drifting by winds, tides, currents or other causes. This is done by the anchor, after it is let go from the ship by means of the cable, fixing itself in the ground and there holding the vessel fast.

The word "anchor" is also used figuratively for anything which gives security, or for any ornament or appendage which takes the same form. Owing to a vessel's safety depending upon the anchor, it is obviously an appliance of great importance, and too much care cannot be expended on its manufacture and proper construction. The most ancient anchors consisted of large stones, baskets full of stones, sacks filled with sand, or logs of wood loaded with lead. Of this kind were the anchors of the ancient Greeks, which, according to Apollonius Rhodius and Stephen of Byzantium, were formed of stone; and Athenaeus states that they were sometimes made of wood. Such anchors held the vessel merely by their weight and by the friction along the bottom. Iron was afterwards introduced for the construction of anchors, and an improvement was made by forming them with teeth or "flukes" to fasten themselves into the bottom;

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[1] A. C. Lyall, *Asiatic Studies* (reprinted by Watts and Co., London, 1907), p. 19.

whence the words ὀδόντες and *dentes* are frequently taken for anchors in the Greek and Latin poets. The invention of the teeth is ascribed by Pliny to the Tuscans; but Pausanias gives the credit to Midas, king of Phrygia. Originally there was only one fluke or tooth, whence anchors were called ἑτερόστομοι; but a second was added, according to Pliny, by Eupalamus, or, according to Strabo, by Anacharsis, the Scythian philosopher. The anchors with two teeth were called ἀμφίβολοι or ἀμφίστομοι, and from ancient monuments appear to have resembled generally those used in modern days, except that the stock is absent from them all. Every ship had several anchors; the largest, corresponding to our sheet anchor, was only used in extreme danger, and was hence peculiarly termed ἱερά or *sacra*, whence the proverb *sacram anchoram solvere*, as flying to the last refuge.

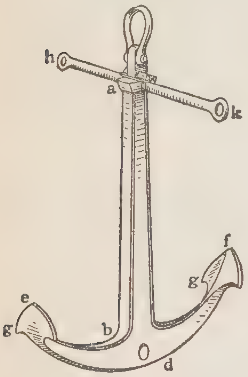

FIG. 1.—Rodger's Anchor.

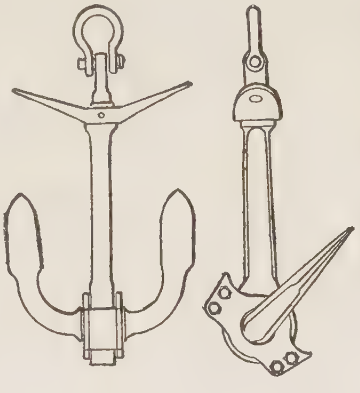

FIG. 2.—Improved Martin Anchor.

Until the beginning of the 19th century anchors were of imperfect manufacture, the means of effecting good and efficient welding being absent and the iron poor, whilst the arms, being straight, generally parted at the crown, when weighing from good holding-ground. A clerk in Plymouth Yard, named Pering, in the early part of that century (1813) introduced curved arms; and after 1852 the Admiralty anchor, under the direction of the Board, was supplied to H.M. ships, followed by Lieutenant (afterwards Captain) Rodger's anchor (fig. 1). This marked a great departure from the form of previous anchors. The arms, *de*, *df* were formed in one piece, and were pivoted at the crown *d* on a bolt passing through the forked shank *ab*. The points or pees *e*, *f*, to the palms *g* were blunt. This anchor had an excellent reputation amongst nautical men of that period, and by the committee on anchors, appointed by the admiralty in 1852, it was placed second only to the anchor of Trotman. Later came the self-canting and close-stowing Martin anchor, which, passing through successive improvements, became the improved Martin anchor (fig. 2) made of forged iron. A projection in the centre of the arms works in a recess at the hub of the shank; the vacancies outside the shank are filled by blocks bolted through on each side, and are flush with the side plates, which keep the flukes in position. The introduction of cast steel in 1894 led to the improved Martin-Adelphi pattern (fig. 3), in which the crown and arms are cast in one, and, with the stock, are made of cast steel, the shank remaining of forged iron. A projection in the crown works in a recess (right, fig. 3), and is secured in its place by a forged steel pin, fitted with a nut and washer, which passes through the crown and the heel of the shank. All the above anchors were provided with a stock (fig. 1, *hk*), the use of which is to "cant" the anchor. If it falls on the ground, resting on one arm and one stock, when a strain is brought on the cable, the stock cants the anchor, causing the arms to lie at a downward angle to the holding ground; and the pees enter and bury themselves below the surface of the soil.

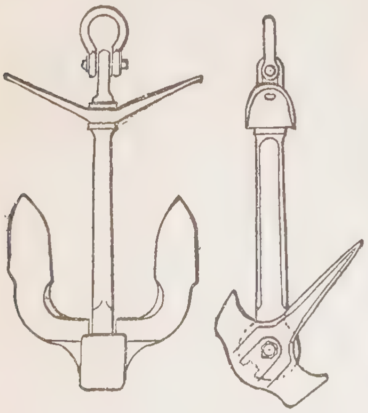

FIG. 3.—Improved Martin-Adelphi Anchor.

To stow a stocked anchor on the forecastle, it is hove up close to the forefoot, and by means of a ground chain (secured to a balancing or gravity band on the anchor), which is joined to a catting chain rove through a cat davit, the anchor is hove up horizontally and placed on its bed, where it is secured by chains passing over a rod fitted with a lever for "letting go." The cat davit is hinged at its base, and can be laid flat on the deck for right ahead fire or when at sea. Ground and catting chains have been superseded in some ships by a wire pendant and cat hook; the anchor is then hove close up to the hawse-pipe. To avoid cutting away a portion of the forecastle, in the "Cressy," "Terrible" and "Diadem" classes of the British navy, the anchors, secured by chains, are stowed a-cock-bill, outside the ship, with their crowns resting on iron shoes secured to the ship's side and the flukes fore and aft. A difficulty is experienced in stowing the anchors when the ship is pitching or rolling heavily. Fig. 4 illustrates an anchor with cat davit or anchor crane used in the P. and O. Company's steamers ("India" class, 8000 tons); for sea the anchor is stowed on board by the anchor crane.

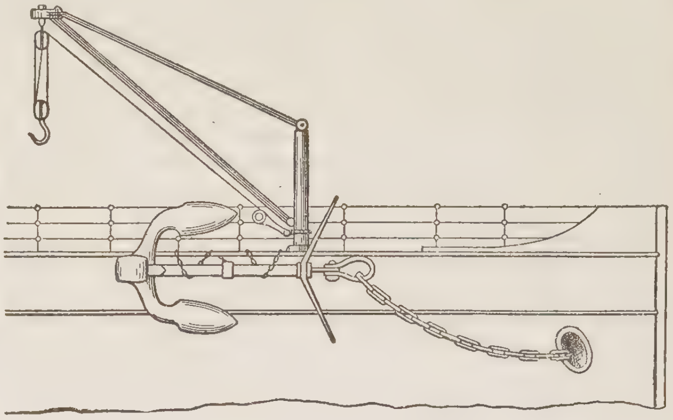

FIG. 4.—Anchor Crane.

Stockless anchors have been extensively used in the British mercantile marine and in some foreign navies. In 1903 they were adopted generally for the British navy, after extensive anchor trials, begun in 1885. Their advantages are:—handiness combined with a saving of time and labour; absence of davits, anchor-beds and other gear, with a resulting reduction in weight; and a clear forecastle for "right ahead" gun fire or for working ship. On the other hand a larger hawse-pipe is required, and there appears to be a consensus of opinion that a stockless anchor

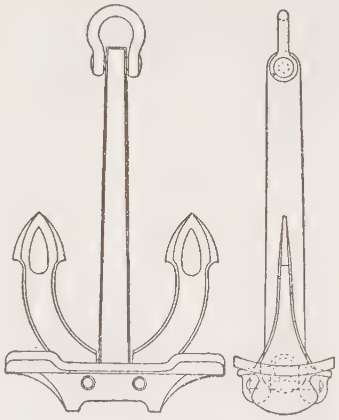

FIG. 5.—Hall's Improved Stockless Anchor.

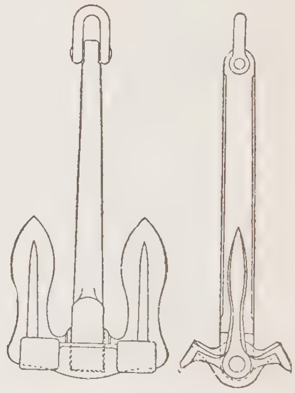

FIG. 6.—W. L. Byer's Stockless Anchor.

when "let go" does not hold so quickly as a stocked one, is more uncertain in its action over uneven ground, and is more liable to "come home" (drag). The stockless anchors principally in use in the British navy are Hall's improved, Byer's, and Wasteneys Smith's. In Hall's improved (fig. 5) the arms and crown of cast steel are in one piece, and the shank of forged steel passes up through an aperture in the crown to which it is secured by two cross bolts. Two trunnions or lugs are forged to the lower end of the shank. In Byer's plan (fig. 6) the flukes and crown consist of a steel-casting secured to a forged shank by a through bolt of mild steel, the axis of which is parallel to the points of the flukes; one end of the bolt has a head, but the other is screwed and fitted with a phosphor bronze nut to allow the bolt to be withdrawn for examination. A palm is cast on each side of the crown to trip the flukes when the anchor is on the ground, and for bringing them snug against the ship's side when weighing. Wasteneys Smith's anchor (fig. 7) is composed of three main parts, the shank and crown which form one forging, and the two flukes or arms which are separate castings. A bolt passes through the crown of the anchor, connecting the flukes to it; to prevent the flukes working off the connecting through bolt, two smaller bolts pass through the flukes at right angles to the through bolt and are recessed half their diameter into it.

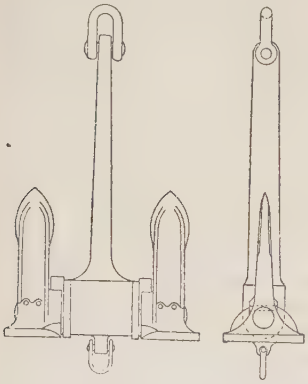

FIG. 7.—Wasteneys Smith's Stockless Anchor.

Fig. 8 represents the starboard bow of H.M.S. "New Zealand" (16,350 tons) with lower and sheet (spare) anchors stowed. To let go a stockless anchor (fig. 9) the cable or capstan holder C is unscrewed, and in practice it is found desirable to knock off the bottle screw-slip A, allowing the weight of the anchor to be taken by the inner slip A′ (Blake's stopper). Stern, stream and kedge anchors are usually stowed with special davits. A portable anchor suitable for small yachts is the invention of Mr Louis Moore; the shank passes through the crown of the anchor like the handle of a pickaxe and the stock over the head of the shank. At the end of the stock are loose pawls. There are no keys or bolts, and the only fastening is for the cable. The anchor takes to pieces readily and stows snugly. In 1890 Colonel Bucknill also invented a portable anchor for small yachts.

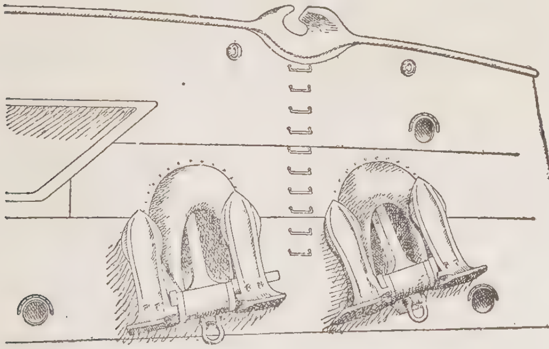

FIG. 8.—Starboard Bow of H.M.S. "New Zealand."

Iron buoy-sinkers (fig. 10), as used by the London Trinity House Corporation, weigh from 8 to 40 cwt.; the specified weight is cast on them in large raised figures, and the cast and wrought irons used are of special quality, of which samples are previously submitted to the engineer-in-chief.

The anchors supplied to ships of the British navy are required to withstand a certain tensile strain, expressed in tons, proportionate to their weights in cwts. New anchors are supplied by contractors, but repairs are made in H.M. dockyards, a record of its repairs being stamped on each anchor. In the Anchors and Cables Act 1899 a list is given of authorized testing-establishments, with their distinctive marks and charges, and testing-houses for foreign-owned vessels are enumerated in Table 22 of *Lloyd's Register of British and Foreign Shipping.* Cast-steel anchors, in addition to the statutory tests, are subjected to percussive, hammering and bending tests, and are stamped "annealed steel." (J. W. D.)

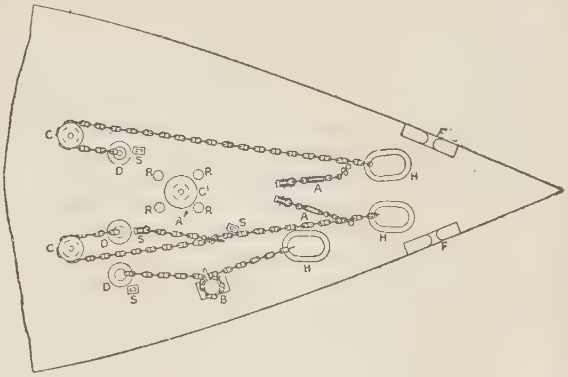

FIG. 9.—Forecastle of H.M.S. "New Zealand."

A.	Bottle or screw-slip.	B.	Deck or navel pipes.
A′.	Slip or Blake's stopper.	F.	Fairleads for wire hawsers.
D.	Bitts.	H.	Hawse-pipes.
C.	Cable or Capstan-holders.	S.	Stopper-bolts.
C′.	Centre line capstan.	R.	Rollers.

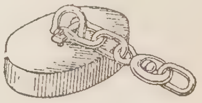

FIG. 10.—Iron Buoy-Sinker.

ANCHOVY (*Engraulis encrasicholus*), a fish of the herring family, easily distinguished by its deeply-cleft mouth, the angle of the gape being behind the eyes. The pointed snout extends beyond the lower jaw. The fish resembles a sprat in having a forked tail and a single dorsal fin, but the body is round and slender. The maximum length is $8\frac{1}{8}$ in. Anchovies are abundant in the Mediterranean, and are regularly caught on the coasts of Sicily, Italy, France and Spain. The range of the species also extends along the Atlantic coast of Europe to the south of Norway. In winter it is common off Devon and Cornwall, but has not hitherto been caught in such numbers as to be of commercial importance. Off the coast of Holland in summer it is more plentiful, entering the Zuider Zee in such numbers as to give rise to a regular and valuable fishery. It is also taken in the estuary of the Scheldt. There is reason to believe that the anchovies found at the western end of the English Channel in November and December are those which annually migrate from the Zuider Zee and Scheldt in autumn, returning thither in the following spring; they must be held to form an isolated stock, for none come up from the south in summer to occupy the English Channel, though the species is resident on the coast of Portugal. The explanation appears to be that the shallow and landlocked waters of the Zuider Zee, as well as the sea on the Dutch coast, become raised to a higher temperature in summer than any part of the sea about the British coasts, and that therefore anchovies are able to spawn and maintain their numbers in these waters. Their reproduction and development were first described by a Dutch naturalist from observations made on the shores of the Zuider Zee. Spawning takes place in June and July, and the eggs, like those of the majority of marine fishes, are buoyant and transparent, but they are peculiar in having an elongated, sausage-like shape, instead of being globular. They resemble those of the sprat and pilchard in having a segmented yolk and there is no oil globule. The larva is hatched two or three days after the fertilization of the egg, and is very minute and transparent. In August young specimens 1½ to 3½ in. in length have been taken in the Zuider Zee, and these must be held to have been derived from the spawning of the previous summer. There is no evidence to decide the question whether all the young anchovies as well as the adults leave the Zuider Zee in autumn, but, considering the winter temperature there, it is probable that they do. The eggs have also been obtained from the Bay of Naples, and near Marseilles, also off the coast of Holland, and once at least off the coast of Lancashire. The occurrence of anchovies in the English Channel has been carefully studied at the laboratory of the Marine Biological Association at Plymouth. They were most abundant in 1889 and 1890. In the former year considerable numbers were taken off Dover in drift nets of small mesh used for the capture of sprats. In the following December large numbers were taken together with sprats at Torquay. In November 1890 a thousand of the fish were obtained in two days from the pilchard boats fishing near Plymouth; these were caught near the Eddystone. When taken in British waters anchovies are either thrown away or sent to the market fresh with the sprats. If salted in the proper way, they would doubtless be in all respects equal to Dutch anchovies, if not to those imported from Italy. The supply, however, is small and inconstant, and for this reason English fish-curers have not learnt the proper way of preparing them. The so-called "Norwegian anchovies" imported into England in little wooden kegs are nothing but sprats pickled in brine with bay-leaves and whole pepper. (J. T. C.)

ANCIEN RÉGIME, The, a French phrase commonly used, even by English writers, to denote the social and political system established in France under the old monarchy, which was swept away by the Revolution of 1789. The phrase is generally applicable only to France, for in no other country, with perhaps the exception of Japan, has there been in modern times so clearly marked a division between "the old order" and the new.

ANCIENT (also spelt Antient; derived, through the Fr. *ancien*, old, from the late Lat. *antianum*, from *ante*, before), old or in olden times. "Ancient history" is distinguished from medieval and modern, generally as meaning before the fall of the western Roman empire. In English legal history, "ancient" tenure or demesne refers to what was crown property in the time of Edward the Confessor or William the Conqueror. "The Ancient of days" is a Biblical phrase for God. In the London Inns of Court the senior barristers used to be called "ancients." From the 16th to the 18th century the word was also used, by confusion with "ensign," *i.e.* flag or standard-bearer, for that military title, as in the case of Shakespeare's "ancient Pistol"; but this use has nothing to do with "ancient" meaning "old."

ANCIENT LIGHTS, a phrase in English law for a negative easement (*q.v.*) consisting in the right to prevent the owner or occupier of an adjoining tenement from building or placing on his own land anything which has the effect of illegally obstructing or obscuring the light of the dominant tenement. At common law a person, who opens a window in his house, has a natural right to receive the flow of light that passes through it. But his neighbour is not debarred thereby from building on his own land even though the effect of his action is to obstruct the flow of light thus obtained. Where, however, a window had been opened for so long a time as to constitute immemorial usage in law, the light became an "ancient light" which the law protected from disturbance. The Prescription Act 1832 created a statutory prescription for light. It provided (s. 3) that "when the access and use of light to and for" (any building) "shall have been actually enjoyed therewith for the full period of 20 years without interruption, the right thereto shall be deemed absolute and indefeasible, any local usage or custom to the contrary notwithstanding, unless it shall appear that the same was enjoyed by some consent or agreement, expressly made or given for that purpose by deed or writing." The statute does not create an absolute or indefeasible right immediately on the expiration of twenty years. Unless and until the dominant owner's claim is brought into question (s. 4) no absolute or indefeasible title can arise under the act. The dominant owner has only an inchoate right, to avail himself under the act of the twenty years' uninterrupted enjoyment, if his claim is brought into question. But in the meantime, however long the enjoyment may have been, his right is just the same, and the origin of his right is just the same as if the act had never been passed. These principles were laid down in 1904 by the House of Lords in the leading case of *Colls* v. *Home & Colonial Stores Ltd.* (1904 A.C. 179). They overrule an earlier view propounded by Lord Westbury in 1865 (*Tapling* v. *Jones*, 11 H.L.C. 290) that the Prescription Act 1832 had abrogated the common law prescription as to light, that the right to "ancient lights" now depends upon positive enactment alone, and does not require, and ought not to be rested on, any fiction of a "lost grant" (see Easement). There has been much difference of judicial opinion as to what constitutes an actionable interference with "ancient lights." On the one hand, the test has been prescribed that if an angle of 45°—uninterrupted sky light—was left, the easement was not interfered with, and, while this is not a rule of law, it is a good rough working criterion. On the other hand, it was held in effect by the Court of Appeal in the case of *Colls* v. *Home & Colonial Stores Ltd.* (1902; 1 Ch. 302) that to constitute an actionable obstruction of ancient lights it was sufficient if the light was sensibly less than it was before. The House of Lords, however, in the same case (1904 A. C. 179) overruled this view, and held that there must be a substantial privation of light enough to render the occupation of the house or building uncomfortable according to the ordinary notions of mankind and (in the case of business premises) to prevent the plaintiff from carrying on his business as beneficially as before. See also *Kine* v. *Jolly* (1905; 1 Ch. 480).

There is, in Scots law, no special doctrine as to "ancient lights." The servitude of light in Scotland is simply the Roman servitude *non officiendi luminibus vel prospectui* (see Easement and Roman Law). The same observation applies to the Code Civil and other European Codes based on it. The doctrine as to ancient lights does not prevail generally in the United States (consult *Ruling Cases*, under "Air").

ANCILLARY (from the Lat. *ancilla*, a handmaid), an adjective meaning "subordinate to" or "merely helping," as opposed to "essential." By Thackeray and some other writers it is also employed rather affectedly in its primary meaning of "pertaining to a maid-servant."

ANCILLON, CHARLES (1659–1715), one of a distinguished family of French Protestants, was born on the 28th of July 1659, at Metz. His father, David Ancillon (1617–1692), was obliged to leave France on the revocation of the edict of Nantes, and became pastor of the French Protestant community in Berlin. Charles Ancillon studied law at Marburg, Geneva, and Paris, where he was called to the bar. At the request of the Huguenots at Metz, he pleaded its cause at the court of Louis XIV., urging that it should be excepted in the revocation of the edict of Nantes, but his efforts were unsuccessful, and he joined his father in Berlin. He was at once appointed by the elector Frederick "juge et directeur de colonie de Berlin." He had before this published several works on the revocation of the edict of Nantes and its consequences, but his literary capacity was mediocre, his style stiff and cold, and it was his personal character rather than his reputation as a writer that earned him the confidence of the elector. In 1687 he was appointed head of the so-called *Académie des nobles*, the principal educational establishment of the state; later on, as councillor of embassy, he took part in the negotiations which led to the assumption of the title of king by the elector. In 1699 he succeeded Pufendorf as historiographer to the elector, and the same year replaced his uncle Joseph Ancillon as judge of all the French refugees in Brandenburg. He died on the 5th of July 1715. Ancillon's chief claim to remembrance is the work that he did for education in Prussia, and the share he took, in co-operation with Leibnitz, in founding the Academy of Berlin. Of his fairly numerous works the only one still of value is the *Histoire de l'établissement des Français réfugiés dans les états de Brandebourg* (Berlin, 1690).

ANCILLON, JOHANN PETER FRIEDRICH (1766–1837), Prussian historian and statesman, great-grandson of Charles Ancillon, was born at Berlin on the 30th of April 1766. He studied theology at Geneva, and after finishing his course was appointed minister to the French community at Berlin. At the same time his reputation as a historical scholar secured him the post of professor of history at the military academy. In 1793 he visited Switzerland, and in 1796 France, and published the impressions gathered during his travels in a series of articles which he afterwards collected under the title of *Mélanges de littérature et de philosophie* (1801). Ancillon took rank among the most famous historians of his day by his next work, *Tableau des révolutions du système politique de l'Europe depuis le XVe siècle* (1803, 4 vols.; new ed., 1824), which gained him the eulogium of the Institute of France, and admission to the Academy of Berlin. It was the first attempt to recognize psychological factors in historical movements, but otherwise its importance was exaggerated. Its "sugary optimism, unctuous phraseology and pulpit logic" appealed, however, to the reviving pietism of the age succeeding the Revolution, and these qualities, as well as his eloquence as a preacher, early brought Ancillon into notice at court. In 1808 he was appointed tutor to the royal princes, in 1809 councillor of state in the department of religion, and in 1810 tutor of the crown prince (afterwards Frederick William IV.), on whose sensitive and dreamy nature he was to exercise a powerful but far from wholesome influence. In October 1814, when his pupil came of age, Ancillon was included by Prince Hardenberg in the ministry, as privy councillor of legation in the department of foreign affairs, with a view to utilizing his supposed gifts as a philosophical historian in the preparation of the projected Prussian constitution. But Ancillon's reputed liberalism was of too invertebrate a type to survive the trial of actual contact with affairs. The practical difficulty of the constitutional problem gave the "court parson"—as Gneisenau had contemptuously called him—excuse enough for a change of front which, incidentally, would please his exalted patrons. He covered his defection from Hardenberg's liberal constitutionalism by a series of "philosophical" treatises on the nature of the state and of man, and became the soul of the reactionary movement at the Berlin court, and the faithful henchman of Metternich in the general politics of Germany and of Europe.

In 1817 Ancillon became a councillor of state, and in 1818 director of the political section of the ministry for foreign affairs under Count Bernstorff. In his chief's most important work, the establishment of the Prussian *Zollverein*, Ancillon had no share, while the entirely subordinate rôle played by Prussia in Europe during this period, together with the personal part taken by the sovereign in the various congresses, gave him little scope for the display of any diplomatic talents he may have possessed. During this time he found plentiful leisure to write a series of works on political philosophy, such as the *Nouveaux essais de politique et de philosophie* (Paris, 1824). In May 1831 he was made an active privy councillor, was appointed chief of the department for the principality of Neuchâtel, in July became secretary of state for foreign affairs, and in the spring of 1832, on Bernstorff's retirement, succeeded him as head of the ministry.

By the German public, to whom Ancillon was known only through his earlier writings and some isolated protests against the "demagogue-hunting" in fashion at Berlin, his advent to power was hailed as a triumph of liberalism. They were soon undeceived. Ancillon had convinced himself that the rigid class distinctions of the Prussian system were the philosophically ideal basis of the state, and that representation "by estates" was the only sound constitutional principle; his last and indeed only act of importance as minister was his collaboration with Metternich in the Vienna Final Act of the 12th of June 1834, the object of which was to rivet this system upon Germany for ever. He died on the 19th of April 1837, the last of his family. His historical importance lies neither in his writings nor in his political activity, but in his personal influence at the Prussian court, and especially in its lasting effect on the character of Frederick William IV.

See C. A. L. P. Varnhagen von Ense, *Blätter aus der preussischen Geschichte*, 5 vols. (Leipzig, 1868–1869); *ib. Tagebücher*, vol. i. (Leipzig, 1861); H. O. Treitschke, *Deutsche Geschichte* (Leipzig, 1879–1894), and essay on Ancillon in *Preussische Jahrbücher* for April 1872; *Allgemeine Deutsche Biographie*, s.v. (Leipzig, 1875).

ANCÓN, a small village and bathing-place on the coast of Peru, 22 m. N. of Lima by rail. The bay is formed by two projecting headlands and is one of the best on the coast. It has a gently sloping beach of fine sand and has been a popular bathing-place since the time of President Balta, although the country behind it is arid and absolutely barren. At some time previous to the discovery of America, Ancón had a large aboriginal population. Traces of terraces on the southern headland can still be seen, and the sand-covered hills and slopes overlooking the bay contain extensive burial-grounds which were systematically explored in 1875 by Messrs W. Reiss and A. Stübel (see Reiss and Stübel's *The Necropolis of Ancón in Peru*, translated by A. H. Keane, 3 vols., Berlin, 1880–1887). In modern times Ancón has been the scene of several important historical events. Its anchorage was used by Lord Cochrane in 1820 during his attacks on Callao; it was the landing-place of an invading Chilean army in 1838; it was bombarded by the Chileans in 1880; and in 1883 it was the meeting-place of the Chilean and Peruvian commissioners who drew up the treaty of Ancón, which ended the war between Chile and Peru.

ANCON (from the Gr. ἀγκών), the anatomical name for "elbow"; "ancones" in architecture are the projecting bosses left on stone blocks or on drums of columns, to allow of their being either hoisted aloft or rubbed backwards and forwards to obtain a fine joint; the term is also given by Vitruvius to the trusses or console brackets on each side of the doorway of a Greek or Roman building which support the cornice over the same. A particular sort of sheep, with short crooked forelegs, is called "ancon" sheep.

ANCONA, ALESSANDRO (1835–), Italian critic and man of letters, was born at Pisa on the 20th of February 1835, of a wealthy Jewish family, and educated in Florence; at the age of eighteen he published his essay on the life and work of the philosopher Tommaso Campanella. In 1855 Ancona went to Turin, nominally to study law, but in reality to act as intermediary between the Tuscan Liberals and Cavour; he was an intimate friend of Luigi Carlo Farini (*q.v.*) and represented Tuscany in the Società Nazionale. On the fall of the Austrian dynasty in Tuscany (April 27, 1859) he returned to Florence, where he edited the newly founded newspaper *La Nazione*. In 1861 he was appointed professor of Italian literature at the university of Pisa. Among his works the following may be mentioned: *Opera di Tommaso Campanella*, 2 vols. (Turin, 1854); *Sacre Rappresentazioni dei secoli XIV., XV., e XVI.* (3 vols., Florence, 1872); *Origini del Teatro in Italia* (2 vols., Florence, 1877); *La Poesia popolare italiana* (Livorno, 1878), besides several volumes of literary essays, editions of the works of Dante and other early Italian writers, &c.

ANCONA, a seaport and episcopal see of the Marches, Italy, capital of the province of Ancona, situated on the N.E. coast of Italy, 185 m. N.E. of Rome by rail and 132 m. direct, and 127 m. S.E. of Bologna. Pop. (1901) 56,835. The town is finely situated on and between the slopes of the two extremities of the promontory of Monte Conero, Monte Astagno to the S., occupied by the citadel, and Monte Guasco to the N., on which the cathedral stands (300 ft.). The latter, dedicated to S. Ciriaco, is said to occupy the site of a temple of Venus, who is mentioned by Catullus and Juvenal as the tutelary deity of the place. It was consecrated in 1128 and completed in 1189. Some writers suppose that the original church was in the form of a Latin cross and belonged to the 8th century. An early restoration was completed in 1234. It is a fine Romanesque building in grey stone, built in the form of a Greek cross, with a dodecagonal dome over the centre slightly altered by Margaritone d' Arezzo in 1270. The façade has a Gothic portal, ascribed to Giorgio da Como (1228), which was intended to have a lateral arch on each side. The interior, which has a crypt in each transept, in the main preserves its original character. It has ten columns which are attributed to the temple of Venus, and there are good screens of the 12th century, and other sculptures. In the dilapidated episcopal palace Pope Pius II. died in 1464. An interesting church is S. Maria della Piazza, with an elaborate arcaded façade (1210). The Palazzo del Comune, with its lofty arched substructures at the back, was the work of Margaritone d' Arezzo, but has been since twice restored. There are also several fine late Gothic buildings, among them the churches of S. Francesco and S. Agostino, the Palazzo Benincasa, and the Loggia dei Mercanti, all by Giorgio Orsini, usually called da Sebenico (who worked much at Sebenico, though he was not a native of it), and the prefecture, which has Renaissance additions. The portal of S. Maria della Misericordia is an ornate example of early Renaissance work. The archaeological museum contains interesting pre-Roman objects from tombs in the district, and two Roman beds with fine decorations in ivory (E. Brizio, in *Notizie degli scavi*, 1902, 437, 478).

To the east of the town is the harbour, now an oval basin of 990 by 880 yards, the finest harbour on the S. W. coast of the Adriatic, and one of the best in Italy. It was originally protected only by the promontory on the N., from the elbow-like shape of which (Gk. *ἀγκών*) the ancient town, founded by Syracusan refugees about 390 B.C., took the name which it still holds. Greek merchants established a purple factory here (Sil. Ital. viii. 438). Even in Roman times it kept its own coinage with the punning device of the bent arm holding a palm branch, and the head of Aphrodite on the reverse, and continued the use of the Greek language. When it became a Roman colony is doubtful.[1] It was occupied as a naval station in the Illyrian war of 178 B.C. (Liv. xli. 1). Caesar took possession of it immediately after crossing the Rubicon. Its harbour was of considerable importance in imperial times, as the nearest to Dalmatia,[2] and was enlarged by Trajan, who constructed the north quay, his architect being Apollodorus of Damascus. At the beginning of it stands the marble triumphal arch with a single opening, and without bas-reliefs, erected in his honour in A.D. 115 by the senate and people. Pope Clement II. prolonged the quay, and an inferior imitation of Trajan's arch was set up; he also erected a lazaretto at the south end of the harbour, now a sugar refinery, Vanvitelli being the architect-in-chief. The southern quay was built in 1880, and the harbour is now protected by forts on the heights, while the place is the seat of the 7th army corps.

The port of Ancona was entered in 1904 by 869 steamships and 600 sailing vessels, with a total tonnage of 961,612 tons. The main imports were coal, timber, metals, jute. The main exports were asphalt and calcium carbide. Sugar refining and shipbuilding are carried on.

Ancona is situated on the railway between Bologna and Brindisi, and is also connected by rail with Rome, via Foligno and Orte.

After the fall of the Roman empire Ancona was successively attacked by the Goths, Lombards and Saracens, but recovered its strength and importance. It was one of the cities of the Pentapolis under the exarchate of Ravenna, the other four being Fano, Pesaro, Senigallia and Rimini, and eventually became a semi-independent republic under the protection of the popes, until Gonzaga took possession of it for Clement VII. in 1532. From 1797 onwards, when the French took it, it frequently appears in history as an important fortress, until Lamoricière capitulated here on the 29th of September 1860, eleven days after his defeat at Castelfidardo. (T. As.)

ANCREN RIWLE, a Middle English prose treatise written for a small community of three religious women and their servants at Tarent Kaines (Tarrant Crawford), at the junction of the Stour and the Tarrant, Dorset. It was generally supposed to date from the first quarter of the 13th century, but Professor E. Kölbing is inclined to place the Corpus Christi MS. about the middle of the 12th century. The house of Tarrant was founded by Ralph de Kahaines, and greatly enriched about 1230 by Richard Poor, bishop successively of Chichester, Salisbury and Durham, who was born at Tarrant and died there in 1237. At the time when the *Ancren Riwle* was addressed to them the anchoresses did not belong to any of the monastic orders, but the monastery was under the Cistercian rule before 1266.[3] There are extant seven English MSS. of the work, and one Latin, the Latin version being generally supposed to be a translation. The Latin MS., *Regula Anachoritarum sive de vita solitaria* (Magdalen College, Oxford, No. 67, fol. 50) has a prefatory note:—*Hic incipit prohemium venerabilis patris magistri Simonis de Gandavo, episcopi Sarum, in librum de vita solitaria, quem scripsit sororibus suis anachoritis apud Tarente.* But Bishop Simon of Ghent, who died in 1315, could not have written the book, if it dates, at latest, from the early 13th century. It has been tentatively attributed to Richard Poor, who was connected with Tarrant, and was actually a benefactor of the monastery. But the adoption of Prof. Kölbing's early date would almost destroy Poor's claim.

The Ancren Riwle is written in a simple, non-rhetorical style. The severity of the doctrine of self-renunciation is softened by the affectionate tone in which it is inculcated. The book contains rules for the conduct of the anchoresses, and gives liturgical directions for divine service; but the greater part of it is taken up with the purely spiritual side of religion. The rules for the restraint of the senses, for confession and penance, are subordinated to the central idea of the supreme importance of purity of heart and the love of Christ. The last chapter deals with the domestic affairs and administration of the monastery. Incidentally the writer gives a picture of the manners and ideas of the time, and provides an account of the doctrine then generally accepted in the English church.

Ancren Riwle was edited for the Camden Society by the Rev. James Morton in 1843 from the Cotton MS. (Nero A xiv.). A collation of this text with the MS. by E. Kölbing is printed in the *Jahrbuch für romanische u. engl. Spr. und Lit.* xv. 180 seq. (1876). The *Ancren Riwle* (ed. Abbot F. A. Gasquet, 1905) is available for the ordinary reader in *The King's Classics.* There are three English MSS. of *Ancren Riwle* in the Cottonian collection in the British Museum, numbered Nero A xiv., Titus D xviii., and Cleopatra C vi. Nero A xiv. is written in pure south-western dialect. Portions of this text are printed in Henry Sweet's *First Middle English Primer* (Oxford, 2nd ed., 1895), which contains a grammatical introduction. MS. 402 in the library of Corpus Christi College, Cambridge, contains the earliest version of *Ancren Riwle*, entitled *Ancren Wissé*, and dating (according to E. Kölbing in *Englische Studien*, 1886, vol. ix. 116) from about 1150. The language shows considerable traces of the Midland dialect. MS. 234 in Caius College, Cambridge, contains a considerable portion of the *Ancren Riwle*, but does not follow the order of the other MSS. For its exact contents see Kölbing, in *Englische Studien*, iii. 535 (1880). A more recently discovered version in Magdalene College, Cambridge, in MS. Pepys 2498, is entitled *The Recluse*, and is abridged and differently arranged. It is written in English of the latter half of the 14th century (see A. C. Paues in *Englische Studien*, xxx. 344-346, 1902). A Latin version (Cotton MS. Vitellius E vii.), and a French copy (*ibid.* F vii.) were seriously damaged in the fire at Ashburnham House, but both MSS. have been recently restored. The Latin MS. (Codex lxvii.) at Magdalen College, Oxford, is probably a copy of another Latin text, for it contains obvious slips.

See also R. Wülker, "Ueber die Sprache der *Ancren Riwle* und die der Homilie: *Hali Meidenhad*," in *Beiträge zur Geschichte der deutschen Sprache und Literatur* (Halle, 1874, i. 209), giving an analysis of the differences in dialect between the two works; and Edgar Elliott Bramlette, "The Original Language of the *Ancren Riwle*," in *Anglia*, xv. 478-498, arguing in favour of a Latin original.

ANCRUM, a village on Ale or Alne Water (a tributary of the Teviot), Roxburghshire, Scotland, 2 m. W. of Jedfoot Bridge station on the Roxburgh-Jedburgh branch of the North British railway. Pop. (1901) 973. The earlier forms of the name, "Alnecrumba," "Ankrom" and "Alnecrom," indicate its Gaelic derivation from *crom*, "crooked"—"the crook or bend of the

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[1] Scanty remains of the ancient town walls, of a gymnasium near the harbour and of the amphitheatre are still extant.

[2] It was connected by a road with the Via Flaminia at Nuceria (Norcera), a distance of 70 m.

[3] For information on the subject of Tarent Kaines see Sir W. Dugdale, *Monasticon Anglicanum* (new ed., 1846), vol. v. 619 et seq.

Alne." The village is of considerable antiquity, and was formerly held by the see of Glasgow. Its cross, said to date from the time of David I., is one of the best preserved crosses in the Border counties. Ancrum Moor, 2 m. N.W., was the scene of the battle in which, on the 17th of February 1545, the Scots under the earl of Angus, Sir Walter Scott of Buccleuch, and Norman Leslie, defeated 5000 English, whose leaders, Sir Ralph Evers or Eure and Sir Brian Latoun or Layton, were slain. A Roman road, 24 ft. broad, forms the N.E. boundary of the parish of Ancrum.

ANCUS MARCIUS (640–616 B.C.), fourth legendary king of Rome. Like Numa, his reputed grandfather, he was a friend of peace and religion, but was obliged to make war to defend his territories. He conquered the Latins, and a number of them he settled on the Aventine formed the origin of the Plebeians. He fortified the Janiculum, threw a wooden bridge across the Tiber, founded the port of Ostia, established salt-works and built a prison.

Ancus Marcius is merely a duplicate of Numa, as is shown by his second name, Numa Marcius, the confidant and pontifex of Numa, being no other than Numa Pompilius himself, represented as priest. The identification with Ancus is shown by the legend which makes the latter a bridge-builder (*pontifex*), the constructor of the first wooden bridge over the Tiber. It is in the exercise of his priestly functions that the resemblance is most clearly shown. Like Numa, Ancus died a natural death.

See Livy i. 32, 33; Dion Halic. iii. 36-45; Cicero, *De Republica*, ii. 18. For a critical examination of the story see Schwegler, *Römische Geschichte*, bk. xiii.; Sir G. Cornewall Lewis, *Credibility of Early Roman History*, ch. xi.; W. Ihne, *History of Rome*, i.; R. Pais, *Storia di Roma*, i. (1898), who considers that the name points to the personification of the cult of Mars, and that the military achievements of Ancus are anticipations of later events.

ANCYLOPODA, or ANCYLODACTYLA, an apparently primitive extinct subordinal group of Ungulata showing certain resemblances to the Perissodactyla, both as regards the cheek-teeth and the skeleton, but broadly distinguished by the feet being of an edentate type, carrying long curved and cleft terminal claws. From this peculiar structure of the feet it would seem that the weight of the body was mainly carried on their outer sides, as in Edentates. The group is typified by *Chalicotherium*, of which the original species was discovered in the Lower Pliocene strata of Eppelsheim, Hesse-Darmstadt, in 1825, and named on the evidence of the teeth, the limbs being subsequently described as *Macrotherium*. The skull is short, with a dental formula of $i.\frac{3}{3}, c.\frac{0}{1}, p.\frac{3}{3}. m.\frac{3}{3}$, but in fully adult animals most of the front teeth were shed. The molar teeth recall those of *Palaeosyops* (see TITANOTHERIIDAE). Remains referred to *Chalicotherium* have been also obtained from the Lower Pliocene and Upper Miocene strata of Greece, Hungary, India, China and North America. A skull from Pikermi, near Mt. Pentelikon, Attica, shows the absence in the adult state of upper and lower incisors and upper canines, much the same condition being indicated in an Indian skull. There were three toes to each foot, and the femur lacked a third trochanter.

Macrotherium, which is typically from the Middle Miocene of Sansan, in Gers, France, may indicate a distinct genus. Limb-bones nearly resembling those of *Macrotherium*, but relatively stouter, have been described from the Pliocene beds of Attica and Samos as *Ancylotherium*. In America the names *Morotherium* and *Moropus* have been applied to similar bones, on the belief that they indicated edentates. *Macrotherium magnum* must have been an animal of about 9 ft. in length.

The South American genus *Homalodontotherium* is often placed in the Ancylopoda, but reasons against this view are given in the article LITOPTERNA. Professor H. F. Osborn considers that the Ancylopoda are directly descended from the Condylarthra.

See also H. F. Osborn, "The Ancylopoda Chalicotherium and Artionyx," *Amer. Nat.* (1893), p. 118, and "Artionyx, a New Genus of Ancylopoda," *Bull. Amer. Mus.* vol. v. p. 1 (1893). [*N.B.—Artionyx* was subsequently found to be an Artiodactyle.] (R. L.*)

ANCYRA (mod. *Angŏra*, *q.v.*), an ancient city of Galatia in Asia Minor, situated on a tributary of the Sangarius. Originally a large and prosperous Phrygian city on the Persian Royal Road, Ancyra became the centre of the Tectosages, one of the three Gaulish tribes that settled permanently in Galatia about 232 B.C. The barbarian occupation dislocated civilization, and the town sank to a mere village inhabited chiefly by the old native population who carried on the arts and crafts of peaceful life, while the Gauls devoted themselves to war and pastoral life (see GALATIA). In 189 B.C. Ancyra was occupied by Cn. Manlius Vulso, who made it his headquarters in his operations against the tribe. In 63 B.C. Pompey placed it (together with the Tectosagan territory) under one chief, and it continued under native rule till it became the capital of the Roman province of Galatia in 25 B.C. By this time the population included Greeks, Jews, Romans and Romanized Gauls, but the town was not yet Hellenized, though Greek was spoken. Strabo (*c.* A.D. 19) calls it not a city, but a fortress, implying that it had none of the institutions of the Graeco-Roman city. Inscriptions and coins show that its civilization consisted of a layer of Roman ideas and customs superimposed on Celtic tribal characteristics, and that it is not until *c.* A.D. 150 that the true Hellenic spirit begins to appear. Christianity was introduced (from the N. or N.W.) perhaps as early as the 1st century, but there is no shred of evidence that the Ancyran Church (first mentioned A.D. 192) was founded by St Paul or that he ever visited northern Galatia. The real greatness of the town dates from the time when Constantinople became the metropolis of the Roman world: then its geographical situation raised it to a position of importance which it retained throughout the middle ages. See further ANGORA (1).

The modern town contains many remains of the Roman and Byzantine periods. The most important monument is the *Augusteum*, a temple of white marble erected to "Rome and Augustus" during the lifetime of that emperor by the common council or diet of the three Galatian tribes. The temple was afterwards converted into a church, and in the 16th century a fine mosque was built against its S. face. On the walls of the temple is engraved the famous *Monumentum Ancyranum*, a long inscription in Latin and Greek describing the *Res gestae divi Augusti*; the Latin portion being inscribed on the inner left-hand wall of the *pronaos*, the Greek on the outside wall of the *naos* (*cella*). The inscription is a grave and majestic narrative of the public life and work of Augustus. The original was written by the emperor in his 76th year (A.D. 13–14) to be engraved on two bronze tablets placed in front of his mausoleum in Rome, and as a mark of respect to his memory a copy was inscribed on the temple walls by the council of the Galatians. Thus has been preserved an absolutely unique historical document of great importance, recounting (1) the numerous public offices and honours conferred on him, (2) his various benefactions to the state, to the *plebs* and to his soldiers, and (3) his military and administrative services to the empire.

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SYNOD OF ANCYRA.—An important ecclesiastical synod was held at Ancyra, the seat of the Roman administration for the province of Galatia, in A.D. 314. The season was soon after Easter; the year may be safely deduced from the fact that the first nine canons are intended to repair havoc wrought in the church by persecution, which ceased after the overthrow of Maximinus in 313. The tenth canon tolerates the marriages of deacons who previous to ordination had reserved the right to take a wife; the thirteenth forbids *chorepiscopi* to ordain presbyters or deacons; the eighteenth safeguards the right of the people in objecting to the appointment of a bishop whom they do not wish.

See Mansi, ii. 514 ff. The critical text of R. B. Rackham (Oxford, 1891), *Studia biblica et ecclesiastica*, iii. 139 ff., is conveniently reprinted in Lauchert 29 ff. H. R. Percival translates and comments on an old text in the Nicene and Post-Nicene Fathers (2nd series), xiv. 61 ff. An elaborate discussion is found in Hefele, *Conciliengeschichte* (2nd ed.), i. 219 ff. (English translation, i. 199 ff.); more briefly in Herzog-Hauck (3rd ed.), i. 497. For full titles see COUNCIL. (W. W. R.*)

ANDALUSIA, or Andalucia, a captaincy-general, and formerly a province, of southern Spain; bounded on the N. by Estremadura and New Castile, E. by Murcia and the Mediterranean Sea, S. by the Mediterranean and Atlantic, and W. by Portugal. Pop. (1900) 3,563,606; area, 33,777 sq. m. Andalusia was divided in 1833 into the eight provinces of Almeria, Cadiz, Cordova, Granada, Jaén, Huelva, Malaga and Seville, which are described in separate articles. Its ancient name, though no longer used officially, except to designate a military district, has not been superseded in popular speech by the names of the eight modern divisions.

Andalusia consists of a great plain, the valley of the Guadalquivir, shut in by mountain ranges on every side except the S.W., where it descends to the Atlantic. This lowland, which is known as *Andalucia Baja*, or Lower Andalusia, resembles the valley of the Ebro in its slight elevation above sea-level (300-400 ft.), and in the number of brackish lakes or fens, and waste lands (*despoblados*) impregnated with salt, which seem to indicate that the whole surface was covered by the sea at no distant geological date. The barren tracts are, however, exceptional and a far larger area is richly fertile. Some districts, indeed, such as the Vega of Granada, are famous for the luxuriance of their vegetation. The Guadalquivir (*q.v.*) rises among the mountains of Jaén and flows in a south-westerly direction to the Gulf of Cadiz, receiving many considerable tributaries on its way. On the north, its valley is bounded by the wild Sierra Morena; on the south, by the mountains of the Mediterranean littoral, among which the Sierra Nevada (*q.v.*), with its peaks of Mulhacen (11,421 ft.) and Veleta (11,148 ft.), is the most conspicuous. These highlands, with the mountains of Jaén and Almería on the east, constitute *Andalucia Alta* or Upper Andalusia.

No part of Spain has greater natural riches. The sherry produced near Jeréz de la Frontera, the copper of the Rio Tinto mines and the lead of Almería are famous. But the most noteworthy characteristics of the province are, perhaps, the brilliancy of its climate, the beauty of its scenery (which ranges in character from the alpine to the tropical), and the interest of its art and antiquities. The climate necessarily varies widely with the altitude. Some of the higher mountains are covered with perpetual snow, a luxury which is highly prized by the inhabitants of the valleys, where the summer is usually extremely hot, and in winter the snow falls only to melt when it reaches the ground. Here the more common European plants and trees give place to the wild olive, the caper bush, the aloe, the cactus, the evergreen oak, the orange, the lemon, the palm and other productions of a tropical climate. On the coasts of the Mediterranean about Marbella and Malaga, the sugar-cane is successfully cultivated. Silk is produced in the same region. Agriculture is in a very backward state and the implements used are most primitive. The chief towns are Seville (pop. 1900, 148,315), which may be regarded as the capital, Malaga (130,109), Granada (75,900), Cadiz (69,382), Jeréz de la Frontera (63,473), Cordova (58,275) and Almería (47,326).

Andalusia has never been, like Castile or Aragon, a separate kingdom. Its history is largely a record of commercial and artistic development. The Guadalquivir valley is often, in part at least, identified with the biblical *Tarshish* and the classical *Tartessus*, a famous Phoenician mart. The port of *Agadir* or *Gaddir*, now Cadiz, was founded as early as 1100 B.C. Later Carthaginian invaders came from their advanced settlements in the Balearic Islands, about 516 B.C. Greek merchants also visited the coasts. The products of the interior were conveyed by the native Iberians to the maritime colonies, such as *Abdera* (Adra), *Calpe* (Gibraltar) or *Malaca* (Malaga), founded by the foreign merchants. The Punic wars transferred the supreme power from Carthage to Rome, and Latin civilization was established firmly when, in 27 B.C., Andalusia became the Roman province of *Baetica*—so called after its great waterway, the *Baetis* (Guadalquivir). In the 5th century the province was overrun by successive invaders—Vandals, Suevi and Visigoths—from the first of whom it may possibly derive its name. The forms *Vandalusia* and *Vandalitia* are undoubtedly ancient; many authorities, however, maintain that the name is derived from the Moorish *Andalus* or *Andalosh*, "Land of the West." The Moors first entered the province in 711, and only in 1492 was their power finally broken by the capture of Granada. Their four Andalusian kingdoms, Seville, Jaén, Cordova and Granada, developed a civilization unsurpassed at the time in Europe. An extensive literature, scientific, philosophical and historical, with four world-famous buildings—the Giralda and Alcázar of Seville, the Mezquita or cathedral of Cordova and the Alhambra at Granada—are its chief monuments. In the 16th and 17th centuries, painting replaced architecture as the distinctive art of Andalusia; and many of the foremost Spanish painters, including Velazquez and Murillo, were natives of this province.

Centuries of alien domination have left their mark upon the character and appearance of the Andalusians, a mixed race, who contrast strongly with the true Spaniards and possess many oriental traits. It is impossible to estimate the influence of the elder conquerors, Greek, Carthaginian and Roman; but there are clear traces of Moorish blood, with a less well-defined Jewish and gipsy strain. The men are tall, handsome and well-made, and the women are among the most beautiful in Spain; while the dark complexion and hair of both sexes, and their peculiar dialect of Spanish, so distasteful to pure Castilians, are indisputable evidence of Moorish descent. Their music, dances and many customs, come from the East. In general, the people are lively, good-humoured and ready-witted, fond of pleasure, lazy and extremely superstitious. In the literature and drama of his country, the Andalusian is traditionally represented as the Gascon of Spain, ever boastful and mercurial; or else as a picaresque hero, bull-fighter, brigand or smuggler. Andalusia is still famous for its bull-fighters; and every outlying hamlet has its legends of highwaymen and contraband.

In addition to the numerous works cited under the heading Spain, see *Curiosidades historicas de Andalucia*, by N. Diáz de Escovar (Malaga, 1900); *Histoire de la conquête de l'Andalousie*, by O. Houdas (Paris, 1889); *Andalousie et Portugal* (Paris, 1886); *El Folk-Lore Andaluz* (Seville, 1883); and *Nobleza de Andalucia*, by G. Argote de Molina (Seville, 1588).

ANDALUSITE, a mineral with the same chemical composition as cyanite and sillimanite, being a basic aluminium silicate, Al_2SiO_5. As in sillimanite, its crystalline form is referable to the orthorhombic system. Crystals of andalusite have the form of almost square prisms, the prism-angle being 89° 12′; they are terminated by a basal plane and sometimes by small dome-faces. As a rule the crystals are roughly developed and rude columnar masses are common, these being frequently altered partially to kaolin or mica. Such crystals, opaque, and of a greyish or brownish colour, occur abundantly in the mica-schist of the Lisens Alp near Innsbruck in Tirol, while the first noted of the many localities of the mineral is in Andalusia, from which place the mineral derives its name. The unaltered mineral is found as transparent pebbles with topaz in the gem-gravels of the Minas Novas district, in Minas Geraes, Brazil. These pebbles are usually green but sometimes reddish-brown in colour, and are remarkable for their very strong dichroism, the same pebble appearing green or reddish-brown according to the direction in which it is viewed. Such specimens make very effective gem-stones, the degree of hardness of the mineral (H. = $7\frac{1}{2}$) being quite sufficient for this purpose. Its specific gravity is 3·18; it is unattacked by acids and is infusible before the blowpipe.

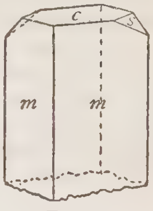


Fig. 1.

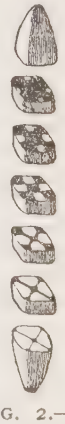


Fig. 2.—Transverse sections of a crystal of Chiastolite.

Andalusite is typically a mineral of metamorphic origin, occurring most frequently in altered clay-slates and crystalline schists, near the junction of these with masses of intrusive igneous rocks such as granite. It has been recognized also, however, as a primary constituent of granite itself.

A curious variety of andalusite known as chiastolite is specially characteristic of clay-slates near a contact with granite. The elongated prismatic crystals enclose symmetrically arranged wedges of carbonaceous material, and in cross-section show a black cross on a greyish ground. Cross-sections of such crystals are polished and worn as amulets or charms. Crystals of a size suitable for this purpose are found in Brittany and the Pyrenees, while still larger specimens have been found recently in South Australia. The name chiastolite is derived from the Greek χιάστος, crossed or marked with the letter χ: *cross-stone* and *macle* are earlier names, the latter having been given on account of the resemblance the cross-section of the stone bears to the heraldic macula or mascle. (L. J. S.)

ANDAMAN ISLANDS, a group of islands in the Bay of Bengal. Large and small, they number 204, and lie 590 m. from the mouth of the Hugli, 120 m. from Cape Negrais in Burma, the nearest point of the mainland, and 340 m. from the northern extremity of Sumatra. Between the Andamans and Cape Negrais intervene two small groups, Preparis and Cocos; between the Andamans and Sumatra lie the Nicobar Islands, the whole group stretching in a curve, to which the meridian forms a tangent between Cape Negrais and Sumatra; and though this curved line measures 700 m., the widest sea space is about 91 m. The extreme length of the Andaman group is 219 m. with an extreme width of 32 m. The main part of it consists of a band of five chief islands, so closely adjoining and overlapping each other that they have long been known collectively as "the great Andaman." The axis of this band, almost a meridian line, is 156 statute miles long. The five islands are in order from north to south: North Andaman (51 m. long); Middle Andaman (59 m.); South Andaman (49 m.); Baratang, running parallel to the east of the South Andaman for 17 m. from the Middle Andaman; and Rutland Island (11 m.). Four narrow straits part these islands: Austin Strait, between North and Middle Andaman; Homfray's Strait between Middle Andaman and Baratang, and the north extremity of South Andaman; Middle (or Andaman) Strait between Baratang and South Andaman; and Macpherson Strait between South Andaman and Rutland Island. Of these only the last is navigable by ocean-going vessels. Attached to the chief islands are, on the extreme N., Landfall Islands, separated by the navigable Cleugh Passage; Interview Island, separated by the very narrow but navigable Interview Passage, off the W. coast of the Middle Andaman; the Labyrinth Island off the S.W. coast of the South Andaman, through which is the safe navigable Elphinstone Passage; Ritchie's (or the Andaman) Archipelago off the E. coast of the South Andaman and Baratang, separated by the wide and safe Diligent Strait and intersected by Kwangtung Strait and the Tadma Juru (Strait). Little Andaman, roughly 26 m. by 16, forms the southern extremity of the whole group and lies 31 m. S. of Rutland Island across Duncan Passage, in which lie the Cinque and other islands, forming Manners Strait, the main commercial highway between the Andamans and the Madras coast. Besides these are a great number of islets lying off the shores of the main islands. The principal outlying islands are the North Sentinel, a dangerous island of about 28 sq. m., lying about 18 m. off the W. coast of the South Andaman; the remarkable marine volcano, Barren Island (1150 ft.), quiescent for more than a century, 71 m. N.E. of Port Blair; and the equally curious isolated mountain, the extinct volcano of Narcondam, rising 2330 ft. out of the sea, 71 m. E. of the North Andaman. The land area of the Andaman Islands is 2508 sq. m. About 18 m. to the W. of the Andamans are the dangerous Western Banks and Dalrymple Bank, rising to within a few fathoms of the surface of the sea and forming, with the two Sentinel Islands, the tops of a line of submarine hills parallel to the Andamans. Some 40 m. distant to the E. is the Invisible Bank, with one rock just awash; and 34 m. S.E. of Narcondam is a submarine hill rising to 377 fathoms below the surface of the sea. Narcondam, Barren Island and the Invisible Bank, a great danger of these seas, are in a line almost parallel to the Andamans inclining towards them from north to south.

Topography.—The islands forming Great Andaman consist of a mass of hills enclosing very narrow valleys, the whole covered by an exceedingly dense tropical jungle. The hills rise, especially on the east coast, to a considerable elevation: the chief heights being in the North Andaman, Saddle Peak (2400 ft.); in the Middle Andaman, Mount Diavolo behind Cuthbert Bay (1678 ft.); in the South Andaman, Koiob (1505 ft.), Mount Harriet (1193 ft.) and the Cholunga range (1063 ft.); and in Rutland Island, Ford's Peak (1422 ft.). Little Andaman, with the exception of the extreme north, is practically flat. There are no rivers and few perennial streams in the islands. The scenery is everywhere strikingly beautiful and varied, and the coral beds of the more secluded bays in its harbours are conspicuous for their exquisite colouring.

Harbours.—The coasts of the Andamans are deeply indented, giving existence to a number of safe harbours and tidal creeks, which are often surrounded by mangrove swamps. The chief harbours, some of which are very capacious, are (starting northwards from Port Blair, the great harbour of South Andaman) on the E. coast: Port Meadows, Colebrooke Passage, Elphinstone Harbour (Homfray's Strait), Stewart Sound and Port Cornwallis. The last three are very large. On the W. coast: Temple Sound, Interview Passage, Port Anson or Kwangtung Harbour (large), Port Campbell (large), Port Mouat and Macpherson Strait. There are besides many other safe anchorages about the coast, notably Shoal Bay and Kotara Anchorage in the South Andaman; Cadell Bay and the Turtle Islands in the North Andaman; and Outram Harbour and Kwangtung Strait in the archipelago. The whole of the Andamans and the outlying islands were completely surveyed topographically by the Indian Survey Department under Colonel Hobday in 1883–1886, and the surrounding seas were charted by Commander Carpenter in 1888–1889.

Geology.—The Andaman Islands, in conjunction with the other groups mentioned above, form part of a lofty range of submarine mountains, 700 m. long, running from Cape Negrais in the Arakan Yoma range of Burma, to Achin Head in Sumatra. This range separates the Bay of Bengal from the Andaman Sea; and it contains much that is geologically characteristic of the Arakan Yoma, and formations common also to the Nicobars and to Sumatra and the adjacent islands. The older rocks are early Tertiary or late Cretaceous but there are no fossils to indicate age. The newer rocks, common also to the Nicobars and Sumatra, are in Ritchie's Archipelago chiefly and contain radiolarians and foraminifera. There is coral along the coasts everywhere, and the Sentinel Islands are composed of the newer rocks with a superstructure of coral. A theory of a still continuing subsidence of the islands was formed by Kurz in 1866 and confirmed by Oldham in 1884. Signs of its continuance are found on the east coast in several places. Barren Island is a volcano of the general Sunda group which includes also the Pegu group to which Narcondam belongs. Barren Island was last in eruption in 1803, but there is still a thin column of steam from a sulphur bed at the top and a variable hot spring at the point where the last outburst of lava flowed into the sea.

Climate.—Rarely affected by a cyclone, though within the influence of practically every one that blows in the Bay of Bengal, the Andamans are of the greatest importance because of the accurate information relating to the direction and intensity of storms which can be communicated from them better than from any other point in the bay, to the vast amount of shipping in this part of the Indian Ocean. Trustworthy information also regarding the weather which may be expected in the north and east of India, is obtained at the islands, and this proves of the utmost value to the controllers of the great trades dependent upon the rainfall. A well-appointed meteorological station has been established at Port Blair since 1868. Speaking generally, the climate of the Andamans themselves may be described as normal for tropical islands of similar latitude. It is warm always, but tempered by pleasant sea-breezes; very hot when the sun is northing; irregular rainfall, but usually dry during the north-east, and very wet during the south-west monsoon. Not only does the rainfall at one place vary from year to year, but there is an extraordinary difference in the returns for places quite close to one another. The official figures in inches for the station at Port Blair, which is situated in by far the driest part of the settlement, were:—

1895.	1896.	1897.	1898.	1899.	1900.	1901.
125·64	107·28	136·41	127·22	87·01	83·28	132·50

A tidal observatory has also been maintained at Port Blair since 1880.

Flora.—A section of the Forest Department of India has been established in the Andamans since 1883, and in the neighbourhood of Port Blair 156 sq. m. have been set apart for regular forest operations which are carried on by convict labour. The chief timber of indigenous growth is padouk (*Pterocarpus dalbergioides*) used for buildings, boats, furniture, fine joinery and all purposes to which teak, mahogany, hickory, oak and ash are applied. This tree is widely spread and forms a valuable export to European markets. Other first-class timbers are koko (*Albizzia lebbek*), white chuglam (*Terminalia bialata*), black chuglam (*Myristica irya*), marble or zebra wood (*Diospyros kurzii*) and satin-wood (*Murraya exotica*), which differs from the satin-wood of Ceylon (*Chloroxylon swietenia*). All of these timbers are used for furniture and similar purposes. In addition there are a number of second-and third-class timbers, which are used locally and for export to Calcutta. Gangaw (*Messua ferrea*) the Assam iron-wood, is suitable for sleepers; and didu (*Bombax insigne*) is used for tea-boxes and packing-cases. Among the imported flora are tea, Siberian coffee, cocoa, Ceara rubber (which has not done well), Manila hemp, teak, cocoanut and a number of ornamental trees, fruit-trees, vegetables and garden plants. Tea is grown in considerable quantities and the cultivation is under a department of the penal settlement. The general character of the forests is Burmese with an admixture of Malay types. Great mangrove swamps supply unlimited fire-wood of the best quality. The great peculiarity of Andaman flora is that, with the exception of the Cocos islands, no cocoanut palms are found in the archipelago.

Fauna.—Animal life is generally deficient throughout the Andamans, especially as regards mammalia, of which there are only nineteen separate species in all, twelve of these being peculiar to the islands. There is a small pig (*Sus andamanensis*), important to the food of the people, and a wild cat (*Paradoxurus tytleri*); but the bats (sixteen species) and rats (thirteen species) constitute nearly three-fourths of the known mammals. This paucity of animal life seems inconsistent with the theory that the islands were once connected with the mainland. Most of the birds also are derived from the distant Indian region, while the Indo-Burmese and Indo-Malayan regions are represented to a far less degree. Rasorial birds, such as peafowl, junglefowl, pheasants and partridges, though well represented in the Arakan hills, are rare in the islands; while a third of the different species found are peculiar to the Andamans. Moreover, the Andaman species differ from those of the adjacent Nicobar Islands. Each group has its distinct harrier-eagle, red-cheeked paroquet, oriole, sunbird and bulbul. Fish are very numerous and many species are peculiar to the Andaman seas. Turtles are abundant and supply the Calcutta market. Of imported animals, cattle, goats, asses and dogs thrive well, ponies and horses indifferently, and sheep badly, though some success has been achieved in breeding them.

Population.—The Andaman Islands, so near countries that have for ages attained considerable civilization and have been the seat of great empires, and close to the track of a great commerce which has gone on at least 2000 years, are the abode of savages as low in civilization as almost any known on earth. Our earliest notice of them is in a remarkable collection of early Arab notes on India and China (A.D. 851) which accurately represents the view entertained of this people by mariners down to modern times. "The inhabitants of these islands eat men alive. They are black, with woolly hair, and in their eyes and countenances there is something quite frightful .... They go naked and have no boats. If they had, they would devour all who passed near them. Sometimes ships that are windbound and have exhausted their provision of water, touch here and apply to the natives for it; in such cases the crews sometimes fall into the hands of the latter and most of them are massacred." The traditional charge of cannibalism has been very persistent; but it is entirely denied by the islanders themselves, and is now and probably always has been untrue. Of their massacres of shipwrecked crews, even in quite modern times, there is no doubt, but the policy of conciliation unremittingly pursued for the last forty years has now secured a friendly reception for shipwrecked crews at any port of the islands except the south and west of Little Andaman and North Sentinel Island. The Andamanese are probably the relics of a negro race that once inhabited the S.E. portion of Asia and its outlying islands, representatives of which are also still to be found in the Malay Peninsula and the Philippines. Their antiquity and their stagnation are attested by the remains found in their kitchen-middens. These are of great age, and rise sometimes to a height exceeding 15 ft. The fossil shells, pottery and rude stone implements, found alike at the base and at the surface of these middens, prove that the habits of the islanders have not varied since a remote past, and lead to the belief that the Andamans were settled by their present inhabitants some time during the Pleistocene period, and certainly no later than the Neolithic age. The population is not susceptible of accurate computation, but probably it has always been small. The estimated total at a census taken in 1901 was only 2000. Though all descended from one stock, there are twelve distinct tribes of the Andamanese, each with its own clearly-defined locality, its own distinct variety of the one fundamental language and to a certain extent its own separate habits. Every tribe is divided into septs fairly well defined. The tribal feeling may be expressed as friendly within the tribe, courteous to other Andamanese if known, hostile to every stranger, Andamanese or other. Another division of the natives is into *Aryauto* or long-shore-men, and the *Eremtaga* or jungle-dwellers. The habits and capacities of these two differ, owing to surroundings, irrespectively of tribe. Yet again the Andamanese can be grouped according to certain salient characteristics: the forms of the bows and arrows, of the canoes, of ornaments and utensils, of tattooing and of language. The average height of males is 4 ft. 10½ in.; of females, 4 ft. 6 in. Being accustomed to gratify every sensation as it arises, they endure thirst, hunger, want of food and bodily discomfort badly. The skin varies in colour from an intense sheeny black to a reddish-brown on the collar-bones, cheeks and other parts of the body. The hair varies from a sooty black to dark and light brown and red. It grows in small rings, which give it the appearance of growing in tufts, though it is really closely and evenly distributed over the whole scalp. The figures of the men are muscular and well-formed and generally pleasing; a straight, well-formed nose and jaw are by no means rare, and the young men are often distinctly good-looking. The only artificial deformity is a depression of the skull, chiefly among one of the southern tribes, caused by the pressure of a strap used for carrying loads. The pleasing appearance natural to the men is not a characteristic of the women, who early have a tendency to stoutness and ungainliness of figure, and sometimes to pronounced prognathism. They are, however, always bright and merry, are under no special social restrictions and have considerable influence. The women's heads are shaved entirely and the men's into fantastic patterns. Yellow and red ochre mixed with grease are coarsely smeared over the bodies, grey in coarse patterns and white in fine patterns resembling tattoo marks. Tattooing is of two distinct varieties. In the south the body is slightly cut by women with small flakes of glass or quartz in zigzag or lineal patterns downwards. In the north it is deeply cut by men with pig-arrows in lines across the body. The male matures when about fifteen years of age, marries when about twenty-six, begins to age when about forty, and lives on to sixty or sixty-five if he reaches old age. Except as to the marrying age, these figures fairly apply to women. Before marriage free intercourse between the sexes is the rule, though certain conventional precautions are taken to prevent it. Marriages rarely produce more than three children and often none at all. Divorce is rare, unfaithfulness after marriage not common and incest unknown. By preference the Andamanese are exogamous as regards sept and endogamous as regards tribe. The children are possessed of a bright intelligence, which, however, soon reaches its climax, and the adult may be compared in this respect with the civilized child of ten or twelve. The Andamanese are, indeed, bright and merry companions, busy in their own pursuits, keen sportsmen, naturally independent and not lustful, but when angered, cruel, jealous, treacherous and vindictive, and always unstable—in fact, a people to like but not to trust. There is no idea of government, but in each sept there is a head, who has attained that position by degrees on account of some tacitly admitted superiority and commands a limited respect and some obedience. The young are deferential to their elders. Offences are punished by the aggrieved party. Property is communal and theft is only recognized as to things of absolute necessity, such as arrows, pigs' flesh and fire. Fire is the one thing they are really careful about, not knowing how to renew it. A very rude barter exists between tribes of the same group in regard to articles not locally obtainable. The religion consists of fear of the spirits of the wood, the sea, disease and ancestors, and of avoidance of acts traditionally displeasing to them. There is neither worship nor propitiation. An anthropomorphic deity, Puluga, is the cause of all things, but it is not necessary to propitiate him. There is a vague idea that the "soul" will go somewhere after death, but there is no heaven nor hell, nor idea of a corporeal resurrection. There is much faith in dreams, and in the utterances of certain "wise men," who practise an embryonic magic and witchcraft. The great amusement of the Andamanese is a formal night dance, but they are also fond of simple games. The bows differ altogether with each group, but the same two kinds of arrows are in general use: (1) long and ordinary for fishing and other purposes; (2) short with a detachable head fastened to the shaft by a thong, which quickly brings pigs up short when shot in the thick jungle. Bark provides material for string, while baskets and mats are neatly and stoutly made from canes and buckets out of bamboo and wood. None of the tribes ever ventures out of sight of land, and they have no idea of steering by sun or stars. Their canoes are simply hollowed out of trunks with the adze and in no other way, and it is the smaller ones which are outrigged; they do not last long and are not good sea-boats, and the story of raids on Car Nicobar, out of sight across a stormy and sea-rippled channel, must be discredited. Honour is shown to an adult when he dies, by wrapping him in a cloth and placing him on a platform in a tree instead of burying him. At such a time the encampment is deserted for three months. The Andaman languages are extremely interesting from the philological standpoint. They are agglutinative in nature, show hardly any signs of syntactical growth though every indication of long etymological growth, give expression to only the most direct and the simplest thought, and are purely colloquial and wanting in the modifications always necessary for communication by writing. The sense is largely eked out by manner and action. *Mincopie* is the first word in Colebrooke's vocabulary for "Andaman Island, or native country," and the term—though probably a mishearing on Colebrooke's part for *Möngebe* ("I am an Önge," *i.e.* a member of the Önge tribe)—has thus become a persistent book-name for the people. Attempts to civilize the Andamanese have met with little success either among adults or children. The home established near Port Blair is used as a sort of free asylum which the native visits according to his pleasure. The policy of the government is to leave the Andamanese alone, while doing what is possible to ameliorate their condition.

Penal Settlement.—The point of enduring interest as regards the Andamans is the penal system, the object of which is to turn the life-sentence and few long-sentence convicts, who alone are sent to the settlement, into honest, self-respecting men and women, by leading them along a continuous course of practice in self-help and self-restraint, and by offering them every inducement to take advantage of that practice. After ten years' graduated labour the convict is given a ticket-of-leave and becomes self-supporting. He can farm, keep cattle, and marry or send for his family, but he cannot leave the settlement or be idle. With approved conduct, however, he may be absolutely released after twenty to twenty-five years in the settlement; and throughout that time, though possessing no civil rights, a quasi-judicial procedure controls all punishments inflicted upon him, and he is as secure of obtaining justice as if free. There is an unlimited variety of work for the labouring convicts, and some of the establishments are on a large scale. Very few experts are employed in supervision; practically everything is directed by the officials, who themselves have first to learn each trade. Under the chief commissioner, who is the supreme head of the settlement, are a deputy and a staff of assistant superintendents and overseers, almost all Europeans, and sub-overseers, who are natives of India. All the petty supervising establishments are composed of convicts. The garrison consists of 140 British and 300 Indian troops, with a few local European volunteers. The police are organized as a military battalion 643 strong. The number of convicts has somewhat diminished of late years and in 1901 stood at 11,947. The total population of the settlement, consisting of convicts, their guards, the supervising, clerical and departmental staff, with the families of the latter, also a certain number of ex-convicts and trading settlers and their families, numbered 16,106. The labouring convicts are distributed among four jails and nineteen stations; the self-supporters in thirty-eight villages. The elementary education of the convicts' children is compulsory. There are four hospitals, each under a resident medical officer, under the general supervision of a senior officer of the Indian medical service, and medical aid is given free to the whole population. The net annual cost of the settlement to the government is about £6 per convict. The harbour of Port Blair is well supplied with buoys and harbour lights, and is crossed by ferries at fixed intervals, while there are several launches for hauling local traffic. On Ross Island there is a lighthouse visible for 19 m. A complete system of signalling by night and day on the Morse system is worked by the police. Local posts are frequent, but there is no telegraph and the mails are irregular.

History.—It is uncertain whether any of the names of the islands given by Ptolemy ought to be attached to the Andamans; yet it is probable that his name itself is traceable in the Alexandrian geographer. Andaman first appears distinctly in the Arab notices of the 9th century, already quoted. But it seems possible that the tradition of marine nomenclature had never perished; that the *'Αγαθοῦ δαίμονος νῆσος* was really a misunderstanding of some form like *Agdamán*, while Νῆσοι Βαρούσσαι survived as Lanka *Bālūs*, the name applied by the Arabs to the Nicobars. The islands are briefly noticed by Marco Polo, who probably saw without visiting them, under the name *Angamanain*, seemingly an Arabic dual, "The two Angamans," with the exaggerated but not unnatural picture of the natives, long current, as dog-faced Anthropophagi. Another notice occurs in the story of Nicolo Conti (*c.* 1440), who explains the name to mean "Island of Gold," and speaks of a lake with peculiar virtues as existing in it. The name is probably derived from the Malay Handuman, coming from the ancient Hanuman (monkey). Later travellers repeat the stories, too well founded, of the ferocious hostility of the people; of whom we may instance Cesare Federici (1569), whose narrative is given in Ramusio, vol. iii. (only in the later editions), and in Purchas. A good deal is also told of them in the vulgar and gossiping but useful work of Captain A. Hamilton (1727). In 1788–1789 the government of Bengal sought to establish in the Andamans a penal colony, associated with a harbour of refuge. Two able officers, Colebrooke of the Bengal Engineers, and Blair of the sea service, were sent to survey and report. In the sequel the settlement was established by Captain Blair, in September 1789, on Chatham Island, in the S.E. bay of the Great Andaman, now called Port Blair, but then Port Cornwallis. There was much sickness, and after two years, urged by Admiral Cornwallis, the government transferred the colony to the N.E. part of Great Andaman, where a naval arsenal was to be established. With the colony the name also of Port Cornwallis was transferred to this new locality. The scheme did ill; and in 1796 the government put an end to it, owing to the great mortality and the embarrassments of maintenance. The settlers were finally removed in May 1796. In 1824 Port Cornwallis was the rendezvous of the fleet carrying the army to the first Burmese war. In 1839, Dr Helfer, a German savant employed by the Indian government, having landed in the islands, was attacked and killed. In 1844 the troop-ships "Briton" and "Runnymede" were driven ashore here, almost close together. The natives showed their usual hostility, killing all stragglers. Outrages on shipwrecked crews continued so rife that the question of occupation had to be taken up again; and in 1855 a project was formed for such a settlement, embracing a convict establishment. This was interrupted by the Indian Mutiny of 1857, but as soon as the neck of that revolt was broken, it became more urgent than ever to provide such a resource, on account of the great number of prisoners falling into British hands. Lord Canning, therefore, in November 1857, sent a commission, headed by Dr F. Mouat, to examine and report. The commission reported favourably, selecting as a site Blair's *original* Port Cornwallis, but pointing out and avoiding the vicinity of a salt swamp which seemed to have been pernicious to the old colony. To avoid confusion, the name of *Port Blair* was given to the new settlement, which was established in the beginning of 1858. For some time sickness and mortality were excessively large, but the reclamation of swamp and clearance of jungle on an extensive scale by Colonel Henry Man when in charge (1868–1870), had a most beneficial effect, and the health of the settlement has since been notable. The Andaman colony obtained a tragical notoriety from the murder of the viceroy, the earl of Mayo, by a Mahommedan convict, when on a visit to the settlement on the 8th of February 1872. In the same year the two groups, Andaman and Nicobar, the occupation of the latter also having been forced on the British government (in 1869) by the continuance of outrage upon vessels, were united under a chief commissioner residing at Port Blair.

See Sir Richard Temple, *The Andaman and Nicobar Islands* (Indian Census, 1901); C. B. Kloss, *In the Andamans and Nicobars* (1903); E. H. Man, *Aboriginal Inhabitants of the Andaman Islands* (1883); M. V. Portman, *Record of the Andamanese* (11 volumes MS. in India Office, London, and Home Department, Calcutta), 1893–1898, *Andamanese Manual* (1887), *Notes on the Languages of the South Andaman Group of Tribes* (1898), and *History of our Relations with the Andamanese* (1899); S. Kurz, *Vegetation of the Andamans* (1867); G. S. Miller, *Mammals of the Andaman and Nicobar Islands* (vol. xxiv. of the *Proceedings of the National Museum*, U.S.A.); A. L. Butler, "Birds of the Andamans and Nicobars" (*Proc. Bombay Nat. Hist. Soc.*, vols. xii. and xiii.); and A. Alcock, *A Naturalist in Indian Seas* (1902).

ANDANTE (Ital. for "moving slowly," from *andare*, to go), a musical term to indicate pace, coming between *adagio* and *allegro*; it is also used of an independent piece of music or of the slow movement in a sonata, symphony, &c.

ANDERIDA, an ancient Roman fort at Pevensey, near Eastbourne in Sussex (England), built about A.D. 300 as part of a scheme of land-defence against the Saxon pirates; repaired, probably by the great Stilicho, about A.D. 400; and after the Norman Conquest utilized by William the Conqueror for a Norman castle. Its massive Roman enceinte still stands but little damaged.

ANDERNACH, a town of Germany, in the Prussian Rhine province, on the left bank of the Rhine, 10 m. N.W. of Coblenz by the main line to Cologne. Pop. (1900) 7889. Viewed from the river it makes a somewhat gloomy, though picturesque, impression, with its parish church (a basilica dating from the 12th century, with four towers), the round watch-tower on the Rhine, old walls in places 15 ft. thick, and a famous crane (erected 1554) for lading merchandise. Among other buildings are a Gothic Minorite church (now Protestant), a town hall, and a prison, formerly the castle of the archbishops of Cologne. Andernach has considerable industries, brewing and manufactures of chemicals and perfumes, and has also a trade in corn and wine. But its most notable article of commerce is that of mill-stones, made of lava and tufa-stone, a product much used by the Dutch in the construction of their dykes.

Andernach (*Antunnacum*) is the old Roman *Castellum ante Nacum*, founded by Drusus and fortified in the 3rd century A.D. In 1109 Andernach received civic rights, passed in 1167 to the electors of Cologne, in 1253 joined the confederation of the Rhine cities and was the most southern member of the Hanseatic league. Here in 1474 a treaty was signed between the emperor Frederick III., the four electors of the Rhine and France. In 1794 Andernach passed to France, but in 1815 was ceded, together with the left bank of the Rhine, to Prussia.

ANDERSEN, HANS CHRISTIAN (1805–1875), Danish poet and fabulist, was born at Odense, in Fünen, on the 2nd of April 1805. He was the son of a sickly young shoemaker of twenty-two, and his still younger wife: the whole family lived and slept in one little room. Andersen very early showed signs of imaginative temperament, which was fostered by the indulgence and superstition of his parents. In 1816 the shoemaker died and the child was left entirely to his own devices. He ceased to go to school; he built himself a little toy-theatre and sat at home making clothes for his puppets, and reading all the plays that he could borrow; among them were those of Holberg and Shakespeare. At Easter 1819 he was confirmed at the church of St Kund, Odense, and began to turn his thoughts to the future. It was thought that he was best fitted to be a tailor; but as nothing was settled, and as Andersen wished to be an opera-singer, he took matters into his own hand and started for Copenhagen in September 1819. There he was taken for a lunatic, snubbed at the theatres, and nearly reduced to starvation, but he was befriended by the musicians Christoph Weyse and Siboni, and afterwards by the poet Frederik Hoëgh Guldberg (1771–1852). His voice failed, but he was admitted as a dancing pupil at the Royal Theatre. He grew idle, and lost the favour of Guldberg, but a new patron appeared in the person of Jonas Collin, the director of the Royal Theatre, who became Andersen's life-long friend. King Frederick VI. was interested in the strange boy and sent him for some years, free of charge, to the great grammar-school at Slagelse. Before he started for school he published his first volume, *The Ghost at Palnatoke's Grave* (1822). Andersen, a very backward and unwilling pupil, actually remained at Slagelse and at another school in Elsinore until 1827; these years, he says, were the darkest and bitterest in his life. Collin at length consented to consider him educated, and Andersen came to Copenhagen. In 1829 he made a considerable success with a fantastic volume entitled *A Journey on Foot from Holman's Canal to the East Point of Amager*, and he published in the same season a farce and a book of poems. He thus suddenly came into request at the moment when his friends had decided that no good thing would ever come out of his early eccentricity and vivacity. He made little further progress, however, until 1833, when he received a small travelling stipend from the king, and made the first of his long European journeys. At Le Locle, in the Jura, he wrote *Agnate and the Merman*; and in October 1834 he arrived in Rome. Early in 1835 Andersen's novel, *The Improvisatore*, appeared, and achieved a real success; the poet's troubles were at an end at last. In the same year, 1835, the earliest instalment of Andersen's immortal *Fairy Tales* (Eventyr) was published in Copenhagen. Other parts, completing the first volume, appeared in 1836 and 1837. The value of these stories was not at first perceived, and they sold slowly. Andersen was more successful for the time being with a novel, *O.T.*, and a volume of sketches, *In Sweden*; in 1837 he produced the best of his romances, *Only a Fiddler*. He now turned his attention, with but ephemeral success, to the theatre, but was recalled to his true genius in the charming miscellanies of 1840 and 1842, the *Picture-Book without Pictures*, and *A Poet's Bazaar*. Meanwhile the fame of his *Fairy Tales* had been steadily rising; a second series began in 1838, a third in 1845. Andersen was now celebrated throughout Europe, although in Denmark itself there was still some resistance to his pretensions. In June 1847 he paid his first visit to England, and enjoyed a triumphal social success; when he left, Charles Dickens saw him off from Ramsgate pier. After this Andersen continued to publish much; he still desired to excel as a novelist and a dramatist, which he could not do, and he still disdained the enchanting *Fairy Tales*, in the composition of which his unique genius lay. Nevertheless he continued to write them, and in 1847 and 1848 two fresh volumes appeared. After a long silence Andersen published in 1857 another romance, *To be or not to be*. In 1863, after a very interesting journey, he issued one of the best of his travel-books, *In Spain*. His *Fairy Tales* continued to appear, in instalments, until 1872, when, at Christmas, the last stories were published. In the spring of that year Andersen had an awkward accident, falling out of bed and severely hurting himself. He was never again quite well, but he lived till the 4th of August 1875, when he died very peacefully in the house called Rolighed, near Copenhagen. (E. G.)

ANDERSON, ADAM (1692–1765), Scottish economist, was born in 1692, and died in London on the 10th of January 1765. He was a clerk for forty years in the South Sea House, where he published a work entitled *Historical and Chronological Deduction of the Origin of Commerce from the Earliest Accounts to the Present Time, containing a History of the Great Commercial Interests of the British Empire* (1762, 2 vols. fol.).

ANDERSON, ALEXANDER (*c.* 1582–1620?), Scottish mathematician, was born at Aberdeen. In his youth he went to the continent and taught mathematics at Paris, where he published or edited, between the years 1612 and 1619, various geometrical and algebraical tracts, which are conspicuous for their ingenuity and elegance. He was selected by the executors of Franciscus Vieta to revise and edit his manuscript works, a task which he discharged with great ability. The works of Anderson amount to six thin 4to volumes, and as the last of them was published in 1619, it is probable that the author died soon after that year, but the precise date is unknown.

ANDERSON, SIR EDMUND (1530–1605), English lawyer, descended from a Scottish family settled in Lincolnshire, was born in 1530 at Flixborough or Broughton in that county. After studying for a short time at Lincoln College, Oxford, he became in 1550 a student of the Inner Temple. In 1579 he was appointed serjeant-at-law to Queen Elizabeth, and also an assistant judge on circuit. As a reward for his services in the trial of Edmund Campian and his followers (1581), he was, on the death of Sir James Dyer, appointed lord chief justice of the Common Pleas (1582), and was knighted. He took part in all the leading state trials which agitated England during the latter years of Elizabeth's reign. Though a great lawyer and thoroughly impartial in civil cases, he became notorious by his excessive severity and harshness when presiding over the trials of catholics and nonconformists; more markedly so in those of Sir John Perrot, Sir Walter Raleigh, and John Udall the puritan minister. Anderson was also one of the commissioners appointed to try Mary queen of Scots in 1586. He died on the 1st of August 1605 at Eyworth in Bedfordshire. In addition to *Reports of Many Principal Cases Argued and Adjudged in the Time of Queen Elizabeth in the Common Bench*, published after his death, he drew up several expositions of statutes enacted in Elizabeth's reign which remain in manuscript in the British Museum.

ANDERSON, ELIZABETH GARRETT (1836–), English medical practitioner, daughter of Newson Garrett, of Aldeburgh, Suffolk, was born in 1836, and educated at home and at a private school. In 1860 she resolved to study medicine, an unheard-of thing for a woman in those days, and one which was regarded by old-fashioned people as almost indecent. Miss Garrett managed to obtain some more or less irregular instruction at the Middlesex hospital, London, but was refused admission as a full student both there and at many other schools to which she applied. Finally she studied anatomy privately at the London hospital, and with some of the professors at St Andrews University, and at the Edinburgh Extra-Mural school. She had no less difficulty in gaining a qualifying diploma to practise medicine. London University, the Royal Colleges of Physicians and Surgeons, and many other examining bodies refused to admit her to their examinations; but in the end the Society of Apothecaries, London, allowed her to enter for the License of Apothecaries' Hall, which she obtained in 1865. In 1866 she was appointed general medical attendant to St Mary's dispensary, a London institution started to enable poor women to obtain medical help from qualified practitioners of their own sex. The dispensary soon developed into the New hospital for women, and there she worked for over twenty years. In 1870 she obtained the Paris degree of M.D. The same year she was elected to the first London School Board, at the head of the poll for Marylebone, and was also made one of the visiting physicians of the East London hospital for children; but the duties of these two positions she found to be incompatible with her principal work, and she soon resigned them. In 1871 she married Mr J. G. S. Anderson (d. 1907), a London shipowner, but did not give up practice. She worked steadily at the development of the New hospital, and (from 1874) at the creation of a complete school of medicine in London for women. Both institutions have since been handsomely and suitably housed and equipped, the New hospital (in the Euston Road) being worked entirely by medical women, and the schools (in Hunter Street, W.C.) having over 200 students, most of them preparing for the medical degree of London University, which was opened to women in 1877. In 1897 Mrs Garrett Anderson was elected president of the East Anglian branch of the British Medical Association. In 1908 she was elected (the first lady) mayor of Aldeburgh. The movement for the admission of women to the medical profession, of which she was the indefatigable pioneer in England, has extended to every civilized country except Spain and Turkey.

ANDERSON, JAMES (1662–1728), Scottish genealogist, antiquary and historian, was born at Edinburgh on the 5th of August 1662. He was educated for the law, and became a writer to the signet in 1691. His profession gave him the opportunity of gratifying his taste for the study of ancient documents; and just before the union the Scottish parliament commissioned him to prepare for publication what remained of the public records of the kingdom, and in their last session voted a sum of £1940 sterling to defray his expenses. At this work he laboured for several years with great judgment and perseverance; but it was not completed at his death in 1728. The book was published posthumously in 1739, edited by Thomas Ruddiman, under the title *Selectus Diplomatum et Numismatum Scotiae Thesaurus*. The preparation of this great national work involved the author in considerable pecuniary loss; and soon after his death, the numerous plates, engraved by Sturt, were sold for £530. These plates are now lost, and the book has become exceedingly scarce. After the union of the crowns, Anderson was appointed in 1715 postmaster-general for Scotland, as some compensation for his labours; but in the political struggles of 1717 he was deprived of this office, and never again obtained any reward for his services. He died on the 3rd of April 1728. He published, during the controversy about the union, *An Historical Essay showing that the Crown and Kingdom of Scotland is Imperial and Independent* (Edin., 1705,), and later *Collections relating to the History of Mary Queen of Scotland* (in 4 vols., Edin., 1727–1728).

ANDERSON, JAMES (1739–1808), Scottish agriculturist and economist, was born at Hermiston, near Edinburgh, in 1739. While still a boy he undertook the working of a farm in Mid-Lothian which his family had occupied for several generations, and later he rented in Aberdeenshire a farm of 1300 acres of unimproved land. In 1783 he settled in Edinburgh, where in 1791 he projected a weekly publication called *The Bee*, which was largely written by himself, and of which eighteen volumes were published. In 1797 he began to reside at Isleworth, and from 1799 to 1802 he produced a monthly publication, *Recreations in Agriculture, Natural History, Arts and Miscellaneous Literature*. He was also the author of many pamphlets on agricultural and economical topics. He died on the 15th of October 1808.

ANDERSON, JOHN (1726–1796), Scottish natural philosopher, was born at Roseneath, Dumbartonshire, in 1726. In 1756 he became professor of oriental languages in the university of Glasgow, where he had finished his education; and in 1760 he was appointed to the more congenial post of professor of natural philosophy. He devoted himself particularly to the application of science to industry, instituting courses of lectures intended especially for artisans, and he bequeathed his property for the foundation of an institution for the furtherance of technical and scientific education in Glasgow, Anderson's College, now merged in the Glasgow and West of Scotland Technical College. He died in Glasgow on the 13th of January 1796. His *Institutes of Physics*, published in 1786, went through five editions in ten years.

ANDERSON, MARY (1859–), American actress, was born at Sacramento, California, on the 28th of July 1859. Her father, an officer in the Confederate service in the Civil War, died in 1863. She was educated in various Roman Catholic institutions, and at the age of thirteen, with the advice of Charlotte Cushman, began to study for the stage, making her first appearance at Louisville, Kentucky, as Juliet in 1875. Her remarkable beauty created an immediate success, and she played in all the large cities of the United States with increasing popularity. Between 1883 and 1889 she had several seasons in London, and was the Rosalind in the performance of *As You Like It* which opened the Shakespeare Memorial theatre at Stratford-on-Avon. Among her chief parts were Galatea (in W. S. Gilbert's *Pygmalion and Galatea*), Clarice (in his *Comedy and Tragedy*, written for her), Hermione, Perdita, and Julia (in *The Hunchback*). In 1889 she retired from the stage and in 1890 married Antonio de Navarro, and settled in England.

See William Winter's *Stage Life of Mary Anderson* (New York, 1886), and her own *A Few Memories* (New York, 1896).

ANDERSON, RICHARD HENRY (1821–1879), American soldier, was born in South Carolina on the 7th of October 1821. Graduating at West Point in 1842, he served in the Mexican War (in which he won the brevet of first lieutenant) and in the Kansas troubles of 1856–1857, becoming first lieutenant in 1848 and captain in 1855. At the outbreak of the Civil War in 1861 he resigned his commission in the U.S. army, and entered the Confederate service as a brigadier-general, being promoted major-general in August 1862 and lieutenant-general in May 1864. With the exception of a few months spent with the army under Bragg in 1862, Anderson's service was wholly in the Army of Northern Virginia. Under Lee and Longstreet he served as a divisional commander in nearly every battle from 1862 to 1864, winning especial distinction at Chancellorsville and Gettysburg. When Longstreet was wounded at the battle of the Wilderness, Anderson succeeded him in command of the 1st corps, which he led in the subsequent battles. His services at the battle of Spottsylvania (*q.v.*) were most important. He remained with the army, as a corps commander, to the close of the war, after which he retired into private life. He died at Beaufort S.C. on the 26th of June 1879.

ANDERSON, ROBERT (1750–1830), Scottish author and critic, was born at Carnwath, Lanarkshire, on the 7th of January 1750. He studied first divinity and then medicine at the university of Edinburgh, and subsequently, after some experience as a surgeon, took the degree of M.D. at St Andrews in 1778. He began to practise as a physician at Alnwick, but he became financially independent by his marriage with the daughter of Mr John Gray, and abandoned his profession for a literary life in Edinburgh. For several years his attention was occupied with his edition of *The Works of the British Poets, with Prefaces Biographical and Critical* (14 vols. 8vo, Edin., 1792–1807). His other publications were, *The Miscellaneous Works of Tobias Smollett, M.D., with Memoirs of his Life and Writings* (Edin., 1796); *Life of Samuel Johnson, LL.D., with Critical Observations on his Works* (Edin., 1815); *The Works of John Moore, M.D., with Memoirs of his Life and Writings* (Edin., 7 vols., 1820); and *The Grave and other Poems, by Robert Blair; to which are prefixed some Account of his Life and Observations on his Writings* (Edin., 1826). Dr Anderson died at Edinburgh on the 20th of February 1830.

ANDERSON, a city and the county-seat of Madison county, Indiana, U.S.A., situated on the west fork of the White river, about 35 m. N.E. of Indianapolis. Pop. (1880) 4126; (1890) 10,741; (1900) 20,178, of whom 1081 were foreign-born; (1910, census) 22,476. It is served by the Central Indiana, the Cleveland, Cincinnati, Chicago & St Louis, and the Pittsburg, Chicago & St Louis railways, and also by the Indiana Union Traction System (electric), the general offices and central power plant of which are situated there. Its importance as a manufacturing centre is due to its location in the natural gas region. In 1905 Anderson ranked first among the cities of the state in the manufacture of carriage and wagon material, and iron and steel. Among its many other manufactures are glass and glassware, paper, strawboards, crockery and tiles. In 1905 the total factory product was valued at $8,314,760. There is a good public library; much attention has been devoted to public improvements; and the water works and the electric lighting plants are owned and operated by the city. In connexion with the water works there is a good filtration plant. First settled about 1822, Anderson was incorporated in 1865.

ANDERSONVILLE, a village of Sumter county, Georgia, U.S.A., in the S.W. part of the state, about 60 m. S. W. of Macon, on the Central of Georgia railway. Pop. (1910) 174. From November 1863 until the close of the Civil War it was the seat of a Confederate military prison. A tract of 16½ acres of land near the village was cleared of trees and enclosed with a stockade. Prisoners began to arrive in February 1864, before the prison was completed and before adequate supplies had been received, and in May their number amounted to about 12,000. In June the stockade was enlarged so as to include 26½ acres, but the congestion was only temporarily relieved, and in August the number of prisoners exceeded 32,000. No shelter had been provided for the inmates: the first arrivals made rude sheds from the débris of the stockade; the others made tents of blankets and other available pieces of cloth, or dug pits in the ground. Owing to the slender resources of the Confederacy, the prison was frequently short of food, and even when this was sufficient in quantity it was of a poor quality and poorly prepared on account of the lack of cooking utensils. The water supply, deemed ample when the prison was planned, became polluted under the congested conditions. During the summer of 1864 the prisoners suffered greatly from hunger, exposure and disease, and in seven months about a third of them died. In the autumn, after the capture of Atlanta, all the prisoners who could be moved were sent to Millen, Georgia and Florence, South Carolina. At Millen better arrangements prevailed, and when, after Sherman began his march to the sea, the prisoners were returned to Andersonville, the conditions there were somewhat improved. During the war 49,485 prisoners were received at the Andersonville prison, and of these about 13,000 died. The terrible conditions obtaining there were due to the lack of food supplies in the Confederate States, the incompetence of the prison officials, and the refusal of the Federal authorities in 1864 to make exchanges of prisoners, thus filling the stockade with unlooked-for numbers. After the war Henry Wirz, the superintendent, was tried by a court-martial, and on the 10th of November 1865 was hanged, and the revelation of the sufferings of the prisoners was one of the factors that shaped public opinion regarding the South in the Northern states, after the close of the Civil War. The prisoners' burial ground at Andersonville has been made a national cemetery, and contains 13,714 graves of which 921 are marked "unknown."

There is an impartial account of the Andersonville prison in James F. Rhodes, *History of the United States* (vol. v., New York, 1904). The partisan accounts are numerous; see, for instance, A. C. Hamlin, *Martyria; or, Andersonville Prison* (Boston, 1866); and R. R. Stevenson, *The Southern Side; or, Andersonville Prison* (Baltimore, 1876).

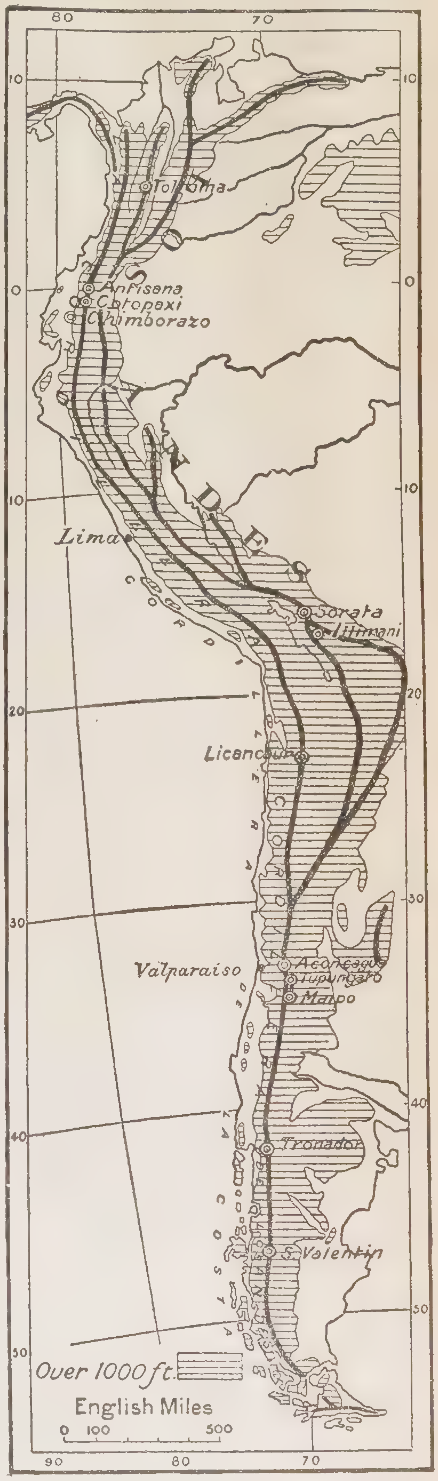
ANDES, a vast mountain system forming a continuous chain of highland along the western coast of South America. It is roughly 4400 m. long, 100 m. wide in some parts, and of an average height of 13,000 ft.[1] The connexion of this system with that of the Rocky Mountains, which has been pointed out by many writers, has received much support from the discovery of the extensive eruptions of granite during Tertiary times, extending from the southern extremity of South America to Alaska. The Andean range is composed of two great principal chains with a deep intermediate depression, in which, and at the sides of the great chains, arise other chains of minor importance, the chief of which is that called the Cordillera de la Costa of Chile. This starts from the southern extremity of the continent, and runs in a northerly direction, parallel with the coast, being broken up at its beginning into a number of islands, and afterwards forming the western boundary of the great central valley of Chile. To the north this coastal chain continues in small ridges or isolated hills along the Pacific as far as Colombia, always leaving the same valley more or less visible to the west of the western great chain.

Tierra del Fuego.

Of the two principal chains the eastern is generally called Los Andes, and the western La Cordillera, in Colombia, Peru and Bolivia, where the eastern is likewise known as Cordillera Real de los Andes, while to the south of parallel 23° S. lat. in Chile and Argentina, the western is called Cordillera de los Andes. The eastern disappears in the centre of Argentina, and it is therefore only the Cordillera de los Andes that is prolonged as far as the south-eastern extremity of the continent. The Cordillera de la Costa begins near Cape Horn, which is composed principally of crystalline rocks, and its heights are inconsiderable when compared with those of the true Cordillera of the Andes. The latter, as regards its main chain, is on the northern coast of the Beagle Channel, in Tierra del Fuego, bounded on the north by the deep depression of Lake Fagnano and of Admiralty Sound. Staten Island appears to be the termination to the east. The Cordillera of the Andes in Tierra del Fuego is formed of crystalline schists, and culminates in the snow-capped peaks of Mount Darwin and Mount Sarmiento (7200 ft.), which contains glaciers of greater extent than those of Mont Blanc. The extent of the glaciers is considerable in this region, which, geographically, is more complex than was formerly supposed. Although, in the explored portion of the Fuegian chain, the volcanoes which have been mentioned from time to time have not been met with, there seem to have existed to the south, on the islands, many neo-volcanic rocks, some of which appear to be contemporaneous with the basaltic sheet that covers a part of eastern Patagonia. The insular region between Mount Sarmiento and the Cordillera de los Andes, properly so called, *i.e.* that which extends from Magellan Strait northwards, is not fully explored, and all that is known of it is that it is principally composed of the same rocks as the Fuegian section, and that the greater part of its upper valleys is occupied by glaciers that reach down to the sea amid dense forest.

Chile-Argentina, 52°-38° S.

As Admiralty Sound and Lake Fagnano bound the Cordillera to the north in Tierra del Fuego, so at the eastern side of the Cordillera in the southernmost part of the continent there is a longitudinal depression which separates the Andes from some independent ridges pertaining to a secondary parallel broken chain called the pre-Cordillera. This depression is occupied in great part by a series of lakes, some of these filling transversal breaches in the range, whilst others are remains of glacial reservoirs, bordered by morainic dams, extending as far as the eastern tableland and corresponding in these cases with transversal depressions which reach the Atlantic Ocean. Between the larger lakes, fed by the Andine glaciers of the eastern slope of the Southern Andes, are Lakes Maravilla, 100 sq. m., and Sarmiento, 26 sq. m., 51° S. lat., which overflow into Last Hope Inlet; Argentino, 570 sq. m., 50° S. lat.; and Viedma, 450 sq. m., 49° 30′ S. lat., which empty into the river Santa Cruz; the fjordian Lake San Martin, 49° S. lat., and Lakes Nansen, 18 sq. m.; Azara, 8 sq. m.; and Belgrano, 18 sq. m., which are dependents of Lake San Martin (380 sq. m.), and Lakes Pueyrredon (98 sq. m.) and Buenos Aires (700 sq. m.), which now overflow into the Pacific, through one of the remarkable inlets that are found throughout the Cordillera, the Calen Inlet, which is the largest western fjord of Patagonia. To the north of Lake Buenos Aires there is Lake Elizalde, which, while situated on the eastern slope, sends its waters to the Pacific Ocean, and Lakes Fontana (30 sq. m.) and La Plata (34 sq. m.), 45° S. lat., which feed the river Senguerr, which flows to the Atlantic. Lake General Paz (66 sq. m.) on the eastern slope of the Andes, at 44° S. lat., is the principal source of the Palena river, which cuts all the Cordillera, while Lakes Fetalauquen (20 sq. m.) Menendez (28 sq. m.), Rivadavia (10 sq. m.), and other smaller lakes, also situated between 43° 30′, and 42° 30′ S. lat. on the eastern slope send their waters to the Pacific by the river Fetaleufu which cuts through the Andes by a narrow gorge. The waters of Lake Puelo (18 sq. m.) likewise flow into the same ocean through the river of that name, which also cuts the Cordillera, and of which the principal affluent likewise drains the waters of a system of small lakes, the largest of which, Lake Mascardi, measures 17 sq. m., which in comparatively recent times formed part of the basin of Lake Nahuel-Huapi (207 sq. m.), 41° S. lat. An extensive area of glacial deposits shows that a sheet of ice formerly covered the whole eastern slope to a great distance from the mountains. To the west another sheet reached at the same time the Pacific Ocean.



From the Strait of Magellan up to 52° S. lat., the western slope of the Cordillera does not, properly speaking, exist. Abrupt walls overlook the Pacific, and great longitudinal and transversal channels and fjords run right through the heart of the range, cutting it generally in a direction more or less oblique to its axis, the result of movements of the earth's crust.

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[1] As to the specific elevations of many of the peaks mentioned in this article, various authorities differ, and it is impossible in many cases to rate one estimate as of greater value than another.

The mountains forming the Cordillera between Magellan Strait and 41° S. lat. are higher than those previously mentioned in Tierra del Fuego. Generally composed of granite, gneiss and Palaeozoic rocks, covered in many parts by rugged masses of volcanic origin, their general height is not less than 6500 ft., while Mount Geikie is 7500 ft. and Mount Stokes 7100 ft. To the north are Mounts Mayo (7600 ft.), Agassiz (10,600 ft.), and Fitzroy, in 49° S. lat. (11,120 ft.). The section from 52° to 48° S. lat. is a continuous ice-capped mountain range, and some of the glaciers extend from the eastern lakes to the western channels, where they reach the sea-level. The level of the lakes begins at 130 ft. at Lake Maravilla and gradually ascends to nearly 700 ft. at Lake San Martin. Passing the breach through which Lake San Martin empties itself into Calen Inlet, in 48° S. lat., is found a wide oblique opening in the range, through which flows the river Las Heras, fed by Lake Pueyrredon, which is only 410 ft. above the sea-level to the east of the Andes, while Lake Buenos Aires, immediately to the north, is 710 ft. The Andes continue to be to the west an enormous rugged mass of ice and snow of an average height of 9000 ft., sending glaciers to all the eastern fjords.

Mount San Lorenzo, detached from the main chain in the pre-Cordillera, is 11,800 ft. high. Mount San Valentin (12,700 ft.) is the culminating point of the Andes in the region extending from 49° to 46° S. lat., a little north of which is the river Huemules which is followed by the breach of the river Aisen. These two rivers have emptied a large system of lakes, which in pre-Glacial times occupied the eastern zone, thus forming a region suitable for colonization in the broad valleys and hollows, where the rivers, as in the case with those in the north, cut through the Andes by narrow gaps, forming cataracts and rapids between the snowy peaks. Volcanic action is still going on in these latitudes, as the glaciers are at times covered by ashes, but the predominant rocks to the east are the Tertiary granite, while to the west gneiss, older granite and Palaeozoic rocks prevail. The highest peaks, however, seem to be of volcanic origin. Farther north, up to 41° S. lat., the water gaps are situated at a lesser distance one from the other, owing mainly to more continuous erosion, this section of the continent being the region of the maximum rainfall on the western coast to the south of the equator. Between the gaps of the river Aisen and river Cisnes or Frias, which also pierces the chain, is found a huge mountain mass, in which is situated Mount la Torre (7150 ft.). These form the continental watershed, but in this region erosion is taking place so rapidly that the day is not far distant when Lakes La Plata and Fontana, situated to the east at a height of 3000 ft. and now tributaries of the Atlantic, may become tributaries of the Pacific. Already filtrations from the former go to feed western affluents through the granitic masses. To the north of Mount la Torre flows in the river Cisnes, 44° 48′ S. lat., across another water gap, continuing the range to the north with high peaks, as Alto Nevado (7350 ft.) and Cacique (7000 ft.). The glaciers reach almost the western channels, as is the case at the river Quelal. The northern glaciers, descending nearly to sea-level, are situated at 43° 40′ S. lat. To the north 45° S. lat. a well-defined western longitudinal valley, at some recent time occupied by lakes and rivers, divides the Cordillera into two chains, the eastern being the main chain, to which belong Mounts Alto Nevado, Cacique, Dentista, Maldonado, Serrano, each over 7000 ft. high; and Torrecillas (7400 ft.), Ventisquero (7500 ft.), and Tronador (11,180 ft.); while the western chain, broken into imposing blocks, contains several high volcanic peaks such as Mounts Tanteles, Corcovado, Minchimahuida, Hornopiren and Yates. The rivers Palena, with its two branches, Pico and Carrenleufu, Fetaleufu, Puelo and Manso cut the two chains, while the rivers Reñihue, Bodadahue and Cochamo have their sources in the main eastern ridge. Mention has been made of active volcanoes in 51°, 49° and 47° S. lat., but these have not been properly located. The active volcanoes south of 41°, concerning which no doubt exists, are the Huequen, in 43° lat., and the Calbuco, both of which have been in eruption in modern times.

The surroundings of Mount Tronador, consisting of Tertiary granite and basalt, form one of the most interesting regions in the Patagonian Andes for the mountaineers of the future. To the east extends the large and picturesque lake of Nahuel-Huapi, to the west is Lake Todos Los Santos (50 sq. m.), to which the access is easy and of which the scenery is of surpassing beauty. Between 41° and 38° S. lat., among other smaller lakes, are Lakes Traful (45 sq. m.), Lacar (32 sq. m.), which, properly belonging to the system of Atlantic lakes, empties itself by the only water gap that occurs in this zone of the Cordillera into the river Valdivia, a tributary of the Pacific, Lake Lolog (15 sq. m.), Huechu-lafquen (45 sq. m.), and Lake Alumine (21 sq. m.). The volcanoes of Lanin (12,140 ft.), Quetropillan (9180 ft.), Villarica (10,400 ft.), Yaimas and Tolhuaca are all more or less active; the first is in the main chain, while the others are on the western slope. The scenery in the neighbourhood is magnificent, the snowy cones rising from amidst woods of araucaria, and being surrounded by blue lakes. While the scenery of the western slope of the Andes is exceedingly grand, with its deep fjords, glaciers and woods, yet the severity of its climate detracts considerably from its charm. The climate of the eastern slope, however, is milder, the landscapes are magnificent, with wooded valleys and beautiful lakes. The valleys are already partly settled by colonists. Between 52° and 40° S. lat. erosion has carried the watershed of the continent from the summit of the Cordillera to the eastern plains of Patagonia.

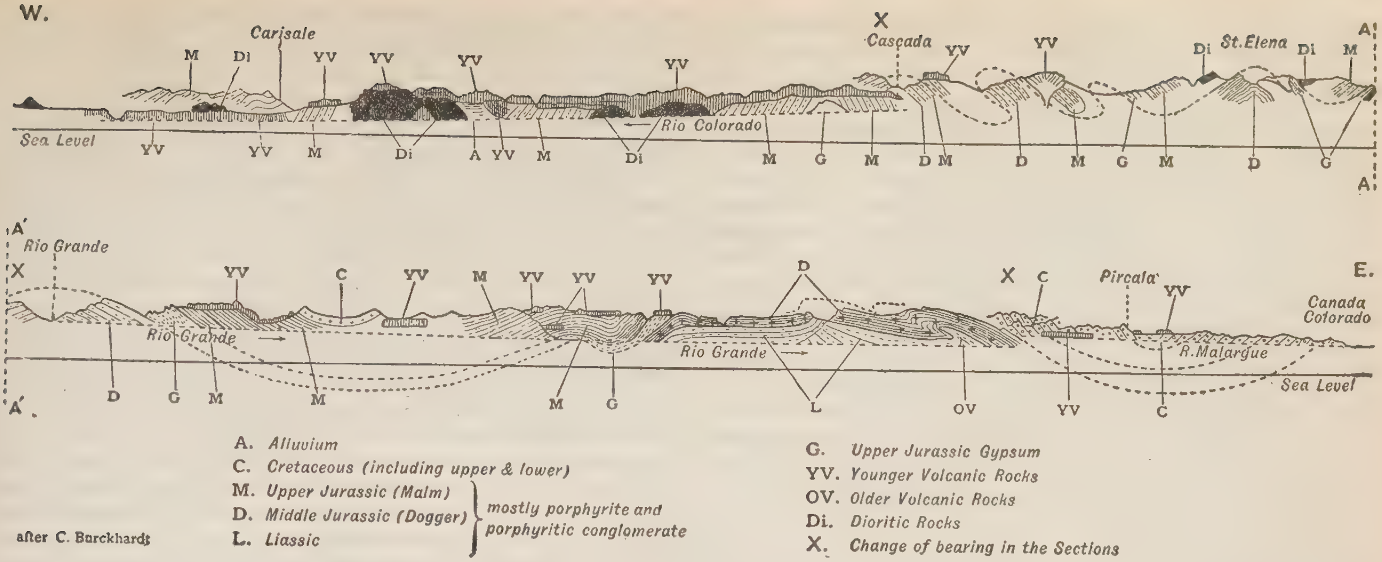
From 40° S. southward the Chile-Argentine Boundary Commission under Sir T. H. Holdich carried out important investigations in 1902; and between 38° and 33° S. lat. the Andes were somewhat extensively explored about the close of the 19th century by Argentine and Chilean Commissions. The highest peaks in the latter section are volcanic and their eruptions have sensibly modified the character of the primitive ridges. Outflows of lava and tufa cover the mountain sides and fill up the valleys. The Jurassic and Cretaceous formations, which in the Southern Cordillera are situated outside of the range to the east, form to a considerable extent the mass of the great range, together with quartz porphyry, the Tertiary, granite and other eruptive rocks, which have been observed along all the chain in South America up to Alaska in the north. Gneiss is seldom met with, but there are crystalline rocks, belonging chiefly to the pre-Cordillera of the eastern and to the Cordillera de la Costa on the western side.

Chile-Argentina from 38° S. northward.

About 38° S. the Andes take a great transversal extension; there are no wide intermediate valleys between the different ridges but the main ridge is perfectly defined. Volcanic cones continue to predominate, the old crystalline rocks almost disappear, while the Mesozoic rocks are most common. The higher peaks are in the main chain, while the Domuyo (15,317 ft.) belongs to a lateral eastern ridge. The principal peaks between this and Mount Tupungato at 33° S. lat. are: Mount Cochico (8255 ft.), Campanario, (13,140 ft.), Peteroa (13,297 ft.), Tinguiririca, Castillo (16,535 ft.), Volcano Maipu (17,576 ft.), Alvarado (14,600 ft.), Amarillo (15,321 ft.), Volcano San Jose (19,849 ft.), Piuquenes (17,815 ft.), and Volcano Bravard (19,619 ft.).

North of Maipu volcano, ascended by R. P. Güssfeldt in 1883, the Cordillera is composed of two huge principal ridges which unite and terminate in the neighbourhood of Mount Tupungato. The valley between them is 9900 ft. high; and in that part of the Cordillera are situated the highest passes south of 33° S. lat., one of which, the Piuquenes Pass, reaches 13,333 ft., whilst the easiest of transit and almost the lowest is that of Pichachen (6505 ft.), which is the most frequented during winter. Mount Tupungato reaches 22,329 ft., according to Argentine measurement. To the north of this mountain, situated at the watershed of the Andes, extends a lofty region comprising peaks such as Chimbote (18,645 ft.) and Mount Polleras (20,266 ft.). The Pircas Pass is situated at a height of 16,962 ft. The gaps of Bermejo and Iglesia, in the Uspallata road, the best known of all the passes between Argentina and Chile, are at 13,025 ft. and 13,412 ft. altitude respectively, while the nearest peaks, those of Juncal and Tolorsa, are 19,358 and 20,140 ft. high.

Mounts Tupungato, Aconcagua (23,393 ft.) and Mercedario



after C. Burckhardt

(21,982 ft.) are the highest peaks of the central Argentine-Chilean Andes. These three peaks are formed of eruptive rocks, surrounded by Jurassic beds which have undergone a thorough metamorphosis. While in the west of the Andes, from the latitude of Aconcagua, the central valley of Chile runs without any notable interruption to the south end of the continent, a valley which almost disappears to the north, leaving only some rare inflexions which are considered by Chilean geographers and geologists to be a continuation of the same valley; to the east in Argentina a longitudinal valley, perfectly characterized, runs along the eastern foot of the Cordillera, separating this from the pre-Cordillera, which is parallel to the Cordillera de la Costa of Chile. Between Aconcagua and Mercedario are the passes of Espinacito (14,803 ft.) and Los Patos or Valle Hermoso (11,736 ft.), chosen by the Argentine General San Martin, when he made his memorable passage across the chain during the War of Independence. North of Valle Hermoso the Andean ridges, while very high, are not abrupt, and the passes are more numerous than in the south; some of them descending 10,000 ft., but most of them between 13,000 and 14,000 ft. The pass of Quebrada Grande is 12,468 ft. in altitude; Cencerro, 12,944 ft.; Mercedario, 13,206 ft.; Ojota, 14,304 ft.; Pachon, 14,485 ft.; while Gordito is 10,318 ft. Farther north the passes are higher. Barahona Pass is 15,092 ft.; Ternera, 15,912 ft.; San Lorenzo, 16,420 ft., while the peak of the volcano reaches 18,143 ft.; Mount Olivares, 20,472 ft.; Porongos, 19,488 ft.; Tortolas, 20,121 ft.; and Potro, 19,357 ft.

Bolivia.

As far as 28° S. lat. the Cordillera de los Andes has been principally formed by two well-defined ridges, but to the north, recent volcanic action has greatly modified its orography. Only a single line of passes characterizes the main ridge, and amongst them are the passes of Ollita (15,026 ft.), Peñas Negras (14,435 ft.), Pircas Negras (13,615 ft.), La Gallina (16,240 ft.), Tres Quebradas (15,535 ft.), and Aguita (15,485 ft.). To the north of Mount Potro the peaks in the Cordillera are not very prominent as far as the great mass of Tres Quebradas, but here are to be met with some that may be considered as amongst the highest of the whole range. Mount Aguita is 20,600 ft., and the culminating peak of those of Tres Cruces reaches 22,658 ft. To the east of the eastern longitudinal valley, at 27° S. lat., begins a high volcanic plateau between the Cordillera and the southern prolongation of the Bolivian Cordillera Real, which contains lofty summits, such as Mount Veladero (20,998 ft.), Mount Bonete (21,980), Mount Reclus (20,670), Mount Pissis (22,146), Mount Ojo del Salado (21,653), and Incahuasi (21,719). To the north of Tres Cruces is a transversal depression in the Cordillera, which is considered to be the southern termination of the high plateau of the Puna de Atacama. The Cordillera of the Andes borders the Puna to the west, while the Bolivian Cordillera Real bounds it to the east. In that region the Cordillera of the Andes is of comparatively recent origin, being principally constituted by a line of high volcanoes, the chief summits being those of Juncal, Panteon de Aliste, Azufre or Listarria (18,636 ft.), Llullaillaco (21,720), Miñiques (19,357), Socompa (19,948), Licancaur (19,685), Viscachuelas (20,605), Tapaquilcha (19,520), Oyahua (19,242), Ancaquilcha (20,275), Olca (19,159), Miño (20,112), Sillilica (21,100), Perinacota (20,918), Sagama (22,339), Tacona (19,740), Misti (19,029); to the east closes in the intermediary high plateau which begins at 28° S. lat. in Argentina. The principal peaks of the Bolivian Andes and its prolongation from south to north, are Famatina, in the centre of Argentina, (20,340 ft.), Languna Blanca (18,307), Diamante (18,045), Cachi (20,000), Granadas, Lipez (19,680), Guadalupe (18,910), Chorolque (18,480), Cuzco (17,930), Enriaca (18,716), Junari (16,200), Michiga (17,410), Quimza-Cruz (18,280), Illimani (21,190) and Sorata (21,490).

While the western range of the Cordillera is principally formed by volcanic rocks, the eastern (to the east of the range is Cerro Potosi, 15,400 ft.) Andes of Bolivia are chiefly composed of old crystalline rocks. Between the ranges in the high plateau north to 27° are numerous isolated volcanoes which have been in activity in recent times, such as Peinado (18,898 ft.), San Pedro (18,701), Antuco (19,029), Antofalla (20,014), Rincon (17,881), Pastos Grandes (17,553), Zapalegui (17,553), Suniguira (19,258), Tahue (17,458); volcanoes which have been elevated from a lacustrine basin, which very recently occupied the whole extension, and the remains of which are, in the south, the Laguna Verde, at 28°, and in the north Lake Titicaca. The discovery of great Pampean mammals in the Pleistocene beds of that region shows that this upheaval of the latter is very recent, for in the heart of the Cordillera, as well as on the west coast of Bolivia and Peru, there have been discovered, in very recent deposits, the remains of some mammals which cannot have crossed the high range as it now exists.

Peru-Ecuador.

The two Cordilleras that formed the Andes to the north of 28° S. lat. are continued in Peru. The western, which reaches an altitude of about 10,000 ft., then ceases to exist as a continuous chain, there remaining only a short, high ridge, called by Edward Whymper the "Pacific range of the equator," and between this ridge and the crystalline Andean axis, the "avenue of volcanoes," to use his words, arises amidst majestic scenery. Chimborazo, which is not in the main chain, reaches 20,517 ft.; Cotopaxi (19,580), Antisana (19,260), Coyambo (19,200) are in the eastern range, with many other peaks over 16,000 ft. which still contain glaciers. Sangay (17,380 ft.), under the equator, according to Wolff, appears to be the most active volcano in the world. Pichincha (15,804 ft.) and Cotocachi (16,297 ft.) are the loftiest volcanoes of the western range. In Colombia the three principal chains are continuations of those under the equator, and show very slight traces of volcanic action, *Colombia.*

In the western chain, which is remarkable for its regularity, the highest peak is 11,150 ft., and the lowest pass 6725 ft. The central chain, separated from the western chain by the valley of the Cauca and from the eastern by the valley of the Magdalena, is unbroken; it is the more important owing to its greater altitudes and is of volcanic character. To the south, near the equator, are Mounts Arapul (13,360 ft.) and Chumbul (15,720 ft.). The volcanoes Campainero (12, 470 ft.) and Pasto (14,000 ft.) are also in that zone. Farther north is the volcano Purace, which presents a height of 16,000 ft.; then come Huila (18,000), Santa Catalina (16,170), and Tolima (18,400), Santa Isabel (16,760), Ruiz (17,390) and Hervas (18,340). The eastern chain begins north of the equator at 6000 ft., gradually rises to the height of Nevado (14,146 ft.), Pan de Azucar (12,140 ft.), and in the Sierra Nevada de Cochi attains to peaks of 16,700 ft.

The snow-line of the Andes is highest in parts of Peru where it lies at about 16,500 ft. Its general range from the extreme north to Patagonia is 14,000 to 15,500 ft., but along the Patagonian frontier it sinks rapidly, until in Tierra del Fuego it lies at about 4900 ft.

Structure.—The structure of the Andes is least complex in the southern portion of the range. Between 33° and 36° S. the chain consists broadly of a series of simple folds of Jurassic and Cretaceous beds. It is probably separated on the east from the recent deposits of the pampas by a great fault, which, however, is always concealed by an enormous mass of scree material. The Cretaceous beds lie in a broad synclinal upon the eastern flank, but the greater part of the chain is formed of Jurassic beds, through which, on the western margin, rise the numerous andesitic volcanic centres. There is no continuous band of ancient gneiss, nor indeed of any beds older than the Jurassic. There is very little over-folding or faulting, and the structure is that of the Jura mountains rather than of the Alps. The inner or eastern ridge farther north of Argentina consists of crystalline rocks with infolded Ordovician and Cambrian beds, often overlaid unconformably by a sandstone with plant-remains (chiefly Rhaetic). In Bolivia this eastern ridge, separated from the western Cordillera by the longitudinal valley in which Lake Titicaca lies, is formed chiefly of Archaean and Palaeozoic rocks. All the geological systems, from the Cambrian to the Carboniferous, are represented and they are all strongly folded, the folds leaning over towards the west. West of the great valley the range is composed of Mesozoic beds, together with Tertiary volcanic rocks. (The Cordillera of Argentina and Chile is clearly the continuation of the western chain alone.) In Ecuador there is still an inner chain of ancient gneisses and schists and an outer chain composed of Mesozoic beds. The longitudinal valley which separates them is occupied mainly by volcanic deposits. North of Ecuador the structure becomes more complex. Of the three main chains into which the mountains are now divided, the western branch is formed mostly of Cretaceous beds; but the inner chains no longer consist exclusively of the older rocks, and Cretaceous beds take a considerable share in their formation.

The great volcanoes, active and extinct, are not confined to any one zone. Sometimes they rise from the Mesozoic zone of the western Cordillera, sometimes from the ancient rocks of the eastern zone. But they all lie within the range itself and do not, as in the Carpathians and the Apennines, form a fringe upon the inner border of the chain.

The curvature of the range around the Brazilian *massif*, and the position of the zone of older rocks upon the eastern flank, led Suess to the conclusion that the Andes owe their origin to an overthrust from east to west, and that the *Vorland* lies beneath the Pacific. In the south Wehrli and Burckhardt maintain that the thrust came from the west, and they look upon the ancient rocks of Argentina as the *Vorland*. In this part of the chain, however, there is but little evidence of overthrusting of any kind.

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ANDESINE, a member of the group of minerals known as *plagioclase felspars*, occupying a position in the isomorphous series about midway between albite ($NaAlSi_3O_8$) and anorthite ($CaAl_2Si_2O_8$); its chemical composition and physical characters are therefore intermediate between those of the two extremes of the series. Distinctly developed crystals or crystallized specimens are rarely met with, the mineral usually occurring as embedded crystals and grains in the igneous and gneissic rocks, of which it forms a component part. It occurs, for example, in the andesite of the Andes, from whence it derives its name.

ANDESITE, a name first applied by C. L. von Buch to a series of lavas investigated by him from the Andes, which has passed into general acceptance as the designation of a great family of rocks playing an important part in the geology of most of the volcanic areas of the globe. Not only the Andes but most of the Cordillera of Central and North America consist very largely of andesites; they occur also in great numbers in Japan, the Philippines, Java and New Zealand. They belong to all geological epochs, and are frequent among the Silurian and Devonian rocks of Britain, forming the ranges of the Cheviots, Ochils, Breidden Hills, and part of the Lake district. The well-known volcanoes, Montagne Pelée, the Soufrière of St Vincent, Krakatoa, Tarawera and Bandaisan have within recent years emitted great quantities of andesitic rocks with disastrous violence. No group of lavas is more widespread and more important from a geographical standpoint than the andesites.

They are typical intermediate rocks, containing on an average about 60 % of silica, but showing a considerable range of composition. Most of them correspond to the plutonic diorites, but others more nearly represent the gabbros. Their essential distinguishing features are mineralogical and consist in the presence of much soda-lime felspar (ranging from oligoclase to bytownite and even anorthite), along with one or more of the ferro-magnesian minerals, biotite, hornblende, augite and hypersthene. Both olivine and quartz are typically absent, though in some varieties they occur in small quantity. Orthoclase is more common than these two, but is never very abundant. The andesites have mostly a porphyritic structure, and the larger felspars and ferro-magnesian minerals are often visible to the naked eye, lying in a finer groundmass, usually crystalline, but sometimes to a large extent vitreous. When very fresh they are dark-coloured if they contain much glass, but paler in colour, red, grey or pinkish when more thoroughly crystallized. They weather to various shades of dark brown, reddish-brown, green, grey and yellow. Many of them are highly vesicular or amygdaloidal.

The older (pre-Tertiary) andesites are grouped together by many German, and formerly by British petrologists, under the term porphyrites, but are distinguished only by being, as a rule, in a less fresh condition. Apart from this there are three great subdivisions of this family of rocks, the quartz-andesites or dacites, the hornblende-and biotite-andesites, and the augite and hypersthene-andesites (or pyroxene-andesites). The dacites, a term first applied by Karl Heinrich Hektor Guido Stache (b. 1833) to quartz-bearing andesite of Transylvania or Dacia, contain primary quartz, and are the most siliceous members of the family; their quartz may appear in small blebs (or phenocrysts), or may occur only as minute interstitial grains in the groundmass; other dacites are very vitreous (dacitic-pitchstones). In many of their structural peculiarities they closely simulate the rhyolites, from which they differ in containing less potash and more soda, and in consequence less orthoclase felspar and more plagioclase. The hornblende- and biotite-andesites, like the dacites, have in most cases a pale colour (pink, yellow or grey), being comparatively rich in felspar. They resemble the trachytes both in appearance and in structure, but their felspar is mostly plagioclase, not sanidine. The biotite and hornblende have much the same characters in both of these groups of rocks, and are often surrounded by black borders produced by corrosion and partial resorption by the magma. A pale green augite is common in these andesites, but bronzite or hypersthene is comparatively rare. The pyroxene-andesites are darker, more basic rocks, with a higher specific gravity, and approach closely to the basalts and dolerites, especially when they contain a small amount of olivine. They are probably the commonest types of andesite, both at the present time and in former geological periods. Often their groundmass consists of brownish glass, filled with small microliths of augite and felspar, and having a velvety, glistening lustre when observed in a good light (hyalopilitic structure).

In addition to the accessory minerals, zircon, apatite and iron oxides, which are practically never absent, certain others occur which, on account of their rarity and importance, are of special interest. Sharply-formed little crystals of cordierite are occasionally found in andesites (Japan, Spain, St Vincent, Cumberland); they seem to depend on more or less complete digestion of fragments of gneiss and other rocks in the molten lava. Garnet and sapphire have also been found in andesites, and perhaps have the same signification; a rose-red variety of epidote (withamite) is known as a secondary product in certain andesites (Glencoe, Scotland), and the famous red porphyry (*porfido rosso*) of the ancients is a rock of this type. Ore deposits very frequently occur in connexion with andesitic rocks (Nevada, California, Hungary, Borneo, &c.), especially those of gold and silver. They have been laid down in fissures as veins of quartz, and the surrounding igneous rocks are frequently altered and decomposed in a peculiar way by the hot ascending metalliferous solutions. Andesites affected in this manner are known as propylites. The alteration is one of those post-volcanic, pneumatolytic processes, so frequent in volcanic districts. Propylitization consists in the replacement of the original minerals of the andesite by secondary products such as kaolin, epidote, mica, chlorite, quartz and chalcedony, often with the retention of the igneous structures of the rocks.

In microscopic characters the andesites present considerable variety; their porphyritic felspars are usually of tabular shape with good crystalline outlines, but often filled with glass enclosures. Zonal structure is exceedingly common, and the central parts of the crystals are more basic (bytownite, &c.) than the edges (oligoclase). Sanidine occurs with considerable frequency, but not in notable amount. The biotite and hornblende are yellow or brown and richly pleochroic. The hypersthene is nearly always idiomorphic, with a distinct pleochroism ranging from salmon-pink to green. Augite may be green in the more acid andesites, but is pale brown in the pyroxene-andesites. The apatite is often filled with minute dust-like enclosures. In the dacites felsitic groundmasses are by no means rare, but microcrystalline types consisting of plagioclase and sanidine with quartz are more prevalent. The hornblende- and mica-andesites have groundmasses composed mainly of acid plagioclase with little orthoclase or glassy base (pilotaxitic groundmass). Clear brown glass with many small crystals of plagioclase and pale brown augite (hyalopilitic groundmass) is very frequent in pyroxene-andesites. Vitreous rocks belonging to all of the above groups are well known though not very common, and exhibit the perlitic, pumiceous, spherulitic and other structures, characteristic to volcanic obsidians and pitchstones. (J. S. F.)

ANDIJAN, a town of Russian Turkestan, Province of Ferghana, eastern terminus of the Transcaspian railway, 84 m. by rail E.N.E. of Khokand, on the left bank of the upper Syr-darya. Altitude 1630 ft. Pop. (1900) 49,682. It was formerly the residence of the khans of Khokand, and has beautiful gardens and a large park in the middle of the town. Andijan is a centre for the trade in raw cotton and has cotton factories. All over Central Asia, West Turkestan merchants are known generally as Andijani. The town was destroyed by an earthquake on the 16th-17th of December 1902, when 5000 persons perished and 16,000 houses were demolished. It has since been rebuilt.

ANDIRON (older form *anderne*; med. Lat. *andena*, *anderia*), a horizontal iron bar, or bars, upon which logs are laid for burning in an open fireplace. Andirons stand upon short legs and are usually connected with an upright guard. This guard, which may be of iron, steel, copper, bronze, or even silver, is often elaborately ornamented with conventional patterns or heraldic ornaments, such as the *fleur-de-lys*, with sphinxes, grotesque animals, mythological statuettes or caryatides supporting heroic figures or emblems. Previously to the Italian Renaissance, andirons were almost invariably made entirely of iron and comparatively plain, but when the ordinary objects of the household became the care of the artist, the metal-worker lavished skill and taste upon them, and even such a man as Jean Bérain, whose fancy was most especially applied to the ornamentation of Boulle furniture, sometimes designed them. Indeed the fire-dog or *chenet* reached its most artistic development under Louis XIV. of France, and the first extant examples—often of cast-iron—are to be found in French museums and royal palaces. Fire-dogs, with little or no ornament, were also used in kitchens, with ratcheted uprights for the spits. Very often these uprights branched out into arms or hobs for stewing or keeping the viands hot.

ANDKHUI, a town and khanate in Afghan Turkestan. The town (said to have been founded by Alexander the Great) stands between the northern spurs of the Paropamisus and the Oxus; it is 100 m. due west of Balkh on the edge of the Turkman desert. The khanate is of importance as being one of the most northern in Afghanistan, on the Russian border. Until 1820 it was subject to Bokhara, but in that year Mahmud Khan besieged it for four months, took it by storm and left it a heap of ruins. To preserve himself from utter destruction the khan threw himself into the arms of the Afghans. The tract in which Andkhui stands is fertile, but proverbially unhealthy; the Persians account it "a hell upon earth" by reason of its scorching sands, brackish water, flies and scorpions. The population, estimated at 15,000, consists principally of Turkmans with a mixture of Uzbegs and a few Tajiks. The district was allotted to Afghanistan by the Russo-Afghan boundary commission of 1885.

ANDOCIDES, one of the "ten" Attic orators, was born about 440 B.C. Implicated in the mutilation of the Hermae (415), although he saved his life by turning informer, he was condemned to partial loss of civil rights and went into exile. He engaged in commercial pursuits, and after two unsuccessful attempts returned to Athens under the general amnesty that followed the restoration of the democracy (403), and filled some important offices. In 391 he was one of the ambassadors sent to Sparta to discuss peace terms, but the negotiations failed, and after this time we hear no more of him. Oligarchical in his sympathies, he offended his own party and was distrusted by the democrats. Andocides was no professional orator; his style is simple and lively, natural but inartistic.

Speeches extant:— *De Reditu*, plea for his return and removal of civil disabilities; *De Mysteriis*, defence against the charge of impiety in attending the Eleusinian mysteries; *De Pace*, advocating peace with Sparta; *Contra Alcibiadem*, generally considered spurious. Text:—Blass, 1880, Lipsius, 1888; *De Myst.*, with notes by Hickie, 1885; *De Red.* and *De Myst.*, with notes by Marchant, 1889; see Jebb, *Attic Orators*; L. L. Forman, *Index Andocideus*, 1897.

ANDORRA, or ANDORRE, a small, neutral, autonomous, and semi-independent state, on the Franco-Spanish frontier, and chiefly on the peninsular side of the eastern Pyrenees. Pop. (1900) about 5500; area about 175 sq. m. Andorra is surrounded by mountains, and comprises one main valley, watered by the Gran Balira, Valira or Balire, a tributary of the Segre, which itself flows into the Ebro; with several smaller valleys, the most important being that of the Balira del Orien, which joins the Gran Balira on the left. The territory was once densely wooded, and is said to derive its name from the Moorish *Aldarra*, "the place thick with trees"; but almost all the forests have been destroyed for fuel. The climate is generally cold, with very severe winters. The land is chiefly devoted to pasture for the numerous flocks and herds; but on the more sheltered southern slopes it is carefully cultivated, and produces grain, potatoes, fruit and tobacco. Game and trout are plentiful; milk, butter, hams, hides and wool are exported, principally to France. The local industries are of the most primitive kind, merely domestic, as in the middle ages. Lack of capital, of coal, and of good means of communication prevents the inhabitants from making use of the iron and lead in their mountains. During the coldest winter months their communications are much easier with Spain than through the snow-clad passes leading into Ariège. The only roads are bridle-paths, and one municipal road by the Balira valley, connecting Andorra with the high road to Seo de Urgel and Manresa; but in 1904 France and Spain agreed to build a railway from Ax to Ripoll, which would greatly facilitate traffic.

The Andorrans are a robust and well-proportioned race, of an independent spirit, simple and severe in their manners. They are all Roman Catholics. Apart from the wealthier landowners, who speak French fluently, and send their children to be educated in France, they use the Catalan dialect of Spanish. Andorra comprises the six parishes or communes of Andorra Vicilla, Canillo, Encamp, La Massana, Ordino and San Julian de Loria, which are subdivided into fifty-two hamlets or *pueblos*.

Preserved from innovations by the mutual jealousy of rival potentates, as well as by the conservative temper of a pastoral population, Andorra has kept its medieval usages and institutions almost unchanged. In each parish two *consuls*, assisted by a local council, decide matters relating to roads, police, taxes, the division of pastures, the right to collect wood, &c. Such matters, as well as the general internal administration of the territory, are finally regulated by a Council General of 24 members (4 to each parish), elected since 1866 by the suffrages of all heads of families, but previously confined to an aristocracy composed of the richest and oldest families, whose supremacy had been preserved by the principle of primogeniture. A general syndic, with two inferior syndics, chosen by the Council General, constitutes the supreme executive of the state. Two *viguiers*—one nominated by France, and the other by the bishop of Urgel—command the militia, which consists of about 600 men, although all capable of bearing arms are liable to be called out. This force is exempt from all foreign service, and the chief office of the *viguiers* is the administration of criminal justice, in which their decisions, given simply according to their judgment and conscience, there being no written laws, are final. Civil cases, on the other hand, are tried in the first instance before one of the two aldermen, who act as deputies of the *viguiers*; the judgment of this court may be set aside by the civil judge of appeal, an officer nominated by France and the bishop of Urgel alternately; the final appeal is either to the Court of Cassation at Paris or to the Episcopal College at Urgel. The French *viguier* is taken from the French department of Ariège and appointed for life, but the *viguier* of the bishop must be an Andorran, holding office for three years and re-eligible. There are notaries and clerks, auditors for each parish elected by the heads of families, police agents and bailiffs, chosen and sworn in, like all the above officers, by the Council General. The archives are mostly kept in the "house of the valley" in the capital, Andorra Vicilla, a struggling village of 600 inhabitants. In this government house the Council General meets and has a chapel. Here also the aldermen, *viguiers* and judge of appeal administer justice and assemble for all purposes of administration. Two magistrates, styled *rahanadores*, are appointed by the Council General to see that *viguiers* and judges preserve the customs and privileges of Andorra. The parishes have a permanent patrol of six armed men besides the militia. Spain and the bishop of Urgel are very jealous of French encroachments, and claim to have a better right ultimately to annex the little state. In the meanwhile it continues to pay each of the suzerain powers £40 a year, levied by a tax on pastures.

Andorra is the sole surviving specimen of the independence possessed in medieval times by the warlike inhabitants of many Pyrenean valleys. Its privileges have remained intact, because the suzerainty of the district became equally and indivisibly shared in 1278 between the bishops of Urgel and the counts of Foix, the divided suzerainty being now inherited by the French crown and the present bishop of Urgel; and the two powers have mutually checked innovations, while the insignificant territory has not been worth a dispute. Thus Andorra is not a republic, but is designated in official documents as the *Vallées et Suzerainetés*. Before 1278 it was under the suzerainty of the neighbouring counts of Castelbo, to whom it had been ceded in 1170 by the counts of Urgel. A marriage between the heiress of Castelbo and Roger Bernard, count of Foix, carried the rights of the above-named Spanish counts into the house of Foix, and hence subsequently to the crown of France, when the heritage of the feudal system was absorbed by the sovereign; but the bishops of Urgel claimed certain rights, which after long disputes were satisfied by the "Act of Division" executed in 1278. The claims of the bishopric dated from Carolingian times, and the independence of Andorra, like most other Pyrenean anomalies, has been traditionally ascribed to Charlemagne (742–814).

AUTHORITIES.—With the exception of *Études géographiques sur la vallée d'Andorre*, by J. Bladé (Paris, 1875), the standard books on Andorra deal mainly with its history and institutions. They comprise the following:—*The Valley of Andorra*, translated from the French of E. B. Berthet by F. H. Deverell (Bristol, 1886); J. Aviles Arnau, *El Pallás y Andorra* (Barcelona, 1893); L. Dalmau de Baquer, *Historia de la Republica de Andorra* (Barcelona, 1849); C. Baudon de Mony, *Origines historiques de la question d'Andorre* (in the *Bibliothèque de l'École des Chartes*, vol. 46, Paris, 1885). See also C. Baudon de Mony, *Relations politiques des comtes de Foix avec la Catalogne, jusqu'au commencement du XIV^{e} siècle* (Paris, 1896). A fair map was published by A. Hartleben, of Vienna, in 1898.

ANDOVER, a market-town and municipal borough in the Andover parliamentary division of Hampshire, England, 67 m. W.S.W. of London by the London & South Western railway, served also by the Midland & South Western Junction railway. Area 8663 acres. Pop. (1901) 6509. It is pleasantly situated on the river Anton, a tributary of the Test, in a hilly district. The church of St Mary replaced an ancient one in 1848; a Norman doorway is preserved from the original structure. The site of a Norman priory can be traced. Several early earthworks are seen in the vicinity, among which the circular camp on Bury Hill, S.W. of the town, is a very fine example. It is probably of British origin. Andover is the centre of a large agricultural district. Malting is carried on and there is a large iron-foundry; but the silk manufactures, once prosperous, are now extinct. The corporation consists of a mayor, 4 aldermen and 12 councillors.

There are numerous Roman villas in the district, but Andover itself is not a Roman site. The town, the name of which appears in the forms Andefeian, Andieura and Andever, probably owes much of its importance to the neighbourhood of the Roman road from Silchester to Old Sarum. It is mentioned in King Edred's will, a document of doubtful authenticity, dated *c.* 955. Later the Witenagemot met here, and it is the traditional scene of the meeting of Æthelred and Olaf the Dane. Andover existed as a borough before 1176, and Henry II. exempted its inhabitants from toll and passage. In 1201 King John increased the farm paid by the burgesses, while Henry III. granted them return of writs, probate of wills and other privileges. The corporation was reconstituted in 1599 and again in 1682. From 1295 till 1305 the burgesses returned two members to parliament but then ceased to do so till 1586. After the reform of 1867 they returned only one member and in 1885 the borough was disfranchised. A gild merchant is mentioned as early as 1175. The cattle-market was granted in 1682, and there is an ancient corn-market, probably held by prescription. The November sheep-fair dates from 1205, and the neighbouring fair at Weyhill (since 1599 a part of the borough) was formerly among the most important in England. The town possessed an iron-market early in the 14th century. At that date the wool-trade also was very prosperous, and the manufactures of silk and parchment are among the extinct industries of the town.

ANDOVER, a township of Essex county, Massachusetts, U.S.A., pleasantly situated on the S. side of the Merrimac Valley. Pop. (1890) 6142; (1900) 6813; (1910, U. S. census) 7301. The Shawsheen river supplies power for a considerable manufacturing industry (twine, woollens and rubber goods being manufactured) in the villages of Andover, Ballardville and Frye. Andover, the principal village, is about 23 m. N. of Boston and is served by the western division of the Boston & Maine railway and by interurban electric railways. The township is noteworthy for its educational institutions. Abbot Academy, opened in 1829, is said to be the oldest existing academy in the United States incorporated for the education of girls alone; an art gallery, given to the academy by Mrs John Byers, was opened in 1907. Phillips Academy, opened in 1778 (incorporated in 1780), was the first incorporated academy of the state; it was founded through the efforts of Samuel Phillips (1752–1802, president of the Massachusetts senate in 1785–1787 and in 1788–1801, and lieutenant-governor of Massachusetts in 1801–1802), by his father, Samuel Phillips (1715–1790), and his uncle, John Phillips (1719–1795), "for the purpose of instructing youth, not only in English and Latin grammar, writing, arithmetic and those sciences wherein they are commonly taught, but more especially to learn them the great end and real business of living." It is one of the largest secondary schools in New England and enjoys a wide and high reputation. An archaeological department, with an important collection in American archaeology, was founded by Robert S. Peabody and his wife in 1901. The Academy grounds include those occupied in 1808–1909 by the Andover Theological Seminary before its removal to Cambridge (*q.v.*). Andover was settled about 1643 and was incorporated in 1646, being named from the English town of Andover, Hampshire, whence some of the chief settlers had migrated; the first settlement was made in what is now the township of North Andover (pop. 5529 in 1910), which was separated from Andover in 1855. Simon Bradstreet (1603–1697), important among the early men of Massachusetts, was one of the founders; and his wife, Anne Dudley Bradstreet (1612–1672), was the first woman versifier of America; the Bradstreet house in North Andover, said to have been built about 1667, is still standing. Andover was a prominent centre in the witchcraft trials of 1692. Elizabeth Stuart Phelps-Ward was born and lived for many years in Andover, and Harriet Beecher Stowe lived here from 1852 to 1864 and is buried here.

See S. L. Bailey, *Historical Sketches of Andover* (Boston, 1880); John L. Taylor, *Memoir of Samuel Phillips* (Boston, 1856); and Philena and Phebe F. M'Keen, *History of Abbot Academy* (Andover, 1880).

ANDRADA, DIEGO DE PAIVA DE (1528–1575), Portuguese theologian, was born at Coimbra, son of the grand treasurer of John III. His original bent was towards foreign mission. He earned distinction in 1562 at the council of Trent as envoy of King Sebastian. Between 1562 and 1567 he published many controversial tracts, especially against the Lutheran, Martin Chemnitz (*q.v.*). His first tract, *De Societatis Jesu Origine*, led to his being erroneously presumed a Jesuit (P. Alegambe, *Biblioth. Scriptorum S. J.*, 1676, p. 177). His *De Conciliorum Auctoritate* was welcomed at Rome as exalting the papal authority. Posthumous were his *Defensio Tridentinae Fidei*, 1578 (remarkable for its learned statement of various opinions regarding the Immaculate Conception), and three sets of his sermons in Portuguese.

His nephew, Diego, the younger (1586–1660), produced *Chauleidos* (1628) and other Latin poems, including sacred dramas; a novel, *Casamento Perfeito* (1630); and shone as a historical critic.

See *Bibliographie Universelle* (1811); N. Antonio, *Biblioth. Hisp. Nova* (1783), i. 304; and for the nephew, life by A. Dos Reys in *Corp. Illust. Poet. Lat.* (1745) iii.

ANDRADA E SYLVA, BONIFACIO JOZÉ D' (1765–1838), Brazilian statesman and naturalist, was born at Villa de Santos, near Rio Janeiro. In 1800 he was appointed professor of geology at Coimbra, and soon after inspector-general of the Portuguese mines; and in 1812 he was made perpetual secretary of the Academy of Lisbon. Returning to Brazil in 1819, he urged Dom Pedro to resist the recall of the Lisbon court, and was appointed one of his ministers in 1821. When the independence of Brazil was declared, Andrada was made minister of the interior and of foreign affairs; and when it was established, he was again elected by the Constituent Assembly, but his democratic principles resulted in his dismissal from office, July 1823. On the dissolution of the Assembly in November, he was arrested and banished to France, where he lived in exile near Bordeaux till, in 1829, he was permitted to return to Brazil. But being again arrested in 1833, and tried for intriguing on behalf of Dom Pedro I., he passed the rest of his days in retirement till he died at Nictheroy in 1838.

ANDRÁSSY, JULIUS (Gyula), Count (1823–1890), Hungarian statesman, the son of Count Károly Andrássy and Etelka Szapáry, was born at Kassa in Hungary on the 8th of March 1823. The son of a Liberal father, who belonged to the Opposition at a time when to be in opposition was to be in danger, Andrássy at a very early age threw himself into the political struggles of the day, adopting at the outset the patriotic side. Count István Széchenyi was the first adequately to appreciate his capacity, when in 1845 the young man first began his public career as president of the society for the regulation of the waters of the Upper Theiss. In 1846 he attracted attention by his bitter articles against the government in Kossuth's paper, the *Pesti Hirlap*, and was returned as one of the Radical candidates to the diet of 1848, where his generous, impulsive nature made him one of the most thorough-going of the patriots. When the Croats under Jellachich invaded Hungary, Andrássy placed himself at the head of the gentry of his county, and served with distinction at the battles of Pákozd and Schwechat, as Görgei's adjutant (Sept. 1848). Towards the end of the war Andrássy was sent to Constantinople by the revolutionary government to obtain at least the neutrality of Turkey during the struggle. After the catastrophe of Vilagós he migrated first to London and then to Paris. On the 21st of September 1851 he was hanged in effigy by the Austrian government for his share in the Hungarian revolt. He employed his ten years of exile in studying politics in what was then the centre of European diplomacy, and it is memorable that his keen eye detected the inherent weakness of the second French empire beneath its imposing exterior. Andrássy returned home from exile in 1858, but his position was very difficult. He had never petitioned for an amnesty, steadily rejected all the overtures both of the Austrian government and of the Magyar Conservatives (who would have accepted something short of full autonomy), and clung enthusiastically to the Deák party. On the 21st of December 1865 he was chosen vice-president of the diet, and in March 1866 became president of the sub-committee appointed by the parliamentary commission to draw up the Composition (commonly known as the *Ausgleich*) between Austria and Hungary, of which the central idea, that of the "Delegations," originated with him. It was said at that time that he was the only member of the commission who could persuade the court of the justice of the national claims. After Königgrätz he was formally consulted by the emperor for the first time. He advised the re-establishment of the constitution and the appointment of a responsible ministry.

On the 17th of February 1867 the king appointed him the first constitutional Hungarian premier. It was on this occasion that Deák called him "the providential statesman given to Hungary by the grace of God." As premier, Andrássy by his firmness, amiability and dexterity as a debater, soon won for himself a commanding position. Yet his position continued to be difficult, inasmuch as the authority of Deák dwarfed that of all the party leaders, however eminent. Andrássy chose for himself the departments of war and foreign affairs. It was he who reorganized the Honved system, and he used often to say that the regulation of the military border districts was the most difficult labour of his life. On the outbreak of the Franco-German War of 1870, Andrássy resolutely defended the neutrality of the Austrian monarchy, and in his speech on the 28th of July 1870 warmly protested against the assumption that it was in the interests of Austria to seek to recover the position she had held in Germany before 1863. On the fall of Beust (6th of November 1871), Andrássy stepped into his place. His tenure of the chancellorship was epoch-making. Hitherto the empire of the Habsburgs had never been able to dissociate itself from its Holy Roman traditions. But its loss of influence in Italy and Germany, and the consequent formation of the Dual State, had at length indicated the proper, and, indeed, the only field for its diplomacy in the future—the near East, where the process of the crystallization of the Balkan peoples into nationalities was still incomplete. The question was whether these nationalities were to be allowed to become independent or were only to exchange the tyranny of the sultan for the tyranny of the tsar. Hitherto Austria had been content either to keep out the Russians or share the booty with them. She was now, moreover, in consequence of her misfortunes deprived of most of her influence in the councils of Europe. It was Andrássy who recovered for her her proper place in the European concert. First he approached the German emperor; then more friendly relations were established with the courts of Italy and Russia by means of conferences at Berlin, Vienna, St Petersburg and Venice.

The "Andrássy Note."

The recovered influence of Austria was evident in the negotiations which followed the outbreak of serious disturbances in Bosnia in 1875. The three courts of Vienna, Berlin and St Petersburg had come to an understanding as to their attitude in the Eastern question, and their views were embodied in the despatch, known as the "Andrássy Note," addressed on the 30th of December 1875 by Count Andrássy to Count Beust, now Austrian ambassador to the court of St James's. In it he pointed out that the efforts of the powers to localize the revolt seemed in danger of failure, that the rebels were still holding their own, and that the Ottoman promises of reform, embodied in various *firmans*, were no more than vague statements of principle which had never had, and were probably not intended to have, any local application. In order to avert the risk of a general conflagration, therefore, he urged that the time had come for concerted action of the powers for the purpose of pressing the Porte to fulfil its promises. A sketch of the more essential reforms followed: the recognition rather than the toleration of the Christian religion; the abolition of the system of farming the taxes; and, in Bosnia and Herzegovina, where the religious was complicated by an agrarian question, the conversion of the Christian peasants into free proprietors, to rescue them from their double subjection to the great Mussulman landowners. In Bosnia and Herzegovina also elected provincial councils were to be established, irremovable judges appointed and individual liberty guaranteed. Finally, a mixed commission of Mussulmans and Christians was to be empowered to watch over the carrying out of these reforms. The fact that the sultan would be responsible to Europe for the realization of his promises would serve to allay the natural suspicions of the insurgents.[1]

To this plan both Great Britain and France gave a general assent, and the Andrássy Note was adopted as the basis of negotiations. When war became inevitable between Russia and the Porte, Andrássy arranged with the Russian court that, in case Russia prevailed, the *status quo* should not be changed to the detriment of the Austrian monarchy. When, however, the treaty of San Stefano threatened a Russian hegemony in the near East, Andrássy concurred with the German and British courts that the final adjustment of matters must be submitted to a European congress. At the Berlin Congress in 1878 he was the principal Austrian plenipotentiary, and directed his efforts to diminish the gains of Russia and aggrandize the Dual Monarchy. The latter object was gained by the occupation of Bosnia-Herzegovina under a mandate from the congress. This occupation was most unpopular in Hungary, both for financial reasons and because of the strong philo-Turk sentiments of the Magyars, but the result brilliantly justified Andrássy's policy. Nevertheless he felt constrained to bow before the storm, and placed his resignation in the emperor's hands (8th of October 1879). The day before his retirement he signed the offensive-defensive alliance with Germany, which placed the foreign relations of Austria-Hungary once more on a stable footing.

After his retirement, Andrássy continued to take an active part in public affairs both in the Delegations and in the Upper House. In 1885 he warmly supported the project for the reform of the House of Magnates, but on the other hand he jealously defended the inviolability of the Composition of 1867, and on the 5th of March 1889 in his place in the Upper House spoke against any particularist tampering with the common army. In the last years of his life he regained his popularity, and his death on the 18th of February 1890 was universally mourned as a national calamity. He was the first Magyar statesman who, for centuries, had occupied a European position. Breadth of view, swift resourcefulness, and an intimate knowledge of men and things were his distinguishing qualities as a statesman. Personally he was the most amiable of men; it has been well said that he united in himself the Magyar magnate with the modern gentleman. His motto was: "It is hard to promise, but it is easy to perform." If Deák was the architect, Andrássy certainly was the master-builder of the modern Hungarian state.

By his wife, the countess Katinka Kendeffy, whom he married in Paris in 1856, Count Andrássy left two sons, and one daughter, Ilona (b. 1859), who married Count Lajos Batthyány. Both the sons gained distinction in Hungarian politics. The eldest, Tivador (Theodore) Andreas (b. 10th of July 1857), was elected vice-president of the Lower House of the Hungarian parliament in 1890. The younger, Gyula (Julius, b. 30th of June 1860), became under-secretary in the Wekerle ministry in 1892; in 1893 he became minister of education, and in June 1894 was appointed minister in attendance on the king, retiring in 1895 with Wekerle; in 1898, with his elder brother, he left the Liberal party, but returned to it again after the fall of the Bánffy ministry; he is the author of *Ungarns Ausgleich mit Österreich vom Jahre 1867* (Ger. ed., Leipzig, 1897), and a work in Hungarian on the origins of the Hungarian state and constitution (Budapest, 1901).

See Andrássy's *Speeches* (Hung.) edited by Béla Lederer (Budapest, 1891); *Memoir* (Hung.) by Benjamin Kállay (Budapest, 1891); *Necrology* (Hung.) in the *Akad. Ertesitö*, Evf. 14 (Budapest, 1891); *Recollections of Count Andrássy* (Hung.), by Máno Kónyi (Budapest, 1891).
(R. N. B.)

ANDRÉ, JOHN (1751–1780), British soldier, was born in London in 1751 of Genevese parents. Accident brought him in 1769 to Lichfield, where, in the house of the Rev. Thomas Seward, whose daughter Anna was the centre of a literary circle, he met the beautiful Miss Honora Sneyd. A strong attachment sprang up between the two, but their marriage was disapproved of by Miss Sneyd's family, and André was sent to cool his love in his father's counting-house in London and on a business tour to the continent. Commerce was, however, too tame an occupation for his ambitious spirit, and in March 1771 he obtained a commission in the Seventh (Royal Fusiliers), which, after travel in Germany, he joined in Canada in 1774. Here his character, conduct and accomplishments gained him rapid promotion. Miss Sneyd in 1773 married R. L. Edgeworth, the father of the novelist, Maria Edgeworth, having previously refused Thomas Day, the author of *Sandford and Merton*; but André remained faithful to his love for her. In a letter to Anna Seward, written shortly after being taken prisoner by the Americans at the capitulation of St John's on the 3rd of November 1775, he states that he has been "stripped of everything except the picture of Honora, which I concealed in my mouth. Preserving this I yet think myself fortunate." Exchanged towards the close of 1776, André became in succession aide-de-camp to General Grey and to the commander-in-chief of the British forces, Sir Henry Clinton, who raised him to the rank of major and appointed him adjutant-general of the forces in 1778. Early in 1780 the American general, Benedict Arnold (*q.v.*), thinking himself injuriously treated by his colleagues, made overtures to the British to betray to them the important fortress of West Point on the Hudson river, the key of the American position, of which he was commandant. This seemed to Sir Henry Clinton a favourable opportunity for concluding the war, and Major André was appointed to negotiate with Arnold. For this purpose he landed from a vessel bearing a flag of truce and had an interview with Arnold, who delivered to him full particulars and plans of the fortress of West Point, and arranged with him to co-operate with the British during an attack which was to be made in a few days. Unfortunately for André, the British vessel was fired on before the negotiations were finished and obliged to drop down the river. André, therefore, could not return by the way he came and was compelled to pass the night within the American lines. After making the fatal mistake of exchanging his uniform for a civilian disguise, he set out next day by land for New York, provided by Arnold with a passport, and succeeded in passing the regular American outposts undetected. Next day, however, just when all danger seemed to be over, André was stopped by three American militiamen, to whom he gave such contradictory answers that, in spite of Arnold's pass, they searched him and discovered in his boots the fatal proofs of his negotiations for the betrayal of West Point. Notwithstanding his offer of a large sum for his release, his captors delivered him up to the nearest American officer. Washington, although admitting that André was "more unfortunate than criminal," sent him before a court-martial, by which, notwithstanding a spirited defence, he was, in consequence of his own admissions, condemned to death as a spy. In spite of the protests and entreaties of Sir Henry Clinton and the threats of Arnold he was hanged at Tappan on the 2nd of October 1780. Arnold, warned by the unfortunate André, escaped by flight the punishment he so richly merited. The justice of André's execution has been a fruitful theme for discussion, but both British and American military writers are agreed that he undoubtedly acted in the character of a spy, although under orders and entirely contrary to his own feelings. Washington's apparent harshness in refusing the condemned man a soldier's death by shooting has also been censured, but it is evident that no other course was open to the American commander, since a mitigation of the sentence would have implied a doubt as to its justice. Besides courage and distinguished military talents, Major André was a proficient in drawing and in music, and showed considerable poetic talent in his humorous *Cow-chase*, a kind of parody on *Chevy-chase*, which appeared in three successive parts at New York, the last on the very day of his capture. His fate excited universal sympathy both in America and Europe, and the whole British army went into mourning for him. A mural sculptured monument to his memory was erected in Westminster Abbey by the British government when his remains were brought over and interred there in 1821; and a memorial has been erected to him by Americans on the spot where he was taken. André's military journal, giving an interesting account of the British movements in America from June 1777 to the close of 1778, was taken to England in 1782 by General Grey, whose descendant, Earl Grey, discovered it in 1902 and disposed of it to an American gentleman.

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[1] Hertslet, *Map of Europe by Treaty*, No. 456, vol. iv. p. 2418.

See *The Life and Career of Major John André, &c.*, by Winthrop Sargent (new ed., New York, 1902); *André's Journal* (Boston, Mass., The Bibliophile Society, 1904).

ANDREA, GIOVANNI (1275–1348), Italian canonist, was born at Mugello, near Florence, about 1275. He studied canon law at Bologna, where he distinguished himself in this subject so much that he was made professor at Padua, and later at Pisa and Bologna, rapidly acquiring a high reputation for his learning and his moral character. Curious stories are told of him; for instance, that by way of self-mortification he lay every night for twenty years on the bare ground with only a bear's skin for a covering; that in an audience he had with Pope Boniface VIII. his extraordinary shortness of stature led the pope to believe he was kneeling, and to ask him three times to rise, to the immense merriment of the cardinals; and that he had a daughter, Novella, so accomplished in law as to be able to read her father's lectures in his absence, and so beautiful, that she had to read behind a curtain lest her face should distract the attention of the students. He is said to have died at Bologna of the plague in 1348, and an epitaph in the church of the Dominicans in which he was buried, calling him *Rabbi Doctorum*, *Lux*, *Censor*, *Normaque Morum*, testifies to the public estimation of his character. Andrea wrote a *Gloss on the Sixth Book of the Decretals*, *Glosses on the Clementines* and a *Commentary on the Rules of Sextus*. His additions to the *Speculum* of Durando are a mere adaptation from the *Consilia* of Oldradus, as is also the book *De Sponsalibus et Matrimonio*, from J. Anguisciola.

ANDREA DEL SARTO (1487–1531). This celebrated painter of the Florentine school was born in Gualfonda, Florence, in 1487, or perhaps 1486, his father Agnolo being a tailor (*sarto*): hence the nickname by which the son is constantly designated. There were four other children. The family, though of no distinction, can be traced back into the 14th century. Vannucchi has since 1677 been constantly given as the surname—according to some modern writers, without any authority. It has recently been said that the true name is Andrea d'Agnolo di Francesco di Luca di Paolo del Migliore. But this only gives, along with our painter's Christian name, the Christian names of his antecessors for five generations, and is in no way his own surname. In 1494 Andrea was put to work under a goldsmith. This occupation he disliked. He took to drawing from his master's models, and was soon transferred to a skilful woodcarver and inferior painter named Gian Barile, with whom he remained until 1498. Barile, though a coarse-grained man enough, would not stand in the way of the advancement of his promising pupil, so he recommended him to Piero di Cosimo as draughtsman and colourist. Piero retained Andrea for some years, allowing him to study from the famous cartoons of Leonardo da Vinci and Michelangelo. Finally Andrea agreed with his friend Franciabigio, who was somewhat his senior, that they would open a joint shop; at a date not precisely defined they took a lodging together in the Piazza del Grano. Their first work in partnership may probably have been the "Baptism of Christ," for the Florentine Compagnia dello Scalzo, a performance of no great merit, the beginning of a series, all the extant items of which are in monochrome chiaroscuro. Soon afterwards the partnership was dissolved. From 1509 to 1514 the brotherhood of the Servites employed Andrea, as well as Franciabigio and Andrea Feltrini, the first-named undertaking in the portico of the Annunziata three frescoes illustrating the life of the Servite saint Filippo Benizzi (d. 1285). He executed them in a few months, being endowed by nature with remarkable readiness and certainty of hand and unhesitating firmness in his work, although in the general mould of his mind he was timid and diffident. The subjects are the saint sharing his cloak with a leper, cursing some gamblers, and restoring a girl possessed with a devil. The second and third works excel the first, and are impulsive and able performances. These paintings met with merited applause, and gained for their author the pre-eminent title "Andrea senza errori" (Andrew the unerring)—the correctness of the contours being particularly admired. After these subjects the painter proceeded with two others—the death of S. Filippo and the children cured by touching his garment,—all the five works being completed before the close of 1510. The youth of twenty-three was already in technique about the best fresco-painter of central Italy, barely rivalled by Raphael, who was the elder by four years. Michelangelo's Sixtine frescoes were then only in a preliminary stage. Andrea always worked in the simplest, most typical and most trying method of fresco—that of painting the thing once and for all, without any subsequent dry-touching. He now received many commissions. The brotherhood of the Servites engaged him to do two more frescoes in the Annunziata at a higher price; he also painted, towards 1512, an Annunciation in the monastery of S. Gallo.

The "Tailor's Andrew" appears to have been an easy-going plebeian, to whom a modest position in life and scanty gains were no grievances. As an artist he must have known his own value; but he probably rested content in the sense of his superlative powers as an executant, and did not aspire to the rank of a great inventor or leader, for which, indeed, he had no vocation. He led a social sort of life among his compeers of the art, was intimate with the sculptor Rustici, and joined a jolly dining-club at his house named the Company of the Kettle, also a second club named the Trowel. At one time, Franciabigio being then the chairman of the Kettle-men, Andrea recited, and is by some regarded as having composed, a comic epic, "The Battle of the Frogs and Mice"—a rechauffé, as one may surmise, of the Greek *Batrachomyomachia*, popularly ascribed to Homer. He fell in love with Lucrezia (del Fede), wife of a hatter named Carlo Recanati; the hatter dying opportunely, the tailor's son married her on the 26th of December 1512. She was a very handsome woman and has come down to us treated with great suavity in many a picture of her lover-husband, who constantly painted her as a Madonna and otherwise; and even in painting other women he made them resemble Lucrezia in general type. She has been much less gently handled by Vasari and other biographers. Vasari, who was at one time a pupil of Andrea, describes her as faithless, jealous, overbearing and vixenish with the apprentices. She lived to a great age, surviving her husband forty years.

By 1514 Andrea had finished his last two frescoes in the court of the Servites, than which none of his works was more admired—the "Nativity of the Virgin," which shows the influence of Leonardo, Domenico Ghirlandajo and Fra Bartolommeo, in effective fusion, and the "Procession of the Magi," intended as an amplification of a work by Baldovinetti; in this fresco is a portrait of Andrea himself. He also executed at some date a much-praised head of Christ over the high altar. By November 1515 he had finished at the Scalzo the allegory of Justice, and the "Baptist preaching in the desert,"—followed in 1517 by "John baptizing," and other subjects. Before the end of 1516 a "Pietà" of his composition, and afterwards a Madonna, were sent to the French court. These were received with applause; and the art-loving monarch Francis I. suggested in 1518 that Andrea should come to Paris. He journeyed thither towards June of that year, along with his pupil Andrea Sguazzella, leaving his wife in Florence, and was very cordially received, and for the first and only time in his life was handsomely remunerated. Lucrezia, however, wrote urging his return to Italy. The king assented, but only on the understanding that his absence from France was to be short; and he entrusted Andrea with a sum of money to be expended in purchasing works of art for his royal patron. The temptation of having a goodly amount of pelf in hand proved too much for Andrea's virtue. He spent the king's money and some of his own in building a house for himself in Florence. This necessarily brought him into bad odour with Francis, who refused to be appeased by some endeavours which the painter afterwards made to reingratiate himself. No serious punishment, however, and apparently no grave loss of professional reputation befell the defaulter.

In 1520 he resumed work in Florence, and executed the "Faith" and "Charity" in the cloister of the Scalzo. These were succeeded by the "Dance of the Daughter of Herodias," the "Beheading of the Baptist," the "Presentation of his head to Herod," an allegory of Hope, the "Apparition of the Angel to Zacharias" (1523), and the monochrome of the Visitation. This last was painted in the autumn of 1524, after Andrea had returned from Luco in Mugello,—to which place an outbreak of plague in Florence had driven him, his wife, his step-daughter and other relatives. In 1525 he painted the very famous fresco named the "Madonna del Sacco," a lunette in the cloisters of the Servites; this picture (named after a sack against which Joseph is represented propped) is generally accounted his masterpiece. His final work at the Scalzo was the "Birth of the Baptist" (1526), executed with some enhanced elevation of style after Andrea had been diligently studying Michelangelo's figures in the sacristy of S. Lorenzo. In the following year he completed at S. Salvi, near Florence, a celebrated "Last Supper," in which all the personages seem to be portraits. This also is a very fine example of his style, though the conception of the subject is not exalted. It is the last monumental work of importance which Andrea del Sarto lived to execute. He dwelt in Florence throughout the memorable siege, which was soon followed by an infectious pestilence. He caught the malady, struggled against it with little or no tending from his wife, who held aloof, and he died, no one knowing much about it at the moment, on the 22nd of January 1531, at the comparatively early age of forty-three. He was buried unceremoniously in the church of the Servites.

Various portraits painted by Andrea are regarded as likenesses of himself, but this is not free from some doubt. One is in London, in the National Gallery, an admirable half-figure, purchased in 1862. Another is at Alnwick Castle, a young man about twenty years of age, with his elbow on a table. Another at Panshanger may perhaps represent in reality his pupil Domenico Conti. Another youthful portrait is in the Uffizi Gallery, and the Pitti Gallery contains more than one. Among his more renowned works not already specified are the following. The Virgin and Child, with St Francis and St John the Evangelist and two angels, now in the Uffizi, painted for the church of S. Francesco in Florence; this is termed the "Madonna di S. Francesco," or "Madonna delle Arpie," from certain figures of harpies which are decoratively introduced, and is rated as Andrea's masterpiece in oil-painting. The altar-piece in the Uffizi, painted for the monastery of S. Gallo, the "Fathers disputing on the doctrine of the Trinity"—SS. Augustine, Dominic, Francis, Lawrence, Sebastian and Mary Magdalene—a very energetic work. Both these pictures are comparatively early—towards 1517. The "Charity" now in the Louvre (perhaps the only painting which Andrea executed while in France). The "Pietà," in the Belvedere of Vienna; this work, as well as the "Charity," shows a strong Michelangelesque influence. At Poggio a Caiano a celebrated fresco (1521) representing Julius Caesar receiving tribute, various figures bringing animals from foreign lands—a striking perspective arrangement; it was left unfinished by Andrea and was completed by Alessandro Allori. Two very remarkable paintings (1523) containing various incidents in the life of the patriarch Joseph, executed for the Borgherini family. In the Pitti Gallery two separate compositions of the "Assumption of the Virgin," also a fine "Pietà." In the Madrid museum the "Virgin and Child," with Joseph, Elizabeth, the infant Baptist and an Archangel. In the Louvre the "Holy Family," the Baptist pointing upwards. In Berlin a portrait of his wife. In Panshanger a fine portrait named "Laura." The second picture in the National Gallery ascribed to Andrea, a "Holy Family," is by some critics regarded as the work rather of one of his scholars—we hardly know why. A very noticeable incident in the life of Andrea del Sarto relates to the copy, which he produced in 1523, of the portrait group of Leo X. by Raphael; it is now in the Naples Museum, the original being in the Pitti Gallery. Ottaviano de' Medici, the owner of the original, was solicited by Frederick II., duke of Mantua, to present it to him. Unwilling to part with so great a pictorial prize and unwilling also to disoblige the duke, Ottaviano got Andrea to make the copy, which was consigned to the duke as being the original. So deceptive was the imitation that even Giulio Romano, who had himself manipulated the original to some extent, was completely taken in; and, on showing the supposed Raphael years afterwards to Vasari, who knew the facts, he could only be undeceived when a private mark on the canvas was named to him by Vasari and brought under his eye. It was Michelangelo who had introduced Vasari in 1524 to Andrea's studio. He is said to have thought very highly of Andrea's powers, saying on one occasion to Raphael, "There is a little fellow in Florence who will bring sweat to your brow if ever he is engaged in great works."

Andrea had true pictorial style, a very high standard of correctness and an enviable balance of executive endowments. The point of technique in which he excelled least was perhaps that of discriminating the varying textures of different objects and surfaces. There is not much elevation or ideality in his works—much more of reality. His chiaroscuro is not carried out according to strict rule, but is adjusted to his liking for harmony of colour and fused tone and transparence; in fresco more especially his predilection for varied tints appears excessive. It may be broadly said that his taste in colouring was derived mainly from Fra Bartolommeo, and in form from Michelangelo; and his style partakes of the Venetian and Lombard, as well as the Florentine and Roman—some of his figures are even adapted from Albert Dürer. In one way or other he continued improving to the last. In drawing from nature, his habit was to sketch very slightly, making only such a memorandum as sufficed to work from. The scholars of Andrea were very numerous; but, according to Vasari, they were not wont to stay long, being domineered over by his wife; Pontormo and Domenico Puligo may be mentioned.

In this account of Andrea del Sarto we have followed the main lines of the narrative of Crowe and Cavalcaselle, supplemented by Vasari, Lanzi and others.

There are biographies by Biadi (1829), by von Reumont (1831), by Baumann (1878), and by Guinness (1899). (W. M. R.)

ANDREANI, ANDREA, Italian engraver on wood, in chiaroscuro, was born at Mantua about 1540 (Brulliot says 1560) and died at Rome in 1623. His engravings are scarce and valuable, and are chiefly copies of Mantegna, Dürer and Titian. The most remarkable of his works are "Mercury and Ignorance," the "Deluge," "Pharaoh's host drowned in the Red Sea" (after Titian), the "Triumph of Caesar" (after Mantegna), and "Christ retiring from the judgment-seat of Pilate."

ANDREE, KARL (1808–1875), German geographer, was born at Brunswick on the 20th of October 1808. He was educated at Jena, Göttingen and Berlin. After having been implicated in a students' political agitation he became a journalist, and in 1851 founded the *Bremer Handelsblatt*. From 1855, however, he devoted himself entirely to geography and ethnography, working successively at Leipzig and at Dresden. In 1862 he founded the important geographical periodical *Globus*. His works include *Nordamerika in geographischen und geschichtlichen Umrissen* (Brunswick, 1854), *Geographische Wanderungen* (Dresden, 1859), and *Geographie des Welthandels* (Stuttgart, 1867–1872). He died at Wildungen on the 10th of August 1875.

His son Richard, born on the 26th of February 1835, followed his father's career, devoting himself especially to ethnography. He wrote numerous books on this subject, dealing notably with the races of his own country, while an important general work was *Ethnographische Parallelen und Vorgleiche* (Stuttgart, 1878). He also took up cartography, having a chief share in the production of the *Physikalisch-statistische Atlas des deutschen Reiches* (Leipzig, 1877), *Allgemeine Handatlas* (first ed., 1881), and other atlases; and he continued the editorship of the *Globus*.

ANDRÉE, SALOMON AUGUST (1854–1897?), Swedish engineer, was born at Grenna, on Lake Vetter, on the 18th of October 1854. After education at the Stockholm technical college, he studied aeronautics, and in 1895 elaborated a plan for crossing the north polar region by a balloon which should be in some degree dirigible by sails and trailing ropes. After an abortive effort in 1896, the winds being contrary, he started with two companions from Danes Island, Spitsbergen, on the 11th of July 1897. The party was never seen again, nor is the manner of its fate known. Of several expeditions sent in search of it, the first started in November 1897, on the strength of a report of cries of distress heard by shipwrecked sailors at Spitsbergen; in 1898 and 1899 parties searched the north Asiatic coast and the New Siberia Islands; and in May 1899 Dr Nathorst headed an expedition to eastern Greenland. None was successful, and only scanty information was obtained or inferred from the discovery of a few buoys (on the west of Spitsbergen, northern Norway, Iceland, &c.) which the balloonists had arranged to drop, and a message taken from a carrier pigeon despatched from the balloon two days after its ascent. There were also messages in two of the buoys, but they dated only from the day of the ascent. The others were empty.

ANDREINI, FRANCESCO, Italian actor, was born at Pistoia in the last half of the 16th century. He was a member of the company of the *Gelosi* which Henry IV. summoned to Paris to please his bride, the young queen Marie de' Medici. His wife Isabella Andreini (1562–1604) was a member of her husband's company, distinguished alike for her acting and her character,—commemorated in the medal struck at Lyons in the year of her death, with her portrait on one side, and the figure of Fame on the reverse with the words *aeterna fama*. She was also known in literature, her books including a pastoral, *Mirtilla* (Verona, 1588), a volume of songs, sonnets and other poems (Milan, 1601), and a collection of letters, published after her death. She inspired many of the French poets, notably Isaac du Ryer (d. *c.* 1631). Her son Giambattista Andreini (1578–1650) was born in Florence, and had a great success as a comedian in Paris under the name of Leylio. He was a favourite with Louis XIII., and also with the public, especially as the young lover. He left a number of plays full of extravagant imagination. The best known are *L'Adamo* (Milan, 1613), *The Penitent Magdalene* (Mantua, 1617), and *The Centaur* (Paris, 1622). From the first of these three volumes, which are extremely rare, Italians have often asserted that Milton, travelling at that time in their country, took the idea of *Paradise Lost*.

ANDRÉOSSY, ANTOINE-FRANÇOIS, Count (1761–1828), French soldier and diplomatist, was born at Castelnaudary, in Languedoc, on the 6th of March 1761. He was of Italian extraction, and his ancestor François Andréossy (1633–1688) had been concerned with Riquet in the construction of the Languedoc Canal in 1669. He had a brilliant career at the school of artillery at Metz, obtained his commission in 1781, and became captain in 1788. On the outbreak of the Revolution he adopted its principles. He saw active service on the Rhine in 1794 and in Italy in 1795, and in the campaign of 1796–97 was employed in engineer duties with the Army of Italy. He became *chef de brigade* in December 1796 and general of brigade in 1798, in which year he accompanied Bonaparte to Egypt. He served in the Egyptian campaign with distinction, and was selected as one of Napoleon's companions on his return to Europe. Andréossy took part in the *coup d'état* of the 18th of Brumaire, and on the 6th of January 1800 was made general of division. Of particular importance was his term of office as ambassador to England during the short peace which followed the treaties of Amiens and Lunéville. It had been shown (Coquille, *Napoleon and England*, 1904) that Andréossy repeatedly warned Napoleon that the British government desired to maintain peace but must be treated with consideration. His advice, however, was disregarded. When Napoleon became emperor he made Andréossy inspector-general of artillery and a count of the empire. In the war of 1805 Andréossy was employed on the headquarters staff of Napoleon. From 1808 to 1809 he was French ambassador at Vienna, where he displayed a hostility to Austria which was in marked contrast to his friendliness to England in 1802–1803. In the war of 1809, Andréossy was military governor of Vienna during the French occupation. In 1812 he was sent by Napoleon as ambassador to Constantinople, where he carried on the policy initiated by Sébastiani. In 1814 he was recalled by Louis XVIII. Andréossy now retired into private life, till the escape of his former master from Elba once again called him forth. In 1826 he was elected to the *Académie des Sciences*, and in the following year was deputy for the department of the Aude. His numerous works included the following:—on artillery (with which arm he was most intimately connected throughout his military career), *Quelques idées relatives à l'usage de l'artillerie dans l'attaque et . . . la défense des places* (Metz); *Essai sur le tir des projectiles creux* (Paris, 1826); and on military history, *Campagne sur le Main et la Rednitz de l'armée gallo-batave* (Paris, 1802); *Opérations des pontonniers en Italie . . . 1795–1796* (Paris, 1843). He also wrote scientific memoirs on the mouth of the Black Sea (1818–1819); on certain Egyptian lakes (during his stay in Egypt); and in particular the history of the Languedoc Canal (*Histoire du canal du Midi*, 2nd ed., Paris, 1804), the chief credit of which he claimed for his ancestor. Andréossy died at Montauban in 1828.

See Marion, *Notice nécrologique sur le Lt.-Général Comte Andréossy.*

ANDRÉS, JUAN (1740–1817), Spanish Jesuit, was born at Planes in the province of Valencia, and became professor of literature at Gandia and finally royal librarian at Naples. He died at Rome on the 12th of January 1817. He is the author of many miscellaneous treatises on science, music, the art of teaching the deaf and dumb, &c. But his chief work, the labour of fully twenty years, is entitled *Dell' origine, progressi, e stato attuale d' ogni Letteratura* (7 vols., Parma, 1782–1799). A Spanish translation by his brother Carlos appeared at Madrid between 1784 and 1806, and an abridgment in French (1838–1846) was compiled by the Jesuit Alexis Nerbonne. The original was frequently reprinted during the first half of the 19th century.

See C. Sommervogel, *Bibliothèque de la compagnie de Jésus, première partie* (Brussels and Paris), vol. i. col. 342-350.

ANDREW (Gr. Ἀνδρέας, manly), the Christian Apostle, brother of Simon Peter, was born at Bethsaida on the Lake of Galilee. He had been a disciple of John the Baptist (John i. 37-40) and was one of the first to follow Jesus. He lived at Capernaum (Mark i. 29). In the gospel story he is referred to as being present on some important occasions as one of the disciples more closely attached to Jesus (Mark xiii. 3; John vi. 8, xii. 22); in Acts there is only a bare mention of him (i. 13). Tradition relates that he preached in Asia Minor and in Scythia, along the Black Sea as far as the Volga. Hence he became a patron saint of Russia. He is said to have suffered crucifixion at Patras (Patrae) in Achaea, on a cross of the form called *Crux decussata* (X) and commonly known as "St Andrew's cross." According to tradition his relics were removed from Patras to Constantinople, and thence to St Andrews (see below). The apocryphal book, *The Acts of Andrew*, mentioned by Eusebius, Epiphanius and others, is generally attributed to Leucius the Gnostic. It was edited and published by C. Tischendorf in the *Acta Apostolorum apocrypha* (Leipzig, 1821). This book, as well as a *Gospel of St Andrew*, was declared apocryphal by a decree of Pope Gelasius. Another version of the Andrew legend is found in the *Passio Andreae*, published by Max Bonnet (*Supplementum II Codicis apocryphi*, Paris, 1895). On this was founded an Anglo-Saxon poem ("Andreas und Elene," first published by J. Grimm, 1841; cf. C. W. Goodwin, *The Anglo-Saxon Legends of S. Andreas and S. Veronica*, 1851). The festival of St Andrew is held on the 30th of November.

See Apocryphal Literature; also Lipsius, *Die apokryphen Apostelgeschichten und Apostellegenden*, vol. i. (1883), and Hastings' *Dictionary of the Bible*, s.v.

Scottish Legends.—About the middle of the 8th century Andrew became the patron saint of Scotland. Concerning this there are several legends which state that the relics of Andrew were brought under supernatural guidance from Constantinople to the place where the modern St Andrews stands (Pictish, Muckross; Gaelic, Kilrymont). The oldest stories (preserved in the Colbertine MSS., Paris, and the Harleian MSS. in the British Museum) state that the relics were brought by one Regulus to the Pictish king Angus (or Ungus) Macfergus (*c.* 731–761). The only historical Regulus (*Riagail* or *Rule*, whose name is preserved by the tower of St Rule) was an Irish monk expelled from Ireland with St Columba; his date, however, is *c.* 573–600. There are good reasons for supposing that the relics were originally in the collection of Acca, bishop of Hexham, who took them into Pictland when he was driven from Hexham (*c.* 732), and founded a see, not, according to tradition, in Galloway, but on the site of St Andrews. The connexion with Regulus is, therefore, due in all probability to the desire to date the foundation of the church at St Andrews as early as possible.

See A. Lang, *St Andrews* (London, 1893), pp. 4 ff.; W. F. Skene, *Celtic Scotland*; also the article St Andrews.

ANDREW II. (1175–1235), king of Hungary, son of Bela III., king of Hungary, succeeded his nephew, the infant Ladislaus III., in 1205. No other Magyar king, perhaps, was so mischievous to his country. Valiant, enterprising, pious as he was, all these fine qualities were ruined by a reckless good nature which never thought of the morrow. He declares in one of his decrees that the generosity of a king should be limitless, and he acted up to this principle throughout his reign. He gave away everything, money, villages, domains, whole counties, to the utter impoverishment of the treasury, thereby rendering the crown, for the first time in Hungarian history, dependent upon the great feudatories, who, in Hungary as elsewhere, took all they could get and gave as little as possible in return. In all matters of government, Andrew was equally reckless and haphazard. He is directly responsible for the beginnings of the feudal anarchy which wellnigh led to the extinction of the monarchy at the end of the 13th century. The great feudatories did not even respect the lives of the royal family, for Andrew was recalled from a futile attempt to reconquer Galicia (which really lay beyond the Hungarian sphere of influence), through the murder of his first wife Gertrude of Meran (September 24, 1213), by rebellious nobles jealous of the influence of her relatives. In 1215 he married Iolanthe of France, but in 1217 was compelled by the pope to lead a crusade to the Holy Land, which he undertook in hopes of being elected Latin emperor of Constantinople. The crusade excited no enthusiasm in Hungary, but Andrew contrived to collect 15,000 men together, whom he led to Venice; whence, not without much haggling and the surrender of all the Hungarian claims upon Zara, about two-thirds of them were conveyed to Acre. But the whole expedition was a forlorn hope. The Christian kingdom of Palestine was by this time reduced to a strip of coast about 440 sq. m. in extent, and after a drawn battle with the Turks on the Jordan (November 10), and fruitless assaults on the fortresses of the Lebanon and on Mount Tabor, Andrew started home (January 18, 1218) through Antioch, Iconium, Constantinople and Bulgaria. On his return he found the feudal barons in the ascendant, and they extorted from him the Golden Bull (see Hungary, *History*). Andrew's last exploit was to defeat an invasion of Frederick of Austria in 1234. The same year he married his third wife, Beatrice of Este. Besides his three sons, Bela, Coloman and Andrew, Andrew had a daughter Iolanthe, who married the king of Aragon. He was also the father of St Elizabeth of Hungary.

No special monograph for the whole reign exists, but there is a good description of Andrew's crusade in Reinhold Roehricht, *Geschichte des Königreiches Jerusalem* (Innsbruck, 1898). The best account of Andrew's government is in László Szalay's *History of Hungary* (Hung.), vol. i. (Leipzig and Pest, 1851–1862). (R. N. B.)

ANDREW OF LONGJUMEAU (Longumeau, Lonjumel, &c.), a French Dominican, explorer and diplomatist. He accompanied the mission under Friar Ascelin, sent by Pope Innocent IV. to the Mongols in 1247; at the Tatar camp near Kars he met a certain David, who next year (1248) appeared at the court of King Louis IX. of France in Cyprus. Andrew, who was now with St Louis, interpreted to the king David's message, a real or pretended offer of alliance from the Mongol general Ilchikdai (Ilchikadai), and a proposal of a joint attack upon the Islamic powers for the conquest of Syria. In reply to this the French sovereign despatched Andrew as his ambassador to the great Khan Kuyuk; with Longjumeau went his brother (a monk) and several others—John Goderiche, John of Carcassonne, Herbert "le sommelier," Gerbert of Sens, Robert a clerk, a certain William, and an unnamed clerk of Poissy. The party set out about the 16th of February 1249, with letters from King Louis and the papal legate, and rich presents, including a chapel-tent, lined with scarlet cloth and embroidered with sacred pictures. From Cyprus they went to the port of Antioch in Syria, and thence travelled for a year to the khan's court, going ten leagues a day. Their route led them through Persia, along the southern and eastern shores of the Caspian (whose inland character, unconnected with the outer ocean, their journey helped to demonstrate), and probably through Talas, north-east of Tashkent. On arrival at the supreme Mongol court—either that on the Imyl river (near Lake Ala-kul and the present Russo-Chinese frontier in the Altai), or more probably at or near Karakorum itself, south-west of Lake Baikal—Andrew found Kuyuk Khan dead, poisoned, as the envoy supposed, by Batu's agents. The regent-mother Ogul Gaimish (the "Camus" of Rubruquis) seems to have received and dismissed him with presents and a letter for Louis IX., the latter a fine specimen of Mongol insolence. But it is certain that before the friar had quitted "Tartary," Mangu Khan, Kuyuk's successor, had been elected. Andrew's report to his sovereign, whom he rejoined in 1251 at Caesarea in Palestine, appears to have been a mixture of history and fable; the latter affects his narrative of the Mongols' rise to greatness, and the struggles of their leader, evidently Jenghiz Khan, with Prester John; it is still more evident in the position assigned to the Tatar homeland, close to the prison of Gog and Magog. On the other hand, the envoy's account of Tatar manners is fairly accurate, and his statements about Mongol Christianity and its prosperity, though perhaps exaggerated (*e.g.* as to the 800 chapels on wheels in the nomadic host), are based on fact. Mounds of bones marked his road, witnesses of devastations which other historians record in detail; Christian prisoners, from Germany, he found in the heart of "Tartary" (at Talas); the ceremony of passing between two fires he was compelled to observe, as a bringer of gifts to a dead khan, gifts which were of course treated by the Mongols as evidence of submission. This insulting behaviour, and the language of the letter with which Andrew reappeared, marked the mission a failure: King Louis, says Joinville, "se repenti fort."

We only know of Andrew through references in other writers: see especially William of Rubruquis in *Recueil de voyages*, iv. (Paris, 1839), pp. 261, 265, 279, 296, 310, 353, 363, 370; Joinville, ed. Francisque Michel (1858, &c.), pp. 142, &c.; Jean Pierre Sarrasin, in same vol., pp. 254-255; William of Nangis in *Recueil des historiens des Gaules*, xx. 359-367; Rémusat, *Mémoires sur les relations politiques des princes chrétiens . . . avec les . . . Mongols* (1822, &c.), p. 52. (C. R. B.)

ANDREW, JOHN ALBION (1818–1867), American political leader, "war governor" of Massachusetts, was born at Windham, Maine, on the 31st of May 1818. He graduated at Bowdoin College in 1837, studied law in Boston, was admitted to the Suffolk bar in 1840, and practised his profession in Boston. He also took a deep interest in religious matters, was a prominent member of the Church of the Disciples (Unitarian; founded in Boston by the Rev. James Freeman Clarke), and was assistant editor for some time of *The Christian World*, a weekly religious paper. With ardent anti-slavery principles, he entered political life as a "Young Whig" opposed to the Mexican War; he became an active Free-Soiler in 1848, and in 1854 took part in the organization in Massachusetts of the new Republican party. He served one term, in 1858, in the state House of Representatives, and in 1859 declined an appointment to a seat on the bench of the state supreme court. In this year he took such an active part in raising funds to defend John Brown, then on trial in Virginia, that he aroused the suspicions of a senatorial committee investigating Brown's raid, and was summoned to Washington to tell what he knew of the affair. In 1860 he was chairman of the Massachusetts delegation to the Republican national convention at Chicago, which nominated Lincoln for the presidency; and from 1861 to January 1866, throughout the trying period of the Civil War, he was governor of Massachusetts, becoming known as one of the ablest, most patriotic and most energetic of the remarkable group of "war governors" in the North. Immediately after his inauguration he began filling the militia regiments with young men ready for active service, saw that they were well drilled and supplied them with good modern rifles. As a result, Massachusetts was the only northern state in any way prepared for war when the Confederates fired on Fort Sumter; and her troops began to muster in Boston on the 16th of April, the very day after President Lincoln's call for volunteers. On the next day the Sixth Massachusetts Volunteer Infantry started south for the defence of Washington, and was the first fully armed and equipped volunteer regiment to reach the capital. Within six days after the call, nearly four thousand Massachusetts volunteers had departed for Washington. In 1863, at Governor Andrew's own request, the secretary of war authorized him to raise several regiments of negro troops, with white commissioned officers, and the Fifty-fourth Massachusetts Infantry was the first regiment of free negroes raised in the North. Governor Andrew's example was quickly followed in other states, and before the end of the year 36,000 negroes had been enrolled in the Union armies. When the war department ruled that the negro troops were entitled to pay only as "labourers" and not as soldiers, Governor Andrew used all his influence with the president and the secretary of war to secure for them the same pay as white troops, and was finally successful. Notwithstanding his loyal support of the administration during the struggle, he did not fully approve of its conduct of the war, which he deemed shifting and timid; and it was with great reluctance that he supported Lincoln in 1864 for a second term. In 1865 he rejected the more radical views of his party as to the treatment to be accorded to the late Confederate states, opposed the immediate and unconditional enfranchisement of freedmen, and, though not accepting President Johnson's views in their entirety, he urged the people of Massachusetts to give the new president their support. On retiring from the governor's office he declined the presidency of Antioch College, at Yellow Springs, Ohio, and various positions in the service of the Federal government, and resumed the practice of law, at once achieving great success. In 1865 he presided at the first national convention of the Unitarian Church. He died suddenly of apoplexy, at Boston, on the 30th of October 1867.

See Henry G. Pearson's *Life of John A. Andrew* (2 vols., Boston and New York, 1904).

ANDREWES, LANCELOT (1555–1626), English divine, was born in 1555 in London. His family was an ancient Suffolk one; his father, Thomas, became master of Trinity House. Lancelot was sent to the Cooper's free school, Ratcliff, in the parish of Stepney, and then to the Merchant Taylors' school under Richard Mulcaster. In 1571 he was entered as a Watts scholar at Pembroke Hall, Cambridge, where in 1574–1575 he graduated B.A., proceeding M.A. in 1578. In 1576 he had been elected fellow of Pembroke. In 1580 he took orders; in 1581 he was incorporated M.A. at Oxford. As catechist at his college he read lectures on the Decalogue, which, both on their delivery and on their publication (in 1630), created much interest. He also gained much reputation as a casuist. After a residence in the north as chaplain to Henry Hastings, earl of Huntingdon, President of the North, he was made vicar of St Giles's, Cripplegate, in 1588, and there delivered his striking sermons on the temptation in the wilderness and the Lord's prayer. In a great sermon on the 10th of April (Easter week) 1588, he stoutly vindicated the Protestantism of the Church of England against the Romanists, and, oddly enough, adduced "Mr Calvin" as a new writer, with lavish praise and affection. Andrewes was preferred to the prebendal stall of St Pancras in St Paul's, London, in 1589, and on the 6th of September of the same year became master of his own college of Pembroke, being at the time one of the chaplains of Archbishop Whitgift. From 1589 to 1609 he was also prebendary of Southwell. On the 4th of March 1590, as one of the chaplains of Queen Elizabeth, he preached before her a singularly outspoken sermon, and in October gave his introductory lecture at St Paul's, undertaking to comment on the first four chapters of Genesis. These seem to have been worked up later into a compilation called *The Orphan Lectures* (1657). Andrewes was an incessant worker as well as preacher, and often laboured beyond his strength. He delighted to move among the people, and yet found time to meet with a society of antiquaries, of which Raleigh, Sidney, Burleigh, Arundel, the Herberts, Saville, Stow and Camden were members. In 1598 he declined the two bishoprics of Ely and Salisbury, as the offers were coupled with a proposal to alienate part of the revenues of those sees. On the 23rd of November 1600 he preached at Whitehall a remarkable sermon on justification, which gave rise to a memorable controversy. On the 4th of July 1601 he was appointed dean of Westminster and gave much attention to the school there. He assisted at the coronation of James I. and in 1604 took part in the Hampton Court conference. His name is the first on the list of divines appointed to make the authorized version of the Bible. In 1605 he was consecrated bishop of Chichester and made lord almoner. In 1609 he published *Tortura Torti*, a learned work which grew out of the Gunpowder

Plot controversy and was written in answer to Bellarmine's *Matthaeus Tortus*, which attacked James I.'s book on the oath of allegiance. After his translation to Ely (1609), he again controverted Bellarmine in the *Responsio ad Apologiam*, a treatise never answered. In 1617 he accompanied James I. to Scotland with a view to persuading the Scots that Episcopacy was preferable to Presbyterianism. In 1618 he attended the synod of Dort, and was soon after made dean of the Chapel Royal and translated to Winchester, a diocese which he administered with loving prudence and the highest success. He died on the 26th of September 1626, mourned alike by leaders in church and state.

Two generations later, Richard Crashaw caught up the universal sentiment, when, in his lines "Upon Bishop Andrewes' Picture before his Sermons," he exclaims:—

> "This reverend shadow cast that setting sun,
> Whose glorious course through our horizon run,
> Left the dim face of this dull hemisphere,
> All one great eye, all drown'd in one great teare."

Andrewes was distinguished in many fields. At court, though no trifler or flatterer, he was a favourite counsellor in three successive reigns, but he never meddled much in civil or temporal affairs. His learning made him the equal and the friend of Grotius, and of the foremost contemporary scholars. His preaching was a unique combination of rhetorical splendour and scholarly richness; his piety that of an ancient saint, semi-ascetic and unearthly in its self-denial. As a churchman he is typically Anglican, equally removed from the Puritan and the Roman positions. He stands in true succession to Richard Hooker in working out the principles of the English Reformation, though while Hooker argued mainly against Puritanism, Andrewes chiefly combated Romanism. A good summary of his position is found in his *First Answer to Cardinal Perron*, who had challenged James I.'s use of the title "Catholic." His position in regard to the Eucharist is naturally more mature than that of the first reformers. "As to the Real Presence we are agreed; our controversy is as to the *mode* of it. As to the mode we define nothing rashly, nor anxiously investigate, any more than in the Incarnation of Christ we ask how the human is united to the divine nature in One Person. There is a real change in the elements—we allow *ut panis iam consecratus non sit panis quem natura formavit; sed, quem benedictio consecravit, et consecrando etiam immutavit*" (*Responsio*, p. 263). Adoration is permitted, and the use of the terms "sacrifice" and "altar" maintained as being consonant with scripture and antiquity. Christ is "a sacrifice—so, to be slain; a propitiatory sacrifice—so, to be eaten" (*Sermons*, vol. ii. p. 296). "By the same rules that the Passover was, by the same may ours be termed a sacrifice. In rigour of speech, neither of them; for to speak after the exact manner of divinity, there is but one only sacrifice, *veri nominis*, that is Christ's death. And that sacrifice but once actually performed at His death, but ever before represented in figure, from the beginning; and ever since repeated in memory to the world's end. That only absolute, all else relative to it, representative of it, operative by it. . . . Hence it is that what names theirs carried, ours do the like, and the Fathers make no scruple at it—no more need we" (*Sermons*, vol. ii. p. 300). As to reservation, "it needeth not: the intent is had without it," since an invalid may always have his private communion. Andrewes declares against the invocation of saints, the apparent examples in patristic literature are "rhetorical outbursts, not theological definitions." His services to his church have been summed up thus:—(1) he has a keen sense of the proportion of the faith and maintains a clear distinction between what is fundamental, needing ecclesiastical commands, and subsidiary, needing only ecclesiastical guidance and suggestion; (2) as distinguished from the earlier protesting standpoint, *e.g.* of the Thirty-nine Articles, he emphasized a positive and constructive statement of the Anglican position.

LITERATURE.—Of his works the *Manual of Private Devotions* is the best known, for it appeals to Christians of every church. One of the many good modern editions is that by Alex. Whyte (1900). Andrewes's other works occupy eight volumes in the Library of Anglo-Catholic Theology (1841–1854). Of biographies we have those by H. Isaacson (1650), A. T. Russell (1863), R. L. Ottley (1894), and Dean Church's essay in *Masters in English Theology*. See also W. H. Frere, *Lancelot Andrewes as a Representative of Anglican Principles* (1898; Church Hist. Soc. Publications, No. 44).

ANDREWS, JAMES PETTIT (*c.* 1737–1797), English historian and antiquary, was the younger son of Joseph Andrews, of Shaw House, Newbury, Berkshire, where he was born. He was educated privately, and having taken to the law was one of the magistrates at the police court in Queen Square, Westminster, from 1792 to his death. He developed a taste for literature, and his miscellaneous works include *The Savages of Europe* (London, 1764), a satire on the English which he translated from the French, and *Anecdotes Ancient and Modern* (London, 1789), an amusing collection of gossip. His chief work was a *History of Great Britain connected with the Chronology of Europe from Caesar's Invasion to Accession of Edward VI.*, in 2 vols. (London, 1794–1795). Its plan is somewhat singular, as a portion of the history of England is given on one page, and a general sketch of the contemporaneous history of Europe on the opposite page. He also wrote a *History of Great Britain from Death of Henry VIII. to Accession of James VI. of Scotland*, a continuation of Robert Henry's *History of Great Britain*, published in 1796 and again in 1806. Andrews died at Brompton on the 6th of August 1797, and was buried in Hampstead Church. He married Anne Penrose, daughter of a rector of Newbury.

ANDREWS, THOMAS (1813–1885), Irish chemist and physicist, was born on the 19th of December 1813 at Belfast, where his father was a linen merchant. After attending the Belfast Academy and also the Academical Institution, he went to Glasgow in 1828 to study chemistry under Professor Thomas Thomson, and thence migrated to Trinity College, Dublin, where he gained distinction in classics as well as in science. Finally, he graduated as M.D. at Edinburgh in 1835, and settled down to a successful medical practice in his native place, also giving instruction in chemistry at the Academical Institution. Ten years later he was appointed vice-president of the newly established Queen's College, Belfast, and professor of chemistry, and these two offices he held till 1879, when failing health compelled his retirement. He died on the 26th of November 1885. Andrews first became known as a scientific investigator by his work on the heat developed in chemical actions, for which the Royal Society awarded him a Royal medal in 1844. Another important research, undertaken with P. G. Tait, was devoted to ozone. But the work on which his reputation mainly rests, and which best displayed his skill and resourcefulness in experiment, was concerned with the liquefaction of gases. He carried out a very complete inquiry into the laws expressing the relations of pressure, temperature and volume in carbonic dioxide, in particular establishing the conceptions of critical temperature and critical pressure, and showing that the gas passes from the gaseous to the liquid state without any breach of continuity.

His scientific papers were published in a collected form in 1889, with a memoir by Professors Tait and Crum Brown.

ANDRIA, a town and episcopal see of Apulia, Italy, in the province of Bari; 35m. W. of the town of Bari by steam tramway, and 6 m. S.S.E. of Barletta. Pop. (1901) 49,569. It was founded probably about 1046 by Peter, the first Norman count of Andria. It was a favourite residence of the emperor Frederick II., whose second and third wives, Iolanthe and Isabella of England, were buried in the cathedral dedicated to St Richard, who is believed to have come from England in 492; their tombs, however, no longer exist. There are several other fine churches of the 13th century. The Castel del Monte, 9½ m. S. of Andria, was constructed by Frederick II., who frequently resided here; it is an octagonal building in two storeys with octagonal towers at each angle, and was further surrounded by three outer walls. Despite its massive and imposing exterior, its details are fine.

See E. Rocchi in *L'Arte*, i. (1898) 121.

ANDRIEU, BERTRAND (1761–1822), French engraver of medals, was born at Bordeaux. He is considered as the restorer of the art in France, which had declined after the time of Louis XIV.; and during the last twenty years of his life he was entrusted by the French government with the execution of every work of importance. Many of his medals are figured in the *Medallic History of Napoleon.*

ANDRIEUX, FRANÇOIS GUILLAUME JEAN STANISLAS (1759–1833), French man of letters, was born at Strassburg on the 6th of May 1759. He was educated at Strassburg and proceeded to Paris to study law. There he became a close friend of Collin d'Harleville. He became secretary to the duke of Uzès, and practised at the bar, but his attention was divided between his profession and literature. His plays are of the 18th century style, comedies of intrigue, but they rank with those of Collin d'Harleville among the best of the period next to those of Beaumarchais. *Les Étourdis*, his best comedy, was represented in 1788 and won for the author the praise of La Harpe. Andrieux hailed the beginning of the Revolution with delight and received a place under the new government, but at the beginning of the Terror he retreated to Mévoisins, the patrimony of his friend Collin d'Harleville. Under the Convention he was made civil judge in the Court of Cassation, and was one of the original members of the Institute. A moderate statesman, he was elected secretary and finally president of the Tribunat, but with other of his colleagues he was expelled for his irreconcilable attitude towards the establishment of the civil code. On his retirement he again turned to write for the stage, producing *Le Trésor* and *Molière avec ses amis* in 1804. He became librarian to Joseph Bonaparte and to the Senate, was professor of grammar and literature at the École Polytechnique and eventually at the Collège de France. As a professor he was extraordinarily successful, and his lectures, which have unhappily not been preserved, attracted mature men as well as the ordinary students. He was rigidly classical in his tastes, and an ardent opponent of romanticism, which tended in his opinion to the subversion of morals. Among his other plays are *La Comédienne* (1816), one of his best comedies, and a tragedy, *Lucius Junius Brutus* (1830). Andrieux was the author of some excellent stories and fables: *La Promenade de Fénelon*, *Le Bulle d'Alexandre VI.* and the *Meunier de Saint-Souci*. In 1829 he became perpetual secretary to the Academy, and in fulfilment of his functions he worked hard at the completion of the Dictionary. He died on the 9th of May 1833 in Paris.

See also A. H. Taillandier, *Notice sur la vie et les ouvrages d'Andrieux* (1850); Sainte-Beuve, *Portraits littéraires*, vol. i.

ANDRISCUS, often called the "pseudo-Philip," a fuller of Adramyttium, who claimed to be a son of Perseus, last king of Macedonia. He occupied the throne for a year (149–148 B.C.). Unable to obtain a following in Macedonia, he applied to Demetrius Soter of Syria, who handed him over to the Romans. He contrived, however, to escape; reappeared in Macedonia with a large body of Thracians; and, having completely defeated the praetor Publius Juventius (149), he assumed the title of king. His conquest of Thessaly and alliance with Carthage made the situation dangerous. Eventually he was defeated by Q. Caecilius Metellus (148), and fled to Thrace, whose prince gave him up to Rome. He figured in the triumph of Metellus (146), who received the title of "Macedonicus" for his victory. Andriscus's brief reign was marked by cruelty and extortion. After this Macedonia was formally reduced to a province.

Velleius Paterculus i. 11; Florus ii. 14; Livy, *Epit.* 49, 50, 52; Diod. Sic. xxxii. 9.

ANDROCLUS, a Roman slave who lived about the time of Tiberius. He is the hero of a story told by Aulus Gellius (v. 14), which states that Androclus had taken refuge from the cruelties of his master in a cave in Africa, when a lion entered the cave and showed him his swollen paw, from which Androclus extracted a large thorn. The grateful animal subsequently recognized him when he had been captured and thrown to the wild beasts in the circus, and, instead of attacking him, began to caress him (Aelian, *De Nat. An.* vii. 48).

ANDROMACHE, in Greek legend, the daughter of Eëtion, prince of Thebe in Mysia, and wife of Hector. Her father and seven brothers fell by the hands of Achilles when their town was taken by him; her mother, ransomed at a high price, was slain by Artemis (*Iliad*, vi. 414). During the Trojan War her husband was slain by Achilles, and after the capture of the city her son Astyanax (or Scamandrius) was hurled from the battlements (Eurip. *Troades*, 720). When the captives were allotted, Andromache fell to Neoptolemus (Pyrrhus), the son of Achilles, whom she accompanied to Epirus, and to whom she bore three sons. When Neoptolemus was slain at Delphi, he left his wife and kingdom to Helenus, the brother of Hector (Virgil, *Aen.* iii. 294). After the death of her third husband, Andromache returned to Asia Minor with her youngest son Pergamus, who there founded a town named after himself. Andromache is one of the finest characters in Homer, distinguished by her affection for her husband and child, her misfortunes and the resignation with which she endures them. The death of Astyanax, and the farewell scene between Andromache and Hector (*Iliad*, vi. 323), were represented in ancient works of art, while Andromache herself is the subject of tragedies by Euripides and Racine.

ANDROMEDA, in Greek legend, the daughter of Cepheus and Cassiopeia (Cassiope, Cassiepeia), king and queen of the Ethiopians. Cassiopeia, having boasted herself equal in beauty to the Nereïds, drew down the vengeance of Poseidon, who sent an inundation on the land and a sea-monster which destroyed man and beast. The oracle of Ammon having announced that no relief would be found until the king exposed his daughter Andromeda to the monster, she was fastened to a rock on the shore. Here Perseus, returning from having slain the Gorgon, found her, slew the monster, set her free, and married her in spite of Phineus, to whom she had before been promised. At the wedding a quarrel took place between the rivals, and Phineus was turned to stone by the sight of the Gorgon's head (Ovid, *Metam.* v. 1). Andromeda followed her husband to Tiryns in Argos, and became the ancestress of the family of the Perseidae. After her death she was placed by Athena amongst the constellations in the northern sky, near Perseus and Cassiopeia. Sophocles and Euripides (and in modern times Corneille) made the story the subject of tragedies, and its incidents were represented in numerous ancient works of art.

Apollodorus ii. 4; Hyginus, *Fab.* 64; Ovid, *Metam.* iv. 662; Fedde, *De Perseo et Andromeda* (1860).

The Greeks personified the constellation Andromeda as a woman with her arms extended and chained. Its Latin names are *Persea*, *Mulier catenata* ("chained woman"), *Virgo devota*, &c.; the Arabians replaced the woman by a seal; Wilhelm Schickard (1592–1635) named the constellation "Abigail"; Julius Schiller assigned to it the figure of a sepulchre, naming it the "Holy Sepulchre." In 1786 Johann Elert Bode formed a new constellation, named the "Honours of Frederick," after his patron Frederick II., out of certain stars situated in the arm of Ptolemy's Andromeda; this innovation found little favour and is now discarded.

Twenty-three stars are catalogued by Ptolemy and Tycho Brahe; Hevelius increased this number to forty-seven, while Flamsteed gave sixty-six. The most brilliant stars are α *Andromedae* or "Andromeda's head," and β *Andromedae* in the girdle (Arabic *mirach* or *mizar*), both of the second magnitude; γ *Andromedae* in the foot (*alamak* or *alhames*), of the third magnitude. Scientific interest centres mainly on the following:—the nebula in Andromeda, one of the finest in the sky (see NEBULA); γ *Andromedae*, the finest binary in the heavens, made up of a yellow star of magnitude $2\frac{1}{2}$, and a blue-green of magnitude $5\frac{1}{2}$, the latter being itself binary; *Nova Andromedae*, a "new" star, discovered in the nebula by C. E. A. Hartwig in 1885, and subsequently spectroscopically examined by many observers; *R Andromedae*, a regularly variable star; and the *Andromedids*, a meteoric swarm, associated with Biela's comet, and having their radiant in this constellation (see METEOR).

ANDRON (Gr. ἀνδρών), that part of a Greek house which was reserved for men, as distinguished from the gynaeceum (γυναικεῖον), the women's quarters.

ANDRONICUS I. (COMNENUS), emperor of the East, son of Isaac, and grandson of Alexius I. Comnenus, was born about the beginning of the 12th century. He was endowed by nature with the most remarkable gifts both of mind and body. He was handsome and eloquent, but licentious; and at the same time active, hardy, courageous, a great general and an able politician. His early years were spent in alternate pleasure and military service. In 1141 he was taken captive by the Turks (Seljuks) and remained in their hands for a year. On being ransomed he went to Constantinople, where was held the court of his cousin, the emperor Manuel, with whom he was a great favourite. Here the charms of his niece, the princess Eudoxia, attracted him. She became his mistress, while her sister Theodora stood in a similar relation to the emperor Manuel. In 1152, accompanied by Eudoxia, he set out for an important command in Cilicia. Failing in his principal enterprise, an attack upon Mopsuestia, he returned, but was again appointed to the command of a province. This second post he seems also to have left after a short interval, for he appeared again in Constantinople, and narrowly escaped death at the hands of the brothers of Eudoxia. About this time (1153) a conspiracy against the emperor, in which Andronicus participated, was discovered and he was thrown into prison. There he remained for about twelve years, during which time he made repeated but unsuccessful attempts to escape. At last, in 1165, he was successful; and, after passing through many dangers, reached the court of Yaroslav, grand prince of Russia, at Kiev. While under the protection of the grand prince, Andronicus brought about an alliance between him and the emperor Manuel, and so restored himself to the emperor's favour. With a Russian army he joined Manuel in the invasion of Hungary and assisted at the siege of Semlin. After a successful campaign they returned together to Constantinople (1168); but a year after, Andronicus refused to take the oath of allegiance to the prince of Hungary, whom Manuel desired to become his successor. He was removed from court, but received the province of Cilicia. Being still under the displeasure of the emperor, Andronicus fled to the court of Raymund, prince of Antioch. While residing here he captivated and seduced the beautiful daughter of the prince, Philippa, sister of the empress Maria. The anger of the emperor was again roused by this dishonour, and Andronicus was compelled to fly. He took refuge with Amalric, king of Jerusalem, whose favour he gained, and who invested him with the town of Berytus, now Beirut. In Jerusalem he saw Theodora, the beautiful widow of the late king Baldwin and niece of the emperor Manuel. Although Andronicus was at that time fifty-six years old, age had not diminished his charms, and Theodora became the next victim of his artful seduction. To avoid the vengeance of the emperor, she fled with him to the court of the sultan of Damascus; but not deeming themselves safe there, they continued their perilous journey through Persia and Turkestan, round the Caspian Sea and across Mount Caucasus, until at length they settled among the Turks on the borders of Trebizond. Into that province Andronicus, with a body of adventurers, made frequent and successful incursions. While he was absent upon one of them, his castle was surprised by the governor of Trebizond, and Theodora with her two children were captured and sent to Constantinople. To obtain their release Andronicus made abject submission to the emperor; and, appearing in chains before him, implored pardon. This he obtained, and was allowed to retire with Theodora into banishment in the little town of Oenoe, on the shores of the Black Sea. In 1180 the emperor Manuel died, and was succeeded by his son Alexius II., who was under the guardianship of the empress Maria. Her conduct excited popular indignation; and the consequent disorders, amounting almost to civil war, gave an opportunity to the ambition of Andronicus. He left his retirement, secured the support of the army and marched upon Constantinople, where his advent was stained by a cruel massacre of the Latin inhabitants. Alexius was compelled to acknowledge him as colleague in the empire, but was soon put to death. Andronicus, now (1183) sole emperor, married Agnes, widow of Alexius II., a child eleven years of age. His short reign was characterized by strong and wise measures. He resolved to suppress many abuses, but, above all things, to check feudalism and limit the power of the nobles. The people, who felt the severity of his laws, at the same time acknowledged their justice, and found themselves protected from the rapacity of their superiors. The aristocrats, however, were infuriated against him, and summoned to their aid William of Sicily. This prince landed in Epirus with a strong force, and marched as far as Thessalonica, which he took and destroyed; but he was shortly afterwards defeated, and compelled to return to Sicily. Andronicus seems then to have resolved to exterminate the aristocracy, and his plans were nearly crowned with success. But in 1185, during his absence from the capital, his lieutenant ordered the arrest and execution of Isaac Angelus, a descendant of the first Alexius. Isaac escaped and took refuge in the church of St Sophia. He appealed to the populace, and a tumult arose which spread rapidly over the whole city. When Andronicus arrived he found that his power was overthrown, and that Isaac had been proclaimed emperor. Isaac delivered him over to his enemies, and for three days he was exposed to their fury and resentment. At last they hung him up by the feet between two pillars. His dying agonies were shortened by an Italian soldier, who mercifully plunged a sword into his body. He died on the 12th of September 1185.

ANDRONICUS II. (Palaeologus) (1260–1332), eastern Roman emperor, was the elder son of Michael Palaeologus, whom he succeeded in 1282. He allowed the fleet, which his father had organized, to fall into decay; and the empire was thus less able than ever to resist the exacting demands of the rival powers of Venice and Genoa. During his reign the Turks under Osman conquered nearly the whole of Bithynia; and to resist them the emperor called in the aid of Roger di Flor, who commanded a body of Spanish adventurers. The Turks were defeated, but Roger was found to be nearly as formidable an enemy to the imperial power. He was assassinated by Andronicus's son and colleague, the emperor Michael IX., in 1305. His adventurers (known as the Catalan Grand Company) declared war upon Andronicus, and, after devastating Thrace and Macedonia, conquered the duchy of Athens and Thebes. From 1320 onwards the emperor was engaged in war with his grandson Andronicus (see below). He abdicated in 1328 and died in 1332.

ANDRONICUS III. (*c.* 1296–1341), eastern Roman emperor, was the son of Michael, son of Andronicus II. His conduct during youth was so violent that, after the death of his father Michael in 1320, his grandfather resolved to deprive him of his right to the crown. Andronicus rebelled; he had a powerful party, and the first period of civil war ended in his being crowned and accepted as colleague by his grandfather, 1325. The quarrel broke out again and, notwithstanding the help of the Bulgarians, the older emperor was compelled to abdicate, 1328. During his reign Andronicus III. was engaged in constant war, chiefly with the Turks, who greatly extended their conquests. He annexed large regions in Thessaly and Epirus, but they were lost before his death to the rising power of Servia under Stephen Dušan. He did something for the reorganization of the navy, and recovered Lesbos and Chios from the Genoese. He died in 1341.

ANDRONICUS OF CYRRHUS, Greek astronomer, flourished about 100 B.C. He built a *horologium* at Athens, the so-called "tower of the winds," a considerable portion of which still exists. It is octagonal, with figures carved on each side, representing the eight principal winds. A brazen Triton on the summit, with a rod in his hand, turned round by the wind, pointed to the quarter from which it blew. From this model is derived the custom of placing weathercocks on steeples.

ANDRONICUS OF RHODES (*c.* 70 B.C.), the eleventh scholarch of the Peripatetics. His chief work was the arrangement of the writings of Aristotle and Theophrastus with materials supplied to him by Tyrannion. Besides arranging the works, he seems to have written paraphrases and commentaries, none of which is extant. Two treatises are sometimes erroneously attributed to him, one on the Emotions, the other a commentary on Aristotle's *Ethics* (really by Constantine Palaeocappa in the 16th century, or by John Callistus of Thessalonica).

ANDROPHAGI (Gr. for "man-eaters"), an ancient nation of cannibals north of Scythia (Herodotus iv. 18, 106), probably in the forests between the upper waters of the Dnieper and Don. They were most likely Finns (Samoyed has the same meaning) and perhaps the ancestors of the Mordvinians (*q.v.*).

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K. S.	Kathleen Schlesinger. Author of *The Instruments of the Orchestra*.	**Arghoul; Asor; Aulos.**
L. H.*	Louis Halphen, D.-ès-L. Lecturer on Medieval History at the University of Bordeaux. Formerly Secretary of the École des Chartes, Paris.	**Anjou.**
L. J. S.	Leonard James Spencer, M.A., F.G.S. Department of Mineralogy, British Museum. Formerly Scholar of Sidney Sussex College, Cambridge, and Harkness Scholar. Editor of the *Mineralogical Magazine*.	**Anhydrite; Ankerite;** **Annabergite; Anorthite;** **Apatite; Apophyllite;** **Aragonite; Argentite;** **Argyrodite; Augite.**
L. M. Br.	Louis Maurice Brandin, M.A. Fielden Professor of French and of Romance Philology in the University of London.	**Anglo-Norman Literature.**
L. W.	Lucien Wolf. Vice-President of the Jewish Historical Society of England. Formerly President of the Society. Joint editor of the *Bibliotheca Anglo-Judaica*.	**Anti-Semitism.**
M. G.	Moses Gaster. Chief Rabbi of the Sephardic communities of England. Vice-President, Zionist Congress, 1898, 1899, 1900. Ilchester Lecturer at Oxford on Slavonic and Byzantine Literature, 1886 and 1891. President, Folklore Society of England. Vice-President, Anglo-Jewish Association. Author of *History of Rumanian Popular Literature*; *A New Hebrew Fragment of Ben-Sira*; *The Hebrew Version of Secretum Secretorum of Aristotle*.	**Anthim the Iberian.**
M. H. C.	Montague Hughes Crackanthorpe, K.C., D.C.L. President of the Eugenics Education Society. Formerly Member of the General Council of the Bar and Council of Legal Education. Late Chairman, Incorporated Council of Law Reporting. Honorary Fellow St John's College, Oxford.	**Arbitration,** *International*.
M. J. De G.	Michael Jan de Goeje. See the biographical article: Goeje, Michael Jan de.	**Arabia:** *Literature* (*in part*).
M. Ja.	Morris Jastrow, Ph.D. (Leipzig). Professor of Semitic Languages, University of Pennsylvania. Author of *Religion of the Babylonians and Assyrians*; &c.	**Anu; Assur** (*God*); **Astrology.**
M. L. H.	Lady Huggins. See the biographical article: Huggins, Sir William.	**Armilla; Astrolabe.**
M. N. T.	Marcus Niebuhr Tod, M.A. Fellow and Tutor of Oriel College, Oxford. University Lecturer in Epigraphy. Joint author of *Catalogue of the Sparta Museum*.	**Apella; Archidamus;** **Aristodemus; Aristomenes.**
M. O. B. C.	Maximilian Otto Bismarck Caspari, M.A. Reader in Ancient History at London University. Lecturer in Greek at Birmingham University, 1905–1908. Author of chapters on Greek History in *The Year's Work in Classical Studies*.	**Aratus of Sicyon; Arcadia;** **Argos:** *History*; **Aristides the Just;** **Athens** (*in part*).
M. P.*	Léon Jacques Maxime Prinet. Formerly Archivist to the French National Archives. Auxiliary to the Institute of France (Academy of Moral and Political Sciences).	**Aumale, Duc d'.**
N. M.	Norman McLean, M.A. Fellow, Lecturer and Librarian of Christ's College, Cambridge. University Lecturer in Aramaic. Examiner for the Oriental Languages Tripos and the Theological Tripos at Cambridge.	**Aphraates.**
N. W. T.	Northcote Whitbridge Thomas, M.A. Government Anthropologist to Southern Nigeria. Corresponding Member of the Société d'Anthropologie de Paris. Author of *Thought Transference*; *Kinship and Marriage in Australia*; &c.	**Animal-Worship;** **Animism.**

O. Ba.	Oswald Barron, F.S.A. Editor of *The Ancestor*, 1902–1905. Hon. Genealogist to Standing Council of Honourable Society of Baronetage.	**Arms and Armour:** *English.*
O. Br.	Oscar Briliant.	**Austria:** *Statistics.*
P. A.	Paul Daniel Alphandéry. Professor of the History of Dogma, École Pratique des Hautes Études, Sorbonne, Paris. Author of *Les Idées morales chez les hétérodoxes latines au début du XIII^e siècle.*	**Apostolici;** **Arnold of Brescia.**
P. A. K.	Prince Peter Alexeivitch Kropotkin. See the biographical article: Kropotkin, Prince Peter A.	**Aral; Astrakhan.**
P. C. M.	Peter Chalmers Mitchell, F.R.S., F.Z.S., D.Sc., LL.D. Secretary to the Zoological Society of London from 1903. University Demonstrator in Comparative Anatomy and Assistant to Linacre Professor at Oxford, 1888–1891. Lecturer on Biology at Charing Cross Hospital, 1892–1894; at London Hospital, 1894. Examiner in Biology to the Royal College of Physicians, 1892–1896, 1901–1903. Examiner in Zoology to the University of London, 1903.	**Animal;** **Annelida.**
P. C. Y	Philip Chesney Yorke, M.A. Magdalen College, Oxford.	**Anglesey, 1st Earl of;** **Anne, Queen;** **Anne of Cleves;** **Anne of Denmark;** **Antrim, 1st Marquess of;** **Argyll, Earls and Dukes of;** **Arlington, Earl of.**
P. G.	Percy Gardner, Litt.D., LL.D. See the biographical article: Gardner, Percy.	**Apelles.**
P. Gi.	Peter Giles, M.A., Litt.D., LL.D. Fellow and Classical Lecturer of Emmanuel College, Cambridge, and University Reader in Comparative Philology. Author of *Manual of Comparative Philology.*	**Aryan.**
P. La.	Philip Lake, M.A., F.G.S. Lecturer on Physical and Regional Geography in Cambridge University. Formerly of the Geological Survey of India. Author of *Monograph of British Cambrian Trilobites.* Translator and editor of Kayser's *Comparative Geology.*	**Apennines;** **Asia:** *Geology;* **Austria:** *Geology.*
P. Vi.	Paul Vinogradoff, D.C.L. (Oxford), LL.D. (Cambridge and Harvard). Corpus Professor of Jurisprudence in the University of Oxford. Fellow of the British Academy. Honorary Professor of History in the University of Moscow. Author of *Villainage in England*; *English Society in the 11th Century*; &c.	**Anglo-Saxon Law.**
R.	The Right Hon. Lord Rayleigh. See the biographical article: Rayleigh, 3rd Baron.	**Argon.**
R. A. S. M.	Robert Alexander Stewart Macalister, M.A., F.S.A. Director of Excavations for the Palestine Exploration Fund.	**Ascalon.**
R. A. W.	Colonel Robert Alexander Wahab, C.M.G., C. I. E. Served in the Afghan War, 1878–1880; with the Hazara Expeditions, 1888 and 1891; with the Tirah Expeditionary Force, 1897–1898, &c. Commissioner for the Aden Boundary Delimitation.	**Arabia:** *Modern History*; **Asir.**
R. C. J.	Sir Richard Claverhouse Jebb, LL.D., D.C.L. See the biographical article: Jebb, Sir Richard C.	**Aristophanes.**
R. G.	Richard Garnett, LL.D. See the biographical article: Garnett, Richard.	**Anthology; Apotheosis.**
R. H. C.	Rev. Robert Henry Charles, M.A., D.D., Litt.D. (Oxon.). Grinfield Lecturer and Lecturer in Biblical Studies, Oxford. Fellow of the British Academy. Professor of Biblical Greek at Trinity College, Dublin, 1898–1906. Author of *Critical History of a Future Life*; &c.	**Apocalyptic Literature;** **Apocryphal Literature.**
R. I. P.	Reginald Innes Pocock, F.Z.S., F.L.S. Superintendent of the Zoological Gardens, London.	**Ant-lion; Aphides.**
R. J. M.	Ronald John McNeill, M.A. Christ Church, Oxford. Formerly Editor of the *St James's Gazette* (London).	**Australia:** *Recent Legislation.*
R. L.*	Richard Lydekker, F.R.S., F.G.S., F.Z.S. Author of *Catalogues of Fossil Mammals, Reptiles and Birds in British Museum*; *The Deer of all Lands*; &c.	**Antelope; Arsinoitherium;** **Artiodactyla; Aurochs.**
R. Ma.	Rev. Robert Mackintosh, M.A., D.D. Professor at Lancashire Independent College, Manchester.	**Anthropomorphism; Apologetics; Apotheosis**(*in part*).
R. N. B.	Robert Nisbet Bain (d. 1909). Assistant Librarian, British Museum, 1883–1909. Author of *Scandinavia: the Political History of Denmark, Norway and Sweden, 1513–1900*; *The First Romanovs, 1613 to 1725*; *Slavonic Europe: the Political History of Poland and Russia from 1469 to 1796*; &c.	**Anne, Empress of Russia;** **Apraksin, T. M.;** **Arakcheev, A. A., Count;** **Arany, Janos;** **Armfelt, G. M., Count.**
R. N. W.	Ralph Nicholson Wornum (1812–1877). Keeper of the National Gallery, 1854–1877. Author of *The Epochs of Painting*; &c.	**Arabesque.**
R. P. S.	R. Phené Spiers, F.S.A., F.R.I.B.A. Formerly Master of the Architectural School, Royal Academy, London. Past President of Architectural Association. Associate and Fellow of King's College, London. Corresponding Member of the Institute of France. Editor of *Fergusson's History of Architecture.* Author of *Architecture: East and West*; &c.	**Apse;** **Arcade;** **Arch;** **Architecture.**

R. Po.	René Poupardin, D.-ès-L. Secretary of the École des Chartes. Honorary Librarian at the Bibliothèque Nationale, Paris.	**Arles, Kingdom of.**
R. S.	Lieut.-Gen. Sir Richard Strachey, R.E., G.C.S.I., LL.D., F.R.S. See the biographical article: Strachey, Sir R.	**Asia:** *Climate, Flora and Fauna.*
R. S. C.	Robert Seymour Conway, M.A., D.Litt. (Cantab.). Professor of Latin in the University of Manchester. Formerly Professor of Latin in University College, Cardiff. Fellow of Gonville and Caius College, Cambridge. Author of *The Italic Dialects.*	**Apulia:** *Archaeology*; **Aricini; Aurunci.**
R. Tr.	Roland Truslove, M.A. Fellow and Lecturer in Classics, Worcester College, Oxford. Formerly Scholar of Christ Church, Oxford.	**Arles.**
S. A. C.	Stanley Arthur Cook, M.A. Editor for Palestine Exploration Fund. Formerly Fellow and Lecturer in Hebrew and Syriac, Gonville and Caius College, Cambridge. Examiner in Hebrew and Aramaic, London University, 1904–1908; Council of Royal Asiatic Society, 1904–1905. Author of *Glossary of Aramaic Inscriptions*; *The Laws of Moses and Code of Hammurabi*; *Critical Notes on Old Testament History*; *Religion of Ancient Palestine*; &c.	**Ark;** **Asa;** **Asher;** **Astarte.**
S. C.	Sidney Colvin, M.A., D.Litt. See the biographical article: Colvin, Sidney.	**Art.**
S. N.	Simon Newcomb, LL.D., D.Sc., D.C.L. (Oxon.). See the biographical article: Newcomb, Simon.	**Astronomy:** *Descriptive* **Astrophysics.**
St C.	Viscount St Cyres. See the biographical article: Iddesleigh, 1st Earl of.	**Arnauld:** *Family.*
Sw.	The Right Hon. Lord Swaythling (Sir Samuel Montagu). M.P. for Whitechapel, 1885–1900. Founder of the firm of Samuel Montagu & Co., Bankers, London.	**Arbitrage.**
T. A. C.	Timothy Augustine Coghlan, I.S.O. Agent-General for New South Wales. President of Australasian Association for the Advancement of Science (Economics and Statistics), 1902. Author of *The Seven Colonies of Australia*; *Statistical Account of Australia and New Zealand.*	**Australia.**
T. A. I.	Thomas Allan Ingram, M.A., LL.D. Trinity College, Dublin.	**Assignats.**
T. As.	Thomas Ashby, M.A., D.Litt. (Oxon.). Director of the British School of Archaeology at Rome. Formerly Scholar of Christ Church, Oxford. Craven Fellow, 1897. Author of numerous articles in the *Papers* of the British School at Rome; *The Classical Topography of the Roman Campagna*; &c.	**Antium; Appia Via;** **Apulia:** *History*; **Aqueduct:** *Roman*; **Aquileia; Aquino;** **Ardea; Arezzo;** **Ariano di Puglia; Aricia;** **Ariminum; Arpi; Arpino;** **Arretium; Ascoli Piceno;** **Asisium; Assisi; Astura;** **Ateste; Aufidena;** **Augusta** (Sicily); **Augusta Bagiennorum;** **Augusta Praetoria Salassorum;** **Aurelia, Via.**
T. Ba.	Sir Thomas Barclay, M.P. Member of the Institute of International Law. Member of the Supreme Council of the Congo Free State. Officer of the Legion of Honour. Author of *Problems of International Practice and Diplomacy*; &c. M.P. for Blackburn, 1910.	**Angary;** **Annexation.** **Asylum, Right of.**
T. Ca.	Thomas Case, M.A. President of Corpus Christi College, Oxford. Formerly Waynflete Professor of Moral and Metaphysical Philosophy at Oxford. Author of *Physical Realism*; &c.	**Aristotle.**
T. H.	Thomas Hodgkin, LL.D., D.Litt. See the biographical article: Hodgkin, T.	**Attila.**
T. H. H.*	Col. Sir Thomas Hungerford Holdich, K.C.M.G., K.C.I.E., D.Sc., F.R.G.S. Superintendent, Frontier Surveys, India, 1892–1898. Author of *The Indian Borderland*; *The Countries of the King's Award*; &c.	**Asia:** *Geography and Ethnology.*
T. L. H.	Sir Thomas Little Heath, K.C.B., D.Sc. (Cantab.). Assistant Secretary to the Treasury. Formerly Fellow of Trinity College, Cambridge.	**Anthemius;** **Apollonius of Perga;** **Archimedes.**
T. M. L.	Rev. Thomas Martin Lindsay, LL.D., D.D. Principal of the United Free Church College, Glasgow. Formerly Assistant to the Professor of Logic and Metaphysics in the University of Edinburgh. Author of *History of the Reformation*; *Life of Luther*; &c.	**Aquinas, Thomas.**
T. W.-D.	Walter Theodore Watts-Dunton. See the biographical article: Watts-Dunton, W. T.	**Arnold, Matthew.**
T. W. R. D.	T. W. Rhys Davids, M.A., Ph.D., LL.D. Professor of Comparative Religion in the University of Manchester. President of the Pali Text Society. Fellow of the British Academy. Secretary and Librarian of Royal Asiatic Society, 1885–1902. Author of *Buddhism*; &c.	**Asoka.**

W. A. B. C.	Rev. William Augustus Brevoort Coolidge, M.A., F.R.G.S., Hon. Ph.D. (Bern). Fellow of Magdalen College, Oxford. Professor of English History, St David's College, Lampeter, 1880–1881. Author of *Guide du haut dauphiné*; *The Range of the Tödi*; *Guide to Grindelwald*; *Guide to Switzerland*; *The Alps in Nature and in History*; &c. Editor of the *Alpine Journal*, 1880–1889; &c.	**Annecy;** **Antibes;** **Appenzell;** **Arnaud, Henri.**
W. A. P.	Walter Alison Phillips, M.A. Principal Assistant Editor of the 11th edition of the *Encyclopaedia Britannica*. Formerly Exhibitioner of Merton College, Oxford, and Senior Scholar of St John's College. Author of *Modern Europe*; &c.	**Archbishop;** **Archdeacon.**
W. Bo.	Wilhelm Bousset, D.Theol. Professor of New Testament Exegesis in the University of Göttingen. Author of *Das Wesen der Religion*; *The Antichrist Legend*; &c.	**Antichrist.**
W. Cr.	Walter Crane. See the biographical article: Crane, Walter.	**Arts and Crafts;** **Art Teaching.**
W. E. Co.	Right Rev. William Edward Collins, D.D., Bishop of Gibraltar. Formerly Professor of Ecclesiastical History, King's College, London. Lecturer, St John's and Selwyn Colleges, Cambridge. Author of *The Beginnings of English Christianity*.	**Apostolical Constitutions.**
W. E. E.	Major William Egerton Edwards. Captain and Brevet Major, Royal Field Artillery. Inspector, Inspection Staff, Woolwich Arsenal. Lecturer on Armour and Explosives at the Royal Naval War College, Greenwich, 1904–1909.	**Armour Plates.**
W. F. C.	William Feilden Craies, M.A. Barrister-at-law, Inner Temple. Lecturer on Criminal Law, King's College, London. Editor of *Archbold's Criminal Pleading* (23rd edition). Author of *Craies on Statute Law*.	**Appeal.**
W. F. Sh.	William Fleetwood Sheppard, M.A., D.Sc. Senior Examiner under the Board of Education. Senior Wrangler, 1884. Formerly Fellow of Trinity College, Cambridge.	**Arithmetic.**
W. H. Be.	William Henry Bennett, M.A., D.D., D.Litt. (Cantab.). Professor of Old Testament Exegesis in New and Hackney Colleges, London. Formerly Fellow of St John's College, Cambridge. Lecturer in Hebrew at Firth College, Sheffield. Author of *Religion of the Post-Exilic Prophets*; &c.	**Angel; Atonement.**
W. H. Di.	William Henry Dines, F.R.S.	**Anemometer.**
W. J. F.	William Justice Ford, M.A. (d. 1904). Formerly Scholar of St John's College, Cambridge. Head Master of Leamington College.	**Archery.**
W. Ma.	Sir William Markby, K.C.I.E., D.C.L. See the biographical article: Markby, Sir W.	**Austin, John.**
W. M. R.	William Michael Rossetti. See the biographical article: Rossetti, Dante Gabriel.	**Angelico, Fra.**
W. P. R.	Hon. William Pember Reeves. Director, London School of Economics. Agent-General and High Commissioner for New Zealand, 1896–1909. Author of *A History of New Zealand*.	**Atkinson, Sir Henry Albert.**
W. R. L.	W. R. Lethaby, F.S.A. Principal of the Central School of Arts and Crafts under the London County Council. Author of *Architecture, Mysticism and Myth*; &c.	**Architecture:** *Romanesque and Gothic in France.*
W. W.	William Wallace, M.A. See the biographical article: Wallace, William (d. 1897).	**Arabian Philosophy** (*in part*).
W. W. F.*	William Warde Fowler, M.A. Fellow of Lincoln College, Oxford. Sub-Rector, 1881–1904. Gifford Lecturer, Edinburgh University, 1908. Author of *The City-State of the Greeks and Romans*; *The Roman Festivals of the Republican Period*; &c.	**Anna Perenna;** **Argei.**
W. W. R.*	William Walker Rockwell, Lic. Theol. Assistant Professor of Church History, Union Theological Seminary, New York.	**Antioch, Synods of;** **Arles, Synod of;** **Augsburg, Confession of.**

PRINCIPAL UNSIGNED ARTICLES

Anglican Communion.
Angola.
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Anselm.
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Arabs.
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THE
ENCYCLOPÆDIA BRITANNICA

VOLUME 2

ANDROS TO AUSTRIA

ANDROS, SIR EDMUND (1637–1714), English colonial governor in America, was born in London on the 6th of December 1637, son of Amice Andros, an adherent of Charles I., and the royal bailiff of the island of Guernsey. He served for a short time in the army of Prince Henry of Nassau, and in 1660–1662 was gentleman in ordinary to the queen of Bohemia (Elizabeth Stuart, daughter of James I. of England). He then served against the Dutch, and in 1672 was commissioned major in what is said to have been the first English regiment armed with the bayonet. In 1674 he became, by the appointment of the duke of York (later James II.), governor of New York and the Jerseys, though his jurisdiction over the Jerseys was disputed, and until his recall in 1681 to meet an unfounded charge of dishonesty and favouritism in the collection of the revenues, he proved himself to be a capable administrator, whose imperious disposition, however, rendered him somewhat unpopular among the colonists. During a visit to England in 1678 he was knighted. In 1686 he became governor, with Boston as his capital, of the "Dominion of New England," into which Massachusetts (including Maine), Plymouth, Rhode Island, Connecticut and New Hampshire were consolidated, and in 1688 his jurisdiction was extended over New York and the Jerseys. But his vexatious interference with colonial rights and customs aroused the keenest resentment, and on the 18th of April 1689, soon after news of the arrival of William, prince of Orange, in England reached Boston, the colonists deposed and arrested him. In New York his deputy, Francis Nicholson, was soon afterwards deposed by Jacob Leisler (*q.v.*); and the inter-colonial union was dissolved. Andros was sent to England for trial in 1690, but was immediately released without trial, and from 1692 until 1698 he was governor of Virginia, but was recalled through the agency of Commissary James Blair (*q.v.*), with whom he quarrelled. In 1693–1694 he was also governor of Maryland. From 1704 to 1706 he was governor of Guernsey. He died in London in February 1714 and was buried at St Anne's, Soho.

See *The Andros Tracts* (3 vols., Boston, 1869–1872).

ANDROS, or ANDRO, an island of the Greek archipelago, the most northerly of the Cyclades, 6 m. S.E. of Euboea, and about 2 m. N. of Tenos; it forms an eparchy in the modern kingdom of Greece. It is nearly 25 m. long, and its greatest breadth is 10 m. Its surface is for the most part mountainous, with many fruitful and well-watered valleys. Andros, the capital, on the east coast, contains about 2000 inhabitants. The ruins of Palaeopolis, the ancient capital, are on the west coast; the town possessed a famous temple, dedicated to Bacchus. The island has about 18,000 inhabitants.

The island in ancient times contained an Ionian population, perhaps with an admixture of Thracian blood. Though originally dependent on Eretria, by the 7th century B.C. it had become sufficiently prosperous to send out several colonies to Chalcidice (Acanthus, Stageirus, Argilus, Sane). In 480 it supplied ships to Xerxes and was subsequently harried by the Greek fleet. Though enrolled in the Delian League it remained disaffected towards Athens, and in 447 had to be coerced by the settlement of a cleruchy. In 411 Andros proclaimed its freedom and in 408 withstood an Athenian attack. As a member of the second Delian League it was again controlled by a garrison and an archon. In the Hellenistic period Andros was contended for as a frontier-post by the two naval powers of the Aegean Sea, Macedonia and Egypt. In 333 it received a Macedonian garrison from Antipater; in 308 it was freed by Ptolemy I. In the Chremonidean War (266–263) it passed again to Macedonia after a battle fought off its shores. In 200 it was captured by a combined Roman, Pergamene and Rhodian fleet, and remained a possession of Pergamum until the dissolution of that kingdom in 133 B.C. Before falling under Turkish rule, Andros was from A.D. 1207 till 1566 governed by the families Zeno and Sommariva under Venetian protection.

ANDROTION (*c.* 350 B.C.), Greek orator, and one of the leading politicians of his time, was a pupil of Isocrates and a contemporary of Demosthenes. He is known to us chiefly from the speech of Demosthenes, in which he was accused of illegality in proposing the usual honour of a crown to the Council of Five Hundred at the expiration of its term of office. Androtion filled several important posts, and during the Social War was appointed extraordinary commissioner to recover certain arrears of taxes. Both Demosthenes and Aristotle (*Rhet.* iii. 4) speak favourably of his powers as an orator. He is said to have gone into exile at Megara, and to have composed an *Atthis*, or annalistic account of Attica from the earliest times to his own days (Pausanias vi. 7; x. 8). It is disputed whether the annalist and orator are identical, but an Androtion who wrote on agriculture is certainly a different person. Professor Gaetano de Sanctis (in *L'Attide di Androzione e un papiro di Oxyrhynchos*, Turin, 1908) attributes to Androtion, the atthidographer, a 4th-century historical fragment, discovered by B. P. Grenfell and A. S. Hunt (*Oxyrhynchus Papyri*, vol. v.). Strong arguments against this view are set forth by E. M. Walker in the *Classical Review*, May 1908.

ANDÚJAR (the anc. *Sliturgi*), a town of southern Spain, in the province of Jaén; on the right bank of the river Guadalquivir and the Madrid-Cordova railway. Pop. (1900) 16,302. Andújar is widely known for its porous earthenware jars, called *alcarrazas*, which keep water cool in the hottest weather, and are manufactured from a whitish clay found in the neighbourhood.

ANECDOTE (from ἀν-, privative, and ἐκδίδωμι, to give out or publish), a word originally meaning something not published. It has now two distinct significations. The primary one is something not published, in which sense it has been used to denote either secret histories—Procopius, *e.g.*, gives this as one of the titles of his secret history of Justinian's court—or portions of ancient writers which have remained long in manuscript and are edited for the first time. Of such *anecdota* there are many collections; the earliest was probably L. A. Muratori's, in 1709. In the more general and popular acceptation of the word, however, anecdotes are short accounts of detached interesting particulars. Of such anecdotes the collections are almost infinite; the best in many respects is that compiled by T. Byerley (d. 1826) and J. Clinton Robertson (d. 1852), known as the *Percy Anecdotes* (1820–1823).

ANEL, DOMINIQUE (1679–1730), French surgeon, was born at Toulouse about 1679. After studying at Montpellier and Paris, he served as surgeon-major in the French army in Alsace; then after two years at Vienna he went to Italy and served in the Austrian army. In 1710 he was teaching surgery in Rouen, whence he went to Genoa, and in 1716 he was practising in Paris. He died about 1730. He was celebrated for his successful surgical treatment of *fistula lacrymalis*, and while at Genoa invented for use in connexion with the operation the fine-pointed syringe still known by his name.

ANEMOMETER (from Gr. ἄνεμος, wind, and μέτρον, a measure), an instrument for measuring either the velocity or the pressure of the wind. Anemometers may be divided into two classes, (1) those that measure the velocity, (2) those that measure the pressure of the wind, but inasmuch as there is a close connexion between the pressure and the velocity, a suitable anemometer of either class will give information about both these quantities.

Velocity anemometers may again be subdivided into two classes, (1) those which do not require a wind vane or weathercock, (2) those which do. The Robinson anemometer, invented (1846) by Dr Thomas Romney Robinson, of Armagh Observatory, is the best-known and most generally used instrument, and belongs to the first of these. It consists of four hemispherical cups, mounted one on each end of a pair of horizontal arms, which lie at right angles to each other and form a cross. A vertical axis round which the cups turn passes through the centre of the cross; a train of wheel-work counts up the number of turns which this axis makes, and from the number of turns made in any given time the velocity of the wind during that time is calculated. The cups are placed symmetrically on the end of the arms, and it is easy to see that the wind always has the hollow of one cup presented to it; the back of the cup on the opposite end of the cross also faces the wind, but the pressure on it is naturally less, and hence a continual rotation is produced; each cup in turn as it comes round providing the necessary force. The two great merits of this anemometer are its simplicity and the absence of a wind vane; on the other hand it is not well adapted to leaving a record on paper of the actual velocity at any definite instant, and hence it leaves a short but violent gust unrecorded. Unfortunately, when Dr Robinson first designed his anemometer, he stated that no matter what the size of the cups or the length of the arms, the cups always moved with one-third of the velocity of the wind. This result was apparently confirmed by some independent experiments, but it is very far from the truth, for it is now known that the actual ratio, or factor as it is commonly called, of the velocity of the wind to that of the cups depends very largely on the dimensions of the cups and arms, and may have almost any value between two and a little over three. The result has been that wind velocities published in many official publications have often been in error by nearly 50%.

The other forms of velocity anemometer may be described as belonging to the windmill type. In the Robinson anemometer the axis of rotation is vertical, but with this subdivision the axis of rotation must be parallel to the direction of the wind and therefore horizontal. Furthermore, since the wind varies in direction and the axis has to follow its changes, a wind vane or some other contrivance to fulfil the same purpose must be employed. This type of instrument is very little used in England, but seems to be more in favour in France. In cases where the direction of the air motion is always the same, as in the ventilating shafts of mines and buildings for instance, these anemometers, known, however, as air meters, are employed, and give most satisfactory results.

Anemometers which measure the pressure may be divided into the plate and tube classes, but the former term must be taken as including a good many miscellaneous forms. The simplest type of this form consists of a flat plate, which is usually square or circular, while a wind vane keeps this exposed normally to the wind, and the pressure of the wind on its face is balanced by a spring. The distortion of the spring determines the actual force which the wind is exerting on the plate, and this is either read off on a suitable gauge, or leaves a record in the ordinary way by means of a pen writing on a sheet of paper moved by clockwork. Instruments of this kind have been in use for a long series of years, and have recorded pressures up to and even exceeding 60 lb per sq. ft., but it is now fairly certain that these high values are erroneous, and due, not to the wind, but to faulty design of the anemometer.

The fact is that the wind is continually varying in force, and while the ordinary pressure plate is admirably adapted for measuring the force of a steady and uniform wind, it is entirely unsuitable for following the rapid fluctuations of the natural wind. To make matters worse, the pen which records the motion of the plate is often connected with it by an extensive system of chains and levers. A violent gust strikes the plate, which is driven back and carried by its own momentum far past the position in which a steady wind of the same force would place it; by the time the motion has reached the pen it has been greatly exaggerated by the springiness of the connexion, and not only is the plate itself driven too far back, but also its position is wrongly recorded by the pen; the combined errors act the same way, and more than double the real maximum pressure may be indicated on the chart.

A modification of the ordinary pressure-plate has recently been designed. In this arrangement a catch is provided so that the plate being once driven back by the wind cannot return until released by hand; but the catch does not prevent the plate being driven back farther by a gust stronger than the last one that moved it. Examples of these plates are erected on the west coast of England, where in the winter fierce gales often occur; a pressure of 30 lb per sq. ft. has not been shown by them, and instances exceeding 20 lb are extremely rare.

Many other modifications have been used and suggested. Probably a sphere would prove most useful for a pressure anemometer, since owing to its symmetrical shape it would not require a weathercock. A small light sphere hanging from the end of 30 or 40 ft. of fine sewing cotton has been employed to measure the wind velocity passing over a kite, the tension of the cotton being recorded, and this plan has given satisfactory results.

Lind's anemometer, which consists simply of a U tube containing liquid with one end bent into a horizontal direction to face the wind, is perhaps the original form from which the tube class of instrument has sprung. If the wind blows into the mouth of a tube it causes an increase of pressure inside and also of course an equal increase in all closed vessels with which the mouth is in airtight communication. If it blows horizontally over the open end of a vertical tube it causes a decrease of pressure, but this fact is not of any practical use in anemometry, because the magnitude of the decrease depends on the wind striking the tube exactly at right angles to its axis, the most trifling departure from the true direction causing great variations in the magnitude. The pressure tube anemometer (fig. 1) utilizes the increased pressure in the open mouth of a straight tube facing the wind, and the decrease of pressure caused inside when the wind blows over a ring of small holes drilled through the metal of a vertical tube which is closed at the upper end. The pressure differences on which the action depends are very small, and special means are required to register them, but in the ordinary form of recording anemometer (fig. 2), any wind capable of turning the vane which keeps the mouth of the tube facing the wind is capable of registration.

The great advantage of the tube anemometer lies in the fact that the exposed part can be mounted on a high pole, and requires no oiling or attention for years; and the registering part can be placed in any convenient position, no matter how far from the external part. Two connecting tubes are required. It might appear at first sight as though one connexion would serve, but the differences in pressure on which these instruments depend are so minute, that the pressure of the air in the room where the recording part is placed has to be considered. Thus if the instrument depends on the pressure or suction effect alone, and this pressure or suction is measured against the air pressure in an ordinary room, in which the doors and windows are carefully closed and a newspaper is then burnt up the chimney, an effect may be produced equal to a wind of 10 m. an hour; and the opening of a window in rough weather, or the opening of a door, may entirely alter the registration.

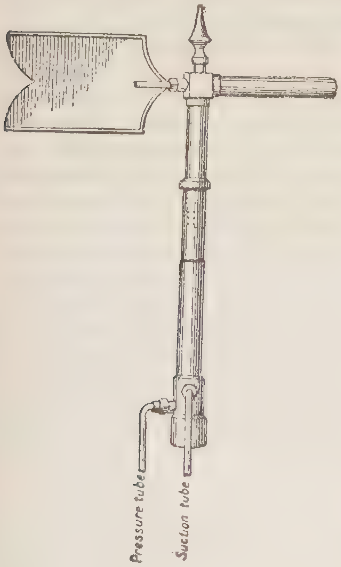

FIG. 1.

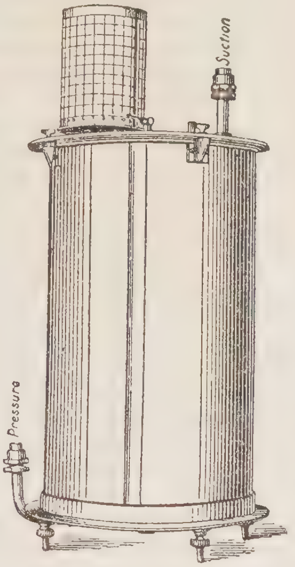

FIG. 2.

The connexion between the velocity and the pressure of the wind is one that is not yet known with absolute certainty. Many text-books on engineering give the relation $P = \cdot 005\, v^2$ when P is the pressure in lb per sq. ft. and v the velocity in miles per hour. The history of this untrue relation is curious. It was given about the end of the 18th century as based on some experiments, but with a footnote stating that little reliance could be placed on it. The statement without the qualifying note was copied from book to book, and at last received general acceptance. There is no doubt that under average conditions of atmospheric density, the .005 should be replaced by ·003, for many independent authorities using different methods have found values very close to this last figure. It is probable that the wind pressure is not strictly proportional to the extent of the surface exposed. Pressure plates are generally of moderate size, from a half or quarter of a sq. ft. up to two or three sq. ft., are round or square, and for these sizes, and shapes, and of course for a flat surface, the relation $P = .003\, v^2$ is fairly correct.

In the tube anemometer also it is really the pressure that is measured, although the scale is usually graduated as a velocity scale. In cases where the density of the air is not of average value, as on a high mountain, or with an exceptionally low barometer for example, an allowance must be made. Approximately 1½% should be added to the velocity recorded by a tube anemometer for each 1000 ft. that it stands above sea-level. (W. H. Di.)

ANEMONE, or WIND-FLOWER (from the Gr. ἄνεμος, wind), a genus of the buttercup order (Ranunculaceae), containing about ninety species in the north and south temperate zones. *Anemone nemorosa*, wood anemone, and *A. Pulsatilla*, Pasque-flower, occur in Britain; the latter is found on chalk downs and limestone pastures in some of the more southern and eastern counties. The plants are perennial herbs with an underground rootstock, and radical, more or less deeply cut, leaves. The elongated flower stem bears one or several, white, red, blue or rarely yellow, flowers; there is an involucre of three leaflets below each flower. The fruits often bear long hairy styles which aid their distribution by the wind. Many of the species are favourite garden plants; among the best known is *Anemone coronaria*, often called the poppy anemone, a tuberous-rooted plant, with parsley-like divided leaves, and large showy poppy-like blossoms on stalks of from 6 to 9 in. high; the flowers are of various colours, but the principal are scarlet, crimson, blue, purple and white. There are also double-flowered varieties, in which the stamens in the centre are replaced by a tuft of narrow petals. It is an old garden favourite, and of the double forms there are named varieties. They grow best in a loamy soil, enriched with well-rotted manure, which should be dug in below the tubers. These may be planted in October, and for succession in January, the autumn-planted ones being protected by a covering of leaves or short stable litter. They will flower in May and June, and when the leaves have ripened should be taken up into a dry room till planting time. They are easily raised from the seed, and a bed of the single varieties is a valuable addition to a flower-garden, as it affords, in a warm situation, an abundance of handsome and often brilliant spring flowers, almost as early as the snowdrop or crocus. The genus contains many other lively spring-blooming plants, of which *A. hortensis* and *A. fulgens* have less divided leaves and splendid rosy-purple or scarlet flowers; they require similar treatment. Another set is represented by *A. Pulsatilla*, the Pasque-flower, whose violet blossoms have the outer surface hairy; these prefer a calcareous soil. The splendid *A. japonica*, and its white variety called Honorine Joubert, the latter especially, are amongst the finest of autumn-blooming hardy perennials; they grow well in light soil, and reach 2½ to 3 ft. in height, blooming continually for several weeks. A group of dwarf species, represented by the native British *A. nemorosa* and *A. apennina*, are amongst the most beautiful of spring flowers for planting in woods and shady places.

The genus *Hepatica* is now generally included in anemone as a subgenus. The plants are known in gardens as hepaticas, and are varieties of the common South European *A. Hepatica*; they are charming spring-flowering plants with usually blue flowers.

ANENCLETUS, or ANACLETUS, second bishop of Rome. About the 4th century he is treated in the catalogues as two persons—Anacletus and Cletus. According to the catalogues he occupied the papal chair for twelve years (*c.* 77–88).

ANERIO, the name of two brothers, musical composers, very great Roman masters of 16th-century polyphony. Felice, the elder, was born about 1560, studied under G. M. Nanino and succeeded Palestrina in 1594 as composer to the papal chapel. Several masses and motets of his are printed in Proske's *Musica Divina* and other modern anthologies, and it is hardly too much to say that they are for the most part worthy of Palestrina himself. The date of his death is conjecturally given as 1630. His brother, Giovanni Francesco, was born about 1567, and seems to have died about 1620. The occasional attribution of some of his numerous compositions to his elder brother is a pardonable mistake, if we may judge by the works that have been reprinted. But the statement, which continues to be repeated in standard works of reference, that "he was one of the first of Italians to use the quaver and its subdivisions" is incomprehensible. Quavers were common property in all musical countries quite early in the 16th century, and semiquavers appear in a madrigal of Palestrina published in 1574. The two brothers are probably the latest composers who handled 16th-century music as their mother-language; suffering neither from the temptation to indulge even in such mild neologisms as they might have learnt from the elder brother's master, Nanino, nor from the necessity of preserving their purity of style by a mortified negative asceticism. They wrote pure polyphony because they understood it and loved it, and hence their work lives, as neither the progressive work of their own day nor the reactionary work of their imitators could live. The 12-part *Stabat Mater* in the seventh volume of Palestrina's complete works has been by some authorities ascribed to Felice Anerio.

ANET, a town of northern France, in the department of Eure-et-Loir, situated between the rivers Eure and Vègre, 10 m. N.E. of Dreux by rail. Pop. (1906) 1324. It possesses the remains of a magnificent castle, built in the middle of the 16th century by Henry II. for Diana of Poitiers. Near it is the plain of Ivry, where Henry IV. defeated the armies of the League in 1590.

ANEURIN, or ANEIRIN, the name of an early 7th-century British (Welsh) bard, who has been taken by Thomas Stephens (1821–1875), the editor and translator of Aneurin's principal epic poem *Gododin,* for a son of Gildas, the historian. *Gododin* is an account of the British defeat (603) by the Saxons at Cattraeth (identified by Stephens with Dawstane in Liddesdale), where Aneurin is said to have been taken prisoner; but the poem is very obscure and is differently interpreted. It was translated and edited by W. F. Skene in his *Four Ancient Books of Wales* (1866), and Stephens' version was published by the Cymmrodorion Society in 1888. See CELT: *Literature* (Welsh).

ANEURYSM, or ANEURISM (from Gr. ἀνεύρισμα, a dilatation), a cavity or sac which communicates with the interior of an artery and contains blood. The walls of the cavity are formed either of the dilated artery or of the tissues around that vessel. The dilatation of the artery is due to a local weakness, the result of disease or injury. The commonest cause is chronic inflammation of the inner coats of the artery. The breaking of a bottle or glass in the hand is apt to cut through the outermost coat of the artery at the wrist (radial) and thus to cause a local weakening of the tube which is gradually followed by dilatation. Also when an artery is wounded and the wound in the skin and superficial structures heals, the blood may escape into the tissues, displacing them, and by its pressure causing them to condense and form the sac-wall. The coats of an artery, when diseased, may be torn by a severe strain, the blood escaping into the condensed tissues which thus form the aneurysmal sac.

The division of aneurysms into two classes, *true* and *false,* is unsatisfactory. On the face of it, an aneurysm which is false is not an aneurysm, any more than a false bank-note is legal tender. A better classification is into *spontaneous* and *traumatic.* The man who has chronic inflammation of a large artery, the result, for instance, of gout, arduous, straining work, or kidney-disease, and whose artery yields under cardiac pressure, has a *spontaneous* aneurysm; the barman or window-cleaner who has cut his radial artery, the soldier whose brachial or femoral artery has been bruised by a rifle bullet or grazed by a bayonet, and the boy whose naked foot is pierced by a sharp nail, are apt to be the subjects of *traumatic* aneurysm. In those aneurysms which are a *saccular* bulging on one side of the artery the blood may be induced to coagulate, or may of itself deposit layer upon layer of pale clot, until the sac is obliterated. This laminar coagulation by constant additions gradually fills the aneurysmal cavity and the pulsation in the sac then ceases; contraction of the sac and its contents gradually takes place and the aneurysm is cured. But in those aneurysms which are *fusiform* dilatations of the vessel there is but slight chance of such cure, for the blood sweeps evenly through it without staying to deposit clot or laminated fibrine.

In the treatment of aneurysm the aim is generally to lower the blood pressure by absolute rest and moderated diet, but a cure is rarely effected except by operation, which, fortunately, is now resorted to more promptly and securely than was previously the case. Without trying the speculative and dangerous method of treatment by compression, or the application of an indiarubber bandage, the surgeon now without loss of time cuts down upon the artery, and applies an aseptic ligature close above the dilatation. Experience has shown that this method possesses great advantages, and that it has none of the disadvantages which were formerly supposed to attend it. Saccular dilatations of arteries which are the result of cuts or other injuries are treated by tying the vessel above and below, and by dissecting out the aneurysm. Popliteal, carotid and other aneurysms, which are not of traumatic origin, are sometimes dealt with on this plan, which is the old "Method of Antyllus" with modern aseptic conditions. Speaking generally, if an aneurysm can be dealt with surgically the sooner that the artery is tied the better. Less heroic measures are too apt to prove painful, dangerous, ineffectual and disappointing. For aneurysm in the chest or abdomen (which cannot be dealt with by operation) the treatment may be tried of injecting a pure solution of gelatine into the loose tissues of the armpit, so that the gelatine may find its way into the blood stream and increase the chance of curative coagulation in the distant aneurysmal sac. (E. O.*)

ANFRACTUOSITY (from Lat. *anfractuosus,* winding), twisting and turning, circuitousness; a word usually employed in the plural to denote winding channels such as occur in the depths of the sea, mountains, or the fissures (*sulci*) separating the convolutions of the brain, or, by analogy, in the mind.

ANGARIA (from ἄγγαρος, the Greek form of a Babylonian word adopted in Persian for "mounted courier"), a sort of postal system adopted by the Roman imperial government from the ancient Persians, among whom, according to Xenophon (*Cyrop.* viii. 6; cf. Herodotus viii. 98) it was established by Cyrus the Great. Couriers on horseback were posted at certain stages along the chief roads of the empire, for the transmission of royal despatches by night and day in all weathers. In the Roman system the supply of horses and their maintenance was a compulsory duty from which the emperor alone could grant exemption. The word, which in the 4th century was used for the heavy transport vehicles of the cursus publicus, and also for the animals by which they were drawn, came to mean generally "compulsory service." So *angaria, angariare,* in medieval Latin, and the rare English derivatives "angariate," "angariation," came to mean any service which was forcibly or unjustly demanded, and oppression in general.

ANGARY (Lat. *jus angariae*; Fr. *droit d'angarie*; Ger. *Angarie*; from the Gr. ἀγγαρεία, the office of an ἄγγαρος, courier or messenger), the name given to the right of a belligerent to seize and apply for the purposes of war (or to prevent the enemy from doing so) any kind of property on belligerent territory, including that which may belong to subjects or citizens of a neutral state. Art. 53 of the Regulations respecting the Laws and Customs of War on Land, annexed to the Hague Convention of 1899 on the same subject, provides that railway plant, land telegraphs, telephones, steamers and other ships (other than such as are governed by maritime law), though belonging to companies or private persons, *may be used* for military operations, but "must be restored at the conclusion of peace *and* indemnities paid for them." And Art. 54 adds that "the plant of railways coming from *neutral* states, whether the property of those states or of companies or private persons shall be sent back to them as soon as possible." These articles seem to sanction the right of angary against neutral property, while limiting it as against both belligerent and neutral property. It may be considered, however, that the right to use implies as wide a range of contingencies as the "necessity of war" can be made to cover. (T. BA.)

ANGEL, a general term denoting a subordinate superhuman being in monotheistic religions, *e.g.* Islam, Judaism, Christianity, and in allied religions, such as Zoroastrianism. In polytheism the grades of superhuman beings are continuous; but in monotheism there is a sharp distinction of kind, as well as degree, between God on the one hand, and all other superhuman beings on the other; the latter are the "angels."

"Angel" is a transcription of the Gr. ἄγγελος, messenger. ἄγγελος in the New Testament, and the corresponding *mal'akh* in the Old Testament, sometimes mean "messenger," and sometimes "angel," and this double sense is duly represented in the English Versions. "Angel" is also used in the English Version for אַבִּיר *'Abbīr*, Ps. lxxviii. 25. (lit. "mighty"), for אלהִים *'Elohīm*, Ps. viii. 5, and for the obscure שִׁנְאָן *shin'ān*, in Ps. lxviii. 17.

In the later development of the religion of Israel, *'Elohim* is almost entirely reserved for the one true God; but in earlier times *'Elohim* (gods), *bnē 'Elohim*, *bnē Elim* (sons of gods, *i.e.* members of the class of divine beings) were general terms for superhuman beings. Hence they came to be used collectively of superhuman beings, distinct from Yahweh, and therefore inferior, and ultimately subordinate.[1] So, too, the angels are styled "holy ones,"[2] and "watchers,"[3] and are spoken of as the "host of heaven"[4] or of "Yahweh."[5] The "hosts," צְבָאוֹת *Sebāōth* in the title *Yahweh Sebaoth*, Lord of Hosts, were probably at one time identified with the angels.[6] The New Testament often speaks of "spirits," πνεύματα.[7] In the earlier periods of the religion of Israel, the doctrine of monotheism had not been formally stated, so that the idea of "angel" in the modern sense does not occur, but we find the *Mal'akh Yahweh*, Angel of the Lord, or *Mal'akh Elohim*, Angel of God. The *Mal'akh Yahweh* is an appearance or manifestation of *Yahweh* in the form of a man, and the term *Mal'akh Yahweh* is used interchangeably with Yahweh (cf. Exod. iii. 2, with iii. 4; xiii. 21 with xiv. 19). Those who see the *Mal' akh Yahweh* say they have seen God.[8] The *Mal'akh Yahweh* (or *Elohim*) appears to Abraham, Hagar, Moses, Gideon, &c., and leads the Israelites in the Pillar of Cloud.[9] The phrase *Mal'akh Yahweh* may have been originally a courtly circumlocution for the Divine King; but it readily became a means of avoiding crude anthropomorphism, and later on, when the angels were classified, the *Mal'akh Yahweh* came to mean an angel of distinguished rank.[10] The identificaton of the *Mal'akh Yahweh* with the *Logos*, or Second Person of the Trinity, is not indicated by the references in the Old Testament; but the idea of a Being partly identified with God, and yet in some sense distinct from Him, illustrates the tendency of religious thought to distinguish persons within the unity of the Godhead, and foreshadows the doctrine of the Trinity, at any rate in some slight degree.

In the earlier literature the *Mal'akh Yahweh* or *Elohim* is almost the only *mal'akh* ("angel") mentioned. There are, however, a few passages which speak of subordinate superhuman beings other than the *Mal'akh Yahweh* or *Elohim*. There are the cherubim who guard Eden. In Gen. xviii., xix. (J) the appearance of Yahweh to Abraham and Lot is connected with three, afterwards two, men or messengers; but possibly in the original form of the story Yahweh appeared alone.[11] At Bethel, Jacob sees the angels of God on the ladder,[12] and later on they appear to him at Mahanaim.[13] In all these cases the angels, like the *Mal'akh Yahweh*, are connected with or represent a theophany. Similarly the "man" who wrestles with Jacob at Peniel is identified with God.[14] In Isaiah vi. the seraphim, superhuman beings with six wings, appear as the attendants of Yahweh. Thus the pre-exilic literature, as we now have it, has little to say about angels or about superhuman beings other than Yahweh and manifestations of Yahweh; the pre-exilic prophets hardly mention angels.[15] Nevertheless we may well suppose that the popular religion of ancient Israel had much to say of superhuman beings other than Yahweh, but that the inspired writers have mostly suppressed references to them as unedifying. Moreover such beings were not strictly angels.

The doctrine of monotheism was formally expressed in the period immediately before and during the Exile, in Deuteronomy[16] and Isaiah[17]; and at the same time we find angels prominent in Ezekiel who, as a prophet of the Exile, may have been influenced by the hierarchy of supernatural beings in the Babylonian religion, and perhaps even by the angelology of Zoroastrianism.[18] Ezekiel gives elaborate discriptions of cherubim[19]; and in one of his visions he sees seven angels execute the judgment of God upon Jerusalem.[20] As in Genesis they are styled "men," *mal'akh* for "angel" does not occur in Ezekiel. Somewhat later, in the visions of Zechariah, angels play a great part; they are sometimes spoken of as "men," sometimes as *mal'akh*, and the *Mal'akh Yahweh* seems to hold a certain primacy among them.[21] Satan also appears to prosecute (so to speak) the High Priest before the divine tribunal.[22] Similarly in Job the *bnē Elohim*, sons of God, appear as attendants of God, and amongst them Satan, still in his rôle of public prosecutor, the defendant being Job.[23] Occasional references to "angels" occur in the Psalter[24]; they appear as ministers of God.

In Ps. lxxviii. 49 the "evil angels" of A.V. conveys a false impression; it should be "angels of evil," as R.V., *i.e.* angels who inflict chastisement as ministers of God.

The seven angels of Ezekiel may be compared with the seven eyes of Yahweh in Zech. iii. 9, iv. 10. The latter have been connected by Ewald and others with the later doctrine of seven chief angels[25], parallel to and influenced by the Ameshaspentas (Amesha Spenta), or seven great spirits of the Persian mythology, but the connexion is doubtful.

In the Priestly Code, *c.* 400 B.C., there is no reference to angels apart from the possible suggestion in the ambiguous plural in Genesis i. 26.

During the Persian and Greek periods the doctrine of angels underwent a great development, partly, at any rate, under foreign influences. In Daniel, *c.* 160 B.C., angels, usually spoken of as "men" or "princes," appear as guardians or champions of the nations; grades are implied, there are "princes" and "chief" or "great princes"; and the names of some angels are known, Gabriel, Michael; the latter is pre-eminent[26], he is the guardian of Judah. Again in Tobit a leading part is played by Raphael, "one of the seven holy angels."[27]

In Tobit, too, we find the idea of the demon or evil angel. In the canonical Old Testament angels may inflict suffering as ministers of God, and Satan may act as accuser or tempter; but they appear as subordinate to God, fulfilling His will; and not as morally evil. The statement[28] that God "chargeth His angels with folly" applies to all angels. In Daniel the princes or guardian angels of the heathen nations oppose Michael the guardian angel of Judah. But in Tobit we find Asmodaeus the evil demon, τὸ πονηρὸν δαιμόνιον, who strangles Sarah's husbands, and also a general reference to "a devil or evil spirit," πνεῦμα.[29] The Fall of the Angels is not properly a scriptural doctrine, though it is based on Gen. vi. 2, as interpreted by the Book of Enoch. It is true that the *bnē Elohim* of that chapter are subordinate superhuman beings (cf. above), but they belong to a different order of thought from the angels of Judaism and of Christian doctrine; and the passage in no way suggests that the *bnē Elohim* suffered any loss of status through their act.

The guardian angels of the nations in Daniel probably represent the gods of the heathen, and we have there the first step of the process by which these gods became evil angels, an idea expanded by Milton in *Paradise Lost*. The development of the doctrine of an organized hierarchy of angels belongs to the Jewish literature of the period 200 B.C. to A.D. 100. In Jewish apocalypses especially, the imagination ran riot on the rank, classes and names of angels; and such works as the various books of Enoch and the *Ascension of Isaiah* supply much information on this subject.

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[1] *E.g.* Gen. vi. 2; Job i. 6; Ps. viii. 5, xxix. 1. [2] Zech. xiv. 5.
[3] Dan. iv. 13. [4] Deut. xvii. 3 (?). [5] Josh. v. 14 (?).

[6] The identification of the "hosts" with the stars comes to the same thing; the stars were thought of as closely connected with angels. It is probable that the "hosts" were also identified with the armies of Israel.

[7] Rev. i. 4. [8] Gen. xxxii. 30; Judges xiii. 22.
[9] Exod. iii. 2, xiv. 19. [10] Zech. i. 11 f.

[11] Cf. xviii. 1 with xviii. 2, and note change of number in xix. 17.

[12] Gen. xxviii. 12, E. [13] Gen. xxxii. 1, E. [14] Gen. xxxii. 24, 30, J.

[15] "An angel" of 1 Kings xiii. 18 might be the *Mal'akh Yahweh*, as in xix. 5, cf. 7, or the passage, at any rate in its present form, may be exilic or post-exilic.

[16] Deut. vi. 4. 5. [17] Isaiah xliii. 10 &c.

[18] It is not however certain that these doctrines of Zoroastrianism were developed at so early a date.

[19] Ezek. i. x. [20] Ezek. ix. [21] Zech. i. 11 f. [22] Zech. iii. 1.
[23] Job i., ii. Cf. 1 Chron. xxi. 1. [24] Pss. xci. 11, ciii. 20 &c.
[25] Tobit xii. 15; Rev. viii. 2. [26] Dan. viii. 16, x. 13, 20, 21.
[27] Tob. xii. 15. [28] Job iv. 18. [29] Tobit iii. 8, 17, vi. 7.

In the New Testament angels appear frequently as the ministers of God and the agents of revelation[1]; and Our Lord speaks of angels as fulfilling such functions[2], implying in one saying that they neither marry nor are given in marriage.[3] Naturally angels are most prominent in the Apocalypse. The New Testament takes little interest in the idea of the angelic hierarchy, but there are traces of the doctrine. The distinction of good and bad angels is recognized; we have names, Gabriel[4], and the evil angels Abaddon or Apollyon[5], Beelzebub[6], and Satan[7]; ranks are implied, archangels[8], principalities and powers[9], thrones and dominions[10]. Angels occur in groups of four or seven[11]. In Rev. i.–iii. we meet with the "Angels" of the Seven Churches of Asia Minor. These are probably guardian angels, standing to the churches in the same relation that the "princes" in Daniel stand to the nations; practically the "angels" are personifications of the churches. A less likely view is that the "angels" are the human representatives of the churches, the bishops or chief presbyters. There seems, however, no parallel to such a use of "angel," and it is doubtful whether the monarchical government of churches was fully developed when the Apocalypse was written.

Later Jewish and Christian speculation followed on the lines of the angelology of the earlier apocalypses; and angels play an important part in Gnostic systems and in the Jewish Midrashim and the Kabbala. Religious thought about the angels during the middle ages was much influenced by the theory of the angelic hierarchy set forth in the *De Hierarchia Celesti*, written in the 5th century in the name of Dionysius the Areopagite and passing for his. The creeds and confessions do not formulate any authoritative doctrine of angels; and modern rationalism has tended to deny the existence of such beings, or to regard the subject as one on which we can have no certain knowledge. The principle of continuity, however, seems to require the existence of beings intermediate between man and God.

The Old Testament says nothing about the origin of angels; but the *Book of Jubilees* and the Slavonic *Enoch* describe their creation; and, according to Col. i. 16, the angels were created in, unto and through Christ.

Nor does the Bible give any formal account of the nature of angels. It is doubtful how far Ezekiel's account of the cherubim and Isaiah's account of the seraphim are to be taken as descriptions of actual beings; they are probably figurative, or else subjective visions. Angels are constantly spoken of as "men," and, including even the Angel of Yahweh, are spoken of as discharging the various functions of human life; they eat and drink[12], walk[13] and speak[14]. Putting aside the cherubim and seraphim, they are not spoken of as having wings. On the other hand they appear and vanish[15], exercise miraculous powers[16], and fly[17]. Seeing that the anthropomorphic language used of the angels is similar to that used of God, the Scriptures would hardly seem to require a literal interpretation in either case. A special association is found, both in the Bible and elsewhere, between the angels and the heavenly bodies[18], and the elements or elemental forces, fire, water, &c[19]. The angels are infinitely numerous[20].

The *function* of the angels is that of the supernatural servants of God, His agents and representatives; the Angel of Yahweh, as we have seen, is a manifestation of God. In old times, the *bnē Elohim* and the seraphim are His court, and the angels are alike the court and the army of God; the cherubim are his throne-bearers. In his dealings with men, the angels, as their name implies, are specially His messengers, declaring His will and executing His commissions. Through them he controls nature and man. They are the guardian angels of the nations; and we also find the idea that individuals have guardian angels[21]. Later Jewish tradition held that the Law was given by angels[22]. According to the Gnostic Basilides, the world was created by angels. Mahommedanism has taken over and further elaborated the Jewish and Christian ideas as to angels.

While the scriptural statements imply a belief in the existence of spiritual beings intermediate between God and men, it is probable that many of the details may be regarded merely as symbolic imagery. In Scripture the function of the angel overshadows his personality; the stress is on their ministry; they appear in order to perform specific acts.

BIBLIOGRAPHY.—See the sections on "Angels" in the handbooks of O. T. Theology by Ewald, Schultz, Smend, Kayser-Marti, &c.; and of N. T. Theology by Weiss, and in van Oosterzee's *Dogmatics*. Also commentaries on special passages, especially Driver and Bevan on *Daniel*, and G. A. Smith, *Minor Prophets*, ii. 310 ff.; and articles *s.v.* "Angel" in Hastings' *Bible Dictionary*, and the *Encyclopaedia Biblica*. (W. H. BE.)

ANGEL, a gold coin, first used in France (*angelot, ange*) in 1340, and introduced into England by Edward IV. in 1465 as a new issue of the "noble," and so at first called the "angel-noble." It varied in value between that period and the time of Charles I. (when it was last coined) from 6s. 8d. to 10s. The name was derived from the representation it bore of St Michael and the dragon. The angel was the coin given to those who came to be touched for the disease known as king's evil; after it was no longer coined, medals, called touch-pieces, with the same device, were given instead.

ANGELICA, a genus of plants of the natural order *Umbelliferae*, represented in Britain by one species, *A. sylvestris*, a tall perennial herb with large bipinnate leaves and large compound umbels of white or purple flowers. The name Angelica is popularly given to a plant of an allied genus, *Archangelica officinalis*, the tender shoots of which are used in making certain kinds of aromatic sweetmeats. *Angelica balsam* is obtained by extracting the roots with alcohol, evaporating and extracting the residue with ether. It is of a dark brown colour and contains angelica oil, angelica wax and angelicin, $C_{18}H_{30}O$. The essential oil of the roots of *Angelica archangelica* contains β-terebangelene, $C_{10}H_{16}$, and other terpenes; the oil of the seeds also contains β-terebangelene, together with methylethylacetic acid and hydroxymyristic acid.

The angelica tree is a member of the order *Avaliaceae*, a species of *Aralia* (*A. spinosa*), a native of North America; it grows 8 to 12 ft. high, has a simple prickle-bearing stem forming an umbrella-like head, and much divided leaves.

ANGELICO, FRA (1387–1455), Italian painter. Il Beato Fra Giovanni Angelico da Fiesole is the name given to a far-famed painter-friar of the Florentine state in the 15th century, the representative, beyond all other men, of pietistic painting. He is often, but not accurately, termed simply "Fiesole," which is merely the name of the town where he first took the vows; more often Fra Angelico. If we turn his compound designation into English, it runs thus—"the Beatified Friar John the Angelic of Fiesole." In his lifetime he was known no doubt simply as Fra Giovanni or Friar John; "The Angelic" is a laudatory term which was assigned to him at an early date,—we find it in use within thirty years after his death; and, at some period which is not defined in our authorities, he was beatified by due ecclesiastical process. His baptismal name was Guido, Giovanni being only his name in religion. He was born at Vicchio, in the Tuscan province of Mugello, of unknown but seemingly well-to-do parentage, in 1387 (not 1390 as sometimes stated); in 1407 he became a novice in the convent of S. Domenico at Fiesole, and in 1408 he took the vows and entered the Dominican order. Whether he had previously been a painter by profession is not certain, but may be pronounced probable. The painter named Lorenzo Monaco may have contributed to his art-training, and the influence of the Sienese school is discernible in his work.

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[1] *E.g.* Matt. i. 20 (to Joseph), iv. 11 (to Jesus), Luke i. 26 (to Mary), Acts xii. 7 (to Peter).

[2] *E.g.* Mark viii. 38, xiii. 27.

[3] Mark xii. 25.

[4] Luke i. 19.

[5] Rev. ix. 11.

[6] Mark iii. 22.

[7] Mark i. 13.

[8] Michael, Jude 9.

[9] Rom. viii. 38; Col. ii. 10.

[10] Col. i. 16.

[11] Rev. vii. 1.

[12] Gen. xviii. 8.

[13] Gen. xix. 16.

[14] Zech. iv. 1.

[15] Judges vi. 12, 21.

[16] Rev. vii. 1. viii.

[17] Rev. viii. 13, xiv. 6.

[18] Job xxxviii. 7; *Asc. of Isaiah*, iv. 18; Slav. *Enoch*, iv. 1.

[19] Rev. xiv. 18, xvi. 5; possibly Gal. iv. 3; Col. ii. 8, 20.

[20] Ps. lxviii. 17; Dan. vii. 10.

[21] Matt. xviii. 10; Acts xii. 15.

[22] Gal. iii. 19; Heb. ii. 2; *LXX.* of Deut. xxxiii. 2.

According to Vasari, the first paintings of this artist were in the Certosa of Florence; none such exist there now. His earliest extant performances, in considerable number, are at Cortona, whither he was sent during his novitiate, and here apparently he spent all the opening years of his monastic life. His first works executed in fresco were probably those, now destroyed, which he painted in the convent of S. Domenico in this city; as a fresco-painter, he may have worked under, or as a follower of, Gherardo Starnina. From 1418 to 1436 he was back at Fiesole; in 1436 he was transferred to the Dominican convent of S. Marco in Florence, and in 1438 undertook to paint the altarpiece for the choir, followed by many other works; he may have studied about this time the renowned frescoes in the Brancacci chapel in the Florentine church of the Carmine and also the paintings of Orcagna. In or about 1445 he was invited by the pope to Rome. The pope who reigned from 1431 to 1447 was Eugenius IV., and he it was who in 1445 appointed another Dominican friar, a colleague of Angelico, to be archbishop of Florence. If the story (first told by Vasari) is true—that this appointment was made at the suggestion of Angelico only after the archbishopric had been offered to himself, and by him declined on the ground of his inaptitude for so elevated and responsible a station—Eugenius, and not (as stated by Vasari) his successor Nicholas V., must have been the pope who sent the invitation and made the offer to Fra Giovanni, for Nicholas only succeeded in 1447. The whole statement lacks authentication, though in itself credible enough. Certain it is that Angelico was staying in Rome in the first half of 1447; and he painted in the Vatican the Cappella del Sacramento, which was afterwards demolished by Paul III. In June 1447 he proceeded to Orvieto, to paint in the Cappella Nuova of the cathedral, with the co-operation of his pupil Benozzo Gozzoli. He afterwards returned to Rome to paint the chapel of Nicholas V. In this capital he died in 1455, and he lies buried in the church of the Minerva.

According to all the accounts which have reached us, few men on whom the distinction of beatification has been conferred could have deserved it more nobly than Fra Giovanni. He led a holy and self-denying life, shunning all advancement, and was a brother to the poor; no man ever saw him angered. He painted with unceasing diligence, treating none but sacred subjects; he never retouched or altered his work, probably with a religious feeling that such as divine providence allowed the thing to come, such it should remain He was wont to say that he who illustrates the acts of Christ should be with Christ. It is averred that he never handled a brush without fervent prayer and he wept when he painted a Crucifixion. The Last Judgment and the Annunciation were two of the subjects he most frequently treated.

Bearing in mind the details already given as to the dates of Fra Giovanni's sojournings in various localities, the reader will be able to trace approximately the sequence of the works which we now proceed to name as among his most important productions. In Florence, in the convent of S. Marco (now converted into a national museum), a series of frescoes, beginning towards 1443; in the first cloister is the Crucifixion with St Dominic kneeling; and the same treatment recurs on a wall near the dormitory; in the chapterhouse is a third Crucifixion, with the Virgin swooning, a composition of twenty life-sized figures—the red background, which has a strange and harsh effect, is the misdoing of some restorer; an "Annunciation," the figures of about three-fourths of life-size, in a dormitory; in the adjoining passage, the "Virgin enthroned," with four saints; on the wall of a cell, the "Coronation of the Virgin," with Saints Paul, Thomas Aquinas, Benedict, Dominic, Francis and Peter Martyr; two Dominicans welcoming Jesus, habited as a pilgrim; an "Adoration of the Magi"; the "Marys at the Sepulchre." All these works are later than the altarpiece which Angelico painted (as before mentioned) for the choir connected with this convent, and which is now in the academy of Florence; it represents the Virgin with Saints Cosmas and Damian (the patrons of the Medici family), Dominic, Peter, Francis, Mark, John Evangelist and Stephen; the pediment illustrated the lives of Cosmas and Damian, but it has long been severed from the main subject. In the Uffizi gallery, an altarpiece, the Virgin (life-sized) enthroned, with the Infant and twelve angels. In S. Domenico, Fiesole, a few frescoes, less fine than those in S. Marco; also an altarpiece in tempera of the Virgin and Child between Saints Peter, Thomas Aquinas, Dominic and Peter Martyr, now much destroyed. The subject which originally formed the predella of this picture has, since 1860, been in the National Gallery, London, and worthily represents there the hand of the saintly painter. The subject is a Glory, Christ with the banner of the Resurrection, and a multitude of saints, including, at the extremities, the saints or beati of the Dominican order; here are no fewer than 266 figures or portions of figures, many of them having names inscribed. This predella was highly lauded by Vasari; still more highly another picture which used to form an altarpiece in Fiesole, and which now obtains world-wide celebrity in the Louvre—the "Coronation of the Virgin," with eight predella subjects of the miracles of St. Dominic. For the church of Santa Trinita, Florence, Angelico executed a "Deposition from the Cross," and for the church of the Angeli, a "Last Judgment," both now in the Florentine academy; for S. Maria Novella, a "Coronation of the Virgin," with a predella in three sections, now in the Uffizi,—this again is one of his masterpieces. In Orvieto cathedral he painted three triangular divisions of the ceiling, portraying respectively Christ in a glory of angels, sixteen saints and prophets, and the virgin and apostles: all these are now much repainted and damaged. In Rome, in the Chapel of Nicholas V., the acts of Saints Stephen and Lawrence; also various figures of saints, and on the ceiling the four evangelists. These works of the painter's advanced age, which have suffered somewhat from restorations, show vigour superior to that of his youth, along with a more adequate treatment of the architectural perspectives. Naturally, there are a number of works currently attributed to Angelico, but not really his; for instance, a "St Thomas with the Madonna's girdle," in the Lateran museum, and a "Virgin enthroned," in the church of S. Girolamo, Fiesole. It has often been said that he commenced and frequently practised as an illuminator; this is dubious and a presumption arises that illuminations executed by Giovanni's brother, Benedetto, also a Dominican, who died in 1448, have been ascribed to the more famous artist. Benedetto may perhaps have assisted Giovanni in the frescoes at S. Marco, but nothing of the kind is distinctly traceable. A folio series of engravings from these paintings was published in Florence, in 1852. Along with Gozzoli already mentioned, Zanobi Strozzi and Gentile da Fabriano are named as pupils of the Beato.

We have spoken of Angelico's art as "pietistic"; this is in fact its predominant character. His visages have an air of rapt suavity, devotional fervency and beaming esoteric consciousness, which is intensely attractive to some minds and realizes beyond rivalry a particular ideal—that of ecclesiastical saintliness and detachment from secular fret and turmoil. It should not be denied that he did not always escape the pitfalls of such a method of treatment, the faces becoming sleek and prim, with a smirk of sexless religiosity which hardly eludes the artificial or even the hypocritical; on other minds, therefore, and these some of the most masculine and resolute, he produces little genuine impression. After allowing for this, Angelico should nevertheless be accepted beyond cavil as an exalted typical painter according to his own range of conceptions, consonant with his monastic calling, unsullied purity of life and exceeding devoutness. Exquisite as he is in his special mode of execution, he undoubtedly falls far short, not only of his great naturalist contemporaries such as Masaccio and Lippo Lippi, but even of so distant a precursor as Giotto, in all that pertains to bold or life-like invention of a subject or the realization of ordinary appearances, expressions and actions—the facts of nature, as distinguished from the aspirations or contemplations of the spirit. Technically speaking, he had much finish and harmony of composition and colour, without corresponding mastery of light and shade, and his knowledge of the human frame was restricted. The brilliancy and fair light scale of his tints is constantly remarkable, combined with a free use of gilding; this conduces materially to that celestial character which so pre-eminently distinguishes his pictured visions of the divine persons, the hierarchy of heaven and the glory of the redeemed.

Books regarding Fra Angelico are numerous. We may mention those by S. Beissel, 1895; V. M. Crawford, 1900; R. L. Douglas, 1900; I. B. Supino, 1901; D. Tumiati, 1897; G. Williamson, 1901. (W. M. R.)

ANGELL, GEORGE THORNDIKE (1823–1909), American philanthropist, was born at Southbridge, Massachusetts, on the 5th of June 1823. He graduated at Dartmouth in 1846, studied law at the Harvard Law School, and in 1851 was admitted to the bar in Boston, where he practised for many years. In 1868 he founded and became president of the Massachusetts Society for the Prevention of Cruelty to Animals, in the same year establishing and becoming editor of *Our Dumb Animals*, a journal for the promotion of organized effort in securing the humane treatment of animals. For many years he was active in the organization of humane societies in England and America. In 1882 he initiated the movement for the establishment of Bands of Mercy (for the promotion of humane treatment of animals), of which in 1908 there were more than 72,000 in active existence. In 1889 he founded and became president of the American Humane Education Society. He became well known as a criminologist and also as an advocate of laws for the safeguarding of the public health and against adulteration of food. He died at Boston on the 16th of March 1909.

ANGEL-LIGHTS, in architecture, the outer upper lights in a perpendicular window, next to the springing; probably a corruption of the word angle-lights, as they are nearly triangular.

ANGELUS, a Roman Catholic devotion in memory of the Annunciation. It has its name from the opening words, *Angelus Domini nuntiavit Mariae.* It consists of three texts describing the mystery, recited as versicle and response alternately with the salutation "Hail, Mary!" This devotion is recited in the Catholic Church three times daily, about 6 A.M., noon and 6 P.M. At these hours a bell known as the Angelus bell is rung. This is still rung in some English country churches, and has often been mistaken for and alleged to be a survival of the curfew-bell. The institution of the Angelus is by some ascribed to Pope Urban II., by some to John XXII. The triple recitation is ascribed to Louis XI. of France, who in 1472 ordered it to be thrice said daily.

ANGELUS SILESIUS (1624–1677), German religious poet, was born in 1624 at Breslau. His family name was Johann Scheffler, but he is generally known by the pseudonym Angelus Silesius, under which he published his poems and which marks the country of his birth. Brought up a Lutheran, and at first physician to the duke of Württemberg-Oels, he joined in 1652 the Roman Catholic Church, in 1661 took orders as a priest, and became coadjutor to the prince bishop of Breslau. He died at Breslau on the 9th of July 1677. In 1657 Silesius published under the title *Heilige Seelenlust, oder geistliche Hirtenlieder der in ihren Jesum verliebten Psyche* (1657), a collection of 205 hymns, the most beautiful of which, such as, *Liebe, die du mich zum Bilde deiner Gottheit hast gemacht* and *Mir nach, spricht Christus, unser Held*, have been adopted in the German Protestant hymnal. More remarkable, however, is his *Geistreiche Sinn- und Schlussreime* (1657), afterwards called *Cherubinischer Wandersmann* (1674). This is a collection of "Reimsprüche" or rhymed distichs embodying a strange mystical pantheism drawn mainly from the writings of Jakob Böhme and his followers. Silesius delighted specially in the subtle paradoxes of mysticism. The essence of God, for instance, he held to be love; God, he said, can love nothing inferior to himself; but he cannot be an object of love to himself without going out, so to speak, of himself, without manifesting his infinity in a finite form; in other words, by becoming man. God and man are therefore essentially one.

A complete edition of Scheffler's works (*Sämtliche poetische Werke*) was published by D. A. Rosenthal, 2 vols. (Regensburg, 1862). Both the *Cherubinischer Wandersmann* and *Heilige Seelenlust* have been republished by G. Ellinger (1895 and 1901); a selection from the former work by O. E. Hartleben (1896). For further notices of Silesius' life and work, see Hoffmann von Fallersleben in *Weimar'sches Jahrbuch I.* (Hanover, 1854); A. Kahlert, *Angelus Silesius* (1853); C. Seltmann, *Angelus Silesius und seine Mystik* (1896), and a biog. by H. Mahn (Dresden, 1896).

ANGERMÜNDE, a town of Germany, in the Prussian province of Brandenburg, on Lake Münde, 43 m. from Berlin by the Berlin-Stettin railway, and at the junction of lines to Prenzlau, Freienwalde and Schwedt. Pop. (1900) 7465. It has three Protestant churches, a grammar school and court of law. Its industries embrace iron founding and enamel working. In 1420 the elector Frederick I. of Brandenburg gained here a signal victory over the Pomeranians.

ANGERONA, or ANGERONIA, an old Roman goddess, whose name and functions are variously explained. According to ancient authorities, she was a goddess who relieved men from pain and sorrow, or delivered the Romans and their flocks from *angina* (quinsy); or she was the protecting goddess of Rome and the keeper of the sacred name of the city, which might not be pronounced lest it should be revealed to her enemies; it was even thought that Angerona itself was this name. Modern scholars regard her as a goddess akin to Ops, Acca Larentia and Dea Dia; or as the goddess of the new year and the returning sun (according to Mommsen, *ab angerendo* = ἀπὸ τοῦ ἀναφέρεσθαι τὸν ἥλιον). Her festival, called Divalia or Angeronalia, was celebrated on the 21st of December. The priests offered sacrifice in the temple of Volupia, the goddess of pleasure, in which stood a statue of Angerona, with a finger on her mouth, which was bound and closed (Macrobius i. 10; Pliny, *Nat. Hist.* iii. 9; Varro, *L. L.* vi. 23). She was worshipped as Ancharia at Faesulae, where an altar belonging to her has been recently discovered. (See FAESULAE.)

ANGERS, a city of western France, capital of the department of Maine-et-Loire, 191 m. S.W. of Paris by the Western railway to Nantes. Pop. (1906) 73,585. It occupies rising ground on both banks of the Maine, which are united by three bridges. The surrounding district is famous for its flourishing nurseries and market gardens. Pierced with wide, straight streets, well provided with public gardens, and surrounded by ample, tree-lined boulevards, beyond which lie new suburbs, Angers is one of the pleasantest towns in France. Of its numerous medieval buildings the most important is the cathedral of St Maurice, dating in the main from the 12th and 13th centuries. Between the two flanking towers of the west façade, the spires of which are of the 16th century, rises a central tower of the same period. The most prominent feature of the façade is the series of eight warriors carved on the base of this tower. The vaulting of the nave takes the form of a series of cupolas, and that of the choir and transept is similar. The chief treasures of the church are its rich stained glass (12th, 13th and 15th centuries) and valuable tapestry (14th to 18th centuries). The bishop's palace which adjoins the cathedral contains a fine synodal hall of the 12th century. Of the other churches of Angers, the principal are St Serge, an abbey-church of the 12th and 15th centuries, and La Trinité (12th century). The prefecture occupies the buildings of the famous abbey of St Aubin; in its courtyard are elaborately sculptured arcades of the 11th and 12th centuries, from which period dates the tower, the only survival of the splendid abbey-church. Ruins of the old churches of Toussaint (13th century) and Notre-Dame du Ronceray (11th century) are also to be seen. The castle of Angers, an imposing building girt with towers and a moat, dates from the 13th century and is now used as an armoury. The ancient hospital of St Jean (12th century) is occupied by an archaeological museum; and the Logis Barrault, a mansion built about 1500, contains the public library, the municipal museum, which has a large collection of pictures and sculptures, and the Musée David, containing works by the famous sculptor David d'Angers, who was a native of the town. One of his masterpieces, a bronze statue of René of Anjou, stands close by the castle. The Hôtel de Pincé or d'Anjou (1523–1530) is the finest of the stone mansions of Angers; there are also many curious wooden houses of the 15th and 16th centuries. The palais de justice, the Catholic institute, a fine theatre, and a hospital with 1500 beds are the more remarkable of the modern buildings of the town. Angers is the seat of a bishopric, dating from the 3rd century, a prefecture, a court of appeal and a court of assizes. It has a tribunal of first instance, a tribunal of commerce, a board of trade-arbitrators, a chamber of commerce, a branch of the Bank of France and several learned societies. Its educational institutions include ecclesiastical seminaries, a lycée, a preparatory school of medicine and pharmacy, a university with free faculties (*facultês libres*) of theology, law, letters and science, a higher school of agriculture, training colleges, a school of arts and handicrafts and a school of fine art. The prosperity of the town is largely due to the great slate-quarries of the vicinity, but the distillation of liqueurs from fruit, cable, rope and thread-making, and the manufacture of boots and shoes, umbrellas and parasols are leading industries. The weaving of sail-cloth and woollen and other fabrics, machine construction, wire-drawing, and manufacture of sparkling wines and preserved fruits are also carried on. The chief articles of commerce, besides slate and manufactured goods, are hemp, early vegetables, fruit, flowers and live-stock.

Angers, capital of the Gallic tribe of the Andecavi, was under the Romans called Juliomagus. During the 9th century it became the seat of the counts of Anjou (*q.v.*). It suffered severely from the invasions of the Northmen in 845 and the succeeding years, and of the English in the 12th and 15th centuries; the Huguenots took it in 1585, and the Vendean royalists were repulsed near it in 1793. Till the Revolution, Angers was the seat of a celebrated university founded in the 14th century.

See L. M. Thorode, *Notice de la ville d'Angers* (Angers, 1897).

ANGERSTEIN, JOHN JULIUS (1735–1822), London merchant, and patron of the fine arts, was born at St Petersburg and settled in London about 1749. His collection of paintings, consisting of about forty of the most exquisite specimens of the art, purchased by the British government, on his death, formed the nucleus of the National Gallery.

ANGILBERT (d. 814), Frankish Latin poet, and minister of Charlemagne, was of noble Frankish parentage, and educated at the palace school under Alcuin. As the friend and adviser of the emperor's son, Pippin, he assisted for a while in the government of Italy, and was later sent on three important embassies to the pope, in 792, 794 and 796. Although he was the father of two children by Charlemagne's daughter, Bertha, one of them named Nithard, we have no authentic account of his marriage, and from 790 he was abbot of St Riquier, where his brilliant rule gained for him later the renown of a saint. Angilbert, however, was little like the true medieval saint; his poems reveal rather the culture and tastes of a man of the world, enjoying the closest intimacy with the imperial family. He accompanied Charlemagne to Rome in 800 and was one of the witnesses to his will in 814. Angilbert was the Homer of the emperor's literary circle, and was the probable author of an epic, of which the fragment which has been preserved describes the life at the palace and the meeting between Charlemagne and Leo III. It is a mosaic from Virgil, Ovid, Lucan and Fortunatus, composed in the manner of Einhard's use of Suetonius, and exhibits a true poetic gift. Of the shorter poems, besides the greeting to Pippin on his return from the campaign against the Avars (796), an epistle to David (Charlemagne) incidentally reveals a delightful picture of the poet living with his children in a house surrounded by pleasant gardens near the emperor's palace. The reference to Bertha, however, is distant and respectful, her name occurring merely on the list of princesses to whom he sends his salutation.

Angilbert's poems have been published by E. Dummler in the *Monumenta Germaniae Historica*. For criticisms of this edition see Traube in Roederer's *Schriften für germanische Philologie* (1888). See also A. Molinier, *Les Sources de l'histoire de France*.

ANGINA PECTORIS (Latin for "pain of the chest"), a term applied to a violent paroxysm of pain, arising almost invariably in connexion with disease of the coronary arteries, a lesion causing progressive degeneration of the heart muscle (see HEART: *Disease*). An attack of angina pectoris usually comes on with a sudden seizure of pain, felt at first over the region of the heart, but radiating through the chest in various directions, and frequently extending down the left arm. A feeling of constriction and of suffocation accompanies the pain, although there is seldom actual difficulty in breathing. When the attack comes on, as it often does, in the course of some bodily exertion, the sufferer is at once brought to rest, and during the continuance of the paroxysm experiences the most intense agony. The countenance becomes pale, the surface of the body cold, the pulse feeble, and death appears to be imminent, when suddenly the attack subsides and complete relief is obtained. The duration of a paroxysm rarely exceeds two or three minutes, but it may last for a longer period. The attacks are apt to recur on slight exertion, and even in aggravated cases without any such exciting cause. Occasionally the first seizure proves fatal; but more commonly death takes place as the result of repeated attacks. Angina pectoris is extremely rare under middle life, and is much more common in males than in females. It must always be regarded as a disorder of a very serious nature. In the treatment of the paroxysm, nitrite of amyl has now replaced all other remedies. It can be carried by the patient in the form of nitrite of amyl pearls, each pearl containing the dose prescribed by the physician. Kept in this way the drug does not lose strength. As soon as the pain begins the patient crushes a pearl in his handkerchief and holds it to his mouth and nose. The relief given in this way is marvellous and usually takes place within a very few seconds. In the rare cases where this drug does not relieve, hypodermic injections of morphia are used. But on account of the well-known dangers of this drug, it should only be administered by a medical man. To prevent recurrence of the attacks something may be done by scrupulous attention to the general health, and by the avoidance of mental and physical strain. But the most important preventive of all is "bed," of which fourteen days must be enforced on the least premonition of anginal pain.

Pseudo-angina.—In connexion with angina pectoris, a far more common condition must be mentioned that has now universally received the name of pseudo-angina. This includes the praecordial pains which very closely resemble those of true angina. The essential difference lies in the fact that pseudo-angina is independent of structural disease of the heart and coronary arteries. In true angina there is some condition within the heart which starts the stimulus sent to the nerve centres. In pseudo-angina the starting-point is not the heart but some peripheral or visceral nerve. The impulse passes thence to the medulla, and so reaching the sensory centres starts a feeling of pain that radiates into the chest or down the arm. There are three main varieties:—(1) the reflex, (2) the vaso-motor, (3) the toxic. The reflex is by far the most common, and is generally due to irritation from one of the abdominal organs. An attack of pseudo-angina may be agonizing, the pain radiating through the chest and into the left arm, but the patient does not usually assume the motionless attitude of true angina, and the duration of the seizure is usually much longer. The treatment is that of the underlying neurosis and the prognosis is a good one, sudden death not occurring.

ANGIOSPERMS. The botanical term "Angiosperm" (ἀγγεῖον, receptacle, and *σπέρμα*, seed) was coined in the form Angiospermae by Paul Hermann in 1690, as the name of that one of his primary divisions of the plant kingdom, which included flowering plants possessing seeds enclosed in capsules, in contradistinction to his Gymnospermae, or flowering plants with achenial or schizo-carpic fruits—the whole fruit or each of its pieces being here regarded as a seed and naked. The term and its antonym were maintained by Linnaeus with the same sense, but with restricted application, in the names of the orders of his class Didynamia. Its use with any approach to its modern scope only became possible after Robert Brown had established in 1827 the existence of truly naked seeds in the Cycadeae and Coniferae, entitling them to be correctly called Gymnosperms. From that time onwards, so long as these Gymnosperms were, as was usual, reckoned as dicotyledonous flowering plants, the term Angiosperm was used antithetically by botanical writers, but with varying limitation, as a group-name for other dicotyledonous plants. The advent in 1851 of Hofmeister's brilliant discovery of the changes proceeding in the embryo-sac of flowering plants, and his determination of the correct relationships of these with the Cryptogamia, fixed the true position of Gymnosperms as a class distinct from Dicotyledons, and the term Angiosperm then gradually came to be accepted as the suitable designation for the whole of the flowering plants other than Gymnosperms, and as including therefore the classes of Dicotyledons and Monocotyledons. This is the sense in which the term is nowadays received and in which it is used here.

The trend of the evolution of the plant kingdom has been in the direction of the establishment of a vegetation of fixed habit and adapted to the vicissitudes of a life on land, and the Angiosperms are the highest expression of this evolution and constitute the dominant vegetation of the earth's surface at the present epoch. There is no land-area from the poles to the equator, where plant-life is possible, upon which Angiosperms are not found. They occur also abundantly in the shallows of rivers and fresh-water lakes, and in less number in salt lakes and in the sea; such aquatic Angiosperms are not, however, primitive forms, but are derived from immediate land-ancestors. Associated with this diversity of habitat is great variety in general form and manner of growth. The familiar duckweed which covers the surface of a pond consists of a tiny green "thalloid" shoot, one, that is, which shows no distinction of parts—stem and leaf, and a simple root growing vertically downwards into the water. The great forest-tree has a shoot, which in the course perhaps of hundreds of years, has developed a wide-spreading system of trunk and branches, bearing on the ultimate twigs or branchlets innumerable leaves, while beneath the soil a widely-branching root-system covers an area of corresponding extent. Between these two extremes is every conceivable gradation, embracing aquatic and terrestrial herbs, creeping, erect or climbing in habit, shrubs and trees, and representing a much greater variety than is to be found in the other subdivision of seed-plants, the Gymnosperms.

Internal structure.

In internal structure also the variety of tissue-formation far exceeds that found in Gymnosperms (see PLANTS: *Anatomy*). The vascular bundles of the stem belong to the collateral type, that is to say, the elements of the wood or xylem and the bast or phloem stand side by side on the same radius. In the larger of the two great groups into which the Angiosperms are divided, the Dicotyledons, the bundles in the very young stem are arranged in an open ring, separating a central pith from an outer cortex. In each bundle, separating the xylem and phloem, is a layer of meristem or active formative tissue, known as cambium; by the formation of a layer of cambium between the bundles (interfascicular cambium) a complete ring is formed, and a regular periodical increase in thickness results from it by the development of xylem on the inside and phloem on the outside. The soft phloem soon becomes crushed, but the hard wood persists, and forms the great bulk of the stem and branches of the woody perennial. Owing to differences in the character of the elements produced at the beginning and end of the season, the wood is marked out in transverse section into concentric rings, one for each season of growth—the so-called annual rings. In the smaller group, the Monocotyledons, the bundles are more numerous in the young stem and scattered through the ground tissue. Moreover they contain no cambium and the stem once formed increases in diameter only in exceptional cases.

Vegetative organs.

As in Gymnosperms, branching is monopodial; dichotomy or the forking of the growing point into two equivalent branches which replace the main stem, is absent both in the case of the stem and the root. The leaves show a remarkable variety in form (see LEAF), but are generally small in comparison with the size of the plant; exceptions occur in some Monocotyledons, *e.g.* in the Aroid family, where in some genera the plant produces one huge, much-branched leaf each season.

In rare cases the main axis is unbranched and ends in a flower, as, for instance, in the tulip, where scale-leaves, forming the underground bulb, green foliage-leaves and coloured floral leaves are borne on one and the same axis. Generally, flowers are formed only on shoots of a higher order, often only on the ultimate branches of a much branched system. A potential branch or bud, either foliage or flower, is formed in the axil of each leaf; sometimes more than one bud arises, as for instance in the walnut, where two or three stand in vertical series above each leaf. Many of the buds remain dormant, or are called to development under exceptional circumstances, such as the destruction of existing branches. For instance, the clipping of a hedge or the lopping of a tree will cause to develop numerous buds which may have been dormant for years. Leaf-buds occasionally arise from the roots, when they are called adventitious; this occurs in many fruit trees, poplars, elms and others. For instance, the young shoots seen springing from the ground around an elm are not seedlings but root-shoots. Frequently, as in many Dicotyledons, the primary root, the original root of the seedling, persists throughout the life of the plant, forming, as often in biennials, a thickened tap-root, as in carrot, or in perennials, a much-branched root system. In many Dicotyledons and most Monocotyledons, the primary root soon perishes, and its place is taken by adventitious roots developed from the stem.

Flower.

The most characteristic feature of the Angiosperm is the flower, which shows remarkable variety in form and elaboration, and supplies the most trustworthy characters for the distinction of the series and families or natural orders, into which the group is divided. The flower is a shoot (stem bearing leaves) which has a special form associated with the special function of ensuring the fertilization of the egg and the development of fruit containing seed. Except where it is terminal it arises, like the leaf-shoot, in the axil of a leaf, which is then known as a bract. Occasionally, as in violet, a flower arises singly in the axil of an ordinary foliage-leaf; it is then termed axillary. Generally, however, the flower-bearing portion of the plant is sharply distinguished from the foliage leaf-bearing or vegetative portion, and forms a more or less elaborate branch-system in which the bracts are small and scale-like. Such a branch-system is called an inflorescence. The primary function of the flower is to bear the spores. These, as in Gymnosperms, are of two kinds, microspores or pollen-grains, borne in the stamens (or microsporophylls) and megaspores, in which the egg-cell is developed, contained in the ovule, which is borne enclosed in the carpel (or megasporophyll). The flower may consist only of spore-bearing leaves, as in willow, where each flower comprises only a few stamens or two carpels. Usually, however, other leaves are present which are only indirectly concerned with the reproductive process, acting as protective organs for the sporophylls or forming an attractive envelope. These form the perianth and are in one series, when the flower is termed monochlamydeous, or in two series (dichlamydeous). In the second case the outer series (calyx of sepals) is generally green and leaf-like, its function being to protect the rest of the flower, especially in the bud; while the inner series (corolla of petals) is generally white or brightly coloured, and more delicate in structure, its function being to attract the particular insect or bird by agency of which pollination is effected. The insect, &c., is attracted by the colour and scent of the flower, and frequently also by honey which is secreted in some part of the flower. (For further details on the form and arrangement of the flower and its parts, see FLOWER.)

Stamen and pollen.

Each stamen generally bears four pollen-sacs (*microsporangia*) which are associated to form the anther, and carried up on a stalk or filament. The development of the microsporangia and the contained spores (pollen-grains) is closely comparable with that of the microsporangia in Gymnosperms or heterosporous ferns. The pollen is set free by the opening (dehiscence) of the anther, generally by means of longitudinal slits, but sometimes by pores, as in the heath family (Ericaceae), or by valves, as in the barberry. It is then dropped or carried by some external agent, wind, water or some member of the animal kingdom, on to the receptive surface of the carpel of the same or another flower. The carpel, or aggregate of carpels forming the pistil or gynaeceum, comprises an ovary containing one or more ovules and a receptive surface or stigma; the stigma is sometimes carried up on a style. The mature pollen-grain is, like other spores, a single cell; except in the case of some submerged aquatic plants, it has a double wall, a thin delicate wall of unaltered cellulose, the endospore or intine, and a tough outer cuticularized exospore or extine. The exospore often bears spines or warts, or is variously sculptured, and the character of the markings is often of value for the distinction of genera or higher groups. Germination of the microspore begins before it leaves the pollen-sac. In very few cases has anything representing prothallial development been observed; generally a small cell (the antheridial or generative cell) is cut off, leaving a larger tube-cell. When placed on the stigma, under favourable circumstances, the pollen-grain puts forth a pollen-tube which grows down the tissue of the style to the ovary, and makes its way along the placenta, guided by projections or hairs, to the mouth of an ovule. The nucleus of the tube-cell has meanwhile passed into the tube, as does also the generative nucleus which divides to form two male- or sperm-cells. The male-cells are carried to their destination in the tip of the pollen-tube.

Pistil and embryo-sac.

Fertilization.

The ovary contains one or more ovules borne on a placenta, which is generally some part of the ovary-wall. The development of the ovule, which represents the macrosporangium, is very similar to the process in Gymnosperms; when mature it consists of one or two coats surrounding the central nucellus, except at the apex where an opening, the micropyle, is left. The nucellus is a cellular tissue enveloping one large cell, the embryo-sac or macrospore. The germination of the macrospore consists in the repeated division of its nucleus to form two groups of four, one group at each end of the embryo-sac. One nucleus from each group, the polar nucleus, passes to the centre of the sac, where the two fuse to form the so-called definitive nucleus. Of the three cells at the micropylar end of the sac, all naked cells (the so-called egg-apparatus), one is the egg-cell or oosphere, the other two, which may be regarded as representing abortive egg-cells (in rare cases capable of fertilization), are known as synergidae. The three cells at the opposite end are known as antipodal cells and become invested with a cell-wall. The gametophyte or prothallial generation is thus extremely reduced, consisting of but little more than the male and female sexual cells—the two sperm-cells in the pollen-tube and the egg-cell (with the synergidae) in the embryo-sac. At the period of fertilization the embryo-sac lies in close proximity to the opening of the micropyle, into which the pollen-tube has penetrated, the separating cell-wall becomes absorbed, and the male or sperm-cells are ejected into the embryo-sac. Guided by the synergidae one male-cell passes into the oosphere with which it fuses, the two nuclei uniting, while the other fuses with the definitive nucleus, or, as it is also called, the endosperm nucleus. This remarkable double fertilization as it has been called, although only recently discovered, has been proved to take place in widely-separated families, and both in Monocotyledons and Dicotyledons, and there is every probability that, perhaps with variations, it is the normal process in Angiosperms. After impregnation the fertilized oosphere immediately surrounds itself with a cell-wall and becomes the oospore which by a process of growth forms the embryo of the new plant. The endosperm-nucleus divides rapidly to produce a cellular tissue which fills up the interior of the rapidly-growing embryo-sac, and forms a tissue, known as endosperm, in which is stored a supply of nourishment for the use later on of the embryo. It has long been known that after fertilization of the egg has taken place, the formation of endosperm begins from the endosperm nucleus, and this had come to be regarded as the recommencement of the development of a prothallium after a pause following the reinvigorating union of the polar nuclei. This view is still maintained by those who differentiate two acts of fertilization within the embryo-sac, and regard that of the egg by the first male-cell, as the true or generative fertilization, and that of the polar nuclei by the second male gamete as a vegetative fertilization which gives a stimulus to development in correlation with the other. If, on the other hand, the endosperm is the product of an act of fertilization as definite as that giving rise to the embryo itself, we have to recognize that twin-plants are produced within the embryo-sac—one, the embryo, which becomes the angiospermous plant, the other, the endosperm, a short-lived, undifferentiated nurse to assist in the nutrition of the former, even as the subsidiary embryos in a pluri-embryonic Gymnosperm may facilitate the nutrition of the dominant one. If this is so, and the endosperm like the embryo is normally the product of a sexual act, hybridization will give a hybrid endosperm as it does a hybrid embryo, and herein (it is suggested) we may have the explanation of the phenomenon of xenia observed in the mixed endosperms of hybrid races of maize and other plants, regarding which it has only been possible hitherto to assert that they were indications of the extension of the influence of the pollen beyond the egg and its product. This would not, however, explain the formation of fruits intermediate in size and colour between those of crossed parents. The signification of the coalescence of the polar nuclei is not explained by these new facts, but it is noteworthy that the second male-cell is said to unite sometimes with the apical polar nucleus, the sister of the egg, before the union of this with the basal polar one. The idea of the endosperm as a second subsidiary plant is no new one; it was suggested long ago in explanation of the coalescence of the polar nuclei, but it was then based on the assumption that these represented male and female cells, an assumption for which there was no evidence and which was inherently improbable. The proof of a coalescence of the second male nucleus with the definitive nucleus gives the conception a more stable basis. The antipodal cells aid more or less in the process of nutrition of the developing embryo, and may undergo multiplication, though they ultimately disintegrate, as do also the synergidae. As in Gymnosperms and other groups an interesting qualitative change is associated with the process of fertilization. The number of chromosomes (see PLANTS: *Cytology*) in the nucleus of the two spores, pollen-grain and embryo-sac, is only half the number found in an ordinary vegetative nucleus; and this reduced number persists in the cells derived from them. The full number is restored in the fusion of the male and female nuclei in the process of fertilization, and remains until the formation of the cells from which the spores are derived in the new generation.

In several natural orders and genera departures from the course of development just described have been noted. In the natural order Rosaceae, the series Querciflorae, and the very anomalous genus *Casuarina* and others, instead of a single macrospore a more or less extensive sporogenous tissue is formed, but only one cell proceeds to the formation of a functional female cell. In *Casuarina*, *Juglans* and the order Corylaceae, the pollen-tube does not enter by means of the micropyle, but passing down the ovary wall and through the placenta, enters at the chalazal end of the ovule. Such a method of entrance is styled chalazogamic, in contrast to the porogamic or ordinary method of approach by means of the micropyle.

Embryology.

The result of fertilization is the development of the ovule into the seed. By the segmentation of the fertilized egg, now invested by cell-membrane, the embryo-plant arises. A varying number of transverse segment-walls transform it into a pro-embryo—a cellular row of which the cell nearest the micropyle becomes attached to the apex of the embryo-sac, and thus fixes the position of the developing embryo, while the terminal cell is projected into its cavity. In Dicotyledons the shoot of the embryo is wholly derived from the terminal cell of the pro-embryo, from the next cell the root arises, and the remaining ones form the suspensor. In many Monocotyledons the terminal cell forms the cotyledonary portion alone of the shoot of the embryo, its axial part and the root being derived from the adjacent cell; the cotyledon is thus a terminal structure and the apex of the primary stem a lateral one—a condition in marked contrast with that of the Dicotyledons. In some Monocotyledons, however, the cotyledon is not really terminal. The primary root of the embryo in all Angiosperms points towards the micropyle. The developing embryo at the end of the suspensor grows out to a varying extent into the forming endosperm, from which by surface absorption it derives good material for growth; at the same time the suspensor plays a direct part as a carrier of nutrition, and may even develop, where perhaps no endosperm is formed, special absorptive "suspensor roots" which invest the developing embryo, or pass out into the body and coats of the ovule, or even into the placenta. In some cases the embryo or the embryo-sac sends out suckers into the nucellus and ovular integument. As the embryo develops it may absorb all the food material available, and store, either in its cotyledons or in its hypocotyl, what is not immediately required for growth, as reserve-food for use in germination, and by so doing it increases in size until it may fill entirely the embryo-sac; or its absorptive power at this stage may be limited to what is necessary for growth and it remains of relatively small size, occupying but a small area of the embryo-sac, which is otherwise filled with endosperm in which the reserve-food is stored. There are also intermediate states. The position of the embryo in relation to the endosperm varies, sometimes it is internal, sometimes external, but the significance of this has not yet been established.

The formation of endosperm starts, as has been stated, from the endosperm nucleus. Its segmentation always begins before that of the egg, and thus there is timely preparation for the nursing of the young embryo. If in its extension to contain the new formations within it the embryo-sac remains narrow, endosperm formation proceeds upon the lines of a cell-division, but in wide embryo-sacs the endosperm is first of all formed as a layer of naked cells around the wall of the sac, and only gradually acquires a pluricellular character, forming a tissue filling the sac. The function of the endosperm is primarily that of nourishing the embryo, and its basal position in the embryo-sac places it favourably for the absorption of food material entering the ovule. Its duration varies with the precocity of the embryo. It may be wholly absorbed by the progressive growth of the embryo within the embryo-sac, or it may persist as a definite and more or less conspicuous constituent of the seed. When it persists as a massive element of the seed its nutritive function is usually apparent, for there is accumulated within its cells reserve-food, and according to the dominant substance it is starchy, oily, or rich in cellulose, mucilage or proteid. In cases where the embryo has stored reserve food within itself and thus provided for self-nutrition, such endosperm as remains in the seed may take on other functions, for instance, that of water-absorption.

Some deviations from the usual course of development may be noted. Parthenogenesis, or the development of an embryo from an egg-cell without the latter having been fertilized has been described in species of *Thalictrum*, *Antennaria* and *Alchemilla*. Polyembryony is generally associated with the development of cells other than the egg-cell. Thus in *Erythronium* and *Limnocharis* the fertilized egg may form a mass of tissue on which several embryos are produced. Isolated cases show that any of the cells within the embryo-sac may exceptionally form an embryo, *e.g.* the synergidae in species of *Mimosa*, *Iris* and *Allium*, and in the last-mentioned the antipodal cells also. In *Coelebogyne* (Euphorbiaceae) and in *Funkia* (Liliaceae) polyembryony results from an adventitious production of embryos from the cells of the nucellus around the top of the embryo-sac. In a species of *Allium*, embryos have been found developing in the same individual from the egg-cell, synergids, antipodal cells and cells of the nucellus. In two Malayan species of *Balanophora*, the embryo is developed from a cell of the endosperm, which is formed from the upper polar nucleus only, the egg apparatus becoming disorganized. The last-mentioned case has been regarded as representing an apogamous development of the sporophyte from the gametophyte comparable to the cases of apogamy described in Ferns. But the great diversity of these abnormal cases as shown in the examples cited above suggests the use of great caution in formulating definite morphological theories upon them.

Fruit and seed.

Dissemination.

As the development of embryo and endosperm proceeds within the embryo-sac, its wall enlarges and commonly absorbs the substance of the nucellus (which is likewise enlarging) to near its outer limit, and combines with it and the integument to form the *seed-coat*; or the whole nucellus and even the integument may be absorbed. In some plants the nucellus is not thus absorbed, but itself becomes a seat of deposit of reserve-food constituting the *perisperm* which may coexist with endosperm, as in the water-lily order, or may alone form a food-reserve for the embryo, as in *Canna*. Endospermic food-reserve has evident advantages over perispermic, and the latter is comparatively rarely found and only in non-progressive series. Seeds in which endosperm or perisperm or both exist are commonly called *albuminous* or *endospermic*, those in which neither is found are termed *exalbuminous* or *exendospermic*. These terms, extensively used by systematists, only refer, however, to the grosser features of the seed, and indicate the more or less evident occurrence of a food-reserve; many so-called exalbuminous seeds show to microscopic examination a distinct endosperm which may have other than a nutritive function. The presence or absence of endosperm, its relative amount when present, and the position of the embryo within it, are valuable characters for the distinction of orders and groups of orders. Meanwhile the ovary wall has developed to form the fruit or pericarp, the structure of which is closely associated with the manner of distribution of the seed. Frequently the influence of fertilization is felt beyond the ovary, and other parts of the flower take part in the formation of the fruit, as the floral receptacle in the apple, strawberry and others. The character of the seed-coat bears a definite relation to that of the fruit. Their function is the twofold one of protecting the embryo and of aiding in dissemination; they may also directly promote germination. If the fruit is a dehiscent one and the seed is therefore soon exposed, the seed-coat has to provide for the protection of the embryo and may also have to secure dissemination. On the other hand, indehiscent fruits discharge these functions for the embryo, and the seed-coat is only slightly developed. Dissemination is effected by the agency of water, of air, of animals—and fruits and seeds are therefore grouped in respect of this as hydrophilous, anemophilous and zooidiophilous. The needs for these are obvious—buoyancy in water and resistance to wetting for the first, some form of parachute for the second, and some attaching mechanism or attractive structure for the third. The methods in which these are provided are of infinite variety, and any and every part of the flower and of the inflorescence may be called into requisition to supply the adaptation (see FRUIT). Special outgrowths, arils, of the seed-coat are of frequent occurrence. In the feature of fruit and seed, by which the distribution of Angiosperms is effected, we have a distinctive character of the class. In Gymnosperms we have seeds, and the carpels may become modified and close around these, as in *Pinus*, during the process of ripening to form an imitation of a box-like fruit which subsequently opening allows the seeds to escape; but there is never in them the closed ovary investing from the outset the ovules, and ultimately forming the ground-work of the fruit.

Germination of seed.

Their fortuitous dissemination does not always bring seeds upon a suitable nidus for germination, the primary essential of which is a sufficiency of moisture, and the duration of vitality of the embryo is a point of interest. Some seeds retain vitality for a period of many years, though there is no warrant for the popular notion that genuine "mummy wheat" will germinate; on the other hand some seeds lose vitality in little more than a year. Further, the older the seed the more slow as a general rule will germination be in starting, but there are notable exceptions. This pause, often of so long duration, in the growth of the embryo between the time of its perfect development within the seed and the moment of germination, is one of the remarkable and distinctive features of the life of Spermatophytes. The aim of germination is the fixing of the embryo in the soil, effected usually by means of the root, which is the first part of the embryo to appear, in preparation for the elongation of the epicotyledonary portion of the shoot, and there is infinite variety in the details of the process. In albuminous Dicotyledons the cotyledons act as the absorbents of the reserve-food of the seed and are commonly brought above ground (*epigeal*), either withdrawn from the seed-coat or carrying it upon them, and then they serve as the first green organs of the plant. The part of the stem below the cotyledons (*hypocotyl*) commonly plays the greater part in bringing this about. Exalbuminous Dicotyledons usually store reserve-food in their cotyledons, which may in germination remain below ground (*hypogeal*). In albuminous Monocotyledons the cotyledon itself, probably in consequence of its terminal position, is commonly the agent by which the embryo is thrust out of the seed, and it may function solely as a feeder, its extremity developing as a sucker through which the endosperm is absorbed, or it may become the first green organ, the terminal sucker dropping off with the seed-coat when the endosperm is exhausted. Exalbuminous Monocotyledons are either hydrophytes or strongly hygrophilous plants and have often peculiar features in germination.

Vegetative reproduction.

Distribution by seed appears to satisfy so well the requirements of Angiosperms that distribution by vegetative buds is only an occasional process. At the same time every bud on a shoot has the capacity to form a new plant if placed in suitable conditions, as the horticultural practice of propagation by cuttings shows; in nature we see plants spreading by the rooting of their shoots, and buds we know may be freely formed not only on stems but on leaves and on roots. Where detachable buds are produced, which can be transported through the air to a distance, each of them is an incipient shoot which may have a root, and there is always reserve-food stored in some part of it. In essentials such a bud resembles a seed. A relation between such vegetative distribution buds and production of flower is usually marked. Where there is free formation of buds there is little flower and commonly no seed, and the converse is also the case. Viviparous plants are an illustration of substitution of vegetative buds for flower.

Phylogeny and taxonomy.

The position of Angiosperms as the highest plant-group is unassailable, but of the point or points of their origin from the general stem of the plant kingdom, and of the path or paths of their evolution, we can as yet say little. Until well on in the Mesozoic period geological history tells us nothing about Angiosperms, and then only by their vegetative organs. We readily recognize in them now-a-days the natural classes of Dicotyledons and Monocotyledons distinguished alike in vegetative and in reproductive construction, yet showing remarkable parallel sequences in development; and we see that the Dicotyledons are the more advanced and show the greater capacity for further progressive evolution. But there is no sound basis for the assumption that the Dicotyledons are derived from Monocotyledons; indeed, the palaeontological evidence seems to point to the Dicotyledons being the older. This, however, does not entitle us to assume the origin of Monocotyledons from Dicotyledons, although there is manifestly a temptation to connect helobic forms of the former with ranal ones of the latter. There is no doubt that the phylum of Angiosperms has not sprung from that of Gymnosperms.

Within each class the flower-characters as the essential feature of Angiosperms supply the clue to phylogeny, but the uncertainty regarding the construction of the primitive angiospermous flower gives a fundamental point of divergence in attempts to construct progressive sequences of the families. Simplicity of flower-structure has appeared to some to be always primitive, whilst by others it has been taken to be always derived. There is, however, abundant evidence that it may have the one or the other character in different cases. Apart from this, botanists are generally agreed that the concrescence of parts of the flower-whorls—in the gynaeceum as the seed-covering, and in the corolla as the seat of attraction, more than in the androecium and the calyx—is an indication of advance, as is also the concrescence that gives the condition of epigyny. Dorsiventrality is also clearly derived from radial construction, and anatropy of the ovule has followed atropy. We should expect the albuminous state of the seed to be an antecedent one to the exalbuminous condition, and the recent discoveries in fertilization tend to confirm this view. Amongst Dicotyledons the gamopetalous forms are admitted to be the highest development and a dominant one of our epoch. Advance has been along two lines, markedly in relation to insect-pollination, one of which has culminated in the hypogynous epipetalous bicarpellate forms with dorsiventral often large and loosely arranged flowers such as occur in Scrophulariaceae, and the other in the epigynous bicarpellate small-flowered families of which the Compositae represent the most elaborate type. In the polypetalous forms progression from hypogyny to epigyny is generally recognized, and where dorsiventrality with insect-pollination has been established, a dominant group has been developed as in the Leguminosae. The starting-point of the class, however, and the position within it of apetalous families with frequently unisexual flowers, have provoked much discussion. In Monocotyledons a similar advance from hypogyny to epigyny is observed, and from the dorsiventral to the radial type of flower. In this connexion it is noteworthy that so many of the higher forms are adapted as bulbous geophytes, or as aerophytes to special xerophilous conditions. The Gramineae offer a prominent example of a dominant self-pollinated or wind-pollinated family, and this may find explanation in a multiplicity of factors.

Though best known for his artificial (or sexual) system, Linnaeus was impressed with the importance of elaborating a natural system of arrangement in which plants should be arranged according to their true affinities. In his *Philosophia Botanica* (1751) Linnaeus grouped the genera then known into sixty-seven orders (*fragmenta*), all except five of which are Angiosperms. He gave names to these but did not characterize them or attempt to arrange them in larger groups. Some represent natural groups and had in several cases been already recognized by Ray and others, but the majority are, in the light of modern knowledge, very mixed. Well-defined polypetalous and gamopetalous genera sometimes occur in the same order, and even Monocotyledons and Dicotyledons are classed together where they have some striking physiological character in common.

Work on the lines suggested by the Linnaean *fragmenta* was continued in France by Bernard de Jussieu and his nephew, Antoine Laurent, and the arrangement suggested by the latter in his *Genera Plantarum secundum Ordines Naturales disposita* (1789) is the first which can claim to be a natural system. The orders are carefully characterized, and those of Angiosperms are grouped in fourteen classes under the two main divisions Monocotyledons and Dicotyledons. The former comprise three classes, which are distinguished by the relative position of the stamens and ovary; the eleven classes of the latter are based on the same set of characters and fall into the larger subdivisions Apetalae, Monopetalae and Polypetalae, characterized respectively by absence, union or freedom of the petals, and a subdivision, *Diclines Irregulares*, a very unnatural group, including one class only. A. P. de Candolle introduced several improvements into the system. In his arrangement the last subdivision disappears, and the Dicotyledons fall into two groups, a larger containing those in which both calyx and corolla are present in the flower, and a smaller, Monochlamydeae, representing the Apetalae and *Diclines Irregulares* of Jussieu. The dichlamydeous group is subdivided into three, Thalamiflorae, Calyciflorae and Corolliflorae, depending on the position and union of the petals. This, which we may distinguish as the French system, finds its most perfect expression in the classic *Genera Plantarum* (1862–1883) of Bentham and Hooker, a work containing a description, based on careful examination of specimens, of all known genera of flowering plants. The subdivision is as follows:—

Dicotyledons.

Polypetalae	Thalamiflorae. Disciflorae. Calyciflorae.
Gamopetalae	Inferae. Heteromerae. Bicarpellatae.

Monochlamydeae in eight series.
Monocotyledons in seven series.

Of the Polypetalae, series 1, Thalamiflorae, is characterized by hypogynous petals and stamens, and contains 34 orders distributed in 6 larger groups or cohorts. Series 2, Disciflorae, takes its name from a development of the floral axis which forms a ring or cushion at the base of the ovary or is broken up into glands; the ovary is superior. It contains 23 orders in 4 cohorts. Series 3, Calyciflorae, has petals and stamens perigynous, or sometimes superior. It contains 27 orders in 5 cohorts.

Of the Gamopetalae, series 1, Inferae, has an inferior ovary and stamens usually as many as the corolla-lobes. It contains 9 orders in 3 cohorts. Series 2, Heteromerae, has generally a superior ovary, stamens as many as the corolla-lobes or more, and more than two carpels. It contains 12 orders in 3 cohorts. Series 3, Bicarpellatae, has generally a superior ovary and usually two carpels. It contains 24 orders in 4 cohorts.

The eight series of Monochlamydeae, containing 36 orders, form groups characterized mainly by differences in the ovary and ovules, and are now recognized as of unequal value.

The seven series of Monocotyledons represent a sequence beginning with the most complicated epigynous orders, such as Orchideae and Scitamineae, and passing through the petaloid hypogynous orders (series Coronarieae) of which Liliaceae is the representative to Juncaceae and the palms (series Calycinae) where the perianth loses its petaloid character and thence to the Aroids, screw-pines and others where it is more or less aborted (series Nudiflorae). Series 6, Apocarpeae, is characterized by 5 carpels, and in the last series Glumaceae, great simplification in the flower is associated with a grass-like habit.

The sequence of orders in the polypetalous subdivision of Dicotyledons undoubtedly represents a progression from simpler to more elaborate forms, but a great drawback to the value of the system is the inclusion among the Monochlamydeae of a number of orders which are closely allied with orders of Polypetalae though differing in absence of a corolla. The German systematist, A. W. Eichler, attempted to remove this disadvantage which since the time of Jussieu had characterized the French system, and in 1883 grouped the Dicotyledons in two subclasses. The earlier Choripetalae embraces the Polypetalae and Monochlamydae of the French systems. It includes 21 series, and is an attempt to arrange as far as possible in a linear series those orders which are characterized by absence or freedom of petals. The second subclass, Gamopetalae, includes 9 series and culminates in those which show the most elaborate type of flower, the series Aggregatae, the chief representative of which is the great and wide-spread order Compositae. A modification of Eichler's system, embracing the most recent views of the affinities of the orders of Angiosperms, has been put forward by Dr Adolf Engler of Berlin, who adopts the suggestive names Archichlamydeae and Metachlamydeae for the two subdivisions of Dicotyledons. Dr Engler is the principal editor of a large series of volumes which, under the title *Die naturlichen Pflanzenfamilien*, is a systematic account of all the known genera of plants and represents the work of many botanists. More recently in *Das Pflanzenreich* the same author organized a series of complete monographs of the families of seed-plants.

As an attempt at a phylogenetic arrangement, Engler's system is now preferred by many botanists. More recently a startling novelty in the way of system has been produced by van Tieghem, as follows:

Monocotyledons.
Liorhizal Dicotyledons.
Dicotyledons.
    INSEMINEAE.
    SEMINEAE.
        Unitegmineae.
        Bitegmineae.

The most remarkable feature here is the class of Liorhizal Dicotyledons, which includes only the families of Nymphaeaceae and Gramineae. It is based upon the fact that the histological differentiation of the epidermis of their root is that generally characteristic of Monocotyledons, whilst they have two cotyledons—the old view of the epiblast as a second cotyledon in Gramineae being adopted. But the presence of a second cotyledon in grasses is extremely doubtful, and though there may be ground for reconsidering the position of Nymphaeaceae, their association with the grasses as a distinct class is not warranted by a comparative examination of the members of the two orders. Ovular characters determine the grouping in the Dicotyledons, van Tieghem supporting the view that the integument, the outer if there be two, is the lamina of a leaf of which the funicle is the petiole, whilst the nucellus is an outgrowth of this leaf, and the inner integument, if present, an indusium. The Insemineae include forms in which the nucellus is not developed, and therefore there can be no seed. The plants included are, however, mainly well-established parasites, and the absence of nucellus is only one of those characters of reduction to which parasites are liable. Even if we admit van Tieghem's interpretation of the integuments to be correct, the diagnostic mark of his unitegminous and bitegminous groups is simply that of the absence or presence of an indusium, not a character of great value elsewhere, and, as we know, the number of the ovular coats is inconstant within the same family. At the same time the groups based upon the integuments are of much the same extent as the Polypetalae and Gamopetalae of other systems. We do not yet know the significance of this correlation, which, however, is not an invariable one, between number of integuments and union of petals.

Within the last few years Prof. John Coulter and Dr C. J. Chamberlain of Chicago University have given a valuable general account of the morphology of Angiosperms as far as concerns the flower, and the series of events which ends in the formation of the seed (*Morphology of Angiosperms*, Chicago, 1903).

AUTHORITIES.—The reader will find in the following works details of the subject and references to the literature: Bentham and Hooker, *Genera Plantarum* (London, 1862–1883); Eichler, *Bluthendiagramme* (Leipzig, 1875–1878); Engler and Prantl, *Die naturlichen Pflanzenfamilien* (Leipzig, 1887–1899); Engler, *Syllabus der Pflanzenfamilien*, 3rd ed. (Berlin, 1903); Knuth, *Handbuch der Blutenbiologie* (Leipzig, 1898, 1899); Sachs, *History of Botany*, English ed. (Oxford, 1890); Solereder, *Systematische Anatomie der Dicotyledonen* (Stuttgart, 1899); van Tieghem, *Eléments de botanique*; Coulter and Chamberlain, *Morphology of Angiosperms* (New York, 1903). (I. B. B.; A. B. R.)

ANGKOR, an assemblage of ruins in Cambodia, the relic of the ancient Khmer civilization. They are situated in forests to the north of the Great Lake (Tonle-Sap), the most conspicuous of the remains being the town of Angkor-Thom and the temple of Angkor-Vat, both of which lie on the right bank of the river Siem-Reap, a tributary of Tonle-Sap. Other remains of the same form and character lie scattered about the vicinity on both banks of the river, which is crossed by an ancient stone bridge.

Angkor-Thom lies about a quarter of a mile from the river. According to Aymonier it was begun about A. D. 860, in the reign of the Khmer sovereign Jayavarman III., and finished towards A.D. 900. It consists of a rectangular enclosure, nearly 2 m. in each direction, surrounded by a wall from 20 to 30 ft. in height. Within the enclosure, which is entered by five monumental gates, are the remains of palaces and temples, overgrown by the forest. The chief of these are:—

(1) The vestiges of the royal palace, which stood within an enclosure containing also the pyramidal religious structure known as the Phimeanakas. To the east of this enclosure there extends a terrace decorated with magnificent reliefs.

(2) The temple of Bayon, a square enclosure formed by galleries with colonnades, within which is another and more elaborate system of galleries, rectangular in arrangement and enclosing a cruciform structure, at the centre of which rises a huge tower with a circular base. Fifty towers, decorated with quadruple faces of Brahma, are built at intervals upon the galleries, the whole temple ranking as perhaps the most remarkable of the Khmer remains.

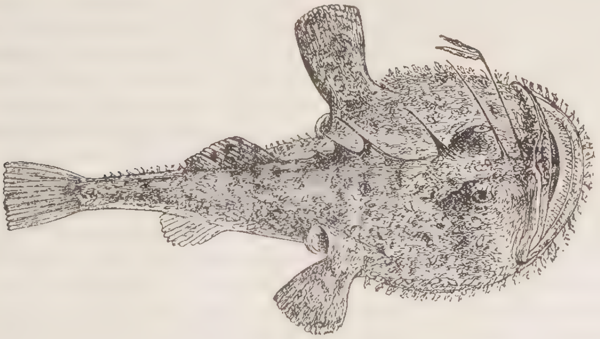
Angkor-Vat, the best preserved example of Khmer architecture, lies less than a mile to the south of the royal city, within a rectangular park surrounded by a moat, the outer perimeter of which measures 6060 yds. On the west side of the park a paved causeway, leading over the moat and under a magnificent portico, extends for a distance of a quarter of a mile to the chief entrance of the main building. The temple was originally devoted to the worship of Brahma, but afterwards to that of Buddha; its construction is assigned by Aymonier to the first half of the 12th century A.D. It consists of three stages, connected by numerous exterior staircases and decreasing in dimensions as they rise, culminating in the sanctuary, a great central tower pyramidal in form. Towers also surmount the angles of the terraces of the two upper stages. Three galleries with vaulting supported on columns lead from the three western portals to the second stage. They are connected by a transverse gallery, thus forming four square basins. Khmer decoration, profuse but harmonious, consists chiefly in the representation of gods, men and animals, which are displayed on every flat surface. Combats and legendary episodes are often depicted; floral decoration is reserved chiefly for borders, mouldings and capitals. Sandstone of various colours was the chief material employed by the Khmers; limonite was also used. The stone was cut into huge blocks which are fitted together with great accuracy without the use of cement.

See E. Aymonier, *Le Cambodge* (3 vols., 1900–1904); Doudart de Lagrée, *Voyage d'exploration en Indo-Chine* (1872–1873); A. H. Mouhot, *Travels in Indo-China, Cambodia and Laos* (2 vols., 1864); Fournereau and Porcher, *Les Ruines d'Angkor* (1890); L. Delaporte, *Voyage au Cambodge: l'architecture Khmer* (1880); J. Moura, *Le Royaume de Cambodge* (2 vols., 1883).

ANGLE (from the Lat. *angulus*, a corner, a diminutive, of which the primitive form, *ăngus*, does not occur in Latin; cognate are the Lat. *angere*, to compress into a bend or to strangle, and the Gr. *ἄγκος*, a bend; both connected with the Aryan root *ank-*, to bend: see ANGLING), in geometry, the inclination of one line or plane to another. Euclid (*Elements*, book 1) defines a plane angle as the inclination to each other, in a plane, of two lines which meet each other, and do not lie straight with respect to each other (see GEOMETRY, EUCLIDEAN). According to Proclus an angle must be either a quality or a quantity, or a relationship. The first concept was utilized by Eudemus, who regarded an angle as a deviation from a straight line; the second by Carpus of Antioch, who regarded it as the interval or space between the intersecting lines; Euclid adopted the third concept, although his definitions of right, acute, and obtuse angles are certainly quantitative. A discussion of these concepts and the various definitions of angles in Euclidean geometry is to be found in W. B. Frankland, *The First Book of Euclid's Elements* (1905). Following Euclid, a right angle is formed by a straight line standing upon another straight line so as to make the adjacent angles equal; any angle less than a right angle is termed an acute angle, and any angle greater than a right angle an obtuse angle. The difference between an acute angle and a right angle is termed the complement of the angle, and between an angle and two right angles the supplement of the angle. The generalized view of angles and their measurement is treated in the article TRIGONOMETRY. A solid angle is definable as the space contained by three or more planes intersecting in a common point; it is familiarly represented by a corner. The angle between two planes is termed dihedral, between three trihedral, between any number more than three polyhedral. A spherical angle is a particular dihedral angle; it is the angle between two intersecting arcs on a sphere, and is measured by the angle between the planes containing the arcs and the centre of the sphere.

The angle between a line and a curve (mixed angle) or between two curves (curvilinear angle) is measured by the angle between the line and the tangent at the point of intersection, or between the tangents to both curves at their common point. Various names (now rarely, if ever, used) have been given to particular cases:—amphicyrtic (Gr. *ἀμφί*, on both sides, *κυρτός*, convex) or cissoidal (Gr. *κισσός*, ivy), biconvex; xystroidal or sistroidal (Gr. *ξυστρίς*, a tool for scraping), concavo-convex; amphicoelic (Gr. *κοίλη*, a hollow) or *angulus lunularis*, biconcave.

ANGLER, also sometimes called fishing-frog, frog-fish, sea-devil (*Lophius piscatorius*), a fish well known off the coasts of Great Britain and Europe generally, the grotesque shape of its body and its singular habits having attracted the attention of naturalists of all ages. To the North Sea fishermen this fish is known as the "monk," a name which more properly belongs to *Rhina squatina*, a fish allied to the skates. Its head is of enormous size, broad, flat and depressed, the remainder of the body appearing merely like an appendage. The wide mouth extends all round the anterior circumference of the head; and both jaws are armed with bands of long pointed teeth, which are inclined inwards, and can be depressed so as to offer no impediment to an object gliding towards the stomach, but to prevent its escape from the mouth. The pectoral and ventral fins are so articulated as to perform the functions of feet, the fish being enabled to move, or rather to walk, on the bottom of the sea, where it generally hides itself in the sand or amongst sea-weed. All round its head and also along the body the skin bears fringed appendages resembling short fronds of sea-weed, a structure which, combined with the extraordinary faculty of assimilating the colour of the body to its surroundings, assists this fish greatly in concealing itself in places which it selects on account of the abundance of prey. To render the organization of this creature perfect in relation to its wants, it is provided with three long filaments inserted along the middle of the head, which are, in fact, the detached and modified three first spines of the anterior dorsal fin. The filament most important in the economy of the angler is the first, which is the longest, terminates in a lappet, and is movable in every direction. The angler is believed to attract other fishes by means of its lure, and then to seize them with its enormous jaws. It is probable enough that smaller fishes are attracted in this way, but experiments have shown that the action of the jaws is automatic and depends on contact of the prey with the tentacle. Its stomach is distensible in an extraordinary degree, and not rarely fishes have been taken out quite as large and heavy as their destroyer. It grows to a length of more than 5 ft.; specimens of 3 ft. are common. The spawn of the angler is very remarkable. It consists of a thin sheet of transparent gelatinous material 2 or 3 ft. broad and 25 to 30 ft. in length. The eggs in this sheet are in a single layer, each in its own little cavity. The spawn is free in the sea. The larvae are free-swimming and have the pelvic fins elongated into filaments. The British species is found all round the coasts of Europe and western North America, but becomes scarce beyond 60° N. lat.; it occurs also on the coasts of the Cape of Good Hope. A second species (*Lophius budegassa*) inhabits the Mediterranean, and a third (*L. setigerus*) the coasts of China and Japan.


The Angler (*Lophius piscatorius*).

ANGLESEY, ARTHUR ANNESLEY, 1st EARL OF (1614–1686), British statesman, son of the 1st Viscount Valentia (cr. 1621) and Baron Mountnorris (cr. 1628), and of Dorothy, daughter of Sir John Philipps of Picton Castle, Pembrokeshire, was born at Dublin on the 10th of July 1614, was educated at Magdalen College, Oxford, and was admitted to Lincoln's Inn in 1634. Having made the grand tour he returned to Ireland; and being employed by the parliament in a mission to the duke of Ormonde, now reduced to the last extremities, he succeeded in concluding a treaty with him on the 19th of June 1647, thus securing the country from complete subjection to the rebels. In April 1647 he was returned for Radnorshire to the House of Commons. He supported the parliamentary as against the republican or army party, and appears to have been one of the members excluded in 1648. He sat in Richard Cromwell's parliament for Dublin city, and endeavoured to take his seat in the restored Rump Parliament of 1659. He was made president of the council in February 1660, and in the Convention Parliament sat for Carmarthen borough. The anarchy of the last months of the commonwealth converted him to royalism, and he showed great activity in bringing about the Restoration. He used his influence in moderating measures of revenge and violence, and while sitting in judgment on the regicides was on the side of leniency. In November 1660 by his father's death he had become Viscount Valentia and Baron Mountnorris in the Irish peerage, and on the 20th April 1661 he was created Baron Annesley of Newport Pagnell in Buckinghamshire and earl of Anglesey in the peerage of Great Britain. He supported the king's administration in parliament, but opposed strongly the unjust measure which, on the abolition of the court of wards, placed the extra burden of taxation thus rendered necessary on the excise. His services in the administration of Ireland were especially valuable. He filled the office of vice-treasurer from 1660 till 1667, served on the committee for carrying out the declaration for the settlement of Ireland and on the committee for Irish affairs, while later, in 1671 and 1672, he was a leading member of various commissions appointed to investigate the working of the Acts of Settlement. In February 1661 he had obtained a captaincy of horse, and in 1667 he exchanged his vice-treasuryship of Ireland for the treasuryship of the navy. His public career was marked by great independence and fidelity to principle. On the 24th of July 1663 he alone signed a protest against the bill "for the encouragement of trade," on the plea that owing to the free export of coin and bullion allowed by the act, and to the importation of foreign commodities being greater than the export of home goods, "it must necessarily follow . . . that our silver will also be carried away into foreign parts and all trade fail for want of money."[1] He especially disapproved of another clause in the same bill forbidding the importation of Irish cattle into England, a mischievous measure promoted by the duke of Buckingham, and he opposed again the bill brought in with that object in January

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[1] *Protests of the Lords*, by J. E. Thorold Rogers (1875), i. 27: Carti's *Life of Ormonde* (1851), iv. 234; *Parl. Hist.* iv. 284.

1667. This same year his naval accounts were subjected to an examination in consequence of his indignant refusal to take part in the attack upon Ormonde;[1] and he was suspended from his office in 1668, no charge, however, against him being substantiated. He took a prominent part in the dispute in 1671 between the two Houses concerning the right of the Lords to amend money bills, and wrote a learned pamphlet on the question entitled *The Privileges of the House of Lords and Commons* (1702), in which the right of the Lords was asserted. In April 1673 he was appointed lord privy seal, and was disappointed at not obtaining the great seal the same year on the removal of Shaftesbury. In 1679 he was included in Sir W. Temple's new-modelled council.

In the bitter religious controversies of the time Anglesey showed great moderation and toleration. In 1674 he is mentioned as endeavouring to prevent the justices putting into force the laws against the Roman Catholics and Nonconformists.[2] In the panic of the "Popish Plot" in 1678 he exhibited a saner judgment than most of his contemporaries and a conspicuous courage. On the 6th of December he protested with three other peers against the measure sent up from the Commons enforcing the disarming of all convicted recusants and taking bail from them to keep the peace; he was the only peer to dissent from the motion declaring the existence of an Irish plot; and though believing in the guilt and voting for the death of Lord Stafford, he interceded, according to his own account,[3] with the king for him as well as for Langhorne and Plunket. His independent attitude drew upon him an attack by Dangerfield, and in the Commons by the attorney-general, Sir W. Jones, who accused him of endeavouring to stifle the evidence against the Romanists. In March 1679 he protested against the second reading of the bill for disabling Danby. In 1681 Anglesey wrote *A Letter from a Person of Honour in the Country*, as a rejoinder to the earl of Castlehaven, who had published memoirs on the Irish rebellion defending the action of the Irish and the Roman Catholics. In so doing Anglesey was held by Ormonde to have censured his conduct and that of Charles I. in concluding the "Cessation," and the duke brought the matter before the council. In 1682 he wrote *The Account of Arthur, Earl of Anglesey . . . of the true state of Your Majesty's Government and Kingdom*, which was addressed to the king in a tone of censure and remonstrance, but appears not to have been printed till 1694.[4] In consequence he was dismissed on the 9th of August 1682 from the office of lord privy seal. In 1683 he appeared at the Old Bailey as a witness in defence of Lord Russell, and in June 1685 he protested alone against the revision of Stafford's attainder. He died at his home at Blechingdon in Oxfordshire on the 26th of April 1686, closing a career marked by great ability, statesmanship and business capacity, and by conspicuous courage and independence of judgment. He amassed a large fortune in Ireland, in which country he had been allotted lands by Cromwell.

The unfavourable character drawn of him by Burnet is certainly unjust and not supported by any evidence. Pepys, a far more trustworthy judge, speaks of him invariably in terms of respect and approval as a "grave, serious man," and commends his appointment as treasurer of the navy as that of "a very notable man and understanding and will do things regular and understand them himself."[5] He was a learned and cultivated man and collected a celebrated library, which was dispersed at his death. Besides the pamphlets already mentioned, he wrote:—*A True Account of the Whole Proceedings betwixt . . . the Duke of Ormond and . . . the Earl of Anglesey* (1682); *A Letter of Remarks upon Jovian* (1683); other works ascribed to him being *The King's Right of Indulgence in Matters Spiritual . . . asserted* (1688); *Truth Unveiled, to which is added a short Treatise on . . . Transubstantiation* (1676); *The Obligation resulting from the Oath of Supremacy* (1688); and *England's Confusion* (1659). *Memoirs* of Lord Anglesey were published by Sir P. Pett in 1693, but contain little biographical information and were repudiated as a mere imposture by Sir John Thompson (Lord Haversham), his son-in-law, in his preface to Lord Anglesey's *State of the Government* in 1694. The author however of the preface to *The Rights of the Lords asserted* (1702), while blaming their publication as "scattered and unfinished papers," admits their genuineness.

Lord Anglesey married Elizabeth, daughter and co-heiress of Sir James Altham of Oxey, Hertfordshire, by whom, besides other children, he had James, who succeeded him, Altham, created Baron Altham, and Richard, afterwards 3rd Baron Altham. His descendant Richard, the 6th earl (d. 1761), left a son Arthur, whose legitimacy was doubted, and the peerage became extinct. He was summoned to the Irish House of Peers as Viscount Valentia, but was denied his writ to the parliament of Great Britain by a majority of one vote. He was created in 1793 earl of Mountnorris in the peerage of Ireland. All the male descendants of the 1st earl of Anglesey became extinct in the person of George, 2nd earl of Mountnorris, in 1844, when the titles of Viscount Valentia and Baron Mountnorris passed to his cousin Arthur Annesley (1785–1863), who thus became 10th Viscount Valentia, being descended from the 1st Viscount Valentia, the father of the 1st earl of Anglesey in the Annesley family. The 1st viscount was also the ancestor of the Earls Annesley in the Irish peerage.

AUTHORITIES.—*Dict. of Nat. Biography*, with authorities there collected; lives in Wood's *Athenae Oxonienses* (Bliss), iv. 181, *Biographia Britannica*, and H. Walpole's *Royal and Noble Authors* (1806), iii. 288 (the latter a very inadequate review of Anglesey's character and career); also *Bibliotheca Anglesiana . . .* per Thomam Philippum (1686); *The Happy Future State of England*, by Sir Peter Pett (1688); *Great News from Poland* (1683), where his religious tolerance is ridiculed; *Somers Tracts* (Scott, 1812), viii. 344; *Notes of the Privy Council* (Roxburghe Club, 1896); *Cal. of State Papers, Dom.*; *State Trials*, viii. and ix. 619. (P. C. Y.)

ANGLESEY, HENRY WILLIAM PAGET, 1st Marquess of (1768–1854), British field-marshal, was born on the 17th of May 1768. He was the eldest son of Henry Paget, 1st earl of Uxbridge (d. 1812), and was educated at Westminster School and Christ Church, Oxford, afterwards entering parliament in 1790 as member for Carnarvon, for which he sat for six years. At the outbreak of the French Revolutionary wars Lord Paget (as he was then styled), who had already served in the militia, raised on his father's estate the regiment of Staffordshire volunteers, in which he was given the temporary rank of lieutenant-colonel (1793). The corps soon became part of the regular army as the 80th Foot, and it took part, under Lord Paget's command, in the Flanders campaign of 1794. In spite of his youth he held a brigade command for a time, and gained also, during the campaign, his first experience of the cavalry arm, with which he was thenceforward associated. His substantive commission as lieutenant-colonel of the 16th Light Dragoons bore the date of the 15th of June 1795, and in 1796 he was made a colonel in the army. In 1795 he married Lady Caroline Elizabeth Villiers, daughter of the earl of Jersey. In April 1797 Lord Paget was transferred to a lieut.-colonelcy in the 7th Light Dragoons, of which regiment he became colonel in 1801. From the first he applied himself strenuously to the improvement of discipline, and to the perfection of a new system of cavalry evolutions. In the short campaign of 1799 in Holland, Paget commanded the cavalry brigade, and in spite of the unsuitable character of the ground, he made, on several occasions, brilliant and successful charges. After the return of the expedition, he devoted himself zealously to his regiment, which under his command became one of the best corps in the service. In 1802 he was promoted major-general, and six years later lieutenant-general. In command of the cavalry of Sir John Moore's army during the Corunna campaign, Lord Paget won the greatest distinction. At Sahagun, Mayorga and Benavente, the British cavalry behaved so well under his leadership that Moore wrote:—"It is impossible for me to say too much in its praise. . . . Our cavalry is very superior in quality to any the French have, and the right spirit has been infused into them by the example and instruction of their . . . leaders . . . ." At Benavente one of Napoleon's best cavalry leaders, General Lefebvre Desnoëttes, was taken prisoner. Corunna was Paget's last service in the Peninsula. His *liaison* with the wife of Henry Wellesley, afterwards Lord Cowley, made it impossible at that time for him to serve with Wellington, whose cavalry, on many occasions during the succeeding campaigns, felt the want of the true cavalry leader to direct them. His only war service from 1809 to 1815 was in the disastrous Walcheren expedition (1809) in which he commanded a division. During these years he occupied himself with his parliamentary duties as member for Milborne Port, which he represented almost continuously up to his father's death in 1812, when he took his seat in the House of Lords as earl of Uxbridge. In 1810 he was divorced and married Mrs Wellesley, who had about the same time been divorced from her husband. Lady Paget was soon afterwards married to the duke of Argyll. In 1815 Lord Uxbridge received command of the British cavalry in Flanders. At a moment of danger such as that of Napoleon's return from Elba, the services of the best cavalry general in the British army could not be neglected. Wellington placed the greatest confidence in him, and on the eve of Waterloo extended his command so as to include the whole of the allied cavalry and horse artillery. He covered the retirement of the allies from Quatre Bras to Waterloo on the 17th of June, and on the 18th gained the crowning distinction of his military career in leading the great cavalry charge of the British centre, which checked and in part routed D'Erlon's *corps d'armée* (see Waterloo Campaign). Freely exposing his own life throughout, the earl received, by one of the last cannon shots fired, a severe wound in the leg, necessitating amputation. Five days later the prince regent created him marquess of Anglesey in recognition of his brilliant services, which were regarded universally as second only to those of the duke himself. He was made a G.C.B. and he was also decorated by many of the allied sovereigns.

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[1] Carti's *Ormonde*, iv. 330, 340.

[2] *Cal. of State Pap. Dom.* (1673–1675), p. 152.

[3] *Memoirs*, 8, 9.

[4] By Sir J. Thompson, his son-in-law. Reprinted in *Somers Tracts* (Scott, 1812), viii. 344, and in *Parl. Hist.* iv. app. xvi.

[5] *Diary* (ed. Wheatley, 1904), iv. 298, vii. 14.

In 1818 the marquess was made a knight of the Garter, in 1819 he became full general, and at the coronation of George IV. he acted as lord high steward of England. His support of the proceedings against Queen Caroline made him for a time unpopular, and when he was on one occasion beset by a crowd, who compelled him to shout "The Queen," he added the wish, "May all your wives be like her." At the close of April 1827 he became a member of the Canning administration, taking the post of master-general of the ordnance, previously held by Wellington. He was at the same time sworn a member of the privy council. Under the Wellington administration he accepted the appointment of lord-lieutenant of Ireland (March 1828), and in the discharge of his important duties he greatly endeared himself to the Irish people. The spirit in which he acted and the aims which he steadily set before himself contributed to the allaying of party animosities, to the promotion of a willing submission to the laws, to the prosperity of trade and to the extension and improvement of education. On the great question of the time his views were opposed to those of the government. He saw clearly that the time was come when the relief of the Catholics from the penal legislation of the past was an indispensable measure, and in December 1828 he addressed a letter to the Roman Catholic primate of Ireland distinctly announcing his view. This led to his recall by the government, a step sincerely lamented by the Irish. He pleaded for Catholic emancipation in parliament, and on the formation of Earl Grey's administration in November 1830, he again became lord-lieutenant of Ireland. The times were changed; the act of emancipation had been passed, and the task of viceroy in his second tenure of office was to resist the agitation for repeal of the union carried on by O'Connell. He felt it his duty now to demand Coercion Acts for the security of the public peace; his popularity was diminished, differences appeared in the cabinet on the difficult subject, and in July 1833 the ministry resigned. To the marquess of Anglesey Ireland is indebted for the board of education, the origination of which may perhaps be reckoned as the most memorable act of his viceroyalty. For thirteen years after his retirement he remained out of office, and took little part in the affairs of government. He joined the Russell administration in July 1846 as master-general of the ordnance, finally retiring with his chief in March 1852. His promotion in the army was completed by his advancement to the rank of field-marshal in 1846. Four years before, he exchanged his colonelcy of the 7th Light Dragoons which he had held over forty years, for that of the Royal Horse Guards. He died on the 29th of April 1854.

The marquess had a large family by each of his two wives, two sons and six daughters by the first and six sons and four daughters by the second. His eldest son, Henry, succeeded him in the marquessate; but the title passed rapidly in succession to the 3rd, 4th and 5th marquesses. The latter, whose extravagances were notorious, died in 1905, when the title passed to his cousin.

Other members of the Paget family distinguished themselves in the army and the navy. Of the first marquess's brothers one, Sir Charles Paget (1778–1839), rose to the rank of vice-admiral in the Royal Navy; another, General Sir Edward Paget (1775–1849), won great distinction by his skilful and resolute handling of a division at Corunna, and from 1822 to 1825 was commander-in-chief in India. One of the marquess's sons by his second marriage, Lord Clarence Edward Paget (1811–1895), became an admiral; another, Lord George Augustus Frederick Paget (1818–1880), led the 4th Light Dragoons in the charge of the Light Brigade at Balaklava, and subsequently commanded the brigade, and, for a short time, the cavalry division in the Crimea. In 1865 he was made inspector-general of cavalry, in 1871 lieutenant-general and K.C.B., and in 1877 full general. His Crimean journals were published in 1881.

ANGLESEY, or Anglesea, an insular northern county of Wales. Its area is 176,630 acres or about 276 sq. m. Anglesey, in the see of Bangor, is separated from the mainland by the Menai Straits (Afon Menai), over which were thrown Telford's suspension bridge, in 1826, and the Stephenson tubular railway bridge in 1850. The county is flat, with slight risings such as Parys, Cadair Mynachdy (or Monachdy, *i.e.* "chair of the monastery"; there is a Nanner, "convent," not far away) and Holyhead Mountain. There are a few lakes, such as Cors cerrig y daran, but rising water is generally scarce. The climate is humid, the land poor for the most part compared with its old state of fertility, and there are few industries.

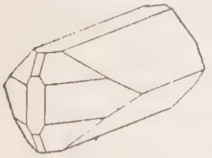
As regards geology, the younger strata in Anglesey rest upon a foundation of very old pre-Cambrian rocks which appear at the surface in three areas:—(1) a western region including Holyhead and Llanfaethlu, (2) a central area about Aberffraw and Trefdraeth, and (3) an eastern region which includes Newborough, Caerwen and Pentraeth. These pre-Cambrian rocks are schists and slates, often much contorted and disturbed. The general line of strike of the formations in the island is from N.E. to S.W. A belt of granitic rocks lies immediately north-west of the central pre-Cambrian mass, reaching from Llanfaelog near the coast to the vicinity of Llanerchymedd. Between this granite and the pre-Cambrian of Holyhead is a narrow tract of Ordovician slates and grits with Llandovery beds in places; this tract spreads out in the N. of the island between Dulas Bay and Carmel Point. A small patch of Ordovician strata lies on the northern side of Beaumaris. In parts, these Ordovician rocks are much folded, crushed and metamorphosed, and they are associated with schists and altered volcanic rocks which are probably pre-Cambrian. Between the eastern and central pre-Cambrian masses carboniferous rocks are found. The carboniferous limestone occupies a broad area S. of Ligwy Bay and Pentraeth, and sends a narrow spur in a south-westerly direction by Llangefni to Malldraeth sands. The limestone is underlain on the N.W. by a red basement conglomerate and yellow sandstone (sometimes considered to be of Old Red Sandstone age). Limestone occurs again on the N. coast about Llanfihangel and Llangoed; and in the S.W. round Llanidan on the border of the Menai Strait. Puffin Island is made of carboniferous limestone. Malldraeth Marsh is occupied by coal measures, and a small patch of the same formation appears near Tall-y-foel Ferry on the Menai Straits. A patch of granitic and felsitic rocks form Parys Mountain, where copper and iron ochre have been worked. Serpentine (Mona Marble) is found near Llanfaerynneubwll and upon the opposite shore in Holyhead. There are abundant evidences of glaciation, and much boulder clay and drift sand covers the older rocks. Patches of blown sand occur on the S.W. coast.

The London & North-Western railway (Chester and Holyhead branch) crosses Anglesey from Llanfairpwllgwyngyll to Gaerwen and Holyhead (Caer Gybi), also from Gaerwen to Amlwch. The staple of the island is farming, the chief crops being turnips, oats, potatoes, with flax in the centre. Copper (near Amlwch), lead, silver, marble, asbestos, lime and sandstone, marl, zinc and coal have all been worked in Anglesey, coal especially at Malldraeth and Trefdraeth. The population of the county in 1901 was 50,606. There is no parliamentary borough, but one member is returned for the county. It is in the north-western circuit, and assizes are held at Beaumaris, the only municipal borough (pop. 2326). Amlwch (2994), Holyhead (10,079), Llangefni (1751) and Menai Bridge (Pont y Borth, 1700) are urban districts. There are six hundreds and seventy-eight parishes.

Môn (a cow) is the Welsh name of Anglesey, itself a corrupted form of O.E., meaning the Isle of the Angles. Old Welsh names are Ynys Dywyll (" Dark Isle ") and Ynys y cedairn (cedyrn or kedyrn; " Isle of brave folk "). It is the Mona of Tacitus (*Ann.* xiv. 29, *Agr.* xiv. 18), Pliny the Elder (iv. 16) and Dio Cassius (62). It is called Mam Cymru by Giraldus Cambrensis. Clas Merddin, Y vel Ynys (honey isle), Ynys Prydein, Ynys Brut are other names. According to the Triads (67), Anglesey was once part of the mainland, as geology proves. The island was the seat of the Druids, of whom 28 cromlechs remain, on uplands overlooking the sea, *e.g.* at Plâs Newydd. The Druids were attacked in A.D. 61 by Suetonius Paulinus, and by Agricola in A.D. 78. In the 5th century Caswallon lived here, and here, at Aberffraw, the princes of Gwynedd lived till 1277. The present road from Holyhead to Llanfairpwllgwyngyll is originally Roman. British and Roman camps, coins and ornaments have been dug up and discussed, especially by the Hon. Mr Stanley of Penrhos. Pen Caer Gybi is Roman. The island was devastated by the Danes (*Dub Gint* or black nations, *gentes*), especially in A.D. 853.

See Edw. Breese, *Kalendar of Gwynedd* (Venedocia), on Anglesey, Carnarvon and Merioneth (London, 1873); and *The History of Powys Fadog*.

ANGLESITE, a mineral consisting of lead sulphate, $PbSO_4$, crystallizing in the orthorhombic system, and isomorphous with barytes and celestite. It was first recognized as a mineral species by Dr Withering in 1783, who discovered it in the Parys copper-mine in Anglesey; the name anglesite, from this locality, was given by F. S. Beudant in 1832. The crystals from Anglesey, which were formerly found abundantly on a matrix of dull limonite, are small in size and simple in form, being usually bounded by four faces of a prism and four faces of a dome; they are brownish-yellow in colour owing to a stain of limonite. Crystals from some other localities, notably from Monteponi in Sardinia, are transparent and colourless, possessed of a brilliant adamantine lustre, and usually modified by numerous bright faces. The variety of combinations and habits presented by the crystals is very extensive, nearly two hundred distinct forms being figured by V. von Lang in his monograph of the species; without measurement of the angles the crystals are frequently difficult to decipher. The hardness is 3 and the specific gravity 6·3. There are distinct cleavages parallel to the faces of the prism {110} and the basal plane {001}, but these are not so well developed as in the isomorphous minerals barytes and celestite.



Anglesite is a mineral of secondary origin, having been formed by the oxidation of galena in the upper parts of mineral lodes where these have been affected by weathering processes. At Monteponi the crystals encrust cavities in glistening granular galena; and from Leadhills, in Scotland, pseudomorphs of anglesite after galena are known. At most localities it is found as isolated crystals in the lead-bearing lodes, but at some places, in Australia and Mexico, it occurs as large masses, and is then mined as an ore of lead, of which the pure mineral contains 68 %.

ANGLI, ANGLII or ANGLES, a Teutonic people mentioned by Tacitus in his *Germania* (cap. 40) at the end of the 1st century. He gives no precise indication of their geographical position, but states that, together with six other tribes, including the Varini (the Warni of later times), they worshipped a goddess named Nerthus, whose sanctuary was situated on " an island in the Ocean." Ptolemy in his *Geography* (ii. 11. § 15), half a century later, locates them with more precision between the Rhine, or rather perhaps the Ems, and the Elbe, and speaks of them as one of the chief tribes of the interior. Unfortunately, however, it is clear from a comparison of his map with the evidence furnished by Tacitus and other Roman writers that the indications which he gives cannot be correct. Owing to the uncertainty of these passages there has been much speculation regarding the original home of the Angli. One theory, which however has little to recommend it, is that they dwelt in the basin of the Saale (in the neighbourhood of the canton Engilin), from which region the *Lex Angliorum et Werinorum hoc est Thuringorum* is believed by many to have come. At the present time the majority of scholars believe that the Angli had lived from the beginning on the coasts of the Baltic, probably in the southern part of the Jutish peninsula. The evidence for this view is derived partly from English and Danish traditions dealing with persons and events of the 4th century (see below), and partly from the fact that striking affinities to the cult of Nerthus as described by Tacitus are to be found in Scandinavian, especially Swedish and Danish, religion. Investigations in this subject have rendered it very probable that the island of Nerthus was Sjaelland (Zealand), and it is further to be observed that the kings of Wessex traced their ancestry ultimately to a certain Scyld, who is clearly to be identified with Skiöldr, the mythical founder of the Danish royal family (Skiöldungar). In English tradition this person is connected with " Scedeland " (pl.), a name which may have been applied to Sjaelland as well as Skåne, while in Scandinavian tradition he is specially associated with the ancient royal residence at Leire in Sjaelland.

Bede states that the Angli before they came to Britain dwelt in a land called Angulus, and similar evidence is given by the *Historia Brittonum*. King Alfred and the chronicler Æthelweard identified this place with the district which is now called Angel in the province of Schleswig (Slesvig), though it may then have been of greater extent, and this identification agrees very well with the indications given by Bede. Full confirmation is afforded by English and Danish traditions relating to two kings named Wermund (*q.v.*) and Offa (*q.v.*), from whom the Mercian royal family were descended, and whose exploits are connected with Angel, Schleswig and Rendsburg. Danish tradition has preserved record of two governors of Schleswig, father and son, in their service, Frowinus (Freawine) and Wigo (Wig), from whom the royal family of Wessex claimed descent. During the 5th century the Angli invaded this country (see BRITAIN, *Anglo-Saxon*), after which time their name does not recur on the continent except in the title of the code mentioned above.

The province of Schleswig has proved exceptionally rich in prehistoric antiquities which date apparently from the 4th and 5th centuries. Among the places where these have been found, special mention should be made of the large cremation cemetery at Borgstedterfeld, between Rendsburg and Eckernförde, which has yielded many urns and brooches closely resembling those found in heathen graves in England. Of still greater importance are the great deposits at Thorsbjaerg (in Angel) and Nydam, which contained large quantities of arms, ornaments, articles of clothing, agricultural implements, &c., and in the latter case even ships. By the help of these discoveries we are able to reconstruct a fairly detailed picture of English civilization in the age preceding the invasion of Britain.

AUTHORITIES.—Bede, *Hist. Ecc.* i. 15; King Alfred's version of *Orosius*, i. 1. §§ 12, 19; Æthelweard's *Chronicle*, lib. i. For traditions concerning the kings of Angel, see under OFFA (1). L. Weiland, *Die Angeln* (1889); A. Erdmann, *Über die Heimat und den Namen der Angeln* (Upsala, 1890—cf. H. Möller in the *Anzeiger für deutsches Altertum und deutsche Litteratur*, xxii. 129 ff.); A. Kock in the *Historisk Tidskrift* (Stockholm), 1895, xv. p. 163 ff.; G. Schütte, *Var Anglerne Tyskere?* (Flensborg, 1900); H. Munro Chadwick, *The Origin of the English Nation* (Cambridge, 1907); C. Engelhardt, *Denmark in the Early Iron Age* (London, 1866); J. Mestorf, *Urnenfriedhöfe in Schleswig-Holstein* (Hamburg, 1886); S. Müller, *Nordische Altertumskunde* (Ger. trans., Strassburg, 1898), ii. p. 122 ff.; see further ANGLO-SAXONS and BRITAIN, *Anglo-Saxon*. (H. M. C.)

ANGLICAN COMMUNION, the name used to denote that great branch of the Christian Church consisting of the various churches in communion with the Church of England. The necessity for such a phrase as "Anglican Communion," first used in the 19th century, marked at once the immense development of the Anglican Church in modern times and the change which has taken place in the traditional conceptions of its character and sphere. The Church of England itself is the subject of a separate article (see ENGLAND, CHURCH OF); and it is not without significance that for more than two centuries after the Reformation the history of Anglicanism is practically confined to its developments within the limits of the British Isles. Even in Ireland, where it was for over three centuries the established religion, and in Scotland, where it early gave way to the dominant Presbyterianism, its religious was long overshadowed by its political significance. The Church, in fact, while still claiming to be Catholic in its creeds and in its religious practice, had ceased to be Catholic in its institutional conception, which was now bound up with a particular state and also with a particular conception of that state. To the native Irishman and the Scotsman, as indeed to most Englishmen, the Anglican Church was one of the main buttresses of the supremacy of the English crown and nation. This conception of the relations of church and state was hardly favourable to missionary zeal; and in the age succeeding the Reformation there was no disposition on the part of the English Church to emulate the wonderful activity of the Jesuits, which, in the 16th and 17th centuries, brought to the Church of Rome in countries beyond the ocean compensation for what she had lost in Europe through the Protestant reformation. Even when English churchmen passed beyond the seas, they carried with them their creed, but not their ecclesiastical organization. Prejudice and real or imaginary legal obstacles stood in the way of the erection of episcopal sees in the colonies; and though in the 17th century Archbishop Laud had attempted to obtain a bishop for Virginia, up to the time of the American revolution the churchmen of the colonies had to make the best of the legal fiction that their spiritual needs were looked after by the bishop of London, who occasionally sent commissaries to visit them and ordained candidates for the ministry sent to England for the purpose.

The change which has made it possible for Anglican churchmen to claim that their communion ranks with those of Rome and the Orthodox East as one of the three great historical divisions of the Catholic Church, was due, in the first instance, to the American revolution. The severance of the colonies from their allegiance to the crown brought the English bishops for the first time face to face with the idea of an Anglican Church which should have nothing to do either with the royal supremacy or with British nationality. When, on the conclusion of peace, the church-people of Connecticut sent Dr Samuel Seabury to England, with a request to the archbishop of Canterbury to consecrate him, it is not surprising that Archbishop Moore refused. In the opinion of prelates and lawyers alike, an act of parliament was necessary before a bishop could be consecrated for a see abroad; to consecrate one for a foreign country seemed impossible, since, though the bestowal of the *potestas ordinis* would be valid, the crown, which, according to the law, was the source of the episcopal *jurisdiction*, could hardly issue the necessary mandate for the consecration of a bishop to a see outside the realm (see BISHOP). The Scottish bishops, however, being hampered by no such legal restrictions, were more amenable; and on the 11th of November 1784 Seabury was consecrated by them to the see of Connecticut. In 1786, on the initiative of the archbishop, the legal difficulties in England were removed by the act for the consecration of bishops abroad; and, on being satisfied as to the orthodoxy of the church in America and the nature of certain liturgical changes in contemplation, the two English archbishops proceeded, on the 14th of February 1787, to consecrate William White and Samuel Prevoost to the sees of Pennsylvania and New York (see PROTESTANT EPISCOPAL CHURCH).

This act had a significance beyond the fact that it established in the United States of America a flourishing church, which, while completely loyal to its own country, is bound by special ties to the religious life of England. It marked the emergence of the Church of England from that insularity to which what may be called the territorial principles of the Reformation had condemned her. The change was slow, and it is not yet by any means complete.

Since the Church of England, whatever her attitude towards the traditional Catholic doctrines, never disputed the validity of Catholic orders whether Roman or Orthodox, nor the jurisdiction of Catholic bishops in foreign countries, the expansion of the Anglican Church has been in no sense conceived as a Protestant aggressive movement against Rome. Occasional exceptions, such as the consecration by Archbishop Plunket of Dublin of a bishop for the reformed church in Spain, raised so strong a protest as to prove the rule. In the main, then, the expansion of the Anglican Church has followed that of the British empire, or, as in America, of its daughter states; its claim, so far as rights of jurisdiction are concerned, is to be the Church of England and the English race, while recognizing its special duties towards the non-Christian populations subject to the empire or brought within the reach of its influence. As against the Church of Rome, with its system of rigid centralization, the Anglican Church represents the principle of local autonomy, which it holds to be once more primitive and more catholic. In this respect the Anglican communion has developed on the lines defined in her articles at the Reformation; but, though in principle there is no great difference between a church defined by national, and a church defined by racial boundaries, there is an immense difference in effect, especially when the race—as in the case of the English—is itself ecumenical.

The realization of what may be called this catholic mission of the English church, in the extension of its organization to the colonies, was but a slow process.

The Church in the Colonies.

On the 12th of August 1787 Dr Charles Inglis was consecrated bishop of Nova Scotia, with jurisdiction over all the British possessions in North America. In 1793 the see of Quebec was founded; Jamaica and Barbados followed in 1824, and Toronto and Newfoundland in 1839. Meanwhile the needs of India has been tardily met, on the urgent representations in parliament of William Wilberforce and others, by the consecration of Dr T. F. Middleton as bishop of Calcutta, with three archdeacons to assist him. In 1817 Ceylon was added to his charge; in 1823 all British subjects in the East Indies and the islands of the Indian Ocean; and in 1824 "New South Wales and its dependencies"! Some five years later, on the nomination of the duke of Wellington, William Broughton was sent out to work in this enormous jurisdiction as archdeacon of Australia. Soon afterwards, in 1835 and 1837, the sees of Madras and Bombay were founded; whilst in 1836 Broughton himself was consecrated as first bishop of Australia. Thus down to 1840 there were but ten colonial bishops; and of these several were so hampered by civil regulations that they were little more than government chaplains in episcopal orders. In April of that year, however, Bishop Blomfield of London published his famous letter to the archbishop of Canterbury, declaring that "an episcopal church without a bishop is a contradiction in terms," and strenuously advocating a great effort for the extension of the episcopate. It was not in vain. The plan was taken up with enthusiasm, and on Whitsun Tuesday of 1841 the bishops of the United Kingdom met and issued a declaration which inaugurated the Colonial Bishoprics Council. Subsequent declarations in 1872 and 1891 have served both to record progress and to stimulate to new effort. The diocese of New Zealand was founded in 1841, being endowed by the Church Missionary Society through the council, and George Augustus Selwyn was chosen as the first bishop. Since then the increase has gone on, as the result both of home effort and of the action of the colonial churches. Moreover, in many cases bishops have been sent to inaugurate new missions, as in the cases of the Universities' Mission to Central Africa. Lebombo, Corea and New Guinea; and the missionary jurisdictions so founded develop in time into dioceses. Thus, instead of the ten colonial jurisdictions of 1841, there are now about a hundred foreign and colonial jurisdictions, in addition to those of the Protestant Episcopal Church of the United States.

It was only very gradually that these dioceses acquired legislative independence and a determinate organization. At first, sees were created and bishops were nominated by the crown by means of letters patent; and in some cases an income was assigned out of public funds. Moreover, for many years all bishops alike were consecrated in England, took the customary "oath of due obedience" to the archbishop of Canterbury, and were regarded as his extra-territorial suffragans. But by degrees changes have been made on all these points.

Provincial organization.

(1) Local conditions soon made a provincial organization necessary, and it was gradually introduced. The bishop of Calcutta received letters patent as metropolitan of India when the sees of Madras and Bombay were founded; and fresh patents were issued to Bishop Broughton in 1847 and Bishop Gray in 1853, as metropolitans of Australia and South Africa respectively. Similar action was taken in 1858, when Bishop Selwyn became metropolitan of New Zealand; and again in 1860, when, on the petition of the Canadian bishops to the crown and the colonial legislature for permission to elect a metropolitan, letters patent were issued appointing Bishop Fulford of Montreal to that office. Since then metropolitans have been chosen and provinces formed by regular synodical action, a process greatly encouraged by the resolutions of the Lambeth conferences on the subject. The constitution of these provinces is not uniform. In some cases, as South Africa, New South Wales, and Queensland, the metropolitan see is fixed. Elsewhere, as in New Zealand, where no single city can claim pre-eminence, the metropolitan is either elected or else is the senior bishop by consecration. Two further developments must be mentioned: (*a*) The creation of diocesan and provincial synods, the first diocesan synod to meet being that of New Zealand in 1844, whilst the formation of a provincial synod was foreshadowed by a conference of Australasian bishops at Sydney in 1850; (*b*) towards the close of the 19th century the title of *archbishop* began to be assumed by the metropolitans of several provinces. It was first assumed by the metropolitans of Canada and Rupert's Land, at the desire of the Canadian general synod in 1893; and subsequently, in accordance with a resolution of the Lambeth conference of 1897, it was given by their synods to the bishop of Sydney as metropolitan of New South Wales and to the bishop of Cape Town as metropolitan of South Africa Civil obstacles have hitherto delayed its adoption by the metropolitan of India.

Freedom from state control.

(2) By degrees, also, the colonial churches have been freed from their rather burdensome relations with the state. The church of the West Indies was disestablished and disendowed in 1868. In 1857 it was decided, in *Regina* v. *Eton College*, that the crown could not claim the presentation to a living when it had appointed the former incumbent to a colonial bishopric, as it does in the case of an English bishopric. In 1861, after some protest from the crown lawyers, two missionary bishops were consecrated without letters patent for regions outside British territory: C. F. Mackenzie for the Zambezi region and J. C. Patteson for Melanesia, by the metropolitans of Cape Town and New Zealand respectively. In 1863 the privy council declared, in *Long* v. *The Bishop of Cape Town*, that "the Church of England, in places where there is no church established by law, is in the same situation with any other religious body." In 1865 it adjudged Bishop Gray's letters patent, as metropolitan of Cape Town, to be powerless to enable him "to exercise any coercive jurisdiction, or hold any court or tribunal for that purpose," since the Cape colony already possessed legislative institutions when they were issued; and his deposition of Bishop Colenso was declared to be "null and void in law" (*re The Bishop of Natal*). With the exception of Colenso the South African bishops forthwith surrendered their patents, and formally accepted Bishop Gray as their metropolitan, an example followed in 1865 in the province of New Zealand. In 1862, when the diocese of Ontario was formed, the bishop was elected in Canada, and consecrated under a royal mandate, letters patent being by this time entirely discredited. And when, in 1867, a coadjutor was chosen for the bishop of Toronto, an application for a royal mandate produced the reply from the colonial secretary that "it was not the part of the crown to interfere in the creation of a new bishop or bishopric, and not consistent with the dignity of the crown that he should advise Her Majesty to issue a mandate which would not be worth the paper on which it was written, and which, having been sent out to Canada, might be disregarded in the most complete manner." And at the present day the colonial churches are entirely free in this matter. This, however, is not the case with the church in India. Here the bishops of sees founded down to 1879 receive a stipend from the revenue (with the exception of the bishop of Ceylon, who no longer does so). They are not only nominated by the crown and consecrated under letters patent, but the appointment is expressly subjected "to such power of revocation and recall as is by law vested" in the crown; and where additional oversight was necessary for the church in Tinnevelly, it could only be secured by the consecration of two assistant bishops, who worked under a commission for the archbishop of Canterbury which was to expire on the death of the bishop of Madras. Since then, however, new sees have been founded which are under no such restrictions: by the creation of dioceses either in native states (Travancore and Cochin), or out of the existing dioceses (Chota Nagpur, Lucknow, &c.). In the latter case there is no *legal* subdivision of the older diocese, the new bishop administering such districts as belonged to it under commission from its bishop, provision being made, however, that in all matters ecclesiastical there shall be no appeal but to the metropolitan of India.

Spiritual autonomy.

(3) By degrees, also, the relations of colonial churches to the archbishop of Canterbury have changed. Until 1855 no colonial bishop was consecrated outside the British Isles, the first instance being Dr MacDougall of Labuan, consecrated in India under a commission from the archbishop of Canterbury; and until 1874 it was held to be unlawful for a bishop to be consecrated in England without taking the suffragan's oath of due obedience. This necessity was removed by the Colonial Clergy Act of 1874, which permits the archbishop at his discretion to dispense with the oath. This, however, has not been done in all cases; and as late as 1890 it was taken by the metropolitan of Sydney at his consecration. Thus the constituent parts of the Anglican communion gradually acquire autonomy: missionary jurisdictions develop into organized dioceses, and dioceses are grouped into provinces with canons of their own. But the most complete autonomy does not involve isolation. The churches are in full communion with one another, and act together in many ways; missionary jurisdictions and dioceses are mapped out by common arrangement, and even transferred if it seems advisable; *e.g.* the diocese Honolulu (Hawaii), previously under the jurisdiction of the archbishop of Canterbury, was transferred in 1900 to the Episcopal Church in the United States on account of political changes. Though the see of Canterbury claims no primacy over the Anglican communion analogous to that exercised over the Roman Church by the popes, it is regarded with a strong affection and deference, which shows itself by frequent consultation and interchange of greetings. There is also a strong common life emphasized by common action.

The conference of Anglican bishops from all parts of the world, *Pan-Anglican Congress.*

instituted by Archbishop Longley in 1867, and known as the Lambeth Conferences (*q.v.*), though even for the Anglican communion they have not the authority of an ecumenical synod, and their decisions are rather of the nature of counsels than commands, have done much to promote the harmony and co-operation of the various branches of the Church. An even more imposing manifestation of this common life was given by the great pan-Anglican congress held in London between the 12th and 24th of June 1908, which preceded the Lambeth conference opened on the 5th of July. The idea of this originated with Bishop Montgomery, secretary to the Society for the Propagation of the Gospel, and was endorsed by a resolution of the United Boards of Mission in 1903. As the result of negotiations and preparations extending over five years, 250 bishops, together with delegates, clerical and lay, from every diocese in the Anglican communion, met in London, the opening service of intercession being held in Westminster Abbey. In its general character, the meeting was but a Church congress on an enlarged scale, and the subjects discussed, *e.g.* the attitude of churchmen towards the question of the marriage laws or that of socialism, followed much the same lines. The congress, of course, had no power to decide or to legislate for the Church, its main value being in drawing its scattered members closer together, in bringing the newer and more isolated branches into consciousness of their contact with the parent stem, and in opening the eyes of the Church of England to the point of view and the peculiar problems of the daughter-churches.

The Anglican communion consists of the following:—(1) The Church of England, 2 provinces, Canterbury and York, with 24 and 11 dioceses respectively. (2) The Church of Ireland, 2 provinces, Armagh and Dublin, with 7 and 6 dioceses respectively. (3) The Scottish Episcopal Church, with 7 dioceses. (4) The Protestant Episcopal Church of the United States, with 89 dioceses and missionary jurisdictions, including North Tokyo, Kyoto, Shanghai, Cape Palmas, and the independent dioceses of Hayti and Brazil. (5) The Canadian Church, consisting of (*a*) the province of Canada, with 10 dioceses; (*b*) the province of Rupert's Land, with 8 dioceses. (6) The Church in India and Ceylon, 1 province of 11 dioceses. (7) The Church of the West Indies, 1 province of 8 dioceses, of which Barbados and the Windward Islands are at present united. (8) The Australian Church, consisting of (*a*) the province of New South Wales, with 10 dioceses; (*b*) the province of Queensland, with 5 dioceses; (*c*) the province of Victoria, with 5 dioceses. (9) The Church of New Zealand, 1 province of 7 dioceses, together with the missionary jurisdiction of Melanesia. (10) The South African Church, 1 province of 10 dioceses, with the 2 missionary jurisdictions of Mashonaland and Lebombo. (11) Nearly 30 isolated dioceses and missionary jurisdictions holding mission from the see of Canterbury.

AUTHORITIES.—*Official Year-book of the Church of England*; Phillimore, *Ecclesiastical Law*, vol. ii. (London, 1895); *Digest of S.P.G. Records* (London, 1893); E. Stock, *History of the Church Missionary Society*, 3 vols. (London, 1899); H. W. Tucker, *The English Church in Other Lands* (London, 1886); A. T. Wirgman, *The Church and the Civil Power* (London, 1893).

ANGLING, the art or practice of the sport of catching fish by means of a baited hook or "angle" (from the Indo-European root *ank-*, meaning "bend").[1] It is among the most ancient of human activities, and may be said to date from the time when man was in the infancy of the Stone Age, eking out a precarious existence by the slaughter of any living thing which he could reach with the rude weapons at his command. It is probable that attack on fishes was at first much the same as attack on animals, a matter of force rather than of guile, and conducted by means of a rude spear with a flint head. It is probable, too, that the primitive harpooners were not signally successful in their efforts, and so set their wits to work to devise other means of getting at the abundant food which waited for them in every piece of water near their caves. Observation would soon show them that fish fed greedily on each other and on other inhabitants of the water or living things that fell into it, and so, no doubt, arose the idea of entangling the prey by means of its appetite. Hence came the notion of the first hook, which, it seems certain, was not a hook at all but a "gorge," a piece of flint or stone which the fish could swallow with the bait but which it could not eject afterwards. From remains found in cave-dwellings and their neighbourhood in different parts of the world it is obvious that these gorges varied in shape, but in general the idea was the same, a narrow strip of stone or flake of flint, either straight or slightly curved at the ends, with a groove in the middle round which the line could be fastened. Buried in the bait it would be swallowed end first; then the tightening of the line would fix it cross-wise in the quarry's stomach or gullet and so the capture would be assured. The device still lingers in France and in a few remote parts of England in the method of catching eels which is known as "sniggling." In this a needle buried in a worm plays the part of the prehistoric gorge.

The evolution of the fish-hook from the slightly curved gorge is easily intelligible. The ends became more and more curved, until eventually an object not unlike a double hook was attained. This development would be materially assisted by man's discovery of the uses of bronze and its adaptability to his requirements. The single hook, of the pattern more or less familiar to us, was possibly a concession of the lake-dweller to what may even then have been a problem—the "education" of fish, and to a recognition of the fact that sport with the crude old methods was falling off. But it is also not improbable that in some parts of the world the single hook developed *pari passu* with the double, and that, on the sea-shore for instance, where man was able to employ so adaptable a substance as shell, the first hook was a curved fragment of shell lashed with fibre to a piece of wood or bone, in such a way that the shell formed the bend of the hook while the wood or bone formed the shank. Both early remains and recent hooks from the Fiji Islands bear out this supposition. It is also likely that flint, horn and bone were pressed into service in a similar manner. The nature of the line or the rod that may have been used with these early hooks is largely a matter of conjecture. The first line was perhaps the tendril of a plant, the first rod possibly a sapling tree. But it is fairly obvious that the rod must have been suggested by the necessity of getting the bait out over obstacles which lay between the fisherman and the water, and that it was a device for increasing both the reach of the arm and the length of the line. It seems not improbable that the rod very early formed a part of the fisherman's equipment.

Literary History.—From prehistoric times down to comparatively late in the days of chronicles, angling appears to have remained a practice; its development into an art or sport is a modern idea. In the earliest literature references to angling are not very numerous, but there are passages in the Old Testament which show that fish-taking with hook as well as net was one of the common industries in the East, and that fish, where it was obtainable, formed an important article of diet. In *Numbers* (xi. 5) the children of Israel mourn for the fish which they "did eat in Egypt freely." So much too is proved by the monuments of Egypt; indeed more, for the figures found in some of the Egyptian fishing pictures using short rods and stout lines are sometimes attired after the manner of those who were great in the land. This indicates that angling had already, in a highly civilized country, taken its place among the methods of diversion at the disposal of the wealthy, though from the uncompromising nature of the tackle depicted and the apparent simplicity of the fish it would scarcely be safe to assume that in Egypt angling arrived at the dignity of becoming an "art." In Europe it took very much longer for the taking of fish to be regarded even as an amusement, and the earliest references to it in the Greek and Latin classics are not very satisfying to the sportsman. There is, however, a passage in the *Odyssey* (xii. 247) which is of considerable importance, as it shows that fishing with rod and line was well enough understood in early Greece to be used as a popular illustration. It occurs in the well-known scene where Scylla seizes the companions of Odysseus out of the ship and bears them upwards, just as "some fisher on a headland with a long rod" brings small fishes gasping to the shore. Another important, though comparatively late, passage in Greek poetry is the twenty-first idyll of Theocritus. In this the fisherman Asphalion relates how in a dream he hooked a large golden fish and describes graphically, albeit with some obscurity of language, how he "played" it. Asphalion used a rod and fished from a rock, much after the manner of the Homeric angler. Among other Greek writers, Herodotus has a good many references to fish and fishing; the capture of fish is once or twice mentioned or implied by Plato, notably in the *Laws* (vii. 823); Aristotle deals with fishes in his *Natural History*; and there are one or two fishing passages in the anthology. But in Greek literature as a whole the subject of angling is not at all prominent. In writers of late Greek, however, there is more material. Plutarch, for instance, gives us the famous story of the fishing match between Antony and Cleopatra, which has been utilized by Shakespeare. Moreover, it is in Greek that the first complete treatise on fishing which has come down to us is written, the *Halieutica* of Oppian (*c.* A.D. 169). It is a hexameter poem in five books with perhaps more technical than sporting interest, and not so much even of that as the length of the work would suggest. Still it contains some information about tackle and methods, and some passages describing battles with big fish, in the right spirit of enthusiasm. Also in Greek is what is famous as the first reference in literature to fly-fishing, in the fifteenth book of Aelian's *Natural History* (3rd century A.D.). It is there described how the Macedonians captured a certain spotted fish in the river Astraeus by means of a lure composed of coloured wool and feathers, which was presumably used in the manner now known as "dapping." That there were other Greek writers who dealt with fish and fishing and composed "halieutics" we know from Athenaeus. In the first book of his *Deipnosophistae* he gives a list of them. But he compares their work unfavourably with the passage of Homer already cited, in a way which suggests that their knowledge of angling was not a great advance upon the knowledge of their remote literary ancestors. In Latin literature allusions to angling are rather more numerous than in Greek, but on the whole they are unimportant. Part of a poem by Ovid, the *Halieuticon*, composed during the poet's exile at Tomi after A.D. 9, still survives. In other Roman writers the subject is only treated by way of allusion or illustration. Martial, however, provides, among other passages, what may perhaps be entitled to rank as the earliest notice of private fishery rights—the epigram *Ad Piscatorem*, which warns would-be poachers from casting a line in the Baian lake. Pliny the elder devoted the ninth book of his *Natural History* to fishes and water-life, and Plautus, Cicero, Catullus, Horace, Juvenal, Pliny the younger and Suetonius all allude to angling here and there. Agricultural writers, too, such as Varro and Columella, deal with the subject of fish ponds and stews rather fully. Later than any of these, but still just included in Latin literature, we have Ausonius (*c.* A.D. 320) and his well-known idyll the *Mosella*, which contains a good deal about the fish of the Moselle and the methods of catching them. In this poem is to be found the first recognizable description of members of the salmon family, and, though the manner of their application is rather doubtful, the names *salmo*, *salar* and *fario* strike a responsive note in the breast of the modern angler.

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[1] As to whether "angling" necessarily implies a rod as well as a line and hook, see the discussion in the law case of *Barnard* v. *Roberts* (*Times L.R.*, April 13, 1907), when the question arose as to the use of night-lines being angling; but the decision against night-lines went on the ground of the absence of the personal element rather than on the absence of a rod. The various dictionaries are blind guides on this point, and the authorities cited are inconclusive; but, broadly speaking, angling now implies three necessary factors—a personal angler, the sporting element, and the use of recognized fishing-tackle.

Post-classical Literature.—As to what happened in the world of angling in the first few centuries of the Christian era we know little. It may be inferred, however, that both fish and fishermen occupied a more honourable position in Christendom than they ever did before. The prominence of fishermen in the gospel narratives would in itself have been enough to bring this about, but it also happened that the Greek word for fish, ΙΧΘΥΣ, had an anagrammatic significance which the devout were not slow to perceive. The initials of the word resolve into what is practically a confession of faith, Ἰησοῦς Χριστὸς Θεοῦ Υἱὸς Σωτήρ (Jesus Christ, Son of God, Saviour). It is therefore not surprising that we find the fish very prominent as a sacred emblem in the painting and sculpture of the primitive church, or that Clement of Alexandria should have recommended it, among other things, as a device for signet rings or seals. The fisherman too is frequently represented in early Christian art, and it is worthy of remark that he more often uses a line and hook than a net. The references to fish and fishing scattered about in the writings of the early fathers for the most part reflect the two ideas of the sacredness of the fish and divine authorization of the fisherman; the second idea certainly prevailed until the time of Izaak Walton, for he uses it to justify his pastime. It is also not unlikely that the practice of fasting (in many cases fish was allowed when meat was forbidden) gave the art of catching fish additional importance. It seems at any rate to have been a consideration of weight when sites were chosen for monasteries in Europe, and in many cases when no fish-producing river was at hand the lack was supplied by the construction of fish-ponds. Despite all this, however, save for an occasional allusion in the early fathers, there is hardly a connecting link between the literature of Pagan Rome and the literature that sprang up on the invention of printing. One volume, the *Geoponica*, a Greek compilation concerning whose authorship and date there has been much dispute, is attributed in *Bibliotheca Piscatoria* to the beginning of the 10th century. It contains one book on fish, fish-ponds and fishing, with prescriptions for baits, &c., extracted for the most part from other writers. But it seems doubtful whether its date should not be placed very much earlier. Tradition makes it a Carthaginian treatise translated into Greek. A more satisfactory fragment of fishing literature is to be found in the *Colloquy* of Ælfric, written (*ad pueros linguae latinae locutionis exercendos*) towards the end of the same century. Ælfric became archbishop of Canterbury in A.D. 995, and the passage in the Anglo-Saxon text-book takes honourable rank as the earliest reference to fishing in English writings, though it is not of any great length. It is to be noted that the fisher who takes a share in the colloquy states that he prefers fishing in the river to fishing in the sea. Ascribed to the 13th or 14th century is a Latin poem *De Vetula*, whose author was apparently Richard de Fournival. It contains a passage on angling, and was placed to the credit of Ovid when first printed (*c.* 1470). A manuscript in the British museum, *Comptes des pêcheries de l'église de Troyes* (A.D. 1349–1413), gives a minute account of the fisheries with the weights of fish captured and the expenses of working. There is, however, practically nothing else of importance till we come to the first printed book on angling (a translation of Oppian, 1478, excepted), and so to the beginning of the literature proper. This first book was a little volume printed in Antwerp probably in 1492 at the press of Matthias van der Goes. In size it is little more than a pamphlet, and it treats of birds as well as fish:—*Dit Boecxken leert hoe men mach Voghelen . . . ende . . . visschen vangen metten handen. Ende oeck andersins. . . .* ("This book teaches how one may catch birds . . . and . . . fish with the hands, and also otherwise"). Only one copy apparently survives, in the Denison library, and a translation privately printed for Mr Alfred Denison in 1872 was limited to twenty-five copies. At least two other editions of the book appeared in Flemish, and it also made its way, in 1502, to Germany, where, translated and with certain alterations and additions, it seems to have been re-issued frequently. Next in date comes the famous *Treatyse of Fysshynge wyth an Angle*, printed at Westminster by Wynkyn de Worde in 1496 as a part of the second edition of *The Book of St Albans*. The treatise is for this reason associated with the name of Dame Juliana Berners, but that somewhat dubious compiler can have had nothing whatever to do with it. The treatise is almost certainly a compilation from some earlier work on angling ("bokes of credence" are mentioned in its text), possibly from a manuscript of the earlier part of the 15th century, of which a portion is preserved in the Denison collection. This was published in 1883 by Mr Thomas Satchell under the title *An Older Form of the Treatyse of Fysshynge wyth an Angle.* But it is also possible that a still older work was the parent of both books, for it has been held that the manuscript is an independent version. However this may be, it is certain that the treatise itself has been the parent of many other works. Many of the instructions contained in it are handed down from generation to generation with little change except in diction. Especially is this the case with the list of trout-flies, a meagre twelve, which survives in many fishing books until well into the 18th century.

From the beginning of the 16th century the fisherman's library begins to grow apace, as, though books solely devoted to fishing are not yet frequent, works on husbandry and country pursuits almost all contain something on the subject. In Italy the fisherman and his occupation apparently were considered poetically; the word *pescatore* or its cognates are common on Italian 16th and 17th century title-pages, though in many instances the fulfilment of the implied promise is not adequate, from an angler's point of view. From the pages of *Bibliotheca Piscatoria* a fairly long list of Italian writers could be gleaned. Among them may be mentioned Sannazaro (*Piscatoria*, &c., Rome, 1526) and Andrea Calmo (*Rime pescatorie*, Venice, 1557). A century later was Parthenius, who published a volume of *Halieutica* at Naples. This writer has an amusing reference to the art of "tickling" trout as practised in Britain. In Germany, as has been shown, the original little Flemish treatise had a wide vogue in the 16th century, and fishing played a part in a good many books on husbandry such as that of Conrad Heresbach (1570). Fish and fish-ponds formed the main topic of a Latin work by Dubravius (1552), while Gesner in the middle of the 16th and Aldrovandi at the beginning of the 17th centuries wrote at length on the natural history of fishes. In France the subject is less well represented, but *Les Pescheries* of Chris. de Gamon (Lyons, 1599) and *Le Plaisir des champs* of Cl. Gauchet (Paris, 1604) deserve to be noted. *Les Ruses innocentes* by François Fortin, first published at Paris in 1600, and several times in later editions, is characterized by Messrs Westwood and Satchell as "on the whole the most interesting contribution made by France to the literature of angling." England during the most part of the 16th century was evidently well enough served by the original treatise out of *The Book of St Albans.* It was republished twice by Wynkyn de Worde, six or seven times by Copland, and some five times by other printers. It was also practically republished in *A Booke of Fishing* by L. M. (1590). L. M. (Leonard Mascall) ranks as an angling author, but he did little more than borrow and edit the treatise. The same may be said of another version of *The Book of St Albans* "now newly collected by W. G. Faulkener" and issued in 1596.

Modern Literature.—In 1600 appeared John Taverner's *Certaine Experiments concerning Fish and Fruite*, and after this the period of angling literature proper begins. The *Secrets of Angling* (1613), by J(ohn) D(ennys), Esq., is one of the most important volumes in the angler's library, both on account of the excellence of the verse in which it is written and also on account of its practical value. Gervase Markham, "the first journalist," as he has been called, published his first book of husbandry at the same date, and, as in most of his many books on the same subject, devoted a certain amount of space to fishing. But Markham gathered his materials in a rather shameless manner and his angling passages have little originality. Thomas Barker's *The Art of Angling* (1st ed., 1651) takes a more honourable position, and received warm commendation from Izaak Walton himself, who followed it in 1653 with *The Compleat Angler.* So much has been written about this treasured classic that it is only necessary to indicate its popularity here by saying that its editions occupy some twenty pages in *Bibliotheca Piscatoria* (1883), and that since that work was published at least forty new editions have to be added to the list. During Walton's life-time the book ran through five editions, and with the fifth (1676) was incorporated Charles Cotton's second part, the "instructions how to angle for a trout or grayling, in a clear stream." In some cases too there was added a third book, the fourth edition of *The Experienced Angler*, by Robert Venables (1st ed., 1662). The three books together bore the title of *The Universal Angler.* Venables's portion was dropped later, but it is worth reading, and contained sound instruction though it has not the literary merit of Walton and Cotton.

A few other notable books of the century call for enumeration, *The Gentleman's Recreation* by Nicholas Cox (1674), Gilbert's *The Angler's Delight* (1676), Chetham's *Vade-Mecum* (1681), *The Complete Troller* by Robert Nobbes (1682), R. Franck's *Northern Memoirs* (1694), and *The True Art of Angling* by J. S. (1696). Of these Chetham, Nobbes, Franck and J. S. have the merit of considerable originality. Franck has gained some notoriety by his round abuse of Walton. In the 18th century among others we find *The Secrets of Angling* by C. G. (1705), Robert Howlett's *The Angler's Sure Guide* (1706), *The Whole Art of Fishing* (1714), *The Compleat Fisherman* by James Saunders (1724), *The Art of Angling* by R. Brookes (1740), another book with the same title by R. and C. Bowlker (Worcester, *c.* 1750), *The Complete Sportsman* by Thomas Fairfax (*c.* 1760), *The Angler's Museum* by T. Shirley (1784), and *A Concise Treatise on the Art of Angling* by Thomas Best (1787). Of these only Saunders's, Bowlker's and Best's books are of much importance, the rest being for the most part "borrowed." One volume of verse in the 18th century calls for notice, Moses Browne's *Piscatory Eclogues* (1729). Among greater names we get angling passages in Pope, Gay and Thomson; the two last were evidently brothers of the angle.

With the 19th century angling literature becomes too big a subject to be treated in detail, and it is only possible to glance at a few of the more important books and writers. Daniel's *Rural Sports* appeared in 1801; it is a treasure-house of odd facts. In 1828 Sir Humphry Davy published his famous *Salmonia*, which was reviewed in the *Quarterly* by Sir Walter Scott. At about this time too were appearing the *Noctes Ambrosianae* in *Blackwood's Magazine.* Christopher North (Professor Wilson) often touched upon angling in them, besides contributing a good many angling articles to the magazine. In 1835 that excellent angling writer Thomas Tod Stoddart began his valuable series of books with *The Art of Angling as Practised in Scotland.* In 1839 he published *Songs and Poems*, among which are pieces of great merit. During this period, too, first appeared, year by year, the *Newcastle Fishers' Garlands*, collected by Joseph Crawhall afterwards and republished in 1864. These border verses, like Stoddart's, have often a genuine ring about them which is missing from the more polished effusions of Gay and Thomson. Alfred Ronalds's *The Fly-Fisher's Entomology* (1st ed., 1836) was a publication of great importance, for it marked the beginning of the scientific spirit among trout-fishers. It ran through many editions and is still a valuable book of reference. A step in angling history is also marked by George Pulman's *Vade-Mecum of Fly-fishing for Trout* (1841), for it contains the first definite instructions on fishing with a "dry fly." Another is marked by Hewett Wheatley's *The Rod and the Line* (1849), where is to be found the earliest reference to the "eyed" hook. Yet another is marked by W. C. Stewart's *The Practical Angler* (1857), in which is taught the new doctrine of "up-stream" fishing for trout. This is a book of permanent value. Among the many books of this period Charles Kingsley's *Miscellanies* (1859) stands out, for it contains the immortal "Chalk-Stream Studies." The work of Francis Francis begins at about the same time, though his *A Book on Angling*, which is still one of the most valuable text-books, was not first published till 1867. Another well-known and excellent writer, Mr H. Cholmondeley Pennell, began in the early 'sixties; it is to him that we owe the admirable volumes on fresh-water fishing in the "Badminton Library." Among other English writers mention must be made of Messrs William Senior, John Bickerdyke and F. M. Halford, who have all performed signal services for angling and its literature. (See further bibliography *ad fin.*) In America the latter half of the 19th century produced a good deal of fishing literature, much of it of a high standard. *I go* *a-Fishing* by Dr W. C. Prime (1873), *Fishing with the Fly* by C. F. Orvis, A. Nelson Cheney and others (1883), *The American Salmon Fisherman* and *Fly Rods and Fly Tackle* by H. P. Wells (1886 and 1885), *Little Rivers* and other books by the Rev. H. Van Dyke—these are only a few specially distinguished in style and matter. Germany and France have not contributed so largely to the modern library, but in the first country we find several useful works by Max von dem Borne, beginning with the *Handbuch der Angelfischerei* of 1875, and there are a good many other writers who have contributed to the subject, while in France there are a few volumes on fishing by different hands. The most noticeable is M. G. Albert Petit's *La Truite de rivière* (1897), an admirable book on fly-fishing. As yet, however, though there are many enthusiastic anglers in France, the sport has not established itself so firmly as to have inspired much literature of its own; the same may be said of Germany.

Modern Conditions.—In the modern history of angling there are one or two features that should be touched upon. The great increase in the number of fishermen has had several results. One is a corresponding increase in the difficulty of obtaining fishing, and a notable rise in the value of rivers, especially those which are famed for salmon and trout. Salmon-fishing now may be said to have become a pastime of the rich, and there are signs that trout-fishing will before long have to be placed in the same exclusive category, while even the right to angle for less-esteemed fish will eventually be a thing of price. The development is natural, and it has naturally led to efforts on the part of the angling majority to counteract, if possible, the growing difficulty. These efforts have been directed chiefly in two ways, one the establishment of fishing clubs, the other the adoption of angling in salt water. The fishing club of the big towns was originally a social institution, and its members met together to sup, converse on angling topics and perhaps to display notable fish that they had caught. Later, however, arose the idea that it would be a convenience if a club could give its members privileges of fishing as well as privileges of reunion. So it comes about that all over the United Kingdom, in British colonies and dependencies, in the United States, and also in Germany and France, fishing clubs rent waters, undertake preservation and restocking and generally lead an active and useful existence. It is a good sign for the future of angling and anglers that they are rapidly increasing in number. One of the oldest fishing clubs, if not the oldest, was the Schuylkill club, founded in Pennsylvania in 1732. An account of its history was published in Philadelphia in 1830. Among the earliest clubs in London are to be numbered such societies as The True Waltonians, The Piscatorial, The Friendly Anglers and The Gresham, which are still flourishing. A certain amount of literary activity has been observable in the world of angling clubs, and several volumes of "papers" are on the records. Most noticeable perhaps are the three volumes of *Anglers' Evenings* published in 1880–1894, a collection of essays by members of the Manchester Anglers' Association. The other method of securing a continuance of sport, the adoption of sea-angling as a substitute for fresh-water fishing, is quite a modern thing. Within the memory of men still young the old tactics of hand-line and force were considered good enough for sea fish. Now the fresh-water angler has lent his centuries of experience in deluding his quarry; the sea-angler has adopted many of the ideas presented to him, has modified or improved others, and has developed the capture of sea-fish into a science almost as subtle as the capture of their fresh-water cousins. One more modern feature, which is also a result of the increase of anglers, is the great advance made in fish-culture, fish-stocking and fish-acclimatization during the last half-century. Fish-culture is now a recognized industry; every trout-stream of note and value is restocked from time to time as a matter of course; salmon-hatcheries are numerous, though their practical utility is still a debated matter, in Great Britain at any rate; coarse fish are also bred for purposes of restocking; and, lastly, it is now considered a fairly simple matter to introduce fish from one country to another, and even from continent to continent. In England the movement owes a great deal to Francis Francis, who, though he was not the earliest worker in the field, was among the first to formulate the science of fish-breeding; his book *Fish-Culture*, first published in 1863, still remains one of the best treatises on the subject. In the United States, where fishery science has had the benefit of generous governmental and official support and countenance and so has reached a high level of achievement, Dr. T. Garlick (*The Artificial Reproduction of Fishes*, Cleveland, 1857) is honoured as a pioneer. On the continent of Europe the latter half of the 19th century saw a very considerable and rapid development in fish-culture, but until comparatively recently the propagation and care of fish in most European waters have been considered almost entirely from the point of view of the fish-stew and the market. As to what has been done in the way of acclimatization it is not necessary to say much. Trout (*Salmo fario*) were introduced to New Zealand in the late 'sixties from England; in the 'eighties rainbow trout (*Salmo irideus*) were also introduced from California; now New Zealand provides the finest trout-fishing of its kind in the world. American trout of different kinds have been introduced into England, and brown trout have been introduced to America; but neither innovation can be said to have been an unqualified success, though the rainbow has established itself firmly in some waters of the United Kingdom. It is still regarded with some suspicion, as it has a tendency to wander from waters which do not altogether suit it. For the rest, trout have been established in Ceylon, in Kashmir and in South Africa, and early in 1906 an attempt was made to carry them to British Central Africa. In fact the possibilities of acclimatization are so great that, it seems probable, in time no river of the civilized world capable of holding trout will be without them.

METHODS AND PRACTICE

Angling now divides itself into two main divisions, fishing in fresh water and fishing in the sea. The two branches of the sport have much in common, and sea-angling is really little more than an adaptation of fresh-water methods to salt-water conditions. Therefore it will not be necessary to deal with it at great length and it naturally comes in the second place. Angling in fresh water is again divisible into three principal parts, fishing on the surface, *i.e.* with the fly; in mid-water, *i.e.* with a bait simulating the movements of a small fish or with the small fish itself; and on the bottom with worms, paste or one of the many other baits which experience has shown that fish will take. With the premise that it is not intended here to go into the minutiae of instruction which may more profitably be discovered in the many works of reference cited at the end of this article, some account of the subdivisions into which these three styles of fishing fall may be given.

Fresh-Water Fishing.

Fly-fishing.—Fly-fishing is the most modern of them, but it is the most highly esteemed, principally because it is the method *par excellence* of taking members of the most valuable sporting family of fish, the *Salmonidae.* It may roughly be considered under three heads, the use of the "wet" or sunk fly, of the "dry" or floating fly, and of the natural insect. Of these the first is the most important, for it covers the widest field and is the most universally practised. There are few varieties of fish which may not either consistently or occasionally be taken with the sunk fly in one of its two forms. The large and gaudy bunch of feathers, silk and tinsel with which salmon, very large trout, black bass and occasionally other predaceous fish are taken is not, strictly speaking, a fly at all. It rather represents, if anything, some small fish or subaqueous creature on which the big fish is accustomed to feed and it may conveniently receive the generic name of salmon-fly. The smaller lures, however, which are used to catch smaller trout and other fish that habitually feed on insect food are in most cases intended to represent that food in one of its forms and are entitled to the name of "artificial flies." The dry or floating fly is simply a development of the imitation theory, and has been evolved from the wet fly in course of closer observation of the habits of flies and fish in certain waters. Both wet and dry fly methods are really a substitute for the third and oldest kind of surface-fishing, the use of a natural insect as a bait. Each method is referred to incidentally below.

Spinning, &c.—Mid-water fishing, as has been said, broadly consists in the use of a small fish, or something that simulates it, and its devices are aimed almost entirely at those fish which prey on their fellows. Spinning, live-baiting and trolling[1] are these devices. In the first a small dead fish or an imitation of it made in metal, india-rubber, or other substance, is caused to revolve rapidly as it is pulled through the water, so that it gives the idea of something in difficulties and trying to escape. In the second a small fish is put on the angler's hook alive and conveys the same idea by its own efforts. In the third a small dead fish is caused to dart up and down in the water without revolving; it conveys the same idea as the spinning fish, though the manipulation is different.

Bottom-Fishing.—Bottom-fishing is the branch of angling which is the most general. There is practically no fresh-water fish that will not take some one or more of the baits on the angler's list if they are properly presented to it when it is hungry. Usually the baited hook is on or near the bottom of the water, but the rule suggested by the name "bottom-fishing" is not invariable and often the bait is best used in mid-water; similarly, in "mid-water fishing" the bait must sometimes be used as close to the bottom as possible. Bottom-fishing is roughly divisible into two kinds, float-fishing, in which a bite is detected by the aid of a float fastened to the line above the hook and so balanced that its tip is visible above the water, and hand-fishing, in which no float is used and the angler trusts to his hand to feel the bite of a fish. In most cases either method can be adopted and it is a matter of taste, but broadly speaking the float-tackle is more suited to water which is not very deep and is either still or not rapid. In great depths or strong streams a float is difficult to manage.

The Fish.

It is practically impossible to classify the fish an angler catches according to the methods which he employs, as most fish can be taken by at least two of these methods, while many of those most highly esteemed can be caught by all three. Sporting fresh-water fish are therefore treated according to their families and merits from the angler's point of view, and it is briefly indicated which method or methods best succeed in pursuit of them.

Salmon.—First in importance come the migratory *Salmonidae*, and at the head of them the salmon (*Salmo salar*), which has a two-fold reputation as a sporting and as a commercial asset. The salmon fisheries of a country are a very valuable possession, but it is only comparatively recently that this has been realized and that salmon rivers have received the legal protection which is necessary to their well-being. Even now it cannot be asserted that in England the salmon question, as it is called, is settled. Partly owing to our ignorance of the life-history of the fish, partly owing to the difficulty of reconciling the opposed interests of commerce and sport, the problem as to how a river should be treated remains only partially solved, though it cannot be denied that there has been a great advance in the right direction. The life-history of the salmon, so far as it concerns the matter in hand, may be very briefly summed up. It is bred in the rivers and fed in the sea. The parent fish ascend in late autumn as high as they can get, the ova are deposited on gravel shallows, hatching out in the course of a few weeks into parr. The infant salmon remains in fresh water at least one year, generally two years, without growing more than a few inches, and then about May assumes what is called the smolt-dress, that is to say, it loses the dark parr-bands and red spots of infancy and becomes silvery all over. After this it descends without delay to the sea, where it feeds to such good purpose that in a year it has reached a weight of 2 lb to 4 lb or more, and it may then reascend as a grilse. Small grilse indeed may only have been in the sea a few months, ascending in the autumn of the year of their first descent. If the fish survives the perils of its first ascent and spawning season and as a kelt or spawned fish gets down to the sea again, it comes up a second time as a salmon of weight varying from 8 lb upwards. Whether salmon come up rivers, and, if so, spawn, every year, why some fish are much heavier than others of the same age, what their mode of life is in the sea, why some run up in spring and summer when the breeding season is not till about November or December, whether they were originally sea-fish or river-fish—these and other similar questions await a conclusive answer. One principal fact, however, stands out amid the uncertainty, and that is that without a free passage up and down unpolluted rivers and without protection on the spawning beds salmon have a very poor chance of perpetuating their species. Economic prudence dictates therefore that every year a considerable proportion of running salmon should be allowed to escape the dangers that confront them in the shape of nets, obstructions, pollutions, rods and poachers. And it is in the adjustment of the interests which are bound up in these dangers (the last excepted; officially poachers have no interests, though in practice their plea of "custom and right" has too often to be taken into consideration) that the salmon question consists. To secure a fair proportion of fish for the market, a fair proportion for the rods and a fair proportion for the redds, without unduly damaging manufacturing interests, this is the object of those who have the question at heart, and with many organizations and scientific observers at work it should not be long before the object is attained. Already the system of "marking" kelts with a small silver label has resulted in a considerable array of valuable statistics which have made it possible to estimate the salmon's ordinary rate of growth from year to year. It is very largely due to the efforts of anglers that the matter has gone so far. Whether salmon feed in fresh water is another question of peculiar interest to anglers, for it would seem that if they do not then the whole practice of taking them must be an anomaly. Champions have arisen on both sides of the argument, some, scientists, asserting that salmon (parr and kelts excluded, for both feed greedily as opportunity occurs) do not feed, others, mostly anglers, maintaining strongly that they do, and bringing as evidence their undoubted and customary capture by rod and line, not only with the fly, but also with such obvious food-stuffs as dead baits, worms and prawns. On the other side it is argued that food is never found inside a salmon after it has been long enough in a river to have digested its last meal taken in salt water. The very few instances of food found in salmon which have been brought forward to support the contrary opinion are in the scientific view to be regarded with great caution; certainly in one case of recent years, which at first appeared to be well authenticated, it was afterwards found that a small trout had been pushed down a salmon's throat after capture by way of a joke. A consideration of the question, however, which may perhaps make some appeal to both sides, is put forward by Dr J. Kingston Barton in the first of the two volumes on *Fishing* (*Country Life* Series). He maintains that salmon do not habitually feed in fresh water, but he does not reject the possibility of their occasionally taking food. His view is that after exertion, such as that entailed by running from pool to pool during a spate, the fish may feel a very transient hunger and be impelled thereby to snap at anything in its vicinity which looks edible. The fact that the angler's best opportunity is undoubtedly when salmon have newly arrived into a pool, supports this contention. The longer they are compelled to remain in the same spot by lack of water the worse becomes the prospect of catching them, and "unfishable" is one of the expressive words which fishermen use to indicate the condition of a river during the long periods of drought which too often distinguish the sport.

Salmon Tackle and Methods.—It is when the drought breaks up and the long-awaited rain has come that the angler has his chance and makes ready his tackle, against the period of a few days (on some short streams only a few hours) during which the water will be right; *right* is a very exact term on some rivers, meaning not only that the colour of the water is suitable to the fly, but that its height shall be within an inch or two of a given mark, prescribed by experience. As to the tackle which is made ready, there is, as in most angling matters, divergence of opinion. Salmon fly-rods are now made principally of two materials, greenheart and split-cane; the former is less expensive, the latter is more durable; it is entirely a matter of taste which a man uses, but the split-cane rod is now rather more in favour, and for salmon-fishing it is in England usually built with a core of steel running from butt to tip and known as a "steel centre." How long the rod shall be is also a matter on which anglers differ, but from 16 ft. to 17 ft. 6 in. represents the limits within which most rods are preferred. The tendency is to reduce rather than to increase the length of the rod, which may be accounted for by the adoption of a heavy line. Early in the 19th century anglers used light-topped rods of 20 ft. and even more, and with them a light line composed partly of horse-hair; they thought 60 ft. with such material a good cast. Modern experience, however, has shown that a shorter rod with a heavier top will throw a heavy dressed silk line much farther with less exertion. Ninety feet is now considered a good fishing cast, while many men can throw a great deal more. In the United States, where rods have long been used much lighter than in England, the limits suggested would be considered too high. From 12 ft. 6 in. to 15 ft. 6 in. is about the range of the American angler's choice, though long rods are not unknown with him. The infinite variety of reels, lines, gut collars[1] and other forms of tackle which is now presented to the angler's consideration and for his bewilderment is too wide a subject to be touched upon here. Something, however, falls to be said about flies. One of the perennially fruitful topics of inquiry is what the fish takes a salmon-fly to be. Beyond a fairly general admission that it is regarded as something endowed with life, perhaps resembling a remembered article of marine diet, perhaps inviting gastronomic experiment, perhaps irritating merely and rousing an impulse to destroy, the discussion has not reached any definite conclusion. But more or less connected with it is the controversy as to variety of colour and pattern. Some authorities hold that a great variety of patterns with very minute differences in colour and shades of colour is essential to complete success; others contend that salmon do not differentiate between nice shades of colour, that they only draw distinctions between flies broadly as being light, medium or dark in general appearance, and that the size of a fly rather than its colour is the important point for the angler's consideration. Others again go some way with the supporters of the colour-scheme and admit the efficacy of flies whose general character is red, or yellow, or black, and so on. The opinion of the majority, however, is probably based on past experience, and a man's favourite flies for different rivers and condition of water are those with which he or someone else has previously succeeded. It remains a fact that in most fly-books great variety of patterns will be discoverable, while certain old standard favourites such as the Jock Scott, Durham Ranger, Silver Doctor, and Thunder and Lightning will be prominent. Coming out of the region of controversy it is a safe generalization to say that the general rule is: big flies for spring fishing when rivers are probably high, small flies for summer and low water, and flies medium or small in autumn according to the conditions. Spring fishing is considered the cream of the sport. Though salmon are not as a rule so numerous or so heavy as during the autumn run, and though kelts are often a nuisance in the early months, yet the clean-run fish of February, March or April amply repays patience and disappointment by its fighting powers and its beauty. Summer fishing on most rivers in the British Islands is uncertain, but in Norway summer is the season, which possibly explains to some extent the popularity of that country with British anglers, for the pleasure of a sport is largely increased by good weather.

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[1] Trolling is very commonly confused in angling writing and talk with *trailing*, which simply means drawing a spinning-bait along behind a boat in motion.

Two methods of using the fly are in vogue, casting and harling. The first is by far the more artistic, and it may be practised either from a boat, from the bank or from the bed of the river itself; in the last case the angler wades, wearing waterproof trousers or wading-stockings and stout nail-studded brogues. In either case the fishing is similar. The fly is cast across and down stream, and has to be brought over the "lie" of the fish, swimming naturally with its head to the stream, its feathers working with tempting movement and its whole appearance suggesting some live thing dropping gradually down and across stream. Most anglers add to the motion of the fly by "working" it with short pulls from the rod-top. When a fish takes, the rise is sometimes seen, sometimes not; in any case the angler should not respond with the rod until he *feels* the pull. Then he should *tighten*, not strike. The fatal word "strike," with its too literal interpretation, has caused many a breakage. Having hooked his fish, the angler must be guided by circumstances as to what he does; the salmon will usually decide that for him. But it is a sound rule to give a well-hooked fish no unnecessary advantage and to hold on as hard as the tackle will allow. Good tackle will stand an immense strain, and with this "a minute a pound" is a fair estimate of the time in which a fish should be landed. A foul-hooked salmon (no uncommon thing, for a fish not infrequently misses the fly and gets hooked somewhere in the body) takes much longer to land. The other method of using the fly, harling, which is practised on a few big rivers, consists in trailing the fly behind a boat rowed backward and forwards across the stream and dropping gradually downwards. Fly-fishing for salmon is also practised on some lakes, into which the fish run. On lakes the boat drifts slowly along a "beat," while the angler casts diagonally over the spots where salmon are wont to lie. Salmon may also be caught by "mid-water fishing," with a natural bait either spun or trolled and with artificial spinning-baits of different kinds, and by "bottom-fishing" with prawns, shrimps and worms. Spinning is usually practised when the water is too high or too coloured for the fly; trolling is seldom employed, but is useful for exploring pools which cannot be fished by spinning or with the fly; the prawn is a valuable lure in low water and when fish are unwilling to rise; while the worm is killing at all states of the river, but except as a last resource is not much in favour. There are a few waters where salmon have the reputation of not taking a fly at all; in them spinning or prawning are the usual modes of fishing. But most anglers, wherever possible, prefer to use the fly. The rod for the alternative methods is generally shorter and stiffer than the fly-rod, though made of like material. Twelve to fourteen feet represents about the range of choice. Outside the British Islands the salmon-fisher finds the headquarters of his sport in Europe in Scandinavia and Iceland, and in the New World in some of the waters of Canada and Newfoundland.

Land-locked Salmon.—The land-locked salmon (*Salmo salar sebago*) of Canada and the lakes of Maine is, as its name implies, now regarded by scientists as merely a land-locked form of the salmon. It does not often attain a greater size than 20 lb, but it is a fine fighter and is highly esteemed by American anglers. In most waters it does not take a fly so well as a spinning-bait, live-bait or worm. The methods of angling for it do not differ materially from those employed for other *Salmonidae*.

Pacific Salmon.—Closely allied to *Salmo salar* both in appearance and habits is the genus *Oncorhynchus*, commonly known as Pacific salmon. It contains six species, is peculiar to the North Pacific Ocean, and is of some importance to the angler, though of not nearly so much as the Atlantic salmon. The quinnat is the largest member of the genus, closely resembles *salar* in appearance and surpasses him in size. The others, sockeye, humpback, cohoe, dog-salmon and masu, are smaller and of less interest to the angler, though some of them have great commercial value. The last-named is only found in the waters of Japan, but the rest occur in greater or less quantities in the rivers of Kamchatka, Alaska, British Columbia and Oregon. The problems presented to science by *salar* are offered by *Oncorhynchus* also, but there are variations in his life-history, such as the fact that few if any fish of the genus are supposed to survive their first spawning season. When once in the rivers none of these salmon is of very much use to the angler; as, though it is stated that they will occasionally take a fly or spoon in fresh water, they are not nearly so responsive as their Atlantic cousin and in many streams are undoubtedly not worth trying for. At the mouths of some rivers, however, where the water is distinctly tidal, and in certain bays of the sea itself they give very fine sport, the method of fishing for them being usually to trail a heavy spoon-bait behind a boat. By this means remarkable bags of fish have been made by anglers. The sport is of quite recent development.

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[1] The precise date when silkworm gut (now so important a feature of the angler's equipment) was introduced is obscure. Pepys, in his *Diary* (1667), mentions "a gut string varnished over" which "is beyond any hair for strength and smallness" as a new angling secret which he likes "mightily." In the third edition (1700) of Chetham's *Vade-Mecum*, already cited, appears an advertisement of the "East India weed, which is the only thing for trout, carp and bottom-fishing." Again, in the third edition of Nobbes's *Art of Trolling* (1805), in the supplementary matter, appears a letter signed by J. Eaton and G. Gimber, tackle-makers of Crooked Lane (July 20, 1801), in which it is stated that gut "is produced from the silkworm and not an Indian weed, *as has hitherto been conjectured. . . .*" The word "gut" is employed before this date, but it seems obvious that silkworm gut was for a long time used under the impression that it was a weed, and that its introduction was a thing of the 17th century. It is probable, however, that vegetable fibre was used too; we believe that in some parts of India it is used by natives to this day. Pepys' "minikin" was probably cat-gut.

Sea-Trout.—Next to the salmon comes the sea-trout, the other migratory salmonid of Europe. This is a fish with many local names and a good deal of local variation. Modern science, however, recognises two "races" only, *Salmo trutta*, the sea-trout proper, and *Salmo cambricus* or *eriox*, the bull-trout, or sewin of Wales, which is most prominent in such rivers as the Coquet and Tweed. The life-history of sea-trout is much the same as that of salmon, and the fish on their first return from the sea in the grilse-stage are called by many names, finnock, herling and whitling being perhaps the best known. Of the two races *Salmo trutta* alone is of much use to the fly-fisher. The bull-trout, for some obscure reason, is not at all responsive to his efforts, except in its kelt stage. Then it will take greedily enough, but that is small consolation. The bull-trout is a strong fish and grows to a great size and it is a pity that it is not of greater sporting value, if only to make up for its bad reputation as an article of food. Some amends, however, are made by its cousin the sea-trout, which is one of the gamest and daintiest fish on the angler's list. It is found in most salmon rivers and also in not a few streams which are too small to harbour the bigger fish, while there are many lakes in Scotland and Ireland (where the fish is usually known as white trout) where the fishing is superb when the trout have run up into them. Fly-fishing for sea-trout is not a thing apart. A three-pounder that will impale itself on a big salmon-fly, might equally well have taken a tiny trout-fly. Many anglers, when fishing a sea-trout river where they run large, 5 ℔ or more, and where there is also a chance of a salmon, effect a compromise by using a light 13 ft. or 14 ft. double-handed rod, and tackle not so slender as to make hooking a salmon a certain disaster. But undoubtedly to get the full pleasure out of sea-trout-fishing a single-handed rod of 10 ft. to 12 ft. with reasonably fine gut and small flies should be used, and the way of using it is much the same as in wet-fly fishing for brown trout, which will be treated later. When the double-handed rod and small salmon-flies are used, the fishing is practically the same as salmon-fishing except that it is on a somewhat smaller scale. Flies for sea-trout are numberless and local patterns abound, as may be expected with a fish which has so catholic a taste. But, as with salmon-fishers so with sea-trout-fishers, experience forms belief and success governs selection. Among the small salmon-flies and loch-flies which will fill his book, the angler will do well to have a store of very small trout-flies at hand, while experience has shown that even the dry fly will kill sea-trout on occasion, a thing that is worth remembering where rivers are low and fish shy. July, August and September are in general the best months for sea-trout, and as they are dry months the angler often has to put up with indifferent sport. The fish will, however, rise in tidal water and in a few localities even in the sea itself, or in salt-water lochs into which streams run. Sea-trout have an irritating knack of "coming short," that is to say, they will pluck at the fly without really taking it. There are occasions, on the other hand, in loch-fishing where plenty of time must be given to the fish without tightening on it, especially if it happens to be a big one. Like salmon, sea-trout are to be caught with spinning-baits and also with the worm. The main controversy that is concerned with sea-trout is whether or no the fish captured in early spring are clean fish or well-mended kelts. On the whole, as sea-trout seldom run before May, the majority of opinion inclines to their being kelts.

Non-migratory Salmonidae.—Of the non-migratory members of the *Salmonidae* the most impotant in Great Britain is the brown trout (*Salmo fario*). Its American cousin the rainbow trout (*S. irideus*) is now fairly well established in the country too, while other transatlantic species both of trout and char (which are some of them partially migratory, that is to say, migratory when occasion offers), such as the steelhead (*S. rivularis*), fontinalis (*S. fontinalis*) and the cut-throat trout (*S. clarkii*), are at least not unknown. All these fish, together with their allied forms in America, can be captured with the fly, and, speaking broadly, the wet-fly method will do well for them all. Therefore it is only necessary to deal with the methods applicable to one species, the brown trout.

Trout.—Of the game-fishes the brown trout is the most popular, for it is spread over the whole of Great Britain and most of Europe, wherever there are waters suited to it. It is a fine sporting fish and is excellent for the table, while in some streams and lakes it grows to a very considerable size, examples of 16 ℔ from southern rivers and 20 ℔ from Irish and Scottish lakes being not unknown. One of the signs of its popularity is that its habits and history have produced some very animated controversies. Some of the earliest discussions were provoked by the liability of the fish to change its appearance in different surroundings and conditions, and so at one time many a district claimed its local trout as a separate species. Now, however, science admits but one species, though, to such well-defined varieties as the Loch Leven trout, the estuarine trout and the gillaroo, it concedes the right to separate names and "races." In effect all, from the great *ferox* of the big lakes of Scotland and Ireland to the little fingerling of the Devonshire brook, are one and the same—*Salmo fario*.

Wet-Fly Fishing for Trout.—Fly-fishing for trout is divided into three kinds: fishing with the artificial fly sunk or "wet," fishing with it floating or "dry" and fishing with the natural insect. Of the two first methods the wet fly is the older and may be taken first. Time was when all good anglers cast their flies down-stream and thought no harm. But in 1857 W. C. Stewart published his *Practical Angler*, in which he taught that it paid better to fish up-stream, for by so doing the angler was not only less likely to be seen by the trout but was more likely to hook his fish. The doctrine was much discussed and criticized, but it gradually won adherents, until now up-stream fishing is the orthodox method where it is possible. Stewart was also one of the first to advocate a lighter rod in place of the heavy 12 ft. and 13 ft. weapons that were used in the North in his time. There are still many men who use the long rod for wet-fly fishing in streams, but there are now more who find 10 ft. quite enough for their purpose. For lake-fishing from a boat, however, the longer rod is still in many cases preferred. In fishing rivers the main art is to place the right flies in the right places and to let them come naturally down with the stream. The right flies may be ascertained to some extent from books and from local wisdom, but the right places can only be learnt by experience. It does not, however, take long to acquire "an eye for water" and that is half the battle, for the haunts of trout in rapid rivers are very much alike. In lake-fishing chance has a greater share in bringing about success, but here too the right fly and the right place are important; the actual management of rod, line and flies, of course, is easier, for there is no stream to be reckoned with. Though there is little left to be said about wet-fly fishing where the fly is an imitation more or less exact of a natural insect, there is another branch of the art which has been stimulated by modern developments. This is the use of salmon-flies for big trout much in the same way as for salmon. In such rivers as the Thames, where the trout are cannibals and run very large, ordinary trout-flies are of little use, and the fly-fisher's only chance is to use a big fly and "work" it, casting across and down stream. The big fly has also been found serviceable with the great fish of New Zealand and with the inhabitants of such a piece of water as Blagdon Lake near Bristol, where the trout run very large. For this kind of fishing much stronger tackle and a heavier rod are required than for catching fish that seldom exceed the pound.

Dry Fly.—Fishing with the floating fly is a device of southern origin, and the idea no doubt arose from the facts that on the placid south-country streams the natural fly floats on the surface and that the trout are accustomed to feed on it there. The controversy "dry *versus* wet" was long and spirited, but the new idea won the day and now not only on the chalk-streams, but on such stretches of even Highland rivers as are suitable, the dry-fly man may be seen testing his theories. These theories are simple and consist in placing before the fish an exact imitation of the insect on which it is feeding, in such a way that it shall float down exactly as if it were an insect of the same kind. To this end special tackle and special methods have been found necessary. Not only the fly but also the line has to float on the water; the line is very heavy and therefore the rod (split-cane or greenheart) must be stiff and powerful; special precautions have to be taken that the fly shall float unhindered and shall not "drag"; special casts have to be made to counteract awkward winds; and, lastly, the matching of the fly with the insect on the water is a matter of much nicety, for the water-flies are of many shades and colours. Many brains have busied themselves with the solution of these problems with such success that dry-fly fishing is now a finished art. The entomology of the dry-fly stream has been studied very deeply by Mr F. M. Halford, the late G. S. Marryat and others, and improvements both in flies and tackle have been very great. Quite lately, however, there has been a movement in favour of light rods for dry-fly fishing as well as wet-fly fishing. The English split-cane rod for dry-fly work weighs about an ounce to the foot, rather more or rather less. The American rod of similar action and material weighs much less—approximately 6 oz. to 10 ft. The light rod, it is urged, is much less tiring and is quite powerful enough for ordinary purposes. Against it is claimed that dry-fly fishing is not "ordinary purposes," that chalk-stream weeds are too strong and chalk-stream winds too wild for the light rod to be efficient against them. However, the light rod is growing in popular favour; British manufacturers are building rods after the American style; and anglers are taking to them more and more. The dry-fly method is now practised by many fishermen both in Germany and France, but it has scarcely found a footing as yet in the United States or Canada.

Fishing with the Natural Fly.—The natural fly is a very killing bait for trout, but its use is not wide-spread except in Ireland. In Ireland "dapping" with the green drake or the daddy-longlegs is practised from boats on most of the big loughs. A light whole-cane rod of stiff build, about 16 ft. in length, is required with a floss-silk line light enough to be carried out on the breeze; the "dap" (generally two mayflies or daddy-long-legs on a small stout-wired hook) is carried out by the breeze and just allowed to touch the water. When a trout rises it is well to count "ten" before striking. Very heavy trout are caught in this manner during the mayfly season. In the North "creeper-fishing" is akin to this method, but the creeper is the larva of the stone-fly, not a fly itself, and it is cast more like an ordinary fly and allowed to sink. Sometimes, however, the mature insect is used with equally good results. A few anglers still practise the old style of dapping or "dibbling" after the manner advised by Izaak Walton. It is a deadly way of fishing small overgrown brooks. A stiff rod and strong gut are necessary, and a grasshopper or almost any large fly will serve for bait.

Other Methods.—The other methods of taking trout principally employed are spinning, live-baiting and worming. For big river trout such as those of the Thames a gudgeon or bleak makes the best spinning or live bait, for great lake trout (*ferox*) a small fish of their own species and for smaller trout a minnow. There are numberless artificial spinning-baits which kill well at times, the Devon being perhaps the favourite. The use of the drop-minnow, which is trolling on a lesser scale, is a killing method employed more in the north of England than elsewhere. The worm is mostly deadly in thick water, so deadly that it is looked on askance. But there is a highly artistic mode of fishing known as "clear-water worming." This is most successful when rivers are low and weather hot, and it needs an expert angler to succeed in it. The worm has to be cast up-stream rather like a fly, and the method is little inferior to fly-fishing in delicacy and difficulty. The other baits for trout, or rather the other baits which they will take sometimes, are legion. Wasp-grubs, maggots, caterpillars, small frogs, bread—there is very little the fish will not take. But except in rural districts little effort is made to catch trout by means less orthodox than the fly, minnow and worm, and the tendency nowadays both in England and America is to restrict anglers where possible to the use of the artificial fly only.

Grayling.—The only other member of the salmon family in England which gives much sport to the fly-fisher is the grayling, a fish which possesses the recommendation of rising well in winter. It can be caught with either wet or dry fly, and with the same tackle as trout, which generally inhabit the same stream. Grayling will take most small trout-flies, but there are many patterns of fly tied specially for them, most of them founded on the red tag or the green insect. Worms and maggots are also largely used in some waters for grayling, and there is a curious contrivance known as the "grasshopper," which is a sort of compromise between the fly and bait. It consists of a leaded hook round the shank of which is twisted bright-coloured wool. The point is tipped with maggots, and the lure, half artificial, half natural, is dropped into deep holes and worked up and down in the water. In some places the method is very killing. The grayling has been very prominent of late years owing to the controversy "grayling *versus* trout." Many people hold that grayling injure a trout stream by devouring trout-ova and trout-food, by increasing too rapidly and in other ways. Beyond, however, proving the self-evident fact that a stream can only support a given amount of fish-life, the grayling's opponents do not seem to have made out a very good case, for no real evidence of its injuring trout has been adduced.

Char.—The chars (*Salvelinus*) are a numerous family widely distributed over the world, but in Great Britain are not very important to the angler. One well-defined species (*Salvelinus alpinus*) is found in some lakes of Wales and Scotland, but principally in Westmorland and Cumberland. It sometimes takes a small fly but is more often caught with small artificial spinning-baits. The fish seldom exceeds 1½ lb in Great Britain, though in Scandinavia it is caught up to 5 lb or more. There are some important chars in America, *fontinalis* being one of the most esteemed. Some members of the genus occasionally attain a size scarcely excelled by the salmon. Among them are the Great Lake trout of America, *Cristivomer namaycush*, and the Danubian "salmon" or huchen, *Salmo hucho*. Both of these fish are caught principally with spinning-baits, but both will on occasion take a salmon-fly, though not with any freedom after they have reached a certain size. An attempt has been made to introduce huchen into the Thames but at the time of writing the result cannot yet be estimated.

Pike.—The pike (*Esox lucius*), which after the *Salmonidae* is the most valued sporting fish in Great Britain, is a fish of prey pure and simple. Though it will occasionally take a large fly, a worm or other ground-bait, its systematic capture is only essayed with small fish or artificial spinning-baits. A live bait is supposed to be the most deadly lure for big pike, probably because it is the method employed by most anglers. But spinning is more artistic and has been found quite successful enough by those who give it a fair and full trial. Trolling, the method of "sink and draw" with a dead bait, referred to previously in this article, is not much practised nowadays, though at one time it was very popular. It was given up because the traditional form of trolling-tackle was such that the bait had to be swallowed by the pike before the hook would take hold, and that necessitated killing all fish caught, whether large or small. The same objection formerly applied to live-baiting with what was known as a gorge-hook. Now, however, what is called snap-tackle is almost invariably used in live-baiting, and the system is by some few anglers extended to the other method too. Pike are autumn and winter fish and are at their best in December. They grow to a very considerable size, fish of 20 ℔ being regarded as "specimens" and an occasional thirty-pounder rewarding the zealous and fortunate. The heaviest pike caught with a rod in recent years which is sufficiently authenticated, weighed 37 ℔, but heavier specimens are said to have been taken in Irish lakes. River pike up to about 10 ℔ in weight are excellent eating.

America has several species of pike, of which the muskelunge of the great lake region (*Esox masquinongy*) is the most important. It is a very fine fish, excelling *Esox lucius* both in size and looks. From the angler's point of view it may be considered simply as a large pike and may be caught by similar methods. It occasionally reaches the weight of 80 ℔ or perhaps more. The pickerel (*Esox reticulatus*) is the only other of the American pikes which gives any sport. It reaches a respectable size, but is as inferior to the pike as the pike is to the muskelunge.

Perch.—Next to the pikes come the perches, also predatory fishes. The European perch (*Perca fluviatilis*) has a place by itself in the affections of anglers. When young it is easy to catch by almost any method of fishing, and a large number of Walton's disciples have been initiated into the art with its help. Worms and small live-baits are the principal lures, but at times the fish will take small bright artificial spinning-baits well, and odd attractions such as boiled shrimps, caddis-grubs, small frogs, maggots, wasp-grubs, &c. are sometimes successful. The drop-minnow is one of the best methods of taking perch. Very occasionally, and principally in shallow pools, the fish will take an artificial fly greedily, a small salmon-fly being the best thing to use in such a case. A perch of 2 ℔ is a good fish, and a specimen of 4½ ℔ about the limit of angling expectation. There have been rare instances of perch over 5 ℔, and there are legends of eight-pounders, which, however, need authentication.

Black Bass.—The yellow perch of America (*Perca flavescens*) is very much like its European cousin in appearance and habits, but it is not so highly esteemed by American anglers, because they are fortunate in being possessed of a better fish in the black bass, another member of the perch family. There are two kinds of black bass (*Micropterus salmoides* and *Micropterus dolomieu*), the large-mouthed and the small-mouthed. The first is more a lake and pond fish than the second, and they are seldom found in the same waters. As the black bass is a fly-taking fish and a strong fighter, it is as valuable to the angler as a trout and is highly esteemed. Bass-flies are *sui generis*, but incline more to the nature of salmon-flies than trout-flies. An artificial frog cast with a fly-rod or very light spinning-rod is also a favourite lure. For the rest the fish will take almost anything in the nature of worms or small fish, like its cousin the perch. A 4 ℔ bass is a good fish, but five-pounders are not uncommon. Black bass have to some extent been acclimatized in France.

The *ruffe* or *pope* (*Acerina vulgaris*) is a little fish common in the Thames and many other slow-flowing English rivers. It is very like the perch in shape but lacks the dusky bars which distinguish the other, and is spotted with dark brown spots on a golden olive background. It is not of much use to the angler as it seldom exceeds 3 oz. in weight. It takes small worms, maggots and similar baits greedily, and is often a nuisance when the angler is expecting better fish. Allied to the perches is the pike-perch, of which two species are of some importance to the angler, one the wall-eye of eastern America (*Stizostedion vitreum*) and the other the zander of Central Europe (*Sandrus lucioperca*). The last especially is a fine fighter, occasionally reaching a weight of 20 ℔. It is usually caught by spinning, but will take live-baits, worms and other things of that nature. The Danube may be described as its headquarters. It is a fish whose sporting importance will be more realized as anglers on the continent become more numerous.

Cyprinidae.—The carp family (*Cyprinidae*) is a large one and its members constitute the majority of English sporting fishes. In America the various kinds of chub, sucker, dace, shiner, &c. are little esteemed and are regarded as spoils for the youthful angler only, or as baits for the better fish in which the continent is so rich. In England, however, the *Cyprinidae* have an honoured place in the affections of all who angle "at the bottom," while in Europe some of them have a commercial value as food-fishes. In India at least one member of the family, the mahseer, takes rank with the salmon as a "big game" fish.

Carp, Tench, Barbel, Bream.—The family as represented in England may be roughly divided into two groups, those which feed on the bottom purely and those which occasionally take flies. The first consists of carp, tench, barbel and bream. Of these carp, tench and bream are either river or pool fish, while the barbel is found only in rivers, principally in the Thames and Trent. The carp grows to a great size, 20 ℔ being not unknown; tench are big at 5 ℔; barbel have been caught up to 14 ℔ or rather more; and bream occasionally reach 8 ℔, while a fish of over 11 ℔ is on record. All these fish are capricious feeders, carp and barbel being particularly undependable. In some waters it seems to be impossible to catch the large specimens, and the angler who seeks to gain trophies in either branch of the sport needs both patience and perseverance. Tench and bream are not quite so difficult. The one fish can sometimes be caught in great quantities, and the other is generally to be enticed by the man who knows how to set about it. Two main principles have to be observed in attacking all these fish, ground-baiting and early rising. Ground-baiting consists in casting food into the water so as to attract the fish to a certain spot and to induce them to feed. Without it very little can be done with shy and large fish of these species. Early rising is necessary because they only feed freely, as a rule, from daybreak till about three hours after sun-rise. The heat of a summer or early autumn day makes them sluggish, but an hour or two in the evening is sometimes remunerative. The bait for them all should usually lie on the bottom, and it consists mainly of worms, wasp and other grubs, pastes of various kinds; and for carp, and sometimes bream, of vegetable baits such as small boiled potatoes, beans, peas, stewed wheat, pieces of banana, &c. None of these fish feed well in winter.

Roach, Rudd, Dace, Chub.—The next group of *Cyprinidae* consists of fish which will take a bait similar to those already mentioned and also a fly. The sizes which limit the ordinary angler's aspirations are roach about 2 ℔, rudd about 2½ ℔, dace about 1 ℔ and chub about 5 ℔. There are instances of individuals heavier than this, one or two roach and many rudd of over 3 ℔ being on record, while dace have been caught up to 1 ℔ 6 oz., and chub of over 7 ℔ are not unknown. Roach only take a fly as a rule in very hot weather when they are near the surface, or early in the season when they are on the shallows; the others will take it freely all through the summer. Ordinary trout flies do well enough for all four species, but chub often prefer something larger, and big bushy lures called "palmers," which represent caterpillars, are generally used for them. The fly may be used either wet or dry for all these fish, and there is little to choose between the methods as regards effectiveness. Fly-fishing for these fish is a branch of angling which might be more practised than it is, as the sport is a very fair substitute for trout fishing. Roach, chub and dace feed on bottom food and give good sport all the winter.

Gudgeon, Bleak, Minnow, &c.—The small fry of European waters, gudgeon, bleak, minnow, loach, stickleback and bullhead, are principally of value as bait for other fish, though the first-named species gives pretty sport on fine tackle and makes a succulent dish. Small red worms are the best bait for gudgeon and minnows, a maggot or small fly for bleak, and the rest are most easily caught in a small-meshed net. The loach is used principally in Ireland as a trout bait, and the other two are of small account as hook-baits, though sticklebacks are a valuable form of food for trout in lakes and pools.

Mahseer.—Among the carps of India, several of which give good sport, special mention must be made of the mahseer (*Barbus mosal*), a fish which rivals the salmon both in size and strength. It reaches a weight of 60 ℔ and sometimes more and is fished for in much the same manner as salmon, with the difference that after about 10 ℔ it takes a spinning-bait, usually a heavy spoon-bait, better than a fly.

Cat-fish.—None of the fresh-water cat-fishes (of which no example is found in England) are what may be called sporting fish, but several may be caught with rod and line. There are several kinds in North America, and some of them are as heavy as 150 ℔, but the most important is the wels (*Silurus glanis*) of the Danube and neighbouring waters. This is the largest European fresh-water fish, and it is credited with a weight of 300 ℔ or more. It is a bottom feeder and will take a fish-bait either alive or dead; it is said occasionally to run at a spinning bait when used very deep.

Burbot.—The burbot (*Lota vulgaris*) is the only fresh-water member of the cod family in Great Britain, and it is found only in a few slow-flowing rivers such as the Trent, and there not often, probably because it is a fish of sluggish habits which feeds only at night. It reaches a weight of 3 ℔ or more, and will take most flesh or fish baits on the bottom. The burbot of America has similar characteristics.

Sturgeon.—The sturgeons, of which there are a good many species in Europe and America, are of no use to the angler. They are anadromous fishes of which little more can be said than that a specimen might take a bottom bait once in a way. In Russia they are sometimes caught on long lines armed with baited hooks, and occasionally an angler hooks one. Such a case was reported from California in *The Field* of the 19th of August 1905.

Shad.—Two other anadromous fish deserve notice. The first is the shad, a herring-like fish of which two species, allice and twaite (*Clupea alosa* and *C. finta*), ascend one or two British and several continental rivers in the spring. The twaite is the more common, and in the Severn, Wye and Teme it sometimes gives very fair sport to anglers, taking worm and occasionally fly or small spinning bait. It is a good fighter, and reaches a weight of about 3 ℔. Its sheen when first caught is particularly beautiful. America also has its shads.

Flounder.—The other is the flounder (*Pleuronectes flesus*), the only flat-fish which ascends British rivers. It is common a long way up such rivers as the Severn, far above tidal influence, and it will take almost any flesh-bait used on the bottom. A flounder of 1 ℔ is, in a river, a large one, but heavier examples are sometimes caught.

Eel.—The eel (*Anguilla vulgaris*) is regarded by the angler more as a nuisance than a sporting fish, but when of considerable size (and it often reaches a weight of 8 ℔ or more) it is a splendid fighter and stronger than almost any fish that swims. Its life history has long been disputed, but it is now accepted that it breeds in the sea and ascends rivers in its youth. It is found practically everywhere, and its occurrence in isolated ponds to which it has never been introduced by human agency has given rise to a theory that it travels overland as well as by water. The best baits for eels are worms and small fish, and the best time to use them is at night or in thundery or very wet weather.

Sea Angling.

Sea angling is attended by almost as many refinements of tackle and method as fresh-water angling. The chief differences are differences of locality and the habits of the fish. To a certain extent sea angling may also be divided into three classes—fishing on the surface with the fly, at mid-water with spinning or other bait, and on the bottom; but the first method is only practicable at certain times and in certain places, and the others, from the great depths that often have to be sounded and the heavy weights that have to be used in searching them, necessitate shorter and stouter rods, larger reels and stronger tackle than fresh-water anglers employ. Also, of course, the sea-fisherman is liable to come into conflict with very large fish occasionally. In British waters the monster usually takes the form of a skate or halibut. A specimen of the former weighing 194 ℔ has been landed off the Irish coast with rod and line in recent years. In American waters there is a much greater opportunity of catching fish of this calibre.

Great Game Fishes.—There are several giants of the sea which are regularly pursued by American anglers, chief among them being the tarpon (*Tarpon atlanticus*) and the tuna or tunny (*Thunnus thynnus*), which have been taken on rod and line up to 223 ℔ and 251 ℔ respectively. Jew-fish and black sea-bass of over 400 ℔ have been taken on rod and line, and there are many other fine sporting fish of large size which give the angler exciting hours on the reefs of Florida, or the coasts of California, Texas or Mexico. Practically all of them are taken with a fish-bait either live or dead, and used stationary on the bottom or in mid-water trailed behind a boat.

British Game Fishes.—On a much smaller scale are the fishes most esteemed in British waters. The bass (*Labrax lupus*) heads the list as a plucky and rather difficult opponent. A fish of 10 ℔ is a large one, but fifteen-pounders have been taken. Small or "school" bass up to 3 ℔ or 4 ℔ may sometimes be caught with the fly (generally a roughly constructed thing with big wings), and when they are really taking the sport is magnificent. In some few localities it is possible to cast for them from rocks with a salmon rod, but usually a boat is required. In other places bass may be caught from the shore with fish bait used on the bottom in quite shallow water. They may again sometimes be caught in mid-water, and in fact there are few methods and few lures employed in sea angling which will not account for them at times. The pollack (*Gadus pollachius*) and coal-fish (*Gadus virens*) come next in esteem. Both in some places reach a weight of 20 ℔ or more, and both when young will take a fly. Usually, however, the best sport is obtained by trailing some spinning-bait, such as an artificial or natural sand-eel, behind a boat. Sometimes, and especially for pollack, the bait must be kept near the bottom and heavy weights on the line are necessary; the coal-fish are more prone to come to the surface for feeding. The larger grey mullet (*Mugil capito*) is a great favourite with many anglers, as it is extremely difficult to hook, and when hooked fights strongly. Fishing for mullet is more akin to fresh-water fishing than any branch of sea-angling, and indeed can be carried on in almost fresh water, for the fish frequent harbours, estuaries and tidal pools. They can be caught close to the surface, at mid-water and at the bottom, and as a rule vegetable baits, such as boiled macaroni, or rag-worms are found to answer best. Usually ground-baiting is necessary, and the finer the tackle used the greater is the chance of sport. Not a few anglers fish with a float as if for river fish. The fish runs up to about 8 ℔ in weight. The cod (*Gadus morhua*) grows larger and fights less gamely than any of the fish already mentioned. It is generally caught with bait used on the bottom from a boat, but in places codling, or young cod, give some sport to anglers fishing from the shore. The mackerel (*Scomber scomber*) gives the best sport to a bait, usually a strip of fish skin, trailed behind a boat fairly close to the surface, but it will sometimes feed on the bottom. Mackerel on light tackle are game fighters, though they do not usually much exceed 2 ℔. Whiting and whiting-pout (*Gadus merlangus* and *Gadus luscus*) both feed on or near the bottom, do not grow to any great size, and are best sought with fine tackle, usually an arrangement of three or four hooks at intervals above a lead which is called a "paternoster." If one or more of the hooks are on the bottom the tackle will do for different kinds of flat fish as well, flounders and dabs being the two species most often caught by anglers. The bream (*Pagellus centrodontus*) is another bottom-feeder which resembles the fresh-water bream both in appearance and habits. It is an early morning or rather a nocturnal fish, and grows to a weight of 3 ℔ or 4 ℔. Occasionally it will feed in mid-water or even close to the surface. The conger eel (*Conger vulgaris*) is another night-feeder, which gives fine sport, as it grows to a great size, and is very powerful. Strong tackle is essential for conger fishing, as so powerful an opponent in the darkness cannot be given any law. The bait must be on or near the bottom. There are, of course, many other fish which come to the angler's rod at times, but the list given is fairly complete as representing the species which are especially sought. Beside them are occasional (in some waters too frequent) captures such as dog-fish and sharks, skates and rays. Many of them run to a great size and give plenty of sport on a rod, though they are not as a rule welcomed. Lastly, it must be mentioned that certain of the Salmonidae, smelts (*Osmerus eperlanus*), sea-trout, occasionally brown trout, and still more occasionally salmon can be caught in salt water either in sea-lochs or at the mouths of rivers. Smelts are best fished for with tiny hooks tied on fine gut and baited with fragments of shrimp, ragworm, and other delicacies.

Modern Authorities and Reference Books.—*History and Literature*: Prof. A. N. Mayer, *Sport with Gun and Rod* (New York and Edinburgh), with a chapter on "The Primitive Fish-Hook," by Barnet Phillips; Dr R. Munro, *Lake Dwellings of Europe* (London, 1890), with many illustrations and descriptions of early fish-hooks, &c.; H. Cholmondeley Pennell and others, *Fishing Gossip* (Edinburgh, 1866), contains a paper on "Fishing and Fish-Hooks of the Earliest Date," by Jonathan Couch; C. D. Badham, *Prose Halieutics* (London, 1854), full of curious lore, relating, however, more to ichthyophagy than angling; *The Angler's Note-Book and Naturalist's Record* (London, 1st series 1881, 2nd series 1888), edited by T. Satchell, the two volumes containing much valuable matter on angling history, literature, and other topics; R. Blakey, *Angling Literature* (London, 1856), inaccurate and badly arranged, but containing a good deal of curious matter not to be found elsewhere; O. Lambert, *Angling Literature in England* (London, 1881), a good little general survey; J. J. Manley, *Fish and Fishing* (London, 1881), with chapters on fishing literature, &c.; R. B. Marston, *Walton and Some Earlier Writers on Fish and Fishing* (London and New York, 1894); *Piscatorial Society's Papers* (vol. i. London, 1890), contains a paper on "The Useful and Fine Arts in their Relation to Fish and Fishing," by S. C. Harding; *Super Flumina* (Anon.; London, 1904), gives *passim* useful information on fishing literature; T. Westwood and T. Satchell, *Bibliotheca Piscatoria* (London, 1883) an admirable bibliography of the sport: together with the supplement prepared by R. B. Marston, 1901, it may be considered wonderfully complete.

Methods and Practice.—General Fresh-water Fishing: F. Francis, *A Book on Angling* (London, 1885), though old, a thoroughly sound text-book, particularly good on salmon fishing; H. C. Pennell and others, *Fishing—Salmon and Trout* and *Pike and Coarse Fish* (Badminton Library, 2 vols., London, 1904); John Bickerdyke, *The Book of the All-Round Angler* (London, 1900); Horace G. Hutchinson and others, *Fishing* (*Country Life* Series, 2 vols., London, 1904), contains useful ichthyological notes by G. A. Boulenger, a chapter on "The Feeding of Salmon in Fresh-Water," by Dr J. Kingston Barton, and a detailed account of the principal salmon rivers of Norway, by C. E. Radclyffe.

Salmon and Trout.—Major J. P. Traherne, *The Habits of the Salmon* (London, 1889); G. M. Kelson, *The Salmon Fly* (London, 1895), contains instructions on dressing salmon-flies; A. E. Gathorne Hardy, *The Salmon* ("Fur, Feather and Fin Series," London, 1898); Sir H. Maxwell, Bt., *Salmon and Sea Trout* (Angler's Library, London, 1898); Sir E. Grey, Bt., *Fly Fishing* (Haddon Hall Library, London and New York, 1899); W. Earl Hodgson, *Salmon Fishing* (London, 1906), contains a series of coloured plates of salmon flies; Marquis of Granby, *The Trout* ("Fur, Feather and Fin Series," London, 1898). Wet Fly Fishing: W. C. Stewart, *The Practical Angler* (London, 1905), a new edition of an old but still valuable work; E. M. Tod, *Wet Fly Fishing* (London, 1903); W. Earl Hodgson, *Trout Fishing* (London, 1905), contains a series of admirable coloured plates of artificial flies. Dry Fly Fishing: F. M. Halford, *Dry-Fly Fishing in Theory and Practice* (London, 1902), the standard work on the subject; G. A. B. Dewar, *The Book of the Dry Fly* (London, 1897). Grayling: T. E. Pritt, *The Book of the Grayling* (Leeds, 1888); H. A. Rolt, *Grayling Fishing in South Country Streams* (London, 1905).

Coarse Fish.—C. H. Wheeley, *Coarse Fish* (Angler's Library, London, 1897); J. W. Martin, *Practical Fishing* (London); *Float-fishing and Spinning* (London, 1885); W. Senior and others, *Pike and Perch* ("Fur, Feather and Fin Series," London, 1900); A. J. Jardine, *Pike and Perch* (Angler's Library, London, 1898); H. C. Pennell, *The Book of the Pike* (London, 1884); Greville Fennell, *The Book of the Roach* (London, 1884).

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Tackle, Flies, &c.—H. C. Pennell, *Modern Improvements in Fishing Tackle* (London, 1887); H. P. Wells, *Fly Rods and Fly Tackle* (New York and London, 1901); A. Ronalds, *The Fly-Fisher's Entomology* (London, 1883); F. M. Halford, *Dry Fly Entomology* (London, 1902); *Floating Flies and How to Dress them* (London, 1886); T. E. Pritt, *North Country Flies* (London, 1886); H. G. M'Clelland, *How to tie Flies for Trout and Grayling* (London, 1905); Capt. J. H. Hale, *How to tie Salmon Flies* (London, 1892); F. G. Aflalo, John Bickerdyke and C. H. Wheeley, *How to buy Fishing Tackle* (London).

Ichthyology, Fisheries, Fish-Culture, &c.—Dr Francis Day, *Fishes of Great Britain and Ireland* (2 vols., London, 1889); *British and Irish Salmonidae* (London, 1887); Dr A. C. L. G. Günther, *Introduction to the Study of Fishes* (London, 1880); Dr D. S. Jordan, *A Guide to the Study of Fishes* (2 vols., New York and London, 1905); F. Francis, *Practical Management of Fisheries* (London, 1883); *Fish Culture* (London, 1865); F. M. Halford, *Making a Fishery* (London, 1902); J. J. Armistead, *An Angler's Paradise* (Dumfries, 1902); F. Mather, *Modern Fish-Culture* (New York, 1899); Livingstone Stone, *Domesticated Trout* (Charlestown and London, 1896).

Angling Guide Books, Geographical Information, &c.—Great Britain: *The Angler's Diary* (London), gives information about most important waters in the British Isles, and about some foreign waters, published annually; *The Sportsman's and Tourist's Guide to Scotland* (London), a good guide to angling in Scotland, published twice a year; Augustus Grimble, *The Salmon Rivers of Scotland* (London, 1900, 4 vols.); *The Salmon Rivers of Ireland* (London, 1903); *The Salmon and Sea Trout Rivers of England and Wales* (London, 1904, 2 vols.), this fine series gives minute information as to salmon pools, flies, seasons, history, catches, &c.; W. M. Gallichan, *Fishing in Wales* (London, 1903); *Fishing in Derbyshire* (London, 1905); J. Watson, *English Lake District Fisheries* (London, 1899); C. Wade, *Exmoor Streams* (London, 1903); G. A. B. Dewar, *South Country Trout Streams* (London, 1899); "Hi Regan," *How and Where to Fish in Ireland* (London, 1900); E. S. Shrubsole, *The Land of Lakes* (London, 1906), a guide to fishing in County Donegal). Europe: "Palmer Hackle," *Hints on Angling* (London, 1846), contains "suggestions for angling excursions in France and Belgium," but they are too old to be of much service; W. M. Gallichan, *Fishing and Travel in Spain* (London, 1905); G. W. Hartley, *Wild Sport with Gun, Rifle and Salmon Rod* (Edinburgh, 1903), contains a chapter on huchen fishing; Max von dem Borne, *Wegweiser für Angler durch Deutschland, Oesterreich und die Schweiz* (Berlin, 1877), a book of good conception and arrangement, and still useful, though out of date in many particulars; *Illustrierte Angler-Schule* (*der deutschen Fischerei Zeitung*), Stettin, contains good chapters on the wels and huchen; H. Storck, *Der Angelsport* (Munich, 1898), contains a certain amount of geographical information; E. B. Kennedy, *Thirty Seasons in Scandinavia* (London, 1904), contains useful information about fishing; General E. F. Burton, *Trouting in Norway* (London, 1897); Abel Chapman, *Wild Norway* (London, 1897); F. Sandeman, *Angling Travels in Norway* (London, 1895). America: C. F. Holder, *Big Game Fishes of the United States* (New York, 1903); J. A. Henshall, *Bass, Pike, Perch and Pickerel* (New York, 1903); Dean Sage and others, *Salmon and Trout* (New York, 1902); E. T. D. Chambers, *Angler's Guide to Eastern Canada* (Quebec, 1899); Rowland Ward, *The English Angler in Florida* (London, 1898); J. Turner Turner, *The Giant Fish of Florida* (London, 1902). India: H. S. Thomas, *The Rod in India* (London, 1897); "Skene Dhu," *The Mighty Mahseer* (Madras, 1906), contains a chapter on the acclimatization of trout in India and Ceylon. New Zealand: W. H. Spackman, *Trout in New Zealand* (London, 1894); Capt. Hamilton, *Trout Fishing and Sport in Maoriland* (Wellington, 1905), contains a valuable section on fishing waters.

Fishery Law.—G. C. Oke, *A Handy Book of the Fishery Laws* (edited by J. W. Willis Band and A. C. M'Barnet, London, 1903).

ANGLO-ISRAELITE THEORY, the contention that the British people in the United Kingdom, its colonies, and the United States, are the racial descendants of the "ten tribes" forming the kingdom of Israel, large numbers of whom were deported by Sargon king of Assyria on the fall of Samaria in 721 B.C. The theory (which is fully set forth in a book called *Philo-Israel*) rests on premises which are deemed by scholars—both theological and anthropological—to be utterly unsound.

ANGLO-NORMAN LITERATURE.—The French language (*q.v.*) came over to England with William the Conqueror. During the whole of the 12th century it shared with Latin the distinction of being the literary language of England, and it was in use at the court until the 14th century. It was not until the reign of Henry IV. that English became the native tongue of the kings of England. After the loss of the French provinces, schools for the teaching of French were established in England, among the most celebrated of which we may quote that of Marlborough. The language then underwent certain changes which gradually distinguished it from the French spoken in France; but, except for some graphical characteristics, from which certain rules of pronunciation are to be inferred, the changes to which the language was subjected were the individual modifications of the various authors, so that, while we may still speak of Anglo-Norman writers, an Anglo-Norman language, properly so called, gradually ceased to exist. The prestige enjoyed by the French language, which, in the 14th century, the author of the *Manière de language* calls "le plus bel et le plus gracious language et plus noble parler, après latin d'escole, qui soit au monde et de touz genz mieulx prisée et amée que nul autre (quar Dieux le fist si douce et amiable principalement à l'oneur et loenge de luy mesmes. Et pour ce il peut comparer au parler des angels du ciel, pour la grand doulceur et biaultée d'icel)," was such that it was not till 1363 that the chancellor opened the parliamentary session with an English speech. And although the Hundred Years' War led to a decline in the study of French and the disappearance of Anglo-Norman literature, the French language continued, through some vicissitudes, to be the classical language of the courts of justice until the 17th century. It is still the language of the Channel Islands, though there too it tends more and more to give way before the advance of English.

It will be seen from the above that the most flourishing period of Anglo-Norman literature was from the beginning of the 12th century to the end of the first quarter of the 13th. The end of this period is generally said to coincide with the loss of the French provinces to Philip Augustus, but literary and political history do not correspond quite so precisely, and the end of the first period would be more accurately denoted by the appearance of the history of William the Marshal in 1225 (published for the *Société de l'histoire de France*, by Paul Meyer, 3 vols., 1891–1901). It owes its brilliancy largely to the protection accorded by Henry II. of England to the men of letters of his day. "He could speak French and Latin well, and is said to have known something of every tongue between 'the Bay of Biscay and the Jordan.' He was probably the most highly educated sovereign of his day, and amid all his busy active life he never lost his interest in literature and intellectual discussion; his hands were never empty, they always had either a bow or a book" (*Dict. of Nat. Biog.*). Wace and Benoît de Sainte-More compiled their histories at his bidding, and it was in his reign that Marie de France composed her poems. An event with which he was closely connected, viz. the murder of Thomas Becket, gave rise to a whole series of writings, some of which are purely Anglo-Norman. In his time appeared the works of Béroul and Thomas respectively, as well as some of the most celebrated of the Anglo-Norman *romans d'aventure*. It is important to keep this fact in mind when studying the different works which Anglo-Norman literature has left us. We will examine these works briefly, grouping them into narrative, didactic, hagiographic, lyric, satiric and dramatic literature.

Narrative Literature: (a) Epic and Romance.—The French epic came over to England at an early date. We know that the *Chanson de Roland* was sung at the battle of Hastings, and we possess Anglo-Norman MSS. of a few *chansons de geste*. The *Pèlerinage de Charlemagne* (Koschwitz, *Altfranzösische Bibliothek*, 1883) was, for instance, only preserved in an Anglo-Norman manuscript of the British Museum (now lost), although the author was certainly a Parisian. The oldest manuscript of the *Chanson de Roland* that we possess is also a manuscript written in England, and amongst the others of less importance we may mention *La Chançun de Willame*, the MS. of which has (June 1903) been published in facsimile at Chiswick (cf. Paul Meyer, *Romania*, xxxii. 597-618). Although the diffusion of epic poetry in England did not actually inspire any new *chansons de geste*, it developed the taste for this class of literature, and the epic style in which the tales of *Horn*, of *Bovon de Hampton*, of *Guy of Warwick* (still unpublished), of *Waldef* (still unpublished), and of *Fulk Fitz Warine* are treated, is certainly partly due to this circumstance. Although the last of these works has come down to us only in a prose version, it contains unmistakable signs of a previous poetic form, and what we possess is really only a rendering into prose similar to the transformations undergone by many of the *chansons de geste* (cf. L. Brandin, *Introduction to Fulk Fitz Warine*, London, 1904).

The interinfluence of French and English literature can be studied in the Breton romances and the *romans d'aventure* even better than in the epic poetry of the period. The *Lay of Orpheus* is known to us only through an English imitation; the *Lai du cor* was composed by Robert Biket, an Anglo-Norman poet of the 12th century (Wulff, Lund, 1888). The *lais* of Marie de France were written in England, and the greater number of the romances composing the *matière de Bretagne* seem to have passed from England to France through the medium of Anglo-Norman. The legends of Merlin and Arthur, collected in the *Historia Regum Britanniae* by Geoffrey of Monmouth († 1154), passed into French literature, bearing the character which the bishop of St Asaph had stamped upon them. Chrétien de Troye's *Perceval* (*c.* 1175) is doubtless based on an Anglo-Norman poem. Robert de Boron (*c.* 1215) took the subject of his *Merlin* (published by G. Paris and J. Ulrich, 1886, 2 vols., *Société des Anciens Textes*) from Geoffrey of Monmouth. Finally, the most celebrated love-legend of the middle ages, and one of the most beautiful inventions of world-literature, the story of Tristan and Iseult, tempted two authors, Béroul and Thomas, the first of whom is probably, and the second certainly, Anglo-Norman (see ARTHURIAN LEGEND; GRAIL, THE HOLY; TRISTAN). One *Folie Tristan* was composed in England in the last years of the 12th century. (For all these questions see *Soc. des Anc. Textes*, Muret's ed. 1903; Bédier's ed. 1902–1905). Less fascinating than the story of Tristan and Iseult, but nevertheless of considerable interest, are the two *romans d'aventure* of Hugh of Rutland, *Ipomedon* (published by Kölbing and Koschwitz, Breslau, 1889) and *Protesilaus* (still unpublished) written about 1185. The first relates the adventures of a knight who married the young duchess of Calabria, niece of King Meleager of Sicily, but was loved by Medea, the king's wife. The second poem is the sequel to *Ipomedon*, and deals with the wars and subsequent reconciliation between Ipomedon's sons, Daunus, the elder, lord of Apulia, and Protesilaus, the younger, lord of Calabria. Protesilaus defeats Daunus, who had expelled him from Calabria. He saves his brother's life, is reinvested with the dukedom of Calabria, and, after the death of Daunus, succeeds to Apulia. He subsequently marries Medea, King Meleager's widow, who had helped him to seize Apulia, having transferred her affection for Ipomedon to his younger son (cf. Ward, *Cat. of Rom.*, i. 728). To these two romances by an Anglo-Norman author, *Amadas et Idoine*, of which we only possess a continental version, is to be added. Gaston Paris has proved indeed that the original was composed in England in the 12th century (*An English Miscellany presented to Dr Furnivall in Honour of his Seventy-fifth Birthday*, Oxford, 1901, 386-394). The Anglo-Norman poem on the *Life of Richard Cœur de Lion* is lost, and an English version only has been preserved. About 1250 Eustace of Kent introduced into England the *roman d'Alexandre* in his *Roman de toute chevalerie*, many passages of which have been imitated in one of the oldest English poems on Alexander, namely, *King Alisaunder* (P. Meyer, *Alexandre le grand*, Paris, 1886, ii. 273, and Weber, *Metrical Romances*, Edinburgh).

(*b*) *Fableaux, Fables and Religious Tales.*—In spite of the incontestable popularity enjoyed by this class of literature, we have only some half-dozen *fableaux* written in England, viz. *Le chevalier à la corbeille*, *Le chevalier qui faisait parler les muets*, *Le chevalier, sa dame et un clerc*, *Les trois dames*, *La gageure*, *Le prêtre d'Alison*, *La bourgeoise d'Orléans* (Bédier, *Les Fabliaux*, 1895). As to fables, one of the most popular collections in the middle ages was that written by Marie de France, which she claimed to have translated from *King Alfred*. In the *Contes moralisés*, written by Nicole Bozon shortly before 1320 (*Soc. Anc. Textes*, 1889), a few fables bear a strong resemblance to those of Marie de France.

The religious tales deal mostly with the Mary Legends, and have been handed down to us in three collections:

(i.) The Adgar's collection. Most of these were translated from William of Malmesbury (†1143?) by Adgar in the 12th century ("Adgar's Marien-Legenden," *Altfr. Biblioth.* ix.; J. A. Herbert, *Rom.* xxxii. 394).

(ii.) The collection of Everard of Gateley, a monk of St Edmund at Bury, who wrote *c.* 1250 three Mary Legends (*Rom.* xxix. 27).

(iii.) An anonymous collection of sixty Mary Legends composed *c.* 1250 (Brit. Museum Old Roy. 20 B, xiv.), some of which have been published in Suchier's *Bibliotheca Normannica*; in the *Altf. Bibl.* See also Mussafia, "Studien zu den mittelalterlichen

Marien-legenden" in *Sitzungsb. der Wien. Akademie* (t. cxiii., cxv., cxix., cxxiii., cxxix.).

Another set of religious and moralizing tales is to be found in Chardri's *Set dormans* and *Josaphat*, *c.* 1216 (Koch, *Altfr. Bibl.*, 1880; G. Paris, *Poèmes et légendes du moyen âge*).

(*c*) *History*.—Of far greater importance, however, are the works which constitute Anglo-Norman historiography. The first Anglo-Norman historiographer is Geoffrey Gaimar, who wrote his *Estorie des Angles* (between 1147 and 1151) for Dame Constance, wife of Robert Fitz-Gislebert (*The Anglo-Norman Metrical Chronicle*, Hardy and Martin, i. ii., London, 1888). This history comprised a first part (now lost), which was merely a translation of Geoffrey of Monmouth's *Historia regum Britanniae*, preceded by a history of the Trojan War, and a second part which carries us as far as the death of William Rufus. For this second part he has consulted historical documents, but he stops at the year 1087, just when he has reached the period about which he might have been able to give us some first-hand information. Similarly, Wace in his *Roman de Rou et des ducs de Normandie* (ed. Andresen, Heilbronn, 1877–1879, 2 vols.), written 1160–1174, stops at the battle of Tinchebray in 1107 just before the period for which he would have been so useful. His *Brut* or *Geste des Bretons* (Le Roux de Lincy, 1836–1838, 2 vols.), written in 1155, is merely a translation of Geoffrey of Monmouth. "Wace," says Gaston Paris, speaking of the *Roman de Rou*, "traduit en les abrégeant des historiens latins que nous possédons; mais çà et là il ajoute soit des contes populaires, par exemple sur Richard I^er^, sur Robert I^er^, soit des particularités qu'il savait par tradition (sur ce même Robert le magnifique, sur l'expédition de Guillaume, &c.) et qui donnent à son œuvre un réel intérêt historique. Sa langue est excellente; son style clair, serré, simple, d'ordinaire assez monotone, vous plaît par sa saveur archaïque et quelquefois par une certaine grâce et une certaine malice."

The *History of the Dukes of Normandy* by Benoît de Sainte-More is based on the work of Wace. It was composed at the request of Henry II. about 1170, and takes us as far as the year 1135 (ed. by Francisque Michel, 1836–1844, *Collection de documents inédits*, 3 vols.). The 43,000 lines which it contains are of but little interest to the historian; they are too evidently the work of a *romancier courtois*, who takes pleasure in recounting love-adventures such as those he has described in his romance of Troy. Other works, however, give us more trustworthy information, for example, the anonymous poem on Henry II.'s *Conquest of Ireland* in 1172 (ed. Francisque Michel, London, 1837), which, together with the *Expugnatio hibernica* of Giraud de Barri, constitutes our chief authority on this subject. The *Conquest of Ireland* was republished in 1892 by Goddard Henry Orpen, under the title of *The Song of Dermot and the Earl* (Oxford, Clarendon Press). Similarly, Jourdain Fantosme, who was in the north of England in 1174, wrote an account of the wars between Henry II., his sons, William the Lion of Scotland and Louis VII., in 1173 and 1174 (*Chronicle of the reigns of Stephen . . . III.*, ed. by Joseph Stevenson and Fr. Michel, London, 1886, pp. 202-307). Not one of these histories, however, is to be compared in value with *The History of William the Marshal, Count of Striguil and Pembroke*, regent of England from 1216–1219, which was found and subsequently edited by Paul Meyer (*Société de l'histoire de France*, 3 vols., 1891–1901). This masterpiece of historiography was composed in 1225 or 1226 by a professional poet of talent at the request of William, son of the marshal. It was compiled from the notes of the marshal's squire, John d'Early († 1230 or 1231), who shared all the vicissitudes of his master's life and was one of the executors of his will. This work is of great value for the history of the period 1186–1219, as the information furnished by John d'Early is either personal or obtained at first hand. In the part which deals with the period before 1186, it is true, there are various mistakes, due to the author's ignorance of contemporary history, but these slight blemishes are amply atoned for by the literary value of the work. The style is concise, the anecdotes are well told, the descriptions short and picturesque; the whole constitutes one of the most living pictures of medieval society. Very pale by the side of this work appear the *Chronique* of Peter of Langtoft, written between 1311 and 1320, and mainly of interest for the period 1294–1307 (ed. by T. Wright, London, 1866–1868); the *Chronique* of Nicholas Trevet (1258?–1328?), dedicated to Princess Mary, daughter of Edward I. (Duffus Hardy, *Descr. Catal.* III., 349-350); the *Scala Chronica* compiled by Thomas Gray of Heaton († *c.* 1369), which carries us to the year 1362–1363 (ed. by J. Stevenson, Maitland Club, Edinburgh, 1836); the *Black Prince*, a poem by the poet Chandos, composed about 1386, and relating the life of the Black Prince from 1346–1376 (re-edited by Francisque Michel, London and Paris, 1883); and, lastly, the different versions of the *Brutes*, the form and historical importance of which have been indicated by Paul Meyer (*Bulletin de la Société des Anciens Textes*, 1878, pp. 104-145), and by F. W. D. Brie (*Geschichte und Quellen der mittelenglischen Prosachronik*, *The Brute of England or The Chronicles of England*, Marburg, 1905).

Finally we may mention, as ancient history, the translation of Eutropius and Dares, by Geoffrey of Waterford (13th century), who gave also the *Secret des Secrets*, a translation from a work wrongly attributed to Aristotle, which belongs to the next division (*Rom.* xxiii. 314).

Didactic Literature.—This is the most considerable, if not the most interesting, branch of Anglo-Norman literature: it comprises a large number of works written chiefly with the object of giving both religious and profane instruction to Anglo-Norman lords and ladies. The following list gives the most important productions arranged in chronological order:—

Philippe de Thaun, *Comput*, *c.* 1119 (edited by E. Mall, Strassburg, 1873), poem on the calendar; *Bestiaire*, *c.* 1130 (ed. by E. Walberg, Paris, 1900; cf. G. Paris, *Rom.* xxxi. 175); *Lois de Guillaume le Conquérant* (redaction between 1150 and 1170, ed. by J. E. Matzke, Paris, 1899); *Oxford Psalter*, *c.* 1150 (Fr. Michel, *Libri Psalmorum versio antiqua gallica*, Oxford, 1860); *Cambridge Psalter*, *c.* 1160 (Fr. Michel, *Le Livre des Psaumes*, Paris, 1877); *London Psalter*, same as Oxford Psalter (cf. Beyer, *Zt. f. rom. Phil.* xi. 513-534; xii. 1-56); *Disticha Catonis*, translated by Everard de Kirkham and Elie de Winchester (Stengel, *Ausg. u. Abhandlungen*); *Le Roman de fortune*, summary of Boetius' *De consolatione philosophiae*, by Simon de Fresne (*Hist. lit.* xxviii. 408); *Quatre livres des rois*, translated into French in the 12th century, and imitated in England soon after (P. Schlösser, *Die Lautverhältnisse der quatre livres des rois*, Bonn, 1886; *Romania*, xvii. 124); *Donnei des Amanz*, the conversation of two lovers, overheard and carefully noted by the poet, of a purely didactic character, in which are included three interesting pieces, the first being an episode of the story of Tristram, the second a fable, *L'homme et le serpent*, the third a tale, *L'homme et l'oiseau*, which is the basis of the celebrated *Lai de l'oiselet* (*Rom.* xxv. 497); *Livre des Sibiles* (1160); *Enseignements Trebor*, by Robert de Ho (=Hoo, Kent, on the left bank of the Medway) [edited by Mary Vance Young, Paris; Picard, 101; cf. G. Paris, *Rom.* xxxii. 141]; *Lapidaire de Cambridge* (Pannier, *Les Lapidaires français*); Frère Angier de Ste. Frideswide, *Dialogues*, 29th of November 1212 (*Rom.* xii. 145-208, and xxix.; M. K. Pope, *Étude sur la langue de Frère Angier*, Paris, 1903); *Li dialoge Grégoire le pape*, ed. by Foerster, 1876; *Petit Plet*, by Chardri, *c.* 1216 (Koch, *Altfr Bibliothek*, i., and Mussafia, *Z. f. r. P.* iii. 591); *Petite philosophie*, *c.* 1225 (*Rom.* xv. 356; xxix. 72); *Histoire de Marie et de Jésus* (*Rom.* xvi. 248-262); *Poème sur l'Ancien Testament* (*Not. et Extr.* xxxiv. 1, 210; *Soc. Anc. Textes*, 1889, 73-74); *Le Corset* and *Le Miroir*, by Robert de Gretham (*Rom.* vii. 345; xv. 296); *Lumière as Lais*, by Pierre de Peckham, *c.* 1250 (*Rom.* xv. 287); an Anglo-Norman redaction of *Image du monde*, *c.* 1250 (*Rom.* xxi. 481); two Anglo-Norman versions of *Quatre sœurs* (Justice, Truth, Peace, Mercy), 13th century (ed. by Fr. Michel, *Psautier d'Oxford*, pp. 364-368, *Bulletin Soc. Anc. Textes*, 1886, 57; *Romania*, xv. 352); another *Comput* by Raüf de Lenham, 1256 (P. Meyer, *Archives des missions*, 2nd series iv. 154 and 160-164; *Rom.* xv. 285); *Le chastel d'amors*, by Robert Grosseteste or Greathead, bishop of

Lincoln (†1253) [ed. by Cooke, *Carmina Anglo-Normannica*, 1852, Caxton Society]; *Poème sur l'amour de Dieu et sur la haine du pêché*, 13th century, second part (*Rom.* xxix. 5); *Le mariage des neuf filles du diable* (*Rom.* xxix. 54); *Ditie d'Urbain*, attributed without any foundation to Henry I. (P. Meyer, *Bulletin Soc. Anc. Textes*, 1880, p. 73 and *Romania* xxxii, 68); *Dialogue de l'évêque Saint Julien et son disciple* (*Rom.* xxix. 21); *Poème sur l'antichrist et le jugement dernier*, by Henri d'Arci (*Rom.* xxix. 78; *Not. et. Extr.* 35, i. 137). Wilham de Waddington produced at the end of the 13th century his *Manuel des péchés*, which was adapted in England by Robert of Brunne in his *Handlying Sinne* (1303) [*Hist. lit.* xxviii. 179-207; *Rom.* xxix. 5, 47-53]; see Furnivall, *Robert of Brunne's Handlying Synne* (Roxb. Club, 1862); in the 14th century we find Nicole Bozon's *Contes moralisés* (see above); *Traité de naturesse* (*Rom.* xiii. 508); *Sermons* in verse (P. Meyer, *op. cit.* xlv.); *Proverbes de bon enseignement* (*op. cit.* xlvi.). We have also a few handbooks on the teaching of French. Gautier de Biblesworth wrote such a treatise *à Madame Dyonise de Mountechensi pur aprise de langage* (Wright, *A Volume of Vocabularies*; P. Meyer, *Rec. d'anc. textes*, p. 360 and *Romania* xxxii, 22); *Orthographia gallica* (Stürzinger, *Altfr. Bibl.* 1884); *La manière de language*, written in 1396 (P. Meyer, *Rev. crit. d'hist. et de litt.* nos. compl. de 1870); *Un petit livre pour enseigner les enfants de leur entreparler comun françois*, *c.* 1399 (Stengel, *Z. für n. f. Spr. u. Litt.* i. 11). The important *Mirour de l'omme*, by John Gower, contains about 30,000 lines written in very good French at the end of the 14th century (Macaulay, *The Complete Works of John Gower*, i., Oxford, 1899).

Hagiography.—Among the numerous lives of saints written in Anglo-Norman the most important ones are the following, the list of which is given in chronological order:—*Voyage de Saint Brandan* (or *Brandain*), written in 1121, by an ecclesiastic for Queen Aelis of Louvain (*Rom. St.* i. 553-588; *Z. f. r. P.* ii. 438-459; *Rom.* xviii. 203. C. Wahlund, *Die altfr. Prosaübersetz. von Brendan's Meerfahrt*, Upsala, 1901); life of St Catherine by Clemence of Barking (*Rom.* xiii. 400, Jarnik, 1894); life of St Giles, *c.* 1170, by Guillaume de Berneville (*Soc. Anc. Textes fr.*, 1881; *Rom.* xi. and xxiii. 94); life of St Nicholas, life of Our Lady, by Wace (Delius, 1850; Stengel, *Cod. Digby*, 66); Uhlemann, *Gram. Krit. Studien zu Wace's Conception und Nicolas*, 1878; life of St George by Simon de Fresne (*Rom.* x. 319; J. E. Matzke, *Public. of the Mod. Lang. Ass. of Amer.* xvii. 1902; *Rom.* xxxiv. 148); *Expurgatoire de Ste. Patrice*, by Marie de France (Jenkins, 1894; Eckleben, *Aelteste Schilderung vom Fegefeuer d. H. Patricius*, 1851; Ph. de Felice, 1906); *La vie de St Edmund le Rei*, by Denis Pyramus, end of 12th century (*Memorials of St Edmund's Abbey*, edited by T. Arnold, ii. 1892; *Rom.* xxii. 170); Henri d'Arci's life of St Thais, poem on the Antichrist, *Visio S. Pauli* (P. Meyer, *Not. et Extr.* xxxv. 137-158); life of St Gregory the Great by Frère Angier, 30th of April 1214 (*Rom.* viii. 509-544; ix. 176; xviii. 201); life of St Modwenna, between 1225 and 1250 (Suchier, *Die dem Matthäus Paris zugeschriebene Vie de St Auban*, 1873, pp. 54-58); Fragments of a life of St Thomas Becket, *c.* 1230 (P. Meyer, *Soc. Anc. Text. fr.*, 1885); and another life of the same by Benoît of St Alban, 13th century (Michel, *Chron. des ducs de Normandie*; *Hist. Lit.* xxiii. 383); a life of Edward the Confessor, written before 1245 (Luard, *Lives of Edward the Confessor*, 1858; *Hist. Lit.* xxvii. 1), by an anonymous monk of Westminster; life of St Auban, *c.* 1250 (Suchier, *op. cit.*; Uhlemann, "Über die vie de St Auban in Bezug auf Quelle," &c. *Rom. St.* iv. 543-626; ed. by Atkinson, 1876). *The Vision of Tnudgal*, an Anglo-Norman fragment, is preserved in MS. 312, Trinity College, Dublin; the MS. is of the 14th century; the author seems to belong to the 13th (*La vision de Tondale*, ed. by Friedel and Kuno Meyer, 1906). In this category we may add the life of Hugh of Lincoln, 13th century (*Hist. Lit.* xxiii. 436; Child, *The English and Scottish Popular Ballads*, 1888, p. v; Wolter, *Bibl. Anglo-Norm.* ii. 115). Other lives of saints were recognized to be Anglo-Norman by Paul Meyer when examining the MSS. of the Welbeck library (*Rom.* xxxii. 637 and *Hist. Lit.* xxxiii. 338-378).

Lyric Poetry.—The only extant songs of any importance are the seventy-one *Ballads* of Gower (Stengel, *Gower's Minnesang*, 1886). The remaining songs are mostly of a religious character. Most of them have been discovered and published by Paul Meyer (*Bulletin de la Soc. Anc. Textes*, 1889; *Not. et Extr.* xxxiv; *Rom.* xiii. 518, t. xiv. 370; xv. p. 254, &c.). Although so few have come down to us such songs must have been numerous at one time, owing to the constant intercourse between English, French and Provençals of all classes. An interesting passage in *Piers Plowman* furnishes us with a proof of the extent to which these songs penetrated into England. We read of:

> ". . . dykers and deluers that doth here dedes ille,
> And dryuen forth the longe day with 'Deu, vous saue,
> Dame Emme!' " (Prologue, 223 f.)

One of the finest productions of Anglo-Norman lyric poetry written in the end of the 13th century, is the *Plainte d'amour* (Vising, Göteborg, 1905; *Romania* xiii. 507, xv. 292 and xxix. 4), and we may mention, merely as literary curiosities, various works of a lyrical character written in two languages, Latin and French, or English and French, or even in three languages, Latin, English and French. In *Early English Lyrics* (Oxford, 1907) we have a poem in which a lover sends to his mistress a love-greeting composed in three languages, and his learned friend replies in the same style (*De amico ad amicam*, *Responcio*, viii and ix).

Satire.—The popularity enjoyed by the *Roman de Renart* and the Anglo-Norman version of the *Riote du Monde* (*Z. f. rom. Phil.* viii. 275-289) in England is proof enough that the French spirit of satire was keenly appreciated. The clergy and the fair sex presented the most attractive target for the shots of the satirists. However, an Englishman raised his voice in favour of the ladies in a poem entitled *La Bonté des dames* (Meyer, *Rom.* xv. 315-339), and Nicole Bozon, after having represented "Pride" as a feminine being whom he supposes to be the daughter of Lucifer, and after having fiercely attacked the women of his day in the *Char d'Orgueil* (*Rom.* xiii. 516), also composed a *Bounté des femmes* (P. Meyer, *op. cit.* 33) in which he covers them with praise, commending their courtesy, their humility, their openness and the care with which they bring up their children. A few pieces of political satire show us French and English exchanging amenities on their mutual shortcomings. The *Roman des Français*, by André de Coutances, was written on the continent, and cannot be quoted as Anglo-Norman although it was composed before 1204 (cf. Gaston Paris: *Trois versions rimées de l'évangile de Nicodème*, *Soc. Anc. Textes*, 1885), it is a very spirited reply to French authors who had attacked the English.

Dramatic Literature.—This must have had a considerable influence on the development of the sacred drama in England, but none of the French plays acted in England in the 12th and 13th centuries has been preserved. *Adam*, which is generally considered to be an Anglo-Norman mystery of the 12th century, was probably written in France at the beginning of the 13th century (*Romania* xxxii. 637), and the so-called Anglo-Norman *Resurrection* belongs also to continental French. It is necessary to state that the earliest English moralities seem to have been imitations of the French ones.

BIBLIOGRAPHY.—Apart from the works already mentioned see generally: Scheibner, "Über die Herrschaft der frz. Sprache in England" (Annaberg, Progr. der Königlichen Realschule, 1880, 38 f.); Groeber, *Grundr. der romanischen Philologie*, ii. iii. (Strassburg, 1902); G. Paris, *La Litt. fr. au moyen âge* (1905); *Esquisse historique de la litt. fr. au moyen âge* (1907); *La Litt. norm. avant l'annexion 912–1204* (Paris, 1899); "L'Esprit normand en Angleterre," *La Poésie au moyen âge* (2nd series 45-74, Paris, 1906); Thomas Wright, *Biographia britannica literaria* (Anglo-Norman period, London, 1846); Ten Brink, *Geschichte der englischen Litteratur* (Berlin, 1877, i. 2); J. J. Jusserand, *Hist. litt. du peuple anglais* (2nd ed. 1895, vol. i.); W. H. Schofield, *English Literature from the Norman Conquest to Chaucer* (London, 1906); Johan Vising, *Franska Språket i England* (Göteborg, 1900, 1901, 1902). (L. BR.)

ANGLO-SAXON CHRONICLE. It is usual to speak of "the Anglo-Saxon Chronicle"; it would be more correct to say that there are four Anglo-Saxon Chronicles. It is true that these all grow out of a common stock, that in some even of their later entries two or more of them use common materials; but the same may be said of several groups of medieval chronicles, which no one dreams of treating as single chronicles. Of this fourfold Chronicle there are seven MSS. in existence; *C.C.C. Cant.* 173 (A); *Cott. Tib.* A vi. (B); *Cott. Tib.* B i. (C); *Cott. Tib.* B iv. (D); *Bodl. Laud. Misc.* 636 (E); *Cott. Domitian* A viii. (F); *Cott. Otho* B xi. (G). Of these G is now a mere fragment, and it is known to have been a transcript of A. F is bilingual, the entries being given both in Saxon and Latin. It is interesting as a stage in the transition from the vernacular to the Latin chronicle; but it has little independent value, being a mere epitome, made at Canterbury in the 11th or 12th century, of a chronicle akin to E. B, as far as it goes (to 977), is identical with C, both having been copied from a common original, but A, C, D, E have every right to be treated as independent chronicles. The relations between the four vary very greatly in different parts, and the neglect of this consideration has led to much error and confusion. The common stock, out of which all grow, extends to 892. The present writer sees no reason to doubt that the idea of a national, as opposed to earlier local chronicles, was inspired by Alfred, who may even have dictated, or at least revised, the entries relating to his own campaigns; while for the earlier parts pre-existing materials, both oral and written, were utilized. Among the latter the chronological epitome appended to Bede's *Ecclesiastical History* may be specially mentioned. But even this common stock exists in two different recensions, in A, B, C, on the one hand, and D, E on the other. The main points of difference are that in D, E (1) a series of northern annals have been incorporated; (2) the Bede entries are taken, not from the brief epitome, but from the main body of the *Eccl. Hist.* The inference is that, shortly after the compiling of this Alfredian chronicle, a copy of it was sent to some northern monastery, probably Ripon, where it was expanded in the way indicated. Copies of this northernized Chronicle afterwards found their way to the south. The impulse given by Alfred was continued under Edward, and we have what may be called an official continuation of the history of the Danish wars, which, in B, C, D extends to 915, and in A to 924. After 915 B, C insert as a separate document a short register of Mercian affairs during the same period (902–924), which might be called the acts of Æthelflaed, the famous "Lady of the Mercians," while D has incorporated it, not very skilfully, with the official continuation. Neither of these documents exists in E. From 925 to 975 all the chronicles are very fragmentary; a few obits, three or four poems, among them the famous ballad on the battle of Brunanburh, make up the meagre tale of their common materials, which each has tried to supplement in its own way. A has inserted a number of Winchester entries, which prove that A is a Winchester book. And this local and scrappy character it retains to 1001, where it practically ends. At some subsequent time it was transferred bodily to Canterbury, where it received numerous interpolations in the earlier part, and a few later local entries which finally tail off into the Latin acts of Lanfranc. A may therefore be dismissed. C has added to the common stock one or two Abingdon entries, with which place the history of C is closely connected; while D and E have a second group of northern annals 901–966, E being however much more fragmentary than D, omitting, or not having access to, much both of the common and of the northern material which is found in D. From 983 to 1018 C, D and E are practically identical, and give a connected history of the Danish struggles under Æthelred II. This section was probably composed at Canterbury. From 1018 the relations of C, D, E become too complicated to be expressed by any formula; sometimes all three agree together, sometimes all three are independent; in other places each pair in turn agree against the third. It may be noted that C is strongly anti-Godwinist, while E is equally pro-Godwinist, D occupying an intermediate position. C extends to 1066, where it ends abruptly, and probably mutilated. D ends at 1079 and is certainly mutilated. In its later history D is associated with some place in the diocese of Worcester, probably Evesham. In its present form D is a comparatively late MS., none of it probably much earlier, and some of it later, than 1100. In the case of entries in the earlier part of the chronicles, which are peculiar to D, we cannot exclude the possibility that they may be late interpolations. E is continued to 1154. In its present form it is unquestionably a Peterborough book. The earlier part is full of Peterborough interpolations, to which place many of the later entries also refer. But (apart from the interpolations) it is only the entries after 1121, where the first hand in the MS. ends, which were actually composed at Peterborough. The section 1023–1067 certainly, and possibly also the section 1068–1121, was composed at St Augustine's, Canterbury; and the former is of extreme interest and value, the writer being in close contact with the events which he describes. The later parts of E show a great degeneration in language, and a querulous tone due to the sufferings of the native population under the harsh Norman rule; "but our debt to it is inestimable; and we can hardly measure what the loss to English history would have been, if it had not been written; or if, having been written, it had, like so many another English chronicle, been lost."

Bibliography.—The above account is based on the introduction in vol. ii. of the Rev. C. Plummer's edition of *Two of the Saxon Chronicles Parallel* (Clarendon Press, 1892, 1899); to which the student may be referred for detailed arguments. The *editio princeps* of the Anglo-Saxon Chronicle was by Abraham Wheloc, professor of Arabic at Cambridge, where the work was printed (1643–1644). It was based mainly on the MS. called G above, and is the chief source of our knowledge of that MS. which perished, all but three leaves, in the Cottonian fire of 1723. Edmund Gibson of Queen's College, Oxford, afterwards bishop of London, published an edition in 1692. He used Wheloc's edition, and E, with collations or transcripts of B and F. Both Wheloc and Gibson give Latin translations. In 1823 appeared an edition by Dr Ingram, of Trinity College, Oxford, with an English translation. Besides A, B, E, F, Ingram used C and D for the first time. But both he and Gibson made the fatal error of trying to combine the disparate materials contained in the various chronicles in a single text. An improvement in this respect is seen in the edition made by Richard Price (d. 1833) for the first (and only) volume of *Monumenta Historica Britannica* (folio 1848). There is still, however, too much conflation, and owing to the plan of the volume, the edition only extends to 1066. A translation is appended. In 1861 appeared Benjamin Thorpe's six-text edition in the Rolls Series. Though not free from defects, this edition is absolutely indispensable for the study of the chronicles and the mutual relations of the different MSS. A second volume contains the translation. In 1865 the Clarendon Press published *Two Saxon Chronicles (A and E) Parallel, with supplementary extracts from the others*, by the Rev. John Earle. This edition has no translation, but in the notes and introduction a very considerable advance was made. On this edition is partly based the later edition by the Rev. C. Plummer, already cited above. In addition to the translations contained in the editions already mentioned, the following have been issued separately. The first translation into modern English was by Miss Anna Gurney, privately printed in 1819. This was largely based on Gibson's edition, and was in turn the basis of Dr Giles' translation, published in 1847, and often reprinted. The best translation is that by the Rev. Joseph Stevenson, in his series of *Church Historians of England* (1853). Up to the Conquest it is a revision of the translation contained in *Mon. Hist. Brit.* From that point it is an independent translation. (C. Pl.)

ANGLO-SAXON LAW. 1. The body of legal rules and customs which obtained in England before the Norman conquest constitutes, with the Scandinavian laws, the most genuine expression of Teutonic legal thought. While the so-called "barbaric laws" (*leges barbarorum*) of the continent, not excepting those compiled in the territory now called Germany, were largely the product of Roman influence, the continuity of Roman life was almost completely broken in the island, and even the Church, the direct heir of Roman tradition, did not carry on a continuous existence: Canterbury was not a see formed in a Roman province in the same sense as Tours or Reims. One of the striking expressions of this Teutonism is presented by the language in which the Anglo-Saxon laws were written. They are uniformly worded in English, while continental laws, apart from the Scandinavian, are all in Latin. The English dialect in which the Anglo-Saxon laws have been handed down to us is in most cases a common speech derived from West Saxon—naturally enough as Wessex became the predominant English state, and the court of its kings the principal literary centre from which most of the compilers and scribes derived their dialect and spelling. Traces of Kentish speech may be detected, however, in the *Textus Roffensis*, the MS. of the Kentish laws, and Northumbrian dialectical peculiarities are also noticeable on some occasions, while Danish words occur only as technical terms. At the conquest, Latin takes the place of English in the compilations made to meet the demand for Anglo-Saxon law texts as still applied in practice.

2. It is easy to group the Anglo-Saxon laws according to the manner of their publication. They would fall into three divisions: (1) laws and collections of laws promulgated by public authority; (2) statements of custom; (3) private compilations of legal rules and enactments. To the first division belong the laws of the Kentish kings, Æthelberht, Hlothhere and Eadric, Withraed; those of Ine of Wessex, of Alfred, Edward the Elder, Æthelstan,[1] Edmund, Edgar, Æthelred and Canute; the treaty between Alfred and Guthrum and the so-called treaty between Edward and Guthrum. The second division is formed by the convention between the English and the Welsh *Dunsaetas*, the law of the Northumbrian priests, the customs of the North people, the fragments of local custumals entered in Domesday Book. The third division would consist of the collections of the so-called *Pseudo-leges Canuti*, the laws of Edward the Confessor, of Henry I., and the great compilation of the *Quadripartitus*, then of a number of short notices and extracts like the fragments on the "wedding of a wife," on oaths, on ordeals, on the king's peace, on rural customs (*Rectitudines singularum personarum*), the treatises on the reeve (*gerefa*) and on the judge (*dema*), formulae of oaths, notions as to wergeld, &c. A fourth group might be made of the charters, as they are based on Old English private and public law and supply us with most important materials in regard to it. Looking somewhat deeper at the sources from which Old English law was derived, we shall have to modify our classification to some extent, as the external forms of publication, although important from the point of view of historical criticism, are not sufficient standards as to the juridical character of the various kinds of material. Direct statements of law would fall under the following heads, from the point of view of their legal origins: i. customary rules followed by divers communities capable of formulating law; ii. enactments of authorities, especially of kings; iii. private arrangements made under recognized legal rules. The first would comprise, besides most of the statements of custom included in the second division according to the first classification, a great many of the rules entered in collections promulgated by kings; most of the paragraphs of Æthelberht's, Hlothhere's, and Eadric's and Ine's laws, are popular legal customs that have received the stamp of royal authority by their insertion in official codes. On the other hand, from Withraed's and Alfred's laws downwards, the element of enactment by central authority becomes more and more prominent. The kings endeavour, with the help of secular and clerical witan, to introduce new rules and to break the power of long-standing customs (*e.g.* the precepts about the keeping of holidays, the enactments of Edmund restricting private vengeance, and the solidarity of kindreds as to feuds, and the like). There are, however, no outward signs enabling us to distinguish conclusively between both categories of laws in the codes, nor is it possible to draw a line between permanent laws and personal ordinances of single sovereigns, as has been attempted in the case of Frankish legislation.

3. Even in the course of a general survey of the legal lore at our disposal, one cannot help being struck by peculiarities in the distribution of legal subjects. Matters which seem to us of primary importance and occupy a wide place in our law-books are almost entirely absent in Anglo-Saxon laws or relegated to the background. While it is impossible to give here anything like a complete or exact survey of the field—a task rendered almost impossible by the arbitrary manner in which paragraphs are divided, by the difficulty of making Old English enactments fit into modern rubrics, and by the necessity of counting several times certain paragraphs bearing on different subjects—a brief statistical analysis of the contents of royal codes and laws may be found instructive.

We find roughly 419 paragraphs devoted to criminal law and procedure as against 91 concerned with questions of private law and civil procedure. Of the criminal law clauses, as many as 238 are taken up with tariffs of fines, while 80 treat of capital and corporal punishment, outlawry and confiscation, and 101 include rules of procedure. On the private law side 18 clauses apply to rights of property and possession, 13 to succession and family law, 37 to contracts, including marriage when treated as an act of sale; 18 touch on civil procedure. A subject which attracted special attention was the law of status, and no less than 107 paragraphs contain disposition dictated by the wish to discriminate between the classes of society. Questions of public law and administration are discussed in 217 clauses, while 197 concern the Church in one way or another, apart from purely ecclesiastical collections. In the public law division it is chiefly the power, interests and privileges of the king that are dealt with, in roughly 93 paragraphs, while local administration comes in for 39 and purely economic and fiscal matter for 13 clauses. Police regulations are very much to the fore and occupy no less than 72 clauses of the royal legislation. As to church matters, the most prolific group is formed by general precepts based on religious and moral considerations, roughly 115, while secular privileges conferred on the Church hold about 62, and questions of organization some 20 clauses.

The statistical contrasts are especially sharp and characteristic when we take into account the chronological sequence in the elaboration of laws. Practically the entire code of Æthelberht, for instance, is a tariff of fines for crimes, and the same subject continues to occupy a great place in the laws of Hlothhere and Eadric, Ine and Alfred, whereas it appears only occasionally in the treaties with the Danes, the laws of Withraed, Edward the Elder, Æthelstan, Edgar, Edmund and Æthelred. It reappears in some strength in the code of Canute, but the latter is chiefly a recapitulation of former enactments. The system of "compositions" or fines, paid in many cases with the help of kinsmen, finds its natural place in the ancient, tribal period of English history and loses its vitality later on in consequence of the growth of central power and of the scattering of maegths. Royalty and the Church, when they acquire the lead in social life, work out a new penal system based on outlawry, death penalties and corporal punishments, which make their first appearance in the legislation of Withraed and culminate in that of Æthelred and Canute.

As regards status, the most elaborate enactments fall into the period preceding the Danish settlements. After the treaties with the Danes, the tendency is to simplify distinctions on the lines of an opposition between twelvehynd-men and twyhynd-men, paving the way towards the feudal distinction between the free and the unfree. In the arrangements of the commonwealth the clauses treating of royal privileges are more or less evenly distributed over all reigns, but the systematic development of police functions, especially in regard to responsibility for crimes, the catching of thieves, the suppression of lawlessness, is mainly the object of 10th and 11th century legislation. The reign of Æthelred, which witnessed the greatest national humiliation and the greatest crime in English history, is also marked by the most lavish expressions of religious feeling and the most frequent appeals to morality. This sketch would, of course, have to be modified in many ways if we attempted to treat the unofficial fragments of customary law in the same way as the paragraphs of royal codes, and even more so if we were able to tabulate the indirect evidence as to legal rules. But, imperfect as such statistics may be, they give us at any rate some insight into the direction of governmental legislation.

4. The next question to be approached concerns the pedigree of Anglo-Saxon law and the latter's natural affinities. What is its position in the legal history of Germanic nations? How far has it been influenced by non-Germanic elements, especially by Roman and Canon law? The oldest Anglo-Saxon codes, especially the Kentish and the West Saxon ones, disclose a close relationship to the barbaric laws of Lower Germany—those of Saxons, Frisians, Thuringians. We find a division of social ranks which reminds us of the threefold gradation of Lower Germany

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[1] The *Judicia civitatis Lundoniae* are a gild statute confirmed by King Æthelstan.

(edelings, frilings, lazzen—eorls, ceorls, laets), and not of the twofold Frankish one (*ingenui Franci*, *Romani*), nor of the minute differentiation of the Upper Germans and Lombards. In subsequent history there is a good deal of resemblance between the capitularies' legislation of Charlemagne and his successors on one hand, the acts of Alfred, Edward the Elder, Æthelstan and Edgar on the other, a resemblance called forth less by direct borrowing of Frankish institutions than by the similarity of political problems and condition. Frankish law becomes a powerful modifying element in English legal history after the Conquest, when it was introduced wholesale in royal and in feudal courts. The Scandinavian invasions brought in many northern legal customs, especially in the districts thickly populated with Danes. The Domesday survey of Lincolnshire, Nottinghamshire, Yorkshire, Norfolk, &c., shows remarkable deviations in local organization and justice (lagmen, sokes), and great peculiarities as to status (socmen, freemen), while from laws and a few charters we can perceive some influence on criminal law (*nidingsvaerk*), special usages as to fines (*lahslit*), the keeping of peace, attestation and sureties of acts (*faestermen*), &c. But, on the whole, the introduction of Danish and Norse elements,apart from local cases, was more important owing to the conflicts and compromises it called forth and its social results, than on account of any distinct trail of Scandinavian views in English law. The Scandinavian newcomers coalesced easily and quickly with the native population.

The direct influence of Roman law was not great during the Saxon period: we notice neither the transmission of important legal doctrines, chiefly through the medium of Visigothic codes, nor the continuous stream of Roman tradition in local usage. But indirectly Roman law did exert a by no means insignificant influence through the medium of the Church, which, for all its insular character, was still permeated with Roman ideas and forms of culture. The Old English "books" are derived in a roundabout way from Roman models, and the tribal law of real property was deeply modified by the introduction of individualistic notions as to ownership, donations, wills, rights of women, &c. Yet in this respect also the Norman Conquest increased the store of Roman conceptions by breaking the national isolation of the English Church and opening the way for closer intercourse with France and Italy.

5. It would be useless to attempt to trace in a brief sketch the history of the legal principles embodied in the documents of Anglo-Saxon law. But it may be of some value to give an outline of a few particularly characteristic subjects.

(*a*) The Anglo-Saxon legal system cannot be understood unless one realizes the fundamental opposition between folk-right and privilege. Folk-right is the aggregate of rules, formulated or latent but susceptible of formulation, which can be appealed to as the expression of the juridical consciousness of the people at large or of the communities of which it is composed. It is tribal in its origin, and differentiated, not according to boundaries between states, but on national and provincial lines. There may be the folk-right of West and East Saxons, of East Angles, of Kentish men, Mercians, Northumbrians, Danes, Welshmen, and these main folk-right divisions remain even when tribal kingdoms disappear and the people is concentrated in one or two realms. The chief centres for the formulation and application of folk-right were in the 10th and 11th centuries the shire-moots, while the witan of the realm generally placed themselves on the higher ground of State expediency, although occasionally using folk-right ideas. The older law of real property, of succession, of contracts, the customary tariffs of fines, were mainly regulated by folk-right; the reeves employed by the king and great men were supposed to take care of local and rural affairs according to folk-right. The law had to be declared and applied by the people itself in its communities, while the spokesmen of the people were neither democratic majorities nor individual experts, but a few leading men—the twelve eldest thanes or some similar quorum. Folk-right could, however, be broken or modified by special law or special grant, and the fountain of such privileges was the royal power. Alterations and exceptions were, as a matter of fact, suggested by the interested parties themselves, and chiefly by the Church. Thus a privileged land-tenure was created—bookland; the rules as to the succession of kinsmen were set at nought by concession of testamentary power and confirmations of grants and wills; special exemptions from the jurisdiction of the hundreds and special privileges as to levying fines were conferred. In process of time the rights originating in royal grants of privilege overbalanced, as it were, folk-right in many respects, and became themselves the starting-point of a new legal system—the feudal one.

(*b*) Another feature of vital importance in the history of Anglo-Saxon law is its tendency towards the preservation of peace. Society is constantly struggling to ensure the main condition of its existence—peace. Already in Æthelberht's legislation we find characteristic fines inflicted for breach of the peace of householders of different ranks—the ceorl, the eorl, and the king himself appearing as the most exalted among them. Peace is considered not so much a state of equilibrium and friendly relations between parties, but rather as the rule of a third within a certain region—a house, an estate, a kingdom. This leads on one side to the recognition of private authorities—the father's in his family, the master's as to servants, the lord's as to his personal or territorial dependents. On the other hand, the tendency to maintain peace naturally takes its course towards the strongest ruler, the king, and we witness in Anglo-Saxon law the gradual evolution of more and more stringent and complete rules in respect of the king's peace and its infringements.

(*c*) The more ancient documents of Anglo-Saxon law show us the individual not merely as the subject and citizen of a certain commonwealth, but also as a member of some group, all the fellows of which are closely allied in claims and responsibilities. The most elementary of these groups is the *maegth*, the association of agnatic and cognatic relations. Personal protection and revenge, oaths, marriage, wardship, succession, supervision over settlement, and good behaviour, are regulated by the law of kinship. A man's actions are considered not as exertions of his individual will, but as acts of the kindred, and all the fellows of the maegth are held responsible for them. What began as a natural alliance was used later as a means of enforcing responsibility and keeping lawless individuals in order. When the association of kinsmen failed, the voluntary associations—gilds—appeared as substitutes. The gild brothers associated in mutual defence and support, and they had to share in the payment of fines. The township and the hundred came also in for certain forms of collective responsibility, because they presented groups of people associated in their economic and legal interests.

(*d*) In course of time the natural associations get loosened and intermixed, and this calls forth the elaborate police legislation of the later Anglo-Saxon kings. Regulations are issued about the sale of cattle in the presence of witnesses. Enactments about the pursuit of thieves, and the calling in of warrantors to justify sales of chattels, are other expressions of the difficulties attending peaceful intercourse. Personal surety appears as a complement of and substitute for collective responsibility. The *hlaford* and his *hiredmen* are an institution not only of private patronage, but also of police supervision for the sake of laying hands on malefactors and suspected persons. The *landrica* assumes the same part in a territorial district. Ultimately the laws of the 10th and 11th centuries show the beginnings of the frankpledge associations, which came to act so important a part in the local police and administration of the feudal age.

The points mentioned are not many, but, apart from their intrinsic importance in any system of law, they are, as it were, made prominent by the documents themselves, as they are constantly referred to in the latter.

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and the fulness of its glossary. B. Thorpe, *Ancient Laws and Institutes of England* (1840) is not very trustworthy. *Domesday Book*, i. ii. (Rec. Comm.); *Codex Diplomaticus Aevi Saxonici*, i.-vi. ed. J. M. Kemble (1839–1848); *Cartularium Saxonicum* (up to 940), ed. W. de Gray Birch (1885–1893); J. Earle, *Land Charters* (Oxford, 1888); Thorpe, *Diplomatarium Anglicanum; Facsimiles of Ancient Charters*, edited by the Ordnance Survey and by the British Museum; Haddan and Stubbs, *Councils of Great Britain*, i.-iii. (Oxford, 1869–1878).

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ANGLO-SAXONS. The term "Anglo-Saxon" is commonly applied to that period of English history, language and literature which preceded the Norman Conquest. It goes back to the time of King Alfred, who seems to have frequently used the title *rex Anglorum Saxonum* or *rex Angul-Saxonum*. The origin of this title is not quite clear. It is generally believed to have arisen from the final union of the various kingdoms under Alfred in 886. Bede (*Hist. Eccl.* i. 15) states that the people of the more northern kingdoms (East Anglia, Mercia, Northumbria, &c.) belonged to the Angli, while those of Essex, Sussex and Wessex were sprung from the Saxons (*q.v.*), and those of Kent and southern Hampshire from the Jutes (*q.v.*). Other early writers, however, do not observe these distinctions, and neither in language nor in custom do we find evidence of any appreciable differences between the two former groups, though in custom Kent presents most remarkable contrasts with the other kingdoms. Still more curious is the fact that West Saxon writers regularly speak of their own nation as a part of the *Angelcyn* and of their language as *Englisc*, while the West Saxon royal family claimed to be of the same stock as that of Bernicia. On the other hand, it is by no means impossible that the distinction drawn by Bede was based solely on the names Essex (East Seaxan), East Anglia, &c. We need not doubt that the Angli and the Saxons were different nations originally; but from the evidence at our disposal it seems likely that they had practically coalesced in very early times, perhaps even before the invasion. At all events the term *Angli Saxones* seems to have first come into use on the continent, where we find it, nearly a century before Alfred's time, in the writings of Paulus Diaconus (Paul the Deacon). There can be little doubt, however, that there it was used to distinguish the Teutonic inhabitants of Britain from the Old Saxons of the continent.

See W. H. Stevenson, *Asser's Life of King Alfred* (Oxford, 1904, pp. 148 ff.); H. Munro Chadwick, *The Origin of the English Nation* (Cambridge, 1907); also BRITAIN, *Anglo-Saxon*. (H. M. C.)

ANGOLA, the general name of the Portuguese possessions on the west coast of Africa south of the equator. With the exception of the enclave of Kabinda (*q.v.*) the province lies wholly south of the river Congo. Bounded on the W. by the Atlantic Ocean, it extends along the coast from the southern bank of the Congo (6° S., 12° E.) to the mouth of the Kunene river (17° 18′ S., 11° 50′ E.). The coast-line is some 900 m. long. On the north the Congo forms for 80 m. the boundary separating Angola from the Congo Free State. The frontier thence (in 5° 52′ S.) goes due east to the Kwango river. The eastern boundary—dividing the Portuguese possessions from the Congo State and Barotseland (N.W. Rhodesia)—is a highly irregular line. On the south Angola borders German South-West Africa, the frontier being drawn somewhat S. of the 17th degree of S. latitude. The area of the province is about 480,000 sq. m. The population is estimated (1906) at 4,119,000.

The name Angola (a Portuguese corruption of the Bantu word *Ngola*) is sometimes confined to the 105 m. of coast, with its hinterland, between the mouths of the rivers Dande and Kwanza, forming the central portion of the Portuguese dominions in West Africa; in a looser manner Angola is used to designate all the western coast of Africa south of the Congo in the possession of Portugal; but the name is now officially applied to the whole of the province. Angola is divided into five districts: four on the coast, the fifth, Lunda, wholly inland, being the N.E. part of the province. Lunda is part of the old Bantu kingdom of Muata Yanvo, divided by international agreement between Portugal and the Congo Free State.

The coast divisions of Angola are Congo on the N. (from the river Congo to the river Loje), corresponding roughly with the limits of the "kingdom of Congo" (see *History* below); Loanda, which includes Angola in the most restricted sense mentioned above; Benguella and Mossamedes to the south. Mossamedes is again divided into two portions—the coast region and the hinterland, known as Huilla.

Physical Features.—The coast is for the most part flat, with occasional low cliffs and bluffs of red sandstone. There is but one deep inlet of the sea—Great Fish Bay (or Bahia dos Tigres), a little north of the Portuguese-German frontier. Farther north are Port Alexander, Little Fish Bay and Lobito Bay, while shallower bays are numerous. Lobito Bay has water sufficient to allow large ships to unload close inshore. The coast plain extends inland for a distance varying from 30 to 100 m. This region is in general sparsely watered and somewhat sterile. The approach to the great central plateau of Africa is marked by a series of irregular terraces. This intermediate mountain belt is covered with luxuriant vegetation. Water is fairly abundant, though in the dry season obtainable only by digging in the sandy beds of the rivers. The plateau has an altitude ranging from 4000 to 6000 ft. It consists of well-watered, wide, rolling plains, and low hills with scanty vegetation. In the east the tableland falls away to the basins of the Congo and Zambezi, to the south it merges into a barren sandy desert. A large number of rivers make their way westward to the sea; they rise, mostly, in the mountain belt, and are unimportant, the only two of any size being the Kwanza and the Kunene, separately noticed. The mountain chains which form the edge of the plateau, or diversify its surface, run generally parallel to the coast, as Tala Mugongo (4400 ft.), Chella and Vissecua (5250 ft. to 6500 ft.). In the district of Benguella are the highest points of the province, viz. Loviti (7780 ft.), in 12° 5′ S., and Mt. Elonga (7550 ft.). South of the Kwanza is the volcanic mountain Caculo-Cabaza (3300 ft.). From the tableland the Kwango and many other streams flow north to join the Kasai (one of the largest affluents of the Congo), which in its upper course forms for fully 300 m. the boundary between Angola and the Congo State. In the south-east part of the province the rivers belong either to the Zambezi system, or, like the Okavango, drain to Lake Ngami.

Geology.—The rock formations of Angola are met with in three distinct regions: (1) the littoral zone, (2) the median zone formed by a series of hills more or less parallel with the coast, (3) the central plateau. The central plateau consists of ancient crystalline rocks with granites overlain by unfossiliferous sandstones and conglomerates considered to be of Palaeozoic age. The outcrops are largely hidden under laterite. The median zone is composed largely of crystalline rocks with granites and some Palaeozoic unfossiliferous rocks. The littoral zone contains the only fossiliferous strata. These are of Tertiary and Cretaceous ages, the latter rocks resting on a reddish sandstone of older date. The Cretaceous rocks of the Dombe Grande region (near Benguella) are of Albian age and belong to the *Acanthoceras mamillari* zone. The beds containing *Schloenbachia inflata* are referable to the Gault. Rocks of Tertiary age are met with at Dombe Grande, Mossamedes and near Loanda. The sandstones with gypsum, copper and sulphur of Dombe are doubtfully considered to be of Triassic age. Recent eruptive rocks, mainly basalts, form a line of hills almost bare of vegetation between Benguella and Mossamedes. Nepheline basalts and liparites occur at Dombe Grande. The presence of gum copal in considerable quantities in the superficial rocks is characteristic of certain regions.

Climate.—With the exception of the district of Mossamedes, the coast plains are unsuited to Europeans. In the interior, above 3300 ft., the temperature and rainfall, together with malaria, decrease. The plateau climate is healthy and invigorating. The mean annual temperature at São Salvador do Congo is 72·5° F.; at Loanda, 74·3°; and at Caconda, 67·2°. The climate is greatly influenced by the prevailing winds, which are W., S.W. and S.S.W. Two seasons are distinguished—the cool, from June to September; and the rainy, from October to May. The heaviest rainfall occurs in April, and is accompanied by violent storms.

Flora and Fauna.—Both flora and fauna are those characteristic of the greater part of tropical Africa. As far south as Benguella the coast region is rich in oil-palms and mangroves. In the northern part of the province are dense forests. In the south towards the Kunene are regions of dense thorn scrub. Rubber vines and trees are abundant, but in some districts their number has been considerably reduced by the ruthless methods adopted by native collectors of rubber. The species most common are various root rubbers, notably the *Carpodinus chylorrhiza*. This species and other varieties of carpodinus are very widely distributed. Landolphias are also found. The coffee, cotton and Guinea pepper plants are indigenous, and the tobacco plant flourishes in several districts. Among the trees are several which yield excellent timber, such as the tacula (*Pterocarpus tinctorius*), which grows to an immense size, its wood being blood-red in colour, and the Angola mahogany. The bark of the musuemba (*Albizzia coriaria*) is largely used in the tanning of leather. The mulundo bears a fruit about the size of a cricket ball covered with a hard green shell and containing scarlet pips like a pomegranate. The fauna includes the lion, leopard, cheetah, elephant, giraffe, rhinoceros, hippopotamus, buffalo, zebra, kudu and many other kinds of antelope, wild pig, ostrich and crocodile. Among fish are the barbel, bream and African yellow fish.

Inhabitants.—The great majority of the inhabitants are of Bantu-Negro stock with some admixture in the Congo district with the pure negro type. In the south-east are various tribes of Bushmen. The best-known of the Bantu-Negro tribes are the Ba-Kongo (Ba-Fiot), who dwell chiefly in the north, and the Abunda (Mbunda, Ba-Bundo), who occupy the central part of the province, which takes its name from the Ngola tribe of Abunda. Another of these tribes, the Bangala, living on the west bank of the upper Kwango, must not be confounded with the Bangala of the middle Congo. In the Abunda is a considerable strain of Portuguese blood. The Ba-Lunda inhabit the Lunda district. Along the upper Kunene and in other districts of the plateau are settlements of Boers, the Boer population being about 2000. In the coast towns the majority of the white inhabitants are Portuguese. The Mushi-Kongo and other divisions of the Ba-Kongo retain curious traces of the Christianity professed by them in the 16th and 17th centuries and possibly later. Crucifixes are used as potent fetish charms or as symbols of power passing down from chief to chief; whilst every native has a "Santu" or Christian name and is dubbed dom or dona. Fetishism is the prevailing religion throughout the province. The dwelling-places of the natives are usually small huts of the simplest constuction, used chiefly as sleeping apartments; the day is spent in an open space in front of the hut protected from the sun by a roof of palm or other leaves.

Chief Towns.—The chief towns are São Paulo de Loanda, the capital, Kabinda, Benguella and Mossamedes (*q.v.*). Lobito, a little north of Benguella, is a town which dates from 1905 and owes its existence to the bay of the same name having been chosen as the sea terminus of a railway to the far interior. Noki is on the southern bank of the Congo at the head of navigation from the sea, and close to the Congo Free State frontier. It is available for ships of large tonnage, and through it passes the Portuguese portion of the trade of the lower Congo. Ambriz—the only seaport of consequence in the Congo district of the province—is at the mouth of the Loje river, about 70 m. N. of Loanda. Novo Redondo and Egito are small ports between Loanda and Benguella. Port Alexander is in the district of Mossamedes and S. of the town of that name.

In the interior Humpata, about 95 m. from Mossamedes, is the chief centre of the Boer settlers; otherwise there are none but native towns containing from 1000 to 3000 inhabitants and often enclosed by a ring of sycamore trees. Ambaca and Malanje are the chief places in the fertile agricultural district of the middle Kwanza, S.E. of Loanda, with which they are in railway communication. São Salvador (pop. 1500) is the name given by the Portuguese to Bonza Congo, the chief town of the "kingdom of Congo." It stands 1840 ft. above sea-level and is about 160 m. inland and 100 S.E. of the river port of Noki, in 6° 15′ S. Of the cathedral and other stone buildings erected in the 16th century, there exist but scanty ruins. The city walls were destroyed in the closing years of the 19th century and the stone used to build government offices. There is a fort, built about 1850, and a small military force is at the disposal of the Portuguese resident. Bembe and Encoje are smaller towns in the Congo district south of São Salvador. Bihe, the capital of the plateau district of the same name forming the hinterland of Benguella, is a large caravan centre. Kangomba, the residence of the king of Bihe, is a large town. Caconda is in the hill country S.E. of Benguella.

Agriculture and Trade.—Angola is rich in both agricultural and mineral resources. Amongst the cultivated products are mealies and manioc, the sugar-cane and cotton, coffee and tobacco plants. The chief exports are coffee, rubber, wax, palm kernels and palm-oil, cattle and hides and dried or salt fish. Gold dust, cotton, ivory and gum are also exported. The chief imports are food-stuffs, cotton and woollen goods and hardware. Considerable quantities of coal come from South Wales. Oxen, introduced from Europe and from South Africa, flourish. There are sugar factories, where rum is also distilled and a few other manufactures, but the prosperity of the province depends on the "jungle" products obtained through the natives and from the plantations owned by Portuguese and worked by indentured labour, the labourers being generally "recruited" from the far interior. The trade of the province, which had grown from about £800,000 in 1870 to about £3,000,000 in 1905, is largely with Portugal and in Portuguese bottoms. Between 1893 and 1904 the percentage of Portuguese as compared with foreign goods entering the province increased from 43 to 201 %, a result due to the preferential duties in force.

The minerals found include thick beds of copper at Bembe, and deposits on the M'Brije and the Cuvo and in various places in the southern part of the province; iron at Ociras (on the Lucalla affluent of the Kwanza) and in Bailundo; petroleum and asphalt in Dande and Quinzao; gold in Lombije and Cassinga; and mineral salt in Quissama. The native blacksmiths are held in great repute.

Communications.—There is a regular steamship communication between Portugal, England and Germany, and Loanda, which port is within sixteen days' steam of Lisbon. There is also a regular service between Cape Town, Lobito and Lisbon and Southampton. The Portuguese line is subsidized by the government. The railway from Loanda to Ambaca and Malanje is known as the Royal Trans-African railway. It is of metre gauge, was begun in 1887 and is some 300 m. long. It was intended to carry the line across the continent to Mozambique, but when the line reached Ambaca (225 m.) in 1894 that scheme was abandoned. The railway had created a record in being the most expensive built in tropical Africa—£8942 per mile. A railway from Lobito Bay, 25 m. N. of Benguella, begun in 1904, runs towards the Congo-Rhodesia frontier. It is of standard African gauge (3 ft. 6 in.) and is worked by an English company. It is intended to serve the Katanga copper mines. Besides these two main railways, there are other short lines linking the seaports to their hinterland. Apart from the railways, communication is by ancient caravan routes and by ox-wagon tracks in the southern district. Riding-oxen are also used. The province is well supplied with telegraphic communication and is connected with Europe by submarine cables.

Government and Revenue.—The administration of the province is carried on under a governor-general, resident at Loanda, who acts under the direction of the ministry of the colonies at Lisbon. At the head of each district is a local governor. Legislative powers, save those delegated to the governor-general, are exercised by the home government. Revenue is raised chiefly from customs, excise duties and direct taxation. The revenue (in 1904–1905 about £350,000) is generally insufficient to meet expenditure (in 1904–1905 over £490,000)—the balance being met by a grant from the mother country. Part of the extra expenditure is, however, on railways and other reproductive works.

History.—The Portuguese established themselves on the west coast of Africa towards the close of the 15th century. The river Congo was discovered by Diogo Cam or Cão in 1482. He erected a stone pillar at the mouth of the river, which accordingly took the title of Rio de Padrão, and established friendly relations with the natives, who reported that the country was subject to a great monarch, Mwani Congo or lord of Congo, resident at Bonza Congo. The Portuguese were not long in making themselves influential in the country. Gonçalo de Sousa was despatched on a formal embassy in 1490; and the first missionaries entered the country in his train. The king was soon afterwards baptized and Christianity was nominally established as the national religion. In 1534 a cathedral was founded at Bonza Congo (renamed São Salvador), and in 1560 the Jesuits arrived with Paulo Diaz de Novaes. Of the prosperity of the country the Portuguese have left the most glowing and indeed incredible accounts. It was, however, about this time ravaged by cannibal invaders (Bangala) from the interior, and Portuguese influence gradually declined. The attention of the Portuguese was, moreover, now turned more particularly to the southern districts of Angola. In 1627 the bishop's seat was removed to São Paulo de Loanda and São Salvador declined in importance. In the 18th century, in spite of hindrances from Holland and France, steps were taken towards re-establishing Portuguese authority in the northern regions; in 1758 a settlement was formed at Encoje; from 1784 to 1789 the Portuguese carried on a war against the natives of Mussolo (the district immediately south of Ambriz); in 1791 they built a fort at Quincollo on the Loje, and for a time they worked the mines of Bembe. Until, however, the "scramble for Africa" began in 1884, they possessed no fort or settlement on the coast to the north of Ambriz, which was first occupied in 1855. At São Salvador, however, the Portuguese continued to exercise influence. The last of the native princes who had real authority was a potentate known as Dom Pedro V. He was placed on the throne in 1855 with the help of a Portuguese force, and reigned over thirty years. In 1888 a Portuguese resident was stationed at Salvador, and the kings of Congo became pensioners of the government.

Angola proper, and the whole coast-line of what now constitutes the province of that name, was discovered by Diogo Cam during 1482 and the three following years. The first governor sent to Angola was Paulo Diaz, a grandson of Bartholomew Diaz, who reduced to submission the region south of the Kwanza nearly as far as Benguella. The city of Loanda was founded in 1576, Benguella in 1617. From that date the sovereignty of Portugal over the coast-line, from its present southern limit as far north as Ambriz (7° 50′ S.) has been undisputed save between 1640 and 1648, during which time the Dutch attempted to expel the Portuguese and held possession of the ports. Whilst the economic development of the country was not entirely neglected and many useful food products were introduced, the prosperity of the province was very largely dependent on the slave trade with Brazil, which was not legally abolished until 1830 and in fact continued for many years subsequently.

In 1884 Great Britain, which up to that time had steadily refused to acknowledge that Portugal possessed territorial rights north of Ambriz, concluded a treaty recognizing Portuguese sovereignty over both banks of the lower Congo; but the treaty, meeting with opposition in England and Germany, was not ratified. Agreements concluded with the Congo Free State, Germany and France in 1885–1886 (modified in details by subsequent arrangements) fixed the limits of the province, except in the S.E., where the frontier between Barotseland (N.W. Rhodesia) and Angola was determined by an Anglo-Portuguese agreement of 1891 and the arbitration award of the king of Italy in 1905 (see Africa: *History*). Up to the end of the 19th century the hold of Portugal over the interior of the province was slight, though its influence extended to the Congo and Zambezi basins. The abolition of the external slave trade proved very injurious to the trade of the seaports, but from 1860 onward the agricultural resources of the country were developed with increasing energy, a work in which Brazilian merchants took the lead. After the definite partition of Africa among the European powers, Portugal applied herself with some seriousness to exploit Angola and her other African possessions. Nevertheless, in comparison with its natural wealth the development of the country has been slow. Slavery and the slave trade continued to flourish in the interior in the early years of the 20th century, despite the prohibitions of the Portuguese government. The extension of authority over the inland tribes proceeded very slowly and was not accomplished without occasional reverses. Thus in September 1904 a Portuguese column lost over 300 men killed, including 114 Europeans, in an encounter with the Kunahamas on the Kunene, not far from the German frontier. The Kunahamas are a wild, raiding tribe and were probably largely influenced by the revolt of their southern neighbours, the Hereros, against the Germans. In 1905 and again in 1907 there was renewed fighting in the same region.

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ANGORA, or Enguri. (1) A city of Turkey (anc. *Ancyra*) in Asia, capital of the vilayet of the same name, situated upon a steep, rocky hill, which rises 500 ft. above the plain, on the left bank of the Enguri Su, a tributary of the Sakaria (Sangarius), about 220 m. E.S.E. of Constantinople. The hill is crowned by the ruins of the old citadel, which add to the picturesqueness of the view; but the town is not well built, its streets being narrow and many of its houses constructed of sun-dried mud bricks; there are, however, many fine remains of Graeco-Roman and Byzantine architecture, the most remarkable being the temple of Rome and Augustus, on the walls of which is the famous *Monumentum Ancyranum* (see Ancyra). Ancyra was the centre of the Tectosages, one of the three Gaulish tribes which settled in Galatia in the 3rd century B.C., and became the capital of the Roman province of Galatia when it was formally constituted in 25 B.C. During the Byzantine period, throughout which it occupied a position of great importance, it was captured by Persians and Arabs; then it fell into the hands of the Seljuk Turks, was held for eighteen years by the Latin Crusaders, and finally passed to the Ottoman Turks in 1360. In 1402 a great battle was fought in the vicinity of Angora, in which the Turkish sultan Bayezid was defeated and made prisoner by the Tatar conqueror Timur. In 1415 it was recovered by the Turks under Mahommed I., and since that period has belonged to the Ottoman empire. In 1832 it was taken by the Egyptians under Ibrahim Pasha. Angora is connected with Constantinople by railway, and exports wool, mohair, grain and yellow berries. Mohair cloth is manufactured, and the town is noted for its honey and fruit. From 1639 to 1768 there was an agency of the Levant Company here; there is now a British consul. Pop. estimated at 28,000 (Moslems, 18,000; Christians, largely Roman Catholic Armenians, about 9400; Jews, 400).

(2) A Turkish vilayet in north-central Asia Minor, which includes most of the ancient Galatia. It is an agricultural country, depending for its prosperity on its grain, wool (average annual export, 4,400,000 ℔), and the mohair obtained from the beautiful Angora goats (average annual clip, 3,300,000 ℔). The fineness of the hair may perhaps be ascribed to some peculiarity in the atmosphere, for it is remarkable that the cats, dogs and other animals of the country are to a certain extent affected in the same way, and that they all lose much of their distinctive beauty when taken from their native districts. The only important industry is carpet-weaving at Kir-sheher and Kaisarieh. There are mines of silver, copper, lignite and salt, and many hot springs, including some of great repute medicinally. Average annual exports 1896–1898, £920,762; imports, £411,836. Pop. about 900,000 (Moslems, 765,000 to 800,000, the rest being Christians, with a few hundred Jews). (J. G. C. A.)

See C. Ritter, *Erdkunde von Asien* (vol. xviii., 1837–1839); V. Cuinet, *La Turquie d'Asie*, t. i. (1891); Murray's *Handbook to Asia Minor* (1895); and other works mentioned under Ancyra.

ANGOULÊME, CHARLES DE VALOIS, Duke of (1573–1650), the natural son of Charles IX. of France and Marie Touchet, was born on the 28th of April 1573, at the castle of Fayet in Dauphiné. His father, dying in the following year, commended him to the care and favour of his brother and successor, Henry III., who faithfully fulfilled the charge. His mother married François de Balzac, marquis d'Entragues, and one of her daughters, Henriette, marchioness of Verneuil, afterwards became the mistress of Henry IV. Charles of Valois, was carefully educated, and was destined for the order of Malta. At the early age of sixteen he attained one of the highest dignities of the order, being made grand prior of France. Shortly after he came into possession of large estates left by Catherine de' Medici, from one of which he took his title of count of Auvergne. In 1591 he obtained a dispensation from the vows of the order of Malta, and married Charlotte, daughter of Henry, Marshal d'Amville, afterwards duke of Montmorency. In 1589 Henry III. was assassinated, but on his deathbed he commended Charles to the good-will of his successor Henry IV. By that monarch he was made colonel of horse, and in that capacity served in the campaigns during the early part of the reign. But the connexion between the king and the marchioness of Verneuil appears to have been very displeasing to Auvergne, and in 1601 he engaged in the conspiracy formed by the dukes of Savoy, Biron and Bouillon, one of the objects of which was to force Henry to repudiate his wife and marry the marchioness. The conspiracy was discovered; Biron and Auvergne were arrested and Biron was executed. Auvergne after a few months' imprisonment was released, chiefly through the influence of his half-sister, his aunt, the duchess of Angoulême and his father-in-law. He then entered into fresh intrigues with the court of Spain, acting in concert with the marchioness of Verneuil and her father d'Entragues. In 1604 d'Entragues and he were arrested and condemned to death; at the same time the marchioness was condemned to perpetual imprisonment in a convent. She easily obtained pardon, and the sentence of death against the other two was commuted into perpetual imprisonment. Auvergne remained in the Bastille for eleven years, from 1605 to 1616. A decree of the parlement (1606), obtained by Marguerite de Valois, deprived him of nearly all his possessions, including Auvergne, though he still retained the title. In 1616 he was released, was restored to his rank of colonel-general of horse, and despatched against one of the disaffected nobles, the duke of Longueville, who had taken Péronne. Next year he commanded the forces collected in the Île de France, and obtained some successes. In 1619 he received by bequest, ratified in 1620 by royal grant, the duchy of Angoulême. Soon after he was engaged on an important embassy to Germany, the result of which was the treaty of Ulm, signed July 1620. In 1627 he commanded the large forces assembled at the siege of La Rochelle; and some years after in 1635, during the Thirty Years' War, he was general of the French army in Lorraine. In 1636 he was made lieutenant-general of the army. He appears to have retired from public life shortly after the death of Richelieu in 1643. His first wife died in 1636, and in 1644 he married Françoise de Narbonne, daughter of Charles, baron of Mareuil. She had no children and survived her husband until 1713. Angoulême himself died on the 24th of September 1650. By his first wife he had three children: Henri, who became insane; Louis Emmanuel, who succeeded his father as duke of Angoulême and was colonel-general of light cavalry and governor of Provence; and François, who died in 1622.

The duke was the author of the following works:—(1) *Mémoires*, from the assassination of Henri III. to the battle of Arques (1589–1593), published at Paris by Boneau, and reprinted by Buchon in his *Choix de chroniques* (1836) and by Petitot in his *Mémoires* (1st series, vol. xliv.); (2) *Les Harangues, prononcés en assemblée de MM. les princes protestants d'Allemagne*, par Monseigneur le duc d' Angoulême (1620); (3) a translation of a Spanish work by Diego de Torres. To him has also been ascribed the work, *La générale et fidèle Rélation de tout ce qui s'est passé en l'isle de Ré, envoyée par le roi à la royne sa mère* (Paris, 1627).

ANGOULÊME, a city of south-western France, capital of the department of Charente, 83 m. N.N.E. of Bordeaux on the railway between Bordeaux and Poitiers. Pop. (1906) 30,040. The town proper occupies an elevated promontory, washed on the north by the Charente and on the south and west by the Anguienne, a small tributary of that river. The more important of the suburbs lie towards the east, where the promontory joins the main plateau, of which it forms the north-western extremity. The main line of the Orleans railway passes through a tunnel beneath the town. In place of its ancient fortifications Angoulême is encircled by boulevards known as the *Remparts*, from which fine views may be obtained in all directions. Within the town the streets are often dark and narrow, and, apart from the cathedral and the hôtel de ville, the architecture is of little interest. The cathedral of St Pierre (see Cathedral), a church in the Byzantine-Romanesque style, dates from the 11th and 12th centuries, but has undergone frequent restoration, and was partly rebuilt in the latter half of the 19th century by the architect Paul Abadie. The façade, flanked by two towers with cupolas, is decorated with arcades filled in with statuary and sculpture, the whole representing the Last Judgment. The crossing is surmounted by a dome, and the extremity of the north transept by a fine square tower over 160 ft. high. The hôtel de ville, also by Abadie, is a handsome modern structure, but preserves two towers of the château of the counts of Angoulême, on the site of which it is built. It contains museums of paintings and archaeology. Angoulême is the seat of a bishop, a prefect, and a court of assizes. Its public institutions include tribunals of first instance and of commerce, a council of trade-arbitrators, a chamber of commerce and a branch of the Bank of France. It also has a lycée, training-colleges, a school of artillery, a library and several learned societies. It is a centre of the paper-making industry, with which the town has been connected since the 14th century. Most of the mills are situated on the banks of the watercourses in the neighbourhood of the town. The subsidiary industries, such as the manufacture of machinery and wire fabric, are of considerable importance. Iron and copper founding, brewing, tanning, and the manufacture of gunpowder, confectionery, heavy iron goods, gloves, boots and shoes and cotton goods are also carried on. Commerce is carried on in wine, brandy and building-stone.

Angoulême (*Iculisma*) was taken by Clovis from the Visigoths in 507, and plundered by the Normans in the 9th century. In 1360 it was surrendered by the peace of Bretigny to the English; they were, however, expelled in 1373 by the troops of Charles V., who granted the town numerous privileges. It suffered much during the Wars of Religion, especially in 1568 after its capture by the Protestants under Coligny

The countship of Angoulême dated from the 9th century, the most important of the early counts being William Taillefer, whose descendants held the title till the end of the 12th century. Withdrawn from them on more than one occasion by Richard Coeur-de-Lion, it passed to King John of England on his marriage with Isabel, daughter of Count Adhémar, and by her subsequent marriage in 1220 to Hugh X. passed to the Lusignan family, counts of Marche. On the death of Hugh XIII. in 1302 without issue, his possessions passed to the crown. In 1394 the countship came to the house of Orleans, a member of which, Francis I., became king of France in 1515 and raised it to the rank of duchy in favour of his mother Louise of Savoy. The duchy afterwards changed hands several times, one of its holders being Charles of Valois, natural son of Charles IX. The last duke was Louis-Antoine, eldest son of Charles X., who died in 1844.

See A. F. Lièvre, *Angoulême: histoire, institutions et monuments* (Angoulême, 1885).

ANGOUMOIS, an old province of France, nearly corresponding to-day to the department of Charente. Its capital was Angoulême.

See *Essai d'une bibliothèque historique de l'Angoumois*, by E. Castaigne (1845).

ANGRA, or Angra do Heroismo ("Bay of Heroism," a name given it in 1829, to commemorate its successful defence against the Miguelist party), the former capital of the Portuguese archipelago of the Azores, and chief town of an administrative district, comprising the islands of Terceira, St George and Graciosa. Pop. (1900) 10,788. Angra is built on the south coast of Terceira in 38° 38′ N. and in 27° 13′ W. It is the headquarters of a military command, and the residence of a Roman Catholic bishop; its principal buildings are the cathedral, military college, arsenal and observatory. The harbour, now of little commercial or strategic importance, but formerly a celebrated naval station, is sheltered on the west and south-west by the promontory of Mt. Brazil; but it is inferior to the neighbouring ports of Ponta Delgada and Horta. The foreign trade is not large, and consists chiefly in the exportation of pineapples and other fruit. Angra served as a refuge for Queen Maria II. of Portugal from 1830 to 1833.

ANGRA PEQUENA, a bay in German South-West Africa, in 26° 38′ S., 15° E., discovered by Bartholomew Diaz in 1487. F. A. E. Lüderitz, of Bremen, established a trading station here in 1883, and his agent concluded treaties with the neighbouring chiefs, who ceded large tracts of country to the newcomers. On the 24th of April 1884 Lüderitz transferred his rights to the German imperial government, and on the following 7th of August a German protectorate over the district was proclaimed. (See Africa, § 5, and German South-West Africa.) Angra Pequena has been renamed by the Germans Lüderitz Bay, and the adjacent country is sometimes called Lüderitzland. The harbour is poor. At the head of the bay is a small town, whence a railway, begun in 1906, runs east in the direction of Bechuanaland. The surrounding country for many miles is absolute desert, except after rare but terrible thunderstorms, when the dry bed of the Little Fish river is suddenly filled with a turbulent stream, the water finding its way into the bay.

The islands off the coast of Angra Pequena, together with others north and south, were annexed to Great Britain in 1867 and added to Cape Colony in 1874. Seal Island and Penguin Island are in the bay; Ichaboe, Mercury, and Hollam's Bird islands are to the north; Halifax, Long, Possession, Albatross, Pomona, Plumpudding, and Roastbeef islands are to the south. On these islands are guano deposits; the most valuable is on Ichaboe Island.

ANGSTRÖM, ANDERS JONAS (1814–1874), Swedish physicist, was born on the 13th of August 1814 at Lögdö, Medelpad, Sweden. He was educated at Upsala University, where in 1839 he became *privat docent* in physics. In 1842 he went to Stockholm Observatory in order to gain experience in practical astronomical work, and in the following year he became observer at Upsala Observatory. Becoming interested in terrestrial magnetism he made many observations of magnetic intensity and declination in various parts of Sweden, and was charged by the Stockholm Academy of Sciences with the task, not completed till shortly before his death, of working out the magnetic data obtained by the Swedish frigate "Eugénie" on her voyage round the world in 1851–1853. In 1858 he succeeded Adolph Ferdinand Svanberg (1806–1857) in the chair of physics at Upsala, and there he died on the 21st of June 1874. His most important work was concerned with the conduction of heat and with spectroscopy. In his optical researches, *Optiska Undersökningar*, presented to the Stockholm Academy in 1853, he not only pointed out that the electric spark yields two superposed spectra, one from the metal of the electrode and the other from the gas in which it passes, but deduced from Euler's theory of resonance that an incandescent gas emits luminous rays of the same refrangibility as those which it can absorb. This statement, as Sir E. Sabine remarked when awarding him the Rumford medal of the Royal Society in 1872, contains a fundamental principle of spectrum analysis, and though for a number of years it was overlooked it entitles him to rank as one of the founders of spectroscopy. From 1861 onwards he paid special attention to the solar spectrum. He announced the existence of hydrogen, among other elements, in the sun's atmosphere in 1862, and in 1868 published his great map of the normal solar spectrum which long remained authoritative in questions of wave-length, although his measurements were inexact to the extent of one part in 7000 or 8000 owing to the metre which he used as his standard having been slightly too short. He was the first, in 1867, to examine the spectrum of the aurora borealis, and detected and measured the characteristic bright line in its yellow green region; but he was mistaken in supposing that this same line, which is often called by his name, is also to be seen in the zodiacal light.

His son, Knut Johan Ångström, was born at Upsala on the 12th of January 1857, and studied at the university of that town from 1877 to 1884. After spending a short time in Strassburg he was appointed lecturer in physics at Stockholm University in 1885, but in 1891 returned to Upsala, where in 1896 he became professor of physics. He especially devoted himself to investigations of the radiation of heat from the sun and its absorption by the earth's atmosphere, and to that end devised various delicate methods and instruments, including his electric compensation pyrheliometer, invented in 1893, and apparatus for obtaining a photographic representation of the infra-red spectrum (1895).

ANGUIER, FRANÇOIS (*c.* 1604–1669), and **MICHEL** (1612–1686), French sculptors, were two brothers, natives of Eu in Normandy. Their apprenticeship was served in the studio of Simon Guillain. The chief works of François are the monument to Cardinal de Bérulle, founder of the Carmelite order, in the chapel of the oratory at Paris, of which all but the bust has been destroyed, and the mausoleum of Henri II., last duc de Montmorency, at Moulins. To Michel are due the sculptures of the triumphal arch at the Porte St Denis, begun in 1674, to serve as a memorial for the conquests of Louis XIV. A marble group of the Nativity in the church of Val de Grâce was reckoned his masterpiece. From 1662 to 1667 he directed the progress of the sculpture and decoration in this church, and it was he who superintended the decoration of the apartments of Anne of Austria in the old Louvre. F. Fouquet also employed him for his château in Vaux.

See Henri Stein, *Les frères Anguier* (1889), with catalogue of works, and many references to original sources; Armand Sanson, *Deux sculpteurs Normands: les frères Anguier* (1889).

ANGUILLA, or Snake, a small island in the British Indies, part of the presidency of St Kitts-Nevis, in the colony of the Leeward Islands. Pop. (1901) 3890, mostly negroes. It is situated in 18° 12′ N. and 63° 5′ W., about 60 m. N.W. of St Kitts, is 16 m. long and has an area of 35 sq. m. The destruction of trees by charcoal-burners has resulted in the almost complete deforestation of the island. Nearly all the land is in the hands of peasant proprietors, who cultivate sweet potatoes, peas, beans, corn, &c., and rear sheep and goats. Cattle, phosphate of lime and salt, manufactured from a lake in the interior, are the principal exports, the market for these being the neighbouring island of St Thomas.

ANGULATE (Lat. *angulus*, an angle), shaped with corners or angles; an adjective used in botany and zoology for the shape of stems, leaves and wings.

ANGUS, EARLS OF. Angus was one of the seven original earldoms of the Pictish kingdom of Scotland, said to have been occupied by seven brothers of whom Angus was the eldest. The Celtic line ended with Matilda (*fl.* 1240), countess of Angus in her own right, who married in 1243 Gilbert de Umfravill and founded the Norman line of three earls, which ended in 1381, the then holder of the title being summoned to the English parliament. Meanwhile John Stewart of Bonkyl, co. Berwick, had been created earl of Angus in a new line. This third creation ended with Margaret Stewart, countess of Angus in her own right, and widow of Thomas, 13th earl of Mar. By an irregular connexion with William, 1st earl of Douglas, who had married Mar's sister, she became the mother of George Douglas, 1st earl of Angus (*c.* 1380–1403), and secured a charter of her estates for her son, to whom in 1389 the title was granted by King Robert II. He was taken prisoner at Homildon Hill and died in England. The 5th earl was his great-grandson.

Archibald Douglas, 5th earl of Angus (*c.* 1450–*c.* 1514), the famous "Bell the-Cat," was born about 1450 and succeeded his father, George the 4th earl, in 1462 or 1463. In 1481 he was made warden of the east marches, but the next year he joined the league against James III. and his favourite Robert Cochrane at Lauder, where he earned his nickname by offering to bell the cat, *i.e.* to deal with the latter, beginning the attack upon him by pulling his gold chain off his neck and causing him with others of the king's favourites to be hanged. Subsequently he joined Alexander Stewart, duke of Albany, in league with Edward IV. of England, on the 11th of February 1483, signing the convention at Westminster which acknowledged the overlordship of the English king. In March however they returned, outwardly at least, to their allegiance, and received pardons for their treason. Later Angus was one of the leaders in the rebellion against James in 1487 and 1488, which ended in the latter's death. He was made one of the guardians of the young king James IV. but soon lost influence, being superseded by the Homes and Hepburns, and the wardenship of the marches was given to Alexander Home. Though outwardly on good terms with James, he treacherously made a treaty with Henry VII. about 1489 or 1491, by which he undertook to govern his relations with James according to instructions from England, and to hand over Hermitage Castle, commanding the pass through Liddesdale into Scotland, on the condition of receiving English estates in compensation. In October 1491 he fortified his castle of Tantallon against James, but was obliged to submit and exchange his Liddesdale estate and Hermitage Castle for the lordship of Bothwell. In 1493 he was again in favour, received various grants of lands, and was made chancellor, which office he retained till 1498. In 1501 he was once more in disgrace and confined to Dumbarton Castle. After the disaster at Flodden in 1513, at which he was not present, but at which he lost his two eldest sons, Angus was appointed one of the counsellors of the queen regent. He died at the close of this year, or in 1514. He was married three times, and by his first wife had four sons and several daughters. His third son, Gavin Douglas, bishop of Dunkeld, is separately noticed.

Archibald Douglas, the 6th earl (*c.* 1489–1557), son of George, master of Douglas, who was killed at Flodden, succeeded on his grandfather's death. In 1509 he had married Margaret (d. 1513), daughter of Patrick Hepburn, 1st earl of Bothwell; and in 1514 he married the queen dowager Margaret of Scotland, widow of James IV., and eldest sister of Henry VIII. By this latter act he stirred up the jealousy of the nobles and the opposition of the French party, and civil war broke out. He was superseded in the government on the arrival of John Stewart, duke of Albany, who was made regent. Angus withdrew to his estates in Forfarshire, while Albany besieged the queen at Stirling and got possession of the royal children; then he joined Margaret after her flight at Morpeth, and on her departure for London returned and made his peace with Albany in 1516. He met her once more at Berwick in June 1517, when Margaret returned to Scotland on Albany's departure in vain hopes of regaining the regency. Meanwhile, during Margaret's absence, Angus had formed a connexion with a daughter of the laird of Traquair. Margaret avenged his neglect of her by refusing to support his claims for power and by secretly trying through Albany to get a divorce. In Edinburgh Angus held his own against the attempts of James Hamilton, 1st earl of Arran, to dislodge him. But the return of Albany in 1521, with whom Margaret now sided against her husband, deprived him of power. The regent took the government into his own hands; Angus was charged with high treason in December, and in March 1522 was sent practically a prisoner to France, whence he succeeded in escaping to London in 1524. He returned to Scotland in November with promises of support from Henry VIII., with whom he made a close alliance. Margaret, however, refused to have anything to do with her husband. On the 23rd, therefore, Angus forced his way into Edinburgh, but was fired upon by Margaret and retreated to Tantallon. He now organized a large party of nobles against Margaret with the support of Henry VIII., and in February 1525 they entered Edinburgh and called a parliament. Angus was made a lord of the articles, was included in the council of regency, bore the king's crown on the opening of the session, and with Archbishop Beaton held the chief power. In March he was appointed lieutenant of the marches, and suppressed the disorder and anarchy on the border. In July the guardianship of the king was entrusted to him for a fixed period till the 1st of November, but he refused at its close to retire, and advancing to Linlithgow put to flight Margaret and his opponents. He now with his followers engrossed all the power, succeeded in gaining over some of his antagonists, including Arran and the Hamiltons, and filled the public offices with Douglases, he himself becoming chancellor. "None that time durst strive against a Douglas nor Douglas's man."[1] The young king James, now fourteen, was far from content under the tutelage of Angus, but he was closely guarded, and several attempts to effect his liberation were prevented, Angus completely defeating Lennox, who had advanced towards Edinburgh with 10,000 men in August, and subsequently taking Stirling. His successes were consummated by a pacification with Beaton, and in 1527 and 1528 he was busy in restoring order through the country. In the latter year, on the 11th of March, Margaret succeeded in obtaining her divorce from Angus, and about the end of the month she and her lover, Henry Stewart, were besieged at Stirling. A few weeks later, however, James succeeded in escaping from Angus's custody, took refuge with Margaret and Arran at Stirling, and immediately proscribed Angus and all the Douglases, forbidding them to come within seven miles of his person. Angus, having fortified himself in Tantallon, was attainted and his lands confiscated. Repeated attempts of James to subdue the fortress failed, and on one occasion Angus captured the royal artillery, but at length it was given up as a condition of the truce between England and Scotland, and in May 1529 Angus took refuge with Henry, obtained a pension and took an oath of allegiance, Henry engaging to make his restoration a condition of peace. Angus had been chiefly guided in his intrigues with England by his brother, Sir George Douglas of Pittendriech (*d.* 1552), master of Angus, a far cleverer diplomatist than himself. His life and lands were also declared forfeit, as were those of his uncle, Archibald Douglas of Kilspindie (*d.* 1535), who had been a friend of James and was known by the nickname of "Greysteel." These took refuge in exile. James avenged himself on such Douglases as lay within his power. Angus's third sister Janet, Lady Glamis, was summoned to answer the charge of communicating with her brothers, and on her failure to appear her estates were forfeited. In 1537 she was tried for conspiring against the king's life. She was found guilty and burnt on the Castle Hill, Edinburgh, on the 17th of July 1537. Her innocence has been generally assumed, but Tytler (*Hist. of Scotland*, iv. pp. 433, 434) considered her guilty. Angus remained in England till 1542, joining in the attacks upon his countrymen on the border, while James refused all demands from Henry VIII. for his restoration, and kept firm to his policy of suppressing and extirpating the Douglas faction. On James V.'s death in 1542 Angus returned to Scotland, with instructions from Henry to accomplish the marriage between Mary and Edward. His forfeiture was rescinded, his estates restored, and he was made a privy councillor and lieutenant-general. In 1543 he negotiated the treaty of peace and marriage, and the same year he himself married Margaret, daughter of Robert, Lord Maxwell. Shortly afterwards strife between Angus and the regent Arran broke out, and in April 1544 Angus was taken prisoner. The same year Lord Hertford's marauding expedition, which did not spare the lands of Angus, made him join the anti-English party. He entered into a bond with Arran and others to maintain their allegiance to Mary, and gave his support to the mission sent to France to offer the latter's hand. In July 1544 he was appointed lieutenant of the south of Scotland, and distinguished himself on the 27th of February 1545 in the victory over the English at Ancrum Moor. He still corresponded with Henry VIII., but nevertheless signed in 1546 the act cancelling the marriage and peace treaty, and on the 10th of September commanded the van in the great defeat of Pinkie, when he again won fame. In 1548 the attempt by Lennox and Wharton to capture him and punish him for his duplicity failed, Angus escaping after his defeat to Edinburgh by sea, and Wharton being driven back to Carlisle. Under the regency of Mary of Lorraine his restless and ambitious character and the number of his retainers gave cause for frequent alarms to the government. On the 31st of August 1547 he resigned his earldom, obtaining a regrant *sibi et suis haeredibus masculis et suis assignatis quibuscumque.* His career was a long struggle for power and for the interests of his family, to which national considerations were completely subordinate. He died in January 1557. By Margaret Tudor he had Margaret, his only surviving legitimate child, who married Matthew, 4th earl of Lennox, and was mother of Lord Darnley. He was succeeded by his nephew David, son of Sir George Douglas of Pittendriech.

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[1] Lindsay of Pitscottie (1814), ii. 314.

Archibald Douglas, 8th earl, and earl of Morton (1555–1588), was the son of David, 7th earl. He succeeded to the title and estates in 1558, being brought up by his uncle, the 4th earl of Morton, a Presbyterian. In 1573 he was made a privy councillor and sheriff of Berwick, in 1574 lieutenant-general of Scotland, in 1577 warden of the west marches and steward of Fife, and in 1578 lieutenant-general of the realm. He gave a strong support to Morton during the attack upon the latter, made a vain attempt to rescue him, and was declared guilty of high treason on the 2nd of June 1581. He now entered into correspondence with the English government for an invasion of Scotland to rescue Morton, and on the latter's execution in June went to London, where he was welcomed by Elizabeth. After the raid of Ruthven in 1582 Angus returned to Scotland and was reconciled to James, but soon afterwards the king shook off the control of the earls of Mar and Gowrie, and Angus was again banished from the court. In 1584 he joined the rebellion of Mar and Glamis, but the movement failed, and the insurgents fled to Berwick. Later they took up their residence at Newcastle, which became a centre of Presbyterianism and of projects against the Scottish government, encouraged by Elizabeth, who regarded the banished lords as friends of the English and antagonists of the French interest. In February 1585 they came to London, and cleared themselves of the accusation of plotting against James's life; a plan was prepared for their restoration and for the overthrow of James Stewart, earl of Arran. In October they invaded Scotland and gained an easy victory over Arran, captured Stirling Castle with the king in November, and secured from James the restoration of their estates and the control of the government. In 1586 Angus was appointed warden of the marches and lieutenant-general on the border, and performed good services in restoring order; but he was unable to overcome the king's hostility to the establishment of Presbyterian government. In January 1586 he was granted the earldom of Morton with the lands entailed upon him by his uncle. He died on the 4th of August 1588. He was succeeded in the earldom by his cousin William, a descendant of the 5th earl. (For the Morton title, see Morton, James Douglas, 4th Earl of.)

William Douglas, 10th earl (*c.* 1554–1611), was the son of William, the 9th earl (1533–1591). He studied at St Andrews University and joined the household of the earl of Morton. Subsequently, while visiting the French court, he became a Roman Catholic, and was in consequence, on his return, disinherited and placed under restraint. Nevertheless he succeeded to his father's titles and estates in 1591, and though in 1592 he was disgraced for his complicity in Lord Bothwell's plot, he was soon liberated and performed useful services as the king's lieutenant in the north of Scotland. In July 1592, however, he was asking for help from Elizabeth in a plot with Erroll and other lords against Sir John Maitland, the chancellor, and protesting his absolute rejection of Spanish offers, while in October he signed the Spanish Blanks (see Erroll, Francis Hay, 9th Earl of) and was imprisoned (on the discovery of the treason) in Edinburgh Castle on his return in January 1593. He succeeded on the 13th in escaping by the help of his countess, joining the earls of Huntly and Erroll in the north. They were offered an act of "oblivion" or "abolition" provided they renounced their religion or quitted Scotland. Declining these conditions they were declared traitors and "forfeited." They remained in rebellion, and in July 1594 an attack made by them on Aberdeen roused James's anger. Huntly and Erroll were subdued by James himself in the north, and Angus failed in an attempt upon Edinburgh in concert with the earl of Bothwell. Subsequently in 1597 they all renounced their religion, declared themselves Presbyterians, and were restored to their estates and honours. Angus was again included in the privy council, and in June 1598 was appointed the king's lieutenant in southern Scotland, in which capacity he showed great zeal and conducted the "Raid of Dumfries," as the campaign against the Johnstones was called. Not long afterwards, Angus, offended at the advancement of Huntly to a marquisate, recanted, resisted all the arguments of the ministers to bring him to a "better mind," and was again excommunicated in 1608. In 1609 he withdrew to France, and died in Paris on the 3rd of March 1611. He was succeeded by his son William, as 11th earl of Angus, afterwards 1st marquis of Douglas (1589–1660). The title is now held by the dukes of Hamilton.

Authorities.—*The Douglas Book*, by Sir W. Fraser (1885); *History of the House of Douglas and Angus*, by D. Hume of Godscroft (1748, legendary in some respects); *History of the House of Douglas*, by Sir H. Maxwell (1902).

ANGUSSOLA or Angussciola, **SOPHONISBA,** Italian portrait painter of the latter half of the 16th century, was born at Cremona about 1535, and died at Palermo in 1626. In 1560, at the invitation of Philip II., she visited the court of Madrid, where her portraits elicited great commendation. Vandyck is said to have declared that he had derived more knowledge of the true principles of his art from her conversation than from any other source. She painted several fine portraits of herself, one of which is at Althorp. A few specimens of her painting are to be seen at Florence and Madrid. She had three sisters, who were also celebrated artists.

ANHALT, a duchy of Germany, and a constituent state of the German empire, formed, in 1863, by the amalgamation of the two duchies Anhalt-Dessau-Cöthen and Anhalt-Bernburg, and comprising all the various Anhalt territories which were sundered apart in 1603. The country now known as Anhalt consists of two larger portions—Eastern and Western Anhalt, separated by the interposition of a part of Prussian Saxony—and of five enclaves surrounded by Prussian territory, viz. Alsleben, Mühlingen, Dornburg, Gödnitz and Tilkerode-Abberode. The eastern and larger portion of the duchy is enclosed by the Prussian government district of Potsdam (in the Prussian province of Brandenburg), and Magdeburg and Merseburg (belonging to the Prussian province of Saxony). The western or smaller portion (the so-called Upper Duchy or Ballenstedt) is also enclosed by the two latter districts and, for a distance of 5 m. on the west, by the duchy of Brunswick. The western portion of the territory is undulating and in the extreme south-west, where it forms part of the Harz range, mountainous, the Ramberg peak attaining a height of 1900 ft. From the Harz the country gently shelves down to the Saale; and between this river and the Elbe there lies a fine tract of fertile country. The portion of the duchy lying east of the Elbe is mostly a flat sandy plain, with extensive pine forests, though interspersed, at intervals, by bog-land and rich pastures. The Elbe is the chief river, and intersecting the eastern portion of the duchy, from east to west, receives at Rosslau the waters of the Mulde. The navigable Saale takes a northerly direction through the western portion of the eastern part of the territory and receives, on the right, the Fuhne and, on the left, the Wipper and the Bode. The climate is on the whole mild, though somewhat inclement in the higher regions to the south-west. The area of the duchy is 906 sq. m., and the population in 1905 amounted to 328,007, a ratio of about 351 to the square mile. The country is divided into the districts of Dessau, Cöthen, Zerbst, Bernburg and Ballenstedt, of which that of Bernburg is the most, and that of Ballenstedt the least, populated. Of the towns, four, viz. Dessau, Bernburg, Cöthen and Zerbst, have populations exceeding 20,000. The inhabitants of the duchy, who mainly belong to the upper Saxon race, are, with the exception of about 12,000 Roman Catholics and 1700 Jews, members of the Evangelical (Union) Church. The supreme ecclesiastical authority is the consistory in Dessau; while a synod of 39 members, elected for six years, assembles at periods to deliberate on internal matters touching the organization of the church. The Roman Catholics are under the bishop of Paderborn. There are within the duchy four grammar schools (gymnasia), five semi-classical and modern schools, a teachers' seminary and four high-grade girls' schools. Of the whole surface, land under tillage amounts to about 60, meadowland to 7 and forest to 25%. The chief crops are corn (especially wheat), fruit, vegetables, potatoes, beet, tobacco, flax, linseed and hops. The land is well cultivated, and the husbandry on the royal domains and the large estates especially so. The pastures on the banks of the Elbe yield cattle of excellent quality. The forests are well stocked with game, such as deer and wild boar, and the open country is well supplied with partridges. The rivers yield abundant fish, salmon (in the Elbe), sturgeon and lampreys. The country is rich in lignite, and salt works are abundant. Of the manufactures of Anhalt, the chief are its sugar factories, distilleries, breweries and chemical works. Commerce is brisk, especially in raw products—corn, cattle, timber or wool. Coal (lignite), guano, oil and bricks are also articles of export. The trade of the country is furthered by its excellent roads, its navigable rivers and its railways (165 m.), which are worked in connexion with the Prussian system. There is a chamber of commerce in Dessau.

Constitution.—The duchy, by virtue of a fundamental law, proclaimed on the 17th of September 1859 and subsequently modified by various decrees, is a constitutional monarchy. The duke, who bears the title of "Highness," wields the executive power while sharing the legislation with the estates. The diet (*Landtag*) is composed of thirty-six members, of whom two are appointed by the duke, eight are representatives of landowners paying the highest taxes, two of the highest assessed members of the commercial and manufacturing classes, fourteen of the other electors of the towns and ten of the rural districts. The representatives are chosen for six years by indirect vote and must have completed their twenty-fifth year. The duke governs through a minister of state, who is the praeses of all the departments—finance, home affairs, education, public worship and statistics. The budget estimates for the financial year 1905–1906 placed the expenditure of the estate at £1,323,437. The public debt amounted on the 30th of June 1904 to £226,300. By convention with Prussia of 1867 the Anhalt troops form a contingent of the Prussian army. Appeal from the lower courts of the duchy lies to the appeal court at Naumburg in Prussian Saxony.

History.—During the 11th century the greater part of Anhalt was included in the duchy of Saxony, and in the 12th century it came under the rule of Albert the Bear, margrave of Brandenburg. Albert was descended from Albert, count of Ballenstedt, whose son Esico (d. 1059 or 1060) appears to have been the first to bear the title of count of Anhalt. Esico's grandson, Otto the Rich, count of Ballenstedt, was the father of Albert the Bear, by whom Anhalt was united with the mark of Brandenburg. When Albert died in 1170, his son Bernard, who received the title of duke of Saxony in 1180, became count of Anhalt. Bernard died in 1212, and Anhalt, separated from Saxony, passed to his son Henry, who in 1218 took the title of prince and was the real founder of the house of Anhalt. On Henry's death in 1252 his three sons partitioned the principality and founded respectively the lines of Aschersleben, Bernburg and Zerbst. The family ruling in Aschersleben became extinct in 1315, and this district was subsequently incorporated with the neighbouring bishopric of Halberstadt. The last prince of the line of Anhalt-Bernburg died in 1468 and his lands were inherited by the princes of the sole remaining line, that of Anhalt-Zerbst. The territory belonging to this branch of the family had been divided in 1396, and after the acquisition of Bernburg Prince George I. made a further partition of Zerbst. Early in the 16th century, however, owing to the death or abdication of several princes, the family had become narrowed down to the two branches of Anhalt-Cöthen and Anhalt-Dessau. Wolfgang, who became prince of Anhalt-Cöthen in 1508, was a stalwart adherent of the Reformation, and after the battle of Mühlberg in 1547 was placed under the ban and deprived of his lands by the emperor Charles V. After the peace of Passau in 1552 he bought back his principality, but as he was childless he surrendered it in 1562 to his kinsmen the princes of Anhalt-Dessau. Ernest I. of Anhalt-Dessau (d. 1516) left three sons, John II., George III., and Joachim, who ruled their lands together for many years, and who, like Prince Wolfgang, favoured the reformed doctrines, which thus became dominant in Anhalt. About 1546 the three brothers divided their principality and founded the lines of Zerbst, Plötzkau and Dessau. This division, however, was only temporary, as the acquisition of Cöthen, and a series of deaths among the ruling princes, enabled Joachim Ernest, a son of John II., to unite the whole of Anhalt under his rule in 1570.

Joachim Ernest died in 1586 and his five sons ruled the land in common until 1603, when Anhalt was again divided, and the lines of Dessau, Bernburg, Plötzkau, Zerbst and Cöthen were refounded. The principality was ravaged during the Thirty Years' War, and in the earlier part of this struggle Christian I. of Anhalt-Bernburg took an important part. In 1635 an arrangement was made by the various princes of Anhalt, which gave a certain authority to the eldest member of the family, who was thus able to represent the principality as a whole. This proceeding was probably due to the necessity of maintaining an appearance of unity in view of the disturbed state of European politics. In 1665 the branch of Anhalt-Cöthen became extinct, and according to a family compact this district was inherited by Lebrecht of Anhalt-Plötzkau, who surrendered Plötzkau to Bernburg, and took the title of prince of Anhalt-Cöthen. In the same year the princes of Anhalt decided that if any branch of the family became extinct its lands should be equally divided between the remaining branches. This arrangement was carried out after the death of Frederick Augustus of Anhalt-Zerbst in 1793, and Zerbst was divided between the three remaining princes. During these years the policy of the different princes was marked, perhaps intentionally, by considerable uniformity. Once or twice Calvinism was favoured by a prince, but in general the house was loyal to the doctrines of Luther. The growth of Prussia provided Anhalt with a formidable neighbour, and the establishment and practice of primogeniture by all branches of the family prevented further divisions of the principality. In 1806 Alexius of Anhalt-Bernburg was created a duke by the emperor Francis II., and after the dissolution of the Empire each of the three princes took this title. Joining the Confederation of the Rhine in 1807, they supported Napoleon until 1813, when they transferred their allegiance to the allies; in 1815 they became members of the Germanic Confederation, and in 1828 joined, somewhat reluctantly, the Prussian *Zollverein.*

Anhalt-Cöthen was ruled without division by a succession of princes, prominent among whom was Louis (d. 1650), who was both a soldier and a scholar; and after the death of Prince Charles at the battle of Semlin in 1789 it passed to his son Augustus II. This prince sought to emulate the changes which had recently been made in France by dividing Cöthen into two departments and introducing the Code Napoléon. Owing to his extravagance he left a large amount of debt to his nephew and successor, Louis II., and on this account the control of the finances was transferred from the prince to the estates. Under Louis's successor Ferdinand, who was a Roman Catholic and brought the Jesuits into Anhalt, the state of the finances grew worse and led to the interference of the king of Prussia and to the appointment of a Prussian official. When the succeeding prince, Henry, died in 1847, this family became extinct, and according to an arrangement between the lines of Anhalt-Dessau and Anhalt-Bernburg, Cöthen was added to Dessau.

Anhalt-Bernburg had been weakened by partitions, but its princes had added several districts to their lands; and in 1812, on the extinction of a cadet branch, it was again united under a single ruler. The feeble rule of Alexander Charles, who became duke in 1834, and the disturbed state of Europe in the following decade, led to considerable unrest, and in 1849 Bernburg was occupied by Prussian troops. A number of abortive attempts were made to change the government, and as Alexander Charles was unlikely to leave any children, Leopold of Anhalt-Dessau took some part in the affairs of Bernburg. Eventually in 1859 a new constitution was established for Bernburg and Dessau jointly, and when Alexander Charles died in 1863 both were united under the rule of Leopold.

Anhalt-Dessau had been divided in 1632, but was quickly reunited; and in 1693 it came under the rule of Leopold I. (see ANHALT-DESSAU, LEOPOLD I., PRINCE OF), the famous soldier who was generally known as the "Old Dessauer." The sons of Leopold's eldest son were excluded from the succession on account of the marriage of their father being morganatic, and the principality passed in 1747 to his second son, Leopold II. The unrest of 1848 spread to Dessau, and led to the interference of the Prussians and to the establishment of the new constitution in 1859. Leopold IV., who reigned from 1817 to 1871, had the satisfaction in 1863 of reuniting the whole of Anhalt under his rule. He took the title of duke of Anhalt, summoned one *Landtag* for the whole of the duchy, and in 1866 fought for Prussia against Austria. Subsequently a quarrel over the possession of the ducal estates between the duke and the *Landtag* broke the peace of the duchy, but this was settled in 1872. In 1871 Anhalt became a state of the German Empire. Leopold IV. was followed by his son Frederick I., and on the death of this prince in 1904 his son Frederick II. became duke of Anhalt.

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ANHALT-DESSAU, LEOPOLD I., PRINCE OF (1676–1747), called the "Old Dessauer" (Alter Dessauer), general field marshal in the Prussian army, was the only surviving son of John George II., prince of Anhalt-Dessau, and was born on the 3rd of July 1676 at Dessau. From his earliest youth he was devoted to the profession of arms, for which he educated himself physically and mentally. He became colonel of a Prussian regiment in 1693, and in the same year his father's death placed him at the head of his own principality; thereafter, during the whole of his long life, he performed the duties of a sovereign prince and a Prussian officer. His first campaign was that of 1695 in the Netherlands, in which he was present at the siege of Namur. He remained in the field to the end of the war of 1697, the affairs of the principality being managed chiefly by his mother, Princess Henriette Catherine of Orange. In 1698 he married Anna Luise Föse, an apothecary's daughter of Dessau, in spite of his mother's long and earnest opposition, and subsequently he procured for her the rank of a princess from the emperor (1701). Their married life was long and happy, and the princess acquired an influence over the stern nature of her husband which she never ceased to exert on behalf of his subjects, and after the death of Leopold's mother she performed the duties of regent when he was absent on campaign. Often, too, she accompanied him into the field. Leopold's career as a soldier in important commands begins with the outbreak of the War of the Spanish Succession. He had made many improvements in the Prussian army, notably the introduction of the iron ramrod about 1700, and he now took the field at the head of a Prussian corps on the Rhine, serving at the sieges of Kaiserswerth and Venlo. In the following year (1703), having obtained the rank of lieutenant-general, Leopold took part in the siege of Bonn and distinguished himself very greatly in the battle of Höchstädt, in which the Austrians and their allies were defeated by the French under Marshal Villars (September 20, 1703). In the campaign of 1704 the Prussian contingent served under Prince Louis of Baden and subsequently under Eugene, and Leopold himself won great glory by his conduct at Blenheim. In 1705 he was sent with a Prussian corps to join Prince Eugene in Italy, and on the 16th of August he displayed his bravery at the hard-fought battle of Cassano. In the following year he added to his reputation in the battle of Turin, where he was the first to enter the hostile entrenchments (September 7, 1706). He served in one more campaign in Italy, and then went with Eugene to join Marlborough in the Netherlands, being present in 1709 at the siege of Tournay and the battle of Malplaquet. In 1710 he succeeded to the command of the whole Prussian contingent at the front, and in 1712, at the particular desire of the crown prince, Frederick William, who had served with him as a volunteer, he was made a general field marshal. Shortly before this he had executed a *coup de main* on the castle of Mörs, which was held by the Dutch in defiance of the claims of the king of Prussia to the possession. The operation was effected with absolute precision and the castle was seized without a shot being fired. In the earlier part of the reign of Frederick William I., the prince of Dessau was one of the most influential members of the Prussian governing circle. In the war with Sweden (1715) he accompanied the king to the front, commanded an army of 40,000 men, and met and defeated Charles XII. in a severe battle on the island of Rügen (November 16). His conduct of the siege of Stralsund which followed was equally skilful, and the great results of the war to Prussia were largely to be attributed to his leadership in the campaign. In the years of peace, and especially after a court quarrel (1725) and duel with General von Grumbkow, he devoted himself to the training of the Prussian army. The reputation it had gained in the wars of 1675 to 1715, though good, gave no hint of its coming glory, and it was even in 1740 accounted one of the minor armies of Europe. That it proved, when put to the test, to be by far the best military force existing, may be taken as the summary result of Leopold's work. The "Old Dessauer" was one of the sternest disciplinarians in an age of stern discipline, and the technical training of the infantry, under his hand, made them superior to all others in the proportion of five to three (see AUSTRIAN SUCCESSION, WAR OF THE). He was essentially an infantry soldier; in his time artillery did not decide battles, but he suffered the cavalry service, in which he felt little interest, to be comparatively neglected, with results which appeared at Mollwitz. Frederick the Great formed the cavalry of Hohenfriedberg and Leuthen himself, but had it not been for the incomparable infantry trained by the "Old Dessauer" he would never have had the opportunity of doing so. Thus Leopold, heartily supported by Frederick William, who was himself called the great drill-master of Europe, turned to good account the twenty years following the peace with Sweden. During this time two incidents in his career call for special mention: first, his intervention in the case of the crown prince Frederick, who was condemned to death for desertion, and his continued and finally successful efforts to secure Frederick's reinstatement in the Prussian army; and secondly, his part in the War of the Polish Succession on the Rhine, where he served under his old chief Eugene and held the office of field marshal of the Empire.

With the death of Frederick William in 1740, Frederick succeeded to the Prussian throne, and a few months later took place the invasion and conquest of Silesia, the first act in the long Silesian wars and the test of the work of the "Old Dessauer's" lifetime. The prince himself was not often employed in the king's own army, though his sons held high commands under Frederick. The king, indeed, found Leopold, who was reputed, since the death of Eugene, the greatest of living soldiers, somewhat difficult to manage, and the prince spent most of the campaigning years up to 1745 in command of an army of observation on the Saxon frontier. Early in that year his wife died. He was now over seventy, but his last campaign was destined to be the most brilliant of his long career. A combined effort of the Austrians and Saxons to retrieve the disasters of the summer by a winter campaign towards Berlin itself led to a hurried concentration of the Prussians. Frederick from Silesia checked the Austrian main army and hastened towards Dresden. But before he had arrived, Leopold, no longer in observation, had decided the war by his overwhelming victory of Kesselsdorf (December 14, 1745). It was his habit to pray before battle, for he was a devout Lutheran. On this last field his words were, "O Lord God, let me not be disgraced in my old days. Or if Thou wilt not help me, do not help these scoundrels, but leave us to try it ourselves." With this great victory Leopold's career ended. He retired from active service, and the short remainder of his life was spent at Dessau, where he died on the 7th of April 1747.

He was succeeded by his son, Leopold II., Maximilian, Prince of Anhalt-Dessau (1700–1751), who was one of the best of Frederick's subordinate generals, and especially distinguished himself by the capture of Glogau in 1741, and his generalship at Mollwitz, Chotusitz (where he was made general field marshal on the field of battle), Hohenfriedberg and Soor.

Another son, Prince Dietrich of Anhalt-Dessau (d. 1769), was also a distinguished Prussian general.

But the most famous of the sons was Prince Moritz of Anhalt-Dessau (1712–1760), who entered the Prussian army in 1725, saw his first service as a volunteer in the War of the Polish Succession (1734–35), and in the latter years of the reign of Frederick William held important commands. In the Silesian wars of Frederick II., Moritz, the ablest of the old Leopold's sons, greatly distinguished himself, especially at the battle of Hohenfriedberg (Striegau), 1745. At Kesselsdorf it was the wing led by the young Prince Moritz that carried the Austrian lines and won the "Old Dessauer's" last fight. In the years of peace preceding the Seven Years' War, Moritz was employed by Frederick the Great in the colonizing of the waste lands of Pomerania and the Oder Valley. When the king took the field again in 1756, Moritz was in command of one of the columns which hemmed in the Saxon army in the lines of Pirna, and he received the surrender of Rutowski's force after the failure of the Austrian attempts at relief. Next year Moritz underwent changes of fortune. At the battle of Kolin he led the left wing, which, through a misunderstanding with the king, was prematurely drawn into action and failed hopelessly. In the disastrous days which followed, Moritz was under the cloud of Frederick's displeasure. But the glorious victory of Leuthen (December 5, 1757) put an end to this. At the close of that day, Frederick rode down the lines and called out to General Prince Moritz, "I congratulate you, Herr Feldmarschall!" At Zorndorf he again distinguished himself, but at the surprise of Hochkirch fell wounded into the hands of the Austrians. Two years later, soon after his release, his wound proved mortal.

Authorities.—Varnhagen von Ense, *Preuss. biographische Denkmale*, vol. ii. (3rd ed., 1872); *Militär Konversations-Lexikon*, vol. ii. (Leipzig, 1833); Anon., *Fürst Leopold I. von Anhalt und seine Söhne* (Dessau, 1852); G. Pauli, *Leben grosser Helden*, vol. vi.; von Orlich, *Prinz Moritz von Anhalt-Dessau* (Berlin, 1842); Crousatz, *Militärische Denkwürdigkeiten des Fürsten Leopold von Anhalt-Dessau* (1875); supplements to *Militär Wochenblatt* (1878 and 1889); Siebigk, *Selbstbiographie des Fürsten Leopold von Anhalt-Dessau* (Dessau, 1860 and 1876); Hosäus, *Zur Biographie des Fürsten Leopold von Anhalt-Dessau* (Dessau, 1876); Würdig, *Des Alten Dessauers Leben und Taten* (3rd ed., Dessau, 1903); *Briefe König Friedrich Wilhelms I. an den Fürsten L.* (Berlin, 1905).

ANHYDRITE, a mineral, differing chemically from the more commonly occurring gypsum in containing no water of crystallization, being anhydrous calcium sulphate, $CaSO_4$. It crystallizes in the orthorhombic system, and has three directions of perfect cleavage parallel to the three planes of symmetry. It is not isomorphous with the orthorhombic barium and strontium sulphates, as might be expected from the chemical formulae. Distinctly developed crystals are somewhat rare, the mineral usually presenting the form of cleavage masses. The hardness is 3½ and the specific gravity 2·9. The colour is white, sometimes greyish, bluish or reddish. On the best developed of the three cleavages the lustre is pearly, on other surfaces it is of the ordinary vitreous type.

Anhydrite is most frequently found in salt deposits with gypsum; it was, for instance, first discovered, in 1794, in a salt mine near Hall in Tirol. Other localities which produce typical specimens of the mineral, and where the mode of occurrence is the same, are Stassfurt in Germany, Aussee in Styria and Bex in Switzerland. At all these places it is only met with at some depth; nearer the surface of the ground it has been altered to gypsum owing to absorption of water.

From an aqueous solution calcium sulphate is deposited as crystals of gypsum, but when the solution contains an excess of sodium or potassium chloride anhydrite is deposited. This is one of the several methods by which the mineral has been prepared artificially, and is identical with its mode of origin in nature, the mineral having crystallized out in salt basins.

The name anhydrite was given by A. G. Werner in 1804, because of the absence of water, as contrasted with the presence of water in gypsum. Other names for the species are muriacite and karstenite; the former, an earlier name, being given under the impression that the substance was a chloride (muriate). A peculiar variety occurring as contorted concretionary masses is known as tripe-stone, and a scaly granular variety, from Vulpino, near Bergamo, in Lombardy, as vulpinite; the latter is cut and polished for ornamental purposes. (L. J. S.)

ANI (anc. *Abnicum*), an ancient and ruined Armenian city, in Russian Transcaucasia, government Erivan, situated at an altitude of 4390 ft., between the Arpa-chai (*Harpasus*) and a deep ravine. In 961 it became the capital of the Bagratid kings of Armenia, and when yielded to the Byzantine emperor (1046) it was a populous city, known traditionally as the "city with the 1001 churches." It was taken eighteen years later by the Seljuk Turks, five times by the Georgians between 1125 and 1209, in 1239 by the Mongols, and its ruin was completed by an earthquake in 1319. It is still surrounded by a double wall partly in ruins, and amongst the remains are a "patriarchal" church finished in 1010, two other churches, both of the 11th century, a fourth built in 1215, and a palace of large size.

See Brosset, *Les Ruines d'Ani* (1860–1861).

ANICETUS, pope *c.* 154–167. It was during his pontificate that St Polycarp visited the Roman Church.

ANICHINI, LUIGI, Italian engraver of seals and medals, a native of Ferrara, lived at Venice about 1550. Michelangelo pronounced his "Interview of Alexander the Great with the high-priest at Jerusalem," "the perfection of the art." His medals of Henry II. of France and Pope Paul III. are greatly valued.

ANILINE, Phenylamine, or Aminobenzene, $(C_6H_5NH_2)$, an organic base first obtained from the destructive distillation of indigo in 1826 by O. Unverdorben (*Pogg. Ann.*, 1826, 8, p. 397), who named it crystalline. In 1834, F. Runge (*Pogg. Ann.*, 1834, 31, p. 65; 32, p. 331) isolated from coal-tar a substance which produced a beautiful blue colour on treatment with chloride of lime; this he named kyanol or cyanol. In 1841, C. J. Fritzsche showed that by treating indigo with caustic potash it yielded an oil, which he named aniline, from the specific name of one of the indigo-yielding plants, *Indigofera anil*, *anil* being derived from the Sanskrit *nīla*, dark-blue, and *nīlā*, the indigo plant. About the same time N. N. Zinin found that on reducing nitrobenzene, a base was formed which he named benzidam. A. W. von Hofmann investigated these variously prepared substances, and proved them to be identical, and thenceforth they took their place as one body, under the name aniline or phenylamine. Pure aniline is a basic substance of an oily consistence, colourless, melting at −8° and boiling at 184° C. On exposure to air it absorbs oxygen and resinifies, becoming deep brown in colour; it ignites readily, burning with a large smoky flame. It possesses a somewhat pleasant vinous odour and a burning aromatic taste; it is a highly acrid poison.

Aniline is a weak base and forms salts with the mineral acids. Aniline hydrochloride forms large colourless tables, which become greenish on exposure; it is the "aniline salt" of commerce. The sulphate forms beautiful white plates. Although aniline is but feebly basic, it precipitates zinc, aluminium and ferric salts, and on warming expels ammonia from its salts. Aniline combines directly with alkyl iodides to form secondary and tertiary amines; boiled with carbon disulphide it gives sulphocarbanilide (diphenyl thio-urea), $CS(NHC_6H_5)_2$, which may be decomposed into phenyl mustard-oil, C_6H_5CNS, and triphenyl guanidine, $C_6H_5N:C(NHC_6H_5)_2$. Sulphuric acid at 180° gives sulphanilic acid, $NH_2 \cdot C_6H_4 \cdot SO_3H$. Anilides, compounds in which the amino group is substituted by an acid radical, are prepared by heating aniline with certain acids; antifebrin or acetanilide is thus obtained from acetic acid and aniline. The oxidation of aniline has been carefully investigated. In alkaline solution azobenzene results, while arsenic acid produces the violet-colouring matter violaniline. Chromic acid converts it into quinone, while chlorates, in the presence of certain metallic salts (especially of vanadium), give aniline black. Hydrochloric acid and potassium chlorate give chloranil. Potassium permanganate in neutral solution oxidizes it to nitrobenzene, in alkaline solution to azobenzene, ammonia and oxalic acid, in acid solution to aniline black. Hypochlorous acid gives para-amino phenol and para-amino diphenylamine (E. Bamberger, *Ber.*, 1898, 31, p. 1522).

The great commercial value of aniline is due to the readiness with which it yields, directly or indirectly, valuable dyestuffs. The discovery of mauve in 1858 by Sir W. H. Perkin was the first of a series of dyestuffs which are now to be numbered by hundreds. Reference should be made to the articles DYEING, FUCHSINE, SAFRANINE, INDULINES, for more details on this subject. In addition to dyestuffs, it is a starting-product for the manufacture of many drugs, such as antipyrine, antifebrin, &c. Aniline is manufactured by reducing nitrobenzene with iron and hydrochloric acid and steam-distilling the product. The purity of the product depends upon the quality of the benzene from which the nitrobenzene was prepared. In commerce three brands of aniline are distinguished—aniline oil for blue, which is pure aniline; aniline oil for red, a mixture of equimolecular quantities of aniline and ortho- and para-toluidines; and aniline oil for safranine, which contains aniline and ortho-toluidine, and is obtained from the distillate (*échappés*) of the fuchsine fusion. Monomethyl and dimethyl aniline are colourless liquids prepared by heating aniline, aniline hydrochloride and methyl alcohol in an autoclave at 220°. They are of great importance in the colour industry. Monomethyl aniline boils at 193–195°; dimethyl aniline at 192°.

ANIMAL (Lat. *animalis*, from *anima*, breath, soul), a term first used as a noun or adjective to denote a living thing, but now used to designate one branch of living things as opposed to the other branch known as plants. Until the discovery of protoplasm, and the series of investigations by which it was established that the cell was a fundamental structure essentially alike in both animals and plants (see CYTOLOGY), there was a vague belief that plants, if they could really be regarded as animated creatures, exhibited at the most a lower grade of life. We know now that in so far as life and living matter can be investigated by science, animals and plants cannot be described as being alive in different degrees. Animals and plants are extremely closely related organisms, alike in their fundamental characters, and each grading into organisms which possess some of the characters of both classes or kingdoms (see PROTISTA). The actual boundaries between animals and plants are artificial; they are rather due to the ingenious analysis of the systematist than actually resident in objective nature. The most obvious distinction is that the animal cell-wall is either absent or composed of a nitrogenous material, whereas the plant cell-wall is composed of a carbohydrate material—cellulose. The animal and the plant alike require food to repair waste, to build up new tissue and to provide material which, by chemical change, may liberate the energy which appears in the processes of life. The food is alike in both cases; it consists of water, certain inorganic salts, carbohydrate material and proteid material. Both animals and plants take their water and inorganic salts directly as such. The animal cell can absorb its carbohydrate and proteid food only in the form of carbohydrate and proteid; it is dependent, in fact, on the pre-existence of these organic substances, themselves the products of living matter, and in this respect the animal is essentially a parasite on existing animal and plant life. The plant, on the other hand, if it be a green plant, containing chlorophyll, is capable, in the presence of light, of building up both carbohydrate material and proteid material from inorganic salts; if it be a fungus, devoid of chlorophyll, whilst it is dependent on pre-existing carbohydrate material and is capable of absorbing, like an animal, proteid material as such, it is able to build up its proteid food from material chemically simpler than proteid. On these basal differences are founded most of the characters which make the higher forms of animal and plant life so different. The animal body, if it be composed of many cells, follows a different architectural plan; the compact nature of its food, and the yielding nature of its cell-walls, result in a form of structure consisting essentially of tubular or spherical masses of cells arranged concentrically round the food-cavity. The relatively rigid nature of the plant cell-wall, and the attenuated inorganic food-supply of plants, make possible and necessary a form of growth in which the greatest surface is exposed to the exterior, and thus the plant body is composed of flattened laminae and elongated branching growths. The distinctions between animals and plants are in fact obviously secondary and adaptive, and point clearly towards the conception of a common origin for the two forms of life, a conception which is made still more probable by the existence of many low forms in which the primary differences between animals and plants fade out.

An animal may be defined as a living organism, the protoplasm of which does not secrete a cellulose cell-wall, and which requires for its existence proteid material obtained from the living or dead bodies of existing plants or animals. The common use of the word animal as the equivalent of mammal, as opposed to bird or reptile or fish, is erroneous.

The classification of the animal kingdom is dealt with in the article ZOOLOGY. (P. C. M.)

ANIMAL HEAT. Under this heading is discussed the physiology of the temperature of the animal body.

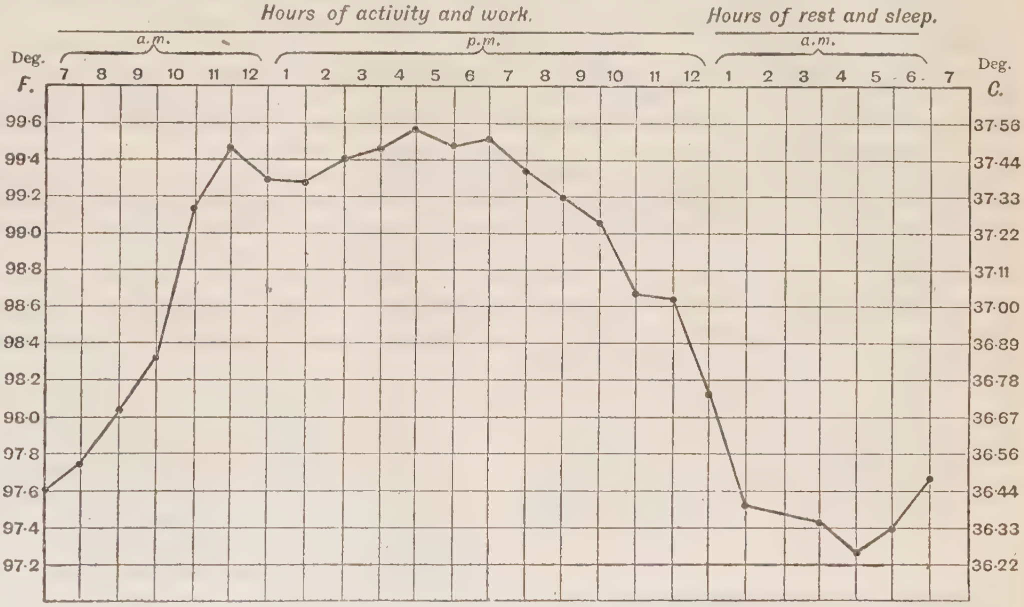
The higher animals have within their bodies certain sources of heat, and also some mechanism by means of which both the production and loss of heat can be regulated. This is conclusively shown by the fact that both in summer and winter their mean temperature remains the same. But it was not until the introduction of thermometers that any exact data on the temperature of animals could be obtained. It was then found that local differences were present, since heat production and heat loss vary considerably in different parts of the body, although the circulation of the blood tends to bring about a mean temperature of the internal parts. Hence it is important to determine the temperature of those parts which most nearly approaches to that of the internal organs. Also for such results to be comparable they must be made in the same situation. The rectum gives most accurately the temperature of internal parts, or in women and some animals the vagina, uterus or bladder.

Occasionally that of the urine as it leaves the urethra may be of use. More usually the temperature is taken in the mouth, axilla or groin.

Warm and Cold Blooded Animals.—By numerous observations upon men and animals, John Hunter showed that the essential difference between the so-called warm-blooded and cold-blooded animals lies in the constancy of the temperature of the former, and the variability of the temperature of the latter. Those animals high in the scale of evolution, as birds and mammals, have a high temperature almost constant and independent of that of the surrounding air, whereas among the lower animals there is much variation of body temperature, dependent entirely on their surroundings. There are, however, certain mammals which are exceptions, being warm-blooded during the summer, but cold-blooded during the winter when they hibernate; such are the hedgehog, bat and dormouse. John Hunter suggested that two groups should be known as "animals of permanent heat at all atmospheres" and "animals of a heat variable with every atmosphere," but later Bergmann suggested that they should be known as "homoiothermic" and "poikilothermic" animals. But it must be remembered there is no hard and fast line between the two groups. Also, from work recently done by J. O. Wakelin Barratt, it has been shown that under certain pathological conditions a warm-blooded (homoiothermic) animal may become for a time cold-blooded (poikilothermic). He has shown conclusively that this condition exists in rabbits suffering from rabies during the last period of their life, the rectal temperature being then within a few degrees of the room temperature and varying with it. He explains this condition by the assumption that the nervous mechanism of heat regulation has become paralysed. The respiration and heart-rate being also retarded during this period, the resemblance to the condition of hibernation is considerable. Again, Sutherland Simpson has shown that during deep anaesthesia a warm-blooded animal tends to take the same temperature as that of its environment. He demonstrated that when a monkey is kept deeply anaesthetized with ether and is placed in a cold chamber, its temperature gradually falls, and that when it has reached a sufficiently low point (about 25° C. in the monkey), the employment of an anaesthetic is no longer necessary, the animal then being insensible to pain and incapable of being roused by any form of stimulus; it is, in fact, narcotized by cold, and is in a state of what may be called "artificial hibernation." Once again this is explained by the fact that the heat-regulating mechanism has been interfered with. Similar results have been obtained from experiments on cats. These facts—with many others—tend to show that the power of maintaining a constant temperature has been a gradual development, as Darwin's theory of evolution suggests, and that anything that interferes with the due working of the higher nerve-centres puts the animal back again, for the time being, on to a lower plane of evolution.

Variations in the Temperature of Man and some other Animals.—As stated above, the temperature of warm-blooded animals is maintained with but slight variation. In health under normal conditions the temperature of man varies between 36° C. and 38° C., or if the thermometer be placed in the axilla, between 36·25° C. and 37·5° C. In the mouth the reading would be from ·25° C. to 1·5° C. higher than this; and in the rectum some ·9° C. higher still. The temperature of infants and young children has a much greater range than this, and is susceptible of wide divergencies from comparatively slight causes.

Of the lower warm-blooded animals, there are some that appear to be cold-blooded at birth. Kittens, rabbits and puppies, if removed from their surroundings shortly after birth, lose their body heat until their temperature has fallen to within a few degrees of that of the surrounding air. But such animals are at birth blind, helpless and in some cases naked. Animals who are born when in a condition of greater development can maintain their temperature fairly constant. In strong, healthy infants a day or two old the temperature rises slightly, but in that of weakly, ill-developed children it either remains stationary or falls. The cause of the variable temperature in infants and young immature animals is the imperfect development of the nervous regulating mechanism.



The average temperature falls slightly from infancy to puberty and again from puberty to middle age, but after that stage is passed the temperature begins to rise again, and by about the eightieth year is as high as in infancy. A diurnal variation has been observed dependent on the periods of rest and activity, the maximum ranging from 10 A.M. to 6 P.M., the minimum from 11 P.M. to 3 A.M. Sutherland Simpson and J. J. Galbraith have recently done much work on this subject. In their first experiments they showed that in a monkey there is a well-marked and regular diurnal variation of the body temperature, and that by reversing the daily routine this diurnal variation is also reversed. The diurnal temperature curve follows the periods of rest and activity, and is not dependent on the incidence of day and night; in monkeys which are active during the night and resting during the day, the body temperature is highest at night and lowest through the day. They then made observations on the temperature of animals and birds of nocturnal habit, where the periods of rest and activity are naturally the reverse of the ordinary through habit and not from outside interference. They found that in nocturnal birds the temperature is highest during the natural period of activity (night) and lowest during the period of rest (day), but that the mean temperature is lower and the range less than in diurnal birds of the same size. That the temperature curve of diurnal birds is essentially similar to that of man and other homoiothermal animals, except that the maximum occurs earlier in the afternoon and the minimum earlier in the morning. Also that the curves obtained from rabbit, guinea-pig and dog were quite similar to those from man. The mean temperature of the female was higher than that of the male in all the species examined whose sex had been determined.

Meals sometimes cause a slight elevation, sometimes a slight depression—alcohol seems always to produce a fall. Exercise and variations of external temperature within ordinary limits cause very slight change, as there are many compensating influences at work, which are discussed later. Even from very active exercise the temperature does not rise more than one degree, and if carried to exhaustion a fall is observed. In travelling from very cold to very hot regions a variation of less than one degree occurs, and the temperature of those living in the tropics is practically identical with those dwelling in the Arctic regions.

Limits compatible with Life.—There are limits both of heat and cold that a warm-blooded animal can bear, and other far wider limits that a cold-blooded animal may endure and yet live. The effect of too extreme a cold is to lessen metabolism, and hence to lessen the production of heat. Both katabolic and anabolic changes share in the depression, and though less energy is used up, still less energy is generated. This diminished metabolism tells first on the central nervous system, especially the brain and those parts concerned in consciousness. Both heart-beat and respiration-number become diminished, drowsiness supervenes, becoming steadily deeper until it passes into the sleep of death. Occasionally, however, convulsions may set in towards the end, and a death somewhat similar to that of asphyxia takes place. In some recent experiments on cats performed by Sutherland Simpson and Percy T. Herring, they found them unable to survive when the rectal temperature was reduced below 16° C. At this low temperature respiration became increasingly feeble, the heart-impulse usually continued after respiration had ceased, the beats becoming very irregular, apparently ceasing, then beginning again. Death appeared to be mainly due to asphyxia, and the only certain sign that it had taken place was the loss of knee jerks. On the other hand, too high a temperature hurries on the metabolism of the various tissues at such a rate that their capital is soon exhausted. Blood that is too warm produces dyspnoea and soon exhausts the metabolic capital of the respiratory centre. The rate of the heart is quickened, the beats then become irregular and finally cease. The central nervous system is also profoundly affected, consciousness may be lost, and the patient falls into a comatose condition, or delirium and convulsions may set in. All these changes can be watched in any patient suffering from an acute fever. The lower limit of temperature that man can endure depends on many things, but no one can survive a temperature of 45° C. (113° F.) or above for very long. Mammalian muscle becomes rigid with heat rigor at about 50° C., and obviously should this temperature be reached the sudden rigidity of the whole body would render life impossible. H. M. Vernon has recently done work on the death temperature and paralysis temperature (temperature of heat rigor) of various animals. He found that animals of the same class of the animal kingdom showed very similar temperature values, those from the Amphibia examined being 38·5° C., Fishes 39°, Reptilia 45°, and various Molluscs 46°. Also in the case of Pelagic animals he showed a relation between death temperature and the quantity of solid constituents of the body, *Cestus* having lowest death temperature and least amount of solids in its body. But in the higher animals his experiments tend to show that there is greater variation in both the chemical and physical characters of the protoplasm, and hence greater variation in the extreme temperature compatible with life.

Regulation of Temperature.—The heat of the body is generated by the chemical changes—those of oxidation—undergone not by any particular substance or in any one place, but by the tissues at large. Wherever destructive metabolism (katabolism) is going on, heat is being set free. When a muscle does work it also gives rise to heat, and if this is estimated it can be shown that the muscles alone during their contractions provide far more heat than the whole amount given out by the body. Also it must be remembered that the heart—also a muscle,—never resting, does in the 24 hours no inconsiderable amount of work, and hence must give rise to no inconsiderable amount of heat. From this it is clear that the larger proportion of total heat of the body is supplied by the muscles. These are essentially the "thermogenic tissues." Next to the muscles as heat generators come the various secretory glands, especially the liver, which appears never to rest in this respect. The brain also must be a source of heat, since its temperature is higher than that of the arterial blood with which it is supplied. Also a certain amount of heat is produced by the changes which the food undergoes in the alimentary canal before it really enters the body. But heat while continually being produced is also continually being lost by the skin, lungs, urine and faeces. And it is by the constant modification of these two factors, (1) heat production and (2) heat loss, that the constant temperature of a warm-blooded animal is maintained. Heat is lost to the body through the faeces and urine, respiration, conduction and radiation from the skin, and by evaporation of perspiration. The following are approximately the relative amounts of heat lost through these various channels (different authorities give somewhat different figures):—faeces and urine about 3, respiration about 20, skin (conduction, radiation and evaporation) about 77. Hence it is clear the chief means of loss are the skin and the lungs. The more air that passes in and out of the lungs in a given time, the greater the loss of heat. And in such animals as the dog, who do not perspire easily by the skin, respiration becomes far more important.

But for man the great heat regulator is undoubtedly the skin, which regulates heat loss by its vasomotor mechanism, and also by the nervous mechanism of perspiration. Dilatation of the cutaneous vascular areas leads to a larger flow of blood through the skin, and so tends to cool the body, and *vice versa*. Also the special nerves of perspiration can increase or lessen heat loss by promoting or diminishing the secretions of the skin. There are greater difficulties in the exact determination in the amount of heat produced, but there are certain well-known facts in connexion with it. A larger living body naturally produces more heat than a smaller one of the same nature, but the surface of the smaller, being greater in proportion to its bulk than that of the larger, loses heat at a more rapid rate. Hence to maintain the same constant bodily temperature, the smaller animal must produce a relatively larger amount of heat. And in the struggle for existence this has become so.

Food temporarily increases the production of heat, the rate of production steadily rising after a meal until a maximum is reached from about the 6th to the 9th hour. If sugar be included in the meal the maximum is reached earlier; if mainly fat, later. Muscular work very largely increases the production of heat, and hence the more active the body the greater the production of heat.

But all the arrangements in the animal economy for the production and loss of heat are themselves probably regulated by the central nervous system, there being a thermogenic centre—situated above the spinal cord, and according to some observers in the optic thalamus.

Authorities.—M. S. Pembrey, "Animal Heat," in Schafer's *Text-book of Physiology* (1898); C. R. Richet, "Chaleur," in *Dictionnaire de physiologie* (Paris, 1898); Hale White, Croonian Lectures, *Lancet*, London, 1897; Pembrey and Nicol, *Journal of Physiology*, vol. xxiii., 1898–1899; H. M. Vernon, "Heat Rigor," *Journal of Physiology*, xxiv., 1899; H. M. Vernon, "Death Temperatures," *Journal of Physiology*, xxv., 1899; F. C. Eve, "Temperature on Nerve Cells," *Journal of Physiology*, xxvi., 1900; G. Weiss, *Comptes Rendus, Soc. de Biol.*, lii., 1900; Swale Vincent and Thomas Lewis, "Heat Rigor of Muscle," *Journal of Physiology*, 1901; Sutherland Simpson and Percy Herring, "Cold and Reflex Action," *Journal of Physiology*, 1905; Sutherland Simpson, *Proceedings of Physiological Soc.*, July 19, 1902; Sutherland Simpson and J. J. Galbraith, "Diurnal Variation of Body Temperature," *Journal of Physiology*, 1905; *Transactions Royal Society Edinburgh*, 1905; *Proc. Physiological Society*, p. xx., 1903; A. E. Boycott and J. S. Haldane, *Effects of High Temperatures on Man*.

ANIMAL WORSHIP, an ill-defined term, covering facts ranging from the worship of the real divine animal, commonly conceived as a "god-body," at one end of the scale, to respect for the bones of a slain animal or even the use of a respectful name for the living animal at the other end. Added to this, in many works on the subject we find reliance placed, especially for the African facts, on reports of travellers who were merely visitors to the regions on which they wrote.

Classification.—Animal cults may be classified in two ways: (A) according to their outward form; (B) according to their inward meaning, which may of course undergo transformations.

(A) There are two broad divisions: (1) all animals of a given species are sacred, perhaps owing to the impossibility of distinguishing the sacred few from the profane crowd; (2) one or a fixed number of a species are sacred. It is probable that the first of these forms is the primary one and the second in most cases a development from it due to (i.) the influence of other individual cults, (ii.) anthropomorphic tendencies, (iii.) the influence of chieftainship, hereditary and otherwise, (iv.) annual sacrifice of the sacred animal and mystical ideas connected therewith, (v.) syncretism, due either to unity of function or to a philosophic unification, (vi.) the desire to do honour to the species in the person of one of its members, and possibly other less easily traceable causes.

(B) Treating cults according to their meaning, which is not necessarily identical with the cause which first led to the deification of the animal in question, we can classify them under ten specific heads: (i.) pastoral cults; (ii.) hunting cults; (iii.) cults of dangerous or noxious animals; (iv.) cults of animals regarded as human souls or their embodiment; (v.) totemistic cults; (vi.) cults of secret societies, and individual cults of tutelary animals; (vii.) cults of tree and vegetation spirits; (viii.) cults of ominous animals; (ix.) cults, probably derivative, of animals associated with certain deities; (x.) cults of animals used in magic.

(i.) The pastoral type falls into two sub-types, in which the species (*a*) is spared and (*b*) sometimes receives special honour at intervals in the person of an individual. (See *Cattle*, *Buffalo*, below.)

(ii.) In hunting cults the species is habitually killed, but (*a*) occasionally honoured in the person of a single individual, or (*b*) each slaughtered animal receives divine honours. (See *Bear*, below.)

(iii.) The cult of dangerous animals is due (*a*) to the fear that the soul of the slain beast may take vengeance on the hunter, (*b*) to a desire to placate the rest of the species. (See *Leopard*, below.)

(iv.) Animals are frequently regarded as the abode, temporary or permanent, of the souls of the dead, sometimes as the actual souls of the dead. Respect for them is due to two main reasons: (*a*) the kinsmen of the dead desire to preserve the goodwill of their dead relatives; (*b*) they wish at the same time to secure that their kinsmen are not molested and caused to undergo unnecessary suffering. (See *Serpent*, below.)

(v.) One of the most widely found modes of showing respect to animals is known as totemism (see TOTEM AND TOTEMISM), but except in decadent forms there is but little positive worship; in Central Australia, however, the rites of the Wollunqua totem group are directed towards placating this mythical animal, and cannot be termed anything but religious ceremonies.

(vi.) In secret societies we find bodies of men grouped together with a single tutelary animal; the individual, in the same way, acquires the nagual or individual totem, sometimes by ceremonies of the nature of the bloodbond.

(vii.) Spirits of vegetation in ancient and modern Europe and in China are conceived in animal form. (See *Goat*, below.)

(viii.) The ominous animal or bird may develop into a deity. (See *Hawk*, below.)

(ix.) It is commonly assumed that the animals associated with certain deities are sacred because the god was originally theriomorphic; this is doubtless the case in certain instances; but Apollo Smintheus, Dionysus Bassareus and other examples seem to show that the god may have been appealed to for help and thus become associated with the animals from whom he protected the crops, &c.

(x.) The use of animals in magic may sometimes give rise to a kind of respect for them, but this is of a negative nature. See, however, articles by Preuss in *Globus*, vol. lxvii., in which he maintains that animals of magical influence are elevated into divinities.

Animal cults.

Bear.—The bear enjoys a large measure of respect from all savage races that come in contact with it, which shows itself in apologies and in festivals in its honour. The most important developments of the cult are in East Asia among the Siberian tribes; among the Ainu of Sakhalin a young bear is caught at the end of winter and fed for some nine months; then after receiving honours it is killed, and the people, who previously show marks of grief at its approaching fate, dance merrily and feast on its body. Among the Gilyaks a similar festival is found, but here it takes the form of a celebration in honour of a recently dead kinsman, to whom the spirit of the bear is sent. Whether this feature or a cult of the hunting type was the primary form, is so far an open question. There is a good deal of evidence to connect the Greek goddess Artemis with a cult of the bear; girls danced as "bears" in her honour, and might not marry before undergoing this ceremony. The bear is traditionally associated with Bern in Switzerland, and in 1832 a statue of Artio, a bear goddess, was dug up there.

Buffalo.—The Todas of S. India abstain from the flesh of their domestic animal, the buffalo; but once a year they sacrifice a bull calf, which is eaten in the forest by the adult males.

Cattle.—Cattle are respected by many pastoral peoples; they live on milk or game, and the killing of an ox is a sacrificial function. Conspicuous among Egyptian animal cults was that of the bull, Apis. It was distinguished by certain marks, and when the old Apis died a new one was sought; the finder was rewarded, and the bull underwent four months' education at Nilopolis. Its birthday was celebrated once a year; oxen, which had to be pure white, were sacrificed to it; women were forbidden to approach it when once its education was finished. Oracles were obtained from it in various ways. After death it was mummified and buried in a rock-tomb. Less widespread was the cult of the Mnevis, also consecrated to Osiris. Similar observances are found in our own day on the Upper Nile; the Nuba and Nuer worship the bull; the Angoni of Central Africa and the Sakalava of Madagascar keep sacred bulls. In India respect for the cow is widespread, but is of post-Vedic origin; there is little actual worship, but the products of the cow are important in magic.

Crow.—The crow is the chief deity of the Thlinkit Indians of N. W. America; and all over that region it is the chief figure in a group of myths, fulfilling the office of a culture hero who brings the light, gives fire to mankind, &c. Together with the eagle-hawk the crow plays a great part in the mythology of S.E. Australia.

Dog.—Actual dog-worship is uncommon; the Nosarii of western Asia are said to worship a dog; the Kalangs of Java had a cult of the red dog, each family keeping one in the house; according to one authority the dogs are images of wood which are worshipped after the death of a member of the family and burnt after a thousand days. In Nepal it is said that dogs are worshipped at the festival called Khicha Puja. Among the Harranians dogs were sacred, but this was rather as brothers of the mystae.

Elephant.—In Siam it is believed that a white elephant may contain the soul of a dead person, perhaps a Buddha; when one is taken the capturer is rewarded and the animal brought to the king to be kept ever afterwards; it cannot be bought or sold. It is baptized and fêted and mourned for like a human being at its death. In some parts of Indo-China the belief is that the soul of the elephant may injure people after death; it is therefore fêted by a whole village. In Cambodia it is held to bring luck to the kingdom. In Sumatra the elephant is regarded as a tutelary spirit. The cult of the white elephant is also found at Ennarea, southern Abyssinia.

Fish.—Dagon seems to have been a fish-god with human head and hands; his worshippers wore fish-skins. In the temples of Apollo and Aphrodite were sacred fish, which may point to a fish cult. Atargatis is said to have had sacred fish at Askelon, and from Xenophon we read that the fish of the Chalus were regarded as gods.

Goat.—Dionysus was believed to take the form of a goat, probably as a divinity of vegetation. Pan, Silenus, the Satyrs and the Fauns were either capriform or had some part of their bodies shaped like that of a goat. In northern Europe the wood spirit, Ljesche, is believed to have a goat's horns, ears and legs. In Africa the Bijagos are said to have a goat as their principal divinity.

Hare.—In North America the Algonquin tribes had as their chief deity a "mighty great hare" to whom they went at death. According to one account he lived in the east, according to another in the north. In his anthropomorphized form he was known as Menabosho or Michabo.

Hawk.—In North Borneo we seem to see the evolution of a god in the three stages of the cult of the hawk among the Kenyahs, the Kayans and the sea Dyaks. The Kenyahs will not kill it, address to it thanks for assistance, and formally consult it before leaving home on an expedition; it seems, however, to be regarded as the messenger of the supreme god Balli Penyalong. The Kayans have a hawk-god, Laki Neho, but seem to regard the hawk as the servant of the chief god, Laki Tenangan. Singalang Burong, the hawk-god of the Dyaks, is completely anthropomorphized. He is god of omens and ruler of the omen birds; but the hawk is not his messenger, for he never leaves his house; stories are, however, told of his attending feasts in human form and flying away in hawk form when all was over.

Horse.—There is some reason to believe that Poseidon, like other water gods, was originally conceived under the form of a horse. In the cave of Phigalia Demeter was, according to popular tradition, represented with the head and mane of a horse, possibly a relic of the time when a non-specialized corn-spirit bore this form. Her priests were called Poloi (colts) in Laconia. In Gaul we find a horse-goddess, Epona; there are also traces of a horse-god, Rudiobus. The Gonds in India worship a horse-god, Koda Pen, in the form of a shapeless stone; but it is not clear that the horse is regarded as divine. The horse or mare is a common form of the corn-spirit in Europe.

Leopard.—The cult of the leopard is widely found in West Africa. Among the Ewe a man who kills one is liable to be put to death; no leopard skin may be exposed to view, but a stuffed leopard is worshipped. On the Gold Coast a leopard hunter who has killed his victim is carried round the town behind the body of the leopard; he may not speak, must besmear himself so as to look like a leopard and imitate its movements. In Loango a prince's cap is put upon the head of a dead leopard, and dances are held in its honour.

Lion.—The lion was associated with the Egyptian gods Rē and Horus; there was a lion-god at Baalbek and a lion-headed goddess Sekhet. The Arabs had a lion-god, Yaghuth. In modern Africa we find a lion-idol among the Balonda.

Lizard.—The cult of the lizard is most prominent in the Pacific, where it appears as an incarnation of Tangaloa. In Easter Island a form of the house-god is the lizard; it is also a tutelary deity in Madagascar.

Mantis.—Cagn is a prominent figure in Bushman mythology; the mantis and the caterpillar, Ngo, are his incarnations. It was called the "Hottentots' god" by early settlers.

Monkey.—In India the monkey-god, Hanuman, is a prominent figure; in orthodox villages monkeys are safe from harm. Monkeys are said to be worshipped in Togo. At Porto Novo, in French West Africa, twins have tutelary spirits in the shape of small monkeys.

Serpent.—The cult of the serpent is found in many parts of the Old World; it is also not unknown in America; in Australia, on the other hand, though many species of serpent are found, there does not appear to be any species of cult unless we include the Warramunga cult of the mythical Wollunqua totem animal, whom they seek to placate by rites. In Africa the chief centre of serpent worship was Dahomey; but the cult of the python seems to have been of exotic origin, dating back to the first quarter of the 17th century. By the conquest of Whydah the Dahomeyans were brought in contact with a people of serpent worshippers, and ended by adopting from them the cult which they at first despised. At Whydah, the chief centre, there is a serpent temple, tenanted by some fifty snakes; every python of the danh-gbi kind must be treated with respect, and death is the penalty for killing one, even by accident. Danh-gbi has numerous wives, who until 1857 took part in a public procession from which the profane crowd was excluded; a python was carried round the town in a hammock, perhaps as a ceremony for the expulsion of evils. The rainbow-god of the Ewe was also conceived to have the form of a snake; his messenger was said to be a small variety of boa; but only certain individuals, not the whole species, were sacred. In many parts of Africa the serpent is looked upon as the incarnation of deceased relatives; among the Amazulu, as among the Betsileo of Madagascar, certain species are assigned as the abode of certain classes; the Masai, on the other hand, regard each species as the habitat of a particular family of the tribe.

In America some of the Amerindian tribes reverence the rattlesnake as grandfather and king of snakes who is able to give fair winds or cause tempest. Among the Hopi (Moqui) of Arizona the serpent figures largely in one of the dances. The rattlesnake was worshipped in the Natchez temple of the sun; and the Aztec deity Quetzalcoatl was a serpent-god. The tribes of Peru are said to have adored great snakes in the pre-Inca days; and in Chile the Araucanians made a serpent figure in their deluge myth.

Over a large part of India there are carved representations of cobras (Nāgas) or stones as substitutes; to these human food and flowers are offered and lights are burned before the shrines. Among the Dravidians a cobra which is accidentally killed is burned like a human being; no one would kill one intentionally; the serpent-god's image is carried in an annual procession by a celibate priestess.

Serpent cults were well known in ancient Europe; there does not, it is true, appear to be much ground for supposing that Aesculapius was a serpent-god in spite of his connexion with serpents. On the other hand, we learn from Herodotus of the great serpent which defended the citadel of Athens; the Roman *genius loci* took the form of a serpent; a snake was kept and fed with milk in the temple of Potrimpos, an old Slavonic god. To this day there are numerous traces in popular belief, especially in Germany, of respect for the snake, which seems to be a survival of ancestor worship, such as still exists among the Zulus and other savage tribes; the "house-snake," as it is called, cares for the cows and the children, and its appearance is an omen of death, and the life of a pair of house-snakes is often held to be bound up with that of the master and mistress themselves. Tradition says that one of the Gnostic sects known as the Ophites caused a tame serpent to coil round the sacramental bread and worshipped it as the representative of the Saviour. See also SERPENT-WORSHIP.

Sheep.—Only in Africa do we find a sheep-god proper; Ammon was the god of Thebes; he was represented as ram-headed; his worshippers held the ram to be sacred; it was, however, sacrificed once a year, and its fleece formed the clothing of the idol.

Tiger.—The tiger is associated with Siva and Durga, but its cult is confined to the wilder tribes; in Nepal the tiger festival is known as Bagh Jatra, and the worshippers dance disguised as tigers. The Waralis worship Waghia the lord of tigers in the form of a shapeless stone. In Hanoi and Manchuria tiger-gods are also found.

Wolf.—Both Zeus and Apollo were associated with the wolf by the Greeks; but it is not clear that this implies a previous cult of the wolf. It is frequently found among the tutelary deities of North American dancing or secret societies. The Thlinkits had a god, Khanukh, whose name means "wolf," and worshipped a wolf-headed image.

AUTHORITIES.—For a fuller discussion and full references to these and other cults, that of the serpent excepted, see N. W. Thomas in Hastings' *Dictionary of Religions*; Frazer, *Golden Bough*; Campbell's *Spirit Basis of Belief and Custom*; Maclennan's *Studies* (series 2); V. Gennep, *Tabou et totémisme à Madagascar.* For the serpent see Ellis, *Ewe-speaking Peoples*, p. 54; *Internat. Archiv*, xvii. 113 Tylor, *Primitive Culture*, ii. 239; Fergusson, *Tree and Serpen Worship*; Mähly, *Die Schlange im Mythus*; Staniland Wake *Serpent Worship, &c.*; *16th Annual Report of the American Bureau of Ethnology*, p. 273, and bibliography, p. 312. For the bull, &c., in Egypt, see EGYPT: *Religion.* (N. W. T.)

ANIMÉ, an oleo-resin (said to be so called because in its natural state it is infested with insects) which is exuded from the locust tree, *Hymenaea coumaril*, and other species of *Hymenaea* growing in tropical South America. It is of a pale brown colour transparent, brittle, and in consequence of its agreeable odou is used for fumigation and in perfumery. Its specific gravity varies from 1·054 to 1·057. It melts readily over the fire, and softens even with the heat of the mouth; it is insoluble in water, and nearly so in cold alcohol. It is allied to copal in it nature and appearance, and is much used by varnish-makers. The name is also given to Zanzibar copal (*q.v.*).

ANIMISM (from *animus*, or *anima*, mind or soul), according to the definition of Dr E. B. Tylor, the doctrine of spiritual beings, including human souls; in practice, however, the term is often extended to include panthelism or animatism, the doctrine that a great part, if not the whole, of the inanimate kingdom, as well as all animated beings, are endowed with reason, intelligence and volition, identical with that of man. This latter theory, which in many cases is equivalent to personification, though it may be, like animism, a feature of the philosophy of peoples of low culture, should not be confused with it. But it is difficult in practice to distinguish the two phases of thought and no clear account of animatism can yet be given, largely on the ground that no people has yet been discovered which has not already developed to a greater or less extent an animistic philosophy. On theoretical grounds it is probable that animatism preceded animism; but savage thought is no more consistent than that of civilized man; and it may well be that animistic and panthelistic doctrines are held simultaneously by the same person. In like manner one portion of the savage explanation of nature may have been originally animistic, another part animatistic.

Origin.—Animism may have arisen out of or simultaneously with animatism as a primitive explanation of many different phenomena; if animatism was originally applied to non-human or inanimate objects, animism may from the outset have been in vogue as a theory of the nature of man. Lists of phenomena from the contemplation of which the savage was led to believe in animism have been given by Dr Tylor, Herbert Spencer, Mr Andrew Lang and others; an animated controversy arose between the former as to the priority of their respective lists. Among these phenomena are: trance (*q.v.*) and unconsciousness, sickness, death, clairvoyance (*q.v.*), dreams (*q.v.*), apparitions (*q.v.*) of the dead, wraiths, hallucinations (*q.v.*), echoes, shadows and reflections.

Primitive ideas on the subject of the soul, and at the same time the origin of them, are best illustrated by an analysis of the terms applied to it. Readers of Dante know the idea that the dead have no shadows; this was no invention of the poet's but a piece of traditionary lore; at the present day among the Basutos it is held that a man walking by the brink of a river may lose his life if his shadow falls on the water, for a crocodile may seize it and draw him in; in Tasmania, North and South America and classical Europe is found the conception that the soul — σκιά, *umbra*—is somehow identical with the shadow of a man. More familiar to the Anglo-Saxon race is the connexion between the soul and the breath; this identification is found both in Aryan and Semitic languages; in Latin we have *spiritus*, in Greek *pneuma*, in Hebrew *ruach*; and the idea is found extending downwards to the lowest planes of culture in Australia, America and Asia. For some of the Red Indians the Roman custom of receiving the breath of a dying man was no mere pious duty but a means of ensuring that his soul was transferred to a new body. Other familiar conceptions identify the soul with the liver (see Omen) or the heart, with the reflected figure seen in the pupil of the eye, and with the blood. Although the soul is often distinguished from the vital principle, there are many cases in which a state of unconsciousness is explained as due to the absence of the soul; in South Australia *wilyamarraba* (without soul) is the word used for insensible. So too the autohypnotic trance of the magician or *shaman* is regarded as due to his visit to distant regions or the other world, of which he brings back an account. Telepathy or clairvoyance (*q.v.*), with or without trance, must have operated powerfully to produce a conviction of the dual nature of man, for it seems probable that facts unknown to the automatist are sometimes discovered by means of crystal-gazing (*q.v.*), which s widely found among savages, as among civilized peoples. Sickness is often explained as due to the absence of the soul; and means are sometimes taken to lure back the wandering soul; when a Chinese is at the point of death and his soul is supposed to have already left his body, the patient's coat is held up on a ong bamboo while a priest endeavours to bring the departed spirit back into the coat by means of incantations. If the bamboo begins to turn round in the hands of the relative who is deputed to hold it, it is regarded as a sign that the soul of the moribund has returned (see Automatism). More important perhaps than all these phenomena, because more regular and normal, was the daily period of sleep with its frequent concomitant of fitful and incoherent ideas and images. The mere immobility of the body was sufficient to show that its state was not identical with that of waking; when, in addition, the sleeper awoke to give an account of visits to distant lands, from which, as modern psychical investigations suggest, he may even have brought back veridical details, the conclusion must have been irresistible that in sleep something journeyed forth, which was not the body. In a minor degree revival of memory during sleep and similar phenomena of the sub-conscious life may have contributed to the same result. Dreams are sometimes explained by savages as journeys performed by the sleeper, sometimes as visits paid by other persons, by animals or objects to him; hallucinations, possibly more frequent in the lower stages of culture, must have contributed to fortify this interpretation, and the animistic theory in general. Seeing the phantasmic figures of friends at the moment when they were, whether at the point of death or in good health, many miles distant, must have led the savage irresistibly to the dualistic theory. But hallucinatory figures, both in dreams and waking life, are not necessarily those of the living; from the reappearance of dead friends or enemies primitive man was inevitably led to the belief that there existed an incorporeal part of man which survived the dissolution of the body. The soul was conceived to be a facsimile of the body, sometimes no less material, sometimes more subtle but yet material, sometimes altogether impalpable and intangible.

Animism and Eschatology.—The psychological side of animism has already been dealt with; almost equally important in primitive creeds is the eschatological aspect. In many parts of the world it is held that the human body is the seat of more than one soul; in the island of Nias four are distinguished, the shadow and the intelligence, which die with the body, a tutelary spirit, termed *begoe*, and a second which is carried on the head. Similar ideas are found among the Euahlayi of S.E. Australia, the Dakotas and many other tribes. Just as in Europe the ghost of a dead person is held to haunt the churchyard or the place of death, although more orthodox ideas may be held and enunciated by the same person as to the nature of a future life, so the savage, more consistently, assigns different abodes to the multiple souls with which he credits man. Of the four souls of a Dakota, one is held to stay with the corpse, another in the village, a third goes into the air, while the fourth goes to the land of souls, where its lot may depend on its rank in this life, its sex, mode of death or sepulture, on the due observance of funeral ritual, or many other points (see Eschatology). From the belief in the survival of the dead arose the practice of offering food, lighting fires, &c., at the grave, at first, maybe, as an act of friendship or filial piety, later as an act of worship (see Ancestor Worship). The simple offering of food or shedding of blood at the grave develops into an elaborate system of sacrifice; even where ancestor-worship is not found, the desire to provide the dead with comforts in the future life may lead to the sacrifice of wives, slaves, animals, &c., to the breaking or burning of objects at the grave or to the provision of the ferryman's toll, a coin put in the mouth of the corpse to pay the travelling expenses of the soul. But all is not finished with the passage of the soul to the land of the dead; the soul may return to avenge its death by helping to discover the murderer, or to wreak vengeance for itself; there is a widespread belief that those who die a violent death become malignant spirits and endanger the lives of those who come near the haunted spot; the woman who dies in child-birth becomes a *pontianak*, and threatens the life of human beings; and man resorts to magical or religious means of repelling his spiritual dangers.

Development of Animism.—If the phenomena of dreams were, as suggested above, of great importance for the development of animism, the belief, which must originally have been a doctrine of human psychology, cannot have failed to expand speedily into a general philosophy of nature. Not only human beings but animals and objects are seen in dreams; and the conclusion would be that they too have souls; the same conclusion may have been reached by another line of argument; primitive psychology posited a spirit in a man to account, amongst other things, for his actions; a natural explanation of the changes in the external world would be that they are due to the operations and volitions of spirits.

Animal Souls.—But apart from considerations of this sort, it is probable that animals must, early in the history of animistic beliefs, have been regarded as possessing souls. Education has brought with it a sense of the great gulf between man and animals; but in the lower stages of culture this distinction is not adequately recognized, if indeed it is recognized at all. The savage attributes to animals the same ideas, the same mental processes as himself, and at the same time vastly greater power and cunning. The dead animal is credited with a knowledge of how its remains are treated and sometimes with a power of taking vengeance on the fortunate hunter. Powers of reasoning are not denied to animals nor even speech; the silence of the brute creation may be put down to their superior cunning. We may assume that man attributed a soul to the beasts of the field almost as soon as he claimed one for himself. It is therefore not surprising to find that many peoples on the lower planes of culture respect and even worship animals (see Totem; Animal Worship); though we need not attribute an animistic origin to all the developments, it is clear that the widespread respect paid to animals as the abode of dead ancestors, and much of the cult of dangerous animals, is traceable to this principle. With the rise of species, deities and the cult of individual animals, the path towards anthropomorphization and polytheism is opened and the respect paid to animals tends to lose its strict animistic character.

Plant Souls.—Just as human souls are assigned to animals, so primitive man often credits trees and plants with souls in both human or animal form. All over the world agricultural peoples practise elaborate ceremonies explicable, as Mannhardt has shown, on animistic principles. In Europe the corn spirit sometimes immanent in the crop, sometimes a presiding deity whose life does not depend on that of the growing corn, is conceived in some districts in the form of an ox, hare or cock, in others as an old man or woman; in the East Indies and America the rice or maize mother is a corresponding figure; in classical Europe and the East we have in Ceres and Demeter, Adonis and Dionysus, and other deities, vegetation gods whose origin we can readily trace back to the rustic corn spirit. Forest trees, no less than cereals, have their indwelling spirits; the fauns and satyrs of classical literature were goat-footed and the tree spirit of the Russian peasantry takes the form of a goat; in Bengal and the East Indies wood-cutters endeavour to propitiate the spirit of the tree which they cut down; and in many parts of the world trees are regarded as the abode of the spirits of the dead. Just as a process of syncretism has given rise to cults of animal gods, tree spirits tend to become detached from the trees, which are thenceforward only their abodes; and here again animism has begun to pass into polytheism.

Object Souls.—We distinguish between animate and inanimate nature, but this classification has no meaning for the savage. The river speeding on its course to the sea, the sun and moon, if not the stars also, on their never-ceasing daily round, the lightning, fire, the wind, the sea, all are in motion and therefore animate; but the savage does not stop short here; mountains and lakes, stones and manufactured articles, are for him alike endowed with souls like his own; he deposits in the tomb weapons and food, clothes and implements, broken, it may be, in order to set free their souls; or he attains the same result by burning them, and thus sending them to the Other World for the use of the dead man. Here again, though to a less extent than in tree cults, the theriomorphic aspect recurs; in the north of Europe, in ancient Greece, in China, the water or river spirit is horse or bull-shaped; the water monster in serpent shape is even more widely found, but it is less strictly the spirit of the water. The spirit of syncretism manifests itself in this department of animism too; the immanent spirit of the earlier period becomes the presiding genius or local god of later times, and with the rise of the doctrine of separable souls we again reach the confines of animism pure and simple.

Spirits in General.—Side by side with the doctrine of separable souls with which we have so far been concerned, exists the belief in a great host of unattached spirits; these are not immanent souls which have become detached from their abodes, but have every appearance of independent spirits. Thus, animism is in some directions little developed, so far as we can see, among the Australian aborigines; but from those who know them best we learn that they believe in innumerable spirits and bush bogies, which wander, especially at night, and can be held at bay by means of fire; with this belief may be compared the ascription in European folk belief of prophylactic properties to iron. These spirits are at first mainly malevolent; and side by side with them we find the spirits of the dead as hostile beings. At a higher stage the spirits of dead kinsmen are no longer unfriendly, nor yet all non-human spirits; as fetishes (see Fetishism), naguals (see Totem), familiars, gods or demi-gods (for which and the general question see Demonology), they enter into relations with man. On the other hand there still subsists a belief in innumerable evil spirits, which manifest themselves in the phenomena of possession (*q.v.*), lycanthropy (*q.v.*), disease, &c. The fear of evil spirits has given rise to ceremonies of expulsion of evils (see Exorcism), designed to banish them from the community.

Animism and Religion.—Animism is commonly described as the most primitive form of religion; but properly speaking it is not a religion at all, for religion implies, at any rate, some form of emotion (see Religion), and animism is in the first instance an explanation of phenomena rather than an attitude of mind toward the cause of them, a philosophy rather than a religion. The term may, however, be conveniently used to describe the early stage of religion in which man endeavours to set up relations between himself and the unseen powers, conceived as spirits, but differing in many particulars from the gods of polytheism. As an example of this stage in one of its aspects may be taken the European belief in the corn spirit, which is, however, the object of magical rather than religious rites; Dr Frazer has thus defined the character of the animistic pantheon, " they are restricted in their operations to definite departments of nature; their names are general, not proper; their attributes are generic rather than individual; in other words, there is an indefinite number of spirits of each class, and the individuals of a class are much alike; they have no definitely marked individuality; no accepted traditions are current as to their origin, life and character." This stage of religion is well illustrated by the Red Indian custom of offering sacrifice to certain rocks, or whirlpools, or to the indwelling spirits connected with them; the rite is only performed in the neighbourhood of the object, it is an incident of a canoe or other voyage, and is not intended to secure any benefits beyond a safe passage past the object in question; the spirit to be propitiated has a purely local sphere of influence, and powers of a very limited nature. Animistic in many of their features too are the temporary gods of fetishism (*q.v.*), naguals or familiars, genii and even the dead who receive a cult. With the rise of a belief in departmental gods comes the age of polytheism; the belief in elemental spirits may still persist, but they fall into the background and receive no cult.

Animism and the Origin of Religion.—Two animistic theories of the origin of religion have been put forward, the one, often termed the " ghost theory," mainly associated with the name of Herbert Spencer, but also maintained by Grant Allen, refers the beginning of religion to the cult of dead human beings; the other, put forward by Dr E. B. Tylor, makes the foundation of all religion animistic, but recognizes the non-human character of polytheistic gods. Although ancestor-worship, or, more broadly, the cult of the dead, has in many cases overshadowed other cults or even extinguished them, we have no warrant, even in these cases, for asserting its priority, but rather the reverse; not only so, but in the majority of cases the pantheon is made up by a multitude of spirits in human, sometimes in animal form, which bear no signs of ever having been incarnate; sun gods and moon goddesses, gods of fire, wind and water, gods of the sea, and above all gods of the sky, show no signs of having been ghost gods at any period in their history. They may, it is true, be associated with ghost gods, but in Australia it cannot even be asserted that the gods are spirits at all, much less that they are the spirits of dead men; they are simply magnified magicians, super-men who have never died; we have no ground, therefore, for regarding the cult of the dead as the origin of religion in this area; this conclusion is the more probable, as ancestor-worship and the cult of the dead generally cannot be said to exist in Australia.

The more general view that polytheistic and other gods are the elemental and other spirits of the later stages of animistic creeds, is equally inapplicable to Australia, where the belief seems to be neither animistic nor even animatistic in character. But we are hardly justified in arguing from the case of Australia to a general conclusion as to the origin of religious ideas in all other parts of the world. It is perhaps safest to say that the science of religions has no data on which to go, in formulating conclusions as to the original form of the objects of religious emotion; in this connexion it must be remembered that not only is it very difficult to get precise information of the subject of the religious ideas of people of low culture, perhaps for the simple reason that the ideas themselves are far from precise, but also that, as has been pointed out above, the conception of spiritual often approximates very closely to that of material. Where the soul is regarded as no more than a finer sort of matter, it will obviously be far from easy to decide whether the gods are spiritual or material. Even, therefore, if we can say that at the present day the gods are entirely spiritual, it is clearly possible to maintain that they have been spiritualized *pari passu* with the increasing importance of the animistic view of nature and of the greater prominence of eschatological beliefs. The animistic origin of religion is therefore not proven.

Animism and Mythology.—But little need be said on the relation of animism and mythology (*q.v.*). While a large part of mythology has an animistic basis, it is possible to believe, *e.g.* in a sky world, peopled by corporeal beings, as well as by spirits of the dead; the latter may even be entirely absent; the mythology of the Australians relates largely to corporeal, non-spiritual beings; stories of transformation, deluge and doom myths, or myths of the origin of death, have not necessarily any animistic basis. At the same time, with the rise of ideas as to a future life and spiritual beings, this field of mythology is immensely widened, though it cannot be said that a rich mythology is necessarily genetically associated with or combined with belief in many spiritual beings.

Animism in Philosophy.—The term "animism" has been applied to many different philosophical systems. It is used to describe Aristotle's view of the relation of soul and body held also by the Stoics and Scholastics. On the other hand monadology (Leibnitz) has also been termed animistic. The name is most commonly applied to vitalism, a view mainly associated with G. E. Stahl and revived by F. Bouillier (1813–1899), which makes life, or life and mind, the directive principle in evolution and growth, holding that all cannot be traced back to chemical and mechanical processes, but that there is a directive force which guides energy without altering its amount. An entirely different class of ideas, also termed animistic, is the belief in the world soul, held by Plato, Schelling and others.

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ANIMUCCIA, GIOVANNI, Italian musical composer, was born at Florence in the last years of the 15th century. At the request of St Filippo Neri he composed a number of *Laudi*, or hymns of praise, to be sung after sermon time, which have given him an accidental prominence in musical history, since their performance in St Filippo's Oratory eventually gave rise (on the disruption of 16th century schools of composition) to those early forms of "oratorio" that are not traceable to the Gregorian-polyphonic "Passions." St Filippo admired Animuccia so warmly that he declared he had seen the soul of his friend fly upwards towards heaven. In 1555 Animuccia was appointed *maestro di capella* at St Peter's, an office which he held until his death in 1571. He was succeeded by Palestrina, who had been his friend and probably his pupil. The manuscript of many of Animuccia's compositions is still preserved in the Vatican Library. His chief published works were *Madrigali e Motetti a quattro e cinque voci* (Ven. 1548) and *Il primo Libro di Messe* (Rom. 1567). From the latter Padre Martini has taken two specimens for his *Saggio di Contrapunto*. A mass from the *Primo Libro di Messe* on the *canto fermo* of the hymn *Conditor alme siderum* is published in modern notation in the *Anthologie des maîtres religieux primitifs* of the *Chanteurs de Saint Gervais*. It is solemn and noble in conception, and would be a great work but for a roughness which is more careless than archaic.

PAOLO ANIMUCCIA, a brother of Giovanni, was also celebrated as a composer; he is said by Fetis to have been *maestro di capella* at S. Giovanni in Laterano from the middle of January 1550 until 1552, and to have died in 1563.

ANISE (*Pimpinella Anisum*), an umbelliferous plant found in Egypt and the Levant, and cultivated on the continent of Europe for medicinal purposes. The officinal part of the plant is the fruit, which consists of two united carpels, called a cremocarp. It is known by the name of aniseed, and has a strong aromatic taste and a powerful odour. By distillation the fruit yields the volatile oil of anise, which is useful in the treatment of flatulence and colic in children. It may be given as *Aqua Anisi*, in doses of one or more ounces, or as the *Spiritus Anisi*, in doses of 5-20 minims. The main constituent of the oil (up to 90%) is anethol, $C_{10}H_{12}O$ or $C_6H_4[1{\cdot}4](OCH_3)(CH{:}CH{\cdot}CH_3.)$ It also contains methyl chavicol, anisic aldehyde, anisic acid, and a terpene. Most of the oil of commerce, however, of which anethol is also the chief constituent, comes from *Illicium verum* (order *Magnoliaceae*, sub-order *Wintereae*), indigenous in N.E. China, the star-anise of *liqueur* makers. It receives its name from its flavour, and from its fruit spreading out like a star. The anise of the Bible (Matt. xxiii. 23) is *Anethum* or *Peucedanum graveolens*, *i.e.* dill (*q.v.*).

ANJAR, a fortified town of India, and the capital of a district of the same name in the native state of Cutch, in the presidency of Bombay. The country is dry and sandy, and entirely depends on well irrigation for its water supply. The town is situated nearly 10 miles from the Gulf of Cutch. It suffered severely from an earthquake in 1819, which destroyed a large number of houses, and occasioned the loss of several lives. In 1901 the population was 18,014. The town and district of Anjar were both ceded to the British in 1816, but in 1822 they were again transferred to the Cutch government in consideration of an annual money payment. Subsequently it was discovered that this obligation pressed heavily upon the resources of the native state, and in 1832 the pecuniary equivalent for Anjar, both prospectively and inclusive of the arrears which had accrued to that date, was wholly remitted by the British government.

ANJOU, the old name of a French territory, the political origin of which is traced to the ancient Gallic state of the *Andes*, on the lines of which was organized, after the conquest by Julius Caesar, the Roman *civitas* of the *Andecavi*. This was afterwards preserved as an administrative district under the Franks with the name first of *pagus*, then of *comitatus*, or countship of Anjou. This countship, the extent of which seems to have been practically identical with that of the ecclesiastical diocese of Angers, occupied the greater part of what is now the department of Maine-et-Loire, further embracing, to the north, Craon, Bazouges (Château-Gontier), Le Lude, and to the east, Château-la-Vallière and Bourgueil, while to the south, on the other hand, it included neither the present town of Montreuil-Bellay, nor Vihiers, Cholet, Beaupréau, nor the whole district lying to the west of the Ironne and Thouet, on the left bank of the Loire, which formed the territory of the Mauges. It was bounded on the north by the countship of Maine, on the east by that of Touraine, on the south by that of Poitiers and by the Mauges, on the west by the countship of Nantes.

From the outset of the reign of Charles the Bald, the integrity of Anjou was seriously menaced by a two-fold danger: from Brittany and from Normandy. Lambert, a former count of Nantes, after devastating Anjou in concert with Nominoé, duke of Brittany, had by the end of the year 851 succeeded in occupying all the western part as far as the Mayenne. The principality, which he thus carved out for himself, was occupied, on his death, by Erispoé, duke of Brittany; by him it was handed down to his successors, in whose hands it remained till the beginning of the 10th century. All this time the Normans had not ceased ravaging the country; a brave man was needed to defend it, and finally towards 861, Charles the Bald entrusted it to Robert the Strong (*q.v.*), but he unfortunately met with his death in 866 in a battle against the Normans at Brissarthe. Hugh the Abbot succeeded him in the countship of Anjou as in most of his other duties, and on his death (886) it passed to Odo (*q.v.*), the eldest son of Robert the Strong, who, on his accession to the throne of France (888), probably handed it over to his brother Robert. In any case, during the last years of the 9th century, in Anjou as elsewhere the power was delegated to a viscount, Fulk the Red (mentioned under this title after 898), son of a certain Ingelgerius.

In the second quarter of the 10th century Fulk the Red had already usurped the title of count, which his descendants kept for three centuries. He was succeeded first by his son Fulk II. the Good (941 or 942–*c.* 960), and then by the son of the latter, Geoffrey I. *Grisegonelle* (Greytunic) (*c.* 960–21st of July 987), who inaugurated a policy of expansion, having as its objects the extension of the boundaries of the ancient countship and the reconquest of those parts of it which had been annexed by the neighbouring states; for, though western Anjou had been recovered from the dukes of Brittany since the beginning of the 10th century, in the east all the district of Saumur had already by that time fallen into the hands of the counts of Blois and Tours. Geoffrey Greytunic succeeded in making the count of Nantes his vassal, and in obtaining from the duke of Aquitaine the concession in fief of the district of Loudun. Moreover, in the wars of king Lothaire against the Normans and against the emperor Otto II. he distinguished himself by feats of arms which the epic poets were quick to celebrate. His son Fulk III. Nerra (*q.v.*) (21st of July 987–21st of June 1040) found himself confronted on his accession with a coalition of Odo I., count of Blois, and Conan I., count of Rennes. The latter having seized upon Nantes, of which the counts of Anjou held themselves to be suzerains, Fulk Nerra came and laid siege to it, routing Conan's army at Conquereuil (27th of June 992) and re-establishing Nantes under his own suzerainty. Then turning his attention to the count of Blois, he proceeded to establish a fortress at Langeais, a few miles from Tours, from which, thanks to the intervention of the king Hugh Capet, Odo failed to oust him. On the death of Odo I., Fulk seized Tours (996); but King Robert the Pious turned against him and took the town again (997). In 1016 a fresh struggle arose between Fulk and Odo II., the new count of Blois. Odo II. was utterly defeated at Pontlevoy (6th of July 1016), and a few years later, while Odo was besieging Montboyau, Fulk surprised and took Saumur (1026). Finally, the victory gained by Geoffrey Martel (*q.v.*) (21st of June 1040–14th of November 1060), the son and successor of Fulk, over Theobald III., count of Blois, at Nouy (21st of August 1044), assured to the Angevins the possession of the countship of Touraine. At the same time, continuing in this quarter also the work of his father (who in 1025 took prisoner Herbert Wake-Dog and only set him free on condition of his doing him homage), Geoffrey succeeded in reducing the countship of Maine to complete dependence on himself. During his father's life-time he had been beaten by Gervais, bishop of Le Mans (1038), but now (1047 or 1048) succeeded in taking the latter prisoner, for which he was excommunicated by Pope Leo IX. at the council of Reims (October 1049). In spite, however, of the concerted attacks of William the Bastard (the Conqueror), duke of Normandy, and Henry I., king of France, he was able in 1051 to force Maine to recognize his authority, though failing to revenge himself on William.

On the death of Geoffrey Martel (14th of November 1060) there was a dispute as to the succession. Geoffrey Martel, having no children, had bequeathed the countship to his eldest nephew, Geoffrey III. the Bearded, son of Geoffrey, count of Gâtinais, and of Ermengarde, daughter of Fulk Nerra. But Fulk le Réchin (the Cross-looking), brother of Geoffrey the Bearded, who had at first been contented with an appanage consisting of Saintonge and the *châtellenie* of Vihiers, having allowed Saintonge to be taken in 1062 by the duke of Aquitaine, took advantage of the general discontent aroused in the countship by the unskilful policy of Geoffrey to make himself master of Saumur (25th of February 1067) and Angers (4th of April), and cast Geoffrey into prison at Sablé. Compelled by the papal authority to release him after a short interval and to restore the countship to him, he soon renewed the struggle, beat Geoffrey near Brissac and shut him up in the castle of Chinon (1068). In order, however, to obtain his recognition as count, Fulk IV. Réchin (1068–14th of April 1109) had to carry on a long struggle with his barons, to cede Gâtinais to King Philip I., and to do homage to the count of Blois for Touraine. On the other hand, he was successful on the whole in pursuing the policy of Geoffrey Martel in Maine: after destroying La Flèche, by the peace of Blanchelande (1081), he received the homage of Robert "Courteheuse" ("Curthose"), son of William the Conqueror, for Maine. Later, he upheld Elias, lord of La Flèche, against William Rufus, king of England, and on the recognition of Elias as count of Maine in 1100, obtained for Fulk the Young, his son by Bertrade de Montfort, the hand of Eremburge, Elias's daughter and sole heiress.

Fulk V. the Young (14th of April 1109–1129) succeeded to the countship of Maine on the death of Elias (11th of July 1110); but this increase of Angevin territory came into such direct collision with the interests of Henry I., king of England, who was also duke of Normandy, that a struggle between the two powers became inevitable. In 1112 it broke out, and Fulk, being unable to prevent Henry I. from taking Alençon and making Robert, lord of Bellême, prisoner, was forced, at the treaty of Pierre Pecoulée, near Alençon (23rd of February 1113), to do homage to Henry for Maine. In revenge for this, while Louis VI. was overrunning the Vexin in 1118, he routed Henry's army at Alençon (November), and in May 1119 Henry demanded a peace, which was sealed in June by the marriage of his eldest son, William the Aetheling, with Matilda, Fulk's daughter. William the Aetheling having perished in the wreck of the "White Ship" (25th of November 1120), Fulk, on his return from a pilgrimage to the Holy Land (1120–1121), married his second daughter Sibyl, at the instigation of Louis VI., to William Clito, son of Robert Courteheuse, and a claimant to the duchy of Normandy, giving her Maine for a dowry (1122 or 1123). Henry I. managed to have the marriage annulled, on the plea of kinship between the parties (1123 or 1124). But in 1127 a new alliance was made, and on the 22nd of May at Rouen, Henry I. betrothed his daughter Matilda, widow of the emperor Henry V., to Geoffrey the Handsome, son of Fulk, the marriage being celebrated at Le Mans on the 2nd of June 1129. Shortly after, on the invitation of Baldwin II., king of Jerusalem, Fulk departed to the Holy Land for good, married Melisinda, Baldwin's daughter and heiress, and succeeded to the throne of Jerusalem (14th of September 1131). His eldest son, Geoffrey IV. the Handsome or "Plantagenet," succeeded him as count of Anjou (1129–7th of September 1151). From the first he tried to profit by his marriage, and after the death of Henry I. (1st of December 1135), laid the foundation of the conquest of Normandy by a series of campaigns: about the end of 1135 or the beginning of 1136 he entered that country and rejoined his wife, the countess Matilda, who had received the submission of Argentan, Domfront and Exmes. Having been abruptly recalled into Anjou by a revolt of his barons, he returned to the charge in September 1136 with a strong army, including in its ranks William, duke of Aquitaine, Geoffrey, count of Vendôme, and William Talvas, count of Ponthieu, but after a few successes was wounded in the foot at the siege of Le Sap (October 1) and had to fall back. In May 1137 began a fresh campaign in which he devastated the district of Hiémois (round Exmes) and burnt Bazoches. In June 1138, with the aid of Robert of Gloucester, Geoffrey obtained the submission of Bayeux and Caen; in October he devastated the neighbourhood of Falaise; finally, in March 1141, on hearing of his wife's success in England, he again entered Normandy, when he made a triumphal procession through the country. Town after town surrendered: in 1141, Verneuil, Nonancourt, Lisieux, Falaise; in 1142, Mortain, Saint-Hilaire, Pontorson; in 1143, Avranches, Saint-Lô, Cérences, Coutances, Cherbourg; in the beginning of 1144 he entered Rouen, and on the 19th of January received the ducal crown in its cathedral. Finally, in 1149, after crushing a last attempt at revolt, he handed over the duchy to his son Henry "Curtmantel," who received the investiture at the hands of the king of France.

All the while that Fulk the Young and Geoffrey the Handsome were carrying on the work of extending the countship of Anjou, they did not neglect to strengthen their authority at home, to which the unruliness of the barons was a menace. As regards Fulk the Young we know only a few isolated facts and dates: about 1109 Doué and L'Île Bouchard were taken; in 1112 Brissac was besieged, and about the same time Eschivard of Preuilly subdued; in 1114 there was a general war against the barons who were in revolt, and in 1118 a fresh rising, which was put down after the siege of Montbazon; in 1123 the lord of Doué revolted, and in 1124 Montreuil-Bellay was taken after a siege of nine weeks. Geoffrey the Handsome, with his indefatigable energy, was eminently fitted to suppress the coalitions of his vassals, the most formidable of which was formed in 1129. Among those who revolted were Guy of Laval, Giraud of Montreuil-Bellay, the viscount of Thouars, the lords of Mirebeau, Amboise, Parthenay and Sablé. Geoffrey succeeded in beating them one after another, razed the keep of Thouars and occupied Mirebeau. Another rising was crushed in 1134 by the destruction of Candé and the taking of L'Île Bouchard. In 1136, while the count was in Normandy, Robert of Sablé put himself at the head of the movement, to which Geoffrey responded by destroying Briollay and occupying La Suze, and Robert of Sablé himself was forced to beg humbly for pardon through the intercession of the bishop of Angers. In 1139 Geoffrey took Mirebeau, and in 1142 Champtoceaux, but in 1145 a new revolt broke out, this time under the leadership of Elias, the count's own brother, who, again with the assistance of Robert of Sablé, laid claim to the countship of Maine. Geoffrey took Elias prisoner, forced Robert of Sablé to beat a retreat, and reduced the other barons to reason. In 1147 he destroyed Doué and Blaison. Finally in 1150 he was checked by the revolt of Giraud, lord of Montreuil-Bellay: for a year he besieged the place till it had to surrender; he then took Giraud prisoner and only released him on the mediation of the king of France.

Thus, on the death of Geoffrey the Handsome (7th of September 1151), his son Henry found himself heir to a great empire, strong and consolidated, to which his marriage with Eleanor of Aquitaine (May 1152) further added Aquitaine.

At length on the death of King Stephen, Henry was recognised as king of England (19th of December 1154). But then his brother Geoffrey, who had received as appanage the three fortresses of Chinon, Loudun and Mirebeau, tried to seize upon Anjou, on the pretext that, by the will of their father, Geoffrey the Handsome, all the paternal inheritance ought to descend to him, if Henry succeeded in obtaining possession of the maternal inheritance. On hearing of this, Henry, although he had sworn to observe this will, had himself released from his oath by the pope, and hurriedly marched against his brother, from whom in the beginning of 1156 he succeeded in taking Chinon and Mirebeau; and in July he forced Geoffrey to give up even his three fortresses in return for an annual pension. Henceforward Henry succeeded in keeping the countship of Anjou all his life; for though he granted it in 1168 to his son Henry "of the Short Mantle," when the latter became old enough to govern it, he absolutely refused to allow him to enjoy his power. After Henry II.'s death in 1189 the countship, together with the rest of his dominions, passed to his son Richard I. of England, but on the death of the latter in 1199, Arthur of Brittany (born in 1187) laid claim to the inheritance, which ought, according to him, to have fallen to his father Geoffrey, fourth son of Henry II., in accordance with the custom by which "the son of the eldest brother should succeed to his father's patrimony." He therefore set himself up in rivalry with John Lackland, youngest son of Henry II., and supported by Philip Augustus of France, and aided by William des Roches, seneschal of Anjou, he managed to enter Angers (18th of April 1199) and there have himself recognized as count of the three countships of Anjou, Maine and Touraine, for which he did homage to the king of France. King John soon regained the upper hand, for Philip Augustus having deserted Arthur by the treaty of Le Goulet (22nd of May 1200), John made his way into Anjou; and on the 18th of June 1200 was recognized as count at Angers. In 1202 he refused to do homage to Philip Augustus, who, in consequence, confiscated all his continental possessions, including Anjou, which was allotted by the king of France to Arthur. The defeat of the latter, who was taken prisoner at Mirebeau on the 1st of August 1202, seemed to ensure John's success, but he was abandoned by William des Roches, who in 1203 assisted Philip Augustus in subduing the whole of Anjou. A last effort on the part of John to possess himself of it, in 1214, led to the taking of Angers (17th of June), but broke down lamentably at the battle of La Roche-aux-Moines (2nd of July), and the countship was attached to the crown of France.

Shortly afterwards it was separated from it again, when in August 1246 King Louis IX. gave it as an appanage to his son Charles, count of Provence, soon to become king of Naples and Sicily (see NAPLES). Charles I. of Anjou, engrossed with his other dominions, gave little thought to Anjou, nor did his son Charles II. the Lame, who succeeded him on the 7th of January 1285. On the 16th of August 1290, the latter married his daughter Margaret to Charles of Valois, son of Philip III. the Bold, giving her Anjou and Maine for dowry, in exchange for the kingdoms of Aragon and Valentia and the countship of Barcelona given up by Charles. Charles of Valois at once entered into possession of the countship of Anjou, to which Philip IV. the Fair, in September 1297, attached a peerage of France. On the 16th of December 1325, Charles died, leaving Anjou to his eldest son Philip of Valois, on whose recognition as king of France (Philip VI.) on the 1st of April 1328, the countship of Anjou was again united to the crown. On the 17th of February 1332, Philip VI. bestowed it on his son John the Good, who, when he became king in turn (22nd of August 1350), gave the countship to his second son Louis I., raising it to a duchy in the peerage of France by letters patent of the 25th of October 1360. Louis I., who became in time count of Provence and king of Naples (see LOUIS I., king of Naples,) died in 1384, and was succeeded by his son Louis II., who devoted most of his energies to his kingdom of Naples, and left the administration of Anjou almost entirely in the hands of his wife, Yolande of Aragon. On his death (29th of April 1417) she took upon herself the guardianship of their young son Louis III., and in her capacity of regent defended the duchy against the English. Louis III., who also succeeded his father as king of Naples, died on the 15th of November 1434, leaving no children. The duchy of Anjou then passed to his cousin René, second son of Louis II. and Yolande of Aragon, and king of Naples and Sicily (see NAPLES).

Unlike his predecessors, who had rarely stayed long in Anjou, René from 1443 onwards paid long visits to it, and his court at Angers became one of the most brilliant in the kingdom of France. But after the sudden death of his son John in December 1470, René, for reasons which are not altogether clear, decided to move his residence to Provence and leave Anjou for good. After making an inventory of all his possessions, he left the duchy in October 1471, taking with him the most valuable of his treasures. On the 22nd of July 1474 he drew up a will by which he divided the succession between his grandson René II. of Lorraine and his nephew Charles II., count of Maine. On hearing this, King Louis XI., who was the son of one of King René's sisters, seeing that his expectations were thus completely frustrated, seized the duchy of Anjou. He did not keep it very long, but became reconciled to René in 1476 and restored it to him, on condition, probably, that René should bequeath it to him. However that may be, on the death of the latter (10th of July 1480) he again added Anjou to the royal domain.

Later, King Francis I. again gave the duchy as an appanage to his mother, Louise of Savoy, by letters patent of the 4th of February 1515. On her death, in September 1531, the duchy returned into the king's possession. In 1552 it was given as an appanage by Henry II. to his son Henry of Valois, who, on becoming king in 1574, with the title of Henry III., conceded it to his brother Francis, duke of Alençon, at the treaty of Beaulieu near Loches (6th of May 1576). Francis died on the 10th of June 1584, and the vacant appanage definitively became part of the royal domain.

At first Anjou was included in the *gouvernement* (or military command) of Orléanais, but in the 17th century was made into a separate one. Saumur, however, and the Saumurois, for which King Henry IV. had in 1589 created an independent military governor-generalship in favour of Duplessis-Mornay, continued till the Revolution to form a separate *gouvernement*, which included, besides Anjou, portions of Poitou and Mirebalais. Attached to the *généralité* (administrative circumscription) of Tours, Anjou on the eve of the Revolution comprised five *élections* (judicial districts):—Angers, Beaugé, Saumur, Château-Gontier, Montreuil-Bellay and part of the *élections* of La Flèche and Richelieu. Financially it formed part of the so-called *pays de grande gabelle* (see GABELLE), and comprised sixteen special tribunals, or *greniers à sel* (salt warehouses):—Angers, Beaugé, Beaufort, Bourgueil, Candé, Château-Gontier, Cholet, Craon, La Flèche, Saint-Florent-le-Vieil, Ingrandes, Le Lude, Pouancé, Saint-Remy-la-Varenne, Richelieu, Saumur. From the point of view of purely judicial administration, Anjou was subject to the parlement of Paris; Angers was the seat of a presidial court, of which the jurisdiction comprised the *sénéchaussées* of Angers, Saumur, Beaugé, Beaufort and the duchy of Richelieu; there were besides presidial courts at Château-Gontier and La Flèche. When the Constituent Assembly, on the 26th of February 1790, decreed the division of France into departments, Anjou and the Saumurois, with the exception of certain territories, formed the department of Maine-et-Loire, as at present constituted.

AUTHORITIES.—(1) *Principal Sources*: The history of Anjou may be told partly with the aid of the chroniclers of the neighbouring provinces, especially those of Normandy (William of Poitiers, William of Jumièges, Ordericus Vitalis) and of Maine (especially *Actus pontificum Cenomannis in urbe degentium*). For the 10th, 11th and 12th centuries especially, there are some important texts dealing entirely with Anjou. The most important is the chronicle called *Gesta consulum Andegavorum*, of which only a poor edition exists (*Chroniques des comtes d'Anjou*, published by Marchegay and Salmon, with an introduction by E. Mabille, Paris, 1856–1871, collection of the *Société de l'histoire de France*). See also with reference to this text Louis Halphen, *Étude sur les chroniques des comtes d'Anjou et des seigneurs d'Amboise* (Paris, 1906). The above may be supplemented by some valuable annals published by Louis Halphen, *Recueil d'annales angevines et vendômoises* (Paris, 1903), (in the series *Collection de textes pour servir à l'étude et à l'enseignement de l'histoire*). For further details see Auguste Molinier, *Les Sources de l'histoire de France* (Paris, 1902), ii. 1276–1310, and the book of Louis Halphen mentioned below.

(2) *Works*: The *Art de vérifier les dates* contains a history of Anjou which is very much out of date, but has not been treated elsewhere as a whole. The 11th century only has been treated in detail by Louis Halphen, in *Le Comté d'Anjou au XI*^{e} *siècle* (Paris, 1906), which has a preface with bibliography and an introduction dealing with the history of Anjou in the 10th century. For the 10th, 11th and 12th centuries, a good summary will be found in Kate Norgate, *England under the Angevin Kings* (2 vols., London, 1887). On René of Anjou, there is a book by A. Lecoy de la Marche, *Le Roi René* (2 vols., Paris, 1875). Lastly, the work of Célestin Port, *Dictionnaire historique, géographique et biographique de Maine-et-Loire* (3 vols., Paris and Angers, 1874-1878), and its small volume of *Préliminaires* (including a summary of the history of Anjou), contain, in addition to the biographies of the chief counts of Anjou, a mass of information concerning everything connected with Angevin history. (L. H.*)

ANKERITE, a member of the mineral group of rhombohedral carbonates. In composition it is closely related to dolomite, but differs from this in having magnesia replaced by varying amounts of ferrous and manganous oxides, the general formula being $Ca(Mg,Fe,Mn)(CO_3)_2$. Normal ankerite is $Ca_2MgFe(CO_3)_4$. The crystallographic and physical characters resemble those of dolomite and chalybite. The angle between the perfect rhombohedral cleavages is 73° 48′, the hardness 3½ to 4, and the specific gravity 2·9 to 3·1; but these will vary slightly with the chemical composition. The colour is white, grey or reddish.

Ankerite occurs with chalybite in deposits of iron-ore. It is one of the minerals of the dolomite-chalybite series, to which the terms brown-spar, pearl-spar and bitter-spar are loosely applied. It was first recognized as a distinct species by W. von Haidinger in 1825, and named by him after M. J. Anker of Styria. (L. J. S.)

ANKLAM, or ANCLAM, a town of Germany in the Prussian province of Pomerania, on the Peene, 5 m. from its mouth in the Kleines Haff, and 53 m. N.W. of Stettin, by the railway to Stralsund. Pop. (1900) 14,602. The fortifications of Anklam were dismantled in 1762 and have not since been restored, although the old walls are still standing; formerly, however, it was a town of considerable military importance, which suffered severely during the Thirty Years' and the Seven Years' Wars; and this fact, together with the repeated ravages of fire and of the plague, has made its history more eventful than is usually the case with towns of the same size. It does not possess any remarkable buildings, although it contains several, private as well as public, that are of a quaint and picturesque style of architecture. The church of St Mary (12th century) has a modern tower, 335 ft. high. The industries consist of iron-foundries and factories for sugar and soap; and there is a military school. The Peene is navigable up to the town, which has a considerable trade in its own manufactures, as well as in the produce of the surrounding country, while some shipbuilding is carried on in wharves on the river.

Anklam, formerly Tanglim, was originally a Slav fortress; it obtained civic rights in 1244 and joined the Hanseatic league. In 1648 it passed to Sweden, but in 1676 was retaken by Frederick William I. of Brandenburg, and after being plundered by the Russians in 1713 was ceded to Prussia by the peace of Stockholm in 1720.

ANKLE, or ANCLE (a word common, in various forms, to Teutonic languages, probably connected in origin with the Lat. *angulus*, or Gr. ἀγκύλος, bent), the joint which connects the foot with the leg (see JOINTS).

ANKOBER, a town in, and at one time capital of, the kingdom of Shoa, Abyssinia, 90 m. N.E. of Adis Ababa, in 9° 34′ N., 39° 54′ E., on a mountain about 8500 ft. above the sea. Ankober was made (*c.* 1890) by Menelek II. the place of detention of political prisoners. Pop. about 2000.

ANKYLOSIS, or ANCHYLOSIS (from Gr. ἀγκύλος, bent, crooked), a stiffness of a joint, the result of injury or disease. The rigidity may be complete or partial and may be due to inflammation of the tendinous or muscular structures outside the joint or of the tissues of the joint itself. When the structures outside the joint are affected, the term "false" ankylosis has been used in contradistinction to "true" ankylosis, in which the disease is within the joint. When inflammation has caused the joint-ends of the bones to be fused together the ankylosis is termed *osseous* or complete. Excision of a completely ankylosed shoulder or elbow may restore free mobility and usefulness to the limb. "Ankylosis" is also used as an anatomical term, bones being said to ankylose (or anchylose) when, from being originally distinct, they coalesce, or become so joined together that no motion can take place between them.

ANKYLOSTOMIASIS, or ANCHYLOSTOMIASIS (also called helminthiasis, "miners' anaemia," and in Germany *Wurmkrank-*

hcit), a disease to which in recent years much attention has been paid, from its prevalence in the mining industry in England, France, Germany, Belgium, North Queensland and elsewhere. This disease (apparently known in Egypt even in very ancient times) caused a great mortality among the negroes in the West Indies towards the end of the 18th century; and through descriptions sent from Brazil and various other tropical and sub-tropical regions, it was subsequently identified, chiefly through the labours of Bilharz and Griesinger in Egypt (1854), as being due to the presence in the intestine of nematoid worms (*Ankylostoma duodenalis*) from one-third to half an inch long. The symptoms, as first observed among the negroes, were pain in the stomach, capricious appetite, pica (or dirt-eating), obstinate constipation followed by diarrhoea, palpitations, small and unsteady pulse, coldness of the skin, pallor of the skin and mucous membranes, diminution of the secretions, loss of strength and, in cases running a fatal course, dysentery, haemorrhages and dropsies. The parasites, which cling to the intestinal mucous membrane, draw their nourishment from the blood-vessels of their host, and as they are found in hundreds in the body after death, the disorders of digestion, the increasing anaemia and the consequent dropsies and other cachectic symptoms are easily explained. The disease was first known in Europe among the Italian workmen employed on the St Gotthard tunnel. In 1896, though previously unreported in Germany, 107 cases were registered there, and the number rose to 295 in 1900, and 1030 in 1901. In England an outbreak at the Dolcoath mine, Cornwall, in 1902, led to an investigation for the home office by Dr Haldane F.R.S. (see especially the Parliamentary Paper, numbered Cd. 1843), and since then discussions and inquiries have been frequent. A committee of the British Association in 1904 issued a valuable report on the subject. After the Spanish-American War American physicians had also given it their attention, with valuable results; see Stiles (*Hygienic Laboratory Bulletin*, No. 10, Washington, 1903). The American parasite described by Stiles, and called *Uncinaria americana* (whence the name Uncinariasis for this disease) differs slightly from the Ankylostoma. The parasites thrive in an environment of dirt, and the main lines of precaution are those dictated by sanitary science. Malefern, santonine, thymol and other anthelmintic remedies are prescribed.

ANNA, BALDASARRE, a painter who flourished during part of the 16th and 17th centuries. He was born at Venice, probably about 1560, and is said to have been of Flemish descent. The date of his death is uncertain, but he seems to have been alive in 1639. For a number of years he studied under Leonardo Corona, and on the death of that painter completed several works left unfinished by him. His own activity seems to have been confined to the production of pieces for several of the churches and a few private houses in Venice, and the old guide-books and descriptions of the city notice a considerable number of paintings by him. Scarcely any of these, however, have survived.

ANNA (Hindustani *ana*), an Indian penny, the sixteenth part of a rupee. The term belongs to the Mahommedan monetary system (see RUPEE). There is no coin of one anna, but there are half-annas of copper and two-anna pieces of silver. The term anna is frequently used to express a fraction. Thus an Anglo-Indian speaks of two annas of dark blood (an octoroon), a four-anna (quarter) crop, an eight-anna (half) gallop.

ANNA AMALIA (1739–1807), duchess of Saxe-Weimar, daughter of Charles I., duke of Brunswick-Wolfenbüttel, was born at Wolfenbüttel on the 24th of October 1739, and married Ernest, duke of Saxe-Weimar, 1756. Her husband died in 1758, leaving her regent for their infant son, Charles Augustus. During the protracted minority she administered the affairs of the duchy with the greatest prudence, strengthening its resources and improving its position in spite of the troubles of the Seven Years' War. She was a patroness of art and literature, and attracted to Weimar many of the most eminent men in Germany. Wieland was appointed tutor to her son; and the names of Herder, Goethe and Schiller shed an undying lustre on her court. In 1775 she retired into private life, her son having attained his majority. In 1788 she set out on a lengthened tour through Italy, accompanied by Goethe. She died on the 10th of April 1807. A memorial of the duchess is included in Goethe's works under the title *Zum Andenken der Fürstin Anna-Amalia.*

See F. Bornhak, *Anna Amalia Herzogin von Saxe-Weimar-Eisenach* (Berlin, 1892).

ANNABERG, a town of Germany, in the kingdom of Saxony, in the Erzgebirge, 1894 ft. above the sea, 6 m. from the Bohemian frontier, 18½ m. S. by E. from Chemnitz by rail. Pop. (1905) 16,811. It has three Evangelical churches, among them that of St Anne, built 1499–1525, a Roman Catholic church, several public monuments, among them those of Luther, of the famous arithmetician Adam Riese, and of Barbara Uttmann. Annaberg, together with the neighbouring suburb, Buchholz, is the chief seat of the braid and lace-making industry in Germany, introduced here by Barbara Uttmann in 1561, and further developed by Belgian refugees, who, driven from their country by the duke of Alva, settled here in 1590. The mining industry, for which the town was formerly also famous and which embraced tin, silver and cobalt, has now ceased. Annaberg has technical schools for lace-making, commerce and agriculture, in addition to high grade public schools for boys and girls.

ANNABERGITE, a mineral consisting of a hydrous nickel arsenate, $Ni_3(AsO_4)_2+8H_2O$, crystallizing in the monoclinic system and isomorphous with vivianite and erythrite. Crystals are minute and capillary and rarely met with, the mineral occurring usually as soft earthy masses and encrustations. A fine apple-green colour is its characteristic feature. It was long known (since 1758) under the name nickel-ochre; the name annabergite was proposed by H. J. Brooke and W. H. Miller in 1852, from Annaberg in Saxony, one of the localities of the mineral. It occurs with ores of nickel, of which it is a product of alteration. A variety, from Creetown in Kirkcudbrightshire, in which a portion of the nickel is replaced by calcium, has been called dudgeonite, after P. Dudgeon, who found it. (L. J. S.)

ANNA COMNENA, daughter of the emperor Alexius I. Comnenus, the first woman historian, was born on the 1st of December 1083. She was her father's favourite and was carefully trained in the study of poetry, science and Greek philosophy. But, though learned and studious, she was intriguing and ambitious, and ready to go to any lengths to gratify her longing for power. Having married an accomplished young nobleman, Nicephorus Bryennius, she united with the empress Irene in a vain attempt to prevail upon her father during his last illness to disinherit his son and give the crown to her husband. Still undeterred, she entered into a conspiracy to depose her brother after his accession; and when her husband refused to join in the enterprise, she exclaimed that "nature had mistaken their sexes, for he ought to have been the woman." The plot being discovered, Anna forfeited her property and fortune, though, by the clemency of her brother, she escaped with her life. Shortly afterwards, she retired into a convent and employed her leisure in writing the *Alexiad*—a history, in Greek, of her father's life and reign (1081–1118), supplementing the historical work of her husband. It is rather a family panegyric than a scientific history, in which the affection of the daughter and the vanity of the author stand out prominently. Trifling acts of her father are described at length in exaggerated terms, while little notice is taken of important constitutional matters. A determined opponent of the Latin church and an enthusiastic admirer of the Byzantine empire, Anna Comnena regards the Crusades as a danger both political and religious. Her models are Thucydides, Polybius and Xenophon, and her style exhibits the striving after Atticism characteristic of the period, with the result that the language is highly artificial. Her chronology especially is defective.

Editions in Bonn *Corpus Scriptorum Hist. Byz.*, by J. Schopen and A. Reifferscheid (1839–1878), with Du Cange's valuable commentary; and Teubner series, by A. Reifferscheid (1884). See also C. Krumbacher, *Geschichte der byzantinischen Literatur* (2nd ed. 1897); C. Neumann, *Griechische Geschichtschreiber im 12 Jahrhunderte* (1888); E. Oster, *Anna Komnena* (Rastatt, 1868–1871); Gibbon, *Decline and Fall*, ch. 48; Finlay, *Hist. of Greece*, iii. pp. 53, 128 (1877); P. Adam, *Princesses byzantines* (1893); Sir Walter Scott, *Count Robert of Paris*; L. du Sommerard, *Anne Comnène . . . Agnès de France* (1907); C. Diehl, *Figures byzantines* (1906).

ANNA LEOPOLDOVNA, sometimes called Anna Carlovna (1718–1746), regent of Russia for a few months during the minority of her son Ivan, was the daughter of Catherine, sister of the empress Anne, and Charles Leopold, duke of Mecklenburg-Schwerin. In 1739 she married Anton Ulrich (d. 1775), son of Ferdinand Albert, duke of Brunswick, and their son Ivan was adopted in 1740 by the empress and proclaimed heir to the Russian throne. A few days after this proclamation the empress died, leaving directions regarding the succession, and appointing her favourite Ernest Biren, duke of Courland, as regent. Biren, however, had made himself an object of detestation to the Russian people, and Anna had little difficulty in overthrowing his power. She then assumed the regency, and took the title of grand-duchess, but she knew little of the character of the people with whom she had to deal, was utterly ignorant of the approved Russian mode of government, and speedily quarrelled with her principal supporters. In December 1741, Elizabeth, daughter of Peter the Great, who, from her habits, was a favourite with the soldiers, excited the guards to revolt, overcame the slight opposition that was offered, and was proclaimed empress. Ivan was thrown into prison, where he soon afterwards perished. Anna and her husband were banished to a small island in the river Dvina, where on the 18th of March 1746 she died in childbed.

ANNALISTS (from Lat. *annus*, year; hence *annales*, sc. *libri*, annual records), the name given to a class of writers on Roman history, the period of whose literary activity lasted from the time of the Second Punic War to that of Sulla. They wrote the history of Rome from the earliest times (in most cases) down to their own days, the events of which were treated in much greater detail. For the earlier period their authorities were state and family records—above all, the *annales maximi* (or *annales pontificum*), the official chronicle of Rome, in which the notable occurrences of each year from the foundation of the city were set down by the pontifex maximus. Although these annals were no doubt destroyed at the time of the burning of Rome by the Gauls, they were restored as far as possible and continued until the pontificate of P. Mucius Scaevola, by whom they were finally published in eighty books. Two generations of these annalists have been distinguished—an older and a younger. The older, which extends to 150 B.C., set forth, in bald, unattractive language, without any pretensions to style, but with a certain amount of trustworthiness, the most important events of each successive year. Cicero (*De Oratore*, ii. 12. 53), comparing these writers with the old Ionic logographers, says that they paid no attention to ornament, and considered the only merits of a writer to be intelligibility and conciseness. Their annals were a mere compilation of facts. The younger generation, in view of the requirements and criticism of a reading public, cultivated the art of composition and rhetorical embellishment. As a general rule the annalists wrote in a spirit of uncritical patriotism, which led them to minimize or gloss over such disasters as the conquest of Rome by Porsena and the compulsory payment of ransom to the Gauls, and to flatter the people by exaggerated accounts of Roman prowess, dressed up in fanciful language. At first they wrote in Greek, partly because a national style was not yet formed, and partly because Greek was the fashionable language amongst the educated, although Latin versions were probably published as well. The first of the annalists, the father of Roman history, as he has been called, was Q. Fabius Pictor (see Fabius Pictor); contemporary with him was L. Cincius Alimentus, who flourished during the Hannibalic war.[1] Like Fabius Pictor, he wrote in Greek. He was taken prisoner by Hannibal (Livy xxi. 38), who is said to have given him details of the crossing of the Alps. His work embraced the history of Rome from its foundation down to his own days. With M. Porcius Cato (*q.v.*) historical composition in Latin began, and a livelier interest was awakened in the history of Rome. Among the principal writers of this class who succeeded Cato, the following may be mentioned. L. Cassius Hemina (about 146), in the fourth book of his Annals, wrote on the Second Punic War. His researches went back to very early times; Pliny (*Nat. Hist.* xiii. 13 [27]) calls him *vetustissimus auctor annalium.* L. Calpurnius Piso, surnamed *Frugi* (see under Piso), wrote seven books of annals, relating the history of the city from its foundation down to his own times. Livy regards him as a less trustworthy authority than Fabius Pictor, and Niebuhr considers him the first to introduce systematic forgeries into Roman history. Q. Claudius Quadrigarius (about 80 B.C.) wrote a history, in at least twenty-three books, which began with the conquest of Rome by the Gauls and went down to the death of Sulla or perhaps later. He was freely used by Livy in part of his work (from the sixth book onwards). A long fragment is preserved in Aulus Gellius (ix. 13), giving an account of the single combat between Manlius Torquatus and the Gaul. His language was antiquated and his style dry, but his work was considered important. Valerius Antias, a younger contemporary of Quadrigarius, wrote the history of Rome from the earliest times, in a voluminous work consisting of seventy-five books. He is notorious for his wilful exaggeration, both in narrative and numerical statements. For instance, he asserts the number of the Sabine virgins to have been exactly 527; again, in a certain year when no Greek or Latin writers mention any important campaign, Antias speaks of a big battle with enormous casualties. Nevertheless, Livy at first made use of him as one of his chief authorities, until he became convinced of his untrustworthiness. C. Licinius Macer (died 66), who has been called the last of the annalists, wrote a voluminous work, which, although he paid great attention to the study of his authorities, was too rhetorical, and exaggerated the achievements of his own family. Having been convicted of extortion, he committed suicide (Cicero, *De Legibus*, i. 2, *Brutus*, 67; Plutarch, *Cicero*, 9).

The writers mentioned dealt with Roman history as a whole; some of the annalists, however, confined themselves to shorter periods. Thus, L. Caelius Antipater (about 120) limited himself to the Second Punic War. His work was overloaded with rhetorical embellishment, which he was the first to introduce into Roman history. He was regarded as the most careful writer on the war with Hannibal, and one who did not allow himself to be blinded by partiality in considering the evidence of other writers (Cicero, *De Oratore*, ii. 12). Livy made great use of him in his third decade. Sempronius Asellio (about 100 B.C.), military tribune of Scipio Africanus at the siege of Numantia, composed *Rerum Gestarum Libri* in at least fourteen books. As he himself took part in the events he describes, his work was a kind of memoirs. He was the first of his class who endeavoured to trace the causes of events, instead of contenting himself with a bare statement of facts. L. Cornelius Sisenna (119–67), legate of Pompey in the war against the pirates, lost his life in an expedition against Crete. He wrote twenty-three books on the period between the Social War and the dictatorship of Sulla. His work was commended by Sallust (*Jugurtha*, 95), who, however, blames him for not speaking out sufficiently. Cicero remarks upon his fondness for archaisms (*Brutus*, 74. 259). Sisenna also translated the tales of Aristides of Miletus, and is supposed by some to have written a commentary on Plautus. The autobiography of Sulla may also be mentioned.

See C. W. Nitzsch, *Die römische Annalistik* (1873); H. Peter, *Zur Kritik der Quellen der älteren römischen Geschichte* (1879); L. O. Bröcker, *Moderne Quellenforscher und antike Geschichtschreiber* (1882); fragments in H. Peter, *Historicorum Romanorum Reliquiae* (1870, 1906), and *Historicorum Romanorum Fragmenta* (1883); also articles Rome, *History* (ancient) *ad fin.*, section "Authorities," and Livy, where the use made of the annalists by the historian is discussed; Pauly-Wissowa, *Realencyclopädie*, art. "Annales"; the histories of Roman Literature by M. Schanz and Teuffel-Schwabe; Mommsen, *Hist. of Rome* (Eng. tr.), bk. ii. ch. 9, bk. iii. ch. 14, bk. iv. ch. 13, bk. v. ch. 12; C. Wachsmuth, *Einleitung in das Studium der alten Geschichte* (1895); H. Peter, bibliography of the subject in Bursian's *Jahresbericht*, cxxvi. (1906). (J. H. F.)

[1] He is not to be confused with L. Cincius, the author of various political and antiquarian treatises (*de Fastis*, *de Comitiis*, *de Priscis Verbis*), who lived in the Augustan age, to which period Mommsen, considering them a later fabrication, refers the Greek annals of L. Cincius Alimentus.

ANNALS (*Annales*, from *annus*, a year), a concise historical record in which events are arranged chronologically, year by year. The chief sources of information in regard to the annals of ancient Rome are two passages in Cicero (*De Oratore*, ii. 12. 52) and in Servius (*ad Aen.* i. 373) which have been the subject of much discussion. Cicero states that from the earliest period down to the pontificate of Publius Mucius Scaevola (*c.* 131 B.C.), it was usual for the pontifex maximus to record on a white tablet (*album*), which was exhibited in an open place at his house, so that the people might read it, first, the name of the consuls and other magistrates, and then the noteworthy events that had occurred during the year (*per singulos dies*, as Servius says). These records were called in Cicero's time the *Annales Maximi*. After the pontificate of Publius, the practice of compiling annals was carried on by various unofficial writers, of whom Cicero names Cato, Pictor and Piso. The *Annales* have been generally regarded as the same with the *Commentarii Pontificum* cited by Livy, but there seems reason to believe that the two were distinct, the *Commentarii* being fuller and more circumstantial. The nature of the distinction between annals and history is a subject that has received more attention from critics than its intrinsic importance deserves. The basis of discussion is furnished chiefly by the above-quoted passage from Cicero, and by the common division of the work of Tacitus into *Annales* and *Historiae*. Aulus Gellius, in the *Noctes Atticae* (v. 18), quotes the grammarian Verrius Flaccus, to the effect that history, according to its etymology (*ἱστορεῖν*, *inspicere*, to inquire in person), is a record of events that have come under the author's own observation, while annals are a record of the events of earlier times arranged according to years. This view of the distinction seems to be borne out by the division of the work of Tacitus into the *Historiae*, relating the events of his own time, and the *Annales*, containing the history of earlier periods. It is more than questionable, however, whether Tacitus himself divided his work under these titles. The probability is, either that he called the whole *Annales*, or that he used neither designation. (See TACITUS, CORNELIUS.)

In the middle ages, when the order of the liturgical feasts was partly determined by the date of Easter, the custom was early established in the Western Church of drawing up tables to indicate that date for a certain number of years or even centuries. These Paschal tables were thin books in which each annual date was separated from the next by a more or less considerable blank space. In these spaces certain monks briefly noted the important events of the year. It was at the end of the 7th century and among the Anglo-Saxons that the compiling of these Annals was first begun. Introduced by missionaries on the continent, they were re-copied, augmented and continued, especially in the kingdom of Austrasia. In the 9th century, during the great movement termed the Carolingian Renaissance, these Annals became the usual form of contemporary history; it suffices to mention the *Annales Einhardi*, the *Annales Laureshamenses* (or "of Lorsch"), and the *Annales S. Bertini*, officially compiled in order to preserve the memory of the more interesting acts of Charlemagne, his ancestors and his successors. Arrived at this stage of development, the Annals now began to lose their primitive character, and henceforward became more and more indistinguishable from the Chronicles.

In modern literature the title annals has been given to a large number of standard works which adhere more or less strictly to the order of years. The best known are the *Annales Ecclesiastici*, written by Cardinal Baronius as a rejoinder to and refutation of the *Historia ecclesiastica* or "Centuries" of the Protestant theologians of Magdeburg (12 vols., published at Rome from 1788 to 1793; Baronius's work stops at the year 1197). In the 19th century the annalistic form was once more employed, either to preserve year by year the memory of passing events (*Annual Register*, *Annuaire de la Revue des deux mondes*, &c.) or in writing the history of obscure medieval periods (*Jahrbücher der deutschen Geschichte*, *Jahrbücher des deutschen Reiches*, Richter's *Reichsannalen*, &c.). (C. B.*)

ANNAM, or ANAM, a country of south-eastern Asia, now forming a French protectorate, part of the peninsula of Indo-China. (See INDO-CHINA, FRENCH). It is bounded N. by Tongking, E. and S.E. by the China Sea, S.W. by Cochin-China, and W. by Cambodia and Laos. It comprises a sinuous strip of territory measuring between 750 and 800 m. in length, with an approximate area of 52,000 sq. m. The population is estimated at about 6,124,000

The country consists chiefly of a range of plateaus and wooded mountains, running north and south and declining on the coast to a narrow band of plain varying between 12 and 50 m. in breadth. The mountains are cut transversely by short narrow valleys, through which run rivers, most of which are dry in summer and torrential in winter. The Song-Ma and the Song-Ca in the north, and the Song-Ba, Don-Nai and Se-Bang-Khan in the south, are alone of any size. The chief harbour is that afforded by the bay of Tourane at the centre of the coast-line. South of this point the coast curves outwards and is broken by peninsulas and indentations; to the north it is concave and bordered in many places by dunes and lagoons.

Climate.—In Annam the rainy season begins during September and lasts for three or four months, corresponding with the north-east monsoon and also with a period of typhoons. During the rains the temperature varies from 59° or even lower to 75° F. June, July and August are the hottest months, the thermometer often reaching 85° or 90°, though the heat of the day is to some degree compensated by the freshness of the nights. The south-west monsoon which brings rain in Cochin-China coincides with the dry season in Annam, the reason probably being that the mountains and lofty plateaus separating the two countries retain the precipitation.

Ethnography.—The Annamese, or, to use the native term, the *Giao-chi*, are the predominant people not only in Annam but in the lowland and cultivated parts of Tongking and in Cochin-China and southern Cambodia. According to their own annals and traditions they once inhabited southern China, a theory which is confirmed by many of their habits and physical characteristics; the race has, however, been modified by crossings with the Chams and other of the previous inhabitants of Indo-China.

The Annamese is the worst-built and ugliest of all the Indo-Chinese who belong to the Mongolian race. He is scarcely of middle height and is shorter and less vigorous than his neighbours. His complexion is tawny, darker than that of the Chinese, but clearer than that of the Cambodian; his hair is black, coarse and long; his skin is thick; his forehead low; his skull slightly depressed at the top, but well developed at the sides. His face is flat, with highly protruding cheek-bones, and is lozenge-shaped or eurygnathous to a degree that is nowhere exceeded. His nose is not only the flattest, but also the smallest among the Indo-Chinese; his eyes are rarely oblique; his mouth is large and his lips thick; his teeth are blackened and his gums destroyed by the constant use of the betel-nut, the areca-nut and lime. His neck is short, his shoulders slope greatly, his body is thick-set and wanting in suppleness. Another peculiarity is a separation of the big toe from the rest, greater than is found in any other people, and sufficiently general and well marked to serve as an ethnographic test. The Annamese of Cochin-China are weaker and smaller than those of Tongking, probably as a result of living amid marshy rice-fields. The Annamese of both sexes wear wide trousers, a long, usually black tunic with narrow sleeves and a dark-coloured turban, or in the case of the lower classes, a wide straw hat; they either go bare-foot or wear sandals or Chinese boots. The typical Annamese dwelling is open to the gaze of the passer-by during the day; at night a sort of partition of bamboo is let down. The roof is supported on wooden pillars and walls are provided only at the sides. The house consists principally of one large room opening on the front verandah and containing the altar of the family's ancestors, a table in the centre and couches placed against the wall. The chief elements of the native diet are rice, fish and poultry; vegetables and pork are also eaten. The family is the base of the social system in Annam and is ruled by its head, who is also priest and judge.

Polygamy is permitted but rarely practised, and the wife enjoys a position of some freedom.

Though fond of ease the Annamese are more industrious than the neighbouring peoples. Theatrical and musical entertainments are popular among them. They show much outward respect for superiors and parents, but they are insincere and incapable of deep emotion. They cherish great love of their native soil and native village and cannot remain long from home. A proneness to gambling and opium-smoking, and a tinge of vanity and deceitfulness, are their less estimable traits. On the whole they are mild and easy-going and even apathetic, but the facility with which they learn is remarkable. Like their neighbours the Cambodians and the Chinese, the Annamese have a great respect for the dead, and ancestor worship constitutes the national religion. The learned hold the doctrine of Confucius, and Buddhism, alloyed with much popular superstition, has some influence. Like the Chinese the Annamese bury their dead.

Among the savage tribes of the interior there is scarcely any idea of God and their superstitious practices can scarcely be considered as the expression of a definite religious idea. Roman Catholics number about 420,000. In the midst of the Annamese live Cambodians and immigrant Chinese, the latter associated together according to the districts from which they come and carrying on nearly all the commerce of the country. In the forests and mountains dwell tribes of savages, chiefly of Indonesian origin, classed by the Annamese under the name *Moïs* or "savages." Some of these tribes show traces of Malay ancestry. Of greater historical interest are the Chams, who are to be found for the most part in southern Annam and in Cambodia, and who, judging from the numerous remains found there, appear to have been the masters of the coast region of Cochin-China and Annam till they succumbed before the pressure of the Khmers of Cambodia and the Annamese. They are taller, more muscular, and more supple than the Annamese. Their language is derived from Malay, and while some of the Chams are Mussulmans, the dominant religion is Brahmanism, and more especially the worship of Siva. Their women have a high reputation for virtue, which, combined with the general bright and honest character of the whole people, differentiates them from the surrounding nations.

Evidently derived from the Chinese, of which it appears to be a very ancient dialect, the Annamese language is composed of monosyllables, of slightly varied articulation, expressing different ideas according to the tone in which they are pronounced. It is quite impossible to connect with our musical system the utterance of the sounds of which the Chinese and Annamese languages are composed. What is understood by a "tone" in this language is distinguished in reality, not by the number of sonorous vibrations which belong to it, but rather by a use of the vocal apparatus special to each. Thus, the sense will to a native be completely changed according as the sound is the result of an aspiration or of a simple utterance of the voice. Thence the difficulty of substituting our phonetic alphabet for the ideographic characters of the Chinese, as well as for the ideophonetic writing partly borrowed by the Annamese from the letters of the celestial empire. To the Jesuit missionaries is due the introduction of an ingenious though very complicated system, which has caused remarkable progress to be made in the employment of phonetic characters. By means of six accents, one bar and a crotchet it is possible to note with sufficient precision the indications of tone without which the Annamese words have no sense for the natives.

Agriculture and other Industries.—The cultivation of rice, which is grown mainly in the small deltas along the coast and in some districts gives two crops annually, and fishing, together with fish-salting and the preparation of nuoc-mam, a sauce made from decaying fish, constitute the chief industries of Annam.

Silk spinning and weaving are carried on on antiquated lines, and silkworms are reared in a desultory fashion. Besides rice, the products of the country include tea, tobacco, cotton, cinnamon, precious woods and rubber; coffee, pepper, sugar-canes and jute are cultivated to a minor extent. The exports (total value in 1905 £237,010) comprise tea, raw silk and small quantities of cotton, rice and sugar-cane. The imports (£284,824 in 1905) include rice, iron goods, flour, wine, opium and cotton goods. There are coal-mines at Nong-Son, near Tourane, and gold, silver, lead, iron and other metals occur in the mountains. Trade, which is in the hands of the Chinese, is for the most part carried on by sea, the chief ports being Tourane and Qui-Nhon, which are open to European commerce.

Administration.—Annam is ruled in theory by its emperor, assisted by the "*comat*" or secret council, composed of the heads of the six ministerial departments of the interior, finance, war, ritual, justice and public works, who are nominated by himself. The resident superior, stationed at Hué, is the representative of France and the virtual ruler of the country. He presides over a council (*Conseil de Protectorat*) composed of the chiefs of the French services in Annam, together with two members of the "*comat*"; this body deliberates on questions of taxation affecting the budget of Annam and on local public works. A native governor (*tong-doc* or *tuan-phu*), assisted by a native staff, administers each of the provinces into which the country is divided, and native officials of lower rank govern the areas into which these provinces are subdivided. The governors take their orders from the imperial government, but they are under the eye of French residents. Native officials are appointed by the court, but the resident superior has power to annul an appointment. The mandarinate or official class is recruited from all ranks of the people by competitive examination. In the province of Tourane, a French tribunal alone exercises jurisdiction, but it administers native law where natives are concerned. Outside this territory the native tribunals survive. The Annamese village is self-governing. It has its council of notables, forming a sort of oligarchy which, through the medium of a mayor and two subordinates, directs the interior affairs of the community—policing, recruiting, the assignment and collection of taxes, &c.—and has judicial power in less important suits and crimes. More serious cases come within the purview of the *an-sat*, a judicial auxiliary of the governor. An assembly of notables from villages grouped together in a canton chooses a cantonal representative, who is the mouthpiece of the people and the intermediary between the government and its subjects. The direct taxes, which go to the local budget of Annam, consist primarily of a poll-tax levied on all males over eighteen and below sixty years of age, and of a land-tax levied according to the quality and the produce of the holding.

The following table summarizes the local budget of Annam for the years 1899 and 1904:—

—	*Receipts.*	*Expenditure.*
1899	£203,082 (direct taxes, £171,160)	£175,117
1904	£247,435 (,, ,, £219,841)	£232,480

In 1904 the sum allocated to the expenses of the court, the royal family and the native administration, the members of which are paid by the crown, was £85,000, the chief remaining heads of expenditure being the government house and residencies (£39,709), the native guard (£32,609) and public works (£24,898).

Education is available to every person in the community. The primary school, in which the pupils learn only Chinese writing and the precepts of Confucius, stands at the base of this system. Next above this is the school of the district capital, where a half-yearly examination takes place, by means of which are selected those eligible for the course of higher education given at the capital of the province in a school under the direction of a *doc-hoc*, or inspector of studies. Finally a great triennial competition decides the elections. The candidate whose work is notified as *très bien* is admitted to the examinations at Hué, which qualify for the title of doctor and the holding of administrative offices. The education of a mandarin includes local history, cognizance of the administrative rites, customs, laws and prescriptions of the country, the ethics of Confucius, the rules of good breeding, the ceremonial of official and social life, and the practical acquirements necessary to the conduct of public or private business. Annamese learning goes no farther. It includes no scientific idea, no knowledge of the natural sciences, and neglects even the most rudimentary instruction conveyed in a European education. The complications of Chinese writing greatly hamper education. The Annamese mandarin must be acquainted with Chinese, since he writes in Chinese characters. But the character being ideographic, the words which express them are dissimilar in the two languages, and official text is read in Chinese by a Chinese, in Annamese by an Annamese.

The chief towns of Annam are Hué (pop. about 42,000), seat both of the French and native governments, Tourane (pop. about 4000), Phan-Thiet (pop. about 20,000) in the extreme south, Qui-Nhon, and Fai-Fo, a commercial centre to the south of Tourane. A road following the coast from Cochin-China to Tongking, and known as the "Mandarin road," passes through or near the chief towns of the provinces and forms the chief artery of communication in the country apart from the railways (see INDO-CHINA, FRENCH).

History.—The ancient tribe of the Giao-chi, who dwelt on the confines of S. China, and in what is now Tongking and northern Annam, are regarded by the Annamese as their ancestors, and tradition ascribes to their first rulers descent from the Chinese imperial family. These sovereigns were succeeded by another dynasty, under which, at the end of the 3rd century B.C., the Chinese invaded the country, and eventually established there a supremacy destined to last, with little intermission, till the 10th century A.D. In 968 Dinh-Bo-Lanh succeeded in ousting the Chinese and founded an independent dynasty of Dinh. Till this period the greater part of Annam had been occupied by the Chams, a nation of Hindu civilization, which has left many monuments to testify to its greatness, but the encroachment of the Annamese during the next six centuries at last left to it only a small territory in the south of the country. Three lines of sovereigns followed that of Dinh, under the last of which, about 1407, Annam again fell under the Chinese yoke. In 1428 an Annamese general Lē-Loi succeeded in freeing the country once more, and founded a dynasty which lasted till the end of the 18th century. During the greater part of this period, however, the titular sovereigns were mere puppets, the reality of power being in the hands of the family of Trinh in Tongking and that of Nguyen in southern Annam, which in 1568 became a separate principality under the name of Cochin-China. Towards the end of the 18th century a rebellion overthrew the Nguyen, but one of its members, Gia-long, by the aid of a French force, in 1801 acquired sway over the whole of Annam, Tongking and Cochin-China. This force was procured for him by Pigneau de Béhaine, bishop of Adran, who saw in the political condition of Annam a means of establishing French influence in Indo-China and counterbalancing the English power in India. Before this, in 1787, Gia-long had concluded a treaty with Louis XVI., whereby in return for a promise of aid he ceded Tourane and Pulo-Condore to the French. That treaty marks the beginning of French influence in Indo-China.

See also Legrand de la Liraye, *Notes historiques sur la nation annamite* (Paris, 1866?); C. Gosselin, *L'Empire d'Annam* (Paris, 1904); E. Sombsthay, *Cours de législation et d' administration annamites* (Paris, 1898).

ANNAN, a royal, municipal and police burgh of Dumfriesshire, Scotland, on the Annan, nearly 2 m. from its mouth, 15 m. from Dumfries by the Glasgow & South-Western railway. It has a station also on the Caledonian railway company's branch line from Kirtlebridge to Brayton (Cumberland), which crosses the Solway Firth at Seafield by a viaduct, 1⅓ m. long, constructed of iron pillars girded together by poles, driven through the sand and gravel into the underlying bed of sandstone. Annan is a well-built town, red sandstone being the material mainly used. Among its public buildings is the excellent academy of which Thomas Carlyle was a pupil. The river Annan is crossed by a stone bridge of three arches dating from 1824, and by a railway bridge. The Harbour Trust, constituted in 1897, improved the shipping accommodation, and vessels of 300 tons approach close to the town. The principal industries include cotton and rope manufactures, bacon-curing, distilling, tanning, shipbuilding, sandstone quarrying, nursery-gardening and salmon-fishing. Large marine engineering works are in the vicinity. Annan is a burgh of considerable antiquity. Roman remains exist in the neighbourhood, and the Bruces, lords of Annandale, the Baliols, and the Douglases were more or less closely associated with it. During the period of the Border lawlessness the inhabitants suffered repeatedly at the hands of moss-troopers and through the feuds of rival families, in addition to the losses caused by the English and Scots wars. Edward Irving was a native of the town. With Dumfries, Kirkcudbright, Lochmaben and Sanquhar, Annan unites in sending one member to parliament. Annan Hill commands a beautiful prospect. Population (1901) 5805.

ANNA PERENNA, an old Roman deity of the circle or "ring" of the year, as the name (*per annum*) clearly indicates. Her festival fell on the full moon of the first month (March 15), and was held at the grove of the goddess at the first milestone on the Via Flaminia. It was much frequented by the city *plebs*, and Ovid describes vividly the revelry and licentiousness of the occasion (*Fasti*, iii. 523 foll.). From Macrobius we learn (*Sat.* i. 12. 6) that sacrifice was made to her "ut annare perannareque commode liceat," *i.e.* that the circle of the year may be completed happily. This is all we know for certain about the goddess and her cult; but the name naturally suggested myth-making, and Anna became a figure in stories which may be read in Ovid (*l.c.*) and in Silius Italicus (8.50 foll.). The coarse myth told by Ovid, in which Anna plays a trick on Mars when in love with Minerva, is probably an old Italian folk-tale, poetically applied to the persons of these deities when they became partially anthropomorphized under Greek influence. (W. W. F.*)

ANNAPOLIS, a city and seaport of Maryland, U.S.A., the capital of the state, the county seat of Anne Arundel county, and the seat of the United States Naval Academy; situated on the Severn river about 2 m. from its entrance into Chesapeake Bay, 26 m. S. by E. from Baltimore and about the same distance E. by N. from Washington. Pop. (1890) 7604; (1900) 8525, of whom 3002 were negroes; (1910 census) 8609. Annapolis is served by the Washington, Baltimore & Annapolis (electric) and the Maryland Electric railways, and by the Baltimore & Annapolis steamship line. On an elevation near the centre of the city stands the state house (the corner stone of which was laid in 1772), with its lofty white dome (200 ft.) and pillared portico. Close by are the state treasury building, erected late in the 17th century for the House of Delegates; Saint Anne's Protestant Episcopal church, in later colonial days a state church, a statue of Roger B. Taney (by W.H. Rinehart), and a statue of Baron Johann de Kalb. There are a number of residences of 18th century architecture, and the names of several of the streets—such as King George's, Prince George's, Hanover, and Duke of Gloucester—recall the colonial days. The United States Naval Academy was founded here in 1845. Annapolis is the seat of Saint John's College, a non-sectarian institution supported in part by the state; it was opened in 1789 as the successor of King William's School, which was founded by an act of the Maryland legislature in 1696 and was opened in 1701. Its principal building, McDowell Hall, was originally intended for a governor's mansion; although £4000 current money was appropriated for its erection in 1742, it was not completed until after the War of Independence. In 1907 the college became the school of arts and sciences of the university of Maryland.

Annapolis, at first called Providence, was settled in 1649 by Puritan exiles from Virginia. Later it bore in succession the names of Town at Proctor's, Town at the Severn, Anne Arundel Town, and finally in 1694, Annapolis, in honour of Princess Anne, who at the time was heir to the throne of Great Britain. In 1694 also, soon after the overthrow of the Catholic government of the lord proprietor, it was made the seat of the new government as well as a port of entry, and it has since remained the capital of Maryland; but it was not until 1708 that it was incorporated as a city. From the middle of the 18th century until the War of

Independence, Annapolis was noted for its wealthy and cultivated society. The *Maryland Gazette*, which became an important weekly journal, was founded by Jonas Green in 1745; in 1769 a theatre was opened; during this period also the commerce was considerable, but declined rapidly after Baltimore, in 1780, was made a port of entry, and now oyster-packing is the city's only important industry. Congress was in session in the state house here from the 26th of November 1783 to the 3rd of June 1784, and it was here on the 23rd of December 1783 that General Washington resigned his commission as commander-in-chief of the Continental Army. In 1786 a convention, to which delegates from all the states of the Union were invited, was called to meet in Annapolis to consider measures for the better regulation of commerce (see ALEXANDRIA, Va.); but delegates came from only five states (New York, Pennsylvania, Virginia, New Jersey, and Delaware), and the convention—known afterward as the "Annapolis Convention,"—without proceeding to the business for which it had met, passed a resolution calling for another convention to meet at Philadelphia in the following year to amend the articles of confederation; by this Philadelphia convention the present Constitution of the United States was framed.

See D. Ridgely, *Annals of Annapolis from 1649 until the War of 1812* (Baltimore, 1841); S. A. Shafer, "Annapolis, Ye Ancient City," in L. P. Powell's *Historic Towns of the Southern States* (New York, 1900); and W. Eddis, *Letters from America* (London, 1792).

ANNAPOLIS, a town of Nova Scotia, capital of Annapolis county and up to 1750 of the entire peninsula of Nova Scotia; situated on an arm of the Bay of Fundy, at the mouth of the Annapolis river, 95 m. W. of Halifax; and the terminus of the Windsor & Annapolis railway. Pop. (1901) 1019. It is one of the oldest settlements in North America, having been founded in 1604 by the French, who called it Port Royal. It was captured by the British in 1710, and ceded to them by the treaty of Utrecht in 1713, when the name was changed in honour of Queen Anne. It possesses a good harbour, and the beauty of the surrounding country makes it a favourite summer resort. The town is surrounded by apple orchards and in May miles of blossoming trees make a beautiful sight. The fruit, which is excellent in quality, is the principal export of the region.

ANN ARBOR, a city and the county-seat of Washtenaw county, Michigan, U.S.A., on the Huron river, about 38 m. W. of Detroit. Pop. (1890) 9431; (1900) 14,509, of whom 2329 were foreign-born; (1910) 14,817. It is served by the Michigan Central and the Ann Arbor railways, and by an electric line running from Detroit to Jackson and connecting with various other lines. Ann Arbor is best known as the seat of the university of Michigan, opened in 1837. The city has many attractive residences, and the residential districts, especially in the east and south-east parts of the city, command picturesque views of the Huron valley. Ann Arbor is situated in a productive agricultural and fruit-growing region. The river provides good water-power, and among the manufactures are agricultural implements, carriages, furniture (including sectional book-cases), pianos and organs, pottery and flour. In 1824 Ann Arbor was settled, laid out as a town, chosen for the county-seat, and named in honour of Mrs Ann Allen and Mrs Ann Rumsey, the wives of two of the founders. It was incorporated as a village in 1833, and was first chartered as a city in 1851.

ANNATES (Lat. *annatae*, from *annus*, "year"), also known as "first-fruits" (Lat. *primitiae*), in the strictest sense of the word, the whole of the first year's profits of a spiritual benefice which, in all countries of the Roman obedience, were formerly paid into the papal treasury. This custom was only of gradual growth. The *jus deportuum*, *annalia* or *annatae*, was originally the right of the bishop to claim the first year's profits of the living from a newly inducted incumbent, of which the first mention is found under Pope Honorius (d. 1227), but which had its origin in a custom, dating from the 6th century, by which those ordained to ecclesiastical offices paid a fee or tax to the ordaining bishop. The earliest records show the *annata* to have been, sometimes a privilege conceded to the bishop for a term of years, sometimes a right based on immemorial precedent. In course of time the popes, under stress of financial crises, claimed the privilege for themselves, though at first only temporarily. Thus, in 1305, Clement V. claimed the first-fruits of all vacant benefices in England, and in 1319 John XXII. those of all Christendom vacated within the next two years. In those cases the rights of the bishops were frankly usurped by the Holy See, now regarded as the ultimate source of the episcopal jurisdiction; the more usual custom was for the pope to claim the first-fruits only of those benefices of which he had reserved the patronage to himself. It was from these claims that the papal annates, in the strict sense, in course of time developed.

These annates may be divided broadly into three classes, though the chief features are common to all: (1) the *servitia communia* or *servitia Camerae Papae*, *i.e.* the payment into the papal treasury by every abbot and bishop, on his induction, of one year's revenue of his new benefice. The *servitia communia* are traceable to the *oblatio* paid to the pope when consecrating bishops as metropolitan or patriarch. When, in the middle of the 13th century, the consecration of bishops became established as the sole right of the pope, the oblations of all bishops of the West were received by him and, by the close of the 14th century, these became fixed at one year's revenue.[1] A small additional payment, as a kind of notarial fee, was added (*servitia minuta*). (2) The *jus deportuum*, *fructus medii temporis*, or *annalia*, *i.e.* the annates due to the bishop, but in the case of "reserved" benefices paid by him to the Holy See. (3) The *quindennia*, *i.e.* annates payable, under a bull of Paul II. (1469), by benefices attached to a corporation, every fifteen years and not at every presentation.

The system of annates was at no time worked with absolute uniformity and completeness throughout the various parts of the church owning obedience to the Holy See, and it was never willingly submitted to by the clergy. Disagreements and disputes were continual, and the easy expedient of rewarding the officials of the Curia and increasing the papal revenue by "reserving" more and more benefices was met by repeated protests, such as that of the bishops and barons of England (the chief sufferers), headed by Robert Grosseteste of Lincoln, at the council of Lyons in 1245.[2] The subject, indeed, frequently became one of national interest, on account of the alarming amount of specie which was thus drained away, and hence numerous enactments exist in regard to it by the various national governments. In England the collection and payment of annates to the pope was prohibited in 1531 by statute. At that time the sum amounted to about £3000 a year. In 1534 the annates were, along with the supremacy over the church in England, bestowed on the crown; but in February 1704 they were appropriated by Queen Anne to the assistance of the poorer clergy, and thus form what has since been known as "Queen Anne's Bounty" (*q.v.*). The amount to be paid was originally regulated by a valuation made under the direction of Pope Innocent IV. by Walter, bishop of Norwich, in 1254, later by one instituted under commission from Nicholas III. in 1292, which in turn was superseded in 1535 by the valuation, made by commissioners appointed by Henry VIII., known as the *King's Books*, which was confirmed on the accession of Elizabeth and is still that by which the clergy are rated. In France, in spite of royal edicts—like those of Charles VI., Charles VII., Louis XI., and Henry II.—and even denunciations of the Sorbonne, at least the custom of paying the *servitia communia* held its ground till the famous decree of the 4th of August during the Revolution of 1789. In Germany it was decided by the concordat of Constance, in 1418, that bishoprics and abbacies should pay the *servitia* according to the valuation of the Roman chancery in two half-yearly instalments. Those reserved benefices only were to pay the *annalia* which were rated above twenty-four gold florins; and as none were so rated, whatever their annual value may have been, the *annalia* fell into disuse. A similar convenient fiction also led to their practical abrogation in France, Spain and Belgium. The council of Basel (1431–1443) wished to abolish the *servitia*, but the concordat of Vienna (1448) confirmed the Constance decision, which, in spite of the efforts of the congress of Ems (1786) to alter it, still remains nominally in force. As a matter of fact, however, the revolution caused by the secularization of the ecclesiastical states in 1803 practically put an end to the system, and the *servitia* have either been commuted *via gratiae* to a moderate fixed sum under particular concordats, or are the subject of separate negotiation with each bishop on his appointment. In Prussia, where the bishops receive salaries as state officials, the payment is made by the government.

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[1] For cases see du Cange, *Glossarium*, s. *Servitium Camerae Papae*; J. C. L. Gieseler, *Eccles. Hist.*, vol. iii. div. iii., notes to p. 181, &c. (Eng. trans., Edinburgh, 1853).

[2] Durandus (Guillaume Durand), in his *de modo generalis concilii celebrandi*, represents contemporary clerical hostile opinion and attacks the corruptions of the officials of the Curia.

In Scotland *annat* or *ann* is half a year's stipend allowed by the Act 1672, *c.* 13, to the executors of a minister of the Church of Scotland above what was due to him at the time of his death. This is neither assignable by the clergyman during his life, nor can it be seized by his creditors.

ANNE (1665–1714), queen of Great Britain and Ireland, second daughter of James, duke of York, afterwards James II., and of Anne Hyde, daughter of the 1st earl of Clarendon, was born on the 6th of February 1665. She suffered as a child from an affection of the eyes, and was sent to France for medical treatment, residing with her grandmother, Henrietta Maria, and on the latter's death with her aunt, the duchess of Orleans, and returning to England in 1670. She was brought up, together with her sister Mary, by the direction of Charles II., as a strict Protestant, and as a child she made the friendship of Sarah Jennings (afterwards duchess of Marlborough), thus beginning life under the two influences which were to prove the most powerful in her future career. In 1678 she accompanied Mary of Modena to Holland, and in 1679 joined her parents abroad and afterwards in Scotland. On the 28th of July 1683 she married Prince George of Denmark, brother of King Christian V., an unpopular union because of the French proclivities of the bridegroom's country, but one of great domestic happiness, the prince and princess being conformable in temper and both preferring retirement and quiet to life in the great world. Sarah Churchill became Anne's lady of the bedchamber, and, by the latter's desire to mark their mutual intimacy and affection, all deference due to her rank was abandoned and the two ladies called each other Mrs Morley and Mrs Freeman.

On the 6th of February 1685 James became king of England. In 1687 a project of settling the crown on the princess, to the exclusion of Mary, on the condition of Anne's embracing Roman Catholicism, was rendered futile by her pronounced attachment to the Church of England, and beyond sending her books and papers James appears to have made no attempt to coerce his daughter into a change of faith,[1] and to have treated her with kindness, while the birth of his son on the 10th of June 1688 made the religion of his daughters a matter of less political importance. Anne was not present on the occasion, having gone to Bath, and this gave rise to a belief that the child was spurious; but it is most probable that James's desire to exclude all Protestants from affairs of state was the real cause. "I shall never now be satisfied," Anne wrote to Mary, "whether the child be true or false. It may be it is our brother, but God only knows . . . one cannot help having a thousand fears and melancholy thoughts, but whatever changes may happen you shall ever find me firm to my religion and faithfully yours."[2] In later years, however, she had no doubt that the Old Pretender was her brother. During the events immediately preceding the Revolution Anne kept in seclusion. Her ultimate conduct was probably influenced by the Churchills; and though forbidden by James to pay Mary a projected visit in the spring of 1688, she corresponded with her, and was no doubt aware of William's plans. Her position was now a very critical and painful one. She refused to show any sympathy with the king after William had landed in November, and wrote, with the advice of the Churchills, to the prince, declaring her approval of his action.[3] Churchill abandoned the king on the 24th, Prince George on the 25th, and when James returned to London on the 26th he found that Anne and her lady-in-waiting had during the previous night followed their husbands' examples. Escaping from Whitehall by a back staircase they put themselves under the care of the bishop of London, spent one night in his house, and subsequently arrived on the 1st of December at Nottingham, where the princess first made herself known and appointed a council. Thence she passed through Leicester, Coventry and Warwick, finally entering Oxford, where she met Prince George, in triumph, escorted by a large company. Like Mary, she was reproached for showing no concern at the news of the king's flight, but her justification was that "she never loved to do anything that looked like an affected constraint." She returned to London on the 19th of December, when she was at once visited by William. Subsequently the Declaration of Rights settled the succession of the crown upon her after William and Mary and their children.

Meanwhile Anne had suffered a series of maternal disappointments. Between 1684 and 1688 she had miscarried four times and given birth to two children who died infants. On the 24th of July 1689, however, the birth of a son, William, created duke of Gloucester, who survived his infancy, gave hopes that heirs to the throne under the Bill of Rights might be forthcoming. But Anne's happiness was soon troubled by quarrels with the king and queen. According to the duchess of Marlborough the two sisters, who had lived hitherto while apart on extremely affectionate terms, found no enjoyment in each other's society. Mary talked too much for Anne's comfort, and Anne too little for Mary's satisfaction. But money appears to have been the first and real cause of ill-feeling. The granting away by William of the private estate of James, amounting to £22,000 a year, to which Anne had some claim, was made a grievance, and a factious motion brought forward in the House to increase her civil list pension of £30,000, which she enjoyed in addition to £20,000 under her marriage settlement, greatly displeased William and Mary, who regarded it as a plot to make Anne independent and the chief of a separate interest in the state, while their resentment was increased by the refusal of Anne to restrain the action of her friends, and by its success. The Marlboroughs had been active in the affair and had benefited by it, the countess (as she then was) receiving a pension of £1000, and their conduct was noticed at court. The promised Garter was withheld from Marlborough, and the incensed "Mrs Morley" in her letters to "Mrs Freeman" styled the king "Caliban" or the "Dutch Monster." At the close of 1691 Anne had declared her approval of the naval expedition in favour of her father, and expressed grief at its failure.[4] According to the doubtful *Life of James*, she wrote to him on the 1st of December a "most penitential and dutiful" letter, and henceforward kept up with him a "fair correspondence."[5] The same year the breach between the royal sisters was made final by the dismissal of Marlborough, justly suspected of Jacobite intrigues, from all his appointments. Anne took the part of her favourites with great zeal against the court, though in all probability unaware of Marlborough's treason; and on the dismissal of the countess from her household by the king and queen she refused to part with her, and retired with Lady Marlborough to the duke of Somerset's residence at Sion House. Anne was now in disgrace. She was deprived of her guard of honour, and Prince George, on entering Kensington Palace, received no salute, though the drums beat loudly on his departure.[6] Instructions were given that the court expected no one to pay his respects, and no attention in the provinces was to be shown to their rank. In May, Marlborough was arrested on a charge of high treason which subsequently broke down, and Anne persisted in regarding his disgrace as a personal injury to herself. In August 1693, however, the two sisters were temporarily reconciled, and on the occasion of Mary's last illness and death Anne showed an affectionate consideration.

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[1] See also *Hist. MSS. Comm., MSS. of Duke of Rutland at Belvoir*, ii. 109.

[2] Dalrymple's *Memoirs*, ii. 175.

[3] Dalrymple's *Memoirs*, ii. 249.

[4] Lord Ailesbury's *Memoirs*, 293.

[5] Macpherson i. 241; Clarke's *Life of James II.*, ii. 476. The letter, which is only printed in fragments, is not in Anne's style, and if genuine was probably dictated by the Churchills.

[6] Luttrell ii. 366, 376.

The death of Mary weakened William's position and made it necessary to cultivate good relations with the princess. She was now treated with every honour and civility, and finally established with her own court at St James's Palace. At the same time William kept her in the background and refrained from appointing her regent during his absence. In March 1695 Marlborough was allowed to kiss the king's hands, and subsequently was made the duke of Gloucester's governor and restored to his employments. In return Anne gave her support to William's government, though about this time, in 1696—according to James, in consequence of the near prospect of the throne—she wrote to her father asking for his leave to wear the crown at William's death, and promising its restoration at a convenient opportunity.[1] The unfounded rumour that William contemplated settling the succession after his death on James's son, provided he were educated a Protestant in England, may possibly have alarmed her.[2] Meanwhile, since the birth of the duke of Gloucester, the princess had experienced six more miscarriages, and had given birth to two children who only survived a few hours, and the last maternal hope flickered out on the death of the young prince on the 29th of July 1700. Henceforth Anne signs herself in her letters to Lady Marlborough as "your poor unfortunate" as well as "faithful Morley." In default of her own issue, Anne's personal choice would probably have inclined at this time to her own family at St Germains, but the necessity of maintaining the Protestant succession caused the enactment of the Act of Settlement in 1701, and the substitution of the Hanoverian branch. She wore mourning for her father in 1701, and before his death James is said to have written to his daughter asking for her protection for his family; but the recognition of his son by Louis XIV. as king of England effectually prevented any good offices to which her feelings might have inclined her.

On the 8th of March 1702 Anne became, by King William's death, queen of Great Britain, being crowned on the 23rd of April. Her reign was destined to be one of the most brilliant in the annals of England. Splendid military triumphs crushed the hereditary national foe. The Act of Union with Scotland constituted one of the strongest foundations of the future empire. Art and literature found a fresh renascence.

In her first speech to parliament, like George III. afterwards, Anne declared her "heart to be entirely English," words which were resented by some as a reflection on the late king. A ministry, mostly Tory, with Godolphin at its head, was established. She obtained a grant of £700,000 a year, and hastened to bestow a pension of £100,000 on her husband, whom she created generalissimo of her forces and lord high admiral, while Marlborough obtained the Garter, with the captain-generalship and other prizes, including a dukedom, and the duchess was made mistress of the robes with the control of the privy purse. The queen showed from the first a strong interest in church matters, and declared her intention to keep church appointments in her own hands. She detested equally Roman Catholics and dissenters, showed a strong leaning towards the high-church party, and gave zealous support to the bill forbidding occasional conformity. In 1704 she announced to the Commons her intention of granting to the church the crown revenues, amounting to about £16,000 or £17,000 a year, from tenths and first-fruits (paid originally by the clergy to the pope, but appropriated by the crown in 1534), for the increase of poor livings; her gift, under the name of "Queen Anne's Bounty," still remaining as a testimony of her piety. This devotion to the church, the strongest of all motives in Anne's conduct, dictated her hesitating attitude towards the two great parties in the state. The Tories had for this reason her personal preference, while the Whigs, who included her powerful favourites the Marlboroughs, identified their interests with the war and its glorious successes, the queen slowly and unwillingly, but inevitably, gravitating towards the latter.

In December, the archduke Charles visited Anne at Windsor and was welcomed as the king of Spain. In 1704 Anne acquiesced in the resignation of Lord Nottingham, the leader of the high Tory party. In the same year the great victory of Blenheim further consolidated the power of the Whigs and increased the influence of Marlborough, upon whom Anne now conferred the manor of Woodstock. Nevertheless, she declared in November to the duchess that whenever things leaned towards the Whigs, "I shall think the church is beginning to be in danger." Next year she supported the election of the Whig speaker, John Smith, but long resisted the influence and claims of the *Junto*, as the Whig leaders, Somers, Halifax, Orford, Wharton and Sunderland, were named. In October she was obliged to appoint Cowper, a Whig, lord chancellor, with all the ecclesiastical patronage belonging to the office. Marlborough's successive victories, and especially the factious conduct of the Tories, who in November 1705 moved in parliament that the electress Sophia should be invited to England, drove Anne farther to the side of the Whigs. But she opposed for some time the inclusion in the government of Sunderland, whom she especially disliked, only consenting at Marlborough's intercession in December 1706, when various other offices and rewards were bestowed upon Whigs, and Nottingham with other Tories was removed from the council. She yielded, after a struggle, also to the appointment of Whigs to bishoprics, the most mortifying submission of all. In 1708 she was forced to dismiss Harley, who, with the aid of Mrs Masham, had been intriguing against the government and projecting the creation of a third party. Abigail Hill, Mrs Masham, a cousin of the duchess of Marlborough, had been introduced by the latter as a poor relation into Anne's service, while still princess of Denmark. The queen found relief in the quiet and respectful demeanour of her attendant, and gradually came to prefer her society to that of the termagant and tempestuous duchess. Abigail, however, soon ventured to talk "business," and in the summer of 1707 the duchess discovered to her indignation that her protégée had already undermined her influence with the queen and had become the medium of Harley's intrigue. The strength of the Whigs at this time and the necessities of the war caused the retirement of Harley, but he remained Anne's secret adviser and supporter against the faction, urging upon her "the dangers to the crown as well as to the church and monarchy itself from their counsels and actions,"[3] while the duchess never regained her former influence. The inclusion in the cabinet of Somers, whom she especially disliked as the hostile critic of Prince George's admiralty administration, was the subject of another prolonged struggle, ending again in the queen's submission after a futile appeal to Marlborough in October 1708, to which she brought herself only to avoid a motion from the Whigs for the removal of the prince, then actually on his deathbed. His death on the 28th of October was felt deeply by the queen, and opened the way for the inclusion of more Whigs. But no reconciliation with the duchess took place, and in 1709 a further dispute led to an angry correspondence, the queen finally informing the duchess of the termination of their friendship, and the latter drawing up a long narrative of her services, which she forwarded to Anne together with suitable passages on the subject of friendship and charity transcribed from the Prayer Book, the *Whole Duty of Man* and from Jeremy Taylor.[4] Next year Anne's desire to give a regiment to Hill, Mrs Masham's brother, led to another ineffectual attempt in retaliation to displace the new favourite, and the queen showed her antagonism to the Whig administration on the occasion of the prosecution of Sacheverell. She was present at his trial and was publicly acclaimed by the mob as his supporter, while the Tory divine was consoled immediately on the expiration of his sentence with the living of St Andrew's, Holborn. Subsequently the duchess, in a final interview which she had forced upon the queen, found her tears and reproaches unavailing. In her anger she had told the queen she wished for no answer, and she was now met by a stony and exasperating silence, broken only by the words constantly repeated, "You desired no answer and you shall have none."

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[1] Macpherson i. 257; Clarke's *James II.*, ii 559. See also Shrewsbury's anonymous correspondent in *Hist. MSS. Comm. Ser.*; *MSS. Duke of Buccleugh at Montagu House*, ii. 169.

[2] Macaulay iv. 799 *note*.

[3] Swift's *Mem. on the Change of the Ministry*.

[4] *Conduct of the Duchess of Marlborough*, p. 225.

The fall of the Whigs, now no longer necessary on account of the successful issue of the war, to accomplish which Harley had long been preparing and intriguing, followed; and their attempt to prolong hostilities from party motives failed. A friend of Harley, the duke of Shrewsbury, was first appointed to office, and subsequently the great body of the Whigs were displaced by Tories, Harley being made chancellor of the exchequer and Henry St John secretary of state. The queen was rejoiced at being freed from what she called a long captivity, and the new parliament was returned with a Tory majority. On the 17th of January 1711, in spite of Marlborough's efforts to ward off the blow, the duchess was compelled to give up her key of office. The queen was now able once more to indulge in her favourite patronage of the church, and by her influence an act was passed in 1712 for building fifty new churches in London. Later, in 1714, she approved of the Schism Bill. She gave strong support to Harley, now earl of Oxford and lord treasurer, in the intrigues and negotiations for peace. Owing to the alliance between the Tory Lord Nottingham and the Whigs, on the condition of the support by the latter of the bill against occasional conformity passed in December 1711, the defeated Whigs maintained a majority in the Lords, who declared against any peace which left Spain to the Bourbons. To break down this opposition Marlborough was dismissed on the 31st from all his employments, while the House of Lords was "swamped" by Anne's creation of twelve peers,[1] including Mrs Masham's husband. The queen's conduct was generally approved, for the nation was now violently adverse to the Whigs and war party; and the peace of Utrecht was finally signed on the 31st of March 1713, and proclaimed on the 5th of May in London.

As the queen's reign drew to its close, rumours were rife on the great subject of the succession to the throne. Various Jacobite appointments excited suspicion. Both Oxford and Bolingbroke were in communication with the Pretender's party, and on the 27th of July Oxford, who had gradually lost influence and quarrelled with Bolingbroke, resigned, leaving the supreme power in the hands of the latter. Anne herself had a natural feeling for her brother, and had shown great solicitude concerning his treatment when a price had been set on his head at the time of the Scottish expedition in 1708. On the 3rd of March 1714 James wrote to Anne, Oxford and Bolingbroke, urging the necessity of taking steps to secure his succession, and promising, on the condition of his recognition, to make no further attempts against the queen's government; and in April a report was circulated in Holland that Anne had secretly determined to associate James with her in the government. The wish expressed by the Whigs, that a member of the electoral family should be invited to England, had already aroused the queen's indignation in 1708; and now, in 1714, a writ of summons for the electoral prince as duke of Cambridge having been obtained, Anne forbade the Hanoverian envoy, Baron Schütz, her presence, and declared all who supported the project her enemies; while to a memorial on the same subject from the electress Sophia and her grandson in May, Anne replied in an angry letter, which is said to have caused the death of the electress on the 8th of June, requesting them not to trouble the peace of her realm or diminish her authority.

These demonstrations, however, were the outcome not of any returning partiality for her own family, but of her intense dislike, in which she resembled Queen Elizabeth, of any "successor," "it being a thing I cannot bear to have any successor here though but for a week"; and in spite of some appearances to the contrary, it is certain that religion and political wisdom kept Anne firm to the Protestant succession.[2] She had maintained a friendly correspondence with the court of Hanover since 1705, and in 1706 had bestowed the Garter on the electoral prince and created him duke of Cambridge; while the Regency Act provided for the declaration of the legal heir to the crown by the council immediately on the queen's death, and a further enactment naturalized the electress and her issue. In 1708, on the occasion of the Scottish expedition, notwithstanding her solicitude for his safety, she had styled James in her speech closing the session of parliament as "a popish pretender bred up in the principles of the most arbitrary government." The duchess of Marlborough stated in 1713 that all the time she had known "that thing" (as she now called the queen), "she had never heard her speak a favourable word of him."[3] No answer appears to have been sent to James's letter in 1714; on the contrary, a proclamation was issued (June 23) for his apprehension in case of his arrival in England. On the 27th of April Anne gave a solemn assurance of her fidelity to the Hanoverian succession to Sir William Dawes, archbishop of York; in June she sent Lord Clarendon to Hanover to satisfy the elector.

The sudden illness and death of the queen now frustrated any schemes which Bolingbroke or others might have been contemplating. On the 27th, the day of Oxford's resignation, the discussions concerning his successor detained the council sitting in the queen's presence till two o'clock in the morning, and on retiring Anne was instantly seized with fatal illness. Her adherence to William in 1688 had been a principal cause of the success of the Revolution, and now the final act of her life was to secure the Revolution settlement and the Protestant succession. During a last moment of returning consciousness, and by the advice of the whole council, who had been joined on their own initiative by the Whig dukes Argyll and Somerset, she placed the lord treasurer's staff in the hands of the Whig duke of Shrewsbury, and measures were immediately taken for assuring the succession of the elector. Her death took place on the 1st of August, and the security felt by the public, and perhaps the sense of perils escaped by the termination of the queen's life, were shown by a considerable rise in the national stocks. She was buried on the south side of Henry VII.'s chapel in Westminster Abbey, in the same tomb as her husband and children. The elector of Hanover, George Louis, son of the electress Sophia (daughter of Elizabeth, daughter of James I.), peacefully succeeded to the throne as George I. (*q.v.*).

According to her physician Arbuthnot, Anne's life was shortened by the "scene of contention among her servants. I believe sleep was never more welcome to a weary traveller than death was to her." By character and temperament unfitted to stand alone, her life had been unhappy and tragical from its isolation. Separated in early years from her parents and sister, her one great friendship had proved only baneful and ensnaring. Marriage had only brought a mournful series of infant funerals. Constant ill-health and suffering had darkened her career. The claims of family attachment, of religion, of duty, of patriotism and of interest, had dragged her in opposite directions, and her whole life had been a prey to jealousies and factions which closed around her at her accession to the throne, and surged to their height when she lay on her deathbed. The modern theory of the relations between the sovereign and the parties, by which the former identifies himself with the faction for the time in power while maintaining his detachment from all, had not then been invented; and Anne, like her Hanoverian successors, maintained the struggle, though without success, to rule independently, finding support in Harley. During the first year of her reign she made known that she was "resolved not to follow the example of her predecessor in making use of a few of her subjects to oppress the rest. She will be queen of all her subjects, and would have all the parties and distinctions of former reigns ended and buried in hers."[4] Her motive for getting rid of the Whigs was not any real dislike of their administration, but the wish to escape from the domination of the party,[5] and on the advent to power of the Tories she carefully left some Whigs in their employments, with the aim of breaking up the party system and acting upon what was called "a moderate scheme." She attended debates in the Lords and endeavoured to influence votes. Her struggles to free herself from the influence of factions only involved her deeper; she was always under the domination of some person or some party, and she could not rise above them and show herself the leader of the nation like Elizabeth.

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[1] For their names see Hume and Smollett's *Hist.* (Hughes, 1854) viii. 110.

[2] See also *Hist. MSS. Comm. Ser.* Rep. vii. App. 246b.

[3] *Ibid. Portland MSS.* v. 338.

[4] Sir J. Leveson-Gower to Lord Rutland, *Hist. MSS. Comm.*, *Duke of Rutland's MSS.* ii. 173.

[5] See Bolingbroke's *Letter to Sir W. Wyndham.*

Anne was a women of small ability, of dull mind, and of that kind of obstinacy which accompanies weakness of character. According to the duchess she had "a certain knack of sticking to what had been dictated to her to a degree often very disagreeable, and without the least sign of understanding or judgment."[1] "I desire you would not have so ill an opinion of me," Anne writes to Oxford, "as to think when I have determined anything in my mind I will alter it."[2] Burnet considered that "she laid down the splendour of a court too much," which was "as it were abandoned." She dined alone after her husband's death, but it was reported by no means abstemiously, the royal family being characterized in the lines:—

> "King William thinks all,
> Queen Mary talks all,
> Prince George drinks all,
> And Princess Anne eats all."[3]

She took no interest in the art, the drama or the literature of her day. But she possessed the homely virtues; she was deeply religious, attached to the Church of England and concerned for the efficiency of the ministry. One of the first acts of her reign was a proclamation against vice, and Lord Chesterfield regretted the strict morality of her court. Instances abound of her kindness and consideration for others. Her moderation towards the Jacobites in Scotland, after the Pretender's expedition in 1708, was much praised by Saint Simon. She showed great forbearance and generosity towards the duchess of Marlborough in the face of unexampled provocation, and her character was unduly disparaged by the latter, who with her violent and coarse nature could not understand the queen's self-restraint in sorrow, and describes her as "very hard" and as "not apt to cry." According to her small ability she served the state well, and was zealous and conscientious in the fulfilment of public duties, in which may be included touching for the king's evil, which she revived. Marlborough testifies to her energy in finding money for the war. She surrendered £10,000 a year for public purposes, and in 1706 she presented £30,000 to the officers and soldiers who had lost their horses. Her contemporaries almost unanimously record her excellence and womanly virtues; and by Dean Swift, no mild critic, she is invariably spoken of with respect, and named in his will as of "ever glorious, immortal and truly pious memory, the real nursing-mother of her kingdoms." She deserves her appellation of "Good Queen Anne," and notwithstanding her failings must be included among the chief authors and upholders of the great Revolution settlement. Her person was described by Spanheim, the Prussian ambassador, as handsome though inclining to stoutness, with black hair, blue eyes and good features, and of grave aspect.

Anne's husband, Prince George (1653–1708), was the second son of Frederick III., king of Denmark. Before marrying Anne he had been a candidate for the throne of Poland. He was created earl of Kendal and duke of Cumberland in 1689. Some censure, which was directed against the prince in his capacity as lord high admiral, was terminated by his death. In religion George remained a Lutheran, and in general his qualities tended to make him a good husband rather than a soldier or a statesman.

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ANNE (1693–1740), empress of Russia, second daughter of Tsar Ivan V., Peter the Great's imbecile brother, and Praskovia Saltuikova. Her girlhood was passed at Ismailovo near Moscow, with her mother, an ignorant, bigoted tsaritsa of the old school, who neglected and even hated her daughters. Peter acted as a second father to the Ivanovs, as Praskovia and her family were called. In 1710 he married Anne to Frederick William, duke of Courland, who died of surfeit on his journey home from St Petersburg. The reluctant young widow was ordered to proceed on her way to Mittau to take over the government of Courland, with the Russian resident, Count Peter Bestuzhev, as her adviser. He was subsequently her lover, till supplanted by Biren (*q.v.*). Anne's residence at Mittau was embittered by the utter inadequacy of her revenue, which she keenly felt. It was therefore with joy that she at once accepted the Russian crown, as the next heir, after the death of Peter II. (January 30, 1730), when it was offered to her by the members of the supreme privy council, even going so far as to subscribe previously nine articles which would have reduced her from an absolute to a very limited monarch. On the 26th of February she made her public entry into Moscow under strict surveillance. On the 8th of March a *coup d'état*, engineered by a party of her personal friends, overthrew the supreme privy council and she was hailed as autocrat. Her government, on the whole, was prudent, beneficial and even glorious; but it was undoubtedly severe and became at last universally unpopular. This was due in the main to the outrageous insolence of her all-powerful favourite Biren, who hated the Russian nobility and trampled upon them mercilessly. Fortunately, Biren was sufficiently prudent not to meddle with foreign affairs or with the army, and these departments in the able hands of two other foreigners, who thoroughly identified themselves with Russia, Andrei Osterman (*q.v.*) and Burkhardt Münnich (*q.v.*) did great things in the reign of Anne. The chief political events of the period were the War of the Polish Succession and the second[4] Crimean War. The former was caused by the reappearance of Stanislaus Leszczynski as a candidate for the Polish throne after the death of Augustus II. (February 1, 1733). The interests of Russia would not permit her to recognize a candidate dependent directly on France and indirectly upon Sweden and Turkey, all three powers being at that time opposed to Russia's "system." She accordingly united with Austria to support the candidature of the late king's son, Augustus of Saxony. So far as Russia was concerned, the War of the Polish Succession was quickly over. Much more important was the Crimean War of 1736–39. This war marks the beginning of that systematic struggle on the part of Russia to recover her natural and legitimate southern boundaries. It lasted four years and a half, and cost her a hundred thousand men and millions of roubles; and though invariably successful, she had to be content with the acquisition of a single city (Azov) with a small district at the mouth of the Don. Yet more had been gained than was immediately apparent. In the first place, this was the only war hitherto waged by Russia against Turkey which had not ended in crushing disaster. Münnich had at least dissipated the illusion of Ottoman invincibility, and taught the Russian soldier that 100,000 janissaries and spahis were no match, in a fair field, for half that number of grenadiers and hussars. In the second place the Tatar hordes had been well nigh exterminated. In the third place Russia's signal and unexpected successes in the Steppe had immensely increased her prestige on the continent. "This court begins to have a great deal to say in the affairs of Europe," remarked the English minister, Sir Claudius Rondeau, a year later.

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[1] *Private Correspondence*, ii. 120.

[2] *Hist. MSS. Comm., MSS. of Marq. of Bath at Longleat*, i. 237.

[3] *Notes and Queries*, xi. 254.

[4] Vasily Golitsuin's expedition under the regency of Sophia was the first Crimean War (1687–89).

The last days of Anne were absorbed by the endeavour to strengthen the position of the heir to the throne, the baby cesarevich Ivan, afterwards Ivan VI., the son of the empress's niece, Anna Leopoldovna, against the superior claims of her cousin the cesarevna Elizabeth. The empress herself died three months later (28th of October 1740). Her last act was to appoint Biren regent during the infancy of her great-nephew.

Anne was a grim, sullen woman, frankly sensual, but as well-meaning as ignorance and vindictiveness would allow her to be. But she had much natural good sense, was a true friend and, in her more cheerful moments, an amiable companion. Lady Rondeau's portrait of the empress shows her to the best advantage. She is described as a large woman, towering above all the cavaliers of her court, but very well shaped for her size, easy and graceful in her person, of a majestic bearing, but with an awfulness in her countenance which revolted those who disliked her.

See R. Nisbet Bain, *The Pupils of Peter the Great* (London, 1897); *Letters from a lady who resided some years in Russia* (*i.e.* Lady Rondeau) (London, 1775); Christoph Hermann Manstein, *Mémoires sur la Russie* (Amsterdam, 1771; English edition, London, 1856); Gerhard Anton von Halem, *Lebensschreibung des Feldm. B. C. Grafen von Münnich* (Oldenburg, 1803); Claudius Rondeau, *Diplomatic Despatches from Russia, 1728–1739* (St Petersburg, 1889–1892). (R. N. B.)

ANNE OF BRITTANY (1477–1514), daughter of Francis II., duke of Brittany, and Marguerite de Foix. She was scarcely twelve years old when she succeeded her father as duchess on the 9th of September 1488. Charles VIII. aimed at establishing his authority over her; Alain d'Albret wished to marry her; Jean de Rohan claimed the duchy; and her guardian, the marshal de Rieux, was soon in open revolt against his sovereign. In 1489 the French army invaded Brittany. In order to protect her independence, Anne concluded an alliance with Maximilian of Austria, and soon married him by proxy (December 1489). But Maximilian was incapable of defending her, and in 1491 the young duchess found herself compelled to treat with Charles VIII. and to marry him. The two sovereigns made a reciprocal arrangement as to their rights and pretensions to the crown of Brittany, but in the event of Charles predeceasing her, Anne undertook to marry the heir to the throne. Nevertheless, in 1492, after the conspiracy of Jean de Rohan, who had endeavoured to hand over the duchy to the king of England, Charles VIII. confirmed the privileges of Brittany, and in particular guaranteed to the Bretons the right of paying only those taxes to which the assembly of estates consented. After the death of Charles VIII. in 1498, without any children, Anne exercised the sovereignty in Brittany, and in January 1499 she married Louis XII., who had just repudiated Joan of France. The marriage contract was ostensibly directed in favour of the independence of Brittany, for it declared that Brittany should revert to the second son or to the eldest daughter of the two sovereigns, and, failing issue, to the natural heirs of the duchess. Until her death Anne occupied herself personally with the administration of the duchy. In 1504 she caused the treaty of Blois to be concluded, which assured the hand of her daughter, Claude of France, to Charles of Austria (the future emperor, Charles V.), and promised him the possession of Brittany, Burgundy and the county of Blois. But this unpopular treaty was broken, and the queen had to consent to the betrothal of Claude to Francis of Angoulême, who in 1515 became king of France as Francis I. Thus the definitive reunion of Brittany and France was prepared.

See A. de la Borderie, *Choix de documents inédits sur le règne de la duchesse Anne en Bretagne* (Rennes, 1866 and 1902)—extracts from the *Mémoires de la Société Archéologique du département d'Ille-et-Vilaine*, vols. iv. and vi. (1866 and 1868); Leroux de Lincy, *Vie de la reine Anne de Bretagne* (1860–1861); A. Dupuy, *La Réunion de la Bretagne à la France* (1880); A. de la Borderie, *La Bretagne aux derniers siècles du moyen âge* (1893), and *La Bretagne aux temps modernes* (1894). (H. Se.)

ANNE OF CLEVES (1515–1557), fourth wife of Henry VIII., king of England, daughter of John, duke of Cleves, and Mary, only daughter of William, duke of Juliers, was born on the 22nd of September 1515. Her father was the leader of the German Protestants, and the princess, after the death of Jane Seymour, was regarded by Cromwell as a suitable wife for Henry VIII. She had been brought up in a narrow retirement, could speak no language but her own, had no looks, no accomplishments and no dowry, her only recommendations being her proficiency in needlework, and her meek and gentle temper. Nevertheless her picture, painted by Holbein by the king's command (now in the Louvre, a modern copy at Windsor), pleased Henry and the marriage was arranged, the treaty being signed on the 24th of September 1539. The princess landed at Deal on the 27th of December; Henry met her at Rochester on the 1st of January 1540, and was so much abashed at her appearance as to forget to present the gift he had brought for her, but nevertheless controlled himself sufficiently to treat her with courtesy. The next day he expressed openly his dissatisfaction at her looks; "she was no better than a Flanders mare." The attempt to prove a pre-contract with the son of the duke of Lorraine broke down, and Henry was forced to resign himself to the sacrifice. On the wedding morning, however, the 6th of January 1540, he declared that no earthly thing would have induced him to marry her but the fear of driving the duke of Cleves into the arms of the emperor. Shortly afterwards Henry had reason to regret the policy which had identified him so closely with the German Protestantism, and denied reconciliation with the emperor. Cromwell's fall was the result, and the chief obstacle to the repudiation of his wife being thus removed, Henry declared the marriage had not been and could not be consummated; and did not scruple to cast doubts on his wife's honour. On the 9th of July the marriage was declared null and void by convocation, and an act of parliament to the same effect was passed immediately. Henry soon afterwards married Catherine Howard. On first hearing of the king's intentions, Anne swooned away, but on recovering, while declaring her case a very hard and sorrowful one from the great love which she bore to the king, acquiesced quietly in the arrangements made for her by Henry, by which she received lands to the value of £4000 a year, renounced the title of queen for that of the king's sister, and undertook not to leave the kingdom. In a letter to her brother, drawn up by Gardiner by the king's direction, she acknowledged the unreality of the marriage and the king's kindness and generosity. Anne spent the rest of her life happily in England at Richmond or Bletchingley, occasionally visiting the court, and being described as joyous as ever, and wearing new dresses every day! An attempt to procure her reinstalment on the disgrace of Catherine Howard failed, and there was no foundation for the report that she had given birth to a child of which Henry was the reputed father. She was present at the marriage of Henry with Catherine Parr and at the coronation of Mary. She died on the 28th of July 1557 at Chelsea, and was buried in Westminster Abbey.

See *Lives of the Queens of England*, by A. Strickland, iii. (1851); *The Wives of Henry VIII.*, by M. Hume (1905); *Henry VIII.*, by A. F. Pollard (1905); *Four Original Documents relating to the Marriage of Henry VIII. to Anne of Cleves*, ed. by E. and G. Goldsmid (1886); for the pseudo Anne of Cleves see *Allgemeine deutsche Biographie*, i. 467. (P. C. Y.)

ANNE OF DENMARK (1574–1619), queen of James I. of England and VI. of Scotland, daughter of King Frederick II. of Denmark and Norway and of Sophia, daughter of Ulric III., duke of Mecklenburg, was born on the 12th of December 1574. On the 20th of August 1589, in spite of Queen Elizabeth's opposition, she was married by proxy to King James, without dower, the alliance, however, settling definitely the Scottish claims to the Orkney and Shetland Islands. Her voyage to Scotland was interrupted by a violent storm—for the raising of which several Danish and Scottish witches were burned or executed—which drove her on the coast of Norway, whither the impatient James came to meet her, the marriage taking place at Opslo (now Christiania) on the 23rd of November. The royal couple, after visiting Denmark, arrived in Scotland in May 1590. The position of queen consort to a Scottish king was a difficult and perilous one, and Anne was attacked in connexion with various scandals and deeds of violence, her share in which, however, is supported by no evidence. The birth of an heir to the throne (Prince Henry) in 1594 strengthened her position and influence; but the young prince, much to her indignation, was immediately withdrawn from her care and entrusted to the keeping of the earl and countess of Mar at Stirling Castle; in 1595 James gave a written command, forbidding them in case of his death to give up the prince to the queen till he reached the age of eighteen. The king's intention was, no doubt, to secure himself and the prince against the unruly nobles, though the queen's Roman Catholic tendencies were probably another reason for his decision. Brought up a Lutheran, and fond of pleasure, she had shown no liking for Scottish Calvinism, and soon incurred rebukes on account of her religion, "vanity," absence from church, "night waking and balling." She had become secretly inclined to Roman Catholicism, and attended mass with the king's connivance. On the death of Queen Elizabeth, on the 24th of March 1603, James preceded her to London. Anne took advantage of his absence to demand possession of the prince, and, on the "flat refusal" of the countess of Mar, fell into a passion, the violence of which occasioned a miscarriage and endangered her life. In June she followed the king to England (after distributing all her effects in Edinburgh among her ladies) with the prince and the coffin containing the body of her dead infant, and reached Windsor on the 2nd of July, where amidst other forms of good fortune she entered into the possession of Queen Elizabeth's 6000 dresses.

On the 24th of July Anne was crowned with the king, when her refusal to take the sacrament according to the Anglican use created some sensation. She communicated on one occasion subsequently and attended Anglican service occasionally; but she received consecrated objects from Pope Clement VIII., continued to hear mass, and, according to Galluzzi, supported the schemes for the conversion of the prince of Wales and of England, and for the prince's marriage with a Roman Catholic princess, which collapsed on his death in 1612. She was claimed as a convert by the Jesuits.[1] Nevertheless on her deathbed, when she was attended by the archbishop of Canterbury and the bishop of London, she used expressions which were construed as a declaration of Protestantism. Notwithstanding religious differences she lived in great harmony and affection with the king, latterly, however, residing mostly apart. She helped to raise Buckingham to power in the place of Somerset, maintained friendly relations with him, and approved of his guidance and control of the king. In spite of her birth and family she was at first favourably inclined to Spain, disapproved of her daughter Elizabeth's marriage with the elector palatine, and supported the Spanish marriages for her sons, but subsequently veered round towards France. She used all her influence in favour of the unfortunate Raleigh, answering his petition to her for protection with a personal letter of appeal to Buckingham to save his life. "She carrieth no sway in state matters," however, it was said of her in 1605, "and, *praeter rem uxoriam*, hath no great reach in other affairs." "She does not mix herself up in affairs, though the king tells her anything she chooses to ask, and loves and esteems her."[2] Her interest in state matters was only occasional, and secondary to the pre-occupations of court festivities, masks, progresses, dresses, jewels, which she much enjoyed; the court being, says Wilson—whose severity cannot entirely suppress his admiration—"a continued maskarado, where she and her ladies, like so many nymphs or Nereides, appeared . . . to the ravishment of the beholders," and "made the night more glorious than the day." Occasionally she even joined in the king's sports, though here her only recorded exploit was her accidental shooting of James's "most principal and special hound," Jewel. Her extravagant expenditure, returned by Salisbury in 1605 at more than £50,000 and by Chamberlain at her death at more than £84,000, was unfavourably contrasted with the economy of Queen Elizabeth; in spite of large allowances and grants of estates which included Oatlands, Greenwich House and Nonsuch, it greatly exceeded her income, her debts in 1616 being reckoned at nearly £10,000, while her jewelry and her plate were valued at her death at nearly half a million. Anne died after a long illness on the 2nd of March 1619, and was buried in Westminster Abbey. She was generally regretted. The severe Wilson, while rebuking her gaieties, allows that she was "a good woman," and that her character would stand the most prying investigation. She was intelligent and tactful, a faithful wife, a devoted mother and a staunch friend. Besides several children who died in infancy she had Henry, prince of Wales, who died in 1612, Charles, afterwards King Charles I., and Elizabeth, electress palatine and queen of Bohemia.

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(P. C. Y.)

ANNE OF FRANCE (1460–1522), dame de Beaujeu, was the eldest daughter of Louis XI. and Charlotte of Savoy. Louis XI. betrothed her at first to Nicholas of Anjou, and afterwards offered her hand successively to Charles the Bold, to the duke of Brittany, and even to his own brother, Charles of France. Finally she married Pierre de Beaujeu, a younger brother of the duke of Bourbon. Before his death Louis XI. entrusted to Pierre de Beaujeu and Anne the entire charge of his son, Charles VIII., a lad of thirteen; and from 1483 to 1492 the Beaujeus exercised a virtual regency. Anne was a true daughter of Louis XI. Energetic, obstinate, cunning and unscrupulous, she inherited, too, her father's avarice and rapacity. Although they made some concessions, the Beaujeus succeeded in maintaining the results of the previous reign, and in triumphing over the feudal intrigues and coalitions, as was seen from the meeting of the estates general in 1484, and the results of the "Mad War" (1485) and the war with Brittany (1488); and in spite of the efforts of Maximilian of Austria they concluded the marriage of Charles VIII. and Anne, duchess of Brittany (1491). But a short time afterwards the king disengaged himself completely from their tutelage, to the great detriment of the kingdom. In 1488 Pierre de Beaujeu had succeeded to the Bourbonnais, the last great fief of France. He died in 1503, but Anne survived him twenty years. From her establishments at Moulins and Chantelle in the Bourbonnais she continued henceforth vigorously to defend the Bourbon cause against the royal family. Anne's only daughter, Suzanne, had married in 1505 her cousin, Charles of Bourbon, count of Montpensier, the future constable; and the question of the succession of Suzanne, who died in 1521, was the determining factor of the treason of the constable de Bourbon (1523). Anne had died some months before, on the 14th of November 1522.

See P. Pelicier, *Essai sur le gouvernement de la Dame de Beaujeu* (Chartres, 1882).

(J. I.)

ANNEALING, HARDENING AND TEMPERING. Annealing (from the prefix *an*, and the old English *aélan*, to burn or bake; the meaning has probably also been modified from the French *nieler*, to enamel black on gold or silver, from the med. Lat. *nigellare*, to make black; cf. *niello*) is a process of treating a metal or alloy by heat with the object of imparting to it a certain condition of ductility, extensibility, or a certain grade of softness or hardness, with all that is involved in and follows from those conditions. The effect may be mechanical only, or a chemical change may take place also. Sometimes the causes are obvious, in other cases they are more or less obscure. But of the actual facts, and the immense importance of this operation as well as of the related ones of tempering and hardening in shop processes, there is no question.

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[1] *Fasti S. J.*, by P. Joannis Drews (pub. 1723), p. 160.

[2] *Cal. of St. Pap.—Venetian*, x. 513.

When the treatment is of a mechanical character only, there can be no reasonable doubt that the common belief is correct, namely, that the metallic crystals or fibres undergo a molecular rearrangement of some kind. When it is of a chemical character, the process is one of cementation, due to the occlusion of gases in the molecules of the metals.

Numerous examples of annealing due to molecular rearrangement might be selected from the extensive range of workshop operations. The following are a few only:—when a boilermaker bends the edges of a plate of steel or iron by hammer blows (flanging), he does so in successive stages (heats), at each of which the plate has to be reheated, with inevitable cooling down during the time work is being done upon it. The result is that the plate becomes brittle over the parts which have been subjected to this treatment; and this brittleness is not uniformly distributed, but is localized, and is a source of weakness, inducing a liability to crack. If, however, the plate when finished is raised to a full red heat, and allowed to cool down away from access of cool air, as in a furnace, or underneath wood ashes, it resumes its old ductility. The plate has been annealed, and is as safe as it was before it was flanged. Again, when a sheet of thin metal is forced to assume a shape very widely different from its original plane aspect, as by hammering, or by drawing out in a press—a cartridge case being a familiar example—it is necessary to anneal it several times during the progress of the operation. Without such annealing it would never arrive at the final stage desired, but would become torn asunder by the extension of its metallic fibres. Cutting tools are made of steel having sufficient carbon to afford capacity for hardening. Before the process is performed, the condition in which the carbon is present renders the steel so hard and tough as to render the preliminary turning or shaping necessary in many cases (*e.g.* in milling cutters) a tedious operation. To lessen this labour, the steel is first annealed. In this case it is brought to a low red heat, and allowed to cool away from the air. It can then be machined with comparative ease and be subsequently hardened or tempered. When a metallic structure has endured long service a state of fatigue results. Annealing is, where practicable, resorted to in order to restore the original strength. A familiar illustration is that of chains which are specially liable to succumb to constant overstrain if continued for only a year or two. This is so well known that the practice is regularly adopted of annealing the chains at regular intervals. They are put into a clear hot furnace and raised to a low red heat, continued for a few hours, and then allowed to cool down in the furnace after the withdrawal of the source of heat. Before the annealing the fracture of a link would be more crystalline than afterwards.

In these examples, and others of which these are typical, two conditions are essential, one being the grade of temperature, the other the cooling. The temperature must never be so high as to cause the metal to become overheated, with risk of burning, nor so low as to prevent the penetration of the substance with a good volume of heat. It must also be continued for sufficient time. More than this cannot be said. Each particular piece of work requires its own treatment and period, and nothing but experience of similar work will help the craftsman. The cooling must always be gradual, such as that which results from removing the source of heat, as by drawing a furnace fire, or covering with non-conducting substances.

The chemical kind of annealing is specifically that employed in the manufacture of malleable cast iron. In this process, castings are made of white iron,—a brittle quality which has its carbon wholly in the combined state. These castings, when subjected to heat for a period of ten days or a fortnight, in closed boxes, in the presence of substances containing oxygen, become highly ductile. This change is due to the absorption of the carbon by the oxygen in the cementing material, a comparatively pure soft iron being left behind. The result is that the originally hard, brittle castings after this treatment may be cut with a knife, and be bent double and twisted into spirals without fracturing.

The distinction between *hardening* and *tempering* is one of degree only, and both are of an opposite character to annealing. Hardening, in the shop sense, signifies the making of a piece of steel about as hard as it can be made—" glass hard "—while tempering indicates some stage in an infinite range between the fully hardened and the annealed or softened condition. As a matter of convenience only, hardening is usually a stage in the work of tempering. It is easier to harden first, and " let down " to the temper required, than to secure the exact heat for tempering by raising the material to it. This is partly due to the long established practice of estimating temperature by colour tints; but this is being rapidly invaded by new methods in which the temper heat is obtained in furnaces provided with pyrometers, by means of which exact heat regulation is readily secured, and in which the heating up is done gradually. Such furnaces are used for hardening balls for bearings, cams, small toothed wheels and similar work, as well as for tempering springs, milling cutters and other kinds of cutting tools. But for the cutting tools having single edges, as used in engineers' shops, the colour test is still generally retained.

In the practice of hardening and tempering tools by colour, experience is the only safe guide. Colour tints vary with degrees of light; steels of different brands require different treatment in regard to temperature and quenching; and steels even of identical chemical composition do not always behave alike when tempered. Every fresh brand of steel has, therefore, to be treated at first in a tentative and experimental fashion in order to secure the best possible results. The larger the masses of steel, and the greater the disparity in dimensions of adjacent parts, the greater is the risk of cracking and distortion. Excessive length and the presence of keen angles increase the difficulties of hardening. The following points have to be observed in the work of hardening and tempering.

A grade of steel must be selected of suitable quality for the purpose for which it has to be used. There are a number of such grades, ranging from about 1½ to ½ % content of carbon, and each having its special utility. Overheating must be avoided, as that burns the steel and injures or ruins it. A safe rule is never to heat any grade of steel to a temperature higher than that at which experience proves it will take the temper required. Heating must be regular and thorough throughout, and must therefore be slowly done when dealing with thick masses. Contact with sulphurous fuel must be avoided. Baths of molten alloys of lead and tin are used when very exact temperatures are required, and when articles have thick and thin parts adjacent. But the gas furnaces have the same advantages in a more handy form. Quenching is done in water, oil, or in various hardening mixtures, and sometimes in solids. Rain water is the principal hardening agent, but various saline compounds are often added to intensify its action. Water that has been long in use is preferred to fresh. Water is generally used cold, but in many cases it is warmed to about 80° F., as for milling cutters and taps, warmed water being less liable to crack the cutters than cold. Oil is preferred to water for small springs, for guns and for many cutters. Mercury hardens most intensely, because it does not evaporate, and so does lead or wax for the same reason; water evaporates, and in the spheroidal state, as steam, leaves contact with the steel. This is the reason why long and large objects are moved vertically about in the water during quenching, to bring them into contact with fresh cold water.

There is a good deal of mystery affected by many of the hardeners, who are very particular about the composition of their baths, various oils and salts being used in an infinity of combinations. Many of these are the result of long and successful experience, some are of the nature of " fads." A change of bath may involve injury to the steel. The most difficult articles to harden are springs, milling cutters, taps, reamers. It would be easy to give scores of hardening compositions.

Hardening is performed the more efficiently the more rapidly the quenching is done. In the case of thick objects, however, especially milling cutters, there is risk of cracking, due to the difference of temperature on the outside and in the central body of metal. Rapid hardening is impracticable in such objects. This is the cause of the distortion of long taps and reamers, and of their cracking, and explains why their teeth are often protected with soft soap and other substances.

The presence of the body of heat in a tool is taken advantage of in the work of tempering. The tool, say a chisel, is dipped, a length of 2 in. or more being thus hardened and blackened. It is then removed, and a small area rubbed rapidly with a bit of grindstone, observations being made of the changing tints which gradually appear as the heat is communicated from the hot shank to the cooled end. The heat becomes equalized, and at the same time the approximate temperature for quenching for temper is estimated by the appearance of a certain tint; at that instant the article is plunged and allowed to remain until quite cold. For every different class of tool a different tint is required.

"Blazing off" is a particular method of hardening applied to small springs. The springs are heated and plunged in oils, fats, or tallow, which is burned off previous to cooling in air, or in the ashes of the forge, or in oil, or water usually. They are hardened, reheated and tempered, and the tempering by blazing off is repeated for heavy springs. The practice varies almost infinitely with dimensions, quality of steel, and purpose to which the springs have to be applied.

The range of temper for most cutting tools lies between a pale straw or yellow, and a light purple or plum colour. The corresponding range of temperatures is about 430° F. to 530° F., respectively. "Spring temper" is higher, from dark purple to blue, or 550° F. to 630° F. In many fine tools the range of temperature possible between good and poor results lies within from 5° to 10° F.

There is another kind of hardening which is of a superficial character only—"case hardening." It is employed in cases where toughness has to be combined with durability of surface. It is a cementation process, practised on wrought iron and mild steel, and applied to the link motions of engines, to many pins and studs, eyes of levers, &c. The articles are hermetically luted in an iron box, packed with nitrogenous and saline substances such as potash, bone dust, leather cuttings, and salt. The box is placed in a furnace, and allowed to remain for periods of from twelve to thirty-six hours, during which period the surface of the metal, to a depth of $\frac{1}{32}$ to $\frac{1}{16}$ in., is penetrated by the cementing materials, and converted into steel. The work is then thrown into water and quenched.

A muffle furnace, employed for annealing, hardening and tempering is shown in fig. 1; the heat being obtained by means of petroleum, which is contained in the tank A, and is kept under pressure by pumping at intervals with the wooden handle, so that when the valve B is opened the oil is vaporized by passing through a heating coil at the furnace entrance, and when ignited burns fiercely as a gas flame. This passes into the furnace through the two holes, C, C, and plays under and up around the muffle D, standing on a fireclay slab. The doorway is closed by two fireclay blocks at E. A temperature of over 2000° F. can be obtained in furnaces of this class, and the heat is of course under perfect control.

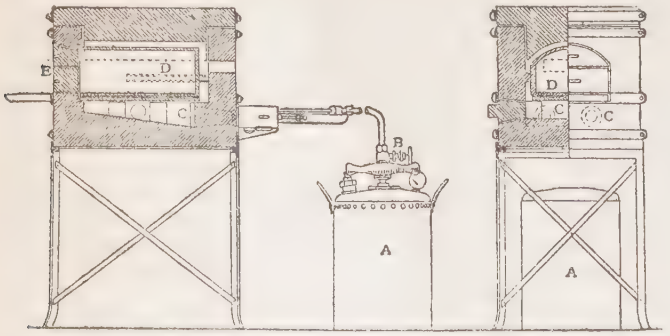


Fig. 1.—Automatic Oil Muffle Furnace.

A reverberatory type of gas furnace, shown in fig. 2, differs from the oil furnace in having the flames brought down through the roof, by pipes A,A,A, playing on work laid on the fireclay slab B, thence passing under this and out through the elbow-pipe C. The hinged doors, D, give a full opening to the interior of the furnace. It will be noticed in both these furnaces (by Messrs Fletcher, Russell & Co., Ltd.) that the iron casing is a mere shell, enclosing very thick firebrick linings, to retain the heat effectively. (J. G. H.)

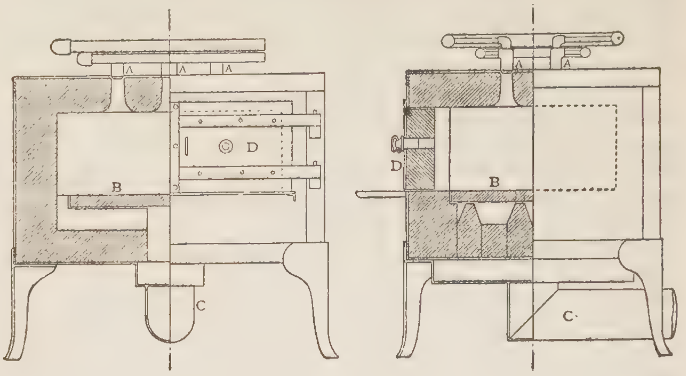


Fig. 2.—Reverberatory Furnace.

ANNECY, the chief town of the department of Haute Savoie in France. Pop. (1906) 10,763. It is situated at a height of 1470 ft., at the northern end of the lake of Annecy, and is 25 m. by rail N.E. of Aix les Bains. The surrounding country presents many scenes of beauty. The town itself is a pleasant residence, and contains a 16th century cathedral church, an 18th century bishop's palace, a 14th–16th century castle (formerly the residence of the counts of the Genevois), and the reconstructed convent of the Visitation, wherein now reposes the body of St François de Sales (born at the castle of Sales, close by, in 1567; died at Lyons in 1622), who held the see from 1602 to 1622. There is also a public library, with 20,000 volumes, and various scientific collections, and a public garden, with a statue of the chemist Berthollet (1748–1822), who was born not far off. The bishop's see of Geneva was transferred hither in 1535, after the Reformation, but suppressed in 1801, though revived in 1822. There are factories of linen and cotton goods, and of felt hats, paper mills, and a celebrated bell foundry at Annecy le Vieux. This last-named place existed in Roman times. Annecy itself was in the 10th century the capital of the counts of the Genevois, from whom it passed in 1401 to the counts of Savoy, and became French in 1860 on the annexation of Savoy.

The Lake of Annecy is about 9 m. in length by 2 m. in breadth, its surface being 1465 ft. above the level of the sea. It discharges its waters, by means of the Thioux canal, into the Fier, a tributary of the Rhone. (W. A. B. C.)

ANNELIDA, a name derived from J. B. P. Lamarck's term *Annélides*, now used to denote a major phylum or division of coelomate invertebrate animals. Annelids are segmented worms, and differ from the Arthropoda (*q.v.*), which they closely resemble in many respects, by the possession of a portion of the coelom traversed by the alimentary canal. In the latter respect, and in the fact that they frequently develop by a metamorphosis, they approach the Mollusca (*q.v.*), but they differ from that group notably in the occurrence of metameric segmentation affecting many of the systems of organs. The body-wall is highly muscular and, except in a few probably specialized cases, possesses chitinous spines, the setae, which are secreted by the ectoderm and are embedded in pits of the skin. They possess a modified anterior end, frequently with special sense organs, forming a head, a segmented nervous system, consisting of a pair of anterior, dorsally-placed ganglia, a ring surrounding the alimentary canal, and a double ventral ganglionated chain, a definite vascular system, an excretory system consisting of nephridia, and paired generative organs formed from the coelomic epithelium. They are divided as follows: (1) Haplodrili (*q.v.*) or Archiannelida; (2) Chaetopoda (*q.v.*); (3) Myzostomida (*q.v.*), probably degenerate Polychaeta; (4) Hirudinea (see CHAETOPODA and LEECH); (5) Echiuroidea (*q.v.*). (P. C. M.)

ANNET, PETER (1693–1769), English deist, is said to have been born at Liverpool. A schoolmaster by profession, he became prominent owing to his attacks on orthodox theologians, and his membership of a semi-theological debating society, the Robin Hood Society, which met at the "Robin Hood and Little John" in Butcher Row. To him has been attributed a work called *A History of the Man after God's own Heart* (1761), intended to show that George II. was insulted by a current comparison with David. The book is said to have inspired Voltaire's *Saul*. It is also attributed to one John Noorthouck (Noorthook). In 1763 he was condemned for blasphemous libel in his paper called the *Free Enquirer* (nine numbers only). After his release he kept a small school in Lambeth, one of his pupils being James Stephen (1758–1832), who became master in Chancery. Annet died on the 18th of January 1769. He stands between the earlier philosophic deists and the later propagandists of Paine's school, and "seems to have been the first freethought lecturer" (J. M. Robertson); his essays (*A Collection of the Tracts of a certain Free Enquirer*, 1739–1745) are forcible but lack refinement. He invented a system of shorthand (2nd ed., with a copy of verses by Joseph Priestley).

ANNEXATION (Lat. *ad*, to, and *nexus*, joining), in international law, the act by which a state adds territory to its dominions; the term is also used generally as a synonym for acquisition. The assumption of a protectorate over another state, or of a sphere of influence, is not strictly annexation, the latter implying the complete displacement in the annexed territory of the government or state by which it was previously ruled. Annexation may be the consequence of a voluntary cession from one state to another, or of conversion from a protectorate or sphere of influence, or of mere occupation in uncivilized regions, or of conquest. The cession of Alsace-Lorraine to Germany by France, although brought about by the war of 1870, was for the purposes of international law a voluntary cession. Under the treaty of the 17th of December 1885, between the French republic and the queen of Madagascar, a French protectorate was established over this island. In 1896 this protectorate was converted by France into an annexation, and Madagascar then became "French territory." The formal annexation of Bosnia-Herzegovina by Austria (Oct. 5, 1908) was an unauthorized conversion of an "occupation" authorized by the Treaty of Berlin (1878), which had, however, for years operated as a *de facto* annexation. A recent case of conquest was that effected by the South African War of 1899–1902, in which the Transvaal republic and the Orange Free State were extinguished, first *de facto* by occupation of the whole of their territory, and then *de jure* by terms of surrender entered into by the Boer generals acting as a government.

By annexation, as between civilized peoples, the annexing state takes over the whole succession with the rights and obligations attaching to the ceded territory, subject only to any modifying conditions contained in the treaty of cession. These, however, are binding only as between the parties to them. In the case of the annexation of the territories of the Transvaal republic and Orange Free State, a rather complicated situation arose out of the facts, on the one hand, that the ceding states closed their own existence and left no recourse to third parties against the previous ruling authority, and, on the other, that, having no means owing to the *de facto* British occupation, of raising money by taxation, the dispossessed governments raised money by selling certain securities, more especially a large holding of shares in the South African Railway Company, to neutral purchasers. The British government repudiated these sales as having been made by a government which the British government had already displaced. The question of at what point, in a war of conquest, the state succession becomes operative is one of great delicacy. As early as the 6th of January 1900, the high commissioner at Cape Town issued a proclamation giving notice that H. M. government would "not recognize as valid or effectual" any conveyance, transfer or transmission of any property made by the government of the Transvaal republic or Orange Free State subsequently to the 10th of October 1899, the date of the commencement of the war. A proclamation forbidding transactions with a state which might still be capable of maintaining its independence could obviously bind only those subject to the authority of the state issuing it. Like paper blockades (see BLOCKADE) and fictitious occupations of territory, such premature proclamations are viewed by international jurists as not being *jure gentium*. The proclamation was succeeded, on the 9th of March 1900, by another of the high commissioner at Cape Town, reiterating the notice, but confining it to "lands, railways, mines or mining rights." And on the 1st of September 1900 Lord Roberts proclaimed at Pretoria the annexation of the territories of the Transvaal republic to the British dominions. That the war continued for nearly two years after this proclamation shows how fictitious the claim of annexation was. The difficulty which arose out of the transfer of the South African Railway shares held by the Transvaal government was satisfactorily terminated by the purchase by the British government of the total capital of the company from the different groups of shareholders (see on this case, Sir Thomas Barclay, *Law Quarterly Review*, July 1905; and Professor Westlake, in the same *Review*, October 1905).

In a judgment of the judicial committee of the privy council in 1899 (*Coote* v. *Sprigg*, A.C. 572), Lord Chancellor Halsbury made an important distinction as regards the obligations of state succession. The case in question was a claim of title against the crown, represented by the government of Cape Colony. It was made by persons holding a concession of certain rights in eastern Pondoland from a native chief. Before the grantees had taken up their grant by acts of possession, Pondoland was annexed to Cape Colony. The colonial government refused to recognize the grant on different grounds, the chief of them being that the concession conferred no legal rights before the annexation and therefore could confer none afterwards, a sufficiently good ground in itself. The judicial committee, however, rested its decision chiefly on the allegation that the acquisition of the territory was an act of state and that "no municipal court had authority to enforce such an obligation" as the duty of the new government to respect existing titles. "It is no answer," said Lord Halsbury, "to say that by the ordinary principles of international law private property is respected by the sovereign which accepts the cession and assumes the duties and legal obligations of the former sovereign with respect to such private property within the ceded territory. All that can be meant by such a proposition is that according to the well-understood rules of international law a change of sovereignty by cession ought not to affect private property, but no municipal tribunal has authority to enforce such an obligation. And if there is either an express or a well-understood bargain between the ceding potentate and the government to which the cession is made that private property shall be respected, that is only a bargain which can be enforced by sovereign against sovereign in the ordinary course of diplomatic pressure." In an editorial note on this case the *Law Quarterly Review* of Jan. 1900 (p. 1), dissenting from the view of the judicial committee that "no municipal tribunal has authority to enforce such an obligation," the writer observes that "we can read this only as meant to lay down that, on the annexation of territory even by peaceable cession, there is a total abeyance of justice until the will of the annexing power is expressly made known; and that, although the will of that power is commonly to respect existing private rights, there is no rule or presumption to that effect of which any court must or indeed can take notice." So construed the doctrine is not only contrary to international law, but according to so authoritative an exponent of the common law as Sir F. Pollock, there is no warrant for it in English common law.

An interesting point of American constitutional law has arisen out of the cession of the Philippines to the United States, through the fact that the federal constitution does not lend itself to the exercise by the federal congress of unlimited powers, such as are vested in the British parliament. The sole authority for the powers of the federal congress is a written constitution with defined powers. Anything done in excess of those powers is null and void. The Supreme Court of the United States, on the other hand, has declared that, by the constitution, a government is ordained and established "for the United States of America" and not for countries outside their limits (*Ross's Case*, 140 U.S. 453, 464), and that no such power to legislate for annexed territories as that vested in the British crown in council is enjoyed by the president of the United States (*Field* v. *Clark*, 143 U.S. 649, 692). Every detail connected with the administration of the territories acquired from Spain under the treaty of Paris (December 10, 1898) has given rise to minute discussion.

See Carman F. Randolph, *Law and Policy of Annexation* (New York and London, 1901); Charles Henry Butler, *Treaty-making Power of the United States* (New York, 1902), vol. i. p. 79 et seq. (T. BA.)

ANNICERIS, a Greek philosopher of the Cyrenaic school. There is no certain information as to his date, but from the statement that he was a disciple of Paraebates it seems likely that he was a contemporary of Alexander the Great. A follower of Aristippus, he denied that pleasure is the general end of human life. To each separate action there is a particular end, namely the pleasure which actually results from it Secondly, pleasure is not merely the negation of pain, inasmuch as death ends all pain and yet cannot be regarded as pleasure. There is, however, an absolute pleasure in certain virtues such as belong to the love of country, parents and friends. In these relations a man will have pleasure, even though it may result in painful and even fatal consequences. Friendship is not merely for the satisfaction of our needs, but is in itself a source of pleasure. He maintains further, in opposition to most of the Cyrenaic school, that wisdom or prudence alone is an insufficient guarantee against error. The wise man is he who has acquired a habit of wise action; human wisdom is liable to lapses at any moment. Diogenes Laertius says that Anniceris ransomed Plato from Dionysius, tyrant of Syracuse, for twenty minas. If we are right in placing Anniceris in the latter half of the 4th century, it is clear that the reference here is to an earlier Anniceris, who, according to Aelian, was a celebrated charioteer.

ANNING, MARY (1799–1847), English fossil-collector, the daughter of Richard Anning, a cabinet-maker, was born at Lyme Regis in May 1799. Her father was one of the earliest collectors and dealers in fossils, obtained chiefly from the Lower Lias in that famous locality. When but a child in 1811 she discovered the first specimen of *Ichthyosaurus* which was brought into scientific notice; in 1821 she found remains of a new saurian, the *Plesiosaurus*, and in 1828 she procured, for the first time in England, remains of a pterodactyl (*Dimorphodon*). She died on the 9th of March 1847.

ANNISTON, a city and the county seat of Calhoun county, Alabama, U.S.A., in the north-eastern part of the state, about 63 m. E. by N. of Birmingham. Pop. (1890) 9998; (1900), 9695, of whom 3669 were of negro descent; (1910 census) 12,794. Anniston is served by the Southern, the Seaboard Air Line, and the Louisville & Nashville railways. The city is situated on the slope of Blue Mountain, a chain of the Blue Ridge, and is a health resort. It is the seat of the Noble Institute (for girls), established in 1886 by Samuel Noble (1834–1888), a wealthy iron-founder, and of the Alabama Presbyterian College for Men (1905). There are vast quantities of iron ore in the vicinity of the city, the Coosa coal-fields being only 25 m. distant. Anniston is an important manufacturing city, the principal industries being the manufacture of iron, steel and cotton. In 1905 the city's factory products were valued at $2,525,455. An iron furnace was established on the site of Anniston during the Civil War, but it was destroyed by the federal troops in 1865; and in 1872 it was rebuilt on a much larger scale. The city was founded in 1872 as a private enterprise, by the Woodstock Iron Company, organized by Samuel Noble and Gen. Daniel Tyler (1799–1882); but it was not opened for general settlement until twelve years later. It was chartered as a city in 1879.

ANNO, or HANNO, **SAINT** (*c.* 1010–1075), archbishop of Cologne, belonged to a Swabian family, and was educated at Bamberg. He became confessor to the emperor Henry III., who appointed him archbishop of Cologne in 1056. He took a prominent part in the government of Germany during the minority of King Henry IV., and was the leader of the party which in 1062 seized the person of Henry, and deprived his mother, the empress Agnes, of power. For a short time Anno exercised the chief authority in the kingdom, but he was soon obliged to share this with Adalbert, archbishop of Bremen, retaining for himself the supervision of Henry's education and the title of *magister*. The office of chancellor of the kingdom of Italy was at this period regarded as an appanage of the archbishopric of Cologne, and this was probably the reason why Anno had a considerable share in settling the papal dispute in 1064. He declared Alexander II. to be the rightful pope at a synod held at Mantua in May 1064, and took other steps to secure his recognition. Returning to Germany, he found the chief power in the hands of Adalbert, and as he was disliked by the young king, he left the court but returned and regained some of his former influence when Adalbert fell from power in 1066. He succeeded in putting down a rising against his authority in Cologne in 1074, and it was reported he had allied himself with William the Conqueror, king of England, against the emperor. Having cleared himself of this charge, Anno took no further part in public business, and died at Cologne on the 4th of December 1075. He was buried in the monastery of Siegburg and was canonized in 1183 by Pope Lucius III. He was a founder of monasteries and a builder of churches, advocated clerical celibacy and was a strict disciplinarian. He was a man of great energy and ability, whose action in recognizing Alexander II. was of the utmost consequence for Henry IV. and for Germany.

There is a *Vita Annonis*, written about 1100, by a monk of Siegburg, but this is of slight value. It appears in the *Monumenta Germaniae historica: Scriptores*, Bd. xi. (Hanover and Berlin, 1826–1892). There is an "Epistola ad monachos Malmundarienses" by Anno in the *Neues Archiv der Gesellschaft für ältere deutsche Geschichtskunde*, Bd. xiv. (Hanover, 1876 seq.). See also the *Annolied*, or *Incerti poetae Teutonici rhythmus de S. Annone*, written about 1180, and edited by J. Kehrein (Frankfort, 1865); Th. Lindner, *Anno II. der Heilige, Erzbischof von Köln* (Leipzig, 1869).

ANNOBON, or ANNO BOM, an island in the Gulf of Guinea, in 1° 24′ S. and 5° 35′ E., belonging to Spain. It is 110 m. S.W. of St Thomas. Its length is about 4 m., its breadth 2, and its area 6¾ sq. m. Rising in some parts nearly 3000 ft. above the sea, it presents a succession of beautiful valleys and steep mountains, covered with rich woods and luxuriant vegetation. The inhabitants, some 3000 in number, are negroes and profess belief in the Roman Catholic faith. The chief town and residence of the governor is called St Antony (San Antonio de Praia). The roadstead is tolerably safe, and passing vessels take advantage of it in order to obtain water and fresh provisions, of which Annobon contains an abundant supply. The island was discovered by the Portuguese on the 1st of January 1473, from which circumstance it received its name (=New Year). Annobon, together with Fernando Po, was ceded to Spain by the Portuguese in 1778. The islanders revolted against their new masters and a state of anarchy ensued, leading, it is averred, to an arrangement by which the island was administered by a body of five natives, each of whom held the office of governor during the period that elapsed till ten ships touched at the island. In the latter part of the 19th century the authority of Spain was re-established.

ANNONA (from Lat. *annus*, year), in Roman mythology, the personification of the produce of the year. She is represented in works of art, often together with Ceres, with a *cornucopia* (horn of plenty) in her arm, and a ship's prow in the background, indicating the transport of grain over the sea. She frequently occurs on coins of the empire, standing between a *modius* (corn-measure) and the prow of a galley, with ears of corn in one hand and a *cornucopia* in the other; sometimes she holds a rudder or an anchor. The Latin word itself has various meanings: (1) the produce of the year's harvest; (2) all means of subsistence, especially grain stored in the public granaries for provisioning the city; (3) the market-price of commodities, especially corn; (4) a direct tax in kind, levied in republican times in several provinces, chiefly employed in imperial times for distribution amongst officials and the support of the soldiery.

In order to ensure a supply of corn sufficient to enable it to be sold at a very low price, it was procured in large quantities from Umbria, Etruria and Sicily. Almost down to the times of the empire, the care of the corn-supply formed part of the aedile's duties, although in 440 B.C. (if the statement in Livy iv. 12, 13 is correct, which is doubtful) the senate appointed a special officer, called *praefectus annonae*, with greatly extended powers. As a consequence of the second Punic War, Roman agriculture was at a standstill; accordingly, recourse was had to Sicily and Sardinia (the first two Roman provinces) in order to keep up the supply of corn; a tax of one-tenth was imposed on it, and its export to any country except Italy forbidden. The price at which the corn was sold was always moderate; the corn law of Gracchus (123 B.C.) made it absurdly low, and Clodius (58 B.C.) bestowed it gratuitously. The number of the recipients of this free gift grew so enormously, that both Caesar and Augustus were obliged to reduce it. From the time of Augustus to the end of the empire the number of those who were entitled to receive a monthly allowance of corn on presenting a ticket was 200,000. In the 3rd century, bread formed the dole. A *praefectus annonae* was appointed by Augustus to superintend the corn-supply; he was assisted by a large staff in Rome and the provinces, and had jurisdiction in all matters connected with the corn-market. The office lasted till the latest times of the empire.

ANNONAY, a town of south-eastern France, in the north of the department of Ardèche, 50 m. S. of Lyons by the Paris-Lyons railway. Pop. (1906) 15,403. Annonay is built on the hill overlooking the meeting of the deep gorges of the Déôme and the Cance, the waters of which supply power to the factories of the town. By means of a dam across the Ternay, an affluent of the Déôme, to the north-west of the town, a reservoir is provided, in which an additional supply of water, for both industrial and domestic purposes, is stored. At Annonay there is an obelisk in honour of the brothers Montgolfier, inventors of the balloon, who were natives of the place. A tribunal of commerce, a board of trade-arbitrators, a branch of the Bank of France, and chambers of commerce and of arts and manufactures are among the public institutions. Annonay is the principal industrial centre of its department, the chief manufactures being those of leather, especially for gloves, paper, silk and silk goods, and flour. Chemical manures, glue, gelatine, brushes, chocolate and candles are also produced.

ANNOY (like the French *ennui*, a word traced by etymologists to a Lat. phrase, *in odio esse*, to be "in hatred" or hateful of someone), to vex or affect with irritation. In the sense of "nuisance," the noun "annoyance," apart from its obvious meaning, is found in the English "Jury of Annoyance" appointed by an act of 1754 to report upon obstructions in the highways.

ANNUITY (from Lat. *annus*, a year), a periodical payment, made annually, or at more frequent intervals, either for a fixed term of years, or during the continuance of a given life, or a combination of lives. In technical language an annuity is said to be payable for an assigned *status*, this being a general word chosen in preference to such words as "time," "term" or "period," because it may include more readily either a term of years certain, or a life or combination of lives. The magnitude of the annuity is the sum to be paid (and received) in the course of each year. Thus, if £100 is to be received each year by a person, he is said to have "an annuity of £100." If the payments are made half-yearly, it is sometimes said that he has "a half-yearly annuity of £100"; but to avoid ambiguity, it is more commonly said he has an annuity of £100, payable by half-yearly instalments. The former expression, if clearly understood, is preferable on account of its brevity. So we may have quarterly, monthly, weekly, daily annuities, when the annuity is payable by quarterly, monthly, weekly or daily instalments. An annuity is considered as accruing during each instant of the status for which it is enjoyed, although it is only payable at fixed intervals. If the enjoyment of an annuity is postponed until after the lapse of a certain number of years, the annuity is said to be deferred. If an annuity, instead of being payable at the end of each year, half-year, &c., is payable in advance, it is called an annuity-due.

If an annuity is payable for a term of years independent of any contingency, it is called an *annuity certain*; if it is to continue for ever, it is called a *perpetuity*; and if in the latter case it is not to commence until after a term of years, it is called a *deferred perpetuity*. An annuity depending on the continuance of an assigned life or lives, is sometimes called a life annuity; but more commonly the simple term "annuity" is understood to mean a life annuity, unless the contrary is stated. A life annuity, to cease in any event after a certain term of years, is called a *temporary annuity*. The holder of an annuity is called an annuitant, and the person on whose life the annuity depends is called the nominee.

If not otherwise stated, it is always understood that an annuity is payable yearly, and that the annual payment (or rent, as it is sometimes called) is £1. It is, however, customary to consider the annual payment to be, not £1, but simply 1, the reader supplying whatever monetary unit he pleases, whether pound, dollar, franc, Thaler, &c.

The annuity is the totality of the payments to be made (and received), and is so understood by all writers on the subject; but some have also used the word to denote an individual payment (or rent), speaking, for instance, of the first or second year's annuity,—a practice which is calculated to introduce confusion and should therefore be carefully avoided.

Instances of perpetuities are the dividends upon the public stocks in England, France and some other countries. Thus, although it is usual to speak of £100 consols, the reality is the yearly dividend which the government pays by quarterly instalments. The practice of the French in this, as in many other matters, is more logical. In speaking of their public funds (*rentes*) they do not mention the ideal capital sum, but speak of the annuity or annual payment that is received by the public creditor. Other instances of perpetuities are the incomes derived from the debenture stocks of railway companies, also the feu-duties commonly payable on house property in Scotland. The number of years' purchase which the perpetual annuities granted by a government or a railway company realize in the open market, forms a very simple test of the credit of the various governments or railways.

Terminable Annuities are employed in the system of British public finance as a means of reducing the National Debt (*q.v.*). This result is attained by substituting for a perpetual annual charge (or one lasting until the capital which it represents can be paid off *en bloc*), an annual charge of a larger amount, but lasting for a short term. The latter is so calculated as to pay off, during its existence, the capital which it replaces, with interest at an assumed or agreed rate, and under specified conditions. The practical effect of the substitution of a terminable annuity for an obligation of longer currency is to bind the present generation of citizens to increase its own obligations in the present and near future in order to diminish those of its successors. This end might be attained in other ways; for instance, by setting aside out of revenue a fixed annual sum for the purchase and cancellation of debt (Pitt's method, in intention), or by fixing the annual debt charge at a figure sufficient to provide a margin for reduction of the principal of the debt beyond the amount required for interest (Sir Stafford Northcote's method), or by providing an annual surplus of revenue over expenditure (the "Old Sinking Fund"), available for the same purpose. All these methods have been tried in the course of British financial history, and the second and third of them are still employed; but on the whole the method of terminable annuities has been the one preferred by chancellors of the exchequer and by parliament.

Terminable annuities, as employed by the British government, fall under two heads:—(*a*) Those issued to, or held by private persons; (*b*) those held by government departments or by funds under government control. The important difference between these two classes is that an annuity under (*a*), once created, cannot be modified except with the holder's consent, *i.e.* is practically unalterable without a breach of public faith; whereas an annuity under (*b*) can, if necessary, be altered by inter-departmental arrangement under the authority of parliament. Thus annuities of class (*a*) fulfil most perfectly the object of the system as explained above; while those of class (*b*) have the advantage that in times of emergency their operation can be suspended without any inconvenience or breach of faith, with the result that the resources of government can on such occasions be materially increased, apart from any additional taxation. For this purpose it is only necessary to retain as a charge on the income of the year a sum equal to the (smaller) perpetual charge which was originally replaced by the (larger) terminable charge, whereupon the difference between the two amounts is temporarily released, while ultimately the increased charge is extended for a period equal to that for which it is suspended. Annuities of class (*a*) were first instituted in 1808, but are at present mainly regulated by an act of 1829. They may be granted either for a specified life, or two lives, or for an arbitrary term of years; and the consideration for them may take the form either of cash or of government stock, the latter being cancelled when the annuity is set up. Annuities (*b*) held by government departments date from 1863. They have been created in exchange for permanent debt surrendered for cancellation, the principal operations having been effected in 1863, 1867, 1870, 1874, 1883 and 1899. Annuities of this class do not affect the public at all, except of course in their effect on the market for government securities. They are merely financial operations between the government, in its capacity as the banker of savings banks and other funds, and itself, in the capacity of custodian of the national finances. Savings bank depositors are not concerned with the manner in which government invests their money, their rights being confined to the receipt of interest and the repayment of deposits upon specified conditions. The case is, however, different as regards forty millions of consols (included in the above figures), belonging to suitors in chancery, which were cancelled and replaced by a terminable annuity in 1883. As the liability to the suitors in that case was for a specified amount of stock, special arrangements were made to ensure the ultimate replacement of the precise amount of stock cancelled.

Annuity Calculations.—The mathematical theory of life annuities is based upon a knowledge of the rate of mortality among mankind in general, or among the particular class of persons on whose lives the annuities depend. It involves a mathematical treatment too complicated to be dealt with fully in this place, and in practice it has been reduced to the form of tables, which vary in different places, but which are easily accessible. The history of the subject may, however, be sketched. Abraham Demoivre, in his *Annuities on Lives*, propounded a very simple law of mortality which is to the effect that, out of 86 children born alive, 1 will die every year until the last dies between the ages of 85 and 86. This law agreed sufficiently well at the middle ages of life with the mortality deduced from the best observations of his time; but, as observations became more exact, the approximation was found to be not sufficiently close. This was particularly the case when it was desired to obtain the value of joint life, contingent or other complicated benefits. Therefore Demoivre's law is entirely devoid of practical utility. No simple formula has yet been discovered that will represent the rate of mortality with sufficient accuracy.

The rate of mortality at each age is, therefore, in practice usually determined by a series of figures deduced from observation; and the value of an annuity at any age is found from these numbers by means of a series of arithmetical calculations. The mortality table here given is an example of modern use.

The first writer who is known to have attempted to obtain, on correct mathematical principles, the value of a life annuity, was Jan De Witt, grand pensionary of Holland and West Friesland. Our knowledge of his writings on the subject is derived from two papers contributed by Frederick Hendriks to the *Assurance Magazine*, vol. ii. p. 222, and vol. iii. p. 93. The former of these contains a translation of De Witt's report upon the value of life annuities, which was prepared in consequence of the resolution passed by the states-general, on the 25th of April 1671, to negotiate funds by life annuities, and which was distributed to the members on the 30th of July 1671. The latter contains the translation of a number of letters addressed by De Witt to Burgomaster Johan Hudde, bearing dates from September 1670 to October 1671. The existence of De Witt's report was well known among his contemporaries, and Hendriks collected a number of extracts from various authors referring to it; but the report is not contained in any collection of his works extant, and had been entirely lost for 180 years, until Hendriks discovered it among the state archives of Holland in company with the letters to Hudde. It is a document of extreme interest, and (notwithstanding some inaccuracies in the reasoning) of very great merit, more especially considering that it was the very first document on the subject that was ever written.

TABLE OF MORTALITY—HM, HEALTHY LIVES—MALE.

Number Living and Dying at each Age, out of 10,000 *entering at Age* 10.

Age.	Living.	Dying.	Age.	Living.	Dying.
10	10,000	79	54	6791	129
11	9,921	0	55	6662	153
12	9,921	40	56	6509	150
13	9,881	35	57	6359	152
14	9,846	40	58	6207	156
15	9,806	22	59	6051	153
16	9,784	0	60	5898	184
17	9,784	41	61	5714	186
18	9,743	59	62	5528	191
19	9,684	68	63	5337	200
20	9,616	56	64	5137	206
21	9,560	67	65	4931	215
22	9,493	59	66	4716	220
23	9,434	73	67	4496	220
24	9,361	64	68	4276	237
25	9,297	48	69	4039	246
26	9,249	64	70	3793	213
27	9,185	60	71	3580	222
28	9,125	71	72	3358	268
29	9,054	67	73	3090	243
30	8,987	74	74	2847	300
31	8,913	65	75	2547	241
32	8,848	74	76	2306	245
33	8,774	73	77	2061	224
34	8,701	76	78	1837	226
35	8,625	71	79	1611	219
36	8,554	75	80	1392	196
37	8,479	81	81	1196	191
38	8,398	87	82	1005	173
39	8,311	88	83	832	172
40	8,223	81	84	660	119
41	8,142	85	85	541	117
42	8,057	87	86	424	92
43	7,970	84	87	332	72
44	7,886	93	88	260	74
45	7,793	97	89	186	36
46	7,696	96	90	150	34
47	7,600	107	91	116	36
48	7,493	106	92	80	36
49	7,387	113	93	44	29
50	7,274	120	94	15	0
51	7,154	124	95	15	5
52	7,030	120	96	10	10
53	6,910	119			

It appears that it had long been the practice in Holland for life annuities to be granted to nominees of any age, in the constant proportion of double the rate of interest allowed on stock; that is to say, if the towns were borrowing money at 6 %, they would be willing to grant a life annuity at 12 %, and so on. De Witt states that "annuities have been sold, even in the present century, first at six years' purchase, then at seven and eight; and that the majority of all life annuities now current at the country's expense were obtained at nine years' purchase"; but that the price had been increased in the course of a few years from eleven years' purchase to twelve, and from twelve to fourteen. He also states that the rate of interest had been successively reduced from 6¼ to 5 %, and then to 4 %. The principal object of his report is to prove that, taking interest at 4 %, a life annuity was worth at least sixteen years' purchase; and, in fact, that an annuitant purchasing an annuity for the life of a young and healthy nominee at sixteen years' purchase, made an excellent bargain. It may be mentioned that he argues that it is more to the advantage, both of the country and of the private investor, that the public loans should be raised by way of grant of life annuities rather than perpetual annuities. It appears conclusively from De Witt's correspondence with Hudde, that the rate of mortality assumed as the basis of his calculations was deduced from careful examination of the mortality that had actually prevailed among the nominees on whose lives annuities had been granted in former years. De Witt appears to have come to the conclusion that the probability of death is the same in any half-year from the age of 3 to 53 inclusive; that in the next ten years, from 53 to 63, the probability is greater in the ratio of 3 to 2; that in the next ten years, from 63 to 73, it is greater in the ratio of 2 to 1; and in the next seven years, from 73 to 80, it is greater in the ratio of 3 to 1; and he places the limit of human life at 80. If a mortality table of the usual form is deduced from these suppositions, out of 212 persons alive at the age of 3, 2 will die every year up to 53, 3 in each of the ten years from 53 to 63, 4 in each of the next ten years from 63 to 73, and 6 in each of the next seven years from 73 to 80, when all will be dead.

De Witt calculates the value of an annuity in the following way. Assume that annuities on 10,000 lives each ten years of age, which satisfy the Hm mortality table, have been purchased. Of these nominees 79 will die before attaining the age of 11, and no annuity payment will be made in respect of them; none will die between the ages of 11 and 12, so that annuities will be paid for one year on 9921 lives; 40 attain the age of 12 and die before 13, so that two payments will be made with respect to these lives. Reasoning in this way we see that the annuities on 35 of the nominees will be payable for three years; on 40 for four years, and so on. Proceeding thus to the end of the table, 15 nominees attain the age of 95, 5 of whom die before the age of 96, so that 85 payments will be paid in respect of these 5 lives. Of the survivors all die before attaining the age of 97, so that the annuities on these lives will be payable for 86 years. Having previously calculated a table of the values of annuities certain for every number of years up to 86, the value of all the annuities on the 10,000 nominees will be found by taking 40 times the value of an annuity for 2 years, 35 times the value of an annuity for 3 years, and so on—the last term being the value of 10 annuities for 86 years—and adding them together; and the value of an annuity on one of the nominees will then be found by dividing by 10,000. Before leaving the subject of De Witt, we may mention that we find in the correspondence a distinct suggestion of the law of mortality that bears the name of Demoivre. In De Witt's letter, dated the 27th of October 1671 (*Ass. Mag.* vol. iii. p. 107), he speaks of a "provisional hypothesis" suggested by Hudde, that out of 80 young lives (who, from the context, may be taken as of the age 6) about 1 dies annually. In strictness, therefore, the law in question might be more correctly termed Hudde's than Demoivre's.

De Witt's report being thus of the nature of an unpublished state paper, although it contributed to its author's reputation, did not contribute to advance the exact knowledge of the subject; and the author to whom the credit must be given of first showing how to calculate the value of an annuity on correct principles is Edmund Halley. He gave the first approximately correct mortality table (deduced from the records of the numbers of deaths and baptisms in the city of Breslau), and showed how it might be employed to calculate the value of an annuity on the life of a nominee of any age (see *Phil. Trans.* 1693; *Ass. Mag.* vol. xviii.).

Previously to Halley's time, and apparently for many years subsequently, all dealings with life annuities were based upon mere conjectural estimates. The earliest known reference to any estimate of the value of life annuities rose out of the requirements of the Falcidian law, which (40 B.C.) was adopted in the Roman empire, and which declared that a testator should not give more than three-fourths of his property in legacies, so that at least one-fourth must go to his legal representatives. It is easy to see how it would occasionally become necessary, while this law was in force, to value life annuities charged upon a testator's estate. Aemilius Macer (A.D. 230) states that the method which had been in common use at that time was as follows:—From the earliest age until 30 take 30 years' purchase, and for each age after 30 deduct 1 year. It is obvious that no consideration of compound interest can have entered into this estimate; and it is easy to see that it is equivalent to assuming that all persons who attain the age of 30 will certainly live to the age of 60, and then certainly die. Compared with this estimate, that which was propounded by the praetorian prefect Ulpian was a great improvement. His table is as follows:—

Age.	Years' Purchase.	Age.	Years' Purchase.
Birth to 20	30	45 to 46	14
20 ,, 25	28	46 ,, 47	13
25 ,, 30	25	47 ,, 48	12
30 ,, 35	22	48 ,, 49	11
35 ,, 40	20	49 ,, 50	10
40 ,, 41	19	50 ,, 55	9
41 ,, 42	18	55 ,, 60	7
42 ,, 43	17	60 and upwards	5
43 ,, 44	16		
44 ,, 45	15		

Here also we have no reason to suppose that the element of interest was taken into consideration; and the assumption, that between the ages of 40 and 50 each addition of a year to the nominee's age diminishes the value of the annuity by one year's purchase, is equivalent to assuming that there is no probability of the nominee dying between the ages of 40 and 50. Considered, however, simply as a table of the average duration of life, the values are fairly accurate. At all events, no more correct estimate appears to have been arrived at until the close of the 17th century.

The mathematics of annuities has been very fully treated in Demoivre's *Treatise on Annuities* (1725); Simpson's *Doctrine of Annuities and Reversions* (1742); P. Gray, *Tables and Formulae*; Baily's *Doctrine of Life Annuities*; there are also innumerable compilations of *Valuation Tables* and *Interest Tables*, by means of which the value of an annuity at any age and any rate of interest may be found. See also the article INTEREST, and especially that on INSURANCE.

Commutation tables, aptly so named in 1840 by Augustus De Morgan (see his paper "On the Calculation of Single Life Contingencies," *Assurance Magazine*, xii. 328), show the proportion in which a benefit due at one age ought to be changed, so as to retain the same value and be due at another age. The earliest known specimen of a commutation table is contained in William Dale's *Introduction to the Study of the Doctrine of Annuities*, published in 1772. A full account of this work is given by F. Hendriks in the second number of the *Assurance Magazine*, pp. 15–17. William Morgan's *Treatise on Assurances*, 1779, also contains a commutation table. Morgan gives the table as furnishing a convenient means of checking the correctness of the values of annuities found by the ordinary process. It may be assumed that he was aware that the table might be used for the direct calculation of annuities; but he appears to have been ignorant of its other uses.

The first author who fully developed the powers of the table was John Nicholas Tetens, a native of Schleswig, who in 1785, while professor of philosophy and mathematics at Kiel, published in the German language an *Introduction to the Calculation of Life Annuities and Assurances*. This work appears to have been quite unknown in England until F. Hendriks gave, in the first number of the *Assurance Magazine*, pp. 1–20 (Sept. 1850), an account of it, with a translation of the passages describing the construction and use of the commutation table, and a sketch of the author's life and writings, to which we refer the reader who desires fuller information. It may be mentioned here that Tetens also gave only a specimen table, apparently not imagining that persons using his work would find it extremely useful to have a series of commutation tables, calculated and printed ready for use.

The use of the commutation table was independently developed in England—apparently between the years 1788 and 1811—by George Barrett, of Petworth, Sussex, who was the son of a yeoman farmer, and was himself a village schoolmaster, and afterwards farm steward or bailiff. It has been usual to consider Barrett as the originator in England of the method of calculating the values of annuities by means of a commutation table, and this method is accordingly sometimes called Barrett's method. (It is also called the commutation method and the columnar method.) Barrett's method of calculating annuities was explained by him to Francis Baily in the year 1811, and was first made known to the world in a paper written by the latter and read before the Royal Society in 1812.

By what has been universally considered an unfortunate error of judgment, this paper was not recommended by the council of the Royal Society to be printed, but it was given by Baily as an appendix to the second issue (in 1813) of his work on life annuities and assurances. Barrett had calculated extensive tables, and with Baily's aid attempted to get them published by subscription, but without success; and the only printed tables calculated according to his manner, besides the specimen tables given by Baily, are the tables contained in Babbage's *Comparative View of the various Institutions for the Assurance of Lives*, 1826.

In the year 1825 Griffith Davies published his *Tables of Life Contingencies*, a work which contains, among others, two tables, which are confessedly derived from Baily's explanation of Barrett's tables.

Those who desire to pursue the subject further can refer to the appendix to Baily's *Life Annuities and Assurances*, De Morgan's paper "On the Calculation of Single Life Contingencies," *Assurance Magazine*, xii. 348-349; Gray's *Tables and Formulae*, chap. viii.; the preface to Davies's *Treatise on Annuities*; also Hendriks's papers in the *Assurance Magazine*, No. 1, p. 1, and No. 2, p. 12; and in particular De Morgan's "Account of a Correspondence between Mr George Barrett and Mr Francis Baily," in the *Assurance Magazine*, vol. iv. p. 185.

The principal commutation tables published in England are contained in the following works:—David Jones, *Value of Annuities and Reversionary Payments*, issued in parts by the Useful Knowledge Society, completed in 1843; Jenkin Jones, *New Rate of Mortality*, 1843; G. Davies, *Treatise on Annuities*, 1825 (issued 1855); David Chisholm, *Commutation Tables*, 1858; Neison's *Contributions to Vital Statistics*, 1857; Jardine Henry, *Government Life Annuity Commutation Tables*, 1866 and 1873; *Institute of Actuaries Life Tables*, 1872; R. P. Hardy, *Valuation Tables*, 1873; and Dr William Farr's contributions to the sixth (1844), twelfth (1849), and twentieth (1857) *Reports* of the Registrar General in England (English Tables, 1, 2), and to the *English Life Table*, 1864.

The theory of annuities may be further studied in the discussions in the English *Journal of the Institute of Actuaries*. The institute was founded in the year 1848, the first sessional meeting being held in January 1849. Its establishment has contributed in various ways to promote the study of the theory of life contingencies. Among these may be specified the following:—Before it was formed, students of the subject worked for the most part alone, and without any concert; and when any person had made an improvement in the theory, it had little chance of becoming publicly known unless he wrote a formal treatise on the whole subject. But the formation of the institute led to much greater interchange of opinion among actuaries, and afforded them a ready means of making known to their professional associates any improvements, real or supposed, that they thought they had made. Again, the discussions which follow the reading of papers before the institute have often served, first, to bring out into bold relief differences of opinion that were previously unsuspected, and afterwards to soften down those differences,—to correct extreme opinions in every direction, and to bring about a greater agreement of opinion on many important subjects. In no way, probably, have the objects of the institute been so effectually advanced as by the publication of its *Journal*. The first number of this work, which was originally called the *Assurance Magazine*, appeared in September 1850, and it has been continued quarterly down to the present time. It was originated by the public spirit of two well-known actuaries (Mr Charles Jellicoe and Mr Samuel Brown), and was adopted as the organ of the Institute of Actuaries in the year 1852, and called the *Assurance Magazine and Journal of the Institute of Actuaries*, Mr Jellicoe continuing to be the editor,—a post he held until the year 1867, when he was succeeded by Mr T. B. Sprague (who contributed to the 9th edition of this *Encyclopaedia* an elaborate article on "Annuities," on which the above account is based). The name was again changed in 1866, the words "Assurance Magazine" being dropped; but in the following year it was considered desirable to resume these, for the purpose of showing the continuity of the publication, and it is now called the *Journal of the Institute of Actuaries and Assurance Magazine*. This work contains not only the papers read before the institute (to which have been appended of late years short abstracts of the discussions on them), and many original papers which were unsuitable for reading, together with correspondence, but also reprints of many papers published elsewhere, which from various causes had become difficult of access to the ordinary reader, among which may be specified various papers which originally appeared in the *Philosophical Transactions*, the *Philosophical Magazine*, the *Mechanics' Magazine*, and the *Companion to the Almanac*; also translations of various papers from the French, German, and Danish. Among the useful objects which the continuous publication of the *Journal* of the institute has served, we may specify in particular two:—that any supposed improvement in the theory was effectually submitted to the criticisms of the whole actuarial profession, and its real value speedily discovered; and that any real improvement, whether great or small, being placed on record, successive writers have been able, one after the other, to take it up and develop it, each commencing where the previous one had left off.

ANNULAR, ANNULATE, &c. (Lat. *annulus*, a ring), ringed. "Annulate" is used in botany and zoology in connexion with certain plants, worms, &c. (see ANNELIDA), either marked with rings or composed of ring-like segments. The word "annulated" is also used in heraldry and architecture. An annulated cross is one with the points ending in an "annulet" (an heraldic ring, supposed to be taken from a coat of mail), while the annulet in architecture is a small fillet round a column, which encircles the lower part of the Doric capital immediately above the neck or trachelium. The word "annulus" (for "ring") is itself used technically in geometry, astronomy, &c., and the adjective "annular" corresponds. An *annular space* is that between an inner and outer ring. The *annular finger* is the ring finger. An *annular eclipse* is an eclipse of the sun in which the visible part of the latter completely encircles the dark body of the moon; for this to happen, the centres of the sun and moon, and the point on the earth where the observer is situated, must be collinear. Certain nebulae having the form of a ring are also called "annular."

ANNUNCIATION, the announcement made by the angel Gabriel to the Virgin Mary of the incarnation of Christ (Luke i. 26-38). The Feast of the Annunciation in the Christian Church is celebrated on the 25th of March. The first authentic allusions to it are in a canon of the council of Toledo (656), and another of the council of Constantinople "in Trullo" (692), forbidding the celebration of all festivals in Lent, excepting the Lord's day and the Feast of the Annunciation. An earlier origin has been claimed for it on the ground that it is mentioned in sermons of Athanasius and of Gregory Thaumaturgus, but both of these documents are now admitted to be spurious. A synod held at Worcester, England (1240), forbade all servile work on this feast day. See further LADY DAY.

ANNUNZIO, GABRIELE D' (1863), Italian novelist and poet, of Dalmatian extraction, was born at Pescara (Abruzzi) in 1863. The first years of his youth were spent in the freedom of the open fields; at sixteen he was sent to school in Tuscany. While still at school he published a small volume of verses called *Primo Vere* (1879), in which, side by side with some almost brutal imitations of Lorenzo Stecchetti, the then fashionable poet of *Postuma*, were some translations from the Latin, distinguished by such agile grace that Giuseppe Chiarini on reading them brought the unknown youth before the public in an enthusiastic article. The young poet then went to Rome, where he was received as one of their own by the *Cronaca Bizantina* group (see CARDUCCI). Here he published *Canto Nuovo* (1882), *Terra Vergine* (1882), *L' Intermezzo di Rime* (1883), *Il Libro delle Vergini* (1884), and the greater part of the short stories that were afterwards collected under the general title of *San Pantaleone* (1886). In *Canto Nuovo* we have admirable poems full of pulsating youth and the promise of power, some descriptive of the sea and some of the Abruzzi landscape, commented on and completed in prose by *Terra Vergine*, the latter a collection of short stories dealing in radiant language with the peasant life of the author's native province. With the *Intermezzo di Rime* we have the beginning of d'Annunzio's second and characteristic manner. His conception of style was new, and he chose to express all the most subtle vibrations of voluptuous life. Both style and contents began to startle his critics; some who had greeted him as an *enfant prodige*—Chiarini amongst others—rejected him as a perverter of public morals, whilst others hailed him as one bringing a current of fresh air and the impulse of a new vitality into the somewhat prim, lifeless work hitherto produced.

Meanwhile the Review of Angelo Sommaruga perished in the midst of scandal, and his group of young authors found itself dispersed. Some entered the teaching career and were lost to literature, others threw themselves into journalism. Gabriele d'Annunzio took this latter course, and joined the staff of the *Tribuna*. For this paper, under the pseudonym of "Duca Minimo," he did some of his most brilliant work, and the articles he wrote during that period of originality and exuberance would well repay being collected. To this period of greater maturity and deeper culture belongs *Il Libro d' Isotta* (1886), a love poem, in which for the first time he drew inspiration adapted to modern sentiments and passions from the rich colours of the Renaissance. *Il Libro d' Isotta* is interesting also, because in it we find most of the germs of his future work, just as in *Intermezzo melico* and in certain ballads and sonnets we find descriptions and emotions which later went to form the aesthetic contents of *Il Piacere*, *Il Trionfo della Morte*, and *Elegie Romane* (1892).

D' Annunzio's first novel *Il Piacere* (1889)—translated into English as *The Child of Pleasure*—was followed in 1891 by *L' Innocente* (*The Intruder*), and in 1892 by *Giovanni Episcopo*. These three novels created a profound impression. *L' Innocente*, admirably translated into French by Georges Herelle, brought its author the notice and applause of foreign critics. His next work, *Il Trionfo della Morte* (*The Triumph of Death*) (1894), was followed at a short distance by *Le Vergini della Roccio* (1896) and *Il Fuoco* (1900), which in its descriptions of Venice is perhaps the most ardent glorification of a city existing in any language.

D' Annunzio's poetic work of this period, in most respects his finest, is represented by *Il Poema Paradisiaco* (1893), the *Odi Navali* (1893), a superb attempt at civic poetry, and *Laudi* (1900).

A later phase of d' Annunzio's work is his dramatic production, represented by *Il Sogno di un mattino di primavera* (1897), a lyrical fantasia in one act; his *Citta Morta* (1898), written for Sarah Bernhardt, which is certainly among the most daring and original of modern tragedies, and the only one which by its unity, persistent purpose, and sense of fate seems to continue in a measure the traditions of the Greek theatre. In 1898 he wrote his *Sogno di un Pomeriggio d' Autunno* and *La Gioconda*; in the succeeding year *La Gloria*, an attempt at contemporary political tragedy which met with no success, probably through the audacity of the personal and political allusions in some of its scenes; and then *Francesca da Rimini* (1901), a perfect reconstruction of medieval atmosphere and emotion, magnificent in style, and declared by one of the most authoritative Italian critics—Edoardo Boutet—to be the first real although not perfect tragedy which has ever been given to the Italian theatre.

The work of d' Annunzio, although by many of the younger generation injudiciously and extravagantly admired, is almost the most important literary work given to Italy since the days when the great classics welded her varying dialects into a fixed language. The psychological inspiration of his novels has come to him from many sources—French, Russian, Scandinavian, German—and in much of his earlier work there is little fundamental originality. His creative power is intense and searching, but narrow and personal; his heroes and heroines are little more than one same type monotonously facing a different problem at a different phase of life. But the faultlessness of his style and the wealth of his language have been approached by none of his contemporaries, whom his genius has somewhat paralysed. In his later work, when he begins drawing his inspiration from the traditions of bygone Italy in her glorious centuries, a current of real life seems to run through the veins of his personages. And the lasting merit of d' Annunzio, his real value to the literature of his country, consists precisely in that he opened up the closed mine of its former life as a source of inspiration for the present and of hope for the future, and created a language, neither pompous nor vulgar, drawn from every source and district suited to the requirements of modern thought, yet absolutely classical, borrowed from none, and, independently of the thought it may be used to express, a thing of intrinsic beauty. As his sight became clearer and his purpose strengthened, as exaggerations, affectations, and moods dropped away from his conceptions, his work became more and more typical Latin work, upheld by the ideal of an Italian Renaissance.

ANOA, the native name of the small wild buffalo of Celebes, *Bos* (*Bubalus*) *depressicornis*, which stands but little over a yard at the shoulder, and is the most diminutive of all wild cattle. It is nearly allied to the larger Asiatic buffaloes, showing the same reversal of the direction of the hair on the back. The horns are peculiar for their upright direction and comparative straightness, although they have the same triangular section as in other buffaloes. White spots are sometimes present below the eyes, and there may be white markings on the legs and back; and the absence or presence of these white markings may be indicative of distinct races. The horns of the cows are very small. The nearest allies of the anoa appear to be certain extinct buffaloes, of which the remains are found in the Siwalik Hills of northern India. In habits the animal appears to resemble the Indian buffalo.

ANODYNE (from Gr. ἀν-, privative, and ὀδύνη, pain), a cause which relieves pain. The term is commonly applied to medicines which lessen the sensibility of the brain or nervous system, such as morphia, &c.

ANOINTING, or greasing with oil, fat, or melted butter, a process employed ritually in all religions and among all races, civilized or savage, partly as a mode of ridding persons and things of dangerous influences and diseases, especially of the demons (Persian *drug*, Greek κῆρες, Armenian *dev*) which are or cause those diseases; and partly as a means of introducing into things and persons a sacramental or divine influence, a holy emanation, spirit or power. The riddance of an evil influence is often synonymous with the introduction of the good principle, and therefore it is best to consider first the use of anointing in consecrations.

The Australian natives believed that the virtues of one killed could be transferred to survivors if the latter rubbed themselves with his caul-fat. So the Arabs of East Africa anoint themselves with lion's fat in order to gain courage and inspire the animals with awe of themselves. Such rites are often associated with the actual eating of the victim whose virtues are coveted. Human fat is a powerful charm all over the world; for, as R. Smith points out, after the blood the fat was peculiarly the vehicle and seat of life. This is why fat of a victim was smeared on a sacred stone, not only in acts of homage paid to it, but in the actual consecration thereof. In such cases the influence of the god, communicated to the victim, passed with the unguent into the stone. But the divinity could by anointing be transferred into men no less than into stones; and from immemorial antiquity, among the Jews as among other races, kings were anointed or greased, doubtless with the fat of the victims which, like the blood, was too holy to be eaten by the common votaries.

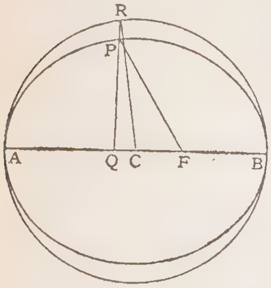
Butter made from the milk of the cow, the most sacred of animals, is used for anointing in the Hindu religion. A newly-built house is smeared with it, so are demoniacs, care being taken to smear the latter downwards from head to foot.

In the Christian religion, especially where animal sacrifices, together with the cult of totem or holy animals, have been given up, it is usual to hallow the oil used in ritual anointings with special prayers and exorcisms; oil from the lamps lit before the altar has a peculiar virtue of its own, perhaps because it can be burned to give light, and disappears to heaven in doing so. In any case oil has ever been regarded as the aptest symbol and vehicle of the holy and illuminating spirit. For this reason the catechumens are anointed with holy oil both before and after baptism; the one act (of eastern origin) assists the expulsion of the evil spirits, the other (of western origin), taken in conjunction with imposition of hands, conveys the spirit and retains it in the person of the baptized. In the postbaptismal anointing the oil was applied to the organs of sense, to the head, heart, and midriff. Such ritual use of oil as a σφραγίς or seal may have been suggested in old religions by the practice of keeping wine fresh in jars and amphorae by pouring on a top layer of oil; for the spoiling of wine was attributed to the action of demons of corruption, against whom many ancient formulae of aversion or exorcism still exist.

The holy oil, chrism, or μύρον, as the Easterns call it, was prepared and consecrated on Maundy Thursday, and in the Gelasian sacramentary the formula used runs thus: "Send forth, O Lord, we beseech thee, thy Holy Spirit the Paraclete from heaven into this fatness of oil, which thou hast deigned to bring forth out of the green wood for the refreshing of mind and body; and through thy holy benediction may it be for all who anoint with it, taste it, touch it, a safeguard of mind and body, of soul and spirit, for the expulsion of all pains, of every infirmity, of every sickness of mind and body. For with the same thou hast anointed priests, kings, and prophets and martyrs with this thy chrism, perfected by thee, O Lord, blessed, abiding within our bowels in the name of our Lord Jesus Christ."

In various churches the dead are anointed with holy oil, to guard them against the vampires or ghouls which ever threaten to take possession of dead bodies and live in them. In the Armenian church, as formerly in many Greek churches, a cross is not holy until the Spirit has been formally led into it by means of prayer and anointing with holy oil. A new church is anointed at its four corners, and also the altar round which it is built; similarly tombs, church gongs, and all other instruments and utensils dedicated to cultual uses. In churches of the Greek rite a little of the old year's chrism is left in the jar to communicate its sanctity to that of the new. (F. C. C.)

ANOMALY (from Gr. ἀνωμαλία, unevenness, derived from ἀν-, privative, and ὁμαλός, even), a deviation from the common rule. In astronomy the word denotes the angular distance of a body from the pericentre of the orbit in which it is moving. Let AB be the major axis of the orbit, B the pericentre, F the focus or centre of motion, P the position of the body. The anomaly is then the angle BFP which the radius vector makes with the major axis. This is the actual or *true anomaly*. *Mean anomaly* is the anomaly which the body would have if it moved from the pericentre around F with a uniform angular motion such that its revolution would be completed in its actual time (see ORBIT). *Eccentric anomaly* is defined thus:—Draw the circumscribing circle of the elliptic orbit around the centre C of the orbit. Drop the perpendicular RPQ through P, the position of the planet, upon the major axis. Join CR; the angle CRQ is then the eccentric anomaly.



In the ancient astronomy the anomaly was taken as the angular distance of the planet from the point of the farthest recession from the earth.

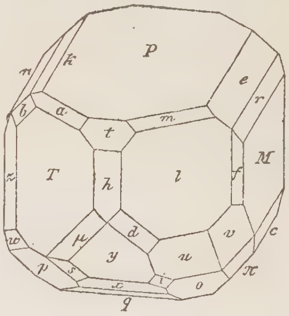
Kepler's Problem, namely, that of finding the co-ordinates of a planet at a given time, which is equivalent—given the mean anomaly—to that of determining the true anomaly, was solved approximately by Kepler, and more completely by Wallis, Newton and others.

The anomalistic revolution of a planet or other heavenly body is the revolution between two consecutive passages through the pericentre. Starting from the pericentre, it is completed on the return to the pericentre. If the pericentre is fixed, this is an actual revolution; but if it moves the anomalistic revolution is greater or less than a complete circumference.

An *Anomalistic year* is the time (365 days, 6 hours, 13 minutes, 48 seconds) in which the earth (and similarly for any other planet) passes from perihelion to perihelion, or from any given value of the anomaly to the same again. Owing to the precession of the equinoxes it is longer than a tropical or sidereal year by 25 minutes and 2·3 seconds. An *Anomalistic month* is the time in which the moon passes from perigee to perigee, &c.

For the mathematics of Kepler's problem see E. W. Brown, *Lunar Theory* (Cambridge 1896), or the work of Watson or of Bauschinger on Theoretical Astronomy.

ANORTHITE, an important mineral of the felspar group, being one of the end members of the plagioclase (*q.v.*) series. It is a calcium and aluminium silicate, $CaAl_2Si_2O_8$, and crystallizes in the anorthic system. Like all the felspars, it possesses two cleavages, one perfect and the other less so, here inclined to one another at an angle of 85° 50′. The colour is white, greyish or reddish, and the crystals are transparent to translucent. The hardness is 6–6½, and the specific gravity 2·75.



Anorthite.

Anorthite is an essential constituent of many basic igneous rocks, such as gabbro and basalt, also of some meteoric stones. The best developed crystals are those which accompany mica, augite, sanidine, &c., in the ejected blocks of metamorphosed limestone from Monte Somma, the ancient portion of Mount Vesuvius; these are perfectly colourless and transparent, and are bounded by numerous brilliant faces. Distinctly developed crystals are also met with in the basalts of Japan, but are usually rare at other localities.

The name anorthite was given to the Vesuvian mineral by G. Rose in 1823, on account of its anorthic crystallization. The species had, however, been earlier described by the comte de Bournon under the name indianite, this name being applied to a greyish or reddish granular mineral forming the matrix of corundum from the Carnatic in India. Several unimportant varieties have been distinguished. (L. J. S.)

ANQUETIL, LOUIS PIERRE (1723–1808), French historian, was born in Paris, on the 21st of February 1723. He entered the congregation of Sainte-Geneviève, where he took holy orders and became professor of theology and literature. Later, he became director of the seminary at Reims, where he wrote his *Histoire civile et politique de Reims* (3 vols., 1756–1757), perhaps his best work. He was then director of the college of Senlis, where he composed his *Esprit de la Ligue ou histoire politique des troubles de la Fronde pendant le XVI^e et le XVII^e siècles* (1767). During the Reign of Terror he was imprisoned at St Lazare; there he began his *Précis de l'histoire universelle*, afterwards published in nine volumes. On the establishment of the national institute he was elected a member of the second group (moral and political sciences), and was soon afterwards employed in the office of the ministry of foreign affairs, profiting by his experience to write his *Motifs des guerres et des traités de paix sous Louis XIV., Louis XV. et Louis XVI.* He is said to have been asked by Napoleon to write his *Histoire de France* (14 vols., 1805), a mediocre compilation at second or third hand, with the assistance of de Mézeray and of Paul François Velly (1709–1759). This work, nevertheless, passed through numerous editions, and by it his name is remembered. He died on the 6th of September 1808.

ANQUETIL DUPERRON, ABRAHAM HYACINTHE (1731–1805), French orientalist, brother of Louis Pierre Anquetil, the historian, was born in Paris on the 7th of December 1731. He was educated for the priesthood in Paris and Utrecht, but his taste for Hebrew, Arabic, Persian, and other languages of the East developed into a passion, and he discontinued his theological course to devote himself entirely to them. His diligent attendance at the Royal Library attracted the attention of the keeper of the manuscripts, the Abbé Sallier, whose influence procured for him a small salary as student of the oriental languages. He had lighted on some fragments of the *Vendidad Sade*, and formed the project of a voyage to India to discover the works of Zoroaster. With this end in view he enlisted as a private soldier, on the 2nd of November 1754, in the Indian expedition which was about to start from the port of L'Orient. His friends procured his discharge, and he was granted a free passage, a seat at the captain's table, and a salary, the amount of which was to be fixed by the governor of the French settlement in India. After a passage of six months, Anquetil landed, on the 10th of August 1755, at Pondicherry. Here he remained a short time to master modern Persian, and then hastened to Chandernagore to acquire Sanskrit. Just then war was declared between France and England; Chandernagore was taken, and Anquetil returned to Pondicherry by land. He found one of his brothers at Pondicherry, and embarked with him for Surat; but, with a view of exploring the country, he landed at Mahé and proceeded on foot. At Surat he succeeded, by perseverance and address in his intercourse with the native priests, in acquiring a sufficient knowledge of the Zend and Pahlavi languages to translate the liturgy called the *Vendidad Sade* and some other works. Thence he proposed going to Benares, to study the language, antiquities, and sacred laws of the Hindus; but the capture of Pondicherry obliged him to quit India. Returning to Europe in an English vessel, he spent some time in London and Oxford, and then set out for France. He arrived in Paris on the 14th of March 1762 in possession of one hundred and eighty oriental manuscripts, besides other curiosities. The Abbé Barthélemy procured for him a pension, with the appointment of interpreter of oriental languages at the Royal Library. In 1763 he was elected an associate of the Academy of Inscriptions, and began to arrange for the publication of the materials he had collected during his eastern travels. In 1771 he published his *Zend-Avesta* (3 vols.), containing collections from the sacred writings of the fire-worshippers, a life of Zoroaster, and fragments of works ascribed to him. In 1778 he published at Amsterdam his *Législation orientale*, in which he endeavoured to prove that the nature of oriental despotism had been greatly misrepresented. His *Recherches historiques et géographiques sur l'Inde* appeared in 1786, and formed part of Thieffenthaler's *Geography of India*. The Revolution seems to have greatly affected him. During that period he abandoned society, and lived in voluntary poverty on a few pence a day. In 1798 he published *L'Inde en rapport avec l'Europe* (Hamburg, 2 vols.), which contained much invective against the English, and numerous misrepresentations. In 1802–1804 he published a Latin translation (2 vols.) from the Persian of the *Oupnek'hat* or *Upanishada*. It is a curious mixture of Latin, Greek, Persian, Arabic, and Sanskrit. He died in Paris on the 17th of January 1805.

See *Biographie universelle*; Sir William Jones, *Works* (vol. x., 1807); and the *Miscellanies* of the Philobiblon Society (vol. iii., 1856–1857). For a list of his scattered writings see Quérard, *La France littéraire*.

ANSA (from Lat. *ansa*, a handle), in astronomy, one of the apparent ends of the rings of Saturn as seen in perspective from the earth: so-called because, in the earlier telescopes, they looked like handles projecting from the planet. In anatomy the word is applied to nervous structures which resemble loops. In archaeology it is used for the engraved and ornamented handle of a vase, which has often survived when the vase itself, being less durable, has disappeared.

ANSBACH, or ANSPACH, originally *Onolzbach*, a town of Germany, in the kingdom of Bavaria, on the Rezat, 27 m. by rail S.W. of Nuremberg, and 90 m. N. of Munich. Pop. (1900) 17,555. It contains a palace, once the residence of the margraves of Anspach, with fine gardens; several churches, the finest of which are those dedicated to St John, containing the vault of the former margraves, and St Gumbert; a gymnasium; a picture gallery; a municipal museum and a special technical school. Ansbach possesses monuments to the poets August, Count von Platen-Hallermund, and Johann Peter Uz, who were born here, and to Kaspar Hauser, who died here. The chief manufactures are machinery, toys, woollen, cotton, and half-silk stuffs, embroideries, earthenware, tobacco, cutlery and playing cards. There is considerable trade in grain, wool and flax. In 1791 the last margrave of Anspach sold his principality to Frederick William II., king of Prussia; it was transferred by Napoleon to Bavaria in 1806, an act which was confirmed by the congress of Vienna in 1815.

ANSDELL, RICHARD (1815–1885), English painter, was born in Liverpool, and first exhibited at the Royal Academy in 1840. He was a painter of genre, chiefly animal and sporting pictures, and he became very popular, being elected A.R.A. in 1861 and R.A. in 1870. His "Stag at Bay" (1846), "The Combat" (1847), and "Battle of the Standard" (1848), represent his best work, in which he showed himself a notable follower of Landseer.

ANSELM (*c.* 1033–1109), archbishop of Canterbury, was born at Aosta in Piedmont. His family was accounted noble, and was possessed of considerable property. Gundulph, his father, was by birth a Lombard, and seems to have been a man of harsh and violent temper; his mother, Ermenberga, was a prudent and virtuous woman, from whose careful religious training the young Anselm derived much benefit. At the age of fifteen he desired to enter a convent, but he could not obtain his father's consent. Disappointment brought on an illness, on his recovery from which he seems for a time to have given up his studies, and to have plunged into the gay life of the world. During this time his mother died, and his father's harshness became unbearable. He left home, and with only one attendant crossed the Alps, and wandered through Burgundy and France. Attracted by the fame of his countryman, Lanfranc, then prior of Bec, he entered Normandy, and, after spending some time at Avranches, settled at the monastery of Bec. There, at the age of twenty-seven, he became a monk; three years later, when Lanfranc was promoted to the abbacy of Caen, he was elected prior. This office he held for fifteen years, and then, in 1078, on the death of Herlwin, the warrior monk who had founded the monastery, he was made abbot. Under his rule Bec became the first seat of learning in Europe, a result due not more to his intellectual powers than to the great moral influence of his noble character and kindly discipline. It was during these quiet years at Bec that Anselm wrote his first philosophical and religious works, the dialogues on Truth and Freewill, and the two celebrated treatises, the *Monologion* and *Proslogion*.

Meanwhile the convent had been growing in wealth, as well as in reputation, and had acquired considerable property in England, which it became the duty of Anselm occasionally to visit. By his mildness of temper and unswerving rectitude, he so endeared himself to the English that he was looked upon and desired as the natural successor to Lanfranc, then archbishop of Canterbury. But on the death of that great man, the ruling sovereign, William Rufus, seized the possessions and revenues of the see, and made no new appointment. About four years after, in 1092, on the invitation of Hugh, earl of Chester, Anselm with some reluctance, for he feared to be made archbishop, crossed to England. He was detained by business for nearly four months, and when about to return, was refused permission by the king. In the following year William fell ill, and thought his death was at hand. Eager to make atonement for his sin with regard to the archbishopric, he nominated Anselm to the vacant see, and after a great struggle compelled him to accept the pastoral staff of office. After obtaining dispensation from his duties in Normandy, Anselm was consecrated in 1093. He demanded of the king, as the conditions of his retaining office, that he should give up all the possessions of the see, accept his spiritual counsel, and acknowledge Urban as pope in opposition to the anti-pope, Clement. He only obtained a partial consent to the first of these, and the last involved him in a serious difficulty with the king. It was a rule of the church that the consecration of metropolitans could not be completed without their receiving the *pallium* from the hands of the pope. Anselm, accordingly, insisted that he must proceed to Rome to receive the pall. But William would not permit this; he had not acknowledged Urban, and he maintained his right to prevent any pope being acknowledged by an English subject without his permission. A great council of churchmen and nobles, held to settle the matter, advised Anselm to submit to the king, but failed to overcome his mild and patient firmness. The matter was postponed, and William meanwhile privately sent messengers to Rome, who acknowledged Urban and prevailed on him to send a legate to the king bearing the archiepiscopal pall. A partial reconciliation was then effected, and the matter of the pall was compromised. It was not given by the king, but was laid on the altar at Canterbury, whence Anselm took it.

Little more than a year after, fresh trouble arose with the king, and Anselm resolved to proceed to Rome and seek the counsel of his spiritual father. With great difficulty he obtained a reluctant permission to leave, and in October 1097 he set out for Rome. William immediately seized on the revenues of the see, and retained them to his death. Anselm was received with high honour by Urban, and at a great council held at Bari, he was put forward to defend the doctrine of the procession of the Holy Ghost against the representatives of the Greek Church. But Urban was too politic to embroil himself with the king of England, and Anselm found that he could obtain no substantial result. He withdrew from Rome, and spent some time at the little village of Schiavi, where he finished his treatise on the atonement, *Cur Deus homo*, and then retired to Lyons.

In 1100 William was killed, and Henry, his successor, at once recalled Anselm. But Henry demanded that he should again receive from him in person investiture in his office of archbishop, thus making the dignity entirely dependent on the royal authority. Now, the papal rule in the matter was plain; all homage and lay investiture were strictly prohibited. Anselm represented this to the king; but Henry would not relinquish a privilege possessed by his predecessors, and proposed that the matter should be laid before the Holy See. The answer of the pope reaffirmed the law as to investiture. A second embassy was sent, with a similar result. Henry, however, remained firm, and at last, in 1103, Anselm and an envoy from the king set out for Rome. The pope, Paschal, reaffirmed strongly the rule of investiture, and passed sentence of excommunication against all who had infringed the law, except Henry. Practically this left matters as they were, and Anselm, who had received a message forbidding him to return to England unless on the king's terms, withdrew to Lyons, where he waited to see if Paschal would not take stronger measures. At last, in 1105, he resolved himself to excommunicate Henry. His intention was made known to the king through his sister, and it seriously alarmed him, for it was a critical period in his affairs. A meeting was arranged, and a reconciliation between them effected. In 1106 Anselm crossed to England, with power from the pope to remove the sentence of excommunication from the illegally invested churchmen. In 1107 the long dispute as to investiture was finally ended by the king resigning his formal rights. The remaining two years of Anselm's life were spent in the duties of his archbishopric. He died on the 21st of April 1109. He was canonized in 1494 by Alexander VI.

Anselm may, with some justice, be considered the first scholastic philosopher and theologian. His only great predecessor, Scotus Erigena, had more of the speculative and mystical element than is consistent with a schoolman; but in Anselm are found that recognition of the relation of reason to revealed truth, and that attempt to elaborate a rational system of faith, which form the special characteristics of scholastic thought. His constant endeavour is to render the contents of the Christian consciousness clear to reason, and to develop the intelligible truths interwoven with the Christian belief. The necessary preliminary for this is the possession of the Christian consciousness. "He who does not believe will not experience; and he who has not experienced will not understand." That faith must precede knowledge is reiterated by him. "*Neque enim quaero intelligere ut credam, sed credo ut intelligam. Nam et hoc credo, quia, nisi credidero, non intelligam.*" ("Nor do I seek to understand that I may believe, but I believe that I may understand. For this too I believe, that unless I first believe, I shall not understand.") But after the faith is held fast, the attempt must be made to demonstrate by reason the truth of what we believe. It is wrong not to do so. "*Negligentiae mihi esse videtur, si, postquam confirmati sumus in fide, non studemus quod credimus, intelligere.*" ("I hold it to be a failure in duty if after we have become steadfast in the faith we do not strive to understand what we believe.") To such an extent does he carry this demand for rational explanation that, at times, it seems as if he claimed for unassisted intelligence the power of penetrating even to the mysteries of the Christian faith. On the whole, however, the qualified statement is his real view; merely rational proofs are always, he affirms, to be tested by Scripture. (*Cur Deus homo*, i. 2 and 38; *De Fide Trin.* 2.)

The groundwork of his theory of knowledge is contained in the tract *De Veritate*, in which, from the consideration of truth as in knowledge, in willing, and in things, he rises to the affirmation of an absolute truth, in which all other truth participates. This absolute truth is God himself, who is therefore the ultimate ground or principle both of things and of thought. The notion of God comes thus into the foreground of the system; before all things it is necessary that it should be made clear to reason, that it should be demonstrated to have real existence. This demonstration is the substance of the *Monologion* and *Proslogion*. In the first of these the proof rests on the ordinary grounds of realism, and coincides to some extent with the earlier theory of Augustine, though it is carried out with singular boldness and fulness. Things, he says, are called good in a variety of ways and degrees; this would be impossible if there were not some absolute standard, some good in itself, in which all relative goods participate. Similarly with such predicates as great, just; they involve a certain greatness and justice. The very existence of things is impossible without some one Being, by whom they are. This absolute Being, this goodness, justice, greatness, is God. Anselm was not thoroughly satisfied with this reasoning; it started from *a posteriori* grounds, and contained several converging lines of proof. He desired to have some one short demonstration. Such a demonstration he presented in the *Proslogion*; it is his celebrated ontological proof. God is that being than whom none greater can be conceived. Now, if that than which nothing greater can be conceived existed only in the intellect, it would not be the absolutely greatest, for we could add to it existence in reality. It follows, then, that the being than whom nothing greater can be conceived, *i.e.* God, necessarily has real existence. This reasoning, in which Anselm partially anticipated the Cartesian philosophers, has rarely seemed satisfactory. It was opposed at the time by the monk Gaunilo, in his *Liber pro Insipiente*, on the ground that we cannot pass from idea to reality. The same criticism is made by several of the later schoolmen, among others by Aquinas, and is in substance what Kant advances against all ontological proof. Anselm replied to the objections of Gaunilo in his *Liber Apologeticus*. The existence of God being thus held proved, he proceeds to state the rational grounds of the Christian doctrines of creation and of the Trinity. With reference to this last, he says we cannot know God from himself, but only after the analogy of his creatures; and the special analogy used is the self-consciousness of man, its peculiar double nature, with the necessary elements, memory and intelligence, representing the relation of the Father to the Son. The mutual love of these two, proceeding from the relation they hold to one another, symbolizes the Holy Spirit. The further theological doctrines of man, original sin, free will, are developed, partly in the *Monologion*, partly in other mixed treatises. Finally, in his greatest work, *Cur Deus homo*, he undertakes to make plain, even to infidels, the rational necessity of the Christian mystery of the atonement. The theory rests on three positions: that satisfaction is necessary on account of God's honour and justice; that such satisfaction can be given only by the peculiar personality of the God-man; that such satisfaction is really given by the voluntary death of this infinitely valuable person. The demonstration is, in brief, this. All the actions of men are due to the furtherance of God's glory; if, then, there be sin, *i.e.* if God's honour be wounded, man of himself can give no satisfaction. But the justice of God demands satisfaction; and as an insult to infinite honour is in itself infinite, the satisfaction must be infinite, *i.e.* it must outweigh all that is not God. Such a penalty can only be paid by God himself, and, as a penalty for man, must be paid under the form of man. Satisfaction is only possible through the God-man. Now this God-man, as sinless, is exempt from the punishment of sin; His passion is therefore voluntary, not given as due. The merit of it is therefore infinite; God's justice is thus appeased, and His mercy may extend to man. This theory has exercised immense influence on the form of church doctrine. It is certainly an advance on the older patristic theory, in so far as it substitutes for a contest between God and Satan, a contest between the goodness and justice of God; but it puts the whole relation on a merely legal footing, gives it no ethical bearing, and neglects altogether the consciousness of the individual to be redeemed. In this respect it contrasts unfavourably with the later theory of Abelard.

Anselm's speculations did not receive, in the middle ages, the respect and attention justly their due. This was probably due to their unsystematic character, for they are generally tracts or dialogues on detached questions, not elaborate treatises like the great works of Albert, Aquinas, and Erigena. They have, however, a freshness and philosophical vigour, which more than makes up for their want of system, and which raises them far above the level of most scholastic writings.

Bibliography.—The main sources for the history of St Anselm and his times are Eadmer's *Vita Anselmi* and his *Historia Novorum*, edited by M. Rule in *Rolls Series* (London, 1884); the best modern work is by Père Ragey, *Histoire de Saint Anselme* (Paris, 1890), and *Saint Anselme professeur* (Paris, 1890). Other appreciations are by A. Möhler, *Anselm Erzbischof von Canterbury* (Regensburg, 1839; Eng. trans. by H. Rymer, London, 1842); F. R. Hasse, *Anselm von Canterbury* (2 vols., Leipzig, 1842–1853); C. de Rémusat, *S. Anselme de Cantorbéry* (Paris, 1853, new ed. 1868); R. W. Church, *St Anselm*, first published in *Sunday Library* (London, 1870; often reprinted); Martin Rule, *Life and Times of St Anselm* (London, 1883).

Works: The best edition of St Anselm's complete works is that of Dom Gerberon (Paris, 1675); reprinted with many notes in 1712; incorporated by J. Migne in his *Patrologia Latina*, tomi clviii.-clix. (Paris, 1853–1854). Migne's reprint contains many errors. The *Cur Deus homo* may be best studied in the editions published by D. Nutt (London, 1885) and by Griffith (1898). The *Mariale*, or poems in honour of the Blessed Virgin, has been carefully edited by P. Ragey (Tournai, 1885); the *Monologion* and *Proslogion*, by C. E. Ubaghs (Louvain, 1854; Eng. trans. by S. N. Deane, Chicago, 1903); the *Meditationes*, many of which are wrongly attributed to Anselm, have been frequently reprinted, and were included in Methuen's *Library of Devotion* (London, 1903).

The best criticism of Anselm's philosophical works is by J. M. Rigg (London, 1896), and Domet de Vorges (*Grands Philosophes* series, Paris, 1901). For a complete bibliography, see A. Vacant's *Dictionnaire de théologie.*

ANSELM, of Laon (d. 1117), French theologian, was born of very humble parents at Laon before the middle of the 11th century. He is said to have studied under St Anselm at Bec. About 1076 he taught with great success at Paris, where, as the associate of William of Champeaux, he upheld the realistic side of the scholastic controversy. Later he removed to his native place, where his school for theology and exegetics rapidly became the most famous in Europe. He died in 1117. His greatest work, an interlinear gloss on the Scriptures, was one of the great authorities of the middle ages. It has been frequently reprinted. Other commentaries apparently by him have been ascribed to various writers, principally to the great Anselm. A list of them, with notice of Anselm's life, is contained in the *Histoire littéraire de la France*, x. 170–189.

The works are collected in Migne's *Patrologia Latina*, tome 162; some unpublished *Sententiae* were edited by G. Lefèvre (Milan, 1894), on which see Hauréau in the *Journal des savants* for 1895.

ANSELME (Father Anselme of the Virgin Mary) (1625–1694), French genealogist, was born in Paris in 1625. As a layman his name was Pierre Guibours. He entered the order of the barefooted Augustinians on the 31st of March 1644, and it was in their monastery (called the Couvent des Petits Pères, near the church of Notre-Dame des Victoires) that he died, on the 17th of January 1694. He devoted his entire life to genealogical studies. In 1663 he published *Le Palais de l'honneur*, which besides giving the genealogy of the houses of Lorraine and Savoy, is a complete treatise on heraldry, and in 1664 *Le Palais de la gloire*, dealing with the genealogy of various illustrious French and European families. These books made friends for him, the most intimate among whom, Honoré Caille, seigneur du Fourny (1630–1713), persuaded him to publish his *Histoire généalogique de la maison royale de France, et des grands officiers de la couronne* (1674, 2 vols. 4); after Father Anselme's death, Honoré Caille collected his papers, and brought out a new edition of this highly important work in 1712. The task was taken up and continued by two other friars of the Couvent des Petits Pères, Father Ange de Sainte-Rosalie (François Raffard, 1655–1726), and Father Simplicien (Paul Lucas, 1683–1759), who published the first and second volumes of the third edition in 1726. This edition consists of nine volumes folio; it is a genealogical and chronological history of the royal house of France, of the peers, of the great officers of the crown and of the king's household, and of the ancient barons of the kingdom. The notes were generally compiled from original documents, references to which are usually given, so that they remain useful to the present day. The work of Father Anselme, his collaborators and successors, is even more important for the history of France than is Dugdale's *Baronage of England* for the history of England. (C. B.*)

ANSON, GEORGE ANSON, Baron (1697–1762), British admiral, was born on the 23rd of April 1697. He was the son of William Anson of Shugborough in Staffordshire, and his wife Isabella Carrier, who was the sister-in-law of Lord Chancellor Macclesfield, a relationship which proved very useful to the future admiral. George Anson entered the navy in February 1712, and by rapid steps became lieutenant in 1716, commander in 1722, and post-captain in 1724. In this rank he served twice on the North American station as captain of the "Scarborough" and the "Squirrel" from 1724 to 1730 and from 1733 to 1735. In 1737 he was appointed to the "Centurion," 60, on the eve of war with Spain, and when hostilities had begun he was chosen to command as commodore the squadron which was sent to attack her possessions in South America in 1740. The original scheme was ambitious, and was not carried out. Anson's squadron, which sailed later than had been intended, and was very ill-fitted, consisted of six ships, which were reduced by successive disasters to his flagship the "Centurion." The lateness of the season forced him to round Cape Horn in very stormy weather, and the navigating instruments of the time did not allow of exact observation. Two of his vessels failed to round the Horn, another, the "Wager," was wrecked in the Golfo de Pañas on the coast of Chile. By the time Anson reached the island of Juan Fernandez in June 1741, his six ships had been reduced to three, while the strength of his crews had fallen from 961 to 335. In the absence of any effective Spanish force on the coast he was able to harass the enemy, and to capture the town of Paita on the 13th–15th of November 1741. The steady diminution of his crew by sickness, and the worn-out state of his remaining consorts, compelled him at last to collect all the survivors in the "Centurion." He rested at the island of Tinian, and then made his way to Macao in November 1742. After considerable difficulties with the Chinese, he sailed again with his one remaining vessel to cruise for one of the richly laden galleons which conducted the trade between Mexico and the Philippines. The indomitable perseverance he had shown during one of the most arduous voyages in the history of sea adventure was rewarded by the capture of an immensely rich prize, the "Nuestra Señora de Covadonga," which was met off Cape Espiritu Santo on the 20th of June 1743. Anson took his prize back to Macao, sold her cargo to the Chinese, keeping the specie, and sailed for England, which he reached by the Cape of Good Hope on the 15th of June 1744. The prize-money earned by the capture of the galleon had made him a rich man for life, and under the influence of irritation caused by the refusal of the admiralty to confirm a captain's commission he had given to one of his officers, Anson refused the rank of rear-admiral, and was prepared to leave the service. His fame would stand nearly as high as it does if he had done so, but he would be a far less important figure in the history of the navy. By the world at large he is known as the commander of the voyage of circumnavigation, in which success was won by indomitable perseverance, unshaken firmness, and infinite resource. But he was also the severe and capable administrator who during years of hard work at the admiralty did more than any other to raise the navy from the state of corruption and indiscipline into which it had fallen during the first half of the eighteenth century. Great anger had been caused in the country by the condition of the fleet as revealed in the first part of the war with France and Spain, between 1739 and 1747. The need for reform was strongly felt, and the politicians of the day were conscious that it would not be safe to neglect the popular demand for it. In 1745 the duke of Bedford, the new first lord, invited Anson to join the admiralty with the rank of rear-admiral of the white. As subordinate under the duke, or Lord Sandwich, and as first lord himself, Anson was at the admiralty with one short break from 1745 till his death in 1762. His chiefs in the earlier years left him to take the initiative in all measures of reform, and supported him in their own interest. After 1751 he was himself first lord, except for a short time in 1756 and 1757. At his suggestion, or with his advice, the naval administration was thoroughly overhauled. The dockyards were brought into far better order, and though corruption was not banished, it was much reduced. The navy board was compelled to render accounts, a duty it had long neglected. A system of regulating promotion to flag rank, which has been in the main followed ever since, was introduced. The Navy Discipline Act was revised in 1749, and remained unaltered till 1865. Courts martial were put on a sound footing. Inspections of the fleet and the dockyards were established, and the corps of Marines was created in 1755. The progressive improvement which raised the navy to the high state of efficiency it attained in later years dates from Anson's presence at the admiralty. In 1747 he, without ceasing to be a member of the board, commanded the Channel fleet which on the 3rd of May scattered a large French convoy bound to the East, and West Indies, in an action off Cape Finisterre. Several men-of-war and armed French Indiamen were taken, but the overwhelming superiority of Anson's fleet (fourteen men-of-war, to six men-of-war and four Indiamen) in the number and weight of ships deprives the action of any strong claim to be considered remarkable. In society Anson seems to have been cold and taciturn. The sneers of Horace Walpole, and the savage attack of Smollett in *The Adventures of an Atom*, are animated by personal or political spite. Yet they would not have accused him of defects from which he was notoriously free. In political life he may sometimes have given too ready assent to the wishes of powerful politicians. He married the daughter of Lord Chancellor Hardwicke on the 27th of April 1748. There were no children of the marriage. His title of Baron Anson of Soberton was given him in 1747, but became extinct on his death. The title of Viscount Anson was, however, created in 1806 in favour of his great-nephew, the grandson of his sister Janetta and Mr Sambrook Adams, whose father had assumed the name and arms of Anson. The earldom of Lichfield was conferred on the family in the next generation. A fine portrait of the admiral by Reynolds is in the possession of the earl of Lichfield, and there are copies in the National Portrait Gallery and at Greenwich. Anson's promotions in flag rank were: rear-admiral in 1745, vice-admiral in 1746, and admiral in 1748. In 1749 he became vice-admiral of Great Britain, and in 1761 admiral of the fleet. He died on the 6th of June 1762.

A life of Lord Anson, inaccurate in some details but valuable and interesting, was published by Sir John Barrow in 1839. The standard account of his voyage round the world is that by his chaplain Richard Walter, 1748, often reprinted. A share in the work has been claimed on dubious grounds for Benjamin Robins, the mathematician. Another and much inferior account was published in 1745 by Pascoe Thomas, the schoolmaster of the "Centurion." (D. H.)

ANSON, SIR WILLIAM REYNELL, Bart. (1843–), English jurist, was born on the 14th of November 1843, at Walberton, Sussex, son of the second baronet. Educated at Eton and Balliol College, Oxford, he took a first class in the final classical schools in 1866, and was elected to a fellowship of All Souls in the following year. In 1869 he was called to the bar, and went the home circuit until 1873, when he succeeded to the baronetcy. In 1874 he became Vinerian reader in English law at Oxford, a post which he held until he became, in 1881, warden of All Souls College. He identified himself both with local and university interests; he became an alderman of the city of Oxford in 1892, chairman of quarter sessions for the county in 1894, was vice-chancellor of the university in 1898–1899, and chancellor of the diocese of Oxford in 1899. In that year he was returned, without opposition, as M.P. for the university in the Liberal Unionist interest, and consequently resigned the vice-chancellorship. In parliament he preserved an active interest in education, being a member of the newly created consultative committee of the Board of Education in 1900, and in 1902 he became parliamentary secretary. He took an active part in the foundation of a school of law at Oxford, and his volumes on *The Principles of the English Law of Contract* (1884, 11th ed. 1906), and on *The Law and Custom of the Constitution* in two parts, "The Parliament" and "The Crown" (1886–1892, 3rd ed. 1907, pt. i. vol. ii.), are standard works.

ANSONIA, a city of New Haven county, Connecticut, U.S.A., coextensive with the township of the same name, on the Naugatuck river, immediately N. of Derby and about 12 m. N.W. of New Haven. It is served by the New York, New Haven & Hartford railway, and by interurban electric lines running N., S. and E. Pop. (1900) 12,681, of whom 4296 were foreign born; (1910 census) 15,152. Land area about 5·4 sq. m. The city has extensive manufactures of heavy machinery, electric supplies, brass and copper products and silk goods. In 1905 the capital invested in manufacturing was $7,625,864, and the value of the products was $19,132,455. Ansonia, Derby and Shelton form one of the most important industrial communities in the state. The city, settled in 1840 and named in honour of the merchant and philanthropist, Anson Green Phelps (1781–1853), was originally a part of the township of Derby; it was chartered as a borough in 1864 and as a city in 1893, when the township of Ansonia, which had been incorporated in 1889, and the city were consolidated.

ANSTED, DAVID THOMAS (1814–1880), English geologist, was born in London on the 5th of February 1814. He was educated at Jesus College, Cambridge, and after taking his degree of M.A. in 1839 was elected to a fellowship of the college. Inspired by the teachings of Adam Sedgwick, his attention was given to geology, and in 1840 he was elected professor of geology in King's College, London, a post which he held until 1853. Meanwhile he became a fellow of the Royal Society in 1844, and from that date until 1847 he was vice-secretary of the Geological Society and edited its *Quarterly Journal*. The practical side of geology now came to occupy his chief attention, and he visited various parts of Europe and the British Islands as a consulting geologist and mining engineer. He was also in 1868 and for many years examiner in physical geography to the science and art department. He died at Melton near Woodbridge, on the 13th of May 1880.

Publications.—*Geology, Introductory, Descriptive and Practical* (2 vols., 1844); *The Ionian Islands* (1863); *The Applications of Geology to the Arts and Manufactures* (1865); *Physical Geography* (1867); *Water and Water Supply* (Surface Water) (1878); and *The Channel Islands* (with R. G. Latham) (1862).

ANSTEY, CHRISTOPHER (1724–1805), English poet, was the son of the rector of Brinkley, Cambridgeshire, where he was born on the 31st of October 1724. He was educated at Eton and King's College, Cambridge, where he distinguished himself for his Latin verses. He became a fellow of his college (1745), but the degree of M.A. was withheld from him, owing to the offence caused by a speech made by him beginning: "Doctores sine doctrina, magistri artium sine artibus, et baccalaurei baculo potius quam lauro digni." In 1754 he succeeded to the family estates and left Cambridge; and two years later he married the daughter of Felix Calvert of Albury Hall, Herts. For some time Anstey published nothing of any note, though he cultivated letters as well as his estates. Some visits to Bath, however, where later, in 1770, he made his permanent home, resulted in 1766 in his famous rhymed letters, *The New Bath Guide* or *Memoirs of the B . . . r . . . d* [*Blunderhead*] *Family* . . ., which had immediate success, and was enthusiastically praised for its original kind of humour by Walpole and Gray. The *Election Ball, in Poetical Letters from Mr Inkle at Bath to his Wife at Gloucester* (1776) sustained the reputation won by the Guide. Anstey's other productions in verse and prose are now forgotten. He died on the 3rd of August 1805. His *Poetical Works* were collected in 1808 (2 vols.) by the author's son John (d. 1819), himself author of *The Pleader's Guide* (1796), in the same vein with the *New Bath Guide*.

ANSTRUTHER (locally pronounced *Anster*), a seaport of Fifeshire, Scotland. It comprises the royal and police burghs of Anstruther Easter (pop. 1190), Anstruther Wester (501) and Kilrenny (2542), and lies 9 m. S.S.E. of St Andrews, having a station on the North British railway company's branch line from Thornton Junction to St Andrews. The chief industries include coast and deep-sea fisheries, shipbuilding, tanning, the making of cod-liver oil and fish-curing. The harbour was completed in 1877 at a cost of £80,000. The two Anstruthers are divided only by a small stream called Dreel Burn. James Melville (1556–1614), nephew of the more celebrated reformer, Andrew Melville, who was minister of Kilrenny, has given in his *Diary* a graphic account of the arrival at Anstruther of a weather-bound ship of the Armada, and the tradition of the intermixture of Spanish and Fifeshire blood still prevails in the district. Anstruther fair supplied William Tennant (1784–1848), who was born and buried in the town, with the subject of his poem of "Anster Fair." Sir James Lumsden, a soldier of fortune under Gustavus Adolphus, who distinguished himself in the Thirty Years' War, was born in the parish of Kilrenny about 1598. David Martin (1737–1798), the painter and engraver; Thomas Chalmers (1780–1847), the great divine; and John Goodsir (1814–1867), the anatomist, were natives of Anstruther. Little more than a mile to the west lies the royal and police burgh of Pittenweem (Gaelic, "the hollow of the cave"), a quaint old fishing town (pop. 1863), with the remains of a priory. About 2 m. still farther westwards is the fishing town of St Monans or Abercromby (pop. 1898), with a fine old Gothic church, picturesquely perched on the rocky shore. These fisher towns on the eastern and south-eastern coasts of Fifeshire furnish artists with endless subjects. Archibald Constable (1774–1827), Sir Walter Scott's publisher, was born in the parish of Carnbee, about 3 m. to the north of Pittenweem. The two Anstruthers, Kilrenny and Pittenweem unite with St Andrews, Cupar and Crail, in sending one member to parliament.

ANSWER (derived from *and*, against, and the same root as *swear*), originally a solemn assertion in opposition to some one or something, and thus generally any counter-statement or defence, a reply to a question or objection, or a correct solution of a problem. In English law, the "answer" in pleadings was, previous to the Judicature Acts 1873–1875, the statement of defence, especially as regards the facts and not the law. Its place is now taken by a "statement of defence." "Answer" is the term still applied in divorce proceedings to the reply of the respondent (see PLEADING). The famous Latin *Responsa Prudentum* ("answers of the learned") were the accumulated views of many successive generations of Roman lawyers, a body of legal opinion which gradually became authoritative. In music an "answer" is the technical name in counterpoint for the repetition by one part or instrument of a theme proposed by another.

ANT (O. Eng. *aémete*, from Teutonic *a*, privative, and *maitan*, cut or bite off, *i.e.* "the biter off"; *aémete* in Middle English became differentiated in dialect use to *amete*, then *amte*, and so *ant*, and also to *emete*, whence the synonym "emmet," now only used provincially, "ant" being the general literary form). The fact that the name of the ant has come down in English from a thousand years ago shows that this class of insects impressed the old inhabitants of England as they impressed the Hebrews and Greeks. The social instincts and industrious habits of ants have always made them favourite objects of study, and a vast amount of literature has accumulated on the subject of their structure and their modes of life.

Characters.—An ant is easily recognized both by the casual observer and by the student of insects. Ants form a distinct and natural family (*Formicidae*) of the great order *Hymenoptera*, to which bees, wasps and sawflies also belong. The insects of this order have mandibles adapted for biting, and two pairs of membranous wings are usually present; the first abdominal segment (propodeum) becomes closely associated with the fore-body (thorax), of which it appears to form a part. In all ants the second (apparently the first) abdominal segment is very markedly constricted at its front and hind edges, so that it forms a "node" at the base of the hind-body (fig. 1), and in many ants the third abdominal segment is similarly "nodular" in form (fig. 3, *b*, *c*,). It is this peculiar "waist" that catches the eye of the observer, and makes the insects so easy of recognition. Another conspicuous and well-known feature of ants is the wingless condition of the "workers," as the specialized females, with undeveloped ovaries, which form the largest proportion of the population of ant-communities, are called. Such "workers" are essential to the formation of a social community of Hymenoptera, and their wingless condition among the ants shows that their specialization has been carried further in this family than among the wasps and bees. Further, while among wasps and bees we find some solitary and some social genera, the ants as a family are social, though some aberrant species are dependent on the workers of other ants. It is interesting and suggestive that in a few families of digging Hymenoptera (such as the *Mutillidae*), allied to the ants, the females are wingless. The perfect female or "queen" ants (figs. 1, *1*, 3, *a*) often cast their wings (fig. 3,*b*) after the nuptial flight; in a few species the females, and in still fewer the males, never develop wings. (For the so-called "white ants," which belong to an order far removed from the *Hymenoptera*, see TERMITE.)

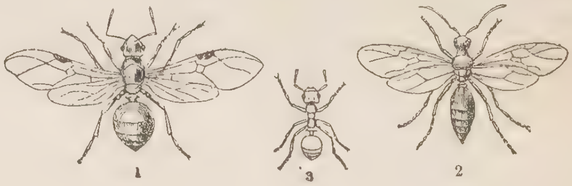


FIG. 1.—Wood Ant (*Formica rufa*). 1, Queen; 2, male; 3, worker.

Structure.—The head of an ant carries a pair of elbowed feelers, each consisting of a minute basal and an elongate second segment, forming the stalk or "scape," while from eight to eleven short segments make up the terminal "flagellum." These segments are abundantly supplied with elongate tooth-like projections connected with nerve-endings probably olfactory in function. The brain is well developed and its "mushroom-bodies" are exceptionally large. The mandibles, which are frequently used for carrying various objects, are situated well to the outside of the maxillae, so that they can be opened and shut without interfering with the latter. The peculiar form and arrangement of the anterior abdominal segments have already been described. The fourth abdominal segment is often very large, and forms the greater part of the hind-body; this segment is markedly constricted at its basal (forward) end, where it is embraced by the small third segment. In many of those ants whose third abdominal segment forms a second "node," the basal dorsal region of the fourth segment is traversed by a large number of very fine transverse striations; over these the sharp hinder edge of the third segment can be scraped to and fro, and the result is a stridulating organ which gives rise to a note of very high pitch. For the appreciation of the sounds made by these stridulators, the ants are furnished with delicate organs of hearing (chordotonal organs) in the head, in the three thoracic and two of the abdominal segments and in the shins of the legs.

The hinder abdominal segments and the stings of the queens and workers resemble those of other stinging Hymenoptera. But there are several subfamilies of ants whose females have the lancets of the sting useless for piercing, although the poison-glands are functional, their secretion being ejected by the insect, when occasion may arise, from the greatly enlarged reservoir, the reduced sting acting as a squirt.

Nests.—The nests of different kinds of ants are constructed in very different situations; many species (*Lasius*, for example) make underground nests; galleries and chambers being hollowed out in the soil, and opening by small holes on the surface, or protected above by a large stone. The wood ant (*Formica rufa*, fig. 1) piles up a heap of leaves, twigs and other vegetable refuse, so arranged as to form an orderly series of galleries, though the structure appears at first sight a chaotic heap. Species of *Camponotus* and many other ants tunnel in wood. In tropical countries ants sometimes make their nests in the hollow thorns of trees or on leaves; species with this habit are believed to make a return to the tree for the shelter that it affords by protecting it from the ravages of other insects, including their own leaf-cutting relations.

Early Stages.—The larvae of ants (fig. 3, *e*) are legless and helpless maggots with very small heads (fig. 3, *f*), into whose mouths the requisite food has to be forced by the assiduous "nurse" workers. The maggots are tended by these nurses with the greatest care, and carried to those parts of the nest most favourable for their health and growth. When fully grown, the maggot spins an oval silken cocoon within which it pupates (fig. 3, *g*). These cocoons, which may often be seen carried between the mandibles of the workers, are the "ants' eggs" prized as food for fish and pheasants. The workers of a Ceylonese ant (*Oecophylla smaragdina*) are stated by D. Sharp to hold the maggots between their mandibles and induce them to spin together the leaves of trees from which they form their shelters, as the adult ants have no silk-producing organs.

Origin of Societies.—Ant-colonies are founded either by a single female or by several in association. The foundress of the nest lays eggs and at first feeds and rears the larvae, the earliest of which develop into workers. C. Janet observed that in a nest of *Lasius alienus*, established by a single female, the first workers emerged from their cocoons on the 102nd day. These workers then take on themselves the labour of the colony, some collecting food, which they transfer to their comrades within the nest whose duty is to tend and feed the larvae. The foundress-queen is now waited on by the workers, who supply her with food and spare her all cares of work, so that henceforth she may devote her whole energies to egg-laying. The population of the colony increases fast, and a well-grown nest contains several " queens " and males, besides a large number of workers. One of the most interesting features of ant-societies is the dimorphism or polymorphism that may often be seen among the workers, the same species being represented by two or more forms. Thus the British " wood ant " (*Formica rufa*) has a smaller and a larger race of workers (" minor " and " major " forms), while in *Ponera* we find a blind race of workers and another race provided with eyes, and in *Atta*, *Eciton* and other genera, four or five forms of workers are produced, the largest of which, with huge heads and elongate trenchant mandibles, are known as the " soldier " caste. The development of such diversely-formed insects as the offspring of the unmodified females which show none of their peculiarities raises many points of difficulty for students in heredity. It is thought that the differences are, in part at least, due to differences in the nature of the food supplied to larvae, which are apparently all alike. But the ovaries of worker ants are in some cases sufficiently developed for the production of eggs, which may give rise parthenogenetically to male, queen or worker offspring.

Food.—Different kinds of ants vary greatly in the substances which they use for food. Honey forms the staple nourishment of many ants, some of the workers seeking nectar from flowers, working it up into honey within their stomachs and regurgitating it so as to feed their comrades within the nest, who, in their turn, pass it on to the grubs. A curious specialization of certain workers in connexion with the transference of honey has been demonstrated by H. C. McCook in the American genus *Myrmecocystus*, and by later observers in Australian and African species of *Plagiolepis* and allied genera. The workers in question remain within the nest, suspended by their feet, and serve as living honey-pots for the colony, becoming so distended by the supplies of honey poured into their mouths by their foraging comrades that their abdomens become sub-globular, the pale intersegmental membrane being tightly stretched between the widely-separated dark sclerites. The " nurse " workers in the nest can then draw their supplies from these " honey-pots." Very many ants live by preying upon various insects, such as the British " red ants " with well-developed stings (*Myrmica rubra*), and the notorious " driver ants " of Africa and America, the old-world species of which belong to *Dorylus* and allied genera, and the new-world species to *Eciton* (fig. 2, *2*, *3*). In these ants the difference between the large, heavy, winged males and females, and the small, long-legged, active workers, is so great, that various forms of the same species have been often referred to distinct genera; in *Eciton*, for example, the female has a single petiolate abdominal segment, the worker two. The workers of these ants range over the country in large armies, killing and carrying off all the insects and spiders that they find and sometimes attacking vertebrates. They have been known to enter human dwellings, removing all the verminous insects contained therein. These driver ants shelter in temporary nests made in hollow trees or similar situations, where the insects may be seen, according to T. Belt, " clustered together in a dense mass like a great swarm of bees hanging from the roof."

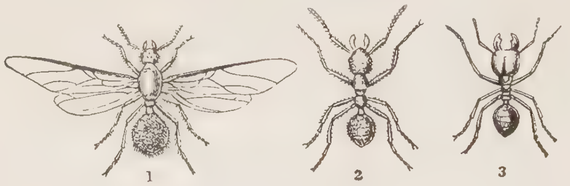


FIG. 2.—Leaf-cutting and Foraging Ants. 1, *Atta cephalus*; 2, *Eciton drepanophora*; 3, *Eciton erratica*.

The harvesting habits of certain ants have long been known, the subterranean store-houses of Mediterranean species of *Aphaenogaster* having been described by J. T. Moggridge and A. Forel, and the complex industries of the Texan *Pogonomyrmex barbatus* by H. C. McCook and W. M. Wheeler. The colonies of *Aphaenogaster* occupy nests extending over an area of fifty to a hundred square yards several feet below the surface of the ground. Into these underground chambers the ants carry seeds of grasses and other plants of which they accumulate large stores. The species of *Pogonomyrmex* strip the husks from the seeds and carry them out of the nest, making a refuse heap near the entrance. The seeds are harvested from various grasses, especially from *Aristida oligantha*, a species known as " ant rice," which often grows in quantity close to the site selected for the nest, but the statement that the ants deliberately sow this grass is an error, due, according to Wheeler, to the sprouting of germinating seeds which the ants have turned out of their store-chambers.

Perhaps no ants have such remarkable habits as those of the genus *Atta*,—the leaf-cutting ants of tropical America (fig. 2, *1*). There are several forms of worker in these species, some with enormous heads, which remain in the underground nests, while their smaller comrades scour the country in search of suitable trees, which they ascend, biting off small circular pieces from the leaves, and carrying them off to the nests. Their labour often results in the complete defoliation of the tree. The tracks along which the ants carry the leaves to their nests are often in part subterranean. H. C. McCook describes an almost straight tunnel, nearly 450 ft. long, made by *Atta fervens*.

Within the nest, the leaves are cut into very minute fragments and gathered into small spherical heaps forming a spongy mass, which—according to the researches of A. Möller—serves as the substratum for a special fungus (*Rozites gongylophora*), the staple food of the ants. The insects cultivate their fungus, weeding out mould and bacterial growths, and causing the appearance, on the surface of their "mushroom garden," of numerous small white bodies formed by swollen ends of the fungus hyphae. When the fungus is grown elsewhere than in the ants' nest it produces gonidia instead of the white masses on which the ants feed, hence it seems that these masses are indeed produced as the result of some unknown cultural process. Other genera of South American ants—*Apterostigma* and *Cyphomyrmex*—make similar fungal cultivations, but they use wood, grain or dung as the substratum instead of leaf fragments. Each kind of ant is so addicted to its own particular fungal food that it refuses disdainfully, even when hungry, the produce of an alien nest.

Guests of Ants.—Many ants feed largely and some almost entirely on the saccharine secretions of other insects, the best known of which are the Aphides (plant-lice or "green-fly"). This consideration leads us to one of the most remarkable and fascinating features of ant-communities—the presence in the nests of insects and other small arthropods, which are tended and cared for by the ants as their "guests," rendering to the ants in return the sweet food which they desire. The relation between ants and aphids has often been compared to that between men and milch cattle. Sir J. Lubbock (Lord Avebury) states that the common British yellow ants (*Lasius flavus*) collect flocks of root-feeding aphids in their underground nests, protect them, build earthen shelters over them, and take the greatest care of their eggs. Other ants, such as the British black garden species (*L. niger*), go after the aphids that frequent the shoots of plants. Many species of aphid migrate from one plant to another at certain stages in their life-cycle when their numbers have very largely increased, and F. M. Webster has observed ants, foreseeing this emigration, to carry aphids from apple trees to grasses. It has been shown by M. Büsgen that the sweet secretion (honey-dew) of the aphids is not derived, as generally believed, from the paired cornicles on the fifth abdominal segment, but from the intestine, whence it exudes in drops and is swallowed by the ants.

Besides the aphids, other insects, such as scale insects (*Coccidae*), caterpillars of blue butterflies (*Lycaenidae*), and numerous beetles, furnish the ants with nutrient secretions. The number of species of beetles that inhabit ants' nests is almost incredibly large, and most of these are never found elsewhere, being blind, helpless and dependent on the ants' care for protection and food; these beetles belong for the most part to the families *Pselaphidae*, *Paussidae* and *Staphylinidae*. Spring-tails and bristle-tails (order *Aptera*) of several species also frequent ants' nests. While some of these "guest" insects produce secretions that furnish the ants with food, some seem to be useless inmates of the nest, obtaining food from the ants and giving nothing in return. Others again play the part of thieves in the ant society; C. Janet observed a small bristle-tail (*Lepismima*) to lurk beneath the heads of two *Lasius* workers, while one passed food to the other, in order to steal the drop of nourishment and to make off with it. The same naturalist describes the association with *Lasius* of small mites (*Antennophorus*) which are carried about by the worker ants, one of which may have a mite beneath her mouth, and another on either side of her abdomen. On patting their carrier or some passing ant, the mites are supplied with food, no service being rendered by them in return for the ants' care. Perhaps the ants derive from these seemingly useless guests the same satisfaction as we obtain by keeping pet animals. Recent advance in our knowledge of the guests and associates of ants is due principally to E. Wasmann, who has compiled a list of nearly 1500 species of insects, arachnids and crustaceans, inhabiting ants' nests. The warmth, shelter and abundant food in the nests, due both to the fresh supplies brought in by the ants and to the large amount of waste matter that accumulates, must prove strongly attractive to the various "guests." Some of the inmates of ants' nests are here for the purpose of preying upon the ants or their larvae, so that we find all kinds of relations between the owners of the nests and their companions, from mutual benefit to active hostility.

Among these associations or guests other species of ants are not wanting. For example, a minute species (*Solenopsis fugax*) lives in a compound nest with various species of *Formica*, forming narrow galleries which open into the larger galleries of its host. The *Solenopsis* can make its way into the territory of the *Formica* to steal the larvae which serve it as food, but the *Formica* is too large to pursue the thief when it returns to its own galleries.

Slaves.—Several species of ants are found in association with another species which stands to them in the relation of slave to master. *Formica sanguinea* is a well-known European slave-making ant that inhabits England; its workers raid the nests of *F. fusca* and other species, and carry off to their own nests pupae from which workers are developed that live contentedly as slaves of their captors. *F. sanguinea* can live either with or without slaves, but another European ant (*Polyergus rufescens*) is so dependent on its slaves—various species of *Formica*—that its workers are themselves unable to feed the larvae. The remarkable genus *Anergates* has no workers, and its wingless males and females are served by communities of *Tetramorium cespitum* (fig. 3).

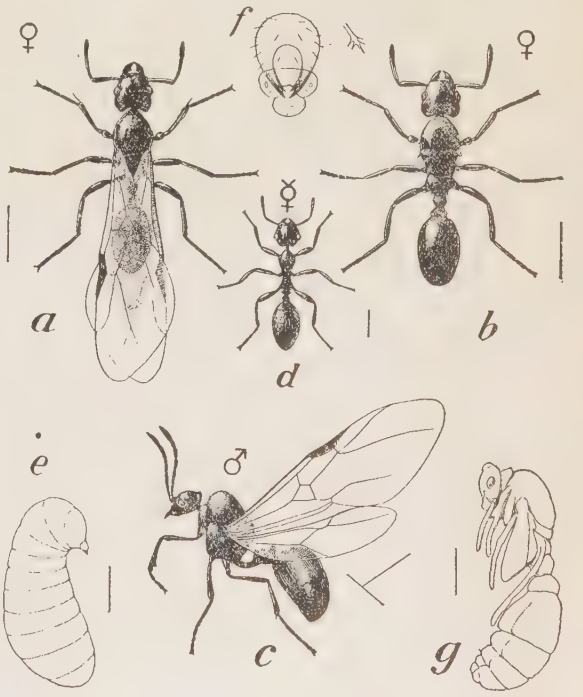


FIG. 3.—Ant, *Tetramorium cespitum* (Linn.). *a*, Female; *b*, female after loss of wings; *c*, male; *d*, worker; *e*, larva; *g*, pupa; *f*, head of larva more highly magnified. After Marlatt, *Bull.* 4 (n.s.) *Div. Ent. U. S. Dept. Agriculture.*

Senses and Intelligence of Ants.—That ants possess highly developed senses and the power of communicating with one another has long been known to students of their habits; the researches of P. Huber and Sir J. Lubbock (Lord Avebury) on these subjects are familiar to all naturalists. The insects are guided by light, being very sensitive to ultra-violet rays, and also by scent and hearing. Recent experiments by A. M. Fielde show that an ant follows her own old track by a scent exercised by the tenth segment of the feeler, recognizes other inmates of her nest by a sense of smell resident in the eleventh segment, is guided to the eggs, maggots and pupae, which she has to tend, by sensation through the eighth and ninth segments, and appreciates the general smell of the nest itself by means of organs in the twelfth segment. Lubbock's experiments of inducing ants to seek objects that had been removed show that they are guided by scent rather than by sight, and that any disturbance of their surroundings often causes great uncertainty in their actions. Ants invite one another to work, or ask for food from one another, by means of pats with the feelers; and they respond to the solicitations of their guest-beetles or mites, who ask for food by patting the ants with their feet. In all probability the actions of ants are for the most part instinctive or reflex, and some observers, such as A. Bethe, deny them all claim to psychical qualities. But it seems impossible to doubt that in many cases ants behave in a manner that must be considered intelligent, that they can learn by experience and that they possess memory. Lubbock goes so far as to conclude the account of his experiments with the remark that "It is difficult altogether to deny them the gift of reason . . . their mental powers differ from those of men, not so much in kind as in degree." Wasmann considers that ants are neither miniature human beings nor mere reflex automata, and most students of their habits will probably accept this intermediate position as the most satisfactory. C. L. Morgan sums up a discussion on Lubbock's experiments in which the ants failed to utilize particles of earth for bridge-making, with the suggestive remark that "What these valuable experiments seem to show is that the ant, probably the most intelligent of all insects, has no claim to be regarded as a rational being." Nevertheless, ants can teach "rational beings" many valuable lessons.

Bibliography.—The literature on ants is so vast that it is only possible to refer the reader to a few of the most important works on the family. Pierre Huber's *Traité des mœurs des fourmis indigènes* (Genève, 1810) is the most famous of the older memoirs. H. W. Bates, *A Naturalist on the Amazons*; T. Belt, *A Naturalist in Nicaragua*; H. C. McCook, *Agricultural Ant of Texas* (Philadelphia, 1880); and A. Möller's paper in *Botan. Mitt. aus den Tropen*, (1893), contain classical observations on American species. Sir J. Lubbock's (Lord Avebury) *Ants, Bees and Wasps* (London, 1882), dealing with British and European species, has been followed by numerous important papers by A. Forel and C. Emery in various Swiss and German periodicals, and especially by C. Janet in his *Études sur les fourmis, les guêpes et les abeilles* (Paris, &c., 1893–1904). Forel (*Ann. Soc. Ent. Belg.* xlvii., 1893, *Journ. Bomnay N. H. Soc.* 1900–1903, and *Biologia Cent. Americana*) and Emery (*Zool. Jahrb. Syst.* viii., 1896) have written on the classification of the *Formicidae*. Among recent American writers on habit may be mentioned W. M. Wheeler (*American Naturalist*, 1900–1902) and A. M. Fielde (*Proc. Acad. Sci. Philadelphia*, 1901); E. Wasmann (*Kritisches Verzeichniss der myrmecophilen und termitophilen Arthropoden*, Berlin, 1894, and 3^{me} *Congrès Intern. Zool.* 1895) is the great authority on ant-guests and associates. D. Sharp's general account of ants in the *Cambridge Nat. Hist.* (vol. vi., 1898) is excellent. For discussions on intelligence see A. Bethe, *Journ. f. d. ges. Physiol.* lxx. (1898); Wasmann, *Die psychischen Fähigkeiten der Ameisen* (Stuttgart, 1899); C. Ll. Morgan, *Animal Behaviour* (London, 1900.)
(G. H. C.)

ANTAE (a Lat. plural word, possibly from *ante*, before), an architectural term given to slightly projecting pilaster strips which terminate the winged walls of the naos of a Greek temple. They owe their origin to the vertical posts of timber employed in the primitive palaces or temples of Greece, as at Tiryns and in the Heraeum at Olympia, to carry the roof timbers, as no reliance could be placed on the walls built with unburnt brick or in rubble masonry with clay mortar. When between these winged walls there are columns to carry the architrave, so as to form a porch, the latter is said to be in-antis. (See Temple.)

ANTAEUS, in Greek mythology, a giant of Libya, the son of Poseidon and Gaea. He compelled all strangers passing through the country to wrestle with him, and as, when thrown, he derived fresh strength from each successive contact with his mother earth, he proved invincible. With the skulls of those whom he had slain he built a temple to his father. Heracles, in combat with him, discovered the source of his strength, and lifting him up from the earth crushed him to death (Apollodorus ii. 5; Hyginus, *Fab.* 31). The struggle between Antaeus and Heracles is a favourite subject in ancient sculpture.

ANTALCIDAS, Spartan soldier and diplomatist. In 393 (or 392 B.C.) he was sent to Tiribazus, satrap of Sardis, to undermine the friendly relations then existing between Athens and Persia by offering to recognize Persian claims to the whole of Asia Minor. The Athenians sent an embassy under Conon to counteract his efforts. Tiribazus, who was favourable to Sparta, threw Conon into prison, but Artaxerxes II. (Mnemon) disapproved and recalled his satrap. In 388 Antalcidas, then commander of the Spartan fleet, accompanied Tiribazus to the Persian court, and secured the active assistance of Persia against Athens. The success of his naval operations in the neighbourhood of the Hellespont was such that Athens was glad to accept terms of peace (the "Peace of Antalcidas"), by which (1) the whole of Asia Minor, with the islands of Clazomenae and Cyprus, was recognized as subject to Persia, (2) all other Greek cities—so far as they were not under Persian rule—were to be independent, except Lemnos, Imbros and Scyros, which were to belong, as formerly, to the Athenians. The terms were announced to the Greek envoys at Sardis in the winter 387–386, and were finally accepted by Sparta in 386. Antalcidas continued in favour with Artaxerxes, until the annihilation of Spartan supremacy at Leuctra diminished his influence. A final mission to Persia, probably in 367, was a failure, and Antalcidas, deeply chagrined and fearful of the consequences, is said to have starved himself to death. (See Sparta.)

ANTANÀNARÌVO, *i.e.* "town of a thousand" (Fr. spelling *Tananarive*), the capital of Madagascar, situated centrally as regards the length of the island, but only about 90 m. distant from the eastern coast, in 18° 55′ S., 47° 30′ E. It is 135 m. W.S.W. of Tamatave, the principal seaport of the island, with which it is connected by railway, and for about 60 m. along the coast lagoons, a service of small steamers. The city occupies a commanding position, being chiefly built on the summit and slopes of a long and narrow rocky ridge, which extends north and south for about 2½ m., dividing to the north in a Y-shape, and rising at its highest point to 690 ft. above the extensive rice plain to the west, which is itself 4060 ft. above sea-level. For long only the principal village of the Hova chiefs, Antananarivo advanced in importance as those chiefs made themselves sovereigns of the greater part of Madagascar, until it became a town of some 80,000 inhabitants. Until 1869 all buildings within the city proper were of wood or rush, but even then it possessed several timber palaces of considerable size, the largest being 120 ft. high. These crown the summit of the central portion of the ridge; and the largest palace, with its lofty roof and towers, is the most conspicuous object from every point of view. Since the introduction of stone and brick, the whole city has been rebuilt and now contains numerous structures of some architectural pretension, the royal palaces, the houses formerly belonging to the prime minister and nobles, the French residency, the Anglican and Roman Catholic cathedrals, several stone churches, as well as others of brick, colleges, schools, hospitals, courts of justice and other government buildings, and hundreds of good dwelling-houses. Since the French conquest in 1895 good roads have been constructed throughout the city, broad flights of steps connect places too steep for the formation of carriage roads, and the central space, called Andohalo, has become a handsome *place*, with walks and terraces, flower-beds and trees. A small park has been laid out near the residency, and the planting of trees and the formation of gardens in various parts of the city give it a bright and attractive appearance. Water is obtained from springs at the foot of the hill, but it is proposed to bring an abundant supply from the river Ikopa, which skirts the capital to the south and west. The population, including that of the suburbs, is 69,000 (1907). The city is guarded by two forts built on hills to the east and south-west respectively. Including an Anglican and a Roman Catholic cathedral, there are about fifty churches in the city and its suburbs, as well as a Mahommedan mosque.
(J. Si.*)

ʽANTARA IBN SHADDĀD, Arabian poet and warrior of the 6th century, was famous both for his poetry and his adventurous life. His chief poem is contained in the *Moʽallakát*. The account of his life forms the basis of a long and extravagant romance. His father Shaddād was a soldier, his mother Zabūba a negro slave. Neglected at first, he soon claimed attention and respect for himself, and by his remarkable personal qualities and courage in battle he gained his freedom and the acknowledgment of his father. He took part in the great war between the related tribes of Abs and Dhubyān, which began over a contest of horses and was named after them the war of Dāhis and Ghabrā.

He died in a fight against the tribe of Ṭai. His poems, which are chiefly concerned with fighting or with his love for Abla, are published in W. Ahlwardt's *The Diwans of the six ancient Arabic Poets* (London, 1870); they have also been published separately at Beirūt (1888). As regards their genuineness, cf. W. Ahlwardt's *Bemerkungen über die Aechtheit der alten arabischen Gedichte* (Greifswald, 1872), pp. 50 ff. *The Romance of ʿAntar* (Sīrat ʿAntar ibn Shaddād) is a work which was long handed down by oral tradition only, has grown to immense proportions and has been published in 32 vols. at Cairo, 1307 (A.D. 1889), and in 10 vols. at Beirūt, 1871. It was partly translated by Terrick Hamilton under the title *ʿAntar, a Bedoueen Romance* (4 vols., London, 1820).

For an account of the poet and his works see H. Thorbeckes, *Antarah, ein vorislamischer Dichter* (Leipzig, 1867), and cf. the *Book of Songs* (see ABULFARAJ), vol. vii. pp. 148-153. (G. W. T.)

ANTARCTIC (Gr. ἀντί, opposite, and ἄρκτος, the Bear, the northern constellation of *Ursa Major*), the epithet applied to the region (including both the ocean and the lands) round the South Pole. The Antarctic circle is drawn at 66° 30′ S., but polar conditions of climate, &c., extend considerably north of the area thus enclosed. (See POLAR REGIONS.)

ANTEATER, a term applied to several mammals, but (zoologically at any rate) specially indicating the tropical American anteaters of the family *Myrmecophagidae* (see EDENTATA). The typical and largest representative of the group is the great anteater or ant-bear (*Myrmecophaga jubata*), an animal measuring 4 ft. in length without the tail, and 2 ft. in height at the shoulder. Its prevailing colour is grey, with a broad black band, bordered with white, commencing on the chest, and passing obliquely over the shoulder, diminishing gradually in breadth as it approaches the loins, where it ends in a point. It is extensively distributed in the tropical parts of South and Central America, frequenting low swampy savannas, along the banks of rivers, and the depths of the humid forests, but is nowhere abundant. Its food consists mainly of termites, to obtain which it opens their nests with its powerful sharp anterior claws, and as the insects swarm to the damaged part of their dwelling, it draws them into its mouth by means of its long, flexible, rapidly moving tongue covered with glutinous saliva. The great anteater is terrestrial in habits, not burrowing underground like armadillos. Though generally an inoffensive animal, when attacked it can defend itself vigorously and effectively with its sabre-like anterior claws. The female produces a single young at a birth. The tamandua anteaters, as typified by *Tamandua* (or *Uroleptes*) *tetradactyla*, are much smaller than the great anteater, and differ essentially from it in their habits, being mainly arboreal. They inhabit the dense primeval forests of South and Central America. The usual colour is yellowish-white, with a broad black lateral band, covering nearly the whole of the side of the body.

The little or two-toed anteater (*Cyclopes* or *Cycloturus didactylus*) is a native of the hottest parts of South and Central America, and about the size of a rat, of a general yellowish colour, and exclusively arboreal in its habits. The name scaly anteater is applied to the pangolin (*q.v.*); the banded anteater (*Myrmecobius fasciatus*) is a marsupial, and the spiny anteater (*Echidna*) is one of the monotremes (see MARSUPIALIA and MONOTREMATA).

ANTE-CHAPEL, the term given to that portion of a chapel which lies on the western side of the choir screen. In some of the colleges at Oxford and Cambridge the ante-chapel is carried north and south across the west end of the chapel, constituting a western transept or narthex. This model, based on Merton College chapel (13th century), of which only chancel and transept were built though a nave was projected, was followed at Wadham, New and Magdalen Colleges, Oxford, in the new chapel of St John's College, Cambridge, and in Eton College. In Jesus College, Cambridge, the transept and a short nave constitute the ante-chapel; in Clare College an octagonal vestibule serves the same purpose; and in Christ's, Trinity and King's Colleges, Cambridge, the ante-chapel is a portion of the main chapel, divided off from the chancel by the choir screen.

ANTE-CHOIR, the term given to the space enclosed in a church between the outer gate or railing of the rood screen and the door of the screen; sometimes there is only one rail, gate or door, but in Westminster Abbey it is equal in depth to one bay of the nave. The ante-choir is also called the "fore choir."

ANTE-FIXAE (from Lat. *antefigere*, to fasten before), the vertical blocks which terminate the covering tiles of the roof of a Greek temple; as spaced they take the place of the cymatium and form a cresting along the sides of the temple. The face of the ante-fixae was richly carved with the anthemion (*q.v.*) ornament.

ANTELOPE, a zoological name which, so far as can be determined, appears to trace its origin, through the Latin, to *Pantholops*, the old Coptic, and *Antholops*, the late Greek name of the fabled unicorn. Its adoption by the languages of Europe cannot apparently be traced farther back than the 4th century of our era, at which date it was employed to designate an imaginary animal living on the banks of the Euphrates. By the earlier English naturalists, and afterwards by Buffon, it was, however, applied to the Indian blackbuck, which is thus entitled to rank as *the* antelope. It follows that the subfamily typified by this species, in which are included the gazelles, is the one to which alone the term antelopes should be applied if it were employed in a restricted and definable sense.

Although most people have a general vague idea of what constitutes an "antelope," yet the group of animals thus designated is one that does not admit of accurate limitations or definition. Some, for instance, may consider that the chamois and the so-called white goat of the Rocky Mountains are entitled to be included in the group; but this is not the view held by the authors of the *Book of Antelopes* referred to below; and, as a matter of fact, the term is only a vague designation for a number of more or less distinct groups of hollow-horned ruminants which do not come under the designation of cattle, sheep or goats; and in reality there ought to be a distinct English group-name for each subfamily into which "antelopes" are subdivided.

The great majority of antelopes, exclusive of the doubtful chamois group (which, however, will be included in the present article), are African, although the gazelles are to a considerable extent an Asiatic group. They include ruminants varying in size from a hare to an ox; and comprise about 150 species, although this number is subject to considerable variation according to personal views as to the limitations of species and races. No true antelopes are American, the prongbuck (*Antilocapra*), which is commonly called "antelope" in the United States, representing a distinct group; while, as already mentioned, the Rocky Mountain or white goat stands on the borderland between antelopes and goats.

The first group, or *Tragelaphinae*, is represented by the African elands (*Taurotragus*), bongo (*Boöcercus*), kudus (*Strepsiceros*) and bushbucks or harnessed antelopes (*Tragelaphus*), and the Indian nilgai (*Boselaphus*). Except in the bongo and elands, horns are present only in the males, and these are angulated and generally spirally twisted, and without rings. The muzzle is naked, small glands are present on the face below the eyes, and the tail is comparatively long. The colours are often brilliant; white spots and stripes being prevalent. The harnessed antelopes, or bushbucks, are closely allied to the kudus, from which they chiefly differ by the spiral formed by the horns generally having fewer turns. They include some of the most brilliantly coloured of all antelopes; the ornamentation taking the form of vertical white lines and rows of spots. Usually the sexes differ in colour. Whereas most of the species have hoofs of normal shape, in some, such as the nakong, or situtunga (*Tragelaphus spekei*), these are greatly elongated, in order to be suited for walking in soft mud, and these have accordingly been separated as *Limnotragus*. The last-named species spends most of its time in water, where it may be observed not infrequently among the reeds with all but its head and horns submerged. The true or smaller bushbucks, represented by the widely spread *Tragelaphus scriptus*, with several local races (fig. 1) are sometimes separated as *Sylvicapra*, leaving the genus *Tragelaphus* to be represented by the larger *T. angasi* and its relatives. The genus *Strepsiceros* is represented by the true or great kudu (*S. capensis* or *S. strepsiceros*), fig. 2, ranging from the Cape to Somaliland, and the smaller *S. imberbis* of North-East Africa, which has no throat-fringe. The large and brightly coloured bongo (*Boöcercus euryceros*) of the equatorial forest-districts serves in some respects to connect the bushbucks with the elands, having horns in both sexes, and a tufted tail, but a brilliant orange coat with vertical white stripes. Still larger are the elands, of which the typical *Taurotragus oryx* of the Cape is uniformly sandy-coloured, although stripes appear in the more northern *T. o. livingstonei*; while the black-necked eland (*T. derbianus*) of Senegambia and the Bahr-el-Ghazal district is a larger and more brilliantly coloured animal. The small horns and bluish-grey colour of the adult bulls serve to distinguish the Indian nilgai (*q.v.*), *Boselaphus tragocamelus*, from the other members of the subfamily.

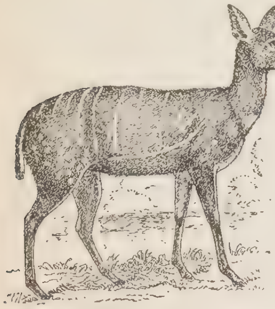


Fig. 1.—Female Bushbuck (*Tragelaphus scriptus*).

The second group, which is mainly African, but also represented in Syria, is that of the *Hippotraginae*, typified by the sable antelope (*Hippotragus niger*) and roan antelope (*H. equinus*), but also including the oryxes (*Oryx*) and addax. These are for the most part large antelopes, with long cylindrical horns, which are present in both sexes, hairy muzzles, no face-glands, long tufted tails and tall thick molars of the ox-type. In *Hippotragus* the stout and thickly ringed horns rise vertically from a ridge above the eyes at an obtuse angle to the plane of the lower part of the face, and then sweep backwards in a bold curve; while there are tufts of long white hairs near the eyes. The sable antelope is a southern species in which both sexes are black or blackish when adult; while the lighter-coloured and larger roan antelope has a much wider distribution. The South African blauwbok (*H. leucophaeus*) is extinct. In the addax (*Addax nasomaculatus*), which is a distinct species common to North Africa and Syria, the ringed horns form an open spiral ascending in the plane of the face, and there is long, shaggy, dark hair on the fore-quarters in winter. The various species of oryx differ from *Hippotragus* by the absence of the white eye-tufts, and by the horns sloping backwards in the plane of the face. In the South African gemsbuck (*Oryx gazella*), fig. 3, the East African beisa or true oryx (*O. beisa*), and the white Arabian (*O. beatrix*) the horns are straight, but in the North African white oryx or algazel (*O. leucoryx* or *O. algazal*) they are scimitar-shaped; the colour of this species being white and pale chestnut (see Addax, Oryx, and Sable Antelope).

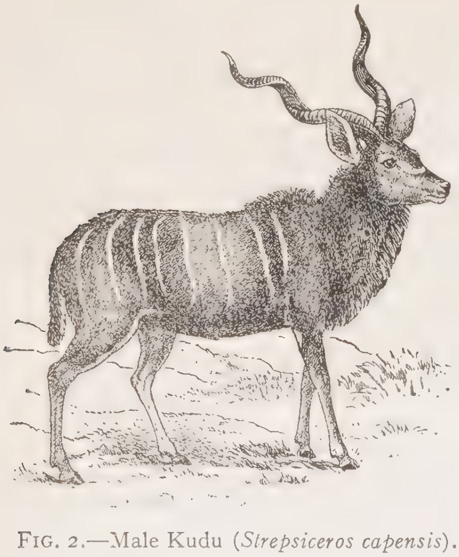


Fig. 2.—Male Kudu (*Strepsiceros capensis*).

The third subfamily is the *Antilopinae*, the members of which have a much wider geographical range than either of the foregoing groups. The subfamily is characterized by the narrow crowns of the molars, which are similar to those of sheep, and the hairy muzzle. Generally there are face-glands below the eyes; and the tail is moderate or short. Pits are present in the forehead of the skull, and the horns are ringed for part of their length, with a compressed base; their form being often lyrate, but sometimes spiral. Lateral hoofs are generally present.

Gazelles (*Gazella*), which form by far the largest genus of the subfamily, are inhabitants of open and frequently more or less desert districts. They are mostly of a sandy colour, with dark and light markings on the face, and often a dark band on the flanks. The horns are more or less lyrate, and generally developed in both sexes; there are frequently brushes of hair on the knees. Gazelles may be divided into groups. The one to which the North African *G. dorcas* belongs is characterized by the presence of lyrate or sub-lyrate horns in both sexes, and by the white of the buttocks not extending on to the haunches. Nearly allied is the group including the Indian *G. bennetti* and the Arabian *G. arabica*, in which the horns have a somewhat S-shaped curvature in profile. In the group represented by the African *G. granti*, *G. thomsoni*, *G. mohr*, &c., the white of the buttocks often sends a prolongation on to the flanks, the horns are long and the size is large. Lastly, the Central Asian *G. gutturosa*, *G. subgutturosa* and *G. picticaudata* form a group in which the females are hornless and the face-markings inconspicuous or wanting.

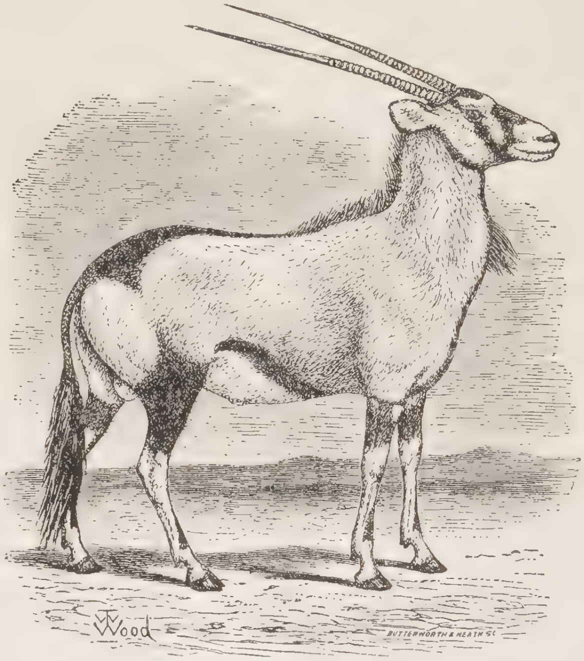


Fig. 3.—Gemsbuck, or Cape Oryx (*Oryx gazella*).

The South African springbuck (*Antidorcas euchore*) is nearly related to the gazelles, from which it is distinguished by the presence on the middle line of the loins of an evertible pouch, lined with long white hairs capable of erection. It has also one premolar tooth less in the lower jaw. Formerly these beautiful antelopes existed in countless numbers on the plains of South Africa, and were in the habit of migrating in droves which completely filled entire valleys. Now they are comparatively rare.

The dibatag or Clarke's gazelle (*Ammodorcas clarkei*), of Somaliland, forms a kind of connecting link between the true gazelles and the gerenuk, this being especially shown in the skull. The face has the ordinary gazelle-markings; but the rather short horns—which are wanting in the female—have a peculiar upward and forward curvature, unlike that obtaining in the gazelles and somewhat resembling that of the reedbuck. The neck is longer and more slender than in ordinary gazelles, and the tail is likewise relatively long. Although local, these animals are fairly common in the interior of Somaliland, where they are known by the name of dibatag. In running, the head and neck are thrown backwards, while the tail is turned forwards over the back.

The East African gerenuk (*q.v.*), or Waller's gazelle (*Lithocranius walleri*), of which two races have been named, is a very remarkable ruminant, distinguished not only by its exceedingly elongated neck and limbs, but also by the peculiar hooked form of the very massive horns of the bucks, the dense structure and straight profile of the skull, and the extreme slenderness of the lower jaw.

A still more aberrant gazelle is a small North-East African species known as the beira (*Dorcatragus melanotis*), with very short horns, large hoofs and a general appearance recalling that of some of the members of the subfamily *Neotraginae*, although in other respects gazelle-like. The blackbuck (*Antilope cervicapra* or *A. bezoartica*) of India, a species taking its name from the deep black coat assumed by the adult bucks, and easily recognized by the graceful, spirally twisted horns ornamenting the heads of that sex, is now the sole representative of the genus *Antilope*, formerly taken to embrace the whole of the true antelopes. Large face-glands are characteristic of the species, which inhabits the open plains of India in large herds. They leap high in the air, like the springbuck, when on the move.

With the palla (*q.v.*), or impala (*Aepyceros melampus*), we reach an exclusively African genus, characterized by the lyrate horns of the bucks, the absence of lateral hoofs, and the presence of a pair of glands with black tufts of hair on the hind-feet.

The sheep-like saiga (*q.v.*), *Saiga tatarica*, of the Kirghiz steppes stands apart from all other antelopes by its curiously puffed and trunk-like nose, which can be wrinkled up when the animal is feeding and has the nostrils opening downwards. More or less nearly related to the saiga is the chiru (*q.v.*), *Pantholops hodgsoni*, of Tibet, characterized by the long upright black horns of the bucks, and the less convex nose, in which the nostrils open anteriorly instead of downwards.

The *Neotraginae* (or *Nanotraginae*) form an exclusively African group of small-sized antelopes divided into several, for the most part nearly related, genera. Almost the only characters they possess in common are the short and spike-like horns of the bucks, which are ringed at the base, with smooth tips, and the large size of the face-gland, which opens by a circular aperture. *Neotragus* is represented by the pigmy royal antelope (*N. pygmaeus*) of Guinea; *Hylarnus* includes one species from Cameroon and a second from the Semliki forest; while *Nesotragus* comprises the East African suni antelopes, *N. moschatus* and *N. livingstonianus*. All three might, however, well be included in *Neotragus*. The royal antelope is the smallest of the Bovidae.

The steinbok (*Rhaphiceros campestris*) and the *grysbok* (*R. melanotis*) are the best-known representatives of a group characterized by the vertical direction of the horns and the small gland-pit in the skull; lateral hoofs being absent in the first-named and present in the second. A bare gland-patch behind the ear serves to distinguish the oribis or ourebis, as typified by *Oribia montana* of the Cape; lateral hoofs being present and the face-pit large.

From all the preceding the tiny dik-diks (*Madoqua*) of North-East Africa differ by their hairy noses, expanded in some species into short trunks; while the widely spread klipspringer (*q.v.*), *Oreotragus saltator*, with its several local races, is unfailingly distinguishable by its rounded blunt hoofs and thick, brittle, golden-flecked hair.

In some respects connecting the last group with the *Cervicaprinae* is the rhebok, or vaal-rhebok (*Pelea capreolus*), a grey antelope of the size of a roebuck, with small upright horns in the bucks recalling those of the last group, and small lateral hoofs, but no face-glands. In size and several structural features it approximates to the more typical *Cervicaprinae*, as represented by the reedbuck (*Cervicapra*), and the waterbucks and kobs (*Cobus* or *Kobus*), all of which are likewise African. These are medium-sized or large antelopes with naked muzzles, narrow sheep-like upper molars, fairly long tails, rudimentary or no face-glands, and pits in the frontal bones of the skull. Reedbuck (*q.v.*), or rietbok (*Cervicapra*), are foxy-red antelopes ranging in size from a fallow-deer to a roe, with thick bushy tails, forwardly curving black horns, and a bare patch of glandular skin behind each ear. They keep to open country near water. The waterbuck (*q.v.*), *Cobus*, on the other hand, actually seek refuge from pursuit in the water. They have heavily fringed necks, tufted tails, long lyrate horns in the bucks (fig. 4) but no glandular ear-patches. The true waterbuck (*C. ellipsiprymnus*), and the defassa or sing-sing (*C. defassa*), are the two largest species, equal in size to red deer, and grey or reddish in colour. Of the smaller forms or kobs, *C. maria* and *C. leucotis* of the swamps of the White Nile are characterized by the black coats of the adult bucks; the West African *C. cob*, and its East African representative *C. thomasi*, are wholly red antelopes of the size of roedeer; the lichi or lechwe (*C. lichi*) is characterized by its long horns, black fore-legs and superior size; while the puku (*C. vardoni*), which is also a swamp-loving species from South-Central Africa, differs from the three preceding species by the fore-legs being uniformly foxy.

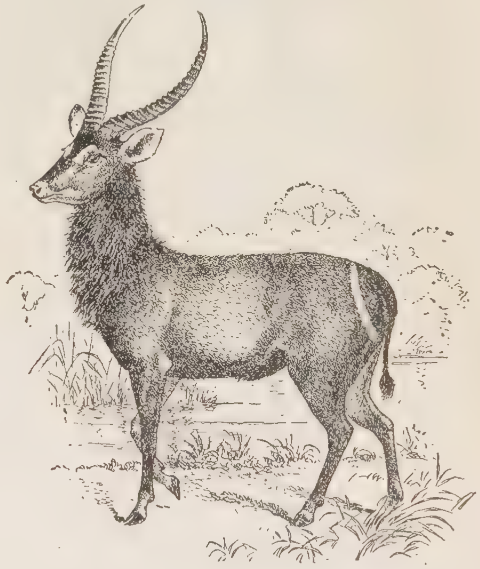


Fig. 4.—Waterbuck (*Cobus ellipsiprymnus*).

The duikers, or duikerboks (*Cephalophus*), of Africa, which range in size from a large hare to a fallow-deer, typify the subfamily *Cephalophinae*, characterized by the spike-like horns of the bucks, the elongated aperture of the face-glands, the naked muzzle, the relatively short tail, and the square-crowned upper molars; lateral hoofs being present. In the duikers themselves the single pair of horns is set in the midst of a tuft of long hairs, and the face-gland opens in a long naked line on the side of the face above the muzzle. The group is represented in India by the chousingha or four-horned antelope (*Tetraceros quadricornis*), generally distinguished by the feature from which it takes its name (see Duiker).

The last section of the true antelopes is the *Bubalinae*, represented by the hartebeest (*q.v.*), *Bubalis*, blesbok and sassaby (*Damaliscus*), and the gnu (*q.v.*) or wildebeest (*Connochaetes*, also called *Catoblepas*), all being African with the exception of one or two hartebeests which range into Syria. All these are large and generally more or less uniformly coloured antelopes with horns in both sexes, long and more or less hairy tails, high withers small face-glands, naked muzzles, tall, narrow upper molars, and the absence of pits in the frontal bones. The long face, high crest for the horns, which are ringed, lyrate and more or less strongly angulated, and the moderately long tail, are the distinctive features of the hartebeests. They are large red antelopes (fig. 5), often with black markings on the face and limbs. In *Damaliscus*, which includes, among many other species, the blesbok and bontebok (*D. albifrons* and *D. pygargus*) and the sassaby or bastard hartebeest (*D. lunatus*), the face is shorter, and the horns straighter and set on a less elevated crest. The colour, too, of these antelopes tends in many cases to purple, with white markings. From the hartebeest the gnus (fig. 6) differ by their smooth and outwardly or downwardly directed horns, broad bristly muzzles, heavy manes and long horse-like tails. There are two chief types, the white-tailed gnu or black wildebeest (*Connochaetes gnu*) of South Africa, now nearly extinct (fig. 6), and the brindled gnu, or blue wildebeest (*C. taurinus*), which, with some local variation, has a large range in South and East Africa.

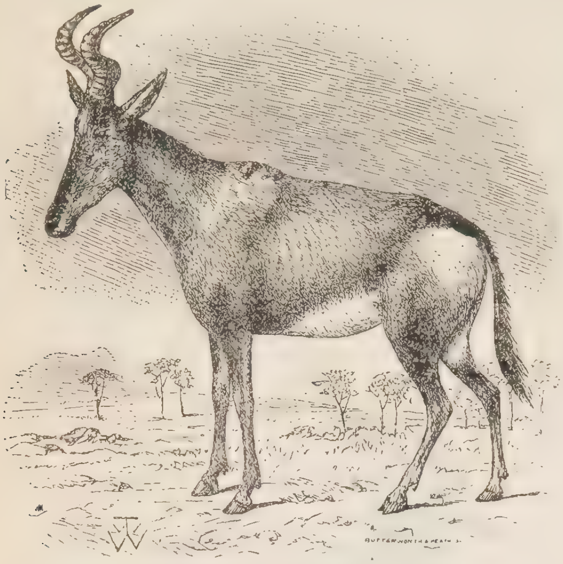


Fig. 5.—Cape Hartebeest (*Bubalis cama*).

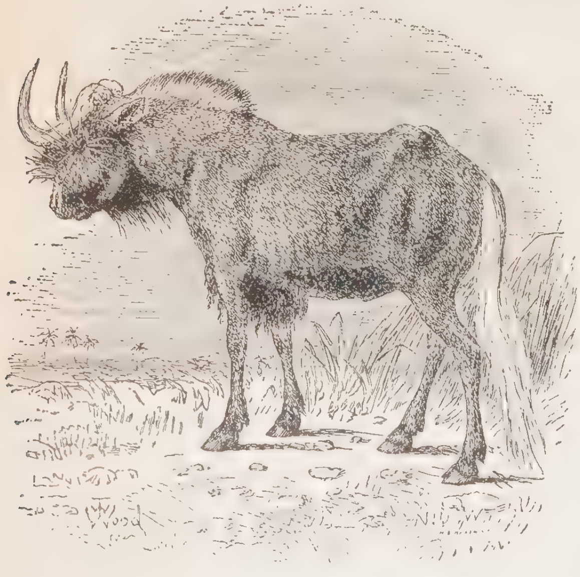


Fig. 6.—White-tailed Gnu, or Black Wildebeest (*Connochaetes gnu*).

In concluding this survey of living antelopes, reference may be made to the subfamily *Rupicaprinae* (typified by the European chamois), the members of which, as already stated, are in some respects intermediate between antelopes and goats. They are all small or medium-sized mountain ruminants, for the most part European and Asiatic, but with one North American representative. They are heavily built ruminants, with horns of nearly equal size in both sexes, short tapering tails, large hoofs, narrow goat-like upper molars, and usually small face-glands. The horns are generally rather small, upright, ringed at the base, and more or less curved backwards, but in the takin they are gnu-like. The group is represented by the European chamois or gemse (*Rupicapra tragus* or *R. rupicapra*), broadly distinguished by its well-known hook-like horns, and the Asiatic gorals (*Urotragus*) and serows (*Nemorhaedus*), which are represented by numerous species ranging from Tibet, the Himalaya, and China, to the Malay Peninsula and islands, being in the two latter areas the sole representatives of both antelopes and goats. In the structure of its horns the North American white Rocky Mountain goat (*Oreamnus*) is very like a serow, from which it differs by its extremely short cannon-bones. In the latter respect this ruminant resembles the takin (*Budorcas*) of Tibet, which, as already mentioned, has horns recalling those of the white-tailed gnu. Possibly the Arctic musk-ox (*Ovibos*) may be connected with the takin by means of certain extinct ruminants, such as the North American Pleistocene *Euceratherium* and the European Pliocene *Criotherium* (see Chamois, Goral, Serow, Rocky Mountain Goat and Takin).

Extinct Antelopes.—Only a few lines can be devoted to extinct antelopes, the earliest of which apparently date from the European Miocene. An antelope from the Lower Pliocene of Northern India known as *Bubalis*, or *Damaliscus*, *palaeindicus* indicates the occurrence of the hartebeest group in that country. *Cobus* also occurs in the same formation, as does likewise *Hippotragus*. *Palaeoryx* from the corresponding horizon in Greece and Samos is to some extent intermediate between *Hippotragus* and *Oryx*. Gazelles are common in the Miocene and Pliocene of both Europe and Asia. Elands and kudus appear to have been represented in India during the Pliocene; the European *Palaeoreas* of the same age seems to be intermediate between the two, while *Protragelaphus* is evidently another European representative of the group. *Helicophora* is another spiral-horned European Pliocene antelope, but of somewhat doubtful affinity; the same being the case with the large *Criotherium* of the Samos Pliocene, in which the short horns are curiously twisted. As already stated, there is a possibility of this latter ruminant being allied both to the takin and the musk-ox. *Palaeotragus* and *Tragoceros*, of the Lower Pliocene of Greece, at one time regarded as antelopes, are now known to be ancestors of the okapi.

For antelopes in general, see P. L. Sclater and O. Thomas, *The Book of Antelopes* (4 vols., London, 1894–1900). (R. L.*)

ANTEMNAE (Lat. *ante amnem*, sc. *Anienem*; Varro, *Ling. Lat.* v. 28), an ancient village of Latium, situated on the W. of the Via Salaria, 2 m. N. of Rome, where the Anio falls into the Tiber. It is said to have been conquered by Romulus after the rape of the Sabine women, and to have assisted the Tarquins. Certainly it soon lost its independence, and in Strabo's time was a mere village. The site is one of great strength, and is now occupied by a fort, in the construction of which traces of the outer walls and of huts, and several wells and a cistern, all belonging to the primitive village, were discovered, and also the remains of a villa of the end of the Republic.

See T. Ashby in *Papers of the British School at Rome*, iii. 14.

ANTENOR, an Athenian sculptor, of the latter part of the 6th century B.C. He was the author of the group of the tyrannicides Harmodius and Aristogeiton, set up by the Athenians on the expulsion of the Peisistratidae, and carried away to Persia by Xerxes. A basis with the signature of Antenor, son of Eumares, has been shown to belong to one of the dedicated female figures of archaic style which have been found on the Acropolis of Athens.

See Greek Art; and E. A. Gardner's *Handbook of Greek Sculpture*, i. p. 182.

ANTENOR, in Greek legend, one of the wisest of the Trojan elders and counsellors. He advised his fellow-townsmen to send Helen back to her husband, and showed himself not unfriendly to the Greeks and an advocate of peace. In the later story, according to Dares and Dictys, he was said to have treacherously opened the gates of Troy to the enemy; in return for which, at the general sack of the city, his house, distinguished by a panther's skin at the door, was spared by the victors. Afterwards, according to various versions of the legend, he either rebuilt a city on the site of Troy, or settled at Cyrene, or became the founder of Patavium.

Homer, *Iliad*, iii. 148, vii. 347; Horace, *Epp.* i. 2. 9; Livy i. 1; Pindar, *Pythia*, v. 83; Virgil, *Aen.* i. 242.

ANTEQUERA (the ancient *Anticaria*), a town of southern Spain, in the province of Málaga; on the Bobadilla-Granada railway. Pop. (1900) 31,609. Antequera overlooks the fertile valley bounded on the S. by the Sierra de los Torcales, and on the N. by the river Guadalhorce. It occupies a commanding position, while the remains of its walls, and of a fine Moorish castle on a rock that overhangs the town, show how admirably its natural defences were supplemented by art. Besides several interesting churches and palaces, it contains a fine arch, erected in 1595 in honour of Philip II., and partly constructed of inscribed Roman masonry. In the eastern suburbs there is one of the largest grave-mounds in Spain, said to be of prehistoric date, and with subterranean chambers excavated to a depth of 65 ft. The Peña de los Enamorados, or "Lovers' Peak," is a conspicuous crag which owes its name to the romantic legend adapted by Robert Southey (1774–1843) in his *Laila and Manuel*. Woollen fabrics are manufactured, and the sugar industry established in 1890 employs several thousand hands; but the majority of the inhabitants are occupied by the trade in grain, fruit, wine and oil. Marble is quarried; and at El Torcal, 6 m. south, there is a very curious labyrinth of red marble rocks. Antequera was captured from the Moors in 1410, and became until 1492 one of the most important outposts of the Christian power in Spain.

See C. Fernandez, *Historia de Antequera, desde su fondacion* (Malaga, 1842).

ANTEROS, pope for some weeks at the end of the year 235. He died on the 3rd of January 236. His original epitaph was discovered in the Catacombs.

ANTHELION (late Gr. ἀνθήλιος, opposite the sun), the luminous ring or halo sometimes seen in Alpine or polar regions surrounding the shadow of the head of an observer cast upon a bank of cloud or mist. The halo diminishes in brightness from the centre outwards, and is probably due to the diffraction of light. Under favourable conditions four concentric rings may be seen round the shadow of the observer's head, the outermost, which seldom appears, having an angular radius of 40°.

ANTHEM, derived from the Gr. ἀντίφωνα, through the Saxon *antefn*, a word which originally had the same meaning as antiphony (*q.v.*). It is now, however, generally restricted to a form of church music, particularly in the service of the Church of England, in which it is appointed by the rubrics to follow the third collect at both morning and evening prayer, "in choirs and places where they sing." It is just as usual in this place to have an ordinary hymn as an anthem, which is a more elaborate composition than the congregational hymns. Several anthems are included in the English coronation service. The words are selected from Holy Scripture or in some cases from the Liturgy, and the music is generally more elaborate and varied than that of psalm or hymn tunes. Anthems may be written for solo voices only, for the full choir, or for both, and according to this distinction are called respectively *Verse*, *Full*, and *Full with Verse*. Though the anthem of the Church of England is analogous to the *motet* of the Roman Catholic and Lutheran Churches, both being written for a trained choir and not for the congregation, it is as a musical form essentially English in its origin and development. The English school of musicians has from the first devoted its chief attention to this form, and scarcely a composer of any note can be named who has not written several good anthems. Tallis, Tye, Byrd, and Farrant in the 16th century; Orlando Gibbons, Blow, and Purcell in the 17th, and Croft, Boyce, James Kent, James Nares, Benjamin Cooke, and Samuel Arnold in the 18th were famous composers of anthems, and in more recent times the names are too numerous to mention.

ANTHEMION (from the Gr. ἀνθέμιον, a flower), the conventional design of flower or leaf forms which was largely employed by the Greeks to decorate (1) the fronts of ante-fixae, (2) the upper portion of the stele or vertical tombstones, (3) the necking of the Ionic columns of the Erechtheum and its continuation as a decorative frieze on the walls of the same, and (4) the cymatium of a cornice. Though generally known as the honeysuckle ornament, from its resemblance to that flower, its origin will be found in the flower of the acanthus plant.

ANTHEMIUS, Greek mathematician and architect, who produced, under the patronage of Justinian (A.D. 532), the original and daring plans for the church of St Sophia in Constantinople, which strikingly displayed at once his knowledge and his ignorance. He was one of five brothers—the sons of Stephanus, a physician of Tralles—who were all more or less eminent in their respective departments. Dioscorus followed his father's profession in his native place; Alexander became at Rome one of the most celebrated medical men of his time; Olympius was deeply versed in Roman jurisprudence; and Metrodorus was one of the distinguished grammarians of the great Eastern capital. It is related of Anthemius that, having a quarrel with his next-door neighbour Zeno, he annoyed him in two ways. First, he made a number of leathern tubes the ends of which he contrived to fix among the joists and flooring of a fine upper-room in which Zeno entertained his friends, and then subjected it to a miniature earthquake by sending steam through the tubes. Secondly, he simulated thunder and lightning, the latter by flashing in Zeno's eyes an intolerable light from a slightly hollowed mirror. Certain it is that he wrote a treatise on burning-glasses. A fragment of this was published under the title Περὶ παραδόξων μηχανημάτων by L. Dupuy in 1777, and also appeared in 1786 in the forty-second volume of the *Hist. de l'Acad. des Inscr.*; A. Westermann gave a revised edition of it in his Παραδοξογράφοι (*Scriptores rerum mirabilium Graeci*), 1839. In the course of constructions for surfaces to reflect to one and the same point (1) all rays in whatever direction passing through another point, (2) a set of parallel rays, Anthemius assumes a property of an ellipse not found in Apollonius (the equality of the angles subtended at a focus by two tangents drawn from a point), and (having given the focus and a double ordinate) he uses the focus and directrix to obtain any number of points on a parabola—the first instance on record of the practical use of the directrix.

On Anthemius generally, see Procopius, *De Aedific.* i. 1; Agathias, *Hist.* v. 6-9; Gibbon's *Decline and Fall*, cap. xl. (T. L. H.)

ANTHESTERIA, one of the four Athenian festivals in honour of Dionysus, held annually for three days (11th–13th) in the month of Anthesterion (February–March). The object of the festival was to celebrate the maturing of the wine stored at the previous vintage, and the beginning of spring. On the first day, called *Pithoigia* (opening of the casks), libations were offered from the newly opened casks to the god of wine, all the household, including servants and slaves, joining in the festivities. The rooms and the drinking vessels in them were adorned with spring flowers, as were also the children over three years of age. The second day, named *Choës* (feast of beakers), was a time of merrymaking. The people dressed themselves gaily, some in the disguise of the mythical personages in the suite of Dionysus, and paid a round of visits to their acquaintances. Drinking clubs met to drink off matches, the winner being he who drained his cup most rapidly. Others poured libations on the tombs of deceased relatives. On the part of the state this day was the occasion of a peculiarly solemn and secret ceremony in one of the sanctuaries of Dionysus in the Lenaeum, which for the rest of the year was closed. The basilissa (or basilinna), wife of the archon basileus for the time, went through a ceremony of marriage to the wine god, in which she was assisted by fourteen Athenian matrons, called *geraerae*, chosen by the basileus and sworn to secrecy. The days on which the Pithoigia and Choës were celebrated were both regarded as ἀποφράδες (*nefasti*) and μιαραί ("defiled"), necessitating expiatory libations; on them the souls of the dead came up from the underworld and walked abroad; people chewed leaves of whitethorn and besmeared their doors with tar to protect themselves from evil. But at least in private circles the festive character of the ceremonies predominated. The third day was named *Chytri* (feast of pots, from χύτρος, a pot), a festival of the dead. Cooked pulse was offered to Hermes, in his capacity of a god of the lower world, and to the souls of the dead. Although no performances were allowed at the theatre, a sort of rehearsal took place, at which the players for the ensuing dramatic festival were selected.

The name Anthesteria, according to the account of it given above, is usually connected with ἄνθος (" flower," or the " bloom " of the grape), but A. W. Verrall (*Journal of Hellenic Studies*, xx., 1900, p. 115) explains it as a feast of " revocation " (from ἀναθέσσασθαι, to " pray back " or " up "), at which the ghosts of the dead were recalled to the land of the living (*cp.* the Roman *mundus patet*). J. E. Harrison (*ibid.* 100,109, and *Prolegomena*), regarding the Anthesteria as primarily a festival of all souls, the object of which was the expulsion of ancestral ghosts by means of placation, explains πιθοιγία as the feast of the opening of the graves (πίθος meaning a large urn used for burial purposes), χόες as the day of libations, and χύτροι as the day of the grave-holes (not " pots," which is χύτραι), in point of time really anterior to the πιθοιγία. E. Rohde and M. P. Nilsson, however, take the χύτροι to mean " water vessels," and connect the ceremony with the Hydrophoria, a libation festival to propitiate the dead who had perished in the flood of Deucalion.

See F. Hiller von Gärtringen in Pauly-Wissowa's *Realencyclopädie* (*s.v.*); J. Girard in Daremberg and Saglio, *Dictionnaire des antiquités* (*s.v.* " Dionysia "); and F. A. Voigt in Roscher's *Lexikon der Mythologie* (*s.v.* " Dionysos "); J. E. Harrison, *Prolegomena to the Study of Greek Religion* (1903); M. P. Nilsson, *Studia de Dionysiis Atticis* (1900) and *Griechische Feste* (1906); G. F. Schömann, *Griechische Alterthümer*, ii. (ed. J. H. Lipsius, 1902), p. 516; A. Mommsen, *Feste der Stadt Athen* (1898); E. Rohde, *Psyche* (4th ed., 1907), p. 237.

ANTHIM THE IBERIAN, a notable figure in the ecclesiastical history of Rumania. A Georgian by birth, he came to Rumania early in the second half of the 17th century, as a simple monk. He became bishop of Râmnicu in 1705, and in 1708 archbishop of Walachia. Taking a leading part in the political movements of the time, he came into conflict with the newly appointed Greek hospodars, and was exiled to Rumelia. But on his crossing the Danube in 1716 he was thrown into the water and drowned, as it is alleged, at the instigation of the prince of Walachia. He was a man of great talents and spoke and wrote many Oriental and European languages. Though a foreigner, he soon acquired a thorough knowledge of Rumanian, and was instrumental in helping to introduce that language into the church as its official language. He was a master printer and an artist of the first order. He cut the wood blocks for the books which he printed in Tîrgovishtea, Râmnicu, Snagov and Bucharest. He was also the first to introduce Oriental founts of type into Rumania, and he printed there the first Arabic missal for the Christians of the East (Râmnicu, 1702). He also trained Georgians in the art of printing, and cut the type with which under his pupil Mihail Ishtvanovitch they printed the first Georgian Gospels (Tiflis, 1709). A man of great oratorical power, Anthim delivered a series of sermons (*Didahii*), and some of his pastoral letters are models of style and of language as well as of exact and beautiful printing. He also completed a whole *corpus* of lectionaries, missals, gospels, &c.

See M. Gaster, *Chrestomathie roumaine* (1881), and " Gesch. d. rumänischen Litteratur," in Gröber, *Grundriss d. rom. Philologie*, vol. ii. (1899); and E. Picot, *Notice sur Anthim d'Ivir* (Paris, 1886). (M. G.)

ANTHOLOGY. The term " anthology," literally denoting a garland or collection of flowers, is figuratively applied to any selection of literary beauties, and especially to that great body of fugitive poetry, comprehending about 4500 pieces, by upwards of 300 writers, which is commonly known as the *Greek Anthology*.

Literary History of the Greek Anthology.—The art of occasional poetry had been cultivated in Greece from an early period,—less, however, as the vehicle of personal feeling, than as the recognized commemoration of remarkable individuals or events, on sepulchral monuments and votive offerings. Such compositions were termed epigrams, *i.e.* inscriptions. The modern use of the word is a departure from the original sense, which simply indicated that the composition was intended to be engraved or inscribed. Such a composition must necessarily be brief, and the restraints attendant upon its publication concurred with the simplicity of Greek taste in prescribing conciseness of expression, pregnancy of meaning, purity of diction and singleness of thought, as the indispensable conditions of excellence in the epigrammatic style. The term was soon extended to any piece by which these conditions were fulfilled. The transition from the monumental to the purely literary character of the epigram was favoured by the exhaustion of more lofty forms of poetry, the general increase, from the general diffusion of culture, of accomplished writers and tasteful readers, but, above all, by the changed political circumstances of the times, which induced many who would otherwise have engaged in public affairs to addict themselves to literary pursuits. These causes came into full operation during the Alexandrian era, in which we find every description of epigrammatic composition perfectly developed. About 60 B.C., the sophist and poet, Meleager of Gadara, undertook to combine the choicest effusions of his predecessors into a single body of fugitive poetry. Collections of monumental inscriptions, or of poems on particular subjects, had previously been formed by Polemon Periegetes and others; but Meleager first gave the principle a comprehensive application. His selection, compiled from forty-six of his predecessors, and including numerous contributions of his own, was entitled *The Garland* (Στέφανος); and in an introductory poem each poet is compared to some flower, fancifully deemed appropriate to his genius. The arrangement of his collection was alphabetical, according to the initial letter of each epigram.

In the age of the emperor Tiberius (or Trajan, according to others) the work of Meleager was continued by another epigrammatist, Philippus of Thessalonica, who first employed the term anthology. His collection, which included the compositions of thirteen writers subsequent to Meleager, was also arranged alphabetically, and contained an introductory poem. It was of inferior quality to Meleager's. Somewhat later, under Hadrian, another supplement was formed by the sophist Diogenianus of Heracleia (2nd century A.D.), and Strato of Sardis compiled his elegant but tainted Μοῦσα Παιδική (Musa Puerilis) from his productions and those of earlier writers. No further collection from various sources is recorded until the time of Justinian, when epigrammatic writing, especially of an amatory character, experienced a great revival at the hands of Agathias of Myrina, the historian, Paulus Silentiarius, and their circle. Their ingenious but mannered productions were collected by Agathias into a new anthology, entitled *The Circle* (Κύκλος); it was the first to be divided into books, and arranged with reference to the subjects of the pieces.

These and other collections made during the middle ages are now lost. The partial incorporation of them into a single body, classified according to the contents in 15 books, was the work of a certain Constantinus Cephalas, whose name alone is preserved in the single MS. of his compilation extant, but who probably lived during the temporary revival of letters under Constantine Porphyrogenitus, at the beginning of the 10th century. He appears to have merely made excerpts from the existing anthologies, with the addition of selections from Lucillius, Palladas, and other epigrammatists, whose compositions had been published separately. His arrangement, to which we shall have to recur, is founded on a principle of classification, and nearly corresponds to that adopted by Agathias. His principle of selection is unknown; it is only certain that while he omitted much that he should have retained, he has preserved much that would otherwise have perished. The extent of our obligations may be ascertained by a comparison between his anthology and that of the next editor, the monk Maximus Planudes (A.D. 1320), who has not merely grievously mutilated the anthology of Cephalas by omissions, but has disfigured it by interpolating verses of his own. We are, however, indebted to him for the preservation of the epigrams on works of art, which seem to have been accidentally omitted from our only transcript of Cephalas.

The Planudean (in seven books) was the only recension of the anthology known at the revival of classical literature, and was first published at Florence, by Janus Lascaris, in 1494. It long continued to be the only accessible collection, for although the Palatine MS., the sole extant copy of the anthology of Cephalas, was discovered in the Palatine library at Heidelberg, and copied by Saumaise (Salmasius) in 1606, it was not published until 1776, when it was included in Brunck's *Analecta Veterum Poetarum Graecorum*. The MS. itself had frequently changed its quarters. In 1623, having been taken in the sack of Heidelberg in the Thirty Years' War, it was sent with the rest of the Palatine Library to Rome as a present from Maximilian I. of Bavaria to Gregory XV., who had it divided into two parts, the first of which was by far the larger; thence it was taken to Paris in 1797. In 1816 it went back to Heidelberg, but in an incomplete state, the second part remaining at Paris. It is now represented at Heidelberg by a photographic facsimile. Brunck's edition was superseded by the standard one of Friedrich Jacobs (1794–1814, 13 vols.), the text of which was reprinted in a more convenient form in 1813–1817, and occupies three pocket volumes in the Tauchnitz series of the classics. The best edition for general purposes is perhaps that of Dübner in Didot's *Bibliotheca* (1864–1872), which contains the Palatine Anthology, the epigrams of the Planudean Anthology not comprised in the former, an appendix of pieces derived from other sources, copious notes selected from all quarters, a literal Latin prose translation by Boissonade, Bothe, and Lapaume and the metrical Latin versions of Hugo Grotius. A third volume, edited by E. Cougny, was published in 1890. The best edition of the Planudean Anthology is the splendid one by van Bosch and van Lennep (1795–1822). There is also a complete edition of the text by Stadtmüller in the Teubner series.

Arrangement.—The Palatine MS., the archetype of the present text, was transcribed by different persons at different times, and the actual arrangement of the collection does not correspond with that signalized in the index. It is as follows: Book 1. Christian epigrams; 2. Christodorus's description of certain statues; 3. Inscriptions in the temple at Cyzicus; 4. The prefaces of Meleager, Philippus, and Agathias to their respective collections; 5. Amatory epigrams; 6. Votive inscriptions; 7. Epitaphs; 8. The epigrams of Gregory of Nazianzus; 9. Rhetorical and illustrative epigrams; 10. Ethical pieces; 11. Humorous and convivial; 12. Strato's Musa Puerilis; 13. Metrical curiosities; 14. Puzzles, enigmas, oracles; 15. Miscellanies. The epigrams on works of art, as already stated, are missing from the *Codex Palatinus*, and must be sought in an appendix of epigrams only occurring in the Planudean Anthology. The epigrams hitherto recovered from ancient monuments and similar sources form appendices in the second and third volumes of Dübner's edition.

Style and Value.—One of the principal claims of the Anthology to attention is derived from its continuity, its existence as a living and growing body of poetry throughout all the vicissitudes of Greek civilization. More ambitious descriptions of composition speedily ran their course, and having attained their complete development became extinct or at best lingered only in feeble or conventional imitations. The humbler strains of the epigrammatic muse, on the other hand, remained ever fresh and animated, ever in intimate union with the spirit of the generation that gave them birth. To peruse the entire collection, accordingly, is as it were to assist at the disinterment of an ancient city, where generation has succeeded generation on the same site, and each stratum of soil enshrines the vestiges of a distinct epoch, but where all epochs, nevertheless, combine to constitute an organic whole, and the transition from one to the other is hardly perceptible. Four stages may be indicated:—1. The Hellenic proper, of which Simonides of Ceos (*c.* 556–469 B.C.), the author of most of the sepulchral inscriptions on those who fell in the Persian wars, is the characteristic representative. This is characterized by a simple dignity of phrase, which to a modern taste almost verges upon baldness, by a crystalline transparency of diction, and by an absolute fidelity to the original conception of the epigram. Nearly all the pieces of this era are actual *bona fide* inscriptions or addresses to real personages, whether living or deceased; narratives, literary exercises, and sports of fancy are exceedingly rare. 2. The epigram received a great development in its second or Alexandrian era, when its range was so extended as to include anecdote, satire, and amorous longing; when epitaphs and votive inscriptions were composed on imaginary persons and things, and men of taste successfully attempted the same subjects in mutual emulation, or sat down to compose verses as displays of their ingenuity. The result was a great gain in richness of style and general interest, counterbalanced by a falling off in purity of diction and sincerity of treatment. The modification—a perfectly legitimate one, the resources of the old style being exhausted—had its real source in the transformation of political life, but may be said to commence with and to find its best representative in the playful and elegant Leonidas of Tarentum, a contemporary of Pyrrhus, and to close with Antipater of Sidon, about 140 B.C. (or later). It should be noticed, however, that Callimachus, one of the most distinguished of the Alexandrian poets, affects the sternest simplicity in his epigrams, and copies the austerity of Simonides with as much success as an imitator can expect. 3. By a slight additional modification in the same direction, the Alexandrian passes into what, for the sake of preserving the parallelism with eras of Greek prose literature, we may call the Roman style, although the peculiarities of its principal representative are decidedly Oriental. Meleager of Gadara was a Syrian; his taste was less severe, and his temperament more fervent than those of his Greek predecessors; his pieces are usually erotic, and their glowing imagery sometimes reminds us of the Song of Solomon. The luxuriance of his fancy occasionally betrays him into far-fetched conceits, and the lavishness of his epithets is only redeemed by their exquisite felicity. Yet his effusions are manifestly the offspring of genuine feeling, and his epitaph on himself indicates a great advance on the exclusiveness of antique Greek patriotism, and is perhaps the first clear enunciation of the spirit of universal humanity characteristic of the later Stoic philosophy. His gaiety and licentiousness are imitated and exaggerated by his somewhat later contemporary, the Epicurean Philodemus, perhaps the liveliest of all the epigrammatists; his fancy reappears with diminished brilliancy in Philodemus's contemporary, Zonas, in Crinagoras, who wrote under Augustus, and in Marcus Argentarius, of uncertain date; his peculiar gorgeousness of colouring remains entirely his own. At a later period of the empire another *genre*, hitherto comparatively in abeyance, was developed, the satirical. Lucillius, who flourished under Nero, and Lucian, more renowned in other fields of literature, display a remarkable talent for shrewd, caustic epigram, frequently embodying moral reflexions of great cogency, often lashing vice and folly with signal effect, but not seldom indulging in mere trivialities, or deformed by scoffs at personal blemishes. This style of composition is not properly Greek, but Roman; it answers to the modern definition of epigram, and has hence attained a celebrity in excess of its deserts. It is remarkable, however, as an almost solitary example of direct Latin influence on Greek literature. The same style obtains with Palladas, an Alexandrian grammarian of the 4th century, the last of the strictly classical epigrammatists, and the first to be guilty of downright bad taste. His better pieces, however, are characterized by an austere ethical impressiveness, and his literary position is very interesting as that of an indignant but despairing opponent of Christianity. 4. The fourth or Byzantine style of epigrammatic composition was cultivated by the *beaux-esprits* of the court of Justinian. To a great extent this is merely imitative, but the circumstances of the period operated so as to produce a species of originality. The peculiarly ornate and *recherché* diction of Agathias and his compeers is not a merit in itself, but, applied for the first time, it has the effect of revivifying an old form, and many of their new locutions are actual enrichments of the language. The writers, moreover, were men of genuine poetical feeling, ingenious in invention, and capable of expressing emotion with energy and liveliness; the colouring of their pieces is sometimes highly dramatic.

It would be hard to exaggerate the substantial value of the Anthology, whether as a storehouse of facts bearing on antique manners, customs and ideas, or as one among the influences which have contributed to mould the literature of the modern world. The multitudinous votive inscriptions, serious and sportive, connote the phases of Greek religious sentiment, from pious awe to irreverent familiarity and sarcastic scepticism; the moral tone of the nation at various periods is mirrored with corresponding fidelity; the sepulchral inscriptions admit us into the inmost sanctuary of family affection, and reveal a depth and tenderness of feeling beyond the province of the historian to depict, which we should not have surmised even from the dramatists; the general tendency of the collection is to display antiquity on its most human side, and to mitigate those contrasts with the modern world which more ambitious modes of composition force into relief. The constant reference to the details of private life renders the Anthology an inexhaustible treasury for the student of archaeology; art, industry and costume receive their fullest illustration from its pages. Its influence on European literatures will be appreciated in proportion to the inquirer's knowledge of each. The further his researches extend, the greater will be his astonishment at the extent to which the Anthology has been laid under contribution for thoughts which have become household words in all cultivated languages, and at the beneficial effect of the imitation of its brevity, simplicity, and absolute verbal accuracy upon the undisciplined luxuriance of modern genius.

Translations, Imitations, &c.—The best versions of the Anthology ever made are the Latin renderings of select epigrams by Hugo Grotius. They have not been printed separately, but will be found in Bosch and Lennep's edition of the Planudean *Anthology*, in the Didot edition, and in Dr Wellesley's *Anthologia Polyglotta*. The number of more or less professed imitations in modern languages is infinite, that of actual translations less considerable. French and Italian, indeed, are ill adapted to this purpose, from their incapacity of approximating to the form of the original, and their poets have usually contented themselves with paraphrases or imitations, often exceedingly felicitous. F. D. Dehèque's French prose translation, however (1863), is most excellent and valuable. The German language alone admits of the preservation of the original metre—a circumstance advantageous to the German translators, Herder and Jacobs, who have not, however, compensated the loss inevitably consequent upon a change of idiom by any added beauties of their own. Though unfitted to reproduce the precise form, the English language, from its superior terseness, is better adapted to preserve the spirit of the original than the German; and the comparative ill success of many English translators must be chiefly attributed to the extremely low standard of fidelity and brevity observed by them. Bland, Merivale, and their associates (1806–1813), are often intolerably diffuse and feeble, from want, not of ability, but of taking pains. Archdeacon Wrangham's too rare versions are much more spirited; and John Sterling's translations of the inscriptions of Simonides deserve high praise. Professor Wilson (*Blackwood's Magazine*, 1833–1835) collected and commented upon the labours of these and other translators, with his accustomed critical insight and exuberant geniality, but damaged his essay by burdening it with the indifferent attempts of William Hay. In 1849 Dr Wellesley, principal of New Inn Hall, Oxford, published his *Anthologia Polyglotta*, a most valuable collection of the best translations and imitations in all languages, with the original text. In this appeared some admirable versions by Goldwin Smith and Dean Merivale, which, with the other English renderings extant at the time, will be found accompanying the literal prose translation of the *Public School Selections*, executed by the Rev. George Burges for Bohn's Classical Library (1854). This is a useful volume, but the editor's notes are worthless. In 1864 Major R. G. Macgregor published an almost complete translation of the Anthology, a work whose stupendous industry and fidelity almost redeem the general mediocrity of the execution. *Idylls and Epigrams*, by R. Garnett (1869, reprinted 1892 in the Cameo series), includes about 140 translations or imitations, with some original compositions in the same style. Recent translations (selections) are: J. W. Mackail, *Select Epigrams from the Greek Anthology* (with text, introduction, notes, and prose translation), 1890, revised 1906, a most charming volume; Graham R. Tomson (Mrs Marriott Watson), *Selections from the Greek Anthology* (1889); W. H. D. Rouse, *Echo of Greek Song* (1899); L. C. Perry, *From the Garden of Hellas* (New York, 1891); W. R. Paton, *Love Epigrams* (1898). An agreeable little volume on the Anthology, by Lord Neaves, is one of Collins's series of *Ancient Classics for Modern Readers*. The earl of Cromer, with all the cares of Egyptian administration upon him, found time to translate and publish an elegant volume of selections (1903). Two critical contributions to the subject should be noticed, the Rev. James Davies's essay on Epigrams in the *Quarterly Review* (vol. cxvii.), especially valuable for its lucid illustration of the distinction between Greek and Latin epigram; and the brilliant disquisition in J. A. Symonds's *Studies of the Greek Poets* (1873; 3rd ed., 1893).

Latin Anthology.—The *Latin Anthology* is the appellation bestowed upon a collection of fugitive Latin verse, from the age of Ennius to about A.D. 1000, formed by Peter Burmann the Younger. Nothing corresponding to the Greek anthology is known to have existed among the Romans, though professional epigrammatists like Martial published their volumes on their own account, and detached sayings were excerpted from authors like Ennius and Publius Syrus, while the *Priapeïa* were probably but one among many collections on special subjects. The first general collection of scattered pieces made by a modern scholar was Scaliger's *Catalecta veterum Poetarum* (1573), succeeded by the more ample one of Pithoeus, *Epigrammata et Poemata e Codicibus et Lapidibus collecta* (1590). Numerous additions, principally from inscriptions, continued to be made, and in 1759–1773 Burmann digested the whole into his *Anthologia veterum Latinorum Epigrammatum et Poematum*. This, occasionally reprinted, was the standard edition until 1869, when Alexander Riese commenced a new and more critical recension, from which many pieces improperly inserted by Burmann are rejected, and his classified arrangement is discarded for one according to the sources whence the poems have been derived. The first volume contains those found in MSS., in the order of the importance of these documents; those furnished by inscriptions following. The first volume (in two parts) appeared in 1869–1870, a second edition of the first part in 1894, and the second volume, *Carmina Epigraphica* (in two parts), in 1895–1897, edited by F. Bücheler. An *Anthologiae Latinae Supplementa*, in the same series, followed. Having been formed by scholars actuated by no aesthetic principles of selection, but solely intent on preserving everything they could find, the Latin anthology is much more heterogeneous than the Greek, and unspeakably inferior. The really beautiful poems of Petronius and Apuleius are more properly inserted in the collected editions of their writings, and more than half the remainder consists of the frigid conceits of pedantic professional exercises of grammarians of a very late period of the empire, relieved by an occasional gem, such as the apostrophe of the dying Hadrian to his spirit, or the epithalamium of Gallienus. The collection is also, for the most part, too recent in date, and too exclusively literary in character, to add much to our knowledge of classical antiquity. The epitaphs are interesting, but the genuineness of many of them is very questionable. (R. G.)

ANTHON, CHARLES (1797–1867), American classical scholar, was born in New York city on the 19th of November 1797. After graduating with honours at Columbia College in 1815, he began the study of law, and in 1819 was admitted to the bar, but never practised. In 1820 he was appointed assistant professor of Greek and Latin in his old college, full professor ten years later, and at the same time headmaster of the grammar school attached to the college, which post he held until 1864. He died at New York on the 29th of July 1867. He produced for use in colleges and schools a large number of classical works, which enjoyed great popularity, although his editions of classical authors were by no means in favour with schoolmasters, owing to the large amount of assistance, especially translations, contained in the notes.

ANTHONY, SAINT, the first Christian monk, was born in Egypt about 250. At the age of twenty he began to practise an ascetical life in the neighbourhood of his native place, and after fifteen years of this life he withdrew into solitude to a mountain by the Nile, called Pispir, now Der el Memun, opposite Arsinoë in the Fayum. Here he lived strictly enclosed in an old fort for twenty years. At last in the early years of the 4th century he emerged from his retreat and set himself to organize the monastic life of the crowds of monks who had followed him and taken up their abode in the caves around him. After a time, again in pursuit of more complete solitude, he withdrew to the mountain by the Red Sea, where now stands the monastery that bears his name (Der Mar Antonios). Here he died about the middle of the 4th century. His *Life* states that on two occasions he went to Alexandria, to strengthen the Christians in the Diocletian persecution and to preach against Arianism. Anthony is recognized as the first Christian monk and the first organizer and father of Christian monachism (see MONASTICISM). Certain letters and sermons are attributed to him, but their authenticity is more than doubtful. The monastic rule which bears his name was not written by him, but was compiled out of these writings and out of discourses and utterances put into his mouth in the *Life* and the *Apophthegmata Patrum.* According to this rule live a number of Coptic Syrian and Armenian monks to this day. The chief source of information about St Anthony is the *Life*, attributed to St Athanasius. This attribution, as also the historical character of the book, and even the very existence of St Anthony, were questioned and denied by the sceptical criticism of thirty years ago; but such doubts are no longer entertained by critical scholars.

The Greek *Vita* is among the works of St Athanasius; the almost contemporary Latin translation is among Rosweyd's *Vitae Patrum* (Migne, *Patrol. Lat.* lxxiii.); an English translation is in the Athanasius volume of the "Nicene and Post-Nicene Library." Accounts of St Anthony are given by Card. Newman, *Church of the Fathers* (Historical Sketches) and Alban Butler, *Lives of the Saints* (Jan. 17). Discussions of the historical and critical questions raised will be found in E. C. Butler's *Lausiac History of Palladius* (1898, 1904), Part I. pp. 197, 215-228; Part II. pp. ix.-xii. (E. C. B.)

ANTHONY OF PADUA, SAINT (1195–1231), the most celebrated of the followers of Saint Francis of Assisi, was born at Lisbon on the 15th of August 1195. In his fifteenth year he entered the Augustinian order, and subsequently joined the Franciscans in 1220. He wished to devote himself to missionary labours in North Africa, but the ship in which he sailed was cast by a storm on the coast of Sicily, whence he made his way to Italy. He taught theology at Bologna, Toulouse, Montpellier and Padua, and won a great reputation as a preacher throughout Italy. He was the leader of the rigorous party in the Franciscan order against the mitigations introduced by the general Elias. His death took place at the convent of Ara Coeli, near Padua, on the 13th of June 1231. He was canonized by Gregory IX. in the following year, and his festival is kept on the 13th of June. He is regarded as the patron saint of Padua and of Portugal, and is appealed to by devout clients for finding lost objects. The meagre accounts of his life which we possess have been supplemented by numerous popular legends, which represent him as a continuous worker of miracles, and describe his marvellous eloquence by pictures of fishes leaping out of the water to hear him. There are many confraternities established in his honour throughout Christendom, and the number of "pious" biographies devoted to him would fill many volumes.

The most trustworthy modern works are by A. Lepître, *St Antoine de Padoue* (Paris, 1902, in *Les Saints* series: good bibliography; Eng. trans. by Edith Guest, London, 1902), and by Léopold de Chérancé, *St Antoine de Padoue* (Paris, 1895; Eng. trans., London, 1896). His works, consisting of sermons and a mystical commentary on the Bible, were published in an appendix to those of St Francis, in the *Annales Minorum* of Luke Wadding (Antwerp, 1623), and are also reproduced by Horoy, *Medii aevi bibliotheca patristica* (1880, vi. pp. 555 et sqq.); see art. "Antonius von Padua" in Herzog-Hauck, *Realencyklopädie.*

ANTHONY, SUSAN BROWNELL (1820–1906), American reformer, was born at Adams, Massachusetts, on the 15th of February 1820, the daughter of Quakers. Soon after her birth, her family moved to the state of New York, and after 1845 she lived in Rochester. She received her early education in a school maintained by her father for his own and neighbours' children, and from the time she was seventeen until she was thirty-two she taught in various schools. In the decade preceding the outbreak of the Civil War she took a prominent part in the anti-slavery and temperance movements in New York, organizing in 1852 the first woman's state temperance society in America, and in 1856 becoming the agent for New York state of the American Anti-slavery Society. After 1854 she devoted herself almost exclusively to the agitation for woman's rights, and became recognized as one of the ablest and most zealous advocates, both as a public speaker and as a writer, of the complete legal equality of the two sexes. From 1868 to 1870 she was the proprietor of a weekly paper, *The Revolution*, published in New York, edited by Mrs Elizabeth Cady Stanton, and having for its motto, "The true republic—men, their rights and nothing more; women, their rights and nothing less." She was vice-president-at-large of the National Woman's Suffrage Association from the date of its organization in 1869 until 1892, when she became president. For casting a vote in the presidential election of 1872, as, she asserted, the Fourteenth Amendment to the Federal Constitution entitled her to do, she was arrested and fined $100, but she never paid the fine. In collaboration with Mrs Elizabeth Cady Stanton, Mrs Matilda Joslyn Gage, and Mrs Ida Husted Harper, she published *The History of Woman Suffrage* (4 vols., New York, 1884–1887). She died at Rochester, New York, on the 13th of March 1906.

See Mrs Ida Husted Harper's *Life and Work of Susan B. Anthony* (3 vols., Indianapolis, 1898–1908).

ANTHOZOA (*i.e.* "flower-animals"), the zoological name for a class of marine polyps forming "coral" (*q.v.*). Although corals have been familiar objects since the days of antiquity, and the variety known as the precious red coral has been for a long time an article of commerce in the Mediterranean, it was only in the 18th century that their true nature and structure came to be understood. By the ancients and the earlier naturalists of the Christian era they were regarded either as petrifactions or as plants, and many supposed that they occupied a position midway between minerals and plants. The discovery of the animal nature of red coral is due to J. A. de Peyssonel, a native of Marseilles, who obtained living specimens from the coral fishers on the coast of Barbary and kept them alive in aquaria. He was thus able to see that the so-called "flowers of coral" were in fact nothing else than minute polyps resembling sea-anemones. His discovery, made in 1727, was rejected by the Academy of Sciences of France, but eventually found acceptance at the hands of the Royal Society of London, and was published by that body in 1751. The structure and classification of polyps, however, were at that time very imperfectly understood, and it was fully a century before the true anatomical characters and systematic position of corals were placed on a secure basis.

The hard calcareous substance to which the name coral is applied is the supporting skeleton of certain members of the *Anthozoa*, one of the classes of the phylum Coelentera. The most familiar Anthozoan is the common sea-anemone, *Actinia equina*, L., and it will serve, although it does not form a skeleton or *corallum*, as a good example of the structure of a typical Anthozoan polyp or zooid. The individual animal or zooid of *Actinia equina* has the form of a column fixed by one extremity, called the *base*, to a rock or other object, and bearing at the opposite extremity a crown of *tentacles*. The tentacles surround an area known as the *peristome*, in the middle of which there is an elongated mouth-opening surrounded by tumid lips. The mouth does not open directly into the general cavity of the body, as is the case in a hydrozoan polyp, but into a short tube called the *stomodaeum*, which in its turn opens below into the general body-cavity or *coelenteron*. In Actinia and its allies, and most generally, though not invariably, in Anthozoa, the stomodaeum is not circular, but is compressed from side to side so as to be oval or slit-like in transverse section. At each end of the oval there is a groove lined by specially long vibratile cilia. These grooves are known as the *sulcus* and *sulculus*, and will be more particularly described hereafter. The elongation of the mouth and stomodaeum confer a bilateral symmetry on the body of the zooid, which is extended to other organs of the body. In Actinia, as in all Anthozoan zooids, the coelenteron is not a simple cavity, as in a Hydroid, but is divided by a number of radial folds or curtains of soft tissue into a corresponding number of radial chambers. These radial folds are known as *mesenteries*, and their position and relations may be understood by reference to figs. 1 and 2. Each mesentery is attached by its upper margin to the peristome, by its outer margin to the body-wall, and by its lower margin to the basal disk. A certain number of mesenteries, known as complete mesenteries, are attached by the upper parts of their internal margins to the stomodaeum, but below this level their edges hang in the coelenteron. Other mesenteries, called incomplete, are not attached to the stomodaeum, and their internal margins are free from the peristome to the basal disk. The lower part of the free edge of every mesentery, whether complete or incomplete, is thrown into numerous puckers or folds, and is furnished with a glandular thickening known as a *mesenterial filament.* The reproductive organs or gonads are borne on the mesenteries, the germinal cells being derived from the inner layer or endoderm.

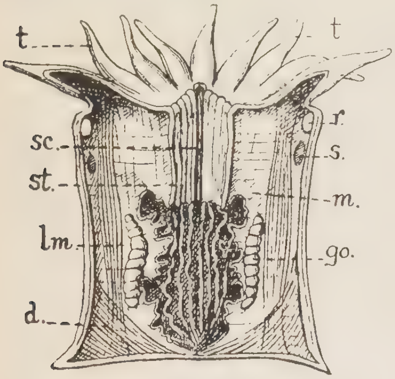


FIG. 1.—Diagrammatic longitudinal section of an Anthozoan zooid.

m, Mesentery.
lm, Longitudinal muscle.
t, Tentacles.
st, Stomodaeum.
d, Diagonal muscle.
sc, Sulcus.
r, Rotteken's muscle.
go, Gonads.
s, Stoma.

In common with all Coelenterate animals, the walls of the columnar body and also the tentacles and peristome of Actinia are composed of three layers of tissue. The external layer, or *ectoderm*, is made up of cells, and contains also muscular and nervous elements. The preponderating elements of the ectodermic layer are elongated columnar cells, each containing a nucleus, and bearing cilia at their free extremities. Packed in among these are *gland cells*, *sense cells*, and *cnidoblasts*. The last-named are specially numerous on the tentacles and on some other regions of the body, and produce the well-known "thread cells," or *nematocysts*, so characteristic of the Coelentera. The inner layer or endoderm is also a cellular layer, and is chiefly made up of columnar cells, each bearing a cilium at its free extremity and terminating internally in a long muscular fibre. Such cells, made up of epithelial and muscular components, are known as epithelio-muscular or myo-epithelial cells. In Actinians the epithelio-muscular cells of the endoderm are crowded with yellow spherical bodies, which are unicellular plants or Algae, living symbiotically in the tissues of the zooid. The endoderm contains in addition gland cells and nervous elements. The middle layer or mesogloea is not originally a cellular layer, but a gelatinoid structureless substance, secreted by the two cellular layers. In the course of development, however, cells from the ectoderm and endoderm may migrate into it. In *Actinia equina* the mesogloea consists of fine fibres imbedded in a homogeneous matrix, and between the fibres are minute branched or spindle-shaped cells. For further details of the structure of Actinians, the reader should consult the work of O. and R. Hertwig.

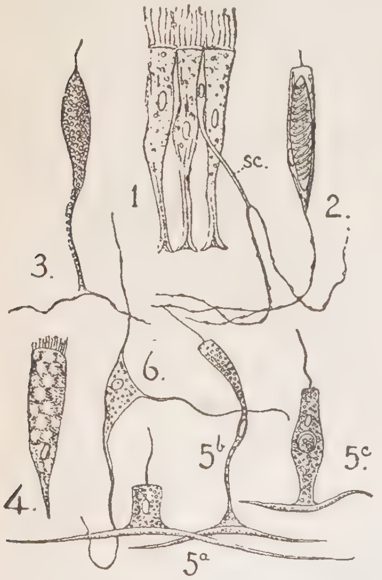


FIG. 2.—1, Portion of epithelium from the tentacle of an Actinian, showing three supporting cells and one sense cell (*sc*); 2, a cnidoblast with enclosed nematocyst from the same specimen; 3 and 4, two forms of gland cell from the stomodaeum; 5*a*, 5*b*, epithelio-muscular cells from the tentacle in different states of contraction; 5*c*, an epithelio-muscular cell from the endoderm, containing a symbiotic zooxanthella; 6, a ganglion cell from the ectoderm of the peristome. (After O. and R. Hertwig.)

The Anthozoa are divisible into two sub-classes, sharply marked off from one another by definite anatomical characters. These are the ALCYONARIA and the ZOANTHARIA. To the first-named belong the precious red coral and its allies, the sea-fans or Gorgoniae; to the second belong the white or Madreporarian corals.

Alcyonaria.—In this sub-class the zooid (fig. 3) has very constant anatomical characters, differing in some important respects from the Actinian zooid, which has been taken as a type. There is only one ciliated groove, the sulcus, in the stomodaeum. There are always eight tentacles, which are hollow and fringed on their sides, with hollow projections or pinnae; and always eight mesenteries, all of which are complete, *i.e.* inserted on the stomodaeum. The mesenteries are provided with well-developed longitudinal retractor muscles, supported on longitudinal folds or plaits of the mesogloea, so that in cross-section they have a branched appearance. These *muscle-banners*, as they are called, have a highly characteristic arrangement; they are all situated on those faces of the mesenteries which look towards the sulcus (fig. 4). Each mesentery has a filament; but two of them, namely, the pair farthest from the sulcus, are longer than the rest, and have a different form of filament. It has been shown that these asulcar filaments are derived from the ectoderm, the remainder from the endoderm. The only exceptions to this structure are found in the arrested or modified zooids, which occur in many of the colonial Alcyonaria. In these the tentacles are stunted or suppressed and the mesenteries are ill-developed, but the sulcus is unusually large and has long cilia. Such modified zooids are called siphonozooids, their function being to drive currents of fluid through the canal-systems of the colonies to which they belong. With very few exceptions a calcareous skeleton is present in all Alcyonaria; it usually consists of spicules of carbonate of lime, each spicule being formed within an ectodermic cell (fig. 3, B). Most commonly the spicule-forming cells pass out of the ectoderm and are imbedded in the mesogloea, where they may remain separate from one another or may be fused together to form a strong mass. In addition to the spicular skeleton an organic horny skeleton is frequently present, either in the form of a horny external investment (*Cornularia*), or an internal axis (*Gorgonia*), or it may form a matrix in which spicules are imbedded (*Keroeides*, *Melitodes*).

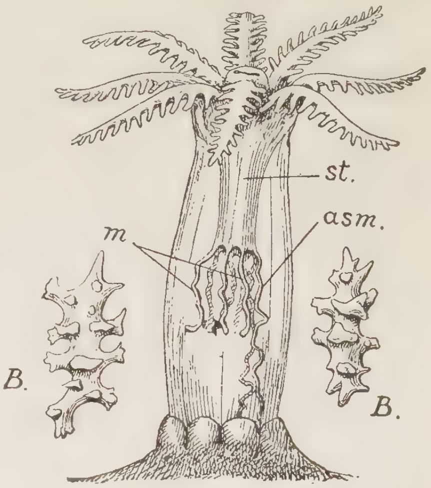


FIG. 3.—An expanded Alcyonarian zooid, showing the mouth surrounded by eight pinnate tentacles. *st*, Stomodaeum in the centre of the transparent body; *m*, mesenteries; *asm*, asulcar mesenteries; B, spicules, enlarged.

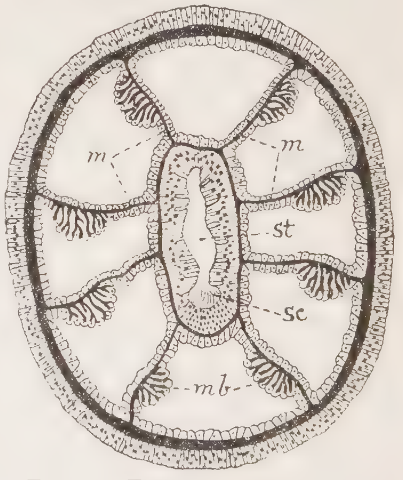


FIG. 4.—Transverse section of an Alcyonarian zooid. *mm*, Mesenteries; *mb*, muscle banners; *sc*, sulcus; *st*, stomodaeum.

Nearly all the Alcyonaria are colonial. Four solitary species have been described, viz. *Haimea funebris* and *H. hyalina*, *Hartea elegans*, and *Monoxenia Darwinii*; but it is doubtful whether these are not the young forms of colonies. For the present the solitary forms may be placed in a grade, *Protalcyonacea*; and the colonial forms may be grouped in another grade, *Synalcyonacea*. Every Alcyonarian colony is developed by budding from a single parent zooid. The buds are not direct outgrowths of the body-wall, but are formed on the courses of hollow outgrowths of the base or body-wall, called *solenia*. These form a more or less complicated canal system, lined by endoderm, and communicating with the cavities of the zooids. The most simple form of budding is found in the genus *Cornularia*, in which the mother zooid gives off from its base one or more simple radiciform outgrowths. Each outgrowth contains a single tube or solenium, and at a longer or shorter distance from the mother zooid a daughter zooid is formed as a bud. This gives off new outgrowths, and these, branching and anastomosing with one another, may form a network, adhering to stones, corals, or other objects, from which zooids arise at intervals. In *Clavularia* and its allies each outgrowth contains several solenia, and the outgrowths may take the form of flat expansions, composed of a number of solenial tubes felted together to form a lamellar surface of attachment. Such outgrowths are called *stolons*, and a stolon may be simple, *i.e.* contain only one solenium, as in *Cornularia*, or may be complex and built up of many solenia, as in *Clavularia*. Further complications arise when the lower walls of the mother zooid become thickened and interpenetrated with solenia, from which buds are developed, so that lobose, tufted, or branched colonies are formed. The chief orders of the Synalcyonacea are founded upon the different architectural features of colonies produced by different modes of budding. We recognize six orders — the STOLONIFERA, ALCYONACEA, PSEUDAXONIA, AXIFERA, STELECHOTOKEA, and COENOTHECALIA.

In the order STOLONIFERA the zooids spring at intervals from branching or lamellar stolons, and are usually free from one another, except at their bases, but in some cases horizontal solenia arising at various heights from the body-wall may place the more distal portions of the zooids in communication with one another. In the genus *Tubipora* these horizontal solenia unite to form a series of horizontal platforms (fig. 5). The order comprises the families *Cornulariidae*, *Syringoporidae*, *Tubiporidae*, and *Favositidae*. In the first-named the zooids are united only by their bases and the skeleton consists of loose spicules. In the *Tubiporidae* the spicules of the proximal part of the body-wall are fused together to form a firm tube, the corallite, into which the distal part of the zooid can be retracted. The corallites are connected at intervals by horizontal platforms containing solenia, and at the level of each platform the cavity of the corallite is divided by a transverse calcareous partition, either flat or cup-shaped, called a *tabula*. Formerly all corals in which tabulae are present were classed together as Tabulata, but Tubipora is an undoubted Alcyonarian with a lamellar stolon, and the structure of the fossil genus Syringopora, which has vertical corallites united by horizontal solenia, clearly shows its affinity to Tubipora. The Favositidae, a fossil family from the Silurian and Devonian, have a massive corallum composed of numerous polygonal corallites closely packed together. The cavities of adjacent corallites communicate by means of numerous perforations, which appear to represent solenia, and numerous transverse tabulae are also present. In *Favosites hemisphaerica* a number of radial spines, projecting into the cavity of the corallite, give it the appearance of a madreporarian coral.

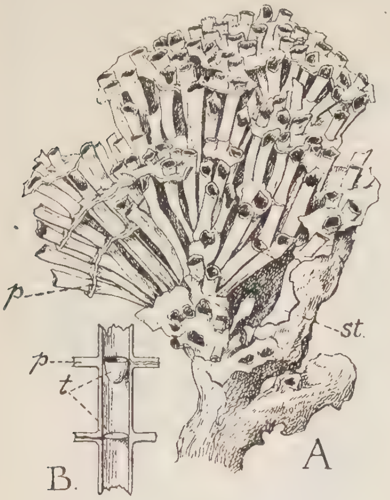


FIG. 5.

A, Skeleton of a young colony of *Tubipora purpurea*. *st*, Stolon; *p*, platform.

B, Diagrammatic longitudinal section of a corallite, showing two platforms, *p*, and simple and cup-shaped tabulae, *t*. (After S. J. Hickson.)

In the order ALCYONACEA the colony consists of bunches of elongate cylindrical zooids, whose proximal portions are united by solenia and compacted, by fusion of their own walls and those of the solenia, into a fleshy mass called the coenenchyma. Thus the coenenchyma forms a stem, sometimes branched, from the surface of which the free portions of the zooids project. The skeleton of the Alcyonacea consists of separate calcareous spicules, which are often, especially in the Nephthyidae, so abundant and so closely interlocked as to form a tolerably firm and hard armour. The order comprises the families *Xeniidae*, *Alcyonidae* and *Nephthyidae*. *Alcyonium digitatum*, a pink digitate form popularly known as "dead men's fingers," is common in 10-20 fathoms of water off the English coasts.

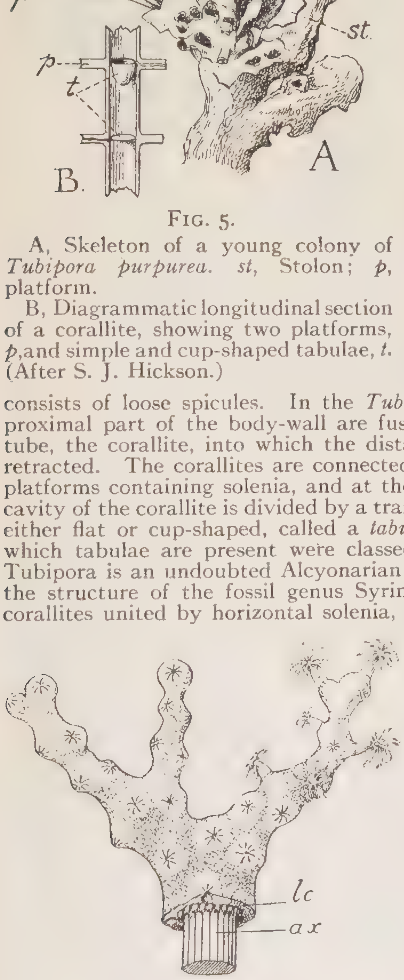


FIG. 6.—Portion of a colony of *Corallium rubrum*, showing expanded and contracted zooids. In the lower part of the figure the cortex has been cut away to show the *axis*, *ax*, and the longitudinal canals, *lc*, surrounding it.

In the order PSEUDAXONIA the colonies are upright and branched, consisting of a number of short zooids whose proximal ends are imbedded in a coenenchyma containing numerous ramifying solenia and spicules. The coenenchyma is further differentiated into a medullary portion and a cortex. The latter contains the proximal moieties of the zooids and numerous but separate spicules. The medullary portion is densely crowded with spicules of different shape from those in the cortex, and in some forms the spicules are cemented together to form a hard supporting axis. There are four families of Pseudaxonia — the *Briareidae*, *Sclerogorgidae*, *Melitodidae*, and *Corallidae*. In the first-named the medulla is penetrated by solenia and forms an indistinct axis; in the remainder the medulla is devoid of solenia, and in the *Melitodidae* and *Corallidae* it forms a dense axis, which in the *Melitodidae* consists of alternate calcareous and horny joints. The precious red coral of commerce, *Corallium rubrum* (fig. 6), a member of the family *Corallidae*, is found at depths varying from 15 to 120 fathoms in the Mediterranean Sea, chiefly on the African coast. It owes its commercial value to the beauty of its hard red calcareous axis which in life is covered by a cortex in which the proximal moieties of the zooids are imbedded. *Corallium rubrum* has been the subject of a beautifully-illustrated memoir by de Lacaze-Duthiers, which should be consulted for details of anatomy.

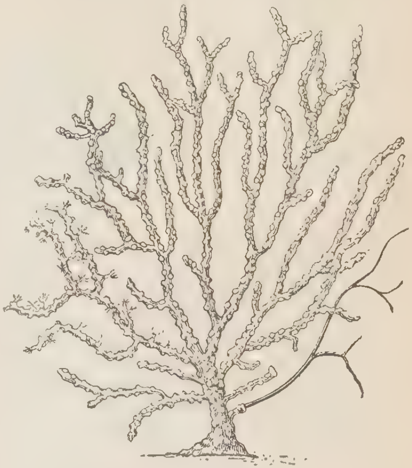


FIG. 7.—The sea-fan (*Gorgonia cavolinii*).

The AXIFERA comprise those corals that have a horny or calcified axis, which in position corresponds to the axis of the Pseudaxonia, but, unlike it, is never formed of fused spicules; the most familiar example is the pink sea-fan, *Gorgonia cavolinii*, which is found in abundance in 10-25 fathoms of water off the English coasts (fig. 7). In this order the axis is formed as an ingrowth of the ectoderm of the base of the mother zooid of the colony, the cavity of the ingrowth being filled by a horny substance secreted by the ectoderm. In *Gorgonia* the axis remains horny throughout life, but in many forms it is further strengthened by a deposit of calcareous matter. In the family *Isidinae* the axis consists of alternate segments of horny and calcareous substance, the latter being amorphous. The order contains six families—the *Dasygorgidae*, *Isidae*, *Primnoidae*, *Muriceidae*, *Plexauridae*, and *Gorgonidae*.

In the order STELECHOTOKEA the colony consists of a stem formed by a greatly-elongated mother zooid, and the daughter zooids are borne as lateral buds on the stem. In the section *Asiphonacea* the colonies are upright and branched, springing from membranous or ramifying stolons. They resemble and are closely allied to certain families of the Cornulariidae, differing from them only in mode of budding and in the disposition of the daughter zooids round a central, much-elongated mother zooid. The section contains two families, the *Telestidae* and the *Coelogorgidae*. The second section comprises the *Pennatulacea* or sea-pens, which are remarkable from the fact that the colony is not fixed by the base to a rock or other

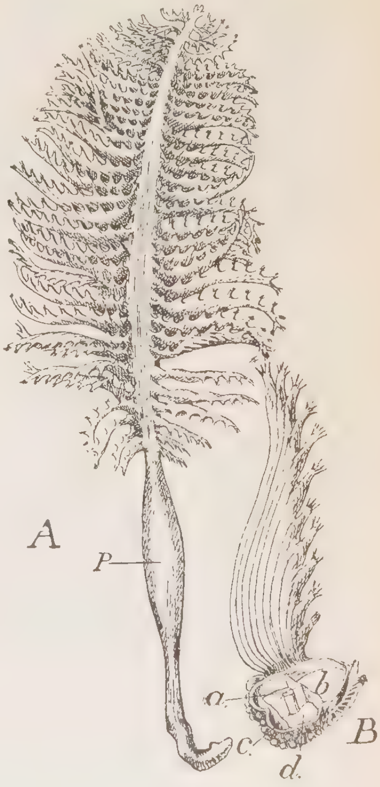


FIG. 8.

A, Colony of *Pennatula phosphorea* from the metarachidial aspect. *p*, The peduncle.

B, Section of the rachis bearing a single pinna. *a*, Axis; *b*, metarachidial; *c*, prorachidial; *d*, pararachidial stem canals.

object, but is imbedded in sand or mud by the proximal portion of the stem known as the peduncle. In the typical genus, Pennatula (fig. 8), the colony looks like a feather having a stem divisible into an upper moiety or rachis, bearing lateral central leaflets (pinnae), and a lower peduncle, which is sterile and imbedded in sand or mud. The stem represents a greatly enlarged and elongated mother zooid. It is divided longitudinally by a partition separating a so-called "ventral" or prorachidial canal from a so-called "dorsal" or metarachidial canal. A rod-like supporting axis of peculiar texture is developed in the longitudinal partition, and a longitudinal canal is hollowed out on either side of the axis in the substance of the longitudinal partition, so that there are four stem-canals in all. The prorachidial and metarachidial aspects of the rachis are sterile, but the sides or pararachides bear numerous daughter zooids of two kinds—(1) fully-formed autozooids, (2) small stunted siphonozooids. The pinnae are formed by the elongated autozooids, whose proximal portions are fused together to form a leaf-like expansion, from the upper edge of which the distal extremities of the zooids project. The siphonozooids are very numerous and lie between the bases of the pinnae on the pararachides; they extend also on the prorachidial and metarachidial surfaces. The calcareous skeleton of the Pennatulacea consists of scattered spicules, but in one species, *Protocaulon molle*, spicules are absent. Although of great interest the Pennatulacea do not form an enduring skeleton or "coral," and need not be considered in detail in this place.

The order COENOTHECALIA is represented by a single living species, *Heliopora coerulea*, which differs from all recent Alcyonaria in the fact that its skeleton is not composed of spicules, but is formed as a secretion from a layer of cells called calicoblasts, which originate from the ectoderm. The corallum of Heliopora is of a blue colour, and has the form of broad, upright, lobed, or digitate masses flattened from side to side. The surfaces are pitted all over with perforations of two kinds, viz. larger star-shaped cavities, called *calices*, in which the zooids are lodged, and very numerous smaller round or polygonal apertures, which in life contain as many short unbranched tubes, known as the *coenenchymal tubes* (fig. 9, A). The walls of the calices and coenenchymal tubes are formed of flat plates of calcite, which are so disposed that the walls of one tube enter into the composition of the walls of adjacent tubes, and the walls of the calices are formed by the walls of adjacent coenenchymal tubes. Thus the architecture of the Helioporid colony differs entirely from such forms as Tubipora or Favosites, in which each corallite has its own distinct and proper wall. The cavities both of the calices and coenenchymal tubes of Heliopora are closed below by horizontal partitions or *tabulae*, hence the genus was formerly included in the group Tabulata, and was supposed to belong to the madreporarian corals, both because of its lamellar skeleton, which resembles that of a Madrepore, and because each calicle has from twelve to fifteen radial partitions or septa projecting into its cavity. The structure of the zooid of Heliopora, however, is that of a typical Alcyonarian, and the septa have only a resemblance to, but no real homology with, the similarly named structures in madreporarian corals. *Heliopora coerulea* is found between tide-marks on the shore platforms of coral islands. The order was more abundantly represented in Palaeozoic times by the *Heliolitidae* from the Upper and Lower Silurian and the Devonian, and by the *Thecidae* from the Wenlock limestone. In *Heliolites porosus* the colonies had the form of spheroidal masses; the calices were furnished with twelve pseudosepta, and the coenenchymal tubes were more or less regularly hexagonal.

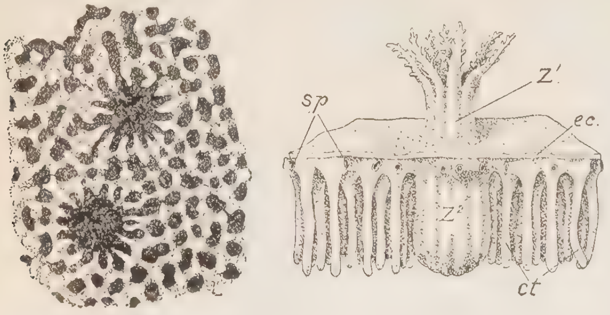


FIG. 9.

A, Portion of the surface of a colony of *Heliopora coerulea* magnified, showing two calices and the surrounding coenenchymal tubes.

B, Single zoold with the adjacent soft tissues as seen after removal of the skeleton by decalcification. Z^1, the distal, and Z^2, the proximal or intracalicular portion of the zooid; *ec*, ectoderm; *ct*, coenenchymal tubes; *sp*, superficial network of solenia.

Zoantharia.—In this sub-class the arrangement of the mesenteries is subject to a great deal of variation, but all the types hitherto observed may be referred to a common plan, illustrated by the living genus *Edwardsia* (fig. 10, A, B). This is a small solitary Zoantharian which lives embedded in sand. Its body is divisible into three portions, an upper *capitulum* bearing the mouth and tentacles, a median *scapus* covered by a friable cuticle, and a terminal *physa* which is rounded. Both capitulum and physa can be retracted within the scapus. There are from sixteen to thirty-two simple tentacles, but only eight mesenteries, all of which are complete. The stomodaeum is compressed laterally, and is furnished with two longitudinal grooves, a sulcus and a sulculus. The arrangement of the muscle-banners on the mesenteries is characteristic. On six of the mesenteries the muscle-banners have the same position as in the Alcyonaria, namely, on the sulcar faces; but in the two remaining mesenteries, namely, those which are attached on either side of the sulcus, the muscle-banners are on the opposite or sulcular faces. It is not known whether all the eight mesenteries of *Edwardsia* are developed simultaneously or not, but in the youngest form which has been studied all the eight mesenteries were present, but only two of them, namely the sulco-laterals, bore mesenterial filaments, and so it is presumed that they are the first pair to be developed. In the common sea-anemone, *Actinia equina* (which has already been quoted as a type of Anthozoan structure), the mesenteries are numerous and are arranged in cycles. The mesenteries of the first cycle are complete (*i.e.* are attached to the stomodaeum), are twelve in number, and arranged in couples, distinguishable by the position of the muscle-banners. In the four couples of mesenteries which are attached to the sides of the elongated stomodaeum the muscle-banners of each couple are turned towards one another, but in the sulcar and sulcular couples, known as the directive mesenteries, the muscle-banners are on the outer faces of the mesenteries, and so are turned away from one another (see fig. 10, C). The space enclosed between two mesenteries of the same couple is called an *entocoele*; the space enclosed between two mesenteries of adjacent couples is called an *exocoele*. The second cycle of mesenteries consists of six couples, each formed in an exocoele of the primary cycle, and in each couple the muscle-banners are *vis-à-vis* The third cycle comprises twelve couples, each formed in an exocoele between the primary and secondary couples, and so on, it being a general rule (subject, however, to exceptions) that new mesenterial couples are always formed in the exocoeles, and not in the entocoeles.

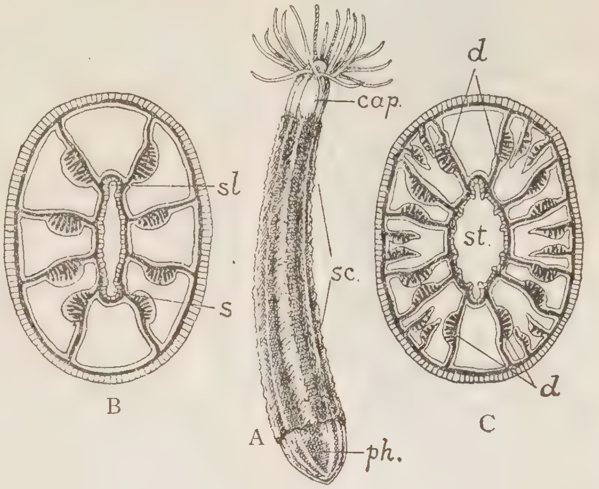


FIG. 10.

A, *Edwardsia claparedii* (after A. Andres). *Cap*, capitulum; *sc*, scapus; *ph*, physa.

B, Transverse section of the same, showing the arrangement of the mesenteries. *s*, Sulcus; *sl*, sulculus.

C, Transverse section of *Halcampa*. *d*, *d*, Directive mesenteries; *st*, stomodaeum.

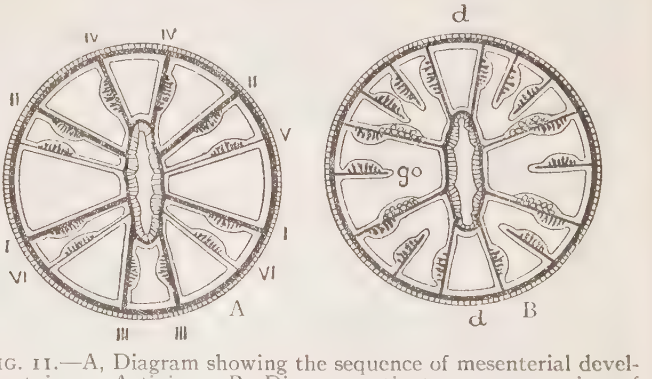


FIG. 11.—A, Diagram showing the sequence of mesenterial development in an Actinian. B, Diagrammatic transverse section of *Gonactinia prolifera*.

While the mesenterial couples belonging to the second and each successive cycle are formed simultaneously, those of the first cycle are formed in successive pairs, each member of a pair being placed on opposite sides of the stomodaeum. Hence the arrangement in six couples is a secondary and not a primary feature. In most Actinians the mesenteries appear in the following order:—At the time when the stomodaeum is formed, a single pair of mesenteries, marked I, I in the diagram (fig. 11, A), makes its appearance, dividing the coelenteric cavity into a smaller sulcar and a large sulcular chamber. The muscle-banners of this pair are placed on the sulcar faces of the mesenteries. Next, a pair of mesenteries, marked II, II in the diagram, is developed in the sulcular chamber, its muscle-banners facing the same way as those of I, I. The third pair is formed in the sulcar chamber, in close connexion with the sulcus, and in this case the muscle-banners are on the *sulcular* faces. The fourth pair, having its muscle-banners on the sulcar faces, is developed at the opposite extremity of the stomodaeum in close connexion with the sulculus. There are now eight mesenteries present, having exactly the same arrangement as in Edwardsia. A pause in the development follows, during which no new mesenteries are formed, and then the six-rayed symmetry characteristic of a normal Actinian zooid is completed by the formation of the mesenteries V, V in the lateral chambers, and VI, VI in the sulcolateral chambers, their muscle-banners being so disposed that they form couples respectively with II, II and I, I. In *Actinia equina* the Edwardsia stage is arrived at somewhat differently. The mesenteries second in order of formation form the sulcular directives, those fourth in order of formation form with the fifth the sulculo-lateral couples of the adult.

As far as the anatomy of the zooid is concerned, the majority of the stony or madreporarian corals agree exactly with the soft-bodied Actinians, such as *Actinia equina*, both in the number and arrangement of the adult mesenteries and in the order of development of the first cycle. The few exceptions will be dealt with later, but it may be stated here that even in these the first cycle of six couples of mesenteries is always formed, and in all the cases which have been examined the course of development described above is followed. There are, however, several groups of Zoantharia in which the mesenterial arrangement of the adult differs widely from that just described. But it is possible to refer all these cases with more or less certainty to the Edwardsian type.

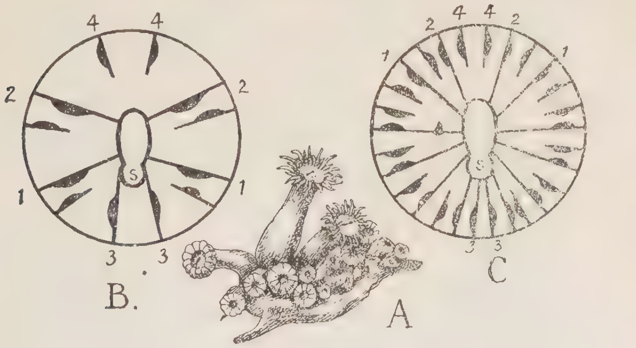


FIG. 12.

A, Zoanthid colony, showing the expanded zooids.

B, Diagram showing the arrangement of mesenteries in a young Zoanthid.

C, Diagram showing the arrangement of mesenteries in an adult Zoanthid. 1, 2, 3, 4, Edwardsian mesenteries.

The order ZOANTHIDEA comprises a number of soft-bodied Zoantharians generally encrusted with sand. Externally they resemble ordinary sea-anemones, but there is only one ciliated groove, the sulcus, in the stomodaeum, and the mesenteries are arranged on a peculiar pattern. The first twelve mesenteries are disposed in couples, and do not differ from those of Actinia except in size. The mesenterial pairs I, II and III are attached to the stomodaeum, and are called macromesenteries (fig. 12, B), but IV, V and VI are much shorter, and are called micromesenteries. The subsequent development is peculiar to the group. New mesenteries are formed only in the sulco-lateral exocoeles. They are formed in couples, each couple consisting of a macromesentery and a micromesentery, disposed so that the former is nearest to the sulcar directives. The derivation of the Zoanthidea from an Edwardsia form is sufficiently obvious.

The order CERIANTHIDEA comprises a few soft-bodied Zoantharians with rounded aboral extremities pierced by pores. They have two circlets of tentacles, a labial and a marginal, and there is only one ciliated groove in the stomodaeum, which appears to be the sulculus. The mesenteries are numerous, and the longitudinal muscles, though distinguishable, are so feebly developed that there are no muscle-banners. The larval forms of the type genus *Cerianthus* float freely in the sea, and were once considered to belong to a separate genus, *Arachnactis*. In this larva four pairs of mesenteries having the typical Edwardsian arrangement are developed, but the fifth and sixth pairs, instead of forming couples with the first and second, arise in the sulcar chamber, the fifth pair inside the fourth, and the sixth pair inside the fifth. New mesenteries are continually added in the sulcar chamber, the seventh pair within the sixth, the eighth pair within the seventh, and so on (fig. 13). In the Cerianthidea, as in the Zoanthidea, much as the adult arrangement of mesenteries differs from that of Actinia, the derivation from an Edwardsia stock is obvious.

The order ANTIPATHIDEA is a well-defined group whose affinities are more obscure. The type form, *Antipathes dichotoma* (fig. 14), forms arborescent colonies consisting of numerous zooids arranged in a single series along one surface of a branched horny axis. Each zooid has six tentacles; the stomodaeum is elongate, but the sulcus and sulculus are very feebly represented. There are ten mesenteries in which the musculature is so little developed as to be almost indistinguishable. The sulcar and sulcular pairs of mesenteries are short, the sulco-lateral and sulculo-lateral pairs are a little longer, but the two transverse are very large and are the only mesenteries which bear gonads. As the development of the Antipathidea is unknown, it is impossible to say what is the sequence of the mesenterial development, but in *Leiopathes glaberrima*, a genus with twelve mesenteries, there are distinct indications of an Edwardsia stage.

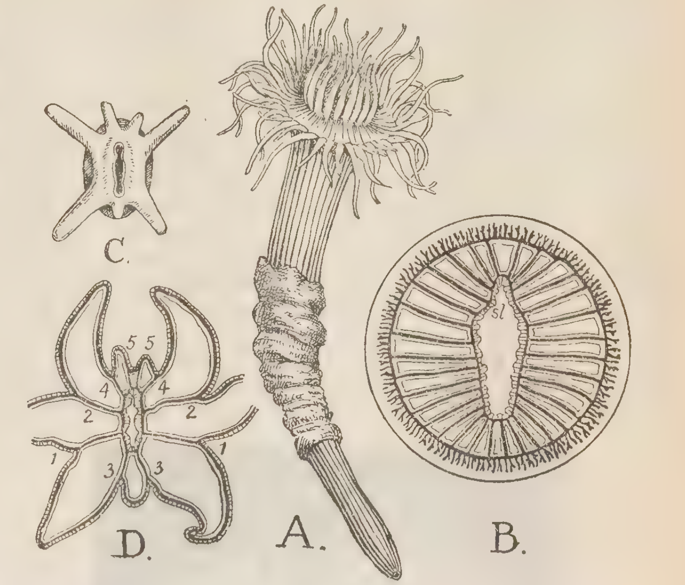


FIG. 13.

A, *Cerianthus solitarius* (after A. Andres).

B, Transverse section of the stomodaeum, showing the sulculus, *sl*, and the arrangement of the mesenteries.

C, Oral aspect of *Arachnactis brachiolata*, the larva of *Cerianthus*, with seven tentacles.

D, Transverse section of an older larva. The numerals indicate the order of development of the mesenteries.

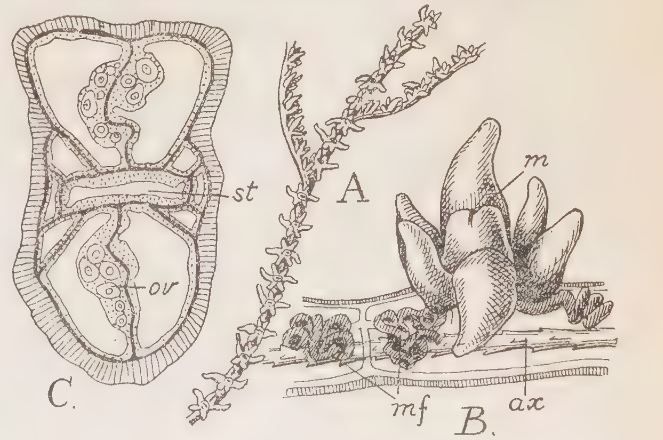


FIG. 14.

A, Portion of a colony of *Antipathes dichotoma*.

B, Single zooid and axis of the same magnified. *m*, Mouth; *mf*, mesenterial filament; *ax*, axis.

C, Transverse section through the oral cone of *Antipathella minor* *st*, Stomodaeum; *ov*, ovary.

There are, in addition to these groups, several genera of Actinians whose mesenterial arrangement differs from the normal type. Of these perhaps the most interesting is *Gonactinia prolifera* (fig. 11, B), with eight macromesenteries arranged on the Edwardsian plan. Two pairs of micromesenteries form couples with the first and second Edwardsian pairs, and in addition there is a couple of micromesenteries in each of the sulculo-lateral exocoeles. Only the first and second pairs of Edwardsian macromesenteries are fertile, *i.e.* bear gonads.

The remaining forms, the ACTINIIDEA, are divisible into the Malacactiniae, or soft-bodied sea-anemones, which have already been described sufficiently in the course of this article, and the Scleractiniae (=Madreporaria) or true corals.

All recent corals, as has already been said, conform so closely to the anatomy of normal Actinians that they cannot be classified apart from them, except that they are distinguished by the possession of a calcareous skeleton. This skeleton is largely composed of a number of radiating plates or *septa*, and it differs both in origin and structure from the calcareous skeleton of all Alcyonaria except Heliopora. It is formed, not from fused spicules, but as a secretion of a special layer of cells derived from the basal ectoderm, and known as *calicoblasts*. The skeleton or corallum of a typical solitary coral—the common Devonshire cup-coral *Caryophyllia smithii* (fig. 15) is a good example—exhibits the followings parts:—(1) The *basal plate*, between the zooid and the surface of attachment. (2) The *septa*, radial plates of calcite reaching from the periphery nearly or quite to the centre of the coral-cup or calicle. (3) The *theca* or wall, which in many corals is not an independent structure, but is formed by the conjoined thickened peripheral ends of the septa. (4) The *columella*, a structure which occupies the centre of the calicle, and may arise from the basal plate, when it is called essential, or may be formed by union of trabecular offsets of the septa, when it is called unessential. (5) The *costae*, longitudinal ribs or rows of spines on the outer surface of the theca. True costae always correspond to the septa, and are in fact the peripheral edges of the latter. (6) *Epitheca*, an offset of the basal plate which surrounds the base of the theca in a ring-like manner, and in some corals may take the place of a true theca. (7) *Pali*, spinous or blade-like upgrowths from the bottom of the calicle, which project between the inner edges of certain septa and the columella. In addition to these parts the following structures may exist in corals:—*Dissepiments* are oblique calcareous partitions, stretching from septum to septum, and closing the interseptal chambers below. The whole system of dissepiments in any given calicle is often called *endotheca*. *Synapticulae* are calcareous bars uniting adjacent septa. *Tabulae* are stout horizontal partitions traversing the centre of the calicle and dividing it into as many superimposed chambers. The septa in recent corals always bear a definite relation to the mesenteries, being found either in every entocoele or in every entocoele and exocoele. Hence in corals in which there is only a single cycle of mesenteries the septa are correspondingly few in number; where several cycles of mesenteries are present the septa are correspondingly numerous. In some cases—*e.g.* in some species of *Madrepora*—only two septa are fully developed, the remainder being very feebly represented.

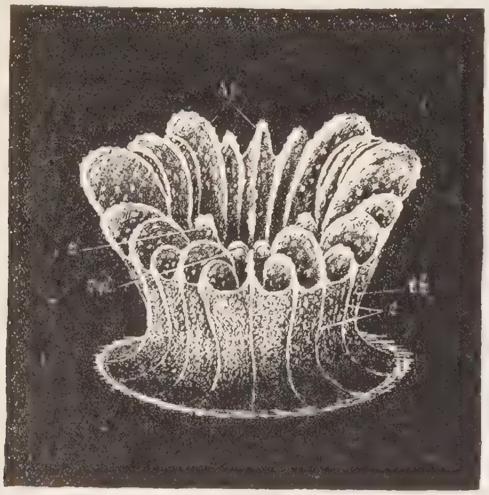


FIG. 15.—Corallum of *Caryophyllia*; semi-diagrammatic. *th*, Theca; *c*, costae; *sp*, septa; *p*, palus; *col*, columella.

Though the corallum appears to live within the zooid, it is morphologically external to it, as is best shown by its developmental history. The larvae of corals are free swimming ciliated forms known as planulae, and they do not acquire a corallum until they fix themselves. A ring-shaped plate of calcite, secreted by the ectoderm, is then formed, lying between the embryo and the surface of attachment. As the mesenteries are formed, the endoderm of the basal disk lying above the basal plate is raised up in the form of radiating folds. There may be six of these folds, one in each entocoele of the primary cycle of mesenteries; or there may be twelve, one in each exocoele and entocoele. The ectoderm beneath each fold becomes detached from the surface of the basal plate, and both it and the mesogloea are folded conformably with the endoderm. The cells forming the limbs of the ectodermic folds secrete nodules of calcite, and these, fusing together, give rise to six (or twelve) vertical radial plates or septa. As growth proceeds new septa are formed simultaneously with the new couples of secondary mesenteries. In some corals, in which all the septa are entocoelic, each new system is embraced by a mesenteric couple; in others, in which the septa are both entocoelic and exocoelic, three septa are formed in every chamber between two primary mesenterial couples, one in the entocoele of the newly formed mesenterial couple of the secondary cycle, and one in each exocoele between a primary and a secondary couple. These latter are in turn embraced by the couples of the tertiary cycle of mesenteries, and new septa are formed in the exocoeles on either side of them, and so forth.

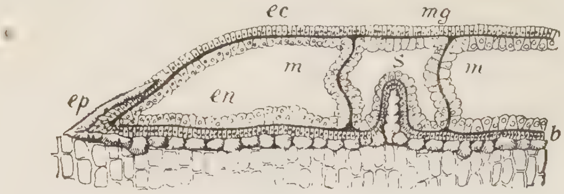


FIG. 16.—Tangential section of a larva of *Astroides calicularis* which has fixed itself on a piece of cork. *ec*, Ectoderm; *en*, endoderm; *mg*, mesogloea; *m*, *m*, mesenteries; *s*, septum; *b*, basal plate formed of ellipsoids of carbonate of lime secreted by the basal ectoderm; *ep*, epitheca. (After von Koch.)

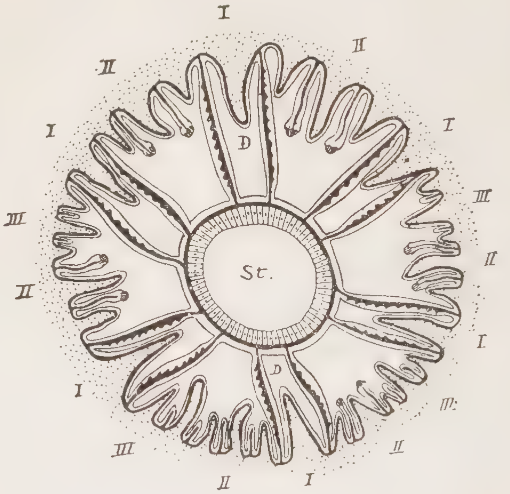


FIG. 17.—Transverse section through a zooid of *Cladocora*. The corallum shaded with dots, the mesogloea represented by a thick line. Thirty-two septa are present, six in the entocoeles of the primary cycle of mesenteries, I; six in the entocoeles of the secondary cycle of mesenteries, II; four in the entocoeles of the tertiary cycle of mesenteries, III, only four pairs of the latter being developed; and sixteen in the entocoeles between the mesenterial pairs. *D*, *D*, Directive mesenteries; *st*, stomodaeum. (After Duerden.)

It is evident from an inspection of figs. 16 and 17 that every septum is covered by a fold of endoderm, mesogloea, and ectoderm, and is in fact pushed into the cavity of the zooid from without. The zooid then is, as it were, moulded upon the corallum. When fully extended, the upper part of the zooid projects for some distance out of the calicle, and its wall is reflected for some distance over the lip of the latter, forming a fold of soft tissue extending to a greater or less distance over the theca, and containing in most cases a cavity continuous over the lip of the calicle with the coelenteron. This fold of tissue is known as the *edge-zone.* In some corals the septa are solid imperforate plates of calcite, and their peripheral ends are either firmly welded together, or are united by interstitial pieces so as to form imperforate theca. In others the peripheral ends of the septa are united only by bars or trabeculae, so that the theca is perforate, and in many such perforate corals the septa themselves are pierced by numerous perforations. In the former, which have been called aporose corals, the only communication between the cavity of the edge-zone and the general cavity of the zooid is by way of the lip of the calicle; in the latter, or perforate corals, the theca is permeated by numerous branching and anastomosing canals lined by endoderm, which place the cavity of the edge-zone in communication with the general cavity of the zooid.

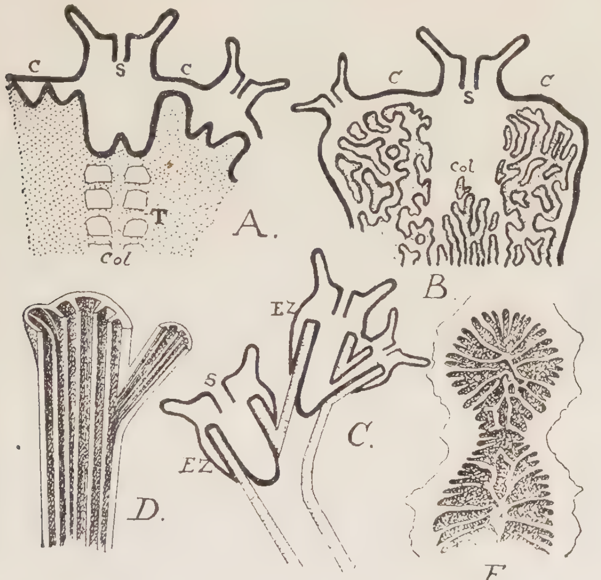


FIG. 18.

A, Schematic longitudinal section through a zooid and bud of *Stylophora digitata.* In A, B, and C the thick black lines represent the soft tissues; the corallum is dotted. *s*, Stomodaeum; *c*, *c*, coenosarc; *col*, columella; *T*, tabulae.

B, Similar section through a single zooid and bud of *Astroides calicularis.*

C, Similar section through three corallites of *Lophohelia prolifera.* *ez*, Edge-zone.

D, Diagram illustrating the process of budding by unequal division.

E, Section through a dividing calicle of *Mussa*, showing the union of two septa in the plane of division, and the origin of new septa at right angles to them.

(C original; the rest after von Koch.)

A large number of corals, both aporose and perforate, are colonial. The colonies are produced by either budding or division. In the former case the young daughter zooid, with its corallum, arises wholly outside the cavity of the parent zooid, and the component parts of the young corallum, septa, theca, columella, &c., are formed anew in every individual produced. In division a vertical constriction divides a zooid into two equal or unequal parts, and the several parts of the two corals thus produced are severally derived from the corresponding parts of the dividing corallum. In colonial corals a bud is always formed from the edge-zone, and this bud develops into a new zooid with its corallum. The cavity of the bud in an aporose coral (fig. 18, A, C) does not communicate directly with that of the parent form, but through the medium of the edge-zone. As growth proceeds, and parent and bud become separated farther from one another, the edge-zone forms a sheet of soft tissue, bridging over the space between the two, and resting upon projecting spines of the corallum. This sheet of tissue is called the *coenosarc.* Its lower surface is clothed with a layer of calicoblasts which continue to secrete carbonate of lime, giving rise to a secondary deposit which more or less fills up the spaces between the individual coralla, and is distinguished as *coenenchyme.* This coenenchyme may be scanty, or may be so abundant that the individual corallites produced by budding seem to be immersed in it. Budding takes place in an analogous manner in perforate corals (fig. 18, B), but the presence of the canal system in the perforate theca leads to a modification of the process. Buds arise from the edge-zone which already communicate with the cavity of the zooid by the canals. As the buds develop the canal system becomes much extended, and calcareous tissue is deposited between the network of canals, the confluent edge-zones of mother zooid and bud forming a coenosarc. As the process continues a number of calicles are formed, imbedded in a spongy tissue in which the canals ramify, and it is impossible to say where the theca of one corallite ends and that of another begins. In the formation of colonies by division a constriction at right angles to the long axis of the mouth involves first the mouth, then the peristome, and finally the calyx itself, so that the previously single corallite becomes divided into two (fig. 18, E). After division the corallites continue to grow upwards, and their zooids may remain united by a bridge of soft tissue or coenosarc. But in some cases, as they grow farther apart, this continuity is broken, each corallite has its own edge-zone, and internal continuity is also broken by the formation of dissepiments within each calicle, all organic connexion between the two zooids being eventually lost. Massive meandrine corals are produced by continual repetition of a process of incomplete division, involving the mouth and to some extent the peristome: the calyx, however, does not divide, but elongates to form a characteristic meandrine channel containing several zooid mouths.

Corals have been divided into *Aporosa* and *Perforata*, according as the theca and septa are compact and solid, or are perforated by pores containing canals lined by endoderm. The division is in many respects convenient for descriptive purposes, but recent researches show that it does not accurately represent the relationships of the different families. Various attempts have been made to classify corals according to the arrangement of the septa, the characters of the theca, the microscopic structure of the corallum, and the anatomy of the soft parts. The last-named method has proved little more than that there is a remarkable similarity between the zooids of all recent corals, the differences which have been brought to light being for the most part secondary and valueless for classificatory purposes. On the other hand, the study of the anatomy and development of the zooids has thrown much light upon the manner in which the corallum is formed, and it is now possible to infer the structure of the soft parts from a microscopical examination of the septa, theca, &c., with the result that unexpected relationships have been shown to exist between corals previously supposed to stand far apart. This has been particularly the case with the group of Palaeozoic corals formerly classed together as *Rugosa.* In many of these so-called rugose forms the septa have a characteristic arrangement, differing from that of recent corals chiefly in the fact that they show a tetrameral instead of a hexameral symmetry. Thus in the family *Stauridae* there are four chief septa whose inner ends unite in the middle of the calicle to form a false columella, and in the *Zaphrentidae* there are many instances of an arrangement, such as that depicted in fig. 19, which represents the septal arrangement of *Streptelasma corniculum* from the lower Silurian. In this coral the calicle is divided into quadrants by four principal septa, the *main septum*, *counter septum*, and two *alar septa.* The remaining septa are so disposed that in the quadrants abutting on the chief septum they converge towards that septum, whilst in the other quadrants they converge towards the alar septa. The secondary septa show a regular gradation in size, and, assuming that the smallest were the most recently formed, it will be noticed that in the chief quadrants the youngest septa lie nearest to the main septum;

in the other quadrants the youngest septa lie nearest to the alar septa. This arrangement, however, is by no means characteristic even of the Zaphrentidae, and in the family *Cyathophyllidae* most of the genera exhibit a radial symmetry in which no trace of the bilateral arrangement described above is recognizable, and indeed in the genus *Cyathophyllum* itself a radial arrangement is the rule. The connexion between the Cyathophyllidae and modern Astraeidae is shown by *Moseleya latistellata*, a living reef-building coral from Torres Strait. The general structure of this coral leaves no doubt that it is closely allied to the Astraeidae, but in the young calicles a tetrameral symmetry is indicated by the presence of four large septa placed at right angles to one another. Again, in the family *Amphiastraeidae* there is commonly a single septum much larger than the rest, and it has been shown that in the young calicles, *e.g.* of *Thecidiosmilia*, two septa, corresponding to the main- and counter-septa of Streptelasma, are first formed, then two alar septa, and afterwards the remaining septa, the latter taking on a generally radial arrangement, though the original bilaterality is marked by the preponderance of the main septum. As the microscopic character of the corallum of these extinct forms agrees with that of recent corals, it may be assumed that the anatomy of the soft parts also was similar, and the tetrameral arrangement, when present, may obviously be referred to a stage when only the first two pairs of Edwardsian mesenteries were present and septa were formed in the intervals between them.

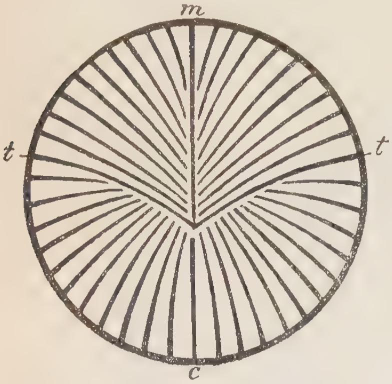


Fig. 19.—Diagram of the arrangement of the septa in a Zaphrentid coral. *m*, Main septum; *c*, counter septum; *t*, *t*, alar septa.

Space forbids a discussion of the proposals to classify corals after the minute structure of their coralla, but it will suffice to say that it has been shown that the septa of all corals are built up of a number of curved bars called trabeculae, each of which is composed of a number of nodes. In many secondary corals (*Cyclolites*, *Thamnastraea*) the trabeculae are so far separate that the individual bars are easily recognizable, and each looks something like a bamboo owing to the thickening of the two ends of each node. The trabeculae are united together by these thickened internodes, and the result is a fenestrated septum, which in older septa may become solid and aporose by continual deposit of calcite in the fenestrae. Each node of a trabecula may be simple, *i.e.* have only one centre of calcification, or may be compound. The septa of modern perforate corals are shown to have a structure nearly identical with that of the secondary forms, but the trabeculae and their nodes are only apparent on microscopical examination. The aporose corals, too, have a practically identical structure, their compactness being due to the union of the trabeculae throughout their entire lengths instead of at intervals, as in the Perforata. Further, the trabeculae may be evenly spaced throughout the septum, or may be grouped together, and this feature is probably of value in estimating the affinities of corals. (For an account of coral formations see Coral-reefs.)

In the present state of our knowledge the Zoantharia in which a primary cycle of six couples of mesenteries is (or may be inferred to be) completed by the addition of two pairs to the eight Edwardsian mesenteries, and succeeding cycles are formed in the exocoeles of the pre-existing mesenterial cycles, may be classed in an order Actiniidea, and this may be divided into the suborders *Malacactiniae*, comprising the soft-bodied Actinians, such as *Actinia*, *Sagartia*, *Bunodes*, &c., and the *Scleractiniae*, comprising the corals. The Scleractiniae may best be divided into groups of families which appear to be most closely related to one another, but it should not be forgotten that there is great reason to believe that many if not most of the extinct corals must have differed from modern Actiniidea in mesenterial characters, and may have only possessed Edwardsian mesenteries, or even have possessed only four mesenteries, in this respect showing close affinities to the Stauromedusae. Moreover, there are some modern corals in which the secondary cycle of mesenteries departs from the Actinian plan. For example, J. E. Duerden has shown that in *Porites* the ordinary zooids possess only six couples of mesenteries arranged on the Actinian plan. But some zooids grow to a larger size and develop a number of additional mesenteries, which arise either in the sulcar or the sulcular entocoele, much in the same manner as in Cerianthus. Bearing this in mind, the following arrangement may be taken to represent the most recent knowledge of coral structure:—

Group A.

Family 1. Zaphrentidae.—Solitary Palaeozoic corals with an epithecal wall. Septa numerous, arranged pinnately with regard to four principal septa. Tabulae present. One or more pits or fossulae present in the calicle. Typical genera—*Zaphrentis*, Raf. *Amplexus*, M. Edw. and H. *Streptelasma*, Hall. *Omphyma*, Raf.

Family 2. Turbinolidae.—Solitary, rarely colonial corals, with radially arranged septa and without tabulae. Typical genera—*Flabellum*, Lesson. *Turbinolia*, M. Edw. and H. *Caryophyllia*, Lamarck. *Sphenotrochus*, Moseley, &c.

Family 3. Amphiastraeidae.—Mainly colonial, rarely solitary corals, with radial septa, but bilateral arrangement indicated by persistence of a main septum. Typical genera—*Amphiastraea*, Étallon. *Thecidiosmilia*.

Family 4. Stylinidae.—Colonial corals allied to the Amphiastraeidae, but with radially symmetrical septa arranged in cycles. Typical genera—*Stylina*, Lamarck (Jurassic). *Convexastraea*, D'Orb. (Jurassic). *Isastraea*, M. Edw. and H. (Jurassic). Ogilvie refers the modern genus *Galaxea* to this family.

Group B.

Family 5. Oculinidae.—Branching or massive aporose corals, the calices projecting above the level of a compact coenenchyme formed from the coenosarc which covers the exterior of the corallum. Typical genera—*Lophohelia*, M. Edw. and H. *Oculina*, M. Edw. and H.

Family 6. Pocilloporidae.—Colonial branching aporose corals, with small calices sunk in the coenenchyme. Tabulae present, and two larger septa, an axial and abaxial, are always present, with traces of ten smaller septa. Typical genera—*Pocillopora*, Lamarck. *Seriatopora*, Lamarck.

Family 7. Madreporidae.—Colonial branching or palmate perforate corals, with abundant trabecular coenenchyme. Theca porous; septa compact and reduced in number. Typical genera—*Madrepora*, Linn. *Turbinaria*, Oken. *Montipora*, Quoy and G.

Family 8. Poritidae.—Incrusting or massive colonial perforate corals; calices usually in contact by their edges, sometimes disjunct and immersed in coenenchyme. Theca and septa perforate. Typical genera—*Porites*, M. Edw. and H. *Goniopora*, Quoy and G. *Rhodaraea*, M. Edw. and H.

Group C.

Family 9. Cyathophyllidae.—Solitary and colonial aporose corals. Tabulae and vesicular endotheca present. Septa numerous, generally radial, seldom pinnate. Typical genera—*Cyathophyllum*, Goldfuss (Devonian and Carboniferous). *Moseleya*, Quelch (recent).

Family 10. Astraeidae.—Aporose, mainly colonial corals, massive, branching, or maeandroid. Septa radial; dissepiments present; an epitheca surrounds the base of massive or maeandroid forms, but only surrounds individual corallites in simple or branching forms. Typical genera—*Goniastraea*, M. Edw. and H. *Heliastraea*, M. Edw. and H. *Maeandrina*, Lam. *Coeloria*, M. Edw. and H. *Favia*, Oken.

Family 11. Fungidae.—Solitary and colonial corals, with numerous radial septa united by synapticulae. Typical genera—*Lophoseris*, M. Edw. and H. *Thamnastraea*, Le Sauvage. *Leptophyllia*, Reuss (Jurassic and Cretaceous). *Fungia*, Dana. *Siderastraea*, Blainv.

Group D.

Family 12. Eupsammidae.—Solitary or colonial perforate corals, branching, massive, or encrusting. Septa radial; the primary septa usually compact, the remainder perforate. Theca perforate. Synapticula present in some genera. Typical genera—*Stephanophyllia*, Michelin. *Eupsammia*, M. Edw. and H. *Astroides*, Blainv. *Rhodopsammia*, M. Edw. and H. *Dendrophyllia*, M. Edw. and H.

Group E.

Family 13. Cystiphyllidae.—Solitary corals with rudimentary septa, and the calicle filled with vesicular endotheca. Genera—

Cystiphyllum, Lonsdale (Silurian and Devonian). *Goniophyllum*, M. Edw. and H. (In this Silurian genus the calyx is provided with a movable operculum, consisting of four paired triangular pieces, the bases of each being attached to the sides of the calyx, and their apices meeting in the middle when the operculum is closed). *Calceola*, Lam. (In this Devonian genus there is a single semicircular operculum furnished with a stout median septum and numerous feebly developed secondary septa. The calyx is triangular in section, pointed below, and the operculum is attached to it by hinge-like teeth.)

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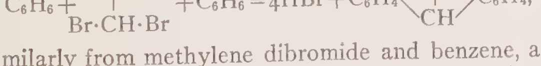
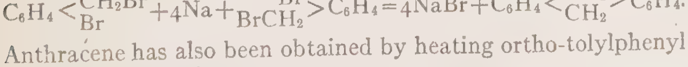
ANTHRACENE (from the Greek ἄνθραξ, coal), $C_{14}H_{10}$, a hydrocarbon obtained from the fraction of the coal-tar distillate boiling between 270° and 400° C. This high boiling fraction is allowed to stand for some days, when it partially solidifies. It is then separated in a centrifugal machine, the low melting-point impurities are removed by means of hot water, and the residue is finally hot-pressed. The crude anthracene cake is purified by treatment with the higher pyridine bases, the operation being carried out in large steam-jacketed boilers. The whole mass dissolves on heating, and the anthracene crystallizes out on cooling. The crystallized anthracene is then removed by a centrifugal separator and the process of solution in the pyridine bases is repeated. Finally the anthracene is purified by sublimation.

Many synthetical processes for the preparation of anthracene and its derivatives are known. It is formed by the condensation of acetylene tetrabromide with benzene in the presence of aluminium chloride:—



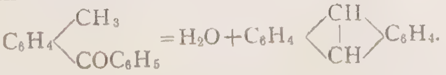
$$\mathrm{C_6H_6} + \begin{matrix}\mathrm{Br\cdot CH\cdot Br}\\ | \\ \mathrm{Br\cdot CH\cdot Br}\end{matrix} + \mathrm{C_6H_6} = \mathrm{4HBr} + \mathrm{C_6H_4}\left\langle\begin{matrix}\mathrm{CH}\\ | \\ \mathrm{CH}\end{matrix}\right\rangle\mathrm{C_6H_4},$$

and similarly from methylene dibromide and benzene, and also when benzyl chloride is heated with aluminium chloride to 200° C. By condensing ortho-brombenzyl bromide with sodium, C. L. Jackson and J. F. White (*Ber.*, 1879, 12, p. 1965) obtained dihydro-anthracene

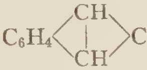
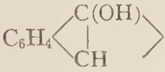


$$\mathrm{C_6H_4}<^{\mathrm{CH_2Br}}_{\mathrm{Br}} + \mathrm{4Na} + {}^{\mathrm{Br}}_{\mathrm{BrCH_2}}>\mathrm{C_6H_4} = \mathrm{4NaBr} + \mathrm{C_6H_4}<^{\mathrm{CH_2}}_{\mathrm{CH_2}}>\mathrm{C_6H_4}.$$

Anthracene has also been obtained by heating ortho-tolylphenyl ketone with zinc dust



$$\mathrm{C_6H_4}\left\langle\begin{matrix}\mathrm{CH_3}\\ \\ \mathrm{COC_6H_5}\end{matrix}\right. = \mathrm{H_2O} + \mathrm{C_6H_4}\left\langle\begin{matrix}\mathrm{CH}\\ | \\ \mathrm{CH}\end{matrix}\right\rangle\mathrm{C_6H_4}.$$

Anthracene crystallizes in colourless monoclinic tables which show a fine blue fluorescence. It melts at 213° C. and boils at 351° C. It is insoluble in water, sparingly soluble in alcohol and ether, but readily soluble in hot benzene. It unites with picric acid to form a picrate, $C_{14}H_{10}\cdot C_6H_2(NO_2)_3\cdot OH$, which crystallizes in needles, melting at 138° C. On exposure to sunlight a solution of anthracene in benzene or xylene deposits para-anthracene $(C_{14}H_{10})_2$, which melts at 244° C. and passes back into the ordinary form. Chlorine and bromine form both addition and substitution products with anthracene; the addition product, anthracene dichloride, $C_{14}H_{10}Cl_2$, being formed when chlorine is passed into a cold solution of anthracene in carbon bisulphide. On treatment with potash, it forms the substitution product, monochloranthracene, $C_{14}H_9Cl$. Nitro-anthracenes are not as yet known. The mono-oxyanthracenes (anthrols), $C_{14}H_9OH$ or  $\mathrm{C_6H_4}\left\langle\begin{matrix}\mathrm{CH}\\ | \\ \mathrm{CH}\end{matrix}\right\rangle\mathrm{C_6H_3OH}$ (α) and (β), resemble the phenols, whilst  $\mathrm{C_6H_4}\left\langle\begin{matrix}\mathrm{C(OH)}\\ | \\ \mathrm{CH}\end{matrix}\right\rangle\mathrm{C_6H_4}$ (γ) (anthranol) is a reduction product of anthraquinone. β-anthrol and anthranol give the corresponding amino compounds (anthramines) when heated with ammonia.

Numerous sulphonic acids of anthracene are known, a monosulphonic acid being obtained with dilute sulphuric acid, whilst concentrated sulphuric acid produces mixtures of the anthracene disulphonic acids. By the action of sodium amalgam on an alcoholic solution of anthracene, an anthracene dihydride, $C_{14}H_{12}$, is obtained, whilst by the use of stronger reducing agents, such as hydriodic acid and amorphous phosphorus, hydrides of composition $C_{14}H_{16}$ and $C_{14}H_{24}$ are produced.

Methyl and phenyl anthracenes are known; phenyl anthranol (phthalidin) being somewhat closely related to the phenolphthaleins (*q.v.*). Oxidizing agents convert anthracene into anthraquinone (*q.v.*); the production of this substance by oxidizing anthracene in glacial acetic acid solution, with chromic acid, is the usual method employed for the estimation of anthracene.

ANTHRACITE (Gr. ἄνθραξ, coal), a term applied to those varieties of coal which do not give off tarry or other hydrocarbon vapours when heated below their point of ignition; or, in other words, which burn with a smokeless and nearly non-luminous flame. Other terms having the same meaning are, "stone coal" (not to be confounded with the German *Steinkohle*) or "blind coal" in Scotland, and "Kilkenny coal" in Ireland. The imperfect anthracite of north Devon, which however is only used as a pigment, is known as *culm*, the same term being used in geological classification to distinguish the strata in which it is found, and similar strata in the Rhenish hill countries which are known as the Culm Measures. In America, culm is used as an equivalent for waste or slack in anthracite mining.

Physically, anthracite differs from ordinary bituminous coal by its greater hardness, higher density, 1·3–1·4, and lustre, the latter being often semi-metallic with a somewhat brownish reflection. It is also free from included soft or fibrous notches and does not soil the fingers when rubbed. Structurally it shows some alteration by the development of secondary divisional planes and fissures so that the original stratification lines are not always easily seen. The thermal conductivity is also higher, a lump of anthracite feeling perceptibly colder when held in the warm hand than a similar lump of bituminous coal at the same temperature. The chemical composition of some typical anthracites is given in the article COAL.

Anthracite may be considered to be a transition stage between ordinary bituminous coal and graphite, produced by the more or less complete elimination of the volatile constituents of the former; and it is found most abundantly in areas that have been subjected to considerable earth-movements, such as the flanks of great mountain ranges. The largest and most important anthracite region, that of the north-eastern portion of the Pennsylvania coal-field, is a good example of this; the highly contorted strata of the Appalachian region produce anthracite exclusively, while in the western portion of the same basin on the Ohio and its tributaries, where the strata are undisturbed, free-burning and coking coals, rich in volatile matter, prevail. In the same way the anthracite region of South Wales is confined to the contorted portion west of Swansea and Llanelly, the central and eastern portions producing steam, coking and house coals.

Anthracites of newer, tertiary or cretaceous age, are found in the Crow's Nest part of the Rocky Mountains in Canada, and at various points in the Andes in Peru.

The principal use of anthracite is as a smokeless fuel. In the eastern United States, it is largely employed as domestic fuel, usually in close stoves or furnaces, as well as for steam purposes, since, unlike that from South Wales, it does not decrepitate when heated, or at least not to the same extent. For proper use, however, it is necessary that the fuel should be supplied in pieces as nearly uniform in size as possible, a condition that has led to the development of the *breaker* which is so characteristic a feature in American anthracite mining (see COAL). The large coal as raised from the mine is passed through breakers with toothed rolls to reduce the lumps to smaller pieces, which are separated into different sizes by a system of graduated sieves, placed in descending order. Each size can be perfectly well burnt alone on an appropriate grate, if kept free from larger or smaller admixtures. The common American classification is as follows:—

Lump, steamboat, egg and stove coals, the latter in two or three sizes, all three being above 1½ in. size on round-hole screens.

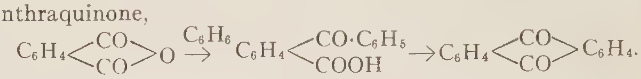
Chestnut	below 1½ inch	above ⅞ inch.
Pea	„ ⅞ „	„ $\frac{9}{16}$ „
Buckwheat	„ $\frac{9}{16}$ „	„ ⅜ „
Rice	„ ⅜ „	„ $\frac{3}{16}$ „
Barley	„ $\frac{3}{16}$ „	„ $\frac{3}{32}$ „

From the pea size downwards the principal use is for steam purposes. In South Wales a less elaborate classification is adopted; but great care is exercised in hand-picking and cleaning the coal from included particles of pyrites in the higher qualities known as best malting coals, which are used for kiln-drying malt and hops.

Formerly, anthracite was largely used, both in America and South Wales, as blast-furnace fuel for iron smelting, but for this purpose it has been largely superseded by coke in the former country and entirely in the latter. An important application has, however, been developed in the extended use of internal combustion motors driven by the so-called "mixed," "poor," "semi-water" or "Dowson gas" produced by the gasification of anthracite with air and a small proportion of steam. This is probably the most economical method of obtaining power known; with an engine as small as 15 horse-power the expenditure of fuel is at the rate of only 1 ℔ per horse-power hour, and with larger engines it is proportionately less. Large quantities of anthracite for power purposes are now exported from South Wales to France, Switzerland and parts of Germany. (H. B.)

ANTHRACOTHERIUM ("coal-animal," so called from the fact of the remains first described having been obtained from the Tertiary lignite-beds of Europe), a genus of extinct artiodactyle ungulate mammals, characterized by having 44 teeth, with five semi-crescentic cusps on the crowns of the upper molars. In many respects, especially the form of the lower jaw, *Anthracotherium*, which is of Oligocene and Miocene age in Europe, and typifies the family *Anthracotheriidae*, is allied to the hippopotamus, of which it is probably an ancestral form. The European *A. magnum* was as large as the last-mentioned animal, but there were several smaller species and the genus also occurs in Egypt, India and North America. (See ARTIODACTYLA.)

ANTHRAQUINONE, $C_{14}H_8O_2$, an important derivative of anthracene, first prepared in 1834 by A. Laurent. It is prepared commercially from anthracene by stirring a sludge of anthracene and water in horizontal cylinders with a mixture of sodium bichromate and caustic soda. This suspension is then run through a conical mill in order to remove all grit, the cones of the mill fitting so tightly that water cannot pass through unless the mill is running; the speed of the mill when working is about 3000 revolutions per minute. After this treatment, the mixture is run into lead-lined vats and treated with sulphuric acid, steam is blown through the mixture in order to bring it to the boil, and the anthracene is rapidly oxidized to anthraquinone. When the oxidation is complete, the anthraquinone is separated in a filter press, washed and heated to 120° C. with commercial oil of vitriol, using about 2½ parts of vitriol to 1 of anthraquinone. It is then removed to lead-lined tanks and again washed with water and dried; the product obtained contains about 95% of anthraquinone. It may be purified by sublimation. Various synthetic processes have been used for the preparation of anthraquinone. A. Behr and W. A. v. Dorp (*Ber.*, 1874, 7, p. 578) obtained orthobenzoyl benzoic acid by heating phthalic anhydride with benzene in the presence of aluminium chloride. This compound on heating with phosphoric anhydride loses water and yields anthraquinone,



$$C_6H_4\left<\begin{matrix}CO\\CO\end{matrix}\right>O \xrightarrow{C_6H_6} C_6H_4\left<\begin{matrix}CO\cdot C_6H_5\\COOH\end{matrix}\right. \rightarrow C_6H_4\left<\begin{matrix}CO\\CO\end{matrix}\right>C_6H_4.$$

It may be prepared in a similar manner by heating phthalyl chloride with benzene in the presence of aluminium chloride. Dioxy- and tetraoxy-anthraquinones are obtained when meta-oxy- and dimeta-dioxy-benzoic acids are heated with concentrated sulphuric acid.

Anthraquinone crystallizes in yellow needles or prisms, which melt at 277° C. It is soluble in hot benzene, sublimes easily, and is very stable towards oxidizing agents. On the other hand, it is readily attacked by reducing agents. With zinc dust in presence of caustic soda it yields the secondary alcohol oxanthranol, $C_6H_4 : CO\cdot CHOH : C_6H_4$, with tin and hydrochloric acid, the phenolic compound anthranol, $C_6H_4 : CO\cdot C(OH) : C_6H_4$; and with hydriodic acid at 150° C. or on distillation with zinc dust, the hydrocarbon anthracene, $C_{14}H_{10}$. When fused with caustic potash, it gives benzoic acid. It behaves more as a ketone than as a quinone, since with hydroxylamine it yields an oxime, and on reduction with zinc dust and caustic soda it yields a secondary alcohol, whilst it cannot be reduced by means of sulphurous acid. Various sulphonic acids of anthraquinone are known, as well as oxy-derivatives, for the preparation and properties of which see ALIZARIN.

ANTHRAX (the Greek for "coal," or "carbuncle," so called by the ancients because they regarded it as burning like coal; cf. the French equivalent *charbon*; also known as *fièvre charbonneuse*, *Milzbrand*, splenic fever, and malignant pustule), an acute, specific, infectious, virulent disease, caused by the *Bacillus anthracis*, in animals, chiefly cattle, sheep and horses, and frequently occurring in workers in the wool or hair, as well as in those handling the hides or carcases, of beasts which have been affected.

Animals.—As affecting wild as well as domesticated animals and man, anthrax has been widely diffused in one or more of its forms, over the surface of the globe. It at times decimates the reindeer herds in Lapland and the Polar regions, and is only too well known in the tropics and in temperate latitudes. It has been observed and described in Russia, Siberia, Central Asia, China, Cochin-China, Egypt, West Indies, Peru, Paraguay, Brazil, Mexico, and other parts of North and South America, in Australia, and on different parts of the African continent, while for other European countries the writings which have been published with regard to its nature, its peculiar characteristics, and the injury it inflicts are innumerable. Countries in which are extensive marshes, or the subsoil of which is tenacious or impermeable, are usually those most frequently and seriously visited. Thus there have been regions notorious for its prevalence, such as the marshes of Sologne, Dombes and Bresse in France; certain parts of Germany, Hungary and Poland; in Spain the half-submerged valleys and the maritime coasts of Catalonia, as well as the Romagna and other marshy districts of Italy; while it is epizootic, and even panzootic, in the swampy regions of Esthonia, Livonia, Courland, and especially of Siberia, where it is known as the *Sibirskaja jaswa* (Siberian boil-plague). The records of anthrax go back to a very ancient date. It is supposed to be the murrain of Exodus. Classical writers allude to anthrax as if it were the only cattle disease worthy of mention (see Virgil, *Georg.* iii.). It figures largely in the history of the early and middle ages as a devastating pestilence attacking animals, and through them mankind; the oldest Anglo-Saxon manuscripts contain many fantastic recipes, leechdoms.

charms and incantations for the prevention or cure of the "blacan blezene" (black blain) and the relief of the "elfshot" creatures. In the 18th and 19th centuries it sometimes spread like an epizootic over the whole of Europe, from Siberia to France. It was in this malady that disease-producing germs (*bacteria*) were first discovered, in 1849, by Pollender of Wipperfürth, and, independently, by veterinary surgeon Brauell of Dorpat, and their real character afterwards verified by C. J. Davaine (1812–1882) of Alfort in 1863; and it was in their experiments with this disease that Toussaint, Pasteur and J. B. Chauveau first showed how to make the morbific poison its own antidote. (See VIVISECTION.)

The symptoms vary with the species of animal, the mode of infection, and the seat of the primary lesion, internal or external. In all its forms anthrax is an inoculable disease, transmission being surely and promptly effected by this means, and it may be conveyed to nearly all animals by inoculation of a wound of the skin or through the digestive organs. Cattle, sheep and horses nearly always owe their infection to spores or bacilli ingested with their food or water, and pigs usually contract the disease by eating the flesh of animals dead of anthrax.

Internal anthrax, of cattle and sheep, exhibits no premonitory symptoms that can be relied on. Generally the first indication of an outbreak is the sudden death of one or more of the herd or flock. Animals which do not die at once may be noticed to stagger and tremble; the breathing becomes hurried and the pulse very rapid, while the heart beats violently; the internal temperature of the body is high, 104° to 106° F.; blood oozes from the nose, mouth and anus, the visible mucous membranes are dusky or almost black. The animal becomes weak and listless, the temperature falls and death supervenes in a few hours, being immediately preceded by delirium, convulsions or coma. While death is usually rapid or sudden when the malady is general, constituting what is designated splenic apoplexy, internal anthrax in cattle is not invariably fatal. In some cases the animal rallies from a first attack and gradually recovers.

In the external or localized form, marked by the formation of carbuncles before general infection takes place, death may not occur for several days. The carbuncles may appear in any part of the body, being preceded or accompanied by fever. They are developed in the subcutaneous connective tissue where this is loose and plentiful, in the interstices of the muscles, lymphatic glands, in the mucous membranes of the mouth and tongue (glossanthrax of cattle), pharynx and larynx (*anthrax angina* of horses and pigs), and the rectum. They begin as small circumscribed swellings which are warm, slightly painful and oedematous. In from two to eight hours they attain a considerable size, are cold, painless and gangrenous, and when they are incised a quantity of a blood-stained gelatinous exudate escapes. When the swellings have attained certain proportions symptoms of general infection appear, and, running their course with great rapidity, cause death in a few hours. Anthrax of the horse usually begins as an affection of the throat or bowel. In the former there is rapid obstructive oedema of the mucous membrane of the pharynx and larynx with swelling of the throat and neck, fever, salivation, difficulty in swallowing, noisy breathing, frothy discharge from the nose and threatening suffocation. General invasion soon ensues, and the horse may die in from four to sixteen hours. The intestinal form is marked by high temperature, great prostration, small thready pulse, tumultuous action of the heart, laboured breathing and symptoms of abdominal pain with straining and diarrhoea. When moved the horse staggers and trembles. Profuse sweating, a falling temperature and cyanotic mucous membranes indicate the approach of a fatal termination.

In splenic fever or splenic apoplexy, the most marked alterations observed after death are—the effects of rapid decomposition, evidenced by the foul odour, disengagement of gas beneath the skin and in the tissues and cavities of the body, yellow or yellowish-red gelatinous exudation into and between the muscles, effusion of citron or rust-coloured fluid in various cavities, extravasations of blood and local congestions throughout the body, the blood in the vessels generally being very dark and tar-like. The most notable feature, however, in the majority of cases is the enormous enlargement of the spleen, which is engorged with blood to such an extent that it often ruptures, while its tissue is changed into a violet or black fluid mass.

The bacillus of anthrax, under certain conditions, retains its vitality for a long time, and rapidly grows when it finds a suitable field in which to develop, its mode of multiplication being by scission and the formation of spores, and depending, to a great extent at least, on the presence of oxygen. The morbid action of the bacillus is indeed said to be due to its affinity for oxygen; by depriving the red corpuscles of the blood of that most essential gas, it renders the vital fluid unfit to sustain life. Albert Hoffa and others assert that the fatal lesions are produced by the poisonous action of the toxins formed by the bacilli and not by the blocking up of the minute blood-vessels, or the abstraction of oxygen from the blood by the bacilli.

It was by the cultivation of this micro-organism, or attenuation of the virus, that Pasteur was enabled to produce a prophylactic remedy for anthrax. His discovery was first made with regard to the cholera of fowls, a most destructive disorder which annually carries off great numbers of poultry. Pasteur produced his inoculation material by the cultivation of the bacilli at a temperature of 42° C. in oxygen. Two vaccines are required. The first or weak vaccine is obtained by incubating a bouillon culture for twenty-four days at 42° C., and the second or less attenuated vaccine by incubating a bouillon culture, at the same temperature, for twelve days. Pasteur's method of protective inoculation comprises two inoculations with an interval of twelve days between them. Immunity, established in about fifteen days after the injection of the second vaccine, lasts from nine months to a year.

Toussaint had, previous to Pasteur, attenuated the virus of anthrax by the action of heat; and Chauveau subsequently corroborated by numerous experiments the value of Toussaint's method, demonstrating that, according to the degree of heat to which the virus is subjected, so is its inocuousness when transferred to a healthy creature. In outbreaks of anthrax on farms where many animals are exposed to infection immediate temporary protection can be conferred by the injection of anthrax serum.

Human Beings.—For many years cases of sudden death had been observed to occur from time to time among healthy men engaged in woollen manufactories, particularly in the work of sorting or combing wool. In some instances death appeared to be due to the direct inoculation of some poisonous material into the body, for a form of malignant pustule was observed upon the skin; but, on the other hand, in not a few cases without any external manifestation, symptoms of blood-poisoning, often proving rapidly fatal, suggested the probability of other channels for the introduction of the disease. In 1880 the occurrence of several such cases among woolsorters at Bradford, reported by Dr J. H. Bell of that town, led to an official inquiry in England by the Local Government Board, and an elaborate investigation into the pathology of what was then called "woolsorters' disease" was at the same time conducted at the Brown Institution, London, by Professor W. S. Greenfield. Among the results of this inquiry it was ascertained: (1) that the disease appeared to be identical with that occurring among sheep and cattle; (2) that in the blood and tissues of the body was found in abundance, as in the disease in animals, the *Bacillus anthracis*, and (3) that the skins, hair, wool, &c., of animals dying of anthrax retain this infecting organism, which, under certain conditions, finds ready access to the bodies of the workers.

Two well-marked forms of this disease in man are recognized, "external anthrax" and "internal anthrax." In external anthrax the infecting agent is accidentally inoculated into some portion of skin, the seat of a slight abrasion, often the hand, arm or face. A minute swelling soon appears at the part, and develops into a vesicle containing serum or bloody matter, and varying in size, but seldom larger than a shilling. This vesicle speedily bursts and leaves an ulcerated or sloughing surface, round about which are numerous smaller vesicles which undergo similar changes, and the whole affected part becomes hard and tender, while the surrounding surface participates in the inflammatory action, and the neighbouring lymphatic glands are also inflamed. This condition, termed "malignant pustule," is frequently accompanied with severe constitutional disturbance, in the form of fever, delirium, perspirations, together with great prostration and a tendency to death from septicaemia, although on the other hand recovery is not uncommon. It was repeatedly found that the matter taken from the vesicle during the progress of the disease, as well as the blood in the body after death, contained the *Bacillus anthracis*, and when inoculated into small animals produced rapid death, with all the symptoms and post-mortem appearances characteristic of the disease as known to affect them.

In internal anthrax there is no visible local manifestation of the disease, and the spores or bacilli appear to gain access to the system from the air charged with them, as in rooms where the contaminated wool or hair is unpacked, or again during the process of sorting. The symptoms usually observed are those of rapid physical prostration, with a small pulse, somewhat lowered temperature (rarely fever), and quickened breathing. Examination of the chest reveals inflammation of the lungs and pleura. In some cases death takes place by collapse in less than one day, while in others the fatal issue is postponed for three or four days, and is preceded by symptoms of blood-poisoning, including rigors, perspirations, extreme exhaustion, &c. In some cases of internal anthrax the symptoms are more intestinal than pulmonary, and consist in severe exhausting diarrhoea, with vomiting and rapid sinking. Recovery from the internal variety, although not unknown, is more rare than from the external, and its most striking phenomena are its sudden onset in the midst of apparent health, the rapid development of physical prostration, and its tendency to a fatal termination despite treatment. The post-mortem appearances in internal anthrax are such as are usually observed in septicaemia, but in addition evidence of extensive inflammation of the lungs, pleura and bronchial glands has in most cases been met with. The blood and other fluids and the diseased tissues are found loaded with the *Bacillus anthracis*.

Treatment in this disease appears to be of but little avail, except as regards the external form, where the malignant pustule may be excised or dealt with early by strong caustics to destroy the affected textures. For the relief of the general constitutional symptoms, quinine, stimulants and strong nourishment appear to be the only available means. An anti-anthrax serum has also been tried. As preventive measures in woollen manufactories, the disinfection of suspicious material, or the wetting of it before handling, is recommended as lessening the risk to the workers. (J. Mac.)

ANTHROPOID APES, or Manlike Apes, the name given to the family of the Simiidae, because, of all the ape-world, they most closely resemble man. This family includes four kinds, the gibbons of S. E. Asia, the orangs of Borneo and Sumatra, the gorillas of W. Equatorial Africa, and the chimpanzees of W. and Central Equatorial Africa. Each of these apes resembles man most in some one physical characteristic: the gibbons in the formation of the teeth, the orangs in the brain-structure, the gorillas in size, and the chimpanzees in the sigmoid flexure of the spine. In general structure they all closely resemble human beings, as in the absence of tails; in their semi-erect position (resting on finger-tips or knuckles); in the shape of vertebral column, sternum and pelvis; in the adaptation of the arms for turning the palm uppermost at will; in the possession of a long vermiform appendix to the short caecum of the intestine; in the size of the cerebral hemispheres and the complexity of their convolutions. They differ in certain respects, as in the proportion of the limbs, in the bony development of the eyebrow ridges, and in the opposable great toe, which fits the foot to be a climbing and grasping organ.

Man differs from them in the absence of a hairy coat; in the development of a large lobule to the external ear; in his fully erect attitude; in his flattened foot with the non-opposable great toe; in the straight limb-bones; in the wider pelvis; in the marked sigmoid flexure of his spine; in the perfection of the muscular movements of the arm; in the delicacy of hand; in the smallness of the canine teeth and other dental peculiarities; in the development of a chin; and in the small size of his jaws compared to the relatively great size of the cranium. Together with man and the baboons, the anthropoid apes form the group known to science as Catarhini, those, that is, possessing a narrow nasal septum, and are thus easily distinguishable from the flat-nosed monkeys or Platyrhini. The anthropoid apes are arboreal and confined to the Old World. They are of special interest from the important place assigned to them in the arguments of Darwin and the Evolutionists. It is generally admitted now that no fundamental anatomical difference can be proved to exist between these higher apes and man, but it is equally agreed that none probably of the Simiidae is in the direct line of human ancestry. There is a great gap to be bridged between the highest anthropoid and the lowest man, and much importance has been attached to the discovery of an extinct primate, Pithecanthropus (*q.v.*), which has been regarded as the "missing link."

See Huxley's *Man's Place in Nature* (1863); Robt. Hartmann's *Anthropoid Apes* (1883; London, 1885); A. H. Keane's *Ethnology* (1896); Darwin's *Descent of Man* (1871; pop. ed., 1901); Haeckel's *Anthropogeny* (Leipzig, 1874, 1903; Paris, 1877; Eng. ed., 1883); W. H. Flower and Rich. Lydekker, *Mammals Living and Extinct* (London, 1891).

ANTHROPOLOGY (Gr. ἄνθρωπος man, and λόγος, theory or science), the science which, in its strictest sense, has as its object the study of man as a unit in the animal kingdom. It is distinguished from ethnology, which is devoted to the study of man as a *racial* unit, and from ethnography, which deals with the *distribution* of the races formed by the aggregation of such units. To anthropology, however, in its more general sense as the natural history of man, ethnology and ethnography may both be considered to belong, being related as parts to a whole.

Various other sciences, in conformity with the above definition, must be regarded as subsidiary to anthropology, which yet hold their own independent places in the field of knowledge. Thus anatomy and physiology display the structure and functions of the human body, while psychology investigates the operations of the human mind. Philology deals with the general principles of language, as well as with the relations between the languages of particular races and nations. Ethics or moral science treats of man's duty or rules of conduct toward his fellow-men. Sociology and the science of culture are concerned with the origin and development of arts and sciences, opinions, beliefs, customs, laws and institutions generally among mankind within historic time; while beyond the historical limit the study is continued by inferences from relics of early ages and remote districts, to interpret which is the task of pre-historic archaeology and geology.

I. *Man's Place in Nature.*—In 1843 Dr J. C. Prichard, who perhaps of all others merits the title of founder of modern anthropology, wrote in his *Natural History of Man*:—

> "The organized world presents no contrasts and resemblances more remarkable than those which we discover on comparing mankind with the inferior tribes. That creatures should exist so nearly approaching to each other in all the particulars of their physical structure, and yet differing so immeasurably in their endowments and capabilities, would be a fact hard to believe, if it were not manifest to our observation. The differences are everywhere striking: the resemblances are less obvious in the fulness of their extent, and they are never contemplated without wonder by those who, in the study of anatomy and physiology, are first made aware how near is man in his physical constitution to the brutes. In all the principles of his internal structure, in the composition and functions of his parts, man is but an animal. The lord of the earth, who contemplates the eternal order of the universe, and aspires to communion with its invisible Maker, is a being composed of the same materials, and framed on the same principles, as the creatures which he has tamed to be the servile instruments of his will, or slays for his daily food. The points of resemblance are innumerable; they extend to the most recondite arrangements of that mechanism which maintains instrumentally the physical life of the body, which

brings forward its early development and admits, after a given period, its decay, and by means of which is prepared a succession of similar beings destined to perpetuate the race."

The acknowledgment of man's structural similarity with the anthropomorphous species nearest approaching him, viz.: the higher or anthropoid apes, had long before Prichard's day been made by Linnaeus, who in his *Systema Naturae* (1735) grouped them together as the highest order of Mammalia, to which he gave the name of Primates. The *Amoenitates Academicae* (vol. vi., Leiden, 1764), published under the auspices of Linnaeus, contains a remarkable picture which illustrates a discourse by his disciple Hoppius, and is here reproduced (see Plate, fig. 1). In this picture, which shows the crudeness of the zoological notions current in the 18th century as to both men and apes, there are set in a row four figures: (*a*) a recognizable orang-utan, sitting and holding a staff; (*b*) a chimpanzee, absurdly humanized as to head, hands, and feet; (*c*) a hairy woman, with a tail a foot long; (*d*) another woman, more completely coated with hair. The great Swedish naturalist was possibly justified in treating the two latter creatures as quasi-human, for they seem to be grotesque exaggerations of such tailed and hairy human beings as really, though rarely, occur, and are apt to be exhibited as monstrosities (see Bastian and Hartmann, *Zeitschrift für Ethnologie*, Index, "Geschwänzte Menschen"; Gould and Pile, *Anomalies and Curiosities of Medicine*, 1897). To Linnaeus, however, they represented normal anthropomorpha or man-like creatures, vouched for by visitors to remote parts of the world. This opinion of the Swedish naturalist seems to have been little noticed in Great Britain till it was taken up by the learned but credulous Scottish judge, Lord Monboddo (see his *Origin and Progress of Language*, 1774, &c.; *Antient Metaphysics*, 1778). He had not heard of the tailed men till he met with them in the work of Linnaeus, with whom he entered into correspondence, with the result that he enlarged his range of mankind with races of sub-human type. One was founded on the description by the Swedish sailor Niklas Köping of the ferocious men with long tails inhabiting the Nicobar Islands. Another comprised the orang-utans of Sumatra, who were said to take men captive and set them to work as slaves. One of these apes, it was related, served as a sailor on board a Jamaica ship, and used to wait on the captain. These are stories which seem to carry their own explanation. When the Nicobar Islands were taken over by the British government two centuries later, the native warriors were still wearing their peculiar loin-cloth hanging behind in a most tail-like manner (E. H. Man, *Journal Anthropological Institute*, vol. xv. p. 442). As for the story of the orang-utan cabin boy, this may even be verbally true, it being borne in mind that in the Malay languages the term *orang-utan*, "man of the forest," was originally used for inland forest natives and other rude men, rather than for the *miyas* apes to which it has come to be generally applied by Europeans. The speculations as to primitive man connected with these stories diverted the British public, headed by Dr Johnson, who said that Monboddo was "as jealous of his tail as a squirrel." Linnaeus's primarily zoological classification of man did not, however, suit the philosophical opinion of the time, which responded more readily to the systems represented by Buffon, and later by Cuvier, in which the human mind and soul formed an impassable wall of partition between him and other mammalia, so that the definition of man's position in the animal world was treated as not belonging to zoology, but to metaphysics and theology. It has to be borne in mind that Linnaeus, plainly as he recognized the likeness of the higher simian and the human types, does not seem to have entertained the thought of accounting for this similarity by common descent. It satisfied his mind to consider it as belonging to the system of nature, as indeed remained the case with a greater anatomist of the following century, Richard Owen. The present drawing, which under the authority of Linnaeus shows an anthropomorphic series from which the normal type of man, the *Homo sapiens*, is conspicuously absent, brings zoological similarity into view without suggesting kinship to account for it. There are few ideas more ingrained in ancient and low civilization than that of relationship by descent between the lower animals and man. Savage and barbaric religions recognize it, and the mythology of the world has hardly a more universal theme. But in educated Europe such ideas had long been superseded by the influence of theology and philosophy, with which they seemed too incompatible. In the 19th century, however, Lamarck's theory of the development of new species by habit and circumstance led through Wallace and Darwin to the doctrines of the hereditary transmission of acquired characters, the survival of the fittest, and natural selection. Thenceforward it was impossible to exclude a theory of descent of man from ancestral beings whom zoological similarity connects also, though by lines of descent not at all clearly defined, with ancestors of the anthropomorphic apes. In one form or another such a theory of human descent has in our time become part of an accepted framework of zoology, if not as a demonstrable truth, at any rate as a working hypothesis which has no effective rival.

The new development from Linnaeus's zoological scheme which has thus ensued appears in Huxley's diagram of simian and human skeletons (fig. 2, (*a*) gibbon; (*b*) orang; (*c*) chimpanzee; (*d*) gorilla; (*e*) man). Evidently suggested by the Linnean picture, this is brought up to the modern level of zoology, and continued on to man, forming an introduction to his zoological history hardly to be surpassed. Some of the main points it illustrates may be briefly stated here, the reader being referred for further information to Huxley's *Essays*. In tracing the osteological characters of apes and man through this series, the general system of the skeletons, and the close correspondence in number and arrangement of vertebrae and ribs, as well as in the teeth, go far towards justifying the opinion of hereditary connexion. At the same time, the comparison brings into view differences in human structure adapted to man's pre-eminent mode of life, though hardly to be accounted its chief causes. It may be seen how the arrangement of limbs suited for going on all-fours belongs rather to the apes than to man, and walking on the soles of the feet rather to man than the apes. The two modes of progression overlap in human life, but the child's tendency when learning is to rest on the soles of the feet and the palms of the hands, unlike the apes, which support themselves on the sides of the feet and the bent knuckles of the hands. With regard to climbing, the long stretch of arm and the grasp with both hands and feet contribute to the arboreal life of the apes, contrasting with what seem the mere remains of the climbing habit to be found even among forest savages. On the whole, man's locomotive limbs are not so much specialized to particular purposes, as generalized into adaptation to many ends. As to the mechanical conditions of the human body, the upright posture has always been recognized as the chief. To it contributes the balance of the skull on the cervical vertebrae, while the human form of the pelvis provides the necessary support to the intestines in the standing attitude. The marked curvature of the vertebral column, by breaking the shock to the neck and head in running and leaping, likewise favours the erect position. The lowest coccygeal vertebrae of man remain as a rudimentary tail. While it is evident that high importance must be attached to the adaptation of the human body to the life of diversified intelligence and occupation he has to lead, this must not be treated as though it were the principal element of the superiority of man, whose comparison with all lower genera of mammals must be mainly directed to the intellectual organ, the brain. Comparison of the brains of vertebrate animals (see BRAIN) brings into view the immense difference between the small, smooth brain of a fish or bird and the large and convoluted organ in man. In man, both size and complexity contribute to the increased area of the cortex or outer layer of the brain, which has been fully ascertained to be the seat of the mysterious processes by which sensation furnishes the groundwork of thought. Schäfer (*Textbook of Physiology*, vol. ii. p. 697) thus defines it: "The cerebral cortex is the seat of the intellectual functions, of intelligent sensation or consciousness, of ideation, of volition, and of memory."

The relations between man and ape are most readily stated in comparison with the gorilla, as on the whole the most anthropomorphous ape. In the general proportions of the body and limbs there is a marked difference between the gorilla and man. The gorilla's brain-case is smaller, its trunk larger, its lower limbs shorter, its upper limbs longer in proportion than those of man. The differences between a gorilla's skull and a man's are truly immense. In the gorilla, the face, formed largely by the massive jaw-bones, predominates over the brain-case or cranium; in the man these proportions are reversed. In man the occipital foramen, through which passes the spinal cord, is placed just behind the centre of the base of the skull, which is thus evenly balanced in the erect posture, whereas the gorilla, which goes habitually on all fours, and whose skull is inclined forward, in accordance with this posture has the foramen farther back. In man the surface of the skull is comparatively smooth, and the brow-ridges project but little, while in the gorilla these ridges overhang the cavernous orbits like penthouse roofs. The absolute capacity of the cranium of the gorilla is far less than that of man; the smallest adult human cranium hardly measuring less than 63 cub. in., while the largest gorilla cranium measured had a content of only 34½ cub. in. The largest proportional size of the facial bones, and the great projection of the jaws, confer on the gorilla's skull its small facial angle and brutal character, while its teeth differ from man's in relative size and number of fangs. Comparing the lengths of the extremities, it is seen that the gorilla's arm is of enormous length, in fact about one-sixth longer than the spine, whereas a man's arm is one-fifth shorter than the spine; both hand and foot are proportionally much longer in the gorilla than in man; the leg does not so much differ. The vertebral column of the gorilla differs from that of man in its curvature and other characters, as also does the conformation of its narrow pelvis. The hand of the gorilla corresponds essentially as to bones and muscles with that of man, but is clumsier and heavier; its thumb is "opposable" like a human thumb, that is, it can easily meet with its extremity the extremities of the other fingers, thus possessing a character which does much to make the human hand so admirable an instrument; but the gorilla's thumb is proportionately shorter than man's. The foot of the higher apes, though often spoken of as a hand, is anatomically not such, but a prehensile foot. It has been argued by Sir Richard Owen and others that the position of the great toe converts the foot of the higher apes into a hand, an extremely important distinction from man; but against this Professor T. H. Huxley maintained that it has the characteristic structure of a foot with a very movable great toe. The external unlikeness of the apes to man depends much on their hairiness, but this and some other characteristics have no great zoological value. No doubt the difference between man and the apes depends, of all things, on the relative size and organization of the brain. While similar as to their general arrangement to the human brain, those of the higher apes, such as the chimpanzee, are much less complex in their convolutions, as well as much less in both absolute and relative weight—the weight of a gorilla's brain hardly exceeding 20 oz., and a man's brain hardly weighing less than 32 oz., although the gorilla is considerably the larger animal of the two.

These anatomical distinctions are undoubtedly of great moment, and it is an interesting question whether they suffice to place man in a zoological order by himself. It is plain that some eminent zoologists, regarding man as absolutely differing as to mind and spirit from any other animal, have had their discrimination of mere bodily differences unconsciously sharpened, and have been led to give differences, such as in the brain or even the foot of the apes and man, somewhat more importance than if they had merely distinguished two species of apes. Many naturalists hold the opinion that the anatomical differences which separate the gorilla or chimpanzee from man are in some respects less than those which separate these man-like apes from apes lower in the scale. Yet all authorities class both the higher and lower apes in the same order. This is Huxley's argument, some prominent points of which are the following: As regards the proportion of limbs, the hylobates or gibbon is as much longer in the arms than the gorilla as the gorilla is than the man, while on the other hand, it is as much longer in the legs than the man as the man is than the gorilla. As to the vertebral column and pelvis, the lower apes differ from the gorilla as much as, or more than, it differs from man. As to the capacity of the cranium, men differ from one another so extremely that the largest known human skull holds nearly twice the measure of the smallest, a larger proportion than that in which man surpasses the gorilla; while, with proper allowance for difference of size of the various species, it appears that some of the lower apes fall nearly as much below the higher apes. The projection of the muzzle, which gives the character of brutality to the gorilla as distinguished from the man, is yet further exaggerated in the lemurs, as is also the backward position of the occipital foramen. In characters of such importance as the structure of the hand and foot, the lower apes diverge extremely from the gorilla; thus the thumb ceases to be opposable in the American monkeys, and in the marmosets is directed forwards, and armed with a curved claw like the other digits, the great toe in these latter being insignificant in proportion. The same argument can be extended to other points of anatomical structure, and, what is of more consequence, it appears true of the brain. A series of the apes, arranged from lower to higher orders, shows gradations from a brain little higher that that of a rat, to a brain like a small and imperfect imitation of a man's; and the greatest structural break in the series lies not between man and the man-like apes, but between the apes and monkeys on one side, and the lemurs on the other. On these grounds Huxley, restoring in principle the Linnean classification, desired to include man in the order of *Primates*. This order he divided into seven families: first, the *Anthropini*, consisting of man only; second, the *Catarhini* or Old World apes; third, the *Platyrhini*, all New World apes, except the marmosets; fourth, the *Arctopithecini*, or marmosets; fifth, the *Lemurini*, or lemurs; sixth and seventh, the *Cheiromyini* and *Galeopithecini*.

It is in assigning to man his place in nature on psychological grounds that the greater difficulty arises. Huxley acknowledged an immeasurable and practically infinite divergence, ending in the present enormous psychological gulf between ape and man. It is difficult to account for this intellectual chasm as due to some minor structural difference. The opinion is deeply rooted in modern as in ancient thought, that only a distinctively human element of the highest import can account for the severance between man and the highest animal below him. Differences in the mechanical organs, such as the perfection of the human hand as an instrument, or the adaptability of the human voice to the expression of human thought, are indeed of great value. But they have not of themselves such value, that to endow an ape with the hand and vocal organs of a man would be likely to raise it through any large part of the interval that now separates it from humanity. Much more is to be said for the view that man's larger and more highly organized brain accounts for those mental powers in which he so absolutely surpasses the brutes.

The distinction does not seem to lie principally in the range and delicacy of direct sensation, as may be judged from such well-known facts as man's inferiority to the eagle in sight, or to the dog in scent. At the same time, it seems that the human sensory organs may have in various respects acuteness beyond those of other creatures. But, beyond a doubt, man possesses, and in some way possesses by virtue of his superior brain, a power of co-ordinating the impressions of his senses, which enables him to understand the world he lives in, and by understanding to use, resist, and even in a measure rule it. No human art shows the nature of this human attribute more clearly than does language. Man shares with the mammalia and birds the direct expression of the feelings by emotional tones and interjectional cries; the parrot's power of articulate utterance almost equals his own; and, by association of ideas in some measure, some of the lower animals have even learnt to recognize words he utters. But, to use words in themselves unmeaning, as symbols by which to conduct and convey the complex intellectual processes in which mental conceptions are suggested, compared, combined, and even analysed, and new ones created – this is a faculty which is scarcely to be traced in any lower animal.

The view that this, with other mental processes, is a function of the brain, is remarkably corroborated by modern investigation of the disease of aphasia, where the power of thinking remains, but the power is lost of recalling the word corresponding to the thought, and this mental defect is found to accompany a diseased state of a particular locality of the brain (see APHASIA). This may stand among the most perfect of the many evidences that, in Professor Bain's words, "the brain is the principal, though not the sole organ of mind." As the brains of the vertebrate animals form an ascending scale, more and more approaching man's in their arrangement, the fact here finds its explanation, that lower animals perform mental processes corresponding in their nature to our own, though of generally less power and complexity. The full evidence of this correspondence will be found in such works as Brehm's *Thierleben*; and some of the salient points are set forth by Charles Darwin, in the chapter on "Mental Powers," in his *Descent of Man*. Such are the similar effects of terror on man and the lower animals, causing the muscles to tremble, the heart to palpitate, the sphincters to be relaxed, and the hair to stand on end. The phenomena of memory, as to both persons and places, is strong in animals, as is manifest by their recognition of their masters, and their returning at once to habits of which, though disused for many years, their brain has not lost the stored-up impressions. Such facts as that dogs "hunt in dreams," make it likely that their minds are not only sensible to actual events, present and past, but can, like our minds, combine revived sensations into ideal scenes in which they are actors,—that is to say, they have the faculty of imagination. As for the reasoning powers in animals, the accounts of monkeys learning by experience to break eggs carefully, and pick off bits of shell, so as not to lose the contents, or of the way in which rats or martens after a while can no longer be caught by the same kind of trap, with innumerable similar facts, show in the plainest way that the reason of animals goes so far as to form by new experience a new hypothesis of cause and effect which will henceforth guide their actions. The employment of mechanical instruments, of which instances of monkeys using sticks and stones furnish the only rudimentary traces among the lower animals, is one of the often-quoted distinctive powers of man. With this comes the whole vast and ever-widening range of inventive and adaptive art, where the uniform hereditary instinct of the cell-forming bee and the nest-building bird is supplanted by multiform processes and constructions, often at first rude and clumsy in comparison to those of the lower instinct, but carried on by the faculty of improvement and new invention into ever higher stages. "From the moment," writes A. R. Wallace (*Natural Selection*), "when the first skin was used as a covering, when the first rude spear was formed to assist in the chase, when fire was first used to cook his food, when the first seed was sown or shoot planted, a grand revolution was effected in nature, a revolution which in all the previous ages of the earth's history had had no parallel; for a being had arisen who was no longer necessarily subject to change with the changing universe,—a being who was in some degree superior to nature, inasmuch as he knew how to control and regulate her action, and could keep himself in harmony with her, not by a change in body, but by an advance of mind."

As to the lower instincts tending directly to self-preservation, it is acknowledged on all hands that man has them in a less developed state than other animals; in fact, the natural defencelessness of the human being, and the long-continued care and teaching of the young by the elders, are among the commonest themes of moral discourse. Parental tenderness and care for the young are strongly marked among the lower animals, though so inferior in scope and duration to the human qualities; and the same may be said of the mutual forbearance and defence which bind together in a rudimentary social bond the families and herds of animals. Philosophy seeking knowledge for its own sake; morality, manifested in the sense of truth, right, and virtue; and religion, the belief in and communion with superhuman powers ruling and pervading the universe, are human characters, of which it is instructive to trace, if possible, the earliest symptoms in the lower animals, but which can there show at most only faint and rudimentary signs of their wondrous development in mankind. That the tracing of physical and even intellectual continuity between the lower animals and our own race, does not necessarily lead the anthropologist to lower the rank of man in the scale of nature, may be shown by citing A. R. Wallace. Man, he considers, is to be placed "apart, as not only the head and culminating point of the grand series of organic nature, but as in some degree a new and distinct order of being."

To regard the intellectual functions of the brain and nervous system as alone to be considered in the psychological comparison of man with the lower animals, is a view satisfactory to those thinkers who hold materialistic views. According to this school, man is a machine, no doubt the most complex and wonderfully adapted of all known machines, but still neither more nor less than an instrument whose energy is provided by force from without, and which, when set in action, performs the various operations for which its structure fits it, namely, to live, move, feel, and think. This view, however, always has been strongly opposed by those who accept on theological grounds a spiritualistic doctrine, or what is, perhaps, more usual, a theory which combines spiritualism and materialism in the doctrine of a composite nature in man, animal as to the body and in some measure as to the mind, spiritual as to the soul. It may be useful, as an illustration of one opinion on this subject, to continue here the citation of Dr Prichard's comparison between man and the lower animals:—

> "If it be inquired in what the still more remarkable difference consists, it is by no means easy to reply. By some it will be said that man, while similar in the organization of his body to the lower tribes, is distinguished from them by the possession of an immaterial soul, a principle capable of conscious feeling, of intellect and thought. To many persons it will appear paradoxical to ascribe the endowment of a soul to the inferior tribes in the creation, yet it is difficult to discover a valid argument that limits the possession of an immaterial principle to man. The phenomena of feeling, of desire and aversion, of love and hatred, of fear and revenge, and the perception of external relations manifested in the life of brutes, imply, not only through the analogy which they display to the human faculties, but likewise from all that we can learn or conjecture of their particular nature, the superadded existence of a principle distinct from the mere mechanism of material bodies. That such a principle must exist in all beings capable of sensation, or of anything analogous to human passions and feelings, will hardly be denied by those who perceive the force of arguments which metaphysically demonstrate the immaterial nature of the mind. There may be no rational grounds for the ancient dogma that the souls of the lower animals were imperishable, like the soul of man: this is, however, a problem which we are not called upon to discuss; and we may venture to conjecture that there may be immaterial essences of divers kinds, and endowed with various attributes and capabilities. But the real nature of these unseen principles eludes our research: they are only known to us by their external manifestations. These manifestations are the various powers and capabilities, or rather the habitudes of action, which characterize the different orders of being, diversified according to their several destinations."

Dr Prichard here puts forward distinctly the time-honoured doctrine which refers the mental faculties to the operation of the soul. The view maintained by a distinguished comparative anatomist, Professor St George Mivart, in his *Genesis of Species*, ch. xii., may fairly follow. "Man, according to the old scholastic definition, is 'a rational animal' (*animal rationale*), and his animality is distinct in nature from his rationality, though inseparably joined, during life, in one common personality. Man's animal body must have had a different source from that of the spiritual soul which informs it, owing to the distinctness of the two orders to which those two existences severally belong." The two extracts just given, however, significant in themselves, fail to render an account of the view of the human constitution which would probably, among the theological and scholastic leaders of public opinion, count the largest weight of adherence. According to this view, not only life but thought are functions of the animal system, in which man excels all other animals as to height of organization: but beyond this, man embodies an immaterial and immortal spiritual principle which no lower creature possesses, and which makes the resemblance of the apes to him but a mocking simulance. To pronounce any absolute decision on these conflicting doctrines is foreign to our present purpose, which is to show that all of them count among their adherents men of high rank in science.

II. *Origin of Man.*—Opinion as to the genesis of man is divided between the theories of creation and evolution. In both schools, the ancient doctrine of the contemporaneous appearance on earth of all species of animals having been abandoned under the positive evidence of geology, it is admitted that the animal kingdom, past and present, includes a vast series of successive forms, whose appearances and disappearances have taken place at intervals during an immense lapse of ages. The line of inquiry has thus been directed to ascertaining what formative relation subsists among these species and genera, the last link of the argument reaching to the relation between man and the lower creatures preceding him in time. On both the theories here concerned it would be admitted, in the words of Agassiz (*Principles of Zoology*, pp. 205-206), that "there is a manifest progress in the succession of beings on the surface of the earth. This progress consists in an increasing similarity of the living fauna, and, among the vertebrates especially, in their increasing resemblance to man." Agassiz continues, however, in terms characteristic of the creationist school: "But this connexion is not the consequence of a direct lineage between the faunas of different ages. There is nothing like parental descent connecting them. The fishes of the Palaeozoic age are in no respect the ancestors of the reptiles of the Secondary age, nor does man descend from the mammals which preceded him in the Tertiary age. The link by which they are connected is of a higher and immaterial nature; and their connexion is to be sought in the view of the Creator himself, whose aim in forming the earth, in allowing it to undergo the successive changes which geology has pointed out, and in creating successively all the different types of animals which have passed away, was to introduce man upon the surface of our globe. Man is the end towards which all the animal creation has tended from the first appearance of the first Palaeozoic fishes." The evolutionist, on the contrary (see Evolution), maintains that different successive species of animals are in fact connected by parental descent, having become modified in the course of successive generations. The result of Charles Darwin's application of this theory to man may be given in his own words (*Descent of Man*, part i. ch. 6):—

> "The Catarhine and Platyrhine monkeys agree in a multitude of characters, as is shown by their unquestionably belonging to one and the same order. The many characters which they possess in common can hardly have been independently acquired by so many distinct species; so that these characters must have been inherited. But an ancient form which possessed many characters common to the Catarhine and Platyrhine monkeys, and others in an intermediate condition, and some few perhaps distinct from those now present in either group, would undoubtedly have been ranked, if seen by a naturalist, as an ape or a monkey. And as man under a genealogical point of view belongs to the Catarhine or Old World stock, we must conclude, however much the conclusion may revolt our pride, that our early progenitors would have been properly thus designated. But we must not fall into the error of supposing that the early progenitor of the whole Simian stock, including man, was identical with, or even closely resembled, any existing ape or monkey."

The problem of the origin of man cannot be properly discussed apart from the full problem of the origin of species. The homologies between man and other animals which both schools try to account for; the explanation of the intervals, with apparent want of intermediate forms, which seem to the creationists so absolute a separation between species; the evidence of useless "rudimentary organs," such as in man the external shell of the ear, and the muscle which enables some individuals to twitch their ears, which rudimentary parts the evolutionists claim to be only explicable as relics of an earlier specific condition,—these, which are the main points of the argument on the origin of man, belong to general biology. The philosophical principles which underlie the two theories stand for the most part in strong contrast, the theory of evolution tending toward the supposition of ordinary causes, such as "natural selection," producing modifications in species, whether by gradual accumulation or more sudden leaps, while the theory of creation has recourse to acts of supernatural intervention (see the duke of Argyll, *Reign of Law*, ch. v.). St George Mivart (*Genesis of Species*) propounded a theory of a natural evolution of man as to his body, combined with a supernatural creation as to his soul; but this attempt to meet the difficulties on both sides seems to have satisfied neither.

The wide acceptance of the Darwinian theory, as applied to the descent of man, has naturally roused anticipation that geological research, which provides evidence of the animal life of incalculably greater antiquity, would furnish fossil remains of some comparatively recent being intermediate between the anthropomorphic and the anthropic types. This expectation has hardly been fulfilled, but of late years the notion of a variety of the human race, geologically ancient, differing from any known in historic times, and with characters approaching the simian, has been supported by further discoveries. To bring this to the reader's notice, top and side views of three skulls, as placed together in the human development series in the Oxford University Museum, are represented in the plate, for the purpose of showing the great size of the orbital ridges, which the reader may contrast with his own by a touch with his fingers on his forehead. The first (fig. 3) is the famous Neanderthal skull from near Düsseldorf, described by Schaafhausen in Müller's *Archiv*, 1858; Huxley in Lyell, *Antiquity of Man*, p. 86, and in *Man's Place in Nature*. The second (fig. 4) is the skull from the cavern of Spy in Belgium (de Puydt and Lohest, *Compte rendu du Congrès de Namur*, 1886). The foreheads of these two skulls have an ape-like form, obvious on comparison with the simian skulls of the gorilla and other apes, and visible even in the small-scale figures in the Plate, fig. 2. Among modern tribes of mankind the forehead of the Australian aborigines makes the nearest approach to this type, as was pointed out by Huxley. This brief description will serve to show the importance of a later discovery. At Trinil, in Java, in an equatorial region where, if anywhere, a being intermediate between the higher apes and man would seem likely to be found, Dr Eugene Dubois in 1891–1892 excavated from a bed, considered by him to be of Sivalik formation (Pliocene), a thighbone which competent anatomists decide to be human, and a remarkably depressed calvaria or skull-cap (fig. 5), bearing a certain resemblance in its proportions to the corresponding part of the simian skull. These remains were referred by their discoverer to an animal intermediate between man and ape, to which he gave the name of *Pithecanthropus erectus* (*q.v.*), but the interesting discussions on the subject have shown divergence of opinion among anatomists. At any rate, classing the Trinil skull as human, it may be described as tending towards the simian type more than any other known.

III. *Races of Mankind.*—The classification of mankind into a number of permanent varieties or races, rests on grounds which are within limits not only obvious but definite. Whether from a popular or a scientific point of view, it would be admitted that a Negro, a Chinese, and an Australian belong to three such permanent varieties of men, all plainly distinguishable from one another and from any European. Moreover, such a division takes for granted the idea which is involved in the word race, that each of these varieties is due to special ancestry, each race thus representing an ancient breed or stock, however these breeds or stocks may have had their origin. The anthropological classification of mankind is thus zoological in its nature, like that of the varieties or species of any other animal group, and the characters on which it is based are in great measure physical, though intellectual and traditional peculiarities, such as moral habit and language, furnish important aid. Among the best-marked race-characters are the colour of the skin, eyes and hair; and the structure and arrangement of the latter. Stature is by no means a general criterion of race, and it would not, for instance, be difficult to choose groups of Englishmen, Kaffirs, and North American Indians, whose mean height should hardly differ. Yet in many cases it is a valuable means of distinction, as between the tall Patagonians and the stunted Fuegians, and even as a help in minuter problems, such as separating the

Teutonic and Celtic ancestry in the population of England (see Beddoe, "Stature and Bulk of Man in the British Isles," in *Mem. Anthrop. Soc. London*, vol. iii.). Proportions of the limbs, compared in length with the trunk, have been claimed as constituting peculiarities of African and American races; and other anatomical points, such as the conformation of the pelvis, have speciality. But inferences of this class have hardly attained to sufficient certainty and generality to be set down in the form of rules. The conformation of the skull is second only to the colour of the skin as a criterion for the distinction of race; and the position of the jaws is recognized as important, races being described as prognathous when the jaws project far, as in the Australian or Negro, in contradistinction to the orthognathous type, which is that of the ordinary well-shaped European skull. On this distinction in great measure depends the celebrated "facial angle," measured by Camper as a test of low and high races; but this angle is objectionable as resulting partly from the development of the forehead and partly from the position of the jaws. The capacity of the cranium is estimated in cubic measure by filling it with sand, &c., with the general result that the civilized white man is found to have a larger brain than the barbarian or savage. Classification of races on cranial measurements has long been attempted by eminent anatomists, and in certain cases great reliance may be placed on such measurements. Thus the skulls of an Australian and a Negro would be generally distinguished by their narrowness and the projection of the jaw from that of any Englishman; but the Australian skull would usually differ perceptibly from the Negroid in its upright sides and strong orbital ridges. The relation of height to breadth may also furnish a valuable test; but it is acknowledged by all experienced craniologists, that the shape of the skull may vary so much within the same tribe, and even the same family, that it must be used with extreme caution, and if possible only in conjunction with other criteria of race. The general contour of the face, in part dependent on the form of the skull, varies much in different races, among whom it is loosely defined as oval, lozenge-shaped, pentagonal, &c. Of particular features, some of the most marked contrasts to European types are seen in the oblique Chinese eyes, the broad-set Kamchadale cheeks, the pointed Arab chin, the snub Kirghiz nose, the fleshy protuberant Negro lips, and the broad Kalmuck ear. Taken altogether, the features have a typical character which popular observation seizes with some degree of correctness, as in the recognition of the Jewish countenance in a European city.

Were the race-characters constant in degree or even in kind, the classification of races would be easy; but this is not so. Every division of mankind presents in every character wide deviations from a standard. Thus the Negro race, well marked as it may seem at the first glance, proves on closer examination to include several shades of complexion and features, in some districts varying far from the accepted Negro type; while the examination of a series of native American tribes shows that, notwithstanding their asserted uniformity of type, they differ in stature, colour, features and proportions of skull. (See Prichard, *Nat. Hist. of Man*; Waitz, *Anthropology*, part i. sec. 5.) Detailed anthropological research, indeed, more and more justifies Blumenbach's words, that "innumerable varieties of mankind run into one another by insensible degrees." This state of things, due partly to mixture and crossing of races, and partly to independent variation of types, makes the attempt to arrange the whole human species within exactly bounded divisions an apparently hopeless task. It does not follow, however, that the attempt to distinguish special races should be given up, for there at least exist several definable types, each of which so far prevails in a certain population as to be taken as its standard. L. A. J. Quetelet's plan of defining such types will probably meet with general acceptance as the scientific method proper to this branch of anthropology. It consists in the determination of the standard or typical "mean man" (*homme moyen*) of a population, with reference to any particular quality, such as stature, weight, complexion, &c. In the case of stature, this would be done by measuring a sufficient number of men, and counting how many of them belong to each height on the scale. If it be thus ascertained, as it might be in an English district, that the 5 ft. 7 in. men form the most numerous group, while the 5 ft. 6 in. and 5 ft. 8 in. men are less in number, and the 5 ft. 5 in. and 5 ft. 9 in. still fewer, and so on until the extremely small number of extremely short or tall individuals of 5 ft. or 7 ft. is reached, it will thus be ascertained that the stature of the mean or typical man is to be taken as 5 ft. 7 in. The method is thus that of selecting as the standard the most numerous group, on both sides of which the groups decrease in number as they vary in type. Such classification may show the existence of two or more types, in a community, as, for instance, the population of a Californian settlement made up of Whites and Chinese might show two predominant groups (one of 5 ft. 8 in., the other of 5 ft. 4 in.) corresponding to these two racial types. It need hardly be said that this method of determining the mean type of a race, as being that of its really existing and most numerous class, is altogether superior to the mere calculation of an average, which may actually be represented by comparatively few individuals, and those the exceptional ones. For instance, the average stature of the mixed European and Chinese population just referred to might be 5 ft. 6 in.—a worthless and indeed misleading result. (For particulars of Quetelet's method, see his *Physique sociale* (1869), and *Anthropométrie* (1871).)

Classifications of man have been numerous, and though, regarded as systems, most of them are unsatisfactory, yet they have been of great value in systematizing knowledge, and are all more or less based on indisputable distinctions. J. F. Blumenbach's division, though published as long ago as 1781, has had the greatest influence. He reckons five races, viz. Caucasian, Mongolian, Ethiopian, American, Malay. The ill-chosen name of Caucasian, invented by Blumenbach in allusion to a South Caucasian skull of specially typical proportions, and applied by him to the so-called white races, is still current; it brings into one race peoples such as the Arabs and Swedes, although these are scarcely less different than the Americans and Malays, who are set down as two distinct races. Again, two of the best-marked varieties of mankind are the Australians and the Bushmen, neither of whom, however, seems to have a natural place in Blumenbach's series. The yet simpler classification by Cuvier into Caucasian, Mongol and Negro corresponds in some measure with a division by mere complexion into white, yellow and black races; but neither this threefold division, nor the ancient classification into Semitic, Hamitic and Japhetic nations can be regarded as separating the human types either justly or sufficiently (see Prichard, *Natural History of Man*, sec. 15; Waitz, *Anthropology*, vol. i. part i. sec. 5). Schemes which set up a larger number of distinct races, such as the eleven of Pickering, the fifteen of Bory de St Vincent and the sixteen of Desmoulins, have the advantage of finding niches for most well-defined human varieties; but no modern naturalist would be likely to adopt any one of these as it stands. In criticism of Pickering's system, it is sufficient to point out that he divides the white nations into two races, entitled the Arab and the Abyssinian (Pickering, *Races of Man*, ch. i.). Agassiz, Nott, Crawfurd and others who have assumed a much larger number of races or species of man, are not considered to have satisfactorily defined a corresponding number of distinguishable types. On the whole, Huxley's division probably approaches more nearly than any other to such a tentative classification as may be accepted in definition of the principal varieties of mankind, regarded from a zoological point of view, though anthropologists may be disposed to erect into separate races several of his widely-differing sub-races. He distinguishes four principal types of mankind, the Australioid, Negroid, Mongoloid and Xanthochroic ("fair whites"), adding a fifth variety, the Melanochroic ("dark whites").

In determining whether the races of mankind are to be classed as varieties of one species, it is important to decide whether every two races can unite to produce fertile offspring. It is settled by experience that the most numerous and well-known crossed races, such as the Mulattos, descended from Europeans and Negroes—the Mestizos, from Europeans and American indigenes—the Zambos, from these American indigenes and Negroes, &c., are permanently fertile. They practically constitute sub-races, with a general blending of the characters of the two parents, and only differing from fully-established races in more or less tendency to revert to one or other of the original types. It has been argued, on the other hand, that not all such mixed breeds are permanent, and especially that the cross between Europeans and Australian indigenes is almost sterile; but this assertion, when examined with the care demanded by its bearing on the general question of hybridity, has distinctly broken down. On the whole, the general evidence favours the opinion that any two races may combine to produce a new sub-race, which again may combine with any other variety. Thus, if the existence of a small number of distinct races of mankind be taken as a starting-point, it is obvious that their crossing would produce an indefinite number of secondary varieties, such as the population of the world actually presents. The working out in detail of the problem, how far the differences among complex nations, such as those of Europe, may have been brought about by hybridity, is still, however, a task of almost hopeless intricacy. Among the boldest attempts to account for distinctly-marked populations as resulting from the intermixture of two races, are Huxley's view that the Hottentots are hybrid between the Bushmen and the Negroes, and his more important suggestion, that the Melanochroic peoples of southern Europe are of mixed Xanthochroic and Australioid stock.

The problem of ascertaining how the small number of races, distinct enough to be called primary, can have assumed their different types, has been for years the most disputed field of anthropology, the battle-ground of the rival schools of monogenists and polygenists. The one has claimed all mankind to be descended from one original stock, and generally from a single pair; the other has contended for the several primary races being separate species of independent origin. The great problem of the monogenist theory is to explain by what course of variation the so different races of man have arisen from a single stock. In ancient times little difficulty was felt in this, authorities such as Aristotle and Vitruvius seeing in climate and circumstance the natural cause of racial differences, the Ethiopian having been blackened by the tropical sun, &c. Later and closer observations, however, have shown such influences to be, at any rate, far slighter in amount and slower in operation than was once supposed. A. de Quatrefages brings forward (*Unité de l'espèce humaine*) his strongest arguments for the variability of races under change of climate, &c. (*action du milieu*), instancing the asserted alteration in complexion, constitution and character of Negroes in America, and Englishmen in America and Australia. But although the reality of some such modification is not disputed, especially as to stature and constitution, its amount is not enough to upset the counter-proposition of the remarkable permanence of type displayed by races ages after they have been transported to climates extremely different from that of their former home. Moreover, physically different peoples, such as the Bushmen and Negroes in Africa, show no signs of approximation under the influence of the same climate; while, on the other hand, the coast tribes of Tierra del Fuego and forest tribes of tropical Brazil continue to resemble one another, in spite of extreme differences of climate and food. Darwin is moderate in his estimation of the changes produced on races of man by climate and mode of life within the range of history (*Descent of Man*, part i. ch. 4 and 7). The slightness and slowness of variation in human races having become known, a great difficulty of the monogenist theory was seen to lie in the apparent shortness of the Biblical chronology. Inasmuch as several well-marked races of mankind, such as the Egyptian, Phoenician, Ethiopian, &c., were much the same three or four thousand years ago as now, their variation from a single stock in the course of any like period could hardly be accounted for without a miracle. This difficulty the polygenist theory escaped, and in consequence it gained ground. Modern views have however tended to restore, though under a new aspect, the doctrine of a single human stock. The fact that man has existed during a vast period of time makes it more easy to assume the continuance of very slow natural variation as having differentiated even the white man and the Negro among the descendants of a common progenitor. On the other hand it does not follow necessarily from a theory of evolution of species that mankind must have descended from a single stock, for the hypothesis of development admits of the argument, that several simian species may have culminated in several races of man. The general tendency of the development theory, however, is against constituting separate species where the differences are moderate enough to be accounted for as due to variation from a single type. Darwin's summing-up of the evidence as to unity of type throughout the races of mankind is as distinctly a monogenist argument as those of Blumenbach, Prichard or Quatrefages—

> "Although the existing races of man differ in many respects, as in colour, hair, shape of skull, proportions of the body, &c., yet, if their whole organization be taken into consideration, they are found to resemble each other closely in a multitude of points. Many of these points are of so unimportant, or of so singular a nature, that it is extremely improbable that they should have been independently acquired by aboriginally distinct species or races. The same remark holds good with equal or greater force with respect to the numerous points of mental similarity between the most distinct races of man. . . . Now, when naturalists observe a close agreement in numerous small details of habits, tastes and dispositions between two or more domestic races, or between nearly allied natural forms, they use this fact as an argument that all are descended from a common progenitor who was thus endowed; and, consequently, that all should be classed under the same species. The same argument may be applied with much force to the races of man."—(Darwin, *Descent of Man*, part i. ch. 7.)

The main difficulty of the monogenist school has ever been to explain how races which have remained comparatively fixed in type during the long period of history, such as the white man and the Negro, should, in even a far longer period, have passed by variation from a common original. To meet this A. R. Wallace suggests that the remotely ancient representatives of the human species, being as yet animals too low in mind to have developed those arts of maintenance and social ordinances by which man holds his own against influences from climate and circumstance, were in their then wild state much more plastic than now to external nature; so that "natural selection" and other causes met with but feeble resistance in forming the permanent varieties or races of man, whose complexion and structure still remained fixed in their descendants (see Wallace, *Contributions to the Theory of Natural Selection*, p. 319). On the whole, it may be asserted that the doctrine of the unity of mankind stands on a firmer basis than in previous ages. It would be premature to judge how far the problem of the origin of races may be capable of exact solution; but the experience gained since 1871 countenances Darwin's prophecy that before long the dispute between the monogenists and the polygenists would die a silent and unobserved death.

IV. *Antiquity of Man.*—Until the 19th century man's first appearance on earth was treated on a historical basis as matter of record. It is true that the schemes drawn up by chronologists differed widely, as was natural, considering the variety and inconsistency of their documentary data. On the whole, the scheme of Archbishop Usher, who computed that the earth and man were created in 4004 B.C., was the most popular (see CHRONOLOGY). It is no longer necessary, however, to discuss these chronologies. Geology has made it manifest that our earth must have been the seat of vegetable and animal life for an immense period of time; while the first appearance of man, though comparatively recent, is positively so remote, that an estimate between twenty and a hundred thousand years may fairly be taken as a minimum. This geological claim for a vast antiquity of the human race is supported by the similar claims of prehistoric archaeology and the science of culture, the evidence of all three departments of inquiry being intimately connected, and in perfect harmony.

Human bones and objects of human manufacture have been found in such geological relation to the remains of fossil species of elephant, rhinoceros, hyena, bear, &c., as to lead to the distinct inference that man already existed at a remote period in localities where these mammalia are now and have long been extinct. The not quite conclusive researches of Tournal and Christol in limestone caverns of the south of France date back to 1828. About the same time P. C. Schmerling of Liége was exploring the ossiferous caverns of the valley of the Meuse, and satisfied himself that the men whose bones he found beneath the stalagmite floors, together with bones cut and flints shaped by human workmanship, had inhabited this Belgian district at the same time with the cave-bear and several other extinct animals whose bones were imbedded with them (*Recherches sur les ossements fossiles découverts dans les cavernes de la province de Liége* (Liége, 1833–1834)). This evidence, however, met with little acceptance among scientific men. Nor, at first, was more credit given to the discovery by M. Boucher de Perthes, about 1841, of rude flint hatchets in a sand-bed containing remains of mammoth and rhinoceros at Menchecourt near Abbeville, which first find was followed by others in the same district (see Boucher de Perthes, *De l'Industrie primitive, ou les arts à leur origine* (1846); *Antiquités celtiques et antédiluviennes* (Paris, 1847), &c.). Between 1850 and 1860 French and English geologists were induced to examine into the facts, and found irresistible the evidence that man existed and used rude implements of chipped flint during the Quaternary or Drift period. Further investigations were then made, and overlooked results of older ones reviewed. In describing Kent's Cavern (*q.v.*) near Torquay, R. A. C. Godwin-Austen had maintained, as early as 1840 (*Proc. Geo. Soc. London*, vol. iii. p. 286), that the human bones and worked flints had been deposited indiscriminately together with the remains of fossil elephant, rhinoceros, &c. Certain caves and rock-shelters in the province of Dordogne, in central France, were examined by a French and an English archaeologist, Edouard Lartet and Henry Christy, the remains discovered showing the former prevalence of the reindeer in this region, at that time inhabited by savages, whose bone and stone implements indicate a habit of life similar to that of the Eskimos. Moreover, the co-existence of man with a fauna now extinct or confined to other districts was brought to yet clearer demonstration by the discovery in these caves of certain drawings and carvings of the animals done by the ancient inhabitants themselves, such as a group of reindeer on a piece of reindeer horn, and a sketch of a mammoth, showing the elephant's long hair, on a piece of a mammoth's tusk from La Madeleine (Lartet and Christy, *Reliquiae Aquitanicae*, ed. by T. R. Jones (London, 1865), &c.).

This and other evidence (which is considered in more detail in the article ARCHAEOLOGY) is now generally accepted by geologists as carrying back the existence of man into the period of the post-glacial drift, in what is now called the Quaternary period, an antiquity at least of tens of thousands of years. Again, certain inferences have been tentatively made from the depth of mud, earth, peat, &c., which has accumulated above relics of human art imbedded in ancient times. Among these is the argument from the numerous borings made in the alluvium of the Nile valley to a depth of 60 ft., where down to the lowest level fragments of burnt brick and pottery were always found, showing that people advanced enough in the arts to bake brick and pottery have inhabited the valley during the long period required for the Nile inundations to deposit 60 ft. of mud, at a rate probably not averaging more than a few inches in a century. Another argument is that of Professor von Morlot, based on a railway section through a conical accumulation of gravel and alluvium, which the torrent of the Tinière has gradually built up where it enters the Lake of Geneva near Villeneuve. Here three layers of vegetable soil appear, proved by the objects imbedded in them to have been the successive surface soils in two prehistoric periods and in the Roman period, but now lying 4, 10 and 19 ft. underground. On this it is computed that if 4 ft. of soil were formed in the 1500 years since the Roman period, we must go 5000 years farther back for the date of the earliest human inhabitants. Calculations of this kind, loose as they are, deserve attention.

The interval between the Quaternary or Drift period and the period of historical antiquity is to some extent bridged over by relics of various intermediate civilizations, *e.g.* the Lake dwellings (*q.v.*) of Switzerland, mostly of the lower grades, and in some cases reaching back to remote dates. And further evidence of man's antiquity is afforded by the kitchen-middens or shell-heaps (*q.v.*), especially those in Denmark. Danish peat-mosses again show the existence of man at a time when the Scotch fir was abundant; at a later period the firs were succeeded by oaks, which have again been almost superseded by beeches, a succession of changes which indicate a considerable lapse of time.

Lastly, chronicles and documentary records, taken in connexion with archaeological relics of the historical period, carry back into distant ages the starting-point of actual history, behind which lies the evidently vast period only known by inferences from the relations of languages and the stages of development of civilization. The most recent work of Egyptologists proves a systematic civilization to have existed in the valley of the Nile at least 6000 to 7000 years ago (see CHRONOLOGY).

It was formerly held that the early state of society was one of comparatively high culture, and thus there was no hesitation in assigning the origin of man to a time but little beyond the range of historical records and monuments. But the researches of anthropologists in recent years have proved that the civilization of man has been gradually developed from an original stone-age culture, such as characterizes modern savage life. To the 6000 years to which ancient civilization dates back must be added a vast period during which the knowledge, arts and institutions of such a civilization as that of ancient Egypt attained the high level evidenced by the earliest records. The evidence of comparative philology supports the necessity for an enormous time allowance. Thus, Hebrew and Arabic are closely related languages, neither of them the original of the other, but both sprung from some parent language more ancient than either. When, therefore, the Hebrew records have carried back to the most ancient admissible date the existence of the Hebrew language, this date must have been long preceded by that of the extinct parent language of the whole Semitic family; while this again was no doubt the descendant of languages slowly shaping themselves through ages into this peculiar type. Yet more striking is the evidence of the Indo-European (formerly called Aryan) family of languages. The Hindus, Medes, Persians, Greeks, Romans, Germans, Celts and Slavs make their appearance at more or less remote dates as nations separate in language as in history. Nevertheless, it is now acknowledged that at some far remoter time, before these nations were divided from the parent stock, and distributed over Asia and Europe, a single barbaric people stood as physical and political representative of the nascent Aryan race, speaking a now extinct Aryan language, from which, by a series of modifications not to be estimated as possible within many thousands of years, there arose languages which have been mutually unintelligible since the dawn of history, and between which it was only possible for an age of advanced philology to trace the fundamental relationship.

From the combination of these considerations, it will be seen that the farthest date to which documentary or other records extend is now generally regarded by anthropologists as but the earliest distinctly visible point of the historic period, beyond which stretches back a vast indefinite series of prehistoric ages.

V. *Language.*—In examining how the science of language bears on the general problems of anthropology, it is not necessary to discuss at length the critical questions which arise, the principal of which are considered elsewhere (see LANGUAGE). Philology is especially appealed to by anthropologists as contributing to the following lines of argument. A primary mental similarity of all branches of the human race is evidenced by their common faculty of speech, while at the same time secondary diversities of race-character and history are marked by difference of grammatical structure and of vocabularies. The existence of groups or families of allied languages, each group being evidently descended from a single language, affords one of the principal aids in classifying nations and races. The adoption by one language of words originally belonging to another, proving as it does the fact of intercourse between two races, and even to some extent indicating the results of such intercourse, affords a valuable clue through obscure regions of the history of civilization.

Communication by gesture-signs, between persons unable to converse in vocal language, is an effective system of expression common to all mankind. Thus, the signs used to ask a deaf and dumb child about his meals and lessons, or to communicate with a savage met in the desert about game or enemies, belong to codes of gesture-signals identical in principle, and to a great extent independent both of nationality and education; there is even a natural syntax, or order of succession, in such gesture-signs. To these gestures let there be added the use of the interjectional cries, such as *oh! ugh! hey!* and imitative sounds to represent the cat's *mew*, the *click* of a trigger, the *clap* or *thud* of a blow, &c. The total result of this combination of gesture and significant sound will be a general system of expression, imperfect but serviceable, and naturally intelligible to all mankind without distinction of race. Nor is such a system of communication only theoretically conceivable; it is, and always has been, in practical operation between people ignorant of one another's language, and as such is largely used in the intercourse of savage tribes. It is true that to some extent these means of utterance are common to the lower animals, the power of expressing emotion by cries and tones extending far down in the scale of animal life, while rudimentary gesture-signs are made by various mammals and birds. Still, the lower animals make no approach to the human system of natural utterance by gesture-signs and emotional-imitative sounds, while the practical identity of this human system among races physically so unlike as the Englishman and the native of the Australian bush indicates extreme closeness of mental similarity throughout the human species.

When, however, the Englishman and the Australian speak each in his native tongue, only such words as belong to the interjectional and imitative classes will be naturally intelligible, and as it were instinctive to both. Thus the savage, uttering the sound *waow!* as an explanation of surprise and warning, might be answered by the white man with the not less evidently significant *sh!* of silence, and the two speakers would be on common ground when the native indicated by the name *bwirri* his cudgel, flung *whirring* through the air at a flock of birds, or when the native described as a *jakkal-yakkal* the bird called by the foreigner a *cockatoo.* With these, and other very limited classes of natural words, however, resemblance in vocabulary practically ceases. The Australian and English languages each consist mainly of a series of words having no apparent connexion with the ideas they signify, and differing utterly; of course, accidental coincidences and borrowed words must be excluded from such comparisons. It would be easy to enumerate other languages of the world, such as Basque, Turkish, Hebrew, Malay, Mexican, all devoid of traceable resemblance to Australian and English, and to one another. There is, moreover, extreme difference in the grammatical structure both of words and sentences in various languages. The question then arises, how far the employment of different vocabularies, and that to a great extent on different grammatical principles, is compatible with similarity of the speakers' minds, or how far does diversity of speech indicate diversity of mental nature? The obvious answer is, that the power of using words as signs to express thoughts with which their sound does not directly connect them, in fact as arbitrary symbols, is the highest grade of the special human faculty in language, the presence of which binds together all races of mankind in substantial mental unity. The measure of this unity is, that any child of any race can be brought up to speak the language of any other race.

Under the present standard of evidence in comparing languages and tracing allied groups to a common origin, the crude speculations as to a single primeval language of mankind, which formerly occupied so much attention, are acknowledged to be worthless. Increased knowledge and accuracy of method have as yet only left the way open to the most widely divergent suppositions. For all that known dialects prove to the contrary, on the one hand, there may have been one primitive language, from which the descendant languages have varied so widely, that neither their words nor their formation now indicate their unity in long past ages, while, on the other hand, the primitive tongues of mankind may have been numerous, and the extreme unlikeness of such languages as Basque, Chinese, Peruvian, Hottentot and Sanskrit may arise from absolute independence of origin.

The language spoken by any tribe or nation is not of itself absolute evidence as to its race-affinities. This is clearly shown in extreme cases. Thus the Jews in Europe have almost lost the use of Hebrew, but speak as their vernacular the language of their adopted nation, whatever it may be; even the Jewish-German dialect, though consisting so largely of Hebrew words, is philologically German, as any sentence shows: "*Ich hab noch hoiom lo geachelt,*" "I have not yet eaten to-day." The mixture of the Israelites in Europe by marriage with other nations is probably much greater than is acknowledged by them; yet, on the whole, the race has been preserved with extraordinary strictness, as its physical characteristics sufficiently show. Language thus here fails conspicuously as a test of race and even of national history. Not much less conclusive is the case of the predominantly Negro populations of the West India Islands, who, nevertheless, speak as their native tongues dialects of English or French, in which the number of intermingled native African words is very scanty: "*Dem hitti netti na ini watra bikasi dem de fisiman,*" "They cast a net into the water, because they were fishermen." (Surinam Negro-Eng.) "*Bef pas ca jamain lasse poter cônes li,*" "Le bœuf n'est jamais las de porter ses cornes." (Haitian Negro-Fr.) If it be objected that the linguistic conditions of these two races are more artificial than has been usual in the history of the world, less extreme cases may be seen in countries where the ordinary results of conquest-colonization have taken place. The Mestizos, who form so large a fraction of the population of modern Mexico, numbering several millions, afford a convenient test in this respect, inasmuch as their intermediate complexion separates them from both their ancestral races, the Spaniard, and the chocolate-brown indigenous Aztec or other Mexican. The mother-tongue of this mixed race is Spanish, with an infusion of Mexican words; and a large proportion cannot speak any native dialect. In most or all nations of mankind, crossing or intermarriage of races has thus taken place between the conquering invader and the conquered native, so that the language spoken by the nation may represent the results of conquest as much or more than of ancestry. The supersession of the Celtic Cornish by English, and of the Slavonic Old-Prussian by German, are but examples of a process which has for untold ages been supplanting native dialects, whose very names have mostly disappeared. On the other hand, the language of the warlike invader or peaceful immigrant may yield, in a few generations, to the tongue of the mass of the population, as the Northman's was replaced by French, and modern German gives way to English in the United States. Judging, then, by the extirpation and adoption of languages within the range of history, it is obvious that to classify mankind into races, Aryan, Semitic, Turanian, Polynesian, Kaffir, &c., on the mere evidence of language, is intrinsically unsound.

VI. *Development of Civilization.*—The conditions of man at the lowest and highest known levels of culture are separated by a vast interval; but this interval is so nearly filled by known intermediate stages, that the line of continuity between the lowest savagery and the highest civilization is unbroken at any critical point.

An examination of the details of savage life shows not only that there is an immeasurable difference between the rudest man and the highest lower animal, but also that the least cultured savages have themselves advanced far beyond the lowest intellectual and moral state at which human tribes can be conceived as capable of existing, when placed under favourable circumstances of warm climate, abundant food, and security from too severe destructive influences. The Australian black-fellow or the forest Indian of Brazil, who may be taken as examples of the lowest modern savage, had, before contact with whites, attained to rudimentary stages in many of the characteristic functions of civilized life. His language, expressing thoughts by conventional articulate sounds, is the same in essential principle as the most cultivated philosophic dialect, only less exact and copious. His weapons, tools and other appliances such as the hammer, hatchet, spear, knife, awl, thread, net, canoe, &c., are the evident rudimentary analogues of what still remains in use among Europeans. His structures, such as the hut, fence, stockade, earthwork, &c., may be poor and clumsy, but they are of the same nature as our own. In the simple arts of broiling and roasting meat, the use of hides and furs for covering, the plaiting of mats and baskets, the devices of hunting, trapping and fishing, the pleasure taken in personal ornament, the touches of artistic decoration on objects of daily use, the savage differs in degree but not in kind from the civilized man. The domestic and social affections, the kindly care of the young and the old, some acknowledgment of marital and parental obligation, the duty of mutual defence in the tribe, the authority of the elders, and general respect to traditional custom as the regulator of life and duty, are more or less well marked in every savage tribe which is not disorganized and falling to pieces. Lastly, there is usually to be discerned amongst such lower races a belief in unseen powers pervading the universe, this belief shaping itself into an animistic or spiritualistic theology, mostly resulting in some kind of worship. If, again, high savage or low barbaric types be selected, as among the North American Indians, Polynesians, and Kaffirs of South Africa, the same elements of culture appear, but at a more advanced stage, namely, a more full and accurate language, more knowledge of the laws of nature, more serviceable implements, more perfect industrial processes, more definite and fixed social order and frame of government, more systematic and philosophic schemes of religion and a more elaborate and ceremonial worship. At intervals new arts and ideas appear, such as agriculture and pasturage, the manufacture of pottery, the use of metal implements and the device of record and communication by picture writing. Along such stages of improvement and invention the bridge is fairly made between savage and barbaric culture; and this once attained to, the remainder of the series of stages of civilization lies within the range of common knowledge.

The teaching of history, during the three to four thousand years of which contemporary chronicles have been preserved, is that civilization is gradually developed in the course of ages by enlargement and increased precision of knowledge, invention and improvement of arts, and the progression of social and political habits and institutions towards general well-being. That processes of development similar to these were in prehistoric times effective to raise culture from the savage to the barbaric level, two considerations especially tend to prove. First, there are numerous points in the culture even of rude races which are not explicable otherwise than on the theory of development. Thus, though difficult or superfluous arts may easily be lost, it is hard to imagine the abandonment of contrivances of practical daily utility, where little skill is required and materials are easily accessible. Had the Australians or New Zealanders, for instance, ever possessed the potter's art, they could hardly have forgotten it. The inference that these tribes represent the stage of culture before the invention of pottery is confirmed by the absence of buried fragments of pottery in the districts they inhabit. The same races who were found making thread by the laborious process of twisting with the hand, would hardly have disused, if they had ever possessed, so simple a labour-saving device as the spindle, which consists merely of a small stick weighted at one end; the spindle may, accordingly, be regarded as an instrument invented somewhere between the lowest and highest savage levels (Tylor, *Early Hist. of Mankind*, p. 193). Again, many devices of civilization bear unmistakable marks of derivation from a lower source; thus the ancient Egyptian and Assyrian harps, which differ from ours in having no front pillar, appear certainly to owe this remarkable defect to having grown up through intermediate forms from the simple strung bow, the still used type of the most primitive stringed instrument. In this way the history of numeral words furnishes actual proof of that independent intellectual progress among savage tribes which some writers have rashly denied. Such words as *hand, hands, foot, man*, &c., are used as numerals signifying 5, 10, 15, 20, &c., among many savage and barbaric peoples; thus Polynesian *lima, i.e.* "hand," means 5; Zulu *tatisitupa, i.e.* "taking the thumb," means 6; Greenlandish *arfersanek-pingasut, i.e.* "on the other foot three," means 18; Tamanac *tevin itoto, i.e.* "one man," means 20, &c., &c. The existence of such expressions demonstrates that the people who use them had originally no spoken names for these numbers, but once merely counted them by gesture on their fingers and toes in low savage fashion, till they obtained higher numerals by the inventive process of describing in words these counting-gestures. Second, the process of "survival in culture" has caused the preservation in each stage of society of phenomena belonging to an earlier period, but kept up by force of custom into the later, thus supplying evidence of the modern condition being derived from the ancient. Thus the mitre over an English bishop's coat-of-arms is a survival which indicates him as the successor of bishops who actually wore mitres, while armorial bearings themselves, and the whole craft of heraldry, are survivals bearing record of a state of warfare and social order whence our present state was by vast modification evolved. Evidence of this class, proving the derivation of modern civilization, not only from ancient barbarism, but beyond this, from primeval savagery, is immensely plentiful, especially in rites and ceremonies, where the survival of ancient habits is peculiarly favoured. Thus the modern Hindu, though using civilized means for lighting his household fires, retains the savage "fire-drill" for obtaining fire by friction of wood when what he considers pure or sacred fire has to be produced for sacrificial purposes; while in Europe into modern times the same primitive process has been kept up in producing the sacred and magical "need-fire," which was lighted to deliver cattle from a murrain. Again, the funeral offerings of food, clothing, weapons, &c., to the dead are absolutely intelligible and purposeful among savage races, who believe that the souls of the departed are ethereal beings capable of consuming food, and of receiving and using the souls or phantoms of any objects sacrificed for their use. The primitive philosophy to which these conceptions belong has to a great degree been discredited by modern science; yet the clear survivals of such ancient and savage rites may still be seen in Europe, where the Bretons leave the remains of the All Souls' supper on the table for the ghosts of the dead kinsfolk to partake of, and Russian peasants set out cakes for the ancestral manes on the ledge which supports the holy pictures, and make dough ladders to assist the ghosts of the dead to ascend out of their graves and start on their journey for the future world; while other provision for the same spiritual journey is made when the coin is still put in the hand of the corpse at an Irish wake. In like manner magic still exists in the civilized world as a survival from the savage and barbaric times to which it originally belongs, and in which is found the natural source and proper home of utterly savage practices still carried on by ignorant peasants in Great Britain, such as taking omens from the cries of animals, or bewitching an enemy by sticking full of pins and hanging up to shrivel in the smoke an image or other object, that similar destruction may fall on the hated person represented by the symbol (Tylor, *Primitive Culture*, ch. i., iii., iv., xi., xii.; *Early Hist. of Man*, ch. vi.).

The comparative science of civilization thus not only generalizes the data of history, but supplements its information by laying down the lines of development along which the lowest prehistoric culture has gradually risen to the highest modern level. Among the most clearly marked of these lines is that which follows the succession of the Stone, Bronze, and Iron Ages (see ARCHAEOLOGY). The Stone Age represents the early condition of mankind in general, and has remained in savage districts up to modern times, while the introduction of metals need not at once supersede the use of the old stone hatchets and arrows, which have often long continued in dwindling survival by the side of the new bronze and even iron ones. The Bronze Age had its most important place among ancient nations of Asia and Europe, and among them was only succeeded after many centuries by the Iron Age; while in other districts, such as Polynesia and Central and South Africa, and America (except Mexico and Peru), the native tribes were moved directly from the Stone to the Iron Age without passing through the Bronze Age at all. Although the three divisions of savage, barbaric, and civilized man do not correspond at all perfectly with the Stone, Bronze, and Iron Ages, this classification of civilization has proved of extraordinary value in arranging in their proper order of culture the nations of the Old World.

Another great line of progress has been followed by tribes passing from the primitive state of the wild hunter, fisher and fruit-gatherer to that of the settled tiller of the soil, for to this change of habit may be plainly in great part traced the expansion of industrial arts and the creation of higher social and political institutions. These, again, have followed their proper lines along the course of time. Among such is the immense legal development by which the primitive law of personal vengeance passed gradually away, leaving but a few surviving relics in the modern civilized world, and being replaced by the higher doctrine that crime is an offence against society, to be repressed for the public good. Another vast social change has been that from the patriarchal condition, in which the unit is the family under the despotic rule of its head, to the systems in which individuals make up a society whose government is centralized in a chief or king. In the growth of systematic civilization, the art of writing has had an influence so intense, that of all tests to distinguish the barbaric from the civilized state, none is so generally effective as this, whether they have but the failing link with the past which mere memory furnishes, or can have recourse to written records of past history and written constitutions of present order. Lastly, still following the main lines of human culture, the primitive germs of religious institutions have to be traced in the childish faith and rude rites of savage life, and thence followed in their expansion into the vast systems administered by patriarchs and priests, henceforth taking under their charge the precepts of morality, and enforcing them under divine sanction, while also exercising in political life an authority beside or above the civil law.

The state of culture reached by Quaternary man is evidenced by the stone implements in the drift-gravels, and other relics of human art in the cave deposits. His drawings on bone or tusk found in the caves show no mean artistic power, as appears by the three specimens copied in the Plate. That representing two deer (fig. 6) was found so early as 1852 in the breccia of a limestone cave on the Charente, and its importance recognized in a remarkable letter by Prosper Merimée, as at once historically ancient and geologically modern (*Congrès d'anthropologie et d'archéologie préhistoriques*, Copenhagen (1869), p. 128). The other two are the famous mammoth from the cave of La Madeleine, on which the woolly mane and huge tusks of *Elephas primigenius* are boldly drawn (fig. 7); and the group of man and horses (fig. 8). There has been found one other contemporary portrait of man, where a hunter is shown stalking an aurochs.

That the men of the Quaternary period knew the savage art of producing fire by friction, and roasted the flesh on which they mainly subsisted, is proved by the fragments of charcoal found in the cave deposits, where also occur bone awls and needles, which indicate the wearing of skin clothing, like that of the modern Australians and Fuegians. Their bone lance-heads and dart-points were comparable to those of northern and southern savages. Particular attention has to be given to the stone implements used by these earliest known of mankind. The division of tribes in the stone implement stage into two classes, the Palaeolithic or Old Stone Age, and the Neolithic or New Stone Age, according to their proficiency in this most important art furnishes in some respects the best means of determining their rank in general culture.

In order to put this argument clearly before the reader, a few selected implements are figured in the Plate. The group in fig. 9 contains tools and weapons of the Neolithic period such as are dug up on European soil; they are evident relics of ancient populations who used them till replaced by metal. The stone hatchets are symmetrically shaped and edged by grinding, while the cutting flakes, scrapers, spear and arrow heads are of high finish. Direct knowledge of the tribes who made them is scanty, but implements so similar in make and design having been in use in North and South America until modern times, it may be assumed for purposes of classification that the Neolithic peoples of the New World were at a similar barbarous level in industrial arts, social organization, moral and religious ideas. Such comparison, though needing caution and reserve, at once proved of great value to anthropology. When, however, there came to light from the drift-gravels and limestone caves of Europe the Palaeolithic implements, of which some types are shown in the group (fig. 10), the difficult problem presented itself, what degree of general culture these rude implements belonged to. On mere inspection, their rudeness, their unsuitability for being hafted, and the absence of shaping and edging by the grindstone, mark their inferiority to the Neolithic implements. Their immensely greater antiquity was proved by their geological position and their association with a long extinct fauna, and they were not, like the Neoliths, recognizable as corresponding closely to the implements used by modern tribes. There was at first a tendency to consider the Palaeoliths as the work of men ruder than savages, if, indeed, their makers were to be accounted human at all. Since then, however, the problem has passed into a more manageable state. Stone implements, more or less approaching the European Palaeolithic type, were found in Africa from Egypt southwards, where in such parts as Somaliland and Cape Colony they lie about on the ground, as though they had been the rough tools and weapons of the rude inhabitants of the land at no very distant period. The group in fig. 11 in the Plate shows the usual Somaliland types. These facts tended to remove the mystery from Palaeolithic man, though too little is known of the ruder ancient tribes of Africa to furnish a definition of the state of culture which might have co-existed with the use of Palaeolithic implements. Information to this purpose, however, can now be furnished from a more outlying region. This is Tasmania, where as in the adjacent continent of Australia, the survival of marsupial animals indicates long isolation from the rest of the world. Here, till far on into the 19th century, the Englishmen could watch the natives striking off flakes of stone, trimming them to convenient shape for grasping them in the hand, and edging them by taking off successive chips on one face only. The group in fig. 12 shows ordinary Tasmanian forms, two of them being finer tools for scraping and grooving. (For further details reference may be made to H. Ling Roth, *The Tasmanians*, (2nd ed., 1899); R. Brough Smyth, *Aborigines of Victoria* (1878), vol. ii.; *Papers and Proceedings of Royal Society of Tasmania*; and papers by the present writer in *Journal of the Anthropological Institute*.) The Tasmanians, when they came in contact with the European explorers and settlers, were not the broken outcasts they afterwards became. They were a savage people, perhaps the lowest in culture of any known, but leading a normal, self-supporting, and not unhappy life, which had probably changed little during untold ages. The accounts, imperfect as they are, which have been preserved of their arts, beliefs and habits, thus present a picture of the arts, beliefs and habits of tribes whose place in the Stone Age was a grade lower than that of Palaeolithic man of the Quaternary period.

The Tasmanian stone implements, figured in the Plate, show their own use when it is noticed that the rude chipping forms a good hand-grip above, and an effective edge for chopping, sawing, and cutting below. But the absence of the long-shape implements, so characteristic of the Neolithic and Palaeolithi series, and serviceable as picks, hatchets, and chisels, shows remarkable limitation in the mind of these savages, who mad a broad, hand-grasped knife their tool of all work to cut, saw, an chop with. Their weapons were the wooden club or wadd notched to the grasp, and spears of sticks, often crooked but we balanced, with points sharpened by tool or fire, and sometime jagged. No spear thrower or bow and arrow was known. Th

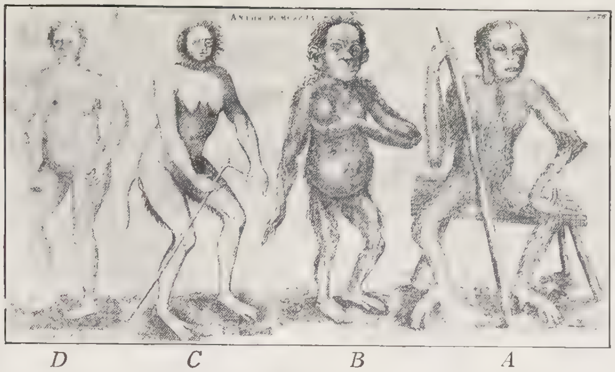


FIG. 1.

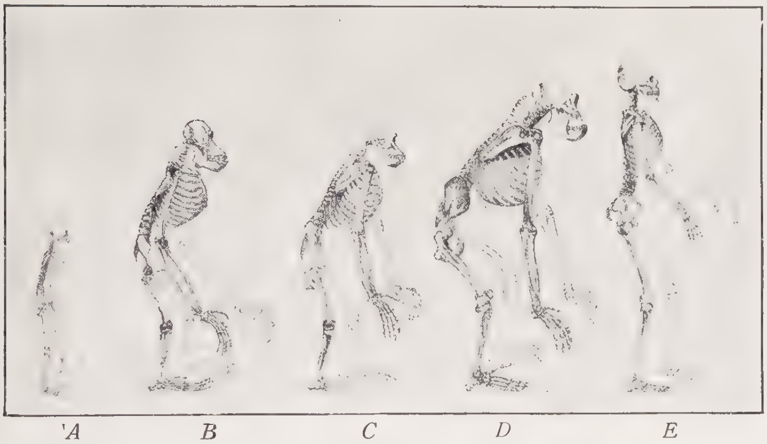


FIG. 2.

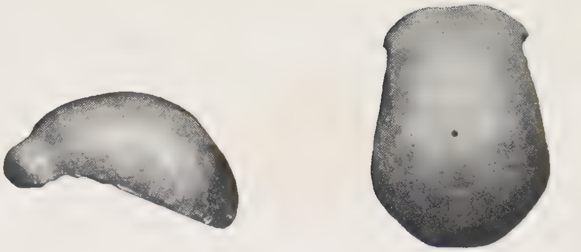


FIG. 3.

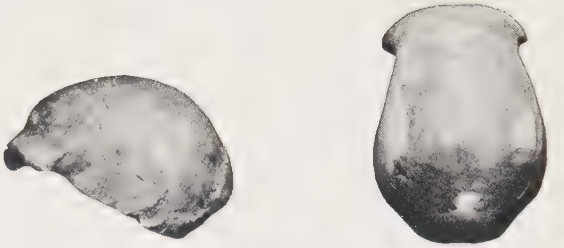


FIG. 4.

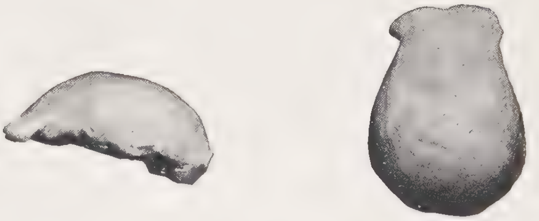


FIG. 5.

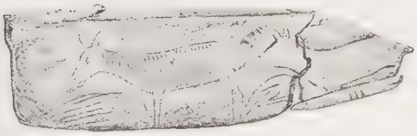


FIG. 6.

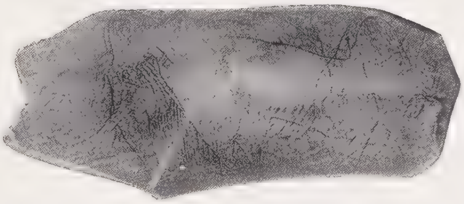


FIG. 7.

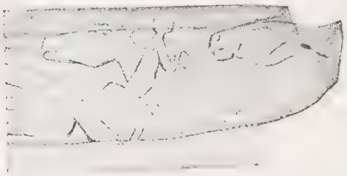


FIG. 8.

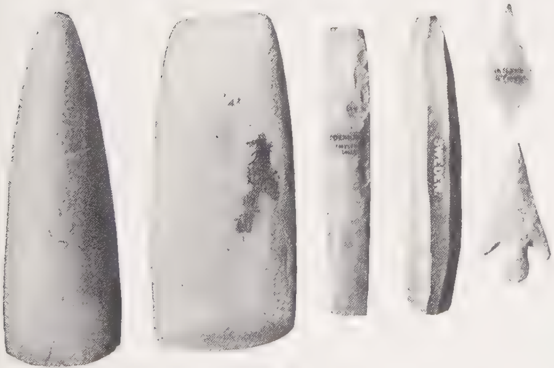


FIG. 9.

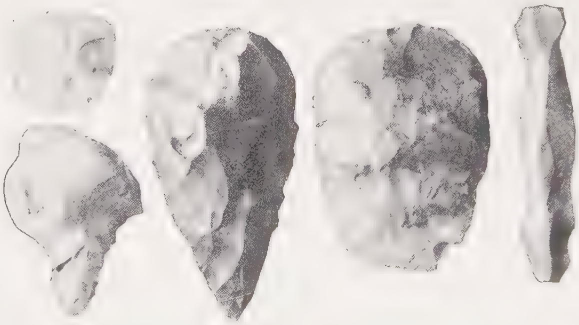


FIG. 10.

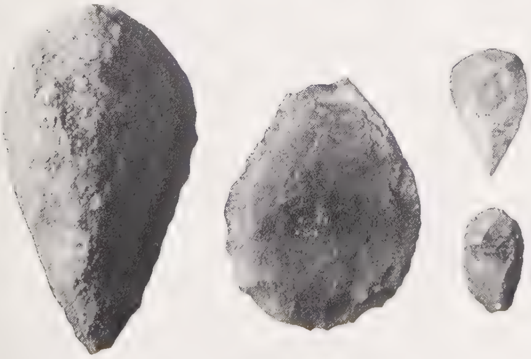


FIG. 11.

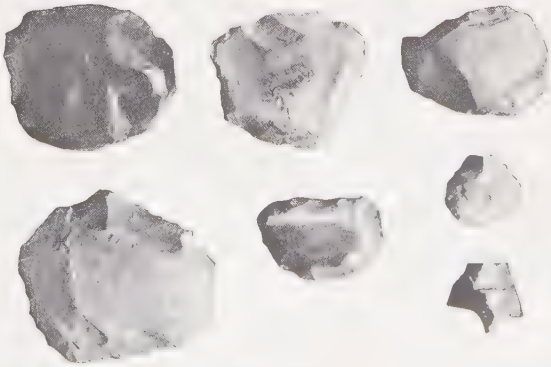


FIG. 12.

Tasmanian savages were crafty warriors and kangaroo-hunters, and the women climbed the highest trees by notching, in quest of opossums. Shell-fish and crabs were taken, and seals knocked on the head with clubs, but neither fish-hook nor fishing-net was known, and indeed swimming fish were taboo as food. Meat and vegetable food, such as fern-root, was broiled over the fire, but boiling in a vessel was unknown. The fire was produced by the ordinary savage fire-drill. Ignorant of agriculture, with no dwellings but rough huts or breakwinds of sticks and bark, without dogs or other domestic animals, these savages, until the coming of civilized man, roamed after food within their tribal bounds. Logs and clumsy floats of bark and grass enabled them to cross water under favourable circumstances. They had clothing of skins rudely stitched together with bark thread, and they were decorated with simple necklaces of kangaroo teeth, shells and berries. Among their simple arts, plaiting and basket-work was one in which they approached the civilized level. The pictorial art of the Tasmanians was poor and childish, quite below that of the Palaeolithic men of Europe. The Tasmanians spoke a fairly copious agglutinating language, well marked as to parts of speech, syntax and inflexion. Numeration was at a low level, based on counting fingers on one hand only, so that the word for man (*puggana*) stood also for the number 5. The religion of the Tasmanians, when cleared from ideas apparently learnt from the whites, was a simple form of animism based on the shadow (*warrawa*) being the soul or spirit. The strongest belief of the natives was in the power of the ghosts of the dead, so that they carried the bones of relatives to secure themselves from harm, and they fancied the forest swarming with malignant demons. They placed weapons near the grave for the dead friend's soul to use, and drove out disease from the sick by exorcising the ghost which was supposed to have caused it. Of greater special spirits of Nature we find something vaguely mentioned. The earliest recorders of the native social life set down such features as their previous experience of rude civilized life had made them judges of. They notice the self-denying affection of the mothers, and the hard treatment of the wives by the husbands, polygamy and the shifting marriage unions. But when we meet with a casual remark as to the tendency of the Tasmanians to take wives from other tribes than their own, it seems likely that they had some custom of exogamy which the foreigners did not understand. Meagre as is the information preserved of the arts, thoughts, and customs of these survivors from the lower Stone Age, it is of value as furnishing even a temporary and tentative means of working out the development of culture on a basis not of conjecture but of fact.

Conclusion.—To-day anthropology is grappling with the heavy task of systematizing the vast stores of knowledge to which the key was found by Boucher de Perthes, by Lartet, Christy and their successors. There have been recently no discoveries to rival in novelty those which followed the exploration of the bone-caves and drift-gravels, and which effected an instant revolution in all accepted theories of man's antiquity, substituting for a chronology of centuries a vague computation of hundreds of thousands of years. The existence of man in remote geological time cannot now be questioned, but, despite much effort made in likely localities, no bones, with the exception of those of the much-discussed *Pithecanthropus*, have been found which can be regarded as definitely bridging the gulf between man and the lower creation. It seems as if anthropology had in this direction reached the limits of its discoveries. Far different are the prospects in other directions where the work of co-ordinating the material and facts collected promises to throw much light on the history of civilization. Anthropological researches undertaken all over the globe have shown the necessity of abandoning the old theory that a similarity of customs and superstitions, of arts and crafts, justifies the assumption of a remote relationship, if not an identity of origin, between races. It is now certain that there has ever been an inherent tendency in man, allowing for difference of climate and material surroundings, to develop culture by the same stages and in the same way. American man, for example, need not necessarily owe the minutest portion of his mental, religious, social or industrial development to remote contact with Asia or Europe, though he were proved to possess identical usages. An example in point is that of pyramid-building. No ethnical relationship can ever have existed between the Aztecs and the Egyptians; yet each race developed the idea of the pyramid tomb through that psychological similarity which is as much a characteristic of the species man as is his physique.

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(E. B. T.)

ANTHROPOMETRY (Gr. *ἄνθρωπος*, man, and *μέτρον*, measure), the name given by the French savant, Alphonse Bertillon (b. 1853), to a system of identification (*q.v.*) depending on the unchanging character of certain measurements of parts of the human frame. He found by patient inquiry that several physical features and the dimensions of certain bones or bony structures in the body remain practically constant during adult life. He concluded from this that when these measurements were made and recorded systematically every single individual would be found to be perfectly distinguishable from others. The system was soon adapted to police methods, as the immense value of being able to fix a person's identity was fully realized, both in preventing false personation and in bringing home to any one charged with an offence his responsibility for previous wrong-doing. "Bertillonage," as it was called, became widely popular, and after its introduction into France in 1883, where it was soon credited with highly gratifying results, was applied to the administration of justice in most civilized countries. England followed tardily, and it was not until 1894 that an investigation of the methods used and results obtained was made by a special committee sent to Paris for the purpose. It reported favourably, especially on the use of the measurements for primary classification, but recommended also the adoption in part of a system of "finger prints" as suggested by Francis Galton, and already practised in Bengal.

M. Bertillon selected the following five measurements as the basis of his system: (1) head length; (2) head breadth; (3) length of middle finger; (4) of left foot, and (5) of cubit or forearm from the elbow to the extremity of the middle finger. Each principal heading was further subdivided into three classes of "small," "medium" and "large," and as an increased guarantee height, length of little finger, and the colour of the eye were also recorded. From this great mass of details, soon represented in Paris by the collection of some 100,000 cards, it was possible, proceeding by exhaustion, to sift and sort down the cards till a small bundle of half a dozen produced the combined facts of the measurements of the individual last sought. The whole of the information is easily contained in one cabinet of very ordinary dimensions, and most ingeniously contrived so as to make the most of the space and facilitate the search. The whole of the record is independent of names, and the final identification is by means of the photograph which lies with the individual's card of measurements.

Anthropometry, however, gradually fell into disfavour, and it has been generally supplanted by the superior system of finger prints (*q.v.*). Bertillonage exhibited certain defects which were first brought to light in Bengal. The objections raised were (1) the costliness of the instruments employed and their liability to get out of order; (2) the need for specially instructed measurers, men of superior education; (3) the errors that frequently crept in when carrying out the processes and were all but irremediable. Measures inaccurately taken, or wrongly read off, could seldom, if ever, be corrected, and these persistent errors defeated all chance of successful search. The process was slow, as it was necessary to repeat it three times so as to arrive at a mean result. In Bengal measurements were already abandoned by 1897, when the finger print system was adopted throughout British India. Three years later England followed suit; and as the result of a fresh inquiry ordered by the Home Office, finger prints were alone relied upon for identification.

Authorities.—Lombroso, *Antropometria di 400 delinquenti* (1872); Roberts, *Manual of Anthropometry* (1878); Ferri, *Studi comparati di antropometria* (2 vols., 1881–1882); Lombroso, *Rughe anomale speciali ai criminali* (1890); Bertillon, *Instructions signalétiques pour l'identification anthropométrique* (1893); Livi, *Anthropometria* (Milan, 1900); Fürst, *Indextabellen zum anthropometrischen Gebrauch* (Jena, 1902); *Report of Home Office Committee on the Best Means of Identifying Habitual Criminals* (1893–1894). (A. G.)

ANTHROPOMORPHISM (Gr. ἄνθρωπος, man, μορφή, form), the attribution (*a*) of a human body, or (*b*) of human qualities generally, to God or the gods. The word anthropomorphism is a modern coinage (possibly from 18th century French). The *New English Dictionary* is misled by the 1866 reprint of Paul Bayne on Ephesians when it quotes "anthropomorphist" as 17th century English. Seventeenth century editions print "anthropomorphits," *i.e.* anthropomorphites, in sense (*a*). The older abstract term is "anthropopathy," literally "attributing human feelings," in sense (*b*).

Early religion, among its many objects of worship, includes beasts (see Animal-Worship), considered, in the more refined theology of the later Greeks and Romans, as metamorphoses of the great gods. Similarly we find "therianthropic," forms—half animal, half human—in Egypt or Assyria-Babylonia. In contrast with these, it is considered one of the glories of the Olympian mythology of Greece that it believed in happy manlike beings (though exempt from death, and using special rarefied foods, &c.), and celebrated them in statues of the most exquisite art. Israel shows us animal images, doubtless of a ruder sort, when Yahweh is worshipped in the northern kingdom under the image of a steer. (Some scholars think the title "mighty one of Jacob," Psalm cxxxii., 2, 5, *et al.*, אֲבִיר as if from אָבַר, is really "steer" אַבִּיר "of Jacob.") But the higher religion of Israel inclined to morality more than to art, and forbade image worship altogether. This prepared the way for the conception of God as an immaterial Spirit. True mythical anthropomorphisms occur in early parts of the Old Testament (*e.g.* Genesis iii. 8, cf. vi. 2), though in the majority of Old Testament passages such expressions are merely verbal (*e.g.* Isaiah lix. 1). In the Christian Church (and again in early Mahommedanism) simple minds believed in the corporeal nature of God. Gibbon and other writers quote from John Cassian the tale of the poor monk, who, being convinced of his error, burst into tears, exclaiming, "You have taken away my God! I have none now whom I can worship!" According to a fragment of Origen (on Genesis i. 26), Melito of Sardis shared this belief. Many have thought Melito's work, *περὶ ἐνσωμάτου θεοῦ*, must have been a treatise on the Incarnation; but it is hard to think that Origen could blunder so. Epiphanius tells of Audaeus of Mesopotamia and his followers, Puritan sectaries in the 4th century, who were orthodox except for this belief and for Quartodecimanism (see Easter). Tertullian, who is sometimes called an anthropomorphist, stood for the Stoical doctrine, that all reality, even the divine, is in a sense material.

The reaction against anthropomorphism begins in Greek philosophy with the satirical spirit of Xenophanes (540 B.C.), who puts the case as broadly as any. The "greatest God" resembles man "neither in form nor in mind." In Judaism—unless we should refer to the prophets' polemic against images—a reaction is due to the introduction of the codified law. God seemed to grow more remote. The old sacred name Yahweh is never pronounced; even "God" is avoided for allusive titles like "heaven" or "place." Still, amid all this, the God of Judaism remains a personal, almost a limited, being. In Philo we see Jewish scruples uniting with others drawn from Greek philosophy. For, though the quarrel with popular anthropomorphism was patched up, and the gods of the Pantheon were described by Stoics and Epicureans as manlike in form, philosophy nevertheless tended to highly abstract conceptions of supreme, or real, deity. Philo followed out the line of this tradition in teaching that God cannot be named. How much exactly he meant is disputed. The same inheritance of Greek philosophy appears in the Christian fathers, especially Origen. He names and condemns the "anthropomorphites," who ascribe a human body to God (on Romans i., *sub fin.*; Rufinus' Latin version). In Arabian philosophy the reaction sought to deny that God had any attributes. And, under the influence of Mahommedan Aristotelianism, the same paralysing speculation found entrance among the learned Jews of Spain (see Maimonides).

Till modern times the philosophical reaction was not carried out with full vigour. Spinoza (*Ethics*, i. 15 and 17), representing here as elsewhere both a Jewish inheritance and a philosophical, but advancing further, sweeps away all community between God and man. So later J. G. Fichte and Matthew Arnold ("a magnified and non-natural man"),—strangely, in view of their strong belief in an objective moral order. For the use of the word "anthropomorphic," or kindred forms, in this new spirit of condemnation for all conceptions of God as manlike—sense (*b*) noted above—see J. J. Rousseau in *Émile* iv. (cited by Littré),—*Nous sommes pour la plupart de vrais anthropomorphites.* Rousseau is here speaking of the language of Christian theology,—a divine Spirit: divine Persons. At the present day this usage is universal. What it means on the lips of pantheists is plain. But when theists charge one another with "anthropomorphism," in order to rebuke what they deem unduly manlike conceptions of God, they stand on slippery ground. All theism implies the assertion of kinship between man, especially in his moral being, and God. As a brilliant theologian, B. Duhm, has said, physiomorphism is the enemy of Christian faith, not anthropomorphism.

The latest extension of the word, proposed in the interests of philosophy or psychology, uses it of the principle according to which man is said to interpret all things (not God merely) through himself. Common-sense intuitionalism would deny that man does this, attributing to him immediate knowledge of reality. And idealism in all its forms would say that man, interpreting through his reason, does rightly, and reaches truth. Even here then the use of the word is not colourless. It implies blame. It is the symptom of a philosophy which confines knowledge within narrow limits, and which, when held by Christians (*e.g.* Peter Browne, or H. L. Mansel), believes only in an "analogical" knowledge of God. (R. Ma.)

ANTI, or Campa, a tribe of South American Indians of Arawakan stock, inhabiting the forests of the upper Ucayali basin, east of Cuzco, on the eastern side of the Andes, south Peru. The Antis, who gave their name to the eastern province of Antisuyu, have always been notorious for ferocity and cannibalism. They are of fine physique and generally good-looking. Their dress is a robe with holes for the head and arms. Their long hair hangs down over the shoulders, and round their necks a toucan beak or a bunch of feathers is worn as an ornament.

ANTIBES, a seaport town in the French department of the Alpes-Maritimes (formerly in that of the Var, but transferred after the Alpes-Maritimes department was formed in 1860 out of the county of Nice). Pop. (1906) of the town, 5730; of the commune, 11,753. It is 12½ m. by rail S.W. of Nice, and is situated on the E. side of the Garoupe peninsula. It was formerly fortified, but all the ramparts (save the Fort Carré, built by Vauban) have now been demolished, and a new town is rising on their site. There is a tolerable harbour, with a considerable fishing industry. The principal exports are dried fruits, salt fish and oil. Much perfume distilling is done here, as the surrounding country produces an abundance of flowers. Antibes is the ancient Antipolis. It is said to have been founded before the Christian era (perhaps about 340 B.C.) by colonists from Marseilles, and is mentioned by Strabo. It was the seat of a bishopric from the 5th century to 1244, when the see was transferred to Grasse.

(W. A. B. C.)

ANTICHRIST (ἀντίχριστος). The earliest mention of the name Antichrist, which was probably first coined in Christian eschatological literature, is in the Epistles of St John (I. ii. 18, 22, iv. 3; II. 7), and it has since come into universal use. The conception, paraphrased in this word, of a mighty ruler who will appear at the end of time, and whose essence will be enmity to God (Dan. xi. 36; cf. 2 Thess. ii. 4; ὁ ἀντικείμενος), is older, and traceable to Jewish eschatology. Its origin is to be sought in the first place in the prophecy of Daniel, written at the beginning of the Maccabean period. The historical figure who served as a model for the "Antichrist" was Antiochus IV. Epiphanes, the persecutor of the Jews, and he has impressed indelible traits upon the conception. Since then ever-recurring characteristics of this figure (cf. especially Dan xi. 40, &c.) are, that he would appear as a mighty ruler at the head of gigantic armies, that he would destroy three rulers (the three horns, Dan. vii. 8, 24), persecute the saints (vii. 25), rule for three and a half years (vii. 25, &c.), and subject the temple of God to a horrible devastation (βδέλυγμα τῆς ἐρημώσεως). When the end of the world foretold by Daniel did not take place, but the book of Daniel retained its validity as a sacred scripture which foretold future things, the personality of the tyrant who was God's enemy disengaged itself from that of Antiochus IV., and became merely a figure of prophecy, which was applied now to one and now to another historical phenomenon. Thus for the author of the *Psalms of Solomon* (c. 60 B.C.), Pompey, who destroyed the independent rule of the Maccabees and stormed Jerusalem, was the Adversary of God (cf. ii. 26, &c.); so too the tyrant whom the *Ascension of Moses* (c. A.D. 30) expects at the end of all things, possesses, besides the traits of Antiochus IV., those of Herod the Great. A further influence on the development of the eschatological imagination of the Jews was exercised by such a figure as that of the emperor Caligula (A.D. 37–41), who is known to have given the order, never carried out, to erect his statue in the temple of Jerusalem. In the little Jewish Apocalypse, the existence of which is assumed by many scholars, which in Mark xiii. and Matt. xxiv. is combined with the words of Christ to form the great eschatological discourse, the prophecy of the "abomination of desolation" (Mark xiii. 14 et seq.) may have originated in this episode of Jewish history. Later Jewish and Christian writers of Apocalypses saw in Nero the tyrant of the end of time. The author of the Syriac *Apocalypse of Baruch* (or his source), cap. 36-40, speaks in quite general terms of the last ruler of the end of time. In 4 Ezra v. 6 also is found the allusion: *regnabit quem non sperant.*

The roots of this eschatological fancy are to be sought perhaps still deeper in a purely mythological and speculative expectation of a battle at the end of days between God and the devil, which has no reference whatever to historical occurrences. This idea has its original source in the apocalypses of Iran, for these are based upon the conflict between Ahura-Mazda (Auramazda, Ormazd) and Añgrō-Mainyush (Ahriman) and its consummation at the end of the world. This Iranian dualism is proved to have penetrated into the late Jewish eschatology from the beginning of the 1st century before Christ, and did so probably still earlier. Thus the opposition between God and the devil already plays a part in the Jewish groundwork of the *Testaments of the Patriarchs*, which was perhaps composed at the end of the period of the Maccabees. In this the name of the devil appears, besides the usual form (σατανᾶς, διάβολος), especially as Belial (Beliar, probably, from Ps. xviii. 4, where the rivers of Belial are spoken of, originally a god of the underworld), a name which also plays a part in the Antichrist tradition. In the *Ascension of Moses* we already hear, at the beginning of the description of the latter time (x. 1): "And then will God's rule be made manifest over all his creatures, then will the devil have an end" (cf. Matt. xii. 28; Luke xi. 20; John xii. 31, xiv. 30, xvi. 11).[1] This conception of the strife of God with the devil was further interwoven, before its introduction into the Antichrist myth, with another idea of different origin, namely, the myth derived from the Babylonian religion, of the battle of the supreme God (Marduk) with the dragon of chaos (Tiamāt), originally a myth of the origin of things which, later perhaps, was changed into an eschatological one, again under Iranian influence.[2] Thus it comes that the devil, the opponent of God, appears in the end often also in the form of a terrible dragon-monster; this appears most clearly in Rev. xii. Now it is possible that the whole conception of Antichrist has its final roots in this already complicated myth, that the form of the mighty adversary of God is but the equivalent in human form of the devil or of the dragon of chaos. In any case, however, this myth has exercised a formative influence on the conception of Antichrist. For only thus can we explain how his figure acquires numerous superhuman and ghostly traits, which cannot be explained by any particular historical phenomenon on which it may have been based. Thus the figure of Antiochus IV. has already become superhuman, when in Dan. viii. 10, it is said that the little horn "waxed great, even to the host of heaven; and cast down some of the host and of the stars to the ground." Similarly Pompey, in the second psalm of Solomon, is obviously represented as the dragon of chaos, and his figure exalted into myth. Without this assumption of a continual infusion of mythological conceptions, we cannot understand the figure of Antichrist. Finally, it must be mentioned that Antichrist receives, at least in the later sources, the name originally proper to the devil himself.[3]

From the Jews, Christianity took over the idea. It is present quite unaltered in certain passages, specifically traceable to Judaism, *e.g.* (Rev. xi.). "The Beast that ascendeth out of the bottomless pit" and, surrounded by a mighty host of nations, slays the "two witnesses" in Jerusalem, is the entirely superhuman Jewish conception of Antichrist. Even if the beast (ch. xiii.), which rises from the sea at the summons of the devil, be interpreted as the Roman empire, and, specially, as any particular Roman ruler, yet the original form of the malevolent tyrant of the latter time is completely preserved.

A fundamental change of the whole idea from the specifically Christian point of view, then, is signified by the conclusion of ch. ii. of the Second Epistle to the Thessalonians.[4] There can, of course, be no doubt as to the identity of the "man of sin, the son of perdition" here described with the dominating figure of Jewish eschatology (cf. ii. 3 &c., ὁ ἄνθρωπος τῆς ἀνομίας, *i.e.* Beliar (?), ὁ ἀντικείμενος — the allusion that follows to Dan xi. 36). But Antichrist here appears as a tempter, who works by signs and wonders (ii. 9) and seeks to obtain divine honours; it is further signified that this "man of sin" will obtain credence, more especially among the Jews, because they have not accepted the truth. The conception, moreover, has become almost more superhuman than ever (cf. ii. 4, "showing himself that he is God"). The destruction of the Adversary is drawn from Isaiah xi. 4, where it is said of the Messiah: "with the breath of his lips shall he slay the wicked."[5] The idea that Antichrist was to establish himself in the temple of Jerusalem (ii. 4) is very enigmatical, and has not yet been explained. The "abomination of desolation" has naturally had its influence upon it; possibly also the experience of the time of Caligula (see above). Remarkable also is the allusion to a power which still retards the revelation of Antichrist (2 Thess. ii. 6 &c., *τὸ κατέχον; ὁ κατέχων*), an allusion which, in the tradition of the Fathers of the church, came to be universally, and probably correctly, referred to the Roman empire. In this then consists the significant turn given by St Paul in the Second Epistle to the Thessalonians to the whole conception, namely, in the substitution for the tyrant of the latter time who should persecute the Jewish people, of a pseudo-Messianic figure, who, establishing himself in the temple of God, should find credence and a following precisely among the Jews. And while the originally Jewish idea led straight to the conception, set forth in Revelation, of the Roman empire or its ruler as Antichrist, here, on the contrary, it is probably the Roman empire that is the power which still retards the reign of Antichrist. With this, the expectation of such an event at last separates itself from any connexion with historical fact, and becomes purely ideal. In this process of transformation of the idea, which has become of importance for the history of the world, is revealed probably the genius of Paul, or at any rate, that of the young Christianity which was breaking its ties with Judaism and establishing itself in the world of the Roman empire.

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[1] See further, Bousset, *Religion des Judentums*, ed. ii. pp. 289 &c., 381 &c., 585 &c.

[2] See Gunkel, *Schöpfung und Chaos* (1893).

[3] It is, of course, uncertain whether this phenomenon already occurs in 2 Cor. vi. 15, since here Belial might still be Satan; cf. however, *Ascensio Jesaiae* iv. 2 &c.; *Sibyll.* iii. 63 &c., ii. 167 &c.

[4] It is not necessary to decide whether the epistle is by St Paul or by a pupil of Paul, although the former seems to the present writer to be by far the more probable, in spite of the brilliant attack on the genuineness of the epistle by Wrede in *Texte und Übersetzungen*, N.F. ix. 2.

[5] Cf. 2 Thess. ii. 8; the Targum also, in its comment on the passage of Isaiah, applies "the wicked" to Antichrist.

This version of the figure of Antichrist, who may now really for the first time be described by this name, appears to have been at once widely accepted in Christendom. The idea that the Jews would believe in Antichrist, as punishment for not having believed in the true Christ, seems to be expressed by the author of the fourth gospel (v. 43). The conception of Antichrist as a perverter of men, leads naturally to his connexion with false doctrine (1 John ii. 18, 22; iv. 3; 2 John 7). The *Teaching of the Apostles* (xvi. 4) describes his form in the same way as 2 Thessalonians (*καὶ τότε φαινήσεται ὁ κοσμοπλάνος ὡς υἱὸς θεοῦ καὶ ποιεῖ σημεῖα καὶ τέρατα*). In the late Christian Sibylline fragment (iii. 63 &c.) also, "Beliar" appears above all as a worker of wonders, this figure having possibly been influenced by that of Simon Magus. Finally the author of the Apocalypse of St John also has made use of the new conception of Antichrist as a wonder-worker and seducer, and has set his figure beside that of the "first" Beast which was for him the actual embodiment of Antichrist (xiii. 11 &c.). Since this second Beast could not appear along with the first as a power demanding worship and directly playing the part of Antichrist, he made out of him the false prophet (xvi. 13, xix. 20, xx. 10) who seduces the inhabitants of the earth to worship the first Beast, and probably interpreted this figure as applying to the Roman provincial priesthood.[1]

But this version of the idea of Antichrist, hostile to the Jews and better expressing the relation of Christianity to the Roman empire, was prevented from obtaining an absolute ascendancy in Christian tradition by the rise of the belief in the ultimate return of Nero, and by the absorption of this outcome of pagan superstition into the Jewish-Christian apocalyptic conceptions. It is known that soon after the death of Nero rumours were current that he was not dead. This report soon took the more concrete form that he had fled to the Parthians and would return thence to take vengeance on Rome. This expectation led to the appearance of several pretenders who posed as Nero; and as late as A.D. 100 many still held the belief that Nero yet lived.[2] This idea of Nero's return was in the first instance taken up by the Jewish apocalyptic writers. While the Jewish author of the fourth Sibylline book (*c.* A.D. 80) still only refers simply to the heathen belief, the author of the (Jewish?) original of the 17th chapter of the Apocalypse of St John expects the return of Nero with the Parthians to take vengeance on Rome, because she had shed the blood of the Saints (destruction of Jerusalem!). In the fifth Sibylline book, which, with the exception of verses 1-51, was mainly composed by a Jewish writer at the close of the first century, the return of Nero plays a great part. Three times the author recurs to this theme, 137-154; 214-227; 361-385. He sees in the coming again of Nero, whose figure he endows with supernatural and daemonic characteristics, a judgment of God, in whose hand the revivified Nero becomes a rod of chastisement. Later, the figure of Nero *redivivus* became, more especially in Christian thought, entirely confused with that of Antichrist. The less it became possible, as time went on, to believe that Nero yet lived and would return as a living ruler, the greater was the tendency for his figure to develop into one wholly infernal and daemonic. The relation to the Parthians is also gradually lost sight of; and from being the adversary of Rome, Nero becomes the adversary of God and of Christ. This is the version of the expectation of Nero's second coming preserved in the form given to the prophecy, under Domitian, by the collaborator in the Apocalypse of John (xiii., xvii.). Nero is here the beast that returns from the bottomless pit, "that was; and is not, and yet is"; the head "as it were wounded to death" that lives again; the gruesome similitude of the Lamb that was slain, and his adversary in the final struggle. The number of the Beast, 666, points certainly to Nero (קסר נרון=666, or קסר נרו=616). In the little apocalypse of the *Ascensio Jesaiae* (iii. 13b–iv. 18), which dates perhaps from the second, perhaps only from the first, decade of the third century,[3] it is said that Beliar, the king of this world, would descend from the firmament in the human form of Nero. In the same way, in *Sibyll.* v. 28-34, Nero and Antichrist are absolutely identical (mostly obscure reminiscences, *Sib.* viii. 68 &c., 140 &c., 151 &c.). Then the Nero-legend gradually fades away. But Victorinus of Pettau, who wrote during the persecution under Diocletian, still knows the relation of the Apocalypse to the legend of Nero; and Commodian, whose *Carmen Apologeticum* was perhaps not written until the beginning of the 4th century, knows two Antichrist-figures, of which he still identifies the first with Nero *redivivus*.

In proportion as the figure of Nero again ceased to dominate the imagination of the faithful, the wholly unhistorical, unpolitical and anti-Jewish conception of Antichrist, which based itself more especially on 2 Thess. ii., gained the upper hand, having usually become associated with the description of the universal conflagration of the world which had also originated in the Iranian eschatology. On the strength of exegetical combinations, and with the assistance of various traditions, it was developed even in its details, which it thenceforth maintained practically unchanged. In this form it is in great part present in the eschatological portions of the *Adv. Haereses* of Irenaeus, and in the *de Antichristo* and commentary on Daniel of Hippolytus. In times of political excitement, during the following centuries, men appealed again and again to the prophecy of Antichrist. Then the foreground scenery of the prophecies was shifted; special prophecies, having reference to contemporary events, are pushed to the front, but in the background remains standing, with scarcely a change, the prophecy of Antichrist that is bound up with no particular time. Thus at the beginning of the *Testamentum Domini*, edited by Rahmani, there is an apocalypse, possibly of the time of Decius, though it has been worked over (Harnack, *Chronol. der altchrist. Litt.* ii. 514 &c.) In the third century, the period of Aurelianus and Gallienus, with its wild warfare of Romans and Persians, and of Roman pretenders one with another, seems especially to have aroused the spirit of prophecy. To this period belongs the Jewish apocalypse of Elijah (ed. Buttenwieser), of which the Antichrist is possibly Odaenathus of Palmyra, while *Sibyll.* xiii., a Christian writing of this period, glorifies this very prince. It is possible that at this time also the Sibylline fragment (iii. 63 &c.) and the Christian recension of the two first Sibylline books were written.[4] To this time possibly belongs also a recension of the Coptic apocalypse of Elijah, edited by Steindorff (*Texte und Untersuchungen*, N. F. ii. 3). To the 4th century belongs, according to Kamper (*Die deutsche Kaiseridee*, 1896, p. 18) and Sackur (*Texte und Forschungen*, 1898, p. 114 &c.), the first nucleus of the "Tiburtine" Sibyl, very celebrated in the middle ages, with its prophecy of the return of

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[1] See Bousset, *Kommentar zur Offenbarung Johannis*, on these passages.

[2] *Ibid.* ch. xvii.; and Charles, *Ascension of Isaiah*, lvii. sq

[3] Harnack, *Chronologie der altchristlichen Literatur*, i. 573.

[4] See Bousset, in Herzog-Hauck, *Realencyklop. für Theologie und Kirche* (ed. 3), xviii. 273 &c.

Constans, and its dream, which later on exercised so much influence, that after ruling over the whole world he would go to Jerusalem and lay down his crown upon Golgotha. To the 4th century also perhaps belongs a series of apocalyptic pieces and homilies which have been handed down under the name of Ephraem. At the beginning of the Mahommedan period, then, we meet with the most influential and the most curious of these prophetic books, the *Pseudo-Methodius*,[1] which prophesied of the emperor who would awake from his sleep and conquer Islam. From the *Pseudo-Methodius* are derived innumerable Byzantine prophecies (cf. especially Vassiliev, *Anecdota Graeco-Byzantina*) which follow the fortunes of the Byzantine emperors and their governments. A prophecy in verse, adorned with pictures, which is ascribed to Leo VI. the Philosopher (Migne, *Patr. Graeca*, cvii. p. 1121 &c.), tells of the downfall of the house of the Comneni and sings of the emperor of the future who would one day awake from death and go forth from the cave in which he had lain. Thus the prophecy of the sleeping emperor of the future is very closely connected with the Antichrist tradition. There is extant a Daniel prophecy which, in the time of the Latin empire, foretells the restoration of the Greek rule.[2] In the East, too, Antichrist prophecies were extraordinarily flourishing during the period of the rise of Islam and of the Crusades. To these belong the apocalypses in Arabic, Ethiopian and perhaps also in Syrian, preserved in the so-called *Liber Clementis discipuli S. Petri* (*Petri apostoli apocalypsis per Clementem*), the late Syrian apocalypse of Ezra (Bousset, *Antichrist*, 45 &c.), the Coptic (14th) vision of Daniel (in the appendix to Woide's edition of the *Codex Alexandrinus*; Oxford, 1799), the Ethiopian *Wisdom of the Sibyl*, which is closely related to the Tiburtine Sibyl (see Basset, *Apocryphes éthiopiennes*, x.); in the last mentioned of these sources long series of Islamic rulers are foretold before the final time of Antichrist. Jewish apocalypse also awakes to fresh developments in the Mahommedan period, and shows a close relationship with the Christian Antichrist literature. One of the most interesting apocalypses is the Jewish *History of Daniel*, handed down in Persian.[3]

This whole type of prophecy reached the West above all through the *Pseudo-Methodius*, which was soon translated into Latin. Especially influential, too, in this respect was the letter which the monk Adso in 954 wrote to Queen Gerberga, *De ortu et tempore Antichristi*. The old Tiburtine Sibylla went through edition after edition, in each case being altered so as to apply to the government of the monarch who happened to be ruling at the time. Then in the West the period arrived in which eschatology, and above all the expectation of the coming of Antichrist, exercised a great influence on the world's history. This period, as is well known, was inaugurated, at the end of the 12th century, by the apocalyptic writings of the abbot Joachim of Floris. Soon the word Antichrist re-echoed from all sides in the embittered controversies of the West. The pope bestowed this title upon the emperor, the emperor upon the pope, the Guelphs on the Ghibellines and the Ghibellines on the Guelphs. In the contests between the rival powers and courts of the period, the prophecy of Antichrist played a political part. It gave motives to art, to lyrical, epic and dramatic poetry.[4] Among the visionary Franciscans, enthusiastic adherents of Joachim's prophecies, arose above all the conviction that the pope was Antichrist, or at least his precursor. From the Franciscans, influenced by Abbot Joachim, the lines of connexion are clearly traceable with Milič of Kremsier (*Libellus de Antichristo*) and Matthias of Janow. For Wycliffe and his adherent John Purvey (probably the author of the *Commentarius in Apocalypsin ante centum annos editus*, edited in 1528 by Luther), as on the other hand for Hus, the conviction that the papacy is essentially Antichrist is absolute. Finally, if Luther advanced in his contest with the papacy with greater and greater energy, he did so because he was borne on by the conviction that the pope in Rome was Antichrist. And if in the *Augustana* the expression of this conviction was suppressed for political reasons, in the Articles of Schmalkalden, drawn up by him, Luther propounded it in the most uncompromising fashion. This sentence was for him an *articulus stantis et cadentis ecclesiae*. To write the history of the idea of Antichrist in the last centuries of the middle ages, would be almost to write that of the middle ages themselves.

AUTHORITIES.—See, for the progress of the idea in Jewish and New Testament times, the modern commentaries on Revelation and the 2nd Epistle to the Thessalonians; Bousset, *Antichrist* (1895), and the article "Antichrist" in the *Encyclop. Biblica*; R. H. Charles, *Ascension of Isaiah*, Introduction, li.-lxxiii. For the history of the legend of Nero, see J. Geffcken, *Nachrichten der Göttinger Gesellschaft der Wissenschaft* (1899), p. 446 &c.; Th. Zahn, *Zeitschrift für kirchliche Wissenschaft und kirchliches Leben* (1886), p. 337 &c.; Bousset, *Kritisch-exegetisches Kommentar zur Offenbarung Johannis*, cap. 17, and the article "Sibyllen" in Herzog-Hauck, *Realencyklopädie für Theologie und Kirche* (3rd ed.), xviii. 265 &c.; Nordmeyer, *Der Tod Neros in der Legende*, a *Festschrift* of the Gymnasium of Moos. For the later history of the legend, see Bousset, *Antichrist*, where will be found a more detailed discussion of nearly all the sources named; Bousset, "Beiträge zur Geschichte der Eschatologie," in *Zeitschrift für Kirchengeschichte*, xx. 2, and especially xx. 3, on the later Byzantine prophecies; Vassiliev, *Anecdota Graeco-Byzantina*, i. (Moscow, 1893), which gives the texts of a series of Byzantine prophecies; E. Sackur, *Sibyllinische Texte und Forschungen* (1898), containing (1) *Pseudo-Methodius*, Latin text, (2) *Epistola Adsonis*, (3) the *Tiburtine Sibylla*; V. Istrin, *The Apocalypse of Methodius of Patara and the Apocryphal Visions of Daniel in Byzantine and Slavo-Russian Literature*, Russian (Moscow, 1897); J. Kampers, *Die deutsche Kaiseridee in Prophetie und Sage* (Munich, 1896), and "Alexander der Grosse und die Idee des Weltimperiums," in H. Grauert's *Studien und Darstellungen aus dem Gebiet der Geschichte*, vol. i. 2-3 (Freiburg, 1901); E. Wadstein, *Die eschatologische Ideengruppe, Antichrist, Weltsabbat, Weltende und Welgericht* (Leipzig, 1896), which contains excellent material for the history of the idea in the West during the middle ages; W Meyer, "Ludus de Antichristo," in *Sitzbericht der Münchener Akad.* (Phil. hist. Klasse 1882, H. i.); Kropatschek, *Das Schriftprincip der lutherischen Kirche*, i. 247 &c. (Leipzig, 1904); H. Preuss, *Die Vorstellungen vom Antichrist im späteren Mittelalter, bei Luther u. i. d. Konfessionellen Polemik* (Leipzig, 1906). (W. Bo.)

ANTICLIMAX (*i.e.* the opposite to "climax"), in rhetoric, an abrupt declension (either deliberate or unintended) on the part of a speaker or writer from the dignity of idea which he appeared to be aiming at; as in the following well-known distich:—

> "The great Dalhousie, he, the god of war,
> *Lieutenant-colonel to the earl of Mar.*"

An anticlimax can be intentionally employed only for a jocular or satiric purpose. It frequently partakes of the nature of antithesis, as—

> "Die and endow a *college* or a *cat.*"

It is often difficult to distinguish between "anticlimax" and "bathos"; but the former is more decidedly a relative term. A whole speech may never rise above the level of bathos; but a climax of greater or less elevation is the necessary antecedent of an anticlimax.

ANTICOSTI, an island of the province of Quebec, Canada, situated in the Gulf of St Lawrence, between 49° and 50° N., and between 61° 40′ and 64° 30′ W., with a length of 135 m. and a breadth of 30 m. Population 250, consisting chiefly of the keepers of the numerous lighthouses erected by the Canadian government. The coast is dangerous, and the only two harbours, Ellis Bay and Fox Bay, are very indifferent. Anticosti was sighted by Jacques Cartier in 1534, and named Assomption. In 1763 it was ceded by France to Britain, and in 1774 became part of Canada. Wild animals, especially bears, are numerous, but prior to 1896 the fish and game had been almost exterminated by indiscriminate slaughter. In that year Anticosti and the shore fisheries were leased to M. Menier, the French chocolate manufacturer, who converted the island into a game preserve, and attempted to develop its resources of lumber, peat and minerals.

See Logan, *Geological Survey of Canada, Report of Progress from its Commencement to 1863* (Montreal, 1863–1865); E. Billings, *Geological Survey of Canada: Catalogue of the Silurian Fossils of Anticosti* (Montreal, 1866); J. Schmitt, *Anticosti* (Paris, 1904).

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[1] Latin text by Sackur, cf. *op. cit.* 1 &c.; Greek text by V. Istrin.

[2] See Bousset, *Zeitschrift für Kirchengeschichte*, xx. p. 289 &c.

[3] Published in Merx, *Archiv zur Erforschung des Alten Testament.*

[4] See especially the *Ludus de Antichristo*, ed. W. Meyer.

ANTICYCLONE (*i.e.* opposite to a cyclone), an atmospheric system in which there is a descending movement of the air and a relative increase in barometric pressure over the part of the earth's surface affected by it. At the surface the air tends to flow outwards in all directions from the central area of high pressure, and is deflected on account of the earth's rotation (see Ferrel's Law) so as to give a spiral movement in the direction of the hands of a watch face upwards in the northern hemisphere, against that direction in the southern hemisphere. Since the air in an anticyclone is descending, it becomes warmed and dried, and therefore transmits radiation freely whether from the sun to the earth or from the earth into space. Hence in winter anticyclonic weather is characterized by clear air with periods of frost, causing fogs in towns and low-lying damp areas, and in summer by still cloudless days with gentle variable airs and fine weather.

ANTICYRA, the ancient name of three cities of Greece. (1) (Mod. *Aspraspitia*), in Phocis, on the bay of Anticyra, in the Corinthian gulf; some remains are still visible. It was a town of considerable importance in ancient times; was destroyed by Philip of Macedon; recovered its prosperity; and was captured by T. Quinctius Flamininus in 198 B.C. The city was famous for its black hellebore, a herb which was regarded as a cure for insanity. This circumstance gave rise to a number of proverbial expressions, like *'Αντικύρας σε δεῖ* or "naviget Anticyram," and to frequent allusions in the Greek and Latin writers. Hellebore was likewise considered beneficial in cases of gout and epilepsy. (2) In Thessaly, on the right bank of the river Spercheus, near its mouth. (3) In Locris, on the north side of the entrance to the Corinthian gulf, near Naupactus.

ANTIETAM, the name of a Maryland creek, near which, on the 16th–17th of September 1862, was fought the battle of Antietam or Sharpsburg (see American Civil War), between the Federals under McClellan and the Confederates commanded by Lee. General McClellan had captured the passes of South Mountain farther east on the 14th, and his Army of the Potomac marched to meet Lee's forces which, hitherto divided, had, by the 16th, successfully concentrated between the Antietam and the Potomac. The Confederate Army of Northern Virginia occupied a position which, in relation to the surrounding country, may be compared to the string of a bow in the act of being drawn, Lee's left wing forming the upper half of the string, his right the lower, and the Potomac in his rear the bow itself. The town of Sharpsburg represents the fingers of the archer drawing the bow. The right wing of the position was covered by the Antietam as it approaches the Potomac, the upper course of that stream formed no part of the battlefield. Generals Longstreet and Jackson commanded the right and left wings. The division of A. P. Hill was at Harper's Ferry, but had received orders to rejoin Lee. McClellan's troops appeared late on the 16th, and Hooker was immediately sent across the upper Antietam. He had a sharp fight with Jackson's men, but night soon put an end to the contest. Early on the 19th the corps of Sumner and Mansfield followed Hooker across the upper stream whilst McClellan's left wing (Burnside's corps) drew up opposite Lee's extreme right. The Federal leader intended to hold back his centre whilst these two forces were rolling up Lee's wings. The battle began with a furious assault on the extreme right by Hooker's corps. After a very severe struggle he was repulsed with the loss of a quarter of his men, Jackson's divisions suffering even more severely and losing nearly all their generals and colonels. It was only the arrival of Hood and D. H. Hill which enabled Stonewall Jackson's corps to hold its ground, and had the other Federal corps been at hand to support Hooker the result might have been very different. Mansfield next attacked farther to the left and with better fortune. Mansfield was killed, but his successor led the corps well, and after heavy fighting Hood and D. H. Hill were driven back. Again want of support checked the Federals and the fight became stationary, both sides losing many men. Sumner now came into action, and overhaste involved him in a catastrophe, his troops being attacked in front and flank and driven back in great confusion with nearly half their number killed and wounded; and their retreat involved the gallant remnants of Mansfield's corps. Soon afterwards the Federal divisions of French and Richardson attacked D. H. Hill, whose men were now exhausted by continuous fighting. Here occurred the fighting in the "Bloody Lane," north of Sharpsburg which French and Richardson eventually carried. Opposed as they were by D. H. Hill, whose men had fought the battle of South Mountain and had already been three times engaged *à fond* on this day, proper support must have enabled the Federals to crush Lee's centre, but Franklin and Porter in reserve were not allowed by McClellan to move forward and the opportunity passed. Burnside, on the southern wing, had received his orders late, and acted on them still later. The battle was over on the right before he fired a shot, and Lee had been able to use nearly all his right wing troops to support Jackson. At last Burnside moved forward, and, after a brilliant defence by the handful of men left to oppose him, forced the Antietam and began to roll up Lee's right, only to be attacked in rear himself by A. P. Hill's troops newly arrived from Harper's Ferry. The repulse of Burnside ended the battle. Pressure was brought to bear on McClellan to renew the fight, but he refused and Lee retired across the Potomac unmolested. The Army of the Potomac had lost 11,832 men out of 46,000 engaged; the cavalry and two corps in reserve had only lost 578. Lee's 31,200 men lost over 8000 of their number.

See the bibliography appended to American Civil War, and also General Palfrey's *Antietam and Fredericksburg.*

ANTI-FEDERALISTS, the name given in the political history of the United States to those who, after the formation of the federal Constitution of 1787, opposed its ratification by the people of the several states. The "party" (though it was never regularly organized as such) was composed of statesrights, particularistic, individualistic and radical democratic elements; that is, of those persons who thought that a stronger government threatened the sovereignty and prestige of the states, or the special interests, individual or commercial, of localities, or the liberties of individuals, or who fancied they saw in the government proposed a new centralized, disguised "monarchic" power that would only replace the cast-off despotism of Great Britain. In every state the opposition to the Constitution was strong, and in two—North Carolina and Rhode Island—it prevented ratification until the definite establishment of the new government practically forced their adhesion. The individualistic was the strongest element of opposition; the necessity, or at least the desirability, of a bill of rights was almost universally felt. Instead of accepting the Constitution upon the condition of amendments,—in which way they might very likely have secured large concessions,—the Anti-Federalists stood for unconditional rejection, and public opinion, which went against them, proved that for all its shortcomings the Constitution was regarded as preferable to the Articles of Confederation. After the inauguration of the new government, the composition of the Anti-Federalist party changed. The Federalist (*q.v.*) party gradually showed broad-construction, nationalistic tendencies; the Anti-Federalist party became a strict-construction party and advocated popular rights against the asserted aristocratic, centralizing tendencies of its opponent, and gradually was transformed into the Democratic-Republican party, mustered and led by Thomas Jefferson, who, however, had approved the ratification of the Constitution and was not, therefore, an Anti-Federalist in the original sense of that term.

See O. G. Libby, *Geographical Distribution of the Vote . . . on the Federal Constitution, 1787–1788* (University of Wisconsin, Bulletin, 1894); S. B. Harding, *Contest over the Ratification of the Federal Constitution in . . . Massachusetts* (Harvard University Studies, New York, 1896); and authorities on political and constitutional history in the article United States.

ANTIGO, a city and the county-seat of Langlade county, Wisconsin, U.S.A., about 160 m. N.W. of Milwaukee. Pop. (1890) 4424; (1900) 5145, of whom 965 were foreign-born; (1905) 6663; (1910) 7196. It is served by the Chicago & North Western railway. Antigo is the centre of a good farming and lumbering district, and its manufactures consist principally of lumber, chairs, furniture, sashes, doors and blinds, hubs and spokes, and other wood products. The city has a Carnegie library. Antigo was first settled in 1880, and was chartered as a city in 1885. Its name is said to be part of an Indian word, *neequee-antigo-sebi*, meaning "evergreen."

ANTIGONE, (1) in Greek legend, daughter of Oedipus and Iocaste (Jocasta), or, according to the older story, of Euryganeia. When her father, on discovering that Iocaste, the mother of his children, was also his own mother, put his eyes out and resigned the throne of Thebes, she accompanied him into exile at Colonus. After his death she returned to Thebes, where Haemon, the son of Creon, king of Thebes, became enamoured of her. When her brothers Eteocles and Polyneices had slain each other in single combat, she buried Polyneices, although Creon had forbidden it. As a punishment she was sentenced to be buried alive in a vault, where she hanged herself, and Haemon killed himself in despair. Her character and these incidents of her life presented an attractive subject to the Greek tragic poets, especially Sophocles in the *Antigone* and *Oedipus at Colonus*, and Euripides, whose *Antigone*, though now lost, is partly known from extracts incidentally preserved in later writers, and from passages in his *Phoenissae*. In the order of the events, at least, Sophocles departed from the original legend, according to which the burial of Polyneices took place while Oedipus was yet in Thebes, not after he had died at Colonus Again, in regard to Antigone's tragic end Sophocles differs from Euripides, according to whom the calamity was averted by the intercession of Dionysus and was followed by the marriage of Antigone and Haemon. In Hyginus's version of the legend, founded apparently on a tragedy by some follower of Euripides, Antigone, on being handed over by Creon to her lover Haemon to be slain, was secretly carried off by him, and concealed in a shepherd's hut, where she bore him a son Maeon. When the boy grew up, he went to some funeral games at Thebes, and was recognized by the mark of a dragon on his body. This led to the discovery that Antigone was still alive. Heracles pleaded in vain with Creon for Haemon, who slew both Antigone and himself, to escape his father's vengeance. On a painted vase the scene of the intercession of Heracles is represented (Heydermann, *Über eine nacheuripideische Antigone*, 1868). Antigone placing the body of Polyneices on the funeral pile occurs on a sarcophagus in the villa Pamfili in Rome, and is mentioned in the description of an ancient painting by Philostratus (*Imag.* ii. 29), who states that the flames consuming the two brothers burnt apart, indicating their unalterable hatred, even in death.

(2) A second Antigone was the daughter of Eurytion, king of Phthia, and wife of Peleus. Her husband, having accidentally killed Eurytion in the Calydonian boar hunt, fled and obtained expiation from Acastus, whose wife made advances to Peleus. Finding that her affection was not returned, she falsely accused Peleus of infidelity to his wife, who thereupon hanged herself (Apollodorus, iii. 13).

ANTIGONUS CYCLOPS (or Monopthalmos; so called from his having lost an eye) (382–301 B.C.), Macedonian king, son of Philip, was one of the generals of Alexander the Great. He was made governor of Greater Phrygia in 333, and in the division of the provinces after Alexander's death (323) Pamphylia and Lycia were added to his command. He incurred the enmity of Perdiccas, the regent, by refusing to assist Eumenes (*q.v.*) to obtain possession of the provinces allotted to him. In danger of his life he escaped with his son Demetrius into Greece, where he obtained the favour of Antipater, regent of Macedonia (321); and when, soon after, on the death of Perdiccas, a new division took place, he was entrusted with the command of the war against Eumenes, who had joined Perdiccas against the coalition of Antipater, Antigonus, and the other generals. Eumenes was completely defeated, and obliged to retire to Nora in Cappadocia, and a new army that was marching to his relief was routed by Antigonus. Polyperchon succeeding Antipater (d. 319) in the regency, to the exclusion of Cassander, his son, Antigonus resolved to set himself up as lord of all Asia, and in conjunction with Cassander and Ptolemy of Egypt, refused to recognize Polyperchon. He entered into negotiations with Eumenes; but Eumenes remained faithful to the royal house. Effecting his escape from Nora, he raised an army, and formed a coalition with the satraps of the eastern provinces. He was at last delivered up to Antigonus through treachery in Persia and put to death (316). Antigonus again claimed authority over the whole of Asia, seized the treasures at Susa, and entered Babylonia, of which Seleucus was governor. Seleucus fled to Ptolemy, and entered into a league with him (315), together with Lysimachus and Cassander. After the war had been carried on with varying success from 315 to 311, peace was concluded, by which the government of Asia Minor and Syria was provisionally secured to Antigonus. This agreement was soon violated on the pretext that garrisons had been placed in some of the free Greek cities by Antigonus, and Ptolemy and Cassander renewed hostilities against him. Demetrius Poliorcetes, the son of Antigonus, wrested part of Greece from Cassander. At first Ptolemy had made a successful descent upon Asia Minor and on several of the islands of the Archipelago; but he was at length totally defeated by Demetrius in a naval engagement off Salamis, in Cyprus (306). On this victory Antigonus assumed the title of king, and bestowed the same upon his son, a declaration that he claimed to be the heir of Alexander. Antigonus now prepared a large army, and a formidable fleet, the command of which he gave to Demetrius, and hastened to attack Ptolemy in his own dominions. His invasion of Egypt, however, proved a failure; he was unable to penetrate the defences of Ptolemy, and was obliged to retire. Demetrius now attempted the reduction of Rhodes, which had refused to assist Antigonus against Egypt; but, meeting with obstinate resistance, he was obliged to make a treaty upon the best terms that he could (304). In 302, although Demetrius was again winning success after success in Greece, Antigonus was obliged to recall him to meet the confederacy that had been formed between Cassander, Seleucus and Lysimachus. A decisive battle was fought at Ipsus, in which Antigonus fell, in the eighty-first year of his age.

Diodorus Siculus xviii., xx. 46-86; Plutarch, *Demetrius*, *Eumenes*; Nepos, *Eumenes*; Justin xv. 1-4. See Macedonian Empire; and Köhler, "Das Reich des Antigonos," in the *Sitzungsberichte d. Berl. Akad.*, 1898, p. 835 f.

ANTIGONUS GONATAS (*c.* 319–239 B.C.), Macedonian king, was the son of Demetrius Poliorcetes, and grandson of Antigonus Cyclops. On the death of his father (283), he assumed the title of king of Macedonia, but did not obtain possession of the throne till 276, after it had been successively in the hands of Pyrrhus, Lysimachus, Seleucus, and Ptolemy Ceraunus. Antigonus repelled the invasion of the Gauls, and continued in undisputed possession of Macedonia till 274, when Pyrrhus returned from Italy, and (in 273) made himself master of nearly all the country. On the advance of Pyrrhus into Peloponnesus, he recovered his dominions. He was again (between 263 and 255) driven out of his kingdom by Alexander, the son of Pyrrhus, and again recovered it. The latter part of his reign was comparatively peaceful, and he gained the affection of his subjects by his honesty and his cultivation of the arts. He gathered round him distinguished literary men—philosophers, poets, and historians. He died in the eightieth year of his age, and the forty-fourth of his reign. His surname was usually derived by later Greek writers from the name of his supposed birthplace, Gonni (Gonnus) in Thessaly; some take it to be a Macedonian word signifying an iron plate for protecting the knee; neither conjecture is a happy one, and in our ignorance of the Macedonian language it must remain unexplained.

Plutarch, *Demetrius*, *Pyrrhus*, *Aratus*; Justin xxiv. 1; xxv. 1-3; Polybius ii. 43-45, ix. 29, 34. See Thirlwall, *History of Greece*, vol. viii. (1847); Holm, *Griech. Gesch.* vol: iv. (1894); Niese, *Gesch. d. griech. u. maked. Staaten*, vols. i. and ii. (1893, 1899); Beloch, *Griech. Gesch.* vol. iii. (1904); also Wilamowitz-Moellendorff, *Antigonos von Karystos* (1881).

ANTIGONUS OF CARYSTUS (in Euboea), Greek writer on various subjects, flourished in the 3rd century B.C. After some time spent at Athens and in travelling, he was summoned to the court of Attalus I. (241–197) of Pergamum. His chief work was the *Lives of Philosophers* drawn from personal knowledge, of which considerable fragments are preserved in Athenaeus and Diogenes Laertius. We still possess his *Collection of Wonderful Tales*, chiefly extracted from the Θαυμάσια Ἀκούσματα attributed to Aristotle and the Θαυμάσια of Callimachus. It is doubtful whether he is identical with the sculptor who, according to Pliny (*Nat. Hist.* xxxiv. 19), wrote books on his art.

Text in Keller, *Rerum Naturalium Scriptores Graeci Minores*, i. (1877); see Köpke, *De Antigono Carystio* (1862); Wilamowitz-Möllendorff, "A. von Karystos," in *Philologische Untersuchungen*, iv. (1881).

ANTIGUA, an island in the British West Indies, forming, with Barbuda and Redonda, one of the five presidencies in the colony of the Leeward Islands. It lies 50 m. E. of St Kitts, in 17° 6′ N. and 61° 45′ W., and is 54 m. in circumference, with an area of 108 sq. m. The surface is comparatively flat, and there is no central range of mountains as in most other West Indian islands, but among the hills in the south-west an elevation of 1328 ft. is attained. Owing to the absence of rivers, the paucity of springs, and the almost complete deforestation, Antigua is subject to frequent droughts, and although the average rainfall is 45·6 in., the variations from year to year are great. The dryness of the air proves very beneficial to persons suffering from pulmonary complaints. The high rocky coast is much indented by bays and arms of the sea, several of which form excellent harbours, that of St John being safe and commodious, but inferior to English Harbour, which, although little frequented, is capable of receiving vessels of the largest size. The soil, especially in the interior, is very fertile. Sugar and pineapples are the chief products for export, but sweet potatoes, yams, maize and guinea corn are grown for local consumption. Antigua is the residence of the governor of the Leeward Islands, and the meeting place of the general legislative council, but there is also a local legislative council of 16 members, half official and half unofficial. Until 1898, when the Crown Colony system was adopted, the legislative council was partly elected, partly nominated. Elementary education is compulsory. Agricultural training is given under government control, and the Cambridge local examinations and those of the University of London are held annually. Antigua is the see of a bishop of the Church of England, the members of which predominate here, but Moravians and Wesleyans are numerous. There is a small volunteer defence force. The island has direct steam communication with Great Britain, the United States and Canada, and is also served by the submarine cable. The three chief towns are St John, Falmouth and Parham. St John (pop. about 10,000), the capital, situated on the north-west, is an exceedingly picturesque town, built on an eminence overlooking one of the most beautiful harbours in the West Indies. Although both Falmouth and Parham have good harbours, most of the produce of the island finds its way to St John for shipment. The trade is chiefly with the United States, and the main exports are sugar, molasses, logwood, tamarinds, turtles, and pineapples. The cultivation of cotton has been introduced with success, and this also is exported. The dependent islands of Barbuda and Redonda have an area of 62 sq. m. Pop. of Antigua (1901), 34,178; of the presidency, 35,073.

Antigua was discovered in 1493 by Columbus, who is said to have named it after a church in Seville, called Santa Maria la Antigua. It remained, however, uninhabited until 1632, when a body of English settlers took possession of it, and in 1663 another settlement of the same nation was effected under the direction of Lord Willoughby, to whom the entire island was granted by Charles II. It was ravaged by the French in 1666, but was soon after reconquered by the British and formally restored to them by the treaty of Breda. Since then it has been a British possession.

ANTILEGOMENA (ἀντιλεγόμενα, contradicted or disputed), an epithet used by the early Christian writers to denote those books of the New Testament which, although sometimes publicly read in the churches, were not for a considerable time admitted to be genuine, or received into the canon of Scripture. They were thus contrasted with the *Homologoumena*, or universally acknowledged writings. Eusebius (*Hist. Eccl.* iii. 25) applies the term *Antilegomena* to the Epistle of James, the Epistle of Jude, 2 Peter, 2 and 3 John, the Acts of Paul, the Shepherd of Hermas, the Teaching of the Apostles, the Apocalypse of John, and the Gospel according to the Hebrews. In later usage it describes those of the New Testament books which have obtained a doubtful place in the Canon. These are the Epistles of James and Jude, 2 Peter, 2 and 3 John, the Apocalypse of John, and the Epistle to the Hebrews.

ANTILIA or **ANTILLIA**, sometimes called the Island of the Seven Cities (Portuguese *Isla das Sete Cidades*), a legendary island in the Atlantic ocean. The origin of the name is quite uncertain. The oldest suggested etymology (1455) fancifully connects it with the name of the Platonic Atlantis, while later writers have endeavoured to derive it from the Latin *anterior* (*i.e.* the island that is reached "before" Cipango), or from the *Jezirat al Tennyn*, "Dragon's Isle," of the Arabian geographers. Antilia is marked in an anonymous map which is dated 1424 and preserved in the grand-ducal library at Weimar. It reappears in the maps of the Genoese B. Beccario or Beccaria (1435), and of the Venetian Andrea Bianco (1436), and again in 1455 and 1476. In most of these it is accompanied by the smaller and equally legendary islands of Royllo, St Atanagio, and Tanmar, the whole group being classified as *insulae de novo repertae*, "newly discovered islands." The Florentine Paul Toscanelli, in his letters to Columbus and the Portuguese court (1474), takes Antilia as the principal landmark for measuring the distance between Lisbon and the island of Cipango or Zipangu (Japan). One of the chief early descriptions of Antilia is that inscribed on the globe which the geographer Martin Behaim made at Nuremberg in 1492 (see MAP: *History*). Behaim relates that in 734—a date which is probably a misprint for 714—and after the Moors had conquered Spain and Portugal, the island of Antilia or "Septe Cidade" was colonized by Christian refugees under the archbishop of Oporto and six bishops. The inscription adds that a Spanish vessel sighted the island in 1414. According to an old Portuguese tradition each of the seven leaders founded and ruled a city, and the whole island became a Utopian commonwealth, free from the disorders of less favoured states. Later Portuguese tradition localized Antilia in the island of St Michael's, the largest of the Azores. It is impossible to estimate how far this legend commemorates some actual but imperfectly recorded discovery, and how far it is a reminiscence of the ancient idea of an elysium in the western seas which is embodied in the legends of the Isles of the Blest or Fortunate Islands.

ANTILLES, a term of somewhat doubtful origin, now generally used, especially by foreign writers, as synonymous with the expression "West India Islands." Like "Brazil," it dates from a period anterior to the discovery of the New World, "Antilia," as stated above, being one of those mysterious lands, which figured on the medieval charts sometimes as an archipelago, sometimes as continuous land of greater or lesser extent, constantly fluctuating in mid-ocean between the Canaries and East India. But it came at last to be identified with the land discovered by Columbus. Later, when this was found to consist of a vast archipelago enclosing the Caribbean Sea and Gulf of Mexico, *Antilia* assumed its present plural form, *Antilles*, which was collectively applied to the whole of this archipelago.

A distinction is made between the Greater Antilles, including Cuba, Jamaica, Haiti, and Porto Rico; and the Lesser Antilles, covering the remainder of the islands.

ANTILOCHUS, in Greek legend, son of Nestor, king of Pylos. One of the suitors of Helen, he accompanied his father to the Trojan War. He was distinguished for his beauty, swiftness of foot, and skill as a charioteer; though the youngest among the Greek princes, he commanded the Pylians in the war, and performed many deeds of valour. He was a favourite of the gods, and an intimate friend of Achilles, to whom he was commissioned to announce the death of Patroclus. When his father was attacked by Memnon, he saved his life at the sacrifice of his own (Pindar, *Pyth.* vi. 28), thus fulfilling an oracle which had bidden him "beware of an Ethiopian." His death was avenged by Achilles. According to other accounts, he was slain by

Hector (Hyginus, *Fab.* 113), or by Paris in the temple of the Thymbraean Apollo together with Achilles (Dares Phrygius 34). His ashes, with those of Achilles and Patroclus, were deposited in a mound on the promontory of Sigeum, where the inhabitants of Ilium offered sacrifice to the dead heroes (*Odyssey*, xxiv. 72; Strabo xiii. p. 596). In the *Odyssey* (xi. 468) the three friends are represented as united in the underworld and walking together in the fields of asphodel; according to Pausanias (iii. 19) they dwell together in the island of Leukē.

ANTIMACASSAR, a separate covering for the back of a chair, or the head or cushions of a sofa, to prevent soiling of the permanent fabric. The name is attributable to the unguent for the hair commonly used in the early 19th century,—Byron calls it "thine incomparable oil, Macassar." The original antimacassar was almost invariably made of white crochet-work, very stiff, hard, and uncomfortable, but in the third quarter of the 19th century it became simpler and less inartistic, and was made of soft coloured stuffs, usually worked with a simple pattern in tinted wools or silk.

ANTIMACHUS, of Colophon or Claros, Greek poet and grammarian, flourished about 400 B.C. Scarcely anything is known of his life. His poetical efforts were not generally appreciated, although he received encouragement from his younger contemporary Plato (Plutarch, *Lysander*, 18). His chief works were: a long-winded epic *Thebais*, an account of the expedition of the Seven against Thebes and the war of the Epigoni; and an elegiac poem *Lydē*, so called from the poet's mistress, for whose death he endeavoured to find consolation by ransacking mythology for stories of unhappy love affairs (Plutarch, *Consol. ad Apoll.* 9; Athenaeus xiii. 597). Antimachus was the founder of "learned" epic poetry, and the forerunner of the Alexandrian school, whose critics allotted him the next place to Homer. He also prepared a critical recension of the Homeric poems.

Fragments, ed. Stoll (1845); Bergk, *Poetae Lyrici Graeci* (1882); Kinkel, *Fragmenta epicorum Graecorum* (1877).

ANTI-MASONIC PARTY, an American political organization which had its rise after the mysterious disappearance, in 1826, of William Morgan (*c.* 1776–*c.* 1826), a Freemason of Batavia, New York, who had become dissatisfied with his Order and had planned to publish its secrets. When his purpose became known to the Masons, Morgan was subjected to frequent annoyances, and finally in September 1826 he was seized and surreptitiously conveyed to Fort Niagara, whence he disappeared. Though his ultimate fate was never known, it was generally believed at the time that he had been foully dealt with. The event created great excitement, and led many to believe that Masonry and good citizenship were incompatible. Opposition to Masonry was taken up by the churches as a sort of religious crusade, and it also became a local political issue in western New York, where early in 1827 the citizens in many mass meetings resolved to support no Mason for public office. In New York at this time the National Republicans, or "Adams men," were a very feeble organization, and shrewd political leaders at once determined to utilize the strong anti-Masonic feeling in creating a new and vigorous party to oppose the rising Jacksonian Democracy. In this effort they were aided by the fact that Jackson was a high Mason and frequently spoke in praise of the Order. In the elections of 1828 the new party proved unexpectedly strong, and after this year it practically superseded the National Republican party in New York. In 1829 the hand of its leaders was shown, when, in addition to its antagonism to the Masons, it became a champion of internal improvements and of the protective tariff. From New York the movement spread into other middle states and into New England, and became especially strong in Pennsylvania and Vermont. A national organization was planned as early as 1827, when the New York leaders attempted, unsuccessfully, to persuade Henry Clay, though a Mason, to renounce the Order and head the movement. In September 1831 the party at a national convention in Baltimore nominated as its candidates for the presidency and vice-presidency William Wirt of Maryland and Amos Ellmaker (1787–1851) of Pennsylvania; and in the election of the following year it secured the seven electoral votes of the state of Vermont. This was the high tide of its prosperity; in New York in 1833 the organization was moribund, and its members gradually united with other opponents of Jacksonian Democracy in forming the Whig party. In other states, however, the party survived somewhat longer, but by 1836 most of its members had united with the Whigs. Its last act in national politics was to nominate William Henry Harrison for president and John Tyler for vice-president at a convention in Philadelphia in November 1838.

The growth of the anti-Masonic movement was due to the political and social conditions of the time rather than to the Morgan episode, which was merely the torch that ignited the train. Under the name of "Anti-Masons" able leaders united those who were discontented with existing political conditions, and the fact that William Wirt, their choice for the presidency in 1832, was not only a Mason but even defended the Order in a speech before the convention that nominated him, indicates that simple opposition to Masonry soon became a minor factor in holding together the various elements of which the party was composed.

See Charles McCarthy, *The Antimasonic Party: A Study of Political Anti-Masonry in the United States, 1827–1840*, in the Report of the American Historical Association for 1902 (Washington, 1903); the *Autobiography of Thurlow Weed* (2 vols., Boston, 1884); A. G. Mackey and W. R. Singleton, *The History of Freemasonry*, vol. vi. (New York, 1898); and J. D. Hammond, *History of Political Parties in the State of New York* (2 vols., Albany, 1842).

ANTIMONY (symbol Sb, atomic weight 120·2), one of the metallic chemical elements, included in the same natural family of the elements as nitrogen, phosphorus, arsenic, and bismuth. Antimony, in the form of its sulphide, has been known from very early times, more especially in Eastern countries, reference to it being made in the Old Testament. The Arabic name for the naturally occurring stibnite is "kohl"; Dioscorides mentions it under the term στίμμι, Pliny as *stibium*; and Geber as *antimonium*. By the German writers it is called *Speissglanz*. Basil Valentine alludes to it in his *Triumphal Car of Antimony* (circa 1600), and at a later date describes the preparation of the metal.

Native mineral antimony is occasionally found, and as such was first recognized in 1748. It usually occurs as lamellar or glanular masses, with a tin-white colour and metallic lustre, in limestone or in mineral veins often in association with ores of silver. Distinct crystals are rarely met with; these are rhombohedral and isomorphous with arsenic and bismuth; they have a perfect cleavage parallel to the basal plane, *c* (111), and are sometimes twinned on a rhombohedral plane, *e* (110). Hardness $3-3\frac{1}{2}$, specific gravity 6·65–6·72. Sala in Sweden, Allemont in Dauphiné, and Sarawak in Borneo may be mentioned as some of the localities for this mineral.

Antimony, however, occurs chiefly as the sulphide, stibnite; to a much smaller extent it occurs in combination with other metallic sulphides in the minerals wolfsbergite, boulangerite, bournonite, pyrargyrite, &c. For the preparation of metallic antimony the crude stibnite is first liquated, to free it from earthy and siliceous matter, and is then roasted in order to convert it into oxide. After oxidation, the product is reduced by heating with carbon, care being taken to prevent any loss through volatilization, by covering the mass with a layer of some protective substance such as potash, soda or glauber salt, which also aids the refining. For rich ores the method of roasting the sulphide with metallic iron is sometimes employed; carbon and salt or sodium sulphate being used to slag the iron. Electrolytic methods, in which a solution of antimony sulphide in sodium sulphide is used as the electrolyte, have been proposed (see German Patent 67973, and also Borcher's *Electro-Metallurgie*), but do not yet appear to have been used on the large scale.

Antimony combines readily with many other metals to form alloys, some of which find extensive application in the arts. Type-metal is an alloy of lead with antimony and tin, to which occasionally a small quantity of copper or zinc is added. The presence of the antimony in this alloy gives to it hardness, and the property of expanding on solidification, thus allowing a sharp cast of the letter to be taken. An alloy of tin and antimony forms the basis of Britannia-metal, small quantities of copper, lead, zinc or bismuth being added. It is a white metal of bluish tint and is malleable and ductile. For the linings of brasses, various white metals are used, these being alloys of copper, antimony and tin, and occasionally lead.

Antimony is a silvery white, crystalline, brittle metal, and has a high lustre. Its specific gravity varies from 6·7 to 6·86; it melts at 432° C. (Dalton), and boils between 1090-1600° C. (T. Carnelley), or above 1300° (V. Meyer). Its specific heat is 0·0523 (H. Kopp). The vapour density of antimony at 1572° C. is 10·74, and at 1640° C. 9·78 (V. Meyer, *Berichte*, 1889, 22, p. 725), so that the antimony molecule is less complex than the molecules of the elements phosphorus and arsenic. An amorphous modification of antimony can be prepared by heating the metal in a stream of nitrogen, when it condenses in the cool part of the apparatus as a grey powder of specific gravity 6·22, melting at 614° C. and containing 98-99% of antimony (F. Hérard, *Comptes Rendus*, 1888, cvii. 420).

Another form of the metal, known as explosive antimony, was discovered by G. Gore (*Phil. Trans.*, 1858, p. 185; 1859, p. 797; 1862, p. 623), on electrolysing a solution of antimony trichloride in hydrochloric acid, using a positive pole of antimony and a negative pole of copper or platinum wire. It has a specific gravity of 5·78 and always contains some unaltered antimony trichloride (from 6 to 20%, G. Gore). It is very unstable, a scratch causing it instantaneously to pass into the stable form with explosive violence and the development of much heat. Similar phenomena are exhibited in the electrolysis of solutions of antimony tribromide and tri-iodide, the product obtained from the tribromide having a specific gravity of 5·4, and containing 18-20% of antimony tribromide, whilst that from the tri-iodide has a specific gravity of 5·2-5·8 and contains about 22% of hydriodic acid and antimony tri-iodide.

The atomic weight of antimony has been determined by the analysis of the chloride, bromide and iodide. J. P. Cooke (*Proc. Amer. Acad.*, 1878, xiii. 1) and J. Bongartz (*Berichte*, 1883, 16, p. 1942) obtained the value 120, whilst F. Pfeiffer (*Ann. Chim. et Phys.* ccix. 173) obtained the value 121 from the electrolysis of the chloride.

Pure antimony is quite permanent in air at ordinary temperatures, but when heated in air or oxygen it burns, forming the trioxide. It decomposes steam at a red heat, and burns (especially when finely powdered) in chlorine. Dilute hydrochloric acid is without action on it, but on warming with the concentrated acid, antimony trichloride is formed; it dissolves in warm concentrated sulphuric acid, the sulphate $Sb_2(SO_4)_3$ being formed. Nitric acid oxidizes antimony either to the trioxide Sb_4O_6 or the pentoxide Sb_2O_5, the product obtained depending on the temperature and concentration of the acid. It combines directly with sulphur and phosphorus, and is readily oxidized when heated with metallic oxides (such as litharge, mercuric oxide, manganese dioxide, &c.). Antimony and its salts may be readily detected by the orange precipitate of antimony sulphide which is produced when sulphuretted hydrogen is passed through their acid solutions, and also by the Marsh test (see ARSENIC); in this latter case the black stain produced is not soluble in bleaching powder solution. Antimony compounds when heated on charcoal with sodium carbonate in the reducing flame give brittle beads of metallic antimony, and a white incrustation of the oxide. The antimonious compounds are decomposed on addition of water, with formation of basic salts.

Antimony may be estimated quantitatively by conversion into the sulphide; the precipitate obtained is dried at 100° C. and heated in a current of carbon dioxide, or it may be converted into the tetroxide by nitric acid.

Antimony, like phosphorus and arsenic, combines directly with hydrogen. The compound formed, antimoniuretted hydrogen or stibine, SbH_3, may also be prepared by the action of hydrochloric acid on an alloy of antimony and zinc, or by the action of nascent hydrogen on antimony compounds. As prepared by these methods it contains a relatively large amount of hydrogen, from which it can be freed by passing through a tube immersed in liquid air, when it condenses to a white solid. It is a poisonous colourless gas, with a characteristic offensive smell. In its general behaviour it resembles arsine, burning with a violet flame and being decomposed by heat into its constituent elements. When passed into silver nitrate solution it gives a black precipitate of silver antimonide, $SbAg_3$. It is decomposed by the halogen elements and also by sulphuretted hydrogen. All three hydrogen atoms are replaceable by organic radicals and the resulting compounds combine with compounds of the type RCl, RBr and RI to form stibonium compounds.

There are three known oxides of antimony, the trioxide Sb_4O_6 which is capable of combining with both acids and bases to form salts, the tetroxide Sb_2O_4 and the pentoxide Sb_2O_5. Antimony trioxide occurs as the minerals valentinite and senarmontite, and can be artificially prepared by burning antimony in air; by heating the metal in steam to a bright red heat; by oxidizing melted antimony with litharge; by decomposing antimony trichloride with an aqueous solution of sodium carbonate, or by the action of dilute nitric acid on the metal. It is a white powder, almost insoluble in water, and when volatilized, condenses in two crystalline forms, either octahedral or prismatic. It is insoluble in sulphuric and nitric acids, but is readily soluble in hydrochloric and tartaric acids and in solutions of the caustic alkalies. On strongly heating in air it is converted into the tetroxide. The corresponding hydroxide, orthoantimonious acid, $Sb(OH)_3$, can be obtained in a somewhat impure form by precipitating tartar emetic with dilute sulphuric acid; or better by decomposing antimonyl tartaric acid with sulphuric acid and drying the precipitated white powder at 100° C. Antimony tetroxide is formed by strongly heating either the trioxide or pentoxide. It is a non-volatile white powder, and has a specific gravity of 6·6952; it is insoluble in water and almost so in acids—concentrated hydrochloric acid dissolving a small quantity. It is decomposed by a hot solution of potassium bitartrate. Antimony pentoxide is obtained by repeatedly evaporating antimony with nitric acid and heating the resulting antimonic acid to a temperature not above 275° C.; by heating antimony with red mercuric oxide until the mass becomes yellow (J. Berzelius); or by evaporating antimony trichloride to dryness with nitric acid. It is a pale yellow powder (of specific gravity 6·5), which on being heated strongly gives up oxygen and forms the tetroxide. It is insoluble in water, but dissolves slowly in hydrochloric acid. It possesses a feeble acid character, giving metantimoniates when heated with alkaline carbonates.

Orthoantimonic acid, H_3SbO_4, is obtained by the decomposition of its potassium salt with nitric acid (A. Geuther); or by the addition of water to the pentachloride, the precipitate formed being dried over sulphuric acid (P. Conrad, *Chem. News*, 1879, xl. 198). It is a white powder almost insoluble in water and nitric acid, and when heated, is first converted into metantimonic acid, $HSbO_3$, and then into the pentoxide Sb_2O_5. Pyroantimonic acid, $H_4Sb_2O_7$ (the metantimonic acid of E. Frémy), is obtained by decomposing antimony pentachloride with hot water, and drying the precipitate so obtained at 100° C. It is a white powder which is more soluble in water and acids than orthoantimonic acid. It forms two series of salts, of the types $M_2H_2Sb_2O_7$ and $M_4Sb_2O_7$. Metantimonic acid, $HSbO_3$, can be obtained by heating orthoantimonic acid to 175° C., or by long fusion of antimony with antimony sulphide and nitre. The fused mass is extracted with water, nitric acid is added to the solution, and the precipitate obtained washed with water (J. Berzelius). It is a white powder almost insoluble in water. On standing with water for some time it is slowly converted into the ortho-acid.

Compounds of antimony with all the halogen elements are known, one atom of the metal combining with three or five atoms of the halogen, except in the case of bromine, where only the tribromide is known. The majority of these halide compounds are decomposed by water, with the formation of basic salts. Antimony trichloride ("Butter of Antimony"), $SbCl_3$, is obtained by burning the metal in chlorine; by distilling antimony with excess of mercuric chloride; and by fractional distillation of antimony tetroxide or trisulphide in hydrochloric acid solution. It is a colourless deliquescent solid of specific gravity 3·06; it melts at 73·2° C. (H. Kopp) to a colourless oil; and boils at 223° (H. Capitaine). It is soluble in alcohol and in carbon bisulphide, and also in a small quantity of water; but with an excess of water it gives a precipitate of various oxychlorides, known as powder of algaroth (*q.v.*). These precipitated oxychlorides on continued boiling with water lose all their chlorine and ultimately give a residue of antimony trioxide. It combines with chlorides of the alkali metals to form double salts, and also with barium, calcium, strontium, and magnesium chlorides. Antimony pentachloride, $SbCl_5$, is prepared by heating the trichloride in a current of chlorine. It is a nearly colourless fuming liquid of unpleasant smell, which can be solidified to a mass of crystals melting at −6° C. It dissociates into the trichloride and chlorine when heated. It combines with water, forming the hydrates $SbCl_5 \cdot H_2O$ and $SbCl_5 \cdot 4H_2O$; it also combines with phosphorus oxychloride, hydrocyanic acid, and cyanogen chloride. In chloroform solution it combines with anhydrous oxalic acid to form a compound, $Sb_2Cl_8(C_2O_4)$, which is to be considered as tetra-chlorstibonium oxalate $\begin{array}{l}COOSbCl_4\\|\\COOSbCl_4\end{array}$ (R. Anschütz and Evans, *Annalen*, 1887, ccxxxix. 235). Antimonyl chloride, $SbOCl$, is produced by the decomposition of one part of the trichloride with four parts of water. Prepared in this way it contains a small quantity of the unaltered chloride, which can be removed by ether or carbon bisulphide. It is a white powder insoluble in water, alcohol and ether. On heating, it is converted into the oxychloride $Sb_4O_5Cl_2$ $(Sb_2O_3 \cdot SbOCl)$. Antimony oxychloride, $SbOCl_3$, is formed by addition of the calculated quantity of water to ice-cooled antimony pentachloride, $SbCl_5+H_2O=SbOCl_3+2HCl$. It forms a yellowish crystalline precipitate which in moist air goes to a thick liquid. Compounds of composition, $SbOCl_3 \cdot 2SbCl_5$ and $SbO_2Cl \cdot 2SbOCl_3$, have also been described (W. C. Williams, *Chem. News*. 1871, xxiv. 234).

Antimony tribromide, $SbBr_3$, and tri-iodide, SbI_3, may be prepared by the action of antimony on solutions of bromine or iodine in carbon bisulphide. The tribromide is a colourless crystalline mass of specific gravity 4·148 (23°), melting at 90° to 94° C. and boiling at 275·4° C. (H. Kopp). The tri-iodide forms red-coloured crystals of specific gravity 4·848 (26°), melting at 165° to 167° C. and boiling at 401° C. By the action of water they give oxybromides and oxyiodides $SbOBr$, $Sb_4O_5Br_2$, $SbOI$. Antimony penta-iodide, SbI_5, is formed by heating antimony with excess of iodine, in a sealed tube, to a temperature not above 130° C. It forms a dark brown crystalline mass, melting at 78° to 79° C., and is easily dissociated on heating. Antimony trifluoride, SbF_3, is obtained by dissolving the trioxide in aqueous hydrofluoric acid or by distilling antimony with mercuric fluoride. By rapid evaporation of its solution it may be obtained in small prisms. The pentafluoride SbF_5 results when metantimonic acid is dissolved in hydrofluoric acid, and the solution is evaporated. It forms an amorphous gummy mass, which is decomposed by heat. Oxyfluorides of composition $SbOF$ and $SbOF_3$ are known.

Two sulphides of antimony are definitely known, the trisulphide Sb_2S_3 and the pentasulphide Sb_2S_5; a third, the tetrasulphide Sb_2S_4, has also been described, but its existence is doubtful. Antimony trisulphide, Sb_2S_3, occurs as the mineral antimonite or stibnite, from which the commercial product is obtained by a process of liquation. The amorphous variety may be obtained from the crystalline form by dissolving it in caustic potash or soda or in solutions of alkaline sulphides, and precipitating the hot solution by dilute sulphuric acid. The precipitate is then washed with water and dried at 100° C., by which treatment it is obtained in the anhydrous form. On precipitating antimony trichloride or tartar emetic in acid solution with sulphuretted hydrogen, an orange-red precipitate of the hydrated sulphide is obtained, which turns black on being heated to 200° C The trisulphide heated in a current of hydrogen is reduced to the metallic state; it burns in air forming the tetroxide, and is soluble in concentrated hydrochloric acid, in solutions of the caustic alkalis, and in alkaline sulphides. By the union of antimony trisulphide with basic sulphides, livers of antimony are obtained. These substances are usually prepared by fusing their components together, and are dark powders which are less soluble in water the more antimony they contain. These thioantimonites are used in the vulcanizing of rubber and in the preparation of matches. Antimony pentasulphide, Sb_2S_5, is prepared by precipitating a solution of the pentachloride with sulphuretted hydrogen, by decomposing "Schlippe's salt" (*q.v.*) with an acid, or by passing sulphuretted hydrogen into water containing antimonic acid. It forms a fine dark orange powder, insoluble in water, but readily soluble in aqueous solutions of the caustic alkalis and alkaline carbonates. On heating in absence of air, it decomposes into the trisulphide and sulphur.

An antimony phosphide and arsenide are known, as is also a thiophosphate, $SbPS_4$, which is prepared by heating together antimony trichloride and phosphorus pentasulphide.

Many organic compounds containing antimony are known. By distilling an alloy of antimony and sodium with mythyl iodide, mixed with sand, trimethyl stibine, $Sb(CH_3)_3$, is obtained; this combines with excess of methyl iodide to form tetramethyl stibonium iodide, $Sb(CH_3)_4I$. From this iodide the trimethyl stibine may be obtained by distillation with an alloy of potassium and antimony in a current of carbon dioxide. It is a colourless liquid, slightly soluble in water, and is spontaneously inflammable. The stibonium iodide on treatment with moist silver oxide gives the corresponding tetramethyl stibonium hydroxide, $Sb(CH_3)_4OH$, which forms deliquescent crystals, of alkaline reaction, and absorbs carbon dioxide readily. On distilling trimethyl stibine with zinc methyl, antimony tetra-methyl and penta-methyl are formed. Corresponding antimony compounds containing the ethyl group are known, as is also a tri-phenyl stibine, $Sb(C_6H_5)_3$, which is prepared from antimony trichloride, sodium and monochlorbenzene. See Chung Yu Wang, *Antimony* (1909).

Antimony in Medicine.—So far back as Basil Valentine and Paracelsus, antimonial preparations were in great vogue as medicinal agents, and came to be so much abused that a prohibition was placed upon their employment by the Paris parlement in 1566. Metallic antimony was utilized to make goblets in which wine was allowed to stand so as to acquire emetic properties, and "everlasting" pills of the metal, supposed to act by contact merely, were administered and recovered for future use after they had fulfilled their purpose. Antimony compounds act as irritants both externally and internally. Tartar emetic (antimony tartrate) when swallowed, acts directly on the wall of the stomach, producing vomiting, and after absorption continues this effect by its action on the medulla. It is a powerful cardiac depressant, diminishing both the force and frequency of the heart's beat. It depresses respiration, and in large doses lowers temperature. It depresses the nervous system, especially the spinal cord. It is excreted by all the secretions and excretions of the body. Thus as it passes out by the bronchial mucous membrane it increases the amount of secretion and so acts as an expectorant. On the skin its action is that of a diaphoretic, and being also excreted by the bile it acts slightly as a cholagogue. Summed up, its action is that of an irritant, and a cardiac and nervous depressant. But on account of this depressant action it is to be avoided for women and children and rarely used for men.

Toxicology.—Antimony is one of the "protoplasmic" poisons, directly lethal to all living matter. In acute poisoning by it the symptoms are almost identical with those of arsenical poisoning, which is much commoner (See ARSENIC). The post-mortem appearances are also very similar, but the gastro-intestinal irritation is much less marked and inflammation of the lungs is more commonly seen. If the patient is not already vomiting freely the treatment is to use the stomach-pump, or give sulphate of zinc (gr. 10–30) by the mouth or apomorphine (gr. $\frac{1}{20}$–$\frac{1}{10}$) subcutaneously. Frequent doses of a teaspoonful of tannin dissolved in water should be administered, together with strong tea and coffee and mucilaginous fluids. Stimulants may be given subcutaneously, and the patient should be placed in bed between warm blankets with hot-water bottles. Chronic poisoning by antimony is very rare, but resembles in essentials chronic poisoning by arsenic. In its medico-legal aspects antimonial poisoning is of little and lessening importance.

ANTINOMIANS (Gr. ἀντί, against, νόμος, law), a term apparently coined by Luther to stigmatize Johannes Agricola (*q.v.*) and his following, indicating an interpretation of the antithesis between law and gospel, recurrent from the earliest times. Christians being released, in important particulars, from conformity to the Old Testament polity as a whole, a real difficulty attended the settlement of the limits and the immediate authority of the remainder, known vaguely as the moral law. Indications are not wanting that St Paul's doctrine of justification by faith was, in his own day, mistaken or perverted in the interests of immoral licence. Gnostic sects approached the question in two ways. Marcionites, named by Clement of Alexandria *Antitactae* (revolters against the Demiurge) held the Old Testament economy to be throughout tainted by its source; but they are not accused of licentiousness. Manichaeans, again, holding their spiritual being to be unaffected by the action of matter, regarded carnal sins as being, at worst, forms of bodily disease. Kindred to this latter view was the position of sundry sects of English fanatics during the Commonwealth, who denied that an elect person sinned, even when committing acts in themselves gross and evil. Different from either of these was the Antinomianism charged by Luther against Agricola. Its starting-point was a dispute with Melanchthon in 1527 as to the relation between repentance and faith. Melanchthon urged that repentance must precede faith, and that knowledge of the moral law is needed to produce repentance. Agricola gave the initial place to faith, maintaining that repentance is the work, not of law, but of the gospel-given knowledge of the love of God. The resulting Antinomian controversy (the only one within the Lutheran body in Luther's lifetime) is not remarkable for the precision or the moderation of the combatants on either side. Agricola was apparently satisfied in conference with Luther and Melanchthon at Torgau, December 1527. His eighteen *Positiones* of 1537 revived the controversy and made it acute. Random as are some of his statements, he was consistent in two objects: (1) in the interest of solifidian doctrine, to place the rejection of the Catholic doctrine of good works on a sure ground; (2) in the interest of the New Testament, to find all needful guidance for Christian duty in its principles, if not in its precepts. From the latter part of the 17th century charges of Antinomianism have frequently been directed against Calvinists, on the ground of their disparagement of "deadly doing" and of "legal preaching." The virulent controversy between Arminian and Calvinistic Methodists produced as its ablest outcome Fletcher's *Checks to Antinomianism* (1771–1775).

See G. Kawerau, in A. Hauck's *Realencyklopädie* (1896); Riess, in I. Goschler's *Dict. Encyclop. de la théol. cath.* (1858); J. H. Blunt, *Dict. of Doct. and Hist. Theol.* (1872); J. C. L. Gieseler, *Ch. Hist.* (New York ed. 1868, vol. iv.).

ANTINOMY (Gr. ἀντί, against, νόμος, law), literally, the mutual incompatibility, real or apparent, of two laws. The term acquired a special significance in the philosophy of Kant, who used it to describe the contradictory results of applying to the universe of pure thought the categories or criteria proper to the universe of sensible perception (phenomena). These antinomies are four—two mathematical, two dynamical—connected with (1) the limitation of the universe in respect of space and time, (2) the theory that the whole consists of indivisible atoms (whereas, in fact, none such exist), (3) the problem of freedom in relation to universal causality, (4) the existence of a universal being—about each of which pure reason contradicts the empirical, as thesis and antithesis. Kant claimed to solve these contradictions by saying, that in no case is the contradiction real, however really it has been intended by the opposing partisans, or must appear to the mind without critical enlightenment. It is wrong, therefore, to impute to Kant, as is often done, the view that human reason is, on ultimate subjects, at war with itself, in the sense of being impelled by equally strong arguments towards alternatives contradictory of each other. The difficulty arises from a confusion between the spheres of phenomena and noumena. In fact no rational cosmology is possible.

See John Watson, *Selections from Kant* (trans. Glasgow, 1897), pp. 155 foll.; W. Windelband, *History of Philosophy* (Eng. trans. 1893); H. Sidgwick, *Philos. of Kant*, lectures x. and xi. (Lond., 1905); F. Paulsen, *I. Kant* (Eng. trans. 1902), pp. 216 foll.

ANTINOÜS, a beautiful youth of Claudiopolis in Bithynia, was the favourite of the emperor Hadrian, whom he accompanied on his journeys. He committed suicide by drowning himself in the Nile (A.D. 130), either in a fit of melancholy or in order to prolong his patron's life by his voluntary sacrifice. After his death, Hadrian caused the most extravagant respect to be paid to his memory. Not only were cities called after him, medals struck with his effigy, and statues erected to him in all parts of the empire, but he was raised to the rank of the gods, temples were built for his worship in Bithynia, Mantineia in Arcadia, and Athens, festivals celebrated in his honour and oracles delivered in his name. The city of Antinoöpolis was founded on the ruins of Besa where he died (Dio Cassius lix. 11; Spartianus, *Hadrian*). A number of statues, busts, gems and coins represented Antinoüs as the ideal type of youthful beauty, often with the attributes of some special god. We still possess a colossal bust in the Vatican, a bust in the Louvre, a bas-relief from the Villa Albani, a statue in the Capitoline museum, another in Berlin, another in the Lateran, and many more.

See Levezow, *Über den Antinous* (1808); Dietrich, *Antinoos* (1884); Laban, *Der Gemütsausdruck des Antinoos* (1891); *Antinoüs, A Romance of Ancient Rome*, from the German of A. Hausrath, by M. Safford (New York, 1882); Ebers, *Der Kaiser* (1881).

ANTIOCH. There were sixteen cities known to have been founded under this name by Hellenistic monarchs; and at least twelve others were renamed Antioch. But by far the most famous and important in the list was 'Αντιόχεια ἡ ἐπὶ Δάφνῃ (mod. *Antakia*), situated on the left bank of the Orontes, about 20 m. from the sea and its port, Seleucia of Pieria (*Suedia*). Founded as a Greek city in 300 B.C. by Seleucus Nicator, as soon as he had assured his grip upon western Asia by the victory of Ipsus (301), it was destined to rival Alexandria in Egypt as the chief city of the nearer East, and to be the cradle of gentile Christianity. The geographical character of the district north and north-east of the elbow of Orontes makes it the natural centre of Syria, so long as that country is held by a western power; and only Asiatic, and especially Arab, dynasties have neglected it for the oasis of Damascus. The two easiest routes from the Mediterranean, lying through the Orontes gorge and the Beilan Pass, converge in the plain of the Antioch Lake (*Balük Geul* or *El Bahr*) and are met there by (1) the road from the Amanic Gates (Baghche Pass) and western Commagene, which descends the valley of the Kara Su, (2) the roads from eastern Commagene and the Euphratean crossings at Samosata (Samsat) and Apamea Zeugma (Birejik), which descend the valleys of the Afrin and the Kuwaik, and (3) the road from the Euphratean ford at Thapsacus, which skirts the fringe of the Syrian steppe. Travellers by all these roads must proceed south by the single route of the Orontes valley. Alexander is said to have camped on the site of Antioch, and dedicated an altar to Zeus Bottiaeus, which lay in the north-west of the future city. But the first western sovereign practically to recognize the importance of the district was Antigonus, who began to build a city, Antigonia, on the Kara Su a few miles north of the situation of Antioch; but, on his defeat, he left it to serve as a quarry for his rival Seleucus. The latter is said to have appealed to augury to determine the exact site of his projected foundation; but less fantastic considerations went far to settle it. To build south of the river, and on and under the last east spur of Casius, was to have security against invasion from the north, and command of the abundant waters of the mountain. One torrent, the Onopniktes ("donkey-drowner"), flowed through the new city, and many other streams came down a few miles west into the beautiful suburb of Daphne. The site appears not to have been found wholly uninhabited. A settlement, *Meroe*, boasting a shrine of Anait, called by the Greeks the "Persian Artemis," had long been located there, and was ultimately included in the eastern suburbs of the new city; and there seems to have been a village on the spur (Mt. Silpius), of which we hear in late authors under the name *Io*, or *Iopolis*. This name was always adduced as evidence by Antiochenes (*e.g.* Libanius) anxious to affiliate themselves to the Attic Ionians—an anxiety which is illustrated by the Athenian types used on the city's coins. At any rate, Io may have been a small early colony of trading Greeks (*Javan*). John Malalas mentions also a village, Bottia, in the plain by the river.

The original city of Seleucus was laid out in imitation of the "gridiron" plan of Alexandria by the architect, Xenarius. Libanius describes the first building and arrangement of this city (i. p. 300. 17). The citadel was on Mt. Silpius and the city lay mainly on the low ground to the north, fringing the river. Two great colonnaded streets intersected in the centre. Shortly afterwards a second quarter was laid out, probably on the east and by Antiochus I., which, from an expression of Strabo, appears to have been the native, as contrasted with the Greek, town. It was enclosed by a wall of its own. In the Orontes, north of the city, lay a large island, and on this Seleucus II. Callinicus began a third walled "city," which was finished by Antiochus III. A fourth and last quarter was added by Antiochus IV. Epiphanes (175–164 B.C.); and thenceforth Antioch was known as *Tetrapolis*. From west to east the whole was about 4 m. in diameter and little less from north to south, this area including many large gardens. Of its population in the Greek period we know nothing. In the 4th century A.D. it was about 200,000 according to Chrysostom, who probably did not reckon slaves. About 4 m. west and beyond the suburb, Heraclea, lay the paradise of Daphne, a park of woods and waters, in the midst of which rose a great temple to the Pythian Apollo, founded by Seleucus I. and enriched with a cult-statue of the god, as Musagetes, by Bryaxis. A companion sanctuary of Hecate was constructed underground by Diocletian. The beauty and the lax morals of Daphne were celebrated all over the western world; and indeed Antioch as a whole shared in both these titles to fame. Its amenities awoke both the enthusiasm and the scorn of many writers of antiquity.

Antioch became the capital and court-city of the western Seleucid empire under Antiochus I., its counterpart in the east being Seleucia-on-Tigris; but its paramount importance dates from the battle of Ancyra (240 B.C.), which shifted the Seleucid centre of gravity from Asia Minor, and led indirectly to the rise of Pergamum. Thenceforward the Seleucids resided at Antioch and treated it as their capital *par excellence.* We know little of it in the Greek period, apart from Syria (*q.v.*), all our information coming from authors of the late Roman time. Among its great Greek buildings we hear only of the theatre, of which substructures still remain on the flank of Silpius, and of the royal palace, probably situated on the island. It enjoyed a great reputation for letters and the arts (Cicero *pro Archia*, 3); but the only names of distinction in these pursuits during the Seleucid period, that have come down to us, are Apollophanes, the Stoic, and one Phoebus, a writer on dreams. The mass of the population seems to have been only superficially Hellenic, and to have spoken Aramaic in non-official life. The nicknames which they gave to their later kings were Aramaic; and, except Apollo and Daphne, the great divinities of north Syria seem to have remained essentially native, such as the "Persian Artemis" of Meroe and Atargatis of Hierapolis Bambyce. We may infer, from its epithet, "Golden," that the external appearance of Antioch was magnificent; but the city needed constant restoration owing to the seismic disturbances to which the district has always been peculiarly liable. The first great earthquake is said by the native chronicler John Malalas, who tells us most that we know of the city, to have occurred in 148 B.C., and to have done immense damage. The inhabitants were turbulent, fickle and notoriously dissolute. In the many dissensions of the Seleucid house they took violent part, and frequently rose in rebellion, for example against Alexander Balas in 147 B.C., and Demetrius II. in 129. The latter, enlisting a body of Jews, punished his capital with fire and sword. In the last struggles of the Seleucid house, Antioch turned definitely against its feeble rulers, invited Tigranes of Armenia to occupy the city in 83, tried to unseat Antiochus XIII. in 65, and petitioned Rome against his restoration in the following year. Its wish prevailed, and it passed with Syria to the Roman Republic in 64 B.C., but remained a *civitas libera.*

The Romans both felt and expressed boundless contempt for the hybrid Antiochenes; but their emperors favoured the city from the first, seeing in it a more suitable capital for the eastern part of the empire than Alexandria could ever be, thanks to the isolated position of Egypt. To a certain extent they tried to make it an eastern Rome. Caesar visited it in 47 B.C., and confirmed its freedom. A great temple to Jupiter Capitolinus rose on Silpius, probably at the instance of Octavian, whose cause the city had espoused. A forum of Roman type was laid out. Tiberius built two long colonnades on the south towards Silpius. Agrippa and Tiberius enlarged the theatre, and Trajan finished their work. Antoninus Pius paved the great east to west artery with granite. A circus, other colonnades and great numbers of baths were built, and new aqueducts to supply them bore the names of Caesars, the finest being the work of Hadrian. The Roman client, King Herod, erected a long *stoa* on the east, and Agrippa encouraged the growth of a new suburb south of this. Under the empire we chiefly hear of the earthquakes which shook Antioch. One, in A.D. 37, caused the emperor Caligula to send two senators to report on the condition of the city. Another followed in the next reign; and in 115, during Trajan's sojourn in the place with his army of Parthia, the whole site was convulsed, the landscape altered, and the emperor himself forced to take shelter in the circus for several days. He and his successor restored the city; but in 526, after minor shocks, the calamity returned in a terrible form, and thousands of lives were lost, largely those of Christians gathered to a great church assembly. We hear also of especially terrific earthquakes on the 29th of November 528 and the 31st of October 588.

At Antioch Germanicus died in A.D. 19, and his body was burnt in the forum. Titus set up the Cherubim, captured from the Jewish temple, over one of the gates. Commodus had Olympic games celebrated at Antioch, and in A.D. 266 the town was suddenly raided by the Persians, who slew many in the theatre. In 387 there was a great sedition caused by a new tax levied by order of Theodosius, and the city was punished by the loss of its metropolitan status. Zeno, who renamed it Theopolis, restored many of its public buildings just before the great earthquake of 526, whose destructive work was completed by the Persian Chosroes twelve years later. Justinian made an effort to revive it, and Procopius describes his repairing of the walls; but its glory was past.

The chief interest of Antioch under the empire lies in its relation to Christianity. Evangelized perhaps by Peter, according to the tradition upon which the Antiochene patriarchate still rests its claim for primacy (cf. Acts xi.), and certainly by Barnabas and Saul, its converts were the first to be called "Christians." They multiplied exceedingly, and by the time of Theodosius were reckoned by Chrysostom at about 100,000 souls. Between 252 and 300 A.D. ten assemblies of the church were held at Antioch and it became the residence of the patriarch of Asia. When Julian visited the place in 362 the impudent population railed at him for his favour to Jewish and pagan rites, and to revenge itself for the closing of its great church of Constantine, burned down the temple of Apollo in Daphne. The emperor's rough and severe habits and his rigid administration prompted Antiochene lampoons, to which he replied in the curious satiric *apologia*, still extant, which he called *Misopogon.* His successor, Valens, who endowed Antioch with a new forum having a statue of Valentinian on a central column, reopened the great church, which stood till the sack of Chosroes in 538. Antioch gave its name to a certain school of Christian thought, distinguished by literal interpretation of the Scriptures and insistence on the human limitations of Jesus. Diodorus of Tarsus and Theodore of Mopsuestia were the leaders of this school. The principal local saint was Simeon Stylites, who performed his penance on a hill some 40 m. east. His body was brought to the city and buried in a building erected under the emperor Leo. In A.D. 635, during the reign of Heraclius, Antioch passed into Saracen hands, and decayed apace for more than 300 years; but in 969 it was recovered for Byzantium by Michael Burza and Peter the Eunuch. In 1084 the Seljuk Turks captured it but held it only fourteen years, yielding place to the crusaders, who besieged it for nine months, enduring frightful sufferings. Being at last betrayed, it was given to Bohemund, prince of Tarentum, and it remained the capital of a Latin principality for nearly two centuries. It fell at last to the Egyptian, Bibars, in 1268, after a great destruction and slaughter, from which it never revived. Little remains now of the ancient city, except colossal ruins of aqueducts and part of the Roman walls, which are used as quarries for modern Antakia; but no scientific examination of the site has been made. A statue in the Vatican and a silver statuette in the British Museum perpetuate the type of its great effigy of the civic Fortune of Antioch—a majestic seated figure, with Orontes as a youth issuing from under her feet.

ANTAKIA, the modern town, is still of considerable importance. Pop. about 25,000, including Ansarieh, Jews, and a large body of Christians of several denominations about 8000 strong. Though superseded by Aleppo (*q.v.*) as capital of N. Syria, it is still the centre of a large district, growing in wealth and productiveness with the draining of its central lake, undertaken by a French company. The principal cultures are tobacco, maize and cotton, and the mulberry for silk production. Liquorice also is collected and exported. In 1822 (as in 1872) Antakia suffered by earthquake, and when Ibrahim Pasha made it his headquarters in 1835, it had only some 5000 inhabitants. Its hopes, based on a Euphrates valley railway, which was to have started from its port of Suedia (Seleucia), were doomed to disappointment, and it has suffered repeatedly from visitations of cholera; but it has nevertheless grown rapidly and will resume much of its old importance when a railway is made down the lower Orontes valley. It is a centre of American mission enterprise, and has a British vice-consul.

See C. O. Müller, *Antiquitates Antiochenae* (1839); A. Freund, *Beiträge zur antiochenischen . . . Stadtchronik* (1882); R. Förster, in *Jahrbuch* of Berlin Arch. Institute, xii. (1897). Also authorities for Syria. (D. G. H.)

Synods of Antioch. Beginning with three synods convened between 264 and 269 in the matter of Paul of Samosata, more than thirty councils were held in Antioch in ancient times. Most of these dealt with phases of the Arian and of the Christological controversies. The most celebrated took place in the summer of 341 at the dedication of the golden Basilica, and is therefore called *in encaeniis* (ἐν ἐγκαινίοις), *in dedicatione*. Nearly a hundred bishops were present, all from the Orient, but the bishop of Rome was not represented. The emperor Constantius attended in person. The council approved three creeds (Hahn, §§ 153-155). Whether or no the so-called "fourth formula" (Hahn, § 156) is to be ascribed to a continuation of this synod or to a subsequent but distinct assembly of the same year, its aim is like that of the first three; while repudiating certain Arian formulas it avoids the Athanasian shibboleth "homoousios." The somewhat colourless compromise doubtless proceeded from the party of Eusebius of Nicomedia, and proved not inacceptable to the more nearly orthodox members of the synod. The twenty-five canons adopted regulate the so-called metropolitan constitution of the church. Ecclesiastical power is vested chiefly in the metropolitan (later called archbishop), and the semi-annual provincial synod (cf. Nicaea, canon 5), which he summons and over which he presides. Consequently the powers of country bishops (*chorepiscopi*) are curtailed, and direct recourse to the emperor is forbidden. The sentence of one judicatory is to be respected by other judicatories of equal rank; re-trial may take place only before that authority to whom appeal regularly lies (see canons 3, 4, 6). Without due invitation, a bishop may not ordain, or in any other way interfere with affairs lying outside his proper territory; nor may he appoint his own successor. Penalties are set on the refusal to celebrate Easter in accordance with the Nicene decree, as well as on leaving a church before the service of the Eucharist is completed. The numerous objections made by eminent scholars in past centuries to the ascription of these twenty-five canons to the synod *in encaeniis* have been elaborately stated and probably refuted by Hefele. The canons formed part of the *Codex canonum* used at Chalcedon in 451 and passed over into the later collections of East and West.

The canons are printed in Greek by Mansi ii. 1307 ff., Bruns i. 80 ff., Lauchert 43 ff., and translated by Hefele, *Councils*, ii. 67 ff. and by H. R. Percival in the *Nicene and Post-Nicene Fathers*, 2nd series, xiv. 108 ff. The four dogmatic formulas are given by G. Ludwig Hahn, *Bibliothek der Symbole*, 3rd edition (Breslau, 1897), 183 ff.; for translations compare the *Nicene and Post-Nicene Fathers*, 2nd series, iv. 461 ff., ii. 39 ff., ix. 12, ii. 44, and Hefele, ii. 76 ff. For full titles see Councils. (W. W. R.*)

ANTIOCH IN PISIDIA, an ancient city, the remains of which, including ruins of temples, a theatre and a fine aqueduct, were found by Arundell in 1833 close to the modern Yalovach. It was situated on the lower southern slopes of the Sultan Dagh, in the Konia vilayet of Asia Minor, on the right bank of a stream, the ancient Anthius, which flows into the Hoiran Geul. It was probably founded on the site of a Phrygian sanctuary, by Seleucus Nicator, before 280 B.C. and was made a free city by the Romans in 189 B.C. It was a thoroughly Hellenized, Greek-speaking city, in the midst of a Phrygian people, with a mixed population that included many Jews. Before 6 B.C. Augustus made it a colony, with the title Caesarea, and it became the centre of civil and military administration in south Galatia, the romanization of which was progressing rapidly in the time of Claudius, A.D. 41–54, when Paul visited it (Acts xiii. 14, xiv. 21, xvi. 6, xviii. 23). In 1097 the crusaders found rest and shelter within its walls. The ruins are interesting, and show that Antioch was a strongly fortified city of Hellenic and Roman type.

ANTIOCHUS, the name of thirteen kings of the Seleucid dynasty in Nearer Asia. The most famous are Antiochus III. the Great (223–187 B.C.) who sheltered Hannibal and waged war with Rome, and his son Antiochus IV. Epiphanes (176–164 B.C.) who tried to suppress Judaism by persecution (see Seleucid Dynasty).

The name was subsequently borne by the kings of Commagene (69 B.C.–A.D. 72), whose house was affiliated to the Seleucid.

Antiochus I. of Commagene, who without sufficient reason has been identified with the Seleucid Antiochus XIII. Asiaticus, made peace on advantageous terms with Pompey in 64 B.C. Subsequently he fought on Pompey's side in the Civil War, and later still repelled an attack on Samosata by Marcus Antonius (Mark Antony.) He died before 31 B.C. and was succeeded by one Mithradates I. This Mithradates was succeeded by an Antiochus II., who was executed by Augustus in 29 B.C. After another Mithradates we know of an Antiochus III., on whose death in A.D. 17 Commagene became a Roman province. In 38 his son Antiochus IV. Epiphanes was made king by Caligula, who deposed him almost immediately. Restored by Claudius in 41, he reigned until 72 as an ally of Rome against Parthia. In that year he was deposed on suspicion of treason and retired to Rome. Several of his coins are extant.

On all the above see "Antiochos" in Pauly-Wissowa's *Realencyclopädie der classischen Altertumswissenschaft*, i. part ii. (1894).

ANTIOCHUS OF ASCALON (1st century B.C.), Greek philosopher. His philosophy consisted in an attempt to reconcile the doctrines of his teachers Philo of Larissa and Mnesarchus the Stoic. Against the scepticism of the former, he held that the intellect has in itself a sufficient test of truth; against Mnesarchus, that happiness, though its main factor is virtue, depends also on outward circumstances. This electicism is known as the Fifth Academy (see Academy, Greek). His writings are lost, and we are indebted for information to Cicero (*Acad. Pr.* ii. 43), who studied under him at Athens, and Sextus Empiricus (*Pyrrh. hyp.* i. 235). Antiochus lectured also in Rome and Alexandria.

See R. Hoyer, *De Antiocho Ascalonita* (Bonn, 1883).

ANTIOCHUS OF SYRACUSE, Greek historian, flourished about 420 B.C. Nothing is known of his life, but his works, of which only fragments remain, enjoyed a high reputation. He wrote a *History of Sicily* from the earliest times to 424, which was used by Thucydides, and the *Colonizing of Italy*, frequently referred to by Strabo and Dionysius of Halicarnassus.

Müller, *Fragmenta Historicorum Graecorum*, i.; Wölfflin, *Antiochos von Syrakus*, 1872.

ANTIOPE. (1) In Greek legend, the mother of Amphion and Zethus, and, according to Homer (*Od.* xi. 260), a daughter of the Boeotian river-god Asopus. In later poems she is called the daughter of Nycteus or Lycurgus. Her beauty attracted Zeus, who, assuming the form of a satyr, took her by force (Apollodorus iii. 5). After this she was carried off by Epopeus, king of Sicyon, who would not give her up till compelled by her uncle Lycus. On the way home she gave birth, in the neighbourhood of Eleutherae on Mount Cithaeron, to the twins Amphion and Zethus, of whom Amphion was the son of the god, and Zethus the son of Epopeus. Both were left to be brought up by herdsmen. At Thebes Antiope now suffered from the persecution of Dirce, the wife of Lycus, but at last escaped towards Eleutherae, and there found shelter, unknowingly, in the house where her two sons were living as herdsmen. Here she was discovered by Dirce, who ordered the two young men to tie her to the horns of a wild bull. They were about to obey, when the old herdsman, who had brought them up, revealed his secret, and they carried out the punishment on Dirce instead (Hyginus, *Fab.* 8). For this, it is said, Dionysus, to whose worship Dirce had been devoted, visited Antiope with madness, which caused her to wander restlessly all over Greece till she was cured, and married by Phocus of Tithorea, on Mount Parnassus, where both were buried in one grave (Pausanias ix. 17, x. 32).

(2) A second Antiope, daughter of Ares, and sister of Hippolyte, queen of the Amazons, was the wife of Theseus. There are various accounts of the manner in which Theseus became possessed of her, and of her subsequent fortunes. Either she gave herself up to him out of love, when with Heracles he captured Themiscyra, the seat of the Amazons, or she fell to his lot as a captive (Diodorus iv. 16). Or again, Theseus himself

invaded the dominion of the Amazons and carried her off, the consequence of which was a counter-invasion of Attica by the Amazons. After four months of war peace was made, and Antiope left with Theseus as a peace-offering. According to another account, she had joined the Amazons against him because he had been untrue to her in desiring to marry Phaedra. She is said to have been killed by another Amazon, Molpadia, a rival in her affection for Theseus. Elsewhere it was believed that he had himself killed her, and fulfilled an oracle to that effect (Hyginus, *Fab.* 241). By Theseus she had a son, the well-known Hippolytus (Plutarch, *Theseus*).

ANTIOQUIA, an interior department of the republic of Colombia, lying S. of Bolivar, W. of the Magdalena river, and E. of Cauca. Area, 22,870 sq. m.; pop. (est. 1899) 464,887. The greater part of its territory lies between the Magdalena and Cauca rivers and includes the northern end of the Central Cordillera. The country is covered with valuable forests, and its mineral wealth renders it one of the most important mining regions of the republic. The capital, Medellin (est. pop. 53,000 in 1902), is a thriving mining centre, 4822 ft. above sea-level, and 125 m. from Puerto Berrió on the Magdalena. Other important towns are Manizales (18,000) in the extreme south, the commercial centre of a rich gold and grazing region; Antioquia, the old capital, on the Cauca; and Puerto Berrió on the Magdalena, from which a railway has been started to the capital.

ANTIPAROS (anc. *Oliaros*), an island of the kingdom of Greece, in the modern eparchy of Naxos, separated by a strait (about 1½ m. wide at the narrowest point) from the west coast of Paros. It is 7 m. long by 3 broad, and contains about 700 inhabitants, most of whom live in Kastro, a village on the north coast, and are employed in agriculture and fishing. Formerly piracy was common. The only remarkable feature in the island is a stalactite cavern on the south coast, which is reached by a narrow passage broken by two steep and dangerous descents which are accomplished by the aid of rope-ladders. The grotto itself, which is about 150 ft. by 100, and 50 ft. high (not all can be seen from any part, and probably some portions are still unexplored), shows many remarkable examples of stalactite formations and incrustations of dazzling brilliance. It is not mentioned by ancient writers; the first western traveller to visit it was the marquis de Nointel (ambassador of Louis XIV. to the Porte) who descended it with a numerous suite and held high mass there on Christmas day 1673. There is, however, in the entrance of the cavern an inscription recording the names of visitors in ancient times.

See J. P. de Tournefort, *Relation d'un voyage au Levant* (1717); English edition, 1718, vol. i. p. 146, and guide-books to Greece.

ANTIPATER (398?–319 B.C.), Macedonian general, and regent of Macedonia during Alexander's Eastern expedition (334–323). He had previously (346) been sent as ambassador by Philip to Athens and negotiated peace after the battle of Chaeroneia (338). About 332 he set out against the rebellious tribes of Thrace; but before this insurrection was quelled, the Spartan king Agis had risen against Macedonia. Having settled affairs in Thrace as well as he could, Antipater hastened to the south, and in a battle near Megalopolis (331) gained a complete victory over the insurgents (Diodorus xvii. 62). His regency was greatly troubled by the ambition of Olympias, mother of Alexander, and he was nominally superseded by Craterus. But, on the death of Alexander in 323, he was, by the first partition of the empire, left in command of Macedonia, and in the Lamian War, at the battle of Crannon (322), crushed the Greeks who had attempted to re-assert their independence. Later in the same year he and Craterus were engaged in a war against the Aetolians, when the news arrived from Asia which induced Antipater to conclude peace with them; for Antigonus reported that Perdiccas contemplated making himself sole master of the empire. Antipater and Craterus accordingly prepared for war against Perdiccas, and allied themselves with Ptolemy, the governor of Egypt. Antipater crossed over into Asia in 321; and while still in Syria, he received information that Perdiccas had been murdered by his own soldiers. Craterus fell in battle against Eumenes (Diodorus xviii. 25-39). Antipater, now sole regent, made several new regulations, and having quelled a mutiny of his troops and commissioned Antigonus to continue the war against Eumenes and the other partisans of Perdiccas, returned to Macedonia, where he arrived in 320 (Justin xiii. 6). Soon after he was seized by an illness which terminated his active career, 319. Passing over his son Cassander, he appointed the aged Polyperchon regent, a measure which gave rise to much confusion and ill-feeling (Diodorus xvii., xviii).

ANTIPHANES, the most important writer of the Middle Attic comedy with the exception of Alexis, lived from about 408 to 334 B.C. He was apparently a foreigner who settled in Athens, where he began to write about 387. He was extremely prolific: more than 200 of the 365 (or 260) comedies attributed to him are known to us from the titles and considerable fragments preserved in Athenaeus. They chiefly deal with matters connected with the table, but contain many striking sentiments.

Fragments in Koch, *Comicorum Atticorum Fragmenta*, ii. (1884); see also Clinton, *Philological Museum*, i. (1832); Meineke, *Historia Critica Comicorum Graecorum* (1839).

ANTIPHILUS, a Greek painter, of the age of Alexander. He worked for Philip of Macedon and Ptolemy I. of Egypt. Thus he was a contemporary of Apelles, whose rival he is said to have been, but he seems to have worked in quite another style. Quintilian speaks of his facility: the descriptions of his works which have come down to us show that he excelled in light and shade, in *genre* representations, and in caricature.

See Brunn, *Geschichte der griechischen Künstler*, ii. p. 249.

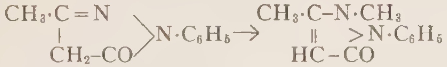
ANTIPHON, of Rhamnus in Attica, the earliest of the "ten" Attic orators, was born in 480 B.C. He took an active part in political affairs at Athens, and, as a zealous supporter of the oligarchical party, was largely responsible for the establishment of the Four Hundred in 411 (see THERAMENES); on the restoration of the democracy he was accused of treason and condemned to death. Thucydides (viii. 68) expresses a very high opinion of him. Antiphon may be regarded as the founder of political oratory, but he never addressed the people himself except on the occasion of his trial. Fragments of his speech then delivered in defence of his policy (called Περὶ μεταστάσεως) have been edited by J. Nicole (1907) from an Egyptian papyrus. His chief business was that of a professional speech-writer (λογογράφος), for those who felt incompetent to conduct their own cases—as all disputants were obliged to do—without expert assistance. Fifteen of Antiphon's speeches are extant: twelve are mere school exercises on fictitious cases, divided into tetralogies, each consisting of two speeches for prosecution and defence—accusation, defence, reply, counter-reply; three refer to actual legal processes. All deal with cases of homicide (φονικαὶ δίκαι). Antiphon is also said to have composed a Τέχνη or art of Rhetoric.

Edition, with commentary, by Maetzner (1838); text by Blass (1881); Jebb, *Attic Orators*; Plutarch, *Vitae X. Oratorum*; Philostratus, *Vit. Sophistarum*, i. 15; van Cleef, *Index Antiphonteus*, Ithaca, N. Y. (1895); see also RHETORIC.

ANTIPHONY (Gr. ἀντί, and φωνή, a voice), a species of psalmody in which the choir or congregation, being divided into two parts, sing alternately. The peculiar structure of the Hebrew psalms renders it probable that the antiphonal method originated in the service of the ancient Jewish Church. According to the historian Socrates, its introduction into Christian worship was due to Ignatius (died 115 A.D.), who in a vision had seen the angels singing in alternate choirs. In the Latin Church it was not practised until more than two centuries later, when it was introduced by Ambrose, bishop of Milan, who compiled an *antiphonary*, or collection of words suitable for antiphonal singing. The antiphonary still in use in the Roman Catholic Church was compiled by Gregory the Great (590 A.D.).

ANTIPODES (Gr. ἀντί, opposed to, and πόδες, feet), a term applied strictly to any two peoples or places on opposite sides of the earth, so situated that a line drawn from the one to the other passes through the centre of the globe and forms a true diameter. Any two places having this relation—as London and, approximately, Antipodes Island, near New Zealand—must be distant from each other by 180° of longitude, and the one must be as many degrees to the north of the equator as the other is to the south, in other words, the latitudes are numerically equal, but one is *north* and the other *south*. Noon at the one place is midnight at the other, the longest day corresponds to the shortest, and mid-winter is contemporaneous with midsummer. In the calculation of days and nights, midnight on the one side may be regarded as corresponding to the noon either of the *previous* or of the *following* day. If a voyager sail eastward, and thus anticipate the sun, his dating will be twelve hours in advance, while the reckoning of another who has been sailing westward will be as much in arrear. There will thus be a difference of twenty-four hours between the two when they meet. To avoid the confusion of dates which would thus arise, it is necessary to determine a meridian at which dates should be brought into agreement, *i.e.* a line the crossing of which would involve the changing of the name of the day either forwards, when proceeding westwards, or backwards, when proceeding eastwards. Mariners have generally adopted the meridian 180° from Greenwich, situated in the Pacific Ocean, as a convenient line for co-ordinating dates. The so-called "International Date Line," which is, however, practically only due to American initiative, is designed to remove certain objections to the meridian of 180° W., the most important of which is that groups of islands lying about this meridian differ in date by a day although only a few miles apart. Several forms have been suggested; these generally agree in retaining the meridian of 180° in the mid Pacific, with a bend in the north in order to make the Aleutian Islands and Alaska of the same time as America, and also in the south so as to bring certain of the South Sea islands into line with Australia and New Zealand.

ANTIPYRINE (phenyldimethyl pyrazolone) ($C_{11}H_{12}N_2O$), is prepared by the condensation of phenylhydrazine with aceto-acetic ester, the resulting phenyl methyl pyrazolone being heated with methyl iodide and methyl alcohol to 100–110° C.:—



Phenyl methyl pyrazolone Antipyrine

On the large scale phenylhydrazine is dissolved in dilute sulphuric acid, the solution warmed to about 40° C. and the aceto-acetic ester added. When the reaction is complete the acid is neutralized with soda, and the phenyl methyl pyrazolone extracted with ether and distilled *in vacuo*. The portion distilling at about 200° C. is then methylated by means of methyl alcohol and methyl iodide at 100–110° C., the excess of methyl alcohol removed and the product obtained decolorized by sulphuric acid. The residue is treated with a warm concentrated solution of soda, and the oil which separates is removed by shaking with benzene. The benzene layer on evaporation deposits the antipyrine as a colourless crystalline solid which melts at 113° C. and is soluble in water. It is basic in character, and gives a red coloration on the addition of ferric chloride. In medicine antipyrine ("phenazonum") has been used as an analgesic and antipyretic. The dose is 5–20 grs., but on account of its depressant action on the heart, and the toxic effects to which it occasionally gives rise, it is now but little used. It is more safely replaced by phenacetine.

ANTIQUARY, a person who devotes himself to the study of ancient learning and "antiques," *i.e.* ancient objects of art or science. The London Society of Antiquaries was formed in the 18th century to promote the study of antiquities. As early as 1572 a society had been founded by Bishop Matthew Parker, Sir Robert Cotton, William Camden and others for the preservation of national antiquities. This body existed till 1604, when it fell under suspicion of being political in its aims, and was abolished by James I. Papers read at their meetings are preserved in the Cottonian library and were printed by Thomas Hearne in 1720 under the title *A Collection of Curious Discourses*, a second edition appearing in 1771. In 1707 a number of English antiquaries began to hold regular meetings for the discussion of their hobby and in 1717 the Society of Antiquaries was formally reconstituted, finally receiving a charter from George II. in 1751. In 1780 George III. granted the society apartments in Somerset House, Strand. The society is governed by a council of twenty and a president who is *ex officio* a trustee of the British Museum. The present headquarters of the society are at Burlington House, Piccadilly.

The Society of Antiquaries of Scotland was founded in 1780, and has the management of a large national antiquarian museum in Edinburgh. In Ireland a society was founded in 1849 called the Kilkenny Archaeological Society, holding its meetings at Kilkenny. In 1869 its name was changed to the Royal Historical and Archaeological Association of Ireland, and in 1890 to the Royal Society of Antiquaries of Ireland, its office being transferred to Dublin. In France *La Société Nationale des Antiquaires de France* was formed in 1814 by the reconstruction of the *Académie Celtique*, which had existed since 1805. The American Antiquarian Society was founded in 1812, with its headquarters at Worcester, Mass. It has a library of upwards of 100,000 volumes and its transactions have been published bi-annually since 1849. In Germany the *Gesamtverein der Deutschen Geschichts-und Altertumsvereine* was founded in 1852. *La Société Royale des Antiquaires du Nord* at Copenhagen is among the best known of European antiquarian societies.

ANTIQUE (Lat. *antiquus*, old), a term conventionally restricted to the remains of ancient art, such as sculptures, gems, medals, seals, &c. In a limited sense it applies only to Greek and Roman art, and includes neither the artistic remains of other ancient nations nor any product of classical art of a later date than the fall of the western empire.

ANTI-SEMITISM. In the political struggles of the concluding quarter of the 19th century an important part was played by a religious, political and social agitation against the Jews, known as "Anti-Semitism." The origins of this remarkable movement already threaten to become obscured by legend. The Jews contend that anti-Semitism is a mere atavistic revival of the Jew-hatred of the middle ages. The extreme section of the anti-Semites, who have given the movement its quasi-scientific name, declare that it is a racial struggle—an incident of the eternal conflict between Europe and Asia—and that the anti-Semites are engaged in an effort to prevent what is called the Aryan race from being subjugated by a Semitic immigration, and to save Aryan ideals from being modified by an alien and demoralizing oriental *Anschauung*. There is no essential foundation for either of these contentions. Religious prejudices reaching back to the dawn of history have been reawakened by the anti-Semitic agitation, but they did not originate it, and they have not entirely controlled it. The alleged racial divergence is, too, only a linguistic hypothesis on the physical evidence of which anthropologists are not agreed (Topinard, *Anthropologie*, p. 444; Taylor, *Origins of Aryans*, cap. i.), and, even if it were proved, it has existed in Europe for so many centuries, and so many ethnic modifications have occurred on both sides, that it cannot be accepted as a practical issue. It is true that the ethnographical histories of the Jews and the nations of Europe have proceeded on widely diverging lines, but these lines have more than once crossed each other and become interlaced. Thus Aryan elements are at the beginning of both; European morals have been ineradicably semitized by Christianity, and the Jews have been Europeans for over a thousand years, during which their character has been modified and in some respects transformed by the ecclesiastical and civil polities of the nations among whom they have made their permanent home. Anti-Semitism is then exclusively a question of European politics, and its origin is to be found, not in the long struggle between Europe and Asia, or between the Church and the Synagogue, which filled so much of ancient and medieval history, but in the social conditions resulting from the emancipation of the Jews in the middle of the 19th century.

If the emancipated Jews were Europeans in virtue of the antiquity of their western settlements, and of the character impressed upon them by the circumstances of their European history, they none the less presented the appearance of a strange people to their Gentile fellow-countrymen. They had been secluded in their ghettos for centuries, and had consequently acquired a physical and moral physiognomy differentiating them in a measure from their former oppressors. This peculiar physiognomy was, on its moral side, not essentially Jewish or even Semitic. It was an advanced development of the main attributes of civilized life, to which Christendom in its transition from feudalism had as yet only imperfectly adapted itself. The ghetto, which had been designed as a sort of quarantine to safeguard Christendom against the Jewish heresy, had in fact proved a storage chamber for a portion of the political and social forces which were destined to sweep away the last traces of feudalism from central Europe. In the ghetto, the pastoral Semite, who had been made a wanderer by the destruction of his nationality, was steadily trained, through centuries, to become an urban European, with all the parasitic activities of urban economics, and all the democratic tendencies of occidental industrialism. Excluded from the army, the land, the trade corporations and the artisan gilds, this quondam oriental peasant was gradually transformed into a commercial middleman and a practised dealer in money. Oppressed by the Church, and persecuted by the State, his theocratic and monarchical traditions lost their hold on his daily life, and he became saturated with a passionate devotion to the ideals of democratic politics. Finally, this former bucolic victim of Phoenician exploitation had his wits preternaturally sharpened, partly by the stress of his struggle for life, and partly by his being compelled in his urban seclusion to seek for recreation in literary exercises, chiefly the subtle dialectics of the Talmudists (Loeb, *Juif de l'histoire*; Jellinek, *Der Jüdische Stamm*). Thus, the Jew who emerged from the ghetto was no longer a Palestinian Semite, but an essentially modern European, who differed from his Christian fellow-countrymen only in the circumstances that his religion was of the older Semitic form, and that his physical type had become sharply defined through a slightly more rigid exclusiveness in the matter of marriages than that practised by Protestants and Roman Catholics (Andree, *Volkskunde der Juden*, p. 58).

Unfortunately, these distinctive elements, though not very serious in themselves, became strongly accentuated by concentration. Had it been possible to distribute the emancipated Jews uniformly throughout Christian society, as was the case with other emancipated religious denominations, there would have been no revival of the Jewish question. The Jews, however, through no fault of their own, belonged to only one class in European society—the industrial *bourgeoisie*. Into that class all their strength was thrown, and owing to their ghetto preparation, they rapidly took a leading place in it, politically and socially. When the mid-century revolutions made the *bourgeoisie* the ruling power in Europe, the semblance of a Hebrew domination presented itself. It was the exaggeration of this apparent domination, not by the *bourgeoisie* itself, but by its enemies among the vanquished reactionaries on the one hand, and by the extreme Radicals on the other, which created modern anti-Semitism as a political force.

Germany.

The movement took its rise in Germany and Austria. Here the concentration of the Jews in one class of the population was aggravated by their excessive numbers. While in France the proportion to the total population was, in the early 'seventies, 0·14 %, and in Italy, 0·12 %, it was 1·22 % in Germany, and 3·85 % in Austria-Hungary; Berlin had 4·36 % of Jews, and Vienna 6·62 % (Andree, *Volkskunde*, pp. 287, 291, 294, 295). The activity of the Jews consequently manifested itself in a far more intense form in these countries than elsewhere. This was apparent even before the emancipations of 1848. Towards the middle of the 18th century, a limited number of wealthy Jews had been tolerated as *Schutz-Juden* outside the ghettos, and their sons, educated as Germans under the influence of Moses Mendelssohn and his school (see JEWS), supplied a majority of the leading spirits of the revolutionary agitation. To this period belong the formidable names of Ludwig Börne (1786–1837), Heinrich Heine (1799–1854), Edward Ganz (1798–1839), Gabriel Riesser (1806–1863), Ferdinand Lassalle (1825–1864), Karl Marx (1818–1883), Moses Hess (1812–1875), Ignatz Kuranda (1811–1884), and Johann Jacobi (1805–1877). When the revolution was completed, and the Jews entered in a body the national life of Germany and Austria, they sustained this high average in all the intellectual branches of middle-class activity. Here again, owing to the accidents of their history, a further concentration became apparent. Their activity was almost exclusively intellectual. The bulk of them flocked to the financial and the distributive (as distinct from the productive) fields of industry to which they had been confined in the ghettos. The sharpened faculties of the younger generation at the same time carried everything before them in the schools, with the result that they soon crowded the professions, especially medicine, law and journalism (Nossig, *Statistik des Jüd. Stammes*, pp. 33-37; Jacobs, *Jew. Statistics*, pp. 41-69). Thus the "Semitic domination," as it was afterwards called, became every day more strongly accentuated. If it was a long time in exciting resentment and jealousy, the reason was that it was in no sense alien to the new conditions of the national life. The competition was a fair one. The Jews might be more successful than their Christian fellow-citizens, but it was in virtue of qualities which complied with the national standards of conduct. They were as law-abiding and patriotic as they were intelligent. Crime among them was far below the average (Nossig, p. 31). Their complete assimilation of the national spirit was brilliantly illustrated by the achievements in German literature, art and science of such men as Heinrich Heine and Berthold Auerbach (1812–1882), Felix Mendelssohn (-Bartholdy) (1809–1847), and Jacob Meyerbeer (1794–1864), Karl Gustav Jacobi the mathematician (1804–1851), Gabriel Gustav Valentin the physiologist (1810–1883), and Moritz Lazarus (1824–1903) and Heymann Steinthal (1823–1899) the national psychologists. In politics, too, Edward Lasker (1829–1884) and Ludwig Bamberger (1823–1899) had shown how Jews could put their country before party, when, at the turning-point of German imperial history in 1866, they led the secession from the *Fortschritts-Partei* and founded the National Liberal party, which enabled Prince Bismarck to accomplish German unity. Even their financiers were not behind their Christian fellow-citizens in patriotism. Prince Bismarck himself confessed that the money for carrying on the 1866 campaign was obtained from the Jewish banker Bleichroeder, in face of the refusal of the money-market to support the war. Hence the voice of the old Jew-hatred—for in a weak way it was still occasionally heard in obscurantist corners—was shamed into silence, and it was only in the European twilight—in Russia and Rumania—and in lands where medievalism still lingered, such as northern Africa and Persia, that oppression and persecution continued to dog the steps of the Jews.

The signal for the change came in 1873, and was given unconsciously by one of the most distinguished Jews of his time, Edward Lasker, the gifted lieutenant of Bennigsen in the leadership of the National Liberal party. The unification of Germany in 1870, and the rapid payment of the enormous French war indemnity, had given an unprecedented impulse to industrial and financial activity throughout the empire. Money became cheap and speculation universal. A company mania set in which was favoured by the government, who granted railway and other concessions with a prodigal hand. The inevitable result of this state of things was first indicated by Jewish politicians and economists. On the 14th of January 1873, Edward Lasker called the attention of the Prussian diet to the dangers of the situation, while his colleague, Ludwig Bamberger, in an able article in the *Preussischen Jahrbücher*, condemned the policy which had permitted the milliards to glut the country instead of being paid on a plan which would have facilitated their gradual digestion by the economic machinery of the nation. Deeply impressed by the gravity of the impending crisis, Lasker instituted a searching inquiry, with the result that he discovered a series of grave company scandals in which financial promoters and aristocratic directors were chiefly involved. Undeterred by the fact that the leading spirit in these abuses, Bethel Henry Strousberg (1823–1884), was a Jew, Lasker presented the results of his inquiry to the diet on the 7th of February 1873, in a speech of great power and full of sensational disclosures. The dramatic results of this speech need not be dwelt upon here (for details see Blum, *Das deutsche Reich zur Zeit Bismarcks*, pp. 153-181). It must suffice to say that in the following May the great Vienna "Krach" occurred, and the colossal bubble of speculation burst, bringing with it all the ruin foretold by Lasker and Bamberger. From the position occupied by the Jews in the commercial class, and especially in the financial section of that class, it was inevitable that a considerable number of them should figure in the scandals which followed. At this moment an obscure Hamburg journalist, Wilhelm Marr, who as far back as 1862 had printed a still-born tract against the Jews (*Judenspiegel*), published a sensational pamphlet entitled *Der Sieg des Judenthums über das Germanthum* ("The Victory of Judaism over Germanism"). The book fell upon fruitful soil. It applied to the nascent controversy a theory of nationality which, under the great sponsorship of Hegel, had seized on the minds of the German youth, and to which the stirring events of 1870 had already given a deep practical significance. The state, according to the Hegelians, should be rational, and the nation should be a unit comprising individuals speaking the same language and of the same racial origin. Heterogeneous elements might be absorbed, but if they could not be reduced to the national type they should be eliminated. This was the pseudo-scientific note of the new anti-Semitism, the theory which differentiated it from the old religious Jew-hatred and sought to give it a rational place in modern thought. Marr's pamphlet, which reviewed the facts of the Jewish social concentration without noticing their essentially transitional character, proved the pioneer of this teaching. It was, however, in the passions of party politics that the new crusade found its chief sources of vitality. The enemies of the *bourgeoisie* at once saw that the movement was calculated to discredit and weaken the school of Manchester Liberalism, then in the ascendant. Agrarian capitalism, which had been dethroned by industrial capitalism in 1848, and had burnt its fingers in 1873, seized the opportunity of paying off old scores. The clericals, smarting under the *Kulturkampf*, which was supported by the whole body of Jewish liberalism, joined eagerly in the new cry. In 1876 another sensational pamphlet was published, Otto Glogau's *Die Börsen und Grundergeschwindel in Berlin* ("The Bourses and the Company Swindles in Berlin"), dealing in detail with the Jewish participation in the scandals first revealed by Lasker. The agitation gradually swelled, its growth being helped by the sensitiveness and *cacoëthes scribendi* of the Jews themselves, who contributed two pamphlets and a much larger proportion of newspaper articles for every one supplied by their opponents (Jacobs, *Bibliog. Jew. Question*, p. xi.). Up to 1879, however, it was more of a literary than a political agitation, and was generally regarded only as an ephemeral craze or a passing spasm of popular passion.

Towards the end of 1879 it spread with sudden fury over the whole of Germany. This outburst, at a moment when no new financial scandals or other illustrations of Semitic demoralization and domination were before the public, has never been fully explained. It is impossible to doubt, however, that the secret springs of the new agitation were more or less directly supplied by Prince Bismarck himself. Since 1877 the relations between the chancellor and the National Liberals had gradually become strained. The deficit in the budget had compelled the government to think of new taxes, and in order to carry them through the Reichstag the support of the National Liberals had been solicited. Until then the National Liberals had faithfully supported the chancellor in nursing the consolidation of the new empire, but the great dream of its leaders, especially of Lasker and Bamberger, who had learnt their politics in England, was to obtain a constitutional and economic *régime* similar to that of the British Isles. The organization of German unity was now completed, and they regarded the new overtures of Prince Bismarck as an opportunity for pressing their constitutional demands. These were refused, the Reichstag was dissolved and Prince Bismarck boldly came forward with a new fiscal policy, a combination of protection and state socialism. Lasker and Bamberger thereupon led a powerful secession of National Liberals into opposition, and the chancellor was compelled to seek a new majority among the ultra-Conservatives and the Roman Catholic Centre. This was the beginning of the famous "journey to Canossa." Bismarck did not hide his mortification. He began to recognize in anti-Semitism a means of "dishing" the Judaized liberals, and to his creatures who assisted him in his press campaigns he dropped significant hints in this sense (Busch, *Bismarck*, ii. 453-454, iii. 16). He even spoke of a new *Kulturkampf* against the Jews (*ibid.* ii. p. 484). How these hints were acted upon has not been revealed, but it is sufficiently instructive to notice that the final breach with the National Liberals took place in July 1879, and that it was immediately followed by a violent revival of the anti-Semitic agitation. Marr's pamphlet was reprinted, and within a few months ran through nine further editions. The historian Treitschke gave the sanction of his great name to the movement. The Conservative and Ultramontane press rang with the sins of the Jews. In October an anti-Semitic league was founded in Berlin and Dresden (for statutes of the league see *Nineteenth Century*, February 1881, p. 344).

The leadership of the agitation was now definitely assumed by a man who combined with social influence, oratorical power and inexhaustible energy, a definite scheme of social regeneration and an organization for carrying it out. This man was Adolf Stöcker (b. 1835), one of the court preachers. He had embraced the doctrines of Christian socialism which the Roman Catholics, under the guidance of Archbishop Ketteler, had adopted from the teachings of the Jew Lassalle (Nitti, *Catholic Socialism*, pp. 94-96, 122, 127), and he had formed a society called "The Christian Social Working-man's Union." He was also a conspicuous member of the Prussian diet, where he sat and voted with the Conservatives. He found himself in strong sympathy with Prince Bismarck's new economic policy, which, although also of Lassallian origin (Kohut, *Ferdinand Lassalle*, pp. 144 et seq.), was claimed by its author as being essentially Christian (Busch, p. 483). Under his auspices the years 1880–1881 became a period of bitter and scandalous conflict with the Jews. The Conservatives supported him, partly to satisfy their old grudges against the Liberal *bourgeoisie* and partly because Christian Socialism, with its anti-Semitic appeal to ignorant prejudice, was likely to weaken the hold of the Social Democrats on the lower classes. The Lutheran clergy followed suit, in order to prevent the Roman Catholics from obtaining a monopoly of Christian Socialism, while the Ultramontanes readily adopted anti-Semitism, partly to maintain their monopoly, and partly to avenge themselves on the Jewish and Liberal supporters of the *Kulturkampf*. In this way a formidable body of public opinion was recruited for the anti-Semites. Violent debates took place in the Prussian diet. A petition to exclude the Jews from the national schools and universities and to disable them from holding public appointments was presented to Prince Bismarck. Jews were boycotted and insulted. Duels between Jews and anti-Semites, many of them fatal, became of daily occurrence. Even unruly demonstrations and street riots were reported. Pamphlets attacking every phase and aspect of Jewish life streamed by the hundred from the printing-press. On their side the Jews did not want for friends, and it was owing to the strong attitude adopted by the Liberals that the agitation failed to secure legislative fruition. The crown prince (afterwards Emperor Frederick) and crown princess boldly set themselves at the head of the party of protest. The crown prince publicly declared that the agitation was "a shame and a disgrace to Germany." A manifesto denouncing the movement as a blot on German culture, a danger to German unity and a flagrant injustice to the Jews themselves, was signed by a long list of illustrious men, including Herr von Forckenbeck, Professors Mommsen, Gneist, Droysen, Virchow, and Dr Werner Siemens (*Times*, November 18, 1880). During the Reichstag elections of 1881 the agitation played an active part, but without much effect, although Stöcker was elected. This was due to the fact that the great Conservative parties, so far as their political organizations were concerned, still remained chary of publicly identifying themselves with a movement which, in its essence, was of socialistic tendency. Hence the electoral returns of that year supplied no sure guide to the strength of anti-Semitic opinion among the German people.

The first severe blow suffered by the German anti-Semites was in 1881, when, to the indignation of the whole civilized world, the barbarous riots against the Jews in Russia and the revival of the medieval Blood Accusation in Hungary (see *infra*) illustrated the liability of unreasoning mobs to carry into violent practice the incendiary doctrines of the new Jew-haters. From this blow anti-Semitism might have recovered had it not been for the divisions and scandals in its own ranks, and the artificial forms it subsequently assumed through factitious alliances with political parties bent less on persecuting the Jews than on profiting by the anti-Jewish agitation. The divisions showed themselves at the first attempt to form a political party on an anti-Semitic basis. Imperceptibly the agitators had grouped themselves into two classes, economic and ethnological anti-Semites. The impracticable racial views of Marr and Treitschke had not found favour with Stöcker and the Christian Socialists. They were disposed to leave the Jews in peace so long as they behaved themselves properly, and although they carried on their agitation against Jewish malpractices in a comprehensive form which seemed superficially to identify them with the root-and-branch anti-Semites, they were in reality not inclined to accept the racial theory with its scheme of revived Jewish disabilities (Huret, *La Question Sociale*—interview with Stöcker). This feeling was strengthened by a tendency on the part of an extreme wing of the racial anti-Semites to extend their campaign against Judaism to its offspring, Christianity. In 1879 Professor Sepp, arguing that Jesus was of no human race, had proposed that Christianity should reject the Hebrew Scriptures and seek a fresh historical basis in the cuneiform inscriptions. Later Dr Eugen Dühring, in several brochures, notably *Die Judenfrage als Frage des Rassencharakters* (1881, 5th ed. Berlin, 1901), had attacked Christianity as a manifestation of the Semitic spirit which was not compatible with the theological and ethical conceptions of the Scandinavian peoples. The philosopher Friedrich Nietzsche had also adopted the same view, without noticing that it was a *reductio ad absurdum* of the whole agitation, in his *Menschliches, Allzumenschliches* (1878), *Jenseits von Gut und Böse* (1886), *Genealogie der Moral* (1887). With these tendencies the Christian Socialists could have no sympathy, and the consequence was that when in March 1881 a political organization of anti-Semitism was attempted, two rival bodies were created, the "Deutsche Volksverein," under the Conservative auspices of Herr Liebermann von Sonnenberg (b. 1848) and Herr Förster, and the "Sociale Reichsverein," led by the racial and Radical anti-Semites, Ernst Henrici (b. 1854) and Otto Böckel (b. 1859). In 1886, at an anti-Semitic congress held at Cassel a reunion was effected under the name of the "Deutsche antisemitische Verein," but this only lasted three years. In June 1889 the anti-Semitic Christian Socialists under Stöcker again seceded.

Meanwhile racial anti-Semitism with its wholesale radical proposals had been making considerable progress among the ignorant lower classes. It adapted itself better to popular passions and inherited prejudice than the more academic conceptions of the Christian Socialists. The latter, too, were largely Conservatives, and their points of contact with the proletariat were at best artificial. Among the Hessian peasantry the inflammatory appeals of Böckel secured many adherents. This paved the way for a new anti-Semitic leader, Herrmann Ahlwardt (b. 1846), who, towards the end of the 'eighties, eclipsed all the other anti-Semites by the sensationalism and violence with which he prosecuted the campaign. Ahlwardt was a person of evil notoriety. He was loaded with debt. In the Manché decoration scandals it was proved that he had acted first as a corrupt intermediary and afterwards as the betrayer of his confederates. His anti-Semitism was adopted originally as a means of *chantage*, and it was only when it failed to yield profit in this form that he came out boldly as an agitator. The wildness, unscrupulousness, and full-bloodedness of his propaganda enchanted the mob, and he bid fair to become a powerful democratic leader. His pamphlets, full of scandalous revelations of alleged malpractices of eminent Jews, were read with avidity. No fewer than ten of them were written and published during 1892. Over and over again he was prosecuted for libel and convicted, but this seemed only to strengthen his influence with his followers. The Roman Catholic clergy and newspapers helped to inflame the popular passions. The result was that anti-Jewish riots broke out. At Neustettin the Jewish synagogue was burnt, and at Xanten the Blood Accusation was revived, and a Jewish butcher was tried on the ancient charge of murdering a Christian child for ritual purposes. The man was, of course, acquitted, but the symptoms it revealed of reviving medievalism strongly stirred the liberal and cultured mind of Germany. All protest, however, seemed powerless, and the barbarian movement appeared destined to carry everything before it.

German politics at this moment were in a very intricate state. Prince Bismarck had retired, and Count Caprivi, with a programme of general conciliation based on Liberal principles, was in power. Alarmed by the non-renewal of the anti-Socialist law, and by the conclusion of commercial treaties which made great concessions to German industry, the landed gentry and the Conservative party became alienated from the new chancellor. In January 1892 the split was completed by the withdrawal by the government of the Primary Education bill, which had been designed to place primary instruction on a religious basis. The Conservatives saw their opportunity of posing as the party of Christianity against the Liberals and Socialists, who had wrecked the bill, and they began to look towards Ahlwardt as a possible ally. He had the advantages over Stöcker that he was not a Socialist, and that he was prepared to lead his apparently large following to assist the agrarian movement and weaken the Social Democrats. The intrigue gradually came to light. Towards the end of the year Herr Liebknecht, the Social Democratic leader, denounced the Conservatives to the Reichstag as being concerned "in using the anti-Semitic movement as a bastard edition of Socialism for the use of stupid people." (1st December). Two days later the charge was confirmed. At a meeting of the party held on the 3rd of December the following plank was added to the Conservative programme: "We combat the oppressive and disintegrating Jewish influence on our national life; we demand for our Christian people a Christian magistracy and Christian teachers for Christian pupils; we repudiate the excesses of anti-Semitism." In pursuance of the resolution Ahlwardt was returned to the Reichstag at a by-election by the Conservative district of Arnswalde-Friedeberg. The coalition was, however, not yet completed. The intransigeant Conservatives, led by Baron von Hammerstein, the editor of the *Kreuz-Zeitung*, justly felt that the concluding sentence of the resolution of the 3rd of December repudiating "the excesses of anti-Semitism" was calculated to hinder a full and loyal co-operation between the two parties. Accordingly on the 9th of December another meeting of the party was summoned. Twelve hundred members met at the Tivoli Hall in Berlin, and with only seven dissentients solemnly expunged the offending sentence from the resolution. The history of political parties may be searched in vain for a parallel to this discreditable transaction.

The capture of the Conservative party proved the high-water mark of German anti-Semitism. From that moment the tide began to recede. All that was best in German national life was scandalized by the cynical tactics of the Conservatives. The emperor, strong Christian though he was, was shocked at the idea of serving Christianity by a compact with unscrupulous demagogues and ignorant fanatics. Prince Bismarck growled out a stinging sarcasm from his retreat at Friedrichsruh. Even Stöcker raised his voice in protest against the "Ahlwardtismus" and "Böckelianismus," and called upon his Conservative colleagues to distinguish between "respectable and disreputable anti-Semitism." As for the Liberals and Socialists, they filled the air with bitter laughter, and declared from the housetops that the stupid party had at last been overwhelmed by its own stupidity. The Conservatives began to suspect that they had made a false step, and they were confirmed in this belief by the conduct of their new ally in the Reichstag. His début in parliament was the signal for a succession of disgraceful scenes. His whole campaign of calumny was transferred to the floor of the house, and for some weeks the Reichstag discussed little else than his so-called revelations. The Conservatives listened to his wild charges in uncomfortable silence, and refused to support him. Stöcker opposed him in a violent speech. The Radicals and Socialists, taking an accurate measure of the shallow vanity of the man, adopted the policy of giving him "enough rope." Shortly after his election he was condemned to five months' imprisonment for libel, and he would have been arrested but for the interposition of the Socialist party, including five Jews, who claimed for him the immunities of a member of parliament. When he moved for a commission to inquire into his revelations, it was again the Socialist party which supported him, with the result that all his charges, without exception, were found to be absolutely baseless. Ahlwardt was covered with ridicule, and when in May the Reichstag was dissolved, he was marched off to prison to undergo the sentence for libel from which his parliamentary privilege had up to that moment protected him.

His hold on the anti-Semitic populace was, however, not diminished. On the contrary, the action of the Conservatives at the Tivoli congress could not be at once eradicated from the minds of the Conservative voters, and when the electoral campaign began it was found impossible to explain to them that the party leaders had changed their minds. The result was that Ahlwardt, although in prison, was elected by two constituencies. At Arnswalde-Friedeberg he was returned in the teeth of the opposition of the official Conservatives, and at Neustettin he defeated no less a person than his anti-Semitic opponent Stöcker. Fifteen other anti-Semites, all of the Ahlwardtian school, were elected. This, however, represented little in the way of political influence; for henceforth the party had to stand alone as one of the many minor factions in the Reichstag, avoided by all the great parties, and too weak to exercise any influence on the main course of affairs.

During the subsequent seven years it became more and more discredited. The financial scandals connected with Förster's attempt to found a Christian Socialist colony in Paraguay, the conviction of Baron von Hammerstein, the anti-Semitic Conservative leader, for forgery and swindling (1895–1896), and several minor scandals of the same unsavoury character, covered the party with the very obloquy which it had attempted to attach to the Jews. At the same time the Christian Socialists who had remained with the Conservative party also suffered. After the elections of 1893, Stöcker was dismissed from his post of court preacher, and publicly reprimanded for speaking familiarly of the empress. Two years later the Christian Socialist, Pastor Neumann, observing the tendency of the Conservatives to coalesce with the moderate Liberals in antagonism to Social Democracy, declared against the Conservative party. The following year the emperor publicly condemned Christian Socialism and the "political pastors," and Stöcker was expelled from the Conservative party for refusing to modify the socialistic propanganda of his organ, *Das Volk*. His fall was completed by a quarrel with the Evangelical Social Union. He left the Union and appealed to the Lutheran clergy to found a new church social organization, but met with no response. Another blow to anti-Semitism came from the Roman Catholics. They had become alarmed by the unbridled violence of the Ahlwardtians, and when in 1894 Förster declared in an address to the German anti-Semitic Union that anarchical outrages like the murder of President Carnot were as much due to the "Anarchismus von oben" as the "Anarchismus von unten," the Ultramontane *Germania* publicly washed its hands of the Jew-baiters (1st of July 1894). Thus gradually German anti-Semitism became stripped of every adventitious alliance; and at the general election of 1898 it only managed to return twelve members to the Reichstag, and in 1903 its party strength fell to nine. A remarkable revival in its fortunes, however, took place between 1905 and 1907. Identifying itself with the extreme Chauvinists and Anglophobes it profited by the anti-national errors of the Clericals and Socialists, and won no fewer than twelve by-elections. At the general election of 1907 its jingoism and aggressive Protestantism were rewarded with twenty-five seats. It is clear, however, from the figures of the second ballots that these successes owed far more to the tendencies of the party in the field of general politics than to its anti-Semitism. Indeed the specifically anti-Semitic movement has shown little activity since 1893.

The causes of the decline of German anti-Semitism are not difficult to determine. While it remained a theory of nationality and a fad of the metaphysicians, it made considerable noise in the world, but without exercising much practical influence. When it attempted to play an active part in politics it became submerged by the ignorant and superstitious voters, who could not understand its scientific justification, but who were quite ready to declaim and riot against the Jew bogey. It thus became a sort of Jacquerie which, being exploited by unscrupulous demagogues, soon alienated all its respectable elements. Its moments of real importance have been due not to inherent strength but to the uses made of it by other political parties for their own purposes. These coalitions are no longer of perilous significance so far as the Jews are concerned, chiefly because, in face of the menace of democratic socialism and its unholy alliance with the Roman Catholic Centrum, all supporters of the present organization of society have found it necessary to sink their differences. The new social struggle has eclipsed the racial theory of nationality. The Social Democrat became the enemy, and the new reaction counted on the support of the rich Jews and the strongly individualist Jewish middle class to assist it in preserving the existing social structure. Hence in Prince Bülow's "Bloc" (1908) anti-Semites figured side by side with Judeophil Radicals.

Russia.

More serious have been the effects of German anti-Semitic teachings on the political and social life of the countries adjacent to the empire—Russia, Austria and France. In Russia these effects were first seriously felt owing to the fury of autocratic reaction to which the tragic death of the tsar Alexander II. gave rise. This, however, like the Strousberg *Krach* in Germany, was only the proximate cause of the outbreak. There were other elements which had created a *milieu* peculiarly favourable to the transplantation of the German craze. In the first place the medieval anti-Semitism was still an integral part of the polity of the empire. The Jews were cooped up in one huge ghetto in the western provinces, "marked out to all their fellow-countrymen as aliens, and a pariah caste set apart for special and degrading treatment" (*Persecution of the Jews in Russia*, 1891, p. 5). In the next place, owing to the emancipation of the serfs which had half ruined the landowners, while creating a free but moneyless peasantry, the Jews, who could be neither nobles nor peasants, had found a vocation as money-lenders and as middlemen between the grain producers, and the grain consumers and exporters. There is no evidence that this function was performed, as a rule, in an exorbitant or oppressive way. On the contrary, the fall in the value of cereals on all the provincial markets, after the riots of 1881, shows that the Jewish competition had previously assured full prices to the farmers (Schwabacher, *Denkschrift*, 1882, p. 27). Nevertheless, the Jewish activity or "exploitation," as it was called, was resented, and the ill-feeling it caused among landowners and farmers was shared by non-Jewish middlemen and merchants who had thereby been compelled to be satisfied with small profits. Still there was but little thought of seeking a remedy in an organized anti-Jewish movement. On the contrary, the abnormal situation aggravated by the disappointments and depression caused by the Turkish war, had stimulated a widespread demand for constitutional changes which would enable the people to adopt a state-machinery more exactly suited to their needs. Among the peasantry this demand was promoted and fomented by the Nihilists, and among the landowners it was largely adopted as a means of checking what threatened to become a new Jacquerie (Walcker, *Gegenwärtige Lage Russlands*, 1873; *Innere Krisis Russlands*, 1876). The tsar, Alexander II., strongly sympathized with this movement, and on the advice of Count Loris-Melikov and the council of ministers a rudimentary scheme of parliamentary government had been drafted and actually signed when the emperor was assassinated. Meanwhile a nationalist and reactionary agitation, originating like its German analogue in the Hegelianism of a section of the lettered public, had manifested itself in Moscow. After some early vicissitudes, it had been organized, under the auspices of Alexis Kireiev, Chomyakov, Aksakov and Kochelev, into the Slavophil party, with a Romanticist programme of reforms based on the old traditions of the pre-Petrine epoch. This party gave a great impetus to Slav nationalism. Its final possibilities were sanguinarily illustrated by Muraviev's campaign in Poland in 1863, and in the war against Turkey in 1877, which was exclusively its handiwork (Statement by General Kireiev: Schütz, *Das heutige Russland*, p. 104). After the assassination of Alexander II. the Slavophil teaching, as expounded by Ignatiev and Pobêdonostsev, became paramount in the government, and the new tsar was persuaded to cancel the constitutional project of his father. The more liberal views of a section of the Slavophils under Aksakov, who had been in favour of representative institutions on traditional lines, were displaced by the reactionary system of Pobêdonostsev, who took his stand on absolutism, orthodoxy and the racial unity of the Russian people. This was the situation on the eve of Easter 1881. The hardening nationalism above, the increasing discontent below, the economic activity of the Hebrew heretics and aliens, and the echoes of anti-Semitism from over the western border were combining for an explosion.

A scuffle in a tavern at Elisabethgrad in Kherson sufficed to ignite this combustible material. The scuffle grew into a riot, the tavern was sacked, and the drunken mob, hounded on by agitators who declared that the Jews were using Christian blood for the manufacture of their Easter bread, attacked and looted the Jewish quarter. The outbreak spread rapidly. On the 7th of May there was a similar riot at Smiela, near Cherkasy, and the following day there was a violent outbreak at Kiev, which left 2000 Jews homeless. Within a few weeks the whole of western Russia, from the Black Sea to the Baltic, was smoking with the ruins of Jewish homes. Scores of Jewish women were dishonoured, hundreds of men, women and children were slaughtered, and tens of thousands were reduced to beggary and left without a shelter. Murderous riots or incendiary outrages took place in no fewer than 167 towns and villages, including Warsaw, Odessa and Kiev. Europe had witnessed no such scenes of mob savagery since the Black Death massacres in the 14th century. As the facts gradually filtered through to the western capitals they caused a thrill of horror everywhere. An indignation meeting held at the Mansion House in London, under the presidency of the lord mayor, was the signal for a long series of popular demonstrations condemning the persecutions, held in most of the chief cities of England and the continent.

Except as stimulated by the Judeophobe revival in Germany the Russian outbreak in its earlier forms does not belong specifically to modern anti-Semitism. It was essentially a medieval uprising animated by the religious fanaticism, gross superstition and predatory instincts of a people still in the medieval stage of their development. This is proved by the fact that, although the Russian peasant was supposed to be a victim of unbearable Jewish "exploitation," he was not moved to riot until he had been brutalized by drink and excited by the old fable of the Blood Accusation. The modern anti-Semitic element came from above and followed closely on the heels of the riots. It has been freely charged against the Russian government that it promoted the riots in 1881 in order to distract popular attention from the Nihilist propaganda and from the political disappointments involved in the cancellation of the previous tsar's constitutional project (Lazare, *L'Antisémitisme*, p. 211). This seems to be true of General Ignatiev, then minister of the interior, and the secret police (Séménoff, *The Russian Government and the Massacres*, pp. 17, 32, 241). It is certain that the local authorities, both civil and military, favoured the outbreak, and took no steps to suppress it, and that the feudal bureaucracy who had just escaped a great danger were not sorry to see the discontented populace venting their passions on the Jews. In the higher circles of the government, however, other views prevailed. The tsar himself was at first persuaded that the riots were the work of Nihilists, and he publicly promised his protection to the Jews. On the other hand, his ministers, ardent Slavophils, thought they recognized in the outbreak an endorsement of the nationalist teaching of which they were the apostles, and, while reprobating the acts of violence, came to the conclusion that the most reasonable solution was to aggravate the legal disabilities of the persecuted aliens and heretics. To this view the tsar was won over, partly by the clamorous indignation of western Europe, which had wounded his national *amour propre* to the quick, and partly by the strongly partisan report of a commission appointed to inquire, not into the administrative complaisance which had allowed riot to run loose over the western and southern provinces, but into the "exploitation" alleged against the Jews, the reasons why "the former laws limiting the rights of the Jews" had been mitigated, and how these laws could be altered so as "to stop the pernicious conduct of the Jews" (Rescript of the 3rd of September 1881). The result of this report was the drafting of a "Temporary Order concerning the Jews" by the minister of the interior, which received the assent of the tsar on the 3rd of May 1882. This order, which was so little temporary that it has not yet been repealed, had the effect of creating a number of fresh ghettos within the pale of Jewish settlement. The Jews were cooped up within the towns, and their rural interests were arbitrarily confiscated. The doubtful incidence of the order gave rise to a number of judgments of the senate, by which all its persecuting possibilities were brought out, with the result that the activities of the Jews were completely paralysed, and they became a prey to unparalleled cruelty. As the gruesome effect of this legislation became known, a fresh outburst of horror and indignation swelled up from western Europe. It proved powerless. Count Ignatiev was dismissed owing to the protests of high-placed Russians, who were disgusted by the new *Kulturkampf*, but his work remained, and, under the influence of Pobêdonostsev, the procurator of the Holy Synod, the policy of the "May Laws," as they were significantly called, was applied to every aspect of Jewish life with pitiless rigour. The temper of the tsar may be judged by the fact that when an appeal for mercy from an illustrious personage in England was conveyed to him at Fredensborg through the gracious medium of the tsaritsa, he angrily exclaimed within the hearing of an Englishman in the ante-room who was the bearer of the message, "Never let me hear you mention the name of that people again!"

The Russian May Laws are the most conspicuous legislative monument achieved by modern anti-Semitism. It is true that they re-enacted regulations which resemble the oppressive statutes introduced into Poland through the influence of the Jesuits in the 16th century (Sternberg, *Gesch. d. Juden in Polen*, pp. 141 et seq.), but their Orthodox authors were as little conscious of this irony of history as they were of the Teutonic origins of the whole Slavophil movement. These laws are an experimental application of the political principles extracted by Marr and his German disciples from the metaphysics of Hegel, and as such they afford a valuable means of testing the practical operation of modern anti-Semitism. Their result was a widespread commercial depression which was felt all over the empire. Even before the May Laws were definitely promulgated the passport registers showed that the anti-Semitic movement had driven 67,900 Jews across the frontier, and it was estimated that they had taken with them 13,000,000 roubles, representing a minimum loss of 60,000,000 roubles to the annual turnover of the country's trade. Towards the end of 1882 it was calculated that the agitation had cost Russia as much as the whole Turkish war of 1877. Trade was everywhere paralysed. The enormous increase of bankruptcies, the transfer of investments to foreign funds, the consequent fall in the value of the rouble and the prices of Russian stocks, the suspension of farming operations owing to advances on growing crops being no longer available, the rise in the prices of the necessaries of life, and lastly, the appearance of famine, filled half the empire with gloom. Banks closed their doors, and the great provincial fairs proved failures. When it was proposed to expel the Jews from Moscow there was a loud outcry all over the sacred city, and even the Orthodox merchants, realizing that the measure would ruin their flourishing trade with the south and west, petitioned against it. The Moscow Exhibition proved a failure. Nevertheless the government persisted with its harsh policy, and Jewish refugees streamed by tens of thousands across the western frontier to seek an asylum in other lands. In 1891 the alarm caused by this emigration led to further protests from abroad. The citizens of London again assembled at Guildhall, and addressed a petition to the tsar on behalf of his Hebrew subjects. It was handed back to the lord mayor by the Russian ambassador, with a curt intimation that the emperor declined to receive it. At the same time orders were defiantly given that the May Laws should be strictly enforced. Meanwhile the Russian minister of finance was at his wits' ends for money. Negotiations for a large loan had been entered upon with the house of Rothschild, and a preliminary contract had been signed, when, at the instance of the London firm, M. Wyshnigradski, the finance minister, was informed that unless the persecutions of the Jews were stopped the great banking-house would be compelled to withdraw from the operation. Deeply mortified by this attempt to deal with him *de puissance à puissance*, the tsar peremptorily broke off the negotiations, and ordered that overtures should be made to a non-Jewish French syndicate. In this way anti-Semitism, which had already so profoundly influenced the domestic politics of Europe, set its mark on the international relations of the powers, for it was the urgent need of the Russian treasury quite as much as the termination of Prince Bismarck's secret treaty of mutual neutrality which brought about the Franco-Russian alliance (Daudet, *Hist. Dipl. de l'Alliance Franco-Russe*, pp. 259 et. seq.).

For nearly three years more the persecutions continued. Elated by the success of his crusade against the Jews, Pobêdonostsev extended his persecuting policy to other non-Orthodox denominations. The legislation against the Protestant Stundists became almost as unbearable as that imposed on the Jews. In the report of the Holy Synod, presented to the tsar towards the end of 1893, the procurator called for repressive measures against Roman Catholics, Moslems and Buddhists, and denounced the rationalist tendency of the whole system of secular education in the empire (*Neue Freie Presse*, 31st January 1894). A year later, however, the tsar died, and his successor, without repealing any of the persecuting laws, let it gradually be understood that their rigorous application might be mitigated. The country was tired and exhausted by the persecution, and the tolerant hints which came from high quarters were acted upon with significant alacrity.

A new era of conflict dawned with the great constitutional struggle towards the end of the century. The conditions, however, were very different from those which prevailed in the 'eighties. The May Laws had avenged themselves with singular fitness. By confining the Jews to the towns at the very moment that Count Witte's policy of protection was creating an enormous industrial proletariat they placed at the disposal of the disaffected masses an ally powerful in numbers and intelligence, and especially in its bitter sense of wrong, its reckless despair and its cosmopolitan outlook and connexions. As early as 1885 the Jewish workmen assisted by Jewish university students led the way in the formation of trades unions. They also became the *colporteurs* of western European socialism, and they played an important part in the organization of the Russian Social Democratic Federation which their "Arbeiter Bund" joined in 1898 with no fewer than 30,000 members. The Jewish element in the new democratic movement excited the resentment of the government, and under the minister of the interior, M. Sipiaguine, the persecuting laws were once more rigorously enforced. The "Bund" replied in 1901 by proclaiming itself frankly political and revolutionary, and at once took a leading place in the revolutionary movement. The reactionaries were not slow to profit by this circumstance. With the support of M. Plehve, the new minister of the interior, and the whole of the bureaucratic class they denounced the revolution as a Jewish conspiracy, engineered for exclusively Jewish purposes and designed to establish a Jewish domination over the Russian people. The government and even the intimates of the tsar became persuaded that only by the terrorization of the Jews could the revolutionary movement be effectually dealt with. For this purpose a so-called League of True Russians was formed. Under high patronage, and with the assistance of the secret police and a large number of the local authorities, it set itself to stir up the populace, chiefly the fanatics and the hooligans, against the Jews. Incendiary proclamations were prepared and printed in the ministry of the interior itself, and were circulated by the provincial governors and the police (Prince Urussov's speech in the Duma, June 8 (21), 1906). The result was another series of massacres which began at Kishinev in 1903 and culminated in wholesale butchery at Odessa and Bielostok in October 1905. An attempt was made to picture and excuse these outbreaks as a national upheaval against the Jew-made revolution but it failed. They only embittered the revolutionists and "intellectuals" throughout the country, and won for them a great deal of outspoken sympathy abroad. The artificiality of the anti-Jewish outbreak was illustrated by the first Duma elections. Thirteen Jews were elected and every constituency which had been the scene of a *pogrom* returned a liberal member. Unfortunately the Jews benefited little by the new parliamentary constitution. The privileges of voting for members of the Duma and of sitting in the new assembly were granted them, but all their civil and religious disabilities were maintained. Both the first and the second Duma proposed to emancipate them, but they were dissolved before any action could be taken. By the modification of the electoral law under which the third Duma was elected the voting power of the Jews was diminished and further restrictions were imposed upon them through official intimidation during the elections. The result was that only two Jews were elected, while the reactionary tendency of the new electorate virtually removed the question of their emancipation from the field of practical politics.

Rumania.

The only other country in Europe in which a legalized anti-Semitism exists is Rumania. The conditions are very similar to those which obtain in Russia, with the important difference that Rumania is a constitutional country, and that the Jewish persecutions are the work of the elected deputies of the nation. Like the *Bourgeois Gentilhomme* who wrote prose all his life without knowing it, the Rumanians practised the nationalist doctrines of the Hegelian anti-Semites unconsciously long before they were formulated in Germany. In the old days of Turkish domination the lot of the Rumanian Jews was not conspicuously unhappy. It was only when the nation began to be emancipated, and the struggle in the East assumed the form of a crusade against Islam that the Jews were persecuted. Rumanian politicians preached a nationalism limited exclusively to indigenous Christians, and they were strongly supported by all who felt the commercial competition of the Jews. Thus, although the Jews had been settled in the land for many centuries, they were by law declared aliens. This was done in defiance of the treaty of Paris of 1856 and the convention of 1858 which declared all Rumans to be equal before the law. Under the influence of this distinction the Jews became persecuted, and sanguinary riots were of frequent occurrence. The realization of a Jewish question led to legislation imposing disabilities on the Jews. In 1878 the congress of Berlin agreed to recognize the independence of Rumania on condition that all religious disabilities were removed. Rumania agreed to this condition, but ultimately persuaded the powers to allow her to carry out the emancipation of the Jews gradually. Persecutions, however, continued, and in 1902 they led to a great exodus of Jews. The United States addressed a strong remonstrance to the Rumanian government, but the condition of the Jews was in no way improved. Their emancipation was in 1908 as far off as ever, and their disabilities heavier than those of their brethren in Russia. For this state of things the example of the anti-Semites in Germany, Russia, Austria and France was largely to blame, since it had justified the intolerance of the Rumans. Owing, also, to the fact that of late years Rumania had become a sort of *annexe* of the Triple Alliance, it was found impossible to induce the signatories of the treaty of Berlin to take action to compel the state to fulfil its obligations under that treaty.

Austria-Hungary.

In Austria-Hungary the anti-Semitic impulses came almost simultaneously from the North and East. Already in the 'seventies the doctrinaire anti-Semitism of Berlin had found an echo in Budapest. Two members of the diet, Victor Istoczy and Geza Onody, together with a publicist named Georg Marczianyi, busied themselves in making known the doctrine of Marr in Hungary. Marczianyi, who translated the German Judeophobe pamphlets into Magyar, and the Magyar works of Onody into German, was the chief medium between the northern and southern schools. In 1880 Istoczy tried to establish a "Nichtjuden Bund" in Hungary, with statutes literally translated from those of the German anti-Semitic league. The movement, however, made no progress, owing to the stalwart Liberalism of the predominant political parties, and of the national principles inherited from the revolution of 1848. The large part played by the Jews in that struggle, and the fruitful patriotism with which they had worked for the political and economic progress of the country, had created, too, a strong claim on the gratitude of the best elements in the nation. Nevertheless, among the ultramontane clergy, the higher aristocracy, the ill-paid minor officials, and the ignorant peasantry, the seeds of a tacit anti-Semitism were latent. It was probably the aversion of the nobility from anything in the nature of a demagogic agitation which for a time prevented these seeds from germinating. The news of the uprising in Russia and the appearance of Jewish refugees on the frontier, had the effect of giving a certain prominence to the agitation of Istoczy and Onody and of exciting the rural communities, but it did not succeed in impressing the public with the pseudo-scientific doctrines of the new anti-Semitism. It was not until the agitators resorted to the Blood Accusation—that never-failing decoy of obscurantism and superstition—that Hungary took a definite place in the anti-Semitic movement. The outbreak was short and fortunately bloodless, but while it lasted its scandals shocked the whole of Europe.

Dr August Rohling, professor of Hebrew at the university of Prague, a Roman Catholic theologian of high position but dubious learning, had for some years assisted the Hungarian anti-Semites with *réchauffés* of Eisenmenger's *Entdecktes Judenthum* (Frankfurt a/M. 1700). In 1881 he made a solemn deposition before the Supreme Court accusing the Jews of being bound by their law to work the moral and physical ruin of non-Jews. He followed this up with an offer to depose on oath that the murder of Christians for ritual purposes was a doctrine secretly taught among Jews. Professor Delitzsch and other eminent Hebraists, both Christian and Jewish, exposed and denounced the ignorance and malevolence of Rohling, but were unable to stem the mischief he was causing. In April 1882 a Christian girl named Esther Sobymossi was missed from the Hungarian village of Tisza Eszlar, where a small community of Jews were settled. The rumour got abroad that she had been kidnapped and murdered by the Jews, but it remained the burden of idle gossip, and gave rise to neither judicial complaint nor public disorders. At this moment the question of the Bosnian Pacification credits was before the diet. The unpopularity of the task assumed by Austria-Hungary, under the treaty of Berlin, which was calculated to strengthen the disaffected Croat element in the empire, had reduced the government majority to very small proportions, and all the reactionary factions in the country were accordingly in arms. The government was violently and unscrupulously attacked on all sides. On the 23rd of May there was a debate in the diet when M. Onody, in an incendiary harangue, told the story of the missing girl at Tisza Eszlar, and accused ministers of criminal indulgence to races alien to the national spirit. In the then excited state of the public mind on the Croat question, the manœuvre was adroitly conceived. The government fell into the trap, and treated the story with lofty disdain. Thereupon the anti-Semites set to work on the case, and M. Joseph Bary, the magistrate at Nyiregyhaza, and a noted anti-Semite, was induced to go to Tisza Eszlar and institute an inquiry. All the anti-liberal elements in the country now became banded together in this effort to discredit the liberal government, and for the first time the Hungarian anti-Semites found themselves at the head of a powerful party. Fifteen Jews were arrested and thrown into prison. No pains were spared in preparing the case for trial. Perjury and even forgery were freely resorted to. The son of one of the accused, a boy of fourteen, was taken into custody by the police, and by threats and cajoleries prevailed upon to give evidence for the prosecution. He was elaborately coached for the terrible *rôle* he was to play. The trial opened at Nyiregyhaza on the 19th of June, and lasted till the 3rd of August. It was one of the most dramatic *causes célèbres* of the century. Under the brilliant cross-examination of the advocates for the defence the whole of the shocking conspiracy was gradually exposed. The public prosecutor thereupon withdrew from the case, and the four judges—the chief of whom held strong anti-Semitic opinions—unanimously acquitted all the prisoners. The case proved the death-blow of Hungarian anti-Semitism. Although another phase of the Jewish question, which will be referred to presently, had still to occupy the public mind, the shame brought on the nation by the Tisza Eszlar conspiracy effectually prevented the anti-Semites from raising their voices with any effect again.

Meanwhile a more formidable and complicated outburst was preparing in Austria itself. Here the lines of the German agitation were closely followed, but with far more dramatic results. It was exclusively political—that is to say, it appealed to anti-Jewish prejudices for party purposes while it sought to rehabilitate them on a pseudo-scientific basis, racial and economic. At first it was confined to sporadic pamphleteers. By their side there gradually grew up a school of Christian Socialists, recruited from the ultra-Clericals, for the study and application of the doctrines preached at Mainz by Archbishop Ketteler. This constituted a complete Austrian analogue to the Evangelical-Socialist movement started in Germany by Herr Stöcker. For some years the two movements remained distinct, but signs of approximation were early visible. Thus one of the first complaints of the anti-Semites was that the Jews were becoming masters of the soil. This found an echo in the agrarian principles of the Christian Socialists, as expounded by Rudolph Meyer, in which individualism in landed property was admitted on the condition that the landowners were "the families of the nation" and not "cosmopolitan financiers." A further indication of anti-Semitism is found in a speech delivered in 1878 by Prince Alois von Liechtenstein (b. 1846), the most prominent disciple of Rudolph Meyer, who denounced the national debt as a tribute paid by the state to cosmopolitan *rentiers* (Nitti, *Catholic Socialism*, pp. 200, 201, 211, 216). The growing disorder in parliament, due to the bitter struggle between the German and Czech parties, served to bring anti-Semitism into the field of practical politics. Since 1867 the German Liberals had been in power. They had made enemies of the Clericals by tampering with the concordat, and they had split up their own party by the federalist policy adopted by Count Taaffe. The Radical secessionists in their turn found it difficult to agree, and an ultra-national German wing formed itself into a separate party under the leadership of Ritter von Schönerer (b. 1842), a Radical nationalist of the most violent type. In 1882 two anti-Semitic leagues had been founded in Vienna, and to these the Radical nationalists now appealed for support. The growing importance of the party led the premier, Count Taaffe, to angle for the support of the Clericals by accepting a portion of the Christian Socialist programme. The hostility this excited in the liberal press, largely written by Jews, served to bring the feudal Christian Socialists and Radical anti-Semites together. In 1891 these strangely assorted factions became consolidated, and during the elections of that year Prince Liechtenstein came forward as an anti-Semitic candidate and the acknowledged leader of the party. The elections resulted in the return of fifteen anti-Semites to the Reichsrath, chiefly from Vienna.

Although Prince Liechtenstein and the bulk of the Christian

Socialists had joined the anti-Semites with the support of the Clerical organ, the *Vaterland*, the Clerical party as a whole still held aloof from the Jew-baiters. The events of 1892–1895 put an end to their hesitation. The Hungarian government, in compliance with long-standing pledges to the liberal party, introduced into the diet a series of ecclesiastical reform bills providing for civil marriage, freedom of worship, and the legal recognition of Judasim on an equality with other denominations. These proposals, which synchronized with Ahlwardt's turbulent agitation in Germany, gave a great impulse to anti-Semitism and served to drive into its ranks a large number of Clericals. The agitation was taken in hand by the Roman Catholic clergy, and the pulpits resounded with denunciations of the Jews. One clergyman, Father Deckert, was prosecuted for preaching the Blood Accusation and convicted (1894). Cardinal Schlauch, bishop of Grosswardein, declared in the Hungarian House of Magnates that the Liberals were in league with "cosmopolitans" for the ruin of the country. In October 1894 the magnates adopted two of the ecclesiastical bills with amendments, but threw out the Jewish bill by a majority of six. The crown sided with the magnates, and the ministry resigned, although it had a majority in the Lower House. An effort was made to form a Clerical cabinet, but it failed. Baron Banffy was then entrusted with the construction of a fresh Liberal ministry. The announcement that he would persist with the ecclesiastical bills lashed the Clericals and anti-Semites into a fury, and the agitation broke out afresh. The pope addressed a letter to Count Zichy encouraging the magnates to resist, and once more two of the bills were amended, and the third rejected. The papal nuncio, Mgr. Agliardi, now thought proper to pay a visit to Budapest, where he allowed himself to be interviewed on the crisis. This interference in the domestic concerns of Hungary was deeply resented by the Liberals, and Baron Banffy requested Count Kalnoky, the imperial minister of foreign affairs, to protest against it at the Vatican. Count Kalnoky refused and tendered his resignation to the emperor. Clerical sympathies were predominant in Vienna, and the emperor was induced for a moment to decline the count's resignation. It soon became clear, however, that the Hungarians were resolved to see the crisis out, and that in the end Vienna would be compelled to give way. The emperor accordingly retraced his steps, Count Kalnoky's resignation was accepted, the papal nuncio was recalled, a batch of new magnates were created, and the Hungarian ecclesiastical bills passed.

Simultaneously with this crisis another startling phase of the anti-Semitic drama was being enacted in Vienna itself. Encouraged by the support of the Clericals the anti-Semites resolved to make an effort to carry the Vienna municipal elections. So far the alliance of the Clericals with the anti-Semites had been unofficial, but on the eve of the elections (January 1895) the pope, influenced partly by the Hungarian crisis and partly by an idea of Cardinal Rampolla that the best antidote to democratic socialism would be a clerically controlled fusion of the Christian Socialists and anti-Semites, sent his blessing to Prince Liechtenstein and his followers. This action alarmed the government and a considerable body of the higher episcopate, who felt assured that any permanent encouragement given to the anti-Semites would in the end strengthen the parties of sedition and disorder. Cardinal Schönborn was despatched in haste to Rome to expostulate with the pontiff, and his representations were strongly supported by the French and Belgian bishops. The mischief was however, done, and although the pope sent a verbal message to Prince Liechtenstein excluding the anti-Semites from his blessing, the elections resulted in a great triumph for the Jew-haters. The municipal council was immediately dissolved by the government, and new elections were ordered, but these only strengthened the position of the anti-Semites, who carried 92 seats out of a total of 138. A cabinet crisis followed, and the premiership was entrusted to the Statthalter of Galicia, Count Badeni, who assumed office with a pledge of war to the knife against anti-Semitism. In October the new municipal council elected as burgomaster of Vienna Dr Karl Lueger (b. 1844), a vehement anti-Semite, who had displaced Prince Liechtenstein as leader of the party. The emperor declined to sanction the election, but the council repeated it in face of the imperial displeasure. Once more a dissolution was ordered, and for three months the city was governed by administrative commissioners. In February 1896 elections were again held, and the anti-Semites were returned with an increased majority. The emperor then capitulated, and after a temporary arrangement, by which for one year Dr Lueger acted as vice-burgomaster and handed over the burgomastership to an inoffensive nominee, permitted the municipal council to have its way. The growing anarchy in parliament at this moment served still further to strengthen the anti-Semites, and their conquest of Vienna was speedily followed by a not less striking conquest of the Landtag of Lower Austria (November 1896).

Since then a reaction of sanity has slowly but surely asserted itself. In 1908 the anti-Semites had governed Vienna twelve years, and, although they had accomplished much mischief, the millennium of which they were supposed to be the heralds had not dawned. On the contrary, the commercial interests of the city had suffered and the rates had been enormously increased (*Neue Freie Presse*, 29th March 1901), while the predatory hopes which secured them office had only been realized on a small and select scale. The spectacle of a Clerico-anti-Semitic tammany in Vienna had strengthened the resistance of the better elements in the country. Time had also shown that Christian Socialism is only a disguise for high Toryism, and that the German Radicals who were originally induced to join the anti-Semites had been victimized by the Clericals. The fruits of this disillusion began to show themselves in the general elections of 1900–1901, when the anti-Semites lost six seats in the Reichsrath. The elections were followed (26th January 1901) by a papal encyclical on Christian democracy, in which Christian Socialism was declared to be a term unacceptable to the Church, and the faithful were adjured to abstain from agitation of a demagogic and revolutionary character, and "to respect the rights of others." Nevertheless, in 1907 the Christian Socialists trebled their representation in the Reichsrath. This, however, was due more to their alliance with the German national parties than to any large increase of anti-Semitism in the electorate.

France.

The last country in Europe to make use of the teachings of German anti-Semitism in its party politics was France. The fact that the movement should have struck root in a republican country, where the ideals of democratic freedom have been so passionately cultivated, has been regarded as one of the paradoxes of our latter-day history. As a matter of fact, it is more surprising that it was not adopted earlier. All the social and political conditions which produced anti-Semitism in Germany were present in France, but in an aggravated form due primarily to the very republican *régime* which at first sight seemed to be a guarantee against it. In the monarchical states the dominance of the *bourgeoisie* was tempered in a measure by the power of the crown and the political activity of the aristocracy, which carried with them a very real restraining influence in the matter of political honour and morality. In France these restraining influences were driven out of public life by the republic. The nobility both of the *ancien régime* and the empire stood aloof, and politics were abandoned for the most part to professional adventurers, while the *bourgeoisie* assumed the form of an omnipotent plutocracy. This naturally attracted to France all the financial adventurers in Europe, and in the train of the immigration came not a few German Jews, alienated from their own country by the agitation of Marr and Stöcker. Thus the *bourgeoisie* was not only more powerful in France than in other countries, but the obnoxiousness of its Jewish element was accentuated by a tinge of the national enemy. The anti-clericalism of the *bourgeois* republic and its unexampled series of financial scandals, culminating in the Panama "Krach," thus sufficed to give anti-Semitism a strong hold on the public mind.

Nevertheless, it was not until 1882 that the anti-Jewish movement was seriously heard of in France. Paul Bontoux (b. 1820), who had formerly been in the employ of the Rothschilds, but had been obliged to leave the firm in consequence of his disastrous speculations, had joined the Legitimist party, and had started the Union Générale with funds obtained from his new allies. Bontoux promised to break up the alleged financial monopoly of the Jews and Protestants and to found a new plutocracy in its stead, which should be mainly Roman Catholic and aristocratic. The bait was eagerly swallowed. For five years the Union Générale, with the blessing of the pope, pursued an apparently prosperous career. Immense schemes were undertaken, and the 125-fr. shares rose gradually to 3200 francs. The whole structure, however, rested on a basis of audacious speculation, and in January 1882 the Union Générale failed, with liabilities amounting to 212,000,000 francs. The cry was at once raised that the collapse was due to the manœuvres of the Jews, and a strong anti-Semitic feeling manifested itself in clerical and aristocratic circles. In 1886 violent expression was given to this feeling in a book since become famous, *La France juive*, by Edouard Drumont (b. 1844). The author illustrated the theories of German anti-Semitism with a *chronique scandaleuse* full of piquant personalities, in which the corruption of French national life under Jewish influences was painted in alarming colours. The book was read with avidity by the public, who welcomed its explanations of the obviously growing debauchery. The Wilson scandals and the suspension of the Panama Company in the following year, while not bearing out Drumont's anti-Semitism, fully justified his view of the prevailing corruption. Out of this condition of things rose the Boulangist movement, which rallied all the disaffected elements in the country, including Drumont's following of anti-Semites. It was not, however, until the flight of General Boulanger and the ruin of his party that anti-Semitism came forward as a political movement.

The chief author of the rout of Boulangism was a Jewish politician and journalist, Joseph Reinach (b. 1856), formerly private secretary to Gambetta, and one of the ablest men in France. He was a Frenchman by birth and education, but his father and uncles were Germans, who had founded an important banking establishment in Paris. Hence he was held to personify the alien Jewish domination in France, and the ex-Boulangists turned against him and his co-religionists with fury. The Boulangist agitation had for a second time involved the Legitimists in heavy pecuniary losses, and under the leadership of the marquis de Morès they now threw all their influence on the side of Drumont. An anti-Semitic league was established, and with Royalist assistance branches were organized all over the country. The Franco-Russian alliance in 1891, when the persecutions of the Jews by Pobêdonostsev were attracting the attention of Europe, served to invest Drumont's agitation with a fashionable and patriotic character. It was a sign of the spiritual approximation of the two peoples. In 1892 Drumont founded a daily anti-Semitic newspaper, *La Libre Parole*. With the organization of this journal a regular campaign for the discovery of scandals was instituted. At the same time a body of aristocratic swashbucklers, with the marquis de Morès and the comte de Lamase at their head, set themselves to terrorize the Jews and provoke them to duels. At a meeting held at Neuilly in 1891, Jules Guérin, one of the marquis de Morès's lieutenants, had demanded rhetorically *un cadavre de Juif*. He had not long to wait. Anti-Semitism was most powerful in the army, which was the only branch of the public service in which the reactionary classes were fully represented. The republican law compelling the seminarists to serve their term in the army had strengthened its Clerical and Royalist elements, and the result was a movement against the Jewish officers, of whom 500 held commissions. A series of articles in the *Libre Parole* attacking these officers led to a number of ferocious duels, and these culminated in 1892 in the death of an amiable and popular Jewish officer, Captain Armand Mayer, of the Engineers, who fell, pierced through the lungs by the marquis de Morès. This tragedy, rendered all the more painful by the discovery that Captain Mayer had chivalrously fought to shield a friend, aroused a great deal of popular indignation against the anti-Semites, and for a moment it was believed that the agitation had been killed with its victim.

Towards the end of 1892, the discovery of the widespread corruption practised by the Panama Company gave a fresh impulse to anti-Semitism. The revelations were in a large measure due to the industry of the *Libre Parole*; and they were all the more welcome to the readers of that journal since it was discovered that three Jews were implicated in the scandals, one of whom, baron de Reinach, was uncle and father-in-law to the hated destroyer of Boulangism. The escape of the other two, Dr Cornelius Herz and M. Arton, and the difficulties experienced in obtaining their extradition, deepened the popular conviction that the authorities were implicated in the scandals, and kept the public eye for a long time absorbed by the otherwise restricted Jewish aspects of the scandals. In 1894 the military side of the agitation was revived by the arrest of a prominent Jewish staff officer, Captain Alfred Dreyfus, on a charge of treason. From the beginning the hand of the anti-Semite was flagrant in the new sensation. The first hint of the arrest appeared in the *Libre Parole*; and before the facts had been officially communicated to the public that journal was busy with a campaign against the war minister, based on the apprehension that, in conspiracy with the *Juiverie* and his republican colleagues, he might exert himself to shield the traitor. Anti-Semitic feeling was now thoroughly aroused. Panama had prepared the people to believe anything; and when it was announced that a court-martial, sitting in secret, had convicted Dreyfus, there was a howl of execration against the Jews from one end of the country to the other, although the alleged crime of the convict and the evidence by which it was supported were quite unknown. Dreyfus was degraded and transported for life amid unparalleled scenes of public excitement.

The Dreyfus Case registers the climax not only of French, but of European anti-Semitism. It was the most ambitious and most unscrupulous attempt yet made to prove the nationalist hypothesis of the anti-Semites, and in its failure it afforded the most striking illustration of the dangers of the whole movement by bringing France to the verge of revolution. For a few months after the Dreyfus court-martial there was a comparative lull; but the highly strung condition of popular passion was illustrated by a violent debate on "The Jewish Peril" in the Chamber of Deputies (25th April 1895), and by two outrages with explosives at the Rothschild bank in Paris. Meanwhile the family of Dreyfus, absolutely convinced of his innocence, were casting about for the means of clearing his character and securing his liberation. They were wealthy, and their activity unsettled the public mind and aroused the apprehensions of the conspirators. Had the latter known how to preserve silence, the mystery would perhaps have been yet unsolved; but in their anxiety to allay all suspicions they made one false step, which proved the beginning of their ruin. Through their friends in the press they secured the publication of a facsimile of a document known as the *Bordereau*—a list of documents supposed to be in Dreyfus's handwriting and addressed apparently to the military attaché of a foreign power, which was alleged to constitute the chief evidence against the convict. It was hoped by this publication to put an end to the doubts of the so-called Dreyfusards. The result, however, was only to give them a clue on which they worked with remarkable ingenuity. To prove that the *Bordereau* was not in Dreyfus's handwriting was not difficult. Indeed, its authorship was recognized almost on the day of publication; but the Dreyfusards held their hands in order to make assurance doubly sure by further evidence. Meanwhile one of the officers of the general staff, Colonel Picquart, had convinced himself by an examination of the *dossier* of the trial that a gross miscarriage of justice had taken place. On mentioning his doubts to his superiors, who were animated partly by anti-Semitic feeling and partly by reluctance to confess to a mistake, he was ordered to the Tunisian hinterland on a dangerous expedition. Before leaving Paris, however, he took the precaution to confide his discovery to his legal adviser. Harassed by their anxieties, the conspirators made further communications to the newspapers; and the government, questioned and badgered in parliament, added to the revelations. The new disclosures, so far from stopping the Dreyfusards, proved to them, among other things, that the conviction had been partially based on documents which had not been communicated to the counsel for the defence, and hence that the judges had been tampered with by the ministry of war behind the prisoner's back. So far, too, as these documents related to correspondence with foreign military attachés, it was soon ascertained that they were forgeries. In this way a terrible indictment was gradually drawn up against the ministry of war. The first step was taken towards the end of 1897 by a brother of Captain Dreyfus, who, in a letter to the minister of war, denounced Major Esterhazy as the real author of the *Bordereau*. The authorities, supported by parliament, declined to reopen the Dreyfus Case, but they ordered a court-martial on Esterhazy, which was held with closed doors and resulted in his acquittal. It now became clear that nothing short of an appeal to public opinion and a full exposure of all the iniquities that had been perpetrated would secure justice at the hands of the military chiefs. On behalf of Dreyfus, Émile Zola, the eminent novelist, formulated the case against the general staff of the army in an open letter to the president of the republic, which by its dramatic accusations startled the whole world. The letter was denounced as wild and fantastic even by those who were in favour of revision. Zola was prosecuted for libel and convicted, and had to fly the country; but the agitation he had started was taken in hand by others, notably M. Clemenceau, M. Reinach and M. Yves Guyot. In August 1898 their efforts found their first reward. A re-examination of the documents in the case by M. Cavaignac, then minister of war, showed that one was undoubtedly forged. Colonel Henry, of the intelligence department of the war office, then confessed that he had fabricated the document, and, on being sent to Mont Valérien under arrest, cut his throat.

In spite of this damaging discovery the war office still persisted in believing Dreyfus guilty, and opposed a fresh inquiry. It was supported by three successive ministers of war, and apparently an overwhelming body of public opinion. By this time the question of the guilt or innocence of Dreyfus had become an altogether subsidiary issue. As in Germany and Austria, the anti-Semitic crusade had passed into the hands of the political parties. On the one hand the Radicals and Socialists, recognizing the anti-republican aims of the agitators and alarmed by the clerical predominance in the army, had thrown in their lot with the Dreyfusards; on the other the reactionaries, anxious to secure the support of the army, took the opposite view, denounced their opponents as *sans patrie*, and declared that they were conspiring to weaken and degrade the army in the face of the national enemy. The controversy was, consequently, no longer for or against Dreyfus, but for or against the army, and behind it was a life-or-death struggle between the republic and its enemies. The situation became alarming. Rumours of military plots filled the air. Powerful leagues for working up public feeling were formed and organized; attempts to discredit the republic and intimidate the government were made. The president was insulted; there were tumults in the streets, and an attempt was made by M. Déroulède to induce the military to march on the Elysée and upset the republic. In this critical situation France, to her eternal honour, found men with sufficient courage to do the right. The Socialists, by rallying to the Radicals against the reactionaries, secured a majority for the defence of the republic in parliament. Brisson's cabinet transmitted to the court of cassation an application for the revision of the case against Dreyfus; and that tribunal, after an elaborate inquiry, which fully justified Zola's famous letter, quashed and annulled the proceedings of the court-martial, and remitted the accused to another court-martial, to be held at Rennes. Throughout these proceedings the military party fought tooth and nail to impede the course of justice; and although the innocence of Dreyfus had been completely established, it concentrated all its efforts to secure a fresh condemnation of the prisoner at Rennes. Popular passion was at fever heat, and it manifested itself in an attack on M. Labori, one of the counsel for the defence, who was shot and wounded on the eve of his cross-examination of the witnesses for the prosecution. To the amazement and indignation of the whole world outside France, the Rennes court-martial again found the prisoner guilty; but all reliance on the conscientiousness of the verdict was removed by a rider, which found "extenuating circumstances," and by a reduction of the punishment to ten years' imprisonment, to which was added a recommendation to mercy. The verdict was evidently an attempt at a compromise, and the government resolved to advise the president of the republic to pardon Dreyfus. This lame conclusion did not satisfy the accused; but his innocence had been so clearly proved, and on political grounds there were such urgent reasons for desiring a termination of the affair, that it was accepted without protest by the majority of moderate men.

The rehabilitation of Dreyfus, however, did not pass without another effort on the part of the reactionaries to turn the popular passions excited by the case to their own advantage. After the failure of Déroulède's attempt to overturn the republic, the various Royalist and Boulangist leagues, with the assistance of the anti-Semites, organized another plot. This was discovered by the government, and the leaders were arrested. Jules Guérin, secretary of the anti-Semitic league, shut himself up in the league offices in the rue Chabrol, Paris, which had been fortified and garrisoned by a number of his friends, armed with rifles. For more than a month these anti-Semites held the authorities at bay, and some 5000 troops were employed in the siege. The conspirators were all tried by the senate, sitting as a high court, and Guérin was sentenced to ten years' imprisonment. The evidence showed that the anti-Semitic organization had taken an active part in the anti-republican plot (see the report of the Commission d'Instruction in the *Petit Temps*, 1st November 1899).

The government now resolved to strike at the root of the mischief by limiting the power of the religious orders, and with this view a drastic Association bill was introduced into the chambers. This anti-clerical move provoked the wildest passions of the reactionaries, but it found an overwhelming support in the elections of 1902 and the bill became law. The war thus definitely reopened soon led to a revival of the Dreyfus controversy. The nationalists flooded the country with incendiary defamations of "the government of national treason," and Dreyfus on his part loudly demanded a fresh trial. It was clear that conciliation and compromise were useless. Early in 1905 M. Jaurès urged upon the chamber that the demand of the Jewish officer should be granted if only to tranquillize the country. The necessary *faits nouveaux* were speedily found by the minister of war, General André, and having been examined by a special commission of revision were ordered to be transmitted to the court of cassation for final adjudication. On the 12th of July 1906, the court, all chambers united, gave its judgment. After a lengthy review of the case it declared unanimously that the whole accusation against Dreyfus had been disproved, and it quashed the judgment of the Rennes court-martial *sans renvoi*. The explanation of the whole case is that Esterhazy and Henry were the real culprits; that they had made a trade of supplying the German government with military documents; and that once the *Bordereau* was discovered they availed themselves of the anti-Jewish agitation to throw suspicion on Dreyfus.

Thus ended this famous case, to the relief of the whole country and with the approval of the great majority of French citizens. Except a knot of anti-Semitic monomaniacs all parties bowed loyally to the judgment of the court of cassation. The government gave the fullest effect to the judgment. Dreyfus and Picquart were restored to the active list of the army with the ranks respectively of major and general of brigade. Dreyfus was also created a knight of the Legion of Honour, and received the decoration in public in the artillery pavilion of the military school. Zola, to whose efforts the triumph of truth was chiefly due, had not been spared to witness the final scene, but the chambers decided to give his remains a last resting-place in the Pantheon. When three months later M. Clémenceau formed his first cabinet he appointed General Picquart minister of war. Nothing indeed was left undone to repair the terrible series of wrongs which had grown out of the Dreyfus case. Nevertheless its destructive work could not be wholly healed. For over ten years it had been a nightmare to France, and it now modified the whole course of French history. In the ruin of the French Church, which owed its disestablishment very largely to the Dreyfus conspiracy, may be read the most eloquent warning against the demoralizing madness of anti-Semitism.

In sympathy with the agitation in France there has been a similar movement in Algeria, where the European population have long resented the admission of the native Jews to the rights of French citizenship. The agitation has been marked by much violence, and most of the anti-Semitic deputies in the French parliament, including M. Drumont, have found constituencies in Algeria. As the local anti-Semites are largely Spaniards and Levantine riff-raff, the agitation has not the peculiar nationalist bias which characterizes continental anti-Semitism. Before the energy of the authorities it has lately shown signs of subsiding.

Great Britain, &c.

While the main activity of anti-Semitism has manifested itself in Germany, Russia, Rumania, Austria-Hungary and France, its vibratory influences have been felt in other countries when conditions favourable to its extension have presented themselves. In England more than one attempt to acclimatize the doctrines of Marr and Treitschke has been made. The circumstance that at the time of the rise of German anti-Semitism a premier of Hebrew race, Lord Beaconsfield, was in power first suggested the Jewish bogey to English political extremists. The Eastern crisis of 1876–1878, which was regarded by the Liberal party as primarily a struggle between Christianity, as represented by Russia, and a degrading Semitism, as represented by Turkey, accentuated the anti-Jewish feeling, owing to the anti-Russian attitude adopted by the government. Violent expression to the ancient prejudices against the Jews was given by Sir J. G. Tollemache Sinclair (*A Defence of Russia*, 1877). Mr T. P. O'Connor, in a life of Lord Beaconsfield (1878), pictured him as the instrument of the Jewish people, "moulding the whole policy of Christendom to Jewish aims." Professor Goldwin Smith, in several articles in the *Nineteenth Century* (1878, 1881 and 1882), sought to synthetize the growing anti-Jewish feeling by adopting the nationalist theories of the German anti-Semites. This movement did not fail to find an equivocal response in the speeches of some of the leading Liberal statesmen; but on the country generally it produced no effect. It was revived when the persecutions in Russia threatened England with a great influx of Polish Jews, whose mode of life was calculated to lower the standard of living in the industries in which they were employed, and it has left its trace in the anti-alien legislation of 1905. In 1883 Stöcker visited London, but received a very unflattering reception. Abortive attempts to acclimatize anti-Semitism have also been made in Switzerland, Belgium, Greece and the United States.

Anti-Semitism made a great deal of history during the thirty years up to 1908, but has left no permanent mark of a constructive kind on the social and political evolution of Europe. It is the fruit of a great ethnographic and political error, and it has spent itself in political intrigues of transparent dishonesty. Its racial doctrine is at best a crude hypothesis: its nationalist theory has only served to throw into striking relief the essentially economic bases of modern society, while its political activity has revealed the vulgarity and ignorance which constitute its main sources of strength. So far from injuring the Jews, it has really given Jewish racial separatism a new lease of life. Its extravagant accusations, as in the Tisza Eszlar and Dreyfus cases, have resulted in the vindication of the Jewish character. Its agitation generally, coinciding with the revival of interest in Jewish history, has helped to transfer Jewish solidarity from a religious to a racial basis. The bond of a common race, vitalized by a new pride in Hebrew history and spurred on to resistance by the insults of the anti-Semites, has given a new spirit and a new source of strength to Judaism at a moment when the approximation of ethical systems and the revolt against dogma were sapping its essentially religious foundations. In the whole history of Judaism, perhaps, there have been no more numerous or remarkable instances of reversions to the faith than in the period in question. The reply of the Jews to anti-Semitism has taken two interesting practical forms. In the first place there is the so-called Zionist movement, which is a kind of Jewish nationalism and is vitiated by the same errors that distinguish its anti-Semitic analogue (see Zionism). In the second place, there is a movement represented by the Maccabaeans' Society in London, which seeks to unite the Jewish people in an effort to raise the Jewish character and to promote a higher consciousness of the dignity of the race. It lays no stress on orthodoxy, but welcomes all who strive to render Jewish conduct an adequate reply to the theories of the anti-Semites. Both these movements are elements of fresh vitality to Judaism, and they are probably destined to produce important fruit in future years. A splendid spirit of generosity has also been displayed by the Jewish community in assisting and relieving the victims of the Jew-haters. Besides countless funds raised by public subscription, Baron de Hirsch founded a colossal scheme for transplanting persecuted Jews to new countries under new conditions of life, and endowed it with no less a sum than £9,000,000 (see Hirsch, Maurice de).

Though anti-Semitism has been unmasked and discredited, it is to be feared that its history is not yet at an end. While there remain in Russia and Rumania over six millions of Jews who are being systematically degraded, and who periodically overflow the western frontier, there must continue to be a Jewish question in Europe; and while there are weak governments, and ignorant and superstitious elements in the enfranchized classes of the countries affected, that question will seek to play a part in politics.

Literature.—No impartial history of modern anti-Semitism has yet been written. The most comprehensive works on the subject, *Israel among the Nations*, by A. Leroy-Beaulieu (1895), and *L'Antisémitisme, son histoire et ses causes*, by Bernard Lazare (1894), are collections of studies rather than histories. M. Lazare's work will be found most useful by the student on account of its detached standpoint and its valuable bibliographical notes. A good list of works relating to Jewish ethnography will be found at the end of M. Isidor Loeb's valuable article, "Juifs," in the *Dictionnaire universel de géographie* (1884). To these should be added, Adolf Jellinek, *Der Jüdische Stamm* (1869); Chwolson, *Die semitischen Völker* (1872); Nossig, *Materialien zur Statistik* (1887); Jacobs, *Jewish Statistics* (1891); and Andree, *Zur Volkskunde der Juden* (1881). A bibliography of the Jewish question from 1875 to 1884 has been published by Mr Joseph Jacobs (1885). Useful additions and rectifications will be found in the *Jewish World*, 11th September 1885. During the period since 1885 the anti-Semitic movement has produced an immense pamphlet literature. Some of these productions have already been referred to; others will be found in current bibliographies under the names of the personages mentioned, such as Stöcker, Ahlwardt, &c. On the Russian persecutions, besides the works quoted by Jacobs, see the pamphlet issued by the Russo-Jewish Committee in 1890, and the annual reports of the Russo-Jewish Mansion House Fund; *Les Juifs de Russie* (Paris, 1891); *Report of the Commissioners of Immigration upon the Causes which incite Immigration to the United States* (Washington, 1892); *The New Exodus*, by Harold Frederic (1892); *Les Juifs russes*, by Leo Errera (Brussels, 1893). The most valuable collection of facts relating to the persecutions of 1881–1882 are to be found in the *Feuilles Jaunes* (52 nos.), compiled and circulated for the information of the European press by the Alliance Israélite of Paris. Complete collections are very scarce. For the struggle during the past decade the *Russische Correspondenz* of Berlin should be consulted, together with its French and English editions. See also the publications of the *Bund* (Geneva; Imprimerie Israélite); Séménoff, *The Russian Government and the Massacres*, and *Quarterly Review*, October 1906. On the Rumanian question, see Bluntschli, *Roumania and the Legal Status of the Jews* (London, 1879); *Wir Juden* (Zürich, 1883); Schloss, *The Persecution of the Jews in Roumania* (London, 1885); Schloss, *Notes of Information* (1886); Sincerus, *Juifs en Roumanie* (London, 1901); Plotke, *Die rumänischen Juden unter dem Fürsten u. König Karl* (1901); Dehn, *Diplomatie u. Hochfinanz in der rumänischen Judenfrage* (1901); Conybeare, "Roumania as a Persecuting Power," *Nat. Rev.*, February 1901. On Hungary and the Tisza Eszlar Case, see (besides the references in Jacobs) Nathan, *Der Prozess von Tisza Eszlar* (Berlin, 1892). On this case and the Blood Accusation generally, see Wright, "The Jews and the Malicious Charge of Human Sacrifice," *Nineteenth Century*, 1883. The origins of the Austrian agitation are dealt with by Nitti, *Catholic Socialism* (1895). This work, though inclining to anti-Semitism, should be consulted for the Christian Socialist elements in the whole continental agitation. The most valuable source of information on the Austrian movement is the *Österreichische Wochenschrift*, edited by Dr Bloch. See also pamphlets and speeches by the anti-Semitic leaders, Liechtenstein, Lueger, Schoenerer, &c. The case of the French anti-Semites is stated by E. Drumont in his *France juive.*

and other works; the other side by Isidor Loeb, Bernard Lazare, Leonce Reynaud, &c. Of the Dreyfus Case there is an enormous literature: see especially the reports of the Zola and Picquart trials, the revision case before the Court of Cassation, the proceedings of the Rennes court-martial, and the final judgment of the Court of Cassation printed in full in the *Figaro*, July 15, 1906; also Reinach, *Histoire de l'affaire Dreyfus* (Paris, 1908, 6 vols.), and the valuable series of volumes by Captain Paul Marin, MM. Clémenceau, Lazare, Yves Guyot, Paschal Grousset, Urbain Gohier, de Haime, de Pressensé, and the remarkable letters of Dreyfus (*Lettres d'un innocent*). An English history of the case was published by F. C. Conybeare (1898), whose articles and those of Sir Godfrey Lushington and L. J. Maxse in the *National Review*, 1897–1900, will be found invaluable by the student. On the Algerian question, see M. Wahl in the *Revue des études juives*; L. Forest, *Naturalisation des Israélites algériens*; and E. Audinet in the *Revue générale de droit international publique*, 1897, No. 4. On the history of the anti-Semitic movement generally, see the annual reports of the Alliance Israélite of Paris and the Anglo-Jewish Association of London, also the annual summaries published at the end of the Jewish year by the *Jewish Chronicle* of London. The connexion of the movement with general party politics must be followed in the newspapers. The present writer has worked with a collection of newspaper cuttings numbering several thousands and ranging over thirty years. (L. W.)

ANTISEPTICS (Gr. ἀντὶ, against, and σηπτικὸς, putrefactive), the name given to substances which are used for the prevention of bacterial development in animal or vegetable matter. Some are true germicides, capable of destroying the bacteria, whilst others merely prevent or inhibit their growth. The antiseptic method of treating wounds (see SURGERY) was introduced by Lord Lister, and was an outcome of Pasteur's germ theory of putrefaction. For the growth of bacteria there must be a certain food supply, moisture, in most cases oxygen, and a certain minimum temperature (see BACTERIOLOGY). These conditions have been specially studied and applied in connexion with the preserving of food (see FOOD PRESERVATION) and in the ancient practice of embalming the dead, which is the earliest illustration of the systematic use of antiseptics (see EMBALMING). In early inquiries a great point was made of the prevention of putrefaction, and work was done in the way of finding how much of an agent must be added to a given solution, in order that the bacteria accidentally present might not develop. But for various reasons this was an inexact method, and to-day an antiseptic is judged by its effects on pure cultures of definite pathogenic microbes, and on their vegetative and spore forms. Their standardization has been effected in many instances, and a water solution of carbolic acid of a certain fixed strength is now taken as the standard with which other antiseptics are compared. The more important of those in use to-day are carbolic acid, the perchloride and biniodide of mercury, iodoform, formalin, salicylic acid, &c. Carbolic acid is germicidal in strong solution, inhibitory in weaker ones. The so-called "pure" acid is applied to infected living tissues, especially to tuberculous sinuses or wounds, after scraping them, in order to destroy any part of the tuberculous material still remaining. A solution of 1 in 20 is used to sterilize instruments before an operation, and towels or lint to be used for the patient. Care must always be taken to avoid absorption (see CARBOLIC ACID). The perchloride of mercury is another very powerful antiseptic used in solutions of strength 1 in 2000, 1 in 1000 and 1 in 500. This or the biniodide of mercury is the last antiseptic applied to the surgeon's and assistants' hands before an operation begins. They are not, however, to be used in the disinfection of instruments, nor where any large abraded surface would favour absorption. Boracic acid receives no mention here; though it is popularly known as an antiseptic, it is in reality only a soothing fluid, and bacteria will flourish comfortably in contact with it. Of the dry antiseptics iodoform is constantly used in septic or tuberculous wounds, and it appears to have an inhibitory action on *Bacillus tuberculosis*. Its power depends on the fact that it is slowly decomposed by the tissues, and free iodine given off. Among the more recently introduced antiseptics, chinosol, a yellow substance freely soluble in water, and lysol, another coal-tar derivative, are much used. But every antiseptic, however good, is more or less toxic and irritating to a wounded surface. Hence it is that the "antiseptic" method has been replaced in the surgery of to-day by the "aseptic" method (see SURGERY), which relies on keeping free from the invasion of bacteria rather than destroying them when present.

ANTISTHENES (*c.* 444–365 B.C.), the founder of the Cynic school of philosophy, was born at Athens of a Thracian mother, a fact which may account for the extreme boldness of his attack on conventional thought. In his youth he studied rhetoric under Gorgias, perhaps also under Hippias and Prodicus. Gomperz suggests that he was originally in good circumstances, but was reduced to poverty. However this may be, he came under the influence of Socrates, and became a devoted pupil. So eager was he to hear the words of Socrates that he used to walk daily from Peiraeus to Athens, and persuaded his friends to accompany him. Filled with enthusiasm for the Socratic idea of virtue, he founded a school of his own in the Cynosarges, the hall of the bastards (νόθοι). Thither he attracted the poorer classes by the simplicity of his life and teaching. He wore a cloak and carried a staff and a wallet, and this costume became the uniform of his followers. Diogenes Laertius says that his works filled ten volumes, but of these fragments only remain. His favourite style seems to have been the dialogue, wherein we see the effect of his early rhetorical training. Aristotle speaks of him as uneducated and simple-minded, and Plato describes him as struggling in vain with the difficulties of dialectic. His work represents one great aspect of Socratic philosophy, and should be compared with the Cyrenaic and Megarian doctrines.

BIBLIOGRAPHY.—Charles Chappuis, *Antisthène* (Paris, 1854); A. Müller, *De Antisthenis cynici vita et scriptis* (Dresden, 1860); T. Gomperz, *Greek Thinkers* (Eng. trans., 1905), vol. ii. pp. 142 ff., 150 ff. For his philosophy see CYNICS, and for his pupils, Diogenes and Crates, see articles under these headings.

ANTISTROPHE, the portion of an ode which is sung by the chorus in its returning movement from west to east, in response to the strophe, which was sung from east to west. It is of the nature of a reply, and balances the effect of the strophe. Thus, in Gray's ode called "The Progress of Poesy," the strophe, which dwelt in triumphant accents on the beauty, power and ecstasy of verse, is answered by the antistrophe, in a depressed and melancholy key—

> "Man's feeble race what ills await,
> Labour, and Penury, the racks of Pain,
> Disease and Sorrow's weeping Train,
> And Death, sad refuge from the storms of Fate," &c.

When the sections of the chorus have ended their responses, they unite and close in the epode, thus exemplifying the triple form in which the ancient sacred hymns of Greece were composed, from the days of Stesichorus onwards. As Milton says, "strophe, antistrophe and epode were a kind of stanza framed only for the music then used with the chorus that sang."

ANTITHESIS (the Greek for "setting opposite"), in rhetoric, the bringing out of a contrast in the meaning by an obvious contrast in the expression, as in the following:—"When there is need of silence, you speak, and when there is need of speech, you are dumb; when present, you wish to be absent, and when absent, you desire to be present; in peace you are for war, and in war you long for peace; in council you descant on bravery, and in the battle you tremble." Antithesis is sometimes double or alternate, as in the appeal of Augustus:—"Listen, young men, to an old man to whom old men were glad to listen when he was young." The force of the antithesis is increased if the words on which the beat of the contrast falls are alliterative, or otherwise similar in sound, as—"The fairest but the falsest of her sex." There is nothing that gives to expression greater point and vivacity than a judicious employment of this figure; but, on the other hand, there is nothing more tedious and trivial than a pseudo-antithetical style. Among English writers who have made the most abundant use of antithesis are Pope, Young, Johnson, and Gibbon; and especially Lyly in his *Euphues*. It is, however, a much more common feature in French than in

English; while in German, with some striking exceptions, it is conspicuous by its absence.

ANTITYPE (Gr. ἀντίτυπος), the correlative of "type," to which it corresponds as the stamp to the die, or vice versa. In the sense of copy or likeness the word occurs in the Greek New Testament (Heb. ix. 24; 1 Peter iii. 21), English "figure." By theological writers antitype is employed to denote the reality of which a type is the prophetic symbol. Thus, Christ is the antitype of many of the types of the Jewish ritual. By the fathers of the Greek church (*e.g.* Gregory Nazianzen) antitype is employed as a designation of the bread and wine in the sacrament of the Lord's Supper.

ANTIUM (mod. *Anzio*), an ancient Volscian city on the coast of Latium, about 33 m. S. of Rome. The legends as to its foundation, and the accounts of its early relations with Rome, are untrustworthy; but Livy's account of wars between Antium and Rome, early in the 4th century B.C., may perhaps be accepted. Antium is named with Ardea, Laurentum and Circeii, as under Roman protection, in the treaty with Carthage in 348 B.C. In 341 it lost its independence after a rising with the rest of Latium against Rome, and the beaks (*rostra*) of the six captured Antiatine ships decorated and gave their name to the orators' tribunal in the Roman Forum. At the end of the Republican period it became a resort of wealthy Romans, and the Julian and Claudian emperors frequently visited it; both Caligula and Nero were born there. The latter founded a colony of veterans and built a new harbour, the projecting moles of which are still extant. In the middle ages it was deserted in favour of Nettuno: at the end of the 17th century Innocent XII. and Clement XI. restored the harbour, not on the old site but to the east of it, with the opening to the east, a mistake which leads to its being frequently silted up; it has a depth of about 15 ft. Remains of Roman villas are conspicuous all along the shore, both to the east and to the north-west of the town. That of Nero cannot be certainly identified, but is generally placed at the so-called Arco Muto, where remains of a theatre (discovered in 1712 and covered up again) also exist. Many works of art have been found. Of the famous temple of Fortune (Horace, *Od.* i. 35) no remains are known. The sea is encroaching slightly at Anzio, but some miles farther north-west the old Roman coast-line now lies slightly inland (see TIBER). The Volscian city stood on higher ground and somewhat away from the shore, though it extended down to it. It was defended by a deep ditch, which can still be traced, and by walls, a portion of which, on the eastern side, constructed of rectangular blocks of tufa, was brought to light in 1897. The modern place is a summer resort and has several villas, among them the Villa Borghese.

See A. Nibby, *Dintorni di Roma*, i. 181; *Notizie degli scavi, passim.* (T. As.)

ANTIVARI (Montenegrin *Bar*, so called by the Venetians from its position opposite Bari in Italy), a seaport of Montenegro which until 1878 belonged to Turkey. Pop. (1900) about 2500. The old town is built inland, on a strip of country running between the Adriatic Sea and the Sutorman range of mountains, overshadowed by the peak of Rumiya (5148 ft.). At a few hundred yards' distance it is invisible, hidden among dense olive groves. Within, there is a ruinous walled village, and the shell of an old Venetian fortress, surrounded by mosques and bazaars; for Antivari is rather Turkish than Montenegrin. The fine bay of Antivari, with Prstan, its port, is distant about one hour's drive through barren and forbidding country, shut in by mountains. At the northern horn of the bay stands Spizza, an Austrian military station. Antivari contains the residence of its Roman Catholic archbishop, and, in the centre of the shore, Topolitsa, the square undecorated palace of the crown prince. Antivari is the name applied both to Prstan and the old town. The Austrian Lloyd steamers call at times, and the "Puglia" S.S. Company runs a regular service of steamers to and from Bari. As an outlet for Montenegrin commerce, however, Antivari cannot compete with the Austrian Cattaro, the harbour being somewhat difficult of access in stormy weather. Fishing and olive-oil refining are the main industries.

ANT-LION, the name given to neuropterous insects of the family *Myrmeleonidae*, with relatively short and apically clubbed antennae and four large densely reticulated wings in which the apical veins enclose regular oblong spaces. The perfect insects are for the most part nocturnal and are believed to be carnivorous. The best-known species, *Myrmeleon formicarius*, which may be found adult in the late summer, occurs in many countries on the European continent, though like the rest of this group it is not indigenous in England. Strictly speaking, however, the term ant-lion applies to the larval form, which has been known scientifically for over two hundred years, on account of its peculiar and forbidding appearance and its skilful and unique manner of entrapping prey by means of a pitfall. The abdomen is oval, sandy-grey in hue and beset with warts and bristles; the prothorax forms a mobile neck for the large square head, which carries a pair of long and powerful toothed mandibles. It is in dry and sandy soil that the ant-lion lays its trap. Having marked out the chosen site by a circular groove, it starts to crawl backwards, using its abdomen as a plough to shovel up the soil. By the aid of one front leg it places consecutive heaps of loosened particles upon its head, then with a smart jerk throws each little pile clear of the scene of operations. Proceeding thus it gradually works its way from the circumference towards the centre. When the latter is reached and the pit completed, the larva settles down at the bottom, buried in the soil with only the jaws projecting above the surface. Since the sides of the pit consist of loose sand they afford an insecure foothold to any small insect that inadvertently ventures over the edge. Slipping to the bottom the prey is immediately seized by the lurking ant-lion; or if it attempt to scramble again up the treacherous walls of the pit, is speedily checked in its efforts and brought down by showers of loose sand which are jerked at it from below by the larva. By means of similar head-jerks the skins of insects sucked dry of their contents are thrown out of the pit, which is then kept clear of refuse. A full-grown larva digs a pit about 2 in. deep and 3 in. wide at the edge. The pupa stage of the ant-lion is quiescent. The larva makes a globular case of sand stuck together with fine silk spun, it is said, from a slender spinneret at the posterior end of the body. In this it remains until the completion of the transformation into the sexually mature insect, which then emerges from the case, leaving the pupal integument behind. In certain species of *Myrmeleonidae*, such as *Dendroleon pantheormis*, the larva, although resembling that of *Myrmeleon* structurally, makes no pitfall, but seizes passing prey from any nook or crevice in which it shelters.

The exact meaning of the name ant-lion (Fr. *fourmilion*) is uncertain. It has been thought that it refers to the fact that ants form a large percentage of the prey of the insect, the suffix "lion" merely suggesting destroyer or eater. Perhaps, however, the name may only signify a large terrestrial biting apterous insect, surpassing the ant in size and predatory habits. (R. I. P.)

ANTOFAGASTA, a town and port of northern Chile and capital of the Chilean province of the same name, situated about 768 m. N. of Valparaiso in 23° 38′ 39″ S. lat. and 70° 24′ 39″ W. long. Pop. (est. 1902) 16,084. Antofagasta is the seaport for a railway running to Oruro, Bolivia, and is the only available outlet for the trade of the south-western departments of that republic. The smelting works for the neighbouring silver mines are located here, and a thriving trade with the inland mining towns is carried on. The town was founded in 1870 as a shipping port for the recently discovered silver mines of that vicinity, and belonged to Bolivia until 1879, when it was occupied by a Chilean military force.

The province of ANTOFAGASTA has an area of 46,611 sq. m. lying within the desert of Atacama and between the provinces of Tarapacá and Atacama. It is rich in saline and other mineral deposits, the important Caracoles silver mines being about 90 m. north-east of the port of Antofagasta. Like the other provinces of this region, Antofagasta produces for export copper, silver,

silver ores, lead, nitrate of soda, borax and salt. Iron and manganese ores are also found. Besides Antofagasta the principal towns are Taltal, Mejillones, Cobija (the old capital) and Tocopilla. Up to 1879 the province belonged to Bolivia, and was known as the department of Atacama, or the Litoral. It fell into the possession of Chile in the war of 1879–82, and was definitely ceded to that republic in 1885.

ANTOINE, ANDRÉ (1858–), French actor-manager, was born at Limoges, and in his early years was in business. But he was an enthusiastic amateur actor, and in 1887 he founded in Paris the Théâtre Libre, in order to realize his ideas as to the proper development of dramatic art. For an account of his work, which had enormous influence on the French stage, see Drama: *France*. In 1894 he gave up the direction of this theatre, and became connected with the Gymnase, and later (1896) with the Odéon.

ANTONELLI, GIACOMO (1806–1876), Italian cardinal, was born at Sonnino on the 2nd of April 1806. He was educated for the priesthood, but, after taking minor orders, gave up the idea of becoming a priest, and chose an administrative career. Created secular prelate, he was sent as apostolic delegate to Viterbo, where he early manifested his reactionary tendencies in an attempt to stamp out Liberalism. Recalled to Rome in 1841, he entered the office of the papal secretary of state, but four years later was appointed pontifical treasurer-general. Created cardinal (11th June 1847), he was chosen by Pius IX. to preside over the council of state entrusted with the drafting of the constitution. On the 10th of March 1848 Antonelli became premier of the first constitutional ministry of Pius IX., a capacity in which he displayed consummate duplicity. Upon the fall of his cabinet Antonelli created for himself the governorship of the sacred palaces in order to retain constant access to and influence over the pope. After the assassination of Pellegrino Rossi (15th November 1848) he arranged the flight of Pius IX. to Gaeta, where he was appointed secretary of state. Notwithstanding promises to the powers, he restored absolute government upon returning to Rome (12th April 1850) and violated the conditions of the surrender by wholesale imprisonment of Liberals. In 1855 he narrowly escaped assassination. As ally of the Bourbons of Naples, from whom he had received an annual subsidy, he attempted, after 1860, to facilitate their restoration by fomenting brigandage on the Neapolitan frontier. To the overtures of Ricasoli in 1861, Pius IX., at Antonelli's suggestion, replied with the famous "*Non possumus*," but subsequently (1867) accepted, too late, Ricasoli's proposal concerning ecclesiastical property. After the September Convention (1864) Antonelli organized the Legion of Antibes to replace French troops in Rome, and in 1867 secured French aid against Garibaldi's invasion of papal territory. Upon the reoccupation of Rome by the French after Mentana, Antonelli again ruled supreme, but upon the entry of the Italians in 1870 was obliged to restrict his activity to the management of foreign relations. He wrote, with papal approval, the letter requesting the Italians to occupy the Leonine city, and obtained from the Italians payment of the Peter's pence (5,000,000 lire) remaining in the papal exchequer, as well as 50,000 scudi—the first and only instalment of the Italian allowance (subsequently fixed by the Law of Guarantees, March 21, 1871) ever accepted by the Holy See. At Antonelli's death the Vatican finances were found to be in disorder, with a deficit of 45,000,000 lire. His personal fortune, accumulated during office, was considerable, and was bequeathed almost entirely to members of his family. To the Church he left little and to the pope only a trifling souvenir. From 1850 until his death he interfered little in affairs of dogma and church discipline, although he addressed to the powers circulars enclosing the Syllabus (1864) and the acts of the Vatican Council (1870). His activity was devoted almost exclusively to the struggle between the papacy and the Italian *Risorgimento*, the history of which is comprehensible only when the influence exercised by his unscrupulous, grasping and sinister personality is fully taken into account. He died on the 6th of November 1876.

ANTONELLO DA MESSINA (*c.* 1430–1479), Italian painter, was probably born at Messina about the beginning of the 15th century, and laboured at his art for some time in his native country. Happening to see at Naples a painting in oil by Jan Van Eyck, belonging to Alphonso of Aragon, he was struck by the peculiarity and value of the new method, and set out for the Netherlands to acquire a knowledge of the process from Van Eyck's disciples. He spent some time there in the prosecution of his art; returned with his secret to Messina about 1465; probably visited Milan; removed to Venice in 1472, where he painted for the Council of Ten; and died there in the middle of February 1479 (see Venturi's article in Thieme-Becker, *Künstlerlexikon*, 1907). His style is remarkable for its union—not always successful—of Italian simplicity with Flemish love of detail. His subjects are frequently single figures, upon the complete representation of which he bestows his utmost skill. There are extant—besides a number more or less dubious—twenty authentic productions, consisting of renderings of "Ecce Homo," Madonnas, saints, and half-length portraits, many of them painted on wood. The finest of all is said to be the nameless picture of a man in the Berlin museum. The National Gallery, London, has three works by him, including the "St Jerome in his Study." Antonello exercised an important influence on Italian painting, not only by the introduction of the Flemish invention, but also by the transmission of Flemish tendencies.

ANTONINI ITINERARIUM, a valuable register, still extant, of the stations and distances along the various roads of the Roman empire, seemingly based on official documents, which were probably those of the survey organized by Julius Caesar, and carried out under Augustus. Nothing is known with certainty as to the date or author. It is considered probable that the date of the original edition was the beginning of the 3rd century, while that which we possess is to be assigned to the time of Diocletian. If the author or promoter of the work is one of the emperors, it is most likely to be Antoninus Caracalla.

Editions by Wesseling, 1735, Parthey and Pindar, 1848. The portion relating to Britain was published under the title *Iter Britanniarum*, with commentary by T. Reynolds, 1799.

ANTONINUS, SAINT [Antonio Pierozzi, also called de Forciglioni] (1389–1459), archbishop of Florence, was born at that city on the 1st of March 1389. He entered the Dominican order in his 16th year, and was soon entrusted, in spite of his youth, with the government of various houses of his order at Cortona, Rome, Naples and Florence, which he laboured zealously to reform. He was consecrated archbishop of Florence in 1446, and won the esteem and love of his people, especially by his energy and resource in combating the effects of the plague and earthquake in 1448 and 1453. He died on the 2nd of May 1459, and was canonized by Pope Adrian VI. in 1523. His feast is annually celebrated on the 13th of May. Antoninus had a great reputation for theological learning, and sat as papal theologian at the council of Florence (1439). Of his various works, the list of which is given in Quétif-Echard, *De Scriptoribus Ord. Praedicat.*, i. 818, the best-known are his *Summa theologica* (Venice, 1477; Verona, 1740) and the *Summa confessionalis* (Mondovi, 1472), invaluable to confessors.

See Bolland, *Acta Sanctorum*, i., and U. Chevalier, *Rep. des. s. hist.* (1905), pp. 285-286.

ANTONINUS LIBERALIS, Greek grammarian, probably flourished about A.D. 150. He wrote a collection of forty-one tales of mythical metamorphoses (Μεταμορφώσεων Συναγωγή), chiefly valuable as a source of mythological knowledge.

Westermann, *Mythographi Graeci* (1843); Oder, *De Antonino Liberali* (1886).

ANTONINUS PIUS [Titus Aurelius Fulvus Boionius Arrius Antoninus], (A.D. 86–161), Roman emperor A.D. 138–161, the son of Aurelius Fulvus, a Roman consul whose family had originally belonged to Nemausus (Nîmes), was born near Lanuvium on the 19th of September 86. After the death of his father, he was brought up under the care of Arrius Antoninus, his maternal grandfather, a man of integrity and culture, and on terms of friendship with the younger Pliny. Having filled with more than usual success the offices of quaestor and praetor, he obtained the consulship in 120; he was next chosen one of the four consulars for Italy, and greatly increased his reputation by his conduct as proconsul of Asia. He acquired much influence with the emperor Hadrian, who adopted him as his son and successor on the 25th of February 138, after the death of his first adopted son Aelius Verus, on condition that he himself adopted Marcus Annius Verus, his wife's brother's son, and Lucius, son of Aelius Verus, afterwards the emperors Marcus Aurelius and Lucius Aelius Verus (colleague of Marcus Aurelius). A few months afterwards, on Hadrian's death, he was enthusiastically welcomed to the throne by the Roman people, who, for once, were not disappointed in their anticipation of a happy reign. For Antoninus came to his new office with simple tastes, kindly disposition, extensive experience, a well-trained intelligence and the sincerest desire for the welfare of his subjects. Instead of plundering to support his prodigality, he emptied his private treasury to assist distressed provinces and cities, and everywhere exercised rigid economy (hence the nickname *κυμινοπρίστης*, "cummin-splitter"). Instead of exaggerating into treason whatever was susceptible of unfavourable interpretation, he turned the very conspiracies that were formed against him into opportunities of signalizing his clemency. Instead of stirring up persecution against the Christians, he extended to them the strong hand of his protection throughout the empire. Rather than give occasion to that oppression which he regarded as inseparable from an emperor's progress through his dominions, he was content to spend all the years of his reign in Rome, or its neighbourhood. Under his patronage the science of jurisprudence was cultivated by men of high ability, and a number of humane and equitable enactments were passed in his name. Of the public transactions of this period we have but scant information, but, to judge by what we possess, those twenty-two years were not remarkably eventful. One of his first acts was to persuade the senate to grant divine honours to Hadrian, which they had at first refused; this gained him the title of Pius (dutiful in affection). He built temples, theatres, and mausoleums, promoted the arts and sciences, and bestowed honours and salaries upon the teachers of rhetoric and philosophy. His reign was comparatively peaceful. Insurrections amongst the Moors, Jews, and Brigantes in Britain were easily put down. The one military result which is of interest to us now is the building in Britain of the wall of Antoninus from the Forth to the Clyde. In his domestic relations Antoninus was not so fortunate. His wife, Faustina, has almost become a byword for her lack of womanly virtue; but she seems to have kept her hold on his affections to the last. On her death he honoured her memory by the foundation of a charity for orphan girls, who bore the name of *Alimentariae Faustinianae*. He had by her two sons and two daughters; but they all died before his elevation to the throne, except Annia Faustina, who became the wife of Marcus Aurelius. Antoninus died of fever at Lorium in Etruria, about 12 m. from Rome, on the 7th of March 161, giving the keynote to his life in the last word that he uttered when the tribune of the night-watch came to ask the password—*aequanimitas*.

The only account of his life handed down to us is that of Julius Capitolinus, one of the *Scriptores Historiae Augustae*. See Bossart-Müller, *Zur Geschichte des Kaisers A.* (1868); Lacour-Gayet, *A. le Pieux et son Temps* (1888); Bryant, *The Reign of Antonine* (Cambridge Historical Essays, 1895); P. B. Watson, *Marcus Aurelius Antoninus* (London, 1884), chap. ii.

ANTONIO, known as "THE PRIOR OF CRATO" (1531–1595), claimant of the throne of Portugal, was the natural son of Louis (Luis), duke of Beja, by Yolande (Violante) Gomez, a Jewess, who is said to have died a nun. His father was a younger son of Emanuel, king of Portugal (1495–1521). Antonio was educated at Coimbra, and was placed in the order of St John. He was endowed with the wealthy priory of Crato. Little is known of his life till 1578. In that year he accompanied King Sebastian (1557–1578) in his invasion of Morocco, and was taken prisoner by the Moors at the battle of Alcazar-Kebir, in which the king was slain. Antonio is said to have secured his release on easy terms by a fiction. He was asked the meaning of the cross of St John which he wore on his doublet, and replied that it was the sign of a small benefice which he held from the pope, and would lose if he were not back by the 1st of January. His captor, believing him to be a poor man, allowed him to escape for a small ransom. On his return to Portugal he found that his uncle, the cardinal Henry, only surviving son of King John III. (1521–1557), had been recognized as king. The cardinal was old, and was the last legitimate male representative of the royal line (see PORTUGAL: *History*). The succession was claimed by Philip II. of Spain. Antonio, relying on the popular hostility to a Spanish ruler, presented himself as a candidate. He had endeavoured to prove that his father and mother had been married after his birth. There was, however, no evidence of the marriage. Antonio's claim, which was inferior not only to that of Philip II., but to that of the duchess of Braganza, was not supported by the nobles or gentry. His partisans were drawn exclusively from the inferior clergy, the peasants and workmen. The prior endeavoured to resist the army which Philip II. marched into Portugal to enforce his pretensions, but was easily routed by the duke of Alva, the Spanish commander, at Alcantara, on the 25th of August 1580. At the close of the year, or in the first days of 1581, he fled to France carrying with him the crown jewels, which included many valuable diamonds. He was well received by Catherine de' Medici, who had a claim of her own on the crown of Portugal, and looked upon him as a convenient instrument to be used against Philip II. By promising to cede the Portuguese colony of Brazil to her, and by the sale of part of his jewels, Antonio secured means to fit out a fleet manned by Portuguese exiles and French and English adventurers. As the Spaniards had not yet occupied the Azores he sailed to them, but was utterly defeated at sea by the marquis of Santa Cruz off Saint Michael's on the 27th of July 1582. He now returned to France, and lived for a time at Ruel near Paris. Peril from the assassins employed by Philip II. to remove him drove Antonio from one refuge to another, and he finally came to England. Elizabeth favoured him for much the same reasons as Catherine de' Medici. In 1589, the year after the Armada, he accompanied an English expedition under the command of Drake and Norris to the coast of Spain and Portugal. The force consisted partly of the queen's ships, and in part of privateers who went in search of booty. Antonio, with all the credulity of an exile, believed that his presence would provoke a general rising against Philip II., but none took place, and the expedition was a costly failure. In 1590 the pretender left England and returned to France, where he fell into poverty. His remaining diamonds were disposed of by degrees. The last and finest was acquired by M. de Sancy; from whom it was purchased by Sully and included in the jewels of the crown. During his last days he lived as a private gentleman on a small pension given him by Henry IV., and he died in Paris on the 26th of August 1595. He left two illegitimate sons, and his descendants can be traced till 1687. In addition to papers published to defend his claims Antonio was the author of the *Panegyrus Alphonsi Lusitanorum Regis* (Coimbra, 1550), and of a cento of the Psalms, *Psalmi Confessionales* (Paris 1592), which was translated into English under the title of *The Royal Penitent* by Francis Chamberleyn (London, 1659), and into German as *Heilige Betrachtungen* (Marburg, 1677).

AUTHORITIES.—Antonio is frequently mentioned in the French, English, and Spanish state papers of the time. A life of him, attributed to Gomes Vasconcellos de Figueredo, was published in a French translation by Mme de Sainctonge at Amsterdam (1696). A modern account of him, *Un prétendant portugais au XVI. siècle*, by E. Fournier (Paris, 1852), is based on authentic sources. See also *Dom Antonio Prior de Crato—notas de bibliographia*, by J. de Aranjo (Lisbon, 1897). (D. H.)

ANTONIO, NICOLAS (1617–1684), Spanish bibliographer, was born at Seville on the 31st of July 1617. After taking his degree at Salamanca (1636–1639), he returned to his native city, wrote his treatise *De Exilio* (which was not printed till 1659), and began his monumental register of Spanish writers. The fame of his learning reached Philip IV., who conferred the order of Santiago on him in 1645, and sent him as general agent to Rome in 1654.

Returning to Spain in 1679, Antonio died at Madrid in the spring of 1684. His *Bibliotheca Hispana nova*, dealing with the works of Spanish authors who flourished after 1500, appeared at Rome in 1672; the *Bibliotheca Hispana vetus*, a literary history of Spain from the time of Augustus to the end of the 15th century, was revised by Manuel Martí, and published by Antonio's friend, Cardinal José Saenz de Aguirre at Rome in 1696. A fine edition of both parts, with additional matter found in Antonio's manuscripts, and with supplementary notes by Francisco Perez Bayer, was issued at Madrid in 1787–1788. This great work, incomparably superior to any previous bibliography, is still unsuperseded and indispensable.

Of Antonio's miscellaneous writings the most important is the posthumous *Censura de historias fabulosas* (Valencia, 1742), in which erudition is combined with critical insight. His *Bibliotheca Hispana rabinica* has not been printed; the manuscript is in the national library at Madrid.

ANTONIO DE LEBRIJA [Antonius Nebrissensis], (1444–1522), Spanish scholar, was born at Lebrija in the province of Andalusia. After studying at Salamanca he resided for ten years in Italy, and completed his education at Bologna University. On his return to Spain (1473), he devoted himself to the advancement of classical learning amongst his countrymen. After holding the professorship of poetry and grammar at Salamanca, he was transferred to the university of Alcalá de Henares, where he lectured until his death in 1522, at the age of seventy-eight. His services to the cause of classical literature in Spain have been compared with those rendered by Valla, Erasmus and Budaeus to Italy, Holland and France. He produced a large number of works on a variety of subjects, including a Latin and Spanish dictionary, commentaries on Sedulius and Persius, and a Compendium of Rhetoric, based on Aristotle, Cicero and Quintilian. His most ambitious work was his chronicle entitled *Rerum in Hispania Gestarum Decades* (published in 1545 by his son as an original work by his father), which twenty years later was found to be merely a Latin translation of the Spanish chronicle of Pulgar, which was published at Saragossa in 1567. De Lebrija also took part in the production of the Complutense polyglot Bible published under the patronage of Cardinal Jimenes.

Antonio, *Bibliotheca Hispana Nova*, i. 132 (1888); Prescott, *History of Ferdinand and Isabella*, i. 410 (note); MacCrie, *The Reformation in Spain in the Sixteenth Century* (1829).

ANTONIUS, the name of a large number of prominent citizens of ancient Rome, of the gens Antonia. Antonius the triumvir claimed that his family was descended from Anton, son of Heracles. Of the Antonii the following are important.

1. Marcus Antonius (143–87 B.C.), one of the most distinguished Roman orators of his time, was quaestor in 113, and praetor in 102 with proconsular powers, the province of Cilicia being assigned to him. Here he was so successful against the pirates that a naval triumph was awarded him. He was consul in 99, censor 97, and held a command in the Marsic War in 90. An adherent of Sulla, he was put to death by Marius and Cinna when they obtained possession of Rome (87). Antonius's reputation for eloquence rests on the authority of Cicero, none of his orations being extant. He is one of the chief speakers in Cicero's *De Oratore*.

Velleius Paterculus ii. 22; Appian, *Bell. Civ.* i. 72; Dio Cassius xlv. 47; Plutarch, *Marius*, 44; Cicero, *Orator*, 5, *Brutus*, 37; Quintilian, *Instit.* iii. 1, 19; O. Enderlein, *De M. Antonio oratore* (Leipzig, 1882).

2. Marcus Antonius, nicknamed Creticus in derision, elder son of Marcus Antonius, the "orator," and father of the triumvir. He was praetor in 74 B.C., and received an extraordinary command (similar to that bestowed upon Pompey by the Gabinian law) to clear the sea of pirates, and thereby assist the operations against Mithradates VI. He failed in the task, and made himself unpopular by plundering the provinces (Sallust, *Hist.* iii., fragments ed. B. Maurenbrecher, p. 108; Velleius Paterculus ii. 31; Cicero, *In Verrem*, iii. 91). He attacked the Cretans, who had made an alliance with the pirates, but was totally defeated, most of his ships being sunk. Diodorus Siculus (xl. 1) states that he only saved himself by a disgraceful treaty. He died soon afterwards (72–71) in Crete. All authorities are agreed as to his avarice and incompetence.

3. Gaius Antonius, nicknamed Hybrida from his half-savage disposition (Pliny, *Nat. Hist.* viii. 213), second son of Marcus Antonius, the "orator," and uncle of the triumvir. He was one of Sulla's lieutenants in the Mithradatic War, and, after Sulla's return, remained in Greece to plunder with a force of cavalry. In 76 he was tried for his malpractices, but escaped punishment; six years later he was removed from the senate by the censors, but soon afterwards reinstated. In spite of his bad reputation, he was elected tribune in 71, praetor in 66, and consul with Cicero in 63. He secretly supported Catiline, but Cicero won him over by promising him the rich province of Macedonia. On the outbreak of the Catilinarian conspiracy, Antonius was obliged to lead an army into Etruria, but handed over the command on the day of battle to Marcus Petreius, on the ground of ill-health. He then went to Macedonia, where he made himself so detested by his oppression and extortions that he left the province, and was accused in Rome (59) both of having taken part in the conspiracy and of extortion in his province. It was said that Cicero had agreed with Antonius to share his plunder. Cicero's defence of Antonius two years before in view of a proposal for his recall, and also on the occasion of his trial, increased the suspicion. In spite of Cicero's eloquence, Antonius was condemned, and went into exile at Cephallenia. He seems to have been recalled by Caesar, since he was present at a meeting of the senate in 44, and was censor in 42.

Cicero, *In Cat.* iii. 6, *pro Flacco*, 38; Plutarch, *Cicero*, 12; Dio Cassius xxxvii. 39, 40; xxxviii. 10. On his trial see article in Pauly-Wissowa's *Realencyclopädie*.

4. Marcus Antonius, commonly called Mark Antony, the Triumvir, grandson of Antonius the "orator" and son of Antonius Creticus, related on his mother's side to Julius Caesar, was born about 83 B.C. Under the influence of his stepfather, Cornelius Lentulus Sura, he spent a profligate youth. For a time he co-operated with P. Clodius Pulcher, probably out of hostility to Cicero, who had caused Lentulus Sura to be put to death as a Catilinarian; the connexion was severed by a disagreement arising from his relations with Clodius's wife, Fulvia. In 58 he fled to Greece to escape his creditors. After a short time spent in attendance on the philosophers at Athens, he was summoned by Aulus Gabinius, governor of Syria, to take part in the campaigns against Aristobulus in Palestine, and in support of Ptolemy Auletes in Egypt. In 54 he was with Caesar in Gaul. Raised by Caesar's influence to the offices of quaestor, augur, and tribune of the plebs, he supported the cause of his patron with great energy, and was expelled from the senate-house when the Civil War broke out. Deputy-governor of Italy during Caesar's absence in Spain (49), second in command in the decisive battle of Pharsalus (48), and again deputy-governor of Italy while Caesar was in Africa (47), Antony was second only to the dictator, and seized the opportunity of indulging in the most extravagant excesses, depicted by Cicero in the *Philippics*. In 46 he seems to have taken offence because Caesar insisted on payment for the property of Pompey which Antony professedly had purchased, but had in fact simply appropriated. The estrangement was not of long continuance; for we find Antony meeting the dictator at Narbo the following year, and rejecting the suggestion of Trebonius that he should join in the conspiracy that was already on foot. In 44 he was consul with Caesar, and seconded his ambition by the famous offer of the crown at the festival of Lupercalia (February 15). After the murder of Caesar on the 15th of March, Antony conceived the idea of making himself sole ruler. At first he seemed disposed to treat the conspirators leniently, but at the same time he so roused the people against them by the publication of Caesar's will and by his eloquent funeral oration, that they were obliged to leave the city. He surrounded himself with a bodyguard of Caesar's veterans, and forced the senate to transfer to him the province of Cisalpine Gaul, which was then administered by Decimus Junius Brutus, one of the conspirators. Brutus refused to surrender the province, and Antony set out to attack him in October 44,

But at this time Octavian, whom Caesar had adopted as his son, arrived from Illyria, and claimed the inheritance of his "father." Octavian obtained the support of the senate and of Cicero; and the veteran troops of the dictator flocked to his standard. Antony was denounced as a public enemy, and Octavian was entrusted with the command of the war against him. Antony was defeated at Mutina (43) where he was besieging Brutus. The consuls Aulus Hirtius and C. Vibius Pansa, however, fell in the battle, and the senate became suspicious of Octavian, who, irritated at the refusal of a triumph and the appointment of Brutus to the command over his head, entered Rome at the head of his troops, and forced the senate to bestow the consulship upon him (August 19th). Meanwhile, Antony escaped to Cisalpine Gaul, effected a junction with Lepidus and marched towards Rome with a large force of infantry and cavalry. Octavian betrayed his party, and came to terms with Antony and Lepidus. The three leaders met at Bononia and adopted the title of *Triumviri reipublicae constituendae* as joint rulers. Gaul was to belong to Antony, Spain to Lepidus, and Africa, Sardinia and Sicily to Octavian. The arrangement was to last for five years. A reign of terror followed; proscriptions, confiscations, and executions became general; some of the noblest citizens were put to death, and Cicero fell a victim to Antony's revenge. In the following year (42) Antony and Octavian proceeded against the conspirators Cassius and Brutus, and by the two battles of Philippi annihilated the senatorial and republican parties. Antony proceeded to Greece, and thence to Asia Minor, to procure money for his veterans and complete the subjugation of the eastern provinces. On his passage through Cilicia in 41 he fell a victim to the charms of Cleopatra, in whose company he spent the winter at Alexandria. At length he was aroused by the Parthian invasion of Syria and the report of an outbreak between Fulvia his wife and Lucius his brother on the one hand and Octavian on the other. On arriving in Italy he found that Octavian was already victorious; on the death of Fulvia, a reconciliation was effected between the triumvirs, and cemented by the marriage of Antony with Octavia, the sister of his colleague. A new division of the Roman world was made at Brundusium, Lepidus receiving Africa, Octavian the west, and Antony the east. Returning to his province Antony made several attempts to subdue the Parthians, without any decided success. In 39 he visited Athens, where he behaved in a most extravagant manner, assuming the attributes of the god Dionysus. In 37 he crossed over to Italy, and renewed the triumvirate for five years at a meeting with Octavian. Returning to Syria, he resumed relations with Cleopatra. His treatment of Octavia, her brother's desire to get rid of him, and the manner in which he disposed of kingdoms and provinces in favour of Cleopatra alienated his supporters. In 32 the senate deprived him of his powers and declared war against Cleopatra. After two years spent in preparations, Antony was defeated at the battle of Actium (2nd September 31). Once more he sought refuge in the society of Cleopatra, who had escaped with sixty ships to Egypt. He was pursued by his enemies and his troops abandoned him. Thereupon he committed suicide in the mistaken belief that Cleopatra had already done so (30 B.C.). Antony had been married in succession to Fadia, Antonia, Fulvia and Octavia, and left behind him a number of children.

See ROME, *History*, II. "The Republic" (*ad fin.*); Caesar, *De Bello Gallico*, *De Bello Civili*; Plutarch, Lives of *Antony*, *Brutus*, *Cicero*, *Caesar*; Cicero, *Letters* (ed. Tyrrell and Purser) and *Philippics*; Appian, *Bell. Civ.* i.-v.; Dio Cassius xli.-liii. In addition to the standard histories, see V. Gardthausen, *Augustus und seine Zeit* (Leipzig, 1891–1904); W. Drumann, *Geschichte Roms* (2nd ed. P. Groebe, 1899), i. pp. 46-384; article by Groebe in Pauly-Wissowa's *Realencyclopädie*; and a short but vivid sketch by de Quincey in his *Essay on the Caesars*.

5. LUCIUS ANTONIUS, youngest son of Marcus Antonius Creticus, and brother of the triumvir. In 44, as tribune of the people, he brought forward a law authorizing Caesar to nominate the chief magistrates during his absence from Rome. After the murder of Caesar, he supported his brother Marcus. He proposed an agrarian law in favour of the people and Caesar's veterans, and took part in the operations at Mutina (43). In 41 he was consul, and had a dispute with Octavian, which led to the so-called Perusian War, in which he was supported by Fulvia (Mark Antony's wife), who was anxious to recall her husband from Cleopatra's court. Later, observing the bitter feelings that had been evoked by the distribution of land among the veterans of Caesar, Antonius and Fulvia changed their attitude, and stood forward as the defenders of those who had suffered from its operation. Antonius marched on Rome, drove out Lepidus, and promised the people that the triumvirate should be abolished. On the approach of Octavian, he retired to Perusia in Etruria, where he was besieged by three armies, and compelled to surrender (winter of 41). His life was spared, and he was sent by Octavian to Spain as governor. Nothing is known of the circumstances or date of his death. Cicero, in his *Philippics*, actuated in great measure by personal animosity, gives a highly unfavourable view of his character.

Appian, *Bellum Civile*, v. 14 ff.; Dio Cassius xlviii. 5-14.

6. GAIUS ANTONIUS, second son of Marcus Antonius Creticus, and brother of the triumvir. In 49 he was legate of Caesar and, with P. Cornelius Dolabella, was entrusted with the defence of Illyricum against the Pompeians. Dolabella's fleet was destroyed; Antonius was shut up in the island of Curicta and forced to surrender. In 44 he was city praetor, his brothers Marcus and Lucius being consul and tribune respectively in the same year. Gaius was appointed to the province of Macedonia, but on his way thither fell into the hands of M. Junius Brutus on the coast of Illyria. Brutus at first treated him generously, but ultimately put him to death (42).

Plutarch, *Brutus*, 28; Dio Cassius xlvii. 21-24. On the whole family, see the articles in Pauly-Wissowa's *Realencyclopädie*, i. pt. 2 (1894).

ANTONOMASIA, in rhetoric, the Greek term for a substitution of any epithet or phrase for a proper name; as "Pelides," or "the son of Peleus," for Achilles; "the Stagirite" for Aristotle; "the author of *Paradise Lost*" for Milton; "the little corporal" for Napoleon I.; "Macedonia's madman" for Alexander the Great, &c. &c. The opposite substitution of a proper name for some generic term is also sometimes called antonomasia; as "a Cicero" for an orator.

ANTRAIGUES, EMMANUEL HENRI LOUIS ALEXANDRE DE LAUNAY, COMTE D' (*c.* 1755–1812), French publicist and political adventurer, was a nephew of François Emmanuel de Saint-Priest (1735–1821), one of the last ministers of Louis XVI. He was a cavalry captain, but, having little taste for the army, left it and travelled extensively, especially in the East. On his return to Paris, he sought the society of philosophers and artists, visited Voltaire at Ferney for three months, but was more attracted by J. J. Rousseau, with whom he became somewhat intimate. He published a *Mémoire sur les états-généraux*, supported the Revolution enthusiastically when it broke out, was elected deputy, and took the oath to the constitution; but he suddenly changed his mind completely, became a defender of the monarchy and emigrated in 1790. He was the secret agent of the comte de Provence (Louis XVIII.) at different courts of Europe, and at the same time received money from the courts he visited. He published a number of pamphlets, *Des monstres ravagent partout*, *Point d'accommodement*, &c. At Venice, where he was attaché to the Russian legation, he was arrested in 1707, but escaped to Russia. Sent as Russian attaché to Dresden, he published a violent pamphlet against Napoleon I., and was expelled by the Saxon government. He then went to London, and it was universally believed that he betrayed the secret articles of the treaty of Tilsit to the British cabinet, but his recent biographer, Pingaud, contests this. In 1812 he and his wife Madame Saint-Huberty, an operatic singer, were assassinated by an Italian servant whom they had dismissed. It has never been known whether the murder was committed from private or political motives.

See H. Vaschalde, *Notice bibliographique sur Louis Alexandre de Launay, comte d'Antraigues, sa vie et ses œuvres*; Léonce Pingaud, *Un Agent secret sous la révolution et l'empire, le comte d'Antraigues* (Paris, 1893); Édouard de Goncourt, *La Saint-Huberty et l'opéra au XVIII*^{e} *siècle*.

ANTRIM, RANDAL MACDONNELL, 1st Earl of (d. 1636), called "Arranach," having been brought up in the Scottish island of Arran by the Hamiltons, was the 4th son of Sorley Boy MacDonnell (*q.v.*), and of Mary, daughter of Conn O'Neill, 1st earl of Tyrone. He fought at first against the English government, participating in his brother James's victory over Sir John Chichester at Carrickfergus in November 1597, and joining in O'Neill's rebellion in 1600. But on the 16th of December he signed articles with Sir Arthur Chichester and was granted protection; in 1601 he became head of his house by his elder brother's death, his pardon being confirmed to him; and in 1602 he submitted to Lord Mountjoy and was knighted. On the accession of James I. in 1603 he obtained a grant of the Route and the Glynns (Glens) districts, together with the island of Rathlin, and remained faithful to the government in spite of the unpopularity he thereby incurred among his kinsmen, who conspired to depose him. In 1607 he successfully defended himself against the charge of disloyalty on the occasion of the flight of the earls of Tyrone and Tyrconnell, and rendered services to the government by settling and civilizing his districts, being well received the following year by James in London. In 1618 he was created Viscount Dunluce, and subsequently he was appointed a privy councillor and lord-lieutenant of the county of Antrim. On the 12th of December 1620 he was created earl of Antrim. In 1621 he was charged with harbouring Roman Catholic priests, confessed his offence and was pardoned. He offered his assistance in 1625 during the prospect of a Spanish invasion, but was still regarded as a person that needed watching. His arbitrary conduct in Ireland in 1627 was suggested as a fit subject for examination by the Star Chamber, but his fidelity to the government was strictly maintained to the last. In 1631 he was busy repairing Protestant churches, and in 1634 he attended the Irish parliament. He made an important agreement in 1635 for the purchase from James Campbell, Lord Cantire, of the lordship of Cantire, or Kintyre, of which the MacDonnells had been dispossessed in 1600 by Argyll; but his possession was successfully opposed by Lord Lorne. He died on the 10th of December 1636. Antrim married Alice, daughter of Hugh O'Neill, earl of Tyrone, by whom, besides six daughters, he had Randal, 2nd earl and 1st marquess of Antrim (*q.v.*), and Alexander, 3rd earl. Three other sons, Maurice, Francis and James, were probably illegitimate. The earldom has continued in the family down to the present day, the 11th earl (b. 1851) succeeding in 1869.

See also *An Historical Account of the MacDonnells of Antrim*, by G. Hill (1873).

ANTRIM, RANDAL MACDONNELL, 1st Marquess of (1609–1683), son of the 1st earl of Antrim, was born in 1609 and educated as a Roman Catholic. He travelled abroad, and on his return in 1634 went to court, next year marrying Katherine Manners, widow of the 1st duke of Buckingham, and living on her fortune for some years in great splendour. In 1639, on the outbreak of the Scottish war, he initiated a scheme of raising a force in Ireland to attack Argyll in Scotland and recover Kintyre (or Cantire), a district formerly possessed by his family; but the plan, discouraged and ridiculed by Strafford, miscarried.[1] Soon afterwards he returned to Ireland, and sought in 1641 to create a diversion, together with Ormonde, for Charles I. against the parliament. He joined in his schemes Lord Slane and Sir Phelim O'Neill, later leaders of the rebellion, but on the outbreak of the rebellion in the autumn he dissociated himself from his allies and retired to his castle at Dunluce. His suspicious conduct, however, and his Roman Catholicism, caused him to be regarded as an enemy by the English party. In May 1642 he was captured at Dunluce Castle by the parliamentary general Robert Munro, and imprisoned at Carrickfergus. Escaping thence he joined the queen at York; and subsequently, having proceeded to Ireland to negotiate a cessation of hostilities, he was again captured with his papers in May 1643 and confined at Carrickfergus, thence once more escaping and making his way to Kilkenny, the headquarters of the Roman Catholic confederation. He returned to Oxford in December with a scheme for raising 10,000 Irish for service in England and 2000 to join Montrose in Scotland, which through the influence of the duchess of Buckingham secured the consent of the king. On the 26th of January 1644 Antrim was created a marquess. He returned to Kilkenny in February, took the oath of association, and was made a member of the council and lieutenant-general of the forces of the Catholic confederacy. The confederacy, however, giving him no support in his projects, he threw up his commission, and with Ormonde's help despatched about 1600 men in June to Montrose's assistance in Scotland, subsequently returning to Oxford and being sent by the king in 1645 with letters for the queen at St Germains. He proceeded thence to Flanders and fitted out two frigates with military stores, which he brought to the prince of Wales at Falmouth. He visited Cork and afterwards in July 1646 joined his troops in Scotland, with the hope of expelling Argyll from Kintyre; but he was obliged to retire by order of the king, and returning to Ireland threw himself into the intrigues between the various factions. In 1647 he was appointed with two others by the confederacy to negotiate a treaty with the prince of Wales in France, and though he anticipated his companions by starting a week before them, he failed to secure the coveted lord-lieutenancy, which was confirmed to Ormonde. He now ceased to support the Roman Catholics or the king's cause; opposed the treaty between Ormonde and the confederates; supported the project of union between O'Neill and the parliament; and in 1649 entered into communications with Cromwell, for whom he performed various services, though there appears no authority to support Carte's story that Antrim was the author of a forged agreement for the betrayal of the king's army by Lord Inchiquin.[1] Subsequently he joined Ireton, and was present at the siege of Carlow. He returned to England in December 1650, and in lieu of his confiscated estate received a pension of £500 and later of £800, together with lands in Mayo. At the Restoration Antrim was excluded from the Act of Oblivion on account of his religion, and on presenting himself at court was imprisoned in the Tower, subsequently being called before the lords justices in Ireland. In 1663 he succeeded, in spite of Ormonde's opposition, in securing a decree of innocence from the commissioners of claims. This raised an outcry from the adventurers who had been put in possession of his lands, and who procured a fresh trial; but Antrim appealed to the king, and through the influence of the queen mother obtained a pardon, his estates being restored to him by the Irish Act of Explanation in 1665.[2] Antrim died on the 3rd of February 1683. He is described by Clarendon as of handsome appearance but "of excessive pride and vanity and of a marvellous weak and narrow understanding." He married secondly Rose, daughter of Sir Henry O'Neill, but had no children, being succeeded in the earldom by his brother Alexander, 3rd earl of Antrim.

See *Hibernia Anglicana*, by R. Cox (1689–1690) esp. app. xlix. vol. ii. 206; *History of the Irish Confederation*, by J. T. Gilbert (1882–1891); *Aphorismical Discovery* (Irish Archaeological Society, 1879–1880); *Thomason Tracts* (Brit. Mus.), E 59 (18), 149 (12), 138 (7), 153 (19), 61 (23); *Murder will out, or the King's Letter justifying the Marquess of Antrim* (1689); *Hist. MSS. Comm. Series—MSS. of Marq. of Ormonde.* (P. C. Y.)

ANTRIM, a county in the north-east corner of Ireland, in the province of Ulster. It is bounded N. and E. by the narrow seas separating Ireland from Scotland, the Atlantic Ocean and Irish Sea, S. by Belfast Lough and the Lagan river dividing it from the county Down, W. by Lough Neagh, dividing it from the counties Armagh and Tyrone, and by county Londonderry, the boundary with which is the river Bann.

The area is 751,965 acres or about 1175 sq. m. A large portion of the county is hilly, especially in the east, where the highest elevations are attained, though these are nowhere great. The range runs north and south, and, following this direction the highest points are Knocklayd (1695 ft.), Slieveanorra (1676), Trostan (1817), Slemish (1457), and Divis (1567). The inland slope is gradual, but on the northern shore the range terminates in abrupt and almost perpendicular declivities, and here, consequently, some of the finest coast scenery in the island is found, widely differing, with its unbroken lines of cliffs, from the indented coast-line of the west. The most remarkable cliffs are those formed of perpendicular basaltic columns, extending for many miles, and most strikingly displayed in Fair Head and the celebrated Giant's Causeway. From the eastern coast the hills rise instantly but less abruptly, and the indentations are wider and deeper. On both coasts there are several frequented watering-places, of which may be mentioned on the north Portrush (with well-known golf links), Port Ballintrae and Ballycastle; on the east Cushendun, Cushendall and Milltown on Red Bay, Carn Lough and Glenarm, Larne, and Whitehead on Belfast Lough. All are somewhat exposed to the easterly winds prevalent in spring. The only island of size is Rathlin, off Ballycastle, 6½ m. in length by 1½ in breadth, 7 m. from the coast, and of similar basaltic and limestone formation to that of the mainland. It is partially arable, and supports a small population. The so-called Island Magee is a peninsula separating Larne Lough from the Irish Channel.

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[1] Strafford's *Letters*, ii. 300.

[1] *Life of Ormonde*, iii. 509; see also *Cal. of State Papers, Ireland, 1660–1662*, pp. 294, 217; *Cal. of Clarendon St. Pap.*, ii. 69, and Gardiner's *Commonwealth*, i. 153.

[2] Hallam, *Const. Hist.*, iii. 396 (ed. 1855).

The valleys of the Bann and Lagan, with the intervening shores of Lough Neagh, form the fertile lowlands. These two rivers, both rising in county Down, are the only ones of importance. The latter flows to Belfast Lough, the former drains Lough Neagh, which is fed by a number of smaller streams, among them the Crumlin, whose waters have petrifying powers. The fisheries of the Bann and of Lough Neagh (especially for salmon) are of value both commercially and to sportsmen, the small town of Toome, at the outflow of the river, being the centre. Immediately below this point lies Lough Beg, the "Small Lake," about 15 ft. lower than Lough Neagh, which it excels in the pleasant scenery of its banks. The smaller streams are of great use in working machinery.

Geology.—On entering the county at the south, a scarped barrier of hills is seen beyond the Lagan valley, marking the edge of the basaltic plateaus, and running almost continuously round the coast to Red Bay. Below it, Triassic beds are exposed from Lisburn to Island Magee, giving sections of red sands and marls. Above these, marine Rhaetic beds appear at intervals, notably near Larne, where they are succeeded by Lower Lias shales and limestones. At Portrush, the Lower Lias is seen on the shore, crowded with ammonites, but silicified and metamorphosed by invading dolerite. The next deposits, as the scarps are approached, are greensands of "Selbornian" age, succeeded by Cenomanian, and locally by Turonian, sands. The Senonian series is represented by the White Limestone, a hardened chalk with flints, which is often glauconitic and conglomeratic at the base. Denudation in earliest Eocene times has produced flint gravels above the chalk, and an ancient stream deposit of chalk pebbles occurs at Ballycastle. The volcanic fissures that allowed of the upwelling of basalt are represented by numerous dykes, many cutting the earlier lava-flows as well as all the beds below them. The accumulations of lava gave rise to the plateaus which form almost the whole interior of the county. In a quiet interval, the Lower Eocene plant-beds of Glenarm and Ballypalady were formed in lakes, where iron-ores also accumulated. Rhyolites were erupted locally near Tardree, Ballymena and Glenarm. The later basalts are especially marked by columnar jointing, which determines the famous structures of the Giant's Causeway and the coast near Bengore Head. Volcanic necks may be recognized at Carrick-a-rede, in the intrusive mass of dolerite at Slemish, at Carnmoney near Belfast, and a few other points. Fair Head is formed of intrusive dolerite, presenting a superb columnar seaward face. Faulting, probably in Pliocene times, lowered the basaltic plateaus to form the basin of Lough Neagh, leaving the eastern scarp at heights ranging up to 1800 ft. The glens of Antrim are deep notches cut by seaward-running streams through the basalt scarp, their floors being formed of Triassic or older rocks. Unlike most Irish counties, Antrim owes its principal features to rocks of Mesozoic and Cainozoic age. At Cushendun, however, a coarse conglomerate is believed to be Devonian, while Lower Carboniferous Sandstones, with several coal-seams, form a small productive basin at Ballycastle. The dolerite of Fair Head sends off sheets along the bedding-planes of these carboniferous strata. "Dalradian" schists and gneisses, with some dark limestones, come out in the north-east of the county, forming a moorland-region between Cushendun and Ballycastle. The dome of Knocklayd, capped by an outlier of chalk and basalt, consists mostly of this far more ancient series. Glacial gravels are well seen near Antrim town, and as drumlins between Ballymena and Ballycastle. The drift-phenomena connected with the flow of ice from Scotland are of special interest. Recently elevated marine clays, of post-glacial date, fringe the south-eastern coast, while gravels with marine shells, side by side with flint implements chipped by early man, have been lifted some 20 ft. above sea-level near Larne.

Rock-salt some 80 ft. thick is mined in the Trias near Carrickfergus. The Keuper clays yield material for bricks. Bauxite, probably derived from the decay of lavas, is found between Glenarm and Broughshane, associated with brown and red pisolitic iron-ores; both these materials are worked commercially. Bauxite occurs also near Ballintoy. The Ballycastle coal is raised and sold locally.

Industries.—The climate is very temperate. The soil varies greatly according to the district, being in some cases a rich loam, in others a chalky marl, and elsewhere showing a coating of peat. The proportion of barren land to the total area is roughly as 1 to 9; and of tillage to pasture as 2 to 3. Tillage is therefore, relatively to other counties, well advanced, and oats and potatoes are largely, though decreasingly, cultivated. Flax is a less important crop than formerly. The numbers of cattle, sheep, pigs and poultry are generally increasing. Dutch, Ayrshire and other breeds are used to improve the breed of cattle by crossing. Little natural wood remains in the county, but plantations flourish on the great estates, and orchards have proved successful.

The linen manufacture is the most important industry. Cotton-spinning by jennies was first introduced by Robert Joy and Thomas M'Cabe of Belfast in 1777; and an estimate made twenty-three years later showed upwards of 27,000 hands employed in this industry within 10 m. of Belfast, which remains the centre for it. Women are employed in the working of patterns on muslin. There are several paper-mills at Bushmills in the north; whisky-distilling is carried on; and there are valuable sea-fisheries divided between the district of Ballycastle and Carrickfergus, while the former is the headquarters of a salmon-fishery district. The workings at the Ballycastle collieries are probably the oldest in Ireland. In 1770 the miners accidentally discovered a complete gallery, which has been driven many hundred yards into the bed of coal, branching into thirty-six chambers dressed quite square, and in a workman-like manner. No tradition of the mine having been formerly worked remained in the neighbourhood. The coal of some of the beds is bituminous, and of others anthracite.

Communications.—Except that the Great Northern railway line from Belfast to the south and west runs for a short distance close to the southern boundary of the county, with a branch from Lisburn to the town of Antrim, the principal lines of communication are those of the Northern Counties system, under the control of the Midland railway of England. The chief routes are:—Belfast, Antrim, Ballymena (and thence to Coleraine and Londonderry); a line diverging from this at White Abbey to Carrickfergus and Larne, the port for Stranraer in Scotland; branches from Ballymena to Larne and to Parkmore; and from Coleraine to Portrush. The Ballycastle railway runs from Ballymoney to Ballycastle on the north coast; and the Giant's Causeway and Portrush is an electric railway (the first to be worked in the United Kingdom). The Lagan Canal connects Lough Neagh with Belfast Lough.

Population and Administration.—The population in 1891 was

208,010, and in 1901, 196,090. The county is among those least seriously affected by emigration. Of the total about 50 % are Presbyterians, about 20 % each Protestant Episcopalians and Roman Catholics; Antrim being one of the most decidedly Protestant counties in Ireland. Of the Presbyterians the greater part are in connexion with the General Synod of Ulster, and the other are Remonstrants, who separated from the Synod in 1829, or United Presbyterians. The principal towns are Antrim (pop. 1826), Ballymena (10,886), Ballymoney (2952), Carrickfergus (4208), Larne (6670), Lisburn (11,461) and Portrush (1941). Belfast though constituting a separate county ranks as the metropolis of the district. Ballyclare, Bushmills, Crumlin, Portglenone and Randalstown are among the lesser towns. Belfast and Larne are the chief ports. The county comprises 14 baronies and 79 civil parishes and parts of parishes. The constabulary force has its headquarters at Ballymena. The assize town is Belfast, and quarter sessions are held at Ballymena, Ballymoney, Belfast, Larne and Lisburn. The county is divided between the Protestant dioceses of Derry and Down, and the Roman Catholic dioceses of Down and Connor, and Dromore. It is divided into north, mid, east and south parliamentary divisions, each returning one member.

History and Antiquities.—At what date the county of Antrim was formed is not known, but it appears that a certain district bore this name before the reign of Edward II. (early 14th century), and when the shiring of Ulster was undertaken by Sir John Perrot in the 16th century, Antrim and Down were already recognized divisions, in contradistinction to the remainder of the province. The earliest known inhabitants were of Celtic origin, and the names of the townlands or subdivisions, supposed to have been made in the 13th century, are pure Celtic. Antrim was exposed to the inroads of the Danes, and also of the northern Scots, who ultimately effected permanent settlements. The antiquities of the county consist of cairns, mounts or forts, remains of ecclesiastical and military structures, and round towers. The principal cairns are: one on Colin mountain, near Lisburn; one on Slieve True, near Carrickfergus; and two on Colinward. The cromlechs most worthy of notice are: one near Cairngrainey, to the north-east of the old road from Belfast to Templepatrick; the large cromlech at Mount Druid, near Ballintoy; and one at the northern extremity of Island Magee. The mounts, forts and intrenchments are very numerous. There are three round towers: one at Antrim, one at Armoy, and one on Ram Island in Lough Neagh, only that at Antrim being perfect. There are some remains of the ecclesiastic establishments at Bonamargy, where the earls of Antrim are buried, Kells, Glenarm, Glynn, Muckamore and White Abbey. The noble castle of Carrickfergus is the only one in perfect preservation. There are, however, remains of other ancient castles, as Olderfleet, Carn's, Shane's, Glenarm, Garron Tower, Redbay, &c., but the most interesting of all is the castle of Dunluce, remarkable for its great extent and romantic situation. Mount Slemish, about 8 m. east of Ballymena, is notable as being the scene of St Patrick's early life. Island Magee had, besides antiquarian remains, a notoriety as a home of witchcraft, and was the scene of an act of reprisal for the much-disputed massacre of Protestants about 1641, by the soldiery of Carrickfergus.

ANTRIM, a market-town in the west of the county Antrim, Ireland, in the south parliamentary division, on the banks of the Six-Mile Water, half a mile from Lough Neagh, in a beautiful and fertile valley. Pop. (1901) 1826. It is $21\frac{3}{4}$ m. north-west of Belfast by the Northern Counties (Midland) railway, and is also the terminus of a branch of the Great Northern railway from Lisburn. There is nothing in the town specially worthy of notice, but the environs, including Shane's Castle and Antrim Castle, possess features of considerable interest. About a mile from the town is one of the most perfect of the round towers of Ireland, 93 ft. high and 50 in circumference at the base. It stands in the grounds of Steeple, a neighbouring seat, where is also the "Witches' Stone," a prehistoric monument. A battle was fought near Antrim between the English and Irish in the reign of Edward III.; and in 1642 a naval engagement took place on Lough Neagh, for Viscount Massereene and Ferrard (who founded Antrim Castle in 1662) had a right to maintain a fighting fleet on the lough. On the 7th of June 1798 there was a smart action in the town between the king's troops and a large body of rebels, in which the latter were defeated, and Lord O'Neill mortally wounded. Before the Union Antrim returned two members to parliament by virtue of letters patent granted in 1666 by Charles II. There are manufactures of paper, linen, and woollen cloth. The government is in the hands of town commissioners.

ANTRUSTION, the name of the members of the bodyguard or military household of the Merovingian kings. The word, of which the formation has been variously explained, is derived from the O.H.Germ. *trost*, comfort, aid, fidelity, trust, through the latinized form *trustis*. Our information about the antrustions is derived from one of the *formulae* of Marculfus (i. 18, ed. Zeumer, p. 55) and from various provisions of the Salic law (see du Cange, *Glossarium, s.* "trustis"). Any one desiring to enter the body of Antrustions had to present himself armed at the royal palace, and there, with his hands in those of the king, take a special oath or *trustis* and *fidelitas*, in addition to the oath of fidelity sworn by every subject at the king's accession. This done, he was considered to be *in truste dominica* and bound to the discharge of all the services this involved. In return for these, the antrustion enjoyed certain valuable advantages, as being specially entitled to the royal assistance and protection; his *wergeld* is three times that of an ordinary Frank; the slayer of a Frank paid compensation of 200 *solidi*, that of an antrustion had to find 600. The antrustion was always of Frankish descent, and only in certain exceptional cases were Gallo-Romans admitted into the king's bodyguard. These Gallo-Romans then took the name of *convivae regis*, and the *wergeld* of 300 *solidi* was three times that of a *homo romanus*. The antrustions, belonging as they did to one body, had strictly defined duties towards one another; thus one antrustion was forbidden to bear witness against another under penalty of 15 *solidi* compensation.

The antrustions seem to have played an important part at the time of Clovis. It was they, apparently, who formed the army which conquered the land, an army composed chiefly of Franks, and of a few Gallo-Romans who had taken the side of Clovis. After the conquest, the rôle of the antrustions became less important. For each of their expeditions, the kings raised an army of citizens in which the Gallo-Romans mingled more and more with the Franks; they only kept one small permanent body which acted as their bodyguard (*trustis dominica*), some members of which were from time to time told off for other tasks, such as that of forming garrisons in the frontier towns. The institution seems to have disappeared during the anarchy with which the 8th century opened. It has wrongly been held to be the origin of vassalage. Only the king had antrustions; every lord could have vassals. The antrustions were a military institution; vassalage was a social institution, the origins of which are very complex.

All historians of Merovingian institutions and law have treated of the antrustions, and each one has his different system. The principal authorities are:—Waitz, *Deutsche Verfassungsgeschichte*, 3rd ed. vol. ii. pp. 335 et seq.; Brunner, *Deutsche Rechtsgeschichte*, vol. ii. p. 97 et seq.; Fustel de Coulanges, *La Monarchie franque*, p. 80 et seq.; Maxime Deloche, *La Trustis et l'antrustion royal sous les deux premières races* (Paris, 1873), collecting and discussing the principal texts; Guilhermoz, *Les Origines de la noblesse* (Paris, 1902), suggesting a system which is new in part. (C. Pf.)

ANTWERP, the most northern of the nine provinces of Belgium. It is conterminous with the Dutch frontier on the north. Malines, Lierre and Turnhout are among the towns of the province. Its importance, however, is derived from the fact that it contains the commercial metropolis of Belgium. It is divided into three administrative districts (*arrondissements*), viz. Antwerp, Malines and Turnhout. These are subdivided into 25 cantons and 152 communes. The area is 707,932 acres or 1106 sq. m. Pop. (1904) 888,980, showing an average of 804 inhabitants to the square mile.

ANTWERP (Fr. *Anvers*), capital of the above province, an important city on the right bank of the Scheldt, Belgium's chief centre of commerce and a strong fortified position.

Modern Antwerp is a finely laid out city with a succession of broad avenues which mark the position of the first enceinte. There are long streets and terraces of fine houses belonging to the merchants and manufacturers of the city which amply testify to its prosperity, and recall the 16th century distich that Antwerp was noted for its moneyed men (" Antwerpia nummis "). Despite the ravages of war and internal disturbances it still preserves some memorials of its early grandeur, notably its fine cathedral. This church was begun in the 14th century, but not finished till 1518. Its tower of over 400 ft. is a conspicuous object to be seen from afar over the surrounding flat country. A second tower which formed part of the original plan has never been erected. The proportions of the interior are noble, and in the church are hung three of the masterpieces of Rubens, viz. " The Descent from the Cross," " The Elevation of the Cross," and " The Assumption." Another fine church in Antwerp is that of St James, far more ornate than the cathedral, and containing the tomb of Rubens, who devoted himself to its embellishment. The Bourse or exchange, which claims to be the first distinguished by the former name in Europe, is a fine new building finished in 1872, on the site of the old Bourse erected in 1531 and destroyed by fire in 1858. Fire has destroyed several other old buildings in the city, notably in 1891 the house of the Hansa League on the northern quays. A curious museum is the Maison Plantin, the house of the great printer C. Plantin (*q.v.*) and his successor Moretus, which stands exactly as it did in the time of the latter. The new picture gallery close to the southern quays is a fine building divided into ancient and modern sections. The collection of old masters is very fine, containing many splendid examples of Rubens, Van Dyck, Titian and the chief Dutch masters. Antwerp, famous in the middle ages and at the present time for its commercial enterprise, enjoyed in the 17th century a celebrity not less distinct or glorious in art for its school of painting, which included Rubens, Van Dyck, Jordaens, the two Teniers and many others.

Commerce.—Since 1863, when Antwerp was opened to the trade of the outer world by the purchase of the Dutch right to levy toll, its position has completely changed, and no place in Europe has made greater progress in this period than the ancient city on the Scheldt. The following figures for the years 1904 and 1905 show that its trade is still rapidly increasing:—

Year.	Exports.		Imports.	
	Tonnage.	Value.	Tonnage.	Value.
1904	6,578,558	£71,349,678	8,427,894	£79,539,100
1905	7,153,655	£80,032,355	9,061,781	£91,194,517

The growth of its commerce in recent times may be measured by a comparison of the following figures. In 1888, 4272 ships entered the port and 4302 sailed from it. In 1905, 6095 entered the port and 6065 sailed from it—an increase of nearly 50 %. In 1888 the total tonnage was 7,800,000; in 1905 it had risen to 19,662,000. These figures explain how and why Antwerp has outgrown its dock accommodation. The eight principal basins or docks already existing in 1908 were (1) the Little or Bonaparte dock; (2) the Great dock, also constructed in Napoleon's time; (3) the Kattendijk, built in 1860 and enlarged in 1881; (4) the Wood dock; (5) the Campine dock, used especially for minerals; (6) the Asia dock, which is in direct communication with the Meuse by a canal as well as with the Scheldt; (7) the Lefebvre dock; and (8) the America dock, which was only opened in 1905. Two new docks, called " intercalary " because they would fit into whatever scheme might be adopted for the rectification of the course of the Scheldt, were still to be constructed, leading out of the Lefebvre dock and covering 70 acres. With the completion of the new maritime lock, ships drawing 30 ft. of water would be able to enter these new docks and also the Lefebvre and America docks. In connexion with the projected *grande coupure* (that is, a cutting through the neck of the loop in the river Scheldt immediately below Antwerp), the importance of these four docks would be greatly increased because they would then flank the new main channel of the river. When the Belgian Chambers voted in February 1906 the sums necessary for the improvement of the harbour of Antwerp no definite scheme was sanctioned, the question being referred to a special mixed commission. The improvements at Antwerp are not confined to the construction of new docks. The quays flanking the Scheldt are 3½ m. in length. They are constructed of granite, and no expense has been spared in equipping them with hydraulic cranes, warehouses, &c.

Fortifications.—Besides being the chief commercial port of Belgium, Antwerp is the greatest fortress of that country. Nothing, however, remains of the former enceinte or even of the famous old citadel defended by General Chassé in 1832, except the *Steen*, which has been restored and contains a museum of arms and antiquities. After the establishment of Belgian independence Antwerp was defended only by the citadel and an enceinte of about 2½ m. round the city. No change occurred till 1859, when the system of Belgian defence was radically altered by the dismantlement of seventeen of the twenty-two fortresses constructed under Wellington's supervision in 1815–1818. At Antwerp the old citadel and enceinte were removed. A new enceinte 8 m. in length was constructed, and the villages of Berchem and Borgerhout, now parishes of Antwerp, were absorbed within the city. This enceinte still exists, and is a fine work of art. It is protected by a broad wet ditch (plans in article FORTIFICATION), and in the caponiers are the magazines and store chambers of the fortress. The enceinte is pierced by nineteen openings or gateways, but of these seven are not used by the public. As soon as the enceinte was finished eight detached forts from 2 to 2½ m. distant from the enceinte were constructed. They begin on the north near Wyneghem and the zone of inundation, and terminate on the south at Hoboken. In 1870 Fort Merxem and the redoubts of Berendrecht and Oorderen were built for the defence of the area to be inundated north of Antwerp. In 1878, in consequence of the increased range of artillery and the more destructive power of explosives, it was recognized that the fortifications of Antwerp were becoming useless and out of date. It was therefore decided to change it from a fortress to a fortified position by constructing an outer line of forts and batteries at a distance varying from 6 to 9 m. from the enceinte. This second line was to consist of fifteen forts, large and small. Up to 1898 only five had been constructed, but in that and the two following years five more were finished, leaving another five to complete the line. A mixed commission selected the points at which they were to be placed. With the completion of this work, which in 1908 was being rapidly pushed on, Antwerp might be regarded as one of the best fortified positions in Europe, and so long as its communications by sea are preserved intact it will be practically impregnable.

Two subsidiary or minor problems remained over. (1) The much-discussed removal of the existing enceinte in order to give Antwerp further growing space. If it were removed there arose the further question, should a new enceinte be made at the first line of outer forts, or should an enceinte be dispensed with? An enceinte following the line of those forts would be 30 m. in length. Then if the city grew up to this extended enceinte the outer forts would be too near. To screen the city from bombardment they would have to be carried 3 m. further out, and the whole Belgian army would scarcely furnish an adequate garrison for this extended position. A new enceinte, or more correctly a rampart of a less permanent character, connecting the eight forts of the inner line and extending from Wyneghem to a little south of Hoboken, was decided upon in 1908. (2) The second problem was the position on the left bank of the Scheldt. All the defences enumerated are on the right bank. On the left bank the two old forts Isabelle and Marie alone defend the Scheldt. It is assumed (probably rightly) that no enemy could get round to this side in sufficient strength to deliver any attack that the existing forts could not easily repel. The more interesting question connected with the left bank is whether it does not provide, as Napoleon thought, the most natural outlet for the expansion of Antwerp. Proposals to connect the two banks by a tunnel under the Scheldt have been made from time to time in a fitful manner, but nothing whatever had been done by 1908 to realize what appears to be a natural and easy project.

Population.—The following statistics show the growth of population in and since the 19th century. In 1800 the population was computed not to exceed 40,000. At the census of 1846 the total was 88,487; of 1851, 95,501; of 1880, 169,100; of 1900, 272,830; and of 1904, 291,949. To these figures ought to be added the populations (1904) of Borgerhout (43,391) and Berchem (26,383), as they are part of the city, which would give Antwerp a total population of 361,723.

History.—The suggested origin of the name Antwerp from *Hand-werpen* (hand-throwing), because a mythical robber chief indulged in the practice of cutting off his prisoners' hands and throwing them into the Scheldt, appeared to Motley rather far-fetched, but it is less reasonable to trace it, as he inclines to do, from *an t werf* (on the wharf), seeing that the form *Andhunerbo* existed in the 6th century on the separation of Austrasia and Neustria. Moreover, hand-cutting was not an uncommon practice in Europe. It was perpetuated from a savage past in the custom of cutting off the right hand of a man who died without heir, and sending it as proof of *main-morte* to the feudal lord. Moreover, the two hands and a castle, which form the arms of Antwerp, will not be dismissed as providing no proof by any one acquainted with the scrupulous care that heralds displayed in the golden age of chivalry before assigning or recognizing the armorial bearings of any claimant.

In the 4th century Antwerp is mentioned as one of the places in the second Germany, and in the 11th century Godfrey of Bouillon was for some years best known as marquis of Antwerp. Antwerp was the headquarters of Edward III. during his early negotiations with van Artevelde, and his son Lionel, earl of Cambridge, was born there in 1338.

It was not, however, till after the closing of the Zwyn and the decay of Bruges that Antwerp became of importance. At the end of the 15th century the foreign trading gilds or houses were transferred from Bruges to Antwerp, and the building assigned to the English nation is specifically mentioned in 1510. In 1560, a year which marked the highest point of its prosperity, six nations, viz. the Spaniards, the Danes and the Hansa together, the Italians, the English, the Portuguese and the Germans, were named at Antwerp, and over 1000 foreign merchants were resident in the city. Guicciardini, the Venetian envoy, describes the activity of the port, into which 500 ships sometimes passed in a day, and as evidence of the extent of its land trade he mentioned that 2000 carts entered the city each week. Venice had fallen from its first place in European commerce, but still it was active and prosperous. Its envoy, in explaining the importance of Antwerp, states that there was as much business done there in a fortnight as in Venice throughout the year.

The religious troubles that marked the second half of the 16th century broke out in Antwerp as in every other part of Belgium excepting Liége. In 1576 the Spanish soldiery plundered the town during what was called "the Spanish Fury," and 6000 citizens were massacred. Eight hundred houses were burnt down, and over two millions sterling of damage was wrought in the town on that occasion.

In 1585 a severe blow was struck at the prosperity of Antwerp when Parma captured it after a long siege and sent all its Protestant citizens into exile. The recognition of the independence of the United Provinces by the treaty of Münster in 1648 carried with it the death-blow to Antwerp's prosperity as a place of trade, for one of its clauses stipulated that the Scheldt should be closed to navigation. This impediment remained in force until 1863, although the provisions were relaxed during French rule from 1795 to 1814, and also during the time Belgium formed part of the kingdom of the Netherlands (1815 to 1830). Antwerp had reached the lowest point of its fortunes in 1800, and its population had sunk under 40,000, when Napoleon, realizing its strategical importance, assigned two millions for the construction of two docks and a mole.

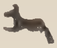
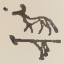
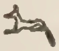
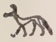
One other incident in the chequered history of Antwerp deserves mention. In 1830 the city was captured by the Belgian insurgents, but the citadel continued to be held by a Dutch garrison under General Chassé. For a time this officer subjected the town to a periodical bombardment which inflicted much damage, and at the end of 1832 the citadel itself was besieged by a French army. During this attack the town was further injured. In December 1832, after a gallant defence, Chassé made an honourable surrender.

See J. L. Motley's *Rise of the Dutch Republic*; C. Scribanii, *Origines Antwerpiensium*; Gens, *Hist. de la ville d'Anvers*; Mertens and Torfs, *Geschiedenis van Antwerp*; Génard, *Anvers à travers les âges*; *Annuaire statisque de la Belgique*. (D. C. B.)

ANU, a Babylonian deity, who, by virtue of being the first figure in a triad consisting of Anu, Bel and Ea, came to be regarded as the father and king of the gods. Anu is so prominently associated with the city of Erech in southern Babylonia that there are good reasons for believing this place to have been the original seat of the Anu cult. If this be correct, then the goddess Nanā (or Ishtar) of Erech was presumably regarded as his consort. The name of the god signifies the "high one" and he was probably a god of the atmospheric region above the earth—perhaps a storm god like Adad (*q.v.*), or like Yahweh among the ancient Hebrews. However this may be, already in the old-Babylonian period, *i.e.* before Khammurabi, Anu was regarded as the god of the heavens and his name became in fact synonymous with the heavens, so that in some cases it is doubtful whether, under the term, the god or the heavens is meant. It would seem from this that the grouping of the divine powers recognized in the universe into a triad symbolizing the three divisions, heavens, earth and the watery deep, was a process of thought which had taken place before the third millennium. To Anu was assigned the control of the heavens, to Bel the earth, and to Ea the waters. The doctrine once established remained an inherent part of the Babylonian-Assyrian religion and led to the more or less complete disassociation of the three gods constituting the triad from their original local limitations. An intermediate step between Anu viewed as the local deity of Erech (or some other centre), Bel as the god of Nippur, and Ea as the god of Eridu is represented by the prominence which each one of the centres associated with the three deities in question must have acquired, and which led to each one absorbing the qualities of other gods so as to give them a controlling position in an organized pantheon. For Nippur we have the direct evidence that its chief deity, En-lil or Bel, was once regarded as the head of an extensive pantheon. The sanctity and, therefore, the importance of Eridu remained a fixed tradition in the minds of the people to the latest days, and analogy therefore justifies the conclusion that Anu was likewise worshipped in a centre which had acquired great prominence. The summing-up of divine powers manifested in the universe in a threefold division represents an outcome of speculation in the schools attached to the temples of Babylonia, but the selection of Anu, Bel and Ea for the three representatives of the three spheres recognized, is due to the importance which, for one reason or the other, the centres in which Anu, Bel and Ea were worshipped had acquired in the popular mind. Each of the three must have been regarded in his centre as the most important member in a larger or smaller group, so that their union in a triad marks also the combination of the three distinctive pantheons into a harmonious whole.

In the astral theology of Babylonia and Assyria, Anu, Bel and Ea became the three zones of the ecliptic, the northern, middle and southern zone respectively. The purely theoretical character of Anu is thus still further emphasized, and in the annals and votive inscriptions as well as in the incantations and hymns, he is rarely introduced as an active force to whom a personal appeal can be made. His name becomes little more than a synonym for the heavens in general and even his title as king or father of the gods has little of the personal element in it. A consort Antum (or as some scholars prefer to read, Anatum) is assigned to him, on the theory that every deity must have a female associate, but Antum is a purely artificial product—a lifeless symbol playing even less of a part in what may be called the active pantheon than Anu.

For works of reference see BABYLONIAN AND ASSYRIAN RELIGION. (M. JA.)

ANUBIS (in Egyptian *Anūp*, written *Ỉnpw* in hieroglyphs), the name of one of the most important of the Egyptian gods. There were two types of canine divinities in Egypt, their leading representatives being respectively Anubis and Ophois (*Wp-wꜣ-wt*, "opener of the ways"): the former type is symbolized by the recumbent animal , the other by a similar animal (in a stiff standing attitude), carried as an emblem on a standard  in war or in religious processions. The former comprised two beneficent gods of the necropolis; the latter also were beneficent, but warlike, divinities. They thus corresponded, at any rate in some measure, respectively to the fiercer and milder aspects of the dog-tribe. In late days the Greeks report that κύνες (dogs) were the sacred animals of Anubis while those of Ophois were λύκοι (wolves). The above figure  is coloured black as befits a funerary and nocturnal animal: it is more attenuated than even a greyhound, but it has the bushy tail of the fox or the jackal. Probably these were the original genii of the necropolis, and in fact the same lean animal figured *passant*  is *sꜣb* "jackal" or "fox." The domestic dog would be brought into the sacred circle through the increased veneration for animals, and the more pronounced view in later times of Anubis as servant, messenger and custodian of the gods.

Anubis was the principal god in the capitals of the XVIIth and XVIIIth nomes of Upper Egypt, and secondary god in the XIIIth and probably in the XIIth nome; but his cult was universal. To begin with, he was the god of the dead, of the cemetery, of all supplies for the dead, and therefore of embalming when that became customary. In very early inscriptions the funerary prayers in the tombs are addressed to him almost exclusively, and he always took a leading place in them. In the scene of the weighing of the soul before Osiris, dating from the New-kingdom onwards, Anubis attends to the balance while Thoth registers the result. Anubis was believed to have been the embalmer of Osiris: the mummy of Osiris, or of the deceased, on a bier, tended by this god, is a very common subject on funerary tablets of the late periods. Anubis came to be considered especially the attendant of the gods and conductor of the dead, and hence was commonly identified with Hermes (cf. the name Hermanubis); but the rôle of Hermes as the god of eloquence, inventor of arts and recorder of the gods was taken by Thoth. In those days Anubis was considered to be son of Osiris by Nephthys; earlier perhaps he was son of Rē, the sun-god. In the 2nd century A.D. his aid was "compelled" by the magicians and necromancers to fetch the gods and entertain them with food (especially in the ceremony of gazing into the bowl of oil), and he is invoked by them sometimes as the "Good Ox-herd." The cult of Anubis must at all times have been very popular in Egypt, and, belonging to the Isis and Serapis cycle, was introduced into Greece and Rome.

See Erman, *Egyptian Religion*; Budge, *Gods of the Egyptians*; Meyer, in *Zeits. f. Aeg. Spr.* 41-97. (F. LL. G.)

ANURADHAPURA, a ruined city of Ceylon, famous for its ancient monuments. It is situated in the North-central province. Anuradhapura became the capital of Ceylon in the 5th century B.C., and attained its highest magnificence about the commencement of the Christian era. In its prime it ranked beside Nineveh and Babylon in its colossal proportions—its four walls, each 16 m. long, enclosing an area of 256 sq. m.,—in the number of its inhabitants, and the splendour of its shrines and public edifices. It suffered much during the earlier Tamil invasions, and was finally deserted as a royal residence in A.D. 769. It fell completely into decay, and it is only of recent years that the jungle has been cleared away, the ruins laid bare, and some measure of prosperity brought back to the surrounding country by the restoration of hundreds of village tanks. The ruins consist of three classes of buildings, *dagobas*, monastic buildings, and *pokunas*. The *dagobas* are bell-shaped masses of masonry, varying from a few feet to over 1100 in circumference. Some of them contain enough masonry to build a town for twenty-five thousand inhabitants. Remains of the monastic buildings are to be found in every direction in the shape of raised stone platforms, foundations and stone pillars. The most famous is the Brazen Palace erected by King Datagamana about 164 B.C. The *pokunas* are bathing-tanks or tanks for the supply of drinking-water, which are scattered everywhere through the jungle. The city also contains a sacred Bo-tree, which is said to date back to the year 245 B.C. The railway was extended from Matale to Anuradhapura in 1905. Population: town, 3672; province, 79,110.

ANVIL (from Anglo-Saxon *anfilt* or *onfilti*, either that on which something is "welded" or "folded," cf. German *falzen*, to fold, or connected with other Teutonic forms of the word, cf. German *amboss*, in which case the final syllable is from "beat," and the meaning is "that on which something is beaten"), a mass of iron on which material is supported while being shaped under the hammer (see FORGING). The common blacksmith's anvil is made of wrought iron, often in America of cast iron, with a smooth working face of hardened steel. It has at one end a projecting conical *beak* or *bick* for use in hammering curved pieces of metal; occasionally the other end is also provided with a bick, which is then partly rectangular in section. There is also a square hole in the face, into which tools, such as the anvil-cutter or chisel, can be dropped, cutting edge uppermost. For power hammers the anvil proper is supported on an anvil block which is of great massiveness, sometimes weighing over 200 tons for a 12-ton hammer, and this again rests on a strong foundation of timber and masonry or concrete. In anatomy the term anvil is applied to one of the bones of the middle ear, the *incus*, which is articulated with the *malleus*.

ANVILLE, JEAN BAPTISTE BOURGUIGNON D' (1697–1782), perhaps the greatest geographical author of the 18th century, was born at Paris on the 11th of July 1697. His passion for geographical research displayed itself from early years: at the age of twelve he was already amusing himself by drawing maps for Latin authors. Later, his friendship with the antiquarian, Abbé Longuerue, greatly aided his studies. His first serious map, that of Ancient Greece, was published when he was fifteen, and at the age of twenty-two he was appointed one of the king's geographers, and began to attract the attention of the first authorities. D'Anville's studies embraced everything of geographical nature in the world's literature, as far as he could master it: for this purpose he not only searched ancient and modern historians, travellers and narrators of every description, but also poets, orators and philosophers. One of his cherished objects was to reform geography by putting an end to the blind copying of older maps, by testing the commonly accepted positions of places through a rigorous examination of all the descriptive authority, and by excluding from cartography every name inadequately supported. Vast spaces, which had before been covered with countries and cities, were thus suddenly reduced almost to a blank.

D'Anville was at first employed in the humbler task of illustrating by maps the works of different travellers, such as Marchais, Charlevoix, Labat and Duhalde. For the history of China by the last-named writer he was employed to make an atlas, which was published separately at the Hague in 1737. In 1735 and 1736 he brought out two treatises on the figure of the earth; but these attempts to solve geometrical problems by literary material were, to a great extent, refuted by Maupertuis' measurements of a degree within the polar circle. D'Anville's historical method was more successful in his 1743 map of Italy, which first indicated numerous errors in the mapping of that country, and was accompanied by a valuable memoir (a novelty in such work), showing in full the sources of the design. A trigonometrical survey which Benedict XIV. soon after had made in the papal states strikingly confirmed the French geographer's results. In his later years d'Anville did yeoman service for ancient and medieval geography, accomplishing something like a revolution in the former; mapping afresh all the chief countries of the pre-Christian civilizations (especially Egypt), and by his *Mémoire et abrégé de géographie ancienne et générale* and his *États formés en Europe après la chute de l' empire romain en occident* (1771) rendering his labours still more generally useful. In 1754, at the age of fifty-seven, he became a member of the Académie des Inscriptions et Belles Lettres, whose transactions he enriched with many papers. In 1775 he received the only place in the Académie des Sciences which is allotted to geography; and in the same year he was appointed, without solicitation, first geographer to the king. His last employment consisted in arranging his collection of maps, plans and geographical materials. It was the most extensive in Europe, and had been purchased by the king, who, however, left him the use of it during his life. This task performed, he sank into a total imbecility both of mind and body, which continued for two years, till his death in January 1782.

D'Anville's published memoirs and dissertations amounted to 78, and his maps to 211. A complete edition of his works was announced in 1806 by de Manne in 6 vols. quarto, only two of which had appeared when the editor died in 1832. See Dacier's *Éloge de d'Anville* (Paris, 1802). Besides the separate works noticed above, d'Anville's maps executed for Rollin's *Histoire ancienne* and *Histoire romaine*, and his *Traité des mesures anciennes et modernes* (1769), deserve special notice.

ANWARI [Auhad-uddin Ali Anwari], Persian poet, was born in Khorasan early in the 12th century. He enjoyed the especial favour of the sultan Sinjar, whom he attended in all his warlike expeditions. On one occasion, when the sultan was besieging the fortress of Hazarasp, a fierce poetical conflict was maintained between Anwari and his rival Rashidi, who was within the beleaguered castle, by means of verses fastened to arrows. Anwari died at Balkh towards the end of the 12th century. The *Diwan*, or collection of his poems, consists of a series of long poems, and a number of simpler lyrics. His longest piece, *The Tears of Khorassan*, was translated into English verse by Captain Kirkpatrick (see also Persia. *Literature*).

ANWEILER, or Annweiler, a town of Germany, in the Bavarian Palatinate, on the Queich, 8 m. west of Landau, and on the railway from that place to Zweibrücken. Pop. 3700. It is romantically situated in the part of the Haardt called the Pfälzer Schweiz (Palatinate Switzerland), and is surrounded by high hills which yield a famous red sandstone. On the Sonnenberg (1600 ft.) lie the ruins of the castle of Trifels, in which Richard Cœur de Lion was imprisoned in 1193. The industries include cloth-weaving, tanning, dyeing and saw mills. There is also a considerable trade in wine.

ANZENGRUBER, LUDWIG (1839–1889), Austrian dramatist and novelist, was born at Vienna on the 29th of November 1839. He was educated at the *Realschule* of his native town, and then entered a bookseller's shop; from 1860 to 1867 he was an actor, without, however, displaying any marked talent, although his stage experience later stood him in good stead. In 1869 he became a clerk in the Viennese police department, but having in the following year made a success with his anti-clerical drama, *Der Pfarrer von Kirchfeld*, he gave up his appointment and devoted himself entirely to literature. He died at Vienna on the 10th of December 1889. Anzengruber was exceedingly fertile in ideas, and wrote a great many plays. They are mostly of Austrian peasant life, and although somewhat melancholy in tone are interspersed with bright and witty scenes. Among the best known are *Der Meineidbauer* (1871), *Die Kreuzelschreiber* (1872), *Der G'wissenswurm* (1874), *Hand und Herz* (1875), *Doppelselbstmord* (1875), *Das vierte Gebot* (1877), and *Der Fleck auf der Ehr'* (1889). Anzengruber also published a novel of considerable merit, *Der Schandfleck* (1876; remodelled 1884); and various short stories and tales of village life collected under the title *Wolken und Sunn'schein* (1888).

Anzengruber's collected works, with a biography, were published in 10 vols. in 1890 (3rd ed. 1897); his correspondence has been edited by A. Bettelheim (1902). See A. Bettelheim, *L. Anzengruber* (1890); L. Rosner, *Erinnerungen an L. Anzengruber* (1890); H. Sittenberger, *Studien zur Dramaturgie der Gegenwart* (1899); S. Friedmann, *L. Anzengruber* (1902).

ANZIN, a town of northern France, in the department of Nord, on the Scheldt, 1½ m. N.W. of Valenciennes, of which it is a suburb. Pop. (1906) 14,077. Anzin is the centre of important coal-mines of the Valenciennes basin belonging to the Anzin Company, the formation of which dates to 1717. The metallurgical industries of the place are extensive, and include iron and copper founding and the manufacture of steam-engines, machinery, chain-cables and a great variety of heavy iron goods. There are also glass-works and breweries.

AONIA, a district of ancient Boeotia, containing the mountains Helicon and Cithaeron, and thus sacred to the Muses, who are called by Pope the "Aonian maids."

AORIST (from Gr. ἀόριστος, indefinite), the name given in Greek grammar to certain past tenses of verbs (first aorist, second aorist).

AOSTA (anc. *Augusta Praetoria Salassorum*), a town and episcopal see of Piedmont, Italy, in the province of Turin, 80 m. N.N.W. by rail of the town of Turin, and 48 m. direct, situated 1910 ft. above sea-level, at the confluence of the Buthier and the Dora Baltea, and at the junction of the Great and Little St Bernard routes. Pop. (1901) 7875. The cathedral, reconstructed in the 11th century (to which one of its campanili and some architectural details belong), was much altered in the 14th and 17th; it has a rich treasury including an ivory diptych of 406 with a representation of Honorius. The church of St Ours, founded in 425, and rebuilt in the 12th century, has good cloisters (1133); the 15th-century priory is picturesque. The castle of Bramafam (11th century) is interesting. Cretinism is common in the district.

After the fall of the Roman empire the valley of Aosta fell into the hands of the Burgundian kings; and after many changes of masters, it came under the rule of Count Humbert I. of Savoy (Biancamano) in 1032. The privilege of holding the assembly of the states-general was granted to the inhabitants in 1189. An executive council was nominated from this body in 1536, and continued to exist until 1802. After the restoration of the rule of Savoy it was reconstituted and formally recognized by Charles Albert, king of Sardinia, at the birth of his grandson Prince Amedeo, who was created duke of Aosta. Aosta was the birthplace of Anselm. For ancient remains see Augusta Praetoria Salassorum.

APACHE (apparently from the Zuni name, = "enemy," given to the Navaho Indians), a tribe of North American Indians of Athapascan stock. The Apaches formerly ranged over south-eastern Arizona and south-western Mexico. The chief divisions of the Apaches were the Arivaipa, Chiricahua, Coyotero, Faraone Gileno, Llanero, Mescalero, Mimbreno, Mogollon, Naisha, Tchikun and Tchishi. They were a powerful and warlike tribe, constantly at enmity with the whites. The final surrender of the tribe took place in 1886, when the Chiricahuas, the division involved, were deported to Florida and Alabama, where they underwent military imprisonment. The Apaches are now in reservations in Arizona, New Mexico and Oklahoma, and number between 5000 and 6000.

For details see *Handbook of American Indians*, ed. F. W. Hodge, (Washington, 1907); also Indians, North American.

APALACHEE (apparently a Choctaw name, = "people on the other side"), a tribe of North American Indians of Muskhogean stock. They have been known since the 16th century, and formerly ranged the country around Apalachee Bay, Florida. About 1600 the Spanish Franciscans founded a successful mission among them, but early in the 18th century the tribe suffered defeat at the hands of the British, the mission churches were burnt, the priests killed, and the tribe practically annihilated, more than one thousand of them being sold as slaves.

See *Handbook of American Indians*, ed. F. W. Hodge (Washington, 1907).

APALACHICOLA, a city, port of entry, and the county-seat of Franklin county, Florida, U.S.A., in the N.W. part of the state, on Apalachicola Bay and at the mouth of the Apalachicola river. Pop. (1890) 2727; (1900) 3077, of whom 1589 were of negro descent; (1905, state census) 3244. It is served by the Apalachicola Northern railway (to Chattahoochee, Florida), and by river steamers which afford connexion with railways at Carrabelle about 25 m. distant, at Chatahoochee (or River Junction), and at Columbus and Bainbridge, Georgia, and by ocean-going vessels with American and foreign ports. The city has a monument (1900) to John Gorrie (1803–1855), a physician who discovered the cold-air process of refrigeration in 1849 (and patented an ice-machine in 1850), as the result of experiments to lower the temperatures of fever patients. The bay is well protected by St Vincent, Flag, Sand, and St George's islands; and the shipping of lumber, naval stores and cotton, which reach the city by way of the river, forms the principal industry. Before the development of railways in the Gulf states, Apalachicola was one of the principal centres of trade in the southern states, ranking third among the Gulf ports in 1835. In 1907 the Federal government projected a channel across the harbour bar 100 ft. wide and 10 ft. deep and a channel 150 ft. wide and 18 ft. deep for Link Channel and the West Pass. In 1907 the exports were valued at $317,838; the imports were insignificant. The value of the total domestic and foreign commerce of the port for the year ending on the 30th of June 1907 was estimated at $1,240,000 (76,000 tons). The fishery products, including oysters, tarpon, sturgeon, caviare and sponges, are also important.

APAMEA, the name of several towns in western Asia.

1. A treasure city and stud-depot of the Seleucid kings in the valley of the Orontes. It was so named by Seleucus Nicator, after Apama, his wife. Destroyed by Chosroes in the 7th century A.D., it was partially rebuilt and known as *Fāmia* by the Arabs; and overthrown by an earthquake in 1152. It kept its importance down to the time of the Crusades. The acropolis hill is now occupied by the ruins of Kalat el-Mudik.

See R. F. Burton and T. Drake, *Unexplored Syria*; E. Sachau, *Reise in Syrien*, 1883.

2. A city in Phrygia, founded by Antiochus Soter (from whose mother, Apama, it received its name), near, but on lower ground than, Celaenae. It was situated where the Marsyas leaves the hills to join the Maeander, and it became a seat of Seleucid power, and a centre of Graeco-Roman and Graeco-Hebrew civilization and commerce. There Antiochus the Great collected the army with which he met the Romans at Magnesia, and there two years later the treaty between Rome and the Seleucid realm was signed. After Antiochus' departure for the East, Apamea lapsed to the Pergamenian kingdom and thence to Rome in 133, but it was resold to Mithradates V., who held it till 120. After the Mithradatic wars it became and remained a great centre for trade, largely carried on by resident Italians and by Jews. In 84 Sulla made it the seat of a *conventus* of the Asian province, and it long claimed primacy among Phrygian cities. Its decline dates from the local disorganization of the empire in the 3rd century A.D.; and though a bishopric, it was not an important military or commercial centre in Byzantine times. The Turks took it first in 1070, and from the 13th century onwards it was always in Moslem hands. For a long period it was one of the greatest cities of Asia Minor, commanding the Maeander road; but when the trade routes were diverted to Constantinople it rapidly declined, and its ruin was completed by an earthquake. A Jewish tradition, possibly arising from a name *Cibotus* (ark), which the town bore, identified a neighbouring mountain with Ararat. The famous "Noah" coins of the emperor Philip commemorate this belief. The site is now partly occupied by *Dineir* (*q.v.*, sometimes locally known also as *Geiklar*, "the gazelles," perhaps from a tradition of the Persian hunting-park, seen by Xenophon at Celaenae), which is connected with Smyrna by railway; there are considerable remains, including a great number of important Graeco-Roman inscriptions.

See W. M. Ramsay, *Cities and Bishoprics of Phrygia*, vol. ii.; G. Weber, *Dineir-Celènes* (1892); D. G. Hogarth in *Journ. Hell. Studies* (1888); O. Hirschfeld in *Trans. Berlin Academy* (1875).

(D. G. H.)

3. A town on the left bank of the Euphrates, at the end of a bridge of boats (*zeugma*); the Til-Barsip of the Assyrian inscriptions, now Birejik (*q.v.*).

4. The earlier Myrlea of Bithynia, now Mudania (*q.v.*), the port of Brusa. The name was given it by Prusias I., who rebuilt it.

5. A city mentioned by Stephanus and Pliny as situated near the Tigris, the identification of which is still uncertain.

6. A Greek city in Parthia, near Rhagae.

APARRI, a town of the province of Cagayán, Luzon, Philippine Islands, on the Grande de Cagayán river near its mouth, about 55 m. N. of Tuguegarao, the capital. Pop. (1903) 18,252. The valley is one of the largest tobacco-producing sections in the Philippines; and the town has a considerable coastwise trade. Here, too, is a meteorological station.

APATITE, a widely distributed mineral, which, when found in large masses, is of considerable economic value as a phosphate. As a mineral species it was first recognized by A. G. Werner in 1786 and named by him from the Greek ἀπατᾶν, to deceive, because it had previously been mistaken for other minerals, such as beryl, tourmaline, chrysolite, amethyst, &c. Although long known to consist mainly of calcium phosphate, it was not until 1827 that G. Rose found that fluorine or chlorine is an essential constituent. Two chemical varieties of apatite are to be distinguished, namely a fluor-apatite, $(CaF)\,Ca_4P_3O_{12}$, and a chlor-apatite, $(CaCl)\,Ca_4P_3O_{12}$: the former, which is much the commoner, contains 42·3% of phosphorus pentoxide (P_2O_5) and 3·8% fluorine, and the latter 4·10% P_2O_5 and 6·8% chlorine. Fluorine and chlorine replace each other in indefinite proportions, and they may also be in part replaced by hydroxyl, so that the general formula becomes $[Ca\,(F, Cl, OH)]\,Ca_4P_3O_{12}$, in which the univalent group $Ca(F, Cl, OH)$ takes the place of one hydrogen atom in orthophosphoric acid H_3PO_4. The formula is sometimes written in the form $3Ca_3(PO_4)_2+CaF_2$. Mangan-apatite is a variety in which calcium is largely replaced by manganese (up to 10% MnO). Cerium, didymium, yttrium, &c., oxides may also sometimes be present, in amounts up to 5%.

Apatite frequently occurs as beautifully developed crystals, sometimes a foot or more in length, belonging to that division of the hexagonal system in which there is pyramidal hemihedrism. In this type of symmetry, of which apatite is the best example, there is only one plane of symmetry, which is perpendicular to the hexad axis. The arrangement of the pyramidal faces *n* and *u* in fig. 2 show the hemihedral character and absence of the full number of planes and axes of symmetry. Fig. 2 represents a highly modified crystal from St Gotthard; a more common form is shown in fig. 1, which is bounded by the hexagonal prism *m*, hexagonal bipyramid *x* and basal pinacoid *c*.

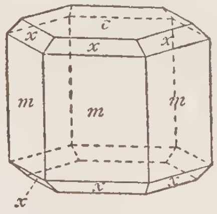


FIG. 1.

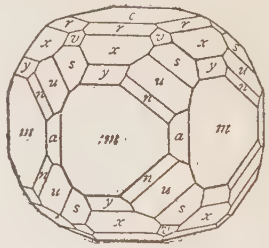


FIG. 2.

In its general appearance, apatite exhibits wide variations. Crystals may be colourless and transparent or white and opaque, but are often coloured, usually some shade of green or brown, occasionally violet, sky-blue, yellow, &c. The lustre is vitreous, inclining to sub-resinous. There is an imperfect cleavage parallel to the basal pinacoid, and the fracture is conchoidal. Hardness 5, specific gravity 3·2.

Yellowish-green prismatic crystals from Jumilla in Murcia in Spain have long been known under the name asparagus-stone. Lazurapatite is a sky-blue variety found as crystals with lapis-lazuli in Siberia; and moroxite is the name given to dull greenish-blue crystals from Norway and Canada. Francolite, from Wheal Franco, near Tavistock in Devonshire, and also from several Cornish mines, occurs as crystallized stalactitic masses. In addition to these crystallized varieties, there are massive varieties, fibrous, concretionary, stalactitic, or earthy in form, which are included together under the name phosphorite (*q.v.*), and it is these massive varieties, together with various rock-phosphates (phosphatic nodules, coprolites, guano, &c.) which are of such great economic importance: crystallized apatite is mined for phosphates only in Norway and Canada.

With regard to its mode of occurrence, apatite is found under a variety of conditions. In igneous rocks of all kinds it is invariably present in small amounts as minute acicular crystals, and was one of the first constituents of the rock to crystallize out from the magma. The extensive deposits of chlor-apatite near Kragerö and Bamle, near Brevik, in southern Norway, are in connexion with gabbro, the felspar of which has been altered, by emanations containing chlorine, to scapolite, and titanium minerals have been developed. The apatite occurring in connexion with granite and veins of tin-stone is, on the other hand, a fluor-apatite, and, like the other fluorine-bearing minerals characteristic of tin-veins, doubtless owes its origin to the emanations of tin fluoride which gave rise to the tin-ore. Special mention may be here made of the beautiful violet crystals of fluor-apatite which occur in the veins of tin-ore in the Erzgebirge, and of the brilliant bluish-green crystals encrusting cavities in the granite of Luxullian in Cornwall. Another common mode of occurrence of apatite is in metamorphic crystalline rocks, especially in crystalline limestones: in eastern Canada extensive beds of apatite occur in the limestones associated with the Laurentian gneisses. Still another mode of occurrence is presented by beautifully developed and transparent crystals found with crystals of felspar and quartz lining the crevices in the gneiss of the Alps. Crystallized apatite is also occasionally found in metalliferous veins, other than those of tin, and in beds of iron ore; whilst if the massive varieties (phosphorite) be considered many other modes of occurrence might be cited. (L. J. S.)

APATURIA (Ἀπατούρια), an ancient Greek festival held annually by all the Ionian towns except Ephesus and Colophon (Herodotus i. 147). At Athens it took place in the month of Pyanepsion (October to November), and lasted three days, on which occasion the various phratries (*i.e.* clans) of Attica met to discuss their affairs. The name is a slightly modified form of *ἀπατόρια = ἁμαπατόρια, ὁμοπατόρια*, the festival of "common relationship." The ancient etymology associated it with *ἀπάτη* (deceit), a legend existing that the festival originated in 1100 B.C. in commemoration of a single combat between a certain Melanthus, representing King Thymoetes of Attica, and King Xanthus of Boeotia, in which Melanthus successfully threw his adversary off his guard by crying that a man in a black goat's skin (identified with Dionysus) was helping him (Schol. Aristophanes, *Acharnians*, 146). On the first day of the festival, called Dorpia or Dorpeia, banquets were held towards evening at the meeting-place of the phratries or in the private houses of members. On the second, Anarrhysis (from *ἀναρρύειν*, to draw back the victim's head), a sacrifice of oxen was offered at the public cost to Zeus Phratrius and Athena. On the third day, Cureotis (*κουρεῶτις*), children born since the last festival were presented by their fathers or guardians to the assembled phratores, and, after an oath had been taken as to their legitimacy and the sacrifice of a goat or a sheep, their names were inscribed in the register. The name *κουρεῶτις* is derived either from *κοῦρος*, that is, the day of the young, or less probably from *κείρω*, because on this occasion young people cut their hair and offered it to the gods. The victim was called *μεῖον*. On this day also it was the custom for boys still at school to declaim pieces of poetry, and to receive prizes (Plato, *Timaeus*, 21 B). According to Hesychius these three days of the festival were followed by a fourth, called *ἐπίβδα*, but this is merely a general term for the day after any festival.

APE (Old Eng. *apa*; Dutch *aap*; Old Ger. *affo*; Welsh *epa*; Old Bohemian *op*; a word of uncertain origin, possibly an imitation of the animal's chatter), the generic English name, till the 16th century, for animals of the monkey tribe, and still used specifically for the tailless, manlike representatives of the order Primates (*q.v.*). The word is now generally a synonym for "monkey," but the common verb for both (as transferred figuratively to human beings) is "to ape," *i.e.* to imitate.

APELDOORN, a town in the province of Gelderland, Holland, and a junction station 26½ m. by rail W. of Amersfoort. It is connected by canal north and south with Zwolle and Zutphen respectively. Pop. (1900) 25,834. The neighbourhood of Apeldoorn is very picturesque and well wooded. The Protestant church was restored after a fire in 1890. Close by is the favourite country-seat of the royal family of Holland called the Loo. It was originally a hunting-lodge of the dukes of Gelderland, but in its present form dates chiefly from the time of the Stadtholder William III., king of England. Apeldoorn possesses large paper-mills.

APELLA, the official title of the popular assembly at Sparta, corresponding to the ecclesia in most other Greek states. Every full citizen who had completed his thirtieth year was entitled to attend the meetings, which, according to Lycurgus's ordinance, must be held at the time of each full moon within the boundaries of Sparta. They had in all probability taken place originally in the Agora, but were later transferred to the neighbouring building known as the Skias (Paus. iii. 12. 10). The presiding officers were at first the kings, but in historical times the ephors, and the voting was conducted by shouts; if the president was doubtful as to the majority of voices, a division was taken and the votes were counted. Lycurgus had ordained that the apella must simply accept or reject the proposals submitted to it, and though this regulation fell into neglect, it was practically restored by the law of Theopompus and Polydorus which empowered the kings and elders to set aside any "crooked" decision of the people (Plut. *Lycurg.* 6). In later times, too, the actual debate was almost, if not wholly, confined to the kings, elders, ephors and perhaps the other magistrates. The apella voted on peace and war, treaties and foreign policy in general: it decided which of the kings should conduct a campaign and settled questions of disputed succession to the throne: it elected elders, ephors and other magistrates, emancipated helots and perhaps voted on legal proposals. There is a single reference (Xen. *Hell.* iii. 3. 8) to a "small assembly" (*ἡ μικρὰ καλουμένη ἐκκλησία*) at Sparta, but nothing is known as to its nature or competence. The term apella does not occur in extant Spartan inscriptions, though two decrees of Gythium belonging to the Roman period refer to the *μεγάλαι ἀπέλλαι* (Le Bas-Foucart, *Voyage archéologique*, ii., Nos. 242*a*, 243).

See G. Gilbert, *Constitutional Antiquities of Sparta and Athens* (Eng trans., 1895), pp. 49 ff.; *Studien zur altspartanischen Geschichte* (Göttingen, 1872), pp. 131 ff.; G. F. Schömann, *Antiquities of Greece: The State* (Eng. trans., 1880), pp. 234 ff.; *De ecclesiis Lacedaemoniorum* (Griefswald, 1836) [=*Opusc. academ.* i. pp. 87 ff.]; C. O. Müller, *History and Antiquities of the Doric Race* (Eng. trans., 2nd ed. 1839), book iii. ch. 5, §§ 8-10; G. Busolt, *Die griechischen Staats- und Rechtsaltertümer*, 1887 (in Iwan Müller's *Handbuch der klassischen Altertumswissenschaft*, iv. 1), § 90; *Griechische Geschichte* (2nd ed.), i. p. 552 ff. (M. N. T.)

APELLES, probably the greatest painter of antiquity. He lived from the time of Philip of Macedon till after the death of Alexander. He was of Ionian origin, but after he had attained some celebrity he became a student at the celebrated school of Sicyon, where he worked under Pamphilus. He thus combined the Dorian thoroughness with the Ionic grace. Attracted to the court of Philip, he painted him and the young Alexander with such success that he became the recognized court painter of Macedon, and his picture of Alexander holding a thunderbolt ranked with the Alexander with the spear of the sculptor Lysippus. Other works of Apelles had a great reputation in antiquity, such as the portraits of the Macedonians Clitus, Archelaus and Antigonus, the procession of the high priest of Artemis at Ephesus, Artemis amid a chorus of maidens, a great allegorical picture representing Calumny, and the noted painting representing Aphrodite rising out of the sea. Of none of these works have we any copy, unless indeed we may consider a painting of Alexander as Zeus in the house of the Vettii at Pompeii as a reminiscence of his work; but some of the Italian artists of the Renaissance repeated the subjects, in a vain hope of giving some notion of the composition of them.

Few things are more hopeless than the attempt to realize the style of a painter whose works have vanished. But a great wealth of stories, true or invented, clung to Apelles in antiquity; and modern archaeologists have naturally tried to discover what they indicate. We are told, for example, that he attached great value to the drawing of outlines, practising every day. The tale is well known of his visit to Protogenes, and the rivalry of the two masters as to which could draw the finest and steadiest line. The power of drawing such lines is conspicuous in the decoration of red-figured vases of Athens. Apelles is said to have treated his rival with generosity, for he increased the value of his pictures by spreading a report that he meant to buy them and sell them as his own. Apelles allowed the superiority of some of his contemporaries in particular matters: according to Pliny he admired the *dispositio* of Melanthius, *i.e.* the way in which he spaced his figures, and the *mensurae* of Asclepiodorus, who must have been a great master of symmetry and proportion. It was especially in that undefinable quality "grace" that Apelles excelled. He probably used but a small variety of colours, and avoided elaborate perspective: simplicity of design, beauty of line and charm of expression were his chief merits. When the naturalism of some of his works is praised—for example, the hand of his Alexander is said to have stood out from the picture—we must remember that this is the merit always ascribed by ignorant critics to works which they admire. In fact the age of Alexander was one of notable idealism, and probably Apelles succeeded in a marked degree in imparting to his figures a beauty beyond nature.

Apelles was also noted for improvements which he introduced in technique. He had a dark glaze, called by Pliny *atramentum*, which served both to preserve his paintings and to soften their colour. There can be little doubt that he was one of the most bold and progressive of artists. (P. G.)

APELLICON, a wealthy native of Teos, afterwards an Athenian citizen, a famous book collector. He not only spent large sums in the acquisition of his library, but stole original documents from the archives of Athens and other cities of Greece. Being detected, he fled in order to escape punishment, but returned when Athenion (or Aristion), a bitter opponent of the Romans, had made himself tyrant of the city with the aid of Mithradates. Athenion sent him with some troops to Delos, to plunder the treasures of the temple, but he showed little military capacity. He was surprised by the Romans under the command of Orobius (or Orbius), and only saved his life by flight. He died a little later, probably in 84 B.C.

Apellicon's chief pursuit was the collection of rare and important books. He purchased from the family of Neleus of Skepsis in the Troad manuscripts of the works of Aristotle and Theophrastus (including their libraries), which had been given to Neleus by Theophrastus himself, whose pupil Neleus had been. They had been concealed in a cellar to prevent their falling into the hands of the book-collecting princes of Pergamum, and were in a very dilapidated condition. Apellicon filled in the lacunae, and brought out a new, but faulty, edition. In 84 Sulla removed Apellicon's library to Rome (Strabo xiii. p. 609; Plutarch, *Sulla*, 26). Here the MSS. were handed over to the grammarian Tyrannion, who took copies of them, on the basis of which the peripatetic philosopher Andronicus of Rhodes prepared an edition of Aristotle's works. Apellicon's library contained a remarkable old copy of the *Iliad*. He is said to have published a biography of Aristotle, in which the calumnies of other biographers were refuted.

APENNINES (Gr. 'Απέννινος, Lat. *Appenninus*—in both cases used in the singular), a range of mountains traversing the entire peninsula of Italy, and forming, as it were, the backbone of the country. The name is probably derived from the Celtic *pen*, a mountain top: it originally belonged to the northern portion of the chain, from the Maritime Alps to Ancona; and Polybius is probably the first writer who applied it to the whole chain, making, indeed, no distinction between the Apennines and the Maritime Alps, and extending the former name as far as Marseilles. Classical authors do not differentiate the various parts of the chain, but use the name as a general name for the whole. The total length is some 800 m. and the maximum width 70 to 80 m.

Divisions.—Modern geographers divide the range into three parts, northern, central and southern.

1. The northern Apennines are generally distinguished (though there is no real solution of continuity) from the Maritime Alps at the Bocchetta dell' Altare, some 5 m. W. of Savona on the high road to Turin.[1] They again are divided into three parts—the Ligurian, Tuscan and Umbrian Apennines. The Ligurian Apennines extend as far as the pass of La Cisa in the upper valley of the Magra (anc. *Macra*) above Spezia; at first they follow the curve of the Gulf of Genoa, and then run east-south-east parallel to the coast. On the north and north-east lie the broad plains of Piedmont and Lombardy, traversed by the Po, the chief tributaries of which from the Ligurian Apennines are the Scrivia (*Olubria*), Trebbia (*Trebia*) and Taro (*Tarus*). The Tanaro (*Tanarus*), though largely fed by tributaries from the Ligurian Apennines, itself rises in the Maritime Alps, while the rivers on the south and south-west of the range are short and unimportant. The south side of the range rises steeply from the sea, leaving practically no coast strip: its slopes are sheltered and therefore fertile and highly cultivated, and the coast towns are favourite winter resorts (see RIVIERA). The highest point (the Monte Bue) reaches 5915 ft. The range is crossed by several railways—the line from Savona to Turin (with a branch at Ceva for Acqui), that from Genoa to Ovada and Acqui, the main lines from Genoa to Novi, the junction for Turin and Milan (both of which[2] pass under the Monte dei Giovi, the ancient Mons Ioventius, by which the ancient Via Postumia ran from Genua to Dertona), and that from Spezia to Parma under the pass of La Cisa.[3] All these traverse the ridge by long tunnels—that on the new line from Genoa to Honco is upwards of 5 m. in length.

The Tuscan Apennines extend from the pass of La Cisa to the sources of the Tiber. The main chain continues to run in an east-south-east direction, but traverses the peninsula, the west coast meanwhile turning almost due south. From the northern slopes many rivers and streams run north and north-north-east into the Po, the Secchia (*Secia*) and Panaro (*Scultenna*) being among the most important, while farther east most of the rivers are tributaries of the Reno (anc. *Rhenus*). Other small streams, *e.g.* the Ronco (*Bedesis*) and Montone (*Utis*), which flow into the sea together east of Ravenna, were also tributaries of the Po; and the Savio (*Sapis*) and the Rubicon seem to be the only streams from this side of the Tuscan Apennines that ran directly into the sea in Roman days. From the south-west side of the main range the Arno (*q.v.*) and Serchio run into the Mediterranean. This section of the Apennines is crossed by two railways, from Pistoia to Bologna and from Florence to Faenza, and by several good high roads, of which the direct road from Florence to Bologna over the Futa pass is of Roman origin; and certain places in it are favourite summer resorts. The highest point of the chain is Monte Cimone (7103 ft.). The so-called Alpi Apuane (the *Apuani* were an ancient people of Liguria), a detached chain south-west of the valley of the Serchio, rise to a maximum height of 6100 ft. They contain the famous marble quarries of Carrara. The greater part of Tuscany, however, is taken up by lower hills, which form no part of the Apennines, being divided from the main chain by the valleys of the Arno, Chiana (*Clanis*) and Paglia (*Pallia*). Towards the west they are rich in minerals and chemicals, which the Apennines proper do not produce.

The Umbrian Apennines extend from the sources of the Tiber to (or perhaps rather beyond) the pass of Scheggia near Cagli, where the ancient Via Flaminia crosses the range. The highest point is the Monte Nerone (5010 ft.). The chief river is the Tiber itself: the others, among which the Foglia (*Pisaurus*), Metauro

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[1] The ancient Via Aemilia, built in 109 B.C., led over this pass, but originally turned east to Dertona (mod. *Tortona*).

[2] There are two separate lines from Sampierdarena to Ronco.

[3] This pass was also traversed by a nameless Roman road.

(*Metaurus*) and Esino[1] may be mentioned, run north-east into the Adriatic, which is some 30 m. from the highest points of the chain. This portion of the range is crossed near its southern termination by a railway from Foligno to Ancona (which at Fabriano has a branch to Macerata and Porto Civitanova, on the Adriatic coast railway), which may perhaps be conveniently regarded as its boundary.[2] By some geographers, indeed, it is treated as a part of the central Apennines.

2. The central Apennines are the most extensive portion of the chain, and stretch as far as the valley of the Sangro (*Sangrus*). To the north are the Monti Sibillini, the highest point of which is the Monte Vettore (8128 ft.). Farther south three parallel chains may be traced, the westernmost of which (the Monti Sabini) culminates to the south in the Monte Viglio (7075 ft.), the central chain in the Monte Terminillo (7260 ft.), and farther south in the Monte Velino (8160 ft.), and the eastern in the Gran Sasso d'Italia (9560 ft.), the highest summit of the Apennines, and the Maiella group (Monte Amaro, 9170 ft.). Between the western and central ranges are the plain of Rieti, the valley of the Salto (*Himella*), and the Lago Fucino; while between the central and eastern ranges are the valleys of Aquila and Sulmona. The chief rivers on the west are the Nera (*Nar*), with its tributaries the Velino (*Velinus*) and Salto, and the Anio, both of which fall into the Tiber. On the east there is at first a succession of small rivers which flow into the Adriatic, from which the highest points of the chain are some 25 m. distant, such as the Potenza (*Flosis*), Chienti (*Cluentus*), Tenna (*Tinna*), Tronto (*Truentus*), Tordino (*Helvinus*), Vomano (*Vomanus*), &c. The Pescara (*Aternus*), which receives the Aterno from the north-west and the Gizio from the south-east, is more important; and so is the Sangro.

The central Apennines are crossed by the railway from Rome to Castelammare Adriatico via Avezzano and Sulmona: the railway from Orte to Terni (and thence to Foligno) follows the Nera valley; while from Terni a line ascends to the plain of Rieti, and thence crosses the central chain to Aquila, whence it follows the valley of the Aterno to Sulmona. In ancient times the Via Salaria, Via Caecilia and Via Valeria-Claudia all ran from Rome to the Adriatic coast. The volcanic mountains of the province of Rome are separated from the Apennines by the Tiber valley, and the Monti Lepini, or Volscian mountains, by the valleys of the Sacco and Liri.

3. In the southern Apennines, to the south of the Sangro valley, the three parallel chains are broken up into smaller groups; among them may be named the Matese, the highest point of which is the Monte Miletto (6725 ft.). The chief rivers on the south-west are the Liri or Garigliano (anc. *Liris*), with its tributary the Sacco (*Trerus*), the Volturno (*Volturnus*), Sebeto (*Sabatus*), Sarno (*Sarnus*), on the north the Trigno (*Trinius*), Biferno (*Tifernus*), and Fortore (*Frento*). The promontory of Monte Gargano, on the east, is completely isolated, and so are the volcanic groups near Naples. The district is traversed from north-west to south-east by the railway from Sulmona to Benevento and on to Avellino, and from south-west to north-east by the railways from Caianello via Isernia to Campobasso and Termoli, from Caserta to Benevento and Foggia, and from Nocera and Avellino to Rocchetta S. Antonio, the junction for Foggia, Spinazzola (for Barletta, Bari, and Taranto) and Potenza. Roman roads followed the same lines as the railways: the Via Appia ran from Capua to Benevento, whence the older road went to Venosa and Taranto and so to Brindisi. while the Via Traiana ran nearly to Foggia and thence to Bari.

The valley of the Ofanto (*Aufidus*), which runs into the Adriatic close to Barletta, marks the northern termination of the first range of the Lucanian Apennines (now Basilicata), which runs from east to west, while south of the valleys of the Sele (on the west) and Basiento (on the east)—which form the line followed by the railway from Battipaglia via Potenza to Metaponto—the second range begins to run due north and south as far as the plain of Sibari (*Sybaris*). The highest point is the Monte Pollino (7325 ft.). The chief rivers are the Sele (*Silarus*)—joined by the Negro (*Tanager*) and Calore (*Calor*)—on the west, and the Bradano (*Bradanus*), Basiento (*Casuentus*), Agri (*Aciris*), Sinni (*Siris*) on the east, which flow into the gulf of Taranto; to the south of the last-named river there are only unimportant streams flowing into the sea east and west, inasmuch as here the width of the peninsula diminishes to some 40 m. The railway running south from Sicignano to Lagonegro, ascending the valley of the Negro, is planned to extend to Cosenza, along the line followed by the ancient Via Popilia, which beyond Cosenza reached the west coast at Terina and thence followed it to Reggio. The Via Herculia, a branch of the Via Traiana, ran from Aequum Tuticum to the ancient Nerulum. At the narrowest point the plain of Sibari, through which the rivers Coscile (*Sybaris*) and Crati (*Crathis*) flow to the sea, occurs on the east coast, extending halfway across the peninsula. Here the limestone Apennines proper cease and the granite mountains of Calabria (anc. *Bruttii*) begin. The first group extends as far as the isthmus formed by the gulfs of S. Eufemia and Squillace; it is known as the Sila, and the highest point reached is 6330 ft. (the Botte Donato). The forests which covered it in ancient times supplied the Greeks and Sicilians with timber for shipbuilding. The railway from S. Eufemia to Catanzaro and Catanzaro Marina crosses the isthmus, and an ancient road may have run from Squillace to Monteleone. The second group extends to the south end of the Italian peninsula, culminating in the Aspromonte (6420 ft.) to the east of Reggio di Calabria. In both groups the rivers are quite unimportant.

Character.—The Apennines are to some extent clothed with forests, though these were probably more extensive in classical times (Pliny mentions especially pine, oak and beech woods, *Hist. Nat.* xvi. 177); they have indeed been greatly reduced in comparatively modern times by indiscriminate timber-felling, and though serious attempts at reafforestation have been made by the government, much remains to be done. They also furnish considerable summer pastures, especially in the Abruzzi: Pliny (*Hist. Nat.* xi. 240) praises the cheese of the Apennines. In the forests wolves were frequent, and still are found, the flocks being protected against them by large sheep-dogs; bears, however, which were known in Roman times, have almost entirely disappeared. Nor are the wild goats called *rotae*, spoken of by Varro (*R. R.* II. i. 5), which may have been either chamois or steinbock, to be found. Brigandage appears to have been prevalent in Roman times in the remoter parts of the Apennines, as it was until recently: an inscription found near the Furlo pass was set up in A.D. 246 by an *evocatus Augusti* (a member of a picked corps) on special police duty with a detachment of twenty men from the Ravenna fleet (G. Henzen in *Römische Mitteilungen*, 1887, 14). Snow lies on the highest peaks of the Apennines for almost the whole year. The range produces no minerals, but there are a considerable number of good mineral springs, some of which are thermal (such as Bagni di Lucca, Monte Catini, Monsummano, Porretta, Telese, &c.), while others are cool (such as Nocera, Sangemini, Cinciano, &c.), the water of which is both drunk on the spot and sold as table water elsewhere. (T. As.)

Geology.—The Apennines are the continuation of the Alpine chain, but the individual zones of the Alps cannot be traced into the Apennines. The zone of the Briançonnais (see ALPS) may be followed as far as the Gulf of Genoa, but scarcely beyond, unless it is represented by the Trias and older beds of the Apuan Alps. The inner zone of crystalline and schistose rocks which forms the main chain of the Alps, is absent in the Apennines except towards the southern end. The Apennines, indeed, consist almost entirely of Mesozoic and Tertiary beds, like the outer zones of the Alps. Remnants of a former inner zone of more ancient rocks may be seen in the Apuan Alps, in the islands off the Tuscan coast, in the Catena Metallifera, Cape Circeo and the island of Zannone, as well as in the Calabrian peninsula. These remnants lie at a comparatively low level, and excepting the Apuan Alps and the Calabrian peninsula they do not now form any part of the Apennine chain. But that in Tertiary times there was a high interior zone of crystalline rocks is indicated by the character of the Eocene beds in the southern Apennines. These are formed to a large extent of thick conglomerates which are full of pebbles and boulders of granite and schist. Many of the boulders are of considerable size and they are often still angular. There is now no crystalline region from which they could reach their present position; and this and other considerations have led the followers of E. Suess to conclude that even in Tertiary times a large land mass consisting of ancient rocks occupied the space which is now covered by the southern portion of the Tyrrhenian Sea. This old land mass has been called Tyrrhenis, and probably extended from Sicily into Latium and as far west as Sardinia. On the Italian border of this land there was raised a mountain chain with an inner crystalline zone and an outer zone of Mesozoic and Tertiary beds. Subsequent faulting has caused the subsidence of the greater part of Tyrrhenis, including nearly the whole of the inner zone of the mountain chain, and has left only the outer zones standing as the present Apennines.

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[1] This river (anc. *Aesis*) was the boundary of Italy proper in the 3rd and 2nd centuries B.C.

[2] The Monte Conero, to the south of Ancona, was originally an island of the Pliocene sea.

Be this as it may, the Apennines, excepting in Calabria, are formed chiefly of Triassic, Jurassic, Cretaceous, Eocene and Miocene beds. In the south the deposits, from the Trias to the middle Eocene, consist mainly of limestones, and were laid down, with a few slight interruptions, upon a quietly subsiding sea-floor. In the later part of the Eocene period began the folding which gave rise to the existing chain. The sea grew shallow, the deposits became conglomeratic and shaly, volcanic eruptions began, and the present folds of the Apennines were initiated. The folding and consequent elevation went on until the close of the Miocene period when a considerable subsidence took place and the Pliocene sea overspread the lower portions of the range. Subsequent elevation, without folding, has raised these Pliocene deposits to a considerable height—in some cases over 3000 ft. and they now lie almost undisturbed upon the older folded beds. This last elevation led to the formation of numerous lakes which are now filled up by Pleistocene deposits. Both volcanic eruptions and movements of elevation and depression continue to the present day on the shores of the Tyrrhenian Sea. In the northern Apennines the elevation of the sea floor appears to have begun at an earlier period, for the Upper Cretaceous of that part of the chain consists largely of sandstones and conglomerates. In Calabria the chain consists chiefly of crystalline and schistose rocks; it is the Mesozoic and Tertiary zone which has here been sunk beneath the sea. Similar rocks are found beneath the Trias farther north, in some of the valleys of Basilicata. Glaciers no longer exist in the Apennines, but Post-Pliocene moraines have been observed in Basilicata.

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APENRADE, a town of Germany in the Prussian province of Schleswig, beautifully situated on the Apenrade Fjord, an arm of the Little Belt, 38 m. N. of the town of Schleswig. Pop. (1900) 5952. It is connected by a branch line with the main railway of Schleswig, and possesses a good harbour, which affords shelter for a large carrying trade. Fishing, shipbuilding and various small factories provide occupation for the population. The town is a bathing resort, as is Elisenlund close by.

APERTURE (from Lat. *aperire*, to open), an opening. In optics, it is that portion of the diameter of an object-glass or mirror through which light can pass free from obstruction. It is equal to the actual diameter of the cylinder of rays admitted by a telescope.

APEX, the Latin word (pl. *apices*) for the top, tip or peak of anything. A diminutive "apiculus" is used in botany.

APHANITE, a name given (from the Gr. ἀφανής, invisible) to certain dark-coloured igneous rocks which are so fine-grained that their component minerals are not detected by the unaided eye. They consist essentially of plagioclase felspar, with hornblende or augite, and may contain also biotite, quartz and a limited amount of orthoclase. Although a few authorities still recognize the aphanites as a distinct class, most systematic petrologists, at the present time, have discarded it, and regard these rocks as merely structural facies of other species. Those which contain hornblende are uniform, fine-grained diorites, vogesites, &c., while when pyroxene predominates they are ascribed to the dolerites, quartz-dolerites, &c. Hence, any rock which is compact, crystalline and fine grained, is frequently said to be *aphanitic*, without implying exactly to which of the principal rock groups it really belongs.

APHASIA[1] (from Gr. α, privative, and φάσις, speech), a term which means literally inability to speak, and is used to denote various defects in the comprehension and expression of both spoken and written language which result from lesions of the brain. Aphasic disorders may be classed in two groups:—first, receptive or sensory aphasia, which comprises (*a*) inability to understand spoken language (auditory aphasia), and (*b*) inability to read (visual aphasia, or *alexia*); second, emissive or motor aphasia, under which category are included (*a*) inability to speak (motor vocal aphasia, or *aphemia*), and (*b*) inability to write (motor graphic aphasia, or *agraphia*). It has been shown that each of these defects is produced by destruction of a special region of the cortex of the brain. These regions, which are termed the speech centres, are, in right-handed people, situated in the left cerebral hemisphere; this is the reason why aphasia is so commonly associated with paralysis of the right side of the body.

A study of the acquisition of the faculty of speech throws light upon the education of the speech centres, and helps to elucidate their physiological interaction and the phenomena of aphasia. The auditory speech centre is the first to show signs of functional activity, for within a few months of birth the child begins to *understand* spoken language. Some months later the motor vocal speech centre begins to functionate. The memories of the auditory word images which are stored up in the auditory speech centre play a most important part in the process of learning to speak. The child born deaf grows up mute. The visual speech centre comes into activity when the child is taught to read. Again, when he learns to write and thus begins to educate his graphic centre, he is constantly calling upon his visual speech centre for the visual images of the words he wishes to produce. From these remarks it will be seen that there is a very intimate association between the auditory speech centre and the motor vocal speech centre, also between the visual speech centre and the graphic centre.

Auditory Aphasia.—The auditory speech centre is situated in the posterior part of the first and second temporo-sphenoidal convolutions on the left side of the brain. Destruction of this centre causes "auditory aphasia." Hearing is unimpaired but spoken language is quite unintelligible. The subject of auditory aphasia may be compared to an individual who is listening to a foreign language of which he does not understand a word. Word deafness, a term often used as synonymous with auditory aphasia, is misleading and should be abandoned. Auditory aphasia commonly interferes with vocal expression, for the majority of people when they speak do so by recalling the auditory memories of words stored up in the auditory speech centre. *Amnesia verbalis* is employed to designate failure to call up in the memory the images of words which are needed for purposes of vocal expression or silent thought.

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[1] In 1906 Pierre Marie of Paris expressed views (*La Semaine medicale*, May 23 and October 17, and elsewhere) upon the question of aphasia which have given rise to much animated controversy, since they are in many respects at complete variance with the classical conception which has been represented in the present article. Marie holds that Broca's convolution plays no special rôle in the function of speech. He admits that a lesion in the region of the lenticular nucleus is followed by inability to speak, but this defect is, in his opinion, to be regarded as an anarthria. He further admits the production of sensory aphasia—the aphasia of Wernicke, as he prefers to call it after its discoverer—by lesions which destroy the angular and supramarginal gyri, and the upper two temporo-sphenoidal convolutions, but he regards the essential foundation of sensory aphasia as a diminution of intelligence. There are, in his opinion, no sensory images of language. Motor aphasia is, he believes, nothing more than a combination of sensory aphasia and anarthria. These conclusions have been vigorously attacked, more especially by Dejerine of Paris (*La Presse medicale*, July 1906, and elsewhere).

Visual Aphasia or Alexia.—The visual speech centre, which is located in the left angular gyrus, is connected with the two centres for vision which are situated one in either occipital lobe. Destruction of the visual speech centre produces visual aphasia or alexia. Word blindness, sometimes used as the equivalent of visual aphasia, is, like word deafness, a misleading term. The individual is not blind, he sees the words and letters perfectly, but they appear to him as unintelligible cyphers. When the visual speech centre is destroyed, the memories of the visual images of words are obliterated and interference with writing, a consequence of *amnesia verbalis*, results. On the other hand, when the lesion is situated deeply in the occipital lobe, and does not implicate the cortex, but merely cuts off the connexions of the angular gyrus with both visual centres, agraphia is not produced, for the visual word centre and its connexion with the graphic centre are still intact (pure, or sub-cortical word blindness).

Motor Vocal Aphasia or Aphemia.—The centre for motor vocal speech is situated in the posterior part of the third left frontal convolution and extends on to the foot of the left ascending frontal convolution (Broca's convolution). Complete destruction of this region produces loss of speech, although it often happens that a few words, such as "yes" and "no," and, it may be, emotional exclamations such as "Oh! dear!" and the like are retained. The utterance of unintelligible sounds is still possible, however, and there is neither defective voice production (*aphonia*) nor paralysis of the mechanism of articulation. The individual can recall the auditory and visual images of the words which he wishes to use, but his memory for the complicated, co-ordinated movements which he acquired in the process of learning to speak, and which are necessary for vocal expression, has been blotted out. In the great majority of cases of motor vocal aphasia there is associated agraphia, a circumstance which is perhaps to be accounted for by the proximity of the graphic centre. When the lesion is situated below the cortex of Broca's convolution but destroys the fibres which pass from it towards the internal capsule, agraphia is not produced (sub-cortical or pure motor vocal aphasia). Destruction of the auditory speech centre is, as we have seen, commonly accompanied by more or less interference with vocal speech, a consequence of *amnesia verbalis*.

Agraphia.—Discussion still rages as to the presence of a special writing centre. Those who favour the separate existence of a graphic centre locate it in the second left frontal convolution. It may be that the want of unanimity as to the graphic centre is to be explained by an anatomical relationship so close between the graphic centre and that for the fine movement of the hand that a lesion in this situation which produces agraphia must at the same time cause a paralysis of the hand. Destruction of the visual speech centre by obliterating the visual memories of words (*amnesia verbalis*) produces agraphia. Further, several instances are on record in which agraphia has followed destruction of the commissure between the visual speech centre and the graphic centre. As already mentioned, agraphia is very often associated with motor vocal aphasia.

A number of aphasic defects are met with in addition to those already mentioned. Thus *paraphasia* is a condition in which the patient makes use of words other than those he intends. He may mix up his words so that his conversation is quite unintelligible. In the most pronounced forms he gabbles away, employing unrecognizable sounds in place of words (*jargon and gibberish aphasia*). *Paragraphia* is a similar defect which occurs in writing. Both paraphasia and paragraphia may be produced by partial lesions of the sensory speech centres or of the commissures which connect these with the motor centres. *Object blindness* (syn. mind-blindness) refers to an inability to recognize an object or its uses by the aid of sight alone. The probable explanation would seem to be that the ordinary centre for vision has been isolated from the other sensory centres with which it is connected. Not uncommonly there is associated visual aphasia. *Optic aphasia* was introduced to designate a somewhat similar state in which, although the uses of an object are recognized, the patient cannot name it at sight, yet, if it is of such a nature that it appeals directly to one of the other senses, he may at once be able to name it. *Tactile aphasia* is a rare defect in which there exists an inability to recognize an object by touch alone although the qualities which, under normal circumstances, suffice for its detection can be accurately described. *Amusia*, or loss of the musical faculty, may occur in association with or independent of aphasia. There is reason for believing that special receptive and emissive centres exist for the musical sense exactly analogous to those for speech.

The speech centres are all supplied by the left middle cerebral artery. When this artery is blocked close to its origin by an *embolus* or *thrombus*, total aphasia results. It may be, however, that only one of the smaller branches of the artery is obstructed, and, according to the region of the brain to which this branch is distributed, one or more of the speech centres may be destroyed. Occlusion of the left posterior cerebral artery causes extensive softening of the occipital lobe and produces pure word blindness. Further, a tumour, abscess, haemorrhage or meningitis may be so situated as to damage or destroy the individual speech centres or their connecting commissures. The amount of recovery to be expected in any given case depends upon the nature, situation and extent of the lesion, and upon the age of the patient. Even after complete destruction of the speech centres, perfect recovery may take place, for the centres in the right hemisphere of the brain are capable of education. This is only possible in young individuals. In the great majority of instances the nature of the lesion is such as to render futile all treatment directed towards its removal. In suitable cases, however, the education of the right side of the brain may be very greatly assisted by an intelligent application of scientific methods.

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APHELION (from Gr. ἀπό, from, and ἥλιος, sun), in astronomy, that point of the orbit of a planet at which it is most distant from the sun. Apogee, Apocentre, Aposaturnium, &c. are terms applied to those points of the orbit of a body moving around a centre of force—as the Earth, Saturn, &c.—at which it is farthest from the central body.

APHEMIA (from Gr. ἀ, without, and φήμη, speech), in pathology, the loss of the power of speech (see APHASIA).

APHIDES (pl. of Aphis), minute insects, also known as "plant-lice," "blight," and "green-fly," belonging to the homopterous division of the order Hemiptera, with long antennae and legs, two-jointed, two-clawed tarsi, and usually a pair of abdominal tubes through which a waxy secretion is exuded. These tubes were formerly supposed to secrete the sweet substance known as "honey-dew" so much sought after by ants; but this is now known to come from the alimentary canal. Both winged and wingless forms of both sexes occur, and the wings when present are normal in number, that is to say two pairs. Apart from their importance from the economic standpoint, Aphides are chiefly remarkable for the phenomena connected with the propagation of the species. The following brief summary of what takes place in the plant-louse of the rose (*Aphis rosae*), may be regarded as typical of the family, though exceptions occur in other species. Eggs produced in the autumn by fertilized females remain on the plant through the winter and hatching in the spring give rise to female individuals which may be winged or wingless. From these females are born parthenogenetically, that is to say without the intervention of males, and by a process that has been compared to internal budding, large numbers of young resembling their parents in every particular except size, which themselves reproduce their kind in the same way. This process continues throughout the summer, generation after generation being produced until the number of descendants from a single individual of the spring-hatched brood may amount to very many thousands. In the autumn winged males appear, union between the sexes takes place and the females lay the fertilized eggs which are destined to carry the species through the cold months of winter. If, however, the food-plant is grown in a conservatory where protection against cold is afforded, the aphides may go on reproducing agamogenetically without cessation for many years together. Not the least interesting features connected with this strange life-history are the facts that the young may be born by the oviparous or viviparous methods and either gamogenetically or agamogenetically, and may develop into winged forms or remain wingless, and that the males only appear in any number at the close of the season. Although the factors which determine these phenomena are not clearly understood, it is believed that the appearance of the males is connected with the increasing cold of autumn and the growing scarcity of food, and that the birth of winged females is similarly associated with decrease in the quantity or vitiation of the quality of the nourishment imbibed. Sometimes the winged females migrate from the plant they were born on to start fresh colonies on others often of quite a different kind. Thus the apple blight (*Aphis mali*) after producing many generations of apterous females on its typical food-plant gives rise to winged forms which fly away and settle upon grass or corn-stalks.

Closely related to the typical aphides is *Phylloxera vastatrix*, the insect which causes enormous loss by attacking the leaves and roots of vines. Its life-history is somewhat similar to that of *Aphis rosae* summarized above. In the autumn a single fertile egg is laid by apterous females in a crevice of the bark of the vine where it is protected during the winter. From this egg in the spring emerges an apterous female who makes a gall in the new leaf and lays therein a large number of eggs. Some of the apterous young that are hatched from these form fresh galls and continue to multiply in the leaves, others descend to the root of the plant, becoming what are known as root-forms. These, like the parent form of spring, reproduce parthenogenetically, giving rise to generation after generation of egg-laying individuals. In the course of the summer, from some of these eggs are hatched females which acquire wings and lay eggs from which wingless males and females are born. From the union of the sexes comes the fertile egg from which the parent form of spring is hatched.

See generally G. B. Buckton, *British Aphides* (Ray Soc. 1876–1883); also Economic Entomology. (R. I. P.)

APHORISM (from the Gr. ἀφορίζειν, to define), literally a distinction or a definition, a term used to describe a principle expressed tersely in a few telling words or any general truth conveyed in a short and pithy sentence, in such a way that when once heard it is unlikely to pass from the memory. The name was first used in the *Aphorisms* of Hippocrates, a long series of propositions concerning the symptoms and diagnosis of disease and the art of healing and medicine. The term came to be applied later to other sententious statements of physical science, and later still to statements of all kinds of principles. Care must be taken not to confound *aphorisms* with *axioms*. Aphorisms came into being as the result of experience, whereas axioms are self-evident truths, requiring no proof, and appertain to pure reason. Aphorisms have been especially used in dealing with subjects to which no methodical or scientific treatment was applied till late, such as art, agriculture, medicine, jurisprudence and politics. The *Aphorisms* of Hippocrates form far the most celebrated as well as the earliest collection of the kind, and it may be interesting to quote a few examples. "Old men support abstinence well: people of a ripe age less well: young folk badly, and children less well than all the rest, particularly those of them who are very lively." "Those who are very fat by nature are more exposed to die suddenly than those who are thin." "Those who eject foaming blood, eject it from the lung." "When two illnesses arrive at the same time, the stronger silences the weaker." The first aphorism, perhaps the best known of all, which serves as a kind of introduction to the book, runs as follows:—"Life is short, art is long, opportunity fugitive, experimenting dangerous, reasoning difficult: it is necessary not only to do oneself what is right, but also to be seconded by the patient, by those who attend him, by external circumstances." Another famous collection of aphorisms is that of the school of Salerno in Latin verse, in which Joannes de Meditano, one of the most celebrated doctors of the school of medicine of Salerno, has summed up the precepts of this school. The book was dedicated to a king of England. It is a disputed point as to which king, some authorities dating the publication as at 1066, others assigning a later date. The dedication gives the following excellent advice:—

> "Anglorum regi scribit schola tota Salernae.
> Si vis incolumem, si vis te reddere sanum,
> Curas tolle graves: irasci crede profanum:
> Parce mero: coenato parum; non sit tibi vanum
> Surgere post epulas: somnum fuge meridianum:
> Ne mictum retine, nec comprime fortiter anum:
> Haec bene si serves, tu longo tempore vives."

Another collection of aphorisms, also medical and also in Latin, is that of the Dutchman Hermann Boerhaave, published at Leiden in the year 1709; it gives a terse summary of the medical knowledge prevailing at the time, and is of great interest to the student of the history of medicine.

APHRAATES (a Greek form of the Persian name Aphrahaṭ or Pharhādh), a Syriac writer belonging to the middle of the 4th century A.D., who composed a series of twenty-three expositions or homilies on points of Christian doctrine and practice. The first ten were written in 337, the following twelve in 344, and the last in 345.[1] The author was early known as *ḥakkīmā phārsāyā* ("the Persian sage"), was a subject of Sapor II., and was probably of heathen parentage and himself a convert from heathenism. He seems at some time in his life to have assumed the name of Jacob, and is so entitled in the colophon to a MS. of A.D. 512 which contains twelve of his homilies. Hence he was already by Gennadius of Marseilles (before 496) confused with Jacob, bishop of Nisibis; and the ancient Armenian version of nineteen of the homilies has been published under this latter name. But (1) Jacob of Nisibis, who attended the council of Nicaea, died in 338; and (2) our author, being a Persian subject, cannot have lived at Nisibis, which became Persian only by Jovian's treaty of 363. That his name was Aphrahaṭ or Pharhādh we learn from comparatively late writers—Bar Bahlul (10th century), Elias of Nisibis (11th), Bar-Hebraeus, and 'Abhd-īshō'. George, bishop of the Arabs, writing in A.D. 714 to a friend who had sent him a series of questions about the "Persian sage," confesses ignorance of his name, home and rank, but infers from his homilies that he was a monk, and of high esteem among the clergy. The fact that in 344 he was selected to draw up a circular letter from a council of bishops and other clergy to the churches of Seleucia and Ctesiphon and elsewhere—included in our collection as homily 14—is held by Dr W. Wright and others to prove that he was a bishop. According to a marginal note in a 14th-century MS. (B.M. Orient. 1017), he was "bishop of Mar Mattai," a famous monastery near Mosul, but it is unlikely that this institution existed so early. The homilies of Aphraates are intended to form, as Professor Burkitt has shown, "a full and ordered exposition of the Christian faith." The standpoint is that of the Syriac-speaking church, before it was touched by the Arian controversy. Beginning with faith as the foundation, the writer proceeds to build up the structure of doctrine and duty. The first ten homilies, which form one division completed in 337, are without polemical reference:

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[1] Hom. 1–22 begin with the letters of the Syriac alphabet in succession. Their present order in the Syriac MSS. is therefore right. The ancient Armenian version, published by Antonelli in 1756, has only 19 of the homilies, and those in a somewhat different order.

their subjects are faith, love, fasting, prayer, wars (a somewhat mysterious setting forth of the conflict between Rome and Persia under the imagery of Daniel), the sons of the covenant (monks or ascetics), penitents, the resurrection, humility, pastors. Those numbered 11–22, written in 344, are almost all directed against the Jews; the subjects are circumcision, passover, the sabbath, persuasion (the encyclical letter referred to above), distinction of meats, the substitution of the Gentiles for the Jews, that Christ is the Son of God, virginity and holiness, whether the Jews have been finally rejected or are yet to be restored, provision for the poor, persecution, death and the last times. The 23rd homily, on the "grape kernel" (Is. lxv. 8), written in 344, forms an appendix on the Messianic fulfilment of prophecy, together with a treatment of the chronology from Adam to Christ. Aphraates impresses a reader favourably by his moral earnestness, his guilelessness, his moderation in controversy, the simplicity of his style and language, his saturation with the ideas and words of Scripture. On the other hand, he is full of cumbrous repetition, he lacks precision in argument and is prone to digression, his quotations from Scripture are often inappropriate, and he is greatly influenced by Jewish exegesis. He is particularly fond of arguments about numbers. How wholly he and his surroundings were untouched by the Arian conflict may be judged from the 17th homily—"that Christ is the Son of God." He argues that, as the name "God" or "Son of God" was given in the O.T. to men who were worthy, and as God does not withhold from men a share in His attributes—such as sovereignty and fatherhood—it was fitting that Christ who has wrought salvation for mankind should obtain this highest name. From the frequency of his quotations, Aphraates is a specially important witness to the form in which the Gospels were read in the Syriac church in his day; Zahn and others have shown that he—mainly at least—used the *Diatessaron.* Finally, he bears important contemporary witness to the sufferings of the Christian church in Persia under Sapor (Shapur) II. as well as the moral evils which had infected the church, to the sympathy of Persian Christians with the cause of the Roman empire, to the condition of early monastic institutions, to the practice of the Syriac church in regard to Easter, &c.

Editions by W. Wright (London, 1869), and J. Parisot (with Latin translation, Paris, 1894); the ancient Armenian version of 19 homilies edited, translated into Latin, and annotated by Antonelli (Rome, 1756). Besides translations of particular homilies by G. Bickell and E. W. Budge, the whole have been translated by G. Bert (Leipzig, 1888). Cf. also C. J. F. Sasse, *Proleg. in Aphr. Sapientis Persae sermones homileticos* (Leipzig, 1879); J. Forget, *De Vita et Scriptis Aphraatis* (Louvain, 1882); F. C. Burkitt, *Early Eastern Christianity* (London, 1904); J. Labourt, *Le Christianisme dans l'empire perse* (Paris, 1904); J. Zahn, *Forschungen* I.; "Aphraates and the Diatessaron," vol. ii. pp. 180-186 of Burkitt's *Evangelion Da-Mepharreshe* (Cambridge, 1904); articles on "Aphraates and Monasticism," by R. H. Connolly and Burkitt in *Journal of Theological Studies* (1905) pp. 522-539; (1906) pp. 10-15. (N. M.)

APHRODITE,[1] the Greek goddess of love and beauty, counterpart of the Roman Venus. Although her myth and cult were essentially Semitic, she soon became Hellenized and was admitted to a place among the deities of Olympus. Some mythologists hold that there already existed in the Greek system an earlier goddess of love, of similar attributes, who was absorbed by the Asiatic importation; and one writer (A. Enmann) goes so far as to deny the oriental origin of Aphrodite altogether. It is therefore necessary first to examine the nature and characteristics of her Eastern prototype, and then to see how far they reappear in the Greek Aphrodite.

Among the Semitic peoples (with the notable exception of the Hebrews) a supreme female deity was worshipped under different names—the Assyrian Ishtar, the Phoenician Ashtoreth (Astarte), the Syrian Atargatis (Derketo), the Babylonian Belit (Mylitta), the Arabian Ilat (Al-ilat). The article "Aphrodite" in Roscher's *Lexikon der Mythologie* is based upon the theory that all these were originally moon-goddesses, on which assumption all their functions are explained. This view, however, has not met with general acceptance, on the ground that, in Semitic mythology, the moon is always a male divinity; and that the full moon and crescent, found as attributes of Astarte, are due to a misinterpretation of the sun's disk and cow's horns of Isis, the result of the dependence of Syrian religious art upon Egypt. On the other hand, there is some evidence in ancient authorities (Herodian v. 6, 10; Lucian, *De Dea Syria,* 4) that Astarte and the moon were considered identical.

This oriental Aphrodite was worshipped as the bestower of all animal and vegetable fruitfulness, and under this aspect especially as a goddess of women. This worship was degraded by repulsive practices (*e.g.* religious prostitution, self-mutilation), which subsequently made their way to centres of Phoenician influence, such as Corinth and Mount Eryx in Sicily. In this connexion may be mentioned the idea of a divinity, half male, half female, uniting in itself the active and passive functions of creation, a symbol of luxuriant growth and productivity. Such was the bearded Aphrodite of Cyprus, called Aphroditos by Aristophanes according to Macrobius, who mentions a statue of the androgynous divinity in his *Saturnalia* (iii. 8. 2; see also HERMAPHRODITUS). The moon, by its connexion with menstruation, and as the cause of the fertilizing dew, was regarded as exercising an influence over the entire animal and vegetable creation.

The Eastern Aphrodite was closely related to the sea and the element of moisture; in fact, some consider that she made her first appearance on Greek soil rather as a marine divinity than as a nature goddess. According to Syrian ideas, as a fish goddess, she represented the fructifying power of water. At Ascalon there was a lake full of fish near the temple of Atargatis-Derketo, into which she was said to have been thrown together with her son Ichthys (fish) as a punishment for her arrogance, and to have been devoured by fishes; according to another version, ashamed of her amour with a beautiful youth, which resulted in the birth of Semiramis, she attempted to drown herself, but was changed into a fish with human face (see ATARGATIS). At Hierapolis (Bambyce) there was a pool with an altar in the middle, sacred to the goddess, where a festival was held, at which her images were carried into the water. Her connexion with the sea is explained by the influence of the moon on the tides, and the idea that the moon, like the sun and the stars, came up from the ocean.

The oriental Aphrodite is connected with the lower world, and came to be looked upon as one of its divinities. Thus, Ishtar descends to the kingdom of Ilat the queen of the dead, to find the means of restoring her favourite Tammuz (Adon, Adonis) to life. During her stay all animal and vegetable productivity ceases, to begin again with her return to earth—a clear indication of the conception of her as a goddess of fertility. This legend, which strikingly resembles that of Persephone, probably refers to the decay of vegetation in winter, and the reawakening of nature in spring (cf. HYACINTHUS). The lunar theory connects it with the disappearance of the moon at the time of change or during an eclipse.

Another aspect of her character is that of a warlike goddess, armed with spear or bow, sometimes wearing a mural crown, as sovereign lady and protectress of the locality where she was worshipped. The spear and arrows are identified with the beams of the sun and moon.

The attributes of the goddess were the ram, the he-goat, the dove, certain fish, the cypress, myrtle and pomegranate, the animals being symbolical of fertility, the plants remedies against sterility.

The worship of Aphrodite at an early date was introduced into Cyprus, Cythera and Crete by Phoenician colonists, whence it spread over the whole of Greece, and as far west as Italy and Sicily. In Crete she has been identified with Ariadne, who, according to one version of her story, was put ashore in Cyprus, where she died and was buried in a grove called after the name of Ariadne-Aphrodite (L. R. Farnell, *Cults of the Greek States*, ii. p. 663). Cyprus was regarded as her true home by the Greeks, and Cythera was one of the oldest seats of her worship (cf. her titles Cytherea, Cypris, Paphia, Amathusia, Idalia—the last three from places in Cyprus). In both these islands there lingered a definite tradition of a connexion with the cult of the oriental Aphrodite Urania, an epithet which will be referred to later. The oriental features of her worship as practised at Corinth are due to its early commercial relations with Asia Minor; the fame of her temple worship on Mount Eryx spread to Carthage, Rome and Latium.

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[1] No satisfactory etymology of the name has been given; although the first part is usually referred to ἀφρός ("the sea foam"), it is equally probable that it is of Eastern origin. F. Homoll (*Jahrbücher für classische Philologie*, cxxv., 1882) explains it as a corruption of Ashtoreth; for other derivations see O. Gruppe, *Griechische Mythologie*, ii. p. 1348, note 2.

In the *Iliad*, Aphrodite is the daughter of Zeus and Dione, a name by which she herself is sometimes called. This has been supposed to point to a confusion between Aphrodite and Hebe, the daughter of Zeus and Hera, Dione being an Epirot name for the last-named goddess. In the *Odyssey*, she is the wife of Hephaestus, her place being taken in the *Iliad* by Charis, the personification of grace and divine skill, possibly supplanted by Aphrodite, the goddess of love and beauty. Her amour with Ares, by whom she became the mother of Harmonia, the wife of Cadmus, is famous (*Od.* viii. 266). From her relations with these acknowledged Hellenic divinites it is argued that there once existed a primitive Greek goddess of love. This view is examined in detail and rejected by Farnell (*Cults*, ii. pp. 619-626).

It is admitted that few traces remain of direct relations of the Greek goddess to the moon, although such possibly survive in the epithets *πασιφαής, ἀστερία, οὐρανία*. It is suggested that this is due to the fact that, at the time of the adoption of the oriental goddess, the Greeks already possessed lunar divinities in Hecate, Selene, Artemis. But, although her connexion with the moon has practically disappeared, in all other aspects a development from the Semitic divinity is clearly manifest.

Aphrodite as the goddess of all fruitfulness in the animal and vegetable world is especially prominent. In the Homeric hymn to Aphrodite she is described as ruling over all living things on earth, in the air, and in the water, even the gods being subject to her influence. She is the goddess of gardens, especially worshipped in spring and near lowlands and marshes, favourable to the growth of vegetation. As such in Crete she is called Antheia ("the flower-goddess"), at Athens ἐν κήποις ("in the gardens"), and ἐν καλάμοις ("in the reed-beds") or ἐν ἕλει ("in the marsh") at Samos. Her character as a goddess of vegetation is clearly shown in the cult and ritual of Adonis (*q.v.*; also Farnell, ii. p. 644) and Attis (*q.v.*). In the animal world she is the goddess of sexual impulse; amongst men, of birth, marriage, and family life. To this aspect may be referred the names Genetyllis ("bringing about birth"), Arma (ἄρω, "to join," *i.e.*, in marriage, cf. Harmonia), Nymphia ("bridal goddess"), Kourotrophos ("rearer of boys"). Aphrodite Apaturus (see G. M. Hirst in *Journal of Hellenic Studies*, xxiii., 1903) refers to her connexion with the clan and the festival Apaturia, at which children were admitted to the *phratria*. It is pointed out by Farnell that this cult of Aphrodite, as the patroness of married life, is probably a native development of the Greek religion, the oriental legends representing her by no means as an upholder of the purer relations of man and woman. As the goddess of the grosser form of love she inspires both men and women with passion (ἐπιστροφία, "turning them to" thoughts of love), or the reverse (ἀποστροφία, "turning them away"). Upon her male favourites (Paris, Theseus) she bestows the fatal gift of seductive beauty, which generally leads to disastrous results in the case of the woman (Helen, Ariadne). As μηχανῖτις ("contriver") she acts as an intermediary for bringing lovers together, a similar idea being expressed in πρᾶξις (of "success" in love, or=*creatrix*). The two epithets ἀνδροφόνος ("man-slayer") and σώσανδρα ("man-preserver") find an illustration in the pseudo-Plautine (in the *Mercator*) address to Astarte, who is described as the life and death, the saviour and destroyer of men and gods. It was natural that a personality invested with such charms should be regarded as the ideal of womanly beauty, but it is remarkable that the only probable instance in which she appears as such is as Aphrodite μορφώ ("form") at Sparta (O. Gruppe suggests the meaning "ghost," C. Tümpel the "dark one," referring to Aphrodite's connexion with the lower world). The function of Aphrodite as the patroness of courtesans represents the most degraded form of her worship as the goddess of love, and is certainly of Phoenician or Eastern origin. In Corinth there were more than a thousand of these ἱερόδουλοι ("temple slaves"), and wealthy men made it a point of honour to dedicate their most beautiful slaves to the service of the goddess.

Like her oriental prototype, the Greek Aphrodite was closely connected with the sea. Thus, in the Hesiodic account of her birth, she is represented as sprung from the foam which gathered round the mutilated member of Uranus, and her name has been explained by reference to this. Further proof may be found in many of her titles—ἀναδυομένη ("rising from the sea"), εὔπλοια ("giver of prosperous voyages"), γαληναία ("goddess of fair weather"), κατασκοπία ("she who keeps a look-out from the heights")—in the attribute of the dolphin, and the veneration in which she was held by seafarers. Aphrodite Aineias, the protectress of the Trojan hero, is probably also another form of the maritime goddess of the East (see E. Wörner, article "Aineias" in Roscher's *Lexikon*, and Farnell, ii. p. 638), which originated in the Troad, where Aphrodite Aineias may have been identical with the earth-goddess Cybele. The title ἔφιππος is connected with the legend of Aeneas, who is said to have dedicated to his mother a statue that represented her on horseback. Remembering the importance of the horse in the cult of the sea-god Poseidon, it is natural to associate it with Aphrodite as the sea-goddess, although it may be explained with reference to her character as a goddess of vegetation, the horse being an embodiment of the corn-spirit (see J. G. Frazer, *The Golden Bough*, ii., 1900, p. 281).

Like Ishtar, Aphrodite was connected with the lower world. Thus, at Delphi there was an image of Aphrodite ἐπιτυμβία ("Aphrodite of the tomb"), to which the dead were summoned to receive libations; the epithets τυμβώρυχος ("grave-digger"), μυχία ("goddess of the depths"), μελαινίς ("the dark one"), the grave of Ariadne-Aphrodite at Amathus, and the myth of Adonis, point in the same direction.

The cult of the armed Aphrodite probably belongs to the earlier period of her worship in Greece, and down to the latest period of Greek history she retained this character in some of the Greek states. The cult is found not only where oriental influence was strongest, but in places remote from it, such as Sparta, where she was known by the name of Areia ("the warlike"), and there are numerous references in the *Anthology* to an Aphrodite armed with helmet and spear. It is possible that the frequent association of Aphrodite with Ares is to be explained by an armed Aphrodite early worshipped at Thebes, the most ancient seat of the worship of Ares.

The most distinctively oriental title of the Greek Aphrodite is Urania, the Semitic "queen of the heavens." It has been explained by reference to the lunar character of the goddess, but more probably signifies "she whose seat is in heaven," whence she exercises her sway over the whole world—earth, sea, and air alike. Her cult was first established in Cythera, probably in connexion with the purple trade, and at Athens it is associated with the legendary Porphyrion, the purple king. At Thebes, Harmonia (who has been identified with Aphrodite herself) dedicated three statues, of Aphrodite Urania, Pandemos, and Apostrophia. A few words must be added on the second of these titles. There is no doubt that Pandemos was originally an extension of the idea of the goddess of family and city life to include the whole people, the political community. Hence the name was supposed to go back to the time of Theseus, the reputed author of the reorganization of Attica and its demes. Aphrodite Pandemos was held in equal regard with Urania; she was called σεμνή ("holy"), and was served by priestesses upon whom strict chastity was enjoined. In time, however, the meaning of the term underwent a change, probably due to the philosophers and moralists, by whom a radical distinction was drawn between Aphrodite Urania and Pandemos. According to Plato

(*Symposium*, 180), there are two Aphrodites, "the elder, having no mother, who is called the heavenly Aphrodite—she is the daughter of Uranus; the younger, who is the daughter of Zeus and Dione—her we call common." The same distinction is found in Xenophon's *Symposium* (viii. 9), although the author is doubtful whether there are two goddesses, or whether Urania and Pandemos are two names for the same goddess, just as Zeus, although one and the same, has many titles; but in any case, he says, the ritual of Urania is purer, more serious, than that of Pandemos. The same idea is expressed in the statement (quoted by Athenaeus, 569*d*, from Nicander of Colophon) that after Solon's time courtesans were put under the protection of Aphrodite Pandemos. But there is no doubt that the cult of Aphrodite was on the whole as pure as that of any other divinities, and although a distinction may have existed in later times between the goddess of legal marriage and the goddess of free love, these titles do not express the idea. Aphrodite Urania was represented in Greek art on a swan, a tortoise or a globe; Aphrodite Pandemos as riding on a goat, symbolical of wantonness. (For the legend of Theseus and Aphrodite ἐπιτραγία, "on the goat," see Farnell, *Cults*, ii. p. 633.)

To her oriental attributes the following may be added: the sparrow and hare (productivity), the wry-neck (as a love-charm, of which Aphrodite was considered the inventor), the swan and dolphin (as a marine divinity), the tortoise (explained by Plutarch as a symbol of domesticity, but connected by Gruppe with the marine deity), the rose, the poppy, and the lime tree.

In ancient art Aphrodite was at first represented clothed, sometimes seated, but more frequently standing; then naked, rising from the sea, or after the bath. Finally, all idea of the divine vanished, and the artists merely presented her as the type of a beautiful woman, with oval face, full of grace and charm, languishing eyes, and laughing mouth, which replaced the dignified severity and repose of the older forms. The most famous of her statues in ancient times was that at Cnidus, the work of Praxiteles, which was imitated on the coins of that town, and subsequently reproduced in various copies, such as the Vatican and Munich. Of existing statues the most famous is the Aphrodite of Melos (Venus of Milo), now in the Louvre, which was found on the island in 1820 amongst the ruins of the theatre; the Capitoline Venus at Rome and the Venus of Capua, represented as a goddess of victory (these two exhibit a lofty conception of the goddess); the Medicean Venus at Florence, found in the porticus of Octavia at Rome and (probably wrongly) attributed to Cleomenes; the Venus stooping in the bath, in the Vatican; and the Callipygos at Naples, a specimen of the most sensual type.

For the oriental Aphrodite see E. Meyer, article "Astarte" in W. H. Roscher's *Lexikon der Mythologie*, and Wolf Baudissin, articles "Astarte" and "Atargatis" in Herzog-Hauck's *Realencyklopädie für protestantische Theologie*; for the Greek, articles in Roscher's *Lexikon* and Pauly-Wissowa's *Realencyclopädie*; L. Preller, *Griechische Mythologie* (4th ed. by C. Robert); L. R. Farnell, *Cults of the Greek States*, ii. (1896); O. Gruppe, *Griechische Mythologie und Religionsgeschichte*, ii. (1906); L. Dyer, *The Gods in Greece* (1891); A. Enmann, *Kypros und der Ursprung des Aphrodite-Kults* (1886). W. H. Engel, *Kypros*, ii. (1841), and J. B. Lajard, *Recherches sur le culte de Vénus* (1837), may still be consulted with advantage. For Aphrodite in art see J. J. Bernoulli, *Aphrodite* (1873); W. J. Stillman, *Venus and Apollo in Painting and Sculpture* (1897). In the article GREEK ART, figs. 71 (pl. v.) and 77 (pl. vi.) represent Aphrodite of Cnidus and Melos respectively. (J. H. F.)

APHTHONIUS, of Antioch, Greek sophist and rhetorician, flourished in the second half of the 4th century A.D., or even later. Nothing is known of his life, except that he was a friend of Libanius and of a certain Eutropius, perhaps the author of the epitome of Roman history. We possess by him Προγυμνάσματα, a text-book on the elements of rhetoric, with exercises for the use of the young before they entered the regular rhetorical schools. They apparently formed an introduction to the Τέχνη of Hermogenes. His style is pure and simple, and ancient critics praise his "Atticism." The book maintained its popularity as late as the 17th century, especially in Germany. A collection of forty fables by Aphthonius, after the style of Aesop, is also extant.

Spengel, *Rhetores Graeci*, ii.; Finckh, *Aphthonii Progymnasmata* (1865); Hoppichler, *De Theone, Hermogene, Aphthonioque Progymnasmatum Scriptoribus* (1884); edition of the fables by Furia (1810).

APHTHONIUS, AELIUS FESTUS, Latin grammarian, possibly of African origin, lived in the 4th century A.D. He wrote a metrical handbook in four books, which has been incorporated by Marius Victorinus in his system of grammar.

Keil, *Grammatici Latini*, vi.; Schultz, *Quibus Auctoribus Aelius Festus Aphthonius usus sit* (1885).

APICIUS, the name of three celebrated Roman epicures. The second of these, M. Gavius Apicius, who lived under Tiberius, is the most famous (Seneca, *Consol. ad Helviam*, 10). He invented various cakes and sauces, and is said to have written on cookery. The extant *De Re Coquinaria* (ed. Schuch, 1874), a collection of receipts, ascribed to one Caelius Apicius, is founded on Greek originals, and belongs to the 3rd century A.D. It is probable that the real title was Caelii *Apicius*, Apicius being the name of the work (cp. Taciti *Agricola*), and *De Re Coquinaria* a sub-title.

APICULTURE (from Lat. *apis*, a bee), bee-keeping (see BEE). So also other compounds of *api-*. *Apiarium* or apiary, a bee-house or hive, is used figuratively by old writers for a place of industry, *e.g.* a college.

APION, Greek grammarian and commentator on Homer, born at Oasis in Libya, flourished in the first half of the 1st century A.D. He studied at Alexandria, and headed a deputation sent to Caligula (in 38) by the Alexandrians to complain of the Jews: his charges were answered by Josephus in his *Contra Apionem*. He settled at Rome—it is uncertain when—and taught rhetoric till the reign of Claudius. Apion was a man of great industry and learning, but extremely vain. He wrote several works, which are lost. The well-known story of Androclus and the lion, preserved in Aulus Gellius, is from his Αἰγυπτιακὰ; fragments of his Γλῶσσαι Ὁμηρικαὶ are printed in the *Etymologicum Gudianum*, ed. Sturz, 1818.

APIS or HAPIS, the sacred bull of Memphis, in Egyptian *Ḥp*, *Hape*, *Hope*. By Manetho his worship is said to have been instituted by Kaiechos of the Second Dynasty. Hape is named on very early monuments, but little is known of the divine animal before the New Kingdom. He was entitled "the renewal of the life" of the Memphite god Ptah: but after death he became Osorapis, *i.e.* the Osiris Apis, just as dead men were assimilated to Osiris, the king of the underworld. This Osorapis was identified with Serapis, and may well be really identical with him (see SERAPIS): and Greek writers make the Apis an incarnation of Osiris, ignoring the connexion with Ptah. Apis was the most important of all the sacred animals in Egypt, and, like the others, its importance increased as time went on. Greek and Roman authors have much to say about Apis, the marks by which the black bull-calf was recognized, the manner of his conception by a ray from heaven, his house at Memphis with court for disporting himself, the mode of prognostication from his actions, the mourning at his death, his costly burial and the rejoicings throughout the country when a new Apis was found. Mariette's excavation of the Serapeum at Memphis revealed the tombs of over sixty animals, ranging from the time of Amenophis III. to that of Ptolemy Alexander. At first each animal was buried in a separate tomb with a chapel built above it. Khamuis, the priestly son of Rameses II. (*c.* 1300 B.C.), excavated a great gallery to be lined with the tomb chambers; another similar gallery was added by Psammetichus I. The careful statement of the ages of the animals in the later instances, with the regnal dates for their birth, enthronization and death have thrown much light on the chronology from the XXIInd dynasty onwards. The name of the mother-cow and the place of birth are often recorded. The sarcophagi are of immense size, and the burial must have entailed enormous expense. It is therefore remarkable that the priests contrived to bury one of the animals in the fourth year of Cambyses.

See Jablonski, *Pantheon*, ii.; Budge, *Gods of the Egyptians*, ii. 350; Mariette-Maspero, *Le Sérapéum de Memphis*. (F. LL. G.)

APLITE, in petrology, the name given to intrusive rock in which quartz and felspar are the dominant minerals. Aplites are usually very fine-grained, white, grey or flesh-coloured, and their constituents are visible only with the help of a magnifying lens. Dykes and threads of aplite are very frequently to be observed traversing granitic bosses; they occur also, though in less numbers, in syenites, diorites, quartz-diabases and gabbros. Without doubt they have usually a genetic affinity to the rocks they intersect. The aplites of granite areas, for example, are the last part of the magma to crystallize, and correspond in composition to the quartzo-felspathic aggregates which fill up the interspaces between the early minerals in the main body of the rock. They bear a considerable resemblance to the eutectic mixtures which are formed on the cooling of solutions of mineral salts, and remain liquid till the excess of either of the components has separated out, finally solidifying *en masse* when the proper proportions of the constituents and a suitable temperature are reached. The essential components of the aplites are quartz and alkali felspar (the latter usually orthoclase or microperthite). Crystallization has been apparently rapid (as the rocks are so fine-grained), and the ingredients have solidified almost at the same time. Hence their crystals are rather imperfect and fit closely to one another in a sort of fine mosaic of nearly equi-dimensional grains. Porphyritic felspars occur occasionally and quartz more seldom; but the relation of the aplites to quartz-porphyries, granophyres and felsites is very close, as all these rocks have nearly the same chemical composition. Yet the aplites associated with diorites and quartz-diabases differ in minor respects from the common aplites, which accompany granites. The accessory minerals of these rocks are principally oligoclase, muscovite, apatite and zircon. Biotite and all ferromagnesian minerals rarely appear in them, and never are in considerable amount. Riebeckite-granites (paisanites) have close affinities to aplites, shown especially in the prevalence of alkali felspars. Tourmaline also occurs in some aplites. The rocks of this group are very frequent in all areas where masses of granite are known. They form dykes and irregular veins which may be only a few inches or many feet in diameter. Less frequently aplite forms stocks or bosses, or occupies the edges or irregular portions of the interior of outcrops of granite. The syenite-aplites consist mainly of alkali felspar; the diorite-aplites of plagioclase; there are nepheline-bearing aplites which intersect some elaeolite-syenites. In all cases they bear the same relation to the parent masses. By increase of quartz aplites pass gradually, in a few localities, through highly quartzose modifications (beresite, &c.) into quartz veins. (J. S. F.)

APNOEA (Gr. *ἄπνοια*, from *ἀ-*, privative, *πνέειν*, to breathe), a technical term for suspension of breathing.

APOCALYPSE (Gr. *ἀποκάλυψις*, disclosure), a term applied to the disclosure to certain privileged persons of something hidden from the mass of men. The Greek root corresponds in the Septuagint to the Heb. *gālāh*, to reveal. The last book of the New Testament bears in Greek the title *'Αποκάλυψις 'Ιωάννου*, and is frequently referred to as the Apocalypse of John, but in the English Bible it appears as the Revelation of St John the Divine (see REVELATION). Earlier among the hellenistic Jews the term was used of a number of writings which depicted in a prophetic and parabolic way the end or future state of the world (*e.g. Apocalypse of Baruch*), the whole class is now commonly known as Apocalyptic Literature (*q.v.*).

APOCALYPSE, KNIGHTS OF THE, a secret society founded in Italy in 1693 to defend the church against the expected Antichrist. Agostino Gabrino, the son of a merchant of Brescia, was its founder. On Palm Sunday 1693, when the choir of St Peter's was chanting *Quis est iste Rex Gloriae?* Gabrino, sword in hand, rushed to the altar crying *Ego sum Rex Gloriae.* Though Gabrino was treated as a madman, the society flourished, until a member denounced it to the Inquisition, who arrested the knights. Though chiefly mechanics they always carried swords even when at work, and wore on their breasts a star with seven rays. Gabrino styled himself monarch of the Holy Trinity. He was credited by his enemies with a desire to introduce polygamy.

APOCALYPTIC LITERATURE. The Apocalyptic literature of Judaism and Christianity embraces a considerable period, from the centuries following the exile down to the close of the middle ages. In the present survey we shall limit ourselves to the great formative periods in this literature—in Judaism to 200 B.C. to A.D. 100, and in Christianity to A.D. 50 to 350 or thereabouts.

The transition from prophecy to apocalyptic (*ἀποκαλύπτειν*, to reveal something hidden) was gradual and already accomplished within the limits of the Old Testament. Beginning in the bosom of prophecy, and steadily differentiating itself from it in its successive developments, it never came to stand in absolute contrast to it. Apocalyptical elements disclose themselves in the prophetical books of Ezekiel, Joel, Zechariah, while in Isaiah xxiv.–xxvii. and xxxiii. we find well-developed apocalypses; but it is not until we come to Daniel that we have a fully matured and classical example of this class of literature. The way, however, had in an especial degree been prepared for the apocalyptic type of thought and literature by Ezekiel, for with him the word of God had become identical with a written book (ii. 9–iii. 3) by the eating of which he learnt the will of God, just as primitive man conceived that the eating of the tree in Paradise imparted spiritual knowledge. When the divine word is thus conceived as a written message, the sole office of the prophet is to communicate what is written. Thus the human element is reduced to zero, and the conception of prophecy becomes mechanical. And as the personal element disappears in the conception of the prophetic calling, so it tends to disappear in the prophetic view of history, and the future comes to be conceived not as the organic result of the present under the divine guidance, but as mechanically determined from the beginning in the counsels of God, and arranged under artificial categories of time. This is essentially the apocalyptic conception of history, and Ezekiel may be justly represented as in certain essential aspects its founder in Israel.

We shall now consider (I.) Apocalyptic, its origin and general characteristics; (II.) Old Testament Apocalyptic; (III.) New Testament Apocalyptic.

I. APOCALYPTIC—ITS ORIGIN AND GENERAL CHARACTERISTICS

i. *Sources of Apocalyptic.*—The origin of Apocalyptic is to be sought in (*a*) unfulfilled prophecy and in (*b*) traditional elements drawn from various sources.

(*a*) The origin of Apocalyptic is to be sought in *unfulfilled prophecy*. That certain prophecies relating to the coming kingdom of God had clearly not been fulfilled was a matter of religious difficulty to the returned exiles from Babylon. The judgments predicted by the pre-exilic prophets had indeed been executed to the letter, but where were the promised glories of the renewed kingdom and Israel's unquestioned sovereignty over the nations of the earth? One such unfulfilled prophecy Ezekiel takes up and reinterprets in such a way as to show that its fulfilment is still to come. The prophets Jeremiah (iv.–vi.) and Zephaniah had foretold the invasion of Judah by a mighty people from the north. But as this northern foe had failed to appear Ezekiel re-edited this prophecy in a new form as a final assault of Gog and his hosts on Jerusalem, and thus established a permanent dogma in Jewish apocalyptic, which in due course passed over into Christian.

But the non-fulfilment of prophecies relating to this or that individual event or people served to popularize the methods of apocalyptic in a very slight degree in comparison with the non-fulfilment of the greatest of all prophecies—the advent of the Messianic kingdom. Thus, though Jeremiah had promised that after seventy years (xxv. 11., xxix. 10) Israel should be restored to their own land (xxiv. 5, 6), and then enjoy the blessings of the Messianic kingdom under the Messianic king (xxiii. 5, 6), this period passed by and things remained as of old. Haggai and Zechariah explained the delay by the failure of Judah to rebuild the temple, and so generation after generation the hope of the kingdom persisted, sustained most probably by ever-fresh reinterpretations of ancient prophecy, till in the first half of the 2nd century the delay is explained in the Books of Daniel and Enoch as due not to man's shortcomings but to the counsels of God. The 70 years of Jeremiah are interpreted by the angel in Daniel (ix. 25-27) as 70 weeks of years, of which 69½ have already expired, while the writer of Enoch (lxxxv.–xc.) interprets the 70 years of Jeremiah as the 70 successive reigns of the 70 angelic patrons of the nations, which are to come to a close in his own generation.

But the above periods came and passed by, and again the expectations of the Jews were disappointed. Presently the Greek empire of the East was overthrown by Rome, and in due course this new phenomenon, so full of meaning for the Jews, called forth a new interpretation of Daniel. The fourth and last empire which, according to Daniel vii. 19-25, was to be Greek, was now declared to be Roman by the Apocalypse of Baruch (xxxvi.–xl.) and 4 Ezra (x. 60–xii. 35). Once more such ideas as those of "the day of Yahweh" and the "new heavens and a new earth" were constantly re-edited with fresh nuances in conformity with their new settings. Thus the inner development of Jewish apocalyptic was always conditioned by the historical experiences of the nation.

(*b*) Another source of apocalyptic was *primitive mythological and cosmological traditions*, in which the eye of the seer could see the secrets of the future no less surely than those of the past. Thus the six days of the world's creation, followed by a seventh of rest, were regarded as at once a history of the past and a forecasting of the future. As the world was made in six days its history would be accomplished in six thousand years, since each day with God was as a thousand years and a thousand years as one day; and as the six days of creation were followed by one of rest, so the six thousand years of the world's history would be followed by a rest of a thousand years (2 Enoch xxxii. 2–xxxiii. 2). Of primitive mythological traditions we might mention the primeval serpent, leviathan, behemoth, while to ideas native to or familiar in apocalyptic belong those of the seven archangels, the angelic patrons of the nations (Deut. xxxii. 8, in LXX.; Isaiah xxiv. 21; Dan. x. 13, 20, &c.), the mountain of God in the north (Isaiah xiv. 13; Ezek. i. 4, &c.), the garden of Eden.

ii. *Object and Contents of Apocalyptic.*—The object of this literature in general was to solve the difficulties connected with the righteousness of God and the suffering condition of His righteous servants on earth. The righteousness of God postulated according to the law the temporal prosperity of the righteous and the *temporal* prosperity of necessity; for as yet there was no promise of life or recompense beyond the grave. But this connexion was not found to obtain as a rule in life, and the difficulties arising from this conflict between promise and experience centred round the lot of the righteous as a community and the lot of the righteous man as an individual. Old Testament prophecy had addressed itself to both these problems, though it was hardly conscious of the claims of the latter. It concerned itself essentially with the present, and with the future only as growing organically out of the present. It taught the absolute need of personal and national righteousness, and foretold the ultimate blessedness of the righteous nation on the present earth. But its views were not systematic and comprehensive in regard to the nations in general, while as regards the individual it held that God's service here was its own and adequate reward, and saw no need of postulating another world to set right the evils of this. But later, with the growing claims of the individual and the acknowledgment of these in the religious and intellectual life, both problems, and especially the latter, pressed themselves irresistibly on the notice of religious thinkers, and made it impossible for any conception of the divine rule and righteousness to gain acceptance, which did not render adequate satisfaction to the claims of both problems. To render such satisfaction was the task undertaken by apocalyptic, as well as to vindicate the righteousness of God alike in respect of the individual and of the nation. To justify their contention they sketched in outline the history of the world and mankind, the origin of evil and its course, and the final consummation of all things. Thus they presented in fact a theodicy, a rudimentary philosophy of religion. The righteous as a nation should yet possess the earth, even in this world the faithful community should attain its rights in an eternal Messianic kingdom on earth, or else in temporary blessedness here and eternal blessedness hereafter. So far as regards the righteous community. It was, however, in regard to the destiny of the individual that apocalyptic rendered its chief service. Though the individual might perish amid the disorders of this world, he would not fail, apocalyptic taught, to attain through resurrection the recompense that was his due in the Messianic kingdom or in heaven itself. Apocalyptic thus forms the indispensable preparation for the religion of the New Testament.

iii. *Form of Apocalyptic.*—The form of apocalyptic is a literary form; for we cannot suppose that the writers experienced the voluminous and detailed visions we find in their books. On the other hand the reality of the visions is to some extent guaranteed by the writer's intense earnestness and by his manifest belief in the divine origin of his message. But the difficulty of regarding the visions as actual experiences, or as in any sense actual, is intensified, when full account is taken of the artifices of the writer; for the major part of his visions consists of what is to him really past history dressed up in the guise of prediction. Moreover, the writer no doubt intended that his reader should take the accuracy of the prediction (?) already accomplished to be a guarantee for the accuracy of that which was still unrealized. How, then, it may well be asked, can this be consistent with reality of visionary experience? Are we not here obliged to assume that the visions are a literary invention and nothing more?

However we may explain the inconsistency, we are precluded by the moral earnestness of the writer from assuming the visions to be pure inventions. But the inconsistency has in part been explained by Gunkel, who has rightly emphasized that the writer did not freely invent his materials but derived them in the main from tradition, as he held that these mysterious traditions of his people were, if rightly expounded, forecasts of the time to come. Furthermore, the visionary who is found at most periods of great spiritual excitement was forced by the prejudice of his time, which refused to acknowledge any inspiration in the present, to ascribe his visionary experiences and reinterpretations of the mysterious traditions of his people to some heroic figure of the past. Moreover, there will always be a difficulty in determining what belongs to his actual vision and what to the literary skill or free invention of the author, seeing that the visionary must be dependent on memory and past experience for the forms and much of the matter of the actual vision.

iv. *Apocalyptic as distinguished from Prophecy.*—We have already dwelt on certain notable differences between apocalyptic and prophecy; but there are certain others that call for attention.

(*a*) *In the Nature of its Message.*—The message of the prophets was primarily a preaching of repentance and righteousness if the nation would escape judgment; the message of the apocalyptic writers was of patience and trust for that deliverance and reward were sure to come.

(*b*) *By its dualistic Theology.*—Prophecy believes that this world is God's world and that in this world His goodness and truth will yet be vindicated. Hence the prophet prophesies of a definite future arising out of and organically connected with the present. The apocalyptic writer on the other hand despairs of the present, and directs his hopes absolutely to the future, to a new world standing in essential opposition to the present. (*Non fecit Altissimus unum saeculum sed duo*, 4 Ezra vii. 50.) Here we have essentially a dualistic principle, which, though it can largely be accounted for by the interaction of certain inner tendencies and outward sorrowful experience on the part of Judaism, may ultimately be derived from Mazdean influences. This principle, which shows itself clearly at first in the conception that the various nations are under angelic rulers, who are in a greater or less degree in rebellion against God, as in Daniel and

Enoch, grows in strength with each succeeding age, till at last Satan is conceived as "the ruler of this world" (John xii. 31) or "the god of this age" (2 Cor. iv. 4). Under the guidance of such a principle the writer naturally expected the world's culmination in evil to be the immediate precursor of God's intervention on behalf of the righteous, and every fresh growth in evil to be an additional sign that the time was at hand. The natural concomitant in conduct of such a belief is an uncompromising asceticism. He that would live to the next world must shun this. Visions are vouchsafed only to those who to prayer have added fasting.

(*c*) *By pseudonymous Authorship.*—We have already touched on this characteristic of apocalyptic. The prophet stood in direct relations with his people; his prophecy was first spoken and afterwards written. The apocalyptic writer could obtain no hearing from his contemporaries, who held that, though God spoke in the past, "there was no more any prophet." This pessimism and want of faith limited and defined the form in which religious enthusiasm should manifest itself, and prescribed as a condition of successful effort the adoption of pseudonymous authorship. The apocalyptic writer, therefore, professedly addressed his book to future generations. Generally directions as to the hiding and sealing of the book (Dan. xii. 4, 9; 1 Enoch i. 4; Ass. Mos. i. 16-18) were given in the text in order to explain its publication so long after the date of its professed period. Moreover, there was a sense in which such books were not wholly pseudonymous. Their writers were students of ancient prophecy and apocalyptical tradition, and, though they might recast and reinterpret them, they could not regard them as their own inventions. Each fresh apocalypse would in the eyes of its writer be in some degree but a fresh edition of the traditions naturally attaching themselves to great names in Israel's past, and thus the books named respectively Enoch, Noah, Ezra would to some slight extent be not pseudonymous.

(*d*) *By its comprehensive and deterministic Conception of History.*—Apocalyptic took an indefinitely wider view of the world's history than prophecy. Thus, whereas prophecy had to deal with temporary reverses at the hands of some heathen power, apocalyptic arose at a time when Israel had been subject for generations to the sway of one or other of the great world-powers. Hence to harmonize such difficulties with belief in God's righteousness, it had to take account of the rôle of such empires in the counsels of God, the rise, duration and downfall of each in turn, till finally the lordship of the world passed into the hands of Israel, or the final judgment arrived. These events belonged in the main to the past, but the writer represented them as still in the future, arranged under certain artificial categories of time definitely determined from the beginning in the counsels of God and revealed by Him to His servants the prophets. Determinism thus became a leading characteristic of Jewish apocalyptic, and its conception of history became severely mechanical.

II. OLD TESTAMENT APOCALYPTIC

i. Canonical:—

Isaiah xxiv.—xxvii.; xxxiii.; xxxiv.–xxxv.
(Jeremiah xxxiii. 14-26?)
Ezekiel ii. 8; xxxviii.–xxxix.
Joel iii. 9-17.
Zech. xii.–xiv.
Daniel.

We cannot enter here into a discussion of the above passages and books.[1] All are probably pseudepigraphic except the passages from Ezekiel and Joel. Of the remaining passages and books Daniel belongs unquestionably to the Maccabean period, and the rest possibly to the same period. Isaiah xxxiii. was probably written about 163 B.C. (Duhm and Marti); Zech. xii.–xiv. about 160 B.C., Isaiah xxiv.–xxvii. about 128 B.C., and xxxiv.–xxxv. sometime in the reign of John Hyrcanus. Jeremiah xxxiii. 14–26 is assigned by Marti to Maccabean times, but this is highly questionable.

ii. Extra-canonical:—

(a) *Palestinian*:—

(200–100 B.C.)
Book of Noah.
1 Enoch vi.–xxxvi.; lxxii.–xc.
Testaments of the XII. Patriarchs.

(100 B.C. to 1 B.C.)
1 Enoch i.–v.; xxxvii.–lxxi.; xci.–civ.
Testaments of the XII. Patriarchs, *i.e.* T. Lev. x., xiv.–xvi., T. Jud. xxi. 6–xxiii, T. Zeb. ix., T. Dan. v. 6, 7.
Psalms of Solomon.

(A.D. 1–100 and later.)
Assumption of Moses.
Apocalypse of Baruch.
4 Ezra.
Greek Apocalypse of Baruch.
Apocalypse of Zephaniah.
Apocalypse of Abraham.
Prayer of Joseph.
Book of Eldad and Modad.
Apocalypse of Elijah.

(b) *Hellenistic*:—

2 Enoch.
Oracles of Hystaspes.
Testament of Job.
Testaments of the III. Patriarchs.
Sibylline Oracles (excluding Christian portions).

Book of Noah.— Though this book has not come down to us independently, it has in large measure been incorporated in the Ethiopic Book of Enoch, and can in part be reconstructed from it. The Book of Noah is mentioned in Jubilees x. 13, xxi. 10. Chapters lx., lxv.–lxix. 25 of the Ethiopic Enoch are without question derived from it. Thus lx. 1 runs: "In the year 500, in the seventh month . . . in the life of Enoch." Here the editor simply changed the name Noah in the context before him into Enoch, for the statement is based on Gen. v. 32, and Enoch lived only 365 years. Chapters vi.–xi. are clearly from the same source; for they make no reference to Enoch, but bring forward Noah (x. 1) and treat of the sin of the angels that led to the flood, and of their temporal and eternal punishment. This section is compounded of the Semjaza and Azazel myths, and in its present composite form is already presupposed by 1 Enoch lxxxviii.–xc. Hence these chapters are earlier than 166 B.C. Chapters cvi.–cvii. of the same book are probably from the same source; likewise liv. 7–lv. 2, and Jubilees vii. 20-39, x. 1-15. In the former passage of Jubilees the subject-matter leads to this identification, as well as the fact that Noah is represented as speaking in the first person, although throughout Jubilees it is the angel that speaks. Possibly Eth. En. xli. 3-8, xliii.-xliv., lix. are from the same work. The book may have opened with Eth. En. cvi.–cvii. On these chapters may have followed Eth. En. vi.–xi., lxv.–lxix. 25, lx., xli. 3-8, xliii.–xliv., liv. 7–lv. 2; Jubilees vii. 26-39, x. 1-15.

The Hebrew Book of Noah, a later work, is printed in Jellinek's *Bet ha-Midrasch*, iii. 155-156, and translated into German in Rönsch, *Das Buch der Jubiläen*, 385-387. It is based on the part of the above Book of Noah which is preserved in the *Book of Jubilees*. The portion of this Hebrew work which is derived from the older work is reprinted in Charles's *Ethiopic Version of the Hebrew Book of Jubilees*, p. 179.

1 Enoch, or the Ethiopic Book of Enoch.— This is the most important of all the apocryphal writings for the history of religious thought. Like the Pentateuch, the Psalms, the Megilloth and the Pirke Aboth, this work was divided into five parts, which, as we shall notice presently, spring from five different sources. Originally written partly in Aramaic (*i.e.* vi.–xxxvi.) and partly in Hebrew (i.–vi., xxxvii.–cviii.), it was translated into Greek, and from Greek into Ethiopic and possibly Latin. Only one-fifth of the Greek version in two forms survives. The various elements of the book were written by different authors at different dates. vi.–xxxvi. was written before 166 B.C., lxxii.–lxxxii. before the *Book of Jubilees*, *i.e.* before 120 B.C. or thereabouts, lxxxiii.–xc. about 166 B.C., i.–v., xci.–civ. before 95 B.C., and xxxvii.–lxxi. before 64 B.C. There are many interpolations drawn mainly from the Book of Noah.

Testaments of the XII. Patriarchs.—This book, in some respects the most important of Old Testament apocryphs, has only recently come into its own. Till a few years ago, owing to Christian interpolations, it was taken to be a Christian apocryph, written originally in Greek in the 2nd century A.D. Now it is acknowledged by Christian and Jewish scholars alike to have been written in Hebrew in the 2nd century B.C. From Hebrew it was translated into Greek and from Greek into Armenian and Slavonic. The versions have come down in their entirety, and small portions of the Hebrew text have been recovered from later Jewish writings. The Testaments were written about the same date as the *Book of Jubilees*. These two books form the only Apology in Jewish literature for the religious and civil hegemony of the Maccabees from the Pharisaic standpoint. To the Jewish interpolation of the 1st century B.C. (about 60–40), *i.e.* T. Lev. x., xiv.–xvi.; T. Jud. xxii.–xxiii., &c., a large interest attaches; for these, like 1 Enoch xci.–civ. and the Psalms of Solomon, constitute an unmeasured attack on every office—prophetic, priestly and kingly—administered by the Maccabees. The ethical character of the book is of the highest type, and its profound influence on the writers of the New Testament is yet to be appreciated. (See TESTAMENTS OF THE XII. PATRIARCHS.)

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[1] See the separate headings for the various apocalyptic books mentioned in this article.

Psalms of Solomon.—These psalms, in all eighteen, enjoyed but small consideration in early times, for only six direct references to them are found in early literature. Their ascription to Solomon is due solely to the copyists or translators, for no such claim is made in any of the psalms. On the whole, Ryle and James are no doubt right in assigning 70–40 B.C. as the limits within which the psalms were written. The authors were Pharisees. They divide their countrymen into two classes—"the righteous," ii. 38-39, iii. 3-5, 7, 8, &c., and "the sinners," ii. 38, iii. 13, iv. 9, &c.; "the saints," iii. 10, &c., and "the transgressors," iv. 11, &c. The former are the Pharisees; the latter the Sadducees. They protest against the Asmonaean house for usurping the throne of David, and laying violent hands on the high priesthood (xvii. 5, 6, 8), and proclaim the coming of the Messiah, the Son of David, who is to set all things right and establish the supremacy of Israel. Pss. xvii.–xviii. and i.–xvi. cannot be assigned to the same authorship. The hopes of the Messiah are confined to the former, and a somewhat different eschatology underlies the two works. Since the Psalms were written in Hebrew, and intended for public worship in the synagogues, it is most probable that they were composed in Palestine. (See SOLOMON, THE PSALMS OF.)

The Assumption of Moses.—This book was lost for many centuries till a large fragment of it was discovered and published by Ceriani in 1861 (*Monumenta Sacra*, I. i. 55-64) from a palimpsest of the 6th century. Very little was known about the contents of this book prior to this discovery. The present book is possibly the long-lost Διαθήκη Μωυσέως mentioned in some ancient lists, for it never speaks of the assumption of Moses, but always of his natural death. About a half of the original Testament is preserved in the Latin version. The latter half probably dealt with questions about the creation. With this "Testament" the "Assumption," to which almost all the patristic references and that of Jude are made, was subsequently edited. The book was written between 4 B.C. and A.D. 7. As for the author, he was no Essene, for he recognizes animal sacrifices and cherishes the Messianic hope; he was not a Sadducee, for he looks forward to the establishment of the Messianic kingdom (x.); nor a Zealot, for the quietistic ideal is upheld (ix.), and the kingdom is established by God Himself (x.). He is therefore a Chasid of the ancient type, and glorifies the ideals which were cherished by the old Pharisaic party, but which were now being fast disowned in favour of a more active rôle in the political life of the nation. He pours his most scathing invectives on the Sadducees, who are described in vii. in terms that recall the anti-Sadducean Psalms of Solomon. His object, therefore, is to protest against the growing secularization of the Pharisaic party through its adoption of popular Messianic beliefs and political ideals. (See also MOSES, ASSUMPTION OF.)

Apocalypse of Baruch—The Syriac.—This apocalypse has survived only in the Syriac version. The Syriac is a translation from the Greek, and the Greek in turn from the Hebrew. The book treats of the Messiah and the Messianic kingdom, the woes of Israel in the past and the destruction of Jerusalem in the present, as well as of theological questions relating to original sin, free will, works, &c. The views expressed on several of these subjects are often conflicting. We must, therefore, assume a number of independent sources put together by an editor or else that the book is on the whole the work of one author who made use of independent writings but failed to blend them into one harmonious whole. In its present form the book was written soon after A.D. 70. For fuller treatment see BARUCH.

4 Ezra.—This apocryph is variously named. In the first Arabic and Ethiopic versions it is called 1 Ezra; in some Latin MSS. and in the English authorized version it is 2 Ezra, and in the Armenian 3 Ezra. With the majority of the Latin MSS. we designate the book 4 Ezra. In its fullest form this apocryph consists of sixteen chapters, but i.–ii. and xv.–xvi. are of different authorship from each other and from the main work iii.–xiv. The book was written originally in Hebrew. There are Latin, Syriac, Ethiopic, Arabic (two), and Armenian versions. The Greek version is lost. This apocalypse is of very great importance, on account of its very full treatment of the theological questions rife in the latter half of the 1st century of the Christian era. The book, even if written by one author, was based on a variety of already existing works. It springs from the same school of thought as the *Apocalypse of Baruch*, and its affinities with the latter are so numerous and profound that scholars have not yet come to any consensus as to the relative priority of either. In its present form it was composed A.D. 80–100. For fuller treatment see EZRA.

Apocalypse of Baruch—The Greek.—This work is referred to by Origen (*de Princip.* II. iii. 6): "Denique etiam Baruch prophetae librum in assertionis hujus testimonium vocant, quod ibi de septem mundis vel caelis evidentius indicatur." This book survives in two forms in Slavonic and Greek. The former was translated by Bonwetsch in 1896, in the *Nachrichten von der königl. Ges. der Wiss. zu Gött.* pp. 91-101; the latter by James in 1897 in *Anecdota*, ii. 84-94, with an elaborate introduction (pp. li.-lxxi.). The Slavonic is only of secondary value, as it is merely an abbreviated form of the Greek. Even the Greek cannot claim to be the original work, but only to be a recension of it; for, whereas Origen states that this apocalypse contained an account of the seven heavens, the existing Greek work describes only five, and the Slavonic only two. As the original work presupposes 2 Enoch and the Syriac *Apocalypse of Baruch* and was known to Origen, it was written between A.D. 80 and 200, and nearer the earlier date than the later, as it would otherwise be hard to understand how it came to circulate among Christians. The superscription shows points of connexion with the *Rest of the Words of Baruch*, but little weight can be attached to the fact, since titles and superscriptions were so frequently transformed and expanded in ancient times. As James and Kohler have pointed out, part of section 4 on the Vine is a Christian addition. A German translation of the Greek appears in Kautzsch's *Apok. u. Pseud.* ii. 448-457, and a strong article by Kohler on the Jewish authorship of the book in the *Jewish Encyclopedia*, ii. 549-551. (See BARUCH.)

Apocalypse of Abraham.—This book is found only in the Slavonic (edited by Bonwetsch, *Studien zur Geschichte d. Theologie und Kirche*, 1897), a translation from the Greek. It is of Jewish origin, but in part worked over by a Christian reviser. The first part treats of Abraham's conversion, and the second forms an apocalyptic expansion of Gen. xv. This book was possibly known to the author of the *Clem. Recognitions*, i. 32, a passage, however, which may refer to Jubilees. It is most probably distinct from the 'Αποκάλυψις 'Αβραάμ used by the gnostic Sethites (Epiphanius, *Haer.* xxxix. 5), which was very heretical. On the other hand, it is probably identical with the apocryphal book 'Αβραάμ mentioned in the Stichometry of Nicephorus, and the Synopsis Athanasii, together with the Apocalypses of Enoch, &c.

Lost Apocalypses: Prayer of Joseph.—The *Prayer of Joseph* is quoted by Origen [*In Joann.* II. xxv. (Lommatzsch, i. 147, 148); *in Gen.* III. ix. (Lommatzsch, viii. 30-31)]. The fragments in Origen represent Jacob as speaking and claiming to be "the first servant in God's presence," "the first-begotten of every creature animated by God," and declaring that the angel who wrestled with Jacob (and was identified by Christians with Christ) was only eighth in rank. The work was obviously anti-Christian. (See Schürer^3, iii. 265-266.)

Book of Eldad and Modad.—This book was written in the name of the two prophets mentioned in Num. xi. 26-29. It consisted, according to the Targ. Jon. on Num. xi. 26-29, mainly of prophecies on Magog's last attack on Israel. The Shepherd of Hermas quotes it *Vis.* ii. 3. (See Marshall in Hastings' *Bible Dictionary*, i. 677.)

Apocalypse of Elijah.—This apocalypse is mentioned in two of the lists of books. Origen, Ambrosiaster, and Euthalius ascribe to it 1 Cor. ii. 9. If they are right, the apocalypse is pre-Pauline. The peculiar form in which 1 Cor. ii. 9 appears in Clemens Alex. *Protrept.* x. 94, and the *Const. Apost.* vii. 32, shows that both have the same source, probably this apocalypse. Epiphanius (*Haer.* xlii., ed. Oehler, vol. ii. 678) ascribes to this work Eph. v. 14. Isr. Lévi (*Revue des études juives*, 1880, i. 108 sqq.) argues for the existence of a Hebrew apocalypse of Elijah from two Talmudic passages. A late work of this name has been published by Jellinek, *Bet ha-Midrasch*, 1855, iii. 65-68, and Buttenwieser in 1897. Zahn, *Gesch. des N.T. Kanons*, ii. 801-810, assigns this apocalypse to the 2nd century A.D. (See Schürer^3, iii. 267-271.)

Apocalypse of Zephaniah.—Apart from two of the lists this work is known to us in its original form only through a citation in Clem. Alex. *Strom.* v. 11, 77. A Christian revision of it is probably preserved in the two dialects of Coptic. Of these the Akhmim text is the original of the Sahidic. These texts and their translations have been edited by Steindorff, *Die Apokalypse des Elias, eine unbekannte Apokalypse und Bruchstücke der Sophonias-Apokalypse* (1899). As Schürer (*Theol. Literaturzeitung*, 1899, No. I. 4-8) has shown, these fragments belong most probably to the Zephaniah apocalypse. They give descriptions of heaven and hell, and predictions of the Antichrist. In their present form these Christianized fragments are not earlier than the 3rd century. (See Schürer, *Gesch. des jüd. Volkes*^{3}, iii. 271-273.)

2 Enoch, or the *Slavonic Enoch*, or the *Book of the Secrets of Enoch.*—This new fragment of the Enochic literature was recently brought to light through five MSS. discovered in Russia and Servia. The book in its present form was written before A.D. 70 in Greek by an orthodox Hellenistic Jew, who lived in Egypt. For a fuller account see ENOCH.

Oracles of Hystaspes.—See under *N. T. Apocalypses*, below.

Testament of Job.— This book was first printed from one MS. by Mai, *Script. Vet. Nov. Coll.* (1833), VII. i. 180, and translated into French in Migne's *Dict. des Apocryphes*, ii. 403. An excellent edition from two MSS. is given by M. R. James, *Apocrypha Anecdota*, ii. pp. lxxii.-cii., 104-137, who holds that the book in its present form was written by a Christian Jew in Egypt on the basis of a Hebrew Midrash on Job in the 2nd or 3rd century A.D. Kohler (*Kohut Memorial Volume*, 1897, pp. 264-338) has given good grounds for regarding the whole work, with the exception of some interpolations, as "one of the most remarkable productions of the pre-Christian era, explicable only when viewed in the light of Hasidean practice." See *Jewish Encycl.* vii. 200-202.

Testaments of the III. Patriarchs.—For an account of these three Testaments (referred to in the *Apost. Const.* vi. 16), the first of which only is preserved in the Greek and is assigned by James to the 2nd century A.D., see that scholar's "Testament of Abraham," *Texts and Studies*, ii. 2 (1892), which appears in two recensions from six and three MSS. respectively, and Vassiliev's *Anecdota Graeco-Byzantina* (1893), pp. 292-308, from one MS. already used by James. This work was written in Egypt, according to James, and survives also in Slavonic, Rumanian, Ethiopic, and Arabic versions. It deals with Abraham's reluctance to die and the means by which his death was brought about. James holds that this book is referred to by Origen (*Hom. in Luc.* xxxv.), but this is denied by Schürer, who also questions its Jewish origin. With the exception of chaps. x.-xi., it is really a legend and not an apocalypse. An English translation of James's texts will be found in the *Ante-Nicene Christian Library* (Clark, 1897), pp. 185-201. The Testaments of Isaac and Jacob are still preserved in Arabic and Ethiopic (see James, *op. cit.* 140-161). See TESTAMENTS OF THE III. PATRIARCHS.

Sibylline Oracles.—Of the books which have come down to us the main part is Jewish, and was written at various dates. iii. 97-829, iv.-v. are decidedly of Jewish authorship, and probably xi.-xii., xiv. and parts of i.-ii. The oldest portions are in iii., and belong to the 2nd century B.C.

III. NEW TESTAMENT APOCALYPTIC

When we pass from Jewish literature to that of the New Testament, we enter into a new and larger atmosphere at once recalling and transcending what had been best in the prophetic periods of the past. Again the heavens had opened and the divine teaching come to mankind, no longer merely in books bearing the names of ancient patriarchs, but on the lips of living men, who had taken courage to appear in person as God's messengers before His people. But though Christianity was in spirit the descendant of ancient Jewish prophecy, it was no less truly the child of that Judaism which had expressed its highest aspirations and ideals in pseudepigraphic and apocalyptic literature. Hence we shall not be surprised to find that the two tendencies are fully represented in primitive Christianity, and, still more strange as it may appear, that New Testament apocalyptic found a more ready hearing amid the stress and storm of the 1st century than the prophetic side of Christianity, and that the type of the forerunner on the side of its declared asceticism appealed more readily to primitive Christianity than that of Him who came "eating and drinking," declaring both worlds good and both God's.

Early Christianity had thus naturally a special fondness for this class of literature. It was Christianity that preserved Jewish apocalyptic, when it was abandoned by Judaism as it sank into Rabbinism, and gave it a Christian character either by a forcible exegesis or by a systematic process of interpolation. Moreover, it cultivated this form of literature and made it the vehicle of its own ideas. Though apocalyptic served its purpose in the opening centuries of the Christian era, it must be confessed that in *many* of its aspects its office is transitory, as they belong not to the essence of Christian thought. When once it had taught men that the next world was God's world, though it did so at the cost of relinquishing the present to Satan, it had achieved its real task, and the time had come for it to quit the stage of history, when Christianity appeared as the heir of this true spiritual achievement. But Christianity was no less assuredly the heir of ancient prophecy, and thus as spiritual representative of what was true in prophecy and apocalyptic; its essential teaching was as that of its Founder that both worlds were of God and that both should be made God's.

(i.) Canonical:—
    Apocalypse in Mark xiii. (Matthew xxiv., Luke xxi.).
    2 Thessalonians ii.
    Revelation.

(ii.) Extra-Canonical:—
    Apocalypse of Peter.
    Testament of Hezekiah.
    Testament of Abraham.
    Oracles of Hystaspes.
    Vision of Isaiah.
    Shepherd of Hermas.
    5 Ezra.
    6 Ezra.
    Christian Sibyllines.
    Apocalypses of Paul, Thomas and Stephen.
    Apocalypses of Esdras, Paul, John, Peter, The Virgin, Sedrach, Daniel.
    Revelations of Bartholomew.
    Questions of Bartholomew.

Apocalypse in Mark xiii.—According to the teaching of the Gospels the second advent was to take the world by surprise. Only one passage (Mark xiii. = Matt. xxiv. = Luke xxi.) conflicts with this view, and is therefore suspicious. This represents the second advent as heralded by a succession of signs which are unmistakable precursors of its appearance, such as wars, earthquakes, famines, the destruction of Jerusalem and the like. Our suspicion is justified by a further examination of Mark xiii. For the words "let him that *readeth* understand" (ver. 14) indicate that the prediction referred to appeared first not in a spoken address but in a written form, as was characteristic of apocalypses. Again, in ver. 30, it is declared that this generation shall not pass away until all these things be fulfilled, whereas in 32 we have an undoubted declaration of Christ "Of that day or of that hour knoweth no one, not even the angels in heaven, neither the Son, but the Father." On these and other grounds verses 7, 8, 14-20, 24-27, 30, 31 should be removed from their present context. Taken together they constitute a Christian adaptation of an originally Jewish work, written A.D. 67–68, during the troubles preceding the fall of Jerusalem. The apocalypse consists of three Acts: Act i. consisting of verses 7, 8, enumerating the woes heralding the parusia, Act ii. describing the actual tribulation, and Act iii. the parusia itself. (See Wendt, *Lehre Jesu*, i. 12-21; Charles, *Eschatology*, 325 sqq.; H. S. Holtzmann, *N. T. Theol.* 1-325 sqq. with literature there given.)

2 Thessalonians ii.—The earliest form of Pauline eschatology is essentially Jewish. He starts from the fundamental thought of Jewish apocalyptic that the end of the world will be brought about by the direct intervention of God when evil has reached its climax. The manifestation of evil culminates in the Antichrist whose parusia (2 Thess. ii. 9) is the Satanic counterfeit of that of the true Messiah. But the climax of evil is the immediate herald of its destruction; for thereupon Christ will descend from heaven and destroy the Antichrist (ii. 8). Nowhere in his later epistles does this forecast of the future reappear. Rather under the influence of the great formative Christian conceptions he parted gradually with the eschatology he had inherited from Judaism, and entered on a progressive development, in the course of which the heterogeneous elements were for the most part silently dropped.

Revelation.—Since this book is discussed separately we shall content ourselves here with indicating a few of the conclusions now generally accepted. The apocalypse was written about A.D. 96. Its object, like other Jewish apocalypses, was to encourage faith under persecution; its burden is not a call to repentance but a promise of deliverance. It is derived from one author, who has made free use of a variety of elements, some of which are Jewish and consort but ill with their new context. The question of the pseudonymity of the book is still an open one.

Apocalypse of Peter.—Till 1892 only some five or more fragments of this book were known to exist. These are preserved in Clem. Alex. and in Macarius Magnes (see Hilgenfeld, *N.T. extra Can.* iv. 74 sqq.; Zahn, *Gesch. Kanons*, ii. 818-819). It is mentioned in the Muratorian Canon, and according to Eusebius (*H.E.* vi. 14. 1) was commented on by Clement of Alexandria. In the fragment found at Akhmim there is a prediction of the last things, and a vision of the abode and blessedness of the righteous, and of the abode and torments of the wicked.

Testament of Hezekiah.—This writing is fragmentary, and has been preserved merely as a constituent of the Ascension of Isaiah. To it belongs iii. 13b-iv. 18 of that book. It is found under the above name, Διαθήκη 'Εζεκίου, only in Cedrenus i. 120-121, who quotes partially iv. 12. 14 and refers to iv. 15-18. For a full account see Isaiah, Ascension of.

Testament of Abraham.—This work in two recensions was first published by James, *Texts and Studies*, ii. 2. Its editor is of opinion that it was written by a Jewish Christian in Egypt in the 2nd century A.D., but that it embodies legends of an earlier date, and that it received its present form in the 9th or 10th century. It treats of Michael being sent to announce to Abraham his death: of the tree speaking with a human voice (iii.), Michael's sojourn with Abraham (iv.-v.) and Sarah's recognition of him as one of the three angels, Abraham's refusal to die (vii.), and the vision of judgment (x.-xx.).

Oracles of Hystaspes.—This eschatological work (Χρήσεις 'Υστάσπου: so named by the anonymous 5th-century writer in Buresch, *Klaros*, 1889, p. 95) is mentioned in conjunction with the Sibyllines by Justin (*Apol.* i. 20), Clement of Alexandria (*Strom.* vi. 5), and Lactantius (*Inst.* VII. xv. 19; xviii. 2-3). According to Lactantius, it prophesied the overthrow of Rome and the advent of Zeus to help the godly and destroy the wicked, but omitted all reference to the sending of the Son of God. According to Justin, it prophesied the destruction of the world by fire. According to the *Apocryph of Paul*, cited by Clement, Hystaspes foretold the conflict of the Messiah with many kings and His advent. Finally, an unknown 5th-century writer (see Buresch, *Klaros*, 1889, pp. 87-126) says that the *Oracles of Hystaspes* dealt with the incarnation of the Saviour. The work referred to in the last two writers has Christian elements, which were absent from it in Lactantius's copy. The lost oracles were therefore in all probability originally Jewish, and subsequently re-edited by a Christian.

Vision of Isaiah.—This writing has been preserved in its entirety in the *Ascension of Isaiah*, of which it constitutes chaps. vi.-xi. Before its incorporation in the latter work it circulated independently in Greek. There are independent versions of these chapters in Latin and Slavonic. (See Isaiah, Ascension of.)

Shepherd of Hermas.—In the latter half of the 2nd century this book enjoyed a respect bordering on that paid to the writings of the New Testament. Irenaeus, Clement of Alexandria and Origen quote it as Scripture, though in Africa it was not held in such high consideration, as Tertullian speaks slightingly of it. The writer belongs really to the prophetic and not to the apocalyptic school. His book is divided into three parts containing visions, commands, similitudes. In incidental allusions he lets us know that he had been engaged in trade, that his wife was a termagant, and that his children were ill brought up. Various views have been held as to the identity of the author. Thus some have made him out to be the Hermas to whom salutation is sent at the end of the Epistle to the Romans, others that he was the brother of Pius, bishop of Rome in the middle of the 2nd century, and others that he was a contemporary of Clement, bishop of Rome at the close of the 1st century. Zahn fixes the date at 97, Salmon a few years later, Lipsius 142. The literature of this book (see Hermas, Shepherd of) is very extensive. Among the chief editions are those of Zahn, *Der Hirt des Hermas* (1868); Gebhardt and Harnack, *Patres Apostolici* (1877, with full bibliographical material); Funk, *Patres Apost.* (1878). Further see Harnack, *Gesch. d. altchristl. Literatur*, i. 49-58; II. i. 257-267, 437 f.

5 Ezra.—This book, which constitutes in the later MSS. the first two chapters to 4 Ezra, falls obviously into two parts. The first (i. 5–ii. 9) contains a strong attack on the Jews whom it regards as the people of God; the second (ii. 10-47) addresses itself to the Christians as God's people and promises them the heavenly kingdom. It is not improbable that these chapters are based on an earlier Jewish writing. In its present form it may have been written before A.D. 200, though James and other scholars assign it to the 3rd century. Its tone is strongly anti-Jewish. The style is very vigorous and the materials of a strongly apocalyptic character. See Hilgenfeld, *Messias Judaeorum* (1869); James in Bensly's edition of 4 Ezra, pp. xxxviii.-lxxx.; Weinel in Hennecke's *N.T. Apokryphen*, 331-336.

6 Ezra.—This work consists of chapters xv.-xvi. of 4 Ezra. It may have been written as an appendix to 4 Ezra, as it has no proper introduction. Its contents relate to the destruction of the world through war and natural catastrophes—for the heathen a source of menace and fear, but for the persecuted people of God one of admonition and comfort. There is nothing specifically Christian in the book, which represents a persecution which extends over the whole eastern part of the Empire. Moreover, the idiom is particularly Semitic. Thus we have xv. 8 *nec* *sustinebo in his quae inique exercent*, that is נשא ב: in 9 *vindicans vindicabo*: in 22 *non parcet dextera mea super peccatores*= φείσεται . . . ἐπί=על . . . יחמול. In verses 9, 19 the manifest corruptions may be explicable from a Semitic background. There are other Hebraisms in the text. It is true that these might have been due to the writer's borrowings from earlier Greek works ultimately of Hebrew origin. The date of the book is also quite uncertain, though several scholars have ascribed it to the 3rd century.

Christian Sibyllines.—Critics are still at variance as to the extent of the Christian Sibyllines. It is practically agreed that vi.-viii. are of Christian origin. As for i.-ii., xi.-xiv. most writers are in favour of Christian authorship; but not so Geffcken (ed. *Sibyll.*, 1902), who strongly insists on the Jewish origin of large sections of these books.

Apocalypses of Paul, Thomas and Stephen.—These are mentioned in the Gelasian decree. The first may possibly be the Ἀναβατικὸν Παύλου mentioned by Epiphanius (*Haer.* xxxviii. 2) as current among the Cainites. It is not to be confounded with the apocalypse mentioned two sections later.

Apocalypse of Esdras.—This Greek production resembles the more ancient fourth book of Esdras in some respects. The prophet is perplexed about the mysteries of life, and questions God respecting them. The punishment of the wicked especially occupies his thoughts. Since they have sinned in consequence of Adam's fall, their fate is considered worse than that of the irrational creation. The description of the tortures suffered in the infernal regions is tolerably minute. At last the prophet consents to give up his spirit to God, who has prepared for him a crown of immortality. The book is a poor imitation of the ancient Jewish one. It may belong, however, to the 2nd or 3rd centuries of the Christian era. See Tischendorf, *Apocalypses Apocryphae*, pp. 24-33.

Apocalypse of Paul.—This work (referred to by Augustine, *Tractat. in Joan.* 98) contains a description of the things which the apostle saw in heaven and hell. The text, as first published in the original Greek by Tischendorf (*Apocalypses Apocr.* 34-69), consists of fifty-one chapters, but is imperfect. Internal evidence assigns it to the time of Theodosius, *i.e.* about A.D. 388. Where the author lived is uncertain. Dr Perkins found a Syriac MS. of this apocalypse, which he translated into English, and printed in the *Journal of the American Oriental Society*, 1864, vol. viii. This was republished by Tischendorf below the Greek version in the above work. In 1893 the Latin version from one MS. was edited by M. R. James, *Texts and Studies*, ii. 1-42, who shows that the Latin version is the completest of the three, and that the Greek in its present form is abbreviated.

Apocalypse of John (Tischendorf, *Apocalypses Apocr.* 70 sqq.) contains a description of the future state, the general resurrection and judgment, with an account of the punishment of the wicked, as well as the bliss of the righteous. It appears to be the work of a Jewish Christian. The date is late, for the writer speaks of the "venerable and holy images," as well as "the glorious and precious crosses and the sacred things of the churches" (xiv.), which points to the 5th century, when such things were first introduced into churches. It is a feeble imitation of the canonical apocalypse.

Arabic Apocalypse of Peter contains a narrative of events from the foundation of the world till the second advent of Christ. The book is said to have been written by Clement, Peter's disciple. This Arabic work has not been printed, but a summary of the contents is given by Nicoll in his catalogue of the Oriental MSS. belonging to the Bodleian (p. 49, xlviii.). There are eighty-eight chapters. It is a late production; for Ishmaelites are spoken of, the Crusades, and the taking of Jerusalem. See Tischendorf, *Apocalypses Apocr.* pp. xx.-xxiv.

The Apocalypse of the Virgin, containing her descent into hell, is not published entire, but only several portions of it from Greek MSS. in different libraries, by Tischendorf in his *Apocalypses Apocryphae*, pp. 95 sqq.; James, *Texts and Studies*, ii. 3. 109-126.

Apocalypse of Sedrach.—This late apocalypse, which M. R. James assigns to the 10th or 11th century, deals with the subject of intercession for sinners and Sedrach's unwillingness to die. See James, *Texts and Studies*, ii. 3. 127-137.

Apocalypse of Daniel.—See Vassiliev's *Anecdota Graeco-Byzantina* (Moscow, 1893), pp. 38-44; *Uncanonical Books of the Old Testament* (Venice, 1901), pp. 237 sqq., 387 sqq.

The Revelations of Bartholomew.—Dulaurier published from a Parisian Sahidic MS., subjoining a French translation, what is termed a fragment of the apocryphal revelations of St Bartholomew (*Fragment des révélations apocryphes de Saint Barthélemy, &c.*, Paris, 1835), and of the history of the religious communities founded by St Pachomius. After narrating the pardon obtained by Adam, it is said that the Son ascending from Olivet prays the Father on behalf of His apostles; who consequently receive consecration from the Father, together with the Son and Holy Spirit—Peter being made archbishop of the universe. The late date of the production is obvious.

Questions of St Bartholomew.—See Vassiliev, *Anec. Graeco-Byzantina* (1893), pp. 10-22. The introduction, which is wanting in the Greek MS., has been supplied by a Latin translation from the Slavonic version (see pp. vii.-ix.). The book contains disclosures by Christ, the Virgin and Beliar and much of the subject-matter is ancient. (R. H. C.)

APOCATASTASIS, a Greek word, meaning "re-establishment," used as a technical scientific term for a return to a previous position or condition.

APOCRYPHAL LITERATURE. The history of the earlier usage of the term "Apocrypha" (from ἀποκρύπτειν, to hide) is not free from obscurity. We shall therefore enter at once on a short account of the origin of this literature in Judaism, of its adoption by early Christianity, of the various meanings which the term "apocryphal" assumed in the course of its history, and having so done we shall proceed to classify and deal with the books that belong to this literature. The word most generally denotes writings which claimed to be, or were by certain sects regarded as, sacred scriptures although excluded from the canonical scriptures.

Apocrypha in Judaism.—Certain circles in Judaism, as the Essenes in Palestine (Josephus, *B.J.* ii. 8. 7) and the Therapeutae (Philo, *De Vita Contempl.* ii. 475, ed. Mangey) in Egypt possessed a secret literature. But such literature was not confined to the members of these communities, but had been current among the Chasids and their successors the Pharisees.[1] To this literature belong essentially the apocalypses which were published in fast succession from Daniel onwards. These works bore, perforce, the names of ancient Hebrew worthies in order to procure them a hearing among the writers' real contemporaries. To reconcile their late appearance with their claims to primitive antiquity the alleged author is represented as "shutting up and sealing" (Dan. xii. 4, 9) the book, until the time of its fulfilment had arrived; for that it was not designed for his own generation but for far-distant ages (1 Enoch i. 2, cviii. 1.; Ass. Mos. i. 16, 17). It is not improbable that with many Jewish enthusiasts this literature was more highly treasured than the canonical scriptures. Indeed, we have a categorical statement to this effect in 4 Ezra xiv. 44 sqq., which tells how Ezra was inspired to dictate the sacred scriptures which had been destroyed in the overthrow of Jerusalem: "In forty days they wrote ninety-four books: and it came to pass when the forty days were fulfilled that the Highest spake, saying: the first that thou hast written publish openly that the worthy and unworthy may read it; but keep the seventy last that thou mayst deliver them only to such as be wise among the people; for in them is the spring of understanding, the fountain of wisdom and the stream of knowledge." Such esoteric books are apocryphal in the original conception of the term. In due course the Jewish authorities were forced to draw up a canon or book of sacred scriptures, and mark them off from those which claimed to be such without justification.

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[1] Judaism was long accustomed to lay claim to an esoteric tradition Thus though it insisted on the exclusive canonicity of the 24 books, it claimed the possession of an oral law handed down from Moses, and just as the apocryphal books overshadowed in certain instances the canonical scriptures, so often the oral law displaced the written in the regard of Judaism.

The true scriptures, according to the Jewish canon (Yad. iii. 5; Toseph. Yad. ii. 3), were those which defiled the hands of such as touched them. But other scholars, such as Zahn, Schürer, Porter, state that the secret books with which we have been dealing formed a class by themselves and were called "Genuizim" (גנוזים), and that this name and idea passed from Judaism over into the Greek, and that *ἀπόκρυφα βιβλία* is a translation of ספרים גנוזים. But the Hebrew verb does not mean "to hide" but "to store away," and is only used of things in themselves precious. Moreover, the phrase is unknown in Talmudic literature. The derivation of this idea from Judaism has therefore not yet been established. Whether the Jews had any distinct name for these esoteric works we do not know. For writings that stood wholly without the pale of sacred books such as the books of heretics or Samaritans they used the designation Hisonim, Sanh. x. 1 (ספרים חצונים and ספרי המינים). To this class in later times even Sirach was relegated, and indeed all books not included in the canon (Midr. r. Num. 14 and on Koheleth xii. 12; cf. Jer. Sabb. 16).[1] In Aqiba's time Sirach and other apocryphal books were not reckoned among the Ḥiṣonim; for Sirach was largely quoted by rabbis in Palestine till the 3rd century A.D.

Apocrypha in Christianity.—Christianity as it springs from its Founder had no secret or esoteric teaching. It was essentially the revelation or manifestation of the truth of God. But as Christianity took its origin from Judaism, it is not unnatural that a large body of Jewish ideas was incorporated in the system of Christian thought. The bulk of these in due course underwent transformation either complete or partial, but there was always a residuum of incongruous and inconsistent elements existing side by side with the essential truths of Christianity. This was no isolated phenomenon; for in every progressive period of the history of religion we have on the one side the doctrine of God advancing in depth and fulness: on the other we have cosmological, eschatological and other survivals, which, however justifiable in earlier stages, are in unmistakable antagonism with the theistic beliefs of the time. The eschatology of a nation—and the most influential portion of Jewish and Christian apocrypha are eschatological—is always the last part of their religion to experience the transforming power of new ideas and new facts.

Now the current religious literature of Judaism outside the canon was composed of apocryphal books, the bulk of which bore an apocalyptic character, and dealt with the coming of the Messianic kingdom. These naturally became the popular religious books of the rising Jewish-Christian communities, and were held by them in still higher esteem, if possible, than by the Jews. Occasionally these Jewish writings were re-edited or adapted to their new readers by Christian additions, but on the whole it was found sufficient to submit them to a system of reinterpretation in order to make them testify to the truth of Christianity and foreshadow its ultimate destinies. Christianity, moreover, moved by the same apocalyptic tendency as Judaism, gave birth to new Christian apocryphs, though, in the case of most of them, the subject matter was to a large extent traditional and derived from Jewish sources.

Another prolific source of apocryphal gospels, acts and apocalypses was Gnosticism. While the characteristic features of apocalyptic literature were derived from Judaism, those of Gnosticism sprang partly from Greek philosophy, partly from oriental religions. They insisted on an allegorical interpretation of the apostolic writings: they alleged themselves to be the guardians of a secret apostolic tradition and laid claim to prophetic inspiration. With them, as with the bulk of the Christians of the 1st and 2nd centuries, apocryphal books as such were highly esteemed. They were so designated by those who valued them. It was not till later times that the term became one of reproach.

We have remarked above that the Jewish apocrypha—especially the apocalyptic section and the host of Christian apocryphs—became the ordinary religious literature of the early Christians. And this is not strange seeing that of the former such abundant use was made by the writers of the New Testament.[2] Thus Jude quotes the Book of Enoch by name, while undoubted use of this book appears in the four gospels and 1 Peter. The influence of the Testaments of the Twelve Patriarchs is still more apparent in the Pauline Epistles and the Gospels, and the same holds true of Jubilees and the Assumption of Moses, though in a very slight degree. The genuineness and inspiration of Enoch were believed in by the writer of the Ep. of Barnabas, Irenaeus, Tertullian and Clement of Alexandria. But the high position which apocryphal books occupied in the first two centuries was undermined by a variety of influences. All claims to the possession of a secret tradition were denied (Irenaeus ii. 27. 2, iii. 2. 1, 3. 1; Tertullian, *Praescript.* 22-27): true inspiration was limited to the apostolic age, and universal acceptance by the church was required as a proof of apostolic authorship. Under the action of such principles apocryphal books tended to pass into the class of spurious and heretical writings.

The Term "Apocryphal."—Turning now to the consideration of the word "apocryphal" itself, we find that in its earliest use it was applied in a laudatory sense to writings, (1) which were kept secret because they were the vehicles of esoteric knowledge which was too profound or too sacred to be imparted to any save the initiated. Thus it occurs in a magical book of Moses, which has been edited from a Leiden papyrus of the 3rd or 4th century by Dieterich (*Abraxas*, 109). This book, which may be as old as the 1st century, is entitled: "A holy and secret Book of Moses, called eighth, or holy" (*Μωυσέως ἱερὰ βίβλος ἀπόκρυφος ἐπικαλουμένη ὀγδόη ἢ ἁγία*). The disciples of the Gnostic Prodicus boasted (Clem. Alex. *Strom.* i. 15. 69) that they possessed the secret (*ἀποκρύφους*) books of Zoroaster. 4 Ezra is in its author's view a secret work whose value was greater than that of the canonical scriptures (xiv. 44 sqq.) because of its transcendent revelations of the future. It is in a like laudatory meaning that Gregory reckons the New Testament apocalypse as *ἐν ἀποκρύφοις* (*Oratio in suam ordinationem*, iii. 549, ed. Migne: cf. Epiphanius, *Haer.* li. 3). The word enjoyed high consideration among the Gnostics (cf. Acts of Thomas, 10, 27, 44). (2) But the word was applied to writings that were kept from public circulation not because of their transcendent, but of their secondary or questionable value. Thus Origen distinguishes between writings which were read by the churches and apocryphal writings: *γραφῇ μὴ φερομένῃ μὲν ἐν τοῖς κοινοῖς καὶ δεδημοσιευμένοις βιβλίοις εἰκὸς δ' ὅτι ἐν ἀποκρύφοις φερομένῃ* (Origen's *Comm. in Matt.*, x. 18, on Matt. xiii. 57, ed. Lommatzsch iii. 49 sqq.). Cf. *Epist. ad Africam*, ix. (Lommatzsch xvii. 31): Euseb. *H.E.* ii. 23, 25; iii. 3, 6. See Zahn, *Gesch. Kanons*, i. 126 sqq. Thus the meaning of *ἀπόκρυφος* is here practically equivalent to "excluded from the public use of the church," and prepares the way for the third and unfavourable sense of this word. (3) The word came finally to mean what is false, spurious, bad, heretical. If we may trust the text, this meaning appears in Origen (*Prolog. in Cant. Cantic.*, Lommatzsch xiv. 325): "De scripturis his, quae appellantur apocryphae, pro eo quod multa in iis corrupta et contra fidem veram inveniuntur a majoribus tradita non placuit iis dari locum nec admitti ad auctoritatem."

In addition to the above three meanings strange uses of the term appear in the western church. Thus the Gelasian Decree includes the works of Eusebius, Tertullian and Clement of Alexandria, under this designation. Augustine (*De Civ. Dei*, xv. 23) explains it as meaning obscurity of origin, while Jerome (*Prologus Galeatus*) declares that all books outside the Hebrew canon belong to this class of apocrypha. Jerome's practice, however, did not square with his theory. The western church did not accept Jerome's definition of apocrypha, but retained the word in its original meaning, though great confusion prevailed. Thus the degree of estimation in which the apocryphal books have been held in the church has varied much according to place and time. As they stood in the Septuagint or Greek canon, along with the other books, and with no marks of distinction, they were practically employed by the Greek Fathers in the same way as the other books; hence Origen, Clement and others often cite them as "scripture," "divine scripture," "inspired," and the like. On the other hand, teachers connected with Palestine, and familiar with the Hebrew canon, rigidly exclude all but the books contained there. This view is reflected, for example, in the canon of Melito of Sardis, and in the prefaces and letters of Jerome. Augustine, however (*De Doct. Christ.* ii. 8), attaches himself to the other side. Two well-defined views in this way prevailed, to which was added a third, according to which the books, though not to be put in the same rank as the canonical scriptures of the Hebrew collection, yet were of value for moral uses and to be read in congregations,—and hence they were called "ecclesiastical"—a designation first found in Rufinus (*ob.* 410). Notwithstanding the decisions of some councils held in Africa, which were in favour of the view of Augustine, these diverse opinions regarding the apocryphal books continued to prevail in the church down through the ages till the great dogmatic era of the Reformation. At that epoch the same three opinions were taken up and congealed into dogmas, which may be considered characteristic of the churches adopting them. In 1546 the council of Trent adopted the canon of Augustine, declaring "He is also to be anathema who does not receive these entire books, with all their parts, as they have been accustomed to be read in the Catholic Church, and are found in the ancient editions of the Latin Vulgate, as sacred and canonical." The whole of the books in question, with the exception of 1st and 2nd Esdras, and the Prayer of Manasses, were declared canonical at Trent. On the other hand, the Protestants universally adhered to the opinion that only the books in the Hebrew collection are canonical. Already Wycliffe had declared that "whatever book is in the Old Testament besides these twenty-five (Hebrew) shall be set among the apocrypha, that is, without authority or belief." Yet among the churches of the Reformation a milder and a severer view prevailed regarding the apocrypha. Both in the German and English translations (Luther's, 1537; Coverdale's, 1535, &c.) these books are separated from the others and set by themselves; but while in some confessions, *e.g.* the Westminster, a decided judgment is passed on them, that they are not "to be any otherwise approved or made use of than other human writings," a milder verdict is expressed regarding them in many other quarters, *e.g.* in the "argument" prefixed to them in the Geneva Bible; in the Sixth Article of the Church of England, where it is said that "the other books the church doth read for example of life and instruction of manners," though not to establish doctrine; and elsewhere.

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[1] See Porter in Hastings' *Bible Dict.* i. 113.

[2] The New Testament shows undoubtedly an acquaintance with several of the apocryphal books. Thus James i. 19 shows dependence on Sirach v. 11, Hebrews i. 3 on Wisdom vii. 26, Romans ix. 21 on Wisdom xv. 7, 2 Cor. v. 1, 4 on Wisdom ix. 15, &c.

OLD TESTAMENT APOCRYPHAL BOOKS

We shall now proceed to enumerate the apocryphal books: first the Apocrypha Proper, and next the rest of the Old and New Testament apocryphal literature.

1. *The Apocrypha Proper*, or the apocrypha of the Old Testament as used by English-speaking Protestants, consists of the following books: 1 Esdras, 2 Esdras, Tobit, Judith, Additions to Esther, Wisdom of Solomon, Ecclesiasticus, Baruch, Epistle of Jeremy, Additions to Daniel (Song of the Three Holy Children, History of Susannah, and Bel and the Dragon), Prayer of Manasses, 1 Maccabees, 2 Maccabees. Thus the Apocrypha Proper constitutes the surplusage of the Vulgate or Bible of the Roman Church over the Hebrew Old Testament. Since this surplusage is in turn derived from the Septuagint, from which the old Latin version was translated, it thus follows that the difference between the Protestant and the Roman Catholic Old Testament is, roughly speaking, traceable to the difference between the Palestinian and the Alexandrian canons of the Old Testament. But this is only true with certain reservations; for the Latin Vulgate was revised by Jerome according to the Hebrew, and, where Hebrew originals were wanting, according to the Septuagint. Furthermore, the Vulgate rejects 3 and 4 Maccabees and Psalm cli., which generally appear in the Septuagint, while the Septuagint and Luther's Bible reject 4 Ezra, which is found in the Vulgate and the Apocrypha Proper. Luther's Bible, moreover, rejects also 3 Ezra. It should further be observed that the Vulgate adds the Prayer of Manasses and 3 and 4 Ezra after the New Testament as apocryphal.

It is hardly possible to form any classification which is not open to some objection. In any case the classification must be to some extent provisional, since scholars are still divided as to the original language, date and place of composition of some of the books which must come under our classification.[1] We may, however, discriminate (i.) the Palestinian and (ii.) the Hellenistic literature of the Old Testament, though even this distinction is open to serious objections. The former literature was generally written in Hebrew or Aramaic, and seldom in Greek; the latter naturally in Greek. Next, within these literatures we shall distinguish three or four classes according to the nature of the subject with which they deal. Thus the books of which we have to treat will be classed as: (*a*) Historical, (*b*) Legendary (Haggadic), (*c*) Apocalyptic, (*d*) Didactic or Sapiential.

The Apocrypha Proper then would be classified as follows:—

i. Palestinian Jewish Literature:—

(*a*) *Historical.*
  1 (*i.e.* 3) Ezra.
  1 Maccabees.
(*b*) *Legendary.*
  Book of Baruch (see BARUCH).
  Judith.
(*c*) *Apocalyptic.*
  2 (*i.e.* 4) Ezra (see also under separate article on APOCALYPTIC LITERATURE.
(*d*) *Didactic.*
  Sirach (see ECCLESIASTICUS).
  Tobit.

ii. Hellenistic Jewish Literature:—

Historical and Legendary.
  Additions to Daniel (*q.v.*).
  ,, ,, Esther (*q.v.*).
  Epistle of Jeremy (*q.v.*).
  2 Maccabees (*q.v.*).
  Prayer of Manasses (see MANASSES).
Didactic.
  Book of Wisdom (see WISDOM, BOOK OF.)

Since all these books are dealt with in separate articles, they call for no further notice here.

LITERATURE.—Texts:—Holmes and Parsons, *Vet. Test. Graecum cum var. lectionibus* (Oxford, 1798–1827); Swete, *Old Testament in Greek*, i.-iii. (Cambridge, 1887–1894); Fritzsche, *Libri Apocryphi V. T. Graece* (1871). Commentaries:—O. F. Fritzsche and Grimm, *Kurzgef. exeget. Handbuch zu den Apok. des A.T.* (Leipzig, 1851–1860); E. C. Bissell, *Apocrypha of the Old Testament* (Edinburgh, 1880); Zöckler, *Apok. des A.T.* (München, 1891); Wace, *The Apocrypha* ("Speaker's Commentary") (1888). Introduction and General Literature:— E. Schürer^3, *Geschichte des jüd. Volkes*, vol. iii. 135 sqq., and his article on "Apokryphen" in Herzog's *Realencykl.* i. 622-653; Porter in Hastings' *Bible Dic.* i. 111-123.

2 (*a*). *Other Old Testament Apocryphal Literature:*—

(*a*) *Historical.*
  History of Johannes Hyrcanus.
(*b*) *Legendary.*
  Book of Jubilees.
  Paralipomena Jeremiae, or the Rest of the Words of Baruch.
  Martyrdom of Isaiah.
  Pseudo-Philo's Liber Antiquitatum.
  Books of Adam.
  Jannes and Jambres.
  Joseph and Asenath.
(*c*) *Apocalyptic.*
  (See separate article.)
(*d*) *Didactic or Sapiential.*
  Pirke Aboth.

(*a*) *Historical.*—The *History of Johannes Hyrcanus* is mentioned in 1 Macc. xvi. 23-24, but no trace has been discovered of its existence elsewhere. It must have early passed out of circulation, as it was unknown to Josephus.

(*b*) *Legendary.*—The *Book of Jubilees* was written in Hebrew by a Pharisee between the year of the accession of Hyrcanus to the high-priesthood in 135 and his breach with the Pharisees some years before his death in 105 B.C. *Jubilees* was translated into Greek and from Greek into Ethiopic and Latin. It is preserved in its entirety only in Ethiopic. *Jubilees* is the most advanced pre-Christian representative of the midrashic tendency, which was already at work in the Old Testament 1 and 2 Chronicles. As the chronicler rewrote the history of Israel and Judah from the basis of the Priests' Code, so our author re-edited from the Pharisaic standpoint of his time the book of Genesis and the early chapters of Exodus. His work constitutes an enlarged targum on these books, and its object is to prove the everlasting validity of the law, which, though revealed in time, was superior to time. Writing in the palmiest days of the Maccabean dominion, he looked for the immediate advent of the Messianic kingdom. This kingdom was to be ruled over by a Messiah sprung not from Judah but from Levi, that is, from the reigning Maccabean family. This kingdom was to be gradually realized on earth, the transformation of physical nature going hand in hand with the ethical transformation of man. (For a fuller account see JUBILEES, BOOK OF.)

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[1] Thus some of the additions to Daniel and the Prayer of Manasses are most probably derived from a Semitic original written in Palestine, yet in compliance with the prevailing opinion they are classed under Hellenistic Jewish literature. Again, the Slavonic Enoch goes back undoubtedly in parts to a Semitic original, though most of it was written by a Greek Jew in Egypt.

Paralipomena Jeremiae, or the *Rest of the Words of Baruch.*—This book has been preserved in Greek, Ethiopic, Armenian and Slavonic. The Greek was first printed at Venice in 1609, and next by Ceriani in 1868 under the title *Paralipomena Jeremiae.* It bears the same name in the Armenian, but in Ethiopic it is known by the second title. (See under BARUCH.)

Martyrdom of Isaiah.—This Jewish work has been in part preserved in the *Ascension of Isaiah.* To it belong i. 1, 2^a, 6^b-13^a; ii. 1-8, 10–iii. 12; v. 1^c-14 of that book. It is of Jewish origin, and recounts the martyrdom of Isaiah at the hands of Manasseh. (See ISAIAH, ASCENSION OF.)

Pseudo-Philo's Liber Antiquitatum Biblicarum.—Though the Latin version of this book was thrice printed in the 16th century (in 1527, 1550 and 1599), it was practically unknown to modern scholars till it was recognized by Conybeare and discussed by Cohn in the *Jewish Quarterly Review*, 1898, pp. 279-332. It is an Haggadic revision of the Biblical history from Adam to the death of Saul. Its chronology agrees frequently with the LXX. against that of the Massoretic text, though conversely in a few cases. The Latin is undoubtedly translated from the Greek. Greek words are frequently transliterated. While the LXX. is occasionally followed in its translation of Biblical passages, in others the Massoretic is followed against the LXX., and in one or two passages the text presupposes a text different from both. On many grounds Cohn infers a Hebrew original. The eschatology is similar to that taught in the similitudes of the Book of Enoch. In fact, Eth. En. li. 1 is reproduced in this connexion. Prayers of the departed are said to be valueless. The book was written after A.D. 70; for, as Cohn has shown, the exact date of the fall of Herod's temple is predicted.

Life of Adam and Eve.—Writings dealing with this subject are extant in Greek, Latin, Slavonic, Syriac, Armenian and Arabic. They go back undoubtedly to a Jewish basis, but in some of the forms in which they appear at present they are christianized throughout. The oldest and for the most part Jewish portion of this literature is preserved to us in Greek, Armenian, Latin and Slavonic. (i.) The Greek *Διήγησις περὶ Ἀδὰμ καὶ Εὔας* (published under the misleading title Ἀποκάλυψις Μωυσέως in Tischendorf's *Apocalypses Apocryphae*, 1866) deals with the Fall and the death of Adam and Eve. Ceriani edited this text from a Milan MS. (*Monumenta Sacra et Profana*, v. 1). This work is found also in Armenian, and has been published by the Mechitharist community in Venice in their *Collection of Uncanonical Writings of the Old Testament*, and translated by Conybeare (*Jewish Quarterly Review*, vii. 216 sqq., 1895), and by Issaverdens in 1901. (ii.) The *Vita Adae et Evae* is closely related and in part identical with (i.). It was printed by W. Meyer in *Abh. d. Münch. Akad.*, Philos.-philol. Cl. xiv., 1878. (iii.) The Slavonic Adam book was published by Jajić along with a Latin translation (*Denkschr. d. Wien. Akad. d. Wiss.* xlii., 1893). This version agrees for the most part with (i.). It has, moreover, a section, §§ 28-39, which though not found in (i.) is found in (ii.). Before we discuss these three documents we shall mention other members of this literature, which, though derivable ultimately from Jewish sources, are Christian in their present form. (iv.) The *Book of Adam and Eve*, also called the *Conflict of Adam and Eve with Satan*, translated from the Ethiopic (1882) by Malan. This was first translated by Dillmann (*Das christl. Adambuch des Morgenlandes*, 1853), and the Ethiopic book first edited by Trump (*Abh. d. Münch. Akad.* xv., 1879–1881). (v.) A Syriac work entitled *Die Schatzhöhle* translated by Bezold from three Syriac MSS. in 1883 and subsequently edited in Syriac in 1888. This work has close affinities to (iv.), but is said by Dillmann to be more original. (vi.) Armenian books on the *Death of Adam* (*Uncanonical Writings of O.T.* pp. 84 sqq., 1901, translated from the Armenian), *Creation and Transgression of Adam* (*op. cit.* 39 sqq.), *Expulsion of Adam from Paradise* (*op. cit.* 47 sqq.), *Penitence of Adam and Eve* (*op. cit.* 71 sqq.) are mainly later writings from Christian hands.

Returning to the question of the Jewish origin of i., ii., iii., we have already observed that these spring from a common original. As to the language of this original, scholars are divided. The evidence, however, seems to be strongly in favour of Hebrew. How otherwise are we to explain such Hebraisms (or Syriacisms) as **ἐνῷ ῥέει τὸ ἔλαιον ἐξ αὐτοῦ** (§ 9), *οὗ εἶπεν . . . μὴ φαγεῖν ἀπ' αὐτοῦ* (§ 21). For others see §§ 23, 33. Moreover, as Fuchs has pointed out, in the words *ἔσῃ ἐν ματαίοις* addressed to Eve (§ 25) there is a corruption of חבלים into הבלים. Thus the words were: "Thou shalt have pangs." In fact, Hebraisms abound throughout this book. (See Fuchs, *Apok. u. Pseud. d. A.T.* ii. 511; *Jewish Encyc.* i. 179 sq.)

Jannes and Jambres.—These two men are referred to in 2 Tim. iii. 8 as the Egyptian magicians who withstood Moses. The book which treats of them is mentioned by Origen (*ad Matt.* xxiii. 37 and xxvii. 9 [*Jannes et Mambres Liber*]), and in the Gelasian Decree as the *Paenitentia Jamnis et Mambre.* The names in Greek are generally Ἰαννῆς καὶ Ἰαμβρῆς (=ינים וימברים) as in the Targ.-Jon. on Exod. i. 15; vii. 11. In the Talmud they appear as יוחני וממרא. Since the western text of 2 Tim. iii. 8 has Μαμβρῆς, Westcott and Hort infer that this form was derived from a Palestinian source. These names were known not only to Jewish but also to heathen writers, such as Pliny and Apuleius. The book, therefore, may go back to pre-Christian times. (See Schürer^3 iii. 292-294; *Ency. Biblica*, ii. 2327-2329.)

Joseph and Asenath.—The statement in Gen. xli. 45, 50 that Joseph married the daughter of a heathen priest naturally gave offence to later Judaism, and gave rise to the fiction that Asenath was really the daughter of Shechem and Dinah, and only the foster-daughter of Potipherah (*Targ.-Jon.* on Gen. xli. 45; Tractat. *Sopherim*, xxi. 9; *Jalkut Shimoni*, c. 134. See Oppenheim, *Fabula Josephi et Asenethae*, 1886, pp. 2-4). Origen also was acquainted with some form of the legend (*Selecta in Genesin*, ad Gen. xli. 45, ed. Lommatzsch, viii. 89-90). The Christian legend, which is no doubt in the main based on the Jewish, is found in Greek, Syriac, Armenian, Slavonic and Medieval Latin. Since it is not earlier than the 3rd or 4th century, it will be sufficient here to refer to Smith's *Dict. of Christ. Biog.* i. 176-177; Hastings' *Bible Dict.* i. 162-163; Schürer, iii. 289-291.

(*d*) *Didactic or Sapiential.*—The *Pirke Aboth*, a collection of sayings of the Jewish Fathers, are preserved in the 9th Tractate of the Fourth Order of the Mishnah. They are attributed to some sixty Jewish teachers, belonging for the most part to the years A.D. 70–170, though a few of them are of a much earlier date. The book holds the same place in rabbinical literature as the Book of Proverbs in the Bible. The sayings are often admirable. Thus in iv. 1-4, "Who is wise? He that learns from every man. . . . Who is mighty? He that subdues his nature. . . . Who is rich? He that is contented with his lot. . . . Who is honoured? He that honours mankind." (See further PIRKE ABOTH.)

2 (*b*). *New Testament Apocryphal Literature:—*

(*a*) *Gospels:—*

Uncanonical sayings of the Lord in Christian and Jewish writings.
Gospel according to the Egyptians.
" " " Hebrews.
Protevangel of James.

Gospel of Nicodemus.
,, ,, Peter.
,, ,, Thomas.
,, ,, the Twelve.
Gnostic gospels of Andrew, Apelles, Barnabas, Bartholomew, Basilides, Cerinthus and some seventeen others.

(*b*) *Acts and Teachings of the Apostles*:—
Acts of Andrew and later forms of these Acts.
,, John.
,, Paul.
,, Peter.
Preaching of Peter.
Acts of Thomas.
Teaching of the Twelve Apostles.
Apostolic constitutions.

(*c*) *Epistles*:—
The Abgar Epistles.
Epistle of Barnabas.
,, ,, Clement.
"Clement's" 2nd Epistle of the Corinthians.
,, Epistles on Virginity.
,, ,, to James.
Epistles of Ignatius.
Epistle of Polycarp.
Pauline Epp. to the Laodiceans and Alexandrians.
3 Pauline Ep. to the Corinthians.

(*d*) *Apocalypses*: see under APOCALYPTIC LITERATURE.

(*a*) GOSPELS.—*Uncanonical Sayings of the Lord in Christian and Jewish Sources.*—Under the head of canonical sayings not found in the Gospels only one is found, *i.e.* that in Acts xx. 35. Of the rest the uncanonical sayings have been collected by Preuschen (*Reste der ausserkanonischen Evangelien*, 1901, pp. 44-47). A different collection will be found in Hennecke, *NTliche Apok.* 9-11. The same subject is dealt with in the elaborate volumes of Resch (*Aussercanonische Paralleltexte zu den Evangelien*, vols. i.-iii., 1893–1895).

To this section belongs also the *Fayum Gospel Fragment* and the *Logia* published by Grenfell and Hunt.[1] The former contains two sayings of Christ and one of Peter, such as we find in the canonical gospels, Matt. xxvi. 31-34, Mark xiv. 27-30. The papyrus, which is of the 3rd century, was discovered by Bickell among the Rainer collection, who characterized it (*Z. f. kath. Theol.*, 1885, pp. 498-504) as a fragment of one of the primitive gospels mentioned in Luke i. 1. On the other hand, it has been contended that it is merely a fragment of an early patristic homily. (See Zahn, *Gesch. Kanons*, ii. 780–790; Harnack, *Texte und Untersuchungen*, v. 4; Preuschen, *op. cit.* p. 19.) The *Logia* (*q.v.*) is the name given to the sayings contained in a papyrus leaf, by its discoverers Grenfell and Hunt. They think the papyrus was probably written about A.D. 200. According to Harnack, it is an extract from the *Gospel of the Egyptians*. All the passages referring to Jesus in the Talmud are given by Laible, *Jesus Christus im Talmud*, with an appendix, "Die talmudischen Texte," by G. Dalman (2nd ed. 1901). The first edition of this work was translated into English by A. W. Streane (*Jesus Christ in the Talmud*, 1893). In Hennecke's *NTliche Apok. Handbuch* (pp. 47-71) there is a valuable study of this question by A. Meyer, entitled *Jesus, Jesu Jünger und das Evangelium im Talmud und verwandten jüdischen Schriften*, to which also a good bibliography of the subject is prefixed.

Gospel according to the Egyptians.—This gospel is first mentioned by Clem. Alex. (*Strom.* iii. 6. 45; 9. 63, 66; 13. 92), subsequently by Origen (*Hom. in Luc.* i.) and Epiphanius (*Haer.* lxii. 2), and a fragment is preserved in the so-called 2 Clem. Rom. xii. 2. It circulated among various heretical circles; amongst the Encratites (Clem. *Strom.* iii. 9), the Naassenes (Hippolyt. *Philos.* v. 7), and the Sabellians (Epiph. *Haer.* lxii. 2). Only three or four fragments survive; see Lipsius (Smith and Wace, *Dict. of Christ. Biog.* ii. 712, 713); Zahn, *Gesch. Kanons*, ii. 628-642; Preuschen, *Reste d. ausserkanonischen Evangelien*, 1901, p. 2, which show that it was a product of pantheistic Gnosticism. With this pantheistic Gnosticism is associated a severe asceticism. The distinctions of sex are one day to come to an end; the prohibition of marriage follows naturally on this view. Hence Christ is represented as coming to destroy the work of the female (Clem. Alex. *Strom.* iii. 9. 63). Lipsius and Zahn assign it to the middle of the 2nd century. It may be earlier.

Protevangel of James.—This title was first given in the 16th century to a writing which is referred to as *The Book of James* (ἡ βίβλος Ἰακώβου) by Origen (tom. xi. *in Matt.*). Its author designates it as Ἱστορία. For various other designations see Tischendorf, *Evang. Apocr.*² 1 seq. The narrative extends from the Conception of the Virgin to the Death of Zacharias. Lipsius shows that in the present form of the book there is side by side a strange "admixture of intimate knowledge and gross ignorance of Jewish thought and custom," and that accordingly we must "distinguish between an original Jewish Christian writing and a Gnostic recast of it." The former was known to Justin (*Dial.* 78, 101) and Clem. Alex. (*Strom.* vii. 16), and belongs at latest to the earliest years of the 2nd century. The Gnostic recast Lipsius dates about the middle of the 3rd century. From these two works arose independently the *Protevangel* in its present form and the Latin pseudo-Matthaeus (*Evangelium pseudo-Matthaei*). The *Evangelium de Nativitate Mariae* is a redaction of the latter. (See Lipsius in Smith's *Dict. of Christ. Biog.* ii. 701-703.) But if we except the Zachariah and John group of legends, it is not necessary to assume the Gnostic recast of this work in the 3rd century as is done by Lipsius. The author had at his disposal two distinct groups of legends about Mary. One of these groups is certainly of non-Jewish origin, as it conceives Mary as living in the temple somewhat after the manner of a vestal virgin or a priestess of Isis. The other group is more in accord with the orthodox gospels. The book appears to have been written in Egypt, and in the early years of the 2nd century. For, since Origen states that many appealed to it in support of the view that the brothers of Jesus were sons of Joseph by a former marriage, the book must have been current about A.D. 200. From Origen we may ascend to Clem. Alex. who (*Strom.* vi. 93) shows acquaintance with one of the chief doctrines of the book—the perpetual virginity of Mary. Finally, as Justin's statements as to the birth of Jesus in a cave and Mary's descent from David show in all probability his acquaintance with the book, it may with good grounds be assigned to the first decade of the 2nd century. (So Zahn, *Gesch. Kanons*, i. 485, 499, 502, 504, 539; ii. 774-780.) For the Greek text see Tischendorf, *Evang. Apocr.*² 1-50; B. P. Grenfell, *An Alexandrian erotic Fragment and other Papyri*, 1896, pp. 13-17: for the Syriac, Wright, *Contributions to Apocryphal Literature of the N.T.*, 1865, pp. 3-7; A. S. Lewis, *Studia Sinaitica*, xi. pp. 1-22. See literature generally in Hennecke, *NTliche Apok. Handbuch*, 106 *seq.*

Gospel of Nicodemus.—This title is first met with in the 13th century. It is used to designate an apocryphal writing entitled in the older MSS. ὑπομνήματα τοῦ Κυρίου ἡμῶν Ἰησοῦ Χριστοῦ πραχθέντα ἐπὶ Ποντίου Πιλάτου: also "Gesta Salvatoris Domini . . . inventa Theodosio magno imperatore in Ierusalem in praetorio Pontii Pilati in codicibus publicis." See Tischendorf, *Evang. Apocr.*² pp. 333-335. This work gives an account of the Passion (i.-xi.), the Resurrection (xii.-xvi.), and the *Descensus ad Inferos* (xvii.-xxvii.). Chapters i.-xvi. are extant in the Greek, Coptic, and two Armenian versions. The two Latin versions and a Byzantine recension of the Greek contain i.-xxvii. (see Tischendorf, *Evangelia Apocrypha*², pp. 210-458). All known texts go back to A. D. 425, if one may trust the reference to Theodosius. But this was only a revision, for as early as 376 Epiphanius (*Haer.* i. 1.) presupposes the existence of a like text. In 325 Eusebius (*H.E.* ii. 2) was acquainted only with the heathen *Acts of Pilate*, and knew nothing of a Christian work. Tischendorf and Hofmann, however, find evidence of its existence in Justin's reference to the Ἄκτα Πιλάτου (*Apol.* i. 35, 48), and in Tertullian's mention of the *Acta Pilati* (*Apol.* 21), and on this evidence attribute our texts to the first half of the 2nd century. But these references have been denied by Scholten, Lipsius, and Lightfoot. Recently Schubert has sought to derive the elements which are found in the Petrine Gospel, but not in the canonical gospels, from the original *Acta Pilati*, while Zahn exactly reverses the relation of these two works. Rendel Harris (1899) advocated the view that the Gospel of Nicodemus, as we possess it, is merely a prose version of the Gospel of Nicodemus written originally in Homeric centones as early as the 2nd century. Lipsius and Dobschütz relegate the book to the 4th century. The question is not settled yet (see Lipsius in Smith's *Dict. of Christ. Biography*, ii. 708-709, and Dobschütz in Hastings' *Bible Dictionary*, iii. 544-547).

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[1] These editors have discovered (1907) a gospel fragment of the 2nd century which represents a dialogue between our Lord and a chief priest—a Pharisee.

Gospel according to the Hebrews.—This gospel was cited by Ignatius (*Ad Smyrnaeos*, iii.) according to Jerome (*Viris illus.* 16, and *in Jes.* lib. xviii.), but this is declared to be untrustworthy by Zahn, *op. cit.* i. 921; ii. 701, 702. It was written in Aramaic in Hebrew letters, according to Jerome (*Adv. Pelag.* iii. 2), and translated by him into Greek and Latin. Both these translations are lost. A collection of the Greek and Latin fragments that have survived, mainly in Origen and Jerome, will be found in Hilgenfeld's *NT extra Canonem receptum*, Nicholson's *Gospel according to the Hebrews* (1879), Westcott's *Introd. to the Gospels*, and Zahn's *Gesch. des NTlichen Kanons*, ii. 642-723; Preuschen, *op. cit.* 3-8. This gospel was regarded by many in the first centuries as the Hebrew original of the canonical Matthew (Jerome, *in Matt.* xii. 13; *Adv. Pelag.* iii. 1). With the canonical gospel it agrees in some of its sayings; in others it is independent. It circulated among the Nazarenes in Syria, and was composed, according to Zahn (*op. cit.* ii. 722), between the years 135 and 150. Jerome identifies it with the *Gospel of the Twelve* (*Adv. Pelag.* iii. 2), and states that it was used by the Ebionites (*Comm. in Matt.* xii. 13). Zahn (*op. cit.* ii. 662, 724) contests both these statements. The former he traces to a mistaken interpretation of Origen (*Hom. I. in Luc.*). Lipsius, on the other hand, accepts the statements of Jerome (Smith and Wace, *Dict. of Christian Biography*, ii. 709-712), and is of opinion that this gospel, in the form in which it was known to Epiphanius, Jerome and Origen, was "a recast of an older original," which, written originally in Aramaic, was nearly related to the Logia used by St Matthew and the Ebionitic writing used by St Luke, "which itself was only a later redaction of the Logia."

According to the most recent investigations we may conclude that the Gospel according to the Hebrews was current among the Nazarenes and Ebionites as early as 100–125, since Ignatius was familiar with the phrase "I am no bodiless demon"—a phrase which, according to Jerome (*Comm. in Is.* xviii.), belonged to this Gospel.

The name "Gospel according to the Hebrews" cannot have been original; for if it had been so named because of its general use among the Hebrews, yet the Hebrews themselves would not have used this designation. It may have been known simply as "the Gospel." The language was Western Aramaic, the mother tongue of Jesus and his apostles. Two forms of Western Aramaic survive: the Jerusalem form of the dialect, in the Aramaic portions of Daniel and Ezra; and the Galilean, in isolated expressions in the Talmud (3rd century), and in a fragmentary 5th century translation of the Bible. The quotations from the Old Testament are made from the Massoretic text.

This gospel must have been translated at an early date into Greek, as Clement and Origen cite it as generally accessible, and Eusebius recounts that many reckoned it among the received books. The gospel is synoptic in character and is closely related to Matthew, though in the Resurrection accounts it has affinities with Luke. Like Mark it seems to have had no history of the birth of Christ, and to have begun with the baptism. (For the literature see Hennecke, *NTliche Apok. Handbuch*, 21-23.)

Gospel of Peter.—Before 1892 we had some knowlege of this gospel. Thus Serapion, bishop of Antioch (A.D. 190–203) found it in use in the church of Rhossus in Cilicia, and condemned it as Docetic (Eusebius, *H.E.* vi. 12). Again, Origen (*In Matt.* tom. xvii. 10) says that it represented the brethren of Christ as his half-brothers. In 1885 a long fragment was discovered at Akhmim, and published by Bouriant in 1892, and subsequently by Lods, Robinson, Harnack, Zahn, Schubert, Swete.

Gospel of Thomas.—This gospel professes to give an account of our Lord's boyhood. It appears in two recensions. The more complete recension bears the title *Θωμᾶ Ἰσραηλίτου Φιλοσόφου ῥητὰ εἰς τὰ παιδικὰ τοῦ Κυρίου*, and treats of the period from the 7th to the 12th year (Tischendorf, *Evangelia Apocrypha*^{2}, 1876, 140-157). The more fragmentary recension gives the history of the childhood from the 5th to the 8th year, and is entitled *Σύγγραμμα τοῦ ἁγίου ἀποστόλου Θωμᾶ περὶ τῆς παιδικῆς ἀναστροφῆς τοῦ Κυρίου* (Tischendorf, *op. cit.* pp. 158-163). Two Latin translations have been published in this work by the same scholar—one on pp. 164-180, the other under the wrong title, *Pseudo-Matthaei Evangelium*, on pp. 93-112. A Syriac version, with an English translation, was published by Wright in 1875. This gospel was originally still more Docetic than it now is, according to Lipsius. Its present form is due to an orthodox revision which discarded, so far as possible, all Gnostic traces. Lipsius (Smith's *Dict. of Christ. Biog.* ii. 703) assigns it to the latter half of the 2nd century, but Zahn (*Gesch. Kan.* ii. 771), on good grounds, to the earlier half. The latter scholar shows that probably it was used by Justin (*Dial.* 88). At all events it circulated among the Marcosians (Irenaeus, *Haer.* i. 20) and the Naasenes (Hippolytus, *Refut.* v. 7), and subsequently among the Manichaeans, and is frequently quoted from Origen downwards (*Hom. I. in Luc.*). If the stichometry of Nicephorus is right, the existing form of the book is merely fragmentary compared with its original compass. For literature see Hennecke, *NTliche Apokryphen Handbuch*, 132 seq.

Gospel of the Twelve.—This gospel, which Origen knew (*Hom. I. in Luc.*), is not to be identified with the *Gospel according to the Hebrews* (see above), with Lipsius and others, who have sought to reconstruct the original gospel from the surviving fragments of these two distinct works. The only surviving fragments of the *Gospel of the Twelve* have been preserved by Epiphanius (*Haer.* xxx. 13-16, 22: see Preuschen, *op. cit.* 9-11). It began with an account of the baptism. It was used by the Ebionites, and was written, according to Zahn (*op. cit.* ii. 742), about A.D. 170.

OTHER GOSPELS MAINLY GNOSTIC AND ALMOST ALL LOST.—*Gospel of Andrew.*—This is condemned in the Gelasian Decree, and is probably the gospel mentioned by Innocent (1 Ep. iii. 7) and Augustine (*Contra advers. Leg. et Proph.* i. 20).

Gospel of Apelles.—Mentioned by Jerome in his *Prooem. ad Matt.*

Gospel of Barnabas.—Condemned in the Gelasian Decree (see under BARNABAS *ad fin.*).

Gospel of Bartholomew.—Mentioned by Jerome in his *Prooem. ad Matt.* and condemned in the Gelasian Decree.

Gospel of Basilides.—Mentioned by Origen (*Tract. 26 in Matt.* xxxiii. 34, and in his *Prooem. in Luc.*); by Jerome in his *Prooem. in Matt.* (See Harnack i. 161; ii. 536-537; Zahn, *Gesch. Kanons*, i. 763-774.)

Gospel of Cerinthus.—Mentioned by Epiphanius (*Haer.* li. 7).

Gospel of the Ebionites.—A fragmentary edition of the canonical Matthew according to Epiphanius (*Haer.* xxx. 13), used by the Ebionites and called by them the Hebrew Gospel.

Gospel of Eve.—A quotation from this gospel is given by Epiphanius (*Haer.* xxvi. 2, 3). It is possible that this is the Gospel of Perfection (*Εὐαγγέλιον τελειώσεως*) which he touches upon in xxvi. 2. The quotation shows that this gospel was the expression of complete pantheism.

Gospel of James the Less.—Condemned in the Gelasian Decree.

Wisdom of Jesus Christ.—This third work contained in the Coptic MS. referred to under *Gospel of Mary* gives cosmological disclosures and is presumably of Valentinian origin.

Apocryph of John.—This book, which is found in the Coptic MS. referred to under *Gospel of Mary* and contains cosmological disclosures of Christ, is said to have formed the source of Irenaeus' account of the Gnostics of Barbelus (i. 29-31). Thus this work would have been written before 170.

Gospel of Judas Iscariot.—References to this gospel as in use among the Cainites are made by Irenaeus (i. 31. 1); Epiphanius (xxxviii. 1. 3).

Gospel, The Living (*Evangelium Vivum*).—This was a gospel of the Manichaeans. See Epiphanius, *Haer.* lxvi. 2; Photius, *Contra Manich.* i.

Gospel of Marcion.—On this important gospel see Zahn, *Gesch. Kanons*, i. 585-718.

Descent of Mary (Γέννα Μαρίας).—This book was an anti-Jewish legend representing Zacharias as having been put to death by the Jews because he had seen the God of the Jews in the form of an ass in the temple (Epiphanius, *Haer.* xxvi. 12).

Questions of Mary (*Great and Little*).—Epiphanius (*Haer.* xxvi. 8) gives some excerpts from this revolting work.

Gospel of Mary.—This gospel is found in a Coptic MS. of the 5th century. According to Schmidt's short account, *Sitzungsberichte d. preuss. Akad. d. Wiss. zu. Berlin* (1896), pp. 839 sqq., this gospel gives disclosures on the nature of matter (ὕλη) and the progress of the Gnostic soul through the seven planets.

Gospel of Matthias.—Though this gospel is attested by Origen (*Hom. in Luc.* i.), Eusebius, *H.E.* iii. 25. 6, and the List of Sixty Books, not a shred of it has been preserved, unless with Zahn ii. 751 sqq. we are to identify it with the *Traditions of Matthias*, from which Clement has drawn some quotations.

Gospel of Perfection (*Evangelium perfectionis*).—Used by the followers of Basilides and other Gnostics. See Epiphanius, *Haer.* xxvi. 2.

Gospel of Philip.—This gospel described the progress of a soul through the next world. It is of a strongly Encratite character and dates from the 2nd century. A fragment is preserved in Epiphanius, *Haer.* xxvi. 13. In Preuschen, *Reste*, p. 13, the quotation breaks off too soon. See Zahn ii. 761-768.

Gospel of Thaddaeus.—Condemned by the Gelasian Decree.

Gospel of Thomas.—Of this gospel only one fragment has been preserved in Hippolytus, *Philos.* v. 7, pp. 140 seq. See Zahn, *op. cit.* i. 746 seq.; ii. 768-773; Harnack ii. 593-595.

Gospel of Truth.—This gospel is mentioned by Irenaeus i. 11. 9, and was used by the Valentinians. See Zahn i. 748 sqq.

(*b*) Acts and Teachings of the Apostles.—*Acts of Andrew.*—These Acts, which are of a strongly Encratite character, have come down to us in a fragmentary condition. They belong to the earliest ages, for they are mentioned by Eusebius, *H.E.* iii. 25; Epiphanius, *Haer.* xlvii. 1; lxi. 1; lxiii. 2; Philaster, *Haer.* lxviii., as current among the Manichaeans and heretics. They are attributed to Leucius, a Docetic writer, by Augustine (*c. Felic. Manich.* ii. 6) and Euodius (*De Fide c. Manich.* 38). Euodius in the passage just referred to preserves two small fragments of the original Acts. On internal grounds the section recounting Andrew's imprisonment (Bonnet, *Acta Apostolorum Apocrypha*, ii. 38-45) is also probably a constituent of the original work. As regards the martyrdom, owing to the confusion introduced by the multitudinous Catholic revisions of this section of the Acts, it is practically impossible to restore its original form. For a complete discussion of the various documents see Lipsius, *Apokryphen Apostelgeschichte*, i. 543-622; also James in Hastings' *Bible Dict.* i. 92-93; Hennecke, *NT. Apokryphen, in loc.* The best texts are given in Bonnet's *Acta Apostolorum Apocrypha*, 1898, II. i. 1-127. These contain also the *Acts of Andrew and Matthew* (or Matthias) in which Matthew (or Matthias) is represented as a captive in the country of the anthropophagi. Christ takes Andrew and his disciples with Him, and effects the rescue of Matthew. The legend is found also in Ethiopic, Syriac and Anglo-Saxon. Also the *Acts of Peter and Andrew*, which among other incidents recount the miracle of a camel passing through the eye of a needle. This work is preserved partly in Greek, but in its entirety in Slavonic.

Acts of John.—Clement of Alexandria in his *Hypotyposes* on 1 John i. 1 seems to refer to chapters xciii. (or lxxxix.) of these Acts. Eusebius (*H.E.* iii. 25. 6), Epiphanius (*Haer.* xlvii. 1) and other ancient writers assign them to the authorship of Leucius Charinus. It is generally admitted that they were written in the 2nd century. The text has been edited most completely by Bonnet, *Acta Apostol. Apocr.*, 1898, 151-216. The contents might be summarized with Hennecke as follows:—Arrival and first sojourn of the apostle in Ephesus (xviii.-lv.); return to Ephesus and second sojourn (history of Drusiana, lviii.-lxxxvi.); account of the crucifixion of Jesus and His apparent death (lxxxvii.-cv.); the death of John (cvi.-cxv.). There are manifest gaps in the narrative, a fact which we would infer from the extent assigned to it (*i.e.* 2500 stichoi) by Nicephorus. According to this authority one-third of the text is now lost. Many chapters are lost at the beginning; there is a gap in chapter xxxvii., also before lviii., not to mention others. The encratite tendency in these Acts is not so strongly developed as in those of Andrew and Thomas. James (*Anecdota*, ii. 1-25) has given strong grounds for regarding the Acts of John and Peter as derived from one and the same author, but there are like affinities existing between the Acts of Peter and those of Paul. For a discussion of this work see Zahn, *Gesch. Kanons*, ii. 856-865; Lipsius, *Apok. Apostelgesch.* i. 348-542; Hennecke, *NT. Apokryphen*, 423-432. For bibliography, Hennecke, *NT. Apok. Handbuch*, 492 sq.

Acts of Paul.—The discovery of the Coptic translation of these Acts in 1897, and its publication by C. Schmidt (*Acta Pauli aus der Heidelberger koptischen Papyrushandschrift herausgegeben*, Leipzig, 1894), have confirmed what had been previously only a hypothesis that the Acts of Thecla had formed a part of the larger Acts of Paul. The Acts therefore embrace now the following elements:—(*a*) Two quotations given by Origen in his *Princip.* i. 2. 3 and his comment on John xx. 12. From the latter it follows that in the Acts of Paul the death of Peter was recounted. (*b*) *Apocryphal 3rd Epistle of Paul to the Corinthians* and *Epistle from the Corinthians to Paul.* These two letters are connected by a short account which is intended to give the historical situation. Paul is in prison on account of Stratonice, the wife of Apollophanes. The Greek and Latin versions of these letters have for the most part disappeared, but they have been preserved in Syriac, and through Syriac they obtained for the time being a place in the Armenian Bible immediately after 2 Corinthians. Aphraates cites two passages from 3 Corinthians as words of the apostle, and Ephraem expounded them in his commentary on the Pauline Epistles. They must therefore have been regarded as canonical in the first half of the 4th century. From the Syriac Bible they made their way into the Armenian and maintained their place without opposition to the 7th century. On the Latin text see Carrière and Berger, *Correspondance apocr. de S. P. et des Corinthiens*, 1891. For a translation of Ephraem's commentary see Zahn ii. 592-611 and Vetter, *Der Apocr. 3. Korinthien*, 70 sqq., 1894. The Coptic version (C. Schmidt, *Acta Pauli*, pp. 74-82), which is here imperfect, is clearly from a Greek original, while the Latin and Armenian are from the Syriac. (*c*) *The Acts of Paul and Thecla.* These were written, according to Tertullian (*De Baptismo*, 17) by a presbyter of Asia, who was deposed from his office on account of his forgery. This, the earliest of Christian romances (probably before A.D. 150), recounts the adventures and sufferings of a virgin, Thecla of Iconium. Lipsius discovers Gnostic traits in the story, but these are denied by Zahn (*Gesch. Kanons*, ii. 902). See Lipsius, *op. cit.* ii. 424-467; Zahn (*op. cit.* ii. 892-910). The best text is that of Lipsius, *Acta Apostol. Apocr.*, 1891, i. 235-272. There are Syriac, Arabic, Ethiopic and Slavonic versions. As we have seen above, these Acts are now recognized as belonging originally to the Acts of Paul. They were, however, published separately long before the Gelasian Decree (496). Jerome also was acquainted with them as an independent work. Thecla was most probably a real personage, around whom a legend had already gathered in the 2nd century. Of this legend the author of the Acts of Paul made use, and introduced into it certain historical and geographical facts. (*d*) The healing of Hermocrates of dropsy in Myra. Through a comparison of the Coptic version with the Pseudo-Cyprian writing "Caena," Rolffs (Hennecke, *NT. Apok.* 361) concludes that this incident formed originally a constituent of our book. (*e*) The strife with beasts at Ephesus. This event is mentioned by Nicephorus Callistus (*H.E.* ii. 25) as recounted in the περίοδοι of Paul. The identity of this work with the Acts of Paul is confirmed by a remark of Hippolytus in his commentary on Daniel iii. 29. 4, ed. Bonwetsch 176 (so Rolffs). (*f*) Martyrdom of Paul. The death of Paul by the sentence of Nero at Rome forms the close of the Acts of Paul. The text is in the utmost confusion. It is best given by Lipsius, *Acta Apostol. Apocr.* i. 104-117.

Notwithstanding all the care that has been taken in collecting the fragments of these Acts, only about 900 stichoi out of the 3600 assigned to them in the Stichometry of Nicephorus have as yet been recovered.

The author was, according to Tertullian (*De Baptism.* 17), a presbyter in Asia, who out of honour to Paul wrote the Acts, forging at the same time 3 Corinthians. Thus the work was composed before 190, and, since it most probably uses the martyrdom of Polycarp, after 155. The object of the writer is to embody in St Paul the model ideal of the popular Christianity of the 2nd century. His main emphasis is laid on chastity and the resurrection of the flesh. The tone of the work is Catholic and anti-Gnostic. For the bibliography of the subject see Hennecke, *NT. Apok.* 358–360.

Acts of Peter.—These acts are first mentioned by Eusebius (*H.E.* iii. 3) by name, and first referred to by the African poet Commodian about A.D. 250. Harnack, who was the first to show that these Acts were Catholic in character and not Gnostic as had previously been alleged, assigns their composition to this period mainly on the ground that Hippolytus was not acquainted with them; but even were this assumption true, it would not prove the non-existence of the Acts in question. According to Photius, moreover, the Acts of Peter also were composed by this same Leucius Charinus, who, according to Zahn (*Gesch. Kanons*, ii. 864), wrote about 160 (*op. cit.* p. 848). Schmidt and Ficker, however, maintain that the Acts were written about 200 and in Asia Minor. These Acts, which Ficker holds were written as a continuation and completion of the canonical Acts of the Apostles, deal with Peter's victorious conflict with Simon Magus, and his subsequent martyrdom at Rome under Nero. It is difficult to determine the relation of the so-called Latin *Actus Vercellenses* (which there are good grounds for assuming were originally called the Πράξεις Πέτρου) with the Acts of John and Paul. Schmidt thinks that the author of the former made use of the latter, James that the Acts of Peter and of John were by one and the same author, but Ficker is of opinion that their affinities can be explained by their derivation from the same ecclesiastical atmosphere and school of theological thought. No less close affinities exist between our Acts and the Acts of Thomas, Andrew and Philip. In the case of the Acts of Thomas the problem is complicated, sometimes the Acts of Peter seem dependent on the Acts of Thomas, and sometimes the converse.

For the relation of the *Actus Vercellenses* to the "Martyrdom of the holy apostles Peter and Paul" (*Acta Apostol. Apocr.* i. 118-177) and to the "Acts of the holy apostles Peter and Paul" (*Acta Apostol. Apocr.* i. 178-234) see Lipsius ii. I. 84 sqq. The "Acts of Xanthippe and Polyxena," first edited by James (*Texts and Studies*, ii. 3. 1893), and assigned by him to the middle of the 3rd century, as well as the "Acts of the Disputation of Archelaus, bishop of Mesopotamia, and the Heresiarch Manes" ("Acta Disputationis Archelai Episcopi Mesopotamiae et Manetis Haeresiarchae," in Routh's *Reliquiae Sacrae*^{2}, v. 36-206), have borrowed largely from our work.

The text of the *Actus Vercellenses* is edited by Lipsius, *Acta Apostol. Apocr.* i. 45-79. An independent Latin translation of the "Martyrdom of Peter" is published by Lipsius (*op. cit.* i. 1-22), *Martyrium beati Petri Apostoli a Lino episcopo conscriptum.* On the Coptic fragment, which Schmidt maintains is an original constituent of these Acts, see that writer's work: *Die alten Petrusakten im Zusammenhang der apokryphen Apostelliteratur nebst einem neuentdeckten Fragment*, and *Texte und Untersuch.* N.F. ix. 1 (1903). For the literature see Hennecke, *Neutestamentliche Apokryphen Handbuch*; 395 sqq.

Preaching of Peter.—This book (Πέτρου κήρυγμα) gave the substance of a series of discourses spoken by one person in the name of the apostles. Clement of Alexandria quotes it several times as a genuine record of Peter's teaching. Heracleon had previously used it (see Origen, *In Evang. Johann.* t. xiii. 17). It is spoken unfavourably of by Origen (*De Prin.* Præf. 8). It was probably in the hands of Justin and Aristides. Hence Zahn gives its date as 90–100 at latest; Dobschütz, as 100–110; and Harnack, as 110–130. The extant fragments contain sayings of Jesus, and warnings against Judaism and Polytheism. They have been edited by Hilgenfeld: *Nov. Test. extra Can.*, 1884, iv. 51-65, and by von Dobschütz, *Das Kerygma Petri*, 1893. Salmon (*Dict. Christ. Biog.* iv. 329-330) thinks that this work is part of a larger work, *A Preaching of Peter and a Preaching of Paul*, implied in a statement of Lactantius (*Inst. Div.* iv. 21); but this view is contested by Zahn, see *Gesch. Kanons*, ii. 820-834, particularly pp. 827-828; Chase, in Hastings' *Bible Dict.* iv. 776.

Acts of Thomas.—This is one of the earliest and most famous of the Gnostic Acts. It has been but slightly tampered with by orthodox hands. These Acts were used by the Encratites (Epiphanius, *Haer.* xlvii. 1), the Manichaeans (Augustine, *Contra Faust.* xxii. 79), the Apostolici (Epiphanius lxi. 1) and Priscillianists. The work is divided into thirteen Acts, to which the Martyrdom of Thomas attaches as the fourteenth. It was originally written in Syriac, as Burkitt (*Journ. of Theol. Studies*, i. 278 sqq.) has finally proved, though Macke and Nöldeke had previously advanced grounds for this view. The Greek and Latin texts were edited by Bonnet in 1883 and again in 1903, ii. 2; the Greek also by James, *Apoc. Anec.* ii. 28-45, and the Syriac by Wright (*Apocr. Acts of the Gospels*, 1871, i. 172-333). Photius ascribes their composition to Leucius Charinus—therefore to the 2nd century, but Lipsius assigns it to the early decades of the 3rd. (See Lipsius, *Apokryphen Apostelgeschichten*, i. 225-347; Hennecke, *N.T. Apokryphen*, 473-480.)

Teaching of the Twelve Apostles (Didachē).—This important work was discovered by Philotheos Bryennios in Constantinople and published in 1883. Since that date it has been frequently edited. The bibliography can be found in Schaff's and in Harnack's editions. The book divides itself into three parts. The first (i.-vi.) contains a body of ethical instruction which is founded on a Jewish and probably pre-Christian document, which forms the basis also of the *Epistle of Barnabas.* The second part consists of vii.-xv., and treats of church ritual and discipline; and the third part is eschatological and deals with the second Advent. The book is variously dated by different scholars: Zahn assigns it to the years A.D. 80–120; Harnack to 120–165; Lightfoot and Funk to 80–100; Salmon to 120. (See Salmon in *Dict. of Christ. Biog.* iv. 806-815, also article DIDACHĒ.)

Apostolical Constitutions.—For the various collections of these ecclesiastical regulations—the Syriac *Didascalia*, *Ecclesiastical Canons of the Holy Apostles*, &c.—see separate article.

(*c*) EPISTLES.—*The Abgar Epistles.*—These epistles are found in Eusebius (*H.E.* i. 3), who translated them from the Syriac. They are two in number, and purport to be a petition of Abgar Uchomo, king of Edessa, to Christ to visit Edessa, and Christ's answer, promising after his ascension to send one of his disciples, who should "cure thee of thy disease, and give eternal life and peace to thee and all thy people." Lipsius thinks that these letters were manufactured about the year 200. (See *Dict. Christ. Biog.* iv. 878-881, with the literature there mentioned.) The above correspondence, which appears also in Syriac, is inwoven with the legend of Addai or Thaddaeus. The best critical edition of the Greek text will be found in Lipsius, *Acta Apostolorum Apocrypha*, 1891, pp. 279-283. (See also ABGAR.)

Epistle of Barnabas.—The special object of this epistle was to guard its readers against the danger of relapsing into Judaism. The date is placed by some scholars as early as 70–79, by others as late as the early years of the emperor Hadrian, 117. The text has been edited by Hilgenfeld in 1877, Gebhardt and Harnack in 1878, and Funk in 1887 and 1901. In these works will be found full bibliographies. (See further BARNABAS.)

Epistle of Clement.—The object of this epistle is the restoration of harmony to the church of Corinth, which had been vexed by internal discussions. The epistle may be safely ascribed to the years 95–96. The writer was in all probability the bishop of Rome of that name. He is named an apostle and his work was reckoned as canonical by Clement of Alexandria (*Strom.* iv. 17. 105), and as late as the time of Eusebius (*H.E.* iii. 16) it was still read in some of the churches. Critical editions have been published by Gebhardt and Harnack, *Patr. Apost. Op.*, 1876, and in the smaller form in 1900, Lightfoot^2, 1890, Funk^2, 1901. The Syriac version has been edited by Kennet, *Epp. of St Clement to the Corinthians in Syriac*, 1899, and the Old Latin version by Morin, *S. Clementis Romani ad Corinthios epistulae versio Latina antiquissima*, 1894.

"Clement's" 2nd Ep. to the Corinthians.—This so-called letter of Clement is not mentioned by any writer before Eusebius (*H.E.* iii. 38. 4). It is not a letter but really a homily written in Rome about the middle of the 2nd century. The writer is a Gentile. Some of his citations are derived from the Gospel to the Egyptians.

Clement's Epistles on Virginity.—These two letters are preserved only in Syriac which is a translation from the Greek. They are first referred to by Epiphanius and next by Jerome. Critics have assigned them to the middle of the 2nd century. They have been edited by Beelen, Louvain, 1856.

Clement's Epistles to James.—On these two letters which are found in the Clementine Homilies, see Smith's *Dict. of Christian Biography*, i. 559, 570, and Lehmann's monograph, *Die Clementischen Schriften*, Gotha, 1867, in which references will be found to other sources of information.

Epistles of Ignatius.—There are two collections of letters bearing the name of Ignatius, who was martyred between 105 and 117. The first consists of seven letters addressed by Ignatius to the Ephesians, Magnesians, Trallians, Romans, Philadelphians, Smyrnaeans and to Polycarp. The second collection consists of the preceding extensively interpolated, and six others of Mary to Ignatius, of Ignatius to Mary, to the Tarsians, Antiochians, Philippians and Hero, a deacon of Antioch. The latter collection is a pseudepigraph written in the 4th century or the beginning of the 5th. The authenticity of the first collection also has been denied, but the evidence appears to be against this contention. The literature is overwhelming in its extent. See Zahn, *Patr. Apost. Op.*, 1876; Funk^2, *Die apostol. Väter*, 1901; Lightfoot^2, *Apostolic Fathers*, 1889.

Epistle of Polycarp.—The genuineness of this epistle stands or falls with that of the Ignatian epistles. See article in Smith's *Dictionary of Christian Biography*, iv. 423-431; Lightfoot, *Apostolic Fathers*, i. 629-702; also POLYCARP.

Pauline Epistles to the Laodiceans and the Alexandrians.—The first of these is found only in Latin. This, according to Lightfoot (see *Colossians*^{8}, 272-298) and Zahn, is a translation from the Greek. Such an epistle is mentioned in the Muratorian canon. See Zahn, *op. cit.* ii. 566-585. The Epistle to the Alexandrians is mentioned only in the Muratorian canon (see Zahn ii. 586-592).

For the *Third Epistle of Paul to the Corinthians*, and *Epistle from the Corinthians to Paul*, see under "Acts of Paul" above. (R. H. C.)

APODICTIC (Gr. ἀποδεικτικός, capable of demonstration), a logical term, applied to judgments which are necessarily true, as of mathematical conclusions. The term in Aristotelian logic is opposed to dialectic, as scientific proof to probable reasoning. Kant contrasts apodictical with problematic and assertorical judgments.

APOLDA, a town of Germany, in the grand-duchy of Saxe-Weimar, near the river Ilm, 9 m. E. by N. from Weimar, on the main line of railway from Berlin via Halle, to Frankfort-on-Main. Pop. (1900) 20,352. It has few notable public buildings, but possesses three churches and monuments to the emperor Frederick III. and to Christian Zimmermann (1759–1842), who, by introducing the hosiery and cloth manufacture, made Apolda one of the most important places in Germany in these branches of industry. It has also extensive dyeworks, bell foundries, and manufactures of steam engines, boilers and bicycles.

APOLLINARIS, "the Younger" (d. A.D. 390), bishop of Laodicea in Syria. He collaborated with his father Apollinaris the Elder in reproducing the Old Testament in the form of Homeric and Pindaric poetry, and the New after the fashion of Platonic dialogues, when the emperor Julian had forbidden Christians to teach the classics. He is best known, however, as a warm opponent of Arianism, whose eagerness to emphasize the deity of Christ and the unity of His person led him so far as a denial of the existence of a rational human soul (νοῦς) in Christ's human nature, this being replaced in Him by a prevailing principle of holiness, to wit the Logos, so that His body was a glorified and spiritualized form of humanity. Over against this the orthodox or Catholic position maintained that Christ assumed human nature in its entirety including the νοῦς, for only so could He be example and redeemer. It was held that the system of Apollinaris was really Docetism (see DOCETAE), that if the Godhood without constraint swayed the manhood there was no possibility of real human probation or of real advance in Christ's manhood. The position was accordingly condemned by several synods and in particular by that of Constantinople (A.D. 381). This did not prevent its having a considerable following, which after Apollinaris's death divided into two sects, the more conservative taking its name (Vitalians) from Vitalis, bishop of Antioch, the other (Polemeans) adding the further assertion that the two natures were so blended that even the body of Christ was a fit object of adoration. The whole Apollinarian type of thought persisted in what was later the Monophysite (*q.v.*) school.

Although Apollinaris was a prolific writer, scarcely anything has survived under his own name. But a number of his writings are concealed under the names of orthodox Fathers, *e.g.* ἡ κατὰ μέρος πίστις, long ascribed to Gregory Thaumaturgus. These have been collected and edited by Hans Lietzmann.

He must be distinguished from the bishop of Hierapolis who bore the same name, and who wrote one of the early Christian "Apologies" (*c.* 170). See A. Harnack, *History of Dogma*, vols. iii. and iv. *passim*; R. L. Ottley, *The Doctrine of the Incarnation*; G. Voisin, *L'Apollinarisme* (Louvain, 1901); H. Lietzmann, *Apollinaris von Laodicea und seine Schule* (Tübingen, 1905).

APOLLINARIS, SULPICIUS, a learned grammarian of Carthage, who flourished in the 2nd century A.D. He taught Pertinax—himself a teacher of grammar before he was emperor,—and Aulus Gellius, who speaks of him in the highest terms (iv. 17). He is the reputed author of the metrical arguments to the *Aeneid* and to the plays of Terence and (probably) Plautus (J. W. Beck, *De Sulpicio Apollinari*, 1884).

APOLLINARIS SIDONIUS, CAIUS SOLLIUS (*c.* 430–487 or 488), Christian writer and bishop, was born in Lyons about A.D. 430. Belonging to a noble family, he was educated under the best masters, and particularly excelled in poetry and polite literature. He married (about 452) Papianilla, the daughter of Avitus, who was consul and afterwards emperor. But Majorianus, in the year 457, having deprived Avitus of the empire and taken the city of Lyons, Apollinaris fell into the hands of the enemy. The reputation of his learning led Majorianus to treat him with the greatest respect. In return Apollinaris composed a panegyric in his honour (as he had previously done for Avitus), which won for him a statue at Rome and the title of count. In 467 the emperor Anthemius rewarded him for the panegyric which he had written in honour of him by raising him to the post of prefect of Rome, and afterwards to the dignity of a patrician and senator. In 472, more for his political than for his theological abilities, he was chosen to succeed Eparchius in the bishopric of Arverna (Clermont). On the capture of that city by the Goths in 474 he was imprisoned, as he had taken an active part in its defence; but he was afterwards restored by Euric, king of the Goths, and continued to govern his bishopric as before. He died in A.D. 487 or 488. His extant works are his *Panegyrics* on different emperors (in which he draws largely upon Statius, Ausonius and Claudian); and nine books of *Letters* and *Poems*, whose chief value consists in the light they shed on the political and literary history of the 5th century. The *Letters*, which are very stilted, also reveal Apollinaris as a man of genial temper, fond of good living and of pleasure. The best edition is that in the *Monumenta Germaniae Historica* (Berlin, 1887), which gives a survey of the manuscripts.

Apollinaris Sidonius (the names are commonly inverted by the French) is the subject of numerous monographs, historical and literary. See, for bibliography, A. Molinier, *Sources de l'histoire de France*, no. 136 (vol. i.). S. Dill, *Roman Society in the Fifth Century*, and T. Hodgkin, *Italy and her Invaders* (vol. vii.), contain interesting sections on Apollinaris. See also Teuffel and Ebert's histories of Latin literature.

APOLLO (Gr. Ἀπόλλων, Ἀπέλλων), in Greek mythology, one of the most important and many-sided of the Olympian divinities. No satisfactory etymology of the name has been given, the least improbable perhaps being that which connects it with the Doric ἀπέλλα (“ assembly ”),[1] so that Apollo would be the god of political life (for other suggested derivations, ancient and modern, see C. Wernicke in Pauly-Wissowa’s *Realencyclopädie*). The derivation of all the functions assigned to him from the idea of a single original light- or sun-god, worked out in his *Lexikon der Mythologie* by Roscher, who regards it as “ one of the most certain facts in mythology,” has not found general acceptance, although no doubt some features of his character can be readily explained on this assumption.

In the legend, as set forth in the Homeric hymn to Apollo and the ode of Callimachus to Delos, Apollo is the son of Zeus and Leto. The latter, pursued by the jealous Hera, after long wandering found shelter in Delos (originally Asteria), where she bore a son, Apollo, under a palm-tree at the foot of Mount Cynthus. Before this, Delos—like Rhodes, the centre of the worship of the sun-god Helios, with whom Apollo was wrongly identified in later times—had been a barren, floating rock, but now became stationary, being fastened down by chains to the bottom of the sea. Apollo was born on the 7th day (ἑβδομαγενής) of the month Thargelion according to Delian, of the month Bysios according to Delphian, tradition. The 7th and 20th, the days of the new and full moon, were ever afterwards held sacred to him. In Homer Apollo appears only as the god of prophecy, the sender of plagues, and sometimes as a warrior, but elsewhere as exercising the most varied functions. He is the god of agriculture, specially connected with Aristaeus (*q.v.*), which, originally a mere epithet, became an independent personality (see, however, Farnell, *Cults of the Greek States*, iv. 123). This side of his character is clearly expressed in the titles *Sitalcas* (“ protector of corn ”); *Erythibius* (“ preventer of blight ”); *Parnopius* (“ destroyer of locusts ”); *Smintheus* (“ destroyer of mice ”), in which, however, some modern inquirers see a totemistic significance (*e.g.* A. Lang, “ Apollo and the Mouse,” in *Custom and Myth*, p. 101; against this, W. W. Fowler, in *Classical Review*, November 1892); *Erithius* (“ god of reapers ”); and *Pasparius* (“ god of meal ”). He is further the god of vegetation generally—*Nomios*, “ god of pastures ” (explained, however, by Cicero, as “ god of law ”), *Hersos*, “ sender of the fertilizing dew.” Valleys and groves are under his protection, unless the epithets *Napaeus* and *Hylates* belong to a more primitive aspect of the god as supporting himself by the chase, and roaming the glades and forests in pursuit of prey. Certain trees and plants, especially the laurel, were sacred to him. As the god of agriculture and vegetation he is naturally connected with the course of the year and the arrangement of the seasons, so important in farming operations, and becomes the orderer of time (*Horomedon*, “ ruler of the seasons ”), and frequently appears on monuments in company with the Horae.

Apollo is also the protector of cattle and herds, hence *Poimnius* (“ god of flocks ”), *Tragius* (“ of goats ”), *Kereatas* (“ of horned animals ”). *Carneius* (probably “ horned ”) is considered by some to be a pre-Dorian god of cattle, also connected with harvest operations, whose cult was grafted on to that of Apollo; by others, to have been originally an epithet of Apollo, afterwards detached as a separate personality (Farnell, *Cults*, iv. p. 131). The epithet *Maleatas*, which, as the quantity of the first vowel (ă) shows,[2] cannot mean god of “ sheep ” or “ the apple-tree,” is probably a local adjective derived from Malea (perhaps Cape Malea), and may refer to an originally distinct personality, subsequently merged in that of Apollo (see below). Apollo himself is spoken of as a keeper of flocks, and the legends of his service as a herdsman with Laomedon and Admetus point in the same direction. Here probably also is to be referred the epithet *Lyceius*, which, formerly connected with λυκ- (“ shine ”) and used to support the conception of Apollo as a light-god, is now generally referred to λύκος (“ wolf ”) and explained as he who keeps away the wolves from the flock (cf. λυκόεργος, λυκοκτόνος). In accordance with this, the epithet λυκηγενής will not mean “ born of ” or “ begetting light,” but rather “ born from the she-wolf,” in which form Leto herself was said to have been conducted by wolves to Delos. The consecration of the wolf to Apollo is probably the relic of an ancient totemistic religion (Farnell, *Cults*, i. 41; W. Robertson Smith, *Religion of the Semites*, new ed., 1894, p. 226).

With the care of the fruits of the earth and the lower animals is associated that of the highest animal, man, especially the youth on his passage to manhood. As such Apollo is κουροτρόφος (“ rearer of boys ”) and patron of the palaestra. In many places gymnastic contests form a feature of his festivals, and he himself is proficient in athletic exercises (ἐναγώνιος). Thus he was supposed to be the first victor at the Olympic games; he overcomes Hermes in the foot-race, and Ares in boxing.

The transition is easy to Apollo as a warlike god; in fact, the earlier legends represent him as engaged in strife with Python, Tityus, the Cyclopes and the Aloidae. He is *Boëdromios* (“ the helper ”), *Eleleus* (“ god of the war-cry ”), and the Paean was said to have been originally a song of triumph composed by him after his victory over Python. In Homer he frequently appears on the field, like Ares and Athene, bearing the aegis to frighten the foe. This aspect is confirmed by the epithets *Argyrotoxos* (“ god of the silver bow ”), *Hecatebolos* (“ the shooter from afar ”), *Chrysaoros* (“ wearer of the golden sword ”), and his statues are often equipped with the accoutrements of war.[3]

The fame of the Pythian oracle at Delphi, connected with the slaying of Python by the god immediately after his birth, gave especial prominence to the idea of Apollo as a god of prophecy. Python, always represented in the form of a snake, sometimes nameless, is the symbol of the old chthonian divinity whose home was the place of “ enquiry ” (πυθέσθαι). When Apollo Delphinius with his worshippers from Crete took possession of the earth-oracle Python, he received in consequence the name Pythius. That Python was no fearful monster, symbolizing the darkness of winter which is scattered by the advent of spring, is shown by the fact that Apollo was considered to have been guilty of murder in slaying it, and compelled to wander for a term of years and expiate his crime by servitude and purification. Possibly at Delphi and other places there was an old serpent-worship ousted by that of Apollo, which may account for expiation for the slaying of Python being considered necessary. In the solar explanation, the serpent is the darkness driven away by the rays of the sun. (On the Delphian cult of Apollo and its political significance, see Amphictyony, Delphi, Oracle; and Farnell, *Cults*, iv. pp. 179-218.) Oracular responses were also given at Claros near Colophon in Ionia by means of the water of a spring which inspired those who drank of it; at Patara in Lycia; and at Didyma near Miletus through the priestly family of the Branchidae. Apollo’s oracles, which he did not deliver on his own initiative but as the mouthpiece of Zeus, were infallible, but the human mind was not always able to grasp their meaning; hence he is called *Loxias* (“ crooked,” “ ambiguous ”). To certain favoured mortals he communicated the gift of prophecy (Cassandra, the Cumaean sibyl, Helenus, Melampus and Epimenides). Although his favourite method was by word of mouth, yet signs were sometimes used; thus Calchas interpreted the flight of birds; burning offerings, sacrificial barley, the arrow of the god, dreams and the lot, all played their part in communicating the will of the gods.

Closely connected with the god of oracles was the god of the healing art, the oracle being frequently consulted in cases of sickness. These two functions are indicated by the titles *Iatromantis* (“ physician and seer.”) and *Oulios*, probably meaning “ health-giving ” (so Suidas) rather than “ destructive.” This side of Apollo’s character does not appear in Homer, where Paieon is mentioned as the physician of the gods. Here again, as in the case of Aristaeus and Carneius, the question arises whether Paean (or Paeon) was originally an epithet of Apollo, subsequently developed into an independent personality, or an independent deity merged in the later arrival (Farnell, *Cults*, iv. p. 234). According to Wilamowitz-Möllendorff in his edition of Isyllus, the epithet Maleatas alluded to above is also connected with the functions of the healing god, imported into Athens in the 4th century B.C. with other well-known health divinities. In this connexion, it is said to mean the "gentle one," who gave his name to the rock Malion or Maleas (O. Gruppe, *Griechische Mythologie*, ii. 1442) on the Gortynian coast. Apollo is further supposed to be the father of Asclepius (Aesculapius), whose ritual is closely modelled upon his. The healing god could also prevent disease and misfortune of all kinds: hence he is ἀλεξίκακος ("averter of evil") and ἀποτρόπαιος. Further, he is able to purify the guilty and to cleanse from sin (here some refer the epithet ἰατρόμαντις, in the sense of "physician of the soul"). Such a task can be fitly undertaken by Apollo, since he himself underwent purification after slaying Python. According to the Delphic legend, this took place in the laurel grove of Tempe, and after nine years of penance the god returned, as was represented in the festival called Stepterion or Septerion (see A. Mommsen, *Delphika*, 1878). Thus the old law of blood for blood, which only perpetuated the crime from generation to generation, gave way to the milder idea of the expiatory power of atonement for murder (cf. the court called τὸ ἐπὶ Δελφινίῳ at Athens, which retained jurisdiction in cases where justifiable homicide was pleaded).

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[1] Hesychius; who also gives the explanation σηκός (“fold”), in which case Apollo would be the god of flocks and herds.

[2] The authority for the quantity is Isyllus.

[3] Hence some have derived “ Apollo ” from ἀπολλύναι, “ to destroy.”

The same element of enthusiasm that affects the priestess of the oracle at Delphi produces song and music. The close connexion between prophecy and song is indicated in Homer (*Odyssey*, viii. 488), where Odysseus suggests that the lay of the fall of Troy by Demodocus was inspired by Apollo or the Muse. The metrical form of the oracular responses at Delphi, the important part played by the paean and the Pythian nomos in his ritual, contributed to make Apollo a god of song and music, friend and leader of the Muses (μουσαγέτης). He plays the lyre at the banquets of the gods, and causes Marsyas to be flayed alive because he had boasted of his superior skill in playing the flute, and the ears of Midas to grow long because he had declared in favour of Pan, who contended that the flute was a better instrument than Apollo's favourite, the lyre.

A less important aspect of Apollo is that of a marine deity, due to the spread of his cult to the Greek colonies and islands. As such, his commonest name is *Delphinius*, the "dolphin god," in whose honour the festival Delphinia was celebrated in Attica. This cult probably originated in Crete, whence the god in the form of a dolphin led his Cretan worshippers to the Delphian shore, where he bade them erect an altar in his honour. He is *Epibaterius* and *Apobaterius* ("embarker" and "disembarker"), *Nasiotas* ("the islander"), *Euryalus* ("god of the broad sea"). Like Poseidon, he looks forth over his watery kingdom from lofty cliffs and promontories (ἀκταῖος, and perhaps ἀκρίτας).

These maritime cults of Apollo are probably due to his importance as the god of colonization, who accompanied emigrants on their voyage. As such he is ἀγήτωρ ("leader"), οἰκίστης ("founder"), δωματίτης ("god of the home"). As *Agyieus* ("god of streets and ways"), in the form of a stone pillar with painted head, placed before the doors of houses, he let in the good and kept out the evil (see Farnell, *Cults*, iv. p. 150, who takes Agyieus to mean "leader"); on the epithet *Prostaterius*, he who "stands before the house," hence "protector," see G. M. Hirst in *Journal of Hellenic Studies*, xxii. (1902). Lastly, as the originator and protector of civil order, Apollo was regarded as the founder of cities and legislation. Thus, at Athens, Apollo *Patroös* was known as the protector of the Ionians, and the Spartans referred the institutions of Lycurgus to the Delphic oracle.

It has been mentioned above that W. H. Roscher, in the article "Apollo" in his *Lexikon der Mythologie*, derives all the aspects and functions of Apollo from the conception of an original light- and sun-god. The chief objections to this are the following. It cannot be shown that on *Greek* soil Apollo originally had the meaning of a sun-god; in Homer, Aeschylus and Plato, the sun-god Helios is distinctly separated from Phoebus Apollo; the constant epithet Φοῖβος, usually explained as the brightness of the sun, may equally well refer to his physical beauty or moral purity; λυκηγενής has already been noticed. It is not until the beginning of the 5th century B.C. that the identification makes its appearance. The first literary evidence is a fragment of Euripides (*Phaëthon*), in which it is especially characterized as an innovation. The idea was taken up by the Stoics, and in the Roman period generally accepted. But the fact of the gradual development of Apollo as a god of light and heaven, and his identification with foreign sun-gods, is no proof of an original Greek solar conception of him. Apollo-Helios must be regarded as "a late by-product of Greek religion" (Farnell, *Cults*, iv. p. 136; Wernicke in Pauly-Wissowa's *Realencyclopädie*). For the manner in which the solar theory is developed, reference must be made to Roscher's article, but one legend may here be mentioned, since it helps to trace the spread of the cult of the god. It was said that Apollo soon after his birth spent a year amongst the Hyperboreans, who dwelt in a land of perpetual sunshine, before his return to Delphi. This return is explained as the second birth of the god and his victory over the powers of winter; the name Hyperboreans is explained as the "dwellers beyond the north wind." This interpretation is now, however, generally rejected in favour of that of H. L. Ahrens,—that Hyperborei is identical with the Perphereës ("the carriers"), who are described as the servants of Apollo, carriers of cereal offerings from one community to another (Herodotus iv. 33). This would point to the fact that certain settlements of Apolline worship along the northernmost border of Greece (Illyria, Thrace, Macedonia) were in the habit of sending offerings to the god to a centre of his worship farther south (probably Delphi), advancing by the route from Tempe through Thessaly, Pherae and Doris to Delphi; while others adopted the route through Illyria, Epirus, Dodona, the Malian gulf, Carystus in Euboea, and Tenos to Delos (Farnell, *Cults*, iv. p. 100).

The most usual attributes of Apollo were the lyre and the bow; the tripod especially was dedicated to him as the god of prophecy. Among plants, the bay, used in expiatory sacrifices and also for making the crown of victory at the Pythian games, and the palm-tree, under which he was born in Delos, were sacred to him; among animals and birds, the wolf, the roe, the swan, the hawk, the raven, the crow, the snake, the mouse, the grasshopper and the griffin, a mixture of the eagle and the lion evidently of Eastern origin. The swan and grasshopper symbolize music and song; the hawk, raven, crow and snake have reference to his functions as the god of prophecy.

The chief festivals held in honour of Apollo were the Carneia, Daphnephoria, Delia, Hyacinthia, Pyanepsia, Pythia and Thargelia (see separate articles).

Among the Romans the worship of Apollo was adopted from the Greeks. There is a tradition that the Delphian oracle was consulted as early as the period of the kings during the reign of Tarquinius Superbus, and in 430 a temple was dedicated to Apollo on the occasion of a pestilence, and during the Second Punic War (in 212) the *Ludi Apollinares* were instituted in his honour. But it was in the time of Augustus, who considered himself under the special protection of Apollo and was even said to be his son, that his worship developed and he became one of the chief gods of Rome. After the battle of Actium, Augustus enlarged his old temple, dedicated a portion of the spoil to him, and instituted quinquennial games in his honour. He also erected a new temple on the Palatine hill and transferred the secular games, for which Horace composed his *Carmen Saeculare*, to Apollo and Diana.

Apollo was represented more frequently than any other deity in ancient art. As Apollo Agyieus he was shown by a simple conic pillar; the Apollo of Amyclae was a pillar of bronze surmounted by a helmeted head, with extended arms carrying lance and bow. There were also rude idols of him in wood (*xoana*), in which the human form was scarcely recognizable. In the 6th century, his statues of stone were naked, stiff and rigid in attitude, shoulders square, limbs strong and broad, hair falling down the back. In the riper period of art the type is softer, and Apollo appears in a form which seeks to combine manhood and eternal youth. His long hair is usually tied in a large knot above his forehead. The most famous statue of him is the Apollo Belvidere in the Vatican (found at Frascati, 1455), an imitation belonging to the early imperial period of a bronze statue representing him, with aegis in his left hand, driving back the Gauls from his temple at Delphi (279 B.C.), or, according to another view, fighting with the Pythian dragon. In the Apollo Citharoedus or Musagetes in the Vatican, he is crowned with laurel and wears the long, flowing robe of the Ionic bard, and his form is almost feminine in its fulness; in a statue at Rome of the older and more vigorous type he is naked and holds a lyre in his left hand; his right arm rests upon his head, and a griffin is seated at his side. The Apollo Sauroctonus (after Praxiteles), copied in bronze at the Villa Albani in Rome and in marble at Paris, is a naked, youthful, almost boyish figure, leaning against a tree, waiting to strike a lizard climbing up the trunk. The gigantic statue of Helios (the sun-god), "the colossus of Rhodes," by Chares of Lindus, celebrated as one of the seven wonders of the world, is unknown to us. Bas-reliefs and painted vases reproduce the contests of Apollo with Tityus, Marsyas, and Heracles, the slaughter of the daughters of Niobe, and other incidents in his life.

Authorities.—F. L. W. Schwartz, *De antiquissima Apollinis Natura* (Berlin, 1843); J. A. Schönborn, *Über das Wesen Apollons* (Berlin, 1854); A. Milchhöfer, *Über den attischen Apollon* (Munich, 1873); T. Schreiber, *Apollon Pythoktonos* (Leipzig, 1879); W. H. Roscher, *Studien zur vergleichenden Mythologie der Griechen und Römer*, i. (Leipzig, 1873); R. Hecker, *De Apollinis apud Romanos Cultu* (Leipzig, 1879); G. Colin, *Le Culte d'Apollon pythien à Athènes* (1905); L. Dyer, *The Gods in Greece* (1891); articles in Pauly-Wissowa's *Realencyclopädie*, W. H. Roscher's *Lexikon der Mythologie*, and Daremberg and Saglio's *Dictionnaire des antiquités*; L. Preller, *Griechische und römische Mythologie* (4th ed. by C. Robert); J. Marquardt, *Römische Staatsverwaltung*, iii.; G. Wissowa *Religion und Kultus der Römer* (1902); D. Bassi, *Saggio di Bibliografia mitologica*, i. *Apollo* (1896); L. Farnell, *Cults of the Greek States*, iv. (1907); O. Gruppe, *Griechische Mythologie und Religionsgeschichte*, ii. (1906). In the article Greek Art, fig. 9 represents a bearded Apollo, playing on the lyre, in a chariot drawn by winged horses; fig. 55 (pl. ii.) Apollo of the Belvidere; fig. 76 (pl. v.) a nude and roughly executed colossal figure of the god. (J. H. F.)

APOLLODORUS, an Athenian painter, who flourished at the end of the 5th century B.C. He is said to have introduced great improvements in perspective and chiaroscuro. What these were it is impossible to say: perspective cannot have been in his day at an advanced stage. Among his works were an Odysseus, a priest in prayer, and an Ajax struck by lightning.

APOLLODORUS, an Athenian grammarian, pupil of Aristarchus and Panaetius the Stoic, who lived about 140 B.C. He was a prolific and versatile writer. There is extant under his name a treatise on the gods and the heroic age, entitled Βιβλιοθήκη, a valuable authority on ancient mythology. Modern critics are of opinion that, if genuine, it is an abridgment of a larger work by him (Περὶ θεῶν).

Edition, with commentary, by Heyne (1803); text by Wagner (1894) (*Mythographi Graeci*, vol. i. Teubner series). Amongst other works by him of which only fragments remain, collected in Müller, *Fragmenta Historicorum Graecorum*, may be mentioned: Χρονικά, a universal history from the fall of Troy to 144 B.C.; Περιήγησις, a gazetteer written in iambics; Περὶ Νεῶν, a work on the Homeric catalogue of ships; and a work on etymology (Ἐτυμολογίαι).

APOLLODORUS, of Carystus in Euboea, one of the most important writers of the New Attic comedy, who flourished at Athens between 300 and 260 B.C. He is to be distinguished from an older Apollodorus of Gela (342–290), also a writer of comedy, a contemporary of Menander. He wrote 47 comedies and obtained the prize five times. Terence borrowed his *Hecyra* and *Phormio* from the Ἑκυρά and Ἐπιδικαζόμενος of Apollodorus.

Fragments in Koch, *Comicorum Atticorum Fragmenta*, ii. (1884); see also Meineke, *Historia Critica Comicorum Graecorum* (1839).

APOLLODORUS, of Damascus, a famous Greek architect, who flourished during the 2nd century A.D. He was a favourite of Trajan, for whom he constructed the stone bridge over the Danube (A.D. 104–105). He also planned a gymnasium, a college, public baths, the Odeum and the Forum Trajanum, within the city of Rome; and the triumphal arches at Beneventum and Ancona. The Trajan column in the centre of the Forum is celebrated as being the first triumphal monument of the kind. On the accession of Hadrian, whom he had offended by ridiculing his performances as architect and artist, Apollodorus was banished, and, shortly afterwards, being charged with imaginary crimes, put to death (Dio Cassius lxix. 4). He also wrote a treatise on *Siege Engines* (Πολιορκητικά), which was dedicated to Hadrian.

APOLLONIA, the name of more than thirty cities of antiquity. The most important are the following: (1) An Illyrian city (known as Apollonia κατ' Ἐπίδαμνον or πρὸς Ἐπιδάμνῳ) on the right bank of the Aous, founded by the Corinthians and Corcyraeans. It soon became a place of increasing commercial prosperity, as the most convenient link between Brundusium and northern Greece, and as one of the starting-points of the Via Egnatia. It was an important military post in the wars against Philip and during the civil wars of Pompey and Caesar, and towards the close of the Roman republic acquired fame as a seat of literature and philosophy. Here Augustus was being educated when the death of Caesar called him to Rome. It seems to have sunk with the rise of Aulon, and few remains of its ruins are to be found. The monastery of Pollina stands on a hill which probably is part of the site of the old city. (2) A Thracian city on the Black Sea (afterwards Sozopolis, and now Sizeboli), colonized by the Milesians, and famous for its colossal statue of Apollo by Calamis, which Lucullus removed to Rome.

APOLLONIUS, surnamed ὁ δύσκολος ("the Surly or Crabbed"), a celebrated grammarian of Alexandria, who lived in the reigns of Hadrian and Antoninus Pius. He spent the greater part of his life in his native city, where he died; he is also said to have visited Rome and attracted the attention of Antoninus. He was the founder of scientific grammar and is styled by Priscian *grammaticorum princeps*. Four of his works are extant: *On Syntax*, ed. Bekker, 1817; and three smaller treatises, on *Pronouns*, *Conjunctions* and *Adverbs*, ed. Schneider, 1878.

Grammatici Graeci, i. in Teubner series; Egger, *Apollonius Dyscole* (1854).

APOLLONIUS, surnamed ὁ μαλακός ("the Effeminate"), a Greek rhetorician of Alabanda in Caria, who flourished about 120 B.C. After studying under Menecles, chief of the Asiatic school of oratory, he settled in Rhodes, where he taught rhetoric, among his pupils being Mark Antony.

APOLLONIUS, surnamed "the Sophist," of Alexandria, a famous grammarian, who probably lived towards the end of the 1st century A.D. He was the author of a Homeric lexicon (Λέξεις Ὁμηρικαί), the only work of the kind we possess. His chief authorities were Aristarchus and Apion's Homeric glossary.

Edition by Villoison (1773), I. Bekker (1833); Leyde, *De Apollonii Sophistae Lexico Homerico* (1885); E. W. B. Nicholson on a newly discovered fragment in *Classical Review* (Nov. 1897).

APOLLONIUS MOLON (sometimes called simply Molon), a Greek rhetorician, who flourished about 70 B.C. He was a native of Alabanda, a pupil of Menecles, and settled at Rhodes. He twice visited Rome as an ambassador from Rhodes, and Cicero and Caesar took lessons from him. He endeavoured to moderate the florid Asiatic style and cultivated an "Atticizing" tendency. He wrote on Homer, and, according to Josephus, violently attacked the Jews.

See C. Müller, *Fragmenta Historicorum Graecorum*, iii.; E. Schürer, *History of the Jewish People*, iii. (Eng. tr. 1886).

APOLLONIUS OF PERGA [Pergaeus], Greek geometer of the Alexandrian school, was probably born some twenty-five years later than Archimedes, *i.e.* about 262 B.C. He flourished in the reigns of Ptolemy Euergetes and Ptolemy Philopator (247–205 B.C.). His treatise on *Conics* gained him the title of The Great Geometer, and is that by which his fame has been transmitted to modern times. All his numerous other treatises have perished, save one, and we have only their titles handed down, with general indications of their contents, by later writers, especially Pappus. After the *Conics* in eight Books had been written in a first edition, Apollonius brought out a second edition, considerably revised as regards Books i.-ii., at the instance of one Eudemus of Pergamum;

the first three books were sent to Eudemus at intervals, as revised, and the later books were dedicated (after Eudemus' death) to King Attalus I. (241–197 B.C.). Only four Books have survived in Greek; three more are extant in Arabic; the eighth has never been found. Although a fragment has been found of a Latin translation from the Arabic made in the 13th century, it was not until 1661 that a Latin translation of Books v.-vii. was available. This was made by Giovanni Alfonso Borelli and Abraham Ecchellensis from the free version in Arabic made in 983 by Abu 'l-Fath of Ispahan and preserved in a Florence MS. But the best Arabic translation is that made as regards Books i.-iv. by Hilāl ibn Abī Hilāl (d. about 883), and as regards Books v.-vii. by Tobit ben Korra (836–901). Halley used for his translation an Oxford MS. of this translation of Books v.-vii., but the best MS. (Bodl. 943) he only referred to in order to correct his translation, and it is still unpublished except for a fragment of Book v. published by L. Nix with German translation (Drugulin, Leipzig, 1889). Halley added in his edition (1710) a restoration of Book viii., in which he was guided by the fact that Pappus gives lemmas "to the seventh and eighth books" under that one heading, as well as by the statement of Apollonius himself that the use of the seventh book was illustrated by the problems solved in the eighth.

The degree of originality of the *Conics* can best be judged from Apollonius' own prefaces. Books i.-iv. form an "elementary introduction," *i.e.* contain the essential principles; the rest are specialized investigations in particular directions. For Books i.-iv. he claims only that the generation of the curves and their fundamental properties in Book i. are worked out more fully and generally than they were in earlier treatises, and that a number of theorems in Book iii. and the greater part of Book iv. are new. That he made the fullest use of his predecessors' works, such as Euclid's four Books on Conics, is clear from his allusions to Euclid, Conon and Nicoteles. The generality of treatment is indeed remarkable; he gives as the fundamental property of all the conics the equivalent of the Cartesian equation referred to *oblique* axes (consisting of a diameter and the tangent at its extremity) obtained by cutting an oblique circular cone in any manner, and the axes appear only as a particular case after he has shown that the property of the conic can be expressed in the same form with reference to any new diameter and the tangent at its extremity. It is clearly the form of the fundamental property (expressed in the terminology of the "application of areas") which led him to call the curves for the first time by the names *parabola*, *ellipse*, *hyperbola*. Books v.-vii. are clearly original. Apollonius' genius takes its highest flight in Book v., where he treats of normals as minimum and maximum straight lines drawn from given points to the curve (independently of tangent properties), discusses how many normals can be drawn from particular points, finds their feet by construction, and gives propositions determining the centre of curvature at any point and leading at once to the Cartesian equation of the evolute of any conic.

The other treatises of Apollonius mentioned by Pappus are —1st, *Λόγου ἀποτομή*, *Cutting off a Ratio*; 2nd, *Χωρίου ἀποτομή*, *Cutting off an Area*; 3rd, *Διωρισμένη τομή*, *Determinate Section*; 4th, *'Επαφαί*, *Tangencies*; 5th, *Νεύσεις*, *Inclinations*; 6th, *Τόποι ἐπίπεδοι*, *Plane Loci*. Each of these was divided into two books, and, with the *Data*, the *Porisms* and *Surface-Loci* of Euclid and the *Conics* of Apollonius were, according to Pappus, included in the body of the ancient analysis.

1st. *De Rationis Sectione* had for its subject the resolution of the following problem: Given two straight lines and a point in each, to draw through a third given point a straight line cutting the two fixed lines, so that the parts intercepted between the given points in them and the points of intersection with this third line may have a given ratio.

2nd. *De Spatii Sectione* discussed the similar problem which requires the rectangle contained by the two intercepts to be equal to a given rectangle.

An Arabic version of the first was found towards the end of the 17th century in the Bodleian library by Dr Edward Bernard, who began a translation of it; Halley finished it and published it along with a restoration of the second treatise in 1706.

3rd. *De Sectione Determinata* resolved the problem: Given two, three or four points on a straight line, to find another point on it such that its distances from the given points satisfy the condition that the square on one or the rectangle contained by two has to the square on the remaining one or the rectangle contained by the remaining two, or to the rectangle contained by the remaining one and another given straight line, a given ratio. Several restorations of the solution have been attempted, one by W. Snellius (Leiden, 1698), another by Alex. Anderson of Aberdeen, in the supplement to his *Apollonius Redivivus* (Paris, 1612), but by far the best is by Robert Simson, *Opera quaedam reliqua* (Glasgow, 1776).

4th. *De Tactionibus* embraced the following general problem: Given three things (points, straight lines or circles) in position, to describe a circle passing through the given points, and touching the given straight lines or circles. The most difficult case, and the most interesting from its historical associations, is when the three given things are circles. This problem, which is sometimes known as the Apollonian Problem, was proposed by Vieta in the 16th century to Adrianus Romanus, who gave a solution by means of a hyperbola. Vieta thereupon proposed a simpler construction, and restored the whole treatise of Apollonius in a small work, which he entitled *Apollonius Gallus* (Paris, 1600). A very full and interesting historical account of the problem is given in the preface to a small work of J. W. Camerer, entitled *Apollonii Pergaei quae supersunt, ac maxime Lemmata Pappi in hos Libros, cum Observationibus, &c.* (Gothae, 1795, 8vo).

5th. *De Inclinationibus* had for its object to insert a straight line of a given length, tending towards a given point, between two given (straight or circular) lines. Restorations have been given by Marino Ghetaldi, by Hugo d'Omerique (*Geometrical Analysis*, Cadiz, 1698), and (the best) by Samuel Horsley (1770).

6th. *De Locis Planis* is a collection of propositions relating to loci which are either straight lines or circles. Pappus gives somewhat full particulars of the propositions, and restorations were attempted by P. Fermat (*Œuvres*, i., 1891, pp. 3-51), F. Schooten (Leiden, 1656) and, most successfully of all, by R. Simson (Glasgow, 1749).

Other works of Apollonius are referred to by ancient writers, viz. (1) *Περὶ τοῦ πυρίου*, *On the Burning-Glass*, where the focal properties of the parabola probably found a place; (2) *Περὶ τοῦ κοχλίου*, *On the Cylindrical Helix* (mentioned by Proclus); (3) a comparison of the dodecahedron and the icosahedron inscribed in the same sphere; (4) *'Η καθόλου πραγματεία*, perhaps a work on the general principles of mathematics in which were included Apollonius' criticisms and suggestions for the improvement of Euclid's *Elements*; (5) *'Ωκυτόκιον* (quick bringing-to-birth), in which, according to Eutocius, he showed how to find closer limits for the value of π than the $3\frac{1}{7}$ and $3\frac{10}{71}$ of Archimedes; (6) an arithmetical work (as to which see PAPPUS) on a system of expressing large numbers in language closer to that of common life than that of Archimedes' *Sand-reckoner*, and showing how to multiply such large numbers; (7) a great extension of the theory of irrationals expounded in Euclid, Book x., from binomial to multinomial and from *ordered* to *unordered* irrationals (see extracts from Pappus' comm. on Eucl. x., preserved in Arabic and published by Woepcke, 1856). Lastly, in astronomy he is credited by Ptolemy with an explanation of the motion of the planets by a system of epicycles; he also made researches in the lunar theory, for which he is said to have been called Epsilon (ϵ).

The best editions of the works of Apollonius are the following: (1) *Apollonii Pergaei Conicorum libri quatuor, ex versione Frederici Commandini* (Bononiae, 1566), fol.; (2) *Apollonii Pergaei Conicorum libri octo, et Sereni Antissensis de Sectione Cylindri et Coni libri duo* (Oxoniae, 1710), fol. (this is the monumental edition of Edmund Halley); (3) the edition of the first four books of the Conics given in 1675 by Barrow; (4) *Apollonii Pergaei de Sectione Rationis libri duo: Accedunt ejusdem de Sectione Spatii libri duo Restituti: Praemittitur, &c., Opera et Studio Edmundi Halley* (Oxoniae, 1706), 4to; (5) a German translation of the *Conics* by H. Balsam (Berlin, 1861); (6) the definitive Greek text of Heiberg (*Apollonii Pergaei quae Graece* *exstant Opera*, Leipzig, 1891–1893); (7) T. L. Heath, *Apollonius, Treatise on Conic Sections* (Cambridge, 1896); see also H. G. Zeuthen, *Die Lehre von den Kegelschnitten im Altertum* (Copenhagen, 1886 and 1902). (T. L. H.)

APOLLONIUS OF RHODES (Rhodius), a Greek epic poet and grammarian, of Alexandria, who flourished under the Ptolemies Philopator and Epiphanes (222–181 B.C.). He was the pupil of Callimachus, with whom he subsequently quarrelled. In his youth he composed the work for which he is known—*Argonautica*, an epic in four books on the legend of the Argonauts. When he read it at Alexandria, it was rejected through the influence of Callimachus and his party. Disgusted with his failure, Apollonius withdrew to Rhodes, where he was very successful as a rhetorician, and a revised edition of his epic was well received. In recognition of his talents the Rhodians bestowed the freedom of their city upon him—the origin of his surname. Returning to Alexandria, he again recited his poem, this time with general applause. In 196, Ptolemy Epiphanes appointed him librarian of the Museum, which office he probably held until his death. As to the *Argonautica*, Longinus' (*De Sublim.* p. 54, 19) and Quintilian's (*Instit.* x. 1, 54) verdict of mediocrity seems hardly deserved; although it lacks the naturalness of Homer, it possesses a certain simplicity and contains some beautiful passages. There is a valuable collection of scholia. The work, highly esteemed by the Romans, was imitated by Virgil (*Aeneid*, iv.), Varro Atacinus, and Valerius Flaccus. Marianus (about A.D. 500) paraphrased it in iambic trimeters. Apollonius also wrote epigrams; grammatical and critical works; and Κτίσεις (the foundations of cities).

Editio Princeps (Florence, 1496); Merkel-Keil (with scholia, 1854); Seaton (1900). English translations: Verse, by Greene (1780); Fawkes (1780); Preston (1811); Way (1901); Prose by Coleridge (1889); see also Couat, *La Poésie alexandrine*; Susemihl, *Geschichte der griech. Lit. in der alexandrinischen Zeit.*

APOLLONIUS OF TRALLES (in Caria), a Greek sculptor, who flourished in the 2nd century B.C. With his brother Tauriscus, he executed the marble group known as the Farnese Bull, representing Zethus and Amphion tying the revengeful Dirce to the tail of a wild bull.

See Greek Art, pl. i. fig. 51.

APOLLONIUS OF TYANA, a Greek philosopher of the Neo-Pythagorean school, born a few years before the Christian era. He studied at Tarsus and in the temple of Asclepius at Aegae, where he devoted himself to the doctrines of Pythagoras and adopted the ascetic habit of life in its fullest sense. He travelled through Asia and visited Nineveh, Babylon and India, imbibing the oriental mysticism of magi, Brahmans and gymnosophists. The narrative of his travels given by his disciple Damis and reproduced by Philostratus is so full of the miraculous that many have regarded him as an imaginary character. On his return to Europe he was saluted as a magician, and received the greatest reverence from priests and people generally. He himself claimed only the power of foreseeing the future; yet in Rome it was said that he raised from death the body of a noble lady. In the halo of his mysterious power he passed through Greece, Italy and Spain. It was said that he was accused of treason both by Nero and by Domitian, but escaped by miraculous means. Finally he set up a school at Ephesus, where he died, apparently at the age of a hundred years. Philostratus keeps up the mystery of his hero's life by saying, "Concerning the manner of his death, *if he did die*, the accounts are various." The work of Philostratus composed at the instance of Julia, wife of Severus, is generally regarded as a religious work of fiction. It contains a number of obviously fictitious stories, through which, however, it is not impossible to discern the general character of the man. In the 3rd century, Hierocles (*q.v.*) endeavoured to prove that the doctrines and the life of Apollonius were more valuable than those of Christ, and, in modern times, Voltaire and Charles Blount (1654–1693), the English freethinker, have adopted a similar standpoint. Apart from this extravagant eulogy, it is absurd to regard Apollonius merely as a vulgar charlatan and miracle-monger. If we cut away the mass of mere fiction which Philostratus accumulated, we have left a highly imaginative, earnest reformer who laboured to infuse into the flaccid dialectic of paganism a saner spirit of practical morality.

See L. Dyer, *Studies of the Gods in Greece* (New York, 1891); A. Chassang, *Le Merveilleux dans l'antiquité* (1882); D. M. Tredwell, *Sketch of the Life of Apollonius of Tyana* (New York, 1886); F. C. Baur, *Apollonius von Tyana und Christus*, ed. Ed. Zeller (Leipzig, 1876,—an attempt to show that Philostratus's story is merely a pagan counterblast to the New Testament history); J. Jessen, *Apollonius v. Tyana und sein Biograph Philostratos* (Hamburg, 1885); J. Göttsching, *Apollonius von Tyana* (Berlin, 1889); J. A. Froude, *Short Studies*, vol. iv.; G. R. S. Mead, *Apollonius of Tyana* (London, 1901); B. L. Gildersleeve, *Essays and Studies* (New York, 1890); Philostratus's *Life of Apollonius* (Eng. trans. New York, 1905); O. de B. Priaulx, *The Indian Travels of Apollonius* (1873); F. W. G. Campbell, *Apoll. of Tyana* (1908); see also Neo-Pythagoreanism.

APOLLONIUS OF TYRE, a medieval tale supposed to be derived from a lost Greek original. The earliest mention of the story is in the *Carmina* (Bk. vi. 8, ll. 5-6) of Venantius Fortunatus, in the second half of the 6th century, and the romance may well date from three centuries earlier. It bears a marked resemblance to the *Antheia and Habrokomes* of Xenophon of Ephesus. The story relates that King Antiochus, maintaining incestuous relations with his daughter, kept off her suitors by asking them a riddle, which they must solve on pain of losing their heads. Apollonius of Tyre solved the riddle, which had to do with Antiochus's secret. He returned to Tyre, and, to escape the king's vengeance, set sail in search of a place of refuge. In Cyrene he married the daughter of King Archistrates, and presently, on receiving news of the death of Antiochus, departed to take possession of the kingdom of Antioch, of which he was, for no clear reason, the heir. On the voyage his wife died, or rather seemed to die, in giving birth to a daughter, and the sailors demanded that she should be thrown overboard. Apollonius left his daughter, named Tarsia, at Tarsus in the care of guardians who proved false to their trust. Father, mother, and daughter were only reunited after fourteen years' separation and many vicissitudes. The earliest Latin MS. of this tale, preserved at Florence, dates from the 9th or 10th century. The pagan features of the supposed original are by no means all destroyed. The ceremonies observed by Tarsia at her nurse's grave, and the preparations for the burning of the body of Apollonius's wife, are purely pagan. The riddles which Tarsia propounds to her father are obviously interpolated. They are taken from the *Enigmata* of Caelius Firmianus Symposius. The many inconsistencies of the story seem to be best explained by the supposition (E. Rohde, *Der griechische Roman*, 2nd ed., 1900, pp. 435 *et seq.*) that the Antiochus story was originally entirely separate from the story of Apollonius's wanderings, and was clumsily tacked on by the Latin author. The romance kept its form through a vast number of medieval re-arrangements, and there is little change in its outlines as set forth in the Shakespearian play of *Pericles*.

The Latin tale is preserved in about 100 MSS., and was printed by M. Velser (Augsburg, 1595), by J. Lapaume in *Script. Erot.* (Didot, Paris, 1856), and by A. Riese in the *Bibl. Teubneriana* (1871, new ed. 1893). The most widespread versions in the middle ages were those of Godfrey of Viterbo in his *Pantheon* (1185), where it is related as authentic history, and in the *Gesta Romanorum* (cap. 153), which formed the basis of the German folk-tale by H. Steinhöwel (Augsburg, 1471), the Dutch version (Delft, 1493), the French in *Le Violier des histoires romaines* (Paris, 1521), the English, by Laurence Twine (London, 1576, new ed. 1607), also of the Scandinavian, Czech, and Hungarian tales.

In England a translation was made as early as the 11th century (ed. B. Thorpe, 1834, and J. Zupitza in *Archiv für neuere Sprachen*, 1896); there is a Middle English metrical version (J. O. Halliwell, *A New Boke about Shakespeare*, 1850), by a poet who says he was vicar of Wimborne; John Gower uses the tale as an example of the seventh deadly sin in the eighth book of his *Confessio Amantis*; Robert Copland translated a prose romance of *Kynge Apollyne of Thyre* (Wynkyn de Worde, 1510) from the French; *Pericles* was entered at Stationers' Hall in 1607, and was followed in the next year by George Wilkins's novel, *The Painfull Adventures of Pericles, Prynce of Tyre* (ed. Tycho Mommsen, Oldenburg, 1857), and George Lillo drew his play *Marina* (1738) from the piece associated with Shakespeare; *Orendel*, by a Middle High German minnesinger, contains some of the episodes of *Apollonius*; Heinrich von Neustadt wrote a poem of 20,000 lines on *Apollonius von Tyrland* (*c.* 1400); the story was well known in Spanish, *Libre de Apolonio* (verse, *c.* 1200), and in J. de Timoneda's *Patrañuelo* (1576); in French much of it was embodied in *Jourdain de Blaives* (13th cent.), and it also appears in Italian and medieval Greek. See A. H. Smyth, *Shakespeare's Pericles and Apollonius of Tyre* (Philadelphia, 1898); Elimar Klebs, *Die Erzählung von A. aus Tyrus* (Berlin, 1899); S. Singer, *Apollonius von Tyrus* (Halle, 1895).

APOLLOS ('Ἀπολλώς; contracted from Apollonius), an Alexandrine Jew who after Paul's first visit to Corinth worked there in a similar way (1 Cor. iii. 6). He was with Paul at a later date in Ephesus (1 Cor. xvi. 12). In 1 Cor. i. 10-12 we read of four parties in the Corinthian church, of which two attached themselves to Paul and Apollos respectively, using their names, though the "division" can hardly have been due to conflicting doctrines. (See PAUL.) From Acts xviii. 24-28 we learn that he spoke and taught with power and success. He may have captivated his hearers by teaching "wisdom," as P. W. Schmiedel suggests, in the allegorical style of Philo, and he was evidently a man of unusual magnetic force. There seems to be some contradiction between Acts xviii. 25 *a b* and Acts xviii. 25 *c*, 26 *b c*; and it has been suggested that these latter passages are subsequent accretions. Since Apollos was a Christian and "taught exactly," he could hardly have been acquainted only with John's baptism or have required to be taught Christianity more thoroughly by Aquila and Priscilla. Martin Luther regarded Apollos as the author of the Epistle to the Hebrews, and many scholars since have shared his view.

Jerome says that Apollos was so dissatisfied with the division at Corinth, that he retired into Crete with Zenas, a doctor of the law; and that the schism having been healed by Paul's letter to the Corinthians, Apollos returned to the city, and became its bishop. Less probable traditions assign to him the bishopric of Duras, or of Iconium in Phrygia, or of Caesarea.

See the articles in the *Encyclopaedia Biblica*; Herzog-Hauck, *Realencyklopädie*; *The Jewish Encyclopaedia*; Hastings' *Dictionary of the Bible*; and cf. Weizsäcker, *Das apostolische Zeitalter*; A. C. McGiffert, *History of Christianity in the Apostolic Age.*

APOLLYON, the "foul fiend" who assaulted Christian on his pilgrimage through the Valley of Humiliation in John Bunyan's great allegory. The name (Gr. 'Ἀπολλύων), which means "destroyer" (ἀπολλύειν, to destroy), is taken from Rev. ix. 11, where it represents the Hebrew word *Abaddon* (lit. "place of destruction," but here personified). The identification with the Asmodeus (*q.v.*) of Tobit iii. 8 is erroneous.

APOLOGETICS, in theology, the systematic statement of the grounds which Christians allege for belief in (at least) a *supernatural revelation* and a *divine redemption* (cf. *e.g.* Heb. i. 1-3). The majority of apologists in the past have further believed in an *infallible Bible*; but they admit this position can only be reached at a late stage in the argument. We should note, however, that even a liberal orthodoxy, while saying nothing about infallibility, is pledged to the *essential* authority of the Bible; it cannot *e.g.* simply ignore the Old Testament with F. E. D. Schleiermacher. Catholic apologetics must further give a central position to *Church* authority, which Roman Catholics explicitly define as infallible; but this position too is debated in a late section of their system. On the other hand, there may be a Christianity which seeks to extricate the "spiritual" from the "supernatural" (Arnold Toynbee, characterizing T.H. Green). It would only lead to confusion, however, if we called this method "apologetic." Any *single* effort in apologetics may be termed "an apology." More elaborate contrasts have been proposed between the two words, but are of little practical importance.

I. *The Word itself.*—In Greek, ἀπολογία is the defendant's reply (personally, not through a lawyer) to the speech for the prosecution—κατηγορία. Sometimes defendants' speeches passed into literature, *e.g.* Plato's splendid version of the *Apology* of Socrates. Thus, in view of persecution or slander, the Christian church naturally produced literary "Apologies." The word has never quite lost this connotation of standing on the defensive and rebutting criticism; *e.g.* Anselm's *Apologia contra insipientem Gaunilonem* (*c.* 1100); or the Lutheran *Apology for the Augsburg Confession* (1531); or J. H. Newman's *Apologia pro vita sua* (1864); or A. B. Bruce's *Apologetics; or Christianity Defensively Stated* (1892). Of course, defence easily passes into counter-attack, as when early apologists denounce Greek and Roman religion. Yet the purpose may be defence even then. And there is perhaps a reason of a deeper kind for holding Apologetics to the defensive. Christianity is a prophetic religion. Now a prophet does not argue; he declares what he feels to be God's will. For himself, he rests, like the mystic, upon an immediate vision of truth; but he differs from most mystics in having a message for others; and—again unlike most mystics—he addresses the hearer's *conscience*, which we might call (in one sense) the mystic element in every man—or better, perhaps, the prophetic. Can the positive grounds for a prophet's message be analysed and stated in terms of argument? If so, apologetics is literally a science, and it is pedantry to claim the defensive and pretend to throw the *onus probandi* upon objectors. But, if not, then apologetics is a mere auxiliary, and is only "a science" in so far as it presents a *conscious* and *systematic* plea. Bruce's title, and his programme of "succouring distressed faith," imply the latter alternative; the moral appeal of Christianity, primary and essential; its confirmation by argument, secondary. The view has its difficulties; but it is highly suggestive.

The word ἀπολογία is used by Origen (*Contra Cel.* ii. 65, v. 19) of the general Christian defence. But the introduction of the adjective "apologetic" and of the substantive "apologetics" is recent. They are serviceable as bracketing together (1) Natural Theology or Theism, (2) Christian Evidences—chiefly "miracles" and "prophecy"; or, on a more modern view, chiefly the character and personality of Christ. The lower usage of Apology (as expression of regret for a fault) has tipped many a sarcasm besides George III.'s on the occasion of Bishop Watson's book, "I did not know that the Bible needed an apology!"

II. *Apologetics in the Bible.*—The Old Testament does not argue in support of its beliefs, unless when (chiefly in parts of the Wisdom literature) it seeks to rebut moral difficulties (cf. T. K. Cheyne, *Job and Solomon*; A. S. Peake, *Problem of Suffering in the Old Testament*, 1904). The New Testament reflects chiefly controversy with Jews. Great emphasis is laid upon alleged fulfilments—striking or fanciful, but very generally striking to that age—of Old Testament prophecy (Matt. especially; rather differently Ep. to Heb.). The miracles of Jesus are also canvassed. Jews do not deny their wonderful character, but attribute them to black art (Mark iii. 22 &c., &c.). On the other hand, Christians and Jews are pretty well agreed on natural theology; so the New Testament tends to take its theism for granted. However, Rom. i. 20 has had great influence on Christian theology (*e.g.* Thomas Aquinas) in leading it to base theism upon reason or argument. One apologetic contention, aimed at Gentile readers, is found among the motives of Acts. Christianity is not a lawless but an excellent law-abiding faith. So (it is alleged) rulers, both Jewish and Gentile, have often admitted (xviii. 14; xix. 37; xxiii. 9; xxvi. 32).

III. *Early Christian.*—When we leave the New Testament, apologetics becomes conspicuous until the political triumph of Christianity, and even somewhat later. The atmosphere is no longer Jewish but fully Greek. True there are, as always, Jewish controversialists. Justin Martyr writes a *Dialogue with Trypho*; Origen deals with many anti-Christian arguments borrowed by Celsus from a certain nameless Jew. Yet Greece was the sovereign power in all the world of ancient culture. And so Christianity was necessarily Hellenized, necessarily philosophized. One result was to bring natural theology into the forefront. A pure morality, belief in one God, hopes extending beyond death—these appealed to the age; the Church taught them as philosophically true *and* divinely revealed. But, further still, philosophy offered a vehicle which could be applied to the contents of Christianity. The Platonic or eclectic theism, which adopted the conception of the Logos, made a place for Christ in terms of philosophy within the Godhead. (John i. 1 may or may not be affected by Philo; it is almost or quite solitary in the N.T.) Similarly, the immortality of the soul may be maintained on Platonic or quasi-Platonic lines, as by St Athanasius (*Contra Gentes*, § 33)—a writer who repeatedly quotes the Alexandrian Book of Wisdom, in which Platonism and the Old Testament had already joined partnership. This phase of Platonism, however, was much more slowly adopted. The earlier apologists dispute the natural immortality of the soul; Athanasius himself, in *De Incarnatione Dei*, §§ 4, 5, tones down the teaching of *Wisdom*; and the somewhat eccentric writer Arnobius, a layman—from Justin Martyr downwards apologetics has always been largely in the hands of laymen—stands for what has recently been called "conditional immortality"—eternal life for the righteous, the children of God, alone.

Allied with this more empiricist stand-point is the assertion that Greek philosophy borrowed from Moses; but in studying the Fathers we constantly find that groundless assertion uttered in the same breath with the dominant Idealist view, according to which Greek philosophy was due to incomplete revelation from the divine Logos.

On purely defensive lines, early apologists rebut charges of cannibalism and sexual promiscuity; the Christians had to meet in secret, and the gossip of a rotten age drew malignant conclusions. They make counter attacks on polytheism as a folly and on the shamefulness of obscene myths. Here they are in line with non-Christian writers or culture-mockers like Lucian of Samosata; or graver spirits like Porphyry, who champions Neo-Platonism as a rival to Christianity, and does pioneer work in criticism by attacks on some of the Old Testament books. Turning to Christian evidence proper, we are struck with the continued prominence of the argument from prophecy. The Old Testament was an immense religious asset to the early church. Their enemies had nothing like it; and—the N.T. canon being as yet but half formed—the Old Testament was pushed into notice by dwelling on this imperfect "argument," which grew more extravagant as the partial control exercised by Jewish learning disappeared. An argument from miracles is also urged, though with more reserve. Formally, every one in that age admitted the supernatural. The question was, whose supernatural? And how far did it carry you? Miracle could not be to a 3rd century writer what it was to W. Paley—a conclusive and well-nigh solitary proof. Other apologies are by Aristides (recently recovered in translation), Athenagoras ("elegant"), Eusebius of Caesarea, Cyril of Alexandria; in Latin by Minucius Felix, Tertullian (a masculine spirit and phrase-coiner like T. Carlyle, if bitterer still), Lactantius Firmianus, &c., &c.[1]

As Christianity wins the day, a new objection is raised to it. The age is full of troubles; Christianity is ruining the empire! Besides notices elsewhere, we find the charge specially dealt with by St Augustine and his friends. Paulus Orosius argues that the world has always been a vale of tears. Salvian contends that not the acceptance of Christianity, but the sins of the people are bringing trouble upon them; and he gives ugly evidence of the continued prevalence of vice. Most impressive of all was Augustine's own contribution in *The City of God*. Powers created by worldliness and sin are crumbling, as they well may; "the city of God remaineth!" Whether he meant it so or not, the saint's argument became a programme and an apologia for the imperializing of the Western Church under the leadership of Rome during the middle ages.

IV. *Middle Ages.*—From the point of view of apologetics, we may mass together the long stretch of history which covers the period between the disappearance and the re-appearance of free discussion. When emperors became converts, the church, so lately a victim and a pleader for liberty, readily learned to persecute. Under such conditions there is little scope for apologetics. Force kills argument and drives doubt below the smooth surface of a nominal conformity. But there were two influences beyond the bounds or beyond the power of the christianized empire. The Jew remained, as always, stubbornly unconvinced, and, as often, fond of slanders. Many of the principal medieval attempts in apologetics are directed chiefly against him, *e.g.* the *Pugio Fidei* of Raymond Martini (*c.* 1280), which became one of Pascal's sources (see V. below), or Peter Abelard's *Dialogus inter Judaeum Philosophum et Christianum*. And the Moslem came on the scenes bringing, as a gift for Christendom, fuller knowledge of classical, especially Aristotelian, texts. The Jews, less bitterly opposed to Mahommedanism than the Christians were, caught fire more rapidly, and in some cases served as an intermediate link or channel of communication. These two religions anticipated the discussion of the problem of faith and reason in the Christian church. According to the great Avicenna and Maimonides, faith and the highest reason are sure to coincide (see ARABIAN PHILOSOPHY). According to Ghazali, in his *Destruction of Philosophers*, the various schools of philosophy cancel each other; reason is bankrupt; faith is everything. (So nearly Jehuda Halevi.) According to Averroes, reason suffices, and faith, with (what he considers) its dreams of immortality and the like, is useful only for the ignorant masses. Christian theology, however, strikes out a line of its own. Moslems and Jews were applying Aristotelian philosophy to rigorously monotheistic faiths; Christianity had been encouraged by Platonism in teaching a trinity of divine persons, and Platonism of a certain order long dominated the middle ages as part of the Augustinian tradition. In sympathy with this Platonism, the medieval church began by assuming the entire mutual harmony of faith and reason. Such is the teaching, along different lines, alike of St Anselm and of Abelard. But, when increased knowledge of Aristotle's texts (and of the commentaries) led to the victory of a supposed Aristotelianism over a supposed Platonism, Albertus Magnus, and his still more distinguished pupil Thomas Aquinas, mark certain doctrines as belonging to faith but not to reason. They adhere to the general position with exceptions (in the case of what had been considered Platonic doctrines). From the point of view of philosophy, this was a compromise. Faith and reason partly agree, partly diverge. The tendency of the later middle ages is to add to the number of the doctrines with which philosophy cannot deal. Thomas's great rival, Duns Scotus, does this to a large extent, at times affirming "two truths." The latter position, ascribed by the schoolmen to the Averroists, becomes dominant among the later Nominalists, William of Occam and his disciples, who withdraw *all* doctrines of faith from the sphere of reason. This was a second and a more audacious compromise. It is not exactly an attempt to base Christian faith on rational scepticism. It is a consistent policy of harbouring inconsistencies in the same mind. A statement may be true in philosophy and false in theology, or vice versa. To the standpoint of Aquinas, however, the Church of Rome (at least in regard to the basis of doctrine) has more and more returned. The councils of Trent and of the Vatican mark the Two Truths hypothesis as heretical, when they affirm that there *is* a natural knowledge of God and natural certainty of immortality. Along with this affirmation, the Church of Rome (if less decisively) has adopted the limitations of the Thomist theory by the condemnation of "Ontologism"; certain mysterious doctrines are beyond reason. This cautious compromise sanctioned by the Church does not represent the *extremest* reaction against nominalism. Even in the nominalistic epoch we have Raymond of Sabunde's *Natural Theology* (according to the article in Herzog-Hauck, not the title of the oldest Paris MS., but found in later MSS. and almost all the printed editions) or *Liber Creaturarum* (*c.* 1435). The book is not what moderns (schooled unconsciously in post-Reformation developments of Thomist ideas) expect under the name of natural theology. It is an attempt once more to demonstrate *all* scholastic dogmas out of the book of creation or on principles of natural reason. At many points it follows Anselm closely, and, of course, very often "makes light work" of its task.

The Thomist compromise—or even the more sceptical view of "two truths"—has the merit of giving filling *of a kind* to the formula "supernatural revelation"—mysteries inaccessible to reason, beyond discovery and beyond comprehension. According to earlier views—repeatedly revived in Protestantism—revelation is just philosophy over again. Can the choice be fairly stated? If revelation is thought of as God's personal word, and redemption as his personal deed, is it reasonable to view them either as open to a sort of scientific prediction or as capricious and unintelligible? Even in the middle ages there were not wanting those—the St Victors, Bonaventura—who sought to vindicate mystical if not moral redemption as the central thought of Christianity.

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[1] While these writings are of great historical value, they do not, of course, represent the Christian argument as conceived to-day. The Church of Rome prefers medieval or modern statements of its position; Protestantism can use only modern statements.

V. *Earlier Modern Period.*—It will be seen that apologetics by no means reissued unchanged from the long period of authority. The compromise of Aquinas, though not unchallenged, holds the field and that even with Protestants. G. W. Leibnitz devotes an introductory chapter in his *Théodicée*, 1710 (as against Pierre Bayle), to faith and reason. He is a good enough Lutheran to quote as a "mystery" the Eucharist no less than the Trinity, while he insists that truths *above* are not *against* reason. Stated thus baldly, has the distinction any meaning? The more celebrated and central thesis of the book—this finite universe, the best of all such that are possible—also restates positions of Augustine and Aquinas.

Before modern philosophy began its career, there was a great revival of ancient philosophy at the Renaissance; sometimes anti-Christian, sometimes pro-Christian. The latter furnishes apologies by Marsilio Ficino, Agostino Steuco, J. L. Vives.

Early in the modern period occurs the great name of Blaise Pascal (1623–1662). A staunch Roman Catholic, but belonging to a school of Augustinian enthusiasts (the Jansenists), whom the Church put down as heretics, he stands pretty much apart from the general currents. His *Pensées*, published posthumously, seems to have been meant for a systematic treatise, but it has come to us in fragments. Once again, a lay apologist! A layman's work may have the advantage of originality or the drawback of imperfect knowledge. Pascal's work exhibits both characters. It has the originality of rare genius, but it borrows its material (as industrious editors have shown) from very few sources—the *Pugio Fidei*, M. de Montaigne, P. Charron. Ideas as well as learning are largely Montaigne's. The latter's cheerful man-of-the-world scepticism is transfigured in Pascal to a deep distrust of human reason, in part, perhaps, from anti-Protestant motives. But this attitude, while not without parallels both earlier (Ghazali, Jehuda Halevi) and later (H. L. Mansel), has peculiarities in Pascal. It is *fallen* man whom he pursues with his fierce scorn; his view of man's nature—intellect as well as character—is to be read in the light of his unflinching Augustinianism. Again, Pascal, unlike most apologists, belongs to the small company of saintly souls. This philosophical sceptic is full of humble joy in salvation, of deep love for the Saviour.

Another French Roman Catholic apologist, P. D. Huet (1630–1721)—within the conditions of his age a prodigy of learning (in apologetics see his *Demonstratio Evangelica*)—is not uninfluenced by Pascal (*Traité de la faiblesse de l'esprit humaine*).

As we might expect, Protestant lands are more busily occupied with apologetics. Intolerant reliance upon *force* presents greater difficulties to them; soon it grows quite obsolete. Benedict Spinoza, the eminent Jewish pantheist (1632–1677), to whom miracle is impossible, revelation a phrase, and who renews pioneer work in Old Testament criticism, finds at least a fair measure of liberty and comfort in Holland (his birth-land). Bayle, the historical sceptic, lectured and published his learned *Dictionnaire* (1696) at Rotterdam. From Holland, earlier, had proceeded an apologetic work by a man of European fame. Hugo Grotius's *De Veritate Christianae Religionis* (1627) is partly the medieval tradition:—Oppose Mahommedans and Jews! It is partly practical:—Arm Christian sailors against religious danger! But in its cool spirit it forecasts the coming age, whose master is John Locke. His *Reasonableness of Christianity* (1695) is the thesis of "a whole century" of theologians. And his *Essay on the Human Understanding* (1690) is almost a Bible to men of education during the same period; its lightest word treasured. Locke does not break with the compromise of Aquinas. But he transfers attention from *contents* to *proof*. Reason proves that a revelation has been made—and then submits. Leibnitz has to supplement rather than correct Locke on this point.

In such an atmosphere, deism readily uttered its protest against mysterious revelation. Deism is, in fact, the Thomist natural theology (more clearly distinguished from dogmatic theology than in the middle ages, alike by Protestants and by the post-Tridentine Church of Rome) now dissolving partnership with dogmatic and starting in business for itself. Or it is the doctrine of unfallen man's "natural state"—a doctrine intensified in Protestantism—separating itself from the theologians' grave doctrine of sin. If Socinianism had challenged natural theology—Christ, according to it, was the prophet who first revealed the way to eternal life—it had glorified the natural powers of man; and the learning of the Arminian divines (friends of Grotius and Locke) had helped to modernize Christian apologetics upon rational lines. Deism now taught that reason, or "the light of nature," was all-sufficient.

Not to dwell upon earlier continental "Deists" (mentioned by Viret as quoted first in Bayle's *Dictionary* and again in the introduction to Leland's *View of the Deistical Writers*), Lord Herbert of Cherbury (*De Veritate*, 1624; *De Religione Gentilium*, 1645?—according to J. G. Walch's *Bibliotheca Theologica* (1757) not published complete until 1663) was universally understood as hinting conclusions hostile to Christianity (cf. also T. Hobbes, *Leviathan*, 1651, ch. xxxi.; Spinoza, *Tractatus Theologico-Politicus*, 1670, ch. xiv.). Professedly, Herbert's contention merely is that non-Christians feeling after the "supreme God" and the law of righteousness must have a chance of salvation. Herbert was also epoch-making for the whole 18th century in teaching that *priests* had *corrupted* this primitive faith. During the 18th century deism spread widely, though its leaders were "irrepressible men like Toland, men of mediocre culture and ability like Anthony Collins, vulgar men like Chubb, irritated and disagreeable men like Matthew Tindal, who conformed that he might enjoy his Oxford fellowship and wrote anonymously that he might relieve his conscience" (A. M. Fairbairn). More distinguished sympathizers are Edward Gibbon, who has the deistic spirit, and David Hume, the historian and philosophical sceptic, who has at least the letter of the deistic creed (*Dialogues Concerning Natural Religion*), and who uses Pascal's appeal to "faith" in a spirit of mockery (*Essay on Miracles*). In France the new school found powerful speaking-trumpets, especially Voltaire, the idol of his age—a great denier and scoffer, but always sincerely a believer in the God of reason—and the deeper but wilder spirit of J. J. Rousseau. Others in France developed still more startling conclusions from Locke's principles, E. B. Condillac's sensationalism—Locke's philosophy purged of its more ideal if less logical elements—leading on to materialism in J. O. de la Mettrie; and at least one of the Encyclopedists (P. H. von Holbach) capped materialism with confessed atheism.

In Germany the parallel movement of "illumination" (H. S. Reimarus; J. S. Semler, pioneer in N.T. criticism; and a layman, the great Lessing) took the form of "rationalism" within the church—interpreting Bible texts by main force in a way which the age thought "enlightened" (H. E. G. Paulus, 1761–1851, &c.).

Among the innumerable English anti-deistic writers (see W. Law, *The Case of Reason*; R. Bentley, or "Phileleutherus Lipsiensis"; &c., &c.), three are of chief importance. Nathaniel Lardner (Arian, 1684–1768) stands in the front rank of the scholarship of his time, and uses his vast knowledge to maintain the genuineness of all books of the New Testament and the perfect accuracy of its history. Joseph Butler, a very original, careful and honest thinker, lifts controversy with deists from details to principles in his *Analogy of Religion both Natural and Revealed to the Constitution and Course of Nature* (1736). This title introduces us to a new conception. Deists and orthodox in those days agreed in recognizing not merely natural theology but natural religion—"essential religion," Butler more than once styles it; the expression shows how near he stood intellectually to those he criticized. But morally he stood aloof. In part i.—on Natural Religion—he defends a moral or punishing Deity against the sentimental softness of the age. The God of Nature, whom deists confess, does punish in time, if they will but look at the facts; why not in eternity? “Morality,” as others have confessed, is “the nature of things”! Not the Being of God is discussed—Butler will not waste words on triflers (as he thinks them) who deny that—but God’s character. Unfortunately (perhaps) Butler prefers to argue on *admitted principles*; holds much of his own moral belief in reserve; tries to reduce everything to a question of *probable fact*. If this hampers him in part i., the situation appears still worse in part ii., which is directly occupied with the defence of Christianity. Butler says nothing about incomprehensible mysteries, and protests that reason is the only ground we have to proceed upon. But by treating the atonement simply as revealed (and unexplained) matter of fact—in spite of some partial analogies in human experience, a thing essentially anomalous—Butler repeats, and applies to the *moral* contents of Christianity, what Aquinas said of its speculative doctrines. (Whether one calls the unknowable a revealed mystery or an unexplained and inexplicable fact makes little difference.) William Paley (1743–1805) borrows from many writers; he borrows Lardner’s learning and Butler’s “particular evidence for Christianity,” viz. miracles, prophecy and “history”; and he states his points with perfect clearness. No man ever filled a typical position more exactly than Paley. Eighteenth-century ethics—Hedonism, with a theological background. Empiricist Natural Theology—the argument from Design. Christian Evidences—the strong probability of the resurrection of Christ and the consequent authority of his teaching. *Horae Paulinae*—mutual confirmations of *Acts* and Epistles; better, though one-sided. When such exclusively “external” arguments are urged, the contents of Christianity go for next to nothing.

VI. *Later Modern Period.*—Towards the end of the 18th century a new epoch of reconstruction begins in the thought and life of civilization. The leader in speculative philosophy is Immanuel Kant, though he includes many agnostic elements, and draws the inference (which some things in the letter of Butler might seem to warrant) that the essence of Christianity is an ethical theism. While he thus created a new and more ethical “rationalism,” Kant’s many-sided influence, alike in philosophy and in theology, worked to further issues. He (and other Germans, but not G. W. F. Hegel) was represented in England in a fragmentary way by S. T. Coleridge (1772–1834), probably the most typical figure of his period—another layman. His general thought was that “rationalism” represents an uprising of the lower reason or “understanding” against the higher or true “reason.” The mysteries of theology are its best part—not alien to reason but of its substance, the “logos.” This is to upset the compromise of Aquinas and go back to a Christian platonism. Of course the difficulty revives again: If a philosophy, why supernaturally revealed? Thomas Arnold, criticizing Edward Hawkins, appeals rather to the atonement as deeper neglected truth. So in Scotland, Thomas Erskine and Thomas Chalmers—the latter in contradiction to his earlier position—hold that the doctrine of salvation, when translated into experience, furnishes “internal evidence”—a somewhat broader use of the phrase than when it applies merely to evidence of date or authorship drawn from the contents of a book. This gives a new and moral filling to the conception of “supernatural revelation.” The attempt to work out either of the reactions against Thomism in new theological systems is pretty much confined to Germany. Hegel’s theological followers, of every shade and party, represent the first, and Schleiermacher’s the second. Schleiermacher rejects natural religion in favour of the positive religions, while the school of A. Ritschl and W. Herrmann reject natural theology outright in favour of revelation—a striking external parallel to early Socinianism. British and American divines, on the other hand, are slow to suspect that a new apologetic principle may mean a new system of apologetics, to say nothing of a new dogmatic. Among the evangelicals, for the most part, natural theology, far from being rejected, is not even modified, and certain doctrines continue to be described as incomprehensible mysteries. No Protestant, of course, can agree with Roman Catholic theology that (supernatural) faith is an obedient assent to church authority and the mysteries it dictates. To Protestantism, faith is personal trust. But the principle is hardly ever carried out to the end. Mysterious doctrines are ascribed by Protestants to *scripture*; so half of revelation is regarded as matter for blind assent, if another half is luminous in experience. The movement of German philosophy which led from Kant to Hegel has indeed found powerful British champions (T. H. Green, J. and E. Caird, &c.), but less churchly than Coleridge (or F. D. Maurice or B. F. Westcott), though churchly again in J. R. Illingworth and other contributors to *Lux Mundi* (1890). Before this wave of thought, H. L. Mansel tried (1858) to play Pascal’s game on Kantian principles, developing the sceptical side of Kant’s many-faceted mind. But as he protested against relying on the human conscience—the one element of positive conviction spared by Kant—his ingenuity found few admirers except H. Spencer, who claims him as justifying anti-Christian agnosticism. Butler’s tradition was more directly continued by J. H. Newman—with modifications on becoming a Roman Catholic in the light of the church’s decision in favour of Thomism. A. M. Fairbairn (*Catholicism, Roman and Anglican*, ch. v., and elsewhere) and E. A. Abbott (*Philomythus*, and elsewhere) suspect Newman of a sceptical leaven and extend the criticism to Butler’s doctrine of “probability.” Yet it seems plain that any theology, maintaining redemption as historical fact (and not merely ideal), must attach religious importance to conclusions which are technically probable rather than proven. If we transfer Christian evidence from the “historical” to the “philosophical” with H. Rashdall—we surely cut down Christianity to the limits of theism. And the *inner* mind of Butler has moral anchorage in the *Analogy*, quite as much as in the *Sermons*. It is in part ii. more than in part i. of his masterpiece that the light seems to grow dim. Another of the Oxford converts to Rome, W. G. Ward, made vigorous contributions to natural theology.

VII. *Contents of Modern Apologetics.*—Superficially regarded, philosophy ebbs and flows, whatever progress the debate may reveal to speculative insight. Old positions re-emerge from forgetfulness, and there is always a philosophy to back every “case.” More visible dangers arise for the apologist in the region of science, historical or physical. There the progress of truth, within whatever limits, is manifest. *Essays and Reviews* (1860) was a vehement announcement of scientific results—startling English conservatism awake for the first time. And in the scientific region the great apologetic classics, like Butler, are hopelessly out of date. The modern apologist must do ephemeral work—unless it should chance that he proves to be the skirmisher, pioneering for a modified dogmatic. He holds a watching brief. While he must beware of hasty speech, he has often to plead that new knowledge does not really threaten faith; or that it is not genuinely established knowledge at all; or else, that faith has mistaken its own grounds, and will gain strength by concentrating on its true field. The work is not always well done; but the Christian church needs it.

1. *Apologetics and Philosophy.*—The main part of this subject is discussed under THEISM. Some notes may be added on special points. (*a*) Freewill is generally assumed on the Christian side (R.C. Church; Scottish philosophy; H. Lotze; J. Martineau; W. G. Ward. Not in a libertarian sense; Leibnitz. New and obscure issues raised by Kant). But there is no continuous tradition or steady trend of discussion. (*b*) Personal immortality is affirmed as philosophically certain by the Church of Rome and many Protestant writers. Others teach “conditional immortality.” Others base the hope on belief in the resurrection of Christ. (*c*) Theodicy—the tradition of Leibnitz is preserved (on libertarian lines) by Martineau (*A Study of Religion*, 1883). See also F. R. Tennant’s *Origin and Propagation of Sin* (1902)—sin a “bye-product” of a generally good evolution. Others find in the gospel of redemption the true theodicy. (*d*) The problem of Christian apologetic has been simplified in the past by the prevalence of the Christian ethics and temper even among many non-Christians (*e.g.* J. S. Mill). But hereafter it may not prove possible for the apologist to assume as unchallenged the Christian

moral outlook. Germans have suspected an anti-Christian strain in Goethe; all the world knows of it in E. von Hartmann or F. Nietzsche.

2. *Apologetics and Physical Science.*—(*a*) Copernicanism has won its battles and the Church of Rome would fain have its error forgotten. The admission is now general that the Bible cannot be expected to use the language of scientific astronomy. Still, it is not certain that the shock of Copernicanism on supernatural Christianity is exhausted. (*b*) Geology has also won its battles, and few now try to harmonize it with Genesis. (*c*) Evolution came down from the clouds when C. Darwin and A. R. Wallace succeeded in displacing the naïf conception of special creation by belief in the origin of species out of other species through a process of natural law. This gave immense vogue to wider and vaguer theories of evolutionary process, notably to H. Spencer's grandiose cosmic formula in terms of mechanism. Here the apologist has more to say. The special Darwinian hypothesis—natural "selection"—may or may not be true; it was at least a fruitful suggestion. If true, it need not be exhaustive. Again, evolution itself need not apply everywhere. We are offered a philosophical rather than a scientific speculation when E. Caird (*Evolution of Religion*, 1893) tries to vindicate Christianity as the highest working of nature—true just *because* evolved from lower religions. The Christian apologist indeed may himself seek, following John Fiske, to philosophize evolution as a restatement of natural theology—"one God, one law, one element and one far-off divine event"—and as at least pointing *towards* personal immortality. But if evolution is to be the whole truth regarding Christianity, we should have to surrender both *supernatural revelation* and *divine redemption.* And these, it may be strongly urged, contain the magic of Christianity. Losing them it might sink into a lifeless theory.

As far as pure science goes, the inference from science in favour of materialism has visibly lost much of its plausibility, and Protestant apologists would probably be prepared to accept in advance all verified discoveries as belonging to a different region from that of faith. Roman Catholic apologetic prefers to negotiate in detail.

3. *Apologetics and History.*—History brings us nearer the heart of the Christian position. (*a*) Old Testament criticism won startling victories towards the end of the 19th century. It blots out much supposed knowledge, but throws a vivid and interesting light on the reconstrued process of history. Most Protestants accept the general scheme of criticism; those who hang back make not a few concessions (*e.g.* J. Orr, *Problem of the O.T.*, 1906). The Roman Catholic Church again prefers an attitude of reserve. (*b*) New Testament criticism raises even more delicate issues. Positively it may be affirmed that the recovered figure of the historical Jesus is the greatest asset in the possession of modern Christian theology and apologetics. The "Lives" of Christ, Roman Catholic and Protestant, "critical" (D. F. Strauss, A. Renan, &c., &c.) and "believing," imply this at least. Negatively, "unchallenged historical certainties" are becoming few in number, or are disappearing altogether, through the industry of modern minds. True, the Tübingen criticism of F. C. Baur and his school—important as the first scientific attempt to conceive New Testament conditions and literature as a whole—has been abandoned. (A. Ritschl's *Entstehung der alt-katholischen Kirche*, 2nd edition, 1857, was an especially telling reply.) The synoptic gospels are now treated with considerable respect. It is no longer suggested in responsible quarters that they are party documents sacrificing truth to "tendency." But not all quarters are responsible; and in the effort to grasp scientifically, *i.e.* accurately, the amazing facts of Christ and primitive Christianity, every imaginable hypothesis is canvassed. Even the Roman Catholic Church produced the Abbé Loisy (though he undertakes to play off church certainties against historical uncertainties). Hitherto at least the fourth gospel has been the touchstone. The authorship of the epistles is in many cases a matter of subordinate importance; at least for Protestants or for those surrendering Bible infallibility, which Rome can hardly do. (*c*) New Testament history. The apologist must maintain (1) that Jesus of Nazareth is a real historical figure—a point well-nigh overlooked by Strauss, and denied by some modern advocates of a mythical theory; (2) that Jesus is knowable (not one "of whom we really know very little"—B. Jowett) in his teaching, example, character, historical personality; and that he is full of moral splendour. On the other hand, faith has no special interest in claiming that we can compose a biographical study of the development of Jesus. Certainly no early writer thought of providing material for such use. It is a common opinion in Germany that our material is in fact too scanty or too self-contradictory. Yet the fascination of the subject will always revive the attempt. If it succeeds, there will be a new line of communication along which that great personality will tell on men's minds and hearts. If it fails—there are other channels; character can be known and trusted even when we are baffled by a thing necessarily so full of mystery as the development of a personality. Notably, the manifest *non-consciousness of personal guilt* in Jesus suggests to us his sinlessness. (3) Apologists maintain that Jesus "claimed" Messiahship. There are speculative constructions of gospel history which eliminate that claim; and no doubt apologetics could—with more or less difficulty—restate its position in a changed form if the paradox of to-day became accepted as historical fact to-morrow. The central apologetic thesis is the *uniqueness* of the "only-begotten"; it is here that "the supernatural" passes into the substance of Christian faith. But most probably the description of Jesus as thus unique will continue to be associated with the allegation—He told us so; he claimed Messiahship and "died for the claim." (See preface to 5th ed. of *Ecce Homo.*) Nor did so superhuman a claim crush him, or deprive his soul of its balance. He imparted to the title a grander significance out of the riches of his personality. (4) In the light of this the "argument from prophecy" is reconstructed. It ceases to lay much stress upon coincidences between Old Testament predictions or "types" and events in Christ's career. It becomes the assertion; historically, providentially, the expectation of a *unique religious figure* arose—"the" Messiah; and Jesus gave himself to be thought of as that great figure. (5) It is also claimed as certain that Jesus had marvellous powers of healing. More reserve is being shown towards the other or "nature" miracles. These latter, it may be remarked, are more unambiguously supernatural. But, if Jesus really cured leprosy or really restored the dead to life, we have miracle plainly enough in the region of healing. (6) For Jesus' own resurrection several lines of evidence are alleged. (i.) All who believe that in any sense Christ rose again insist upon the impression which his personality made during life. It was *he* whose resurrection seemed credible! Some practically stop here; the apologist proceeds. (ii.) There is the report of the empty grave; historically, not easily waved aside. (iii.) We have New Testament reports of appearances of the risen Jesus; subjective? the mere clothing of the impression made by his personality during life? or objective? "telegrams" from heaven (Th. Keim)—"Veridical Hallucinations"? or something even more, throwing a ray of light perhaps on the state and powers of the happy dead? (iv.) There is the immense influence of Jesus Christ in history, *associated with belief in him* as the risen Son of God.

In view of the claims of Jesus, different possibilities arise. (i.) The evangelists impute to him a higher claim than he made. This may be called the rationalistic solution; with sympathy in Christ's ethical teaching, there is relief at minimizing his great claim. So, brilliantly, Wellhausen's Gospel commentaries and Introduction. (Mark fairly historical; other gospels' fuller account of Christ's teaching and claims unreliable.) (ii.) The claim was fraudulent (Reimarus; Renan, ed. 1; popular anti-Christian agitation). This is a counsel of despair. (iii.) He was an enthusiastic dreamer, expecting the world's end. This the apologist will recognize as the most plausible hostile alternative. He may feel bound to admit an element of illusion in Christ's vision of the future; but he will contend that the apocalyptic form did not destroy the spiritual content of Christ's revelations—nay, that it was itself the vehicle of great truths. So he will argue as the essence of the matter that (iv.) he who has occupied Christ's place in history, and won such reverence from the purest souls, was what he claimed to be, and that his many-sidedness comes to focus and harmony when we recognize him as the Christ of God and the Saviour of the world.

To a less extent, similar problems and alternatives arise in regard to the church:—Catholicism a compromise between Jewish Christianity and Pauline or Gentile Christianity (F. C. Baur, &c.); Catholicism the Hellenizing of Christianity (A. Ritschl, A. Harnack); the Catholic church for good and evil the creation of St Paul (P. Wernle, H. Weinel); the church supernaturally guided (R.C. apologetic; in a modified degree High Church apologetic); essential—not necessarily exclusive—truth of Paulinism, essential error in first principles of Catholicism (Protestant apologetic).

Literature.—Omitting the Christian fathers as remote from the present day, we recognize as works of genius Pascal's *Pensées* and Butler's *Analogy*, to which we might add J. R. Seeley's *Ecce Homo* (1865). The philosophical, Platonist, or Idealist line of Christian defence is represented among recent writers by J. R. Illingworth [Anglican], in *Personality, Human and Divine* (1894), *Divine Immanence* (1898), *Reason and Revelation* (1902), who at times seems rather to presuppose the Thomist compromise, and A. M. Fairbairn [Congregationalist], in *Place of Christ in Modern Theology* (1893), *Philosophy of the Christian Religion* (1902). The appeal to ethical or Christian experience—“ internal evidence ”—is found especially in E. A. Abbott [Christianity supernatural and divine, but not miraculous], *Through Nature to Christ* (1877), *The Kernel and the Husk* (1886), *The Spirit on the Waters* (1897), &c., or A. B. Bruce, *Chief End of Revelation* (1881), *The Miraculous Element in the Gospels* (1886), *Apologetics* (1892), and other works; Bruce's posthumous article, “ Jesus ” in *Encyc. Bib.*, was understood by some as exchanging Christian orthodoxy for bare theism, but probably its tone of aloofness is due to the attempt to keep well within the limits of what the author considered pure scientific history. Scholarly and apologetic discussion on the gospels and life of Jesus is further represented by the writings of W. Sanday or (earlier) of J. B. Lightfoot. Much American work of merit on the character of Christ is headed by W. E Channing, and by H. Bushnell (in *Nature and the Supernatural*). For defence of Christ's resurrection, reference may be made to H. Latham's *The Risen Lord* and R. Mackintosh's *First Primer of Apologetics*. For modification in light of recent scholarship of argument from prophecy, to Riehm's *Messianic Prophecy*, Stanton's *Jewish and Christian Messiah*, and Woods's *Hope of Israel*. Roman Catholic apologetics—of necessity, Thomist—is well represented by Professor Schanz of Tübingen. The whole Ritschl movement is apologetic in spirit; best English account in A. E. Garvie's *Ritschlian Theology* (1899). See also the chief church histories or histories of doctrine (Harnack; Loofs; Hagenbach; Shedd); A. S. Farrar's *Critical History of Free* (*i.e.* anti-Christian) *Thought* (Bampton Lectures, 1862); R. C. Trench's Introduction to *Notes on the Miracles*, and F. W. Macran's *English Apologetic Theology* (1905). For the 18th century, G. V. Lechler's *Geschichte des englischen Deismus* (1841); Mark Pattison in *Essays and Reviews* (1860); Leslie Stephen's *English Thought in 18th Century* (agnostic); John Hunt, *Religious Thought in England* (3 vols., 1870–1873).

(R. Ma.)

APOLOGUE (from the Gr. ἀπόλογος, a statement or account), a short fable or allegorical story, meant to serve as a pleasant vehicle for some moral doctrine or to convey some useful lesson. One of the best known is that of Jotham in the Book of Judges (ix. 7-15); others are “ The City Rat and Field Rat,” by Horace, “ The Belly and its Members,” by the patrician Menenius Agrippa in the second book of Livy, and perhaps most famous of all, those of Aesop. The term is applied more particularly to a story in which the actors or speakers are taken from the brute creation or inanimate nature. An apologue is distinguished from a fable in that there is always some moral sense present, which there need not be in a fable. It is generally dramatic, and has been defined as “ a satire in action.” It differs from a parable in several respects. A parable is equally an ingenious tale intended to correct manners, but it can be *true*, while an apologue, with its introduction of animals and plants, to which it lends our ideas and language and emotions, is necessarily devoid of real truth, and even of all probability. The parable reaches heights to which the apologue cannot aspire, for the points in which brutes and inanimate nature present analogies to man are principally those of his lower nature, and the lessons taught by the apologue seldom therefore reach beyond prudential morality, whereas the parable aims at representing the relations between man and God. It finds its framework in the world of nature as it actually is, and not in any grotesque parody of it, and it exhibits real and not fanciful analogies. The apologue seizes on that which man has in common with creatures below him, and the parable on that which he has in common with God. Still, in spite of the difference of moral level, Martin Luther thought so highly of apologues as counsellors of virtue that he edited and revised Aesop and wrote a characteristic preface to the volume. The origin of the apologue is extremely ancient and comes from the East, which is the natural fatherland of everything connected with allegory, metaphor and imagination. Veiled truth was often necessary in the East, particularly with the slaves, who dared not reveal their minds too openly. It is noteworthy that the two fathers of apologue in the West were slaves, namely Aesop and Phaedrus. La Fontaine in France; Gay and Dodsley in England; Gellert, Lessing and Hagedorn in Germany; Tomas de Iriarte in Spain, and Krilov in Russia, are leading modern writers of apologues. Length is not an essential matter in the definition of an apologue. Those of La Fontaine are often very short, as, for example, “ Le Coque et la Perle.” On the other hand, in the romances of Reynard the Fox we have medieval apologues arranged in cycles, and attaining epical dimensions. An Italian fabulist, Corti, is said to have developed an apologue of “ The Talking Animals ” to the bulk of twenty-six cantos. La Motte, writing at a time when this species of literature was universally admired, attributes its popularity to the fact that it *ménage et flatte l'amour-propre* by inculcating virtue in an amusing manner without seeming to dictate or insist. This was the ordinary 18th-century view of the matter, but Rousseau contested the educational value of instruction given in this indirect form.

A work by P. Soullé, *La Fontaine et ses devanciers* (1866), is a history of the apologue from the earliest times until its final triumph in France.

APOLOGY (from Gr. ἀπολογία, defence), in its usual sense, an expression of regret for something which has been wrongfully said or done; a withdrawal or retraction of some charge or imputation which is false. In an action for libel, the fact that an apology has been promptly and fully made is a plea in mitigation of damages. The apology should have the same form of publicity as the original charge. If made publicly, the proper form is an advertisement in a newspaper; if made within the hearing of a few only, a letter of apology, which may be read to those who have heard what was said, should be sufficient. By the English Libel Act 1843, s. 2, it was enacted that in an action for libel contained in a newspaper it is a defence for the defendant to plead that the libel was inserted without actual malice and without gross negligence, and that before the commencement of the action and at the earliest opportunity afterwards he inserted in the newspaper a full apology for the libel, or, where the newspaper in which the libel appeared was published at intervals exceeding one week, he offered to publish the apology in any newspaper selected by the plaintiff. The apology must be full and must be printed in as conspicuous a place and manner as the libel was.

The word “ apology ” or “ apologia ” is also used in the sense of defence or vindication, the only meaning of the Greek ἀπολογία, especially of the defence of a doctrine or system, or of religious or other beliefs, &c., *e.g.* Justin Martyr's *Apology* or J. H. Newman's *Apologia pro vita sua*. (See Apologetics.)

APONEUROSIS (Gr. ἀπό, away, and νεῦρον, a sinew), in anatomy, a membrane separating muscles from each other.

APOPHTHEGM (from the Gr. ἀπόφθεγμα), a short and pointed utterance. The usual spelling up to Johnson's day was *apothegm*, which Webster and Worcester still prefer; it indicates the pronunciation—*i.e.* “ apothem ”—better than the other, which, however, is more usual in England and follows the derivation. Such sententious remarks as “ Knowledge is Power ” are apophthegms. They become “ proverbs ” by age and acceptance. Plutarch made a famous collection in his *Apophthegmata Laconica*.

APOPHYGE (Gr. ἀποφυγή, a flying off), in architecture, the lowest part of the shaft of an Ionic or Corinthian column, or the highest member of its base if the column be considered as a whole. The apophyge is the inverted cavetto or concave sweep, on the upper edge of which the diminishing shaft rests.

APOPHYLLITE, a mineral often classed with the zeolites, since it behaves like these when heated before the blowpipe and has the same mode of occurrence; it differs, however, from the zeolites proper in containing no aluminium. It is a hydrous potassium and calcium silicate, $H_7KCa_4(SiO_3)_8+4\frac{1}{2}H_2O$. A small amount of fluorine is often present, and it is one of the few minerals in which ammonium has been detected. The temperature at which the water is expelled is higher than is usually the case with zeolites; none is given off below 200°, and only about half at 250°; this is slowly reabsorbed again from moist air, and is therefore regarded as water of crystallization, the remainder being water of constitution. When heated before the blowpipe, the mineral exfoliates, owing to loss of water, and on this account was named apophyllite by R. J. Haüy in 1806, from the Greek ἀπό, from, and φύλλον, a leaf.

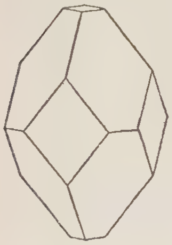

Fig. 1.

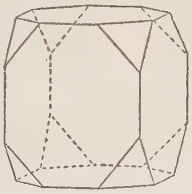

Fig. 2.

Apophyllite always occurs as distinct crystals, which belong to the tetragonal system. The form is either a square prism terminated by the basal planes (fig. 2), or an acute pyramid (fig. 1). A prominent feature of the mineral is its perfect basal cleavage, on which the lustre is markedly pearly, presenting, in white crystals, somewhat the appearance of the eye of a fish after boiling, hence the old name fish-eye-stone or ichthyophthalmite for the mineral. On other surfaces the lustre is vitreous. The crystals are usually transparent and colourless, sometimes with a greenish or rose-red tint. Opaque white crystals of cubic habit have been called albine; xylochlore is an olive-green variety. The hardness is 4½, and the specific gravity 2·35.

The optical characters of the mineral are of special interest, and have been much studied. The sign of the double refraction may be either positive or negative, and some crystals are divided into optically biaxial sectors. The variety known as leucocyclite shows, when examined in convergent polarized light, a peculiar interference figure, the rings being alternately white and violet-black and not coloured as in a normal figure seen in white light.

Apophyllite is a mineral of secondary origin, commonly occurring, in association with other zeolites, in amygdaloidal cavities in basalt and melaphyre. Magnificent groups of greenish and colourless tabular crystals, the crystals several inches across, were found, with flesh-red stilbite, in the Deccan traps of the Western Ghâts, near Bombay, during the construction of the Great Indian Peninsular railway. Groups of crystals of a beautiful pink colour have been found in the silver veins of Andreasberg in the Harz and of Guanaxuato in Mexico. Crystals of recent formation have been detected in the Roman remains at the hot springs of Plombières in France. (L. J. S.)

APOPHYSIS (Gr. ἀπόφυσις, offshoot), a bony protuberance, in human physiology; also a botanical term for the swelling of the spore-case in certain mosses.

APOPLEXY (Gr. ἀποπληξία, from ἀποπλήσσειν, to strike down, to stun), the term employed by Galen to designate the "sudden loss of feeling and movement of the whole body, with the exception of respiration," to which, after the time of Harvey, was added "and with the exception of the circulation." Although the term is occasionally employed in medicine with other significations, yet in its general acceptation apoplexy may be defined as a sudden loss of consciousness, of sensibility, and of movement without any *essential* modification of the respiratory and circulatory functions occasioned by some brain disease. It was discovered that the majority of the cases of apoplexy were due to cerebral haemorrhage, and what looked like cerebral haemorrhage, red softening; and the idea for a long time prevailed that apoplexy and cerebral haemorrhage could be employed as synonymous terms, and that an individual who, in popular parlance, "had an apoplectic stroke," had necessarily suffered from haemorrhage into his brain. A small haemorrhage may not, however, cause an apoplectic fit, nor is an apoplectic fit always caused by haemorrhage; it may be due to sudden blocking of a large vessel by a clot from a distant part (embolism), or by a sudden clotting of the blood in the vessel itself (thrombosis). Owing to the prevailing idea in former times that cerebral haemorrhage and apoplexy were synonymous terms, the word apoplexy was applied to haemorrhage into other organs than the brain; thus the terms pulmonary apoplexy, retinal apoplexy and splenic apoplexy were used.

The term "apoplexy" is now used in clinical medicine to denote that form of coma or deep state of unconsciousness which is due to sudden disturbance of the cerebral circulation occasioned by a local cause within the cranial cavity, as distinct from the loss of consciousness due to sudden failure of the heart's action (syncope) or the coma of narcotic or alcoholic poisoning, of *status epilepticus*, of uraemia or of head injury.

The sudden coma of sunstroke and heat-stroke might be included, although owing to the suddenness with which a person may be struck down, the term *heat apoplexy* is frequently used, and, from an etymological point of view, quite justifiably. The older writers use the term *simple apoplexy* for a sudden attack which could not be explained by any visible disease. Again, *congestive apoplexy* was applied to those cases of coma where, at the autopsy, nothing was found to account for the coma and death except engorgement of the vessels of the brain and its membranes. In senile dementia and in general paralysis the brain is shrunken and the convolutions atrophied, the increased space in the ventricles and between the convolutions being filled up with the cerebro-spinal fluid. In these diseases apoplectic states may arise, terminating fatally; the excess of fluid found in such cases was formerly thought to be the cause of the symptoms, consequently the condition was called *serous apoplexy*. Such terms are no longer used, owing to the better knowledge of the pathology of brain disease.

Having thus narrowed down the application of the term "apoplexy," we are in a position to consider its chief features, and the mechanism by which it is produced. Apoplexy may be rapidly fatal, but it is very seldom *instantly* fatal. The onset is usually sudden, and sometimes the individual may be struck down in an instant, senseless and motionless, "warranting those epithets, which the ancients applied to the victims of this disease, of *attoniti* and *siderati*, as if they were thunder-stricken or planet-struck" (Sir Thomas Watson). The attack, however, may be less sudden and, not infrequently, attended by a convulsion; while occasionally, in the condition termed *ingravescent apoplexy*, the coma is gradual in its onset, occupying hours in its development. Although unexpected, various warning symptoms, sometimes slight, sometimes pronounced, occur in the majority of cases. Such are, fulness in the head, headache, giddiness, noises in the ears, mental confusion, slight lapses of consciousness, numbness or tingling in the limbs. A characteristic apoplectic attack presents the following phenomena: the individual falls down suddenly and lies without sense or motion, except that his pulse keeps beating and his breathing continues. He appears to be in a deep sleep, from which he cannot be roused; the breathing is laboured and stertorous, and is accompanied with puffing out of the cheeks; the pulse may be beating more strongly than natural, and the face is often flushed and turgid. The reflexes are abolished. Although apoplexy may occur without paralysis, and paralysis without apoplexy, the two, owning the same cause, very frequently co-exist, or happen in immediate sequence and connexion; consequently there is in most cases definite evidence of paralysis affecting usually one side of the body in addition to the coma. Thus the pupils are unequal; there may be asymmetry of the face, or the limbs may be more rigid or flaccid on one side than on the other. These signs of localized disease enable a distinction to be made from the coma of narcotic poisoning and alcoholic intoxication. It must be borne in mind that a person smelling strongly of liquor and found lying in the street in a comatose state may be suffering from apoplexy, and the error of sending a dying man to a police cell may be avoided by this knowledge.

If the fit is only moderately severe, the reflexes soon return, and the patient may in a few hours show indications of returning consciousness by making some movements or opening his eyes when spoken to, although later it may be found that he is unable to speak, or may be paralysed or mentally afflicted (see PARALYSIS). In severe cases the coma deepens and the patient dies, usually from interference with the breathing, or, less commonly, from arrest of the heart's action.

The mechanism by which apoplexy is produced has been a matter of much dispute; the condition was formerly ascribed to the pressure exerted by the clot on the rest of the brain, but there is no increase of intracranial pressure in an apoplectic fit occurring as a result of the sudden closure of a large vessel by embolism or thrombosis. Suddenness of the lesion appears to be, then, the essential element common to all cases of apoplexy from organic brain disease. It is the sudden shock to the delicate mechanism that produces the unconsciousness; but seeing that the coma is usually deeper and more prolonged in cerebral haemorrhage than when occasioned by vascular occlusion, and that an ingravescent apoplexy coma gradually develops and deepens as the amount of haemorrhage increases, we may presume that increase of intracranial pressure does play an important part in the degree and intensity of the coma caused by the rupture of a vessel. Apoplexy seldom occurs under forty years of age, but owing to the fact that disease of the cerebral vessels may exist at any age, from causes which are fully explained in the article NEUROPATHOLOGY, no period of life is exempt; consequently cases of true apoplexy are not wanting even in very young children. Recognizing that there are two causes of apoplexy in advanced life, viz. (1) sudden rupture of a diseased vessel usually associated with high arterial pressure, enlarged, powerfully acting heart and chronic renal disease, and (2) the sudden clotting of blood in a large diseased vessel favoured by a low arterial pressure due to a weak-acting heart, it is obvious that the character of the pulse forms a good guide to the diagnosis of the cause, the prevention and warding off of an attack, and the treatment of such should it occur.

Anything which tends directly or indirectly to increase arterial pressure within the cerebral blood-vessels may bring on an attack of cerebral haemorrhage; and although the identification of an apoplectic habit of body with a stout build, a short neck and florid complexion is now generally discredited, it being admitted that apoplexy occurs as frequently in thin and spare persons who present no such peculiarity of conformation, yet a plethoric habit of body, occasioned by immoderate eating or drinking associated with the gouty diathesis, leads to a general arterio-sclerosis and high arterial pressure. All conditions which can give rise to a local intracranial or a general bodily increase of the arterial pressure, *i.e.* severe exertion of body and mind, violent emotions, much stooping, overheated rooms, exposure to the sun, sudden shocks to the body, constipation and straining at stool, may, by suddenly increasing the strain on the wall of a diseased vessel, lead to its rupture.

The outlook of apoplexy is generally unfavourable in cases where the coma is profound; death may take place at different intervals after the onset. If the patient, after recovering from the initial coma, suffers with continual headache and lapses into a drowsy state, the result is likely to be serious; for such a condition probably indicates that an inflammatory change has taken place about the clot or in the area of softening.

Treatment.—The patient should be placed in the recumbent position with the head and shoulders slightly raised. He should be moved as little as possible from the place where the attack occurred. The medical man who is summoned will probably give the following directions: an ice-bag to be applied to the head; a few grains of calomel or a drop of croton oil in butter to be placed on the tongue, or an enema of castor oil to be administered. He may find it necessary to draw off the water with a catheter. The practice of blood-letting, once so common in this disease, is seldom resorted to, although in some cases, where there is very high arterial tension and a general state of plethora, it might be beneficial. Depletives are not employed where there is evidence of failure of the heart's action; indeed the cautious administration of stimulants may be necessary, either subcutaneously or by the mouth (if there exist a power of swallowing), together with warm applications to the surface of the body; a water-bed may be required, and careful nursing is essential to prevent complications, especially the formation of bedsores. (F. W. Mo.)

APOROSE (from Gr. ἀ, without, and *πόρος*, passage), a biological term meaning imperforate, or not porous: there is a group of corals called *Aporosa*.

APOSIOPESIS (the Greek for "becoming silent"), a rhetorical device by which the speaker or writer stops short and leaves something unexpressed, but yet obvious, to be supplied by the imagination. The classical example is the threat, "*Quos ego*——!" of Neptune (in Virgil, *Aen.* i. 135).

APOSTASY (ἀπόστασις, in classical Greek a defection or revolt from a military commander), a term generally employed to describe a complete renunciation of the Christian faith, or even an exchange of one form of it for another, especially if the motive be unworthy. In the first centuries of the Christian era, apostasy was most commonly induced by persecution, and was indicated by some outward act, such as offering incense to a heathen deity or blaspheming the name of Christ.[1] In the Roman Catholic Church the word is also applied to the renunciation of monastic vows (*apostasis a monachatu*), and to the abandonment of the clerical profession for the life of the world (*apostasis a clericatu*). Such defection was formerly often punished severely.

APOSTIL, or APOSTILLE (possibly connected with Lat. *appositum*, placed near), a marginal note made by a commentator.

APOSTLE (ἀπόστολος, one sent forth on a mission, an envoy, as in Is. xviii. 2; Symmachus, ἀποστέλλειν ἀποστόλους; Aquila, πρεσβευτάς), a technical term used in the New Testament and in Christian literature generally for a special envoy of Jesus Christ. How far it had any similar use in Judaism in Christ's day is uncertain; but in the 4th century A.D., at any rate, it denoted responsible envoys from the central Jewish authority, especially for the collection of religious funds. In its first and simplest Christian form, the idea is present already in Mark iii. 14 f., where from the general circle of his disciples Jesus "made twelve ('whom he also named apostles,' Luke vi. 13, but doubtful in Mark), that they should be with him, and that he might from time to time send them forth (ἵνα ἀποστέλλῃ) to preach and to have authority to cast out demons." Later on (vi. 6 ff.), in connexion with systematic preaching among the villages of Galilee, Jesus begins actually to "send forth" the twelve, two by two; and on their return from this mission (vi. 30) they are for the first time described as "apostles" or missionary envoys. Matthew (x. 1 ff.) blends the calling of the twelve with their actual sending forth, while Luke (vi. 13) makes Jesus himself call them "apostles" (for Luke's usage cf. xi. 49, "prophets and apostles," where Matthew, xxiii. 34, has "prophets and wise men and scribes"). But it is doubtful whether Jesus ever used the term for the Twelve, in relation to their temporary missions, any more than for the "seventy others" whom he "sent forth" later (Luke x. 1). Even the Fourth Gospel never so describes them. It simply has "a servant is not greater than his lord, neither an apostle (envoy) greater than he that sent him" (xiii. 16); and applies the idea of "mission" alike to Jesus (cf. Heb. iii. 1, "Jesus, the apostle . . . of our profession") and to his disciples, generally, as represented by the Twelve (xvii. 18, with 3, 6 ff.). But while ideally all Christ's disciples were "sent" with the Father's Name in charge, there were different degrees in which this applied in practice; and so we find "apostle" used in several senses, once it emerges as a technical term.

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[1] The readmission of such apostates to the church was a matter that occasioned serious controversy. The emperor Julian's "Apostasy" is discussed under JULIAN.

1. In the Apostolic age itself, "apostle" often denotes simply an "envoy," commissioned by Jesus Christ to be a primary witness and preacher of the Messianic Kingdom. This wide sense was shown by Lightfoot (in his commentary on *Galatians*, 1865) to exist in the New Testament, *e.g.* in 1 Cor. xii. 28 f., Eph. iv. 11, Rom. xvi. 7; and his view has since been emphasized[1] by the discovery of the *Teaching of the Twelve Apostles* (see DIDACHĒ), with its itinerant order of "apostles," who, together with "prophets" (cf. Eph. ii. 20, iii. 5) and "teachers," constituted a *charismatic* and seemingly unordained ministry of the Word, in some part of the Church (in Syria?) during the early sub-apostolic age. Paul is our earliest witness, as just cited; also in 1 Cor. xv. 5 ff., where he seems to quote the language of Palestinian tradition, in saying that Christ "appeared to Cephas; then to the Twelve; then . . . to James; then to the apostles one and all (τοῖς ἀποστόλοις πᾶσιν); and last of all . . . to me also." The appearance to "*all* the Apostles" must refer to the final commission given by the risen Christ to certain assembled disciples (Acts i. 6 ff., cf. Luke xxiv. 33), including not only the Twelve and the Lord's brethren (i. 13 f.), but also some at least of the Seventy. Of this wider circle of witnesses, taken from among personal disciples during Jesus's earthly ministry, we get a further glimpse in the election of one from their number to fill Judas's place among the Twelve (i. 21 ff.), as the primary official witnesses of Messiah and his resurrection. Many of the 120 then present (Acts i. 15), and not only the two set forward for final choice, must have been personal disciples, who by the recent commission had been made "apostles." Among such we may perhaps name Judas Barsabbas and Silas (Acts xv. 22, cf. i. 23), if not also Barnabas (1 Cor. ix. 6) and Andronicus and Junia (Rom. xvi. 7).

So far, then, we gather that the original Palestinian type of apostleship meant simply (*a*) personal mission from the risen Christ (cf. 1 Cor. ix. 1), following on (*b*) some preliminary intercourse with Jesus in his earthly ministry. It was pre-eminence in the latter qualification that gave the Twelve their special status among apostles (Acts i. 26, ii. 14, vi. 2; in Acts generally they are simply "the apostles"). Conversely, it was Paul's lack in this respect which lay at the root of his difficulties as an apostle.

It is possible, though not certain, that even those Judaizing missionaries at Corinth whom Paul styles "false-apostles" or, ironically, "the superlative apostles" (2 Cor. xi. 5, 13; xii. 11), rested part of their claim to superiority over Paul on (*b*), possibly even as having done service to Christ when on earth (2 Cor. xi. 18, 23). There is no sign in 2 Cor. that they laid claim to (*a*). If this be so, they were "Christ's apostles" only indirectly, "through men" (as some had alleged touching Paul, cf. Gal. i. 1), *i.e.* as sent forth on mission work by certain Jerusalem leaders with letters of introduction (2 Cor. iii. 1; E. von Dobschütz, *Probleme der apost. Zeitalters*, p. 106).

2. *The Twelve.*—When Jesus selected an inner circle of disciples for continuous training by personal intercourse, his choice of "twelve" had direct reference to the tribes of Israel (Matt. xix. 28; Luke xxii. 30). This gave them a symbolic or representative character as a closed body (cf. Rev. xxi. 14), marking them off as the primary religious authority (cf. Acts ii. 42, "the apostles' teaching") among the "disciples" or "brethren," when these began to assume the form of a community or church. The relationship which other "apostles" had enjoyed with the Master had been uncertain; *they* had been his recognized intimates, and that as a body. Naturally, then, they took the lead, collectively—in form at least, though really the initiative lay with one or two of their own number, Peter in particular. The process of practical differentiation from their fellow-apostles was furthered by the concentration of the Twelve, or at least of its most marked representatives, in Jerusalem, for a considerable period (Acts viii. 1, cf. xii. 1 ff.; an early tradition specifies twelve years). Other apostles soon went forth on their mission to "the cities of Israel" (cf. Acts ix. 31), and so exercised but little influence on the central policy of the Church. Hence their shadowy existence in the New Testament, though the actual wording of Matt. x. 5-42, read in the light of the *Didachē*, may help us to conceive their work in its main features.

3. "*Pillar*" *Apostles.*—But in fact differentiation between apostles existed among the Twelve also. There were "pillars," like Peter and John (and his brother James until his death), who really determined matters of grave moment, as in the conference with Paul in Gal. ii. 9—a conference which laid the basis of the latter's status as an apostle even in the eyes of Jewish Christians. Such pre-eminence was but the sequel of personal distinctions visible even in the preparatory days of discipleship, and it warns us against viewing the primitive facts touching apostles in the official light of later times.

Consciousness of such personal pre-eminence has left its marks on the lists of the Twelve in the New Testament. Thus (1) Peter, James, John, Andrew, always appear as the first four, though the order varies, Mark representing relative prominence during Christ's ministry, and Acts actual influence in the Apostolic Church (cf. Luke viii. 51, ix. 28). (2) The others also stand in groups of four, the first name in each being constant, while the order of the rest varies.

The same lesson emerges when we note that one such apostolic "pillar" stood outside the Twelve altogether, viz. James, the Lord's brother (Gal. ii. 9, cf. i. 19); and further, that "the Lord's brethren" seem to have ranked above "apostles" generally, being named between them and Peter in 1 Cor. ix. 5. That is, they too were apostles with the addition of a certain personal distinction.

4. *Paul, the* "*Apostle of the Gentiles.*"—So far apostles are only of the Palestinian type, taken from among actual hearers of the Messiah and with a mission primarily to Jews—apostles "of the circumcision" (Gal. ii. 7-9). Now, however, emerges a new apostleship, that to the Gentiles; and with the change of mission goes also some change in the type of missionary or apostle. Of this type Paul was the first, and he remained its primary, and in some senses its only, example. Though he could claim, on occasion, to satisfy the old test of having seen the risen Lord (1 Cor. ix. 1, cf. xv. 8), he himself laid stress not on this, but on the revelation within his own soul of Jesus as God's Son, and of the Gospel latent therein (Gal. i. 16). This was his divine call as "apostle of the Gentiles" (Rom. xi. 13); here lay both his qualification and his credentials, once the fruits of the divine inworking were manifest in the success of his missionary work (Gal. ii. 8 f.; 1 Cor. xi. 1 f.; 2 Cor. iii. 2 f., xii. 12). But this new criterion of apostleship was capable of wider application, one dispensing altogether with vision of the risen Lord—which could not even in Paul's case be proved so fully as in the case of the original apostles—but appealing to the "signs of an apostle" (1 Cor. ix. 2; 2 Cor. xii. 12), the tokens of spiritual gift visible in work done, and particularly in the planting of the Gospel in fresh fields (2 Cor. x. 14-18). It may be in this wide *charismatic* sense that Paul uses the term in 1 Cor. xii. 28 f., Eph. ii. 20, iii. 5, iv. 11, and especially in Rom. xvi. 7, "men of mark among the apostles" (cf. 2 Cor. xi. 13, "pseudo-apostles" masquerading as "apostles of Christ," and perhaps 1 Thess. ii. 6, of himself and Silas). That he used it in senses differing with the context is proved by 1 Cor. xv. 9, where he styles himself "the least of apostles," although in other connexions he claims the very highest rank, co-ordinate even with the Twelve as a body (Gal. ii. 7 ff.), in virtue of his distinctive Gospel.

This point of view was not widely shared even in circles appreciative of his actual work. To most he seemed but a fruitful worker within lines determined by "the twelve apostles of the Lamb" as a body (Rev. xxi. 14). So we read of "the plant (Church) which the twelve apostles of the Beloved shall plant" (*Ascension of Isaiah*, iv. 3); "those who preached the Gospel to us (especially Gentiles) . . . unto whom He gave authority over the Gospel, being twelve for a witness to the tribes" (Barn. viii. 3, cf. v. 9); and the going forth of the

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[1] By analogy, that is; for the wider sense of "apostle" in the Apostolic age need not be identical with a sub-apostolic use of the term (see below, 4 *fin.*).

Twelve, after twelve years, beyond Palestine "into the world," to give it a chance to hear (*Preaching of Peter*, in Clem. Alex. *Strom.* vi. 5. 43; 6. 48). Later on, however, his own claim told on the Church's mind, when his epistles were read in church as a collection styled simply "the Apostle."

As the primary medium of the Gentile Gospel (Gal. i. 16, cf. i. 8, ii. 2) Paul had no peers as an "apostle of the Gentiles" (Rom. xi. 13, cf. xv. 15-20, and see 1 Cor. xv. 8, "last of all to me"), unless it were Barnabas who shares with him the title "apostle" in Acts xiv. 4, 14—possibly with reference to the special "work" on which they had recently been "sent forth by the Spirit" (xiii. 2, 4). Yet such as shared the spiritual gift (*charisma*) of missionary power in sufficient degree, were in fact apostles of Christ in the Spirit (1 Cor. xii. 28, 11). Such a secondary type of apostolate—answering to "apostolic missionaries" of later times (cf. the use of ἱεραπόστολος in this sense by the Orthodox Eastern Church to-day)—would help to account for the apostolic claims of the missionaries censured in Rev. ii. 2, as also for the "apostles" of the second generation implied in the *Didachē*.

In the *sub-apostolic age*, however, the class of "missionaries" enjoying a *charisma* such as was conceived to convey apostolic commission through the Spirit, soon became distinguished from "apostles" (cf. Hermas, *Sim.* ix. 15. 4, "the apostles and teachers of the message of the Son of God," so 25. 2; in 17. 1 the apostles are reckoned as twelve), as the title became more and more confined by usage to the original apostles, particularly the Twelve as a body (*e.g. Ascension of Isaiah* and the *Preaching of Peter*), or to them and Paul (*e.g.* in Clement and Ignatius), and as reverence for these latter grew in connexion with their story in the Gospels and in Acts.[1] Thus Eusebius describes as "evangelists" (cf. Philip the Evangelist in Acts xxi. 8, also Eph. iv. 11, 2 Tim. iv. 5) those who "occupied the first rank in the succession to the Apostles" in missionary work (*Hist. Eccl.* iii. 37, cf. v. 10). Yet the wider sense of "apostle" did not at once die out even in the third and fourth generations. It lingered on as applied to the Seventy[2]—by Irenaeus, Tertullian, Clement and Origen—and even to Clement of Rome, by Clem. Alex. (? as a "fellow-worker" of Paul, Phil. iv. 3); while the adjective "apostolic" was applied to men like Polycarp (in his contemporary *Acts of Martyrdom*) and the Phrygian, Alexander, martyred at Lyons in A.D. 177 (Eus. v. 1), who was "not without share of apostolic *charisma*."

The *authority* attaching to apostles was essentially spiritual in character and in the conditions of its exercise. Anything like autocracy among his followers was alien to Jesus's own teaching (Matt. xxiii. 6-11). All Christians were "brethren," and the basis of pre-eminence among them was relative ability for service. But the personal relation of the original Palestinian apostles to Jesus himself as Master gave them a unique fitness as authorized witnesses, from which flowed naturally, by sheer spiritual influence, such special forms of authority as they came gradually to exercise in the early Church. "There is no trace in Scripture of a formal commission of authority for government from Christ Himself" (Hort, *Chr. Eccl.* p. 84) given to apostles, save as representing the brethren in their collective action. Even the "resolutions" (δόγματα) of the Jerusalem conference were not set forth by the apostles present simply in their own name, nor as *ipso facto* binding on the conscience of the Antiochene Church. They expressed "a claim to deference rather than a right to be obeyed" (Hort, *op. cit.* 81-85). Such was the kind of authority attaching to apostles, whether collectively or individually. It was not a fixed notion, but varied in quantity and quality with the growing maturity of converts. This is how Paul, from whom we gather most on the point, conceives the matter. The exercise of his spiritual authority is not absolute, lest he "lord it over their faith"; consent of conscience or of "faith" is ever requisite (2 Cor. i. 24; cf. Rom. xiv. 23). But the principle was elastic in application, and would take more patriarchal forms in Palestine than in the Greek world. The case was essentially the same as on the various mission-fields to-day, where the position of the "missionary" is at first one of great spiritual initiative and authority, limited only by his own sense of the fitness of things, in the light of local usages. So the notion of formal or constitutional authority attaching to the apostolate, in its various senses, is an anachronism for the apostolic age. The tendency, however, was for their authority to be conceived more and more on formal lines, and, particularly after their deaths, as absolute.

The authority attaching to apostles as writers, which led gradually to the formation of a New Testament Canon—"the Apostles" side by side with "the Books" of the Old Testament (so 2 Clement xiv., *c.* A.D. 120–140)—is a subject by itself (see BIBLE).

This change of conception helped to further the notion of a certain devolution of apostolic powers to successors constituted by act of ordination. The earliest idea of an *apostolical succession* meant simply the re-emergence in others of the apostolic spirit of missionary enthusiasm. "The first rank in the succession of the apostles" consisted of men eminent as disciples of theirs, and so fitted to continue their labours (Euseb. iii. 37); and even under Commodus (A.D. 180–193) there were "evangelists of the word" possessed of "inspired zeal to emulate apostles" (v. 10). Such were perhaps the "apostles" of the *Didachē*. Of the notion of apostolic succession in ministerial grace conferred by ordination, there is little or no trace before Irenaeus. The famous passage in Clement of Rome (xliv. 2) refers simply to the succession of one set of men to another in an office of apostolic institution. The grace that makes Polycarp "an apostolic and prophetic teacher" (*Mart. Polyc.* 16) is peculiar to him personally. But Irenaeus holds, apparently on *a priori* grounds, that "elders" who stand in orderly succession to the apostolic founders of the true tradition in the churches, have, "along with the succession of oversight," also an "assured gift of (insight into) truth" by the Father's good pleasure ("cum episcopatus successione charisma veritatis certum secundum placitum Patris acceperunt"), in contrast to heretics who wilfully stand outside this approved line of transmission (*adv. Haer.* iv. 26. 2). So far, indeed, the succession is not limited to the monarchical episcopate as distinct from the presbyteral order to which it belonged (cf. "presbyterii ordo, principalis consessio" in the same context, and see iii. 14. 2), though the bishops of apostolic churches, as capable of being traced individually (iii. 3. 1), are specially appealed to as witnesses (cf. iv. 33. 8, v. 10. 2)—as earlier by Hegesippus (Euseb. iv. 22). Nor is there mention of sacerdotal grace attaching to the succession in apostolic truth.[3] But once the idea of supernatural grace going along with office as such (of which we have already a trace in the Ignatian bishop, though without the notion of actual apostolic succession) arose in connexion with *successio ab apostolis*, the full development of the doctrine was but a matter of time.[4]

LITERATURE.—In England the modern treatment of the subject dates from J. B. Lightfoot's dissertation in his *Commentary on Galatians*, to which Dr F. J. A. Hort's *The Christian Ecclesia* added elements of value; see also T. M. Lindsay, *The Church and the Ministry*, and articles in Hastings' *Dictionary of the Bible* and the *Ency. Biblica*; A. Harnack, *Die Lehre der Apostel*, pp. 93 ff., and

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[1] The tendency is already visible in the Lucan writings. An analogous process is seen in the use of "disciple," applicable in the apostolic age to Christians at large, but in the course of the sub-apostolic age restricted to personal "disciples of the Lord" or to martyrs (Papias in Eus. iii. 39, cf. Ignatius, *Ad Eph.* i. 2).

[2] In the Edessene legend of Abgar, in Eus. i. 12, we read that "Judas, who is also Thomas, sent Thaddaeus as apostle—one of the Seventy," where simply an authoritative envoy of Jesus seems intended. For traces of the wider sense of "apostle" in Gnostic, Marcionite and Montanist circles, see Monnier (as below).

[3] The above is substantially the view taken by J. B. Lightfoot in his essay on "The Christian Ministry" (*Comm. on Philippians*, 6th ed., pp. 239, 252 f.), and by T. M. Lindsay, *The Church and the Ministry* (1902), pp. 224-228, 278 ff. Even C. Gore, *The Church and the Ministry* (1889), pp. 119 ff., while inferring a sacerdotal element in Irenaeus's conception of the episcopate, says: "But it is mainly as preserving the catholic traditions that Irenaeus regards the apostolic succession" (p. 120).

[4] See Lightfoot's essay for Cyprian's contribution, as also for that of the Clementines, which fix on the twofold position of James at Jerusalem, as apostle and bishop, as bearing on apostolic succession in the episcopate.

Dogmengeschichte (3rd ed.), i. 153 ff.; E. Haupt, *Zum Verständnis d. Apostolats in NT.* (Halle, 1896); and especially H. Monnier, *La Notion de l'apostolat, des origines à Irénée* (Paris, 1903). The later legends and their sources are examined by T. Schermann, *Propheten- und Apostellegenden* (Leipzig, 1907). (J. V. B.)

APOSTLE SPOONS, a set of spoons, usually of silver or silver gilt, with the handles terminating in figures of the apostles, each bearing their distinctive emblem. They were common baptismal gifts during the 15th and 16th centuries, but were dying out by 1666. Often single spoons were given, bearing the figure of the patron or name saint of the child. Sets of the twelve apostles are not common, and complete sets of thirteen, with the figure of our Lord on a larger spoon, are still rarer. The Goldsmiths' Company in London has one such set, all by the same maker and bearing the hall-mark of 1626, and a set of thirteen was sold at Christie's in 1904 for £4900.

See William Hone, *The Everyday Book* and *Table Book* (1831); and W. J. Cripps, *Old English Plate* (9th ed., 1906).

APOSTOLICAL CONSTITUTIONS (*Διαταγαὶ or Διατάξεις τῶν ἁγίων ἀποστόλων διὰ Κλήμεντος τοῦ Ῥωμαίων ἐπισκόπου τε καὶ πολίτου. Καθολικὴ διδασκαλία*), a collection of ecclesiastical regulations in eight books, the last of which concludes with the eighty-five *Canons of the Holy Apostles*. By their title the Constitutions profess to have been drawn up by the apostles, and to have been transmitted to the Church by Clement of Rome; sometimes the alleged authors are represented as speaking jointly, sometimes singly. From the first they have been very variously estimated; the *Canons*, as a rule, more highly than the rest of the work. For example, the Trullan Council of Constantinople (*quini-sextum*), A.D. 692, accepts the Canons as genuine by its second canon, but rejects the Constitutions on the ground that spurious matter had been introduced into them by heretics; and whilst the former were henceforward used freely in the East, only a few portions of the latter found their way into the Greek and oriental law-books. Again, Dionysius Exiguus (*c.* A.D. 500) translated fifty of the Canons into Latin,[1] although under the title *Canones qui dicuntur Apostolorum*, and thus they passed into other Western collections; whilst the Constitutions as a whole remained unknown in the West until they were published in 1563 by the Jesuit Turrianus. At first received with enthusiasm, their authenticity soon came to be impugned; and their true significance was largely lost sight of as it began to be realized that they were not what they claimed to be. Vain attempts were still made to rehabilitate them, and they were, in general, more highly estimated in England than elsewhere. The most extravagant estimate of all was that of Whiston, who calls them "the most sacred standard of Christianity, equal in authority to the Gospels themselves, and superior in authority to the epistles of single apostles, some parts of them being our Saviour's own original laws delivered to the apostles, and the other parts the public acts of the apostles" (Historical preface to *Primitive Christianity Revived*, pp. 85-86). Others, however, realized their composite character from the first, and by degrees some of the component documents became known. Bishop Pearson was able to say that "the eight books of the Apostolic Constitutions have been after Epiphanius's time compiled and patched together out of the *didascaliae* or doctrines which went under the names of the holy apostles and their disciples or successors" (*Vind. Ign.* i. cap. 5); whilst a greater scholar still, Archbishop Usher, had already gone much further, and concluded, forestalling the results of modern critical methods, that their compiler was none other than the compiler of the spurious Ignatian epistles (*Epp. Polyc. et Ign.* p. lxiii. f., Oxon. 1644). The Apostolical Constitutions, then, are spurious, and they are one of a long series of documents of like character. But we have not really gauged their significance by saying that they are spurious. They are the last stage and climax of a gradual process of compilation and crystallization, so to speak, of unwritten church custom; and a short account of this process will show their real importance and value.

Origin and real nature.

These documents are the outcome of a tendency which is found in every society, religious or secular, at some point in its history. The society begins by living in accordance with its fundamental principles. By degrees these translate themselves into appropriate action. Difficulties are faced and solved as they arise; and when similar circumstances recur they will tend to be met in the same way. Thus there grows up by degrees a body of what may be called customary law. Plainly, there is no particular point of time at which this customary law can be said to have begun. To all appearance it is there from the first in solution and gradually crystallizes out; and yet it is being continually modified as time goes on. Moreover, the time comes when the attempt is made, either by private individuals or by the society itself, to put this "customary law" into writing. Now when this is done, two tendencies will at once show themselves. (*a*) This "customary law" will at once become more definite: the very fact of putting it into writing will involve an effort after logical completeness. There will be a tendency on the part of the writer to fill up gaps; to state local customs as if they obtained universally; to introduce his personal equation, and to add to that which is the custom that which, in his opinion, *ought* to be. (*b*) There will be a strong tendency to fortify that which has been written with great names, especially in days when there is no very clear notion of literary property. This is done, not always with any deliberate consciousness of fraud (although it must be clearly recognized that truth is not one of the "natural virtues," and that the sense of the obligations of truthfulness was far from strong), but rather to emphasize the importance of what was written, and the fact that it was no new invention of the writer's. In a non-literary age fame gathers about great names; and that which, *ex hypothesi*, has gone on since the beginning of things is naturally attributed to the founders of the society. Then come interpolations to make this ascription more probable, and the prefixing of a title, then or subsequently, which states it as a fact. This is precisely the way in which the Apostolical Constitutions and other kindred documents have come into being. They are attempts, made in various places and at different times, to put into writing the order and discipline and character of the Church; in part for private instruction and edification, but in part also with a view to actual use; frequently even with an actual reference to particular circumstances. In this lies their importance, to a degree which is only just being adequately realized. They contain evidence of the utmost value as to the order of the Church in early days; evidence, however, which needs to be sifted with the greatest care, since the personal preferences of the writer and the customs of the local church to which he belongs are continually mixed up with things which have a wider prevalence. It is only by careful investigation, by the method of comparisons, that these elements can be disentangled; but as the number of documents of this class known to us is continually increasing, their value increases even more than proportionately. And whilst their local and fugitive character must be fully recognized and allowed for, is it unjustifiable to set them aside or leave them out of account as heretical, and therefore negligible.

Other collections.

It will be sufficient here to mention shortly the chief collections of this kind which came into existence during the first four centuries; generally as the work of private individuals, and having, at any rate, no more than a local authority of some kind. (*a*) The earliest known to us is the *Didachē* or *Teaching of the Twelve Apostles*, itself compiled from earlier materials, and dating from about 120 (see DIDACHĒ). (*b*) *The Apostolic Church Order* (*apostolische Kirchenordnung* of German writers); *Ecclesiastical Canons of the Holy Apostles* of one MS.; *Sententiae Apostolorum* of Pitra: of about 300, and emanating probably from Asia Minor. Its earlier part, cc. 1-14, depends upon the *Didachē*, and the rest of it is a book of discipline in which Harnack has attempted to distinguish two older fragments of church law (*Texte u. Unters.* ii. 5). (*c*) The so-called *Canones Hippolyti*, probably Alexandrian or Roman, and of the first half of the 3rd century. It will be observed that these make no claim to apostolic authorship; but otherwise their origin is like that of the rest, unless indeed, as has been suggested, they represent the work of an actual Roman synod. (*d*) The so-called *Egyptian Church Order*, in Coptic from a Greek pre-Nicene original (*c.* 310). It is part of the Egyptian Heptateuch and contains neither communion nor ordination forms. (*e*) The *Ethiopic Church Order*, perhaps twenty years later than (*d*), and forming part of the *Ethiopic Statutes.* (*f*) The *Verona Latin Fragments*, discovered and published by Hauler, portions of a form akin to (*e*), which may be dated *c.* 340, though possibly earlier. It has a preface which refers to a treatise *Concerning Spiritual Gifts* as having immediately preceded it. (*g*) The recently discovered *Testament of the Lord*, which is somewhat later in date (*c.* 350), and likewise depends upon the *Canones Hippolyti.* (*h*) The so-called *Canons of Basil.* This is an Arabic work perhaps based on a Coptic and ultimately on a Greek original, embodying with modifications large portions of the Canons of Hippolytus. (On the relations between the six last-named, see HIPPOLYTUS, CANONS OF.)

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[1] Why he did not go on to give the remaining thirty-five is not clear; they belong to the same date as, and are not inferior to, the first fifty.

Here also may be noticed the *Didascalia Apostolorum*, originally written in Greek, but known through a Syriac version and a fragmentary Latin one published by Hauler. It is of the middle of the 3rd century—in fact, a passage in the Latin translation seems to give us the date A.D. 254. It emanates from Palestine or Syria, and is independent of the documents already mentioned; and upon it the *Constitutions* themselves very largely depend. It is a mixture of moral and ecclesiastical instruction. The *Sacramentary of Serapion* (*c.* 350), *The Pilgrimage of Etheria* (*Silvia*) (*c.* 385), and *The Catechetical Lectures of Cyril of Jerusalem* (348) are also of value in this connexion. In the (so-called) *Constitutions through Hippolytus* we have possibly a preliminary draft of the famous 8th book of the *Apostolical Constitutions.*[1]

Contents.

The Constitutions themselves fall into three main divisions. (i.) The first of these consists of books i.-vi., and throughout runs parallel to the *Didascalia.* Bickell, indeed, held that this latter was an abbreviated form of books i.-vi.; but it is now agreed on all hands that the Constitutions are based on the *Didascalia* and not vice versa. (ii.) Then follows book vii., the first thirty-one chapters of which are an adaptation of the *Didachē*, whilst the rest contain various liturgical forms of which the origin is still uncertain, though it has been acutely suggested by Achelis, and with great probability, that they originated in the schismatical congregation of Lucian at Antioch. (iii.) Book viii. is more composite, and falls into three parts. The first two chapters, περὶ χαρισμάτων, may be based upon a lost work of St Hippolytus, otherwise known only by a reference to it in the preface of the *Verona Latin Fragments*; and an examination shows that this is highly probable. The next section, cc. 3-27, περὶ χειροτονιῶν, and cc. 28-46, περὶ κανόνων, is twofold, and is evidently that upon which the writer sets most store. The apostles no longer speak jointly, but one by one in an apostolic council, and the section closes with a joint decree of them all. They speak of the ordination of bishops (the so-called Clementine Liturgy is that which is directed to be used at the consecration of a bishop, cc. 5-15), of presbyters, deacons, deaconesses, subdeacons and lectors, and then pass on to confessors, virgins, widows and exorcists; after which follows a series of canons on various subjects, and liturgical formulae. With regard to this section, all that can be said is that it includes materials which are also to be found elsewhere—in the *Egyptian Church Order* and other documents already spoken of—and that the precise relation between them is at present not determined. The third section consists of the Apostolic Canons already referred to, the last and most significant of which places the Constitutions and the two epistles of Clement in the canon of Scripture, and omits the Apocalypse. They are derived in part from the preceding Constitutions, in part from the canons of the councils of Antioch, 341, Nicaea, 325, and possibly Laodicaea, 363.

A comparison of the Constitutions with the material upon which they are based will illustrate the compiler's method. (*a*) To begin with the *Didascalia* already mentioned. It is unmethodical and badly digested, homiletical in style, and abounding in biblical quotations. There is no precise arrangement; but the subjects, following a general introduction, are the bishop and his duties, penance, the administration of the offerings, the settlement of disputes, the divine service, the order of widows, deacons and deaconesses, the poor, behaviour in persecution, and so forth. The compiler of the Constitutions finds here material after his own heart. He is even more discursive and more homiletical in style; he adds fresh citations of the Scriptures, and additional explanations and moral reflexions; and all this with so little judgment that he often leaves confusion worse confounded (*e.g.* in ii. 57, where, upon a symbolical description of the Church as a sheepfold, he has superimposed the further symbolism of a ship). (*b*) Passing on to books vii. and viii., we observe that the compiler's method of necessity changes with his new material. In the former book he still makes large additions and alterations, but there is less scope for his prolixity than before; and in the latter, where he is no longer dealing with generalities, but making actual definitions, the Constitutions of necessity become more precise and statutory in form. Throughout he adopts and adapts the language of his sources as far as possible, "only pruning in the most pressing cases," but towards the end he cannot avoid making larger alterations from time to time. And his alterations throughout are not made aimlessly. Where he finds things which would obviously clash with the customs of his own day, he unhesitatingly modifies them. An account of the Passion, with a curiously perverted chronology, the object of which was to justify the length of the Passion-tide fast, is entirely revised for this reason (v. 14); the direction to observe Easter according to the Jewish computation is changed into the exact contrary for the same reason (v. 17); and where his archetype lapses into speaking of a lull in persecution he naïvely informs us that the Romans have now given up persecuting and have adopted Christianity (vi. 26), forgetting altogether that he is speaking in the character of the apostles. Above all, he both magnifies the office of the Christian ministry as a whole and alters what is said of it in detail (for example, the deaconess loses rank not a little), to make it agree with the circumstances of his day in general, and with his own ideas of fitness in particular. It is here that his evidence is at once most valuable and needs to be used with the greatest care. To give one striking example of the value of these documents. The *Canones Hippolyti* (vi. 43) provide that one who has been a confessor for the faith may be received as a presbyter by virtue of his confessorship and not by the laying on of the bishop's hands; but if he be chosen a bishop, he is to be ordained. This provision passes on into the Egyptian *Ecclesiastical Canons* and other kindred documents, and even into the *Testamentum Domini.* But the corresponding passage in the Apostolical Constitutions (viii. 23) entirely reverses it: "A confessor is not ordained, for he is so by choice and patience, and is worthy of great honour. . . . But if there be occasion, he is to be ordained either a bishop, priest, or deacon. But if any one of the confessors who is not ordained snatches to himself any such dignity upon account of his confession, let the same person be deprived and rejected; for he is not in such an office, since he has denied the constitution of Christ, and is worse than an infidel."

Authorship, place and date.

Who, then, is the author of the Constitutions, and what can be inferred with regard to him? (i.) By separating off the sources which he used from his own additions to them, it at once becomes clear that the latter are the work of one man: the style is unmistakable, and the method of working is the same throughout. The compiler of books i.-vi. is also the compiler of books vii., viii. (ii.) As to his theological position, different views have been held. Funk suggests Apollinarianism, which is the refuge of the destitute, and Achelis inclines in the same direction. But the affinities of the author are quite otherwise, the most pronounced of them being a strong subordinationist tendency, denial of a human soul to Christ, and the like, which suggest not indeed Arianism but an inclination towards Arianism. Above all, his polemic is directed against the dying heresies of the 3rd century; and he writes with an absence of constraint which is not the language of one who lives amidst violent controversies or who is conscious of being in a minority. All this points to the position of a "conservative" or semi-Arian of the East, one who belongs, perhaps, to the circle of Lucian of Antioch and writes before the time of Julian. It is hard to think of any other time or circumstances in which a man could write like this. (iii.) The indications of *time* have been held to point to a different conclusion. On the one hand, the fact that the attempt to rebuild the temple by Julian in 363 is not mentioned in vi. 24 points to an earlier date; and the fact that the κοπιᾶται are not mentioned amongst the church officers points in the same direction, for elsewhere they are first mentioned in a rescript of Constantius in A.D. 357. On the other hand, in the cycle of feasts occur the names of several which are probably of later date—*e.g.* Christmas and St Stephen, which were introduced at Antioch *c.* A.D. 378 and 379 respectively. Again, Epiphanius (*c.* A.D. 374) appears to be unacquainted with it; he still quotes from the *Didascalia*, and elaborately explains it away where it is contrary to the usages of his own day. But as regards the former point, it is possible that the Apostolical Constitutions constantly gave rise to these festivals; or, on the other hand, that the two passages were subsequently introduced either by the writer himself or by some other hand, when the last book of the Constitutions was being used as a law-book. And as regards the latter, the fact that Epiphanius does not use the Constitutions is no proof that they had not yet been compiled. (iv.) As to the region of composition there is no real doubt. It was clearly the East, Syria or Palestine. Many indications are against the latter, and Syria is strongly suggested by the use of the Syro-Macedonian calendar. Moreover, the writer represents the Roman Clement as the channel of communication between the apostles and the Church. This fact both supplies him with the name by which he is commonly known, Pseudo-Clement, and also furnishes corroboration of his Syrian birth; since the other spurious writings bearing the name of Clement, the *Homilies* and *Recognitions*, are likewise of Syrian origin. Moreover, the spurious Ignatian epistles, which are also Syrian, depend throughout upon the Constitutions. (v.) But this is not all. It was long ago noticed that Pseudo-Clement bears a very close resemblance to Pseudo-Ignatius, the interpolator of the Ignatian Epistles in the longer Greek recension. Usher, as we have seen, identified them, and modern criticism accepts this identification as a fact (Lagarde, Harnack, Funk, Brightman). Lightfoot, indeed, still hesitated (*Ap. Fathers*, II. i. 266 n.) on the ground that Pseudo-Ignatius occasionally misunderstands the Constitutions, that the two writings give the Roman succession differently, and that Pseudo-Clement shows no knowledge of the Christological controversies of Nicaea. But as regards the first of these, it is rather a case of condensed citation than of misinterpretation; the second is explained by the writer's carelessness as shown in other passages, and all are solved if a considerable interval of time elapsed between the compilation of the Constitutions and the spurious Ignatian epistles.

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[1] At a later date various collections were made of the documents above mentioned, or some of them, to serve as law-books in different churches—*e.g.* the Syrian Octateuch, the Egyptian Heptateuch, and the Ethiopic Sīnōdōs. These, however, stand on an entirely different footing, since they are simply collections of existing documents, and no attempt is made to claim apostolic authorship for them.

It seems clear then that the compiler was a Syrian, and that he also wrote the spurious Ignatian epistles; he was likewise probably a semi-Arian of the school of Lucian of Antioch. His date is given by Harnack as A.D. 340–360, with a leaning to 340–343; by Lightfoot as the latter half of the 4th century; by Brightman, 370–380; by Maclean, 375; and by Funk as the beginning of the 5th century.

AUTHORITIES.—W. Ueltzen, *Constitutiones Apostolicae* (Schwerin, 1853); P. A. de Lagarde, *Didascalia Apostolorum Syriace* (Leipz., 1854); *Constitutiones Apostolorum* (Leipz. and Lond., 1862); M. D. Gibson, *Didascalia Apost. Syriace*, with Eng. trans. (*Horae Semiticae*, i. and ii., Cambridge, 1903); J. B. Pitra, *Juris Ecclesiastici Graecorum Historia et Monumenta*, i. (Rome, 1864); Hauler, *Didascaliae Apostolorum Fragmenta Ueronensia Latina* (Leipzig, 1900); Bickell, *Geschichte des Kirchenrechts*, i. (Giessen, 1843); F. X. Funk, *Die apostolischen Konstitutionen* (Rottenb., 1891); A. Harnack, *Geschichte d. altchristl. Litteratur*, i. 515 ff. (Leipz., 1893); F. E. Brightman, *Liturgies Eastern and Western*, I. xvii. ff. (Oxford, 1896); H. Achelis, in Hauck's *Realencyklopädie*, i. 734 f., art. "Apostolische Konstitutionen und Kanones" (Leipz., 1896); A. S. Maclean, *Recent Discoveries illustrating Early Christian Worship* (Lond., 1904); J. Wordsworth, *The Ministry of Grace*, pp. 18 ff; J. P. Arendzen, "The Apostolic Church Order" (Syriac Text, Eng. trans. and notes) in *Journ. of Theol. Studies*, iii. 59. Trans. of *Apost. Constitutions*, book viii., in Ante-Nicene Christian Library. (W. E. Co.)

APOSTOLIC CANONS, a collection of eighty-five rules for the regulation of clerical life, appended to the eighth book of the *Apostolical Constitutions* (*q.v.*). They are couched in brief legislative form though on no definite plan, and deal with the vexed questions of ecclesiastical discipline as they were raised towards the end of the 4th century. At least half of the canons are derived from earlier constitutions, and probably not many of them are the actual productions of the compiler, whose aim was to gloss over the real nature of the *Constitutions*, and secure their incorporation with the Epistles of Clement in the New Testament of his day. The *Codex Alexandrinus* does indeed append the Clementine Epistles to its text of the New Testament. The Canons may be a little later in date than the preceding *Constitutions*, but they are evidently from the same Syrian theological circle.

APOSTOLIC FATHERS, a term used to distinguish those early Christian writers who were believed to have been the personal associates of the original Apostles. While the title "Fathers" was given from at least the beginning of the 4th century to church writers of former days, as being the parents of Christian belief and thought for later times, the expression "Apostolic Fathers" dates only from the latter part of the 17th century. The idea of recognizing these "Fathers" as a special group exists already in the title "Patres aevi apostolici, sive SS. Patrum qui temporibus apostolicis floruerunt . . . opera," under which in 1672 J. B. Cotelier published at Paris the writings current under the names of Barnabas, Clement of Rome, Hermas, Ignatius and Polycarp. But the name itself is due to their next editor, Thomas Ittig (1643–1710), in his *Bibliotheca Patrum Apostolicorum* (1699), who, however, included under this title only Clement, Ignatius and Polycarp. Here already appears the doubt as to how many writers can claim the title, a doubt which has continued ever since, and makes the contents of the "Apostolic Fathers" differ so much from editor to editor. Thus the Oratorian Andrea Gallandi (1709–1779), in re-issuing Cotelier's collection in his *Bibliotheca Veterum Patrum* (1765–1781), included the fragments of Papias and the Epistle to Diognetus, to which recent editors have added the citations from the "Elders" of Papias's day found in Irenaeus and, since 1883, the *Didachē*.

The degree of historic claim which these various writings have to rank as the works[1] of Apostolic Fathers varies greatly on any definition of "apostolic." Originally the epithet was meant to be taken strictly, viz. as denoting those whom history could show to have been personally connected, or at least coeval, with one or more apostles; and an effort was made, as by Cotelier, to distinguish the writings rightly and wrongly assigned to such. Thus editions tended to vary with the historical views of editors. But the convenience of the category "Apostolic Fathers" to express not only those who might possibly have had some sort of direct contact with apostles—such as "Barnabas," Clement, Ignatius, Papias, Polycarp—but also those who seemed specially to preserve the pure tradition of apostolic doctrine during the sub-apostolic age, has led to its general use in a wide and vague sense.

Conventionally, then, the title denotes the group of writings which, whether in date or in internal character, are regarded as belonging to the main stream of the Church's teaching during the period between the Apostles and the Apologists (*i.e.* to *c.* A.D. 140). Or to put it more exactly, the "Apostolic Fathers" represent, chronologically in the main and still more from the religious and theological standpoint, the momentous process of transition from the type of teaching in the New Testament to that which meets us in the early Catholic Fathers, from the last quarter of the 2nd century onwards. The Apologists no doubt show us certain fresh factors entering into this development; but on the whole the Apostolic Fathers by themselves go a long way to explain the transition in question, so far as knowledge of this *saeculum obscurum* is within our reach at all. It is true that they do not include the whole even of the ecclesiastical literature of the sub-apostolic age, not to mention what remains of Gnostic and other minority types. The *Preaching* and *Apocalypse* of Peter, for instance, are quite typical of the same period, and help us to read between the lines of the Apostolic Fathers. Yet they do not really add much to what is there already, and they have the drawbacks of pseudonymity; they lack concrete and personal qualities; they are general expressions of tendencies which we cannot well locate or measure, save by means of the Apostolic Fathers themselves or of their earliest Catholic successors.

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[1] Cotelier included the Acts of Martyrdom of Clement, Ignatius and Polycarp; and those of Ignatius and Polycarp are still often printed by editors.

(A) In *external features* the group is far from homogeneous, a fact which has led to their being disintegrated as a group in certain histories of early Christian literature (*e.g.* those of Harnack and Krüger), and classed each under its own literary type—so sacrificing to outer form, which is quite secondary in primitive Christian writings, the more significant fact of religious affinity. Its original members, those still best entitled to their name in any strict sense, are epistles, and in this respect also most akin to Apostolic writings. Indeed Ignatius takes pleasure in saluting his readers "after the apostolic stamp" (*ad Trall.* inscr.), while yet disclaiming all desire to emulate the apostolic manner in other respects, being fully conscious of the gulf between himself and apostles like Peter and Paul in claim to authority (*ib.* iii. 3, *ad Rom.* iv. 3). The like holds of Polycarp, who, in explaining that he writes to exhort the Philippians only at their own request, adds, "for neither am I, nor is any other like me, able to follow the wisdom of the blessed and glorious Paul" (iii. 2). Clement's epistle, indeed, conforms more to the elaborate and treatise-like form of the Epistle to the Hebrews, on which it draws so largely; and the same is true of "Barnabas." But one and all are influenced by study of apostolic epistles, and witness to the impression which these produced on the men of the next generation. Unconsciously, too, they correspond to the apostolic type of writing in another respect, viz. their occasional and practical character. They are evoked by pressing needs of the hour among some definite body of Christians and not by any literary motive.[1] This is a universal trait of primitive Christian writings; so that to speak of primitive Christian "literature" at all is hardly accurate, and tends to an artificial handling of their contents. These sub-apostolic epistles are veritable "human documents," with the personal note running through them. They are after all personal expressions of Christianity, in which are discernible also specific types of local tradition. To such spontaneous actuality a large part of their interest and value is due.

Nor is this pre-literary and vital quality really absent even from the writing which is least entitled to a place among "Apostolic Fathers," the Epistle to Diognetus. This beautiful picture of the Christian life as a realized ideal, and of Christians as "the soul" of the world, owes its inclusion to a double error: first, to the accidental attachment at the end of another fragment (§ 11), which opens with the writer's claim to stand forth as a teacher as being "a disciple of apostles"; and next, to mistaken exegesis of this phrase as implying personal relations with apostles, rather than knowledge of their teaching, written or oral. Whether in form addressed to Diognetus, the tutor of Marcus Aurelius, as a typical cultured observer of Christianity, or to some other eminent person of the same name in the locality of its origin, or, as seems more likely, to cultured Greeks generally, personified under the significant name "Diognetus" ("Heaven-born," cf. Acts xvii. 28 along with § iii. 4)—the epistle is in any case an "open letter" of an essentially literary type. Further, its opening seems modelled on the lines of the preface to Luke's Gospel, to which, along with *Acts*, it may owe something of its very conception as a reasoned appeal to the lover of truth. But while literary in form and conception, its appeal is in spirit so personal a testimony to what the Gospel has done for the writer and his fellow Christians, that it is akin to the piety of the Apostolic Fathers as a group. It is true that it has marked affinities, *e.g.* in its natural theology, with the earliest Apologists, Aristides and Justin, even as it is itself in substance an apology addressed not to the State, but to thoughtful public opinion. But this only means that we cannot draw a hard and fast line between groups of early Christian writings at a time when practical religious interests overshadowed all others.

If thus related to the Apologists of the middle of the 2nd century, the Epistle to Diognetus has also points of contact with one of the most practical and least literary writings found among our Apostolic Fathers, viz. the homily originally known as the Second Epistle of Clement (for this ascription, as for other details, see CLEMENTINE LITERATURE). The recovery of its concluding sections in the same MS. which brought the *Didachē* to light, proves beyond question that we have here the earliest extant sermon preached before a Christian congregation, about A.D. 120–140 (so J. B. Lightfoot). Its opening section, recalling to its hearers the passing of the mists of idolatry before the revelation in Jesus Christ, is markedly similar in tone and tenor to passages in the Epistle to Diognetus. Far closer, however, are the affinities between the homily and the *Shepherd of Hermas*, "the first Christian allegory," which as a literary whole dates from about A.D. 140, but probably represents a more or less prolonged prophetic activity on the part of its author, the brother of Pius, the Roman bishop of his day (*c.* 139–154). In both the primary theme is repentance, as called for by serious sins, after baptism has placed the Christian on his new and higher level of responsibility. Thus both are hortatory writings, the one argumentative in form, the other prophetic, after the manner of later Old Testament prophets whose messages came in visions and similitudes. This prophetic and apocalyptic note, which characterizes Hermas among the Apostolic Fathers (though there are traces of it also in the *Didachē* and in Ignatius, *ad Eph.* xx.), is a genuinely primitive trait and goes far to explain the vogue which the *Shepherd* enjoyed in the generations immediately succeeding, as also the influence of its disciplinary policy, which is its prophetic "burden" (see HERMAS, SHEPHERD OF).

We come finally to the anonymous *Teaching of the Twelve Apostles* and Papias's *Exposition of Oracles of the Lord*, so far as this is known to us. The former, besides embodying catechetical instruction in Christian conduct (the "Two Ways"), which goes back in substance to the early apostolic age and is embodied also in "Barnabas," depicts in outline the fundamental usages of church life as practised in some conservative region (probably within Syria) about the last quarter of the 1st century and perhaps even later. The whole is put forth as substantially the apostolic teaching (*Didachē*) on the subjects in question. This is probably a *bona fide* claim. It expresses the feeling common to the Apostolic Fathers and general in the sub-apostolic age, at any rate in regions where apostles had once laboured, that local tradition, as held by the recognized church leaders, did but continue apostolic doctrine and practice. Into later developments of this feeling an increasing element of illusion entered, and all other written embodiments of it known to us take the form of literary fictions, more or less bold. It is in contrast to these that the *Didachē* is justly felt to be genuinely primitive and of a piece with the Apostolic Fathers. Thus while its form would by analogy tend *per se* to awaken suspicion, its contents remove this feeling; and we may even infer from this surviving early formulation of local ecclesiastical tradition, that others of somewhat similar character came into being in the sub-apostolic age, but failed to survive save as embodied in later local teaching, oral or written, very much as if the *Didachē* had perished and its literary offspring alone remained (see DIDACHĒ).

As regards Papias's *Exposition*, which Lightfoot describes as "among the earliest forerunners of commentaries, partly explanatory, partly illustrative, on portions of the New Testament," we need here only remark that, whatever its exact form may have been—as to which the extant fragments still leave room for doubt—it was in conception expository of the historic meaning of Christ's more ambiguous Sayings, viewed in the light of definitely ascertained apostolic traditions bearing on the subject. The like is true also of the fragments of the Elders preserved in Irenaeus (so far as these do not really come from Papias). Both bodies of exposition represent the traditional principle at work in the sub-apostolic age, making for the preservation in relative purity, over against merely subjective interpretations—those of the Gnostics in particular—of the historic or original sense of Christ's teaching, just as Ignatius stood for the historicity of the facts of His earthly career in their plain, natural sense.

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[1] See G. A. Deissmann, *Bible Studies*, pp. 1-60, for this distinction between the genuine "letter" and the literary "epistle," as applied to the New Testament in particular.

(B) Here the question of external form passes readily over into that of the *internal character and spirit*. Indeed much has already been said or suggested bearing on these. The relation of these writers to the apostolic teaching generally has become pretty evident. It is one of absolute loyalty and deference, as to the teaching of inspiration. They are conscious, as are we in reading them, that they are not moving on the same level of insight as the Apostles; they are sub-apostolic in that sense also. Hence there appear constant traces of study of the Apostolic writings, so far as these were accessible in the locality of each writer at his date of writing (for the details of this subject, and its bearing on the history of the Canonical Scriptures of the New Testament, see *The New Testament in the Apostolic Fathers*, Oxford, 1905). As Lightfoot points out (*Apostolic Fathers*, pt. i. vol. i. p. 7), however, personality, with its variety of temperament and emphasis, largely colours the Apostolic Fathers, especially the primary group. Clement has all the Roman feeling for duly constituted order and discipline; Ignatius has the Syrian or semi-oriental passion of devotion, showing itself at once in his mystic love for his Lord and his over-strained yearning to become His very "disciple" by drinking the like cup of martyrdom; Polycarp is, above all things, steady in his allegiance to what had first won his conscience and heart, and his "passive and receptive character" comes out in the contents of his epistle. Of the rest, whose personalities are less known to us, Papias shares Polycarp's qualities and their limitations, the anonymous homilist and Hermas are marked by intense moral earnestness, while the writer to Diognetus joins to this a profound religious insight. These personal traits determine by selective affinity, working under conditions given by the special local type of tradition and piety, the elements in the Apostolic writings which each was able to assimilate and express—though we must allow also for variety in the occasions of writing. Thus one New Testament type is echoed in one and another in another; or it may be several in turn. The latter is the case in Clement, Ignatius and Polycarp; perhaps also in "Barnabas." In Hermas there is special affinity to the language and thought of the epistle of James, and in the homilist to those of Paul. Yet their very use of the same terms or ideas makes us the more aware of "a marked contrast to the depth and clearness of conception with which the several Apostolic writers place before us different aspects of the Gospel" (Lightfoot). While Apostolic phrases are used, the sense behind them is often different and less evangelic. They have not caught the Apostolic meaning, because they have not penetrated to the full religious experience which gave to the words, often words with long and varied history both in the Septuagint and in ordinary Greek usage, their specific meaning to each apostle and especially to Paul. This phenomenon was noted particularly by E. Reuss, in his *Histoire de la théologie chrétienne au siècle apostolique* (3rd ed., 1864). Take for instance Clement. Lightfoot, indeed, dwells on the all-round "comprehensiveness" with which Clement, as the mouthpiece of the early Roman Church, utters in succession phrases or ideas borrowed impartially from Peter and Paul and James and the Epistle to Hebrews. He admits, however, that such mere co-ordination of the language of Paul and James, for instance, as appears in his twice bracketing "faith and hospitality" as grounds of acceptance with God (the cases are those of Abraham and Rahab, in chs. x. and xii.), is "from a strictly dogmatic point of view" his weakness. But the weakness is more than a dogmatic one; it is one of religious experience, as the source of spiritual insight. It is not merely that "there is no *dogmatic system* in Clement" or in any other of the Apostolic Fathers; that may favour, not hinder, religious insight. There is a want of depth in Christian experience, in the power of realizing relative spiritual values in the light of the master principle involved in the distinctively Christian consciousness, such as could raise Clement above a verbal eclecticism, rather than comprehensiveness, in the use of Apostolic language. As R. W. Dale remarks, in a note on Reuss's too severe words (Eng. trans. ii. 295): "The vital force of the Apostolic convictions gave to Apostolic thought a certain organic and consistent form." It is lack of this organic quality in the thought, not only of Clement but also of the Apostolic Fathers generally—with the possible exception of Ignatius, who seems to share the Apostolic experience more fully than any other, to which Reuss rightly directs attention. In virtue of this defect, due largely to the failure to enter into the Apostolic experience of mystic union with Christ, he can rightly speak of "an immense retrogression" in theology visible "at the end of the century, and in circles where it might have been least expected" (ii. p. 294, cf. 541).

In fact the perspective of the Gospel was seriously changed and its most distinctive features obscured. This was specially the case with the experimental doctrines of grace. Here the central glory of the Cross as "the power of God unto salvation" suffered some eclipse, although the passion of Christ was felt to be a transcendent act of Divine Grace in one way or another. But even more serious was the loss of an adequate sense of the contrast between "grace" and "works" as conditions of salvation. There was little or no sense of the danger of the *legal principle*, as related to human egoism and the instinct to seek salvation as a reward for merit. The passages in which these things are laid bare by Paul's remorseless analysis of his own experience "under Law" seem to have made practically no impression on the Apostolic Fathers as a whole. Gentile Christians had not felt the fang of the Law as the ex-Pharisee had occasion to feel it. Even if first trained in the Hellenistic synagogues of the Dispersion, as was often the case, they apprehended the Law on its more helpful and less exacting side, and had not been brought "by the Law to die unto the Law," that they might "live unto God." The result was too great a continuity between their religious conceptions before and after embracing the Gospel. Thus the latter seemed to them simply to bring forgiveness of past sins for Christ's sake, and then an enhanced moral responsibility to the New Law revealed in Him. Hence a new sort of legalism, known to recent writers as Moralism, underlies much of the piety of the Apostolic Fathers, though Ignatius is quite free from it, while Polycarp and "Barnabas" are less under its influence than are the *Didachē*, Clement, the Homilist and Hermas. It conceives salvation as a "wages" (μισθός) to be earned or forfeited; and regards certain good works, such as prayer, fasting, alms—especially the last—as efficacious to cancel sins. The reality of this tendency, particularly at Rome, betrays itself in Hermas, who teaches the supererogatory merit of alms gained by the self-denial of fasting (*Sim.* v. 3. 3 ff.). Marcion's reaction, too, against the Judaic temper in the Church as a whole, in the interests of an extravagant Paulinism, while it suggests that Paul's doctrines of grace generally were inadequately realized in the sub-apostolic age, points also to the prevalence of such moralism in particular.

(C) In attempting a final estimate of the value of the Apostolic Fathers for the historian to-day, we may sum up under these heads: ecclesiastical, theological, religious. (*a*) As a mine of materials for reconstructing the history of Church institutions, they are invaluable, and that largely in virtue of their spontaneous and "esoteric" character, with no view to the public generally or to posterity. (*b*) Theologically, as a stage in the history of Christian doctrine, their value is as great negatively as positively. Impressive as is their witness to the persistence of the Apostolic teaching in its essential features, amidst all personal and local variations, perhaps the most striking thing about these writings is the degree in which they fail to appreciate certain elements of the Apostolic teaching as embodied in the New Testament, and those its higher and more distinctively Christian elements.[1] This negative aspect has a twofold bearing. Firstly, it suggests the supernormal level to which the Apostolic consciousness was raised at a bound by the direct influence of the Founder of Christianity, and justifies the marking-off of the Apostolic writings as a Canon, or body of Christian classics of unique religious authority. To this principle Marcion's Pauline Canon is a witness, though in too one-sided a spirit. Secondly, it means that the actual development of ecclesiastical doctrine began, not from the Apostolic consciousness itself, but from a far lower level, that of the inadequate consciousness of the sub-apostolic Church, even when face to face with their written words. This theological "retrogression" is of much significance for the history of dogma. (*c*) On the other hand, there is great religious and moral continuity, beneath even theological discontinuity, in the life working below all conscious apprehension of the deeper ideas involved (E. von Dobschütz, *Christian Life in the Primitive Church*, 1905). There is continuity in character; the Apostolic Fathers strike us as truly good men, with a goodness raised to a new type and power. This is what the Gospel of Christ aims chiefly at producing as its proper fruit; and the Apostolic Fathers would have desired no better record than that they were themselves genuine "epistles of Christ."

LITERATURE.—This is too large to indicate even in outline, but is given fully in the chief modern editions, viz. of Gebhardt, Harnack and Zahn jointly (1875–1877), J. B. Lightfoot (1885–1890) and F. X. Funk (1901); also in O. Bardenhewer, *Gesch. der altkirchlichen Litteratur* (1902), Band i., and in *Neutestamentliche Apokryphen*, with *Handbuch* thereto, edited by E. Hennecke (Tübingen, 1904). The fullest discussion in English of the teaching of Barnabas, Clement, Ignatius and Polycarp is by J. Donaldson, *The Apostolical Fathers* (1874), which, however, suffers from the imperfect state of the texts when he wrote. The most useful edition for ready reference, containing critical texts (up to date) and good translations, is Lightfoot's one-volume edition, *The Apostolic Fathers* (London, 1891). (J. V. B.)

APOSTOLICI, APOSTOLIC BRETHREN, or APOSTLES, the names given to various Christian heretics, whose common doctrinal feature was an ascetic rigidity of morals, which made them reject property and marriage. The earliest Apostolici appeared in Phrygia, Cilicia, Pisidia and Pamphylia towards the end of the 2nd century or the beginning of the 3rd. According to the information given by Epiphanius (*Haer.* 61) about the doctrines of these heretics, it is evident that they were connected with the Encratites and the Tatianians. They condemned individual property, hence the name sometimes given to them of *Apotactites* or *Renuntiatores*. They preserved an absolute chastity and abstained from wine and meat. They refused to admit into their sect those Christians whom the fear of martyrdom had once restored to paganism. As late as the 4th century St Basil (*Can.* 1 and 47) knew some Apostolici. After that period they disappeared, either becoming completely extinct, or being confounded with other sects (see St Augustine, *Haer.* 40; John of Damascus, *Haer.* 61).

Failing a more exact designation, the name of Apostolici has been given to certain groups of Latin heretics of the 12th century. It is the second of the two sects of Cologne (the first being composed very probably of Cathari) that is referred to in the letter addressed in 1146 by Everwin, provost of Steinfeld, to St Bernard (Mabillon, *Vet. Anal.* iii. 452). They condemned marriage (save, perhaps, first marriages), the eating of meat, baptism of children, veneration of saints, fasting, prayers for the dead and belief in purgatory, denied transubstantiation, declared the Catholic priesthood worthless, and considered the whole church of their time corrupted by the "negotia saecularia" which absorbed all its zeal (cf. St Bernard, *Serm.* 65 and 66 *in Cantic.*). They do not seem to have been known as Apostles or Apostolici: St Bernard, in fact, asks his hearers: "Quo nomine istos titulove censebis?" (*Serm.* 66 *in Cantic.*). Under this designation, too, are included the heretics of Périgueux in France, alluded to in the letter of a certain monk Heribert (Mabillon, *Vet. Anal.* iii. 467). Heribert says merely: "Se dicunt apostolicam vitam ducere." It is possible that they were Henricians (see HENRY OF LAUSANNE). During his mission in the south-east of France in 1146–1147 St Bernard still met disciples of Henry of Lausanne in the environs of Périgueux. The heretics of whom Heribert speaks condemned riches, denied the value of the sacraments and of good works, ate no meat, drank no wine and rejected the veneration of images. Their leader, named Pons, gathered round him nobles, priests, monks and nuns.

In the second half of the 13th century appeared in Italy the *Order of the Apostles* or *Apostle Brethren* (see especially the *Chron.* of Fra Salimbene). This was a product of the mystic fermentation which proceeded from exalted Franciscanism and from Joachimism (see FRATICELLI and JOACHIM). It presents great analogies with groups of the same character, *e.g.* Sachets, Bizocchi, Flagellants, &c. The order of the Apostles was founded about 1260 by a young workman from the environs of Parma, Gerard Segarelli, who had sought admission unsuccessfully to the Franciscan order. To make his life conform to that of Christ, his contemporaries say that he had himself circumcised, wrapped in swaddling clothes and laid in a cradle, and that he then, clad in a white robe and bare-footed, walked through the streets of Parma crying "Penitenz agite!" ("Poenitentiam agite!"). He was soon followed by a throng of men and women, peasants and mechanics. All had to live in absolute poverty, chastity and idleness. They begged, and preached penitence. Opizo, bishop of Parma, protected them until they caused trouble in his diocese. Their diffusion into several countries of Christendom disturbed Pope Honorius IV., who in 1286 ordered them to adhere to an already recognized rule. On their refusal, the pope condemned them to banishment and Opizo imprisoned Segarelli. The councils of Würzburg (1287) and Chichester (1289) took measures against the Apostles of Germany and England. But in 1291 the sect reappeared, sensibly increased, and Pope Nicholas IV. published anew the bull of Honorius IV. From that day the Apostles, regarded as rebels, were persecuted pitilessly. Four were burned in 1294, and Segarelli, as a relapsed heretic, went to the stake at Parma in 1300.

They had had close relations with the dissident Franciscans, but the Spirituals often disavowed them, especially when the sect, which in Segarelli's time had had no very precise doctrinal character, became with Dolcino frankly heterodox. Dolcino of Novara was brought up at Vercelli, and had been an Apostle since 1291. Thrice he fell into the hands of the Inquisition, and thrice recanted. But immediately after Segarelli's death he wrote an epistle, soon followed by a second, in which he declared that the third Joachimite age began with Segarelli and that Frederick of Sicily was the expected conqueror (*Hist. Dulcini* and *Addit. ad Hist. Dulcini* in Muratori, *Scriptores*, vol. ix.). He gave himself out as an angel sent from God to elucidate the prophecies. Soon he founded an *Apostolic congregation* at whose head he placed himself. Under him were his four lieutenants, his "mystic sister," Margherita di Franck, and 4000 disciples. He taught almost the same principles of devotion as Segarelli, but the Messianic character which he attributed to himself, the announcement of a communistic millennial kingdom, and, besides, an aggressive anti-sacerdotalism, gave to Dolcino's sect a clearly marked character, analogous only to the theocratic community of the Anabaptists of Münster in the 16th century. On the 5th of June 1305 Pope Clement V., recognizing the impotence of the ordinary methods of repression, issued bulls for preaching a crusade against the Dolcinists. But four crusades, directed by the bishop of Vercelli, were required to reduce the little army of the heresiarch, entrenched in the mountains in the neighbourhood of Vercelli. Not till the 23rd of March 1307 were the sectaries definitively overcome. The Catholic crusaders seized Dolcino in his entrenchments on Mount Rubello, and the pope at once announced the happy event to King Philip the Fair. At Vercelli Dolcino suffered a horrible punishment. He was torn in pieces with red-hot pincers—the torture lasting an entire day—while Margherita was burned at a slow fire. Dante mentions Dolcino's name (*Inferno*, c. xxviii.), and his memory is not yet completely effaced in the province of Novara. The Apostles continued their propaganda in Italy, Languedoc, Spain and Germany. In turn they were condemned by the councils of Cologne (1306), Treves (1310) and Spoleto (1311). The inquisitor of Languedoc, Bernard Gui, persecuted them unremittingly (see Gui's *Practica Inquisitionis*). From 1316 to 1322 the condemnations of Apostles increased at Avignon and Toulouse. They disappeared, however, at a comparatively late date from those regions (council of Lavaur, 1368; council of Narbonne, 1374). In Germany two Apostles were burned at Lübeck and Wismar at the beginning of the 15th century (1402–1403) by the inquisitor Eylard.

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[1] One result is their inability to form a true theory of Judaism and of the Old Testament in relation to the Gospel, a matter of great moment for them and for their successors.

Several controversialists, including Gotti, Krohn and Stockmann, have mentioned among the innumerable sects that have sprung from Anabaptism a group of individuals whose open-air preaching and rigorous practice of poverty gained them the name of Apostolici. These must be carefully distinguished from the *Apostoolians*, Mennonites of Frisia, who followed the teachings of the pastor Samuel Apostool (1638–beginning of 18th century). In the Mennonite church they represent the rigid, conservative party, as opposed to the Galenists, who inclined towards the Arminian latitudinarianism and admitted into their community all those who led a virtuous life, whatever their doctrinal tendencies. (P. A.)

APOSTOLIC MAJESTY, a title borne by the kings of Hungary. About A.D. 1000 it was conferred by Pope Silvester II. upon St Stephen (975–1038), the first Christian king of Hungary, in return for his zeal in seeking the conversion of the heathen. It was renewed by Pope Clement XIII. in 1758 in favour of the empress Maria Theresa and her descendants. The emperor of Austria bears the title of apostolic king of Hungary.

APOSTOLIUS, MICHAEL (d. *c.* 1480), a Greek theologian and rhetorician of the 15th century. When, in 1453, the Turks conquered Constantinople, his native city, he fled to Italy, and there obtained the protection of Cardinal Bessarion. But engaging in the great dispute that then raged between the upholders of Aristotle and Plato, his zeal for the latter led him to speak so contemptuously of the more popular philosopher and of his defender, Theodorus Gaza, that he fell under the severe displeasure of his patron. He afterwards retired to Crete, where he earned a scanty living by teaching and by copying manuscripts. Many of his copies are still to be found in the libraries of Europe. One of them, the *Icones* of Philostratus at Bologna, bears the inscription: "The king of the poor of this world has written this book for his living." Apostolius died about 1480, leaving two sons, Aristobulus Apostolius and Arsenius. The latter became bishop of Malvasia (Monemvasia) in the Morea.

Of his numerous works a few have been printed: *Παροιμίαι* (Basel, 1538), now exceedingly rare; a collection of proverbs in Greek, of which a fuller edition appeared at Leiden, "Curante Heinsio," in 1619; "Oratio Panegyrica ad Fredericum III." in Freher's *Scriptores Rerum Germanicarum*, vol. ii. (Frankfort, 1624); Georgii Gemisthi Plethonis et Mich. Apostolii *Orationes funebres duae in quibus de Immortalitate Animae exponitur* (Leipzig, 1793); and a work against the Latin Church and the council of Florence in Le Moine's *Varia Sacra.*

APOSTROPHE (Gr. *ἀποστροφή*, turning away; the final *e* being sounded), the name given to an exclamatory rhetorical figure of speech, when a speaker or writer breaks off and addresses some one directly in the vocative. The same word (representing, through the French, the Greek *ἀπόστροφος προσῳδία*, the accent of elision) means also the sign (') for the omission of a letter or letters, *e.g.* in "don't." In physiology, "apostrophe" is used more precisely in connexion with its literal meaning of "turning away," *e.g.* for movement away from the light, in the case of the accumulation of chlorophyll-corpuscles on the cells of leaves.

APOTACTITES, or APOTACTICI (from Gr. *ἀποτακτός*, set apart), a sect of early Christians, who renounced all their worldly possessions. (See APOSTOLICI *ad init.*)

APOTHECARY (from the Lat. *apothecarius*, a keeper of an *apotheca*, Gr. *ἀποθήκη*, a store), a word used by Galen to denote the repository where his medicines were kept, now obsolete in its original sense. An apothecary was one who prepared, sold and prescribed drugs, but the preparing and selling of drugs prescribed by others has now passed into the hands of duly qualified and authorized persons termed "chemists and druggists," while the apothecary, by modern legislation, has become a general medical practitioner, and the word itself, when used at all, is applied, more particularly in the United States and in Scotland, to those who in England are called "pharmaceutical chemists." The Apothecaries' Society of London is one of the corporations of that city, and both by royal charters and acts of parliament exercises the power of granting licences to practise medicine. The members of this society do not possess and never have possessed any exclusive power to deal in or sell drugs; and until 1868 any person whatever might open what is called a chemist's shop, and deal in drugs and poisons. In that year, however, the Pharmacy Act was passed, which prohibits any person from engaging in this business without being registered.

From early records we learn that the different branches of the medical profession were not regularly distinguished till the reign of Henry VIII., when separate duties were assigned to them, and peculiar privileges were granted to each. In 1518 the physicians of London were incorporated, and the barber-surgeons in 1540. But, independently of the physicians and the surgeons, there were a great number of irregular practitioners, who were more or less molested by their legitimate rivals, and it became necessary to pass an act in 1543 for their protection and toleration. As many of these practitioners kept shops for the sale of medicines, the term "apothecary" was used to designate their calling.

In April 1606 James I. incorporated the apothecaries as one of the city companies, uniting them with the grocers. On their charter being renewed in 1617 they were formed into a separate corporation, under the title of the "Apothecaries of the City of London." These apothecaries appear to have prescribed medicines in addition to dispensing them, and to have claimed an ancient right of acting in this double capacity; and it may be mentioned that Henry VIII., after the grant of the charter to the College of Physicians, appointed an apothecary to the Princess Mary, who was delicate and unhealthy, at a salary of 40 marks a year, "*pro meliore cura et consideratione sanitatis suae.*" During the 17th century, however, there arose a warm contest between the physicians and the apothecaries,—the former accusing the latter of usurping their province, and the latter continuing and justifying the usurpation until the dispute was finally set at rest by a judgment of the House of Lords in 1703 (*Rose* v. *College of Physicians*, 5 Bro. P. C. 553), when it was decided that the duty of the apothecary consisted not only in compounding and dispensing, but also in directing and ordering the remedies employed in the treatment of disease. In 1722 an act was obtained empowering the Apothecaries' Company to visit the shops of all apothecaries practising in London, and to destroy such drugs as they found unfit for use. In 1748 great additional powers were given to the company by an act authorizing them to appoint a board of ten examiners, without whose licence no person should be allowed to dispense medicines in London, or within a circuit of 7 m. round it. In 1815, however, an act of parliament was passed which gave the Apothecaries' Society a new position, empowering a board, consisting of twelve of their members, to examine and license all apothecaries throughout England and Wales. It also enacted that, from the 1st of August of that year, no persons except those who were so licensed should have the right to act as apothecaries, and it gave the society the power of prosecuting those who practised without such licence. But the act expressly exempted from prosecution all persons who were then in actual practice, and it distinctly excluded from its operation all persons pursuing the calling of chemists and druggists. It was also provided that the act should in no way interfere with the rights or privileges of the English universities, or of the English College of Surgeons or the College of Physicians; and indeed a clause imposed severe penalties on any apothecaries who should refuse to compound and dispense medicines on the order of a physician, legally qualified to act as such. It is therefore clear that the act contemplated the creation of a class of practitioners who, while having the right to practise medicine, should assist and co-operate with the physicians and surgeons.

Before this act came into operation the education of the medical practitioners of England and Wales was entirely optional on their own part, and although many of them possessed degrees or licences from the universities or colleges, the greater number possessed no such qualification, and many of them were wholly illiterate and uneducated. The court of examiners of the Apothecaries' Society, being empowered to enforce the acquisition of a sufficient medical education upon its future licentiates, specified from time to time the courses of lectures or terms of hospital practice to be attended by medical students before their examination, and in the progress of years regular schools of medicine were organized throughout England.

As it was found that, notwithstanding the stringent regulations as to medical acquirements, the candidates were in many instances deficient in preliminary education, the court of examiners instituted, about the year 1850, a preliminary examination in arts as a necessary and indispensable prerequisite to the medical curriculum, and this provision has been so expanded that, at the present day, all medical students in the United Kingdom are compelled to pass a preliminary examination in arts, unless they hold a university degree. An act of parliament, passed in 1858, and known as the Medical Act, made very little alteration in the powers exercised by the Apothecaries' Society, and indeed it confirmed and in some degree amplified them, for whereas by the act of 1815, the licentiates of the society were authorized to practise as such only in England and Wales, the new measure gave them the same right in Scotland and Ireland. The Medical Act 1886 extended the qualifications necessary for registration under the medical acts, by making it necessary to pass a qualifying examination in medicine, surgery and midwifery. (See Medical Education.)

An act, passed in 1874, related exclusively to the Apothecaries' Society, and is termed the Apothecaries' Act Amendment Act. By this measure some provisions of the act of 1815, which had become obsolete or unsuitable, were repealed, and powers were given to the society to unite or co-operate with other medical licensing bodies in granting licences to practise. The act of 1815 had made it compulsory on all candidates for a licence to have served an apprenticeship of five years to an apothecary, and although by the interpretation of the court of examiners of the society this term really included the whole period of medical study, yet the regulation was felt as a grievance by many members of the medical profession. It was accordingly repealed, and no apprenticeship is now necessary. The restriction of the choice of examiners to the members of the society was also repealed, and the society was given the power (which it did not before possess) to strike off from the list of its licentiates the names of disreputable persons. The act of 1874 also specified that the society was not deprived of any right or obligation they may have to admit women to examination, and to enter their names on the list of licentiates if they acquit themselves satisfactorily.

The Apothecaries' Society is governed by a master, two wardens and twenty-two assistants. The members are divided into three grades, yeomanry or freemen, the livery, and the court. Women are not, however, admitted to the freedom. The hall of the society, situated in Water Lane, London, and covering about three-quarters of an acre, was acquired in 1633. It was destroyed by the great fire, but was rebuilt about ten years later and enlarged in 1786. This is the only property possessed by the society. In 1673, the society established a botanic and physic garden at Chelsea, and in 1722 Sir Hans Sloane, who had become the ground owner, gave it to the society on the condition of presenting annually to the Royal Society fifty dried specimens of plants till the number should reach 2000. This condition was fulfilled in 1774. Owing to the heavy cost of maintenance and other reasons, the "physic garden" was handed over in 1902, with the consent of the Charity Commissioners, to a committee of management, to be maintained in the interests of botanical study and research.

See C. R. B. Barrett, *The History of the Society of Apothecaries of London* (1905).

APOTHEOSIS (Gr. ἀποθεοῦν, to make a god, to deify), literally deification. The term properly implies a clear polytheistic conception of gods in contrast with men, while it recognizes that some men cross the dividing line. It is characteristic of polytheism to blur that line in several ways. Thus the ancient Greek religion was especially disposed to belief in heroes and demigods. Founders of cities, and even of colonies, received worship; the former are, generally speaking, mythical personages and, in strictness, heroes. But the worship after death of historical persons, such as Lycurgus, or worship of the living as true deities, *e.g.* Lysander and Philip II. of Macedon, occurred sporadically even before Alexander's conquests brought Greek life into contact with oriental traditions. It was inevitable, too, that ancient monarchies should enlist polytheistic conceptions of divine or half-divine men in support of the dynasties; "*Seu deos regesve canit deorum Sanguinem,*" Horace (*Odes*, iv. 2, ll. 12, 13) writes of Pindar; though the reference is to myths, yet the phrase is significant. In the East all such traits are exaggerated, a result perhaps rather of the statecraft than of the religions of Egypt and Persia. Whatever part vanity or the flattery of courtiers may have played with others, or with Alexander, it is significant that the dynasties of Alexander's various successors all claim divine honours of some sort (see Ptolemies, Seleucid Dynasty, &c.). Theocritus (*Idyll* 17) hails Ptolemy Philadelphus as a demigod, and speaks of his father as seated among the gods along with Alexander. Ancestor worship, or reverence for the dead, was a third factor. It may work even in Cicero's determination that his daughter should enjoy "ἀποθέωσις"—as he writes to Atticus—or receive the "honour" of *consecratio* (fragment of his *De Consolatione*). Lastly, we need not speak of mere sycophancy. Yet it was common; Verres was worshipped before he was impeached!

The Romans had, up to the end of the Republic, accepted only one official apotheosis; the god Quirinus, whatever his original meaning, having been identified with Romulus. But the emperor Augustus carried on the tradition of ancient statecraft by having Julius Caesar recognized as a god (*divus Julius*), the first of a new class of deities proper (*divi*). The tradition was steadily followed and was extended to some ladies of the imperial family and even to imperial favourites. Worship of an emperor during his lifetime, except as the worship of his *genius*, was, save in the cases of Caligula and Domitian, confined to the provinces. Apotheosis after his death, being in the hands of the senate, did not at once cease, even when Christianity was officially adopted. The Latin term is *consecratio*, which of course has a variety of senses, including simple burial. (Inscription in G. Boissier, *La Religion romaine*; Renier, *Inscriptions d'Algiers*, 2510.) The Greek term Apotheosis, probably a coinage of the Hellenistic epoch, becomes more nearly technical for the deification of dead emperors. But it is still used simply for the erection of tombs (clearly so in some Greek inscriptions, *Corpus Inscript. Graec.* 2831, 2832, quoted in Pauly-Wissowa, *s.v. Apotheosis*). Possibly there is a trace of ancestor worship even here; but the two usages have diverged. The squib of the philosopher Seneca on the memory of Claudius (d. A.D. 54), *Apocolocyntosis* ("pumpkinification"), is evidence that, as early as Seneca's lifetime, apotheosis was in use for the recognition of a departed emperor as a god. It also indicates how much contempt might be associated with this pretended worship. The people, says

Suetonius (*Jul. Caes.* c. 88), fully believed in the divinity of Julius Caesar, hinting at the same time that this was by no means the case with the majority of the apotheoses subsequently decreed by the senate. Yet we learn from Capitolinus that Marcus Aurelius was still worshipped as a household divinity in the time of Diocletian, and was believed to impart revelations in dreams (*Vit. M. Ant.* c. 18). Antinous, the favourite of Hadrian, was adored in Egypt a century after his death (Origen, *Contra Celsum*, iii. 36), though, according to Boissier, his worship never had official sanction. The ceremonies attendant on an imperial apotheosis are very fully described by Herodianus (bk. iv. c. 2) on occasion of the obsequies of Severus, which he appears to have witnessed. The most significant was the liberation, at the moment of kindling the funeral pyre, of an eagle which was supposed to bear the emperor's soul to heaven. Sharp-sighted persons had actually beheld the ascension of Augustus (Suet. *August.* c. 100), and of Drusilla, sister of Caligula. Representations of apotheoses occur on several works of art; the most important are the apotheosis of Homer on a relief in the Townley collection of the British Museum, that of Titus on the arch of Titus, and that of Augustus on a magnificent cameo in the Louvre.

In China at the present day many Taoist gods are (or are given out as) men deified for service to the state. This again may be statecraft. In India, the (still unexplained) rise of the doctrine of transmigration hindered belief. Apotheosis can mean nothing to those who hold that a man may be reborn as a god, but still needs redemption, and that men on earth may win redemption, if they are brave enough. Curiously, Buddhism itself is ruled by the ghost or shadowy remainder of belief in transmigration—Karma.

Apotheosis may also be used in wider senses. (*a*) Some (*e.g.* Herbert Spencer) hold that most gods are deified men, and most myths historical traditions which have been grotesquely distorted. This theory is known as Euhemerism (see EUHEMERUS). It is needless to say that the attitude of those holding the Euhemerist theory is at the farthest pole from belief in apotheosis. According to the latter, some men may become gods. According to the former, all gods are but men; or, some men have been erroneously supposed to become gods. The Euhemerist theory mainly appeals to ancestor worship — a fact of undoubted importance in the history of religion, especially in China and in ancient Rome. In India, too, a dead person treated with funeral honours becomes a guardian spirit—if neglected, a tormenting demon. But whether the great gods of polytheism were really transfigured ancestors is very doubtful. (*b*) Again, there is a tendency to offer something like worship to the founders of religions. Thus more than human honour is paid to Zoroaster and Buddha and even to the founders of systems not strictly religious, *e.g.* to Confucius and Auguste Comte. It is noticeable that this kind of worship is not accorded in rigidly monotheistic systems, *e.g.* to Moses and Mahomet. Nor is it accurate to speak of apotheosis in cases where the founder is in his lifetime regarded as the incarnation of a god (cf. Ali among Shi'ite Mahommedans; the Bâb in Babism; the Druse Hakim). Most Christians on this ground repudiate the application of the term to the worship of Jesus Christ. Curiously, *Apotheosis* is used by the Latin Christian poet, Prudentius (*c.* 400), as the title of a poem defending orthodox views on the person of Christ and other points of doctrine—the affectation of a decadent age. (*c*) The worship paid to Saints, in those Christian churches which admit it, is formally distinguished as *dulia* (δουλεία) from true worship or *latria* λατρεία). Even the Virgin Mary, though she is styled Mother of God and Queen of Heaven, receives only *dulia* or at most *hyperdulia*.

(R. G.; R. MA.)

APPALACHIAN MOUNTAINS, the general name given to a vast system of elevations in North America, partly in Canada, but mostly in the United States, extending as a zone, from 100 to 300 m. wide, from Newfoundland, Gaspé Peninsula and New Brunswick, 1500 m. south-westward to central Alabama. The whole system may be divided into three great sections: the *Northern*, from Newfoundland to the Hudson river; the *Central*, from the Hudson Valley to that of New river (Great Kanawha), in Virginia and West Virginia; and the *Southern*, from New river onwards. The northern section includes the Shickshock Mountains and Notre Dame Range in Quebec, scattered elevations in Maine, the White Mountains and the Green Mountains; the central comprises, besides various minor groups, the Valley Ridges between the Front of the Allegheny Plateau and the Great Appalachian Valley, the New York-New Jersey Highlands and a large portion of the Blue Ridge; and the southern consists of the prolongation of the Blue Ridge, the Unaka Range, and the Valley Ridges adjoining the Cumberland Plateau, with some lesser ranges.

The Chief Summits.—The Appalachian belt includes, with the ranges enumerated above, the plateaus sloping southward to the Atlantic Ocean in New England, and south-eastward to the border of the coastal plain through the central and southern Atlantic states; and on the north-west, the Allegheny and Cumberland plateaus declining toward the Great Lakes and the interior plains. A remarkable feature of the belt is the longitudinal chain of broad valleys—the Great Appalachian Valley—which, in the southerly sections divides the mountain system into two subequal portions, but in the northernmost lies west of all the ranges possessing typical Appalachian features, and separates them from the Adirondack group. The mountain system has no axis of dominating altitudes, but in every portion the summits rise to rather uniform heights, and, especially in the central section, the various ridges and intermontane valleys have the same trend as the system itself. None of the summits reaches the region of perpetual snow. Mountains of the Long Range in Newfoundland reach heights of nearly 2000 ft. In the Shickshocks the higher summits rise to about 4000 ft. elevation. In Maine four peaks exceed 3000 ft., including Katahdin (5200 ft.), Mount Washington, in the White Mountains (6293 ft.), Adams (5805), Jefferson (5725), Clay (5554), Monroe (5390), Madison (5380), Lafayette (5269); and a number of summits rise above 4000 ft. In the Green Mountains the highest point, Mansfield, is 4364 ft.; Lincoln (4078), Killington (4241), Camel Hump (4088); and a number of other heights exceed 3000 ft. The Catskills are not properly included in the system. The Blue Ridge, rising in southern Pennsylvania and there known as South Mountain, attains in that state elevations of about 2000 ft.; southward to the Potomac its altitudes diminish, but 30 m. beyond again reach 2000 ft. In the Virginia Blue Ridge the following are the highest peaks east of New river: Mount Weather (about 1850 ft.), Mary's Rock (3523), Peaks of Otter (4001 and 3875), Stony Man (4031), Hawks Bill (4066). In Pennsylvania the summits of the Valley Ridges rise generally to about 2000 ft., and in Maryland Eagle Rock and Dans Rock are conspicuous points reaching 3162 ft. and 2882 ft. above the sea. On the same side of the Great Valley, south of the Potomac, are the Pinnacle (3007 ft.) and Pidgeon Roost (3400 ft.). In the southern section of the Blue Ridge are Grandfather Mountain (5964 ft.), with three other summits above 5000, and a dozen more above 4000. The Unaka Ranges (including the Black and Smoky Mountains) have eighteen peaks higher than 5000 ft., and eight surpassing 6000 ft. In the Black Mountains, Mitchell (the culminating point of the whole system) attains an altitude of 6711 ft., Balsam Cone, 6645, Black Brothers, 6690, and 6620, and Hallback, 6403. In the Smoky Mountains we have Clingman's Peak (6611), Guyot (6636), Alexander (6447), Leconte (6612), Curtis (6588), with several others above 6000 and many higher than 5000.

In spite of the existence of the Great Appalachian Valley, the master streams are transverse to the axis of the system. The main watershed follows a tortuous course which crosses the mountainous belt just north of New river in Virginia; south of this the rivers head in the Blue Ridge, cross the higher Unakas, receive important tributaries from the Great Valley, and traversing the Cumberland Plateau in spreading gorges, escape by way of the Cumberland and Tennessee rivers to the Ohio and Mississippi, and thus to the Gulf of Mexico; in the central section the rivers, rising in or beyond the Valley Ridges, flow through great gorges (water gaps) to the Great Valley, and by southeasterly courses across the Blue Ridge to tidal estuaries penetrating the coastal plain; in the northern section the water-parting lies on the inland side of the mountainous belt, the main lines of drainage running from north to south.

Geology.—The rocks of the Appalachian belt fall naturally into two divisions; ancient (pre-Cambrian) crystallines, including marbles, schists, gneisses, granites and other massive igneous rocks, and a great succession of Paleozoic sediments. The crystallines are confined to the portion of the belt east of the Great Valley where Paleozoic rocks are always highly metamorphosed and occur for the most part in limited patches, excepting in New England and Canada, where they assume greater areal importance, and are besides very generally intruded by granites. The Paleozoic sediments, ranging in age from Cambrian to Permian, occupy the Great Valley, the Valley Ridges and the plateaus still farther west. They are rarely metamorphosed to the point of recrystallization, though locally shales are altered to roofing slates, sandstones are indurated, limestones slightly marblized, and coals, originally bituminous, are changed to anthracite in northern Pennsylvania, and to graphite in Rhode Island. Igneous intrusions consist only of unimportant dikes of trap. The most striking and uniformly characteristic geologic feature of the mountains is their internal structure, consisting of innumerable parallel, long and narrow folds, always closely appressed in the eastern part of any cross-section (Piedmont Plateau to Great Valley), less so along a central zone (Great Valley and Valley Ridges), and increasingly open on the west (Allegheny and Cumberland Plateaus). Asymmetry of the folds is a marked characteristic in the zones of closer folding, the anticlines having long gently inclined easterly limbs, and short, steep and even overturned limbs upon the west. The effect of such folds is often exaggerated by thrusts, and faulting of this sort is prominent in the southern section, where the existence of over-thrusts measured by several miles has been established.

What may be termed the ancestral Appalachian system was formed during the post-carboniferous revolution, though certain of its elements had been previously outlined, and perhaps at different dates. Folding of the rocks resulted from the operation of great compressive forces acting tangentially to the figure of the earth. Extensive and deep-seated crumpling was necessarily accompanied by vertical uplift throughout the zone affected, but once at least since their birth the mountains have been worn down to a lowland, and the mountains of to-day are the combined product of subsequent uplift of a different sort, and dissection by erosion. Produced by long-continued subaerial decay and erosion, in later Cretaceous times this lowland extended from the Atlantic Ocean well toward the interior of North America; since then the whole continent has been generally elevated, and by successive steps the Appalachian belt has been raised to form a wide but relatively low arch. The crosswise courses of the greater rivers result from the rivers being older than the mountains, which indeed have been produced by circumdenudation. The master streams of the present have inherited their channels from the drainage systems of the Cretaceous lowland, and though raised athwart the courses of the lowland trunk streams the great arch was developed so slowly that these channels could be maintained through *pari passu* deepening. Former tributaries have given place to others developed with reference to the distribution of more or less easily eroded strata, the present longitudinal valleys being determined by the out-crop of soft shales or soluble limestones, and the parallel ridges upheld by hard sandstones or schists. Parallelism of mountain ridges and intervening valleys is thus attributable to the folding of the rocks, but the origin of the interior structure of the mountains is to be kept distinct from the origin of the mountains as features of topography.

Flora and Fauna.—Much of the region is covered with forest yielding quantities of valuable timber, especially in Canada and northern New England. The most valuable trees for lumber are spruce, white pine, hemlock, cedar, white birch, ash, maple and basswood; all excepting pine and hemlock and poplar in addition are ground into wood pulp for the manufacture of paper. In the central and southern parts of the belt oak and hickory constitute valuable hard woods, and certain varieties of the former furnish quantities of tan bark. The tulip tree produces a good clear lumber known as white wood or poplar, and is also a source of pulp. In the south both white and yellow pine abounds. Many flowering and fruit-bearing shrubs of the heath family add to the beauty of the mountainous districts, rhododendron and kalmia often forming impenetrable thickets. Bears, mountain lions (pumas), wild cats (lynx) and wolves haunt the more remote fastnesses of the mountains; foxes abound; deer are found in many districts and moose in the north.

Influence on History.—For a century the Appalachians were a barrier to the westward expansion of the English colonies; the continuity of the system, the bewildering multiplicity of its succeeding ridges, the tortuous courses and roughness of its transverse passes, a heavy forest and dense undergrowth all conspired to hold the settlers on the seaward-sloping plateaus and coastal plains. Only by way of the Hudson and Mohawk valleys, and round about the southern termination of the system were there easy routes to the interior of the country, and these were long closed by hostile aborigines and jealous French or Spanish colonists. In eastern Pennsylvania the Great Valley was accessible by reason of a broad gateway between the end of South Mountain and the Highlands, and here in the Lebanon Valley settled German Moravians, whose descendants even now retain the peculiar patois known as "Pennsylvania Dutch." These were late comers to the New World forced to the frontier to find unclaimed lands. With their followers of both German and Scotch-Irish origin, they worked their way southward and soon occupied all of the Virginia Valley and the upper reaches of the Great Valley tributaries of the Tennessee. By 1755 the obstacle to westward expansion had been thus reduced by half; outposts of the English colonists had penetrated the Allegheny and Cumberland plateaus, threatening French monopoly in the transmontane region, and a conflict became inevitable. Making common cause against the French to determine the control of the Ohio valley, the unsuspected strength of the colonists was revealed, and the successful ending of the French and Indian War extended England's territory to the Mississippi. To this strength the geographic isolation enforced by the Appalachian mountains had been a prime contributor. The confinement of the colonies between an ocean and a mountain wall led to the fullest occupation of the coastal border of the continent, which was possible under existing conditions of agriculture, conducing to a community of purpose, a political and commercial solidarity, which would not otherwise have been developed. As early as 1700 it was possible to ride from Portland, Maine, to southern Virginia, sleeping each night at some considerable village. In contrast to this complete industrial occupation, the French territory was held by a small and very scattered population, its extent and openness adding materially to the difficulties of a disputed tenure. Bearing the brunt of this contest as they did, the colonies were undergoing preparation for the subsequent struggle with the home government. Unsupported by shipping, the American armies fought toward the sea with the mountains at their back protecting them against Indians leagued with the British. The few settlements beyond the Great Valley were free for self-defence because debarred from general participation in the conflict by reason of their position.

See the separate articles on the states, and also the following references:—Topographic maps and Geologic Folios of the United States Geological Survey; Bailey Willis, "The Northern Appalachians," and C. W. Hayes, "The Southern Appalachians," both in *National Geographic Monographs*, vol. i.; and chaps. iii., iv. and v. of Miss E. C. Semple's *American History and its Geographic Conditions* (Boston, 1903).

(A. C. Sp.)

APPANAGE, or Apanage (a French word from the late Lat. *apanagium*, formed from *apanare*, *i.e. panem porrigere*, to give bread, *i.e.* sustenance), in its original sense, the means of subsistence given by parents to their younger children as distinct from the rights secured to the eldest born by the custom of primogeniture. In its modern usage it is practically confined to the money endowment given to the younger children of reigning or mediatized houses in Germany and Austria, which reverts to the state or to the head of the family on the extinction of the line of the original grantee. In English history the system of appanages never played any great part, and the term is now properly applied only to the appanages of the crown: the duchy of Cornwall, assigned to the king's eldest son at birth, or on his father's accession to the crown, and the duchy of Lancaster. In the history of France, however, the appanage was a very important factor. The word denotes in very early French law the portion of lands or money given by fathers and mothers to their sons or daughters on marriage, and usually connotes a renunciation by the latter of any future inheritance; or it may denote the portion given by the eldest son to his brothers and sisters when he was sole inheritor. The word *apanage* is still employed in this sense in French official texts of some *Customs*; but it was in old public law that it received its definite meaning and importance. Under the kings of the third dynasty, the division of the kingdom among the sons of the dead monarch which had characterized the Merovingian and Carolingian dynasties, ceased. The eldest son alone succeeded to the crown; but at the same time a custom was established by which the king made territorial provision suitable to their rank for his other children or for his brothers and sisters; custom forbade their being left landless. Lands and lordships thus bestowed constituted the appanages, which interfered so greatly with the formation of ancient France. While the persevering policy of the Capets, which aimed at reuniting the great fiefs, duchies, countships, baronies, &c., to the domain of the crown, gradually reconstructed for their benefit a territorial sovereignty over France, the institution of the appanage periodically subtracted large portions from it. Louis XI., in particular, had to struggle against the appanaged nobles. The old law, however, never abolished this institution. The edict of Moulins (1566) maintained it, as one of the exceptions to the inalienability of the crown-lands; only it was then decided that daughters of France should be appanaged in money, or that if, in default of coin, lands were assigned to them, these lands should be redeemable by the crown in perpetuity. The efforts of the kings to minimize this evil, and of the old jurisprudence to deal with the matter, resulted in two expedients: (1) the reversion of the appanage to the crown was secured as far as possible, being declared inalienable and transmissible only to male descendants in the male line of the person appanaged; (2) originally the person appanaged had possessed all the rights of a duke or count—that is to say, in the middle ages nearly all the attributes of sovereignty; the more important of these attributes were now gradually reserved to the monarch, including public authority over the inhabitants of the appanage in all essential matters. However, it is evident from the letters of appanage, dated April 1771, in favour of the count of Provence, how many functions of public authority an appanaged person still held. The Constituent Assembly, by the law dated the 22nd of November 1790, decided that in future there should be no appanages in real estate, and that younger sons of monarchs, married and over twenty-five years of age, should be provided for by yearly grants (*rentes apanagères*) from the public funds. The laws of the 13th of August and the 21st of December 1790 revoked all the existing appanages, except those of the Luxembourg Palace and the Palais Royal. To each person hitherto appanaged an annual income of one million *livres* was assigned, and two millions for the brothers of the king. All this came to an end with the monarchy. Napoleon, by the *sénatus-consulte* of the 30th of January 1810, resolved to create appanages for the emperor's princely descendants, such appanages to consist for the most part of lands on French soil. The fall of the empire again annulled this enactment. The last appanage known in France was that enjoyed by the house of Orleans. Having been re-established, or recognized as still existing, by the Restoration, it was formally confirmed by the law of the 15th of January 1825. On the accession of Louis Philippe it was united to the national property by the law of the 2nd of March 1832.

For appanages in ancient law see the *Essai sur les apanages ou mémoires historiques de leur établissement*, attributed to Du Vaucel, about 1780. (J. P. E.)

APPAREL (from O. Fr. *aparail*, *apareiller*, mod. *appareil*, from Low Lat. *adpariculare*, to make fit or equal), equipment, outfit, things furnished for the proper performance of anything, now chiefly used of dress. The word is also applied to the "orphreys," *i.e.* embroidered strips or borders, on ecclesiastical vestments.

APPARITIONS. An apparition, strictly speaking, is merely an appearance (Lat. *apparere*, to appear), the result of perception exercised on any stimulus of any of the senses. But in ordinary usage the word apparition denotes a perception (generally through the sense of sight) which cannot, as a rule, be shown to be occasioned by an object in external nature. We say "as a rule" because many so-called apparitions are merely illusions, *i.e.* misconstructions of the perceptive processes, as when a person in a bad light sees a number of small children leading a horse, and finds, on nearer approach, that he sees two men carrying bee-hives suspended from a pole. Again, Sir Walter Scott's vision of Byron, then lately dead, proved to be a misconstruction of certain plaids and cloaks hanging in the hall at Abbotsford, or so Sir Walter declared. Had he not discovered the physical basis of this illusion (which, while it lasted, was an apparition, technically speaking), he and others might have thought that it was an apparition in the popular sense of the word, a ghost. In popular phraseology a ghost is understood to be a phantasm produced in some way by the spirit of a dead person, the impression being usually visual, though the ghost, or apparition, may also affect the sense of hearing (by words, knocks, whistles, groans and so forth), or the sense of touch, or of weight, as in the case of the "incubus." In ordinary speech an apparition of a person not known to the percipient to be dead is called a wraith, in the Highland phrase, a spirit of the living. The terms *ghost* and *wraith* involve the hypothesis that the false perceptions are caused by spirits, a survival of the archaic animistic hypothesis (see Animism), an hypothesis as difficult to prove as to disprove. Apparitions, of course, are not confined to anthropomorphic phantasms; we hear of phantom coaches (sometimes seen, but more frequently heard), of phantom dogs, cats, horses, cattle, deer, and even of phantom houses.

Whatever may be the causes of these and other false perceptions,—most curious when the impression is shared by several witnesses,—they may best be considered under the head of hallucination (*q.v.*). Hallucinations may be pathological, *i.e.* the result of morbid conditions of brain or nerve, of disease, of fever, of insanity, of alcoholism, of the abuse of drugs. Again, they may be the result of dissociation, or may occur in the borderland of sleep or waking, and in this case they partake of the hallucinatory nature of dreams (*q.v.*). Again, hallucinations may, once or twice in a lifetime, come into the experience of the sane, the healthy, and, as far as any tests can be applied, of the wide-awake. In such instances the apparition (whether it take the form of a visual phantasm, of a recognized voice, of a touch, or what not) may be coincidental or non-coincidental. The phantasm is called coincidental if it represents a known and distant person who is later found to have been dying or in some other crisis at the moment of the percipient's experience. When the false perception coincides with nothing of the sort, it is styled non-coincidental. Coincidental apparitions have been explained by the theory of telepathy (*q.v.*), one mind or brain impressing another in some unknown way so as to beget an hallucinatory apparition or phantasm. On the evidence, so far as it has been collected and analysed, it seems that the mind which, on the hypothesis, begets the hallucinations, usually does so without *conscious* effort (see Subliminal Self). There are, however, a few cases in which the experiment of begetting, in another, an hallucination from a distance, is said to have been experimentally and consciously made, with success.

If the telepathic theory of coincidental hallucinations be accepted, we have still to account for the much more common non-coincidental apparitions of the living who do not happen to be in any particular crisis. In these instances it cannot be demonstrated that telepathy has *not* been at work, as when a person is seen at a place which he thought of visiting, but did not visit. F. W. Myers even upheld a theory of psychorhagy, holding that the spirits of some persons have a way of manifesting themselves at a distance by a psychic invasion. This involves, as he remarked, paleolithic psychology, and the old savage doctrine of animism, rather than telepathy (see Myers, *Human Personality*). Of belief in coincidental hallucinations or wraiths among savages, records are scanty; the belief, however, is found among Maoris and Fuegians (see Lang, *Making of Religions*). The perception of apparitions of distant but actual scenes and occurrences is usually called clairvoyance (*q.v.*). The belief is also familiar under the name of second sight(see SECOND SIGHT), a term of Scots usage, though the belief in it, and the facts if accepted, are of world-wide diffusion. The apparitions may either represent actual persons and places, or may be symbolical, taking the form of phantasmic lights, coffins, skeletons, shrouds and so forth. Again, the appearances may either represent things, persons and occurrences of the past (see RETROCOGNITION), or of the present (clairvoyance), or of the future (see PREMONITION). When the apparitions produce themselves in given rooms, houses or localities, and are exhibited to various persons at various times, the locality is popularly said to be haunted by spirits, that is, of the dead, on the animistic hypothesis (see HAUNTINGS). Like the other alleged facts, these are of world-wide diffusion, or the belief in them is world-wide, and peculiar to no race, age, or period of culture. A haunted place is a centre of permanent possibilities of hallucinations, or is believed to be so. A distinct species of hauntings are those in which unexplained sounds and movements of objects, apparently untouched, occur. The German term *Poltergeist* (*q.v.*) has been given to the supposed cause of these occurrences where the cause is not ascertained to be sportive imposture. In the performances of modern spiritualists the Poltergeist appears, as it were, to be domesticated, and to come at the call of the medium.

An intermittent kind of ominous haunting attached, not to places, but to families, is that of the banshee (Celtic) or family death omen, such as the white bird of the Oxenhams, the Airlie drummer, the spectral rider of Clan Gilzean, the rappings of the Woodde family. These apparitions, with fairies and *djinns* (the Arab form of fairy), haunt the borderland between folk-lore and psychical research.

So far we have been concerned with spontaneous apparitions, or with the belief in them. Among induced apparitions may be reckoned the materialized forms of spiritual *séances*, which have a material basis of veils, false moustaches, wigs and the *corpus vile* of the medium. It is also possible that mere expectancy and suggestion induce hallucinatory perceptions among the members of the circle. That apparitions of a sort can be induced by hypnotic and posthypnotic suggestion is certain enough (see HYPNOTISM). Savages produce apparitions in similar ways by suggestion, accompanied by dances, fumigations, darkness, fasting, drugs, and whatever can affect the imaginations of the onlookers (see MAGIC). Both in savage and civilized life, some persons can provoke themselves into beholding apparitions usually fantastic, but occasionally coincidental, by sedulously staring into any clear deep water, a fragment of rock crystal, a piece of polished basalt or obsidian, a mirror, a ring, a sword blade, or a glass of sherry (see CRYSTAL GAZING). Indeed any object, a wall, the palm of the hand, the shoulder-blade-bone of a sheep, may be, and has been used to this end (see DIVINATION).

Almost all known apparitions may accommodate themselves to one or other of the categories given, whether they be pathological, coincidental or spontaneous, induced, permanently localized, or sporadic.

See generally, SPIRITUALISM and PSYCHICAL RESEARCH. (A. L.)

APPARITOR, or APPARATOR (Latin for a servant of a public official, from *apparere*, to attend in public), an attendant who executed the orders of a Roman magistrate; hence a beadle in a university, a pursuivant or herald; particularly, in English ecclesiastical courts, the official who serves the processes of the court and causes defendants to appear by summons.

APPEAL, in law. In the old English common law the term "appeal" was used to describe a process peculiar to English criminal procedure. It was a right of prosecution possessed as a personal privilege by a party individually aggrieved by a felony, a privilege of which the crown could not directly or indirectly deprive him, since he could use it alike when the prisoner was tried and acquitted, and when he was convicted and pardoned. It was chiefly known in practice as the privilege of the nearest relation of a murdered person. When in 1729 (after Colonel Oglethorpe's inquiry and report on the London prisons) Banbridge and other gaolers were indicted for their treatment of prisoners, but were acquitted for deficiency of evidence, appeals for murder were freely brought by relatives of deceased prisoners. In the case of Slaughterford (1708) the accused was charged with murdering a woman whom he had seduced; the evidence was very imperfect, and he was acquitted on indictment. But public indignation being aroused by the atrocities alleged to have been perpetrated, an appeal was brought, and on conviction he was hanged, as his execution was a privilege belonging to the prosecutor, of which the crown could not deprive him by a pardon. In 1818 an appeal was ingeniously met by an offer of battle, since if the appellee were an able-bodied man he had the choice between combat or a jury (see WAGER). This neutralizing of one obsolete and barbarous process by another called the attention of the legislature to the subject, and appeal in criminal cases, along with trial by battle, was abolished in 1819. The history of this appeal is fully dealt with in Pollock and Maitland, *History of English Law*, 1898.

In its usual modern sense the term appeal is applied to the proceeding by which the decision of a court of justice is brought for review before another tribunal of higher authority. In Roman jurisprudence it was used in this and in other significations; it was sometimes equivalent to prosecution, or the calling up of an accused person before a tribunal where the accuser appealed to the protection of the magistrate against injustice or oppression. The derivation from *appellare* ("call") suggests that its earliest meaning was an urgent outcry or prayer against injustice. During the republic the magistrate was generally supreme within his sphere, and those who felt themselves outraged by injustice threw themselves on popular protection by *provocatio*, instead of looking to redress from a higher official authority. Under the empire different grades of jurisdiction were established, and the ultimate remedy was an appeal to the emperor; thus Paul, when brought before Festus, appealed unto Caesar. Such appeals were, however, not heard by the emperor in person but by a supreme judge representing him. In the *Corpus Juris* the appeal to the emperor is called indiscriminately *appellatio* and *provocatio*. A considerable portion of the 49th book of the *Pandects* is devoted to appeals; but little of the practical operation of the system is to be deduced from the propositions there brought together.

During the middle ages full scope was afforded for appeals from the lower to the higher authorities in the church. In matters ecclesiastical, including those matrimonial, testamentary and other departments, which the church ever tried to bring within the operation of the canon law, there were various grades of appeal, ending with the pope. The claims of the church to engross appeals in matters trenching on the temporal rights of princes led to continual conflicts between church and state, terminated in England at the reformation by the suppression in 1534 of appeals to Rome, which had previously been discouraged by legislation of Edward III. and Richard II.

In temporal, as distinct from spiritual matters, it became customary for ambitious sovereigns to encourage appeals from the courts of the crown vassals to themselves as represented by the supreme judges, and Charlemagne usually enjoys the credit of having set the example of this system of centralization by establishing *missi dominici*. It is not improbable that his claim was suggested or justified by the practice of the Roman empire, to the sovereignty whereof he claimed to be successor.

England.—When the royal authority in England grew strong as against that of the tenants *in capite*, the king's courts in England were more effectively organized, and their net swept wider so as to draw within their cognizance matters previously adjudged in courts baron or courts leet or in the county court, and they acquired authority to supervise and review the decisions of the inferior and local courts, to control and limit their claims to exercise jurisdiction, and to transfer causes from the local to the royal courts. The machinery by which this process was usually effected, under the common law, was not by what is now known as appeal, but by the process of *certiorari* or writs of error or prohibition. Recourse was also had against the decisions of the royal courts by appeal to the great council of the king, or to parliament as a whole. The supremacy of the king's courts over all causes, as well ecclesiastical as civil, has been completely established since the reign of Henry VIII., and they have effectually asserted the power to regulate and keep within their proper jurisdiction all other tribunals within the realm. Since that date the organization of judicial tribunals has gradually been changed and improved with the object (1) of creating a judicial hierarchy independent of executive control; (2) of ensuring that all decisions on questions of law shall be co-ordinated and rendered systematic by correction of the errors and vagaries of subordinate tribunals; and (3) of securing so far as possible uniformity in the judicial interpretation and administration of the law, by creating a supreme appellate tribunal to whose decisions all other tribunals are bound to conform. It would be undesirable to detail at length the history of appellate jurisdiction in England, involving as it would the discussion in great detail of the history and procedure of English law, and it may suffice to indicate the system of appeals as at present organized, beginning with the lowest courts.

Justices of the Peace.—The decisions of justices of the peace sitting as courts of summary jurisdiction are subject to review on questions of law only by the High Court of Justice. This review is in a sense consultative, because it is usually effected by means of a case voluntarily stated by the justices at the request of the aggrieved party, in which are set forth the facts as determined by the justices, the questions of law raised and their decision thereon, as to the correctness whereof the opinion of the High Court is invited. The procedure is equally open in criminal and civil matters brought before the justices. But when the justices decline to state a case for the opinion of the High Court, the latter, if review seems desirable, may order the justices to state a case. And the High Court has also power to control the action of justices by prohibiting them from acting in a case beyond their jurisdiction, ordering them to exercise jurisdiction where they have improperly declined (*mandamus*), or bringing up for review and quashing orders or convictions which they have made in excess of jurisdiction, or in cases in which interested or biassed justices have adjudicated (*certiorari*). None of these regulative processes exactly corresponds to what is popularly known as an appeal, but in effect if not in form an appeal is thus given.

There is also another form of appeal, in the fullest sense of the term, from the decision of justices sitting as a court of summary jurisdiction to the justices of the same county sitting in general or quarter sessions, or in the case of a borough to the recorder as judge of the borough court of quarter sessions. This form of appeal is in every case the creation of statute: and even in text-books it is hardly possible to find a really complete list of the matters in respect of which such appeal lies. But as regards criminal cases there is an approximately general rule, given by § 19 of the Summary Jurisdiction Act 1879, viz. that an appeal to quarter sessions lies from the conviction or order of a court of summary jurisdiction directing imprisonment without the option of a fine as a punishment for an offence, or for failing to do or to abstain from doing any act required to be done or left undone other than an order for the payment of money, or to find sureties or give security or to enter into a recognizance, or a conviction made on a plea of guilty or admission of the truth of the matter of complaint.

As a general rule, subject to particular statutory exceptions, appeals of this kind are by way of rehearing, *i.e.* the actor or prosecutor must before the appellate tribunal call his witnesses and prove his case just as if no previous hearing had taken place before the court appealed from (Pritchard, *Quarter Sessions Practice*, 2nd ed., 461). The only limit is that the appellant must confine himself to the grounds of appeal stated in the notice of appeal given by him.

Justices in Quarter Sessions.—This tribunal has under the commission of the peace and under statute power to refer questions of difficulty arising before it for decision to the High Court. The old mode of exercising this power was by sending on to assizes indictments raising difficult questions which had been presented at quarter sessions. The High Court has *ex officio* power to transfer such indictments where the nature of the case and the demands of justice call for such transfer. The quarter sessions had also power under statute on trying an indictment to refer to the court for crown cases reserved (Crown Cases Act 1848), abolished by the Criminal Appeal Act 1907, questions of law which had arisen at the trial, and in all civil cases the quarter sessions has power of its own volition and subject to no direct compulsion to consult the High Court on legal questions of difficulty which have arisen. Until 1894 this jurisdiction was regarded as consultative only. It was and is exercised by stating the facts, of which the court of quarter sessions is the sole judge, and indicating the questions of law arising on the facts, and the view of quarter sessions thereon, and inviting the opinion of the High Court. Under the Judicature Act 1894 cases stated in this way are now treated as "appeals" in the popular sense.

Inferior Courts of purely Civil Jurisdiction.—An appeal also lies as a general rule to the High Court from the judgment of a county court or of any inferior tribunal having civil jurisdiction.

(*a*) County Courts. Any party to an action or matter in a county court who is dissatisfied with the determination or direction of the judge in law or equity, or upon the admission or rejection of any evidence, may appeal against the decision in the following cases: (1) if the amount of claim or counter-claim in the proceeding exceeds £20; or (2) in all equity matters or cases in which an injunction has been given; or (3) in actions to recover possession of land where questions of title are involved (County Courts Act 1888, § 120). In the case of a claim below £20 no appeal lies except by the leave of the county court. The old practice of appeal by way of special case as in appeals from justices has been abolished, and the present procedure is by notice of motion (R.S.C. O. LIX. rr. 10-18).

These appeals are heard in the king's bench division, except in the case of appeals from judgments of a county court sitting in the exercise of admiralty jurisdiction, which are heard by two or more judges sitting in the probate, divorce and admiralty division. The chancery division has never sat to hear "appeals" from a county court exercising equity jurisdiction; but at times, by *prohibition* or *certiorari*, has, in effect, reviewed or restrained excess of jurisdiction by county courts in equity matters.

The decision of the High Court on county court appeals is final unless an appeal to the court of appeal is brought by leave of that court or of the High Court (Judicature Act 1894, § 1, sub. sect. 5; Judicature Act 1873, § 45).

(*b*) Other inferior courts of civil jurisdiction. Appeals from the local courts of record which still survive in certain cities, towns and districts are in a somewhat anomalous position. The general rule is that, unless a statute regulates such appeal, it may be brought in the king's bench division of the High Court on notice of motion in any case in which, before the Judicature Acts, the court of king's bench could have reviewed the decision of the inferior court by writ of error. The history of this question is dealt with in *Darlow* v. *Shuttleworth*, 1902, 1 K.B. 721.

In the case of the mayor's court of London, under the local and general statutes regulating that court, the appeal is usually to the king's bench division, but where there is what is termed "error" on the face of the proceedings of the mayor's court, the appeal lies direct to the court of appeal as successor of the court of exchequer chamber. Appeals from the Liverpool court of passage and from the chancery courts of the duchies of Lancaster and Durham lie by statute direct to the court of appeal.

High Court of Justice.—Until the Supreme Court of Judicature Acts of 1873 and 1875 came into operation, the superior courts in England were imperfectly co-ordinated both as to jurisdiction and appeals. The effect of these acts was to create a Supreme Court of Judicature divided into two main branches, the High Court of Justice, which is an appellate court with respect to the inferior courts already mentioned, and to certain other special courts and persons; and the court of appeal, which is mainly concerned with appeals from the High Court of Justice.

The High Court of Justice acts as an appellate court or court of consultation with reference to courts of summary jurisdiction or quarter sessions and to county courts and other inferior courts of civil jurisdiction in the cases already indicated. The three divisions of the court are somewhat differently placed with reference to appeals.

In the chancery division (made up, in 1908, of six single judge courts) no appeals are heard except from subordinate officials (masters) of the court, or an occasional interference by *certiorari* or *prohibition* with a county court.

In the probate, divorce and admiralty division, besides the supervision which may be exercised by a single judge over the subordinate officers of the court (registrars), divisional courts (of two judges) hear appeals from decisions of the county court in admiralty causes, and appeals from justices in cases between husband and wife under the Summary Jurisdiction (Married Women) Act 1895, as amended by the Licensing Act 1902. In the first of these cases the appeal is on law only as in the case of other county court appeals; in the second, the procedure is by rehearing, or reconsideration of the facts as minuted in the court appealed from, and of the law there applied to these facts.

The bulk of the appellate work of the High Court is conducted in the king's bench division—which, as successor of the old court of king's bench in the duties of *custos morum* of the realm, still retains supervisory power over all inferior courts in all cases in which that supervision has not been transferred to the other divisions of the High Court or to the court of appeal, or to the court of criminal appeal.

The king's bench division exercises appellate jurisdiction in the following cases.

With respect to decisions of justices of the peace sitting at quarter sessions, or as a court of summary jurisdiction, except in the case above stated, the subject matter of appeal is for the most part of a criminal or quasi-criminal character, the civil jurisdiction of justices being comparatively limited. The appeal in such cases is as to matters of law only, the justices' decision on facts not being subject to review.

In the case of the courts above named, the appeal is brought by writ of *certiorari*, where the jurisdiction of quarter sessions to give the judgment challenged is denied *in toto*, or in some cases by writ of *habeas corpus*, where the appellant is in custody under an order of the court appealed from (Judicature Act 1894, § 2). The best example of this is the right of a fugitive criminal committed for extradition to challenge the legality of the decision of the committing magistrate by writ of *habeas corpus*. Save in cases of want of jurisdiction or refusal to exercise it, no appeal lies from quarter sessions except by consent of the court appealed from, which states the facts as ascertained by the inferior court, and invites the review of the superior court upon the questions of law raised by the facts as found.

Decisions of justices sitting in the exercise of summary jurisdiction are subject to review by a special case in which the justices state the facts found by them and their decision on the points of law, and invite the review of the appellate court on these grounds. Such cases for appeal are usually stated by consent of the justices, but in the event of their refusal the appellate court may order that a case shall be stated.

Decisions of justices in the exercise of summary jurisdiction may also be challenged by writ of *certiorari* as having been wholly outside their jurisdiction; and in such proceeding the appellate tribunal may review the evidence taken below so far as to ascertain whether the justices have by an erroneous finding of fact enabled themselves to assume a jurisdiction which upon the true facts they did not possess.

Where the decision appealed from is in a criminal cause or matter the decision of the High Court is final. Where it is in a civil matter a further appeal also lies to the court of appeal by leave of the High Court or of the court of appeal (Judicature Act 1873, § 45).

Appeals in criminal cases tried on indictment, criminal information or coroner's inquisition, stand on a different footing from other appeals.

For many years the question of criminal appeal in general had been a matter of great controversy. As early as 1844 a bill had been unsuccessfully introduced for the purpose of establishing appeal in criminal cases, and from that time up to 1906 nearly thirty bills were brought forward with the same object, but none succeeded in passing. In 1892 the question was referred to the council of judges and favourably reported upon by them. It may be remarked that England was practically the only civilized country in which there was no appeal in criminal cases. It is true there was an appeal on questions of law arising at the trial. But the procedure was intricate and technical, being either (1) by writ of error, issued by the consent of the attorney-general (expressed by his *fiat*), to review errors of law appearing in the record of the trial, or (2) by special case, stated by the judge presiding at the trial, with respect to a question of law raised at the trial. These appeals were heard by the king's bench division. Meanwhile there had been a considerable development of public opinion in favour of the establishment of criminal appeal, a development undoubtedly hastened by the report of a committee of inquiry in the case of Adolf Beck (1904), showing clearly that the home office was not a satisfactory tribunal of final appeal. In 1906 the lord chancellor (Lord Loreburn) introduced another criminal appeal bill, which passed the House of Lords, but was dropped in the House of Commons after a first reading. The next year the act (Criminal Appeal Act 1907), which was ultimately carried, was introduced into the House of Commons. By this act a court is established consisting of the lord chief justice and eight judges of the king's bench division, the jurisdiction of the court for crown cases reserved being transferred to the new court. The court to be duly constituted must consist of not less than three judges and of an uneven number of judges. The court may sit in two or more divisions if the lord chief justice so directs. Its sittings are held in London unless special directions are given by the lord chief justice that it shall sit at some other place. The opinion of the majority of those hearing the case determines any question before the court, and judgment is pronounced by the president (who is the lord chief justice or senior member present), unless in questions of law, when, if it is convenient that separate judgments should be pronounced by the members of the court, they may be so pronounced. The judgment of the court of criminal appeal is final, except where the decision involves a point of law of exceptional public importance, and a certificate must be obtained from the attorney-general to that effect. The court of criminal appeal is a superior court of record. An appeal may be made either against conviction or against sentence. A person convicted on indictment may appeal either on a question of law alone or of fact alone, or on a question of mixed law and fact. On a point of law a prisoner has an unqualified right of appeal, on a question of fact or of mixed law and fact there is a right of appeal only if leave be obtained from the court of criminal appeal or a certificate be granted by the judge who tried the prisoner that it is a fit case for appeal. The court is given a wide discretion as to whether a conviction may be sustained or set aside. The court may allow the appeal if they think that the verdict of the jury should be set aside because it is unreasonable, or because it cannot be supported having regard to the evidence, or that the judgment should be set aside on the ground of a wrong decision on any point of law, or that on any ground there was a miscarriage of justice. Power is given to the court to dismiss the appeal if they consider that no substantial miscarriage of justice has occurred, even though they are of opinion that the point raised in the appeal might be decided in favour of the appellant. The sentence passed at the trial may be quashed by the appeal court and such other sentence (whether more or less severe) warranted in law by the verdict substituted. Notice of appeal or notice of application for leave to appeal must be given within ten days of the date of conviction; where a conviction involves sentence of death or corporal punishment the sentence must not be executed until after the expiration of ten days, and, if notice of appeal is given, not until after the determination of the appeal or the final dismissal of the application for leave to appeal. The act gives the court power to order any witnesses who would have been compellable witnesses at the trial to attend and be examined before the court, and to receive the evidence, if tendered, of any witness who is a competent but not compellable witness. If any question arises on the appeal involving prolonged examination of documents or accounts or any scientific or local investigation, which the court thinks cannot be conveniently conducted before it, the matter may be referred to a special commissioner appointed by the court, and the court may act on the report of that commissioner if it thinks fit. An appellant is given the right to be present on the hearing of his appeal, if he desires it, except where the appeal is on some ground involving a question of law alone, but rules of court may provide for his presence in such a case, or the court may give him leave. The act requires shorthand notes to be taken of the proceedings at the trial of any person, who, if convicted, would have a right to appeal under the act. Nothing in the act affects the prerogative of mercy, and the home secretary may, if he thinks fit, at any time refer a case to the court of criminal appeal.

The Court of Appeal.—The court of appeal, constituted under the Judicature Acts, is one of the two permanent divisions of the Supreme Court of Judicature. As now constituted the court consists of *ex officio* members and five ordinary members, styled lords justices of appeal. The *ex officio* members are the lord chancellor, every person who has held that office, the lord chief justice, the master of the rolls, and the president of the probate, &c., division.

The ordinary business of the court is carried on by the lords justices under the presidency of the master of the rolls, who in 1881 ceased to be a judge of the High Court (Judicature Act 1881, § 2). The court usually sits in two divisions of three judges, but on occasion a third court can be formed, with the assistance of the other *ex officio* judges, in the absence of the ordinary judges from illness or public engagements, or to deal with arrears of business. The quorum for final appeals is three, for interlocutory appeals two judges.

The court of appeal has succeeded to the appellate authority exercised (1) in the case of equity and bankruptcy matters by the lord chancellor and the lords justices of appeal in chancery (Judicature Act 1873, § 18); (2) in the case of common law matters, by the court of exchequer chamber, as a court of error, and the superior courts of common law sitting to review the decisions of single judges of these courts sitting with or without a jury at first instance in civil actions; (3) in the case of divorce or probate causes by the full court of divorce (Judicature Act 1881, § 9); (4) in the case of admiralty causes by the king in council or the judicial committee of the privy council; (5) in the case of applications for new trials in jury actions by the king's bench division (Judicature Act 1890, § 1).

The court never had jurisdiction to hear an appeal in any criminal cause or matter, but was able to review by writ of error decisions of the king's bench division in such cases, unless the court for crown cases reserved had dealt with the question under the Crown Cases Act 1848. This procedure has been abolished by the Criminal Appeal Act 1907. Instances of procedure by writ of error were rare. Those best worth notice are the cases of the Tichborne claimant on his conviction of perjury, and the case of C. Bradlaugh on the sufficiency of the indictment against him for publishing the *Fruits of Philosophy*.

The appellate jurisdiction of the court as now exercised entitles the court to hear and determine (1) appeals from every judgment or decree of every division of the High Court in all civil cases in which such judgment is not declared final by statute; (2) applications for a new trial in civil cases tried in the king's bench division by judge and jury which, until 1890, were dealt with by two or more judges in that division; (3) appeals in matters of civil practice and procedure from decisions of a single judge in chambers, which, until 1894, were dealt with in a divisional court or by a judge in open court; (4) appeals from the chancery courts of Durham (Palatine Court of Durham Act 1889) and Lancaster (act of 1890, c. 23) and the Liverpool court of passage (*Anderson* v. *Dean*, 1894, 2 Q.B. 222), and on error in a record of the mayor's court of London (*Le Blanche* v. *Heaton Telegram Co.*, 1876, 1 Ex.D. 408); and from county courts under the Agricultural Holdings Acts and Workmen's Compensation Acts; (5) appeals on questions of law from decisions of the railway commissioners in England (Railway and Canal Traffic Act 1888).

The court of appeal also exercises the lunacy jurisdiction of the lord chancellor, but in regard to this the jurisdiction of the court is for the most part original and not appellate.

The jurisdiction of the court of appeal is excluded or limited in the following cases:—(1) judgments of the High Court—(*a*) where its jurisdiction is consultative only; (*b*) where there is an appeal to the High Court from an inferior court of civil jurisdiction; (*c*) where there is an appeal to the High Court from any court of person, unless in cases (*b*) and (*c*) leave be obtained of the court by which the order is made, or of the court of appeal; (2) orders of the High Court in registration and election cases except with the like leave; (3) orders made by consent of parties, or as to costs only which by law are left to the discretion of the court; (4) certain interlocutory orders mentioned in § 1 of the Supreme Court of Judicature (Procedure) Act 1894, except by leave of the judge appealed from or of the court of appeal (5) orders of the admiralty division in cases of prize, the appeal from which lies to His Majesty in Council; (6) where the decision of any court whose jurisdiction was transferred to the High Court is declared by statute to be final; (7) matters which from their nature were not appealable to any court before the Judicature Acts, or in which the court of appeal has no means of enforcing or executing its judgment. For example, it was held in the House of Lords, in *Cox* v. *Hakes*, 1890, 15 A.C. 506, that no appeal lies from the order of a judge discharging a prisoner under a writ of *habeas corpus*. "If," said Lord Herschell, "the contention of the respondent is to prevail, the statute has effected a grave constitutional change"; and later, "if" the High Court "has inherited the combined powers of the courts whose functions were transferred to it, but none of them had any jurisdiction or authority to review a discharge by a competent court under a writ of *habeas corpus*, or to enforce the arrest of one thus freed from custody . . . it seems to me to follow, that however wrong the court of appeal might think a discharge to have been, it would have been powerless to order a rearrest, or at least to enforce such an order."

The procedure of the court of appeal is regulated by the rules of the Supreme Court. A distinction is drawn between appeals from a final judgment or order (which, unless the parties consent to a smaller quorum, must be heard by three judges) and an appeal from an interlocutory order (which may be determined by two judges of the court of appeal).

In the case of appeals from a final or interlocutory "judgment," or from an order, including applications for a new trial, the appeal must be brought within three months from the time when the judgment or order is signed, entered or otherwise perfected, or in the case of refusal of an application from the date of refusal. The appeal is by notice of motion, which except in cases of application for a new trial, need not state the grounds of appeal. Fourteen clear days' notice of the motion must be given by the appellant to the other party, the respondent.

In the case of appeals from an interlocutory order, or from a final order, or from an order made in any matter which is not an action, or from an order made in chambers, the appeal must be brought within fourteen days by motion, of which four clear days' notice must be given by the appellant to all parties directly affected by the appeal. Controversies have arisen as to the meaning of the term "interlocutory," which (in the absence of any authoritative definition) the court of appeal settles as they arise. The test most generally accepted is that a judgment or order is final if, as made, it finally disposes of the rights of the parties in a manner equally conclusive between them. The court may by special leave allow appeals of either class to be brought after the time above limited. The respondent may by proper notice bring a cross appeal against any portion of the judgment or order made below with which he is dissatisfied. The court has power to order the appellant to find security for the costs of an appeal, if special circumstances, such as insolvency or poverty or foreign domicile or the like, make the giving of security desirable. The court of appeal "rehears" the case. Under ordinary circumstances it does not permit a new case to be set up inconsistent with the case as presented below; and it is content with the judges' notes, or a transcript of the evidence given below, and with a note or transcript of the judgment appealed from, but has power on special grounds to receive fresh evidence either *viva voce* or on affidavit. The court may call in for its assistance assessors who are experts on the matters of fact or science involved in the appeal, and usually does so in cases arising out of collisions at sea.

The court of appeal may make any order which it deems just as to the costs of the whole or any part of an appeal, except possibly in the case of certain appeals in matters on the crown side of the High Court, as to which some doubt still exists. In practice the costs follow the event, unless the court in a particular case makes an order to the contrary.

A decision of the court of appeal is final in appeals from the High Court in bankruptcy, unless leave be given to appeal to the House of Lords (§ 104, Bankruptcy Act 1883), and in divorce appeals, except where the decision either is upon the grant or refusal of a decree for dissolution or nullity of marriage, or for a declaration of legitimacy, or is upon any question of law on which the court gives leave to appeal (Supreme Court of Judicature Act 1881, § 9); but no further appeal to the House of Lords lies, even with leave of the court of appeal, on appeals from the High Court sitting as a court of appeal from county courts in bankruptcy. With these exceptions there is now a right of appeal from every order of the court of appeal to the House of Lords.

The House of Lords.—The House of Lords has for centuries been the court of last resort, and is still the final court of appeal from the chief courts in the United Kingdom. The origin of the appellate jurisdiction of the House of Lords was undoubtedly of that partly feudal and partly popular character already alluded to, which made the suitor seek from the high court of parliament the justice denied elsewhere in the baronial courts or by the king's judges. The lords exercised the mixed function of jurymen and judges, and, as in judgments on impeachment, might be influenced by private or party considerations, debating and dividing on the question before the House. A revolution was silently accomplished, however, by which the function of reviewing the decisions of the courts fell entirely to the lawyers raised to the peerage, while the unprofessional lords only attended to give the sanction of a quorum to the proceedings, and the House has always had the right to invoke the assistance of the judges of the superior courts to advise on the questions of law raised by an appeal. The letters and memoirs, so late as Queen Anne's reign, show that party or personal influence and persuasion were employed to procure votes on appeals, as they have been in later times on railway or other local bills. The last instance probably in which a strong division of opinion was manifested among the unprofessional lords was the celebrated Douglas cause in 1769, when the House was addressed by the dukes of Newcastle and Bedford, but was led by the authoritative opinion of Lord Mansfield on the effect of the evidence—an opinion which was treated rather as that of a political partisan than of a judge. The case of Daniel O'Connell and others, brought up on writ of error from the queen's bench in Ireland in 1844, may be said to have finally established the precedent that the judgments of the House of Lords were to be given solely by the law lords. On that occasion there was a difference of opinion among the law lords themselves. The judgment of the majority of the House was strongly against the political feeling of the government and of the peers as a body, while the law lords who carried the decision had been appointed by previous governments opposed in politics to the existing cabinet. But all these temptations to a party vote by the unprofessional members were resisted.

By § 20 of the act of 1873, the appellate jurisdiction of the House of Lords (so far as it affects England) was abolished, but this section was repealed by the Appellate Jurisdiction Act 1876. Under that act and an amending act of 1887, the appellate business of the House of Lords is conducted solely by the law lords, though lay peers may still sit (*Bradlaugh* v. *Clarke*, 1882, 8 App. Cas. 354). No appeal may be heard or determined except in the presence of not less than three of the following persons:—(1) the lord chancellor; (2) the lords of appeal, four of whom are appointed under the act from among persons who hold, or have held, high judicial office, or, at the date of appointment, have been in practice for not less than fifteen years as barristers in England or Ireland, or as advocates in Scotland; (3) such peers of parliament as hold, or have held, high judicial office. By "high judicial office" is meant the office of lord chancellor of Great Britain or Ireland, lord of appeal in ordinary, paid judge of the judicial committee or member of that committee, or judge of one of the superior courts of Great Britain or Ireland.

An appeal lies to the House of Lords (1) from any order or judgment of the court of appeal in England except as above stated; (2) from a judgment or order of any court in Scotland or Ireland from which error or an appeal to the House of Lords lay by common law or statute immediately before the 1st of November 1876. No appeals are heard from the decision of courts in criminal cases. The House of Lords has an indirect power by standing orders to admit appeals from Scotland or Ireland which under former law or practice could not be admitted (Appellate Jurisdiction Act 1876, § 12). The procedure on appeals is regulated by standing orders of the House. The proceedings are commenced by petition of appeal, which must be lodged with the clerk of the parliaments within one year from the date of the last judgment it appealed from. Security for costs (£200) must be given by bond or lodgment of the money, unless dispensed with by the House on the ground of poverty (act of 1893). Each party lodges a printed case signed and certified by counsel, containing a resumé of the matters to be discussed and of the contentions for or against the allowance of the appeal. The hearing is before three or more law lords, who may call in nautical assessors in admiralty cases (acts of 1893 and 1894). It is not public in the full sense of the term, as persons not concerned in the appeal can attend only by consent of the House. The House pronounces the judgment which in the opinion of the majority of the law lords should have been pronounced below, and has jurisdiction in the case of all appeals to give or refuse costs to the successful party. The costs of the appeal if given are taxed by the officers of the House. The jurisdiction as to costs does not directly arise under any statute (see *West Ham Guardians* v. *Bethnal Green Churchwardens*, 1896, A.C. 477).

Appeals to the King in Council.—The decisions of ecclesiastical courts when acting within the limits of their jurisdiction, and the decisions of courts in the king's dominions outside the United Kingdom, and of courts in foreign countries set up under the Foreign Jurisdiction Acts, cannot be dealt with by the

House of Lords or any of the ordinary tribunals of any part of the United Kingdom. The power once claimed by the court of king's bench in England to control the courts of Ireland has lapsed, and its power to intervene in colonial cases is limited to the grant of the writ of *habeas corpus* to a possession in which no court exists having power to issue that writ or one of like effect (Habeas Corpus Act 1862). As regards all British possessions, the appeal to the king in council is in its origin and nature like that of the provincials unto Caesar, and flows from the royal prerogative to admit appeals. With the growth of the British empire it has been found necessary to create a comparatively constant and stable tribunal to advise the king in the exercise of this prerogative. For this purpose the judicial committee of the privy council was created in 1833. In 1851, and again in 1870, it was reorganized, and by acts of 1876, 1887 and 1898 it received its present form. The committee consists of the president of the council, and of the following persons, if privy councillors—the lord chancellor and ex-chancellors of Great Britain and of Ireland, the four lords of appeal in ordinary, the lords justices of appeal in England or retired lords justices of appeal in England, and persons who hold or have held the office (*a*) of judge of the High Court of Justice or the court of appeal in England or Ireland, or of the court of session in Scotland; (*b*) any person who is or has been chief justice or a judge of the Supreme Court of Canada or of a superior court of any province of Canada, of any of the Australian states (except Fiji and Papua), or of New Zealand or the Cape of Good Hope or Natal. The number of persons of this class who may be members at once is limited to five (1895, c. 44); (*c*) provision is also made for the payment of two privy councillors who have been judges in India who attend the privy council.

Numerous as are the members of the committee, the quorum is three. One or more of the lords of appeal in ordinary usually attend at every hearing, but the composition of the committee is very fluctuating. Appeals from the British dominions abroad lie in criminal as well as civil matters. The right of appeal is regulated as to most possessions by order in council, and in some cases is limited by imperial or colonial statute. Appeals are on fact as well as on law, but the committee rarely if ever disturbs the concurrent judgments on facts of two colonial courts. In the case of admiralty appeals from colonial or consular courts, naval assessors may be called in. The committee also hears (with the aid of ecclesiastical assessors) appeals from ecclesiastical courts. The judgment of the committee is in the form of a report and advice to the king, which is read by one of the members sitting, and no indication is given as to whether the members present are unanimous. Effect is given to the advice by orders in council dismissing or allowing the appeal, and giving direction as to the payment of costs and as to the further proceedings to be taken in the colonial courts.

The procedure of the committee is on the same lines as that on appeals to the House of Lords; no well-arranged code of practice existed however up to the end of 1908, and new rules were then being proposed on the subject. The appeal is commenced by a petition of appeal, and by the giving of security for costs. In colonial appeals printed cases are lodged containing a summary of the contentions of the parties, and with this a printed copy of the record of the proceedings and documents used in the courts appealed from. The hearing is in the privy council chamber and is not public. When an appeal is called on, the counsel and parties are summoned into the chamber, and when the arguments are concluded they are requested to retire. The appeals to the king in council from colonial states having a federal constitution, like Canada and Australia, stand in an exceptional position. The act creating the Supreme Court of Canada purports to make the decision of that court final. But it is still the practice to admit by special leave a prerogative appeal from the court, and to entertain appeals from courts of the provinces of Canada direct to the king in council, without requiring them to go to the Supreme Court. The constitution of the Australian Commonwealth contemplates (§73) the possibility of restricting appeals to the king in council from the supreme courts of Australia, and sec. 74 forbids appeals to the king in council except by leave of the High Court of Australia from decision of that court on any question however arising as to the limits *inter se* of the constitutional powers of the commonwealth and those of any state or states, or as to the limits *inter se* of the constitutional powers of any two or more states. The exact effect of these enactments and of Australian legislation under § 73 is a matter of controversy.

Scotland.—In Scotland the ordinary appellate tribunal for decisions of inferior courts and of the lords ordinary is the court of session, which for appellate purposes sits in two divisions. Appeals from inferior tribunals in criminal cases go before the judges of the court of session sitting in the High Court of Justiciary. The court of session was in its original constitution a committee of parliament for the performance of its judicial functions, and an appeal to parliament was consequently anomalous. In the reign of Charles II., however, the courts grew so intolerably corrupt that a determined effort was made to have their judgments overturned, by an appeal which was strictly of the old character of a cry for protection against flagrant injustice. It was called a "protest for remeid of law," and was inserted as one of the national claims in the Petition of Right at the revolution. The treaty of union is silent as to appeals, though definitely excluding the right of English courts to interfere with Scottish courts or cases. The House of Lords has since the Union acted without challenge as the final appellate tribunal for Scotland in civil causes; but has always declined jurisdiction in Scottish criminal cases.

Ireland.—The Supreme Court of Judicature (Ireland) Acts have remodelled the courts and appellate system of Ireland on the same lines as those of England. The High Court of Justice in Ireland now consists of two divisions only, the chancery division, which has little or no appellate functions, and the king's bench division, which has for Ireland substantially the same power of reviewing and correcting the decisions of inferior courts as has the corresponding court in England. To this there is one exception, that appeals from a county court in Ireland may be heard on circuit by a single judge of assize. In Ireland there is also a court of appeal, created in 1877, whose jurisdiction and procedure follow the same lines as that of the English court of appeal.

France.—The court of last resort in France for all cases, whether civil or criminal (*en matière criminelle, correctionnelle et de police*), is the *cour de cassation*, which sits in Paris. It is a court of error for the review of all judgments of tribunals of last resort (except *juges de paix* in certain cases), and for the transfer of causes from one court to another when justice so demands, and to determine conflicts of jurisdiction (Law 1 Dec. 1790). Ordinarily it is confined to errors of law and procedure, but where evidence not available below is brought before the court, it may send the case back for retrial or give the appropriate final judgment, as in the case of Dreyfus (1906). It also hears appeals from courts martial.

Next to the *cour de cassation* are the courts of appeal, which have jurisdiction to hear appeals (1) in civil matters from courts of first instance, *juges de paix*, and where the amount in dispute exceeds £60 from commercial courts, *tribunaux de commerce* (Civil Proc. Code, arts. 443-475); (2) in criminal matters from *tribunaux correctionnels* (Com. Proc. Code, arts. 202-235). The appeal is both on fact and on law, and applies to interlocutory or preparatory as well as to final judgments.

Spain.—In Spain the jurisdiction and procedure with reference to appeals is on the same lines as in France. As regards civil matters it is regulated by title 21 of the Civil Procedure Code. The appeal to the supreme court is for the most part on questions of law (*por infraccion de ley o de doctrina*); but the court has also power to review judgments on materials not available at the first hearing (arts. 1796, 1801).

British India.—In British India complete and systematic provision is made for appeals both in civil and in criminal cases by the Procedure Codes (Civil of 1882, with subsequent amendments, and Criminal of 1898), and also to some extent by the charters of the high courts of Calcutta, Bombay and Madras (see Ilbert, *Government of India*, Oxford, 1898, p. 137). In addition, the decisions of subordinate tribunals may be revised by a superior tribunal *proprio motu*, or reviewed in a proper case by the tribunal which has given them; and provision is made for the consultation of a superior by an inferior tribunal in cases of legal difficulty. The policy of admitting so many appeals has been criticized. But with an enormous population which has no representative institutions it has been deemed wise to provide ample means of correcting judicial errors at the instance not only of the aggrieved person but also at the instance of the supervising judicial authorities, as a means of ensuring regularity and propriety in the conduct of judicial business by subordinate judges in out-of-the-way districts.

Civil Appeals.—(1) Except where otherwise expressly provided by the Civil Procedure Code, or by any other law for the time being in force, an appeal lies from the whole or part of any decree, whether made *ex parte* or *inter partes*, of a court exercising original jurisdiction (Civil Procedure Code, § 540). By "decree" is meant the final expression of an adjudication upon a right claimed or defence set up in a civil court, when such adjudication, so far as regards the court expressing it, decides the suit (§ 2). The appeal is both on facts and on law. The procedure on the appeal is prescribed by c. 41 of the Civil Procedure Code, and the directions of the code deal even with the language of the judgment on appeal and the matters to be stated therein. (2) Decrees passed on an appeal to any court in India subordinate to a High Court are as a general rule subject to appeal to the High Court on the grounds (*a*) that they are contrary to a specified law, or usage having the force of law; (*b*) that they have failed to determine some material issue of law, or usage having the force of law; (*c*) of substantial error or defect in procedure prescribed by the code or other law, which might possibly have produced error or defect in the decision of the case upon the merits (§ 584). The procedure on these appeals is regulated by c. 42 of the Civil Procedure Code. (3) Appeals from orders which do not fall within the definition of decrees are allowed in the cases specified in § 588 of the code. The procedure with respect to these appeals is on the same lines as that on appeals against decrees (§ 590). Provision is made (by c. 44) for allowing appeals *in forma pauperis* after certain preliminary inquiries. In the High Courts appeals lie from the decision of one judge to two or more judges of the High Court, whose decision has effect as a judgment of the full court. Appeals, in civil cases, from the courts of India to the king in council are regulated by c. 45 of the Civil Procedure Code. The appealable amount is for most cases Rs.10,000 or a claim or question as to property of like amount.

Besides the provisions stated as to appeals, Indian courts have power in certain contingencies to review their own decisions (§ 623). An inferior court may also refer cases of difficulty to the High Court on a statement of the facts as found in the referring court and of the opinion thereon of that court (§§ 617-620); and in cases in which no appeal lies to the High Court, that court may call for the record of any case in which the court below appears to have acted without jurisdiction or failed to exercise its jurisdiction, or to have exercised its jurisdiction illegally or with material illegality (§ 622).

Criminal Matters.—Criminal jurisdiction in India is exercised by magistrates of the first, second and third class, by sessions courts, and the high or chief courts of the presidencies or provinces (Criminal Procedure Code of 1898). The higher judges in a district have the power of revising those decisions which are not absolutely summary of the judges of the classes below them in the same district; *i.e.* the sessions judge can revise the decisions of a first-class magistrate, and the High Court those of a sessions judge (§ 435). Inferior tribunals can also refer questions of law to the High Court (§§ 432, 433); and where a sentence of death is passed, or a sessions judge differs from the jury (§ 307), the matter must be referred to the High Court. On matters of reference or revision the parties have no right to be heard.

Provision is also made for appeals by c. 31 of the Code. Appeals from second- or third-class magistrates are dealt with by the district (first-class) magistrate (§ 407). Persons convicted on trial by assistant sessions judges or first-class magistrates, except in cases where the punishment is very small, have an appeal to the sessions judge (§§ 408, 413). A person convicted on trial by the sessions judge has an appeal to the High Court (§ 410), but where he has pleaded guilty the only point on which appeal is open is the legality or extent of sentence (§ 412). Special provision is made as to appeals by persons born in Europe (whether British subjects or not) and Americans (§§ 408, 415, and c. 33).

In criminal cases there is a right of appeal to the king in council in certain cases provided for by the charters of the chartered high courts (see Ilbert, *Government of India*, Oxford, 1898, p. 137).

An appeal also lies in certain cases from the courts of British officers in feudatory states of India to a high court in India, and from the courts of Aden and Zanzibar and British East Africa to the High Court of Bombay. Appeals do not lie from the courts of native states to British courts in India, though in some cases there is an appeal of a political rather than judicial nature from the judicial tribunals of feudatory states; *e.g.* in the case of Kathiawar (*Hemchand Derchand* v. *Azam Sakarlal*; 1906. L.R. A.C. 212).

Canada.—In Canada each province has the regulation of its own courts of justice. In Ontario the judiciary are organized, under the Provincial Judicature Acts, in much the same manner as in England; and the review of decisions of inferior courts (by appeal or other proceedings based on English practice) is in the hands of the High Court of Justice, subject to appeal to the provincial court of appeal. In Quebec the highest court (king's bench), besides its original jurisdiction, has appellate jurisdiction over the superior court (see Quebec Civil Procedure Code, art. 1114 *et seq.*). The jurisdiction is exercised by writ of error or by appeal, according to the nature of the decision appealed from. The judges of the superior court have also, under art. 494, power to review before three judges decisions of a judge of that court or of a circuit court (arts. 494-504). Nova Scotia, New Brunswick, Manitoba and British Columbia have supreme courts with appellate authority over decisions of single judges of the court and over inferior tribunals in the province. Appeals lie from the highest courts of each province, in civil matters, to the Supreme Court of Canada, or to the king in council in cases falling within the orders in council applying to each province, but in criminal matters to the king in council. From the Supreme Court of Canada no appeal lies as of right to the king in council (Dominion Act 1875, 38 Vic. c. 11, § 47), and the royal prerogative of granting special leave to appeal is sparingly exercised. The principles on which the judicial committee acts in advising for or against the grant of special leave in civil cases are stated in *Daily Telegraph Newspaper Co.* v. *M'Laughlin*, 1904, L.R. A.C. 776. It is, however, as before, quite common for appeals to be brought direct to the privy council from the provincial courts without resort to the Dominion court (see Wheeler, *Privy Council Law*, p. 955).

Australia.—Each of the states of the Australian Commonwealth has its own supreme court. The Commonwealth parliament constituted in 1903 a High Court for Australia, which, besides its original federal jurisdiction, is also a court of appeal from the supreme courts of the constitutional states, or from any state court from which an appeal lay to the king in council at the establishment of the Commonwealth. The jurisdiction of the court is defined by the Judiciary Act of 1903, by which it is created. The right of appeal is given both as to criminal and civil matters.

South Africa.—In Cape Colony and Natal the appellate courts are the supreme courts, subject to further appeal in certain cases to the king in council. The superior courts of Cape Colony are empowered to review the proceedings of all inferior courts in the colony and its dependencies in cases where no appeal lies. There was for a time an appeal from the High Court of Orange

River Colony to the supreme court of the Transvaal, and from that court (whether acting for its own colony or on appeal from the Orange Colony), an appeal to the king in council. In other colonies the provisions as to appeal follow more or less closely the lines of English law and procedure as to appeals, and in all cases the ultimate appeal is to the king in council.

United States.—In the American courts the term "appeal" covers (1) a removal of a cause to a higher court for retrial on all the questions of law or fact involved, or (2) taking up points of law only by proceedings in error, for revision by a higher court. Decrees in admiralty, bankruptcy and equity, in the federal courts, are the subjects of an appeal; judgments in actions at law, of a writ of error. On an equity appeal the evidence taken at the original hearing is reported at length to the appellate court, and it has the right to review the conclusions of fact reached by the court below and come to different ones. This, however, is seldom done, the appeal being almost always decided on points of law based upon the conclusions of fact reached in the original hearing. In admiralty appeals the conclusions of fact reached by the trial court are specially set forth, and are final.

"Appeal" in many of the states is the general term for reviewing any judgment of an inferior court on assignments of error. It is also often used to signify a mode of reviewing proceedings of municipal bodies, affecting the interests of particular persons, *e.g.* in matters of licences or assessments.

In criminal prosecutions an appeal, or writ of error on points of law, is almost everywhere allowed by statute to the defendant, and often to the state. (*United States* v. *Sanges*, 144 United States Reports, 310; *State* v. *Lee*, 65 Connecticut Reports, 265.)

By the constitution of the United States the Supreme Court is vested with "appellate jurisdiction, both as to law and fact, with such exceptions, and under such regulations, as the Congress shall make." This provision is held not to create but only to authorize the creation of the jurisdiction. In the words of Chancellor Kent, "If congress had not provided any rule to regulate the proceedings in appeal, the court could not exercise an appellate jurisdiction: and, if a rule be provided, the court could not depart from it." In pursuance of this principle, the Supreme Court decided in *Clarke* v. *Bazadone* that a writ of error did not lie to that court from a court of the United States territory north-west of the Ohio, because the act had not authorized an appeal or writ of error from such a court (*Commentaries*, i. 324). The appellate jurisdiction of the court is now regulated by title 13 chap. ii. of the Revised Statutes of the United States (1873), §§ 690-710; and by the acts enumerated at p. 901 of the Revised Statutes, United States, 1873 to 1891. Under these statutes the Supreme Court may entertain appeals from the highest court of a state of the Union, but only (1) where the state court has decided against the validity of a treaty or statute of the United States, or of an authority exercised under the United States; (2) where a state court has affirmed the validity of a statute, or of an authority exercised which has been challenged on the ground of repugnance to the constitution, laws or treaties of the United States; (3) where the state court has decided against the existence of a title, right, privilege, or immunity claimed or set up under the constitution of, or under any statute, treaty, commission or authority of the United States.

The appeal from state courts is by writ of error, *i.e.* on law only; and applies as well in criminal as in civil cases. The Supreme Court will not act unless the federal question was raised in the court below (*Chicago U. S. Mail Co.* v. *McGuire*, 1904, 196, U.S. 128). The circuit court of appeals, established in 1891, deals with appeals from the district and circuit courts of the United States, except where other provision is made, *e.g.* where the jurisdiction of the court appealed from is in question; in prize causes and convictions of capital crimes (U.S. Statutes, 1801, c. 54, § 5); in cases involving the construction or application of the constitution; in cases arising in district or circuit courts involving the constitutional questions already stated as subject of appeal from state courts.

The review by the circuit court of appeals is effected by appeal or by writ of error, and its decision is final, with certain exceptions but with power to certify cases to the Supreme Court for instructions (1891, c. 511, § 6).

The Supreme Court hears appeals from the circuit court of appeals within the limits above stated, and appeals from the circuit and district courts in cases in which an appeal does not lie to the circuit court of appeals, and has power to issue a *certiorari* to transfer a case from the circuit court of Appeals. (W. F. C.)

APPEARANCE (from Lat. *apparere*, to appear), in law, the coming into court of either of the parties to a suit; the formal act by which a defendant submits himself to the jurisdiction of the court. The defendant in an action in the High Court of England enters his appearance to the writ of summons by delivering, either at the central office of the Supreme Court, or a district registry, a written memorandum either giving his solicitor's name or stating that he defends in person. He must also give notice to the plaintiff of his appearance, which ought, according to the time limited by the writ, to be within eight days after service; a defendant may, however, appear any time before judgment. The *Rules of the Supreme Court*, orders xii. and xiii., regulate the procedure with respect to the entering of an appearance, the giving of notice, the limit of time, the setting aside and the general effect of default of appearance. In county courts there is no appearance other than the coming into court of the parties to the suit. In criminal cases the accused appears in person. In civil cases infants appear by their guardians *ad litem*; lunatics by their committee; companies by a solicitor; friendly societies by the trustee or other officer appointed to sue or be sued on behalf thereof.

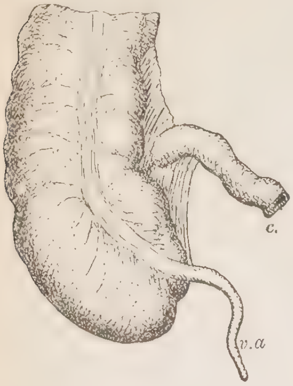
APPENDICITIS, the modern medical term for inflammation of that part of the intestine which is known as the "appendix." Though not a new disease, there can be no doubt that it is far commoner than it used to be, though the explanation of this increased frequency is not yet forthcoming. Amongst the virulent micro-organisms associated with the disease no one specific germ has hitherto been found. It may be remarked that the theories that influenza, or the use of preserved foods, may be connected with the disease as cause and effect, have supporters. Sometimes the disease is due to the impaction of a pin, shot-corn, tooth-brush bristle, or fish-bone in the appendix, which has set up inflammation and ulceration. In many cases a patch of mortification with perforation of the appendix is caused by the presence of a hard faecal concretion, or "stercolith," which from its size, shape and appearance has been mistaken by a casual observer for a date-stone or cherry-stone.

Apart from the fact of the more frequent occurrence of appendicitis, the disease is now better understood and more promptly recognized. It was formerly included under the term "perityphlitis"—that is, inflammation connected with the caecum or *blind* portion of the large intestine. But in the vast majority of cases the inflammation begins in the appendix, not in the intestine proper. It is apt to extend and set up a localized peritonitis, which in the worst cases may become general.

Appendicitis is more often met with in the young than the old, and in boys rather than girls; and in some families there is a strange predisposition towards it. It is often started by a chill, or by over-exertion, and sometimes the attack follows a blow or strain, or some other direct injury, after which the virulent micro-organisms seize on the mucous membrane and involve the appendix in acute inflammation.

The appendix is a narrow tube, about the size of a goose-quill, with an average length of 3 in. It terminates in a blunt point, and from its worm-like shape is called *vermiformis*. It is an appendage of the large intestine, into which it opens, and is regarded as the degenerate relic, surviving in man and other mammals, of an earlier form of intestine. Foreign bodies passing down the intestinal canal may find their way into the appendix and lodge there. Frequently the diseased appendix is found blocked by hard faeces or undigested particles of food, such as nuts, fibrous vegetable matter, and other imperfectly masticated substances; inflammation may occur, however, without the presence of any impacted material. The appendix may be twisted, bent, or otherwise strangulated, or its orifice may be blocked, so that the tube is distended with mucus which can find no outlet; or ulceration of tuberculous or malignant origin may occur. Inflammation started in the appendix is liable to spread to the peritoneum, and herein lies the gravity of the affection and the indication for treatment. The symptoms vary from "indigestion," and slight pain and sickness, which pass off in a few short days, to an exceedingly violent illness, which may cause death in a few hours. Pain is usually first felt in the belly, low down on the right side or across the region of the navel; sometimes, however, it is diffuse, and at other times it is scarcely complained of. There is some fever, the temperature rising to 101° or 102° F., with nausea, and very likely with vomiting. The abdomen is tender to pressure, and the tenderness may be referred to the spot mentioned above. Some swelling may also be made out in that region. The attack may last for two, three or four days, and then subside. There are, however, other cases less well defined, in which the mischief pursues a latent course, producing little more than a vague abdominal uneasiness, until it suddenly advances into a violent stage. In some chronic cases the trouble continues, on and off, for months or even for years.

On paper it is easy to arrange cases of appendicitis into three classes—catarrhal, ulcerative and mortifying—but in actual practice this is neither desirable nor possible. Such classification is based upon the symptoms, and in appendicitis symptoms may be actually misleading. The three conditions to which the surgeon chiefly looks for guidance are the aspect of the patient, the rate of his pulse and the degree of fever as shown by the thermometer. But in certain cases of appendicitis, though the surgeon knows intuitively, or, at least, suspects, that the general condition is extremely serious, the patient looks fairly well and says that he is not in pain, his pulse-rate being but little quickened and his temperature being but slightly above normal. Nevertheless, when the surgeon has opened the belly in the appendix region, he finds the appendix swollen, perforated and mortified, and lying in a stinking abscess, whilst inflammation has already spread to the neighbouring coils of intestine. Unfortunately, the surgeon can no more tell what he is going to find at his operation in some of these cases than he can foretell the course which any particular case is going to run.



Large Intestine showing Vermiform Appendix (*v.a.*) and Caecum (*c*).

We may most usefully give here the symptoms as they are likely to be found in an ordinary case of appendicitis, and as they may be observed by one who is not a member of the medical profession, in a way that may prove helpful to him when circumstances have awakened his interest in the disease.

The case taken shall be that of a boy at school, for, as already stated, boys are more prone to the disease than girls. The boy has had, may be, occasional attacks of "indigestion" which have duly passed away under the influence of aperient medicines, and, being heated at play, he has sat down upon the cold ground. Or he has got wet through or over-tired during a long walk or ride. At any rate, his vital powers have been suddenly lowered, and the micro-organisms teeming in his bowel have seized upon the lining membrane of the appendix. He feels out of sorts, and if he manages to eat a meal he very likely vomits it soon after, for the whole nervous system of his abdomen is disturbed by the local inflammation. The act of vomiting gives slight relief, however, and probably he begins to complain of pains in his head as well as in his abdomen, and possibly he has an attack of shivering—the result of disturbance of his general nervous system. By this time he may be attacked with intense pain in the part of his abdomen a little above the middle of the right groin, and at that spot there may be a tenderness, and a feeling of resistance may be made out by the gentle pressure of the finger. In order to relax the pressure upon the tender area he probably lies with his right thigh slightly bent. By this time he may look ill, his face being slightly flushed, or pale and anxious. If the clinical thermometer is placed under his tongue, the index may rise a degree or two, perhaps several degrees, above normal, and his pulse may be quickened to 90 or 100 beats a minute. Perhaps it is a good deal quicker than this. Later, the skin of the lower part of the right side of the abdomen may be flushed or reddened.

This clinical picture leaves no room for doubt. The boy has an attack of acute septic inflammation of his appendix. Let it be that the symptoms have come on quickly, and that the affection is not more than ten or twelve hours old; no one can tell precisely what course the disease is going to run. It may be that with rest in bed, constant fomentations, and absolute starvation, the inflammation will subside; but it is just as likely that in spite of this judicious treatment the symptoms will go from bad to worse, and that a belated operation will fail to rescue the boy from a general peritonitis which may end fatally. But at present, so far as one can tell, the disease is still limited to the appendix. And what, at this moment, is the best line of treatment? Some practitioners would answer—"Let the acute attack settle down,and then, after a week or ten days, when everything is quiet, remove the appendix, for statistics show that when the operation is done in the quiet interval the results are extremely favourable, whilst if it is done in the acute stage the outlook is not so bright." This is quite right. But one cannot be sure that the "quiet interval" will ever arrive. The case in question may be one of those which rapidly go on from bad to worse, and mortification and perforation of the appendix having taken place over some hard faecal concretion, general peritonitis is inevitable, with distension of the bowel and hopeless blood-poisoning. If it were certain that the attack of appendicitis would subside and become quiescent, it would be wise to wait. But it too often happens that the first attack is, indeed, the last. Acute appendicitis is one thing; relapsing appendicitis is another. The latter condition is very manageable.

Inasmuch, then, as it is impossible to know what direction the disease will take, whether to quiescence or to disaster, it is for the greatest good in the greatest number of cases that the inflamed appendix be removed by operation whilst the disease is still limited to the appendix. It is highly probable that if every available hospital surgeon were asked if he had ever had cause to regret having advised early operation in a case of appendicitis the answer would be "No"; on the other hand, every surgeon would be able to recall cases in which delay had been followed by disaster—which an early resort to operation would, in all probability, have prevented.

If the disease is going to assume the severe form, all the symptoms, as a rule, increase in severity. The facial expression becomes more anxious, and the accumulation of gas in the paralysed intestine causes an increase in the abdominal distension, so that the patient lies with his knees drawn up. The vomiting continues. The pulse quickens to 120 or 140 a minute, and the temperature rises, perhaps to 104° F. The swelling and tenderness increase on the right side of the abdomen, and if the abscess does not find escape externally it probably bursts into the general peritoneal cavity, and the patient becomes bathed in profuse sweat, the result of blood-poisoning. Death is likely to follow within two days, the result of blood-poisoning and exhaustion.

Catarrhal and Relapsing Appendicitis.—Some cases of appendicitis run a mild course, giving rise to no worse symptoms, perhaps, than those of "indigestion" and nausea, with a feeling of general discomfort in the abdomen, and, probably, some local tenderness. The attack may be preceded or accompanied by constipation. The administration of a mild aperient or an enema, rest, starvation and fomentation will probably put matters right again—at any rate for a time.

This form of the disease may be due to the presence of "bolted," unchewed or indigestible food in that part of the large intestine into which the appendix opens. And these mild recurrent attacks may sometimes be got rid of altogether by having the teeth put in order, and by inducing the individual to choose his food with discretion, to chew it carefully, to take his meals regularly and to eat slowly.

Obviously, these attacks are very different from those of the acute septic form of the disease described above, though there is no telling that one of them may not develop into the acute form. Some of the mild attacks are due to a kink in the appendix, or to some other condition which temporarily prevents the secretions of the appendix from finding their way into the large intestine. Others of them are caused by a passing catarrhal inflammation of the lining of the appendix and have a distant resemblance to a recurring "sore throat."

After undergoing one or two of these mild attacks the patient would be well advised to have his appendix removed when it has once more got into the "quiet stage." Experience abundantly shows that the operation can then be performed with but slight disturbance of the patient, and with the smallest possible amount of risk. And until his vulnerable appendix has been removed he is never safe.

In the *chronic* form of the disease though the patient is never desperately ill he is never quite well. He has pains and discomfort in the abdomen, with slight tenderness and nausea, with "indigestion," as he may call it. And as one can never tell when the smouldering inflammation may break out into conflagration, he is well advised to submit himself to operation without further delay. To carry about a diseased appendix is to run the constant risk of being laid up at a time most inconvenient, as when travelling or when staying in some place where skilled assistance is far distant or absolutely unobtainable. But having made up his mind that the appendix had better be removed, the patient can choose time, place and surgeon, and, having undergone a week's careful training for the ordeal, can safely count on being back at work again in a month or six weeks' time.

As regards *treatment*, the greatest safety consists in the prompt removal of the inflamed appendix, and statistics show that if the operation can be done in the first or second day of even an acute attack, the result is generally favourable—that is to say, if the appendix can be removed whilst the disease is still shut up within its tissues. But in some cases ulceration and perforation, or mortification, may have taken place over a hard faecal concretion within the first twenty-four or forty-eight hours, and, the septic germs having been let loose, peritonitis may have already set in, and operation may be followed by disappointment. Still, if the case had been left unoperated on, no other result could have been expected. It was not to the operation, but to the intensely acute disease that the calamity must be attributed.

Nature is marvellously clever in some of these cases in shutting off the area of the disease by glueing together the neighbouring coils of intestine, the limited local peritonitis causing the tissues to build themselves into a wall which securely shuts in the abscess cavity. But in other cases she seems helpless, no barrier being formed for limiting the area of disturbance. In such a case it is inevitable that disappointment must result from the surgeon delaying operation in the hope that delimitation might take place. And when at last he makes his incision he sees that the disease has had so long a start that his own chance of success is but a poor one. In a less severe attack, under the influence of rest, starvation and fomentation, and in cases of chronic and of relapsing disease, the surgeon may watch and wait and choose his own time for operating. But when the symptoms are steadily increasing in severity he should urge an immediate incision. When, as often happens, the inflammation begins suddenly and severely, and, under the influence of treatment, steadily quiets down, the surgeon does well to delay operation. But in a fortnight or so, when everything has become once more quiet, he will urge the removal of the appendix, for this one attack is more than likely to be the forerunner of other attacks if the diseased appendix is left.

The most serious cases are those in which the aspect, the pulse, and the temperature of the patient fail to give warning of a very advanced state of disease. Every surgeon of experience has met with cases in which, though there is nothing pointing to the fact that the patient is on the brink of a disaster, the operation has shown that the appendix is mortified, and that it is surrounded with abundant foul matter. It is then that he regrets not having operated a day or two earlier. Consequently it is a good rule to operate in all doubtful cases. In cases in which one happens to know that previous attacks have passed off under palliative treatment, there is no need for immediate operation; the quiet interval may be safely waited for. But in cases in which there is "no history," and in which the surgeon has nothing to guide him, the greatest safety is in prompt operation.

If an attack of acute appendicitis is allowed to take its course unoperated on, abscess forms in the peritoneal cavity in the region of the appendix, but if already inflammation has happily glued the intestines together around that area, the pus is confined within definite limits. But as the abscess increases in size the demand for its evacuation becomes urgent. The pus, under the influence of a natural law, seeks its escape by the path of least resistance; sometimes this is into the intestine, and occasionally into the bladder. The most satisfactory course which it can take is through the wall of the abdomen and out above the right groin. As it is making its way in this direction the skin over that part becomes red, swollen, hot and tender, and the tissues between it and the skin become swollen and brawny. Rarely is *fluctuation* to be made out until the pus has worked its way close to the surface. Later, ulceration takes place in the undermined skin, and the stinking contents of the abscess escape, greatly to the relief of the patient. But long before this could happen the surgeon should have made an incision through the inflamed tissues in order to give nature some greatly needed help. For in many cases she allows the pus blindly to discover that the course of least resistance is not towards the surface of the abdomen but through the inflammatory barrier formed by the adherent coils of bowel, and so into the general peritoneal cavity. This unfortunate issue may give temporary relief to the patient, so that he says that he feels much better, and that his pain has nearly gone. But though his temperature may fall, his pulse is apt to quicken—an ominous coupling of symptoms; the paralysed bowels become further distended, so that the lungs are pressed upon and breathing is embarrassed; hiccough comes on; and whether operation is now resorted to or not, a fatal end is highly probable. In other cases, the escaping pus finds its way up towards the liver and forms an abscess below the base of the lungs.

If operation is performed when appendicitis has run on to the formation of abscess, and the diseased appendix presents itself, it should of course be removed; but if it does not present itself the surgeon should abstain from making a determined search for it, as in so doing he may break down the barrier which nature has provided, and thus himself become the means of spreading a septic peritonitis. Nor should he attempt to make clean the foul abscess cavity. All that he should do is to provide for efficient drainage. A large proportion of these cases do extremely well with incision and drainage, and in the subsequent healing of the cavity the wreckage of the appendix either undergoes disintegration or is rendered harmless for further anxiety.

In some cases, however, the damaged appendix remains as a smouldering ember, ready at any moment to cause further conflagration. This is made manifest by lingering pains, and by tenderness and warnings after the abscess has healed, and the patient will be well advised to have what is left of the appendix removed by operation at a time of quiescence. The operation, however, may turn out to be a very difficult one. Sometimes the wound by which the abscess has been evacuated, by nature or by art, refuses to heal completely, a little discharge of a faecal odour continuing to escape. The small wound leads into a faecal fistula, and a bent probe passed along it would probably find its way into the bowel. The wound is likely to close of itself in due course; but if after many weeks of disappointment it still continues to discharge, the surgeon may advise an operation for its obliteration.

It occasionally happens that after operation the scar of the wound in the abdominal wall yields under the pressure from within, and a bulging of the intestines beneath the skin occurs. This is called a *ventral hernia*, and if the patient cannot be made comfortable by wearing a truss with a large flat pad, an operation may be deemed advisable.

If, in a case of appendicitis, for one reason or another operation is to be delayed, what treatment should be resorted to? The patient should be put to bed with his knees resting over a pillow, and a large fomentation under oil silk should be laid over the lower part of the abdomen. No food should be given beyond an occasional sip of hot water. Purgatives should not be administered, as this would be to set in movement an inflamed piece of bowel. If the case is not acute, a large enema of soap and water with turpentine may be given, or, possibly, a dose of castor oil by the mouth. As a rule, however, it is unwise to set the bowels in vigorous action until the diseased appendix has been removed. No opium should be given.

Acute intestinal obstruction, cancer of the intestine, inflammation of the ovary, typhoid fever and renal and gallstone colic, are affections which are apt to be mistaken for appendicitis. The first of these resembles it most closely, and diagnosis is sometimes impossible without resort to operation. And it is a fortunate thing that, when error of diagnosis has been made, the operation which was designed for dealing with an inflamed appendix may be directed with equal advantage to the morbid condition which is found on opening the abdomen. In typhoid fever the characteristic temperature, the general condition of the patient, and the presence of delirium are differentiating signs of importance; in renal and gallstone colic the situation and the more paroxysmal character of the pain are usually distinctive. (E. O.*)

APPENDICULATA, a zoological name introduced by E. Ray Lankester (preface to the English edition of C. Gegenbaur's *Comparative Anatomy*), and employed by the same writer in the 9th edition of this encyclopaedia (article "Zoology") to denote the eighth phylum, or major division, of coelomate animals. The animals thus associated, the Rotifera, Chaetopoda and Arthropoda, are composed of a larger or smaller number of hollow rings, each ring possessing typically a pair of hollow lateral appendages, moved by intrinsic muscles and penetrated by blood-spaces.

APPENDINI, FRANCESCO MARIA (1768–1837), Italian historian and philologist, was born at Poirino, near Turin, on the 4th of November 1768. Educated at Rome, he took orders and was sent to Ragusa, where he was appointed professor of rhetoric. When the French seized Ragusa, Napoleon placed Appendini at the head of the Ragusan academy. After the Austrian occupation he was appointed principal of a college at Zara, where he died in 1837. Appendini's chief work was his *Notizie Istorico-critiche sulle Antichità, Storia, e Letteratura dei Ragusci* (1802–1803).

APPENZELL, one of the cantons of north-east Switzerland, entirely surrounded by the canton of St Gall; both were formed out of the dominions of the prince abbots of St Gall, whence the name Appenzell (*abbatis cella*). It is an alpine region, particularly in its south portion, where rises the Alpstein limestone range (culminating in the Säntis, 8216 ft.), though towards the north the surface is composed rather of green hills, separating green hollows in which nestle neat villages and small towns. It is mainly watered by two streams that descend from the Säntis, the Urnäsch joining the Sitter (on which is the capital, Appenzell), which later flows into the Thur. There are light railways from Appenzell to St Gall either ($12\frac{1}{2}$ m.) past Gais or ($20\frac{1}{2}$ m.) past Herisau, as well as lines from St Gall to Trogen (6 m.) and from Rorschach to Heiden ($4\frac{1}{4}$ m.). Since 1597 it has been divided, for religious reasons, into two half-cantons, which are quite independent of each other, and differ in many points

The north and west portion or *Ausser Rhoden* has a total area of 93·6 sq. m. (of which 90·6 are classed as "productive"; forests covering 22·5 sq. m. and glaciers ·038 sq. m.), with a population (in 1900) of 55,281, mainly German-speaking, and containing 49,797 Protestants as against 5418 Romanists. Its political capital is Trogen (*q.v.*), though the largest town is Herisau (*q.v.*), while Teufen has 4595 inhabitants, and Heiden (3745 inhabitants) in the north-east corner is the most frequented of the many goats' whey cure resorts for which the entire canton is famous (Urnäsch and Gais are also in Ausser Rhoden). This half-canton is divided into three administrative districts, comprising twenty communes, and is mainly industrial, the manufacture of cotton goods, muslins, and embroidery being very flourishing. It sends one member (elected by the *Landsgemeinde*) to the federal *Ständerath* and three to the federal *Nationalrath* (elected by a direct popular vote).

The south or more mountainous portion of Appenzell forms the half-canton of Appenzell, *Inner Rhoden*. It has a total area of 66·7 sq. m. (of which 62·8 sq. m. are classed as "productive," forests covering 12·8 sq. m. and glaciers ·38 sq. m.), and a total population of 13,499, practically all German-speaking, and all but 833 Romanists. Its political capital is Appenzell (*q.v.*), which is also the largest village, while Weissbad (near it) and Gonten are the best-known goats' whey cure resorts. Embroidery and muslins are made in this half-canton, though wholly at home by the work-people. But it is very largely pastoral, containing 168 mountain pastures or "alps," maintaining each summer 4000 cows, and of an estimated capital value of 2,682,955 francs (the figures for Ausser Rhoden are respectively 100 alps, 2800 cows, and 1,749,900 francs). Inner Rhoden is extremely conservative, and has the reputation of always rejecting any federal *Referendum*. For similar reasons it has preserved many old customs and costumes, those of the women being very elaborate and picturesque, while the herdsmen have retained their festival attire of red waistcoats, embroidered braces and canary-coloured shorts. It sends one member (named by the *Landsgemeinde*) to the federal *Ständerath*, and one also to the federal *Nationalrath*, while it forms but a single administrative district, though divided into six communes.

To the outer world the canton of Appenzell is best known by its institution of *Landsgemeinden*, or primitive democratic assemblies held in the open air, in which every male citizen (not being disqualified) over twenty years of age *must* (under a money penalty) appear personally: each half-canton has such an assembly of its own, that of Inner Rhoden always meeting at Appenzell, and that of Ausser Rhoden in the odd years at Hundwil (near Herisau) and in the even years at Trogen. This institution is of immemorial antiquity, and the meetings in either case are always held on the last Sunday in April. The *Landsgemeinde* is the supreme legislative authority, and elects both the executive (in Inner Rhoden composed of nine members and called *Ständeskommission*, and in Ausser Rhoden of seven members and called *Regierungsrath*) and the president or *Landammann*; in each half-canton there is also a sort of standing committee (composed of the members of the executive and representatives from the communes—in Inner Rhoden one member per 250 or fraction over 125 of the population, and in Ausser Rhoden one member per 1000 of the inhabitants) which prepares business for the *Landsgemeinde* and decides minor matters; in Inner Rhoden it is named the *Grossrath* and in Ausser Rhoden the *Kantonsrath*. As various old-fashioned ceremonies are observed at the meetings and the members each appear with his girded sword, the sight of a meeting of the *Landsgemeinde* is most striking and interesting. The existing constitution of Inner Rhoden dates mainly from 1872, and that of Ausser Rhoden from 1876.

By the middle of the 11th century the abbots of St Gall had established their power in the land later called Appenzell, which, too, became thoroughly teutonized, its early inhabitants having probably been romanized Raetians. But as early as 1377, this portion of the abbots' domains formed an alliance with the Swabian free imperial cities and adopted a constitution of its own. The repeated attempts of the abbots to put down this independence of their rule were defeated in the battles of Vögelinsegg (1403), north-west of Trogen, and of the Stoss (1405), the pass leading from Gais over to Altstätten in the Rhine valley. In 1411 Appenzell was placed under the "protection" of the Swiss Confederation, of which, in 1452, it became an "allied member," and in 1513 a full member. Religious differences broke up the land after the Reformation into two portions, each called *Rhoden*, a term that in the singular is said to mean a "clearing," and occurs in 1070, long before the final separation. From 1798 to 1803 Appenzell, with the other domains of the abbot of St Gall, was formed into the canton Säntis of the Helvetic Republic, but in 1803, on the creation of the new canton of St Gall, shrank back within its former boundaries. The oldest codes of the laws and customs of the land date from 1409 and 1585, the original MS. of the latter (called the "Silver Book" from its silver clasps) being still used in Inner Rhoden when, at the close of the annual *Landsgemeinde*, the newly elected *Landammann* first takes the oath of office, and the assembled members then take that of obedience to him, in either case with uplifted right hands.

See also *Appenzellische Jahrbücher* (3 series from 1854, Trogen); G. Baumberger, "*Juhu-Juuhu*"—*Appenzellerland und Appenzellerleut'* (Einsiedeln, 1903); J. G. Ebel, *Schilderung d. Gebirgsvölker d. Schweiz*, vol. i. (Leipzig, 1798); W. Kobelt, *Die Alpwirthschaft im Kant. App. Inner Rhoden* (Soleure, 1899); I. B. Richman, *Appenzell* (London, 1895); H. Ryffel, *Die schweiz. Landsgemeinden* (Zürich, 1903); J. J. Tobler and A. Strüby, *Die Alpwirthschaft im Kant. App. Ausser Rhoden* (Soleure, 1900); J. C. Zellweger, *Geschichte d. app. Volkes* (to 1597), 6 vols in 11 parts (Trogen, 1830–1838); J.C. Zellweger, junior, *Der Kant. App.* (Trogen, 1867); A. Tobler, *Das Volkslied im Appenzellerland* (Basel, 1906); J. J. Blumer, *Staats- und Rechtsgeschichte d. schweiz. Demokratien* (3 vols. St Gall, 1850–1859). (W. A. B. C.)

APPENZELL, the political capital of the Inner Rhoden half of the Swiss canton of Appenzell. It is built in a smiling green hollow on the left bank of the Sitter stream, which is formed by the union of several mountain torrents descending from the Säntis. By light railways it is 12½ m. from St Gall past Gais or 20½ m. past Herisau. Its chief streets are paved, but it is rather a large village than a town, though in 1900 it had 4574 inhabitants, practically all German-speaking and Romanists. It has a stately modern parish church (attached to a Gothic choir), a small but very ancient chapel of the abbots of St Gall (whose summer residence was this village), and two Capuchin convents (one for men, founded in 1588, and one for women, founded in 1613). Among the archives, kept in the sacristy of the church, are several banners captured by the Appenzellers in former days, among them one taken in 1406 at Imst, near Lanedeck, with the inscription *Hundert Teufel*, though popularly this number is multiplied a thousandfold. In the principal square the *Landsgemeinde* (or cantonal democratic assembly) is held annually in the open air on the last Sunday in April. The inhabitants are largely employed in the production of embroidery, though also engaged in various pastoral occupations. About 2½ m. by road south-east of Appenzell is Weissbad, a well-known goat's whey cure establishment, while 1½ hours above it is the quaint little chapel of Wildkirchli, built (1648) in a rock cavern, on the way to the Säntis. (W. A. B. C.)

APPERCEPTION (Lat. *ad* and *percipere*, perceive), in psychology, a term used to describe the presentation of an object on which attention is fixed, in relation to the sum of consciousness previous to the presentation and the mind as a whole. The word was first used by Leibnitz, practically in the sense of the modern Attention (*q.v.*), by which an object is apprehended as "not-self" and yet in relation to the self. In Kantian terminology apperception is (1) *transcendental*—the perception of an object as involving the consciousness of the pure self as subject, and (2) *empirical*,—the cognition of the self in its concrete existence. In (1) apperception is almost equivalent to self-consciousness; the existence of the ego may be more or less prominent, but it is always involved. According to J. F. Herbart (*q.v.*) apperception is that process by which an aggregate or "mass" of presentations becomes systematized (*apperceptions-system*) by the accretion of new elements, either sense-given or product of the inner workings of the mind. He thus emphasizes in apperception the connexion with the self as resulting from the sum of antecedent experience. Hence in education the teacher should fully acquaint himself with the mental development of the pupil, in order that he may make full use of what the pupil already knows.

Apperception is thus a general term for all mental processes in which a presentation is brought into connexion with an already existent and systematized mental conception, and thereby is classified, explained or, in a word, understood; *e.g.* a new scientific phenomenon is explained in the light of phenomena already analysed and classified. The whole intelligent life of man is, consciously or unconsciously, a process of apperception, inasmuch as every act of attention involves the appercipient process.

See Karl Lange, *Ueber Apperception* (6th ed. revised, Leipzig, 1899; trans. E. E. Brown, Boston, 1893); G. F. Stout, *Analytic Psychology* (London, 1896), bk. ii. ch. viii., and in general text-books of psychology; also PSYCHOLOGY.

APPERLEY, CHARLES JAMES (1777–1843), English sportsman and sporting writer, better known as "Nimrod," the pseudonym under which he published his works on the chase and the turf, was born at Plasgronow, near Wrexham, in Denbighshire, in 1777. Between the years 1805 and 1820 he devoted himself to fox-hunting. About 1821 he began to contribute to the *Sporting Magazine*, under the pseudonym of "Nimrod," a series of racy articles, which helped to double the circulation of the magazine in a year or two. The proprietor, Mr Pittman, kept for "Nimrod" a stud of hunters, and defrayed all expenses of his tours, besides giving him a handsome salary. The death of Mr Pittman, however, led to a law-suit with the proprietors of the magazine for money advanced, and Apperley, to avoid imprisonment, had to take up his residence near Calais (1830), where he supported himself by his writings. He died in London on the 19th of May 1843. The most important of his works are: *Remarks on the Condition of Hunters, the Choice of Horses*, &c. (1831); *The Chase, the Turf, and the Road* (originally written for the *Quarterly Review*), (1837); *Memoirs of the Life of the Late John Mytton* (1837); *Nimrod's Northern Tour* (1838); *Nimrod Abroad* (1842); *The Horse and the Hound* (a reprint from the seventh edition of the *Encyclopaedia Britannica*) (1842); *Hunting Reminiscences* (1843).

APPERT, BENJAMIN NICOLAS MARIE (1797–1847), French philanthropist, was born in Paris on the 10th of September 1797. While a young man he introduced a system of mutual instruction into the regimental schools of the department of the Nord. The success which it obtained induced him to publish a *Manual* setting forth his system. While engaged in teaching prisoners at Montaigu, he fell under the suspicion of having connived at the escape of two of them, and was thrown into the prison of La Force. On his release he resolved to devote the rest of his life to bettering the condition of those whose lot he had for a time shared, and he travelled much over Europe for the purpose of studying the various systems of prison discipline, and wrote several books on the subject. After the revolution of 1830 he became secretary to Queen Marie Amélie, and organized the measures taken for the relief of the needy. He was decorated with the Legion of Honour in 1835.

His brother, FRANÇOIS APPERT (d. 1840), was the inventor of the method of preserving food by enclosing it in hermetically sealed tins; he left a work entitled *Art de conserver les substances animales et végétables*.

APPIAN (Gr. 'Αππιανός), of Alexandria, Roman historian, flourished during the reigns of Trajan, Hadrian and Antoninus Pius. He tells us that, after having filled the chief offices in his native place, he repaired to Rome, where he practised as an advocate. When advanced in years, he obtained, by the good offices of his friend Fronto, the dignity of imperial procurator—it is supposed in Egypt. His work ('Ρωμαικά) in twenty-four books, written in Greek, is rather a number of monographs than a connected history. It gives an account of various peoples and countries from the earliest times down to their incorporation into the Roman empire. Besides a preface, there are extant eleven complete books and considerable fragments. In spite of its unattractive style, the work is very valuable, especially for the period of the civil wars.

Editio princeps, 1551; Schweighäuser, 1785; Bekker, 1852; Mendelssohn, 1878–1905. English translations: by W. B., 1578 (black letter); J. D[avies], 1679; H. White, 1899 (Bohn's Classical Library); bk. i. ed. by J. L. Strachan-Davidson, 1902.

APPIANI, ANDREA (1754–1817), the best fresco painter of his age, was born at Milan. He was made pensioned artist to the kingdom of Italy by Napoleon, but lost his allowance after the events of 1814 and fell into poverty. Correggio was his model, and his best pieces, which are in the church of Santa Maria presso San Celso and the royal palace at Milan, almost rival those of his great master. He also painted Napoleon and the chief personages of his court. Among the most graceful of his oil-paintings are his "Venus and Love," and "Rinaldo in the Garden of Armida." He is known as "the elder," to distinguish him from his great-nephew Andrea Appiani (1817–1865), an historical painter at Rome. Other painters of the same name were Niccolo Appiani (fl. 1510) and Francesco Appiani (1704–1792).

APPIA, VIA, a high-road leading from Rome to Campania and lower Italy, constructed in 312 B.C. by the censor Appius Claudius Caecus. It originally ran only as far as Capua, but was successively prolonged to Beneventum, Venusia, Tarentum and Brundusium, though at what dates is unknown. Probably it was extended as far as Beneventum not long after the colonization of this town in 268 B.C., and it seems to have reached Venusia before 190 B.C. Horace, in the journey to Brundusium described in *Sat.* i. 5, followed the Via Appia as far as Beneventum, but not beyond.

The original road was no doubt only gravelled (*glarea strata*); in 298 B.C. a footpath was laid *saxo quadrato* from the Porta Capena, by which it left Rome, to the temple of Mars, about 1 m. from the gate. Three years later, however, the whole road was paved with *silex* from the temple to Bovillae, and in 191 B.C. the first mile from the gate to the temple was similarly treated. The distance from Rome to Capua was 132 m. For the first few miles the road is flanked by an uninterrupted series of tombs and other buildings (see L. Canina, *Via Appia*, Rome, 1853). As far as Terracina it ran in an almost entirely straight line, even through the Alban Hills, where the gradients are steep. A remarkably fine embankment belonging to it still exists at Aricia. At Forum Appii it entered the Pomptine Marshes; that this portion (19 m. long, hence called Decennovium) belonged to the original road was proved by the discovery at Ad Medias (Mesa) of a milestone of about 250 B.C. (Ch. Hülsen, in *Römische Mitteilungen*, 1889, 83; 1895, 301). A still older road ran along the foot of the Volscian mountains past Cora, Norba and Setia; this served as the post road until the end of the 18th century. At the time of Strabo and Horace, however, it was the practice to travel by canal from Forum Appii to Lucus Feroniae; to Nerva and Trajan were due the paving of the road and the repair of the bridges along this section. Theodoric in A.D. 486 ordered the execution of similar repairs, the success of which is recorded in inscriptions, but in the middle ages it was abandoned and impassable, and was only renewed by Pius VI. The older road crossed the back of the promontory at the foot of which Terracina stands; in imperial times, probably, the rock was cut away perpendicularly for a height of 120 ft. to allow the road to pass. Beyond Fundi it passed through the mountains to Formiae, the engineering of the road being noteworthy; and thence by Minturnae and Sinuessa (towns of the Aurunci which had been conquered in 314 B.C.)[1] to Capua. The remains of the road in this first portion are particularly striking.

Between Capua and Beneventum, a distance of 32 m., the road passed near the defile of Caudium (see CAUDINE FORKS). The modern highroad follows the ancient line, and remains of the latter, with the exception of three well-preserved bridges, which still serve for the modern highroad, are conspicuous by their absence. The portion of the road from Rome to Beneventum is described by Sir R. Colt Hoare, *Classical Tour through Italy*, 57 seq. (London, 1819). He was accompanied on his journey, made in 1789, by the artist Carlo Labruzzi, who executed a series of 226 drawings, the greater part of which have not been published; they are described by T. Ashby in *Mélanges de l'École Française de Rome* (1903), p. 375 seq., and *Atti del Congresso Internazionale per le Scienze Storiche*, vol. v. (Rome, 1904), p. 125 seq.

From Beneventum to Brundusium by the Via Appia, through Venusia and Tarentum, was 202 m. A shorter route, but more fitted for mule traffic, though Horace drove along part of it,[2] ran by Aequum Tuticum, Aecae, Herdoniae, Canusium, Barium, and Gnatia (Strabo vi. 282); it was made into a main road by Trajan, and took the name Via Traiana. The original road, too, adopted in imperial times a more devious but easier route by Aeclanum instead of by Trevicum. This was restored by Hadrian for the 15 m. between Beneventum and Aeclanum. Under Diocletian and Maximian a road (the Via Herculia) was constructed from Aequum Tuticum to Pons Aufidi near Venusia, where it crossed the Via Appia and went on into Lucania, passing through Potentia and Grumentum, and joining the Via Popilia near Nerulum. Though it must have lost much of its importance through the construction of the Via Traiana, the last portion from Tarentum to Brundusium was restored by Constantine about A.D. 315.

The Via Appia was the most famous of Roman roads; Statius, *Silvae*, ii. 2. 12, calls it *longarum regina viarum*. It was administered under the empire by a curator of praetorian rank, as were the other important roads of Italy. A large number of milestones and other inscriptions relating to its repair at various times are known. See Ch. Hülsen in Pauly-Wissowa, *Realencyclopädie*, ii. 238 seq. (Stuttgart, 1896). (T. As.)

APPIN. a coast district of Argyllshire, Scotland, bounded W. by Loch Linnhe, S. by Loch Creran, E. by the districts of Benderloch and Lorne, and N. by Loch Leven. It lies north-east to south-west, and measures 14 m. in length by 7 m. in breadth. The scenery of the coast is extremely beautiful, and inland the country is rugged and mountainous. The principal hills are the double peaks of Ben Vair (3362 ft. and 3284 ft.) and Creag Ghorm (2372 ft.) in the north, and Fraochie (2883 ft.), Meall Ban (2148 ft.) and Ben Mhic na Ceisich (2093 ft.) near the right flank of Glen Creran. The chief streams are the Coe and Laroch, flowing into Loch Leven, the Duror and Salachan flowing into Loch Linnhe, and the Iola and Creran flowing into Loch Creran. The leading industries comprise slate and granite quarries and lead mining. Ballachulish, Duror, Portnacroish, Appin and Port Appin are the principal villages. Ballachulish and Port Appin are ports of call for steamers, and the Caledonian railway company's branch line from Connel Ferry to Ballachulish runs through the coast land and has stations at Creagan, Appin, Duror, Kentallen and Ballachulish Ferry. Appin was the country of a branch of the Stewarts.

APPLAUSE (Lat. *applaudere*, to strike upon, clap), primarily the expression of approval by clapping of hands, &c.; generally any expression of approval. The custom of applauding is doubtless as old and as widespread as humanity, and the variety of its forms is limited only by the capacity for devising means of making a noise. Among civilized nations, however, it has at various times been subject to certain conventions. Thus the Romans had a set ritual of applause for public performances, expressing degrees of approval: snapping the finger and thumb, clapping with the flat or hollow palm, waving the flap of the toga, for which last the emperor Aurelian substituted a handkerchief (*orarium*), distributed to all Roman citizens (see STOLE). In the theatre, at the close of the play, the chief actor called out "Valete et plaudite!", and the audience, guided by an unofficial choregus, chaunted their applause antiphonally. This was often organized and paid for (Böttiger, *Über das Applaudieren im Theater bei den Alten*, Leipz., 1822). When Christianity became fashionable the customs of the theatre were transferred to the churches. Eusebius (*Hist. Eccl.* vii. 30) says that Paul of Samosata encouraged the congregation to applaud his preaching by waving linen cloths (ὀθόναις), and in the 4th and 5th centuries applause of the rhetoric of popular preachers had become an established custom. Though, however, applause may provide a healthy stimulus, its abuse has led to attempts at abolishing or restricting it even in theatres. The institution of the *claque*, people hired by performers to applaud them, has largely discredited the custom, and indiscriminate applause has been felt as an intolerable interruption to serious performances. The reverential spirit which abolished applause in church has tended to spread to the theatre and the concert-room, largely under the influence of the quasi-religious atmosphere of the Wagner performances at Baireuth. In Germany (*e.g.* the court theatres at Berlin) applause during the performance and "calling before the curtain" have been officially forbidden, but even in Germany this is felt to be in advance of public opinion. (See also ACCLAMATION and CHEERING.)

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[1] It is important to note how the Romans followed up every victory with a road.

[2] From Beneventum he followed the older line of the Via Appia to Trevicum; thence, leaving the main road at Aquilonia, he went to Ausculum ("quod versu dicere non est"), the mod. Ascoli Satriano, by a by-road, for the milestones which have been found there, though they probably belong to the Via Traiana, cannot be in their original position, but must have been transplanted thither (Th. Mommsen in *Corp. Inscrip. Lat.*, ix. 1883, No. 6016)—and on to Herdoniae (why Mommsen says that he left Herdoniae on the left, *op. cit.* p. 592, is not clear), where he joined the line of the later Via Traiana.

APPLE (a common Teut. word, A.S. *aepl, aeppel*, O.H.G. *aphul, aphal, apfal*, mod. Ger. *Apfel*), the fruit of *Pyrus Malus*, belonging to the sub-order *Pomaceae*, of the natural order *Rosaceae*. It is one of the most widely cultivated and best-known and appreciated of fruits belonging to temperate climates. In its wild state it is known as the crab-apple, and is found generally distributed throughout Europe and western Asia, growing in as high a latitude as Trondhjem in Norway. The crabs of Siberia belong to different species of *Pyrus*. The apple-tree as cultivated is a moderate-sized tree with spreading branches, ovate, acutely serrated or crenated leaves, and flowers in corymbs. The fruit is too well known to need any description of its external characteristics. The apple is successfully cultivated in higher latitudes than any other fruit tree, growing up to 65° N., but notwithstanding this, its blossoms are more susceptible of injury from frost than the flowers of the peach or apricot. It comes into flower much later than these trees, and so avoids the night frost which would be fatal to its fruit-bearing. The apples which are grown in northern regions are, however, small, hard, and crabbed, the best fruit being produced in hot summer climates, such as Canada and the United States. Besides in Europe and America, the fruit is now cultivated at the Cape of Good Hope, in northern India and China, and in Australia and New Zealand.

Apples have been cultivated in Great Britain probably since the period of the Roman occupation, but the names of many varieties indicate a French or Dutch origin of much later date. In 1688 Ray enumerated seventy-eight varieties in cultivation in the neighbourhood of London, and now it is calculated that about 2000 kinds can be distinguished. According to the purposes for which they are suitable, they can be classed as—1st, dessert; 2nd, culinary; and 3rd, cider apples. The principal dessert apples are the Pippins (*pepins*, seedlings), of which there are numerous varieties. As culinary apples, besides Rennets and other dessert kinds, Codlins and Biffins are cultivated. In England, Herefordshire and Devonshire are famous for the cultivation of apples, and in these counties the manufacture of cider (*q.v.*) is an important industry. Cider is also extensively prepared in Normandy and in Holland. Verjuice is the fermented juice of crab apples.

A large trade in the importation of apples is carried on in Britain, imports coming chiefly from French, Belgian and Dutch growers, and from the United States and British North America. Dried and pressed apples are imported from France for stewing, under the name of Normandy Pippins, and similarly prepared fruits come also from America.

The apple may be propagated by seeds to obtain stocks for grafting, and also for the production of new varieties. The established sorts are usually increased by grafting, the method called whip-grafting being preferred. The stocks should be at least as thick as the finger; and should be headed back to where the graft is to be fixed in January, unless the weather is frosty, but in any case before vegetation becomes active. The scions should be cut about the same time, and laid in firmly in a trench, in contact with the moist soil, until required.

The tree will thrive in any good well-drained soil, the best being a good mellow calcareous loam, while the less iron there is in the subsoil the better. The addition of marl to soils that are not naturally calcareous very much improves them. The trees are liable to canker in undrained soils or those of a hot sandy nature. Where the soil is not naturally rich enough, it should be well manured, but not to the extent of encouraging over-luxuriance. It is better to apply manure in the form of a compost than to use it in a fresh state or unmixed.

To form an orchard, standard trees should be planted at from 25 to 40 ft. between the rows, according to the fertility of the soil and other considerations. The trees should be selected with clean, straight, self-supporting stems, and the head should be shapely and symmetrical, with the main branches well balanced. In order to obtain such a stem, all the leaves on the first shoot from the graft or bud should be encouraged to grow, and in the second season the terminal bud should be allowed to develop a further leading shoot, while the lateral shoots should be allowed to grow, but so that they do not compete with the leader, on which the growth of leaves should be encouraged in order that they may give additional strength to the stem below them. The side shoots should be removed gradually, so that the diminution of foliage in this direction may not exceed the increase made by the new branches and shoots of the upper portion. Dwarf pyramids, which occupy less space than open dwarfs, if not allowed to grow tall, may be planted at from 10 to 12 ft. apart. Dwarf bush trees may be planted from 10 to 15 ft. apart, according to the variety and the soil. Dwarf bushes on the Paradise stock are both ornamental and useful in small gardens, the trees being always conveniently under control. These bush trees, which must be on the proper stock—the French Paradise—may be planted at first 6 ft. apart, with the same distance between the rows, the space being afterwards increased, if desired, to 12 ft. apart, by removing every alternate row.

"Cordons" are trees trained to a single shoot, the laterals of which are kept spurred. They are usually trained horizontally, at about $1\frac{1}{2}$ ft. from the ground, and may consist of one stem or of two, the stems in the latter case being trained in opposite directions. In cold districts the finer sorts of apples may be grown against walls as upright or oblique cordons. From these cordon trees very fine fruit may often be obtained. The apple may also be grown as an espalier tree, a form which does not require much lateral space. The ordinary trained trees for espaliers and walls should be planted 20 ft. apart.

The fruit of the apple is produced on spurs which form on the branchlets of two years old and upwards, and continue fertile for a series of years. The principal pruning should be performed in summer, the young shoots if crowded being thinned out, and the superabundant laterals shortened by breaking them half through. The general winter pruning of the trees may take place any time from the beginning of November to the beginning of March, in open weather. The trees are rather subject to the attacks of the American blight, the white cottony substance found on the bark and developed by an insect (*Eriosoma mali*), somewhat similar to the green-fly of the garden, but not a true aphis. It may be removed by scrubbing with a hard brush, by painting the affected spots with any bland oil, or by washing them with dilute paraffin and soft soap.

The apple-blossom weevil (*Anthonomus pomorum*), a small reddish-brown beetle, often causes serious damage to the flowers. The female bores and lays an egg in the unopened bud, and the maggot feeds on the stamens and pistil. The weevil hibernates in the crannies of the bark or in the soil at the base of the trees, and bandages of tarred cloth placed round the stem in spring will prevent the female from crawling up.

The codlin moth (*Carpocapsa pomonana*) lays its eggs in May in the calyx of the flowers. The young caterpillar, which is white with black head and neck, gnaws its way through the fruit, and pierces the rind. When nearly full grown it attacks the core, and the fruit soon drops. The insect emerges and spins its cocoon in a crack of the bark.

To check this disease the apples which fall before ripening should be promptly removed. A loosely made hay-band twisted round the stem about a foot from the ground is of use. The grubs will generally choose the bands in which to make their cocoon; at the end of the season the bands are collected and burned.

The following are a few of the most approved varieties of the apple tree, arranged in order of their ripening, with the months in which they are in use:—

Dessert Apples.

White Juneating	July
Early Red Margaret	Aug.
Irish Peach	Aug.
Devonshire Quarrenden	Aug., Sept.
Duchess of Oldenburg	Aug., Sept.
Red Astrachan	Sept.
Kerry Pippin	Sept., Oct.
Peasgood's Nonesuch	Sept.–Nov.
Sam Young	Oct.–Dec.
King of the Pippins	Oct.–Jan.
Cox's Orange Pippin	Oct.–Feb.
Court of Wick	Oct.–Mar.
Blenheim Pippin	Nov.–Feb.
Sykehouse Russet	Nov.–Feb.
Fearn's Pippin	Nov.–Mar.
Mannington's Pearmain	Nov.–Mar.
Margil	Nov.–Mar.
Ribston Pippin	Nov.–Mar.
Golden Pippin	Nov.–Jan.
Reinette de Canada	Nov.–Apr.
Ashmead's Kernel	Nov.–Apr.
White Winter Calville (grown under glass)	Dec.–Mar.
Braddick's Nonpareil	Dec.–Apr.
Court-pendû Plat	Dec.–Apr.
Northern Spy	Dec.–May
Cornish Gilliflower	Dec.–May
Scarlet Nonpareil	Jan.–Mar.
Cockle's Pippin	Jan.–Apr.
Lamb Abbey Pearmain	Jan.–May
Old Nonpareil	Jan.–May
Duke of Devonshire	Feb.–May
Sturmer Pippin	Feb.–June

Kitchen Apples

Keswick Codlin	Aug.–Sept.
Lord Suffield	Aug.–Sept.
Manks Codlin	Aug.–Oct.
Ecklinville Seedling	Aug.–Nov.
Stirling Castle	Aug.–Nov.
New Hawthornden	Sept.–Oct.
Stone's Seedling	Sept.–Nov.
Emperor Alexander	Sept.–Dec.
Waltham Abbey Seedling	Sept.–Jan.
Cellini	Oct., Nov.
Gravenstein	Oct.–Dec.
Hawthornden	Oct.–Dec.
Baumann's Red Winter Reinette	Nov.–Mar.
Mère de Ménage	Oct.–Mar.
Beauty of Kent	Oct.–Feb.
Yorkshire Greening	Oct.–Feb.
Gloria Mundi	Nov.–Jan.
Blenheim Pippin	Nov.–Feb.
Tower of Glammis	Nov.–Feb.
Warner's King	Nov.–Mar.
Alfriston	Nov.–Apr.
Northern Greening	Nov.–Apr.
Reinette de Canada	Nov.–Apr.
Bess Pool	Nov.–May
Winter Queening	Nov.–May
Lane's Prince Albert	Oct.–May
Norfolk Beaufin	Nov.–July

Apples for table use should have a sweet juicy pulp and rich aromatic flavour, while those suitable for cooking should possess the property of forming a uniform soft pulpy mass when boiled or baked. In their uncooked state they are not very digestible, but when cooked they form a very safe and useful food, exercising a gentle laxative influence.

According to Hutchison their composition is as follows:—

	Water.	Proteid.	Ether Extract.	Carbohydrate.	Ash.	Cellulose.	Acids.
Fresh	82·5	0·4	0·5	12·5	0·4	2·7	1·0
Dried	36·2	1·4	3·0	49·1	1·8	4·9	3·6

Many exotic fruits, having nothing in common with the apple, are known by that name, *e.g.* the Balsam apple, *Momordica Balsamina*; the custard apple (*q.v.*), *Anona reticulata*; the egg apple, *Solanum esculentum*; the rose apple, various species of *Eugenia*; the pineapple (*q.v.*), *Ananas sativus*; the star apple, *Chrysophyllum Cainito*; and the apples of Sodom, *Solanum sodomeum*. (A. B. R.)

APPLEBY, a market town and municipal borough, and the county town of Westmorland, England, in the Appleby parliamentary division, 276 m. N.N.W. from London, on the Midland and a branch of the North Eastern railways. Pop. (1901) 1764. It is picturesquely placed in the valley of the Eden, which is richly wooded, and flanked on the north-east by spurs of Milburn Forest and Dufton and other fells, which rise up to 2600 ft. On a hill above the town stands the castle, retaining a fine Norman keep and surrounded by a double moat, now partly laid out as gardens. The remainder of the castle was rebuilt as a mansion in the 17th century. It was held for the royalists in the civil wars by Sir Philip Musgrave, and was the residence of Anne, countess of Pembroke, the last of the family of Clifford, which had great estates in this part of England. St Ann's hospital for thirteen poor women (1654) was of her foundation. The grammar school (1453) was refounded by Queen Elizabeth. The modern incorporation dates from 1885, with a mayor, four aldermen and twelve councillors. Area, 1876 acres.

Appleby is not mentioned in any Saxon records, but after the Conquest it rose to importance as the head of the barony of Appleby which extended over the eastern portion of the present county of Westmorland. This barony formed part of the province of Carlisle granted by Henry I. to Ranulf Meschin, who erected the castle at Appleby and made it his place of residence. Appleby is a borough by prescription, and the old charter of incorporation, granted in the first year of James II., was very shortly abandoned. In 1292 we find the mayor and commonalty claiming the right to elect a coroner and to have tolls of markets and fairs. In 1685 the governing body comprised a mayor, aldermen, a town clerk, burgesses of the common council, a coroner and subordinate officers. An undated charter from Henry II. conceding to the burgesses the customs of York, was confirmed in 1 John, 16 Henry III., 14 Edward I., and 5 Edward III. John granted the borough to the burgesses for a fee-farm rent. The impoverishment caused by the Scottish raids led to its seizure by Edward II. for arrears of payment, but Edward III. restored it on the same terms as before. Henry VIII. reduced the fee-farm rent from 20 marks to 2 marks, after an inquisition which found that Appleby was burnt by the Scots in 1388 and that part of it still lay in ruins. The town, however, never seems to have regained its prosperity, and 16th and 17th century writers speak of it as a poor and insignificant village. Appleby returned two members to parliament from 1295 until disfranchised by the Reform Act of 1832. The market and the St Lawrence fair are held by prescription. James I. granted an additional fair on the second Thursday in April. In the early 18th century Appleby was celebrated for the best corn-market in the country.

See *Victoria County History, Westmorland*; W. Hewitson, *Appleby Charters* (Cumberl. and Westm. Antiq. and Archaeol. Soc., Transactions, xi. 279-285; Kendal, 1891).

APPLETON, NATHAN (1779–1861) American merchant and politician, was born in New Ipswich, New Hampshire, on the 6th of October 1779. He was educated in the New Ipswich Academy, and in 1794 entered mercantile life in Boston, in the employment of his brother, Samuel (1766–1853), a successful and benevolent man of business, with whom he was in partnership from 1800 to 1809. He co-operated with Francis C. Lowell and others in introducing the power-loom and the manufacture of cotton on a large scale into the United States, a factory being established at Waltham, Massachusetts, in 1814, and another in 1822 at Lowell, Massachusetts, of which city he was one of the founders. He was a member of the general court of Massachusetts in 1816, 1821, 1822, 1824 and 1827, and in 1831–1833 and 1842 of the national House of Representatives, in which he was prominent as an advocate of protective duties. He died in Boston on the 14th of July 1861.

His son, THOMAS GOLD APPLETON (1812–1884), who graduated at Harvard in 1831, had some reputation as a writer, an artist and a patron of the fine arts, but was better known for his witticisms, one of which, the oft-quoted "Good Americans, when they die, go to Paris," is sometimes attributed to Oliver Wendell Holmes. He published some poems and, in prose, *Nile Journal* (1876), *Syrian Sunshine* (1877), *Windfalls* (1878), and *Chequer-Work* (1879).

See the memoir of Nathan Appleton by Robert C. Winthrop (Boston, 1861); and Susan Hale's *Life and Letters of Thomas Gold Appleton* (New York, 1885).

APPLETON, a city and the county-seat of Outagamie county, Wisconsin, U.S.A., on the lower Fox river, about 90 m. N. of Milwaukee. Pop. (1890) 11,869; (1900) 15,085, of whom 3605 were foreign-born; (1910, census) 16,773. It is served by the Chicago & North-Western, and the Chicago, Milwaukee & St Paul railways, and by steamboats on the Fox river, by means of which it meets lake transportation at De Pere and Green Bay. Appleton was one of the first cities in the United States to have an electric street railway line in operation; and electric street railways now traverse the entire Fox river valley as far as Fond du Lac on the south and Green Bay on the north. The city is attractively laid out on high bluffs above the river. It has several beautiful parks, two hospitals, a number of fine churches and school buildings, and a public library. The city is the seat of Lawrence college (changed from university in 1908), an interdenominational (originally a Methodist Episcopal) co-educational institution, founded in 1847 as the Lawrence Institute of Wisconsin and named in honour of Amos Adams Lawrence (1814–1886) of Boston, son of Amos Lawrence, and giver of $10,000 for the founding of the Institute. The college comprises an academy, a college of liberal arts, a school of expression, a school of commerce, schools of music and of art, and a school of correspondence; and in 1907–1908 had 33 instructors, 575 students and a library of 24,400 volumes. The Fox river furnishes about 10,000 h.p., which is largely utilized for the manufacture of paper (of which Appleton is one of the largest producers in the United States), wood-pulp, sulphite fibre, machinery, wire screens, woollen goods, knit goods, furniture, dyes and flour. The total value of factory products in 1905 was $6,672,457, an increase of 72·8% over the product value of 1900. Appleton was first permanently settled in 1833, and was named in honour of Samuel Appleton of Massachusetts, who owned part of the original town plot. It was incorporated as a village in 1853, and received in 1857 a city charter, which was revised in 1887 and in 1905.

APPOGGIATURA (from Ital. *appoggiare*, to lean upon), a musical term for a melodic ornament, a grace-note prefixed to a principal note and printed in small character. The effect is to suspend the principal note, by taking away the time-value of the *appoggiatura* prefixed to it. There are two kinds, the long *appoggiatura*, now usually printed as played, and the short, where the suspension of the principal note is scarcely perceptible; this is often called *acciatura*, a word properly applied to an ornament now obsolete, in which a principal note in a melody is struck together with the note immediately below, the lower note being at once released and the other held on.

APPOINTMENT, POWER OF, in English law, an authority reserved by or limited to a person, to dispose, either wholly or partially, of real or personal property, either for his own benefit or for that of others. Thus if A settle property upon trustees to such uses as B shall by deed or will appoint and in default of and until such appointment to the use of C and his heirs, B, though he has no interest in the property, can at any time appoint the property to any one he pleases, including himself, and C's interest which has hitherto been vested in him will be divested. In the above case A is said to be the donor, B the donee, and the persons in whose favour the appointment is exercised are called the appointees. Such powers are either general or limited. A general power is one which the appointor may exercise in favour of any person he pleases. It is obvious that such a power is very nearly equivalent to ownership, and consequently property which is the subject of a general power has been made to share the liabilities of ownership. By the Judgments Act 1838 all hereditaments over which a judgment debtor has such a power may be seized by the sheriff under a writ of *elegit*, and by the Bankruptcy Act 1883 similar property will vest in the trustees of a bankrupt. By the Finance Act 1894 property of which the deceased had a general power of appointment is subject to the payment of estate duty, even though the power has not been exercised. A limited power is one which can only be exercised in favour of certain specified persons or classes; such a power is frequently inserted in marriage settlements in which after life estates to the husband and wife a power is given to appoint among the children of the marriage. In such a case no appointment to any one but children of the marriage is valid. Formerly it was held that the intention of the donor of such a power was that each of the class which are the objects of the power should take some part of the fund, and from this arose the equitable doctrine of illusory appointments, by which the courts of equity set aside an appointment which was good at law on the ground that a merely nominal share had been appointed to one of the objects. The great difficulty of deciding what was a nominal or illusory share caused the passing of the Illusory Appointments Act of 1830, whereby it was enacted that no appointment should be set aside merely on the ground that a share appointed was illusory. It was still necessary, however, that some share should be appointed to each object, and consequently it was possible in the popular phrase to be "cut off with a shilling," but now by the Powers Amendment Act 1874 the appointor is no longer obliged to appoint a share to each object of the power.

It is a general rule that every circumstance required by the instrument creating the power to accompany the execution of it must be strictly observed. Thus it might be required that the appointment should be by an instrument witnessed by four witnesses, or that the consent in writing of some third party should be signified. The general rule, however, has been modified both by statute and by the rules of equity. By the Wills Act 1837 a will made pursuant to the requirements of that statute shall be a valid execution of a power of appointment by will, notwithstanding that some additional form or solemnity shall have been required by the instrument creating the power, and by the Wills Act 1861 a will made out of the United Kingdom by a British subject according to the forms required by the law of the place where the will was made shall, as regards personal estate, be held to be well executed and admitted to probate; consequently it has been held that an appointment made by such a will is a valid exercise of the power. As regards appointments by deed the Law of Property Amendment Act 1859 enacts that a deed attested by two witnesses shall, so far as execution and attestation go, be a valid exercise of a power to appoint by deed. The courts of equity also will interfere in some cases of defective execution in order to carry out the intentions of the settlor. The principle upon which the court acts is obscure, but the rule has been thus stated:—"Whenever a man having power over an estate, whether ownership or not, in discharge of moral or natural relations, shows an intention to execute such power, the court will operate upon the conscience of the heir (or of the persons entitled in default) to make him perfect this intention." Equity, however, only relieves against defects not of the essence of the power, such as the absence of seal or execution by will instead of deed, but where the defect is of the essence of the power, as where a consent is not obtained, equity will not assist, nor will it relieve where a power to appoint by will is purported to be exercised by deed. A power of appointment if exercised must be exercised bona fide, otherwise it will be void as fraudulent; thus it has been frequently decided that where a father, having a limited power of appointment among his children, appoints the whole fund to an infant child, who is in no need of the appointment and who is ill, in the expectation of the death of the child whereby the fund will come to him as next of kin, such appointment is void as a fraud upon the power. Where an execution is partly fraudulent and partly valid the court will, if possible, separate the two and only revoke that which is fraudulent; if, however, the two parts are not separable the whole is void. The same rule is applied in cases of excessive execution where the power is exercised in favour of persons some of whom are and some of whom are not objects of the power. The doctrine of *Election* (*q.v.*) applies to appointments under powers, but there must be a gift of free and disposable property to the persons entitled in default of appointment.

The appointment must in law be read into the instrument creating the power in lieu of the power itself. Thus an appointor under a limited power cannot appoint to any person to whom the donor could not have appointed by reason of the rule against perpetuities, but this is not so in the case of a general power, for there the appointor is virtually owner of the property appointed. In applying this rule to appointments a distinction arises between powers created by deed and will, for a deed speaks from the date of its execution but a will from the death of the testator, and so limitations bad when the will was made may have become good when it comes into operation. Since the Conveyancing Act 1881 all powers may be released by the donees thereof, unless the power is coupled with a trust in respect of which there is a duty cast on the donee to exercise it; and this is so even though the donee gets a benefit by such release as one entitled in default of appointment, for this is not a fraud upon the power. (E. S. M. B.)

APPOMATTOX COURT HOUSE, a village of Appomattox county, Virginia, U.S.A., 25 m. E. of Lynchburg, in the S. part of the state. It is served by the Norfolk & Western railway. The village was the scene of the surrender of the Confederate Army of Northern Virginia under General Robert E. Lee to the Federal forces under Lieutenant-General U. S. Grant on Sunday the 9th of April 1865. The terms were: "the officers to give their individual paroles not to take up arms against the government of the United States until properly exchanged, and each company or regimental commander to sign a like parole for the men of their commands," . . . neither "side arms of the officers nor their private horses or baggage" to be surrendered; and, as many privates in the Confederate Army owned horses and mules, all horses and mules claimed by men in the Confederate Army to be left in their possession.

APPONYI, ALBERT, Count (1846–), Hungarian statesman, the most distinguished member of an ancient noble family, dating back to the 13th century, and son of the chancellor György Apponyi (1808–1899) and the accomplished and saintly Countess Julia Sztáray, was born at Pesth on the 29th of May 1846. Educated at the Jesuit seminary at Kalksburg and at the universities of Vienna and Pesth, a long foreign tour completed his curriculum, and at Paris he made the acquaintance of Montalembert, a kindred spirit, whose influence on the young Apponyi was permanent. He entered parliament in 1872 as a liberal Catholic, attaching himself at first to the Deák party; but the feudal and ultramontane traditions of his family circle profoundly modified, though they could never destroy, his popular ideals. On the break up of the Deák party he attached himself to the conservative group which followed Baron Pál Senynyey (1824–1888) and eventually became its leader. Until 1905 Count Albert was constantly in opposition, but in May of that year he consented to take office in the second Wekerle ministry. A lofty and magnetic orator, his speeches were published at Budapest in 1896; and he is the author of an interesting dissertation, *Esthetics and Politics, the Artist and the Statesman* (Hung.) (Budapest, 1895).

APPORTIONMENT (Fr. *apportionement*; Med. Lat. *apportionamentum*; derived from Lat. *portio*, share), distribution or allotment in proper shares; a term used in law in a variety of senses. (1) Sometimes it is employed roughly and with no technical meaning to indicate the distribution of a benefit (*e.g.* salvage or damages under the Fatal Accidents Act 1846, § 2), or liability (*e.g.* general average contributions, or tithe rent-charge), or the incidence of a duty (*e.g.* obligations as to the maintenance of highways). (2) In its strict legal interpretation apportionment falls into two classes, "apportionment in respect of estate" and "apportionment in respect of time."

1. *Apportionment in respect of Estate* may result either from the act of the parties or from the operation of law. Where a lessee is evicted from, or surrenders or forfeits possession of part of the property leased to him, he becomes liable at common law to pay only a rent apportioned to the value of the interest which he still retains. So where the person entitled to the reversion of an estate assigns part of it, the right to an apportioned part of the rent incident to the whole reversion passes to his assignee. The lessee is not bound, however, by an apportionment of rent made upon the grant of part of the reversion unless it is made either with his consent or by the verdict of a jury. The assignee of the reversion of part of demised premises could not, at common law, re-enter for breach of a condition, inasmuch as a condition of re-entry in a lease could not at common law be apportioned. But this has now been altered by statute both in England (Law of Property Amendment Act 1859, § 3; Conveyancing Act 1881, § 12) and in many of the British colonies (*e.g.* Ontario, Rev. Stats., 1897, c. 170, § 9; Barbados, No. 12 of 1891, § 9). In the cases just mentioned there is apportionment in respect of estate by act of the parties.

Apportionment by operation of law may be brought about where by act of law a lease becomes inoperative as regards its subject-matter, or by the "act of God" (as, for instance, where part of an estate is submerged by the encroachments of the sea). To the same category belongs the apportionment of rent which takes place under various statutes (*e.g.* the Lands Clauses Consolidation Act 1845, § 119, when land is required for public purposes; the Agricultural Holdings Act 1883, § 41, in the case of a tenant from year to year receiving notice to quit part of a holding; and the Irish Land Act 1903, § 61, apportionment of quit and crown rents).

2. *Apportionment in respect of Time.*—At common law, there was no apportionment of rent in respect of time. Such apportionment was, however, in certain cases allowed in England by the Distress for Rent Act 1737, and the Apportionment Act 1834, and is now allowed generally under the Apportionment Act 1870. Under that statute (§ 2) all rents, annuities, dividends and other periodical payments in the nature of income are to be considered as accruing from day to day and to be apportionable in respect of time accordingly. It is provided, however, that the apportioned part of such rents, &c., shall only be payable or recoverable in the case of a continuing payment, when the entire portion of which it forms part itself becomes payable, and, in the case of a payment determined by re-entry, death or otherwise, only when the next entire portion would have been payable if it had not so determined (§ 3). Persons entitled to apportioned parts of rent have the same remedies for recovering them when payable as they would have had in respect of the entire rent; but a lessee is not to be liable for any apportioned part specifically. The rent is recoverable by the heir or other person who would, but for the apportionment, be entitled to the entire rent, and he holds it subject to distribution (§ 4). The Apportionment Act 1870 extends to payments not made under any instrument in writing (§ 2), but not to annual sums made payable in policies of insurance (§ 6). Apportionment under the act can be excluded by express stipulation.

The apportionment created by this statute is "apportionment in respect of time." The cases to which it applies are mainly cases of either (A) apportionment of rent due under leases where at a time between the dates fixed for payment the lessor or lessee dies, or some other alteration in the position of parties occurs; or (B) apportionment of income between the representatives of a limited owner and the remainder-man when the limited interest determines at a time between the date when such income became due.

(A) With regard to the former of these classes, it may be noticed that although apportioned rent becomes payable only when the whole rent is due, the landlord, in the case of the bankruptcy of an ordinary tenant, may prove for a proportionate part of the rent up to the date of the receiving order (Bankruptcy Act 1883, Sched. ii. r. 19); and that a similar rule holds good in the winding up of a company (*in re South Kensington Co-operative Stores*, 1881, 17 Ch.D. 161); and further that the act of 1870 applies to the liability to pay, as well as to the right to receive, rent (*in re Wilson*, 1893, 62 L.J.Q.B. 628, 632). Accordingly where an assignment of a lease is made between two half-yearly rent-days, the assignee is not liable to pay the full amount of the half-year's rent falling due on the rent-day next after the date of the assignment, but only an apportioned part of that half-year's rent, computed from the last mentioned date (*Glass* v. *Patterson*, 1902, 2 Ir.R. 660).

(B.) With regard to the apportionment of income, the only points requiring notice here are that all dividends payable by public companies are apportionable, whether paid at fixed periods or not, unless the payment is, in effect, a payment of capital (§ 5).

The Apportionment Act 1870 extends to Scotland and Ireland. It has been followed in many of the British colonies (*e.g.* Ontario, Rev. Stats., 1897, c. 170, §§ 4-8; New Zealand, No. 4 of 1886; Tasmania, No. 8 of 1871; Barbados, No. 12 of 1891, §§ 9-12). Similar legislation has been adopted in many of the states of the American Union, where, as in England, rent was not, at common law, apportionable as to time (Kent, *Comm.* iii. 469-472).

An *equitable apportionment*, apart from statute law, arises where property is bequeathed on trust to pay the income to a tenant for life and the reversion to others, and the realization of the property in the form of a fund capable of producing income is postponed for the benefit of the estate. In such cases there is an ultimate apportionment between the persons entitled to the income and those entitled to the capital of the accumulations for the period of such postponement. The rule followed is this: the proceeds, when realized, are apportionable between capital and income by ascertaining the sum which, put out and accumulated at 3% *per annum* from the day of the testator's death (with yearly rents and deducting income tax) would have produced at the day of receipt the sum actually received. The sum so ascertained should be treated as capital and the residue as income. (*In re Earl of Chesterfield's Trusts*, 1883, 24 Ch.D. 643; *In re Goodenough*, 1895, 2 Ch. 537; *Rowlls* v. *Bebb*, 1900, 2 Ch. 107.)

In addition to the authorities cited in the text, see Stroud, *Jud. Dict.* (2nd ed., London, 1903), s.v. "Apportion"; Bouvier, *Law Dict.* (London and Boston, 1897), s.v. "Apportionment"; *Ruling Cases* (London, 1895), tit. "Apportionment"; Fawcett, *Landlord and Tenant* (London, 1905), pp. 238 et seq.; Foa, *Landlord and Tenant* (3rd ed., London, 1901), pp. 112 et seq. (A. W. R.)

APPORTIONMENT BILL, an act passed by the Congress of the United States after each decennial census to determine the number of members which each state shall send to the House of Representatives. The ratio of representation fixed by the original constitution was 1 to 30,000 of the free population, and the number of the members of the first House was 65. As the House would, at this ratio, have become unmanageably large, the ratio, which is first settled by Congress before apportionment, has been raised after each census, as will be seen from the accompanying table.

Under	Census.		Apportionment.		Whole Number of Representatives.
	Year.	Population.	Year.	Ratio.	
Constitution . .	..	..	1789	30,000	65
First Census . .	1790	3,929,214	1793	33,000	105
Second Census . .	1800	5,308,483	1803	33,000	141
Third Census . .	1810	7,239,881	1813	35,000	181
Fourth Census . .	1820	9,633,822	1823	40,000	213
Fifth Census . .	1830	12,866,020	1833	47,700	240
Sixth Census . .	1840	17,069,453	1843	70,680	223
Seventh Census .	1850	23,191,876	1853	93,423	234
Eighth Census . .	1860	31,443,321	1863	127,381	241
Ninth Census . .	1870	38,558,371	1873	131,425	292
Tenth Census . .	1880	50,155,783	1883	151,911	325
Eleventh Census .	1890	62,622,250	1893	173,901	356
Twelfth Census .	1900	75,568,686	1903	194,182	386

The same term is applied to the acts passed by the state legislatures for correcting and redistributing the representation of the counties. Such acts are usually passed at decennial intervals, more often after the federal census, but the dates may vary in different states. The state representatives are usually apportioned among the several counties according to population and not by geographical position. The electoral districts so formed are expected to be equal in proportion to the number of inhabitants; but this method has led to much abuse in the past, through the making of unequal districts for partisan purposes. (See GERRYMANDER.)

If a state has received an increase in the number of its representatives and its legislature does not pass an apportionment bill before the next congressional election, the votes of the whole state elect the additional members on a general ticket and they are called "congressmen-at-large."

APPRAISER (from Lat. *appretiare*, to value), one who sets a value upon property, real or personal. In England the business of an appraiser is usually combined with that of an auctioneer, while the word itself has given place, to a great extent, to that of "valuer." (See the articles AUCTIONS AND AUCTIONEERS, and VALUATION AND VALUERS.)

In the United States appraiser is a term often used to describe a person specially appointed by a judicial or quasi-judicial authority to put a valuation on property, *e.g.* on the items of an inventory of the estate of a deceased person or on land taken for public purposes by the right of eminent domain. Appraisers of imported goods and boards of general appraisers have extensive functions in administering the customs laws of the United States. Merchant appraisers are sometimes appointed temporarily under the revenue laws to value where there is no resident appraiser without holding the office of appraiser (U.S. Rev. Stats. § 2609).

APPREHENSION (Lat. *ad*, to; *prehendere*, to seize), in psychology, a term applied to a mode of consciousness in which nothing is affirmed or denied of the object in question, but the mind is merely aware of ("seizes") it. "Judgment" (says Reid, ed. Hamilton, i. p. 414) "is an act of the mind specifically different from simple apprehension or the bare conception of a thing"; and again, "Simple apprehension or conception can neither be true nor false." This distinction provides for the large class of mental acts in which we are simply aware of or "take in" a number of familiar objects, about which we in general make no judgment unless our attention is suddenly called by a new feature. Or again two alternatives may be apprehended without any resultant judgment as to their respective merits. Similarly G. F. Stout points out that while we have a very vivid idea of a character or an incident in a work of fiction, we can hardly be said in any real sense to have any belief or to make any judgment as to its existence or truth. With this mental state may be compared the purely aesthetic contemplation of music, wherein apart from, say, a false note, the faculty of judgment is for the time inoperative. To these examples may be added the fact that one can fully understand an argument in all its bearings without in any way judging its validity.

Without going into the question fully, it may be pointed out that the distinction between judgment and apprehension is relative. In every kind of thought there is judgment of some sort in a greater or less degree of prominence. Judgment and thought are in fact psychologically distinguishable merely as different, though correlative, activities of consciousness. Professor Stout further investigates the phenomena of apprehension, and comes to the conclusion that "it is possible to distinguish and identify a whole without apprehending any of its constituent details." On the other hand, if the attention focuses itself for a time on the apprehended object, there is an expectation that such details will as it were emerge into consciousness. Hence he describes such apprehension as "implicit," and in so far as the implicit apprehension determines the order of such emergence he describes it as "schematic." A good example of this process is the use of formulae in calculations; ordinarily the formula is used without question; if attention is fixed upon it, the steps by which it is shown to be universally applicable emerge and the "schema" is complete in detail.

With this result may be compared Kant's theory of apprehension as a synthetic act (the "synthesis of apprehension") by which the sensory elements of a perception are subjected to the formal conditions of time and space.

See G. F. Stout, *Analytic Psychology* (London, 1896); F. Brentano, *Psychologie* (bk. ii. ch. vii.), and *Vom Ursprung sittlicher Erkenntnis*; B. Titchener, *Outlines of Psychology* (New York, 1902), and text-books of psychology. Also PSYCHOLOGY.

APPRENTICESHIP (from Fr. *apprendre*, to learn), a contract whereby one person, called the master, binds himself to teach, and another, called the apprentice, undertakes to learn, some trade or profession, the apprentice serving his master for a certain time.

Roman law is silent on the subject on this contract, nor does it seem to have had any connexion with the division of the Roman citizens into tribes or colleges. So far as can be seen it arose in the middle ages, and formed an integral part of the system of trade gilds and corporations by which skilled labourers of all kinds sought protection against the feudal lords, and the maintenance of those exclusive privileges with which in the interests of the public they were favoured. In those times it was believed that neither arts nor sciences would flourish unless such only were allowed to practise them as had given proofs of reasonable proficiency and were formed into bodies corporate, with certain powers of self-government and the exclusive monopoly of their respective arts within certain localities; and the medieval *universitas* (corporation)—whether of smiths and tailors or of scholars—included both such as were entitled to practise and teach and such as were in course of learning. The former were the masters, the latter the apprentices. Hence the term *apprentice* was applied indifferently to such as were being taught a trade or a learned profession, and even to undergraduates or scholars who were qualifying themselves for the degree of doctor or master in the liberal arts. When barristers were first appointed by Edward I. of England they were styled *apprenticii ad legem*—the serjeants-at-law being *servientes ad legem*; and these two terms corresponded respectively to the trade names of apprentices and journeymen. During the middle ages the term of apprenticeship was seven years, and this period was thought no more than sufficient to instruct the learner in his profession, craft or mystery under a properly qualified master, teacher or doctor—for these names were synonymous—and to reimburse the latter by service for the training received. After this the apprentice became himself a master and a member of the corporation, with full rights to practise the business and to teach others in his turn; so also it would seem that undergraduates had to pass through a curriculum of seven years before they could attain the degree of doctor or master in the liberal arts. On the continent of Europe these rules were observed with considerable rigour, both in the learned professions and in those which we now designate as trades. In England they made their way more slowly and did not receive much countenance, there being always a jealousy of anything savouring of interference with the freedom of trade. Nevertheless the formation of gilds and companies of tradesmen in England dates probably from the 12th century, and the institution of apprenticeships cannot be of much later date. In 1388 and 1405 it is noticed in acts of parliament. By various subsequent statutes provisions were made for the regulation of the institution, and from them it appears that seven years was its ordinary and normal term in the absence of special arrangement. By a statute of 1562 this was made the law of the land, and it was enacted that no person should exercise any "trade or mystery" without having served a seven years' apprenticeship. In no place did the apprentices become so formidable by their numbers and organization as in London. During the Great Rebellion they took an active part as a political body, and were conspicuous after the Restoration by being frequently engaged in tumults. It was probably owing to this circumstance, quite as much as to economic considerations of freedom of trade, that the act of Elizabeth never found much favour with the courts of law. Soon after the Great Rebellion we find the apprentice laws strongly reprobated by the judges, who endeavoured, on the theory that the act of Elizabeth could apply to no trades which were not in existence at its date, to limit its operation as far as possible. Such limitation of the act gave rise to many absurd anomalies and inconsistencies, *e.g.* that a coachmaker could not make his own wheels but must buy them of a wheelwright, while the latter might make both wheels and coaches, because coach-making was not a trade in England when the act of Elizabeth was passed. For the like reason the great textile and metal manufactures which arose at Manchester and Birmingham were held exempt from the operation of the statute. Concurrently with the dislike to the apprentice laws which such anomalies generated, the doctrines of Adam Smith, that all monopolies or restrictions on the freedom of trade were injurious to the public interest, had gradually been making their way, and notwithstanding much opposition an act was passed in 1814 by which the statute of Elizabeth, in so far as it enacts that no person shall engage in any trade without a seven years' apprenticeship, was wholly repealed. The effect of this act was to give every person the fullest right to exercise any occupation or calling of a mechanical or trading kind for which he deemed himself qualified.

Apprenticeship, therefore, which was formerly a compulsory, now became a voluntary contract. In the case of the learned professions the principles and theories which gave birth to corporations with monopolies, and required apprenticeship or its equivalents, have—contrary to what has taken place in trade—been not only maintained but intensified; that is to say, not only have such bodies retained and even extended in some cases their exclusive privileges, but in general no one is allowed to practise in such professions unless his capabilities have been tested and approved by public authority. Thus no man is allowed to practise law or medicine in any of their branches who has not undergone the appropriate training by attendance at a university or by apprenticeship—sometimes by both combined—and passed certain examinations. Entrance to the church is guarded by similar checks. In such instances the old principle—now generally abandoned in trade—of granting a monopoly to those possessing a certain standard of qualification is maintained in greater vigour than ever.

In some kinds of manufacture the old conditions have been modified by the subdivisions of labour or by the introduction of machinery, which have reduced the amount of skill which formerly was requisite, and thus they have passed out of the category of the higher skilled handicrafts, as only a very slight or short training is necessary to make an efficient worker; but a large number of the higher skilled trades remain which require a long period of training at the bench, and a careful inquiry into this subject has shown that in nearly all of such trades there is a scarcity of skilled workers, which is due to the falling off in the number of apprenticeships. Many persons qualified to form an opinion deplore that something in the nature of the old standard of qualification is not still applied to those trades, and consider that the only method of restoring a high standard of skill is by apprenticeship. The decay of apprenticeship in these trades is due, not to any inherent defect in the system, nor to its having been superseded by any other form of technical education, but to difficulties, especially in London and some other large towns, which place it beyond the reach of that class of persons who have the greatest need of it. Among these difficulties are:—first, insufficient organization, and secondly, want of funds to pay premiums where such are required. These difficulties are accentuated in London and some other large towns, but in many other districts apprenticeship is actively proceeded with. Efforts are being made, notably by the National Institution of Apprenticeship, to meet these difficulties. The Charity Commissioners in their report for 1905 recognized the value of this institution, and stated that they would in future enable the trustees of charity endowments for apprenticeship to avail themselves of the practical co-operation of the institution. The modern trade unions, on the other hand, have done nothing to assist in restoring apprenticeship to its proper place; on the contrary, they have hampered it by restrictions which they have imposed, limiting the number of apprentices who may be taken. The result of fewer apprentices has been not only to lower the standard of skill in the higher trades, but to reduce the productive capacity of the artisans. The altered conditions now attending apprenticeship are, mainly, that the apprentice does not live with the master, and that the term is generally five years instead of a longer period; but the principle remains precisely the same, and the fact that it is applied more and more largely in Austria, Germany and other countries is an evidence of its necessity.

The contract of apprenticeship is generally created by indenture, but any writing properly expressed and attested will do. The full consideration must be set out, and the instrument, whether a premium is paid or not, must be duly stamped, except in the case of parish apprentices and apprentices to the sea service (see SEAMEN, LAWS RELATING TO). Where a charity or institution intervenes, it retains control over the indentures until the end of the term of apprenticeship, when the indenture should be cancelled and given up to the apprentice. Any one who is capable of making a contract can take an apprentice, and the law does not limit the number which may be taken by any master. Any person of legal capacity can bind himself as an apprentice, provided he is over seven years of age, though, as he is by the common law exempt from all liability *ex contractu*, it is usual for the apprentice's relations or friends to become bound for his service and good conduct during the period of his apprenticeship. The consent of the apprentice, however, must be expressed by his executing the indenture. No child under nine can be bound as a parish apprentice. The master must teach the apprentice the agreed trade or trades; should the master exercise two trades (which he has agreed to teach) and give up one, it would be good ground for dissolving the contract by the apprentice. An apprentice is not bound to work on Sundays, but he may be required to work on bank holidays. He cannot become a volunteer (soldier) without his master's consent. It is usual in the indenture to state whether the apprentice is to be paid wages or otherwise. If the contract is to pay wages, no deduction can be made owing to illness or accident, unless it has been so provided for in the indentures. Nor is the apprentice liable for breakages or similar faults. The master has been supposed to have a right to administer moderate corporal punishment, though he may not delegate it. But this right is really obsolete. According to old custom a master provided proper food for his apprentices, and medical attendance when required; but the modern practice is for apprentices to reside with their parents or friends who maintain them. A master cannot assign indentures without the approval of the apprentice or such parties as are named in the contract for this purpose, even if he should transfer his business. The contract of apprenticeship may be dissolved by (1) efflux of time; (2) by death (if the master dies, some part of the premium is usually returnable, but if the apprentice dies no part is returnable); (3) by consent; (4) in case of grave misconduct; (5) under the Bankruptcy Act 1883, providing for discharge of the indentures of apprenticeship and for payment on account of premium. Disputes between master and apprentice, in cases where no premium has been paid, or where the premium does not exceed £25, are dealt with by courts of summary jurisdiction. Apprentices bound according to the "custom of London," who are infants above the age of fourteen years and under twenty-one and unmarried, are responsible upon covenants contained in indentures executed by them just as if they were of full age. The term of apprenticeship is usually not less than four years. Apprentices by the custom of London in agreements made at the Guildhall are subject to the jurisdiction of the chamberlain of London.

Parish apprentices are those bound out by guardians of the poor in England. By the Poor Relief Act 1601, overseers of the poor were empowered, with the consent of two justices, to put out poor children as apprentices "where they shall be convenient." Owing to the disinclination to receive such apprentices it became necessary to make the reception compulsory (1696), but this compulsion to receive them was abolished in 1844. Many statutes have been passed from time to time regulating the apprenticing of parish children, but it is now under the control of the Local Government Board, which issues rules specifying fully the manner in which such children are to be bound, assigned and maintained.

AUTHORITIES.—See E. Austin, *Law Relating to Apprentices* (1890); Addison, *On Contracts* (1905). For the state of apprenticeship in European countries, and, more particularly in France, see *Apprentissage, enquête et documents* (Paris, 1904, Conseil Supérieur du Travail, Ministère du Commerce, de l'Industrie, des Postes et des Télégraphes, session de 1902). See also the literature issued by the National Institution of Apprenticeship, London. (J. S. B.)

APPROPRIATION (from Lat. *appropriare*, to set aside), the act of setting apart and applying to a particular use to the exclusion of all other. In ecclesiastical law, appropriation is the perpetual annexation of an ecclesiastical benefice to the use of some spiritual corporation, either aggregate or sole. In the middle ages in England the custom grew up of the monasteries reserving to their own use the greater part of the tithes of their appropriated benefices, leaving only a small portion to their vicars in the parishes. On the dissolution of the monasteries these "great tithes" were often granted, with the monastic lands, to laymen, whose successors, known as "lay impropriators" or "lay rectors," still hold them, the system being known as *impropriation*. Appropriation may be severed and the church become disappropriate, by the presentation of a clerk, properly instituted and inducted, or by the dissolution of the corporation possessing the benefice.

In the law of debtor and creditor, appropriation of payments is the application of a particular payment for the purpose of paying a particular debt. When a creditor has two debts due to him from the same debtor on distinct accounts, the general law as to the appropriation of payments made by the debtor is that the debtor is entitled to apply the payments to such account as he thinks fit; *solvitur in modum solventis*. In default of appropriation by the debtor the creditor is entitled to determine the application of the sums paid, and may appropriate them even to the discharge of debts barred by the Statute of Limitations. In default of appropriation by either debtor or creditor, the law implies an appropriation of the earlier payments to the earlier debts.

In constitutional law, appropriation is the assignment of money for a special purpose. In the United Kingdom an Appropriation Bill is a bill passed at the end of each session of parliament, enumerating the money grants made during the session, and appropriating the various sums, as voted by committee of supply, to the various purposes for which it is to be applied. The United States constitution (art. I. § 9) says: "No money shall be drawn from the treasury, but in consequence of appropriations made by law." Bills for appropriating money originate in the House of Representatives, but may be amended in the Senate.

APPURTENANCES (from late Lat. *appertinentia*, from *appertinere*, to appertain), a legal term for what belongs to and goes with something else, the accessories or things usually conjoined with the substantive matter in question.

APRAKSIN, THEDOR MATVYEEVICH (1671–1728), Russian soldier, began life as one of the pages of Tsar Theodore III., after whose death he served the little tsar Peter in the same capacity. The playfellowship of the two lads resulted in a lifelong friendship. In his twenty-first year Apraksin was appointed governor of Archangel, then the most important commercially of all the Russian provinces, and built ships capable of weathering storms, to the great delight of the tsar. He won his colonelcy at the siege of Azov (1696). In 1700 he was appointed chief of the admiralty, in which post (from 1700 to 1706) his unusual technical ability was of great service. While Peter was combating Charles XII., Apraksin was constructing fleets, building fortresses and havens (Taganrog). In 1707 he was transferred to Moscow. In 1708 he was appointed commander-in-chief in Ingria, to defend the new capital against the Swedes, whom he utterly routed, besides capturing Viborg in Carelia. He held the chief command in the Black Sea during the campaign of the Pruth (1711), and in 1713 materially assisted the conquest of Finland by his operations from the side of the sea. In 1719–1720 he personally conducted the descents upon Sweden, ravaging that country mercilessly, and thus extorting the peace of Nystad, whereby she surrendered the best part of her Baltic provinces to Russia. For these great services he was made a senator and admiral-general of the empire. His last expedition was to Reval in 1726, to cover the town from an anticipated attack by the English government, with whom the relations of Russia at the beginning of the reign of Catharine I. were strained almost to breaking-point. Though frequently threatened with terrible penalties by Peter the Great for his incurable vice of peculation, Apraksin, nevertheless, contrived to save his head, though not his pocket, chiefly through the mediation of the good-natured empress, Catharine, who remained his friend to the last, and whom he assisted to place on the throne on the death of Peter. Apraksin was the most genial and kind-hearted of all Peter's pupils. He is said to have never made an enemy. He died on the 10th of November 1728.

See R. Nisbet Bain, *The Pupils of Peter the Great* (London, 1897). (R. N. B.)

APRICOT (from the Lat. *praecox*, or *praecoquus*, ripened early, *coquere*, to cook, or ripen; the English form, formerly "apricock" and "abrecox," comes through the Fr. *abricot*, from the Span. *albaricoque*, which was an adaptation of the Arabic *al-burquk*, itself a rendering of the late Gr. πρεκόκκια or πραικόκιον, adapted from the Latin; the derivation from *in aprico coctus* is a mere guess), the fruit of *Prunus armeniaca*, also called *Armeniaca vulgaris*. Under the former name it is regarded as a species of the genus to which the plums belong, the latter establishes it as a distinct genus of the natural order *Rosaceae*. The apricot is, like the plum, a stone fruit, cultivated generally throughout temperate regions, and used chiefly in the form of preserves and in tarts. The tree has long been cultivated in *Armenia* (hence the name *Armeniaca*); it is a native of north China and other parts of temperate Asia. It flowers very early in the season, and is a hardy tree, but the fruit will scarcely ripen in Britain unless the tree is trained against a wall. A great number of varieties of the apricot, as of most cultivated fruits, are distinguished by cultivators. The kernels of several varieties are edible, and in Egypt those of the Musch-Musch variety form a considerable article of commerce. The French liqueur *Eau de noyaux* is prepared from bitter apricot kernels. Large quantities of fruit are imported from France into the United Kingdom.

The apricot is propagated by budding on the mussel or common plum stock. The tree succeeds in good well-drained loamy soil, rather light than heavy. It is usually grown as a wall tree, the east and west aspects being preferred to the south, which induces mealiness in the fruit, though in Scotland the best aspects are necessary. The most usual and best mode of training is the fan method. The fruit is produced on shoots of the preceding year, and on small close spurs formed on the two-year-old wood. The trees should be planted about 20 ft. apart. The summer pruning should begin early in June, at which period all the irregular fore-right and useless shoots are pinched off; and, shortly afterwards, those which remain are fastened to the wall. At the winter pruning all branches not duly furnished with spurs and fruit buds are removed. The young bearing shoots are moderately pruned at the points, care being, however, taken to leave a terminal shoot or leader to each branch. The most common error in the pruning of apricots is laying in the bearing shoots too thickly; the branches naturally diverge in fan training, and when they extend so as to be about 15 in. apart, a fresh branch should be laid in, to be again subdivided as required. The blossoms of the apricot open early in spring, but are more hardy than those of the peach; the same means of protection when necessary may be employed for both. If the fruit sets too numerously, it is thinned out in June and in the beginning of July, the later thinnings being used for tarts. In the south of England, where the soil is suitable, the hardier sorts of apricot, as the Breda and Brussels, bear well as standard trees in favourable seasons. In such cases the trees may be planted from 20 to 25 ft. apart.

The ripening of the fruit of the apricot is accelerated by culture under glass, the trees being either planted out like peaches or grown in pots on the orchard-house system. They must be very gently excited, since they naturally bloom when the spring temperature is comparatively low. At first a maximum of 40° only must be permitted; after two or three weeks it may be raised to 45°, and later on to 50° and 55°, and thus continued till the trees are in flower, air being freely admitted, and the minimum or night temperature ranging from 40° to 45°. After the fruit is set the temperature should be gradually raised, being kept higher in clear weather than in dull. When the fruit has stoned, the temperature may be raised to 60° or 65° by day and 60° by night; and for ripening off it may be allowed to reach 70° or 80° by sun heat.

The Moorpark is one of the best and most useful sorts in cultivation, and should be planted for all general purposes; the Peach is a very similar variety, not quite identical; and the Hemskerk is also similar, but hardier. The Large Early, which ripens in the end of July and beginning of August, and the Kaisha, a sweet-kernelled variety, which ripens in the middle of August, are also to be recommended. For standard trees in favourable localities the Breda and Brussels may be added.

APRIES ('Απρίης), the name by which Herodotus (ii. 161) and Diodorus (i. 68) designate *Uehabrēʿ*, Οὐαφρής (Pharaoh-Hophra), the fourth king (counting from Psammetichus I.) of the twenty-sixth Egyptian dynasty. He reigned from 589 to 570 B.C. See EGYPT and AMASIS.

APRIL, the second month of the ancient Roman, and the fourth of the modern calendar, containing thirty days. The derivation of the name is uncertain. The traditional etymology from Lat. *aperire*, "to open," in allusion to its being the season when trees and flowers begin to "open," is supported by comparison with the modern Greek use of ἄνοιξις (opening) for spring. This seems very possible, though, as all the Roman months were named in honour of divinities, and as April was sacred to Venus, the *Festum Veneris et Fortunae Virilis* being held on the first day, it has been suggested that Aprilis was originally her month Aphrilis, from her Greek name Aphrodite. Jacob Grimm suggests the name of a hypothetical god or hero, *Aper* or *Aprus*. On the fourth and the five following days, games (*Ludi Megalenses*) were celebrated in honour of Cybele; on the fifth there was the *Festum Fortunae Publicae*; on the tenth (?) games in the circus, and on the nineteenth equestrian combats, in honour of Ceres; on the twenty-first—which was regarded as the birthday of Rome—the *Vinalia urbana*, when the wine of the previous autumn was first tasted; on the twenty-fifth, the *Robigalia*, for the averting of mildew; and on the twenty-eighth and four following days, the riotous *Floralia*. The Anglo-Saxons called April *Oster-monath* or *Eostur-monath*, the period sacred to *Eostre* or *Ostara*, the pagan Saxon goddess of spring, from whose name is derived the modern Easter. St George's day is the twenty-third of the month; and St Mark's Eve, with its superstition that the ghosts of those who are doomed to die within the year will be seen to pass into the church, falls on the twenty-fourth. In China the symbolical ploughing of the earth by the emperor and princes of the blood takes place in their third month, which frequently corresponds to our April; and in Japan the feast of Dolls is celebrated in the same month. The "days of April" (*journées d'avril*) is a name appropriated in French history to a series of insurrections at Lyons, Paris and elsewhere, against the government of Louis Philippe in 1834, which led to violent repressive measures, and to a famous trial known as the *procès d'avril*.

See Chambers's *Book of Days*; Grimm's *Geschichte der deutschen Sprache*, Cap. "Monate"; also APRIL-FOOLS' DAY.

APRIL-FOOLS' DAY, or ALL-FOOLS' DAY, the name given to the 1st of April in allusion to the custom of playing practical jokes on friends and neighbours on that day, or sending them on fools' errands. The origin of this custom has been much disputed, and many ludicrous solutions have been suggested, *e.g.* that it is a farcical commemoration of Christ being sent from Annas to Caiaphas, from Caiaphas to Pilate, from Pilate to Herod, and from Herod back again to Pilate, the crucifixion having taken place about the 1st of April. What seems certain is that it is in some way or other a relic of those once universal festivities held at the vernal equinox, which, beginning on old New Year's day, the 25th of March, ended on the 1st of April. This view gains support from the fact that the exact counterpart of April-fooling is found to have been an immemorial custom in India. The festival of the spring equinox is there termed the feast of Huli, the last day of which is the 31st of March, upon which the chief amusement is the befooling of people by sending them on fruitless errands. It has been plausibly suggested that Europe derived its April-fooling from the French. They were the first nation to adopt the reformed calendar, Charles IX. in 1564 decreeing that the year should begin with the 1st of January. Thus the New Year's gifts and visits of felicitation which had been the feature of the 1st of April became associated with the first day of January, and those who disliked the change were fair butts for those wits who amused themselves by sending mock presents and paying calls of pretended ceremony on the 1st of April. Though the 1st of April appears to have been anciently observed in Great Britain as a general festival, it was apparently not until the beginning of the 18th century that the making of April-fools was a common custom. In Scotland the custom was known as "hunting the gowk," *i.e.* the cuckoo, and April-fools were "April-gowks," the cuckoo being there, as it is in most lands, a term of contempt. In France the person befooled is known as *poisson d'avril.* This has been explained from the association of ideas arising from the fact that in April the sun quits the zodiacal sign of the fish. A far more natural explanation would seem to be that the April fish would be a young fish and therefore easily caught.

A PRIORI (Lat. *a*, from, *prior*, *prius*, that which is before, precedes), (1) a phrase used popularly of a judgment based on general considerations in the absence of particular evidence; (2) a logical term first used, apparently, by Albert of Saxony (14th century), though the theory which it denotes is as old as Aristotle. In the order of human knowledge the particular facts of experience come first and are the basis of generalized laws or causes (the Scholastic *notiora nobis*); but in the order of nature the latter rank first as the self-existent, fundamental truths of existence (*notiora naturae*). Thus to Aristotle the *a priori* argument is from law or cause to effect, as opposed to what we call *a posteriori* (*posterior*, subsequent, derived), from effect to cause. Since Kant the two phrases have become purely adjectival (instead of adverbial) with a technical controversial sense, closely allied to the Aristotelian, in relation to knowledge and judgments generally. *A priori* is applied to judgments which are regarded as independent of experience, and belonging to the essence of thought; *a posteriori* to those which are derived from particular observations. The distinction is analogous to that between analysis and synthesis, deduction and induction (but there may be a synthesis of *a priori* judgments, cf. Kant's "Synthetic Judgment *a priori*"). Round this distinction a rather barren controversy has raged, and almost all modern philosophers have labelled themselves either "Intuitionalist" (*a priori*) or "Empiricist" (*a posteriori*) according to the view they take of knowledge. In fact, however, the rival schools are generally arguing at cross purposes; there is a knowledge based on particulars, and also a knowledge of laws or causes. But the two work in different spheres, and are complementary. The observation of isolated particulars gives not necessity, but merely strong probability; necessity is purely intellectual or "transcendental." If the empiricist denies the intellectual element in scientific knowledge, he must not claim absolute validity for his conclusions; but he may hold against the intuitionalist that absolute laws are impossible to the human intellect. On the other hand, pure *a priori* knowledge can be nothing more than form without content (*e.g.* formal logic, the laws of thought). The simple fact at the bottom of the controversy is that in all empirical knowledge there is an intellectual element, without which there is no correlation of empirical data, and every judgment, however simple, postulates a correlation of some sort if only that between the predicate and its contradictory.

APRON (a corruption arising from a wrong division of "a napron" into "an apron," from the Fr. *naperon*, *napperon*, a diminutive of *nappe*, Lat. *mappa*, a napkin), an article of costume used to protect the front of the clothes. It forms part of the ceremonial dress of Freemasons. The "apron" worn by church dignitaries is a shortened cassock (*q.v.*). The word has many technical uses, as for the protecting slope in front of the sill of dock-gates, or at the foot of weirs.

APSARAS, in Hindu mythology, a female spirit of the clouds and waters. In the Rig-Veda there is one Apsaras, wife of Gandharva; in the later scriptures there are many Apsaras who act as the handmaidens of Indra and dance before his throne. They are able to change their form, and specially rule over the fortunes of gaming. One of their duties is to guide to paradise the heroes who fall in battle, whose wives they then become. They are distinguished as *daivika* ("divine") or *laukika* ("worldly").

APSE (Gr. ἁψίς, a fastening, especially the felloe of a wheel; Lat. *absis*), in architecture, a semicircular recess covered with a hemispherical vault. The term is applied also to the termination to the choir, transept or aisle of any church which is either semicircular or polygonal in plan, whether vaulted or covered with a timber roof; a church is said to be "apsidal" when it terminates in an apse.

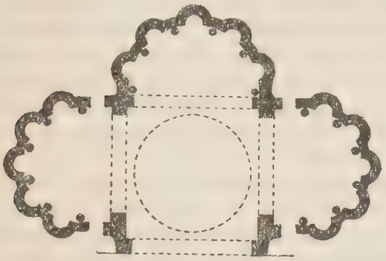
The earliest example of an apse is found in the temple of Mars Ultor at Rome (2 B.C.), and it formed afterwards the favourite feature terminating the rear of any temple, and one which gave importance to the statue of the deity to whom the temple was dedicated. Its use by the Romans was not confined to the temples, as it is found in the palaces on the Palatine Hill, the great Thermae (Baths) and other monuments. In the civil basilicas the apse was screened off by columns, and constituted the court of justice. In the Ulpian (Trajan's) Basilica the apses at each end were of such great dimensions as to come better under the definition of hemicycles (*q.v.*). In these apses the floor was raised, and had an altar placed in the centre of its chord, where sacrifices were made prior to the sittings. The only other two Roman basilicas in which the semicircular apse can still be traced are that commenced by Maxentius and completed by Constantine at Rome and the basilica at Trier (Trèves).

In the earliest Christian basilica, St Peter's at Rome, built 330 A.D., the apse, 57 ft. in diameter, raised above the confessio or crypt, was placed at the west end of the church. This orientation was originally followed in the churches of St Paul and St Lawrence (S. Lorenzo fuori le Mura), both outside the walls of Rome, and is found in most of the churches at Rome. On the other hand, in the Byzantine church, the apse was built at the east end of the church.

During the reign of Justin the Second (A.D. 565–574), owing to a change in the liturgy, two more apses were added, one on each side of the central apse. These in the Greek Church were provided not to hold altars but for ceremonial purposes. One of the earliest examples is found in the church of St Nicholas at Myra of the 6th century, and the basilica erected in the great court of the temple at Baalbek shows the triple apse. The earliest example in Rome is found in the church of Sta Maria in Cosmedin (772–795), built probably by Greek craftsmen, who had been exiled by the Iconoclasts. Other triapsal choirs are found in the cathedral of Parenzo (542 A.D.), in St Mark's, Venice, in Sta Fosca and the Duomo at Torcello, and in numerous examples throughout Italy and Germany. In central Syria there is one example only, at Kalat Seman, where the side apses were a later addition.

There is one important distinction to be drawn between the Byzantine and the Latin apses; they are both semicircular internally, but externally the former are nearly always polygonal. It follows, therefore, that in those churches in Italy where the apse is polygonal externally, it is a sign of direct Byzantine influence. This is found in St Mark's, Venice; Sta Fosca, Torcello; Murano; nearly all the churches at Ravenna; and in the Crusaders' churches throughout Syria.

In the Coptic church in Egypt we find other characteristics; in the churches of the Red and White Monasteries, attributed to St Helena, an unusual depth is given to the apse, in the walls of which niches are sunk; in the church of St John at Antinoë there are no fewer than seven. Similar niches are found in the apses of St Mark's, Venice, built in A.D. 828, it is said in imitation of St Mark's in Alexandria, to receive the relics of St Mark brought over from there.



Apse of the White Monastery.

In a large number of the apses in the Coptic churches the seats round the apse with the bishop's throne in the centre are still preserved; of these the best examples are at Abu Sargah, Al 'Adra and Abu-s-Sifain. Unfortunately there are no remains of the fittings in the tribunes of the ancient Roman basilicas, but those in St Peter's at Rome, which were probably copied from them, are recorded in drawings, there being two or three rows of stone seats with the papal throne in the centre. It is possible also that some may still exist in the other early Christian basilicas at Rome, but there have been so many changes that it is not possible to trace them. In the cathedral of Parenzo in Istria (A.D. 532–535), the hemicycle of marble seats for the clergy with the episcopal chair in the centre still exists. A similar arrangement is found in the apse of the church of the 6th century attached to the church of St Helena in the island of Paros, where there are eight steep grades of semicircular stone seats with the bishop's chair in the centre. The aspect of the interior of this apse has in consequence very much the appearance of a Roman theatre. A third example, better known, exists at Torcello, with six concentric seats rising one above the other, and in the centre the episcopal chair with a flight of thirteen steps down in front of it.

In the basilica at Bethlehem, the east end of which was reconstructed probably in the 5th century, apses of similar dimensions to the eastern apse were built at the north and south end of the transept. The same disposition is found in the Coptic churches of the Red and White Monasteries just referred to, in the church of St Elias at Salonica (*c.* 1012), the cathedral of Echmiadzin in Armenia, at Vatopedi, Mt. Athos, and some other Byzantine churches. An early example in France exists in the church of Germigny-des-Prés on the Loire (806; rebuilt 1868), where the three apses are horseshoe on plan, and the same is found in the church at Oberzell in the island of Reichenau, Lake of Constance, except that the eastern apse there is square. Small examples also are found at Querqueville and at St Wandrille near Caudebec, both in Normandy, but the finest development takes place in the church of St Maria im Capitol at Cologne, where the aisles are carried round both the northern and southern apses. The same feature exists in the cathedral of Tournai in Belgium and the churches at Cambrai, Soissons and Valenciennes (the last destroyed at the Revolution) in France, and also in the cathedrals of Como and of Pisa in Italy. Without aisles, there are examples in the churches of the Apostles and of St Martin at Cologne; St Quirinus at Neuss; at Roermond; St Cross, Breslau; the cathedral of Bonn; and, at a later date in the Marienkirche at Trier; S. Elizabeth at Marburg; the church of Sta Maria-del-Fiore at Florence; and the cathedral of Parma.

In consequence of a change made in the orientation of apses in the 6th or 7th century, others were subsequently added at the west end of existing churches, and this is considered to have been the case at Canterbury; but in the German churches sometimes apses were built from the first at both ends, such as are shown on the manuscript plan of St Gall, of the 9th century. Western apses exist at Gernrode; Drübeck; Huyseburg; the Obermünster of Regensburg; St Godehard in Hildesheim; the cathedrals of Worms and Trier; the Abbey church of Laach; the Minster at Bonn; and in St Pietro-in-Grado near Pisa.

The triapsal churches, to which we have referred, are those in which the side apses form the termination of the side aisles; but where there are transepts, the aisles are sometimes not continued beyond them, and the expansion of the transept to north and south gives more ample space for apses; of these there are many examples, as in the Abbey church of Laach in Germany; at Romsey; Christchurch, Hants; Gloucester, Ely, Norwich and Canterbury cathedrals, in England; and at St Georges de Boscherville in France; sometimes there being space for two apses on each side.

In the beginning of the 13th century in France, the apses became radiating chapels outside the choir aisle, henceforth known as the chevet. These radiating chapels would seem to have been suggested in Norwich and Canterbury cathedrals, but the feature is essentially a French one and in England is found only in Westminster Abbey, into which it was introduced by Henry III., to whom the chevets of Amiens, Beauvais and Reims were probably well known. (R. P. S.)

APSE and **APSIDES,** in mechanics, either of the two points of an orbit which are nearest to and farthest from the centre of motion. They are called the lower or nearer, and the higher or more distant apsides respectively. The "line of apsides" is that which joins them, forming the major axis of the orbit.

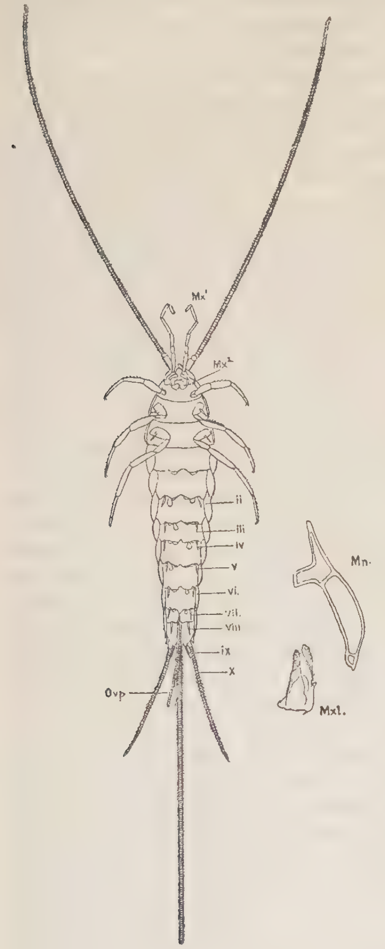
APSINES of Gadara, a Greek rhetorician, who flourished during the 3rd century A.D. After studying at Smyrna, he taught at Athens, and gained such a reputation that he was raised to the consulship by the emperor Maximinus (235–238). He was the friend of Philostratus, the author of the *Lives of the Sophists*, who speaks of his wonderful memory and accuracy. Two rhetorical treatises by him are extant: Τέχνη ῥητορική, a handbook of rhetoric greatly interpolated, a considerable portion being taken from the *Rhetoric* of Longinus; and a smaller work, Περὶ ἐσχηματισμένων προβλημάτων, on Propositions maintained figuratively.

Editions by Bake, 1849; Spengel-Hammer in *Rhetores Graeci*, ii. (1894); see also Hammer, *De Apsine Rhetore* (1876); Volkmann, *Rhetorik der Griechen und Römer* (1885).

APT, a town of south-eastern France, in the department of Vaucluse, on the left bank of the Coulon, 41 m. E. of Avignon by rail. Pop. (1906) 4990. The town was formerly surrounded by massive ancient walls, but these have now been for the most part replaced by boulevards; many of its streets are narrow and irregular. The chief object of interest is the church of Sainte-Anne (once the cathedral), the building of which was begun about the year 1056 on the site of a much older edifice, but not completed until the latter half of the 17th century. Many Roman remains have been found in and near the town. A fine bridge, the Pont Julien, spanning the Coulon below the town, dates from the 2nd or 3rd century. A tribunal of first instance and a communal college are the chief public institutions. The chief manufactures are silk, confectionery and earthenware; and there is besides a considerable trade in fruit, grain and cattle. Apt was at one time the chief town of the Vulgientes, a Gallic tribe; it was destroyed by the Romans about 125 B.C. and restored by Julius Caesar, who conferred upon it the title *Apta Julia*; it was much injured by the Lombards and the Saracens, but its fortifications were rebuilt by the counts of Provence. The bishopric, founded in the 3rd century, was suppressed in 1790.

APTERA (Greek for "wingless"), a term in zoological classification applied by Linnaeus to various groups of wingless arthropods, including some of the insects, the centipedes, the millipedes, the Arachnida (scorpions, spiders, &c.) and the Crustacea. In modern zoology the term has become restricted to the lowest order of the class Hexapoda or true insects. This order includes the bristle-tails and the springtails.

Many wingless insects—such as lice, fleas and certain earwigs and cockroaches—are placed in various orders together with winged insects to which they show evident relationships. In such cases the absence of wings must be regarded as secondary—due to a parasitic or other special manner of life. But the bristle-tails and springtails, which form the modern order Aptera, are all without any trace of wings, and, on account of several remarkable archaic characters which they exhibit, there is reason for believing that they are primitively wingless—that they represent an early offshoot which sprang from the ancestral stock of the Hexapoda before organs of flight had been acquired by the class.



From *Knowledge*.

FIG. 1.—A typical Thysanuran (*Machilis maritima*). Female, ventral view.

*Mx*¹, *Mx*², 1st and 2nd maxillae.
ii.-x, Appendages on 2nd to 10th abdominal segments. The eversible sacs on the abdominal segments are shown, some protruded and some retracted.
Ovp, Ovipositor.
Mn, Mandible, and *Mxl*. maxillula, dissected out of head.

Characters.—In addition to the complete absence of wings and of metamorphosis, the Aptera are characterized by peculiar elongate mandibles (figs. 1, *Mn.*; 2, *4*), with toothed apex and sub-apical grinding surface, like those of certain Crustacea; by the presence between the mandibles and maxillae of a pair of appendages (superlinguae or maxillulae), fig. 1, *Mxl.*, which are absent or vestigial in all other insects; and, in most genera, by the presence in the adult of abdominal appendages used for locomotion, these latter varying in number from one to nine pairs. Among peculiarities of the internal organs the segmental arrangement of the ovaries in most members of the order is noteworthy. Many Aptera are covered with flattened scales like those of moths.

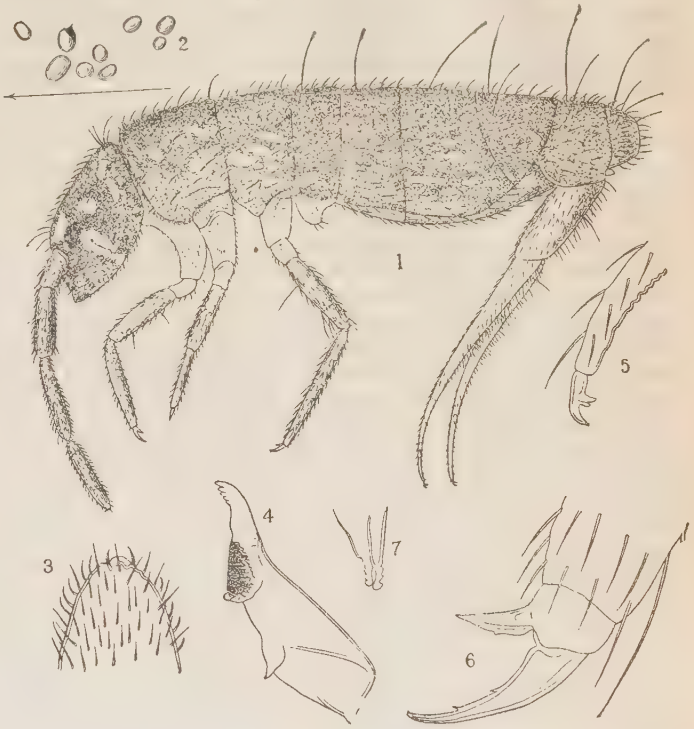
Classification.—The Aptera are divided into two divergent sub-orders, the *Thysanura* (*q.v.*) or bristle-tails, and the *Collembola* or springtails.

Thysanura.—The bristle-tails have an abdomen of eleven segments, the tenth usually carrying a pair of long many-jointed tail-feelers (cerci, fig. 1, x.); sometimes a median, jointed tail-appendage is also present. To these feelers the popular name is due. There may also be abdominal appendages—in the form of simple unjointed stylets (fig. 1, ii.-ix.), accompanied by paired eversible sacs, probably respiratory in function—on eight (or fewer) other abdominal segments. The head of a bristle-tail carries a pair of compound eyes and a pair of elongate many-jointed feelers.

The air-tube system is developed in varying degree in different bristle-tails, the number of pairs of spiracles being three (*Campodea*), nine (*Machilis*), ten (*Lepisma*), or eleven (*Japyx*).

Four families of Thysanura are usually recognized. In the *Machilidae* and *Lepismidae* (these two families are known as the Ectotrophi) the maxillae are like those of typical biting insects, and there is a median tail-bristle in addition to the paired cerci; while in the *Campodeidae* and *Japygidae* (which form the group Entotrophi) the jaws are apparently sunk in the head, through a deep inpushing at the mouth, and there is no median tail-bristle. The cerci in *Japyx* are not, as usual, jointed feelers, but strong, curved appendages forming a forceps as in earwigs.

Collembola.—In springtails, or *Collembola*, the jaws are sunk into the head, as in the entotrophous Thysanura; the head carries a pair of feelers with not more than six (usually four) segments, and there are eight (or fewer) distinct simple eyes on each side of the head (fig. 2, *1*, *2*). These are in some genera like the single elements (*ommatidia*) of a compound insect eye, in others like simple ocelli. The abdomen consists of six segments only. The first of these usually carries a ventral tube, furnished with paired eversible sacs which assist the insects in walking on smooth surfaces, and perhaps serve also as organs for breathing. From the researches of V. Willem it appears that the viscid fluid which causes the adherence of the ventral tube is secreted by a pair of glands in the head whose ducts open into a superficial groove leading from the second maxillae backward to the tube on the first abdominal segment. The third abdominal segment usually carries a pair of short appendages whose basal segments are fused together; this is the "catch" (fig. 2, 7) whose function is to hold in place the "spring," which is formed by the fourth pair of abdominal appendages—also with fused basal segments. In most Collembola the spring appears to belong to the fifth abdominal somite, but Willem, by study of the muscles, has shown that it really belongs to the fourth. The fused basal segments of the appendages form the "manubrium" of the spring, which carries the two "dentes" (usually elongate



From Carpenter, *Proc. R. Dub. Soc.* vol. xi.

FIG. 2.—Structure of Collembola.

1. *Isotoma hibernica.* Side view.
2. " Ocelli and post-antennal organ of right side.
3. " Tip of terminal antennal segment with antennal organ.
4. " Mandible.
5. " Tip of left dens with mucro. Outer view
6. " Hind-foot with claws. × 240.
7. *Entomobrya anomala.* Catch.

and flexible), each with a "mucro" at its tip (fig. 2, *5*). The fifth abdominal segment is the genital, and the sixth the anal somite.

The spring serves the Collembola which possess it as an efficient leaping-organ (see SPRINGTAIL). But in some genera it is greatly reduced and in many quite vestigial.

Most springtails are without air-tubes, and breathe through the general cuticle of the body. But in one family (*Sminthuridae*) a spiracle, opening on either side between the head and the prothorax, leads to a branching system of air-tubes. The *Sminthuridae* are further characterized by the globular abdomen, which shows but little external trace of segmentation, and by the well-developed spring.

In the *Entomobryidae* the body is elongate and clearly segmented, but the dorsal region (tergum) of the prothorax is much reduced and the head downwardly directed; the spring is well developed. In the *Achorutidae* the head is forwardly directed, the tergum of the prothorax conspicuous, and the spring small or vestigial.

In many genera of springtails a curious post-antennal organ, consisting of sensory structures (often complex in form) surrounded by a firm ring, is to be noticed on the cuticle of the head between the eyes and the feelers. It may be of use as an organ of smell. Other sensory organs occur on the third and fourth antennal segments in the *Achorutidae* and *Entomobryidae* (fig. 2, *3*).

Distribution and Habits.—The Aptera are probably the most widely distributed of all insects. Among the bristle-tails we find the genus *Machilis*, represented in Europe (including the Faeroe Islands) and in Chile; while *Campodea* lives high on the mountains and in the deepest caves. The springtails have even a wider distribution. The genus *Isotoma*, for example, has some of its numerous species in regions so remote as Alaska, Franz Josef Land, the Sandwich Islands, the South Orkneys, Graham Land, Kerguelen and South Victoria Land. As it is unlikely that these delicate insects could be transported across sea-channels, their wide and discontinuous range suggests both their great antiquity and the former existence of continental tracts over which they may have travelled to their present stations.

Springtails and bristle-tails live in damp concealed places—under stones or tree-bark, in moss, and in the decaying vegetable or animal matter which serves as food for most of them. Some species, however, eat fresh plant-tissues. A species of bristle-tail (*Machilis maritima*) and quite a number of springtails haunt the sea-coast at or below high-water mark. In such localities many thousands of individuals may sometimes be found associated together. The insect fauna of limestone caves both in Europe and North America is largely composed of Aptera, especially Collembola.

Geological History.—A supposed Thysanuran from the Silurian of New Brunswick has been described by G. F. Matthew, and another genus from the French Carboniferous by C. Brongniart. Not till the Tertiary do we find remains of Aptera in any quantity, species both of living and extinct genera being represented in the amber.

Development.—The embryonic development of several genera of Aptera, which has been carefully studied, will be more suitably described in comparison with that of other insects than here (see HEXAPODA).

BIBLIOGRAPHY.—The modern study of the Aptera may be said to date from the classical memoirs of T. Tullberg, "Sveriges Podurider," in *Kongl. Svensk Vetensk. Akad. Handl.* x., 1872, and Sir J. Lubbock (Lord Avebury), "Monograph of the Collembola and Thysanura," *Ray Society*, 1873. In these, full references to the older literature will be found. Subsequently our knowledge of the Thysanura has been markedly advanced by J. T. Oudemans, *Bijdrage tot de Kennis den Thysanura en Collembola* (Amsterdam, 1888); B. Grassi, who published between 1885 and 1889 a series of memoirs entitled "I progenitori dei Miriapodi e degli Insetti," in the *Atti Accad. di Scienz. Nat. Catania*, and the *Memor. R. Accad. dei Lincei*; and V. Willem, whose "Recherches sur les Collemboles et les Thysanoures," in *Mem. Cour. Acad. Roy. Belgique*, lviii., 1900, are indispensable to the student. In addition to this work of Willem, valuable anatomical papers on Collembola have been published by H. J. Hansen (*Zool. Anz.* xvi., 1893), J. W. Folsom (*Bull. Mus. Comp. Anat. Harv.* xxxv., 1899), C. Börner (*Zool. Anz.* xxiii., 1900), and K. Absolon (*Zool. Anz.* xxiii. and xxiv., 1900, 1901), the two latter writers having paid especial attention to the peculiar post antennal and antennal sense-organs of springtails. Absolon has also written on the Collembola of caves. These writers, with H. Schött, C. Schäffer and others, have published many systematic papers on Collembola, as has F. Silvestri on Thysanura. British species are mentioned in Lubbock's monograph; for recent additions, see G. H. Carpenter and W. Evans (*Proc. R. Phys. Soc. Edinb.* xiv., 1899, and xv., 1903). (G. H. C.)

APTERAL (from the Gr. *ἄπτερος*, wingless, *ἀ*-, privative and *πτερόν*, a wing), an architectural term applied to amphiprostyle temples which have no columns on the sides; in the Ionic temple on the Acropolis at Athens known as Nike Apteros, the adjective is used, not as applying to the goddess of victory but to the absence of any peristyle on the sides.

APTIAN (Fr. *Aptien*, from Apt in Vaucluse, France), in geology, the term introduced in 1843 by A. d'Orbigny (*Pal. France Crêt.* ii.) for the upper stage of the Lower Cretaceous rocks. In England it comprises the Lower Greensand and part of the Speeton beds; in France it is divided into two sub-stages, the lower, "Bedoulian," of Bedoule in Provence, with *Hoplites deshayesei* and *Ancyloceras Matheroni*; and an upper, "Gargasian," from Gargas near Apt, with *Hoplites furcatus* (*Dufrenoyi*) and *Phylloceras Guettardi*. To this stage belong the *Toucasia* limestone and *Orbitolina* marls of Spain; the *Schrattenkalk* (part) of the Alpine and Carpathian regions; and the *Terebrirostra* limestone of the same area. Parts of the Flysch of the eastern Alps, the Biancone of Lombardy, and *argile scagliose* of Emilia, are of Aptian age; so also are the "Trinity Beds" of North America. Deposits of bauxite occur in the Aptian hippurite limestone at Les Baux near Arles, and in the Pyrenees. The Aptian rocks are generally clays, marls and green glauconitic sands with occasional limestones. (See GREENSAND and CRETACEOUS.)

APULEIUS, LUCIUS, Platonic philosopher and rhetorician, was born at Madaura in Numidia about A.D. 125. As the son of one of the principal officials, he received an excellent education, first at Carthage and subsequently at Athens. After leaving Athens he undertook a long course of travel, especially in the East, principally with the view of obtaining initiation into religious mysteries. Having practised for some time as an advocate at Rome, he returned to Africa. On a journey to Alexandria he fell sick at Oea (Tripoli), where he made the acquaintance of a rich widow, Aemilia Pudentilla, whom he subsequently married. The members of her family disapproved of the marriage, and indicted Apuleius on a charge of having gained her affections by magical arts. He easily established his innocence, and his spirited, highly entertaining, but inordinately long defence (*Apologia* or *De Magia*) before the proconsul Claudius Maximus is our principal authority for his biography. From allusions in his subsequent writings, and the mention of him by St Augustine, we gather that the remainder of his prosperous life was devoted to literature and philosophy. At Carthage he was elected provincial priest of the imperial cult, in which capacity he occupied a prominent position in the provincial council, had the duty of collecting and managing the funds for the temples of the cult, and the superintendence of the games in the amphitheatre. He lectured on philosophy and rhetoric, like the Greek sophists, apparently with success, since statues were erected in his honour at Carthage and elsewhere. The year of his death is not known.

The work on which the fame of Apuleius principally rests has little claim to originality. The *Metamorphoses* or *Golden Ass* (the latter title seems not to be the author's own, but to have been bestowed in compliment, just as the *Libri Rerum Quotidianarum* of Gaius were called *Aurei*) was founded on a narrative in the *Metamorphoses* of Lucius of Patrae, a work extant in the time of Photius. From Photius's account (impugned, however, by Wieland and Courier), this book would seem to have consisted of a collection of marvellous stories, related in an inartistic fashion, and in perfect good faith. The literary capabilities of this particular narrative attracted the attention of Apuleius's contemporary, Lucian, who proceeded to work it up in his own manner, adhering, as Photius seems to indicate, very closely to the original, but giving it a comic and satiric turn. Apuleius followed this rifacimento, making it, however, the groundwork of an elaborate romance, interspersed with numerous episodes, of which the beautiful story of Cupid and Psyche is the most celebrated, and altering the *dénouement* to suit the religious revival of which he was an apostle.

The adventures of the youthful hero in the form of an ass are much the same in both romances, but in Apuleius he is restored to human shape by the aid of Isis, into whose mysteries he is initiated, and finally becomes her priestess. The book is a remarkable illustration of the contemporary reaction against a period of scepticism, of the general appetite for miracle and magic, and of the influx of oriental and Egyptian ideas into the old theology. It is also composed with a well-marked literary aim, defined by Kretzschmann as the emulation of the Greek sophists, and the transplantation of their *tours de force* into the Latin language. Nothing, indeed, is more characteristic of Apuleius than his versatility, unless it be his ostentation and self-confidence in the display of it. The dignified, the ludicrous, the voluptuous, the horrible, succeed each other with bewildering rapidity; fancy and feeling are everywhere apparent, but not less so affectation, meretricious ornament, and that effort to say everything finely which prevents anything being said well. The Latinity has a strong African colouring, and is crammed with obsolete words, agreeably to the taste of the time. When these defects are mitigated or overlooked, the *Golden Ass* will be pronounced a most successful work, invaluable as an illustration of ancient manners, and full of entertainment from beginning to end. The most famous and poetically beautiful portion is the episode of Cupid and Psyche, adapted from a popular legend of which traces are found in most fairy mythologies, which explains the seeming incongruity of its being placed in the mouth of an old hag. The allegorical purport he has infused into it is his own, and entirely in the spirit of the Platonic philosophy. Don Quixote's adventure with the wine-skins, and Gil Blas's captivity among the robbers, are palpably borrowed from Apuleius; and several of the humorous episodes, probably current as popular stories long before his time, reappear in Boccaccio.

Of Apuleius's other writings, the *Apology* has been already mentioned. The *Florida* (probably meaning simply "anthology," without any reference to style) consists of a collection of excerpts from his declamations, ingenious but highly affected, and in general perfect examples of the sophistical art of saying nothing with emphasis. They deal with the most varied subjects, and are intended to exemplify the author's versatility. The pleasing little tract *On the God of Socrates* expounds the Platonic doctrine of beneficent daemons, an intermediate class between gods and men. Two books on Plato (*De Platone et Ejus Dogmate*) treat of his life, and his physical and ethical philosophy; a third, treating of logic, is generally considered spurious. The *De Mundo* is an adaptation of the Περὶ κόσμου wrongly attributed to Aristotle. Apuleius informs us that he had also composed numerous poems in almost all possible styles, and several works on natural history, some in Greek. In the preparation of these he seems to have attended more closely to actual anatomical research than was customary with ancient naturalists. Some other works—dealing with theology, the properties of herbs, medical remedies and physiognomy, are wrongly attributed to him.

The character of Apuleius, as delineated by himself, is attractive; he appears vehement and passionate, but devoid of rancour; enterprising, munificent, genial and an enthusiast for the beautiful and good. His vanity and love of display are conspicuous, but are extenuated by a genuine thirst for knowledge and a surprising versatility of attainments. He prided himself on his proficiency in both Greek and Latin. His place in letters is accidentally more important than his genius strictly entitles him to hold. He is the only extant example in Latin literature of an accomplished sophist in the good sense of the term. The loss of other ancient romances has secured him a peculiar influence on modern fiction; while his chronological position in a transitional period renders him at once the evening star of the Platonic, and the morning star of the Neo-Platonic philosophy.

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APULIA (sometimes APPULIA in manuscripts but never in inscriptions), the district inhabited in ancient times by the Apuli. Strictly a Samnite tribe (see SAMNITES) settled round Mount Garganus on the east coast of Italy (Strabo vi. 3. 11), the Apuli mingled with the Iapygian tribes of that part of the coast (Dauni, Peucetii, Poediculi) who, like the Messapii, had come from Illyria, so that the name Apulia reached down to the border of the ancient Calabria. Almost the only monument of Samnite speech from the district is the famous *Tabula Bantina* from Bantia, a small city just inside the Peucetian part of Apulia, on the Lucanian border. This inscription is one of the latest and in some ways the most important monument of Oscan, though showing what appear to be some southern peculiarities (see OSCA LINGUA). Its date is almost certainly between 118 and 90 B.C., and it shows that Latin had not even then spread over the district (cf. LUCANIA). Far older than this are some coins from Ausculum and Teate (later known as Teanum Apulum), of which the earliest belong to the 4th century B.C. Roman or Latin colonies were few, Luceria (planted 314 B.C.) in the north and Brundisium (soon after 268) being the chief. (See R. S. Conway, *Italic Dialects*, xxviii.-xxx. pp. 15 f.; and Mommsen's introduction to the opening sections of *C.I.L.* ix.) (R. S. C.)

The wars of the 4th and 3rd centuries B.C. brought a great part of the pastures of the Apulian plain into the hands of the Roman state, and a tax was paid on every head of cattle and every sheep, at first to the tax farmer and later to the imperial procurator. It was under the Romans that the system of migration for the flocks reached its full development, and the practice is still continued; the sheep-tracks (*tratturi*), 350 ft. wide, leading from the mountains of the Abruzzi to the plain of Apulia date in the main at least from the Roman period, and are mentioned in inscriptions. The plain, however, which once served as winter grazing ground for a million sheep, now gives pasture to about one-half of that number.[1] The shepherds, who were slaves, often gave considerable trouble; we hear that some 7000 of them, who had made the whole country unsafe, were condemned to death in 185 B.C. (Livy xxxix. 29). Sheep-farming on a large scale was no doubt detrimental to the interests of the towns. We hear of repeated risings, for the last time in the Social War. Even in the 4th century B.C. the then chief town of Apulia, Teate or Teanum Apulum (see above), suffered in this way. Luceria subsequently took its place, largely owing to its military importance; but under the Empire it was succeeded by Canusium.

The road system of Apulia, which touched all the important towns, consisted of three main lines, the Via Appia (see APPIA, VIA), the Via Traiana, and the coast road, running more or less parallel in an east-south-east direction. The first (the southernmost), coming east from Beneventum, entered Apulia at the Pons Aufidi, and ran through Venusia to Tarentum, and thence, turning north-east, to Brundusium. The second, coming north-east from Beneventum, turned east at Aecae, and ran through Herdoniae, Canusium, Butuntum, Barium and Gnathia (Gnatia) to Brundusium. There was also a short cut from Butuntum to Gnathia through Caelia, keeping inland. The third parallel line ran to the north of the Via Traiana, in continuation of the road along the north-east coast of Picenum and Samnium; it entered Apulia near Larinum (whence a branch ran south to Bovianum Undecimanorum), and thence, keeping in the plain to the south of the Mons Garganus, rejoined the coast at Sipontum, where it received a branch road from the Via Traiana at Aecae, passing through Luceria and Arpi. It then passed through Barduli (where it was joined by a road from Canusium by way of Cannae) to Barium, where it joined the Via Traiana. From Barium a road probably ran direct to Caelia, and thence south-south-east to join the Via Appia some 25 m. north-west of Tarentum.

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[1] The migration was made compulsory by Alphonso I. in 1442, and remained so until 1865. Since that time the *tratturi* have been to some extent absorbed by private proprietors.

Barium was an important harbour, though less so than Brundusium and Tarentum, which, however, belonged to Calabria in the Roman sense. Apulia, with Calabria, formed the second region of Augustus, though we once find Calabria treated as a part of the third region, Lucania (*C. I. L.* ix. 2213). The Hannibalic and later wars had, Strabo tells us, destroyed the former prosperity of the country; in imperial times we hear little or nothing of it. Both were governed by a *corrector* from the time of Constantine onwards, but in 668 the Lombards conquered Calabria and Apulia, and it was then that the former name was transferred to Bruttium, the meaning of the latter being extended to include Calabria also. In the 10th century the greater part of this territory was recovered by the Byzantine emperors, whose governor was called Κατεπανός, a name which, under the corrupt form Capitanata, belonged to the province of Foggia till 1861. It was conquered by the Normans under William Bras-de-fer, who took the title of *comes Apuliae* in 1042; it was raised to a dukedom with Calabria by Robert Guiscard in 1059, and united to the Sicilian monarchy in 1127. Many of the important towns possess fine Romanesque cathedrals, constructed under the Normans and the Hohenstaufen rulers. It shared the subsequent fate of Sicily, becoming a part of the kingdom of the Two Sicilies in 1734, and being united with Italy in 1861.

Modern Apulia.

Modern Apulia comprises the three provinces of Foggia, Bari and Lecce (the latter corresponding roughly with the ancient Calabria, which, however, extended somewhat farther north inland), and is often known as Le Puglie; it stretches from Monte Gargano to the south-east extremity of Italy, with an area of 7376 sq. m.; it is bounded on the north and east by the Adriatic, on the south-east by the Gulf of Taranto, on the south by Basilicata and on the west by Campania and the Abruzzi. The three provinces correspond to the three natural divisions into which it falls. That of Foggia, though it has mountains on the west and south-west boundary, and the Monte Gargano at its north-east extremity, is in the main a great plain called the Tavoliere (chessboard) di Puglia, with considerable lagoons on its north and east coast. That of Bari, east-south-east of Foggia and divided from it by the Ofanto (Aufidus), the only considerable river of Apulia, 104 m. long, is a hilly district with a coast strip along which are the majority of the towns—the lack of villages is especially noticeable; in the *circondario* of Barletta, the north-east portion of the province, there are only eleven communes, with a total population of 335,934. That of Lecce, to the east-south-east again, is a low flat limestone terrace.

The industries of Apulia are mainly pastoral or agricultural. Besides sheep, a considerable number of horses, cattle and swine are bred; while despite the lack of water, which is the great need of modern Apulia (in 1906 arrangements were made for a great aqueduct, to supply the three provinces from the head-waters of the Sele), cultivation is actively carried on, especially in the province of Bari, where grain, wine, olives, almonds, lemons, oranges, tobacco, &c., are produced in abundance, and the export of olive oil is attaining considerable importance. The salt works of Margherita di Savoia produce large quantities of salt, and nitre is extracted near Molfetta.

Railway communications are fairly good, the main line from Bologna to Brindisi passing through the whole length of Apulia, by way of Foggia and Bari, and having branches from Foggia (the main railway centre of Apulia) to Benevento and Caserta, to Manfredonia, to Lucera and to Rocchetta S. Antonio (and thence to either Avellino, Potenza or Gioia del Colle), from Ofantino to Margherita di Savoia, from Barletta to Spinazzola (between Rocchetta S. Antonio and Gioia del Colle), from Bari to Putignano, and via Gioia del Colle to Taranto, and from Brindisi to Taranto, and to Lecce and Otranto; besides which, there is a steam tramway from Barletta to Bari via Andria.

The most important harbours of Apulia are Brindisi, Bari, Taranto, Barletta, Molfetta and Gallipoli. The export of olive oil to foreign countries from the province of Lecce in 1905 amounted to 1048 tons, as against 3395 in 1901; but that to home ports increased from 7077 to 9025 tons in the same period. The production of wine was 358,953 tons in 1905 as against 203,995 tons in 1901 (an exceptionally bad year) and 284,156 tons in 1902. Of this 211,872 tons were forwarded by rail and sea, in the proportion of five to two respectively, the rest being used for home consumption and as a reserve. The cultivation of oriental tobacco is extending in the province (see *Consular Report*, No. 3672, July 1906).

The population of the province of Foggia was 425,450 (1901) as against 322,758 in 1871, the chief towns being Foggia (53,151), Cerignola (34,195), S. Severo (30,040), Monte S. Angelo (21,870), S. Marco in Lamis (17,309), Lucera (17,515); that of Bari, 827,698 (1901) as against 604,540 in 1871, the chief towns being Bari (77,478), Andria (49,569), Barletta (42,022), Corato (41,573), Molfetta (40,135), Trani (31,800), Bisceglie (30,885), Bitonto (30,617), Canosa (24,169), Ruvo (23,776), Terlizzi (23,232), Altamura (22,729), Monopoli (22,545), Gioia del Colle (21,721); that of Lecce, 706,520 (1901) as against 493,594 in 1871, the chief towns being Taranto (60,733), Lecce (32,687), Brindisi (25,317), Martina Franca (25,007), Ostuni (22,997), Francavilla Fontana (20,422), Ceglie Messapica (16,867), Nardo (14,387), Galatina (14,071), Gallipoli (13,552), Manduria (13,113). (T. As.)

APURÉ, a river of western Venezuela, formed by the confluence of the Sarare and Uribante at 6° 45′ N. lat. and 71° W. long., and flowing eastward across the Venezuelan *llanos* to a junction with the Orinoco at about 7° 40′ N. lat. and 66° 45′ W. long. Its drainage area includes the slopes of both the Colombian and Venezuelan Andes. It has a sluggish course across the *llanos* for about 300 m., and is navigable throughout its length. Its principal tributaries are the Caparro, Portuguesa and Guarico on the north, and the Caucagua on the south. Its lateral channels on the south mingle with those of the Arauca for many miles, forming an extensive district subject to annual inundations.

APURIMAC, a river of central Peru, rising in the Laguna de Villafra in the western Cordilleras, 7 m. from Caylloma, a village in the department of Arequipa, and less than 100 m. from the Pacific coast. It flows first north-easterly, then north-westerly past Cuzco to the mouth of the Perené tributary, thence east and north to its junction with the Ucayali at 10° 41′ S. lat., and 73° 34′ W. long. It is known as the Apurimac only down to the mouth of the Mantaro tributary, 11° 45′ S. lat. and 1325 ft. above sea-level. Thence to the mouth of the Perené (984 ft.) it is known as the Ené, and from that point to its junction with the Ucayali (859 ft.) as the Tambo.

APURIMAC, an interior department of southern Peru, bounded N. by the department of Ayacucho, E. by Cuzco, S. and W. by Cuzco and Ayacucho. Area, 8187 sq. m.; pop. (1896) 177,387. The department was created in 1873 and comprises five provinces. Its physical features and productions are very similar to those of Ayacucho (*q.v.*), with the exception that sugar-cane is cultivated with noteworthy success in the low valley of the province of Abancay. The capital, Abancay, 110 m. south-west of Cuzco, which is only a village in size but is rich in historical associations and Andahuaylas, in the north-west part of the department, are its principal towns.

APYREXIA (Gr. ἀπυρεξία, from ἀ-, privative, πυρέσσειν, to be in a fever, πῦρ, fire, fever), in pathology, the normal interval or period of intermission in a fever.

ʽAQĪBA BEN JOSEPH (*c.* 50–132), Jewish Palestinian rabbi, of the circle known as *tana* (*q.v.*). It is almost impossible to separate the true from the false in the numerous traditions respecting his life. He became the chief teacher in the rabbinical school of Jaffa, where, it is said, he had 24,000 scholars. Whatever their number, it seems certain that among them was the celebrated Rabbi Meir, and that through him and others ʽAqība exerted a great influence on the development of the doctrines embodied in the Mishnah. He sided with Bar Cochebas in the last Jewish revolt against Rome, recognized him as the Messiah, and acted as his sword-bearer. Being taken prisoner by the Romans under Julius Severus, he was flayed alive with circumstances of great cruelty, and met his fate, according to tradition, with marvellous steadfastness and composure. He is said by some to have been a hundred and twenty years old at the time of his death. He is one of the ten Jewish martyrs whose names occur in a penitential prayer still used in the synagogue service. ʽAqība was among the first to systematize the Jewish tradition, and he paved the way for the compilation of the Mishnah. From his school emanated the Greek translation of the scriptures by Aquila.

AQUAE (Lat. for "waters"), a name given by the Romans to sites where mineral springs issued from the earth. Over a hundred can be identified, some declaring by their modern names their ancient use: Aix-les-Bains in Savoy (*Aquae Sabaudicae*), Aix-en-Provence (*Aquae Sextiae*), Aix-la-Chapelle or Aachen (*Aquae Grani*), &c. Only two occur in Britain: *Aquae Sulis*—less correctly *Aquae Solis*—at Bath in Somerset, which was famous, and Buxton (called *Aquae* simply), which seems to have been far less important. Aquae Sulis was occupied by the Romans almost as soon as they entered the island in A.D. 43, and flourished till the end of the Roman period. It was frequented by soldiers quartered in Britain, by the Britons, and by visitors from north Gaul, and its name was known in Italy, though patients probably seldom travelled so far. Like most mineral springs known to the ancients, it was under the protection of a local deity, the Celtic Sul, whom the Romans equated with their Minerva. Stately remains of its baths and temple have been found at various times, especially in 1790 and 1878–1895, and may still be seen there.

AQUAE CUTILIAE, a mineral spring in Italy, near the modern Cittaducale, 9 m. E. of Rieti. The lake near it was supposed by classical writers to be the central point of Italy, and was renowned for its floating islands, which, as in other cases, were formed from the partial petrification of plants by the mineral substances contained in the water. Considerable remains of baths may still be seen there: they were apparently resorted to by both Vespasian and Titus in their last illnesses, for both died there.

AQUAMARINE (Lat. *aqua marina*, "water of the sea"), a transparent variety of beryl (*q.v.*), having a delicate blue or bluish-green colour, suggestive of the tint of sea-water. It occurs at most localities which yield ordinary beryl, some of the finest coming from Russia. The gem-gravels of Ceylon contain aquamarine. Clear yellow beryl, such as occurs in Brazil, is sometimes called aquamarine chrysolite. When corundum presents the bluish tint of typical aquamarine, it is often termed Oriental aquamarine.

AQUARELLE (from Ital. *acquarella*, water-colour), a form of painting with thin water-colour or ink.

AQUARII, a name given to the Christians who substituted water for wine in the Eucharist. They were not a sect, for we find the practice widely in vogue at an early time, even among the orthodox. In Greek they were called *Hydroparastatae*, or those who offer water. Theodosius, in his persecuting edict of 382, classes them as a special sect with the Manicheans, who also eschewed wine. See EUCHARIST.

AQUARIUM (plural *aquaria*), the name given to a receptacle for a marine flora and fauna. Until comparatively recently, aquaria were little more than domestic toys, or show-places of a popular character, but they have now not only assumed a profound scientific importance for the convenient study of anatomical and physiological problems in marine botany and zoology, but have also attained an economic value, as offering the best opportunities for that study of the habits and environment of marketable food-fish without which no steps for the improvement of sea-fisheries can be safely taken. The numerous "zoological stations" which have sprung up, chiefly in Europe and the United States, but also in the British colonies and Japan, often endeavour to unite these two aims, and have in many cases become centres of experimental work in problems relating to fisheries, as well as in less directly practical subjects. Of these stations, the oldest and the most important is that at Naples, which, though designed for purely scientific objects, also encourages popular study by means of a public aquarium. The following account (1902) of this station by Dr W. Giesbrecht, a member of the staff, will serve to show the methods and aims, and the complex and expensive equipment, of a modern aquarium:—

"The zoological station at Naples is an institution for the advancement of biological science—that is, of comparative anatomy, zoology, botany, physiology. It serves this end by providing the biologist with the various objects of his study and the necessary appliances; it is not a teaching institution. The station was founded by Dr Anton Dohrn, and opened in the spring of 1874; it is the oldest and largest of all biological stations, of which there are now about thirty in existence. Its two buildings are situated near the seashore in the western town park (Villa Nazionale) of Naples. The older and larger one, 33 metres long, 24 m. deep, 16 m. high, contains on the ground floor the aquarium, which is open to the public. On the first floor there is, facing south, the principal library, ornamented with fresco paintings, and, facing north, a large hall containing twelve working tables, several smaller rooms and the secretarial offices. On the second floor is the physiological laboratory, and on the third floor the small library, a hall with several working tables, and the dark rooms used in developing photographs. The ground floor of the smaller building, which was finished in 1887, contains the rooms in which the animals are delivered, sorted and preserved, and the fishing tackle kept, together with the workshop of the engineer; on the first and second floors are workrooms, amongst others the botanical laboratory; on the third floor are store-rooms. In the basement of both buildings, which is continued underneath the court, there are sea-water cisterns and filters, engines and store-rooms. The materials for study which the station offers to the biologist are specimens of marine animals and plants which abound in the western part of the Mediterranean, and especially in the Gulf of Naples. To obtain these, two screw-steamers and several rowing boats are required, which are moored in the harbour of Mergellina, situated close by. The larger steamer, 'Johannes Müller' (15 m. long, 2½ m. wide, 1 m. draught), which can steam eight to ten English miles per hour, is provided with a steam dredge working to a depth of eighty fathoms. From the small steamer, 'Frank Balfour,' and the rowing boats, the fishing is done by means of tow-nets. Besides these there are fishermen and others who daily supply living material for study. The plankton (small floating animals) is distributed in the morning, other animals as required. The animals brought in by the fishermen are at once distributed amongst the biologists, whereas the material brought up by the dredges is placed in flat revolving wooden vessels, so as to give the smaller animals time to come out of their hiding-places. The students who work in the station have the first claim on specimens of plants and animals; but specimens are also supplied to museums, laboratories and schools, and to individuals engaged in original research elsewhere. Up to the present time about 4000 such parcels have been despatched, and not infrequently live specimens of animals are sent to distant places. This side of the work has been of very great value to science. The principal appliances for study with which the station provides the biologist are workrooms furnished with the apparatus and chemicals necessary for anatomical research and physiological experiments and tanks. Every student receives a tank for his own special use. The large tanks of the principal aquarium are also at his disposal for purposes of observation and experiment if necessary.

"The water in the tanks is kept fresh by continual circulation, and is thus charged with the oxygen necessary to the life of the organisms. It is not pumped into the tanks directly from the sea, but from three large cisterns (containing 300 cubic metres), to which it again returns from the tanks. The water wasted or evaporated during this process is replaced by new water pumped into the cisterns directly from the sea. The water flows from the large cisterns into a smaller cistern, from which it is distributed by means of an electric pump through vulcanite or lead pipes to the various tanks. The water with which the tanks on the upper floors are filled is first pumped into large wooden tanks placed beneath the roof, thence it flows, under almost constant pressure, into the tanks. The water circulated in this manner contains by far the largest number of such animals as are capable of living in captivity in good condition. Some of them even increase at an undesirable rate, and it sometimes happens that young Mytilus or Ciona stop up the pipes; in laying these, therefore, due regard must be had to the arrangements for cleaning. For the cultivation of very delicate animals it is necessary to keep the water absolutely free from harmful bacteria; for this purpose large sand-filters have lately been placed in the system, through which the water passes after leaving the cisterns. Each of the smaller cisterns, which are fixed in the workrooms, consist of two water-tanks, placed one above the other; their frames are of wrought iron and the walls generally of glass. Vessels containing minute animals can be placed between these two tanks, receiving their water through a siphon from the upper tank; the water afterwards flows away into the lower tank.

"The twenty-six tanks of the public aquarium (the largest of which contains 112 cubic metres of water) have stone walls, the front portion alone being made of glass. As the tanks hold a very large number of animals in proportion to the quantity of water, they require to be well aerated. The pipes through which the water is conducted are therefore placed above the surface of the water, and the fresh supply is driven through them under strong pressure. A large quantity of air in the form of fine bubbles is thus taken to the bottom of the tank and distributed through the entire mass of water. Should the organisms which it is desired to keep alive be very minute, there is a danger of their being washed away by the circulating water. To obviate this, either the water which flows away is passed through a strainer, or the water is not changed at all, air being driven through it by means of an apparatus put into motion by the drinking-water supply.

"The library contains about 9000 volumes, which students use with the help of a slip catalogue, arranged according to authors. The station has published at intervals since 1879 two periodicals treating of the organisms of the Mediterranean. One is *Fauna und Flora des Golfes von Neapel*, the other *Mittheilungen aus der zoologischen Station zu Neapel*. The former consists of monographs in which special groups of animals and plants are most exhaustively treated and the Mediterranean species portrayed according to life in natural colours; up to the present time twenty-one zoological and five botanical monographs have appeared, making altogether 1200 4to sheets with about 400 plates. Of the *Mittheilungen*, which contain smaller articles on organisms of the Mediterranean, fourteen volumes in 8vo have been published. The station also publishes a *Zoologischer Jahresbericht*, which at first treated of the entire field of zoology, but since 1886 has been confined principally to comparative anatomy and ontogeny; it appears eight to nine months after the end of the year reported. The *Guide to the Aquarium*, with its descriptions and numerous pictures, is meant to give the lay visitor an idea of the marine animal world.

"There are about forty officials, amongst them six zoologists, one physiologist, one secretary, two draughtsmen, one engineer. The station is a private institution, open to biologists of all nations under the following conditions: there are agreements with the governments of Austria, Baden, Bavaria, Belgium, Hamburg, Holland, Hesse, Italy, Prussia, Russia, Saxony, Switzerland, Hungary, Württemberg, the province of Naples, and the universities of Cambridge, Oxford, Strassburg, Columbia College (New York), and the British Association for the Advancement of Science, the Smithsonian Institution; and a society of women in the United States of North America (formerly also with Bulgaria, Rumania, Spain, the Academy of Sciences in Berlin, Williams College, University of Pennsylvania), by virtue of which the governments and corporate bodies named have the right, on payment of £100 per annum, to send a worker to the station; this places at his disposal a 'table' or workplace, furnished with all the necessary appliances and materials as set down in the agreement. At present there are agreements for thirty-three tables, and since the foundation of the station nearly 1200 biologists have worked there. The current expenses are paid out of the table-rents, the entrance fees to the public aquarium, and an annual subvention paid by the German empire."

In England a station on similar lines, but on a smaller scale, is maintained at Plymouth by the Marine Biological Association of the United Kingdom, with the help of subsidies from the government and the Fishmongers' Company.

Little difficulty is experienced in maintaining, breeding and rearing fresh-water animals in captivity, but for many various reasons it is only by unremitting attention and foresight that most marine animals can be kept even alive in aquaria, and very few indeed can be maintained in a condition healthy enough to breed. Much experience, however, has been gained of late years at considerable expense, both in England and abroad. In starting a marine aquarium of whatever size, it should be obvious that the first consideration must be a supply of the purest possible water, as free as may be, not only from land-drainage and sewage, but also from such suspended matters as chalk, fine sand or mud. This is most ideally and economically secured by placing the station a few feet above high-water mark, in as sheltered a position as possible, on a rocky coast, pumping from the sea to a large reservoir above the station, and allowing the water to circulate gently thence through the tanks by gravity (Banyuls). At an inland aquarium (Berlin, Hamburg), given pure water in the first instance, excellent if less complete results may nevertheless be obtained. The next consideration is the method by which oxygen is to be supplied to the organisms in the aquarium. Of the two methods hitherto in use, that of pumping a jet of air into tanks otherwise stagnant or nearly so (Brighton), while supplying sufficient oxygen, has so many other disadvantages, that it has not been employed regularly in any of the more modern aquaria. It is, however, still useful in aerating quite small bodies of water in which hardy and minute organisms can be isolated and kept under control. In the other method, now in general use, a fine jet of water under pressure falls on to the surface of the tank; this carries down with it a more than sufficient air-supply, analysis showing in some cases a higher percentage of oxygen in aquarium water than in the open sea.

The water supply is best effected by gravity from reservoirs placed above the tanks, but may be also achieved by direct pumping from low reservoirs or from the sea to the tanks. Provided that an unlimited supply of pure water can be obtained cheaply, the overflow from the tanks is best run to waste; but in aquaria less fortunately placed, it returns to a storage low-level reservoir, from which it is again pumped, thus circulating round and round (Naples, Plymouth). The storage reservoirs should be in all cases very large in comparison with the bulk of water in circulation; if practicable, they should be excavated in rock, and lined with the best cement. There is no reason why they should not be shallow, exposed to light and air, and cultivated as rock-pools by the introduction of seaweeds and small animals, but they must then be screened from rain, cold and dust. The pumps used in circulation will be less likely to kill minute animals if of the plunger or ram type, rather than rotary, and should be of gun-metal or one of the new bronze-alloys which take a patina in salt water. For the circulating pipes many materials have been tried. Vulcanite is not only expensive and brittle, but has other disadvantages; common iron pipes, coated internally with cement or asphalt or glazed internally, with all unions and joints cemented, have been used with more or less success. Probably best of all is common lead piping, the joints being served with red-lead; water should be circulated through such pipes till they become coated with insoluble carbonate, for some time before animals are put into the tanks. For small installations glass may be used, the joints being made with marine glue or other suitable cement.

In building the tanks themselves, regard must be had to their special purposes. If intended for show-tanks for popular admiration, or for the study of large animals, they must be large with a plate-glass front; for ordinary scientific work small tanks with all sides opaque are preferable from every point of view. According to their character, size and position, fixed tanks may be of brickwork, masonry or rock, coated in each case with cement; asphalting the sides offers no particular advantages, and often gives rise to great trouble and expense. All materials, and especially the cements, must be of the finest quality procurable. For smaller and movable tanks, slate slabs bolted or screwed together have some disadvantages, notably those of expense, weight and brittleness, but are often used. Better, cheaper and lighter, if less permanent, are tanks of wood bolted together, pitched internally. Glass bell-jars, useful in particular cases, should generally have their sides darkened, except when required for observation. Provision should always be made for cleaning every part of the tanks, pipes and reservoirs; all rock-work in tanks should therefore be removable. As regards the lighting of fixed tanks, it should always be directly from above. In all tanks with glass sides, whether large or small, as much light as possible should be kept from entering through the glass; otherwise, with a side-light, many animals become restless, and wear themselves out against the glass, affected by even so little light as comes through an opposite tank.

In cases where distance from the sea or other causes make it impracticable to allow the overflow from the tanks to run to waste, special precautions must be taken to keep the water pure. Chemically speaking, the chief character of the water in an aquarium circulation, when compared with that of the open sea, lies in the excessive quantity of nitrogen present in various forms, and the reduced alkalinity; these two being probably connected. The excess of nitrogen is referable to dead animals, to waste food and to the excreta of the living organisms. The first two of these sources of contamination may be reduced by care and cleanliness, and by the maintenance of a flow of water sufficient to prevent the excessive accumulation of sediment in the tanks. The following experiment shows the rapid rise of nitrogen if unchecked. A tank with a considerable fauna was isolated from the general circulation and aerated by four air-jets, except during hours 124–166 of the experiment; column I. shows per 100,000 the nitrogen estimated as ammonia, column II. the total inorganic nitrogen:—

	I.	II.
Sea-water at source of original supply	0·001	0·003
Aquarium water in tank at commencement of experiment . .	0·012	0·400
After 22½ hours	0·020	. .
„ 75 „	0·025	1·200
„ 93 „	0·019	. .
„ 121½ „	0·012	. .
„ 141 „	0·015	2·200
„ 165 „	0·025	. .
„ 169 „	0·025	. .
„ 189 „	0·012	. .

During this time the alkalinity was reduced to the equivalent of 30 mg. $CaCO_3$ per litre, ocean water having an alkalinity equivalent to 50–55 mg. per litre. It has been suggested that the organic nitrogen becomes oxidized into nitrous, then into nitric acid, which lowers the carbonate values. A great deal of reduction of this nitrogenous contamination can be effected by filtration, a method first introduced successfully at Hamburg, where a most thriving aquarium has been maintained by the local Zoological Society for many years on the circulation principle, new water being added only to compensate for waste and evaporation. The filters consist of open double boxes, the inner having a bottom of perforated slate on which rests rough gravel; on the latter is fine gravel, then coarse, and finally fine sand. Filtration may be either upwards or downwards through the inner box to the outer. Such filters, intercalated between tanks and reservoir, have been shown by analysis to stop a very large proportion of nitrogenous matter. It is doubtful whether aquarium water will not always show an excess of nitrogenous compounds, but they must be kept down in every way possible. In small tanks, well lighted, seaweeds can be got to flourish in a way that has not been found practicable in large tanks with a circulation; these, with Lamellibranchs and small Crustacea as scavengers, will be found useful in this connexion. Slight or occasional circulation should be employed here also, to remove the film of dust and other matters, which otherwise covers the surface of the water and prevents due oxygenation.

In such small tanks for domestic use the fauna must be practically limited to bottom-living animals, but for purposes of research it is often desired to keep alive larval and other surface-swimming animals (plankton). In this case a further difficulty is presented, that of helping to suspend the animals in the water, and thus to avoid the exhaustion and death which soón follow their unaided efforts to keep off the bottom; this duty is effected in nature by specific gravity, tide and surface current. In order to deal with this difficulty a simple but efficient apparatus has been devised by Mr E. T. Browne; a "plunger," generally a glass plate or filter funnel, moves slowly up and down in a bell-jar or other small tank, with a period of rest between each stroke; the motive power is obtained through a simple bucket-and-siphon arrangement worked by the overflow from other tanks. This apparatus (first used at the Plymouth Laboratory of the Marine Biological Association in 1897, and since introduced into similar institutions), by causing slight eddies in the water, keeps the floating fauna in suspension, and has proved very successful in rearing larvae and in similar work. (G. H. Fo.)

AQUARIUS (the "Water-bearer" or "Cup-bearer"), in astronomy, the eleventh sign of the zodiac (*q.v.*), situated between Capricornus and Pisces. Its symbol is ♒, representing part of a stream of water, probably in allusion to the fact that when the sun is in this part of the heavens (January, February) the weather is rainy. It is also a constellation mentioned by Eudoxus (4th century B.C.) and Aratus (3rd century B.C.); Ptolemy catalogued forty-five stars, Tycho Brahe forty-one, Hevelius forty-seven. ζ *Aquarii* is a well-defined binary, having both components of the fourth magnitude; it is probably of long period.

AQUATINT (Lat. *aqua*, water, and *tincta*, dyed), a kind of etching (*q.v.*) which imitates washes with a brush. There are many ways of preparing a plate for aquatint, the following being recommended by P. G. Hamerton. Have three different solutions of rosin in rectified alcohol, making them of various degrees of strength, but always thin enough to be quite fluid, the weakest solution being almost colourless. First pour the strongest solution on the plate. When it dries it will produce a granulation; and you may now bite as in ordinary etching for your darker tones, stopping out what the acid is not to operate upon, or you may use a brush charged with acid, perchloride of iron being a very good mordant for the purpose. After cleaning the plate, you proceed with the weaker solutions in the same way, the weakest giving the finest granulation for skies, distances, &c. The process requires a good deal of stopping-out, and some burnishing, scraping, &c., at last. Aquatint may be effectively used in combination with line etching, and still more harmoniously with soft ground etching in which the line imitates that of the lead pencil.

AQUAVIVA, CLAUDIO (1542–1615), fifth general of the Jesuits, the youngest son of the duke d'Altri, was born at Naples. He joined the Jesuits at Rome in 1567, and his high administrative gifts marked him out for the highest posts. He was soon nominated provincial of Naples and then of Rome; and during this office he offered to join the Jesuit mission to England that set out under Robert Parsons (*q.v.*) in the spring of 1580. The following year, being then only thirty-seven years old, he was elected, by a large majority, general of the society in succession to Mercurian, to the great surprise of Gregory XIII.; but the extraordinary political ability he displayed, and the vast increase that came to the Society during his long generalate, abundantly justified the votes of the electors. He, together with Lainez, may be regarded as the real founder of the Society as it is known to history. A born ruler, he secured all authority in his own hands, and insisted that those who prided themselves on their obedience should act up to the profession. In his first letter "On the happy increase of the Society" (25th of July 1581), he treats of the necessary qualifications for superiors, and points out that government should be directed not by the maxims of human wisdom but by those of supernatural prudence. He successfully quelled a revolt among the Spanish Jesuits, which was supported by Philip II., and he made use in this matter of Parsons. A more difficult task was the management of Sixtus V., who was hostile to the Society. By consummate tact and boldness Aquaviva succeeded in playing the king against the pope, and Sixtus against Philip. For prudential reasons, he silenced Mariana, whose doctrine on tyrannicide had produced deep indignation in France; and he also appears to have discountenanced the action of the French Jesuits in favour of the League, and was thus able to secure solid advantages when Henry IV. overcame the confederacy. To him is due the Jesuit system of education in the book *Ratio atque institutio studiorum* (Rome, 1586). But the Dominicans denounced it to the Inquisition, and it was condemned both in Spain and in Rome, on account of some opinions concerning the Thomist doctrines of the divine physical premotion in secondary causes and predestination. The incriminated chapters were withdrawn in the edition of 1591. In the fierce disputes that arose between the Jesuit theologians and the Dominicans on the subject of grace, Aquaviva managed, under Clement VIII. and Paul V., to save his party from a condemnation that at one time seemed probable. He died at Rome on the 31st of January 1615, leaving the Society numbering 13,000 members in 550 houses and 15 provinces. The subsequent influence exercised by the Jesuits, in their golden age, was largely due to the far-seeing policy of Aquaviva, who is undoubtedly the greatest general that has governed the Society. (E. Tn.)

AQUEDUCT (Lat. *aqua*, water, and *ducere*, to lead; Gr. *ὑδραγωγεῖον, ὑδραγώγιον, ὑπόνομος*), a term properly including artificial works of every kind by means of which water is conveyed from one place to another, but generally used in a more limited sense. It is, in fact, rarely employed except in cases where the work is of considerable magnitude and importance, and where the water flows naturally by gravitation. The most important purpose for which aqueducts are constructed is that of conveying pure water, from sources more or less distant, to large masses of population. Aqueducts are either below ground, on the surface, or raised on walls either solid or pierced with arches; to the last the term is often confined in popular language. The choice of method naturally depends on the contour of the country.

Phoenician.

I. *Ancient Aqueducts.*—In Egypt, Babylonia and Assyria—flat countries traversed by big rivers and subject to floods—water was supplied by means of open canals with large basins. In Persia devices of all kinds were adopted according to the nature of the country. In relation to the achievements of Greece and Rome, the Phoenicians are the most important among pre-classical engineers. In Cyprus water was supplied to temples by rock-cut subterranean conduits carried across intervening valleys in siphons. Such conduits have been found near Citium, Amathus, &c. (Cesnola, *Cyprus*, pp. 187, 341). In Syria the most striking of Phoenician waterworks is the well of Ras-el-Ain near Tyre, which consisted of four strong octagonal towers through which rises to a height of 18 to 20 ft. the water from four deep artesian wells. The water thus accumulated was carried off in conduits to reservoirs near the shore, and thence in vessels or skins to the island. The aqueduct across to the island is, of course, of Roman work.

Jerusalem.

It is not possible in all cases to find a satisfactory date for the numerous conduits which have supplied Jerusalem; some probably go back to the times of the kings of Judah. The principal reservoir consists of the three Pools of Solomon which supplied the old aqueduct; the highest is about 20 ft. above the middle one and 40 above the lowest. These pools collected the water from Ain Saleh and other springs, and sent it to the city by two conduits. The higher of these—probably the older—was partly a rock-cut canal, partly carried on masonry; the siphon-pipe system was adopted across the lower ground near Rachel's Tomb, where the pipe (15 in. wide) is formed of large pierced stones embedded in rubble masonry. The lower conduit is still complete; it winds so much as to be altogether some 20 m. long. Near the Birket-es-Sultan it passes over the valley of Hinnom on nine low arches and reaches the city on the hill above the Tyropeon valley. It enters the Haram enclosure at the Gate of the Chain (Bāb es-Silsila), outside which is a basin 84 ft. by 42 by 24 deep. It is interesting to note in the case of the underground tunnel which brought water from the Virgin's Fountain to the pool of Siloam, that the two boring parties had no certain means of keeping the line; there is evidence that they had to make shafts to discover their position, and that ultimately the parties almost passed one another. Though the direct distance is 1100 ft., the length of the conduit is over 1700 ft. Perrot and Chipiez incline to attribute the Pools of Solomon to the 'Asmonaeans, followed by Roman governors, whereas the earlier tunnels of the Kedron and Tyropeon valley may be Punic-Jewish (see also *Palest. Explor. Fund Mem.*, "Jerusalem," pp. 346-365). Besides these conduits excavation has discovered traces of many other cisterns, tunnels and conduits of various kinds. Many of them point to periods of great prosperity and engineering enterprise which gave to the city a water-supply far superior to that which exists at present.

See the publications of the Palestine Exploration Fund; A. S. Murray's *Handbook to Syria and Palestine* (1903), pp. 63-67; Perrot and Chipiez, *History of Art in Sardinia, Judaea, &c.* (Eng. trans., 1890), pp. 321 ff.; other authorities quoted under Jerusalem.

Greek.

The earliest attempts in Europe to solve the problems of water-supply were made by the Greeks, who perhaps derived their ideas from the Phoenicians. It has generally been held, partly on the strength of a passage in Strabo (v. 3. 8, p. 235), and partly owing to the comparative unimportance of the remains discovered, that the Greek works were altogether inferior to the Roman. Research in the Greek towns of Asia Minor, together with a juster appreciation of the remains as a whole, must be held to modify this view. Among the earliest examples of Greek work are the tunnels or *emissaria* which drained Lake Copais in Boeotia; these, though not strictly aqueducts, were undoubtedly the precursors of such works, consisting as they did of subterranean tunnels (*ὑπόνομοι*) with vertical shafts (*φρεατίαι*), sixteen of which are still recognizable, the deepest being about 150 ft. They may be compared with that described by Polybius as conveying water from Taurus to Hecatompylos, and with numerous other remains in Asia Minor, Syria, Phoenicia and Palmyra. Popular legend ascribed them to Cadmus, just as Argos referred the irrigation of its lands to Danaüs. They are undoubtedly of great antiquity.

The insufficiency of water, supplied by natural springs and cisterns hewn in the rock, which in an early age had satisfied the small communities of Greece, had become a pressing public question by the time of the Tyrants, of whom Polycrates of Samos and Peisistratus of Athens were distinguished for their wisdom and enterprise in this respect. The former obtained the services of Eupalinus, an engineer celebrated for the skill with which he had carried out the works for the water-supply of Megara (see *Athen. Mittheil.* xxv., 1900, 23) under the direction of the Tyrant Theagenes (*c.* 625 B.C.). At Samos the difficulty lay in a hill which rose between the town and the water source. Through this hill Eupalinus cut a tunnel 8 ft. broad, 8 ft. high and 4200 ft. long, building within the tunnel a channel 3 ft. broad and 11 ells deep. The water, flowing by an accurately reckoned declivity, and all along open to the fresh air, was received at the lower end by a conduit of masonry, and so led into the town, where it supplied fountains, pipes, baths, cloacae, &c., and ultimately passed into the harbour (Herod. iii. 60). In Athens, under the rule of the Peisistratids (*c.* 560–510 B.C.), a similarly extensive, if less difficult, series of works was completed to bring water from the neighbouring hills to supplement the inadequate supply from the springs. From Hymettus were two conduits passing under the bed of the Ilissus, most of the course being cut in the rock. Pentelicus, richer in water, supplied another conduit, which can still be traced from the modern village of Chalandri by the air shafts built several feet above the ground, and at a distance apart of 130–160 ft.; the diameter of these shafts is 4–5 ft., and the number of them still preserved is about sixty. Tributary channels conveyed into the main stream the waters of the district through which it passed. Outside Athens, those two conduits met in a large reservoir, from which the water was distributed by a ramification of underground channels throughout the city. These latter channels vary in form, being partly round, partly square, and generally walled with stone; the chief one is sufficiently large for two men to pass in it. The precise location of the reservoir depends on the value of Dr Wilhelm Dörpfeld's theory as to the site of the Enneacrunus of Thucydides and Pausanias (see ATHENS: *Topography and Antiquity*). Dörpfeld places it south-west of the Acropolis, where there is a cistern connected with an aqueduct which passed under the theatre of Dionysus and on towards the Ilissus (see map under ATHENS). Others have placed it south of the Olympieum in the Ilissus bed. Beside these works water was brought from Pentelicus in an underground conduit begun by the emperor Hadrian and completed by Antoninus Pius. This aqueduct is still in use, having been repaired in 1869.

In Sicily, the works by which Empedocles, it is said, brought the water into the town of Selinus, are no longer visible; but it is probable that, like those of Syracuse, they consisted chiefly of tunnels and pipes laid under the ground. Syracuse was supplied by two aqueducts, one of which the Athenians destroyed (Thuc. vi. 100). One was fed by an affluent (the mod. Buttigliara) of the Anapus (mod. Anapo); it carried the water up to the top of Epipolae, where the channel was open, and thence down to the city and finally into the harbour. The other also ascends to the top of Epipolae, skirts the city on the north, and then proceeds along the coast. Its course is marked by rectangular shafts (*spiragli*) at the bottom of which water is still visible.

An example of what appears to have been the earliest form of aqueduct in Greece was discovered in the island of Cos beside the fountain Burinna (mod. Fountain of Hippocrates) on Mount Oromedon. It consists of a bell-shaped chamber, built underground in the hill-side, to receive the water of the spring and keep it cool; a shaft from the top of the chamber supplied fresh air. From this reservoir the water was led by a subterranean channel, 114 ft. long and 6½ ft. high. (J. M. M.)

Roman.

In comparing Greek and Roman aqueducts, many writers have enlarged on the greatness of the latter as an example of Roman contempt for natural obstacles, or even of Roman ignorance of the laws of nature. Now, in the first place, the Romans were not unacquainted with the law that water finds its own level (see Pliny, *Hist. Nat.* xxxi. 57, "subit altitudinem exortus sui"), and took full advantage of it in the construction of lofty fountains and the supplying of the upper floors of houses. That they built aqueducts across valleys in preference to carrying pipes underground was due simply to economy. Pipes had to be made of lead which was weak, or of bronze which was expensive; and the Romans were not sufficiently expert in the casting of large pipes which would stand a very great pressure to employ them for the whole course of a great aqueduct. Secondly, the water was so extremely hard that it was important that the channels should be readily accessible for repair as well as for the detection of leakage.[1] Moreover, as we shall see, the Roman aqueducts did not, in fact, preserve a straight line regardless of the configuration of the country. A striking example is the aqueduct of Nemausus (Nîmes), the springs of which are some 10 m. from the town, though the actual distance traversed is about 25. Other devices, such as changing the level and then modifying the slope, and siphon arrangements of various kinds, were adopted (as in the aqueduct at Aspendus).

Sextus Julius Frontinus, appointed *curator aquarum* in A.D. 97, mentions in his treatise *de aquaeductibus urbis Romae* (on the aqueducts of the city of Rome) nine aqueducts as being in use in his time (the lengths of the aqueducts as given here follow his measurements). These are: (1) AQUA APPIA, which took its rise between the 6th and 7th milestones of the Via Collatina, and measured from its source to the Porta Trigemina 11 Roman miles, of which all but about 300 ft. were below ground. It appears to have been the first important enterprise of the kind at Rome, and was the work of the censor Appius Claudius Caecus, from whom it derived its name. The date of its construction was 312 B.C. (2) ANIO VETUS, constructed in 272–269 B.C. by the censor Manius Curius Dentatus. From its source near Tivoli, on the left side of the Anio, it flowed some 43 m.,[2] of which only 1100 ft. was above ground. At the distance of 2 m. from Rome (Frontinus, i. 21), it parted into two courses, one of which led to the *horti Asiniani*, and was thence distributed; while the other (*rectus ductus*) led by the temple of Spes to the Porta Esquilina. (3) AQUA MARCIA, reconstructed in 1869–1870 under the name of Acqua Pia or Marcia-Pia after Pius IX. (though from Tivoli to Rome the modern aqueduct takes an entirely different course), rising on the left side of the Via Valeria near the 36th milestone. It traversed 61¾ m., of which 54¼ were underground, and for the remaining distance was carried partly on substructions and partly on arches. It was the work of the praetor Quintus Marcius Rex (144–140 B.C.), not of Ancus Marcius, the fourth king of Rome, as Pliny (*N.H.* xxxi. 3) fancied, and took its name from its constructor. Its waters were celebrated for their coolness and excellent quality. Its volume was largely increased by Augustus, who added to it the Aqua Augusta; and it was repaired and restored by Titus, Septimus Severus, Caracalla and Diocletian. (4) AQUA TEPULA, from its source (now known as Sorgente Preziosa) in the district of Tusculum, to Rome, was some 11 m. in length. The first portion of its course must have been almost entirely subterranean and is not now traceable. For the last 6½ m. it ran on the same series of arches that carried the Aqua Marcia, but at a higher level. It was the work of the censors Cn. Servilius Caepio and L. Cassius Longinus, and was completed in the year 125 B.C. Its water is warm (about 63° Fahr.) and not of the best quality. (5) The AQUA JULIA, from a source 2 m. from that of the Tepula, joined its course at the 10th milestone of the Via Latina. The combined stream, after a distance of 4 m., was received in a reservoir, and then once more divided into two channels. The entire length of the Julia was 15½ m. It was constructed in the year 33 B.C. by M. Vipsanius Agrippa, who also built the (6) AQUA VIRGO which, from its origin at a copious spring in a marsh on the Via Collatina, measured 14 m. in length; it was conveyed in a channel, partly under and partly above ground. It was begun in the year 33 B.C. and was celebrated for the excellence of its waters. It was restored to use by Pius V. in 1570. (7) AQUA ALSIETINA or AUGUSTA, the source of which is the Lacus Alsietinus (mod. Lago di Martignano), to the north of Rome, was over 22 m. in length, of which 358 paces were on arches. It was the work of Augustus, probably with the object of furnishing water for his *naumachia* (a basin for sham sea-fights), and not for drinking purposes. Its course is unknown, as no remains of it exist, but an inscription relating to it is given in *Notizie d. Scavi* (1887), p. 182. (8, 9) The Aqua Claudia and Anio Novus were two aqueducts begun by Caligula in A.D. 38 and completed by Claudius in A.D. 52. The springs of the former belonged to the same group as those of the Marcia, and were situated near the 38th milestone of the Via Sublacensis, not far from its divergence from the Via Valeria, while the original intake of the latter from the river Anio was 4 m. farther along the same road. As the water was thick it was collected in a purifying tank, and 4 m. below, a branch stream, the Rivus Herculaneus, was added to it. According to Frontinus, over 10 m. of the course of the Claudia and nearly 9½ of that of the Anio Novus were above ground. Seven miles out of Rome they united and ran from that point into Rome, following a natural isthmus formed by a lava stream from the Alban volcano, upon a line of arches, which still forms one of the most conspicuous features of the Campagna. The original inscription of Claudius (A.D. 52) on the Porta Maggiore, by which the Aqua Claudia and Anio Novus crossed the Via Praenestina and the Via Labicana, gives the length of the Aqua Claudia as 45 m., and that of the Anio Novus as 62 m. Frontinus, on the other hand, gives 46·406 m. (*i.e.* about 43 English miles) and 58·700 m. (*i.e.* about 54 English miles). Albertini (*Mélanges de l'École Française*, 1906, 305) explains the difference as due to the fact that Frontinus was calculating the length of the Claudia from the farthest spring, the Fons Albudinus, and that of the Anio Novus from the new intake constructed by Trajan in one of the three lakes constructed by Nero for the adornment of his villa above Subiaco. Two other inscriptions on the Porta Maggiore record restorations by Vespasian in A.D. 70, and by Titus in A.D. 80. That the aqueducts should be spoken of as *vetustate dilapsi* so soon after their construction is not a little surprising, and may be attributed either to hasty construction in order to complete them by a fixed date, or to jobbery by the imperial freedmen who under Claudius were especially powerful, or to the fact that a line of arches intended originally in all probability for the Aqua Claudia alone was made to carry the Anio Novus as well.

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[1] There have been found at Caerwent, in Monmouthshire, clear traces of wooden pipes (internal diameter about 2 in.) which must have carried drinking-water, and almost certainly a pressure supply from the surrounding hills. Some patches of lead also have been found obviously nailed on to the pipes at points where they had burst (see *Archaeologia*, 1908).

[2] This distance will not agree with the length given on some of the *cippi* (Lanciani, *Bull. Com.*, 1899, 38).

The size of the channels (*specus*) of the principal aqueducts varies considerably at different points of their course. The Anio Novus has the largest of them all, measuring 3 to 4 ft. wide and 9 ft. high to the top of the roof, which is pointed. They are lined with hard cement (*opus signinum*) containing fragments of broken brick. Those aqueducts of which the most conspicuous remains exist in the neighbourhood of Rome are the four from the upper valley of the Anio, the two which took their supply and their name from the river itself, and the Marcia and the Claudia, which originated from the same group of springs, in the floor of the Anio valley 6 m. below Subiaco. Those of the Anio Vetus, which travelled at a considerably lower level than the other three, are the least conspicuous, while the Claudia and Anio Novus as a rule kept close together, the latter at the highest level of all. The ruins of bridges and substructions in the Anio valley down to Tivoli, though comparatively little known, are of great importance. In all the aqueducts the original construction of the bridges was in *opus quadratum* (masonry), while the substructions are in brick-faced concrete; but the bridges are as a rule strengthened (and often several times) with reinforcing walls of concrete faced with *opus reticulatum* or brickwork. Below Tivoli, where the Anio leaves its narrow valley, the aqueducts sweep round towards the Alban hills, and pass through some very difficult country between Tivoli and Gallicano, alternately crossing ravines, some of which are as much as 300 ft. deep, and tunnelling through hills.[1]

The engineering skill displayed is remarkable, and one wonders what instruments were employed—probably the so-called *chorobates*, an improvement upon the ordinary water-level (Vitruvius viii. 6), though this would be slow and complicated. The optical properties of glass lenses were, however, unknown to the ancients, and the *dioptra*, or angle measure, was considered by Vitruvius less trustworthy than the *chorobates* for the planning of aqueducts (cf. E. Hultsch, *s.v.* in Pauly-Wissowa, *Real-encyclopädie*). The aqueducts as a rule were carried on separate bridges, though all four united at the Ponte Lupo, a huge structure, which after the addition of all the four, and with the inclusion of all the later strengthening walls that were found necessary in course of time, measures 105 ft. in height, 508 in length, and 46 in thickness at the bottom, without including the buttresses. From Gallicano onwards the course of these four aqueducts follows the lower slopes of the Alban Hills. Previous writers on the subject have been unable to determine their course, which is largely subterranean; but it can be followed step by step with the indications given by the presence of the calcareous deposit which was thrown out at the *putei* or shafts (which were, as a rule, placed at intervals of 240 ft., as were the *cippi*) when the *specus* was cleaned; and remains of bridges, though less important, owing to the less difficult character of the country, are not entirely absent (cf. the works by T. Ashby cited in bibliography).[2] Near the 7th milestone of the Via Latina at Le Capanelle, the Aqua Claudia and Anio Novus emerge from their underground course, and run into Rome upon the long series of arches already mentioned, passing over the Porta Maggiore. The Claudia sent off an important branch from the Porta Maggiore over the Caelian to the Palatine, but the main aqueduct soon reached its termination. A mile farther on the Aqua Marcia also, owing to the gradual slope of the ground towards Rome, begins to be supported on arches, which were also used to carry the Aqua Tepula and the Aqua Julia (of the two latter, before their junction with the Marcia, no remains exist above ground, but inscribed *cippi* of the last named and its underground channel have been found at Le Capanelle, and *cippi* also close to its springs, which are a little way above Grottaferrata at Gli Squarciarelli). The Anio Vetus followed the same line, but kept underground (as was natural at the early period at which it was constructed) until the immediate neighbourhood of Rome, near the locality known as "ad Spem veterem" (from a temple of Spes, of which no remains are known) close to the Porta Maggiore. At this point, besides the aqueducts named, the Aqua Appia, as we are told by Frontinus, entered the city, and received an important branch, the Appia Augusta. No remains of either have been discovered outside the city.

The Aqua Alexandrina must also have entered the city here, though its channel, which lay at some depth below ground, has not been discovered. Considerable remains of its brick aqueducts exist in the district between the Via Praenestina and the Via Labicana.

Of the two aqueducts on the right bank of the Tiber, the Alsietina, as we have said, has no remains at all, while those of the Traiana are not of great importance. The line of the aqueducts was marked by *cippi*, inscribed (in the case of the Anio Vetus, Marcia, Tepula, Julia and Virgo—those of the Claudia and Anio Novus are uninscribed, and those of the Traiana are differently worded) with the name of the aqueduct, the distance from the next *cippus* (generally 240 ft.) and the number, counting from Rome (not from the springs). These boundary stones were erected in pairs, to mark off the strip of land 30 ft. in width reserved for the aqueduct, and for the road or path which generally followed it. The shafts (*putei*) often stood, but not necessarily, at the same points as the *cippi*.

To these nine must be added the two following, constructed after Frontinus's time: (10) Aqua Traiana, from springs to the north-west of the Lacus Sabatinus (Lago di Bracciano), constructed by Trajan in A.D. 109, about 36½ English miles in length. It was restored by Paul V. in 1611, who made use of and largely transformed the remains of the ancient aqueduct; he allowed some of the inferior water of the lake to flow into the channel, and it is thus no longer used for drinking. (11) Aqua Alexandrina,

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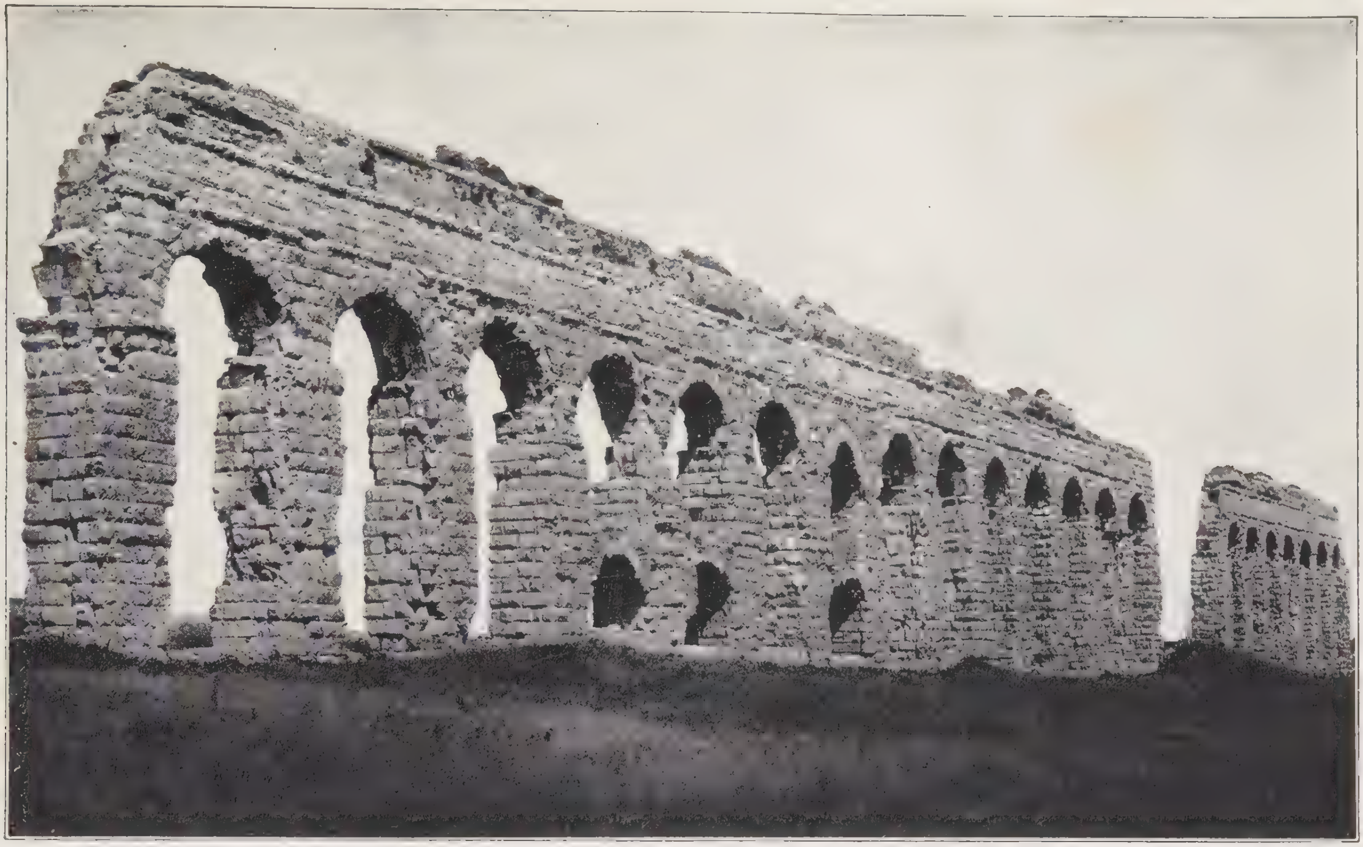
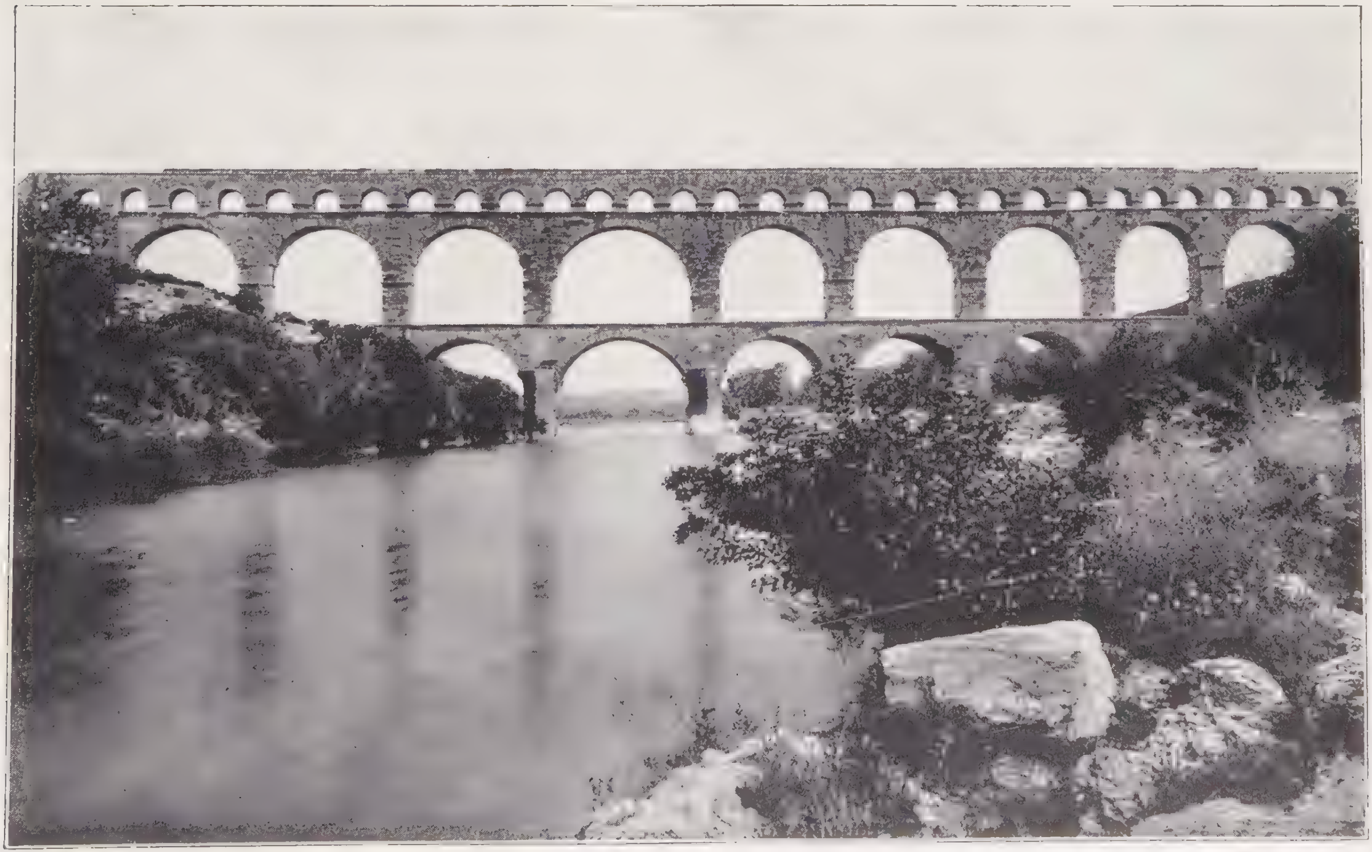
[1] The course of the Aqua Claudia was considerably shortened by the cutting of a tunnel 3 m. long under the Monte Affliano in the time of Domitian (T. Ashby, in *Papers of the British School at Rome*, iii. 133).

[2] About 3 m. south-east of this point the presence of large quantities of deposit and a sudden fall in the level of the channels seems to indicate the existence of settling tanks, of which no actual traces can be seen.



Photo, Alinari.

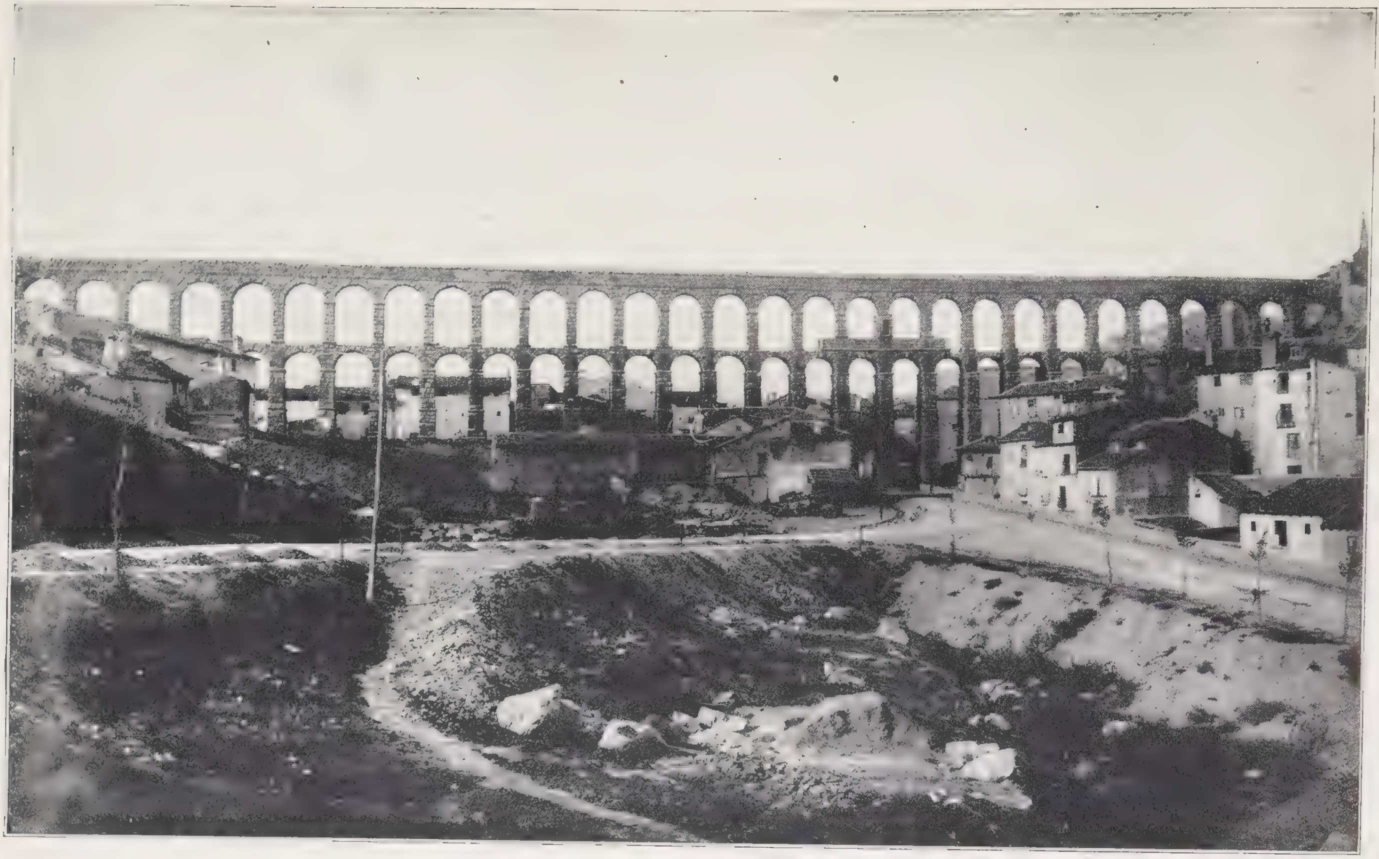
AQUA CLAUDIA, ROME.



Photo, Neurdein

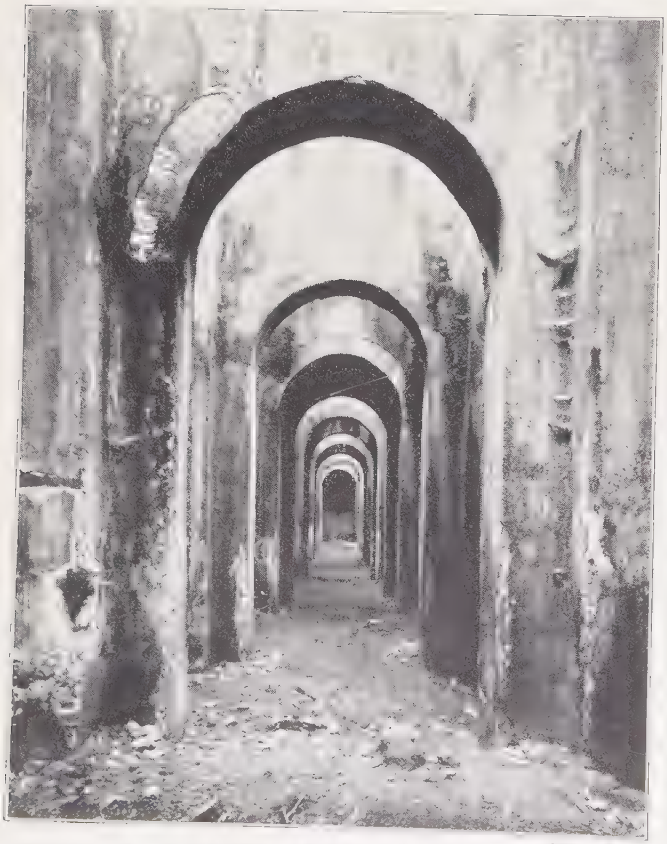
PONT DU GARD, NÎMES (NEMAUSUS).

AQUEDUCT



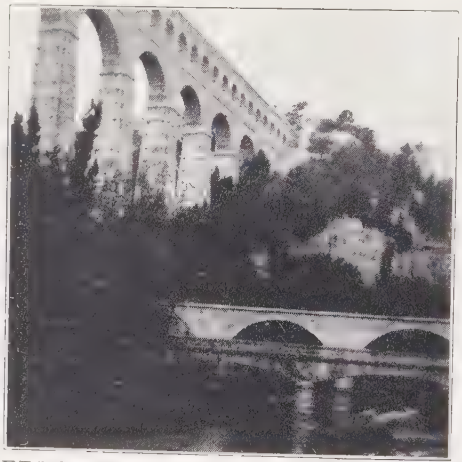
ROMAN AQUEDUCT AT SEGOVIA.

Photo, Laureat y Cia.



PISCINA MIRABILIS AT BAIAE.

Photo, Brogi.



AQUEDUCT OF ROQUEFAVOUR, MARSEILLES.
Early nineteenth century.

AQUA MARCIA, ROME.

Photo, Dr T. Ashby.

rising about 14 English miles from Rome, between the Via Praenestina and the Via Labicana, the work of Alexander Severus (A.D. 226). The springs now supply the modern Acqua Felice, constructed by Sixtus V. in 1585, but the course of the latter is mainly subterranean and not identical with that of the former.

It is agreed that these eleven are all that were constructed. Procopius speaks of fourteen (and the Regionary catalogues mention others), but this number includes branch conduits. All the aqueducts ended in the city in huge *castella* or reservoirs for the purpose of distribution. Vitruvius recommends the division of these into three parts—one for the supply of fountains, &c., one for the public baths and one for private consumers. In the Piazza Vittorio Emmanuele at Rome there are still to be seen the remains of a large ornamental fountain built probably for the Aqua Julia by Domitian or Alexander Severus (Jordan-Hülsen, *Topographie*, i. 3350). Besides these main *castella* there were also many minor *castella* in various parts of the city for sub-distribution. To allow the water to purify itself before being distributed in the city, filtering and settling tanks (*piscinae limariae*) were built outside the walls. These *piscinae* were covered in with a vaulted roof, and were sometimes on a very large scale, as in the example still preserved at Fermo, which consists of two stories, each having three oblong basins communicating with each other; or the Piscina Mirabilis at Baiae, which is covered in by a vaulted roof, supported on forty-eight pillars and perforated to permit the escape of foul air. Two stairs lead by forty steps to the bottom of the reservoir. In the middle of the basin is a sinking to collect the deposit of the water. The walls and pillars are coated with a stucco so hard as to resist a tool.

The oversight of aqueducts was placed, in the times of the republic, under the aediles, who were not, however, the constructors of them; of the four aqueducts built during this period, three are the work of censors, one (the Marcia) of a praetor. Under the empire this task devolved on special officials styled *Curatores Aquarum*, instituted by Augustus, who, as he himself says, "rivos aquarum omnium refecit" (inscription on the arch by which the Aqua Marcia crossed the Via Tiburtina). (T. As.)

Among the aqueducts outside Italy, constructed in Roman times and existing still, the most remarkable are: (1) the aqueduct at Nîmes (Nemausus), erected probably by Vipsanius Agrippa in the time of Augustus, which rose to 160 ft. The Pont du Gard, as this aqueduct is now called, consists of three tiers of arches across the valley of the river Gardon. In the lowest tier are six arches, of which one has a span of 75 ft., the others each 60 ft. In the second tier are eleven arches, each with a span of 75 ft. In the third tier are thirty-five smaller arches which carried the *specus*. As a bridge, the Pont du Gard has no rival for lightness and boldness of design among the existing remains of works of this class carried out in Roman times. (2) The aqueduct bridges at Segovia (Merckel, *Ingenieurtechnik*, pp. 566–568), Tarragona (*ibid.* 565–566), and Merida in Spain, the former being 2400 ft. long, with 109 arches of fine masonry, in two tiers, and reaching the height of 102 ft. The bridge at Tarragona is 876 ft. long and 83 ft. high. (3) At Mainz are the ruins of an aqueduct 7000 yds. long, about half of which is carried on from 500 to 600 pillars (*Archaeological Journal*, xlvii., 1890, pp. 211-214). This aqueduct was built by the XIVth legion and was for the use of the camp, not for the townspeople. For the similar aqueduct at Luynes see *Arch. Journ.* xlv. (1888), pp. 235-237. Similar witnesses of Roman occupation are to be seen in Dacia, Africa (see especially under CARTHAGE), Greece and Asia Minor. (4) The aqueduct at Jouy-aux-Arches, near Metz, which originally extended across the Moselle, here very broad, conveyed to the city an abundance of excellent water from Gorze. From a large reservoir at the source of the aqueduct the water passed along subterranean channels built of hewn stone, and sufficiently spacious for a man to walk in them upright. Similar channels received the water after it had crossed the Moselle by this bridge, at the distance of about 6 m. from Metz, and conveyed it to the city. The bridge consisted of only one row of arches nearly 60 ft. high. The middle arches have given way under the force of the water, but the others are still perfectly solid. This aqueduct is probably to be attributed to the latter half of the 4th century A.D. It is for the use of the town; hence its size. (5) One of the principal bridges of the aqueduct of Antioch in Syria is 700 ft. long, and at the deepest point 200 ft. high. The lower part consists almost entirely of solid wall, and the upper part of a series of arches with very massive pillars. The masonry and design are rude. The water supply was drawn from several springs at a place called Beit el-Ma (anc. Daphne) about 4 or 5 m. from Antioch. From these separate springs the water was conducted by channels of hewn stone into a main channel, similarly constructed, which traversed the rest of the distance, being carried across streams and valleys by means of arches or bridges. (6) At the village of Moris, about an hour's distance north-west from the town of Mytilene, is the bridge of an aqueduct, carried by massive pillars built of large hewn blocks of grey marble, and connected by means of three rows of arches, of which the uppermost is of brick. The bridge extended about 500 ft. in length, and at the deepest point was from 70 to 80 ft. high. Judged by the masonry and the graceful design, it has been thought to be a work of the age of Augustus. Remains of this aqueduct are to be seen at Larisson Lamarousia, an hour's distance from Moris, and at St Demetri, two hours and a half from Ayasos, on the road to Vasilika.

Asia Minor.

The whole subject of the ancient and medieval aqueducts of Asia Minor has been considered in great detail by G. Weber ("Wasserleitungen in kleinasiatischen Städten," in the *Jahrbuch des kaiserl. deutsch. archäolog. Instit.* xix., 1904; see also earlier articles in *Jahrbuch*, 1892, 1899). The aqueducts examined are those at Pergamum, Laodicea and Smyrna (in the earlier articles), and those at Metropolis (Ionia), Tralles (Aidin), Antioch-on-Maeander, Aphrodisias, Trapezopolis, Hierapolis, Apamea Cibotus and Antioch in Pisidia. In most of these cases it is difficult or even impossible to decide whether the work is Hellenistic or Roman; to the Romans Weber inclines to attribute, *e.g.* those at Metropolis, Tralles (perhaps), Aphrodisias; to the Greeks, *e.g.* those at Antioch-on-Maeander and Antioch in Pisidia. Since, therefore, a detailed description of these remains does not provide material for any satisfactory generalizations as to the distinctive features of Hellenistic and Roman work, it will be sufficient here to mention a few of the more interesting discoveries.

In the case of Metropolis, the aqueduct in the valley of the Astraeus consisted of an arcade about 13 to 16 ft. high. Nearer to the town in the hills there are distinct traces of a canal with brick walls. It is clear that the water could not have served more than the lower parts of the town, the acropolis of which is nearly 200 ft. above the level of the conduit. In the case of Tralles the water was supplied by a high pressure conduit and distributed from the acropolis, where there are the remains of a basin (13 ft. by 10) arched over with brick. The ancient aqueduct is to be distinguished from a later, probably Byzantine, canal conduit, the course of which avoids the deeper depressions, crossed by the old aqueduct. Of the Antioch-on-Maeander aqueduct only a few clay-pipes remain, and the same is true of the aqueduct which was built by Carminius in the 2nd century A.D. to supply the community when reinforced by the amalgamation of Plarasa and Tauropolis; two of its basins are still distinguishable, but the two water-towers which are still standing belong to a later Byzantine structure. Trapezopolis was supplied from Mt. Salbacus (Baba Dagh): some twenty stone-pipes have been found built into a low wall which varies from 3¼ to about 5 ft. wide. Of the pillars which carried the conduit-pipe to Antioch in Pisidia, nineteen are still standing. Each arch consists of eleven keystones; no cement was used. The conduit, which was high-pressure, ends in a distributing tower and reservoir. (J. M. M.)

II. *Medieval.*—The aqueduct near Spoleto, which now serves also as a bridge, is deserving of notice as an early instance of the use of the pointed arch, belonging as it does to the 7th or 8th century. It has ten arches, remarkable for the elegance of their design and the airy lightness of their proportions, each over 66 ft. in span, and about 300 ft. in height.

Constantinople.

The aqueduct of Pyrgos, near Constantinople, is a remarkable example of works of this class carried out in the later times of the Roman empire, and consisted of two branches. From this circumstance it was called Egri Kemer ("the Crooked Aqueduct"), to distinguish it from the Long Aqueduct, situated near the source of the waters. One of the branches extends 670 ft. in length, and is 106 ft. in height at the deepest part. It is composed of three tiers of arches, those in each row increasing in width from the bottom to the top—an arrangement very properly introduced with the view of saving materials without diminishing the strength of the work. The two upper rows consisted of arches of semicircles, the lower of Gothic arches; and this circumstance leads to the belief that the date of the structure is about the 10th century. The breadth of the building at the base was 21 ft., and it diminished with a regular batter on each side to the top, where it was only 11 ft. The base also was protected by strong buttresses or counterforts, erected against each of the pillars. The other branch of the aqueduct was 300 ft. long, and consisted of twelve semicircular arches. This aqueduct serves to convey to Constantinople the waters of the valley of Belgrad, one of the principal sources from which the city is supplied. These are situated on the heights of Mount Haemus, the extremity of the Balkan Mountains, which overhangs the Black Sea. The water rises about 15 m. from the city, and between 3 and 4 m. west of the village of Belgrad, in three sources, which run in three deep and very confined valleys. These unite a little below the village, and then are collected into a large reservoir. After flowing a mile or two from this reservoir, the waters are augmented by two other streams, and conveyed by a channel of stone to the Crooked Aqueduct. From this they are conveyed to another which is the Long Aqueduct; and then, with various accessions, into a third, termed the Aqueduct of Justinian. From this they enter a vaulted conduit, which skirts the hills on the left side of the valley, and crosses a broad valley 2 m. below the Aqueduct of Justinian, by means of an aqueduct, with two tiers of arches of a very beautiful construction. The conduit then proceeds onward in a circuitous route, till it reaches the reservoir of Egri Kapu, situated just without and on the walls of the city. From this the water is conducted to the various quarters of the city, and also to the reservoir of St Sophia, which supplies the seraglio of the grand signior. The Long Aqueduct (Usun Kemer) is more imposing by its extent than the Crooked one, but is far inferior in the regularity of design and disposition of the materials. It is evidently a work of the Turks. It consists of two tiers of arches, the lower being forty-eight in number, and the upper fifty. The whole length was about 2200 ft., and the height 80 ft. The aqueduct of Justinian (Muallak Kemer or "Hanging Aqueduct") is without doubt one of the finest monuments which remain to us of the middle ages. It consists of two tiers of large pointed arches, pierced transversely. Those of the lower story have 55 ft. of span, the upper ones 40 ft. The piers are supported by strong buttresses, and at different heights they have little arches passing through them laterally, which relieve the deadness of the solid pillar. The length of this aqueduct is 720 ft. and the height 108 ft. This aqueduct has been attributed both to Constantine I. and to Justinian, the latter being perhaps the more probable.

Besides the waters of Belgrad, Constantinople was supplied from several other principal sources, one of which took its rise on the heights of the same mountains, 3 or 4 m. east of Belgrad. This was conveyed in a similar manner by an arched channel elevated, when it was necessary, on aqueduct bridges, till it reached the northern parts of the city. It was in the course of this aqueduct that the contrivance of the *souterasi* or hydraulic obelisks, described by Andréossy (on his voyage to the Black Sea, the account of the Thracian Bosporus), was constructed, which excited some attention, as being an improvement on the method of conducting water by aqueduct bridges. "The souterasi," says Andréossy, "are masses of masonry, having generally the form of a truncated pyramid or an Egyptian obelisk. To form a conduit with souterasi, we choose sources of water, the level of which is several feet higher than the reservoir by which it is to be distributed over the city. We bring the water from its sources in subterranean canals, slightly declining until we come to the borders of a valley or broken ground. We there raise on each side a souterasi, to which we adapt vertically leaden pipes of determinate diameters, placed parallel to the two opposite sides of the building. These pipes are disjoined at the upper part of the obelisk, which forms a sort of basin, with which the pipes are connected. The one permits the water to rise to the level from whence it had descended; by the other, the water descends from this level to the foot of the souterasi, where it enters another canal underground, which conducts it to a second and to a third souterasi, where it rises and again descends, as at the last station. Here a reservoir receives it and distributes it in different directions by orifices of which the discharge is known." Again he says, "it requires but little attention to perceive that this system of conducting tubes is nothing but a series of siphons open at their upper part, and communicating with each other. The expense of a conduit by souterasi is estimated at only one-fifth of that of an aqueduct with arcades." There seems to be really no advantage in these pyramids, further than as they serve the purpose of discharging the air which collects in the pipes. They are in themselves an evident obstruction, and the water would flow more freely without any interruption of the kind. In regard to the leaden pipes, again, they would have required, with so little head pressure as is stated, to be used of very extraordinary dimensions to pass the same quantity of water as was discharged along the arched conduits (see also works quoted under CONSTANTINOPLE). The other principal source from which Constantinople is supplied, is from the high grounds 6 or 8 m. west of the town, from which it is conducted by conduits and arches, in the same manner as the others. The supply drawn from all these sources, as detailed by Andréossy, amounted to 400,000 cubic ft. per day. (A. S. M.; J. M. M.)

Aqueducts and water supply.

III. *Modern Construction.*—Where towns are favourably situated the aqueduct may be very short and its cost bear a relatively small proportion to the total outlay upon a scheme of water supply, but where distant sources have to be relied upon the cost of the aqueduct becomes one of the most important features in the scheme, and the quantity of water obtainable must be considerable to justify the outlay. Hence it is that only very large towns can undertake the responsibility for this expenditure. In Great Britain it has in all large schemes become a condition that, when a town is permitted to go outside its own watershed, it shall, subject to a priority of a certain number of gallons per day per head of its own inhabitants, allow local authorities, any part of whose district is within a certain number of miles of the aqueduct, to take a supply on reasonable terms. The first case in which this principle was adopted on a large scale was the Thirlmere scheme sanctioned by parliament in 1879, for augmenting the supply of Manchester. The previous supply was derived from a source only about 15 m. distant, and the cost of the aqueduct, chiefly cast-iron pipes, was insignificant compared with the cost of the impounding reservoirs. But Thirlmere is 96 m. distant from the service reservoir near Manchester, and the cost of the aqueduct was more than 90 % of the total cost. As a supply of about 50,000,000 gallons a day is available the outlay was justifiable, and the water is in fact very cheaply obtained. Liverpool derives a supply of about 40,000,000 gallons a day from the river Vyrnwy in North Wales, 68 m. distant, and Birmingham has constructed works for impounding water in Radnorshire, and conveying it a distance of 74 m., the supply being about 75,000,000 gallons a day. In the year 1899 an act of parliament was passed authorizing the towns of Derby, Leicester, Sheffield and Nottingham, jointly to obtain a supply of water from the head waters of the river Derwent in Derbyshire. Leicester is 60 m. distant from this source, and its share of the supply is about 10,000,000 gallons a day. For more than half the distance, however, the aqueduct is common to Derby and Nottingham, which together are entitled to about 16,000,000 gallons a day, and the expense to Leicester is correspondingly reduced. These are the most important cases of long aqueducts in England, and all are subsequent to 1879. It is obvious, therefore, how greatly the design and construction of the aqueduct have grown in importance, and what care must be exercised in order that the supply upon which such large populations depend may not be interrupted, and that the country through which such large volumes of water are conveyed may not be flooded in consequence of the failure of any of the works.

Construction.

Practically only two types of aqueduct are used in England. The one is built of concrete, brickwork, &c., the other of cast-iron (or, in special circumstances, steel) pipes. In the former type the water surface coincides with the hydraulic gradient, and the conditions are those of an artificial river; the aqueduct must therefore be carefully graded throughout, so that the fall available between source and termination may be economically distributed. This condition requires that the ground in which the work is built shall be at the proper elevation; if at any point this is not the case, the aqueduct must be carried on a substructure built up to the required level. Such large structures are, however, extremely expensive, and require elaborate devices for maintaining water-tightness against the expansion and contraction of the masonry due to changes of temperature. They are now only used where their length is very short, as in cases where mountain streams have to be crossed, and even these short lengths are avoided by some engineers, who arrange that the aqueduct shall pass, wherever practicable, under the streams. Where wide valleys interrupt the course of the built aqueduct, or where the absence of high ground prevents the adoption of that type at any part of the route, the cast-iron pipes hereafter referred to are used.

Masonry aqueducts.

The built aqueduct may be either in tunnel, or cut-and-cover, the latter term denoting the process of cutting the trench, building the floor, side-walls, and roof, and covering with earth, the surface of the ground being restored as before. For works conveying water for domestic supply, the aqueduct is in these days, in England, always covered. Where, as is usually the case, the water is derived from a tract of mountainous country, the tunnel work is sometimes very heavy. In the case of the Thirlmere aqueduct, out of the first 13 m. the length of the tunnelled portions is 8 m., the longest tunnel being 3 m. in length. Conditions of time, and the character of the rock, usually require the use of machinery for driving, at any rate in the case of the longer tunnels. For the comparatively small tunnels required for aqueducts, two percussion drilling machines are usually mounted on a carriage, the motive power being derived from compressed air sent up the tunnel in pipes. The holes when driven are charged with explosives and fired. In the Thirlmere tunnels, driven through very hard Lower Silurian strata, the progress was about 13 yds. a week at each face, work being carried on continuously day and night for six days a week. Where the character of the country through which the aqueduct passes is much the same as that from which the supply is derived, the tunnels need not be lined with concrete, &c., more than is absolutely necessary for retaining the water and supporting weak places in the rock; the floor, however, is nearly always so treated. The lining, whether in tunnel or cut-and-cover, may be either of concrete, or brickwork, or of concrete faced with brickwork. To ensure the impermeability of work constructed with these materials is in practice somewhat difficult, and no matter how much care is taken by those supervising the workmen, and even by the workmen themselves, it is impossible to guarantee entire freedom from trouble in this respect. With a wall only about 15 in. thick, any neglect is certain to make the work permeable; frequently the labourers do not distribute the broken stone and fine material of the concrete uniformly, and no matter how excellent the design, the quality of materials, &c., a leak is sure to occur at such places (unless, indeed, the pressure of the outside water is superior and an inflow occurs). A further cause of trouble lies in the water which flows from the strata on to the concrete, and washes away some of the cement upon which the work depends for its watertightness, before it has time to set. For this reason it is advisable to put in the floor before, and not after, the side-walls and arch have been built, otherwise the only outlet for the water in the strata is through the ground on which the floor has to be laid. Each length of about 20 ft. should be completely constructed before the next is begun, the water then having an easy exit at the leading end. Manholes, by which the aqueduct can be entered, are usually placed in the roof at convenient intervals; thus, in the case of the Thirlmere aqueduct, they occur at every quarter of a mile.

Timber aqueducts.

In some parts of America aqueducts are frequently constructed of wood, being then termed flumes. These are probably more extensively used in California than in any other part of the world, for conveying large quantities of water which is required for hydraulic mining, for irrigation, for the supply of towns and for transporting timber. The flumes are frequently carried along precipitous mountain slopes, and across valleys, supported on trestles. In Fresno county, California, there is a flume 52 m. in length for transporting timber from the Sierra Nevada Mountains to the plain below; it has a rectangular V-shaped section, 3 ft. 7 in. wide at the top, and 21 in. deep vertically. The boards which form the sides are 1¼ in. thick, and some of the trestlework is 130 ft. high. The steepest grade occurs where there is a fall of 730 ft. in a length of 3000 ft. About 9,000,000 ft. of timber were used in the construction. At San Diego there is a flume 35 m. long for irrigation and domestic supply, the capacity being 50 ft. per second; it has 315 trestle bridges (the longest of which is that across Los Coches Creek, 1794 ft. in length and 65 ft. in height) and 8 tunnels, and the cost was $900,000. The great bench flume of the Highline canal, Colorado, is 2640 ft. in length, 28 ft. wide, and 7 ft. deep; the gradient is 5·28 ft. per mile, and the discharge 1184 ft. per second.

Aqueduct in iron piping.

As previously stated, the type of aqueduct built of concrete, &c., can only be adopted where the ground is sufficiently elevated to carry it, and where the quantity of water to be conveyed makes it more economical than piping. Where the falling contour is interrupted by valleys too wide for a masonry structure above the surface of the ground, the detached portions of the built aqueduct must be connected by rows of pipes laid beneath, and following the main undulations of, the surface. In such cases the built aqueduct terminates in a chamber of sufficient size to enclose the mouths of the several pipes, which, thus charged, carry the water under the valley up to a corresponding chamber on the farther hillside from which the built aqueduct again carries on the supply. These connecting pipes are sometimes called siphons, although they have nothing whatever to do with the principle of a siphon, the water simply flowing into the pipe at one end and out at the other under the influence of gravity, and the pressure of the atmosphere being no element in the case. The pipes are almost always made of cast-iron, except in such cases as the lower part of some siphons, where the pressure is very great, or where they are for use abroad, when considerations of weight are of importance, and when they are made of rolled steel with riveted or welded seams. It is frequently necessary to lay them in deep cuttings, in which case cast-iron is much better adapted for sustaining a heavy weight of earth than the thinner steel, though the latter is more adapted to resist internal pressure. Mr D. Clarke (*Trans. Am. Soc. C.E.* vol. xxxviii. p. 93) gives some particulars of a riveted steel pipe 24 m. long, 33 to 42 in. diameter, varying in thickness from 0·22 in. to 0·375 in. After a length of 9 m. had been laid, and the trench refilled, it was found that the crown of the pipe had been flattened by an amount varying from ½ in. to 4 in. Steel pipes suffer more from corrosion than those made of cast-iron, and as the metal attacked is much thinner the strength is more seriously reduced. These considerations have prevented any general change from cast-iron to steel.

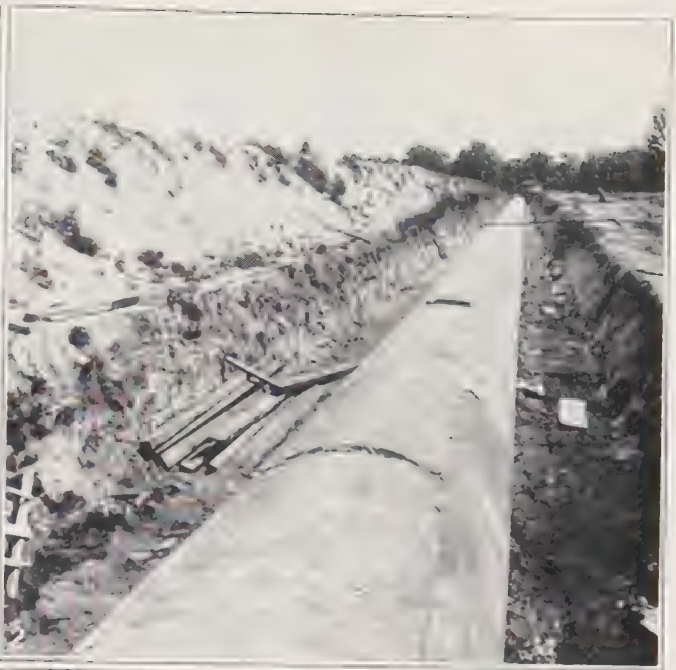
Mr. Clemens Herschel has made some interesting remarks (*Proc. Inst. C.E.* vol. cxv. p. 162) as to the circumstances in which steel pipes have been found preferable to cast-iron. He says that it had been demonstrated by practice that cast-iron cannot compete with wrought-iron or steel pipes in the states west of the Rocky Mountains, on the Pacific slope. This is due to the absence of coal and iron ore in these states, and to the weight of the imported cast-iron pipes compared with steel pipes of equal capacity and strength. The works of the East Jersey Water Company for the supply of Newark, N.J., include a riveted steel conduit 48 in. in diameter and 21 m. long. This conduit is designed to resist only the pressure due to the hydraulic gradient, in contradistinction to that which would be due to the hydrostatic head, this arrangement saving 40% in the weight and cost of the pipes. For the supply of Rochester, N.Y., there is a riveted steel conduit 36 in. in diameter and 20 m. long; and for Allegheny City, Pennsylvania, there is a steel conduit 5 ft. in diameter and nearly 10 m. long. The works for bringing the water from La Vigne and Verneuil to Paris include a steel main 5 ft. in diameter between St Cloud and Paris.

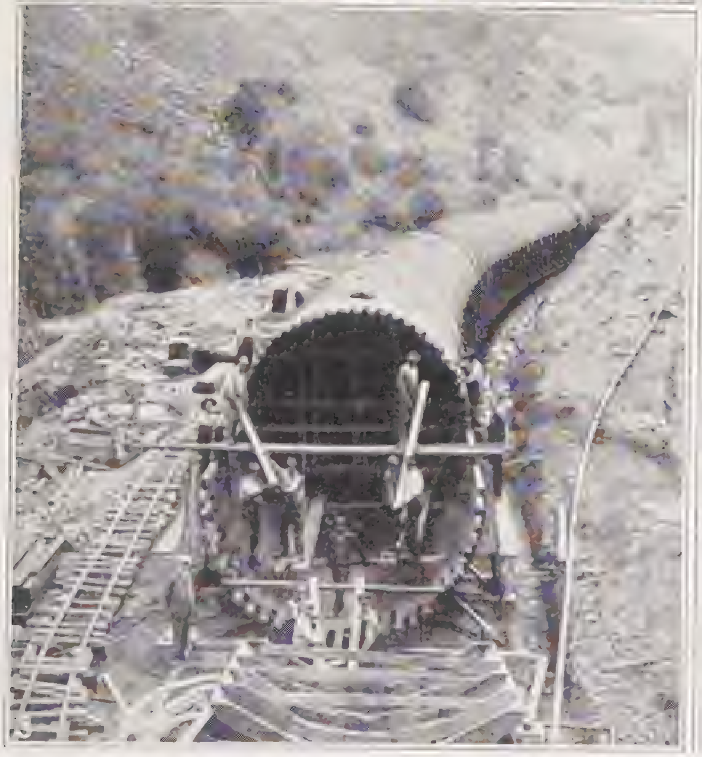
Cast-iron pipes rarely exceed 48 in. in diameter, and even this diameter is only practicable where the pressure of the water is low. In the Thirlmere aqueduct the greatest pressure is nearly 180 ℔ on the square inch, the pipes where this occurs being 40 in. in diameter and $1\frac{3}{4}$ in. thick. These large pipes, which are usually made in lengths of 12 ft., are generally cast with a socket at one end for receiving the spigot end of the next pipe, the annular space being run with lead, which is prevented from flowing into the interior of the pipe by a spring ring subsequently removed; the surface of the lead is then caulked all round the outside of the pipe. A wrought-iron ring is sometimes shrunk on the outer rim of the socket, previously turned to receive it, in order to strengthen it against the wedging action of the caulking tool. Sometimes the pipes are cast as plain tubes and joined with double collars, which are run with lead as in the last case. The reason for adopting the latter type is that the stresses set up in the thicker metal of the socket by unequal cooling are thereby avoided, a very usual place for pipes to crack under pressure being at the back of the socket. The method of turning and boring a portion, slightly tapered, of spigot and socket so as to ensure a watertight junction by close annular metallic contact, is not suitable for large pipes, though very convenient for smaller diameters in even ground. Spherical joints are sometimes used where a line of main has to be laid under a large river or estuary, and where, therefore, the pipes must be jointed before being lowered into the previously dredged trench. This was the case at the Willamette river, Portland, Oregon, where a length of 2000 ft. was required. The pipes are of cast-iron 28 in. in diameter, $1\frac{1}{2}$ in. thick, and 17 ft. long. The spigots were turned to a spherical surface of 20 in. radius outside, the inside of the sockets being of a radius $\frac{3}{8}$ in. greater. After the insertion of the spigot into the socket, a ring, 3 in. deep, turned inside to correspond with the socket, was bolted to the latter, the annular space then being run with lead. These pipes were laid on an inclined cradle, one end of which rested on the bed of the river and the other on a barge where the jointing was done; as the pipes were jointed the barge was carefully advanced, thus trailing the pipes into the trench (*Trans. Am. Soc. C.E.* vol. xxxiii. p. 257). As may be conjectured from the pressure which they have to stand, very great care has to be taken in the manufacture and handling of cast-iron pipes of large diameter, a care which must be unfailing from the time of casting until they are jointed in their final position in the ground. They are cast vertically, socket downwards, so that the densest metal may be at the weakest part, and it is advisable to allow an extra head of metal of about 12 in., which is subsequently cut off in a lathe. An inspector representing the purchaser watches every detail of the manufacture, and if, after being measured in every part and weighed, they are found satisfactory they are proved with internal fluid pressure, oil being preferable to water for this purpose. While under pressure, they are rapped from end to end with a hand hammer of about 5 ℔ in weight, in order to discover defects. The wrought-iron rings are then, if required, shrunk on to the sockets, and the pipes, after being made hot in a stove, are dipped vertically in a composition of pitch and oil, in order to preserve them from corrosion. All these operations are performed under cover. A record should be kept of the history of the pipe from the time it is cast to the time it is laid and jointed in the ground, giving the date, number, diameter, length, thickness, and proof pressure, with the name of the pipe-jointer whose work closes the record. Such a history sometimes enables the cause (which is often very obscure) of a burst in a pipe to be ascertained, the position of every pipe being recorded.

Cast-iron pipes, even when dipped in the composition referred to, suffer considerably from corrosion caused by the water, especially soft water, flowing through them. One pipe may be found in as good a condition as when made, while the next may be covered with nodules of rust. The effect of the rust is twofold; it reduces the area of the pipe, and also, in consequence of the resistance offered by the rough surface, retards the velocity of the water. These two results, expecially the latter, may seriously diminish the capability of discharge, and they should always be allowed for in deciding the diameter. Automatic scrapers are sometimes used with good results, but it is better to be independent of them as long as possible. In one case the discharge of pipes, 40 in. in diameter, was found after a period of about twelve years to have diminished at the rate of about 1% per year; in another case, where the water was soft and where the pipes were 40 in. in diameter, the discharge was diminished by 7% in ten years. An account of the state of two cast-iron mains supplying Boston with water is given in the *Trans. Am. Soc. C.E.* vol. xxxv. p. 241. These pipes, which were laid in 1877, are 48 in. in diameter and 1800 ft. long. When they were examined in 1894–1895, it was estimated that the tubercles of rust covered nearly one-third of the interior surfaces, the bottom of the pipe being more encrusted than the sides and top. They had central points of attachment to the iron, at which no doubt the coating was defective, and from them the tubercles spread over the surface of the surrounding coating. In this case they were removed by hand, and the coating of the pipes was not injured in the process. Cast-iron pipes must not be laid in contact with cinders from a blast furnace with which roads are sometimes made, because these corrode the metal. Mr Russell Aitken (*Proc. Inst. C.E.* vol. cxv. p. 93) found in India that cast-iron pipes buried in the soil rapidly corroded, owing to the presence of nitric acid secreted by bacteria which attacked the iron. The large cast-iron pipes conveying the water from the Tansa reservoir to Bombay are laid above the surface of the ground. Cast-iron pipes of these large diameters have not been in existence sufficiently long to enable their life to be predicted. A main, 40 in. in diameter, conveying soft water, after being in existence fifty years at Manchester, was apparently as good as ever. In 1867 Mr J. B. Francis found that no apparent deterioration had taken place in a cast-iron main, 8 in. diameter, which was laid in the year 1828, a period of thirty-nine years (*Trans. Soc. Am. C.E.* vol. i. p. 26). These two instances are probably not exceptional.

Methods of laying.

Pipes in England are usually laid with not less than 2 ft. 6 in. of cover, in order that the water may not be frozen in a severe winter. Where they are laid in deep cutting they should be partly surrounded with concrete, so that they may not be fractured by the weight of earth above them. Angles are turned by means of special bend pipes, the curves being made of as large a radius as convenient. In the case of the Thirlmere aqueduct, double socketed castings about 12 in. long (exclusive of the sockets) were used, the sockets being inclined to each other at the required angle. They were made to various angles, and for any particular curve several would be used connected by straight pipes 3 ft. long. As special castings are nearly double the price of the regular pipes, the cost was much diminished by making them as short as possible, while a curve, made up of the slight angles used, offered practically no more impediment to the flow of water in consequence of its polygonal form, than would be the case had special bend pipes been used. In all cases of curves on a line of pipes under internal fluid pressure, there exists a resultant force tending to displace the pipes. When the curve is in a horizontal plane and the pipes are buried in the ground, the side of the pipe trench offers sufficient resistance to this force. Where, however, the pipes are above ground, or when the curve is in a vertical plane, it is necessary to anchor them in position. In the case of the Tansa aqueduct to Bombay, there is a curve of 500 ft. radius near Bassein Creek. At this point the hydrostatic head is about 250 ft., and the engineer, Mr Clerke, mentions that a tendency to an outward movement of the line of pipes was observed. At the siphon under Kurla Creek the curves on the approaches as originally laid down were sharp, the hydrostatic head being there about 210 ft.; here the outward movement was so marked that it was considered advisable to realign the approaches with easier curves (*Proc. Inst. C.E.* vol. cxv. p. 34). In the case of the Thirlmere aqueduct the greatest hydrostatic pressure, 410 ft., occurs at the bridge over the river Lune, where the pipes are 40 in. in diameter, and in descending from the bridge make reverse angles of $31\frac{1}{2}°$. The displacing force at each of these angles amounts to 54 tons, and as the design includes five lines of pipes, it is obvious that the anchoring arrangements must be very efficient. The steel straps used for anchoring these and all other bends were curved to fit as closely as possible the castings to be anchored. Naturally the metal was not in perfect contact, but when the pipes were charged the disappearance of all the slight inequalities showed that the straps were fulfilling their intended purpose. At every summit on a line of pipes one or more valves must be placed in order to allow the escape of air, and they must also be provided on long level stretches, and at changes of gradient where the depth of the point of change below the hydraulic gradient is less than that at both





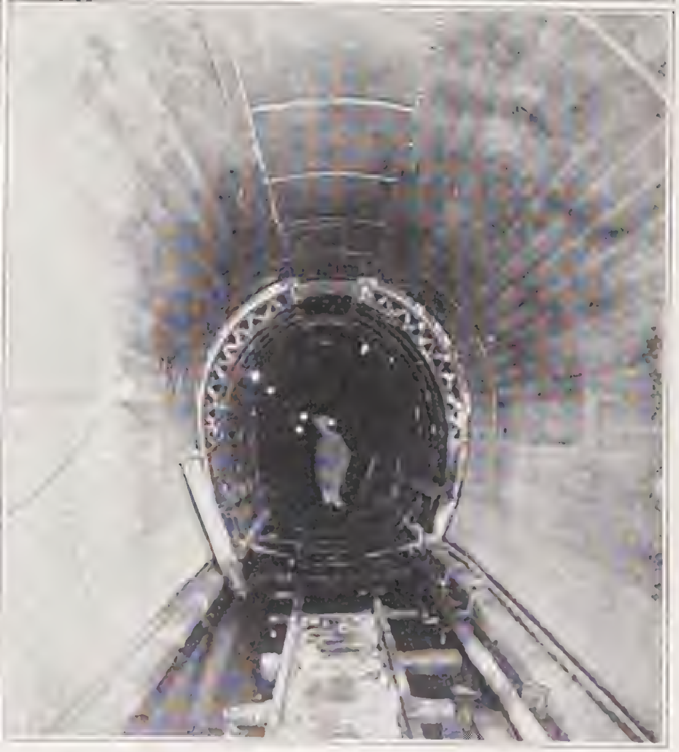


Fig. 1. Making a concrete aqueduct, 6 ft. in diameter, tapping the Mississippi river 14 m. above St. Paul. Steel reinforcement in the foreground. In the background the concrete is being applied.

Fig. 2. The same aqueduct with concrete applied. Ready to be covered with earth.

Fig. 3. Pipe-line of California-Oregon Power Co., northern California. It is of creosoted wood, 1,316 ft. in length, with an inside diameter of 16 feet. Supported on steel cradles, and open to the air. Capacity 2,000 cu. ft. of water per second.

Fig. 4. Aqueduct tunnel on the Mountain division of the Hetch Hetchy water system, San Francisco, This tunnel is 18 8 m. in length About 11 m. of the tunnel are lined with concrete.

For recent developments, see Aqueduct (Vol. 29), Hydroelectric Engineering (Vol. 30).

(Figs. 1, 2 and 4. Ewing Galloway. Fig. 3. "Wide World.")

sides, causing what may be called a virtual summit. It is better to have too many than too few, as accumulations of air may cause an enormous diminution in the quantity of water delivered. In all depressions discharge valves should be placed for emptying the pipes when desired, and for letting off the sediment which accumulates at such points. Automatic valves are frequently placed at suitable distances for cutting off the supply in case of a burst. At the inlet mouth of the pipe they may depend for their action on the sudden lowering of the water (due to a burst in the pipe) in the chamber from which they draw their supply, causing a float to sink and set the closing arrangement in motion. Those on the line of main are started by the increased velocity in the water, caused by the burst on the pipe at a lower level. The water, when thus accelerated, is able to move a disk hung in the pipe at the end of a lever and weighted so as to resist the normal velocity; this lever releases a catch, and a door is then gradually revolved by weights until it entirely closes the pipe. Reflux valves on the ascending leg of a siphon prevent water from flowing back in case of a burst below them; they have doors hung on hinges, opening only in the normal direction of flow. Due allowance must be made, in the amount of head allotted to a pipe, for any head which may be absorbed by such mechanical arrangements as those described where they offer opposition to the flow of the water. These large mains require most careful and gradual filling with water, and constant attention must be given to the air-valves to see that the gutta-percha balls do not wedge themselves in the openings. A large mass of water, having a considerable velocity, may cause a great many bursts by water-ramming, due to the admission of the water at too great a speed. In places where iron is absent and timber plentiful, as in some parts of America, pipes, even of large diameter and in the most important cases, are sometimes made of wooden staves hooped with iron. A description of two of these will be found below.

Thirlmere.

The *Thirlmere Aqueduct* is capable of conveying 50,000,000 gallons a day from Thirlmere, in the English lake district, to Manchester. The total length of 96 m. is made up of 14 m. of tunnels, 37 m. of cut-and-cover, and 45 m. of cast-iron pipes, five rows of the latter being required. The tunnels where lined, and the cut-and-cover, are formed of concrete, and are 7 ft. in height and width, the usual thickness of the concrete being 15 in. The inclination is 20 in. per mile. The floor is flat from side to side, and the side-walls are 5 ft. high to the springing of the arch, which has a rise of 2 ft. The water from the lake is received in a circular well 65 ft. deep and 40 ft. in diameter, at the bottom of which there is a ring of wire-gauze strainers. Wherever the concrete aqueduct is intersected by valleys, cast-iron pipes are laid; in the first instance only two of the five rows 40 in. in diameter were laid, the city not requiring its supply to be augmented by more than 20,000,000 gallons a day, but in 1907 it was decided to lay a third line. All the elaborate arrangements described above for stopping the water in case of a burst have been employed, and have perfectly fulfilled their duties in the few cases in which they have been called into action. The water is received in a service reservoir at Prestwich, near Manchester, from which it is supplied to the city. The supply from this source was begun in 1894. The total cost of the complete scheme may be taken at about £5,000,000, of which rather under £3,000,000 had been spent up to the date of the opening, at which time only one line of pipes had been laid.

Vyrnwy.

The *Vyrnwy Aqueduct* was sanctioned by parliament in 1880 for the supply of Liverpool from North Wales, the quantity of water obtainable being at least 40,000,000 gallons a day. A tower built in the artificial lake from which the supply is derived, contains the inlet and arrangements for straining the water. The aqueduct is 68 m. in length, and for nearly the whole distance will consist of three lines of cast-iron pipes, two of which, varying in diameter from 42 in. to 39 in., are now in use. As the total fall between Vyrnwy and the termination at Prescot reservoirs is about 550 ft., arrangements had to be made to ensure that no part of the aqueduct be subjected to a greater pressure than is required for the actual discharge. Balancing reservoirs have therefore been constructed at five points on the line, advantage being taken of high ground where available, so that the total pressure is broken up into sections. At one of these points, where the ground level is 110 ft. below the hydraulic gradient, a circular tower is built, making a most imposing architectural feature in the landscape. At the crossing of the river Weaver, 100 ft. wide and 15 ft. deep, the three pipes, here made of steel, were connected together laterally, floated into position, and sunk into a dredged trench prepared to receive them. Under the river Mersey the pipes are carried in a tunnel, from which, during construction, the water was excluded by compressed air.

Denver.

Denver Aqueduct.—The supply to Denver City, initiated by the Citizens Water Company in 1889, is derived from the Platte river, rising in the Rocky Mountains. The first aqueduct constructed is rather over 20 m. in length, of which a length of 16½ m. is made of wooden stave pipe, 30 in. in diameter. The maximum pressure is that due to 185 ft. of water; the average cost of the wooden pipe was $1·36½ per foot, and the capability of discharge 8,400,000 gallons a day. Within a year of the completion of the first conduit, it became evident that another of still greater capacity was required. This was completed in April 1893; it is 34 in. in diameter and will deliver 16,000,000 gallons a day. By increasing the head upon the first pipe, the combined discharge is 30,000,000 gallons a day. An incident in obtaining a temporary supply, without waiting for the completion of the second pipe, was the construction of two wooden pipes, 13 in. in diameter, crossing a stream with a span of 104 ft., and having no support other than that derived from their arched form. One end of the arch is 24½ ft. above the other end, and, when filled with water, the deflection with eight men on it was only $\frac{7}{8}$ of an inch. A somewhat similar arch, 60 ft. span, occurs on the 34-in. pipe where it crosses a canal. Schuyler points out (*Trans. Am. Soc. C.E.* vol. xxxi. p. 148) that the fact that the entire water supply of a city of 150,000 inhabitants is conveyed in wooden mains, is so radical a departure from all precedents, that it is deserving of more than a passing notice. He says that it is manifestly and unreservedly successful, and has achieved an enormous saving in cost. The sum saved by the use of wooden, in preference to cast-iron pipes, is estimated at $1,100,000. It is perhaps necessary to state that the pipe is buried in the ground in the same way as metal pipes. The edges of the staves are dressed to the radius with a minute tongue $\frac{1}{16}$ in. high on one edge of each stave, but with no corresponding groove in the next stave; its object is to ensure a close joint when the bands are tightened up. Leaks seldom or never occur along the longitudinal seams, but the end shrinkage caused troublesome joint leaks. The shrinkage in California redwood, which had seasoned 60 to 90 days before milling, was frequently as much as 3 in. in the 20 staves that formed the 34-in. pipe, and the space so formed had to be filled by a special closing stave. Metallic tongues, $\frac{3}{4}$ in. deep, are inserted at the ends of abutting staves, in a straight saw cut. The bands, which are of mild steel, have a head at one end and a nut and washer at the other; the ends are brought together on a wrought-iron shoe, against which the nut and washer set. The staves forming the lower half of the pipe are placed on an outside, and the top staves on an inside, mould. While the bands are being adjusted the pipe is rounded out to bring the staves out full, and the staves are carefully driven home on to the abutting staves. The spacing of the bands depends on circumstances, but is about 150 bands per 100 ft. With low heads the limit of spacing was fixed at 17 in. The outer surface of the pipe, when charged, shows moisture oozing slightly over the entire surface. This condition Schuyler considers an ideal one for perfect preservation, and the staves were kept as thin as possible to ensure its occurrence. Samples taken from pipes in use from three to nine years are quite sound, and it is concluded that the wood will last as long as cast-iron if the pipe is kept constantly charged. The bands are the only perishable portion, and their life is taken at from fifteen to twenty years. Other portions of the second conduit for a length of nearly 3 m. were formed of concrete piping, 38 in. diameter, formed on a mould in the trench, the thickness being 2½ to 3 in. So successful an instance of the use of wooden piping on a large scale is sure to lead to a large development of this type of aqueduct in districts where timber is plentiful and iron absent.

Pioneer, Utah.

Pioneer Aqueduct, Utah.—The construction of the Pioneer Aqueduct, Utah, was begun in 1896 by the Pioneer Electric Power Company, near the city of Ogden, 35 m. north of Salt Lake City. The storage reservoir, from which it draws its water, will cover an area of 2000 acres, and contain about 15,000 million gallons of water. The aqueduct is a pipe 6 ft. in diameter, and of a total length of 6 m.; for a distance of rather more than 5 m. it is formed of wooden staves, the remainder, where the head exceeds 117 ft., being of steel. It is laid in a trench and covered to a depth of 3 ft. The greatest pressure on the steel pipe is 200 lb per sq. in., and the thickness varies from $\frac{3}{8}$ to $\frac{11}{16}$ in. The pipe was constructed according to the usual practice of marine boiler-work for high pressures, and each section, about 9 ft. long, was dipped in asphalt for an hour. These sections were supported on timber blocking, placed from 5 to 9 ft. apart, and consisting of three to six pieces of 6 x 6 in. timbers laid one on the top of the other; they were then riveted together in the ordinary way. The wooden stave-pipe is of the type successfully used in the Western States for many years, but its diameter is believed to be unequalled for any but short lengths. There were thirty-two staves in the circle, 2 in. in thickness, and about 20 ft. long, hooped with round steel rods $\frac{5}{8}$ in. in diameter, each hoop being in two pieces. The pipe is supported at intervals of 8 ft. by sills 6 x 8 in. and 8 ft. long. The flow through it is 250 cubic ft. per second.

Santa Ana.

The *Santa Ana Canal* was constructed for irrigation purposes in California, and is designed to carry 240 cub. ft. of water per second (*Trans. Am. Soc. C.E.* vol. xxxiii. p. 99). The cross section of the flumes shows an elliptical bottom and straight sides consisting of wooden staves held together by iron and steel ribs. The width and depth are each 5 ft. 6 in., the intended depth of water being 5 ft. The staves are held by T-iron supports resting on wooden sills spaced 8 ft. apart, and are compressed together by a framework. They were caulked with oakum, on the top of which, to a third of the total depth, hot asphalt was run. The use of nails was altogether avoided except in parts of the framework, it being noticed that decay usually starts at nail-holes. It was found possible to make the flume absolutely watertight, and in case of repair being necessary at any part the framework is easily taken to pieces so that new staves can be inserted. The water in the flume has a velocity of 9·6 ft. per second. The Warm Springs, Deep, and Morton cañons on the line are crossed by wooden stave pipes 52 in. in diameter, bound with round steel rods, and laid above the surface of the ground. The work is planned for two rows of pipes, each capable of carrying 123 cub. ft. per second; of these one so far has been laid. The lengths of the pipes at each of the three cañons are 551, 964 and 756 ft. respectively, and the maximum head at any place is 160 ft. The pipes are not painted, and it has been suggested that they would suffer in their exposed position in case of a bush fire, a contingency to which, of course, flumes are also liable.

New York.

Aqueducts of New York.—There are three aqueducts in New York —the Old Croton Aqueduct (1837–1843), the Bronx River Conduit (1880–1885), and the New Croton Aqueduct (1884–1893), discharging respectively 95, 28, and 302 million U. S. gallons a day; their combined delivery is therefore 425 million gallons a day. The Old Croton Aqueduct is about 41 m. in length, and was constructed as a masonry conduit, except at the Harlem and Manhattan valleys, where two lines of 36-in. pipe were used. The inclination of the former is at the rate of about 13 in. per mile. The area of the cross-section is 53·34 sq. ft., the height is 8½ ft., and the greatest width 7 ft. 5 in.; the roof is semicircular, the floor segmental, and the sides have a batter on the face of ½ in. per foot. The sides and invert are of concrete, faced with 4 in. of brickwork, the roof being entirely of brickwork. There is a bridge over the Harlem river 1450 ft. in length, consisting of fifteen semicircular arches; its soffit is 100 ft. above high water, and its cost was $963,427. The construction of the New Croton Aqueduct was begun in 1885, and the works were sufficiently advanced by the 15th of July 1890 to allow the supply to be begun. The lengths of the various parts of the aqueduct are as follows:—

	Miles.
Tunnel	29·75
Cut-and-cover	1·12
Cast-iron pipes, 48 in. diameter, 8 rows	2·38
Croton Inlet to Central Park	33·25

The length of tunnel under pressure (circular form) is 7·17 m., and that not under pressure (horse-shoe form) 23·70 m. The maximum pressure in the former is 55 ℔ per sq. in. The width and height of the horse-shoe form are each 13 ft. 7 in., and the diameter of the circular form (with the exception of two short lengths) is 12 ft. 3 in. The reason for constructing the aqueduct in tunnel for so long a distance was the enhanced value of the low-lying ground near the old aqueduct. The tunnel deviates from a straight line only for the purpose of intersecting a few transverse valleys at which it could be emptied. For 25 m. the gradient is 0·7 foot per mile; the tunnel is then depressed below the hydraulic gradient, the maximum depth being at the Harlem river, where it is 300 ft. below high water. The depth of the tunnel varies from 50 to 500 ft. from the surface of the ground. Forty-two shafts were sunk to facilitate driving, and in four cases where the surface of the ground is below the hydraulic gradient these are closed by watertight covers. The whole of the tunnel is lined with brickwork from 1 to 2 ft. in thickness, the voids behind the lining being filled with rubble-in-mortar. The entry to the old and new aqueducts is controlled by a gatehouse of elaborate and massive design, and the pipes which take up the supply at the end of the tunnel are also commanded by a gate-house. The aqueduct, where it passes under the Harlem river, is worthy of special notice. As it approaches the river it has a considerable fall, and eventually ends in a vertical shaft 12 ft. 3 in. in diameter (where the water has a fall of 174 ft.), from the bottom of which, at a depth of 300 ft. below high-water level, the tunnel under the river starts. The latter is circular in form, the diameter being 10 ft. 6 in., and the length is 1300 ft.; it terminates at the bottom of another vertical shaft also 12 ft. 3 in. in diameter. The depth of this shaft, measured from the floor of the lower tunnel to that of the upper tunnel leading away from it, is 321 ft.; it is continued up to the surface of the ground, though closed by double watertight covers a little above the level of the upper tunnel. Adjoining this shaft is another shaft of equal diameter, by means of which the water can be pumped out, and there is also a communication with the river above high-water level, so that the higher parts can be emptied by gravitation. The cost of the Old Croton Aqueduct was $11,500,000; that of the new aqueduct is not far short of $20,000,000.

Nadrai.

The *Nadrai Aqueduct Bridge*, in India, opened at the end of 1889, is the largest structure of its kind in existence. It was built to carry the water of the Lower Ganges canal over the Kali Naddi, in connexion with the irrigation canals of the north-west provinces. In the year 1888–1889 this canal had 564 m. of main line, with 2050 m. of minor distributaries, and irrigated 519,022 acres of crops. The new bridge replaces one of much smaller size (five spans of 35 ft.), which was completely destroyed by a high flood in July 1885. It gives the river a waterway of 21,000 sq. ft., and the canal a waterway of 1040 sq. ft., the latter representing a discharge of 4100 cub. ft. per second. Its length is 1310 ft., and it is carried on fifteen arches having a span of 60 ft. The width between the faces of the arches is 149 ft. The foundations below the river-bed have a depth of 52 ft., and the total height of the structure is 88 ft. It cost 44½ lakhs of rupees, and occupied four years in building. The foundations consist of 268 circular brick cylinders, and the fifteen spans are arranged in three groups, divided by abutment piers; the latter are founded on a double row of 12-ft. cylinders, and the intermediate piers on a single row of 20-ft. cylinders, all the cylinders being hearted with hydraulic lime concrete filled in with skips. This aqueduct-bridge has a very fine appearance, owing to its massive proportions and design. (E. P. H.*)

Authorities.—For ancient aqueducts in general: Curt Merckel, *Die Ingenieurtechnik im Alterthum* (Berlin, 1899); ch. vi. contains a very full account from the earliest Assyrian aqueducts onwards, with illustrations, measurements and an excellent bibliography. For Greek aqueducts see E. Curtius, "Über städtische Wasserbauten der Hellenen," in *Archaeologische Zeitung* (1847); G. Weber (as above); papers in *Athen. Mittheil.* (Samos), 1877, (Enneacrunus) 1892, 1893, 1894, 1905, and articles on Athens, Pergamum, &c. For Roman aqueducts: R. Lanciani, "I Commentari di Frontino intorno le acque e gli acquedotti," in *Memorie dei Lincei*, serie iii. vol. iv. (Rome, 1880), 215 sqq., and separately; C. Herschel, *The Two Books on the Water Supply of the City of Rome of Sextus Julius Frontinus* (Boston, 1899); T. Ashby in *Classical Review* (1902), 336, and articles in *The Builder*; cf. also the maps to T. Ashby's "Classical Topography of the Roman Campagna," in *Papers of the British School at Rome*, i., iii., iv. (in progress).

For modern aqueducts, see Rickman's *Life of Telford* (1838); Schramke's *New York Croton Aqueduct; Second Annual Report of the Department of Public Works of the City of New York in 1872*; *Report of the Aqueduct Commissioners* (1887–1895), and *The Water Supply of the City of New York* (1896), by Wegmann; *Mémoires sur les eaux de Paris*, presentés par le Préfet de la Seine au Conseil Municipal (1854 and 1858); *Recherches statistiques sur les sources du bassin de la Seine*, par M. Belgrand, Ingénieur en chef des ponts et chaussées (1854); "Descriptions of Mechanical Arrangements of the Manchester Waterworks," by John Frederic Bateman, F.R.S., Engineer-in-chief, from the *Minutes of Proceedings of the Institution of Mechanical Engineers* (1866); *The Glasgow Waterworks*, by James M. Gale, Member Inst. C.E. (1863 and 1864); *The Report of the Royal Commission on Water Supply, and the Minutes of Evidence* (1867 and 1868). For accounts of other aqueducts, see the Transactions of the Societies of Engineers in the different countries, and the Engineering Journals.

AQUILA (Ἀκύλας), (1) a Jew from Rome, who with his wife Prisca or Priscilla had settled in Corinth, where Paul stayed with them (Acts xviii. 2, 3). They became Christians and fellow-workers with Paul, to whom they seem to have shown their devotion in some special way (Rom. xvi. 3, 4). (2) A native of Pontus, celebrated for a very literal and accurate translation of the Old Testament into Greek. Epiphanius (*De Pond. et Mens.* c. 15) preserves a tradition that he was a kinsman of the emperor Hadrian, who employed him in rebuilding Jerusalem (Aelia Capitolina, *q.v.*), and that he was converted to Christianity, but, on being reproved for practising pagan astrology, apostatized to Judaism. He is said also to have been a disciple of Rabbi ʿAqība (d. A.D. 132), and seems to be referred to in Jewish writings as עקילס. Aquila's version is said to have been used in place of the Septuagint in the synagogues. The Christians generally disliked it, alleging without due grounds that it rendered the Messianic passages incorrectly, but Jerome and Origen speak in its praise. Origen incorporated it in his *Hexapla*.

It was thought that this was the only copy extant, but in 1897 fragments of two codices were brought to the Cambridge University Library. These have been published—the fragments containing 1 Kings xx. 7-17; 2 Kings xxiii. 12-27 by F. C. Burkitt in 1897, those containing parts of Psalms xc.-ciii. by C. Taylor in 1899. See F. C. Burkitt's article in the *Jewish Encyclopaedia*.

AQUILA, CASPAR [Kaspar Adler] (1488–1560), German reformer, was born at Augsburg on the 7th of August 1488, educated there and at Ulm (1502), in Italy (he met Erasmus in Rome), at Bern (1508), Leipzig (1510) and Wittenberg (1513). According to his son, he entered the ministry in August 1514, at Bern. He was for some time a military chaplain. In 1516 he became pastor of Jenga, near Augsburg. Openly proclaiming his adhesion to Luther's doctrine, he was imprisoned for half a year (1520 or 1522) at Dillingen, by order of the bishop of Augsburg; a death sentence was commuted to banishment through the influence of Isabella, wife of Christian II. of Denmark and sister of Charles V. Returning to Wittenberg he met Luther, acted as tutor to the sons of Franz von Sickingen at Ebernburg, taught Hebrew at Wittenberg, and aided Luther in his version of the Old Testament. The dates and particulars of his career are uncertain till 1527, when he became pastor at Saalfeld, and in 1528, superintendent. His vehement opposition to the Augsburg Interim (1548) led him to take temporary shelter at Rudolstadt with Catherine, countess of Schwarzburg. In 1550 he was appointed dean of the Collegiatstift in Schmalkalden. Here he had a controversy with Andreas Osiander. Restored to Saalfeld, not without opposition, in 1552, he remained there, still engaged in controversy, till his death on the 12th of November 1560. He was twice married, and left four sons. He published numerous sermons, a few Old Testament expositions and some controversial tracts.

See G. Kawerau, in A. Hauck's *Realencyklopädie* (1896); *Allgemeine deutsche Biog.* (1875); Lives by J. Avenarius (1718); J. G. Hillinger (1731); Chr. Schlegel (1737); Fr. Gensler (1816).

AQUILA, SERAFINO DELL' (1466–1500), Italian poet and improvisatore, was born in 1466 at the town of Aquila, from which he took his name, and died in the year 1500. He spent several years at the courts of Cardinal Sforza and Ferdinand, duke of Calabria; but his principal patrons were the Borgias at Rome, from whom he received many favours. Aquila seems to have aimed at an imitation of Dante and Petrarch; and his poems, which were extravagantly praised during the author's lifetime, are occasionally of considerable merit. His reputation was in great measure due to his remarkable skill as an improvisatore and musician. His works were printed at Venice in 1502, and there have been several subsequent editions.

AQUILA, a city of the Abruzzi, Italy, the capital of the province of Aquila, and the seat of an archbishop, 2360 ft. above sea-level, 50 m. directly N.E. of Rome, and 145 m. by rail. Pop. (1901) town, 18,494; commune, 21,261. It lies on a hill in the wide valley of the Aterno, surrounded by mountains on all sides, the Gran Sasso d'Italia being conspicuous on the north-east. It is a favourite summer resort of the Italians, but is cold and windy in winter. In the highest part of the town is the massive citadel, erected by the Spanish viceroy Don Pedro de Toledo in 1534. The church of S. Bernardino di Siena (1472) has a fine Renaissance façade by Nicolò Filotesio (commonly called Cola dell' Amatrice), and contains the monumental tomb of the saint, decorated with beautiful sculptures, and executed by Silvestro Ariscola in 1480. The church of S. Maria di Collemaggio, just outside the town, has a very fine Romanesque façade of simple design (1270–1280) in red and white marble, with three finely decorated portals and a rose-window above each. The two side doors are also fine. The interior contains the mausoleum of Pope Celestine V. (d. 1296) erected in 1517. Many smaller churches in the town have similar façades (S. Giusta, S. Silvestro, &c.). The town also contains some fine palaces: the municipality has a museum, with a collection of Roman inscriptions and some illuminated service books. The Palazzi Dragonetti and Persichetti contain private collections of pictures. Outside the town is the *Fontana delle novantanove cannelle*, a fountain with ninety-nine jets distributed along three walls, constructed in 1272. Aquila has some trade in lace and saffron, and possesses other smaller industries. It was a university town in the middle ages, but most of its chairs have now been suppressed.

Aquila was founded by Conrad, son of the emperor Frederick II., about 1250, as a bulwark against the power of the papacy. It was destroyed by Manfred in 1259, but soon rebuilt by Charles I. of Anjou. Its walls were completed in 1316; and it maintained itself as an almost independent republic until it was subdued in 1521 by the Spaniards, who had become masters of the kingdom of Naples in 1503. It was twice sacked by the French in 1799.

See V. Bindi, *Monumenti storici ed artistici degli Abruzzi* (Naples, 1889), pp. 771 seq.

AQUILA, in astronomy, the "Eagle," sometimes named the "Vulture," a constellation of the northern hemisphere, mentioned by Eudoxus (4th cent. B.C.) and Aratus (3rd cent. B.C.). Ptolemy catalogued nineteen stars jointly in this constellation and in the constellation *Antinous*, which was named in the reign of the emperor Hadrian (A.D. 117–138), but sometimes, and wrongly, attributed to Tycho Brahe, who catalogued twelve stars in Aquila and seven in Antinous; Hevelius determined twenty-three stars in the first, and nineteen in the second. The most brilliant star of this constellation, *α-Aquilae* or Altair, has a parallax of 0·23″, and consequently is about eight times as bright as the sun; *η-Aquilae* is a short-period variable, while *Nova Aquilae* is a "temporary" or "new" star, discovered by Mrs Fleming of Harvard in 1899.

AQUILA ROMANUS, a Latin grammarian who flourished in the second half of the 3rd century A.D. He was the author of an extant treatise *De Figuris Sententiarum et Elocutionis*, written as an instalment of a complete rhetorical handbook for the use of a young and eager correspondent. While recommending Demosthenes and Cicero as models, he takes his own examples almost exclusively from Cicero. His treatise is really adapted from that by Alexander, son of Numenius, as is expressly stated by Julius Rufinianus, who brought out a supplementary treatise, augmented by material from other sources. Aquila's style is harsh and careless, and the Latin is inferior.

Halm, *Rhetores Latini minores* (1863); Wensch, *De Aquila Romano* (1861).

AQUILEIA, an ancient town of Italy, at the head of the Adriatic at the edge of the lagoons, about 6 m. from the sea, on the river Natiso (mod. Natisone), the course of which has changed somewhat since Roman times. It was founded by the Romans in 181 B.C. as a frontier fortress on the north-east, not far from the site where, two years before, Gaulish invaders had attempted to settle. The colony was led by two men of consular and one of praetorian rank, and 3000 *pedites* formed the bulk of the settlers. It was probably connected by road with Bononia in 175 B.C.; and subsequently with Genua in 148 B.C. by the Via Postumia, which ran through Cremona, Bedriacum and Altinum, joining the first-mentioned road at Concordia, while the construction of the Via Popilia from Ariminum to Ad Portum near Altinum in 132 B.C. improved the communications still further. In 169 B.C., 1500 more families were settled there as a reinforcement to the garrison. The discovery of the goldfields near the modern Klagenfurt in 150 B.C. (Strabo iv. 208) brought it into notice, and it soon became a place of importance, not only owing to its strategic position, but as a centre of trade, especially in agricultural products. It also had, in later times at least, considerable brickfields. It was originally a Latin colony, but became a *municipium* probably in 90 B.C. The customs boundary of Italy was close by in Cicero's day. It was plundered by the Iapydes under Augustus, but, in the period of peace which followed, was able to develop its resources. Augustus visited it during the Pannonian wars in 12–10 B.C. and it was the birthplace of Tiberius's son by Julia, in the latter year. It was the starting-point of several important roads leading to the north-eastern portion of the empire—the road (Via Iulia Augusta) by Iulium Carnicum to Veldidena (mod. Wilten, near Innsbruck), from which branched off the road into Noricum, leading by Virunum (Klagenfurt) to Lauricum (Lorch) on the Danube, the road into Pannonia, leading to Emona (Laibach)[1] and Sirmium (Mitrowitz), the road to Tarsatica (near Fiume) and Siscia (Sissek), and that to Tergeste (Trieste) and the Istrian coast.

In the war against the Marcomanni in A.D. 167, the town was hard pressed; the fortifications had fallen into disrepair during the long peace. In A.D. 238, when the town took the side of the senate against the emperor Maximinus, they were hastily restored, and proved of sufficient strength to resist for several months, until Maximinus himself was assassinated. The 4th century marks, however, the greatest importance of

[1] This road is described in detail by O. Cuntz in *Jahreshefte des Österr. Arch. Inst.* v. (1902), Beiblatt, pp. 139 seq.

Aquileia; it became a naval station and, probably, the seat of the *corrector Venetiarum et Histriae;* a mint was established here, the coins of which are very numerous, and the bishop obtained the rank of patriarch. An imperial palace was constructed here, in which the emperors after the time of Diocletian frequently resided; and the city often played a part in the struggles between the rulers of the 4th century. At the end of the century, Ausonius enumerated it as the ninth among the great cities of the world, placing Rome, Mediolanum and Capua before it, and called it "moenibus et portu celeberrima." In A.D. 452, however, it was destroyed by Attila, though it continued to exist until the Lombard invasion of A.D. 568. After this the patriarchate was transferred to Grado. In 606 the diocese was divided into two parts, and the patriarchate of Aquileia, protected by the Lombards, was revived, that of Grado being protected by the exarch of Ravenna and later by the doges of Venice. In 1027 and 1044 Patriarch Poppo of Aquileia entered and sacked Grado, and, though the pope reconfirmed the patriarch of the latter in his dignities, the town never recovered, though it continued to be the seat of the patriarchate until its formal transference to Venice in 1450. The seat of the patriarchate of Aquileia had been transferred to Udine in 1238, but returned in 1420 when Venice annexed the territory of Udine. It was finally suppressed in 1751, and the sees of Udine and Gorizia (Görz) established in its stead. Its buildings served as stone quarries for centuries, and no edifices of the Roman period remain above ground. Excavations have revealed one street and the north-west angle of the town walls, while the local museum contains over 2000 inscriptions, besides statues and other antiquities. The cathedral, a flat-roofed basilica, was erected by Patriarch Poppo in 1031 on the site of an earlier church, and rebuilt about 1379 in the Gothic style by Patriarch Marquad. The narthex and baptistery belong to an earlier period. Of the palace of the patriarchs only two isolated columns remain standing. The modern village (pop. 2300) is rendered unhealthy by rice-fields.

See T. W. Jackson, *Dalmatia, Istria and the Quarnero* (Oxford, 1887), iii. 377 seq.; H. Maionica, *Aquileia zur Römerzeit* (Görz, 1881), *Fundkarte von Aquileia* (Görz, 1893), "Inschriften in Grado" (Roman inscriptions removed thither from Aquileia) in *Jahreshefte des Österr. Arch. Instituts*, i. (1898), Beiblatt, 83, 125. (T. As.)

AQUILLIUS, MANIUS, Roman general, consul in 101 B.C. He successfully put down a revolt of the slaves under Athenion in Sicily. After his return, being accused of extortion, he was acquitted on account of his military services, although there was little doubt of his guilt. In 88 he acted as legate against Mithradates the Great, by whom he was defeated and taken prisoner. Mithradates treated him with great cruelty, and is said to have put him to death by pouring molten gold down his throat.

Diodorus Siculus xxxvi. 3; Appian, *Mithrid.* ii. 17. 21; Vell. Paterculus ii. 18; Cicero, *Verres*, iii. 54, *De Officiis*, ii. 14, *Tusc.* v. 5.

AQUINAS, THOMAS [Thomas of Aquin or Aquino], (*c* 1227–1274), scholastic philosopher, known as *Doctor Angelicus*, *Doctor Universalis*, was of noble descent, and nearly allied to several of the royal houses of Europe. He was born in 1225 or 1227, at Roccasecca, the castle of his father Landulf, count of Aquino, in the territories of Naples. Having received his elementary education at the monastery of Monte Cassino, he studied for six years at the university of Naples, leaving it in his sixteenth year. While there he probably came under the influence of the Dominicans, who were doing their utmost to enlist within their ranks the ablest young scholars of the age, for in spite of the opposition of his family, which was overcome only by the intervention of Pope Innocent IV., he assumed the habit of St Dominic in his seventeenth year.

His superiors, seeing his great aptitude for theological study, sent him to the Dominican school in Cologne, where Albertus Magnus was lecturing on philosophy and theology. In 1245 Albertus was called to Paris, and there Aquinas followed him, and remained with him for three years, at the end of which he graduated as bachelor of theology. In 1248 he returned to Cologne with Albertus, and was appointed second lecturer and *magister studentium.* This year may be taken as the beginning of his literary activity and public life. Before he left Paris he had thrown himself with ardour into the controversy raging between the university and the Friar-Preachers respecting the liberty of teaching, resisting both by speeches and pamphlets the authorities of the university; and when the dispute was referred to the pope, the youthful Aquinas was chosen to defend his order, which he did with such success as to overcome the arguments of Guillaume de St Amour, the champion of the university, and one of the most celebrated men of the day. In 1257, along with his friend Bonaventura, he was created doctor of theology, and began to give courses of lectures upon this subject in Paris, and also in Rome and other towns in Italy. From this time onwards his life was one of incessant toil; he was continually engaged in the active service of his order, was frequently travelling upon long and tedious journeys, and was constantly consulted on affairs of state by the reigning pontiff.

In 1263 we find him at the chapter of the Dominican order held in London. In 1268 he was lecturing now in Rome and now in Bologna, all the while engaged in the public business of the church. In 1271 he was again in Paris, lecturing to the students, managing the affairs of the church and consulted by the king, Louis VIII., his kinsman, on affairs of state. In 1272 the commands of the chief of his order and the request of King Charles brought him back to the professor's chair at Naples. All this time he was preaching every day, writing homilies, disputations, lectures, and finding time to work hard at his great work the *Summa Theologiae.* Such rewards as the church could bestow had been offered to him. He refused the archbishopric of Naples and the abbacy of Monte Cassino. In January 1274 he was summoned by Pope Gregory X. to attend the council convened at Lyons, to investigate and if possible settle the differences between the Greek and Latin churches. Though suffering from illness, he at once set out on the journey; finding his strength failing on the way, he was carried to the Cistercian monastery of Fossa Nuova, in the diocese of Terracina, where, after a lingering illness of seven weeks, he died on the 7th of March 1274. Dante (*Purg.* xx. 69) asserts that he was poisoned by order of Charles of Anjou. Villani (ix.218) quotes the belief, and the *Anonimo Fiorentino* describes the crime and its motive. But Muratori, reproducing the account given by one of Thomas's friends, gives no hint of foul play. Aquinas was canonized in 1323 by Pope John XXII., and in 1567 Pius V. ranked the festival of St Thomas with those of the four great Latin fathers, Ambrose, Augustine, Jerome and Gregory. No theologian save Augustine has had an equal influence on the theological thought and language of the Western Church, a fact which was strongly emphasized by Leo XIII. (*q.v.*) in his *Encyclical* of August 4, 1879, which directed the clergy to take the teachings of Aquinas as the basis of their theological position. In 1880 he was declared patron of all Roman Catholic educational establishments. In a monastery at Naples, near the cathedral of St Januarius, is still shown a cell in which he is said to have lived.

The writings of Thomas are of great importance for philosophy as well as for theology, for by nature and education he is the spirit of scholasticism incarnate. The principles on which his system rested were these. He held that there were two sources of knowledge—the mysteries of Christian faith and the truths of human reason. The distinction between these two was made emphatic by Aquinas, who is at pains, especially in his treatise *Contra Gentiles*, to make it plain that each is a distinct fountain of knowledge, but that revelation is the more important of the two. Revelation is a source of knowledge, rather than the manifestation in the world of a divine life, and its chief characteristic is that it presents men with mysteries, which are to be believed even when they cannot be understood. Revelation is not Scripture alone, for Scripture taken by itself does not correspond exactly with his description; nor is it church tradition alone, for church tradition must so far rest on Scripture. Revelation is a divine source of knowledge, of which Scripture and church tradition are the channels; and he who would rightly understand theology must familiarize himself with Scripture, the teachings of the fathers, and the decisions of councils, in such a way as to be able to make part of himself, as it were, those channels along which this divine knowledge flowed. Aquinas's conception of reason is in some way parallel with his conception of revelation. Reason is in his idea not the individual reason, but the fountain of natural truth, whose chief channels are the various systems of heathen philosophy, and more especially the thoughts of Plato and the methods of Aristotle. Reason and revelation are separate sources of knowledge; and man can put himself in possession of each, because he can bring himself into relation to the church on the one hand, and the system of philosophy, or more strictly Aristotle, on the other. The conception will be made clearer when it is remembered that Aquinas, taught by the mysterious author of the writings of the pseudo-Dionysius, who so marvellously influenced medieval writers, sometimes spoke of a natural revelation, or of reason as a source of truths in themselves mysterious, and was always accustomed to say that reason as well as revelation contained two kinds of knowledge. The first kind lay quite beyond the power of man to receive it, the second was within man's reach. In reason, as in revelation, man can only attain to the lower kind of knowledge; there is a higher kind which we may not hope to reach.

But while reason and revelation are two distinct sources of truths, the truths are not contradictory; for in the last resort they rest on *one* absolute truth—they come from the one source of knowledge, God, the Absolute One. Hence arises the compatibility of philosophy and theology which was the fundamental axiom of scholasticism, and the possibility of a Summa Theologiae, which is a Summa Philosophiae as well. All the many writings of Thomas are preparatory to his great work the *Summa Theologiae*, and show us the progress of his mind training for this his life work. In the *Summa Catholicae Fidei contra Gentiles* he shows how a Christian theology is the sum and crown of all science. This work is in its design apologetic, and is meant to bring within the range of Christian thought all that is of value in Mahommedan science. He carefully establishes the necessity of revelation as a source of knowledge, not merely because it aids us in comprehending in a somewhat better way the truths already furnished by reason, as some of the Arabian philosophers and Maimonides had acknowledged, but because it is the absolute source of our knowledge of the mysteries of the Christian faith; and then he lays down the relations to be observed between reason and revelation, between philosophy and theology. This work, *Contra Gentiles*, may be taken as an elaborate exposition of the method of Aquinas. That method, however, implied a careful study and comprehension of the results which accrued to man from reason and revelation, and a thorough grasp of all that had been done by man in relation to those two sources of human knowledge; and so, in his preliminary writings, Thomas proceeds to master the two provinces. The results of revelation he found in the Holy Scriptures and in the writings of the fathers and the great theologians of the church; and his method was to proceed backwards. He began with Peter of Lombardy (who had reduced to theological order, in his famous book on the *Sentences*, the various authoritative statements of the church upon doctrine) in his *In Quatuor Sententiarum P. Lombardi libros*. Then came his deliverances upon undecided points in theology, in his *XII. Quodlibeta Disputata*, and his *Quaestiones Disputatae*. His *Catena Aurea* next appeared, which, under the form of a commentary on the Gospels, was really an exhaustive summary of the theological teaching of the greatest of the church fathers. This side of his preparation was finished by a close study of Scripture, the results of which are contained in his commentaries, *In omnes Epistolas Divi Apostoli Expositio*, his *Super Isaiam et Jeremiam*, and his *In Psalmos*. Turning now to the other side, we have evidence, not only from tradition but from his writings, that he was acquainted with Plato and the mystical Platonists; but he had the sagacity to perceive that Aristotle was *the* great representative of philosophy, and that his writings contained the best results and method which the natural reason had as yet attained to. Accordingly Aquinas prepared himself on this side by commentaries on Aristotle's *De Interpretatione*, on his *Posterior Analytics*, on the *Metaphysics*, the *Physics*, the *De Anima*, and on Aristotle's other psychological and physical writings, each commentary having for its aim to lay hold of the material and grasp the method contained and employed in each treatise. Fortified by this exhaustive preparation, Aquinas began his *Summa Theologiae*, which he intended to be the sum of all known learning, arranged according to the best method, and subordinate to the dictates of the church. Practically it came to be the theological dicta of the church, explained according to the philosophy of Aristotle and his Arabian commentators. The *Summa* is divided into three great parts, which shortly may be said to treat of God, Man and the God-Man. The first and the second parts are wholly the work of Aquinas, but of the third part only the first ninety quaestiones are his; the rest of it was finished in accordance with his designs. The first book, after a short introduction upon the nature of theology as understood by Aquinas, proceeds in 119 questions to discuss the nature, attributes and relations of God; and this is not done as in a modern work on theology, but the questions raised in the physics of Aristotle find a place alongside of the statements of Scripture, while all subjects in any way related to the central theme are brought into the discourse. The second part is divided into two, which are quoted as *Prima Secundae* and *Secunda Secundae*. This second part has often been described as ethic, but this is scarcely true. The subject is man, treated as Aristotle does, according to his τέλος, and so Aquinas discusses all the ethical, psychological and theological questions which arise; but any theological discussion upon man must be mainly ethical, and so a great proportion of the first part, and almost the whole of the second, has to do with ethical questions. In his ethical discussions (a full account of which is given under ETHICS) Aquinas distinguishes theological from natural virtues and vices; the theological virtues are faith, hope and charity; the natural, justice, prudence and the like. The theological virtues are founded on faith, in opposition to the natural, which are founded on reason; and as faith with Aquinas is always belief in a proposition, not trust in a personal Saviour, conformably with his idea that revelation is a new knowledge rather than a new life, the relation of unbelief to virtue is very strictly and narrowly laid down and enforced. The third part of the *Summa* is also divided into two parts, but by accident rather than by design. Aquinas died ere he had finished his great work, and what has been added to complete the scheme is appended as a *Supplementum Tertiae Partis*. In this third part Aquinas discusses the person, office and work of Christ, and had begun to discuss the sacraments, when death put an end to his labours.

The purely philosophical theories of Aquinas are explained in the article SCHOLASTICISM. In connexion with the problem of universals, he held that the diversity of individuals depends on the quantitative division of matter (*materia signata*), and in this way he attracted the criticism of the Scotists, who pointed out that this very matter is individual and determinate, and, therefore, itself requires explanation. In general, Aquinas maintained in different senses the real existence of universals *ante rem*, *in re* and *post rem*.

The best modern edition of the works of Aquinas is that prepared at the expense of Leo XIII. (Rome, 1882–1903). The Abbé Migne published a very useful edition of the *Summa Theologiae*, in four 8vo vols., as an appendix to his *Patrologiae Cursus Completus*; English editions, J. Rickaby (London, 1872), J. M. Ashley (London, 1888). See *Acta Sanct.*, vii. Martii; A. Touron, *La Vie de St Thomas d'Aquin, avec un exposé de sa doctrine et de ses ouvrages* (Paris, 1737); Karl Werner, *Der Heilige Thomas von Aquino* (1858); and R. B. Vaughan, *St Thomas of Aquin, his Life and Labours* (London, 1872): other lives by P. Cavanagh (London, 1890); E. Desmousseaux de Giuré (Paris, 1888); M. Didot (Louvain, 1894). For the philosophy of Aquinas, see Albert Stöckl, *Geschichte der Philosophie des Mittelalters*, ii.; B. Hauréau, *De la philosophie scolastique*, vol. ii.; J. Frohschammer, *Die Philos. d. Th. von A.* (Leipzig, 1889); K. Prantl, *Geschichte d. Logik*, vol. iii.; C. M. Schneider, *Natur, Vernunft, Gott* (Regensburg, 1883), *Das Wissen Gottes nach d. Lehre des Th. v. A.* (4 vols. Regensburg, 1884–1886), *Die socialistische Staatsidee beleuchtet durch Th. v. A.* (Paderborn, 1894); A. Harnack, *Hist. of Dogma* (trans. Wm.

Gilchrist, London, 1899); Ueberweg's *History of Philosophy*, vol. i. See also H. C. O'Neill, *New Things and Old in St Thomas Aquinas* (1909), with biography. (T. M. L.; J. M. M.)

AQUINO, a town and episcopal see of Campania, Italy, in the province of Caserta; it is 56 m. N.W. by rail from the town of Caserta, and 7½ m. N.W. of Cassino. Pop. (1901) 2672. The modern town, close to the ancient, is unimportant, though the canons of the cathedral have the privilege of wearing the mitre and *cappa magna* at great festivals. It is close to the site of the ancient Aquinum, a *municipium* in the time of Cicero, and made a colony by the Triumviri, the birthplace of Juvenal and of the emperor Pescennius Niger. The Via Latina traversed it; one of the gates through which it passed, now called Porta S. Lorenzo, is still well preserved, and there are remains within the walls (portions of which, built of large blocks of limestone, still remain) of two (so called) temples, a basilica and an amphitheatre (see R. Delbrück in *Röm. Mitteilungen*, 1903, p. 143). Outside, on the south is a well-preserved triumphal arch with composite capitals, and close to it the 11th-century basilica of S. Maria Libera, a handsome building in the Romanesque style, but now roofless. Several Roman inscriptions are built into it, and many others that have been found indicate the ancient importance of the place, which, though it does not appear in early history, is vouched for by Cicero and Strabo.[1] A colony was planted here by the Triumviri. St Thomas Aquinas was born in the castle of Roccasecca, 5 m. N.

See E. Grossi, *Aquinum* (Rome, 1907). (T. As.)

AQUITAINE, the name of an ancient province in France, the extent of which has varied considerably from time to time. About the time of Julius Caesar the name *Aquitania* was given to that part of Gaul lying between the Pyrenees and the Garonne, and its inhabitants were a race, or races, distinct from the Celts. The name Aquitania is probably a form of Auscetani, which in its turn is a lengthened form of Ausces, and is thus cognate with the words Basque and Wasconia, *i.e.* Gascony. Although many of the tribes of Aquitania submitted to Julius Caesar, it was not until about 28 B.C. that the district was brought under the Roman yoke. In keeping with the Roman policy of denationalization, the term Aquitania was extended, and under Augustus it included the whole of Gaul south and west of the Loire and the Allier, and thus ceased to possess ethnographical importance. In the 3rd century A.D. this larger Aquitania was divided into three parts: *Aquitania Prima*, the eastern part of the district between the Loire and the Garonne; *Aquitania Secunda*, the western part of the same district; and *Aquitania Tertia*, or *Novempopulana*, the region between the Garonne and the Pyrenees, or the original Aquitania. The seats of government were respectively Bourges, Bordeaux and Eauze; the province contained twenty-six cities, and was in the diocese of Vienne. Like the rest of Gaul, Aquitania absorbed a large measure of Roman civilization, and this continued to distinguish the district down to a late period. In the 5th century the Visigoths established themselves in Aquitania Secunda, and also in parts of Aquitania Prima and Novempopulana, but after the defeat of their king Alaric II. by the Franks under Clovis in 507, they were supplanted by their conquerors. Clovis and his successors extended their authority nominally to the Pyrenees, but, as Guizot has remarked, "the conquest of Aquitania by Clovis left it almost as alien to the people and king of Franks as it had formerly been." Subsequently during the Merovingian period it was contended for by the feeble rulers of the various Frankish kingdoms, and was frequently partitioned among them; but the Aquitanians had little difficulty in effectually resisting this authority, although they did not establish themselves as a separate kingdom. About 628, indeed, they gathered around Charibert, or Haribert, a brother of the Frankish king, Dagobert I., in the hope of national independence; but after his death in 630 they returned to their former condition. But this effort, although a failure, brought about a certain measure of concord between the two principal races inhabiting the district, and so prepared the way for the stubborn resistance which, subsequently, the Aquitanians were able to offer to the Franks.

The first line of dukes began about 660 with one Felix, who, like his successor, Lupus, probably owned allegiance to the Frankish kings, and whose seat of government was Toulouse. About the end of the 7th century an adventurer named Odo, or Eudes, made himself master of this region. Attacked by the Saracens he inflicted on them a crushing defeat, but when they reappeared, he was obliged to invoke the aid of Charles Martel, who, as the price of his support, claimed and received the homage of his ally. Odo was succeeded by his son Hunald, who after carrying on a war against the Franks under Pippin the Short, retired to a convent, leaving both the kingdom and the conflict to Waifer, or Guaifer. For some years Waifer strenuously carried on an unequal struggle with the Franks, but he was assassinated in 768, and with him perished the national independence, although not the national individuality, of the Aquitanians. In 781 Charlemagne bestowed Aquitaine upon his young son, Louis, and as Louis was generally described as a king, Aquitaine is referred to during the Carolingian period as a kingdom, and not as a duchy. When Louis succeeded Charlemagne as emperor in 814, he granted Aquitaine to his son Pippin, on whose death in 838 the Aquitanians chose his son Pippin II. (d. 865) as their king. The emperor Louis I., however, opposed this arrangement and gave the kingdom to his youngest son Charles, afterwards the emperor Charles the Bald. Now followed a time of confusion and conflict which resulted eventually in the success of Charles, although from 845 to 852 Pippin was in possession of the kingdom. In 852 Pippin was imprisoned by Charles the Bald, who soon afterwards gave to the Aquitanians his own son Charles as their king. On the death of the younger Charles in 866, his brother Louis the Stammerer succeeded to the kingdom, and when, in 877, Louis became king of the Franks, Aquitaine was united to the Frankish crown.

A new period now begins in the history of Aquitaine. By a treaty made in 845 between Charles the Bald and Pippin II. the kingdom had been diminished by the loss of Poitou, Saintonge and Angoumois, which had been given to Rainulf I., count of Poitiers. Somewhat earlier than this date the title of duke of the Aquitanians had been revived, and this was now borne by Rainulf, although it was also claimed by the counts of Toulouse. The new duchy of Aquitaine, comprising the three districts already mentioned, remained in the hands of Rainulf's successors, in spite of some trouble with their Frankish overlords, until 893 when Count Rainulf II. was poisoned by order of King Charles III. the Simple. Charles then bestowed the duchy upon William the Pious, count of Auvergne, the founder of the abbey of Cluny, who was succeeded in 918 by his nephew, Count William II., who died in 926. A succession of dukes followed, one of whom, William IV., fought against Hugh Capet, king of France, and another of whom, William V., called the Great, was able considerably to strengthen and extend his authority, although he failed in his attempt to secure the Lombard crown. William's duchy almost reached the limits of the Roman Aquitania Prima and Secunda, but did not stretch south of the Garonne, a district which was in the possession of the Gascons. William died in 1030, and the names of William VI. (d. 1038), Odo or Eudes (d. 1039), who joined Gascony to his duchy, William VII. and William VIII. bring us down to William IX. (d. 1127), who succeeded in 1087, and made himself famous as a crusader and a troubadour. William X. (d. 1137) married his daughter Eleanor to Louis VII., king of France, and Aquitaine went as her dowry. When Eleanor was divorced from Louis and was married in 1152 to Henry II. of England the duchy passed to her new husband, who, having suppressed a revolt there, gave it to his son Richard. When Richard died in 1199, it reverted to Eleanor, and on her death five years later, was united to the English crown and henceforward followed the fortunes of the English possessions in France. Aquitaine as it came to the English kings stretched as of old from the Loire to the Pyrenees, but its extent was curtailed on the south-east by the wide lands of the counts of Toulouse. The name Guienne, a corruption of Aquitaine, seems to have come into use about the 10th century, and the subsequent history of Aquitaine is merged in that of Gascony (*q.v.*) and Guienne (*q.v.*).

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[1] According to H. Nissen, *Ital. Landeskunde* (Berlin, 1902), ii. 665, a road ran from here to Minturnae; but no traces of it are to be seen.

See E. Desjardins, *Géographie historique et administrative de la Gaule romaine* (Paris, 1876, 93); A. Luchaire, *Les Origines linguistiques de l'Aquitaine* (Paris, 1877); A. Longnon, *Géographie de la Gaule au VI^e siècle* (Paris, 1876); A. Perroud, *Les Origines du premier duché d'Aquitaine* (Paris, 1881); and E. Mabille, *Le Royaume d'Aquitaine et ses marches sous les Carlovingiens* (Paris, 1870).

ARABESQUE, a word meaning simply "Arabian," but technically used for a certain form of decorative design in flowing lines intertwined; hence comes the more metaphorical use of this word, whether in nature or in morals, indicating a fantastic or complicated interweaving of lines against a background. In decorative design the term is historically a misnomer. It is applied to the grotesque decoration derived from Roman remains of the early time of the empire, not to any style derived from Arabian or Moorish work. Arabesque and Moresque are really distinct; the latter is from the Arabian style of ornament, developed by the Byzantine Greeks for their new masters, after the conquests of the followers of Mahomet; and the former is a term pretty well restricted to varieties of cinquecento decoration, which have nothing in common with any Arabian examples in their details, but are a development derived from Greek and Roman grotesque designs, such as we find them in the remains of ancient palaces at Rome, and in ancient houses at Pompeii. These were reproduced by Raphael and his pupils in the decoration of some of the corridors of the Loggie of the Vatican at Rome: grotesque is thus a better name for these decorations than Arabesque. This technical Arabesque, therefore, is much more ancient than any Arabian or Moorish decoration, and has really nothing in common with it except the mere symmetrical principles of its arrangement. Pliny and Vitruvius give us no name for the extravagant decorative wall-painting in vogue in their time, to which the early Italian revivers of it seem to have given the designation of grotesque, because it was first discovered in the arched or underground chambers (*grotte*) of Roman ruins—as in the golden house of Nero, or the baths of Titus. What really took place in the Italian revival was in some measure a supplanting of the Arabesque for the classical grotesque, still retaining the original Arabian designation, while the genuine Arabian art, the Saracenic, was distinguished as Moresque or Moorish. So it is now the original Arabesque that is called by its specific names of Saracenic, Moorish and Alhambresque, while the term Arabesque is applied exclusively to the style developed from the debased classical grotesque of the Roman empire.

There is still much of the genuine Saracenic element in Renaissance Arabesques, especially in that selected for book-borders and for silver-work, the details of which consist largely of the conventional Saracenic foliations. But the Arabesque developed in the Italian cinquecento work repudiated all the original Arabian elements and devices, and limited itself to the manipulating of the classical elements, of which the most prominent feature is ever the floriated or foliated scroll; and it is in this cinquecento decoration, whether in sculpture or in painting, that *Arabesque* has been perfected.

In the Saracenic, as the elder sister of the two styles, which was ingeniously developed by the Byzantine Greek artists for their Arabian masters in the early times of Mahommedan conquest, every natural object was proscribed; the artists were, therefore, reduced to making symmetrical designs from forms which should have no positive meaning; yet the Byzantine Greeks, who were Christians, managed to work even their own ecclesiastical symbols, in a disguised manner, into their tracery and diapers; as the lily, for instance. The cross was not so introduced; this, of course, was inadmissible; but neither was the crescent ever introduced into any of this early work in Damascus or Cairo. The crescent was itself not a Mahommedan device till after the conquest of Constantinople in 1453 A.D. The crescent, as the new moon, was the symbol of Byzantium; and it was only after that capital of the Eastern empire fell into the hands of the Turks that this symbol was adopted by them. The crescent and the cross became antagonist standards, therefore, first in the 15th century. And the crescent is not an element of original Moorish decoration.

The Alhambra diapers and original Majolica (Majorca) ware afford admirable specimens of genuine Saracenic or Moorish decoration. A conventional floriage is common in these diapers; tracery also is a great feature in this work, in geometrical combinations, whether rectilinear or curvilinear; and the designs are rich in colour; idolatry was in the reproduction of natural forms, not in the fanciful combination of natural colours. These curves and angles, therefore, or interlacings, chiefly in stucco, constitute the prominent elements of an Arabian ornamental design, combining also Arabic inscriptions; composed of a mass of foliation or floral forms conventionally disguised, as the exclusion of all natural images was the fundamental principle of the style in its purity. The Alhambra displays almost endless specimens of this peculiar work, all in relief, highly coloured, and profusely enriched with gold. The mosque of Tulun, in Cairo, A.D. 876, the known work of a Greek, affords the completest example of this art in its early time; and Sicily contains many remains of this same exquisite Saracenic decoration.

Such is the genuine Arabesque of the Arabs, but a very different style of design is implied by the Arabesque of the cinquecento, a purely classical ornamentation. This owes its origin to the excavation and recovery of ancient monuments, and was developed chiefly by the sculptors of the north, and the painters of central Italy; by the Lombardi of Venice, by Agostino Busti of Milan, by Bramante of Urbino, by Raphael, by Giulio Romano, and others of nearly equal merit. Very beautiful examples in sculpture of this cinquecento Arabesque are found in the churches of Venice, Verona and Brescia; in painting, the most complete specimens are those of the Vatican Loggie, and the Villa Madama at Rome and the ducal palaces at Mantua. The Vatican Arabesques, chiefly executed for Raphael by Giulio Romano, Gian Francesco Penni, and Giovanni da Udine, though beautiful as works of painting, are often very extravagant in their composition, ludicrous and sometimes aesthetically offensive; as are also many of the decorations of Pompeii. The main features of these designs are balanced scrolls in panels; or standards variously composed, but symmetrically scrolled on either side, and on the tendrils of these scrolls are suspended or placed birds and animals, human figures and chimeras, of any or all kinds, or indeed any objects that may take the fancy of the artist. The most perfect specimens of cinquecento Arabesque are certainly found in sculpture. As specimens of exquisite work may be mentioned the Martinengo tomb, in the church of the Padri Riformati at Brescia, and the façade of the church of Santa Maria dei Miracoli there, by the Lombardi; and many of the carvings of the Château de Gaillon, France—all of which fairly illustrate the beauties and capabilities of the style.

See also Wornum, *Analysis of Ornament* (1874). (R. N. W.)

ARABGIR, or Arabkir (Byz. *Arabraces*), a town of Turkey in Asia in the Mamuret el-Aziz or Kharput vilayet, situated near the confluence of the eastern and western Euphrates, but some miles from the right bank of the combined streams. Pop. about 20,000, of which the larger half is Mussulman. It is connected with Sivas by a *chaussée*, prolonged to the Euphrates. The inhabitants are enterprising and prosperous, many of them leaving their native city to push their fortunes elsewhere, while of those that remain the greater part is employed in the manufacture of silk and cotton goods, or in the production of fruit. The present town was built at a comparatively recent date; but about 2 m. north-east is the old town, now called Eski-Shehr, given (*c.* 1021) to Senekherim of Armenia by the emperor Basil II. It contains the ruins of a castle and of several Seljuk mosques. The Armenian population suffered severely during the massacres of 1895. (D. G. H.)

ARABIA, a peninsula in the south-west of Asia, lying between 34° 30′ and 12° 45′ N., and 32° 30′ and 60° E., is bounded W. by the Red Sea, S. by the Gulf of Aden and the Indian Ocean, and E. by the Gulf of Oman and the Persian Gulf. Its northern or land boundary is more difficult to define; most authorities, however, agree in taking it from El Arish on the Mediterranean, along the southern border of Palestine, between the Dead Sea and the Gulf of Akaba, then bending northwards along the Syrian border nearly to Tadmur, thence eastwards to the edge of the Euphrates valley near Anah, and thence south-east to the mouth of the Shat el Arab at the head of the Persian Gulf,—the boundary so defined includes the northern desert, which belongs geographically to Arabia rather than to Syria; while on the same grounds lower Mesopotamia and Irak, although occupied by an Arab population, are excluded.

In shape, the peninsula forms a rough trapezium, with its greatest length from north-west to south-east. The length of its western side from Port Said to Aden is 1500 m.; its base from the Straits of Bab-el-Mandeb (or Bab al Mandab) to Ras el Had is 1300 m., its northern side from Port Said to the Euphrates 600 m.; its total area approximately 1,200,000 sq. m.

GEOGRAPHY

General Features.—In general terms Arabia may be described as a plateau sloping gently from south-west to north-east, and attaining its greatest elevation in the extreme south-west. The western escarpment of the plateau rises steeply from the Red Sea littoral to a height of from 4000 to 8000 ft., leaving a narrow belt of lowland rarely exceeding 30 m. in width between the shore and the foot-hills. On the north-east and east the plateau shelves gradually to the Euphrates and the Persian Gulf; only in the extreme east is this general easterly slope arrested by the lofty range of Jebel Akhdar, which from Ras Musandan to Ras el Had borders the coast of Oman.

Its chief characteristic is the bareness and aridity of its surface; one-third of the whole desert, and of the remainder only a small proportion is suited to settled life, owing to its scanty water-supply and uncertain rainfall. Its mountains are insufficient in elevation and extent to attract their full share of the monsoon rains, which fall so abundantly on the Abyssinian highlands on the other side of the Red Sea; for this reason Arabia has neither lakes nor forests to control the water-supply and prevent its too rapid dissipation, and the rivers are mere torrent beds sweeping down occasionally in heavy floods, but otherwise dry.

The country falls naturally into three main divisions, a northern, a central and a southern; the first includes the area between the Midian coast on the west and the head of the Persian Gulf on the east, a desert tract throughout, stony in the north, sandy in the south, but furnishing at certain seasons excellent pasturage; its population is almost entirely nomad and pastoral. The central zone includes Hejaz (or Hijaz), Nejd and El Hasa; much of it is a dry, stony or sandy steppe, with few wells or watering-places, and only occupied by nomad tribes; but the great wadis which intersect it contain many fertile stretches of alluvial soil, where cultivation is possible and which support a considerable settled population, with several large towns and numerous villages.

The third or southern division contains the highland plateaus of Asir and Yemen in the west, and J. Akhdar in the east, which with a temperate climate, due to their great elevation and their proximity to the sea, deserve, if any part of Arabia does, the name of Arabia Felix—the population is settled and agricultural, and the soil, wherever the rainfall is sufficient, is productive. The Batina coast of Oman, irrigated by the mountain streams of J. Akhdar, is perhaps the most fertile district in the peninsula; Hadramut, too, contains many large and prosperous villages, and the torrents from the Yemen highlands fertilize several oases in the Tehama (or Tihama) or lowlands of the western and southern coast. These favourable conditions of soil and climate, however, extend only a comparatively short distance into the interior, by far the larger part of which is covered by the great southern desert; the Dahna, or Ruba el Khali, empty as its name implies, and uninhabitable.

Exploration.—Before entering on a detailed description of the several provinces of Arabia, our sources of information will be briefly indicated. Except in the neighbourhood of Aden, no regular surveys exist, and professional work is limited to the marine surveys of the Indian government and the admiralty, which, while laying down the coast line with fair accuracy, give little or no topographical information inland. For the mapping of the whole vast interior, except in rare cases, no data exist beyond the itineraries of explorers, travelling as a rule under conditions which precluded the use of even the simplest surveying instruments. These journeys, naturally following the most frequented routes, often cover the same ground, while immense tracts, owing to their difficulty of access, remain unvisited by any European.

The region most thoroughly explored is Yemen, in the south-west corner of the peninsula, where the labours of a succession of travellers from Niebuhr in 1761 to E. Glaser and R. Manzoni in 1887 have led to a fairly complete knowledge of all that part of the province west of the capital Sana; while in 1902–1904 the operations of the Anglo-Turkish boundary commission permitted the execution of a systematic topographical survey of the British protectorate from the Red Sea to the Wadi Bana, 30 m. east of Aden. North of Yemen up to the Hejaz border the only authority is that of E. F. Jomard's map, published in 1839, based on the information given by the French officers employed with Ibrahim Pasha's army in Asir from 1824 to 1827, and of J. Halévy in Nejran. On the south coast expeditions have penetrated but a short distance, the most notable exceptions being those of L. Hirsch and J. T. Bent in 1887 to the Hadramut valley. S. B. Miles, J. R. Wellsted, and S. M. Zwemer have explored Oman in the extreme east; but the interior south of a line drawn from Taif to El Katr on the Persian Gulf is still virgin ground. In northern Arabia the Syrian desert and the great Nafud (Nefud) have been crossed by several travellers, though a large area remains unexplored in the north-east between Kasim and the gulf. In the centre, the journeys of W. Palgrave, C. Doughty, W. Blunt and C. Huber have done much to elucidate the main physical features of the country. Lastly, in the north-west the Sinai peninsula has been thoroughly explored, and the list of travellers who have visited the Holy Cities and traversed the main pilgrim routes through Hejaz is a fairly long one, though, owing to the difficulties peculiar to that region, the hydrography of southern Hejaz is still incompletely known.

Modern Exploration in Yemen.

The story of modern exploration begins with the despatch of C. Niebuhr's mission by the Danish government in 1761. After a year spent in Egypt and the Sinai peninsula the party reached Jidda towards the end of 1762, and after a short stay sailed on to Lohaia in the north of Yemen, the exploration of which formed the principal object of the expedition; thence, travelling through the Tehama or lowlands, Niebuhr and his companions visited the towns of Bet el Fakih, Zubed and Mokha, then the great port for the coffee trade of Yemen. Continuing eastward they crossed the mountainous region and reached the highlands of Yemen at Uden, a small town and the centre of a district celebrated for its coffee. Thence proceeding eastwards to higher altitudes where coffee plantations give way to fields of wheat and barley, they reached the town of Jibla situated among a group of mountains exceeding 10,000 ft. above sea-level; and turning southwards to Taiz descended again to the Tehama via Hes and Zubed to Mokha. The mission, reduced in numbers by the death of its archaeologist, von Haven, again visited Taiz in June 1763, where after some delay permission was obtained to visit Sana, the capital of the province and the residence of the ruling sovereign or imam. The route lay by Jibla, passing the foot of the lofty Jebel Sorak, where, in spite of illness, Forskal, the botanist of the party, was able to make a last excursion; a few days later he died at Yarim. The mission continued its march, passing Dhamar, the seat of a university of the Zedi sect, then frequented by 500 students. Thence four marches, generally over a stony plateau dominated by bare, sterile mountains, brought them to

Sana, where they received a cordial welcome from the imam, el Mahdi Abbas.

The aspect of the city must have been nearly the same as at present; Niebuhr describes the *enceinte* flanked by towers, the citadel at the foot of J. Nukum which rises 1000 ft. above the valley, the fortress and palace of the imams, now replaced by the Turkish military hospital, the suburb of Bir el Azab with its scattered houses and gardens, the Jews' quarter and the village of Rauda, a few miles to the north in a fertile, irrigated plain which Niebuhr compares to that of Damascus. After a stay of ten days at Sana the mission set out again for Mokha, travelling by what is now the main route from the capital to Hodeda, through the rich coffee-bearing district of J. Haraz, and thence southward to Mokha, where they embarked for India. During the next year three other members of the party died, leaving Niebuhr the sole survivor. Returning to Arabia a year later, he visited Oman and the shores of the Persian Gulf, and travelling from Basra through Syria and Palestine he reached Denmark in 1764 after four years' absence.

The period was perhaps specially favourable for a scientific mission of the sort. The outburst of fanaticism which convulsed Arabia twenty years later had not then reached Yemen, and Europeans, as such, were not exposed to any special danger. The travellers were thus able to move freely and to pursue their scientific enquiries without hindrance from either people or ruler. The results published in 1772 gave for the first time a comprehensive description not only of Yemen but of all Arabia; while the parts actually visited by Niebuhr were described with a fulness and accuracy of detail which left little or nothing for his successors to discover.

Asir.

Jauf and Marib.

C. G. Ehrenberg and W. F. Hemprich in 1825 visited the Tehama and the islands off the coast, and in 1836 P. E. Botta made an important journey in southern Yemen with a view to botanical research, but the next advance in geographical knowledge in south Arabia was due to the French officers, M. O. Tamisier, Chedufau and Mary, belonging to the Egyptian army in Asir; another Frenchman, L. Arnaud, formerly in the Egyptian service, was the first to visit the southern Jauf and to report on the rock-cut inscriptions and ruins of Marib, though it was not till 1869 that a competent archaeologist, J. Halévy, was able to carry out any complete exploration there. Starting from Sana, Halévy went north-eastward to El Madid, a town of 5000 inhabitants and the capital of the small district of Nihm; thence crossing a plateau, where he saw the ruins of numerous crenellated towers, he reached the village of Mijzar at the foot of J. Yam, on the borders of Jauf, a vast sandy plain, extending eastwards to El Jail and El Hazm, where Halévy made his most important discoveries of Sabaean inscriptions: here he explored Main, the ancient capital of the Minaeans, Kamna on the banks of the W. Kharid, the ancient Caminacum, and Kharibat el Beda, the Nesca of Pliny, where the Sabaean army was defeated by the Romans under Aelius Gallus in 24 B.C. From El Jail Halévy travelled northward, passing the oasis of Khab, and skirting the great desert, reached the fertile district of Nejran, where he found a colony of Jews, with whom he spent several weeks in the oasis of Makhlaf. An hour's march to the east he discovered at the village of Medinat el Mahud the ruins of the Nagra metropolis of Ptolemy. In June 1870 he at last reached the goal of his journey, Marib; here he explored the ruins of Medinat an Nahas (so called from its numerous inscriptions engraved on brass plates), and two hours to the east he found the famous dam constructed by the Himyarites across the W. Shibwan, on which the water-supply of their capital depended.

One other explorer has since visited Marib, the Austrian archaeologist, E. Glaser (1855–1908), who achieved more for science in Yemen than any traveller since Niebuhr. Under Turkish protection, he visited the territory of the Hashid and Bakil tribes north-east of Sana, and though their hostile attitude compelled him to return after reaching their first important town, Khamr, he had time to reconnoitre the plateau lying between the two great wadis Kharid and Hirran, formerly covered with Himyaritic towns and villages; and to trace the course of these wadis to their junction at El Ish in the Dhu Husen country, and thence onward to the Jauf. In 1889 he succeeded, again under Turkish escort, in reaching Marib, where he obtained, during a stay of thirty days, a large number of new Himyaritic inscriptions. He was unable, however, to proceed farther east than his predecessors, and the problem of the Jauf drainage and its possible connexion with the upper part of the Hadramut valley still remains unsolved.

Exploration in Hadramut.

The earliest attempt to penetrate into the interior from the south coast was made in 1835 when Lieuts. C. Cruttenden and J. R. Wellsted of the "Palinurus," employed on the marine survey of the Arabian coast, visited the ruins of Nakb (el Hajar) in the W. Mefat. The Himyaritic inscriptions found there and at Husn Ghurab near Mukalla, were the first records discovered of ancient Arabian civilization in Hadramut. Neither of these officers was able to follow up their discoveries, but in 1843 Adolph von Wrede landed at Mukalla and, adopting the character of a pilgrim to the shrine of the prophet Hud, made his way northward across the high plateau into the W. Duwan, one of the main southern tributaries of the Hadramut valley, and pushed on to the edge of the great southern desert; on his return to the W. Duwan his disguise was detected and he was obliged to return to Mukalla. Though he did not actually enter the main Hadramut valley, which lay to the east of his track, his journey established the existence of this populous and fertile district which had been reported to the officers of the "Palinurus" as lying between the coast range and the great desert to the north. This was at last visited in 1893 by L. Hirsch under the protection of the sultan of Mukalla, the head of the Kaiti family, and practically ruler of all Hadramut, with the exception of the towns of Saiyun and Tarim, which belong to the Kathiri tribe. Starting like von Wrede from Mukalla, Hirsch first visited the W. Duwan and found ancient ruins and inscriptions near the village of Hajren; thence he proceeded north-eastward to Hauta in the main valley, where he was hospitably received by the Kaiti sultan, and sent on to his deputy at Shibam. Here he procured a Kathiri escort and pushed on through Saiyun to Tarim, the former capital. After a very brief stay, however, he was compelled by the hostility of the people to return in haste to Shibam, from which he travelled by the W. bin Ali and W. Adim back to Mukalla. J. Theodore Bent and his wife followed in the same track a few months later with a well-equipped party including a surveyor, Imam Sharif, lent by the Indian government, who made a very valuable survey of the country passed through. Both parties visited many sites where Himyaritic remains and inscriptions were found, but the hostile attitude of the natives, more particularly of the Seyyids, the religious hierarchy of Hadramut, prevented any adequate examination, and much of archaeological interest undoubtedly remains for future travellers to discover.

Exploration in Oman.

In Oman, where the conditions are more favourable, explorers have penetrated only a short distance from the coast. Niebuhr did not go inland from Muscat; the operations by a British Indian force on the Pirate coast in 1810 gave no opportunities for visiting the interior, and it was not till 1835 that J. R. Wellsted, who had already tried to penetrate into Hadramut from the south, landed at Muscat with the idea of reaching it from the north-east. Sailing thence to Sūr near Ras el Had, he travelled southward through the country of the Bani bu Ali to the borders of the desert, then turning north-west up the Wadi Betha through a fertile, well-watered country, running up to the southern slopes of J. Akhdar, inhabited by a friendly people who seem to have welcomed him everywhere, he visited Ibra, Semed and Nizwa at the southern foot of the mountains. Owing to the disturbed state of the country, due to the presence of raiding parties from Nejd, Wellsted was unable to carry out his original intention of exploring the country to the west, and after an excursion along the Batina coast to Sohar he returned to India.

In 1876 Colonel S. B. Miles, who had already done much to advance geographical interests in south Arabia, continued Wellsted's work in Oman; starting from Sohar on the Batina coast he crossed the dividing range into the Dhahira, and reached Birema, one of its principal oases. His investigations show that the Dhahira contains many settlements, with an industrious agricultural population, and that the unexplored tract extending 250 m. west to the peninsula of El Katr is a desolate gravelly steppe, shelving gradually down to the salt marshes which border the shores of the gulf.

Exploration in Hejaz.

Leaving southern Arabia, we now come to the centre and north. The first explorer to enter the sacred Hejaz with a definite scientific object was the Spaniard, Badia y Leblich, who, under the name of Ali Bey and claiming to be the last representative of the Abbasid Caliphs, arrived at Jidda in 1807, and performed the pilgrimage to Mecca. Besides giving to the world the first accurate description of the holy city and the Haj ceremonies, he was the first to fix the position of Mecca by astronomical observations, and to describe the physical character of its surroundings. But the true pioneer of exploration in Hejaz was J. L. Burckhardt, who had already won a reputation as the discoverer of Petra, and whose experience of travel in Arab lands and knowledge of Arab life qualified him to pass as a Moslem, even in the headquarters of Islam. Burckhardt landed in Jidda in July 1814, when Mehemet Ali had already driven the Wahhābi invaders out of Hejaz, and was preparing for his farther advance against their stronghold in Nejd. He first visited Taif at the invitation of the pasha, thence he proceeded to Mecca, where he spent three months studying every detail of the topography of the holy places, and going through all the ceremonies incumbent on a Moslem pilgrim. In January 1815 he travelled to Medina by the western or coast route, and arrived there safely but broken in health by the hardships of the journey. His illness did not, however, prevent his seeing and recording everything of interest in Medina with the same care as at Mecca, though it compelled him to cut short the further journey he had proposed to himself, and to return by Yambu and the sea to Cairo, where he died only two years later.

His striking successor, Sir Richard Burton, covered nearly the same ground thirty-eight years afterwards. He, too, travelling as a Moslem pilgrim, noted the whole ritual of the pilgrimage with the same keen observation as Burckhardt, and while amplifying somewhat the latter's description of Medina, confirms the accuracy of his work there and at Mecca in almost every detail. Burton's topographical descriptions are fuller, and his march to Mecca from Medina by the eastern route led him over ground not traversed by any other explorer in Hejaz: this route leads at first south-east from Medina, and then south across the lava beds of the Harra, keeping throughout its length on the high plateau which forms the borderland between Hejaz and Nejd. His original intention had been after visiting Mecca to find his way across the peninsula to Oman, but the time at his disposal (as an Indian officer on leave) was insufficient for so extended a journey; and his further contributions to Arabian geography were not made until twenty-five years later, when he was deputed by the Egyptian government to examine the reported gold deposits of Midian. Traces of ancient workings were found in several places, but the ores did not contain gold in paying quantities. Interesting archaeological discoveries were made, and a valuable topographical survey was carried out, covering the whole Midian coast from the head of the Gulf of Akaba to the mouth of the Wadi Hamd, and including both the Tehama range and the Hisma valley behind it; while the importance of the W. Hamd and the extent of the area drained by its tributaries was for the first time brought to light.

Exploration in Nejd.

Burckhardt had hoped in 1815 that the advance of the Egyptian expedition would have given him the opportunity to see something of Nejd, but he had already left Arabia before the overthrow of the Wahhābi power by Ibrahim Pasha had opened Nejd to travellers from Hejaz, and though several European officers accompanied the expedition, none of them left any record of his experience. It is, however, to the Egyptian conquest that the first visit of a British traveller to Nejd is due. The Indian government, wishing to enter into relations with Ibrahim Pasha, as *de facto* ruler of Nejd and El Hasa, with a view to putting down piracy in the Persian Gulf, which was seriously affecting Indian trade, sent a small mission under Captain G. F. Sadlier to congratulate the pasha on the success of the Egyptian arms, and no doubt with the ulterior object of obtaining a first-hand report on the real situation. On his arrival at Hofuf, Sadlier found that Ibrahim had already left Deraiya, but still hoping to intercept him before quitting Nejd, he followed up the retreating Egyptians through Yemama, and Wushm to Ras in Kasim, where he caught up the main body of Ibrahim's army, though the pasha himself had gone on to Medina. Sadlier hesitated about going farther, but he was unable to obtain a safe conduct to Basra, or to return by the way he had come, and was compelled reluctantly to accompany the army to Medina. Here he at last met Ibrahim, but though courteously received, the interview had no results, and Sadlier soon after left for Yambu, whence he embarked for Jidda, and after another fruitless attempt to treat with Ibrahim, sailed for India. If the political results of the mission were *nil*, the value to geographical science was immense; for though no geographer himself, Sadlier's route across Arabia made it possible for the first time to locate the principal places in something like their proper relative positions; incidentally, too, it showed the practicability of a considerable body of regular troops crossing the deserts of Nejd even in the months of July and August.

Sadlier's route had left Jebel Shammar to one side; his successor, G. A. Wallin, was to make that the objective of his journey. Commissioned by Mehemet Ali to inform him about the situation in Nejd brought about by the rising power of Abdallah Ibn Rashid, Wallin left Cairo in April 1845, and crossing the pilgrim road at Maʽan, pushed on across the Syrian desert to the Wadi Sirhan and the Jauf oasis, where he halted during the hot summer months. From the wells of Shakik he crossed the waterless Nafud in four days to Jubba, and after a halt there in the nomad camps, he moved on to Hail, already a thriving town, and the capital of the Shammar state whose limits included all northern Arabia from Kasim to the Syrian border. After a stay in Hail, where he had every opportunity of observing the character of the country and its inhabitants, and the hospitality and patriarchal, if sometimes stern, justice of its chief, he travelled on to Medina and Mecca, and returned thence to Cairo to report to his patron. Early in 1848 he again returned to Arabia, avoiding the long desert journey by landing at Muwela, thence striking inland to Tebuk on the pilgrim road, and re-entering Shammar territory at the oasis of Tema, he again visited Hail; and after spending a month there travelled northwards to Kerbela and Bagdad.

Palgrave's journey to Nejd.

The effects of the Egyptian invasion had passed away, and central Arabia had settled down again under its native rulers when W. G. Palgrave made his adventurous journey through Nejd, and published the remarkable narrative which has taken its place as the classic of Arabian exploration. Like Burton he was once an officer in the Indian army, but for some time before his journey he had been connected with the Jesuit mission in Syria. By training and temperament he was better qualified to appreciate and describe the social life of the people than their physical surroundings, and if the results of his great journey are disappointing to the geographer, his account of the society of the oasis towns, and of the remarkable men who were then ruling in Hail and Riad, must always possess an absorbing interest as a portrait of Arab life in its freest development.

Following Wallin's route across the desert by Maʽan and Jauf, Palgrave and his companion, a Syrian Christian, reached Hail in July 1862; here they were hospitably entertained by the amir Talāl, nephew of the founder of the Ibn Rashid dynasty, and after some stay passed on with his countenance through Kasim to southern Nejd. Palgrave says little of the desert part of the journey or of its Bedouin inhabitants, but much of the fertility of the oases and of the civility of the townsmen; and like other travellers in Nejd he speaks with enthusiasm of its bright, exhilarating climate. At Riad, Fēsal, who had been in power since the Egyptian retirement, was still reigning; and the religious tyranny of Wahhābism prevailed, in marked contrast to the liberal régime of Talal in Jebel Shammar. Still, Palgrave and his companions, though known as Christians, spent nearly two months in the capital without molestation, making short excursions in the neighbourhood, the most important of which was to El Kharfa in Aflaj, the most southerly district of Nejd. Leaving Riad, they passed through Yemama, and across a strip of sandy desert to El Hasa where Palgrave found himself in more congenial surroundings. Finally, a voyage to the Oman coast and a brief stay there brought his adventures in Arabia to a successful ending.

Doughty.

Charles Doughty, the next Englishman to visit northern Arâbia, though he covered little new ground, saw more of the desert life, and has described it more minutely and faithfully than any other explorer. Travelling down from Damascus in 1875 with the Haj caravan, he stopped at El Hajr, one of the pilgrim stations, with the intention of awaiting the return of the caravan and in the meantime of exploring the rock-cut tombs of Medain Salih and El Ala. Having successfully completed his investigations and sent copies of inscriptions and drawings of the tombs to Renan in Paris, he determined to push on farther into the desert. Under the protection of a sheikh of the Fukara Bedouin he wandered over the whole of the borderland between Hejaz and Nejd. Visiting Tema, where among other ancient remains he discovered the famous inscribed stone, afterwards acquired by Huber for the Louvre. Next summer he went on to Hail and thence back to Khaibar, where the negro governor and townsmen, less tolerant than his former Bedouin hosts, ill-treated him and even threatened his life. Returning to Hail in the absence of the amir, he was expelled by the governor; he succeeded, however, in finding protection at Aneza, where he spent several months, and eventually after many hardships and perils found his way to the coast at Jidda.

Three years later Mr Wilfrid and Lady Anne Blunt made their expedition to J. Shammar. In their previous travels in Syria they had gained the confidence and friendship of a young sheikh whose family, though long settled at Tadmur, came originally from Nejd, and who was anxious to renew the connexion with his kinsmen by seeking a bride among them. In his company the Blunts set out from Damascus, and travelled across the Syrian desert by the Wadi Sirhan to Jauf. Here the sheikh found some of his relations and the matrimonial alliance was soon arranged; but though the object of the journey had been attained, the Blunts were anxious to visit Hail and make the acquaintance of the amir Ibn Rashid, of whose might and generosity they daily heard from their hosts in Jauf. The long stretch of waterless desert between Jauf and J. Shammar was crossed without difficulty, and the party was welcomed by the amir and hospitably entertained for a month, after which they travelled northwards in company with the Persian pilgrim caravan returning to Kerbela and Bagdad.

Huber.

In 1883 the French traveller, C. Huber, accompanied by the archaeologist, J. Euting, followed the same route from Damascus to Hail. The narrative of the last named forms a valuable supplement to that published by the Blunts, and together with Doughty's, furnishes as complete a picture as could be wished for of the social and political life of J. Shammar, and of the general nature of the country. Huber's journal, published after his death from his original notes, contains a mass of topographical and archaeological detail of the greatest scientific value: his routes and observations form, in fact, the first and only scientific data for the construction of the map of northern Arabia. To archaeology also his services were of equal importance, for, besides copying numerous inscriptions in the district between Hail and Tema, he succeeded in gaining possession of the since famous Tema stone, which ranks with the Moabite stone among the most valuable of Semitic inscriptions. From Hail Huber followed nearly in Doughty's track to Aneza and thence across central Nejd to Mecca and Jidda, where he despatched his notes and copies of inscriptions. A month later, in July 1884, he was murdered by his guides a few marches north of Jidda, on his way back to Hail.

One other traveller visited Hail during the lifetime of the amir Mahommed—Baron E. Nolde—who arrived there in 1893, not long after the amir had by his victory over the combined forces of Riad and Kasim brought the whole of Nejd under his dominion. Nolde crossed the Nafud to Haiyania by a more direct track than that from Shakik to Jubba. The amir was away from his capital settling the affairs of his newly acquired territory; Nolde therefore, after a short halt at Hail, journeyed on to Ibn Rashid's camp somewhere in the neighbourhood of Shakra. Here he was on new ground, but unfortunately he gives little or no description of his route thither, or of his journey northwards by the Persian pilgrim road, already traversed by Huber in 1881. His narrative thus, while containing much of general interest on the climate and on the animal life of northern Arabia, its horses and camels in particular, adds little to those of his predecessors as regards topographical detail.

General results of exploration.

If the journeys detailed above be traced on the map they will be found to cover the northern half of the peninsula above the line Mecca-Hofuf, with a network of routes, which, though sometimes separated by wide intervals, are still close enough to ensure that no important geographical feature can have been overlooked, especially in a country whose general character varies so little over wide areas. In the southern half, on the other hand, except in Nejran and Jauf, no European traveller has penetrated 100 m. in a direct line from the coast. The vast extent of the Dahna, or great southern desert, covering perhaps 250,000 sq. m., accounts for about a third of this area, but some of the most favoured districts in Arabia—Asir and northern Yemen—remain unexplored, and the hydrography of the Dawasir basin offers some interesting problems, while a great field remains for the archaeologist in the seat of the old Sabaean kingdom from Jauf to the Hadramut valley.

Sinai Peninsula.

Topographical Details.—Beginning from the north-west, the Sinai peninsula belongs to Egypt, though geographically part of Arabia. It is bounded on the E. by a line drawn from Ar Rafa, a few miles E. of El Arish on the Mediterranean, to the head of the Gulf of Akaba; and on the W. by the Suez Canal: its length from El Arish to its most southern point is 240 m., and its breadth from Suez to Akaba is nearly 160 m. The greater part drains to the Mediterranean, from which the land rises gradually to the summit of the Tih plateau. The deep depression of Wadi Feran separates the Tih from the higher mass of Sinai (*q.v.*), in which J. Katherine attains a height of 8500 ft.; except in W. Feran there is little cultivable land, the greater part consisting of bare, rocky hills and sandy valleys, sparsely covered with tamarisk and acacia bushes. The Egyptian pilgrim road crosses the peninsula from Suez to Akaba, passing the post of An Nakhl, with a reservoir and a little cultivation, about half way; a steep descent leads down from the edge of the Tih plateau to Akaba.

Syrian desert.

The rest of the northern borderland is covered by the Syrian desert, extending from the borders of Palestine to the edge of the Euphrates valley. This tract, known as the Hamad, is a gravelly plain unbroken by any considerable range of hills or any continuous watercourse except the Wadi Hauran, which in rainy seasons forms a succession of pools from J. Hauran to the Euphrates. Its general slope is to the north-east from the volcanic plateau of the Harra south of J. Hauran to the edge of the Euphrates valley. The Wadi Sirhan, a broad depression some 500 ft. below the average level of the Hamad, crosses it from north-east to south-west between Hauran and Jauf; it has a nearly uniform height above sea-level of 1850 ft., and appears to be the bed of an inland sea rather than a true watercourse. Water is found in it a few feet below the surface, and a little cultivation is carried on at the small oases of Kaf and Ithri, whence salt produced in the neighbouring salt lakes is exported. The W. Sirhan is continuous with the depression known as the Jauf, situated on the northern edge of the Nefud or Nafud, and the halfway station between Damascus and Hail; and it is possible that this depression continues eastward towards the Euphrates along a line a little north of the thirtieth parallel, where wells and pasturages are known to exist. Jauf is a small town consisting, at the time of the Blunts' visit in 1879, of not more than 500 houses. The town with its gardens, surrounded by a mud wall, covers a space of 2 m. in length by half a mile in width; the basin in which it lies is barely 3 m. across, and except for the palm gardens and a few patches of corn, it is a dead flat of white sand, closed in by high sandstone cliffs, beyond which lies the open desert. The oases of Sakaka and Kara are situated in a similar basin 15 m. to the east; the former a town of 10,000 inhabitants and somewhat larger than Jauf according to Huber.

The Nafud.

A short distance south of Jauf the character of the desert changes abruptly from a level black expanse of gravel to the red sands of the Nafud. The northern edge of this great desert follows very nearly the line of the thirtieth parallel, along which it extends east and west for a length of some 400 m.; its breadth from north to south is 200 m. Though almost waterless, it is in fact better wooded and richer in pasture than any part of the Hamad; the sand-hills are dotted with *ghada*, a species of tamarisk, and other bushes, and several grasses and succulent plants—among them the *adar*, on which sheep are said to feed for a month without requiring water—are found in abundance in good seasons. In the spring months, when their camels are in milk, the Bedouins care nothing for water, and wander far into the Nafud with their flocks in search of the green pasture which springs up everywhere after the winter rains. A few wells exist actually in the Nafud in the district called El Hajra, near its north-eastern border, and along its southern border, between J. Shammar and Tema, there are numerous wells and artificial as well as natural reservoirs resorted to by the nomad tribes.

Owing to the great extent of the Nafud desert, the formation of sand-dunes is exemplified on a proportionate scale. In many places longitudinal dunes are found exceeding a day's journey in length, the valleys between which take three or four hours to cross; but the most striking feature of the Nafud are the high crescent-shaped sand-hills, known locally as *falk* or *falj*, described by Blunt and Huber, who devoted some time to their investigation. The falks enclose a deep hollow (known as *ka'r*), the floor of which is often hard soil bare of sand, and from which the inner slopes of the falk rise as steeply as the sand will lie (about 50°). On the summit of the falk there is generally a mound known as *tas* or *barkhus* composed of white sand which stands out conspicuously against the deep red of the surrounding deserts; the exterior slopes are comparatively gentle. The falks are singularly uniform in shape, but vary greatly in size; the largest were estimated by Huber and Euting at 1¼ m. across and 330 ft. deep. They run in strings irregularly from east to west, corresponding in this with their individual direction, the convex face of the falk being towards the west, *i.e.* the direction of the prevailing wind, and the cusps to leeward. In the south of the Nafud, where Huber found the prevailing wind to be from the south, the falks are turned in that direction. Though perhaps subject to slight changes in the course of years, there is no doubt that these dunes are practically permanent features; the more prominent ones serve as landmarks and have well-known distinctive names. The character of the vegetation which clothes their slopes shows that even superficial changes must be slight. The general level of the Nafud was found by Huber's observations to be about 3000 ft. above sea-level; the highest point on the Jauf-Hail route is at Falk Alam, the rocky peaks of which rise 200 or 300 ft. above the surface of the sand. Other peaks cropping out of the Nafud are Jebel Tawil, near the wells of Shakik, and J. Abrak Rada, a long black ridge in the middle of the desert.

The Harra.

The high plateau which from J. Hauran southward forms the main watershed of the peninsula is covered in places by deep beds of lava, which from their hardness have preserved the underlying sandstones from degradation, and now stand up considerably above the general level. These tracts are known as *harra*; the most remarkable is the Harrat El Awerid, west of the Haj route from Tebuk to El Ala, a mountain mass 100 m. in length with an average height of over 5000 ft., and the highest summit of which, J. Anaz, exceeds 7000 ft. The harra east of Khaibar is also of considerable extent, and the same formation is found all along the Hejaz border from Medina to the Jebel el Kura, east of Mecca. The surface of the harra is extremely broken, forming a labyrinth of lava crags and blocks of every size; the whole region is sterile and almost waterless, and compared with the Nafud it produces little vegetation; but it is resorted to by the Bedouin in the spring and summer months when the air is always fresh and cool. In winter it is cold and snow often lies for some time.

Hejaz.

Hejaz, if we except the Taif district in the south, which is properly a part of the Yemen plateau, forms a well-marked physical division, lying on the western slope of the peninsula, where that slope is at its widest, between the Harra and the Red Sea. A high range of granite hills, known as the Tehama range, the highest point of which, J. Shar, in Midian, exceeds 6500 ft., divides it longitudinally into a narrow littoral and a broader upland zone 2000 or 3000 ft. above the sea. Both are generally bare and unproductive, the uplands, however, contain the fertile valleys of Khaibar and Medina, draining to the Wadi Hamd, the principal river system of western Arabia; and the Wadi Jadid or Es Safra, rising in the Harra between Medina and Es Safina, which contain several settlements, of which the principal produce is dates. The quartz reefs which crop out in the granite ranges of the Tehama contain traces of gold. These and the ancient copper workings were investigated by Burton in 1877. The richer veins had evidently been long ago worked out, and nothing of sufficient value to justify further outlay was discovered. The coast-line is fringed with small islets and shoals and reefs, which make navigation dangerous. The only ports of importance are Yambu and Jidda, which serve respectively Medina and Mecca; they depend entirely on the pilgrim traffic to the holy cities, without which they could not exist.

Nejd.

The great central province of Nejd occupies all inner Arabia between the Nafud and the southern desert. Its northern part forms the basin of the Wadi Rumma, which, rising in the Khaibar harra, runs north-eastward across the whole width of Nejd, till it is lost in the sands of the eastern Nafud, north of Aneza. The greater portion of this region is an open steppe, sandy in places and in others dotted with low volcanic hills, but with occasional ground water and in favourable seasons furnishing support for a considerable pastoral population. Its elevation varies from about 5000 ft. in the west to 2500 ft. in the east. In Jebel Shammar, Kasim and Wushm, where the water in the wadi beds rises nearly to the ground level, numerous fertile oases are found with thriving villages and towns.

Jebel Shammar, from which the northern district of Nejd takes its name, is a double range of mountains some 20 m. apart, rising sharply out of the desert in bare, granite cliffs. J. Aja, the western and higher of the two ranges, has a length of about 100 m. from north-east to south-west, where it merges into the high plateau extending from and continuous with the Khaibar harra. The highest point, J. Fara, near its north-eastern extremity, is about 4600 ft. above sea-level, or 1600 ft. above the town of Hail, which, like most of the larger villages, lies along the wadi bed at the foot of J. Aja. The town, which has risen with the fortunes of the Ibn Rashid family to be the capital of Upper Nejd, is at the mouth of the valley between the twin ranges, about 2 m. from the foot of J. Aja, and contained at the time of Nolde's visit in 1893 about 12,000 inhabitants.

The principal tributaries of the W. Rumma converge in lower Kasim, and at Aneza Doughty says its bed is 3 m. wide from bank to bank. Forty years before his visit a flood is said to have occurred, which passed down the river till it was blocked by sand-drifts at Thuwerat, 50 m. lower down, and for two years a lake stood nearly 100 m. long, crowded by waterfowl not known before in that desert country. Below this its course has not been followed by any European traveller, but it may be inferred from the line of watering-places on the road to Kuwet, that it runs out to the Persian Gulf in that neighbourhood.

East of Kasim the land rises gradually to the high plateau culminating in the ranges of Jebel Tuwek and J. Arid. The general direction of these hills is from north-west to south-east. On the west they rise somewhat steeply, exposing high cliffs of white limestone, which perhaps gave Palgrave the impression that the range is of greater absolute height than is actually the case. J. Tuwek in any case forms an important geographical feature in eastern Nejd, interrupting by a transverse barrier 200 m. in length the general north-easterly slope of the peninsula, and separating the basin of the W. Rumma from that of the other great river system of central Arabia, the Wadi Dawasir. The districts of Suder and Wushm lie on its northern side, Arid in the centre, and Aflaj, Harik and Yemama on its south, in the basin of the W. Dawasir; the whole of this hilly region of eastern Nejd is, perhaps, rather a rolling down country than truly mountainous, in which high pastures alternate with deep fertile valleys, supporting numerous villages with a large agricultural population. The W. Hanifa is its principal watercourse; its course is marked by an almost continuous series of palm groves and settlements, among which Deraiya the former, and Riad the present, capital of the Ibn Saūd kingdom are the most extensive. Its lower course is uncertain, but it probably continues in a south-east direction to the districts of El Harik and Yemama when, joined by the drainage from Aflaj and the W. Dawasir, it runs eastward till it disappears in the belt of sandy desert 100 m. in width that forms the eastern boundary of Nejd, to reappear in the copious springs that fertilize El Hasa and the Bahrein littoral.

Unexplored region of S. Nejd.

As regards the unexplored southern region, Palgrave's informants in Aflaj, the most southerly district visited by him, stated that a day's march south of that place the Yemen road enters the W. Dawasir, up which it runs for ten days, perhaps 200 m., to El Kura, a thinly peopled district on the borders of Asir; this accords with the information of the French officers of the Egyptian army in that district, and with that of Halévy, who makes all the drainage from Nejran northward run to the same great wadi. Whether there be any second line of drainage in southern Nejd skirting the edge of the great desert and following the depression of the W. Yabrin must remain a matter of conjecture. Colonel Miles concluded, from his enquiries, that the low salt swamp, extending inland for some distance from Khor ed Duwan, in the bay east of El Katr, was the outlet of an extensive drainage system which may well be continuous with the W. Yabrin and extend far into the interior, if not to Nejran itself.

El Hasa.

East of Nejd a strip of sandy desert 50 m. in width extends almost continuously from the great Nafud to the Dahna. East of this again a succession of stony ridges running parallel to the coast has to be crossed before El Hasa is reached. This province, which skirts the Persian Gulf from the mouth of the Euphrates to the frontiers of Oman, is low and hot; its shores are flat, and with the exception of Kuwet at the north-west corner of the gulf, it possesses no deep water port. North of Katif it is desert and only inhabited by nomads; at Katif, however, and throughout the district to the south bordering on the Gulf of Bahrein there are ample supplies of underground water, welling up in abundant springs often at a high temperature, and bringing fertility to an extensive district of which El Hofuf, a town of 15,000 to 20,000 inhabitants, is the most important centre.

South-western Arabia.

South-western Arabia, from the twenty-first parallel down to the Gulf of Aden, including the Taif district of Hejaz, Asir and Yemen, forms one province geographically. Throughout its length it consists of three zones, a narrow coastal strip, rarely exceeding 20 m. in width, a central mountainous tract, embracing the great chain which runs parallel to the coast from near Taif to within 50 m. of Aden, and an inner plateau falling gradually to the north-east till it merges in the Nejd steppes or the sands of the great desert.

The lowland strip or Tehama consists partly of a gravelly plain, the *Khabt*, covered sparsely with acacia and other desert shrubs and trees, and furnishing pasturage for large flocks of goats and camels; and partly of sterile wastes of sand like the *Ramla*, which extends on either side of Aden almost from the seashore to the foot of the hills. The Tehama is, however, by no means all desert, the mountain torrents where they debouch into the plain have formed considerable tracts of alluvial soil of the highest degree of fertility producing in that warm equable climate two and even three crops in the year. The flood-water is controlled by a system of dams and channels constructed so as to utilize every drop, and the extent of cultivation is limited more by the supply of water available than by the amount of suitable soil. These districts support a large settled population and several considerable towns, of which Bet el Fakih and Zubed in the western and Lahej in the southern Tehama, with 4000 to 6000 inhabitants, are the most important. There are signs that this coastal strip was until a geologically recent period below sea-level; and that the coast-line is still receding is evidenced by the history of the town of Muza, once a flourishing port, now 20 m. inland; while Bet el Fakih and Zubed, once important centres of the coffee trade, have lost their position through the silting up of the ports which formerly served them.

The jebel or mountain-land is, however, the typical Yemen, the *Arabia Felix* of the ancients. Deep valleys winding through the barren foothills lead gradually up to the higher mountains, and as the track ascends the scenery and vegetation change their character; the trees which line the banks of the wadi are overgrown with creepers, and the running stream is dammed at frequent intervals, and led off in artificial channels to irrigate the fields on either side; the steeper parts of the road are paved with large stones, substantially built villages, with their masonry towers or *dars*, crowning every height, replace the collection of mud walls and brushwood huts of the low country; while tier above tier, terraced fields cover the hill slopes and attest the industry of the inhabitants and the fertility of their mountains. On the main route from Hodeda to Sana the first coffee plantations are reached at Usil, at an altitude of 4300 ft., and throughout the western slopes of the range up to an altitude of 7000 ft. it is the most important crop. Jebel Haraz, of which Manakha, a small town of 3000 inhabitants is the chief place, is described by Glaser as one vast coffee garden. Here the traveller ascending from the coast sees the first example of the jebel or highland towns, with their high three-storeyed houses, built of quarried stone, their narrow façades pierced with small windows with white-washed borders and ornamented with varied arabesque patterns; each dar has the appearance of a small castle complete in itself, and the general effect is rather that of a cluster of separate forts than of a town occupied by a united community.

The scenery in this mountain region is of the most varied description; bare precipitous hill-sides seamed with dry, rocky water-courses give place with almost startling rapidity to fertile slopes, terraced literally for thousands of feet. General Haig in describing them says: "One can hardly realize the enormous labour, toil and perseverance that these represent; the terrace walls are usually 5 to 8 ft. in height, but towards the top of the mountains they are sometimes as much as 15 or 18 ft.; they are built entirely of rough stone without mortar, and I reckon that on an average each wall retains not more than twice its own height in breadth, and I do not think I saw a single break in them unrepaired."

The highest summits as determined by actual survey are between 10,000 and 11,000 ft. above sea-level. J. Sabur, a conspicuous mass in the extreme south, is 9900 ft., with a fall to the Taiz valley of 5000 ft.; farther north several points in the mountains above Ibb and Yarim attain a height of 10,500 ft., and J. Hadur, near the Sana-Hodeda road, exceeds 10,000 ft. From the crest of the range there is a short drop of 2000 or 3000 ft. to the broad open valleys which form the principal feature of the inner plateau. The town of Yarim lies near its southern extremity at an altitude of about 8000 ft.; within a short distance are the sources of the W. Yakla, W. Bana and W. Zubed, running respectively east and south and west. The first named is a dry watercourse ultimately joining the basin of the W. Hadramut; the two others run for a long distance through fertile valleys and, like many of the wadis on the seaward side of the range, have perennial streams down to within a few miles of the sea. Sana, the capital of Yemen, lies in a broad valley 7300 ft. above sea-level, sloping northwards to the W. Kharid which, with the Ghail Hirran, the sources of which are on the eastern slopes of J. Hadur, run north-eastward to the Jauf depression. The Arhab district, through which these two great wadis run, was formerly the centre of the Himyar kingdom; cultivation is now only to be found in the lower parts on the borders of the watercourses, all above being naked rock from which every particle of soil has been denuded. In the higher parts there are fine plains where Glaser found numerous Himyaritic remains, and which he considers were undoubtedly cultivated formerly, but they have long fallen out of cultivation owing to denudation and desiccation—the impoverishment of the country from these causes is increasing. Eastward the plateau becomes still more sterile, and its elevation probably falls more rapidly till it reaches the level of the Jauf and Nejran valleys on the borders of the desert. The water-parting between central and southern Arabia seems to be somewhere to the south of Nejran, which, according to Halévy, drains northward to the W. Dawasir, while the Jauf is either an isolated depression, or perhaps forms part of the Hadramut basin.

Asir.

Farther north, in Asir, the plateau is more mountainous and contains many fertile valleys. Of these may be mentioned Khamis Mishet and the Wadi Shahran rising among the high summits of the maritime chain, and the principal affluents of the Wadi Besha; the latter is a broad well-watered valley, with numerous scattered hamlets, four days' journey (perhaps 80 m.) from the crest of the range. Still farther north is the Wadi Taraba and its branches running down from the highland district of Zahran. The lower valleys produce dates in abundance, and at higher elevations wheat, barley, millets and excellent fruit are grown, while juniper forests are said to cover the mountain slopes. In Yemen this tree was probably more common formerly; the place-name Arar, signifying juniper, is still often found where the tree no longer exists.

Coast of Yemen.

Hadramut.

The western coast of Yemen, like that of Hejaz, is studded with shoals and islands, of which Perim in the Straits of Bab-el-Mandeb, Kamaran, the Turkish quarantine post, 40 m. north of Hodeda, and the Farsan group, off the Abu Arish coast, are the principal. Hodeda is the only port of any importance since the days of steamships began; the other ports, Mokha, Lohaia and Kanfuda merely share in the coasting trade. The south coast is free from the shoals that imperil the navigation of the Red Sea, and in Aden it possesses the only safe natural harbour on the route between Suez and India. Several isolated volcanic hills crop out on the shore line between Aden and the straits; the most remarkable are J. Kharaz, 2500 ft., and J. Shamshan, 1700 ft., at the base of which Aden itself is built. In both of these the crater form is very clearly marked. A low maritime plain, similar to the Tehama of the western coast, extends for some 200 m. east of the Straits of Bab-el-Mandeb, backed by mountains rising to 7000 ft. or more; farther east the elevation of the highland decreases steadily, and in the Hadramut, north of Mukalla, does not much exceed 4000 ft. The mountain chain, too, is less distinctly marked, and becomes little more than the seaward escarpment of the plateau which intervenes between the coast and the Hadramut valley. This valley runs nearly east and west for a distance of 500 m. from the eastern slopes of the Yemen highlands to its mouth on the Mahra coast near Sihut. The greater part of it is desert, but a short stretch lying between the 48th and 50th meridians is well watered and exceptionally fertile. This begins a little to the east of Shabwa, the ancient capital, now half buried in the advancing sand, and for a distance of over 70 m. a succession of villages and towns surrounded by fields and date groves extends along the main valley and into the tributaries which join it from the south. Shibam, Saiyun and Tarim are towns of 6000 or more inhabitants, and Hajren and Haura in the W. Duwan are among the larger villages. Himyaritic remains have been found here and in the W. Mefat which enters the Gulf of Aden near Balhaf. A few small fishing villages or ports are scattered along the coast, but except Mukalla and Shihr none is of any importance.

The Gara coast was visited by the Bents, who went inland from Dhafar, one of the centres of the old frankincense trade, to the crest of the plateau. The narrow coastal strip seems to be moderately fertile, and the hills which in places come down to the seashore are covered with trees, among which the frankincense and other gum-bearing trees are found. On the plateau, which has an altitude of 4000 ft., there is good pasturage; inland the country slopes gently to a broad valley beyond which the view was bounded by the level horizon of the desert.

Oman.

Oman (*q.v.*) includes all the south-eastern corner of the peninsula. Its chief feature is the lofty range of J. Akhdar, 10,000 ft. above sea-level. Like the great range of western Arabia, it runs parallel to the coast; it differs, however, from the western range in that its fall on the landward side is as abrupt and nearly as great as on its seaward side. Its northern extremity, Ras Musandan, rises precipitously from the straits of Hormuz; farther south the range curves inland somewhat, leaving a narrow but fertile strip, known as the Batina coast, between it and the sea, and containing several populous towns and villages of which Sohar, Barka and Sib are the chief. Muscat, the capital of the province and the principal port on the coast, is surrounded on three sides by bare, rocky hills, and has the reputation of being the hottest place in

Arabia. Zwemer says the fertility of the highland region of J. Akhdar is wonderful and is in striking contrast to the barrenness of so much of the coast; water issues in perennial springs from many rocky clefts, and is carefully husbanded by the ingenuity of the people; underground channels, known here as *faluj*, precisely similar to the *kanat* or *karez* of Persia and Afghanistan, are also largely used. The principal villages on the eastern slopes are Rustak, Nakhl and Semail in the well-watered valley of the same name; on the western slopes are Tanuf and Nizwa, lying immediately below the highest summit of the range; Semed, Ibra and Bidiya in the W. Betha are all well-built villages with palm-groves and irrigated fields. In the north-west the Dhahira district sloping towards the Jewasimi coast is more steppe-like in character; but there two oases of great fertility are found, of which Birema, visited by both Miles and Zwemer, supports a population of 15,000. West of Abu Dhabi a low flat steppe with no settled inhabitants extends up to the Katr peninsula, merging on the north into the saline marshes which border the Persian Gulf, and on the south into the desert.

The southern desert.

The great desert known as the Dahna or the Rub‘a el Khali (“ the empty quarter ”) is believed to cover all the interior of southern Arabia from the borders of Yemen in the west to those of Oman in the east. Halévy in Nejran, Von Wrede in Hadramut, and Wellsted in Oman reached its edge, though none of them actually entered it, and the guides accompanying them all concurred in describing it as uninhabitable and uncrossed by any track. Its northern fringe is no doubt frequented by the Bedouin tribes of southern Nejd after the rains, when its sands, like those of the northern desert, produce herbage; but towards the east, according to Burckhardt's information, it is quite without vegetation even in the winter and spring. The farthest habitable spot to the south of Nejd is the Wadi Yabrin, which L. Pelly heard of from the Ahl Murra Bedouins as once a fertile district, and which still produces dates, though, owing to malaria, it is now deserted; thence southward to the Hadramut valley no communication is known to exist.

[*Geology*.—The geological structure of Arabia is very similar to that of Egypt. The oldest rocks consist of granite and schist, penetrated by intrusive dykes, and upon this foundation rest the flat-lying sedimentary deposits, beginning with a sandstone like the Nubian sandstone of Egypt. In the northern part of Arabia the crystalline rocks form a broad area extending from the peninsula of Sinai eastwards to Hail and southwards at least as far as Mecca. Towards the north the crystalline floor is overlaid by the great sandstone series which covers nearly the whole of the country north of Hail. Upon the sandstone rest a few scattered outliers of limestone, probably of Cretaceous age, the largest of which occur near Jauf and east of Bureda. Over both sandstone and granite great sheets of lava have been poured, and these, protecting the softer beds beneath from further denudation, now stand up as the high plateaus and hills called *harra*. Volcanic cones still exist in large numbers, and the sheets of lava appear as fresh as any recent flows of Etna or Vesuvius. Arabian manuscripts describe an eruption on the harra near Medina in A.D. 1256. In the south of Arabia the crystalline floor appears at intervals along the southern coast and on the shores of the Gulf of Oman. At Marbat the granite is overlaid by sandstone, presumably the Nubian sandstone: this is followed by marls containing Cenomanian fossils; and these are overlaid by Upper Cretaceous limestones, upon which rest isolated patches of *Alveolina* limestone. Generally, however, the Cretaceous beds do not appear, and the greater part of southern Arabia seems to be formed of *Alveolina* and nummulite limestones of Tertiary age. An extinct volcano occurs at Aden, and volcanic rocks are found at other places near the Straits of Bab-el-Mandeb. Throughout the whole of Arabia, so far as is known, the sedimentary beds show no signs of any but the most gentle folding. Faulting, however, is by no means absent, and some of the faults are of considerable magnitude. The Gulf of Akaba is a strip of country which has been let down between two parallel faults, and several similar faulted troughs occur in the Sinai peninsula. The Red Sea itself is a great trough bounded by faults along each side.]

Climate.—Owing to its low latitude and generally arid surface, Arabia is on the whole one of the hottest regions of the earth; this is especially the case along the coasts of the Persian Gulf and the southern half of the Red Sea, where the moist heat throughout the year is almost intolerable to Europeans. In the interior of northern and central Arabia, however, where the average level of the country exceeds 3000 ft., the fiery heat of the summer days is followed by cool nights, and the winter climate is fresh and invigorating; while in the highlands of Asir and Yemen in the south-west, and of Oman in the east, the summer heat is never excessive, and the winters are, comparatively speaking, cold.

In the northern desert the temperature is subject to extreme variations. Nolde states that on the 1st of February 1893 in the desert north of Hail the thermometer fell from 78° a little before sunset to 18° a quarter of an hour after. The midday temperatures recorded by Huber at Hail during January and the first half of February average about 65° F., and water froze on several nights; at Medina the winters are cold and night frosts of frequent occurrence, and these conditions prevail over all the western part of the Nejd plateau. In the east where the elevation is lower the climate is warmer. In the elevated highland district which extends from Taif to within 50 m. of Aden, the summer heat is tempered by the monsoon winds, and the seasonal variation of temperature is less marked. From observations made at Sana by Manzoni, Deflers and Glaser, the mean temperature for the year of that city at an altitude of 7300 ft. and in 15° 22′ N. appears to be 60° F.; for July the mean maximum was 77°, mean minimum 54°; for January the figures were 62° and 40° respectively, the lowest recorded temperature in 1878 was 26·6° on the 26th of January. At Aden at the sea-level the mean temperature for the year is 83°; the highest observed temperature in 1904 was 97·3°, the lowest 67·4°.

The rainfall throughout northern and central Arabia is chiefly in the winter months between October and April, and is scanty and irregular. Doughty states that in 1876 rain to wet the ground had not fallen for three years at Medain Salih; in that year showers fell on the 29th of December and on two days in January and again in March. After a very hot summer the bright weather changed to clouded skies on the 2nd of October, rain fell tempestuously the same evening, and there were showery days and nights till the 14th. The autumn rains fell that year abundantly in the Nafud towards Jauf, but very little in the basin of the W. Hamd (on the western slope). Doughty adds that the Nejd highlands between Kasim and Mecca are watered yearly by seasonable rains, which at Taif are expected about the end of August and last commonly from four to six weeks. This appears to be about the northern limit reached by the south-west monsoon, which from June to September brings a fairly abundant rainfall to the Yemen highlands, though the Tehama remains almost entirely rainless. The rainfall is heaviest along the western fringe of the plateau, and penetrates inland in decreasing quantity over a zone which perhaps extends to 100 m. in width. In good seasons it is sufficient for the cultivation of the summer crop of millet, and for the supply of the perennial streams and springs, on which the irrigation of the winter crops of wheat and barley depend. The amount measured at Dhala at the extreme south of the plateau at an elevation of 4800 ft. was in 1902 as follows:—June, 4·0 in.; July, 5·5; August, 5·8; September, 1·9. Only slight showers were recorded in the other months of the year. At higher elevations the rainfall is no doubt heavier; Manzoni mentions that at Sana there was constant rain throughout August and September 1878, and that the thermometer during August did not reach 65°. In the Tehama occasional showers fall during the winter months; at Aden the average rainfall for the year is 2·97 in., but during 1904 only 0·5 in. was recorded. Snow falls on the Harra and on the Tehama range in northern Arabia, and Nolde records a fall of snow which lay on the Nafud on the 1st of February 1893. It also falls on J. Akhdar in Oman, but is very rarely known on the Yemen mountains, probably because the precipitation during the winter months is so slight.

The prevailing winds in northern Arabia as far as is known are from the west; along the southern coast they are from the east; at Sana there is generally a light breeze from the north-north-west from 9 to 11 A.M., from noon till 4 P.M. a steady and often strong wind blows from the south-south-east, which dies away later. The climate is extremely dry, but this is compensated for by the heavy mists which sweep up from the plains during the rainless months and exercise a most beneficial effect in the coffee-growing districts. This phenomenon is known as the sukhemani or amama. In the morning the Tehama, as seen from the mountain tops, appears buried in a sea of white cloud; towards noon the clouds drift up the mountain slopes and cover the summits with wreaths of light mist charged with moisture which condenses on the trees and vegetation; in the afternoon they disappear, and the evenings are generally clear and still.

Fauna.—The wild animals of Arabia are all of the desert-loving type: antelopes and gazelles are found in small numbers throughout the peninsula; the latter are similar to the *chikara* or ravine deer of India. The larger antelopes, so common on the African side of the Gulf of Aden, are not found, except one variety, the *Oryx beatrix* (called by the Arabs, wild cow), which is an inhabitant of the Nafud between Tema and Hail; it is about the size of a donkey, white, and with long straight horns. Hares are numerous both in the desert and in cultivated tracts. In the Yemen mountains the *wal*, a wild goat with massive horns, similar to the Kashmir ibex, is found; monkeys also abound. Among smaller animals the jerboa and other descriptions of rat, and the *wabar* or cony are common; lizards and snakes are numerous, most of the latter being venomous. Hyenas, wolves and panthers are found in most parts of the country, and in the mountains the leopard and wild cat. Of birds the ostrich is found in the Nafud and in the W. Dawasir. Among game birds the bustard, guinea fowl, sand grouse (*kata*), blue rock, green pigeon, partridge, including a large chikor (*akb*) and a small species similar to the Punjab sisi; quail and several kinds of duck and snipe are met with. In the cultivated parts of Yemen and Tehama small birds are very numerous, so also are birds of prey, vultures, kites and hawks.

Insects of all sorts abound; scorpions, centipedes, spiders, and an ugly but harmless millipede known in Yemen as *hablub* are very common in summer. Ants and beetles too are very numerous, and anthills are prominent features in many places. Locusts appear in great swarms and do much damage; fires are lighted at night to attract them, and large quantities are caught and eaten by the poorer people. Bees are kept, and in Yemen and Hadramut the honey is exceptionally good.

Camel.

Of domesticated animals the camel is far the most useful to the Arab. Owing to its endurance of thirst the long desert journeys which separate the populous centres are made practicable, and in the spring months, when green forage is plentiful in the desert, the Bedouins pitch their camps for long periods far from any water, and not only men but horses subsist on camel's milk. The Arabian camel belongs to the one-humped species, though there are many varieties differing in appearance as much as the thoroughbred race-horse from the English cart-horse. The ordinary load for a pack camel is about 400 lb, and in hot weather good camels will march 20 to 25 m. daily and only require water every third or fourth day: in cool weather, with ample green fodder they can go twenty-five days or more without drinking. A good *dalul* or riding camel will carry his rider 100 m. a day for a week on end. Nolde gives an instance from his own experience of a camel rider covering 62 m. in seven hours. The pure-bred riding camel is only found in perfection in inner Arabia; for some unexplained reason when taken out of their own country or north of the 30th degree they rapidly degenerate.

Horse.

The horse does not occupy the important position in the Bedouin economy that is popularly supposed. In Nejd the number of horses is, comparatively speaking, very small; the want of water in the Nafud where alone forage is obtainable, and the absence of forage in the neighbourhood of the towns makes horse-breeding on a large scale impracticable there. Horses are in fact only kept by the principal sheiks, and by far the larger proportion of those now in Nejd are the property of the amir and his family. These are kept most of the year in the Nafud, five or ten days' march from Hail, where they find their own food on the desert herbage. When a raid is in contemplation, they are brought in and given a little barley for a few weeks. Reared in this way they are capable of marvellous endurance, marching during a raid twenty hours a day for eight or ten days together. As a rule, they are only mounted at the moment of attack, or in pursuit. Water and forage have to be carried for them on camels.

The great majority of the horses that come into the market as Arabs, are bred in the northern desert and in Mesopotamia, by the various sections of the Aneza and Shammar tribes, who emigrated from Nejd generations ago, taking with them the original Nejd stock. In size and appearance, and in everything but endurance, these northern horses are admittedly superior to the true Nejdi. A few of the latter are collected by dealers in the nomad camps and exported chiefly from Kuwet. The amir Mahommed Ibn Rashid used to send down about one hundred young horses yearly.

Asses of excellent quality are bred all over the country; they are much used as mounts by the richer townsmen. Except in the settled districts horned cattle are not numerous; they are similar to the Indian humped cattle, but are greatly superior in milking qualities. The great wealth of the Arabs is in their flocks of sheep and goats; they are led out to pasture soon after sunrise, and in the hotter months drink every second day. In the spring when the succulent *ashub* and *adar* grow plentifully in the desert, they go for weeks without drinking. They are milked once a day about sunset by the women (the men milk the camels), and a large proportion of the milk is made into *samn*, clarified butter, or *marisi*, dried curd. The wool is not of much value, and is spun by the women and woven into rugs, and made up into saddlebags or into the black Bedouin tents.

Flora.—The flora of Arabia has been investigated by P. Forskal, the botanist of Niebuhr's mission, P. E. Botta, G. Schweinfurth and A. Deflers, to whose publications the technical reader is referred. Its general type approaches more closely to the African than to that of southern Asia. In the higher regions the principal trees are various species of fig, tamarind, carob and numerous kinds of cactiform *Euphorbia*, of which one, the *Euphorbia arborea*, grows to a height of 20 ft. Of Coniferae the juniper is found on the higher slopes of J. Sabur near Taiz, where Botta describes it as forming an extensive forest and growing to a large size; it is also found in the range overlooking the W. Madin, 50 m. W. of Aden. Considerable forests are said to exist in Asir, and Burton found a few fine specimens which he regarded as the remains of an old forest, on the Tehama range in Midian. On the rocky hill-sides in Yemen the *Adenium Obesum* is worthy of notice, with its enormous bulb-like stems and brilliant red flowers. Some fine aloes or agaves are also found. In the cultivated upland valleys all over Arabia the *Zizyphus jujuba*, called by some travellers lotus, grows to a large tree; its thorny branches are clipped yearly and used to fence the cornfields among which it grows. In the broad sandy wadi beds the tamarisk (*athl*) is everywhere found; its wood is used for making domestic implements of all sorts. Among fruit trees the vine, apricot, peach, apple, quince, fig and banana are cultivated in the highlands, and in the lower country the date palm flourishes, particularly throughout the central zone of Arabia, in Hejaz, Nejd and El Hasa, where it is the prime article of food. A hundred kinds of date are said to grow at Medina, of which the *birni* is considered the most wholesome; the *halwa* and the *jalebi* are the most delicately flavoured and sell at very high rates; the *khulas* of El Hasa is also much esteemed.

Of cereals the common millets, *dhura* and *dukhn*, are grown in all parts of the country as the summer crop, and in the hot irrigated Tehama districts three crops are reaped in the year; in the highlands maize, wheat and barley are grown to a limited extent as the winter crop, ripening at the end of March or in April. Among vegetables the common kinds grown include radishes, pumpkins, cucumbers, melons, potatoes, onions and leeks. Roses are grown in some places for the manufacture of *atr*, or attar of roses; mignonette, jasmine, thyme, lavender and other aromatic plants are favourites in Yemen, when the Arabs often stick a bunch in their head-dress.

Coffee.

Of the products special to Arabia coffee comes first; it is nowhere found wild, and is believed to have been introduced from Abyssinia in the 6th century A. D. It thrives on the seaward slopes of the western range in the zone of the tropical rains, at altitudes between 4000 and 7000 ft. The principal centres of production are the upper valleys of the W. Surdad, between Kaukaban and Manakha, and particularly on J. Haraz; in the Wadi Zubed west of Uden; in Hajaria on the slopes of J. Sabur, and in the Yafa district north-east of Aden. It is planted in terraces on the mountain slopes; shady trees, such as tamarind and fig, are planted in the border as a protection from the sun, and the terraces are irrigated by channels led from a neighbouring rivulet or spring. The plants are raised from seedlings, and when six or seven weeks old they are transplanted in rows 4 to 6 ft. apart; they require watering twice a month, and bear in two to four years. The berries are dried in the sun and sent down to Hodeda or Aden, where they are subjected to a process for separating the husk from the bean; the result is about 50% of cleaned berries, *bun safi*, which is exported, and a residue of husk or *kishr*, from which the Yemenis make their favourite beverage.

Another plant universally used as a stimulant in Southern Arabia is *khat* (*Catha edulis*). The best is grown on J. Sabur and the mountainous country round Taiz. It is a small bush propagated from cuttings which are left to grow for three years; the leaves are then stripped, except a few buds which develop next year into young shoots, these being cut and sold in bunches under the name of *khat mubarak*; next year on the branches cut back new shoots grow; these are sold as *khat malhani*, or second-year kat, which commands the highest price. The bush is then left for three years, when the process is repeated. The leaves and young shoots are chewed; they have stimulating properties, comparable with those of the coca of Peru.

The aromatic gums for which Arabia was famed in ancient times are still produced, though the trade is a very small one. The tree from which myrrh is extracted grows in many places, but the industry is chiefly carried on at Suda, 60 m. north-north-east of Sana. Longitudinal slits are made in the bark, and the gum is caught in cups fixed beneath. The balsam of Mecca is produced in the same way, chiefly in the mountains near the W. Safra between Yambu and Medina.

The stony plains which cover so large a part of the country are often covered with acacia jungle, and in the dry water-courses a kind of wild palm, the *dom*, abounds, from the leaves of which baskets and mats are woven. Brushwood and rough pasturage of some sort is found almost everywhere, except in the neighbourhood of the larger settlements, where forage and firewood have to be brought in from long distances. The Nafud sands, too, are tufted in many places with bushes or small trees, and after the winter rains they produce excellent pasture.

Population.—The people, according to their own traditions, are derived from two stocks, the pure Arabs, descended from Kahtan or Joktan, fourth in descent from Shem; and the Mustarab or naturalized Arabs, from Ishmael. The former are represented at the present day by the inhabitants of Yemen, Hadramut and Oman, in general a settled agricultural population; the latter by those of Hejaz, Nejd, El Hasa, the Syrian desert and Mesopotamia, consisting of the Bedouin or pastoral tribes (see ARABS and BEDOUINS). This distinction between the characteristics of the two races is only true in a general sense, for a considerable population of true Bedouin origin has settled down to agricultural life in the oases of Hejaz and Nejd, while in southern Arabia the tribes dwelling on the fringe of the great desert have to a certain extent adopted the nomad life.

Both among the nomad and settled Arabs the organization is essentially tribal. The affairs of the tribe are administered by the sheiks, or heads of clans and families; the position of sheik in itself gives no real governing power, his word and counsel carry weight, but his influence depends on his own personal qualities. All matters affecting the community are discussed in the *majlis* or assembly, to which any tribesman has access; here, too, are brought the tribesmen's causes; both sides plead and judgment is given impartially, the loser is fined so many head of small cattle or camels, which he must pay or go into exile. Murder can be expiated by the payment of *diya* or blood-money, if the kinsmen of the murdered man consent; they may, however, claim the life of the murderer, and long and troublesome blood feuds often ensue, involving the relatives of both sides for generations.

Apart from the tribesmen there is in Hejaz and south Arabia a privileged, religious class, the Sharifs or Seyyids, who claim descent from Mahomet through his daughter Fatima. Until the Egyptian invasion in 1814 the Sharifs of Mecca were the recognized rulers of Hejaz, and though the Turks have attempted to suppress their importance, the Sharif still executes justice according to the Mahommedan law in the holy cities, though, nominally, as a Turkish official. In Yemen and Hadramut many villages are occupied exclusively by this religious hierarchy, who are known as Ashraf, Sada or Kudha (*i.e.*Sharifs, Seyyids or Kadhis); the religious affairs of the tribes are left in their hands; they do not, however, interfere in tribal matters generally, or join in fighting.

Below these two classes, which may be looked on as the priestly and the military castes, there is, especially in the settled districts, a large population of artisans and labourers, besides negro slaves and their descendants, slave or free. The population of Khaibar consists almost entirely of the latter, and in Hail Huber estimates the pure Arab inhabitants at only one-third of the whole. In the desert, too, there is a widely scattered tribe, the Salubi, which from its name (*Salib*, cross) is conjectured to be of early Christian origin; they are great hunters, killing ostriches and gazelles; the Arabs despise them as an inferior race, but do not harm them; they pay a small tax to the tribe under whose protection they live, and render service as labourers, for which they receive in the spring milk and cheese; at the date harvest they get wages in kind; with this, and the produce of the chase, they manage to exist in the desert without agriculture or flocks.

The Jews in Arabia.

In southern Arabia the Jews form a large element in the town population. According to one authority their presence in Yemen dates from the time of Solomon, others say from the capture of Jerusalem by Nebuchadrezzar. Manzoni estimated their number in Sana in 1878 at 1700 out of a total population of 20,000; at Aden they are a numerous and wealthy community, with agents in most of the towns of Yemen. Even in remote Nejran, Halévy, himself a Jew, found a considerable colony of his co-religionists. They wear a distinctive garb and are not allowed to carry arms or live in the same quarter as Moslems. Another foreign element of considerable strength in the coast towns of Muscat, Aden and Jidda, is the British Indian trading class; many families of Indian origin also have settled at Mecca, having originally come as pilgrims.

Estimates of the population of Arabia vary enormously, and the figures given in the following table can only be regarded as a very rough approximation:—

Hejaz	300,000
Yemen and Asir	1,800,000
Nejd	1,000,000
Hadramut	150,000
Oman	1,000,000
El Hasa	300,000
Syrian desert and border	275,000
	4,825,000

Communications.—The principal land routes in Arabia are those leading to the holy cities. In the present day the Syrian pilgrim route, or Darb el Haj, from Damascus to Medina and Mecca is the most used. The annual pilgrim caravan or haj, numbering some 6000 people with 10,000 pack animals, is escorted by a few Turkish irregulars known as *agel*; small fortified posts have been established at the regular halting-places some 30 m. apart, each furnished with a well and reservoir, and for the further protection of the haj, payments are made to the Bedouin tribes through whose territories the route passes. The road is a mere camel track across the desert, the chief places passed are Ma'an on the Syrian border, a station on the old Sabaean trade route to Petra, and Medain Salih, the site of the rock-cut tombs and inscriptions first brought to notice by Doughty. From Medina the route usually followed descends the W. Safra to Badr Hunen, whence it keeps near the coast passing Rabigh and Khulesa to Mecca. The total distance, 1300 m., is covered in forty days.

The Egyptian pilgrim route from Cairo, across the Sinai peninsula and down the Midian coast to El Wijh, joins the Syrian route at Badr Hunen. It also was formerly provided with stations and reservoirs, but owing to the greater facilities of the sea journey from Suez to Jidda it is now little used. Another important route is that taken by the Persian or Shia pilgrims from Bagdad and Kerbela across the desert, by the wells of Lina, to Bureda in Kasim; thence across the steppes of western Nejd till it crosses the Hejaz border at the Ria Mecca, 50 m. north-east of the city. It lies almost entirely in the territory of the amir Ibn Rashid of J. Shammar, who derives a considerable revenue from the pilgrimage. The old reservoirs on this route attributed to Zubeda, wife of Harun al Rashid, were destroyed during the Wahhābi raids early in the 19th century, and have not been repaired. The Yemen pilgrim route, known as the Haj el Kabsi, led from Sada through Asir to Taif and Mecca, but it is no longer used.

The principal trade routes are those leading from Damascus to Jauf and across the Nafud to Hail. Other important routes leading to Nejd are those from Kuwet to Hail, and from El Hasa to Riad respectively. In the west and south the principal routes, other than those already mentioned, are from Yambu to Medina, from Jidda to Mecca, Hodeda to Sana, Aden to Sana, and from Mukalla to the Hadramut valley. Railway construction has begun in Arabia, and in 1908 the Hejaz line, intended to connect Damascus with Mecca, had reached Medina, 500 m. south of Ma'an. This line is of great strategical importance, as strengthening the Turkish hold on the Red Sea provinces. But the principal means of commercial communication for a country like Arabia must always be by sea. Bahrein, Kuwet and Muscat are in steam communication with India, and the Persian Gulf ports; all the great lines of steamships call at Aden on their way between Suez and the East, and regular services are maintained between Suez, Jidda, Hodeda and Aden, as well as to the ports on the African coast, while native coasting craft trade to the smaller ports on the Red Sea and Indian Ocean.

Commerce.—The total value of the trade of Aden for 1904 amounted to over £6,000,000. The imports to Jidda in the same year were £1,405,000, largely consisting of rice, wheat and other food stuffs from India; the exports, which have dwindled away in late years, amounted in 1904 to only £25,000. To balance the exports and imports specie was exported in the three years 1902–1904 amounting to £2,319,000; a large proportion of this was perhaps provided by cash brought into the country by pilgrims.

The pilgrim traffic increased largely in 1904 as compared with previous years; 74,600 persons landed at Jidda, 18,000 of whom were from British India, 13,000 from Java and the Straits Settlements, and the remainder from Turkish territory, Egypt and other countries: 235 out of a total of 334 steamships engaged in this traffic were British.

The trade of Hodeda, which contributes by far the largest share to that of Turkish Yemen, fell off considerably during the period from 1901–1905, chiefly owing to the disturbed state of the country. In the latter year the imports amounted to £467,000, and the exports to £451,000; coffee, the mainstay of Yemen trade, shows a serious decline from £302,000 in 1902 to £229,000 in 1904; this is attributable partly to the great increase of production in other countries, but mainly to the insecurity of the trade routes and the exorbitant transit dues levied by the Turkish administration.

Oman, through its chief port Muscat, had a total trade of about £550,000, two-thirds of which is due to imports and one-third to exports. The chief items of imports are arms and ammunition, rice, coffee and piece goods; the staple export is dates, which in a good year accounts for nearly half the total; much of the trade is in the hands of British Indians, and of the shipping 92% is British.

The principal trade centre of the Arabian side of the Persian Gulf is Bahrein; the total volume of trade of which amounted in 1904 to £1,900,000, nearly equally divided between imports and exports; rice, piece goods, &c., form the bulk of the former, while pearls are the most valuable part of the latter. (R. A. W.)

ANTIQUITIES

Arabia cannot be said to be "destitute of antiquities," but the material for the study of these is still very incomplete.

The difficulties in the way of travelling in Arabia with a view to scientific investigation are such that little or nothing is being done, and the systematic work which has given such good results in Egypt, Palestine and Babylonia-Assyria is unknown in Arabia. Yet the passing notes of travellers from the time of Carsten Niebuhr show that antiquities are to be found.

Prehistoric Remains.—Since prehistoric remains must be studied where they are found, the difficulty in the way of exploration makes itself severely felt. That such remains exist seems clear from the casual remarks of travellers. Thus Palgrave (*Central and Eastern Arabia*, vol. i. ch. 6) speaks of part of a circle of roughly shaped stones taken from the adjacent limestone mountains in the Nejd. Eight or nine of these stones still exist, some of them 15 ft. high. Two of them, 10 to 12 ft. apart, still bear their horizontal lintel. They are all without ornament. Palgrave compares them with the remains at Stonehenge and Karnak. Doughty (*Arabia Deserta*, vol. ii.), travelling in north-west Arabia, saw stones of granite in a row and "flagstones set edgewise" (though he does not regard these as religious), also "round heaps, perhaps barrows," and "dry-built round chambers," which may be ancient tombs. J. T. Bent (*Southern Arabia*, pp. 24 ff.) explored one of several mounds in Bahrein. It proved to be a tomb, and the remains in it are said to be Phoenician.

Castles and Walls.—In the south of Arabia, where an advanced civilization existed for centuries before the Christian era, the ruins of castles and city-walls are still in existence, and have been mentioned, though not examined carefully, by several travellers. In Yemen and Hadramut especially these ruins abound, and in some cases inscriptions seem to be still *in situ*. Great castles are often mentioned in early Arabian literature. One in the neighbourhood of Sanʻa was described as one of the wonders of the world by Qazwīnī (*Athār ul-Bilād*, p. 33, ed. Wüstenfeld, Göttingen, 1847, cf. *Journal of the German Oriental Society*, vol. 7, pp. 472, 476, and for other castles vol. 10, pp. 20 ff.). The ruins of the city of Ma'rib, the old Sabaean capital, have been visited by Arnaud, Halévy and Glaser, but call for further description, as Arnaud confined himself to a description of the dike (see below), while Halévy and Glaser were interested chiefly in the inscriptions.

Wells and Dikes.—From the earliest times the conservation of water has been one of the serious cares of the Arabs. All over the country wells are to be found, and the masonry of some of them is undoubtedly ancient. Inscriptions are still found in some of these in the south. The famous well Zemzem at Mecca is said to belong to the early times, when the eastern traffic passed from the south to the north-west of Arabia through the Hejaz, and to have been rediscovered shortly before the time of Mahomet. Among the most famous remains of Ma'rib are those of a great dike reminding one of the restored tanks familiar to visitors at Aden. These remains were first described by Arnaud (*Journal asiatique*, January 1874, with plan). Their importance was afterwards emphasized by Glaser's publication of two long inscriptions concerning their restoration in the 5th and 6th centuries A.D. ("Zwei Inschriften über den Dammbruch von Mārib," in the *Mitteilungen der Vorderasiatischen Gesellschaft*, Berlin, 1897). Another dike about 150 yds. long was seen by W. B. Harris at Hirran in Yemen. Above it was a series of three tanks (*A Journey through the Yemen*, p. 279, London, 1893).

Stones and Bronzes.—The 19th century has brought to the museums of Europe (especially to London, Paris, Berlin and Vienna) a number of inscriptions in the languages of Minea and Saba, and a few in those of Hadramut and Katabania (Qattabania). These inscriptions are generally on limestone or marble or on tablets of bronze, and vary from a few inches to some feet in length and height. In some cases the originals have been brought to Europe, in other cases only squeezes of the inscriptions. The characters employed are apparently derived from the Phoenician (cf. Lidzbarski's *Ephemeris*, vol. i. pp. 109 ff.). The languages employed have been the subject of much study (cf. F. Hommel's *Süd-arabische Chrestomathie*, Munich, 1893), but the archaeological value of these remains has not been so fully treated. Very many of them are votive inscriptions and contain little more than the names of gods and princes or private men. A few are historical, but being (with few and late exceptions) undated, have given rise to much controversy among scholars. Their range seems to be from about 800 B.C. (or 1500 B.C. according to E. Glaser) to the 6th century A.D. Few are still *in situ*, the majority having been taken from their original positions and built into houses, mosques or wells of more recent date. Among these remains are altars, and bases for statues of gods or for golden images of animals dedicated to gods. The earlier stones are devoid of ornamentation, but the later stones and bronzes are sometimes ornamented with designs of leaves, flowers, ox-heads, men and women. Some bear figures of the conventionalized sacred tree with worshippers, similar to Babylonian designs. Besides these there are gravestones, stelae with human heads, fragments of limestone, architectural designs as well as bronze castings of camels, horses, mice, serpents, &c. (cf. D. H. Müller's *Südarabische Alterthümer im Kunsthistorischen Museum*, Vienna, 1899, with plates).

Seals, Weights and Coins.—The Vienna Museum possesses a small number of seals and gems. The seals are inscribed with Sabaean writing and are of bronze, copper, silver and stone. The gems of onyx, carnelian and agate are later and bear various figures, and in some cases Arabic inscriptions. One or two weights are also in existence. A number of coins have been brought to the British Museum from Aden, Sanʻa and Ma'rib. Others were purchased by G. Schlumberger in Constantinople; others have been brought to Europe by Glaser, and are now in the Vienna Museum. These are imitations of Greek models, while the inscriptions are in Sabaean characters (cf. B. V. Head, in the *Numismatic Chronicle*, 1878, pp. 273–284; G. Schlumberger, *Le Trésor de Sanʻa*, Paris, 1880; D. H. Müller, *op. cit.* pp. 65 ff. and plates).

For the problem of Arabic antiquities in Rhodesia see RHODESIA and ZIMBABWE. (G. W. T.)

HISTORY

Introduction.—Arabia is a land of Semites, and is supposed by some scholars to have been the original home of the Semitic peoples. Although this cannot be said to be proved, the studies, linguistic and archaeological, of Semitic scholars have shown it to be probable. The dispersion from Arabia is easy to imagine. The migration into Babylonia was simple, as there are no natural boundaries to separate it from north-east Arabia, and similar migrations have taken place in historic times. That of the Aramaeans at an early period is likewise free from any natural hindrance. The connexion with Palestine has always been close; and the Abyssinian settlement is probably as late as the beginning of the Christian era. Of these migrations, however, history knows nothing, nor are they expressed in literature. Arabian literature has its own version of prehistoric times, but it is entirely legendary and apocryphal. It was, and still is, the custom of Arabian historians to begin with the creation of the world and tell the history from then to the time of which they are writing. Consequently even the more sober histories contain a mass of fables about early days. Many of these, taken in part from Jewish and Christian sources, find a place in the Koran. Of all these stories current at the time of Mahomet, the only ones of any value are the accounts of the "days of the Arabs," *i.e.* accounts of some famous inter-tribal battles in Arabia.

Authorities.—Until recently the Arab traditions were practically the only source for the pre-Islamic history of Arabia. The Old Testament references to Arabs were obscure. The classical accounts of the invasion of Aelius Gallus in 26 B.C. threw little light on the state of Arabia at the time, still less on its past history. The Greek writers from Theophrastus in the 4th century B.C. to Ptolemy in the 2nd century A.D. mention many names of Arabian peoples and describe the situation of their cities, but contribute little to their history, and that little could not be controlled. The same applies to the information of Pliny in his *Natural History*. In the 19th century the discovery and decipherment of the Assyrian inscriptions gave a slight glance into the relations between Arabs and Assyrians from the

8th century B.C. But the great contribution of the century to the early history of Arabia was the collecting and translating of numerous early Arabian inscriptions (cf. section *Antiquities* above), which have done service both by their own indication of a great civilization in Arabia for nearly (or more than) a thousand years before the Christian era, and by the new stimulus which they gave to the study and appreciation of the materials in the Assyrian inscriptions, the Old Testament, and the Greek and Roman writers. At the same time the facts that the inscriptions are undated until a late period, that few are historical in their contents, and for the most part yield only names of gods and rulers and domestic and religious details, and that our collection is still very incomplete, have led to much serious disagreement among scholars as to the reconstruction of the history of Arabia in the pre-Christian centuries.

All scholars, however, are agreed that the inscriptions reach as far back as the 9th century B.C. (some say to the 16th) and prove the existence of at least four civilized kingdoms during these centuries. These are the kingdoms of Maʽīn (Minaean), of Saba (Sabaean), of Hadramaut (Hadramut) and of Katabania (Katabanū). Of the two latter little is known. That of Hadramut had kings from the time of the Minaeans to about A.D. 300, when it was conquered by Ethiopia. The limits of the kingdom of Katabania are not known, but it has its own inscriptions.

As to the Sabaean kingdom there is fair agreement among scholars. The inscriptions go back to 800 B.C. or earlier, and the same applies to the kingdom. A queen of this people (the "Queen of Sheba") is said (1 Kings x.) to have visited Solomon about 950 B.C. There is, however, no mention of such a queen in the inscriptions. An Assyrian inscription mentions Ithʽamara the Sabaean who paid tribute to Sargon in 715 B.C. At this time the Sabaeans must have been in north Arabia unless the inscription refers to a northern colony of the southern Sabaeans. The former opinion is held by E. Glaser, who thinks that in the 9th and 8th centuries they moved down along the west coast to the south, where they conquered the Minaeans (see below). The Sabaean rule is generally divided into periods indicated by the titles given to their rulers. In the first of these ruled the Makārib, who seem to have been priest-kings. Their first capital was at Ṣirwāḥ. Ten such rulers are mentioned in the inscriptions. Their rule extended from the 9th to the 6th century. The second period begins about 550 B.C. The rulers are known as "kings of Saba." Their capital was Ma'rib. The names of seventeen of these kings are known from the inscriptions. Their sway lasted until about 115 B.C., when they were succeeded by the Himyarites. During this period they were engaged in constant strife with the neighbouring kingdoms of Hadramut and Katabania. The great prosperity of south-west Arabia at this time was due in large measure to the fact that the trade from India with Egypt came there by sea and then went by land up the west coast. This trade, however, was lost during this period, as the Ptolemies established an overland route from India to Alexandria. The connexion of Saba with the north, where the Nabataeans (*q.v.*) had existed from about 200 B.C., was now broken. The decay that followed caused a number of Sabaeans to migrate to other parts of Arabia.

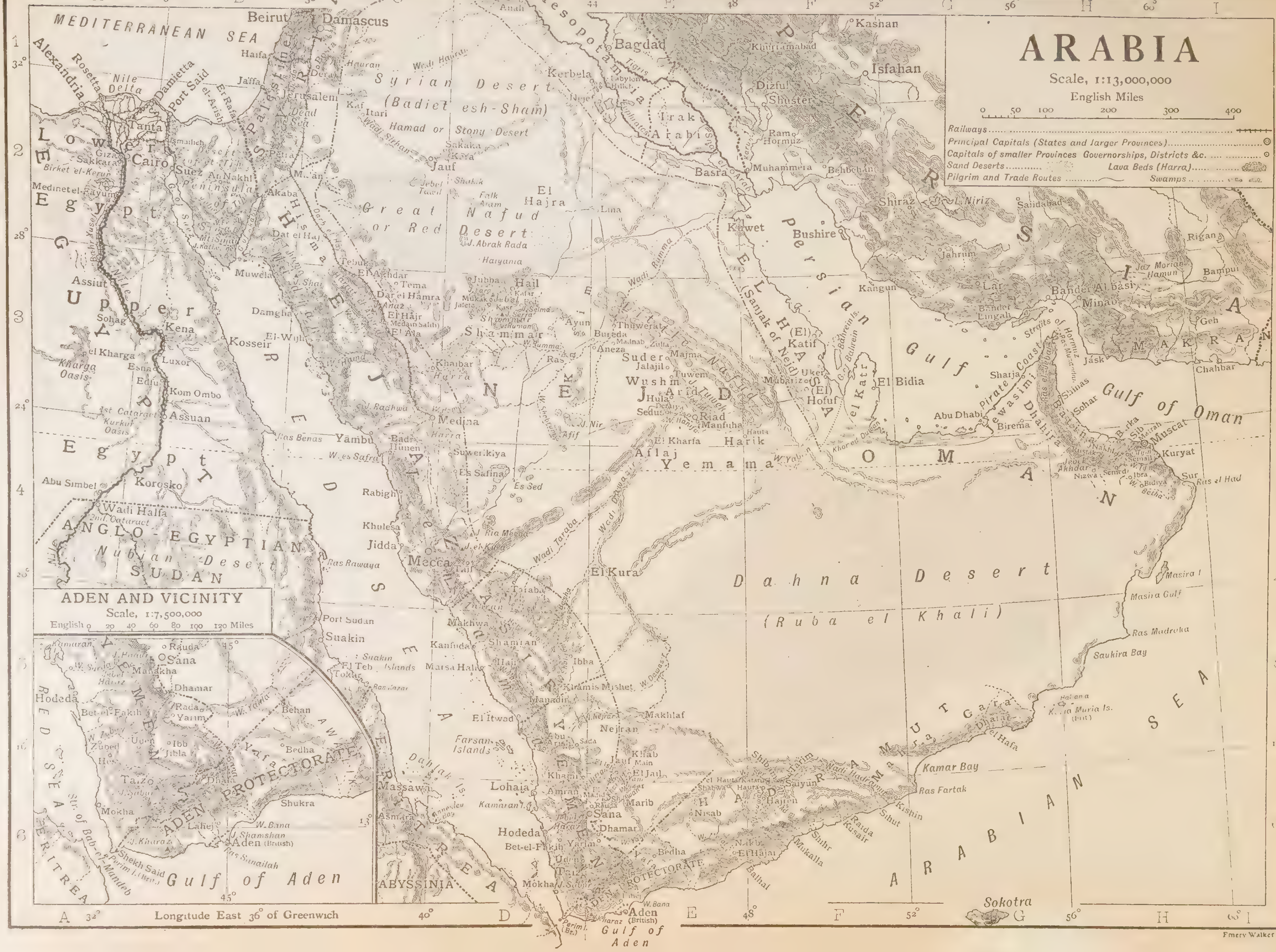
The Minaean kingdom extended over the south Arabian Jauf, its chief cities being Karnau, Maʽīn and Yathil. Some twenty-five kings are known from the inscriptions; of these twenty are known to be related to one another. Their history must thus cover several centuries. As inscriptions in the Minaean language are found in al-ʽUlā in north Arabia, it is probable that they had colonies in that district. With regard to their date opinion is very much divided; some, with E. Glaser and F. Hommel, maintaining that their kingdom existed prior to that of Saba, probably from about 1500 B.C. or earlier until the Sabaeans came from their home in the north and conquered them in the 9th century. Other scholars think, with D. H. Müller, partly on palaeographical grounds (cf. M. Lidzbarski's *Ephemeris*, vol. i. pp. 109 seq., Giessen, 1902), that none of the inscriptions are earlier than about 800 B.C. and that the Minaean kingdom existed side by side with the Sabaean. It is curious that the Sabaean inscriptions contain no mention of the Minaeans, though this may be due to the fact that very few of the inscriptions are historical in content.

About 115 B.C. the power over south Arabia passed from the Sabaeans to the Himyarites, a people from the extreme southwest of Arabia; and about this time the kingdom of Katabania came to an end. The title taken by the new rulers was "king of Saba and Raidān." Twenty-six kings of this period are known from the inscriptions, some of which are dated. In this period the Romans made their one attempt at direct interference in the affairs of Arabia. The invasion under Aelius Gallus was an absolute failure, the expedition being betrayed by the guides and lost in the sands of the desert. During the latter part of this time the Abyssinians, who had earlier migrated from Arabia to the opposite coast of Africa, began to flow back to the south of Arabia, where they seem to have settled gradually and increased in importance until about A.D. 300, when they became strong enough to overturn the Himyarite kings and establish a dynasty of their own. The title assumed by them was "king of Saba, Raidān, Hadramut and Yemen." The Himyarites were, however, still active, and after a struggle succeeded in establishing a Jewish Sabaean kingdom, having previously accepted Judaism as their religion. Their best-known king was Dhu Nuwās. The struggle between them and the Abyssinians now became one of Judaism against Christianity. The persecution of the Christians was very severe (see E. Glaser's *Die Abyssinier in Arabien und Afrika*, Munich, 1895, and F. M. E. Pereira's *Historia dos Martyres de Nagran*, Lisbon, 1899). Apparently for this reason Christian Abyssinia was supported from Byzantium in its attempts to regain power. These attempts were crowned with success in 525. Of the Christian Abyssinian kings in Arabia tradition tells of four, one only of whom is mentioned in inscriptions. The famous expedition of Abraha, the Abyssinian viceroy, against Mecca, took place in 570. Five years later the Persians, who had been called in by the opponents of Christianity, succeeded in taking over the rule and in appointing governors over Yemen. (See further ETHIOPIA: *The Axumite Kingdom.*)

Hīra, Ghassān and Kinda.—Before passing to the time of Mahomet it is necessary to take account of three other Arabian powers, those of Hīra, Ghassān and Kinda.

Hira.

The kingdom of Hira (Ḥīra) was established in the boundary land between the Euphrates and the Arabian desert, a district renowned for its good air and extraordinary fertility. The chief town was Hīra, a few miles south of the site of the later town of Kufa. The inhabitants of this land are said in Ṭabari's history to have been of three classes:—(1) The Tanukh (Tnuhs), who lived in tents and were made up of Arabs from the Tehama and Nejd, who had united in Bahrein to form a new tribe, and who migrated from there to Hīra, probably at the beginning or middle of the 3rd century A.D., when the Arsacid power was growing weak. The Arabian historians relate their conflict with Zenobia. (2) The ʽIbād or ʽIbādites, who dwelt in the town of Hīra in houses and so led a settled life. These were Christians, whose ecclesiastical language was Syriac, though the language of intercourse was Arabic. A Christian bishop of Hīra is known to have attended a synod in 410. In the 5th century they became Nestorians. (3) Refugees of various tribes, who came into the land but did not belong to the Tanukh or the ʽIbād. There is no trustworthy information as to the earlier chiefs of this people. The dynasty of the Lakhmids, famed in Arabian history and literature, arose towards the end of the 3rd century and lasted until about 602. The names of twenty kings are given by Hishām al-Kalbī in Ṭabari's history. Although so many of their subjects were Christian, the Lakhmids remained heathen until Nu'mān, the last of the dynasty. The kingdom of Hīra was never really independent, but always stood in a relation of dependence on Persia, probably receiving pay from it and employing Persian soldiers. At the height of its power it was able to render valuable aid to its suzerain. Much of its time was spent in wars with Rome and Ghassān. Its revenues were derived from the Bedouins of the surrounding lands as well as from its own subjects at home. About 602 the


ARABIA
Scale, 1:13,000,000
English Miles
0 50 100 200 300 400
Railways
Principal Capitals (States and larger Provinces)
Capitals of smaller Provinces Governorships, Districts &c.
Sand Deserts
Lava Beds (Harra)
Pilgrim and Trade Routes
Swamps
ADEN AND VICINITY
Scale, 1:7,500,000
English 0 20 40 60 80 100 120 Miles
Longitude East 36° of Greenwich
MEDITERRANEAN SEA
Alexandria
Rosetta
Nile Delta
Damietta
Port Said
el-Arish
Er Rafa
Jaffa
Haifa
Beirut
Damascus
Tadmur
Jerusalem
Dead Sea
Tanta
Cairo
Giza
Sakkara
Birket el-Kerun
Medinet el-Fayum
Suez
Ismailieh
Nakhl
Peninsula of Tih
Akaba
Lower Egypt
Upper Egypt
Egypt
Assiut
Sohag
Kena
Luxor
Esna
Edfu
Kom Ombo
Assuan
1st Cataract
el Kharga
Kharga Oasis
Kurkur Oasis
Kosseir
Abu Simbel
Korosko
Wadi Halfa
2nd Cataract
ANGLO-EGYPTIAN SUDAN
Nubian Desert
Port Sudan
Suakin
Tokar
El Teb
Massawa
Asmara
Dahlak Is.
ERITREA
ABYSSINIA
RED SEA
Palestine
Syrian Desert
(Badiet esh-Sham)
Hamad or Stony Desert
Wadi Sirhan
Hauran
Wadi Hauran
Kaf
Itari
Sakaka
Kara
Jauf
Ma'an
Petra
Great Nafud or Red Desert
J. Abrak Rada
Haiyanía
El Hajra
Lina
Hisma
Dat el Haj
Tebuk
El Akhdar
Tema
Dar el Hamra
El Hajr
Medain Salih
El Ala
Muwela
Damgha
El-Wijh
Jubba
Hail
Shammar
Ayun
Khaibar
Harra
Medina
J. Radhwa
Yambu
Badr
Hunein
Ras Benas
Suwerkiya
Es Safina
Es Sed
Rabigh
Khulesa
Jidda
Mecca
Taif
Ras Rawaya
HEJAZ
NEJD
Kasim
Bureda
Aneza
Thuwerat
Suder
Majma
Zulfa
Jalajil
Wushm
Tuwem
Arid
Tuwek
Riad
Manfuha
Hauta
Harik
Sedus
Hula
El Kharfa
Aflaj
Yemama
W. Rumma
Wadi Rumma
J. Nir
Afif
Wadi Dawasir
Wadi Taraba
El Kura
Taraba
Asir
Makhwa
Kunfuda
Marsa Hali
Shamran
Haji
Ibba
Khamis Mishet
Manadir
Nejran
Makhlaf
Sada
Abu Arish
El Itwad
Farsan Islands
Kamaran I.
Lohaia
Hodeda
Bet-el-Fakih
Khamir
Amran
Sana
Marib
Jauf
Main
Khab
El Jail
Dhamar
Yarim
Udein
Taiz
Mokha
Perim I. (Br.)
Aden (British)
W. Bana
ADEN PROTECTORATE
YEMEN
Bedha
Gulf of Aden
Mesopotamia
Bagdad
Tigris
Euphrates
Kerbela
Babylon
Hillah
Nejef
Anah
Irak Arabi
Shat el Arab
Basra
Kuwet
Muhammera
Karun
Ram Hormuz
Dizful
Shuster
Khurramabad
Kashan
Isfahan
Behbehan
Bushire
PERSIA
Shiraz
L. Niriz
Saidabad
Jahrum
Lar
Bander Lingah
Bander Abbas
Minab
Jask
Jaz Morian Hamun
Rigan
Bampur
Geh
Chahbar
MAKRAN
Kangun
Persian Gulf
EL HASA
(Sanjak of Nejd)
(El) Katif
Bahrein Is.
G. of Bahrein
el Katr
Uker
Mubariz
(El) Hofuf
El Bidia
Khor el Odeid
Abu Dhabi
Sharja
Pirate Coast
Jewasimi
Dhahira
Birema
Straits of Hormuz
Ras Musandam
Ras el Jebel
Shinas
Sohar
Batina
Gulf of Oman
Barka
Sib
Matrah
Muscat
Kuryat
Nakhl
Rustak
Jebel Akhdar
Semail
Nizwa
Semed
Ibra
W. Bidiya
W. Betha
Sur
Ras el Had
OMAN
Dahna Desert
(Ruba el Khali)
Masira I.
Masira Gulf
Ras Madraka
Saukira Bay
Halana
Kuria Muria Is. (Brit.)
Mahra
Gara
Dhafar
El Hafa
Kamar Bay
Ras Fartak
Kishin
Sihut
Raida
Kusair
Shihr
Mukalla
Balhal
HADRAMAUT
Wadi Hadramaut
Shibam
Saiyun
Hajrin
Shabwa
el Hauta
Katan
Nisab
El Hajar
Nakib
ARABIAN SEA
Sokotra
Shukra
Lahej
Sheikh Said
Str. of Bab-el-Mandeb
J. Kharaz
Ras Sunailah
Shamshan
Rauda
Menakha
Rada
Ibb
Jibla
Zubed
Hes
Behan
Awalik
Yafa
W. Tuban
Dhala
A B C D E F G H I
1 2 3 4 5 6
32° 36° 40° 44° 45° 48° 52° 56° 60°
32° 28° 24° 20° 16° 13°

Emery Walker sc.

Lakhmid dynasty fell, and the Persian Chosroes (Khosrau) II. appointed as governor an Arab of the tribe of Tāi. Shortly after it came into relation with Islam.

See G. Rothstein's *Die Dynastie der Lakhmiden in al-Hira* (Berlin, 1899); Th. Nöldeke's *Geschichte der Perser und Araber zur Zeit der Sassaniden* (Leiden, 1879).

Ghassân.

In the beginning of the 6th century A.D. a dynasty known as the Jafnids, enter into the history alike of the Roman and Persian empires. They ruled over the tribe of Ghassān in the extreme north-west of Arabia, east of the Jordan, from near Petra in the south to the neighbourhood of Rosāfa in the north-east. Of their origin little is known except that they came from the south. A part of the same tribe inhabited Yathrib (Medina) at the time of Mahomet. The first certain prince of the Jafnid house was Hārith ibn Jabala, who, according to the chronicle of John Malalas, conquered Mondhir (Mundhir) of Hīra in 528. In the following year, according to Procopius, Justinian perceived the value of the Ghassānids as an outpost of the Roman empire, and as opponents of the Persian dependants of Hīra, and recognized Hārith as king of the Arabs and patrician of the Roman empire. He was thus constantly engaged in battles against Hīra. In 541 he fought under Belisarius in Mesopotamia. After his death about 569 or 570 the friendly relations with the West continued, but about 583 there was a breach. The Ghassānid kingdom split into sections each with its own prince. Some passed under the sway of Persia, others preserved their freedom at the expense of their neighbours. At this point their history ceases to be mentioned in the Western chronicles. There are references to the Ghassānid Nu'mān in the poems of Nābigha. Arabian tradition tells of their prince Jabala ibn Aiham who accepted Islam, after fighting against it, but finding it too democratic, returned to Christianity and exile in the Roman empire. As Islam advanced, some of the Ghassānids retreated to Cappadocia, others accepted the new faith.

See Th. Nöldeke, *Die ghassanischen Fürsten aus dem Hause Gafna's* (Berlin, 1887).

Kinda.

In the last decade of the 5th century a new power arose in central Arabia. This was the tribe of Kinda under the sway of the family of Āqil ul Murār, who came from the south. They seem to have stood in much the same relation to the rulers of Yemen, as the people of Hīra to the Persians and the Ghassānids to Rome. Abraha in his invasion of the Hejaz was accompanied by chiefs of Kinda. Details of their history are not known, but they seem to have gained power at one time even over the Lakhmids of Hīra; and to have ruled over Bahrein as well as Yemama until the battle of Shi'b ul Jabala, when they lost this province to Hīra. The poet Amru'ul Qais was a member of the princely family of Kinda.

Other parts of Arabia.

Outside the territory of the powers mentioned above, Arabia in the 6th century was in a state of political chaos. Bahrein, inhabited chiefly by the Bani'Abd Qais and the Bani Bakr, was largely subject to Persian influence near its coast, and a Persian governor, Sebocht, resided in Hajar, its chief town. In Oman the Arabs, who were chiefly engaged in fishing and seafaring, were Azdites mixed with Persians. The ruling dynasty of Julanda in their capital Suhār lasted on till the Abbasid period. No Persian officials are mentioned in this country; whether Persians exercised authority over it is doubtful. On the west coast of Arabia the influence of the kingdom of Yemen was felt in varying degree according to the strength of the rulers of that land. Apart from this influence the Hejaz was simply a collection of cities each with its own government, while outside the cities the various tribes governed themselves and fought continual battles with one another.

Time of Mahomet.—Thus at the time of Mahomet's advent the country was peopled by various tribes, some more or less settled under the governments of south Arabia, Kinda, Hīra and Ghassān, these in turn depending on Abyssinia, Persia and Rome (*i.e.* Byzantium); others as in the Hejaz were ruled in smaller communities by members of leading families, while in various parts of the peninsula were wandering Arabs still maintaining the traditions of old family and tribal rule, forming no state, sometimes passing, as suited them, under the influence and protection of one or another of the greater powers. To these may be added a certain number of Jewish tribes and families deriving their origin partly from migrations from Palestine, partly from converts among the Arabs themselves. Mahomet appealed at once to religion and patriotism, or rather created a feeling for both. For Mahomet as a religious teacher and for the details of his career see MAHOMET. It is enough here to outline his actions in so far as he attempted to create a united, and then a conquering, Arabia. Though the external conquests of the Arabs belong more properly to the period of the caliphate, yet they were the natural outcome of the prophet's ideas. His idea of Arabia for the Arabians could only be realized by summoning the great kings of the surrounding nations to recognize Islam; otherwise Abyssinia, Persia and Rome (Byzantium) would continue their former endeavours to influence and control the affairs of the peninsula. Tradition tells that a few years before his death he did actually send letters to the emperor Heraclius, to the negus of Abyssinia, the king of Persia, and Cyrus, patriarch of Alexandria, the "Mukaukis" of Egypt, summoning them to accept Islam and threatening them with punishment in case of refusal. But the task of carrying out these threats fell to the lot of his successors; the work of the prophet was to be the subjugating and uniting of Arabia. This work, scarcely begun in Mecca, was really started after the migration to Medina by the formation of a party of men—the *Muhājirun* (Refugees or Emigrants) and the *Ansār* (Helpers or Defenders)—who accepted Mahomet as their religious leader. As the necessity of overcoming his enemies became urgent, this party became military. A few successes in battle attracted to him men who were interested in fighting and who were willing to accept his religion as a condition of membership of his party, which soon began to assume a national form. Mahomet early found an excuse for attacking the Jews, who were naturally in the way of his schemes. The Bani Nadīr were expelled, the Bani Quraiza slaughtered. By the time he had successfully stormed the rich Jewish town of Khaibar, he had found that it was better to allow industrious Jews to remain in Arabia as payers of tribute than to expel or kill them: this policy he followed afterwards. The capture of Mecca (630) was not only an evidence of his growing power, which induced Arabs throughout the peninsula to join him, but gave him a valuable centre of pilgrimage, in which he was able by a politic adoption of some of the heathen Arabian ceremonies into his own rites to win men over the more easily to his own cause. At his death in 623 Mahomet left Arabia practically unified. It is true that rival prophets were leading rebellions in various parts of Arabia, that the tax-collectors were not always paid, and that the warriors of the land were much distressed for want of work owing to the brotherhood of Arabs proclaimed by Mahomet. The tribes were a seething mass of restlessness, their old feuds ready to break out again. But they had realized that they had common interests. The power of the foreigner in Arabia was broken. Islam promised rich booty for those who fought and won, paradise for those who fell.

Early Caliphs.[1] 1. *Conquest.*—One task of the early caliphs was to find an outlet for the restless fighting spirit. Abu Bekr (632–634), the first of these caliphs, was a man of simple life and profound faith. He understood the intention of Mahomet as to foreign nations, and set himself resolutely to carry it out in the face of much difficulty. Hence as soon as he assumed office he sent out the army already chosen to advance against the Romans in the north. The successful reduction of the rebels in Arabia enabled him in his first year to send his great general Khālid with his Arab warriors first against Persians, then against Romans. His early death prevented him from seeing the fruits of his policy. Under the second caliph Omar (634–644) the Persians were defeated at Kadesiya (Kadessia), and Irak was completely subdued and the new cities of Kufa and Basra were founded (635). In the same year Damascus fell into the hands of the Arabs under Abu ʽUbaida. In 636 Jerusalem fell and received a visit from the caliph. Three years later the fateful step was taken of appointing Moawiya (Mu'awīyya) governor of Syria. In 640 ʽAmr-ibn-el-Ass (Amr ibn al-ʽĀs) invaded Egypt and the following year took Alexandria and founded Fostat (which later became Cairo). The victory at Nehavend in 641 over the Persians, the flight of the last Sassanid king and the capture of Rei or Rai (class. Rhagae) in 643 meant the entire subjugation of Persia and crowned the conquests of Omar's caliphate. The reign of the third caliph Othman (644–656) was marked by the beginning of that internal strife which was to ruin Arabia; but the foreign conquests continued. In the north the Moslem arms reached Armenia and Asia Minor; on the west they were successful as far as Carthage on the north coast of Africa. After the murder of Othman, ʽAli (656–661) became caliph, but Moawiya, governor of Syria, soon rebelled on the pretext of avenging the death of Othman. After the battle of Siffin (657) arbitration was resorted to for the settlement of the rival claims. By a trick ʽAli was deposed (658), and the Omayyad dynasty was established with its capital at Damascus.

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[1] For the general history of the succeeding period see CALIPHATE; EGYPT: *History*, § "Mahommedan."

Institution of navy.

During these early years the Arabs had not only made conquests by land, but had found an outlet for their energy at sea In 640 Omar sent a fleet of boats across the Red Sea to protect the Moslems on the Abyssinian coast. The boats were wrecked. Omar was so terrified by this that when Moawiya applied to him for permission to use ships for an attack on the islands of the Levant, he resolutely refused. Othman was less careful, and allowed a fleet from Africa to help in the conquests of the Levant and Asia Minor. In 649 he sanctioned the establishment of a maritime service, on condition that it should be voluntary. Abu Qais, appointed admiral, showed its usefulness by the capture of Cyprus. In 652 Abu Sarḥ with a fleet from Egypt won a naval battle over the Byzantine fleet near Alexandria.

2. *Internal Affairs.*—In the meantime what had become of Arabia and its unification? The first task of Abu Bekr had been to reduce those rebels who threatened to destroy that unity even before it was fully established. This he did by the aid of the great general Khālid. First he swept down on the Bani Hanīfa in Yemāma, who with their rival prophet Mosailama (Mosailima) and 40,000 men were in arms. The battle of Yemāma (633) was fierce and decisive. Mosailama was slain. The Bani Hanīfa returned to Islam. Bahrein was influenced by this battle, and the rebellion there, which was threatening, was crushed. Oman was reconquered by Huddhaifa, who became its governor. Ikrima settled Māhra. Muhājir, with the help of Ikrima, succeeded with difficulty, but thoroughly, in defeating Amr ibn Ma'dikārib and Qais ibn ʽAbd Yaghūth in Yemen and Ashath ibn Qais in Hadramut. The Hejaz and Tehama were cleared of the plundering nomads by ʽAttāb and Ṭāhir. At the end of the first year of his caliphate Abu Bekr saw Arabia united under Islam. The new national feeling demanded that all Arabs should be free men, so the caliph ordained that all Arab slaves should be freed on easy terms. The solidarity of Arabia survived the first foreign conquests. It was not intended that Arabs should settle in the conquered lands except as armies of occupation. Thus it was at first forbidden that Arabs should buy or possess land in these countries. Kūfa was to be only a military camp, as was Fostat in Egypt. The taxes with the booty from conquests were to be sent to Arabia for distribution among the Moslems. Omar tried to prevent the advance of conquests lest Arabia should suffer. "I would rather the safety of my people than thousands of spoil and further conquest." But men could not be prevented from pouring out from their homes in search of new conquests and more booty. Many of those who went forth did not return. They acquired property and rank in the new lands. Kūfa attracted chiefly men of south Arabia, Basra those of the north. Both became great cities, each with a population of 150,000 to 200,000 Arabians. Yet so long as the caliphs lived in Medina, the capital of Arabia was the capital of the expanding Arabian empire. To it was brought a large share of the booty. The caliphs were chosen there, and there the rules for the administration were framed. Thence went out the governors to their provinces. Omar was the great organizer of Arabian affairs. He compiled the Koran, instituted the civil list, regulated the military organization. He, too, desired that Mahomet's wish should be carried out and that Arabia should be purely Moslem. To this end he expelled the Christians from Nejrān and gave them lands in Syria and Irak, where they were allowed to live in peace on payment of tribute. The Jews, too, were shortly after expelled from Khaibar. The secondary position that Arabia was beginning to assume in the Arabian empire is clearly marked in the progress of events during the caliphate of Othmān. In his appointments to governorships and other offices, as well as in his distribution of spoil, Othmān showed a marked preference for the members of his own tribe the Koreish (Quraish) and the members of his own family the Bani Omayya (Umayya). The other Arab tribes became increasingly jealous of the Koreish, while among the Koreish themselves the Hāshimite family came to hate the Omayyad, which now had much power, although it had been among the last to accept Islam and never was very strict in its religious duties. But the quarrels which led to the murder of Othmān were fomented not so much in Arabia as in Kūfa and Baṣra and Fostat. In these cities the rival parties were composed of the most energetic fighting men, who were brought into the most intimate contact with one another, and who kept up their quarrels from the home land. In Kūfa a number of the Koreish had settled, and their arrogance became insupportable. The governors of all these towns were of Othmān's own family. After some years of growing dissatisfaction deputies from these places came to Medina, and the result was the murder of the caliph. Syria alone remained loyal to the house of Omayya, and Othmān had been advised to take refuge there, but had refused. Arabia itself counted for little in the strife. Yet its prestige was not altogether lost. After the murder the rebels were unwilling to return home until a new caliph had been chosen in the capital. The Egyptian rebels managed to gain most influence, and, in accordance with their desire, ʽAlī was appointed caliph by the citizens of Medina. But Medina itself was being corrupted by the constant influx of captives, who, employed at first as servants, soon became powerful enough to dictate to their masters. In the struggle that ensued upon the election of ʽAlī, Arabia was involved. Ayesha, Ṭalḥa and Zobair, who were strong in Mecca, succeeded in obtaining possession of Baṣra, but were defeated in 656 at the battle of the Camel (see ALI). In the south of Arabia ʽAlī succeeded in establishing his own governor in Yemen, though the government treasure was carried off to Mecca. But the centre of strife was not to be Arabia. When ʽAlī left Medina to secure Baṣra, he abandoned it as the capital of the Arabian empire. With the success of Moawiya Damascus became the capital of the caliphate (658) and Arabia became a mere province, though always of importance because of its possession of the two sacred cities Mecca and Medina. Both these cities were secured by Moawiya in 660, and at the same time Yemen was punished for its adherence to ʽAlī. The final blow to any political pretensions of Medina was dealt by the caliph when he had his son Yazīd declared as his successor, thus taking away any claim on the part of the citizens of Medina to elect to the caliphate.

The Omayyads.—The early years of the Omayyads were years of constant strife in Arabia. The Khārijites who had opposed ʽAlī on the ground that he had no right to allow the appeal to arbitration, were defeated at Nahrawān or Nahrwān (658), but those who escaped became fierce propagandists against the Koreish, some claiming that the caliph should be chosen by the Faithful from any tribe of the Arabs, some that there should be no caliph at all, that God alone was their ruler and that the government should be carried on by a council. They broke up into many sects, and were long a disturbing political force in Arabia as elsewhere. On the death of ʽAlī his house was represented by his two sons Ḥasan and Ḥosain (Ḥusain). Ḥasan soon made peace with Moawiya. On the accession of Yazid, Ḥosain refused homage and raised an army, but was slain at

Kerbela (680). ʿĀbdallah ibn Zobair (of the house of Hāshim) immediately stepped forward in Mecca as the avenger of ʿAlī's family and the champion of religion. The two sacred cities supported him. Medina was besieged and sacked by the troops of Yazīd (682) and Mecca was besieged the following year. The siege was raised in the third month on the news of the death of Yazīd, but not before the Kaʿba had been destroyed. ʿĀbdallah remained in Mecca recognized as caliph in Arabia, and soon after in Egypt and even a part of Syria. He defeated the troops of Merwān I., but could not win the support of the Khārijites. In 691 Abdalmalik (ʿAbdul-Malik) determined to crush his rival and sent his general Hajjāj against Mecca. The siege was begun in March 692, and in October the city was taken and ʿĀbdallah slain. Abdalmalik was now supreme in Arabia and throughout the Moslem world. During the remaining years of the Omayyad dynasty (*i.e.* until 750) little is heard of Arabia in history. The conquests of Islam in Spain on the one side and India on the other had little or no effect on it. It was merely a province.

The ʿAbbāsids.—The accession of Abul ʿAbbās (of the house of Hāshim) and the transference of the capital of the caliphate from Damascus to Kūfa, then Anbar and soon after (in 760) to Bagdad meant still further degradation to Arabia and Arabs. From the beginning the ʿAbbāsids depended for help on Persians and Turks, and the chief offices of state were frequently filled with foreigners. In one thing only the Arabs conquered to the end; that was in their language. The study of Arabic was taken up by lexicographers, grammarians and poets (mostly of foreign origin) with a zeal rarely shown elsewhere. The old Arabian war spirit was dying. Although the Arabians, as a rule, were in favour of the Omayyad family, they could not affect the succession of the ʿAbbāsids. They returned more and more to their old inter-tribal disputes. They formed now not only a mere branch of the empire of the caliphate, but a branch deriving little life from and giving less to the main stock. In 762 there was a rebellion in favour of a descendant of ʿAlī, but it was put down with great severity by the army of the caliph Manṣūr. A more local ʿAlyite revolt in Mecca and Medina was crushed in 785. In the contest between the two sons of Harūn al Rashīd all Arabia sided with Mamūn (812). In 845–846 the lawless raids of Bedouin tribes compelled the caliph Wāthiq to send his Turkish general Bogha, who was more successful in the north than in the centre and south of Arabia in restoring peace.

The Carmathians.—Towards the close of the 9th century Arabia was disturbed by the rise of a new movement which during the next hundred years dominated the peninsula, and at its close left it shattered never to be united again. In the year 880 Yemen was listening to the propaganda of the new sect of the Carmathians (*q.v.*) or followers of Hamdān Qarmaṭ. Four years later these had become a public force. In 900 ʿAbū Saʿīd al-Jannābi, who had been sent to Bahrein by Hamdān, had secured a large part of this province and had won the city of Kaṭīf (Ketif) which contained many Jews and Persians. The Arabs who lived more inland were mostly Bedouin who found the obligations of Islam irksome, and do not seem to have made a very vigorous opposition to the Carmathians who took Hajar the capital of Bahrein in 903. From this they made successful attacks on Yemāma (Yamama), and attempts only partially successful at first at Oman. In 906 the court at Bagdad learned that these sectaries had gained almost all Yemen and were threatening Mecca and Medina. Abū Saʿīd was assassinated (913) in his palace at Laḥsa (which in 926 was fortified and became the Carmathian capital of Bahrein). His son Saʿīd succeeded him, but proved too weak and was deposed and succeeded by his brother Abu Ṭāhir. His success was constant and the caliphate was brought very low by him. In Arabia he subjugated Oman, and swooping down on the west in 929 he horrified the Moslem world by capturing Mecca and carrying off the sacred black stone to Bahrein. The Fatimite caliph ʿObaidallah (see FATIMITES), to whom Abu Ṭāhir professed allegiance, publicly wrote to him to restore the stone, but there is some reason to believe that he secretly encouraged him to retain it. In 939, however, the stone was restored and pilgrimages to the holy cities were allowed to pass unmolested on payment of a tax. So long as Abū Ṭāhir lived the Carmathians controlled Arabia. After his death, however, they quarrelled with the Fatimite rulers of Egypt (969) and began to lose their influence. In 985 they were completely defeated in Irak, and soon after lost control of the pilgrimages. Oman recovered its independence. Three years later Kaṭīf, at that time their chief city, was besieged and taken by a Bedouin sheik, and subsequently their political power in Arabia came to an end. It was significant that their power fell into the hands of Bedouins. Arabia was now completely disorganized, and was only nominally subject to the caliphate. The attempt of Mahomet to unify Arabia had failed. The country was once more split up into small governments, more or less independent, and groups of wandering tribes carrying on their petty feuds. Of the history of these during the next few centuries little is known, except in the case of the Hejaz. Here the presence of the sacred cities led writers to record their annals (cf. F. Wüstenfeld's *Die Chroniken der Stadt Mekka*, 4 vols., Leipzig, 1857–1861). The two cities were governed by Arabian nobles (*sherīfs*), often at feud with one another, recognizing formally the overlordship of the caliph at Bagdad or the caliph of Egypt. Thus in 966 the name of the caliph Moti was banished from the prayers at Mecca, and an ʿAlyite took possession of the government of the city and recognized the Egyptian caliph as his master. About a century later (1075–1094) the ʿAbbāsid caliph was again recognized as spiritual head owing to the success in arms of his protector the Seljuk Malik-Shah. With the fall of the Bagdad caliphate all attempts at control from that quarter came to an end. After the visit of the Sultan Bibars (1269) Mecca was governed by an amir dependent on Egypt. Outside the two cities anarchy prevailed, and the pilgrimage was frequently unsafe owing to marauding Bedouins. In 1517 the Osmānlī Turkish sultan Selīm conquered Egypt, and having received the right of succession to the caliphate was solemnly presented by the sherīf of Mecca with the keys of the city, and recognized as the spiritual head of Islam and ruler of the Hejaz. At the same time Yemen, which since the 9th century had been in the power of a number of small dynasties ruling in Zubed, Sanʿā, Saʿda and Aden, passed into the hands of the Turk.

For the history of Yemen during this period cf. H. C. Kay, *Omarah's History of Yaman* (London, 1892), and S. Lane-Poole, *The Mahommedan Dynasties*, pp. 87-103 (Westminster, 1894). Little more than a century later (1630), a Yemen noble Khāṣim succeeded in expelling the Turk and establishing a native imāmate, which lasted until 1871. For descriptions of it in the 18th century cf. C. Niebuhr's accounts of his travels in Arabia in 1761.

Oman.—Since the separation from the caliphate (before 1000 A.D.) Oman had remained independent. For more than a century it was governed by five elected imāms, who were chosen from the tribe of al-Azd and generally lived at Nizwa. After them the Bani Nebhān gained the upper hand and established a succession of kings (*māliks*) who governed from 1154 to 1406. During this time the country was twice invaded by Persians. The "kings of Hormūz" claimed authority over the coast land until the beginning of the 16th century. In 1435 the people rose against the tyranny of the Bani Nebhān and restored the imāmate of the tribe al-Azd. In 1508 the Portuguese under Albuquerque seized most of the east coast of Oman. In 1624 a new dynasty arose in the interior, when Nāṣir ibn Murshid of the Yariba (Yaʿaruba) tribe (originally from Yemen) was elected imām and established his capital at Rustak. He was able to subdue the petty princes of the country, and the Portuguese were compelled to give up several towns and pay tribute for their residence at Muscat. About 1651 the Portuguese were finally expelled from this city, and about 1698 from the Omanite settlements on the east coast of Africa.

For the history of Oman from 661 to 1856 cf. G. P. Badger, *History of the Imāms and Seyyids of Oman by Salil-ibn-Razik* (London, Hakluyt Society, 1871).

(G. W. T.)

Wahhābi Movement.—Modern Arabian history begins with that of the Wahhābi movement in the middle of the 18th century. Its originator, Mahommed Ibn Abdul Wahhāb, was born (1691) at Ayana in Nejd, and after studying in Basra and Damascus, and making the pilgrimage to Mecca returned to his native country and settled down at Huremala near Deraiya. The abuses and corruptions which had overgrown the practice of orthodox Islam had deeply impressed him, and he set to work to combat them, and to inculcate on all good Moslems a return to the pure simplicity of their original faith. In 1742 Mahommed Ibn Saūd, sheik of Deraiya, accepted his doctrines, and enforced them by his sword with such effect that before his death in 1765 the whole of eastern Nejd and El Hasa was converted to the faith of Abdul Wahhāb, and accepted the political supremacy of Ibn Saūd. His son and successor, Abdul Aziz, in a rapid series of successful campaigns, extended his dominion and that of the reformed faith far beyond the limits of Nejd. His attacks on the pilgrim caravans, begun in 1783 and constantly repeated, startled the Mahommedan world,[1] and compelled the attention of the sultan, as the nominal protector of the faithful. In 1798 a Turkish force was sent from Bagdad into El Hasa, but was compelled to retreat without accomplishing anything, and its discomfiture added much to the renown of the Wahhābi power. In 1801 Saūd, son of the amir Abdul Aziz, led an expedition to the Euphrates, and on the festival of Bairam, the 20th of April, stormed Kerbela, put the defenders to the sword, destroyed the sacred tomb, scattered the sacred relics and returned laden with the treasures, accumulated during centuries in the sanctuary of the Shiā faith. Mecca itself was taken; plundering was forbidden, but the tombs of the saints and all objects of veneration were ruthlessly destroyed, and all ceremonies which seemed in the eye of the stern puritan conqueror to suggest the taint of idolatry were forbidden.

On the 14th of October 1802 the amir Abdul Aziz, at the age of eighty-two years, was murdered by a Shiā fanatic when at prayers in the mosque of Deraiya, and Saūd, who had for many years led the Wahhābi armies, became the reigning amir. In 1804 Medina was taken and with its fall all resistance ceased. The Wahhābi empire had now attained its zenith, a settled government was established able to enforce law and order in the desert and in the towns, and a spirit of Arabian nationality had grown up which bade fair to extend the Wahhābi dominion over all the Arab race. It already, however, bore within it the germ of decay; the accumulation of treasure in the capital had led to a corruption of the simple manners of the earlier times; the exhaustion of the tribes through the heavy blood tax had roused discontent among them; the plundering of the holy places, the attacks on the pilgrim caravans under the escort of Turkish soldiers, and finally, in 1810, the desecration of the tomb of Mahomet and the removal of its costly treasures, raised a cry of dismay throughout the Mahommedan world, and made it clear even to the Turkish sultan that unless the Wahhābi power were crushed his claims to the caliphate were at an end.

But Turkey was herself fully occupied by affairs in Europe, and to Mehemet Ali, then pasha of Egypt, was deputed the task of bringing the Wahhābis into subjection. In October 1811 an expedition consisting of 10,000 men under Tusun Pasha, the pasha's son, a youth of sixteen, landed in Hejaz without opposition. Saūd with his main forces had started northwards to attack Bagdad, but returning at once he met and defeated Tusun with great loss and compelled him to retire. Medina and subsequently Mecca were eventually taken by the Egyptians, but in spite of continual reinforcements they could do little more than hold their own in Hejaz. In 1813 Mehemet Ali was compelled to take the field himself with fresh troops, but was unable to achieve any decisive success, and in 1814 Tusun was again defeated beyond Taif. In May 1814 Saūd died, and his son, Ābdallah, attempted to negotiate, but Mehemet Ali refused all overtures, and in January 1815 advanced into Nejd, defeated the Wahhābi army and occupied Ras, then the chief town in Kasim. Terms of peace were made, but on the retirement of the Egyptians Ābdallah refused to carry out the conditions agreed on, which included the return of the jewels plundered by his father, and another campaign had to be fought before his submission was obtained. Ibrahim Pasha replaced Tusun in command, and on reaching Arabia in September 1816 his first aim was to gain over the great Bedouin tribes holding the roads between Hejaz and his objective in Nejd; having thus secured his line of advance he pushed on boldly and defeated Ābdallah at Wiya, where he put to death all prisoners taken; thence rapidly advancing, with contingents of the friendly Harb and Mutēr tribes in support of his regular troops, he laid siege to Ras; this place, however, held out and after a four months' siege he was compelled to give up the attack. Leaving it on one side he pushed on eastwards, took Aneza after six days' bombardment and occupied Bureda. Here he waited two months for reinforcements, and with his Bedouin contingent, strengthened by the adhesion of the Āteba and Bani Khālid tribes, advanced on Shakra in Wushm, which fell in January 1818 after a regular siege. After destroying Huremala and massacring its inhabitants, he arrived before Deraiya on the 14th of April 1818. For six months the siege went on with varying fortune, but at last the courage and determination of Ibrahim triumphed, and on the 9th of September, after a heroic resistance, Ābdallah, with a remnant of four hundred men, was compelled to surrender. The Wahhābi leader was soon after sent to Constantinople, where, in spite of Mehemet Ali's intercession, he and the companions who had followed him in his captivity were condemned to death, and after being paraded through the city with ignominy for three days were finally beheaded.

Deraiya was razed to the ground and the principal towns of Nejd were compelled to admit Egyptian garrisons; but though the Arabs saw themselves powerless to stand before disciplined troops, the Egyptians, on the other hand, had to confess that without useless sacrifices they could not retain their hold on the interior.

In 1824 Turki, son of the unfortunate Ābdallah, headed a rising which resulted in the re-establishment of the Wahhābi state with Riad as its new capital; and during the next ten years he consolidated his power, paying tribute to and under the nominal suzerainty of Egypt till his murder in 1834. His son, Fēsal, succeeded him, but in 1836 on his refusal to pay tribute an Egyptian force was sent to depose him and he was taken prisoner and sent to Cairo, while a rival claimant, Khalid, was established as amir in Riad. Mehemet Ali and his son Ibrahim Pasha were, however, now committed to their conflict with Turkey for Syria and Asia Minor, and had no troops to spare for the thankless task of holding the Arabian deserts; the garrisons were gradually withdrawn, and in 1842 Fēsal, who had escaped from his prison at Cairo reappeared and was everywhere recognized as amir. The few remaining Egyptian troops were ejected from Riad, and with them all semblance of Egyptian or Turkish rule disappeared from central Arabia.

For a time it looked as if the supremacy of the Wahhābi empire was to be renewed; El Hasa, Harik, Kasim and Asir returned to their allegiance, but over Oman and Yemen Fēsal never re-established his dominion, and the Bahrein sheiks with British support kept their independence.

Ibn Rashid.

A rival state had, however, arisen, under Ābdallah Ibn Rashid in Jebel Shammar. Driven into exile owing to a feud between his family and the Ibn Āli, the leading family of the Shammar, Ābdallah came to Riad in 1830, and was favourably received by the amir Turki. In 1834 he was with Fēsal on an expedition against El Hasa when news came of the amir's murder by his cousin Mashārah. By Ābdallah's advice the expedition was abandoned; Fēsal hastened back with all his forces to Riad, and invested the citadel where Mashārah had taken refuge, but failed to gain possession of it, until Ābdallah with two companions found his way into the palace, killed Mashārah, and placed Fēsal on the throne of his father. As a reward for his services Ābdallah was appointed governor of Jebel Shammar, and had already established himself in Hail when the Egyptian expedition of 1836 removed Fēsal temporarily from Nejd. During the exile of the latter he steadily consolidated his power, extending his influence more especially over the desert tribes, till on Fēsal's return in 1842 he had created a state subject only in name to that of which Riad was the capital.

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[1] For further details of this period, see EGYPT: *History*, "Mahommedan Period," § 8.

On the death of Ābdallah in 1843, his son Talāl succeeded. He set himself to work to establish law and order throughout the state, to arrange its finances, and to encourage the settlement in Hail of artificers and merchants from abroad; the building of the citadel and palace commenced by Mehemet Ali, and continued by Ābdallah Ibn Rashid, was completed by Talāl. The town walls were strengthened, new wells dug, gardens planted, mosques and schools built. His uncle Obed, to whom equally with Ābdallah is due the foundation of the Ibn Rashid dynasty, laboured to extend the Shammar boundaries. Khaibar, Tema and Jauf became tributary to Hail.

Though tolerant in religion Talāl was careful to avoid the suspicion of lukewarmness towards the Wahhābi formulas. Luxury in clothing and the use of tobacco were prohibited; attendance at the mosque was enforced: any doubt as to his orthodoxy was silenced by the amount and regularity of the tribute sent by him to Riad. Equally guarded was his attitude to the Turkish authorities; it is not improbable that Talāl had also entered into relations with the viceroy of Egypt to ensure his position in case of a collision with the Porte. During his twenty years' reign Jebel Shammar became a model state, where justice and security ruled in a manner before unheard of. Fēsal may well have watched with jealous anxiety the growing strength of his neighbour's state as compared with his own, where all progress was arrested by the deadening tyranny of religious fanaticism.

The amir Mahommed.

On the 11th of March 1868 Talāl, smitten with an incurable malady, fell by his own hand and was succeeded by his brother Matāb; after a brief reign he was murdered by his nephews, the elder of whom, Bandar, became amir. Mahommed, the third son of the amir Ābdallah, was at the time absent; with a view of getting his uncle into his power, Bandar invited him to return to Hail, and on his arrival went out to meet him accompanied by Hamud, son of Obed, and a small following. Warned by a hurried sign by Hamud that his life was in danger, Mahommed at once attacked Bandar, stabbed him and took possession of the citadel; a general massacre of all members of the house of Ibn Rashid followed, and next day Mahommed appeared with his cousin Hamud in the market-place of Hail, and announced his assumption of the amirship. A strong and capable ruler, he soon established his authority over all northern and western Nejd, and in 1872 the opportunity arrived for his intervention in the east. In that year Ābdallah, who had succeeded Fēsal in Riad in 1867, was deposed, but with the assistance of Mahommed was reinstated; two years later, however, he was again deposed and forced to seek refuge at Hail, from which place he appealed for assistance to the Turkish authorities at Bagdad. Midhat Pasha, then governor-general, seized the occasion of asserting Turkish dominion on the Persian Gulf coast, and in 1875, in spite of British protests, occupied El Hasa and established a new province under the title of Nejd, with its headquarters at Hofuf, of which Ābdallah was appointed governor. This was an event of some importance, as it consituted the first Turkish claim to the sovereignty over Nejd abandoned by Egypt thirty-three years earlier. The Turks did not support their client by advancing into Nejd itself, and he and his rivals were left to fight out their battles among themselves. Turkey was indeed too much occupied by the war with Russia to pay much attention to Arab affairs, though a few years later she attempted to occupy Bahrein by a *coup de main*, which was only frustrated by the action of a British gunboat.

Owing to the dissensions among the ruling family of Riad, the towns of eastern Nejd gradually reverted to their former condition of independence, but menaced in turn by the growing power of Hail, they formed a coalition under the leadership of Zāmil, sheik of Aneza, and in the spring of 1891, Aneza, Bureda, Shakra, Ras and Riad assembled their contingents to contest with Ibn Rashid the supremacy in Nejd. The latter had besides 20,000 of his own south Shammar tribesmen, the whole strength of the Harb Bedouins, some 10,000 men, and an additional support of 1000 mounted men from his kinsmen, the northern Shammar from the Euphrates, while the Muter and Āteba tribes took part with the allies. The total strength of each side amounted to about 30,000 men. Zāmil's forces held a strong position between Aneza and Bureda, and for over a month desultory fighting went on; finally an attack was made against the defenders' centre, covered by 20,000 camel riders; the men of Aneza broke and the whole allied forces fled in disorder; Zamil and his eldest son were killed, as were also two of the Ibn Saūd family, while the remainder were taken prisoners. Aneza and Bureda surrendered the same day, and shortly after Ras, Shakra and Riad tendered their submission.

This victory placed the whole of northern and central Arabia under the supremacy of Mahommed Ibn Rashid, which he held undisputed during the rest of his life.

Recent history.

On his death in 1897 his nephew Abdul-Aziz, son of the murdered amir Matāb, succeeded; during his reign a new element has been introduced into Nejd politics by the rising importance of Kuwet (Koweit) and the attempts of Turkey to obtain possession of its important harbour. In 1901 a quarrel arose between Sheik Mubārak of Kuwet and the amir of Hail whose cause was supported by Turkey. A force was equipped at Basra under Ahmad Feizi Pasha with the intention of occupying Kuwet; Mubārak thereupon appealed to Great Britain and action was taken which prevented the Turkish designs from being carried out. Kuwet was not formally placed under British protection, but it was officially announced by the government on the 5th of May 1903 "that the establishment of a naval base or fortified port in the Persian Gulf by any other power would be regarded as a very grave menace to British interests which would certainly be resisted with all the means at its disposal."

In the meantime Sheik Mubārak had found useful allies in the Muntafik Arabs from the lower Euphrates, and the Wahhābis of Riad; the latter under the amir Ibn Saūd marched against Ibn Rashid, who at the instigation of the Porte had again threatened Kuwet (Koweit), compelled him to retire to his own territory and took possession of the towns of Bureda and Aneza. Sheik Mubārak and his allies continued their advance, defeated Ibn Rashid in two engagements on the 22nd of July and the 26th of September 1904, and drove him back on his capital, Hail. The Porte now made another effort to assist its protégé; two columns were despatched from Medina and Basra respectively, to relieve Hail, and drive out the Wahhābis. Ahmad Feizi Pasha, in command of the Basra column, 4200 strong, crossed the desert and reached the wells of Lina, 200 m. from Hail, on the 5th of March 1905; here, however, he received orders to halt and negotiate before proceeding farther. The Turkish government realized by this time the strength of the hostile combination, and in view of the serious state of affairs in Yemen, hesitated to undertake another campaign in the deserts of Nejd. Arrangements were accordingly made with the Wahhābis, and on the 10th of April Ahmad Feizi Pasha left Lina, ostensibly with the object of protecting the pilgrim road, and joined the Medina column by the end of the month. Bureda and Aneza were occupied without opposition, the rebellious sheiks amnestied by the sultan and loaded with gifts, and formal peace was made between the rival factions.

History of European influence.

European influence was not felt in Arabia until the arrival of the Portuguese in the eastern seas, following on the discovery of the Cape route. In 1506 Hormuz was taken by Albuquerque, and Muscat and the coast of Oman (*q.v.*) were occupied by the Portuguese till 1650. In 1516 their fleets appeared in the Red Sea and an unsuccessful attempt was made against Jidda; but the effective occupation of Yemen by the Turks in the next few years frustrated any designs the Portuguese may have had in S.W. Arabia. Even in Oman their hold on the country was limited to Muscat and the adjacent ports, while the interior was ruled by the old Yāriba

British intervention in Oman.

(Ya-'aruba) dynasty from their capital at Rustak. The Persian occupation, which followed that of the Portuguese, came to an end in the middle of the 18th century, when Ahmad Ibn Sāid expelled the invaders and in 1759 established the Ghafari dynasty which still reigns in Oman. He was succeeded by his son, who in 1798 made a treaty with the East India Company with the object of excluding the French from Oman, and the connexion with Great Britain was further strengthened during the long reign of his grandson Sultan Sāid, 1804–1856. During the earlier years of his reign he was constantly at war with the Wahhābi empire, to which Oman became for a time tributary. The piracies committed by the Jawāsimi Arabs in the gulf compelled the intervention of England, and in 1810 their strongholds were destroyed by a British-Indian expedition. The overthrow of the Wahhābis in 1817 restored Sultan Sāid to independence; he equipped and armed on Western models a fleet built in Indian ports, and took possession of Sokotra and Zanzibar, as well as the Persian coast north of the straits of Hormuz as far east as Gwadur, while by his liberal policy at home Sohar, Barka and Muscat became prosperous commercial ports.

On his death in 1856 the kingdom was divided, Majīd, a younger son, taking Zanzibar, while the two elder sons contested the succession to Oman. The eldest, Thuwēni, with British support, finally obtained the throne, and in 1862 an engagement was entered into by the French and English governments respecting the independence of the sultans of Oman. He was assassinated in 1866, and his successor, Seyyid Turki, reigned till 1888. On his death several claimants disputed the succession; ultimately his son Fēsal was recognized by the British government, and was granted a subsidy from British-Indian revenues, in consideration of which he engaged not to cede any of his territory without the consent of the British government; similar engagements have been entered into by the tribes who occupy the south coast from the borders of Oman westward to the straits of Bab-el-Mandeb.

British sphere of influence.

The opening of the overland route to India again brought the west coast of Arabia into importance. Aden was occupied by the British in 1839. The Hejaz coast and some of the Yemen ports were still held by Mehemet Ali, as viceroy of Egypt, but on his final withdrawal from Arabia in 1845, Hejaz came under direct Turkish rule, and the conquest of Yemen in 1872 placed the whole Red Sea littoral (with the exception of the Midian coast, ceded by Egypt on the accession of Abbas Hilmi Pasha) under Ottoman administration. The island of Perim at the southern entrance of the Red Sea has been a British possession since 1857, while the promontory of Shekh Said on the Arabian side of the strait is in Turkish occupation. In order to define the limits between Turkish territory and that of the independent Arab tribes in political relations with Great Britain, a joint commission of British and Turkish officers in 1902–1905 laid down a boundary line from Shekh Said to a point on the river Bana, 12 m. north-east of the small town of Kataba, from which it is continued in a north-easterly direction up to the great desert. This delimitation places the whole of southern Arabia, east of this line, within the British sphere of influence, which thus includes the district surrounding Aden (*q.v.*), the Hadramut and Oman with its dependencies.

Turkish rule.

The provinces of Hejaz and Yemen are each administered by a Turkish governor-general, with headquarters at Taif and Sana respectively; the country is nominally divided up into divisions and districts under minor officials, but Turkish rule has never been acquiesced in by the inhabitants, and beyond the larger towns, all of which are held by strong garrisons, Turkish authority hardly exists. The powerful Bedouin tribes of Hejaz have always asserted their independence, and are only kept quiet by the large money payments made them by the sultan on the occasion of the annual pilgrimage to the holy cities. A large part of Asir and northern Yemen has never been visited by Turkish troops, and such revenues as are collected, mainly from vexatious customs and transit duties, are quite insufficient to meet the salaries of the officials, while the troops, ill-fed and their pay indefinitely in arrears, live on the country as best they can.

Yemen revolt.

A serious revolt broke out in Yemen in 1892. A Turkish detachment collecting taxes in the Bani Merwan lands north of Hodeda was destroyed by a body of Arabs. This reverse set all Yemen aflame; under the leadership of the imām, who had, since the Turkish occupation, lived in retirement at Sada, 120 m. north of the capital, the powerful tribes between Asir and Sana advanced southwards, occupied the principal towns and besieged the few Turkish fortified posts that still held out. In many cases the garrisons, Arab troops from Syria, went over to the insurgents. Meanwhile, reinforcements under General Ahmad Feizi Pasha reached Hodeda, Manakha was retaken, Sana relieved, and by the end of January 1893 the country with the exception of the northern mountainous districts was reconquered.

A state of intermittent rebellion, however, continued, and in 1904 a general revolt took place with which the normal garrison of Yemen, the 7th army corps, was quite unable to cope. The military posts were everywhere besieged, and Sana, the capital, was cut off from all communication with the coast. During February 1905 reinforcements were sent up which raised the garrison of Sana to a strength of eight battalions, and in March a further reinforcement of about the same strength arrived, and fought its way into the capital with the loss of almost all its guns and train. The position was then desperate, wholesale desertion and starvation had decimated the garrison, and three weeks later Ali Riza Pasha, the Turkish commander, was compelled to surrender. The fall of Sana made a deep impression at Constantinople, every effort was made to hasten out reinforcements, the veteran Ahmad Feizi Pasha was nominated to the supreme command, and Anatolian troops in place of the unreliable Syrian element were detailed. The scale of the operations may be judged from the fact that the total number of troops mobilized up to the beginning of July 1905 amounted to 126 battalions, 8 squadrons and 15 batteries; the rebel leader Mahommed Yahiya had at this time a following of 50,000.

By the end of June, Ahmad Feizi Pasha was in a position to advance on Manakha, where he organized an efficient transport, rallied the scattered remnants of Ali Riza's army, and with the newly arrived troops had by the middle of July a force of some 40 battalions available for the advance on Sana. He left Manakha on the 17th of July, and after almost daily fighting reached Sana on the 30th of August; on the 31st he entered the city without serious opposition, the insurgents having retreated northward.

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Literature

The literature of Arabia has its origin in the songs, improvisations, recitations and stories of the pre-Mahommedan Arabs. Of written literature in those days there was, so far as we know, none. But where books failed memory was strong and the power of retaining things heard was not confined to a professional class. At every festive meeting many could contribute a poem or a story, many could even improvise the one or the other. When members of different tribes met in peace (as at the fair of ʽUkāẓ) the most skilful reciters strove to maintain the honour of their own people, and a ready improviser was held in high esteem. The smartest epigrams, the fairest similes, the keenest satires, spoken or sung on such occasions, were treasured in the memory of the hearers and carried by them to their homes. But the experience of all peoples in that memory requires to be helped by form. Sentences became balanced and were made clear by some sort of definite ending. The simplest form of this in Arabian literature is the *sajʽ* or rhymed prose, in which the sentences are usually (though not always) short and end in a rhyme or assonance. Mahomet used this form in many parts of the Koran (*e.g. Sura*, 81). The next step was the introduction of metre into the body of the sentence and the restriction of the passages to a definite length. This in its simplest form gave rise to the *rajaz* verses, where each half-line ends in the same rhyme and consists of three feet of the measure ⏓ – ⏑ –. Other metres were introduced later until sixteen altogether were recognized. In all forms the rhyme is the same throughout the poem, and is confined to the second half of the line except in the first line where the two halves rhyme. While, however, these measures were in early use, they were not systematically analysed or their rules enunciated until the time of Khalīl ibn Aḥmad in the 8th century. Two other features of Arabian poetry are probably connected with the necessity for aiding the memory. The first of these is the requirement that each line should have a complete sense in itself; this produces a certain jerkiness, and often led among the Arabs to displacement in the order of the lines in a long poem. The other feature, peculiar to the long poem (*qasīda*, elegy), is that, whatever its real object, whatever its metre, it has a regular scheme in the arrangement of its material. It begins with a description of the old camping-ground, before which the poet calls on his companion to stop, while he bewails the traces of those who have left for other places. Then he tells of his love and how he had suffered from it, how he had journeyed through the desert (this part often contains some of the most famous descriptions and praises of animals) until his beast became thin and worn-out. Then at last comes the real subject of the poem, usually the panegyric of some man of influence or wealth to whom the poet has come in hope of reward and before whom he recites the poem.

Poetry.—The influence of the poet in pre-Mahommedan days was very great. As his name, *ash-Shāʽir*, "the knowing man," indicates, he was supposed to have more than natural knowledge and power. Panegyric and satire (*hijāʽ*) were his chief instruments. The praise of the tribe in well-chosen verses ennobled it throughout the land, a biting satire was enough to destroy its reputation (cf. I. Goldziher's *Abhandlungen zur arabischen Philologie*, i. pp. 1-105). Before Mahomet the ethics of the Arabs were summed up in *muruwwa* (custom). Hospitality, generosity, personal bravery were the subjects of praise; meanness and cowardice those of satire. The existence of poetry among the northern Arabs was known to the Greeks even in the 4th century (cf. St Nilos in Migne's *Patrologia Graeca*, vol. 79, col. 648, and Sozomen's *Ecclesiastical History*, bk. 6, ch. 38). Women as well as men composed and recited poems before the days of the Prophet (cf. L. Cheikho's *Poetesses of the Jāhilīyya*, in Arabic, Beirut, 1897).

The transmission of early Arabic poetry has been very imperfect. Many of the reciters were slain in battle, and it was not till the 8th to the 10th centuries and even later that the earliest collections of these poems were made. Many have to be recovered from grammars, dictionaries, &c., where single lines or groups of lines are quoted to illustrate the proper use of words, phrases or idioms. Moreover, many a reciter was not content to declaim the genuine verses of ancient poets, but interpolated some of his own composition, and the change of religion introduced by Islam led to the mutilation of many verses to suit the doctrines of the new creed.[1]

The language of the poems, as of all the best Arabian literature, was that of the desert Arabs of central Arabia; and to use it aright was the ambition of poets and scholars even in the Abbasid period. For the man of the towns its vocabulary was too copious to be easily understood, and in the age of linguistic studies many commentaries were written to explain words and idioms.

Of the pre-Mahommedan poets the most famous were the six whose poems were collected by Asmaʽī about the beginning of the 9th century (ed. W. Ahlwardt, *The Diwans of the Six Ancient Arabic Poets*, London, 1870). Single poems of four of these—Amru-ul-Qais, Ṭarafa, Zuhair and ʽAntara—appear in the Moʽallakat (*q.v.*). The other two were Nābigha (*q.v.*) and ʽAlqama (*q.v.*). But besides these there were many others whose names were famous; such as Taʽabbata Sharran, a popular hero who recites his own adventures with great gusto; his companion Shanfarā, whose fame rests on a fine poem which has been translated into French by de Sacy (in his *Chrestomathie Arabe*) and into English by G. Hughes (London, 1896); Aus ibn Hajar of the Bani Tamīn, famous for his descriptions of weapons and hunting scenes (ed. R. Geyer, Vienna, 1892); Ḥātim Tāʼi, renowned for his open-handed generosity as well as for his poetry (ed. F. Schulthess, Leipzig, 1897, with German translation); and ʽUrwa ibn ul-Ward of the tribe of ʽAbs, rival of Ḥātim in generosity as well as in poetry (ed. Th. Nöldeke, Göttingen, 1863). Among these early poets are found one Jew of repute, Samauʼal (Samuel) ibn Adiyā (cf. Th. Nöldeke's *Beiträge*, pp. 52-86; art. *s.v.* "Samuel ibn Adiya" in *Jewish Encyc.* and authorities there quoted), and some Christians such as ʽAdīʽibn Zaid of Hira, who sang alike of the pleasures of drink and of death (ed. by Louis Cheikho in his *Les Poètes arabes chrétiens*, pp. 439-474, Beirut, 1890; in this work many Arabian poets are considered to be Christian without sufficient reason). One poet, a younger contemporary of Mahomet, has attracted much attention because his poems were religious and he was a monotheist. This is Umayya ibn Abi-ṣ-Ṣalt, a Meccan who did not accept Islam and died in 630. His poems are discussed by F. Schulthess in the *Orientalische Studien* dedicated by Th. Nöldeke, Giessen, 1906, and his relation to Mahomet by E. Power in the *Mélanges de la faculté orientale de l'université Saint-Joseph*, Beirut, 1906). Mahomet's relation to the poets generally was one of antagonism because of their influence over the Arabs and their devotion to the old religion and customs. Kaʽb ibn Zuhair, however, first condemned to death, then pardoned, later won great favour for himself by writing a panegyric of the Prophet (ed. G. Freytag, Halle, 1823). Another poet, Aʽsha (*q.v.*), followed his example. Labīd (*q.v.*) and Hassān ibn Thābit (*q.v.*) were also contemporary. Among the poetesses of the time Khansa (*q.v.*) is supreme. In the scarcity of poets at this time two others deserve mention; Abū Mihjan, who made peace with Islam in 630 but was exiled for his love of wine, which he celebrated in his verse (ed. L. Abel, Leiden, 1887; cf. C. Landberg's *Primeurs arabes*, 1, Leiden, 1886), and Jarwal ibn Aus, known as al-Ḥutaiʼa, a wandering poet whose keen satires led to his imprisonment by Omar (Poems, ed. by I. Goldziher in the *Journal of the German Oriental Society*, vols. 46 and 47).

Had the simplicity and religious severity of the first four caliphs continued in their successors, the fate of poetry would have been hard. Probably little but religious poetry would have been allowed. But the Omayyads (with one exception) were not religious men and, while preserving the outward forms of Islam, allowed full liberty to the pre-Islamic customs of the Arabs and the beliefs and practices of Christians. At the same time the circumstances of the poet's life were altered. Poetry depended on patronage, and that was to be had now chiefly in the court of the caliph and the residences of his governors. Hence the centre of attraction was now the city with its interests, not the desert. Yet the old forms of poetry were kept. The *qasīda* still required the long introduction (see above), which was entirely occupied with the affairs of the desert. Thus poetry became more and more artificial, until in the Abbasid period poets arose who felt themselves strong enough to give up the worn-out forms and adopt others more suitable. The names of three great poets adorn the Omayyad period: Akhtal, Farazdaq and Jarīr were contemporaries (see separate articles). The first was a Christian of the tribe of Taghlib, whose Christianity enabled him to write many verses which would have been impossible to a professing Moslem. Protected by the caliph he employed the old weapons of satire to support them against the "Helpers" and to exalt his own tribe against the Qaisites. Farazdaq of the Bani Tamīm, a good Moslem but loose in morals, lived chiefly in Medina and Kufa, and was renowned for his command of language. Jarīr of another branch of the Bani Tamīm lived in Irak and courted the favour of Hajjāj, its governor. His satires were so effective that he is said to have crushed forty-three rivals. His great efforts were against Farazdaq, who was supported by Akhtal (cf. *The Naka'id of Jarīr and al-Farazdaq*, ed. A. A. Bevan, Leiden, 1906 foll.). Among many minor poets one woman is conspicuous. Laila ul-Akhyalīyya (d. 706) was married to a stranger. On the death of her lover in battle, she wrote numerous elegies bewailing him, and so became famous and devoted the rest of her life to the writing of verse. Two poets of the Koreish attained celebrity in Arabia itself at this time. Qais ur-Ruqayyāt was the poet of ʽAbdallah ibn uz-Zubair (Abdallah ibn Zobair) and helped him until circumstances went against him, when he made his peace with the caliph. His poems are chiefly panegyrics and love songs (ed. N. Rhodonakis, Vienna, 1902). ʽUmar ibn Abī Rabīʽa (*c.* 643–719) was a wealthy man, who lived a life of ease in his native town of Mecca, and devoted himself to intrigues and writing love songs (ed. P. Schwarz, Leipzig, 1901–1902). His poems were very popular throughout Arabia. As a dweller in the town he was independent of the old forms of poetry, which controlled all others, but his influence among poets was not great enough to perpetuate the new style. One other short-lived movement of the Omayyad period should be mentioned. The *rajaz* poems (see above) had been a subordinate class generally used for improvisations in pre-Mahommedan times. In the 7th and 8th centuries, however, a group of poets employed them more seriously. The most celebrated of these were ʽAjjāj and his son Ru'ba of the Bani Tamīm (editions by W. Ahlwardt, Berlin, 1903; German trans. of Ru'ba's poems by Ahlwardt, Berlin, 1904).

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[1] On the subject of transmission cf. Th. Nöldeke's *Beiträge zur Kenntniss der Poesie der alten Araber* (Hanover, 1804); and W. Ahlwardt's *Bemerkungen über die Aechtheit der alten arabischen Gedichte* (Greifswald, 1872).

With the establishment of the Abbasid dynasty, a new epoch in Arabian poetry began. The stereotyped beginning of the *qasīda* had been recognized as antiquated and out of place in city life even in the Omayyad period (cf. Goldziher, *Abhandlungen*, i. 144 ff.). This form had been ridiculed but now it lost its hold altogether, and was only employed occasionally by way of direct imitation of the antique. The rise of Persian influence made itself felt in much the same way as the Norman influence in England by bringing a newer refinement into poetry. Tribal feuds are no longer the main incentives to verse. Individual experiences of life and matters of human interest become more usual subjects. Cynicism, often followed by religion in a poet's later life, is common. The tumultuous mixture of interests and passions to be found in a city like Bagdad are the subjects of a poet's verse. One of the earliest of these poets, Mutīʽ ibn Ayās, shows the new depth of personal feeling and refinement of expression. Bashshār ibn Burd (d. 783), a blind poet of Persian descent, shows the ascendancy of Persian influence as he openly rails at the Arabs and makes clear his own leaning to the Persian religion. In the 8th century Abu Nuwās (*q.v.*) is the greatest poet of his time. His language has the purity of the desert, his morals are those of the city, his universalism is that of the man of the world. Abū-l-ʽAtāhiya (*q.v.*), his contemporary, is fluent, simple and often didactic. Muslim ibn ul-Walīd (ed. de Goeje, Leiden, 1875), also contemporary, is more conservative of old forms and given to panegyric and satire. In the 9th century two of the best-known poets—Abū Tammām (*q.v.*) and Buḥturī (*q.v.*)—were renowned for their knowledge of old poetry (see Hamasa) and were influenced by it in their own verse. On the other hand Ibn ul-Moʽtazz (son of the caliph) was the writer of brilliant occasional verse, free of all imitation. In the 10th century the centre of interest is in the court of Saif ud-Daula (addaula) at Aleppo. Here in Motanabbī (*q.v.*) the claims of modern poetry not only to equal but to excel the ancient were put forward and in part at any rate recognized. Abū Firās (932–968) was a member of the family of Saif ud-Daula, a soldier whose poems have all the charm that comes from the fact that the writer has lived through the events he narrates (ed. by R. Dvořák, Leiden, 1895). Many Arabian writers count Motanabbī the last of the great poets. Yet Abū-l-ʽAlā ul-Maʽarrī (*q.v.*) was original alike in his use of rhymes and in the philosophical nature of his poems. Ibn Fārid (*q.v.*) is the greatest of the mystic poets, and Busīri (*q.v.*) wrote the most famous poem extant in praise of the Prophet. In the provinces of the caliphate there were many poets, who, however, seldom produced original work. Spain, however, produced Ibn ʽAbdūn (d. 1126), famous for the grace and finish of his style (ed. with commentary of Ibn Badrun by R. P. A. Dozy, Leiden, 1846). The Sicilian Ibn Hamdīs (1048–1132) spent the last fifty years of his life in Spain (*Diwān*, ed. Moaçada, Palermo, 1883; *Canzoniere*, ed. Schiaparelli, Rome, 1897). It was also apparently in this country that the strophe form was first used in Arabic poems (cf. M. Hartmann's *Das arabische Strophengedicht*, Weimar, 1897), and Ibn Quzmān (12th century), a wandering singer, here first used the language of everyday life in the form of verse known as *Zajal*.

Anthologies.—As supplemental to the account of poetry may be mentioned here some of the chief collections of ancient verse, sometimes made for the sake of the poems themselves, sometimes to give a *locus classicus* for usages of grammar or lexicography, sometimes to illustrate ancient manners and customs. The earliest of these is the *Moʽallakat* (*q.v.*). In the 8th century Ibn Mofaddal compiled the collection named after him the *Mofaddalīyāt*. From the 9th century we have the Hamasas of Abū Tammām and Buḥturī, and a collection of poems of the tribe Hudhail (second half ed. in part by J.G.L.Kosegarten, London, 1854; completed by J. Wellhausen in *Skizzen und Vorarbeiten*, i. Berlin, 1884). The numerous quotations of Ibn Qutaiba (*q.v.*) in the *ʽUyūn ul-Akhbār* (ed. C. Brockelmann, Strassburg, 1900 ff.) and the *Book of Poetry and Poets* (ed. M. J. de Goeje, Leiden, 1904) bring these works into this class. In the 10th century were compiled the *Jamharat ashʽar al Arab*, containing forty-nine poems (ed. Būlāq, 1890), the work *al-ʽIqd ul-Farīd* of Ibn ʽAbdi-r-Rabbihi (ed. Cairo, various years), and the greatest work of all this class, the *Kitāb ul-Aghāni* ("Book of Songs") (cf. Abu-l Faraj). The 12th century contributes the *Diwān Mukhtarāt ush-Shuʽarā'i* with fifty *qasīdas*. The *Khizānat ul-Adab* of Abdulqādir, written in the 17th century in the form of a commentary on verses cited in a grammar, contains much old verse (ed. 4 vols., Būlāq, 1882).

Belles-Lettres and Romances.—Mahomet in the Koran had made extensive use of *saj*ʽ or rhymed prose (see above). This form then dropped out of use almost entirely for some time. In the 10th century, however, it was revived, occurring almost simultaneously in the *Sermons* of Ibn Nubāta (946–984) and the *Letters* of Abū Bakr ul-Khwārizmī. Both have been published several times in the East. The epistolary style was further cultivated by Hamadhāni (*q.v.*) and carried to perfection by Abū-l'Alā ul-Maʽarrī. Hamadhāni was also the first to write in this rhymed prose a new form of work, the *Maqāma* ("assembly"). The name arose from the fact that scholars were accustomed to assemble for the purpose of rivalling one another in orations showing their knowledge of Arabic language, proverb and verse. In the *Maqāmas* of Hamadhāni a narrator describes how in various places he met a wandering scholar who in these assemblies puts all his rivals to shame by his eloquence.

Each oration forms the substance of a *Maqāma*, while the *Maqāmas* themselves are united to one another by the constant meetings of narrator and scholar. Harīrī (*q.v.*) quite eclipsed the fame of his predecessor in this department, and his *Maqāmas* retain their influence over Arabian literature to the present day. As late as the 19th century the sheik Nāṣīf ul Yāzījī (1800–1871) distinguished himself by writing sixty clever *Maqāmas* in the style of Harīrī (ed. Beirut, 1856, 1872). While this class of literature had devoted itself chiefly to the finesses of the language, another set of works was given to meeting the requirements of moral education and the training of a gentleman. This, which is known as "Adab literature," is anecdotic in style with much quotation of early poetry and proverb. Thus government, war, friendship, morality, piety, eloquence, are some of the titles under which Ibn Qutaiba groups his stories and verses in the *'Uyūn ul Akhbār*. *Jāhiz* (*q.v.*) in the 9th century and Baihaqī (*The Kitāb al-Maḥāsin val-Masāwi*, ed. F. Schwally, Giessen, 1900–1902) early in the 10th, wrote works of this class. A little later a Spaniard, Ibn 'Abdrabbihi (Abdi-r-Rabbihi), wrote his *'Iqd ul-Farīd* (see section *Anthologies*). The growth of city life in the Abbasid capital led to the desire for a new form of story, differing from the old tales of desert life. This was met in the first place by borrowing. In the 8th century Ibn Muqaffa', a convert from Mazdaism to Islam, translated the Pahlavi version of Bidpai's fables (itself a version of the Indian *Panchatantra*) into Arabic with the title *Kalīla wa Dimna* (ed. Beirūt, various years). Owing to the purity of its language and style it has remained a classic work. The *Book of the 1001 Nights* (*Arabian Nights*) also has its basis in translations from the Indian through the Persian, made as early as the 9th century. To these stories have been added others originating in Bagdad and Egypt and a few others, which were at first in independent circulation. The whole work seems to have taken its present form (with local variations) about the 13th century. Several other romances of considerable length are extant, such as the *Story of 'Antar* (ed. 32 vols., Cairo, 1869, &c., translated in part by Terrick Hamilton, 4 vols., London, 1820), and the *Story of Saif ibn Dkī Yezen* (ed. Cairo, 1892). (G. W. T.)

Historical Literature.—Arabian historians differ from all others in the unique form of their compositions. Each event is related in the words of eye-witnesses or contemporaries transmitted to the final narrator through a chain of intermediate reporters (*rāwis*), each of whom passed on the original report to his successor. Often the same account is given in two or more slightly divergent forms, which have come down through different chains of reporters. Often, too, one event or one important detail is told in several ways on the basis of several contemporary statements transmitted to the final narrator through distinct lines of tradition. The writer, therefore, exercises no independent criticism except as regards the choice of authorities; for he rejects accounts of which the first author or one of the intermediate links seems to him unworthy of credit, and sometimes he states which of several accounts seems to him the best.

A second type of Arabian historiography is that in which an author combines the different traditions about one occurrence into one continuous narrative, but prefixes a statement as to the lines of authorities used and states which of them he mainly follows. In this case the writer recurs to the first method, already described, only when the different traditions are greatly at variance with one another. In yet a third type of history the old method is entirely forsaken and we have a continuous narrative only occasionally interrupted by citation of the authority for some particular point. But the principle still is that what has been well said once need not be told again in other words. The writer, therefore, keeps as close as he can to the letter of his sources, so that quite a late writer often reproduces the very words of the first narrator.

From very early times story-tellers and singers found their subjects in the doughty deeds of the tribe on its forays, and sometimes in contests with foreign powers and in the impression produced by the wealth and might of the sovereigns of Persia and Constantinople. The appearance of the Prophet with the great changes that ensued, the conquests that made the Arabs lords of half the civilized world, supplied a vast store of new matter for relations which men were never weary of hearing and recounting. They wished to know everything about the apostle of God. Every one who had known or seen him was questioned and was eager to answer. Moreover, the word of God in the Koran left many practical points undecided, and therefore it was of the highest importance to know exactly how the Prophet had spoken and acted in various circumstances. Where could this be better learned than at Medina, where he had lived so long and where the majority of his companions continued to live? So at Medina a school was gradually formed, where the chief part of the traditions about Mahomet and his first successors took a form more or less fixed. Soon men began to assist memory by making notes, and pupils sought to take written jottings of what they had heard from their teachers. Thus by the close of the 1st century many *dictata* were already in circulation. For example, Ḥasan of Baṣra (d. 728 A.D.) had a great mass of such notes, and he was accused of sometimes passing off as oral tradition things he had really drawn from books; for oral tradition was still the one recognized authority, and it is related of more than one old scholar, and even of Ḥasan of Baṣra himself, that he directed his books to be burned at his death. The books were mere helps. Long after this date, when all scholars drew mainly from books, the old forms were still kept up. Ṭabarī, for example, when he cites a book expresses himself as if he had heard what he quotes from the master with whom he read the passage or from whose copy he transcribed it. He even expresses himself in this wise: "'Omar b. Shabba has *related* to me in his book on the history of Baṣra." No independent book of the 1st century from the Flight (*i.e.* 622–719) has come down to us. It is told, however, that Moawiya summoned an old man named 'Abid ibn Sharya from Yemen to Damascus to tell him all he knew about ancient history and that he induced him to write down his information. This very likely formed the nucleus of a book which bore the name of that sheik and was much read in the 3rd century from the Flight. It seems to be lost now. But in the 2nd century (719–816) real books began to be composed. The materials were supplied in the first place by oral tradition, in the second by the *dictata* of older scholars, and finally by various kinds of documents, such as treaties, letters, collections of poetry and genealogical lists. Genealogical studies had become necessary through Omar's system of assigning state pensions to certain classes of persons according to their kinship with the Prophet, or their deserts during his lifetime. This subject received much attention even in the 1st century, but books about it were first written in the 2nd, the most famous being those of Ibn al-Kalbī (d. 763), of his son Hishām (d. 819), and of Al-Sharqī ibn al-Quṭāmī. Genealogy, which often called for elucidations, led on to history. Balādhurī's excellent *Ansāb al-Ashrāf* (Genealogies of the Nobles) is a history of the Arabs on a genealogical plan.

The oldest extant history is the biography of the Prophet by Ibn Isḥāq (d. 767). This work is generally trustworthy. Mahomet's life before he appeared as a prophet and the story of his ancestors are indeed mixed with many fables illustrated by spurious verses. But in Ibn Isḥāq's day these fables were generally accepted as history—for many of them had been first related by contemporaries of Mahomet—and no one certainly thought it blameworthy to put pious verses in the mouth of the Prophet's forefathers, though, according to the *Fihrist* (p. 92), Ibn Isḥāq was duped by others with regard to the poems he quotes. The original work of Ibn Isḥāq seems to be lost. That which we possess is an edition of it by Ibn Hishām (d. 834) with additions and omissions (text ed. by F. Wüstenfeld, Göttingen, 1858–1860; German translation by Weil, Stuttgart, 1864).

The *Life* of the Prophet by Ibn Oqba (d. 758), based on the statements of two very trustworthy men, 'Urwa ibn az-Zubair (d. 713) and Az-zuhri (d. 742), was still much read in Syria in the 14th century. Fragments of this have been edited by E. Sachau, Berlin, 1904. We fortunately possess the *Book of the Campaigns* of the Prophet by al-Wāqidī (d. 822) and the important *Book of Classes* of his disciple Ibn Sa'd (*q.v.*). Wāqidī had much more copious materials than Ibn Isḥāq, but gives way much more to a popular and sometimes romancing style of treatment. Nevertheless he sometimes helps us to recognize in Ibn Isḥāq's narrative modifications of the genuine tradition made for a purpose, and the additional details he supplies set various events before us in a clearer light. Apart from this his chief merits lie in his studies on the subject of the traditional authorities, the results of which are given by Ibn Sa'd, and in his chronology, which is often excellent. A special study of the traditions about the conquest of Syria made by M. J. de Goeje in 1864 (*Mémoires sur la conquête de la Syrie*, 2nd ed., Leiden, 1900), led to the conclusion that Wāqidī's chronology is sound as regards the main events, and that later historians have gone astray by forsaking his guidance. This result has been confirmed by certain contemporary notices found by Th. Nöldeke in 1874 in a Syriac MS. of the British Museum. And that Ibn Isḥāq agrees with Wāqidī in certain main dates is important evidence for the trustworthiness of the former also. For the chronology before the year 10 of the Flight Wāqidī did his best, but here, the material being defective, many of his conclusions are precarious. Wāqidī had already a great library at his disposal. He is said to have had 600 chests of books, chiefly *dictata* written by or for himself, but in part real books by Abū Mikhnaf (d. 748), Ibn Isḥāq (whom he uses but does not name), 'Awāna (d. 764), Abū Mashar (d. 791) and other authors. Abū Mikhnaf left a great number of monographs on the chief events from the death of the Prophet to the caliphate of Walīd II. These were much used by later writers, and we have many extracts from them, but none of the works themselves except a sort of romance based on his account of the death of Hosain (Ḥusain) of which Wüstenfeld has given a translation. With regard to the history of Irak in particular he was deemed to have the best information, and for this subject he is Ṭabarī's chief source, just as Madāinī, a younger contemporary of Wāqidī, is followed by preference in all that relates to Khorasan. Madāinī's *History of the Caliphs* is the best, if not the oldest, published before Ṭabarī; but this book is known only by the excerpts given by later writers, particularly Balādhurī and Ṭabarī. From these we judge that he had great narrative power, with much clear and exact learning, and must be placed high as a critical historian. His plan was to record the various traditions about an event, choosing them with critical skill; sometimes, however, he fused the several traditions into a continuous narrative. A just estimate of the relative value of the historians can only be reached by careful comparison in detail. This has been essayed by Brünnow in his study on the Khārijites (Leiden, 1884), in which the narrative of Mubarrad in the *Kāmil* is compared with the excerpts of Mādainī given by Balādhurī and those of Abū Mikhnaf given by Ṭabarī. The conclusion reached is that Abū Mikhnaf and Mādainī are both well informed and impartial.

Among the contemporaries of Wāqidī and Mādainī were Ibn Khidāsh (d. 838), the historian of the family Muhallab, whose work was one of Mubarrad's sources for the *History of the Khārijites*; Haitham ibn 'Adī (d. 822), whose works, though now lost, are often cited; and Saif ibn 'Omar at-Tamīmī, whose book on the revolt of the tribes under Abu-Bekr and on the Mahommedan conquests was much used by Ṭabarī. His narratives are detailed and often tinged with romance, and he is certainly much inferior to Wāqidī in accuracy. Wellhausen has thoroughly examined the work of Saif in *Skizzen und Vorarbeiten*, vi. Besides these are to be mentioned Abū 'Ubaida (d. 825), who was celebrated as a philologist and wrote several historical monographs that are often cited, and Azraqī, whose excellent *History of Mecca* was published after his death by his grandson (d. 858). With these writers we pass into the 3rd century of Islam. But we have still an important point to notice in the 2nd century; for in it learned Persians began to take part in the creation of Arabic historical literature. Ibn Muqaffa' translated the great *Book of Persian Kings*, and others followed his example. Ṭabarī and his contemporaries, senior and junior, such as Ibn Qutaiba, Ya'qūbī, Dīnawarī, preserve to us a good part of the information about Persian history made known through such translations.[1] But even more important than the knowledge conveyed by these works was their influence on literary style and composition. Half a century later began versions from the Greek either direct or through the Syriac. The pieces translated were mostly philosophical; but the Arabs also learned something, however superficially, of ancient history.

The 3rd century (816–913) was far more productive than the 2nd. Abū 'Ubaida was succeeded by Ibn al-A'rābī (d. 846), who in like manner was chiefly famous as a philologist, and who wrote about ancient poems and battles. Much that he wrote is quoted in Tabrīzī's commentary on the *Ḥamāsa*, which is still richer in extracts from the historical elucidations of early poems given by ar-Riyāshī (d. 871). Of special fame as a genealogist was Ibn Ḥabīb (d. 859), of whom we have a booklet on Arabian tribal names (ed. Wüstenfeld, 1850). Azraqī again was followed by Fākihī, who wrote a *History of Mecca* in 885,[2] and 'Omar b. Shabba (d. 876), who composed an excellent history of Baṣra, known to us only by excerpts. Of the works of Zubair b. Bakkār d . 870), one of Ṭabarī's teachers, a learned historian and genealogist much consulted by later writers, there is a fragment in the Köprülü library at Constantinople, and another in Göttingen, part of which has been made known by Wüstenfeld (*Die Familie Al-Zobair*, Göttingen, 1878). Ya'qūbī (Ibn Wāḍiḥ) wrote a short general history of much value (published by Houtsma, Leiden, 1883). About India he knows more than his predecessors and more than his successors down to Berūnī. Ibn Khordādhbeh's historical works are lost. Ibn 'Abdalḥakam (d. 871) wrote of the conquest of Egypt and the West. Extracts from this book are given by M'G. de Slane in his *Histoire des Berbères*, from which we gather that it was a medley of true tradition and romance, and must be reckoned, with the book of his slightly senior contemporary, the Spaniard Ibn Ḥābīb, in the class of historical romances. A high place must be assigned to the historian Ibn Qutaiba or Kotaiba (d. 889), who wrote a very useful *Handbook of History* (ed. Wüstenfeld, Göttingen, 1850). Much more eminent is Balādhurī (d. 893), whose book on the Arab conquest (ed. M. J. de Goeje, Leiden, 1865–1866) merits the special praise given to it by Mas'ūdī, and who also wrote a large work, the *Ansāb al-Ashrāf*. A contemporary, Ibn abī Tāhir Taifūr (d. 894), wrote on the Abbasid caliphs and was drawn on by Ṭabarī. The sixth part of his work is in the British Museum. The universal history of Dīnawarī (d. 896), entitled *The Long Narratives*, has been edited by Girgas (1887).

All these histories are more or less thrown into the shade by the great work of Ṭabarī (*q.v.*), whose fame has never faded from his own day to ours. The *Annals* (ed. M. de Goeje, Leiden, 1879–1901) are a general history from the creation to 302 A.H. (=A.D. 915). As a literary composition they do not rank very high, which may be due partly to the author's years, partly to the inequality of his sources, sometimes superabundant, sometimes defective, partly perhaps to the somewhat hasty condensation of his original draft. Nevertheless the value of the book is very great: the author's selection of traditions is usually happy, and the episodes of most importance are treated with most fulness of detail, so that it deserves the high reputation it has enjoyed from the first. This reputation rose steadily; there were twenty copies (one of them written by Ṭabarī's own hand) in the library of the Fatimite caliph 'Aziz (latter half of the 4th century), whereas, when Saladin became lord of Egypt, the princely library contained 1200 copies (Maqrīzī, i. 408 seq.).

The *Annals* soon came to be dealt with in various ways. They were published in shorter form with the omission of the names of authorities and of most of the poems cited; some passages quoted by later writers are not found even in the Leiden edition. On the other hand, some interpolations took place, one in the author's lifetime and perhaps by his own hand. Then many supplements were written, *e.g.* by Ferghānī (not extant) and by Hamadhānī (partly preserved in Paris). 'Arīb of Cordova made an abridgment, adding the history of the West and continuing the story to about 975.[1] Ibn Mashkawaih wrote a history from the creation to 980, with the purpose of drawing the lessons of the story, following Ṭabarī closely, as far as his book is known, and seldom recurring to other sources before the reign of Moqtadir; what follows is his own composition and shows him to be a writer of talent.[2] In 963 an abridgment of the *Annals* was translated into Persian by Bal'amī, who, however, interwove many fables.[3] Ibn al-Athīr (d. 1234) abridged the whole work, usually with judgment, but sometimes too hastily. Though he sometimes glided lightly over difficulties, his work is of service in fixing the text of Ṭabarī. He also furnished a continuation to the year 1224. Later writers took Ṭabarī as their main authority, but sometimes consulted other sources, and so add to our knowledge—especially Ibn al-Jauzī (d. 1201), who adds many important details. These later historians had valuable help from the biographies of famous men and special histories of countries and cities, dynasties and princes, on which much labour was spent from the 4th century from the Flight onwards.

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[1] For details see the introduction to Nöldeke's translation of Ṭabarī's *Geschichte der Perser und Araber zur Zeit der Sasaniden* (Leiden, 1879).

[2] Published in excerpt by Wüstenfeld along with Azraqī (Leipzig, 1857–1859).

The chief historians after Ṭabarī may be briefly mentioned in chronological order. Rāzī (d. A.D. 932) wrote a *History of Spain*; Eutychius (d. 940) wrote *Annals* (ed. L. Cheikho, Paris, 1906), which are very important because he gives the Christian tradition; Sūlī (d. 946) wrote on the Abbasid caliphs, their viziers and court poets; Mas'udi (*q.v.*) composed various historical and geographical works (d. 956). Of Ṭabarī's contemporary Hamza Ispahānī (*c.* 940) we have the *Annals* (ed. Gottwaldt, St Petersburg, 1844); Ibn al-Qūṭīya wrote a *History of Spain*; Ibn Zūlāq (d. 997) a *History of Egypt*; 'Otbi wrote the *History of Mahmud of Ghazna*, at whose court he lived (printed on the margin of the Egyptian edition of Ibn al-Athīr); Tha'labī (d. 1036) wrote a well-known *History of the Old Prophets*; Abu Nu'aim al-Ispahānī (d. 1039) wrote a *History of Ispahan*, chiefly of the scholars of that city; Tha'ālibī (d. *c.* 1038) wrote, *inter alia*, a well-known *History of the Poets of his Time*, published at Damascus, 1887; Birūnī (*q.v.*) (d. 1048) takes a high place among historians; Kodā'ī (d. 1062) wrote a *Description of Egypt* and also various historical pieces, of which some are extant; Ibn Sā'id of Cordova (d. 1070) wrote a *View of the History of the Various Nations*. Bagdad and its learned men found an excellent historian in al-Khātib al-Baghdādī (d. 1071), and Spain in Ibn Ḥayān (d. 1076), and half a century later in Ibn Khaqān (d. 1135) and Ibn Bassām (d. 1147). Sam'ani (d. 1167) wrote an excellent book on genealogies; 'Umāra (d. 1175) wrote a *History of Yemen* (ed. H. C. Kay, London, 1892); Ibn 'Asaqir (d. 1176) a *History of Damascus and her Scholars*, which is of great value, and exists in whole or in part in several libraries. The *Biographical Dictionary* of the Spaniard Ibn Pascual (d. 1182) and that of Dabbi, a somewhat junior contemporary, are edited in Codera's *Bibliotheca Arab. Hisp.* (1883–1885); Saladin found his historian in the famous 'Imād uddīn (d. 1201) (Arabic text, ed. C. Landberg, Leiden, 1888). Ibn ul-Jauzī, who died in the same year, has been already mentioned. Abdulwahid's *History of the Almohades*, written in 1224, was published by Dozy (2nd ed., 1881). Abdullatīf or Abdallatīf (d. 1232) is known by his writings about Egypt (trans. de Sacy, 1810); Ibn al-Athīr (d. 1233) wrote, in addition to the *Chronicle* already mentioned, a *Biographical Dictionary of Contemporaries of the Prophet*. Qifṭī (d. 1248) is especially known by his *History of Arabic Philologists*. Sibt ibn al-Jauzi (d. 1256), grandson of the Ibn al-Jauzī already mentioned, wrote a great *Chronicle*, of which much the larger part still exists. Codera has edited (Madrid, 1886) Ibn al-'Abbar's (d. 1260) *Biographical Lexicon*, already known by Dozy's excerpts from it. Ibn al-'Adīm (d. 1262) is famed for his *History of Aleppo*, and Abu Shama (d. 1267) wrote a well-known *History of Saladin and Nureddin*, taking a great deal from 'Imad uddin. Ibn abī Usaibia (d. 1269) wrote a *History of Physicians*, ed. A. Müller. The *History* of Ibn al-'Amīd (d. 1276), better known as Elmacin, was printed by Erpenius in 1625. Ibn Sa'īd al-Maghribī (d. 1274 or 1286) is famous for his histories, but still more for his geographical writings. The noted theologian Nawāwī (*q.v.*; d. 1278) wrote a *Biographical Dictionary of the Worthies of the First Ages of Islam*. Pre-eminent as a biographer is Ibn Khallikān (*q.v.*; d. 1282), whose much-used work was partly edited by de Slane and completely by Wüstenfeld (1835–1840), and translated into English by the former scholar (4 vols., 1843–1871).

Abu 'l-Faraj, better known as Bar-Hebraeus (d. 1286), wrote, besides his Syriac *Chronicle*, an Arabic *History of Dynasties* (ed. E. Pocock, Oxford, 1663, Beirūt, 1890). Ibn 'Adharī's *History of Africa and Spain* has been published by Dozy (2 vols., Leiden, 1848–1851), and the *Qartās* of Ibn abī Zar' by Tornberg (1843). One of the best-known of Arab writers is Abulfeda (d. 1331) (*q.v.*). Not less famous is the great *Encyclopaedia* of his contemporary Nuwairī (d. 1332), but only extracts from it have been printed. Ibn Sayyid an-Nās (d. 1334) wrote a full biography of the Prophet; Mizzī (d. 1341) an extensive work on the men from whom traditions have been derived. We still possess, nearly complete, the great *Chronicle* of Dhahabī (d. 1347), a very learned biographer and historian. The geographical and historical *Masālik al-Absār* of Ibn Fadlallāh (d. 1348) is known at present by extracts given by Quatremère and Amari. Ibn al-Wardī (d. *c.* 1349), best known by his *Cosmography*, wrote a *Chronicle* which has been printed in Egypt. Ṣafadī (d. 1363) got a great name as a biographer. Yafi'ī (d. 1367) wrote a *Chronicle of Islam* and *Lives of Saints*. Subkī (d. 1369) published *Lives of the Theologians of the Shāfi'ite School*. Of Ibn Kathīr's *History* the greatest part is extant. For the history of Spain and the Maghrib the writings of Ibn al-Khatīb (d. 1374) are of acknowledged value. Another history, of which we possess the greater part, is the large work of Ibn al-Furāt (d. 1404). Far superior to all these, however, is the famous Ibn Khaldūn (*q.v.*) (d. 1406). Of the historical works of the famous lexicographer Fairūzabādī (*q.v.*) (d. 1414) only a *Life of the Prophet* remains. Maqrizī (d. 1442) is the subject of a separate article; Ibn Hajar (d. 1448) is best known by his *Biographical Dictionary of Contemporaries of the Prophet*, published in the *Bibliotheca Indica*. Ibn 'Arabshāh (d. 1450) is known by his *History of Timur* (Leeuwarden, 1767). 'Ainī (d. 1451) wrote a *General History*, still extant. Abu'l-Mahāsin ibn Taghrībirdī (d. 1469) wrote at length on the history of Egypt; the first two parts have been published by Juynboll and Matthes, Leiden, 1855–1861. Flügel has published Ibn Kotlubogha's *Biographies of the Hanifite Jurists*. Ibn Shihna (d. 1485) wrote a *History of Aleppo*. Of Sakhāwī we possess a bibliographical work on the historians. The polymath Suyūtī (*q.v.*) (d. 1505) contributed a *History of the Caliphs* and many biographical pieces. Samhūdī's *History of Medina* is known through the excerpts of Wüstenfeld (1861). Ibn Iyās (d. 1524) wrote a *History of Egypt*, and Diarbekri (d. 1559) a *Life of Mahomet*. To these names must be added Maqqari (Makkari) (*q.v.*) and Hajji Khalīfa (*q.v.*) (d. 1658). He made use of European sources, and with him Arabic historiography may be said to cease, though he had some unimportant successors.

A word must be said of the historical romances, the beginnings of which go back to the first centuries of Islam. The interest in all that concerned Mahomet and in the allusions of the Koran to old prophets and races led many professional narrators to choose these subjects. The increasing veneration paid to the Prophet and love for the marvellous soon gave rise to fables about his childhood, his visit to heaven, &c., which have found their way even into sober histories, just as many Jewish legends told by the converted Jew Ka'b al-Aḥbār and by Wahb ibn Monabbih, and many fables about the old princes of Yemen told by 'Abīd, are taken as genuine history (see, however, Mas'ūdī, iv. 88 seq.). A fresh field for romantic legend was found in the history of the victories of Islam, the exploits of the first heroes of the faith, the fortunes of ʿAlī and his house. Then, too, history was often expressly forged for party ends. The people accepted all this, and so a romantic tradition sprang up side by side with the historical, and had a literature of its own, the beginnings of which must be placed as early as the 2nd century of the Flight. The oldest specimens still extant are the fables about the conquest of Spain ascribed to Ibn Ḥabīb (d. 852), and those about the conquest of Egypt and the West by Ibn ʿAbd al-Hakam (d. 871). In these truth and falsehood are mingled. But most of the extant literature of this kind is, in its present form, much more recent; *e.g.* the *Story of the Death of Hosain* by the pseudo-Abū Mikhnaf (translated by Wüstenfeld); the *Conquest of Syria* by Abū Ismāʿīl al-Basrī (edited by Nassau Lees, Calcutta, 1854, and discussed by de Goeje, 1864); the pseudo-Wāqidī (see Hamaker, *De Expugnatione Memphidis et Alexandriae*, Leiden, 1835); the pseudo-Ibn Qutaiba (see Dozy, *Recherches*); the book ascribed to Aʿṣam Kūfī, &c. Further inquiry into the origin of these works is called for, but some of them were plainly directed to stirring up fresh zeal against the Christians. In the 6th century of the Flight some of these books had gained so much authority that they were used as sources, and thus many untruths crept into accepted history (M. J. DE G.; G. W. T.)

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[1] Of this work the Gotha Library has a portion containing 290–320 A.H., of which the part about the West has been printed by Dozy in the *Bayān*, and the rest was published at Leiden in 1897.

[2] A fragment (198–251 A.H.) is printed in de Goeje, *Fragm. Hist. Ar.* (vol. ii., Leiden, 1871).

[3] The first part was rendered into French by Dubeux in 1836. There is an excellent French translation by Zotenberg (1874).

Geography.—The writing of geographical books naturally began with the description of the Moslem world, and that for practical purposes. Ibn Khordādhbeh, in the middle of the 9th century, wrote a *Book of Roads and Provinces* to give an account of the highways, the posting-stations and the revenues of the provinces. In the same century Yaʿqūbī wrote his *Book of Countries*, describing specially the great cities of the empire. A similar work describing the provinces in some detail was that of Qudāma or Kodāma (d. 922). Hamdāni (*q.v.*) was led to write his great geography of Arabia by his love for the ancient history of his land. Muqaddasi (Mokaddasi) at the end of the 10th century was one of the early travellers whose works were founded on their own observation. The study of Ptolemy's geography led to a wider outlook, and the writing of works on geography (*q.v.*) in general. A third class of Arabian geographical works were those written to explain the names of places which occur in the older poets. Such books were written by Bakrī (*q.v.*) and Yāqūt (*q.v.*)[1]

Grammar and Lexicography.—Arab tradition ascribes the first grammatical treatment of the language to Abū-l-Aswad ud-Duʿalī (latter half of the 7th century), but the certain beginnings of Arabic grammar are found a hundred years later. The Arabs from early times have always been proud of their language, but its systematic study seems to have arisen from contact with Persian and from the respect for the language of the Koran. In Irāk the two towns of Basra and Kūfa produced two rival schools of philologists. Bagdad soon had one of its own (cf. G. Flügel's *Die grammatischen Schulen der Araber*, Leipzig, 1862). Khalīl ibn Aḥmad (718–791), an Arab from Omān, of the school of Basra, was the first to enunciate the laws of Arabic metre and the first to write a dictionary. His pupil Sībawaihi (*q.v.*), a Persian, wrote the grammar known simply as *The Book*, which is generally regarded in the East as authoritative and almost above criticism. Other members of the school of Basra were Abū ʿUbaida (*q.v.*), Asmaʿī (*q.v.*), Mubarrad (*q.v.*) and Ibn Duraid (*q.v.*). The school of Kūfa claimed to pay more attention to the living language (spoken among the Bedouins) than to written laws of grammar. Among its teachers were Kisāʾī, the tutor of Harūn al-Rashīd's sons, Ibn Aʿrābi, Ibn as-Sikkīt (d. 857) and Ibn ul-Anbāri (885–939). In the fourth century of Islam the two schools of Kūfa and Basra declined in importance before the increasing power of Bagdad, where Ibn Qutaiba, Ibn Jinnī (941–1002) and others carried on the work, but without the former rivalry of the older schools. Persia from the beginning of the 10th century produced some outstanding students of Arabic. Hamadhāni (d. 932) wrote a book of synonyms (ed. L. Cheikho, Beirūt, 1885). Jauharī (*q.v.*) wrote his great dictionary the *Sahāh*. Thaʿālibi (*q.v.*) and Jurjānī (*q.v.*) were almost contemporary, and a little later came Zamakhsharī (*q.v.*), whose philological works are almost as famous as his commentary on the Koran. The most important dictionaries of Arabic are late in origin. The immense work, *Lisān ul Arab* (ed. 20 vols., Būlāq, 1883–1889), was compiled by Ibn Manzūr (1232–1311), the *Qāmūs* by Fairūzābādī, the *Taj ulʿArūs* (ed. 10 vols., Būlāq, 1890), founded on the *Qāmūs*, by Murtadā uz-Zabīdī (1732–1790).

Scientific Literature.—The literature of the various sciences is dealt with elsewhere. It is enough here to mention that such existed, and that it was not indigenous. It was in the early Abbasid period that the scientific works of Greece were translated into Arabic, often through the Syriac, and at the same time the influence of Sanskrit works made itself felt. Astronomy seems in this way to have come chiefly from India. The study of mathematics learned from Greece and India was developed by Arabian writers, who in turn became the teachers of Europe in the 16th century. Medical literature was indebted for its origin to the works of Galen and the medical school of Gondesapur. Many of the Arabian philosophers were also physicians and wrote on medicine. Chemistry proper was not understood, but Arabian writings on alchemy led Europe to it later. So also the literature of the animal world (cf. Damīrī) is not zoological but legendary, and the works on minerals are practical and not scientific. See ARABIAN PHILOSOPHY and historical sections of such scientific articles as ASTRONOMY, &c. (G. W. T.)

ARABIAN PHILOSOPHY. What is known as "Arabian" philosophy owed to Arabia little more than its name and its language. It was a system of Greek thought, expressed in a Semitic tongue, and modified by Oriental influences, called into existence amongst the Moslem people by the patronage of their more liberal princes, and kept alive by the intrepidity and zeal of a small band of thinkers, who stood suspected and disliked in the eyes of their nation. Their chief claim to the notice of the historian of speculation comes from their warm reception of Greek philosophy when it had been banished from its original soil, and whilst western Europe was still too rude and ignorant to be its home (9th to 12th century).

Origin.

In the course of that exile the traces of Semitic or Mahommedan influence gradually faded away, and the last of the line of Saracenic thinkers was a truer exponent of the one philosophy which they all professed to teach than the first. The whole movement is little else than a chapter in the history of Aristotelianism. That system of thought, after passing through the minds of those who saw it in the hazy light of an orientalized Platonism, and finding many laborious but narrow-purposed cultivators in the monastic schools of heretical Syria, was then brought into contact with the ideas and mental habits of Islam. But those in whom the two currents converged did not belong to the pure Arab race. Of the so-called Arabian philosophers of the East, al-Fārābī, Ibn-Sīnā and al-Ghazālī were natives of Khorasan, Bokhara and the outlying provinces of north-eastern Persia; whilst al-Kindī, the earliest of them, sprang from Basra, on the Persian Gulf, on the debatable ground between the Semite and the Aryan. In Spain, again, where Ibn-Bājja, Ibn-Tufail and Ibn Rushd rivalled or exceeded the fame of the Eastern schools, the Arabians of pure blood were few, and the Moorish ruling class was deeply intersected by Jewish colonies, and even by the natives of Christian Spain. Thus, alike at Bagdad and at Cordova, Arabian philosophy represents the temporary victory of exotic ideas and of subject races over the theological one-sidedness of Islam, and the illiterate simplicity of the early Saracens.

Islam had, it is true, a philosophy of its own among its theologians (see MAHOMMEDAN RELIGION). It was with them that the Moslem theology—the science of the word (*Kalām*)—first came into existence. Its professors, the *Mutākallimūn* (known in Hebrew as *Medabberim*, and as *Loquentes* in the Latin versions), may be compared with the scholastic doctors of the Catholic Church. Driven in the first instance to speculation in theology by the needs of their natural reason, they came, in after days, when Greek philosophy had been naturalized in the Caliphate, to adapt its methods and doctrines to the support of their views. They employed a quasi-philosophical method, by which, according to Maimonides, they first reflected how things ought to be in order to support, or at least not contradict, their opinions, and then, when their minds were made up with regard to this imaginary system, declared that the world was no otherwise constituted. The dogmas of creation and providence, of divine omnipotence, chiefly exercised them; and they sought to assert for God an immediate action in the making and the keeping of the world. Space they looked upon as pervaded by atoms possessing no quality or extension, and time was similarly divided into innumerable instants. Each change in the constitution of the atoms is a direct act of the Almighty. When the fire burns, or the water moistens, these terms merely express the habitual connexion which our senses perceive between one thing and another. It is not the man that throws a stone who is its real mover: the supreme agent has for the moment created motion. If a living being die, it is because God has created the attribute of death; and the body remains dead, only because that attribute is unceasingly created. Thus, on the one hand, the object called the cause is denied to have any efficient power to produce the so-called effect; and, on the other hand, the regularities or laws of nature are explained to be direct interferences by the Deity. The supposed uniformity and necessity of causation is only an effect of custom, and may be at any moment rescinded. In this way, by a theory which, according to Averroes, involves the negation of science, the Moslem theologians believed that they had exalted God beyond the limits of the metaphysical and scientific conceptions of law, form and matter; whilst they at the same time stood aloof from the vulgar doctrines, attributing a causality to things. Thus they deemed they had left a clear ground for the possibility of miracles.

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[1] The chief Arabian geographical works have been edited by M. J. de Goeje in his *Bibliotheca Geographorum arabicorum* (Leiden, 1874 ff.).

But at least one point was common to the theological and the philosophical doctrine. Carrying out, it may be, the principles of the Neo-Platonists, they kept the sanctuary of the Deity securely guarded, and interposed between him and his creatures a spiritual order of potent principles, from the Intelligence, which is the first-born image of the great unity, to the Soul and Nature, which come later in the spiritual rank. Of God the philosophers said we could not tell what He is, but only what He is not. The highest point, beyond which strictly philosophical inquirers did not penetrate, was the active intellect,—a sort of soul of the world in Aristotelian garb—the principle which inspires and regulates the development of humanity, and in which lies the goal of perfection for the human spirit. In theological language the active intellect is described as an angel. The inspirations which the prophet receives by angelic messengers are compared with the irradiation of intellectual light, which the philosopher wins by contemplation of truth and increasing purity of life. But while the theologian incessantly postulated the agency of that God whose nature he deemed beyond the pale of science, the philosopher, following a purely human and natural aim, directed his efforts to the gradual elevation of his part of reason from its unformed state, and to its final union with the controlling intellect which moves and draws to itself the spirits of those who prepare themselves for its influences. The philosophers in their way, like the mystics of Persia (the Sufites) in another, tended towards a theory of the communion of man with the spiritual world, which may be considered a protest against the practical and almost prosaic definiteness of the creed of Mahomet.

Arabian philosophy, at the outset of its career in the 9th century, was able without difficulty to take possession of those resources for speculative thought which the Latins had barely achieved at the close of the 12th century by the slow process of rediscovering the Aristotelian logic from the commentaries and verses of Boētius. What the Latins painfully accomplished, owing to their fragmentary and unintelligent acquaintance with ancient philosophy, was already done for the Arabians by the scholars of Syria. In the early centuries of the Christian era, both within and without the ranks of the church, the Platonic tone and method were paramount throughout the East. Their influence was felt in the creeds which formulated the orthodox dogmas in regard to the Trinity and the Incarnation. But in its later days the Neo-Platonist school came more and more to find in Aristotle the best exponent and interpreter of the philosopher whom they thought divine. It was in this spirit that Porphyry, Themistius and Joannes Philoponus composed their commentaries on the treatises of the Peripatetic system which, modified often unconsciously by the dominant ideas of its expositors, became in the 6th and 7th centuries the philosophy of the Eastern Church. But the instrument which, in the hands of John of Damascus (Damascenus), was made subservient to theological interests, became in the hands of others a dissolvent of the doctrines which had been reduced to shape under the prevalence of the elder Platonism. Peripatetic studies became the source of heresies; and conversely, the heretical sects prosecuted the study of Aristotle with peculiar zeal. The church of the Nestorians, and that of the Monophysites, in their several schools and monasteries, carried on from the 5th to the 8th century the study of the earlier part of the *Organon*, with almost the same means, purposes and results as were found among the Latin schoolmen of the earlier centuries. Up to the time when the religious zeal of the emperor Zeno put a stop to the Nestorian school at Edessa, this "Athens of Syria" was active in translating and popularizing the Aristotelian logic. Their banishment from Edessa in 489 drove the Nestorian scholars to Persia, where the Sassanid rulers gave them a welcome; and there they continued their labours on the *Organon*. A new seminary of logic and theology sprang up at Nisībis, not far from the old locality; and at Gandisapora (or Nishapur), in the east of Persia, there arose a medical school, whence Greek medicine, and in its company Greek science and philosophy, ere long spread over the lands of Iran. Meanwhile the Monophysites had followed in the steps of the Nestorians, multiplying Syriac versions of the logical and medical science of the Greeks. Their school at Resaina is known from the name of Sergius, one of the first of these translators, in the days of Justinian; and from their monasteries at Kinnesrīn (Chalcis) issued numerous versions of the introductory treatises of the Aristotelian logic. To the *Isagoge* of Porphyry, the *Categories* and the *Hermeneutica* of Aristotle, the labours of these Syrian schoolmen were confined. These they expounded, translated, epitomized and made the basis of their compilations, and the few who were bold enough to attempt the *Analytics* seem to have left their task unaccomplished.

The energy of the Monophysites, however, began to sink with the rise of the Moslem empire; and when philosophy revived amongst them in the 13th century, in the person of Gregorius Bar-Hebraeus (Abulfaragius) (1226–1286), the revival was due to the example and influence of the Arabian thinkers. It was otherwise with the Nestorians. Gaining by means of their professional skill as physicians a high rank in the society of the Moslem world, the Nestorian scholars soon made Bagdad familiar with the knowledge of Greek philosophy and science which they possessed. But the narrow limits of the Syrian studies, which added to a scanty knowledge of Aristotle some acquaintance with his Syrian commentators, were soon passed by the curiosity and zeal of the students in the Caliphate. During the 8th and 9th centuries, rough but generally faithful versions of Aristotle's principal works were made into Syriac, and then from the Syriac into Arabic. The names of some of these translators, such as Johannitius (Hunain ibn-Ishāq), were heard even in the Latin schools. By the labours of Hunain and his family the great body of Greek science, medical, astronomical and mathematical, became accessible to the Arab-speaking races. But for the next three centuries fresh versions, both of the philosopher and of his commentators, continued to succeed each other.

To the Arabians Aristotle represented and summed up Greek philosophy, even as Galen became to them the code of Greek medicine. They adopted the doctrine and system which the progress of human affairs had made the intellectual aliment of their Syrian guides. From first to last Arabian philosophers made no claim to originality; their aim was merely to propagate the truth of Peripateticism as it had been delivered to them. It was with them that the deification of Aristotle began; and from them the belief that in him human intelligence had reached its limit passed to the later schoolmen (see SCHOLASTICISM). The progress amongst the Arabians on this side lies in a closer adherence to their text, a nearer approach to the bare exegesis of their author, and an increasing emancipation from control by the tenets of the popular religion.

Under the Caliphate.

Secular philosophy found its first entrance amongst the Saracens in the days of the early caliphs of the Abbasid dynasty, whose ways and thoughts had been moulded by their residence in Persia amid the influences of an older creed, and of ideas which had in the last resort sprung from the Greeks. The seat of empire had been transferred to Bagdad, on the highway of Oriental commerce; and the distant

Khorasan became the favourite province of the caliph. Then was inaugurated the period of Persian supremacy, during which Islam was laid open to the full current of alien ideas and culture. The incitement came, however, not from the people, but from the prince: it was in the light of court favour that the colleges of Bagdad and Nishapur first came to attract students from every quarter, from the valleys of Andalusia as well as the upland plains of Transoxiana. Mansūr, the second of the Abbasids, encouraged the appropriation of Greek science; but it was al-Ma'mūn, the son of Harūn al-Rashīd, who deserves in the Mahommedan empire the same position of royal founder and benefactor which is held by Charlemagne in the history of the Latin schools. In his reign (813–833) Aristotle was first translated into Arabic. Orthodox Moslems, however, distrusted the course on which their chief had entered, and his philosophical proclivities became one ground for doubting as to his final salvation.

In the eastern provinces the chief names of Arabian philosophy are those known to the Latin schoolmen as Alkindius, Alfarabius, Avicenna and Algazel, or under forms resembling these. The first of these, Alkindius (see KINDI), flourished at the court of Bagdad in the first half of the 9th century. His claims to notice at the present day rest upon a few works on medicine, theology, music and natural science. With him begins that encyclopaedic character—the simultaneous cultivation of the whole field of investigation which is reflected from Aristotle on the Arabian school. In him too is found the union of Platonism and Aristotelianism expressed in Neo-Platonic terms. Towards the close of the 10th century the presentation of an entire scheme of knowledge, beginning with logic and mathematics, and ascending through the various departments of physical inquiry to the region of religious doctrine, was accomplished by a society which had its chief seat at Basra, the native town of al-Kindi. This society—the Brothers of Purity or Sincerity (Ikhwān us Safā'i)—divided into four orders, wrought in the interests of religion no less than of science; and though its attempt to compile an encyclopaedia of existing knowledge may have been premature, it yet contributed to spread abroad a desire for further information. The proposed reconciliation between science and faith was not accomplished, because the compromise could please neither party. The fifty-one treatises of which this encyclopaedia consists are interspersed with apologues in true Oriental style, and the idea of goodness, of moral perfection, is as prominent an end in every discourse as it was in the alleged dream of al-Ma'mūn. The materials of the work come chiefly from Aristotle, but they are conceived in a Platonizing spirit, which places as the bond of all things a universal soul of the world with its partial or fragmentary souls. Contemporary with this semi-religious and semi-philosophical society lived Alfarabius (see FARĀBĪ), who died in 950. His paraphrases of Aristotle formed the basis on which Avicenna constructed his system, and his logical treatises produced a permanent effect on the logic of the Latin scholars. He gave the tone and direction to nearly all subsequent speculations among the Arabians. His order and enumeration of the principles of being, his doctrine of the double aspect of intellect, and of the perfect beatitude which consists in the aggregation of noble minds when they are delivered from the separating barriers of individual bodies, present at least in germ the characteristic theory of Averroes. But al-Farābī was not always consistent in his views; a certain sobriety checked his speculative flights, and although holding that the true perfection of man is reached in this life by the elevation of the intellectual nature, he came towards the close to think the separate existence of intellect no better than a delusion.

Avicenna.

Unquestionably the most illustrious name amongst the Oriental Moslems was Avicenna (980–1037). His rank in the medieval world as a philosopher was far beneath his fame as a physician. Still, the logic of Albertus Magnus and succeeding doctors was largely indebted to him for its formulae. In logic Avicenna starts from distinguishing between the isolated concept and the judgment or assertion; from which two primitive elements of knowledge there is artificially generated a complete and scientific knowledge by the two processes of definition and syllogism. But the chief interest for the history of logic belongs to his doctrine in so far as it bears upon the nature and function of abstract ideas. The question had been suggested alike to East and West by Porphyry, and the Arabians were the first to approach the full statement of the problem. Farābī had pointed out that the universal and individual are not distinguished from each other as understanding from the senses, but that both universal and individual are in one respect intellectual, just as in another connexion they play a part in perception. He had distinguished the universal essence in its abstract nature, from the universal considered in relation to a number of singulars. These suggestions formed the basis of Avicenna's doctrine. The essences or forms—the *intelligibilia* which constitute the world of real knowledge—may be looked at in themselves (metaphysically), or as embodied in the things of sense (physically), or as expressing the processes of thought (logically). The first of these three points of view deals with the form or idea as self-contained in the principles of its own being, apart from those connexions and distinctions which it receives in real (sensuous) science, and through the act of intellect. Secondly, the form may be looked at as the similarity evolved by a process of comparison, as the work of mental reflection, and in that way as essentially expressing a relation. When thus considered as the common features derived by examination from singular instances, it becomes a universal or common term strictly so called. It is intellect which first makes the abstract idea a true universal. *Intellectus in formis agit universalitatem.* In the third place, the form or essence may be looked upon as embodied in outward things (*in singularibus propriis*), and thus it is the type more or less represented by the members of a natural kind. It is the designation of these outward things which forms the "first intention" of names; and it is only at a later stage, when thought comes to observe its own modes, that names, looked upon as predicables and universals, are taken in their "second intention." Logic deals with such second intentions. It does not consider the forms *ante multiplicitatem*, *i.e.* as eternal ideas—nor *in multiplicitate*, *i.e.* as immersed in the matter of the phenomenal world—but *post multiplicitatem*, *i. e.* as they exist in and for the intellect which has examined and compared. Logic does not come in contact with things, except as they are subject to modification by intellectual forms. In other words, universality, individuality and speciality are all equally modes of our comprehension or notion; their meaning consists in their setting forth the relations attaching to any object of our conception. In the mind, *e.g.*, one form may be placed in reference to a multitude of things, and as thus related will be universal. The form animal, *e.g.*, is an abstract intelligible or metaphysical idea. When an act of thought employs it as a schema to unify several species, it acquires its logical aspect (*respectus*) of generality; and the various living beings qualified to have the name animal applied to them constitute the natural class or kind. Avicenna's view of the universal may be compared with that of Abelard, which calls it "that whose nature it is to be predicated of several," as if the generality became explicit only in the act of predication, in the *sermo* or proposition, and not in the abstract, unrelated form or essence. The three modes of the universal before things, in things, and after things, spring from Arabian influence, but depart somewhat from his standpoint.

The place of Avicenna amongst Moslem philosophers is seen in the fact that Shahrastānī takes him as the type of all, and that Ghazālī's attack against philosophy is in reality almost entirely directed against Avicenna. His system is in the main a codification of Aristotle modified by fundamental views of Neo-Platonist origin, and it tends to be a compromise with theology. In order, for example, to maintain the necessity of creation, he taught that all things except God were admissible or possible in their own nature, but that certain of them were rendered necessary by the act of the creative first agent,—in other words, that the possible could be transformed into the necessary. Avicenna's theory of the process of knowledge is an interesting part of his doctrine. Man has a rational soul, one face of which is turned towards the body, and, by the help of the higher aspect, acts as practical understanding; the other face lies open to the reception and acquisition of the intelligible forms, and its aim is to become a reasonable world, reproducing the forms of the universe and their intelligible order. In man there is only the susceptibility to reason, which is sustained and helped by the light of the active intellect. Man may prepare himself for this influx by removing the obstacles which prevent the union of the intellect with the human vessel destined for its reception. The stages of this process to the acquisition of mind are generally enumerated by Avicenna as four; in this part he follows not Aristotle, but the Greek commentator. The first stage is that of the hylic or material intellect, a state of mere potentiality, like that of a child for writing, before he has ever put pen to paper. The second stage is called *in habitu*; it is compared to the case of a child that has learned the elements of writing, when the bare possibility is on the way to be developed, and is seen to be real. In this period of half-trained reason, it appears as happy conjecture, not yet transformed into art or science proper. When the power of writing has been actualized, we have a parallel to the *intellectus in actu*—the way of science and demonstration is entered. And when writing has been made a permanent accomplishment, or lasting property of the subject, to be taken up at will, it corresponds to the *intellectus adeptus*—the complete mastery of science. The whole process may be compared to the gradual illumination of a body naturally capable of receiving light. There are, however, grades of susceptibility to the active intellect, *i.e.* in theological language, to communication with God and his angels. Sometimes the receptivity is so vigorous in its affinity, that without teaching it rises at one step to the vision of truth, by a certain "holy force" above ordinary measure. (In this way philosophy tried to account for the phenomenon of prophecy, one of the ruling ideas of Islam.) But the active intellect is not merely influential on human souls. It is the universal giver of forms in the world.

In several points Avicenna endeavoured to give a *rationale* of theological dogmas, particularly of prophetic rule, of miracles, divine providence and immortality. The permanence of individual souls he supports by arguments borrowed from those of Plato. The existence of a prophet is shown to be a corollary from a belief in God as a moral governor, and the phenomena of miracles are required to evidence the genuineness of the prophetic mission. Thus Avicenna, like his predecessors, tried to harmonize the abstract forms of philosphy with the religious faith of his nation. But his arguments are generally vitiated by the fallacy of assuming what they profess to prove. His failure is made obvious by the attack of Ghazālī on the tendencies and results of speculation.

Ghazālī.

To Ghazālī (*q.v.*) it seemed that the study of secular philosophy had resulted in a general indifference to religion, and that the scepticism which concealed itself under a pretence of piety was destroying the life and purity of the nation. With these views he carried into the fields of philosophy the aims and spirit of the Moslem theologian. His restless life was the reflex of a mental history disturbed by prolonged agitation. Revolting, in the height of his success, against the current creed, he began to examine the foundations of knowledge. The senses are contradicted by one another, and disproved by reason. Reason, indeed, professes to furnish us with necessary truths; but what assurance have we that the verdicts of reason may not be reversed by some higher authority? Ghazālī then interrogated all the sects in succession to learn their criterion of truth. He first applied to the theological schoolmen, who grounded their religion on reason; but their aim was only to preserve the faith from heresy. He turned to the philosophers, and examined the accepted Aristotelianism in a treatise which has come down to us—*The Destruction of the Philosophers*. He assails them on twenty points of their mixed physical and metaphysical peripateticism, from the statement of which, in spite of his pretended scepticism, we can deduce some very positive metaphysical opinions of his own. He claims to have shown that the dogmas of the eternity of matter and the permanence of the world are false; that their description of the Deity as the demiurgos is unspiritual; that they fail to prove the existence, the unity, the simplicity, the incorporeality or the knowledge (both of species and accidents) of God; that their ascription of souls to the celestial spheres is unproved; that their theory of causation, which attributes effects to the very natures of the causes, is false, for that all actions and events are to be ascribed to the Deity; and, finally, that they cannot establish the spirituality of the soul, nor prove its mortality. These criticisms disclose nothing like a sceptical state of mind, but rather a reversion from the metaphysical to the theological stage of thought. He denies the intrinsic tendencies, or souls, by which the Aristotelians explained the motion of the spheres, because he ascribes their motion to God. The sceptic would have denied both. G. H. Lewes censures Renan for asserting of Ghazālī's theory of causation—"*Hume n'a rien dit plus.*" It is true that Ghazālī maintains that the natural law according to which effects proceed inevitably from their causes is only custom, and that there is no *necessary* connexion between them. But while Hume absolutely denies the necessity, Ghazālī merely removes it one stage farther back, and plants it in the mind of the Deity. This, of course, is not metaphysics, but theology. Having, as he believed, refuted the opinions of the philosophers, he next investigated the pretensions of the Allegorists, who derived their doctrines from an imam. These Arabian ultramontanes had no word for the doubter. They could not, he says, even understand the problems they sought to resolve by the assumption of infallibility, and he turned again, in his despair, to the instructors of his youth—the Sūfīs. In their mystical intuition of the laws of life, and absorption in the immanent Deity, he at last found peace. This shows the true character of the treatise which, alike in medieval and modern times, has been quoted as containing an exposition of his opinions. The work called *The Tendencies of the Philosophers*, translated in 1506, with the title *Logica et Philosophia Algazelis Arabis*, contains neither the logic nor the philosophy of Ghazālī. It is a mere abstract or statement of the Peripatetic systems, and was made preliminary to that *Destruction* of which we have already spoken.

This indictment against liberal thought from the standpoint of the theological school was afterwards answered in Spain by Averroes; but in Bagdad it heralded the extinction of the light of philosophy. Moderate and compliant with the popular religion as Alfarabius and Avicenna had always been, as compared with their Spanish successor, they had equally failed to conciliate the popular spirit, and were classed in the same category with the heretic or the member of an immoral sect. The 12th century exhibits the decay of liberal intellectual activity in the Caliphate, and the gradual ascendancy of Turkish races animated with all the intolerance of semi-barbarian proselytes to the Mahommedan faith. Philosophy, which had only sprung up when the purely Arabian influences ceased to predominate, came to an end when the sceptre of the Moslem world passed away from the dynasty of Persia. Even in 1150 Bagdad had seen a library of philosophical books burned by command of the caliph Mostanjid; and in 1192 the same place might have witnessed a strange scene, in which the books of a physician were first publicly cursed, and then committed to the flames, while their owner was incarcerated. Thus, while the Latin church showed a marvellous receptivity for ethnic philosophy, and assimilated doctrines which it had at an earlier date declared impious, in Islam the theological system entrenched itself towards the end of the 12th century in the narrow orthodoxy of the Asharites, and reduced the votaries of Greek philosophy to silence.

In Spain.

The same phenomena were repeated in Spain under the Mahommedan rulers of Andalusia and Morocco, with this difference, that the time of philosophical development was shorter, and the heights to which Spanish thinkers soared were greater. The reign of al-Hakam the Second (961–976) inaugurated in Andalusia those scientific and philosophical studies which were simultaneously prosecuted by the Society of Basra. From Cairo, Bagdad, Damascus and Alexandria, books both old and new were procured at any price for the library of the prince; twenty-seven free schools were opened in Cordova for the education of the poor; and intelligent knowledge was perhaps more widely diffused in Mahommedan Spain than in any other part of Europe at that day. The mosques of the city were filled with crowds who listened to lectures on science and literature, law and religion. But the future glory thus promised was long postponed. The usurping successor of Hakam found it a politic step to request the most notable doctors of the sacred law to examine the royal library; and every book treating of philosophy, astronomy and other forbidden topics was condemned to the flames. But the spirit of research, fostered by the fusion of races and the social and intellectual competition thus engendered, was not crushed by these proceedings; and for the next century and more the higher minds of Spain found in Damascus and Bagdad the intellectual aliment which they desired. At last, towards the close of the 11th century, the long-pent spiritual energies of Mahommedan Spain burst forth in a brief series of illustrious men. Whilst the native Spaniards were narrowing the limits of the Moorish kingdoms, and whilst the generally fanatical dynasty of the Almohades might have been expected to repress speculation, the century preceding the close of Mahommedan sway saw philosophy cultivated by Avempace, Abubacer and Averroes. Even amongst the Almohades there were princes, such as Yusūf (who began his reign in 1163) and Yaqūb Almansūr (who succeeded in 1184), who welcomed the philosopher at their courts and treated him as an intellectual compeer. But about 1195 the old distrust of philosophy revived; the philosophers were banished in disgrace; works on philosophical topics were ordered to be confiscated and burned; and the son of Almansūr condemned a certain Ibn-Habīb to death for the crime of philosophizing.

Avempace.

Arabian speculation in Spain was heralded by Avicebron or Ibn Gabirol (*q.v.*), a Jewish philosopher (1021–1058). About a generation later the rank of Moslem thinkers was introduced by Abū-Bakr Muhammad ibn Yahya, surnamed Ibn-Bājja, and known to the Latin world as Avempace. He was born at Saragossa, and died comparatively young at Fez in 1138. Besides commenting on various physical treatises of Aristotle's, he wrote some philosophical essays, notably one on the *Republic or Régime of the Solitary*, understanding by that the organized system of rules, by obedience to which the individual may rise from the mere life of the senses to the perception of pure intelligible principles and may participate in the divine thought which sustains the world. These rules for the individual are but the image or reflex of the political organization of the perfect or ideal state; and the man who strives to lead this life is called the *solitary*, not because he withdraws from society, but because, while in it, he guides himself by reference to a higher state, an ideal society. Avempace does not develop at any length this curious Platonic idea of the perfect state. His object is to discover the highest end of human life, and with this view he classifies the various activities of the human soul, rejects such as are material or animal, and then analyses the various spiritual forms to which the activities may be directed. He points out the graduated scale of such forms, through which the soul may rise, and shows that none are final or complete in themselves, except the pure intelligible forms, the ideas of ideas. These the intellect can grasp, and in so doing it becomes what he calls *intellectus acquisitus*, and is in a measure divine. This self-consciousness of pure reason is the highest object of human activity, and is to be attained by the speculative method. The intellect has in itself power to know ultimate truth and intelligence, and does not require a mystical illumination as Ghazālī taught. Avempace's principles, it is clear, lead directly to the Averroistic doctrine of the unity of intellect, but the obscurity and incompleteness of the *Régime* do not permit us to judge how far he anticipated the later thinker. (See Munk, *Mélanges de phil. juive et arabe*, pp. 383-410.)

The same theme was developed by Ibn.-Ṭufail (*q.v.*) in his philosophical romance, called *Hayy ibn-Yakdhān* (the Living, Son of the Waking One), best known by Pococke's Latin version, as the *Philosophus Autodidactus*. It describes the process by which an isolated truth-seeker detaches himself from his lower passions, and raises himself above the material earth and the orbs of heaven to the forms which are the source of their movement, until he arrives at a union with the supreme intellect. The experiences of the religious mystic are paralleled with the ecstatic vision in which the philosophical hermit sees a world of pure intelligences, where birth and decease are unknown. It was this theory which Averroes (1126–1198), the last and most famous of the thinkers of Moslem Spain, carried out to his doctrine of the unity of intellect.

Averroes.

For Aristotle the reverence of Averroes was unbounded, and to expound him was his chosen task. The uncritical receptivity of his age, the defects of the Arabic versions, the emphatic theism of his creed, and the rationalizing mysticism of some Oriental thought, may have sometimes led him astray, and given prominence to the less obvious features of Aristotelianism. But in his conception of the relation between philosophy and religion, Averroes had a light which the Latins were without. The science, falsely so called, of the several theological schools, their groundless distinctions and sophistical demonstrations, he regarded as the great source of heresy and scepticism. The allegorical interpretations and metaphysics which had been imported into religion had taken men's minds away from the plain sense of the Koran. God had declared a truth meet for all men, which needed no intellectual superiority to understand, in a tongue which each human soul could apprehend. Accordingly, the expositors of religious metaphysics, Ghazālī included, are the enemies of true religion, because they make it a mere matter of syllogism. Averroes maintains that a return must be made to the words and teaching of the prophet; that science must not expend itself in dogmatizing on the metaphysical consequences of fragments of doctrine for popular acceptance, but must proceed to reflect upon and examine the existing things of the world. Averroes, at the same time, condemns the attempts of those who tried to give demonstrative science where the mind was not capable of more than rhetoric: they harm religion by their mere negations, destroying an old sensuous creed, but cannot build up a higher and intellectual faith.

In this spirit Averroes does not allow the fancied needs of theological reasoning to interfere with his study of Aristotle, whom he simply interprets as a truth-seeker. The points by which he told on Europe were all implicit in Aristotle, but Averroes set in relief what the original had left obscure, and emphasized things which the Christian theologian passed by or misconceived. Thus Averroes had a double effect. He was the great interpreter of Aristotle to the later Schoolmen. On the other hand, he came to represent those aspects of Peripateticism most alien to the spirit of Christendom; and the deeply religious Moslem gave his name to the anti-sacerdotal party, to the materialists, sceptics and atheists, who defied or undermined the dominant beliefs of the church.

On three points Averroes, like other Moslem thinkers, came specially into relation, real or supposed, with the religious creed, viz. the creation of the world, the divine knowledge of particular things, and the future of the human soul.

The real grandeur of Averroes is seen in his resolute prosecution of the standpoint of science in matters of this world, and in his recognition that religion is not a branch of knowledge to be reduced to propositions and systems of dogma, but a personal and inward power, an individual truth which stands distinct from, but not contradictory to, the universalities of scientific law. In his science he followed the Greeks, and to the Schoolmen he and his compatriots rightly seemed philosophers of the ancient world. He maintained alike the claim of demonstrative science with its generalities for the few who could live in that ethereal world, and the claim of religion for all—the common life of each soul as an individual and personal consciousness. But theology, or the mixture of the two, he regarded as a source of evil to both—fostering the vain belief in a hostility of philosophers to religion, and meanwhile corrupting religion by a pseudo-science.

The latent nominalism of Aristotle only came gradually to be emphasized through the prominence which Christianity gave to the individual life, and, apart from passing notices as in Abelard, first found clear enunciation in the school of Duns Scotus. The Arabians, on the contrary, emphasized the idealist aspect which had been adopted and promoted by the Neo-Platonist commentators. Hence, to Averroes the eternity of the world finds its true expression in the eternity of God. The ceaseless movement of growth and change, which presents matter in form after form as a continual search after a finality which in time and movement is not and cannot be reached, represents only the aspect the world shows to the physicist and to the senses. In the eye of reason the full fruition of this desired finality is already and always attained; the actualization, invisible to the senses, is achieved now and ever, and is thus beyond the element of time. This transcendent or abstract being *is* that which the world of nature is always *seeking*. He is thought or intellect, the actuality, of which movement is but the fragmentary attainment in successive instants of time. Such a mind is not in the theological sense a creator, yet the onward movement is not the same as what some modern thinkers seem to mean by development. For the perfect and absolute, the consummation of movement is not generated at any point in the process; it is an ideal end, which guides the operations of nature, and does not wait upon them for its achievement. God is the unchanging essence of the movement, and therefore its eternal cause.

A special application of this relation between the prior perfect, and the imperfect, which it influences, is found in the doctrine of the connexion of the abstract (transcendent) intellect with man. This transcendent mind is sometimes connected with the moon, according to the theory of Aristotle, who assigned an imperishable matter to the sphere beyond the sublunary, and in general looked upon the celestial orbs as living and intelligent. Such an intellect, named active or productive, as being the author of the development of reason in man, is the permanent, eternal thought, which is the truth of the cosmic and physical movement. It is in man that the physical or sensible passes most evidently into the metaphysical and rational. Humanity is the chosen vessel in which the light of the intellect is revealed; and so long as mankind lasts there must always be some individuals destined to receive this light. What seems from the material point of view to be the acquisition of learning, study and a moral life, is from the higher point of view the manifestation of the transcendent intellect in the individual. The preparation of the heart and faculties gives rise to a series of grades between the original predisposition and the full acquisition of actual intellect. These grades in the main resemble those given by Avicenna. But beyond these, Averroes claims as the highest bliss of the soul a union in this life with the actual intellect. The intellect, therefore, is one and continuous in all individuals, who differ only in the degree which their illumination has attained. Such was the Averroist doctrine of the unity of intellect —the eternal and universal nature of true intellectual life. By his interpreters it was transformed into a theory of one soul common to all mankind, and when thus corrupted conflicted not unreasonably with the doctrines of a future life, common to Islam and Christendom.

Opponents of Averroism.

Averroes, rejected by his Moslem countrymen, found a hearing among the Jews, to whom Maimonides had shown the free paths of Greek speculation. In the cities of Languedoc and Provence, to which they had been driven by Spanish fanaticism, the Jews no longer used the learned Arabic, and translations of the works of Averroes became necessary. His writings became the text-book of Levi ben Gerson at Perpignan, and of Moses of Narbonne. Meanwhile, before 1250, Averroes became accessible to the Latin Schoolmen by means of versions, accredited by the names of Michael Scot and others. William of Auvergne is the first Schoolman who criticizes the doctrines of Averroes, not, however, by name. Albertus Magnus and St Thomas devote special treatises to an examination of the Averroist theory of the unity of intellect, which they labour to confute in order to establish the orthodoxy of Aristotle. But as early as Aegidius Romanus (1247–1316), Averroes had been stamped as the patron of indifference to theological dogmas, and credited with the emancipation which was equally due to wider experience and the lessons of the Crusades. There had never been an absence of protest against the hierarchical doctrine. Berengar of Tours (11th century) had struggled in that interest, and with Abelard, in the 12th century, the revolt against authority in belief grew loud. The dialogue between a Christian, a Jew and a philosopher suggested a comparative estimate of religions, and placed the natural religion of the moral law above all positive revelations. Nihilists and naturalists, who deified logic and science at the expense of faith, were not unknown at Paris in the days of John of Salisbury. In such a critical generation the words of Averroism found willing ears, and pupils who outran their teacher. Paris became the centre of a sceptical society, which the decrees of bishops and councils, and the enthusiasm of the orthodox doctors and knights-errant of Catholicism, were powerless to extinguish. At Oxford Averroes told more as the great commentator. In the days of Roger Bacon he had become an authority. Bacon, placing him beside Aristotle and Avicenna, recommends the study of Arabic as the only way of getting the knowledge which bad versions made almost hopeless. In Duns Scotus, Averroes and Aristotle are the unequalled masters of the science of proof; and he pronounces distinctly the separation between Catholic and philosophical truth, which became the watchword of Averroism. By the 14th century Averroism was the common leaven of philosophy; John Baconthorpe is the chief of Averroists, and Walter Burley has similar tendencies.

Meanwhile Averroism had come to be regarded by the great Dominican school as the arch-enemy of the truth. When the emperor Frederick II. consulted a Moslem free-thinker on the mysteries of the faith, when the phrase or legend of the "Three Impostors" presented in its most offensive form the scientific survey of the three laws of Moses, Christ and Mahomet, and when the characteristic doctrines of Averroes were misunderstood, it soon followed that his name became the badge of the scoffer and the sceptic. What had begun with the subtle disputes of the universities of Paris, went on to the materialist teachers in the medical schools and the sceptical men of the world in the cities of northern Italy. The patricians of Venice and the lecturers of Padua made Averroism synonymous with doubt and criticism in theology, and with sarcasm against the hierarchy. Petrarch refuses to believe that any good thing can come out of Arabia, and speaks of Averroes as a mad dog barking against the church. In works of contemporary art Averroes is at one time the comrade of Mahomet and Antichrist; at another he lies with Arius and Sabellius, vanquished by the lance of St Thomas.

The school of Padua.

It was in the universities of north Italy that Averroism finally settled, and there for three centuries it continued as a stronghold of Scholasticism to resist the efforts of revived antiquity and of advancing science. Padua became the seat of Averroist Aristotelianism; and, when Padua was conquered by Venice in 1405, the printers of the republic spread abroad the teaching of the professors in the university. As early as 1300, at Padua, Petrus Aponensis, a notable expositor of medical theories, had betrayed a heterodoxy in faith; and John of Jandun, one of the pamphleteers on the side of Louis of Bavaria, was a keen follower of Averroes, whom he styles a "perfect and most glorious physicist." Urbanus of Bologna, Paul of Venice (d. 1428), and Cajetanus de Thienis (1387–1465), established by their lectures and their discussions the authority of Averroes; and a long list of manuscripts rests in the libraries of Lombardy to witness the diligence of these writers and their successors. Even a lady of Venice, Cassandra Fedele, in 1480, gained her laurels in defence of Averroist theses.

With Pietro Pomponazzi (*q.v.*) in 1495, a brilliant epoch began for the school of Padua. Questions of permanent and present interest took the place of outworn scholastic problems. The disputants ranged themselves under the rival commentators, Alexander and Averroes; and the immortality of the soul became the battle-ground of the two parties. Pomponazzi defended the Alexandrist doctrine of the utter mortality of the soul, whilst Agostino Nifo (*q.v.*), the Averroist, was entrusted by Leo X. with the task of defending the Catholic doctrine. The parties seemed to have changed when Averroism thus took the side of the church; but the change was probably due to compulsion. Nifo had edited the works of Averroes (1495–1497); but his expressions gave offence to the dominant theologians, and he had to save himself by distinguishing his personal faith from his editorial capacity. Alessandro Achillini, the persistent philosophical adversary of Pomponazzi, both at Padua and subsequently at Bologna, attempted, along with other moderate but not brilliant Averroists, to accommodate their philosophical theory with the requirements of Catholicism. It was this comparatively mild Averroism, reduced to the merely explanatory activity of a commentator, which continued to be the official dogma at Padua during the 16th century. Its typical representative is Marc-Antonio Zimara (d. 1552), the author of a reconciliation between the tenets of Averroes and those of Aristotle.

Summary.

Meanwhile, in 1497, Aristotle was for the first time expounded in Greek at Padua. Plato had long been the favourite study at Florence; and Humanists, like Erasmus, Ludovicus Vives and Nizolius, enamoured of the popular philosophy of Cicero and Quintilian, poured out the vials of their contempt on scholastic barbarism with its "impious and thrice-accursed Averroes." The editors of Averroes complain that the popular taste had forsaken them for the Greek. Nevertheless, while Fallopius, Vesalius and Galileo were claiming attention to their discoveries, G. Zabarella, Francesco Piccolomini (1520–1604) and Cesare Cremonini (1550–1631) continued the traditions of Averroism, not without changes and additions. Cremonini, the last of them, died in 1631, after lecturing twelve years at Ferrara, and forty at Padua. The great educational value of Arabian philosophy for the later schoolmen consisted in its making them acquainted with an entire Aristotle. At the moment when it seemed as if everything had been made that could be made out of the fragments of Aristotle, and the compilations of Capella, Cassiodorus and others, and when mysticism and scepticism seemed the only resources left for the mind, the horizon of knowledge was suddenly widened by the acquisition of a complete Aristotle. Thus the mistakes inevitable in the isolated study of an imperfect *Organon* could not henceforth be made. The real bearing of old questions, and the meaninglessness of many disputes, were seen in the new conception of Aristotelianism given by the *Metaphysics* and other treatises. The former Realism and Nominalism were lifted into a higher phase by the principle of the universalizing action of intellect—*Intellectus in formis agit universalitatem.* The commentaries of the Arabians in this respect supplied nutriment more readily assimilated by the pupils than the pure text would have been.

Arabian philosophy, whilst it promoted the exegesis of Aristotle and increased his authority, was not less notable as the source of the separation between theology and philosophy. Speculation fell on irreligious paths. In many cases the heretical movement was due less to foreign example than to the indwelling tendencies of the dominant school of realism. But it is not less certain that the very considerable freedom of the Arabians from theological bias prepared the time when philosophy shook off its ecclesiastical vestments. In the hurry of first terror, the church struck Aristotle with the anathema launched against innovations in philosophy. The provincial council of Paris in 1209, which condemned Amalricus and his followers, as well as David of Dinant's works, forbade the study of Aristotle's *Natural Philosophy* and the *Commentaries.* In 1215 the same prohibition was repeated, specifying the *Metaphysics* and *Physics*, and the *Commentaries* by the Spaniard Mauritius (*i.e.* probably Averroes). Meanwhile Albertus Magnus and Thomas Aquinas, accepting the exegetical services of the Arabians, did their best to controvert the obnoxious doctrine of the Intellect, and to defend the orthodoxy of Aristotle against the unholy glosses of infidels. But it is doubtful whether even they kept as pure from the infection of illegitimate doctrine as they supposed. The tide meanwhile flowed in stronger and stronger. In 1270 Étienne Tempier, bishop of Paris, supported by an assembly of theologians, anathematized thirteen propositions bearing the stamp of Arabian authorship; but in 1277 the same views and others more directly offensive to Christians and theologians had to be censured again. Raymond Lully, in a dialogue with an infidel thinker, broke a lance in support of the orthodox doctrine, and carried on a crusade against the Arabians in every university; and a disciple of Thomas Aquinas drew up a list (*De erroribus philosophorum*) of the several delusions and errors of each of the thinkers from Kindi to Averroes. Strong in their conviction of the truth of Aristotelianism, the Arabians carried out their logical results in the theological field, and made the distinction of necessary and possible, of form and matter, the basis of conclusions in the most momentous questions. They refused to accept the doctrine of creation because it conflicted with the explanation of forms as the necessary evolution of matter. They denied the particular providence of God, because knowledge in the divine sphere did not descend to singulars. They excluded the Deity from all direct action upon the world, and substituted for a cosmic principle the active intellect,—thus holding a form of Pantheism. But all did not go the same length in their divergence from the popular creed.

The half-legendary accounts which attribute the introduction of Arabian science to Gerbert, afterwards Pope Sylvester II., to Constantinus Africanus and to Adelard of Bath, if they have any value, refer mainly to medical science and mathematics. It was not till about the middle of the 12th century that under the patronage of Raymond, archbishop of Toledo, a society of translators, with the archdeacon Dominicus Gundisalvi at their head, produced Latin versions of the *Commentaries* of Avicenna, and Ghazālī, of the *Fons Vitae* of Avicebron, and of several Aristotelian treatises. The working translators were converted Jews, the best-known among them being Joannes Avendeath. With this effort began the chief translating epoch for Arabic works. Avicenna's *Canon of Medicine* was first translated into Latin by Gerard of Cremona (d. 1187), to whom versions of other medical and astronomical works are due. The movement towards introducing Arabian science and philosophy into Europe, however, culminated under the patronage of the emperor Frederick II. (1212–1250). Partly from superiority to the narrowness of his age, and partly in the interest of his struggle with the Papacy, this *Malleus ecclesiae Romanae* drew to his court those savants whose pursuits were discouraged by the church, and especially students in the forbidden lore of the Arabians. He is said to have pensioned Jews for purposes of translation. One of the scholars to whom Frederick gave a welcome was Michael Scot, the first translator of Averroes. Scot had sojourned at Toledo about 1217, and had accomplished the versions of several astronomical and physical treatises, mainly, if we believe Roger Bacon, by the labours of a Jew named Andrew. But Bacon is apparently hypercritical in his estimate of the translators from the Arabic. Another protégé of Frederick's was Hermann the German (Alemannus), who, between the years 1243 and 1256, translated amongst other things a paraphrase of al-Fārābī on the *Rhetoric*, and of Averroes on the *Poetics* and *Ethics* of Aristotle. Jewish scholars held an honourable place in transmitting the Arabian commentators to the schoolmen. It was amongst them, especially in Maimonides, that Aristotelianism found refuge after the light of philosophy was extinguished in Islam; and the Jewish family of the Ben-Tibbon were mainly instrumental in making Averroes known to southern France.

See S. Munk, *Mélanges de philosophie juive et arabe* (Paris, 1859); E. Renan, *De Philosophia Peripatetica apud Syros* (1852), and *Averroës et l'Averroisme* (Paris, 3rd ed., 1867); Am. Jourdain, *Recherches critiques sur l'âge et l'origine des traductions latines d'Aristote* (Paris, 2^{me} ed. 1843); B. Hauréau, *Philosophie scolastique*

(Paris, 1850), tome i. p. 359; E. Vacherot, *École d'Alexandrie* (1846–1851), tome iii. p. 85; Schmölders, *Documenta philosophiae Arabum* (Bonn, 1836), and *Essai sur les écoles philosophiques chez les Arabes* (Paris, 1842); Shahrastani, *History of Religious and Philosophical Sects*, in German translation by Haarbrücker (Halle, 1850–1851); Dieterici, *Streit zwischen Mensch und Thier* (Berlin, 1858), and his other translations of the *Encyclopaedia of the Brothers of Sincerity* (1861 to 1872); T. J. de Boer, *The History of Philosophy in Islam* (London, 1903); K. Prantl, *Geschichte der Logik* (Leipzig, 1861); and the Histories of Philosophy; also the literature under the biographies of philosophers mentioned. (W. W.; G. W. T.)

ARABIAN SEA (anc. *Mare Erythraeum*), the name applied to the portion of the Indian Ocean bounded E. by India, N. by Baluchistan and part of the southern Persian littoral, W. by Arabia, and S., approximately, by a line between Cape Guardafui, the north-east point of Somaliland, and Cape Comorin in India. It has two important branches—at the south-west the Gulf of Aden, connecting with the Red Sea through the strait of Bab-el-Mandeb; and at the north-west the Gulf of Oman, connecting with the Persian Gulf. Besides these larger ramifications, there are the Gulfs of Cambay and Kach on the Indian coast. An interest and importance belong to this sea as forming part of the chief highway between Europe and India. Its islands are few and insignificant, the chief being Sokotra, off the African, and the Laccadives, off the Indian coast.

ARABICI, a religious sect originating about the beginning of the 3rd century, which is mentioned by Augustine (*De Haeres.* c. lxxxiii.), and called also *θνητοψυχίται* ("mortal-souled") by John of Damascus (*De Haeres.* c. xc.) The name is given to the Arabians mentioned by Eusebius (*Hist. Eccl.* vi. 37), whose distinctive doctrine was a form of Christian materialism, showing itself in the belief that the soul perished and was restored to life along with the body. We may compare Tatian's view of the soul as a subtler variety of matter. According to Eusebius, they were convinced of their error by Origen, and renounced it at a council held about A.D. 246.

ARABI PASHA (*c.* 1839–), more correctly AHMAD ʽARĀBĪ, to which in later years he added the epithet *al-Misrī*, "the Egyptian," Egyptian soldier and revolutionary leader, was born in Lower Egypt in 1839 or 1840 of a fellah family. Having entered the army as a conscript he was made an officer by Said Pasha in 1862, and was employed in the transport department in the Abyssinian campaign of 1875 under Ismaїl Pasha. A charge of peculation, unproved, was made against him in connexion with this expedition and he was placed on half-pay. During this time he joined a secret society formed by Ali Rubi with the object of getting rid of Turkish officers from the Egyptian army. Arabi also attended lectures at the mosque El Azhar and acquired a reputation as an orator. In 1878 he was employed by Ismail in fomenting a disturbance against the ministry of Nubar, Rivers Wilson and de Blignières, and received in payment a wife from Ismail's harem and the command of a regiment. This increased his influence with the secret society, which, under the feeble government of Tewfik Pasha and the Dual Control, began to agitate against Europeans. In all that followed Arabi was put forward as the leader of the discontented Egyptians; he was in reality little more than the mouthpiece and puppet of abler men such as Ali Rubi and Mahmud Sami. On the 1st of February 1881 Arabi and two other Egyptian colonels, summoned before a court-martial for acts of disobedience, were rescued by their soldiers, and the khedive was forced to dismiss his then minister of war in favour of Mahmud Sami. A military demonstration on the 8th of September 1881, led by Arabi, forced the khedive to increase the numbers and pay of the army, to substitute Sherif Pasha for Riaz Pasha as prime minister, and to convene an assembly of notables. Arabi became under-secretary for war at the beginning of 1882, but continued his intrigues. The assembly of notables claimed the right of voting the budget, and thus came into conflict with the foreign controllers who had been appointed to guard the interests of the bondholders in the management of the Egyptian finances. Sherif fell in February, Mahmud Sami became prime minister, and Arabi (created a pasha) minister of war. Arabi, after a brief fall from office, acquired a dictatorial power that alarmed the British government. British and French warships went to Alexandria at the beginning of June; on the 11th of that month rioting in that city led to the sacrifice of many European lives. Order could only be restored through the intervention of Arabi, who now adopted a more distinctly anti-European attitude. His arming of the forts at Alexandria was held to constitute a menace to the British fleet. On the refusal of France to co-operate, the British fleet bombarded the forts (11th July), and a British force, under Sir Garnet Wolseley, defeated Arabi on the 13th of September at Tel-el-Kebir. Arabi fled to Cairo where he surrendered, and was tried (3rd of December) for rebellion. In accordance with an understanding made with the British representative, Lord Dufferin, Arabi pleaded guilty, and sentence of death was immediately commuted to one of banishment for life to Ceylon. The same sentence was passed on Mahmud Sami and others. After Arabi's exile had lasted for nearly twenty years, however, the khedive Abbas II. exercised his prerogative of mercy, and in May 1901 Arabi was permitted to return to Egypt. Arabi, as has been said, was rather the figurehead than the inspirer of the movement of 1881–1882; and was probably more honest, as he was certainly less intelligent, than those whose tool, in a large measure, he was. The movement which he represented in the eye of Europe, whatever the motives of its leaders, "was in its essence a genuine revolt against misgovernment,"[1] and it was a dim recognition of this fact which led Arabi to style himself "the Egyptian."

See EGYPT: *History*; also the accounts of Arabi in *Khedives and Pashas*, by C. F. Moberly Bell (1884); and in Lord Cromer's *Modern Egypt* (1908).

ARABISTAN (formerly KHUZISTAN), a province of Persia, bounded on the S. by the Persian Gulf, on the W. by Turkish territory, on the N. by Luristan and on the E. by the Bakhtiari district and Fars. It has its modern name, signifying "land of the Arabs," from the Arabs who form the bulk of the population, and is subdivided into the districts of Muhamrah, Fellahiyeh (the old Dorak), Ram Hormuz (popularly known as Ramiz), Havizeh, Shushter and Dizful. It has a population of about 200,000 and pays a yearly revenue of about £30,000. The soil is very fertile, but since the dam over the Karun at Ahvaz was swept away and the numerous canals which diverted the waters of the river for irrigation became useless, a great part of the province is uncultivated, and most of the crops and produce depend for water on rainfall and wells. The climate is hot, and in the low-lying, swampy districts very unhealthy; the prevailing winds are north-west and south-east, the former hot and dry from the arid districts west of Mesopotamia, the latter bearing much moisture from the Persian Gulf and the Indian Ocean. The principal Arab tribes are the Kab (generally known as Chaab) and Beni Lam, the former mostly settled in towns and villages and by religion Shiʽites, the latter nomads and Sunnites. The staples of food are dates and fish in the south, elsewhere the produce of the herds and flocks and rice, wheat and barley. Other products are maize, cotton, silk and indigo, and the manufactures include carpets without pile, coarse woollens, cottons and silk nettings. Dyeing is extensively carried on in Dizful where most of the indigo is grown.

Khuzistan (meaning "the land of the Khuz") was a part of the Biblical Elam, the classical Susiana, and appears in the great inscription of Darius as Uvaja.

ARABS, the name given to that branch of the Semitic race which from the earliest historic times inhabited the south-western portion of the Arabian peninsula. The name, to-day the collective term for the overwhelming majority of the surviving Semitic peoples, was originally restricted to the nomad tribes who ranged the north of the peninsula east of Palestine and the Syro-Arabian desert. In this narrow sense "Arab" is used in the Assyrian inscriptions, in the Old Testament and in the Minaean inscriptions. Before the Christian era it had come to include all the inhabitants of the peninsula. This, it is suggested, may have been due to the fact that the "Arabs" were the chief people near the Greek and Roman colonies in Syria and Mesopotamia. Classical writers use the term both in its local and general sense. The Arabs to-day occupy, besides Arabia, a part of Mesopotamia, the western shores of the Red Sea, the eastern coast of the Persian Gulf and the north of Africa. The finest type of the race is found in south Arabia among the Ariba Arabs, among the mountaineers of Hadramut and Yemen and among the Bedouin tribes roaming over the interior of central and northern Arabia. The Arabs of the coasts and those of Mesopotamia are hybrids, showing Turkish, Negroid and Hamitic crossings. The people of Syria and Palestine are hybrids of Arab, Phoenician and Jewish descent. The theory that early Arab settlements were made on the east coast of Africa as far as Sofala south of the Zambezi, is without foundation; the earliest Arab settlement on the east coast of Africa that can be proved is Magadoxo (Mukdishu) in the 10th century, and the ruined cities of Mashonaland, once supposed to be the remains of Arab settlements, are now known to be of medieval African origin. On the East African coast-lands Arab influence is still considerable. Traces of the Arab type are met with in Asia Minor, the Caucasus, western Persia and India, while the influence of the Arab language and civilization is found in Europe (Malta and Spain), China and Central Asia.

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[1] Lord Cromer in *Egypt*, No. 1, 1905, p. 2.

Ethnology.

The Arabs are at once the most ancient as they in many ways are the purest surviving type of the true Semite. Certainly the inhabitants of Yemen are not, and in historic times never were, pure Semites. Somali and other elements, generally described under the collective racial name of Hamitic, are clearly traceable; but the inland Arabs still present the nearest approach to the primitive Semitic type. The origin of the Arab race can only be a matter of conjecture. From the remotest historic times it has been divided into two branches, which from their geographical position it is simplest to call the North Arabians and the South Arabians. Arabic and Jewish tradition trace the descent of the latter from Joktan (Arabic *Kahtan*) son of Heber, of the former from Ishmael. The South Arabians—the older branch—were settled in the south-western part of the peninsula centuries before the uprise of the Ishmaelites. These latter include not only Ishmael's direct descendants through the twelve princes (Gen. xxv. 16), but the Edomites, Moabites, Ammonites, Midianites and other tribes. This ancient and undoubted division of the Arab race—roughly represented to-day by the universally adopted classification into Arabs proper and Bedouin Arabs (see BEDOUINS)—has caused much dispute among ethnologists. All authorities agree in declaring the race to be Semitic in the broadest ethnological signification of that term, but some thought they saw in this division of the race an indication of a dual origin. They asserted that the purer branch of the Arab family was represented by the sedentary Arabs who were of Hamitic (Biblical Cushite), *i.e.* African ancestry, and that the nomad Arabs were Arabs only by adoption, and were nearer akin to the true Semite as sons of Ishmael. Many arguments were adduced in support of this theory. (1) The unquestioned division in remote historic times of the Arab race, and the immemorial hostility between the two branches. (2) The concurrence of pre-Islamitic literature and records in representing the first settlement of the "pure" Arab as made in the extreme south-western part of the peninsula, near Aden. (3) The use of Himyar, "dusky" or "red" (suggesting African affinities), as the name sometimes for the ruling class, sometimes for the entire people. (4) The African affinities of the Himyaritic language. (5) The resemblance of the grammar of the Arabic now spoken by the "pure" Arabs, where it differs from that of the North, to the Abyssinian grammar. (6) The marked resemblance of the pre-Islamitic institutions of Yemen and its allied provinces—its monarchies, courts, armies and serfs—to the historical Africo-Egyptian type and even to modern Abyssinia. (7) The physique of the "pure" Arab, the shape and size of the head, the slenderness of the lower limbs, all suggesting an African rather than an Asiatic origin. (8) The habits of the people, viz. their sedentary rather than nomad occupations, their fondness for village life, for dancing, music and society, their cultivation of the soil, having more in common with African life than with that of the western Asiatic continent. (9) The extreme facility of marriage which exists in all classes of the southern Arabs with the African races, the fecundity of such unions and the slightness or even total absence of any caste feeling between the dusky "pure" Arab and the still darker African, pointing to a community of origin. And further arguments were found in the characteristics of the Bedouins, their pastoral and nomad tendencies; the peculiarities of their idiom allied to the Hebrew; their strong clan feeling, their continued resistance to anything like regal power or centralized organization.

Such, briefly, were the more important arguments; but latterly ethnologists are inclined to agree that there is little really to be said for the African ancestry theory and that the Arab race had its beginning in the deserts of south Arabia, that in short the true Arabs are aborigines.

Mahommedans call the centuries before the Prophet's birth *waqt-el jahilīya*, "the time of ignorance," but the fact is that the Arab world has in some respects never since reached so high a level as it had in those days which it suits Moslems to paint in dreary colours. Writing was a fine art and poetry flourished. Eloquence was an accomplishment all strove to acquire, and each year there were assemblies, lasting sometimes a month, which were devoted to contests of skill among the orators and poets, to listen to whose friendly rivalry tribesmen journeyed long distances. Last, that surest index of a people's civilization—the treatment of women—contrasted very favourably with their position under the Koran. Women had rights and were respected. The veil and the harem system were unknown before Mahomet. According to Nöldeke the Nabataean inscriptions and coins show that women held a high social position in northern Arabia, owning large estates and trading independently. Polyandry and polygamy, it is true, were practised, but the right of divorce belonged to the woman as well as the man. Two kinds of marriage were celebrated. One was a purely personal contract, with no witnesses, the wife not leaving her home or passing under marital authority. The other was a formal marriage, the woman becoming subject to her husband by purchase or capture. Even captive women were not kept in slavery. Arabic wealth and culture had indeed thus early reached a stage which justified Professor Robertson Smith in writing, "In this period the name of Arab was associated to Western writers with ideas of effeminate indolence and peaceful opulence . . . the golden age of Yemen." But long before Mahomet's time this early Arab predominance was at an end, possibly due in great measure to the loss of the caravan trade through the increase of shipping. The abandonment of great cities and the ruin of many tribes contributed to the apparent nationalization of the Arab peoples. Though the traditional jealousy and hostility of the two branches, the Yemenites and Maadites or Ishmaelites, remained, the Arab world had attained by the levelling process of common misfortune the superficial unity it presents to-day. The nation thus formed, never a nation in the strict sense of the word, was distinctively and thoroughly Semitic in character and language, and has remained unchanged to the present day. The sporadic brilliancy of the ancient Arab kingdoms gave place to a social and political lethargy, the continuation of which for many centuries made the uprise of Saracenic empires seem a miracle to a world ignorant of the Arab past. The Arab race up to Mahomet's day had been in the main pagan. Monotheism, if it ever prevailed, early gave place to sun and star worship, or simple idolatry. Professor Robertson Smith suggests that totemism was the earliest form of Arabian idolatry, and that each tribe had its sacred animal. This he supports by the fact that some tribal names were derived from those of animals, and that animal-worship was not unknown in Arabia. What seems certain is that Arab religion was of a complex hybrid nature, not much to be wondered at when one remembers that Arabia was the asylum of many religious refugees, Zoroastrians, Jews, Christians. In the later pre-Islamitic times spirits, or jinns, as they were called, of which each tribe or family had its own, were worshipped, and there was but a vague idea of a Supreme Being. Images of the jinns to the number of 360, one for each day of the lunar year, were collected in the temple at Mecca, the chief seat of their worship. That worship was of a sanguinary nature. Human sacrifice was fairly frequent. Under the guise of religion female infanticide was a common practice. At Mecca the great object of worship was a plain black stone, and to it pilgrimages were made from every part of Arabia. This stone was so sacred to the Arabs that even Mahomet dared not dispense with it, and it remains the central object of sanctity in the Ka'ba to-day. The temples of the Sabaeans and the Minaeans were built east of their cities, a fact suggesting sun-worship, yet this is not believed to have been the cult of the Minaeans. Common to both was the worship of Attar, the male Ashtoreth.

With the appearance of Mahomet the Arabs took anew a place in the world's history.

Physique.

Physically the Arabs are one of the strongest and noblest races of the world. Baron de Larrey, surgeon-general to Napoleon on his expedition to Egypt and Syria, writes: "Their physical structure is in all respects more perfect than that of Europeans; their organs of sense exquisitely acute, their size above the average of men in general, their figure robust and elegant, their colour brown; their intelligence proportionate to their physical perfection and without doubt superior, other things being equal, to that of other nations." The typical Arab face is of an oval form, lean-featured; the eyes a brilliant black, deep-set under bushy eyebrows; nose aquiline, forehead straight but not high. In body the Arab is muscular and long-limbed, but lean. Deformed individuals or dwarfs are rare among Arabs; nor, except leprosy, which is common, does any disease seem to be hereditary among them. They often suffer from ophthalmia, though not in the virulent Egyptian form. They are scrupulously clean in their persons, and take special care of their teeth, which are generally white and even. Simple and abstemious in their habits, they often reach an extreme yet healthy old age; nor is it common among them for the faculties of the mind to give way sooner than those of the body.

Character.

Thus, physically, they yield to few races, if any, of mankind; mentally, they surpass most, and are only kept back in the march of progress by the remarkable defect of organizing power and incapacity for combined action. Lax and imperfect as are their forms of government, it is with impatience that even these are borne; of the four caliphs who alone reigned—if reign theirs could be called—in Arabia proper, three died a violent death; and of the Wahhābi princes, the most genuine representatives in later times of pure Arab rule, almost all have met the same fate. The Arab face, which is not unkindly, but never smiling, expresses that dignity and gravity which are typical of the race. While the Arab is always polite, good-natured, manly and brave, he is also revengeful, cruel, untruthful and superstitious. Of the Arab nature Burckhardt (other authorities, *e.g.* Barth and Rohlfs, are far less complimentary) wrote: "The Arab displays his manly character when he defends his guest at the peril of his own life, and submits to the reverses of fortune, to disappointment and distress, with the most patient resignation. He is distinguished from a Turk by the virtues of pity and gratitude. The Turk is cruel, the Arab of a more kind temper; he pities and supports the wretched, and never forgets the generosity shown to him even by an enemy." The Arab will lie and cheat and swear false oaths, but once his word is pledged he may be trusted to the last. There are some oaths such as *Wallah* (by Allah) which mean nothing, but such an oath as the threefold one with *wa*, *bi* and *ta* as particles of swearing the meanest thief will not break. In temper, or at least in the manifestation of it, the Arab is studiously calm; and he rarely so much as raises his voice in a dispute. But this outward tranquillity covers feelings alike keen and permanent; and the remembrance of a rash jest or injurious word, uttered years before, leads only too often to that blood-revenge which is a sacred duty everywhere in Arabia.

There exist, however, marked tribal or almost semi-national diversities of character among the Arabs. Thus, the inhabitants of Hejaz are noted for courtesy and blamed for fickleness; those of Nejd are distinguished by their stern tenacity and dignity of deportment; the nations of Yemen are gentle and pliant, but revengeful; those of Hasa and Oman cheerful and fond of sport, though at the same time turbulent and unsteady. Anything approaching to a game is rare in Nejd, and in the Hejaz religion and the yearly occurrence of the pilgrim ceremonies almost exclude all public diversions; but in Yemen the well-known game of the "jerīd," or palm-stick, with dances and music is not rare. In Oman such amusements are still more frequent. Again in Yemen and Oman, coffee-houses, where people resort for conversation, and where public recitals, songs and other amusements are indulged in, stand open all day; while nothing of the sort is tolerated in Nejd. So too the ceremonies of circumcision or marriage are occasions of gaiety and pastime on the coast, but not in the central provinces.

Manners and customs.

An Arab town, or even village, except it be the merest hamlet, is invariably walled round; but seldom is a stronger material than dried earth used; the walls are occasionally flanked by towers of like construction. A dry ditch often surrounds the whole. The streets are irregular and seldom parallel. The Arab, indeed, lacks an eye for the straight. The Arab carpenter cannot form a right angle; an Arab servant cannot place a cloth square on a table. The Ka'ba at Mecca has none of its sides or angles equal. The houses are of one or two storeys, rarely of three, with flat mud roofs, little windows and no external ornament. If the town be large, the expansion of one or two streets becomes a market-place, where are ranged a few shops of eatables, drugs, coffee, cottons or other goods. Many of these shops are kept by women. The chief mosque is always near the market-place; so is also the governor's residence, which, except in size and in being more or less fortified Arab fashion, does not differ from a private house. Drainage is unthought of; but the extreme dryness of the air obviates the inconvenience and disease that under other skies could not fail to ensue, and which in the damper climates of the coast make themselves seriously felt. But the streets are roughly swept every day, each householder taking care of the roadway that lies before his own door. Whitewash and colour are occasionally used in Yemen, Hejaz and Oman; elsewhere a light ochre tint, the colour of the sun-dried bricks, predominates, and gives an Arab town the appearance at a distance of a large dust-heap in the centre of the bright green ring of gardens and palm-groves. Baked bricks are unknown in Arabia, and stone buildings are rare, especially in Nejd. Palm branches and the like, woven in wattles, form the dwellings of the poorer classes in the southern districts. Many Arab towns possess watch-towers, like huge round factory chimneys in appearance, built of sun-dried bricks, and varying in height from 50 to 100 ft. or even more. Indeed, two of these constructions at the town of Birkat-el-Mauj, in Oman, are said to be each of 170 ft. in height, and that of Nezwah, in the same province, is reckoned at 140; but these are of stone.

The principal feature in the interior of an Arab house is the "kahwah" or coffee-room. It is a large apartment spread with mats, and sometimes furnished with carpets and a few cushions. At one end is a small furnace or fireplace for preparing coffee. In this room the men congregate; here guests are received, and even lodged; women rarely enter it, except at times when strangers are unlikely to be present. Some of these apartments are very spacious and supported by pillars; one wall is usually built transversely to the compass direction of the Ka'ba; it serves to facilitate the performance of prayer by those who may happen to be in the kahwah at the appointed times. The other rooms are ordinarily small.

The Arabs are proverbially hospitable. A stranger's arrival is often the occasion of an amicable dispute among the wealthier inhabitants as to who shall have the privilege of receiving him.

Arab cookery is of the simplest. Roughly-ground wheat cooked with butter; bread in thin cakes, prepared on a heated iron plate or against the walls of an open oven; a few vegetables, generally of the leguminous kinds; boiled mutton or camel's flesh, among the wealthy; dates and fruits—this is the *menu* of an ordinary meal. Rice is eaten by the rich and fish is common on the coasts. Tea, introduced only a few decades back, is now largely drunk. A food of which the Arabs are fond is locusts boiled in salt and water and then dried in the sun. They taste like stale shrimps, but there is a great sale for them. Spices are freely employed; butter much too largely for a European taste.

After eating, the hands are always washed, soap or the ashes of an alkaline plant being used. A covered censer with burning incense is then passed round, and each guest perfumes his hands, face, and sometimes his clothes; this censer serves also on first receptions and whenever special honour is intended. In Yemen and Oman scented water often does duty for it. Coffee, without milk or sugar, but flavoured with an aromatic seed brought from India, is served to all. This, too, is done on the occasion of a first welcome, when the cups often make two or three successive rounds; but, in fact, coffee is made and drunk at any time, as frequently as the desire for it may suggest itself; and each time fresh grains are sifted, roasted, pounded and boiled—a very laborious process, and one that requires in the better sort of establishments a special servant or slave for the work. Arabs generally make but one solid meal a day—that of supper, soon after sunset. Even then they do not eat much, gluttony being rare among them, and even daintiness esteemed disgraceful. Wine, like other fermented drinks, is prohibited by the Koran, and is, in fact, very rarely taken, though the inhabitants of the mountains of Oman are said to indulge in it. On the coast spirits of the worst quality are sometimes procured; opium and hashish are sparingly indulged in. On the other hand, wherever Wahhābiism has left freedom of action, tobacco-smoking prevails; short pipes of clay, long pipes with large open bowls, or most frequently the water-pipe or "narghileh," being used. The tobacco smoked is generally strong and is either brought from the neighbourhood of Bagdad or grown in the country itself. The strongest quality is that of Oman; the leaf is broad and coarse, and retains its green colour even when dried; a few whiffs have been known to produce absolute stupor. The aversion of the Wahhābis to tobacco is well known; they entitle it "mukhzi" or "the shameful," and its use is punished with blows, as the public use of wine would be elsewhere.

Dress.

In dress much variety prevails. The loose cotton drawers girded at the waist, which in hot climates do duty for trousers, are not often worn, even by the upper classes, in Nejd or Yemama, where a kind of silk dressing-gown is thrown over the long shirt; frequently, too, a brown or black cloak distinguishes the wealthier citizen; his head-dress is a handkerchief fastened round the head by a band. But in Hejaz, Yemen and Oman, turbans are by no means uncommon; the ordinary colour is white; they are worn over one or more skull-caps. Trousers also form part of the dress in the two former of these districts; and a voluminous sash, in which a dagger or an inkstand is stuck, is wrapped round the waist. The poorer folk, however, and the villagers often content themselves with a broad piece of cloth round the loins, and another across the shoulders. In Oman trousers are rare, but over the shirt a long gown, of peculiar and somewhat close-fitting cut, dyed yellow, is often worn. The women in these provinces commonly put on loose drawers and some add veils to their head-dresses; they are over-fond of ornaments (gold and silver); their hair is generally arranged in a long plait hanging down behind. All men allow their beards and moustaches full growth, though this is usually scanty. Most Arabs shave their heads, and indeed all, strictly speaking, ought by Mahommedan custom to do so. An Arab seldom or never dyes his hair. Sandals are worn more often than shoes; none but the very poorest go barefoot.

Slavery.

Slavery is still, as of old times, a recognized institution throughout Arabia; and an illicit traffic in blacks is carried on along the coasts of the Persian Gulf and the Red Sea. The slaves themselves were obtained chiefly from the east African coast districts down as far as Zanzibar, but this source of supply was practically closed by the end of the 19th century. Slaves are usually employed in Arabia as herdsmen or as domestic servants, rarely in agricultural work; they also form a considerable portion of the bodyguards with which Eastern greatness loves to surround itself. Like their countrymen elsewhere, they readily embrace the religion of their masters and become zealous Mahommedans. Arab custom enfranchises a slave who has accepted Islam at the end of seven years of bondage, and when that period has arrived, the master, instead of exacting from his slave the price of freedom, generally, on giving him his liberty, adds the requisite means for supporting himself and a family in comfort. Further, on every important occasion, such as a birth, circumcision, a marriage or a death, one or more of the household slaves are sure of acquiring their freedom. Hence Arabia has a considerable free black population; and these again, by inter-marriage with the whites around, have filled the land with a mulatto breed of every shade, till, in the eastern and southern provinces especially, a white skin is almost an exception. In Arabia no prejudice exists against negro alliances; no social or political line separates the African from the Arab. A negro may become a sheik, a kadi, an amir, or whatever his industry and his talents may render him capable of being. This is particularly so in Nejd, Yemen and Hadramut; in the Hejaz and the north a faint line of demarcation may be observed between the races.

Military qualities.

The Arabs are good soldiers but poor generals. Personal courage, wonderful endurance of privation, fixity of purpose, and a contempt of death are qualities common to almost every race, tribe and clan that compose the Arab nation. In skirmishing and harassing they have few equals, while at close quarters they have often shown themselves capable of maintaining, armed with swords and spears alone, a desperate struggle against guns and bayonets, neither giving nor receiving quarter. Nor are they wholly ignorant of tactics, their armies, when engaged in regular war, being divided into centre and wings, with skirmishers in front and a reserve behind, often screened at the outset of the engagement by the camels of the expedition. These animals, kneeling and ranged in long parallel rows, form a sort of entrenchment, from behind which the soldiers of the main body fire their matchlocks, while the front divisions, opening out, act on either flank of the enemy. This arrangement of troops may be traced in Arab records as far back as the 5th century, and was often exemplified during the Wahhābi wars.

Arab women are scarcely less distinguished for their bravery than the men. Records of armed heroines occur frequently in the chronicles or myths of the pre-Islamitic time; and in authentic history the Battle of the Camel, 656 A.D., where Ayesha, the wife of Mahomet, headed the charge, is only the first of a number of instances in which Arab amazons have taken, sword in hand, no inconsiderable share in the wars and victories of Islam. Even now it is the custom for an Arab force to be always accompanied by some courageous maiden, who, mounted on a blackened camel, leads the onslaught, singing verses of encouragement for her own, of insult for the opposing tribe. Round her litter the fiercest of the battle rages, and her capture or death is the signal of utter rout; it is hers also to head the triumph after the victory of her clan.

Education.

There is little education, in the European sense of the word, in Arabia. Among the Bedouins there are no schools, and few, even of the most elementary character, in the towns or villages. Where they exist, little beyond the mechanical reading of the Koran, and the equally mechanical learning of it by rote, is taught. On the other hand, Arab male-children, brought up from early years among the grown-up men of the house or tent, learn more from their own parents and at home than is common in other countries; reading and writing are in most instances thus acquired, or rather transmitted; besides such general principles of grammar and eloquence, often of poetry and history, as the elders themselves may be able to impart. To this family schooling too are due the good manners, politeness, and self-restraint that early distinguish Arab children. In the very few instances where a public school of a higher class exists, writing, grammar and rhetoric sum up its teachings. Law and theology, in the narrow sense that both these words have in the Islamitic system, are explained in afternoon lectures given in most mosques; and some verses of the Koran, with one of the accepted commentaries, that of Baidāwī for example, form the basis of the instruction. Great attention is paid to accuracy of grammar and purity of diction throughout Arabia; yet something of a dialectic difference may be observed in the various districts. The purest Arabic, that which is as nearly as possible identical in the choice of words and in its inflections with the language of the Koran, is spoken in Nejd, and the best again of that in the province of Sudēr. Next in purity comes the Arabic of Shammar. Throughout the Hejaz in general, the language, though extremely elegant, is not equally correct; in el-Hasa, Bahrein and Oman it is decidedly influenced by the foreign element called Nabataean. In Yemen, as in other southern districts of the peninsula, Arabic merges insensibly into the Himyaritic or African dialect of Hadramut and Mahra. (See Semitic Languages.)

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ARACAJÚ, a city and seaport of Brazil, capital of the state of Sergipe, 170 m. N.N.E. of Bahia, on the river Cotinguiba, or Cotindiba, 6 m. from the coast. The municipality, of which it forms a part, had a population in 1890 of 16,336, about two-thirds of whom lived in the city itself. Aracajú is a badly built town on the right bank of the river at the base of a ridge of low sand-hills and has the usual features of an unprogressive provincial capital. Good limestone is quarried in its vicinity, and the country tributary to this port produces large quantities of sugar. Cotton is also grown, and the back country sends down hides and skins for shipment. The anchorage is good, but a dangerous bar at the mouth of the river prevents the entrance of vessels drawing more than 12 ft. The port is visited, therefore, only by the smaller steamers of the coastwise lines. The river is navigable as far as the town of Maroim, about 10 m. beyond Aracajú. The city was founded in 1855.

ARACATY, or Aracatí, a city and port of Brazil, in the state of Ceará, 75 m. S.E. of Fortaleza, on the river Jaguaribe, 8 m. from the sea. Pop. of the municipality (1890) 20,182, of whom about 12,000 belonged to the city. A dangerous bar at the mouth of the river permits the entrance only of the smaller coasting steamers, but the port is an important commercial centre, and exports considerable quantities of cotton, hides, maniçoba, rubber, fruit, and palm wax.

ARACHNE, in Greek mythology, the daughter of Idmon of Colophon in Lydia, a dyer in purple. She had acquired such skill in the art of weaving that she ventured to challenge Athena. While the goddess took as subjects her quarrel with Poseidon as to the naming and possession of Attica, and the warning examples of those who ventured to pit themselves against the immortals, Arachne depicted the metamorphoses of the gods and their amorous adventures. Her work was so perfect that Athena, enraged at being unable to find any blemish in it, tore it to pieces. Arachne hanged herself in despair; but the goddess out of pity loosened the rope, which became a cobweb, while Arachne herself was changed into a spider (Ovid, *Metam.* vi. 5-145). The story probably indicates the superiority of Asia over Greece in the textile arts.

ARACHNIDA, the zoological name given in 1815 by Lamarck (Gr. ἀράχνη, a spider) to a class which he instituted for the reception of the spiders, scorpions and mites, previously classified by Linnaeus in the order Aptera of his great group Insecta. Lamarck at the same time founded the class Crustacea for the lobsters, crabs and water-fleas, also until then included in the order Aptera of Linnaeus. Lamarck included the Thysanura and the Myriapoda in his class Arachnida. The Insecta of Linnaeus was a group exactly equivalent to the Arthropoda founded a hundred years later by Siebold and Stannius. It was thus reduced by Lamarck in area, and made to comprise only the six-legged, wing-bearing "Insecta." For these Lamarck proposed the name Hexapoda; but that name has been little used, and they have retained to this day the title of the much larger Linnaean group, viz. Insecta. The position of the Arachnida in the great sub-phylum Arthropoda, according to recent anatomical and embryological researches, is explained in the article Arthropoda. The Arachnida form a distinct class or line of descent in the grade Euarthropoda, diverging (perhaps in common at the start with the Crustacea) from primitive Euarthropods, which gave rise also to the separate lines of descent known as the classes Diplopoda, Crustacea, Chilopoda and Hexapoda.

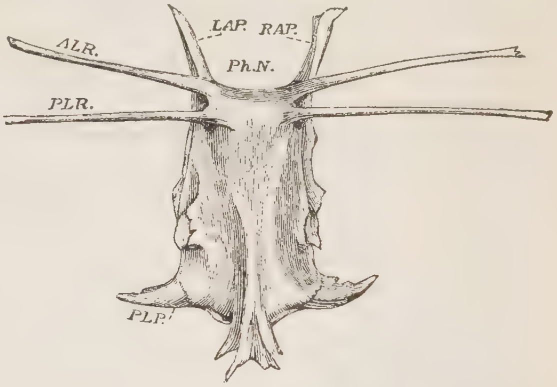

Fig. 1.—Entosternum, entosternite or plastron of *Limulus polyphemus*, Latr. Dorsal surface.

LAP, Left anterior process.
RAP, Right anterior process.
PhN, Pharyngeal notch.
ALR, Anterior lateral rod or tendon.
PLR, Posterior lateral rod or tendon.
PLP, Posterior lateral process.
Natural size.

(From Lankester, *Q. J. Mic. Sci.*, N.S. vol. xxiv., 1884.)

Limulus an Arachnid.—Modern views as to the classification and affinities of the Arachnida have been determined by the demonstration that *Limulus* and the extinct Eurypterines (*Pterygotus*, &c.) are Arachnida; that is to say, are identical in the structure and relation of so many important parts with *Scorpio*, whilst differing in those respects from other Arthropoda, that it is impossible to suppose that the identity is due to homoplasy or convergence, and the conclusion must be accepted that the resemblances arise from close genetic relationship. The view that Limulus, the king-crab, is an Arachnid was maintained as long ago as 1829 by Strauss-Dürckheim (1), on the ground of its possession of an internal cartilaginous sternum—also possessed by the Arachnida (see figs. 1, 2, 3, 4, 5 and 6)—and of the similarity of the disposition of the six leg-like appendages around the mouth in the two cases (see figs. 45 and 63). The evidence of the exact equivalence of the segmentation and appendages of Limulus and Scorpio, and of a number of remarkable points of agreement in structure, was furnished by Ray Lankester in an article published in 1881 ("Limulus an Arachnid," *Quart. Journ. Micr. Sci.* vol. xxi. N.S.), and in a series of subsequent memoirs, in which the structure of the entosternum, of the coxal glands, of the eyes, of the veno-pericardiac muscles, of the respiratory lamellae, and of other parts, was for the first time described, and in which the new facts discovered were shown uniformly to support the hypothesis that Limulus is an Arachnid. A list of these memoirs is given at the close of this article (**2, 3, 4, 5** and **13**). The Eurypterines (Gigantostraca) were included in the identification, although at that time they were supposed to possess only five pairs of anterior or prosomatic appendages. They have now been shown to possess six pairs (fig. 47), as do Limulus and Scorpio.

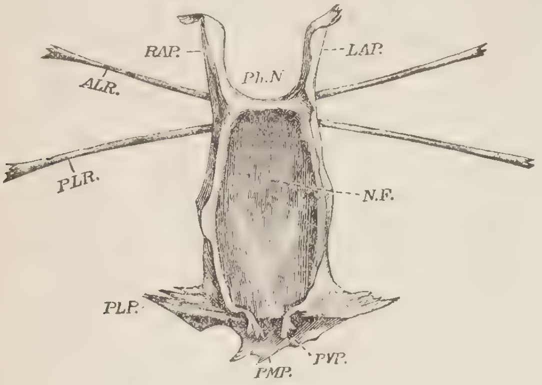

FIG. 2.—Ventral surface of the entosternum of *Limulus polyphemus*, Latr. Letters as in fig. 1 with the addition of NF, neural fossa protecting the aggregated ganglia of the central nervous system; PVP, left posterior ventral process; PMP, posterior median process. Natural size.

(From Lankester.)

The various comparisons previously made between the structure of Limulus and the Eurypterines on the one hand, and that of a typical Arachnid, such as Scorpio, on the other, had been vitiated by erroneous notions as to the origin of the nerves supplying the anterior appendages of Limulus (which were finally removed by Alphonse Milne-Edwards in his beautiful memoir (**6**) on the structure of that animal), and secondly by the erroneous identification of the double sternal plates of Limulus, called "chilaria," by Owen, with a pair of appendages (**7**). Once the identity of the chilaria with the pentagonal sternal plate of the scorpion is recognized—an identification first insisted on by Lankester—the whole series of segments and appendages in the two animals, Limulus and Scorpio, are seen to correspond most closely, segment for segment, with one another (see figs. 7 and 8). The structure of the prosomatic appendages or legs is also seen to present many significant points of agreement (see figures), but a curious discrepancy existed in the six-jointed structure of the limb in Limulus, which differed from the seven-jointed limb of Scorpio by the defect of one joint. R. I. Pocock of the British Museum has observed that in Limulus a marking exists on the fourth joint, which apparently indicates a previous division of this segment into two, and thus establishes the agreement of Limulus and Scorpio in this small feature of the number of segments in the legs (see fig. 11).

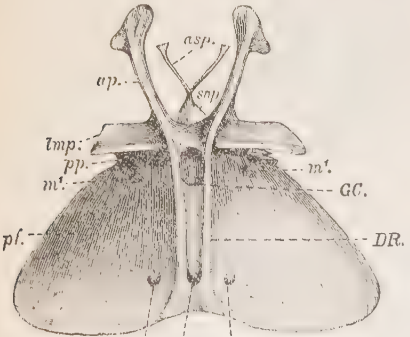

FIG. 3.—Entosternum of scorpion (*Palamnaeus indus*, de Geer); dorsal surface.
asp, Paired anterior process of the sub-neural arch.
snp, Sub-neural arch.
ap, Anterior lateral process (same as RAP and LAP in fig. 1).
lmp, Lateral median process (same as ALR and PLR of fig. 1).
pp, Posterior process (same as PLP in fig. 1).
pf, Posterior flap or diaphragm of Newport.
m^1 and m^2, Perforations of the diaphragm for the passage of muscles.
DR, The paired dorsal ridges.
GC, Gastric canal or foramen.
AC, Arterial canal or foramen.

(After Lankester, *loc. cit.*)

It is not desirable to occupy the limited space of this article by a full description of the limbs and segments of Limulus and Scorpio. The reader is referred to the complete series of figures here given, with their explanatory legends (figs. 12, 13, 14, 15). Certain matters, however, require comment and explanation to render the comparison intelligible. The tergites, or chitinized dorsal halves of the body rings, are fused to form a "prosomatic carapace," or carapace of the prosoma, in both Limulus and Scorpio (see figs. 7 and 8). This region corresponds in both cases to six somites, as indicated by the presence of six pairs of limbs. On the surface of the carapace there are in both animals a pair of central eyes with simple lens and a pair of lateral eye-tracts, which in Limulus consist of closely-aggregated simple eyes, forming a "compound" eye, whilst in Scorpio they present several separate small eyes. The microscopic structure of the central and the lateral eyes has been shown by Lankester and A. G. Bourne (**5**) to differ; but the lateral eyes of Scorpio were shown by them to be similar in structure to the lateral eyes of Limulus, and the central eyes of Scorpio to be identical in structure with the central eyes of Limulus (see below).

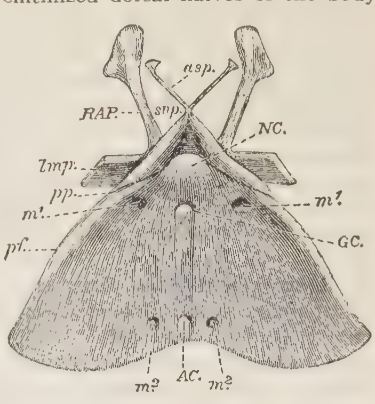

FIG. 4.—Ventral surface of the same entosternum as that drawn in fig. 3. Letters as in fig. 3 with the addition of NC, neural canal or foramen.

(After Lankester, *loc. cit.*)

Following the prosoma is a region consisting of six segments (figs. 14 and 15), each carrying a pair of plate-like appendages in both Limulus and Scorpio. This region is called the mesosoma. The tergites of this region and those of the following region, the metasoma, are fused to form a second or posterior carapace in Limulus, whilst remaining free in Scorpio. The first pair of foliaceous appendages in each animal is the genital operculum; beneath it are found the openings of the genital ducts. The second pair of mesosomatic appendages in Scorpio are known as the "pectens." Each consists of an axis, bearing numerous blunt tooth-like processes arranged in a series. This is represented in Limulus by the first gill-bearing appendage. The leaves (some 150 in number) of the gill-book (see figure) correspond to the tooth-like processes of the pectens of Scorpio. The next four pairs of appendages (completing the mesosomatic series of six) consist, in both Scorpio and Limulus, of a base carrying each 130 to 150 blood-holding, leaf-like plates, lying on one another like the leaves of a book. Their minute structure is closely similar in the two cases; the leaf-like plates receive blood from the great sternal sinus, and serve as respiratory organs. The difference between the gill-books of Limulus and the lung-books of Scorpio depends on the fact that the latter are adapted to aerial respiration, while the former serve for aquatic respiration. The appendage carrying the gill-book stands out on the surface of the body in Limulus, and has other portions developed besides the gill-book and its base; it is fused with its fellow of the opposite side On the other hand, in Scorpio, the gill-book-bearing appendage has sunk below the surface, forming a recess or chamber for itself, which communicates with the exterior by an oval or circular "stigma" (fig. 10, *stg*). That this in-sinking has taken place, and that the lung-books or in-sunken gill-books of Scorpio really represent appendages (that is to say, limbs or parapodia) is proved by their developmental history (see

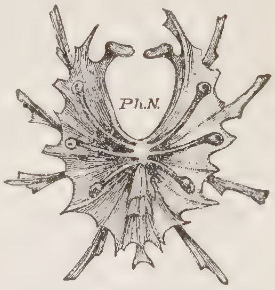

FIG. 5.—Entosternum of one of the mygalomorphous spiders; ventral surface. Ph.N., pharyngeal notch The posterior median process with its repetition of triangular segments closely resembles the same process in Limulus.

(From Lankester, *loc. cit.*)

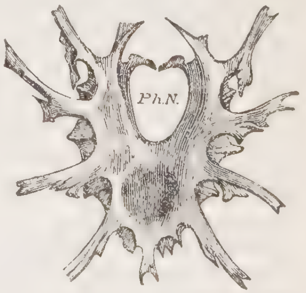

FIG. 6.—Dorsal surface of the same entosternum as that drawn in fig. 5. Ph.N., pharyngeal notch.

(After Lankester, *loc. cit.*)

figs. 17 and 18). They appear at first as outstanding processes on the surface of the body.

The exact mode in which the in-sinking of superficial outstanding limbs, carrying gill-lamellae, has historically taken place has been a matter of much speculation. It was to be hoped that the specimen of the Silurian scorpion (*Palaeophonus*) from Scotland, showing the ventral surface of the mesosoma (fig. 49), would throw light on this matter; but the specimen recently carefully studied by the writer and Pocock reveals neither gill-bearing limbs nor stigmata. The probability appears to be against an actual introversion of the appendage and its lamellae, as was at one time suggested by Lankester. It is probable that such an in-sinking as is shown in the accompanying diagram has taken place (fig. 15); but we are yet in need of evidence as to the exact equivalence of margins, axis, &c., obtaining between the lung-book of Scorpio and the gill-book of Limulus. Zoologists are familiar with many instances (fishes, crustaceans) in which the protective walls of a water-breathing organ or gill-apparatus become converted into an air-breathing organ or lung, but there is no other case known of the conversion of gill processes themselves into air-breathing plates.

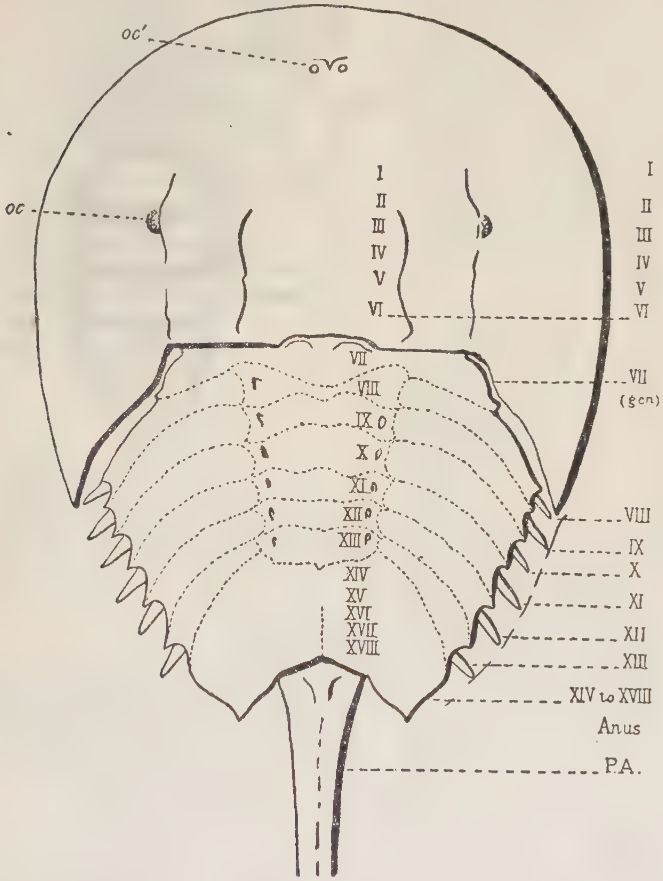

FIG. 7.—Diagram of the dorsal surface of *Limulus polyphemus*.

oc, Lateral compound eyes.
oc′, Central monomeniscous eyes.
PA, Post-anal spine.
I to VI, The six appendage-bearing somites of the prosoma.
VII, Usually considered to be the tergum of the genital somite, but suggested by Pocock to be that of the otherwise suppressed praegenital somite.
VIII to XIII, The six somites of the mesosoma, each with a movable pleural spine and a pair of dorsal entopophysis or muscle-attaching ingrowths.
XIV to XVIII, The confluent or unexpressed six somites of the metasoma.

[According to the system of numbering explained in the text, if VII is the tergum of the praegenital somite (as is probable) it should be labelled *Prg* without any number, and the somites VIII to XIII should be lettered 1 to 6, indicating that they are the six normal somites of the mesosoma; whilst XV to XVIII should be replaced by the numbers 7 to 12—an additional suppressed segment (making up the typical six) being reckoned to the metasomatic fusion.]

(From Lankester, *Q. J. Micr. Sci.* vol. xxi., 1881.)

The identification of the lung-books of Scorpio with the gill-books of Limulus is practically settled by the existence of the pectens in Scorpio (fig. 14, VIII) on the second mesosomatic somite. There is no doubt that *these* are parapodial or limb appendages, carrying numerous imbricated secondary processes, and therefore comparable in essential structure to the leaf-bearing plates of the second mesosomatic somite of Limulus. They have remained unenclosed and projecting on the surface of the body, as once were the appendages of the four following somites. But they have lost their respiratory function. In non-aquatic life such an unprotected organ cannot subserve respiration. The "pectens" have become more firmly chitinized and probably somewhat altered in shape as compared with their condition in the aquatic ancestral scorpions. Their present function in scorpions is not ascertained. They are not specially sensitive under ordinary conditions, and may be touched or even pinched without causing any discomfort to the scorpion. It is probable that they acquire special sensibility at the breeding season and serve as "guides" in copulation. The shape of the legs and the absence of paired terminal claws in the Silurian *Palaeophonus* (see figs. 48 and 49) as compared with living scorpions (see fig. 10) show that the early scorpions were aquatic, and we may hope some day in better-preserved specimens than the two as yet discovered, to find the respiratory organs of those creatures in the condition of projecting appendages serving aquatic respiration somewhat as in Limulus, though not necessarily repeating the exact form of the broad plates of Limulus.

It is important to note that the series of lamellae of the lung-book and the gill-book correspond *exactly* in structure, the narrow, flat blood-space in the lamellae being interrupted by pillar-like junctions of the two surfaces in both cases (see Lankester (4)), and the free surfaces of the adjacent lamellae being covered with a very delicate chitinous cuticle which is drawn out into delicate hairs and processes. The elongated axis which opens at the stigma in Scorpio and which can be cleared of soft, surrounding tissues and coagulated blood so as to present the appearance of a limb axis carrying the book-like leaves of the lung is not really, as it would seem to be at first sight, the limb axis. That is necessarily a blood-holding structure and is obliterated and fused with soft tissues of the sternal region so that the lamellae cannot be detached and presented as standing out from it. The apparent axis or basal support of the scorpion's lung-books shown in the figures, is a false or secondary axis and merely a part of the infolded surface which forms the air-chamber. The maceration of the soft parts of a scorpion preserved in weak spirit and the cleaning of the chitinized in-grown cuticle give rise to the false appearance of a limb axis carrying the lamellae. The margins of the lamellae of the scorpion's lung-book, which are *lowermost* in the figures (fig. 15) and appear to be free, are really those which are attached to the blood-holding axis. The true free ends are those nearest the stigma.

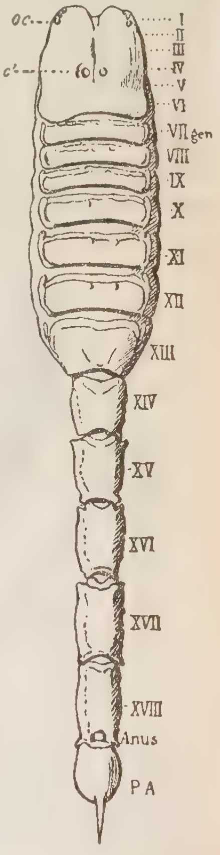

FIG. 8.—Diagram of the dorsal surface of a scorpion to compare with fig. 7. Letters and Roman numerals as in fig. 7, excepting that VII is here certainly the tergum of the first somite of the mesosoma—the genital somite—and is *not* a survival of the embryonic praegenital somite. The anus (not seen) is on the sternal surface.

(From Lankester, *loc. cit.*)

Passing on now from the mesosoma we come in Scorpio to the metasoma of six segments, the first of which is broad whilst the rest are cylindrical. The last is perforated by the anus and carries the post-anal spine or sting. The somites of the metasoma carry no parapodia. In Limulus the metasoma is practically suppressed. In the allied extinct Eurypterines it is well developed, and resembles that of Scorpio. In the embryo Limulus (fig. 42) the six somites of the mesosoma are not fused to form a carapace at an early stage, and they are followed by three separately marked metasomatic somites; the other three somites of the metasoma have disappeared in Limulus, but are represented by the unsegmented prae-anal region. It is probable that we have in the metasoma of Limulus a case of the disappearance of once clearly demarcated somites. It would be possible to suppose, on the other hand, that new somites are only beginning to make their appearance here. The balance of various considerations is against the latter hypothesis. Following the metasoma in Limulus, we have as in Scorpio the post-anal spine—in this case not a sting, but a powerful and important organ of locomotion, serving to turn the animal over when it has fallen upon its back. The nature of the post-anal spine has been strangely misinterpreted by some writers. Owen (7) maintained that it represented a number of coalesced somites, regardless of its post-anal position and mode of development. The agreement of the grouping of the somites, of the form of the parapodia (appendages, limbs) in each region, of the position of the genital aperture and operculum, of the position and character of the eyes, and of the powerful post-anal spines not seen in other Arthropods, is very convincing as to the affinity of Limulus and Scorpio. Perhaps the most important general agreement of Scorpio compared with Limulus and the Eurypterines is the division of the body into the three regions (or tagmata)—prosoma, mesosoma and metasoma—each consisting of six segments, the prosoma having leg-like appendages, the mesosoma having foliaceous appendages, and the metasoma being destitute of appendages.

In 1893, some years after the identification of the somites of Limulus with those of Scorpio, thus indicated, had been published, zoologists were startled by the discovery by a Japanese zoologist, Kishinouye (8), of a seventh prosomatic somite in the embryo of Limulus longispina. This was seen in longitudinal sections, as shown in fig. 19. The simple identification of somite with somite in Limulus and Scorpio seemed to be threatened by this discovery. But in 1896 Dr August Brauer of Marburg (9) discovered in the embryo of Scorpio a seventh prosomatic somite (see VII PrG, figs. 17 and 18), or, if we please so to term it, a *praegenital* somite, hitherto unrecognized. In the case of Scorpio this segment is indicated in the embryo by the presence of a pair of rudimentary appendages, carried by a well-marked somite. As in Limulus, so in Scorpio, this unexpected somite and its appendages disappear in the course of development. In fact, more or less complete "excalation" of the somite takes place. Owing to its position it is convenient to term the somite which is excalated in Limulus and Scorpio "the praegenital somite." It appears not improbable that the sternal plates wedged in between the last pair of legs in both Scorpio and Limulus, viz. the pentagonal sternite of Scorpio (fig. 10) and the chilaria of Limulus (see figs. 13 and 20), may in part represent in the adult the sternum of the excalated praegenital somite. This has not been demonstrated by an actual following out of the development, but the position of these pieces and the fact that they are (in Limulus) supplied by an independent segmental nerve, favours the view that they may comprise the sternal area of the vanished praegenital somite. This interpretation, however, of the "metasternites" of Limulus and Scorpio is opposed by the coexistence in Thelyphonus (figs. 55, 57 and 58) of a similar metasternite with a complete praegenital somite. H. J. Hansen (10) has recognized that the "praegenital somite" persists in a rudimentary condition, forming a "waist" to the series of somites in the Pedipalpi and Araneae. The present writer is of opinion that it will be found most convenient to treat this evanescent somite as something special, and not to attempt to reckon it to either the prosoma or the mesosoma. These will then remain as typically composed each of six appendage-bearing somites—the prosoma comprising in addition the ocular prosthomere.[1] When the praegenital somite or traces of it are present it should not be called "the seventh prosomatic" or the "first mesosomatic," but simply the "praegenital somite." The first segment of the mesosoma of Scorpio and Limulus thus remains the first segment, and can be identified as such throughout the Eu-arachnida, carrying as it always does the genital apertures. But it is necessary to remember, in the light of recent discoveries, that the sixth prosomatic pair of appendages is carried on the seventh somite of the whole series, there being two prosthomeres or somites in front of the mouth, the first carrying the eyes, the second the chelicerae; also that the first mesosomatic or genital somite is not the seventh or even the eighth of the whole series of somites which have been historically present, but is the ninth, owing to the presence or to the excalation of a praegenital somite. It seems that confusion and trouble will be best avoided by abstaining from the introduction of the non-evident somites, the ocular and the praegenital, into the numerical nomenclature of the component somites of the three great body regions. We shall, therefore, ignoring the ocular somite, speak of the first, second, third, fourth, fifth and sixth leg-bearing somites of the prosoma, and indicate the appendages by the Roman numerals, I, II, III, IV, V, VI, and whilst ignoring the praegenital somite we shall speak of the first, second, third, &c., somite of the mesosoma or opisthosoma (united mesosoma and metasoma) and indicate them by the Arabic numerals.

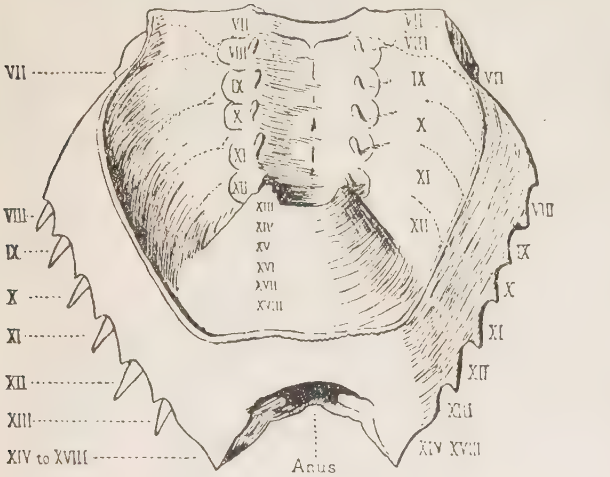

FIG. 9.—Ventral view of the posterior carapace or meso-metasomatic (opisthosomatic) fusion of *Limulus polyphemus*. The soft integument and limbs of the mesosoma have been removed as well as all the viscera and muscles, so that the inner surface of the terga of these somites with their entopophyses are seen. The unsegmented dense chitinous sternal plate of the metasoma (XIII to XVIII) is not removed. Letters as in fig. 7.

(After Lankester, *loc. cit.*)

There are a number of other important points of structure besides those referring to the somites and appendages in which Limulus agrees with Scorpio or other Arachnida and differs from other Arthropoda. The chief of these are as follows:—

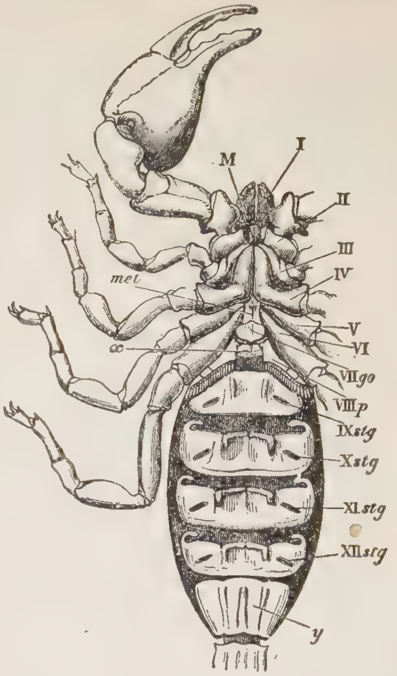

FIG. 10.—Ventral view of a scorpion, *Palamnaeus indus*, de Geer, to show the arrangement of the coxae of the limbs, the sternal elements, genital plate and pectens.

M, Mouth behind the oval median camerostome.
I, The chelicerae.
II, The chelae.
III to VI, the four pairs of walking legs.
VII*go*, The genital somite or first somite of the mesosoma with the genital operculum (a fused pair of limbs).
VIII*p*, The pectiniferous somite.
IX*stg* to XII*stg*, the four pulmonary somites.
met, The pentagonal metasternite of the prosoma behind all the coxae.
x, The sternum of the pectiniferous somite.
y, The broad first somite of the metasoma.

1. *The Composition of the Head* (that is to say, of the anterior part of the prosoma) *with especial Reference to the Region in Front of the Mouth.*—It appears (see ARTHROPODA) that there is embryological evidence of the existence of two somites in Arachnida which were originally post-oral, but have become prae-oral by adaptational shifting of the oral aperture. These forwardly-slipped somites are called "prosthomeres." The first of these has, in Arachnids as in other Arthropods, its pair of appendages represented by the eyes. The second has for its pair of appendages the small pair of limbs which in all living Arachnids is either chelate or retrovert (as in spiders), and is known as the chelicerae. It is possible, as maintained by some writers (Patten and others), that the lobes of the cerebral nervous mass in Arachnids indicate a larger number of prosthomeres as having fused in this region, but there is no *embryological* evidence at present which justifies us in assuming the existence in Arachnids of more than two prosthomeres. The position of the chelicerae of Limulus and of the ganglionic nerve-masses from which they receive their nerve-supply, is closely similar to that of the same structures in Scorpio. The cerebral mass is in Limulus more easily separated by dissection as a median lobe distinct from the laterally-placed ganglia of the cheliceral somite than is the case in Scorpio, but the relations are practically the same in the two forms. Formerly it was supposed that in Limulus both the chelicerae and the next following pair of appendages were prosthomerous, as in Crustacea, but the dissections of Alphonse Milne-Edwards (6) demonstrated

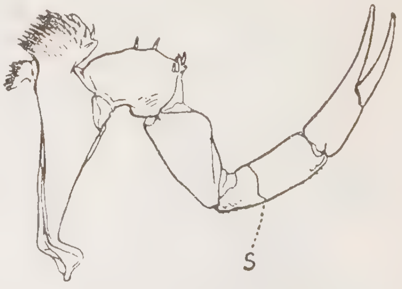

FIG. 11.—Third leg of *Limulus polyphemus*, showing the division of the fourth segment of the leg by a groove S into two, thus giving seven segments to the leg as in scorpion.

(From a drawing by Pocock.)

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[1] See the article ARTHROPODA for the use of the term "prosthomere."

the true limitations of the cerebrum, whilst embryological researches have done as much for Scorpio. Limulus thus agrees with Scorpio and differs from the Crustacea, in which there are three prosthomeres—one ocular and two carrying palpiform appendages. It is true that in the lower Crustacea (Apus, &c.) we have evidence of the gradual movement forward of the nerve-ganglia belonging to these palpiform appendages. But although in such lower Crustacea the nerve-ganglia of the third prosthomere have not fused with the anterior nerve-mass, there is no question as to the prae-oral position of two appendage-bearing somites in addition to the ocular prosthomere. The Crustacea have, in fact, three prosthomeres in the head and the Arachnida only two, and Limulus agrees with the Arachnida in this respect and differs from the Crustacea. The central nervous systems of Limulus and of Scorpio present closer agreement in structure than can be found when a Crustacean is compared with either. The wide divarication of the lateral cords in the prosoma and their connexion by transverse commissures, together with the "attraction" of ganglia to the prosomatic ganglion group which properly belong to hinder segments, are very nearly identical in the two animals. The form and disposition of the ganglion cells are also peculiar and closely similar in the two. (See Patten (**42**) for important observations on the neuromeres, &c., of Limulus and Scorpio.)

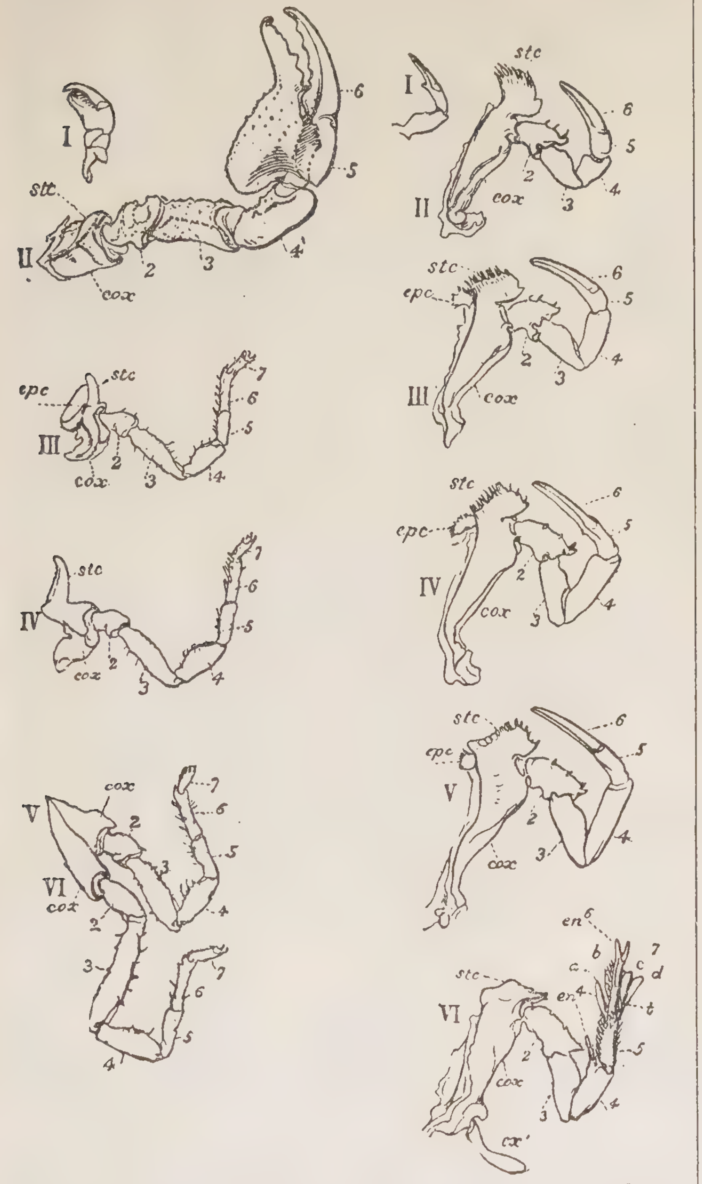

FIG. 12.—The prosomatic appendages of *Limulus polyphemus* (right) and Scorpio (left), *Palamnaeus indus* compared. The corresponding appendages are marked with the same Roman numeral. The Arabic numerals indicate the segments of the legs.

cox, Coxa or basal segment of the leg.
stc, The sterno-coxal process or jaw-like up-growth of the coxa.
epc, The articulated movable outgrowth of the coxa, called the epi-coxite (present only in III of the scorpion and III, IV and V of Limulus).
*ex*¹, The exopodite of the sixth limb of Limulus.
a, *b*, *c*, *d*, Movable processes on the same leg (see for some suggestions on the morphology of this leg, Pocock in *Quart. Journ. Micr. Sci.* March 1901; see also fig. 50 below and explanation).

(From Lankester, *loc. cit.*)

§ 2. *The Minute Structure of the Central Eyes and of the Lateral Eyes.*—Limulus agrees with Scorpio not only in having a pair of central eyes and also lateral eyes, but in the microscopic structure of those organs, which differs in the central and lateral eyes respectively. The central eyes are "simple eyes," that is to say, have a single lens, and are hence called "monomeniscous." The lateral eyes are in Limulus "compound eyes," that is to say, consist of many lenses placed close together; beneath each lens is a complex of protoplasmic cells, in which the optic nerve terminates. Each such unit is termed an "ommatidium." The lateral eyes of Scorpio consist of groups of separate small lenses each with its ommatidium, but they do not form a continuous compound eye as in Limulus. The ommatidium (soft structure beneath the lens-unit of a compound eye) is very simple in both Scorpio and Limulus. It consists of a single layer of cells, continuous with those which secrete the general chitinous covering of the prosoma. The cells of the ommatidium are a good deal larger than the neighbouring common cells of the epidermis. They secrete the knob-like lens (fig. 22). But they also receive the nerve fibres of the optic nerve. They are at the same time both optic nerve-end cells, that is to say, retina cells, and corneagen cells or secretors of the chitinous lens-like cornea. In Limulus (fig. 23) each ommatidium has a peculiar ganglion cell developed in a central position, whilst the ommatidium of the lateral eyelets of Scorpio shows small intermediate cells between the larger nerve-end cells. The structure of the lateral eye of Limulus was first described by Grenacher, and further and more accurately by Lankester and Bourne (**5**) and by Watase; that of Scorpio by Lankester and Bourne, who showed that the statements of von Graber were erroneous, and that the lateral eyes of Scorpio have a single cell-layered or "monostichous" ommatidium like that of Limulus. Watase has shown, in a very convincing way, how by deepening the pit-like set of cells beneath a simple lens the more complex ommatidia of the compound eyes of Crustacea and Hexapoda may be derived from such a condition as that presented in the lateral eyes of Limulus and Scorpio. (For details the reader is referred to Watase (**11**) and to Lankester and Bourne (**5**).) The structure of the central eyes of Scorpio and spiders and also of Limulus differs essentially from that of the lateral eyes in having two layers of cells (hence called diplostichous) beneath the lens, separated from one another by a membrane (figs. 24 and 25). The upper layer is the corneagen and secretes the lens, the lower is the retinal layer. The mass of soft cell-structures beneath a large lens of a central eye is called an "ommatoeum." It shows in Scorpio and Limulus a tendency to segregate into minor groups or "ommatidia." It is found that in embryological growth the retinal layer of the central eyes forms as a separate pouch, which is pushed in laterally beneath the corneagen layer from the epidermic cell layer. Hence it is in origin double, and consists of a true retinal layer and a post-retinal layer (fig. 24, B), though these are not separated by a membrane. Accordingly the diplostichous ommatoeum or soft tissue of the Arachnid's central eye should strictly be called "triplostichous," since the deep layer is itself doubled or folded. The retinal cells of both the lateral and central eyes of Limulus and Scorpio produce cuticular structures on their sides; each such piece is a rhabdomere and a number (five or ten) uniting form a rhabdom (fig. 26). In the specialized ommatidia of the compound eyes of Crustacea and Hexapods the rhabdom is an important structure.[1] It is a very significant fact that the lateral and central eyes of Limulus and Scorpio not only agree each with each in regard to their monostichous and diplostichous structure, but also in the formation in both classes of eyes of rhabdomeres and rhabdoms in which the component pieces are five or a multiple of five (fig. 26). Whilst each unit of the lateral eye of Limulus has a rhabdom of ten[2] pieces

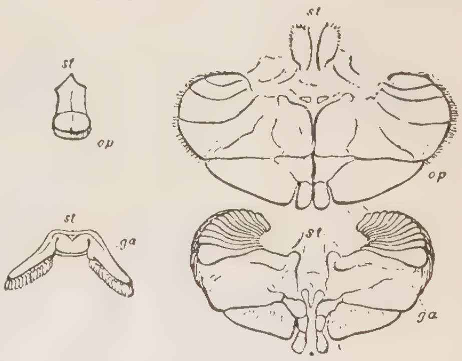

FIG. 13.—Diagrams of the meta-sternite *st*, with genital operculum *op*, and the first lamelligerous pair of appendages *ga*, with uniting sternal element *st* of Scorpio (left) and Limulus (right).

(From Lankester, *loc. cit.*)

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[1] See fig. 12 in the article ARTHROPODA.

[2] Though ten is the prevailing number of retinula cells and rhabdomeres in the lateral eye of Limulus, Watase states that they may be as few as nine and as many as eighteen.

forming a star-like chitinous centre in section, each lateral eye of Scorpio has several rhabdoms of five or less rhabdomeres, indicating that the Limulus lateral eye-unit is more specialized than the detached lateral eyelet of Scorpio, so as to present a coincidence of one lens with one rhabdom. Numerous rhabdomeres (grouped as rhabdoms in Limulus) are found in the retinal layer of the central eyes also.

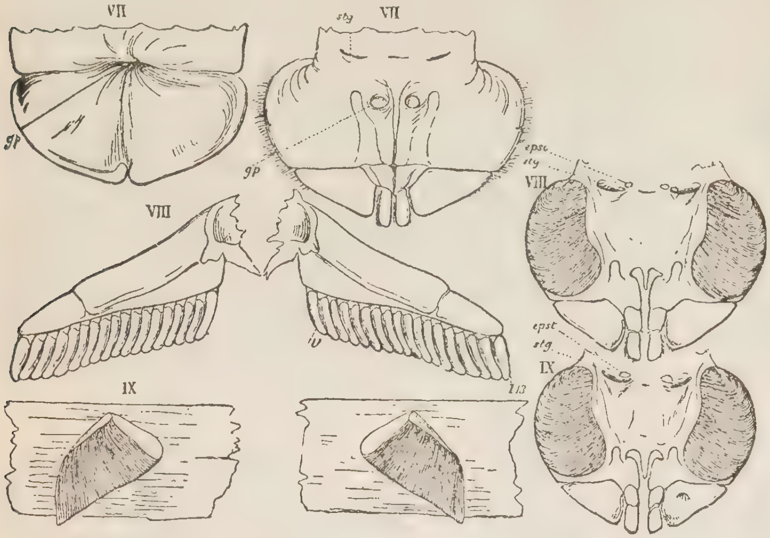


Fig. 14.—The first three pairs of mesosomatic appendages of Scorpio and Limulus compared.

VII, The genital operculum.
VIII, The pectens of Scorpio and the first branchial plate of Limulus.
IX, The first pair of lung-books of Scorpio and the second branchial plate of Limulus.
gp, Genital pore.
epst, Epistigmatic sclerite.
stg, Stigma or orifice of the hollow tendons of the branchial plates of Limulus.

(After Lankester, *loc. cit.*)

Whilst Limulus agrees thus closely with Scorpio in regard to the eyes, it is to be noted that no Crustacean has structures corresponding to the peculiar diplostichous central eyes, though these occur again (with differences in detail) in Hexapoda. Possibly, however, an investigation of the development of the median eyes of some Crustacea (Apus, Palaemon) may prove them to be diplostichous in origin.

3. *The so-called "Coxal Glands."*—In 1882 (*Proc. Roy. Soc.* No. 221) Lankester described under the name "coxal glands" a pair of brilliantly white oviform bodies lying in the Scorpion's prosoma immediately above the coxae of the fifth and sixth pairs of legs (fig. 27). These bodies had been erroneously supposed by Newport (12) and other observers to be glandular outgrowths of the alimentary canal. They are really excretory glands, and communicate with the exterior by a very minute aperture on the posterior face of the coxa of the fifth limb on each side. When examined with the microscope, by means of the usual section method, they are seen to consist of a labyrinthine tube lined with peculiar cells, each cell having a deep vertically striated border on the surface farthest from the lumen, as is seen in the cells of some renal organs. The coils and branches of the tube are packed by connective tissue and blood spaces. A similar pair of coxal glands, lobate instead of ovoid in shape, was described by Lankester in Mygale, and it was also shown by him that the structures in Limulus called "brick-red glands" by Packard have the same structure and position as the coxal glands of Scorpio and Mygale. In Limulus these organs consist each of four horizontal lobes lying on the coxal margin of the second, third, fourth, and fifth prosomatic limbs, the four lobes being connected to one another by a transverse piece or stem (fig. 28). Microscopically their structure is the same in essentials as that of the coxal glands of Scorpio (13). Coxal glands have since been recognized and described in other Arachnida. In 1900 it was shown that the coxal gland of Limulus is provided with a very delicate thin-walled coiled duct which opens, even in the adult condition, by a minute pore on the coxa of the fifth leg (Patten and Hazen, 13A). Previously to this, Lankester's pupil Gulland had shown (1885) that in the embryo the coxal gland is a comparatively simple tube, which opens to the exterior in this position and by its other extremity into a coelomic space. Similar observations were made by Laurie (17) in Lankester's laboratory (1890) with regard to the early condition of the coxal gland of Scorpio, and by Bertkau (41) as to that of the spider Atypus. H. M. Bernard (13B) showed that the opening remains in the adult scorpion. In all the embryonic or permanent opening is on the coxa of the fifth pair of prosomatic limbs. Thus an organ newly discovered in Scorpio was found to have its counterpart in Limulus.

The name "coxal gland" needs to be carefully distinguished from "crural gland," with which it is apt to be confused. The crural glands, which occur in many terrestrial Arthropods, are epidermal in origin and totally distinct from the coxal glands. The coxal glands of the Arachnida are structures of the same nature as the green glands of the higher Crustacea and the so-called "shell glands" of the Entomostraca. The latter open at the base of the fifth pair of limbs of the Crustacean, just as the coxal glands open on the coxal joint of the fifth pair of limbs of the Arachnid. Both belong to the category of "coelomoducts," namely, tubular or funnel-like portions of the coelom opening to the exterior in pairs in each somite (potentially,) and usually persisting in only a few somites as either "urocoels" (renal organs) or "gonocoels" (genital tubes). In Peripatus they occur in every somite of the body. They have till recently been very generally identified with the nephridia of Chaetopod worms, but there is good reason for considering the true nephridia (typified by the nephridia of the earthworm) as a distinct class of organs (see Lankester in vol. ii. chap. iii. of *A Treatise on Zoology*, 1900). The genital ducts of Arthropoda are, like the green glands, shell glands and coxal glands, to be regarded as coelomoducts (gonocoels). The coxal glands do not establish any special connexion between Limulus and Scorpio, since thay also occur in the same somite in the lower Crustacea, but it is to be noted that the coxal glands of Limulus are in minute structure and probably in function more like those of Arachnids than those of Crustacea.

4. *The Entosternites and their Minute Structure.*—Strauss-Dürckheim (1) was the first to insist on the affinity between Limulus and the Arachnids, indicated by the presence of a free suspended entosternum or plastron or entosternite in both. We have figured here (figs. 1 to 6) the entosternites of Limulus, Scorpio and Mygale. Lankester some years ago made a special study of the histology (3) of these entosternites for the purpose of comparison, and also ascertained the relations of the very numerous muscles which are inserted into them (4). The entosternites are cartilaginous in texture, but they have neither the chemical character nor the microscopic structure of the hyaline cartilage of Vertebrates. They yield chitin in place of chondrin or gelatin—as does also the cartilage of the Cephalopod's endoskeleton. In microscopic structure they all present the closest agreement with one another. We find a firm, homogeneous or sparsely fibrillated matrix in which are embedded nucleated cells (corpuscles of protoplasm) arranged in rows of three, six or eight, parallel with the adjacent lines of fibrillation.

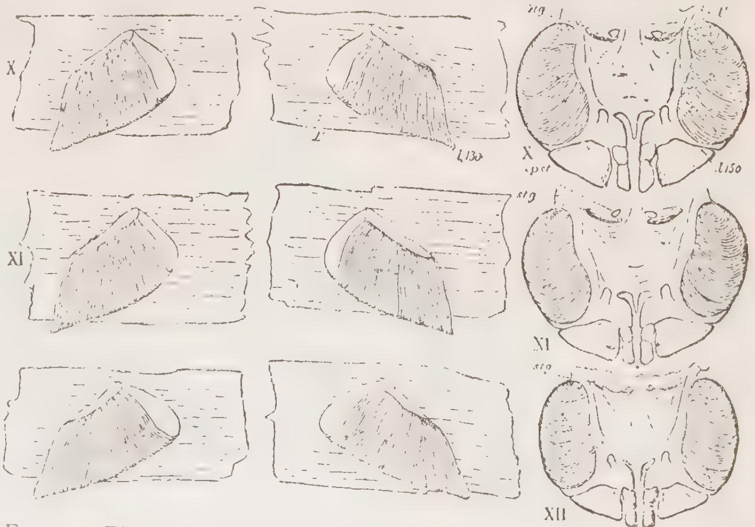


Fig. 15.—The remaining three pairs of mesosomatic appendages of Scorpio and Limulus. Letters as in fig. 14. *l*130 indicates that there are 130 lamellae in the scorpion's lung-book, whilst *l*150 indicates that 150 similar lamellae are counted in the gill of Limulus.

(After Lankester, *loc. cit.*)

A minute entosternite having the above-described structure is found in the Crustacean Apus between the bases of the mandibles, and also in the Decapoda in a similar position, but in no Crustacean does it attain to any size or importance. On the other hand, the entosternite of the Arachnida is a very large and important feature in the structure of the prosoma, and must play an important part in the economy of these organisms. In Limulus (figs. 1 and 2) it has as many as twenty-five pairs of muscles attached to it, coming to it from the bases of the surrounding limbs and from the dorsal carapace and from the pharynx. It consists of an oblong plate 2 in. in length and 1 in breadth, with a pair of tendinous outgrowths standing out from it at right angles on each side. It "floats" between the prosomatic nerve centres and the alimentary canal. In each somite of the mesosoma is a small, free entosternite having a similar position, but below or ventral to the nerve cords, and having a smaller number of muscles attached to it. The entosternite was probably in origin part of the fibrous connective tissue lying close to the integument of the sternal surface—giving attachment to muscles corresponding more or less to those at present attached to it. It became isolated and detached, why or with what advantage to the organism it is difficult to say, and at that period of Arachnidan development the great ventral nerve cords occupied a more lateral position than they do at present. We know that such a lateral position of the nerve cords preceded the median position in both Arthropoda and Chaetopoda. Subsequently to the floating off of the entosternite the approximation of the nerve cords took place in the prosoma, and thus they were able to take up a position below the entosternite. In the mesosoma the approximation had occurred before the entosternites were formed.

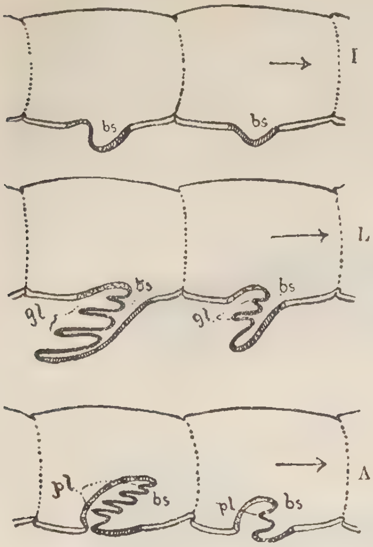


FIG. 16.—Diagram to show the way in which an outgrowing gill-process bearing blood-holding lamellae, may give rise, if the sternal body wall sinks inwards, to a lung-chamber with air-holding lamellae.

I is the embryonic condition.

bs, Blood sinus.

L is the condition of outgrowth with *gl*, gill lamellae.

A is the condition of in-sinking of the sternal surface and consequent enclosure of the lamelligerous surface of the appendage in a chamber with narrow orifice—the pulmonary air-holding chamber.

pl, Pulmonary lamellae.

bs, Blood sinus.

(After Kingsley.)

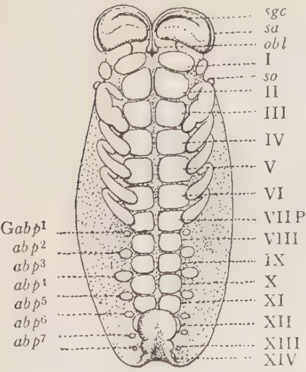


FIG. 17.—Embryo of scorpion, ventral view showing somites and appendages.

sgc, Frontal groove.

sa, Rudiment of lateral eyes.

obl, Camerostome (upper lip).

so, Sense-organ of Patten.

PrGabp^1, Rudiment of the appendage of the praegenital somite which disappears.

abp^2, Rudiment of the right half of the genital operculum.

abp^3, Rudiment of the right pecten.

abp^4 to abp^7, Rudiments of the four appendages which carry the pulmonary lamellae.

I to VI, Rudiments of the six limbs of the prosoma.

VIIPrG, The evanescent praegenital somite.

VIII, The first mesosomatic somite or genital somite.

IX, The second mesosomatic somite or pectiniferous somite.

X to XIII, The four pulmoniferous somites.

XIV, The first metasomatic somite.

(After Brauer, *Zeitsch. wiss. Zool.* vol. lix., 1895.)

In the scorpion (figs. 3 and 4) the entosternite has tough membrane-like outgrowths which connect it with the body-wall, both dorsally and ventrally, forming an oblique diaphragm, cutting off the cavity of the prosoma from that of the mesosoma. It was described by Newport as "the diaphragm." Only the central and horizontal parts of this structure correspond precisely to the entosternite of Limulus: the right and left anterior processes (marked *ap* in figs. 3 and 4, and RAP, LAP, in figs. 1 and 2) correspond in the two animals, and the median lateral process *lmp* of the scorpion represents the tendinous outgrowths ALR, PLR of Limulus. The scorpion's entosternite gives rise to outgrowths, besides the great posterior flaps, *pf*, which form the diaphragm, unrepresented in Limulus. These are a ventral arch forming a neural canal through which the great nerve cords pass (figs. 3 and 4, *snp*), and further a dorsal gastric canal and arterial canal which transmit the alimentary tract and the dorsal artery respectively (figs. 3 and 4, GC, DR).

In Limulus small entosternites are found in each somite of the appendage-bearing mesosoma, and we find in Scorpio, in the only somite of the mesosoma which has a well-developed pair of appendages, that of the pectens, a small entosternite with ten pairs of muscles inserted into it. The supra-pectinal entosternite lies ventral to the nerve cords.

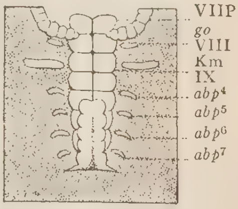


FIG. 18.—Portion of a similar embryo at a later stage of growth. The praegenital somite, VII PrG, is still present, but has lost its rudimentary appendages; *go*, the genital operculum, left half; Km, the left pecten; abp^4 to abp^7, the rudimentary appendages of the lung-sacs.

(After Brauer, *loc. cit.*)

In Mygale (figs. 5 and 6) the form of the entosternite is more like that of Limulus than is that of Scorpio. The anterior notch Ph.N. is similar to that in Limulus, whilst the imbricate triangular pieces of the posterior median region resemble the similarly-placed structures of Limulus in a striking manner.

It must be confessed that we are singularly ignorant as to the functional significance of these remarkable organs—the entosternites. Their movement in an upward or downward direction in Limulus and Mygale must exert a pumping action on the blood contained in the dorsal arteries and the ventral veins respectively. In Scorpio the completion of the horizontal plate by oblique flaps, so as to form an actual diaphragm shutting off the cavity of the prosoma from the rest of the body, possibly gives to the organs contained in the anterior chamber a physiological advantage in respect of the supply of arterial blood and its separation from the venous blood of the mesosoma. Possibly the movement of the diaphragm may determine the passage of air into or out of the lung-sacs. Muscular fibres connected with the suctorial pharynx are in Limulus inserted into the entosternite, and the activity of the two organs may be correlated.

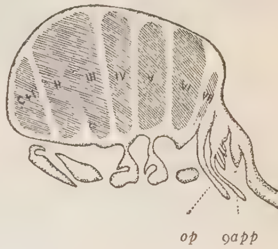


FIG. 19.—Section through an early embryo of *Limulus longispina*, showing seven transverse divisions in the region of the unsegmented anterior carapace. The seventh, VII, is anterior to the genital operculum, *op*, and is the cavity of the praegenital somite which is more or less completely suppressed in subsequent development, possibly indicated by the area marked VII in fig. 7 and by the great entopophyses of the prosomatic carapace.

(After Kishinouye, *Journ. Sci. Coll. Japan*, vol. v., 1892.)

5. *The Blood and the Blood-vascular System.*—The blood fluids of Limulus and Scorpio are very similar. Not only are the blood corpuscles of Limulus more like in form and granulation to those of Scorpio than to those of any Crustacean, but the fluid is in both animals strongly impregnated with the blue-coloured respiratory proteid, haemocyanin. This body occurs also in the blood of Crustacea and of Molluscs, but its abundance in both Limulus and Scorpio is very marked, and gives to the freshly-shed blood a strong indigo-blue tint.

The great dorsal contractile vessel or "heart" of Limulus is closely similar to that of Scorpio; its ostia or incurrent orifices are placed in the same somites as those of Scorpio, but there is one additional posterior pair. The origin of the paired arteries from the

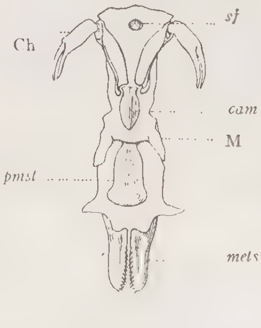


FIG. 20.—View of the ventral surface of the mid-line of the prosomatic region of *Limulus polyphemus*. The coxae of the five pairs of limbs following the chelicerae were arranged in a series on each side between the mouth, M, and the meta sternites, *mets*.

sf, The sub-frontal median sclerite.

Ch, The chelicerae.

cam, The camerostome or upper lip.

M, The mouth.

pmst, The promesosternal sclerite or chitinous plate, unpaired.

mets, The right and left metasternites (corresponding to the similarly placed pentagonal sternite of Scorpio). Natural size.

(After Lankester.)

heart differs in Limulus from the arrangement obtaining in Scorpio, in that a pair of lateral commissural arteries exist in Limulus (as described by Alphonse Milne-Edwards (6)) leading to a suppression of the more primitive direct connexion of the four pairs of posterior lateral arteries and of the great median posterior arteries with the heart itself (fig. 29). The arterial system is very completely developed in both Limulus and Scorpio, branching repeatedly until minute arterioles are formed, not to be distinguished from true capillaries; these open into irregular swollen vessels which are the veins or venous sinuses. A very remarkable feature in Limulus, first described by Owen, is the close accompaniment of the prosomatic nerve centres and nerves by arteries, so close indeed that the great ganglion mass and its out-running nerves are actually sunk in or invested by arteries. The connexion is not so intimate in Scorpio, but is nevertheless a very close one, closer than we find in any other Arthropods in which the arterial system is well developed, *e.g.* the Myriapoda and some of the arthrostracous Crustacea. It seems that there is a primitive tendency in the Arthropoda for the arteries to accompany the nerve cords, and a "supra-spinal" artery—that is to say, an artery in close relation to the ventral nerve cords—has been described in several cases. On the other hand, in many Arthropods, especially those which possess tracheae, the arteries do not have a long course, but soon open into wide blood sinuses. Scorpio certainly comes nearer to Limulus in the high development of its arterial system, and the intimate relation of the anterior aorta and its branches to the nerve centres and great nerves, than does any other Arthropod.

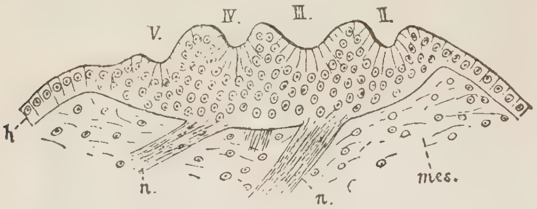


FIG. 21.—Development of the lateral eyes of a scorpion. *h*, Epidermic cell-layer; *mes*, mesoblastic connective tissue; *n*, nerves; II, III, IV, V, depressions of the epidermis in each of which a cuticular lens will be formed.

(From Korschelt and Heider, after Laurie.)

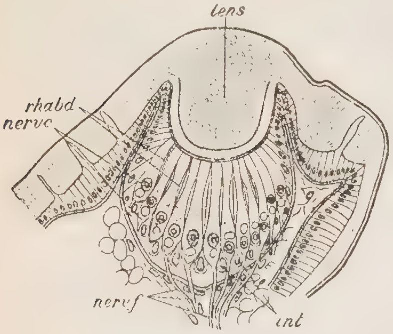


FIG. 22. — Section through the lateral eye of *Euscorpius italicus*.

lens, Cuticular lens.
nerv.c, Retinal cells (nerve-end cells).
rhabd, Rhabdomes.
nerv.f, Nerve fibres of the optic nerve.
int, Intermediate cells (lying between the bases of the retinal cells).

(After Lankester and Bourne from Parker and Haswell's *Text book of Zoology*, Macmillan & Co.)

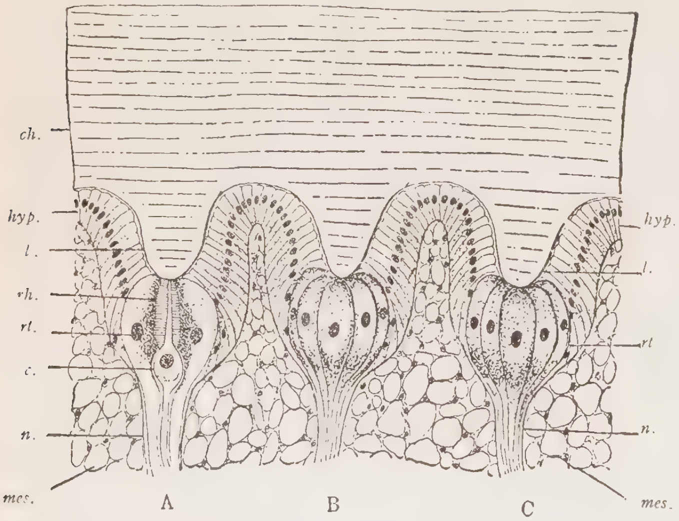


FIG. 23.—Section through a portion of the lateral eye of Limulus, showing three ommatidia—A, B and C. *hyp*, The epidermic cell-layer (so-called hypodermis), the cells of which increase in volume below each lens, *l*, and become nerve-end cells or retinula-cells, *rt*; in A, the letters *rh* point to a rhabdomere secreted by the cell *rt*; *c*, the peculiar central spherical cell; *n*, nerve fibres; *mes*, mesoblastic skeletal tissue; *ch*, chitinous cuticle.

(From Korschelt and Heider after Watase.)

An arrangement of great functional importance in regard to the venous system must now be described, which was shown in 1883 by Lankester to be common to Limulus and Scorpio. This arrangement has not hitherto been detected in any other class than the Arachnida, and if it should ultimately prove to be peculiar to that group, would have considerable weight as a proof of the close genetic affinity of Limulus and Scorpio.

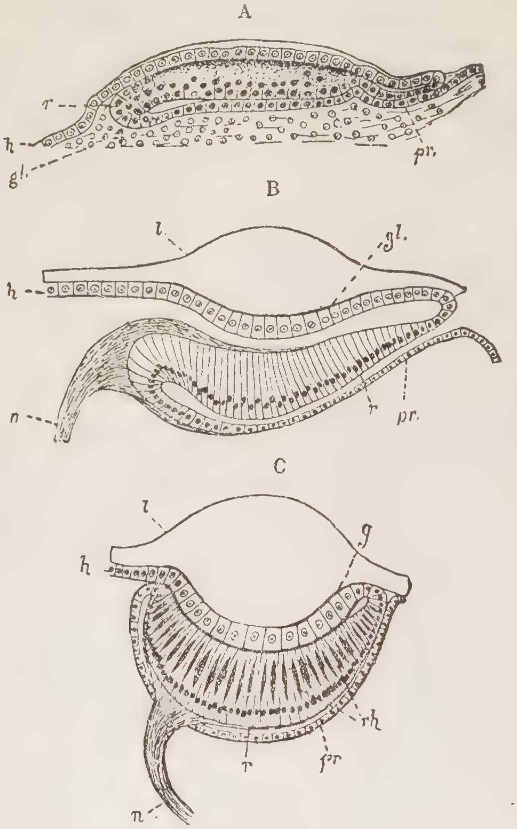


FIG. 24.—Diagrams of the development and adult structure of one of the paired central eyes of a scorpion.

A, Early condition before the lens is deposited, showing the folding of the epidermic cell-layer into three.
B, Diagram showing the nature of this infolding.
C, Section through the fully formed eye.
h, Epidermic cell-layer.
r, The retinal portion of the same which, owing to the infolding, lies between *gl*, the corneagen or lens-forming portion, and *pr*, the post-retinal or capsular portion or fold.
l, Cuticular lens.
g, Line separating lens from the lens-forming or corneagen cells of the epidermis.
n, Nerve fibres.
rh, Rhabdomeres.

[How the inversion of the nerve-end-cells and their connexion with the nerve-fibres is to be reconciled with the condition found in the adult, or with that of the monostichous eye, has not hitherto been explained.]

(From Korschelt and Heider.)

The great pericardial sinus is strongly developed in both animals. Its walls are fibrous and complete, and it holds a considerable volume of blood when the heart itself is contracted. Opening in pairs in each somite, right and left into the pericardial sinus are large veins, which bring the blood respectively from the gill-books and the lung-books to that chamber, whence it passes by the ostia into the heart. The blood is brought to the respiratory organs in both cases by a great venous collecting sinus having a ventral median position. In both animals *the wall of the pericardial sinus is connected by vertical muscular bands to the wall of the ventral venous sinus* (its lateral expansions around the lung-books in Scorpio) in each somite through which the pericardium passes. There are seven pairs of these *veno-pericardiac vertical muscles* in Scorpio, and eight in Limulus (see figs. 30, 31, 32). It is obvious that the contraction of these muscles must cause a depression of the floor of the pericardium and a rising of the roof of the ventral blood sinus, and a consequent increase of volume and flow of blood to each. Whether the pericardium and the ventral sinus are made to expand simultaneously or all the movement is made by one only of the surfaces concerned, must depend on conditions of tension. In any case it is clear that we have in these muscles an apparatus for causing the blood to flow differentially in increased volume into either the pericardium, through the veins leading from the respiratory organs, or from the body generally into the great sinuses which bring the blood to the respiratory organs. These muscles act so as to pump the blood through the respiratory organs.

It is not surprising that with so highly developed an arterial system Limulus and Scorpio should have a highly developed mechanism for determining the flow of blood to the respiratory organs. That this is, so to speak, a need of animals with localized respiratory organs is seen by the existence of provisions serving a similar purpose in other animals, *e.g.* the branchial hearts of the Cephalopoda.

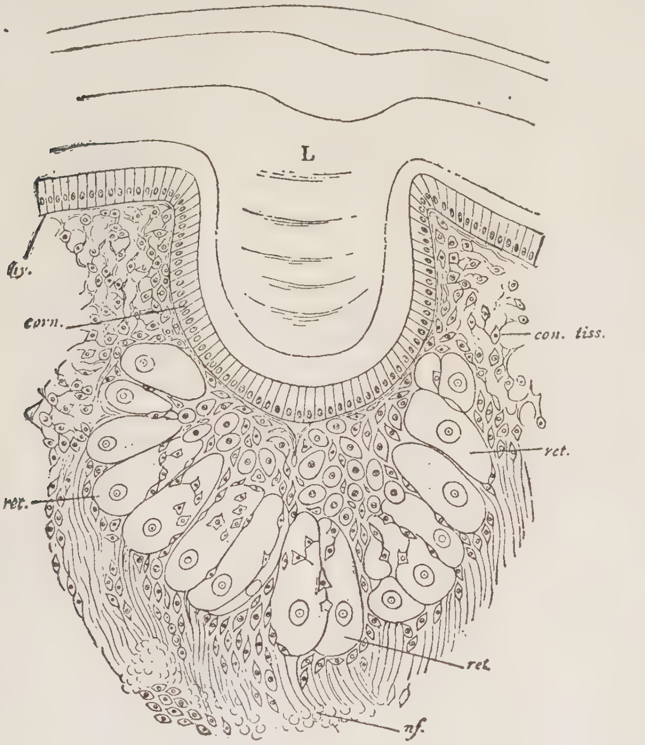


FIG. 25.—Section through one of the central eyes of a young Limulus.

L, Cuticular or corneous lens.
hy, Epidermic cell-layer.
corn, Its corneagen portion immediately underlying the lens.
ret, Retinula cells.
nf, Nerve fibres.
con. tiss, Connective tissue (mesoblastic skeletal tissue).

(After Lankester and Bourne, *Q. J. Mic. Sci.*, 1883.)

The veno-pericardiac muscles of Scorpio were seen and figured by Newport but not described by him. Those of Limulus were described and figured by Alphonse Milne-Edwards, but he called them merely "transparent ligaments," and did not discover their muscular structure. They are figured and their importance for the first time recognized in the memoir on the muscular and skeletal systems of Limulus and Scorpio by Lankester, Beck and Bourne (4).

6. *Alimentary Canal and Gastric Glands.*—The alimentary canal in Scorpio, as in Limulus, is provided with a powerful suctorial pharynx, in the working of which extrinsic muscles take a part. The mouth is relatively smaller in Scorpio than in Limulus—in fact is minute, as it is in all the terrestrial Arachnida which suck the juices of either animals or plants. In both, the alimentary canal takes a straight course from the pharynx (which bends under it downwards and backwards towards the mouth in Limulus) to the anus, and is a simple, narrow, cylindrical tube (fig. 33). The only point in which the gut of Limulus resembles that of Scorpio rather than that of any of the Crustacea, is in possessing more than a single pair of ducts or lateral outgrowths connected with ramified gastric glands or gastric caeca. Limulus has two pairs of these, Scorpio as many as six pairs. The Crustacea never have more than one pair. The minute microscopic structure of the gastric glands in the two animals is practically identical. The functions of these gastric diverticula have never been carefully investigated. It is very probable that in Scorpio they do not serve merely to secrete a digestive fluid (shown in other Arthropoda to resemble the pancreatic fluid), but that they also become distended by the juices of the prey sucked in by the scorpion—as certainly must occur in the case of the simple unbranched gastric caeca of the spiders.

The most important difference which exists between the structure of Limulus and that of Scorpio is found in the hinder region of the alimentary canal. Scorpio is here provided with a single or double pair of renal excretory tubes, which have been identified by earlier authors with the Malpighian tubes of the Hexapod and Myriapod insects. Limulus is devoid of any such tubes. We shall revert to this subject below.

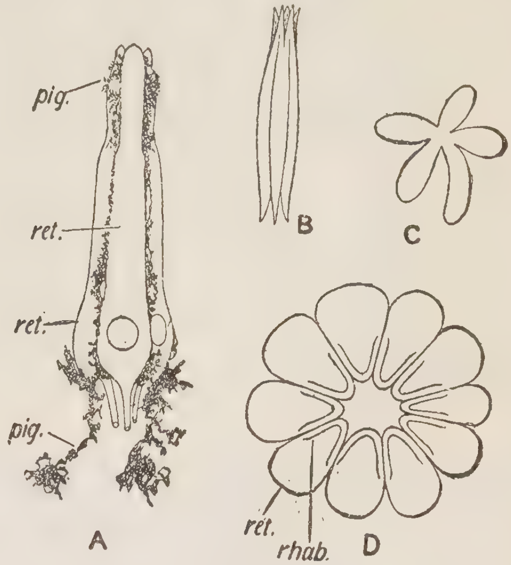


FIG. 26.

A, Diagram of a retinula of the central eye of a scorpion consisting of five retina-cells (*ret*), with adherent branched pigment cells (*pig*).
B, Rhabdom of the same, consisting of five confluent rhabdomeres.
C, Transverse section of the rhabdom of a retinula of the scorpion's central eye, showing its five constituent rhabdomeres as rays of a star.
D, Transverse section of a retinula of the lateral eye of Limulus, showing ten retinula cells (*ret*), each bearing a rhabdomere (*rhab*).

(After Lankester.)

7. *Ovaries and Spermaries: Gonocoels and Gonoducts.*—The scorpion is remarkable for having the specialized portion of coelom from the walls of which egg-cells or sperm-cells are developed according to sex, in the form of a simple but extensive network. It is not a pair of simple tubes, nor of dendriform tubes, but a closed network. The same fact is true of Limulus, as was shown by Owen (7) in regard to the ovary, and by Benham (14) in regard to the testis. This is a very definite and remarkable agreement, since such a reticular gonocoel is not found in Crustacea (except in the male Apus). Moreover, there is a significant agreement in the character of the spermatozoa of Limulus and Scorpio. The Crustacea are—with the exception of the Cirrhipedia—remarkable for having stiff, motionless spermatozoids. In Limulus Lankester found (15) the spermatozoa to possess active flagelliform "tails," and to resemble very closely those of Scorpio which, as are those of most terrestrial Arthropoda, are actively motile. This is a microscopic point of agreement, but is none the less significant.

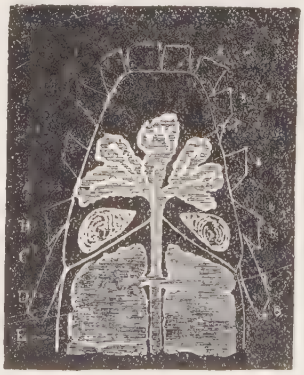


FIG. 27.—Diagram showing the position of the coxal glands of a scorpion, *Buthus australis*, Lin., in relation to the legs, diaphragm (entosternal flap), and the gastric caeca.
1 to 6, The bases of the six prosomatic limbs.
A, prosomatic gastric gland (sometimes called salivary).
B, Coxal gland.
C, Diaphragm of Newport = fibrous flap of the entosternum.
D, Mesosomatic gastric caeca (so-called liver).
E, Alimentary canal.

(From Lankester, *Q. J. Mic. Sci.*, vol. xxiv. N.S. p. 152.)

In regard to the important structures concerned with the fertilization of the egg, Limulus and Scorpio differ entirely from one another.

The eggs of Limulus are fertilized in the sea after they have been laid. Scorpio, being a terrestrial animal, fertilizes by copulation. The male possesses elaborate copulatory structures of a chitinous nature, and the eggs are fertilized in the female without even quitting the place where they are formed on the wall of the reticular gonocoel. The female scorpion is viviparous, and the young are produced in a highly developed condition as fully formed scorpions.

Differences between Limulus and Scorpio.—We have now passed in review the principal structural features in which Limulus agrees with Scorpio and differs from other Arthropoda. There remains for consideration the one important structural difference between the two animals. Limulus agrees with the majority of the Crustacea in being destitute of renal excretory caeca or tubes opening into the hinder part of the gut. Scorpio, on the other hand, in common with all air-breathing Arthropoda except Peripatus, possesses these tubules, which are often called Malpighian tubes. A great deal has been made of this difference by some writers. It has been considered by them as proving that Limulus, in spite of all its special agreements with Scorpio (which, however, have scarcely been appreciated by the writers in question), really belongs to the Crustacean line of descent, whilst Scorpio, by possessing Malpighian tubes, is declared to be unmistakably tied together with the other Arachnida to the tracheate Arthropods, the Hexapods, Diplopods, and Chilopods, which all possess Malpighian tubes.

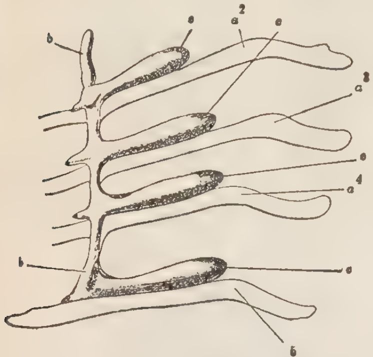


FIG. 28.—The right coxal gland of *Limulus polyphemus*, Latr.

a^2 to a^5, Posterior borders of the chitinous bases of the coxae of the second, third, fourth and fifth prosomatic limbs.

b, Longitudinal lobe or stolon of the coxal gland.

c. Its four transverse lobes or outgrowths corresponding to the four coxae.

(From Lankester, *loc. cit.*, after Packard.)

It must be pointed out that the presence or absence of such renal excretory tubes opening into the intestine appears to be a question of adaptation to the changed physiological conditions of respiration, and not of morphological significance, since a pair of renal excretory tubes of this nature is found in certain Amphipod Crustacea (Talorchestia, &c.) which have abandoned a purely aquatic life. This view has been accepted and supported by Professors Korschelt and Heider (**16**). An important fact in its favour was discovered by Laurie (**17**), who investigated the embryology of two species of Scorpio under Lankester's direction. It appears that the Malpighian tubes of Scorpio are developed from the mesenteron, viz. that portion of the gut which is formed by the hypoblast, whereas in Hexapod insects the similar caecal tubes are developed from the proctodaeum or in-pushed portion of the gut which is formed from epiblast. In fact it is not possible to maintain that the renal excretory tubes of the gut are of one common origin in the Arthropoda. They have appeared independently in connexion with a change in the excretion of nitrogenous waste in Arachnids, Crustacea, and the other classes of Arthropoda when aerial, as opposed to aquatic, respiration has been established—and they have been formed in some cases from the mesenteron, in other cases from the proctodaeum. Their appearance in the air-breathing Arachnids does not separate those forms from the water-breathing Arachnids which are devoid of them, any more than does their appearance in certain Amphipoda separate those Crustaceans from the other members of the class.

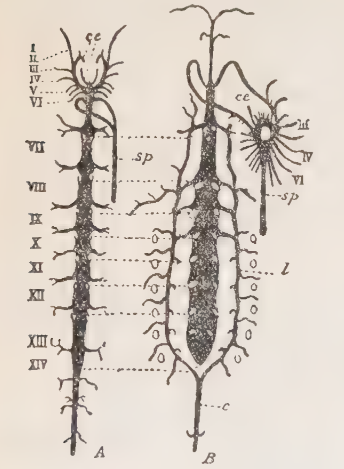


FIG. 29.—Diagram of the arterial system of A, Scorpio, and B, Limulus. The Roman numerals indicate the body somites and the two figures are adjusted for comparison. *ce*, Cerebral arteries; *sp*, supra-spinal or medullary artery; *c*, caudal artery; *l*, lateral anastomotic artery of Limulus. The figure B also shows the peculiar neural investiture formed by the cerebral arteries in Limulus and the derivation from this of the arteries to the limbs, III, IV, VI, whereas in Scorpio the latter have a separate origin from the anterior aorta.

(From Lankester, "Limulus an Arachnid.)

Further, it is pointed out by Korschelt and Heider that the hinder portion of the gut frequently acts in Arthropoda as an organ of nitrogenous excretion in the absence of any special excretory tubules, and that the production of such caeca from its surface in separate lines of descent does not involve any elaborate or unlikely process of growth. In other words, the Malpighian tubes of the terrestrial Arachnida are *homoplastic* with those of Hexapoda and Myriapoda, and not *homogenetic* with them. We are compelled to take a similar view of the agreement between the tracheal air-tubes of Arachnida and other tracheate Arthropods. They are homoplasts (see **18**) one of another, and do not owe their existence in the various classes compared to a common inheritance of an ancestral tracheal system.

Conclusions arising from the Close Affinity of Limulus and Scorpio.—When we consider the relationships of the various classes of Arthropoda, having accepted and established the fact of the close genetic affinity of Limulus and Scorpio, we are led to important conclusions. In such a consideration we have to make use not only of the fact just mentioned, but of three important generalizations which serve as it were as implements for the proper estimation of the relationships of any series of organic forms. First of all there is the generalization that the relationships of the various forms of animals (or of plants) to one another is that of the ultimate twigs of a much-branching genealogical tree. Secondly, identity of structure in two organisms does not necessarily indicate that the identical structure has been inherited from an ancestor common to the two organisms compared (homogeny), but may be due to independent development of a like structure in two different lines of descent (homoplasy). Thirdly, those members of a group which, whilst exhibiting undoubted structural characters indicative of their proper assignment to that group, yet are simpler than and inferior in elaboration of their organization to other members of the group, are not necessarily representatives of the earlier and primitive phases in the development of the group—but are very often examples of retrogressive change or degeneration. The second and third implements of analysis above cited are of the nature of cautions or checks. Agreements are not *necessarily* due to common inheritance; simplicity is not *necessarily* primitive and ancestral.

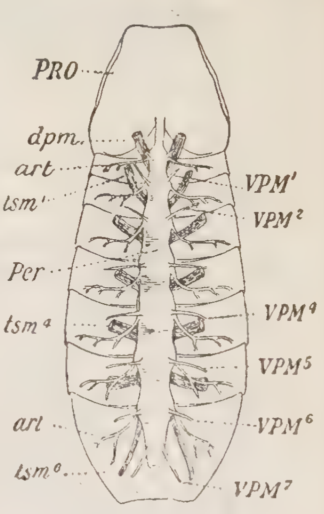


FIG. 30.—View from below of a scorpion (*Buthus occitanus*) opened and dissected so as to show the pericardium with its muscles, the lateral arteries, and the tergo-sternal muscles.

PRO, Prosoma.

dpm, Dorso-plastral muscle.

art, Lateral artery.

tsm^1, Tergo-sternal muscle (labelled *dv* in fig. 31) of the second (pectiniferous) mesosomatic somite; this is the most anterior pair of the series of six, none are present in the genital somite.

tsm^4, Tergo-sternal muscle of the fifth mesosomatic somite.

tsm^6, Tergo-sternal muscle of the enlarged first metasomatic somite.

Per, Pericardium.

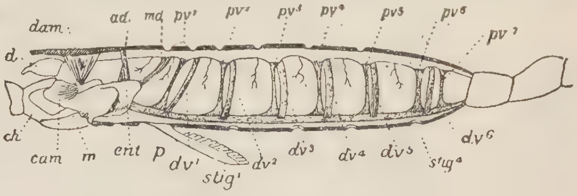
VPM^1 to VPM^7, The series of seven pairs of veno-pericardiac muscles (labelled *pv* in fig. 31). There is some reason to admit the existence of another more anterior pair of these muscles in Scorpio; this would make the number exactly correspond with the number in Limulus.

(After Lankester, *Trans. Zool. Soc.* Vol. XI, 1885.)

On the other hand, we must not rashly set down agreements as due to "homoplasy" or "convergence of development" if we find two or three or more concurrent agreements. The probability is against agreement being due to homoplasy when the agreement involves a number of really separate (not correlated) coincidences. Whilst the chances are in favour of some *one* homoplastic coincidence or structural agreement occurring between some member or other of a large group *a* and some member or other of a large group *b*, the matter is very different when by such an initial coincidence the two members have been particularized. The chances against these two selected members exhibiting *another* really independent homoplastic agreement are enormous: let us say 10,000 to 1. The chances against yet another coincidence are a hundred million to one, and against yet one more "coincidence" they are the square of a hundred million to one. Homoplasy can only be assumed when the coincidence is of a simple nature, and is such as may be reasonably supposed to have arisen by the action of like selective conditions upon like material in two separate lines of descent.[1]

So, too, degeneration is not to be lightly assumed as the explanation of a simplicity of structure. There is a very definite criterion of the simplicity due to degeneration, which can in most cases be applied. Degenerative simplicity is never uniformly distributed over all the structures of the organism. It affects many or nearly all the structures of the body, but leaves some, it may be only one, at a high level of elaboration and complexity. Ancestral simplicity is more uniform, and does not co-exist with specialization and elaboration of a single organ. Further: degeneration cannot be inferred safely by the examination of an isolated case; usually we obtain a series of forms indicating the steps of a change in structure—and what we have to decide is whether the movement has been from the simple to the more complex, or from the more complex to the simple. The feathers of a peacock afford a convenient example of primitive and degenerative simplicity. The highest point of elaboration in colour, pattern and form is shown by the great eye-painted tail feathers. From these we can pass by gradual transitions in two directions, viz. either to the simple lateral tail feathers with a few rami only, developed only on one side of the shaft and of uniform metallic coloration—or to the simple contour feathers of small size, with the usual symmetrical series of numerous rami right and left of the shaft and no remarkable colouring. The one-sided specialization and the peculiar metallic colouring of the lateral tail feathers mark them as the extreme terms of a degenerative series, whilst the symmetry, likeness of constituent parts *inter se*, and absence of specialized pigment, as well as the fact that they differ little from any average feather of birds in general, mark the contour feather as primitively simple, and as the starting-point from which the highly elaborated eye-painted tail feather has gradually evolved.

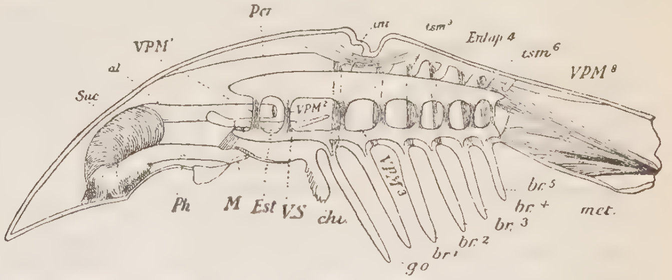
Applying these principles to the consideration of the Arachnida, we arrive at the conclusion that the smaller and simpler Arachnids are not the more primitive, but that the Acari or mites are, in fact, a degenerate group. This was maintained by Lankester in 1878 (**19**), again in 1881 (**20**); it was subsequently announced as a novelty by Claus in 1885 (**21**). Though the aquatic members of a class of animals are in some instances derived from terrestrial forms, the usual transition is from an aquatic ancestry to more recent land-living forms. There is no doubt, from a consideration of the facts of structure, that the aquatic water-breathing Arachnids, represented in the past by the Eurypterines and to-day by the sole survivor Limulus, have preceded the terrestrial air-breathing forms of that group. Hence we see at once that the better-known Arachnida form a series, leading from Limulus-like aquatic creatures through scorpions, spiders and harvest-men, to the degenerate Acari or mites. The spiders are specialized and reduced in apparent complexity, as compared with the scorpions, but they cannot be regarded as degenerate since the concentration of structure which occurs in them results in greater efficiency and power than are exhibited by the scorpion. The determination of the relative degree of perfection of organization attained by two animals compared is difficult when we introduce, as seems inevitable, the question of efficiency and power, and do not confine the question to the perfection of morphological development. We have no measure of the degree of power manifested by various animals—though it would be possible to arrive at some conclusions as to how that "power" should be estimated. It is not possible here to discuss that matter further. We must be content to point out that it seems that the spiders, the pedipalps, and other large Arachnids have not been derived from the scorpions directly, but have independently developed from aquatic ancestors, and from one of these independent groups—probably through the harvest-men from the spiders—the Acari have finally resulted.



After Beck, *Trans. Zool. Soc.* VOL. xi., 1883.

FIG. 31.—Diagram of a lateral view of a longitudinal section of a scorpion.

d, Chelicera.
ch, Chela.
cam, Camerostome.
m, Mouth.
ent, Entosternum.
p, Pecten.
stig^1, First pulmonary aperture.
stig^4, Fourth pulmonary aperture.
dam, Muscle from carapace to a praeoral entosclerite.
ad, Muscle from carapace to entosternum.
md, Muscle from tergite of genital somite to entosternum (same as *dpm* in fig. 30).
dv^1 to *dv*^{6}, Dorso-ventral muscles (same as the series labelled *tsm* in fig. 30).
pv^1 to *pv*^{7}, The seven veno-pericardiac muscles of the right side (labelled VPM in fig. 30).



After Benham, *Trans. Zool. Soc.* vol. xi., 1883.

FIG. 32.—Diagram of a lateral view of a longitudinal section of Limulus.

Suc, Suctorial pharynx.
al, Alimentary canal.
Ph, Pharynx.
M, Mouth.
Est, Entosternum.
VS, Ventral venous sinus.
chi, Chilaria.
go, Genital operculum.
br^1 to *br*^{5}, Branchial appendages.
met, Unsegmented metasoma.
Entap^4, Fourth dorsal entapophysis of left side.
tsm, Tergo-sternal muscles, six pairs as in Scorpio (labelled *dv* in fig. 31).
VPM^1 to VPM^8, The eight pairs of veno-pericardiac muscles (labelled *pv* in fig. 31). VPM^1 is probably represented in Scorpio, though not marked in figs. 30 and 31.

Leaving that question for consideration in connexion with the systematic statement of the characters of the various groups of Arachnida which follows on p. 299, it is well now to consider the following question, viz., seeing that Limulus and Scorpio are such highly developed and specialized forms, and that they seem to constitute as it were the first and second steps in the series of recognized Arachnida—what do we know, or what are we led to suppose with regard to the more primitive Arachnida from which the Eurypterines and Limulus and Scorpio have sprung? Do we know in the recent or fossil condition any such primitive Arachnids? Such a question is not only legitimate, but prompted by the analogy of at least one other great class of Arthropods. The great Arthropod class, the Crustacea, presents to the zoologist at the present day an immense range of forms, comprising the primitive phyllopods, the minute copepods, the parasitic cirrhipedes and the powerful crabs and lobsters, and the highly elaborated sand-hoppers and slaters. It has been insisted, by those who accepted Lankester's original doctrine of the direct or genetic affinity of the Chaetopoda and Arthropoda, that Apus and Branchipus really come very near to the ancestral forms which connected those two great branches of Appendiculate (Parapodiate) animals. On the other hand, the land crabs are at an immense distance from these simple forms.

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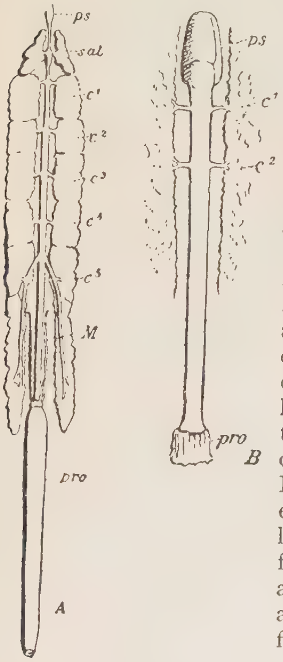
[1] A great deal of superfluous hypothesis has lately been put forward in the name of "the principle of convergence of characters" by a certain school of palaeontologists. The horse is supposed by these writers to have originated by separate lines of descent in the Old World and the New, from five-toed ancestors! And the important consequences following from the demonstration of the identity in structure of Limulus and Scorpio are evaded by arbitrary and even phantastic invocations of a mysterious transcendental force which brings about "convergence" irrespective of heredity and selection. Morphology becomes a farce when such assumptions are made. (E. R. L.)



From Lankester, "Limulus an Arachnid."

FIG. 33.—The alimentary canal and gastric glands of a scorpion (A) and of Limulus (B).

ps, Muscular suctorial enlargement of the pharynx.

sal, Prosomatic pair of gastric caeca in Scorpio, called salivary glands by some writers.

c^1, and c^2, The anterior two pairs of gastric caeca and ducts of the mesosomatic region.

c^3, c^4 and c^5, Caeca and ducts of Scorpio not represented in Limulus.

M, The Malpighian or renal caecal diverticula of Scorpio.

pro, The proctodaeum or portion of gut leading to anus and formed embryologically by an inversion of the epiblast at that orifice.

The record of the Crustacean family-tree is, in fact, a fairly complete one—the lower primitive members of the group are still represented by living forms in great abundance. In the case of the Arachnida, if we have to start their genealogical history with Limulus and Scorpio, we are much in the same position as we should be in dealing with the Crustacea, were the whole of the Entomostraca and the whole of the Arthrostraca wiped out of existence and record. There is no possibility of doubt that the series of forms corresponding in the Arachnidan line of descent, to the forms distinguished in the Crustacean line of descent as the lower grade—the Entomostraca—have ceased to exist, and not only so, but have left little evidence in the form of fossils as to their former existence and nature. It must, however, be admitted as probable that we should find some evidence, in ancient rocks or in the deep sea, of the early more primitive Arachnids. And it must be remembered that such forms must be expected to exhibit, when found, differences from Limulus and Scorpio as great as those which separate Apus and Cancer. The existing Arachnida, like the higher Crustacea, are "nomomeristic," that is to say, have a fixed typical number of somites to the body. Further, they are like the higher Crustacea, "somatotagmic," that is to say, they have this limited set of somites grouped in three (or more) "tagmata" or regions of a fixed number of similarly modified somites—each tagma differing in the modification of its fixed number of somites from that characterizing a neighbouring "tagma." The most primitive among the lower Crustacea, on the other hand, for example, the Phyllopoda, have not a fixed number of somites, some genera—even allied species—have more, some less, within wide limits; they are "anomomeristic." They also, as is generally the case with anomomeristic animals, do not exhibit any conformity to a fixed plan of "tagmatism" or division of the somites of the body into regions sharply marked off from one another; the head or prosomatic tagma is followed by a trunk consisting of somites which either graduate in character as we pass along the series or exhibit a large variety in different genera, families and orders, of grouping of the somites. They are anomotagmic, as well as anomomeristic.

When it is admitted—as seems to be reasonable—that the primitive Arachnida would, like the primitive Crustacea, be anomomeristic and anomotagmic, we shall not demand of claimants for the rank of primitive Arachnids agreement with Limulus and Scorpio in respect of the exact number of their somites and the exact grouping of those somites; and when we see how diverse are the modifications of the branches of the appendages both in Arachnida and in other classes of Arthropoda (*q.v.*), we shall not over-estimate a difference in the form of this or that appendage exhibited by the claimant as compared with the higher Arachnids. With those considerations in mind, the claim of the extinct group of the trilobites to be considered as representatives of the lower and more primitive steps in the Arachnidan genealogy must, it seems, receive a favourable judgment. They differ from the Crustacea in that they have only a single pair of prae-oral appendages, the second pair being definitely developed as mandibles. This fact renders their association with the Crustacea impossible, if classification is to be the expression of genetic affinity inferred from structural coincidence. On the contrary, this particular point is one in which they agree with the higher Arachnida. But little is known of the structure of these extinct animals; we are therefore compelled to deal with such special points of resemblance and difference as their remains still exhibit. They had lateral eyes[1] which resemble no known eyes so closely as the lateral eyes of Limulus. The general form and structure of their prosomatic carapace are in many striking features identical with that of Limulus. The trilobation of the head and body—due to the expansion and flattening of the sides or "pleura" of the tegumentary skeleton—is so closely repeated in the young of Limulus that the latter has been called "the trilobite stage" of Limulus (fig. 42 compared with fig. 41). No Crustacean exhibits this trilobite form. But most important of the evidences presented by the trilobites of affinity with Limulus, and therefore with the Arachnida, is the tendency less marked in some, strongly carried out in others, to form a pygidial or telsonic shield—a fusion of the posterior somites of the body, which is precisely identical in character with the metasomatic carapace of Limulus. When to this is added the fact that a post-anal spine is developed to a large size in some trilobites (fig. 38), like that of Limulus and Scorpio, and that lateral spines on the pleura of the somites are frequent as in Limulus, and that neither metasomatic fusion of somites nor post-anal spine, nor lateral pleural spines are found in any Crustacean, nor all three together in any Arthropod besides the trilobites and Limulus—the claim of the trilobites to be considered as representing one order of a lower grade of Arachnida, comparable to the grade Entomostraca of the Crustacea, seems to be established.

The fact that the single pair of prae-oral appendages of trilobites, known only as yet in one genus, is in that particular case a pair of uni-ramose antennae—does not render the association of trilobites and Arachnids improbable. Although the prae-oral pair of appendages in the higher Arachnida is usually chelate, it is not always so; in spiders it is not so; nor in many Acari. The bi-ramose structure of the post-oral limbs, demonstrated by Beecher in the trilobite Triarthrus, is no more inconsistent with its claim to be a primitive Arachnid than is the foliaceous modification of the limbs in Phyllopods inconsistent with their relationship to the Arthrostracous Crustaceans such as Gammarus and Oniscus.

Thus, then, it seems that we have in the trilobites the representatives of the lower phases of the Arachnidan pedigree. The simple anomomeristic trilobite, with its equi-formal somites and equi-formal appendages, is one term of the series which ends in the even more simple but degenerate Acari. Between the two and at the highest point of the arc, so far as morphological differentiation is concerned, stands the scorpion; near to it in the trilobite's direction (that is, on the ascending side) are Limulus and the Eurypterines—with a long gap, due to obliteration of the record, separating them from the trilobite. On the other side—tending downwards from the scorpion towards the Acari—are the Pedipalpi, the spiders, the book-scorpions, the harvest-men and the water-mites.

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[1] A pair of round tubercles on the labrum (camerostome or hypostoma) of several species of Trilobites has been described and held to be a pair of eyes (**22**). Sense-organs in a similar position were discovered in Limulus by Patten (**42**) in 1894.

The strange nobody-crabs or Pycnogonids occupy a place on the ascending half of the arc below the Eurypterines and Limulus. They are strangely modified and degenerate, but seem to be (as explained in the systematic review) the remnant of an Arachnidan group holding the same relation to the scorpions which the Laemodipoda hold to the Podophthalmate Crustacea.

We have now to offer a classification of the Arachnida and to pass in review the larger groups, with a brief statement of their structural characteristics.

In the bibliography at the close of this article (referred to by leaded arabic numerals in brackets throughout these pages), the titles of works are given which contain detailed information as to the genera and species of each order or sub-order, their geographical distribution and their habits and economy so far as they have been ascertained. The limits of space do not permit of a fuller treatment of those matters here.

TABULAR CLASSIFICATION[1] OF THE ARACHNIDA.

CLASS. ARACHNIDA.
Grade A. ANOMOMERISTICA.
Sub-Class. TRILOBITAE.
Orders. Not satisfactorily determined.
Grade B. NOMOMERISTICA.
Sub-Class I. PANTOPODA.
Order 1. Nymphonomorpha.
„ 2. Ascorhynchomorpha.
„ 3. Pycnogonomorpha.
Sub-Class II. EU-ARACHNIDA.
Grade *a*. DELOBRANCHIA, Lankester (*vel* HYDROPNEUSTEA, Pocock).
Order 1. Xiphosura.
„ 2. Gigantostraca.
Grade *b*. EMBOLOBRANCHIA, Lankester (*vel* AEROPNEUSTEA, Pocock).
Section α. Pectinifera.
Order 1. Scorpionidea.
Sub-order *a*. Apoxypoda.
„ *b*. Dionychopoda.
Section β. Epectinata.
Order 2. Pedipalpi.
Sub-order *a*. Uropygi.
Tribe 1. Urotricha.
„ 2. Tartarides.
Sub-order *b*. Amblypygi.
Order 3. Araneae.
Sub-order *a*. Mesothelae.
„ *b*. Opisthothelae.
Tribe 1. Mygalomorphae.
„ 2. Arachnomorphae.
Order 4. Palpigradi (=Microthelyphonidae).
Order 5. Solifugae (=Mycetophorae).
Order 6. Pseudoscorpiones (=Chelonethi).
Sub-order *a*. Panctenodactyli.
„ *b*. Hemictenodactyli.
Order 7. Podogona (=Ricinulei).
Order 8. Opiliones.
Sub-order *a*. Laniatores.
„ *b*. Palpatores.
„ *c*. Anepignathi.
Order 9. Rhynchostomi (=Acari).
Sub-order *a*. Notostigmata.
„ *b*. Cryptostigmata.
„ *c*. Metastigmata.
„ *d*. Prostigmata.
„ *e*. Astigmata.
„ *f*. Vermiformia.
„ *g*. Tetrapoda.

CLASS. ARACHNIDA.—Euarthropoda having two prosthomeres (somites which have passed from a post-oral to a prae-oral position), the appendages of the first represented by eyes, of the second by solitary rami which are rarely antenniform, more usually chelate. A tendency is exhibited to the formation of a metasomatic as well as a prosomatic carapace by fusion of the tergal surfaces of the somites. Intermediate somites forming a mesosoma occur, but tend to fuse superficially with the metasomatic carapace or to become co-ordinated with the somites of the metasoma, whether fused or distinct to form one region, the opisthosoma (abdomen of authors). In the most highly developed forms the two anterior divisions (tagmata) of the body, prosoma and mesosoma, each exhibit six pairs of limbs, pediform and plate-like respectively, whilst the metasoma consists of six limbless somites and a post-anal spine. The genital apertures are placed in the first somite following the prosoma, excepting where a praegenital somite, usually suppressed, is retained. Little is known of the form of the appendages in the lowest archaic Arachnida, but the tendency of those of the prosomatic somites has been (as in the Crustacea) to pass from a generalized bi-ramose or multi-ramose form to that of uni-ramose antennae, chelae and walking legs.

The Arachnida are divisible into two grades of structure—according to the fixity or non-fixity of the number of somites building up the body:—

Grade A (of the Arachnida). ANOMOMERISTICA.—Extinct archaic Arachnida, in which (as in the Entomostracous Crustacea) the number of well-developed somites may be more or less than eighteen and may be grouped only as head (prosoma) and trunk or may be further differentiated. A telsonic tergal shield of greater or less size is always present, which may be imperfectly divided into well-marked but immovable tergites indicating incompletely differentiated somites. The single pair of palpiform appendages in front of the mouth has been found in one instance to be antenniform, whilst the numerous post-oral appendages in the same genus were bi-ramose. The position of the genital apertures is not known. Compound lateral eyes present; median eyes wanting. The body and head have the two pleural regions of each somite flattened and expanded on either side of the true gut-holding body-axis. Hence the name of the sub-class signifying tri-lobed, a condition realized also in the Xiphosurous Arachnids. The members of this group, whilst resembling the lower Crustacea (as all lower groups of a branching genealogical tree must do), differ from them essentially in that the head exhibits only one prosthomere (in addition to the eye-bearing prosthomere) with palpiform appendages (as in all Arachnida) instead of two. The Anomomeristic Arachnida form a single sub-class, of which only imperfect fossil remains are known.

Sub-class (of the Anomomeristica). TRILOBITAE.—The single sub-class Trilobitae constitutes the grade Anomomeristica. It has been variously divided into orders by a number of writers. The greater or less evolution and specialization of the metasomatic carapace appears to be the most important basis for classification—but this has not been made use of in the latest attempts at drawing up a system of the Trilobites. The form of the middle and lateral regions of the prosomatic shield has been used, and an excessive importance attached to the demarcation of certain areas in that structure. Sutures are stated to mark off some of these pieces, but in the proper sense of that term as applied to the skeletal structures of the Vertebrata, no sutures exist in the chitinous cuticle of Arthropoda. That any partial fusion of originally distinct chitinous plates takes place in the cephalic shield of Trilobites, comparable to the partial fusion of bony pieces by suture in Vertebrata, is a suggestion contrary to fact.

The Trilobites are known only as fossils, mostly Silurian and prae-Silurian; a few are found in Carboniferous and Permian strata. As many as two thousand species are known. Genera with small metasomatic carapace, consisting of three to six fused segments distinctly marked though not separated by soft membrane, are *Harpes*, *Paradoxides* and *Triarthrus* (fig. 34). In *Calymene*, *Homalonotus* and *Phacops* (fig. 38) from six to sixteen segments are clearly marked by ridges and grooves in the metasomatic tagma, whilst in *Illaenus* the shield so formed is large but no somites are marked out on its surface. In this genus ten free somites (mesosoma) occur between the prosomatic and metasomatic carapaces. *Asaphus* and *Megalaspis* (fig. 39) are similarly constituted. In *Agnostus* (fig. 40) the anterior and posterior carapaces constitute almost the entire body, the two carapaces being connected by a mid-region of only two free somites. It has been held that the forms with a small number of somites marked in the posterior carapace and numerous free somites between the anterior and posterior carapace, must be considered as anterior to those in which a great number of posterior somites are traceable in the metasomatic carapace, and that those in which the traces of distinct somites in the posterior or metasomatic carapace are most completely absent must be regarded as derived from those in which somites are well marked in the posterior carapace and similar in appearance to the free somites. The genus *Agnostus*, which belongs to the last category, occurs abundantly in Cambrian strata and is one of the earliest forms known. This would lead to the supposition that the great development of metasomatic carapace is a primitive and not a late character, were it not for the fact that *Paradoxides* and *Atops*, with an inconspicuous telsonic carapace and numerous free somites, are also Cambrian in age, the latter indeed anterior in horizon to *Agnostus*.

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[1] The writer is indebted to R. I. Pocock, assistant in the Natural History departments of the British Museum, for valuable assistance in the preparation of this article and for the classification and definition of the groups of Eu-arachnida here given. The general scheme and some of the details have been brought by the writer into agreement with the views maintained in this article. Pocock accepts those views in all essential points and has, as a special student of the Arachnida, given to them valuable expansion and confirmation. The writer also desires to express his thanks to Messrs. Macmillan & Co. for permission to use figs. 22, 43, 44 and 45, which are taken from Parker and Haswell's *Text-book of Zoology*; and to Messrs. Swan Sonnenschein & Co. for the loan of several figures from the translations published by them of the admirable treatise on *Embryology* by Professors Korschelt and Heider; also to the publishers of the treatise on *Palaeontology* by Professor Zittel, Herr Oldenbourg and The Macmillan Co., New York, for several cuts of extinct forms.

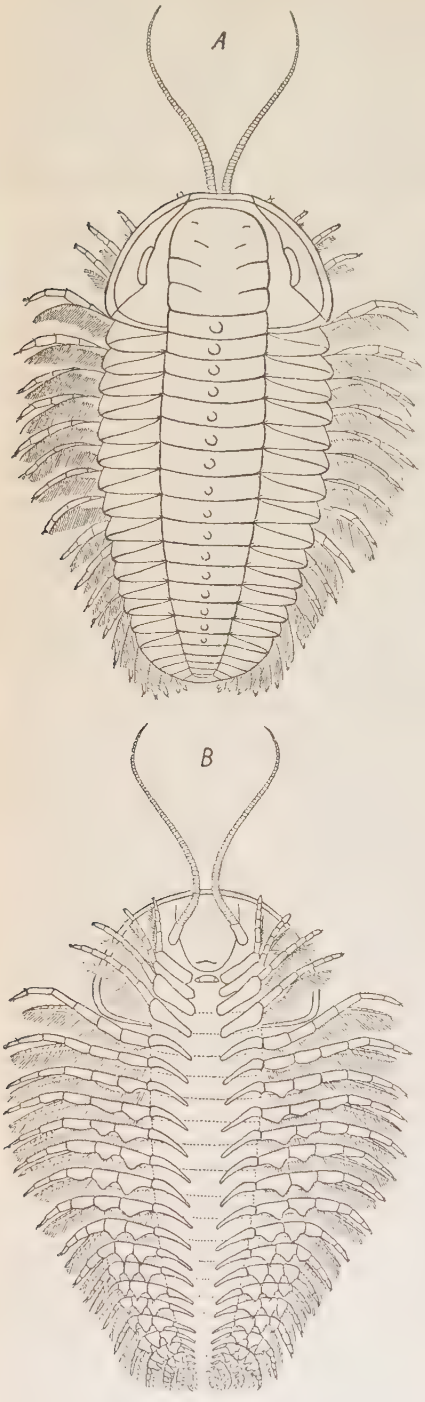

FIG. 34.—Restoration of *Triarthrus Becki*, Green, as determined by Beecher from specimens obtained from the Utica Slates (Ordovician), New York. A, dorsal; B, ventral surface. In the latter the single pair of antennae springing up from each side of the camerostome or hypostome or upper lip-lobe are seen. Four pairs of appendages besides these are seen to belong to the cephalic tergum. All the appendages are pediform and bi-ramose; all have a prominent gnathobase, and in all the exopodite carries a comb-like series of secondary processes.

(After Beecher, from Zittel.)

On the other hand, it may well be doubted whether the pygidial or posterior carapace is primarily due to a fusion of the tergites of somites which were previously movable and well developed. The posterior carapace of the Trilobites and of *Limulus* is probably enough in origin a telsonic carapace—that is to say, is the tergum of the last segment of the body which carries the anus. From the front of this region new segments are produced in the first instance, and are added during growth to the existing series. This telson may enlarge, it may possibly even become internally and sternally developed as partially separate somites, and the tergum may remain without trace of somite formation, or, as appears to be the case in *Limulus*, the telson gives rise to a few well-marked somites (mesosoma and two others) and then enlarges without further trace of segmentation, whilst the chitinous integument which develops in increasing thickness on the terga as growth advances welds together the unsegmented telson and the somites in front of it, which were previously marked by separate tergal thickenings. It must always be remembered that we are liable (especially in the case of fossilized integuments) to attach an unwarranted interpretation to the mere discontinuity or continuity of the thickened plates of chitinous cuticle on the back of an Arthropod. These plates may fuse, and yet the somites to which they belong may remain distinct, and each have its pair of appendages well developed. On the other hand, an unusually large tergal plate, whether terminal or in the series, is not always due to fusion of the dorsal plates of once-separate somites, but is often a case of growth and enlargement of a single somite without formation of any trace of a new somite. For the literature of Trilobites see (22*).

Grade B (of the Arachnida) NOMOMERISTICA.—Arachnida in which, excluding from consideration the eye-bearing prosthomere, the somites are primarily (that is to say, in the common ancestor of the grade) grouped in three regions of six—(*a*) the "prosoma" with palpiform appendages, (*b*) the "mesosoma" with plate-like appendages, and (*c*) the "metasoma" with suppressed appendages. A somite placed between the prosoma and mesosoma—the prae-genital somite—appears to have belonged originally to the prosomatic series (which with its ocular prosthomere and palpiform limbs [Pantopoda], would thus consist of eight somites), but to have been gradually reduced. In living Arachnids, excepting the Pantopoda, it is either fused (with loss of its appendages) with the prosoma (*Limulus*,[1] *Scorpio*), after embryonic appearance, or is

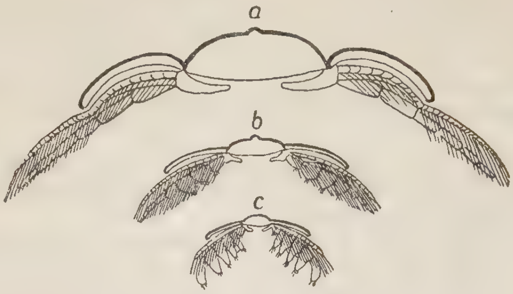

FIG. 35.—*Triarthrus Becki*, Green. *a*, Restored thoracic limbs in transverse section of the animal; *b*, section across a posterior somite; *c*, section across one of the sub-terminal somites.

(After Beecher.)

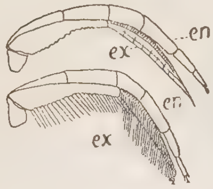

FIG. 36.—*Triarthrus Becki*, Green. Dorsal view of second thoracic leg with and without setae. *en*, Inner ramus; *ex*, Outer ramus.

(After Beecher.)

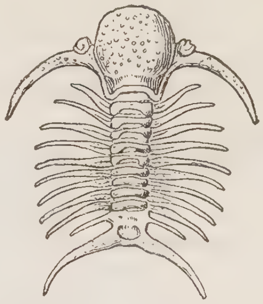

FIG. 37.—*Deiphon Forbesii*, Barr. One of the Cheiruridae. Silurian Bohemia.

(From Zittel's *Palaeontology*.)

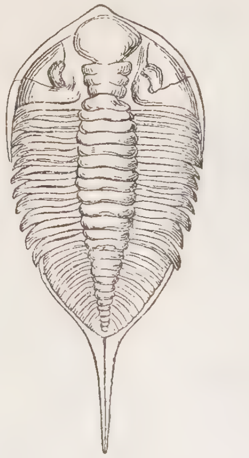

FIG. 38.—*Dalmanites limulurus*, Green. One of the *Phacopidae*, from the Silurian, New York.

(From Zittel.)

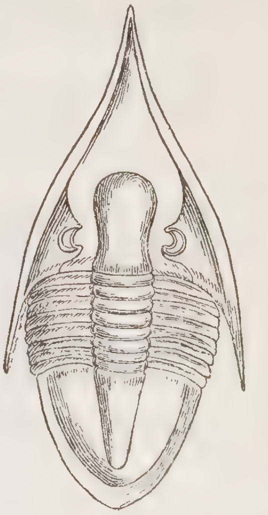

FIG. 39.—*Megalaspis extenuatus*. One of the *Asaphidae* allied to *Illaenus*, from the Ordovician of East Gothland, Sweden.

(From Zittel).

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[1] Pocock suggests that the area marked vii. in the outline figure of the dorsal view of *Limulus* (fig. 7) may be the tergum of the suppressed prae-genital somite. Embryological evidence must settle whether this is so or not.

retained as a rudimentary, separate, detached somite in front of the mesosoma, or disappears altogether (excalation). The atrophy and total disappearance of ancestrally well-marked somites frequently take place (as in all Arthropoda) at the posterior extremity of the body, whilst excalation of somites may occur at the constricted areas which often separate adjacent "regions," though there are very few instances in which it has been recognized. Concentration of the organ-systems by fusion of neighbouring regions (prosoma, mesosoma, metasoma), previously distinct, has frequently occurred, together with obliteration of the muscular and chitinous structures indicative of distinct somites. This concentration and obliteration of somites, often accompanied by dislocation of important segmental structures (such as appendages and nerve-ganglia), may lead to highly developed specialization (individuation, H. Spencer), as in the Araneae and Opiliones, and, on the other hand, may terminate in simplification and degeneration, as in the Acari.

The most important general change which has affected the structure of the nomomeristic Arachnida in the course of their historic development is the transition from an aquatic to a terrestrial life. This has been accompanied by the conversion of the lamelliform gill-plates into lamelliform lung-plates, and later the development from the lung-chambers, and at independent sites, of tracheae or air-tubes (by adaptation of the vasifactive tissue of the blood-vessels) similar to those independently developed in *Peripatus*, Diplopoda, Hexapoda and Chilopoda. Probably tracheae have developed independently by the same process in several groups of tracheate Arachnids. The nomomeristic Arachnids comprise two sub-classes—one a very small degenerate offshoot from early ancestors; the other, the great bulk of the class.

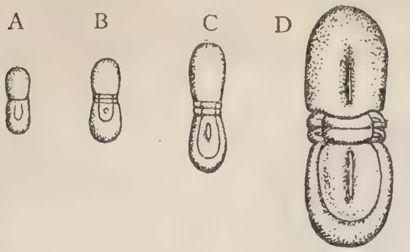
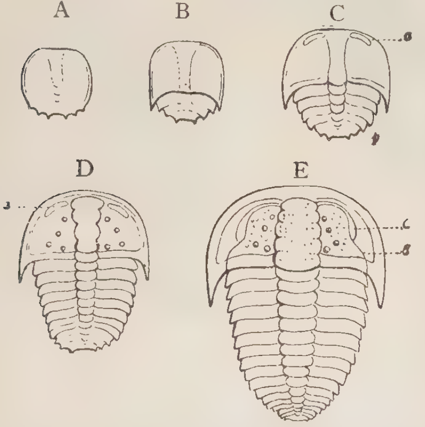


FIG. 40.—Four stages in the development of the trilobite *Agnostus nudus*. A, Youngest stage with no mesosomatic somites; B and C, stages with two mesosomatic somites between the prosomatic and telsonic carapaces; D, adult condition, still with only two free mesosomatic somites.

(From Korschelt and Heider.)



From Korschelt and Heider, after Barrande.

FIG. 41.—Five stages in the development of the trilobite *Sao hirsuta*.

A, Youngest stage.
B, Older stage with distinct pygidial carapace.
C, Stage with two free mesosomatic somites between the prosomatic and telsonic carapaces.
D, Stage with seven free intermediate somites.
E, Stage with twelve free somites; the telsonic carapace has not increased in size.
a, Lateral eye.
g, So-called facial "suture" (not really a suture).
p, Telsonic carapace.

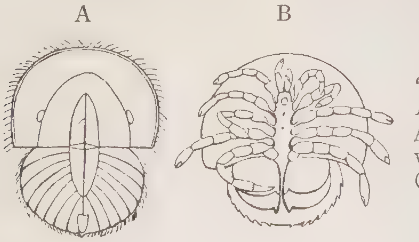
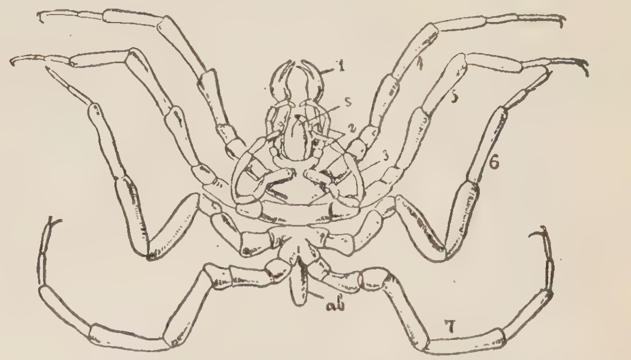


FIG. 42.—So-called "trilobite stage" of *Limulus polyphemus*. A, Dorsal; B, ventral view.

(From Korschelt and Heider, after Leuckart.)

Sub-Class I. (of the Nomomeristica). PANTOPODA.—Nomomeristic Arachnids, in which the somites corresponding to mesosoma and metasoma have entirely aborted. The seventh, and sometimes the eighth, leg-bearing somite is present and has its leg-like appendages fully developed. Monomeniscous eyes with a double (really triple) cell-layer formed by invagination, as in the Eu-arachnida, are present. The Pantopoda stand in the same relation to *Limulus* and *Scorpio* that *Cyamus* holds to the thoracostracous Crustacea.

The reduction of the organism to seven leg-bearing somites, of which the first pair, as in so many Eu-arachnida, are chelate, is a form of degeneration connected with a peculiar quasi-parasitic habit resembling that of the crustacean Laemodipoda. The genital pores are situate at the base of the 7th pair of limbs, and may be repeated on the 4th, 5th, and 6th. In all known Pantopoda the size of the body is quite minute as compared with that of the limbs: the alimentary canal sends a long caecum into each leg (cf. the Araneae) and the genital products are developed in gonocoels also placed in the legs.



From Parker and Haswell's *Text-book of Zoology*, after Hoek.

FIG. 43.—One of the Nymphonomorphous Pantopoda, *Nymphon hispidum*, showing the seven pairs of appendages 1 to 7; *ab*, the rudimentary opisthosoma; *s*, the mouth-bearing proboscis.

The Pantopoda are divided into three orders, the characters of which are dependent on variation in the presence of the full number of legs.

Order 1 (of the Pantopoda). Nymphonomorpha, Pocock (nov.) (fig. 43).—In primitive forms belonging to the family *Nymphonidae* the full complement of appendages is retained—the 1st (mandibular), the 2nd (palpiform), and the 3rd (ovigerous) pairs being well developed in both sexes. In certain derivative forms constituting the family *Pallenidae*, however, the appendages of the 2nd pair are either rudimentary or atrophied altogether.

Two families: 1. Nymphonidae (genus *Nymphon*), and 2. Pallenidae (genus *Pallene*).

Order 2. Ascorhynchomorpha, Pocock (nov.).—Appendages of the 2nd and 3rd pairs retained and developed, as in the more primitive types of Nymphonomorpha; but those of the 1st pair are either rudimentary, as in the *Ascorhynchidae*, or atrophied, as in the *Colossendeidae*. In the latter a further specialization is shown in the fusion of the body segments.

Two families: 1. Ascorhynchidae (genera *Ascorhynchus* and *Ammothea*); 2. Colossendeidae (genera *Colossendeis* and *Discoarachne*).

Order 3. Pycnogonomorpha, Pocock (nov.).—Derivative forms in which the reduction in number of the anterior appendages is carried farther than in the other orders, reaching its extreme in the *Pycnogonidae*, where the 1st and 2nd pairs are absent in both sexes, and the 3rd pair also are absent in the female. In the *Hannoniidae*, however, which resemble the *Pycnogonidae* in the absence of the 3rd pair in the female and of the 2nd pair in both sexes, the 1st pair are retained in both sexes.

Two families: 1. Hannoniidae (genus *Hannonia*); 2. Pycnogonidae (genera *Pycnogonum* and *Phoxichilus*).

Remarks.—The Pantopoda are not known in the fossil condition. They are entirely marine, and are not uncommon in the coralline zone of the sea-coast. The species are few, not more than fifty (**23**). Some large species of peculiar genera are taken at great depths. Their movements are extremely sluggish. They are especially remarkable for the small size of the body and the extension of viscera into the legs. Their structure is eminently that of degenerate forms. Many frequent growths of coralline Algae and hydroid polyps, upon the juices of which they feed, and in some cases a species of gall is produced in hydroids by the penetration of the larval Pantopod into the tissues of the polyp.

Sub-Class II. (of the Nomomeristic Arachnida). EU-ARACHNIDA.—These start from highly developed and specialized aquatic branchiferous forms, exhibiting a prosoma with six pediform pairs of appendages, an intermediate prae-genital somite, a mesosoma of six somites bearing lamelliform pairs of appendages, and a metasoma of six somites devoid of appendages, and the last provided with a post-anal spine. Median eyes are present, which are monomeniscous, with distinct retinal and corneagenous cell-layers, and placed centrally on the prosoma. Lateral eyes also may be present, arranged in lateral groups, and having a single or double cell-layer beneath the lens. The first pair of limbs is often chelate or prehensile, rarely antenniform; whilst the second, third and fourth may also be chelate, or may be simple palps or walking legs.

An internal skeletal plate, the so-called "entosternite" of fibro-cartilaginous tissue, to which many muscles are attached, is placed between the nerve-cords and the alimentary tract in the prosoma of the larger forms (*Limulus*, *Scorpio*, *Mygale*). In the same and other leading forms a pair of much-coiled glandular tubes, the coxal glands (coelomocoels in origin), is found with a duct opening on the coxa of the fifth pair of appendages of the prosoma. The vascular system is highly developed (in the non-degenerate forms); large arterial branches closely accompany or envelop the chief nerves; capillaries are well developed. The blood-corpuscles are large amoebiform cells, and the blood-plasma is coloured blue by haemocyanin.

The alimentary canal is uncoiled and cylindrical, and gives rise laterally to large gastric glands, which are more than a single pair in number (two to six pairs), and may assume the form of simple caeca. The mouth is minute and the pharynx is always suctorial, never gizzard-like. The gonadial tubes (gonocoels or gonadial coelom) are originally reticular and paired, though they may be reduced to a simpler condition. They open on the first somite of the mesosoma. In the numerous degenerate forms simplification occurs by obliteration of the demarcations of somites and the fusion of body-regions, together with a gradual suppression of the lamelliferous respiratory organs and the substitution for them of tracheae, which, in their turn, in the smaller and most reduced members of the group, may also disappear.

The Eu-arachnida are divided into two grades with reference to the condition of the respiratory organs as adapted to aquatic or terrestrial life.

Grade *a* (of the Eu-arachnida). DELOBRANCHIA
(Hydropneustea).

Mesosomatic segments furnished with large plate-like appendages, the 1st pair acting as the genital operculum, the remaining pairs being provided with branchial lamellae fitted for breathing oxygen dissolved in water. The prae-genital somite partially or wholly obliterated in the adult. The mouth lying far back, so that the basal segments of all the prosomatic appendages, excepting those of the 1st pair, are capable of acting as masticatory organs. Lateral eyes consisting of a densely packed group of eye-units ("compound" eyes).

Order 1. Xiphosura.—The prae-genital somite fuses in the embryo with the prosoma and disappears (see fig. 19). Not free-swimming, none of the prosomatic appendages modified to act as paddles; segments of the mesosoma and metasoma (=opisthosoma) not more than ten in number, distinct or coalesced.

Family—Limulidae (*Limulus*).
,, *Belinuridae (*Belinurus*, *Aglaspis*, *Prestwichia*).
,, *Hemiaspidae (*Hemiaspis*, *Bunodes*).

Remarks.—The Xiphosura are marine in habit, frequenting the shore. They are represented at the present day by the single genus *Limulus* (figs. 44 and 45; also figs. 7, 9, 11, to 15 and 20), often termed the king-crab, which occurs on the American coast of the Atlantic Ocean, but not on its eastern coasts, and on the Asiatic coast of the Pacific. The Atlantic species (*L. polyphemus*) is common on the coasts of the United States, and is known as the king-crab or horse-shoe crab. A single specimen was found in the harbour of Copenhagen in the 18th century, having presumably been carried over by a ship to which it clung.

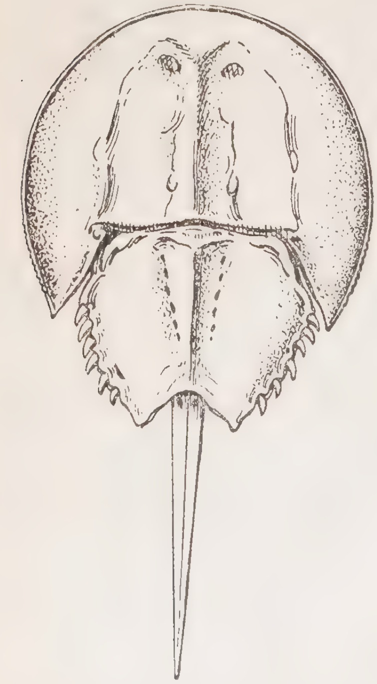


Fig. 44.—Dorsal view of *Limulus polyphemus*, Latr.

(From Parker and Haswell, *Text-book of Zoology*, after Leuckart.)

A species of *Limulus* is found in the Buntersandstein of the Vosges; *L. Walchi* is abundant in the Oolitic lithographic slates of Bavaria.

The genera *Belinurus*, *Aglaspis*, *Prestwichia*, *Hemiaspis* and *Bunodes* consist of small forms which occur in Palaeozoic rocks. In none of them are the appendages known, but in the form of the two carapaces and the presence of free somites they are distinctly intermediate between *Limulus* and the Trilobitae. The young form of *Limulus* itself (fig. 40) is also similar to a Trilobite so far as its segmentation and trilobation are concerned. The lateral eyes of *Limulus* appear to be identical in structure and position with those of certain Trilobitae.

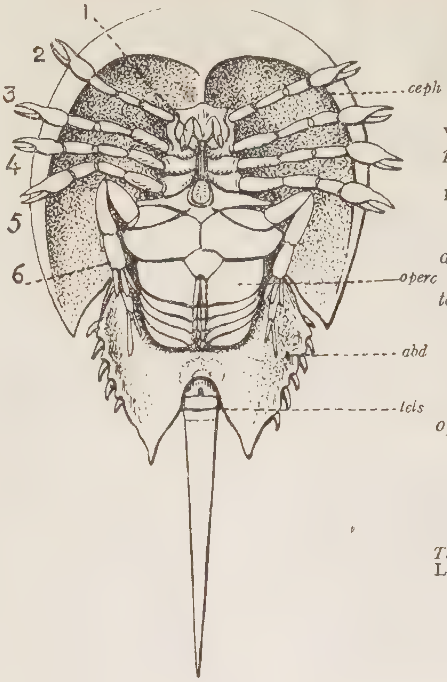


Fig. 45.—Ventral view of *Limulus polyphemus*.

1 to 6, The six prosomatic pairs of appendages.
abd, the solid opisthosomatic carapace.
tels, the post-anal spine (*not* the telson as the lettering would seem to imply, but only its post-anal portion).
operc, the fused first pair of mesosomatic appendages forming the genital operculum.

(From Parker and Haswell, *Text-book of Zoology*, after Leuckart.)

Order 2. Gigantostraca (figs. 46, 47).—Free-swimming forms, with the appendages of the 6th or 5th and 6th pairs flattened or lengthened to act as oars; segments of mesosoma and metasoma (=opisthosoma), twelve in number.

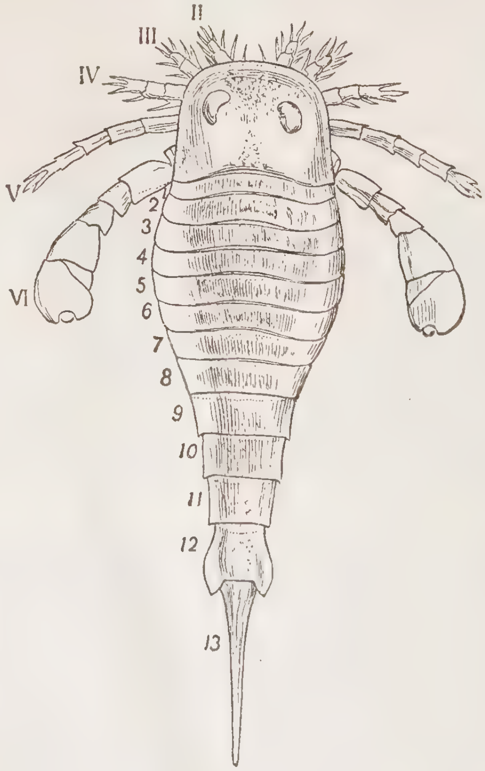


Fig. 46.—*Eurypterus Fischeri*, Eichwald. Silurian of Rootzikil. Restoration after Schmidt. The dorsal aspect is presented showing the prosomatic shield with paired compound eyes and the prosomatic appendages II. to VI. The small first pair of appendages is concealed from view by the carapace. 1 to 12 are the somites of the opisthosoma; 13, the post-anal spine.

(From Zittel's *Text-book of Palaeontology*, The Macmillan Co., New York, 1896.)

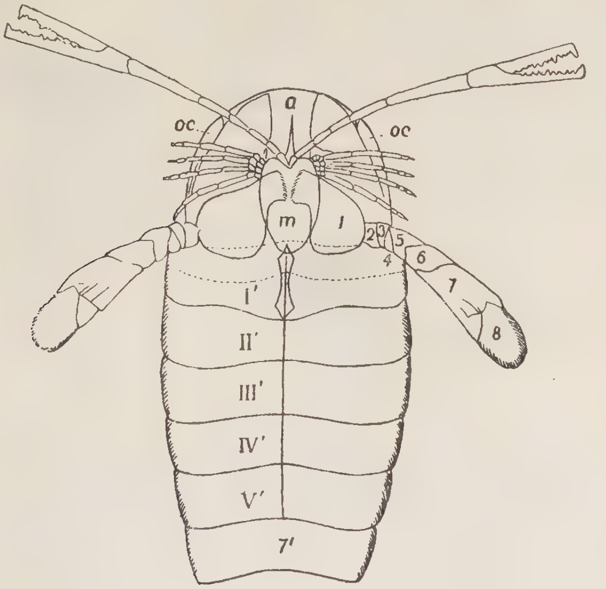
Appendages of anterior pair very large and chelate.

Sub-order Pterygotomorpha, Pterygotidae (*Pterygotus*).

Appendages of anterior pair minute and chelate.

Sub-order Eurypteromorpha { Stylonuridae (*Stylonurus*).
Eurypteridae (*Eurypterus*, *Slimonia*).

Remarks.—The Gigantostraca are frequently spoken of as "the Eurypterines." Not more than thirty species are known. They became extinct in Palaeozoic times, and are chiefly found in the Upper Silurian, though extending upwards as far as the Carboniferous. They may be regarded as "macrourous" Xiphosura; that is to say, Xiphosura in which the nomomeristic number of eighteen well-developed somites is present and the posterior ones form a long tail-like region of the body. There still appears to be some doubt whether in the sub-order Eurypteromorpha the first pair of prosomatic appendages (fig. 46) is atrophied, or whether, if present, it has the form of a pair of tactile palps or of minute chelae. Though there are indications of lamelliform respiratory appendages on mesosomatic somites following that bearing the genital operculum, we cannot be said to have any proper knowledge as to such appendages, and further evidence with regard to them is much to be desired. (For literature see Zittel, **22***.)



From Zittel's *Palaeontology*.

FIG. 47.—*Pterygotus osiliensis*, Schmidt. Silurian of Rootzikil. Restoration of the ventral surface, about a third natural size, after Schmidt.

a, Camerostome or epistoma.
m, Chilarium or metasternite of the prosoma (so-called metastoma).
oc, The compound eyes.
1 to 8, Segments of the sixth prosomatic appendage.
I′ to V′, First five opisthosomatic somites.
7′, Sixth opisthosomatic somite.

[Observe the powerful gnathobases of the sixth pair of prosomatic limbs and the median plates behind *m*. The dotted line on somite I indicates the position of the genital operculum which was probably provided with branchial lamellae.]

Grade *b* (of the Eu-arachnida). EMBOLOBRANCHIA (Aeropneustea).

In primitive forms the respiratory lamellae of the appendages of the 3rd, 4th, 5th and 6th, or of the 1st and 2nd mesosomatic somites are sunk beneath the surface of the body, and become adapted to breathe atmospheric oxygen, forming the leaves of the so-called lung-books. In specialized forms these pulmonary sacs are wholly or partly replaced by tracheal tubes. The appendages of the mesosoma generally suppressed; in the more primitive forms one or two pairs may be retained as organs subservient to reproduction or silk-spinning. Mouth situated more forwards than in Delobranchia, no share in mastication being taken by the basal segments of the 5th and 6th pairs of prosomatic appendages. Lateral eyes, when present, represented by separate ocelli.

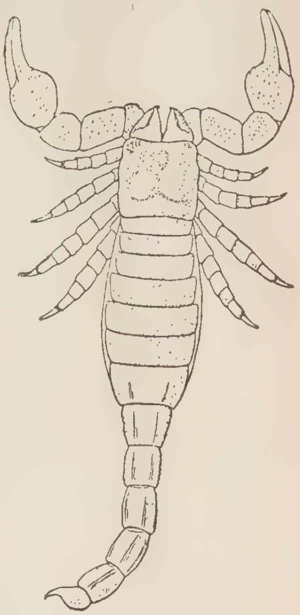
The prae-genital somite, after appearing in the embryo, either is obliterated (*Scorpio*, *Galeodes*, *Opilio* and others) or is retained as a reduced narrow region of the body, the "waist," between prosoma and mesosoma. It is represented by a full-sized tergal plate in the Pseudo-scorpiones.

Section *α*. *Pectinifera*.—The primitive distinction between the mesosoma and the metasoma retained, the latter consisting of six somites and the former of six somites in the adult, each of which is furnished during growth with a pair of appendages. Including the prae-genital somite (fig. 16), which is suppressed in the adult, there are thirteen somites behind the prosoma. The appendages of the 1st and 2nd mesosomatic somites persisting as the genital operculum and pectones respectively, those of the 3rd, 4th, 5th and 6th somites (? in *Palaeophonus*) sinking below the surface during growth in connexion with the formation of the four pairs of pulmonary sacs (see fig. 17). Lateral eyes monostichous.

Order 1. Scorpiones.—Prosoma covered by a single dorsal shield, bearing typically median and lateral eyes; its sternal elements reduced to a single plate lodged between or behind the basal segments of the 5th and 6th pairs of appendages. Appendages of 1st pair tri-segmented, chelate; of 2nd pair chelate, with their basal segments subserving mastication; of 3rd, 4th, 5th and 6th pairs similar in form and function, except that in recent and Carboniferous forms the basal segments of the 3rd and 4th are provided with sterno-coxal (maxillary) lobes, those of the 4th pair meeting in the middle line and underlying the mouth. The five posterior somites of the metasoma constricted to form a "tail," the post-anal sclerite persisting as a weapon of offence and provided with a pair of poison glands (see figs. 8, 10, 12, 13, 14, 15, 21 and 22).

Sub-order Apoxypoda.—The 3rd, 4th, 5th and 6th pairs of appendages short, stout, tapering, the segments about as wide as long, except the apical, which is distally slender, pointed, slightly curved, and without distinct movable claws.

Family—Palaeophonidae, *Palaeophonus* (figs. 48 and 49).



Restored after Thorell's indications by R. I. Pocock.

FIG. 48.—Dorsal view of a restoration of *Palaeophonus nuncius*, Thorell. The Silurian scorpion from Gothland.

Sub-order Dionychopoda.—The 3rd, 4th, 5th and 6th pairs of appendages slender, not evenly tapering, the segments longer than wide; the apical segment short, distally truncate, and provided with a pair of movable claws. Basal segments of the 5th and 6th pairs of appendages abutting against the sternum of the prosoma (see fig. 10 and figs. 51, 52 and 53).

Family—Pandinidae (*Pandinus*, *Opisthophthalmus*, *Urodacus*).
,, Vejovidae (*Vaejovis*, *Jurus*, *Euscorpius*, *Broteas*).
,, Bothriuridae (*Bothriurus*, *Cercophonius*).
,, Buthidae (*Buthus*, *Centrurus*).
,, *Cyclophthalmidae (*Cyclophthalmus*) { Carboniferous.
,, *Eoscorpiidae (*Eoscorpius*, *Centromachus*)

Remarks on the Order Scorpiones.—The Scorpion is one of the great animals of ancient lore and tradition. It and the crab are the only two invertebrates which had impressed the minds of early men sufficiently to be raised to the dignity of astronomical representation. It is all the more remarkable that the scorpion proves to be the oldest animal form of high elaboration which has persisted to the present day. In the Upper Silurian two specimens of a scorpion have been found (figs. 48, 49), one in Gothland and one in Scotland,

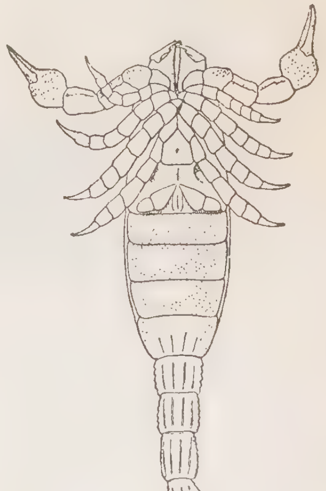


FIG. 49.—Ventral view of a restoration of *Palaeophonus Hunteri*, Pocock, the Silurian scorpion from Lesmahagow, Scotland. Restored by R. I. Pocock. The meeting of the coxae of all the prosomatic limbs in front of the pentagonal sternum; the space for a genital operculum; the pair of pectens, and the absence of any evidence of pulmonary stigmata are noticeable in this specimen.

(See Pocock, *Quart. Jour. Micr. Sci.*, 1901.)

which would be recognized at once as true scorpions by a child or a savage. The Silurian scorpion *Palaeophonus*, differs, so far as obvious points are concerned, from a modern scorpion only in the thickness of its legs and in their terminating in strong spike-like joints, instead of being slight and provided with a pair of terminal claws. The legs of the modern scorpion (fig. 10: fig. 51) are those of a terrestrial Arthropod, such as a beetle; whilst those of the Silurian scorpion are the legs of an aquatic Arthropod, such as a crab or lobster. It is probable that the Silurian scorpion was an aquatic animal, and that its respiratory lamellae were still projecting from the surface of the body to serve as branchiae. No trace of "stigmata," the orifices of the lung-chambers of modern scorpions, can be found in the Scottish specimen of *Palaeophonus*, which presents the ventral surface of the animal to view. On the other hand, no trace of respiratory appendages excepting the pectens can be detected in the specimen (see fig. 49).

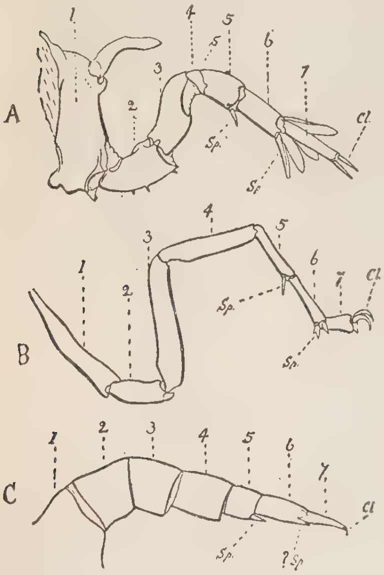
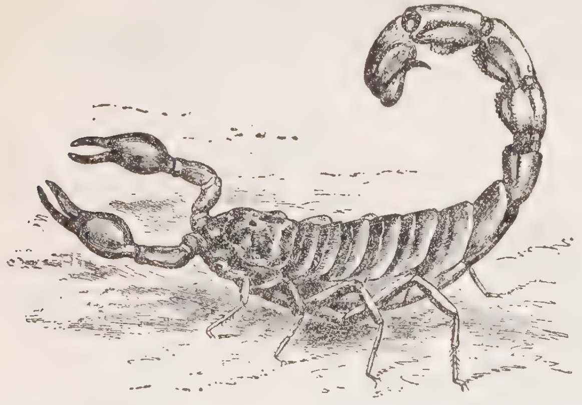


FIG. 50.—Comparison of the sixth prosomatic limb of a recent scorpion (B), of Palaeophonus (C), and of Limulus (A), showing their agreement in the number of segments; in the existence of a movable spine, Sp, at the distal border of the fifth segment; in the correspondence of the two claws at the free end of the limb of Scorpio with two spines similarly placed in Limulus; and, lastly, in the correspondence of the three talon-like spines carried on the distal margin of segment six of recent scorpions with the four larger but similarly situated spines on the leg of Limulus; *s*, groove dividing the ankylosed segments 4 and 5 of the Limulus leg into two.

(After Pocock, *Q. J. Mic. Sci.*, 1901.)

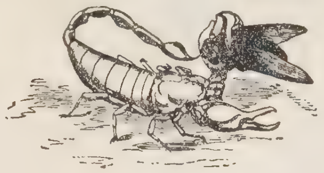
Fossil scorpions of the modern type are found in the Coal Measures. At the present day scorpions of various genera are found in all the warm regions of the world. In Europe they occur as far north as Bavaria and the south of France. The largest species measure 9 in. from the front of the head to the end of the sting, and occur in tropical India and Africa. Between 200 and 300 species are known.



From Lankester, *Journ. Linn. Soc. Zool.* vol. xvi., 1881.

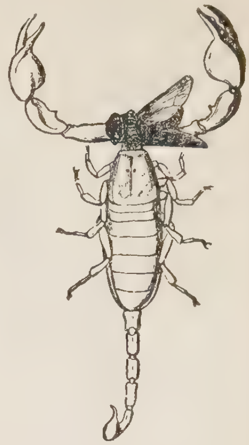
FIG. 51.—Drawing from life of the desert scorpion, *Buthus australis*, Lin., from Biskra, N. Africa.

The scorpions use their large chelae for seizing prey and for fighting with one another. They never use the sting when (as frequently happens) they attack another scorpion, because, as was ascertained by A. G. Bourne (**24**), the poison exuded by the sting has no injurious effect on another scorpion nor on the scorpion itself. The stories of a scorpion stinging itself to death when placed in a circle of burning coals are due to erroneous observation. When placed in such a position the scorpion faints and becomes inert. It is found (Bourne, **24**) that some species of scorpion faint at a temperature of 40° Cent. They recover on being removed to cooler conditions. A scorpion having seized its prey (usually a large insect, or small reptile or mammal) with the large chelae brings its tail over its head, and deliberately punctures the struggling victim twice with its sting (fig. 52). The poison of the sting is similar to snake-poison (Calmette), and rapidly paralyses animals which are not immune to it. It is probably only sickly adults or young children of the human race who can be actually killed by a scorpion's sting. When the scorpion has paralysed its prey in this way, the two short chelicerae are brought into play (fig. 53). By the crushing action of their pincers, and an alternate backward and forward movement, they bring the soft blood-holding tissues of the victim close to the minute pin-hole aperture which is the scorpion's mouth. The muscles acting on the bulb-like pharynx now set up a pumping action (see Huxley, **26**); and the juices—but no solid matter, excepting such as is reduced to powder—are sucked into the scorpion's alimentary canal. A scorpion appears to prefer for its food another scorpion, and will suck out the juices of an individual as large as itself. When this has taken place, the gorged scorpion becomes distended and tense in the mesosomatic region. It is certain that the absorbed juices do not occupy the alimentary canal alone, but pass also into its caecal off-sets which are the ducts of the gastric glands (see fig. 33).



From Lankester, *Journ. Linn. Soc.*

FIG. 52.—Drawing from life of the Italian scorpion *Euscorpius italicus*, Herbst, holding a blue-bottle fly with its left chela, and carefully piercing it between head and thorax with its sting. Two insertions of the sting are effected and the fly is instantly paralysed by the poison so introduced into its body.



From Lankester, *Journ. Linn. Soc.*

FIG. 53.—The same scorpion carrying the now paralysed fly held in its chelicerae, the chelae liberated for attack and defence. Drawn from life.

All Arachnida, including *Limulus*, feed by suctorial action in essentially the same way as *Scorpio*.

Scorpions of various species have been observed to make a hissing noise when disturbed, or even when not disturbed. The sound is produced by stridulating organs developed on the basal joints of the limbs, which differ in position and character in different genera (see Pocock, **27**). Scorpions copulate with the ventral surfaces in contact. The eggs are fertilized, practically in the ovary, and develop *in situ*. The young are born fully formed and are carried by the mother on her back. As many as thirty have been counted in a brood. For information as to the embryology of scorpions, the reader is referred to the works named in the bibliography below. Scorpions do not possess spinning organs nor form either snares or nests, so far as is known. But some species inhabiting sandy deserts form extensive burrows. The fifth pair of prosomatic appendages is used by these scorpions when burrowing, to kick back the sand as the burrow is excavated by the great chelae.

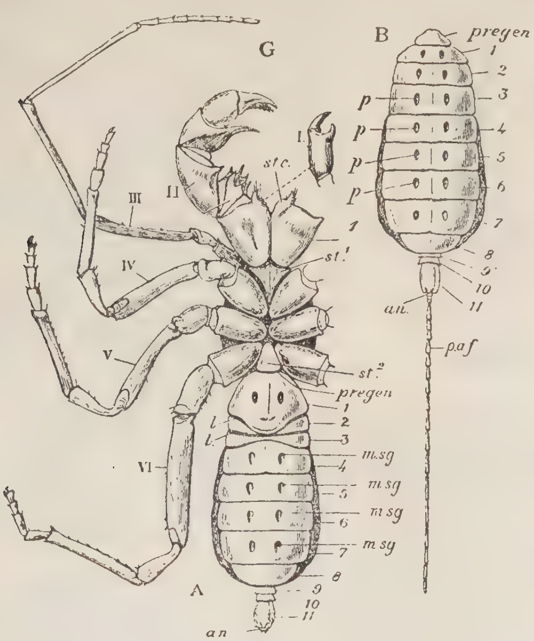
References to works dealing with the taxonomy and geographical distribution of scorpions are given at the end of this article (**28**).

Section β. *Epectinata.*—The primitive distinction between the mesosoma and the metasoma wholly or almost wholly obliterated, the two regions uniting to form an opisthosoma, which never consists of more than twelve somites and never bears appendages or breathing-organs behind the 4th somite. The breathing-organs of the opisthosoma, when present, represented by two pairs of stigmata, opening either upon the 1st and 2nd (Pedipalpi) or the 2nd and 3rd somites (Solifugae, Pseudo-scorpiones), or by a single pair upon the 3rd (? 2nd) somite (Opiliones) of the opisthosoma, there being rarely an additional stigma on the 4th (some Solifugae). The appendages of the 2nd somite of the opisthosoma absent, rarely minute and bud-like (some Amblypygi), never pectiniform. A prae-genital somite is often present either in a reduced condition forming a waist (Pedipalpi, Araneae, Palpigradi) or as a full-sized tergal plate (Pseudo-scorpiones); in some it is entirely atrophied (Solifugae, Holosomata, and Rhynchostomi). Lateral eyes when present diplostichous.

Remarks.—The Epectinate Arachnids do not stand so close to the aquatic ancestors of the Embolobranchia as do the Pectiniferous scorpions. At the same time we are not justified in supposing that the scorpions stand in any way as an intermediate grade between any of the existing Epectinata and the Delobranchia. It is probable that the Pedipalpi, Araneae, and Podogona have been separately evolved as distinct lines of descent from the ancient aquatic Arachnida. The Holosomata and Rhynchostomi are probably offshoots from the stem of the Araneae, and it is not unlikely (in view of the structure of the prosomatic somites of the Tartarides) that the Solifugae are connected in origin with the Pedipalpi. The appearance of tracheae in place of lung-sacs cannot be regarded as a starting-point for a new line of descent comprising all the tracheate forms;

tracheae seem to have developed independently in different lines of descent. On the whole, the Epectinata are highly specialized and degenerate forms, though there are few, if any, animals which surpass the spiders in rapidity of movement, deadliness of attack and constructive instincts.

Order 2. Pedipalpi (figs. 54 to 59).—Appendages of 1st pair bisegmented, without poison gland; of 2nd pair prehensile, their basal segments underlying the proboscis, and furnished with sterno-coxal (maxillary) process, the apical segment tipped with a single movable or immovable claw; appendages of 3rd pair different from the remainder, tactile in function, with at least the apical segment many-jointed and clawless. The ventral surface of the prosoma bears prosternal, metasternal and usually mesosternal chitine-plates (fig. 55). A narrow prae-genital somite is present between opisthosoma and prosoma (figs. 55, 57). Opisthosoma consisting of eleven somites, almost wholly without visible appendages. Intromittent organ of male beneath the genital operculum (=sternum of the 1st somite of opisthosoma).



From Lankester, *Q. J. Mic. Sci.* N.S. vol. xxi., 1881.

FIG. 54.—*Thelyphonus*, one of the Pedipalpi.

A, Ventral view.
I, Chelicera (detached).
II, Chelae.
III, Palpiform limb.
IV to VI, The walking legs.
stc, Sterno-coxal process (gnathobase) of the chelae.
st^1, Anterior sternal plate of the prosoma.
st^2, Posterior sternal plate of the prosoma.
pregen, Position of the prae-genital somite (not seen).
l, *l*, Position of the two pulmonary sacs of the right side.
1 to 11, Somites of the opisthosoma (mesosoma plus metasoma).
msg, Stigmata of the tergo-sternal muscles.
an, Anus.
B, Dorsal view of the opisthosoma of the same.
pregen, The prae-genital somite.
p, The tergal stigmata of the tergo-sternal muscles.
paf, Post-anal segmented filament corresponding to the post-anal spine of Limulus.

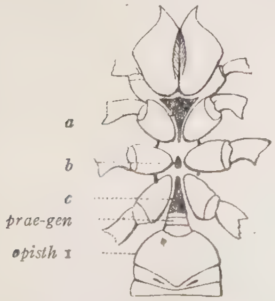


FIG. 55.—*Thelyphonus sp.* Ventral view of the anterior portion of the body to show the three prosomatic sternal plates *a*, *b*, *c*, and the rudimentary sternal element of the prae-genital somite; *opisth* I, first somite of the opisthosoma.

(From a drawing made by Pickard-Cambridge, under the direction of R. I. Pocock.)

Note.—The possibility of another interpretation of the anterior somites of the mesosoma and the prae-genital somite must be borne in mind. Possibly, though not probably, the somites carrying the two lung-sacs correspond to the first two lung-bearing somites of *Scorpio*, and it is the genital opening which has shifted. The same caution applies in the case of the Araneae. Excalation of one or of two anterior mesosomatic somites, besides the prae-genital somite, would then have to be supposed to have occurred also.

Sub-order *a*. Uropygi.—Prosoma longer than wide, its sternal area very narrow, furnished with a large prosternal and metasternal plate, and often with a small mesosternal sclerite. Appendages of 2nd pair with their basal segments united in the middle line and incapable of lateral movement; appendages of 3rd pair with only the apical segment many-jointed. Opisthosoma without trace of appendages; its posterior somites narrowed to form a movable tail for the support of the post-anal sclerite, which has no poison glands.

Tribe 1. Urotricha.—Dorsal area of prosoma covered with a single shield (? two in *Geralinura*), bearing median and lateral eyes. Post-anal sclerite modified as a long, many-jointed feeler. Appendages of 2nd pair folding in a horizontal plane, completely chelate, the claw immovably united to the sixth segment. Respiratory organs present in the form of pulmonary sacs.

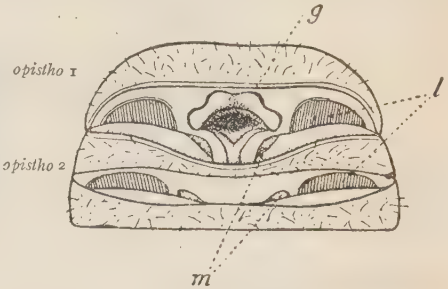


FIG. 56.—*Thelyphonus assamensis* ♂. Ventral surface of the anterior region of the opisthosoma, the first somite being pushed upwards and forwards so as to expose the subjacent structures. *opistho* 1, First somite of the opisthosoma; *opistho* 2, second do.; *g*, genital aperture; *l*, edges of the lamellae of the lung-books; *m*, stigmata of tergo-sternal muscles.

(Original drawing by Pocock.)

Family—Thelyphonidae (*Thelyphonus* (fig. 54), *Hypoctonus*, **Geralinura*).

Tribe 2. Tartarides.—Small degenerate forms with the dorsal area of the prosoma furnished with two shields, a larger in front covering the anterior four somites, and a smaller behind covering the 5th and 6th somites; the latter generally subdivided into a right and left portion. There is also a pair of narrow tergal sclerites interposed between the anterior and posterior shields. Eyes evanescent or absent. Appendages of 2nd pair folding in a vertical plane, not chelate, the claw long and movable. Post-anal sclerite short and undivided. No distinct respiratory stigmata behind the sterna of the 1st and 2nd somites of the opisthosoma.

Family—Hubbardiidae (*Schizomus*, *Hubbardia*) (figs. 57-59).

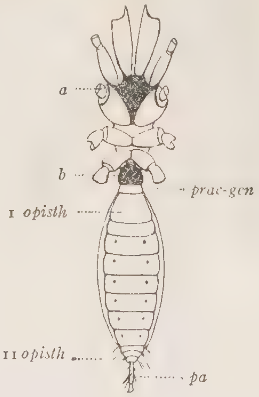


FIG. 57.—*Schizomus crassicaudatus*, one of the Tartarid Pedipalpi. Ventral view of a female with the appendages cut short near the base.

a, Prosternum of prosoma.
b, Metasternum of prosoma.
prae-gen, The prae-genital somite.
I *opisth*, First somite of the opisthosoma.
II *opisth*, Eleventh somite of the opisthosoma.
pa, Post-anal lobe of the female (compare the jointed filament in *Thelyphonus*, fig. 54).

(Original drawing by Pickard-Cambridge, directed by Pocock.)

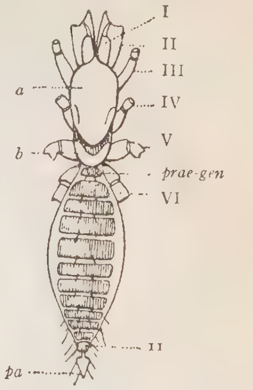


FIG. 58.—*Schizomus crassicaudatus*, a Tartarid Pedipalp. Dorsal view of a male with the appendages cut short.

I to VI. The prosomatic appendages.
a, Anterior plate.
b, Posterior plate of the prosomatic carapace.
prae-gen, Tergum of the prae-genital somite.
II, The eleventh somite of the opisthosoma.
pa, Post-anal lobe of the male—a conical body with narrow basal stalk.

(Original as preceding)

Sub-order *b*. Amblypygi.—Prosoma wider than long, covered above by a single shield bearing median and lateral eyes, which have diplostichous ommatea. Sternal area broad, with prosternal, two mesosternal, and metasternal plates, the prosternum projecting forwards beneath the coxae of the 2nd pair of appendages. Appendages of 2nd pair folding in a horizontal plane; their basal segments freely movable; claw free or fused; basal segments of 4th and 5th pairs widely separated by the sternal area; appendages of 3rd pair with all the segments except the proximal three, forming a many-jointed flagellum. Opisthosoma without post-anal sclerite and posterior caudal elongation: with frequently a pair of small lobate appendages on the sternum of the 3rd somite. Respiratory organs, as in Urotricha.

Family—Phrynichidae (*Phrynichus*, *Damon*).
,, Admetidae (*Admetus*, *Heterophrynus*).
,, Charontidae (*Charon*, *Sarax*).
(Family ?)—**Graeophonus*.

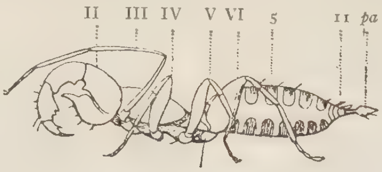


Fig. 59.—*Schizomus crassicaudatus*, one of the Pedipalpi. Lateral view of a male. II to VI, the prosomatic appendages, the first being concealed (see fig. 58); 5, the fifth, and 11, the eleventh tergites of the opisthosoma; *pa*, the conical post-anal lobe.

(Original as preceding.)

Remarks.—The Pedipalpi are confined to the tropics and warmer temperate regions of both hemispheres. Fossil forms occur in the Carboniferous. The small forms known as *Schizomus* and *Hubbardia* are of special interest from a morphological point of view. The Pedipalpi have no poison glands. (Reference to literature **(29)**.)

Order 3. Araneae (figs. 60 to 64).—Prosoma covered with a single shield and typically furnished with median and lateral eyes of diplostichous structure, as in the Amblypygi. The sternal surface wide, continuously chitinized, but with prosternal and metasternal elements generally distinguishable at the anterior and posterior ends respectively of the large mesosternum. Prosternum underlying the proboscis. Appendages of 1st pair have two segments, as in Pedipalpi, but are furnished with poison gland, and are retroverts. Appendages of 2nd pair not underlying the mouth, but freely movable and, except in primitive forms, furnished with a maxillary lobe; the rest of the limb like the legs, tipped with a single claw and quite unmodified (except in ♂). Remaining pairs of appendages similar in form and function, each tipped with two or three claws. Opisthosoma when segmented showing the same number of somites as in the Pedipalpi; usually unsegmented, the prae-genital somite constricted to form the waist; the appendages of its 3rd and 4th somites retained as spinning mammillae. Respiratory organs (see fig. 63,*stg*), as in the Amblypygi, or with the posterior pair, rarely the anterior pair as well, replaced by tracheal tubes. Intromittent organ of male in the apical segment of the 2nd prosomatic appendage.

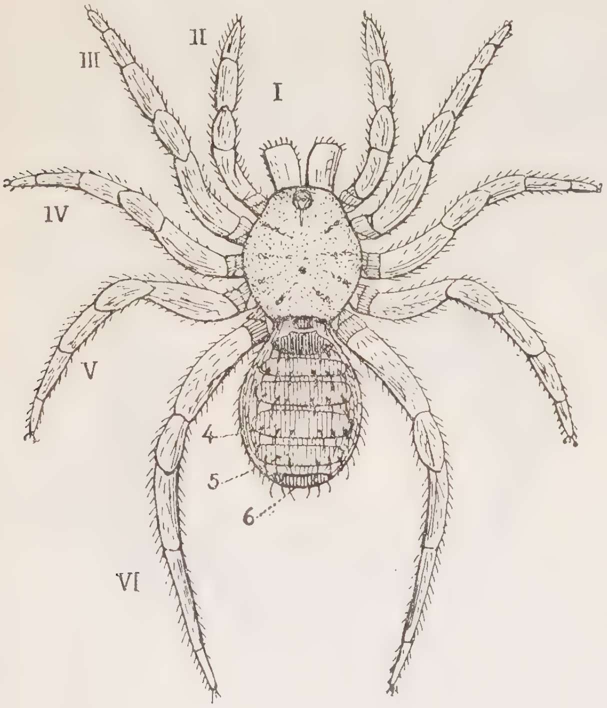


Fig. 60.—*Liphistius desultor*, Schiödte, one of the Araneae Mesothelae. Dorsal view. I to VI, the prosomatic appendages; 4, 5, 6, the fourth, fifth and sixth tergites of the opisthosoma. Between the bases of the sixth pair of limbs and behind the prosomatic carapace is seen the tergite of the small prae-genital somite.

(Original by Pickard-Cambridge and Pocock.)

Sub-order *a.* Mesothelae (see figs. 60 to 62).—Opisthosoma distinctly segmented, furnished with 11 tergal plates, as in the Amblypygi; the ventral surface of the 1st and 2nd somites with large sternal plates, covering the genital aperture and the two pairs of pulmonary sacs, the sternal plates from the 6th to the 11th somites represented by integumental ridges, weakly chitinized in the middle. The two pairs of spinning appendages retain their primitive position in the middle of the lower surface of the opisthosoma far in advance of the anus on the 3rd and 4th somites, each appendage consisting of a stout, many-jointed outer branch and a slender, unsegmented inner branch. Prosoma as in the Mygalomorphae, except that the mesosternal area is long and narrow.

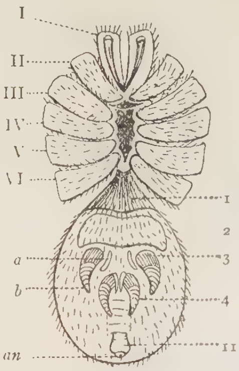


Fig. 61.—*Liphistius desultor.* Ventral view with the prosomatic appendages cut short excepting the chelicerae (I) whose sharp retroverts are seen. Between the bases of the prosomatic limbs an anterior and a posterior sternal plate (black) are seen. 1, The sternum of the first opisthosomatic or genital somite covering the genital aperture and the first pair of lung-sacs. In front of it the narrow waist is formed by the soft sternal area of the praegenital somite; 2, the sternite of the second opisthosomatic somite covering the posterior pair of lung-sacs; 3 and 4, the spinning appendages (limbs) of the opisthosoma; *a*, inner, *b*, outer ramus of the appendage; 11, sternite of the eleventh somite of the opisthosoma: in front of it other rudimentary sternites; *an*, anus.

(Original as above.)

Family—Liphistiidae (*Liphistius*, **Arthrolycosa*).

Sub-order *b.* Opisthothelae (see fig. 63).—Opisthosoma without trace of separate terga and sterna, the segmentation merely represented posteriorly by slight integumental folds and the sterna of the 1st and 2nd somites by the opercular plates of the pulmonary sacs. The spinning appendages migrate to the posterior end of the opisthosoma and take up a position close to the anus; the inner branches of the anterior pair either atrophy or are represented homogenetically by a plate, the cribellum, or by an undivided membranous lobe, the colulus.

Tribe 1. Mygalomorphae.—The plane of the articulation of the appendages of the 1st pair to the prosoma (the retrovert) vertical, the basal segment projecting straight forwards at its proximal end, the distal segment or fang closing backwards in a direction subparallel to the long axis of the body. Two pairs of pulmonary sacs.

Families—Theraphosidae (*Avicularia*, *Poecilotheria*). Barychelidae (*Barychelus*, *Plagiobothrus*). Dipluridae (*Diplura*, *Macrothele*). Ctenizidae (*Ctenizia*, *Nemesia*). Atypidae (*Atypus*, *Calommata*).

Tribe 2. Arachnomorphae.—The plane of the articulation of the appendages of the 1st pair to the prosoma horizontal, the basal segment projecting vertically downwards, at least at its proximal end, the distal segment or fang closing inwards nearly or quite at right angles to the long axis of the body. The posterior pulmonary sacs (except in *Hypochilus*) replaced by tracheal tubes; the anterior and posterior pairs replaced by tracheal tubes in the Caponiidae.

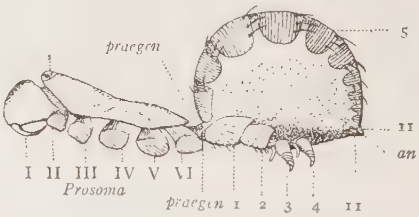


Fig. 62.—*Liphistius desultor.* Lateral view.

I to VI, Appendages of the prosoma cut off at the base.
o, Ocular tubercle.
praegen, The prae-genital somite.
1 and 2, Sternites of the first and second opisthosomatic somites.
3 and 4, Appendages of the third and fourth opisthosomatic somites, which are the spinning organs, and in this genus occupy their primitive position instead of migrating to the anal region as in other spiders.
5, Tergite of the fifth opisthosomatic somite.
11, Eleventh opisthosomatic somite; *an*, Anus.

(Original.)

Principal families—Hypochilidae (*Hypochilus*). Dysderidae (*Dysdera*, *Segestria*). Caponiidae (*Caponia*, *Nops*). Filistatidae (*Filistata*). Uloboridae (*Uloborus*, *Dinopis*). Argiapidae (*Nephila*, *Gasteracantha*). Pholcidae (*Pholcus*, *Artema*). Agelenidae (*Tegenaria*). Lycosidae (*Lycosa*). Clubionidae (*Clubiona*, *Olios*, *Sparassus*) Gnaphosidae (*Gnaphosa*, *Hemiclaea*). Thomisidae (*Thomisus*). Attidae (*Salticus*). Urocteidae (*Uroctea*). Eresidae (*Eresus*).

Remarks on the Araneae.—The Spiders are the most numerous and diversified group of the Arachnida; about 2000 species are known. No noteworthy fossil spiders are known; the best-preserved are in amber of Oligocene age. *Protolycosa* and *Arthrolycosa* occur in the Carboniferous. Morphologically, the spiders are remarkable for the concentration and specialization of their structure, which is accompanied with high physiological efficiency. The larger species of Bird's Nest Spiders (*Avicularia*), the opisthosoma of which is as large as a bantam's egg, undoubtedly attack young birds, and M'Cook gives an account of the capture in its web by an ordinary house spider of a small mouse. The "retrovert" or bent-back

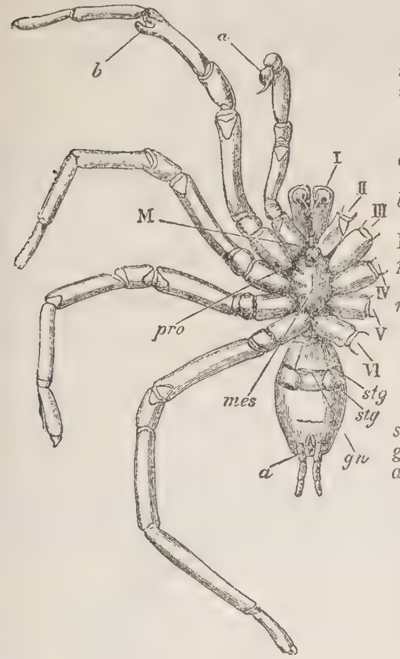


FIG. 63.—Ventral view of a male mygalomorphous spider.

I to VI, The six pairs of prosomatic appendages.
a, Copulatory apparatus of the second appendage.
b, Process of the fifth joint of the third appendage.
M, Mouth.
pro, Prosternite of the prosoma.
mes, Mesosternite of the prosoma: observe the contact of the coxae of the sixth pair of limbs behind it; compare *Liphistius* (fig. 61) where this does not occur.
stg, Lung aperture.
gn, Genital aperture.
a, Anus with a pair of backwardly migrated spinning appendages on each side of it; compare the position of these appendages in *Liphistius* (fig. 61).

(From Lankester, "Limulus an 'Arachnid.'")

irst pair of appendages is provided with a poison gland opening on he fang or terminal segment. Spiders form at least two kinds of onstructions—snares for the capture of prey and nests for the reservation of the young. The latter are only formed by the female, hich is a larger and more powerful animal than the male. Like he scorpions the spiders have a special tendency to cannibalism, nd accordingly the male, in approaching the female for the purpose f fertilizing her, is liable to be fallen upon and sucked dry by the bject of his attentions. The sperm is removed by the male from he genital aperture into a special receptacle on the terminal segment

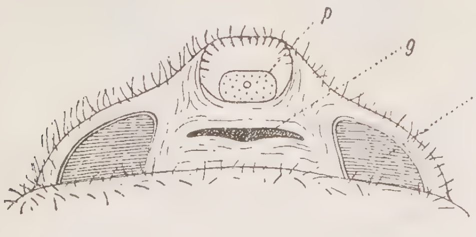


FIG. 64.—*Liphistius desultor*. Under side of the uplifted genital first opisthosomatic somite of the female; *g*, genital aperture; pitted plate, probably a gland for the secretion of adhesive material r the eggs; *l*, the edges of the lamellae of the lung-books of the st pair.

(Original drawing by Pocock.)

the 2nd prosomatic appendage. Thus held out at some distance om the body, it is cautiously advanced by the male spider to the nital aperture of the female.

For an account of the courtship and dancing of spiders, of their bs and floating lines, the reader is referred to the works of 'Cook (**30**) and the Peckhams (**31**), whilst an excellent account of e nests of trap-door spiders is given by Moggridge (**32**). References systematic works will also be found at the end of this article (**33**).

Order 4. Palpigradi = Microthelyphonidae (see fig. 65).—Prosoma vered above by three plates, a larger representing the dorsal elents of the first four somites, and two smaller representing the rsal elements of the 5th and 6th.

ts ventral surface provided with one prosternal, two mesosternal l one metasternal plate. Appendages of 1st pair consisting of ee segments, completely chelate, without poison gland; of 2nd r slender, leg-like, tipped with three claws, the basal segment hout sterno-coxal process taking no share in mastication, and widely separated from its fellow of the opposite side; 3rd, 4th, 5th and 6th appendages similar in form to the 2nd and to each other.

Proboscis free, not supported from below by either the prosternum or the basal segments of the appendages of the 2nd pair.

Opisthosoma consisting of only ten somites, which have no tergal and sternal elements, the prae-genital somite contracted to form a "waist," as in the Pedipalpi; the last three narrowed to form a caudal support for the many-jointed flagelliform telson, as in the Urotricha. Respiratory organs atrophied.

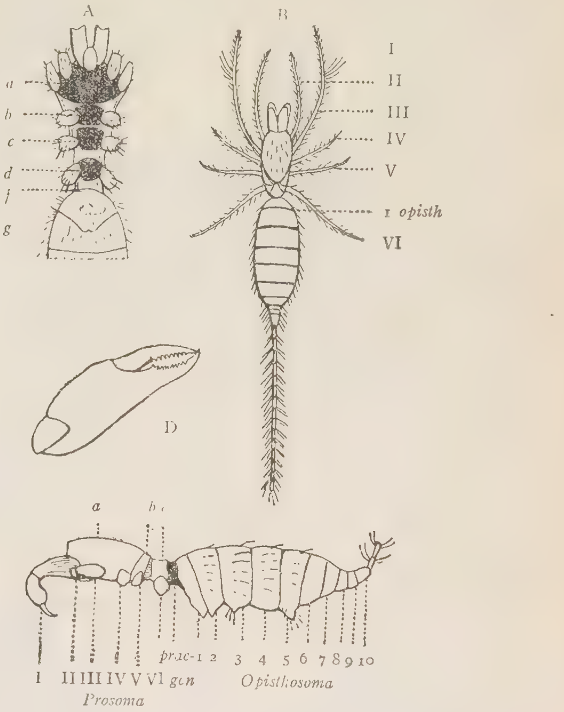


FIG. 65.—*Koenenia mirabilis*, Grassi, one of the Palpigradi.

A, Ventral view of prosoma and of anterior region of opisthosoma with the appendages cut off near the base; *a* and *b*, prosternites; *c*, mesosternite; and *d*, metasternite of the prosoma; *f*, ventral surface of the prae-genital somite; *g*, sternite of the genital somite (first opisthosomatic somite).

B, Dorsal view. I to VI, prosomatic appendages; 1 *opisth*, genital somite (first opisthosomatic somite).

C, Lateral view, I to VI, prosomatic appendages; *a*,*b*,*c*, the three tergal plates of the prosoma; *prae-gen*, the praegenital somite; 1 to 10, the ten somites of the opisthosoma.

D, Chelicera.

(Original drawing by Pocock and Pickard-Cambridge, after Hansen and Sörensen.)

Family—Koeneniidae (*Koenenia*).

Remarks.—An extremely remarkable minute form originally described by Grassi (**34**) from Sicily, and since further described by Hansen (**35**). Recently the genus has been found in Texas, U.S.A. Only one genus of the order is known.

Order 5. Solifugae = Mycetophorae (see figs. 66 to 69).—Dorsal area of prosoma covered with three distinct plates, two smaller representing the terga of the 5th and 6th somites, and a larger representing those of the anterior four somites, although the reduced terga of the 3rd and 4th are traceable behind the larger plate. The latter bears a pair of median eyes and obsolete lateral eyes on each side. Sternal elements of prosoma almost entirely absent, traces of a prosternum and metasternum alone remaining. Rostrum free, not supported by either the prosternum or the basal segments of the appendages. Appendages of 1st pair large, chelate, bisegmented, articulated to the sides of the head-shield; appendages of 2nd pair simple, pediform, with protrusible (? suctorial) organ, and no claws at the tip; their basal segments united in the middle line and furnished with sterno-coxal process. Remaining pairs of appendages with their basal segments immovably fixed to the sternal surface, similar in form, the posterior three pairs furnished with two claws supported on long stalks; the basal segments of the 6th pair bearing five pairs of tactile sensory organs or malleoli. The prae-genital somite is suppressed. Opisthosoma composed of ten somites. Respiratory organs tracheal, opening upon the ventral surface of the 2nd and 3rd, and sometimes also of the 4th somite of the opisthosoma. A supplementary pair of tracheae opening behind the basal segment of the 4th appendage of the prosoma.

(? Intromittent organ of male lodged on the dorsal side of the 1st pair of prosomatic appendages.)

Families—Hexisopodidae (*Hexisopus*). Solpugidae (*Solpuga*, *Rhagodes*). Galeodidae (*Galeodes*).

Remarks.—These most strange-looking Arachnids occur in warmer temperate, and tropical regions of Asia, Africa and America. Their anatomy has not been studied, as yet, by means of freshly-killed material, and is imperfectly known, though the presence of the coxal glands was determined by Macleod in 1884. The proportionately enormous chelae (chelicerae) of the first pair of appendages are not provided with poison glands; their bite is not venomous.

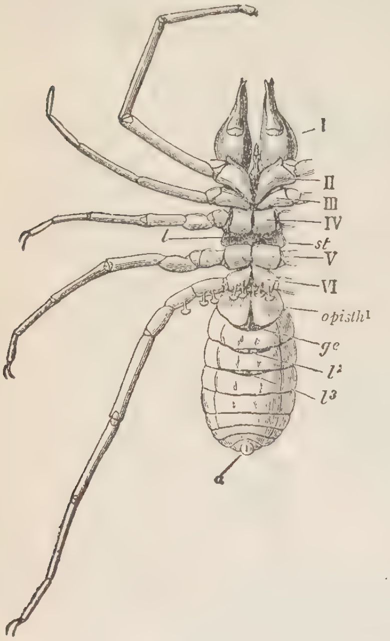


FIG. 66.—*Galeodes sp.*, one of the Solifugae. Ventral view to show legs and somites.

I to VI, The six leg-bearing somites of the prosoma.
opisth 1, First or genital somite of the opisthosoma.
ge, Site of the genital aperture.
st, Thoracic tracheal aperture.
l^2, Anterior tracheal aperture of the opisthosoma in somite 2 of the opisthosoma.
l^3, Tracheal aperture in somite 3 of the opisthosoma.
a, Anus.

(From Lankester, "Limulus and Arachnid.")

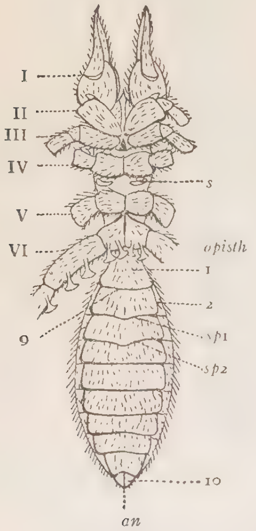


FIG. 67.—*Galeodes sp.*, one of the Solifugae. Ventral view with the appendages cut off at the base.

I to VI, Prosomatic appendages.
s, Prosomatic stigma or aperture of the tracheal system.
1, First opisthosomatic sternite covering the genital aperture g.
2, Second opisthosomatic sternite covering the second pair of tracheal apertures *sp*1.
*sp*2, The third pair of tracheal apertures.
10, The tenth opisthosomatic somite.
an, The anal aperture.

(Original by Pickard-Cambridge and Pocock.)

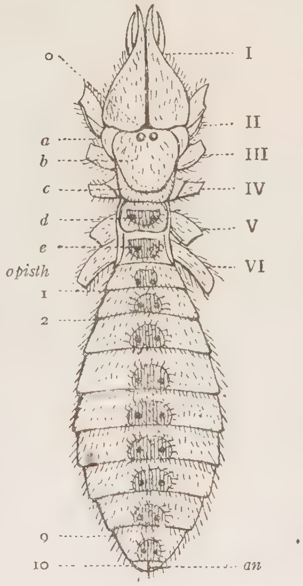


FIG. 68.—*Galeodes sp.*, one of the Solifugae. Dorsal view.

I to VI, Bases of the prosomatic appendages.
o, Eyes.
a, Lateral region of the cephalic plate to which the first pair of appendages are articulated.
b, Cephalic plate with median eye.
c, Dorsal element of somites bearing third and fourth pairs of appendages.
d, Second plate of the prosoma with fifth pair of appendages.
e, Third or hindermost plate of the prosoma beneath which the sixth pair of legs is articulated.
1, 2, 9, 10, First, second, ninth and tenth somites of the opisthosoma.
an, Anus.

(Original.)

Galeodes has been made the means of a comparison between the structure of the Arachnida and Hexapod insects by Haeckel and other writers, and it was at one time suggested that there was a genetic affinity between the two groups—through *Galeodes*, or extinct forms similar to it. The segmentation of the prosoma and the form of the appendages bear a homoplastic similarity to the head, pro-, meso-, and meta-thorax of a Hexapod with mandibles, maxillary palps and three pairs of walking legs; while the opisthosoma agrees in form and number of somites with the abdomen of a Hexapod, and the tracheal stigmata present certain agreements in the two cases. Reference to literature (**36**).

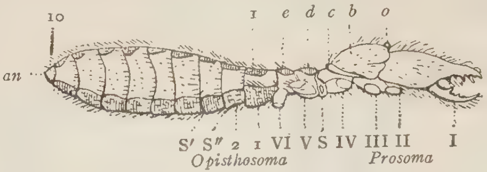


FIG. 69.—*Galeodes sp.*, one of the Solifugae.

I to VI, The six prosomatic limbs cut short.
o, The eyes.
b, *c*, Demarcated areae of the cephalic or first prosomatic plate corresponding respectively to appendages I, II, III, and to appendage IV (see fig. 68).
d, Second plate of the prosoma carrying appendage V.
e, Third plate of the prosoma carrying appendage VI. The prae-genital somite is absent.
1, First somite of the opisthosoma.
2, Second do.
S, Prosomatic tracheal aperture between legs IV and V.
S' and S'', Opisthosomatic tracheal apertures.
10, Tenth opisthosomatic somite.
an, Anus.

(Original.)

Order 6. Pseudoscorpiones = Chelonethi, also called Chernetidia (see figs. 70, 71, 72).—Prosoma covered by a single dorsal shield, at most furnished with one or two diplostichous lateral eyes; sternal elements obliterated or almost obliterated. Appendages of the 1st pair bisegmented completely chelate, furnished with peculiar organs, the *serrula* and the *lamina*. Appendages of 2nd pair very large and completely chelate, their basal segments meeting in the middle line, as in the Uropygi, and provided in front with membranous lip-like processes underlying the proboscis. Appendages of the 3rd, 4th, 5th and 6th pairs similar in form and function, tipped with two claws, their basal segments in contact in the median ventral line. The prae-genital somite wide, not constricted, with large tergal plate, but with its sternal plate small or inconspicuous. Opisthosoma

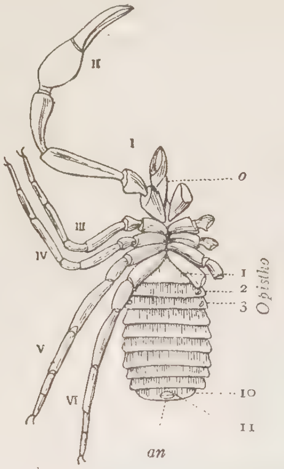


FIG. 70.—*Garypus litoralis*, one of the Pseudoscorpiones. Ventral view.

I to VI, Prosomatic appendages.
o, Sterno-coxal process of the basal segment of the second appendage.
1, Sternite of the genital or first opisthosomatic somite; the prae-genital somite, though represented by a tergum, has no separate sternal plate.
2 and 3, Sternites of the second and third somites of the opisthosoma, each showing a tracheal stigma.
10 and 11, Sternites of the tenth and eleventh somites of the opisthosoma.
an, Anus.

(Original by Pocock and Pickard-Cambridge.)

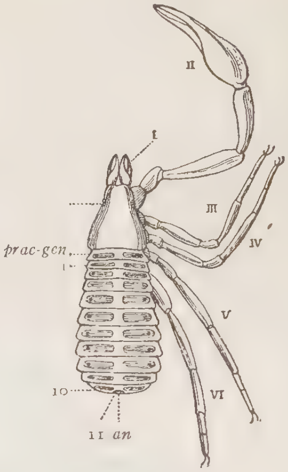


FIG. 71.—*Garypus litoralis*, one of the Pseudoscorpiones. Dorsal view.

I to VI, The prosomatic appendages.
o, Eyes.
prae-gen, Prae-genital somite.
1, Tergite of the genital or first opisthosomatic somite.
10, Tergite of the tenth somite of the opisthosoma.
11, The evanescent eleventh somite of the opisthosoma.
an, Anus.

(Original.)

composed, at least in many cases, of eleven somites, the 11th somite very small, often hidden within the 10th. Respiratory organs in the form of tracheal tubes opening by a pair of stigmata in the 2nd and 3rd somites of the opisthosoma. Intromittent organ of male beneath sternum of the 1st somite of the opisthosoma.

Sub-order *a*. Panctenodactyli.—Dorsal plate of prosoma (carapace) narrowed in front; the appendages of the 1st pair small, much narrower, taken together, than the posterior border of the carapace. Serrula on movable digit of appendages of 1st pair fixed throughout its length, and broader at its proximal than at its distal end; the immovable digit with an external process.

Family—Cheliferidae (*Chelifer* (figs. 70, 71, 72), *Chiridium*).
,, Garypidae (*Garypus*).

Sub-order *b*. Hemictenodactyli.—Dorsal plate of prosoma scarcely narrowed in front; the appendages of the 1st pair large, not much narrower, taken together, than the posterior border of the carapace.

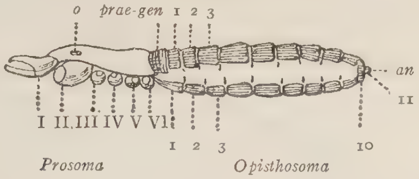


FIG. 72.—*Garypus litoralis*, one of the Pseudoscorpiones. Lateral view.

I to VI, Basal segments of the six prosomatic appendages.
o, Eyes.
prae-gen, Tergite of the prae-genital somite.
1, Genital or first opisthosomatic somite.
2, 3, 10, The second, third and tenth somites of the opisthosoma.
11, The minute eleventh somite;
an, The anus.

(Original.)

The serrula or the movable digit free at its distal end, narrowed at the base; no external lamina on the immovable digit.

Family—Obisiidae (*Obisium*, *Pseudobisium*).
,, Chthoniidae (*Chthonius*, *Tridenchthonius*).

Remarks.—The book-scorpions—so called because they were, in old times, found not unfrequently in libraries—are found in rotten wood and under stones. The similarity of the form of their appendages to those of the scorpions suggests that they are a degenerate group derived from the latter, but the large size of the prae-genital somite in them would indicate a connexion with forms preceding the scorpions. Reference to literature (37).

Order 7. Podogona = Ricinulei (see figs. 73 to 76).—Dorsal area of prosoma furnished with two shields, a larger behind representing, probably, the tergal elements of the somites, and a smaller in front, which is freely articulated to the former and folds over the appendages of the 1st pair. Ventral area without distinct sternal plates. Appendages of 1st pair, bi-segmented, completely chelate. Appendages of 2nd pair, with their basal segments uniting in the middle line below the mouth, weakly chelate at apex. Appendages of 3rd, 4th, 5th and 6th pairs similar in form; their basal segments in contact in the middle line and immovably welded, except those of the 3rd pair, which have been pushed aside so that the bases of the 2nd and 4th pairs are in contact with each other. A movable membranous joint between the prosoma and the opisthosoma, the generative aperture opening upon the ventral side of the membrane. Prae-genital somite suppressed; the opisthosma consisting of nine segments, whereof the first and second are almost suppressed and concealed within the joint between the prosoma and the opisthosoma; the following four large and manifest, and the remaining three minute and forming a slender generally-retracted tail like that of *Thelyphonus*. Respiratory organs tracheal, opening by a pair of spiracles in the prosoma above the base of the fifth appendage on each side. Intromittent organ of male placed at the distal end of the appendage of the 5th pair.

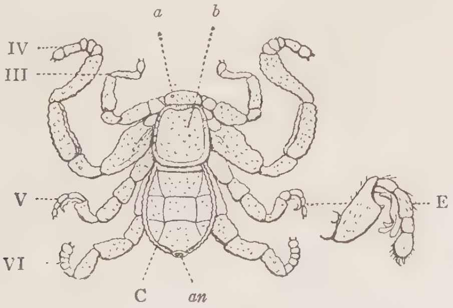


FIG. 73.—*Cryptostemma Karschii*, one of the Podogona. Dorsal view of male.

II to VI, The third, fourth, fifth and sixth appendages of the prosoma.
a, Movable (hinged) sclerite (so-called hood) overhanging the first pair of appendages.
b, Fused terga of the prosoma followed by the opisthosoma of four visible somites.
an, Orifice within which the caudal segments are withdrawn.
E, Extremity of the fifth appendage of the male modified to subserve copulation.

(Original drawing by Pocock and Pickard-Cambridge.)

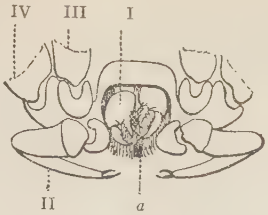


FIG. 74.—*Cryptostemma Karschii*. anterior aspect of the prosoma with the "hood" removed. I to IV, first to fourth appendages of the prosoma; *a*, basal segment of the second pair of appendages meeting its fellow in the middle line (see fig. 75).

(Original drawing by Pocock and Pickard-Cambridge.)

Family—Cryptostemmidae (*Cryptostemma*, *Poliochera*), Carboniferous.

Remarks on the Podogona.—The name given to this small but remarkable group has reference to the position of the male intromittent organ (fig. 73, E). They are small degenerate animals with a relatively firm integument. Not more than four species and twice that number of specimens are known. They have been found in West Africa and South America. A fact of special interest in regard to them is that the genus Poliochera, from the Coal Measures, appears to be a member of the same group. The name Cryptostemma, given to the first-known genus of the order, described by Guérin-Méneville, refers to the supposed concealment of the eyes by the movable cephalic sclerite. Reference to literature (38).

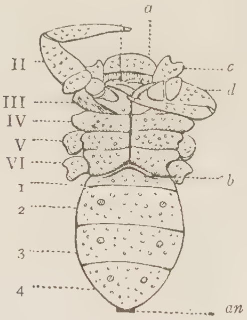


FIG. 75.—*Cryptostemma Karschii*, one of the Podogona. Ventral view.

I to VI, The six pairs of appendages of the prosoma, the last three cut short.
1, 2, 3, 4, The four somites of the opisthosoma.
a, Visible hood overhanging the first pair of appendages.
b, Position of the genital orifice.
c, Part of 3rd appendage.
d, Fourth segment of 2nd appendage. Observe that the basal segment of appendage III does *not* meet its fellow in the middle line.

(Original drawing by Pocock and Pickard-Cambridge.)

Order 8. Opiliones (see fig. 77).—Dorsal area of prosoma covered by a single shield usually bearing a pair of eyes. Sternal elements much reduced. Appendages of 1st pair large, three segmented and completely chelate; of 2nd pair either simple and pediform, or prehensile and subchelate; of remaining four pairs, similar in form, ambulatory in function; the basal segment of the 2nd, 3rd and sometimes of the 4th pairs of appendages furnished with sterno-coxal (maxillary) lobe. Opisthosoma confluent throughout its breadth with the prosoma, with the dorsal plate of which its anterior tergal plates are more or less fused; at most ten opisthosomatic somites traceable; the generative aperture thrust far forwards between the basal segments of the 6th appendages. Prae-genital somite suppressed. Respiratory organs tracheal, opening by a pair of stigmata situated immediately behind the basal segments of the 6th pair of appendages on what is probably the sternum of the 2nd opisthosomatic somite and also in some cases upon the 5th segment of the legs.

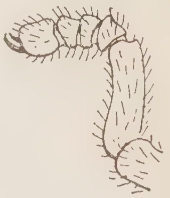


FIG. 76.—*Cryptostemma Karschii*. Extremity of the fifth pair of appendages of the female for comparison with that of the male E in fig. 73.

Intromittent organ of male lying within the genital orifice.

Sub-order *a*. Laniatores.—Orifice of foetid glands opening above the coxa of the 4th appendage, not raised upon a tubercle. Orifice of coxal gland situated just behind that of the foetid gland. Sternal plate of prosoma long and narrow, with a distinct prosternal element underlying the mouth. Coxae of 4th, 5th and 6th appendages immovable. Appendages of 2nd pair, strong, usually prehensile and spiny. Genital orifice covered by an operculum.

Families—Gonoleptidae (*Gonoleptes*, *Goniasoma*).
Biantidae (*Biantes*).
Oncopodidae (*Oncopus*, *Pelitnus*).
Trioenonychidae (*Trioenonyx*, *Acumontia*).

Sub-order *b*. Palpatores.—Orifice of foetid glands opening above the coxa of the 3rd appendage, not raised upon a tubercle. Orifice of coxal gland situated between the coxae of the 5th and 6th appendages. Sternal plate of prosoma usually short and wide, rarely longer than broad; with a larger or smaller prosternal element underlying the mouth. Coxae of 3rd, 4th, 5th and 6th appendages movable or immovable. Appendages of 2nd pair weak, pediform not prehensile. Genital orifice covered by an operculum.

Families—Phalangiidae (*Phalangium, Gagrella*).
Ischyropsalidae (*Ischyropsalis, Taracus*).
Nemastomidae (*Nemastoma*).
Trogulidae (*Trogulus, Anelasmocephalus*).

Sub-order *c. Cyphophthalmi* (*Anepignathi*).—Orifice of foetid glands opening on a tubercle situated near the lateral border of the carapace above the base of the 5th appendage. Orifice of coxal gland probably situated at base of coxa of 5th appendage; sternal plate of prosoma minute or absent; no prosternal element underlying the mouth. Coxae of 5th and 6th, and usually also of 4th appendages immovable. Appendages of 2nd pair weak, pediform, not prehensile. Genital orifice not covered by an operculum.

Families—Sironidae (*Siro, Pettalus*).
Stylocellidae (*Stylocellus*).

Remarks on the Opiliones.—These include the harvest-men, sometimes called also daddy-long-legs, with round undivided bodies and very long, easily-detached legs. The intromittent organs of the male are remarkable for their complexity and elaboration. The confluence of the regions of the body and the dislocation of apertures from their typical position are results of degeneration. The Opiliones seem to lead on from the Spiders to the Mites. Reference to literature (**39**).

Apparently related to the Opiliones are two extinct groups, the Anthracomarti and Phalangiotarbi, which are not known to have survived the Carboniferous period. In the Anthracomarti the opisthosoma was movably articulated to the prosoma, and consisted of from eight to ten segments furnished with movable lateral plates, the anal segment being overlapped dorsally by a laminate expansion of the preceding segment. The carapace of the prosoma was unsegmented and often bore a pair of eyes. The appendages of the 2nd pair were slender and pediform; those of the 3rd, 4th, 5th and 6th pairs were similar in form and ambulatory in function with their basal segments arranged round a sternal area as in the order Araneae. The best-known genera were *Anthracomartus* and *Eophognus*.

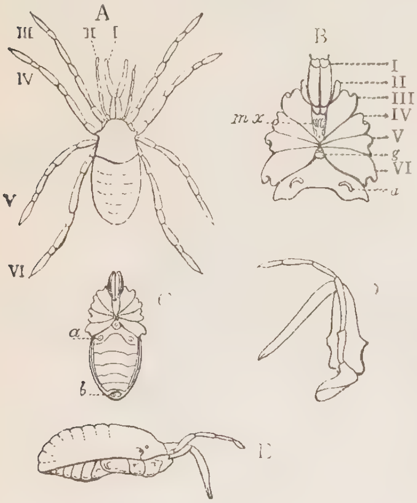


FIG. 77.—*Stylocellus sumatranus*, one of the Opiliones; after Thorell. Enlarged.
A, Dorsal view; I to VI, the six prosomatic appendages.
B, Ventral view of the prosoma and of the first somite of the opisthosoma, with the appendages I to VI cut off at the base; *a*, tracheal stigma; *mx*, maxillary processes of the coxae of the 3rd pair of appendages; *g*, genital aperture.
C, Ventral surface of the prosoma and opisthosoma; *a*, tracheal stigma; *b*, last somite.
D, Lateral view of the 1st and 2nd pair of appendages.
E, Lateral view of the whole body and two 1st appendages, showing the fusion of the dorsal elements of the prosoma into a single plate, and of those of the opisthosoma into an imperfectly segmented plate continuous with that of the prosoma.

In the Phalangiotarbi the appendages resembled those of the Anthracomarti, except that the basal segments of the last four pairs were usually approximated in the middle line leaving a long and narrow sternal area between; and the carapace of the prosoma was unsegmented. The prosoma and opisthosoma were broadly confluent and probably immovably welded together. The opisthosoma consisted of eight or nine segments, whereof the anterior five or six were very short in the dorsal region, and the posterior three exceptionally large with the anal orifice terminal.

Several genera have been established, the best-characterized being *Geraphognus* and *Architarbus*.

Order 9. Rhynchostomi = Acari (see fig. 78).—Degenerate Arachnids resembling the Opiliones in many structural points, but chiefly distinguishable from them by the following features:—The basal segments of the appendages of the 2nd pair are united in the middle line behind the mouth, those of the 3rd, 4th, 5th and 6th pairs are widely separated and not provided with sterno-coxal (maxillary) lobes, and take no share in mastication; the respiratory stigmata, when present, belong to the prosoma, and the primitive segmentation of the opisthosoma has entirely or almost entirely disappeared.

Sub-order *a. Notostigmata.*—Opisthosoma consisting of ten segments defined by integumental grooves, each of the anterior four of these furnished with a single pair of dorsally-placed spiracles or tracheal stigmata.

Family—Opilioacaridae (*Opilioacarus*).

Sub-order *b. Cryptostigmata.*—Integument hard, strengthened by a continuously chitinized dorsal and ventral sclerite. Tracheae typically opening by stigmata situated in the articular sockets (acetabula) of the 3rd, 4th, 5th and 6th pairs of appendages.

Family—Oribatidae (*Oribata, Nothrus, Hoplophora*).

Sub-order *c. Metastigmata.*—Integument mostly like that of the Cryptostigmata. Tracheae opening by a pair of stigmata situated above and behind the base of the 4th or 5th or 6th pair of appendages.

Families—Gamasidae (*Gamasus, Pteroptus*).
Argasidae (*Argas, Ornithodoros*).
Ixodidae (*Ixodes, Rhipicephalus*).

Sub-order *d. Prostigmata.*—Integument soft, strengthened by special sclerites, those on the ventral surface of the prosoma apparently representing the basal segments of the legs embedded in the skin. Tracheae, except in the aquatic species in which they are atrophied, opening by a pair of stigmata situated close to or above the base of the appendages of the 1st pair (mandibles).

Families—Trombidiidae (*Trombidium, Tetranychus*).
Hydrachnidae (*Hydrachna, Atax*).
Halacaridae (*Halacarus, Leptognathus*).
Bdellidae (*Bdella, Eupodes*).

Sub-order *e. Astigmata.*—Degenerate, mostly parasitic forms approaching the Prostigmata in the development of integumental sclerites and the softness of the skin, but with the respiratory system absent.

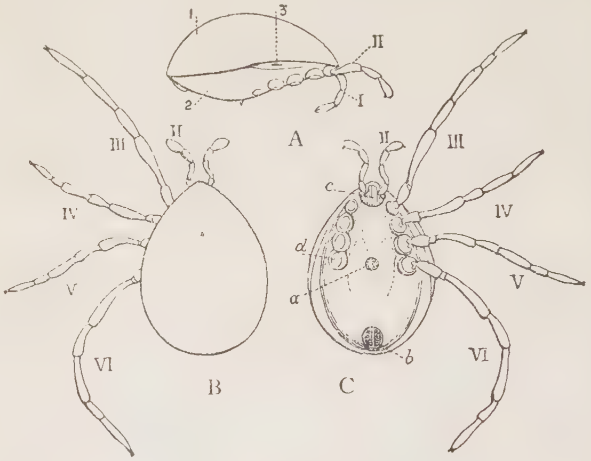


FIG. 78.—*Holothyrus nitidissimus*, one of the Acari; after Thorell.

A, Lateral view with appendages III to VI removed; 1, plate covering the whole dorsal area, representing the fused tergal sclerites of the prosoma and opisthosoma; 2, similarly-formed ventral plate; 3, tracheal stigma.
B, Dorsal view of the same animal; II to VI, 2nd to 6th pairs of appendages. The 1st pair of appendages both in this and in C are retracted.
C, Ventral view of the same; II to VI as in B; *a*, genital orifice; *b*, anus; *c*, united basal segments of the second pair of appendages; *d*, basal segment of the 6th prosomatic appendage of the right side. The rest of the appendage, as also of app. III, IV and V, has been cut away.

Families—Tyroglyphidae (*Tyroglyphus, Rhizoglyphus*).
Sarcoptidae (*Sarcoptes, Analges*).

Sub-order *f. Vermiformia.*—Degenerate atracheate parasitic forms with the body produced posteriorly into an annulated caudal prolongation, and the 3rd, 4th, 5th and 6th pairs of appendages short and only three-jointed.

Family—Demodicidae (*Demodex*).

Sub-order *g. Tetrapoda.*—Degenerate atracheate gall-mites in which the body is produced posteriorly and annulated, as in *Demodex*, but in which the appendages of the 3rd and 4th pairs are long and normally segmented and those of the 5th and 6th pairs entirely absent.

Family—Eriophyidae (*Eriophyes, Phyllocoptes*).

Remarks on the Rhynchostomi.—The Acari include a number of forms which are of importance and special interest on account of their parasitic habits. The ticks (*Ixodes*) are not only injurious as blood-suckers, but are now credited with carrying the germs of Texas cattle-fever, just as mosquitoes carry those of malaria. The itch-insect (*Sarcoptes scabiei*) is a well-known human parasite, so minute that it was not discovered until the end of the 18th century, and "the itch" was treated medicinally as a rash. The female burrows in the epidermis much as the female trap-door spider burrows in turf in order to make a nest in which to rear her young. The male does not burrow, but wanders freely on the surface of the skin. *Demodex folliculorum* is also a common parasite of the sebaceous glands of the skin of the face in man, and is frequent in the skin of the dog. Many Acari are parasitic on marine and freshwater molluscs, and others are found on the feathers of birds and the hair of mammals. Others have a special faculty of consuming dry, powdery vegetable and animal refuse, and are liable to multiply in manufactured products of this nature, such as mouldy cheese. A species of Acarus is recorded as infesting a store of powdered strychnine and feeding on that drug, so poisonous to larger organisms. Reference to literature (**40**).

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ARAD, or Ó-ARAD, a town of Hungary, capital of the county of the same name, 159 m. S.E. of Budapest by rail. Pop. (1900) 53,903. It is situated on the right bank of the river Maros, and consists of the inner town and five suburbs. Arad is a modern-built town, and contains many handsome private and public buildings, including a cathedral. It is the seat of a Greek-Orthodox bishop, and possesses a Greek-Orthodox theological seminary, two training schools for teachers—one Hungarian, and the other Rumanian—and a conservatoire for music. The town played an important part in the Hungarian revolution of 1848–49, and possesses a museum containing relics of this war of independence. One of the public squares contains a martyrs' monument, erected in memory of the thirteen Hungarian generals shot here on the 6th of October 1849, by order of the Austrian general Haynau. It consists of a colossal figure of

Hungary, with four allegorical groups, and medallions of the executed generals. Arad is an important railway junction, and has become the largest industrial and commercial centre of south-eastern Hungary. Its principal industries are: distilling, milling, machinery-making, leather-working and saw-milling. A large trade is carried on in grain, flour, alcohol, cattle and wood. Arad was a fortified place, and was captured by the Turks during the wars of the 17th century, and kept by them till the end of that century. The new fortress, built in 1763, although small, was formidable, and played a great rôle during the Hungarian struggle for independence in 1849. Bravely defended by the Austrian general Berger until the 1st of July 1849, it was then captured by the Hungarian rebels, who made it their headquarters during the latter part of the insurrection. It was from it that Kossuth issued his famous proclamation (11th August 1849), and it was here that he handed over the supreme military and civil power to Görgei. The fortress was recaptured shortly after the surrender of Görgei to the Russians at Világos. The fortress is now used as an ammunition depot.

The town of Uj-Arad, *i.e.* New Arad (pop. 6124), situated on the opposite bank of the Maros, is practically a suburb of Arad, with which it is connected by a bridge. The town was founded during the Turkish wars of the 17th century. The works erected by the Turks for the capture of the fortress of Arad formed the nucleus of the new town.

Világos, the town where the famous capitulation of Görgei to the Russians took place on the 13th of August 1849, lies 21 m. by rail north-east of Arad.

ARAEOSTYLE (Gr. ἀραιός, weak or widely spaced, and στῦλος, column), an architectural term for the intercolumniation (*q.v.*) given to those temples where the columns had only timber architraves to carry.

ARAEOSYSTYLE (Gr. ἀραιός, widely spaced, and σύστυλος, with columns set close together), an architectural term applied to a colonnade, in which the intercolumniation (*q.v.*) is alternately wide and narrow, as in the case of the western porch of St Paul's cathedral and the east front of the Louvre by Perrault.

ARAGO, DOMINIQUE FRANÇOIS JEAN (1786–1853), French physicist, was born on the 26th of February 1786, at Estagel, a small village near Perpignan, in the department of the eastern Pyrenees. He was the eldest of four brothers. Jean (1788–1836) emigrated to America and became a general in the Mexican army. Jacques Étienne Victor (1799–1855) took part in L. C. de S. de Freycinet's exploring voyage in the "Uranie" from 1817 to 1821, and on his return to France devoted himself to journalism and the drama. The fourth brother, Étienne Vincent (1802–1892), is said to have collaborated with H. de Balzac in the *Héritière de Birague*, and from 1822 to 1847 wrote a great number of light dramatic pieces, mostly in collaboration. A strong republican, he was obliged to leave France in 1849, but returned after the amnesty of 1859. In 1879 he was nominated director of the Luxembourg museum.

Showing decided military tastes François Arago was sent to the municipal college of Perpignan, where he began to study mathematics in preparation for the entrance examination of the polytechnic school. Within two years and a half he had mastered all the subjects prescribed for examination, and a great deal more, and, on going up for examination at Toulouse, he astounded his examiner by his knowledge of Lagrange. Towards the close of 1803 he entered the polytechnic school, with the artillery service as the aim of his ambition, and in 1804, through the advice and recommendation of S. D. Poisson, he received the appointment of secretary to the Observatory of Paris. He now became acquainted with Laplace, and through his influence was commissioned, with J. B. Biot, to complete the meridional measurements which had been begun by J. B. J. Delambre, and interrupted since the death of P. F. A. Méchain (1744–1804). The two left Paris in 1806 and began operations among the mountains of Spain, but Biot returned to Paris after they had determined the latitude of Formentera, the southernmost point to which they were to carry the survey, leaving Arago to make the geodetical connexion of Majorca with Ivica and with Formentera.

The adventures and difficulties of the latter were now only beginning. The political ferment caused by the entrance of the French into Spain extended to these islands, and the ignorant populace began to suspect that Arago's movements and his blazing fires on the top of Mount Galatzo were telegraphic signals to the invading army. Ultimately they became so infuriated that he was obliged to cause himself to be incarcerated in the fortress of Belver in June 1808. On the 28th of July he managed to escape from the island in a fishing-boat, and after an adventurous voyage he reached Algiers on the 3rd of August. Thence he procured a passage in a vessel bound for Marseilles, but on the 16th of August, just as the vessel was nearing Marseilles, it fell into the hands of a Spanish corsair. With the rest of the crew, Arago was taken to Rosas, and imprisoned first in a windmill, and afterwards in the fortress of that seaport, until the town fell into the hands of the French, when the prisoners were transferred to Palamos. After fully three months' imprisonment they were released on the demand of the dey of Algiers, and again set sail for Marseilles on the 28th of November, but when within sight of their port they were driven back by a northerly wind to Bougie on the coast of Africa. Transport to Algiers by sea from this place would have occasioned a weary stay of three months; Arago, therefore, set out for it by land under conduct of a Mahommedan priest, and reached it on Christmas day. After six months' stay in Algiers he once again, on the 21st of June 1809, set sail for Marseilles, where he had to undergo a monotonous and inhospitable quarantine in the lazaretto, before his difficulties were over. The first letter he received, while in the lazaretto, was from A. von Humboldt; and this was the origin of a connexion which, in Arago's words, "lasted over forty years without a single cloud ever having troubled it."

Through all these vicissitudes Arago had succeeded in preserving the records of his survey; and his first act on his return home was to deposit them in the Bureau des Longitudes at Paris. As a reward for his adventurous conduct in the cause of science, he was in September 1809 elected a member of the Academy of Sciences, in room of J. B. L. Lalande, at the remarkably early age of twenty-three, and before the close of the same year he was chosen by the council of the polytechnic school to succeed G. Monge in the chair of analytical geometry. About the same time he was named by the emperor one of the astronomers of the Royal Observatory, which was accordingly his residence till his death, and it was in this capacity that he delivered his remarkably successful series of popular lectures on astronomy, which were continued from 1812 to 1845.

In 1816, along with Gay-Lussac, he started the *Annales de chimie et de physique*, and in 1818 or 1819 he proceeded along with Biot to execute geodetic operations on the coasts of France, England and Scotland. They measured the length of the seconds-pendulum at Leith, and in Unst, one of the Shetland isles, the results of the observations being published in 1821, along with those made in Spain. Arago was elected a member of the Board of Longitude immediately afterwards, and contributed to each of its *Annuals*, for about twenty-two years, important scientific notices on astronomy and meteorology and occasionally on civil engineering, as well as interesting memoirs of members of the Academy.

In 1830, Arago, who always professed liberal opinions of the extreme republican type, was elected a member of the chamber of deputies for the Lower Seine, and he employed his splendid gifts of eloquence and scientific knowledge in all questions connected with public education, the rewards of inventors, and the encouragement of the mechanical and practical sciences. Many of the most creditable national enterprises, dating from this period, are due to his advocacy—such as the reward to L. J. M. Daguerre for the invention of photography, the grant for the publication of the works of P. Fermat and Laplace, the acquisition of the museum of Cluny, the development of railways and electric telegraphs, the improvement of the navigation of the Seine, and the boring of the artesian wells at Grenelle.

In the year 1830 also he was appointed director of the Observatory, and as a member of the chamber of deputies he was able to obtain grants of money for rebuilding it in part, and for the addition of magnificent instruments. In the same year, too, he was chosen perpetual secretary of the Academy of Sciences, in room of J. B. J. Fourier. Arago threw his whole soul into its service, and by his faculty of making friends he gained at once for it and for himself a world-wide reputation. As perpetual secretary it fell to him to pronounce historical *éloges* on deceased members; and for this duty his rapidity and facility of thought, his happy piquancy of style, and his extensive knowledge peculiarly adapted him.

In 1834 he again visited England, to attend the meeting of the British Association at Edinburgh. From this time till 1848 he led a life of comparative quiet—not the quiet of inactivity, however, for his incessant labours within the Academy and the Observatory produced a multitude of contributions to all departments of physical science,—but on the fall of Louis Philippe he left his laboratory to join in forming the provisional government. He was entrusted with the discharge of two important functions, that had never before been united in one person, viz. the ministry of war and of marine; and in the latter capacity he effected some salutary reforms, such as the improvement of rations in the navy and the abolition of flogging. He also abolished political oaths of all kinds, and, against an array of moneyed interests, succeeded in procuring the abolition of negro slavery in the French colonies.

In the beginning of May 1852, when the government of Louis Napoleon required an oath of allegiance from all its functionaries, Arago peremptorily refused, and sent in his resignation of his post as astronomer at the Bureau des Longitudes. This, however, the prince president, to his credit, declined to accept, and made "an exception in favour of a *savant* whose works had thrown lustre on France, and whose existence his government would regret to embitter." But the tenure of office thus granted did not prove of long duration. Arago was now on his death-bed, under a complication of diseases, induced, no doubt, by the hardships and labours of his earlier years. In the summer of 1853 he was advised by his physicians to try the effect of his native air, and he accordingly set out for the eastern Pyrenees. But the change was unavailing, and after a lingering illness, in which he suffered first from diabetes, then from Bright's disease, complicated by dropsy, he died in Paris on the 2nd of October 1853.

Arago's fame as an experimenter and discoverer rests mainly on his contributions to magnetism and still more to optics. He found that a magnetic needle, made to oscillate over non-ferruginous surfaces, such as water, glass, copper, &c., falls more rapidly in the extent of its oscillations according as it is more or less approached to the surface. This discovery, which gained him the Copley medal of the Royal Society in 1825, was followed by another, that a rotating plate of copper tends to communicate its motion to a magnetic needle suspended over it ("magnetism of rotation"). Arago is also fairly entitled to be regarded as having proved the long-suspected connexion between the aurora borealis and the variations of the magnetic elements.

In optics we owe to him not only important optical discoveries of his own, but the credit of stimulating the genius of A. J. Fresnel, with whose history, as well as with that of E. L. Malus and of Thomas Young, this part of his life is closely interwoven. Shortly after the beginning of the 19th century the labours of these three philosophers were shaping the modern doctrine of the undulatory theory of light. Fresnel's arguments in favour of that theory found little favour with Laplace, Poisson and Biot, the champions of the emission theory; but they were ardently espoused by Humboldt and by Arago, who had been appointed by the Academy to report on the paper. This was the foundation of an intimate friendship between Arago and Fresnel, and of a determination to carry on together further researches in this subject, which led to the enunciation of the fundamental laws of the polarization of light known by their names (see POLARIZATION). As a result of this work Arago constructed a *polariscope*, which he used for some interesting observations on the polarization of the light of the sky. To him is also due the discovery of the power of *rotatory polarization* exhibited by quartz, and last of all, among his many contributions to the support of the undulatory hypothesis, comes the *experimentum crucis* which he proposed to carry out for comparing directly the velocity of light in air and in water or glass. On the emission theory the velocity should be accelerated by an increase of density in the medium; on the wave theory, it should be retarded. In 1838 he communicated to the Academy the details of his apparatus, which utilized the revolving mirrors employed by Sir C. Wheatstone in 1835 for measuring the velocity of the electric discharge; but owing to the great care required in the carrying out of the project, and to the interruption to his labours caused by the revolution of 1848, it was the spring of 1850 before he was ready to put his idea to the test; and then his eyesight suddenly gave way. Before his death, however, the retardation of light in denser media was demonstrated by the experiments of H. L. Fizeau and J. B. L. Foucault, which, with improvements in detail, were based on the plan proposed by him.

Arago's *Œuvres* were published after his death under the direction of J. A. Barral, in 17 vols., 8vo, 1854–1862; also separately his *Astronomie populaire*, in 4 vols.; *Notices biographiques*, in 3 vols.; *Notices scientifiques*, in 5 vols.; *Voyages scientifiques*, in 1 vol.; *Mémoires scientifiques*, in 2 vols.; *Mélanges*, in 1 vol.; and *Tables analytiques et documents importants* (with portrait), in 1 vol. English translations of the following portions of his works have appeared:—*Treatise on Comets*, by C. Gold, C.B. (London, 1833); also translated by Smyth and Grant (London, 1861); *Hist. éloge of James Watt*, by James Muirhead (London, 1839); also translated, with notes, by Lord Brougham; *Popular Lectures on Astronomy*, by Walter Kelly and Rev. L. Tomlinson (London, 1854); also translated by Dr W. H. Smyth and Prof. R. Grant, 2 vols. (London, 1855); *Arago's Autobiography*, translated by the Rev. Baden Powell (London, 1855, 1858); *Arago's Meteorological Essays*, with introduction by Humboldt, translated under the superintendence of Colonel Sabine (London, 1855), and *Arago's Biographies of Scientific Men*, translated by Smyth, Powell and Grant, 8vo (London, 1857).

ARAGON, or ARRAGON (in Span. *Aragón*), a captaincy-general, and formerly a kingdom of Spain; bounded on the N. by the Pyrenees, which separate it from France, on the E. by Catalonia and Valencia, S. by Valencia, and W. by the two Castiles and Navarre. Pop. (1900) 912,711; area, 18,294 sq. m. Aragon was divided in 1833 into the provinces of Huesca, Teruel and Saragossa; an account of its modern condition is therefore given under these names, which have not, however, superseded the older designation in popular usage.

Aragon consists of a central plain, edged by mountain ranges. On the south, east and west, these ranges, though wild and rugged, are of no great elevation, but on the north the Pyrenees attain their greatest altitude in the peaks of Aneto (11,168 ft.) and Monte Perdido (10,998 ft.)—also known as Las Tres Sorores, and, in French, as Mont Perdu. The central pass over the Pyrenees is the Port de Canfranc, on the line between Saragossa and Pau. Aragon is divided by the river Ebro (*q.v.*), which flows through it in a south-easterly direction, into two nearly equal parts, known as Trans-ibero and Cis-ibero. The Ebro is the principal river, and receives from the north, in its passage through the province, the Arba, the Gallego and the united waters of the Cinca, Esera, Noguera Ribagorzana, Noguera Pallaresa and Segre—the last three belonging to Catalonia. From the south it receives the Jalon and Jiloca (or *Xalon* and *Xiloca*) and the Guadalope. The Imperial Canal of Aragon, which was begun by the emperor Charles V. in 1529, but remained unfinished for nearly two hundred years, extends from Tudela to El Burgo de Ebro, a distance of 80 m.; it has a depth of 9 ft., and an average breadth of 69, and is navigable for vessels of about 80 tons. The Royal Canal of Tauste, which lies along the north side of the Ebro, was cut for purposes of irrigation, and gives fertility to the district. Two leagues north-north-east of Albarracin is the remarkable fountain called Cella, 3700 ft. above the sea, which forms the source of the Jiloca; and between this river and the Sierra Molina is an extensive lake called Gallocanta, covering about 6000 acres. The climate is characterized by extreme heat in the summer and cold in the winter; among the mountains the snowfall is heavy, and thunderstorms are frequent, but there is comparatively little rain.

Within a recent geological period, central Aragon was undoubtedly submerged by the sea, and the parched chalky soil remains saturated with salt, while many of the smaller streams run brackish. As the mountains of Valencia and Catalonia effectually bar out the fertilizing moisture of the sea-winds, much of the province is a sheer wilderness, stony, ash-coloured, scarred with dry watercourses, and destitute of any vegetation except thin grass and heaths. In contrast with the splendid fertility of Valencia or the south of France, the landscape of this region, like the rest of central Spain, seems almost a continuation of the north African desert area. There are, however, extensive oak, pine and beech forests in the highlands, and many beautiful oases in the deeply sunk valleys, and along the rivers, especially beside the Ebro, which is, therefore, often called the "Nile of Aragon." In such oases the flora is exceedingly rich. Wheat, maize, rice, oil, flax and hemp, of fine quality, are grown in considerable quantities; as well as saffron, madder, liquorice, sumach, and a variety of fruits. Merino wool is one of the chief products.

In purity of race the Aragonese are probably equal to the Castilians, to whom, rather than to the Catalans or Valencians, they are also allied in character. The dress of the women is less distinctive than that of the men, who wear a picturesque black and white costume, with knee-breeches, a brilliantly coloured sash, black hempen sandals, and a handkerchief wound round the head.

Three counties—Sobrarbe, situated near the headwaters of the Cinca, Aragon, to the west, and Ribagorza or Ribagorça, to the east—are indicated by tradition and the earliest chronicles as the cradle of the Aragonese monarchy. These districts were never wholly subdued when the Moors overran the country (711–713). Sobrarbe especially was for a time the headquarters of the Christian defence in eastern Spain. About 1035, Sancho III. the Great, ruler of the newly established kingdom of Navarre, which included the three counties above mentioned, bequeathed them to Gonzalez and Ramiro, his sons. Ramiro soon rid himself of his rival, and welded Sobrarbe, Ribagorza and Aragon into a single kingdom, which thenceforward grew rapidly in size and power and shared with Castile the chief part in the struggle against the Moors. The history of this period, which was terminated by the union of Castile and Aragon under Ferdinand and Isabella in 1479, is given, along with a full account of the very interesting constitution of Aragon, under SPAIN (*q.v.*). At the height of its power under James I. (1213–1276), the kingdom included Valencia, Catalonia, the Balearic Islands and the considerable territory of Montpellier in France; while Peter III. (1276–1285) added Sicily to his dominions.

The literature relating to Aragon is very extensive. See, in addition to the works cited in the article SPAIN (section *History*), "Les Archives d'Aragon et de Navarre," by L. Cadier, in *Bibliothèque de l'École des Chartes*, 49 (Paris, 1888). Among the more important original authorities, the following may be selected:— for general history, *Anales de la corona de Aragón*, by G. Çurita, 3rd ed. in 7 folio volumes (Saragossa, 1668–1671; 1st ed. 1562–1580);—for ecclesiastical history, *Teatro histórico de las iglesias de Aragón* (Pamplona, 1770–1807); for economic history, *História de la economia politica de Aragón*, by I. J. de Asso y del Rio (Saragossa, 1798). For the constitution and laws of Aragon, see *Orígines del Justicia de Aragón*, &c., by J. Ribera Tarrago (Saragossa, 1897), and *Instituciones y reyes de Aragón*, by V. Balaguér (Madrid, 1896). The topography, inhabitants, art, products, &c., of the kingdom are described in a volume of the series *España* entitled *Aragón*, by J. M. Quadrado (Barcelona, 1886).

ARAGONITE, one of the mineral forms of calcium carbonate ($CaCO_3$), the other form being the more common mineral calcite. It crystallizes in the orthorhombic system, and the crystals are either prismatic or acicular in habit. Simple crystals are, however, rare; twinning on the prism planes (*M* in the figures) being a characteristic feature of the mineral (fig. 1). This twinning is usually often repeated on the same plane (fig. 2), and gives rise to striations on the terminal faces (*k*) of the crystals; often, also, three crystals are twinned together on two of the prism planes of one of them, producing an apparently hexagonal prism. The mineral is colourless, white or yellowish, transparent or translucent, has a vitreous lustre, and, in fact, is not unlike calcite in general appearance. It may, however, always be readily distinguished from calcite by the absence of any marked cleavage, and by its greater hardness ($H. = 3\frac{1}{2} - 4$) and specific gravity (2·93); further, it is optically biaxial, whilst calcite is uniaxial. It is brittle and has a subconchoidal fracture; on a fractured surface the lustre is decidedly resinous in character.

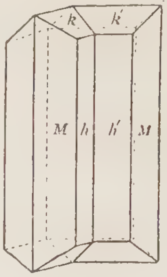


FIG. 1.

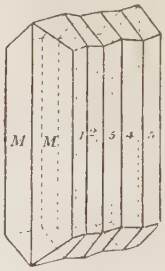


FIG. 2.

The mineral was first found, as reddish twinned crystals with the form of six-sided prisms, at Molina in Aragon, Spain, where it occurs with gypsum and small crystals of ferruginous quartz in a red clay. It is from this locality that the mineral takes its name, which was originally spelt arragonite. Fine groups of crystals of the same habit are found in the sulphur deposits of Girgenti in Sicily; also at Herrengrund near Neusohl in Hungary. At many other localities the mineral takes the form of radiating groups of acicular crystals, such as those from the haematite mines of west Cumberland: beautiful feathery forms have been found in a limestone cave in the Transvaal. Fibrous forms are also common. A peculiar coralloidal variety known as *flosferri* ("flower of iron") consists of radially arranged fibres: magnificent snow-white specimens of this variety have long been known from the iron mines of Eisenerz in Styria. The calcareous secretions of many groups of invertebrate animals consist of aragonite (calcite is also common); pearls may be specially cited as an example.

Aragonite is a member of the isomorphous group of minerals comprising witherite ($BaCO_3$), strontianite ($SrCO_3$), cerussite ($PbCO_3$) and bromlite ($(Ba, Ca)CO_3$); and crystals of aragonite sometimes contain small amounts of strontium or lead. A variety known as tarnowitzite, from Tarnowitz in Silesia, contains about 5% of lead carbonate.

Aragonite is the more unstable of the two modifications of calcium carbonate. A crystal of aragonite when heated becomes converted into a granular aggregate of calcite individuals: altered crystals of this kind (paramorphs) are not infrequently met with in nature, whilst in fossil shells the original nacreous layer of aragonite has invariably been altered to calcite. From a solution of calcium carbonate in water containing carbon dioxide crystals of calcite are deposited at the ordinary temperature, but from a warm solution aragonite crystallizes out. The thermal springs of Carlsbad deposit spherical concretions of aragonite, forming masses known as pisolite or *Sprudelstein*. (L. J. S.)

ARAGUA, one of the smaller states of Venezuela under the redivision of 1904, lying principally within the parallel ranges of the Venezuelan Cordillera, and comprising some of the most fertile and healthful valleys of the republic. It is bounded E. by the Federal District and Maturin, S. by Guárico and W. by Zamora and Carabobo. Pop. (1905, est.) 152,364. Aragua has a short coast-line on the Caribbean west of the Federal District, but has no port of consequence. Cattle, swine and goats are raised, and the state produces coffee, sugar, cacao, beans, cereals and cheese. The climate of the higher valleys is subtropical, the mean annual temperature ranging from 74° to 80° F. The capital, La Victoria (pop. 7800), is situated in the fertile Aragua valley, 1558 ft. above sea-level and 36 m. south-west of Carácas. Other important towns are Barbacoas (pop. 13,109) on the left bank of the Guárico in a highly fertile region, Ciudad de Cura and Maracay (pop. 7500), 56 m. west-south-west of

Carácas near the north-east shore of Lake Valencia. The last two towns are on the railway between Carácas and Valencia.

ARAGUAYA, Araguay or Araguia, a river of Brazil and principal affluent of the Tocantins, rising in the Serra do Cayapó, where it is known as the Rio Grande, and flowing in a north by east direction to a junction with the Tocantins at São João do Araguaya, or São João das Duas Barras. Its upper course forms the boundary line between Goyaz and Matto Grosso. The river divides into two branches at about 13° 20′ S. lat., and unites again at 10° 30′, forming the large island of Santa Anna or Bananal. The eastern branch, called the Furo, is the one used by boats, as the main channel is obstructed by rapids. Its principal affluent is the Rio das Mortes, which rises in the Serra de São Jeronymo, near Cuyabá, Matto Grosso, and is utilized by boatmen going to Pará. Of other affluents, the Bonito, Garças, Cristallino and Tapirapé on the west, and the Pitombas, Claro, Vermelho, Tucupá and Chavante on the east, nothing definite is known as the country is still largely unexplored. The Araguaya has a course of 1080 m., considerable stretches of which are navigable for small river steamers, but as the river below Santa Anna Island is interrupted by reefs and rapids in two places—one having a fall of 85 ft. in 18 m., and the other a fall of 50 ft. in 12 m.—it affords no practicable outlet for the products of the state. It was explored in part by Henri Coudreau in 1897.

See Coudreau's *Voyage au Tocantins-Araguaya* (Paris, 1897).

ARAKAN, a division of Lower Burma. It consists of a strip of country running along the eastern seaboard of the Bay of Bengal, from the Naaf estuary, on the borders of Chittagong, to Cape Negrais. Length from northern extremity to Cape Negrais, about 400 m.; greatest breadth in the northern part, 90 m., gradually diminishing towards the south, as it is hemmed in by the Arakan Yoma mountains, until, in the extreme south, it tapers away to a narrow strip not more than 15 m. across. The coast is studded with islands, the most important of which are Cheduba, Ramree and Shahpura. The division has its headquarters at Akyab and consists of four districts—namely, Akyab, Northern Arakan Hill Tracts, Sandoway and Kyaukpyu, formerly called Ramree. Its area is 18,540 sq. m. The population at the time of the British occupation in 1826 did not exceed 100,000. In 1831 it amounted to 173,000; in 1839 to 248,000, and in 1901 to 762,102.

The principal rivers of Arakan are—(1) the Naaf estuary, in the north, which forms the boundary between the division and Chittagong; (2) the Myu river, an arm of the sea, running a course almost parallel with the coast for about 50 m.; (3) the Koladaing river, rising near the Blue mountain, in the extreme north-east, and falling into the Bay of Bengal a few miles south of the Myu river, navigable by vessels of from 300 to 400 tons burden for a distance of 40 m. inland; and (4) the Lemyu river, a considerable stream falling into the bay a few miles south of the Koladaing. Farther to the south, owing to the nearness of the range which bounds Arakan on the east, the rivers are of but little importance. These are the Talak and the Aeng, navigable by boats; and the Sandoway, the Taungup and the Gwa streams, the latter of which alone has any importance, owing to its mouth forming a good port of call or haven for vessels of from 9 to 10 ft. draught. There are several passes over the Yoma mountains, the easiest being that called the Aeng route, leading from the village of that name into Upper Burma. The staple crop of the province is rice, along with cotton, tobacco, sugar, hemp and indigo. The forests produce abundance of excellent oak and teak timber.

The natives of Arakan trace their history as far back as 2666 B.C., and give a lineal succession of 227 native princes down to modern times. According to them, their empire had at one period far wider limits, and extended over Ava, part of China, and a portion of Bengal. This extension of their empire is not, however, corroborated by known facts in history. At different times the Moguls and Pegus carried their arms into the heart of the country. The Portuguese, during the era of their greatness in Asia, gained a temporary establishment in Arakan; but in 1782 the province was finally conquered by the Burmese, from which period until its cession to the British in 1826, under the treaty of Yandaboo, its history forms part of that of Burma. The old city of Arakan, formerly the capital of the province, is situated on an inferior branch of the Koladaing river. Its remoteness from the ports and harbours of the country, combined with the extreme unhealthiness of its situation, have led to its gradual decay subsequently to the formation of the comparatively recent settlement of Akyab, which place is now the chief town of the province. The old city (now Myohaung) lies 50 m. north-east of Akyab. The Maghs, who form nearly the whole population of the province, follow the Buddhist doctrines, which are universally professed throughout Burma. The priests are selected from all classes of men, and one of their chief employments is the education of children. Instruction is consequently widely diffused, and few persons, it is said, can be found in the province who are unable to read. The qualifications for entering into the priestly order are good conduct and a fair measure of learning—such conduct at least as is good according to Buddhist tenets, and such learning as is esteemed among their votaries.

The Arakanese are of Burmese origin, but separated from the parent stock by the Arakan Yoma mountains, and they have a dialect and customs of their own. Though conquered by the Burmese, they have remained distinct from their conquerors.

The Northern Arakan Hill Tracts district is under a superintendent, who is usually a police officer, with headquarters at Paletwa. The area of the Hill Tracts is 5233 sq. m.; pop. (1901) 20,682. (J. G. Sc.)

ARAKCHEEV, ALEKSYEI ANDREEVICH, Count (1769–1834), Russian soldier and statesman, was descended from an ancient family of Great Novgorod. From his mother, Elizabeth Vitlitsaya, he inherited most of his characteristics, an insatiable love of work, an almost pedantic love of order and the most rigorous sense of duty. In 1788 he entered the corps of noble cadets in the artillery and engineering department, where his ability, especially in mathematics, soon attracted attention. In July 1791 he was made an adjutant on the staff of Count N. I. Saltuikov, who (September 1792) recommended him to the cesarevich Paul Petrovich as the artillery officer most capable of reorganizing the army corps maintained by the prince at Gatchina. Arakcheev speedily won the entire confidence of Paul by his scrupulous zeal and undeniable technical ability. His inexorable discipline (magnified into cruelty by later legends) soon made the Gatchina corps a model for the rest of the Russian army. On the accession of Paul to the throne Arakcheev was promptly summoned to St Petersburg, appointed military commandant in the capital, and major-general in the grenadier battalion of the Preobrazhenskoe Guard. On the 12th of December 1796, he received the ribbon of St Anne and a rich estate at Gruzina in the government of Novgorod, the only substantial gift ever accepted by him during the whole of his career. At the coronation (5th of April 1797) Paul created him a baron, and he was subsequently made quartermaster-general and colonel of the whole Preobrazhenskoe Guard. It was to Arakcheev that Paul entrusted the reorganization of the army, which during the latter days of Catherine had fallen into a state of disorder and demoralization. Arakcheev remorselessly applied the iron Gatchina discipline to the whole of the imperial forces, beginning with the Guards. He soon became generally detested by the army, but pursued his course unflinchingly and introduced many indispensable hygienic reforms. "Clean barracks are healthy barracks," was his motto. Nevertheless, the opposition of the officers proved too strong for him, and on the 18th of March 1798 he was dismissed from all his appointments. Arakcheev's first disgrace only lasted six months. On the 11th of August he was received back into favour, speedily reinstated in all his former offices, and on the 5th of May 1799 was created a count, the emperor himself selecting the motto: "Devoted, not servile." Five months later he was again in disgrace, the emperor dismissing him on the strength of a denunciation subsequently proved to be false. It was a fatal step on Paul's part, for everything goes to prove that he would never have been assassinated had Arakcheev continued by his side. During the earlier years of Alexander, Arakcheev was completely overlooked. Only on the 27th of April 1803, was the count recalled to St Petersburg, and employed as inspector-general of the artillery. His wise and thorough reorganization of the whole department contributed essentially to the victories of the Russians during the Napoleonic wars. All critics agree, indeed, that the Arakcheev administration was the golden era of the Russian artillery. The activity of the inexhaustible inspector knew no bounds, and he neglected nothing which could possibly improve this arm. His principal reforms were the subdivision of the artillery divisions into separate independent units, the formation of artillery brigades, the establishment of a committee of instruction (1808), and the publishing of an *Artillery Journal.* At Austerlitz he had the satisfaction of witnessing the actual results of his artillery reforms. The commissariat scandals which came to light after the peace of Tilsit convinced the emperor that nothing short of the stern and incorruptible energy of Arakcheev could reach the sources of the evil, and in January 1808 he was appointed inspector-general and war minister. When, on the outbreak of the Swedish war of 1809, the emperor ordered the army to take advantage of an unusually severe frost and cross the ice of the Gulf of Finland, it was only the presence of Arakcheev that compelled an unwilling general and a semi-mutinous army to begin a campaign which ended in the conquest of Finland. On the institution of the "Imperial Council" (1st of January 1810), Arakcheev was made a member of the council of ministers and a senator, while still retaining the war office. Subsequently Alexander was alienated from him owing to the intrigues of the count's enemies, who hated him for his severity and regarded him as a dangerous reactionary. The alienation was not, however, for long. It is true, Arakcheev took no active part in the war of 1812, but all the correspondence and despatches relating to it passed through his hands, and he was the emperor's inseparable companion during the whole course of it. At Paris (31st of March 1814) Alexander, with his own hand, wrote the *ukaz* appointing him a field-marshal, but he refused the dignity, accepting, instead, a miniature portrait of his master. From this time Alexander's confidence in Arakcheev steadily increased, and the emperor imparted to him, first of all, his many projects of reform, especially his project of military colonies, the carrying out of the details of which was committed to Arakcheev (1824). The failure of the scheme was due not to any fault of the count, but to the inefficiency and insubordination of the district officers. In Alexander's last years Arakcheev was not merely his chief counsellor, but his dearest friend, to whom he submitted all his projects for consideration and revision. The most interesting of these projects was the plan for the emancipation of the peasantry (1818). On the accession of Nicholas I., Arakcheev, thoroughly broken in health, gradually restricted his immense sphere of activity, and on the 26th of April 1826, resigned all his offices and retired to Carlsbad. The 50,000 roubles presented to him by the emperor as a parting gift he at once handed to the Pavlovsk Institute for the education of the daughters of poor gentlemen. His last days he spent on his estate at Gruzina, carefully collecting all his memorials of Alexander, whose memory he most piously cherished. He also set aside 25,000 roubles for the author of the best biography of his imperial friend. Arakcheev died on the 21st of April 1834, with his eyes fixed to the last on the late emperor's portrait. "I have now done everything," he said, "so I can go and make my report to the emperor Alexander." In 1806 he had married Natalia Khomutova, but they lived apart, and he had no children by her.

See Vasily Ratch, *Memorials of Count Arakcheev* (Rus.) (St Petersburg, 1864); Mikhail Ivanovich Semevsky, *Count Arakcheev and the Military Colonies* (Rus.) (St Petersburg, 1871); Theodor Schiemann, *Gesch. Russland's unter Kaiser Nikolaus I.*, vol. i., *Alexander I.*, &c. (Berlin, 1904). (R. N. B.)

ARAL, a lake or inland sea in the west of Asia, situated between lat. 43° 30′ and 46° 51′ N., and long. 58° 13′ and 61° 56′ E. It was known to the ancient Arab and Persian geographers as the Sea of Khwārizm or Kharezm, from the neighbouring district of the Chorasmians, and derives its present name from the Kirghiz designation of Aral-denghiz, or Sea of Islands. In virtue of its area (26,233 sq.m.) it is the fourth largest inland sea of the world. It has nearly the same length as width, namely about 170 m., if its northern gulf (Kichkineh-denghiz) is left out of account. Its depth is insignificant, the maximum being 220 ft. in a depression in the north-west, and the mean depth only 50 ft., so that notwithstanding its area it contains only eleven times as much water as the Lake of Geneva. Its altitude is 242½ ft. above the Caspian, *i.e.* about 155 ft. above the ocean. The lake is surrounded on the north by steppes; on the west by the rocky plateau of Ust-Urt, which separates it from the Caspian; on the south by the alluvial district of Khiva; and on the east by the Kyzyl-kum, or Red Sand Desert. On the north the shores are comparatively low, and the coast-line is broken by a number of irregular bays, of which the most important are those of Sary-chaganak and Paskevich. On the west an almost unbroken wall of rock extends from Chernychev Bay southwards, rising towards the middle to 500 ft. The southern coast is occupied by the delta of the Oxus (Jīhūn, Amu-darya), one of the arms of which, the Laudan, forms a swamp, 80 m. long and 20 broad, before it discharges into the sea. The only other tributary of any size that the sea receives is the Jaxartes (Sihūn, Syr-darya) which enters towards the northern extremity of the east coast, and is suspected to be shifting its embouchure more and more to the north. This river, as well as the Amu, conveys vast quantities of sediment into the lake; the delta of the Syr-darya increased by 13¾ sq. m. between 1847 and 1900. The eastern coast is fringed with multitudes of small islands, and other islands, some of considerable size, are situated in the open towards the north and west. Kug-Aral, the largest, lies opposite the mouth of the Syr-darya, cutting off the Kichkineh-denghiz or Little Sea. The next largest island is the Nikolai, nearly in the middle. Navigation is dangerous owing to the frequency and violence of the storms, and the almost total absence of shelter. The north-east wind is the most prevalent, and sometimes blows for months together. The only other craft, except the steamships of the Russians, that venture on the waters, are the flat-bottomed boats of the Kirghiz.

In regard to the period of the formation of the Aral there were formerly two theories. According to Sir H. C. Rawlinson (*Proc. Roy. Geog. Soc.*, March 1867) the disturbances which produced the present lake took place in the course of the middle ages; while Sir Roderick Murchison contended (*Journ. of Roy. Geog. Soc.*, 1867, p. cxliv. &c.) that the Caspian and Aral existed as separate seas before and during all the historic period, and that the main course of the rivers Jaxartes and Oxus was determined in a prehistoric era. The former based his opinion largely on historical evidence, and the latter trusted principally to geological data. There is no doubt that in recent historical times Lake Aral had a much greater extension than it has at the present time, and that its area is now diminishing. This is, of course, due to the excess of evaporation over the amount of water supplied by its two feeders, the Amu-darya and the Syr-darya, both of which are seriously drawn upon for irrigation in all the oases they flow through. Old shore lines and other indications point to the level of the lake having once been 50 ft. above the existing level. Nevertheless the general desiccation is subject to temporary fluctuations, which appear to correspond to the periods recently suggested by Eduard Brückner (b. 1862); for, whereas the lake diminished and shrank during 1850–1880, since the latter year it has been rising again. Islands which were formerly connected with the shore are now some distance away from it and entirely surrounded by water. Moreover, on a graduated level, put down in 1874, there was a permanent rise of nearly 4 ft. by 1901. The temperature at the bottom was found (1900–1902) by Emil Berg to be 33·8° Fahr., while that of the surface varied from 44·5° to 80·5° between May and September; the mean surface temperature for July was 75°. The salinity of the water is much less than that of the ocean, containing only 1·05% of salt, and the lake freezes every year for a great distance from its shores. The opinion that Lake Aral periodically disappeared, which was for a long time countenanced by Western geographers, loses more and more probability now that it is evident that at a relatively recent period the Caspian Sea extended much farther eastward than it does now, and that Lake Aral communicated with it through the Sary-kamysh depression. The present writer is even inclined to think that, besides this southern communication with the Caspian, Lake Aral may have been, even in historical times, connected with the Mortvyi Kultuk (Tsarevich) Gulf of the Caspian, discharging part of its water into that sea through a depression of the Ust-Urt plateau, which is marked by a chain of lakes (Chumyshty, Asmantai). In this case it might have been easily confounded with a gulf of the Caspian (as by Jenkinson). That the level of Lake Aral was much higher in post-Pliocene times is proved by the discovery of shells of its characteristic species of *Pecten* and *Mytilus* in the Kara-kum Desert, 33 m. south of the lake and at an altitude of 70 ft. above its present level, and perhaps even up to 200 ft. (by Syevertsov).

The fish of Lake Aral belong to fresh-water species, and in some of its rapid tributaries the interesting *Scaphirhynchus*, which represents a survival from the Tertiary epoch, is found. The fishing is very productive, the fish being exported to Turkestan, Merv and Russia. The shores of the lake are uninhabited; the nearest settlements are Kazala, 55 m. east, on the Syr, and Chimbai and Kungrad in the delta of the Amu.

Authorities.—Makshéev's "Description of Lake Aral," and Kaulbars' "Delta of the Amu," in *Zapiski of Russ. Geogr. Soc.*, 1st series, v., and new series, ix.; Grimm's *Studies of the Aral-Caspian Expedition*; Nikolsky's "Fishing in Lake Aral," in *Izvestia, Russ. Geogr. Soc.*, 1887; Prof. Mushketov, *Turkestan*, vol. i. (1886), which contains bibliographical references; Rösler, *Die Aralseefrage* (1873); Wood, *The Shores of the Aral Lake* (1876); and Berg in *Izvestia, Turkestan Branch of Russian Geog. Soc.* (vol. iii., Tashkent, 1902). (P. A. K.)

ARAM, EUGENE (1704–1759), English scholar, but more famous as the murderer celebrated by Hood in his ballad, the *Dream of Eugene Aram*, and by Bulwer Lytton in his romance of *Eugene Aram*, was born of humble parents at Ramsgill, Yorkshire, in 1704. He received little education at school, but manifested an intense desire for learning. While still young, he married and settled as a schoolmaster at Netherdale, and during the years he spent there, he taught himself both Latin and Greek. In 1734 he removed to Knaresborough, where he remained as schoolmaster till 1745. In that year a man named Daniel Clark, an intimate friend of Aram, after obtaining a considerable quantity of goods from some of the tradesmen in the town, suddenly disappeared. Suspicions of being concerned in this swindling transaction fell upon Aram. His garden was searched, and some of the goods found there. As, however, there was not evidence sufficient to convict him of any crime, he was discharged, and soon after set out for London, leaving his wife behind. For several years he travelled through parts of England, acting as usher in a number of schools, and settled finally at Lynn, in Norfolk. During his travels he had amassed considerable materials for a work he had projected on etymology, to be entitled a *Comparative Lexicon of the English, Latin, Greek, Hebrew and Celtic Languages*. He was undoubtedly an original philologist, who realized, what was then not yet admitted by scholars, the affinity of the Celtic language to the other languages of Europe, and could dispute the then accepted belief that Latin was derived from Greek. Aram's writings show that he had grasped the right idea on the subject of the Indo-European character of the Celtic language, which was not established till J. C. Prichard published his book, *Eastern Origin of the Celtic Nations*, in 1831. But he was not destined to live in history as the pioneer of a new philology. In February 1758 a skeleton was dug up at Knaresborough, and some suspicion arose that it might be Clark's. Aram's wife had more than once hinted that her husband and a man named Houseman knew the secret of Clark's disappearance. Houseman was at once arrested and confronted with the bones that had been found. He affirmed his innocence, and, taking up one of the bones, said, "This is no more Dan Clark's bone than it is mine." His manner in saying this roused suspicion that he knew more of Clark's disappearance than he was willing to admit. He was again examined, and confessed that he had been present at the murder of Clark by Aram and another man, Terry, of whom nothing further is heard. He also gave information as to the place where the body had been buried in St Robert's Cave, a well-known spot near Knaresborough. A skeleton was dug up here, and Aram was immediately arrested, and sent to York for trial. Houseman was admitted as evidence against him. Aram conducted his own defence, and did not attempt to overthrow Houseman's evidence, although there were some discrepancies in that; but made a skilful attack on the fallibility of circumstantial evidence in general, and particularly of evidence drawn from the discovery of bones. He brought forward several instances where bones had been found in caves, and tried to show that the bones found in St Robert's Cave were probably those of some hermit who had taken up his abode there. He was found guilty, and condemned to be executed on the 6th of August 1759, three days after his trial. While in his cell he confessed his guilt, and threw some light on the motives for his crime, by asserting that he had discovered a criminal intimacy between Clark and his own wife. On the night before his execution he made an unsuccessful attempt at suicide by opening the veins in his arm.

ARAMAIC LANGUAGES, a class of languages so called from Aram, a geographical term, which in old Semitic usage designates nearly the same districts as the Greek word Syria. Aram, however, does not include Palestine, while it comprehends Mesopotamia (Heb. Aram of two rivers), a region which the Greeks frequently distinguish from Syria proper. Thus the Aramaic languages may be geographically defined as the Semitic dialects originally current in Mesopotamia and the regions extending south-west from the Euphrates to Palestine. (See Semitic Languages; Syriac; Targum.)

ARANDA, PEDRO PABLO ABARCA DE BOLEA, Count of (1719–1798), Spanish minister and general, was born at the castle of Siétamo, a lordship of his family near Huesca in Aragon, on the 1st of August 1719. The house of Abarca was very ancient, a fact of which Don Pedro, who never forgot that he was a "rico hombre" (noble) of Aragon, was deeply conscious. He was educated partly at Bologna and partly at the military school of Parma. In 1740 he entered the army as captain in the regiment "Castilla," of which his father was proprietary colonel. On the death of his father he became colonel, and served in the Italian campaigns of the War of the Austrian Succession. In 1749 he married Doña Ana, daughter of the 9th duke of Hijar, by whom he had one son, who died young, and a daughter. During the following years he travelled and visited the camp of Frederick the Great, whose system of drill he admired and afterwards introduced into the Spanish army. After a short period of diplomatic service in Portugal, where his exacting temper made it impossible for him to agree with the premier, Pombal, he returned to Madrid, was made a knight of the Golden Fleece, and director-general of artillery—a post which he threw up, together with his rank of lieutenant-general, because he was not allowed to punish certain fraudulent contractors. The king, Ferdinand VI., exiled him to his estates, but Charles III. on his accession took him into favour. He was again employed in diplomacy, and then appointed to command an army against Portugal in 1763. In 1764 he was made governor of Valencia. When in 1766 the king was driven from his capital in a riot, he summoned Aranda to Madrid and made him president of the council, and captain-general of New Castile. Until 1773 Aranda was the most important minister in Spain. He restored order and aided the king most materially in his work of administrative reform. But his great achievements, which gave him a high reputation throughout Europe with the philosophical and anti-clerical parties, were his expulsion of the Jesuits, whom the king considered responsible for the riot of 1766, and the active part he took in the suppression of the order. Aranda had come much under foreign influence by his education and his travels, and had acquired the reputation of being a confirmed sceptic. By Voltaire and the Encyclopaedists he was erected into a hero from whom great things were expected. His ability, his remarkable capacity for work, and his popularity made him indispensable to the king. But he was a trying servant, for his temper was captious and his tongue sarcastic, while his aristocratic arrogance led him to display an offensive contempt for the *golillas* (the stiff collars), as he called the lawyers and public servants whom the king preferred to choose as ministers, and he permitted himself an amazing freedom of language with his sovereign. At last Charles III. sent him as ambassador to Paris in a disguised disgrace. Aranda held this position till 1787, but in Paris he was chiefly known for his oddities of manner and for perpetual wrangling with the French on small points of etiquette. He resigned his post for private reasons. In the reign of Charles IV., with whom he had been on familiar terms during the life of the old king, he was for a very short time prime minister in 1792. In reality he was merely used as a screen by the queen Maria Louisa and her favourite Godoy. His open sympathy with the French Revolution brought him into collision with the violent reaction produced in Spain by the excesses of the Jacobins, while his temper, which had become perfectly uncontrollable with age, made him insufferable to the king. After his removal from office he was imprisoned for a short time at Granada, and was threatened with a trial by the Inquisition. The proceedings did not go beyond the preliminary stage, and Aranda died at Epila on the 9th of January 1798.

See Don Jacobo de la Pezuela in the *Revista de España*, vol. xxv. (1872); Don Antonio Mª. Fabié, in the *Diccionario general de politica y administracion* of Don E. Suarez Inclan (Madrid, 1868), vol. i.; M. Morel Fatio, *Études sur l'Espagne* (2nd series, Paris, 1890). (D. H.)

ARAN ISLANDS, or SOUTH ARAN, three islands lying across Galway Bay, on the west coast of Ireland, in a south-easterly direction, forming a kind of natural breakwater. They belong to the county Galway, and their population in 1901 was 2863. They are called respectively—beginning with the northernmost—Inishmore (or Aranmore), the Great Island; Inishmaan, the Middle Island; and Inisheer, the Eastern Island. The first has an elevation of 354 ft., the second of 259, and the third of 202. Their formation is carboniferous limestone. These islands are remarkable for a number of architectural remains of a very early date. In Inishmore there stand, on a cliff 220 ft. high, large remains of a circular cyclopean tower, called Dun-Aengus, ascribed to the Fir-bolg or Belgae; or, individually, to the first of three brothers, Aengus, Conchobar and Nil, who reached Aran Islands from Scotland in the 1st century A.D. There are seven other similar structures in the group. Inishmore also bears the name of *Aran-na-naomh*, Aran-of-the-Saints, from the number of religious recluses who took up their abode in it, and gave a celebrity to the holy wells, altars and shrines, to which many are still attracted. No less, indeed, than twenty buildings of ecclesiastical or monastic character have been enumerated in the three islands. On Inishmore are remains of the abbey of Killenda. Christianity was introduced in the 5th century, and Aran soon became one of the most famous island-resorts of religious teachers and ascetics. The extraordinary fame of the foundations here has been inferred from the inscription "VII. Romani" on a stone in the church Teampull Brecain on Inishmore, attributed to disciples from Rome. The total area of the islands is 11,579 acres. The Congested Districts Board made many efforts to improve the condition of the inhabitants, especially by introducing better methods of fishing. A curing station is established at Killeany, the harbour of Inishmore.

ARANJUEZ (perhaps the ancient *Ara Jovis*), a town of central Spain, in the province of Madrid, 30 m. S. of Madrid, on the left bank of the river Tagus, at the junction of the main southern railways to Madrid, and at the western terminus of the Aranjuez-Cuenca railway. Pop. (1900) 12,670. Aranjuez occupies part of a wide valley, about 1500 ft. above the sea. Its formal, straight streets, crossing one another regularly at right angles, and its uniform, two-storeyed houses were built in imitation of the Dutch style, under the direction of Jerónimo, marquis de Grimaldi (1716–1788), ambassador of Charles III. at the Hague. A rapid in the Tagus, artificially converted into a weir, renders irrigation easy, and has thus created an oasis in the midst of the barren plateau of New Castile. On every side the town is surrounded by royal parks and woods of sycamores, plane-trees and elms, often of extraordinary size. The prevalence of the dark English elms, first introduced into the country and planted here by order of Philip II. (1527–1598), gives to the Aranjuez district a character wholly distinct from that of other Spanish landscapes; and at an early period, despite the unhealthy climate, and especially the oppressive summer heat, which often approaches 100° F., Aranjuez became a favourite residence of the Spanish court. In the 14th and 15th centuries, the master of the Order of Santiago had a country seat here, which passed, along with the mastership, into the possession of the crown of Spain in 1522. Its successive occupants, from the emperor Charles V. (1500–1558) down to Ferdinand VII. (1784–1833), modified it according to their respective tastes. The larger palace was built by Pedro Caro for Philip V. (1683–1746), in the French style of the period. It overlooks the Jardin de la Isla, a beautiful garden laid out for Philip II. on an island in the Tagus, which forms the scene of Schiller's famous drama *Don Carlos.* The Casa del Labrador, or Labourer's Cottage, as it is called, is a smaller palace built by Charles IV. in 1803, and full of elaborate ornamentation. The chief local industry is farming, and an annual fair is held in September for the sale of live stock. Great attention is given to the rearing of horses and mules, and the royal stud used to be remarkable for the beauty of its cream-coloured breed. The treaty of 1772 between France and Spain was concluded at Aranjuez, which afterwards suffered severely from the French during the Peninsular War. Here, also, in 1808, the insurrection broke out which ended in the abdication of Charles IV.

For a fuller description of Aranjuez see D.S. Viñas y Rey, *Aranjuez* (Madrid, 1890); F. Nard, *Guia de Aranjuez, su historia y descripcion* (Madrid. 1851), (illustrated); Alvarez de Quindos, *Descripcion historica del real bosque y casa de Aranjuez* (Madrid, 1804).

ARANY, JÁNOS (1817–1882), the greatest poet of Hungary after Petöfi, was born at Nagy-Szalontá on the 2nd of March 1817, the son of György Arany and Sara Mégyeri; his people were small Calvinist yeomen of noble origin, whose property consisted of a rush-thatched cottage and a tiny plot of land. An only son, late born, seeing no companions of his own age, hearing nothing but the voices of his parents and the hymns and prayers in the little Calvinist chapel, Arany grew up a grave and gentle, but by no means an ignorant child. His precocity was remarkable. At six years of age he went to school at Szalontá, where he read everything he could lay his hands upon in Hungarian and Latin. From 1832 to 1836 Arany was a preceptor at Kis-Ujszállás and Debreczen, still a voracious reader with a wider field before him, for he had by this time taught himself French and German. Tiring of the monotony of a scholastic life, he joined a troupe of travelling actors. The hardships he suffered were as nothing compared with the pangs of conscience which plagued him when he thought of the despair of his father, who had meant to make a pastor of this prodigal son, to whom both church and college now seemed for ever closed. At last he borrowed sixpence from the stage-manager and returned home, carrying all his property tied up in a handkerchief. Shortly after his home-coming his mother died and his father became stone-blind. Arany at once resolved that it was his duty never to leave his father again, and a conrectorship which he obtained at this time enabled them to live in modest comfort. In 1840 he obtained a notaryship also, and the same year married Juliana Ercsey, the penniless orphan daughter of an advocate. The next few happy years were devoted to his profession and a good deal of miscellaneous reading, especially of Shakespeare (he learnt English in order to compare the original with his well-thumbed German version) and Homer. Meanwhile the reactionaries of Vienna were goading the Magyar Liberals into revolt, and Arany found a safety-valve for his growing indignation by composing a satirical poem in hexameters, entitled "The Lost Constitution." The Kisfaludy Society, the great literary association of Hungary, about this time happened to advertise a prize for the best satire on current events. Arany sent in his work, and shortly afterwards was awarded the 25-gulden prize (7th of February 1846) by the society, which then advertised another prize for the best Magyar epic poem. Arany won this also with his *Toldi* (the first part of the present trilogy), and immediately found himself famous. All eyes were instantly turned towards the poor country notary, and Petöfi was the first to greet him as a brother. In February of the following year Arany was elected a member of the Kisfaludy Society. In the memorable year 1848 the people of Szalontá elected him their deputy to the Hungarian parliament. But neither now nor subsequently (1861, 1869) would he accept a parliamentary mandate. He wrote many articles, however, in the gazette *Népbarátja*, an organ of the Magyar government, and served in the field as a national guard for eight or ten weeks. In 1849 he was in the civil service of the revolutionary government, and after the final catastrophe returned to his native place, living as best he could on his small savings till 1850, when Lajos Tisza, the father of Kálmán Tisza, the future prime minister, invited him to his castle at Geszt to teach his son Domokos the art of poetry. In the following year Arany was elected professor of Hungarian literature and language at the Nagy-Körös gymnasium. He also attempted to write another epic poem, but the time was not favourable for such an undertaking. The miserable condition of his country, and his own very precarious situation, weighed heavily upon his sensitive soul, and he suffered severely both in mind and body. On the other hand reflection on past events made clear to him not only the sufferings but the defects and follies of the national heroes, and from henceforth, for the first time, we notice a bitterly humorous vein in his writings. Thus *Bolond Istók*, the first canto of which he completed in 1850, is full of sub-acrid merriment. During his nine years' residence at Nagy-Körös, Arany first seriously turned his attention to the Magyar ballad, and not only composed some of the most beautiful ballads in the language, but wrote two priceless dissertations on the technique of the ballad in general: "Something concerning assonance" (1854), and "On Hungarian National Versification" (1856).

When the Hungarian Academy opened its doors again after a ten years' cessation, Arany was elected a member (15th of December 1858). On the 15th of July 1860 he was elected director of the revived Kisfaludy Society, and went to Pest. In November, the same year, he started *Szépirodalmi Figyelö*, a monthly review better known by its later name, *Koszeru*, which did much for Magyar criticism and literature. He also edited the principal publications of the society, including its notable translation of *Shakespeare's Dramatic Works*, to which he contributed the *Midsummer Night's Dream* (1864), *Hamlet* and *King John* (1867). The same year he won the Nádasdy prize of the Academy with his poem "Death of Buda." From 1865 to 1879 he was the secretary of the Hungarian Academy.

Domestic affliction, ill-health and his official duties made these years comparatively unproductive, but he issued an edition of his collected poems in 1867, and in 1880 won the Karácsonyi prize with his translation of the *Comedies of Aristophanes* (1880). In 1879 he completed his epic trilogy by publishing *The Love of Toldi* and *Toldi's Evening*, which were received with universal enthusiasm. He died suddenly on the 24th of October 1882. The first edition of his collected works, in 8 volumes, was published in 1884–1885.

Arany reformed Hungarian literature. Hitherto classical and romantic successively, like other European literatures, he first gave it a national direction. He compelled the poetry of art to draw nearer to life and nature, extended its boundaries and made it more generally intelligible and popular. He wrote not for one class or school but for the whole nation. He introduced the popular element into literature, but at the same time elevated and ennobled it. What Petöfi had done for lyrical he did for epic poetry. Yet there were great differences between them. Petöfi was more subjective, more individual; Arany was more objective and national. As a lyric poet Petöfi naturally gave expression to present moods and feelings; as an epic poet Arany plunged into the past. He took his standpoint on tradition. His art was essentially rooted in the character of the whole nation and its glorious history. His genius was unusually rich and versatile; his artistic conscience always alert and sober. His taste was extraordinarily developed and absolutely sure. To say nothing of his other great qualities, he is certainly the most artistic of all the Magyar poets.

See *Posthumous Writings and Correspondence of Arany*, edited by László Arany (Hung.), (Budapest, 1887–1889); article "Arany," in *A Pallas Nagy Lexikona*, Köt 2 (Budapest, 1893); Mór Gaal, *Life of János Arany* (Hung.), (Budapest, 1898); L. Gyöngyösy, *János Arany's Life and Works* (Hung.), (Budapest, 1901). Translations from Arany: *The Legend of the Wondrous Hunt* (canto 6 of *Buda's Death*), by D. Butler (London, 1881); *Toldi, poème en 12 chants* (Paris, 1895); *Dichtungen* (Leipzig, 1880); *König Buda's Tod* (Leipzig, 1879); *Balladen* (Vienna, 1886). (R. N. B.)

ARAPAHO (possibly from the Pawnee for "trader"), a tribe of North American Indians of Algonquian stock. They formerly ranged over the central portion of the plains between the Platte and Arkansas. They were a brave, warlike, predatory tribe. With the Sioux and Cheyennes they waged unremitting warfare upon the Utes. The southern divisions of the tribe were placed (1867) on a reservation in the west of Indian Territory (now Oklahoma), while the northern are in western Wyoming. The southern section sold their reservations in 1892 and became American citizens. The Arapahos number in all some 2000.

See Indians, North American; H. R. Schoolcraft, *History of the Indian Tribes of the United States* (1851–1857, 6 vols.); *Handbook of American Indians*, ed. F. W. Hodge (Washington, 1907).

ARARAT (Armen. *Massis*, Turk. *Egri Dagh*, *i.e.* "Painful Mountain," Pers. *Koh-i-Nuh*, *i.e.* "Mountain of Noah,"), the name given to the culminating point of the Armenian plateau which rises to a height of 17,000 ft. above the sea. The *massif* of Ararat rises on the north and east out of the alluvial plain of the Aras, here from 2500 ft. to 3000 ft. above the sea, and on the south-west sinks into the plateau of Bayezid, about 4500 ft. It is thus isolated on all sides but the north-west, where a *col* about 6900 ft. high connects it with a long ridge of volcanic mountains. Out of the *massif* rise two peaks, "their bases confluent at a height of 8800 ft., their summits about 7 m. apart." The higher, Great Ararat, is "a huge broad-shouldered mass, more of a dome than a cone"; the lower, Little Ararat, 12,840 ft. on which the territories of the tsar, the sultan, and the shah meet, is "an elegant cone or pyramid, rising with steep, smooth, regular sides into a comparatively sharp peak" (Bryce). On the north and west the slopes of Great Ararat are covered with glittering fields of unbroken *névé*. The only true glacier is on the north-east side, at the bottom of a large chasm which runs into the heart of the mountain. The great height of the snow-line, 14,000 ft., is due to the small rainfall and the upward rush of dry air from the plain of the Araxes. The middle zone of Ararat, 5000–11,500 ft., is covered with good pasture, the upper and lower zones are for the most part sterile. Whether the tradition which makes Ararat the resting-place of Noah's Ark is of any historical value or not, there is at least poetical fitness in the hypothesis, inasmuch as this mountain is about equally distant from the Black Sea and the Caspian, from the Mediterranean and the Persian Gulf. Another tradition—accepted by the Kurds, Syrians and Nestorians—fixes on Mount Judi, in the south of Armenia, on the left bank of the Tigris, near Jezire, as the Ark's resting-place. There so-called genuine relics of the ark were exhibited, and a monastery and mosque of commemoration were built; but the monastery was destroyed by lightning in 776 A.D., and the tradition has declined in credit. Round Mount Ararat, however, gather many traditions connected with the Deluge. The garden of Eden is placed in the valley of the Araxes; Marand is the burial-place of Noah's wife; at Arghuri, a village near the great chasm, was the spot where Noah planted the first vineyard, and here were shown Noah's vine and the monastery of St James, until village and monastery were overwhelmed by a fall of rock, ice and snow, shaken down by an earthquake in 1840. According to the Babylonian account, the resting-place of the Ark was "on the Mountain of Nizir," which some writers have identified with Mount Rowanduz, and others with Mount Elburz, near Teheran.

From the Armenian plateau, Ararat rises in a graceful isolated cone far into the region of perennial snow. It was long believed by the Armenian monks that no one was permitted to reach the "secret top" of Ararat with its sacred remains, but on the 27th of September 1829, Dr. Johann Jacob Parrot (1792–1840) of Dorpat, a German in the employment of Russia, set foot on the "dome of eternal ice." Ararat has since been ascended by S. Aftonomov (1834 and 1843); M. Wagner and W. H. Abich (1845); J. Chodzko, N. W. Chanykov, P. H. Moritz and a party of Cossacks in the service of the Russian government (1850); Stuart (1856); Monteith (1856); D. W. Freshfield (1868); James Bryce (1876); A. V. Markov (1888); P. Pashtukhov and H. B. Lynch (1893). Mr Freshfield thus described the mountain:—"It stands perfectly isolated from all the other ranges, with the still more perfect cone of Little Ararat (a typical volcano) at its side. Seen thus early in the season (May), with at least 9000 ft. of snow on its slopes, from a distance and height well calculated to permit the eye to take in its true proportions, we agreed that no single mountain we know presented such a magnificent and impressive appearance as the Armenian Giant." There are a number of glaciers in the upper portion, and the climate of the whole district is very severe. The greater part of the mountain is destitute of trees, but the lower Ararat is clothed with birches. The fauna and flora are both comparatively meagre.

Both Great and Little Ararat consist entirely of volcanic rocks, chiefly andesites and pyroxene andesites, with some obsidian. No crater now exists at the summit of either, but well-formed parasitic cones occur upon their flanks. There are no certain historic records of any eruption. The earthquake and fall of rock which destroyed the village of Arghuri in 1840 may have been caused by a volcanic explosion, but the evidence is unsatisfactory.

The name of Ararat also applies to the Assyrian *Urardhu*, the country in which the Ark rested after the Deluge (Gen. viii. 4), and to which the murderers of Sennacherib fled (2 Kings xix. 37; Isaiah xxxvii. 38). The name Urardhu, originally that of a principality which included Mount Ararat and the plain of the Araxes, is given in Assyrian inscriptions from the 9th century B.C. downwards to a kingdom that at one time included the greater part of the later Armenia. The native name of the kingdom was *Biainas*, and its capital was *Dhuspas*, now Van. The first king, Sarduris I. (*c.* 833 B.C.), subdued the country of the Upper Euphrates and Tigris. His inscriptions are written in cuneiform, in Assyrian, whilst those of his successors are in cuneiform, in their own language, which is neither Aryan nor Semitic. The kings of Biainas extended their kingdom eastward and westward, and defeated the Assyrians and Hittites. But Sarduris II. was overthrown by Tiglath Pileser III. (743 B.C.), and driven north of the Araxes, where he made Armavir, *Armauria*, his capital. Interesting specimens of Biainian art have been found on the site of the palace of Rusas II., near Van. Shortly after 645 B.C. the kingdom fell, possibly conquered by Cyaxares, and a way was thus opened for the immigration of the Aryan Armenians. The name Ararat is unknown to the Armenians of the present day. The limits of the Biblical Ararat are not known, but they must have included the lofty Armenian plateau which overlooks the plain of the Araxes on the north, and that of Mesopotamia on the south. It is only natural that the highest and most striking mountain in the district should have been regarded as that upon which the Ark rested, and that the old name of the country should have been transferred to it.

See also H. B. Lynch, *Armenia* (1901); Sayce, "Cuneiform Inscriptions of Lake Van," in *Journal of Royal Asiatic Society*, vols. xiv., xx. and xxvi.; Maspero, *Histoire ancienne des peuples de l'Orient classique*, tome iii., *Les Empires* (Paris, 1899); J. Bryce, *Transcaucasia and Ararat* (4th ed., 1896); D. W. Freshfield, *Travels in the Central Caucasus and Bashan* (1869); Parrot, *Reise zum Ararat* (1834); Wagner, *Reise nach dem Ararat* (1848); Abich, *Die Besteigung des Ararat* (1849); articles "Ararat," in Hastings' *Dictionary of the Bible*, and the *Encyclopaedia Biblica*. (C. W. W.)

ARARAT, a municipal town of Ripon county, Victoria, Australia, 130 m. by rail W.N.W. of Melbourne. Pop. (1901) 3580. It lies at an elevation of 1028 ft. towards the western extremity of the Great Dividing range. It is the commercial centre of the north-western grain and wool-producing district and is also noted for its quartz and alluvial gold-mines. Excellent wine is made, and flour-milling, leather-working, brick and candle making and soap-boiling are the chief industries. The district also yields the best timber in great quantity. Granite, bluestone, limestone and slate abound in the neighbourhood.

ARAROBA POWDER, a drug occurring in the form of a yellowish-brown powder, varying considerably in tint, which derives an alternative name—Goa powder—from the Portuguese colony of Goa, where it appears to have been introduced about the year 1852. The tree which yields it is the *Andira Araroba* of the natural order Leguminosae. It is met with in great abundance in certain forests in the province of Bahia, preferring as a rule low and humid spots. The tree is from 80 to 100 ft. high and has large imparipinnate leaves, the leaflets of which are oblong, about 1½ in. long and ¾ in. broad, and somewhat truncate at the apex. The flowers are papilionaceous, of a purple colour and arranged in panicles. The Goa powder or araroba is contained in the trunk, filling crevices in the heartwood. It is a morbid product in the tree, and yields to hot chloroform 50% of a substance known officially as chrysarobin, which has a definite therapeutic value and is contained in most modern pharmacopoeias. It occurs as a micro-crystalline, odourless, tasteless powder, very slightly soluble in either water or alcohol; it also occurs in rhubarb root. This complex mixture contains pure chrysarobin ($C_{15}H_{12}O_3$), di-chrysarobin methylether ($C_{30}H_{23}O_7 \cdot OCH_3$), di-chrysarobin ($C_{30}H_{24}O_7$). Chrysarobin is a methyl trioxyanthracene and exists as a glucoside in the plant, but is gradually oxidized to chrysophanic acid (a dioxy-methyl anthraquinone) and glucose. This strikes a blood-red colour in alkaline solutions, and may therefore cause much alarm if administered to a patient whose urine is alkaline. The British pharmacopoeia has an ointment containing one part of chrysarobin and 24 of benzoated lard.

Both internally and externally the drug is a powerful irritant. The general practice amongst modern dermatologists is to use only chrysophanic acid, which may be applied externally and given by the mouth in doses of about one grain in cases of psoriasis and chronic eczema. The drug is a feeble parasiticide, and has been used locally in the treatment of ringworm. It stains the skin—and linen—a deep yellow or brown, a coloration which may be removed by caustic alkali in weak solution.

ARAS, the anc. *Araxes*, and the *Phasis* of Xenophon (Turk. and Arab. *Ras*, Armen. *Yerash*, Georg. *Rashki*), a river which rises south of Erzerum, in the Bingeul-dagh, and flows east through the province of Erzerum, across the Pasin plateau, and then through Russian Armenia, passing between Mount Ararat and Erivan, and forming the Russo-Persian frontier. Its course is about 600 m. long; its principal tributary is the Zanga, which flows by Erivan and drains Lake Gokcha or Sevanga. It is a rapid and muddy stream, dangerous to cross when swollen by the melting of the snows in Armenia, but fordable in its ordinary state. It formerly joined the Kura; but in 1897 it changed its lower course, and now runs direct to the Kizil-agach Bay of the Caspian. On an island in its bed stood Artaxata, the capital of Armenia from 180 B.C. to A.D. 50.

ARASON, JON (1484–1551), Icelandic bishop and poet, became a priest about 1504, and having attracted the notice of Gottskalk, bishop of Holar, was sent by that prelate on two missions to Norway. In 1522 he succeeded Gottskalk in the see of Holar, but he was soon driven out by the other Icelandic bishop, Ogmund of Skalholt. His exile, however, was brief, and some years after his return he became involved in a dispute with his sovereign, Christian III., king of Denmark, because he refused to further the progress of Lutheranism in the island. Then in 1548, when a large number of the islanders had accepted the reformed doctrines, Arason and Ogmund joined their forces and attacked the Lutherans. Civil war broke out, and in 1551 the bishop of Holar and two of his sons were captured and executed. Arason, who was the last Roman Catholic bishop in Iceland, is celebrated as a poet, and as the man who introduced printing into the island.

ARATOR, of Liguria, a Christian poet, who lived during the 6th century. He was an orphan, and owed his early education to Laurentius, archbishop of Milan, and Ennodius, bishop of Pavia, who took great interest in him. After completing his studies, he practised with success as an advocate, and was appointed to an influential post at the court of Athalaric, king of the Ostrogoths. About 540, he quitted the service of the state, took orders and was elected sub-deacon of the Roman Church. He gained the favour of Pope Vigilius, to whom he dedicated his *De Actibus Apostolorum* (written about 544), which was much admired in the middle ages. The poem, consisting of some 2500 hexameters, is of little merit, being full of mystical and allegorical interpretations and long-winded digressions; the versification, except for certain eccentricities in prosody, is generally correct.

Text by Hübner, 1850. See Leimbach, "Der Dichter Arator," in *Theologische Studien und Kritik* (1873); Manitius, *Geschichte der christlich-lateinischen Poesie* (1891).

ARATUS, Greek statesman, was born at Sicyon in 271 B.C., and educated at Argos after the death of his father, at the hands of Abantidas, tyrant of Sicyon. When twenty years old Aratus delivered Sicyon from its tyrant by a bold *coup de main.* By enrolling it in the Achaean League (*q.v.*) he secured it against Macedonia, and with funds received from Ptolemy Philadelphus he pacified the returned exiles. Ever anxious to extend the league, in which after 245 he was general almost every second year, Aratus took Corinth by surprise (243), and with mingled threats and persuasion won over other cities, notably Megalopolis (233) and Argos (229), whose tyrants abdicated voluntarily. He fought successfully against the Aetolians (241), and in 228 induced the Macedonian commander to evacuate Attica. But when Cleomenes III. (*q.v.*) opened hostilities, Aratus sustained several reverses, and was badly defeated near Dyme (226 or 225). Rather than admit Cleomenes as chief of the league, where he might have upset the existing timocracy, Aratus opposed all attempts at mediation. As plenipotentiary in 224 he called in Antigonus Doson of Macedonia, and helped to recover Corinth and Argos and to crush Cleomenes at Sellasia, but at the same time sacrificed the independence of the league. In 220–219 the Aetolians defeated him in Arcadia and harried the Peloponnese unchecked. When Philip V. of Macedon came to expel these marauders, Aratus became the king's adviser, and averted a treacherous attack on Messene (215); before long, however, he lost favour and in 213 was poisoned. The Sicyonians accorded him hero-worship as a "son of Asclepius." To Aratus is due the credit of having made the Achaean League an effective instrument against tyrants and foreign enemies. But his military incapacity and his blind hatred of democratic reform went far to undo his work.

Polybius (ii.-viii.) follows the *Memoirs* which Aratus wrote to justify his statesmanship,—Plutarch (*Aratus* and *Cleomenes*) used this same source and the hostile account of Phylarchus; Paus. ii. 10; see Neumeyer, *Aratos von Sikyon* (Leipzig, 1886).

(M. O. B. C.)

ARATUS, of Soli in Cilicia, Greek didactic poet, a contemporary of Callimachus and Theocritus, was born about 315 B.C. He was invited (about 276) to the court of Antigonus Gonatas of Macedonia, where he wrote his most famous poem, Φαινόμενα (Appearances, or Phenomena). He then spent some time with Antiochus I. of Syria; but subsequently returned to Macedonia, where he died about 245. Aratus's only extant works are two short poems, or two fragments of his one poem, written in hexameters; an imitation of a prose work on astronomy by Eudoxus of Cnidus, and Διοσημεῖα (on weather signs), chiefly from Theophrastus. The work has all the characteristics of the Alexandrian school of poetry. Although Aratus was ignorant of astronomy, his poem attracted the favourable notice of distinguished specialists, such as Hipparchus, who wrote commentaries upon it. Amongst the Romans it enjoyed a high reputation (Ovid, *Amores*, i. 15, 16). Cicero, Caesar Germanicus and Avienus translated it; the two last versions and fragments of Cicero's are still extant. Quintilian (*Instit.* x. 1, 55) is less enthusiastic. Virgil has imitated the *Prognostica* to some extent in the *Georgics*. One verse from the opening invocation to Zeus has become famous from being quoted by St Paul (Acts xvii. 28). Several accounts of his life are extant, by anonymous Greek writers.

Editio princeps, 1499; Buhle, 1793; Maass, 1893; *Aratea* (1892), *Commentariorum in Aratum Reliquiae* (1898), by the same. English translations: Lamb, 1848; Poste, 1880; R. Brown, 1885; Prince, 1895. On recently discovered fragments, see H. I. Bell, in *Classical Quarterly*, April 1907; also *Berliner Klassikertexte*, Heft v. 1, pp. 47-54.

ARAUCANIA, the name of a large territory of Chile, South America, S. of the Bio-bio river, belonging to the Araucanian Indians (see below) at the time of their independence of Spanish and Chilean authority. The loss of their political independence has been followed by that of the greater part of their territory, which has been divided up into the Chilean provinces of Arauco, Bio-bio, Malleco and Cautin, and the Indians, much reduced in number, now live in the wooded recesses of the three provinces last named.

ARAUCANIANS (or AUCA), a tribal group of South American Indians in southern Chile (see above). Physically a fine race, their hardiness and bravery enabled them successfully to resist the Incas in the 15th century. Their government was by four *toquis* or princes, independent of one another, but confederates against foreign enemies. Each tetrarchy was divided into five provinces, ruled by five chiefs called *apo-ulmen*; and each province into nine districts, governed by as many *ulmen*, who were subject to the apo-ulmen, as the latter were to the toquis. These various chiefs (who all bore the title of ulmen) composed the aristocracy of the country. They held their dignities by hereditary descent in the male line, and in the order of primogeniture. The supreme power of each tetrarchy resided in a council of the ulmen, who assembled annually in a large plain. The resolutions of this council were subject to popular assent. The chiefs, indeed, were little more than leaders in war; for the right of private revenge limited their authority in judicial matters; and they received no taxes. Their laws were merely traditional customs. War was declared by the council, messengers bearing arrows dipped in blood being sent to all parts of the country to summon the men to arms. From the time of the first Spanish invasion (1535) the Araucanians made a vigorous resistance, and after worsting the best soldiers and the best generals of Spain for two centuries obtained an acknowledgment of their independence. Their success was due as much to their readiness in adopting their enemy's methods of warfare as to their bravery. Realizing the inefficiency of their old missiles when opposed to musket balls, they laid aside their bows, and armed themselves with spears, swords or other weapons fitted for close combat. Their practice was to advance rapidly within such a distance of the Spaniards as would not leave the latter time to reload after firing. Here they received without shrinking a volley, which was certain to destroy a number of them, and then rushing forward in close order, fought their enemies hand to hand.

The Araucanians believe in a supreme being, and in many subordinate spirits, good and bad. They believe also in omens and divination, but they have neither temples nor idols, nor religious rites. Very few have become Roman Catholics. They believe in a future state, and have a confused tradition respecting a deluge, from which some persons were saved on a high mountain. They divide the year into twelve months of thirty days, and add five days by intercalation. They esteem poetry and eloquence, but can scarcely be induced to learn reading or writing.

The tribal divisions have little or no organization. Some 50,000 in number, they spend a nomad existence wandering from pasture to pasture, living in low skin tents, their herds providing their food. They still preserve their warlike nature, though in 1870 they formally recognized Chilean rule. In 1861 Antoine de Tounens (1820–1878), a French adventurer in Chile, proclaimed himself king of Araucania under the title of Orélie Antoine I., and tried to obtain subscriptions from France to support his enterprise. But his pretensions were ludicrous; he was quickly captured by the Chileans and sent back to France (1862) as a madman; and though he made one more abortive effort in 1874 to recover his “ kingdom,” and occupied his pen in magnifying his achievements, nobody took him seriously except a few of the deluded Indians.

See Domeyko, *Araucania y sus habitantes* (Santiago, 1846); de Ginoux, “ Le Chili et les Araucans,” in *Bull. de la soc. de géogr.* (1852); E. R. Smith, *Araucanians* (New York, 1855); J. T. Medina, *Los aborjenes de Chile* (Santiago, 1882); A. Polakowsky, *Die heutigen Araukanen*, Globus No. 74 (Brunswick, 1898).

ARAUCARIA, a genus of coniferous trees included in the tribe *Araucarineae.* They are magnificent evergreen trees, with apparently whorled branches, and stiff, flattened, pointed leaves, found in Brazil and Chile, Polynesia and Australia. The name of the genus is derived from Arauco, the name of the district in southern Chile where the trees were first discovered. *Araucaria imbricata*, the Chile pine, or “ monkey puzzle,” was introduced into Britain in 1796. It is largely cultivated, and usually stands the winter of Britain; but in some years, when the temperature fell very low, the trees have suffered much. Care should be taken in planting to select a spot somewhat elevated and well drained. The tree grows to the height of 150 ft. in the Cordilleras of Chile. The cones are from 8 to $8\frac{1}{2}$ in. broad, and 7 to $7\frac{1}{2}$ in. long. The wood of the tree is hard and durable. This is the only species which can be cultivated in the open air in Britain. *Araucaria brasiliana*, the Brazil pine, is a native of the mountains of southern Brazil, and was introduced into Britain in 1819. It is not so hardy as *A. imbricata*, and requires protection during winter. It is grown in conservatories for half-hardy plants. *Araucaria excelsa*, the Norfolk Island pine, a native of Norfolk Island and New Caledonia, was discovered during Captain Cook’s second voyage, and introduced into Britain by Sir Joseph Banks in 1793. It cannot be grown in the open air in Britain, as it requires protection from frost, and is more tender than the Brazilian pine. It is a majestic tree, sometimes attaining a height of more than 220 ft. The scales of its cones are winged, and have a hook at the apex. *Araucaria Cunninghami*, the Moreton Bay pine, is a tall tree abundant on the shores of Moreton Bay, Australia, and found through the littoral region of Queensland to Cape York Peninsula, also in New Guinea. It requires protection in England during the winter. *Araucaria Bidwilli*, the Bunya-Bunya pine, found on the mountains of southern Queensland, between the rivers Brisbane and Burnett, at 27° S. lat., is a noble tree, attaining a height of 100 to 150 ft., with a straight trunk and white wood. It bears cones as large as a man’s head. Its seeds are very large, and are used as food by the natives. *Araucaria Rulei*, which is a tree of New Caledonia, attains a height of 50 or 60 ft. *Araucaria Cookii*, also a native of New Caledonia, attains a height of 150 ft. It is found also in the Isle of Pines, and in the New Hebrides. The tree has a remarkable appearance, due to shedding its primary branches for about five-sixths of its height and replacing them by a small bushy growth, the whole resembling a tall column crowned with foliage, suggesting to its discoverer, Captain Cook, a tall column of basalt.

ARAUCO, a coast province of southern Chile, bounded N., E. and S. by the provinces of Concepción, Bio-bio, Malleco and Cautin. Area, 2458 sq. m.; pop. (est. 1902) 70,635. The province originally covered the once independent Indian territory of Araucania (*q.v.*), but this was afterwards divided into four provinces. It is devoted largely to agricultural pursuits. The capital Lebú (pop. in 1902, 3178) is situated on the coast about 55 m. south of Concepción, with which it is connected by rail.

ARAVALLI HILLS, a range of mountains in India, running for 300 m. in a north-easterly direction, through the Rajputana states and the British district of Ajmere-Merwara, situated between 24° and 27° 10′ N. lat., and between 72° and 75° E. long. They consist of a series of ridges and peaks, with a breadth varying from 6 to 60 m. and an elevation of 1000 to 3000 ft., the highest point being Mount Abu, rising to 5653 ft., near the south-western extremity of the range. Geologically they belong to the primitive formation—granite, compact dark blue slate, gneiss and syenite. The dazzling white effect of their peaks is produced, not by snow, as among the Himalayas, but by enormous masses of vitreous rose-coloured quartz. On the north their drainage forms the Luni and Sakhi rivers, which fall into the Gulf of Cutch. To the south, their drainage supplies two distinct river systems, one of which debouches in comparatively small streams on the Gulf of Cambay, while the other unites to form the Chambal river, a great southern tributary of the Jumna, flowing thence via the Ganges, into the Bay of Bengal on the other side of India. The Aravalli hills are for the most part bare of cultivation, and even of jungle. Many of them are mere heaps of sand and stone; others consist of huge masses of quartz. The valleys between the ridges are generally sandy deserts, with an occasional oasis of cultivation. At long intervals, however, a fertile tract marks some great natural line of drainage, and among such valleys Ajmere city, with its lake, stands conspicuous. The hills are inhabited by a very sparse population of Mhairs, an aboriginal race. For long these people formed a difficult problem to the British government. Previously to the British occupation of India they had been accustomed to live, almost destitute of clothing, by the produce of their herds, by the chase and by plunder. But Ajmere having been ceded to the East India Company in 1818, the Mhair country was soon afterwards brought under British influence, and the predatory instincts of the people were at the same time controlled and utilized by forming them into a Merwara battalion. As the peaceful results of British rule developed, and the old feuds between the Mhairs and their Rajput neighbours died out, the Mhair battalion was transformed into a police force. The Aravalli mountaineers strongly objected to this change, and pleaded a long period of loyal usefulness to the state. They were accordingly again erected into a military battalion and brought upon the roll of the British army. Under Lord Kitchener’s scheme of 1903 they were entitled the 50th Merwara Infantry. The Aravalli hills send off rocky ridges in a north-easterly direction through the states of Alwar and Jaipur, which from time to time reappear in the form of isolated hills and broken rocky elevations to near Delhi.

ARAWAK (“ meal-eaters,” in reference to cassava, their staple food), a tribe of South American Indians of Dutch and British Guiana. The Arawaks have given their name to a linguistic stock of South America, the Arawakan, which includes many once powerful tribes. The Arawakans were once numerous, their tribes stretching from southern Brazil and Bolivia to Central America, occupying the whole of the West Indies and having settlements on the Florida seaboard. They were found by the Spaniards in Haiti and possibly in the Bahamas, but the Caribs had expelled them from most of the islands. The Arawaks proper were physically an undersized, weakly people, peaceable agriculturists, by far the most civilized of all Guiana peoples, being skilful weavers and workers in stone and gold. The chief tribes which may be called Arawakan are the Anti, Arawak, Barre, Goajiro, Guana, Manaos, Maneteneri, Maipuri, Maranho, Moxo, Passé, Piro and Taruma.

See Everard F. im Thurn, *Among the Indians of Guiana* (London, 1883).

ARBACES, according to Ctesias (Diodor. ii. 24 ff. 32), one of the generals of Sardanapalus, king of Assyria and founder of the Median empire about 830 B.C. But Ctesias’s whole history of the Assyrian and Median empires is absolutely fabulous; his Arbaces and his successors are not historical personages. From the inscriptions of Sargon of Assyria we know one “ Arbaku Dynast of Arnashia ” as one of forty-five chiefs of Median districts who paid tribute to Sargon in 713 B.C. See MEDIA. (ED. M.)

ARBE (Serbo-Croatian *Rab*), an island in the Adriatic Sea, forming the northernmost point of Dalmatia, Austria. Pop. (1900) 4441. Arbe is 13 m. long; its greatest breadth is 5 m. The capital, which bears the same name, is a walled town, remarkable, even among the Dalmatian cities, for its beauty. It occupies a steep ridge jutting out from the west coast. At the seaward end of this promontory is the 13th-century cathedral; behind which the belfries of four churches, at least as ancient, rise in a row along the crest of the ridge; while behind these, again, are the castle and a background of desolate hills. Many of the houses are roofless and untenanted;

for, after five centuries of prosperity under Venetian or Hungarian rule, an outbreak of plague in 1456 swept away the majority of the townsfolk, and ruined the survivors. Some of the old palaces are, nevertheless, of considerable interest; one especially as the birthplace of the celebrated philosopher, Marc Antonio de Dominis. Fishing and agriculture constitute the chief resources of the islanders, whose ancient silk industry is still maintained. In 1018 the yearly tribute due to Venice was fixed at ten pounds of silk or five pounds of gold.

ARBELA (Arbaʿil, *i.e.* "Four-god-city"), an ancient town in Adiabene, the capital in Assyrian and pre-Assyrian times of the country between the greater and lesser Zab, and seat of an important cult of Ishtar. The battle in which Alexander overthrew Darius in 331 B.C., though named in the old books after Arbela, was probably fought at Gaugamela, some 60 m. away (Yorck von Wartenburg, *Kurze Übersicht der Feldzüge A. des Gr.*). The modern town of Erbil or Arbil, in the vilayet of Mosul, is about 40 m. from Mosul on the road to Bagdad. The greater part of the town, which seems at one time to have been very large, is situated on an artificial mound about 150 ft. high. It became the seat of the Ayyūbite sultan Saladin in 1184; was bequeathed in 1233 to the caliphs of Bagdad; was plundered by the Mongols in 1236 and in 1393 by Timur, and was taken in 1732 by the Persians under Nadir Shah. In the 14th century the Christians were almost exterminated. The population, which varies from 2000 to 6000, is chiefly composed of Kurds.

The ruins of another Arbela (Irbid, Beth-Arbel) in Palestine, situated near the west shore of the Sea of Galilee, a little north of its centre, are not in themselves of high interest, but the site is noteworthy through its connexion with the neighbouring caves in the lofty flank of the Wadi Hamam, above which Arbela stood. These caves (called by the Arabs Kulat ibn Maʿan) are apparently natural, but were enlarged and fortified. They were used by the inhabitants of Arbela as a place of refuge from the army of Bacchides, general of Demetrius III., king of Syria, and were the resort of bandits in the reign of Herod the Great. He laid siege to them, and his men could only gain access to the caves by being let down from above. The caves were also fortified against the Romans by Josephus.

ARBER, EDWARD (1836–), English man of letters, was born in London on the 4th of December 1836. From 1854 to 1878 he was a clerk in the admiralty; from 1878 to 1881 lecturer on English, under Prof. H. Morley, at University College; and from 1881 to 1894 professor of English at Mason College, Birmingham. From 1894 he lived in London as emeritus professor, being also a fellow of King's College. In 1905 he received the honorary degree of D. Litt. at Oxford. He married in 1869, and had two sons, one of them, E. A. N. Arber, becoming demonstrator in palaeobotany at Cambridge. As a scholarly editor Professor Arber's services to English literature are memorable. His name is associated particularly with the series of "English Reprints" (1868–1880), by which an accurate text of the works of many English authors, formerly only accessible in rare or expensive editions, was placed within reach of the general public. Among the thirty volumes of the series were Gosson's *School of Abuse*, Ascham's *Toxophilus*, *Tottel's Miscellany*, Naunton's *Fragmenta Regalia*, &c. It was followed by the "English Scholar's Library" (16 vols.) which included the *Works* (1884) of Captain John Smith, governor of Virginia, and the *Poems* (1882) of Richard Barnfield. In his *English Garner* (8 vols. 1877–1896) he made an admirable collection of rare old tracts and poems; in 1899–1901 he issued *British Anthologies* (10 vols.), and in 1907 began a series called *A Christian Library*. He also accomplished single-handed the editing of two vast, and invaluable, English bibliographies: *A Transcript of the Registers of the Stationers' Company, 1553–1640* (1875–1894), and *The Term Catalogues, 1668–1709; with a number for Easter Term 1711* (1904–1906), edited from the quarterly lists of the booksellers.

ARBITRAGE, the term applied to the system of equalizing prices in different commercial centres by buying in the cheaper market and selling in the dearer. These transactions, or their converse, are mainly confined to stocks and shares, foreign exchanges and bullion; and are for the most part carried on between London and other European capitals and largely with New York. When prices in London are affected by financial or political causes, all other markets are sooner or later influenced, as London is the banking and financial centre for the commerce of the world. It may, however, also occur that some local event of importance initiates a rise or fall in a particular market which must ultimately affect other countries. For instance, a crisis in France would immediately depress all French securities, and by exciting the fears of capitalists would stimulate transfers of funds and raise all the exchanges against France.

In ordinary times those engaged in arbitrage operate with a very small margin of profit. The great improvement in postal, telegraphic and telephonic communication enables operators to close transactions with amazing rapidity, while competition reduces the margin of profit to a minimum. Operations in American stocks and shares are carried on between London and New York on a vast scale, while transactions in African mining shares are undertaken to a considerable extent between London and Paris. The frequent fluctuations in the prices of the latter securities offer a large and fruitful field to bold operators possessed of large resources, while those who have small means often succumb in a commercial crisis. As regards foreign exchange and bullion, arbitrage operators stand on a fairly safe foundation, the fluctuations being slight and involving little or no risk, although they yield a very small margin of profit. Arbitrage operations are for these reasons resorted to frequently by one country in supplying the requirements of another. The slightest advantage in any market is put to profit, and as the margin in ordinary exchange transactions is minute, the ability to operate in this cross fashion renders business possible, which would otherwise be impracticable. To give concrete instances of the working of arbitrage the following may be cited:—

On the 21st of May 1906 the exchange on London in Vienna was telegraphed from that city 24 kronen $4\frac{3}{4}$ cents; London, requiring to purchase remittances, found that Antwerp had some Vienna to sell, and arranged to buy there. The transactions worked out as follows:—The direct exchange in Antwerp on London being $25{\cdot}25\frac{1}{2}$, and Antwerp's selling price of Vienna being 105 francs for 100 kronen, on dividing $25{\cdot}25\frac{1}{2}$ by 105 an exchange of $24{\cdot}05\frac{1}{4}$ was obtained or $\frac{1}{2}$ cent cheaper than the direct exchange between Vienna and London.

Again a portion of the proceeds of the Russian loan of 1906 had to be remitted to Berlin from Paris. Having exhausted local balances in Berlin, Paris on one side, and Berlin on the other, sought to prevent gold shipments from Berlin, and thus cause stringency in that money market. On the 21st of May 1906 Berlin was therefore seeking to sell Paris in London at 81·35 marks for 100 francs, and draw on London for the proceeds at 20·50. This transaction produced a parity between the exchanges of 25·20, which left a small margin in London.

Two instances of arbitrage of stocks are the following:—On the 24th of March 1906, Japanese exchequer bonds, series 2 and 3, were bought in Tokio at $93\frac{1}{4}$ and were paid for by telegraphic transfer at $24\frac{3}{8}$ pence per yen, and were sold in London the same day at 94 for payment on arrival of bonds. It took five weeks for the transmission of the bonds to London, where they were dealt in on the fixed basis of exchange, namely $24\frac{1}{2}$ pence per yen. The London price works out thus:

$$\frac{93{\cdot}25 \times 24{\cdot}375}{24{\cdot}50} = 92{\cdot}77,$$

to which must be added the loss of interest, as the firm in London paid cash on the 24th of March for the telegraphic transfer, and did not recover payment until the arrival of the bonds from Tokio five weeks later. The following is a computation of the transaction:—

London price	92·77
Five weeks at 5 %	·45
English stamp $\frac{1}{2}$ % on nominal amount	·50
Insurance $\frac{1}{8}$ %	·12
	93·84

This sum represents the net cost to the arbitrage house in London, and the money paid on the 28th of April left a profit of about $\frac{3}{16}$ %. The bonds being "to bearer" insurance was necessary for the safety in this, as in all similar transactions.

In the next example, however, this expense was unnecessary, the bonds being "inscribed." On the 21st of May 1906 American Steel common shares were sold for cash in New York at 41$\frac{3}{16}$ dollars per share, and were bought in London at 42$\frac{7}{32}$ for the account day, May 31st. These figures are explained by the fact that transactions in the United States stocks and shares are on the fixed basis of five dollars per pound sterling, while as regards payments in New York the exchange varies daily. Railway shares are generally 100 dollars each. In the London market, however, five shares of 100 dollars would be £100 nominal. These shares, therefore, cost in London, at the purchase price of 42$\frac{7}{32}$, £42: 4: 5. The money realized in New York for five shares at 41$\frac{3}{16}$ was 205·93 dollars. A cheque on London was bought at 4 dollars 85$\frac{1}{4}$ cents, realizing £42 :8 :9. It should be noted that the shares in these cases are generally lent by the New York correspondent, thus saving loss of interest. The resulting profit in this particular instance was 4s. 4d. for each five shares, divided between the London and New York arbitrage firms. Arbitrage operations with distant countries such as India are large and mainly profitable. Arbitrage with India consists chiefly in buying bills of exchange in London, such as India Council rupee bills amounting to about 16 millions sterling annually, and commercial bills drawn against goods exported to India. The counter-operation consists in purchasing in India, for short or long delivery, sterling bills drawn against exports to Great Britain of Indian produce, such as cotton, tea, indigo, jute and wheat. These operations greatly facilitate trade and the moving of produce from the interior of India to the seaports. Without this assistance Great Britain's enormous trade could not be carried on, and she would have to revert to the primitive system of barter. The same advantages are afforded to her vast trade with China and Japan, with the material difference that the supply of government council bills is confined to the Indian trade. The balance of trade with all countries is generally settled by specie shipments; hence, with the Far East, silver and gold play an important part in arbitrage.

It will thus be seen that arbitrage fills a useful place in commerce; the profits are small because the competition is great; nevertheless huge transactions employing thousands of clerks result from this system.

The literature of the subject is extremely meagre. Lord Goschen's *Theory of Foreign Exchanges* (London, 1866) is general and theoretical, but throws great light upon particular aspects of the philosophy of arbitrage, without touching specially on the details of the subject itself. The principal other works are: Kelly's *Cambist* (1811, 1835); Otto Swoboda, *Die kaufmännische Arbitrage* (Berlin, 1873), and *Börse und Actien* (Cologne, 1869); Coquelin et Guillaumin, *Dictionnaire de l'économie politique* (Paris, 1851–1853); Ottomar Haupt, *London Arbitrageur* (London, 1870); Charles le Touzé, *Traité théorique et pratique du change* (Paris, 1868); Tate, *Modern Cambist* (London, 1868); Simon Spitzer, *Ueber Münz- und Arbitragenrechnung* (Vienna, 1872); J. W. Gilbart, *Principles and Practice of Banking* (London, 1871); G. Clare, *The A B C of Foreign Exchanges* (2nd ed., 1895); *Money Market Primer and Key to the Exchanges* (2nd ed., 1900); J. Pallain, *Les Changes étrangers et les prix* (Paris, 1905). (Sw.)

ARBITRATION (Lat. *arbitrari*, to examine or judge), a term derived from the nomenclature of Roman law, and applied to an arrangement for taking, and abiding by, the judgment of a selected person in some disputed matter, instead of carrying it to the established courts of justice. In disputes between states, arbitration has long played an important part (see ARBITRATION, INTERNATIONAL). The present article is restricted to arbitration under municipal law; but a separate article is also devoted to the use of arbitration in labour disputes (see ARBITRATION AND CONCILIATION).

Roman Law.—Arrangements for avoiding the delay and expense of litigation, and referring a dispute to friends or neutral persons, are a natural practice, of which traces may be found in any state of society; but it is from Roman Law that we derive arbitration as a system which has found its way into the practice of European nations in general, and has even evaded the dislike of the English common lawyers to the civil law. The praetor, who had the arrangement of all trials or private suits and the formal appointment of judges for them, referred the great majority of such cases for decision to a judge who was styled usually *judex* but sometimes *arbiter*. The phrase *judex arbiterve* frequently occurs. The *judex* and the *arbiter* had the same functions, and apparently the only express basis for the distinction between the two words is that there might be several *arbitri* but never more than one *judex* in a cause. The term *arbiter* seems, however, to have been sometimes used when the referee had a certain degree of latitude, and was entitled to give weight to equitable considerations (Roby, *Inst. Rom. Law*, i. 318; Hunter, *Roman Law* (1897), p. 48; and see Cicero *pro Rosc. Com.* 4, ss. 10-13; Gaius, *Inst.* iv. s. 163). Apart from this system of compulsory reference by the praetor, Roman law recognized a voluntary reference (*compromissum*) to an *arbiter* or arbitrator by the parties themselves. The arbitrator *ex compromisso sumptus* had no coercive jurisdiction, and in order to make his award effective, the agreement of reference was confirmed by a stipulation and usually provided a penalty (*poena, pecunia compromissa*) in case of disobedience. The sum agreed on by way of penalty might be either specific or unliquidated, *e.g.* "whatever the matter may be worth" (*Dig.* iv., tit. 8, s. 28). The arbitrator *ex compromisso sumptus*, like the judicial *arbiter*, was expected to take account of equitable considerations in coming to a decision. If three arbitrators were appointed, a majority could decide; in case of two being appointed and not agreeing, the praetor would compel them to choose a third (Roby, *ubi sup.*, i. 320, 321; *Dig.* iv., tit. 8, s. 17). As in English law, it was necessary that the award should cover all the points submitted (*Dig.* iv., tit. 8, s. 21).

Law of England.—The law of England as to arbitration is now practically summed up in the Arbitration Act of 1889. This statute is an express code as to proceedings in all arbitration, but "criminal proceedings by the crown" cannot be referred under it (ss. 13, 14). The statute subdivides its subject-matter into two headings. I. References by consent out of court; II. References under order of court.

References by consent out of court.

(1) Here the first matter to be dealt with is the submission. A submission is defined as a written agreement (it need not be signed by both parties) to submit present or future differences to arbitration, whether a particular arbitrator is named in it or not. The capacity of a person to agree to arbitration, or to act as arbitrator, depends on the general law of contract. A submission by an infant is not void, but is voidable at his option (see INFANT). A counsel has a general authority to deal with the conduct of an action, which includes authority to refer it to arbitration, but he has no authority to refer an action against the wishes of his client, or on terms different from those which his client has sanctioned; and if he does so, the reference may be set aside, although the limit put by the client on his counsel's authority is not made known to the other side when the reference is agreed upon (*Neale* v. *Gordon Lennox*, 1902, A.C. 465). The committee of a lunatic, with the sanction of the judge in lunacy, may refer disputes to arbitration. As an arbitrator is chosen by the parties themselves the question of his eligibility is of comparatively minor importance; and where an arbitrator has been chosen by both parties, the courts are reluctant to set the appointment aside. This question has arisen chiefly in contracts for works, which frequently contain a provision that the engineer shall be the arbitrator, in any dispute between the contractor and his own employer. The practical result is to make the engineer judge in his own cause. But the courts will not in such cases prevent the engineer from acting, where the contractor was aware of the facts when he signed the contract, and there is no reason to believe that the engineer will be unfair (*Ives and Barker* v. *Willans*, 1894, 2 Ch. 478). Even the fact that he has expressed an opinion on matters in dispute will not of itself disqualify him (*Halliday* v. *Hamilton's Trustees*, 1903, 5 Fraser, 800). So, too, where a barrister was appointed arbitrator, the

court refused to stop the arbitration on the mere ground that he was the client of a firm of solicitors, the conduct of one of whom was in question (*Bright* v. *River Plate Construction Co.*, 1900, 2 Ch. 835).

Under the law prior to the act of 1889 (*a*) an agreement to refer disputes generally, without naming the arbitrators, was always irrevocable, and an action lay for the breach of it, although the court could not compel either of the parties to proceed under it; (*b*) an agreement to refer to a particular arbitrator was revocable, and if one of the parties revoked that particular arbitrator's authority he could not be compelled to submit to it; (*c*) when, however, the parties had got their tribunal fixed, and were proceeding to carry out the agreement to refer, the act 9 and 10 Will. III. c. 15 provided that the submission might be made a rule of court, a provision which gave the court power to assist the parties in the trial of the case, and to enforce the award of the arbitrators; (*d*) the statute 3 and 4 Will. IV. c. 42 (s. 39) put an end to the power to revoke the authority of a particular arbitrator after the reference to him had been made a rule of court; and—a liability which existed also under the act of 9 and 10 Will. III. c. 15—any person revoking the appointment of an arbitrator after the submission had been made a rule of court might be attached. The Arbitration Act 1889 provides that a submission, unless a contrary intention is expressed in it, is irrevocable except by leave of the court or a judge, and is to have the same effect in all respects as if it had been made an order of court. The object of this enactment was to save the expense of making a submission a rule of court by treating it as having been so made, and it leaves the law in this position, that while the authority of an arbitrator, once appointed, is irrevocable, there is no power—any more than there was under the old law—to compel an unwilling party to proceed to a reference, except in cases specially provided for by sections 5 and 6 of the act of 1889. The former of these sections deals with the power of the court, the latter with the power of the parties to a reference, to appoint an arbitrator in certain circumstances. Section 5 provides that where a reference is to be to a single arbitrator, and all the parties do not concur in appointing one, or an appointed arbitrator refuses to act or becomes incapable of acting, or where the parties or two arbitrators fail, when necessary, to appoint an umpire or third arbitrator, or such umpire or arbitrator when appointed refuses to act, or becomes incapable of acting, and the default is not rectified after seven clear days' notice, the court may supply the vacancy. Under section 6, where a reference is to two arbitrators, one to be appointed by each party, and either the appointed arbitrator refuses to act, or becomes incapable of acting, and the party appointing him fails, after seven clear days' notice, to supply the vacancy, or such party fails, after similar notice, to make an original appointment, a binding appointment (subject to the power of the court to set it aside) may be made by the other party to the reference. The court may compel parties to carry out an arbitration, not only in the above cases by directly appointing an arbitrator, &c., or by allowing one appointed by a party to proceed alone with the reference, but also indirectly by staying any proceedings before the legal tribunals to determine matters which come within the scope of the arbitration. Where the agreement to refer stipulates that the submission of a dispute to arbitration shall be a condition precedent to the right to bring an action in regard to it, an action does not lie until the arbitration has been held and an award made, and it is usual in such cases not to apply for a stay of proceedings, but to plead the agreement as a bar to the action (*Viney* v. *Bignold*, 1887, 20 Q.B.D. 172). The court will refuse to stay proceedings where the subject-matter of the litigation falls outside the scope of the reference, or there is some serious objection to the fitness of the arbitrator, or some other good reason of the kind exists.

An arbitrator is not liable to be sued for want of skill or for negligence in conducting the arbitration (*Pappa* v. *Rose*, 1872, L.R. 7 C.P. 525). When a building contract provides that a certificate of the architect, showing the final balance due to the contractor, shall be conclusive evidence of the works having been duly completed, the architect occupies the position of an arbitrator, and enjoys the same immunity from liability for negligence in the discharge of his functions (*Chambers* v. *Goldthorpe*, 1901, 1 Q.B. 624). An arbitrator cannot be compelled to act unless he is a party to the submission.

An arbitrator (and the following observations apply *mutatis mutandis* to an umpire after he has entered on his duties) has power to administer oaths to, or take the affirmations of, the parties and their witnesses; and any person who wilfully and corruptly gives false evidence before him may be prosecuted and punished for perjury (Arbitration Act 1889, sched. i. and s. 22). At any stage in the reference he may, and shall if he be required by the court, state in the form of a special case for the opinion of the court any question of law arising in the arbitration. The arbitrator may also state his award in whole or in part as a special case (*ib.* s. 19), and may correct in an award any clerical mistake or error arising from an accidental slip or omission. The costs of the reference and the award—which, under sched. i. of the act, must be in writing, unless the submission otherwise provides—are in the arbitrator's discretion, and he has a lien on the award and the submission for his fees, for which—if there is an express or implied promise to pay them—he can also sue (*Crampton* v. *Ridley*, 1887, 20 Q.B.D. 48). An arbitrator or umpire ought not, however, to state his award in such a way as to deprive the parties of their right to challenge the amount charged by him for his services; and accordingly where an umpire fixed for his award a lump sum as costs, including therein his own and the arbitrators' fees, the award was remitted back to him to state how much he allotted to himself and how much to the arbitrators (in *Re Gilbert* v. *Wright*, 1904, 20 *Times* L.R. 164). But in the absence of evidence to show that the fees charged by arbitrators or umpire are extortionate, or unfair and unreasonable, the courts will not interfere with them (*Llandrindod Wells Water Co.* v. *Hawksley*, 1904, 20 *Times* L.R. 241).

If there is no express provision on the point in the submission, an award under the Arbitration Act 1889 must be made within three months after the arbitrator has entered on the reference, or been called upon to act by notice in writing from any party to the submission. The time may, however, be extended by the arbitrator or by the court. An umpire is required to make his award within one month after the original or extended time appointed for making the award of the arbitrators has expired, or any later day to which he may enlarge it. The court may by order remit an award to the arbitrators or umpire for reconsideration, in which case the reconsidered award must be made within three months after the date of the order.

An award must be *intra vires*: it must dispose of all the points referred; and it must be final, except as regards certain matters of valuation, &c. (see in *Re Stringer and Riley Brothers*, 1901, 1 K.B. 105). An award may, however, be set aside where the arbitrator has misconducted himself (an arbitrator may also be removed by the court on the ground of misconduct), or where it is *ultra vires*, or lacks any of the other requisites—above mentioned—of a valid award, or where the arbitrator has been wilfully deceived by one of the parties, or some such state of things exists. An award may, by leave of the court, be enforced in the same manner as a judgment or decree to the same effect. Under the Revenue Act 1906, s. 9, a uniform duty of ten shillings is payable on awards in England or Ireland, and on decreets arbitral in Scotland.

Provisions for the arbitration of special classes of disputes are contained in many acts of parliament, *e.g.* the Local Government Acts 1888, 1894, the Agricultural Holdings (England) Acts 1883 to 1906, the Small Holdings and Allotments Act 1907, the Light Railways Act 1896, the Housing of the Working Classes Act 1890, the Workmen's Compensation Act 1906, &c.

The Conciliation Act 1896 provides machinery for the prevention and settlement of trade disputes, and in 1892 a chamber of arbitration for business disputes was established by the joint action of the corporation of the city of London and the London chamber of commerce. At the time when the London chamber of arbitration was established, there was considerable dissatisfaction among the mercantile community with the delays that occurred in the disposal of commercial cases before the ordinary tribunals. But the special provision made by the judges in 1895 for the prompt trial of commercial causes to a large extent destroyed the *raison d'être* of the chamber of arbitration, and it did not attain any great measure of success.

References under order of court.

(2) The court or a judge may refer any question arising in any cause or matter to an official or special referee, whose report may be enforced like a judgment or order to the same effect. This power may be exercised whether the parties desire it or not. The official referees are salaried officers of court. The remuneration of special referees is determined by the court or judge. An entire action may be referred, if all parties consent, or if it involves any prolonged examination of documents, or scientific or local examination, or consists wholly or partly of matters of account.

Scots Law.—The Arbitration (Scotland) Act 1894, unlike the English Arbitration Act 1889, did not codify the previously existing law, and it becomes necessary, therefore, to deal with that law in some detail. It differs in important particulars from the law of England. Although (as in England apart from the Arbitration Act 1889) there is nothing to prevent a verbal reference, submissions are generally not merely written but are effected by deed. The deed of submission first defines the terms of the reference, the name or names of the arbiters or arbitrators, and the "oversman" or umpire, whose decision in the event of the arbiters differing in opinion is to be final. Formerly, where no oversman was named in the submission, and no power given to the arbiters to name one, the proceedings were abortive if the arbiters disagreed, unless the parties consented to a nomination. But under the Arbitration (Scotland) Act 1894, s. 4, where arbiters differ in opinion, they, or, if they fail to agree on the point, the court, on the application of either party, may nominate an oversman whose decision is to be final. The deed of submission next gives to the arbiters the necessary powers for disposing of the matters referred (*e.g.* powers to summon witnesses, to administer oaths and to award expenses), and specifies the time within which the "decreet arbitral" is to be pronounced. If this date is left blank, practice has limited the arbiter's power of deciding to a year and a day, unless, having express or clearly implied power in the submission, he exercises this power, or the parties expressly or tacitly agree to its prorogation. The deed of submission then goes on to provide that the parties bind themselves, under a stipulated penalty to abide by the decreet arbitral, that, in the event of the death of either of them, the submission shall continue in force against their heirs and representatives, and that they consent to the registration, for preservation and execution, both of the deed itself and of the decreet arbitral. The power to enforce the award depends on this last provision. Under the common law of Scotland, a submission of future disputes or differences to an arbiter, or arbiters, unnamed, was ineffectual except where the agreement to refer did not contemplate the decision of proper disputes between the parties but the adjustment of some condition, or the liquidation of some obligation, contained in the contract of which the agreement to submit formed a part. And by the Arbitration (Scotland) Act 1894, s. 1, an agreement to refer to arbitration is not invalid by reason of the reference being to a person not named, or to be named by another, or to a person merely described as the holder for the time being of any office or appointment. An arbiter who has accepted office may be compelled by an action in court of session to proceed with his duty unless he has sufficient cause, such as ill-health or supervening interest, for renouncing. The court may name a sole arbiter, where provision is made for one only and the parties cannot agree (Arbitration [Scotland] Act 1894, s. 2); and may name an arbiter where a party having the right or duty to nominate one of two arbiters will not exercise it (*ib.* s. 3). Scots law as to the requisites of a valid award is practically identical with the law of England. The grounds of reduction of a decreet arbitral are "corruption," "bribery," "false hold" (Scots Act of Regulations 1695, s. 25). An attempt was made to include, under the expression "constructive corruption," among these statutory grounds of reduction, irregular conduct on the part of an arbitrator, with no suggestion of any corrupt motive. But it was definitely overruled by the House of Lords (*Adams* v. *Great North of Scotland Railway Co.*, 1891, A.C. 31). The statutory definition of the grounds of reduction was intended, however, merely to put an end to the practice which had previously obtained of reviewing awards on their merits, and it does not prevent the courts from setting aside an award where the arbitrator has exceeded his jurisdiction, or disregarded any one of the expressed conditions of the submission, or been guilty of misconduct. A private arbiter cannot demand remuneration except in virtue of contract, or by implication from the nature of the work done, or if the reference is in pursuance of some statutory enactment (*e.g.* the Lands Clauses [Scotland] Act 1845, s. 32).

Judicial References have been long known to the law of Scotland. When an action is in court the parties may at any stage withdraw it from judicial determination, and refer it to arbitration. This is done by minute of reference to which the court interpones its authority. When the award is issued it becomes the judgment of the court. The court has no power to compel parties to enter into a reference of this kind, and it is doubtful whether counsel can bind their clients in such a matter. A judicial reference falls like the other by the elapse of a year; and the court cannot review the award on the ground of miscarriage. By the Court of Session Act 1850, s. 50, a provision is introduced whereby parties to an action in the supreme court may refer judicially any issue for trial to one, three, five or seven persons, who shall sit as a jury, and decide by a majority.

Law of Ireland.—The Common Law Procedure Act (Ireland) 1856, which is incorporated by s. 60 of the Supreme Court of Judicature Act (Ireland) 1877, and thereby made applicable to all divisions of the High Court of Justice, provides, on the lines of the English Common Law Procedure Act 1854, for the conduct of arbitrations and the enforcement of awards. Irish statute law, like that of England and Scotland, contains numerous provisions for arbitration under special enactments.

Indian and Colonial Law.—The provisions of the English Arbitration Act 1889 have in substance been adopted by the Indian Legislature (see Act ix. of 1899), and by many of the colonies (see, *e.g.*, Act No. 13 of 1895, Western Australia; No. 24 of 1898, Natal; c. 20 of 1899, Bahamas; No. 10 of 1895, Gibraltar; No. 29 of 1898, Cape of Good Hope: s. 7 of this last statute excludes from submission to arbitration criminal cases, so far as prosecution and punishment are concerned, and, without the special leave of the court, matters relating to status, matrimonial causes, and matters affecting minors or other perons under legal disability; Trinidad and Tobago, No. 35 of 1898).

United States.—The common law and statute law of the United States as to arbitration bear a general resemblance to the law of England.

Voluntary submissions

All controversies of a civil nature, and any question of personal injury on which a suit for damages will lie, although it may also be indictable, may be referred to arbitration; but crimes, and perhaps actions on penal statutes by common informers may not. The submission may be effected sometimes by parol, sometimes by written instrument, sometimes by deed or deed poll. Capacity to refer depends on the general law of contractual capacity. The law of England as to the capacity to act as an arbitrator and as to objections to an arbitrator on the ground of interest has been closely followed by the American courts. The same observation applies as to the requisites of an award, the mode of its enforcement and the grounds on which it will be set aside. The arbitrator has a lien on the award for his fees; and—a point of difference from the English law—he may sue for them without an express promise to pay (cf. *Goodall* v. *Cooley*, 1854, 29 New Hamp. 48). At common law, a submission is generally revocable at any time before award; and it is also, in the absence of stipulation to the contrary, revoked by the death of one of the parties. Provision has been made in Pennsylvania for compulsory arbitration by an act of the 16th of June 1836 (see Pepper and Lewis, *Pennsylvania Digest, tit.* "arbitration").

References by rule of court.

The rules of court also of many of the states of the United States provide for reference through the intervention of the court at any stage in the progress of a litigation. Such submissions are usually declared irrevocable by the rules providing for them.

Statutory arbitrations.

In addition to voluntary submissions and references by rules of court there are in America, as in the United Kingdom, various statutes which provide for arbitration in particular cases. Most of these statutes are founded on the 9 and 10 Will. III., c. 15, and 3 and 4 Will. IV. c. 42, s. 49, "by which it is allowed to refer a matter in dispute (not then in court) to arbitrators, and agree that the submission be made a rule of court. This agreement, being proved on the oath of one of the witnesses thereto, is enforced as if it had been made at first a rule of court" (Bouvier, *Law Dict.* s.v. "Arbitration").

Ample provision is made in America for the arbitration of labour disputes.

Law of France.—Voluntary arbitration has always been recognized in France. In cases of mercantile partnerships, arbitration was formerly compulsory; but in 1856 (law of the 17th of July 1856) jurisdiction in disputes between parties was conferred on the Tribunals of Commerce (as to which see *Code de Commerce*, arts.

615 et seq.), and arbitration at the present time is purely voluntary. The subject is very fully dealt with in the *Code de Procédure Civile* (arts. 1003-1028). The submission to arbitration (*compromis*) must, on pain of nullity, be acted upon within three months from its date (art. 1007). The submission terminates (i.) by the death, refusal, resignation or inability to act of one of the arbitrators; (ii.) by the expiration of the period agreed upon, or of three months if no time had been fixed; (iii.) by the disagreement of two arbitrators, unless power be reserved to them to appoint an umpire (art. 1012). An arbitrator cannot resign if he has once commenced to act, and can only be relieved on some ground arising subsequently to the submission (art. 1014). Each party to the arbitration is required to produce his evidence at least fifteen days before the expiration of the period fixed by the submission (art. 1016). If the arbitrators, differing in opinion, cannot agree upon an umpire (*tiers arbitre*), the president of the Tribunal of Commerce will appoint one, on the application of either party (art. 1017). The umpire is required to give his decision within one month of his acceptance of the appointment; before making his award, he must confer with the previous arbitrators who disagreed (art. 1018). Arbitrators and umpire must proceed according to the ordinary rules of law, unless they are specially empowered by the submission to proceed as *amiables compositeurs* (art. 1019). The award is rendered executory by an order of the president of the Civil Tribunal of First Instance (art. 1020). Awards cannot be set up against third parties (art. 1022), or attacked by way of opposition. An appeal against an award lies to the Civil Tribunal of First Instance, or to the court of appeal, according as the subject-matter, in the absence of arbitration, would have been within the jurisdiction of the justice of the peace, or of the Civil Tribunal of First Instance (art. 1023). In the manufacturing towns of France, there are also boards of umpires (*Conseils de Prud'hommes*) to deal with trade disputes between masters and workmen belonging to certain specified trades.

Other Foreign Laws.—The provisions of French law as to arbitration are in force in Belgium (*Code de Proc. Civ.*, arts. 1003 et seq.); and a convention (8th of July 1899) between France and Belgium regulates, *inter alia*, the mutual enforcement of awards. The law of France has also been reproduced in substance in the Netherlands (Code of Civil Procedure, arts. 620 et seq.). The German Imperial Code of Procedure did not create any system of arbitration in civil cases. But this omission was supplied in Prussia by a law of the 29th of March 1879, which provided for the appointment, in each commune, of an arbitrator (*Schiedsmann*) before whom conciliation proceedings in contentious matters might be conducted. The procedure was gratuitous and voluntary; and the functions of the arbitrator were not judicial; he merely recorded the arrangement arrived at, or the refusal of conciliation. This law was followed in Brunswick by a law of the 2nd of July 1896, and in Baden by a law of the 16th of April 1886. In Luxemburg, compulsory arbitration in matters affecting commercial partnerships was abolished in 1879 (law of the 16th of April 1879). A system of conciliation, similar to the Prussian, exists in Italy (laws of the 16th of June 1892, and the 26th of December 1892) and in some of the Swiss cantons (law of the 29th of April 1883). Spain (Code of Civil Proc., arts. 1003-1028; Civil Code, arts. 1820-1821) and Sweden and Norway (law of the 28th of October 1887) have followed the French law. In Portugal, provision has been made for the creation in important industrial centres, on the application of the administrative corporations, of boards of conciliation (decrees of the 14th of August 1889, and the 18th of May 1893).

AUTHORITIES.—Russell, *Arbitration* (London, 1906); *Annual Practice* (London, yearly); Redman, *Arbitration* (London, 1897); Crewe, *Arbitration Act of 1889* (London, 1898); Pollock, *On Arbitrators* (London, 1906). As to Scots law: Bell, *On Arbitration* (2nd ed., Edinburgh, 1877); Erskine, *Principles* (20th ed., Edinburgh, 1903). As to American law: Morse, *Law of Arbitration* (Boston, 1872). As to foreign law generally: the texts of the laws cited, and the *Annuaire de législation étrangère*. (A. W. R.)

ARBITRATION, INTERNATIONAL. International arbitration is a proceeding in which two nations refer their differences to one or more selected persons, who, after affording to each party an opportunity of being heard, pronounce judgment on the matters at issue. It is understood, unless otherwise expressed, that the judgment shall be in accordance with the law by which civilized nations have agreed to be bound, whenever such law is applicable. Some authorities, notably the eminent Swiss jurist, J. K. Bluntschli, consider that unless this tacit condition is complied with, the award may be set aside. This would, however, be highly inconvenient since international law has never been codified. A fresh arbitration might have to be entered on to decide (1) what the law was, (2) whether it applied to the matter in hand. Arbitration differs from Mediation (*q.v.*) in so far as it is a judicial act, whereas Mediation involves no decision, but merely advice and suggestions to those who invoke its aid.

Arbitral Tribunals.—An international arbitrator may be the chief of a friendly power, or he may be a private individual. When he is an emperor, a king, or a president of a republic, it is not expected that he will act personally; he may appoint a delegate or delegates to act on his behalf, and avail himself of their labours and views, the ultimate decision being his only in name. In this respect international arbitration differs from civil arbitration, since a private arbitrator cannot delegate his office without express authority. The analogy between the two fails to hold good in another respect also. In civil arbitration, the decision or award may be made a rule of court, after which it becomes enforceable by writ of execution against person or property. An international award cannot be enforced directly; in other words it has no legal sanction behind it. Its obligation rests on the good faith of the parties to the reference, and on the fact that, with the help of a world-wide press, public opinion can always be brought to bear on any state that seeks to evade its moral duty. The obligation of an ordinary treaty rests on precisely the same foundations. Where there are two or any other even number of arbitrators, provision is usually made for an umpire (French *sur-arbitre*). The umpire may be chosen by the arbitrators themselves or nominated by a neutral power. In the "Alabama" arbitration five arbitrators were nominated by the president of the United States, the queen of England, the king of Italy, the president of the Swiss Confederation, and the emperor of Brazil respectively. In the Bering Sea arbitration there were seven arbitrators, two nominated by Great Britain, two by the United States, and the remaining three by the president of the French Republic, the king of Italy, and the king of Sweden and Norway respectively. In neither of these cases was there an umpire; nor was any necessary, since the decision, if not unanimous, lay with the majority. (See separate articles on BERING SEA ARBITRATION and "ALABAMA" ARBITRATION.)

Arbitral tribunals may have to deal with questions either of law or fact, or of both combined. When they have to deal with law only, that is to say, to lay down a principle or decide a question of liability, their functions are judicial or quasi-judicial, and the result is arbitration proper. Where they have to deal with facts only, *e.g.* the evaluation of pecuniary claims, their functions are administrative rather than judicial, and the term commission is applied to them. "Mixed commissions," so called because they are composed of representatives of the parties in difference, have been frequently resorted to for delimitation of frontiers, and for settling the indemnities to be paid to the subjects of neutral powers in respect of losses sustained by non-combatants in times of war or civil insurrection. The two earliest of these were nominated in 1794 under the treaty negotiated by Lord Grenville with Mr John Jay, commonly called the "Jay Treaty," their tasks being (1) to define the boundary between Canada and the United States which had been agreed to by the treaty signed at Paris in 1783; (2) to estimate the amount to be paid by Great Britain and the United States to each other in respect of illegal captures or condemnation of vessels during the war of the American Revolution.

Although arbitrations proper may be thus distinguished from "mixed commissions," it must not be supposed that any hard or fast theoretical line can be drawn between them. Arbitrators strictly so called may (as in the "Alabama" case) proceed to award damages after they have decided the question of liability; whilst "mixed commissions," before awarding damages, usually have to decide whether the pecuniary claims made are or are not well founded.

Awards.—International awards, as already pointed out, differ from civil awards in having no legal sanction by which they can be enforced. On the other hand, they resemble civil awards in that they may be set aside, *i.e.* ignored, for sufficient reason, as, for example, if the tribunal has not acted in good faith, or has not given to each party an opportunity of being heard, or has exceeded its jurisdiction. An instance under the last head occurred in 1831, when it was referred to the king of the Netherlands as sole arbitrator to fix the north-eastern boundary of the state of Maine. The king's representatives were unable to draw the frontier line by reason of the imperfection of the maps then in existence, and he therefore directed a further survey. This direction was beyond the terms of the reference, and the award, when made, was repudiated by the United States as void for excess. The point in dispute was only finally disposed of by the Webster-Ashburton treaty of 1842.

Subject-matter.—The history of international arbitration is dealt with in the article Peace, where treaties of general arbitration are discussed, both those which embrace all future differences thereafter to arise between the contracting parties, and also those more limited conventions which aim at the settlement of all future differences in regard to particular subjects, *e.g.* commerce or navigation. The rapid growth of international arbitration in recent times may be gathered from the following figures. Between 1820 and 1840, there were eight such instances; between 1840 and 1860, there were thirty; between 1860 and 1880, forty-four; between 1880 and 1900, ninety. Of the governments which were parties in these several cases Great Britain heads the list in point of numbers, the United States of America being a good second. France, Portugal, Spain and the Netherlands are the European states next in order. The present article is concerned exclusively with arbitration in regard to such existing differences as are capable of precise statement and of prompt adjustment. These differences may be arranged in two main groups:—

(*a*) Those which have arisen between state and state in their sovereign capacities;

(*b*) Those in which one state has made a demand upon another state, ostensibly in its sovereign capacity, but really on behalf of some individual, or set of individuals, whose interests it was bound to protect.

To group (*a*) belong territorial differences in regard to ownership of land and rights of fishing at sea; to group (*b*) belong pecuniary claims in respect of acts wrongfully done to one or more subjects of one state by, or with the authority of, another state. To enumerate even a tenth part of the successful arbitrations in recent times would occupy too much space. Some prominent examples (dealt with elsewhere under their appropriate titles) are the dispute between the United States and Great Britain respecting the "Alabama" and other vessels employed by the Confederate government during the American Civil War (award in 1872); that between the same powers respecting the fur-seal fishery in Bering Sea (award in 1893); that between Great Britain and Venezuela respecting the boundary of British Guiana (award in 1899); that between Great Britain, the United States and Portugal respecting the Delagoa railway (award in 1900); that between Great Britain and the United States respecting the boundary of Alaska (award in 1903). The long-standing Newfoundland fishery dispute with France (finally settled in 1904) is dealt with under Newfoundland. Other examples are shortly noticed in the tables on p. 329, which although by no means exhaustive, sufficiently indicate the scope and trend of arbitration during the years covered. The cases decided by the permanent tribunal at the Hague established in 1900 are not included in these tables. They are separately discussed later.

The Hague Tribunal.—The establishment of a permanent tribunal at the Hague, pursuant to the Peace convention of 1899, marks a momentous epoch in the history of international arbitration. This tribunal realized an idea put forward by Jeremy Bentham towards the close of the 18th century, advocated by James Mill in the middle of the 19th century, and worked out later by Mr Dudley Field in America, by Dr Goldschmidt in Germany, and by Sir Edmund Hornby and Mr Leone Levi in England. The credit of the realization is due, in the first place, to the tsar of Russia, who initiated the Hague Conference of 1899, and, in the second place to Lord Pauncefote (then Sir Julian Pauncefote, British ambassador at Washington), who urged before a committee of the conference the importance of organizing a permanent international court, the service of which should be called into requisition at will, and who also submitted an outline of the mode in which such a court might be formed. The result was embodied in the following articles of the Convention, signed on behalf of sixteen of the assembled powers on the 29th of July 1899.

(Art. 23). Each of the signatory powers is to designate within three months from the ratification of the convention four persons at the most, of recognized competence in international law, enjoying the highest moral consideration, and willing to accept the duties of arbitrators. Two or more powers may agree to nominate one or more members in common, or the same person may be nominated by different powers. Members of the court are to be appointed for six years and may be re-nominated. (Art. 25). The signatory powers desiring to apply to the tribunal for the settlement of a difference between them are to notify the same to the arbitrators. The arbitrators who are to determine this difference are, unless otherwise specially agreed, to be chosen from the general list of members in the following manner:—each party is to name two arbitrators, and these are to choose a chief arbitrator or umpire (*sur-arbitre*). If the votes are equally divided the selection of the chief arbitrator is to be entrusted to a third power to be named by the parties. (Art. 26). The tribunal is to sit at the Hague when practicable, unless the parties otherwise agree. (Art. 27). "The signatory powers consider it a duty in the event of an acute conflict threatening to break out between two or more of them to remind these latter that the permanent court is open to them. This action is only to be considered as an exercise of good offices." Several of the powers nominated members of the permanent court pursuant to Art. 25, quoted above, those nominated on behalf of Great Britain being Lord Pauncefote, Sir Edward Malet, Sir Edward Fry and Professor Westlake. On the death of Lord Pauncefote, Major-General Sir John C. Ardagh was appointed in his place.

The pious fund of the Californias.

Hague Cases.—(1) The first case decided by the Hague court was concerned with the "Pious Fund of the Californias." A fund bearing this name was formed in the 18th century for the purpose of converting to the Catholic faith the native Indians of Upper and Lower California, both of which then belonged to Mexico, and of maintaining a Catholic priesthood there. By a decree of 1842 this fund was transferred to the public treasury of Mexico, the Mexican government undertaking to pay interest thereon in perpetuity in furtherance of the design of the original donors. After the sale of Upper California to the United States, effected by the treaty of Guadalupe Hidalgo (1848), the Mexican government refused to pay the proportion of the interest to which Upper California was entitled. The question of liability was then referred to commissioners appointed by each state, and, on their failing to agree, to Sir Edward Thornton, British minister at Washington, who by his award, in 1875, found there was due from Mexico to Upper California, or rather to the bishops there as administrators of the fund, an arrear of interest amounting to nearly $100,000, which was directed to be paid in gold. This award was carried out, but payment of the current interest was again withheld as from the 24th of October 1868. Claim was thereupon made on Mexico by the United States on behalf of the bishops, but without success. Ultimately, in May 1902, an agreement was come to between the two governments which provided for the settlement of the dispute by the Hague tribunal. The points to be determined were (1) whether the matter was *res judicata* by reason of Sir E. Thornton's award; (2) whether, if not, the claim for the interest was just. The arbitrators selected by the United States were Sir E. Fry and Professor F. de Martens, and by Mexico, Professor Asser and Professor de Savornin Lohman, both of Amsterdam. These four (none of whom, it will be observed, was of the nationality of either party in difference) chose for their umpire Professor Matzen, of Copenhagen, president of the Landsthing there. In October 1902, the court decided both questions in the affirmative, awarding the payment by Mexico of the annual sum claimed, not in gold, but *en monnaie ayant cours légal au Mexique.* The direction to pay in gold made by Sir E. Thornton was held to be referable only to the mode of the execution of the award, and therefore not to be *chose jugée.*

Great Britain, Germany and Italy versus Venezuela.

(2) The second arbitration before the Hague court was more important than the first, not only because so many of the great powers were concerned in it, but also because it brought about the discontinuance of acts of war. The facts may be stated shortly thus. By three several protocols signed at Washington in February 1903, it was agreed that certain claims by Great Britain, Germany and Italy, on behalf of their respective subjects against the Venezuelan government should be referred to three mixed commissions, and that for the purpose of securing the payment of these claims 30% of the customs revenues at the ports of La Guayra and Puerto Caballo should be remitted in monthly instalments to the representative of the Bank of England at Caracas. Prior to the date of these protocols, an attempt had been made by Great Britain, Germany and Italy to enforce their claims by blockade, and a further question arose as between these three powers on the one hand, and the United States of America, France, Spain, Belgium, the Netherlands, Sweden and Norway, and Mexico (all of whom had claims against Venezuela, but had abstained from hostile action) on the other hand, as to whether the blockading powers were entitled to preferential treatment. By three several protocols signed in May

1903 this question was agreed to be submitted to the Hague court, three members of which were to be named as arbitrators by the tsar of Russia, but no arbitrator was to be a subject or citizen of any of the signatory or creditor powers. The arbitrators named by the tsar were M. Muraviev, minister of justice and attorney-general of the Russian empire; Professor Lammasch, member of the Upper House of the Austrian parliament; and M. de Martens, then member of the council of the ministry of foreign affairs at St Petersburg. The arbitrators by their award in February 1904 decided unanimously in favour of the blockading powers and ordered payment of their claims out of the 30 % of the receipts at the two Venezuelan ports which had been set apart to meet them.

Great Britain, France and Germany versus Japan.

(3) The third case before the Hague court was heard in 1904–1905. A controversy not amenable to ordinary diplomatic methods arose between Great Britain, France and Germany on the one hand and Japan on the other hand as to the legality of a house-tax imposed by Japan on certain subjects of those powers who held leases in perpetuity. The question turned upon the true construction of certain treaties between the European powers and Japan which had been made a few years previously. By three protocols signed at Tokyo in August 1902 this question was agreed to be submitted to arbitrators, members of the court at the Hague, one to be chosen by each party with power to name an umpire. The arbitrators chosen were M. Renault, professor of the law faculty in Paris, and M. Montono, the Japanese envoy to the French capital. They named as their umpire and president M. Gram, ex-minister of the state of Norway. In May 1905, an award was pronounced by the majority (M. Gram and M. Renault) in favour of the European contention, M. Montono dissenting both from the conclusion of his colleagues and from the reasons on which it was based.

Great Britain and the French flag at Muscat.

(4) Barely two months had elapsed since the date of the last award when the Hague court was again called into requisition. The scene of dispute this time was on the S.E. coast of Arabia. Muscat, the capital of the kingdom of Oman on that coast, is ruled by a sultan, whose independence both Great Britain and France had, in March 1862, "reciprocally engaged to respect." Notwithstanding this, the French republic had issued to certain native dhows, owned by subjects of the sultan, papers authorizing them to fly the French flag, not only on the Oman littoral but in the Red Sea. A question thereupon arose as to the manner in which the privileges thereby purported to be conferred affected the jurisdiction of the sultan over such dhows, the masters of which, as was alleged, used their immunity from search for the purpose of carrying on contraband trade in slaves, arms and ammunition. In October 1904 the two governments agreed to refer this question to the Hague court. Chief Justice Melville W. Fuller, of the Supreme Court of the United States, was named as arbitrator on the part of Great Britain, M. de Savornin Lohman, who had acted in the case of the Californias (No. 1), as arbitrator on the part of France. The choice of an umpire was entrusted to the king of Italy. He named Professor Lammasch, who, as we have seen, had acted in the arbitration with Venezuela in 1903.

A unanimous award was made in August 1905. It was held that although generally speaking every sovereign may decide to whom he will accord the right to fly his flag, yet in this case such right was limited by the general act of the Brussels conference of July 1890 relative to the African slave trade, an act which was ratified by France on the 2nd of June 1892; that accordingly the owners and master of dhows who had been authorized by France to fly the French flag before the last-named date retained this authorization

Dates of agreement to refer.	Parties.	Arbitrating Authority.	Subject-Matter.	Date of award.
		TABLE I. *Territorial Disputes (Ownership).*		
1857	Holland and Venezuela	Queen of Spain	Island of Aves in Venezuela	1865
1869	Great Britain and Portugal	President of United States	Island of Bulama on West Coast of Africa	1870
1872	Great Britain and Portugal	President of French Republic	Delagoa Bay (part of), Inyack and Elephant Is., S.E. Africa	1875
1876	Argentine Republic and Paraguay	President of United States	Territory between the Verde and the Pilcomayo river of Paraguay	1878
1885	Great Britain and Germany	Mixed Commission	Islets and guano deposits on S.W. Coast of Africa	1886
1886	Bulgaria and Servia	Mixed Commission	Territory near the village of Bregovo	1887
1902	Austria and Hungary	Mixed Commission (with President of Swiss Federal tribunal as umpire)	Territory in the district of Upper Tatra	1902
		TABLE II. *Delimitation of Frontiers.*		
1869	Great Britain and the Transvaal	Lieutenant Governor of Natal	The southern boundary of the S. African Republic	1870
1871	Great Britain and the United States	The German Emperor	The San Juan water boundary	1872
1873	Italy and Switzerland	Mixed Commission (with U.S. Minister at Rome as umpire)	The Canton of Ticino	1874
1885	Great Britain and Russia	Mixed Commission	North-western Afghanistan	1887
1890	France and Holland	Tsar of Russia	French Guiana and Dutch Guiana	1891
1895	Great Britain and Portugal	President of the Italian Court of Appeal	Manicaland	1897
1897	France and Brazil	President of the Swiss Confederation	River Yapoe named in the Treaty of Utrecht 1813	1900
1901	Great Britain and Brazil	King of Italy	British Guiana	1904
1903	Great Britain and Portugal	King of Italy	Barotseland	1905
		TABLE III. *Pecuniary Claims in respect of Seizures and Arrests.*		
1851	United States and Portugal	President of French Republic	Seizure of the American privateer "General Armstrong"	1852
1863	Great Britain and Brazil	King of the Belgians	Arrest of three British officers of the ship "La Forte"	1863
1863	Great Britain and Peru	Senate of Hamburg	Arrest at Callao of Capt. Melville White, a British subject	1864
1870	United States and Spain	Mixed Commission	The American S.S. "Col. Lloyd Aspinwall"	1870
1873	Japan and Peru	Tsar of Russia	The Peruvian barque "Maria Luz"	1875
1874	United States and Colombia	Mixed Commission	The American S.S. "Montijo"	1875
1879	France and Nicaragua	French Court of Cassation	The French ship "Le Phare"	1880
1885	United States and Spain	Italian Minister at Madrid	The American S.S. "The Masonic"	1885
1888	United States and Denmark	British Minister at Athens	The S.S. "Benjamin Franklin" and the barque "Catherine Augusta"	1890
1895	Great Britain and the Netherlands	Tsar of Russia, who delegated his duties to Professor F. de Martens	Arrest of the master of the "Costa Rica" packet (a British subject)	1897

so long as France chose to renew it, but that after that date such authorization was improper unless the guarantees could establish that they had been treated by France as her protégés within the meaning of that term as explained in a treaty of 1863 between France and Morocco. A further point decided was that the owners or master of dhows duly authorized to fly the French flag within the ruling of the first point, did not enjoy, in consequence of that fact, any such right of extra-territoriality as would exempt them from the sovereignty and jurisdiction of the sultan. Such exemption would be contrary to the engagement to respect the independence of the sultan solemnly made in 1862.

Arbitral Procedure.—Not the least of the benefits of the Hague convention of 1899 (strengthened by that of 1907) is that it contains rules of procedure which furnish a guide for all arbitrations whether conducted before the Hague court or not. These may be summarized as follows:—The initial step is the making by the parties of a special agreement clearly defining the subject of the dispute. The next is the choice of the arbitrators and of an umpire if the number of arbitrators is even. Each party then by its agents prepares and presents its case in a narrative or argumentative form, annexing thereto all relevant documents. The cases so presented are interchanged by transmission to the opposite party. The hearing consists in the discussion of the matters contained in the several cases, and is conducted under the direction of the president who is either the umpire, or, if there is no umpire, one of the arbitrators. The members of the tribunal have the right of putting questions to the counsel and agents of the parties and to demand from them explanation of doubtful points. The arbitral judgment is read out at a public sitting of the tribunal, the counsel and agents having been duly summoned to hear it. Any application for a revision of the award must be based on the discovery of new evidence of such a nature as to exercise a decisive influence on the judgment and unknown up to the time when the hearing was closed, both to the tribunal itself and to the party asking for the revision. These general rules are universally applicable, but each case may require that special rules should be added to them. These each tribunal must make for itself.

One special and necessary rule is in regard to the language to be employed. This rule must vary according to convenience and is therefore made *ad hoc*. In case No. 1 noted above, the court allowed English or French to be spoken according to the nationality of the counsel engaged. The judgment was delivered in French only. In case No. 2 it was agreed that the written and printed memoranda should be in English but might be accompanied by a translation into the language of the power on whose behalf they were put in. The oral discussion was either in English or French as happened to be convenient. The judgment was drawn up in both languages. In case No. 3 French was the official language throughout, but the parties were allowed to make any communication to the tribunal, in French, English, German or Japanese. In case No. 4 French was again the official language, but the counsel and agents of both parties were allowed to address the tribunal in English. The protocols and the judgment were drawn up in French accompanied by an official English translation.

Limits of International Arbitration.—Of the numerous treaties for general arbitration which have been made during the 20th century that between Great Britain and France (1903) is a type. This treaty contains reservations of all questions involving the vital interests, the independence or the honour of the contracting parties. The language of the reservation is open to more interpretations than one. What, for instance, is meant by the phrase "national independence" in this connexion? If it be taken in its strict acceptation of autonomous state sovereignty, the exception is somewhat of a truism. No self-respecting power would, of course, consent to submit to arbitration a question of life or death. This would be as if two men were to agree to draw lots as to which should commit suicide in order to avoid fighting a duel. On the other hand, if the exception be taken to exclude all questions which, when decided adversely to a state, impose a restraint on its freedom of action, then the exception would seem to exclude such a question as the true interpretation of an ambiguous treaty, a subject with which experience shows international arbitration is well fitted to deal. Again, we may ask, what is meant by the phrase "national honour"? It was thought at one time that the honour of a nation could only be vindicated by war, though all that had happened was the slighting of its flag, or of its accredited representative, during some sudden ebullition of local feeling. France once nearly broke off peaceful relations with Spain because her ambassador at London was assigned a place below the Spanish ambassador, and on another occasion she despatched troops into Italy because her ambassador at Rome had been insulted by the friends and partisans of the pope. The truth is that the extent to which national honour is involved depends on factors which have nothing to do with the immediate subject of complaint. So long as general good feeling subsists between two nations, neither will easily take offence at any discourteous act of the other. But when a deep-seated antagonism is concealed beneath an unruffled surface, the most trivial incident will bring it to the light of day. "Outraged national honour" is a highly elastic phrase. It may serve as a pretext for a serious quarrel whether the alleged "outrage" be great or small.

The prospects of the expansion of international arbitration will be more clearly perceived if we classify afresh all state differences under two heads:—(1) those which have a legal character, (2) those which have a political character. Under "legal differences" may be ranged such as are capable of being decided, when once the facts are ascertained, by settled, recognized rules, or by rules not settled nor recognized, but (as in the "Alabama" case) taken so to be for the purpose in hand. Boundary cases and cases of indemnity for losses sustained by non-combatants in time of war, of which several instances have already been mentioned, belong to this class. To the same class belong those cases in which the arbitrators have to adapt the provisions of an old treaty to new and altered circumstances, somewhat in the way in which English courts of justice apply the doctrine of "cy-près." "Political differences" on the other hand, are such as affect states in their external relations, or in relation to their subjects or dependants who may be in revolt against them. Some of these differences may be slight, while others may be vital, or (which amounts to the same thing) may seem to the parties to be so. All differences falling under the first of these two general heads appear to be suitable for international arbitration. Differences falling under the second general head are, for the most part, unsuitable, and may only be adjusted (if at all) through the mediation of a friendly power.

The interesting problem of the future is—are we to regard this classification as fixed or as merely transitory? The answer depends on several considerations which can only be glanced at here. It may be that, just as the usages of civilized nations have slowly crystallized into international law, so there may come a time when the political principles that govern states in relation to each other will be so clearly defined and so generally accepted as to acquire something of a legal or quasi-legal character. If they do, they will pass the line which at present separates arbitrable from non-arbitrable matter. This is the juridical aspect of the problem. But there is also an economic side to it by reason of the conditions of modern warfare. Already the nations are groaning under the burdens of militarism, and are for ever diverting energies that might be employed in the furtherance of useful productive work to purposes of an opposite character. The interruption of maritime intercourse, the stagnation of industry and trade, the rise in the price of the necessaries of life, the impossibility of adequately providing for the families of those—call them reservists, "landwehr," or what you will—who are torn away from their daily toil to serve in the tented field,—these are considerations that may well make us pause before we abandon a peaceful solution and appeal to brute force. Lastly, there is the moral aspect of the problem. In order that international arbitration may do its perfect work, it is not enough to set up a standing tribunal, whether at the Hague or elsewhere, and to equip it with elaborate rules of procedure. Tribunals and rules are, after all, only machinery. If this machinery is to act smoothly we must improve our motive power, the source of which is human passion and sentiment. Although religious animosities between Christian nations have died out, although dynasties may now rise and fall without raising half Europe to arms, the springs of warlike enterprise are still to be found in commercial jealousies, in imperialistic ambitions and in the doctrine of the survival of the fittest which lends scientific support to both. These must one and all be cleared away before we can enter on that era of universal peace towards the attainment of which the tsar of Russia declared, in his famous circular of 1898, the efforts of all governments should be directed. Meanwhile it is legitimate to share the hope expressed by President Roosevelt in his message to Congress of December 1905 that some future Hague conference may succeed in making arbitration the customary method of settling international disputes in all save the few classes of cases indicated above, and that—to quote Mr Roosevelt's words—"these classes may themselves be as sharply defined and rigidly limited as the governmental and social development of the world will for the time being permit."

AUTHORITIES.—Among special treatises are: Kamarowsky, *Le Tribunal international* (traduit par Serge de Westman) (Paris, 1887); Rouard de Card, *Les Destinées de l'arbitrage international, depuis la sentence rendue par le tribunal de Genève* (Paris, 1892); Michel Revon, *L'Arbitrage international* (Paris, 1892); Ferdinand Dreyfus, *L'Arbitrage international* (Paris, 1894) (where the earlier authorities are collected); A. Merignhac, *Traité de l'arbitrage international* (Paris, 1895); Le Chevalier Descamps, *Essai sur l'organisation de l'arbitrage international* (Bruxelles, 1896); Feraud-Giraud, *Des Traités d'arbitrage international général et permanent, Revue de droit international* (Bruxelles, 1897); *Pasicrisie International*, by Senator H. Lafontaine (Berne, 1902); *Recueils d'actes et protocols de la cour permanente d'Arbitrage*, Langenhuysen Frères, the Hague.

Of works in English there is a singular dearth. The most important is by an American, J. B. Moore, *History of the International Arbitrations to which the United States has been a Party* (Washington, 1898). The appendices to this work (which is in six volumes) contain, with much other matter of great value, full historical notes of arbitrations between other powers. Arbitration and mediation will be found briefly noticed in Phillimore's *International Law*; in Sir Henry Maine's *Lectures*, delivered in Cambridge in 1887; in W. E. Hall's *International Law*, and more at length in an interesting paper contributed by John Westlake to the *International Journal of Ethics*, October 1896, which its author has reprinted privately. A London journal, *The Herald of Peace and International Arbitration*, issued some years ago a list of instances in which arbitration or mediation had been successfully resorted to during the 19th century. David Dudley Field, of New York, subsequently enlarged this list, which has been continued under the title *International Tribunals*, by Dr W. Evans Darby, and is published, along with the texts of several projects for general arbitration, at the offices of the Peace Society, 47 New Broad Street, London. (M. H. C.)

ARBITRATION AND CONCILIATION. The terms "arbitration and conciliation" as employed in this article, are used to describe a group of methods of settling disputes between employers and work-people or among two or more sets of work-people, of which the common feature is the intervention of some outside party not directly affected by the dispute. If the parties agree beforehand to abide by the award of the third party, the mode of settlement is described as "arbitration." If there be no such agreement, but the offices of the mediator are used to promote an amicable arrangement between the parties themselves, the process is described as "conciliation." The third party may be one or more disinterested individuals, or a joint-board representative of the parties or of other bodies or persons.

The process here termed "arbitration" is rarely an arbitration in the strict legal sense of the term (at least in the United Kingdom), because of the defective legal personality of the associations or groups of individuals who are usually parties to labour disputes, and the consequent absence in the great majority of cases of a valid legal "submission" of the difference to arbitration. Whether or not trade unions of employers or workmen in the United Kingdom are capable of entering through their agents into contracts which are legally binding on their members it is fairly certain that the great majority of the agreements actually made by the representatives of employers and workmen to submit a dispute to the decision of a third party are of no legal force except as regards the actual signatories. Broadly speaking, therefore, the provisions of the Arbitration Act 1889, which consolidated the law relating to arbitration in general, would as a rule have no application to the settlement of collective disputes between employers and workmen, even if the act had not been expressly excluded by section 3 of the Conciliation Act of 1896 in the case of disputes to which that act applies. Besides the absence of a legal "submission," labour arbitrations differ from ordinary arbitrations in the fact that the questions referred often (though by no means always) relate to the terms on which future contracts shall be made, whereas the vast majority of ordinary arbitrations relate to questions arising out of existing contracts. The defective "personality" of the parties to labour disputes also prevents the enforcement of an award by legal penalties. Since, however, difficulties of enforcement affect not only settlements arrived at by arbitration, but all agreements between bodies of employers and work-people with regard to the terms of employment, they are most appropriately considered at a later stage of this article.

The term "conciliation" is ordinarily used to cover a large number of methods of settlement, shading off in the one direction into "arbitration" and in the other into ordinary direct negotiation between the parties. In some cases conciliation only differs from arbitration in the absence of a previous agreement to accept the award. The German "*Gewerbegerichten*," when dealing with labour disputes, communicate a decision to both parties, who must notify their acceptance or otherwise (see below). Some of the state boards in America take similar action. The conciliation boards established under the New Zealand Arbitration Act of 1894 (see below) make recommendations, though either side may decline to accept them and may appeal to the court of arbitration, which in that colony has compulsory powers. Most frequently, however, in Great Britain, the mediating party abstains from pronouncing a definite judgment of his own, but confines himself to friendly suggestions with a view of removing obstacles to an agreement between the parties. On the other hand, it is not easy to define how far the "outside party" must be independent of the parties to the dispute, in order that the method of settlement may be properly described as "conciliation." There is a sense in which a friendly conversation between an employer or his manager and a deputation of aggrieved workmen is rightly described as "conciliation," but such an interview would certainly not be covered by the term as ordinarily used at the present day. Again, when the parties are represented by agents (*e.g.* the officials of an employers' association and of a trade union) the actual negotiators or some of them may not personally be affected by the particular dispute, and may often exercise some of the functions of the mediator or conciliator in a manner not clearly to be distinguished from the action of an outside party. It seems best, however, to exclude such negotiations from our purview so long as those between whom they are carried on merely act as the authorized agents for the parties affected. In the same way, a meeting arranged *ad hoc* between delegates of an employers' association and a trade union, for the purpose of arranging differences as to the terms on which the members of the association shall employ members of the union is not usually classed as "conciliation," unless the meeting is held in the presence of an independent chairman or conciliator, or in pursuance of a permanent agreement between the associations laying down the procedure for the settlement of disputes. If, however, the dispute is considered and arranged not by a casual meeting between two committees and deputations appointed *ad hoc*, but by a permanently organized "joint committee" or board with a constitution, rules of procedure and officers of its own, the process of settlement is by ordinary usage described as "conciliation," even though the board be entirely representative of the persons engaged in the industry. Such joint boards, as will be seen, play a most important part in conciliation at the present day, and they almost always have attached to them some machinery for the ultimate decision by arbitration of questions on which they fail to agree. Another form of conciliation is that in which the mediating board represents a wider group of industries than those affected by the dispute (*e.g.* the London and other "district" boards referred to below). Moreover, in some of the most important cases of settlement of disputes by conciliation, the mediating party has not been a permanent board but a disinterested individual, *e.g.* the mayor, county court judge, government official or member of parliament. As will be seen below, the Conciliation Act now provides for the appointment of "conciliators" by the Board of Trade.

Voluntary trade boards, however (*i.e.* permanent joint boards representing employers and work-people in particular trades), are at once the most firmly established and the most important agencies in Great Britain for the prevention and settlement of labour disputes. Among the earliest of such bodies was the board of arbitration in the Macclesfield silk trade, formed in 1849, in imitation of the French "*Conseils de Prud'hommes,*" but which only lasted four years. The first board, however, which attained any degree of permanent success was that established for the hosiery and glove trade in Nottingham in 1860, through the efforts of A. J. Mundella. In 1864 a board was established in the Wolverhampton building trades, with Rupert Kettle as chairman, and in 1868 boards were formed for the pottery trade, the Leicester hosiery trade and the Nottingham lace trade. In 1869 there was formed one of the most important of the still existing boards, viz. the board of arbitration and conciliation in the manufactured iron and steel trades of the north of England, with which the names of Rupert Kettle, David Dale and others are associated. In 1872 and 1873 joint committees were formed in the Durham and Northumberland coal trades to deal with local questions. The Leicester boot and shoe trade board, the first of an elaborate system of local boards in this trade, was founded in 1875. From about 1870 onwards there was a great movement for the establishment of "sliding scales" in the coal and iron and steel trades, which by regulating wages automatically rendered unnecessary the settlement of general wages by conciliation or arbitration. These sliding scales, however, usually had attached to them joint committees for dealing with disputed questions. A sliding scale arranged by David Dale was attached to the manufactured iron trade board in 1871. A sliding scale for the Cleveland blast furnacemen came into force in 1879. Sliding scales were also adopted in the coal trade in many districts, *e.g.* South Wales (1875), Durham (1877) and Northumberland (1879). The movement was, however, followed by a reaction, and several of the sliding scales in the coal trade were terminated between 1887 and 1889. In 1902 the last surviving sliding scale in the coal trade, viz. in South Wales, ceased to exist and was replaced by a conciliation board.

The formation on a large scale of conciliation boards in the coal trade to fix the rate of wages dates from the great miners' dispute of 1893, one of the terms of settlement agreed to at the conference held at the foreign office under Lord Rosebery being the formation of a conciliation board covering the districts affected. Northumberland followed in 1894, Durham in 1895, Scotland in 1900 and South Wales in 1903.

In 1907 an important scheme for the formation of conciliation boards for railway companies and their employees was adopted as the result of the action taken by the president of the Board of Trade to prevent a general strike of railway servants in that year. Under this scheme separate boards (sectional and general) were to be formed for the employees of each railway company which adhered to the scheme, with provision for reference in case of a deadlock to an umpire.

The first general district board to be formed was that established in London in 1890, through the London chamber of commerce, as a sequel to the Mansion House committee which mediated in the great London dock strike of 1889. The example was followed by several large towns, but the action taken by the boards in most of these provincial districts has been very limited.

In addition there are two boards composed of representatives of co-operators and trade-unionists for the settlement of disputes arising between co-operative societies and their employees.

Constitution and functions of voluntary conciliation boards.

The most typical form of machinery for the settlement of disputes by voluntary conciliation is a joint board consisting of equal numbers of representatives of employers and employed. The members of the board are usually elected by the associations of employers and workmen, though in some cases (*e.g.* in the manufactured iron trade board) the workmen's representatives are elected not by their trade union but by meetings of workmen employed at the various works. The chairman may be an independent person, or, more usually, a representative of the employers, the vice-chairman being a representative of the workmen. In the arbitration and conciliation boards in the boot and shoe trade, provision is made by which the chair may be occupied by representatives of the employers and workmen in alternate years. An independent chairman usually has a casting vote, which practically makes him an umpire in case of equal voting, but where there is no outside chairman there is often provision for reference of cases on which the board cannot agree to an umpire, who may either be a permanent officer of the board elected for a period of time (as in the case of several of the boards in the boot and shoe trade), or selected *ad hoc* by the board or appointed by some outside person or body. Thus the choice of the permanent chairman or umpire of the miners' conciliation board, formed in pursuance of the settlement of the coal dispute of 1893 by Lord Rosebery, was left to the speaker of the House of Commons. The nomination of umpires under the Railway Agreement of 1907 was left to the speaker and the master of the rolls. Since the passing of the Conciliation Act, several conciliation boards have provided in their rules for the appointment of umpires by the Board of Trade.

Conciliation boards constituted as described above usually have rules providing that there shall always be equality of voting as between employer and workmen, in spite of the casual absence of individuals on one side or the other. In order to expedite business it is sometimes provided that all questions shall be first considered by a sub-committee, with power to settle them by agreement before coming before the full board. Boards of conciliation and arbitration conforming more or less to the above type exist in the coal, iron and steel, boot and shoe and other industries in the United Kingdom. A somewhat different form of organization has prevailed in the cotton-spinning trade (since the dispute of 1892–1893) and in the engineering trade (since the engineering dispute of 1897–1898). In these important industries there are no permanent boards for the settlement of general questions, but elaborate agreements are in force between the employers' and workmen's organizations which among other things prescribe the mode in which questions at issue shall be dealt with and if possible settled. In the first place, if the question cannot be settled between the employer and his workmen, it is dealt with by the local associations or committees or their officials, and failing a settlement in this manner, is referred to a joint meeting of the executive committees of the two associations. In neither agreement is there any provision for the ultimate decision of unsettled questions by arbitration. The agreement in the cotton trade is known as the "Brooklands Agreement," and a large number of questions have been amicably settled under its provisions. In the building trade, it is very customary for the local "working rules," agreed to mutually by employers and employed in particular districts, to contain "conciliation rules" providing for the reference of disputed questions to a joint committee with or without an ultimate reference to arbitration. Yet another form of voluntary board is the "district board," consisting in most cases of representatives elected in equal numbers by the local chamber of commerce and trades council respectively. In the case, however, of the London Conciliation Board the workmen's representatives are elected, twelve by specially summoned meetings of trade union delegates and two by co-optation. The functions of district boards are to deal with disputes in any trade which may occur within their districts, and of course they can only take action with the consent of both parties to the dispute, in this respect differing from the majority of "trade" boards, which, as a rule, are empowered by the agreement under which they are constituted to deal with questions on the application of either party. Another interesting type of board is that representing two or more groups of workmen and sometimes their employers, with the object of settling "demarcation" disputes between the groups of workmen (*i.e.* questions as to the limits of the work which each group may claim to perform). Examples of such boards are those representing shipwrights and joiners on the Clyde, Tyne and elsewhere. While the arrangements for voluntary conciliation and arbitration differ in this way in various industries, there is an equally wide variation in the character and range of questions which the boards are empowered to determine. For example, some boards in the coal trade (*e.g.* the conciliation boards in Northumberland and the so-called "Federated Districts") deal solely with the general rate of wages. Others, *e.g.* the "joint committee" in Northumberland and Durham, confine their attention solely to local questions not affecting the counties as a whole. The Durham conciliation board deals with any general or county questions. This distinction between "general" and "local" questions corresponds nearly, though not entirely, to the distinction often drawn between questions of the terms of future employment and of the interpretation of existing agreements. Some conciliation boards are unlimited as regards the scope of the questions which they may consider. This was formerly the case with the boards in the boot and shoe trade, but under the "terms of settlement" of the dispute in 1895 drawn up at the Board of Trade, certain classes of questions (*e.g.* the employment of particular individuals, the adoption of piece-work or time-work, &c.) were wholly or partially withdrawn from their consideration, and any decision of a board contravening the "terms of settlement" is null and void. A special feature in the procedure for conciliation and arbitration in the boot and shoe trade, is the deposit by each party of £1000 with trustees, as a financial guarantee for the performance of agreements and awards. A certain class of conciliation boards, mostly in the Midland metal trades, were attached to "alliances" of employers and employed, having for their object the regulation of production and of prices (*e.g.* the Bedstead Trade Wages Board). None of these alliances, however, have survived.

Legislation in the United Kingdom.

At all events up to the year 1896, the development of arbitration and conciliation as methods of settling labour disputes in the United Kingdom was entirely independent of any legislation. Previously to the Conciliation Act of 1896 several attempts had been made by parliament to promote arbitration and conciliation, but with little or no practical result, and the act of 1896 repealed all previous legislation on the subject, at the same time excluding the operation of the Arbitration Act of 1889 from the settlement of "any difference or dispute to which this act applies." The laws repealed by the Conciliation Act need only a few words of mention. During the 18th century the fixing of wages by magistrates under the Elizabethan legislation gradually decayed, and acts of 1745 and 1757 gave summary jurisdiction to justices of the peace to determine disputes between masters and servants in certain circumstances, although no rate of wages had been fixed that year by the justices of the peace of the shire. These and other laws, relating specially to disputes in the cotton-weaving trade, were consolidated and amended by the Arbitration Act of 1824. This act seems chiefly to have been aimed at disputes relating to piece-work in the textile trades, though applicable to other disputes arising out of a wages contract. It expressly excluded, however, the fixing of a rate of wages or price of labour or workmanship at which the workmen should in future be paid unless with the mutual consent of both master and workmen. The act gave compulsory powers of settling the disputes to which it relates on application of either party to a court of arbitrators representing employers and workmen nominated by a magistrate. The award could be enforced by distress or imprisonment. The act was subsequently amended in detail, and by the "Councils of Conciliation" Act of 1867 power was given to the home secretary to license "equitable councils of conciliation and arbitration" equally representative of masters and workmen, who should thereupon have the powers conferred by the act of 1824. The act contains provisions for the appointment of conciliation committees, and other details which are of little interest seeing that the act was never put into operation. Another amendment of the act of 1824 was made by the Arbitration (Masters and Workmen) Act of 1872, which contemplated the conclusion of agreements between employers and employed, designating some board of arbitration by which disputes included within the scope of the former acts should be determined. A master or workman should be deemed to be bound by an agreement under the act, if he accepted a printed copy of the agreement and did not repudiate it within forty-eight hours. Like the previous legislation, however, the act of 1872 was inoperative. The evidence given before the Royal Commission on Labour (1891–1894) disclosed the existence of a considerable body of opinion in favour of some further action by the state for the prevention or settlement of labour disputes, and some impetus was given to the movement by the settlement through official mediation of several important disputes, *e.g.* the great coal-miners' dispute of 1893 by a conference presided over by Lord Rosebery, the cab-drivers' dispute of 1894 by the mediation of the home secretary (H. H. Asquith), and the boot and shoe trade dispute of 1895 by a Board of Trade conference under the chairmanship of Sir Courtenay Boyle. In these, and a few other less important cases, the intervention of the Board of Trade or other department took place without any special statutory sanction. The Conciliation Act passed in 1896 was framed with a view to giving express authorization to such action in the future.

This act is of a purely voluntary character. Its most important provisions are those of section 2, empowering the Board of Trade in cases "where a difference exists or is apprehended between any employer, or any class of employers, and workmen, or between different classes of workmen," to take certain steps to promote a settlement of the difference. They may of their own initiative hold an inquiry or endeavour to arrange a meeting between the parties under a chairman mutually agreed on or appointed from the outside, and on the application of either party they may appoint a conciliator or a board of conciliation who shall communicate with the parties and endeavour to bring about a settlement and report their proceedings to the Board of Trade. On the application of both parties the Board of Trade may appoint an arbitrator. In all cases the Board of Trade has discretion as to the action to be taken, and there is no provision either for compelling the parties to accept their mediation or to abide by any agreement effected through their intervention. There are other provisions in the act providing for the registration of voluntary conciliation boards, and for the promotion by the Board of Trade of the formation of such boards in districts and trades in which they are deficient. During the first eleven years after the passage of the act the number of cases arising under section 2 (providing for action by the Board of Trade for the settlement of actual or apprehended disputes) averaged twenty-one per annum, and the number of settlements effected fifteen. In the remaining cases the Board of Trade either refused to entertain the application or failed to effect a settlement, or the disputes were settled between the parties during the negotiations. About three-quarters of the settlements were effected by arbitration and one-quarter by conciliation. A number of voluntary conciliation boards formed or reorganized since the passing of the act provide in their rules for an appeal to the Board of Trade to appoint an umpire in case of a deadlock. At least thirty-six trade boards are known to have already adopted this course. The figures given above show that the Conciliation Act of 1896 has not, like previous legislation, been a dead letter, though the number of actual disputes settled is small compared with the total number annually recorded.

Proposals for compulsion.

Arbitration and conciliation in labour disputes as practised in the United Kingdom are entirely voluntary, both as regards the initiation and conduct of the negotiations and the carrying out of the agreement resulting therefrom. In all these respects arbitration, though terminating in what is called a binding award, is on precisely the same legal footing as conciliation, which results in a mutual agreement. Various proposals have been made (and in some cases carried into effect in certain countries) for introducing an element of compulsion into this class of proceeding. There are three stages at which compulsion may conceivably be introduced. (1) The parties may be compelled by law to submit their dispute to some tribunal or board of conciliation; (2) the board of conciliation or arbitration may have power to compel the attendance of witnesses and the production of documents; (3) the parties may be compelled to observe the award of the board of arbitration. The most far-reaching schemes of compulsory arbitration in force in any country are those in force in New Zealand and certain states in Australia. Bills have been introduced into the British House of Commons for clothing voluntary boards of conciliation and arbitration, under certain conditions, with powers to require attendance of witnesses and production of documents, without, however, compelling the parties to submit their disputes to these boards or to abide by their decisions. In the United Kingdom, however, more attention has recently been given to the question of strengthening the sanction for the carrying out of awards and agreements than of compelling the parties to enter into such arrangements. An interesting step towards the solution of the difficulty of enforcement in certain cases is perhaps afforded by the provisions of the terms of settlement of the dispute in the boot and shoe trade drawn up at the Board of Trade in 1895. Under this agreement £1000 was deposited by each party with trustees, who were directed by the trust-deed to pay over to either party, out of the money deposited by the other, any sum which might be awarded as damages by the umpire named in the deed, for the breach of the agreement or of any award made by an arbitration board in consonance with it. Very few claims for damages have been sustained under this agreement. Nevertheless it cannot be doubted that the pecuniary liability of the parties has given stability to the work of the local arbitration boards, and the satisfaction of both sides with the arrangement is shown by the fact that the trust-deed which lapsed in 1900 has been several times renewed by common agreement for successive periods of two years, and is now in force for an indefinite period subject to six months' notice from either side. Theoretically a trust-deed of this kind can only offer a guarantee up to the point at which the original deposit on one side or the other is exhausted, as it is impossible to compel either party to renew the deposit. A proposal was made by the duke of Devonshire and certain of his colleagues on the Royal Commission on Labour for empowering associations of employers and employed to acquire, if they desired it, sufficient legal personality and corporate character to enable them to sue each other or their own members for breach of agreement. This would give the association aggrieved by a breach of award the power of suing the defaulting organization to recover damages out of their corporate funds, while each association could exact penalties from its members for such a breach. For this reason the suggestion has met with a good deal of support by many interested in arbitration and conciliation, but has been steadily opposed by representatives of the trade unions.

The question is not free from difficulties. The object of the change would be to convert what are at present only morally binding understandings into legally enforceable contracts. But apart from the possibility that some of such contracts would be held by the courts to be void as being "in restraint of trade," the tendency might be to give a strict legal interpretation to working agreements which might deprive them of some of their effectiveness for the settlement of the conditions of future contracts between employers and workmen, while possibly deterring associations from entering into such agreements for fear of litigation. Individuals, moreover, could avoid liability by leaving their associations. In practice the cases of repudiation or breach of an award or agreement are not common. In countries like New Zealand, where the parties are compelled to submit their differences to arbitration, some of the above objections do not apply.

Statistics of existing agencies.

The following statistics are based on the reports of the Labour department of the Board of Trade. The number of boards of conciliation and arbitration known to be in existence in the United Kingdom is nearly 200, but a good many of these do little or no active work. Only about one-third of these boards deal with actual cases in any one year, the active boards being mainly connected with mining, iron and steel, engineering and shipbuilding, boot and shoe and building trades. During the ten years 1897–1906 the total number of cases considered by these boards averaged about 1500 annually, of which they have settled about half, the remainder having been withdrawn, referred back or otherwise settled. About three-quarters of the cases settled were determined by the boards themselves and only one-quarter by umpires. The great majority of the cases settled were purely local questions. Thus more than half the total were dealt with by the "joint committees" in the Northumberland and Durham coal trades, which confine their action to local questions, such as fixing the "hewing prices" for new seams. The great majority of the cases settled did not actually involve stoppage of work, the most useful work of these permanent boards being the prevention rather than the settlement of strikes and lock-outs. A certain number of disputes are settled every year by the mediation or arbitration of disinterested individuals, *e.g.* the local mayor or county court judge.

Future scope and limits.

The extent to which the methods of arbitration and conciliation can be expected to afford a substitute for strikes and lock-outs is one on which opinions differ very widely. The difficulties arising from the impossibility of enforcing agreements or awards by legal process have already been discussed. Apart from these, however, it is evident that both methods imply that the parties, especially the work-people, are organized at least to the extent of being capable of negotiating through agents. In some industries (*e.g.* agriculture or domestic service) this preliminary condition is not satisfied; in others the men's leaders possess little more than consultative powers, and employers may hesitate to deal either directly or through a third party with individuals or committees who have so little authority over those whom they claim to represent. And even where the trade organizations are strong, some employers refuse in any way to recognize the representative character of the men's officials. The question of the "recognition" of trade unions by employers is a frequent cause of disputes (see STRIKES AND LOCK-OUTS.) It may be observed, however, that it often occurs that in cases in which both employers and employed are organized into associations which are accustomed to deal with each other, one or both parties entertain a strong objection to the intervention of any outside mediator, or to the submission of differences to an arbitrator. Thus the engineering employers in 1897 were opposed to any outside intervention, though ready to negotiate with the delegates chosen by the men. On the other hand, the cotton operatives have more than once opposed the proposal of the employers to refer the rate of wages to arbitration, and throughout the great miners' dispute of 1893 the opposition to arbitration came from the men. Naturally, the party whose organization is the stronger is usually the less inclined to admit outside intervention. But there have also been cases in which employers, who refused to deal directly with trade union officials, have been willing to negotiate with a mediator who was well known to be in communication with these officials, *e.g.* in the case of the Railway Settlement of 1907.

Apart, however, from the disinclination of one or both parties to allow of any outside intervention, we have to consider how far the nature of the questions in dispute may in any particular case put limits to the applicability of conciliation or arbitration as a method of settlement. Since conciliation is only a general term for the action of a third party in overcoming the obstacles to the conclusion of an agreement by the parties themselves, there is no class of questions which admit of settlement by direct negotiation which may not equally be settled by this method, provided of course that there is an adequate supply of sufficiently skilful mediators. As regards arbitration the case is somewhat different, seeing that in this case the parties agree to be bound by the award of a third party. For the success of arbitration, therefore, it is important that the general principles which should govern the settlement of the particular question at issue should be admitted by both sides. Thus in the manufactured iron trade in the north of England, it has throughout been understood that wages should depend on the prices realized, and the only question which an arbitrator has usually had to decide has been how far the state of prices at the time warranted a particular change of wage. On the other hand, there are many questions on which disputes arise (*e.g.* the employment of non-union labour, the restriction of piece-work, &c.) on which there is frequently no common agreement as to principles, and an arbitrator may be at a loss to know what considerations he is to take into account in determining his award. Generally speaking, employers are averse from submitting to a third party questions involving discipline and the management of their business, while in some trades workmen have shown themselves opposed to allowing an arbitrator to reduce wages beyond a certain point which they wish to regard as a guaranteed "minimum."

Another objection on the part of some employers and workmen to unrestricted arbitration is its alleged tendency to multiply disputes by providing an easy way of solving them without recourse to strikes or lock-outs, and so diminishing the sense of responsibility in the party advancing the claims. It is also sometimes contended that arbitrators, not being governed in their decisions by a definite code of principles, may tend to "split the difference," so as to satisfy both sides even when the demands on one side or the other are wholly unwarranted. This, it is said, encourages the formulation of demands purposely put high in order to admit of being cut down by an arbitrator. One of the chief practical difficulties in the way of the successful working of permanent boards of conciliation, consisting of equal numbers of employers and employed, with an umpire in case of deadlock, is the difficulty of inducing business men whose time is fully occupied to devote the necessary time to the work of the boards, especially when either side has it in its power to compel recourse to the umpire, and so render the work of the conciliation board fruitless. In spite of all these difficulties the practice of arranging differences by conciliation and arbitration is undoubtedly spreading, and it is to be remembered that even in cases in which theoretically a basis for arbitration can scarcely be said to exist, recourse to that method may often serve a useful purpose in putting an end to a deadlock of which both parties are tired, though neither cares to own itself beaten.

New Zealand.—The New Zealand Industrial Conciliation and Arbitration Act 1894 is important as the first practical attempt of any importance to enforce compulsory arbitration in trade disputes. The original act was amended by several subsequent measures, and the law has been more than once consolidated. The law provides for the incorporation of associations of employers or workmen under the title of industrial unions, and for the creation in each district of a joint conciliation board, elected by these industrial unions, with an impartial chairman elected by the board, to which a dispute may be referred by any party, a strike or lock-out being thenceforth illegal. If the recommendation of the conciliation board is not accepted by either party, the matter goes to a court of arbitration consisting of two persons representing employers and workmen respectively, and a judge of the supreme court. Up to 1901 disputes were ordinarily required to go first to a board of conciliation except by agreement of the parties, but now either party may carry a dispute direct to the arbitration court. The amendment was adopted because it was found in practice that the great majority of cases went ultimately to the arbitration court, and conciliation board proceedings were often mere waste of time. The award of the court is enforceable by legal process, financial penalties up to £500 being recoverable from defaulting associations or individuals. If the property of an association is insufficient to pay the penalty, its members are individually liable up to £10 each. It is the duty of factory inspectors to see that awards are obeyed. The law provides for the extension of awards to related trades, to employers entering the industry hereafter, and in some cases to a whole industry.

The above is only an outline of the principal provisions of this law, under which questions of wages, hours and the relations of employers and workmen generally in New Zealand (*q.v.*) industries became practically the subject of state regulation. The act must more properly be judged as a measure for the state regulation of industry, but as a method of putting an end to labour disputes its success has only been partial.

Australia.—The laws which are practically operative in Australia with respect to arbitration and conciliation are all based with modifications on the New Zealand system. The first compulsory arbitration act passed in Australia was the New South Wales Act of 1901. The principal points of difference between this and the New Zealand act are that the conciliation procedure is entirely omitted, the New South Wales measure being purely an arbitration act. The arbitration court has greater power over unorganized trades than in New Zealand, and the scope of its awards is greatly enlarged by its power to declare any condition of labour to be common rule of an industry, and thus binding on all existing and future employers and work-people in that industry. In Western Australia laws were passed in 1900 and 1902 which practically adopted the New Zealand legislation with certain modifications in detail.

In 1904 the commonwealth of Australia passed a compulsory arbitration law based mainly on those in force in New Zealand and New South Wales, and applicable to disputes affecting more than one Australian state. The arbitration court is empowered to require any dispute within its cognizance to be referred to it by the state authority proposing to deal with it. There are other Australian laws which, though unrepealed (*e.g.* the South Australian Act of 1894), are a dead-letter. Generally speaking, the Australasian laws on arbitration and conciliation are more stringent and far-reaching than any others in the world.

Canada.—In 1900 a conciliation act was passed by the Dominion parliament resembling the United Kingdom act in most of its features, and in 1903 the Canadian Railway Labour Disputes Act made special provision for the reference of railway disputes to a conciliation board and (failing settlement) to a court of arbitration.

This act was consolidated with the Conciliation Act 1900 during 1906 in an act respecting conciliation and labour, and in March 1907 the Industrial Disputes Investigation Act became law by which machinery is set up for the constitution of a board, on the application of either side to a dispute in mines and industries connected with public utilities, whenever a strike involving more than ten employees is threatened. The provisions of the act may be extended to other industries and railway companies, and their employees may take action under either the Conciliation and Labour Act or the Industrial Disputes Investigation Act. Under the Investigation Act it is unlawful for any employer to cause a lock-out, or for an employee to go on strike on account of any dispute prior to or during a reference of such dispute to a board constituted under the act, or prior to or during a reference under the provisions concerning railway disputes under the Conciliation and Labour Act. There is nothing, however, in the act to prevent a strike or lock-out taking place after the dispute has been investigated.

France.—The French Conciliation and Arbitration Law of December 1892 provides that either party to a labour dispute may apply to the *juge de paix* of the canton, who informs the other party of the application. If they concur within three days, a joint committee of conciliation is formed of not more than five representatives of each party, which meets in the presence of the *juge de paix*, who, however, has no vote. If no agreement results the parties are invited to appoint arbitrators. If such arbitrators are appointed and cannot agree on an umpire, the president of the civil tribunal appoints an umpire. In the case of an actual strike, in the absence of an application from either party it is the duty of the *juge de paix* to invite the parties to proceed to conciliation or arbitration. The results of the action of the *juge de paix* and of the conciliation committee are placarded by the mayors of the communes affected. The law leaves the parties entirely free to accept or reject the services of the *juge de paix*.

During the ten years 1897–1906 the act was put in force in 1809 cases—viz. 916 on application of workmen; 49 of employers; 40 of both sides; and 804 without application. Altogether 616 disputes were settled—549 by conciliation and 67 by arbitration.

Germany.—In several continental European countries, courts or boards are established by law to settle cases arising out of existing labour contracts,—*e.g.* the French "*Conseils de Prud'hommes*," the Italian "*Probi-Viri*," and the German "*Gewerbegerichten*,"—and some of the questions which come before these bodies are such as might be dealt with in England by voluntary boards or joint committees. The majority, however, are disputes between individuals as to wages due, &c., which would be determined in the United Kingdom by a court of summary jurisdiction. It is noteworthy, however, that the German industrial courts (*Gewerbegerichten*) are empowered under certain conditions to offer their services to mediate between the parties to an ordinary labour dispute. The main law is that of 1890 which was amended in 1901. In the case of a strike or lock-out the court must intervene on application of both parties, and may do so of its own initiative or on the invitation of one side. The conciliation board for this purpose consists under the amending law of 1901 of the president of the court and four or more representatives named by the parties in equal numbers but not concerned in the dispute. Failing appointment by the parties the president appoints them. Failing a settlement at a conference between the parties in the presence of the president and assessors of the court, the court arrives at a decision on the merits of the dispute which is communicated to the parties, who are allowed a certain time within which to notify their acceptance or rejection. The court has no power to compel the observance of its decision, but in certain cases it may fine a witness for non-attendance. In the first five years after the passage of the amending law of 1901 (viz. 1902–1906) there were 1139 applications for the intervention of the industrial courts: 492 agreements were brought about and 107 decisions were pronounced by the courts, of which 64 were accepted by both parties.

Switzerland.—The canton of Geneva enacted a law in 1900 providing for the settlement by negotiation, conciliation or arbitration of the general terms of employment in a trade, subject, however, to special arrangements between employers and workmen in particular cases. The negotiations take place between delegates chosen by the associations of employers and employed, or failing them, by meetings summoned by the council of state on sufficient applications. Failing settlement, the council of state, on application from either party, is to appoint one or more conciliators from its members, and if this fail the central committee of the *Prud'hommes*, together with the delegates of employers and workmen, is to form a board of arbitration, whose decision is binding. Any collective suspension of work is illegal during the period covered by the award or agreement. Up to the end of 1904 only seven cases occurred of application of the law to industrial differences. In Basel (town) a law providing for voluntary conciliation by means of boards of employers and workmen with an independent chairman appointed *ad hoc* by the council of state of the canton, has been in force since 1897, but it remained practically unused until 1902. In the period from January 1902 to May 1905, 18 disputes were dealt with and 10 settled under this law. A similar law was adopted in St Gall in 1902. In the three years 1902–1904, 10 disputes were dealt with and 3 settled.

Sweden.—By a law which came into force on the 1st of January 1907, Sweden was divided into seven districts and in each district a conciliator was appointed by the crown. The conciliator must reside within his district and his principal duty is to promote the settlement of disputes between employers and work-people or between members of either class among themselves. He is also on request to advise and otherwise assist employers and work-people in framing agreements affecting the conditions of labour if and so far as agreements are designed to promote good relations between the two classes and to obviate stoppages of work.

United States.—In the United States several states have legislated on the subject of conciliation and arbitration, among the first of such acts being the "Wallace" Act of 1883, in Pennsylvania, which, however, was almost inoperative. Altogether, 24 states have made constitutional or statutory provision for mediation in trade disputes, of which 17 contemplate the formation of permanent state boards. The only state laws which require notice are those of Massachusetts and New York providing for the formation of state boards of arbitration. The Massachusetts board, founded in 1886, consists of one employer, one employed and one independent person chosen by both. The New York board (1886) consists of two representatives of different political parties, and one member of a *bona fide* trade organization within the state. In both states it is the duty of the board, with or without application from the parties, to proceed to the spot where a labour dispute has occurred, and to endeavour to promote a settlement. The parties may decline its services, but the board is empowered to issue a report, and on application from either side to hold an inquiry and publish its decision, which (in Massachusetts) is binding for six months, unless sixty days' notice to the contrary is given by one side to the other. Several states, including Massachusetts and New York, provide not only for state boards, but also for local boards.

In Massachusetts, during 1906, the state board dealt with 158 disputes. Of these the board was appealed to as arbitrator in 95 cases. Awards were rendered in 80 cases, 12 cases were withdrawn and 3 cases were still pending at the end of the year. In New York the number of cases dealt with is much smaller.

Federal legislation can only touch the question of arbitration and conciliation so far as regards disputes affecting commerce between different states. Thus an act of June 1898 provides that in a dispute involving serious interruption of business on railways engaged in inter-state commerce, the chairman of the Inter-State Commerce Commission and the commissioner of labour shall, on application of either party, endeavour to effect a settlement, or to induce the parties to submit the dispute to arbitration. While an arbitration under the act is pending a strike or lock-out is unlawful.

AUTHORITIES.—For the recent development of arbitration and conciliation in the United Kingdom, see the *Annual Reports of the Labour Department of the Board of Trade on Strikes and Lock-outs* from 1888 onwards. Since 1890 these reports have contained special appendices on the work of arbitration boards. See also the *Labour Gazette* (the monthly journal of the Labour Department) from 1893 onward, and the *Report on Rules of Voluntary Conciliation and Arbitration Boards and Joint Committees*. The *Reports of the Royal Commission on Labour* (1891–1894) contain much valuable information on the subject. For the working of the Conciliation Act see the *Reports* of the Board of Trade on their proceedings under the Conciliation Act 1896. For the earlier history in the United Kingdom: Crompton, *Industrial Conciliation* (1876); Price, *Industrial Peace* (1887). For foreign and colonial developments: the third *Abstract of Foreign Labour Statistics* (1906), issued by the Board of Trade; *Report on Government Industrial Arbitration*, by L. W. Hatch (Bulletin of Bureau of Labour of United States Department of Commerce and Labour, September 1905); the report of the French *Office du Travail, De la conciliation et de l'arbitrage dans les conflits collectifs entre patrons et ouvriers en France et à l'étranger* (1893); the Annual Reports of the same Department on *Strikes, Lock-outs and Arbitration*; the *Reports of the Massachusetts and New York State Arbitration Boards*, and of the *New Zealand Department of Labour*; and the *Labour Gazette*. See also the following general works: N. P. Gilman, *Methods of Industrial Peace* (Boston, 1904); A. C. Pigou, *Principles and Methods of Industrial Peace* (1905). (X.)

ARBOGAST (d. 394), a barbarian officer in the Roman army, at the end of the 4th century. His nationality is uncertain, but Zosimus, Eunapius and Sulpicius Alexander (a Gallo-Roman historian quoted by Gregory of Tours) all refer to him as a Frank. Having served with distinction against the Goths in Thrace, he was sent by Theodosius in 388 against Maximus, who had usurped the empire of the west and had murdered Gratian. His complete success, which resulted in the destruction of Maximus and his sons and the pacification of Gaul, led Theodosius to appoint him chief minister for his young brother-in-law

Valentinian II. His rule was most energetic; but while he favoured the barbarians in the imperial service, and appointed them to high office, Valentinian, openly jealous of his minister, sought to surround himself with Romans. As an offset to this, Arbogast allied himself with the pagan element in Rome, while Valentinian was strictly orthodox. In 392 Valentinian was secretly put to death at Vienne (in Gaul), and Arbogast, naming as his successor Eugenius, a rhetorician, descended into Italy to meet the expedition which Theodosius was heading against him. He proclaimed himself the champion of the old Roman gods, and as a response to the appeal of Ambrose, is said to have threatened to stable his horses in the cathedral of Milan, and to force the monks to fight in his army. His defeat in the hard-fought battle of the Frigidus saved Italy from these dangers. Theodosius, after a two days' fight, gained the victory by the treachery of one of Arbogast's generals, sent to cut off his retreat. Eugenius was captured and executed, but Arbogast escaped to the mountains, where however he slew himself three days afterwards (8th of September 394). Although we have only most distorted narratives upon which to rely—pagan eulogy and Christian denunciation—Arbogast appears to have been one of the greatest soldiers of the later empire, and a statesman of no mean rank. His energy, and his apparent disdain for the effete civilization which he protected, but which did not affect his character, make his personality one of the most interesting of the 4th century.

See T. Hodgkin, *Italy and her Invaders* (1880), vol. i. chap. ii.

ARBOIS, a town of eastern France, in the department of Jura, on the Cuisance, 29 m. N.N.E. of Lons-le-Saunier by rail. Pop. (1906) 3454. The town is the seat of the tribunal of first instance of the arrondissement of Poligny, and has a communal college. The church of St Just, founded in the 10th century, has good wood-carving. An Ursuline convent, built in 1764, serves as hôtel de ville and law court, and a church of the 14th century is used as a market. There is an old château of the dukes of Burgundy. Arbois is well known for its red and white wines, and has saw-mills, tanneries and market gardens, and manufactures paper, oil and casks.

ARBOIS DE JUBAINVILLE, MARIE HENRI D' (1827–1910), French historian and philologist, was born at Nancy on the 5th of December 1827. In 1851 he left the École des Chartes with the degree of palaeographic archivist. He was placed in control of the departmental archives of Aube, and remained in that position until 1880, when he retired on a pension. He published several volumes of inventorial abstracts, a *Répertoire archéologique du département* in 1861; a valuable *Histoire des ducs et comtes de Champagne depuis le VI^e^ siècle jusqu'à la fin du XI^e^*, which was published between 1859 and 1869 (8 vols.), and in 1880 an instructive monograph upon *Les Intendants de Champagne*. But already he had become attracted towards the study of the most ancient inhabitants of Gaul; in 1870 he brought out an *Étude sur la déclinaison des noms propres dans la langue franque à l'époque mérovingienne*; and in 1877 a learned work upon *Les Premiers Habitants de l'Europe* (2nd edition in 2 vols. 1889 and 1894). Next he concentrated his efforts upon the field of Celtic languages, literature and law, in which he soon became an authority. Appointed in 1882 to the newly founded professorial chair of Celtic at the Collège de France, he began the *Cours de littérature celtique* which in 1908 extended to twelve volumes. For this he himself edited the following works: *Introduction à l'étude de la littérature celtique* (1883); *L'Épopée celtique en Irlande* (1892); *Études sur le droit celtique* (1895); and *Les Principaux Auteurs de l'antiquité à consulter sur l'histoire des Celtes* (1902). He was among the first in France to enter upon the study of the most ancient monuments of Irish literature with a solid philological preparation and without empty prejudices. We owe to him also *Les Celtes depuis les temps les plus reculés jusqu'à l'an 100 avant notre ère* (1904), and a study of comparative law in *La Famille celtique* (1905). Numerous detailed studies upon the Gaulish names of persons and places took synthetic form in the *Recherches sur l'origine de la propriété foncière* (1890), which illumined one of the most interesting aspects of the Roman occupation of Gaul. The *Recueil de mémoires concernant la littérature et l'histoire celtiques*, made by the most notable among his disciples on the occasion of his seventy-eighth birthday (1906), was a well-deserved tribute to his persevering and fruitful industry. He died in February 1910. (C. B.*)

ARBOR DAY, the name applied in the United States of America to a day appointed for the public planting of trees (see Arbour). Originating, or at least being first successfully put into operation, in Nebraska in 1872 through the instrumentality of J. Sterling Morton, then president of the state Board of Agriculture, it received the official sanction of the state by the proclamation of Governor R. W. Furnas in 1874 and by the enactment in 1885 of a law establishing it as a legal holiday in Nebraska. The movement spread rapidly throughout the United States until with hardly an exception every state and territory celebrates such a day either as a legal or a school holiday. The time of celebration varies in different states—sometimes even in different localities in the same state—but April or early May is the rule in the northern states, and February, January and December are the months in various southern states. A like practice has been introduced in New Zealand.

See N. H. Egleston, *Arbor Day: Its History and Observance* (Washington, 1896), Robert W. Furnas, *Arbor Day* (Lincoln, Neb., 1888), and R. H. Schauffler (ed.), *Arbor Day* (New York, 1909).

ARBORETUM, the name given to that part of a garden or park which is reserved for the growth and display of trees. The term, in this restricted sense, was seemingly first so employed in 1838 by J. C. Loudon, in his book upon arboreta and fruit trees. Professor Bayley Balfour, F.R.S., the Regius Keeper of the Royal Botanic Garden in Edinburgh, has described an arboretum as a living collection of species and varieties of trees and shrubs arranged after some definite method—it may be properties, or uses, or some other principle—but usually after that of natural likeness. The plants are intended to be specimens showing the habit of the tree or shrub, and the collection is essentially an educational one. According to another point of view, an arboretum should be constructed with regard to picturesque beauty rather than systematically, although it is admitted that for scientific purposes a systematic arrangement is a *sine qua non*. In this more general respect, an arboretum or woodland affords shelter, improves local climate, renovates bad soils, conceals objects unpleasing to the eye, heightens the effect of what is agreeable and graceful, and adds value, artistic and other, to the landscape. What Loudon called the "gardenesque" school of landscape naturally makes particular use of trees. By common consent the arboretum in the Royal Botanical Gardens at Kew is one of the finest in the world. Its beginnings may be traced back to 1762, when, at the suggestion of Lord Bute, the duke of Argyll's trees and shrubs were removed from Whitton Place, near Hounslow, to adorn the princess of Wales's garden at Kew. The duke's collection was famous for its cedars, pines and firs. Most of the trees of that date have perished, but the survivors embrace some of the finest of their kind in the gardens. The botanical gardens at Kew were thrown open to the public in 1841 under the directorate of Sir William Hooker. Including the arboretum, their total area did not then exceed 11 acres. Four years later the pleasure grounds and gardens at Kew occupied by the king of Hanover were given to the nation and placed under the care of Sir William for the express purpose of being converted into an arboretum. Hooker rose to the occasion and, zealously reinforced by his son and successor, Sir Joseph, established a collection which rapidly grew in richness and importance. It is perhaps the largest collection of hardy trees and shrubs known, comprising some 4500 species and botanical varieties. A large proportion of the total acreage (288) of the Gardens is monopolized by the arboretum. Of the more specialized public arboreta in the United Kingdom the next to Kew are those in the Royal Botanic Garden in Edinburgh and the Glasnevin Garden in Dublin. The collection of trees in the Botanic Garden at Cambridge is also one of respectable proportions. There is a small but very select collection of trees at Oxford, the oldest botanical garden in Great Britain, which was founded in 1632. In the United States the Arnold Arboretum at Boston ranks with Kew for size and completeness. It takes its name from its donor, the friend of Emerson. It was originally a well-timbered park, which, by later additions, now covers 222 acres. Practically, it forms part of the park system so characteristic of the city, being situated only 4 m. from the centre of population. There is a fine arboretum in the botanical gardens at Ottawa, in Canada (65 acres). On the continent of Europe the classic example is still the *Jardin des Plantes* in Paris, where, however, system lends more of formality than of beauty to the general effect. The collection of trees and shrubs at Schönbrunn, near Vienna, is an extensive one. At Dahlem near Berlin the new *Kgl. Neuer Botanischer Garten* has been laid out with a view to the accommodation of a very large collection of hardy trees and shrubs. There are now many large collections of hardy trees and shrubs in private parks and gardens throughout the British Islands, the interest taken in them by their proprietors having largely increased in recent years. Rich men collect trees, as they do paintings or books. They spare neither pains nor money in acquiring specimens, even from distant lands, to which they often send out expert collectors at their own expense. This, too, the Royal Horticultural Society was once wont to do, with valuable results, as in the case of David Douglas's remarkable expedition to North America in 1823–1824. It will be remembered that when the laird of Dumbiedikes lay dying (Scott's *Heart of Midlothian*, chap. viii.) he gave his son one bit of advice which Bacon himself could not have bettered. "Jock," said the old reprobate, "when ye hae naething else to do, ye may be aye sticking in a tree; it will be growing, Jock, when ye're sleeping." Sir Walter assures us that a Scots earl took this maxim so seriously to heart that he planted a large tract of country with trees, a practice which in these days is promoted by the English and Royal Scottish Arboricultural Societies.

ARBORICULTURE (Lat. *arbor*, a tree), the science and art of tree-cultivation. The culture of those plants which supply the food of man or nourish the domestic animals must have exclusively occupied his attention for many ages; whilst the timber employed in houses, ships and machines, or for fuel, was found in the native woods. Hence, though the culture of fruit-trees, and occasionally of ornamental trees and shrubs, was practised by the Egyptians, Greeks and Romans, the cultivation of timber-trees on a large scale only took place in modern times. In the days of Charlemagne, the greater part of France and Germany was covered with immense forests; and one of the benefits conferred on France by that prince was the rooting up of portions of these forests throughout the country, and substituting orchards or vineyards. Artificial plantations appear to have been formed in Germany sooner than in any other country, apparently as early as the 15th century. In Britain planting was begun, though sparingly, a century later. After the extensive transfers of property on the seizure of the church lands by Henry VIII., much timber was sold by the new owners, and the quantity thus thrown into the market so lowered its price, as Hollingshed informs us, that the builders of cottages, who had formerly employed willow and other cheap and common woods, now built them of the best oak. The demand for timber constantly increased, and the need of an extended surface of arable land arising at the same time, the natural forests became greatly circumscribed, till at last timber began to be imported, and the proprietors of land to think, first of protecting their native woods, afterwards of enclosing waste ground and allowing it to become covered with self-sown seedlings, and ultimately of sowing acorns and mast in such enclosures, or of filling them with young plants collected in the woods—a practice which exists in Sussex and other parts of England even now. Planting, however, was not general in England till the beginning of the 17th century, when the introduction of trees was facilitated by the interchange of plants by means of botanic gardens, which, in that century, were first established in different countries. Evelyn's *Sylva*, the first edition of which appeared in 1664, rendered an extremely important service to arboriculture; and there is no doubt that the ornamental plantations in which England surpasses all other countries are in some measure the result of his enthusiasm. In consequence of a scarcity of timber for naval purposes, and the increased expense during the Napoleonic war of obtaining foreign supplies, planting received a great stimulus in Britain in the early part of the 19th century. After the peace of 1815 the rage for planting with a view to profit subsided; but there was a growing taste for the introduction of trees and shrubs from foreign countries, and for their cultivation for ornament and use. The profusion of trees and shrubs planted around suburban villas and country mansions, as well as in town squares and public parks, shows how much arboriculture is an object of pleasure to the people. While isolated trees and old hedgerows are disappearing before steam cultivation, the advantages of shelter from well-arranged plantations are more fully appreciated; and more attention is paid to the principles of forest conservancy both at home and abroad. In all thickly peopled countries the forests have long ceased to supply the necessities of the inhabitants by natural reproduction; and it has become needful to form plantations either by government or by private enterprise, for the growth of timber, and in some cases for climatic amelioration. This subject is, however, dealt with more fully under FORESTS AND FORESTRY (*q.v.*); and the separate articles on the various sorts of tree may be consulted for details as to each.

ARBOR VITAE (Tree of Life), a name given by Clusius to species of *Thuja*. The name *Thuja*, which was adopted by Linnaeus from the *Thuya* of Tournefort, seems to be derived from the Greek word θύος, signifying sacrifice, probably because the resin procured from the plant was used as incense. The plants belong to the natural order Coniferae, tribe Cupressineae (Cypresses). *Thuja occidentalis* is the Western or American arbor vitae, the *Cupressus Arbor Vitae* of old authors. It is a native of North America, and ranges from Canada to the mountains of Virginia and Carolina. It is a moderate-sized tree, and was introduced into Britain before 1597, when it was mentioned in Gerard's *Herbal*. In its native country it attains a height of about 50 ft. The leaves are small and imbricate, and are borne on flattened branches, which are apt to be mistaken for the leaves. When bruised the leaves give out an aromatic odour. The flowers appear early in spring, and the fruit is ripened about the end of September. In Britain the plant is a hardy evergreen, and can only be looked upon as a large shrub or low tree. It is often cut so as to form hedges in gardens. The wood is very durable and useful for outdoor work, such as fencing, posts, etc. Another species of arbor vitae is *Thuja orientalis*, known also as *Biota orientalis*. The latter generic name is derived from the Greek adjective βιωτός, formed from βίος, life, probably in connexion with the name "tree of life." This is the Eastern or Chinese arbor vitae. It is a native of China. It was cultivated in the Chelsea Physick Garden in 1752, and was believed to have been sent to Europe by French missionaries. It has roundish cones, with numerous scales and wingless seeds. The leaves, which have a pungent aromatic odour, are said to yield a yellow dye. There are numerous varieties of this plant in cultivation, one of the most remarkable of which is the variety *pendula*, with long, flexible, hanging, cord-like branches; it was discovered in Japan about 1776 by Carl Peter Thunberg, a pupil of Linnaeus, who made valuable collections at the Cape of Good Hope, in the Dutch East Indies and in Japan. The variety *pygmaea* forms a small bush a few inches high.

Thuja gigantea, the red or canoe cedar, a native of north-western America from southern Alaska to north California, is the finest species, the trunk rising from a massive base to the height of 150 to 200 ft. It was not introduced to Britain till 1853. It is one of the handsomest of conifers, forming an elongated cone of foliage, which in some gardens has already reached 70 or 80 ft. in height. It thrives in most kinds of soils. The timber is easily worked and used for construction, especially where exposed to the weather.

ARBOS, FERNANDEZ (1863–   ), Spanish violinist and composer, was born in Madrid, and trained at the conservatoire there, and later at Brussels and at Berlin under Joachim. He became a professor at Hamburg and then at Madrid, becoming famous meanwhile as one of the finest violinists of the day; and after visiting England in 1890 and establishing his reputation there, he became professor at the Royal College of Music in London. As a composer he is best known by his violin pieces, and by a comic opera, *El Centro de la Tierra* (1895).

ARBOUR, or Arbor (originally "herber" or "erber," O. Fr. *herbier*, from Lat. *herbarium*, a collection of herbs, *herba*, grass; the word came to be spelt "arber" through its pronunciation, as in the case of Derby, and by the 16th century was written "arbour," helped by a confusion of derivation from Lat. *arbor*, a tree, and by change of meaning), a grass-plot or lawn, a herb-garden, or orchard, and a shady bower of interlaced trees, or climbing plants trained on lattice-work. The application of the word has shifted from the grass-covered ground, the proper meaning, to the covering of trees overhead. "Arbor" (from the Latin for "tree") is a term applied to the spindle of a wheel, particularly in clock-making.

ARBROATH, or Aberbrothock, a royal, municipal and police burgh, and seaport of Forfarshire, Scotland. It is situated at the mouth of Brothock water, 17 m. N.E. of Dundee by the North British railway, which has a branch to Forfar, via Guthrie, on the Caledonian railway. Pop. (1891) 22,821; (1901) 22,398. The town is under the jurisdiction of a provost, bailies and council, and, with Brechin, Forfar, Inverbervie and Montrose, returns one member to parliament. The leading industries include the manufacture of sailcloth, canvas and coarse linens, tanning, boot and shoe making, and bleaching, besides engineering works, iron foundries, chemical works, shipbuilding and fisheries. The harbour, originally constructed and maintained by the abbots, by an agreement between the burgesses and John Gedy, the abbot in 1394, was replaced by one more commodious in 1725, which in turn was enlarged and improved in 1844. The older portion was converted into a wet dock in 1877, and the entrance and bar of the new harbour were deepened. A signal tower, 50 ft. high, communicates with the Bell Rock (*q.v.*) lighthouse on the Inchcape Rock, 12 m. south-east of Arbroath, celebrated in Southey's ballad. The principal public buildings are the town-hall, a somewhat ornate market house, the gildhall, the public hall, the infirmary, the antiquarian museum (including some valuable fossil remains) and the public and mechanics' libraries. The parish church dates from 1570, but has been much altered, and the spire was added in 1831. The ruins of a magnificent abbey, once one of the richest foundations in Scotland, stand in High Street. It was founded by William the Lion in 1178 for Tironesian Benedictines from Kelso, and consecrated in 1197, being dedicated to St Thomas Becket, whom the king had met at the English court. It was William's only personal foundation, and he was buried within its precincts in 1214. Its style was mainly Early English, the western gable Norman. The cruciform church measured 276 ft. long by 160 ft. wide, and was a structure of singular beauty and splendour. The remains include the vestry, the southern transept (the famous rose window of which is still entire), part of the chancel, the southern wall of the nave, part of the entrance towers and the western doorway. It was here that the parliament met which on the 6th of April 1320 addressed to the pope the notable letter, asserting the independence of their country and reciting in eloquent terms the services which their "lord and sovereign" Robert Bruce had rendered to Scotland. The last of the abbots was Cardinal Beaton, who succeeded his uncle James when the latter became archbishop of St Andrews. At the Reformation the abbey was dismantled and afterwards allowed to go to ruin. Part of the secular buildings still stand, and the abbot's house, or Abbey House as it is now called, is inhabited. Arbroath was created a royal burgh in 1186, and its charter of 1599 is preserved. King John exempted it from "toll and custom" in every part of England excepting London. Arbroath is "Fairport" of Scott's *Antiquary*, and Auchmithie, 3 m. north-east ("Musselcrag" of the same romance), is a quaint old-fashioned place, where the men earn a precarious living by fishing. On each side of the village the coast scenery is remarkably picturesque, the rugged cliffs—reaching in the promontory of Red Head, the scene of a thrilling incident in the *Antiquary*, a height of 267 ft.—containing many curiously shaped caves and archways which attract large numbers of visitors. At the 14th-century church of St Vigeans, 1 m. north of Arbroath, stands one of the most interesting of the sculptured stones of Scotland, with what is thought to be the only legible inscription in the Pictish tongue. The parish—originally called Aberbrothock and now incorporated with Arbroath for administrative purposes—takes its name from a saint or hermit whose chapel was situated at Grange of Conon, 3½ m. north-west. Two miles west by south are the quarries of Carmyllie, the terminus of a branch line from Arbroath, which was the first light railway in Scotland and was opened in 1900.

ARBUTHNOT, ALEXANDER (1538–1583), Scottish ecclesiastic and poet, educated at St Andrews and Bourges, was in 1569 elected principal of King's College, Aberdeen, which office he retained until his death. He played an active part in the stirring church politics of the period, and was twice moderator of the kirk, and a member of the commission of inquiry into the condition of the university of St Andrews (1583). The "correctness" of his attitude on all public questions won for him the commendation of Catholic writers; he is not included in Nicol Burne's list of "periurit apostatis"; but his policy and influence were misliked by James VI., who, when the Assembly had elected Arbuthnot to the charge of the church of St Andrews, ordered him to return to his duties at King's College. He had been for some time minister of Arbuthnott in Kincardineshire. His extant works are (*a*) three poems, "The Praises of Wemen" (224 lines), "On Luve" (10 lines), and "The Miseries of a Pure Scholar" (189 lines), and (*b*) a Latin account of the Arbuthnot family, *Originis et Incrementi Arbuthnoticae Familiae Descriptio Historica* (still in MS.), of which an English continuation, by the father of Dr John Arbuthnot, is preserved in the Advocates' Library, Edinburgh. The praise of the fair sex in the first poem is exceptional in the literature of his age; and its geniality may help us to understand the author's popularity with his contemporaries. Arbuthnot must not be confused with his contemporary and namesake, the Edinburgh printer, who produced the first edition of Buchanan's *History of Scotland* in 1582. Some have discovered in the publication of this work a false clue to James's resentment against the principal of King's College.

The particulars of Arbuthnot's life are found in Calderwood, Spottiswood, and other Church historians, and in Scott's *Fasti Ecclesiae Scoticanae*. The poems are printed in Pinkerton's *Ancient Scottish Poems* (1786), i. pp. 138-155.

ARBUTHNOT, JOHN (1667–1735), British physician and author, was born at Arbuthnott, Kincardineshire, and baptized on the 29th of April 1667. His father, Alexander Arbuthnot, was an episcopalian minister who was deprived of his living in 1689 by his patron, Viscount Arbuthnott, for refusing to conform to the Presbyterian system. After his death, in 1691, John went to London, where he lived in the house of a learned linen-draper, William Pate, and supported himself by teaching mathematics. In 1692 he published *Of the Laws of Chance . . .*, based on the Latin version, *De Ratociniis in ludo aleae*, of a Dutch treatise by Christiaan Huygens. In 1692 he entered University College, Oxford, as a fellow-commoner, acting as private tutor to Edward Jefferys; and in 1696 he graduated M.D. at St Andrews university. In *An Examination of Dr Woodward's Account of the Deluge* (1697) he confuted an extraordinary theory advanced by Dr William Woodward. An *Essay on the Usefulness of Mathematical Learning* followed in 1701, and in 1704 he became a fellow of the Royal Society. He had the good fortune to be called in at Epsom to prescribe for Prince George of Denmark, and in 1705 he was made physician extraordinary to Queen Anne. Four years later he became royal physician in ordinary, and in 1710 he was elected fellow of the Royal College of Physicians. Arbuthnot's ready wit and varied learning made him very valuable to the Tory party. He was a close friend of Jonathan Swift and of Alexander Pope, and Lord Chesterfield says that even the generous acknowledgment they made of his assistance fell short of their real indebtedness. He had no jealousy of his fame as an author, and his abundant imagination was always at the service of his friends. In 1712 appeared "Law is a Bottomless Pit, Exemplify'd in the case of the Lord Strutt, John Bull, Nicholas Frog and Lewis Baboon, who spent all they had in a law-suit. Printed from a Manuscript found in the Cabinet of the famous Sir Humphrey Polesworth." This was the first of a series of five pamphlets advocating the conclusion of peace. Arbuthnot describes the confusion after the death of the Lord Strutt (Charles II. of Spain), and the quarrels between the greedy tradespeople (the allies). These put their cause into the hands of the attorney, Humphrey Hocus (the duke of Marlborough), who does all he can to prolong the struggle. The five tracts are printed in two parts as the "History of John Bull" in the *Miscellanies in Prose and Verse* (1727, preface signed by Pope and Swift). Arbuthnot fixed the popular conception of John Bull, though it is not certain that he originated the character, and the lively satire is still amusing reading. It was often asserted at the time that Swift wrote these pamphlets, but both he and Pope refer to Arbuthnot as the sole author. In the autumn of the same year he published a second satire, "Proposals for printing a very Curious Discourse in Two Volumes in Quarto, entitled, Ψευδολογία Πολιτική; or, A Treatise of the Art of Political Lying," best known by its sub-title. This ironical piece of work was not so popular as "John Bull." "'Tis very pretty," says Swift, "but not so obvious to be understood." Arbuthnot advises that a lie should not be contradicted by the truth, but by another judicious lie. "So there was not long ago a gentleman, who affirmed that the treaty with France for bringing popery and slavery into England was signed the 15th of September, to which another answered very judiciously, not by opposing truth to his lie, that there was no such treaty; but that, to his certain knowledge, there were many things in that treaty not yet adjusted."

Arbuthnot was one of the leading spirits in the Scriblerus Club, the members of which were to collaborate in a universal satire on the abuses of learning. *The Memoirs of the extraordinary Life, Works, and Discoveries of Martinus Scriblerus*, of which only the first book was finished, first printed in Pope's *Works* (1741), was chiefly the work of Arbuthnot, who is at his best in the whimsical account of the birth and education of Martin. Swift, writing on the 3rd of July 1714 to Arbuthnot, says:—"To talk of Martin in any hands but yours, is a folly. You every day give better hints than all of us together could do in a twelvemonth: and to say the truth, Pope who first thought of the hint has no genius at all to it, to my mind; Gay is too young: Parnell has some ideas of it, but is idle; I could put together, and lard, and strike out well enough, but all that relates to the sciences must be from you."

The death of Queen Anne put an end to Arbuthnot's position at court, but he still had an extensive practice, and in 1727 he delivered the Harveian oration before the Royal College of Physicians. Lord Chesterfield and William Pulteney were his patients and friends; also Mrs Howard (Lady Suffolk) and William Congreve. His friendship with Swift was constant and intimate; he was friend and adviser to Gay; and Pope wrote (2nd of August 1734) that in a friendship of twenty years he had found no one reason of complaint from him. Arbuthnot's youngest son, who had just completed his education, died in December 1731. He never quite recovered his former spirits and health after this shock. On the 17th of July 1734 he wrote to Pope: "A recovery in my case, and at my age, is impossible; the kindest wish of my friends is Euthanasia." In January 1735 was published the "Epistle to Dr Arbuthnot," which forms the prologue to Pope's satires. He died on the 27th of February 1735 at his house in Cork Street, London.

Among Arbuthnot's other works are:—*An Argument for Divine Providence, taken from the constant regularity observed in the Births of both sexes* (Phil. Trans. of the Royal Soc., 1710); "Virgilius Restauratus," printed in the second edition of Pope's *Dunciad* (1729); *An Essay concerning the Effects of Air on Human Bodies* (1733); *An Essay concerning the Nature of Ailments . . .* (1731); and a valuable *Table of Ancient Coins, Weights and Measures* (1727), which is an enlargement of an earlier treatise (1705). He had a share in the unsuccessful farce of *Three Hours after Marriage*, printed with Gay's name on the title-page (1717). Some pieces printed in *A Supplement to Dr Swift's and Mr Pope's Works . . .* (1739) are there asserted to be Arbuthnot's. *The Miscellaneous Works of the late Dr Arbuthnot* were published at Glasgow in an unauthorized edition in 1751. This includes many spurious pieces.

See *The Life and Works of John Arbuthnot* (1892), by George A. Aitken.

ARCACHON, a coast town of south-western France, in the department of Gironde, 37 m. W.S.W. of Bordeaux on the Southern railway. Pop. (1906) 9006. Arcachon is situated on the southern border of the lagoon of Arcachon at the foot of dunes covered with splendid pine-woods. It comprises two distinct parts, the summer town, extending for 2½ m. along the shore, and bordered by a firm sandy beach, frequented by bathers, and the winter town, farther inland, consisting of numerous villas scattered amongst the pines.

Owing to the mildness of its climate the winter town is a resort for consumptive patients. The principal industries are oyster-breeding, which is conducted on a very large scale, and fishing. The port has trade with Spain and England.

ARCADE, in architecture, a range of arches, supported either by columns or piers; isolated in the case of those separating the nave of a church from the aisles, or forming the front of a covered ambulatory, as in the cloisters in Italy and Sicily, round the Ducal Palace or the Square of St Mark's, Venice, round the courts of the palaces in Italy, or in Paris round the Palais-Royal and the Place des Vosges. The earliest examples known are those of the Tabularium, the theatre of Marcellus, and the Colosseum, in Rome. In the palace of Diocletian at Spalato the principal street had an arcade on either side, the arches of which rested direct on the capital without any intervening entablature or impost block. The term is also applied to the galleries, employed decoratively, on the façades of the Italian churches, and carried round the apses where they are known as eaves-galleries. Sometimes these arcades project from the wall sufficiently to allow of a passage behind, and sometimes they are built into and form part of the wall; in the latter case, they are known as blind or wall arcades; and they were constantly employed to decorate the lower part of the walls of the aisles and the choir-aisles in English churches. Externally, blind arcades are more often found in Italy and Sicily, but there are examples in

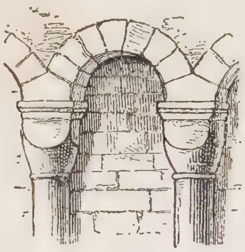


FIG. 1.—Arcade, Westminster Abbey.

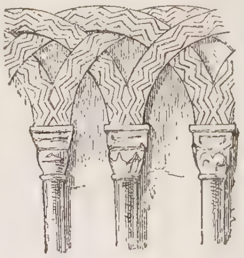
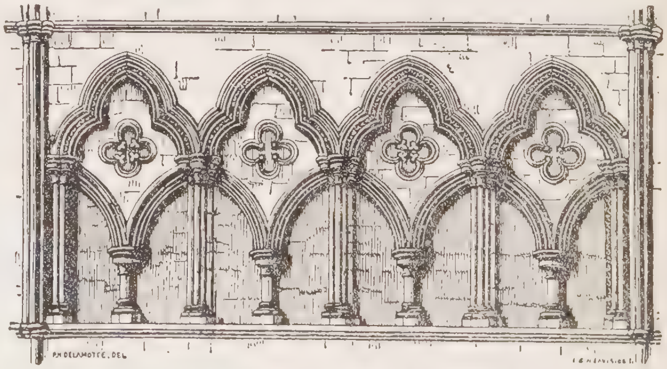


FIG. 2.—Arcade, St John's, Devizes.



From Rickman's *Styles of Architecture*, by permission of Parker & Co.

FIG. 3.—Triforium at Beverley.

England at Canterbury, Ely, Peterborough, Norwich, St John's (Chester), Colchester and elsewhere. Internally, the oldest example is that of the old refectory in Westminster Abbey (fig. 1). Sometimes the design is varied with interlacing arches as in St John's, Devizes (fig. 2), and Beverley Minster (fig. 3). In Sicily and the south of Italy these interlacing arcades are the special characteristic of the Saracenic work there found, and their origin may be found in the interlaced arches of the Mosque of Cordova in Spain. In the cathedral of Palermo and at Monreale they are carried round the apses at the east end. At Caserta-Vecchia, in South Italy, they decorate the lantern over the crossing, and at Amalfi the turrets on the north-west campanile.

The term is also applied to the covered passages which form thoroughfares from one street to another, as in the Burlington Arcade, London; in Paris such an arcade is usually called *passage*, and in Italy *galleria*. (R. P. S.)

ARCADELT, or ARCHADELT, **JACOB** (*c.* 1514–*c.* 1556), a Netherlands composer, of the early part of the Golden Age. In 1539 he left a position at Florence to teach the choristers of St Peter's, Rome, and became one of the papal singers in 1540. He was a prolific church composer, but the works published in his Italian time consist entirely of madrigals, five books of which, published at Venice, probably gave a great stimulus to the beginnings of the Venetian school of composition. In 1555 he left Italy and entered the service of Cardinal Charles of Lorraine, duke of Guise, and after this published three volumes of masses, besides contributing motets to various collections. The *Ave Maria*, ascribed to him and transcribed as a pianoforte piece by Liszt, does not seem to be traced to an earlier source than its edition by Sir Henry Bishop, which has possibly the same kind of origin in Arcadelt as the hymn tune "Palestrina" has in the delicate and subtle *Gloria* of Palestrina's *Magnificat Quinti Toni*, the fifth in his first *Book of Magnificats*.

ARCADIA, a district of Greece, forming the central plateau of Peloponnesus. Shut off from the coast lands on all sides by mountain barriers, which rise in the northern peaks of Erymanthus (mod. *Olonos*) to 7400, of Cyllene (Ziria) to 7900, in the southern corner buttresses of Parthenium and Lycaeum to more than 5000 ft., this inland plateau is again divided by numerous subsidiary ranges. In eastern or "locked" Arcadia these heights run in parallel courses intersected by cross-ridges, enclosing a series of upland plains whose waters have no egress save by underground channels or *zerethra*. The western country is more open, with isolated mountain-groups and winding valleys, where the Alpheus with its tributaries the Ladon and Erymanthus drains off in a complex river-system the overflow from all Arcadia. The ancient inhabitants were a nation of shepherds and huntsmen, worshipping Pan, Hermes and Artemis, primitive nature-deities. The difficulties of communication and especially the lack of a seaboard seriously hindered intercourse with the rest of Greece. Consequently the same population, whose origins Greek tradition removed back into the world's earliest days, held the land throughout historic times, without even an admixture of Dorian immigrants. Their customs and dialect persisted, the latter maintaining a peculiar resemblance to that of the equally conservative Cypriotes. Thus Arcadia lagged behind the general development of Greece, and its political importance was small owing to chronic feuds between the townships (notably between Mantineia and Tegea) and the readiness of its youth for mercenary service abroad.

The importance of Arcadia in Greek history was due to its position between Sparta and the Isthmus. Unable to force their way through Argolis, the Lacedaemonians early set themselves to secure the passage through the central plateau. The resistance of single cities, and the temporary union of the Arcadians during the second Messenian war, did not defer the complete subjugation of the land beyond the 6th century. In later times revolts were easily stirred up among individual cities, but a united national movement was rarely concerted. Most of these rebellions were easily quelled by Sparta, though in 469 and again in 420 the disaffected cities, backed by Argos, formed a dangerous coalition and came near to establishing their independence. A more whole-hearted attempt at union in 371 after the battle of Leuctra resulted in the formation of a political league out of an old religious synod, and the foundation of a federal capital in a commanding strategic position (see MEGALOPOLIS). But a severe defeat at the hands of Sparta in 368 (the "tearless battle") and the recrudescence of internal discord soon paralysed this movement. The new fortress of Megalopolis, instead of supplying a centre of national life, merely accentuated the mutual jealousy of the cities. During the Hellenistic age Megalopolis stood staunchly by Macedonia; the rest of Arcadia rebelled against Antipater (330, 323) and Antigonus Gonatas (266). Similarly the various cities were divided in their allegiance between the Achaean and the Aetolian leagues, with the result that Arcadia became the battleground of these confederacies, or fell a prey to Sparta and Macedonia. These conflicts seem to have worn out the land, which already in Roman times had fallen into decay. An influx of Slavonic settlers in the 8th century A.D. checked the depopulation for a while, but Arcadia suffered severely from the constant quarrels of its Frankish barons (1205–1460). The succeeding centuries of Turkish rule, combined with an Albanian immigration, raised the prosperity of the land, but in the Wars of Independence the strategic importance of Arcadia once more made it a centre of conflict. In modern times the population remains sparse, and pending the complete restoration of the water conduits the soil is unproductive. The modern department of Arcadia extends to the Gulf of Nauplia with a sea-coast of about 40 m.

AUTHORITIES.—Strabo pp. 388 sq.; Pausanias viii.; W. M. Leake, *Travels in the Morea* (London, 1830), chs. iii., iv., xi.-xviii., xxiii.-xxvi.; E. Curtius, *Peloponnesos* (Gotha, 1851), i. 153-178; H. F. Tozer, *Geography of Greece* (London, 1873), pp. 287-292; E. A. Freeman, *Federal Government* (ed. 1893, London), ch. iv. § 3; B. V. Head, *Historia Numorum* (Oxford, 1887), pp. 372-373; B. Niese in *Hermes* (1899), pp. 520 f. (M. O. B. C.)

ARCADIUS (378–408), Roman emperor, the elder son of Theodosius the Great, was created Augustus in 383, and succeeded his father in 395 along with his brother Honorius. The empire was divided between them, Honorius governing the two western prefectures (Gaul and Italy), Arcadius the two eastern (the Orient and Illyricum). Both were feeble, and, in Gibbon's phrase, slumbered on their thrones, leaving the government to others. Arcadius submitted at first to the guidance of the praetorian prefect Rufinus, and, after his murder (end of 395) by the troops, to the counsels of the eunuch Eutropius (executed end of 399). His consort Eudoxia (daughter of a Frank general, Bauto), a woman of strong will, exercised great influence over him; she died in 404. In the last year of his reign, Anthemius (praetorian prefect) was the chief adviser and support of the throne. The first years of the reign were marked by the ravaging of the Greek peninsula by the West Goths under Alaric (*q.v.*) in 395–396. The movement of the Goth Gainas (who held the post of master of soldiers) in 399–400 is less famous but was more dangerous. At that time there were two rival political parties at Constantinople, the "Roman" party led by Aurelian (son of Taurus), praetorian prefect, and supported by the empress and a Germanizing and Arianizing party led by Aurelian's brother (possibly Caesarius, praetorian prefect in 400). Gainas entered into a close league with the latter; fomented a Gothic rebellion in Phrygia; and forced the emperor to put Eutropius to death. For some months he and the party which he supported were supreme in Constantinople. He was, however, finally forced to leave, and having plundered for some time in Thrace was captured and killed by the loyal Goth Fravitta. The Roman party recovered its power; Aurelian was again praetorian prefect in 402; and the Germanization which was to befall the western world was averted from the east. Another important question was decided in this reign, the relation of the patriarch of Constantinople to the emperor. The struggle between the court and the patriarch John Chrysostom (*q.v.*), who assumed an independent attitude and gravely offended the empress by his sermons against the worldliness and frivolity of the court, with open allusions to herself, resulted in his fall and exile (404). This virtually determined the subordination of the patriarch of Constantinople to the emperor. The rivalry of the see of Alexandria with Constantinople was also displayed in the contest, Theophilus, patriarch of Alexandria, assisting the court in bringing about the fall of Chrysostom. Throughout the reign of Arcadius there was estrangement and jealousy between the two brothers or their governments. The principal ground of this hostility was probably dissatisfaction on both sides with the territorial partition. The line had been drawn east of Dalmatia. The ministers of Arcadius desired to annex Dalmatia to his portion, while the general Stilicho, who was supreme in the west, wished to wrest from the eastern realm the prefecture of Illyricum or a considerable part of it. His designs were unsuccessful, and during the reign of Theodosius II., son of Arcadius (who died in 408), Dalmatia was transferred to the dominion of the eastern ruler.

Authorities.—Ancient: Fragments of Eunapius and Olympiodorus (in Müller's *Fragmenta Historicorum Graecorum*, vol. iv.); fragments of Philostorgius, Socrates, Sozomen, Zosimus, Synesius of Cyrene (" The Egyptian "), Claudian. Modern: Gibbon's *Decline and Fall*, vol. iii., ed. Bury; J. B. Bury, *Later Roman Empire*, vol. i. (1889); T. Hodgkin, *Italy and her Invaders*, vol. i. (ed. 2, 1892); Güldenpenning, *Geschichte des oströmischen Reiches unter den Kaisern Arcadius und Theodosius II.* (1885).

ARCADIUS, of Antioch, Greek grammarian, flourished in the 2nd century A.D. According to Suidas, he wrote treatises on orthography and syntax, and an onomaticon (vocabulary), described as a wonderful production. An epitome of the great work of Herodian on general prosody in twenty books, wrongly attributed to Arcadius, is probably the work of Theodosius of Alexandria or a grammarian named Aristodemus. This epitome (Περὶ Τόνων) only includes nineteen books of the original work; the twentieth is the work of a forger of the 16th century. Although meagre and carelessly put together, it is valuable, since it preserves the order of the original and thus affords a trustworthy foundation for its reconstruction.

Text by Barker, 1823; Schmidt, 1860; see also Galland, *De Arcadii qui fertur libro de accentibus* (1882).

ARCELLA (C. G. Ehrenberg), a genus of lobose Rhizopoda, characterized by a chitinous plano-convex shell, the circular aperture central on the flat ventral face, and more than one nucleus and contractile vacuole. It can develop vacuoles, or rather fine bubbles of carbonic acid gas in its cytoplasm, to float up to the surface of the water.

ARCESILAUS (316–241 B.C.), a Greek philosopher and founder of the New, or Middle, Academy (see Academy, Greek). Born at Pitane in Aeolis, he was trained by Autolycus, the mathematician, and later at Athens by Theophrastus and Crantor, by whom he was led to join the Academy. He subsequently became intimate with Polemon and Crates, whom he succeeded as head of the school. Diogenes Laertius says that he died of excessive drinking, but the testimony of others (*e.g.* Cleanthes) and his own precepts discredit the story, and he is known to have been much respected by the Athenians. His doctrines, which must be gathered from the writings of others (Cicero, *Acad.* i. 12, iv. 24; *De Orat.* iii. 18; Diogenes Laertius iv. 28; Sextus Empiricus, *Adv. Math.* vii. 150, *Pyrrh. Hyp.* i. 233), represent an attack on the Stoic φαντασία καταληπτική (*Criterion*) and are based on the sceptical element (see Scepticism) which was latent in the later writings of Plato. He held that strength of intellectual conviction cannot be regarded as valid, inasmuch as it is characteristic equally of contradictory convictions. The uncertainty of sensible *data* applies equally to the conclusions of reason, and therefore man must be content with *probability* which is sufficient as a practical guide. " We know nothing, not even our ignorance "; therefore the wise man will be content with an agnostic attitude. He made use of the Socratic method of instruction and left no writings. His arguments were marked by incisive humour and fertility of ideas.

See R. Brodeisen, *De Arcesila philosopho* (1821); Aug. Geffers, *De Arcesila* (1842); Ritter and Preller, *Hist. philos. graec.* (1898); Ed. Zeller, *Phil. d. Griech.* (iii. 1448); and general works under Scepticism.

ARCH, JOSEPH (1826–   ), English politician, founder of the National Agricultural Labourers' Union, was born at Barford, a village in Warwickshire, on the 10th of November 1826. His parents belonged to the labouring class. He inherited a strong sentiment of independence from his mother; and his objections to the social homage expected by those whom the catechism boldly styled his " betters " made him an " agitator." Having educated himself by unremitting exertions, and acquired fluency of speech as a Methodist local preacher, he founded in 1872 the National Agricultural Labourers' Union, of which he was president. A rise then came in the wages of agricultural labourers, but this had the unforeseen effect of destroying the union; for the labourers, deeming their object gained, ceased to " agitate." Mr Arch nevertheless retained sufficient popularity to be returned to parliament for north-west Norfolk in 1885; and although defeated next year owing to his advocacy of Irish Home Rule, he regained his seat in 1892, and held it in 1895, retiring in 1900. He was deservedly respected in the House of Commons; seldom has an agitator been so little of a demagogue.

A biography written by himself or under his direction, and edited by Lady Warwick (1898), tells the story of his career.

ARCH,[1] in building, a constructional arrangement of blocks of any hard material, so disposed on the lines of some curve that they give mutual support one to the other.

The blocks, which are technically known as voussoirs, should be of a wedge shape, the centre or top block (see fig. 1, A) being the keystone A; the lower blocks B B which rest on the supporting pier are the springers, the upper surface of which is called the skewback, C C; the side blocks, as D, are termed the haunches. The lower surface or soffit of the arch is the intrados, E, and the upper surface the extrados, F. The rise of the arch is the distance from the springing to the soffit, G, the width between the springers is called the span, H, and the radius I. The triangular spaces between the arches are termed spandrils, K.

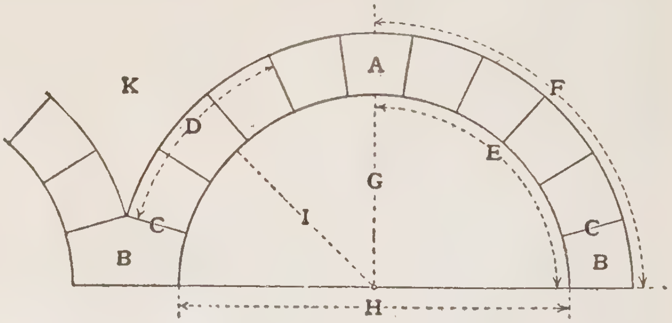


Fig. 1.

The arch is employed for two purposes:—(1) to span an opening in a wall and support the superstructure; (2) when continuous to form a vault known as a barrel or waggon vault.

The arch has been used from time immemorial by every nation, but owing to the tendency of the upper portion to sink, especially when bearing any superincumbent weight, it requires strong lateral support, and it is for this reason that in the earliest examples in unburnt brick at Nippur in Chaldaea, *c.* 4000 B.C., and at Rakākna (Requaqna) and Dendera in Egypt, 3500–3000 B.C., it was employed only below the level of the ground which served as an abutment on either side.

In the building of an arch, the voussoirs have to be temporarily supported, until the keystone is inserted. This at the present day is effected by means of centreing an assemblage of timbers framed together, with its upper surface of the same form as the arch required; the voussoirs are laid on the centreing till the ring of the arch is completed. In the case of arches of small span, such as the early examples referred to, limited to about 6 ft., such centreing might be dispensed with in various ways, but it is difficult to see how the arches of the great entrance gateways, shown in the Assyrian bas-reliefs, could have been built without temporary support of some kind. In those days, when any amount of labour could be obtained, even the erection of a temporary wall might have been less costly than the employment of timber, of which there was great scarcity.

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[1] The ultimate derivation of " arch " is the Latin *arcus*, a bow, or arch, in origin meaning something bent, from which through the French is also derived " arc," a curve. In French there are two words *arche*, one meaning a chest or coffer, from Latin *arca* (*arcere*, to keep close), hence the English " ark "; the other meaning a vaulted arch, such as that of a bridge, and derived from a Low Latin corruption of *arcus*, into *arca* (du Cange, *Glossarium*, s.v.). The word " arch," prefixed to names of offices, seen in " archbishop," " archdeacon," " archduke," &c., means " principal " or " chief," and comes from the Greek prefix ἀρχ- or ἀρχι- from ἄρχειν, to begin, lead, or rule; it is also prefixed to other words, and usually with words implying hatred or detestation, such as " arch-fiend ", " arch-scoundrel "; it is from an adaptation of this use, as seen in such expressions as " arch-rogue," extended to " arch-look," " arch-face," that the word comes to mean a mischievous, roguish expression of face or demeanour.

The Assyrian tradition would seem to have descended first to the Parthian builders, who in the palace of El Hadr built semicircular arches with regular voussoirs decoratively treated. The Sassanians who followed them employed the elliptical or egg-shaped arch, of which the lower part was built in horizontal courses up to about one-third of the height, which lessened the span of the arched portion.

In Europe the earliest arches were those built by the Etruscans, either over canals (see article ARCHITECTURE: *Etruscan*), or in the entrance gateways of their towns. The skew-arch in the gateway at Perugia shows great knowledge in its execution. From the Etruscans the adoption of the arch passed to the Romans, who certainly employed centreing of some kind, but always economized its use, as is clearly shown by Choisy. Although their walls from the Augustan age were built in concrete, arches of brick were always turned over their entrance doorways, sometimes in two or three rings. The Romans utilized the arch in other ways, sometimes burying it in their concrete construction, as in their vaults, and sometimes introducing it as a veneer only, as in the Pantheon. In their monumental structures in stone, the arch was sometimes built with regular voussoirs, *i.e.* with a semicircular extrados, and sometimes with the joint carried far beyond. The latter was not done in the early examples of the Tabularium and the Theatre of Marcellus, but in the Colosseum and all the arches of triumph the joints run through the spandrils, notwithstanding the recognition of the arch proper by its moulded archivolt.

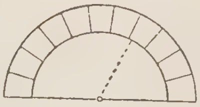
Although the value of the pointed arch as a stronger constructional feature than the semicircular (owing to the tendency to sink in the keystone of the latter) had been recognized by the Assyrian builders, who employed it in their drains, it was not used systematically as an architectural feature till the 9th century, in the mosque of Tulun at Cairo; it seems to have been regarded by the Mahommedans as an emblem of their faith, and its use spread through Syria to Persia, was brought to Sicily from Egypt, and was taken back by the Sicilian masons to Palestine and employed throughout the Crusaders' churches during the 12th century. As the pointed arch had already, for constructional reasons, been employed in Périgord from the commencement of the 11th century, it does not follow that the Crusaders brought it from Palestine, but there is no doubt that its universal employment in France early in the 12th century may have been partly due to its adoption in the Crusaders' churches. At first in Gothic work both the semicircular and pointed arches were used simultaneously in the same building, the larger arches being pointed, the smaller ones and windows being semicircular. The great value of the pointed arch in vaulting is described in the article VAULT.

We have suggested that the pointed arch became an emblem of Mahommedan faith, and it was introduced in India but not as a constructive feature, for the Hindus objected to the arch, which they say *never sleeps*, meaning that it is always exerting a thrust which tends to its destruction. In India therefore it was built in horizontal courses with vertical slabs leaning against one another to form the apex. The Moors of north Africa, however, never employed it, preferring the horseshoe arch which they brought into Spain and developed in the mosque of Cordova. In the additions made to this mosque the prayer chamber was enriched by the caliph Mansur, who, to eke out the height, raised arch upon arch. In the Alhambra it appears in the decorative plaster work, and travels northwards into the south of France, where at Le Puy and elsewhere it is found decorating doorways and windows; in England it was employed towards the end of the 12th century.

About the middle of the 14th century at Gloucester the four-centred pointed arch was introduced, which became afterwards the leading characteristic feature of the Tudor style. In France they adopted the three-centred arch in the 15th century.

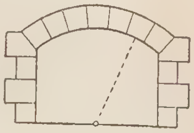
The ogee arch was the natural result of the development of tracery in the commencement of the 14th century, and in Gloucester (about 1310) the foliations were run one into the other without the enclosing circles. About the middle of the 14th century, in the arcade of the first storey of the ducal palace in Venice, flowing tracery is found, from which the ogee arch there was probably derived, as throughout Venice it becomes the favourite feature in domestic architecture of that and the succeeding century.

The arches are of various forms as follows:—



2

2. Semicircular arch, the centre of which is in the same line with its springers.



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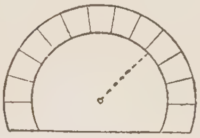
3. Segmental arch, where the centre is below the springing.



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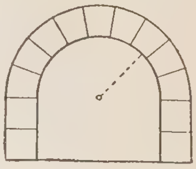
4. Horseshoe arch, with the centre above the springing; employed in Moorish architecture.



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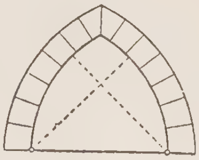
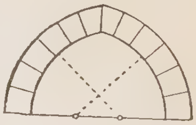
5. Stilted arches, where the centre is below the springing, but the sides are carried down vertically.



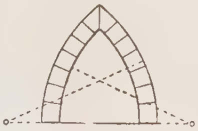
6

6. Equilateral pointed arches, described from two centres, the radius being the whole width of the arch.



7

7. Drop arches, with centres within the arch.



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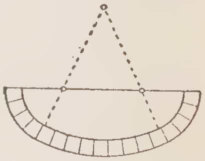
8. Lancet arches, with centres outside the arch.



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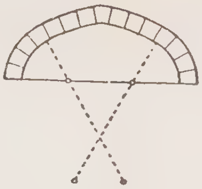
9. Three centre arches, employed in French Flamboyant.



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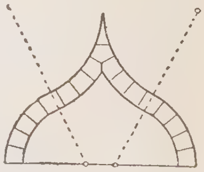
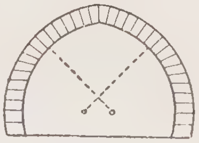
10. Four centre arches, employed in the Perpendicular and Tudor periods.



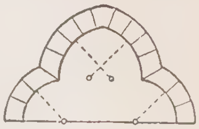
11

11. Ogee arches, with curves of counter flexure, found in English Decorated and French Flamboyant.



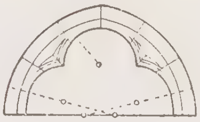
12

12. Pointed horseshoe arches, found in the mosque of Tulun, Cairo, 9th century.



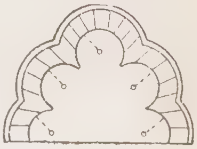
13

13. Pointed foiled arches, in the arcades of Beverley Minster (*c.* 1230) and Netley Abbey.



14

14. Cusped arch; Christchurch Priory, Hants.



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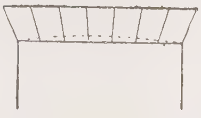
15. Multifoil cusped arch, invented by the Moors at Cordova in the 10th century.



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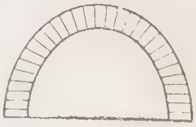
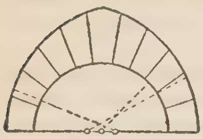
16. Flat arch, where the soffit is horizontal and sometimes slightly cambered (dotted line).



17

17. Upright elliptical arch, sometimes called the egg-shaped arch, employed in Egyptian and Sassanian architecture.



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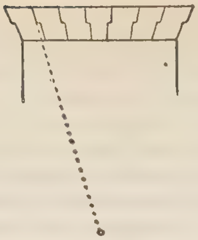

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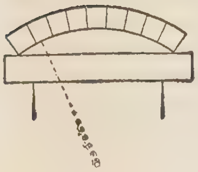

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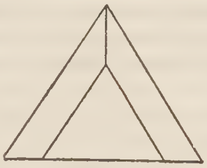


21

18. The Tuscan arch, where the extrados takes the form of a pointed arch.

19. The joggled arch used in medieval chimneypieces and in Mahommedan architecture.

20. The discharging or relieving arch, built above the architrave or lintel to take off the weight of the superstructure.

21. The relieving arch as used in Egypt, in the pyramid of Cheops; and in Saxon architecture, where it was built with Roman bricks or tiles, or consisted of two sloping slabs of stone.

(R. P. S.)

ARCHAEOLOGY (from Gr. ἀρχαῖα, ancient things, and λόγος, theory or science), a general term for the study of antiquities. The precise application of the term has varied from time to time with the progress of knowledge, according to the character of the subjects investigated and the purpose for which they were studied. At one time it was thought improper to use it in relation to any but the artistic remains of Greece and Rome, *i.e.* the so-called *classical archaeology* (now dealt with in this encyclopaedia under the headings of GREEK ART and ROMAN ART); but of late years it has commonly been accepted as including the whole range of ancient human activity, from the first traceable appearance of man on the earth to the middle ages. It may thus be conceived how vast a field archaeology embraces, and how intimately it is connected with the sciences of geology (*q.v.*) and anthropology (*q.v.*), while it naturally includes within its borders the consideration of all the civilizations of ancient times.

In dealing with so vast a subject, it becomes necessary to distinguish. The archaeology of zoological species constitutes the sphere of palaeontology (*q.v.*), while that of botanical species is dealt with as palaeobotany (*q.v.*); and every different science thus has its archaeological side. For practical purposes it is now convenient to separate the sphere of archaeology in its relation to the study of the purely *artistic* character of ancient remains, from that of the investigation of these remains as an instrument for arriving at conclusions as to the political and social *history* of the nations of antiquity; and in this work the former is regarded primarily as "art" and dealt with in the articles devoted to the history of art or the separate arts, while "archaeology" is particularly regarded as the study of the evidences for the history of mankind, whether or not the remains are themselves artistically and aesthetically valuable. In this sense a knowledge of the archaeology is part of the materials from which every historical article in this encyclopaedia is constructed, and in recent years no subject has been more fertile in yielding information than "archaeology," as representing the work of trained excavators and students of antiquity in all parts of the world, but notably in the countries round the Mediterranean. It is for its services in illuminating the days before those of documentary history and for checking and reinforcing the evidence of the raw material (the "unwritten history" of architecture, tombs, art-products, &c.), that recent archaeological work has been so notable. The work of the literary critic and historian has been amplified by the spade-work of the expert excavator and explorer to an extent undreamt of by former generations; and ancient remains, instead of being treated merely as interesting objects of art, have been forced to give up their secret to the historian, as evidence for the period, character and affiliations of the peoples who produced and used them. The increase of precise knowledge of the past, due to greater opportunities of topographical research, more care and observation in dealing with ancient remains and improved methods of studying them in museums (*q.v.*) and collections, has led to more accurate reading of results by a comparison of views, under the auspices of learned societies and institutions, thus raising archaeology from among the more empirical branches of learning into the region of the more exact sciences. This change has improved not only the status of archaeology but also its material, for the higher standard of work now demanded necessarily acts as a deterrent on the poorly equipped worker, and the tendency is for the general result to be of a higher quality.

The archaeological details concerning all subjects which have their "unwritten history" are dealt with in the separate articles in this work, including the ancient civilizations of Assyria, Egypt and other countries and peoples, while the articles on separate sites where excavations have been particularly noteworthy may be referred to for their special interest; see also ANTHROPOLOGY; ETHNOLOGY, &c. It remains here to deal generally with the early conditions of the prehistoric ancient world in their broader aspects, which constitute the starting-place for the archaeologist in various parts of the world at different times, and the foundations of our present understanding of the primitive epochs in the history of man.

Quaternary period.

The beginning of archaeology, as the study of pre-documentary history, may be broadly held to follow on the last of the geological periods, viz., the Quaternary, though it is claimed, and with some reason, that traces of man have been found in deposits of the preceding or Tertiary period. Although there is no valid reason against the existence of Tertiary man, it must be confessed that the evidence in favour of the belief is of a very inconclusive and unconvincing kind. The discussion has been mainly confined to the two questions (1) whether the deposit containing the relics was without doubt of Tertiary times, and (2) whether the objects found showed undoubted signs of human workmanship. Vast quantities of material have been brought forward, and endless discussions have taken place, but hitherto without carrying entire conviction to the minds of the more serious and cautious students of prehistoric archaeology. A chronic difficulty, and one which can never be entirely removed, is our ignorance of the precise methods of nature's working. It is an obvious fact, that natural forces, such as glacial action, earthquakes, landslips and the like, must crush and chip flints and break up animal remains, grinding and scratching them in masses of gravel or sand. If it were possible to determine with precision what were the peculiarities of the flint or bone, thus altered by natural agencies, it would be easy to separate them from others purposely made by man to serve some useful end. Our present knowledge, however, does not allow us to go so far in dealing with the ruder early attempts of man to fabricate weapons or implements. Even the one feature that is commonly held to determine human agency, the "bulb of percussion," cannot be considered satisfactory, without collateral evidence of some kind. Flint breaks with what is called a conchoidal fracture, as do many other substances, such as glass. Thus on the face of a flint flake, at the end where the blow was delivered to detach it from the nodule, is seen a lump or bulb, which is usually regarded as evidence of human workmanship. To produce such a bulb it is necessary to deliver a somewhat heavy blow of a peculiar kind at a particular point of a flattened surface; and the operation requires a certain amount of practice. The fulfilment of all the necessary conditions might well be a rare occurrence in nature, and the bulb of percussion has come to be regarded as the hall-mark of human manufacture; but recent investigations have shown that the intervention of man is not necessary and that natural forces frequently produce a similar result. When, therefore, it is a question whether or no a group of rude flints are of human workmanship, evidence of design or purpose in their forms must be established. If this be found, and in addition if a number of flints, all having this character of design, be found together, then and then only is it safe to admit them into the domain of archaeology. There can be no doubt that much time and energy have been wasted, and a number of intelligent workers have been fruitlessly occupied in following up archaeological will-o'-the-wisps, through neglecting this elementary precaution.

Eolithic.

Whether or no man produced flint implements before Quaternary times, it would seem to be a necessity that he should have passed through an earlier stage, before arriving at the precision of workmanship and the fixed types found in the old Stone Age deposits known as palaeolithic. It is now claimed that this earlier and ruder stage has actually been discovered in what are known as the Plateau-gravels of Kent, in Belgium, and even in Egypt, and the name of eolithic (ἠώς, dawn, λίθος, stone) has been bestowed upon them. The controversy as to the human character has been very keen, some alleging that the fractured edges and even the definite and fairly constant types are entirely produced by natural forces. Sir Joseph Prestwich in England, and Alfred Rutot in Belgium, the latter arguing from his own discoveries in that country, have strongly supported the artificial character of the relics. On the other hand it is pointed out that the existence of these implements on the high levels of Kent furnished confirmation of Sir Joseph Prestwich's theory of the submergence of the district, and that his support was thus somewhat biassed, while the geological conditions in Belgium are not quite comparable with those of the Kent plateau; and the Belgian evidence, whatever it may be worth in itself, is of no avail as corroboration of the Kentish case. It is to be regretted that the conditions are not more convincing, for, as stated above, they agree fairly well with the evolution theory of man's handiwork, and if they could be accepted, would carry back the evidences to a more remote time when the physical features of Kent were of a very different character. The critics of eoliths have brought forward some facts that at first sight would seem to be of a very damaging nature. It was observed that in the process of cement manufacture the flints that had passed through a rotary machine in which they were violently struck by its teeth or knocked against each other, possessed just those features that were claimed as indisputable proof of man's handiwork, and that even the forms were the same. These statements have, of course, been met by counter-statements equally forcible, and the matter may still be considered to be in suspense. The great struggle, therefore, is now more closely restricted to the nature of the chipping than as to the quasi-geological question, and if the solution is ever to be found, it will be by means of a closer examination and a better understanding of the difference between intentional and accidental flaking.

Palaeolithic.

On reaching the Palaeolithic period we come to firmer ground and to evidence that is more certain and generally accepted. This evidence is fundamentally geological, inasmuch as the age of the archaeological remains is dependent upon that of the beds in which they are found. That they were deposited at the same time is now no longer questioned. The flints are found to have the same colour and surface characteristics as the unworked nodules among which they lie, and are generally rolled and abraded in the same way. This in itself suffices to show that the worked and unworked flints were deposited in their present stratigraphical position at the same time. The remote age of the beds themselves is demonstrated by the presence of bones of animals either now extinct or found only in far distant latitudes, such as the mammoth, reindeer, rhinoceros, &c., and in some cases these bones are found in such relative positions as to prove they were deposited with the flesh still adhering to them, and also that the animal was contemporary with the makers of the flint implements. Evidence of a somewhat different kind is provided for the palaeolithic period by certain caverns that have been discovered in England and on the continent. In these limestone caves palaeolithic man has lived, slept, eaten his food and made his tools and weapons. Much of his handiwork has been left, with the bones of animals on which he lived, scattered upon the floor of the cave, and has been sealed up by the infiltration of lime-charged water, so that the deposit remains, untouched to our own day, below an impermeable bed of stalagmite. In such circumstances there can be no doubt of the contemporaneous character of the remains, natural or artificial, if found on the same level. Moreover, so far as type is a criterion of age, the flint tools found in the cave deposits tend to confirm the date assigned to those of the river-gravels.

It is fairly certain that about the middle of the Tertiary period the northern hemisphere possessed a temperate climate, such that even the polar regions were habitable. But the physical aspect of northern Europe was very different from that of Quaternary times. North of a line drawn roughly from southern England to St Petersburg all was sea. It was during the latter half of the Tertiary period that the continent assumed its present general form, though even in Pleistocene (Quaternary) times England and Ireland formed part of it. The great change of climate from temperate to arctic conditions during the latter half of the Tertiary period has been interpreted in various ways, no one of which is yet universally accepted. There can be little doubt, however, that no single cause was responsible for so complete a change. There may have been some alteration in the relative positions of the earth and the sun, which would conceivably have produced it; but what is practically certain is that the physical geography of northern Europe was affected by considerable difference in level, and it is clear that the raising of mountain ranges and the general elevation of the continent must necessarily have reacted on the climatic conditions. If in the later Tertiary time we find that the Alps, the Carpathians and the Caucasus have come into existence, it is not surprising to find that these huge condensers have brought about a humid condition of the continent to such an extent that this phase has been called the Pluvial Age. The humidity, however, was in some ways only a secondary result of the protrusion of high mountain ranges. The primary cause of the physical conditions that we now find in the valleys and plains was the formation of glaciers. These rivers of ice descending far into the lower levels during the winter months, melted during the summer, causing enormous volumes of water to rush through the valleys and over the plains, carrying with it masses of mud and boulders which were left stranded sometimes at immense distances. The intensity and force of the rivers thus formed would depend upon two factors, first the extent of the watershed, and secondly, the height of the mountains from which the water was derived. The result of increasing cold was that in course of time the northern hemisphere was surmounted by a cap of ice, of immense thickness (about 6000 ft.) in the Scandinavian area and gradually becoming thinner towards the south, but at no time does it seem to have extended quite to the south of England. This is proved by the absence of boulder-clay (glacial mud) in the districts south of London. These arctic conditions were not, however, continuous, but alternated with periods of a much less rigorous temperature during what has been called the Ice Age. Remains both of mammals and plants have been found, under conditions that are held to prove this alternation.

Such being the natural forces at work remodelling the surface of the earth, forces of such gigantic power as to be almost inconceivable in these more placid times, it can easily be understood how, in the course of the many thousands of years before the Quaternary period, when the surface of the globe attained its present aspect, the powerful river-systems of Europe wore their beds deep into the solid rocks. In some cases in Europe the erosive power of the river has worn through its bed to such an extent that the present stream is some hundreds of feet lower than its forerunner in palaeolithic times. From various causes, however, the rivers did not always wear for themselves a deep channel, but spread themselves over a wide area. This seems to have been the case with the Thames near London: the river-bed is not of any great depth, but at various periods it has occupied the space between Clapton on the north-east and Clapham on the south-west. It must not be assumed that the whole of this area of 7 m. or more was filled by the river at any one time, but rather that during the course of the palaeolithic period the river had its bed somewhere between these two limits. For instance, it is probable that at one period the bank of the Thames was at a point nearly midway between the northern and southern limits, where Gray's Inn Road now stands. It was here that the earliest recorded palaeolithic implement (now in the British Museum) was found towards the close of the 17th century in association with mammoth bones. But it is safe to say that the Thames was a very much wider and more imposing river in palaeolithic times than it is now, when its average width at London is under 300 yds. As, in the course of ages, it changed its bed and by degrees lessened in size and volume, it would leave, on the terraces formed on its banks, the deposits of brick-earth and gravel brought down by the stream, and it is on these terraces that the relics of palaeolithic man are found, sometimes in great quantities. It will be obvious from the nature of the case that the highest terraces, and those farthest apart, should contain the earliest implements; but it is by no means easy in the present state of the land surface and with our present knowledge, to place the remains in their relative sequence. More accurate observation, and a better understanding of the conditions under which these deposits were made, should solve many such problems. Much light has been thrown upon many points by Worthington Smith, who has excavated with great care two palaeolithic floors at Clapton and at Caddington near Dunstable. The latter discovery was of quite exceptional interest as confirming the geological evidence by that of archaeology. In this case the original level at which palaeolithic man had worked was clearly defined, and was prolific of dark-grey implements, which had evidently been made on the spot, as Smith found that many of the flakes could be replaced on the blocks or cores from which they had been struck by palaeolithic man; there were also the flint hammers that had been used in the operation. Above the floor was a layer of brick-earth, again covered by contorted drift, in which also implements occurred, but of a very different kind from those found below. In place of being sharp and unabraded, and with the refuse flakes accompanying them, they were rolled and disfigured, of an ochreous tint, and evidently had been transported in the drift from a much higher level now no longer existing, as the site where they occurred is the highest in the vicinity, about 500–600 ft. above sea-level. Here then we have a clear case of palaeolithic man being compelled to abandon his working place on the lower level by the descent of the waters containing the products of his own forerunners, probably then very remote. In this case the sequence of the various strata may be considered certain, and the remains thus accurately determined and correlated are naturally of extreme value and importance. But even this does not enable us to diagnose another discovery unless the internal evidence is equally clear and conclusive. One point of importance that may be noted is that the older abraded implements were mostly of the usual drift type, while the more recent ones from the "floor" contained forms more highly developed and elaborated, such as occur in the French caves. Explorations of this kind, carefully conducted in a strictly scientific spirit by men of training and intelligence, are the only means by which real progress will be made in this puzzling branch of archaeology.

Although many problems yet remain to be solved in England, its small area, and the relatively large number of workers, have together sufficed to put the main facts of the earlier stages of man's existence on a fairly satisfactory basis. In France, owing to the richness of the results, a great number of trained and ardent workers have made equal, if not better, progress. But unfortunately the real scientific spirit is not invariably found. Not so long ago an apparently serious writer in a well-known scientific magazine gave a detailed account of his studies in primitive methods and explained at great length his attempts at the manufacture of flint and stone implements. He found by the processes he adopted that it was much more easy for him to produce a polished implement than one merely flaked. From this fact he seriously argued that a great mistake had been made in the relative ages of the neolithic and palaeolithic periods, and that the former must necessarily be the older of the two. The evidence of geological position and of the mammalian remains accompanying the obviously older flints was entirely disregarded, just as on the other hand it was forgotten that in regard to neolithic remains the proofs were in every way in favour of a relatively modern origin. Such attempts not only bring the serious study of early man into disrepute, but tend to retard the progress of real knowledge and are therefore to be deplored and when possible discouraged.

Cave Period.

Caves (*q.v.*) have been at all periods regarded as something uncanny and mysterious, with perhaps a tinge of the supernatural. In classical times they were associated with semi-divine beings, with oracles, and even with the gods themselves, while half the legends of dwarfs and gnomes that run through the folk-lore of medieval and modern Europe are associated with caves. They have been used as shelters or habitations at all times, and in examining them it is fully as necessary to sift the evidence of age as it would be in dealing with the river-gravels. Their exploration in the first instance may well have been due to chance, but it is fairly certain that during the 16th century the search for the horn of the unicorn as an antidote to disease, was responsible for the opening up of a certain number. Among the finds were no doubt the fossil bones of Quaternary animals to which mythical names and imaginary properties were attached, and the popular belief in such amulets naturally gave a great impetus to the search. It is, however, only a little more than a century ago that these investigations took anything like a scientific turn, and even then they had only a palaeontological end in view. The idea that archaeology entered into the matter was not at all realized for some years. The remains of many extinct or migrated animals, such as the hyena, grizzly bear, reindeer and bison, were found in quantities in the now famous cave at Gailenreuth in Franconia; and later, William Buckland explored the equally well-known hyena-cave at Kirkdale in Yorkshire, where he demonstrated that these animals had lived on the spot, feeding on the mammoth, rhinoceros and other creatures that had been their prey. The remains of man, however, had not been found, nor were they even looked for. It was not until Kent's cavern, near Torquay, was examined by the Rev. J. McEnery, that man was clearly proved to have been contemporary with these extinct beasts. So contrary was this contention to the ideas prevalent in the second quarter of the 19th century, that the pioneer in this work had died (in 1841) before the immense importance of his discovery was admitted. To Godwin Austen in the first place and to W. Pengelley in the second, with the aid of the British Association, was due the vindication of McEnery's veracity and accuracy.

Several circumstances conspire to give a special interest to Kent's cavern, and not the least is the fact that the age and appearance of the various strata indicate that it has been the home or the refuge of human beings at all ages even up to medieval times, and perhaps from a period even more remote than is the case elsewhere. In the black mould that formed the uppermost layer were found fragments of medieval pottery, and relatively in close proximity were ancient British and Roman remains as well as relics of the earliest days of metallurgy, in the shape of bronze fragments. The two thousand years or more that may have separated the oldest from the most modern of these later products, is as nothing in comparison with the immense intervals that lie between the earliest of them and the infinitely more remote period when gigantic mammals first inhabited the cave. Attempts have been made from time to time to express in years what the interval must have been: but as the computations have differed by hundreds of thousands of years, according to the method adopted, it is scarcely wise to do more than speculate. Beneath the black mould, containing what may be called the recent remains, was a layer of stalagmite, some feet in thickness; and under this at one place was a great quantity of charcoal, which has been with good reason assumed to show the site of fireplaces. A quantity of implements of palaeolithic type was found, but the main layer at this level consisted of a reddish clay known as cave-earth, and in this deposit were implements both of flint and horn, as well as bones of extinct animals. The flint implements were mostly of the usual river-drift type, but some were of types generally confined to cave-deposits of this period; while the barbed harpoon heads, and more especially a bone needle, were definitely of the cave class, so well represented in the caves of Dordogne. Again, below the cave-earth was a *breccia* formed of limestone and sandstone pebbles cemented together by a calcareous paste. In this also were found implements and bones of bears.

The succession of strata indicated above may be taken as typical of the caverns used by palaeolithic man, the breccia and stalagmite flooring being in themselves proof of a very considerable age, while the association in the former, or under the latter, of remains of human handiwork, with bones of extinct animals, may be safely taken to show contemporaneous existence.

Once the mind has fairly grasped the fact that man was living at so remote a time, it is a simple and natural conclusion that he should have provided himself with weapons and tools more or less rudely fashioned from the stones he found ready to his hand. The analogy of the recently extinct Tasmanian is sufficient to show that even the meanest savage is not without such aids. But the caves of France, of the same palaeolithic period, and used by men theoretically in the same stage of culture, bring before us a race of artists of first-rate capacity, who for accuracy of observation, and for skill in indicating the character and peculiarities of the animals around them, have never been surpassed. Such a statement sounds like a contradiction in terms. We are dealing with human beings whose intellect, to judge by their physical characters, should be on a level with that of the Fuegian or the Australian black, and far below that of the Maori or the Sandwich Islander. Yet none of these gentle and relatively cultured brown races produced anything in the nature of art that can in any sense be compared with the masterly drawings or sculptures of the cave-men of France. The best-known of the engravings, that of the mammoth on a piece of ivory, is in the Jardin des Plantes in Paris. It is evidently intended to be nothing more than a sketch, the lines of the finely curved tusks being repeated several times in the desire for accuracy. But the heavy lumbering walk of the ponderous beast, his attitude, and even the character of the hairy hide, are all shown or suggested with a skill and freedom that not only denotes daily familiarity with the thing represented, but a most complete mastery of the art of translating the idea into simple line. This mammoth-drawing is probably the most important and monumental of its class, but there are many others that possess artistic qualities not less remarkable, while they have in addition a grace and beauty of line not less astonishing. One of these, in the British Museum, the head of an ibex-like creature, is outlined with a decision and refinement that can scarcely be surpassed, and many other sketches in horn or stone in the same collection show a keen appreciation of the characteristic features of the different animals as well as a masterly deftness in the handling of the graving-tool. If we are forced to marvel at the graphic skill of the cave-men, their sculptures in the round are on a still higher plane, as may be seen in the figures of reindeer in ivory in the British Museum. While they are not highly finished, they show a complete understanding of the animal's peculiar forms and contours, which are rendered in a direct, unhesitating way that should betoken a long period of artistic training and an executive power uncommon at any time. These drawings and sculptures have always been appreciated and even regarded as being of a much more advanced style than was to be expected among men who are always classed in the lower grades of culture. But enough stress has not hitherto been laid on the artistic quality of the work, which would be considered fine at any time in the world's history. This high artistic level was attained by a race of men whom we cannot credit with any great intellectual equipment; men, moreover, who were engaged in a daily struggle for the barest necessaries of life, in a trying climate and surrounded by a fauna whose means of attack and defence were infinitely superior to their own. There are many astonishing problems in archaeology, but none so badly in need of solution. Had the discovery been confined to a single drawing or even to a single site, fraud or a misreading of the conditions might have been alleged, but the case is very different. The drawings and sculptures have been found generally enough in France to demonstrate that such artistic power was fairly common, while the question of the authenticity and period of the discoveries has long since been satisfactorily settled. It is true that the climatic conditions in pleistocene France were more favourable to man than was the case farther north, but even an agreeable climate does not necessarily produce an artistic race; if it were so, the Polynesians would probably be the greatest artists the world has ever seen. The physical remains of palaeolithic man, even when found under unquestionable conditions, are, however, so scanty, that it is unlikely that the important question of the race or races inhabiting central and northern Europe will ever be settled by their means. The evidence at present is in favour of two very different types, one dwarfish and brutal (Canstadt), the other more advanced and noble in physical character (Cro-Magnon). To the latter were due the artistic productions, and until further physical evidence is forthcoming recourse must be had to the most minute examination of the objects themselves and to accurate observation of the conditions under which they are found. So far as our present materials go, these are the only means by which more light may be thrown on the many problems of early man.

In spite of the unquestioned and unquestionable character of palaeolithic discoveries in general, it must not be assumed that there has been an absence of falsification, forgery, and what the French call "mystification"; on the contrary, such attempts to meet the demand have been common enough. Apart from Edward Simpson, who was notorious as "Flint Jack" in the middle of the 19th century, many others, both in England and on the continent of Europe, have devoted themselves to this peculiar industry. Boucher de Perthes tried to conquer the scepticism of some of his friends who doubted the human origin of the Abbeville flints, by unwisely offering his workmen a reward for the discovery of human bones in the same beds. The Moulin Quignon jaw was accordingly produced, and became the subject of much controversy; but the evidence finally showed that it had originally come from elsewhere. The cave drawings also have found their imitators in modern times. One Meillet, a man of education, took a special pleasure in the production of spurious examples, and even published an account of his pretended discoveries. But here, as in all the attempts at imitation of the cave drawings, the modern efforts were betrayed by their poor artistic quality, and a comparison of the new discoveries with the old was generally enough to disclose the forgery. Two drawings on bone of a wolf and a bear, declared to have been found in a cave at Thayingen in Switzerland, were afterwards shown to have been copied from a child's picture-book. In Switzerland also a brisk trade was carried on some years ago in false antiquities said to come from the Lake-dwellings; and fantastic types of tools and implements were placed on the market. In Italy, too, a lively discussion has taken place of late years over the authenticity of curiously shaped flint implements from the neighbourhood of Verona; while America has provided similar food for discussion in the well-known Lenapé stone and the Calaveras skull. The former bears drawings of the French cave type, while the latter if genuine would carry back the story of man in the American continent before Pliocene times.

Mesolithic.

An apparent break in the continuity of man's history in Europe occurs at the end of the palaeolithic period. Attempts have been made to bridge the gap by means of a "mesolithic" period (μέσος, middle); but it would not seem probable that the missing links will occur at all events so far north as Britain. We leave palaeolithic man in a cold climate, surrounded by a somewhat mixed fauna that formed his prey. We know him as a hunter and artist, but the remains show that he had no knowledge of pottery till towards the close of the period. Among the humbler arts he practised at least sewing, and lived in caves or took shelter at the base of overhanging rocks; but like the Australian, he frequently camped in the open. His successor of the later Stone Age (neolithic) we find to be a very different character and with very different surroundings. The configuration of the land in which he lived is practically the same as we now see it. The severe arctic conditions with the appropriate fauna had entirely disappeared, and the introduction of new arts must have radically changed his daily life. The most important of these are the training of domestic animals, agriculture, and the development of pottery. What were the burial rites of palaeolithic man we have at present no means of knowing, but for his neolithic successor we know that these were matters of great moment. The abundance of arrowheads of flint indicate the common use of the bow and arrow as a weapon, while the art of weaving marks an immense stride in the direction of comfort and civilization. Of the form and construction of his dwelling we have only a limited knowledge, derived with some uncertainty from the analogy of the dwellings for the dead (barrows) and more certainly from the remains of the villages found erected on piles on the shores of lakes.

A much-debated question arises here that cannot be passed over. The changes just mentioned are not such as would be produced by internal causes alone. Much of the evidence is in favour of neolithic man being an immigrant, coming into northern and central Europe long after palaeolithic man and his characteristic fauna had disappeared. Where did the earlier race go and who are its modern representatives, if any? The answers to this question are many. W. Boyd Dawkins is of opinion that the reindeer was followed by man in its journey to the north after the retreating glaciers, and that the modern representative of palaeolithic man is the Eskimo. His arguments are ingenious but unconvincing; they mainly consist in the similarity of the habits of both races in using harpoons and implements of similar form and make, their power of carving and drawing on bone, the absence of pottery, disregard of the dead, &c. As to the positive evidence, it is almost enough to say that the Eskimo, like the cave-men, used the material nearest to hand that served their purpose, and that nothing is more remarkable than the similarity of primitive weapons used by widely separated peoples; while the negative evidence as to the absence of pottery is of little value; their conditions of life would allow them neither to make it nor keep it. Till recently we had no evidence at all of the treatment of the dead by palaeolithic man, but this is no longer the case; the discoveries in the Grottes de Grimaldi, Monaco, show several methods of burial, near a hearth, or in rude stone cists (see Dr Verneau in *L'Anthropologie*, xvii. 291). A stronger argument would be furnished if it could be shown that by his physical character the Eskimo is an intruder in his present home, and is unrelated to his neighbours. But this has not yet been done, and the skulls of the Eskimo do not resemble any of those hitherto found in the caves. In fact, what evidence there is on the subject is rather against than in favour of the wanderings northward of the inhabitants of the caves. There are indications, on the other hand, that in the south of France, in the Pyrenees, the reindeer was in existence, with man, at a later period than that of the caves, while the type of skull is that of Cro-Magnon. Here, therefore, it may be that something like a bridging of the gap between palaeolithic and neolithic times may be forthcoming. But it still remains to be found, and for the present we must be content with uncertainty.

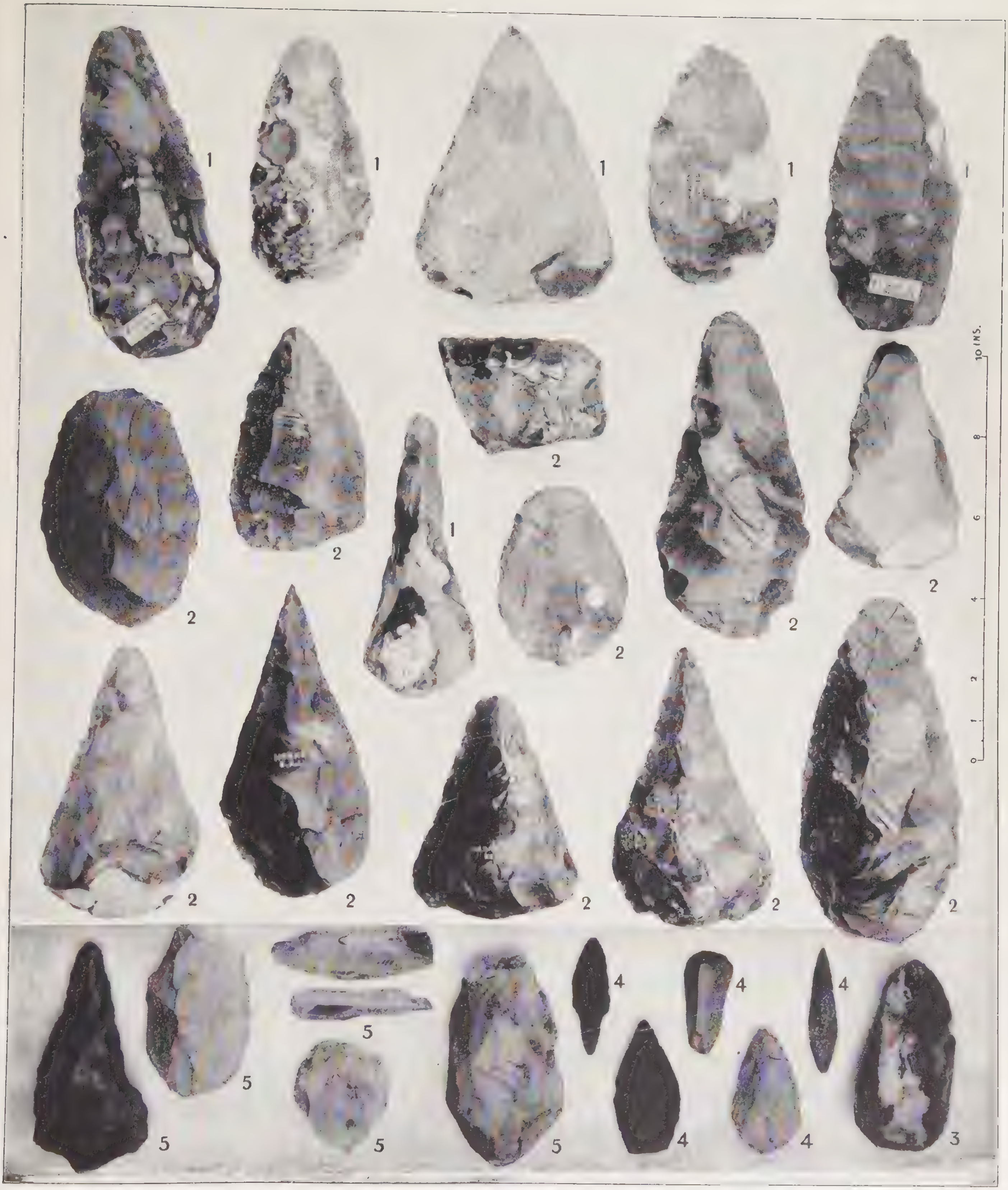
Neolithic.

The neolithic period has often been loosely called the age of polished stone, from the fact that in no case has a polished or ground stone implement been found in a palaeolithic deposit. The term is not only loose but inaccurate. In the first place, there is no reason why the cave-men should not be found to have polished a stone implement on occasion, for they habitually polished their weapons of bone. Secondly, neolithic man was by no means uniform in his methods; he polished or ground the surfaces of such tools or weapons as would be improved by the process; but to take a common instance, he found that the efficacy of his arrow-point was sufficient when chipped only, and polishing is only occasionally found, as in Ireland. Many other implements also are found in neolithic times with no trace of grinding and yet with every appearance of being complete.

The most trustworthy evidence with regard to this and the succeeding archaeological periods is to be found in the grave-mounds. For the earlier part of the neolithic age, however, these are by no means fruitful of relics. From their shape they are called in England "long barrows" to distinguish them from the round barrows which belong to a succeeding time, though evidence is being accumulated to show that this division is not of universal application. Long barrows are by no means of such frequent occurrence in Britain as the round variety; they are most common in Wiltshire, Gloucestershire and Dorset, and occur as far north as Caithness. Some of them contain within the mound a stone chamber, at times with a gallery leading to it, and in the chamber the interment or interments took place. Similar barrows have been found on the continent of Europe, and both in Britain and abroad have one feature in common, viz. that no metal, with possibly the exception of gold, has ever been found in them. This similarity of burial custom, though it may conceivably indicate intercourse, certainly does not prove identity of race, as has been sometimes claimed. The type of skulls found in the interment is clear evidence against such an assumption.

In Britain, the burials were at times by inhumation only, and occasionally a great number of bodies were interred in the same barrow: at others, cremation had preceded burial. Another remarkable feature is that in many instances it is certain from the relative position of the bones of the unburnt burials that the corpse had been allowed to decay before the burial took place. This curious practice is known among many savage tribes of the present day. Its occurrence in Britain has been adduced in favour of the prevalence of cannibalism at this time, and not altogether without reason. While metal is entirely absent in the long barrows (and in fact relics of any kind are very rarely found), it is significant that in the succeeding round barrows also metal occurs but seldom, and then always of the types attributed to the earliest part of the Bronze Age. When, therefore, the mound pottery is of a class that may well be anterior to metal, and no metal is found with the burial, it is not unreasonable to assign such barrows to the Stone Age. A similar argument may be applied to the stone implements, but in the opposite direction. Many stone implements are found either isolated, or perhaps with no other relics that serve to fix their period. The material alone is often considered sufficient evidence of their being before the age of metals; but it is at any rate quite certain that a large number of stone axes, more particularly those with a socket for the handle, belong really to the Bronze Age. This uncertainty makes any account of the neolithic age difficult, unless the material is taken as the main basis.

Neolithic man, like his forerunners, still recognized that flint and allied stones provided the best material for his cutting and piercing implements, though he made use to a great extent of other hard stones that came ready to his hand. The mining of flint was undertaken on a large scale, and great care was taken to get down to the layer containing the best quality. In Norfolk, at Grime's Graves, and in Sussex, at Cissbury near Worthing, the flint shafts have been carefully explored by William Greenwell, General Pitt-Rivers and others. The system was to sink two shafts some little distance apart and deep enough to reach the desired flint-bed, and the two shafts were then joined by a gallery at the bottom. At Grime's Graves large numbers of deer's horns were found, which had evidently been used as picks, as is proved by the marks found in the chalk walls; and the horn had been trimmed for the purpose. Cups of chalk were also found in the galleries and were believed to have been used as lamps. At Cissbury great quantities of unfinished and defective implements were found in the work, as well as horn tools, as in Norfolk. At such factories the primitive appliances correspond very closely with those in use among existing savages. The pebble was used as a hammer or an anvil, and the more delicate flaking was done by pressure with a piece of horn rather than by blows. Naturally enough the number of completed implements found in these factories is small; the finished tools would be bartered at once and carried away from the factory. All the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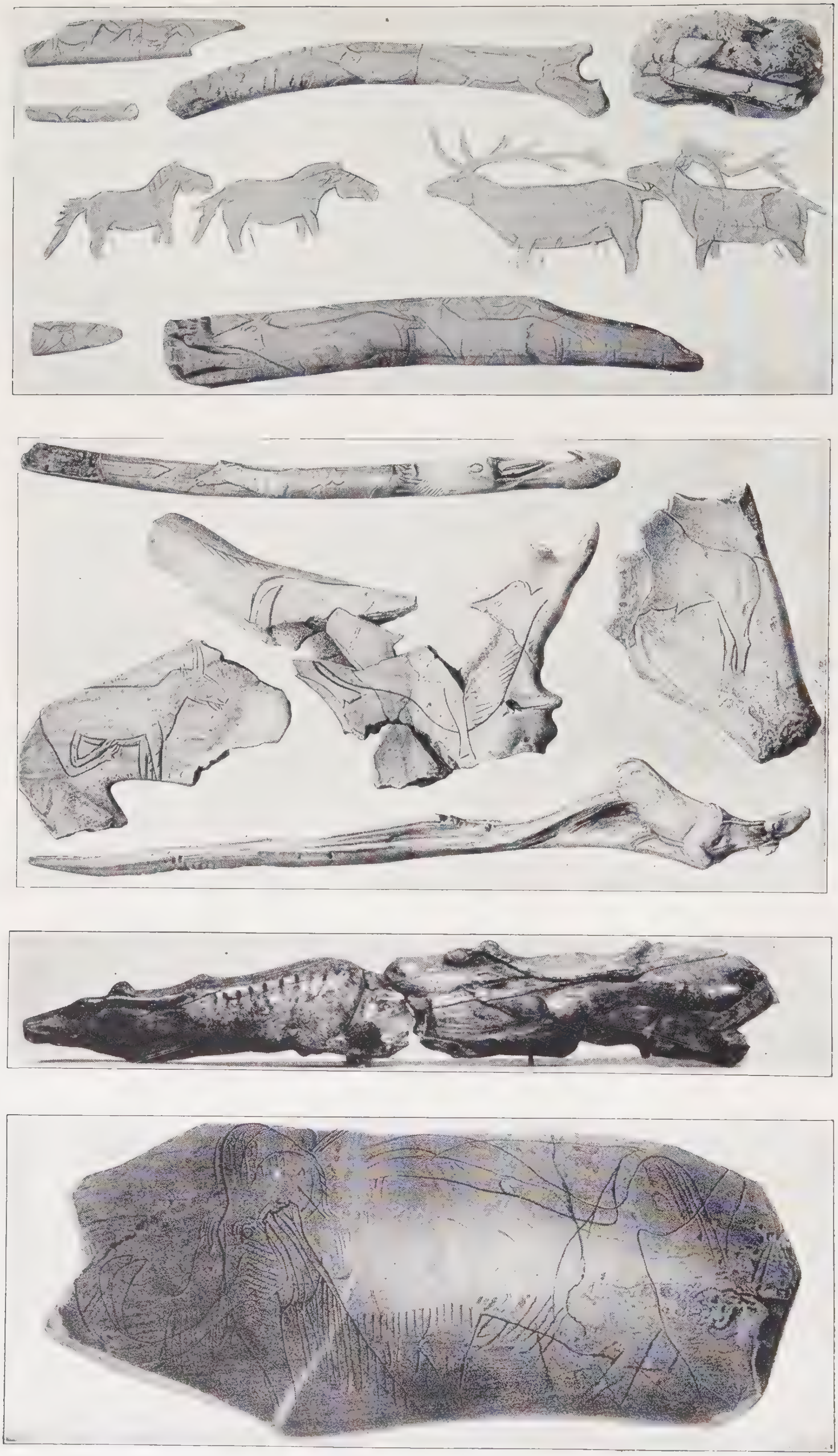
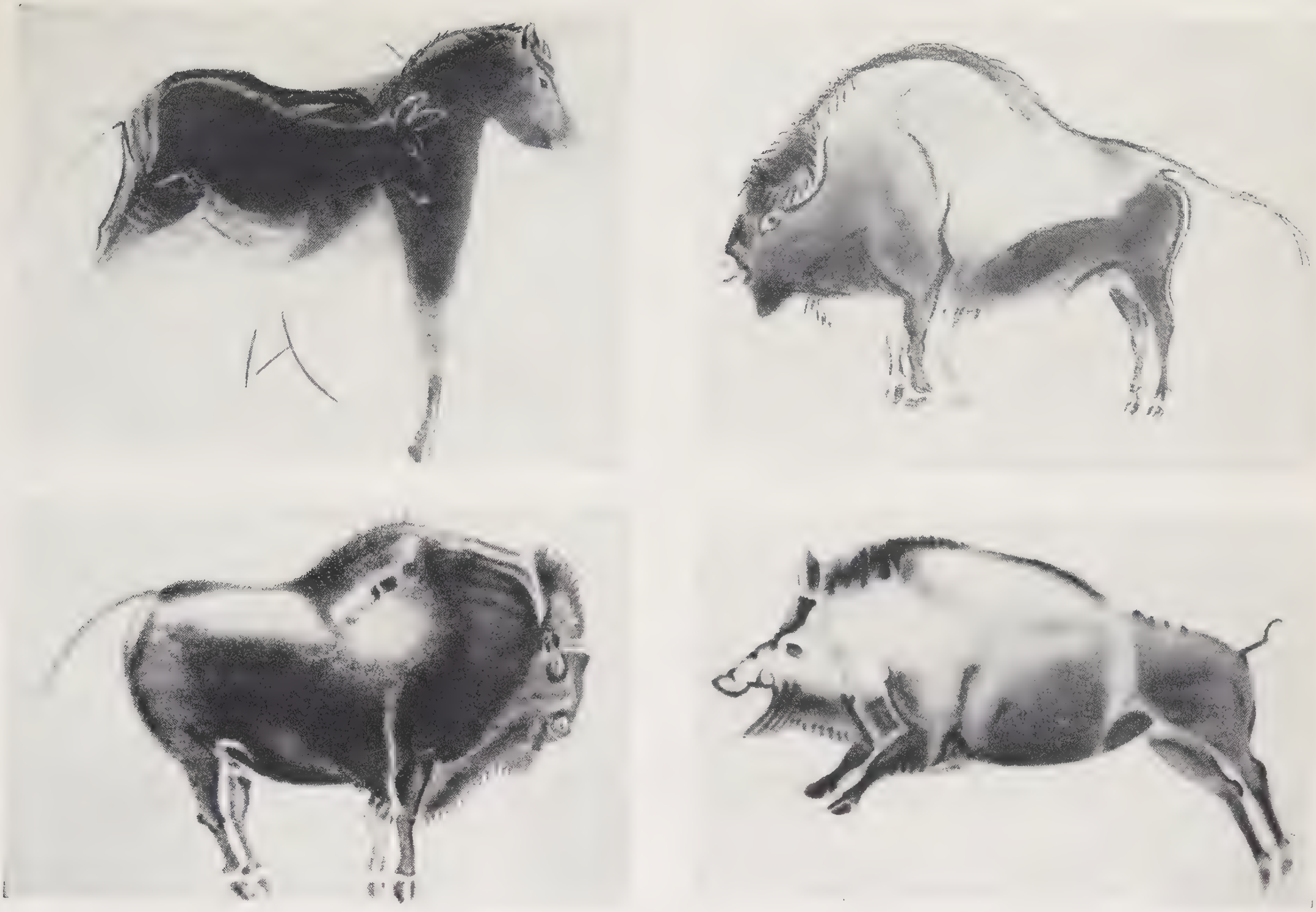
PALAEOLITHIC PERIOD.

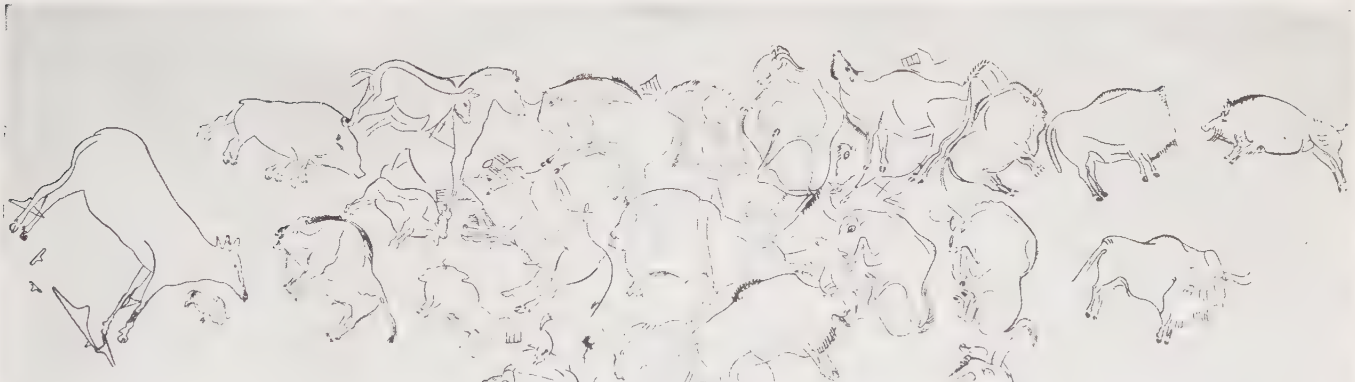
1. French Drift. 2. English Drift. 3. French transition (Le Moustier). 4. French Cave Period. 5. English Cave Period.



SCULPTURE AND ENGRAVINGS OF THE CAVE PERIOD.
FROM DORDOGNE, FRANCE.

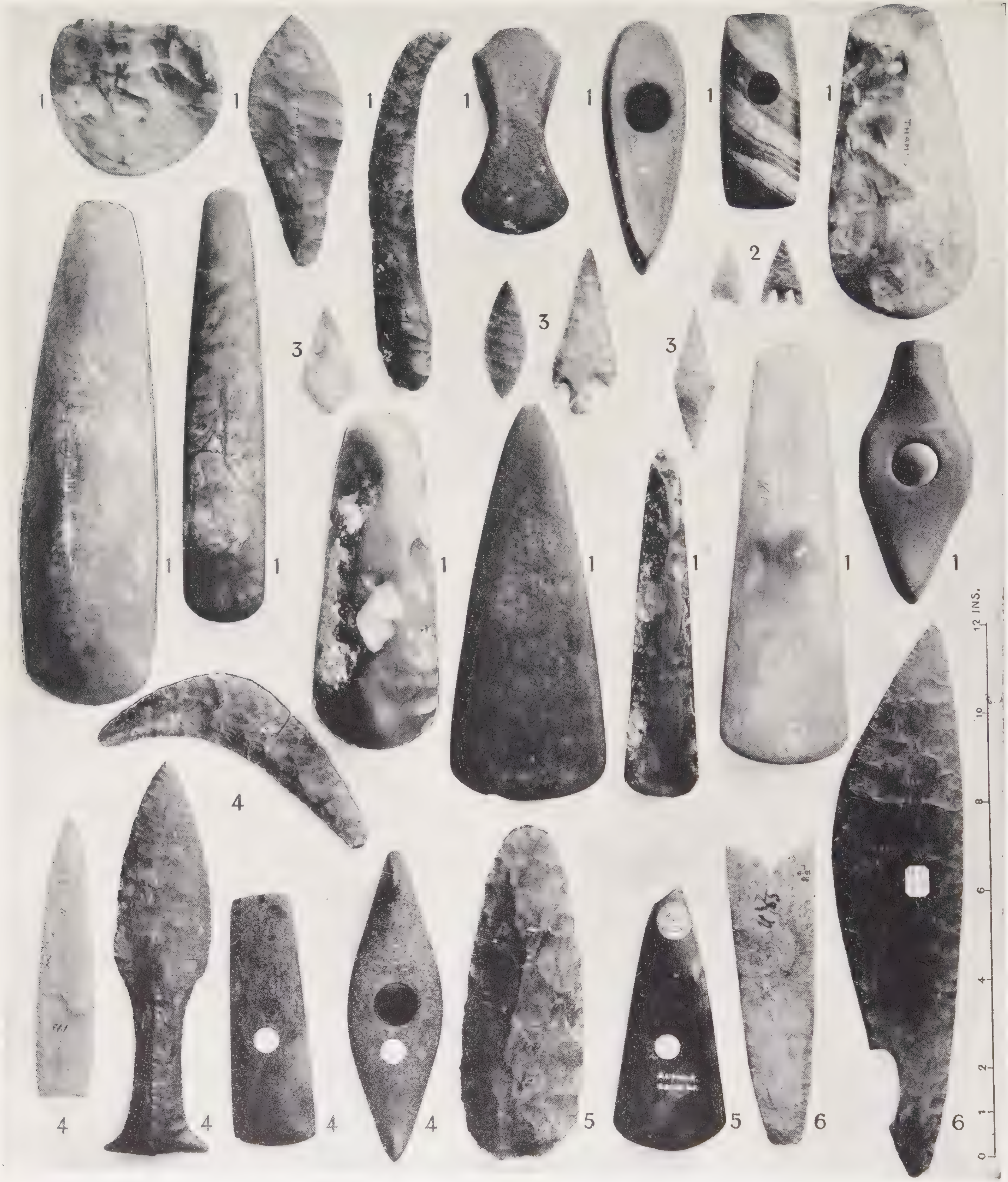


WALL-PAINTINGS OF THE CAVE PERIOD,
CAVERN OF ALTAMIRA, SANTANDER, SPAIN.



OUTLINE OF WALL-PAINTINGS, ALTAMIRA, LENGTH ABOUT 45½ FT.
(*cf.* Painting, Plate I.)

By permission, from *La Caverne d'Altamira* by Cartailhac and Breuil, Monaco, 1906.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NEOLITHIC PERIOD.

1. Flint and stone implements, England.
2. Flint arrow-heads, England.
3. Arrow-heads, Ireland.
4. Flint and stone implements, Denmark.
5. Flint implements, France.
6. Flint implements, Egypt.

animal remains found in these pits belong to present geological conditions, thus emphasizing what has been stated above, that the absence of polished implements is no evidence for great age. Many other factories have been found in Britain, in Ireland and on the continent of Europe: at Grovehurst in Kent, at Stourpaine near Blandford, at Whitepark Bay, county Antrim, and in Belgium at Spiennes. Among the North American Indians the method would seem to have been somewhat different. After journeying to the site of a suitable quality of stone, they did not always complete the implements on the spot, but made a number of oval chipped disks of good stone which they carried away and worked up into the required implements at their leisure. These disks bear a strong likeness to some of the ovate implements from the Drift in Europe; in fact, but for the difference of surface condition or patina, they would be identical.

While the severe climatic conditions that preceded the neolithic age restricted the presence of man to the more temperate parts of the globe, it may be assumed that in neolithic times there was nothing to prevent him from occupying the greater part of the earth's surface, short of the neighbourhood of the two poles. Thus it may be expected that an age of stone will be found, if looked for, in every part of the globe. So far as our present knowledge goes, all is in favour of the use of stone before metals, in all countries. The one material requires no special treatment before being adapted to man's use, while the other demands considerable knowledge, even if reasoning power have but little place in the process. Thus the probabilities are here borne out by the facts. In the extensive "kitchen-middens" of Japan are found great numbers of chert implements mixed with pottery of a primitive type, recalling that of European early Bronze Age barrows, while the succeeding periods of metal are equally clear. Even in the Far East, therefore, the same sequence is to be observed. In China, the conditions are more obscure. The superstitious regard for ancestors has prevented the exploration of ancient tombs in that country, and thus systematic search has been impossible, while the precise details of the discovery of such relics as have come to light are difficult to obtain. In spite of the assertion that China had no Stone Age, it is surely more probable, in the absence of exact knowledge, that she followed the normal course. Modern territorial divisions, more especially if they are independent of the natural physical conditions of the land, such as mountain ranges, great rivers and the like, have but little value in considering the race problems of remote ages. If, therefore, we find that, in the countries bordering on what is now the Chinese empire, the ancient inhabitants followed the same broad lines of culture that are evident elsewhere, it is easy to believe that China too was normal in this respect. The negroes and Bantu races of Africa also were thought to have passed direct to the use of iron, perhaps owing to the existence on the Nile of a civilization of great antiquity, which enabled them to pass over the intervening stages. Inherently improbable, this is now known not to have been the case. Stone implements, whether ground or merely chipped, have been discovered on the Congo, and more recently on the Zambezi. It is quite true that in both cases they are found in superficial deposits, and may be of any age. But here again the probabilities are greatly in favour of their having been in use before iron was known. While stone tools, such as knives or arrow-heads, may possess qualities that render them superior to bronze or copper, it is certain that once the working of iron was understood, its superiority to stone would at once be perceived, and the stone tools be discarded. There can be little doubt that investigations in Central Africa will demonstrate that the same course was followed there as elsewhere. In South Africa, in Egypt and in Somaliland large quantities of stone implements have been discovered, and of the great age of most of them there can be no doubt. Some from the banks of the Nile have even been claimed as "eolithic"; but here, as in Europe, we can only say that the case is not proven: General Pitt-Rivers did good service in Egypt by discovering among the stratified gravels near Thebes a number of rude flints bearing unmistakeable signs of human workmanship, but he described them merely as of "palaeolithic type," and deplored the absence of mammalian remains in the gravels. At the same time he pointed out that the bulk of the implements claimed as palaeolithic (and, it may be, correctly) are found on the surface, and therefore cannot be dissociated from the surface types; hence form alone cannot be trusted to determine age. Further, we are by no means well informed as to the value of patination in flints found on the surface in Egypt. The depth and intensity of the patination would no doubt have a direct relation to the age of the implement, if only it could be proved that all of them had been equally subjected to the conditions that produced the discoloration. But this is clearly impossible. Some implements may conceivably have been continuously on the surface of the desert from the time they were made, and have been acted upon by the sun and air for many thousands of years, while others, though of equal age, may have been covered by sand or otherwise protected for a large part of the intervening centuries. Patination, therefore, like form, can only claim a conditional value. It is at the best an uncertain indication of age, as great age may be possible without it. Similarly, in Somaliland, the condition of the implements is very curious, and in some respects puzzling, while their forms resemble those from the Drift in Europe. But as to the climatic conditions we know nothing, and it is therefore useless to speculate on the condition of the stones; as to the geology we know next to nothing, and no mammalian remains give us a helping hand, while the form alone is a dangerous foundation for argument.

Europe and America.

Investigations in the more remote parts of the world, though they may occasionally produce some startling novelty in the history of mankind, can scarcely be expected to furnish the same trustworthy continuous story as is to be found in the European area. Here history provides us with a fairly truthful account of what has happened for a period varying from two to three thousand years, or in some places even longer, and we are thus able to judge whether particular discoveries come into the historical stage or not. In more primitive lands where history (if there be any) partakes more of the character of mythical tradition, the task of defining the period to which particular discoveries belong is rendered much more difficult. In America, where history may be said to have begun five hundred years ago, such a feat is of course impossible, until a great deal of work on comparative lines has been accomplished. The accounts of the civilization of Mexico and Peru at the time of the Spanish conquest show a state of culture which in some respects must have put the Spaniards to shame, while in others it was primitive in the extreme. As regards internal communications, the working of gold and copper, and the manufacture and decoration of pottery, these American kingdoms were on a level with all but the most advanced nations; but of history in the true sense of the word they have none. In spite of this, it is by no means a hopeless task to disentangle the apparent confusion of their archaeology. It is now fairly well known what were the races or tribes that inhabited particular districts, and it is thus easy to make a *corpus* of the types adopted by the various peoples. This is the first certain step in the application of archaeological method. By degrees, as these types become familiar to the trained eye, it will not be difficult to arrange them in a progressive series, from the earliest in style to the latest. That this will be done by the archaeologists of the American continent, even with the present scanty materials, there can be little doubt. Numbers of young and enthusiastic workers have now had a good training in exploration in historical lands, and will usefully employ their experience on the antiquities of their own country. But if once a key be found to the ancient Mexican inscriptions, so plentifully scattered through the ancient monuments, it may be that enlightenment will come even more suddenly and more surely. The one problem that is of the greatest interest still awaits solution, viz. whether there is any relation, in culture or more remotely in race, between the inhabitants of ancient America and those of Europe or Asia. One thing is certain, that if there be any connexion, it is of infinite remoteness. But it is at any rate noteworthy that the same designs, patterns and even games are found in ancient Mexico and in India or China; and whether these resemblances arise from relations between the peoples using them or from accident, is a problem well worth investigation.

In countries like Scandinavia or Switzerland, the story of the early ages is clear and comparatively free from complications. The one by its remoteness was left to develop with but little help from the rest of Europe up to historical times; the other, protected on so many sides by its mountain ranges, seems to have enjoyed a peaceful existence during the Stone and Bronze Ages. A community of fishermen and agriculturists, they led a calm domestic life on the edges of their many lakes where they constructed dwellings on piles with only a gangway to the shore, to prevent the attacks of predatory animals. The practice of building houses in lakes was a common one not only in Switzerland, but also in Britain and in Ireland, as in modern times among the natives of New Guinea. Besides securing the safety of the inhabitants, it had the not unimportant advantage of being more healthy; all refuse of food and other useless matter could at once be thrown into the water where it would be harmless. A similar form of dwelling is the Irish "crannog," constructed on an island or shoal in a lake, in some cases artificially heightened so as to bring it above water. These crannogs were probably inhabited in Ireland up to comparatively recent times, if one may judge by the remains found on the sites.

It must not be forgotten that although the neolithic period had many phases, yet its duration is in no way comparable to the incalculable length of the palaeolithic age. For a variety of reasons it is thought that one of the earliest stages of neolithic times is represented by the now well-known kitchen-middens (refuse-heaps) of Denmark. These heaps are often of great size, sometimes reaching 10 ft. in height, and nearly 350 yds. in length. Here along the coast line the natives of Denmark lived, apparently building their huts upon the mounds and cooking their food upon hearths of stone. The conditions of their daily life would seem to have resembled those of the natives of Tierra del Fuego. Their implements of flint seem to have been chipped only, and it is conjectured that the few polished and more highly finished implements that have been found in the middens are importations from more cultured tribes living inland. Their food was in very great part composed of shell-fish, though they evidently caught and ate various kinds of deer, boar and a variety of carnivorous animals. The race which made these mounds is believed to have been akin to the Lapps, and their dwellings can hardly have been anything more than the rudest protection from the weather. The Swiss lake-dwellers were far more advanced, even in the Stone Age; their dwellings were elaborately planned and constructed, and remains of them have been plentifully found in the various Swiss lakes. Various forms of construction were adopted: in one the foundations consisted of poles driven into the bed of the lake; in others a kind of framework simply rested on the bottom, and in a third, the substructure was formed of layers of sticks reaching from the bottom of the lake up to the surface. The walls were of wattle, closed up with clay to keep out the weather; the hearths were of stone slabs, and the floors of clay well trodden down. Practically the same type of dwelling seems to have continued through the Stone and Bronze Ages, though on some sites no metal whatever is found and it is therefore assumed that these are of the earlier period. These people cultivated the land, growing wheat and barley; they were also hunters and fishermen, capable of manufacturing pottery without the aid of the wheel, which had not yet come into use so far north; and they wove mats and garments, while ropes and netting are plentiful. Their tools and weapons were made of stone, and to a great extent of deer's horn. Human remains are hardly ever found on the sites of the lake-dwellings, and it is therefore uncertain what were the social affinities of the people; but the evidence of the sites is in favour of the same race being continuous into the Bronze Age, when their condition was more comfortable, as is shown by the abundant remains of domesticated animals.

Stone Age relics.

Among the most notable and obvious relics of pre-historic times, both in Britain and in many other countries such as Spain, Portugal, France and even India, are gigantic circles and avenues of stone and dolmens (see STONE MONUMENTS). These enduring monuments have excited the wonder of countless generations, and lent themselves to superstitious practices down to modern times. But the precise purpose for which they were erected and even the period to which they belonged, had never been definitely settled. They had been called burial places of great chiefs, and not unnaturally had been thought by others to have been temples or places of primitive worship used by the Druids, who moreover were often credited with their erection. Obviously such a question called for settlement, and the British Association in the year 1898 appointed a committee to investigate these stone circles with a view to ascertaining their age. Operations were begun at the well-known circle of Arbor Low, south of Buxton in Derbyshire; careful excavations were made through the ditch and the encircling mound and also within the circle, and although the evidence was not of the most complete kind, yet the committee came to the conclusion that the circle belonged to the end of the neolithic age. At Arbor Low all the stones are now lying on the ground (although, to judge from the other circles in England, they were certainly once upright), and the opportunities for surveying were thereby much diminished. It is a fortunate circumstance, therefore, that the fall of one of the stones at Stonehenge (*q.v.*) at the end of the 19th century, and the increasingly perilous state of some of the others, caused the owner, with the advice of the Society of Antiquaries of London, to undertake the raising of the great leaning stone in the interior of the circle. The work was superintended by W. Gowland, F.S.A., who made special investigations during the necessary digging, for the purpose of recovering any remains of man's handiwork that had been left by the builders of the monument. In this he was very successful, finding in the course of the very limited excavation at the base of the monolith, a great number of stone mauls or hammers that corresponded so nearly with the bruised surfaces of the monoliths, that there can be no doubt of their having been used to dress the standing stones.

From a review of all the evidence of an archaeological nature that was to be obtained, Gowland came to the conclusion that the construction of Stonehenge belonged to the latter part of the neolithic age. No trace of a metal implement occurred in any of the debris. This would of itself be an interesting fact, but it became infinitely more interesting from researches in quite another direction, which brought corroborative evidence of a curious kind. For many years Sir Norman Lockyer and Prof. Penrose were engaged in examining the orientation of temples in Egypt and Greece, with a view to determining on what astronomical principle, if any, the plans had been laid down. With a rectangular plan, and with portions of the interior still well defined, they were able by elaborate calculation to determine that the temples had been definitely planned with relation to the rising or setting of the sun or of a particular star. Having been successful in these investigations they proceeded to apply the test to Stonehenge. The experiment was made on the longest day in the year 1901. Owing to a gradual change in the obliquity of the earth's orbit, the point of sunrise on corresponding days of each year is not constant; and though the difference is hardly perceptible from year to year, in the course of centuries it becomes great enough for use as a measure of time. Enough remains of the monument to show the direction of sunrise at the time that Stonehenge was erected, it being always assumed that the coincidence of the main axis with the central line of the Avenue was designed with reference to sunrise on the longest day of the year. At the date of the experiment it was found that the sun had shifted nearly two diameters in the interval, and this variation gives a date of about 1680 B.C., which practically confirms the verdict of archaeology and seems to prove, moreover, that Stonehenge was a temple of the sun.

Stonehenge therefore may be taken as marking for Britain the close of the neolithic period and heralding the dawn of a new era, in which the inhabitants of the British Isles first acquired the art of working metal.

Bronze Age.

There is reason to believe that the transition from the use of stone to that of bronze was not due to the peaceful advance of civilization, but rather to the irruption of an Aryan race from the south-east of Europe into the countries to the west and north. Of these people the Celts are to some extent the representatives at a somewhat more recent period. Here, however, we are dealing with terms the precise meaning of which is not yet generally admitted, and which, moreover, have too intimate a relation to the problems of philology to be fully discussed here (see INDO-EUROPEAN). The term Aryan (*q.v.*) itself is not free from objections. It was held by Max Müller to relate to a language and a civilization that took its rise in Central Asia, while others now contend that, although it is the mother language of the Sanskrit, Greek, Latin, Teutonic and Celtic languages, it might equally well have originated in Europe. However this may be, and even this brief statement shows how wide a field the arguments would cover, there can be little doubt that the Bronze Age Celts were of this stock, and that in course of time they gradually spread their language and culture over a large part of Europe. Whether or no the knowledge of bronze started from one or more centres, it gradually spread from the south-east of Europe until it reached Scandinavia; the dates being roughly in Crete, 3000 B.C.; in Sicily, 2500 B.C.; in central France, 2000 B.C.; in Britain and in Scandinavia 1800 B.C. The appearance of the Celts in Britain is indicated by the presence of the round barrows. They were a fairly tall, short-headed race, using cremation and also inhumation in their burials, skilful in the manufacture of pottery and of the simpler forms of bronze implements, and freely using bone, jet, and at times amber, while gold was well known and evidently greatly esteemed. In the early centuries of the Bronze Age, swords, spears and shields were apparently quite unknown, the principal metallic products being flat axes, simple knives or daggers, and small tools or ornaments. In the burial places the bodies, if unburnt, are nearly always found in a crouching position, as if in the attitude of sleep; if cremated, the burnt bones are generally enshrined in an urn under the tumulus, the burial being sometimes in a cist formed of large stones. The pottery vessels are remarkable in more ways than one. In the first place they would seem to have been specially made for the burial rites, for whenever domestic pottery has been found, it is of quite a different character, unornamented and simple in outline. It must be confessed, however, that this latter is by no means common. The sepulchral vessels are at times highly decorated, and sometimes of great size. They are invariably hand made, and though they are by no means well fired they are never sun-dried, as is often said to be the case. A common kind of decoration is produced by impressing twisted cords in the damp clay, and this is believed with some reason to have had its origin in the practice of winding cords round the unbaked vessel to prevent distortion before or during the process of firing. That operation would of course burn away the cord and leave only its impression on the urn. Other forms of ornament are also used, incised lines in rudely geometrical designs, impressions of the end of a stick, and at times rows of hollows produced by the finger or thumb. The method of the burial, beyond giving an insight into the art of the period, also helps us to realize to some extent the ideas of primitive man. The underlying reason for careful and ceremonial burial is not always readily understood, apart from a knowledge of the ritual, such as existed in ancient Egypt. But in the Bronze Age in Britain it was the custom to bury with the dead not only carefully made vessels which doubtless contained food for the journey to the lower world, but also the ornaments and weapons of the deceased. Often the bones of a pig have been found in the grave, doubtless representing part of the provender which could not conveniently be placed in the so-called food-vessel. Such practices indicate with a fair amount of certainty a belief in a future life in another world, where probably the conditions were thought to be much the same as in this. The burial of the weapons and other property of a dead man is, however, not always due to the belief that he may need them in some future state. The reason may well be that it would be thought unlucky for a survivor to use them.

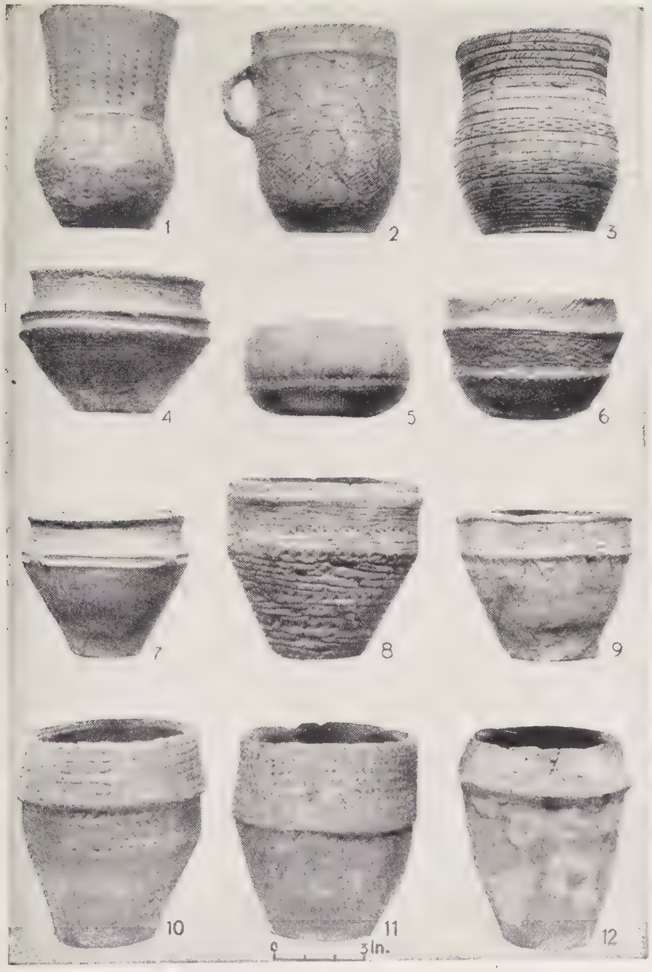
Just as the neolithic age was immeasurably shorter than the palaeolithic, but was notable for great improvements in the arts of life, so the Bronze Age in its turn was shorter than the neolithic age, and again witnessed even more marked advance in culture. It is in fact an illustration of the truism that each step in knowledge renders all that follow less laborious; but it is not easy to understand how the transition from stone to metal came about, nor why bronze came to be the chosen metal rather than iron. Bronze, in the first place, is a composite metal, a mixture of copper and tin, while iron can be at once reduced from its ores; indeed, in the form of meteoric iron, it is already metallic, and needs but a hammer to produce whatever form may be wanted. From the archaeological point of view, there is, however, good reason for believing that bronze preceded iron. The forms of axes that are without doubt the earliest, are in outline much the same as the stone prototype, being only thinner in proportion. Then again, iron implements are never found on the earlier sites, and if they had been in existence some of them certainly would remain: further, at the end of the Bronze Age it is found that the forms of weapons in that metal are exactly copied in iron, as, for instance, at Hallstatt (*q.v.*) in the Salzkammergut, the famous cemetery which best illustrates the passage from the use of bronze to that of iron. It has been claimed that bronze was preceded by copper, a sequence which seems inherently probable; and whether or no it was general enough or enduring enough to constitute a period, there can be no reasonable doubt that in the Mediterranean area, and in central Europe, as well as in Ireland, great numbers of implements were made of copper alone without any appreciable admixture of tin. The casting of pure copper presents certain difficulties, in that the metal is not adapted for anything but a mould open to the air, and this would limit its utility, until the discovery that tin in a certain proportion (roughly 1 : 9) not only made the resulting metal much harder and better fitted for cutting-tools and weapons, but at the same time rendered possible the use of closed moulds.

There are thus two problems in connexion with the history of the Bronze Age. How was the metal discovered? And by whom or where? As to the first, it must be remembered that in some parts of the world, *e.g.* in China and in Cornwall, copper and tin are found together, and it may well be that tin was first accidentally included as an impurity, which, had it been noticed, would have been eliminated. Once it was found to produce a more useful metal, the blend would be deliberately made, and repeated trials would eventually demonstrate the most suitable proportion of one metal to the other. The question of where it was first discovered is one that is not likely to be answered with certainty, but the one essential is the presence of the two metals in one and the same locality. Tin does not exist in either Egypt or Mesopotamia, although bronze articles from the fourth and third millennium respectively B.C. have been found in these countries. The tin to produce the mere metal must have come from some foreign country, and the choice seems to be very small. Spain at the other end of the Mediterranean is unlikely, and Britain still more so; central Asia, Asia Minor, or China again seem too remote; for the spread of metallurgy from these centres would imply a trade connexion nearly 4000 B.C. In later times, later perhaps by 3000 years, Spain and Britain were undoubtedly among the chief sources of the tin supply of Europe and of the Mediterranean generally; but it will long remain a problem where bronze was first produced. There is indeed, no real necessity for confining its origin to a single locality; it is easily conceivable that the invention occurred independently in more places than one.

The history of early metallurgy has been carefully studied by W. Gowland, who communicated the results of his researches to the Society of Antiquaries of London in 1899. In his opinion the ores from which copper was first obtained by smelting were originally found as pebbles or boulders in the beds of streams, where man in the Stone Age had been accustomed to search for stones to convert into implements; and in the same way the beds of rivers were for a long subsequent period the only sources of tin. Actual mining belongs in his opinion to a far later period, and naturally had its origin in the discovery of outcrops of the metal on the surface. By the simple application of fire, lumps of ore were reduced to a smaller size, and were then prepared for smelting by further reduction to the condition of a coarse powder. This latter process was carried out in the same way that grain was crushed between two stones; and stone-mills, doubtless used for the purpose, have been found in ancient workings in Wales. The next stage would be the furnace, and there can be little doubt that this would be of the simplest kind, merely a hole in the ground with the fire covering the metal, and with nothing but a natural draught. But Gowland holds that even with these singularly inadequate appliances, copper could be smelted from the surface ores, though the output would naturally be of the most uncertain and intermittent character, depending, as it must have done, on the wind. And until the discovery of bellows or some other method of increasing the draught of air, no progress could be made in this direction. With regard to the resulting metal, viz. copper, we have certain knowledge. From time to time there are found in the earth in Britain and elsewhere, hoards of fragmentary or imperfect bronze implements, portions of axes, swords, rings, &c., all of which have been failures in castings. These hoards are assumed to have been gathered together by the bronze founders to be recast into perfect and useful implements. Now, frequently associated with these hoards are portions of cakes of pure copper, originally circular in shape, flat on one face and convex on the other, like a lens with one flat face. The form of these cakes is in itself a fair proof of the prevalence of the method of smelting described above, as it is quite clear that the convex face of the cake followed the contour of the hole in the ground above which the fire was placed. The cakes are generally found broken up into small handy blocks. This can only be done in one way, viz. by watching the cake, after the fire and slag has been raked off it, until it is on the point of becoming solid, when it is quickly pulled out of the hole and broken up. It will be noted that while the implements in these founders' hoards are invariably of bronze, the cakes are as invariably of copper. This is at first sight puzzling, until it is realized that these founders probably carried the tin necessary for forming bronze in the form of ore, and that tin ore in its pure state is a snuff-coloured powder very easily overlooked when lying on the earth, which it might very nearly resemble in colour, though it would be much heavier. Thus it is probable that in many such discoveries the tin ore has accompanied the copper cakes and bronze fragments, but has hitherto eluded the eyes of the finder. Not only have we this conclusive evidence of the methods by which Bronze Age man produced his raw material, but the discovery of crucibles and moulds takes us a step further towards the finished implements. The crucibles are generally simple bowls of thick clay with an extension of the lip at one side to pour out the molten metal. Several of these, with plentiful traces of metal still remaining in them, were found by the brothers Siret in the Bronze Age settlement at El Argar in Murcia. In the same place also were found moulds of stone for the casting of simple triangular axes. These were of the class known as open moulds, one stone being hollowed to the desired form, the other half being simply a flat cover, with no relation to the form of the implement to be produced. From the nature of the metal, such a mould is the only kind in which the casting of an efficient copper implement would be possible; and among the objects discovered by the Sirets were articles in plenty of pure copper.

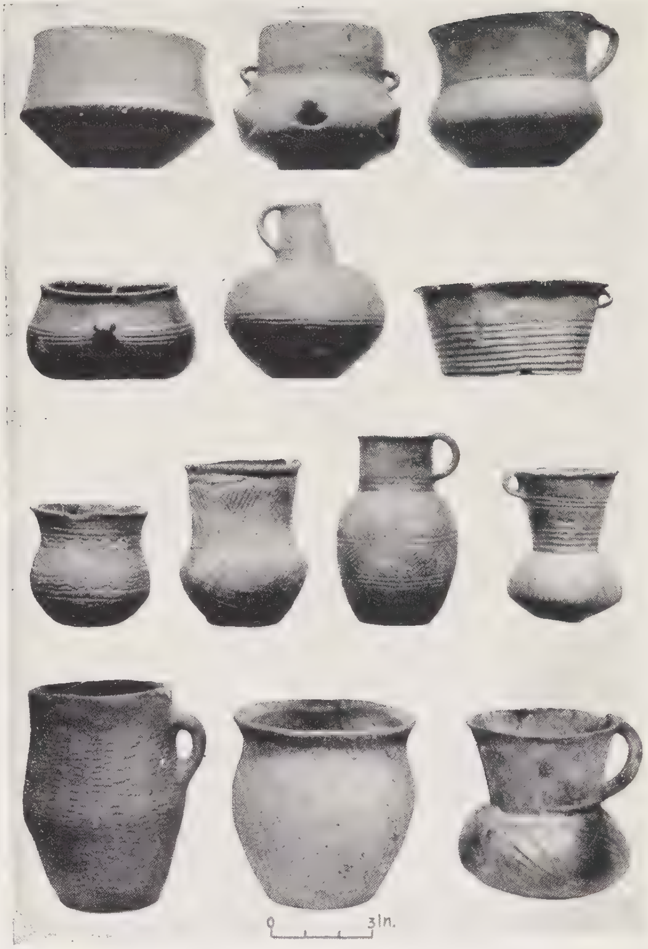
Much has been written in support of the theory that the bronze tools and implements found in this or that country must have been importations from southern and more highly civilized lands. More particularly has this been alleged with regard to Britain, which, lying as it did on the extreme limit of the ancient world, was regarded as being dependent on the continent for the more complex weapons. The constant discovery, however, of these hoards of rough metal, as well as of moulds of the highest finish for casting swords, daggers, celts, and almost every kind of ancient bronze implement and weapon known to us, provides a conclusive proof of the contrary. The occurrence of a foreign type of implement is so rare as to be a source of especial gratification to the collector who secures it; and it may be taken that, in general terms, all the bronze swords, daggers and spears found in Britain were of home manufacture. Relations with the continent, however, did exist, as is shown by the occurrence of an Irish type of gold ornament in France and Scandinavia, and by the similarity of ornamental motives in the British Isles and elsewhere. Among the continental races it is natural to find intercommunication more common, owing to the absence of natural barriers. The weapons of the Bronze Age were swords, spears, daggers and axes (celts), though the last would be equally well adapted for more peaceful purposes. The swords were usually of a narrow leaf shape, cast with the handle in one piece, the mounting of the grip and the pommel being added. For perfection of workmanship the weapons of this period have never been surpassed, and the skill of adjustment in the moulds, the fine and equal quality of the metal, and the flawless condition of the surfaces still excite wonder among the most expert of modern founders. The cutting edges of swords and "celts" were often, if not always, hammered to serve the double purpose of hardening that part of the weapon and sharpening the edge. In the case of the axe-heads (celts), this hammering had a distinct influence on the evolution of the form of the implement. The earliest celts, whether of copper or bronze, were in form, copies of their stone prototypes, and curiously enough exactly like the ordinary woodman's axe of to-day, but of course without the socket for the handle. Hammering rendered the cutting edge both broader and thinner, giving it at the same time a curved outline. This widened curve eventually became an ornamental feature, the two ends of the cutting edge becoming curved points and adding greatly to the elegance of the outline. Later, the other edges were finished by hammering also, at times in a simple ornamental fashion; and whether for greater rigidity or for some other reason, flanges were produced in the same way on those edges, which again affected the ultimate form of the celt. The early flat celt was no doubt simply fixed in a perforated wooden handle, which would naturally tend to split if wielded with any vigour. The side-flanges were in course of time utilized to prevent this, by allowing the use of a different form of handle. In place of the simple straight handle, a branch was cut with an elbow-joint, and its shorter limb then divided into two prongs, between which the metal passed, while the flanges, beaten up from the edges, overlapped the two forks; and no doubt a lashing of sinew was added to render the whole secure. This made a good serviceable tool or weapon, and prevented the splitting of the handle; but still another step was taken. The flanges on the edges met over the prong of the handle on either side, while the upper end of the celt itself eventually became a mere septum dividing the two openings. This septum was finally judged to be useless, and done away with; and the celt was cast with one hollow only for the reception of the ends of the handle; thus the flat celt became, by a natural process of evolution and improvement, a socketed celt. It is a curious fact, however, that the modern form of axe where the handle passes through a socket in the metal itself does not seem to have been much in favour in the Bronze Age, although it was a stone form that certainly survived into the succeeding period.

This and other shortcomings in what must have been the universal weapon and implement of the race, were remedied from time to time by various improvements in the form of the bronze axe-head and the method of hafting; and the various stages of development, from the flat blade of copper or bronze to the socketed implement and even to a pattern now in use, can still be traced in the Bronze Age specimens that have come down to us.

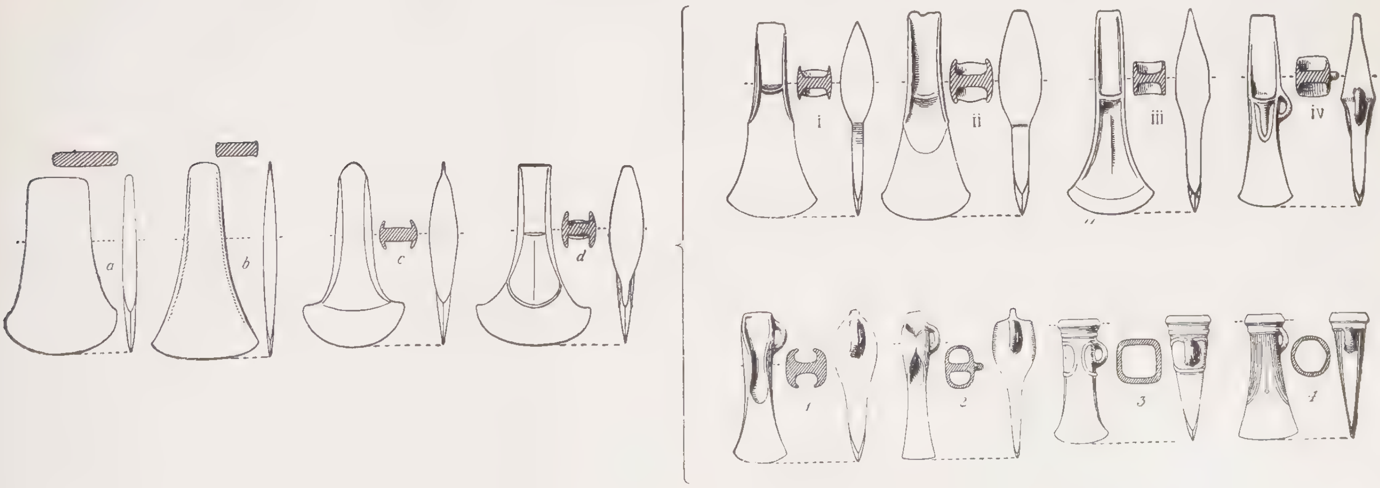


SEPULCHRAL POTTERY, BRITISH ISLES (BRONZE AGE).

1–3, Drinking cups or beakers. 4–9, Food vessels.
10–12, Cinerary urns.



SEPULCHRAL POTTERY FROM THE CONTINENT OF EUROPE (NEOLITHIC, BRONZE, AND IRON AGES).

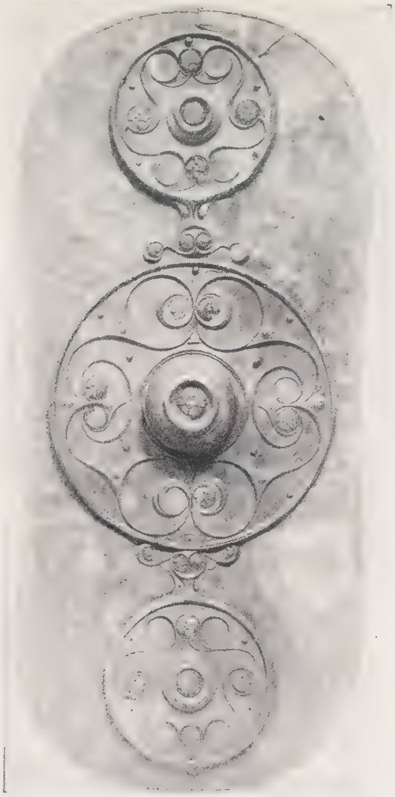


STAGES IN THE EVOLUTION OF THE CELT OR IMPLEMENT OF CHISEL FORM.

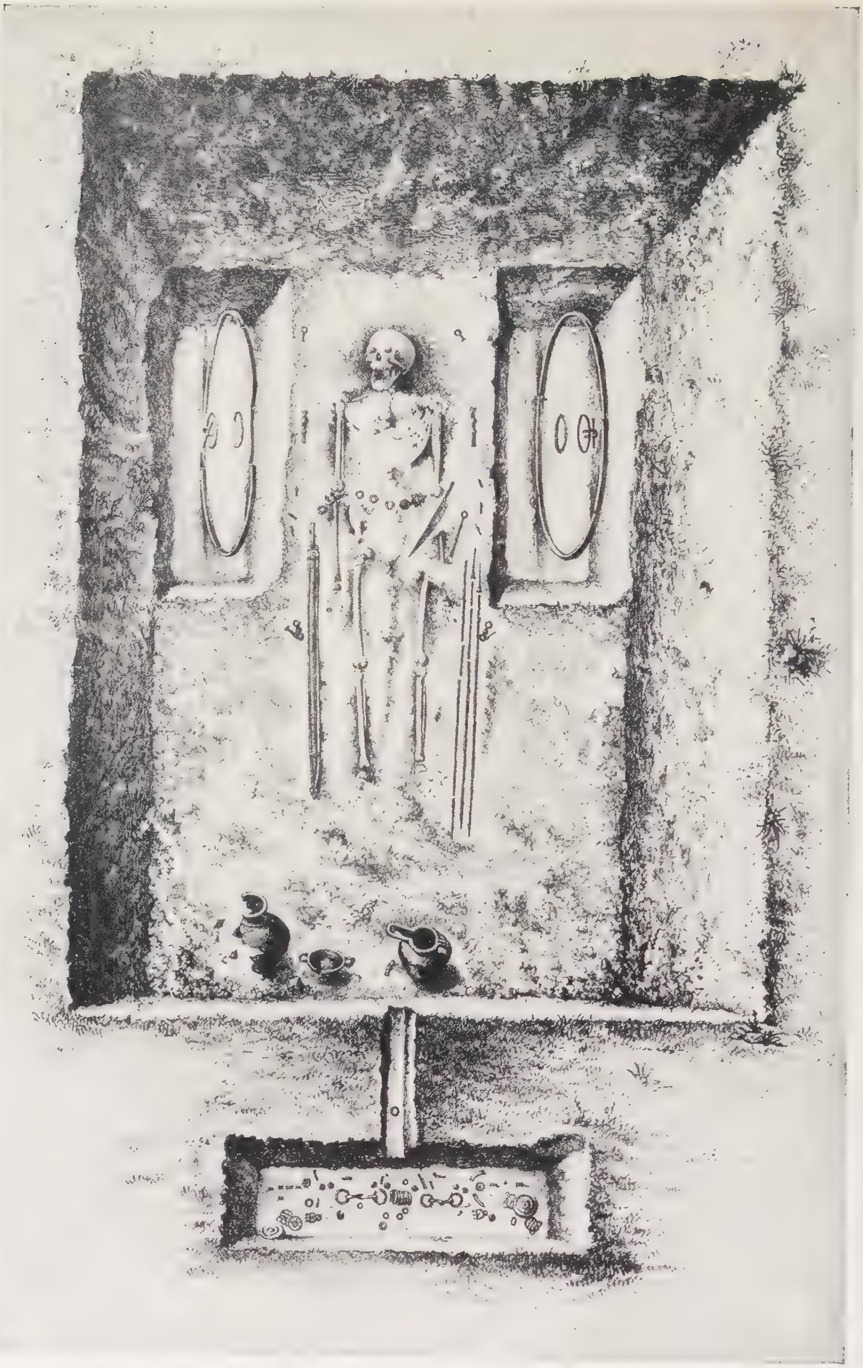
(1) From stone to metallic form. (2) Growth of the stop ridge to palstave. (3) Growth of the wings to socket-celt.

By permission, from the British Museum *Guide to the Bronze Age.*

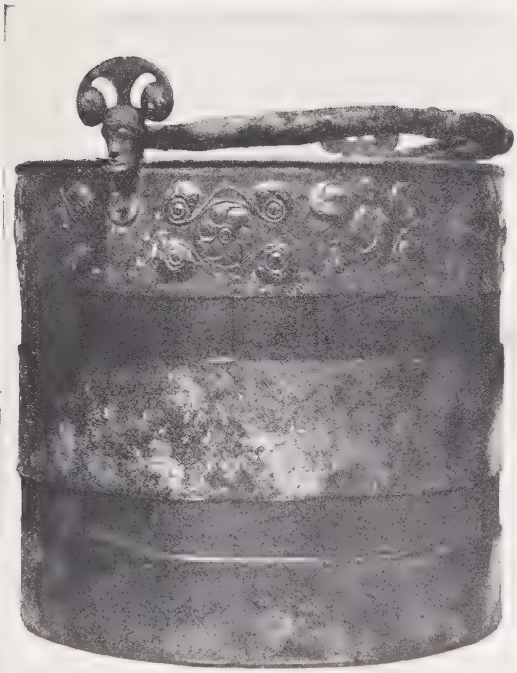
ARCHAEOLOGY



1. Bronze shield with red enamel ornaments, found in the Thames near Battersea; about 31 in. long.



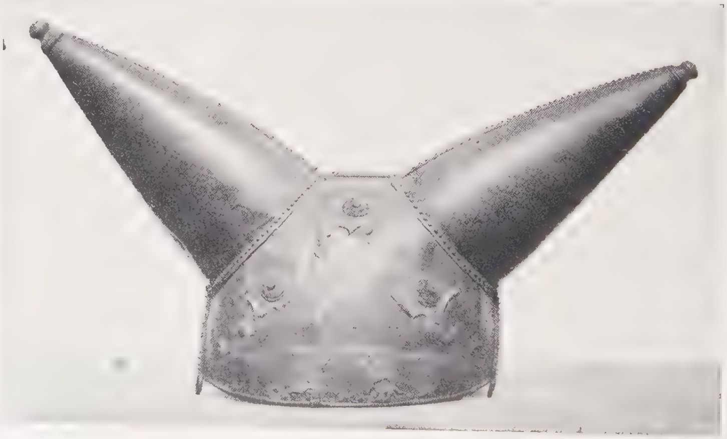
Chariot burial of a Gaulish chief, Somme Bionne, Marne, France.



Bronze mounted wooden bucket found in a pit burial at Aylesford.

Early Iron Age.
The objects here represented are all in the British Museum.

By permission, from the British Museum *Guide to the Early Iron Age.*



Horned bronze helmet with traces of enamel ornament, found in the Thames near Waterloo Bridge.

Iron age.

With the discovery of iron as the ideal metal for cutting implements and weapons, we enter into the millennium before the Christian era; for roughly speaking, the development of the civilization associated with the gradual substitution of iron for bronze began about 1000 B.C. Again we look towards the south-east of Europe for the earliest evidence of this great advance; from that quarter it gradually spread over the whole continent, reaching the more northern parts about five hundred years later. In Egypt, the home of a marvellous civilization at a very early time, the conditions were different, and there is reason to suppose that iron was known there long before it was in use on the northern side of the Mediterranean. Our knowledge of the dates at which iron was first known in parts of Asia is still very limited, and further discoveries must be awaited.

Ireland.

The archaeology of Ireland presents features in many respects different from those of the rest of the British Islands in the Stone and Bronze Ages. Such affinities in style as are traceable connect it rather with Scotland than with any part of the south, a fact doubtless due to proximity as well as in part to race connexions. A special feature is the astonishing quantity of gold that was produced in Ireland during the early Bronze Age. The frequent discovery of gold ornaments of this time has enriched to a surprising degree the museum of the Royal Irish Academy in Dublin, while many private and public collections both in Ireland and elsewhere contain a considerable number of similar relics. If these represented the total wealth of gold of the Bronze Age the amount would probably exceed that of any ancient period in any country, except perhaps the republic of Colombia in South America. But the known remains can only be a small proportion of the original wealth. Vast quantities must have been discovered from medieval times onwards, nearly all of which would be melted down, owing to the ignorance of the finders or to the uncertainty of ownership. Further, it may be taken as certain that there still remains in the earth a great mass of the metal which may or may not be discovered at some future time. If it were by any means possible to estimate what these united categories would amount to, the result would scarcely be credited. It is well known that gold has been, and still is, found in Ireland; but it is hard to believe that there were no richer deposits than are now known. It is at any rate certain that the rivers were worked as late as the opening centuries of our era. In the Bronze Age the most characteristic ornaments were penannular objects of all sizes from a small finger ring up to an armlet, generally known as "ring money" from the difficulty of assigning a definite use to the whole series; and the flat, crescent-shaped, diadem-like objects called "lunulae," which are perhaps even more definitely characteristic of Ireland. Such objects of gold, if ornamented at all, are, like some of the flat axe-heads, engraved with simple geometrical patterns, lozenge-shaped chequers and the like, a type of decoration in itself easily determined as being of the Bronze Age, but bearing at the same time an interesting and very curious analogy to remains of the same period from the Iberian Peninsula, more especially from Portugal. If any overland culture-relations existed between the two countries, it would be only reasonable to expect the occurrence of the objects in question in the intervening districts. But so far nothing of the kind has been discovered. Moreover, had it been an isolated instance of resemblance it might be negligible, but an equally odd similarity is found in the fact that the Irish were in the habit of grinding the faces of their flint arrow-heads, an apparently useless refinement, while the Portuguese of the early Bronze Age did the same. Again, the dolmens of Ireland bear a distinct resemblance to those of Spain and Portugal, while the French dolmens, with few exceptions in the north, have a different character. These curious points are in favour of the tradition that the original inhabitants of Ireland were of Iberian origin, and further, that they did not come overland but by sea, and there are indeed signs of extensive navigation in the Bronze Age of northern Europe. It was perhaps in the middle of our Bronze Age, say about 1000 B.C., that this Iberian race was supplanted by the Celts, who took a considerable time to emerge from their native barbarism. It is, at any rate, fairly certain that for some hundreds of years previous to this Celtic invasion, Ireland was an enormously rich country, supplying not only herself, but also Britain and part of the Atlantic seaboard with gold. The fact became eventually an ingrained tradition in the history of the country, subsisting in Irish literature for centuries after the Christian era. Such natural wealth must have produced in these early times a marked effect on the relations and culture of these Iberian Irish, and one might reasonably expect a much higher level of luxury and wealth than is indicated by the remains commonly found. With the opportunities provided by communication with the continent, and the interchange of goods, with all the chances of benefiting by ideas current among other races, it is astonishing that Ireland did not play a more prominent part in Europe, more than a thousand years before the Christian era.

Mediterranean area.

While gold as a metal was known in Europe, even before copper, it is a curious fact that silver was almost unknown, and hardly ever used. One of the most interesting sites for the metal, at about the same period of which we have just been speaking in Ireland, was the Mediterranean coast of Spain. Here in the neighbourhood of Almeria have been found remains of a large and apparently prosperous population ranging from the Stone Age to the end of the Bronze Age, with houses and tombs, besides the fortifications rendered necessary, in the later period, by their possession of the rare and precious metal, silver. Rare it certainly was, for the quantity found was exceedingly small, tiny slender rings for the fingers or the ears, and rivets to hold the axe-blade in its handle; but nothing to compare with the lavish richness of the American mines. The interesting race who occupied these dwellings and finally were laid to rest in the adjoining graves were evidently connected more or less closely with the peoples inhabiting the eastern coasts of the Mediterranean.

Recent discoveries in the central Mediterranean area not only furnish new and trustworthy (though none the less surprising) dates in ancient history, but may also bridge the distance between the Levant and the Pillars of Hercules. The results achieved by Arthur Evans and other distinguished explorers in Crete (*q.v.*) opened a new chapter in the history of European civilization, and may fitly be compared with the excavation of Troy, Mycenae and Tiryns by Schliemann some thirty years before. The progress of archaeology in the interval can be well tested by a comparison of the discussions to which the two series of discoveries gave rise. The mistaken attributions and unfortunate animosities in connexion with earlier excavations are almost forgotten, while the brilliant discoveries in the island of King Minos have not only themselves been made on scientific principles, but are illumined by the splendid revelation of the civilizations of the Mycenaean and the pre-Mycenaean era.

Classical.

A great change indeed took place in the methods of classical study during the last decade of the 19th century, a change which affected the entire character of future classical research. It was formerly the common habit among students and professors of archaeology to confine their attention and their interests entirely to classical texts and even to classical sites, rejecting as outside the scope of their studies anything that was not manifestly beautiful as art. Whatever was primitive in its aspect, or wanting in the familiar characteristics that had for centuries been associated with Greek art, was either rejected entirely or at any rate relegated to a second place, as having but a poor claim to be classed with objects of the finer periods. The result was necessarily misleading. The uninstructed majority very naturally regarded the art of Pheidian times as a thing of supernatural growth, which had been bestowed by divine favour upon a chosen spot on the earth, without a human parentage, and almost without leaving any descendants. The evolutionary methods of other branches of science, however, were by degrees brought to bear upon the sacred precincts of pure Greek art. It was found that the crude products of the second millennium B.C., the formless images evolved by the uncultured dwellers in the Mediterranean area more than a thousand years before the time of Pheidias, were in truth the prototypes of the creations of himself and his contemporaries. This step being taken, the rest became easy. The most commonplace and ordinary relics were collected with as much avidity as they had formerly been rejected, in the belief that their simple forms would aid in the elucidation of their more complex and highly elaborated descendants. This minute attention, moreover, was not only given to the works of man, but even the remains of humanity received the attention they merited. It has been rightly thought, during recent years, that the question of race was a factor that deserved treatment in dealing with works of art of early times; and that natural evolution due to man's tendency to change with time, might not be sufficient to account for the differences of type observed in human remains from the same country. For this reason, not only the objects associated with the burial have been preserved, but also the skeleton itself. This has been examined, measurements taken and recorded for comparison, and inferences made, sometimes of a surprising character. For example, if a cemetery be found with a preponderance of tall, long-headed skeletons in a district where the prevailing type of skeleton is short and brachycephalic (short-headed), the observer may reasonably expect a different kind of burial-furniture, and suspect an intruding race. In this particular respect, archaeology owes a signal debt to physical anthropology and to anthropological methods in general. The combination of the two is far more likely to lead to a reasonable and satisfactory conclusion than would be possible if the one branch of science had been pursued alone.

Value of ethnology.

When once the existence of abundant remains of prehistoric man had been admitted, and their study had received recognition as a branch of science, the evidence supplied by the relics themselves and by their relation to extinct or existing animals would have sufficed to give a considerable insight into the conditions of primitive life. But, fortunately, corroborative evidence of the most useful kind was at hand, and has been of the greatest service in solving what might otherwise have been insoluble problems. Though the progress of civilization, and more especially the ever increasing rapidity of communication, are rapidly changing the habits of life among the primitive peoples in various parts of the world, yet till past the middle of the 19th century, a certain number of tribes, if not races, were still in the Stone Age. Even at the present day stone-using tribes still exist, although by chance metal may be known to them. The importance of the study of their conditions of life and their technical processes, and of the collecting of their implements for the express purpose of illustrating prehistoric man, was recognized by Henry Christy (1810–1865), who had made extensive investigations and collected relics in conjunction with Edouard Lartet in the now famous caverns of the Dordogne, at a time when such explorations were somewhat of a novelty; and concurrently he formed a large collection of the productions of existing savage peoples, both collections after his death passing to the British Museum, his intention being that the one should elucidate the other. (It is only fair to his memory, however, to state here that, by his express wish, the most important of the relics that he had obtained from the Dordogne caves were returned to France where they now are. Such instances of international courtesy are rare enough to deserve mention.) The value and interest of such a series can scarcely be over-rated. Almost till the 20th century, the Indians of North America, the Australian and Tasmanian natives, as well as those of New Zealand and the many archipelagoes of the Pacific, were, if not ignorant of the use of metals, at least habitually using stone where civilized man would use metal. The Maori made his war club of jade and the pounders for preparing his food of stone. The Australian had his stone axe-blade; and low as he stands in the culture scale, his spear-heads are chipped with an exquisite precision. The Papuan of inland New Guinea is still making his weapons of stone and wood; while until quite recently the North American Indian was making his delicate stone arrow-points, and the Solomon islander his beautiful polished stone axe-blades. The knowledge gained by the study of a large series of such objects enables us to fill up very many gaps in the story of early man as told by his own remains. In fact, in this respect, the value of the comparison is much greater than could reasonably be expected; for, whatever may be the reason, nothing is more marked than the extraordinary similarity of stone implements at all times and over the whole world. An arrow-point made by a Patagonian Indian, one from a Japanese shell mound, and a third of the Stone Age from Ireland, are found to be practically identical. Whether it is that the same material and the same necessity naturally produce a like result, or whether there has existed throughout a continuity of type, is a question that will never be satisfactorily answered. The results, however, are of eminently practical value. The arrow-heads of neolithic man, which are found by hundreds all over Europe, may be seen fixed in their shafts in the hands of an American Indian; rude pieces of quartz, which unmounted would escape notice as implements, are seen to make excellent tools when mounted in a handle by the Australian black, while flakes of slate find a use when mounted as skinning-knives by the Eskimo.

Organized study.

Now that the narrower conception of archaeology as a minor branch of classical studies has been given up, the new science has gradually won its way to universal recognition; and anthropology, a still wider subject but in many points closely allied to the scientific study of ancient remains, has still more recently found favour at all the leading universities, and practical measures have been taken to establish the study on a firm and scientific basis. Apart from this official encouragement, much has been done towards the systematization and teaching of archaeology by practical excavators, whose pupils have attained considerable numbers and celebrity. Something has been done, too, in the national and provincial museums, to present the relics of past ages in an intelligible manner, so that the collections no longer consist of curiosities but of documents rich in instruction and interest even to the general visitor. The progress of photography, as well as the improvement and cheapening of methods of illustration, have also assisted enormously in the advance of archaeology; and similarly, the antiquities exhibited in museums and private collections to illustrate and amplify written records, have in the last generation received much attention on their own account, and have reacted in various ways on the teaching of ancient history. In some countries a further step in general education has been taken, and the lamentable waste of archaeological material arrested to some extent by the distribution of pictures and diagrams among schools and institutions, to call attention to the more ordinary local types, and to encourage those who are likely to discover them in the soil to save them from destruction and render them available for scientific study. A certain familiarity on the part of the young with the mere appearance of antiquities that come to light continually and are almost as often discarded or destroyed, would probably result in valuable additions being made to the available data.

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(C. H. RD.)

ARCHAEOPTERYX. The name of *Archaeopteryx lithographica* was based by Hermann von Meyer upon a feather (Gr. πτέρυξ, wing) found in 1861 in the lithographic slate quarries of Solenhofen in Bavaria, the geological horizon being that of the Kimmeridge clay of the Upper Oolite or Jurassic system. In the same year and at the same place was discovered the specimen (figs. 1 and 3) now in the British Museum, named by Andreas Wagner *Griphosaurus.* Sir R. Owen has described it as *A. macroura.* Stimulated by the high price paid by the British Museum, the quarry owners diligently searched, and in 1872 another, much finer, preserved specimen was found. This was bought by K. W. v. Siemens, who presented it to the Berlin Museum. The late W. Dames has written an excellent monograph on it.

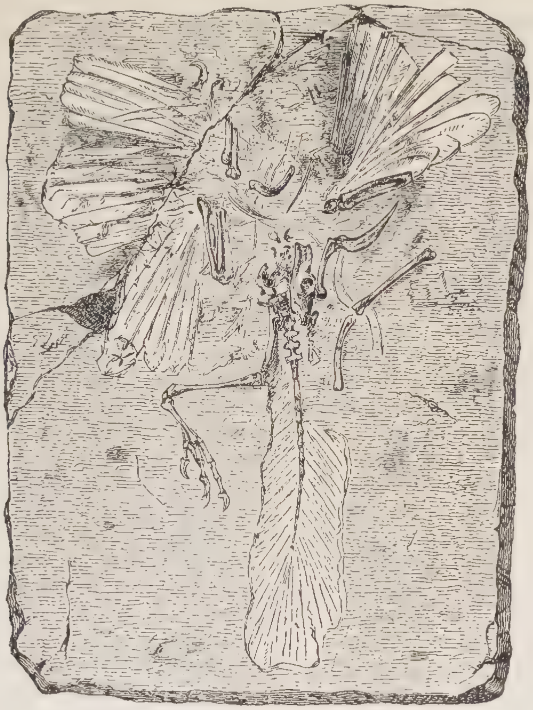

Fig. 1.—The British Museum specimen.

Archaeopteryx was a bird, without any doubt, but still with so many low, essentially reptilian characters that it forms a link between these two classes. About the size of a rook, its most obvious peculiarity is the long reptilian tail, composed of 20 vertebrae and not ending in a pygostyle. The last dozen vertebrae each carry a pair of well-developed typical quills. Upon these features of the tail E. Haeckel established the subclass Saururae, containing solely Archaeopteryx, in opposition to the Ornithurae, comprising all the other birds. Herein he has been followed by many zoologists. However, the fact that various recent birds possess the same kind of caudal skeleton, likewise without a pygostyle, although reduced to at least 13 vertebrae, shows that the two terms do not express a fundamental difference.

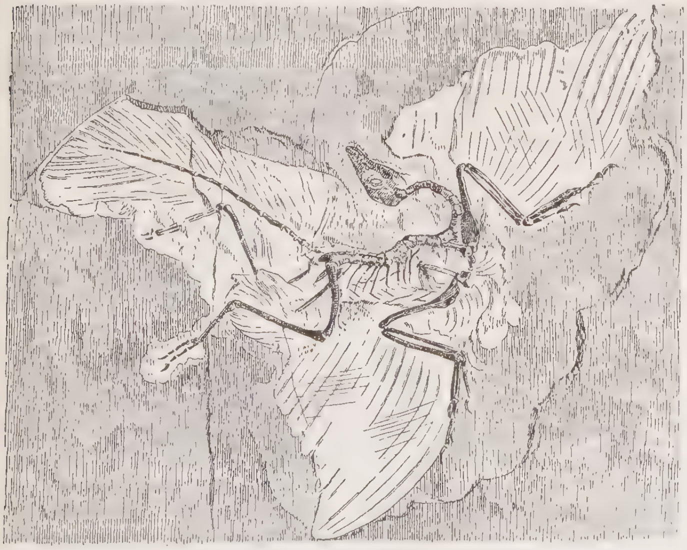

Fig. 2.—The specimen in the Museum für Naturkunde, Berlin. After a photograph taken from a cast.

The importance of *Archaeopteryx* justifies the following descriptive detail. Vertebral column composed of about 50 vertebrae, viz. 10-11 cervical, 12-11 thoracic, 2 lumbar, 5-6 sacral, and 20 or 21 caudal, with a total caudal length of the Berlin specimen of 7 in. The cervical and thoracic vertebrae seem to be biconcave; the cervical ribs are much reduced and were apparently still movable; the thoracic ribs are devoid of uncinate processes. Paired abdominal ribs are doubtful. Scarcely anything is known of the sternum, and little of the shoulder-girdle, except the very stout furcula; scapula typically bird-like. Humerus about $2\frac{1}{2}$ in. long, with a strong crista lateralis, which indicates a strongly developed great pectoral muscle and hence, by inference, the presence of a keel to the sternum. Radius and ulna typically avine, 2·1 in. in length. Carpus with two separate bones. The hand skeleton consists of 3 completely separate metacarpals, each carrying a complete, likewise free, finger; the shortened thumb with 2, the index with 3, the third with 4 phalanges; each finger with a curved claw. The whole wing is consequently, although essentially avine, still reptilian in the unfused state of the metacarpals and the numbers of the phalanges. The pelvis is imperfectly known. The preacetabular portion of the ilium is shorter than the posterior half. The hind-limb is typically avine, with intertarsal joint, distally reduced fibula, and the three elongated metatarsals which show already considerable anchylosis; reduction of the toes to four, with 2, 3, 4 and 5 phalanges; the hallux is separate, and as usual in recent birds posterior in position. Skull bird-like, except that the short bill cannot have been enclosed in a horny rhamphotheca, since the upper jaw shows a row of 13, the lower jaw 3 conical teeth, all implanted in distinct sockets.

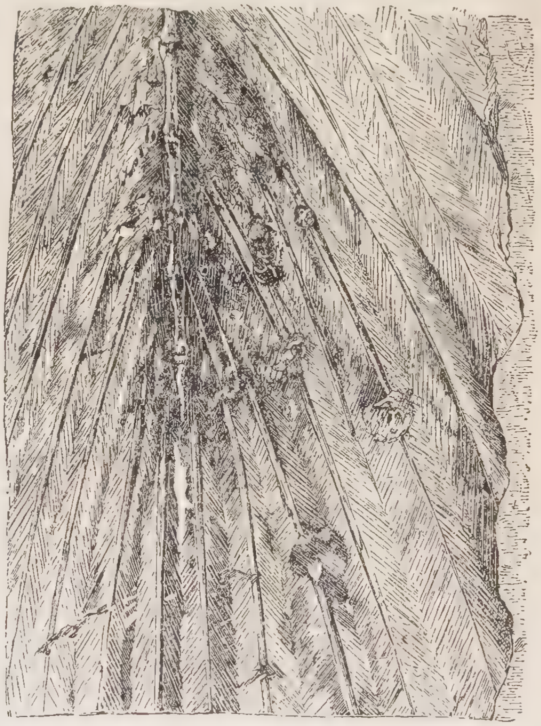

Fig. 3.—Tail of British Museum specimen.

The remiges and rectrices indicate perfect feathers, with shaft and complete vanes which were so neatly finished that they must have possessed typical radii and hooklets. Some of the quills measure fully 5 in. in length. Six or seven remiges were attached to the hand, ten to the ulna.

It is idle to speculate on the habits of this earliest of known birds. That it could fly is certain, and the feet show it to have been well adapted to arboreal life. The clawed slender fingers did not make *Archaeopteryx* any more quadrupedal or bat-like in its habits than is a kestrel hawk, with its equally large, or even larger thumb-claw.

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ARCHAISM (adj. "archaic"; from Gr. ἀρχαῖος, old), an old-fashioned usage, or the deliberate employment of an out-of-date and ancient mode of expression.

ARCHANGEL (Archangelsk), a government of European Russia, bounded N. by the White Sea and Arctic Ocean, W. by Finland and Olonets, S. by Vologda, and E. by the Ural mountains. It comprehends the islands of Novaya-Zemlya, Vaygach and Kolguev, and the peninsula of Kola. Its area is 331,505 sq. m., and its population in 1867 was 275,779 and in 1897, 349,943. The part which lies within the Arctic Circle is very desolate and sterile, consisting chiefly of sand and reindeer moss. The winter is long and severe, and even in summer the soil is frozen. The rivers (Tuloma, Onega, Dvina, Mezen and Pechora) are closed in September and scarcely thaw before July. The Kola peninsula is, however, diversified by hills exceeding 3000 ft. in altitude and by large lakes (*e.g.* Imandra), and its coast enjoys a much more genial climate. South of the Arctic Circle the greater part of the country is covered with forests, intermingled with lakes and morasses, though in places there is excellent pasturage. Here the spring is moist, with cold, frosty nights; the summer a succession of long foggy days; the autumn again moist. The rivers are closed from October to April. The inhabitants of the northern districts—nomad tribes of Samoyedes, Zyryans, Lapps, and the Finnish tribes of Karelians and Chudes—support themselves by fishing and hunting. In the southern districts hemp and flax are raised, but grain crops are little cultivated, so that the bark of trees has often to be ground up to eke out the scanty supply of flour. Potatoes are grown as far north as 65°. Shipbuilding is carried on, and the forests yield timber, pitch and tar. Excellent cattle are raised in the district of Kholmogory on the Dvina, veal being supplied to St Petersburg. Gold is found in the districts of Kola, naphtha and salt in those of Kem and Pinega, and lignite in Mezen. Sulphurous springs exist in the districts of Kholmogory and Shenkursk. The industry and commerce are noticed below in the article on the town Archangel, which is the capital. The government is divided into nine districts, the chief towns of which are—Alexandrovsk or Kola (pop. 300), Archangel (*q.v.*), Kem (1825), Kholmogory (1465), Mezen (2040), Novaya-Zemlya (island), Pechora, Pinega (1000) and Shenkursk (1308).

See A. P. Engelhardt, *A Russian Province of the North* (Eng. trans., by H. Cooke, 1899).

ARCHANGEL (Archangelsk), chief town of the government of Archangel, Russia, at the head of the delta of the Dvina, on the right bank of the river, in lat. 64° 32′ N. and long. 40° 33′ E. Pop. (1867) 19,936; (1897) 20,933. As early as the 10th century, if not earlier, the Norsemen frequented this part of the world (Bjarmeland) on trading expeditions; the best-known is that made by Ottar or Othere between 880 and 900 and described (or translated) by Alfred the Great, king of England. The modern town dates, however, from the visit of the English voyager, Richard Chancellor, in 1553. An English factory was erected on the lower Dvina soon after that date, and in 1584 a fort was built, around which the town grew up. Archangel was for long the only seaport of Russia (or Muscovy). The tsar Boris Godunov (1598–1605) threw the trade open to all nations; and the chief participants in it were England, Holland and Germany. In 1668–1684 the great bazaar and trading hall was built, principally by Tatar prisoners. In 1691–1700 the exports to England averaged £112,210 annually. After Peter the Great made St Petersburg the capital of his dominions (1702), he placed Archangel under vexatious commercial disabilities, and consequently its trade declined. In 1762 it was granted the same privileges as St Petersburg, and since then it has gradually recovered its former prosperity. It is the seat of a bishop, and has a cathedral (1709–1743), a museum, the monastery of the Archangel Michael (whence the city gets its name), an ecclesiastical seminary, a school of navigation and a naval hospital. Linen, leather, canvas, cordage, mats, tallow, potash and beer are manufactured. There is a lively trade with St Petersburg, and the sea-borne exports, which consist chiefly of timber, flax, linseed, oats, flour, pitch, tar, skins and mats, amount in value to about 1½ millions sterling annually (82½ % for timber), but the imports (mostly fish) are worth only about £200,000. A fish fair is held every year on the 1st (15th) of September. Archangel communicates with the interior of Russia by river and canal, and has a railway line (522 m.) to Yaroslavl. The harbour, deepened to 18¼ ft., is about a mile below the city, and is accessible from May to October. About 12 m. lower down there are a government dockyard and merchants' warehouses. A new military harbour, Alexandrovsk or Port Catherine, has been made on Catherine (Ekaterininsk) Bay, on the Murman coast of the Kola peninsula. The shortest day at Archangel has only 3 hrs. 12 min., the longest 21 hrs. 48 min. of daylight.

ARCHBALD, a borough of Lackawanna county, Pennsylvania, U.S.A., in the N.E. part of the state, 10 m. N.E. of Scranton. Pop. (1890) 4032; (1900) 5396; (1869 foreign-born); (1910) 7194. It is served by the Delaware & Hudson, and the New York, Ontario & Western railways, and by an interurban electric line. It is about 900 ft. above sea-level; in the vicinity are extensive deposits of anthracite coal, the mining and breaking of which is the principal industry; silk throwing and weaving is another industry of the borough. At Archbald is a large glacial "pot hole," about 20 ft. in diameter and 40 ft. in depth. Archbald, named in honour of James Archbald, formerly chief engineer of the Delaware & Hudson railway, was a part of Blakely township (incorporated in 1818) until 1877, when it became a borough.

ARCHBISHOP (Lat. *archiepiscopus*, from Gr. ἀρχιεπίσκοπος), in the Christian Church, the title of a bishop of superior rank, implying usually jurisdiction over other bishops, but no superiority of order over them. The functions of the archbishop, as at present exercised, developed out of those of the metropolitan (*q.v.*); though the title of archbishop, when it first appeared, implied no metropolitan jurisdiction. Nor are the terms interchangeable now; for not all metropolitans are archbishops,[1] nor all archbishops metropolitans. The title seems to have been introduced first in the East, in the 4th century, as an honorary distinction implying no superiority of jurisdiction. Its first recorded use is by Athanasius, bishop of Alexandria, who applied it to his predecessor Alexander as a mark of respect. In the same way Gregory of Nazianzus bestowed it upon Athanasius himself. In the next century its use would seem to have been more common as the title of bishops of important sees; for several archbishops are stated to have been present at the council of Chalcedon in 451. In the Western Church the title was hardly known before the 7th century, and did not become common until the Carolingian emperors revived the right of the metropolitans to summon provincial synods. The metropolitans now commonly assumed the title of archbishop to mark their pre-eminence over the other bishops; at the same time the obligation imposed upon them, mainly at the instance of St Boniface, to receive the *pallium* (*q.v.*) from Rome, definitely marked the defeat of their claim to exercise metropolitan jurisdiction independently of the pope.

At the present day, the title of archbishop is retained in the Roman Catholic Church, the various oriental churches, the Anglican Church, and certain branches of the Lutheran (Evangelical) Church.

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[1] In the Roman Church it is safe to say that all metropolitans are archbishops. In, *e.g.*, the Scottish and American episcopal churches however, the metropolitan is the senior bishop *pro tem.*

Roman Catholic Church.

In the Roman Catholic Church the powers of the archbishop are considerably less extensive than they were in the middle ages. According to the medieval canon law, based on the decretals, and codified in the 13th century in the *Corpus juris canonici*, by which the earlier powers of metropolitans had been greatly curtailed, the powers of the archbishop consisted in the right (1) to confirm and consecrate suffragan bishops; (2) to summon and preside over provincial synods; (3) to superintend the suffragans and visit their dioceses, as well as to censure and punish bishops in the interests of discipline, the right of deprivation, however, being reserved to the pope; (4) to act as a court of appeal from the diocesan courts; (5) to exercise the *jus devolutionis*, *i.e.* present to benefices in the gift of bishops, if these neglect their duty in this respect. These rights were greatly curtailed by the council of Trent. The confirmation and consecration of bishops (*q.v.*) is now reserved to the Holy See. The summoning of provincial synods, which was made obligatory every three years by the council, was long neglected, but is now more common wherever the political conditions, *e.g.* in the United States, Great Britain and France, are favourable. The disciplinary powers of the archbishop, on the other hand, can scarcely be said to survive. The right to hold a visitation of a suffragan's diocese or to issue censures against him was, by Sess. xxiv. c. 3 *de ref.*, of the council of Trent, made dependent upon the consent of the provincial synod after cause shown (*causa cognita et probata*); and the only two powers left to the archbishop in this respect are to watch over the diocesan seminaries and to compel the residence of the bishop in his diocese. The right of the archbishop to exercise a certain disciplinary power over the regular orders is possessed by him, not as archbishop, but as the delegate *ad hoc* of the pope. Finally, the function of the archbishop as judge in a court of appeal, though it still subsists, is of little practical importance now that the clergy, in civil matters, are universally subject to the secular courts.

Besides archbishops who are metropolitans there are in the Roman Catholic Church others who have no metropolitan jurisdiction. Such are the titular archbishops *in partibus*, and certain archbishops of Italian sees who have no bishops under them. Archbishops rank immediately after patriarchs and have the same precedence as primates. The right to wear the *pallium* is confined to those archbishops who are not merely titular. It must be applied for, either in person or by proxy, at Rome by the archbishop within three months of his consecration or enthronement, and, before receiving it, he must take the oaths of fidelity and obedience to the Holy See. Until the *pallium* is granted, the archbishop is known only as archbishop-elect, and is not empowered to exercise his *potestas ordinis* in the archdiocese nor to summon the provincial synod and exercise the jurisdiction dependent upon this. He may, however, exercise his purely *episcopal* functions. The special ensign of his office is the cross, *crux erecta* or *gestatoria*, carried before him on solemn occasions (see Cross).

Eastern Church.

In the Orthodox and other churches of the East the title of archbishop is of far more common occurrence than in the West, and is less consistently associated with metropolitan functions. Thus in Greece there are eleven archbishops to thirteen bishops, the archbishop of Athens alone being metropolitan; in Cyprus, where there are four bishops and only one archbishop, all five are of metropolitan rank.

Lutheran Church.

In the Protestant churches of continental Europe the title of archbishop has fallen into almost complete disuse. It is, however, still borne by the Lutheran bishop of Upsala, who is metropolitan of Sweden, and by the Lutheran bishop of Åbo in Finland. In Prussia the title has occasionally been bestowed by the king on general superintendents of the Lutheran church, as in 1829, when Frederick William III. gave it to his friend and spiritual adviser, the celebrated preacher, Ludwig Ernst Borowski (1740–1831), general superintendent of Prussia (1812) and bishop (1816).

Church of England.

In the Church of England and its sister and daughter churches the position of the archbishop is defined by the medieval canon law as confirmed or modified by statute since the Reformation. It is, therefore, as regards both the *potestas ordinis* and jurisdiction, substantially the same as in the Roman Catholic Church, save as modified on the one hand by the substitution of the supremacy of the crown for that of the Holy See, and on the other by the restrictions imposed by the council of Trent.

The ecclesiastical government of the Church of England is divided between two archbishops—the archbishop of Canterbury, who is "primate of all England" and metropolitan of the province of Canterbury, and the archbishop of York, who is "primate of England" and metropolitan of the province of York. The jurisdiction of the archbishop of Canterbury as primate of all England extends in certain matters into the province of York. He exercised the jurisdiction of *legatus natus* of the pope throughout all England before the Reformation, and since that event he has been empowered, by 25 Hen. VIII. c. 21, to exercise certain powers of dispensation in cases formerly sued for in the court of Rome. Under this statute the archbishop continues to grant special licences to marry, which are valid in both provinces; he appoints notaries public, who may practise in both provinces; and he grants dispensations to clerks to hold more than one benefice, subject to certain restrictions which have been imposed by later statutes. The archbishop also continues to grant degrees in the faculties of theology, music and law, which are known as Lambeth degrees. His power to grant degrees in medicine, qualifying the recipients to practise, was practically restrained by the Medical Act 1858.

The archbishop of Canterbury exercises the twofold jurisdiction of a metropolitan and a diocesan bishop. As metropolitan he is the guardian of the spiritualities of every vacant see within the province, he presents to all benefices which fall vacant during the vacancy of the see, and through his special commissary exercises the ordinary jurisdiction of a bishop within the vacant diocese. He exercises also an appellate jurisdiction over each bishop, which, in cases of licensed curates, he exercises personally under the Pluralities Act 1838; but his ordinary appellate jurisdiction is exercised by the judge of the Arches court (see Arches, Court of). The archbishop had formerly exclusive jurisdiction in all causes of wills and intestacies, where parties died having personal property in more than one diocese of the province of Canterbury, and he had concurrent jurisdiction in other cases. This jurisdiction, which he exercised through the judge of the Prerogative court, was transferred to the crown by the Court of Probate Act 1857. The Arches court was also the court of appeal from the consistory courts of the bishops of the province in all testamentary and matrimonial causes. The matrimonial jurisdiction was transferred to the crown by the Matrimonial Causes Act 1857. The court of Audience, in which the archbishop presided personally, attended by his vicar-general, and sometimes by episcopal assessors, has fallen into desuetude. The vicar-general, however, exercises jurisdiction in matters of ordinary marriage licences and of institutions to benefices. The master of the faculties regulates the appointment of notaries public, and all dispensations which fall under 25 Hen. VIII. c. 21.

A right very rarely exercised by the archbishop of Canterbury, but one of great importance, is that of the visitation and deprivation of inferior bishops. Since there is no example of the archbishop of York exercising or being reputed to have such disciplinary jurisdiction over his suffragans,[1] and this right could, according to the canon law cited above, in the middle ages only be exercised normally in concert with the provincial synod, it would seem to be a survival of the special jurisdiction enjoyed by the pre-Reformation archbishop as *legatus natus* of the pope. It was somewhat freely exercised by Cranmer and his successors immediately after the Reformation; but the main precedent now relied upon is that of Dr Watson, bishop of St Davids, who was deprived in 1695 by Archbishop Tennison for simony and other offences, the legality of the sentence being finally confirmed by the House of Lords on the 25th of January 1705. It was proved in the course of the long argument in this case that the archbishop of Canterbury had undoubtedly exercised such independent power of visitation both before and after the Reformation; and it was on this precedent that in 1888 the judicial committee of the privy council mainly relied in deciding that the archbishop had the right to cite before him the bishop of Lincoln (Dr Edward King), who was accused of certain irregular ritual practices. The trial began on the 12th of February 1889 before the archbishop and certain assessors, the protest of Dr King, based on the claim that he could only be tried in a provincial synod, being overruled by Archbishop Benson on the grounds above stated. The main importance of the "Lincoln Judgment," delivered on the 21st of November 1890, is that it set a new precedent for the effective jurisdiction of the archbishop, based on the ancient canon law, and so did something towards the establishment of a purely "spiritual" court, the absence of which had been one of the main grievances of a large body of the clergy.

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[1] Unless the case of the claim of Mark, bishop of Carlisle, to be tried by his ordinary instead of by a temporal court, be a precedent (Phillimore, *Eccles. Law*, p. 74, ed. 1895).

It is the privilege of the archbishop of Canterbury to crown the kings and queens of England. He is entitled to consecrate all the bishops within his province and was formerly entitled, upon consecrating a bishop, to select a benefice within his diocese at his option for one of his chaplains, but this practice was indirectly abolished by 3 and 4 Vict. c. 111, § 42. He is entitled to nominate eight chaplains, who had formerly certain statutory privileges, which are now abolished. He is *ex officio* an ecclesiastical commissioner for England, and has by statute the right of nominating one of the salaried ecclesiastical commissioners.

The archbishop exercises the ordinary jurisdiction of a bishop over his diocese through his consistory court at Canterbury, the judge of which court is styled the commissary-general of the city and diocese of Canterbury. The archbishop holds a visitation of his diocese personally every three years, and he is the only diocesan who has kept up the triennial visitation of the dean and chapter of his cathedral.[1] The archbishop of Canterbury takes precedence immediately after princes of the blood royal and over every peer of parliament, including the lord chancellor.

The archbishop of York has immediate spiritual jurisdiction as metropolitan in the case of all vacant sees within the province of York, analogous to that which is exercised by the archbishop of Canterbury within the province of Canterbury. He has also an appellate jurisdiction of an analogous character, which he exercises through his provincial court, whilst his diocesan jurisdiction is exercised through his consistorial court, the judges of both courts being nominated by the archbishop. His ancient testamentary and matrimonial jurisdiction was transferred to the crown by the same statutes which divested the see of Canterbury of its jurisdiction in similar matters. It is the privilege of the archbishop of York to crown the queen consort and to be her perpetual chaplain. The archbishop of York takes precedence over all subjects of the crown not of royal blood, but after the lord high chancellor of England. He is *ex officio* an ecclesiastical commissioner for England (see further ENGLAND, CHURCH OF).

The Church of Ireland had at the time of the Act of Union four archbishops, who took their titles from Armagh, Dublin, Cashel and Tuam. By acts of 1833 and 1834, the metropolitans of Cashel and of Tuam were reduced to the status of diocesan bishops. The two archbishoprics of Armagh and Dublin are maintained in the disestablished Church of Ireland.

The title archbishop has been used in certain of the colonial churches, *e.g.* Australia, South Africa, Canada, and the West Indies, since 1893, when it was assumed by the metropolitans of Canada and Rupert's Land (see ANGLICAN COMMUNION). Archbishops have the title of His (or Your) Grace and Most Reverend Father in God.

See Hinschius, *System des katholischen Kirchenrechts* (Berlin, 1869), also article "Erzbischof," in Hauck, *Realencyklopädie* (1898); Phillimore, *The Ecclesiastical Law of the Church of England*, and authorities there cited. (W. A. P.)

ARCHCHANCELLOR (Lat. *Archicancellarius*; Ger. *Erzkanzler*), or chief chancellor, a title given to the highest dignitary of the Holy Roman Empire, and also used occasionally during the middle ages to denote an official who supervised the work of chancellors or notaries.

In the 9th century Hincmar, archbishop of Reims, in his work, *De ordine palatii et regni*, speaks of a *summus cancellarius*, evidently an official at the court of the Carolingian emperors and kings. A charter of the emperor Lothair I. dated 844 refers to Agilmar, archbishop of Vienne, as archchancellor, and there are several other references to archchancellors in various chronicles. This office existed in the German kingdom of Otto the Great, and about this time it appears to have become an appanage of the archbishopric of Mainz. When the Empire was restored by Otto in 962, a separate chancery seems to have been organized for Italian affairs, and early in the 11th century the office of archchancellor for the kingdom of Italy was in the hands of the archbishop of Cologne. The theory was that all the imperial business in Germany was supervised by the elector of Mainz, and for Italy by the elector of Cologne. However, the duties of archchancellor for Italy were generally discharged by deputy, and after the virtual separation of Italy and Germany, the title alone was retained by the elector. When the kingdom of Burgundy or Arles was acquired by the emperor Conrad II. in 1032 it is possible that a separate chancery was established for this kingdom. However this may be, during the 12th century the elector of Trier took the title of archchancellor for the kingdom of Arles, although it is doubtful if he ever performed any duties in connexion with this office. This threefold division of the office of imperial archchancellor was acknowledged in 1356 by the Golden Bull of the emperor Charles IV., but the duties of the office were performed by the elector of Mainz. The office in this form was part of the constitution of the Empire until 1803 when the archbishopric of Mainz was secularized. The last elector, Karl Theodor von Dalberg, however, retained the title of archchancellor until the dissolution of the Empire in 1806. H. Reincke in *Der alte Reichstag und der neue Bundesrat* (Tübingen, 1906) points out a marked resemblance between the medieval archchancellor and the German imperial chancellor of the present day.

See du Cange, *Glossarium*, s. "Archicancellarius"; and CHANCELLOR.

ARCHDEACON (Lat. *archidiaconus*, Gr. ἀρχιδιάκονος), a high official of the Christian Church. The office of archdeacon is of great antiquity. So early as the 4th century it is mentioned as an established office, and it is probable that it was in existence in the 3rd. Originally the archdeacon was, as the name implies, the chief of the deacons attached to the bishop's cathedral, his duty being, besides preaching, to supervise the deacons and their work, *i.e.* more especially the care of the sick and the arrangement of the externals of divine worship. Even thus early their close relation to the bishop and their employment in matters of episcopal administration gave them, though only in deacons' orders, great importance, which continually developed. In the East, in the 5th century, the archdeacons were already charged with the proof of the qualifications of candidates for ordination; they attended the bishops at ecclesiastical synods, and sometimes acted as their representatives; they shared in the administration of sees during a vacancy. In the West, in the 6th and 7th centuries, besides the original functions of their office, archdeacons had certain well-defined rights of visitation and supervision, being responsible for the good order of the lower clergy, the upkeep of ecclesiastical buildings and the safe-guarding of the church furniture—functions which involved a considerable disciplinary power. During the 8th and 9th centuries the office tended to become more and more exclusively purely administrative, the archdeacon by his visitations relieving the bishop of the minutiae of government and keeping him informed in detail of the condition of his diocese. The archdeacon had thus become, on the one hand, the *oculus episcopi*, but on the other hand, armed as he was with powers of imposing penance and, in case of stubborn disobedience, of excommunicating offenders, his power tended more and more to grow at the bishop's expense. This process received a great impulse from the erection in the 11th and 12th centuries of defined territorial jurisdictions for the archdeacons, who had hitherto been itinerant representatives of the central power of the diocese. The dioceses were now mapped out into several archdeaconries (*archidiaconatus*), which corresponded with the political divisions of the countries; and these defined spheres, in accordance with the prevailing feudal tendencies of the age, gradually came to be regarded as independent centres of jurisdiction.[1] The bishops, now increasingly absorbed in secular affairs, were content with a somewhat theoretical power of control, while the archdeacons rigorously asserted an independent position which implied great power and possibilities of wealth. The custom, moreover, had grown up of bestowing the coveted office of archdeacon on the provosts, deans and canons of the cathedral churches, and the archdeacons were thus involved in the struggle of the chapters against the episcopal authority. By the 12th century the archdeacon had become practically independent of the bishop, whose consent was only required in certain specified cases.

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[1] The court of Peculiars is no longer held, inasmuch as the peculiars have been placed by acts of parliament under the ordinary jurisdiction of the bishops of the respective dioceses in which they are situated.

The power of the archdeacon reached its zenith at the outset of the 13th century. Innocent III. describes him as *judex ordinarius*, and he possesses in his own right the powers of visitation, of holding courts and imposing penalties, of deciding in matrimonial causes and cases of disputed jurisdiction, of testing candidates for orders, of inducting into benefices. He has the right to certain procurations, and to appoint and depose archpriests and rural deans. And these powers he may exercise through delegated *officiales*. His jurisdiction has become, in fact, not subordinate to, but co-ordinate with that of the bishop. Yet, so far as orders were concerned, he remained a deacon; and if archdeacons were often priests, this was because priests who were members of chapters were appointed to the office.

From the 13th century onward a reaction set in. The power of the archdeacons rested upon custom and prescription, not upon the canon law; and though the bishops could not break, they could circumvent it. This they did by appointing new officials to exercise in their name the rights still reserved to them, or to which they laid claim. These were the *officiales*: the *officiales foranei*, whose jurisdiction was parallel with that of the archdeacons, and the *officiales principales* and vicars-general, who presided over the courts of appeal. The clergy having thus another authority, and one moreover more canonical, to appeal to, the power of the archdeacons gradually declined; and, so far as the Roman Catholic Church is concerned, it received its death-blow from the council of Trent (1564), which withdrew all matrimonial and criminal causes from the competence of the archdeacons, forbade them to pronounce excommunications, and allowed them only to hold visitations in connexion with those of the bishop and with his consent. These decrees were not, indeed, at once universally enforced; but the convulsions of the Revolutionary epoch and the religious reorganization that followed completed the work. In the Roman Church to-day the office of archdeacon is merely titular, his sole function being to present the candidates for ordination to the bishop. The title, indeed, hardly exists save in Italy, where the archdeacon is no more than a dignified member of a chapter, who takes rank after the bishop. The ancient functions of the archdeacon are exercised by the vicar-general. In the Lutheran church the title *Archidiakonus* is given in some places to the senior assistant pastor of a church.

In the Church of England, on the other hand, the office of archdeacon, which was first introduced at the Norman conquest, survives, with many of its ancient duties and prerogatives. Since 1836 there have been at least two archdeaconries in each diocese, and in some dioceses there are four archdeacons. The archdeacons are appointed by their respective bishops, and they are, by an act of 1840, required to have been six full years in priest's orders. The functions of the archdeacon are in the present day ancillary in a general way to those of the bishop of the diocese. It is his especial duty to inspect the churches within his archdeaconry, to see that the fabrics are kept in repair, and to hold annual visitations of the clergy and churchwardens of each parish, for the purpose of ascertaining that the clergy are in residence, of admitting the newly elected churchwardens into office, and of receiving the presentments of the outgoing churchwardens. It is his privilege to present all candidates for ordination to the bishop of the diocese. It is his duty also to induct the clergy of his archdeaconry into the temporalities of their benefices after they have been instituted into the spiritualities by the bishop or his vicar-general. Every archdeacon is entitled to appoint an official to preside over his archidiaconal court, from which there is an appeal to the consistory court of the bishop. The archdeacons are *ex officio* members of the convocations of their respective provinces.

It is the privilege of the archdeacon of Canterbury to induct the archbishop and all the bishops of the province of Canterbury into their respective bishoprics, and this he does in the case of a bishop under a mandate from the archbishop of Canterbury, directing him to induct the bishop into the real, actual, and corporal possession of the bishopric, and to install and to enthrone him; and in the case of the archbishop, under an analogous mandate from the dean and chapter of Canterbury, as being guardians of the spiritualities during the vacancy of the archiepiscopal see. In the colonies there are two or more archdeacons in each diocese, and their functions correspond to those of English archdeacons. In the Episcopal church of America the office of archdeacon exists in only one or two dioceses.

See Hinschius, *Kirchenrecht*, ii., §§ 86, 87; Schröder, *Die Entwicklung des Archdiakonats bis zum 11. Jahrhundert* (Munich, 1890); Wetzer and Welte, *Kirchenlexikon* (Freiburg-im-Breisgau, 1882–1901); Herzog-Hauck, *Realencyklopädie* (ed. 1896); Phillimore, *Ecclesiastical Law*, part ii. chap. v. (London, 1895). (W. A. P.)

ARCHDUKE (Lat. *archidux*, Ger. *Erzherzog*), a title peculiar now to the Austrian royal family. According to Selden it denotes "an excellency or pre-eminence only, not a superiority or power over other dukes, as in archbishop it doth over other bishops." Yet in this latter sense it would seem to have been assumed by Bruno of Saxony, archbishop of Cologne, and duke of Lorraine (953–965), when he divided his duchy into the dukedoms of Upper and Lower Lorraine. The designation was, however, exceedingly rare during the middle ages. The title of archduke of Lorraine ceased with the circumstances which had produced it. The later dynasties of Brabant and Lorraine, when these fiefs became hereditary, bore only the title of duke. The house of Habsburg, therefore, did not acquire this title with the inheritance of the dukes of Lorraine. Nor does it occur in any of the charters granted to the dukes of Austria by the emperors; though in that creating the first duke of Austria the *archiduces palatii*, *i.e.* the principal dukes of the court, are mentioned. The "Archidux Austriae, seu Austriae inferioris" is spoken of by Abbot Rudolph (d. 1138) in his chronicles of the abbey of St Trond (*Gesta Abbatum Trudonensium*) but this is no more than a rhetorical flourish, and the title of "archduke palatine" (Pfalz-Erzherzog) was, in fact, assumed first by Duke Rudolph IV. (d. 1365), and was one of the rights and privileges included in his famous forgery of the year 1358, the *privilegium maius*, which purported to have been bestowed by the emperor Frederick I. on the dukes of Austria in extension of the genuine *privilegium minus* of 1156, granted to the margrave Henry II. Rudolph IV. used the title on his seals and charters till he was compelled to desist by the emperor Charles IV. The title was also assumed for a time, probably on the strength of the *privilegium maius*, by Duke Ernest of Styria (d. 1424); but it did not legally belong to the house of Habsburg until 1453, when Duke Ernest's son, the emperor Frederick III. (Frederick V., duke of Styria and Carinthia, 1424–1493, of Austria, 1463–1493), confirmed the *privilegium maius* and conferred the title of archduke of Austria on his son Maximilian and his heirs. The title archduke (or archduchess) is now borne by all members of the Austrian imperial house.

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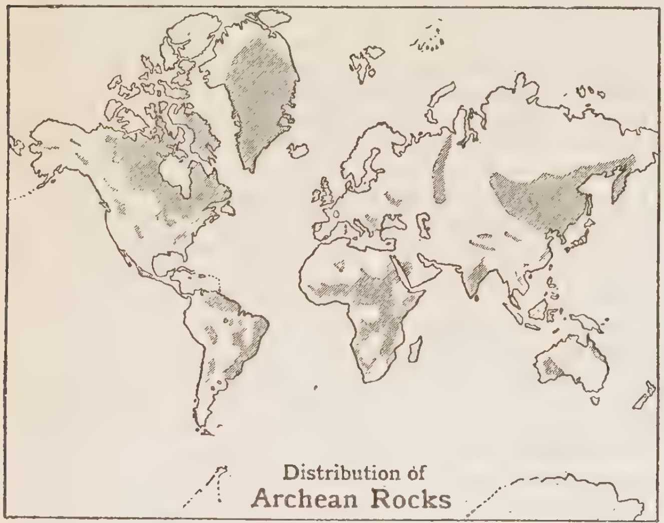
[1] Archdeaconries were, indeed, sometimes treated as ordinary fiefs and were held as such by laymen. Thus Ordericus Vitalis says that "(Fulk) granted to the monks the archdeaconry which he and his predecessors held in fee of the archbishop of Rouen" (*Hist. Eccl.* ii. 12).

See John Selden, *Titles of Honor* (1672); Antonius Matthaeus, *De nobilitate, de principibus, de ducibus, &c., libri quatuor* (Amsterdam and Leiden, 1696, lib. i. cap. 6); Pfeffel, *Abrégé chronologique de l'hist. et du droit public d'Allemagne* (Paris, 1766); Brinckmeier, *Glossarium diplomaticum, &c.* (1850–1863, 2 vols.); J. F. Joachim, "Abhandlung von dem Titel 'Erzherzog,' welchen das Haus Oesterreich führt," in *Prüfende Gesellschaft zu Halle*, 7; F. Wachter, art. "Erzherzog," in *Allgem. Encykl. der Wissenschaften u. Künste* (1842, pub. by Ersch and Gruber); A. Huber, *Ueber die Entstehungszeit der oesterreichischen Freiheitsbriefe* (Vienna, 1860); W. Erben, *Das Privilegium Friedrichs I. für das Herzogtum Österreich* (Vienna, 1902).

ARCHEAN SYSTEM (from ἀρχή, beginning), in geology. Below the lowest distinctly fossiliferous strata, that is, below those Cambrian rocks which bear the *Olenellus* fauna, there lies a great mass of stratified, metamorphic and igneous rock, to which the non-committal epithet "pre-Cambrian" is often applied; and indeed in not a few instances this general term is sufficiently precise for the present state of our knowledge. Nevertheless there are large tracts, both in the Old World and in the New, in which a subdivision of this assemblage of ancient rocks is not only possible but desirable. It is quite clear in certain regions that there is a lowermost group with a prevailing granitoid, gneissic and schistose facies, mainly of igneous origin, above which there are one or several groups bearing a distinctly sedimentary aspect. It is to this lowermost gneissic group that the term "Archean" may be conveniently limited.



Distribution of Archean Rocks

Emery Walker sc.

Thus, while the name "pre-Cambrian" may be used to indicate *all* these very old rocks whenever there is still any difficulty in subdividing them further, it is an advantage to have a special appellation for the oldest group where this can be distinguished.

It must be pointed out that the term "Archean" has been used as a synonym for pre-Cambrian; and that the expressions *Azoic* (from α-, privative; ζωή, life), *Eozoic* (from ἠώς, dawn), and *Fundamental Complex*, have been employed in somewhat the same sense. *Archeozoic* has been proposed by American writers to apply to the lowest pre-Cambrian rocks with the same significance as "Archean" in the restricted sense employed here; but it is perhaps safer to avoid any reference to the supposed stage of life development where all direct evidence is non-existent. The so-called "Azoic" rocks have already been made to yield evidence of life, and there is no reason to presuppose the impossibility of finding other records of still earlier organisms.

The prevailing rocks of the Archean system are igneous, with metamorphosed varieties of the same; sedimentary rocks, distinctly recognizable as such, are scarce, though highly metamorphosed rocks supposed to be sediments, in some regions, take an important place.

There are several features which are peculiarly characteristic of the Archean rocks:—(1) the extraordinary complexity of the assemblage of igneous materials; (2) the extreme metamorphism and deformation which nearly all the rocks have suffered; and (3) the inextricable intermixture of igneous rocks with those for which a sedimentary origin is postulated. Wherever the Archean rocks have been closely examined two great groups of rocks are distinguishable, an older, schistose group and a younger, granitoid and gneissic group. For many years the latter was supposed to be the older, hence the epithets "primitive" or "fundamental" were applied to it. Now, however, it has been shown, both in Europe and in North America, that in certain regions a schistose series is penetrated by a gneissose series and when this occurs the schists must be the older. But bearing in mind the difficulties of interpretation, it is not at all unreasonable to assume that there may yet be regions where the gneissose rocks are the oldest; for where no schistose series is present there may be no criterion for estimating the age of the granites and gneisses. The exceedingly great difficulties which lie in the way of every attempt to unravel the history of an Archean rock-complex cannot be too forcibly emphasized; for to be able to demonstrate the order of events and succession of rocks we should at least know whether we are dealing with sediments, flows of volcanic material, or intrusions, yet in many instances this cannot be done. In some areas the gradual passage of highly foliated and metamorphosed schists may be traced into comparatively unaltered arkoses, greywackes, conglomerates; or into volcanic lava-flows, pyro-clastic rocks or dikes; or again through a gneissose rock into a granite or a gabbro; but the districts wherein these relationships have been thoroughly worked out are very few.

This much may be said, that where the Archean system has been most carefully studied, there appears to be (1) a schistose series, of itself by no means simple but containing the foliated equivalents of sedimentary and igneous rocks; into this series a gneissose group (2) has been intruded in the form of batholites, great sheets and sills with accompanying intrusional prolongations into the schists; subsequently, into the gneisses and schists, after they had been further deformed, sheared and foliated, another set (3) of dikes or thin sheet-like intrusions penetrated. All this, namely, the formation of sediments, the outpouring of volcanic rocks, their repeated deformation by powerful dynamic agencies and then their penetration by dikes and sheets had been completed and erosion had been at work upon the hardened and exposed rocks, before the earliest pre-Cambrian sediment was deposited.

There has been much premature speculation as to the nature and origin of these very ancient rocks. The prevalence of regular foliation with layers of different mineral composition, producing a close resemblance to bedding, has led some to imagine that the gneisses and schists were themselves the product of the primeval oceans, a supposition that is no longer worthy of further discussion. Others have supposed that the gneisses were largely produced by the resorption and fusion of older sediments in the molten interior of the earth; there is no evidence that this has taken place upon an extended scale, though there is reason to believe that something of this kind has happened in places, and there is in the hypothesis nothing radically untenable. In one way the sedimentary schists have undoubtedly been incorporated within the gneissose mass, namely, by the extremely thorough and intimate penetration of the former by the latter along planes of foliation; and when a complex mass such as this has been further sheared and metamorphosed, a uniform gneiss appears to result from the intermixture.

A not uncommon cause of the apparently bedded arrangement of layers of different mineralogical composition may be traced to the original differentiation of the granitoid magma into different mineral-sheets. When these mineralogically different layers were forced into other rocks, sometimes before the complete consolidation of the former and sometimes subsequent to it, in the generally metamorphosed condition of the whole, it is easy to see a superficial resemblance to bedding.

The Archean rocks have frequently been spoken of as the original crust of the earth; but even granting a cooling molten globe with a first-formed stony surface, it is tolerably clear that such a crust has nowhere yet been found, nor is it ever likely to be discovered. The very earliest recognizable sediments are the result of the destruction of still earlier exposures of rock; the oldest known volcanic rocks were poured upon a surface we can no longer distinguish, and as for the great granitoid masses, they could only have been formed under the pressure of superincumbent masses of material. The earliest known sediments must have been deep in the zones of shearing and rock flowage before the first pre-Cambrian denudation. The time required for these changes is difficult to conceive.

As regards the life of the Archean, or, as some call it, the "Archeozoic" period, we know nothing. The presence of carbonaceous shale and graphitic schists as well as of the altered sedimentary iron ores has been taken as indicative of vegetable life. Similarly, the occurrence of limestones suggests the existence of organic activity, but direct evidence is wanting. Much interest naturally attaches to this remote period, and when Sir William E. Logan in 1854 found the foraminifera-like *Eozoon Canadense*, high hopes of further discoveries were entertained, but the inorganic nature of this structure has since been clearly proved.

Distribution.—It is generally assumed that the Archean rocks underlie all the younger formations over the whole globe, and presumably this is the only system that does so. Naturally, the area of its outcrop is limited, for, directly or indirectly, all the younger rock groups must rest upon it.

It has been estimated that Archean rocks appear at the surface over one-fifth of the land area (omitting coverings of superficial drifts). This estimate is no more than the roughest approximation, and is liable at any time to revision as our knowledge of little-known regions is increased. It must ever be borne in mind that the presence of a gneissose or schistose complex does not in itself imply the Archean age of such a set of rocks. Local manifestations of a similar petrological facies may and do appear which are of vastly inferior geological age; and unless there is unequivocal evidence that such rocks lie beneath the oldest fossil-bearing strata, there can be no absolute certainty as to their antiquity. It is more than likely that certain occurrences of gneiss and schist, at present regarded as Archean, may prove on fuller examination to be metamorphosed representatives of younger periods.

Britain.—The most important exposure of Archean rocks in Britain is in the north-west of Scotland, where they form the mainland in Sutherland and Ross-shire, and appear also in the outer Hebrides. Their great development in the isle of Lewis has given rise to the term "Lewisian" (Hebridean), by which the gneisses of this region are now generally known. The Lewisian series comprises two great groups of rocks, (1) the so-called "fundamental complex," an assemblage of acid, basic and intermediate irruptive rocks, associated together in a complex of extraordinary intricacy, and (2) a series of dikes, which like the rocks they traverse, show every gradation from ultra-basic to ultra-acid types. But the above bald statement conveys no idea of the complexity of the series, for before the "fundamental complex" had been pierced by the later dike system it had been subjected to severe dynamo-metamorphism and many of the massive rocks had been folded, thrust and sheared, and a very general state of foliation had been produced. Nor was this all, for fter the intrusion of the dikes, great movements brought about ertical dislocations, and thrust planes, which traversed the rocks t all angles, accompanied by still further internal shearing and uperinduced foliation.

In the valley of Loch Maree and thence south-westward into Glenelg, a series of mica-schists, quartz-schists, saccharoid limestones nd graphitic schists has been regarded as a group of sedimentary rigin through which the Lewisian rocks have been irrupted.

In England several small masses of gneiss, notably at Primrose Hill on the Wrekin, Shropshire, in the Malvern hills, and on the land of Anglesey in North Wales, are supposed to correspond with he Lewisian of Scotland.

North America.—In this continent there is a great development of Archean rocks in Canada. On the eastern side it covers nearly the whole of the Labrador peninsula, and extends into Baffin Bay and possibly over much of Greenland; a broad tract unites the great lake region with Labrador, and from the same region, by way of the Mackenzie valley, a similar tract extends in a north-westerly direction to the Arctic Ocean. This northern (Canadian) area of Archean includes portions of the states of Minnesota, Michigan, Wisconsin and the Adirondack region of New York. On the western side of the continent a series of disconnected exposures of Archean rocks runs downwards in a narrow belt from Alaska to New Mexico; and on the eastern side a similar belt reaches from Newfoundland to Alabama.

Much attention is now being given to the more scattered exposures of Archean rocks, but the best-known area is the classical ground in the vicinity of Lake Superior and Lake Huron and in the Ottawa gneiss region of Canada. Some of the more important districts are the following:—

Rainy Lake district, Canada: The Archean rocks here consist of altered diorites and diabases (the lower Keewatin series) and black hornblende schists (probably altered igneous rocks), with mica gneisses which are perhaps of sedimentary origin.

The Mona and Kitichi schists; metamorphosed lava and tuffs, with serpentine and dolomite, probably derived from peridotites; there are also gneissic granites and syenites.

In the Menominee region of Michigan and Wisconsin, the Quinnesec schist series mainly consist of schistose quartz porphyry with associated gneisses.

In the Mesaba district of Minnesota the Archean consists of a complex of more or less foliated igneous rocks mostly basic in character.

The Archean of the Vermilion district of Minnesota comprises the Soudan formation, an altered sedimentary series with banded cherts, jasper and magnetite schists; the iron ores are extensively mined. At the base is a conglomerate containing pebbles from the formation below, the Ely greenstone, which is made up of altered basalts and andesites, generally in a schistose condition, but occasionally exhibiting spherulitic structures. Into these two formations a series of granites have been intruded.

Europe.—In Scandinavia, as in Scotland, the pre-Cambrian is represented by an earlier and a later series of rocks of which the former (Grundfjeldet, Urberget) may be taken to be the equivalent of the Lewisian gneisses. This assemblage of coarse red and grey banded gneisses, with associated granulites and many varieties of acid, basic and intermediate rocks in a gneissose condition, is intimately related to a highly metamorphosed sedimentary series comprising limestones, quartzites and schists, which, as in Scotland, is apparently older than the gneisses. Similar rocks occur in Sweden and Finland.

In Bavaria and Bohemia the Archean is divisible into a lower red gneiss, a comparatively simple series, called by C. W. von Gümbel the "gneiss of Bojan"; and an upper, grey gneiss with other schistose rocks, serpentine and graphitic limestone, termed by the same author the "Hercynian gneiss."

In Brittany a gneissose and schistose igneous series lies at the base of the pre-Cambrian. The pre-Cambrian cores of the eastern and central Pyrenees, consisting of gneiss, schists and altered limestones, are presumably of Archean age.

Asia, Australia, &c.—In northern China, mica-gneisses and granite-gneisses with associated schists may be regarded as Archean. In India the system is represented by the Bundelkhand gneiss and the central older gneisses of the Himalayas. In Japan, in the Abukuma plateau, there is much granite, gneiss and schist which may be of this age. In Australia, similar rocks are recognized as Archean in South Australia and Westralia, and they are estimated to cover an area of no less than 20,000 sq. m.; in Tasmania they are well developed on the western side. Although a great area is occupied by crystalline rocks in New Zealand, the Archean age of any portion of the series is not yet satisfactorily established; the lower granites and gneisses may belong to this period. Africa contains enormous tracts of crystalline gneisses, granites and schists, and some of these are almost certainly of Archean age; but in the present state of our knowledge it is impossible to speak more exactly.

REFERENCES.—A good general account of the Archean system will be found in Sir A. Geikie's *Text Book of Geology*, vol. ii., 4th ed. (1903), and in T. C. Chamberlin and R. D. Salisbury's *Geology*, vol. ii. (1906); these volumes contain references to all important literature. (J. A. H.)

ARCHELAUS OF CAPPADOCIA (1st century B.C.), general of Mithradates the Great in the war against Rome. In 87 B.C. he was sent to Greece with a large army and fleet, and occupied the Peiraeus after three days' fighting with Bruttius Sura, prefect of Macedonia, who in the previous year had defeated Mithradates' fleet under Metrophanes and captured the island of Sciathus. Here he was besieged by Sulla, compelled to withdraw into Boeotia, and completely defeated at Chaeroneia (86). A fresh army was sent by Mithradates, but Archelaus was again defeated at Orchomenus, after a two days' battle (85). On the conclusion of peace, Archelaus, finding that he had incurred the suspicion of Mithradates, deserted to the Romans, by whom he was well received. Nothing further is known of him.

Appian, *Mithrid.* 30, 49, 56, 64; Plutarch, *Sulla*, 11, 16-19, 20, 23; *Lucullus*, 8.

Archelaus, king of Egypt, was his son. In 56 B.C. he married Berenice, daughter of Ptolemy Auletes, queen of Egypt, but his reign only lasted six months. He was defeated by Aulus Gabinius and slain (55).

See Strabo xii. p. 558, xvii. p. 796; Dio Cassius xxxix. 57-58; Cicero, *Pro Rabirio*, 8; Hirtius (?), *Bell. Alex.* 66; also Ptolemies.

Archelaus, king of Cappadocia, was grandson of the last named. In 41 B.C. (according to others, 34), he was made king of Cappadocia by Mark Antony, whom, however, he deserted after the battle of Actium. Octavian enlarged his kingdom by the addition of part of Cilicia and Lesser Armenia. He was not popular with his subjects, who even brought an accusation against him in Rome, on which occasion he was defended by Tiberius. Subsequently he was accused by Tiberius, when emperor, of endeavouring to stir up a revolution, and died in confinement at Rome (A.D. 17). Cappadocia was then made a Roman province. Archelaus was said to have been the author of a geographical work, and to have written treatises *On Stones* and *Rivers*.

Strabo xii. p. 540; Suetonius, *Tiberius*, 37, *Caligula*, 1; Dio Cassius xlix. 32-51; Tacitus, *Ann.* ii. 42.

ARCHELAUS, king of Judaea, was the son of Herod the Great. He received the kingdom of Judaea by the last will of his father, though a previous will had bequeathed it to his brother Antipas. He was proclaimed king by the army, but declined to assume the title until he had submitted his claims to Augustus at Rome. Before setting out, he quelled with the utmost cruelty a sedition of the Pharisees, slaying nearly 3000 of them. At Rome he was opposed by Antipas and by many of the Jews, who feared his cruelty; but Augustus allotted to him the greater part of the kingdom (Judaea, Samaria, Ituraea) with the title of ethnarch. He married Glaphyra, the widow of his brother Alexander, though his wife and her second husband, Juba, king of Mauretania, were alive. This violation of the Mosaic law and his continued cruelty roused the Jews, who complained to Augustus. Archelaus was deposed (A.D. 7) and banished to Vienne. The date of his death is unknown.

Archelaus is mentioned in Matt. ii. 22, and the parable of Luke xix. 11 f. probably refers to his journey to Rome.

See Schürer, *Gesch. des jüdischen Volkes*, i. 449-453.

(J. H. A. H.)

ARCHELAUS, king of Macedonia (413–399 B.C.), was the son of Perdiccas and a slave mother. He obtained the throne by murdering his uncle, his cousin and his half-brother, the legitimate heir, but proved a capable and beneficent ruler. He fortified cities, constructed roads and organized the army. He endeavoured to spread among his people the refinements of Greek civilization, and invited to his court, which he removed from Aegae to Pella, many celebrated men, amongst them Zeuxis, Timotheus, Euripides and Agathon. In 399 he was killed by one of his favourites while hunting; according to another account he was the victim of a conspiracy.

Diodorus Siculus xiii. 49, xiv. 37; Thucydides ii. 100. See Macedonia.

ARCHELAUS OF MILETUS, Greek philosopher of the 5th century B.C., was born probably at Athens, though Diogenes Laërtius (ii. 16) says at Miletus. He was a pupil of Anaxagoras, and is said by Ion of Chios (*ap.* Diog. Laërt. ii. 23) to have been the teacher of Socrates. Some argue that this is probably only an attempt to connect Socrates with the Ionian school; others (*e.g.* Gomperz, *Greek Thinkers*) uphold the story. There is similar difference of opinion as regards the statement that Archelaus formulated certain ethical doctrines. In general, he followed Anaxagoras, but in his cosmology he went back to the earlier Ionians. He postulated primitive Matter, identical with air and mingled with Mind, thus avoiding the dualism of Anaxagoras. Out of this conscious "air," by a process of thickening and thinning, arose cold and warmth, or water and fire, the one passive, the other active. The earth and the heavenly bodies are formed from mud, the product of fire and water, from which springs also man, at first in his lower forms. Man differs from animals by the possession of the moral and artistic faculty. No fragments of Archelaus remain; his doctrines have to be extracted from Diogenes Laërtius, Simplicius, Plutarch and Hippolytus.

See Ionian School; for his ethical theories see T. Gomperz, *Greek Thinkers* (Eng. trans., 1901), vol. i. p. 402.

ARCHENHOLZ, JOHANN WILHELM VON (1743–1812), German historian, was born at Langfuhr, a suburb of Danzig, on the 3rd of September 1743. From the Berlin Cadet school he passed into the Prussian army at the age of sixteen, and took part in the last campaigns of the Seven Years' War. Retiring from military service, on account of his wounds, with the rank of captain in 1763, he travelled for sixteen years and visited nearly all the countries of Europe, and resided in England for ten years (1769–1779). Returning to Germany in 1780, he obtained a lay canonry at the cathedral of Magdeburg, and immediately entered upon a literary career by publishing the periodical *Litteratur- und Völkerkunde* (Leipzig, 1782–1791). This was followed in 1785 by *England und Italien* (2nd ed., Leipzig, 1787), in which he gives a remarkably unprejudiced appreciation of English political and social institutions. Between 1789 and 1798 he published his *Annalen der britischen Geschichte* (20 vols). But the work by which he is best known to fame is his brilliantly written history of the Seven Years' War, *Geschichte des siebenjährigen Krieges* (first published in the *Berliner historisches Taschenbuch* of 1787, and later in 2 vols., Berlin, 1793; 13th ed., Leipzig, 1892). This work, though as regards the main facts and details it only follows other writers, is still a useful source of information upon the epoch with which it deals. In 1792 Archenholz removed to Hamburg, and there, from 1792 to 1812, edited the journal *Minerva*, which had a great reputation for its literary, historical and political information. Archenholz died at his country seat, Oyendorf, near Hamburg, on the 28th of February 1812.

ARCHER, WILLIAM (1856–   ), English critic, was born at Perth on the 23rd of September 1856, and was educated at Edinburgh University. He became a leader-writer on the *Edinburgh Evening News* in 1875, and after a year in Australia returned to Edinburgh. In 1879 he became dramatic critic of the *London Figaro*, and in 1884 of the *World*. In London he soon took a prominent literary place. Mr Archer had much to do with introducing Ibsen to the English public by his translation of *The Pillars of Society*, produced at the Gaiety Theatre, London, in 1880. He also translated, alone or in collaboration, other productions of the Scandinavian stage: Ibsen's *Doll's House* (1889), *Master Builder* (1893); Edvard Brandes's *A Visit* (1892); Ibsen's *Peer Gynt* (1892); *Little Eyolf* (1895); and *John Gabriel Borkman* (1897); and he edited *Henrik Ibsen's Prose Dramas* (5 vols., 1890–1891). Among his critical works are:—*English Dramatists of To-day* (1882); *Masks or Faces?* (1888); five vols. of critical notices reprinted, *The Theatrical World* (1893–1897); *America To-day, Observations and Reflections*; *Poets of the Younger Generation* (1901); *Real Conversations* (1904).

ARCHERMUS, a Chian sculptor of the middle of the 6th century B.C. His father Micciades, and his sons, Bupalus and Athenis, were all sculptors of marble, using doubtless the fine marble of their native land. The school excelled in draped female figures. Archermus is said by a scholiast (on Aristophanes' *Birds*, v. 573) to have been the first to represent Victory and Love with wings. This statement gives especial interest to a discovery made at Delos of a basis signed by Micciades and Archermus which was connected with a winged female figure in rapid motion (see Greek Art), a figure naturally at first regarded as the Victory of Archermus. Unfortunately further investigation has discredited the notion that the statue belongs to the basis, which seems rather to have supported a sphinx.

ARCHERY, the art and practice of shooting with the bow (*arcus*) and arrow, or with crossbow and bolts. Though these weapons are by no means widely used amongst savage tribes of the present day, their origin is lost in the mists of antiquity.

History in war.

Amongst the great peoples of ancient history the Egyptians were the first and the most famous of archers, relying on the bow as their principal weapon in war. Their bows were somewhat shorter than a man, and their arrows varied between 2 ft. and 2 ft. 8 in. in length. Here, as elsewhere, flint heads for arrows were by no means rare, but bronze was the usual material employed. The Biblical bow was of reed, wood or horn, and the Israelites used it freely both in war (Gen. xlviii. 22) and in the chase (xxi. 20). The Assyrians also were a nation of archers. Amongst the Greeks of the historic period archery was not much in evidence, in spite of the tradition of Teucer, Ulysses and many other archers of the *Iliad* and *Odyssey*. The Cretans, however, supplied Greek armies with the bowmen required. In the "Ten Thousand" figured two hundred Cretan bowmen of Sosias' corps. Rüstow and Köchly (*Geschichte des griechischen Kriegwesens*, p. 131) estimate the range of the Cretan bow at eighty to one hundred paces, as compared with the sling-bullet's forty or fifty, and the javelin's thirty to forty. The Romans as a nation were, equally with the Greeks, indifferent to archery; in their legions the archer element was furnished by Cretans and Asiatics. On the other hand nearly all Asiatic and derived nations were famous bowmen, from the nations who fought under Xerxes' banner onwards. The Persian, Scythian and Parthian bow was far more efficient than the Cretan, though the latter was not wanting in the heterogeneous armies of the East. The *sagittarii*, three thousand strong, who fought in the Pharsalian campaign, were drawn from Crete, Pontus, Syria, &c. But the Roman view of archery was radically altered when the old legionary system perished at Adrianople (A.D. 378). After this time the armies of the empire consisted in great part of horse-archers. Their missiles, we are told, pierced cuirass and shield with ease, and they shot equally well dismounted and at the gallop. These troops, combined with heavy cavalry and themselves not unprovided with armour, played a decisive part in the Roman victories of the age of Belisarius and Narses. The destruction of the Franks at Casilinum (A.D. 554) was practically the work of the horse-archers.

In the main, the nations whose migrations altered the face of Europe were not archers. Only with the Welsh, the Scandinavians, and the peoples in touch with the Eastern empire was the bow a favourite weapon. The edicts of Charlemagne could not succeed in making archery popular in his dominions, and Abbot Ebles, the defender of Paris in 886, is almost the only instance of a skilled archer in the European records of the time. The sagas, on the other hand, have much to say as to the feats of northern heroes with the bow. With English, French and Germans the bow was the weapon of the poorest military classes. The Norman archers, who doubtless preserved the traditions of their Danish ancestors, were in the forefront of William's line at Hastings (1066), but contemporary evidence points conclusively to the short bow, drawn to the chest, as the weapon used on this occasion. The combat of Bourgtheroulde in 1124 shows that the Normans still combined heavy cavalry and archers as at Hastings. Horse-archers too (contrary to the usual belief) were here employed by the English.

Yet the "Assize of Arms" of 1181 does not mention the bow, and Richard I. was at great pains to procure crossbowmen for the Crusades. The crossbow had from about the 10th century gradually become the principal missile weapon in Europe, in spite of the fact that it was condemned by the Lateran Council of 1139. As early as 1270 in France, and rather later in Spain, the master of the crossbowmen had become a great dignitary, and in Spain the weapon was used by a *corps d'élite* of men of gentle birth, who, with their gay apparel, were a picturesque feature of continental armies of the period. But the Genoese, Pisans and Venetians were the peoples which employed the crossbow most of all. Many thousand Genoese crossbowmen were present at Creçy.

It was in the Crusades that the crossbow made its reputation, opposing heavier weight and greater accuracy to the missiles of the horse-archers, who invariably constituted the greatest and most important part of the Asiatic armies. So little change in warfare had centuries brought about that a crusading force in 1104 perished at Carrhae, on the same ground and before the same mounted-archer tactics, as the army of Crassus in 55 B.C. But individually the crusading crossbowman was infinitely superior to the Turkish or Egyptian horse-archer.

English use.

England, which was to become the country of archers *par excellence*, long retained the old short bow of Hastings, and the far more efficient crossbow was only used as a rule by mercenaries, such as the celebrated Falkes de Breauté and his men in the reign of John. South Wales, it seems certain, eventually produced the famous long-bow. In Ireland, in Henry II.'s time, Strongbow made great use of Welsh bowmen, whom he mounted for purposes of guerrilla warfare, and eventually the prowess of Welsh archers taught Edward I. the value of the hitherto discredited arm. At Falkirk (*q.v.*), once for all, the long-bow proved its worth, and thenceforward for centuries it was the principal weapon of English soldiers. By 1339, archers had come to be half of the whole mass of footmen, and later the proportion was greatly increased. In 1360 Edward III. mounted his archers, as Strongbow had done. The long-bow was about 5 ft., and its shaft a cloth-yard long. Shot by a Welsh archer, a shaft had penetrated an oak door (at Abergavenny in 1182) 4 in. thick and the head stood out a hand's breadth on the inner side. Drawn to the right ear, the bow was naturally capable of long shooting, and in Henry VIII.'s time practice at a less range than one furlong was forbidden. In rapidity it was the equal of the short bow and the superior of the crossbow, which weapon, indeed, it surpassed in all respects. Falkirk, and still more Creçy, Poitiers and Agincourt, made the English archers the most celebrated infantry in Europe, and the kings of England, in whatever else they differed from each other, were, from Edward II. to Henry VIII., at one in the matter of archery. In 1363 Edward III. commanded the general practice of archery on Sundays and holidays, all other sports being forbidden. The provisions of this act were from time to time re-issued, particularly in the well-known act of Henry VIII. The price of bows and arrows was also regulated in the reign of Edward III., and Richard III. ordained that for every ton of certain goods imported ten yew-bows should be imported also, while at the same time long-bows of unusual size were admitted free of duty. In order to prevent the too rapid consumption of yew for bow-staves, bowyers were ordered to make four bows of wych-hazel, ash or elm to one of yew, and only the best and most useful men were allowed to possess yew-bows. Distant and exposed counties were provided for by making bowyers, fletchers, &c., liable (unless freemen of the city of London) to be ordered to any point where their services might be required. In Scotland and Ireland also, considerable attention was paid to archery. In 1478 archery was encouraged in Ireland by statute, and James I. and James IV. of Scotland, in particular, did their best to stimulate the interest of their subjects in the bow, whose powers they had felt in so many battles from Falkirk to Homildon Hill.

Decline as weapon.

The introduction of hand-firearms was naturally fatal to the bow as a warlike weapon, but the conservatism of the English, and the non-professional character of wars waged by them, added to the technical deficiencies of early firearms, made the process of change in England very gradual. The mercenary or professional element was naturally the first to adopt the new weapons. At Pont de l'Arche in 1418 the English had "*petits canons*" (which seem to have been hand guns), and during the latter part of the Hundred Years' War their use became more and more frequent. The crossbow soon disappeared from the more professional armies of the continent. Charles the Bold had, before the battle of Morat (1476), ten thousand *coulevrines à main*. But in the hands of local forces the crossbow lingered on, at least in rural France, until about 1630. Its last appearance in war was in the hands of the Chinese at Taku (1860). But the long-bow, an incomparably finer weapon, endured as one of the principal arms of the English soldier until about 1590. Edward IV. entered London after the battle of Barnet with 500 "smokie gunners" (foreign mercenaries), but at that engagement Warwick's centre consisted solely of bows and bills (1471). The new weapons gradually made their way, but even in 1588, the year of the Armada, the local forces of Devonshire comprised 800 bows to 1600 "shot," and 800 bills to 800 pikes. But the Armada year saw the last appearance of the English archer, and the same county in 1598 provides neither archers nor billmen, while in the professional army in Ireland these weapons had long given way to musket and caliver, pike and halberd. Archers appeared in civilized warfare as late as 1807, when fifteen hundred "baskiers," horse-archers, clad in chain armour, fought against Napoleon in Poland.

As a weapon of the chase the bow was in its various forms employed even more than in war. The rise of archery as a sport in England was, of course, a consequence of its military value, which caused it to be so heartily encouraged by all English sovereigns.

Japan.

The Japanese were from their earliest times great archers, and the bow was the weapon *par excellence* of their soldiers. The standard length of the bow (usually bamboo) was 7 ft. 6 in., of the arrow 3 ft. to 3 ft. 9 in. Numerous feats of archery are recorded to have taken place in the "thirty-three span" halls of Kioto and Tokyo, where the archer had to shoot the whole length of a very low corridor, 128 yds. long. Wada Daihachi in the 17th century shot 8133 arrows down the corridor in twenty-four consecutive hours, averaging five shots a minute, and in 1852 a modern archer made 5583 successful shots in twenty hours, or over four a minute.

History of sport.

The Pastime of Archery.—The use of the bow and arrow as a pastime naturally accompanied their use as weapons of war, but when the gun began to supersede the bow the pastime lost its popularity. Charles II., however, and his queen, Catherine of Braganza, interested themselves in English archery, the queen in 1676 presenting a silver badge or shield to the "Marshall of the Fraternity of Archers," which badge, once the property of the Finsbury Archers, was transferred to the keeping of the Royal Toxophilite Society, when in 1841 the two clubs combined. The Toxophilite Society was founded in 1781; for though in the north archery had long been practised, its resuscitation in the south really dates from the formation of this club by Sir Ashton Lever. This society received the title of "Royal" in 1847, though it had long been patronized by royalty. It is an error to suppose that the Finsbury Archers were connected with the Archers' division of the Hon. Artillery Company, but many members of the Toxophilite Society joined that division, and used its ground for shooting, securing, however, a London ground of their own in the district where Gower Street, W.C., now is. When this ground became unavailable, the shooting probably took place at Highbury, and later in 1820, on Lord's cricket ground, the present ground in the Inner Circle of Regent's Park, near the Botanical Gardens, not being acquired till 1833. The society may be regarded as the most important body connected with archery, most of the leading archers belonging to it, though the Grand National Archery Society controls the public meetings. Among its more important events is the shooting of 144 arrows at 100 yds. for the Crunder Cup and Bugle. In the early days of the club targets of different sizes were used at the different ranges, and the scores were recorded in money (*e.g.* "Mr Elwin, 86 hits, £5 : 5 : 6"). The Woodmen of Arden can claim an almost equal antiquity, having been founded—some say "revived"—in 1785. The number of members is limited to 80; at one time there were 81, Sir Robert Peel having been elected as a supernumerary by way of compliment. The headquarters of the Woodmen are at Meriden in Warwickshire; the club has a nominal authority over vert and venison, whence its officers bear appropriate names—warden, master-forester and verderers; and the annual meeting is called the Wardmote. The master-forester, or captain for the year, is the maker of the first "gold" at the annual target; he who makes the second is the senior verderer. The club devotes itself to the old-fashioned clout-shooting at long ranges, reckoned by "scores," nine score meaning 180 yds., and so on. (*Vide* "Clout-shooting" *infra.*) The chief matches in which the Woodmen engage are those against the Royal Company of Scottish Archers. The Royal British Bowmen date back to the end of the 18th century. Like many others, during the Napoleonic war they suspended operations, revived when peace was made. The club was finally dissolved in 1880. The Royal Kentish Bowmen were founded in 1785, but did not survive the war. John O'Gaunt's Bowmen, who still meet at Lancaster, were revived, not created, at the same time, and still flourish. The Herefordshire Bowmen only shoot at 60 yds., while the West Berks Society is limited to twelve members, who meet at each other's houses, except for their Autumn Handicap, shot on the Toxophilite Grounds—216 arrows at 100 yds. The Royal Company of Archers is the chief Scottish society. Originally a semi-military body constituted in 1676, it practised archery as a pastime from the time of its foundation, several meetings being held in the first few years of its existence. It devoted itself to "rovers," or long-range shooting at the "clout," among its most interesting trophies being the "Musselburgh Arrow," first shot for in 1603, possibly even earlier, in that town; the competition was then open to all comers, for archery was long popular in Scotland, especially at Kilwinning, the headquarters of popinjay (*q.v.*) shooting. Other prizes are the "Peebles Silver Arrow," dating back to 1626, the "Edinburgh Silver Arrow" (1709), the "Selkirk Arrow," a very ancient prize, the "Dalhousie Sword," the "Hopetoun Royal Commemoration Prize," and others, shot for at ranges of 180 or 200 yds. The most curious is the "Goose Medal." Originally a goose was buried in a butt with only its head visible, and this was the archers' mark; now a small glass globe is substituted. The "Popingo (Popinjay) Medal," for which a stuffed parrot was once used as the mark, is now contested at the ordinary butts. The Kilwinning Society of Archers, founded in 1688, did not disband till 1870; the Irvine Toxophilites flourished from 1814 till about 1867. But of all societies the Grand National Archery Society, regulating the great meetings, though comparatively young, is the most important. Various open meetings were already in existence, but in 1844 a few leading archers projected a Grand National Meeting, which was held in York in that year and in 1845 and 1846, and subsequently in other places. But the society did not exist as such till 1861, after the meeting held at Liverpool, since when, notwithstanding some financial troubles, it has been the legislative and managing body of English archery. The chief meetings are the "Championship," the "Leamington and Midland Counties," the "Crystal Palace," the "Grand Western" and the "Grand Northern." For some years a "Scottish Grand National" was held, but fell into abeyance. The "Scorton Arrow" is no longer shot for in the Yorkshire village of that name, but the meeting, held regularly in the county, dates back to 1673 by record, and is probably far older. The silver arrow and the captaincy are awarded to the man who makes the first gold; the silver bugle and lieutenancy to the first red; the gold medal to most hits, and a horn spoon to the last white.

In the United States archery has had a limited popularity. The only one of the early clubs that lasted long was the "United Bowmen of Philadelphia," founded in 1828, but defunct in 1859. There was a revival twenty years later, when a National Association was formed; and various meetings were held annually and championships instituted, but there was never any popular enthusiasm for the sport, though it showed signs of increasing favour towards the end of the 19th century. The longer ranges are not greatly favoured by American archers, though at some meetings the regulation "York Round" (*vide infra* under "Targets") and the "National" are shot. Other rounds are the "Potomac," 24 arrows at 80, 24 at 70, and 24 at 60 yds.; the "Double American," 60 arrows each at 60, 50 and 40 yds.; and the "Double Columbia," for ladies, 48 each at 50, 40 and 30 yds. In team matches ladies shoot 96 arrows at 50 yds., gentlemen 96 at 60.

The Bow.—As used in the pastime of archery the length of the bows does not vary much, though it bears some relation to the length of the arrow and the length of the arrow to the strength of the archer, to which the weight of the bow has to be adapted. The proper weight of a bow is the number of ℔ which, attached to the string, will draw a full-length arrow to its head. For men's bows the drawing-power varies from 40 to 60 ℔, anything above this being extreme; ladies' bows draw from 24 to 32 ℔. Estimating 50 ℔ as a fair average, such a bow would be 6 ft. 1 in. long for a 30-in., 6 ft. for a 28-in., and 5 ft. 11 in. for a 27-in. arrow, but the height as well as the strength of the archer have to be considered. Similarly a lady's bow on the average measures about 5 ft. 6 in. and her arrows 25 in. Modern bows are either made entirely of yew (occasionally of other woods), when they are called "self-bows," or of a combination of woods, when they are called "backed-bows." Self-bows are rarely or never made in a single stave, owing to the difficulty of obtaining true and flawless wood of the necessary length; hence two staves joined by a double fish-joint, which forms the centre of the bow, are used, tested and adjusted so that they may be as equally elastic as possible. The best yew is imported from Italy and Spain, and is allowed to season for three years before it is made into a bow, which again is not used till it is two years older. In backed-bows the belly, the rounded part nearest to the string, is generally but not necessarily made of yew, the back, or flat part, of yew (the best), hickory, lance or other woods, glued together in strips. The centre of the bow, for about 18 in., should be stiff and resisting, then tapering off gradually to the horns in which the string is fitted, the greatest care being taken that the two limbs are uniform. The bow of self-yew is generally considered more agreeable to handle and has a better "cast," throwing the arrow more smoothly and with less jar, and since no glued parts are exposed, it is less liable to injury from wet. On the other hand, "crysals" (tiny cracks, which are apt to extend) are more frequent in this class of bow. Self-yew bows cost £8 or £10, where a good backed-bow can be bought for about half that. The self-bow is more sensitive than other bows, and its work is mostly done during the last few inches of the pull, where the backed-bow pulls evenly throughout. The backed-bow should be perfectly straight in the back, but after use often loses its shape either by "following the string," *i.e.* getting bent inwards on the string-side, or by becoming "reflex" (bending the opposite way). Self-bows are even more apt to lose their shape than backed-bows, as there is no hard wood to counteract the natural grain. A bow that is strongly reflexed at the ends is known as a "Cupid's bow." To form the handle the wood of the bow is left thick in the centre, and braid, leather or indiarubber is wound round it to give a better grip.

The String and Stringing.—The string is made of three strands of hemp, dressed with a preparation of glue, and should be perfectly round, smooth and not frayed, as a broken string may result in a broken bow. The string, at its centre, is 6 in. from the belly of the man's bow; 5 in. in the lady's bow. The clenched fist with the thumb upright was the old, rough and ready estimate, known as "fist-mele." For a few inches above and below the nocking point the string is lapped with carpet-thread to save it from fraying by contact with the arm; the nocking point being made by another lapping of filoselle silk, so that the string may exactly fit the nock of the arrow. When a bow is properly strung the string should be longitudinally along the middle of the belly.

Arrows and Nocking.—The parts of the arrow are the shaft, the "nock" or notch, the "pile" or point, and the feathers. The shaft is made of seasoned red deal, and may be "self" or "footed." Most arrows are "footed," *i.e.* a piece of hard wood to which the pile is attached is spliced to the deal shaft, which should be perfectly straight and stiff. The shaft is made in several shapes. Most archers prefer the "parallel" pattern—the shaft being the same size from nock to pile; the next is the "barrelled," the shape being thick in the centre and tapering towards the ends. The "bob-tail" diminishes from the pile to the nock; the "chested" tapers from the middle to the pile. The pile should not be taper but cylindrical, "broadshouldered" where the point begins. The nock is cut square. There are three feathers, the body feathers of a turkey or peacock being the best. They should all curve the same way, are about 1½ in. long and ½ in. deep, with the ends near the nock either square, or balloon-shaped. The weight of an arrow is its weight in new English silver; a five-shilling arrow is heavy for a man's bow, while four-shillings is light. A 28-in. arrow for a 50-℔ bow may weigh four-and-ninepence; a 27-in. arrow four-and-sixpence. This may serve as a rough standard.

Other Implements.—The archer uses finger-tips, or a "tab" of leather, to protect the fingers against the string, and a leather "bracer" to protect the left arm from its blow. Quivers are not now used except by ladies. A special box for carrying bows and arrows about; a proper cupboard, known as an "ascham," in which they may be kept at home in a dry, even temperature, not too hot; and a baize or leather case for use on the ground, are important minor articles of equipment.

Targets, Scoring and Handicapping.—The targets, 4 ft. in diameter, are made of straw 3 to 4 in. thick, and are supported sloping slightly backwards by an iron stand. The faces are of floor-cloth painted with concentric rings, 4⅘ in. each in breadth. The outer ring, white, counts one point; the next, black, three; the next, blue, five; the next, red, seven; and the next, gold—a complete circle of 4⅘ in. radius—nine. The exact centre of the gold is called the "pin-hole." The targets are set up in pairs, facing each other, the distances for men being 100, 80 and 60 yds.; for ladies, 60 and 50; for convenience, 5 yds. are added to allow for a shooting-line that distance in front of each target. The centre of the gold should be 4 ft. from the ground. Each archer shoots three arrows—an "end"—at one target; they then cross over and mark the scores. If an arrow cuts two rings, the archer is credited with the value of the higher one. In matches a "York Round" or a "St George's Round" is usually shot by men, the former consisting of 144 arrows, 72 at 100 yds., 48 at 80 yds., and 24 at 60 yds., the latter of 36 arrows at each of these distances. One York Round only is shot on a day; a double York Round is shot, one on each day, at the more important meetings. Ladies usually shoot the "National Round" of 48 arrows at 60 yds. and 24 at 50 yds. At most meetings the prizes are awarded on the gross scores; at others, including the Championship meeting, on points, two points for the highest score on the round and two for most hits on the round, one point each for highest score and most hits at each of the three ranges, ten points in all. Ladies' scores are calculated similarly. To decide the Championship, the Grand National Archery Society passed a rule in 1894 that "The Champion prizes shall be awarded to the archer gaining the greatest number of points, provided that those for gross hits or gross score are included; any points won by other archers shall be redistributed among those gaining the points for gross hits or gross score." Handicapping may be done by "rings," the winner of a first prize not being allowed to count "whites" at subsequent meetings, and "blacks" and "blues" being lost for further successes. Better methods are (1) to deduct a percentage from the gross score of successful shooters, (2) to handicap by points, as in other pastimes, or (3) to rate a shooter according to the average of his last year's performances, re-rating him monthly, or at convenient intervals, the system being to add his average of the current year to his average of last year, and divide the sum by two to form his new rating.

Clout and Long Distance Shooting.—This form of archery is chiefly supported by the Woodmen of Arden and the Royal Company. At 100 yds., the target (smaller by 4 in. than the usual one, but with an inner white circle instead of the blue) is set up against a butt only 18 in. from the ground, but for nine-score, ten-score, and twelve-score shooting it is a white target, 2 ft. 6 in. in diameter, with a black centre. The target, the centre and the arrow that hits the centre are each known as a "clout." Hits and misses are signalled by a marker stationed, rather perilously, by the side of the butt. The target is sloped backwards to an angle of 60°, with rings marked round it on the ground at distances of 1½ ft., 3 ft., 6 ft. and 9 ft., a hit in the outer ring counting one, and in the next two, and so on, the clout or centre counting six. For the longer ranges lighter arrows are used. The Scottish clout was a piece of canvas, stretched on a frame; the range 180 or 200 yds.; all arrows counted one that were within 24 ft. of the target, the clout counting two. Modern archers have paid scant attention to mere distance-shooting, which is an art of its own, but their experiments prove that with a fairly heavy bow, say 60 ℔ or 63 ℔, and a long light arrow, known as a "flight arrow," a good archer should be able to reach 300 or 310 yds. With a heavier bow, properly under control, 50 or 60 yds. might be added to this by a strong man. These experiments seem to be verified by a quotation from Shakespeare (*Henry IV.* Act iii. Sc. 2): "A' would have clapped i' the clout and twelve score, and carried you a forehand shaft a fourteen and fourteen and a half," *i.e.* 280 or 290 yds. Instances are recorded of Englishmen shooting 340 and 360 yds., but in 1795 Mahmoud Effendi of the Turkish embassy shot 482 yds. with a Turkish bow, and Sultan Selim 972. The Turk, however, used a Turkish bow and a 14-in. arrow, with a grooved rest on his left arm along which the arrow passed, to compensate for the difference between the draw of the bow and the shortness of the arrow. The diplomatist's shot is supported by good evidence, but the sultan's is regarded as improbable at least.

Championship and Scores.—The British championship meetings, instituted in 1844, are conducted under the laws of the Grand National Archery Society: the prizes, apart from the Challenge prizes, are given in money, there being also a rule that any one who makes three golds at one end receives a shilling from all others of the same sex who are shooting. The most notable champion was Horace A. Ford (d. 1880), who held the title for eleven consecutive years, 1849 to 1859 inclusive, and again in 1867. He made a four-figure score at four other championship meetings, his highest, 1251 (in 1857) for 245 hits being unapproached. To him the modern scientific practice of archery must largely be attributed, together with its improvement and its popularity. The names of G. Edwards, Major C. Hawkins Fisher, H. H. Palairet, C. E. Nesham, and G. E. S. Fryer, are also notable as champions. Among ladies Mrs Horniblow was champion for eleven years between 1852 and 1881, Miss Legh for nineteen years between 1880 and 1908; Mrs Piers Legh, Miss Betham and Mrs Bowly claim the title on four occasions. Mrs Bowly's score of 823 (1894) was the highest made for the championship till Miss Legh made 825 with 143 hits—only one arrow missed altogether—in 1898; beating her own record with a score of 841 (143 hits) in 1904. It should not be forgotten that as the championship is awarded by points, the highest score does not necessarily win.

See Roger Ascham, *Toxophilus* (1545), edited by Edward Arber (London, 1868); *The Arte of Warre*, by William Garrard (London 1591); *The Arte of Archerie*, by Gervase Markham (London, 1634); *Ancient and Modern Methods of Arrow Release*, by E. S. Morse (1885); *The English Bowman*, by T. Roberts (London, 1801); *A Treatise on Archery*, by Thomas Waring (London, 9th ed., 1832); *The Theory and Practice of Archery*, by Horace A. Ford (new ed., London, 1887); *Archery*, by C. J. Longman and H. Walrond (Badminton Library, London, 1894). (W. J. F.)

ARCHES, COURT OF, the English ecclesiastical court of appeal of the archbishop of Canterbury, as metropolitan of the province of Canterbury, from all the consistory and commissary courts in the province. It derives its name from its ancient place of judicature, which was in the church of *Beata Maria de Arcubus*—St Mary-le-Bow or St Mary of the Arches, "by reason of the steeple thereof raised at the top with stone pillars in fashion like a bow bent archwise." This parish was the chief of thirteen locally situated within the diocese of London but exempt from the bishop's jurisdiction, and it was no doubt owing to this circumstance that it was selected originally as the place of judicature for the archbishop's court. The proper designation of the judge is official principal of the Arches court, but by custom he came to be styled the dean of the Arches, a title belonging formerly to the chief official of the subordinate court. Originally, the official principal exercised metropolitan jurisdiction, while the dean of the Arches exercised the "peculiar" jurisdiction. The jurisdictions called "peculiars" at one time numbered nearly 300 in England. They were originally introduced by the pope for the purpose of curtailing the bishop's legitimate authority within his diocese; "an object which," says Phillimore, "they certainly attained, to the great confusion of ecclesiastical jurisdiction for many years." The dean of the Arches originally had jurisdiction over the thirteen London parishes above mentioned, but as the official principal was often absent as ambassador on the continent, he became his substitute, and gradually the two offices were blended together. The original office of the dean of the Arches may now be regarded as extinct, though the title is still popularly used, for no dean of the Arches has been appointed *eo nomine* for several centuries, and by an act of 1838 bishops have jurisdiction over all peculiars within their diocese. The judge of the Arches court was until 1874 appointed by the archbishop of Canterbury by patent which, when confirmed by the dean and chapter of Canterbury, conferred the office for the life of the holder. He took the oaths of office required by the 127th canon. But by the Public Worship Regulation Act 1874 the two archbishops were empowered, subject to the approval of the sovereign by sign-manual, from time to time to appoint a practising barrister of ten years' standing, or a person who had been a judge of one of the superior courts (being a member of the Church of England) to be, during good behaviour, a judge for the purpose of exercising jurisdiction under that act, and it was enacted (sec. 7) that on a vacancy occurring in the office of official principal of the Arches court the judge should become *ex officio* such official principal. In this way the late Lord Penzance became dean on the retirement of Sir Robert Phillimore in 1875. Lord Penzance received in 1878 a supplemental patent as dean from Archbishop Tait, but did not otherwise fulfil the conditions observed on the appointment of his predecessors. On Lord Penzance's retirement in 1899, his successor, Sir Arthur Charles, received a patent from the archbishop of Canterbury as official principal of the Arches court, and he took the oaths of office according to the practice before the Public Worship Regulation Act. He was subsequently and separately appointed judge under that act. Sir A. Charles resigned in 1903 and was succeeded by Sir L. T. Dibdin, who qualified in the same way as his immediate predecessor. The official principal of the Arches court is the only ecclesiastical judge who is empowered to pass a sentence of deprivation against a clerk in holy orders. The appeals from the decisions of the Arches court were formerly made to the king in chancery, but they are now by statute addressed to the king in council, and they are heard before the judicial committee of the privy council. By an act of Henry VIII. (Ecclesiastical Jurisdiction Act 1532) the Arches court is empowered to hear, in the first instance, such suits as are sent up to it by letters of request from the consistorial courts of the bishops of the province of Canterbury, and by the Church Discipline Act 1840, this jurisdiction is continued to it, and it is further empowered to accept letters of request from the bishops of the province of Canterbury after they have issued commissions of inquiry under that statute, and the commissioners have made their report.

The Arches court was also the court of appeal from the consistory courts of the bishops of the province in all testamentary and matrimonial causes. The matrimonial jurisdiction was transferred to the crown by the Matrimonial Causes Act 1857. Under the Clergy Discipline Act 1892 an appeal lies from the judgment of a consistory court under that act, in respect of fact by leave of the appellate court, and in respect of law without leave, to either the Arches court or the judicial committee of the privy council at the option of the appellant. Under the Benefices Act 1898 the official principal of the archbishop is required to institute a presentee to a benefice if the tribunal constituted under that act decides that there is no valid ground for refusing institution and the bishop of the diocese notwithstanding fails to institute him. After the College of Advocates was incorporated and had established itself in Doctors' Commons, the archbishop's court of appeal, as well as his prerogative court, were usually held in the hall of the College of Advocates, but after the destruction of the buildings of the college, the court of appeal held its sittings, for the most part, in Westminster Hall. For many years past there has been but little business in the Arches court, mainly owing to the unwillingness of a large number of the clergy to recognize the jurisdiction of what they deny to be any longer a spiritual court, and the consistent use by the bishops of their right of veto in the case of prosecutions under the Public Worship Regulation Act. On the rare occasions when a sitting of the court is necessary, it is held in the library of Lambeth Palace, or at the Church House, Westminster.

ARCHESTRATUS, of Syracuse or Gela, a Greek poet, who flourished about 330 B.C. After travelling extensively in search of foreign delicacies for the table, he embodied the result in a humorous poem called Ἡδυπάθεια, afterwards freely translated by Ennius under the title *Heduphagetica*. About 300 lines of this gastronomical poem are preserved in Athenaeus. The writer, who has been styled the Hesiod or Theognis of gluttons, parodies the style of the old gnomic poets; chief attention is paid to details concerning fish.

Ribbeck, *Archestrati Reliquiae* (1877); Brandt, *Corpusculum Poesis Epicae Graecae ludibundae*, i. 1888; Schmid, *De Archestrati Gelensis Fragmentis* (1896).

ARCHIAC, ÉTIENNE JULES ADOLPHE DESMIER DE SAINT SIMON, VICOMTE D' (1802–1868), French geologist and palaeontologist, was born at Reims on the 24th of September 1802. He was educated in the Military School of St Cyr, and served for nine years as a cavalry officer until 1830, when he retired from the service. Prior to this he had published an historical romance; but now geology came to occupy his chief attention. In his earlier scientific works, which date from 1835, he described the Tertiary and Cretaceous formations of France, Belgium and England, and dealt especially with the distribution of fossils geographically and in sequence. Later on he investigated the Carboniferous, Devonian and Silurian formations. His great work, *Histoire des progrès de la géologie, 1834–1859*, was published in 8 volumes at Paris (1847–1860). In 1853 the Wollaston Medal of the Geological Society was awarded to him. In the same year, with Jules Haime (1824–1856), he published a monograph on the Nummulitic formation of India. In 1857 he was elected a member of the Academy of Sciences, and in 1861 he was appointed professor of palaeontology in the Muséum d'Histoire Naturelle in Paris. Of later works his *Paléontologie stratigraphique*, in 3 vols. (1864–1865); his *Géologie et paléontologie* (1866); and his palaeontological contributions to de Tchihatcheff's *Asie mineure* (1866), may be specially mentioned. He died on the 24th of December 1868.

See *Notice sur les travaux scientifiques du vicomte d'Archiac*, par A. Gaudry (Meulan, 1874); *Extrait du Bull. Soc. Géol. de France*, ser. 3, t. ii. p. 230 (1874).

ARCHIAS, AULUS LICINIUS, Greek poet, was born at Antioch in Syria 120 B.C. In 102, his reputation having been already established, especially as an improvisatore, he came to Rome, where he was well received amongst the highest and most influential families. His chief patron was Lucullus, whose gentile name he assumed. In 93 he visited Sicily with his patron, on which occasion he received the citizenship of Heracleia, one of the federate towns, and indirectly, by the provisions of the lex Plautia Papiria, that of Rome. In 61 he was accused by a certain Gratius of having assumed the citizenship illegally; and Cicero successfully defended him in his speech *Pro Archia*. This speech, which furnishes nearly all the information concerning Archias, states that he had celebrated the deeds of Marius and Lucullus in the Cimbrian and Mithradatic wars, and that he was engaged upon a poem of which the events of Cicero's consulship formed the subject. The Greek Anthology contains thirty-five epigrams under the name of Archias, but it is doubtful how many of these (if any) are the work of the poet of Antioch.

Cicero, *Pro Archia*; T. Reinach, *De Archia Poeta* (1890).

ARCHIDAMUS, the name of five kings of Sparta, of the Eurypontid house.

1. The son and successor of Anaxidamus. His reign, which began soon after the close of the second Messenian War, is said to have been quiet and uneventful (Pausanias iii. 7. 6).

2. The son of Zeuxidamus, reigned 476–427 B.C. (but see LEOTYCHIDES). He succeeded his grandfather Leotychides upon the banishment of the latter, his father having already died. His coolness and presence of mind are said to have saved the Spartan state from destruction on the occasion of the great earthquake of 464 (Diodorus xi. 63; Plutarch, *Cimon*, 16), but this story must be regarded as at least doubtful. He was a friend of Pericles and a man of prudence and moderation. During the negotiations which preceded the Peloponnesian War he did his best to prevent, or at least to postpone, the inevitable struggle, but was overruled by the war party. He invaded Attica at the head of the Peloponnesian forces in the summers of 431, 430 and 428, and in 429 conducted operations against Plataea. He died probably in 427, certainly before the summer of 426, when we find his son Agis on the throne.

Herod. vi. 71; Thuc. i. 79–iii. 1; Plut. *Pericles*, 29. 33; Diodorus xi. 48–xii. 52.

3. The son and successor of Agesilaus II., reigned 360–338 B.C. During his father's later years he proved himself a brave and capable officer. In 371 he led the relief force which was sent to aid the survivors of the battle of Leuctra. Four years later he captured Caryae, ravaged the territory of the Parrhasii and defeated the Arcadians, Argives and Messenians in the "tearless battle," so called because the victory did not cost the Spartans a single life. In 364, however, he sustained a severe reverse in attempting to relieve a besieged Spartan garrison at Cromnus in south-western Arcadia. He showed great heroism in the defence of Sparta against Epaminondas immediately before the battle of Mantineia (362). He supported the Phocians during the Sacred War (355–346), moved, no doubt, largely by the hatred of Thebes which he had inherited from his father: he also led the Spartan forces in the conflicts with the Thebans and their allies which arose out of the Spartan attempt to break up the city of Megalopolis. Finally he was sent with a mercenary army to Italy to protect the Tarentines against the attacks of Lucanians or Messapians: he fell together with the greater part of his force at Mandonion[1] on the same day as that on which the battle of Chaeronea was fought.

Xen. *Hell.* v. 4, vi. 4, vii. 1. 4, 5; Plut. *Agis*, 3, *Camillus*, 19, *Agesilaus*, 25, 33, 34, 40; Pausanias iii. 10, vi. 4; Diodorus xv. 54, 72, xvi. 24, 39, 59, 62, 88.

4. The son of Eudamidas I., grandson of Archidamus III. The dates of his accession and death are unknown. In 294 B.C. he was defeated at Mantineia by Demetrius Poliorcetes, who invaded Laconia, gained a second victory close to Sparta, and was on the point of taking the city itself when he was called away by the news of the successes of Lysimachus and Ptolemy in Asia Minor and Cyprus.

Plut. *Agis*, 3, *Demetrius*, 35; Pausanias, i. 13. 6, vii. 8. 5; Niese, *Gesch. der griech. u. makedon. Staaten*, i. 363.

5. The son of Eudamidas II., grandson of Archidamus IV., brother of Agis IV. On his brother's murder he fled to Messenia (241 B.C.). In 227 he was recalled by Cleomenes III., who was then reigning without a colleague, but shortly after his return he was assassinated. Polybius accuses Cleomenes of the murder, but Plutarch is probably right in saying that it was the work of those who had caused the death of Agis, and feared his brother's vengeance.

Plutarch, *Cleomenes*, i. 5; Polybius v. 37, viii. 1; Niese, *op. cit.* ii. 304, 311. (M. N. T.)

ARCHIL (a corruption of "orchil," Ital. *oricello*, the origin of which is unknown), a purple dye obtained from various species of lichens. Archil can be extracted from many species of the genera *Roccella*, *Lecanora*, *Umbilicaria*, *Parmelia* and others, but in practice two species of *Roccella*—*R. tinctoria* and *R. fuciformis*— are almost exclusively used. These, under the name of "orchella weed" or "dyer's moss," are obtained from Angola, on the west coast of Africa, where the most valuable kinds are gathered; from Cape Verde Islands; from Lima, on the west coast of South America; and from the Malabar coast of India. The colouring properties of the lichens do not exist in them ready formed, but are developed by the treatment to which they are subjected. A small proportion of a colourless, crystalline principle, termed orcinol (a dioxytoluene), is found in some, and in all a series of acid substances, erythric, lecanoric acids, &c. Orcinol in presence of oxygen and ammonia takes up nitrogen and becomes changed into a purple substance, orceine ($C_7H_7NO_3$), which is essentially the basis of all lichen dyes. Two other colouring-matters, azoerythin and erythroleinic acid, are sometimes present. Archil is prepared for the dyer's use in the form of a "liquor" (archil) and a "paste" (persis), and the latter, when dried and finely powdered, forms the "cudbear" of commerce, a dye formerly manufactured in Scotland from a native lichen, *Lecanora tartarea*. The manufacturing process consists in washing the weeds, which are then ground up with water to a thick paste. If archil paste is to be made this paste is mixed with a strong ammoniacal solution, and agitated in an iron cylinder heated by steam to about 140° F. till the desired shade is developed—a process which occupies several days. In the preparation of archil liquor the principles which yield the dye are separated from the ligneous tissue of the lichens, agitated with a hot ammoniacal solution, and exposed to the action of air. When potassium or sodium carbonate is added, a blue dye known as litmus, much used as an "indicator," is produced. French purple or lime lake is a lichen dye prepared by a modification of the archil process, and is a more brilliant and durable colour than the other. The dyeing of worsted and home-spun cloth with lichen dyes was formerly a very common domestic employment in Scotland; and to this day, in some of the outer islands, worsted continues to be dyed with "crottle," the name given to the lichens employed.

ARCHILOCHUS, Greek lyric poet and writer of lampoons, was born at Paros, one of the Cyclades islands. The date of his birth is uncertain, but he probably flourished about 650 B.C.; according to some, about forty years earlier but certainly not before the reign of Gyges (687–652), whom he mentions in a well-known fragment. His father, Telesicles, who was of noble family, had conducted a colony to Thasos, in obedience to the command of the Delphic oracle. To this island Archilochus himself, hard pressed by poverty, afterwards removed. Another reason for leaving his native place was personal disappointment and indignation at the treatment he had received from Lycambes, a citizen of Paros, who had promised him his daughter Neobule in marriage, but had afterwards withdrawn his consent. Archilochus, taking advantage of the licence allowed at the feasts of Demeter, poured out his wounded feelings in unmerciful satire. He accused Lycambes of perjury, and his daughters of leading the most abandoned lives. Such was the effect produced by his verses, that Lycambes and his daughters are said to have hanged themselves. At Thasos the poet passed some unhappy years; his hopes of wealth were disappointed; according to him, Thasos was the meeting-place of the calamities of all Hellas. The inhabitants were frequently involved in quarrels with their neighbours, and in a war against the Saians—a Thracian tribe—he threw away his shield and fled from the field of battle. He does not seem to have felt the disgrace very keenly, for, like Alcaeus and Horace, he commemorates the event in a fragment in which he congratulates himself on having saved his life, and says he can easily procure another shield. After leaving Thasos, he is said to have visited Sparta, but to have been at once banished from that city on account of his cowardice and the licentious character of his works (Valerius Maximus vi. 3, *externa* 1). He next visited Siris, in lower Italy, a city of which he speaks very favourably. He then returned to his native place, and was slain in a battle against the Naxians by one Calondas or Corax, who was cursed by the oracle for having slain a servant of the Muses.

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[1] So Plut. *Agis*, 3 (all MSS.). Following Cellarius, some authorities read Manduria or Mandyrium.

The writings of Archilochus consisted of elegies, hymns—one of which used to be sung by the victors in the Olympic games (Pindar, *Olympia*, ix. 1)—and of poems in the iambic and trochaic measures. To him certainly we owe the invention of iambic poetry and its application to the purposes of satire. The only previous measures in Greek poetry had been the epic hexameter, and its offshoot the elegiac metre; but the slow measured structure of hexameter verse was utterly unsuited to express the quick, light motions of satire. Archilochus made use of the iambus and the trochee, and organized them into the two forms of metre known as the iambic trimeter and the trochaic tetrameter. The trochaic metre he generally used for subjects of a serious nature; the iambic for satires. He was also the first to make use of the arrangement of verses called the epode. Horace in his metres to a great extent follows Archilochus (*Epistles*, i. 19. 23-35). All ancient authorities unite in praising the poems of Archilochus, in terms which appear exaggerated (Longinus xiii. 3; Dio Chrysostom, *Orationes*, xxxiii.; Quintilian x. i. 60; Cicero, *Orator*, i.). His verses seem certainly to have possessed strength, flexibility, nervous vigour, and, beyond everything else, impetuous vehemence and energy. Horace (*Ars Poetica*, 79) speaks of the "rage" of Archilochus, and Hadrian calls his verses "raging iambics." By his countrymen he was reverenced as the equal of Homer, and statues of these two poets were dedicated on the same day.

His poems were written in the old Ionic dialect. Fragments in Bergk, *Poetae Lyrici Graeci*; Liebel, *Archilochi Reliquiae* (1818); A. Hauvette-Besnault, *Archiloque, sa vie et ses poésies* (1905).

ARCHIMANDRITE (from Gr. *ἄρχων*, a ruler, and *μάνδρα*, a fold or monastery), a title in the Greek Church applied to a superior abbot, who has the supervision of several abbots and monasteries, or to the abbot of some specially great and important monastery, the title for an ordinary abbot being hegumenos. The title occurs for the first time in a letter to Epiphanius, prefixed to his *Panarium* (c. 375), but the *Lausiac History* of Palladius may be evidence that it was in common use in the 4th century as applied to Pachomius (*q.v.*). In Russia the bishops are commonly selected from the archimandrites. The word occurs in the *Regula Columbani* (c. 7), and du Cange gives a few other cases of its use in Latin documents, but it never came into vogue in the West. Owing to intercourse with Greek and Slavonic Christianity, the title is sometimes to be met with in southern Italy and Sicily, and in Hungary and Poland.

See the article in the *Dictionnaire d'archéologie chrétienne et de liturgie*.

ARCHIMEDES (*c.* 287–212 B.C.), Greek mathematician and inventor, was born at Syracuse, in Sicily. He was the son of Pheidias, an astronomer, and was on intimate terms with, if not related to, Hiero, king of Syracuse, and Gelo his son. He studied at Alexandria and doubtless met there Conon of Samos, whom he admired as a mathematician and cherished as a friend, and to whom he was in the habit of communicating his discoveries before publication. On his return to his native city he devoted himself to mathematical research. He himself set no value on the ingenious mechanical contrivances which made him famous, regarding them as beneath the dignity of pure science and even declining to leave any written record of them except in the case of the *σφαιροποιΐα* (*Sphere-making*), as to which see below. As, however, these machines impressed the popular imagination, they naturally figure largely in the traditions about him. Thus he devised for Hiero engines of war which almost terrified the Romans, and which protracted the siege of Syracuse for three years. There is a story that he constructed a burning mirror which set the Roman ships on fire when they were within a bowshot of the wall. This has been discredited because it is not mentioned by Polybius, Livy or Plutarch; but it is probable that Archimedes had constructed some such burning instrument, though the connexion of it with the destruction of the Roman fleet is more than doubtful. More important, as being doubtless connected with the discovery of the principle in hydrostatics which bears his name and the foundation by him of that whole science, is the story of Hiero's reference to him of the question whether a crown made for him and purporting to be of gold, did not actually contain a proportion of silver. According to one story, Archimedes was puzzled till one day, as he was stepping into a bath and observed the water running over, it occurred to him that the excess of bulk occasioned by the introduction of alloy could be measured by putting the crown and an equal weight of gold separately into a vessel filled with water, and observing the difference of overflow. He was so overjoyed when this happy thought struck him that he ran home without his clothes, shouting *εὕρηκα, εὕρηκα*, "I have found it, I have found it." Similarly his pioneer work in mechanics is illustrated by the story of his having said *δός μοι ποῦ στῶ καὶ κινῶ τὴν γῆν* (or as another version has it, in his dialect, *πᾶ βῶ καὶ κινῶ τὰν γᾶν*), "Give me a place to stand and I (will) move the earth." Hiero asked him to give an illustration of his contention that a very great weight could be moved by a very small force. He is said to have fixed on a large and fully laden ship and to have used a mechanical device by which Hiero was enabled to move it by himself: but accounts differ as to the particular mechanical powers employed. The water-screw which he invented (see below) was probably devised in Egypt for the purpose of irrigating fields.

Archimedes died at the capture of Syracuse by Marcellus, 212 B.C. In the general massacre which followed the fall of the city, Archimedes, while engaged in drawing a mathematical figure on the sand, was run through the body by a Roman soldier. No blame attaches to the Roman general, Marcellus, since he had given orders to his men to spare the house and person of the sage; and in the midst of his triumph he lamented the death of so illustrious a person, directed an honourable burial to be given him, and befriended his surviving relatives. In accordance with the expressed desire of the philosopher, his tomb was marked by the figure of a sphere inscribed in a cylinder, the discovery of the relation between the volumes of a sphere and its circumscribing cylinder being regarded by him as his most valuable achievement. When Cicero was quaestor in Sicily (75 B.C.), he found the tomb of Archimedes, near the Agrigentine gate, overgrown with thorns and briers. "Thus," says Cicero (*Tusc. Disp.* v. c. 23, § 64), "would this most famous and once most learned city of Greece have remained a stranger to the tomb of one of its most ingenious citizens, had it not been discovered by a man of Arpinum."

Works.—The range and importance of the scientific labours of Archimedes will be best understood from a brief account of those writings which have come down to us; and it need only be added that his greatest work was in geometry, where he so extended the method of *exhaustion* as originated by Eudoxus, and followed by Euclid, that it became in his hands, though purely geometrical in form, actually equivalent in several cases to *integration*, as expounded in the first chapters of our text-books on the integral calculus. This remark applies to the finding of the area of a parabolic segment (mechanical solution) and of a spiral, the surface and volume of a sphere and of a segment thereof, and the volume of any segments of the solids of revolution of the second degree.

The extant treatises are as follows:—

(1) *On the Sphere and Cylinder* (*Περὶ σφαίρας καὶ κυλίνδρου*). This treatise is in two books, dedicated to Dositheus, and deals

with the dimensions of spheres, cones, "solid rhombi" and cylinders, all demonstrated in a strictly geometrical method. The first book contains forty-four propositions, and those in which the most important results are finally obtained are: 13 (surface of right cylinder), 14, 15 (surface of right cone), 33 (surface of sphere), 34 (volume of sphere and its relation to that of circumscribing cylinder), 42, 43 (surface of segment of sphere), 44 (volume of sector of sphere). The second book is in nine propositions, eight of which deal with segments of spheres and include the problems of cutting a given sphere by a plane so that (*a*) the surfaces, (*b*) the volumes, of the segments are in a given ratio (Props. 3, 4), and of constructing a segment of a sphere similar to one given segment and having (*a*) its volume, (*b*) its surface, equal to that of another (5, 6).

(2) *The Measurement of the Circle* (Κύκλου μέτρησις) is a short book of three propositions, the main result being obtained in Prop. 2, which shows that the circumference of a circle is less than $3\frac{1}{7}$ and greater than $3\frac{10}{71}$ times its diameter. Inscribing in and circumscribing about a circle two polygons, each of ninety-six sides, and assuming that the perimeter of the circle lay between those of the polygons, he obtained the limits he has assigned by sheer calculation, starting from two close approximations to the value of $\sqrt{3}$, which he assumes as known ($265/153<\sqrt{3}<1351/780$).

(3) *On Conoids and Spheroids* (Περὶ κωνοειδέων καὶ σφαιροειδέων) is a treatise in thirty-two propositions, on the solids generated by the revolution of the conic sections about their axes, the main results being the comparisons of the volume of any segment cut off by a plane with that of a cone having the same base and axis (Props. 21, 22 for the paraboloid, 25, 26 for the hyperboloid, and 27-32 for the spheroid).

(4) *On Spirals* (Περὶ ἑλίκων) is a book of twenty-eight propositions. Propositions 1-11 are preliminary, 13-20 contain tangential properties of the curve now known as the spiral of Archimedes, and 21-28 show how to express the area included between any portion of the curve and the radii vectores to its extremities.

(5) *On the Equilibrium of Planes or Centres of Gravity of Planes* (Περὶ ἐπιπέδων ἰσορροπιῶν ἢ κεντρα βαρῶν ἐπιπέδων). This consists of two books, and may be called the foundation of theoretical mechanics, for the previous contributions of Aristotle were comparatively vague and unscientific. In the first book there are fifteen propositions, with seven postulates; and demonstrations are given, much the same as those still employed, of the centres of gravity (1) of any two weights, (2) of any parallelogram, (3) of any triangle, (4) of any trapezium. The second book in ten propositions is devoted to the finding the centres of gravity (1) of a parabolic segment, (2) of the area included between any two parallel chords and the portions of the curve intercepted by them.

(6) *The Quadrature of the Parabola* (Τετραγωνισμὸς παραβολῆς) is a book in twenty-four propositions, containing two demonstrations that the area of any segment of a parabola is $\frac{4}{3}$ of the triangle which has the same base as the segment and equal height. The first (a mechanical proof) begins, after some preliminary propositions on the parabola, in Prop. 6, ending with an integration in Prop. 16. The second (a geometrical proof) is expounded in Props. 17-24.

(7) *On Floating Bodies* (Περὶ ὀχουμένων) is a treatise in two books, the first of which establishes the general principles of hydrostatics, and the second discusses with the greatest completeness the positions of rest and stability of a right segment of a paraboloid of revolution floating in a fluid.

(8) The *Psammites* (Ψαμμίτης, Lat. *Arenarius*, or sand reckoner), a small treatise, addressed to Gelo, the eldest son of Hiero, expounding, as applied to reckoning the number of grains of sand that could be contained in a sphere of the size of our "universe," a system of naming large numbers according to "orders" and "periods" which would enable any number to be expressed up to that which we should write with 1 followed by 80,000 ciphers!

(9) *A Collection of Lemmas*, consisting of fifteen propositions in plane geometry. This has come down to us through a Latin version of an Arabic manuscript; it cannot, however, have been written by Archimedes in its present form, as his name is quoted in it more than once.

Lastly, Archimedes is credited with the famous *Cattle-Problem* enunciated in the epigram edited by G. E. Lessing in 1773, which purports to have been sent by Archimedes to the mathematicians at Alexandria in a letter to Eratosthenes. Of lost works by Archimedes we can identify the following: (1) investigations on *polyhedra* mentioned by Pappus; (2) Ἀρχαί, *Principles*, a book addressed to Zeuxippus and dealing with the *naming of numbers* on the system explained in the *Sand Reckoner*; (3) Περὶ ζυγῶν, *On balances or levers*; (4) Κεντροβαρικά, *On centres of gravity*; (5) Κατοπτρικά, an optical work from which Theon of Alexandria quotes a remark about refraction; (6) Ἐφόδιον, a *Method*, mentioned by Suidas; (7) Περὶ σφαιροποιΐας, *On Sphere-making*, in which Archimedes explained the construction of the sphere which he made to imitate the motions of the sun, the moon and the five planets in the heavens. Cicero actually saw this contrivance and describes it (*De Rep.* i. c. 14, §§ 21-22).

BIBLIOGRAPHY.—The *editio princeps* of the works of Archimedes, with the commentary of Eutocius, is that printed at Basel, in 1544, in Greek and Latin, by Hervagius. D. Rivault's edition (Paris, 1615) gave the enunciations in Greek and the proofs in Latin somewhat retouched. A Latin version of them was published by Isaac Barrow in 1675 (London, 4to); Nicolas Tartaglia published in Latin the treatises on *Centres of Gravity*, on the *Quadrature of the Parabola*, on the *Measurement of the Circle*, and on *Floating Bodies*, i. (Venice, 1543); Trojanus Curtius published the two books on *Floating Bodies* in 1565 after Tartaglia's death; Frederic Commandine edited the Aldine edition of 1558, 4to, which contains *Circuli Dimensio*, *De Lineis Spiralibus*, *Quadratura Paraboles*, *De Conoidibus et Spheroidibus*, and *De numero Arenae*; and in 1565 the same mathematician published the two books *De iis quae vehuntur in aqua*. J. Torelli's monumental edition of the works with the commentaries of Eutocius, published at Oxford in 1792, folio, remained the best Greek text until the definitive text edited, with Eutocius' commentaries, Latin translation, &c., by J. L. Heiberg (Leipzig, 1880–1881) superseded it. The *Arenarius* and *Dimensio Circuli*, with Eutocius' commentary on the latter, were edited by Wallis with Latin translation and notes in 1678 (Oxford), and the *Arenarius* was also published in English by George Anderson (London, 1784), with useful notes and illustrations. The first modern translation of the works is the French edition published by F. Peyrard (Paris, 1808, 2 vols. 8vo.). A valuable German translation with notes, by E. Nizze, was published at Stralsund in 1824. There is a complete edition in modern notation by T. L. Heath (*The Works of Archimedes*, Cambridge, 1897). On Archimedes himself, see Plutarch's *Life of Marcellus*. (T. L. H.)

ARCHIMEDES, SCREW OF, a machine for raising water, said to have been invented by Archimedes, for the purpose of removing water from the hold of a large ship that had been built by King Hiero II. of Syracuse. It consists of a water-tight cylinder, enclosing a chamber walled off by spiral divisions running from end to end, inclined to the horizon, with its lower open end placed in the water to be raised. The water, while occupying the lowest portion in each successive division of the spiral chamber, is lifted mechanically by the turning of the machine. Other forms have the spiral revolving free in a fixed cylinder, or consist simply of a tube wound spirally about a cylindrical axis. The same principle is sometimes used in machines for handling wheat, &c. (see CONVEYORS).

ARCHIPELAGO, a name now applied to any island-studded sea, but originally the distinctive designation of what is now generally known as the Aegean Sea (Αἰγαῖον πέλαγος), its ancient name having been revived. Several etymologies have been proposed: *e.g.* (1) it is a corruption of the ancient name, *Egeopelago;* (2) it is from the modern Greek, Ἅγιο πέλαγο, the Holy Sea; (3) it arose at the time of the Latin empire, and means the Sea of the Kingdom (*Archè*); (4) it is a translation of the Turkish name, Ak Denghiz, *Argon Pelagos*, the White Sea; (5) it is simply *Archipelagus*, Italian, *arcipelago*, the chief sea. For the Grecian Archipelago see AEGEAN SEA. Other archipelagoes are described in their respective places.

ARCHIPPUS, an Athenian poet of the Old Comedy, who flourished towards the end of the 5th century B.C. His most famous play was the *Fishes*, in which he satirized the fondness of the Athenian epicures for fish. The Alexandrian critics attributed to him the authorship of four plays previously assigned to Aristophanes. Archippus was ridiculed by his contemporaries for his fondness for playing upon words (Schol. on Aristophanes, *Wasps*, 481).

Titles and fragments of six plays are preserved, for which see T. Kock, *Comicorum Atticorum Fragmenta*, i. (1880); or A. Meineke, *Poetarum Comicorum Graecorum Fragmenta* (1855).

ARCHITECTURE (Lat. *architectura*, from the Gr. ἀρχιτέκτων, a master-builder), the art of building in such a way as to accord with principles determined, not merely by the ends the edifice is intended to serve, but by high considerations of beauty and harmony (see FINE ARTS). It cannot be defined as the art of building simply, or even of building well. So far as mere excellence of construction is concerned, see BUILDING and its allied articles. The end of building as such is convenience, use, irrespective of appearance; and the employment of materials to this end is regulated by the mechanical principles of the constructive art. The end of architecture as an art, on the other hand, is so to arrange the plan, masses and enrichments of a structure as to impart to it interest, beauty, grandeur, unity, power. Architecture thus necessitates the possession by the builder of gifts of imagination as well as of technical skill, and in all works of architecture properly so called these elements must exist, and be harmoniously combined.

Like the other arts, architecture did not spring into existence at an early period of man's history. The ideas of symmetry and proportion which are afterwards embodied in material structures could not be evolved until at least a moderate degree of civilization had been attained, while the efforts of primitive man in the construction of dwellings must have been at first determined solely by his physical wants. Only after these had been provided for, and materials amassed on which his imagination might exercise itself, would he begin to plan and erect structures, possessing not only utility, but also grandeur and beauty. It may be well to enumerate briefly the elements which in combination form the architectural perfection of a building. These elements have been very variously determined by different authorities. Vitruvius, the only ancient writer on the art whose works have come down to us, lays down three qualities as indispensable in a fine building: *Firmitas*, *Utilitas*, *Venustas*, stabilty, utility, beauty. From an architectural point of view the last is the principal, though not the sole element; and, accordingly, the theory of architecture is occupied for the most part with aesthetic considerations, or the principles of beauty in designing. Of such principles or qualities the following appear to be the most important: size, harmony, proportion, symmetry, ornament and colour. All other elements may be reduced under one or other of these heads.

With regard to the first quality, it is clear that, as the feeling of power is a source of the keenest pleasure, size, or vastness of proportion, will not only excite in the mind of man the feelings of awe with which he regards the sublime in nature, but will impress him with a deep sense of the majesty of human power. It is, therefore, a double source of pleasure. The feelings with which we regard the Pyramids of Egypt, the great hall of columns at Karnak, the Pantheon, or the Basilica of Maxentius at Rome, the Trilithon at Baalbek, the choir of Beauvais cathedral, or the Arc de l'Étoile at Paris, sufficiently attest the truth of this quality, *size*, which is even better appreciated when the buildings are contemplated simply as masses, without being disturbed by the consideration of the details.

Proportion itself depends essentially upon the employment of mathematical ratios in the dimensions of a building. It is a curious but significant fact that such proportions as those of an exact cube, or of two cubes placed side by side—dimensions increasing by one-half (*e.g.*, 20 ft. high, 30 wide and 45 long)—or the ratios of the base, perpendicular and hypotenuse of a right-angled triangle (*e.g.* 3, 4, 5, or their multiples)—please the eye more than dimensions taken at random. No defect is more glaring or more unpleasant than want of proportion. The Gothic architects appear to have been guided in their designs by proportions based on the equilateral triangle.

By harmony is meant the general balancing of the several parts of the design. It is proportion applied to the mutual relations of the details. Thus, supported parts should have an adequate ratio to their supports, and the same should be the case with solids and voids. Due attention to proportion and harmony gives the appearance of stability and repose which is indispensable to a really fine building. Symmetry is uniformity in plan, and, when not carried to excess, is undoubtedly effective. But a building too rigorously symmetrical is apt to appear cold and tasteless. Such symmetry of general plan, with diversity of detail, as is presented to us in leaves, animals, and other natural objects, is probably the just medium between the excesses of two opposing schools.

Next to general beauty or grandeur of form in a building comes architectural ornament. Ornament, of course, may be used to excess, and as a general rule it should be confined to the decoration of constructive parts of the fabric; but, on the other hand, a total absence or a paucity of ornament betokens an unpleasing poverty. Ornaments may be divided into two classes—mouldings and the sculptured representation of natural or fanciful objects. Mouldings, no doubt, originated, first, in simply taking off the edge of anything that might be in the way, as the edge of a square post, and then sinking the chamfer in hollows of various forms; and thence were developed the systems of mouldings we now find in all styles and periods. Each of these has its own system; and so well are their characteristics understood, that from an examination of them a skilful architect will not only tell the period in which any building has been erected, but will even give an estimate of its probable size, as professors of physiology will construct an animal from the examination of a single bone. Mouldings require to be carefully studied, for nothing offends an educated eye like a confusion of mouldings, such as Roman forms in Greek work, or Early English in that of the Tudor period. The same remark applies to sculptured ornaments. They should be neither too numerous nor too few, and above all, they should be consistent. The carved ox skulls, for instance, which are appropriate in a temple of Vesta or of Fortune would be very incongruous on a Christian church.

Colour must be regarded as a subsidiary element in architecture, and although it seems almost indispensable and has always been extensively employed in interiors, it is doubtful how far external colouring is desirable. Some contend that only local colouring, *i.e.* the colour of the materials, should be admitted; but there seems no reason why any colour should not be used, provided it be employed with discretion and kept subordinate to the form or outline.

Origin of the Art.—The origin of the art of architecture is to be found in the endeavours of man to provide for his physical wants; in the earliest days the cave, the hut and the tent may have given shelter to those who devoted themselves to hunting and fishing, to agriculture and to a pastoral and nomadic life, and in many cases still afford the only shelter from the weather. There can be no doubt, however, that climate and the materials at hand affect the forms of the primitive buildings; thus, in the two earliest settlements of mankind, in Chaldaea and Egypt, where wood was scarce, the heat in the day-time intense, and the only material which could be obtained was the alluvial clay, brought down by the rivers in both those countries, they shaped this into bricks, which, dried in the sun, enabled them to build rude huts, giving them the required shelter. These may have been circular or rectangular on plan, with the bricks laid in horizontal courses, one projecting over the other, till the walls met at the top. The next advance in Egypt was made by the employment of the trunks of the palm tree as a lintel over the doorway, to support the wall above, and to cover over the hut and carry the flat roof of earth which is found down to the present day in all hot countries. Evidence of this system of construction is found in some of the earliest rock-cut tombs at Giza, where the actual dwelling of the deceased was reproduced in the tomb, and from these reproductions we gather that the corners, or quoins of the hut were protected by stems of the douva plant, bound together in rolls by the leaves, which, in the form of torus rolls, were also carried across the top of the wall. Down to the present day the huts of the fellahs are built in the same way, and, surmounted as they are by pigeon-cots, bear so strong a resemblance to the pylons and the walls of the temples as at all events to suggest, if not to prove, that in their origin these stone erections were copies of unburnt brick structures. From long exposure in the sun, these bricks acquire a hardness and compactness not much inferior to some of the softer qualities of stone, but they are unable to sustain much pressure; consequently it is necessary to make the walls thicker at the bottom than at the top, and it is this which results in the batter or raking sides of all the unburnt brick walls. The same raking sides are found in all their *mastabas*, or tombs, sometimes built in unburnt brick and sometimes in stone, in the latter case being simple reproductions of the former. In some of the early mastabas, built in brick, either to vary the monotony of the mass and decorate the walls, or to ensure greater care in their construction, vertical brick pilasters are provided, forming sunk panels. These form the principal decoration, as reproduced in stone, of an endless number of tombs, some of which are in the British Museum. At the top of each panel they carve a portion of trunk necessary to support the walls of brick, and over the doorway a similar feature. In Chaldaea the same decorative features are found in the stage towers which constituted their temples, and broad projecting buttresses, indented panels and other features, originally constructive, form the decorations of the Assyrian palaces. There also, built in the same material, unburnt brick, the walls have a similar batter, though they were faced with burnt bricks. In later times in Greece and Asia Minor, where wood was plentiful, the stone architecture suggests its timber origin, and though unburnt brick was still employed for the mass of the walls, the remains in Crete and the representations in painting, &c., show that it was encased in timber framing, so that the raking walls were no longer a necessary element in their structure. The clearest proofs of original timber construction are shown in the rock-cut tombs of Lycia, where the ground sill, vertical posts, cross beams, purlins and roof joists are all direct imitations of structures originally erected in wood.

The numerous relics of structures left by primeval man have generally little or no architectural value; and the only interesting problem regarding them—the determination of their date and purpose and of the degree of civilization which they manifest—falls within the province of archaeology (see Archaeology; Barrow; Lake-Dwellings; Stone Monuments).

Technical terms in architecture will be found separately explained under their own headings in this work, and in this article a general acquaintance with them is assumed. A number of architectural subjects are also considered in detail in separate articles; see, for instance, Capital; Column; Design; Order; and such headings as Abbey; Aqueduct; Arch; Basilica; Baths; Bridges; Catacomb; Crypt; Dome; Mosque; Palace; Pyramid; Temple; Theatre; &c., &c. Also such general articles on national art as China: *Art*; Egypt: *Art and Archaeology*; Greek Art; Roman Art; &c., and the sections on architecture and buildings under the headings of countries and towns.

In the remainder of this article the general history of the evolution of the art of architecture will be considered in various sections, associated with the nations and periods from which the leading historic styles are chronologically derived, in so far as the dominant influences on the art, and not the purely local characteristics of countries outside the main current of its history, are concerned; but the opportunity is taken to treat with some attempt at comprehensiveness the leading features of the architectural history of those countries and peoples which are intimately connected with the development of modern architecture.

These consecutive sections are as follows:—

- Egyptian
- Assyrian
- Persian
- Greek
- Parthian
- Sassanian
- Etruscan
- Roman
- Byzantine
- Early Christian
- Early Christian Work in Central Syria
- Coptic Church in Egypt
- Romanesque and Gothic in—
    - Italy
    - France
    - Spain
    - England
    - Germany
    - Belgium and Holland
- Renaissance: Introduction
    - Italy
    - France
    - Spain
    - England
    - Germany
    - Belgium and Holland
- Mahommedan

Finally, a section on what can only be collectively termed *Modern* architecture deals with the main lines of the later developments down to the present day in the architectural history of different countries. (R. P. S.)

Egyptian Architecture

Although structures discovered in Chaldaea, at Tello and Nippur, seeming to date back to the fifth millennium B.C., suggest that the earlier settlements of mankind were in the valley of the Tigris and Euphrates, north of the Persian Gulf, it is to Egypt that we must turn for the most ancient records of monumental architecture (see also Egypt: *Art and Archaeology*). The proximity of the ranges of hills (the Arabian and Libyan chains) to the Nile, and the facilities which that river afforded for the transport of the material quarried in them, enabled the Egyptians at a very early period to reproduce in stone those structures in unburnt brick to which we have already referred.

Although the great founder of the first Egyptian monarchy is reputed to be Menes, the Thinite who traditionally founded the capital at Memphis, he was preceded, according to Flinders Petrie, by an earlier invading race coming from the south, who established a monarchy at This near Abydos, having entered the country by the Kosseir road from the Red Sea; and this may account for the early tradition that it was the Ethiopians who founded the earliest dynastic race, "Ethiopians" being a wide term which may embrace several races.

Egyptian architecture is usually described under the principal periods in which it was developed. They are as follows[1]:—(A) the Memphite kingdom, whose capital was at Memphis, south-west of Cairo, the Royal Domain extending south some 30 to 40 m.; (B) the first Theban kingdom with Thebes as the capital; this covers three dynasties. Then follows an interregnum of five dynasties, when the invasion of the Hyksos took place; this was architecturally unproductive. On the expulsion of the Hyksos there followed (C) the second Theban kingdom, consisting of three dynasties, under whose reign the finest temples were erected throughout the country. After 1102 followed six dynasties (1102–525 B.C.), with capitals at Sais, Tanis and Bubastis, when the decadence of art and power took place. Then followed the Persian invasion, 525–331 B.C., which was destructive instead of being reproductive. On the defeat of the Persians by Alexander the Great, and after his death in 323 B.C., was founded (D) the Ptolemaic kingdom, with Alexandria as the capital. A great revival of art then took place, which to a certain extent was carried on under the Roman occupation from 27 B.C., and lasted about 300 years.

With the exception of a small temple, found by Petrie in front of the temple of Medum, and the so-called "Temple of the Sphinx," the only monuments remaining of the Memphite kingdom are the Pyramids, which were built by the kings as their tombs, and the *mastabas*, in which the members of the royal family and of the priests and chiefs were buried. The mastaba (Arabic for "bench") was a tomb, oblong in plan, with battering side and a flat roof, containing various chambers, of which the principal were (1) the Chapel for offerings, (2) the Serdab, in which the Ka or double of the deceased was deposited, and (3) the well, always excavated in the rock, in which the mummy was placed.

The three best-known pyramids are those situated about 7 m. south-west of Cairo, which were built by the second, third and fourth kings of the fourth dynasty,—Khufu (*c.* 3969–3908 B.C.), Khafra (*c.* 3908–3845 B.C.), and Menkaura (*c.* 3845–3784 B.C.), who are better known as Cheops, Cephren and Mycerinus. The first of these is the largest and most remarkable in its construction and setting out. The pyramid of Cephren was slightly smaller, and that of Mycerinus still more so, compensated for by a casing in granite. The dimensions and other details are given in the article Pyramids. From the purely architectural point of view they are the least impressive of masses, and their immense size is not realized until on a close approach.

The temple of the Sphinx, attributed to Cephren, is T-shaped in plan, with two rows of square piers down the vertical and one row down the cross portion. These carried a flat roof of stone. The temple is remarkable for the splendid finish given to the granite piers, and to the alabaster slabs which cased the rock in which it had been partially excavated (but see Egypt: *History*, I.).

The Serapeum at Sakkara, in which the sacred bulls were embalmed and buried, the tomb of Ti (a fifth dynasty courtier), and the tombs of the kings and queens of Thebes, have no special architectural features which call for description here.

We pass on to the first Theban kingdom, the eighth king of which, Nebheprē Menthotp III., built the temple lately discovered on the south side of the temple at Deir-el-Bahri, of which it is the prototype. It was a sepulchral temple, and being built on rising ground was approached by flights of steps. In the centre was a solid mass of masonry which, it is thought by some authorities, was crowned by a pyramid. This was surrounded by a double portico with square piers in the outer range, and octagonal piers in the inner range, there being a wall between the two ranges.

The earliest tombs in which the *column* (*q.v.*) appears, as an architectural feature, are those at Beni Hasan, attributed to the period of Senwosri (formerly read Usertesen) I., the second king of the twelfth dynasty. These are carved in the solid rock. There are two types, the Polygonal column, sometimes in error called the Protodoric, which was cut in the rock in imitation of a wooden column, and a second variety known as the Lotus column, which is employed inside, supporting the rock-cut roof, but having such slender proportions as to suggest that it was copied from the posts of a porch, round which the Lotus plant had been tied.

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[1] For the various chronological systems proposed see Egypt: *Chronology*.

The culminating period of the Egyptian style begins with the kings of the eighteenth dynasty, their principal capital being Thebes, described by Herodotus as the "City with the Hundred Gates"; and although the execution of the masonry is inferior to that of the older dynasties, the grandeur of the conception of their temples, and the wealth displayed in their realization entitle Thebes to the most important position in the history of the Egyptian style, especially as the temples there grouped on both sides of the river exceed in number and dimensions the whole of the other temples throughout Egypt. This to a certain extent may possibly be due to the distance of Thebes from the Mediterranean, which has contributed to their preservation from invaders. We have already referred to the probable origin of the peculiar batter or raking side given to the walls of the pylons and temples, with the Torus moulding surrounding the same and crowned with the cavetto cornice. What, however, is more remarkable is the fact that, once accepted as an important and characteristic feature, it should never have been departed from, and that down to and during the Roman occupation the same batter is found in all the temples, though constructively there was no necessity for it. The strict adherence to tradition may possibly account for this, but it has resulted in a magnificent repose possessed by these structures, which seem built to last till eternity.

An avenue with sphinxes on both sides forms the approach to the temple. These avenues were sometimes of considerable length, as in the case of that reaching from Karnak to Luxor, which is 1½ m. long. The leading features of the temple (see fig. 1) were:—(A) The pylon, consisting of two pyramidal masses of masonry crowned with a cavetto cornice, united in the centre by an immense doorway, in front of which on either side were seated figures of the king and obelisks. (B) A great open court surrounded by peristyles on two or three sides. (C) A great hall with a range of columns down the centre on either side, forming what in European architecture would be known as nave and aisles, with additional aisles on each side; these had columns of less height than those first mentioned, so as to allow of a clerestory, lighting the central avenue. (D) Smaller halls with their flat roofs carried by columns. And finally (E) the sanctuary, with passage round giving access to the halls occupied by the priest.

Broadly speaking, the temples bear considerable resemblance to one another (see TEMPLE), except in dimensions. There is one important distinction, however, to be drawn between the Theban temples and those built under the Ptolemaic rule. In these latter the halls are not enclosed between pylons, but left open on the side of the entrance court with screens in between the columns, the hall being lighted from above the screens. The temples of Edfu, Esna and Dendera are thus arranged.

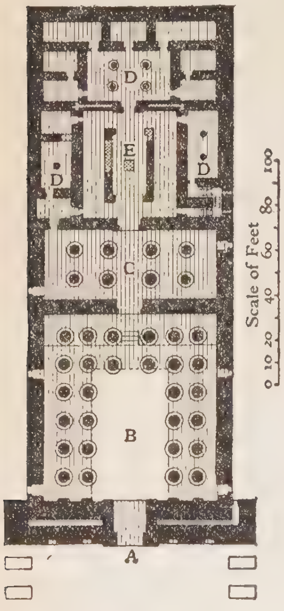
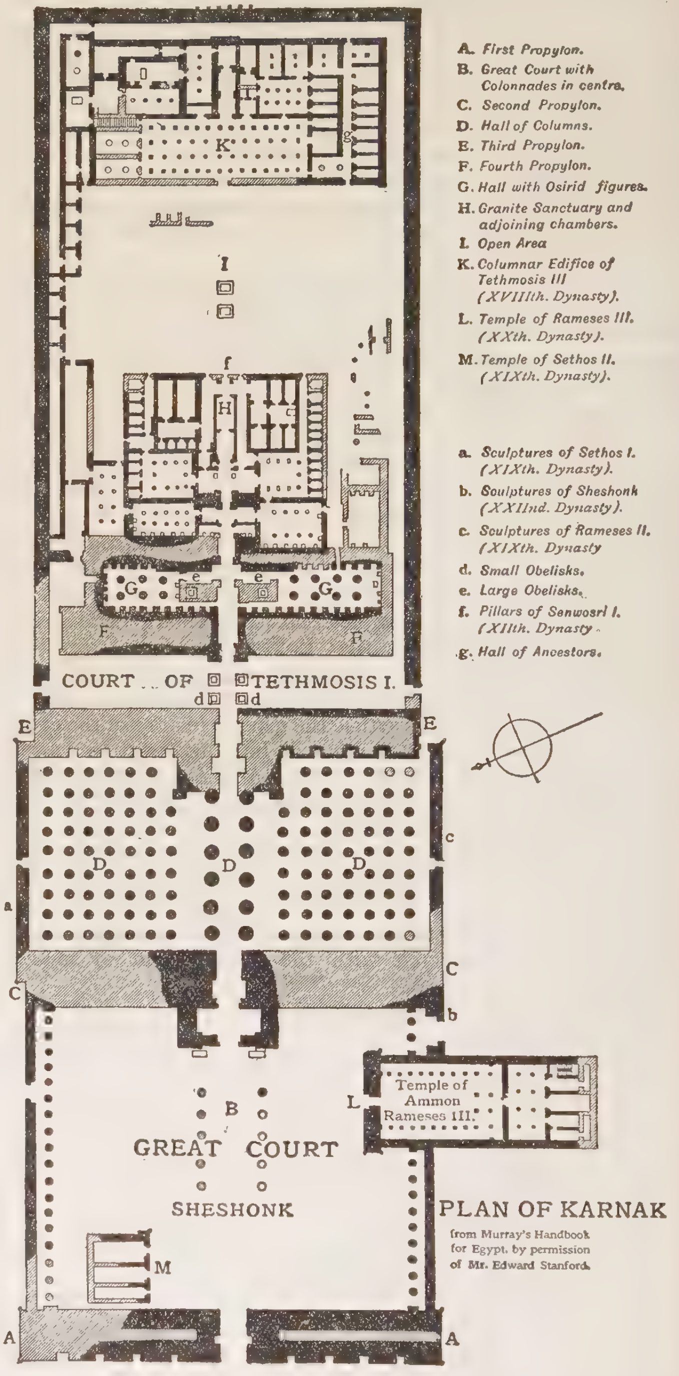

D
E
D
D
C
B
A
Scale of Feet
0 10 20 40 60 80 100

FIG. 1.—Plan of the Temple of Chons.

A, Pylon.
B, Great court.
C, Hall of columns.
D, Priest's hall.
E, Sanctuary.

The great temple of Karnak (fig. 2) differs from the type just described, in that it was the work of many successive monarchs. Thus the sanctuary, built in granite, and the surrounding chambers, were erected by Senwosri (Usertesen) I. of the twelfth dynasty. In front of this, on the west side, pylons were added by Tethmosis (Thothmes, Tahutmes) I. (1541–1516), enclosing a hall, in the walls of which were Osirid figures. In front of this a third pylon was added, which Seti (Sethos) I. utilized as one of the enclosures of the great hall of columns (fig. 3), measuring 170 ft. deep by 329 ft. wide, having added a fourth pylon on the other side to enclose it. Again in front of this was the great open court with porticoes on two sides, and a great pylon, forming the entrance. In the rear of all these buildings, and some distance beyond the sanctuary, Tethmosis III. (1503–1449) built a great colonnaded hall with other halls round, considered to have been a palace. All these structures form a part only of the great temple, on the right and left of which (*i.e.* to the north-east and south-west) were other temples preceded by pylons and connected one with the other by avenues of sphinxes. Though of small size comparatively, one of the best preserved is the temple of Chons, built by Rameses III. It was from this temple that an avenue of sphinxes led to the temple of Luxor, which was begun by Amenophis III. (1414–1379 B.C.), and completed by Rameses II. (1300–1234).

On the opposite or west bank of the Nile are the temple of Medīnet Abū, the Ramesseum, the temples of Kurna and of Deir-el-Bahri; the last being a sepulchral temple, which, built on rising ground, had flights of steps leading to the higher level (fig. 4), and porticoes with square piers at the foot of each terrace. In the rear on the right-hand side was found an altar, the only example of its kind known in Egypt. The halls behind this and the portico of the right flank had polygonal columns.


K
g
I
f
H
G
e
e
G
F
F
COURT OF TETHMOSIS I.
d
d
E
E
D
D
D
a
c
C
C
b
B
GREAT COURT
SHESHONK
L
Temple of Ammon Rameses III.
M
A
A
PLAN OF KARNAK
A. First Propylon.
B. Great Court with Colonnades in centre.
C. Second Propylon.
D. Hall of Columns.
E. Third Propylon.
F. Fourth Propylon.
G. Hall with Osirid figures.
H. Granite Sanctuary and adjoining chambers.
I. Open Area
K. Columnar Edifice of Tethmosis III (XVIIIth. Dynasty).
L. Temple of Rameses III. (XXth. Dynasty).
M. Temple of Sethos II. (XIXth. Dynasty).
a. Sculptures of Sethos I. (XIXth. Dynasty).
b. Sculptures of Sheshonk (XXIInd. Dynasty).
c. Sculptures of Rameses II. (XIXth. Dynasty
d. Small Obelisks.
e. Large Obelisks.
f. Pillars of Senwosri I. (XIIth. Dynasty.
g. Hall of Ancestors.

from Murray's Handbook for Egypt, by permission of Mr. Edward Stanford.

FIG. 2.

In the palace of Tell el-Amarna, built shortly before 1350 B.C. by the heretic king Akhenaton (whose name was originally Amenophis IV.), and discovered by Petrie, there were no special architectural developments, but the painted decoration of the walls and pavements assumed a literal interpretation of natural forms of plants and foliage and of birds and animals, recalling to some extent that found at Cnossus in Crete.

Ascending the river from Cairo, the first temples of which important remains exist are the two at Abydos. One of these has an exceptional plan, with seven sanctuaries in the rear. It was built by Seti I., and consists of an outer portico with square piers, a hall with two rows of columns down to the centre, and a second hall with three rows of columns. These halls are placed longitudinally to give access to the seven sanctuaries. The second temple is of the ordinary type, with pylon, court with portico on all four sides, two halls of columns, and three sanctuaries in the rear. The next temple is that of Dendera, commenced under the second Ptolemy but not completed until the reign of Nero. It has been completely excavated, and retains the whole of its external walls. Above Thebes is the temple of Esna, of which the hall of columns only has been cleared out. The capitals of the front belong to the lotus-bud type, and those of the interior are carved with many varieties of river plant. The temple of Edfu is the best preserved in Egypt. Its plan (fig. 5) would seem to have been determined from the first, and it is singular to note that it presents the traditional type of plan, which in the Theban examples was evolved from additions made by successive monarchs. In dimensions it is but little inferior to these. Its pylon (fig. 6) is 250 ft. wide and 150 ft. high; the first court has porticoes on three sides. The great hall of columns, all of which here are of the same height, is lighted from above (fig. 7), the screen facing the court. Then follow the second hall of columns, two vestibules, and the sanctuary, surrounded by a passage giving access to the priest's rooms round. The temple of Kōm Ombo, which comes next, was dedicated to two deities, and had therefore two sanctuaries.

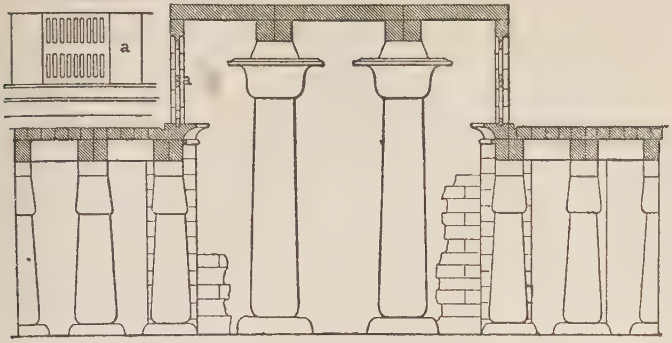
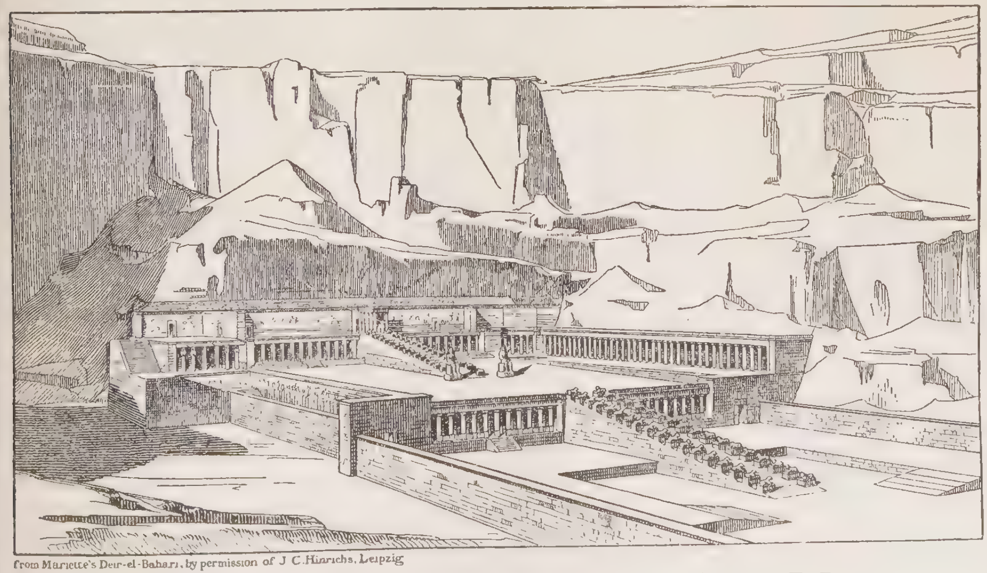


FIG. 3.—Section through Hall of Columns, Karnak. *a*, Clerestory window.

The temples of Philae owe much of their beauty and picturesqueness to the island on which they are situated; their plans, and that of the long porticoes in front of the pylons of the great temple, being fitted to the irregularity of the site. In the first court is a well-preserved example of the Mammeisi temple (see TEMPLE), the sanctuary and other rooms in which are entirely enclosed in a peristyle. It was built by Ptolemy Euergetes (247–222 B.C.). A second monarch of the same name (about 125 B.C.) built the pavilion on the north side of the island, known as "Pharaoh's bed," the roof of which was covered with stone slabs, resting on timber beams. In consequence of the building of the Assuan dam all these temples are submerged for the greater part of the year. The principal temples between Philae and the second cataract are:—Dabōd, of which little remains; Kartassi; Kalābsha, still preserving its pylon and great hall of columns; the Bēt el-Wāli, in which are two ancient polygonal columns; Gerf Husen, partially cut in the rock; Dakka; Wadi es-Sebū'a; and lastly Abū Simbel. Owing to the proximity of the ranges of hills to the Nile, there was no room for the ordinary type of temple at Abū Simbel, so that those founded here by Rameses the Great (*c.* 1300–1234 B.C.) were excavated in the rock. In the place of the pylon the side of the cliff was worked off, leaving in relief four immense seated figures, 66 ft. high. The first hall had three aisles, divided by four piers on each side, in front of which Osirid figures (18 ft. high) were carved; beyond was a second hall, vestibule and sanctuary. The long rectangular chambers on each side are provided with benches cut in the rock. The depth of the temple is 90 ft. There is a second temple of smaller size which faces the Nile.



From Mariette's Deir-el-Bahari, by permission of J. C. Hinrichs, Leipzig

FIG. 4.—Temple of Deir-el-Bahri, conjectural restoration by Prof. E. Brune.

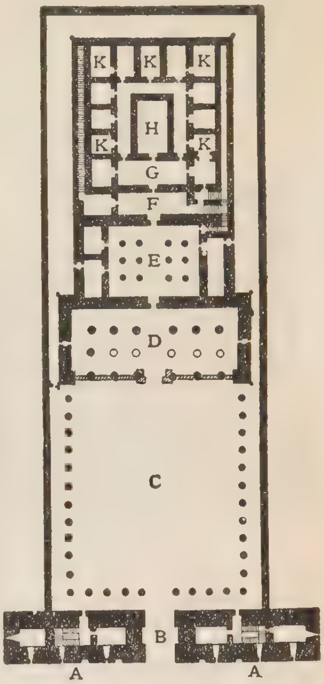


FIG. 5.—Plan of the Temple of Edfu.

AA, Pylon.
B, Entrance door.
C, Great Court.
D, Hall of Columns.
E, Second Hall.
F, Hall of the Altar.
G, Hall of the Centre.
H, Sanctuary.
KK, Storerooms.

We have already referred to the lotus columns at Beni Hasan; these, when employed constructionally to carry stone roofs, assumed a far more solid appearance, and the stems of the lotus plant carved in the earlier examples were omitted in the later, in order to give more surface for intaglio carving. The capital and its neck still retain the lotus buds and the bands which tied them round the column. In the central avenues of the great halls the columns had bell capitals, the decoration of which was based on the flower of the papyrus. There are a few examples of the palm capital, often carved in granite, which date from an early period. Commencing with the Ptolemaic revival the capitals assume a much greater variety of form, their decoration being based on river plants; but here again the lotus plant, which seems still to be the favourite type, predominates, the buds in various degrees of their growth alternating one with the other. All these varieties of form are described in the article CAPITAL, but two or three may be mentioned here, as they depart from the usual type. The Hathor-headed capital, with faces on all four sides, and surmounted with a miniature shrine, is found at Dendera, Philae and other temples of the Ptolemaic or Roman periods; one of the earliest examples, but without the shrine, dates back to Tethmosis III. (1503–1449 B.C.). As a distinct type of pier decoration, the Osirid figures at Medinet Abū, at Karnak, Gerf Husen, Abū Simbel and other temples, constitute important features: the figure is carved in front of the pier and does not serve any constructive function.

With the exception of the great building in the rear of the temple at Karnak, built by Tethmosis III., and the pavilion of Medinet Abū on the west bank of the Nile at Thebes, no palatial residences of any importance have yet been found, from which it might be inferred that the king, being the head of the Egyptian religion, occupied with his family the sacred precincts of the temple; but large as these temple enclosures are, there would have been no room for the immense army of attendants and servants required in an Oriental court. Moreover, the darkness of the halls and the rigid enclosures would have made a residence in them anything but cheerful. There are two instances where, in consequence of the subsequent desertion of the site, remains have been found of ancient towns. At Tell el-Amarna, built by the heretic king, Akhenaton, portions of the houses remain, and at Kahun, in the Fayum, Petrie discovered the walls of a town which, erected for the overseers and workmen employed in the construction of the pyramid of Illahun, built by Senwosri (Usertesen) II. (2684–2666 B.C.), was abandoned when the pyramid was completed. The houses were all built in unburnt brick, and in those cases where the rooms exceeded 8 or 9 ft. in width, columns in stone or wood were employed to assist in carrying the roof, which was constructed of beams carrying smaller timbers covered over with a flat roof of mud. The plans of the houses were not unlike those found in Pompeii, with open courts and porticoes and no external windows. The streets ran at right angles to one another, and the houses varied in size from the workman's hut, of one room, to the overseer's house with several rooms and courts; the principal residence, in the centre, occupied by the governor of the town, being of still larger dimensions.

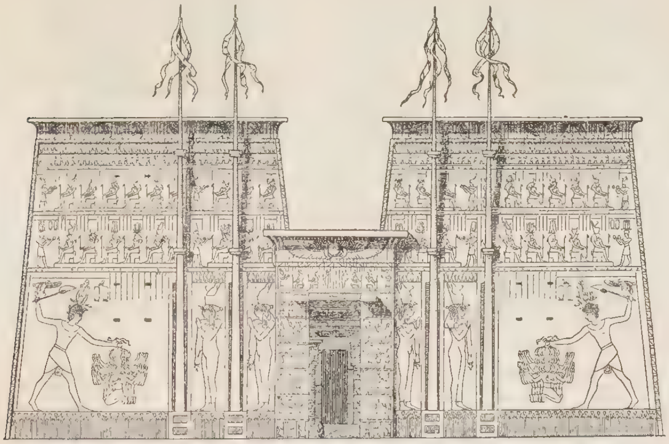


FIG 6.—Exterior of the Pylon of the Temple of Edfu.

Further knowledge of the Egyptian dwellings is chiefly derived from the "soul-houses" recently discovered by Petrie, and from the paintings in the tombs, which suggest that they corresponded to that class of residence which in Rome was known as a villa, viz. a series of detached buildings built in immense enclosures, with porticoes round, groves of trees, artificial lakes, &c. The walls, gates and buildings were all built probably in unburnt brick, and the whole site, if on the borders of the river, raised on great mounds. In this respect they accord with the houses of the fellah at the present day, which are raised on the accumulation of centuries, for when, owing to the rise of the Nile, the houses succumb to the moisture creeping up, another house is built on the top. The representations in paintings show that the houses were chiefly built in unburnt brick, and they sometimes were of two or three storeys in height, with windows in the upper floors, and a flat roof with a kind of dormer known as the Mulhuf, turned towards the north-west to ventilate the house. The paintings frequently represent the store-rooms, or granaries; and the preservation of those built by Rameses the Great, in the rear of the Ramesseum at Thebes, as granaries to hold corn, enables us to follow their construction. These granaries consist of a series of long cellars, about 12 to 14 ft. wide, placed side by side, and roofed over with elliptical barrel vaults. The reason for the elliptical form and the method of their construction is given in the article VAULT (*q.v.*).

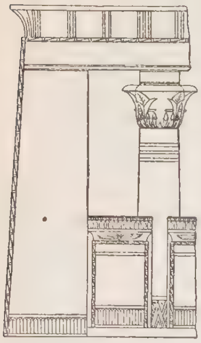


FIG. 7. — Façade of the Great Hall of Columns of the Ptolemaic temple at Edfu.

The pavilion of Medinet Abū was built in stone, and consequently has been preserved more or less complete to our day. It consisted of three storeys with a flat roof and battlement round, said to be in imitation of those on a Syrian fortress, as they are quite unlike anything else in Egypt. The floors were in wood, but there are traces of a stone staircase. The windows, of large size, were filled with thin stone slabs pierced with vertical slits, like those of the hall of columns at Karnak. (R. P. S.)

ASSYRIAN ARCHITECTURE

About 3800 B.C. the earlier inhabitants of Chaldaea or Babylonia were invaded and absorbed by a Semitic race, whose first monarch was Sargon of Agade (Akkad). 1800 years later, emigrations took place northward, and founded Nineveh on the banks of the Tigris, about 250 m. north of Babylon. 1200 years later, the Assyrians began building the magnificent series of palaces from which were brought the winged man-headed bulls and the sculptured slabs now in the British Museum. The leading characteristics of the style, and the nature of the structures, temples and palaces, evolved by the Chaldaeans (or first Babylonian empire), the Assyrians, and the new Babylonian empire, are similar; they are best known by those which represent a culmination of the style in north Mesopotamia, and are therefore described here.

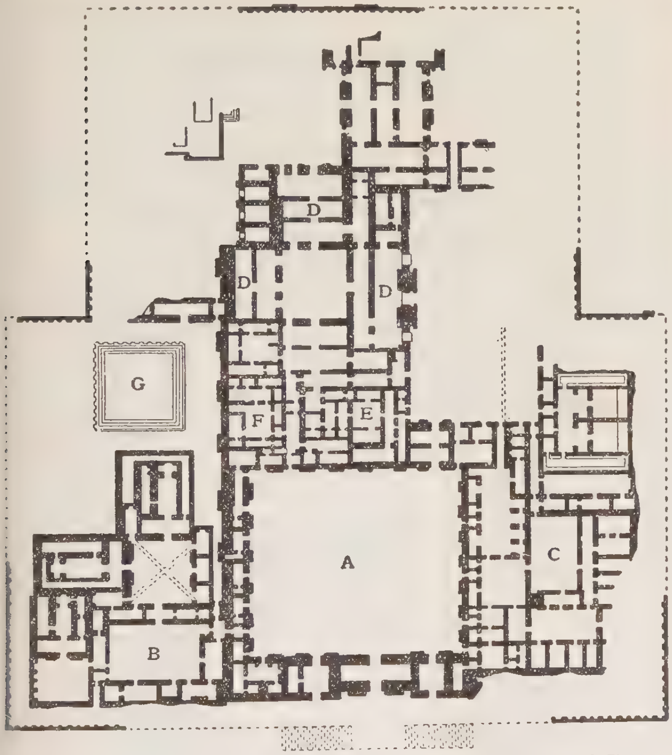
By a singular coincidence the remains of the oldest building found at Nippur (Niffar), in lower Mesopotamia, bear a close resemblance to the oldest pyramid in Egypt, Medum, before it received its final casing. The latter, however, is known to have been a tomb, whereas the structure at Nippur was a temple, which took the form of a *ziggurat* or stage tower. It consisted of several storeys built one over the other, the upper storey in each case being set back behind the lower, in order to leave a terrace all round. In some cases the terrace was wider in front, to give space for staircases ascending from storey to storey. In consequence of the extreme flatness of the country and its liability to sudden inundations, it became necessary, when erecting buildings of any kind, to raise them on mounds of earth. The more important the structure, the higher was it deemed necessary to raise it, so as to make it the most conspicuous feature in the landscape. The result is that from Abu Shahrain, the most southern town, to Akarkuf (Aqarquf), 220 m. north, there are a series of immense mounds, sometimes nearly a mile in diameter, and rising to a height of 200 ft., crowned with the remains of towns, which, notwithstanding the thirty centuries more or less during which they have been exposed to the torrential rains and the destructive agencies of man, form still the most prominent features in the country. The structures which were raised on the mound, *i.e.* the temples and palaces with their enclosure walls, were all built with bricks made of the alluvial clay of the country, shaped in wooden moulds and dried in the heat of the sun, a heat so intense that they acquired sometimes the hardness of the inferior qualities of stone. The walls of the temples, palaces and enclosures had the same batter as that already referred to in the preceding section on Egypt. In the latter country they were reproduced in stone, of which there were many quarries on either side of the Nile; in Chaldaea they were obliged to content themselves with the preservation of their ziggurats by outer casings of burnt brick and with pavements of tiles for their terraces. In order to vary the monotony of their temple walls, and perhaps to give them greater strength, they built vertical bands or buttresses at intervals, or they sank panels in the walls to two depths, a natural decoration to which brick work lends itself; and these two methods, which were employed in early times, were followed by the Assyrians in the palaces of Nimrud, Nineveh and Khorsabad.

The earlier settlements were those founded between the mouths of the Tigris and the Euphrates, on what was then the shore of the Persian Gulf, now some 140 m. farther south. The principal towns where the remains of ziggurats have been found, all on the borders of the Euphrates, beginning with the most southern, are:—Abu Shahrain (Eridu); Mugheir (Ur of the Chaldees); Senkera (? Ellasar or Larsa); Warka (Erech); Tello (Eninnu); Nippur; Birs Nimrūd (Borsippa); Babil (Babylon); El Ohemir (Kish); Abu Habba (Sippara); and Akarkuf (Durkurigalsu).

Although the ziggurats at Warka, Nippur and Tello are probably of older foundation, the great temple of Borsippa at Birs Nimrud is in better preservation, having been restored or rebuilt by Nebuchadrezzar, and may be taken as a typical example. The ground storey was 272 ft. square, and, according to Fergusson, 45 ft. high. The upper storeys or stages receded back, one behind the other, so as to leave a terrace all round. Although it is not possible to trace more than four storeys, it is known from the description on a cylinder found on the site that there were seven storeys, dedicated to the planets, each coloured with the special tint prescribed. The total height was about 160 ft., and on the top was a shrine dedicated to the god Nebo. An invaluable record of the researches which have been made during the last three centuries or more is given in H. V. Hilprecht's *Explorations in Bible Lands during the 19th Century.* Two or three of them might be mentioned here. At Warka Mr Kenneth Loftus uncovered a wall, strengthened by buttresses 15 ft. wide and projecting 18 in., between which were panels filled with a series of semicircular shafts side by side, both buttresses and shafts being decorated with geometrical patterns consisting of small earthenware cones embedded in the wall, the ends of which were enamelled in various colours. The design of these patterns is so unlike anything found in Assyrian work, but bears so close a resemblance to the geometrical designs carved on the columns at Diarbekr ascribed to the Parthians, that this wall may have been built at a much later period; and this becomes the more probable in view of the discoveries made subsequently at Tello and Nippur, where Parthian palaces have been found, crowning the summits of the ancient Chaldaean mounds. In both these towns the researches made in later years have been carried out far more methodically than previously, and, following the example of Schliemann, excavations have been made to great depths, careful notes being taken of the strata shown by the platforms at different levels. At Tello, de Sarzac discovered the magnificent collection of statues of diorite now in the Louvre, one of them (unfortunately headless) of Gudea, priest-king and architect of Lagash, seated and carrying on his lap a tablet, on which is engraved the plan of a fortified enclosure, whilst a divided scale and a stylos are carved in relief near the upper and right-hand side. A silver inlaid vase of Entemena, also priest-king of Lagash (about 3950 B.C.), and other treasures, were found on the same site.

At Nippur (the ancient Calneh) the research undertaken by the university of Pennsylvania resulted in the discovery, under a ziggurat dated from 4000–4500 B.C., of a barrel-vaulted tunnel, in the floor of which were found terra-cotta drain pipes with flanged mouths. At a later date (3750 B.C.) Naram-Sin, the son of Sargon, had built over the older ziggurat a loftier and larger temple, above which was a third built by Ur Gur (2500 B.C.), which still retained its burnt brick casing, 5 ft. thick. Crowning all these was the Parthian palace mentioned in the section on Parthian architecture below. The result of these researches has not only carried back the date of the earlier settlements to a prehistoric period quite unknown, but has suggested that if similar researches are carried out in other well-known mounds, among which the great city of Babylon should be counted as the most important, further revelations may still be made.

But we have now to pass to the principal cities of the Assyrian monarchy on the river Tigris. At Nineveh, the capital, which is about 250 m. north of Babylon, the remains of three palaces have been found, those of Sennacherib (705–681 B.C.), Esarhaddon (681–668 B.C.), and Assurbanipal (668–626 B.C.). At Nimrud (the ancient Calah, founded by Assur), 20 m. south of Nineveh, are also three palaces, one (the earliest known) built by Assurnazirpal (885–860 B.C.), the others by Shalmaneser II. (860–825 B.C.) and Esarhaddon. At Balawat, 10 m. east of Nineveh, was a second palace of Shalmaneser II., and at Khorsabad, 10 m. north-east of Nineveh, the palace (fig. 8) built by Sargon 722–705 B.C.), which was situated on the banks of the Khanser, a tributary of the Tigris. As this palace is one of the most extensive of those hitherto explored, its description will best give the general idea of the plan and conception of an Assyrian palace.



From *The History of Art in Chaldaea and Assyria*, by permission of Chapman & Hall, Ltd.

FIG. 8.—Plan of the Palace at Khorsabad.

A, Principal courtyard.
B, The harem.
C, The offices.
DD, The halls of state.
E, Official residences.
F, The king's residence.
G, The ziggurat or temple.

The palace was built on an immense platform, made of sun-dried bricks, enclosed in masonry, and covering an area of nearly one million square feet, raised 48 ft. above the town level. The principal front of the palace measured 900 ft., there being a terrace in front. The approach was probably by a double inclined ramp which chariots and horses could mount. A central and two side portals (fig. 9), flanked with winged human-headed bulls (now in the British Museum), led to the principal courtyard (A), measuring 300 ft. by 240 ft. The block (B) on the left of the court, containing smaller courts and rooms, constituted the harem; that on the right the offices (C); those in the rear the halls of state (DDD), the residences of the officers of the court (E), the king's private apartments (F) being on the left, facing the ziggurat or temple (G). In the extreme rear were other state rooms with terraces probably laid out as gardens and commanding a view of the river and country beyond.

As there must have been nearly 700 rooms in the palace, the destination of the greater number of which it would be difficult to determine, it will be sufficient to refer only to those state rooms in which the principal sculptured slabs were found, and which decorated the lower 9 ft. of the walls. The two chief factors to be noted are (1) the great length of the halls compared with their width, the chief hall being 150 ft. long and 30 ft. wide, and (2) the immense thickness of the walls, which measured 28 ft. The only reason for walls of this thickness would be to resist the thrust of a vault, and as La Place, the French explorer, found many blocks of earth of great size, the soffits of which were covered with stucco and had apparently fallen from a height, he was led to the conclusion, now generally accepted, that these halls were vaulted. These discoveries, and the fact that in none of the palaces excavated has a single foundation of the base of any column been found, quite dispose of Fergusson's restoration, which was based on the palaces of Persepolis. Moreover, the two climates are entirely different. In the mountainous country of Persia the breezes might be welcomed, but in Mesopotamia the heat is so intense that every precaution has to be taken to protect the inmates of the house or palace. Thick walls and vaults were a necessity in Nineveh, and even the windows or openings must have been of small dimensions. No windows have been found, nor are any shown on the bas-reliefs, except on the upper parts of towers. It is possible therefore that the light was admitted through terra-cotta pipes or cylinders, of which many were found on the site, and this is the modern system of lighting the dome in the East. Although no remains have ever been found of domes in any of the Assyrian palaces, the representation of many domical

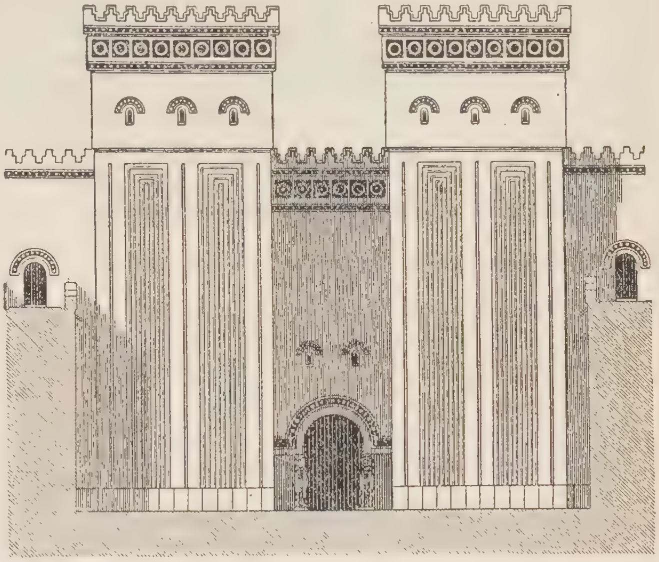


FIG. 9.—Entrance gateway, Palace of Khorsabad.

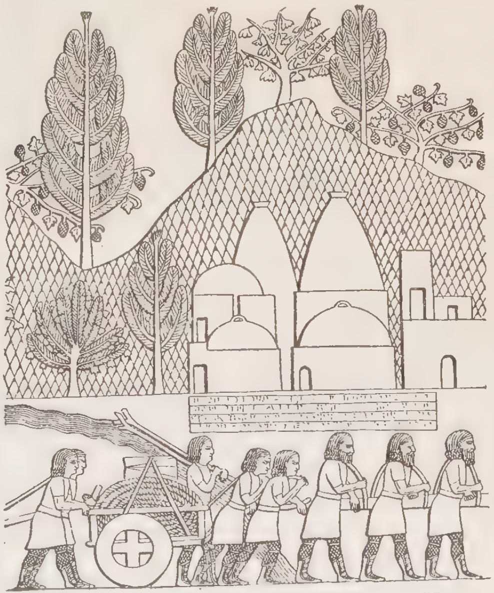


FIG. 10.—Bas-relief of group of buildings at Kuyunjik. (After Layard.)

forms is given in a bas-relief found at Kuyunjik (fig. 10), suggesting that the dome was often employed to roof over their halls.

Reference has already been made to the bas-reliefs which decorated the lower portion of the great halls; the less important rooms had their walls covered with stucco and painted. Externally the architectural decoration was of the simplest kind; the lower portion of the walls was faced with stone; and the monumental portals, in addition to the winged bulls which flanked them, had deep archivolts in coloured enamels on glazed brick, with figures and rosettes in bright colours. A similar decoration would seem to have been applied to the crenellated battlements, which crowned all the exterior walls, as also those of the courts. The buttresses inside the courts, and the towers which flanked the chief entrance, were decorated with vertical semicircular mouldings of brick. This system of decoration is also found in the ziggurats or observatories behind the harem, where the three lower storeys still exist. A winding ramp was carried round this tower, the storeys of which were set back one behind the other, the burnt brick paving of the ramp and the crenellated battlements forming a parapet, portions of which are still *in situ*.

Although not unknown in either Chaldaea or Assyria, the stone column, according to Perrot and Chipiez, found no place in those structures of crude brick of which the real architecture of Mesopotamia consisted. Only one example in stone, in which the shaft and capital together are 3 ft. 4 in. in height, has been found. Two bases of similar design to the capital are supposed to have supported wooden columns carrying an awning. There are representations in the bas-reliefs of kiosks in a garden, the columns in which, with volute capitals, are supposed to have been of wood sheathed in metal, and on the bronze bands of the Balawat gates in the British Museum are representations of the interior of a house with wood columns and bracket capitals, and several awnings carried by posts. Small windows are shown in some of the bas-reliefs, with balustrades of small columns, which were doubtless copied from the ivory plaques found at Nimrud and now in the British Museum. (R. P. S.)

PERSIAN ARCHITECTURE

The origin of Persian architecture must be sought for in that of the two earlier dynasties,—the Assyrian and Median, to whose empire the Persian monarchy succeeded by conquest in 560 B.C. From the former, it borrowed the raised platform on which their palaces were built, the broad flights of steps leading up to them and the winged human-headed bulls which flank the portals of the propylaea. Fro Media it would seem to have derived the great halls of columns an the porticoes of the palaces, so clearly described by Polybius (x. 2 as existing at Ecbatana; the principal difference being that th columns of the stoas and peristyle, which there consisted of ceda and cypress covered with silver plates, were in the Persian palace built of stone. The ephemeral nature of the one material, and th intrinsic value of the other, are sufficient to account for their enti disappearance; but as Ecbatana was occupied by Darius an Xerxes as one of their principal cities, the stone column, bases an capitals, which still exist there, may be regarded as part of th restoration and rebuilding of the palace; and as they are similar t those found at Persepolis and Susa, it is fair to assume that the sourc of the first inspiration of Persian architecture came from the Medians especially as Cyrus, the first king, was brought up at the court Astyages, the last Median monarch.

The earliest Persian palace, of which but scanty remains hav been found, was built at Pasargadae by Cyrus. There is sufficien however, to show that it was of the simplest kind, and consisted of central hall, the roof of which was carried by two rows of ston columns, 30 ft. high, and porticoes *in antis* on two if not on thre sides.

The great platform, also at Pasargadae, known as the Takht-i Suleiman, or throne of Solomon, covered an area of about 40,00 sq. ft., and is remarkable for the beauty of its masonry and the larg stones of which it is built. These are all sunk round the edge, bein the earliest example of what is known as "drafted masonry," whic at Jerusalem and Hebron gives so magnificent an effect to the grea walls of the temple enclosures. No remains have ever been trace on this platform of the palace which it was probably built to support

We pass on therefore to Persepolis, the most important of th Persian cities, if we may judge by the remains still existing there Here, as at Pasargadae, builders availed themselves of a natura rocky platform, at the foot of a range of hills, which they raised i parts and enclosed with a stone wall. Here the masonry is no drafted, and the stones are not always laid in horizontal courses but they are shaped and fitted to one another with the greates accuracy, and are secured by metal clamps. The plan (fig. 11 shows the general configuration of the platform on which the palace of Persepolis are built, which covered an area of about 1,600,00 sq. ft. The principal approach to it was at the north-west end, u a magnificent flight of steps (A) with a double ramp, the steps bein 22 ft. wide, with a tread of 15 in. and a rise of 4, so that they could b

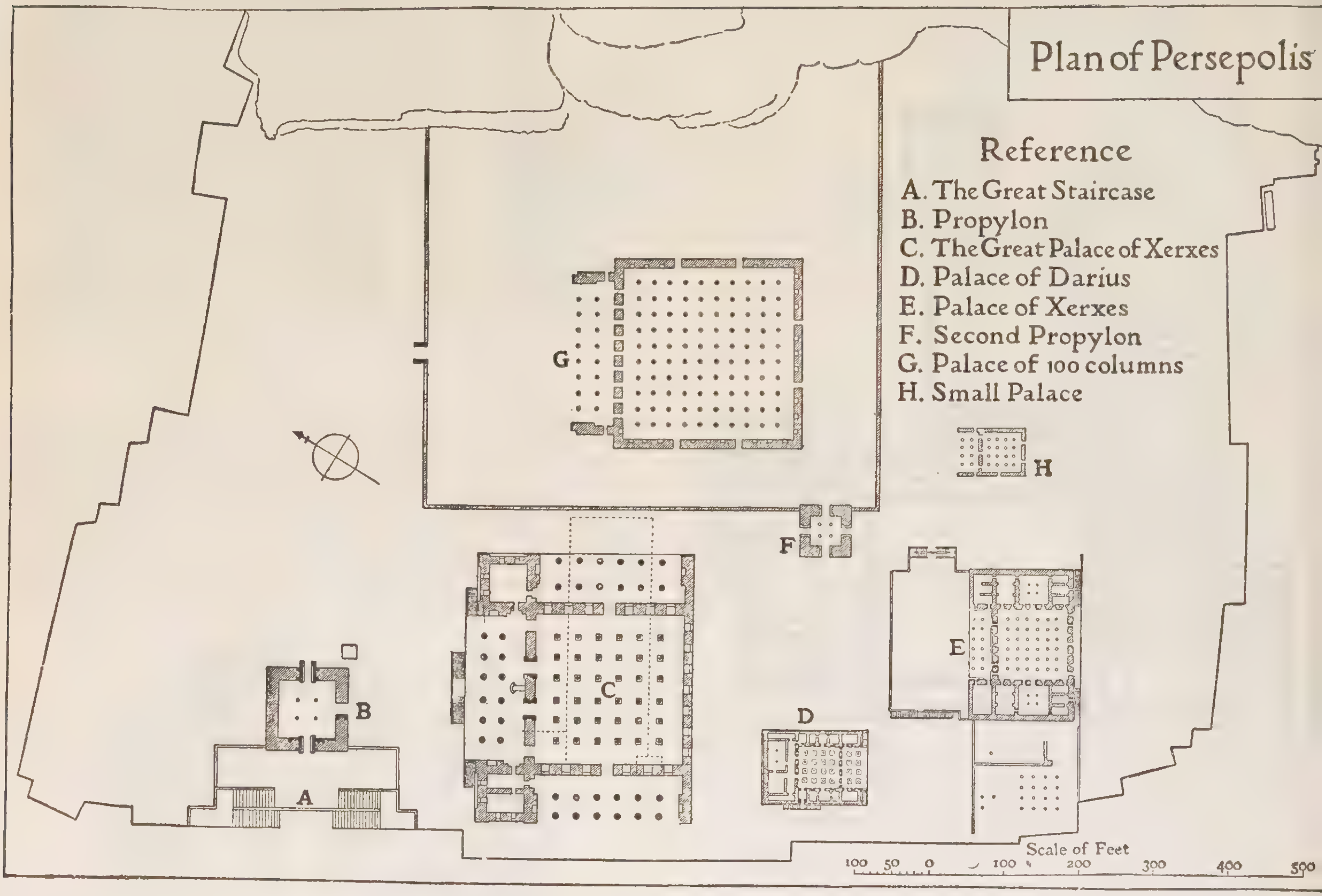


FIG. 11.

ascended by horses. The first building opposite this staircase was the entrance gateway or propylaea (B), a square hall, with four columns carrying the roof and with portals in the front and rear flanked by winged bulls. The earliest palace on the platform (D) is that which was built by Darius, 521 B.C. It was rectangular on plan, raised on a platform approached by two flights of steps, and consisted of an entrance portico of eight columns, in two rows of four placed *in antis*, between square chambers, in which were probably staircases leading to the roof. This portico led to the great hall, square on plan, whose roof was carried by sixteen columns in four rows. This hall was lighted by two windows on each side of the central doorway, all of which, being in stone, still exist, the lintels and jambs of both doors and windows being monolithic. The walls between these features, having been built in unburnt brick, or in rubble masonry with clay mortar, have long since disappeared. There were other rooms on each side of the hall and an open court in the rear. The bases of the columns of the portico still remain *in situ*, as also one of the antae in solid masonry; and as these in their relative position and height are in exact accordance with those represented on the tomb of Darius (fig. 12) and other tombs carved in the rock near Persepolis (*q.v.*), there is no difficulty in forming a fairly accurate conjectural restoration of the same. In the representation of this palace, as shown on the tomb, and above the portico, has been sculptured the great throne of Darius, on which he sat, rendering adoration to the Sun god.

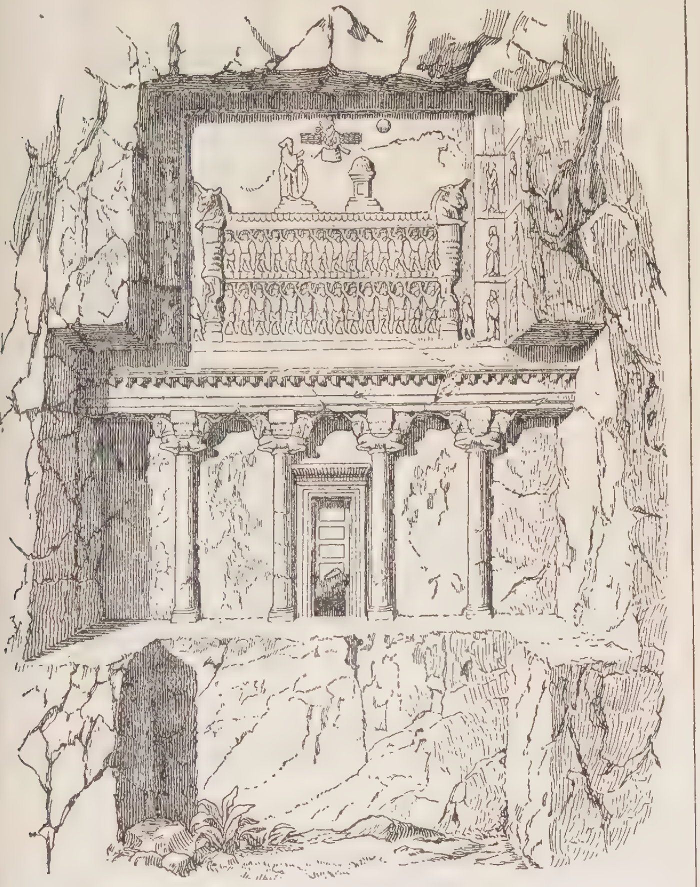
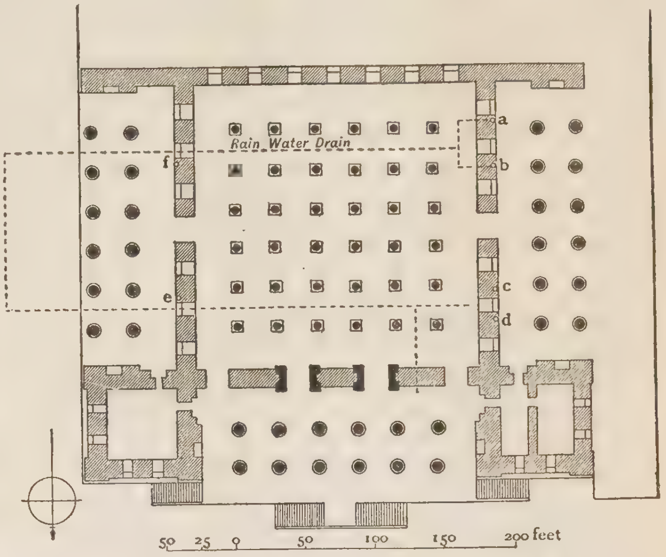


FIG. 12.—The Tomb of Darius, cut in the cliff at Nakshi Rustam, near Persepolis.

All the other palaces on the site, built or added to by various monarchs and at different periods, preserve very much the same plan, consisting always of a great square hall, the roof of which was carried by columns, with one or more porticoes round, and smaller rooms and courts in the rear. In one of the palaces (G) the roof was carried by 100 columns in ten rows of ten each. The most important building, however, and one which from its extent, height and magnificence, is one of the most stupendous works of antiquity, is the great palace of Xerxes (C), which, though it consists only of a great central hall and three porticoes, covered an area of over 100,000 sq. ft., greater than any European cathedral, those of Milan and St Peter's at Rome alone excepted.

It was built on a platform raised 10 ft. above the terrace and approached by four flights of steps on the north side, the principal entrance. The columns of the porticoes and of the great hall were 65 ft. high, including base and capital. In the east and west porticoes the capitals consist only of the double bull or griffin; the cross corbels on their backs, similar to those shown on the tomb of Darius, have disappeared, being probably in wood. In the north or entrance portico, and in the great hall, the capitals are of a much more elaborated nature, as under the double capital was a composition of Ionic capitals set on end, and below that the calix and pendant leaves of the lotus plant. It can only be supposed that Xerxes, thinking the columns of the east portico required more decoration, instructed his architects to add some to those of the entrance portico and hall, and that they copied some of the spoils brought from Branchidae and others from Egypt.

Fig. 13 shows the plan of the palace according to the researches of Mr Weld Blundell, who found the traces of the walls surrounding the great hall and of the square chambers at the angles, and also proved that the lines of the drains as shown in Coste's and Texier's plans were incorrect. M. Dieulafoy also traced the existence of walls enclosing the Apadana at Susa from the paving of the hall and the portico which stopped on the lines of the wall. The plan of the palace at Susa was similar to that of the palace of Xerxes, except that on the side facing the garden facing south the apadana or throne room was left open. M. Dieulafoy's discoveries at Susa of the frieze of archers, the frieze of the lions, and other decorations of the walls flanking the staircase, all executed in bright coloured enamels on concrete blocks, revealed the exceptional beauty of the decoration both externally and internally applied to the Persian palaces.



From R. P. Spiers's *Architecture, East and West.*

FIG. 13.—Plan of the Hall of Xerxes.

The only other monumental works of Persian architecture are the tombs; to those cut in the solid rock, of which there are some examples, we have already referred. The most ancient tomb is that erected to Cyrus the Elder at Pasargadae, and consists of a small shrine or cella in masonry raised on a series of steps, inspired (according to Fergusson) by the ziggurat or terrace-temples of Assyria, but on a small scale. The tomb was surrounded on three sides by porticoes of columns. There are two other tombs, one at Persepolis and one at Pasargadae—small square towers with an entrance opening high up on one side, sunk panels in the stone, and a dentil cornice, copied from early Ionian buildings. (R. P. S.)

GREEK ARCHITECTURE

Prehistoric Period.—We have now to retrace our steps and go back to the prehistoric period of Greek architecture, to the origin and early development of that style which sowed the seed and determined the future form and growth of all subsequent European art.

The discoveries in Crete and Argolis have shown that Greek architecture owes much less than was at one time supposed to Egyptian and Chaldaean architecture; and although from very early times there may have been a commercial exchange between the several countries, the objects imported suggested only new and various schemes of decorative design, and exercised no influence on the development of architectural style. The remains of the palace at Cnossus in Crete, together with the representations in fresco painting and other decorative objects, show that whilst the lower part of the walls under the level of the ground and up to a height of 5 ft. above were all built in well-worked masonry, the upper portions were constructed in unburnt brick with timber framing, which not only gave strength and solidity to the walls, but carried the cross beams and timbers of intermediate floors and the roof, and further, that the walls were always vertical, which was not the case in Egypt or Chaldaea.

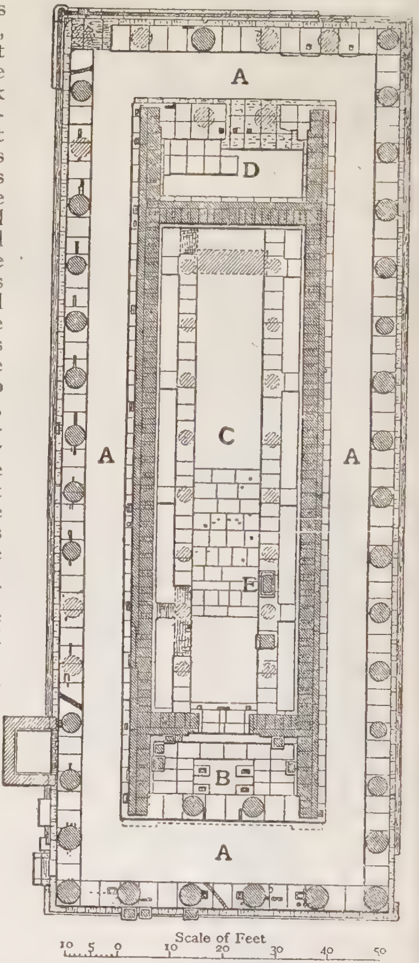
The principal remains discovered by Dr Arthur J. Evans (see CRETE) are described by him as belonging to the later Minoan age, from which it may be inferred they are the result of some centuries of previous development. What, however, is most remarkable is the admirable planning of the whole palace, the bringing together, under one roof and in proper and regular intercommunication, of the numerous services, which in a palace are somewhat complicated. The palace measured about 400 ft. square, and was built round an open court, nearly 200 ft. long by 90 ft. wide; as the same arrangement was found at Phaestus, excavated by the Italian archaeologists, it may be assumed to have been the Cretan plan. It was built on the crest of a hill, and in the western or highest portion was the court entrance from the agora to the megaron or throne-room, and the halls of the officers of the state. In the lower portion facing the east (the rooms in which were two storeys below the level of the court on account of the slope of the hill) was the private suite of apartments of the king and queen. All the services of the palace were at the north end of the palace, where the entrance gateway to the central court was situated. This northern entrance, Dr Evans points out, "represents the main point of intercourse between the palace and the city on the one hand and the port on the other." This is the only part of the palace in which there is evidence of some kind of fortification, as the road of access is dominated by a tower or bastion. Other provisions also in the plan of the western entrance suggest that its passage was guarded to some extent. In this respect the palace of Tiryns, excavated by Dr Schliemann, presents an entirely different aspect; the whole stronghold bears a singular resemblance to a fortified castle of the middle ages; a high wall from 24 to 50 ft. thick surrounded the acropolis, and the inclined paths of approach and the double gateways gave that protection at Tiryns which at Cnossus was assured, as Dr Evans remarks, by the bulwarks of the Minoan navy. The area on the spur of the hill, on which the citadel of Tiryns was placed, was very much smaller, but if we accept the forecourt at Tiryns as equivalent to the great central court at Cnossus, there are great similarities in the plans of the two palaces. The propylaea, the altar court, the portico, and the megaron are found in both, and those details which are missing in the one are found in the other. The discoveries at Cnossus have enabled Dr Evans to reconstitute the timber columns, of which the bases only were found at Tiryns, and the spur walls of the portico of the megaron and the sills of the doorways at Tiryns give some clue to the restoration of similar features at Cnossus; and if in the latter palace we find the origin of the Doric column, at Tiryns is found that of the antae and of the door linings, further substantiated by the careful analysis made by Dr Dörpfeld of the Heraeum at Olympia.

The reconstruction by Dr Evans of the timber columns at Cnossus, which tapered from the top downwards, the lower diameter being about six-sevenths of the upper, has little historical importance (see ORDER), so that we may now pass on to the next early monument of importance, the tomb of Agamemnon, the principal and the best preserved of the beehive tombs found at Mycenae and in other parts of Greece. This tomb consists of three parts, the *dromos* or open entrance passage, the *tholos* or circular portion domed over, and a smaller chamber excavated in the rock and entered from the larger one. The tomb was subterranean, the masonry being concealed beneath a large mound of earth. The domed part, 48 ft. 6 in. in diameter and 45 ft. high, is built in horizontal courses of stone, which project one over the other till they meet at the top. Subsequently the projecting edges were dressed down, so that the section through the dome is nearly that of an equilateral triangle. Notwithstanding the great thickness of the lintel (3 ft.) over the entrance doorway, the Mycenaeans left a triangular void over, to take off the superincumbent weight, subsequently (it is supposed) filled with sculpture, as in the Lions' Gate at Mycenae. The doorway was flanked by semi-detached columns 20 ft. high, the shafts of which tapered downwards like those reconstituted at Cnossus; the shafts rested on a base of three steps, and carried a capital with echinus and abacus. These shafts carried a lintel which has now disappeared; the wall above was set back, and was at one time faced with stone slabs carved with spiral and other patterns, of which there are fragments in various museums, the most important remains being those of the shafts, of which the greater part, which was brought over to England in the beginning of the 19th century by the 2nd marquess of Sligo, was presented by the 5th marquess to the British Museum in 1905. These shafts, as also the echinus moulding of the capitals, are richly carved with the chevron and spirals, probably copied from the brass sheathing of wood columns and doorways referred to by Homer.

The Archaic Period.—The buildings just referred to belong to what is known as the prehistoric age in Greece; the dispersion of the tribes by invaders from the north about 1100 B.C. destroyed the Mycenaean civilization, and some centuries have to pass before we reach the results of the new development. Among the invaders the Dorians would seem to have been the chief leaders, who eventually became supreme. They brought with them from Olympus the worship of Apollo, so that henceforth the sanctuary of the god takes the place of the megaron of the king. From Greece the Dorians spread their colonies through the Greek islands and southern Italy. Later they passed on to Sicily and founded Syracuse, and subsequently Selinus and Agrigentum (Acragas). The prosperity of all these colonies is shown in the splendid temples which they built in stone, the remains of many of which have lasted to our day.

The earliest Greek temple of which remains have been discovered[1] is that of the Heraeum at Olympia, ascribed to about 1000 B.C. Its plan (fig. 14) shows that the enclosure of the sanctuary and its porticoes in a peristyle had already been found necessary, if only to protect the walls of the cella, built in unburnt brick on a stone plinth; further, that the antae of the portico and the dressings of the entrance were in wood; and, following Pausanias' statement relative to the wood column in the opisthodomos, all the columns of the peristyle were in that material, gradually replaced by stone columns as they decayed, evidenced by the character of their capitals, which in style date from the 6th century B.C. to Roman times. The ephemeral nature of the materials employed in this and other early temples, and the risk of fire, must have naturally led to the desire to render the Greek sanctuaries more permanent by the employment of stone. But the Greeks were always timid as regards the bearing value of that material, and would seem to have imagined that unless the blocks were of megalithic dimensions it was impossible to build in stone. This may be gathered from the remains of the earliest example found, the temple of Apollo in the island of Ortygia, Syracuse, where the monolith columns had widely projecting capitals, the abaci of which were set so close together that the intercolumniation was less than one diameter of the column.

Following the temple of Apollo at Syracuse is the temple of Corinth, ascribed to 650 B.C., of which seven columns remain *in situ*, all monoliths, and the Olympieum at Syracuse. Nearly contemporary with the latter is one of the temples at Selinus in Sicily, 630 B.C., remarkable for the archaic nature of its sculptured metopes. Of later date there are five or six other temples in Selinus, all overthrown by earthquakes; the temple of Athena at Syracuse, which having been converted into a church is in fair preservation; an unfinished temple at Segesta; and six at Agrigentum, built on the brow of a hill facing the sea, one of which was so large that it was necessary to build in walls between the columns.



From Curtius and Adler's *Olympia*, by permission of Behrend & Co.

FIG. 14.—Plan of the Heraeum. A, Peristyle; B, Pronaos; C, Naos; D, Opisthodomus; E, Base of statue of Hermes.

In Magna Graecia, in the acropolis at Tarentum, are the remains of a 7th century temple and three at Paestum about a century later in date. In one of these, the temple of Poseidon (figs. 15 and 16) the columns which carried the ceiling and roof over the cella are still standing; these are in two stages superimposed with an architrave between them, and although there are no traces in this instance of a gallery, they serve to render more intelligible Pausanias' description of that which existed in the temple of Zeus at Olympia.

The temple of Assus in Asia Minor is an early example remarkable for its sculptured architrave, the only one known, and in the temple of Aphaea in Aegina (*q.v.*) we find the immediate predecessor of the Parthenon, if we may judge by its sculpture and the proportions of its columns.

So far we have only referred to the early temples of the Doric order; of the origin and development of those of the Ionic order far less is known. The earliest examples are those of the temple of Apollo at Naucratis in Egypt, and of the archaic temple of Diana at Ephesus, both about 560 B.C. The remains of the latter, discovered by Wood, are now in the British Museum; they consist of two capitals, one with a portion of a shaft in good preservation; the sculptured drum and the base of one of the columns, inscribed with the name of Croesus, who is known to have contributed to it;

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[1] Except, possibly, the earliest of those at Sparta (*q.v.*).—ED.

two other bases, and the cornice or cymatium. The treasury of the Cnidians at Delphi was Ionic, judging by the carved ornament enriching the cornice and architraves, and in the Naxian votive column we have another early example of an early voluted capital.

The tombs of Tantalais, near Smyrna, and of Alyattes, near Sardis, belong to the same date as those we shall find in Etruria. The Harpy tomb, now in the British Museum, built after 547 B.C., is the predecessor of many other Lycian tombs of the 5th and 4th centuries, to which we return.

As already pointed out, in the temple of Hera at Olympia (10th century B.C.), we find the complete plan of an hexastyle peripteral Greek temple, where columns originally in wood supported a wood architrave and superstructure protected by terra-cotta plaques and roofed over with tiles. The temple of Apollo at Syracuse, and the temple at Corinth (7th century B.C.) represent the earliest examples in stone, and in the temple of Poseidon at Paestum (6th century) are preserved the columns of the cella which carried the ceiling and roof. The structural development therefore of the temple was completed, and no great constructional improvements reveal themselves after 550 B.C. The next century would seem to have been chiefly directed to the beautifying and refining of the features already prescribed, and it was the traditional respect for, and the conservative adherence to, the older type, which led the architects to the production of such masterpieces as the Parthenon and the Erechtheum, which would have been impossible but for the careful and logical progression of preceding centuries.

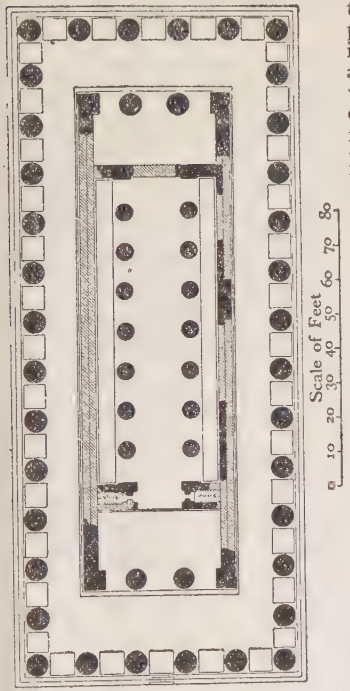


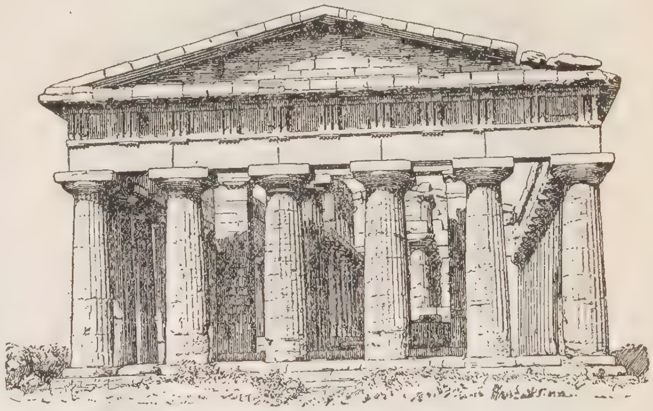
FIG. 15.—Plan of the Temple of Poseidon at Paestum.

The Parthenon (*q.v.*) at Athens represents the highest type of perfection, not only in its conception but in its realization. It is only necessary here to give a general description. It was designed by Ictinus in collaboration with Callicrates, and built on the south side of the Acropolis on a foundation carried down to the solid rock. The temple, commenced in 454 B.C. and completed in 438 B.C., was of the Doric order and raised on a stylobate of three steps; it had eight columns in front and rear and was surrounded by a peristyle, there being twenty columns on the flanks. It contained two divisions; the eastern chamber was originally known as the Hekatompedos (temple of 100 ft.), that being the dimension of the cella of the ancient temple which it was built to replace. The chamber on the western side was called the Parthenon (*i.e.* chamber of the virgin). All the principal lines of the building had delicate curves. The entablature rose about 3 in. in the middle to correct an optical illusion caused by the sloping lines of the pediment, which gave to the horizontal cornice the appearance of having sunk in the centre. The stylobate had therefore to be similarly curved so that the columns should be all of the same height. The columns are not all equidistant, those nearer the angle being closer together than the others, which gave a greater appearance of strength to the temple; this was increased by a slight inclination inwards of all the columns. In order to correct another optical illusion, which causes the shaft of a column, when it diminishes as it rises, and is formed with absolute straight lines, to appear hollow or concave, an increment known as the entasis was given to the column, about one-third up the shaft. The columns were not monoliths, like those of the earliest stone temples mentioned above; they were built in several drums, so closely fitted together that the joint would be imperceptible but for the slight discoloration of the marble. The setting of the lowest drum of these columns on the curved stylobate, with the slight inclination of the column, must have been a work of an extraordinary nature, only possible with such a material as Pentelic marble. The cella or naos was built to enshrine the chryselephantine statue of Athena by Pheidias. In order to carry the ceiling and roof there was a range of columns on each side of the cella returning round the end. These columns probably carried an upper range as in the temple of Poseidon at Paestum. The tympana of the two pediments and all the metopes were enriched with the finest sculpture, and were realized, designed, and executed by Pheidias and his pupils. On the upper part of the cella wall and under the peristyle was the Panathenaic frieze, of which, as also of the other sculptures, the British Museum possesses the finest examples.

The Propylaea (*q.v.*), designed by Mnesicles and built 437–432 B.C., was the only entrance to the Acropolis. It was of the Doric order, and consisted of a portico of six columns, the two centre ones being wider apart, to allow of the road through, up which the chariots and beasts for sacrifices ascended. The columns carrying the marble ceiling of the vestibule were of the Ionic order; beyond them the wall was pierced by three doorways, and on the other side and facing east was another portico of six columns. The front entrance was flanked on the left hand by a chamber known as the Pinacotheca, and on the right by a chamber intended probably to be a replica but subsequently curtailed in size in consequence of the proximity of another temple.

The Erechtheum on the north side of the Acropolis occupied the site of three older shrines, which may account for its irregular plan. The eastern portion was the temple of Athena Polias, with a portico of six columns of the Ionic order. At a lower level on the north side was a portico of six columns (four in front and two at the sides) leading to the shrine of Erechtheus; the west front of this shrine had originally a frontispiece of four columns *in antis* raised on a podium; subsequently during the Roman occupation these columns were taken down and reproduced as semi-detached columns with windows between. On the west side was a court in which was the olive tree and the shrine of Pandrosus (Pandroseion). At the south-west angle was the well-known portico or tribune of the Caryatides. There was a small entrance through the podium at the side, and stairs leading down to the shrine of Erechtheus.

The only other building remaining on the Acropolis is the temple of Niké Apteros, raised on a lofty substructure south-west of the propylaea. It also was of the Ionic order, and belonged to the type known as "amphiprostyle," with a portico of four columns in the front and rear but no peristyle. The term "apteros" applied to the temple and not to the goddess of victory.



From a photo by Brogi.

FIG. 16.—Temple of Poseidon at Paestum.

In 430 B.C., shortly after the completion of the Parthenon, Ictinus was employed to design the temple of Apollo Epicurius, at Bassae, in Arcadia. This temple externally was of the Doric order, but, being built in local stone, no attempt was made to introduce those refinements which are found in the Parthenon. In the rear of the cella is a second sanctuary with a doorway facing east; it was probably the site of an ancient temple which had to be preserved, and this may account for the fact that the temple runs north and south. The cella is flanked by five columns of the Ionic order which are connected by spur walls to the cella wall. These columns carry an architrave, frieze richly sculptured with figure subjects, cornice and wall above rising to the roof. There was no ceiling therefore, and the interior was probably lighted through pierced Parian marble tiles, of which three examples were found. The Corinthian capital found on the site is supposed by Cockerell to have belonged to the shaft between the two cellas.

The same architect, Ictinus, was employed in 420 B.C. to rebuild the hall of the mysteries at Eleusis on a larger scale. The hall was 185 ft. square, and its ceiling and roof were carried by seven rows of columns with six in each row. The propylaea, which gave access to the sacred enclosure at Eleusis, was copied from the propylaea at Athens. The so-called lesser propylaea had some connexion with the mysteries.

The temple of Zeus at Olympia had much in common with the Parthenon, being nearly contemporaneous, built to enshrine a second chryselephantine statue by Pheidias, and in plan having a similar arrangement of columns inside the cella; the lower range of columns (according to Pausanias) supported a gallery round, so that privileged visitors could approach nearer to the statue. The temple, however, was built in the local conglomerate stone covered with a thin coat of stucco and painted.

Of circular temples there are two examples known, the Philippeion at Olympia and the Tholos at Epidaurus. The latter had, inside the cella, a peristyle of Corinthian columns, the capitals of which are of great beauty and represent in their design the transition between those of the monument of Lysicrates and the temple of Zeus Olympius at Athens.

In the sacred enclosures of the Greek sanctuaries were other smaller temples or shrines, altars, statues and treasuries, the latter being built by the various cities, from which pilgrimages were made, to contain their treasures. At Olympia there were ten or eleven, the remains of some of which are of great interest. Of the treasury of the Cnidians at Delphi, discovered by the French, so much has been found that it has been possible to evolve a complete conjectural restoration in plaster, now in the Louvre. Its sculpture and the rich carving of its architectural features show that it was Ionian in character. In front was a portico-in-antis, in which the caryatide figures standing on pedestals took the place of columns. These are the earliest examples known of caryatide figures, and they precede those of the Erechtheum by about a century.

The most important temple in Asia Minor was the temple of Diana (Artemis) at Ephesus (356–334 B.C.). The archaic temple was burnt in 356, and was immediately rebuilt with greater splendour from the designs of Paeonius. The site of the temple was discovered by Wood in 1869, and the remains brought over to the British Museum in 1875. There were 100 columns, 36 of which (according to Pliny) were sculptured, and it was probably on account of the magnificence of the sculpture that this temple was included among the seven wonders of the world. The sculptured bases are of two kinds, square and circular, in the latter case being the lower drums of the columns. Examples of both are in the British Museum, and several conjectural restorations have been made, among which that of Dr A. S. Murray has been generally accepted, but recent researches (1905) suggest that it remains still an unsolved problem.

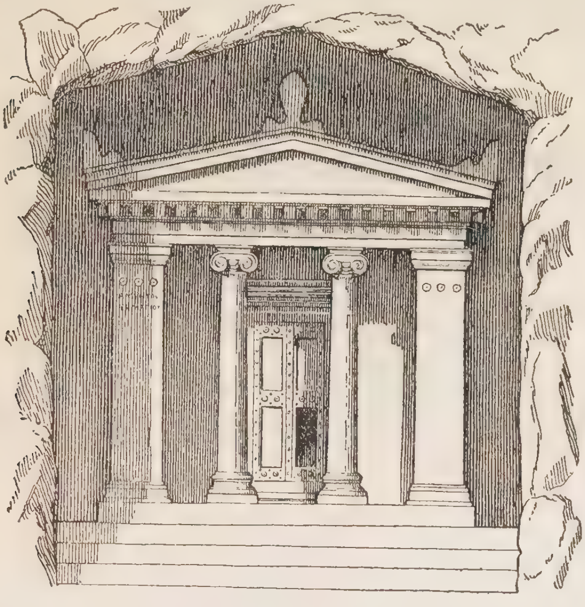


Fig. 17.—Lycian Tomb of Telmessus.

The temple of Apollo Didymaeus, near Miletus, was the largest temple in Asia Minor, and its erection followed that of the temple at Ephesus, Paeonius and Daphnis of Miletus being the architects. The temple was decastyle, dipteral, with pronaos and vestibule, but no opisthodomos. The cella was so wide (75 ft.) that it remained open to the sky. The bases of the columns were elaborately carved with ornament, as if in rivalry with the temple of Diana. Both these temples were of the Ionic order, as also were those of Athena Polias at Priene (340 B.C.), many of the capitals of which are in the British Museum, and the temples of Aphrodite at Aphrodisias and Cybele at Sardis.

The mausoleum at Halicarnassus, also of the Ionic order, built by Queen Artemisia in memory of her husband Mausolus, who died in 353 B.C., was, according to Pliny, recorded as one of the seven wonders of the world, probably on account of the eminence of the sculptors employed, Bryaxis, Leochares, Timotheus, Scopas and Pythius. Pliny's description is somewhat vague, so that its actual design is a problem not yet solved. Professor Cockerell's restoration is in accord with the description, but does not quite agree with the actual remains brought over by Newton and deposited in the British Museum. If the Nereid monument and the tombs at Cnidus and Mylasa be taken as suggesting the design, the peristyle (pteron) of thirty-six columns of the Ionic order with entablature stood on a lofty podium, richly decorated with bands of sculpture, and was crowned by a pyramid which, according to Pliny, "contracted itself by twenty-four steps into the summit of a meta." The steps found are not high enough to constitute a meta, and it is possible therefore that, according to Mr J. J. Stevenson, these steps were over the peristyle only, and that the lofty steps which constituted the meta were in the centre, carried by the inner row of columns. The magnificent sculpture of the Macedonian period has in recent times been demonstrated by the discovery of the marble sarcophagi found at Sidon by Hamdi Bey and now in the museum at Constantinople.

The Lycian tombs, of which there are many hundreds carved in the rock in the south of Asia Minor, are copies of timber structures, based on the stone architecture of the neighbouring Greek cities (fig. 17). The Paiafa or Payava tomb (375–362 B.C.), found at Xanthus and now in the British Museum, is apparently a copy, cut in the solid rock, of a portable shrine, in which the wood construction is clearly defined.

Capitals of the Greek Corinthian order have been found at Bassae, Epidaurus, Olympia and Miletus, but the earliest example of the complete order is represented in the Choragic monument of Lysicrates at Athens.

The most important example of the Greek Corinthian order is that of the temple of Jupiter Olympius at Athens, begun in 174 B.C., but not completed till the time of Hadrian, A.D. 117. The temple was 135 ft. wide and 354 ft. long, built entirely in Pentelic marble, the columns being 56 ft. high. There were eight columns in front and a double peristyle round.

The two porches of the Tower of the Winds at Athens (*c.* 75 B.C.) had Corinthian capitals. The upper part of the tower, which was octagonal in plan, was sculptured with figures representing the winds.

The Greek houses discovered at Delos and Priene were very simple and unpretentious, but the palace near Palatitza in Macedonia, discovered by Messrs Heuzey and Daumet, would seem to have been of a very sumptuous character. The front of the palace measured 250 ft. In the centre was a vestibule flanked with Ionic columns on either side, leading to a throne room at one time richly decorated with marble, and with numerous other halls on either side. The date is ascribed to the middle of the 4th century B.C.

In selecting the sites for their theatres, the Greeks always utilized the slope of a hill, in which they could cut out the cavea, and thus save the expense of raising a structure to carry the seats, at the same time obtaining a beautiful prospect for the background. The theatre of Dionysus at Athens was discovered and excavated in 1864, and has fortunately preserved all the seats round the orchestra, sixty-seven in number, all in Pentelic marble, with the names inscribed thereon of the priests and dignitaries who occupied them. The largest theatre was at Megalopolis, with an auditorium 474 ft. in diameter. The most perfect, so far as the seats are concerned, is the theatre at Epidaurus, with a diameter of 415 ft. Other theatres are known at Dodona in Greece, Pergamum and Tralles in Asia Minor, and Syracuse and Segesta in Sicily. (R. P. S.)

Parthian Architecture

The architecture of the Parthian dynasty, who from 250 B.C. to A.D. 226 occupied the greater part of Mesopotamia, their empire in 160 B.C. extending over 480,000 sq. m., was quite unknown until Sir A. H. Layard, following in the steps of Ross and Ainsworth, visited and measured the plan of the palace at Hatra (el Hadr) about 30 m. south of Mosul; the architecture of this palace shows that, on the one hand, the Parthians carried on the traditions of the barrel vault of the Assyrian palace, and on the other, from their contact with Hellenistic methods of building, had acquired considerable knowledge in the working of ashlar masonry.

El Hadr is first mentioned in history as having been unsuccessfully besieged by Trajan in A.D. 116, and it is recorded to have been a walled town containing a temple of the sun, celebrated for the value of its offerings. The temple referred to is probably the large square building at the back of the palace, as above the doorway is a rich frieze carved with griffins, similar to those found at Warka by Loftus, together with large quantities of Parthian coins. The remains (fig. 18) consist of a block of 380 ft. frontage, facing east, and 128 ft. deep, subdivided by walls of great thickness, running at right angles to the main front, and built in an immense court, divided down the centre by a wall, separating that portion on the south side, where the temple was situated, from that on the north side, which constituted the king's palace. The seven subdivisions of the different widths were all covered with semi-circular barrel vaults which, being built side by side, mutually resisted the thrust, the outer walls being of greater thickness, with the same object. In the centre of the south block was an immense hall 49 ft. wide and 98 ft. deep, which formed the vestibule to the temple in the rear; this vestibule was flanked by a series of three smaller halls on either side, over which there was probably a second floor. On the palace or north side were

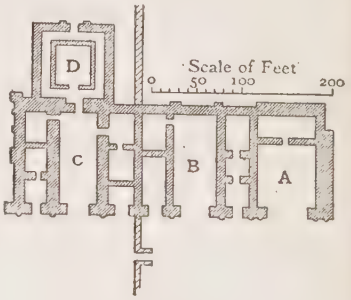


Fig. 18.—Plan of Palace of el Hadr.

A, Throne or reception room.
B, Large hall, or
C, Entrance hall of temple.
D, Temple.

two great aiwans or reception halls. The main front (fig. 19) was built in finely jointed ashlar masonry with semicircular attached shafts between the entrance doorways, which had semicircular heads, every third voussoir of the three larger doors being decorated by busts in strong relief with a headgear similar to that shown on Parthian coins; other carvings, with the acanthus leaf, belonged to that type of Syrio-Greek work, of which Loftus found so many examples at Warka (Loftus, *Chaldaea, Susiana*, p. 225). In the great mosque of Diarbekr are two wings at the north and south ends respectively, which are said to have been Parthian palaces built by Tigranes, 74 B.C.; they have evidently been rearranged or rebuilt at various times, the columns with their capitals and the entablature having been utilized again. The shafts of the columns of the upper storey are richly carved with geometrical patterns similar to those found by Loftus at Warka.

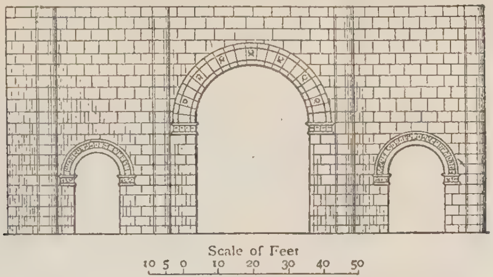
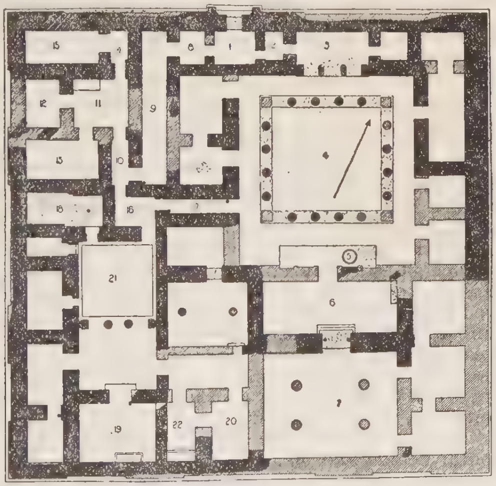


FIG. 19.—Portion of front of Palace of el Hadr.

The American researches at Nippur have resulted in the discovery on the top of the mounds of the remains of a Parthian palace; and the disposition of its plan (fig. 20), and the style of the columns of the peristylar court, show so strong a resemblance to Greek work as to suggest the same Hellenistic influence as in the palace of el Hadr. Having no stone, however, they were obliged to build up these columns at Nippur with sections in brick, covered afterwards with stucco. The columns diminished at the top to about one-fifth of the lower diameter, and would seem to have had an entasis, as the lower portion up to one-third of the height is nearly vertical. A similar palace was discovered at Tello by the French archaeologists, and the bases of some of the brick columns are in the Louvre. (R. P. S.)

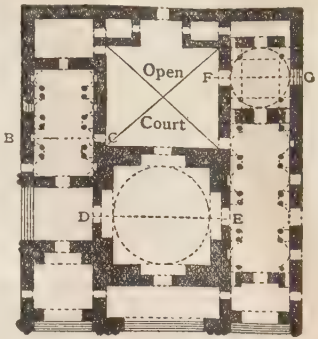


From Prof. H. V. Hilprecht's *Exploration in Bible Lands*, by permission of A. J. Holman & Co. and T. & T. Clark.

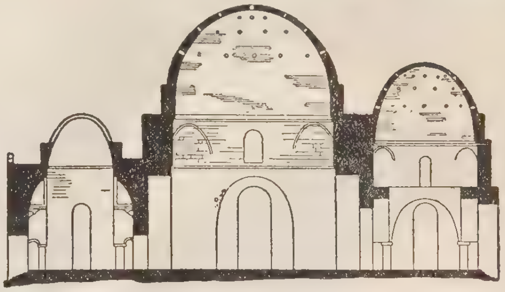
FIG. 20.—Plan of the Parthian Palace at Nippur.

SASSANIAN ARCHITECTURE

Although, on the overthrow of the Parthian dynasty in A.D. 226, the monarchs of the Sassanian dynasty succeeded to the immense Parthian empire, the earliest building found, according to Fergusson, is that at Serbistan, to which he ascribes the date A.D. 380. The palace (fig. 21), which measures 130 ft. frontage and 143 ft. deep, with an internal court, shows so great an advance in the arrangements of its plan as to suggest considerable acquaintance with Roman work. The fine ashlar work of el-Hadr is no longer adhered to, and in its place we find rubble masonry with thick mortar joints, the walls being covered afterwards, both externally and internally, with stucco. While the barrel vault is still retained for the chief entrance porches, it is of elliptical section, and the central hall is covered with a dome, a feature probably handed down from the Assyrians, such as is shown in the bas-relief (fig. 10) from Kuyunjik, now in the British Museum. In order to carry a dome, circular on plan, over a square hall, it was necessary to arch across the angles, and here to a certain extent the Sassanians were at fault, as they did not know how to build pendentives, and the construction of these are of the most irregular kind. As, however, their mortar had excellent tenacious properties, these pendentives still remain *in situ* (fig. 22), and their defects were probably hidden under the stucco. In the halls which flank the building on either side, however, they displayed considerable knowledge of construction. Instead of having enormously thick walls to resist the thrust of their vaults, to which we have already drawn attention in the Assyrian work and at el Hadr, they built piers at intervals, covering over the spaces between them, with semi-domes on which the walls carrying the vaults are supported, so that they lessened the span of the vault and brought the thrust well within the wall. This, however, lessened the width of the hall, so they replaced the lower portions of the piers by the columns, leaving a passage round. It is possible that this idea was partly derived from the great Roman halls of the thermae (baths), where the vault is brought forward on columns; but it was an improvement to leave a passage behind. The elliptical sections given to all the barrel vaults may have been the traditional method derived from Assyria, of which, however, no remains exist. In the article VAULT there will be found a reason why these elliptical sections were adopted (see also below in the description of the great hall at Ctesiphon). In the palace of Firuzabad, attributed by Fergusson to Perōz (Firuz) (A.D. 459–485), the plan (fig. 23) follows more closely the disposition of the Assyrian palaces, and we return again to the thick walls, which might incline us to give a later date to Serbistan, except that in the pendentives carrying the three great domes in the centre of the palace at Firuzabad they show greater knowledge in their construction. The angles of the square hall are vaulted, with a series of concentric arches, each ring as it rises being brought forward, the object being to save centreing, because each ring rested on the ring beneath it. The plan is a rectangular parallelogram with a frontage of 180 ft. and a depth of 333 ft., more than double, therefore, of the size of Serbistan. An immense entrance hall in the centre of the main front is flanked on each side by two halls placed at right angles to it, so as to resist the thrust of the elliptical barrel vaults of the entrance hall. This hall leads to a series of three square halls, side by side, each surmounted by a dome carried on pendentives. Beyond is an open court, the smaller rooms round all covered with barrel vaults. Here, as in Serbistan, the material employed is rubble masonry with thick joints of mortar, and fortunately portions of the stucco with which this Sassanian masonry was covered remain both externally and internally. As there are no windows of any sort, the wall surface of the exterior has been decorated with semi-circular attached shafts and panelling between, which recall the primitive decorations found in the early Chaldaean temples, except that arches are carried at the top across the sunk panels. Internally an attempt has been made to copy the decoration of the Persian doorway, which represents a kind of renaissance of the ancient style. But instead of the lintel the arch has been introduced, and the ornament in stucco representing the Persian cavetto cornice shows imperfect knowledge of the original and is clumsily worked. The niches also, in the main front, have been copied from



Plan.



Section in lines BC, DE, FG of plan.

FIG. 21 and FIG. 22.—The Palace of Serbistan.

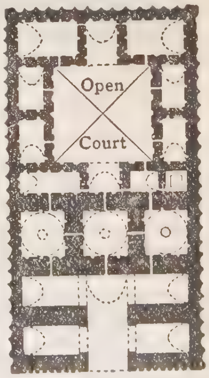
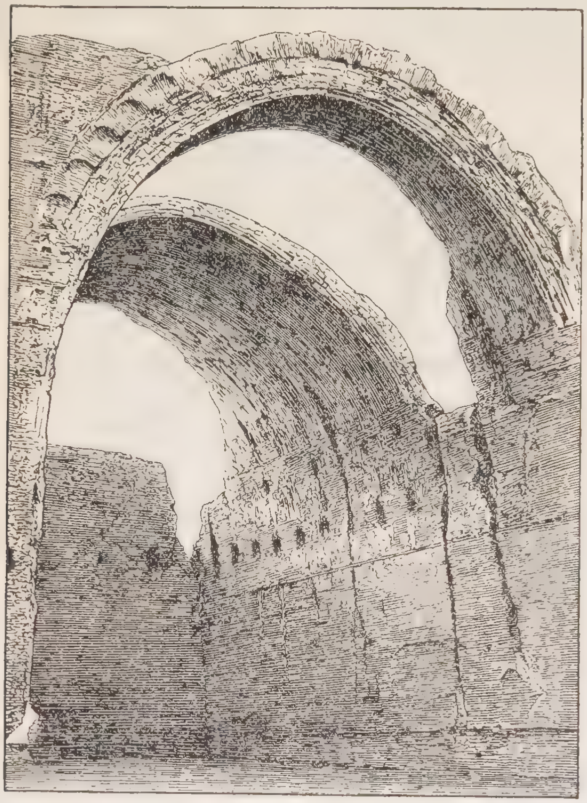


FIG. 23.—Plan of the Palace at Firuzabad.

the windows which flank the doorway in the Persian palace. But they are decorative only, and are too shallow to serve any purpose.

If there has been some difficulty in determining the exact date of Firuzabad, that of the third great palace, at Ctesiphon, on the borders of the Tigris, is known to have been built by Chosroes I. in A.D. 550. Owing probably to its proximity to Bagdad, from which it lies about 25 m. distant, it is much better known than the other examples we have quoted; but while they are constructed in rubble masonry, Ctesiphon is built of brick, because we have now returned to the alluvial plain where no stone could be procured. The only portion of the palace which still exists is that which was built in burnt brick, and this far exceeds in dimensions Serbistan and Firuzabad. Its main front measured 312 ft.; its height was about 115 ft.; and its depth 175 ft. The plan is very simple, and consisted of an *aiwan* or immense hall, 86 ft. in width and 163 ft. long, covered with an elliptical barrel vault, the thrust of which is counteracted by five long halls on each side, also covered with barrel vaults and probably used as guard chambers or stores. The great hall was open in the front, and constituted an immense portal, 83 ft. wide and 95 ft. to the crown of the arch. The springing of the vault is 40 ft. from the ground, but up to about 26 ft. above the springing the walls are built in horizontal courses projecting inwards as they rise, so that the actual width of the vaulted portion (fig. 24) has been diminished one-sixth and measures only about 71 ft. The crown of the vault is 9 ft. thick, the walls at the base being 23 ft. The bricks or tiles of which the vault is built are, like those at Thebes, laid flat-wise, and there is also a similar inclination of the rings of brick-work, which are about 10° out of the vertical. This leads to the conclusion that this immense vault was built without centreing, as the tenacious quality of the mortar would probably be sufficient to hold each tile in its position until the ring was complete. In the building of the arch of the great portal other precautions were taken; bond timbers 23 ft. long and in five rows, one above the other, were carried through the wall from front to back. The lower portion of the arch (5 ft. in height) was built with bricks placed flat-wise; the upper portion (4 ft. in height) in the usual way, viz. right angles to the face. The reason for this change was probably that the upper portions might be carved, as they have been, with a series of semi-circular cusps.



From Dieulafoy's *L'Art Antique*, by permission of Morel et Cie.

FIG. 24.—The Great Hall at Ctesiphon.

The decoration of the flanks of this great central portal is of the most bewildering description. There has evidently been a desire to give a monumental character to the main front. With this idea in view they would seem to have attempted to reproduce Roman features, such as are found decorating the fronts of the various amphitheatres of the Empire. But the semi-circular shafts which form the decoration do not come one over the other on the several storeys, and there is a reckless employment of blank arcades distributed over the surface.

There are remains of two other palaces at Imamzade and Tag Iran, and in Moab a small example, the Hall of Rabboth Ammon, supposed to have been erected for Chosroes II. during the subjugation of Palestine, which is richly decorated with carving, probably by Syrio-Greek artists, with a mixture of Greek, Jewish and Sassanian details. At Takibostan and Behistun (Bisutun), some 200 m. north-east of Ctesiphon, are some remarkable Sassanian capitals and panels (published in Flandin and Coste's *Voyage en Perse*, 1851, Paris). (R. P. S.)

Etruscan Architecture

Although our acquaintance with Etruscan architecture is confined chiefly to the entrance gateways and the walls of towns, and to tombs, it forms a very important link between the East and the West. Though little is known of the history of Etruria (*q.v.*), the influence which her people exerted on Roman architecture, lasting down to the period when Greece was overrun and plundered of her treasures, was so great that it would be difficult to follow the origin of Roman architecture without some inquiry into the work of its immediate predecessor. The theory put forward by Fergusson, as to the migration of the Etruscans from Asia Minor in the 12th or 11th century B.C., is substantiated by the resemblance of the tumuli in the latter country, such as those at Tantalais, on the northern shore of the gulf of Smyrna, and that of Alyattes near Sardis, as compared with the Regulini Galeassi tomb at Cervetri and the Cucumella tomb at Vulci, in all cases consisting of a sepulchral chamber buried under an immense mound surrounded by a podium in stone. The chamber was covered over with masonry, laid in horizontal courses, each stone projecting slightly over the one below. The same system of construction prevailed in the bee-hive tombs of Greece, except that the latter were always circular on plan, whilst these cited above were rectangular. Similar methods of construction are found at Tusculum and in a gateway at Arpino. In all these cases the projecting courses were worked off on the completion of the tomb, in Greece and at Tusculum and Arpino following a curve, and in the Regulini Galeassi tomb a raking line.

The earliest example known of the arched vault, with regular voussoirs in stone, is found in the canal of the Marta near Graviscae, ascribed to the 7th century. The vault is 14 ft. in span, with voussoirs from 5 to 6 ft. in depth. In the tomb of Pythagoras near Cortona, with a span of about 10 ft., only four voussoirs were employed. In the Cloaca Maxima at Rome the vault (now ascribed by Commendatore Boni to the 1st century B.C.) is built with three concentric rings of voussoirs. In all these cases the thrust of the arch was amply resisted as they were constructed under ground, and in the entrance gateways at Volterra, Perugia and Falerii a similar resistance was given by the immense walls in which they were built.

We have already referred to one class of tomb in which the sepulchral chamber, built above the ground, was covered over with a mound of earth; there is a second class, carved out of the solid rock, in which we find the same treatment as that described in connexion with Egypt. The tomb represents, in its internal arrangements and in its decorations, the earthly dwelling of the defunct (compare the Egyptian "soul-houses"). The ceilings are carved in imitation of the horizontal beams and slanting rafters of the roof, the former carried by square piers with capitals; one well-known tomb at Corneto (fig. 25) represents the atrium of an Etruscan house, which corresponds with the description given by Vitruvius of the *cavaedia displuviata*, in which there was a small opening at the top, known as the compluvium, the roof sloping down on all four sides.

The paintings which decorate these tombs have very much the same character as those which are found on what were thought to have been Etruscan, but are now generally considered as Greek vases, the principal difference being that instead of allegorical subjects, domestic scenes recalling the life of the deceased are represented. In a tomb at Cervetri the walls and piers were carved with representations of the helmets, swords and other accoutrements of a soldier, and also the mirrors and jewelry of his wife, even the kitchen utensils being included, so as to give the complete fittings of the house they occupied. In two examples at Castel D'Asso the rock has been cut away on all sides, leaving a rectangular block, crowned with reverse mouldings.

Scarcely any remains *in situ* of Etruscan temples have been found, and the description given by Vitruvius is very scanty. Of late years, however, in the British Museum and in the museums at Florence and Rome, a large amount of material has been brought together, from which it is possible to make some kind of conjectural restoration. This has been facilitated by the discoveries made at Olympia, Delphi and elsewhere in Greece, showing the important function which terra-cotta served in the protection and decoration of the timber roofs of the Greek temples and treasuries. The cornices, antefixae, pendant slabs and other decorative features in terra-cotta, found on the sites of the Etruscan temples, show that the timber construction of their roofs was protected in the same way; and although Vitruvius (bk. iii. ch. 2) considered the temple of Ceres at Rome to be clumsy and heavy, and its roofs low and wide, in comparison with the purer examples of Greek architecture, the remains of terra-cotta found at Civita Castellana (the ancient

Falerii), at Luna, Telamon and Lanuvium (the latter in the British Museum), show that in their modelling and colour they must have possessed considerable decorative effect, and when raised on an eminence, as in the case of the temple of Jupiter on the Capitol, formed striking features of importance, enriched as they were with gilding. There is one feature in the Etruscan examples which seems to have been peculiar to their temples, viz. the pendant slabs hung round the eaves to protect the walls; these latter were probably covered with stucco and decorated with paintings. The lower portions of many of these slabs were decorated in relief and in colour at the back, showing that they were exposed to view below the soffit of the projecting eaves.

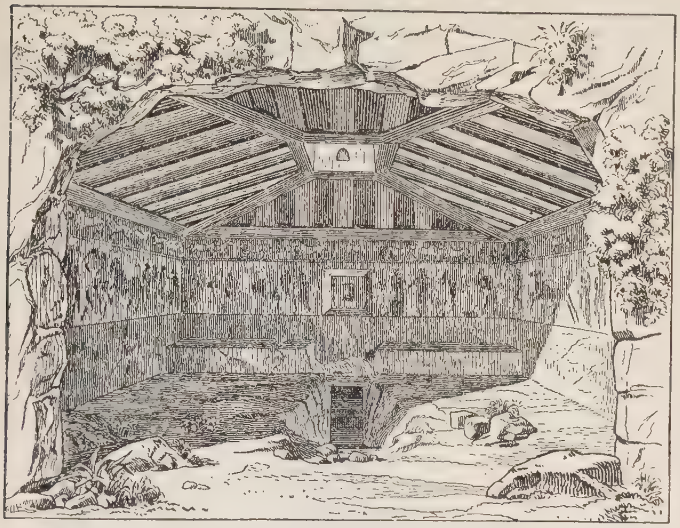


Fig. 25.—The Corneto Tomb.

Owing to the ephemeral nature of the materials employed in the building of the walls of Etruscan temples, viz. unburned brick or rubble masonry with clay mortar, the roofs being in timber, little is known of their general design; the terra-cotta decorations are, however, fortunately in good preservation, and suggest that although the Etruscan temple, architecturally speaking, was not of a very monumental character, its external decoration and colour added considerably to its effect. (R. P. S.)

Roman Architecture

The rebuilding of Rome, which began in the reign of Augustus, and was carried on by his successors to a much greater extent, has caused the destruction of nearly all those examples of early work to which the student, working out the history of a style, would turn. There are, however, a few early buildings still existing, and these are of value as showing the extremely simple nature of their design. The temple of Fortuna Virilis (so-called) in the Forum Boarium, attributed to the beginning of the 1st century B.C., shows the great difference between Greek and Roman temples. Like the Etruscan temple, it is raised on a podium, and approached by a flight of steps. The Etruscan cella is dispensed with; and what may be looked upon as the semblance of a Greek peristyle is retained in the semi-detached columns which are carried round the walls of the cella. To the entrance portico, however, the Roman architect attached great importance, and we find here that one-third of the whole length of the temple is given up to the portico. The Tabularium built by Lutatius Catulus (78 B.C.) is a second example of early work. On a lofty substructure, built of peperino stone, was raised an arcade, which formed a passage from one side of the capitol to the other, and here we find the earliest example of the use of the Classic order, as a decorative feature only, applied to the face of a wall. The arcade consists of a series of arches with intermediate semi-detached Doric columns carrying an entablature. The architectural design of the substructure is of the simplest kind, depending for its effect only on the size of the stones employed and the finish given to the masonry. The same remark applies to the few remains left of the Forum Julium (47 B.C.), where an additional decorative effect was produced by the bevelled edge worked round all the stones, producing the effect of rusticated masonry.

If, however, the remains are few, the records of classical writers show that already before the beginning of the 1st century B.C. the influence of Greece had been shown in the transformation of the Forum, the embanking of the river Tiber, the erection of numerous porticoes throughout the Campus Martius, and of basilicas, one of which, rebuilt by Paulus Aemilius in 50 B.C., was remarkable for its monolithic columns of pavonazetto marble; and further that on the Palatine hill were various mansions, the courts and peristyles of which were richly decorated with marble.

The boast of Augustus that he found Rome built of brick and left it in marble is true in a sense, but not in the way it is usually interpreted. He greatly encouraged the use of marble—the temple of Venus in the forum of Julius Caesar is said to have been built entirely of that material—but as a rule marble was only used as a facing. This, however, led to the substitution of solid concrete for the core of walls, in place of the unburnt brick which up to that time had been employed. On this subject the writings of Vitruvius, the Roman architect, are of the greatest value, as they describe clearly not only the materials used at this time (about 30 B.C.), but the different methods of building walls (see Rome). The material which contributed more than any other to the magnificent conceptions of the Roman Imperial style was that known as pozzolana, a volcanic earth which, mixed with lime, formed an hydraulic cement of great cohesion and strength. Not only the walls but the vaults were built in this pozzolana concrete, and formed one solid mass. Bricks were employed in arches, on the quoins of walls, occasionally in bond courses, and in the constructional vaults as ribs, in order to relieve the centreing of the weight until the pozzolana concrete had been poured in and had consolidated. The bricks employed in these ribs, and for the voussoirs of arches, were of the kind we should describe as tiles, being about 2 ft. square and 2 in. thick. Bricks also of smaller size and triangular in shape were used for the facing of walls, the triangular portions being embedded into the concrete walls.

The Romans themselves do not seem to have realized the tenacious properties of this pozzolana cement which, when employed for the foundation of temples, formed a solid mass capable of bearing as much weight as the rock itself. They feared also the thrust of the immense vaults over their halls, and always provided crosswalls to counteract the same, as shown in the plan of all the thermae; when, however, they had discovered the secret of covering over large spaces with a permanent casing indestructible by fire, it not only gave an impetus to the great works in Rome, but led to a new type of plan, which spread all through the Empire, varied only by the difference in materials and in labour. In this respect the Romans always availed themselves of the resources of the country, which they turned to the best account. As pozzolana was not to be found in North Africa or Syria, they had to trust to the excellent qualities of the Roman mortar, but even in Syria, where stone was plentiful and could be obtained in great dimensions, when they attempted to erect vaults of great span similar to those in Rome, these probably collapsed before the building was finished, and were replaced by roofs in wood.

In the styles hitherto described the gradual development has been traced to their primitive, culminating and decadent periods. This is not called for in a description of the Roman style of architecture, which to a certain extent appeared phoenix-like in its highest development under Augustus. Roman orders in the Augustan age had reached their culminating development. The capitals of the portico of the Pantheon (27 B.C.), or of the temple of Mars Ultor (2 B.C.), constitute the finest examples of the Corinthian order, whilst those of later temples show a falling off in style. It was only in the application of the orders that new combinations presented themselves, and this can be better understood when we refer to the monuments themselves. The description of the Roman orders, with the subsequent modifications, is given in the article Order. It is necessary, however, here to draw attention to two very important developments which the Roman architect introduced as regards the orders: firstly, their employment as decorative features in combination with the arcade, known as composite arcades, and secondly, their superposition one above the other in storeys. The earliest example of the first class is that found in the Tabularium as it now exists; of the second class the Colosseum and the theatre of Marcellus are the best known examples. In principle the practice must be condemned, for the employment of the column and entablature, which was designed by the Greek architect as an independent constructive feature, in a purely decorative sense stuck on the face of a wall, is contrary to good taste, but it is impossible not to recognize in its application to the Colosseum the value of the scale which it has given to the whole structure, a scale which would have been entirely lost if the building had been treated as one storey. The superposition of the orders as exemplified in the Roman theatres and amphitheatres throughout the Empire constitutes the greatest development made in the style, and it is one which, from the Italian revivalists down to our time, has had more influence in the design of monumental work than any other Roman innovation.

In the preceding sections it has been necessary to confine our descriptions, in the case of Egypt and Greece, more or less to temples and tombs, and in that of Assyria to palaces, but in Roman architecture the monuments are not only of the most extensive and varied kinds, but in some parts of the Empire they become modified by the requirements of the country, so that a tabulated list alone would occupy a considerable space. The following are the principal subdivisions: The Roman forum (see Rome); the colonnaded streets in Syria and elsewhere, and temple enclosures; temples (*q.v.*), rectangular and circular; basilicas (*q.v.*); theatres (*q.v.*) and amphitheatres (*q.v.*); thermae or baths (*q.v.*); entrance gateways and triumph arches (see Triumphal Arch); memorial buildings and tombs, aqueducts (*q.v.*) and bridges (*q.v.*), palatial architecture (see Palace); domestic architecture (see House).

The *Forum Romanum* under the Republic would seem to have served several purposes. The principal temples and important public buildings occupied sites round it, and up to the time of Julius Caesar there were shops on both sides: it was also used as a hippodrome and served for combats and other displays. Under the Empire, however, these were relegated to the amphitheatre and the theatre, markets were provided for elsewhere, and the forum became the chief centre for the temples, basilicas, courts of law and exchanges. But already in the time of Julius Caesar the Forum Romanum had become too small, and others were built by succeeding emperors. In order to find room for these, not only were numerous crowded sites cleared, but vast portions of the Quirinal hill were cut away to make place for them. The Fora added were those of Julius Caesar, Augustus, Trajan, Nerva and Vespasian. Outside Rome, in provincial towns and in Africa and Syria, the Forum was generally built on the intersection of the two main streets, and was surrounded by porticoes, temples and civic monuments.

Colonnaded Streets.—We gather from some Roman authors that in early days the Campus Martius was laid out with porticoes. All these features have disappeared, but there are still some existing in Syria, North Africa and Asia Minor, which are known as colonnaded streets. The most important of these are found in Palmyra, where the street was 70 ft. wide with a central avenue open to the sky and side avenues roofed over with stone. The columns employed were of the Corinthian order, 31 ft. high, and formed a peristyle on each side of the street, which was nearly a mile in length. The triple archway in this street is still one of the finest examples of Roman architecture. At Gerasa, the colonnaded streets had columns of the Ionic order, the street being 1800 ft. long, with other streets at right angles to it; similar streets are found at Amman, Bosra, Kanawat, &c. At Pompeiopolis, in Asia Minor, are still many streets of columns, and in North Africa the French archaeologists have traced numerous others.

Temple Enclosures.—In Rome the great cost, and the difficulty of obtaining large sites, restricted the size of the enclosures of the temples; this was to a certain extent compensated for by the magnificence of the porticoes surrounding them. The most important was that built by Hadrian, measuring 480 ft. by 330 ft., to enclose the double temples of Venus and Rome. The portico of Octavia measures 400 ft. by 370 ft., enclosing two temples, and the portico of the Argonauts, which enclosed the temple of Neptune, was about 300 ft. square. These dimensions, however, are far exceeded by those of the enclosures in Syria and Asia Minor. The court of the temple of the Sun at Palmyra was raised on an artificial platform 16 ft. high, and measured 735 ft. by 725 ft., with an enclosure wall of 74 ft. on the west and 67 ft. high on the other three sides.

At Baalbek the platform was raised 25 ft. above the ground, the dimensions being 400 ft. wide and 900 ft. deep. At Damascus the enclosure of the temple of the Sun has been traced, and it extended to about 1000 ft. square. Similar enclosures are found at Gerasa, Amman and other Syrian towns. In Asia Minor, at Aizani the platform was 520 by 480 ft., raised about 20 ft., and in Africa the French have found the remains of similar enclosures.

Roman Temples.—The Romans, following the Etruscan custom, invariably raised their temples on a podium with a flight of steps on the main front. Their temples were not orientated, and being regarded more as monuments than religious structures occupied prominent sites facing the Forum or some great avenue. Much importance was attached to the entrance portico, which was deeper than those in Greek temples, and the peristyle when it existed was rarely carried round the back. On the other hand the cella exceeded in span those of the Greek temples, as the Roman, being acquainted with the principle of trussing timbers, could roof over wider spaces. The principal temples in Rome, of which remains still exist, are those of Fortuna Virilis, Mars Ultor, Castor, Neptune, Antoninus and Faustina, Concord, Vespasian, Saturn and portions of the double temples of Venus and Rome. At Pompeii are the temples of Jupiter and Apollo, at Cora the temple of Mercury, and in France, the Maison Carrée at Nîmes and the temple at Vienne. In Syria are the temples of Jupiter at Baalbek, of the Sun at Palmyra and Gerasa, and in Spalato the temple of Aesculapius.

Of circular temples the chief are the Pantheon at Rome, the temple of Vesta on the Forum, of Mater Matuta, so-called, on the Forum Boarium, the temple of Vesta at Tivoli, of Jupiter at Spalato and of Venus at Baalbek.

Of the rectangular temples the Maison Carrée at Nîmes is the most perfect example existing (fig. 26). It was built by Antoninus Pius, and dedicated to his adopted sons Lucius and Martius. This temple, 59 ft. by 117 ft., is of the Corinthian order, hexastyle, pseudoperipteral, with a portico three columns deep, and is raised on a podium 12 ft. high. The next best preserved example is the temple of Jupiter at Baalbek, also of the Corinthian order, octastyle, peripteral, with a deep portico, and a cella richly decorated with three-quarter detached shafts of the Corinthian order.

Of the circular temples the Pantheon is the most remarkable. It was built by Hadrian, and consists of an immense rotunda 142 ft. in diameter, covered with a hemispherical dome 140 ft. high. Its walls are 20 ft. thick, and have alternately semicircular and rectangular recesses in them. In the centre of the dome is a circular opening 30 ft. in diameter open to the sky, the only source from which the light is obtained. The rotunda is preceded by a portico, originally built by Agrippa as the front of the rectangular temple erected by him, taken down and re-erected after the completion of the rotunda, with the omission of the two outer columns. In other words Agrippa's portico was decastyle; the actual portico is octastyle.

Basilicas.—The earliest example of which remains exist is that of the Basilica Julia on the Forum, the complete plan of which is now exposed to view. It consisted of a central hall measuring 255 ft. by 60 ft., surrounded by a double aisle of arches carried on piers, which were covered with groined vaults. The Basilica Ulpia built by Trajan was similar in plan, but in the place of the piers were monolith columns, with Corinthian capitals carrying an entablature, with an upper storey forming a gallery round.

The third great basilica, commenced by Maxentius and completed by Constantine, differs entirely from the two above mentioned. It followed the design and construction of the Tepidarium of the Roman thermae, and consisted of a hall 275 ft. long by 82 ft. wide and 114 ft. high, covered with an intersecting barrel vault with deep recesses on each side which communicated one with the other by arched openings and constituted the aisles.

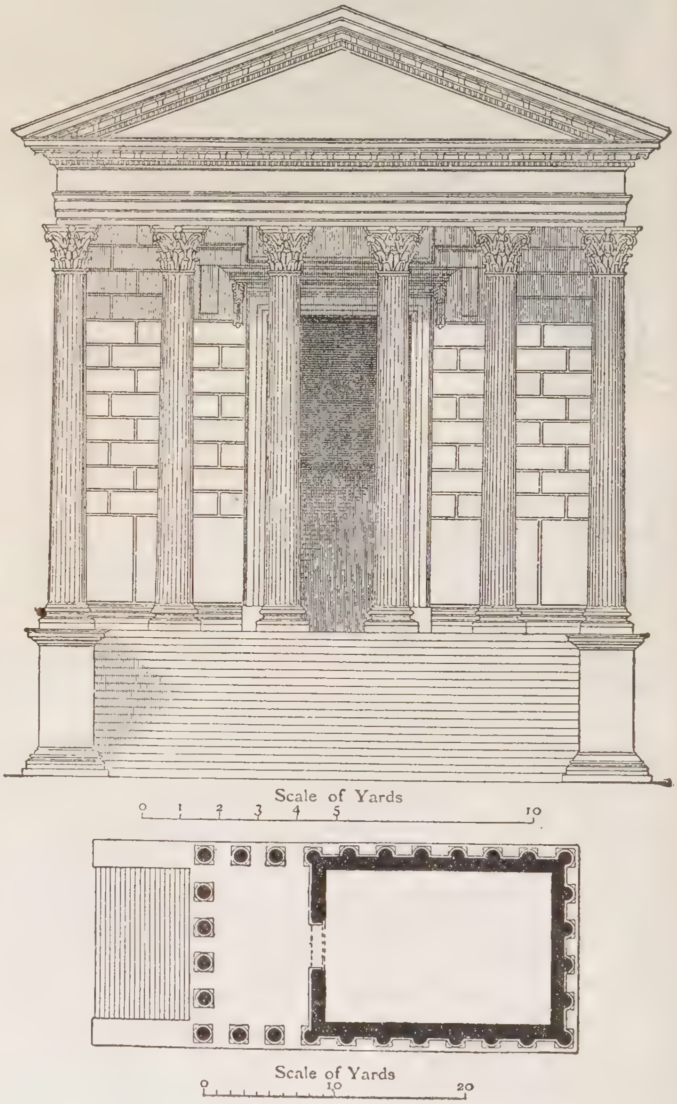


FIG. 26.—Elevation and plan of the Maison Carrée, Nîmes.

Theatres.—The only example in Rome is the theatre of Marcellus, built by Augustus 13 B.C., and one of the purest examples of Roman architecture. Amongst the best preserved examples is the theatre of Orange in the south of France, the stage of which was 203 ft. long. In the theatre at Taormina in Sicily are still preserved some of the columns which decorated the rear wall of the stage. The theatre of Herodes Atticus at Athens (A.D. 160) retains portions of its enclosure walls and some of the marble seats. There are two theatres in Pompeii where the seats and the stage are in fair preservation. Other examples in Asia Minor are at Aizani, Side, Telmessus, Alinda, and in Syria at Amman, Gerasa, Shuhba and Beisan.

Amphitheatres.—The largest amphitheatre is that known as the Colosseum, commenced by Vespasian in A.D. 72, continued by Titus and dedicated by the latter in A.D. 80. This refers to the three lower storeys, for the topmost storey was not erected until the first part of the 3rd century, when it was completed by Severus Alexander and Gordianus. The building is elliptical in plan and measures 620 ft. for the major axis and 513 ft. for the minor axis. There were eighty entrances, two of which were reserved for the emperor and his suite. The Cavea (*q.v.*) was divided into four ranges of seats; the whole of the exterior and the principal corridors were built in travertine stone, and all other corridors, staircases and substructures in concrete. Externally the wall was divided into four storeys, the three lower ones with arcades divided by semi-detached columns of the Tuscan, the Ionic and the Corinthian orders respectively. The walls of the topmost storey were decorated with pilasters of the Corinthian order, the only openings there being small windows, to light the corridors and the upper range of seats. Among other amphitheatres the best preserved are those found at Capua, Verona, and Pompeii in Italy; at El Jem in North Africa; at Pola in Istria, and at Arles and Nîmes in France.

The Thermae or *Imperial Baths.*—The term thermae is given to the immense bathing establishments which were built by the emperors to ingratiate themselves with the people. Of the ordinary baths (*Balneae*) there were numerous examples not only in Rome but at Pompeii and throughout the Empire. The thermae were devoted not only to baths but to gymnastic pursuits of every kind, and being the resorts of the poets, philosophers and statesmen of the day, contained numerous halls where discussions and orations could take place. The plans of these thermae were measured by Palladio about 1560, at a time when they were in far better preservation and more extensive than they are to-day. They have, however, been measured since by some of the French Grand Prix students; and Blouet's work on the *Thermae of Caracalla* (1828) and Paulin's on the *Thermae of Diocletian* (1890) give accurate drawings as well as conjectural restorations which are of the greatest value. The earliest thermae were those built by Agrippa (20 B.C.) in the Campus Martius, and of others those of Titus and Trajan are the best preserved; plans can be found in Cameron's *Baths* (1775).

Entrance Gateways and *Arches of Triumph.*—As the entrance gateways were sometimes erected to commemorate some important event, we have grouped these together, the real difference being that the arch of triumph was an isolated feature and served no utilitarian purpose, whereas the entrance gateway constituted part of the external walls of the city and could be opened and closed at will. Of the latter those at Verona, Susa, Perugia and Aosta in Italy, Autun in France, and the Porta Nigra at Trèves (Trier) are the best known, but there are also numerous examples throughout Syria and North Africa. The arches of triumph offered a fine scope for decoration with bas-reliefs setting forth the principal events of the campaign; the representation on coins also suggests that they were looked upon as pedestals to carry large groups of sculpture. The best known examples are those of Titus, Septimius Severus and Constantine at Rome, of Trajan at Ancona, and, in France, at Orange, St Remi and Reims. There were numerous examples throughout North Africa and Syria, of which the arch of Caracalla at Tebessa in the former and the great gateway of Palmyra in Syria are the best preserved.

Memorial Buildings and Tombs.—Columns of victory constituted another type of memorial, and the shafts of the columns of Trajan and Marcus Aurelius in Rome lent themselves to a better representation of the records of victory than those which could be obtained in the panels of a triumphal arch. Other columns erected are those of Antoninus Pius in Rome, a column at Alexandria, and others in France and Italy.

If the Romans derived from the Etruscans a custom of erecting tombs in memory of the dead, they did not follow on the same lines, for whilst the Etruscans always excavated the tomb in the solid rock, constituting a more lasting memorial, the Romans regarded them as monumental features and lined the routes of the *via sacra* of their towns with them. The earliest example remaining is that of Caecilia Metella (58 B.C.), of which the upper portion, consisting of a circular drum 93 ft. in diameter, remains. Of the tomb of Hadrian the core only exists in the castle of Sant' Angelo. From the descriptions given it must have been a work of great magnificence. The tombs known as Columbaria (*q.v.*) were always below ground, but in some cases an upper storey was built above them consisting of a small temple, and these flanked the Via Appia in large numbers. At Pompeii outside the Herculaneum Gate the Via Appia was lined on both sides with tombs of varied design, and with exedrae or circular seats in marble, provided for the use of those visiting the tombs. The tombs in Syria form a very large and important series, the earliest perhaps being those in Palmyra, where they took the form of lofty towers, from 70 to 90 ft. high, externally simple as regards their design, but in the several storeys inside profusely decorated with Corinthian pilasters and coffered ceilings in stone. The tombs in Jerusalem built in the 1st century of our era are partly excavated in the rock and partly erected. The most important were those known as the tomb of Absalom, the tomb of St James, and the tombs of the judges and the kings, all cut in the solid rock. In central Syria some of the tombs are excavated in the rock, and over them are built a group of two or more columns held together by their entablatures. The most important series are the tombs at Petra, all cut in the side of cliffs and of elaborate design. The sculptor, being free from the restriction of construction, realized his conception much in the same way as a scene-painter produces a theatrical background.

Aqueducts and *Bridges.*—Although at the present day aqueducts and bridges would be classed under the head of engineering works, those built by the Romans are so fine in their conception and design that they take their place as monuments. The Pont-du-Gard near Nîmes, and the aqueducts of Segovia, Tarragona and Merida in Spain, and some of those in or near Rome, are of the simplest design, depending for their effect on their magnificent construction, their dimensions both in length and height, and the scale given in the ranges of arches one above the other. Few of the Roman bridges have lasted to our day; the bridges of Augustus at Rimini and of Alcantara in Spain may be taken as types of the design, in which we note that there are no architectural superfluities; the quality of the design depends on the graceful proportion of the arches and the fine masonry in which they are built.

Palatial Architecture.—By far the most magnificent group of palaces are those which were erected by the Caesars on the Palatine hill at Rome. Commenced by Augustus and added to by his successors down to the reign of Severus, they cover an area considerably over 1,000,000 sq. ft., and comprise an immense series of great halls, throne room, banqueting hall, basilicas, peristylar courts, temple, libraries, schools, barracks, a stadium and separate suites for princes and courtiers. The service of the palace would seem to have been carried on in vaulted corridors in several storeys, some of which on the north side, overlooking the Circus Maximus, must have been over 100 ft. in height. Except under the Villa Mills, the greater part of the plan has been traced; and large remains of mosaic pavements have been found *in situ*, and in the approaches, vaulted halls, some still retaining their stucco decoration.

A similar variety of groups of every description of structure is found at Tivoli, but spread over a very much larger area. The villa of Hadrian extended over 7 m.; the works there were probably begun about A.D. 123, the first portion being his own residential palace. In addition to the numerous halls, courts, libraries, &c., Hadrian attempted to reproduce some of the most remarkable monuments which he had seen during his long travels; the Stadium, Palaestra, Odeum, the two theatres, the artificial lake, Canopus and other features were, however, constructed in the Roman style. Built on a ridge between two valleys, the several buildings occupied various levels, so that immense terraces and flights of stairs existed throughout the site and, combined with the natural scenery, must have been of extraordinary beauty.

The palace of Diocletian at Spalato, to which he retired after his abdication, constituted a fortress, three of its walls being protected by towers, the fourth on the south by the sea. For an account of its well-preserved remains see SPALATO. The emperor's own residence was on the south side, and had a gallery 520 ft. long overlooking the sea. The two main streets, with arcades on each side and crossing one another, divided the whole palace into four sections. One of these streets crossed from gate to gate, the other from the north gate led to the entrance into the palace of the emperor.

Private Houses.—The entire absence of the remains of the private houses of Rome, with the single exception of the house of Livia on the Palatine, would have left us with a very poor insight into their design were it not for the discovery of Pompeii (*q.v.*) and Herculaneum (*q.v.*). The descriptions given by Pliny of the lavish extravagance in the Roman houses, and the employment of various Greek marbles in the shape of monolith columns and panelling of walls, are substantiated by those which are found in the Pantheon, in the palaces on the Palatine, and in Hadrian's villa at Tivoli; and these compared with what is found at Pompeii show that the latter was only a provincial town of second or third-rate importance, where painted imitations took the place of real marbles, and where the wall paintings were very inferior to those which have been discovered in Rome. (R. P. S.)

BYZANTINE ARCHITECTURE

The term "Byzantine" is applied to the style of architecture which was developed in Byzantium after Constantine had transferred the capital of the Roman empire to that city in A.D. 324.

It is not possible, in the early ages of any style which is based on preceding or contemporaneous styles, to draw any hard and fast line of demarcation; and already before the Peace of the Church, a gradual transformation in the Roman style had been taking place, even in Rome itself. Thus the arch had gradually been taking the place of the lintel, either frankly as a relieving arch above it (portico of Pantheon), or introduced in the frieze just above the architrave (San Lorenzo), or by the conversion of the architrave into a flat arch by dividing it into voussoirs, as in the Forum Julium at Rome or in the temple of Jupiter at Baalbek. In the palace built by Diocletian at Spalato, the architrave or lintel of the Golden Gate is built with several voussoirs, and the pressure is further relieved by an arch thrown across above it. Long before this, however, and already in the 2nd century A.D. in Syria, this relieving arch had been moulded and decorated, with the result of emphasizing it as a new architectural feature. In this same palace at Spalato, in order to obtain a wider opening in the centre of the portico, leading to the throne room, it was spanned by an arch, round which were carried the mouldings of the whole entablature, viz. architrave, frieze and cornice. At a still earlier date in Syria the same had been done in the Propylaea of the temple at Damascus (A.D. 151) and other examples are found in North Africa.

Now when Constantine transferred the capital to Byzantium, he is said to have imported immense quantities of monolith columns from Rome, and also workmen to carry out the embellishments of the new capital; for his work there was not confined to churches, but included amphitheatres, palaces, thermae and other public buildings. Owing to the haste with which these were built, and in some cases probably to the ephemeral materials employed, for the roofs of the churches were only in timber, all these early works have been swept away; but there remain two structures at least, which are said to date from Constantine's time, viz. the Binbirderek or cistern of a thousand columns, and the Yeri-Batan-Serai, both in Constantinople. As one of the first tasks a Roman emperor set himself to perform was the provision of an ample supply of water, of which Byzantium was much in need, there is every reason to suppose that they are correctly attributed to Constantine's time. If so, as the construction of their vaults is quite different from that employed by the Romans, it suggests that there already existed in the East a traditional method of building vaults of which the emperor availed himself; and, although it is not possible to trace all the earlier developments, the traditional art of the East, found throughout Syria and Asia Minor, must from the first have wrought great changes in the architectural style, and in some measure this would account for the comparatively short period of two centuries which elapsed between the foundation of the new empire and the culminating period of the style under Justinian in AD. 532–558.

Constantine is said to have built three churches in Palestine, but these have either disappeared or have been reconstructed since; an early basilican church is that of St John Studius (the Baptist) in Constantinople, dating from A.D. 463, and though it shows but little deviation from classic examples, in the design and vigorous execution of the carving in the capitals and the entablature we find the germ of the new style. The next typical example is that found in the church of St Demetrius at Salonica, a basilican church with atrium in front, a narthex, nave and double aisles, with capacious galleries on the first floor for women, and an apsidal termination to the nave. Instead of the classic entablature, the monolithic columns of the nave carry arches both on the ground and upper storeys; above the capitals, however, we find a new feature known as the *dosseret*, already employed in the two cisterns referred to, a cubical block projecting beyond the capital on each side and enabling it to carry a thicker wall above. In later examples, when the aisles were vaulted, the dosseret served a still more important purpose, in carrying the springing of the vaults. The nave and aisles of this church of St Demetrius were covered with timber roofs, as the architects had neither the knowledge, the skill, nor perhaps the materials to build vaults, so as to render the whole church indestructible by fire.

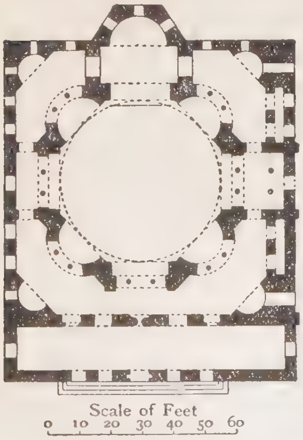


FIG. 27.—Plan of SS. Sergius and Bacchus.

One of the first attempts at this (though the early date given is disputed) would seem to have been made at Hierapolis, on the borders of Phrygia in Asia Minor, where there are two churches covered with barrel vaults carried on transverse ribs across the nave, the thrust of which was met by carrying up solid walls on each side, these walls being pierced with openings so as to form aisles on the ground floor and galleries above. The same system was carried out a century earlier in central Syria, where, in consequence of the absence of timber, the buildings had to be roofed with slabs of stone carried on arches across the nave. It is probable that in course of time other examples will be found in Asia Minor, giving a more definite clue to the next development, which we find in the work of Justinian, who would seem to have recognized that the employment of timber or combustible materials was fatal to the long duration of such buildings. Accordingly in the first church which he built (fig. 27), that of SS. Sergius and Bacchus (A.D. 527), the whole building is vaulted; the church is about 100 ft. square, with a narthex on one side. The central portion of the church is octagonal (52 ft. wide), and is covered by a dome, carried on arches across the eight sides, which are filled in with columns on two storeys. These are recessed on the diagonal lines, forming apses. The vault is divided into thirty-two zones, the zones being alternately flat and concave.

We now pass to Justinian's greatest work, the church of St Sophia (fig. 28), begun in 532 and dedicated in 537, which marks the highest development of the Byzantine style and became the model on which all Greek churches, and even the mosques built by the Mahommedans in Constantinople, from the 15th century onwards, were based. The architects employed were Anthemius of Tralles and Isidorus of Miletus, and the problem they had to solve was that of carrying a dome 107 ft. in diameter on four arches. The four arches formed a square on plan, and between them were built spherical pendentives, which, overhanging the angles, reduced the centre to a circle on which the dome was built. This dome fell down in 555, and when rebuilt was raised higher and pierced round its lower part with forty circular-headed windows, which give an extraordinary lightness to the structure. At the east and west ends are immense apses, the full width of the dome, which are again subdivided into three smaller apses. The north and south arches are filled with lofty columns carrying arches opening into the aisle on the ground storey and a gallery on the upper storey, the walls above being pierced with windows of immense size. The church was built in brick, and internally the walls were encased with thin slabs of precious marble up to a great height (fig. 29). The walls and vault above were covered with mosaics on a gold ground, which, as they represented Christian subjects, were all covered over with stucco by the Turks after the taking of Constantinople. During the restoration in the middle of the 19th century, when it became necessary to strip off the stucco, these mosaics were all drawn and published by Salzenburg, and they were covered again with plaster to prevent their destruction by the Turks. The columns of the whole church on the ground floor are of porphyry, and on the upper storey of verd antique. The length of the church from entrance door to eastern apse is 260 ft.; in width, including the aisles, it measures 238 ft., and it measures 175 ft. to the apex of the dome. The columns and arches give scale to the small apses, the small apses to the larger ones, and the latter to the dome, so that its immense size is grasped from the first. The lighting is admirably distributed, and the rich decoration of the marble slabs, the monolith columns, the elaborate carving of the capitals, the beautiful marble inlays of the spandrils above the arches, and the glimpse here and there of some of the mosaic, which shows through the stucco, give to this church an effect which is unparalleled by any other interior in the world. The narthex or entrance vestibule forms a magnificent hall 240 ft. in length, equally richly decorated. Externally the building has little pretensions to architectural beauty, but its dimensions and varied outline, with the groups of smaller and larger apses and domes, make it an impressive structure, to which the Turkish minarets, though ungainly, add picturesqueness.

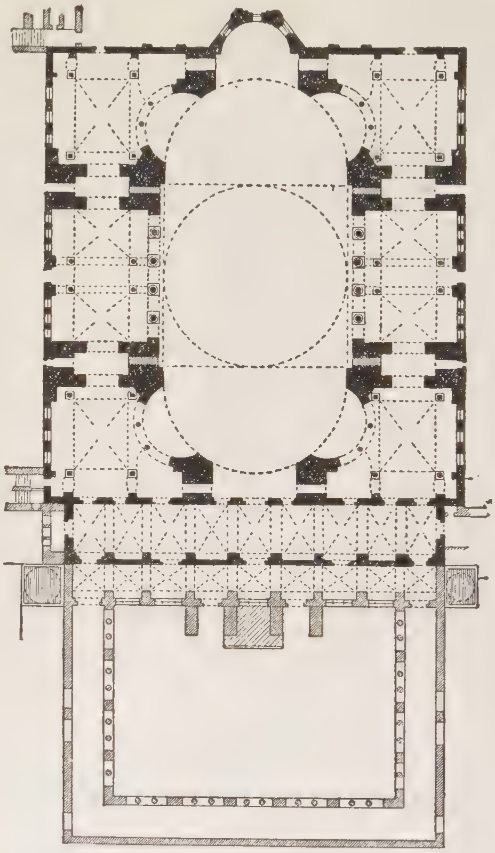


FIG. 28.—Plan of St Sophia.

In A.D. 536 a second important church was begun by Theodora, the church of the Holy Apostles, which was destroyed in 1454 by order of Mahommed II. to build his mosque. The design of this church is known only from the clear description given by Procopius, the historian who has transmitted to us the record of Justinian's work, and its chief interest to us now is that it forms the model on which the church of St Mark at Venice was based, when it was restored, added to, and almost rebuilt about 1063.

The church of St Sophia was not only the finest of its kind at the time of its erection, but no building approaching it has ever been built since in the Byzantine style, nor does much seem to have been done for two or three centuries afterwards. At the same time the erection of new churches must have been going on, because there are certain changes in design, the results probably of many trials. The difficulty of obtaining sufficient light in domes of small diameter led to the windows being placed in vertical drums, of which the earliest example is that of the western dome of St Irene at Constantinople, rebuilt A.D. 718–740. This simplified the construction and externally added to the effect of the church. The greatest change, however, which took place, arose in consequence of the comparatively small dimensions given to the central dome, which rendered it necessary to provide more space in another way, by increasing the area on each side, so that the plan developed into what is known as the Greek cross, in which the four arms are almost equal in dimensions to the central dome, and were covered with barrel vaults which amply resisted its thrust. In front of the church a narthex and sometimes an exonarthex was added, which was of greater width than the church itself, as in the churches (both in Constantinople) of the Theotokos and of Chora (A.D. 1080). The latter, better known as the "mosaic mosque," on account of its splendid decoration in that material, is of special interest, because in the five arches of its façade we find the same design as that which originally constituted the front of the lower part of St Mark's at Venice, before it was encrusted with the marble casing and the plethora of marble columns and capitals brought over from Constantinople.

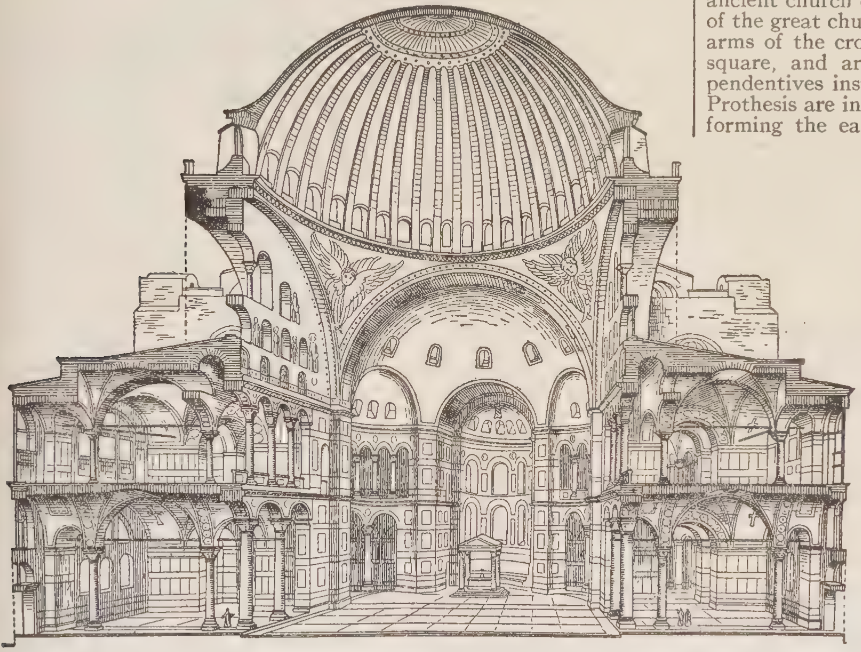


FIG. 29.—Cross section of the interior of St Sophia.

Sometimes an additional church was built adjoining the first church and dedicated to the immaculate Virgin, as in the church of St Mary Panachrantos, Constantinople, the church of St Luke of Stiris, Phocis, and the church in the island of Paros. In the last-named church the apse still retains its marble seats, rising one above the other, with the bishop's throne in the centre. In addition to the churches already mentioned in Constantinople, there are still some which have been appropriated by the Turks and utilized as mosques. At Mount Athos there are a large number of Greek churches, ranging from the 10th to the 16th centuries, which are attached to the monasteries. At Athens one of the most beautiful examples is preserved in the Catholicon or cathedral, the materials of which were taken from older classical buildings. This cathedral measures only 40 ft. by 25 ft., and is now overpowered by the new cathedral erected close by.

The external design of the Byzantine churches, as a rule, is extremely simple, but it owes its quality to the fact that its features are those which arise out of the natural construction of the church. The domes, the semi-domes over the apses, and the barrel vaults over other parts of the church, appear externally as well as internally, and as they are all covered with lead or with tiles, laid direct on the vaults, they give character to the design and an extremely picturesque effect. The same principle is observed in the doorways and windows, to which importance is given by accentuating their constructive features. The arches, always in brick, are of two orders or rings of arches set one behind the other, and the voussoirs, alternately in brick and stone, have the most pleasing effect. The same simple treatment is given to the walls by the horizontal courses of bricks or tiles, alternating with the stone courses. In the apse of the church of the Apostles at Salonica, variety is given by the interlacing of brick patterns. This elaboration of the surface decoration is carried still further in the palace of Hebdomon at Blachernae, in Constantinople, built by Constantine Porphyrogenitus (913–949), where the spandrils of the arches are inlaid with a mosaic of bricks in various colours arranged in various patterns.

There would seem to have been a revival in the 11th century, possibly a reflex of that which was taking place in Europe, and it is to this period we owe the churches of St Luke in Phocis, the church at Daphne, and the churches of St Nicodemus and St Theodore in Athens. The finest example of brick patterns is that which is found in the church of St Luke of Stiris, attached to the monastery in the province of Phocis, north of the Gulf of Corinth, of which an admirable monograph was published in 1901 by the committee of the British School at Athens, illustrated by measured drawings of the plans, elevations, sections and mosaics by Messrs Schultz and Barnsley, with a detailed description. The church of St Luke of Stiris is one of those already referred to, where a second church dedicated to the Holy Virgin has been added, but in this case, according to Messrs Schultz and Barnsley, on the site of a more ancient church of which the narthex alone was retained. The plan of the great church differs from the ordinary Greek cross in that the arms of the cross are of much less width than the central domed square, and arches being thrown across the angles carry eight pendentives instead of four. On the east side the Diaconicon and Prothesis are included in the width of the domed portion instead of forming the eastern termination of the aisles. The churches at Daphne in Attica and of St Nicodemus at Athens have a similar plan.

The decoration of the smaller church of St Luke of Stiris is of the most elaborate character, bright patterns of infinite variety alternating with the brick courses, and as blocks of marble, removed from the site of the old city near, were available, they have been utilized in various parts of the structure and richly carved. The church at Mistra in the Peloponnesus, 13th century, built in the side of a hill, is one of the most picturesque examples, and is almost the only example in which a tower is to be found.

Armenia.—One other phase of the Byzantine style has still to be mentioned, the development of church architecture in Armenia, which follows very much on the same lines as that of the Greek church, with a central dome on the crossing, a narthex at the west end and a triapsal east end. In two churches at Echmiadzin and Kutais there are transeptal apses in addition to those at the east end. One of the differences to be noted is that the domes and roofs are generally in stone externally, and this has led to another change; the domes, though hemispherical inside, have conical roofs over them. There is also a greater admixture of styles, the Persian, Byzantine and Romanesque phases entering into the design; the last was probably derived from the churches of central Syria, as the Armenians were the only race who seem to have penetrated there, and the finest example, at Kalat Seman, was at one time in their possession. The church at Dighur near Ani, of the 7th century, also probably owes its classical details to the work in central Syria. The most important example of the Armenian style is found in the cathedral at Ani, the capital of Armenia, dating from A.D. 1010. In this church pointed arches and coupled piers are found, with all the characteristics of a complete pointed-arch style, which, as Fergusson remarks, "might be found in Italy or Sicily in the 12th or 14th century." Externally the walls are decorated with lofty blind arcades similar to those in the cathedral at Pisa and other churches in the same town, which are probably fifty years later. The elaborate fret carving of the window dressings and hood moulds are probably borrowed from the tile decoration found in Persia.

Russia.—The architecture of Russia is only a somewhat degraded version of the style of the Byzantine empire. The earliest buildings of importance are the cathedrals of Kiev and Novgorod, 1019–1054. The original church of Kiev consisted of nave, with triple aisles each side, the piers in which are of enormous size, a transept and square bays of the choir beyond, each with deep apsidal chapels. Externally the chief features are the bulbous domes adopted from the Tatars, which sometimes assume great dimensions. Internally, the chief feature is the Iconostasis, which corresponds to the English rood screen, except that in Russia it forms a complete separation between the church and the sanctuary with its altar.

One of the most remarkable churches is that of St Basil at Moscow (1534–1584), which in plan looks like a central hall, surrounded by eight other halls of smaller dimensions, all separated one from the other by vaulted corridors; this arrangement is not intelligible until one sees the exterior view, which accounts for the plan; each one of these halls is crowned by lofty towers with bulbous domes, the centre one rising above all the others and terminated with an octagonal roof, probably derived from the Armenian conical roof. The oldest and most interesting church in Moscow is the church of the Assumption (1479), where the tsars are always crowned; but as it measures only 74 ft. by 50 ft., it is virtually little more than a chapel; the plan is that of a Greek cross with central dome and four others over the angles. One other church deserves mention—at Curtea de Argesh, in Rumania. It was built in 1517–1526, and though small (90 by 50 ft.), is built entirely of stone, instead of brick covered with stucco, as is the case with the churches in Moscow. The interior has been entirely sacrificed to the exterior, the domes being raised to an extravagant height. The relative proportion of width of nave to height of dome in St Sophia at Constantinople is about one to two; in the church at Curtea de Argesh it is about one to five; and yet there can be little doubt the design was made by one of those Armenian architects who seem to have been always employed at Constantinople, and who presumably based their designs there on St Sophia as regards its principal features. Here, however, he was working for Tatar employers who attached more importance to display than to good proportion. In general design the church is based on Armenian work. The elaborately carved panels and disks are copied from the inlays in the mosques in Damascus and of Sultan Hassan at Cairo, and the stalactite cornices and capitals of the columns are transcripts of the Mahommedan style of Constantinople, which was derived from the style developed by the Seljuks.

We were only able to point to a single example of a tower in the Byzantine style, but in Russia the towers not only constitute the principal accessory to the church but were necessary adjuncts, in order to provide accommodation for bells, the casting of which has at all times formed one of the most important crafts in Russia. The chief examples, all in Moscow, are the tower attached to the church of the Assumption; the tower of Boris, inside the Kremlin; and that erected over the sacred gate of the same. But they abound throughout Russia, and in some cases form important features in the principal elevations on either side of the narthex. (R. P. S.)

Early Christian Architecture

Of the earliest examples of the housing of the Christian church few remains exist, owing partly to their destruction from time to time by imperial edicts, and partly to the fact that in most cases they were only oratories of a small and unpretending nature, which, immediately after the Peace of the Church, were rebuilt of greater size and with increased magnificence. In Rome itself, the principal religious centre was that which was found in the catacombs (*q.v.*), almost the only resort in times of persecution. In the houses of the wealthy Romans who had been converted, rooms were set apart for the reception of the faithful, and these may have been increased in size by the addition of side aisles. At all events, either in Rome or in the East, where greater freedom of worship was observed, the requirements of the religious had already resulted in a traditional type of plan, which may account for the similarity of all the great churches built by Constantine. It has often been assumed that the great Roman basilicas, if not actually utilized by the Christians, were copied so far as their design is concerned. This, however, is not borne out by the facts, there being very little similarity between the first churches built and the two great Roman basilicas, the Ulpian basilica and that built by Constantine; the latter was roofed with an immense vault, an imperishable covering, not attempted till two centuries later in Byzantium, and the former had its entrance in the centre of the longer side, and the tribunes at either end were divided off from the basilica by a double aisle of columns. The basilica plan was adopted because it was the simplest and most economical building of large size which could be erected, having an immense central area or nave well lighted by clerestory windows, and single or double aisles to divide the two sexes, and further because the immense supply of columns which could be taken from existing temples or porticoes enabled the architect to provide at small cost the colonnades or arcades between the nave and the aisles. On the other hand, there is no doubt that the temples, for which there was no further use, were largely appropriated, not only in Italy but in Greece, Sicily and elsewhere, and it is to this appropriation that we owe the preservation of the Parthenon, the Erechtheum and the temple of Theseus at Athens. There are some cases in which it is interesting to note the changes which were made to convert the temple into a church. In the temple of Athena at Syracuse, walls were built in between the columns of the peristyle, the cella was appropriated for the nave, and arcades were cut through the cella walls to communicate with the peristyle, so as to constitute the aisles. In the temple of Aphrodisias, in Asia Minor, a further development occurred. The walls of the cella were taken down, a wall was built outside the columns of the peristyle to form aisles, and the columns of the east and west end were taken down and placed in line with the others, in order to increase the length of the church.

The earliest Christian basilica built in Rome was the Lateran, which has, however, been so completely transformed in subsequent rebuildings as to have lost its original character. The next in date was that of the old St Peter's, which was taken down in 1506, in consequence of its ruinous condition, in order to make way for the present cathedral, begun by Pope Julius II. It was of considerable size, covering an area of 73,000 ft. Its plan consisted of an atrium, or open court, having a fountain in the centre, and arcades round; a nave, 275 ft. long and 77 ft. wide, with double aisles on each side; a transept, 270 ft. long by 54 ft. wide; and a semi-circular apse or tribune with a radius of 27 ft.: the high altar being in the centre of its choir, and ranges of marble seats and the papal throne in the middle, corresponding to the benches and the judge's seat of the Roman tribune. The nave, therefore, with its double aisles, was similar to that of the Ulpian basilica, but the aisles were not returned across the east end, and at the west end, in their place, was the great triumphal arch opening into the transept. The monolith columns of the nave and their capitals (together 40 ft. high) were all taken from ancient buildings, as also were those of the aisle arcades and in the atrium.

The basilica of St Paul, outside the walls, was originally of comparatively small dimensions, with its apse at the west end; in A.D. 386 the church was rebuilt on a plan similar to St Peter's, with nave and double aisles, divided by columns carrying arches, transept and apse. In the Lateran basilica, St Peter's, Santa Maria Maggiore, and St Lawrence (outside the walls), the columns of the nave were close-set (*i.e.* with narrow intercolumniations) and supported architraves, but in St Paul (outside the walls) the columns of the second church (A.D. 386) were wider apart and carried arches. The same feature is found in the church of St Agnes, founded A.D. 324, but rebuilt 620–640; here the arcade is carried across the west end and there are galleries above, the arches being carried on dosseret blocks above the capitals; these are also found in the galleries over the western end of St Lawrence, added by Honorius (A.D. 620–640); the dosseret, a Byzantine feature, being derived either from Ravenna or from the East. In the church of Santa Maria-in-Cosmedin (A.D. 772–795) another Byzantine feature appears in the triple apse at the east end, the earliest example in Europe. In this church, as also in those of San Clemente and San Prassede, piers are built at intervals to carry the arcades separating the nave and aisles. Those in the latter, however, were probably added when the great arches were thrown across the nave. The church of San Clemente was built in 1108, above a much older church dating from 385 and restored later; it is almost the only church in Rome which has preserved its atrium intact; the internal arrangement of the church also is different from that found elsewhere, the choir, enclosed with marble piers and screens removed from the lower church and erected in front of the tribune, dating from A.D. 514–523. The mosaics executed in 1112 are in fine preservation.

Other early churches in Rome are those of Santa Pudenziana (335); San Pietro-in-Vincoli (442), with Doric columns in the nave; SS. Quattro Coronati (450); Santa Sabina (450), an interesting church on account of the marble inlaid decoration in the arch spandrils of the nave, which date from 824; San Prassede (817), with arches thrown across the nave later; San Vincenzo ed Anastasio alle Tre Fontane (626); and Santa Maria in Domnica, where there are galleries over the aisles and across the east end as in St Agnes.

Hitherto we have said little about the architectural design, the fact being that externally these churches had the appearance of barns; it is only in a few cases, notably in St Peter's, that the principal fronts were decorated with mosaics. The magnificent materials employed internally, the monolith marble columns, the enrichment of the apse and the triumphal arch with mosaics, and probably the painting and gilding of the ceiling or roof, gave to the early basilican churches in Rome that splendour which characterizes those in Byzantium and in Ravenna.

With the exception of the baptistery attached to St John Lateran, and the so-called tomb of Santa Constantia, both erected by Constantine, the circular form of church was not adopted in Rome; there is one remarkable circular building of great size, San Stefano Rotondo, at one time thought to have been a Roman market, but now known to have been erected by Pope Simplicius (468–482). It consisted of a central circular nave, 44 ft. in diameter, and double aisles round. In the arcade dividing the aisles the arches are carried on dosserets, the earliest known example of this feature in Rome.

Although inferior in size, the two churches of S. Apollinare Nuovo, built by Theodoric (493–525) and Sant' Apollinare-in-Classe (538–549), both in Ravenna, have the special advantage that they were constructed in new materials, there being no ancient Roman temples there to pull down. The ordinary basilican plan was adhered to, but as the architects and workmen came from Constantinople, they incorporated in the building various details of the Byzantine style, with which they were best acquainted. Thus the contour of the mouldings, the carrying of the capitals and imposts, the dosseret above the capital, and the scheme of decoration of the interior with marble casing on the lower portion of the walls and mosaic above, are all Byzantine. Externally the churches are extremely plain, the wall surfaces of the nave and aisle walls being varied by blind arcades.

The earliest building in Ravenna is the tomb of Galla Placidia, built 450, a small cruciform structure with a dome on pendentives over the centre, perhaps the earliest example known. The baptistery of St John, which was attached to the cathedral built by Archbishop

Ursus (380), now destroyed, is a plain octagonal building, 40 ft. in diameter, originally with a timber roof; when in 451 it was determined to replace this by a vault, in order to resist the thrust, the upper part of the walls was brought forward on arches and corbels, and the interior richly decorated with paintings, stucco reliefs and mosaics in the dome. The most interesting building in Ravenna, however, from many points of view, is the church of San Vitale (fig. 30), built 539–547, its plan and design being based on the church of SS. Sergius and Bacchus at Constantinople. The proportions of the interior of St Sergius are much finer than those in San Vitale, where the dome is raised too high; the timber roofs also of San Vitale have deprived the church externally of that fine architectural effect found in Byzantine churches. In order to lighten the dome, its shell was built with hollow pots, the end of one fitted into the mouth of the other. The interior of the church is of great beauty, owing to the alternating of the piers carrying the eight arches with the columns set back in apsidal recesses. Unfortunately the church has been much restored, but the magnificent mosaics in the choir and the variety of design shown in the capitals and dosserets render this church, though small, one of the most attractive in Italy. One other Ravenna building must be mentioned, though it would be difficult to know under what style to class it. The tomb of Theodoric, having a decagonal plan in two storeys, the lower one vaulted at the upper storey, set back to allow of a "terrace" round, once sheltered by a small arcade, and covered by a single stone 35 ft. in diameter, belongs to no definite style; the mouldings of the upper portion have some resemblance to the mouldings of some of the Etruscan tombs at Castel d'Asso, which was probably known to Theodoric.

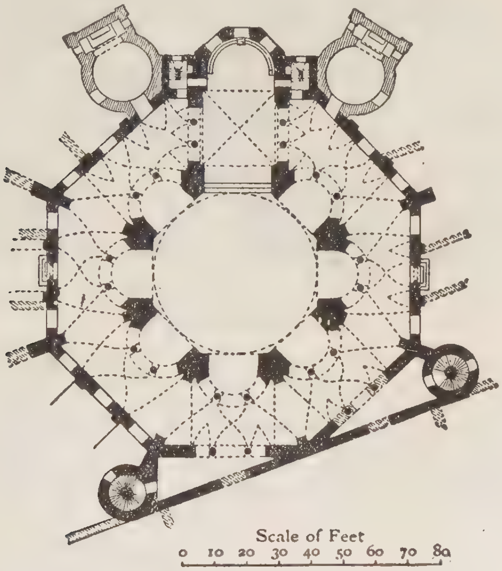


FIG. 30.—Plan of S. Vitale, Ravenna.

As Dalmatia and Istria both formed part of Theodoric's kingdom, we find there the same Byzantine influence as that which was asserted in Ravenna, in both cases the work being done by artists and masons from Constantinople. There is not much left in Dalmatia, but in Istria are two important examples,—the churches at Parenzo (535–543) and Grado (571–586). Like the two churches in Ravenna, they are basilican in plan, with apses, semi-circular internally and polygonal externally, the latter being a characteristic found in all the churches in Europe which were influenced directly by Byzantine custom. Although the monolith columns were derived from ancient Roman buildings, all the capitals were specially carved for the two churches, and they have the same variety of design and in many cases are identical with those in San Vitale, Sant' Apollinare Nuovo, Sant' Apollinare-in-Classe, and those brought over from Constantinople, which now decorate St Mark's at Venice internally as well as externally. The decoration of the lower part of the walls internally with marble slabs, and the upper portion and apsidal vaults with mosaic, follows on the same lines as those at Ravenna and Constantinople. The church at Parenzo still retains its baptistery and atrium, from which fragments of the mosaics which originally decorated the west front can be seen. The church at Aquileia was rebuilt in the 11th century, and the Duomo of Trieste has been so altered as to lose its original Byzantine character. (R. P. S.)

EARLY CHRISTIAN WORK IN CENTRAL SYRIA

Contemporaneously with the early developments of the Christian churches just described, another line of treatment was being evolved in central Syria, which would seem to have been quite independent of the others, though at first sight it bears considerable resemblance to the Byzantine style, and for that reason was probably classed and described under that head by Fergusson. But the leading characteristic of the Byzantine style is the dome over the centre of the church round which all other features are grouped, whereas in central Syria, with the exception of two examples—one a circular, the other a polygonal church—there are no domes. There is considerable Greek feeling in the mouldings and carvings of the capitals, but that is probably due to the fact that the masons were originally of Greek extraction. A comparison, for instance, of the design and carving of the largest church in central Syria, the famous building erected round the column of St Simeon Stylites at Kalat-Seman, dating from the 6th century, with any Byzantine church of the same date, shows very little resemblance, because the former was inspired more or less directly by the Roman remains in the country. A similar inspiration is found in the churches of St Trophime at Arles and St Gilles in the south of France, and at Autun and Langres in Burgundy. Both were founded on Roman work, and the mouldings of the pediments and archivolts and the fluting of the pilasters at Kalat-Seman, of the 6th century, are identical with what is found, quite independently, in Provence and Burgundy in the 11th and 12th centuries. There is, however, another special characteristic found in the masonry of the churches in central Syria, which is peculiar to the whole of Palestine, and is found in the earliest remains there, as also in Roman work, and to a certain extent in much of the Mahommedan construction and in that of the Crusaders, viz. its megalithic qualities. Instead of building an arch in several voussoirs, they preferred to do it in three or five only, and sometimes would cut the whole arch out of a single vertical slab. If they employed voussoirs, they were not content with ordinary depth, shown by the archivolt mouldings, but made them three or four times as deep.

The masons, in fact, would seem to have retained the traditional Phoenician custom of the country to employ the largest stones they were able to quarry, transport and raise on the building. Subsequently, in working down the masonry, they reproduced the architectural features they found in Roman buildings; this was done, however, without any knowledge as to their constructional origin or meaning; thus, in copying a Roman pilaster, the capital and part of the shaft would be worked out of one stone, and the lower part of the shaft and the base out of another. It is only from this point of view that we can account for the peculiar development given to the decoration of their later work, where archivolts, wood mouldings and window dressings are looked upon as simply surface decoration to be applied round doorways and windows, without any reference to the jointing of the masonry.

The immense series of monuments, civil as well as religious existing throughout central Syria, were almost entirely unknown before the publication of the marquis of Vogüé's work, *La Syrie centrale*, in 1865–1867. This work, illustrated with measured plans, sections and elevations, with perspective views, and accompanied by detailed descriptions of the various buildings, forms an invaluable record of an architectural style, more or less completely developed, which flourished from the 3rd to the beginning of the 7th century. An American archaeological expedition made further investigations in 1899–1900, and its report, written by Mr H. C. Butler, contains additional plans and a large number of photogravures, which bear testimony to the truth and accuracy of the engraved plates of the marquis de Vogüé. The preservation of these central Syrian remains, more or less intact, is considered to have been due either to the desertion of all the towns in which they were situated by the inhabitants at the time of the Mahommedan invasion, or, according to Mr H. C. Butler, to the deforesting of the whole country about the commencement of the 7th century.

The monuments and buildings illustrated may be divided into three classes,—ecclesiastical, including monasteries; civil and domestic; and tombs. It is in the two first that the principal interest is centred.

Churches.—The earliest of these date from the end of the 4th century, and the latest inscription on a church is 609, so that a little over 200 years includes the whole series. With one or two small exceptions all the churches follow the basilican plan, with nave and aisles separated by arcades, the arches of which are carried by columns, four arches on each side in the smaller churches, ten in the largest. The churches are all orientated, and have generally a semi-circular apse, and occasionally a square or rectangular sanctuary at the east end, on either side of which are square chambers,—the *diaconicon*, reserved for the priests, on the south side, and the *prothesis*, on the north side, in which the offerings of the faithful were deposited. Except in the earliest churches, the entrance was generally at the west end, and was sometimes preceded by a porch. In addition to the west entrance, there were sometimes doorways leading direct into the north and south aisles, with projecting porticoes. About the middle of the 6th century a change was made in the design of the arcades in the nave, and rectangular piers with arches of wide span were substituted for the ordinary arcade with columns. The effect as shown in the engravings and photogravures is so fine that it is strange that the scheme was never adopted in the earlier Romanesque churches of Europe. The two more important examples are at Kalb-Lauzeh (fig. 31) and Ruweiha, but three or four others are known, and this plan was adopted in the basilica erected in the great court of the temple at Baalbek. All the churches are built in fine ashlar masonry, with moulded archivolts and architraves to doorways and windows, and moulded string courses and cornices of simple design. The principal decoration externally is found in the hood-mould or label round the windows, continued as a string-course and carried round other windows, and sometimes terminating in a disk with cross in centre. These hood-moulds are occasionally richly carved. All the churches in central Syria had open timber roofs which have now disappeared; this is proved by the sinkings in the end walls to receive the purlins, and the corbels provided to carry the tie beams. The apses were always covered with semi-domes. The three most important churches were those of Turmanin, Kalb-Lauzeh and Kalat-Seman. The plans of the two first are similar, except that in Turmanin the nave arcade is of the ordinary type, with seven arches carried on columns, while in Kalb-Lauzeh (fig. 32) there are three wide arches on each side carried on two rectangular piers and responds. Both have entrance porches (fig. 33), which are flanked by angle buildings carried up as towers in three storeys; these probably contained wooden staircases to ascend to an open gallery, which consisted of four columns in-antis between the angle towers above the porch. The north and south walls were quite plain, except for window and door dressings and string courses; the apse was richly decorated, with wall shafts superimposed between the windows, and carrying a projecting cornice with alternate corbels. The church at Ruweiha has a similar plan to that at Kalb-Lauzeh, but two transverse arches in stone are thrown across the nave, resting on abutments attached to the nave piers.

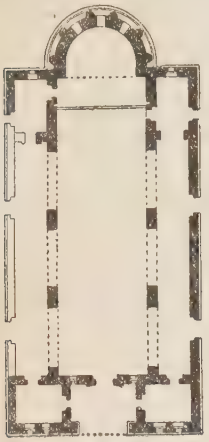


FIG. 31.—Plan of Church of Kalb-Lauzeh.

The most remarkable example and by far the largest is the great basilica at Kalat-Seman (fig. 34), which was erected round the pillar on which St Simeon Stylites spent thirty years of his life. The base of the pillar stands in the centre of an immense octagonal court open to the sky. The plan consists of nave, transept and choir, all with side aisles, separated in the centre by the octagonal court which constitutes the crossing. The nave built on the side of a hill is raised on a crypt, and the principal entrance would seem to have been through the porch of the north transept, which occupies the full width of transept and aisles. There were, however, in addition two doorways with porches to each aisle, as well as portico and doors to the north transept. At the eastern end were three apses, the two outer ones, facing the aisles, being additions in the second half of the 6th century. St Simeon died in 459, and the church was probably begun shortly afterwards, but not completed till the 6th century. The archivolts of the great arches on each side of the octagonal court consist of architrave, frieze and cornice, copied from the arch of the propylaea at Baalbek or other Roman work. Here, as in the great southern porch, the classic nature of the details is remarkable, the pilasters are all fluted, and the modillion and dentil, derived from Roman models, exist throughout. On the other hand, the carving of the foliage was certainly executed by Greek artists, and the well-known Byzantine capital, with the leaves bending under the influence of the wind, is here reproduced. The great apse externally retains its decoration with superimposed shafts and cornice, as in Turmanin and Kalb-Lauzeh.

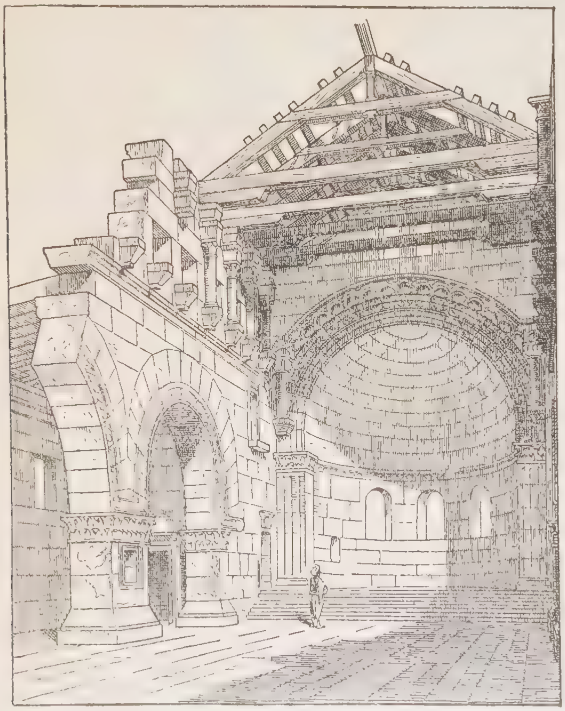


FIG. 32.—Interior of the Church of Kalb-Lauzeh.

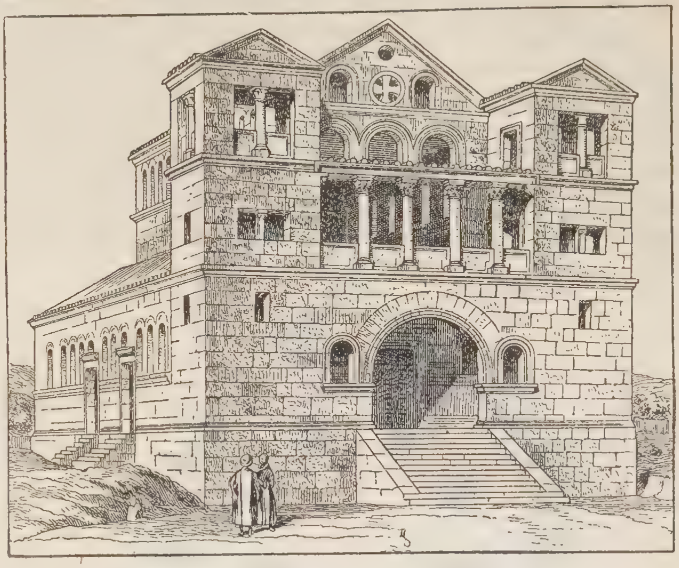


FIG. 33.—Church of Turmanin.

The monastery of Kalat-Seman was built on the south side of the great church, and many of the rooms had roofs of slabs of stone carried on arches across the room, a method of construction universally found in the Hauran, where the absence of timber necessitated this more permanent method of construction. The monasteries differ from the domestic work in being much plainer, and, instead of columns in the porticoes, having invariably square piers of stone.

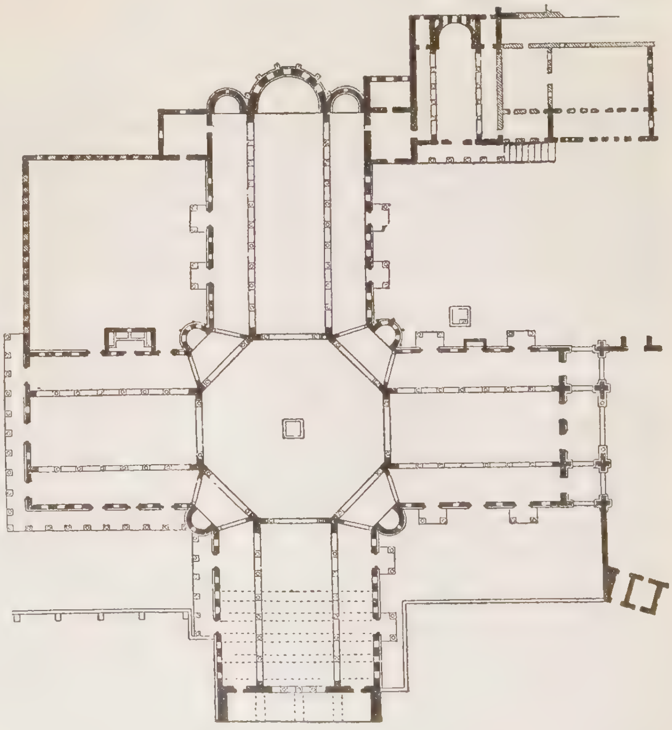


FIG. 34.—Plan of Church of Kalat-Seman.

Among circular churches, the walls of the cathedral at Bozra are gone, so that the conjectural restoration shown in de Vogüé's work is purely speculative, but in the church at Ezra (510) the central octagon is covered by a high dome of elliptical section. An aisle is carried round the octagon with similar recesses on the diagonal lines, the whole being enclosed in a square; in the apse at the east end the seats of the tribune are still preserved.

Domestic Work.—The domestic work in central Syria is, in a way, even more remarkable than the ecclesiastical. Broadly speaking, there are two types of plan—those found in the towns and grouped together, and those which, with increased area, constituted a villa. At El Barah the average house occupied a site of about 80 ft. by 60 ft., of which about 30 ft. in width was occupied by an open court; facing this court, which was enclosed with high walls, is an open colonnade on two floors, which always faces south, occupies the whole front (80 ft.) of the house, and is the only means of approach to the rooms in the rear, three on each floor, side by side. In the centre of these rooms, 14 ft. wide each, an arch is thrown across on each floor, which carries slabs of stone covering the first floor and the roof; the upper storey was reached probably by a timber staircase, now gone, but in poorer dwellings an external flight of steps in stone led to an upper floor. All the houses face the same way. The colonnade of the house consisted of about fifteen columns on each storey. Each column, including its capital and base, was cut out of a single stone; on the upper storey, between the columns, are stone vertical slabs forming a balustrade; the houses are all built in fine ashlar masonry with architraves and cornices to doors and windows, a luxury which in England could rarely be indulged in for ordinary houses. At El Barah, in an area of about 250 ft. by 150 ft. as shown by de Vogüé, there are about 100 monolith columns, 12 ft. high, on the ground storey alone. In a villa at El Barah the open court is surrounded on three sides by buildings, those at the east end of considerable extent and in three storeys. A smaller example at Mujeleia has two courts, one of them being for stables and other services; otherwise the residence of the proprietor is similar to the one above described. Here and there the fantasy of the artist has been allowed to revel in the carving of the balustrades, door lintels, &c. The capitals are of endless design, and show interpretations of Ionic and Corinthian capitals, in some cases not dissimilar to the Byzantine versions in St Mark's at Venice.

Hostelries and public baths are amongst other civil buildings which are recognizable, the hostelries in some cases being attached to the monasteries.

Tombs.—The principal tombs are either excavated in the rock, with an open court in front and an entrance portico, like the tombs of the kings at Jerusalem, and sometimes a superstructure of columns or a podium raised above them; or again they are built in masonry, and take the form of sepulchral chapels; in the latter case, if many sarcophagi have to be deposited, and the chapel is of great length, arches are thrown across, about 6 ft. centre to centre, to support the slabs of stone with which they are covered. This carries on the traditional custom of the Roman temples in Syria, the roofs of which, in stone, were similarly supported. Sometimes there will be two storeys, the upper one covered with a dome. Those which are peculiar to the country are square tombs, with a pyramidal stone roof all built in horizontal courses, and either enclosed with a peristyle all round, on one or two storeys, or having a portico in front with flat stone roof. The cornices, string courses and lintels of the doors of these tombs of the 4th and 5th centuries, are enriched with carving, showing strong Byzantine influence, though probably due to the employment of Greek artists. (R. P. S.)

THE COPTIC CHURCH IN EGYPT

The earliest places of Christian worship in Egypt were probably only chapels or oratories of small dimensions attached to the monasteries, which were spread throughout the country; a wholesale destruction of these took place at various times, more especially by the order of Severus, about 200 B.C., so that no remains have come down to us. The most ancient examples known are those which are attributed to the empress Helena, of which there are important portions preserved in the churches of the White and Red monasteries at the foot of the Libyan hills near Suhag.

Although the plan of the Coptic church is generally basilican, *i.e.* consists of nave and aisles, it is probable that they were not copied from Roman examples, but were based on expansions of the first oratories built, to which aisles had afterwards been added. There are no long transepts, as in the early Christian basilicas of St Peter's at Rome, and of St Paul outside the walls, and there is only one example of a cruciform church with a dome in the centre following the Byzantine plan. Even at an early period the nave and aisles were covered sometimes with barrel vaults, either semicircular or elliptical. The Coptic church was always orientated with the sanctuaries at the east end. The aisles were returned round the west end and had galleries above for women. Sometimes the western aisle has been walled up to form a narthex; in many cases a narthex was built, but, in consequence of the persecution to which the Copts were subject at the hands of the Moslems, its three doors have been blocked up and a separate small entrance provided. The narthex was the place for penitents, but was sometimes used for baptism by total immersion, there being epiphany tanks sunk in the floor of the churches at Old Cairo, known as Abu Serga, Abu-s-Sifain (Abu Sefen) and El Adra; these are now boarded over, as total immersion is no longer practised.

There are a few exceptions to the basilican plan; and in four examples (two in Cairo and two at Deir-Mar-Antonios in the eastern desert by the Gulf of Suez) there are three aisles of equal widths, divided one from the other by two rows of columns with three in each row, thus dividing the roof into twelve square compartments, each of which is covered with a dome.

The sanctuaries at the east end, as developed in the Coptic church, differ in some particulars from those of any other religious structures. There are always three chapels or sanctuaries, with an altar in each, the central chapel being known as the Haikal. The chapels are more often square than apsidal, and are always surmounted by a complete dome, a peculiarity not found out of Egypt. The seats of the tribune are still preserved in a large number of the sanctuaries, and there are probably more examples in Egypt than in all Europe, if Russia and Mount Athos be excepted. Those of Abu-Serga, El Adra and Abu-s-Sifain, with three concentric rows of seats and a throne in the centre, are the most important; but even in the square sanctuaries the tradition is retained, and seats are ranged against the east wall, and in one case (at Anba-Bishôi) three steps are carried across, and behind them is a segmental tribune of three steps, with throne in the centre.

The most remarkable Coptic churches in Egypt are those of the Deir-el-Abiad (the White monastery) and the Deir-el-Akhmar (the Red monastery) at Suhag. These were of great size, measuring about 240 ft. by 130 ft. with vaulted narthex, nave and aisles separated by two rows of monolith columns taken from ancient buildings, twelve in each row and probably roofed over in timber, and three apses, directed respectively towards the east, north and south. These apses are unusually deep and have five niches in each, in two storeys separated by superimposed columns. In the church of St John at Antinoe there are seven niches. A similar arrangement is found in the three apses, placed side by side, in the more ancient portion of St Mark's, Venice, built A.D. 820, and said to have been copied from St Mark's at Alexandria. There is no external architecture in the Coptic churches; they are all masked with immense enclosure walls, so as to escape attention. The walls of the interior still preserve a great portion of the paintings of scriptural subjects; the screens dividing off the Haikal and other chapels from the choir are of great beauty, and evidently formed the models from which the panelled woodwork, doors and pulpits of the Mahommedan mosques have been copied and reproduced by Copts.

Illustrations are given in A. J. Butler's *Ancient Coptic Churches of Egypt* (1884); Wladimir de Bock's *Matériaux archéologiques de l'Égypte chrétienne* (1901); and A. Gayet's *L'art coptique.* (R. P. S.)

ROMANESQUE AND GOTHIC ARCHITECTURE IN ITALY

"Romanesque" is the broad generic term adopted about the beginning of the 19th century by French archaeologists in order to bring under one head all the various phases of the round-arched Christian style, hitherto known as Lombard and Byzantine Romanesque in Italy, Rhenish in Germany, "Romane" and Norman in France, Saxon and Norman in England, &c. In character, as well as in time, the Romanesque lies between the Roman and the Gothic or Pointed style, but its first manifestation in Italy has already been described in the section on "Early Christian Architecture," and it only remains to deal with the subsequent development from the age of Charlemagne, which marks an epoch in the history of architecture, and from which period examples are to be found in every country.

In consequence of the lack of homogeneousness in the Romanesque style as developed in Italy, owing to the mixture of styles, and the difficulty of tracing the precise influence of any one race in buildings frequently added to, restored or rebuilt, their description will be more easily followed if a geographical subdivision be made, the simplest being Northern or Lombard Romanesque, Central Romanesque and Southern Romanesque; after the latter would follow the Sicilian Romanesque, which, owing to the Saracenic craftsman, constitutes a type by itself. This leaves still one other phase to be noted, the influence recognized in northern Italy of the architectural style of the Eastern Empire at Byzantium, either direct or through Istria and Dalmatia. In the churches at Ravenna, this influence has already been referred to in the section on "Early Christian Architecture," but it appears again in the church of St Mark at Venice, and in much of its domestic architecture, so that it is necessary to recognize another term, that of "Byzantine Romanesque."

Northern or Lombard Romanesque.—Although the materials for forming an adequate notion of the earlier work of the Lombards are very scanty, after their conversion to the Catholic faith the Church probably exercised a powerful influence in their architectural work. Under Liutprand, towards the close of the 8th century, an order known as the Magistri Commacini was established, to whom were given the privileges of freemen in the Lombard State. These Commacini, so named from the island in the lake of Como whence they sprang, were trained masons and builders, who in the 9th and 10th century would seem to have carried the Lombard style through north and south Italy, Germany and portions of France. It was at one time assumed that they had influenced the church architecture throughout Europe, but this is not borne out by the evidence of the buildings themselves, except in the Rhenish provinces and in the districts on the slope of the Harz Mountains, where in sculpture a strange mixture is found of monstrous animals with Scandinavian interlaced patterns and Byzantine foliage, bearing a close resemblance to the early sculpture in Sant' Ambrogio at Milan and San Michele at Pavia (Plate V., fig. 72). Although the earliest Lombard buildings in Italy (such as those of San Salvatore in Brescia, San Vincenzo-in-Prato at Milan, the church of Agliate and Santa Maria delle Caccie at Pavia) were basilican in plan with nave and aisles, there are some instances in which the adoption of a transept has produced the Latin cross plan (*e.g.* San Michele at Pavia, Sant' Antonino at Piacenza, San Nazaro-Grande at Milan, and the cathedrals of Parma and Modena), though to what extent this is due to subsequent rebuilding is not known. In the early basilicas above mentioned, the columns, carrying the arcades between nave and aisles, were taken from earlier buildings, while the capitals, where not Roman, were either rude imitations of Roman, or Byzantine in style. The roofs were always in wood, and the exteriors of the simplest description. In the external decoration, however, of the apses of the churches of San Vincenzo-in-Prato, Santa Maria delle Caccie, the church at Agliate and the ancient portion of S. Ambrogio at Milan, we find the germ of that decorative feature which (afterwards developed into the eaves-gallery) became throughout Italy and on the Rhine the most beautiful and characteristic element of the Lombard style. In order to lighten the wall above the hemispherical vault of the apse, a series of niches was sunk within the arches of the corbel table, which gave to the cornice that deep shadow where it was most wanted for effect. In addition to the churches above named, similar niches are found in the baptisteries of Novara and Arsago, the Duomo Vecchio at Brescia and the church of San Nazaro Grande at Milan. Towards the close of the 11th century, the imposts of these niches take the form of isolated piers, with a narrow gallery behind, and eventually small shafts with capitals are substituted for the piers, producing the eaves-galleries of the apses, which in Santa Maria Maggiore at Bergamo (1137) and the cathedral of Piacenza are the forerunners of numerous others in Italy, and in the churches of Cologne, Bonn, Bacharach and other examples on the Rhine, constitute their most important external decoration.

In the apses of San Vincenzo-in-Prato and of the church at Agliate (both of the 9th century) there is another decorative feature, destined afterwards to become one of the most important methods of breaking up or subdividing the wall surface, *i.e.* the thin pilaster strips, which, at regular intervals, rise from the lower part of the wall to the corbel table of the cornice.

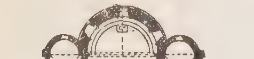


Fig. 35.—Plan of S. Ambrogio.

The two most important churches of the Lombard Romanesque style are those of Sant' Ambrogio at Milan and S. Michele at Pavia, their importance being increased by the fact that they probably represent the earliest examples of the solution of the great problem which was exercising the minds of the church builders towards the end of the 11th century, the vaulting of the nave. In the original church, of the 9th century, the nave and aisles of Sant' Ambrogio were divided in the usual way with arcades, and were covered with open timber roofs. In the rebuilding of the church (fig. 35) the nave (38 ft. wide) was divided into four square bays, and compound piers of large dimensions were built, to carry the transverse and diagonal ribs of the new vault. To resist the thrust, the walls across the aisles were built up to the roof, and had external buttresses; the diagonal ribs, instead of following the elliptical curve which the intersection of the Roman semicircular barrel-vault gave to the groin, were made semicircular, so that the web or vaulting surface which rested on these ribs rose upwards towards the centre of the bay, giving a distinct domical form to the vault. The aisles, being half the width of the nave, were divided into eight compartments, two to each bay of the nave, and were covered both in the ground storey and the triforium with intersecting groin vaults. When this rebuilding took place, the front of the church was brought forward, bearing a narthex, and the arcades of the atrium were rebuilt in the first years of the 12th century. The triple apse, to the external decoration of which we have called attention, the crypt underneath, and the south campanile, are the only remains of the 9th century church. The campanile on the north side was built 1125–1149, and the decoration with pilaster strips, semi-detached shafts, and arched corbel table, is repeated on the façade of the church and on the arcade round the atrium. In the rebuilding, portions of the sculptural decoration of the 9th century church were utilized; this would appear to have been a Lombard custom, as in the church of San Michele the lower part of the main front is encrusted with sculptured decoration taken from the earlier churches built on the site. These ancient sculptures are of special interest, as they constitute the best records of the rude Lombard work of the 8th and 9th centuries, and are intermingled with Byzantine scroll work and interlaced patterns. If the plan of Sant' Ambrogio, with its comparatively thin enclosure walls, suggests its original construction as an ordinary basilica, this is not the case with San Michele (fig. 36), where all the external walls are of great thickness, showing that from the first it was intended to vault the whole structure. The church is much smaller than Sant' Ambrogio, there being originally only two square bays to the nave (in the 15th century the vaults were rebuilt with four bays); the transept, however, projects widely beyond the aisles, and as there is another bay given to the choir in front of the apse, the area of the two churches is about the same. The existing church was probably begun shortly after the destructive earthquake of 1117, and was consecrated in 1132. In Sant' Ambrogio the transverse and diagonal arches spring from just above the triforium floor, so that there was no room for clerestory windows, and consequently the interior is dark. In San Michele the ribs rise from the level of the top of the triforium arcades, and two clerestory windows are provided to each bay. The crossing of the nave and transept is covered with a dome, carried on squinches, which dates from the first building. The dome over the fourth bay of Sant' Ambrogio replaced the original vault about the beginning of the 13th century.

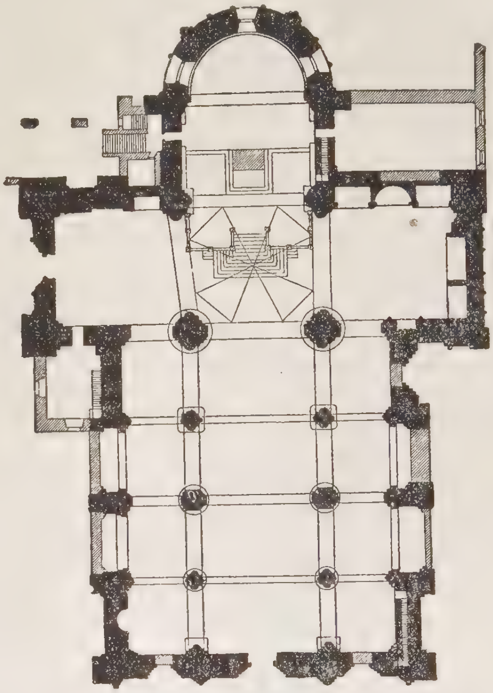
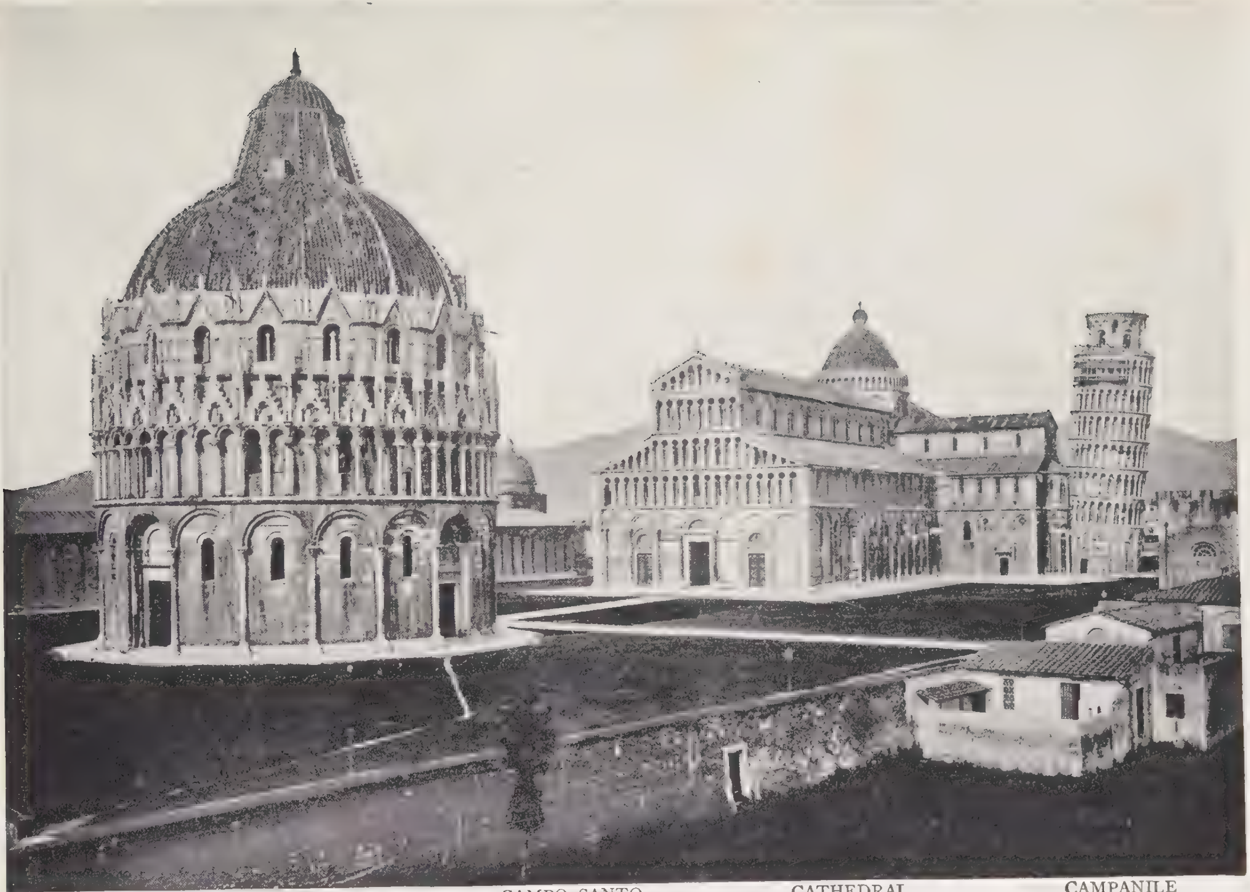


Fig. 36.—Plan of San Michele, Pavia.

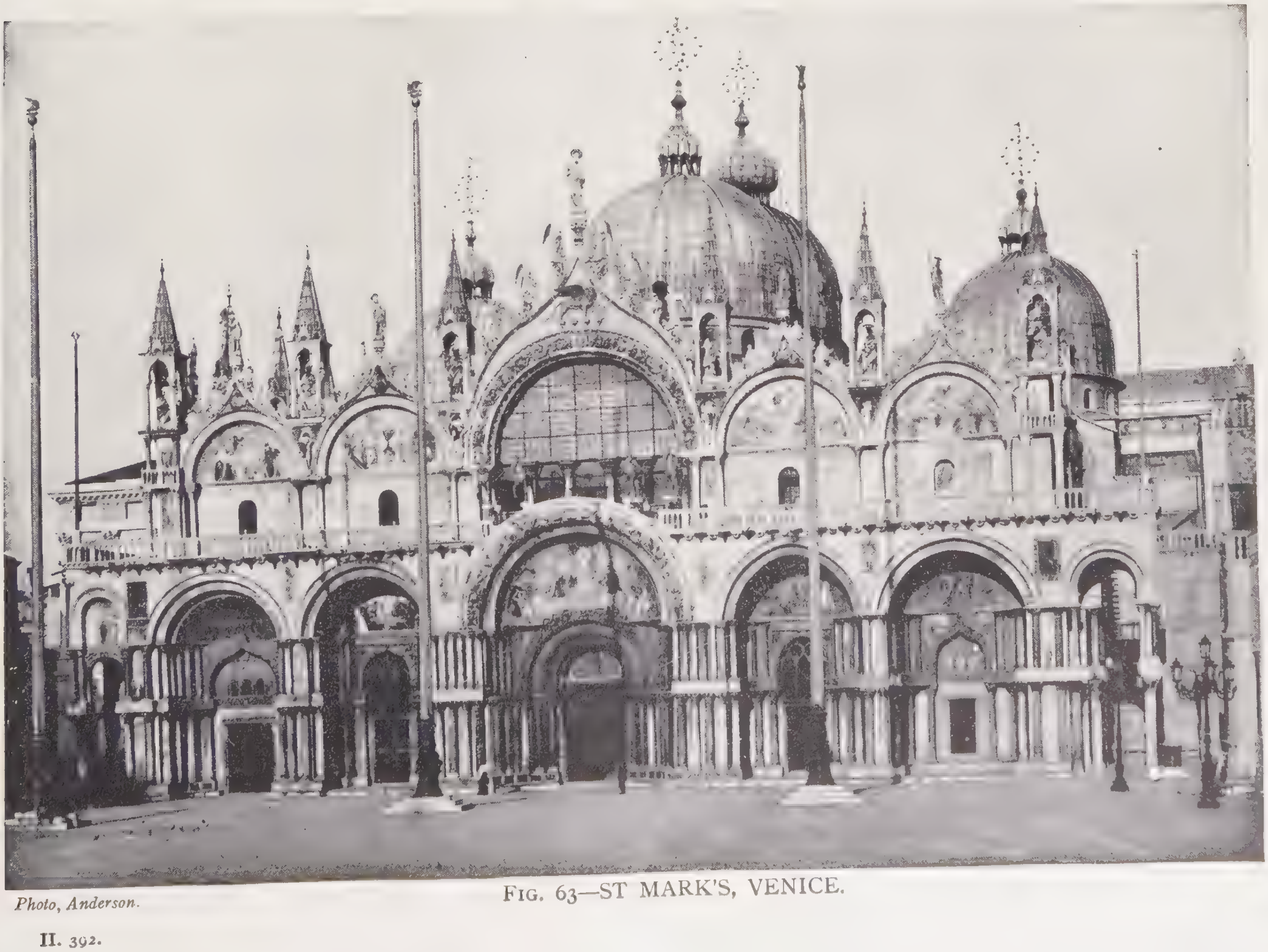
The cathedral of Novara, originally of the ordinary basilica type of the 10th century with timber roofs, was reconstructed in the 11th century, compound piers being built to carry the transverse and diagonal ribs, and walls built across the outer aisles to resist the thrust; on the other hand SS. Pietro and Paolo at Bologna is a 12th century church, which was designed from the first to be vaulted. To these, and still belonging to the basilican plan, must be added San Pietro in Cielo d'oro (1136) and San Teodoro, both in Pavia; S. Evasio at Casale-Monferrato, having a comparatively narrow nave with double aisles on either side and a very remarkable narthex or porch: S. Lorenzo at Verona (lately restored), which in the 12th century was rebuilt with compound piers to carry a vault (the apse and the two remarkable circular towers in the west front belong to the ancient church); and Sant' Abbondio at Como, often restored and partly rebuilt, retaining, however, some of the original sculpture of the early Lombard period.

Of churches built on the plan of the Latin cross, examples are Sant' Antonino at Piacenza, with an octagonal lantern tower over the crossing; Parma cathedral (*c.* 1175), with an octagonal pointed dome over the crossing; Modena cathedral, rebuilt and consecrated



Photo, Brogi. BAPTISTRY. CAMPO SANTO. CATHEDRAL CAMPANILE

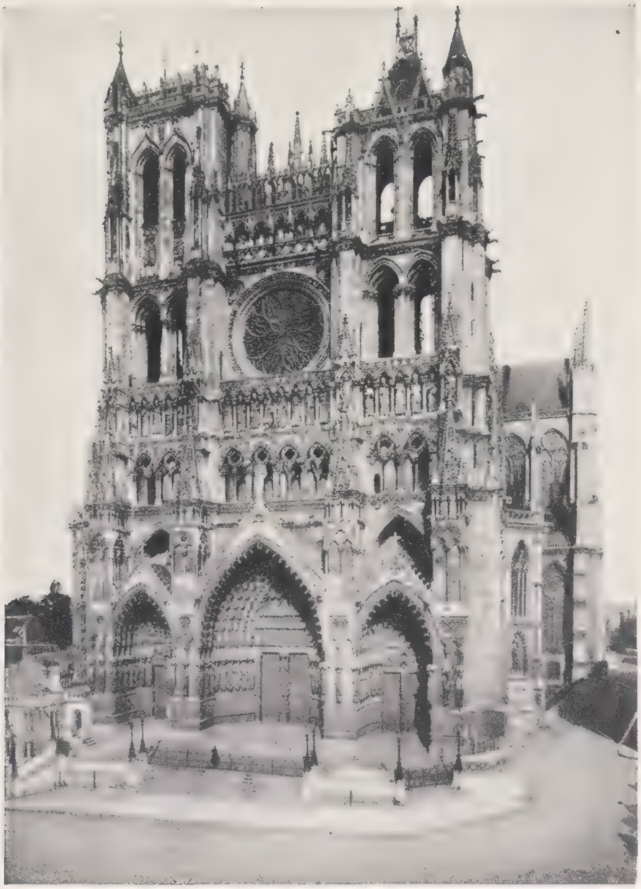
FIG. 62.—PISA.



Photo, Anderson.

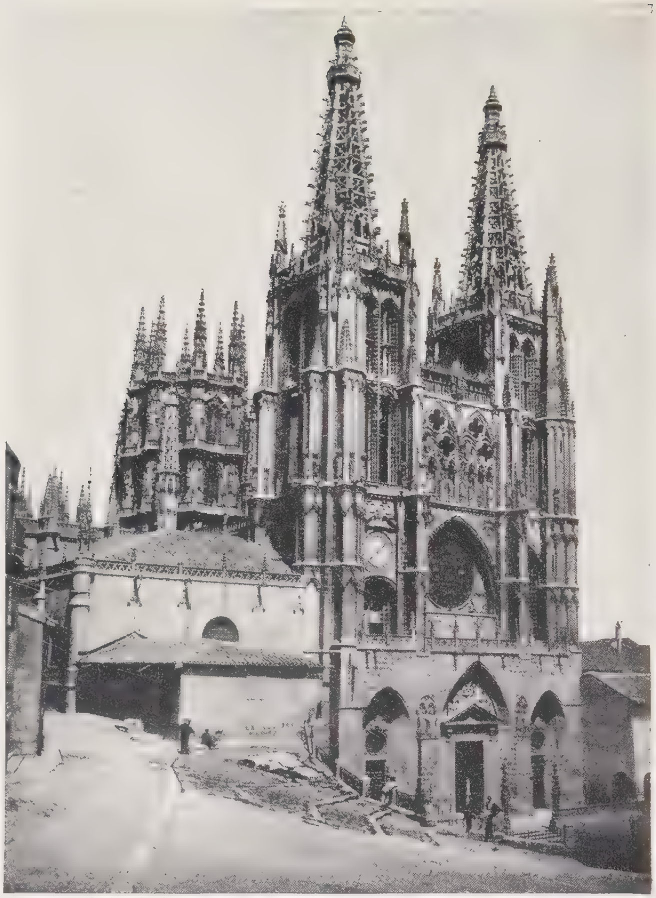
FIG. 63—ST MARK'S, VENICE.

ARCHITECTURE



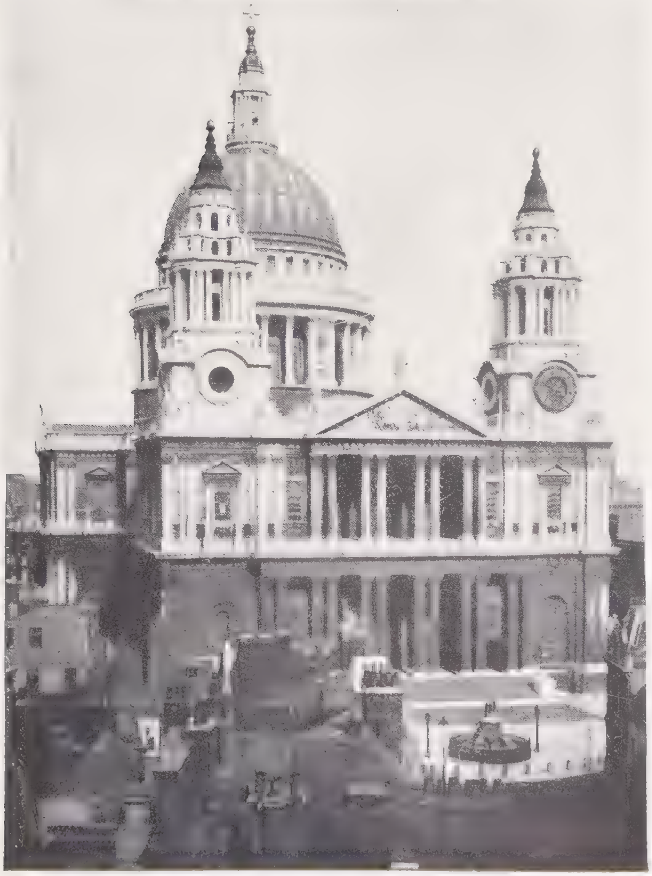
Photo, Neurdein.

FIG. 64.—AMIENS CATHEDRAL.



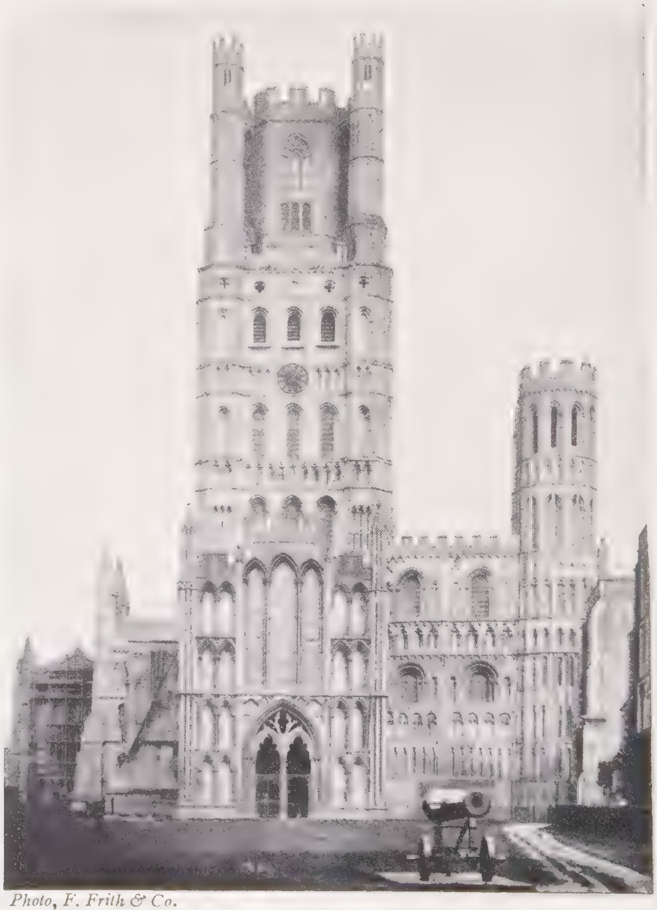
Photo, F. Frith & Co.

FIG. 65.—BURGOS CATHEDRAL.



Photo, F. Frith & Co.

FIG. 66.—ST PAUL'S, LONDON.



Photo, F. Frith & Co.

FIG. 67.—ELY CATHEDRAL.

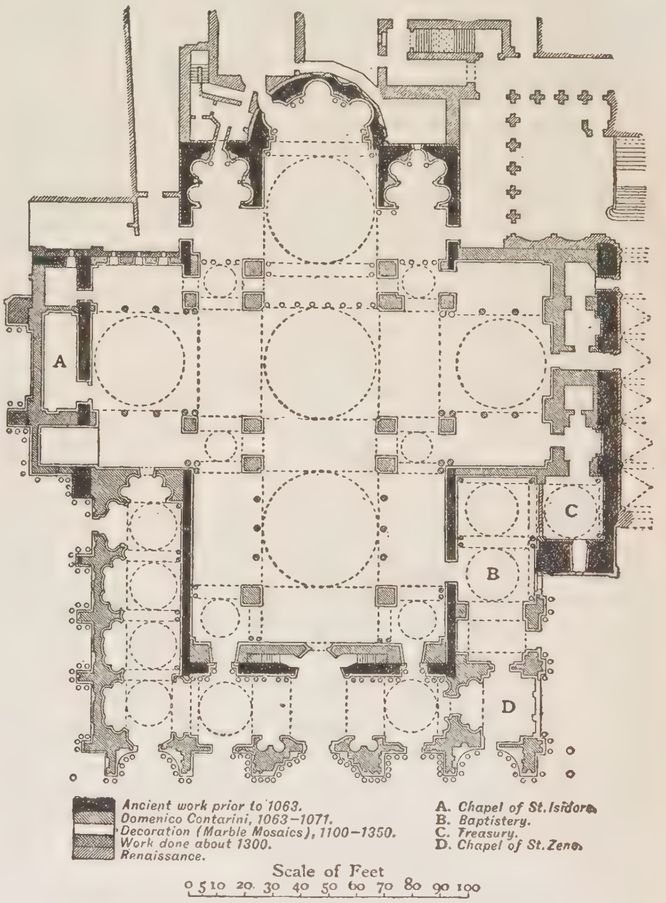
in 1184; San Nazaro-Grande at Milan; and San Lanfranco at Pavia, the two latter without aisles.

Reference has already been made to the eaves-galleries of the apses of the Lombard churches. A similar gallery was carried across the main front, rising with the slope of the roof, as in San Michele, Pavia; also on the west fronts of San Pietro in Cielo d'oro and San Lanfranco, at Pavia; and in the cathedrals of Parma and Piacenza. In all these cases the galleries are not quite continuous, vertical buttresses or groups of shafts or single shafts being carried up through them to the corbel tables. In S. Ambrogio at Milan the central original lantern is surrounded with two tiers of galleries. The finest example of their employment, however, is in the magnificent central tower of the Cistercian church at Chiaravalle, near Milan, where the two lower storeys form the drum of the internal dome, the two storeys above are set back, and the upper storey consists of a lofty octagonal tower with conical spire.

One of the serious defects in the front of the church of San Michele at Pavia is that it forms a mask, and takes no cognizance of the aisle roofs, which are at a lower level, and the same is found in San Pietro-in-Cielo d'oro at Pavia. This mask is carried to an absurd extent in the church of Santa Maria della Pieve at Arezzo, in which, above the ground storey of the arcades, are three galleries forming strong horizontal lines, which suggest the numerous floors of a civic building instead of the vertical subdivisions of a church. This defect is not found in the church of San Zeno at Verona, which is one of the finest of the Lombard churches; the church is basilican in plan, the nave being divided into five bays with compound piers, as in Sant' Ambrogio, as if it were intended to vault it; this, however, was never done, but stone arches are thrown across the two westernmost bays of the nave as if to carry the roof (now concealed by a wooden ceiling). The façade is of marble and sandstone, with pilaster-strips rising from the base to the arched corbel table, and the outline of the nave and aisles is preserved in the front, in which all the mouldings and carving are of the utmost delicacy. Both here and in the cathedral are fine examples of those projecting porches, the columns of which are carried on the backs of lions or other beasts. At Piacenza, Parma, Mantua, Bergamo and Modena are porches of a similar kind, and in the cathedral of Modena the columns which support the balcony on the entrance to the crypt are all carried on the backs of lions. The cathedral of Verona has suffered so much from rebuilding and restoration that little remains of the earlier structure, but the apse of the choir, decorated with a close set range of pilaster-strips, with bases and Corinthian capitals and crowned with a highly enriched entablature, is quite unique in its design.

Among circular buildings, the Rotonda at Brescia was at one time considered to date from the 8th century, owing to its massive construction and the simplicity and plainness of its external design. Later discoveries, however, have shown that the early date can only be given to the crypt of San Filasterio situated to the eastward of the Rotonda. The church of Santo Sepolcro at Bologna, as its name implies, is one of those reproductions of the church of the Holy Sepulchre at Jerusalem which were built by the Templars during the crusades. Of much earlier date is the circular church of San Tommaso-in-Limine, an early Lombard work of the 9th century, to which period belong also the baptisteries of Albenga, Arsago, Biella, Galliano and Asti. One of the most beautiful examples is the baptistery of Santa Maria at Gravedona, at the northern end of the lake of Como, built in black and white marble. The plan is unusual, and consists of a square with circular apses on three sides.

Byzantine Romanesque.—Although in the first basilican church of St Mark at Venice, erected in 929 to receive the relics of the saint recovered from St Mark's in Alexandria, the capitals of the columns and other decorative accessories showed Greek influence, its transformation into a five-domed Byzantine structure was not begun till about the middle of the 11th century. The date given by Cattanco is 1063, the same year in which the cathedral of Pisa was begun; it is probable, however, that the scheme had already been in contemplation for some years, as the problem was not an easy one to solve, owing to the restrictions of the site, and to the desire to reproduce in some way the leading features of the church of the Holy Apostles at Constantinople. This church was destroyed in 1464, but its description by Procopius is so clear, and corresponds so closely with St Mark's, completed towards the end of the 11th century, as to leave little doubt about the source of its inspiration. From what has already been said with reference to the great changes made when it was proposed to vault the early Lombard basilican churches, those of equal importance which were carried out in St Mark's will be better understood. The nave was divided into three square bays (fig. 37), with additional bays on the north and south to form transepts; the five square bays thus obtained were covered with domes carried on pendentives, as in St Sophia at Constantinople, and on wide transverse barrel vaults; the domes over the north and south transepts and the choir were of slightly less dimensions than those over the nave and crossing, in consequence of the limitations in area caused by the chapel of St Theodore on the north, the ducal palace on the south, and the ancient apse of the original basilica which it was desired to retain. In the reconstruction, many of the old columns, capitals and parapets were utilized again in the arcades carrying the galleries and in the balustrades over them. Externally the brick walls were decorated with blind arcades and niches of Lombard style, and all the roof vaults were covered with lead as in Constantinople. The subsequent decoration of the exterior took two centuries to carry out, not including the florid work of later date. There is no precedent in the East for the superimposed columns and capitals exported from Constantinople and Syria which now decorate the north, south and west fronts (Plate I., fig. 63), though the materials were all of the finest Byzantine type. Internally, the mosaic decoration of the domes, vaults and the upper part of the walls, was carried out by Greek artists from Constantinople, who probably also were employed for the marble panelling of the lower part of the walls. The marble casing of the front was certainly executed by Constantinopolitan artists, since the moulded string known as the "Venetian dentil" is a direct reproduction of that in St Sophia. At a later date the domes were all surmounted by lanterns in wood, covered with lead, and the roofs were all raised. So far, therefore, the building departs from its prototype, the church of the Apostles. A similar transformation took place in the church of Santa Fosca at Torcello, where a single large dome was contemplated over the centre of the original basilican church, but was never built. The cathedral of Torcello and the church at Murano are richly decorated with carved panels, capitals, choir screens and other features, either imported from the East or reproduced by Greek artists or Italians trained in the style. The influence of St Mark's in this respect extended far and wide on the east coast of Italy; and at Pomposa, Ancona, and as far south as Brindisi, Byzantine details can be traced everywhere. The designs of the churches of San Ciriaco at Ancona and of Sant' Antonio at Padua were both based on St Mark's. Sant' Antonio's had six domes, there being two over the nave; and in all cases the domes were surmounted by domes in timber like those of St Mark's.



From R. P. Spiers's *Architecture, East and West.*

FIG. 37.—Plan of St Mark's, Venice.

In domestic work, Venice is richer in Byzantine architecture than Constantinople, for with the exception of the Hebdomon palace the continual fires there have destroyed all the earlier palaces and houses. The Fondaco-dei-Turchi, built probably in the 11th century, is one of the most remarkable; the front on the great canal is 160 ft. long, having a lofty arcade with ten stilted arches on the ground storey and an arcade of eighteen arches above; the pavilion wings at the east end are in three storeys, with blind arcades and windows pierced in the central arcade. The whole was built in brick encased with marble, with panels or disks enriched with bas-reliefs or coloured marbles. A second example is found in the Palazzo Loredan, having similar arcades, stilted arches and marble panelling; and there are two others, one on the Grand Canal and the other on the Rio-Cà-Foscari. Throughout Venice the decoration of these Byzantine palaces would seem to have influenced those of later date; for the Venetian dentil, interlaced scroll-work and string courses, with the Byzantine pendant leaf, are found intermingled with Gothic work, even down to the 15th century, and the same to a certain extent is found at Padua, Verona and Vicenza.

Central Romanesque.—The builders in the centre of Italy would seem to have followed more closely the Roman basilican plan, for in two of the earliest churches, Santa Maria Fuorcivitas at Lucca and San Paolo a Ripa d'Arno at Pisa, the T-shaped plan of St Peter's and St Paul's, with widely projecting transepts, was adopted; the difference also between the north and central developments is very marked, as in the place of the massive stone walls, compound piers, and internal and external buttresses deemed necessary to resist the thrusts of the great vaults, and the low clerestory of the northern churches, those in the south retain the light arcades with classic columns, the wooden roofs, and the high clerestory of the Roman basilicas. Instead of the vigorous sculpture of the Lombards in the Tuscan churches, marbles of various colours take its place, the carving being more refined in character and much quieter in effect.

The earliest church now existing is that of San Frediano at Lucca, dating from the end of the 7th century. Originally it was a five-aisled basilica, with an eastern apse, but when it was included within the walls in the 11th century the apse and the entrance doorway changed places, and a fine eaves-gallery was carried round the new apse; the outer aisles were also transformed into chapels. So many of the churches in Pisa and Lucca had new fronts given to them in the 11th or 12th century, that it is interesting to find, in the church of San Pietro-in-Grado at Pisa, an example in which the external decoration with pilaster strips and arched corbel tables is retained, showing that in the 9th century, when that church was built, the Lombard style prevailed there. Other early churches are those of San Casciano (9th century), San Nicola and San Frediano (1007), all in Pisa.

Of early foundation, but probably rebuilt in the 11th century, are two interesting churches in Toscanella, Santa Maria and San Pietro; they are both basilican on plan, but the easternmost bay is twice the width of the other arches of the arcade, and is divided from the nave by a triumphal arch. In both churches the floor of the transept is raised some feet above the nave, and a crypt occupies the whole space below it.

One of the earliest and most perfect examples of this subdivision is the church of San Miniato, on a hill overlooking Florence. The church was rebuilt in 1013, and some of the Roman capitals of the earlier building are incorporated in the new one. It is divided into nave and aisles by an arcade of nine arches, and every third support consists of a compound pier with four semi-detached shafts, one of which, on each side of the nave, rises to the level of the summit of the arcade and carries a massive transverse arch to support the roof. The east end of the church, occupying the last three bays of the arcade, is raised 11 ft. above the floor of the nave, over a vaulted crypt extending the whole width of the church and carried under the eastern apse. The interior of the church, which is covered over with an open timber roof, painted in colour and gilded, is decorated with inlaid patterns of black and white marble of conventional design, and the same scheme is adopted in the main façade, enriching the panels of the blind arcade on the lower storey, and above an extremely classic design of Corinthian pilasters, entablature and pediment.

As none of the façades of the Pisan churches was built before the middle of the 11th century, it is possible that Buschetto, the architect of the cathedral of Pisa, may have profited by the scheme suggested in the lower storey of San Miniato; if so he departed from its classic proportions. There are seven blind arcades in the lower storey of the Pisan cathedral, the arcades are loftier, and the position of the side doors which open into the inner aisle on each side is of much better effect. The cathedral was begun in 1063, the year following the brilliant capture of Palermo by the Pisans, when they returned in triumph with immense spoils. In plan it consists of a Latin cross, with double aisles on either side of the nave extending to the east end, a central apse, transepts with single aisles on each side, and north and south transepted apses (fig. 38). The nave arcade, with its Corinthian capitals and monolith stone columns, is of exceptional boldness, and as it is carried across the transept up to the east end (a length of 320 ft.) it forms a continuous line greater than that in any other cathedral. The crossing is covered by a dome, elliptical on plan, being from east to west the length of the transept and aisles. The result is unfortunate, and detracts both externally and internally from its beauty; otherwise the exterior decoration, which must have been schemed out in its entirety from the beginning (with the exception of the dome, which is of later design), has the most satisfactory and pleasing effect. The lofty blind arcade of the lower storey and the open gallery above on the façade (the latter represented by a blind arcade), are carried round the whole building, and the horizontal lines of the galleries of the upper storeys accord with the roofs of the aisles and nave respectively and the blind arcade of the clerestory. The walls are faced within and without with white and grey marble, and the combination of sculpture and inlay which enriches the arcades of the façades gives an additional attraction to the building. The cathedral is sometimes quoted as Byzantine in style, but its plan and design are of widely different character from those of any building found in the East, and the mosaics, which constitute the finest decorative element in that style, were not added till the 14th century, and formed no part of the architect Buschetto's scheme.

The Baptistery, begun in 1153, was not completed till towards the close of the 13th century, when important alterations were made in the design to bring it into accordance with the new Gothic style. The crocketed gables, and the upper gallery, substituted for the arcades, which followed on the lines of those in the cathedral, have taken away the quiet repose found in the latter; the lower storey, however, with its lofty blind arcades, similar to those of the cathedral, and the principal doorway, are of great beauty. The central area of the baptistery, which is surrounded by aisles and triforium gallery, is covered by a conical dome; internally as well as externally this can never have been a beautiful feature, and the additions of the 13th century have made it one of the ugliest roofs in existence.

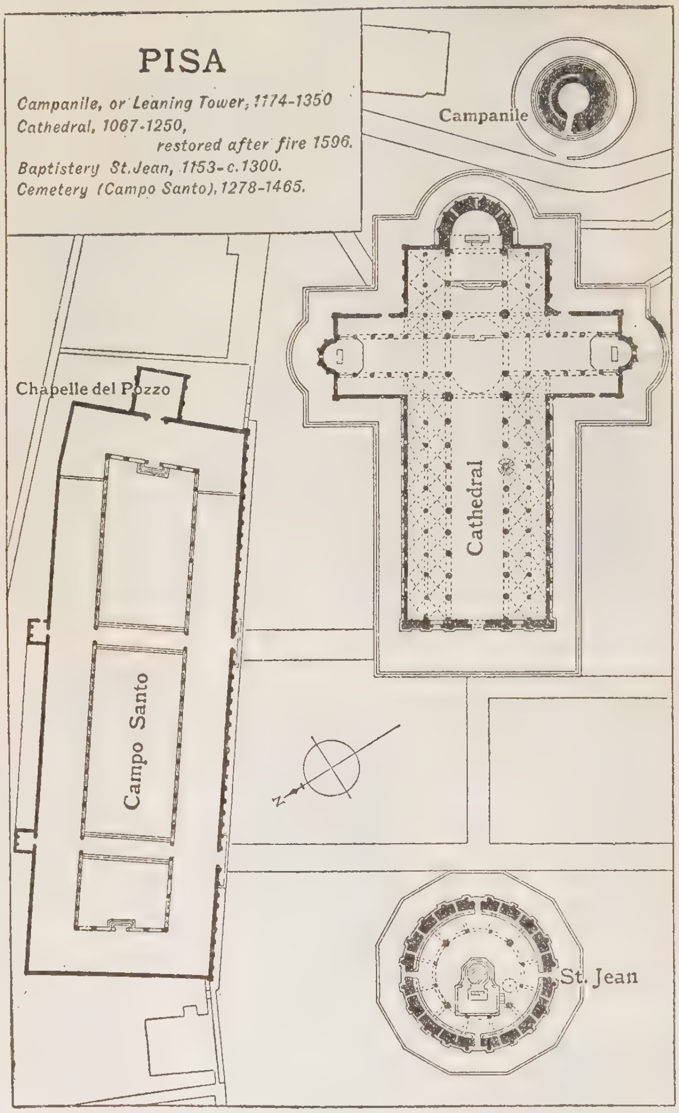

PISA
Campanile, or Leaning Tower, 1174-1350
Cathedral, 1067-1250,
restored after fire 1596.
Baptistery St.Jean, 1153-c.1300.
Cemetery (Campo Santo), 1278-1465.
Campanile
Chapelle del Pozzo
Cathedral
Campo Santo
N
St. Jean

FIG. 38.

The Campanile or leaning tower was begun in 1174. Owing, however, to the treacherous nature of the ground, the piles driven in to support the tower gave way on the south side, so that, when only 35 ft. above the ground, a settlement was noticed, and slight additions in height were made from time to time in order to obtain a horizontal level for the stone courses; but this was without avail, and on the completion of the third gallery above the ground storey the work was suspended for many years. In 1350 it was recommenced, three more gallery storeys were added, and the upper or belfry stage was set back in the inner wall. The tower is now 178 ft. high, and overhangs nearly 14 ft. on the south side; its design is made to harmonize with the cathedral, but shows much less refinement and grace.

The Campo Santo, an immense rectangular court 350 ft. long by 70 ft. wide, surrounded by a cloister 35 ft. wide, was begun in 1280; the details are refined, but the poverty in the design of the tracery with which the arcades were fitted in at a much later date detracts from its interest, which is now mainly concerned with the beautiful frescoes which decorate its walls.

As might have been expected, the cathedral of Pisa set the model not only for the restoration of existing churches but also for new ones, in Pisa itself and also at Lucca, Pistoia and Prato. In Pisa, the church of San Paolo a Ripa d'Arno was rebuilt about 1060, possibly by the architect of the cathedral; San Pietro-in-Vincoli and San Nicola date from the early years of the 12th century. At Lucca the churches of Santa Giulia, San Giusto, San Martino, San Michele, and the restored front of Santa Maria Fuorcivitas, are the principal examples in which the Pisan cathedral has suggested the design; and at Pistoia we can point to the cathedral, Sant' Andrea, San Pietro and San Giovanni Fuorcivitas, the latter with a south wall decorated with three stages of blind arcades of great richness. The cathedral of Lucca was either restored or rebuilt at the beginning of the 14th century, and has a distinctly Gothic effect. The lower storey of the façade presents the unusual feature of an open porch across the whole front with three great archways. This porch with the three galleries above was added to the cathedral at the beginning of the 13th century.

Southern Romanesque.—The influences exerted in the early development of the Romanesque style in the south of Italy are much more complicated than in the north, since two new elements come into the field, the Norman and Saracenic. Of early work very little remains, owing to the general rebuilding in the 11th century; what is more remarkable, there is scarcely any trace of the result of the Byzantine occupation for so many centuries; the only exception being the church of San Gregorio at Bari, a small basilican structure in which the arches of the arcades separating the nave from the aisles are stilted like those of the Fondaco-dei-Turchi at Venice.

One of the chief characteristics noticeable in the plan is the almost universal adoption of a transept projecting north and south slightly beyond the aisle walls, and in some cases raised over a crypt, as in the churches at Toscanella. Since, however, there is no choir bay, and the central apse opens direct into the transept, the plan is not that of the Latin cross. The most complete development of this arrangement is found in the cathedral and in the church of San Nicola at Bari (fig. 39); both being basilican churches with a triumphal arch opening into the transept,—in this respect similar to the churches of St Peter and St Paul at Rome, except that the transepts project only slightly, beyond the aisles. There is one peculiarity in both these churches, as also in that of the cathedral at Molfetta. East of the transept, and at the north and south sides, are towers, between which is carried a wall which hides the apse, the only indication of its existence being the round arched window which lights it. A similar arrangement exists in the cathedrals of Giovenazzo, Bitetto and Bitonto. The central bay of the transept of the cathedral at Bari is surmounted by an octagonal drum, the dome within which is carried on squinches; a similar dome was projected in San Nicola, but never built. In the cathedral at Bari, as also in San Nicola, the lofty nave is covered with a timber roof, and has an arcade on the ground storey and a fine triforium and clerestory windows above.

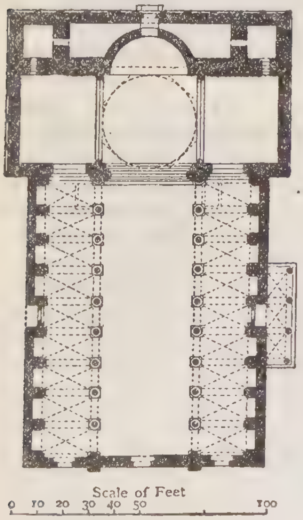


FIG. 39.—Plan of S. Nicola at Bari.

Externally these churches depend for their effect more on their fine masonry than on any decorative treatment; the blind arcades of the lower storey have very little projection, and the pilaster strips which in the Lombard churches break up the wall surface are not found here; the arched corbel table is freely employed but rarely the open gallery. There is one remarkable example in Bitonto cathedral; above the aisle chapels, and approached from the triforium, is an open gallery, the arches of which rest on widely projecting capitals sculptured with animals and foliage, half Lombardic and half Byzantine in style. The small shafts supporting these capitals are of infinite variety of design, with spirals, chevrons, fluting and vertical mouldings of many kinds.

The cathedral at Molfetta is in plan quite different from those already described, and consists of square bays with aisles, transept and apse, having domes over the nave and crossing. The Byzantine influence here comes in, but it is much more pronounced in La Cattolica at Stilo, a small church square on plan with four columns carrying the superstructure, which consists of a central and four domes on the angles. Other domed churches are those of the Immaculata at Trani; San Sabino, Canosa; and San Marco, Rossano. The lower part of the cathedral at Troja shows the direct influence of the cathedral at Pisa. The cathedral at Trani has the same plan as the churches at Bari, except that the earlier apses are not enclosed. The cathedral of Salerno retains still the fine atrium by Robert Guiscard in 1077. In the cathedrals of Acerenza, Aversa and Venosa, the French chevet was introduced towards the end of the 12th century.

In the magnificent octagonal tower which encloses the dome on the crossing in the cathedral of Caserta-Vecchia, we find the interlacing blind arcades of the Norman architecture in Sicily, as also in the cathedral at Amalfi. The porches, entrance doorways and windows being the chief decorative feature of the south Italian churches, were enriched with splendid sculptures. So were the pulpits of the cathedrals of Sessa, Ravello, Salerno and Troja, the rich mosaic inlays at Sessa, Ravello and Salerno according in design with the Cosmati work in Rome, though they possibly had an earlier origin in Sicily.

Sicilian Romanesque.—Although the earliest remains in Sicily date from the Norman occupation of the island, they are so permeated with Saracenic detail as to leave no doubt that the conqueror employed the native workmen, who for two centuries at all events had been building for the Mahommedans, and therefore, whether Arab or Greek, had been reproducing the same style as that found in Egypt or North Africa.

It is possible that, so far as the Norman palaces of the 12th century are concerned, they were based on those built under the Saracenic rule, but the requirements of a mosque and of a church are entirely different, and therefore in the earliest church existing (San Giovanni-dei-Leprosi, at Palermo, built by Robert Guiscard in A.D. 1071) we find a completely developed Christian structure, having nave, aisles and transepts, with a dome over the crossing and three apses. The next church, at Troina (1078), was similar on plan, but had three square wings at the east end instead of apses. The next two churches, La Martorana and San Cataldo (1129), at Palermo, followed the plan of the Greek church, with four columns carrying the superstructure and three domes over the nave bays carried on Saracenic squinches, similar to those in San Giovanni-dei-Leprosi. San Giovanni-degli-Eremiti (T-shaped on plan) has no aisles, but carries domes over the nave and three smaller domes on the transept. The most important feature found in all these churches is the pointed arch, of Saracenic origin imported from the East, which was employed for the nave, arcades, the crossing, and in the squinches carrying the domes. The blind arcades which decorate the walls of San Cataldo and of the Norman palaces—La Favara, the Torre della Ninfa, La Ziza and La Cuba (all in or near Palermo),—in two or three orders, and sometimes (as in the Favara palace) of great height, have all pointed arches and no impost mouldings or capitals. The distinguishing characteristic of these blind arcades (and the same is found in the open arcades) is the very slight projection of the outer order of arch.

The finest early example of Norman architecture in Sicily is the Cappella Palatina, at Palermo, consecrated in 1140, and attached to the palace. The plan consists of nave, aisles, transept and triple apse, the arches, all pointed and stilted, being carried on monolith columns of granite and marble alternately. The nave is covered over with a timber roof with stalactitic coves and coffered ceiling, richly decorated in colour and gilded, the borders of the panels bearing Arabic inscriptions in Cufic characters. Similar inscriptions exist on the upper part of the walls of the Cuba and Ziza palaces, proving that they were built by Saracenic workmen. The plans of the cathedrals of Palermo, Messina (destroyed 1908), Cefalu and Monreale are all similar, with nave and aisles separated by arcades, in which the arches are all pointed and stilted, transepts projecting north and south beyond the aisle walls, and square bays beyond, with apsidal terminations. That of Palermo has much suffered from restorations, but the cathedral of Monreale is in perfect condition. It was begun in 1176 and consecrated in 1182. The proportions of the arcade are much finer than in the Cappella Palatina, where the stilted arch was of the same height as the shaft of the columns, whereas here it is only half the height. The columns are all of granite with extremely fine capitals, some of which were taken from ancient buildings. All the roofs are in wood, with coffered ceilings richly decorated in gold and colour. The walls to a height of 22 ft. are all lined with slabs of marble with mosaic friezes, and all the surfaces of walls and arches are covered above with mosaics representing scenes from the Old and New Testaments, while in the apse at the east end a gigantic figure of Christ dominates the whole church. The same is found at Cefalu, where the mosaic decorations, however, are confined to the apses. Externally the walls are comparatively plain, the decoration being confined to the east end, where the three apses are covered with a series of blind intersecting arcades of pointed arches. This class of enrichment prevails throughout the great Sicilian churches, and extends sometimes to the smaller churches, as that of the Chiesa-dei-Vespri. Of the conventual buildings attached to the cathedral of Monreale, which occupied an immense site, there remain only the cloisters, about 140 ft. square, enclosed by an arcade with pointed arches carried on coupled columns, the shafts of which are elaborately carved and inlaid with mosaic; the capitals are of the most varied design and of exquisite execution.

Italian Gothic.—Italy is poorer than any other country in examples of the transition from round arched to pointed arched buildings. The use of the pointed arch was accepted at last as a necessity, and cannot be said ever to have been welcomed. The first buildings in which it is seen worked out fully in detail are those of Niccola Pisano, and but few examples exist of good Gothic work earlier than his time. The elaborately arcaded and sculptured west front of Ferrara cathedral is a screen to an early building. The cathedral and other churches at Genoa are certainly exquisite works, but they appear to owe their internal design rather to the influence of (perhaps) Sicilian taste than north Italian, and the exquisite beauty of the west front owes a good deal, at any rate, to French influence, softened, refined and decorated by the extreme taste of an Italian architect. The feature which most marks all Italian Gothic is the indifference to the true use of the pointed arch. Everywhere arches were constructed which could not have stood for a day had they not been held together by iron rods. There was none of that sense of the unities of art which made a northerner so jealous to maintain the proper relations of all parts of his structure. In Niccola Pisano's works the arch mould rarely fits the capital on which it rests. The proportions of buttresses to the apparent work to be done by them are bad and clumsy. The window traceries look like bad copies of some northern tracery, only once seen in a hurry by an indifferent workman. There is no life, or development, or progress in the work. If we look at the ground-plans of Italian Gothic churches, we shall find nothing whatever to delight us. The columns are widely spaced, so as to diminish the number of vaulting bays, and to make the proportions of the oblong aisle vaulting bay very ungainly. Clustered shafts are almost unknown, the columns being plain cylinders with poorly sculptured capitals. There are no triforium galleries, and the clerestory is generally very insignificant. In short, a comparison of the best Gothic works in Italy with the most moderate French or English work would show at once how vast its inferiority must be allowed to be. Still there were beauties which ought not to be forgotten or passed over. Such were the beautiful cloisters, whose arcades are carried on delicate coupled shafts,—*e.g.* in St John Lateran and St Paul's at Rome. Such also were the porches and monuments at Verona and elsewhere; and the campaniles,—both those in Rome, divided by a number of string-courses into a number of storeys, and those of the north, where there are hardly any horizontal divisions, and the whole effort is to give an unbroken vertical effect; or that unequalled campanile, the tower of the cathedral at Florence by Giotto, where one sees in ordered proportion, accurately adjusted, line upon line, and storey upon storey, perhaps the most carefully wrought-out work in all Europe.

The Italian architects were before all others devoted to the display of colour in their works. St Mark's had led the way in this, but, throughout the peninsula, the bountiful plenty of nature in the provision of materials was seconded by the zeal of the artist. They were also distinguished for their use of brick. Just as in parts of Germany, France, Spain and England, there were large districts in which no stone could be had without the greatest labour and trouble; and here the reality and readiness which always marked the medieval workman led to his at once availing himself of the natural material, and making a feature of his brickwork.

The Gothic of Italy has, it must be admitted, no such grand works to show as more northern countries have. Allowance has to be made at every turn for some incompleteness or awkwardness of plan, design or construction. There is no attempt to emulate the beauties of the best French plans. Milan cathedral, magnificent as its scale and material make it, is clumsy and awkward both in plan and section, though its vast size makes it impressive internally. San Francesco, Assisi, is only a moderately good early German Gothic church, converted into splendour by its painted decorations. At Orvieto a splendid west front is put, without any proper adjustment, against a church whose merit is mainly that it is large and in parts beautifully coloured.

The finest Gothic interiors are of the class of which the Frari at Venice and Sant' Anastasia at Verona are examples. They are simple vaulted cruciform churches, with aisles and chapels on the east side of the transepts. But even in these the designs of the various parts in detail are poor and meagre, and only redeemed from failure by the picturesque monuments built against their walls, by the work of the painter, and by their furniture. In fine, Gothic art was never really understood in Italy, and, consequently, never reached to perfection.

Whilst the Pointed style was almost exclusively known and practised in northern Europe, the Italians were but slowly improving in their Gothic style; and the improvement was more evinced in their secular than in their ecclesiastical structures. Florence, Bologna, Vicenza, Udine, Genoa, and, above all, Venice, contain palaces and mansions of the 12th, 13th, 14th and 15th centuries, which for simplicity, utility and beauty far excel most of those in the same and other places of the three following centuries. The contemporary churches do not exhibit the same degree of improvement in style that is conspicuous in these domestic works, for there are no works in Europe more worthy of study and admiration than the Ducal Palace at Venice, and some of the older works of the same class, and even of earlier date. The town halls of Perugia, Piacenza and Siena, and many houses in these cities, and at Corneto, Amalfi, Asti, Orvieto and Lucca, the fountains of Perugia and Viterbo, and the monuments at Bologna, Verona and Arezzo, may be named as evidence of the interest which the national art affords to the architectural student even in Italy, as late as the end of the 14th century; but after this it gradually gave way to the new style, though in some instances its influence may be traced even when it had been overborne by it. (R. P. S.)

Romanesque and Gothic Architecture in France

Most generally, Romanesque art is thought of as that period of art which followed and partook of the nature of Roman art and yet was too far removed from it to be classed as Roman. The difference, however, was not merely one of decay; it is rather in positive factors that we shall find the true characteristics of the style. Its formation was parallel to the development of the Romance languages, and like them it acquired barbaric elements.

In Rome itself hardly any, if any, contributions were made to its growth, and there as late as the 12th century the early Christian form of basilican church continued to be built. It may, perhaps, best be conceived as a Germano-Roman product, for even in Spain and north Italy, which became such strong centres of the art, the Visigoths and Lombards provided the Teutonic element. Besides this change of "blood" in the style, there is another element of change in the influences obtained from the more rapidly developed art of the East. This influence indeed was so strong and constant that, having it in view, we might almost describe the Romanesque style as Germano-Byzantine.

In the 6th and 7th centuries we have, on the one hand, the almost pure traditional early Christian art of Rome and indeed of western Europe, and on the other the direct establishment of matured Byzantine art at Ravenna, Parenzo, Naples and even in Rome. Then followed the mixture of these and of barbaric elements in the formation of several pre-Romanesque varieties, one of which has been named Italo-Byzantine. It was not until the age of Charlemagne that a centre was established strong enough for the formation of a new western school which should persist. From this time a progressive style was developed which led straight forward to the Gothic, and it is this movement which is best called Romanesque. This art was a perfect ferment of striving and experiment, of gathering and even of research; Roman, Byzantine and Saxon elements entered into its composition. It is probable also, as a result of Saracenic pressure on Syria, Asia Minor, North Africa and Spain, that artists, "bringing their crafts with them," drew together from still remoter parts to gain the protection of the great ruler of the West and to help in the formation of Carolingian art. With the disintegration of the empire of Charlemagne many local schools arose in Germany, France and Lombardy, which—especially after the year 1000, when there appears to have been a renewed burst of building energy—resulted in considerable differentiation of styles. The centre of energy seems to have been now here, now there, yet with all the differences there was a general resemblance over the whole field. Until the exact date of a very large number of monuments is more perfectly established, it will be impossible to trace out exactly the intricate windings of the line of advance. In fact there are two conflicting sides to the question presented by Romanesque art. In the first place we have to consider the several schools in regard to a standard of absolute attainment, and in the second as relative to the line of persistence and to the formation of Gothic, which was so largely the culmination, and then the decay, of the forces present in Romanesque art. Some of the most beautiful and complete of the Romanesque schools contributed least, some of the most inchoate gave the most, to that which was to be.

The most important existing monument of the age of Charlemagne is the cathedral of Aix-la-Chapelle (see fig. 44), which was being built in the year 800. It has an octagonal central area, covered by a dome and surrounded with two storeys of aisles both completely vaulted. The interior surface of the dome was encrusted with mosaic. Another important work of about the same time is the church of Germigny-des-Prés near Orleans, which also is of the "central type," having a square tower above four piers surrounded

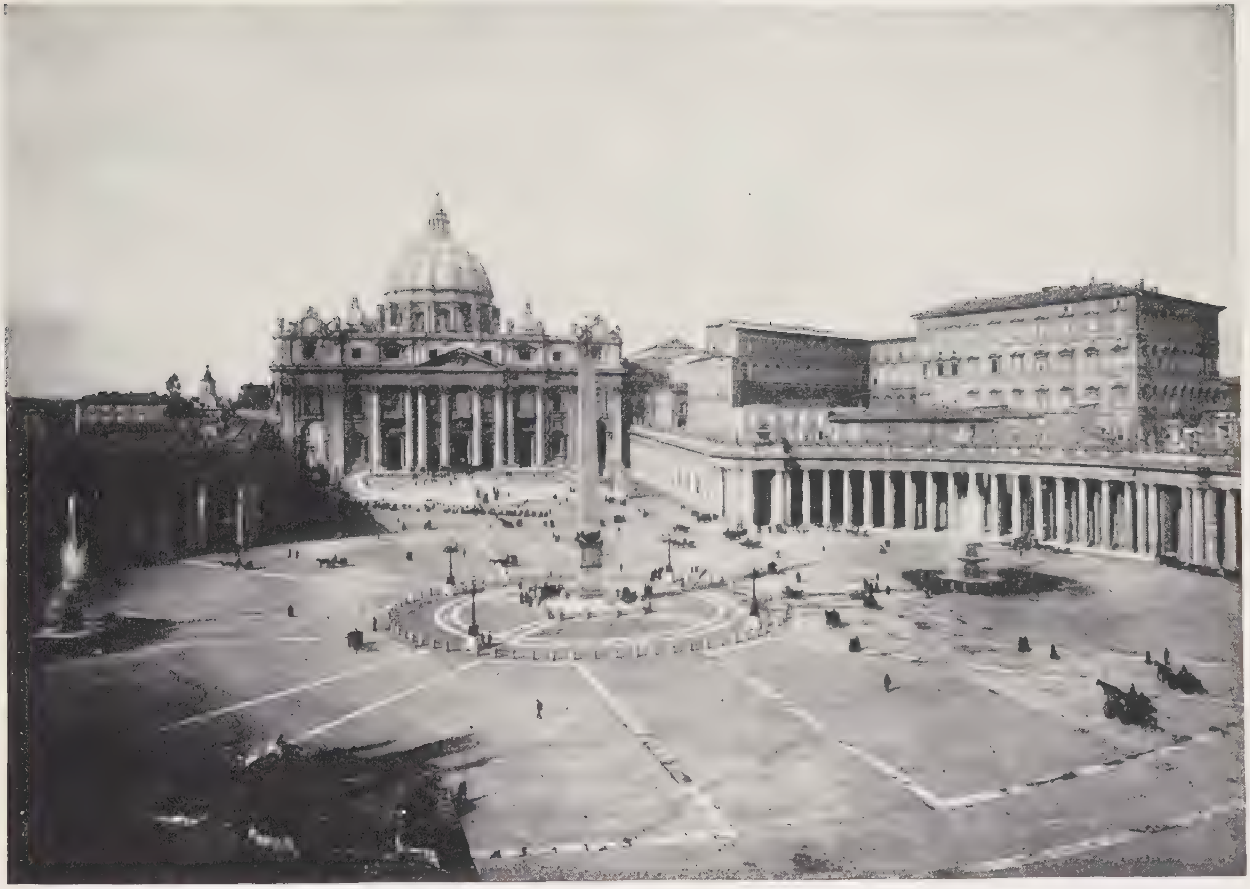


Photo. Brogi.

FIG. 68.—ST PETER'S, ROME.

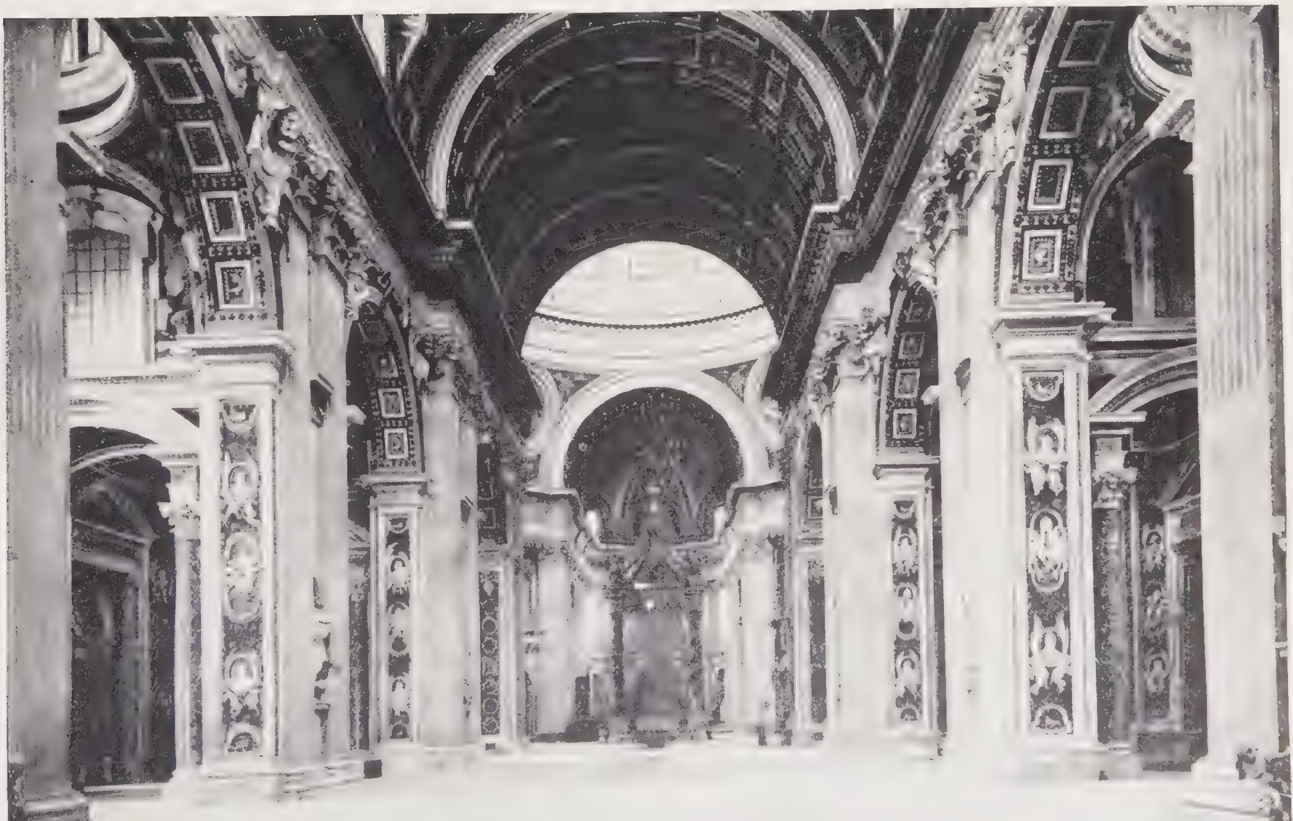
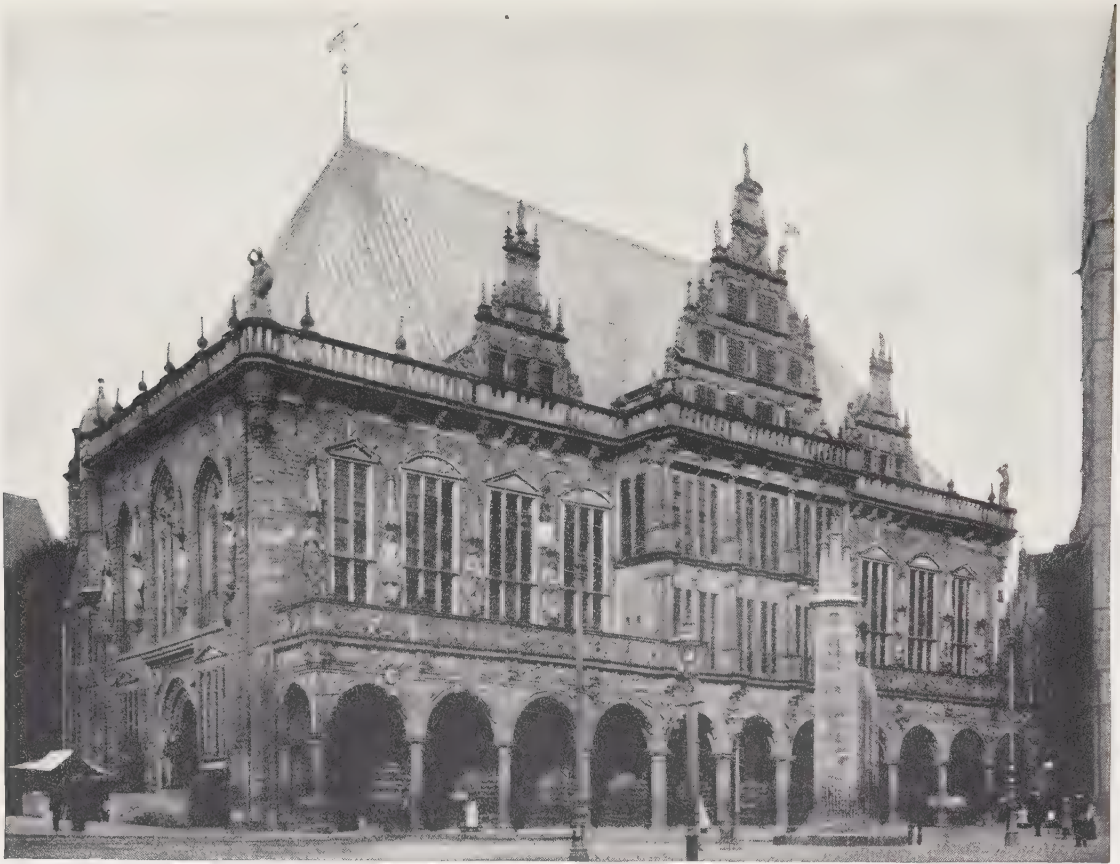


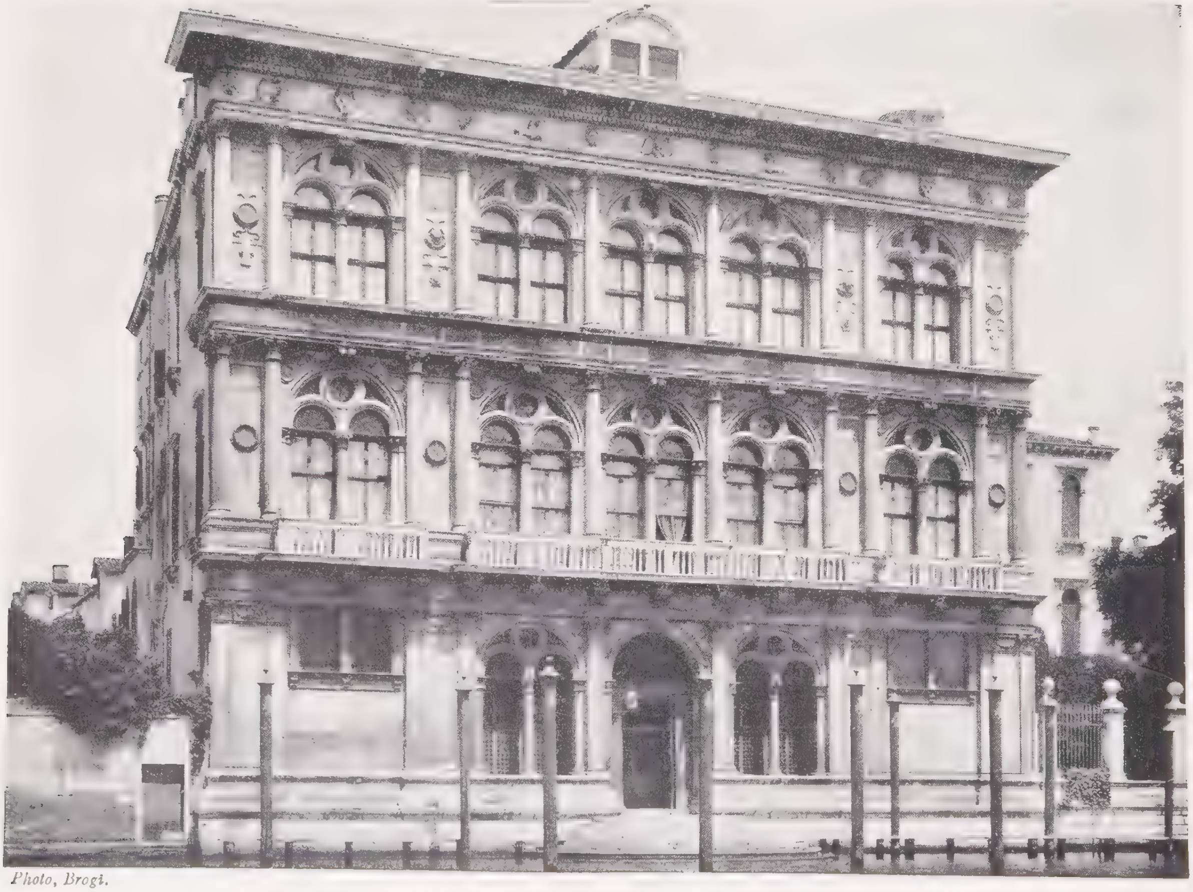
Photo. Alinari.

FIG. 69.—INTERIOR OF ST PETER'S, ROME.



Photo, Koch.

Fig. 70. TOWN HALL, BREMEN.



Photo, Brogi.

Fig. 71.—VENDRAMINI PALACE, VENICE.

by an aisle with semicircular apses in the centre of each external wall, the apse to the east having a mosaic.

From the 9th to the 11th century the great problem worked out was that of perfecting the standard plans of large churches. In the MS. plan of the monastic church of St Gall, drawn about 820, we find a great nave with aisles, apsidal terminations both to the east and the west, transepts and probably a central tower (cf. the abbey church of Saint-Riquier near Abbeville, built *c.* 800, of which a slight representation has been preserved). In St Martin at Tours was probably evolved the most perfect type of plan, that with an ambulatory and radiating chapels surrounding the eastern apse. A magnificent church of this form was built here at the beginning of the 11th century, but not for the first time. Excavations have shown that the plan was probably suggested by a still earlier church in which five tomb-niches surrounded the central apse and tomb of St Martin. At Jumièges (begun 1040) it has recently been found that the plan terminated to the east with parallel apses, as at St Albans in England; this is a second important type. A third type is that in which the transepts as well as the east end are finished with apses, like St Mary-in-the-Capitol at Cologne.

When we come to the developed Romanesque of the end of the 11th century, we find not only several French varieties, but strong schools in Lombardy and on the Rhine. Without distinguishing too minutely, four broad types representing schools of the east and west, north and south (or rather north-east, north-west, south-east and south-west) of France, may be spoken of, and all of these were engaged in the task of completely covering with vaults large churches of basilican plan—the typical problem of this period. In the east of France we have a school represented by the monastic church of Tournus, where the nave was vaulted by a series of compartments placed transversely to the axis of the church. This church, which has a plan of the type of St Martin's at Tours, was begun in 1019, but the nave vaults were not reached until after 1066. This style of vaulting persisted in Burgundy, and from thence it spread to Fountains Abbey in England, where it is found over the aisles. The most beautiful class of buildings in eastern France is that of which the church at Issoire is the most perfect example. The external walls are here ornamented with patterns countercharged in light and dark stone. The wonderful church at Le Puy also belongs to this group, but here strong Moorish influence is to be traced. The inlays were probably derived from a late Gallo-Roman source. Countercharging of stones of two colours was a favourite method of building in Romanesque churches erected between 1100 and 1150. We find it at Vézelay, a magnificent abbey church of Burgundy, at Le Mans cathedral, and as far north-west as Exeter and Worcester. In the west (south-west) the most prominent school was that of Perigord, of which the church of St Front, Périgueux, may be taken as the example. St Front was rebuilt after a fire in 1120, but there are many earlier specimens, two of the most important being at Angoulême (1105–1128) and Fontevrault. This school applied a series of domes of eastern fashion not only at the centre but over the whole extent of the church. St Front so closely resembles St Mark's, Venice, that it must be derived from it or from some similar eastern church. The method largely influenced the Angevin school of vaulting, but it does not seem to have been effective as a protection from the weather. Some examples were covered by external roofs, as was St Front itself at a late time. St Ours at Loches, originally a small church covered by domes, had spire-like pyramids substituted for them when the church was enlarged about 1168.

The third class of vaulting we may for symmetry's sake associate with the south, though it is found widely distributed. The chapel in the Tower of London is an example, and its true centre seems to be the Auvergne. The vaults of this type run along with the axis of the space to be covered. In the case of large churches the central span is frequently supported by quadrant vaults leaning against it on either side. One of the most noble churches in which the central span is covered by such a barrel vault is that of St Savin near Poitiers, where very much has been preserved of the complete series of paintings which once adorned it and the walls beneath.

The most characteristic buildings of the south are the churches of Moissac, St Trophime at Arles, St Gilles near Nîmes and St James of Compostella, where there is much sculpture of a Lombardic type. There was a great revival of sculpture, going together with a study of the antique, in Lombardy at the end of the 11th century. Wiligelmus, who later worked at San Zeno, Verona, signed some sculptures at Modena in 1099.

Of the schools of the north, Normandy took the lead. It was adventurous, if somewhat barbaric. It derived much from Germany and gave much to the Gothic style. About the middle of the 11th century the Normans began to experiment with cross-groined vaults and their application to the church problem. This from the first contained an important possibility of future development, in that it allowed of windows of considerable height being placed in the lunettes of these vaults. Soon a very great step in advance was made by the invention or application of diagonal ribs under the intersection of the plain groined vault. This association of strengthening ribs in a cross form to each bay of the structure forms the *ogive*, the characteristic form from which the alternative name to Gothic, "ogival," has been derived. The first instance we know of the use of this system is at Durham cathedral, where the aisles of the east end were so covered about 1093, and where the high vault erected about 1104 was almost certainly of the same kind. Another outcome of the genius of Norman builders seems to have been the donjon or keep type of castle.

The word "Gothic" was applied by Italian writers of the Renaissance to buildings later than Roman, which in some cases (*e.g.* Theodoric's works at Ravenna) might be properly so named. What we now call Gothic the same writers called Modern. Later the word came to mean the art which filled the whole interval between the Roman period and the Renaissance, and then last of all, when the Byzantine and Romanesque forms of art were defined, Gothic became the art which intervened between the Romanesque era and the Renaissance.

As remarked above, Gothic architecture is to a large extent the crown of Romanesque. It is agreed that its chief element of construction was the ogival vaulting which was being widely used by Romanesque builders in the first half of the 12th century; and pointed arches appeared as early.

The eminent architect, G. E. Street, writing[1] of what we have called the standard plan of great 12th-century churches, says, "In whatever way the early *chevets* (as the French term them) grew up there is no doubt that they contain the germ of the magnificent *chevets* in the complete Gothic churches of the north of France." Architecture of the middle ages having been continuously developed, it is necessarily somewhat arbitrary to mark off any given period; all are agreed, however, that about the year 1150 there was a time of rapid change towards a slenderer and more energetic type of building, and the forms which followed for about four centuries we now call Gothic. The special character which the architecture of this period took was partially conditioned by the fact that the expanding power of the French kingdom, with its centre at Paris, was situated in a particular artistic environment. The body of ideas on which it for the most part worked was furnished by the Romanesque art of north France, the German borderland and Burgundy. A great contributory cause was the immense monastic activity of the time, and the need of accomplishing large results with limited means resulted in a casting aside of old ornamental commonplaces and in innovations of planning and structure. This was especially the case with the Cistercian order, which carried certain transitional Gothic forms of building into England, Germany, Italy and Spain. If, however, we make the transition to Gothic date from the first use of "ogival" vaults in north-west Europe, then Durham cathedral is, so far as we now know, the earliest example of the transitional style. The next step, the appearance of Gothic itself, may best be held to date from the systematic but not exclusive use of pointed arches in association with ogival vaults about the middle of the 12th century.

At this time was waged a war of domination amongst the styles, a war which resulted not necessarily in the victory of the most beautiful nor even of the strongest, but one in which political and geographical considerations had much to do with the decision. When the French kingdom took the lead in western civilization, it was settled that a northern form of art, one which had perforce to make a chief element of the window, should be followed out. The consequent development of the window is, after all, as the first observers thought, the great mark of the mature style. As to the position of France in the movement, Mr Street may again be quoted:—"When once the Gothic style was well established, the zeal with which the work of building was pursued in France was almost incredibly great. A series of churches exists there within short distances of each other, so superb in all their features that it is impossible to contest their superiority to any corresponding group of buildings. The old Domaine Royale is that in which French art is seen in its perfection. Notre Dame, Paris, is a monument second to nothing in the world; but for completeness in all its parts it would be better to cite the cathedral of Chartres, a short description of which must suffice as an explanation of what French art at its zenith was. The plan has a nave with aisles, transepts with aisles on each side, a choir with two aisles all round it, and chapels beyond them. There are two immense steeples at the west end, two towers to each transept and two towers at the junction of the choir with its apse. The doorways are triple at the west end, whilst to each transept is a vast triple porch in front of the three doorways. The whole of these doorways are covered with sculpture, much of it refined, spirited and interesting in the highest degree. You enter and find the interior surpassing even the exterior. The order of the columns and arches, and of all the details, is so noble and simple that no fault can be found with it. The whole is admirably executed; and, finally, every window throughout its vast interior is full of the richest glass coeval with the fabric. As compared with English churches of the same class, there are striking differences. The French architects aimed at greater height, greater size, but much less effect of length. Their roofs were so lofty that it was almost impossible for them to build steeples which should have the sort of effect that ours have. The turret on Amiens cathedral is nearly as lofty as Salisbury spire, but is only a turret; and so throughout. Few French churches afford the exquisite complete views of the exterior which English churches do; but, on the other hand, their interiors are more majestic, and man feels himself smaller and more insignificant in them than in ours. The palm must certainly be given to them above all others. There is no country richer in examples of architecture than France. The student who wishes to understand what it was possible for a country to do in the way of creating monuments of its grandeur, would find in almost every part of the country, at every turn and in great profusion, works of the rarest interest and beauty. The 19th century may be the consummation of all, but the evidences of its existence to posterity will not be one-tenth in number of those which such a reign as that of Philip Augustus has left us, whilst none of them will come up to the high standard which in his time was invariably reached."

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[1] Article "Architecture," *Ency. Brit.*, 9th ed.

The remarks which have been made as to the variation in style visible in various parts of the same country, apply with more force, perhaps, in what we now call France than to any other part of Europe. For the purposes of complete study it would be necessary to keep distinct from each other in the mind the following important divisions:—(1) Provence and Auvergne; (2) Aquitaine; (3) Burgundy; (4) Anjou and Poitou; (5) Brittany; (6) Normandy; (7) the Île-de-France and Picardy; (8) Champagne; and, finally, (9) the eastern border-land (neither quite German nor quite French in its character), the meeting-point of the two very different developments of French and German art. Speaking generally, it is safe to say that Gothic architecture was never brought to its highest perfection in any portion of the south of France. Aquitaine, Auvergne and Provence were too wedded to classic traditions to excel in an art which seems to have required for its perfection no sort of looking back to such a past. Hence there is no Gothic work in the south for which it is possible to feel the same admiration and enthusiasm as must be felt by every artist in presence of the great works of the north. In Anjou this is less the case; but even there the art is extremely inferior to that which is seen in Normandy and the Île-de-France. Brittany may be dismissed from consideration, as being, like Cornwall, so provincial and so cut off from neighbours, that its art could not fail to be very local, and without much influence outside its own borders.

There are examples of true Gothic outside its proper habitat, almost pure French works being found as far south as Laon and Burgos, as far east as Strassburg and Lausanne and as far north as Canterbury and Cologne. Westminister Abbey was profoundly influenced by direct study of French work. Normandy, Burgundy, and the land as far north as Tournay seem to have shared in the work of transition; but the Gothic area proper is the Île-de-France with Picardy and Champagne, then Burgundy, Normandy and England.

Four remarkable buildings best represent the early phase of the Gothic style, the abbey church of St Denis, and the cathedrals of Noyon, Senlis and Sens. The first was begun in 1137, and the choir was consecrated in 1143. The few parts of this work which remain are sufficient to show how stately and yet fresh the whole work must have been. Noyon cathedral, begun after a fire which occurred in 1131, had its choir consecrated in 1157. The cathedral of Senlis was begun in 1155. Sens cathedral, begun about the same time, or even earlier, is the first of the great cathedrals. Many other buildings belong to the first years of the style; such are the abbey churches of St Remi at Reims, Notre Dame at Châlons and St Germain-des-Prés, Paris. The choir of this last was consecrated in 1163, and in the same year Notre Dame, Paris, was begun This mighty building, although very complete, was altered as to its effect by the substitution, early in the 13th century, of large two-light windows for the earlier lancets of the clerestory. The sculptures of the west front are exquisite. Laon cathedral, another of the great churches, is of about the same age as Notre Dame. It also has beautiful sculpture in its western porches, but its most marked characteristic is the group of six great and romantic towers which flank the fronts to the west, the north and the south. In the 13th century, the church was extended to the east and the original *chevet* was destroyed. From the evidence furnished by fine double-staged chapels to the transepts, it is most probable that three similar chapels were set about the ambulatory of the apse, the upper chapels opening from the fine vaulted triforium. Such an arrangement existed at the noble church of Valenciennes, now destroyed, but well recorded. At the end of the 12th century Chartres cathedral was begun, perhaps its most notable constructive feature being the high development that the flying buttresses have here attained. It was followed in the early years of the 13th century by Rouen cathedral, which derived much from its prototype. St Omer, a fine early church, in turn followed Rouen.

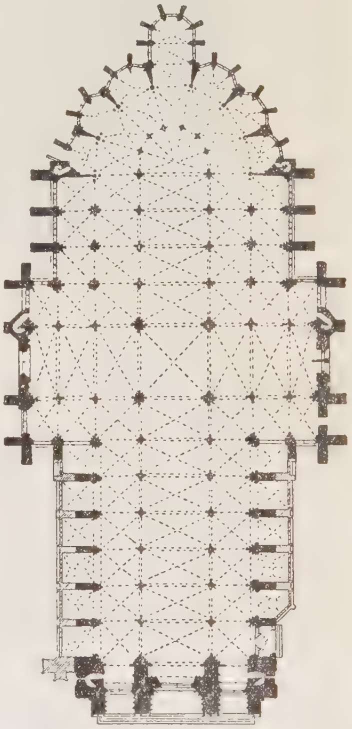


FIG. 40.—Plan of Cathedral at Amiens.

The second stage of Gothic, introducing the traceried window, was opened by the building of the cathedral of Reims, begun in 1211. This is in every way one of the most perfect of cathedrals, as well for its sculpture and glass as for its structure. Reims was followed by the still greater cathedral at Amiens (fig. 40), which was begun in 1220 at the west front, so that the superb sculpture (Plate II., fig. 64) of the porches is earlier than that of Reims. Beauvais cathedral was begun in 1247 on a still vaster scale, and with an ambition that o'erleaped itself. Auxerre cathedral, and the very beautiful collegiate churches of St Quentin and Semur, also followed Reims. Two other cathedrals of the first rank which must be mentioned are those of Bourges and Le Mans, each of these having double aisles about the apse, with a large clerestory to the inner one of the two, above which rises the great clerestory. This scheme is one of the great feats of Gothic construction. Le Mans again furnished the most highly developed form of *chevet* planning (fig. 41). On this point Mr Street may again be cited. "It was in the planning of the apse, with its surrounding aisles and chapels, that all their ingenuity and science were displayed. A simple apse is easy enough of construction, but directly it is surrounded by an aisle or aisles, with chapels again beyond them, the difficulties are great. The bays of the circular aisle, instead of being square, are very much wider on one side than the other, and it is most difficult to fit the vaulting to the unequal space. In order to get over this, various plans were tried. At Notre Dame, Paris, the vaulting bays were all triangular on plan, so that the points of support might be twice as many on the outside line of the circle as on the inside. But this was rather an unsightly contrivance, and was not often repeated, though at Bourges there is something of the same sort. At Le Mans the aisle vaulting bays are alternately triangular and square; and this is, perhaps, the best arrangement of all, as the latter are true and square, and none of the lines of the vault are twisted or distorted in the slightest degree. The arrangement of the chapels round the apse was equally varied. Usually they are too crowded in effect; and, perhaps, the most beautiful plan is that of Rouen cathedral, where there are only three chapels with unoccupied bays between, affording much greater relief and variety of lighting than the commoner plan which provided a chapel to every bay. The planning and design of the *chevet* is the great glory of the French medieval school. When the same thing was attempted, as at Westminster, or by the Germans at Cologne, it was evidently a copy, and usually an inferior copy, of French work. No English works led up to Westminster Abbey, and no German works to the cathedral at Cologne."

The variety in the planning of the *chevets* must be remarked. There might be only one chapel opening from the semicircular ambulatory, as at Langres, Sens, Auxerre, Bayeux and Lausanne. Canterbury cathedral, designed by William of Sens, is perhaps the most perfect example. There were three separated chapels, as at Rouen, St Omer, Semur, &c., or there might be five filling the whole space, which became the general later scheme. Chartres furnishes an intermediate plan, in having the alternate chapels much shallower than the others. The chapels might be circular or polygonal or alternately square and round. Of the last the cathedral of Toledo is a wonderful example. The plan with parallel apses also continued in use, as at the beautiful abbey church at Dijon and St Urbain at Troyes. Apsidal transepts were built at Noyon, Soissons and Valenciennes.

Another stage of development was reached with the building of the Sainte Chapelle in Paris, begun in 1244. With this work the Gothic system reached complete maturity. Here for the first time large traceried windows seem to have been perfected, and, moreover, the structure was so organized into a series of wide window spaces, only divided by strong far-projecting buttress piers, that the stained glass ideal found full expression and the building became a lantern for its display.

During the next half-century the influence of the Sainte Chapelle is to be traced everywhere, and its system of construction was developed to the furthest possible point in St Urbain at Troyes, begun in 1260. Exploration of the Gothic theory of structure could be carried no further. From this point the style turned in on itself, becoming more unreasonably intricate, artificial and mannerized. One of the finest examples of the style of the early 14th century is the eastern limb of St Ouen, Rouen; Troyes cathedral is also an important example of later work. As Mr Street says: "Later French architecture ran a very similar course to that in England. The 13th century was that in which it was seen at its best. In the 14th the same sort of change took place as elsewhere; and art was beautiful, but it was too much an evidence of skilfulness and adroitness. It was harder and colder also than English work of the same age; and when it fell, it did so before the inroads of a taste for what has been called Flamboyant architecture,—a gay and meretricious style which trusted to ornament for all its effect, and, in spite of many beauties, had none of the sturdy magnificence of much of our English Perpendicular style."

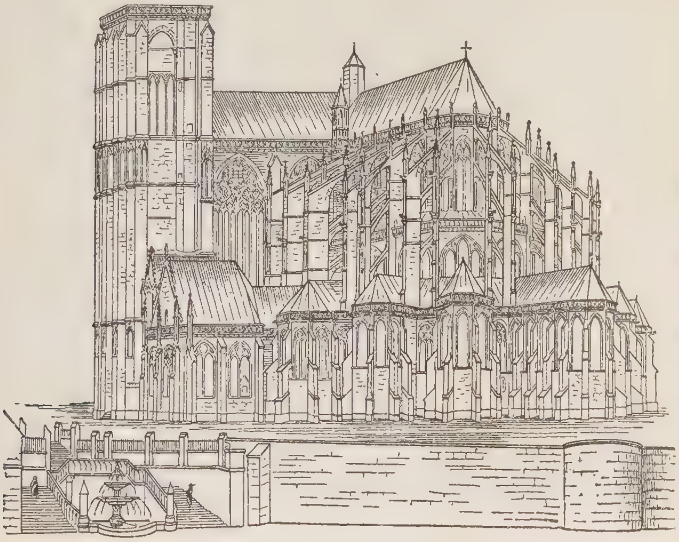


FIG. 41.—Cathedral of Le Mans. East end and Chevet.

M. Enlart has recently accepted the view that the germs of flamboyancy in the later French Gothic are to be found in the flowing curvilinear forms of early 14th-century work in England.

Up to the middle of the 16th century, magnificent works in the national style were still being executed. St Vulfran at Abbeville, St Maclou in Rouen, and the façade of the cathedral of Rouen, may be mentioned; some of the last works were the immense transepts of Beauvais cathedral and the façade of Tours.

We have necessarily spoken most of churches, but the palaces, castles and civic buildings form another great class hardly less interesting. The castles of Coucy and Château Gaillard may rival any cathedral. Among civic buildings may be mentioned the palais de justice at Rouen and the hôtel de ville at Compiègne, both late but beautiful and impressive types. The royal palace of Paris is now represented by the Sainte Chapelle, but accounts of its splendid hall and general arrangements have been preserved. At Poitiers is still extant the hall of the palace of the counts of Poitou; at Laon the episcopal palace is almost entire; there are considerable remains of the bishops' palaces of Beauvais, Evreux, Rouen, Reims: and the pope's palace at Avignon must also be mentioned in this connexion. The most perfect existing great houses of the middle ages are those of Jacques Cœur at Bourges and of the abbot of Cluny in Paris. A large number of fine houses on a small scale, dating from the 12th and 13th centuries, are still preserved at Beauvais, Auxerre, Chartres, Cordes, &c. The house of the musicians at Reims, *c.* 1280, is adorned by a series of seated life-sized figures playing instruments, in sculpture of a very high order. A good and concise account of the smaller houses in France is given in Hudson Turner's *Some Account of Domestic Architecture*, and in C. Enlart's *Manuel d'archéologie*, the best and most recent survey of the whole field of medieval antiquities in France. (W. R. L.)

ROMANESQUE AND GOTHIC ARCHITECTURE IN SPAIN

What strikes the architectural student most forcibly in Spain is the concurrent existence of two schools of art during the best part of the middle ages. The Moors invaded Spain in 711, and were not finally expelled from Granada until 1492. During the whole of this period they were engaged, with more or less success, in contests for superiority with the Christian natives. In those portions of the country which they held longest, and with the firmest hand, they enforced their own customs and taste in art almost to the exclusion of all other work. Where their rule was not permanent their artistic influence was still felt, and even beyond what were ever the boundaries of their dominion, there are still to be seen in Gothic buildings some traces of acquaintance with Arabic art not seen elsewhere in Europe, with the exception, perhaps, of the southern part of the Italian peninsula, and there differing much in its development. The mosque of Cordova in the 9th century, the Alcazar and Giralda at Seville in the 13th, the Court of Lions in the Alhambra in the 14th, several houses in Toledo in the 15th century, are examples of what the Moors were building during the period of the middle ages in which the best Gothic buildings were being erected. Some portions of Spain were never conquered by the Moors. These were the greater part of Aragon, Navarre, Asturias, Biscay and the northern portion of Galicia. Toledo was retaken by the Christians in 1085, Tarragona in 1089, Saragossa in 1118, Lerida in 1149, Valencia in 1238 and Seville in 1248. In the districts occupied by the Moors Gothic architecture had no natural growth, whilst even in those which were not held by them the arts of war were of necessity so much more thought of than those of peace, that the services of foreign architects were made use of to an extent unequalled in any other part of Europe.

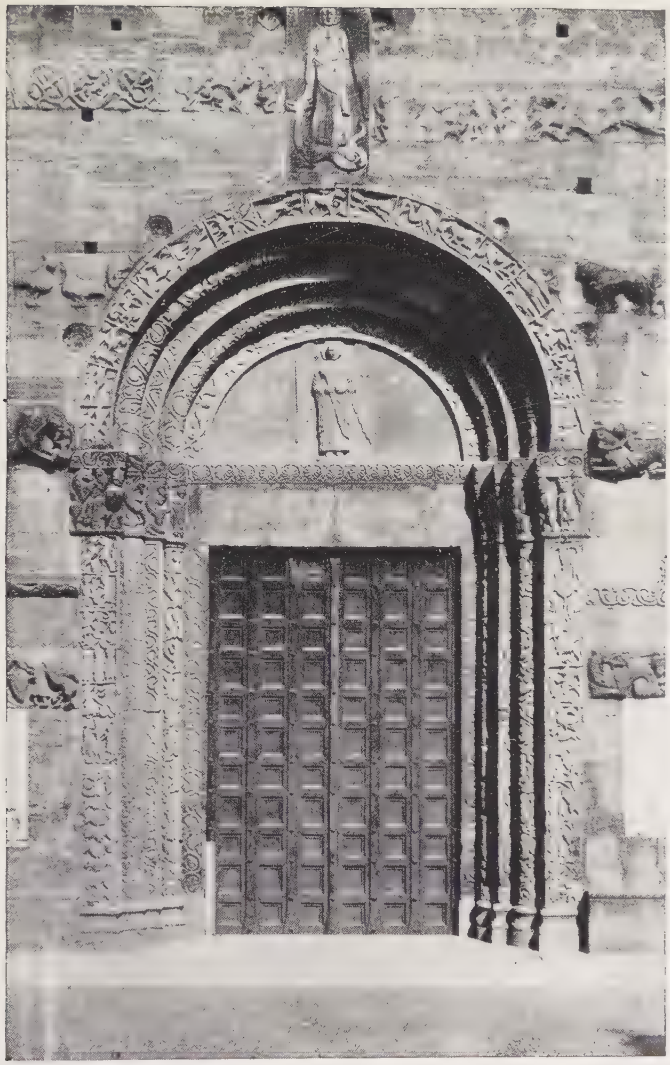
Of early Christian buildings erected from the 9th to the 11th century remains of some twenty to thirty are known, and there are probably others which will be found when the communications in the country become more extended. The most interesting of these is Santa Maria de Naranco near Oviedo, originally built in 848 as part of a palace. It consisted of a rectangular hall, 42 ft. long and 16 ft. wide, with entrance doorways in the centre of each side, and at each end an arcade of three arches, carried on piers and coupled columns, which led to an open loggia from which the hall was lighted. Fifty to sixty years later it was converted into a church by blocking up the end of the east loggia. The church is remarkable for its barrel vault, built in fine masonry, and for the knowledge that is displayed in meeting its thrust. Internally, in order to lessen the span, the upper part of the walls is brought forward and carried on a series of arches on each side, which are supported on piers consisting of four coupled columns, virtually constituting an interior abutment. Externally, the thrust is met by buttresses, features not found in France until about a century and a half later. All the columns are spiral-fluted, and a twisted-cord torus-moulding decorates the capitals and other features in the church. The transverse ribs of the hall, which are of slight projection, are carried on broad bands with disks in the spandrils of the arches, the disks having badges in the centre, and being bordered, as well as the bands, with twisted cords. Underneath the church is a spacious vaulted crypt, which was built as a cellar or basement storey, to raise and give more importance to the palace. The twisted cord seems to have been a favourite device in all the early churches, and is extensively employed in the decoration of San Miguel de Lino, a small church about a quarter of a mile from Santa Maria de Naranco and coeval with that church. Externally the church of San Miguel has all the character of a Byzantine church; the windows in the front are pierced with Moorish tracery, probably brought there by those Christians who were flying to the sanctuaries of Asturias from the incursions of the Moors. In another church, about 15 m. south of Oviedo, Santa Christina de Leon, all the attached staffs are decorated with spiral fluting. The choir is raised, and approached by steps on either side through a screen of three arches, of the type known as Transennae in the earlier Christian of Rome. Here, as in Santa Maria de Naranco, the church is covered with a barrel vault with similar constructive and decorative features. Externally the buttresses are in great profusion, there being two to each bay. The screen, the pierced marble slabs between the columns carrying it, and the decoration of the capitals, all show Byzantine influence. Other early churches are those of San Pablo del Campo (930) and San Pedro de las Puellas, both in Barcelona, the fine church at the village of Priesca near Villaviciosa (915), the monastery of Valdedios (893) and that of San Salvador (1218), in which, notwithstanding its late date, there is a distinct Moorish influence. This influence is also to be noticed in the north of Spain, although it was never occupied by the Moors. Thus in the earliest church known, at Baños de Cerrato near Palencia (founded in 662, but restored in 711), there is a horse-shoe barrel vault over the square apse. Again in San Miguel de Escalada (913) near Leon, there are horse-shoe arches in the nave, and the three apses are horse-shoe on plan. San Pedro at Zamora is a vaulted church with horse-shoe arches in the nave, but otherwise Byzantine in style. In the church of Corpus Christi at Segovia the nave is Moorish in style, and the octagonal columns of the nave have capitals with fir cones, as in the well-known Santa Maria la Blanca at Toledo, originally a synagogue. The most remarkable church of all, so far as Moorish style is concerned, is the church of the monastery of Santiago de Peñalva, near Villafranca del Vierzo, built between 931 and 951, and therefore coeval with Cordova. The church is 40 ft. long by 20 ft. wide, covered by a barrel vault with transverse horse-shoe arch in the centre carrying the same. At each end is an apse with horse-shoe arches carried on marble shafts with Byzantine capitals. Though of later date, there is another interesting Romanesque example in the Templars' church of La Vera Cruz at Segovia (1204), which is twelve-sided with three apses, and in the centre has a chapel built in imitation of the Holy Sepulchre at Jerusalem.

The buildings which come next in point of date are all evidently derived from or erected by the architects of those which were at the time being built in the south of France. These churches are uniform in plan, with central lanterns and three eastern apses. The nave has usually a waggon or barrel vault, supported by quadrant vaults in the aisles, and the steeples are frequently polygonal in plan. If these churches are compared with examples like that of the cathedral at Carcassonne on the other side of the Pyrenees, their identity in style will at once be seen. A still more remarkable evidence of similarity has been pointed out between the church of St Sernin, Toulouse, and the cathedral of Santiago. The plan, proportions and general design of the two churches are identical. Here we see a noble ground-plan, consisting of nave with aisles, transepts, central lantern and *chevet*, consisting of an apsidal choir, with a surrounding aisle and chapels opening into it at intervals. This example is the more remarkable, inasmuch as the early Spanish architects very rarely built a regular *chevet*, and almost always preferred the simpler plan of apsidal chapels on either side of the choir. And its magnificent scale and perfect preservation to the present day combine to make it one of the most interesting architectural relics in the country.

Among the more remarkable buildings of the 12th and the beginning of the 13th century are San Isidoro, Leon; San Vicente, Avila; several churches in Segovia; and the old cathedral at Lerida. They are much more uniform in character than are the churches of the same period in the various provinces of France, and the developments in style, where they are seen at all, seldom have much appearance of being natural local developments. This, indeed, is the most marked feature of Spanish architecture in all periods of its history. In such a country it might have been expected that many interesting local developments would have been seen; but of these there are but one or two that deserve notice. One of them is illustrated admirably in the church of San Millan, Segovia, where beyond the aisles of the nave are open cloisters or aisles arcaded on the outside, and opening by doors into the aisles of the nave. A similar external south portico exists in San Miguel de Escalada, already referred to, Santo Domingo, Burgos, and San Estéban at Segovia. It would be difficult to devise a more charming arrangement for buildings in a hot country, whilst at the same time the architectural effect is in the highest degree beautiful. The universality of the central tower and lantern has been already mentioned. This was often polygonal, and its use led to the erection of some lanterns or domes of almost unique beauty and interest. The old cathedral at Salamanca, the church at Toro and the cathedral of Zamora, all deserve most careful study on this score. Their lanterns are almost too lofty in proportion to be properly called domes, and yet their treatment inside and outside suggests a very beautiful form of raised dome. They are carried on pointed arches, and are circular in plan internally and octagonal on the exterior, the angles of the octagon being filled with large turrets, which add much to the beauty of the design, and greatly also to its strength. Between the supporting arches and the vault there are, at Salamanca, two tiers of arcades continued all round the lantern, the lower one pierced with four, and the upper with twelve lights, and the vault or dome is decorated with ribs radiating from the centre. On the exterior the effect is rather that of a low steeple covered with a stone roof with spherical sides than of a dome, but the design is so novel and so suggestive, that it is well worth detailed description. Nothing can be more happy than the way in which the light is admitted, whilst it is also to be noted that the whole work is of stone, and that there is nothing in the design but what is essentially permanent and monumental in construction. The only other Spanish development is the introduction, to a very moderate extent, of features derived from the practice of the Moorish architects. This is, however, much less seen than might have been expected, and is usually confined to some small feature of detail, such, *e.g.* as the carving of a boss, or the filling in of small tracery in circular windows, where it would in no way clash with the generally Christian character of the art.

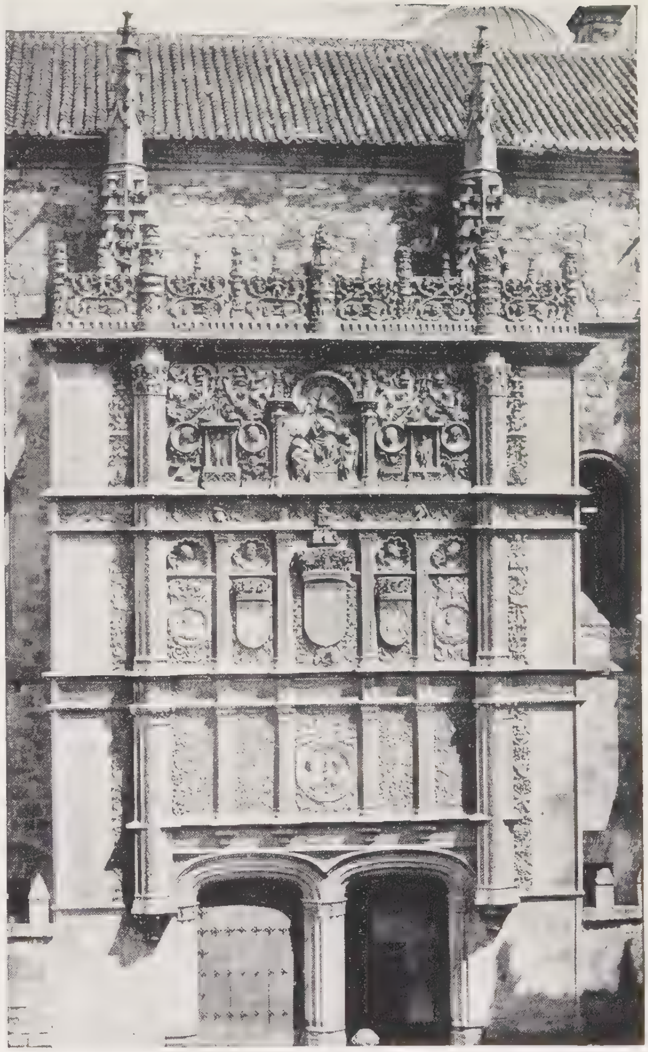
The debateable period of transition which is usually so interesting is very sterile in Spain. A good model once adopted from the French was adhered to with but little modification, and it was not till the 13th-century style was well established in France and England that any introduction of its features is seen here; and then, again, it is the work of foreign architects imported for the work and occasion, bringing with them a fully developed style to which nothing whatever in Spain itself led up by a natural or evident development. The three great Spanish churches of this period are the cathedrals of Toledo, Leon and Burgos (Plate II., fig. 65). Those of Siguënza, Lerida and Tarragona, fine as they are, illustrate the art of the 12th rather than of the 13th century, but these three great churches are perfect Early Pointed works, and most complete in all their parts. The cathedral of Toledo is one of the most nobly designed churches in Europe. In dimensions it is surpassed only by the cathedrals of Milan and Seville, whilst in beauty of plan it leaves both those great churches far behind. The *chevet*, in which two broad aisles are carried round the apse with chapels alternately square and apsidal opening out of them, is perhaps the most perfect of all the schemes we know. It is as if the French *chevets*, all of which were more or less tentative in their plan, had culminated in this grand work to which they had led the way. The architectural detail of this great church is generally on a par with the beauty and grandeur of its plan, but is perhaps surpassed by the somewhat later church at Leon. Here we have a church built by architects whose sole idea was the erection of a building with as few and small points of support as possible, and with the largest possible amount of window opening. It was the work of men whose art had been formed in a country where as much sun and light as possible were necessary, and is quite unsuited for such a country as Spain. Nevertheless it is a building of rare beauty and delicacy of design. Burgos, better known than either of the others, is inferior in scale and interest, and its character has been much altered by added works more or less Rococo in character, so that it is only by analysis and investigation that the 13th-century church is still seen under and behind the more modern excrescences.

The next period is again marked by work which seems to be that of foreigners. The fully developed Middle Pointed or Geometrical Gothic is indeed very uniform all over Europe. Here, however, its efforts were neither grand in scale nor interesting. Some of the church furniture, as, *e.g.* the choir screens at Toledo, and some of the cloisters, are among the best features. The work is all correct, tame and academical, and has none of the dignity, power and interest which marked the earlier Spanish buildings. Towards the end of the 14th century the work of Spanish architects becomes infinitely more interesting. The country was free from trouble with the Moors; it was rich and prosperous, and certainly its buildings at this period were so numerous, so grand and so original, that they cannot be too much praised. Moreover, they were carefully designed to suit the requirements of the climate, and also with a sole view to the accommodation conveniently of enormous congregations, all within sight of the preacher or the altar. This last development seems to have been very much the work of a great architect of Majorca, Jayme Fabre by name. The grandest works of his school are still to be seen in Catalonia. Their churches are so vast in their dimensions that the largest French and English buildings seem to be small by comparison, and being invariably covered with stone vaults, they cannot be compared to the great wooden-roofed churches of the preaching orders in Italy and elsewhere, in which the only approach is made to their magnificent dimensions. The cathedral of Gerona is the most remarkable example. Here the choir is planned like the French *chevet* with an aisle and chapels round it, and opens with three lofty arches into the east wall of a nave which measures no less than 73 ft. in the clear, and is covered with a stone vaulted ceiling. In Barcelona there are several churches of very similar description; at Manresa another, but with aisles to its nave; and at Palma in Majorca one of the same plan as the last, but of even much larger dimensions. Perhaps there is no effort of any local school of architects more worthy of study and respect than this Catalonian work of the 14th and 15th centuries. Such a happy combination of noble design and proportions with entirely practical objects places its author among the very greatest architects of any time. It is one thing to develop patiently step by step from the work of one's fathers in art, quite another to strike out an entirely new form by a new combination of the old elements. In comparison with the works just mentioned the other great Spanish churches of the 15th century are uninteresting. But still their scale is grand and though their detail is over-elaborated and not beautiful, it is impossible to deny the superb effect of the interior of such churches as those of Seville, Segovia and Salamanca (new cathedral). They



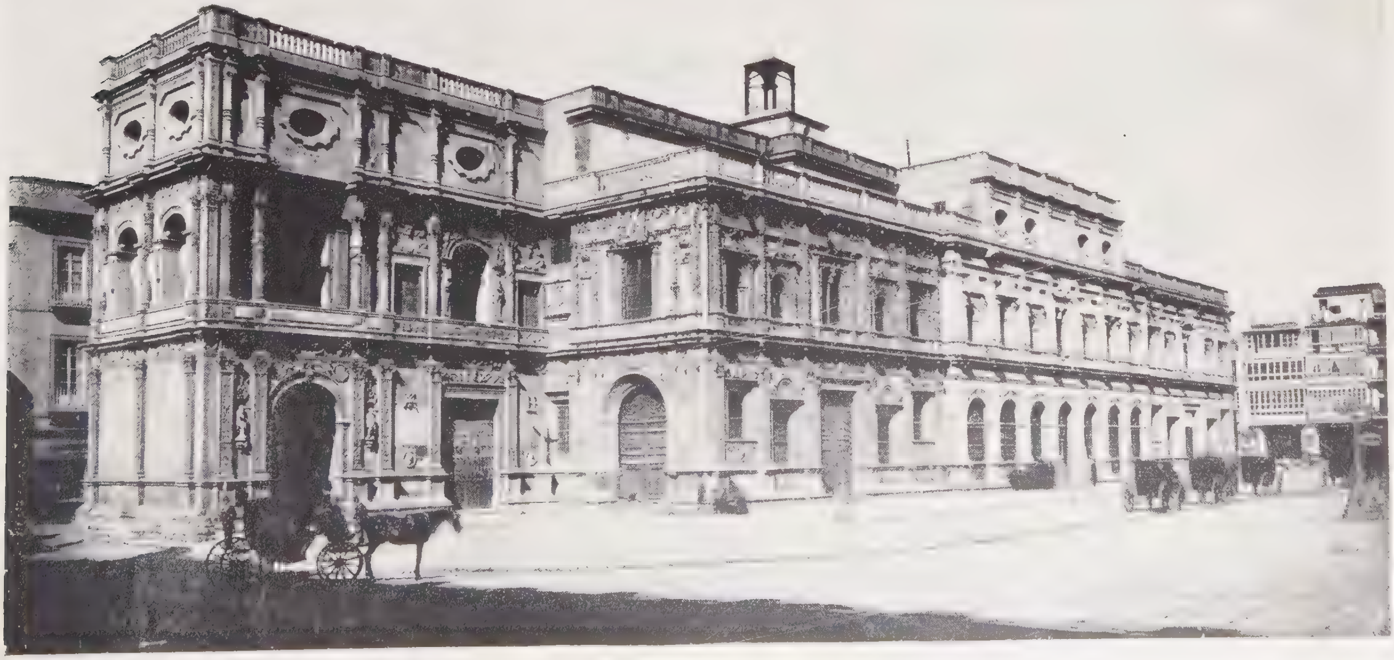
Photo, Alinari.

FIG. 72.—DOOR OF SAN MICHELE, PAVIA.



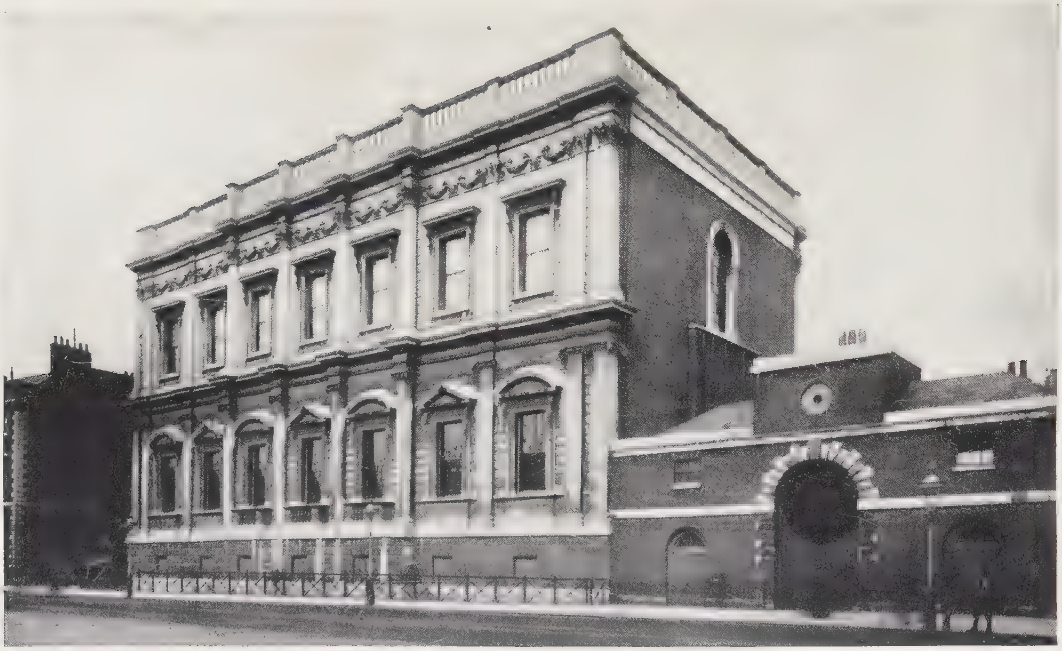
Photo, Lacoste.

FIG. 73.—UNIVERSITY, SALAMANCA.



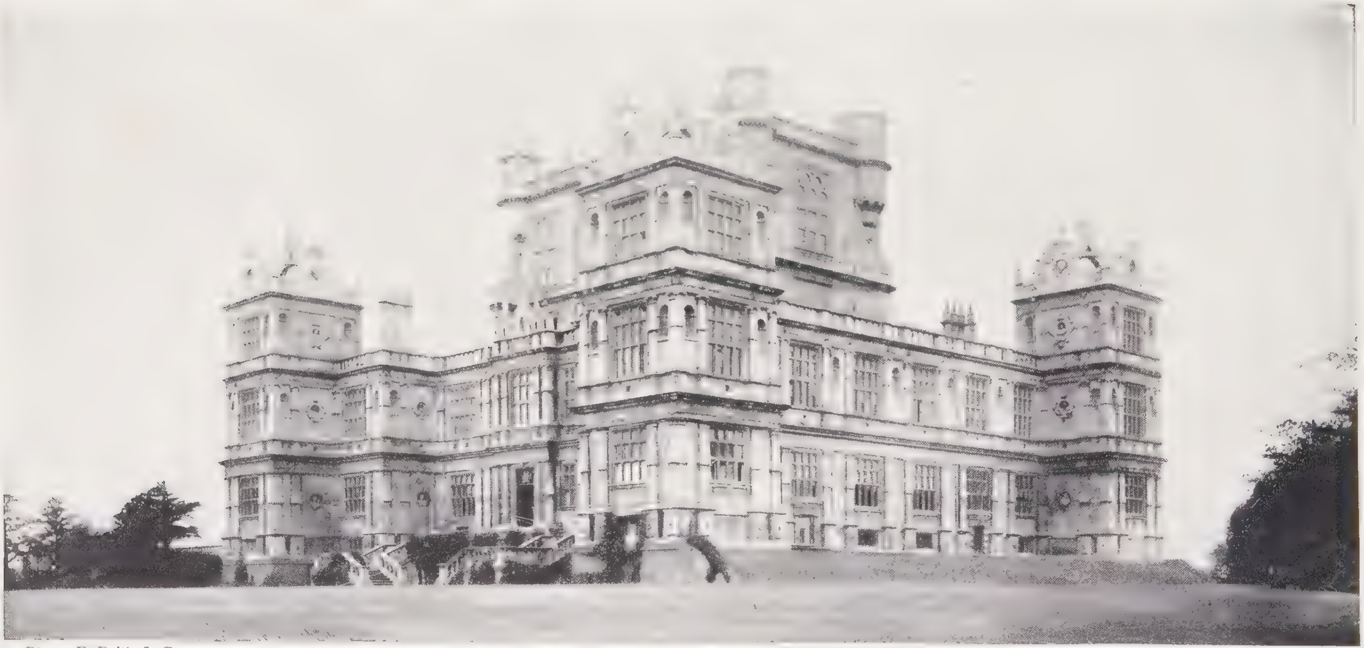
Photo, Lacoste.

FIG. 74.—TOWN HALL, SEVILLE.



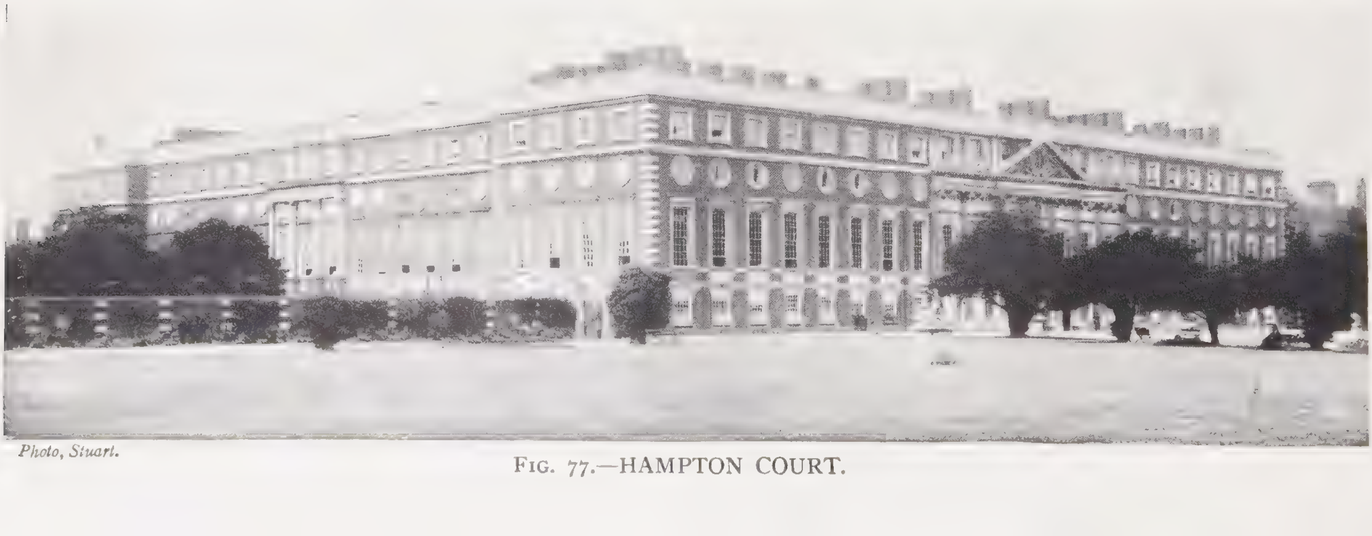
Photo, F. Frith & Co.

FIG. 75.—BANQUETING HOUSE, WHITEHALL.



Photo, F. Frith & Co.

FIG. 76.—WOLLATON HALL.



Photo, Stuart.

FIG. 77.—HAMPTON COURT.

are very similar in their character, their columns are formed by the prolongation of the reedy mouldings of the arches, their window traceries are poorly designed, and their roofs are covered with a complex multitude of lierne ribs. Yet the scale is fine, the admission of light, generally high up and in sparing quantity, is artistic, and much of the furniture is either picturesque or interesting. The *tout ensemble* is generally very striking, even where the architectural purist is apt to grumble at the shortcomings of most of the detail.

The remarks which have been made so far have been confined to the fabrics of the churches of Spain. It would be easy to add largely to them by reference to the furniture which still so often adorns them, unaltered even if uncared for; to the monuments of the mighty dead; to the sculpture which frequently adorns the doorways and screens; and to the cloisters, chapter-houses and other dependent buildings, which add so much charm in every way to them. Besides this, there are very numerous castles, often planned on the grandest scale, and some, if not very many, interesting remains of domestic houses and palaces; and most of these, being to some extent flavoured by the neighbourhood of Moorish architects, have more character of their own than has been accorded to the churches. Finally, there are considerable tracts of country in which brick was the only material used; and it is curious that this is almost always more or less Moorish in the character of its detail. The Moors were great brickmakers. Their elaborate reticulated enrichments were easily executed in it, and the example set by them was, of course, more likely to be followed by Spaniards than that of the nearest French brick building district in the region of Toulouse. The brick towers are often very picturesque; several are to be seen at Toledo, others at Saragossa, and, perhaps the most graceful of all, in the old city of Tarazona in Aragon, where the proportions are extremely lofty, the face of the walls everywhere adorned with sunk panels, arcading, or ornamental brickwork, and at the base there is a bold battered slope which gives a great air of strength and stability to the whole. On the whole, it must be concluded that the medieval architecture of Spain from the 12th century is of less interest than that of most other countries, because its development was hardly ever a national one. The architects were imported at one time from France, at another from the Low Countries, and they brought with them all their own local fashions, and carried them into execution in the strictest manner; and it was not till the end of the 14th century, and even then only in Catalonia, that any buildings which could be called really Spanish in their character were erected. (R. P. S.)

Romanesque and Gothic Architecture in England

Pre-Conquest.—The history of English architecture before the Norman Conquest is still only imperfectly known. Its parentage is triple: Roman, Celtic and Teutonic. To the first belongs the general building tradition of the Romanized West, and the influence of the mission of Augustine at the end of the 6th century, and of such men as Wilfrid in the 7th. The Celtic element is due to the Scottish (Irish) church, which never gained much hold on the south of England, while the Teutonic influence shows itself in the later developments, which are allied to the early buildings of kindred peoples in Germany. Fragments of existing early churches have been attributed to the time of the Roman occupation, but all are doubtful, with the exception of the remains of what is believed to have been a Christian church excavated at Silchester in 1892. This was a basilica of ordinary form, comprising an apse with western orientation, nave and aisles, transepts of slight projection, and narthex. Augustine's cathedral church of Canterbury, which he had learned was originally constructed by the labours of Roman believers (Bede), was also a basilica with western apse; its eastern apse and *confessio* beneath were probably a later addition. Remains of early churches are found on several sites where churches are recorded to have been built during the missionary period. Of these, Reculver (*c.* 670) and Brixworth (*c.* 680) have aisled naves and eastern apses. At Brixworth a square bay intervenes between the apse and the nave. St Pancras, Canterbury, of the time of Augustine, Rochester (604), and Lyminge (founded 633), show unaisled naves of relatively wide proportion, with eastern apses of stilted curve. In some of these churches there was a triple arcade in front of the sanctuary, in place of the usual "triumphal arch." The technique shows Roman influence, and Roman materials are largely used. The existing crypts of Hexham and Ripon were built by Wilfrid, *c.* 675. The description of Wilfrid's church at Hexham gives the impression of an elaborate structure (*columnis variis et porticibus multis suffultam*). Wilfrid also built at Hexham a church of central plan, with projections (*porticus*) on the four sides, a type of which no example has survived in England. Escomb (Durham) and parts of Monkwearmouth and Jarrow, which are attributed to the same period, have plans of an entirely different type—a relatively long and narrow nave, with small square-ended chancel—a plan, usually attributed to Celtic influence, which is most extensively represented in churches recognized as Saxon.

The evolution of the characteristic features of pre-Conquest architecture was slow, and was doubtless greatly hindered by the invasions of the Northmen from the end of the 8th century onward, but germs of the fully developed style are to be found in the earliest buildings. The western tower, usually of tall and slender proportion, was developed from the western porch found at St Pancras, Canterbury, and Monkwearmouth; sometimes, as in the latter church, actually raised over the older porch. The lateral chapels of St Pancras, which existed also in the Saxon cathedral of Canterbury, were developed into a transept, culminating in the cruciform plan with central tower. The characteristic "long-and-short" work, which consists of tall upright stones alternating with stones bedded flat bonding into the rubble work of the wall, has its prototype in the western arch of the porch of Monkwearmouth, and in the jambs of the chancel arch at Escomb. Sometimes the flat stones are cut back on the face, so that the plaster which covered the rubble extended up to the line of the upright stones, thus giving the quoin the appearance of a narrow pilaster. The repetition of these pilasters on the face of the walling constitutes rib-work, and these ribs are frequently connected by semicircular or so-called "triangular" arches, forming a kind of rude arcading (Earls Barton, Barton-on-Humber.) Windows in the earliest Saxon work are generally wide in proportion, and splayed on the inside only; in the later work they commonly have splays both on the inside and outside. Doorways have square jambs, without splay or rebate; sometimes the jambs of doorways and windows are inclined, as in early buildings in Ireland. Imposts to doorways, tower arches or chancel arches are often square projecting blocks, sometimes chamfered on the lower edge. The mid-wall shaft is a characteristic feature in the belfry openings of Saxon towers; it supports an impost or through-stone, of the full thickness of the wall, which receives the semicircular arches over the openings. The method is analogous to that commonly found in northern Italy and the Rhineland. Sometimes the mid-wall shaft is a baluster, turned in a lathe. In some of the later belfry openings, a capital intervenes between the mid-wall shaft and the impost. The dating of buildings of this style is at present a matter of considerable difficulty, but certain points, such as the development of the cruciform plan, are useful for comparison. A fully developed cross church was built at Romsey in 969, having also a single axial western tower, and this seems to have been the normal type of a large church in the later years of the style. Cruciform plans, not yet fully developed, are found at Deerhurst, Breamore and St Mary in the castle at Dover, and fully developed at Norton (Durham) and Stow (Lincolnshire). The most advanced detail which occurs in pre-Conquest buildings is the recessing of arches in orders. But for the Conquest, English architecture might have developed somewhat on the lines of contemporary work in Germany. It must be remembered, however, that, although the Norman Conquest marks the beginning of a new epoch in English architecture, the Norman manner had already been introduced into England under Edward the Confessor, as is proved by the considerable remains of that king's work at Westminster Abbey.

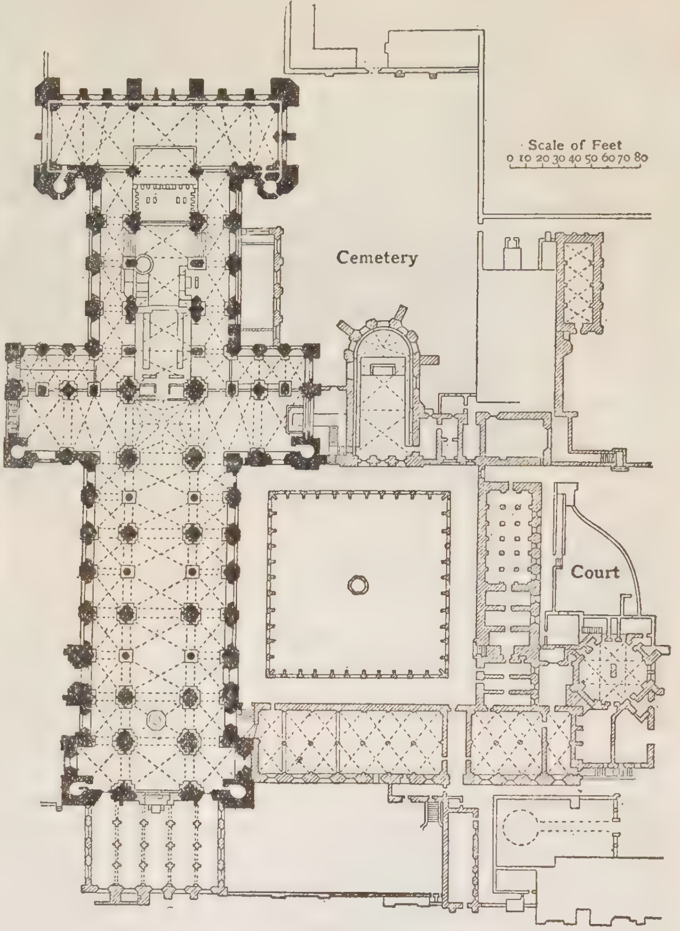
The succeeding periods of English architecture have been divided into so-called "styles" or "periods," though it should be recognized that all such hard and fast divisions are purely artificial, and that, apart from the objection that they exaggerate the importance of mere details, they tend to obscure the fact that the history of Gothic architecture is a history of continuous development. The following classifications, those of Thomas Rickman and Edmund Sharpe, are in most general use for the present by such students as are not content with a nomenclature based on simple chronology:—

Rickman.		Sharpe.	
1066–1189	Norman.	1066–1145	Norman.
		1145–1190	Transitional.
1189–1307	Early English.	1190–1245	Lancet.
		1245–1315	Geometrical.
1307–1377	Decorated.	1315–1360	Curvilinear.
1377–1546	Perpendicular.	1360–1550	Rectilinear.

Norman Conquest to c. 1150.—At the time of the Conquest of England, the Norman school was already one of the most advanced Romanesque schools of western Europe. Its marked individuality and logical character are clearly expressed in the abbey churches of Jumièges and St Étienne and Sainte-Trinité at Caen, and it quickly supplanted the less advanced Romanesque manner of the conquered English. As soon as the conqueror had made himself master in his new kingdom, cathedral and abbey churches were rebuilt on a scale hitherto unknown either in Normandy or England. As the effect of the Norman Conquest was to incorporate the church in England more closely with western Christendom, so its effect on architecture was to bring it into line with the best continental achievement of its time. The immense energy of the Norman bishops and abbots gave such a stimulus to architecture that by the close of the 11th century, England, rather than Normandy, had become the real *foyer* of the Norman school.

The plans of the larger churches show greater development in the length of choir, transept and nave than was usual in Normandy. Many follow the type of choir plan generally represented in the contemporary churches of Normandy which have survived—a central apse, flanked by an apse terminating each aisle, but the two bays usual in the Norman churches frequently became four in England. The Confessor's church of Westminster seems to have had an ambulatory with radiating chapels, a plan which, although rare in the surviving churches of Normandy, was adopted in several of the more important English churches (St Augustine's, Canterbury; Winchester; Worcester; Gloucester; Bury St Edmunds; Norwich; Tewkesbury). Some of these have great vaulted crypts extending under the choir and its aisles. The transept, generally of considerable length, has one or more apsidal chapels on the east side of each arm, or an eastern aisle, or even (as at Winchester and Ely) both eastern and western aisles. The lantern-tower over the crossing was a characteristic feature in England, as in Normandy. Frequently the nave was of great length, extending to twelve bays at Winchester, thirteen at Ely, and fourteen at Norwich. Some churches, as Ely, Bury St Edmunds, and later Peterborough (Plate VIII., fig. 81), show a western transept, with corresponding development of the west front. Two western towers are most usual, but Ely (Plate II., fig. 67), and originally Winchester, had the single western tower, a survival from pre-Conquest times, which is found also in numberless parish churches. In their general design, the Norman churches show great skill in composition, and in the logical expression of structure, and sure grasp of the problems to be solved. The subordination of arches (arches built in rings, or orders, recessed one within the other) was carried further than in other Romanesque schools, and with this went the subordination of the pier, planned with a shaft to receive each order of the semicircular arch. Sometimes the shafted piers of the great arcades alternate with cylindrical (or later with octagonal) pillars; sometimes, as at Gloucester and Tewkesbury, all the pillars are cylindrical. The triforium usually has a single wide semicircular arched opening, enclosing two or more minor semicircular arches springing from detached shafts. Usually the aisle wall is carried up to form a complete triforium storey, unvaulted, and lighted by windows in the outer wall. The clerestory has a single window in each bay, with a wall passage between the window and an internal arcade, usually of three semicircular arches on shafts, the central arch being wider than the side arches. Most frequently naves and transepts were unvaulted, and finished with wood ceilings, while the aisles were covered with groined vaults of rubble, on transverse arches. The general design of the greater churches indicates, however, that the Norman builders were aiming at a completely vaulted structure. The half-barrel vault over the triforium of Gloucester, and the transverse arches over the triforium of Chichester, seem to be constructed to afford the necessary abutment to vaults over the choir, such indeed as still exist over some choirs in Normandy built before the end of the 11th century. The problem was only successfully solved by the introduction of the diagonal rib, which completed the structural membering of the vault. Durham, begun in 1093 (fig. 42), is the earliest example in England of this important innovation, and it precedes by some quarter of a century the earliest ribbed vaults of the Île-de-France. The abutting arches under the roof of its triforium are actually rudimentary flying-buttresses, and we have here all the essential elements of Gothic architecture, except the pointed arch, which is only systematically used in English vaulted construction from about the middle of the 12th century. The decorative forms of the earlier buildings of the Norman school are severely simple. Arches, which at first were usually unmoulded, soon received effective mouldings of rolls and hollows, continuing a tradition of the latest pre-Conquest architecture. Two types of capitals are found in the earlier buildings after the Conquest; the volute capital, descended from the Corinthian, which was the normal type in Normandy; and the cubic or cushion capital, formed by the penetration of a segment of a sphere, or segments of cones, with a cube, a type which, appearing earlier in England than in Normandy, was doubtless derived from pre-Conquest models, and in the 12th century developed into the scalloped capital. The decoration of wall-surfaces by arcades, frequently of intersecting semicircular arches, is characteristic of the Norman school. Windows are splayed in the interior, and in the more important buildings are enriched with shafts and moulded arches. Ornamentation is frequently concentrated on the doorways, which are often of many orders, with a shaft under each order. Based chiefly on geometric forms, such as the chevron or zigzag, star, fret and cable, the decoration becomes richer and more refined as the 12th century advances, though in sculpture the Norman was less advanced than some other Romanesque schools.

The foregoing generalization applies more particularly to the greater churches, but numberless parish churches present similar characteristics. Chancels are sometimes apsidal, but by far the most prevalent type of plan is the aisleless oblong nave and square-ended chancel, with or without a western tower. Other types of aisleless plans are the cruciform church with central tower, or simply nave and chancel with central tower. Even where subsequent alterations and rebuildings have destroyed almost everything, the influence of these plans on the later work is the key to a right understanding of the history of the greater number of English medieval churches.



From Rickman's *Styles of Architecture*, by permission of Parker & Co.

FIG. 42.—Plan of Durham Cathedral.

12th Century (second half).—The second half of the 12th century is the period of transition *par excellence*—of transition from Romanesque to Gothic. The school of the Île-de-France, which up to *c.* 1120 was one of the most backward of the Romanesque schools, had made enormous progress when the ambulatory of Suger's church of Saint-Denis was built (1140–1144), and thenceforth it continued to lead the way. There is no doubt that, from the middle of the 12th century, English architecture was continuously influenced by the Île-de-France, for the most part through Normandy, but it must be considered to be a development on parallel lines, with strongly marked characteristics of its own, and not merely as an importation of forms already developed elsewhere. At the same time, the influence of the Cistercian revival was considerable, not so much in the introduction of foreign forms as in the direction of simplicity and severity, which acted as a valuable check to the prevalent tendency to exaggerate the importance of surface decoration.

The substitution of the square east-end for the apse in the plans of the greater churches, already effected at Romsey, was furthered by the simple plans of the Cistercian churches. The altar spaces provided by the radiating chapels of the French chevet were in England obtained by returning the aisles across the square east-end of the choir, or by an eastern transept. The latter occurs first here in "the glorious choir of Conrad" of the beginning of the 12th century at Canterbury, which affords also the first example of the eastward extension of the choir, which became so characteristic a feature of English planning. The reconstruction of Conrad's choir after the fire of 1174 led to a further extension eastward, with the eastern chapel, which was adopted in many of the greater churches, either in the form of a lower building, sometimes of three spans, eastward of the east gable, or of an extension of the choir itself to its full height. The work of William of Sens at Canterbury (1175–1178) was naturally more French in character than other contemporary works in England, but the work of his successor, William the Englishman (1179–1184), shows the beginnings of what became the characteristically English manner of the 13th century.

The second half of the 12th century was a period of rapid development of architectural forms in the direction of increased elegance and refinement. The pointed arch, employed at first for the arches of construction, entirely superseded the semicircular arch in doorways, windows and arcades by the end of the century, and its adoption finally solved the problem of vaulted construction. The abutting arches under the triforium roofs of the earlier churches were developed into flying buttresses above the roofs, springing from buttresses of increased projection, and weighted by pinnacles. Mouldings became more graceful and subtle in their profiles. Capitals reverted to the volute type, transformed and refined. The massive Romanesque pier was gradually developed into the lighter Gothic pier, in which detached shafts were extensively adopted. The use of Purbeck marble for these shafts must be considered in relation to the painted decoration of the wall-surfaces, which, although now almost entirely lost, was an important factor in the internal effect.

13th Century (first half).—The last decade of the 12th century marks the achievement of a fully developed Gothic style, with strongly marked national individuality. During the 13th century, English Gothic follows the same general course of evolution as that of northern France, but the parallelism is less close than in the preceding century.

St Hugh's choir at Lincoln (begun 1192) had indeed an apse, with ambulatory and radiating chapels, though its plan does not appear to have been controlled by the vaulting as in the French chevets, and what there is of French influence seems to have come rather through Canterbury than by a more direct route. This choir has the eastern transept which characterizes several of the greater churches of the first half of the 13th century—Salisbury (fig. 43), Beverley, Worcester, Rochester, Southwell. The square eastern termination, the less ambitious height, and the comparatively simple buttress-system, combine to give the English Gothic cathedral an air of greater repose than is found in the magnificent triumphs of French Gothic art. In its structural system, too, English Gothic retained something of the Romanesque treatment of wall-surface; the suppression of the wall, and the concentration of the masonry in the pier, was never carried so far as in the complete Gothic of France. The general tendency during the 13th century, as in the 12th, was in the direction of increased lightness and elegance. The employment of detached shafts, and the extensive use of marble (generally Purbeck) for these shafts, is a distinguishing feature of the first half of the century. The vaulting system is fully developed; the most usual form is the simple quadripartite, but the tendency to introduce additional ribs (tiercerons) and ridge-ribs already makes its appearance in the nave of Lincoln and the presbytery of Ely (Plate VIII., fig. 82), to be yet further developed in the second half of the century. Capitals are either simply moulded, an elaboration of the plain bell capitals of the latter part of the 12th century, or finely sculptured, with conventional, or "stiff-leaved," foliage of the crocket type. The use of the circular abacus, begun in the preceding century, entirely supersedes the square abacus, which was retained in France. Mouldings are profiled with great refinement, the alternation of rounds and hollows producing effective contrasts of light and shade, and the far more complicated profiles of arch mouldings provide another feature which distinguishes English work of this period from French. Windows of single pointed lights, the so-called "lancet," though frequently by no means sharply pointed, are the prevalent type, grouped in pairs, triplets, &c., and arranged in tiers in the large gables, or sometimes with only a single group of tall lights, like the "five sisters" of the north transept of York. Few works are more admirably designed than some of the towers of this period. Probably the greatest excellence ever attained in English art of the 13th century was reached in the great Yorkshire abbeys; for purity of general design, excellence of construction, and beauty of detail, they are unsurpassed by the work of any other period.

13th Century (second half).—The grouping together of "lancet" windows, the piercing of the wall above them with foiled circles, and the combination of the whole under an enclosing arch, soon led to the introduction of tracery, for which the design of earlier triforium arcades had also afforded a suggestion.

Bar-tracery appears just before the middle of the 13th century, and the great tracery window filling the whole width of a bay, or the entire gable-end, soon becomes a most characteristic feature. The earlier tracery windows show only simple geometrical forms, foiled arches to the heads of the lights, and foiled circles above, of which the abbey-church and the chapter-houses of Westminster and Salisbury afford most beautiful examples. In some particulars, such as its chevet plan and its comparatively great height, Westminster approaches more nearly to the French type than other English churches of the 13th century, but its details are characteristically English and of great beauty. In the last quarter of the century, pointed trefoils or quatrefoils are largely used in tracery, and the foliations frequently form the lines of the tracery, without enclosing circles. Contemporary with this change is the gradual absorption of the triforium into the clerestory, of which Southwell and Pershore are precocious examples. Contemporary also was the adoption of an excessively naturalistic type of foliage. The art of masonry and stone-cutting was rapidly developed. The detached shaft, always structurally weak, was abandoned for the pier with engaged shafts separated by mouldings. The mouldings of arches become less deeply undercut, and the greater use of the fillet tends to give a more liney effect. The whole practice of art was growing more scholarly, perhaps, but at the same time it was more conscious, and the cleverness of the mason was almost as often suggested as the noble character of his work.

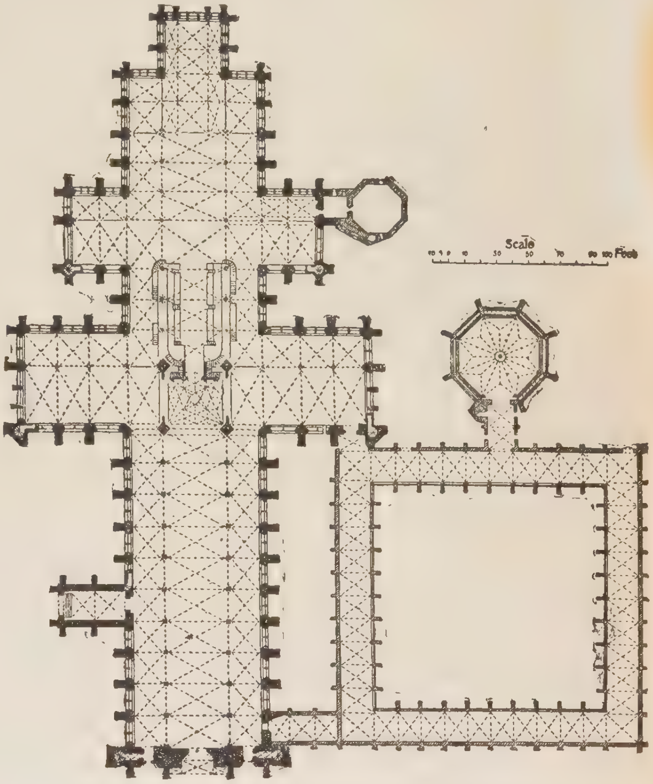


FIG. 43.—Plan of Salisbury Cathedral.

14th Century (first half).—The juxtaposition of the foliations without enclosing circles in tracery windows produced curves of contraflexure, which led insensibly to the complete substitution of flowing lines for geometrical forms in tracery.

Flowing tracery makes its appearance in England about 1310, and lasts some fifty years. Up to the end of the 13th century, window tracery had developed in France and England on parallel lines, though the English work was always slightly behind France in point of date. All this is changed with the adoption of flowing tracery in England; its development was purely national, and owed nothing to France. Indeed, the French flamboyant only makes its appearance at the time when flowing tracery was being abandoned in England. Not only window traceries, but mouldings, carvings and other details are changed in character. The ogee form is used in arches, in wall-arcades of great beauty and elaboration, as in the Lady-chapel at Ely, and in the canopies of tombs, such as the magnificent Percy tomb at Beverley. Niches and arcades are richly ornamented, and small decorative buttresses are used in the jambs of doorways, windows and niches. The moulded capital is still used, along with the capital with a continuous convex band of wavy foliage. Many of the most beautiful English towers and spires date from this period, the work of which is perhaps seen at its best in the parish churches of south Lincolnshire.

From Middle of 14th Century.—The over-elaboration of flowing tracery inevitably led to a reaction. The beauty of the lines of the tracery had controlled everything, and the resulting forms of the openings, which presented serious difficulties for the glass painter, had been a secondary consideration. Hence an endeavour to return to a simpler and more dignified, if more mechanical, style of building. The splendid exuberance of the earlier 14th century style gave way to the introduction of vigorous, straight, vertical and horizontal lines.

The beginnings of the new manner are to be seen in the south transept of Gloucester before 1337. After the great interruption of building works caused by the Black Death of 1349 and its recurrence in following years, the so-called "Perpendicular" style became general all over the country. The preference for straight in place of flowing lines became more and more developed. Doorways and arches were enclosed within well-defined square outlines; walls were decorated by panelling in rectangular divisions; vertical lines were emphasized by the addition of pinnacles, and buttresses were used as mere decorations, while horizontal lines were multiplied in string-courses, parapets and window transoms. Capitals were frequently omitted, and the mouldings of arches were continued down the piers. The use of the depressed "four-centred" arch became common. Vaulting, which had already been enriched by the multiplication of ribs, was further complicated by cross-ribs (liernes), subdividing the simple spaces naturally produced by the intersection of necessary ribs into panels; these, again, were filled with tracery. The fan-vault was developed by giving to all the ribs the same curvature; the outline of the fan is bounded by a horizontal circular rib, and its effect is that of a solid of revolution upon whose surface panels are sunk. The cloister of Gloucester presents the earliest and perhaps the most beautiful example. Finally, the builders displayed their mechanical skill by introducing pendants, as in Henry VII.'s chapel at Westminster. This latest period of English Gothic was a purely national development of which it has been too much the fashion to speak disparagingly; for it is futile to call such works as the nave of Winchester or the choir and Lady-chapel of Gloucester "debased." Perhaps the worst that can be said of this period is that there was too great a love of display, and too much mechanical repetition, but it is none the less true that it is to the 15th century that a very large number of English parish churches owe their fine effect. East Anglia and Somersetshire possess some of the choicest examples, and few things can be more beautiful than the central towers of Gloucester and Canterbury, and the towers of the Somersetshire churches. The open timber roofs, as, for instance, those of the East Anglian churches, are superb, while many of the churches of this period are still full of interesting furniture and decoration. Finally, a word must be said of the wealth of interesting examples of domestic architecture, which yet count among the ornaments of the country.

After the middle of the 16th century the practice of Gothic architecture virtually died out, though traces of its influence, especially in rural districts, were hardly lost until the end of the 17th century. Good, sound, solid and simple forms, well constructed by men who respected themselves and their work, and did not build only for the passing hour, were still popular and general, so that the vernacular architecture to a late period was often good and never absolutely uninteresting.

Scotland.—A few words will suffice for Scottish and Irish architecture, since the development in these countries followed much the same course of change as in England.

The earliest ecclesiastical structures which still survive in Scotland follow the same general type as those of Ireland. The monastic foundations of Queen Margaret and her sons introduced into Scotland the Norman manner then universal in England. The best examples, such as the nave of Dunfermline, which is an obvious inspiration from Durham, Kelso of the later 12th century, and the parish churches of Dalmeny and Leuchars, present the same characteristics as are found in English churches of somewhat earlier dates than the buildings in question, and some Romanesque forms survive to a later period than in England. In the 13th century, too, the style of the Scottish churches corresponds very closely with that of England, though the details are generally simpler, and the structures are smaller. It is naturally allied most closely with the north of England, where Cistercian influence in the direction of simplicity and severity had been exercised with the best results. The transept of Dryburgh, the choir and crypt of Glasgow cathedral, the nave of Dunblane, the choir of Brechin, and later Elgin cathedral, exhibit the style at its purest and best. The disturbed condition of the country during the 14th century was unfavourable to architecture, and when building revived at the beginning of the 15th century its style became more national. During the first half of the 15th century, it shows a certain borrowing from English architecture of the flowing-tracery period. Later, many features are borrowed both from England and France, and architecture develops in picturesque and interesting fashion. Melrose is one of the most characteristic, as it certainly is one of the most charming of Scottish buildings; its earlier parts bear a close resemblance to the earlier 14th-century work at York, while its later parts show more similarity to English "Perpendicular" than is common in Scotland. One of the most characteristic features of Scottish architecture in the 15th century is the pointed barrel vault, which directly supports the stone flagged roof. French influence is seen in the employment of the polygonal apse for the termination of choirs, and in some approaches to Flamboyant tracery. The details of the later Gothic churches have but slight connexion either with France or England, and show a curious revival of earlier motives. The semicircular arch is in frequent use, and the "nail-head" and "dog-tooth" ornament, as well as the use of detached shafts, are revived. One of the most remarkable buildings of the 15th century in Scotland is the collegiate church of Roslin, which has a pointed barrel vault over its choir, with transverse barrel vaults over the aisles, and is distinguished by the extreme richness of its decoration.

The domestic remains in Scotland are full of picturesque beauty and magnificence. They are a distinctly national class of buildings of great solidity, and much was sacrificed by their builders to the genius of the picturesque. They can only be classed with the latest Gothic buildings of other countries, but the mode of design shown in them lasted much later than the late Gothic style did in England. The vast height to which their walls were carried, the picturesque use made of circular towers, the freedom with which buildings were planned at various angles of contact to each other, and the general simplicity of the ordinary wall, are their most distinct characteristics.

Ireland.—The chief interest of the medieval architecture of Ireland belongs to the buildings which were erected before the English conquest of the 12th century. The early monastic settlements seem to have resembled the primitive Celtic fortresses, and consisted of a series of huts or cells, surrounded by an enclosing wall. The so-called "bee-hive" cell, which goes back to pre-Christian times, was built of rough stone rubble without mortar, and roofed in the same manner by corbelling over the courses of masonry. Some of these were certainly dwellings, but others were oratories. The largest of those in Skellig Michael is four-sided, and from this type the stone-roofed church of oblong plan was developed. The later type, with oblong nave and small square-ended chancel, retained much of the character of these primitive structures, and their barrel vaults were sometimes independent of the stone roof-covering, a system which lasted into the 12th and 13th centuries. A certain megalithic character, and the inclined jambs of doorway openings, are marked features of these early churches. The round towers so frequently associated with them are believed to be not earlier than the 9th century. Before the introduction of Norman forms, Ireland possessed a Romanesque style of her own, characterized by the survival of horizontal forms and their incorporation into the round-arched style, the retention of the inclined jambs of doorways, rich surface decoration, and the use of certain ornamental motives of earlier Celtic origin. King Cormac's chapel at Cashel is one of the best examples of the imported Norman manner of the 12th century, and here we find much of the influence of the earlier native style. The English conquest may be said to have been the introduction to Ireland of Gothic art, and it was the local variety of western England and south Wales which the conquerors introduced. Among the buildings erected by the English in Ireland, Kilkenny cathedral and the two 13th-century cathedrals of Dublin—Christ Church and St Patrick's—are the most remarkable, but there are many others. Their style is most plainly that of the English conqueror, with no concession to, or consideration of, earlier Irish forms of art. The result of the conquest was that the native style of construction was never applied to large buildings, though it did not at once disappear, as is witnessed by the church St Doulough near Malahide, which appears to be a 14th-century building. The characteristic features of later medieval Irish buildings, such as the stepped battlements, the retention of flowing lines in the tracery, and the peculiar treatment of crockets, are matters of no great importance in the history of architecture, and indeed it is hardly to be expected that a country with so stormy a history could have given rise to any systematic developments. Of the monastic remains those of the friaries are the most numerous, Ireland having many more friars' churches to show than England, but such peculiarities as they possess belong rather to the order than to any local influences. (J. Bn.)

Romanesque and Gothic Architecture in Germany

With the exception of the church built at Trèves (Trier) by the empress Helena, of which small portions can still be traced in the cathedral, there are no remains of earlier date than the tomb-house built by Charlemagne at Aachen (Aix-la-Chapelle), which, though much restored in the 19th century, is still in good preservation. It consists (fig. 44) of an octagonal domed hall surrounded by aisles in two storeys, both vaulted; externally the structure is a polygon of sixteen sides, about 105 ft. in diameter, and it was preceded by a porch flanked by turrets. It is thought to have been copied from S. Vitale at Ravenna, but there are many essential differences. The same design was repeated at Ottmarsheim and Essen, and a simpler version exists at Nijmwegen in the Netherlands, also built by Charlemagne. Although no remains exist of the monastery of St Gall in Switzerland (see Abbey), built in the beginning of the 9th century, a valuable manuscript plan was found in the 17th century, in its library, which would seem to have been a design for a complete monastery. It contains features which are peculiar to the early German churches and are rarely found elsewhere, and is therefore of considerable interest, suggesting that some of the accessories of a monastery, supposed to have been the result of subsequent development, were all clearly set forth at this early period. The plan shows an eastern apse with a crypt, and a choir in front; a western apse, nave and aisles, with a series of altars down the latter; and on the west side, but detached from the apse, two circular towers with staircases in them. Unfortunately there are no churches remaining of the same date from which we might judge how far these arrangements were followed; but there are three early churches in the island of Reichenau on the Lake of Constance, in one of which, Mittelzell, is a western apse with staircases (here built up into a central tower), nave, and aisles with altars at the side between every window. The eastern portion has been rebuilt. At Oberzell, at the south end of the island, is a vaulted crypt, which dates from the end of the 10th century. In the third and much smaller church, Unterzell, there was no crypt, but three eastern apses and a western apse, which was destroyed when the present nave was built. At Gernrode in the Harz is a church with western and eastern apses with vaulted crypts underneath (one of which dates from 960 when the church was founded), and circular towers with staircases in them on either side of the western apse. The church was completed about a century later. In the arcade between the nave and aisles piers alternate with the columns. Alternating piers are found also in Quedlinburg (the crypt of which dates from 936 and the church above about 1030) and many other early churches. Western apses exist at Drübeck, Ilbenstadt, Trèves, Huyseberg, St Michael and St Godehard at Hildesheim, Mainz, the Obermünster at Regensburg, Laach, Worms, and at a later date at Naumberg and Bamberg, showing that it was a feature generally accepted in early and late periods. It has, however, one great defect, that of depriving the west end of the church of those magnificent porches which are the glory of the churches of France; the cathedral of Spires (Speyer), the church at Limburg near Dürkheim, the cathedrals of Erfurt and Regensburg, being the few examples where a dignified entrance is given; and further, that on entering the church from the side, one is distracted by the rivalry of the two apses, and it is only when turning the back on one or the other that one is able to judge of the monumental effect of the interior.

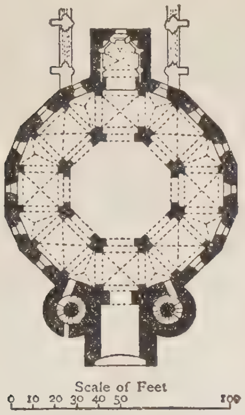


FIG. 44.—Plan of Cathedral at Aix-la-Chapelle.

The greater number of the churches above mentioned were covered over with open timber roofs or flat ceilings; but the problem to be solved in Germany, as well as in Italy, was that of vaulting over the nave, and the cathedrals of Spires, Worms and Mainz (fig. 45) are the three most important churches in which this was accomplished. The dates of their vaults have never been quite settled; that of Spires would seem to have been the earliest built, probably after 1162, when the church was seriously damaged by a conflagration, and the vault is groined only. In Worms (fig. 46) and Mainz there are diagonal moulded ribs, which suggest a later date. Although of great height and width, the absence of a triforium gallery in these cathedrals is a serious defect, as it deprives the interior of that scale which the smaller arcades in such a gallery give to the nave arcade below and the clerestory above, and of those horizontal lines given by string courses which are entirely wanting in these churches. Seeing that in some of the earlier churches, as at Gernrode, St Ursula (Cologne), and Nieder-Lahnstein, the triforium had already been introduced, and that it was repeated in the later examples at Limburg on the Lahn, Bacharach, Andernach, Bonn, Sinzig, and St Gereon (Cologne), it is difficult to understand why, in the three great typical German Romanesque churches, they should have been omitted. Externally the design is extremely fine, owing to the grouping of the many towers at the west and on either side of the transept or choir. In this respect the cathedral of Mainz is the most superb structure in Germany, and to the cathedral of Spires with its fine entrance porch (fig. 47) must be given the second place.

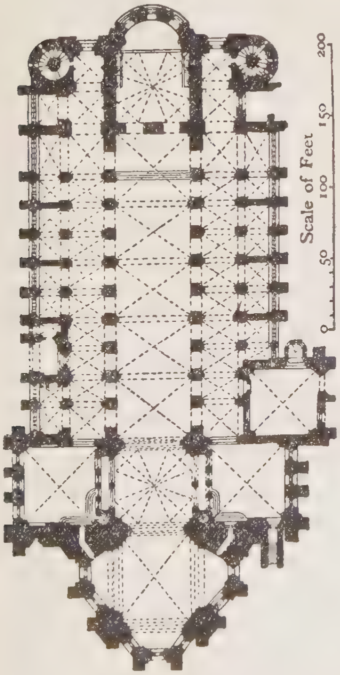


FIG. 45.—Plan of Cathedral at Mainz.

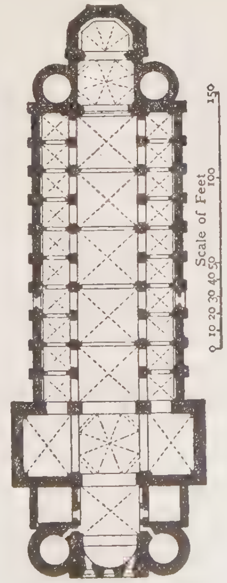


FIG. 46.—Plan of Cathedral at Worms.

One of the most perfect examples of the Rhenish-Romanesque styles is the church of the abbey of Laach, completed shortly after the middle of the 12th century. The eastern part of the church resembles the ordinary type, but at the west end there is a narrow transept flanked by circular towers, and a western apse enclosed in an atrium with cloisters round, which forms the entrance to the church. The sculptures in the capitals of the atrium are of the finest description and represent the perfected type of the German Romanesque style. In addition to the two circular towers flanking the west transept, a square tower rises in the centre of the west front, two square towers flank the choir and a crystal lantern crowns the crossing of the main transept, and the grouping of all these features is very fine and picturesque in effect. A small church at Rosheim in Alsace is quite Lombardic in its exterior design, the pilaster strips and arched corbel tables being almost identical. The same applies to the church at Marmoutier, but the towers flanking the main front and the square tower on the crossing of the western transept produce a composition which one looks for in vain in the greater number of the churches in Italy.

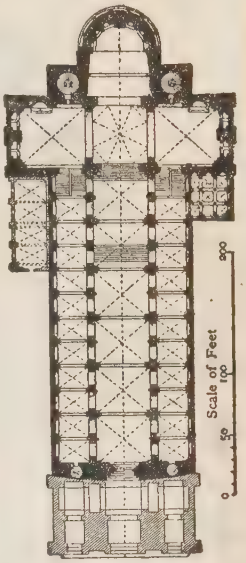


FIG. 47.—Plan of Cathedral at Spires.

In describing the Lombardic churches of North Italy, reference has been made to the probable origin of the eaves-gallery, best represented in the eastern apse of Santa Maria Maggiore, Bergamo. This feature was largely adopted throughout the Rhine churches, and in the Apostles' church and St Martin's at Cologne receives its fullest development, being in addition to the eastern apse carried round the apses of the north and south transepts, which in these two churches and in St-Mary-in-the-Capitol, also in Cologne, constitute a special treatment. In the Apostles' church, where round towers are built at the junction of the three apses, the effect is extremely pleasing. In the church at Bonn, the single apse is flanked by two lofty towers which give great importance to the east front.

The steeples of the same period have a character of their own. They are either square or octangular in plan, arcaded or pierced with windows, and roofed with gables or with spires rising out of the gables.

One peculiarity found in some of the German churches, and specially those in the north-east, is that the nave and aisles are of the same height. To these the term *Hallenkirchen* is given. This type of design is very grand internally, owing to the vast height of the piers and arches. It also dispenses with the necessity for flying buttresses, as the aisles, which are only half the width of the nave, carry the thrust of the vault direct to the external buttresses. The nave, however, is not so well lighted, though the aisle windows are sometimes of stupendous height. The principal examples are those of the church of St Stephen, Vienna, where both nave and aisles are carried over with one vast roof; at Münster, the *Wiesenkirche* at Soest; St Lawrence, Nuremberg; St Martin's, Landshut; Munich cathedral, and others.

St Gereon (1200–1227) and St Cunibert (1205–1248), in Cologne, besides churches at Naumburg, Limburg and Gelnhausen, in which the pointed arch is employed, are almost the only transitional examples in Germany, and respond to work of a century earlier in France. Toward the end of the 13th century the Romanesque style was supplanted by a style which in no way grew out of it, but was rather an imitation of a foreign style, the earliest examples being in the *Liebfrauenkirche* at Trèves (1227–1243), and the churches at Marburg (1235–1283) and Altenberg (1255–1301). In the latter church is a French *chevet* with seven apsidal chapels. This brings us to the great typical cathedral of Germany at Cologne (fig. 48), which had the advantages of having been designed at the best age and completed on the original design, so that with small exceptions a uniformity of style reigns throughout it. It was begun in 1270 and apparently based on the plan of Amiens, the transepts however having an additional bay each, and the two first bays of the nave having thicker piers so as to carry the enormous towers and spires which flank the chief façade. The principal defect of the building is its relative shortness, owing to its disproportionate height. This has always been felt in the interior, and now that the lofty buildings all round have been taken down, isolating the cathedral on all sides, it has the appearance of an overgrown monster. The length of the cathedral is 468 ft., 17 ft. less than the cathedral at Ulm, the longest in Germany. The height of the nave vault is 155 ft., and as the width is only 41·6 (about one in four) the proportion is very unpleasing. There is also a certain mechanical finish throughout the design, which renders it far less poetical than the great French cathedrals. Where, however, it excels is in the extraordinary vigour of its execution, the depth of the mouldings, and the projection given to the leading architectural features; and in this respect, when compared with St Ouen at Rouen, about fifty years later, the latter (which is even more mechanical in its setting out) looks wire-drawn and poor. The twin spires of the façade rise to the height of 510 ft.; they were completed only in the latter part of the 19th century, and would have gained in breadth of effect if there had been some plain surfaces left. In this respect the spire of Freiburg cathedral, which is simple in outline and detail, is finer, and gains in contrast on account of the simpler masonry of the lower part of the tower. The spire at Ulm cathedral, only recently terminated, rises to the height of 530 ft. In both these cases the single tower is preferable to the double towers of Cologne, when elaborated to the same extent, as they are in all these examples; and perhaps that is one of the reasons why the spires of Strassburg and Antwerp cathedrals are more satisfactory, as the twin towers were never built. The front of Strassburg cathedral (1277–1318), by Erwin von Steinbach, is too much cut up by vertical lines of masonry, owing to the *tours-de-force* in tracery of which the German mason was so fond. On the whole the most beautiful of German spires is that of St Stephen's at Vienna, and one of its advantages would seem to be that its transition from the square base to the octagon is so well marked in the design that it is difficult to say where the tower ends and the spire begins. The strong horizontal courses under the spires of Strassburg or Freiburg are defects from this point of view.

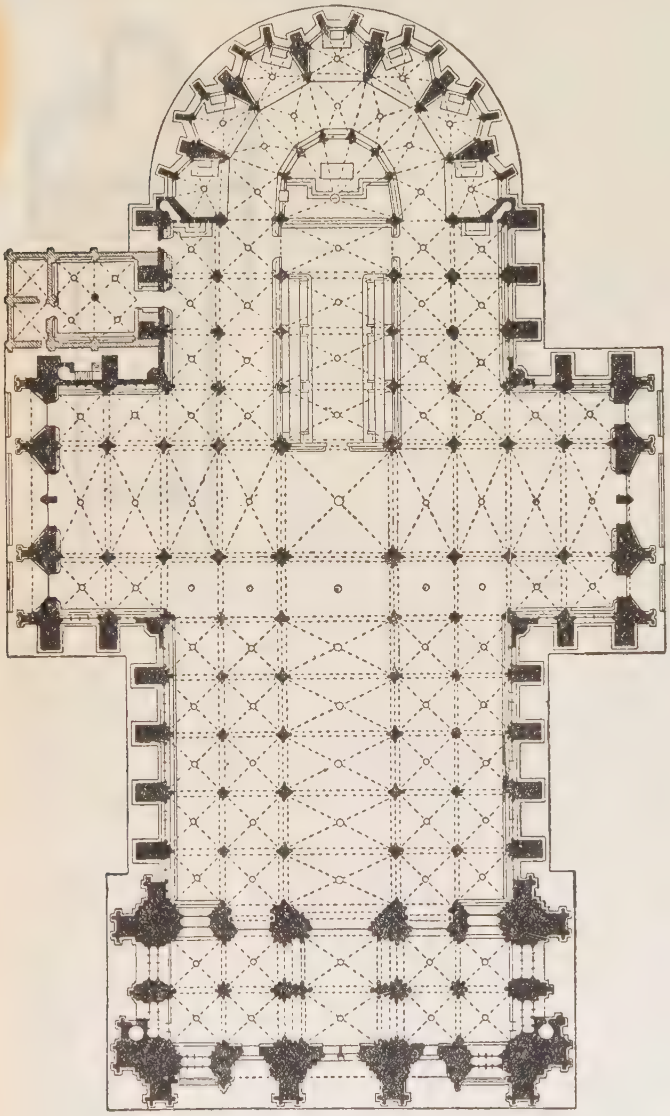


FIG. 48.—Plan of Cathedral at Cologne.

In domestic architecture nothing remains of the palace at Aix-la-Chapelle, but at Lorsch near Mannheim is the entrance gateway of the convent which was dedicated by Charlemagne in 774. It is in two storeys, in the lower one three semicircular arches flanked by columns with extremely classic capitals. The upper storey is decorated with what might have been described as a blind arcade, except that instead of arches are triangular spaces similar to some windows found in Saxon architecture; the whole gateway being crowned with a classic cornice. The palaces at Goslar (1050) and Dankwarderode in Brunswick (1150–1170) still preserve their great halls, and in the palace built (1130–1150) by the emperor Frederick I. at Gelnhausen there remain portions extremely fine and vigorous in style, and showing a strong Byzantine influence. The largest and most important castle is that of the Wartburg at Eisenach, which is in complete preservation.

To sum up, the German Complete Gothic is essentially national in its complete character. It has many and obvious defects. From the first there is conspicuous in it that love of lines, and that desire to play with geometrical figures, which in time degenerated into work more full of conceit and triviality than that of any school of medieval artists. These conceits are worked out most elaborately in the traceries of windows and panelling. The finest early examples are in the cathedral at Minden; a little later, perhaps, the best series is in the cloister of Constance cathedral; and of the latest description the examples are innumerable. But it is worth observing that they rarely at any time have any ogee lines. They are severely geometrical and regular in their form, and quite unlike our own late Middle Pointed, or the French Flamboyant. In sculpture the Germans did not shine. They, like the English, did not introduce it with profusion, though they were very prone to the representations of effigies of the deceased as monuments.

In one or two respects, however, Germany is still possessed of a wealth of medieval examples, such as is hardly to be paralleled in Europe. The vast collection of brick buildings, for instance, is unequalled. If a line be drawn due east and west, and passing through Berlin, the whole of the plain lying to the north, and extending from Russia to Holland, is destitute of stone, and the medieval architects, who always availed themselves of the material which was most natural in the district, built all over this vast extent of country almost entirely in brick. The examples of their works in this humble material are not at all confined to ecclesiastical works; houses, castles, town-halls, town walls and gateways, are so plentiful and so invariably picturesque and striking in their character, that it is impossible to pass a harsh verdict on the architects who left behind them such extraordinary examples of their skill and fertility of resource.

This development is largely due to the fact that all these countries in north-east Germany were connected and very much influenced by the confederation of the Hanse towns, and hence the similarity in the design of all their buildings. Although some of the earliest buildings date from the 12th century, the chief development took place in the 14th and 15th centuries, and in the 16th century formed the basis of the transitional works of the Renaissance. The principal Hanse towns are Hamburg, Lübeck and Danzig. The chief buildings in Hamburg were destroyed by the fire in 1842, and it is in Lübeck that the most important churches are to be found. The church of St Mary (Marienkirche), 1304, is the most striking on account of its dimensions, 346 ft. in length, the nave being 123 ft. high, with two western towers 407 ft. high. Great scale is given to the building in consequence of the small material (brick) used, and some of the windows in this or other churches are nearly 100 ft. in height, with lofty mullions, all in moulded brick. The *Dom* or cathedral of Lübeck, though slightly larger, is not so good in design, but has a remarkable north porch in richly moulded brick, with marble shafts and carved capitals. In the church of St Catherine the choir is raised above a lofty vaulted crypt, similar to examples in some of the Italian churches. The *Marienkirche* at Danzig (1345–1503), built by a grand master of the Teutonic knights, to whom the chief development of the architecture of north-east Germany is largely due, is one of those examples already mentioned as *Hallenkirchen*. The nave, aisles, side chapels, transept and aisles, and choir with square east end, are all of the same height; as the church is 280 ft. long and 125 ft. wide, with a transept 200 ft. long, the effect is that of one stupendous hall, but as the light is only obtained through the windows of the side chapels, the interior, though impressive, is somewhat gloomy. The same is found in the choir of the Franciscan church at Salzburg, where five slender piers, 70 ft. in height and

4 ft. in diameter, carry the vault over an area 160 ft. long by 66 ft. wide. Right up in the north of Germany, in Pomerania, are many fine examples in brick and sometimes of great size, such as those at Stralsund, Stettin, Stargard, Pasewalk, and in the island of Rügen. The *Marienkirche* at Stralsund, owing to its massive construction and picturesque grouping, is an interesting example. Its western transept or narthex with tower in centre is a common type of the churches in Pomerania, and though very inferior in design is a version of those which in England are seen in Ely and Peterborough cathedrals.

In the entrance gateways to the towns and in domestic architecture north Germany is very rich; the palace of the grand master of the Teutonic Order at Marienburg is a vast and imposing structure in brick (1276–1335), in which the chapter house of the grand master, with its fan-vaulted roof, resting on a single pillar of granite in the centre, and the entrance porch of the church richly carved in brick, are among the finest examples executed in that material. (R. P. S.)

Romanesque and Gothic in Belgium and Holland

Of early Romanesque work neither Belgium nor Holland retains any examples; for with the exception of the small building at Nijmwegen built by Charlemagne, there are no churches prior to the 11th century, and at first the influence in Belgium would seem to have come from Lombardy, through the Rhine Provinces. As all her large churches are built in the centres of her most important towns, it is probable that the older examples were pulled down to make way for others more in accordance with the increasing wealth and population. In the 13th century they came under the influence of the great Gothic movement in France, and two or three of their cathedrals compare favourably with the French cathedrals. The finest example of earlier date is that of the cathedral of Tournai (fig. 49), the nave of which was built in the second half of the 11th century, to which a transept with north and south apses and aisles round them was added about the middle of the 12th century. These latter features are contemporaneous with similar examples at Cologne, and the idea of the plan may have been taken from them; externally, however, they differ so widely that the design may be looked upon as an original conception, though the nave arcades, triforium storey, and clerestory resemble the contemporaneous work in Normandy. The original choir was pulled down in the 14th century, and a magnificent *chevet* of the French type erected in its place. The grouping of the towers which flank the transept, with the central lantern, the apses, and lofty choir, is extremely fine (fig. 50). The sculptures on the west front, dating from the 12th to the 16th century, protected by a portico of the late 15th century, are of remarkable interest and in good preservation. They are in three tiers, the two lowest consisting of bas-reliefs, the upper tier with life-size figures in niches, resting on corbels. The Romanesque tower of the church of St Jacques in the same town, with angle turrets, is a picturesque and well-designed structure.

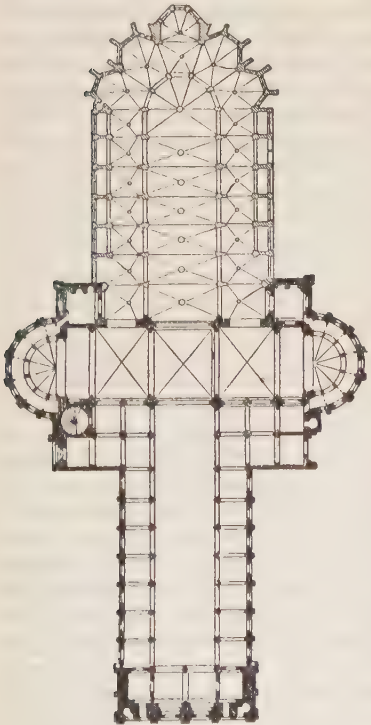


Fig. 49.—Plan of Cathedral at Tournai.

Other early examples are those of St Bartholomew at Liége (A.D. 1015) and the churches at Roermonde and St Servais at Maastricht, both belonging to Holland. The latter is an extremely fine example, which recalls the work at Cologne, and in its great western narthex follows on the lines of the German churches at Gernrode, Corvey and Brunswick.

Among other churches of later date are St Gudule at Brussels, with Gothic 13th century choir and a 14th century nave with great circular pillars, the west front of later date, approached by a lofty flight of steps, having a very fine effect; Ste Croix at Liége, with a western apse; St Martin at Ypres and St Bavon at Ghent, both with 13th-century choir and 14th-century nave; Tongres, 13th century with great circular pillars and an early Romanesque cloister; Notre Dame de Pamele at Oudenarde; and Notre Dame at Bruges, 14th century. Of 15th and 16th century work (for the Gothic style lasted without any trace of the Renaissance till the middle of the 16th century) are St Gommaire at Lierre (1425–1557); St Martin, Alost (1498); St Jacques, Antwerp; and St Martin and St Jacques, both at Liége. The largest in area, and in that sense the most important church in Belgium, is Notre Dame at Antwerp (misnamed the cathedral). It was begun in 1352, but not completed till the 16th century, so that it possesses many transitional features. It is one of the few churches with three aisles on each side of the nave, the outer aisle being nearly as wide as the nave, which is too narrow to have a fine effect. Only one of the two spires of the west front is built, perhaps to its advantage; the upper portion presents in its pierced stone spires one of those remarkable *tours-de-force* of which masons are so proud, and having a simple substructure it gains by contrast with and is much superior to the spires of Cologne, Vienna and Ulm.

Among the most remarkable features in these Belgian churches are the rood screens, the earliest of which is in the church of St Peter at Louvain, dating from 1400, in rich Flamboyant Gothic, retaining all its statues. In the church at Dixmuiden, St Gommaire at Lierre (1534), and in Notre Dame, Walcourt (1531), are other examples all in perfect preservation; the last is said to have been given by the emperor Charles V., and in the same church is a lofty tabernacle in Flamboyant Gothic.

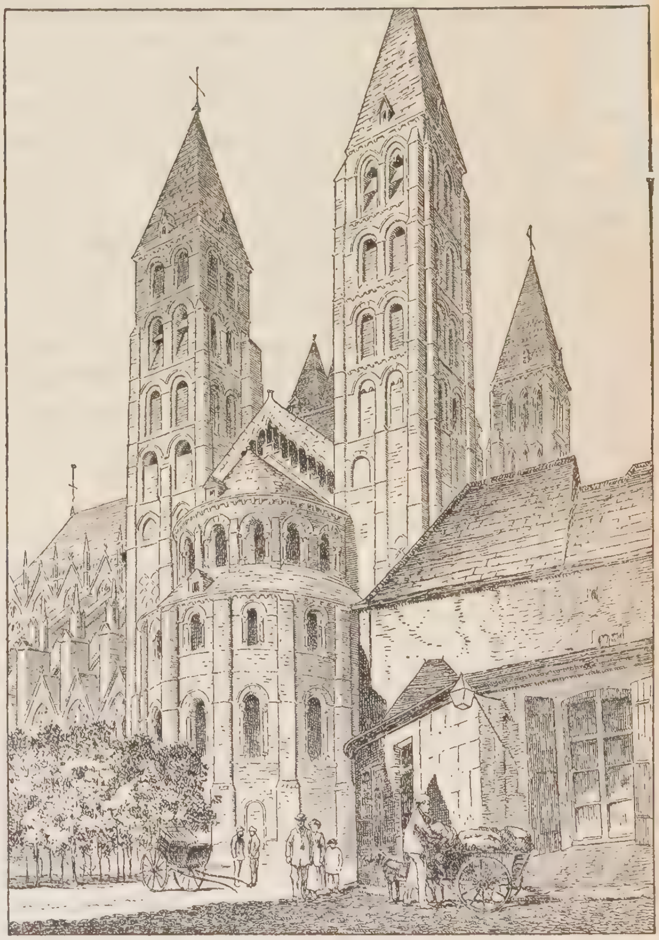


Fig. 50.—Tournai Cathedral.

Owing to the comparatively late date of many of the Belgian churches, they are all more or less unfinished, as the religious fervour of the citizens who built them would seem to have changed in favour of their town halls and civic buildings immediately connected with trade. The Cloth Hall at Ypres (1200–1334) with a frontage of 460 ft., three storeys high with a lofty central tower and a hall on the upper storey 435 ft. long, one of the finest buildings of the period in Europe; Les Halles at Bruges, originally built as a cloth hall, also with a lofty central tower; and a simple example at Malines, are the earliest buildings of this type.

There follow a series of magnificent town halls, of which that at Brussels is the largest, but the tower not being quite in the centre of its façade gives it a lopsided appearance. There is no tower to the town hall at Louvain (1448–1469), but this is compensated for by the angle turrets, and the design is far bolder. In both these examples the vertical lines are too strongly accentuated, and seeing that they are in two or three storeys, the latter should have been maintained in the design of the façades. In this respect the town hall of Oudenarde (1527–1535) is more truthful, and as a result is far superior to them; the tower also is in the centre of the principal front, which at all events is better than at Brussels, though as a matter of composition it would have been more effective and picturesque if it had been placed at one end of the façade. In the town hall at Mons there is no tower, but a fine upper storey with ten windows filled with good tracery. Of the town hall at Ghent only one half is Gothic (1480–1482), as it was not completed till a century later, and though overladen with Flamboyant ornament it has fine qualities in its design. Although but few examples still exist of the Gothic structures belonging to the various gilds, owing to their having been rebuilt in the Renaissance style, those of the Bateliers at Ghent (1531), and of the Fishmongers at Malines (1519), bear witness in the rich decoration to the wealth of these corporations.

Holland is extremely poor in church architecture, but there are two examples which should be noted, at Utrecht and Bois-le-Duc ('s Hertogenbosch). Of the former only the choir exists. It is of great height (115 ft.), and belongs to the finest period of Gothic architecture (1251–1267). The nave was destroyed by a hurricane in 1674, and so seriously damaged that it was all taken down (a wall being built to enclose the choir) and an open square left between it and the lofty west tower. The cathedral of St John at Bois-le-Duc, though founded in 1300, was rebuilt in the Flamboyant period (1419–1497). It is of great length (400 ft.) with a fine *chevet*, and possessed originally a magnificent rood screen in the early Renaissance style (1625); this seemed to the burghers to be out of keeping with the Gothic church, so it was taken down and sold to the South Kensington Museum, being replaced by a very poor example in Modern Gothic.

There is only one Gothic town hall of importance in Holland, that at Middleburg (1468), a fine example, and quite equal to those in Belgium. The ground and upper floors are kept distinct, and as the wall surface of these lower storeys is in plain masonry, the traceried windows and the canopied niches (all of which retain their statues) gain by the contrast. There is a small picturesque specimen at Gouda, and at Leeuwarden in the house of correction (Kanselary) a rich example in brick and stone, with a remarkable stepped gable in the centre having statues on its steps.

Both in Belgium and Holland there are numerous examples of domestic architecture in brick with quoins and tracery in stone, in both cases alternating with brick courses and arch voussoirs and with infinite variety of design. (R. P. S.)

The Renaissance Style: Introduction

The causes which led to the evolution of the Renaissance style in Italy in the 15th century were many and diverse. The principal impulse was that derived from the revival of classical literature. Already in the 14th century the coming movement was showing itself in the works of the painters and sculptors, especially the latter, owing to the influence of the classic sculpture which abounded throughout Italy. Thus in the tomb of St Dominic (1221) at Bologna, the pulpits of Pisa (1260) and Siena (1268), and in the fountain of Perugia (1277–1280) by Niccola Pisano and his son Giovanni, all the figures would seem to have been inspired in their character by those found in Roman sarcophagi. A classic treatment is noticeable in the doorway of the Baptistery of Florence by Andrea Pisano (1330), probably influenced by Giotto, in whose paintings are found the representation of imaginary buildings in which Gothic and Classic details are mixed up together. The time for its full development, however, did not come till the following century, when, with the papal throne again firmly established under Martin V., the amelioration of the city of Rome was commenced, and discoveries were made which awakened an archaeological interest fostered by the Medici at Florence, who not only became enthusiastic collectors of ancient works of art, but promoted the study of the antique figure. In addition to the acquisition of marbles and bronzes, ancient manuscripts of classic writers were sought for and supplied by Greek exiles who seemed to have foreseen the breaking up of the eastern empire; everything, therefore, at the beginning of the 15th century fostered the spread of the new movement. Accordingly, when a great architect like Brunelleschi, who for fifteen years had been making a special study of the ancient monuments in Rome and who possessed in addition great scientific knowledge, brought forward his proposals for the completion of the cathedral built by Arnolfo di Lapo, and showed how the existing substructure could be covered over with a dome like the Pantheon at Rome, his designs were accepted by the town council of Florence, and in 1420 he was entrusted with the work. Subsequently he carried out other works, in which pure classic architectural forms are the chief characteristics. There were, however, other causes which not only promoted the encouragement of the revival, but extended it to other countries, though at a later period; the most important of these was the invention of printing (1453), which in a sense revolutionized art, not so much in its enabling classical literature to be more extensively studied and known, as in its taking away to a certain extent from the painter and sculptor and indirectly the architect one of their principal missions, so far as ecclesiastical architecture is concerned. Henceforth these who had hitherto taught their lessons in sculpture, painting, stained glass and fresco, could, through the printed book, bring them more immediately before and directly to mankind. Victor Hugo's pithy saying, "*ceci tuera cela*; *le livre tuera l'église*," expressed not only the fall of architecture from the position it occupied as the principal teacher, but to a certain extent the change in the channel by which religious teachers and the writers of the day, the poets and philosophers, could best make their works known.

With the invention of printing came the partial cessation of fresco painting, stained glass and sculpture, which subsequently came to be regarded more as decorative adjuncts than as having educational functions. But this transfer from the Church to the Book, the extinction of the one by the other, led to another important change. Henceforth the architect or master-mason, as he was then known, could no longer count on the co-operation of the various craftsmen, men often of greater culture than himself; and the individuality of the man, which has sometimes been put forward as a gain to humanity, was a loss so far as architecture is concerned, since it was scarcely possible that the imagination and conceptions of a single individual, however brilliant they might be, could ever reach to the high level of the joint product of many minds, or that there could be the same natural expression in what had hitherto been the traditional work of centuries.

In France the introduction of the Revival resulted at first in a transitional period during which classic details gradually crept in, displacing the Gothic. In Italy this does not seem to have been the case to the same extent. It is true that in Florence and Venice, where an independent style existed, the new buildings in their general principles of design were copied from the old, but with no mixture of details as in France; in Brunelleschi's church, Santo Spirito at Florence, the capitals and details are all pure Italian, as pure as if they had been carried out in the 3rd or 4th century, the fact being that already before the 15th century the craftsman's work was approaching the new movement, and this was facilitated by the numerous remains still existing of Roman architecture. In the four or five years Brunelleschi spent in Rome, he had the opportunity of studying a far larger number of Roman buildings than are preserved at the present day, so that the purity of style in the work which he carried out in Florence was due to his previous training; the same is found in Alberti's work, and with these two great men leading the way it is not surprising that throughout the earlier Renaissance period in Italy we find a classic perfection of detail which it took half a century to develop in other countries.

It is difficult to say what might have been its ultimate development if another discovery had not been made about 1452, that of the manuscript of Vitruvius, a Roman architect who lived in the time of the emperor Augustus; his work on architecture gives an admirable description of the building materials employed in his day (*c.* 25 B.C.), and among other subjects, a series of rules regulating the employment of the various orders and their correct proportions. These rules were based on the descriptions which Vitruvius had studied of Greek temples, but as he was not acquainted with the examples quoted, never having been in Greece or even in south Italy at Paestum, his knowledge was confined to the architectural monuments then existing in Rome. Vitruvius's manuscript, entitled *De re aedificatoria*, was illustrated by drawings, none of which have however been preserved; when therefore in subsequent years translations of the architectural portion of the manuscript were printed and published by various Italian architects, among whom Vignola and Palladio were the more important, they were accompanied by woodcuts representing their interpretation of the lost illustrations, and thus copybooks of the orders were published, with more or less fidelity to those of existing Roman monuments, in which attempts were made to adhere to the rules laid down by Vitruvius. In Rome and other parts of Italy, where ancient monuments or portions of them still remained *in situ*, architects could study their details and base their designs on them, but in other countries they were bound to follow the copybook, and thus they lost that originality and freedom of design which characterizes the earlier work of the Renaissance.

On the other hand, there is no doubt that the publications of Vignola and Palladio, based as they were on the remains of ancient Rome, then much better preserved than at the present day, tended to maintain a high standard in the employment of the Classic orders, with correct proportions and details; so much so, that in referring to the influence which those works exerted from the middle of the 16th century in France and Spain, and during the 17th and 18th centuries in England and to a certain extent in Spain, Germany and the Netherlands, it is generally spoken of as the introduction of the pure Italian style. The tendency, however, of such hard and fast rules leads eventually to an excess in the opposite direction, and the works of Borromini in Italy and Churriguera in Spain in the middle of the 17th century resulted in the production of what is generally referred to as the Rococo style. This style was fostered in France by the attempts to reproduce, externally and in stone, ornamental decoration of a type which is only fitted for internal work in stucco, and in Germany and the Netherlands by reproductions of fantastic designs published in copybooks, which led to the bastard style of the Zwinger palace in Dresden and the Dutch architecture of the 18th century. Vignola's work on the five orders was published in 1563, and Palladio's in 1570; they were preceded by a publication of Serlio's in 1540, giving examples of various architectural compositions, and to him is probably due the introduction of the pure Italian style in the Louvre in 1546. They were followed by other authors, as Scamozzi in Italy, Philibert de l'Orme in France, and, at a later date, Sir William Chambers in England.

The term given to the earlier Renaissance or transition work in Italy is the Cinque-cento style, though sometimes that title is given to buildings erected in the 16th century; in France it is known as the François I. style, in Spain as the Plateresque or Silversmiths' style, and in England as the Elizabethan and Jacobean styles.

There is still another and very important difference to be noted between the styles of the middle ages and those of the Renaissance. Although the names of the designers in the former are occasionally known and have been handed down to us, they were only partially responsible, as the works were carried out by other craftsmen working on traditional lines, whereas in the latter they are of much more importance because of the independent thought and study of the individual; and though to a certain extent the development of each man's work may have been influenced by others working in the same direction, his special object was to acquire personal fame and by his own fancy or predilection to produce what he conceived to be an original work peculiar to himself. Consequently in our description the name of the architect who designed a particular building, as well as the date of its erection, are necessarily given to show the progress made in his studies or otherwise. (R. P. S.)

RENAISSANCE ARCHITECTURE IN ITALY

In the styles hitherto described a chronological order has been followed, as far as possible, in order to show the gradual development of the style; that course is adopted here to a certain extent, when dealing with the Renaissance, though the introduction of the personal element, to which reference has been made, brings in a change of some importance. Henceforth the career of the individual has to be taken into consideration, and at times it may be an advantage when describing a building by an architect of eminence to mention other works by him, and so depart from the chronological sequence.

Ecclesiastical.—The classic revival in Italy, though foreshadowed in other branches of art, as in painting and sculpture, and also to a marked degree in literature, was virtually introduced by one great man, Filippo Brunelleschi of Florence, who, trained as a sculptor, and disappointed with his want of success in the competition held in 1403 for the bronze gates of the baptistery at Florence, determined to devote himself to architecture, possibly in the hope that he might some day be able to solve the great problem of erecting over the crossing of Arnolfo di Lapo's great cathedral the dome projected by the latter but never executed. Having spent some years in Rome, Brunelleschi returned to his native town about 1410, with a profound knowledge of classic architecture and of Roman construction, as shown in the Pantheon, the thermae, Colosseum and other remains, then in much better preservation than at the present day. Some years passed in the production of various schemes and in deliberations with the council of Florence, but eventually in 1420 the completion of the cathedral was entrusted to him, and he undertook to construct the dome without centreing, and to raise it on a drum so as to give it greater importance than Arnolfo had contemplated, as shown in the fresco of the Spanish chapel of Santa Maria Novella, Florence. The dome as projected by Brunelleschi was of considerable size, being 130 ft. in diameter and 135 ft. from the cornice to the eye of the dome, including the drum on which it was raised; it was octagonal in plan, and built with an inner and outer casing partly in brick, with angle and two intermediate ribs on each face, which were in stone. The construction of the dome was completed in 1434; but the lantern, built on the basis of the model he had made, was not carried out till 1462, some years after his death. Brunelleschi's other works in Florence consisted of the church of San Lorenzo, which he rebuilt in 1425 after a fire, and the church of Santo Spirito (1433), a very remarkable building, the design of which was based on the medieval basilicas of Rome, with such modifications in plan and section as his knowledge of ancient Roman work suggested. This church consists of nave, transept and choir, with aisles all round, the centre or crossing being covered with a dome on pendentives, which henceforth became the chief characteristic in all the Renaissance churches. Brunelleschi's earliest work was the Pazzi chapel, an original conception which is more remarkable for the pure classic feeling and refinement in all its details than for the design. The weakness of the archivolt round the central archway, and the mass of panelled wall carried on columns (far too slight in their dimensions), detract seriously from the effect of the façade; internally the structural function of the pilasters is not sufficiently maintained, and instead of a simple hemispherical dome, as in the cathedral, a quasi-Gothic type was built, with twelve ribs and scalloped cells, which destroys its dignity.

Brunelleschi was followed by another great Florentine architect, Leon Battista Alberti, who was also a great mathematician and a scholar, and further promoted the study of classic architecture by writing a treatise in Latin, *Opus praestantissimum de re aedificatoria*, which was based partly on that of Vitruvius and was published in 1485, after his death, accompanied by illustrations. The first building with which he was connected was the church of San Francesco at Rimini, to which in 1440 he added the front. In this he was evidently inspired by the Roman triumphal arch in that city, and his interpretation of it, to meet the requirements in its façade which were imposed upon him by the existing nave, was admirable. Unfortunately the principal front was never completed, but on the south side he designed a series of recesses to hold the sarcophagi containing the remains of the friends of his client, Sigismondo Malatesta, the effect of which is simple and grand. Alberti's largest work, the church of Sant' Andrea at Mantua (1472), in which the nave, transept and choir are all covered with barrel vaults, recalls the vaulted corridors of the Colosseum. There are no aisles, but a series of rectangular chapels on each side, the division walls of which act as buttresses to resist the thrust of the great vault. The lofty arched openings to the chapels, separated by Corinthian pilasters with entablature supporting the coffered vault and a central dome (since rebuilt), complete the structure, which has served since as the model for all the Renaissance churches of the same type. The principal front is not satisfactory, as it takes no cognizance of the width of the nave, and the side doors have no use or meaning; here Alberti seems to have been led astray in his triumphal arch treatment, which is inferior to his scheme for the church at Rimini.

In 1462 Michelozzo, another Florentine architect, built the chapel of St Peter at the east end of the church of Sant' Eustorgio, Milan. Externally it has little attraction, but internally the dome, with its magnificent frieze of winged angels in relief with a painted background of arcades and other accessories, is the most beautiful composition of the Renaissance. Michelozzo's first work was the Dominican monastery and church of San Marco at Florence (1439–1452), but he is better known for his secular work, to which we shall return.

The next great architect chronologically is Bramante d' Urbino, to whom was entrusted the commencement of the church of St Peter at Rome. His first important work was the church of Santa Maria della Consolazione at Todi (1472), which consists of a square nave with immense semicircular apses, one on each side. The nave is covered with a dome raised on a drum, and carried on pendentives, and the apses with hemispherical vaults butt against the nave walls and form externally a very fine group. Bramante was the architect of the chapel in the cloisters of San Pietro-in-Montorio, Rome (1472), a small circular building covered with a dome and surrounded with a peristyle of columns of the Doric order; and of the dome of the church of Santa Maria delle Grazie in Milan, as also of the three apses, which are decorated with pilasters and baluster shafts with circular medallions enclosing busts, all in terra cotta. Before passing to his work at St Peter's there are some other early churches we must notice. The Certosa, near Pavia, was begun in 1396, and in one sense suggests the revival of classic architecture, in that all its arches have semicircular heads. The magnificent façade of the church was commenced in 1473 from the designs of Borgognone, a Milanese architect: it is one of the few examples in Italy of large size in which the transition is noticeable, for although there are no Gothic details the design follows that of the middle ages, and instead of great pilasters of the Corinthian order, buttresses with niches containing statues divide the façade and accentuate the internal divisions of the church; the open galleries above the entrance doorway crossing the upper storey of the central portion are all derived from well-known Lombardic features. The upper part of the façade is inferior to the lower, Borgognone's design having been departed from. The enrichment of the whole front, from the lower plinth to the string course under the first gallery, with bas-reliefs, panelled pilasters, niches, medallions and other decorative accessories, all in white marble, so completely covers the whole surface that scarcely any portion is left plain, which to a certain extent detracts from its effect as a whole; but there is an endless variety of design, and the baluster or candelabrum shafts dividing the windows and the friezes and cresting above their cornices, are of great beauty. The circular rose window above, with its enclosing frontispiece of later date, shows the coming influence of the later Italian style. The cloisters adjoining are surrounded with a light arcade, with enrichments in the spandrils and frieze, all in terra cotta.

The cathedral of Como is also a transitional example, where buttresses are employed all round the church, and it is only in the finials which surmount them, the great projecting cornice which crowns the structure, and the doorways and windows, that we find classical details; the doorways recall the porches of the Lombard churches, and are of great beauty in design, the south doorway being said to be by Bramante. Another example, remarkable for its elaborately carved front and porch, is the church of Santa Maria dei Miracoli at Brescia (1487–1490) by Ludovici Beretta, which both externally and internally is one of the richest specimens of the early Italian Renaissance. The church dedicated to Santa Maria dei Miracoli in Venice (1481–1489), by Pietro Lombardo, is another transitional example in which the Byzantine influence of St Mark's is recognizable in the semicircular pediments of its façade and of the exterior of the chancel, and Lombardic influence in its external decorations with pilaster strips and blind arcades. The interior is one of the gems of the Renaissance, on account of its splendid decoration with marble linings and fine cinque-cento carving. Similar semicircular pediments are found in the façade of the church of San Zaccharia at Venice (1515), but are purely decorative because the roof behind is not semicircular like that of the Miracoli. The decoration of the main front, here all in marble, is of an entirely different design, and is subdivided into a series of storeys, the lower panelled, the first storey with arcades and the upper ones with pilasters. An earlier example (1461) in San Bernardino at Perugia is of a far higher standard, and its enrichment with bas-reliefs by the Florentine sculptor Agostino di Duccio (*c.* 1418–*c.* 1490) gives it the first place for its conception and execution. Among others, the church of Spirito Santo, Bologna, in terra cotta; the church of Santa Giustina, Padua (1532); the sacristy of San Satiro, Milan (1479), by Bramante; and the sacristy of the church of Santo Spirito, Florence (1489–1496), by Sangallo, are all interesting examples of the early Renaissance in Italy.

In 1505, on the advice of Michelangelo, Bramante was instructed to prepare designs for a new church in Rome dedicated to St Peter, to take the place of the early basilica, which, built in haste, began to show serious signs of failure. Already, fifty years earlier, Pope Nicholas V. had commenced a new building, the erection of which was stopped by his death in 1454. The scheme was revived by Julius II., and the foundation stone of the new structure was laid in 1506. On Bramante's death in 1514, Raphael, Peruzzi and Sangallo were successively appointed, and the last named prepared a new design, which, however, was not carried out, as he found it necessary first to strengthen the piers of the dome provided by Bramante and to remedy the defects of his successors. In 1546 Michelangelo, then seventy-two years of age, was entrusted with the continuance of the work, and he made radical changes, chiefly in the design of the dome. Comparison of the plans of Bramante and Sangallo with that actually carried out by Michelangelo shows that he not only increased the size of the piers to carry his dome, but the outer walls of the north, south and west apses, and omitted the aisles which surrounded the latter (fig. 51). He would seem to have availed himself of the foundation walls already built and of Bramante's piers to carry the dome, which had been raised up to the cornice, but otherwise the architectural features of the whole building externally and internally were carried out from Michelangelo's own designs. Sangallo had suggested for the exterior a series of superimposed orders with three storeys; Michelangelo elected to have one order only with an attic storey. The building gained thereby in dignity, but it lost in scale, for the huge pilasters of the Corinthian order (87 ft. high) look considerably smaller, in spite of the two storeys of windows between them. These windows also, which from their design are apparently about 10 to 12 ft. high, actually measure 20 ft. in height. The same defect exists in the interior, where the Corinthian order, over 100 ft. in height to the top of the cornice (Plate III., fig. 69), calls for a similar increase in the dimensions of all the sculptured decorations; the figures in the spandrils being 20 ft. high, and the cherubs supporting the holy water spouts 10 ft. Otherwise the scheme realizes the conception which Bramante proposed from the first, viz. to raise the dome of the Pantheon on the top of the basilica of Constantine; the latter being represented by the magnificent barrel vault (75 ft. in span) of the nave, transepts and choir; the former by the great hemispherical dome, 140 ft. in diameter, which, including the drum, is 162 ft. from the top of the cornice above the pendentives to the soffit of the dome. The dome is built in two shells with connecting ribs on the same principle as Brunelleschi's dome in Florence, and was nearly completed before Michelangelo's death in 1563, and the lantern in 1590 from the model which he had made. In 1605 the east end of the old basilica was taken down, and three more bays were added, thus converting the Greek cross of Michelangelo's design into the Latin cross originally conceived by Bramante. The nave and the eastern vestibule were completed in 1620, and the great semicircular portico was added by Bernini in 1667. The immense height of the east façade, and its prolongation in front of Michelangelo's chief feature, the dome, hides the design of a great portion of the latter, so that it can only be seen either from a great distance

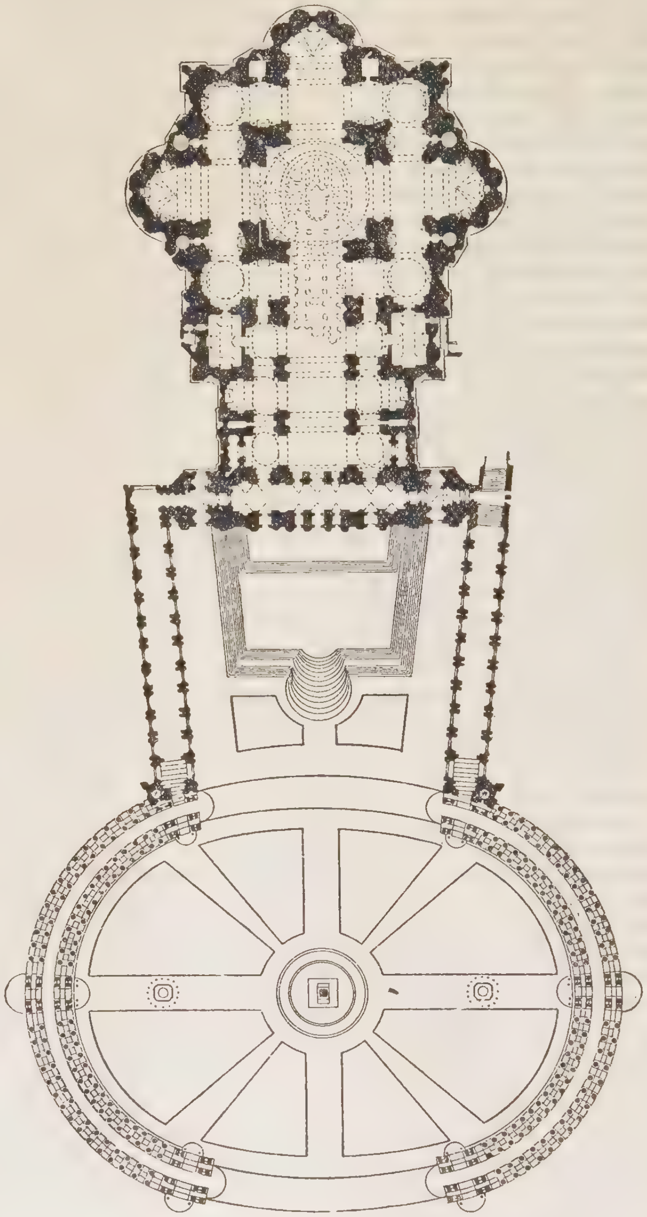


FIG. 51.—Plan of St Peter's at Rome.

(Plate III., fig. 68), or from behind the western apse, where the relative grouping with the great apses can be properly appreciated. A second well-known work by Michelangelo is the new sacristy of the church of San Lorenzo, Florence (1523–1529), designed to contain the monuments of Giuliano and Lorenzo de' Medici, the architectural design of which is poor.

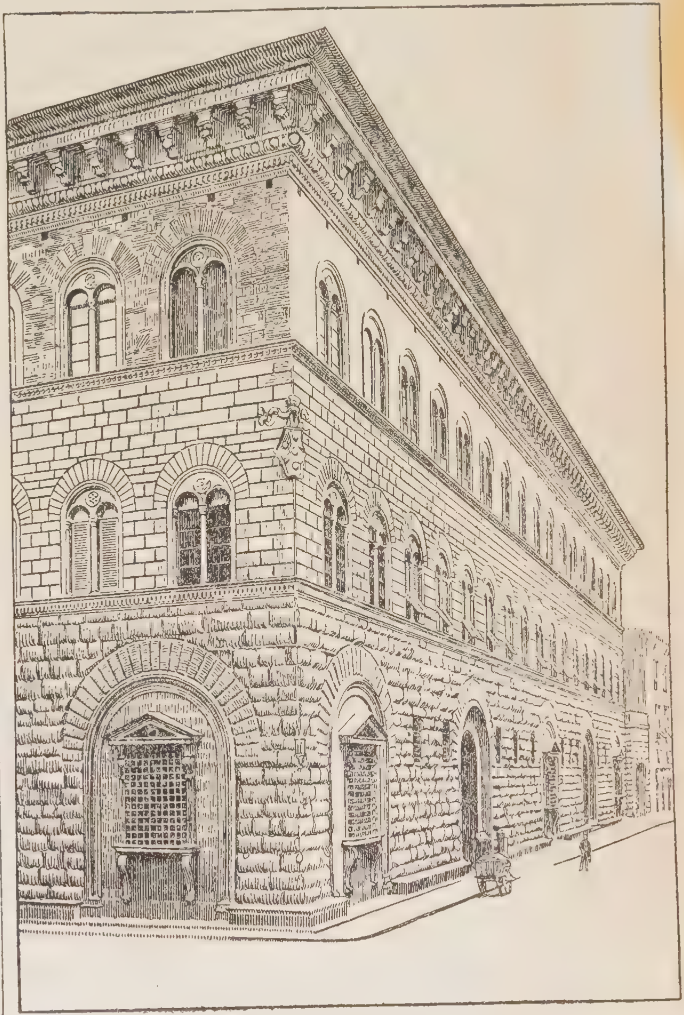
Antonio di Sangallo was the architect of the church of San Biagio at Montepulciano (1518), with a cruciform plan, and dome in the centre, and a campanile at the south-west angle somewhat similar to those of Wren in London.

The church of Santa Maria-di-Carignano (1552) at Genoa, by Galeazzo Alessi, is finely situated but unsatisfactory in its design, the lower part being stunted in its proportions and its order to a different scale from that in the campanile towers and the dome. The most beautiful interior is that of the Annunziata in the same town, by Giacomo della Porta (1587); the arches of its nave arcade are carried on Corinthian columns of marble, of fine proportion, and the nave is covered with a barrel vault with penetrations admitting the light from clerestory windows. The churches of San Giorgio Maggiore (1556–1579), San Francesco della Vigna (1562), and Il Redentore (1577), all in Venice, were designed by Palladio, the interior of the latter being the finest; the façade of the first named is the best-proportioned, but whether its design is due to Palladio, or to Scamozzi, who built it in 1610, is not known. A far finer church in its picturesque grouping and the originality of its design is that of Santa Maria della Salute on the Grand Canal (1631), by Baldassare Longhena; the church is octagonal on plan, with aisles round, giving access to six recesses with altars and to an important eastern chapel with central dome. The central octagon is covered with a lofty dome with immense corbel buttresses of vigorous and fine design. The entrance portal of the west front is perhaps the best example of the period in Italy. Longhena also designed the Santa Maria degli Scalzi (1680), completed by Sardi in 1689, the latter being responsible for the heavy front of San Salvatore (1663), as also of the rich but somewhat debased church, in the Jesuit style, Santa Maria Zobenigo (1680–1683).

Secular Architecture.—In the application of the leading features of classical architectural design to palaces and mansions, the Italians had a much easier field on which to exercise their originality, as the requirements were very different from those which obtained in the middle ages. Moreover, the classic style lent itself more readily to the horizontal lines given by string courses, cornices and ranges of windows, which naturally exist in dwelling-houses on account of the various storeys. As in ecclesiastical, so in secular architecture, the first introduction of the Revival takes place in Florence, which was then the principal art centre of Italy, and the earliest examples are in a sense transitional, in that they are based on the earlier medieval work. As in the Palazzo Vecchio (1298) in Florence, and the Ricciarelli palace at Volterra (*c.* 1320), the rusticated masonry which gives them so fine a character forms the chief characteristic of the Riccardi and Strozzi palaces, the only changes being the substitution of a classic cornice of considerable projection in the place of the machicolations of the Palazzo Vecchio, and the employment of circular arches in the windows in the place of the pointed and curved arches.

The earliest example, the Riccardi palace (1430), by Michelozzo (fig. 52), built for Cosimo de' Medici, is certainly the finest, owing partly to its size but more especially to the magnificent bossed and rusticated masonry of the ground storey and the bold projecting cornice, which crowns so admirably the whole structure. The lower two storeys of the main front of the Pitti palace were built by Brunelleschi in 1435, the return wings and court not being carried out till after 1550 from the designs of Ammanati; compared with the other Tuscan palaces the cornice is extremely poor and the whole front too monotonous. The beautiful court of the Palazzo Vecchio was reconstructed and decorated by Michelozzo in 1434. The Strozzi palace (1489), by Benedetto da Maiano and S. Pollajuolo, (Cronaca), comes next to the Riccardi as regards general design, but in comparison with it the windows are too small, and the want of a much bolder rustication, as provided in the latter, is much felt. Other examples of the same type are the Gondi (1481) and the Antinori palaces, by G. di Sangallo, and the Casa Larderel, all in Florence; the Spanochi (1470) and the Piccolomini (1460) palaces in Siena, and the Piccolomini palace (1490) in Pienza. In the Guadagni palace at Florence, by S. Pollajuolo, there is a third storey, consisting of an open gallery, which gives the depth of shadow otherwise afforded by the projecting cornice. In the Ruccellai palace (1460), by Alberti, the design is spoilt by the introduction of the classic pilasters at regular intervals on each storey, which suggest no structural object and have too little projection to give any effect of light and shade, so that it is only on account of the purity of their details that they are worth notice. The Pandolphini palace, the design of which is attributed to Raphael, carried out after his death by Sangallo, is a simple and unpretentious building of fine proportions: the Pall Mall façade of Sir Charles Barry's Travellers' Club in London is a reproduction of this palace. The Bartolini palace (1520), by Baccio d' Agnolo, is said to have been the first astylar example in which the Classic orders were employed only to decorate the entrance door and windows, but this had already been done in 1488 in the Scuola di San Marco in Venice.

Throughout the greater part of the 15th century, the Venetian Gothic style still held its own in the palaces of Venice, so that it is only towards the close of the century we find the first actual results of the Classic Revival. The earlier palaces may be looked upon as transitional work, in which Gothic principles rule the design while the details are borrowed from classic sources. The intimate acquaintance with the proportions of the Classic orders and their ornamental detail shows that the designers of the earliest Renaissance palaces must have acquired their knowledge outside Venice. Among these designers we find the names of members of the Lombardi family (which, as the name suggests, come from Lombardy), who for three or four generations, either as architects or sculptors, would seem to have been the chief founders of the Renaissance style in Venice. One of these, Pietro Lombardo, has already been referred to as the designer of the church of the Miracoli, and to him is due the Vendramini-Calerghi palace on the Grand Canal (Plate IV., fig. 71), built in 1481, which in some respects is the finest example in Venice. It should be observed that all these palaces on the Grand Canal have an architectural frontage only, the flanks being built in plain masonry or brick stuccoed over, and with very poor, if any, dressings to the windows. This is well exemplified in the Vendramini palace, where there are gardens on each side, showing the total want of correlation between the rich architectural front and the poverty of the flanks.



From a photo by Alinari.

FIG. 52.—Riccardi Palace, Florence.

In a still earlier example, the Dario palace, one of the flanks borders on a side canal, so that its brick construction, partly covered with stucco, contrasts strangely with the rich marbles encrusting the main front. In the Dario palace the transition from Gothic to Renaissance is more clearly seen, as the only changes made are the substitution of circular window-heads for the Ogee Venetian arch, the projecting cornice with modillions, and more or less pure classic details. In the Vendramini palace the employment of the orders, to break up or subdivide the wall surface, has become a recognized treatment, based on the theatre of Marcellus and the Colosseum at Rome. On the ground storey there are panelled pilasters only, but on the first and second storeys three-quarter detached columns of the Corinthian order are employed, and the entablature is doubled in height with a bold projecting cornice, so as to crown properly the whole building.

The semicircular-headed windows of the palace are filled with moulded tracery carried on columns in the centre of each, which must be looked upon as the classic version of the arcade of the Ducal palace. This feature is found in other early Renaissance work in Venice, as in the Scuola de San Rocco (1517), and the Cornaro Spinelli palace (1480). In the latter, probably also by Pietro Lombardo, there are pilasters only on the groins of the main front, and the window-heads are enclosed in square-headed frames. In the Scuola de San Marco (1488), by Lombardo, we find another type of window, single and lofty, with pilaster strips each side carrying an entablature with pediment. The same window decoration is found on the south and west fronts of the court of the Ducal palace and the external south front, and also in the Camerlenghi palace (1525), by Bergamasco and in other examples of early 16th-century work. In the Scuola de San Rocco the columnar decoration assumes much greater importance, and, in imitation of the triumphal arches of Septimus Severus and Constantine in Rome, the column is completely detached, with a wall-respond behind. Among other examples to be noted are the Cornaro-della-Grande palace (1532), by Sansovino, which is very inferior to his other work in Venice; the Grimani palace (1554), by San Michele (who also designed the fortifications of the Lido); the Zecca or mint (1537), the small loggetta (1540) at the foot of the campanile of St Mark's and now destroyed, and the Procuratie Nuove (completed by Scamozzi in 1584), all by Sansovino; the Balbi palace (1582), by Vittoria; and the Ponte Rialto (1588), by Antonio da Ponte. Sansovino's greatest work in Venice was the library of St Mark's, which was commenced in 1531; in this he has shown not only remarkable powers of design but great boldness in the projection of his columns, cornices and other architectural features. The upper frieze has been increased in height, so as to admit of the introduction of small windows to light an upper storey, and this gives much greater importance and dignity to the entablature crowning the whole structure. Two of the most imposing palaces on the Grand Canal, but of later date, are the Pesaro (1679) and the Rezzonico (1680), both by Longhena, the architect of the Salute church. The former is too much overcharged with ornament, but it has one advantage, the classic superimposed orders of the main front being repeated on the flank overlooking the side canal, with pilasters substituted for the detached columns of the main front. The Rezzonico palace is much quieter in design, and finer in its proportions, but even there the cherubs in the spandrils are too pronounced in their relief.

In Rome there are no important examples of the 15th century, with the exception of the so-called "Venetian palace," which still retains externally the features of the feudal castle, such as machicolations, small windows and rusticated masonry. This was owing probably to the comparative poverty of the city, which had to recover from the disasters of the 14th century. The earliest example of the Renaissance is that of the Cancellaria palace (1495–1505), by Bramante, the architect of the church at Todi; this was followed by a second and less important example, the Giraud or Torlonia palace (1506). The former is an immense block, 300 ft. long and 76 ft. high, in three storeys, with coursed masonry and slightly bevelled joints, the upper two storeys decorated with Corinthian pilasters of slight projection and crowned with a poor cornice, so that its general effect is very monotonous, and the design is only relieved by the purity of its details, such as those of the window and balcony on the return flank. In 1506 Bramante was instructed to carry out the court of the Vatican, of which the great hemicycle at one end, designed in imitation of similar features in the Roman thermae, is an extremely fine example; to what extent he was responsible for the court of the Loggie, decorated by Raphael, is not known. The Villa Farnesina (1506), best known for its fresco decorations by Raphael and his pupils; the Ossoli palace (1525); and the Massimi palace (1532–1536), with magnificent interiors, were all built by Baldassare Peruzzi. The finest example in Rome is the Farnese palace, commenced in 1530 from the designs of Antonio di Sangallo; the design is astylar, as the employment of the orders is confined to the window dressings, the angles of the front having rusticated quoins; the upper storey, with the magnificent cornice which crowns the whole building, was designed by Michelangelo, and in the upper storey he introduced a feature borrowed from the Roman thermae, brackets supporting the three-quarter detached columns flanking the windows. The brilliance of the design is not confined to the exterior, and the entrance vestibule and the great central court are the finest examples in Rome. Here the upper storey added by Michelangelo is inferior to the two lower storeys by Sangallo.

The museum in the Capitol at Rome, by Michelangelo (1546), is one of those examples in which the principles of design are violated by the suppression of the horizontal divisions of the storeys which it should have been an object to emphasize. By carrying immense Corinthian pilasters through the ground and first storeys, Michelangelo, it is true, obtained the entablature of the order as the chief crowning feature, and so far the result is a success, but in other hands it led to the decadence of the style. Among other examples in Rome which should be mentioned are the Villa Madama by Giulio Romano (1524); the Nicolini palace (1526) by Giacomo Sansovino; the Villa Medici (1540) by Annibale Lippi; the Chigi palace (1562) by G. de la Porta; the Spada palace (1564) by Mazzoni; the Quirinal palace (1574) by Fontana (the architect who raised the obelisk in the Piazza di San Pietro); and the Borghese palace (1590) by Martino Lunghi.

We now return to about the middle of the 16th century, to the period when the great architects Barozzi da Vignola and Andrea Palladio of Vicenza commenced their career, and by their works and publications exercised a great and important influence on European architecture.

The villa of Pope Julius (1550), and the Costa palace, Rome, are good examples of Vignola's style, always very pure and of good proportions, but his principal work was that of the Caprarola palace (1555–1559), about 30 m. from Rome, which he built for the cardinal Alessandro Farnese. The plan is pentagonal with a central circular court, and it is raised on a lofty terrace; the palace is in two storeys with rusticated quoins to the angle wings, and the Doric and Ionic orders, superimposed, separating arcades on the lower storeys and windows on the upper. The arcade of the central court is of admirable proportions and detail, second only to that of the Farnese palace.

Palladio in his earlier career measured and drew many of the remains of ancient Rome, and more particularly the thermae (the drawings of which are in the Burlington-Devonshire Collection), but he does not seem to have carried out any buildings there. His most important work, and the one which established his reputation, is that known as the basilica at Vicenza (1545–1549), which he enclosed with an arcaded loggia in two storeys of fine design and proportion, and extremely vigorous in its details. He built a large number of palaces in his native town, among which the Tiene (1550) and the Colleone Porto are the simplest and best, the latter being the model on which the front of Old Burlington House (London) was rebuilt in 1716. In the Valmarana, the Consiglio and the Casa del Diavolo he departed from his principles, in carrying the Corinthian pilasters through two floors, and by returning the cornice round the order he destroyed its value as a crowning feature. Among other works of his are the Chiericate (1560), Trissino (1582) and Barbarano (1570) palaces; the Olympic theatre (1580), which was completed after his death; and the Rotonda Capra near Vicenza, reproduced by Lord Burlington at Chiswick.

Though he laid down no rules for the guidance of others, the works of San Michele are superior to those of Palladio, with the exception, perhaps, of the basilica at Vicenza and the library at Venice. In the Bevilacqua palace (1527), at Verona, there is far greater variety of design than in Palladio's work, and the Pompei palace (1530) and the two gateways at Verona (1533 and 1552) are all bold and simple designs. In the same town is an extremely beautiful example of the early Renaissance, the Loggia del Consiglio (1476) by Fra Giocondo; a similar example with open gallery on the ground storey exists at Padua, where there is also the Giustiniani palace (1524) by Falconetto, an interesting example of a master not much known. The town hall of Brescia (1492) was built from the designs of Tommaso Formentone, who employed for the carving of the medallions on the lower storey, and the pilasters with their capitals and the friezes, various artists of high merit, so that the building takes its rank as one of the finest in north Italy, but independently of their collaboration the design of the first floor is in design and execution equal to Greek work. The upper storey and its circular windows are said to have been added by Palladio, and they are so commonplace and out of scale that by contrast they increase the artistic value of Formentone's work.

The so-called Palazzo de' Diamanti at Ferrara, built in 1493 for Sigismondo d' Este, is decorated externally with a peculiar kind of rustication, in which the square face of the stones is bevelled towards the centre in imitation of diamond facets: the quoins of the palace have panelled pilasters richly carved, and similar pilasters flank the entrance door; the windows, with simple architrave mouldings and cornices on ground storey and pediments on the first storey, constitute the only architectural features of a novel treatment.

At Bologna there are two or three palaces of interest,—the Bevilacqua by Nardi (1484), chiefly remarkable for its central court surrounded with arcades, there being two arches on the upper storey to one on the lower, which presents a pleasant contrast and gives scale to the latter; the Fava palace (1484), in which on one side of the court are elaborately carved corbels carrying arches supporting an upper wall; and the Albergati palace (1521), by Peruzzi, in which the architectural decoration is confined to the entrance doorway windows flanked with pilasters and cornices in pediments and the entablatures of the ground and upper storeys, all the features being in stone on a background of simple brick construction. The Casa Tacconi is similarly treated. Many of the streets in Bologna have arcades on which the upper part of the house is built, and there is an endless variety in the capitals of these arcades.

If the palaces of Genoa are disappointing as regards their external design, this is in some measure compensated for by the magnificence of their entrance vestibules, which (with the staircases and the arcades in the courts beyond) are built in white marble, and have probably suggested the title of the "marble palaces of Genoa." Many of these palaces are situated in narrow streets, so that no general view can be obtained of them, which may account for their exterior being erected in inferior materials with stucco facing. The ground storey of the palaces is almost always raised about 6 to 8 ft. above the street level, so that the first flight of steps leading up to the court forms a prominent feature in every palace; the ceilings of the entrance vestibule are also mostly decorated with arabesque work in stucco, or with painted devices, &c. The palaces in the town are lofty, and as a rule crowned with fine cornices, and there are no examples of pilasters being carried through the floors; the palaces and villas in the vicinity of Genoa are of less height, and owe much of their magnificence to the terraces on which they are erected. They have no special qualities except in slight variations of the external wall surface decoration, consisting of the applied orders on the several storeys. Among the best examples are the Palazzo Cataldi, formerly Palazzo Carega (1560), in which there are no pilasters, but rusticated quoins at the angles and windows with moulded dressings and pediments. The entrance vestibules of the Durazzo-Pallavicini, Rosso (1558) and Balbi (1610) palaces are in each case their finest features. The Pallavicini palace, and the Pallavicini, Spinola, Giustiniani and Durazzo villas, are all fairly well designed and in good proportions, but with no original treatment. Two of the palaces are flanked by open loggias with arcades, from which fine views are obtained, giving them a special character; that of the Durazzo palace being on the first floor, and of the Doria Tursi on the ground storey. The University (1623) and the Ducal palaces have very magnificent entrance vestibules, the former with lions on the lower ramp of the staircase.

Many of the finest palaces at Genoa are by Galeazzo Alessi, but in none of them has he approached the design of the Marino or municipal palace at Milan, in which he produced a remarkable work; the internal courtyard surrounded with arcades carried on coupled columns is an original combination which is not excelled in any other court in Italy, and the exterior façades are very fine.

The internal courtyard of the hospital at Milan (243 ft. by 220 ft.), with an arcade in two storeys, was designed by Bramante and begun in 1457; only one side was completed by him, but in 1621, in consequence of a large benefaction, the remainder was completed by Ricchini according to the original design; the proportions of the arcade are extremely pleasing, and it forms now one of the chief monuments of the town. Ricchini was the architect of the Litta palace, one of the largest in Milan.

There still remains to be mentioned one of the early examples of the Renaissance, the triumphal arch which was erected in 1470 at Naples to commemorate the entry of Alphonso of Aragon into the town. It is built against the walls of the old castle in four storeys, and connected with bas-reliefs and statues. The largest palace in Italy, that of the Caserta at Naples, with a frontage of 766 ft., built in 1752 by Vanvitelli, is one of the most monotonous designs, rivalled in that respect only by the Escurial in Spain. (R. P. S.)

RENAISSANCE ARCHITECTURE IN FRANCE

The classical revival of the 15th century in Italy was too important a movement to have remained long without its influence extending to other countries. In France this was accelerated by the campaigns of Charles VIII., Louis XII. and Francis I., which led to the revelation of the artistic treasures in Italy; the result being the importation of great numbers of Italian craftsmen, who would seem to have been employed in the carving of decorative architectural accessories, such as the panels and capitals of pilasters, niches and canopies, corbels, friezes, &c., either in tombs, as for instance in those of Charles of Anjou at Le Mans (1472) and at Solesmes (1498), of Francis, duke of Brittany (1501), and of the children of Charles VIII. (1506) at Tours, and of Cardinal d'Amboise in Rouen cathedral, the figures in all these cases being carved by French sculptors. They were also employed in architectural buildings, where the design and execution were by French master-masons, and the Italians were called in to carve the details, as in the choir screens of Chartres, Albi and Limoges cathedrals, the portal of St. Michel at Dijon, the eastern chapels of St Pierre at Caen, and numerous other churches throughout France; or for mansions like the Hôtel d'Alluye at Blois, the Hôtel d'Allemand at Bourges, and the châteaux of Meillant (1503), Châteaudun and Nantouillet (1519). The great centre of the artistic regeneration was at first at Tours, so that in Touraine, and generally on the borders of the Loire and the Cher at Amboise, Blois, Gaillon, Chenonceaux, Azay-le-Rideau and Chambord, are found the principal examples; later, Francis I. transferred the court to Paris, and the château of Madrid, and the palaces of Fontainebleau, St Germain-en-Laye, and the Louvre, follow the change. In all these châteaux the Italian craftsman would seem to have been under the direction of the master-mason or architect, because the whole scheme of the design and its execution is French, and only the decoration Italian. In cases where the Italian was not called in, the Gothic flamboyant style flourishes in full vigour with no suggestion of foreign influence, as in the palais de justice at Rouen, the church of Brou (Ain), 1505–1532, the Hôtel de Cluny, Paris, and the rood-screen of the church of the Madeleine at Troyes (1531).

Between the last phase of Flamboyant Gothic and the introduction of the pure Italian Revival there existed a transitional period, known generally as the "Francis I. style," which may be subdivided under three heads:—the Valois period, comprising the reigns of Charles VIII. and Louis XII. (1483–1515); the Francis I. period (1515–1547); and the Henry II. and Catherine de' Medici period (1547–1589). The first two are characterized by the lofty roofs, dormers and chimneys, by circular or square towers at the angles of the main building with decorative machicolations and hourds, by buttresses set anglewise, which run up into the cornice, and square-headed windows with mullions and transoms. In the second period the machicolations are converted into corbels carrying semicircular arcaded niches in which shells are carved; the buttresses become pilasters with Renaissance capitals; and the Gothic detail, which in the first period is mixed up with the Renaissance, disappears altogether. In the third period Italian design begins to exert its influence in the regular interspacing of the pilasters or columns with due proportion of height to diameter, in the completion of the order with the regular entablature, and its employment generally in a more structural manner than in the earlier work.

The two first periods are well represented in the château of Blois, where, in the east wing built by Louis XII., square-headed windows alternate with three central arches, the buttresses are set anglewise running into the cornice, and pillars and angle shafts are carved with chevrons, spiral flutings, or cinque-cento arabesque; the cornices of the towers containing staircases project and are carried on arched niches supported on corbels (the new interpretation of the machicolations of the feudal castle); above the cornice is a balustrade with pierced flamboyant tracery, and the dormer windows retain their Gothic detail. In the north wing of Francis I. all these Gothic ornamental details disappear, and are replaced by the Renaissance. Panels and pilasters take the place of the buttresses—the panels sometimes enriched with cinque-cento arabesque; shells are carved in the arched niches of the cornice, and modillions and dentil courses are introduced; the balustrade is pierced with flowing Renaissance foliage interspersed with the salamanders and coronets; the same high roofs are maintained, but the dormer windows and chimneys, still Gothic in design, are entirely clothed with Renaissance detail.

The finest feature of the façade of this north wing, facing the court, is the magnificent polygonal staircase tower in its centre (Plate VIII., fig. 84); four great piers rise from ground to cornice, between which the rising balustrade is fitted; the whole feature Gothic in design, but Renaissance in all its details. The splendid carving of the panels of the piers and the niches with their canopies was probably done by Italian artists. The figures in these niches are said to be by Jean Goujon. The great dormers and chimneys have not the refinement in their design which characterizes the lower portion, and may be of later date. The north front of the château is raised on the foundation walls of the old castle, part of which is encased in it, and this may account for the slight irregularities in the widths of the bays. The design differs from that of the south front, the windows all being recessed behind three-centre arched openings; the open loggia at the top, which is admirable in effect, is a subsequent alteration.

Before passing to the Louvre and Tuileries, representing the third period, we must refer to some other important early châteaux and buildings. Some of these, such as the châteaux of Madrid and Gaillon, are known chiefly from du Cerceau's work, as they were destroyed at the Revolution. Of the latter building, the entrance gateway is still *in situ*; there are some portions in the court of the École des Beaux-Arts at Paris, consisting of a second entrance gateway, a portico and some large panels. The gateway shows a singular mixture of Gothic and Renaissance; the centre portion, with the gateway and great niche over, is debased classic, the side portions retaining the buttresses, mouldings, panels and other features belonging to the latest phase of Flamboyant Gothic.

Of buildings still existing, the hôtel de ville of Orleans (1497) is a good example of early transition work, in which Gothic and Renaissance work is intermingled, and it is interesting to compare it with the hôtel de ville at Beaugency, built by the same architect, Viart, some twenty-five years later. There is the same principle in design, much improved in the later example, but all the Gothic details have disappeared.

In the château of Chenonceaux (1515–1524) we find a compromise between the two styles; Gothic corbels, piers and three-centre arches are employed, varied with debased classic mouldings, shells and capitals; here, as at Azay-le-Rideau (1520), the château was not transformed like those at Langeais and Rochefoucauld, where what was externally a 14th-century castle developed internally into a 16th-century mansion; both Chenonceaux and Azay-le-Rideau were built as residences, and yet in both are displayed those features which belong to the fortified castle; at the angles of the main structure in both cases are circular towers, in the latter case crowned with machicolations and hourds, which, however, are purely decorative, pierced with windows, and broken at intervals with dormer windows, a feature which gives it the aspect of an attic storey. The lofty roofs and conical terminations to these angle towers, with dormer and chimney, give the same picturesque aspect to the grouping as that which was afforded in the fortified castle, where, however, they originated in the necessity for defence. The entrance portals of both châteaux are beautiful features, absolutely Gothic in design, and only transformed by cinque-cento detail.

In the château of Chambord (1526) we find the same defensive features introduced, in the shape of great circular towers at the angles, but here with more reason, as the château was intended more for display than habitation. The château itself, about 200 ft. square, has circular towers at the angles, and in the centre a spiral staircase with double flight, leading to great halls on each side, which give access to the comparatively small rooms in the angles of the square and the towers beyond, and to the roof, which would seem to have been the chief attraction, as there is a fine view therefrom; and the elaborate octagonal lantern over the staircase, the dormer windows, chimneys and lanterns on the conical roofs of the towers, are all elaborately carved. There are three storeys to the building, subdivided horizontally by string courses, and terminated with a fine cornice carrying a balustrade, and vertically by a series of pilasters of the Corinthian order. The varied outline of this building, with the alternation of blank panels and windows between the pilasters, relieves what might otherwise have been its monotony. The château is situated on the east side of a great court measuring about 500 ft. by 370 ft., with a moat all round. To the right and left of the central block the walls are carved up three storeys, and an attic, with open arcades inside, leading to the angle towers of the enclosure. At a later period Louis XIV. continued the unfinished structure by a one-storey building round. The carving of the capitals, corbels and other decorative work was all done by Italian artists, under the direction of some architect whose name is not known.

One of the gems of Francis I.'s work is the small hunting lodge originally built at Moret near Fontainebleau, to which at one time the king thought of adding, before he began his great palace there. This was taken down in 1826, and re-erected in the Cours-la-Reine at Paris. Though small, it is the purest example of the first Renaissance. Other examples are the hôtel de ville of Paray-le-Monial (1526); the Hôtel d'Anjou at Angers (1530), built by Pierre de Pincé; the Hôtel Bernuy at Toulouse (1530); the Hôtel d'Ecoville at Caen (1532); the Manoir of Francis I. at Orleans; the Hotel Bourgthéroulde at Rouen (1520–1532) and other buildings opposite Rouen cathedral, and what remains of the château known as the Manoir d'Ango (1525) at Varengeville, near Dieppe. The château of St Germain-en-Laye (1539–1544), the upper half of which is built in brick, belongs also to the early period, as also the hôtel de ville at Paris, built in 1533 by Domenico da Cortona, an Italian, who after spending some thirty years in France would seem to have caught the spirit of the French Renaissance so well as to be able to produce one of the most remarkable examples of the Francis I. style. In the existing building the original design has been copied from the building burnt down by the Communists in 1871.

From this we pass to the palace at Fontainebleau, begun by Francis I. in 1526, to which there have been so many subsequent additions and alterations that it is difficult to differentiate between them. The building owes its picturesque effect more to its irregular plan (as portions of an earlier structure were enclosed in it) than to any brilliant conceptions on the part of its architect. There is an endless variety of charming detail in the capitals, corbels and other decorative features, but the employment of pilaster strips purely as decorative features (without any such structural property as that in the Porte Dorée at the Cour Ovale) suggests that the Italian architect Serlio, to whom sometimes the work is ascribed, certainly had nothing to do with it.

On the other hand, there is every reason to believe that the designs made by Pierre Lescot for the Louvre, begun in 1546, were, as regards their style, largely based on the principles set forth in Serlio's work on architecture, published in 1540. The south-west angle of the court of the Louvre is the earliest example of the third period of the Renaissance, in which the orders are employed in correct proportions with columns or pedestals carrying entablatures with mouldings based on classic precedent. The portion built from Lescot's designs (Plate VIII., fig. 83) consists of the nine bays on the east and north sides, the latter not being completed till 1574, as the workmen would seem to have been transferred to the building of the Tuileries, begun in 1564.

The Corinthian order is employed for the ground and first storeys and an attic storey above, in which the pilaster capitals run into the bedmold of the upper cornice. Of the nine bays, the central and side bays are twice the width of the others, and project slightly with the cornices breaking round them; this feature, and the crowning of the western bays with a segmental pediment, give a variety to the design, which otherwise might have become monotonous by its repetition of similar features. The balustrade also is replaced by the *chêneau*, a cresting in stone, which hereafter is found in nearly all French buildings. The sculptor, Jean Goujon, would seem to have worked in complete harmony with the architect, thus producing what will always be considered as one of the *chef-d'œuvres* of French architecture.

The architect employed by Catherine de' Medici for the Tuileries was Philibert de l'Orme, who combined the taste of the architect with the scientific knowledge of the engineer. Only a portion of his design was carried out, and of that much disappeared in the 17th century, when his dormer windows were taken down and replaced by a second storey and an attic. Bullant and du Cerceau also added buildings on each side.

The Tuileries were built about 500 yds. from the Louvre, and Catherine de' Medici conceived the idea of connecting the two. The work, which began with the "Petite Galerie," with the south wing, as far as the Pavillon Lesdiguieres, was started in 1566, being of one storey only. The mezzanine and upper storey were not completed till the beginning of the 17th century. In 1603 the remainder of the south front and the Pavillon-de-Flore were completed by Jacques Androuet du Cerceau.

Of Philibert de l'Orme's work at Anet (1549), only the entrance gateway, the left-hand side of court, and the chapel remain, sufficient, however, to show that he had already at that early date mastered the principles of the Italian Revivalists. The chapel is in its way a remarkable design, but the hemispherical dome, pierced by elliptical winding arches inside, is not happy in its effect. The frontispiece which he created opposite the entrance, now in the court of the École des Beaux-Arts in Paris, shows great refinement in its details, but proportionally errs in many points. De l'Orme built also the bridge and gallery on the river Cher, forming an addition to the château of Chenonceaux.

Amongst other work of this period are the additions made by Bullant to the château de Chantilly, where he traversed the principles of classic design by running Corinthian pilasters through two storeys and cutting through the cornice of his dormer windows. At Écouen (1550) he destroyed the scale of the earlier buildings of 1532 by raising in front of the left wing of the court four lofty Corinthian columns with entablature complete, which he copied from the temple of Castor in Rome.

Among the early Renaissance work are the château of Ancy le Franc (Yonne), Italian in character, which may be by Serlio (1546); the Hôtel d'Assézat at Toulouse (1555), in which there is a strong resemblance to the court of the Louvre; the houses at Orleans, known as those of Agnes Sorel, Jeanne d'Arc and Diane de Poitiers (1552); and there is other work at Caen, Rouen, Toulouse, Dijon, Chinon, Périgueux, Cahors, Rodez, Beauvais and Amiens, dating up to the close of the 16th century. In this list might also be included the fine town hall of La Rochelle, the Hôtel Lamoignon in the rue des Francs-Bourgeois, Paris (1580), and the Hôtel de Vogüé at Dijon, which retained the Renaissance character, though built in the first year of the 17th century.

In the reigns of Henry IV. and Louis XIII. the first work of importance in Paris is that of the Place Royale, now the Place des Vosges; in this brick was largely employed, and the conjunction of brick and stone gave a decorative effect which dispensed with the necessity of employing the Classic orders. At Fontainebleau, where Henry IV. made large additions, the same mixture of brick and stone is found in the Galerie des Cerfs, and in the great service court (*cour des cuisines*). The example set was followed largely through the country, and numerous mansions and private houses in brick and stone still exist. Henry IV.'s most important work at Fontainebleau is the Porte Dauphine, of which the lower part, with rusticated columns and courses of masonry, does not quite accord in scale or character with the superstructure, in which is put some of the best work of the century.

Except perhaps for the monotony of the rusticated masonry which is spread all over the building, the palace of the Luxembourg, by Salomon de Brosse (1615), is an important work, in which he was probably instructed by Marie de' Medici to reproduce the general effect of the Pitti palace at Florence. The three storeys of the main block are well proportioned, but the absence of a boldly projecting cornice, such as is found in the Riccardi and Strozzi palaces, is a defect; the same architect reconstructed the great hall of the palace of justice at Paris, burnt in 1871 but now rebuilt to the same design.

In 1629 the building subsequently known as the Palais Royal was begun from the designs of Lemercier; but it has been so materially altered since that scarcely anything remains of his design, though the works carried out from his designs at the Louvre were of the greatest possible importance. The court of the latter, as begun by Pierre Lescot, was of small dimensions, corresponding with that of the palace of Philip Augustus, but Lemercier proposed to quadruple its dimensions. It is not certain whether he built the lower portion of the Pavillon d'Horloge, but he designed the upper part, with the caryatid figures sculptured by Jacques Sarrazin. On the north side of this pavilion he built a wing similar in length and design to that of Pierre Lescot, and continued the wing along the north side to the centre pavilion; this was continued by Levau, the architect of Louis XIV., round the other sides of the court. His design for the east front, however, did not recommend itself to the king or to his minister Colbert, and a competition was held, the first place being given to the design by a physician, Dr Perrault. Prior to its being begun, however, Bernini was sent for, and he submitted other designs, fortunately not carried out, as they would have destroyed the court of the Louvre. In 1665 the works were begun on the design of Perrault, a grandiose frontispiece which appealed to Louis XIV., but in which no cognizance had been taken of the various rooms against which it was built; consequently no windows could be opened, and it forms now a useless peristyle. Moreover it was so much wider than the original building that on the north side it became necessary to add a new front. Fortunately the example set by Perrault of coupling columns together has rarely been followed since in France, so that in the Garde-Meuble on the south side of the Place de la Concorde, by Gabriel, we return again to the original classic peristyle. The works undertaken at the Louvre progressed but slowly, in consequence of the greater interest taken by Louis XIV. in the palace he was building at Versailles, an extension of the hunting-box built by his father Louis XIII., which he insisted should be maintained and incorporated as the central feature in the new building. But as it was comparatively small in dimensions, of simple design, and in brick and stone, it was quite unfit to become the central feature of the main front of the largest palace in Europe. To make it worse, the new wings built on either side were lofty and of more importance architecturally, and as they projected some 300 ft. in advance of the earlier building, they reduced it to still greater insignificance. But even then the architect, Jules Hardouin Mansart, might have redeemed his reputation by buildings of greater interest than those which now exist. The back elevation of the central block is 330 ft. wide, the returns 280 ft., and the length of the wings on each side 500 ft.; in other words he had nearly 1900 ft. run of façade, and it is simply a repetition of the same bays from one end to the other, in three storeys all of the same height, the lower one with semicircular arched openings, the first floor decorated with pilasters on columns of the Ionic order, and an attic storey above with balustrade. The slight projection given to the central and side bays of each block, just sufficient to allow of columns in the first floor as decorative features instead of pilasters, is of no value in fronts of such great dimensions. The great galleries inside have the same monotonous design as in the façades, relieved only by the rich decoration in the first case and the splendid masonry in the latter. There is one saving clause in the main front, the chapel by R. de Cotte on the right-hand side being externally and internally a fine structure, and the best ecclesiastical example of the period.

Among other buildings of the 17th century are those begun by Cardinal Mazarin in the rue de Richelieu, which now constitute the National library; the Hôtel de Toulouse (1626), now the Bank of France; the Hôtel de Sully (1630), by du Cerceau; the Hôtel de Beauvais (1654), by le Pautre; the Hôtel Lambert (also by le Pautre), in the Île St Louis; the château at Maisons, near St Germain-en-Laye, by François Mansart (1656); the Institute of France (1662), by Levau; two triumphal arches, of St Denis (1672), by Blondel, and St Martin (1674) by Bullet; the Hôtel des Invalides (1670), by Bruant; the Place des Victoires and the Place Vendôme (1695–1699), by Jules Hardouin Mansart, in which a series of large houses are grouped together in one design; the Trianon at Versailles (1676), and the château of Marly (1682), both by J. H. Mansart; and important monumental buildings in the principal provincial cities, such as Lyons, Bordeaux, Nantes and Tours.

In the 18th century those which are worthy of note are the Hôtel Soubise (1706), now the "Archives Nationales"; the fountain in the rue de Grenelle, a fine composition; the École Militaire (1752), by Gabriel; the École de Médecine (1769), by Gondouin; the mint (1772), by Antoine; the Place de la Concorde, with the Garde-Meuble, by Gabriel (1765); the Hôtel de Salm, now the Legion of Honour; the Place Stanislas at Nancy (1738–1766), in which are grouped the town hall, archbishop's palace, theatre and other public buildings, with triumphal arch and avenues leading to the palace of the duke Stanislaus (with magnificent wrought-iron enclosures and gates by Jean Lamour, the greatest craftsman of the century); the theatre at Bordeaux by Louis; and the Odéon, Paris (1789).

The ecclesiastical architecture of the French Renaissance comes at the end of our description owing to the far greater importance of the palaces, mansions and public monuments, and also because in the beginning of the 16th century France found herself in possession of a much larger number of cathedrals and large churches than she could maintain. Some of these are still unfinished, so that her first efforts would seem to have been directed to the completion of those already begun rather than to the erection of new ones, St Eustache in Paris being nearly the only exception of importance prior to the 17th century.

We have from time to time dwelt upon the important consideration which must not be lost sight of, viz. that nearly all the buildings erected in France up to the accession of Henry IV. were conceived and carried out in the spirit of the Flamboyant Gothic style, cinque-cento details mixed up with Gothic at first, then superseding them, and even when the influence of the Italian revivalists began to exert itself, still retaining much of her traditional methods of design. If this was the case in civil architecture, it was naturally more pronounced in the additions made to ecclesiastical structures, and the gradual development of the style may be more easily followed in the latter. These are, however, so numerous, and they are so universally spread throughout France, that only a few of the most interesting examples can be here given; for instance, the porch of St Michel at Dijon; the upper part of the western towers of the cathedrals of Orleans and Tours; the three eastern chapels of St Jacques, Dieppe, built at the cost of Jean Ango, a celebrated merchant-prince of Dieppe, to whose château at Varengeville we have already referred; the eastern chapels of St Peter's, Caen, from the designs of Hector Sohier (1521), both internally and externally of great interest; the west end of the church at Vétheuil (Seine-et-Oise); the magnificent work of the west front and tower of the church at Gisors; the upper part of the west front of the cathedral at Angers; the portals of the church at Auxonne (Fichot); the choir at Tillières; the lantern of the church of St Peter, Coutances (1541); the porch of the Dalbade at Toulouse; and the north front of the church of Ste Clotilde at Les Andelys, which dates from the age of Henry II.

The church of St Eustache at Paris, begun in 1533, but not completed till the end of the century, is a large cruciform Gothic structure with lofty double aisles on each side and carried round the choir, and rectangular chapels round the whole building, excepting the west end. Structurally also it possesses all the most characteristic features of the Gothic church, with nave arcades carried on compound piers, triforium and clerestory, vaulted throughout, and flying buttresses outside. Close examination shows that all the details are of the early cinque-cento work, panelled pilasters of varying proportions, but with Renaissance capitals, corbels, niches and canopies all grouped together in a Gothic manner, and quite opposed to the principles of the Italian revivalists; what is more remarkable is that though long before its completion these principles had already borne fruit in the Louvre and Tuileries, the original conception was adhered to, and the portals of the north and south transepts (the last features added, with the exception of the ugly west front of the 18th century) still retain the character of the early French Renaissance.

In St Étienne-du-Mont, sometimes claimed as a second example, the church is Flamboyant Gothic throughout, the chief additions being the magnificent rood-screen of 1600, and the west portal, in which the banded columns of the Bourbon period form the chief features.

Coming to churches of later date, Salomon de Brosse (*c.* 1565–1627), the architect of the Luxembourg palace, added in 1616 a fresh front to the church of St Gervais, finely proportioned and of pure Italian design, which contrasts favourably with the Jesuits' church of St Paul and St Louis (1627–1641), overladen with rococo ornament; then came the churches of the Sorbonne (1629), by Jacques Lemercier, and of the Val-de-Grace (1645), by François Mansart, the dome of the latter, though small, being a fine design; the church of the Invalides, also by Mansart, the dome of which is the most graceful in France; the cathedral of Nancy (1703–1742), by Jules Hardouin Mansart and Germain Boffrand (1667–1754), the principal front of which is flanked by two towers with octagonal lanterns which group so well with the central portion (of the usual design, in two stages with pilasters and coupled columns, carrying a third stage with circular pediment) that it is unfortunate it should be almost the only example of its kind; and lastly the church of Ste Geneviève, better known as the Panthéon (1755), by Jacques Germain Soufflot (1713–1780), the dome of which is based largely on that of St Peter's in Rome. The main building with its great portico is a simple and fine piece of design, and unlike St Peter's the dome is well seen from every point of view; the decoration of its walls with paintings by Puvis de Chavannes and other French artists has now rendered the interior one of the most interesting in France. (R. P. S.)

Renaissance Architecture in Spain

In Spain, as in France, the revival of classic architecture was engrafted on the Flamboyant style of the country, influenced here and there by Moorish work, so that the earlier examples of Spanish Renaissance constitute a transitional style which lasted till the accession of Philip II. (1558), who introduced what was then considered to be the purer Italian style of Palladio and Vignola. This, however, did not seem to have had much attraction for the Spaniards, owing to its coldness and formality, so that in the latter half of the 17th century a reaction took place in favour of the most depraved and decadent architecture in existence.

The magnificence of the earlier Renaissance work, which was introduced into Spain when she was at the zenith of her power, and (owing to the discovery of a new world) the possessor of enormous wealth, has scarcely yet been recognized, in consequence of the greater attraction of the Moorish architecture; there is no doubt that its exuberant richness in the 16th century derives its inspiration from the latter, and especially so in patios or courts found in every class of building, ecclesiastical as well as civil. There is still, however, another characteristic in the early Renaissance of Spain, which is not found in Italy or France, and which again owes its source to Moorish work, where the external walls and towers consist of simple plain masonry, and the rich decoration, generally in stucco brilliantly coloured and gilded, is confined to the courts and to the interiors of their magnificent halls. The Italian method of decorating the external front of the palaces with flat pilasters of the various orders placed at regular intervals, the windows and doors forming features of second-rate importance, was not followed by the architects of the Spanish Renaissance, who retained the simple plain masonry and reserved their decorations for the entrance doorways and windows, emphasizing therefore these features, and by contrast increasing their value and interest.

Instead also of the huge *cornicione* which the Italians employed to give the shadows required to emphasize the crowning features of their palaces, the Spanish architects preferred to obtain a similar effect by an open arcaded upper storey, which, as Fergusson remarks, " forms one of the most pleasing architectural features that can be applied to palatial architecture, giving lightness combined with shadow exactly where wanted for effect and where they can be applied without any apparent interference with solidity." These galleries would seem to have been provided to serve as promenades to the occupants of the palace, and more especially for the ladies when it would have been unwise or imprudent for them to venture into the streets. There is one well-known example in France, in the château of Blois, which is so attractive a feature that it is singular it has not been more often adopted.

Instead also of the monotonous balustrade, which is invariably found in Italy, the Spanish architects introduced richly carved crestings, with finials at regular intervals, a feature probably borrowed from Flamboyant Gothic and Moorish.

The three periods into which the architectural phases of the Renaissance style in Spain are divided are:—(1) The Plateresque or Silversmiths' work, from the conquest of Granada to the reign of Philip II. (2) The purer Italian style, called by the Spanish the Greco-Roman, though it has no Greek elements in its design, being based on the work of Palladio and Vignola. This style prevailed until the end of the 17th century. (3) The Rococo or Churrigueresque style, so called from the name of the architect, José Churriguera (d. 1725), the chief leader of the movement, which lasted for about 100 years.

Ecclesiastical Architecture.—The cathedral of Granada, built from the designs of Diego de Siloé, is the earliest example of the Renaissance in Spain, and in some respects the most remarkable, not only for its plan, in which there is an entirely new feature, but for the scheme adopted in the vaulting, which covers the whole church, and shows that its architect had studied the earlier Gothic churches, and was well acquainted with the principles of thrust and counter-thrust developed in them. The cathedral is 400 ft. long by 230 ft. wide, and therefore of the first class as far as size is concerned. The western portion consists of nave and double aisles on each side, the outer aisle being carried round the whole church and giving access to the chapels which enclose the building. The principal feature of the cathedral is at the east end, where the place of the ordinary apse is occupied by a great circular area, 70 ft. in diameter, crowned by a lofty dome, in the centre of which in a flood of light stands the high altar. The vista from the nave through the great arch (37 ft. 6 in. wide and 97 ft. high) is extremely fine, and it is strange that it should be the only example of its kind. The west front was completed at a later date; the only feature of it belonging to the original church being the north-west tower, which, in its design, resembles the south-west tower of the church at Gisors in France. There are two other important Renaissance cathedrals at Jaen and Valladolid. The latter was built from a design of Juan de Badajoz in 1585 but never completed. On the south side of the cathedral is the chapel in which the Catholic kings lie buried, where there are two fine marble tombs enclosed by the *reja* or wrought-iron screen partly gilt, forged in 1522 by Maestre Bartholomé. The *sagrario* or parish church, also on the south side, is a small version of the scheme of design employed in the cathedral.

In Spain, as in France, magnificent portals have been added to cathedrals and churches, and these are amongst the finest works of the Renaissance period. The more remarkable of these are the portals of the cathedral of Malaga, a deeply recessed porch, enriched with slender shafts and niches between; of Santa Engracia at Saragossa; and of Santo Domingo and the cathedral at Salamanca. Externally the Renaissance domes over the crossings of Spanish cathedrals are poor, but this is compensated for by the lofty steeples which form striking features. The western towers of the cathedral at Valladolid; the tower of the Seo in Saragossa, which bears some resemblance to Wren's steeples in the setting back of the several storeys and the crowning with octagonal lanterns; the tower of the cathedral Del Pilar at Saragossa, and that at Santiago, are all interesting examples of the Spanish Renaissance.

One of the most beautiful features of the Spanish Renaissance is found in the magnificent *rejas* or wrought-iron grilles, richly gilt, which form the enclosures of the chapels. Besides the example at Granada, others are found at Seville, where is the masterpiece of Sancho Muñoz (1528); at Palencia (1582); Cuenca (1557), where there are three fine examples; Toledo; Salamanca; and other cathedrals. The iron pulpit at Avila, the eagle lectern at Cuenca and the staircase railing at Burgos are all remarkable works in metal.

Secular Architecture.—With the exception of the magnificent portals, the finest works of the Renaissance in Spain as in France are to be found in the secular buildings, but with this difference, that the best examples in France are those built in the country or in comparatively small provincial towns, whereas in Spain they are all in the midst of the larger towns, and further they are not confined to palaces and châteaux; monasteries and universities coming in for an equal share in the great architectural development.

The characteristic style of the Spanish architecture of the Renaissance period is due probably to the influence of the earlier Moorish work, where the value of the rich Alhambresque decorations in the entrance doorways and windows, and the patios or courts, is enhanced by contrast with the plain masonry of their walls and towers. This influence had already been felt in the Spanish flamboyant Gothic panelling and tracery; when translated into Renaissance, and probably, at first, executed by Italian artists, it displayed a variety and beauty in its design scarcely inferior to some of the best work in Italy. And this development, taking place at a time when Spain was overflowing with wealth, resulted in that exuberant richness we find in the entrance doorways and windows, the external galleries of the upper storey, and the rich cresting surmounting the cornice.

Comparison with the contemporary and even earlier work in Italy, where the principal thought of the architect would seem to have been to break the wall surface by an unmeaning series of flat pilasters, and then fill in the windows as features of secondary importance, will show that the Spanish architect recognized more fully the true principle of design, and although, in the profiles of their mouldings, and the execution of the sculpture decorating their pilasters and friezes, Spanish work in contrast with Italian looks somewhat coarse, in general picturesqueness it is far in advance of the palaces of Rome, Florence, and even Venice, and has not yet received the recognition which it deserves.

The earliest palace built in the Renaissance style is that which adjoins the Alhambra at Granada, and was begun by the emperor Charles V. for his own residence in 1527, but never completed. The building is nearly an exact square of 205 ft., with a great circular court in the centre, nearly 100 ft. in diameter. This central court was enclosed by a colonnade with Doric columns, and an upper storey with columns of the Ionic order. From the unfinished condition of the palace and the absence of roofs, it is difficult to decide what the form of the latter might have been. But the design, begun by Pedro Machuca and continued by Alonso Berruguete (1480–1561), is so remarkable that it ought to be better known. Its proximity to the Alhambra, however, deprives it of the attention which otherwise it deserves for the purity of its details and for its good proportion.

A second palace, the Alcazar at Toledo, was begun in 1540 by Charles II., but little else than the bare walls remain, as it was destroyed by fire in 1886, after having been twice rebuilt. In its design it belongs to the true Spanish type of the Renaissance, with the simple ashlar masonry of its walls and the accentuation of the principal entrance doorway and the windows. In this palace also the plan is square, about 110 ft., with a square courtyard (240 ft.).

The third palace built, the Escorial, some 20 m. to the north-east of Madrid, is the most renowned—more, however, on account of its immense size than for its design. It was built for Philip II. and begun in 1563 from the designs of Juan Bautista de Toledo, being completed by his pupil, Juan de Herrera, in 1584. The principal front is 680 ft. in width, the depth of the palace 540 ft., with the king's residence in the rear. The plan is a fine conception, and consists of a large entrance court in the centre, with the church in the rear, having on the right the Colegio and on the left the monastery, with numerous courts in each case. The church is 320 ft. long by 220 ft. wide, the principal portion being the intersection of the nave and transept, which is covered by a dome. The coro is placed above the entrance vestibule, which is 100 ft. long and 27 ft. high, imperfectly lighted, but by contrast emphasizing the dimensions and the splendour of the church beyond. Externally the grouping is fine; the lofty towers at the angles, the central composition of the main front, and at the rear of the court the front of the church with its corner towers and the great dome, all form an exceedingly picturesque group, and it is only when one begins to examine the work in detail that its poverty in design reveals itself. Instead of accentuating the windows of the principal storeys and giving them appropriate dressings, the fronts are pierced with innumerable windows, which give the appearance of a factory, and the angle towers, nine storeys high, look like ordinary "sky-scrapers," without any of the dignity and importance which the architectural design of a palace requires. The same applies to the great entrance courts five storeys high with an attic, all of the most commonplace design. Internally the church is fine, but it is dwarfed by the immense size of the Doric pilasters, 62 ft. high, all in plain stone masonry, the coldness of which is emphasized by the rich colouring of the vaulted ceilings and the elaboration of the pavement, all in coloured marbles. The palace is regarded by the Spaniards as the Versailles of Spain, and if it had been possible to have interchanged some of the features, to transfer to Versailles some of the towers, and to break up the wall surface of the Escorial with the superimposed order of pilasters, which became monotonous by their repetition at Versailles, both palaces would have gained.

The palace at Madrid is the last of the series, and although it was begun at a much later period, by Philip V. in 1737, from the designs of the Italian architect Sachetti, it is a fine and simple composition, consisting of a lofty ground storey with coursed masonry, carrying semi-detached columns of the Ionic order, rising through three storeys, the whole crowned by an entablature and a bold balustrade. The slightly projecting wings at each end of the main front and the central frontispiece give that variety and play of light and shade of which one regrets the absence in the Cancellaria palace at Rome.

We must, however, retrace our steps to the beginning of the 16th century, to take up the early buildings of the style; the palace of the Conde de Monterey at Salamanca, built in 1530 from the designs of Alonso de Covarrubias, is a fine example. The masonry of the ground and first floors is of the simplest character, the decoration being confined to the entrance doorways and to the windows of the important rooms. It is on the second floor that the design becomes enriched with an open arcade and entablature above, crowned with a rich cresting. In the wings at the angles, and in the central block, the buildings are carried up an additional storey, the plain masonry of which gives value to the open galleries between. On these wings and the central block are other galleries crowned with entablature and cresting. These features therefore form towers, which break the sky-line. There is still another treatment peculiar to the Spanish Renaissance, in which the example of the Moorish palaces would seem to have been followed, viz. the elaborate carving of the pilasters and their capitals, of the panelling and the horizontal friezes, which is extremely minute and finished in the lower storeys, but increases in scale and projection towards the upper storeys. This is very notable in the entrance gateway of the university of Salamanca (Plate V., fig. 73), where the carved arabesque in the panelling above the doors is of the finest description, equal to what might be found in cabinet work, whilst that of the upper portion immediately under the cornice is at least twice the scale of that below and is in bold relief.

The principal buildings characteristic of the Spanish Renaissance, in chronological order, are:—the hospital of Santa Cruz at Toledo, built in 1504–1514, and the Hospicio de los Reyes at Santiago (1504), both from the designs of Enrique de Egas, the former with a magnificent portal rising through two storeys and a gallery with an open arcade above; the Irish college at Salamanca, built (1521) from the designs of Pedro de Ibarra, Alonso de Covarrubias, and Berruguete; the convent of San Marcos, Leon, by Juan de Badajoz (1514–1545)—here, however, the whole façade is panelled out in imitation of late Gothic work, Renaissance pilasters and devices taking the place of the buttresses set angle-wise and flamboyant panelling; the Colegio de San Ildefonso at Alcalá de Henares (formerly the seat of the university), built in 1557–1584 by Rodrigo Gil de Ontañon.

Of municipal buildings the Lonja or exchange at Toledo (1551), built in brick-work, is somewhat Florentine in style.

The town hall of Seville (1527–1532), by Diego de Riaño and Martin Garuza, may be taken as the most gorgeous example in Spain (Plate V., fig. 74). The front facing the square is very simple, compared with the façade in the street at the rear, and here again we find, in the ornamental carving of the windows and door mouldings on the ground floor, a different scale from that adopted on the first floor, where the shafts are enriched with a superabundance of carved ornament in strong relief. There is still one other feature of great importance in Spain, the magnificent galleries of the patios or courts found in all the important buildings. It is from these galleries that access is obtained to the rooms on the first floor. They have sometimes arcades on the first floor, and columns with bracket-capitals on the upper storey. There is an infinite variety of design in these capitals, the brackets on each side of which lessen the bearing of the architrave.

The earliest Renaissance example of these patios (1525) is in the Irish college at Salamanca; it was carved by Berruguete, Alonso de Covarrubias being the architect. In the same town is the Casa de la Salinas, another example with fine sculpture. In the Casa Polentina (1550) at Avila, and the Casa de Miranda at Burgos, columns with bracket-capitals are employed on both storeys. Rich examples are found in the Casa de la Infanta and Casa Zaporta (1580), both at Saragossa. Of late examples the patio of the Lonja at Seville by Juan de Herrera resembles in its style the courtyard of the Farnese palace at Rome; and the same style obtains in the court of the Escorial, built at a time when the purer Italian style was introduced into Spain. These courts, though cold in design, compared with the earlier Renaissance type, are of fine proportion. Two other examples are found in the bishop's palace at Alcalá de Henares, one of which has a magnificent staircase. (R. P. S.)

Renaissance Architecture in England

In England, as in France, the influence of the Classic Revival was first seen in connexion with tombs and church work, though not nearly to the same extent as in France, where throughout the country the work of the Italian sculptor is to be found not only in churches but in country mansions. On the other hand, two if not three of the Italian artists who came over to England were men of some reputation, such as Pietro Torrigiano, a Florentine sculptor who was invited over by Henry VIII. and entrusted with the tomb of Henry VII. in Westminster Abbey (1512–1518), and executed the tomb of John Young (in terra-cotta) in the Rolls chapel (1516). Another Italian was Giovanni da Maiano, who was also a Florentine, who modelled the busts of the emperors in the terra-cotta medallions over the entrance gates at Hampton Court, and probably the panel flanked by Corinthian pilasters, in which are modelled the arms of Cardinal Wolsey, also in terra-cotta. Benedetto da Rovezzano (1478–*c.* 1552), and Toto del Nunziata, Italian artists of note, were also employed in England, the first on the tomb of Cardinal Wolsey (now destroyed), and the second on the palace of Nonsuch, built by Henry VIII., which was pulled down in 1670. Other early Renaissance work is found at Christchurch Priory, in the Salisbury Chantry (1529), the design of which is Gothic and some of the details Italian, and in the tombs of the countess of Richmond in Westminster Abbey (1519), of the earl of Arundel in Arundel church, Sussex, of Henry, Lord Marney, at Layer Marney (1525), of the duke of Richmond (1537) and the duchess of Norfolk (1572) in Framlingham church; and of Queen Anne of Cleves (1557) in Westminster Abbey, attributed to Haveus of Cleves. The sedilia (in terra-cotta) of Wymondham church, Norfolk, the choir screen at St Cross, and Bishop Gardiner's chantry, Winchester, and the vaulted roof of Bishop West's chapel at Ely, all show the direct influence of the Italian cinque-cento style. The most beautiful example in England of Italian woodwork is the organ screen in King's College chapel, Cambridge (1534–1539), which, except for the coats of arms, the roses, portcullis and other English emblems, might be in some Italian church, so perfect is its design and execution. Of early domestic work, Sutton Place (1523–1525), near Guildford, Surrey, is a good example of transition work. The design is Tudor, but the window mullions and panels inserted throughout the structure, which is built in brick, are all enriched with cinque-cento details in terra-cotta, and probably executed by Italian craftsmen. Similar enrichments in the same material are found decorating the entrance tower (1522–1525) at Layer Marney, Essex.

Nearly all the examples above mentioned come within the first half of the 16th century. Passing into the second half and dealing with domestic architecture, we find the history of the introduction of classic work into England more complicated than in other countries, because in addition to the Italian, we have French, Flemish and German influences to reckon with, and it is sometimes difficult to decide from which source the features are borrowed. There were, however, two still more important considerations to be taken into account—firstly, the extremely conservative character of the English people, who were satisfied with the traditional work of the country, and the methods by which it was carried out, and secondly, the great progress in design which was made during the Elizabethan period, resulting in a phase which was peculiarly English and did not lend itself easily to classic embellishment.

Already in the last phase of Gothic work, to which the title of Tudor is generally given, important changes were being made in the planning of the larger country mansions, and features were introduced which seemed to give an impetus towards their further development.

The most important of these features were the following:—the bow window, rectangular or polygonal, of which the earliest examples date from the reign of Edward IV. (1461–1483), such as Eltham Palace in Kent, Cowdray Castle in Sussex, and Thornbury Castle in Gloucestershire, and at a later period at Hampton Court; octagonal towers or turrets flanking the entrance gateway at each end of the main front; the projecting forward of the side wings so as to get better light to the rooms in them by having windows on both sides, such projections varying the otherwise monotonous effect of a uniform façade without breaks; the long gallery (generally on an upper floor), which was an important characteristic of the Elizabethan house; and last but not least, the adherence to the type of old Tudor window, with its moulded mullions and transoms but with square head.

One of the first modifications was the introduction of semicircular bow windows, as in Kirby Hall, Northamptonshire, followed by a second example at Burton Agnes in Yorkshire (1602–1610), and a third at Lilford Hall in Northamptonshire (1635). They were carried up through three storeys at Kirby Hall, the upper storey in the roof; three storeys at Burton Agnes with balcony and balustrade; and two storeys at Lilford Hall—these features being extremely simple but fine in effect, and the windows with moulded mullions and transoms lending themselves naturally to the curve.

The projecting bays and bow windows seemed to have such an attraction for the builders of these country mansions that at Burton Agnes (with a rectangular plan of 120 ft. by 80 ft.) there are no fewer than thirteen of them, which break up the wall surface and give a picturesque group externally, whilst internally they add to the fine effect of the rooms. At Barlborough Hall, Derbyshire, with a frontage of 80 ft., there is a central rectangular bay forming the entrance porch and carried up above the roof, and two large octagonal bow windows which rise as towers with an extra storey. In all these mansions the only influence which the Revival seems to have exerted was in the introduction of an entablature, which sometimes takes the place of the Gothic string course, balustrades which crown the building, but with no projecting cornice, and gables with curved outlines and Renaissance panels or scrolls. The fact is that, with prominent features so widely differing from those which were represented on the perspective drawings attached to the earlier publications of the five orders, such as those of Serlio (1537) and Vredeman de Vries of Antwerp (1577), the only course left open to the master-mason was to decorate the principal entrance with columns and pilasters of the Classic orders, sometimes superposed one upon the other.

To the further development of this singular introduction of the Classic orders we shall return; for the moment it will be better to follow a chronological sequence and take up the principal examples of the country mansion, some of which were from the first intended to be Classic buildings. Of the house built at Gorhambury in Hertfordshire (1563) for Sir Nicholas Bacon, the father of Lord Bacon, too little remains to render its design intelligible, except that it still retains in its lofty window the Tudor pointed arch; but in Longleat in Wiltshire, built by Sir John Thynne (1567–1580), we have a typical example, the design of which departs from the English type, though it would seem to have been carried out according to the traditional custom of entrusting the whole work to a master-mason, and furnishing him with sketch designs of some kind suggesting the required arrangements of the plan, the principal features of the exterior elevation and the internal disposition. This custom was adhered to far into the 18th century at Oxford and Cambridge, where the alterations and additions to some of the colleges, such as the chapel of Clare College, Cambridge (1763), were carried out by master-masons or builders who were supplied with sketch designs and sometimes even the materials for the buildings they had to carry out, notwithstanding the existence of properly trained architects, who from the first half of the 17th century were usually entrusted with the preparation of the necessary designs for new structures of any considerable importance.

The name of the designer of Longleat is not known; the master-mason was Robert Smithson, who in 1580 went to Wollaton in Nottinghamshire and constructed the mansion there. Longleat is so Italian in style that it must have been conceived by some one who had been in Italy, because it departs from the usual English type. The plan is rectangular, with a frontage of 220 ft. by 180 ft. deep, an entrance porch in the centre, with two projecting bays on each side carried up through the three storeys, and three similar bays on the flanks. The whole block is crowned with a parapet, the centre portion of which is pierced with a balustrade, but the main cornice bears no resemblance to the Italian feature, being only that of the entablature of the upper order. The projecting bays are decorated with pilasters of the Doric, Ionic and Corinthian orders, each with its proper entablature. These classic features would seem to have been copied from a work by John Shute, painter and architect, who had been sent to Italy by the duke of Northumberland in 1551, and in 1563 brought out his *Chief Groundes of Architecture*, the first practical work published in English on architecture. Shute died in the same year, but two other editions appeared in 1579 and 1584, which shows that it must have had an extensive circulation and probably exercised the greatest influence on English architecture. A second book on the orders, already referred to as published in 1577 by Jan Vredeman de Vries of Antwerp, was not of the same type, for instead of confining his work, like Shute and Serlio, to a simple representation of the Classic orders, he introduced, on the shafts of his columns and on the pedestals, designs of the most debased rococo type, with additional plates suggesting their application to various buildings. Robert Smithson, or his client Sir Fr. Willoughby, apparently obtained a copy of this book, and the result is seen (Plate VI., fig. 76) in the mansion built at Wollaton (1580–1588), in which we find the first examples of elaborately decorated pedestals; crestings on the angle towers, the design of which is known as strap-work; and medallions with busts in them, enclosed with twisted curves similar to those which flowers and leaves take when thrown into the fire. The plan and the scheme of the design of Wollaton is, however, so far superior to the usual type, that it may fairly be ascribed to John Thorpe, an architect or surveyor, of whose drawings there is a large collection in the Soane Museum, representing many of the more important mansions of the Elizabethan era; some of his own design, others either plans measured from existing buildings upon which he was called in to report or copies from other sources, and some reproduced from published works such as Vredeman de Vries's pattern book and Androuet du Cerceau's *Des plus excellents bastiments de France* (1576).

To John Thorpe is also attributed the design of Kirby Hall (1570–1572) in Northamptonshire, in which the plan of the feudal castle with great central court is still retained. This court is symmetrically designed, and was evidently considered to be the principal feature, the decoration being far richer than that of the exterior of the building.

Amongst other important mansions are Moreton Old Hall (1550–1559, partly rebuilt in 1602; see HOUSE, Plate III., fig. 11) in Cheshire, a fine house in half-timber; Knole House, Kent (1570), possibly also designed by John Thorpe; Charlecote Hall (1572) near Stratford-on-Avon; Burleigh House, Northamptonshire (1575), the most remarkable feature in which is the great tower in the courtyard, decorated with the Doric, Ionic and Corinthian orders superposed, the design apparently suggested by a similar feature in the château of Anet, France (published in du Cerceau); Apethorpe Hall, Northamptonshire (1580); Montacute House, Somersetshire (1580–1600); Castle Ashby, Northamptonshire (1583–1589); Brereton Hall, Cheshire (1575–1586), in brick and stone; Westwood Park, Worcestershire (1590); Wakehurst Place, Sussex (1590); Hardwick Hall, Derbyshire (1590–1597); Longford Castle, Wiltshire (1591–1612); Cobham Hall, Kent (1594); Dorton House, Buckinghamshire (1596); Speke Hall, Lancashire (1598), partly in half-timber work; Holland House, Kensington (1606; wings and arcades, 1624); Bolsover Castle, Derbyshire (1607–1613); Charlton House, Kent (1607); Bramshill, Hampshire (1607–1612), an interesting example of Jacobean architecture; Hatfield, Hertfordshire (1608–1611), with an extremely fine courtyard (north side in brick and stone, 1621); Audley End, Essex (1610–1616), a great portion of which was afterwards pulled down; Ham House, Surrey (1610), chiefly in brick; Pinkie House, at Musselburgh in Midlothian (1613); Aston Hall near Birmingham (1618–1635); Blickling Hall, Norfolk (1619); Heriot's hospital, Edinburgh (1628–1659); and Lanhydroc, Cornwall (1636–1641), which brings us down to the period of the pure Italian Revival introduced by Inigo Jones.

We have already referred to the reproduction of the Classic orders, superposed as an enrichment of the principal entrance doorways. In addition to Burton Agnes and Burleigh House, there are endless examples in mansions and country houses, but the most remarkable are those at Oxford: in the old Schools, where coupled columns flank the entrance gateway with the five orders superposed, and in Merton and Wadham Colleges, with four orders (the Tuscan being omitted), in neither case taking any cognizance of the levels of windows or string courses of the earlier building to which they were applied, or serving any structural purpose. The orders were all taken from one of the pattern books, and in the Schools and in Merton College the rococo ornament and strap-work found in Vredeman de Vries's work were copied with more or less fidelity to the original. There are, however, two or three buildings in Northamptonshire which are free from rococo work, and in their design form a pleasant contrast, as much to the elaboration of the buildings just described as to the cold formality of the works of the later Italian style. Lyveden new buildings (1577), the Triangular Lodge at Rushton, and the Market House at Rothwell, are all examples in which the orders from Serlio or John Shute are faithfully represented, and are of a refined character; in the first named the entablatures only of the orders are introduced. In Rushton Hall (1595) the cresting of the bow windows shows the evil influence of Vredeman de Vries's pattern-book and of numerous designs by him and other Belgian artists, which were printed at the Plantin press. Two other publications of a similar rococo type were brought out in Germany, one by Cammermayer (1564) and the other by Dietterlin (1594), both at Nuremberg; neither of them would seem to have been much known in England, but indirectly through German craftsmen they may have influenced some of the work of the Jacobean period, and more particularly the chimney pieces and the ceilings of the gallery and other important rooms in which strap-work is found. Among the finer examples of ceilings of early date are those of Knole, Kent; Haddon Hall, Derbyshire; Sizergh Hall, Westmorland; South Wraxall Manor House, Wiltshire; the Red Lodge, Bristol; Chastleton House; and Canons Ashby—in the last three with pendants. Two of the best-designed ceilings of modest dimensions are those of the Reindeer Inn at Banbury and the Star Inn at Great Yarmouth. The principal decorative feature of the reception rooms was the chimney-piece, rising from floor to ceiling, in early examples being very simple—as those at Broughton House and Lacock Abbey—but at a later date overlaid with rococo strap-work ornament and misshapen figures, as at South Wraxall and Castle Ashby. One of the most beautiful chimney-pieces is in the ballroom at Knole, probably of Flemish design, but at Cobham Hall, Hardwick, Hatfield and Bolsover Castle are fine examples in which different-coloured marbles are employed, there being a remarkable series at the last-named place.

The long gallery has already been incidentally mentioned. Its origin has never been clearly explained; it was generally situated in an upper storey, and may have been for exercise, like the eaves galleries in Spain. The dimensions were sometimes remarkable; one at Ampthill (no longer existing) was 245 ft. long; and a second at Audley End, 220 ft. long and 34 ft. wide. Of moderate length, the best known are those of Haddon Hall, with rich wainscotting carried up to the ceiling, Hardwick, Knole, Longleat, Blickling Hall and Sutton Place, Surrey.

In early work the staircases were occasionally in stone with circular or rectangular newels, but the more general type was that known as the open well staircase, with balustrade and newels in timber. Of these the more remarkable examples are those at Hatfield; Benthall Hall, Shropshire; Sydenham House, Devonshire; Charterhouse, London; Ockwells Manor House, Berkshire; Blickling, Norfolk; and the Old Star Inn at Lewes, Sussex.

One of the important features in the old halls was the screen separating the hall from the passage, over the latter being a gallery; the front of the screen facing the hall was considered to be its chief decoration, and was accordingly enriched with columns of the Classic orders, and balustrade or cresting over. The screens of Charterhouse (London), Trinity College (Cambridge), Wadham College (Oxford), and the Middle Temple Hall (London), are remarkable for their design and execution. The great hammer-beam roof (1562–1572) in the last named is the finest example of the Renaissance in existence (see ROOFS, Plate I., fig. 25).

With the exception of chantry or other chapels added to existing buildings, there was only one church built in the period we are now describing, St John's at Leeds. This church is divided down the centre by an arcade of pointed arches, virtually constituting a double nave, and the rood-screen is carried through both. The window tracery and the arcade show how the master-mason adhered to the traditional Gothic style, but the rood-screen, notwithstanding its rococo decoration, is a fine Jacobean work, eclipsed only by the magnificent example at Croscombe, which, with the pulpit and other church accessories, dating from 1616, constitutes the most complete example of that period.

Inigo Jones.

The pure Italian style, as it is sometimes called, was introduced into France probably by Serlio, and the result of its first influence is shown in the Louvre, begun in 1546. It entered Spain about 20 years later, under the rule of Philip II., and Germany about the same time, creating about 100 years later a reaction in Spain in favour of a less cold and formal style, and scarcely taking any root in Germany. In England its first appearance does not take place till 1619, when Inigo Jones, after his second visit to Rome, designed an immense palace, measuring 1150 ft. by 900 ft., of which the only portion built was the Banqueting House in Whitehall (Plate VI., fig. 75); a fine design, in which the emphasizing of the central portion by columns in place of pilasters is an original treatment not found in Italy, but of excellent effect. Unfortunately many subsequent designs of Inigo Jones were either not carried out or have since been destroyed; but nothing approached this admirable work in Whitehall.

Among his buildings still remaining are St Paul's, Covent Garden (1631), a simple and massive structure which requires perhaps an Italian sun to make it cheerful; York Stairs Water-gate (1626); the front of Wilton House, near Salisbury (1633); the Queen's House, Greenwich (1617), a very poor design; Coleshill, Berkshire; Raynham Park, Norfolk, with weakly-designed gables and an entrance doorway with curved broken pediment, which can scarcely be regarded as pure Italian; and Ashburnham House, Westminster (the staircase of which is extremely fine), carried out after his death by his pupil John Webb, who, at Thorpe Hall, near Peterborough (1656), shows that he possessed some of his master's qualities in his employment of simple and bold details.

Wren.

Sir Christopher Wren, who follows, was by far the greatest architect of the Italian school, though curiously enough he had never been in Italy. His first work was the library of Pembroke College, Cambridge (1663–1664), followed by the Sheldonian theatre at Oxford, in the construction of the roof of which, with a span of 68 ft., he showed his great scientific knowledge. In 1665 he went to Paris, where he stopped six months studying the architectural buildings there and in its vicinity, and where he came across Bernini, whose designs for destroying the old Louvre (fortunately not carried out) were being started. On his return Wren occupied himself with designs for the rebuilding of the old St Paul's, but these were rendered useless by the great fire of the 22nd of September 1666, which opened out his future career. His plan for the reconstruction of the city was not followed, owing to the opposition of the owners of the sites, but he began plans for the rebuilding of the churches and of St Paul's cathedral. In his treatment of the former, where he was obliged to limit himself to the old sites, often very irregular, and in most cases to the old foundations, he adopted, perhaps quite unconsciously, one of the principles of ancient Roman architecture, and made the central feature the key of his plan, fitting the aisles, vestries, porches, &c., into what remained of the site; this central feature varied according to its extent and proportions, and sometimes from a desire to work out a new problem. The central dome was a favourite conception, the finest example of which is that of St Stephen's, Walbrook (1676); other domed churches are St Mary-at-Hill, St Mildred's, Bread Street, St Mary Abchurch (1681), where the dome virtually covers the whole area of the church, and St Swithin's, Cannon Street, an octagonal example. In St Anne and St Agnes, Aldersgate, the crossing is covered with an intersecting barrel vault; and in this small church, about 52 ft. square with four supporting columns, he manages to get nave, transept and choir with aisles in the angles. In those churches where there was sufficient length, the ordinary arrangement of nave and aisle is adopted, with an elliptical barrel vault over the nave, sometimes intersected and lighted from clerestory windows, the finest example of these being St Bride's, Fleet Street; other examples are St Mary-le-Bow (Cheapside), Christchurch (Newgate) and St Andrew's (Holborn). In St James's, Piccadilly, of which the site was a new one, the plan of nave and aisles with galleries over, and a fine internal design with barrel-vaulted ceiling, was adopted; the exterior is very simple, which suggests that Wren attached much more importance to the interior. It should be pointed out that in all these cases, the vaults, to which we have referred, were in lath and plaster, and consequently covered over with slate roofs, and as a rule the exteriors (which are rarely visible) were deemed to be of less importance. This is, however, made up for by the position selected for the towers, and in their varied design those of St Mary-le-Bow, St Bride's (Fleet Street) and St Magnus (London Bridge) are perhaps the finest of a most remarkable series.

The foundation stone of St Paul's cathedral was laid in 1675, and the lantern was finished in 1710. The silhouette of the dome (Plate II., fig. 66), which is, of course, its principal feature, is far superior to those of St Peter's at Rome, or the Invalides or Panthéon at Paris, and the problem of its construction with the central lantern was solved much more satisfactorily than in any other example. Wren realized that the attempt to render a dome beautiful internally as well as externally could only be obtained by having three shells in its construction; the inner one for inside effect, the outer one to give greater prominence externally, and the third, of conical form, to support the lantern.

In plan, Wren's design (fig. 53) was in accordance with the traditional arrangement of an English cathedral, with nave, north and south transepts and choir, in all cases with side aisles, and a small apse to the choir. The great dome over the crossing is, like the octagon at Ely, of the same width as nave and aisles together. It resembles the plan of that cathedral also in the four great arches opening into nave, transepts and choir, with smaller arches between. Instead of the great barrel vault of St Peter's, Rome, Wren introduced a series of cupolas over the main arms of the cathedral, which enabled him to light the same with clerestory windows; these are not visible on the exterior, as they are masked by the upper storey which Wren carried round the whole structure, in order, probably, to give it greater height and importance; by its weight, however, it serves to resist the thrust of the vaults transmitted by buttresses across the aisles. The grouping of the two lanterns on the west front with the central dome is extremely fine; the west portico is not satisfactory, but the semicircular porticoes of the north and south transepts are very beautiful features. Greater importance is given to the cathedral by raising it on a podium about 12 ft. above the level of the pavement outside, which enables the crypt under the whole cathedral to be lighted by side windows.

The principal examples of the churches which followed are those of St George's, Bloomsbury; St Mary Woolnoth; Christ Church, Spitalfields, by Nicholas Hawksmoor; and St Mary-le-Strand (1714), and St Martin's-in-the-Fields (1721), by James Gibbs. Gibbs's interiors are second only to those of Wren, while Hawksmoor's are very weak; in both cases, however, the exteriors are finely designed. Amongst subsequent works are St John's, Westminster, and St Philip's, Birmingham (1710), by Thomas Archer; St George's, Hanover Square (1713–1714), by John James; All Saints' church, Oxford, by Dean Aldrich; St Giles-in-the-Fields (1731), by Henry Flitcroft; and St Leonard's, Shoreditch (1736), by George Dance.

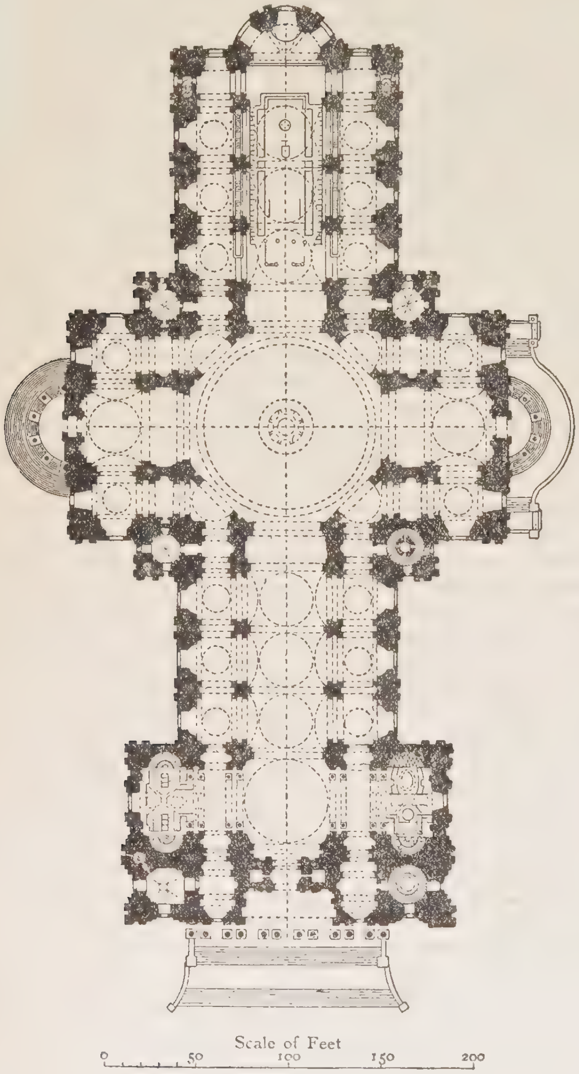


FIG. 53.—Plan of St Paul's Cathedral, London.

Sir Christopher Wren's chief monumental work was Greenwich hospital, in the arrangement of which he had to include the Queen's House, and a block already begun on the west side. His solution was of the most brilliant kind, and seen from the river the grouping of the several blocks with the colonnade and cupolas of the two central ones is admirable.

Wren's next great work was the alterations and additions to Hampton Court palace, begun in 1689, the east front facing the park (Plate VI., fig. 77), the south front facing the river, the fountain court and the colonnade opposite the great hall. Chelsea hospital (1682–1692), the south front (now destroyed) to Christ's hospital (1692), and Winchester school (1684–1687), are all examples in brick with stone quoins, cornices, door and window dressings, which show how Wren managed with simple materials to give a monumental effect. The library which he built in Trinity College, Cambridge (1678), with arcades on two storeys divided by three-quarter detached columns of the Doric and Ionic orders, is based on the same principle of design as those in the court of the Farnese palace at Rome by Sangallo, a part of the palace which is not likely to have been known by him.

The results of the Italian Revival in domestic architecture were not altogether satisfactory, for although it is sometimes claimed that the style was adapted by its architects to the traditional requirements and customs of the English people, the contrary will be found if they are compared with the work of the 16th century. The chief aim seems to have been generally to produce a great display of Classic features, which, even supposing they followed more closely the ancient models, were quite superfluous and generally interfered with the lighting of the chief rooms, which were sacrificed to them. In fact there are many cases in which one cannot help feeling how much better the effect would be if the great porticoes rising through two storeys were removed. This is specially the case in Sir John Vanbrugh's mansion, Seaton Delaval, in Northumberland (1720); his other works, Blenheim (1714) and Castle Howard (1702), are vulgarized also by the employment of the large orders. The same defect exists in Stoneleigh Abbey, Leamington, where the orders carried up through two and three storeys respectively destroy the scale of the whole structure.

Among other mansions, the principal examples are Houghton in Norfolk (1723), a fine work, the villa at Mereworth in imitation of the Villa Capra near Vicenza, and the front of old Burlington House (1718), copied from the Porto palace at Vicenza, by Colin Campbell; Holkham in Norfolk and Devonshire House, London, by William Kent; Ditchley in Oxfordshire, and Milton House near Peterborough, by Gibbs; Chesterfield House, London, by Isaac Ware; Wentworth House in Yorkshire (1740), and Woburn Abbey in Bedfordshire (1747), by Henry Flitcroft; Spencer House, London (1762), by John Vardy; Prior Park and various works in Bath by John Wood; the Mansion House, London, by George Dance; Wardour in Wiltshire, Kedleston Hall in Derbyshire, and Worksop in Nottinghamshire (1763), by James Paine; Gopsall Hall, Ely House, Dover Street, London (1772), and Heveringham Hall in Suffolk, by Sir Robert Taylor, to whose munificence we owe the Taylor Buildings at Oxford; Harewood House in Yorkshire (1760), Lytham Hall in Lancashire, and (part of) Wentworth House in Yorkshire, by John Carr; and Luton Hoo (1767), now largely reconstructed, and Sion House (1761), the best-known mansions by Robert Adam, who with his brothers built the Adelphi and many houses in London. Adam designed a type of decoration in stucco for ceilings and mantelpieces, the dies of which are still in existence and are utilized extensively in modern houses. His labours were not confined to buildings, but extended to their decoration, furniture and fittings.

The works of Sir William Chambers were of a most varied nature, but his fame is chiefly based on Somerset House in the Strand, London (1776), with its façade facing the river, a magnificent work second only to Inigo Jones's Whitehall, but infinitely more extensive and difficult to design. He was also the author of a work on *The Decorative Part of Civil Architecture*, which is still the standard work on the subject in England. His pupil, James Gandon, won the first gold medal given by the Royal Academy in 1769, and his principal work was the Custom House in Dublin (1781). Newgate prison (1770), a remarkable building now destroyed, was the chief work carried out by George Dance, jun.

Other buildings not yet mentioned are the Alcove and Banqueting Hall (Orangery) of Kensington Palace, by Wren; the Radcliffe library, Oxford, by Gibbs, an extremely fine work both externally and internally; Queen's College, Oxford, by Hawksmoor; the county hall, Northampton, by Sir Roger Norwich; the town hall, Abingdon (1677), designer unknown; the Ashmolean museum, Oxford (1677), by T. Wood; Clare College, Cambridge, and St Catherine's Hall, Cambridge (1640–1679), by Thomas and Robert Grumboll, master-masons; the custom house, King's Lynn (1681), by Henry Bell; Nottingham Castle, designed by the duke of Newcastle in 1674 and carried out by March, his clerk of works—the central portion is finely proportioned, and it is only in the pilasters at the quoins that one recognizes the amateur; two houses in Cavendish Square, London (1717), on the north side, by John James; Lord Burlington's villa (1740) at Chiswick, by William Kent, which with its internal decorations is still perfect; the celebrated Palladian Bridge at Wilton, by R. Morris; and last but not least, in consequence of its great influence on modern architecture, Sparrowe's house at Ipswich (1567–1662), the timber oriel windows of which are now so often reproduced. (R. P. S.)

RENAISSANCE ARCHITECTURE IN GERMANY

The classical revival does not seem to have taken root in Germany much before the middle of the 16th century, some forty to fifty years later than in France, from which country it is said to have been introduced, and in some of the early work there is a great similarity to French examples, but without the refinement and variety of detail which one finds in the châteaux of the Loire and in many of the French towns. In the rood-screen of the cathedral at Hildesheim (1546), the court of the town hall at Görlitz (1534), the portal of the Petershof at Halberstadt

(1552); and the entrance gateway of the castle at Brieg (1553), one is able to recognize certain ornamental details and a similar superposition of pilasters in several storeys to that which is found in various towns in Normandy and on the Loire. In both countries the new style was engrafted on the last phase of the Gothic period, so forming at first a transitional style, which lasted about fifty years. Thus the lofty roofs which prevailed in the 15th century are developed further, but with this great divergence in the two countries. In France there are rarely gable ends, in Germany they are not only the chief characteristic feature of the main front, but are introduced in the side elevations in the shape of immense dormers with two or three storeys and rising the full height of the roof, as in the castle at Hämelschenburg near Hameln. Throughout Germany, therefore, the gable end and the dormer gable became the chief features on which they lavished all their ornamental designs, the main walls of the building being as a rule either in plain masonry, rubble masonry with stucco facing, or brick and stone. Other prominent features are the octagonal and circular oriel windows rising through two or three storeys at the corners of their buildings—rectangular bow windows in two or three storeys, which were allowed apparently to encroach on the pavement, and octagonal turrets or towers instead of circular as in France. In the vicinity of the Harz mountains, where timber was plentiful, a large proportion of the factories, houses and even public buildings, are erected in half-timber work with elaborate carving of the door and window jambs, projecting corbels, &c. At Hildesheim, Wernigerode, Goslar, &c., these structures are sometimes of immense size and richly decorated. Among early examples in stone, the porch added to the town hall of Cologne (1571), the projecting wings of the town halls at Halberstadt and Lemgo (1565), and the town halls at Posen (1550), Altenburg (1562–1567) and Rothenburg (1572–1590), are all picturesque examples more or less refined in design. In the last-named example the purer Italian style has exercised its influence in the principal doorway and in the arcaded gallery on the east front. This same influence shows itself in the courtyard of the town hall at Nuremberg, where the arcades of the two upper storeys might be taken for those of the courts of the palaces at Rome.

Amongst other 16th-century work there are two entrance gates at Danzig, the Hohe Tor (1588), a fine massive structure, and the Langgasse Tor (1600), more or less pure Italian in style. At Augsburg, the arsenal (1603–1607), by the architect Elias Holl (1573–1646), is of a bold and original design, and the town hall has magnificent ceilings and wainscotting round the walls of the principal halls. This brings us to the castle of Heidelberg (Plate VII., figs. 78, 79 and 80), which is looked upon by the Germans as the chef d'œuvre of the Renaissance in Germany. As seen from the great court it forms an interesting study, there being the work of three periods: in the centre the picturesque group of the older building (*c.* 1525), on the right the Otto-Heinrichs-Bau (1556–1559), and on the left the Friedrichs-Bau (1602–1607). Of the two the latter is the finer. The architect of the Otto-Heinrichs-Bau would seem to have been undecided whether to give greater prominence and projection to his pilasters and cornices or to his windows with their dressings and pediments, so he has compromised the matter by making them both about the same, and the effect is most monotonous. In the Friedrichs-Bau, which is a remarkable work, the pilasters are of great projection, with bold cornices and simple windows well set back, while the tracery of the ground-floor windows is a pleasant relief from the constant repetition of pilaster window dressings. The gables also of the Friedrichs-Bau break the horizontal sky-line agreeably. A more minute examination of the decorative details, however, betrays the advent of a peculiar rococo style of a most debased type, which throughout the 17th century spread through Germany, and the repetition of the same details suggests that it was copied from some of the pattern books which were published towards the end of the 16th century, comprising heterogeneous designs for title pages, door heads, frontispieces, and even extending to new versions of the orders, which apparently appealed to the German mason and saved him the trouble of invention. These books, compiled by de Vries and Dietterlin, emanated from the Low Countries, and their influence extended to England during the Elizabethan period. At all events in Germany it would seem to have arrested the purer Italian work, which we have already noticed, and henceforth in the gable ends one finds the most extraordinary accumulation of distorted forms which, though sometimes picturesque, disfigure the German work of the 17th century. An exception might perhaps be made in favour of the Peller'sche Haus in Nuremberg (1625), one of the best houses of modest dimensions in Germany. The façade in the Aegidien-Platz is a fine composition; inside is a very picturesque court and staircase, and the painted ceiling and the wainscotting of one of the rooms in woods of different colours, though not very pure in style, are of excellent design and execution.

Some of the most characteristic work of this type exists at Hameln, where the façades of the Rattenfängerhaus (1602), the Hochzeitshaus (1610), and many other buildings, are covered with the most extraordinary devices, leaving scarcely a foot of plain masonry as a relief. The south front of the town hall of Bremen (1612) is in the same style (Plate IV., fig. 70), relieved, however, by the fine large windows of the great hall and the arcade in front, in which there is some picturesque detail. Later in the century the degradation increases until it reaches its climax in the Zwinger palace at Dresden (1711), the most terrible rococo work ever conceived, if we except some of the Churrigueresque work in Spain.

Among the most pleasing features in Germany are the fountains which abound in every town; of these there are good examples at Tübingen, Prague, Hildesheim, Ulm, Nuremberg, already famed for its Gothic fountains, Mainz and Rothenburg. In the latter town, built on an eminence, they are of great importance for the supply of the town, and some of them are extremely picturesque and of good design.

Up to the present we have said nothing about the ecclesiastical buildings in Germany, for the reason that the period between the Reformation and the conclusion of the Thirty Years' War was not favourable to church building. The only example worth mentioning is the church of St Michael at Munich (1583–1597), and that more for its plan than for its architecture. It has a wide nave covered with a barrel vault, and a series of chapels forming semicircular recesses on each side, the walls between acting as buttresses to the great vault. The transept is not deep enough to have any architectural value, but if at the east end there had been only an apse it would have been a better termination than the long choir. The Liebfrauenkirche at Dresden (1726–1745) has a good plan, but internally is arranged like a theatre with pit, tiers of boxes, and a gallery, all in the worst possible taste, and externally the dome is far too high and destroys the scale of the lower part of the church. An elliptical dome is never a pleasing object, and in the church of St Charles Borromeo, at Vienna, there are no other features to redeem its ugliness. The Marienkirche at Wolfenbüttel (1608–1622) has a fine Italian portal; its side elevation is spoilt by the series of gable dormers, which are of no possible use, as the church (of the *Hallenkirchen* type) is well lighted through the aisle windows. The portal of the Schlosskapelle (1555) at Dresden is a fine work in the Italian style; and lastly the church at Bückeburg, in a late debased style, is redeemed only by the fact that it is built in fine masonry and that the joints run through all the rococo details. (R. P. S.)

Renaissance Architecture in Belgium and Holland

The Gothic development in the 15th century in Belgium, as evidenced in her magnificent town halls and other public buildings, not only supplied her requirements in the century following, but hindered the introduction of the Classic Revival, so that it is not till the second half of the 16th century that we find in the town hall of Antwerp a building which is perhaps more Italian in design than any work in Germany. There are, however, a few instances of earlier Renaissance, such as the Salm Inn (1534) at Malines; the magnificent chimneypiece, by Conrad van Noremberger of Namur, in the council chamber of the palais de justice at Bruges (1529); and the palais de justice of Liége (1533), formerly the bishop's palace, in the court of which are features suggesting a Spanish influence. The influence of the cinque-cento style of Italy may be noticed in the tomb of the count de Borgnival (1533) in the cathedral of Breda, and in the choir stalls of the church at Enkhuisen on the borders of the Zuyder Zee, both in Holland, and in the choir stalls of the cathedral of Ypres in Belgium; the carving of these bears so close a resemblance to cinque-cento work in design and execution that one might conclude they were the work of Italian artists, but their authors are known to have been Flemish, who must, however, have studied in Italy. Again, in the stained-glass windows of the church of St Jacques at Liége, the details are all cinque-cento, with circular arches on columns, festoons of leaves and other ornament, all apparently derived from Italian sources, but necessarily executed by Flemish painters, as stained-glass windows of that type are not often found in Italian churches.

Of public buildings in Belgium, the most noted example is that of the town hall at Antwerp, designed by Cornelius de Vriendt (1564). It has a frontage of over 300 ft. facing the Grande Place, and is an imposing structure in four storeys, arcaded on the lower storey and the classic orders above, with mullioned windows between on the three other storeys, the uppermost storey being an open loggia, which gives that depth of shadow obtained in Italy by a projecting cornice. It is almost the only building in Belgium without the usual gable, the centre block being carried up above the eaves and terminated with an entablature supporting at each end a huge obelisk, and in the centre what looks like the miniature representation of a church. The only other classic building is the Renaissance portion of the town hall at Ghent, which is very inferior to the older Gothic portion.

What is wanting in the town halls, however, is amply replaced by the magnificence of the houses built for the various gilds, as for instance those of the Fishmongers at Malines (1580), of the Brewers, the Archers, the Tanners and the Cordeliers (rope-makers) at Antwerp, and, in the Grande Place at Brussels, the gilds of the Butchers, the Archers, the Skippers (the gable end of which represents the stern of a vessel with four cannons protruding), the Carpenters and others. Besides these, and especially in Antwerp, are to be found a very large series of warehouses, which in the richness of their decoration and their monumental appearance vie with the gilds in the evolution of a distinct style of Renaissance architecture—a type from which the architect of the present day might derive more inspiration than from the modest brick houses of Queen Anne's time.

In domestic architecture, the best-preserved example of the 16th and 17th centuries is the Musée Plantin at Antwerp, the earliest portion of which dates from 1535. This was bought by Ch. Plantin, who was employed by Philip of Spain to print all the breviaries and missals for Spain and the Netherlands; the fortune thus acquired enabled him and his successors to purchase from time to time adjoining properties which they rebuilt in the style of the earlier buildings. After 1637 the buildings followed the style of the period, but up to that date they were all erected in brick with stone courses and window dressings round a central court. Internally the whole of the ancient fittings are retained, including those of the old shop, the show-rooms, reception rooms and the residential portion of the house, with the wainscotting and Spanish leather on the walls above, panelled ceilings, chimney-pieces, stained glass, &c., the most complete representation of the domestic style of Belgium.

Of ecclesiastical architecture in the Renaissance style there are scarcely any examples worth noting. The tower of the church of St Charles Borromeo at Antwerp (1595–1610) is a fine composition similar in many respects to Wren's steeples, and the nave of St Anne's church at Bruges is of simple design and good proportion. The Belgian churches are noted for their immense pulpits, sometimes in marble and of a somewhat degraded style. The finest features in them are the magnificent rood-screens, in which the tradition of the Gothic examples already quoted seems to have been handed down. In the cathedral at Tournai is a fine specimen by Cornelius de Vriendt of Antwerp (1572), and there is a second at Nieuport, both similar in design to the example from Bois-le-Duc now in the Victoria and Albert Museum; and in the church of St Leonard at Léau is a tabernacle in stone, over 50 ft. high, in seven stages, with numerous figures by Cornelius de Vriendt (1550).

In Holland, nearly all the principal buildings of the Renaissance date from the time of her greatest prosperity when the Dutch threw off their allegiance to the Spanish throne (1565). With the exception of the palace at Amsterdam (1648–1655), an immense structure in stone with no architectural pretensions, there are no buildings in Holland in which the influence of the purer style of the Italian revival can be traced. Internally the great hall of the palace and the staircase in the Louis XIV. style are fine examples of that period.

The earliest Renaissance town hall is that of the Hague (1564), situated at the angle of two streets, which is an extremely picturesque building, in fact one of the few in which the architect has known how to group the principal features of his design. The Renaissance addition made to the old town hall of Haarlem is a characteristic example of the Dutch style. The walls are in red brick, the decorative portions, consisting of superimposed pilasters with mullioned and transomed windows, cornices and gable end, all being in stone. Inside this portion of the town hall, which is now a gallery and museum, is an ancient hall (not often shown to visitors) in which all the decorations and fittings date from the 17th century. There is a second example of an ancient hall in the Stadthuis at Kampen, one of the dead cities of the Zuyder Zee, which served originally as a court of justice, and retains all its fittings of the 16th century, including a magnificent chimneypiece in stone, some 25 ft. high and dated 1543.

The town hall at Bolsward in Friesland is another typical specimen of Dutch architecture, in which the red brick, alternating with stone courses running through the semi-detached columns which decorate the main front, has given variety to the usual treatment of such features. The external double flight of steps with elaborate balustrade, and the twisted columns which flank the principal doorway, are extremely picturesque, if not quite in accordance with the principles of Palladio or Vignola.

A similar flight of steps with balustrade forms the approach to the entrance doorway (on the first floor) of the town hall at Leiden, where the rich decoration of the centre block and its lofty gable is emphasized by contrast with the plain design of the chief front.

In the three chief cities in Holland, the Hague, Amsterdam and Rotterdam, there are few buildings remaining of 17th-century work, so that they must be sought in the south at Dordrecht and Delft, or in the north at Leiden, Haarlem, Alkmaar, Hoorn, Enkhuisen, or, crossing the Zuyder Zee into Friesland, in Leeuwarden, Bolsward, Kampen and Zwolle, the dead cities. In all these towns ancient buildings have been preserved, there being no resaon to pull them down. Of the entrance gateways at Hoorn there is an example left, of which the lower portion might be taken for a Roman triumphal arch, so closely does it adhere to the design of those monuments, extending even to a long Latin inscription in the frieze. The tower (1531–1652), built to protect the entrance to the harbour, has no gateway. There are some old buildings in Kampen, in one of which the entrance gateway is a simple and fine composition in brick and stone, the chief characteristics of the gateways here being the enormously high roofs of the circular towers flanking them. A finer and more picturesque grouping of roofs exists in the entrance gateway (Amsterdam Gate) at Haarlem, which is perhaps, however, eclipsed by those of the Waaghuis at Amsterdam with its seven conical roofs.

The Waaghuisen, or weighing-houses for cheeses, are, next to the town halls, the most important buildings in Holland, and in fact vie with them in richness of design. The example at Alkmaar possesses not only an imposing front with gable in three storeys, but a lofty tower with belfry. At Deventer the main building is late Gothic (1528), in brick and stone, with an external double flight of steps and balustrades added in 1643.

The Fleesch Halle (meat-market) at Haarlem, also in brick and stone, is of a very rococo style, but notwithstanding all its vagaries presents a most picturesque appearance.

The domestic architecture of Holland and the shop fronts retain more of their original dispositions than will be found in any other country. At Hoorn, Enkhuisen and other towns, there has virtually been no change during the last 200 years. In the more flourishing towns as Amsterdam and Rotterdam, the increasing prosperity of the inhabitants led them in the latter portion of the 17th and in the 18th centuries to adapt features borrowed from the French work of Louis XIV. and Louis XV., without, however, their refinement, luxuriance or variety, so that although substantial structures they are extremely monotonous in general effect. (R. P. S.)

Mahommedan Architecture

Before proceeding with "modern architecture," to which the styles now discussed have gradually led us, we have still another important architectural style to describe, in Mahommedan architecture. The term "Mahommedan" has been selected in preference to "Saracenic," because it includes a much wider field, and enables us to bring in many developments which could not well come under the latter title. It was the Mahommedan religion which prescribed the plan and the features of the mosques, and it was the restriction of that faith which led to the principal characteristics of the style. The term "Saracenic" could hardly be applied to the architecture of Spain, Persia or Turkey.

The earliest mosques at Mecca and Medina, which have long since passed away, were probably of the simplest kind; there were no directions on the subject in the Koran, and, as Fergusson remarks, had the religion been confined to its native land, it is probable that no mosques worthy of the name would have ever been erected. In the first half-century of their conquest in Egypt and Syria the Mahommedans contented themselves with desecrated churches and other buildings, and it was only when they came among the temple-building nations that they seemed to have felt the necessity of providing some visible monument of their religion. The first requirement was a structure of some kind, which should indicate to the faithful the direction of Mecca, towards which, at stated times, they were to turn and pray. The earliest mosque, built by Omar at Jerusalem, no longer exists, but in the mosque of ʻAmr at Cairo (fig. 54), founded in 643 and probably restored or added to at various times, we find the characteristic features which form the base of the plans of all subsequent mosques. These features consist of (*a*) a wall built at right angles to a line drawn towards Mecca, in which, sunk in the wall, was a niche indicating the direction towards which the faithful should turn; (*b*) a covered space for shelter from the sun or inclement weather, which was known as the prayer chamber; (*c*) in front of the prayer chamber, a large open court, in which there was a fountain for ablution; and (*d*) a covered approach on either side of these courts and from the entrance. The materials employed in the earlier mosque were all taken from ancient structures, Egyptian, Roman and Byzantine, but so arranged as to constitute the elements of a new style. The columns employed were not always of sufficient size, and therefore in order to obtain a greater height, above the capitals were square dies, carrying ranges of arches, all running in the direction of Mecca; to resist the thrust, wood ties were built in under the arches, so that the structure was of the lightest appearance. The same principle was observed in the mosque of Kairawan in Tunisia (675), and in the mosque of Cordova (786–985), copied from it. Similar wooden ties are found in the mosque of El Aksa and the Dome of the Rock at

Jerusalem (built 691), so that they became one of the characteristics of the style. For constructional reasons, however, this method of building was not always adhered to, and in the mosque of Tulun (fig. 55) in Cairo (879), the first mosque in Egypt, built of original materials, we find an important departure. The arcades, instead of running at right angles to the Mecca wall, are built parallel with it, on account of the great thrust of the arches, all built in brick (fig. 56). The wood ties would have been quite insufficient to resist the thrust, and in the case of this mosque were probably used to carry lanterns.

The mosque of Tulun is the earliest example in which the pointed arch appears throughout, and it forms the leading and most characteristic constructional feature of the style in its subsequent developments in every country, except in Barbary and Spain, where the circular-headed horse-shoe arch seems to be preferred. As it is also the earliest mosque in which the decoration applied is that which was by inference laid down in the Koran, some allusion to the restrictions therein contained, and the consequent result, may not be out of place. The representation of nature in any form was absolutely forbidden, and this applied generally to foliage of all kinds, and plants, the representation of birds or animals, and above all of the human figure. The only exceptions to the rule would seem to be those found in the very conventional representations of lions carved over the gateways of Cairo and Jerusalem and in the courts of the Alhambra. It was this restriction which produced the extremely beautiful conventional patterns which are carried round the arches of the mosque of Tulun, and are found in the friezes, string-courses and the capitals of the shafts, and when these patterns form the background of the text of the Koran in high relief, in the splendid Arabic characters, it would be difficult to find a more beautiful decorative scheme in the absence of natural forms. As the mosque of Tulun was built by a Coptic architect, and its decoration is evidently the result of many years of previous developments, it is probably to the Copts that its evolution was due. The second type of decoration is that which is given by geometrical forms, and either in pavements or wall decorations in marble, or in the framing of woodwork in ceilings, or in doorways, the most elaborate and beautiful combinations were produced. The third type of decoration is one which in a sense is found in the origin of most styles, but which, restricted as the Mahommedans were to conventional representations, received a development of far greater importance, and in one of its forms—that known as stalactite vaulting—constitutes the one feature in the style which is not found in any other, and which, from the western coast of Spain to the east of India, at once differentiates it from any other style.

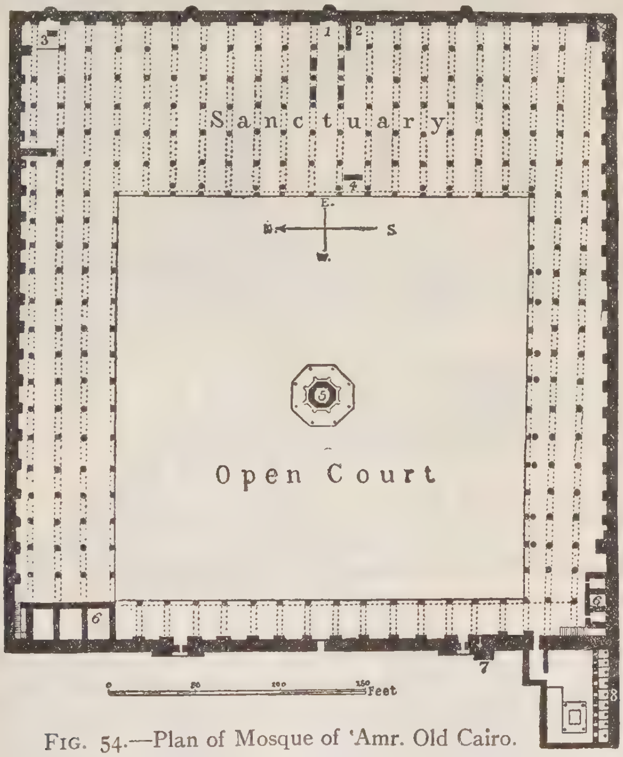
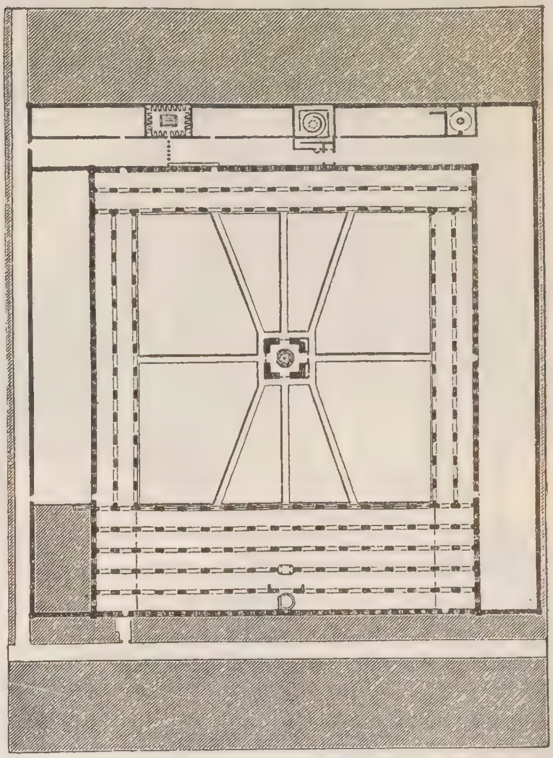


Fig. 54.—Plan of Mosque of ‘Amr. Old Cairo.

1. Kibla.
2. Mimbar.
3. Tomb of ‘Amr.
4. Dakka.
5. Fountain for Ablution.
6. Rooms built later.
7. Minaret.
8. Latrines.

A complete account, with illustrations of the origin of the stalactite will be found in the *Journal of the Royal Institute of British Architects* (1898). The earliest example is found in the tomb of Zobeide, the favourite wife of Harun al-Rashid, at Bagdad, built at the end of the 8th century. This tomb, octagonal in plan, and of modest dimensions, was vaulted over by a series of niches in nine stages or levels rising one above the other, and brought forward on the inside, so that the ninth course completed the covering of the tomb. It was built in this way to save centreing, each niche when completed being self-supporting. There is a second tomb at Bagdad, of later date—the tomb of Ezekiel,—constructed in the same way, except that in each stage the niches are built not one over the other but astride between the two, and this is the way in which in subsequent developments it always appears to have been built. Its application to the pendentives of the portals of the mosque at Tabriz and Sultaniya was the next development; and when some two centuries later it is found in Europe, in the palaces of the Ziza at Palermo, dating from about the beginning of the 11th century, it has lost its brick constructive origin, and, being cut in slabs of stone, has become simply a decorative feature. Its earliest example in Egypt is in the tomb of ash-Shafi‘i at Cairo, built by Saladin about 1240. Here and in all subsequent examples throughout Egypt and Syria it is always carved in stone. In the Alhambra another material was employed, the elaborate vaults being built with a series of small moulds in stucco. In the ceilings of the mosques at Cairo it was frequently carved in wood, and consequently lost all trace of its origin.



From Coste's *Architecture Arabe en Caire.*

Fig. 55.—Plan of Mosque of Tulun, Cairo.

Two other decorative features, but having a constructive origin, are (1) the alternating of courses of stone of different colour, probably derived from Byzantine work, where bands of brick were employed; and (2) the elaborate forms given to the voussoirs of the arches of the Mecca niche.

Having now described the principles which ruled the plans of the mosques and formed the *motifs* of their architectural design, it remains to take the principal examples in the various countries where the style was developed.

Although the tendency of modern research points to Persia as the country in which the first development of the art took place, and we have already referred to two tombs at Bagdad, in which the earliest examples of a stalactite vault are found, so far as remains are concerned nothing can be traced earlier than the work of Ghazan Khan (1294), whose mosque at Tabriz, half in ruins, is the earliest example.

It is to Egypt therefore we turn first. There still exist—and sometimes in good preservation—mosques and other buildings in Cairo of every period showing the development of the Mahommedan style, from the 9th to the 17th century. Owing to the magnificent material at their command—for unfortunately more of it was taken from the ancient Egyptian monuments than from the quarries—a much purer style was evolved than in Persia; and owing to the absence of rain those ephemeral structures built in brick and covered with stucco, which in other countries would long have passed away, retained the crispness of their flowing ornament, which is still as sharp and well defined as when executed. We have already referred to two of the earlier mosques, those of ‘Amr in Old Cairo and of Tulun. The next in date, and built also in brick, is the mosque El Hakim (*c.* 1003). The mosque of El Azhar ("the Splendid") was founded about 970, but entirely rebuilt in 1270 and enlarged in 1470. It is the university, and its Liwan or prayer chamber is the largest in Cairo, there being 380 columns carrying its roof.

The mosque of al-Zahir (founded 1264) is now occupied as barracks. In one of its entrance porches the arches are decorated with the well-known zigzag or chevron ornament, and a second porch with cushion voussoirs, features found elsewhere only in Sicily, so that the mosque was probably built by masons brought from thence. Then follows a series of mosques: Kalaun (1287); al-Nāsir (1299–1303); Merdani (1338); all based on the same plan as those described with a large courtyard surrounded by porticoes. The mosque of al-Nāsir has a portal with clustered piers and pointed and moulded orders. This is said to have been brought over as a trophy from Acre, but it is more probable that Syrian masons were imported to carry on the style introduced by the Crusaders.

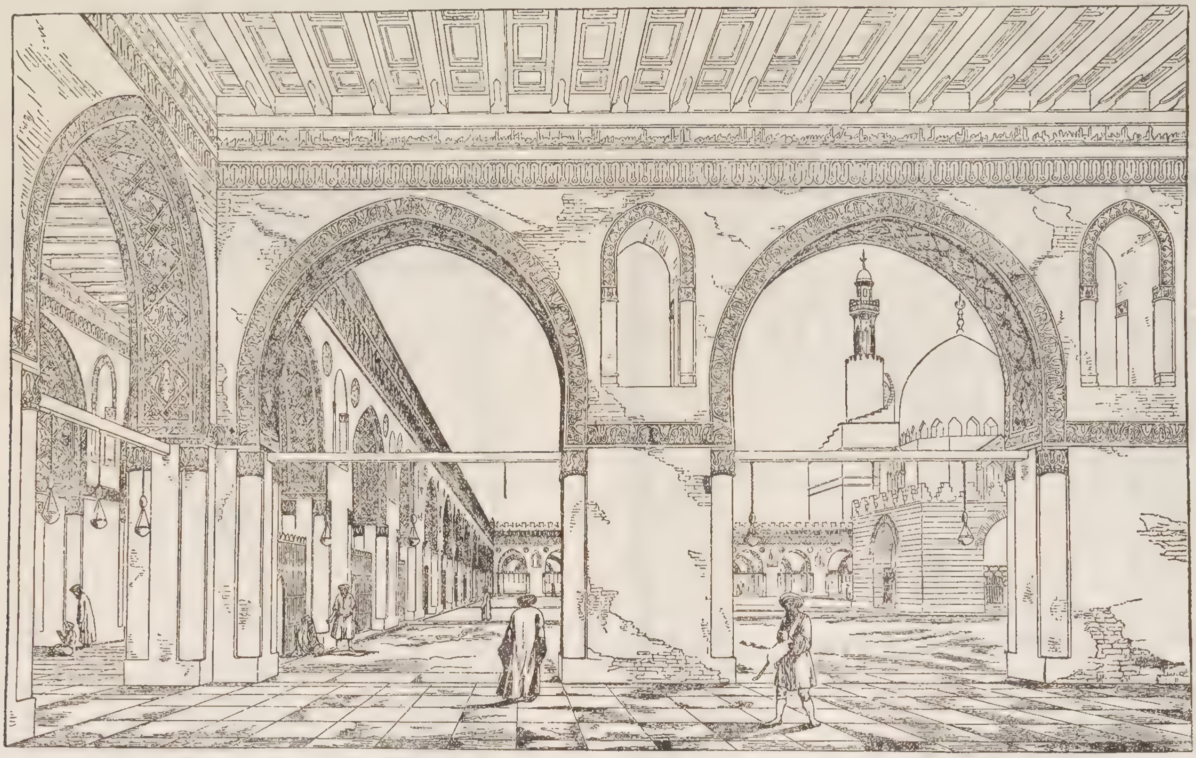


Fig. 56.—Court of the Mosque of Tulun, Cairo. (From Coste.)

The mosque of Sultan Hasan (1357–1360) marks an important change in the scheme of its plan, which served afterwards as a future model (fig. 57). It consists of a central court, 117 ft. by 105 ft. open to the sky, and instead of the covered porticoes on each side there are immense recesses covered over with pointed vaults. The prayer chamber is 90 ft. deep, 90 ft. high to the apex of the vault and 69 ft. wide, a greater span than any Gothic cathedral, and only exceeded in dimensions by the great hall of the palace at Ctesiphon built by the Sassanian dynasty. The mosque covers a large area, and would seem to have been occupied by four religious sects, whose rooms, situated on the outer side, are lighted by windows in eight or ten storeys, giving the appearance of a factory. Its entrance portal, 60 ft. to 70 ft. high, is the finest in Egypt, and is only exceeded in dimensions by those of the Persian and Indian mosques. The vestibule is covered by a dome with stalactite pendentives, and is perhaps the most complete and perfect example in Cairo. Beyond the prayer chamber is the tomb of the founder, which is covered by a dome. This, according to Poole, was not originally a feature in Saracenic mosques. A dome, he says, has nothing to do with prayer and therefore nothing with a mosque. It is simply the roof of a tomb, and only exists when there is at least a tomb to be covered. The greater number of the mosques in and outside Cairo are mausoleums, which accounts for the large number of domes found there.

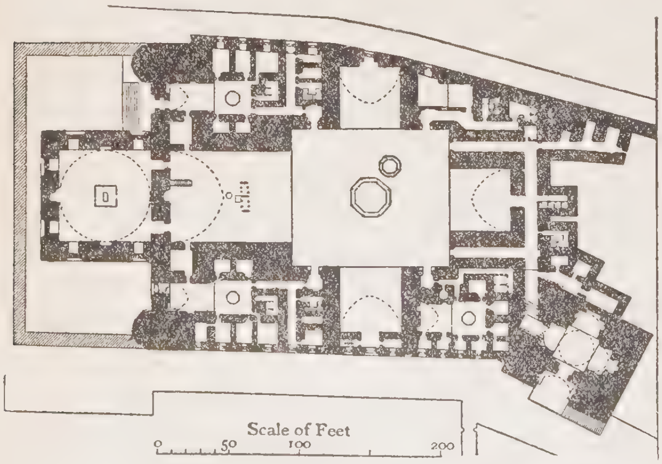
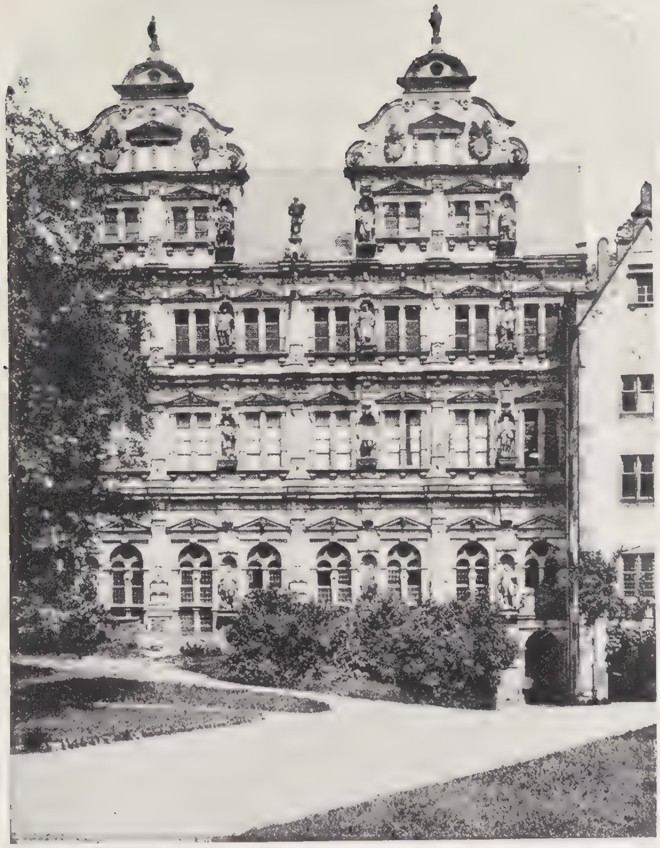


Fig. 57.—Plan of the Mosque of the Sultan Hasan.

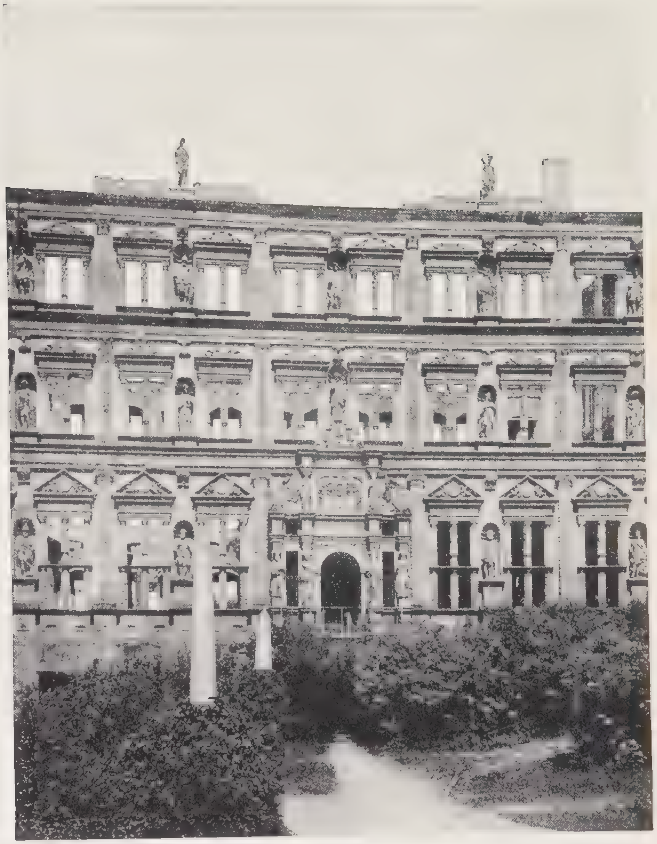
Of the tombs of the caliphs, outside Cairo, the most important is the tomb of ash-Shafi‘ī, reputed to have been built by Saladin but now quite changed by restoration. The tomb of Barkuk, in which the courtyard plan of Sultan Hasan is retained, has porticoes round it, which are of much more solid construction than those in earlier examples, and carry small domes. The two great domes on the east side and the minarets on the west are among the finest in Cairo. The tomb-mosque of Kait Bey (*c.* 1470), though comparatively small, is the finest in design and most elegant of its type in Egypt. Here the central court is covered by a cupola lantern (fig. 58), and the ceiling over the prayer chamber and other recesses is framed in timber and elaborately painted and gilded. The tomb is at the south-east corner, and is covered with a dome in stone, beautifully carved with conventional designs. In some of the mosques by the side of the portal is a fountain enclosed with bronze grilles, and above it a small room sometimes used as a school with open arcades on two sides. This feature in the mosque of Kait Bey, with the portal on its right, the lofty minaret beyond, and the great dome at the farther end, makes it the most picturesque in aspect of any Cairene mosque. (For plan see Mosque, fig. 3.)

It was in Egypt that the minaret received its highest development. The earliest example is that of the mosque of Tulun, which is of unusual shape, and has winding round it an inclined plane or staircase of easy ascent which can be made on horseback. The original design of this scheme was probably derived from the mosque of Samara, a town 60 m. north of Bagdad, where the minaret built *c.* 850 has a spiral ascent round it, recalling that of the Assyrian ziggurat as at Khorsabad. The general design of the Cairo minarets would seem to have been universally adhered to from the 12th century onwards, but the upper storeys are all varied in detail, there being virtually no two alike. As a rule the lower portion of the minaret forms part of the main wall of the mosque, and was carried up square a few feet



Photo, L. L. Paris.

FIG. 78.—HEIDELBERG CASTLE, FRIEDRICHSBAU.



Photo, L. L. Paris.

FIG. 79.—HEIDELBERG CASTLE, OTTO-HEINRICHSBAU.

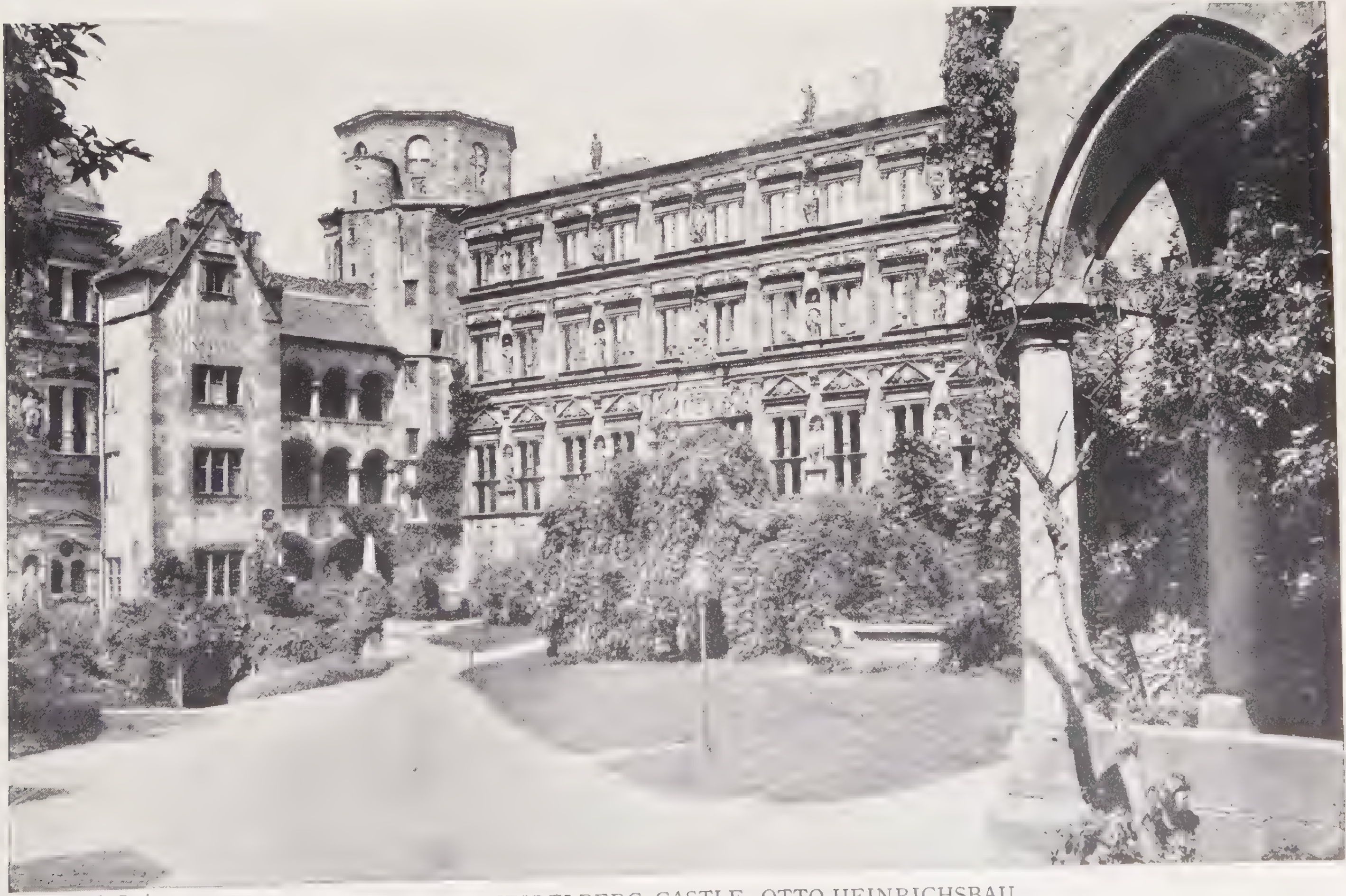
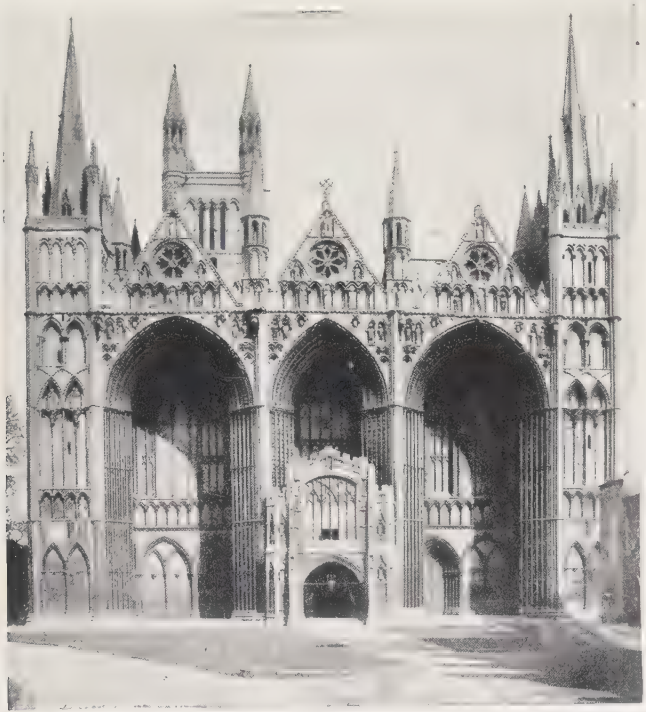


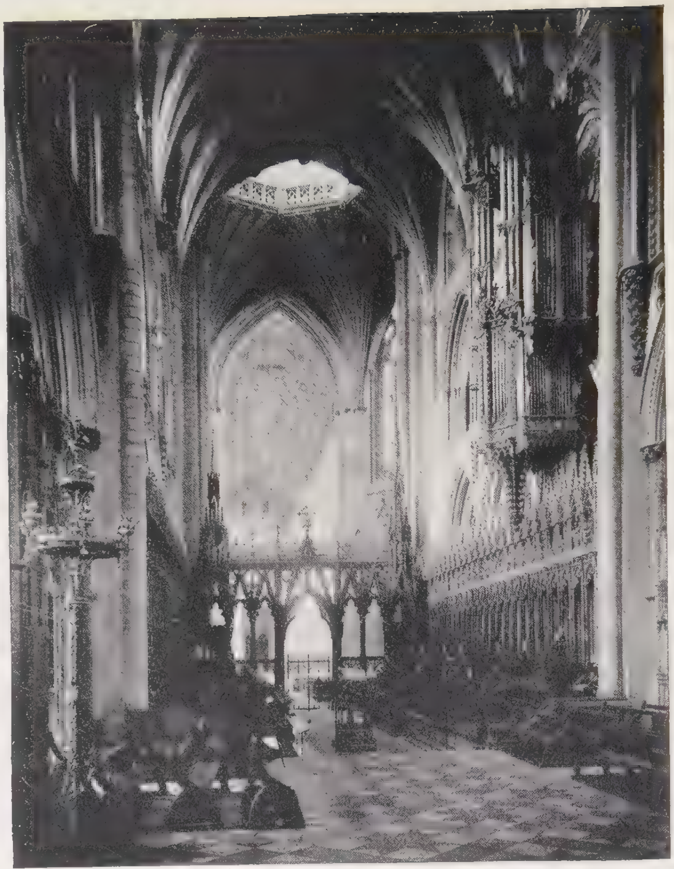
Photo L. L. Paris.

FIG. 80.—HEIDELBERG CASTLE, OTTO-HEINRICHSBAU.



Photo, J. Valentine, Ltd.

FIG. 81.—PORCH, PETERBORO' CATHEDRAL.



Photo, G. W. Wilson & Co.

FIG. 82.—ELY CATHEDRAL.

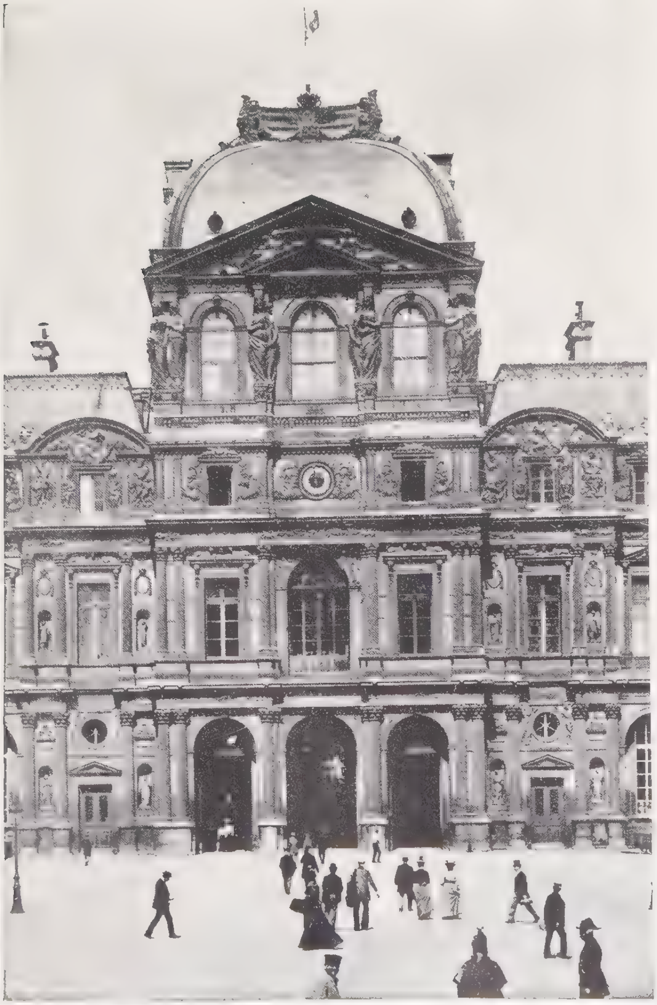
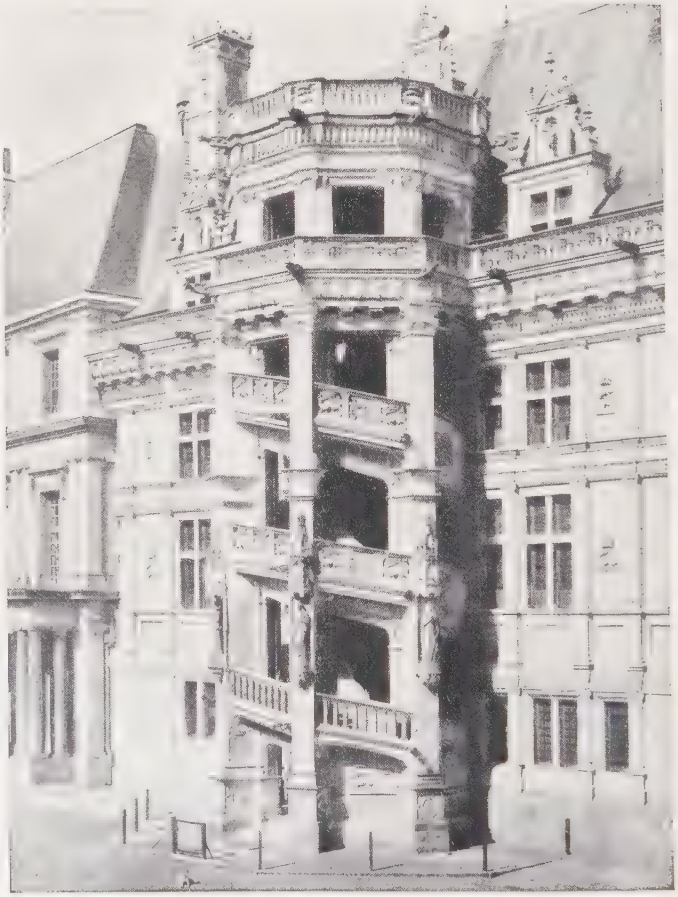


Photo. Neurdein.

FIG. 83.—THE LOUVRE—PAVILLON HENRI II.
(Portion of Lescot's work on left.)



Photo, Neurdein.

FIG. 84.—GRAND STAIRWAY, CHATEAU OF BLOIS.

above the cresting. It then became octagonal on plan, the sides decorated with niches or geometrical ornaments in bold relief. This, the first independent storey, was crowned by a stalactite cornice carrying the balcony (fig. 59), from which the *muezzin* (call-to-prayer) was chanted. In the early and fine examples the balustrade round it consisted of vertical posts with panels between, pierced with geometric ornaments, and all in stone. The second storey, also octagonal, was set back sufficiently to allow a passage round, and this was crowned by a similar stalactite cornice and balustrade. A third storey, sometimes circular on plan, completed the tower, which was crowned with a bulbous terminal. In one of the mosques, that of El Azhar, the first storey is square on plan, and the second storey has twin towers with lofty bulbous finials. The elaboration of the carved ornament on the various storeys of the minarets is of considerable beauty. Among the most remarkable, other than those already referred to, are the minarets of the mosque of al-Bordeni, of Kalaun, al-Nazir, Mu‘ayyad (built on the semicircular bastion wall of the Zuwela Gate), Sultan Barkuk (1348), and numerous other mosques or tombs outside Cairo.

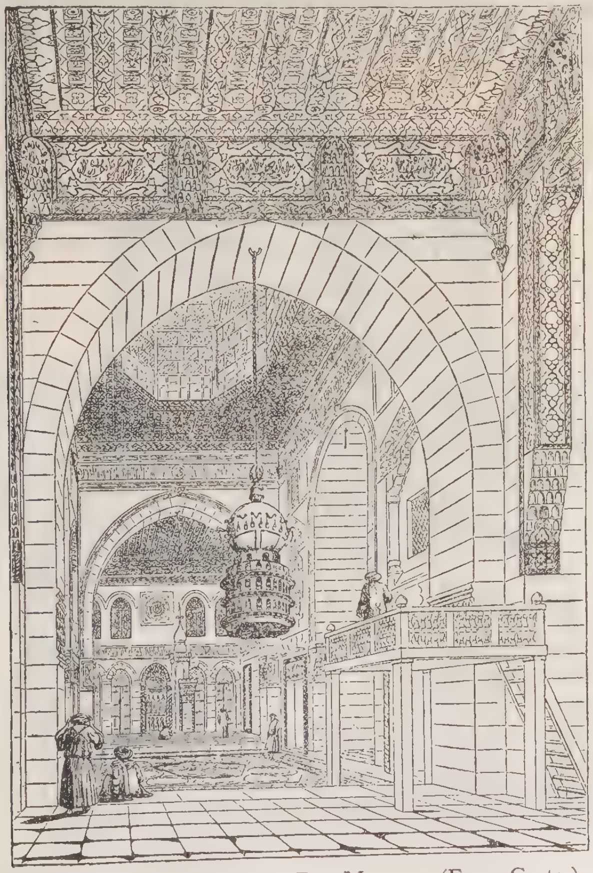


Fig. 58.—Interior of Kait Bey Mosque. (From Coste.)

The earlier domes were quite plain, hemispherical, with buttresses round the base, similar to those of St Sophia at Constantinople. In the later domes it was found that by raising the upper portion so as to take the form in section of a pointed arch, they could be built in horizontal courses of masonry up to about two-thirds of their height, the upper portion forming a lid without any thrust. It is probably owing to this method of construction that they still exist in such large numbers. The outer surfaces are decorated in various ways with geometrical designs, star patterns, chevrons, diapers, &c. Domes built in brick were covered with stucco and divided up into godroons.

We have already referred to the lofty portal of the mosque of Sultan Hasan; portals of smaller dimensions form the principal entrance to all the mosques and private houses. The recessed portion rises to twice or three times the height of the door, and its pointed or cusped head is always filled by a rich stalactite vault.

The descriptions of the disposition of plan, and the principles which have governed the plans of the Cairene mosques, apply equally to those in Syria, so that it now only remains necessary to quote the chief examples. Of these the earliest is the Dome of the Rock, incorrectly called the mosque of Omar, which was built by Abdalmalik in 691, partly with materials taken from the buildings destroyed by Chosroes. At first it consisted of a central area enclosing the sacred rock, covered with a dome and with aisles round carried on columns and piers, and like the smaller Dome of the Chain open all round, but the climate of Syria is very different from that in Egypt, and consequently at a later period (813–833) the sultan Mamun built the walls which now enclose the whole structure. Many restorations have taken place since, and the dome with its rich internal decoration is attributed to Saladin (1189). The magnificent Persian tiles which encase the walls, the marble casing of some of the piers, and the stained glass, form part of the works of Suleiman (1520–1560).

The great mosque of Damascus occupied the site of an ancient church dedicated to St John the Baptist, which for a time was divided between the Christians and the Mahommedans. But in 705 the caliph al-Walid took possession of the whole church, which he rebuilt, retaining, however, the whole of the south wall, portions of which belonged to a Roman temple. This, which by chance happened to face south, became the Mecca wall, the niche being sunk in one of the doorways of the original temple. Its plan, therefore, is a variation of those we have already described. It consists of a transept with dome over the centre, three aisles of equal width, running both east and west, and a great court on the north side surrounded by arcades. The great transept is virtually the prayer chamber. The new building was erected by Byzantine masons sent from Constantinople, and decorated with marbles and mosaic by Greek artists. The mosque was almost entirely destroyed by fire in 1893, but has since been rebuilt.

The mosque of El Aksa in the sacred enclosure in Jerusalem, and south of the Dome of the Rock, was commenced by Abdalmalik (691), who used up materials taken from the church of St Mary, built by Justinian on Mount Sion, which had been destroyed by Chosroes. There have been so many restorations and rebuildings since, owing to destructive earthquakes and other causes, that it is difficult to give the precise dates of the various portions. The columns of the nave and aisles are extremely stunted in proportion, and their capitals are of a very debased type, copied by inferior artists from Byzantine models. They carry immense wood beams cased, and above them a range of pointed arches, among the earliest examples used throughout a mosque, and probably dating from the rebuilding (774–785). The Crusaders made various additions in the rear, but the great entrance porch is said to have been added by Saladin, after 1187, and was built probably by Christian masons who were allowed to remain in the country.

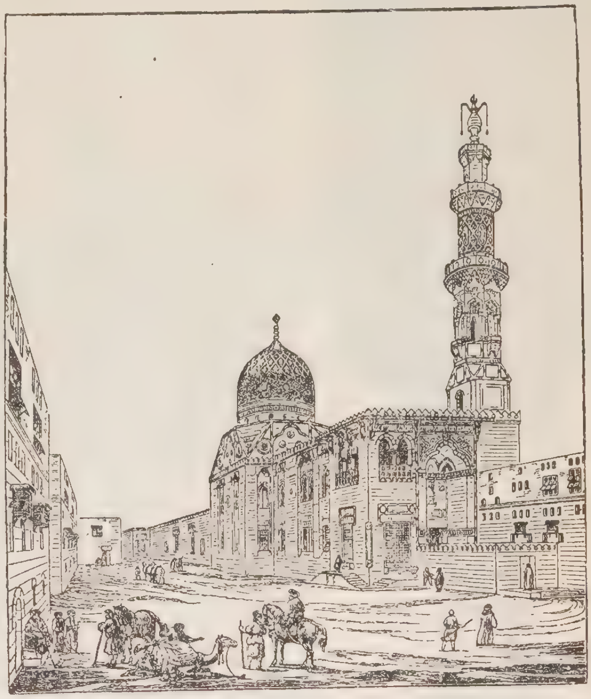


Fig. 59.—Exterior of Kait Bey Mosque, Cairo. (From Coste.)

The numerous minarets at Jerusalem and Damascus in general design follow those of Egypt, but instead of the incised work are generally encased with marble in geometric patterns.

The great mosque at Mecca, from which it was thought at one time the plan of the Egyptian and other mosques was taken, is necessarily different from all others, because the Ka‘ba or Holy Stone, towards which all the niches in all other mosques turn, stood in its centre. The arcades which surround the court were nearly all rebuilt in the 17th century, as the whole mosque was washed away by a torrent in 1626.

The mosque of Kairawan in Tunisia was built in 675. It occupies an area of 427 ft. deep and 225 ft. wide, with a prayer chamber at the Mecca end of 17 aisles and 11 bays deep, more than twice, therefore, that of ‘Amr in Old Cairo. The columns to the prayer chamber, all taken from ancient buildings, are 22 ft. high in the central aisle and 15 ft. in all the others. They carry horse-shoe arches, which, as in the mosque of 'Amr, are all tied together by wood beams inserted at the springing of the arches.

The mosque of Cordova was built by Abdarrahman (Abd-ar-Rahman) in 786–789 in imitation of the mosque of Kairawan. There were eleven aisles of twenty-one bays, the centre one slightly wider than the other. The materials were taken from earlier buildings, and, as the columns and caps were not considered high enough, above the horse-shoe arches are built a second row of arches which carry the barrel vaults. To this mosque Hakim added twelve more bays in depth at the Mecca end (962), and in 985 Mansur added eight more aisles of thirty-three bays on the east side. Part of the open court on the north side dates from Abdarrahman's foundation (690) and part from Mansur.

In the mosque of Cordova we find the earliest example of the cusped arch, in the additions made by Hakim in 961; in order to obtain a greater height above the columns, it became necessary to employ the expedient of raising arch above arch in order to obtain the height they required for the ceilings; and as these arches formed purely decorative features, which might otherwise have become monotonous, variety was given by introducing the cusped form of arch and interlacing them one within the other. It is probably this elaborate design which suggested the plaster decorations of the screens above the arches in the court of the Alhambra. Though commenced in 1245, the existing palace of the Alhambra was built in the first half of the 14th century, at a time when the style was fully developed. There are two great courts at right angles to one another, the most important of which was the Court of the Lions, so called from the fountain in the centre, with twelve conventional representations of that animal carrying the basins. This court is surrounded by an arcade with stilted arches carried on slender marble columns with extremely rich decoration above, partly in stucco painted and gilt. The hall of the Abencerrages (35 ft. square) has a polygonal dome covered with arabesque (fig. 60). Two other halls are roofed with lofty stalactite vaults of great intricacy, richly gilded and of remarkable effect (fig. 61), but the employment of stucco instead of stone, as in Egypt, has led to an abuse in the wealth of enrichment, which is only partly redeemed by the plain masonry of the towers and walls enclosing the palace. The Giralda at Seville is the only example of a tower, but it does not seem to have served the purpose of a minaret.

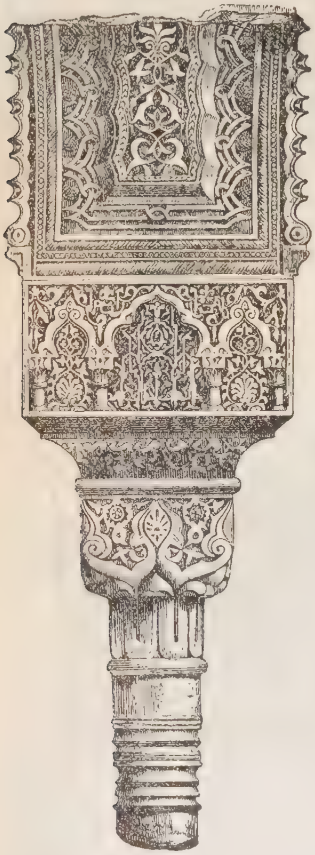


FIG. 60.—Capital and Springing of Arch, from the Hall of Abencerrages, Alhambra.

With the exception of the tombs of Zobeide and Ezekiel near Bagdad, and a hospital at Erzerum of the 12th century, built by the Seljukian dynasty, the Mahommedan style in Persia dates from the 13th century, *i.e.* if Ghazan Khan built the mosque at Tabriz in 1294. The plan is that of a Byzantine church with a central dome, aisles and sanctuary. The portal consists of a lofty niche vaulted with semi-domes and stalactite pendentives, similar in many respects to the well-known example of Sultan Hasan in Cairo, built sixty years later. It is built in brick and covered internally and externally with glazed bricks of various colours, wrought into most intricate patterns with interlacing ornament and with Cufic inscriptions. The dazzling and perfect beauty in point of colour is not to be surpassed, but from the architectural point of view it possesses the fatal sin of not showing its construction. The bricks and tiles are only a veneer, and though in certain features (such as the portal and the dome) the construction is at least suggested, the tendency is to trust to decoration alone to produce architectural effects. (But see TABRIZ.)

The great mosque at Isfahan (1585) is a good illustration of the danger attending a too free use of surface decoration. Strip the walls of their tiles, and nothing is left except square box-like forms with pointed arched openings of different form. The interior, however, owing to the variety of its features, and the varied play of light and shade given in the hemispherical vaults of its transepts and niches and the vaulted aisles, constitutes one of the most beautiful monuments of Mahommedan art.

Apart from the great development of Mahommedan architecture in India (see INDIAN ARCHITECTURE), there remains now to be described only one other phase of the style, that found in Constantinople.

Prior to the conquest of Constantinople in 1445, two mosques were built by the Turks at Brusa in Asia Minor. The plan of Ulu Jami, the great mosque, follows the original courtyard type. Yeshil Jami, the Green mosque (1430), built on the site of a Byzantine church, is cruciform on plan. In both of them the Persian influence is shown, in the magnificent towers with which they are covered, the marble casing and the stalactite vaults.

After the conquest of Constantinople, the supreme beauty of St Sophia, and the adaptability of its plan to the requirements of the Mahommedan faith, caused it to be accepted as the model on which all the new mosques were based. The first two erected were the Bayezid (1497–1515) and the Selim mosques (1520–1526). In the former the dome and its pendentives are carried on octagonal piers. and the dome, 108 ft. in diameter, is greater than in any subsequent example. The finest mosque, and the example in which we find the complete development of the Turkish style, is that erected by Suleiman the Magnificent in 1550–1555. This mosque, designed by Sinan, an Armenian architect, is still quite perfect. The plan follows very closely its model, St Sophia, and consists of a central dome, 86 ft. in diameter and 156 ft. high, carried on pendentives, resting on great arches which are slightly pointed, with great apses on the east and west sides, and three smaller apses in each, the arches of which are all circular. The principal change in design is that found in the north and south walls, under the arches carrying the dome; in St Sophia they were subdivided into two storeys with galleries overlooking the church, but in the Suleimanic mosque the galleries are set back in the outer aisles, and the screen walls consist of a wide central and two side pointed arches, and voussoirs alternately of black and white marble. The tympana above this is pierced with eighteen windows filled with geometric tracery. Stalactite work is employed in the pendentive of the smaller apses and in the capitals of the columns carrying the pointed arches. The columns are of porphyry, the shafts, 28 ft. high, being taken from the Hippodrome and probably brought originally from Egypt. The walls are cased with marble up to the springing of the dome, but the magnificent mosaics of St Sophia are here replaced by vulgar colouring and plaster decoration of a rococo style, due probably to recent restorations. The mosque is preceded by a forecourt, surrounded by an arcade on all sides and containing a fountain, and in the garden in the rear is the tomb of the founder and his wife.

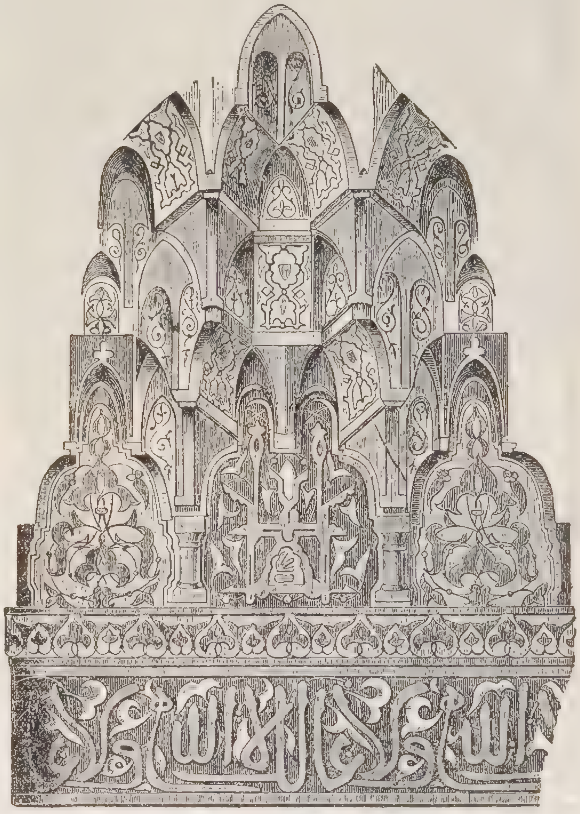


FIG. 61.—Pendentive, from the Court of the Lions, Alhambra.

The Shah-Zadeh mosque, known as the prince's mosque, was also built by Sultan Suleiman, from the designs of Sinan, the same

Armenian architect who built the Suleimanic mosque. Here, instead of confining the great apses to the east and west sides, they are introduced on the north and south sides in place of the screen, and produce a monotonous and poor effect. The same design is found in the Ahmedin mosque, built 1608, and with the same result. Externally, however, they are both fine, owing to the variety of domes, semi-domes and other curved forms of roof.

The minarets of the Turkish mosques are very inferior to those of Cairo. They are of great height, generally semicircular, with narrow balconies round the upper part, and crowned with extinguisher roofs. To a certain extent, however, they contrast very well with the domes and semi-domes of St Sophia and those of the mosques built by the Turks.

In the mosque of Osman, built 1748–1757, we find the first trace of Western influence in its rococo design, but here, as in the mosque of Mehemet Ali in Cairo, built in 1837, the scheme is so good that, notwithstanding the great falling off in design, and, in the latter mosque, the construction, the effect of the interior is very fine.

Amongst other architectural features, the fountains in the courtyards of the mosques and those which decorate the public squares are extremely pleasing in design. The latter are square on plan with polygonal angles, elaborate niches with stalactite heads, with overhanging eaves on each side; the ornament is very varied and the colour sometimes very attractive. The roofs have sometimes most picturesque outlines. (R. P. S.)

Modern Architecture

The beginning of the 19th century may be considered to mark the beginning of the modern era in architecture. The 19th century is the period *par excellence* of architectural "revivals." The great Renaissance movement in Italy already described was something more than a mere revival. It was a new spirit affecting the whole of art and literature and life, not an architectural movement only; and as far as architecture is concerned it was not a mere imitative revival. The great Italian architects of the Renaissance, as well as Wren, Vanbrugh and Hawksmoor in England, however they drew their inspiration from antique models, were for the most part original architects; they put the ancient materials to new uses of their own. The tendency of the 19th-century revivals, on the other hand, except in France, was distinctly imitative in a sense in which the architecture of the great Renaissance period was not. Correctness of imitation, in the English Gothic revival especially, was an avowed object; and conformity to precedent became, in fact, except with one or two individual architects, almost the admitted test of excellence.

Classical revival in British architecture.

The earliest classical London building of note in the 19th century is Soane's Bank of England, which as a matter of date belongs in fact to the end of the 18th century; but its architect lived well into the 19th century, and the bank may be classed with this section of the subject. Soane had to make something architectural out of the walls of a very extended building of only one storey, in which external windows were not admissible; and he did so by applying a classical columnar order to the walls and introducing sham window architraves. The latter are indefensible, and weaken the expression of the building; the columnar order was the received method at the time of making a building (as was supposed) "architectural," and the building has grace and dignity, and could hardly be taken for anything except a bank, although a more robust and massive treatment would have been more expressive of the function of the building, as a kind of fortress for the storage of money. It was only some years later that the Greek revival took some hold of English architects (the Bank of England is rather Roman than Greek); the impetus to it was probably given by the "Elgin marbles"; Stuart and Revett's great work on the *Antiquities of Athens* had been issued a good while previously, the three first volumes being dated respectively 1762, 1787 and 1794; but the appearance of the fourth volume in 1816 was no doubt influenced by the transportation to London of the Elgin marbles, and the sensation created by them. One of the first architectural results was the erection, at an immense cost in comparison with its size, of the church of St Pancras in London (1819–1822), designed by Inwood, who published a fine and still valuable monograph on the Erechtheum, and showed his enthusiasm for Greek architecture by copying the Erechtheum order and doorways for his façade, and erecting over it a tower composed of the Temple of the Winds with an octagonal imitation of the monument of Lysicrates imposed above it. This use of Greek monuments was architecturally absurd, though at the time it was no doubt the offspring of a genuine enthusiasm.

A better use was made of the study of Greek architecture by William Wilkins (1778–1839), who was in his way a great architect, and whose University College (1827–1828), as designed by him, was a noble and dignified building, of which he only carried out the central block with the cupola and portico. The wings were somewhat altered from his design but not materially spoiled, but the university authorities permitted the vandalism of erecting a low building as a partial return of the quadrangle on the fourth side, for the purposes of a mechanical laboratory, which ruined the appearance of the building.[1] Wilkins's other well-known work is the National Gallery (1832–1838), which he was not allowed to carry out exactly as he wished, and in which the cupola and the "pepperpots" are exceedingly poor and weak. But his details, especially the profiles of his mouldings, are admirably refined, and show the influence of a close study of Greek work. Among other prominent English architects of the classic revival in England are Sir Robert Smirke and Decimus Burton (1800–1881). To Burton we owe the Constitution Hill arch and the Hyde Park screen. The latter is a very graceful erection of its kind; the arch has never been completed by the quadriga group which the architect intended as its crowning feature, though for many years it was allowed to be disfigured by the colossal equestrian statue of Wellington, completely out of scale and crushing the structure. Smirke is kept in memory by his fine façade of the British Museum, which has been much criticized for its "useless" colonnades and the wasted space under them. The criticism is hardly just; for classic colonnades have at least some affinity with the purposes of a museum of antique art, and it conveys the impression of being a frontispiece to a building containing something of permanent value and importance. The early classic revival set its mark also, in a very fine and unmistakable manner, on the capital of the sister island. Dublin is almost a museum of fine classic buildings of the period, among which the most remarkable is the present Bank of Ireland (fig. 85), originally begun as the Parliament House. The beginning of the building belongs to the 18th

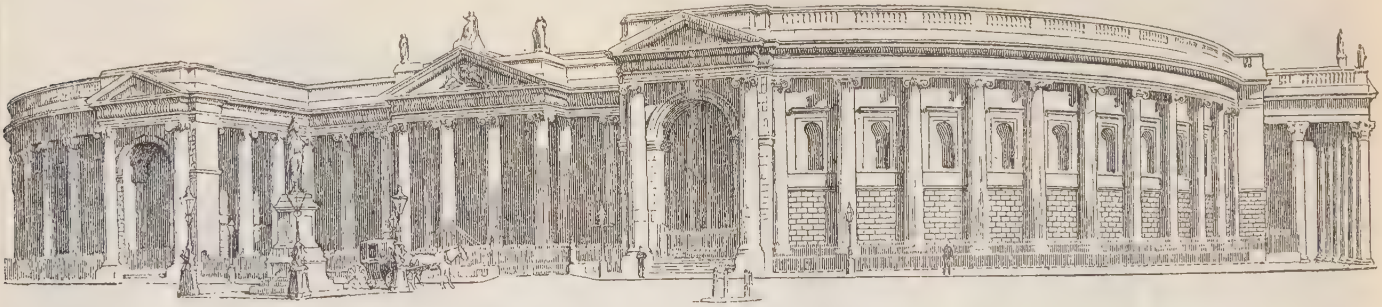


Fig. 85.—Bank of Ireland, Dublin.

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[1] Wilkins made two designs for the whole building; one leaving the quadrangle entirely open on the fourth side, towards the street; the other showing a low open colonnaded screen connecting the ends of the two wings. He never for a moment contemplated closing in the quadrangle by buildings on the fourth side.

century, but it was not completed in its present form till 1805, and was the work of five successive architects, only one of them, James Gandon (1743–1823), a man of the first importance; but it was Gandon who in 1790 did most to give the building its effective outline on plan, by introducing one of the curved quadrant walls, the building being subsequently finished in accordance with this suggestion. It is a remarkable combination of symmetry and picturesqueness, and as a one-storey classic building is far superior to Soane's Bank of England, with which a comparison is naturally suggested. Gandon's custom house, with its fine central cupola, is another notable example. Edinburgh too can show examples of the classic revival, and bears the title of "modern Athens" as much from her architectural experiments as from her intellectual claims; she illustrates the application of Greek architecture to modern buildings in two really fine examples, the Royal Institution by W. H. Playfair (1789–1857), and the high school by Thomas Hamilton (1784–1858). It was a pity that she added to these the collection of curiosities on the Calton Hill.

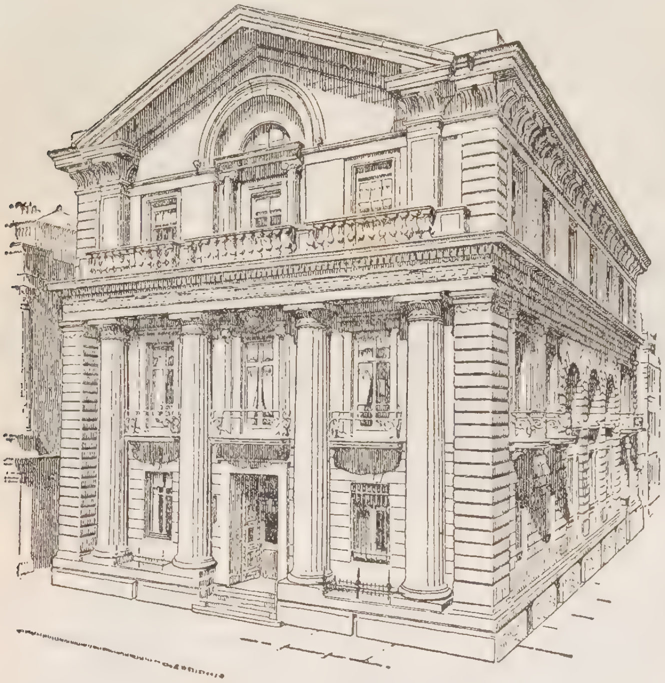
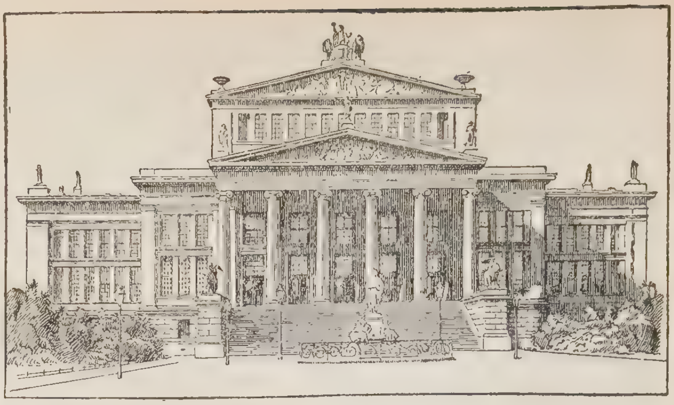


Fig. 86.—Liverpool Branch of the Bank of England. (Cockerell.)

But before we quit the classic revival in England, there are two architects to be named who came a little later in the day, living in fact into the time of the Gothic revival, who were superior to any of the earlier classic practitioners: Harvey Lonsdale Elmes and C. R. Cockerell. Elmes, who died very young, seems to have been as completely a born architectural genius as Wren, and his great work, St. George's Hall at Liverpool, has done more than any other building in the world to glorify the memory of the classic revival. Granting all that may be said as to the unsuitability of Greek architecture to the English climate, one can hardly complain of any movement in architecture which gave the opportunity for the production of so grand an architectural monument. It is true that it is badly planned and lighted, and the exterior and interior do not agree with each other (the exterior is Greek, and the great hall is Roman); but if from our present point of view it is a mistake, it is certainly one of the finest mistakes ever made in architecture. Cockerell, who completed the interior of the building after Elmes's death, was an architect permeated with the principles and feeling of Greek architecture, who brought to his work a refinement of taste and perception in regard to detail which has rarely been equalled and never surpassed. Perhaps the very best example of his scholarly taste in the application of classic architecture to modern uses is to be found in his façade to the branch Bank of England at Liverpool (fig. 86).

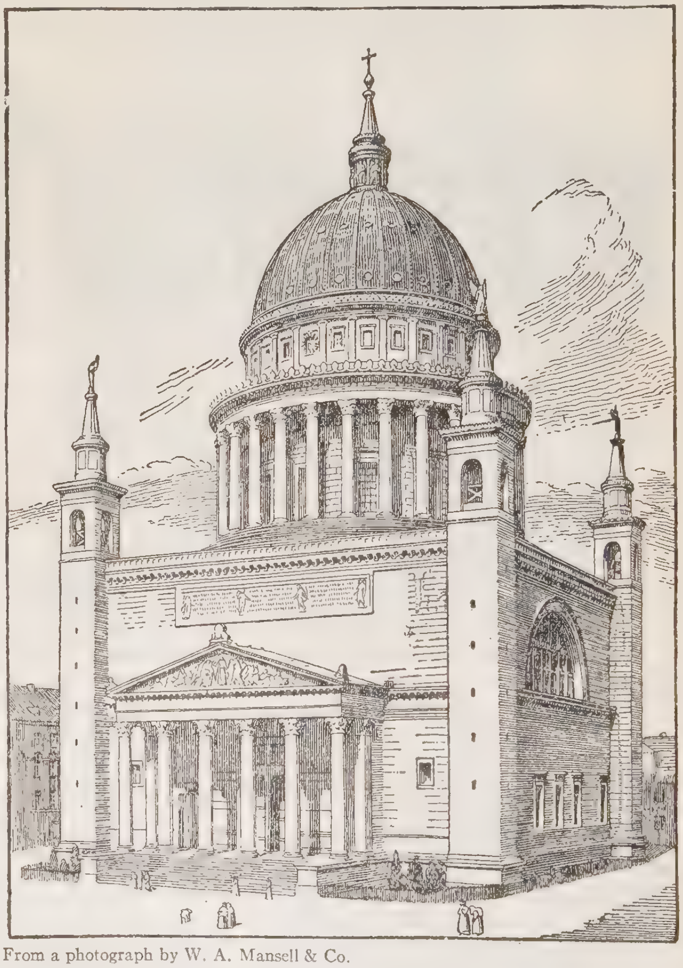


From a photo by W. A. Mansell & Co.

Fig. 87.—Royal Theatre, Berlin. (Schinkel.)

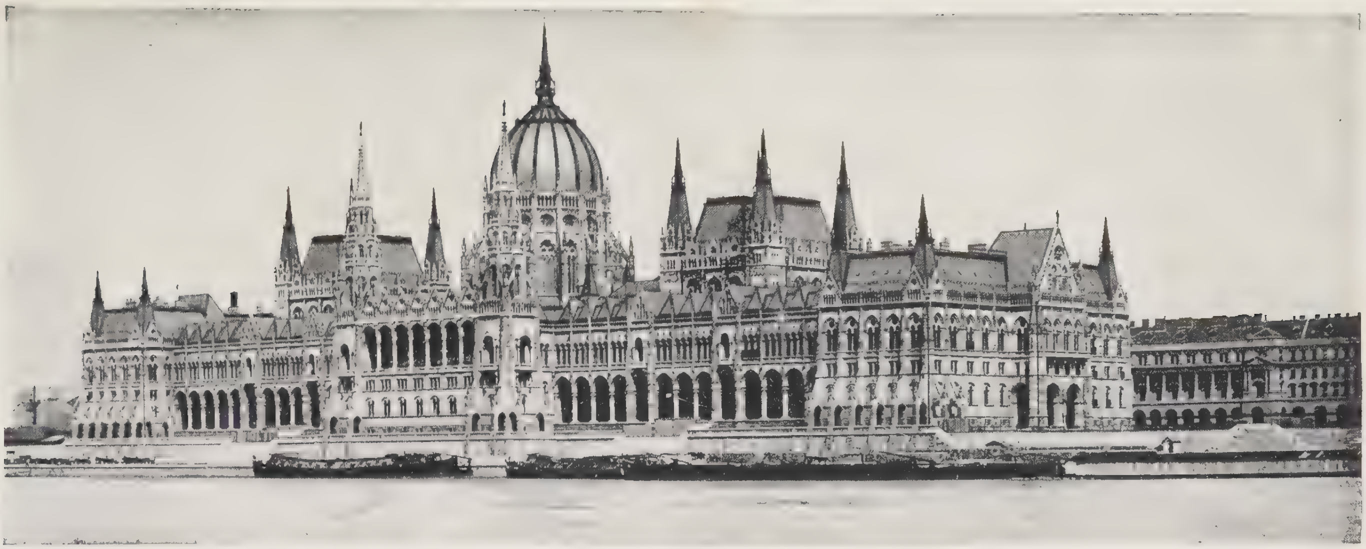
Classical revival in Germany.

In Germany, and especially at Berlin and Munich, the Greek revival took hold of architecture in the early part of the century in a more decisive but also in a more academical spirit than in England. The movement is connected more especially with the name of one eminent architect, Karl Friedrich Schinkel, who must have been a man of genius to have so impressed his taste on his generation as he did in Berlin, where he was regarded as the great and central power in the architecture of his day; yet his buildings are marked by learning and academical correctness rather than original genius. Elmes's St George's Hall, already referred to as one great English work of the classic revival, is by no means a mere piece of academical architecture; it exhibits in some of its details a great deal of originality, and in its general design a remarkably fine feeling for architectural grouping. In particular, the solid masses and the heavy square columns at the



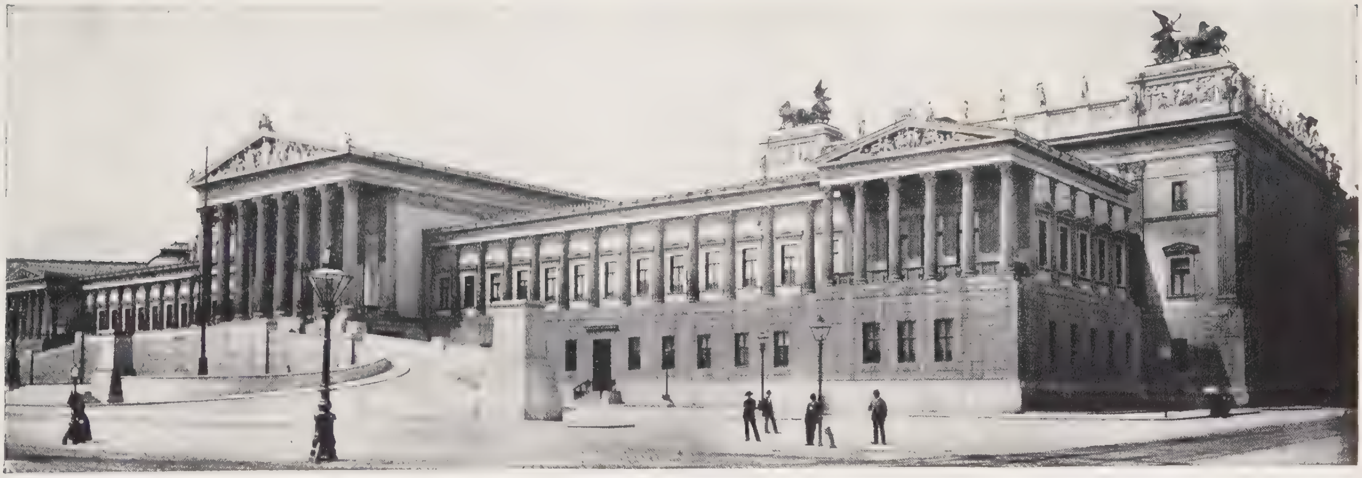
From a photograph by W. A. Mansell & Co.

Fig. 88.—Nikolai Kirche, Potsdam. (Schinkel.)



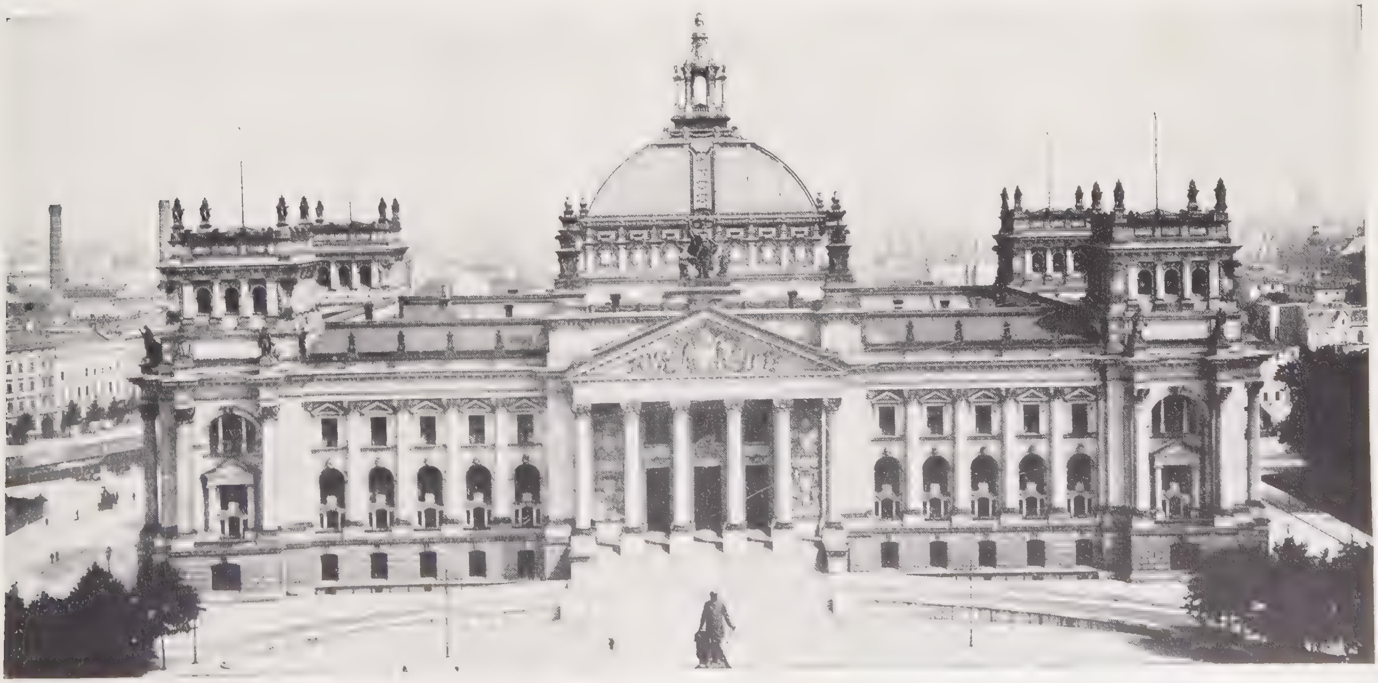
Photo, Beer.

FIG. 115.—PARLIAMENT BUILDINGS, BUDAPEST. (STEINDL.)



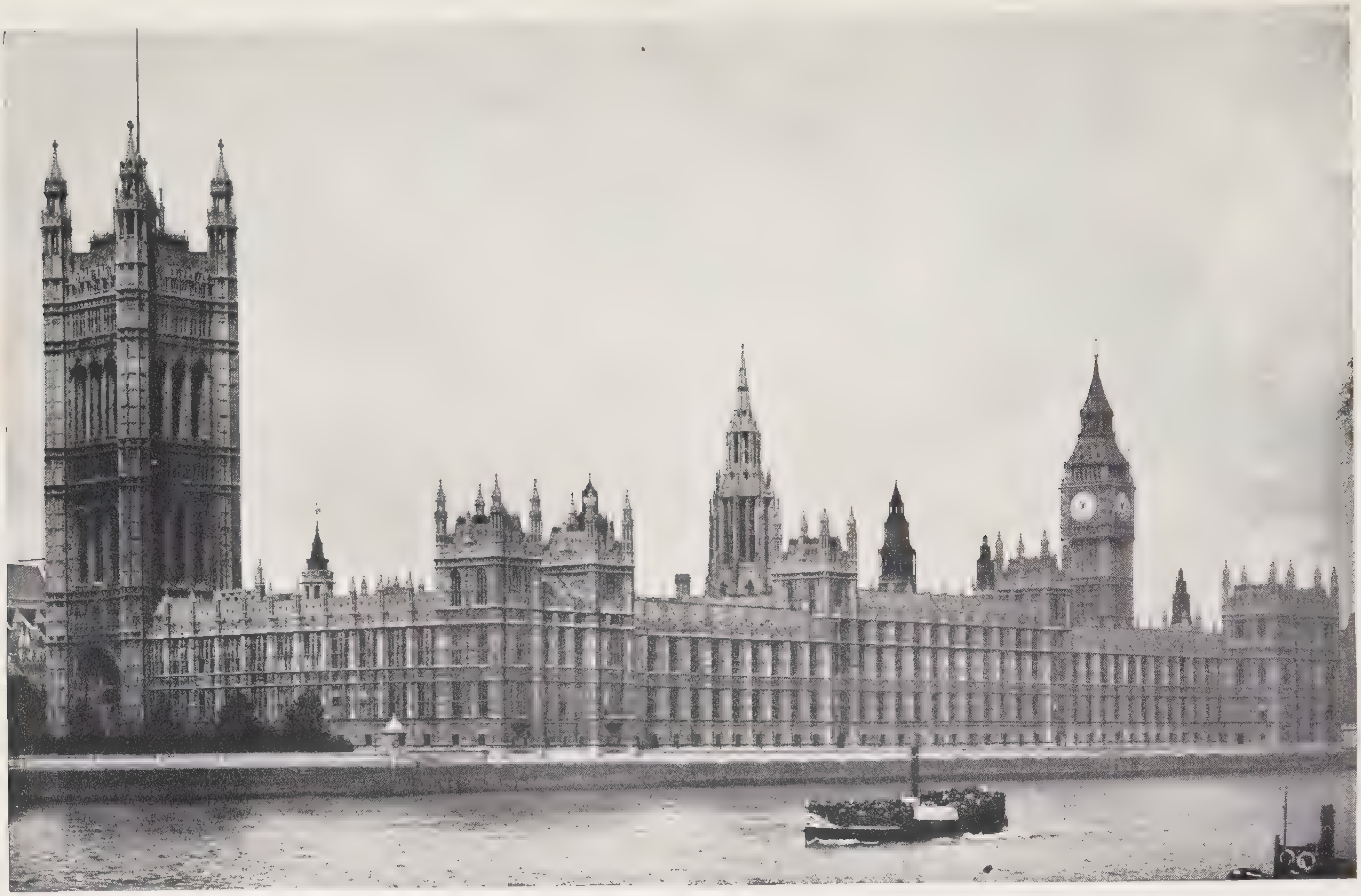
Photo, Lowy.

FIG. 116.—PARLIAMENT BUILDINGS, VIENNA. (HANSEN.)



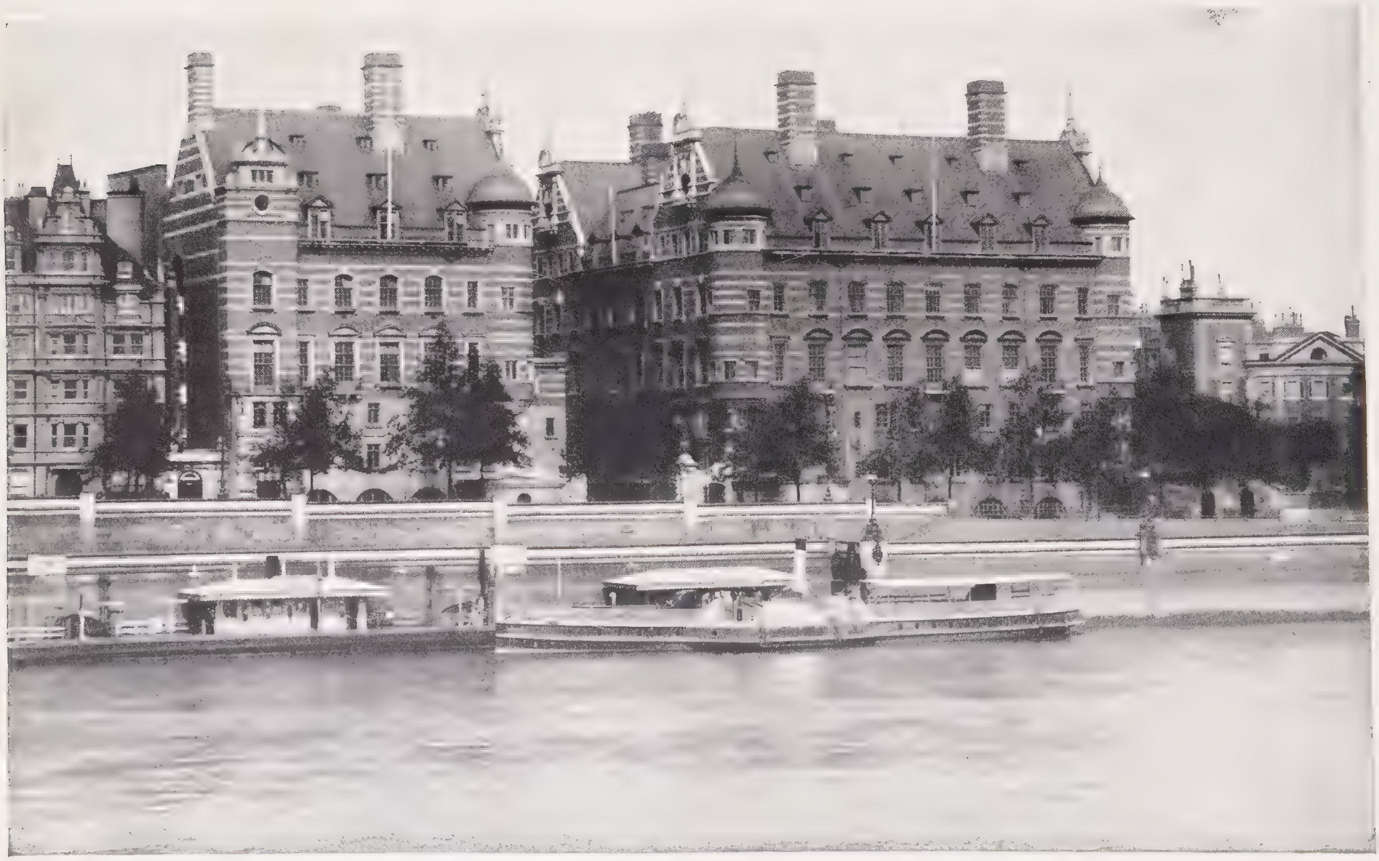
Photo, Linde.

FIG. 117.—PARLIAMENT BUILDINGS, BERLIN. (WALLOT.)



Photo, F. G. O. Stuart.

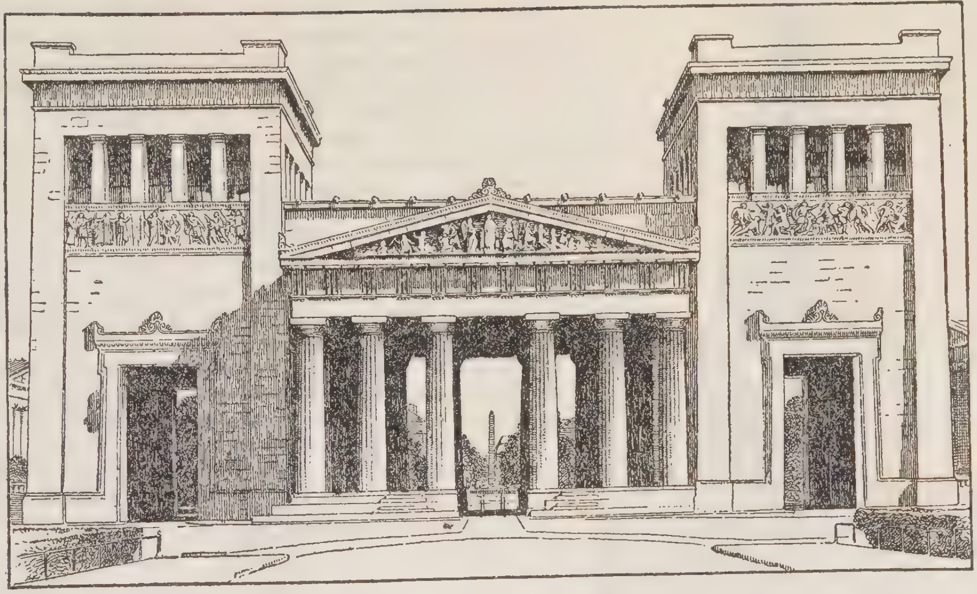
Fig. 118.—HOUSES OF PARLIAMENT, LONDON. (BARRY.)



Photo, Emery Walker.

Fig. 119.—SCOTLAND YARD, LONDON. (SHAW.)

ends of his building, which seem like Greek architecture treated with Egyptian feeling, give support to, while they form a most effective contrast with, the richer and more delicate Corinthian order of the central portion. The only work of Schinkel's which shows something of the same feeling for contrast in architectural composition is one of his smaller buildings, the Königswache or Royal Guard-house, in which a Doric colonnaded portico is effectively flanked and supported by two great masses of plain wall. But in general Schinkel does not seem to have known what to do with the angles of his buildings, or to have realized the value of mass as a support to his colonnades. This is strikingly exemplified in his museum at Berlin, where the tall narrow piers at the angles have a very weak effect, and are quite inadequate as a support to the long open colonnade. His Royal theatre also (fig. 87), though the central portico is fine, is monotonous and weak in its two-storeyed repetition of the small order in the wings, and it has also the fault (which it shares, no doubt, with a great many theatres, large and small) that its exterior design gives no hint of the theatre form; it might just as well be a museum. His Nikolai Kirche (1830–1837) at Potsdam (fig. 88), which has considerable celebrity, though not so merely academical in character, and in fact possessed of a certain originality, has a fault of another kind, in its entire lack of architectural unity; the dome does not seem to belong to or to have any connexion with the substructure, while the portico is quite out of scale with the great block of building in its rear, and looks like a subsequent addition. The fault of the Schinkel school of architecture is an almost total want of what may be called architectural life; it is an artificial production of the studio. The same kind of cold classicism prevailed at Munich, where Leo von Klenze (1784–1864), though a lesser man than Schinkel, played somewhat the same part as the latter played at Berlin. His Propylaea (fig. 89), in which Greek and Egyptian influences are combined, is a characteristic example of his cold and scholastic style. His well-known *Ruhmeshalle*, with its boldly projecting colonnaded wings and the colossal statue of Bavaria in front of it, is in its way a fine architectural conception—perhaps finer and more consistent in its kind than any one work of Schinkel, though he evidently did not exercise so wide an influence on the German art of his day. A third eminent name in the German classic revival is that of Gottfried Semper (1803–1879), somewhat later in date (Schinkel was born in 1781), but more or less of the same school. Semper practised successively at Dresden and at Zürich, but finally settled in Vienna, where, however, he did not live to see the execution of his two most important designs, the museum and the Hofburg theatre, which were carried out by Baron Karl von Hasenauer (1833–1894) from his designs, or approximately so. Semper's theatre at Dresden, however, shows that he could recognize the practical basis of architecture, as the expression of plan, in a way that Schinkel could not; for in that building he frankly adopted the curve of the auditorium as the *motif* for his exterior design, thus producing a building which is obviously a theatre, and could not be taken for anything else, and putting some of that life into it which is so much wanting in Schinkel's rigid classicalities.



From a photograph by Ferd. Finsterlin.

FIG. 89.—Propylaea at Munich. (Von Klenze.)

French classicism.

In spite of the Romanizing influence of the First Empire, the classic revival did not leave by any means so academical a stamp on French as on German architecture of the early period of the century. French architects in the main have always had too much original genius to be entirely taken captive by a general movement of this kind. There is the weak classicism of Bernard Poyet's façade to the chamber of deputies, a very poor affair; and there are two important buildings in the guise of Roman peripteral temples, devoted respectively to business and to religion—the Bourse, by Alexandre Théodore Brongniart (1739–1813), and the Madeleine, begun under Napoleon, as a "Temple de la Gloire," by Pierre Vignon (1763–1828), and completed as a church in 1841 by Jean Jacques Huvé (1783–1852). Both of these are very well carried out externally, and enable us to judge of what would be the effect of a Roman temple of the kind. It must be admitted that the plain oblong mass of the Bourse has really been very much improved by the recent addition of the two wings, carried out by Cavel, though there was a great deal of opposition at first to meddling with so celebrated a building. Unfortunately, the exterior of the Bourse is a mere piece of architectural scenery, quite unconnected with the internal object and arrangement of the building. The Madeleine is a really fine exterior in its way; if a modern church was to put on the guise of a pagan temple, the task could hardly have been better carried out; and the interior might have been as fine if properly treated, but it has little artistic relation with the noble exterior, and is spoiled by poor architectural treatment and bad ornament. The church of St Vincent de Paul, by Jacques Ignace Hittorff (1792–1867), an architect who was one of the most learned students of Greek architecture of his day, is another important example of the French classical church of the period (Plate XII., fig. 125). In this the interior is more consistent with the exterior than is the case in the Madeleine; and by adding a tower at each angle of the façade, above the colonnaded portico, the architect gave it more the expression of a church, which the Madeleine wants. In the Arc de l'Étoile, by Jean François T. Chalgrin (1739–1811), we have a really great, even sublime work, which, though suggested by the Roman triumphal arches, is no mere copy, but bears the impress of the French genius in its details as well as in François Rude's grand sculptures on the east face, while its great scale places it above everything else of the kind in the world. It is only after ascending the interior and seeing the vaults carrying the roof that one fully realizes what a stupendous piece of work this is. Under Napoleon there was at least no jerry-building.[1]

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[1] A remarkable instance of this is shown by the railway viaduct at Passy, a large and monumental piece of work in itself, which is built along the centre of the roadway of Napoleon's bridge. It was at first proposed to have a steel railway viaduct parallel with the old bridge, but it was found that the latter, both in respect of solidity and spacious dimensions, would fully bear the erection of the railway viaduct along its centre.

Barry's "common-sense" style, in England.

Returning to the consideration of architecture in England, we come, at about the close of the classic revival, to the name of the man who was undoubtedly the most remarkable English architect since Wren, Sir Charles Barry. To class him, as some would do, with the classic revival, would be a misapprehension. Barry was no revivalist; he never attempted to recreate Greek architecture on English soil. He adopted for most of his works what has been called, for want of a better name, the Italian style, which may really rather be called the common-sense style of a civilized society. The two first works which brought him into notice, the Travellers' and Reform clubs in London, were no doubt based on special Italian models, the Pandolfini and Farnese palaces; but a consideration of his whole career shows that he was in fact anything but a copyist. The comparison of him with Wren is justified by the fact that he was, like Wren, a born architect, in the sense that he grasped every problem presented to him from the true architect's point of view; with both of them architecture was not the dressing up of an exterior, but the fashioning of a building as a conception based on plan and section as well as on the desire to secure a certain external appearance; and, like Wren, he never failed to grasp the true requirements of a site and to adapt his architectural conception to it; a power perfectly different from that of merely producing agreeable elevations in this or that adopted style. Though very careful of his detail, he did not rely on detail, but on the general conception of an architectural scheme. This power was never so remarkably shown as in his grand scheme, unhappily never carried out, for the concentration of all the British government offices in one great architectural *ensemble*, which was to extend, on the west of Parliament Street and Whitehall, from Great George Street nearly to Charing Cross, the whole of the buildings to be carried out as one design, distributed into quadrangles, each of which was to be connected with one department of the administration, while all would have internal communication. Had this great idea been carried out we might at the present day have found some of the detail of the building unsatisfying to our taste, as we often find the detail in some of Wren's buildings, but we should have had a grand architectural achievement which would have made London pre-eminent among the capitals of the world. Nothing so great had been proposed in England since Inigo Jones's plan for Whitehall Palace, which also survives only in drawings, except the one noble bit of classic architecture known as the Banqueting House (Plate VI., fig. 75). It was one of the greatest misfortunes to London as a capital city that the government of the day could not rise to the height of Barry's ambitious scheme, in which there was nothing financially insuperable, since it was all designed to be carried out by portions at a time, as funds could be spared; but each government office built would in that way have been one step towards the completion of a great central idea; whereas the nation now spends the same money in erecting detached government buildings which have no architectural connexion with each other.

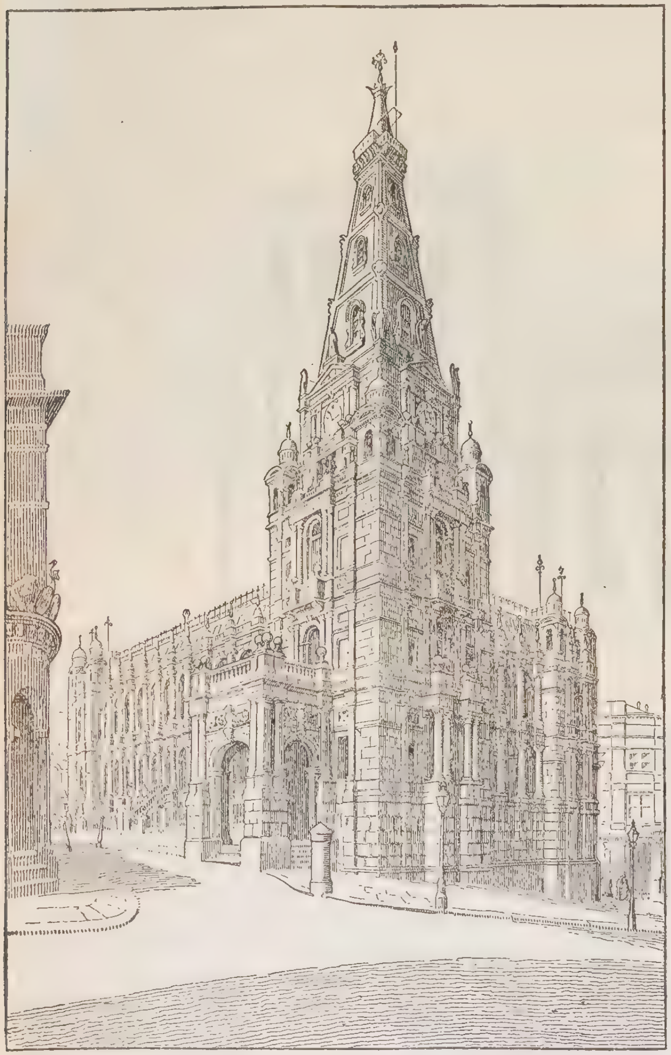


FIG. 90.—Halifax Town Hall. (Barry.)

Barry's two clubs before mentioned are almost ideals of club architecture—the architecture of a civilized society; his Bridgewater House is a building on a larger scale of the same type. That he had architectural ideas less staid and sober than these is shown, however, by the remarkable tower and spire of the Halifax Town Hall (fig. 90), his last work, which he did not live to see carried out, in which he contrived with remarkable success to give the Gothic spirit and multiplicity of effect to a tower which is nevertheless classic in detail. This tower is one of the most original and striking things in modern English architecture and shows how Barry's architectural ideas were developing up to the close of his life.

Barry's great building, the Houses of Parliament (Plate X., fig. 118), with which his name will always be more especially associated, comes accidentally, though not by natural development nor by his own choice, under the head of the Gothic revival. The style of Tudor Gothic was dictated to the competitors, apparently from a mistaken idea that the building ought to "harmonize" with the architecture of Henry VII.'s chapel adjacent to the site. Had Barry been left to himself, there is no doubt that the Houses of Parliament, with the same main characteristics of plan and grouping, would have been of a classic type of detail, and would possibly have been a still finer building than it is; and since the choice of the Gothic style in this case was not a direct consequence of the Gothic revival movement, it may be considered separately from that. The architectural greatness of the building consists, in the first place, in the grand yet simple scheme of Barry's plan, with the octagon hall in the centre, as the meeting-point for the public, the two chambers to north and south, and the access to the committee-rooms and other departments subordinate to the chambers. The plan (fig. 91) in itself is a stroke of genius, and has been more or less imitated in buildings for similar purposes all over the world; the most important example, the Parliament House of Budapest (Plate IX., fig. 115 and fig. 92), being almost a literal copy of Barry's plan. Thus, as in all great architecture, the plan is the basis of the whole scheme, and upon it is built up a most picturesque and expressive grouping, arising directly out of the plan. The two towers are most happily contrasted, as expressive of their differing purposes; the Victoria Tower is the symbol of the State entrance, a piece of architectural display solely for the sake of a grand effect; the Clock Tower is a utilitarian structure, a lofty stalk to carry a great clock high in the air; the two are differentiated accordingly, and the placing of them at opposite ends of the structure has the fortunate effect of indicating, from a distance, the extent of the plan. The graceful spire in the centre offers an effective contrast to the masses of the two towers, while forming the outward architectural expression of the octagon hall, which is, as it were, the keystone of the plan.

The detail is another consideration. Barry, having had a style forced upon him (most unwisely), which he had not studied much and with which he was not much in sympathy, associated Pugin with him to design a good deal of the detail; exactly how much is not certainly known; probably Pugin was responsible for all the interior detail and fittings; the exterior detail may have been only suggested or sketched by him. On this ground absurd attempts have been made, by people who do not seem to understand what architecture in the true sense means, to claim for Pugin what they call the "artistic merit" of the Houses of Parliament. The artistic merit consists in the whole plan, conception and grouping, which

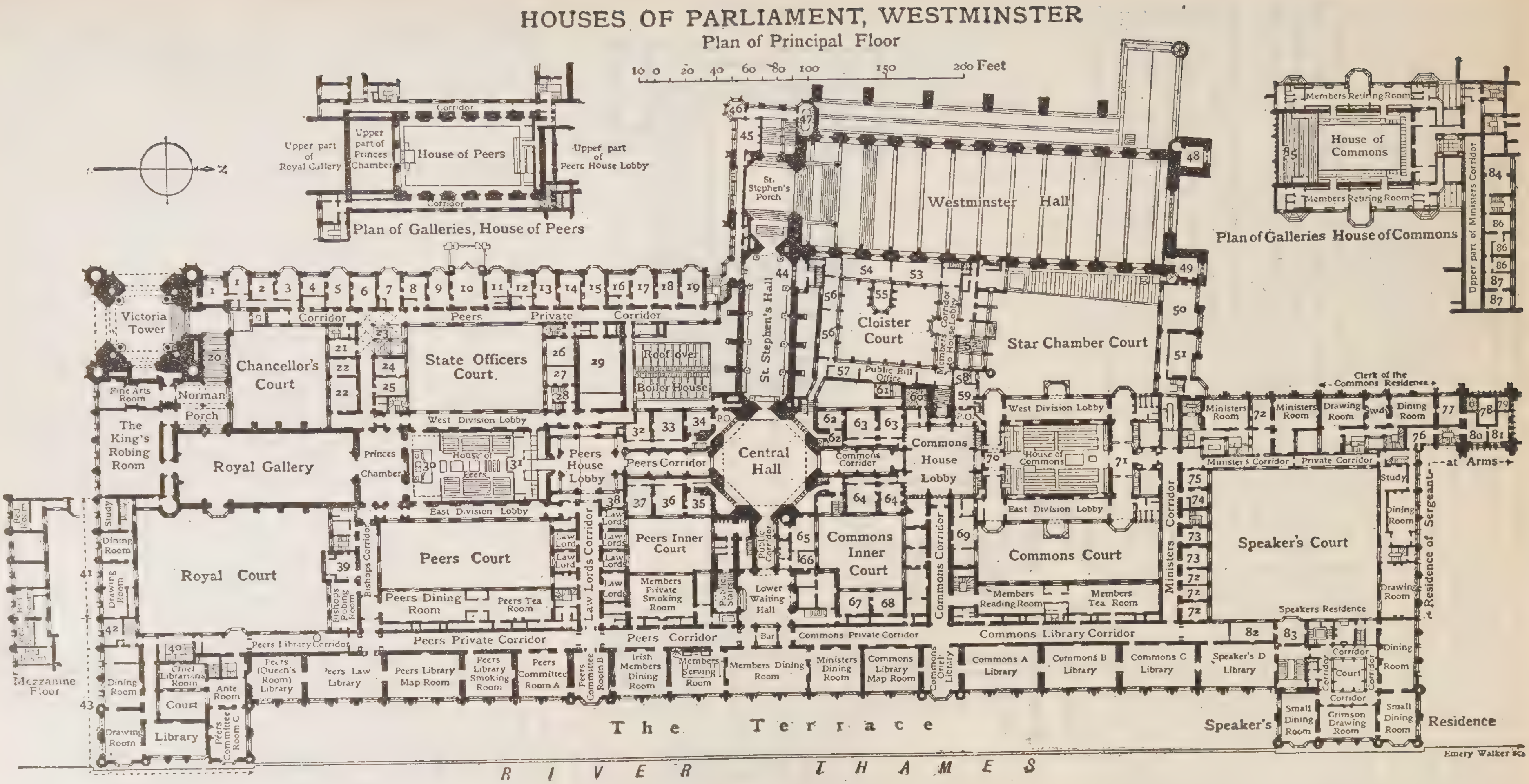

HOUSES OF PARLIAMENT, WESTMINSTER
Plan of Principal Floor
10 0 20 40 60 80 100 150 200 Feet
N
Upper part of Royal Gallery
Upper part of Princes Chamber
House of Peers
Corridor
Upper part of Peers House Lobby
Plan of Galleries, House of Peers
House of Commons
Members Retiring Room
Upper part of Ministers Corridor
Plan of Galleries House of Commons
Victoria Tower
Fine Arts Room
Norman Porch
The King's Robing Room
Chancellor's Court
Royal Gallery
State Officers Court
Princes Chamber
House of Peers
West Division Lobby
East Division Lobby
Royal Court
Peers Court
Peers Dining Room
Peers Tea Room
Bishops Corridor
Bishops Robing Room
Roof over Boiler House
Peers House Lobby
Peers Corridor
Law Lords Corridor
Peers Inner Court
Members Private Smoking Room
St. Stephen's Porch
St. Stephen's Hall
Westminster Hall
Central Hall
Public Corridor
Public Stairs
Lower Waiting Hall
Cloister Court
Public Bill Office
Members Corridor to House Lobby
Star Chamber Court
Commons Corridor
Commons House Lobby
Commons Inner Court
Commons Corridor
House of Commons
Commons Court
Members Reading Room
Members Tea Room
Ministers Corridor
Ministers Room
Drawing Room
Study
Dining Room
Clerk of the Commons Residence
Private Corridor
Speaker's Court
Speakers Residence
Residence of Sergeant-at-Arms
Peers Private Corridor
Peers Library Corridor
Peers Corridor
Commons Private Corridor
Commons Library Corridor
Bar
Mezzanine Floor
Dining Room
Drawing Room
Chief Librarians Room
Ante Room
Court
Library
Peers Committee Room C
Peers (Queen's Room) Library
Peers Law Library
Peers Library Map Room
Peers Library Smoking Room
Peers Committee Room A
Peers Committee Room B
Irish Members Dining Room
Members Serving Room
Members Dining Room
Ministers Dining Room
Commons Library Map Room
Commons Oriel Library
Commons A Library
Commons B Library
Commons C Library
Speaker's D Library
Corridor
Small Dining Room
Crimson Drawing Room
Speaker's Residence
The Terrace
RIVER THAMES
Emery Walker sc.

FIG. 91.

1. Reading Clerk.
2. Dressing Room.
3. Clerk of the Parliament.
4. Clerk Assistant's Dressing Room.
5. Clerk Assistant.
6. Clerk, House of Lords.
7. Messengers.
8. Waiting Room.
9. Lord Chancellor's Secretaries.
10. Lord Chancellor.
11. Lord Chancellor's Dressing Room.
12. Permanent Secretary.
13. Sergeant-at-Arms.
14. Yeoman Usher of the Black Rod.
15. Private Bill Office.
16. Chairman's **Dressing** Room.
17. Chairman of Committees.
18. Clerk to Private Bill and Taxing Office. [Counsel.
19. Chairman of Committees.
20. Royal Staircase.
21. Clerk to Public Bills.
22. Minutes.
23. Peers' Staircase.
24. Inner Office.
25. Printed Papers Office.
26. Private Bills and Taxing Office.
27. Earl Marshal.
28. Strangers' and Reporters' Stairs.
29. Peers' Standing Order Committee Room.
30. The Thrones.
31. Bar of the House.
32. Leader of the Opposition in the House of Lords.
33. Premier.
34. Telegraph.
35. Solicitor-General.
36. Attorney-General.
37. Lord Advocate.
38. Resident Superintendent.
39. Archbishops.
40. Principal Stairs.
41. Residence of the Yeoman Usher of the Black Rod.
42. Sitting Room.
43. Residence of the Clerk of Parliament.
44. Members' Entrance.
45. Dining Room of the Deputy Sergeant-at-Arms.
46. Turret Room.
47. Private Stairs of the Deputy Sergeant-at-Arms.
48. Journal Office Stores.
49. Police.
50. Ministers.
51. Opposition Ministers.
52. Members' Entrance Stairs.
53. Members' Conference Room.
54. Members' Private Secretaries.
55. Members' Small Conference Room.
56. Votes and Proceedings.
57. Accountant and Chief Public Bill Office.
58. Old Treasury Stairs.
59. Post Master.
60. Strangers' Stairs.
61. Cistern Tower.
62. Irish Whips.
63. Government Whips.
64. Opposition Whips.
65. Deputy Sergeant-at-Arms.
66. Clerk to Deputy Sergeant-at-Arms.
67. Speaker's Counsel.
68. Speaker's Counsel's Clerk.
69. Vote Office.
70. Bar Lobby.
71. Speaker's Lobby.
72. Ministers.
73. Clerk Assistant.
74. Train Bearers.
75. Speaker's Retiring Room.
76. Old Prison Rooms Lobby.
77. Sergeant-at-Arms' Smoking Room.
78. Clock Weight Shaft.
79. Air Shaft.
80. Smoking Room Lobby.
81. Butler.
82. Speaker's Secretary.
83. Audience Room.
84. *Times* Reporters.
85. Strangers' Gallery.
86. Waste Paper.
87. Mess.

are entirely Barry's, and which represent something beyond Pugin's grasp; the detail is in fact the weak element in the building. That Pugin's Gothic detail is better than Barry's would have been is very likely the case; but had Barry been left unfettered to work out the detail in his own school, the result would probably have been still better. Even as it is, however, the Houses of Parliament is one of the finest buildings in the world, ancient or modern, and it is to be regretted that Englishmen generally seem to be so little aware of this.

The Gothic Revival, England.

We may now turn to consider the Gothic Revival movement itself, of which Pugin was one of the most important pioneers. New ideas, however, as to the importance of Gothic architecture had been in the air before he came on the scene, and quite early in the century John Britton's *Architectural Antiquities of Great Britain* and *Cathedral Antiquities*, with their beautiful steel engravings by Le Keux, had done much to call attention to the neglected beauty of English medieval churches; and Thomas Rickman's remarkable and (for its day) masterly analysis of the variations of style in Gothic architecture, which first appeared in 1817, and went through edition after edition in succeeding years, gave the first intelligent direction to the study of the subject. Pugin supplied to the movement not analysis, but passion. He had the merit of having perceived, when quite a youth, that one thing wanted was better craftsmanship, and that craftsmanship in the medieval period was something very different from what it was in the early Victorian period; he set up an atelier of craftsmen, and was the real pioneer of what may be called the Arts and Crafts movement in England. An enthusiast by nature, he flung his whole soul into the task of reviving, as he believed, the glory of English medieval architecture; nothing else in architecture was worth thinking of; Classic and Renaissance were only worth sarcasm. The result in his works was a curious inconsistency. Pugin was not in the true sense a great architect; his mind was not practical enough to grasp an architectural problem as a whole, plan and building combined; in fact, he was no master of plan, and does not seem to have troubled himself much about it. But he had a remarkable perception of interior effect; whenever you go into one of his churches you recognize the desire to realize the greatest effect of height, the most soaring effect of lines, possible within the actual vertical measurements. But in his passion for this soaring expression he seems to have entirely lost sight of the essential quality of solidity and genuineness of material in the medieval architecture which he was trying to emulate or to outvie. So long as he could get his effect of height, his poetic interior, he was content to have thin walls and plaster vaults and ornaments; or, in other words, he spent upon height what should first have been spent upon solid and monumental building. The result has been gently but effectively satirized by Browning in "Bishop Blougram's Apology":—

> "It's different preaching in Basilicas
> To doing duty in some masterpiece
> Like this of brother Pugin's, bless his heart.
> I doubt if they're half-baked, those chalk rosettes,
> Ciphers and stucco-twiddlings everywhere;
> It's just like breathing in a limekiln, eh?"

It is too true; and there is something pathetic in Pugin's career, in this passionate and sincere pursuit after a revival of the medieval spirit in life and in architecture—a pursuit which towards the close of his life he himself evidently more than half suspected to have been a fallacy.

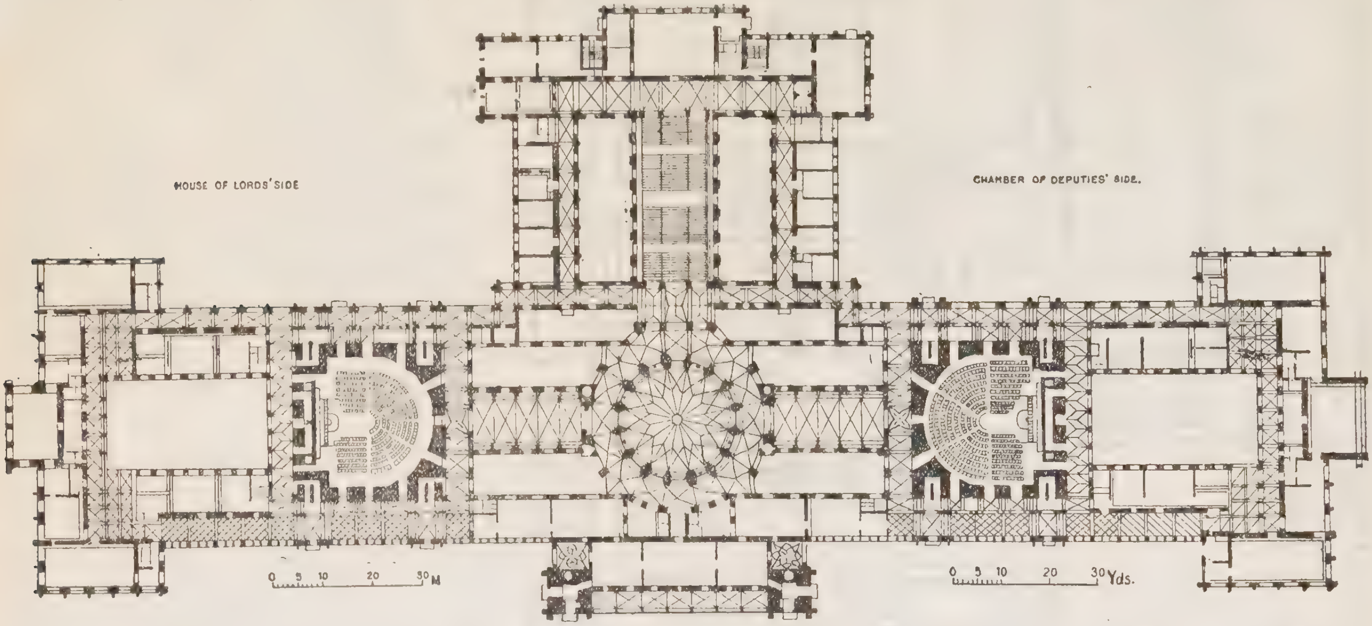


FIG. 92.—Plan of the Parliament House, Budapest. (Steindl.)

The full tide of the Gothic revival is connected more especially with the name of Sir Gilbert Scott. He was hardly a pure enthusiast like Pugin; he was a shrewd man of the world, the commencement of whose professional career coincided with the rising tide of ecclesiological reform, and he had the ability to make the best of the opportunity. He appears to have had, even as a child, an inborn interest in church architecture and in Gothic detail (witness the description, in his *Memoirs*, of his astonishment and interest, at the age of eleven, at the first sight of capitals of the Early English type), and he acquired by unremitting study a knowledge of English Gothic architecture in its every detail which few architects have ever equalled. His numerous churches were, intentionally and confessedly, as close reproductions as possible of medieval architecture, generally that of the Early Decorated period; and if it were desirable that modern church architecture should consist in the reproduction of medieval churches, the task could not have been carried out with more learning and exactitude than it was by him. It was this minute and accurate knowledge of medieval church architecture which made him such a power when the idea of restoring English cathedrals became popular. He had an acquired instinct in tracing out the existence of details which had been overlaid by modern repairs or plasterwork; in going over a cathedral to decide on a scheme of restoration he seemed to know it as an anatomist knows the suggestions of a fossil skeleton; and in the course of his restorations he unearthed many points in the architectural history of the buildings which but for him would never have been elucidated. We now recognize that much of this "restoration" was a mistake, which destroyed the real interest of the cathedrals; and it is unhappily a mistake which cannot be undone. But the violent reproaches which have been heaped upon Scott's memory on this account are rather unjust. It is forgotten that he was doing what at the time every one
]

considered to be the right thing; cathedral bodies vied with each other in restoration, and were enthusiastic in the cause; there were few if any dissenting voices; and in regard to the interiors of the cathedrals which were in modern use as places of worship, much that he did really required to be done to put them into decent condition. His churches have ceased to be interesting now, as is usually the case with copied architecture; but when they were built they were exactly what every one wanted and was asking for. And he produced at all events one original work which is a great deal better than it is now the fashion to think—the Albert Memorial. It is injured by the statue, for which the commission went to the wrong sculptor; but Scott's idea of producing, as he phrased it, "a shrine on a great scale," was really a fine one, and finely carried out. The most important objection to it is one which popular criticism does not recognize, viz. that the vault is tied by concealed iron ties, and would hardly be safe without them. But apart from that it is a fine conception, and Scott was right in regarding it as his best work.

G. E. Street, who was a pupil of Scott, was a greater enthusiast for medieval architecture (which, with him, as with Pugin, included medieval religion) than even Scott, and an architect of greater force and individuality. He was especially devoted to the early Transitional type of Gothic, and in all his buildings there is apparent the feeling for the solidity and monumental character, and the reticence in the use of ornament, which is characteristic of the Transitional period. His churches are noteworthy for their monumental character; and he had a remarkable faculty for giving an appearance of scale and dignity to the interiors of comparatively small churches. Hence his modern-medieval churches retain their interest more than Scott's, but in respect of secular architecture his taste was hopelessly medievalized, and his great building, the law courts in London, can only be regarded as a costly failure; it is not even beautiful except in regard to some good detail; it is badly planned; and the one fine interior feature, the great vaulted hall, is rendered useless by not being on the same floor with the courts, so that instead of being a *salle des pas perdus* it is a desert. Street's career is a warning how real architectural talent and vigour may be stultified by a sentimental adherence to a past phase of architecture. No modern architect had more fully penetrated the spirit of Gothic architecture, and his nave of Bristol cathedral is as good as genuine medieval work, and might pass for such when time-worn; but that is rather archaeology than architecture.

The competition for the law courts was one of the great architectural events of the middle of the century, and made or raised the reputation even of some of the unsuccessful competitors. Edward Barry (the son of Sir Charles) gained the first place for "plan," which the advisers of the government had foolishly separated from "design" (as if the plan of a building could be considered apart from the architectural conception!), giving first marks for plan, and second for design. E. Barry therefore had really gained the competition, "design," which was awarded to Street, counting second; but Street managed to push him out, and it is a nemesis on him for this by no means loyal proceeding that the building he contrived to get entirely into his own hands has served to injure rather than benefit his reputation. William Burges (1827–1881), an ardent devotee of French early Gothic, produced a design in that style, which, though quite unsuitable practically, is a greater evidence of architectural power than is furnished by any of his executed buildings. J. P. Seddon (1828–1906), an old adherent of Rossetti and the pre-Raphaelite brotherhood, an architect of genius who never got his opportunity, produced a design which was wildly picturesque in appearance but in reality more practical than might be thought at first sight, and his proposal for a great Record tower for housing official records was a really fine and original idea.

Among the ecclesiastical buildings of the Gothic revival those of William Butterfield (1814–1900), much less numerous than those of Scott and Street, have a special interest as the work of a revival architect who was something more than a mere archaeologist. All Saints, Margaret Street (1859), is the production of an architectural artist using medieval materials to carry out a conception of his own, and hence, like Babbacombe church and others by the same hand, it has an interest for the present day which Scott's churches have not. His Keble College chapel rather failed from an exaggeration of the use of polychromatic materials, which in some of his other churches he had used with moderation and with good effect. J. L. Pearson was another distinguished architect of the later period of the Gothic revival who was able to put something of his own into modern Gothic churches. No one was more learned in medieval architecture than he was; and as of Street's nave of Bristol, so we may say of Pearson's nave of Truro, that it is as good as medieval Gothic; indeed Truro nave is finer in character than some of the ancient cathedral naves, and represents pure Gothic at its best. But in the exteriors of his churches, as at Truro and in the churches of Kilburn and Red Lion Square, Pearson evolved a Gothic of his own which is Pearsonesque and not merely archaeological. James Brooks (1825–1901) also deserves an honoured place in the chronicle of the Gothic revival for being the first to show how large town churches might be erected in brick (fig. 93), in which largeness of scale and a certain grandeur of effect could be obtained without extravagant cost, and in which it was practically demonstrated that architecture in the true Gothic spirit could be produced without depending on ornament.

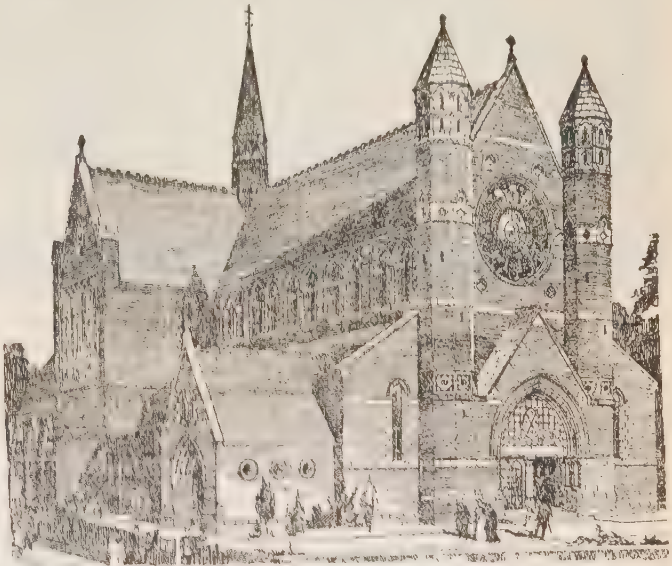


FIG. 93.—Exterior of modern English Church. (James Brooks.)

Alfred Waterhouse began his remarkable career as an adherent of the Gothic revival, and merits separate mention inasmuch as he was the only one of the Gothic revivalists who from the first set himself to adapt Gothic to secular uses and to make out of it a modern Gothic manner of his own. His first success was made with the Manchester law courts, a design more purely Gothic than his later works, and an admirably planned building (the only good point in the national law courts plan, the access to the public galleries, is taken from it); his special style was more developed in the Manchester town hall, a building typical both of the defects and merits of his secular Gothic style. This style of his received the compliment, for a good many years, of an immense amount of imitation; in fact, during that earlier period of his work it may be said to have influenced every secular building that was erected in the medieval style all over England. His Gothic detail was, however, not very refined, and he has been subject to the same kind of retrospective injustice which has fallen on Scott, critics in both instances forgetting that what they do not like *now* was what every one liked *then*, and could not have enough of. Waterhouse was a master of plan, and a man of immense business and administrative ability, without which he could not have carried out the number of great building schemes which fell into his hands, and he had much more of the qualities of a great architect than are to be found in the works of some of his latter-day critics. His later works, one or two of which will be referred to, do not come under the head of the Gothic revival.

France.

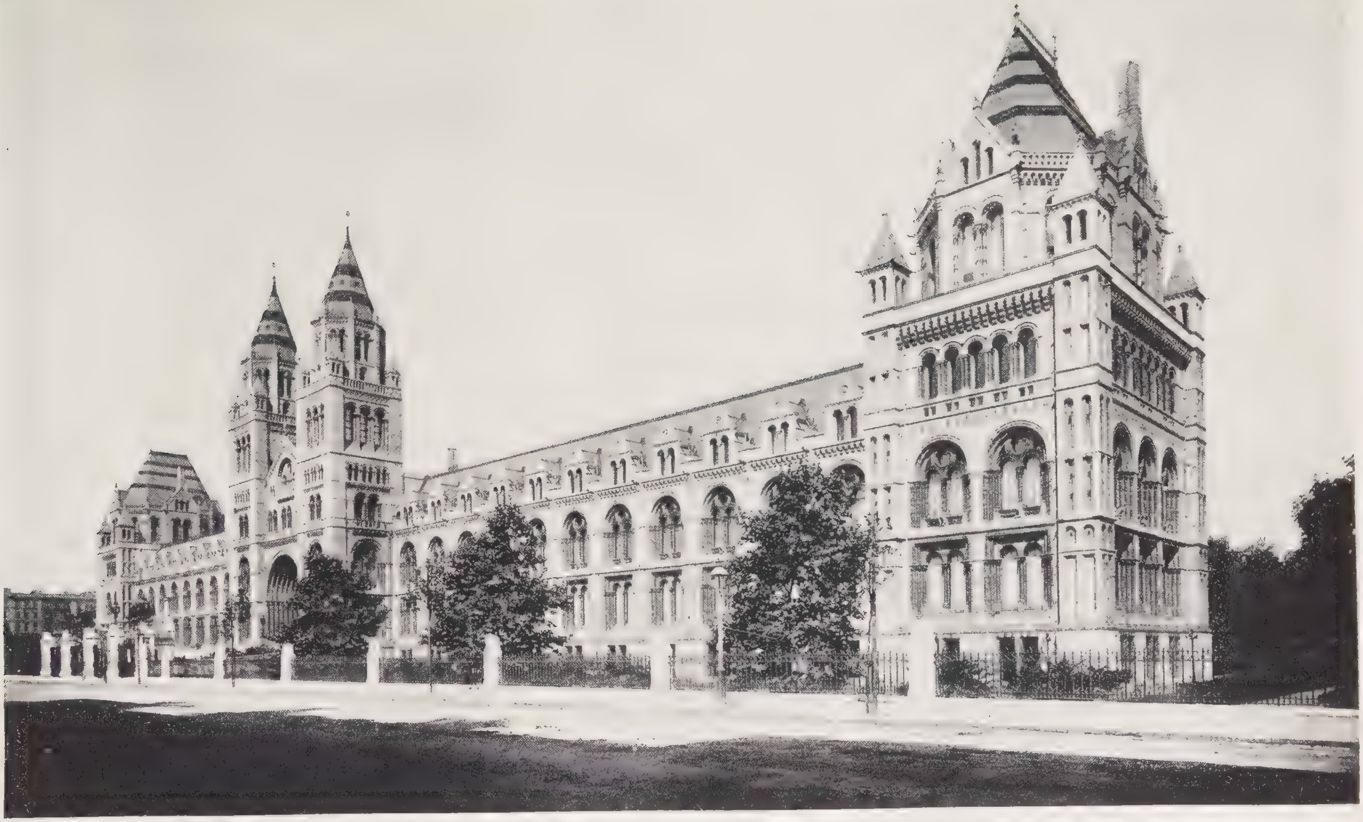
In France, the Gothic revival, which so strongly affected the whole school of English architecture for thirty or forty years, took little hold. Its most remarkable monument is the church of Ste Clotilde at Paris, built about the middle of the century from the designs of Ballu. In size it equals a second-class cathedral, and is a fine monument, though it does not show that complete knowledge of medieval Gothic which we find in the churches of Scott, Street, Pearson and G. F. Bodley. But as with the Classic, so with the Gothic revival—the leading French architects of the period had too much personal architectural feeling to be carried along in the wake of a "movement." Two very important Paris churches, built just after the middle of the century, illustrate well this independence of spirit. The one is the domed church of St Augustin in the Boulevard Malesherbes (Plate XII., fig. 122), designed by Victor Baltard (1805–1874). It may be called a Classic church treated in a quasi-Byzantine manner. A remarkable point about it is that, standing between the divergence of two streets at an acute angle, the outer walls of the nave follow the line of the two streets, the church thus expanding towards the centre; internally the colonnades are parallel, the chapels outside of them increasing in depth from the entrance of the nave towards the centre—a very clever device for reconciling exterior and interior effect. The other church referred to, built about the same time, is La Trinité (Plate XII., fig. 123) by Théodore Ballu (1817–1885)—a church which is Renaissance in detail and yet distinctly Gothic in its general effect and in the multiplicity of its detail, somewhat recalling in this sense Barry's Halifax tower before referred to. The sense in which there has really been a general movement in church architecture in France has been in the direction of a kind of modernized Byzantine, of which one of the earliest and best examples is the church of St Pierre de Montrouge, by Joseph Auguste E. Vaudremer (Plate XII., fig. 124). A later and more important example is the cathedral of Marseilles, by Léon Vaudoyer (1803–1872) and Henry Espérandieu (1829–1874), a mingling of Romanesque and Byzantine, and in many respects a fine building (Plate XIII., fig. 126). This modern feeling in favour of a Byzantine type of church architecture culminated in the great church of the Sacré Cœur on Montmartre, at Paris, begun in the early 'eighties from the designs of Paul Abadie (1812–1884). This grand building stands on a most effective site, and is of a monumental solidity seldom met with in modern architecture; it is more pure and consistent in style than many of the smaller churches of the same school of architecture. These latter are not for the most part very attractive; they represent in general a kind of Frenchified Byzantine detail which exhibits neither Byzantine spirit nor French grace and finish; and on the whole it may be said that church architecture is the field in which the French architects of the 19th century were least successful.

As regards secular buildings, on the other hand, the Paris of the middle portion of the 19th century can show some of the most unquestionable architectural successes of the period. The modern portions of the Palais de Justice by Louis Joseph Duc (1802–1879)—not Viollet-le-Duc, as is often mistakenly asserted in guide-books—and of the École des Beaux-Arts, by Jacques Félix Duban (1797–1870), are among the best examples of the application of classic forms of architecture to modern buildings; and the Bibliothèque Ste Geneviève (Plate XIII., fig. 128), by Henri Labrouste (1801–1875), was in its day (about 1850) a new creation in applied classic architecture; a building in which the exterior design was entirely subservient to and expressive of the requirements of a library, a large portion of the wall being left unpierced for the storage of books, windows being only inserted where they did not interfere with this object; and the manner in which these walls are treated so as to produce a decorative architectural effect without having recourse to sham colonnades and sham window openings, was entirely new at the time in modern work. It is instructive to compare this design with that of the Bank of England, as examples of the right and the wrong way of treating buildings in which much blank wall space was required. The new buildings of the Louvre (Plate XIV., fig. 129), built under Napoleon III. from the designs of Louis Tullius Joachim Visconti (1791–1853), are not to be passed over, though they have too much of the showy and flaunting character which belonged to both the society and the art of the Second Empire; a fault which also destroys some of the value of the Grand Opera house, a remarkable work by a remarkable architect (Jean Louis Charles Garnier), and typical, more than any other structure, of the epoch in which it was built. Some of its effect it owes to the admirable painting and sculpture with which it is decorated, but the grand staircase is a fine architectural conception (see GARNIER).

Recent English architecture.

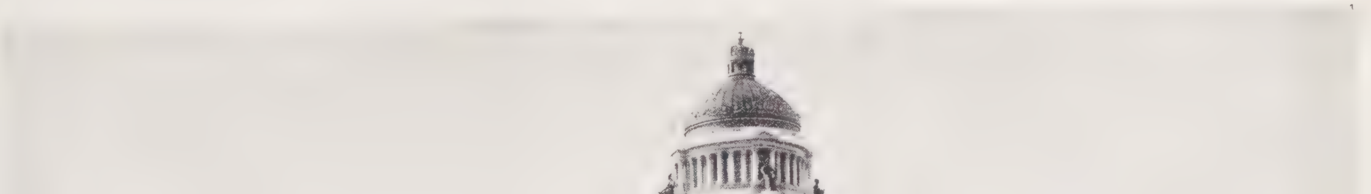
In England and in the United States, the last quarter of the 19th century was a period of unusual interest and activity in architectural development. While other nations have been content to carry on their architecture, for the most part, on the old scholastic lines which had been prevalent since the Renaissance, in the two countries named there has been manifest a spirit of unrest, of critical inquiry into the basis and objects of architecture; an aspiration to make new and original creations in or applications of the art, without example in any other period in the modern history of architecture. In England, the "note"—heard with increasing shrillness of *crescendo* towards the very last year of the century—was the cry for originality, for throwing off the trammels of the past, for rendering architecture more truly a direct expression of the conditions of practical requirement and of structure. This was no doubt to some extent the effect of a reaction. During the greater part of the century architectural strength, as has been already shown, had been spent in revivals of past styles. Churches indeed, up to the close of the century, continued to be built, for the most part, in revived Gothic; but this was owing to special clerical influence, which saw in Gothic a style specially consecrated to church architecture, and would be satisfied, as a rule, with nothing else. Efforts have been made by architects to modify the medieval church plan into something more practically suited to modern congregational worship, by a system of reducing the side aisles to mere narrow passages for access to the seats, thus retaining the architectural effect of the arcade, while keeping it out of the way of the seated congregation; and there have been occasional reversions to the ancient Christian basilica type of plan, or sometimes, as in the church in Davies Street, London, attempts to treat a church in a manner entirely independent of architectural precedent; but in the main, Gothic has continued to rule for churches. Apart from this special class of building, however, revived Gothic began to droop during the 'seventies. All had been copied that could be copied, and the result, to the architectural mind, was not satisfaction but satiety. Gothic began to be regarded as "played out." The immediate result, however, was not an organized attempt to think for ourselves, and make our own style, but a recourse to another class of precedent, represented in the type of early 18th-century building which became known as "Queen Anne," and which, like Gothic before it, was now to be recommended as "essentially English," as in fact it is. It can hardly, however, be called an architectural style; it would have no right to figure in any work illustrating the great architectural styles of the world. It was, in fact, the last dying phase of the English Renaissance; the architecture of the classic order reduced to a threadbare condition, treated very simply and in plain materials, in many cases shorn of its columnar features, and reflecting faithfully enough the prim rationalistic taste in literature and art of the England of the 18th century. Though not to be dignified as a *style*, it was, however, a recognizable and consistent *manner* in building; it made extensive use of brick, a material inexpensive and at the same time very well suited to the English climate and atmosphere; and it was generally carried out in very solid proportions, and with very good workmanship. To a generation tired of imitating a great

"Queen Anne."



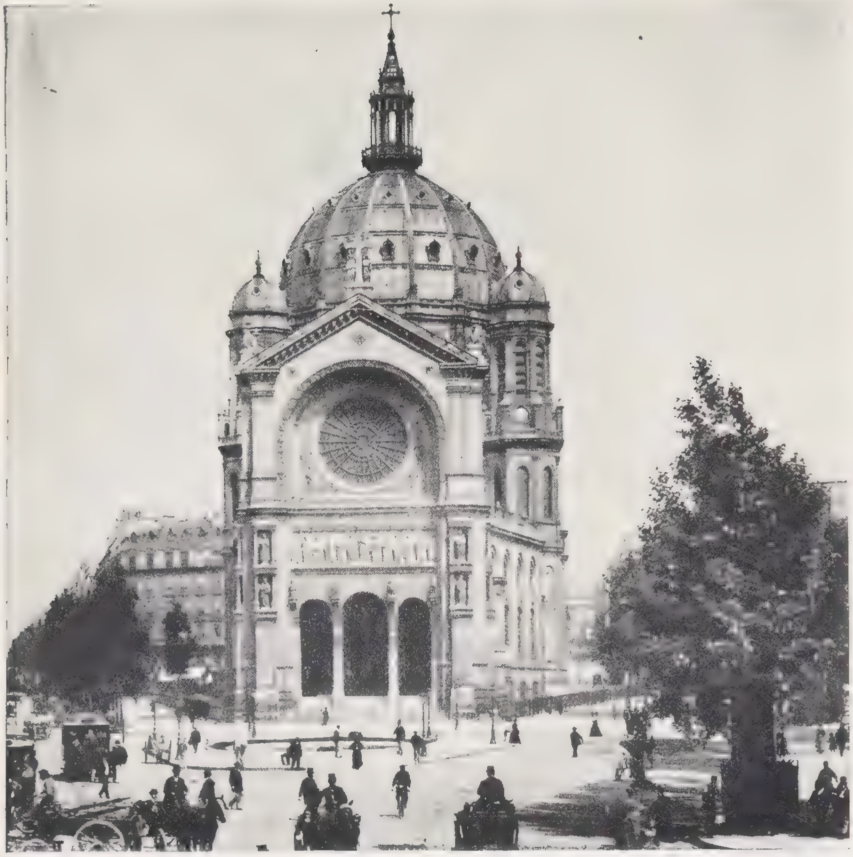
Photo, Valentine & Sons, Dundee.

FIG. 120.—NATURAL HISTORY MUSEUM, SOUTH KENSINGTON. (WATERHOUSE.)



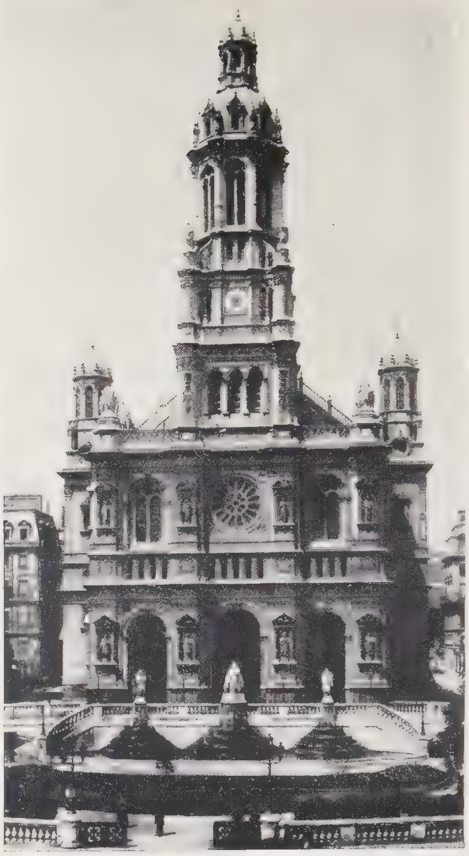
Photo, M. Gerbeault.

FIG. 121.—LAW COURTS, BRUSSELS. (POELAERT.)



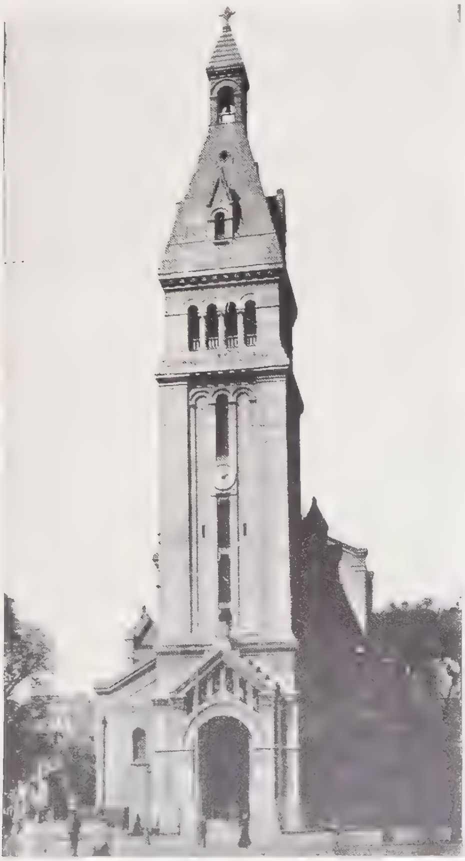
Photo, Neurdein.

FIG. 122.—CHURCH OF ST AUGUSTIN, PARIS. (BALTARD.)



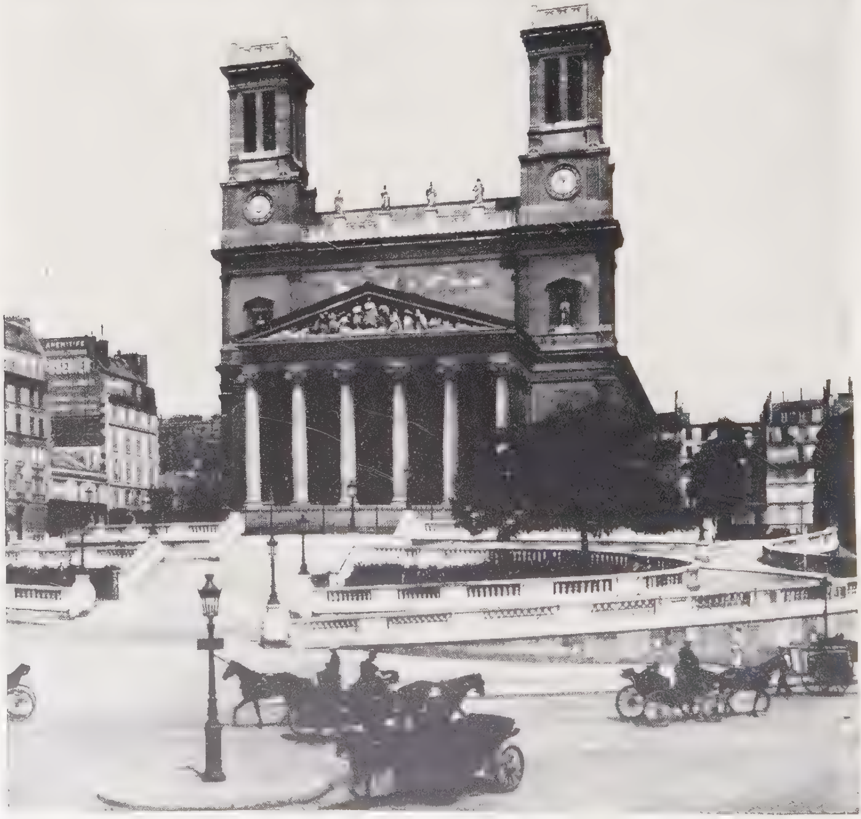
Photo, Neurdein.

FIG. 123.—CHURCH OF LA TRINITÉ, PARIS. (BALLU.)



Photo, A. Levy.

FIG. 124.—CHURCH OF ST PIERRE DE MONTROUGE, PARIS. (VAUDREMER.)



Photo, Neurdein.

FIG. 125.—CHURCH OF ST VINCENT DE PAUL, PARIS. (HITTORFF.)

style at second hand, this unpretending and simple model was a welcome relief, and led to the erection of a considerable number of modern buildings, dwelling-houses especially, the obvious aim of which was to look as like 18th-century buildings as possible. A typical example is the large London house by Norman Shaw, at the corner of Queen's Gate and Imperial Institute Road. The Chelsea town hall (fig. 94), by J. M. Brydon (1840–1901), is a good example of a public building in the revived Queen Anne style.

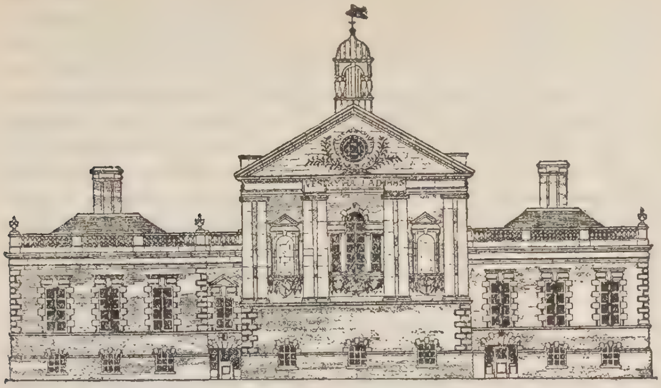


FIG. 94.—Chelsea Town Hall. (J. M. Brydon.)

"Free classic."

A change of front from copying a great style like the medieval to copying what is at best a bastard one, if a style at all, might not seem to promise very much for the emancipation of modern architecture; yet there turned out to be one element of progress in it, resting on the fact that the comparatively simple detail of the 18th-century buildings formed a kind of vernacular of building workmanship, which could be comprehended and carried out by good artisans as a recognized tradition. Now to reduce architecture to good sound building and good workmanship seemed to promise at any rate a better basis to work upon than the mere imitation of classic or medieval detail; it might conceivably furnish a new starting-point. This was the element of life in the Queen Anne revival, and it had, as we shall see, an influence beyond the circle of the special revivers of the style. But almost concurrently with, or following hard upon, the "Queen Anne" movement arose the idea of a modern architecture, founded on a free and unfettered treatment of the materials of our earlier Renaissance architecture, as illustrated in buildings of the Stuart period. This new ideal was styled "free classic," and it gave the prevailing tone to English architecture for the last fifteen years of the century, though it had its commencement in certain characteristic buildings a good many years earlier than that. In 1873, for instance, there arose a comparatively small front in Leadenhall Street, under the name of "New Zealand Chambers" (fig. 95), designed by Norman Shaw, which excited more attention, and had more influence on contemporary architecture than many a building of far greater size and importance. This represented the playful and picturesque possibilities of "free classic." Its more restrained and refined achievements were early exemplified in G. F. Bodley's design for the front of the London School Board offices on the Thames Embankment,[1] a comparatively small building which also exercised a considerable influence. There were no details here, however, but what could be found in Stuart (or, as it is more often called, Jacobean) architecture, but the building, and the prominence of its architect's name, helped to draw attention to the possibilities of the style, and it has been discovered that free classic is susceptible of a great deal of original treatment based on Renaissance elements. As an example we may cite a street front built some twenty years later by another academician-architect, viz. the offices of the Chartered Accountants in the City, by J. Belcher. More dignified and more monumental than New Zealand Chambers, more original than the School Board offices, this front contains some details and a general treatment which may be said to be absolutely new; it affords another example of a piece of street architecture which attracted a great deal of attention, and has had an effect quite disproportionate to its size and importance as a building; and it gives a general measure of the progress of the "free classic" idea. During the last decade of the century "free classic" was almost the recognized style in English architecture, and has been illustrated in many town halls and other large and important buildings, among which the Imperial Institute is a prominent example (fig. 96).

The allied arts.

Concurrently with this tendency towards a free classic style there has arisen another movement which has had a considerable influence on English architecture, viz. an increased perception of the importance of decorative arts—sculpture, painting, mosaic, etc.—in alliance with architecture, and of the architect and the decorative artist working together and in harmony. This is no more than what has long been understood and acted on in France, but it has been a new light to modern English architecture, in which, until a comparatively recent period, decorative painting was hardly

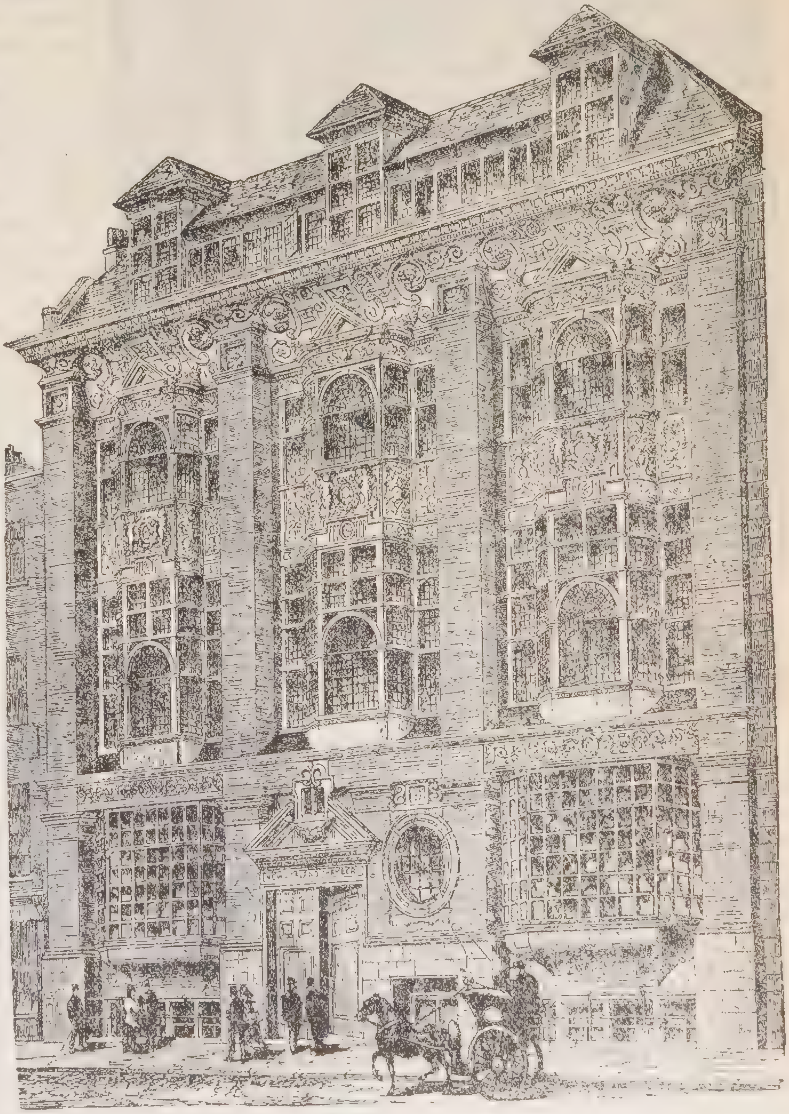


FIG. 95.—New Zealand Chambers. (R. Norman Shaw, R.A.)

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[1] The western half of the present front; the design was duplicated afterwards, on the extension of the building, but Bodley originated it.

thought of, and decorative sculpture, where it was introduced, was too often, or indeed generally, the mere work of some trading firm of masons. But of late years sculpture has taken a far more prominent place in connexion with architecture; it has become a habit with the best architects to rely largely on the introduction of appropriate and symbolic sculpture to add to the interest of their buildings, and to associate with them eminent sculptors, who, instead of regarding their work only in the light of isolated statues or groups for the exhibition room and the art gallery, are willing to give their best efforts to produce high-class sculpture for the decoration of an architectural design which forms the framework to it.

Notice should be taken, however, of another movement in English architecture during the closing years of the 19th century.

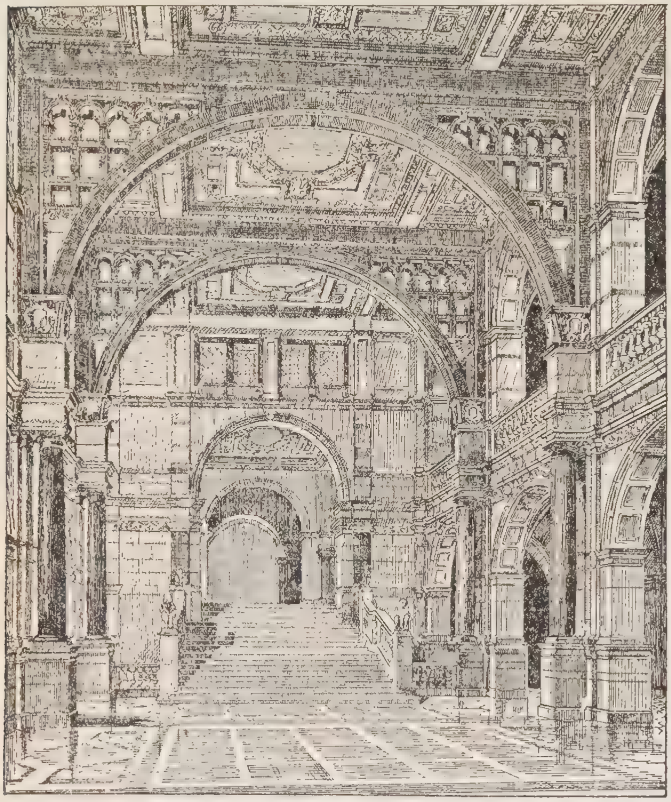


Fig. 96.—Staircase, Imperial Institute. (Collcutt.)

The craftsmanship ideal.

Reference has already been made to one idea which prompted the culture of the "Queen Anne" type of architecture: that it presented a simple vernacular of construction and detail, in which solid workmanship was a more prominent element than elaboration of what is known as architectural style. To a small group of clever and enthusiastic architects of the younger generation it appeared that this idea of reducing architecture to the common-sense of construction might be carried still further; that as all the revivals of styles since the Renaissance had failed to give permanent satisfaction and had tended to reduce architecture to a learned imitation of the work of former epochs, the real chance for giving life to architecture as a modern art was to throw aside all the conventionally accepted insignia of architectural style—columns, pilasters, cornices, buttresses, etc.—and to begin over again with mere workmanship—wall-building and carpentry—and trust that in process of time a new decorative detail would be evolved, indebted to no precedent. The building artisans, in fact, were collectively to take the place of the architect and the form of the building to be evolved by a natural process of growth. This was a favourite idea also with William Morris, who insisted that medieval art—the only art which he recognized as of any value (Greek, Roman and Renaissance being alike contemptible in his eyes)—was essentially an art of the people, and that in fact it was the modern architects who stood in the way of our having a genuine architecture of the 19th century. Considering how much of merely formal, conventional and soulless architecture has been produced in our time under the guidance of the professional architect, it is impossible to deny that there is an element of truth in this reasoning; at all events, that there have been a good many modern architects who have done more harm than good to architecture. But when we come to follow out this reasoning to its logical results, it is obvious that there are serious flaws in it. Morris's idea that medieval architecture alone was worthy the name, we may, of course, dismiss at once; it was the prejudice of a man of genius whose sympathies, both in matters social and artistic, were narrow. Nor can we regard the medieval cathedrals as artisan's architecture. The name of "architect" may have been unknown, but that the personage was present in some guise, the very individuality and variety of our English cathedrals attest. Peterborough front was no mere mason's conception. And when we come to consider modern conditions of building, it is perfectly obvious that with the complicated practical requirements of modern building, in regard to planning, heating, ventilation, etc., the planning of the whole in a complete set of drawings, before the building is begun, is an absolute necessity. We are no longer in medieval times; modern conditions require the modern architect. The real cause of failure, as far as modern architecture is a failure, lies partly in the fact that it is practised too much as a profession or business, too little as an art; partly in the deadening effect of public indifference to art in Britain. If the public really desired great and impressive works of architecture they would have them; but neither the British public nor its mouthpiece the government, care anything about it. Their highest ambition is to get convenient and economical buildings. And as to the theory of the new school, that we should throw overboard all precedent in architectural detail, that is intellectually impossible. We are not made so that we can invent everything *de novo*, or escape the effect on our minds of what has preceded us; the attempt can only lead to baldness or eccentricity. Every great style of architecture of the past has, in fact, been evolved from the detail of preceding styles; and some of the ablest and most earnest architects of the present day are, indeed, urging the desirability of clinging to traditional forms in regard to detail, as a means of maintaining the continuity of the art. This does not by any means imply the absence of original architecture; there is scope for endless origination in the plan and the general design of a building. The Houses of Parliament is a prominent example. The detail is a reproduction of Tudor detail, but the plan and the general conception are absolutely original, and resemble those of no other pre-existing building in the world.

United States.

It is necessary to take account of all these movements of opinion and principle in English architecture to appreciate properly its position and prospects at the time with which we are here dealing. Turning now from England to the United States, which, as already observed, is the only other important country in which there has been a general new movement in architecture, we find, singular to say, that the course of development has in America been almost the reverse of what has taken place in England. The rapidity of architectural development in America, it may be observed, since about 1875, has been something astonishing; there is no parallel to it anywhere else. Before then the currently accepted architecture of the American Republic was little more than a bad repetition of the English Gothic and Classic types of revived architecture. At the present day no nation, except perhaps France, takes so keen an interest in architecture and produces so many noteworthy buildings; and it may be observed that in the United States the public and the official authorities seem really to have some enthusiasm on the subject, and to desire fine buildings. But the stirring of the dry bones began in America where it ended in England. The first symptoms of an original spirit operating in American architecture showed themselves in domestic architecture, in town and country houses, the latter especially; and the form which the movement took was a desire to escape conventional architectural detail and to return to the simplest form of mere *building*; rock-faced masonry, sometimes of materials picked up on the site; chimneys which were plain shafts of masonry or brickwork; woodwork simply hewn and squared; but the whole arranged with a view to picturesque effect (figs. 97 and 98). This form of American house became an incident in the course of modern architecture; it even had a recognizable influence on English architects. About the same time an impetus of a more special nature was given to American architecture by a man of genius, H. H. Richardson, who, falling back on Romanesque and Byzantine types of architecture as a somewhat unworked field, evolved from them a type of architectural treatment so distinctly his own (though its *origines* were of course quite traceable) that he came very near the credit of having personally invented a style; at all events he invented a manner, which was so largely admired and imitated that for some ten or fifteen years American architecture showed a distinct tendency to become "Richardsonesque" (see also Plate XVI., fig. 137). As with all architectural fashions, however, people got tired of this, and the influence of another very able American architect, Richard M. Hunt, coupled perhaps with the proverbial philo-Gallic tendencies of the modern American, led to the American architects, during the last decade of the 19th century, throwing themselves almost entirely into the arms, as it were, of France; seeking their education as far as possible in Paris, and adopting the theory and practice of the École des Beaux-Arts so completely that it is often impossible to distinguish their designs, and even their methods of drawing, from those of French architects brought up in the strictest régime of the "École." By this French movement the Americans have, on the one hand, shared the advantages and the influence of what is undoubtedly the most complete school of architectural training in the world; but, on the other hand, they have foregone the opportunity which might have been afforded them of developing a school or style of their own, influenced by the circumstances of their own requirements, climate and materials. Figs. 133 and 134, Plate XV., show examples of recent American architecture of the European classic type. Thus, in the two countries which in this period have shown the most activity and restlessness in their architectural aspirations, and given the most original thought to the subject, England has constantly tended towards throwing off the yoke of precedent and escaping from the limits of a scholastic style; while America, commencing her era of architectural emancipation with an attempt at first principles and simple but picturesque building, has ended by a pretty general adoption of the highly-developed scholastic system of another country. The contrast is certainly a curious one. Only one original contribution to the art has been made by America in recent days—one arising directly out of practical conditions, viz. the "high buildings" in cities; a form of architecture which may be said to have originated in the fact that New York is built on a peninsula, and extension of the city is only possible vertically and not horizontally. The tower-like buildings (see Plate XV., fig. 131, and Steel Construction, Plate II., figs. 3 and 4), served internally by lifts, to which this condition of things has given rise, form a really new contribution to architecture, and have been handled by some of the American architects in a very effective manner; though, unfortunately, the rage for rapid building in the cities of the United States has led to the adoption of the false architectural system of running up such structures in the form of a steel framing, cased with a mere skin of masonry or terra-cotta, for appearance' sake, which in reality depends for its stability on the steel framing. It must be admitted, however, to be a new contribution to architecture, and renders New York, as seen from the harbour, a "towered city" in a sense not realized by the poet.

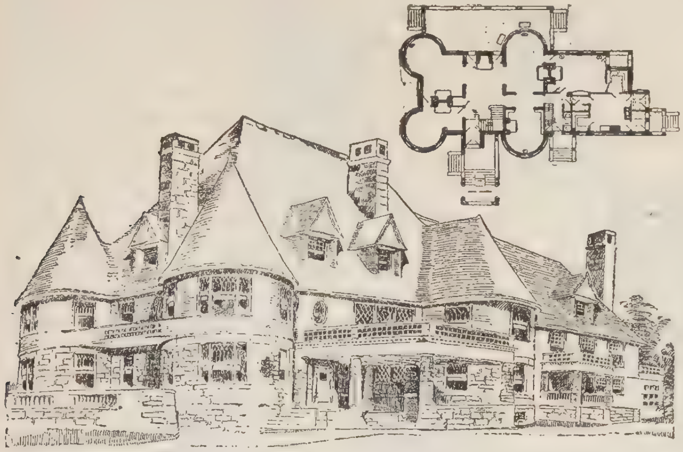


Fig. 97.—American Type of Country-House Architecture.

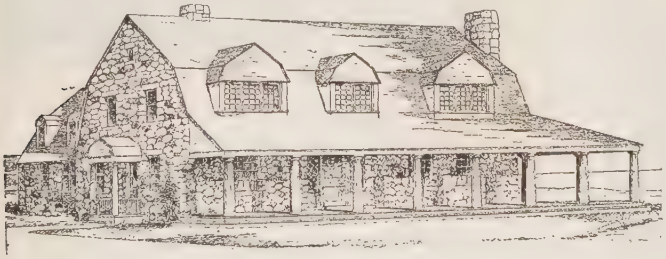


Fig. 98.—American Seaside Villa. (Bruce Price.)

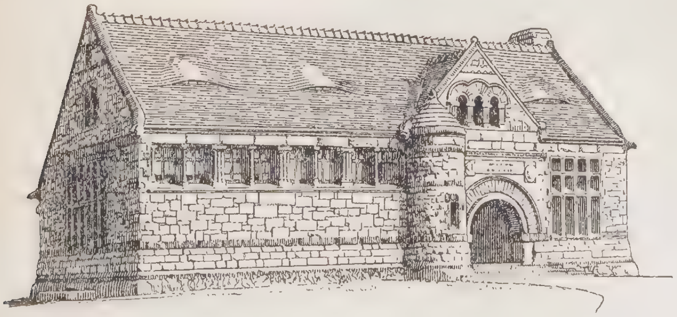


Fig. 99.—Crane Public Library, Quincy, Mass. (H. H. Richardson.)

English progress.

Some sketch of the state of recent architectural thought or endeavour in England seemed essential to the subject, since it is there that what may be called the philosophy of architecture has been most debated, and that thought has had the most obvious and most direct effect on architectural style and movement. That this has been the case has no doubt been largely due to the influence of Ruskin, who, though his architectural judgment was on many points faulty and absurd in the extreme, had at any rate the effect of setting people thinking—not without result. In other countries architecture continued to pursue, up to the close of the century, the scholastic ideal impressed upon it by the Renaissance, without exciting doubt or controversy unless in a very occasional and partial manner, and without any changes save those minor ones arising from changing habits of execution and use of material. In Germany there appears to be a certain tendency to a greater freedom in the use of the materials of classic architecture, a certain relaxation of the bonds of scholasticism; but it has hardly assumed such proportions as to be ranked as a new movement in architecture.

English churches.

The last years of the 19th century witnessed the progress to an advanced stage of the most remarkable piece of English church architecture of the period, the Roman Catholic cathedral at Westminster, by J. H. Bentley (1839–1902), a building which is not a Gothic revival, but goes back to earlier (Byzantine) precedents; not, however, without a considerable element of novelty and originality in the design, especially in some of the exterior detail. The interior was intended for decoration in applied marble and mosaic, yet even as a shell of brickwork, with its solid domes and the immense masses of the piers, it is one of the most impressive and monumental interiors of modern date.

In ordinary church architecture, though there is still a good deal of mere imitation medieval work carried out, England has not been without examples of a new and original application of Gothic materials. The interior of the church of St Clare, Liverpool, by Mr Leonard Stokes (fig. 100), is a good example of the modified treatment of the three-aisled medieval plan already referred to, the side aisles being reduced to passages; and also of the tendency in recent years to simplify the treatment of Gothic, in contrast to the florid and over-carved churches of the Gothic revival. The churches of James Brooks, as already noted, have shown many examples of a solid plain treatment of Gothic, yet with a great deal of character; and J. D. Sedding (1838–1891) built some showing great originality, among which the interior of his church of the Holy Redeemer, Clerkenwell, affords also an interesting example of the modern free treatment of forms derived from classic architecture.

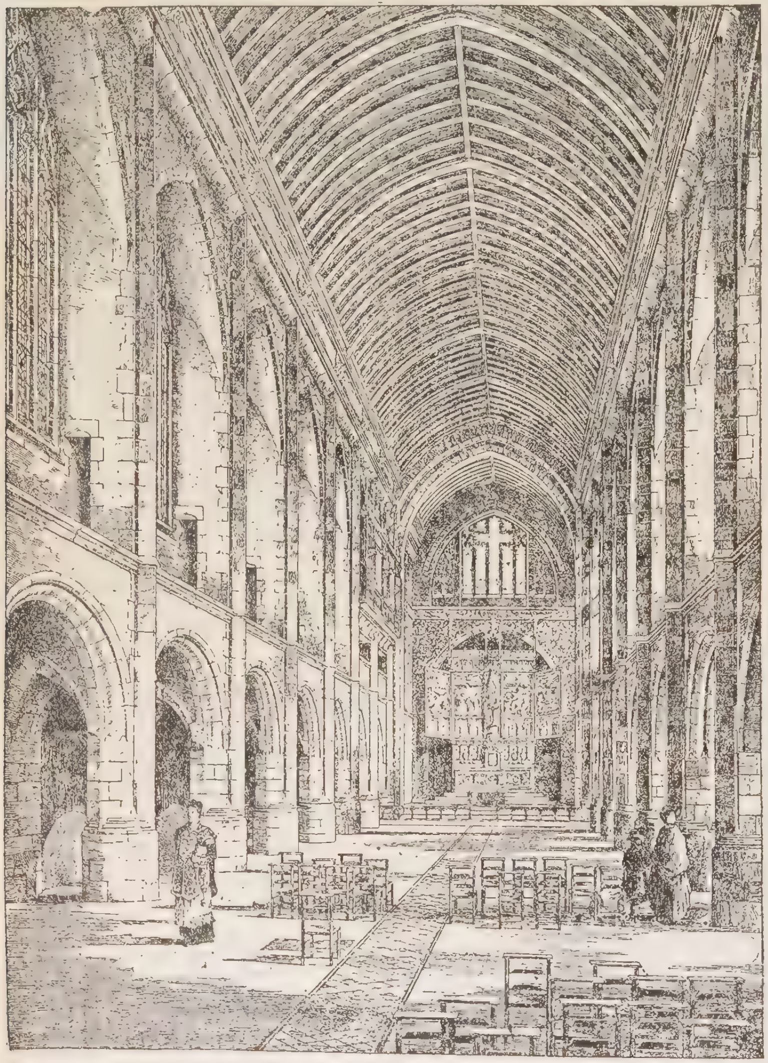


Fig. 100.—Interior, St Clare's, Liverpool. (Leonard Stokes.)

The event of most importance in English church architecture at the beginning of the 20th century was the commencement of a modern cathedral at Liverpool. In the early 'eighties the proposal for a cathedral had led to an important competition between three sets of invited architects, Sir William Emerson, Messrs Bodley and Garner and James Brooks. Nothing, however, resulted, except the production of three very fine sets of drawings. Subsequently the subject was taken up again with more energy, and a sketch competition invited for a cathedral on a new site (the one originally intended being no longer available); from among the sketch competitors five were invited to join in a final competition, viz. Messrs Austin and Paley, C. A. Nicholson, Gilbert Scott (grandson of Sir Gilbert Scott), Malcolm Stark and W. J. Tapper. Mr Scott's design was selected (May 1903) and the building of it commenced not long after. It is a design in revived Gothic, of the orthodox type as to detail, though containing some points of decided originality in the general treatment. The condition proposed in the first instance by the committee, that the designs sent in must be in the Gothic style, gave rise to a strong protest, in the architectural journals and elsewhere, on the ground that the revival of ancient styles was a mistaken and exploded fallacy; and in deference to this expression of opinion the committee officially withdrew the limitation as to style. That, in view of their obvious bias, they would confine their selection to designs in the Gothic style, was, however, a foregone conclusion. It is much to be regretted that the opportunity was not taken to evolve a modern and Protestant type of cathedral, with a central area and a dome as its principal feature.

English public buildings.

In the architecture of public buildings one of the earliest incidents in this latest period was the completion of the Albert Hall, which, though the work of an engineer, and commonplace in detail, is in the main a fine and novel architectural conception, and a practical success (considering its abnormal size) as a building for musical performances. Had its constructor been bold enough to roof it with a solid masonry dome, with an "eye" in the centre (as in the Pantheon) instead of a huge dish-cover of glass and iron, there would have been little to find fault with in its general conception. It was also the first modern English building of importance to be decorated externally with symbolical figure composition, in the shape of the large frieze in coarse mosaic of terra-cotta, which is carried round the upper portion of the exterior, and which, if not very interesting in detail, at all events fulfils very well its purpose as a piece of decorative effect. The subject of the government offices in London forms in itself an important chapter in recent architectural history. The home and foreign office block was finished in 1874; a sumptuous, but weak and ill-planned building designed by Scott, *invita Minerva*, in a style alien to his own predilections. In 1884 took place the great competition for the war and admiralty offices conjointly, won by a commonplace but admirably drawn design, presenting some good points in planning. The building was to stand between Whitehall and St James's Park, with a front both ways. The competition came to nothing, and the successful architects were eventually employed to build the new admiralty as it now stands, a mean and commonplace building with no street frontage, in which economy was the main consideration, and totally discreditable to the greatest naval power in the world. In 1898–1899 it was at last resolved to build a war office and other government offices much needed, and an irregular site opposite the Horse Guards was selected for the war office and one in Great George Street for the others. In this case there was no competition, but the government selected two architects after inquiry as to their works ("classic" architecture being a *sine qua non*); W. Young (d. 1900) for the war office, and J. M. Brydon for the Great George Street block. The war office site is inadequate and totally unsymmetrical, the boundary of the building being settled by the boundary of the street curb, and the inner courtyards are of very mean proportions compared with the great courtyard of the home and foreign office. Both architects produced grandiose designs, but in regard to the war office at least the government threw away a great opportunity.

There can only be further enumerated a few of the more important buildings erected in England during the later years

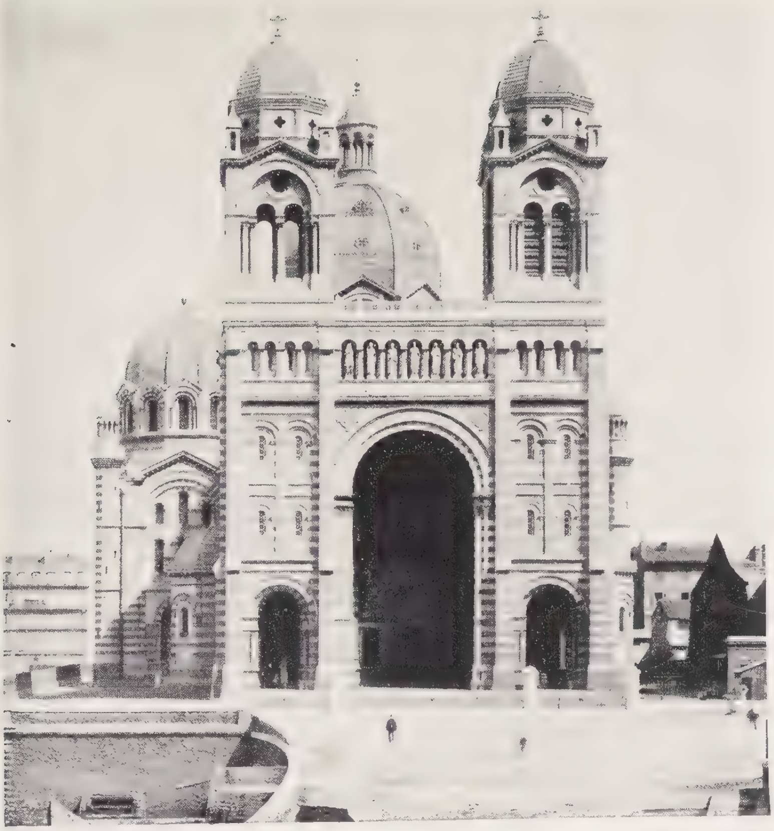
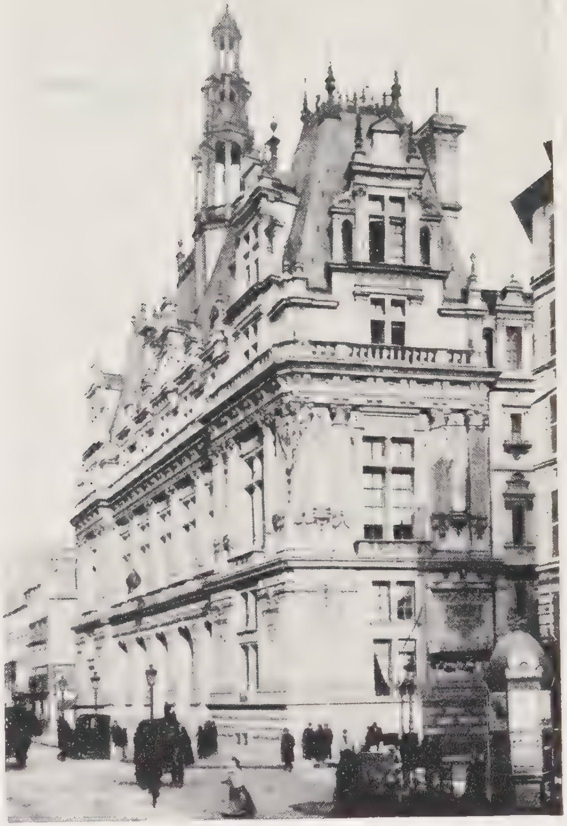


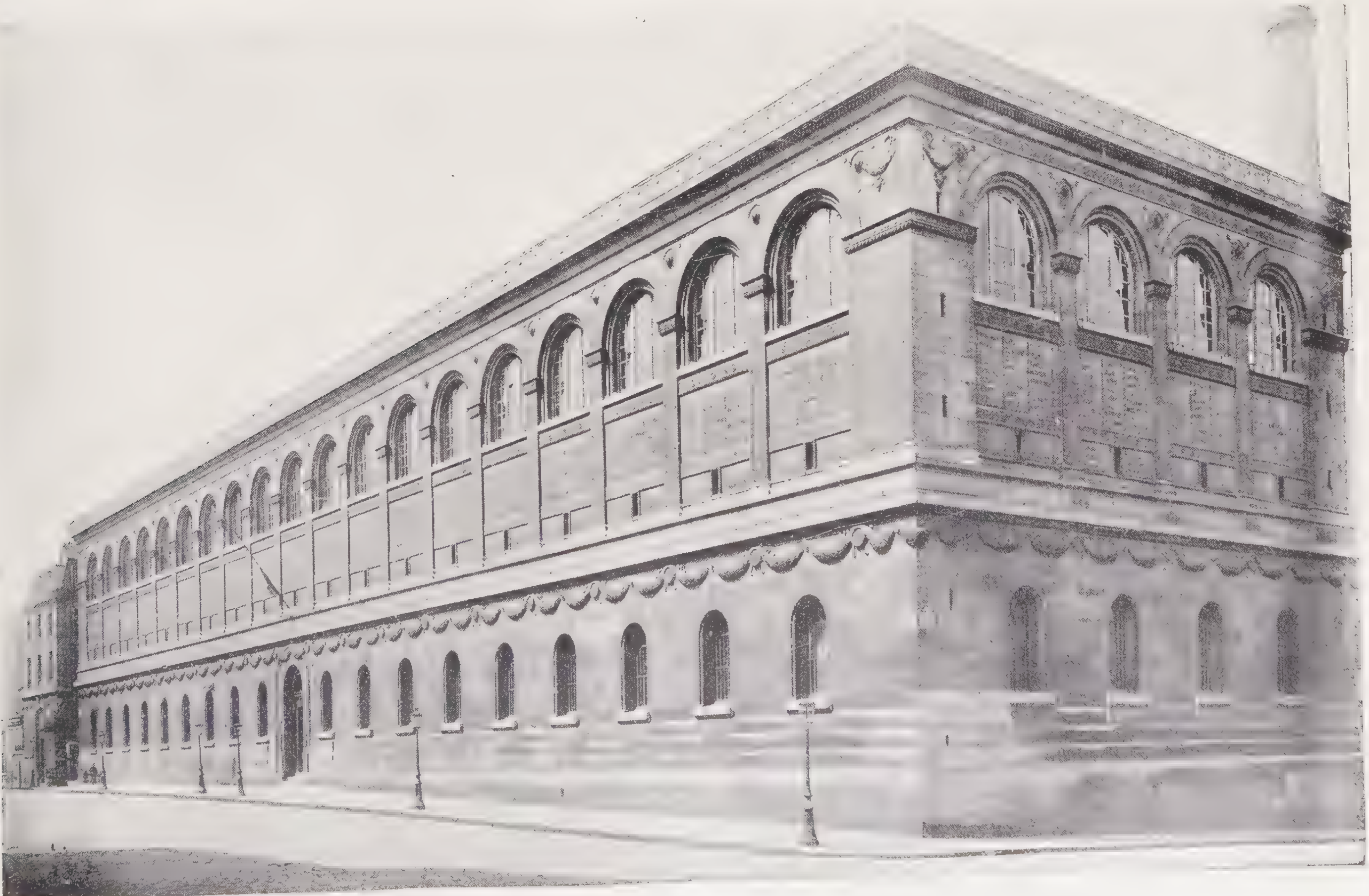
Photo. Neurdein.

FIG. 126.—CATHEDRAL, MARSEILLES. (VAUDOYER AND ESPERANDIEU.)



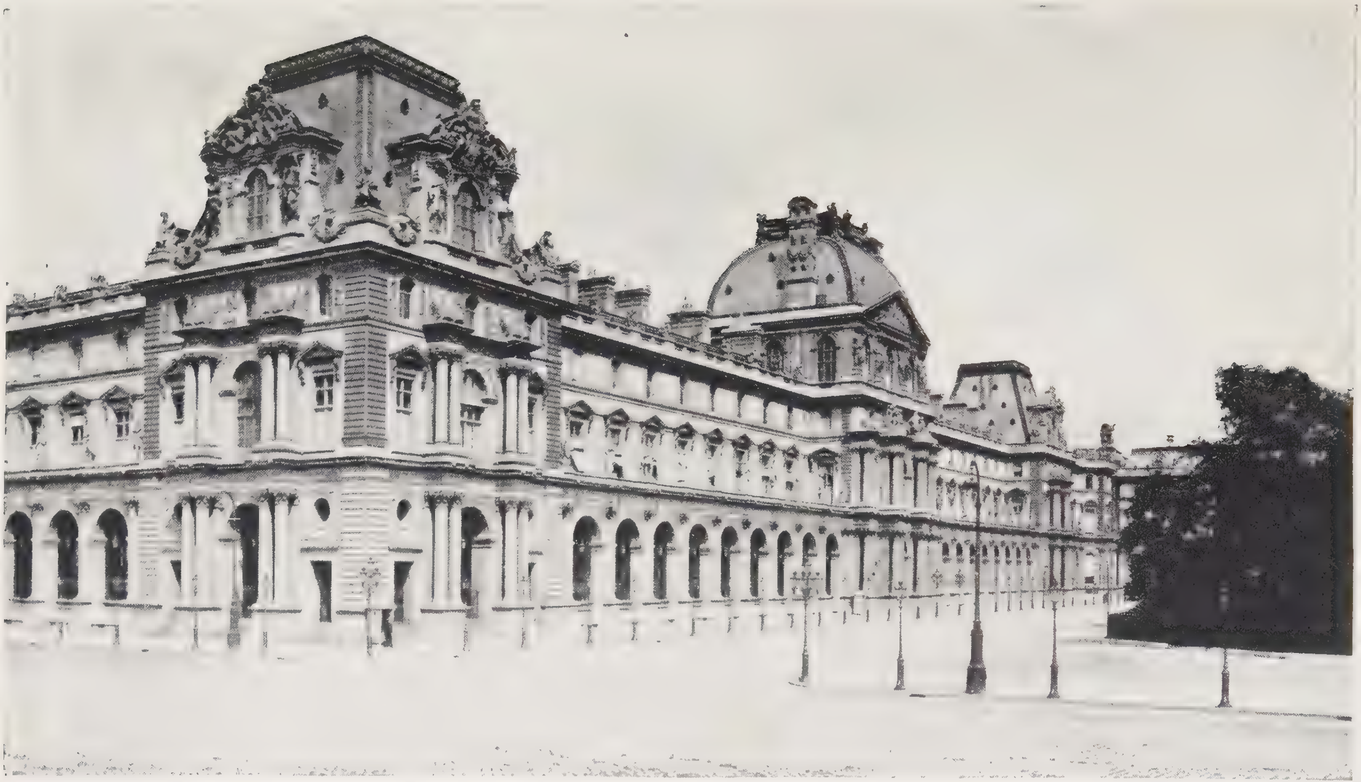
Photo, Neurdein.

FIG. 127.—MAIRIE, Xth ARRONDISSEMENT, PARIS. (ROUYER.)



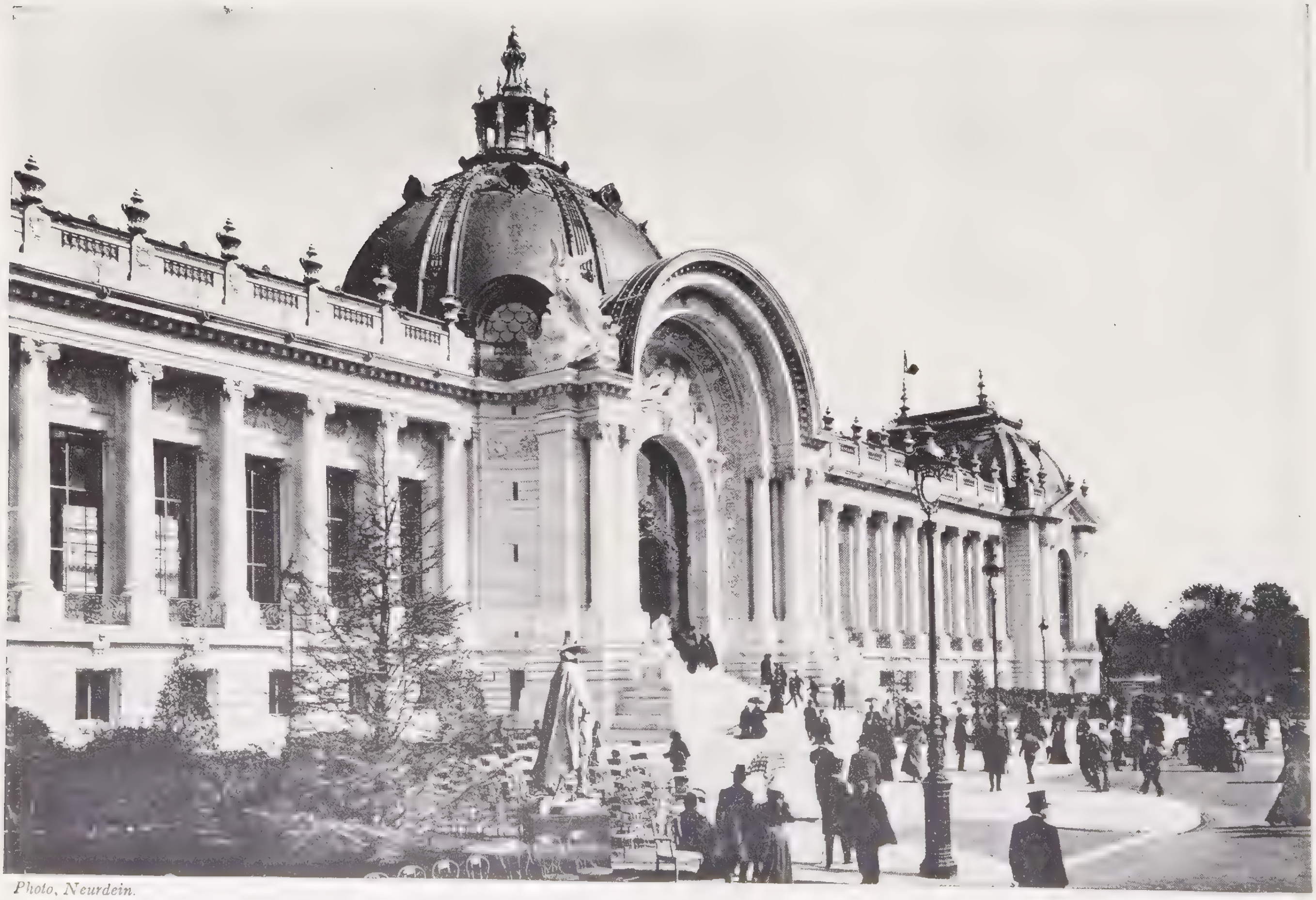
Photo, A. Lévy.

FIG. 128.—BIBLIOTHÈQUE STE GENEVIÈVE, PARIS. (LABROUSTE.)



Photo, L.L. Paris.

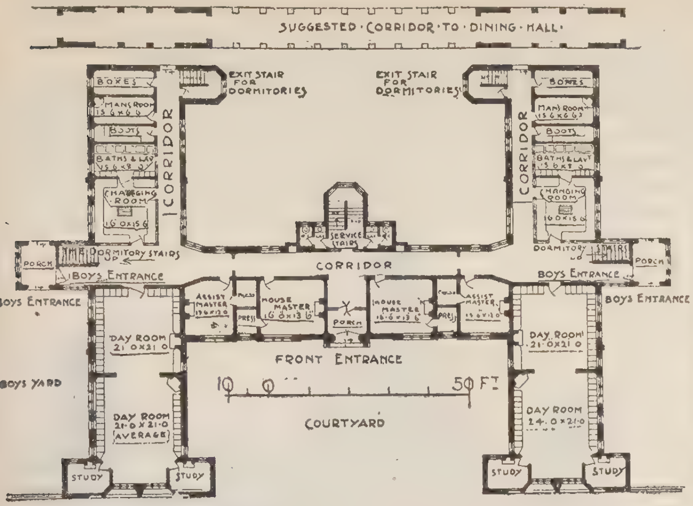
FIG. 129.—PAVILLON RICHELIEU, THE LOUVRE, PARIS. (VISCONTI.)



Photo, Neurdein.

FIG. 130.—PETIT PALAIS, PARIS. (GIRAULT.)

of the 19th century, and mention made of the general course which architecture has taken in regard to special classes of buildings. The Natural History Museum (Plate XI., fig. 120), completed in 1881 by Alfred Waterhouse, may stand as a type of the taste for the employment of terra-cotta, with all its dangerous facilities in ornamental detail, of which that architect specially set the example. Detail is certainly overdone here, but the building is strikingly original; a point not to be overlooked in these days of architectural copying. The Imperial Institute, the result of a competition among six selected architects, represents also a type of architecture which its architect, T. E. Collcutt, may be said to have matured for himself, and which has been extensively imitated; a refined variety of free classic, always quiet and delicate in detail, though perhaps rather wanting in architectonic force. The next great architectural competition was that for the completion of the South Kensington Museum, the bare brick exterior of which, waiting for architectural completion, had long been a national disgrace. The competition produced some fine and striking designs, some of them perhaps more so than the selected one by Sir Aston Webb, whose fine plan, however, justified the selection. Another competition which excited general interest was that in 1894, for the rebuilding on a country site of Christ's Hospital schools, also gained by Aston Webb (in collaboration with Ingress Bell), by a design which, in its arrangement of schoolhouses in detached blocks (fig. 101), but in a symmetrical grouping, opened up a new idea in public-school planning, and struck a blow at the picturesque but insanitary quadrangle system. Among notable public buildings of the period ought to be mentioned Norman Shaw's New Scotland Yard, built in a style neither classic nor Gothic, but partaking of the elements of both (Plate X., fig. 119). A competition in 1908 for the design of the new county hall for the London County Council, to be "English Renaissance" in style, was won by a young architect, till then unknown, Mr Ralph Knott.


SUGGESTED · CORRIDOR · TO · DINING · HALL ·
EXIT STAIR FOR DORMITORIES
EXIT STAIR FOR DORMITORIES
BOXES
MANS ROOM 15 6 x 6 6
BOOTS
BATHS & LAV 15 6 x 8 0
CHANGING ROOM 16 0 x 15 6
CORRIDOR
SERVICE STAIRS
CORRIDOR
BOXES
MANS ROOM 15 6 x 6 6
BOOTS
BATHS & LAVY 15 6 x 8 0
CHANGING ROOM 16 0 x 15 6
PORCH
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DORMITORY STAIRS UP
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BOYS ENTRANCE
ASSIST MASTER 15 6 x 12 0
PRESS
HOUSE MASTER 16 0 x 13 6
PORCH
HOUSE MASTER 16 6 x 13 6
PRESS
ASSIST MASTER 15 6 x 12 0
BOYS ENTRANCE
DAY ROOM 21 0 x 21 0
DAY ROOM 21 0 x 21 0
FRONT ENTRANCE
BOYS YARD
10 0 50 FT
DAY ROOM 21·0 x 21·0 (AVERAGE)
COURTYARD
DAY ROOM 24·0 x 21·0
STUDY
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FIG. 101.—Plan of a Master's House, New Christ's Hospital. (Webb and Bell.)

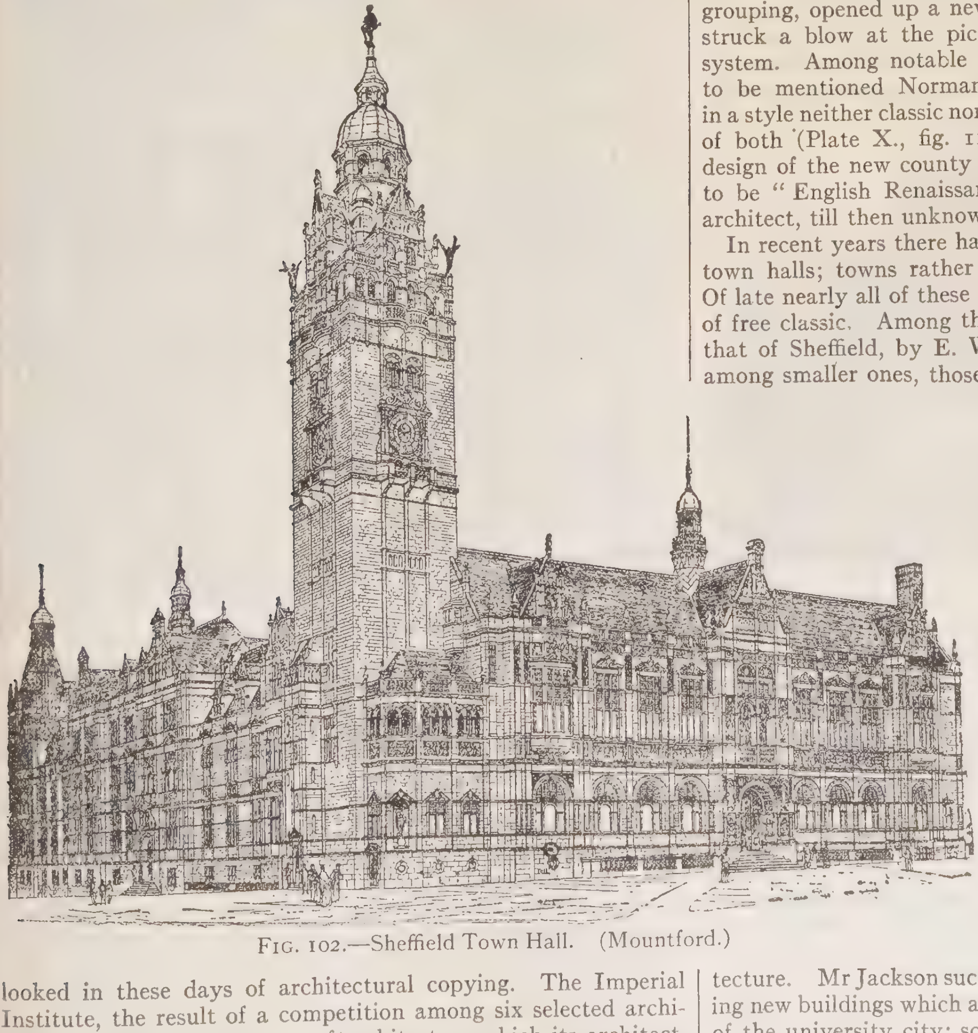

FIG. 102.—Sheffield Town Hall. (Mountford.)

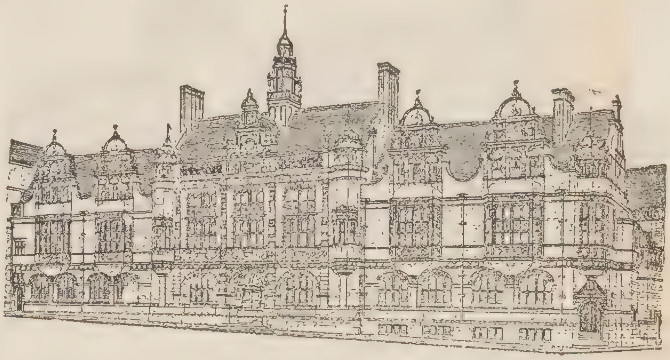

FIG. 103.—Oxford Town Hall. (Hare.)

In recent years there has been a great movement for building town halls; towns rather vying with each other in this way. Of late nearly all of these have been carried out in some variety of free classic. Among the more important in point of scale is that of Sheffield, by E. W. Mountford (1856–1908) (fig. 102); among smaller ones, those of Oxford, by H. T. Hare (fig. 103); and Colchester, by John Belcher, are particularly good examples of recent architecture of this class, the former distinguished also by an exceptionally good plan. The merit of excellent planning also belongs to Aston Webb and Ingress Bell's Birmingham law courts, one of the modern terra-cotta buildings of somewhat too florid detail, though picturesque as a whole. Among public halls the M'Ewan Hall at Edinburgh, completed in 1898 from the designs of Sir Rowand Anderson, deserves mention as one of the most original and most carefully designed of recent buildings in Great Britain.

The various new buildings erected in connexion with the university of Oxford, those by T. G. Jackson (b. 1835) especially, form an important incident in modern English architecture. Mr Jackson succeeded to a remarkable degree in designing new buildings which are in harmony with the old architecture of the university city; sometimes perhaps a little too imitative of it, but at any rate he has the credit of having added rather extensively to Oxford without spoiling it; while his school buildings in different parts of the country have a refinement and domesticity of feeling which is the true note of school architecture. Among buildings of an educational class, the move in technical education has led to the erection of a good many large polytechnic and similar institutions, which in many cases have been well treated architecturally; the Northampton Institute at Clerkenwell (fig. 104), by Mountford, being perhaps one of the boldest and most effective of recent public buildings. In the building of hospitals and asylums much has been done, and great progress made in the direction of hygienic and practical planning and construction, but the tendency has been (perhaps rightly) towards making this practical efficiency the main consideration and reducing architectural treatment to the simplest character. St Thomas's hospital at Lambeth exemplifies the treatment of hospital architecture at the commencement of the last quarter of the 19th century; the separate pavilion system had been already adopted on practical grounds, but the building is treated in a sumptuous architectural style, as if representing so many detached mansions—a treatment which would now be deprecated as an expenditure foreign to the main purpose of the building. One recent hospital, however, that at Birmingham, by W. Henman, combining architectural effect with the latest hygienic improvements, was the first large hospital in Great Britain in which the system of mechanical ventilation was completely and consistently carried out.

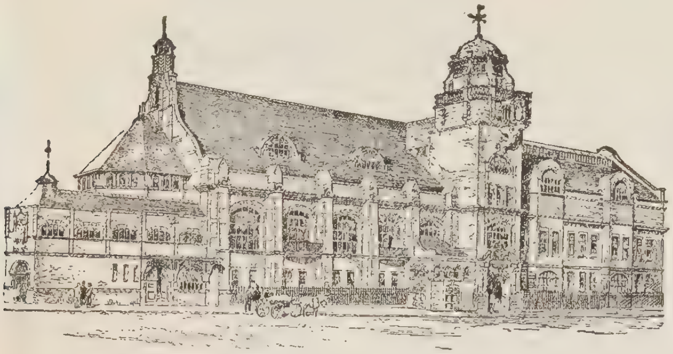
FIG. 104.—Northampton Institute, Clerkenwell. (Mountford.)

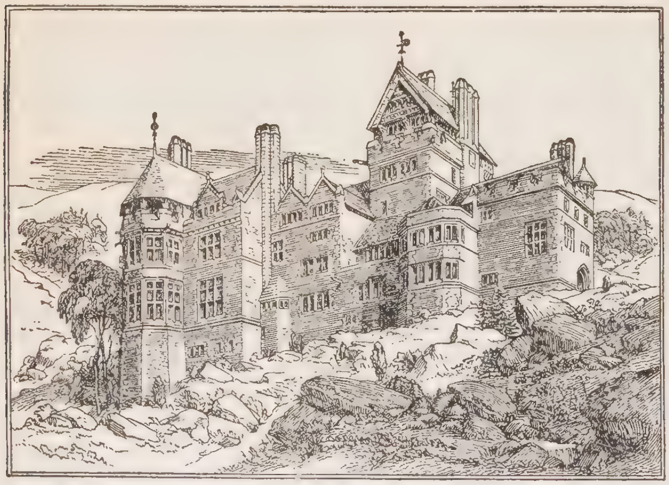
FIG. 105.—Cragside. (R. Norman Shaw.)

In theatre building there has been an immense improvement in regard to planning, ventilation and fireproof construction, but little to note in an architectural sense, since theatres in England are never designed by eminent architects, the financial and practical aspects being alone considered.

In domestic architecture the tendency has been to quit picturesque irregularity for a more formal and more dignified treatment. Such a house as Norman Shaw's "Cragside," built in the earlier part of our period (fig. 105), however its picturesque treatment may still be admired, would hardly be built now on a large scale; its architect himself has of late years shown a preference for a symmetrical and regular treatment of house architecture sometimes to the extent of making the mansion look too like a barrack. In street architecture, however, the tendency has been towards a more characteristic and more picturesque treatment; nor is there any class of building in which the improvement in English architecture has been more marked and more unquestionable. Many of the new residential streets in the west end of London present a really picturesque *ensemble*, and many shops and other commercial street buildings have been erected with admirable fronts from the designs of some of the best architects of the day. Norman Shaw's building at the corner of St James's Street and Pall Mall was one of the first, and is still one of the best examples of modern street architecture, though surpassed by the same architect's more recent building opposite, at the south-west angle of St James's Street—one of the finest and most monumental examples of street architecture in London. Among other examples may be cited T. E. Collcutt's London City & Midland Bank in Ludgate Hill (fig. 106) and R. Blomfield's narrow house-front in Buckingham Gate (fig. 107). The introduction of sculpture in street fronts is also beginning to receive attention; and a simple house-front recently erected in Margaret Street, London, from the design of Beresford Pite (fig. 108), is an excellent example of the use of sculpture in

English domestic and street architecture.

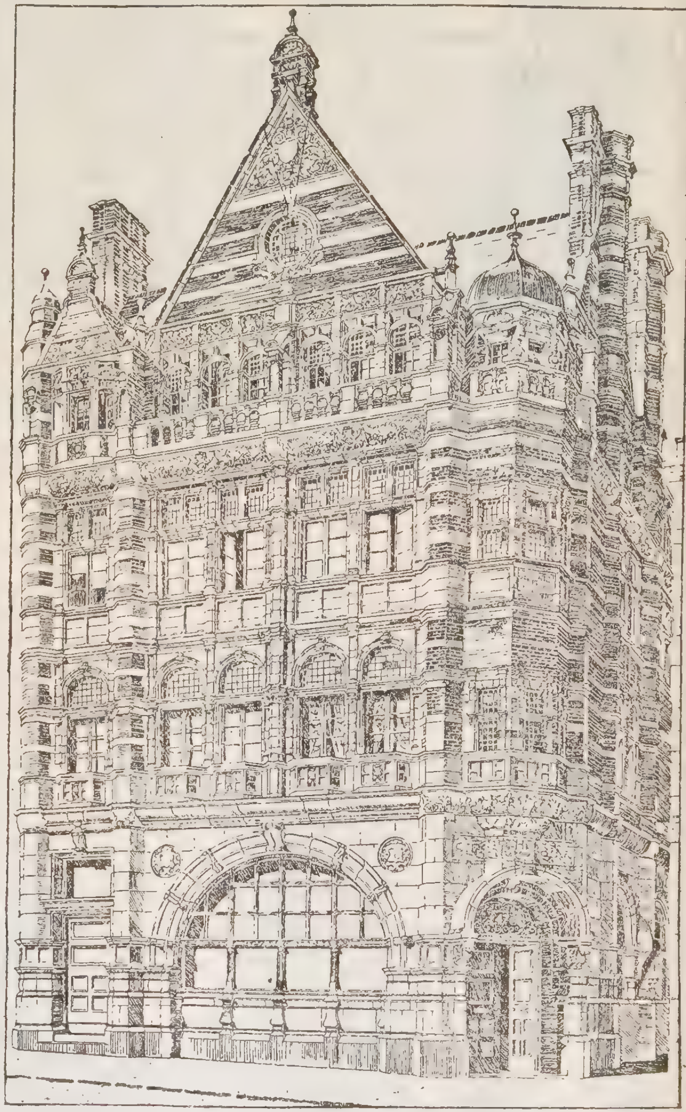
FIG. 106.—London City & Midland Bank, Ludgate Hill Branch. (Collcutt.)

connexion with ordinary street architecture. It is significant of the increased attention accorded to street architecture, that the most important architectural event in England at the very close of the 19th century, was the outlay of £2000 by the London County Council, in fees to eight architects for designs for the front of the proposed new streets of Kingsway and Aldwych. The idea was to treat these streets as comprehensive architectural designs with a certain unity of effect. Unfortunately this idea was abandoned for merely commercial reasons, it being feared that there would be a difficulty in letting the sites if tenants were required to conform their frontages to a general design. In the case of Aldwych, which is a crescent street, this decision was fatal. A crescent loses all its effect unless treated as a complete and symmetrical architectural design.

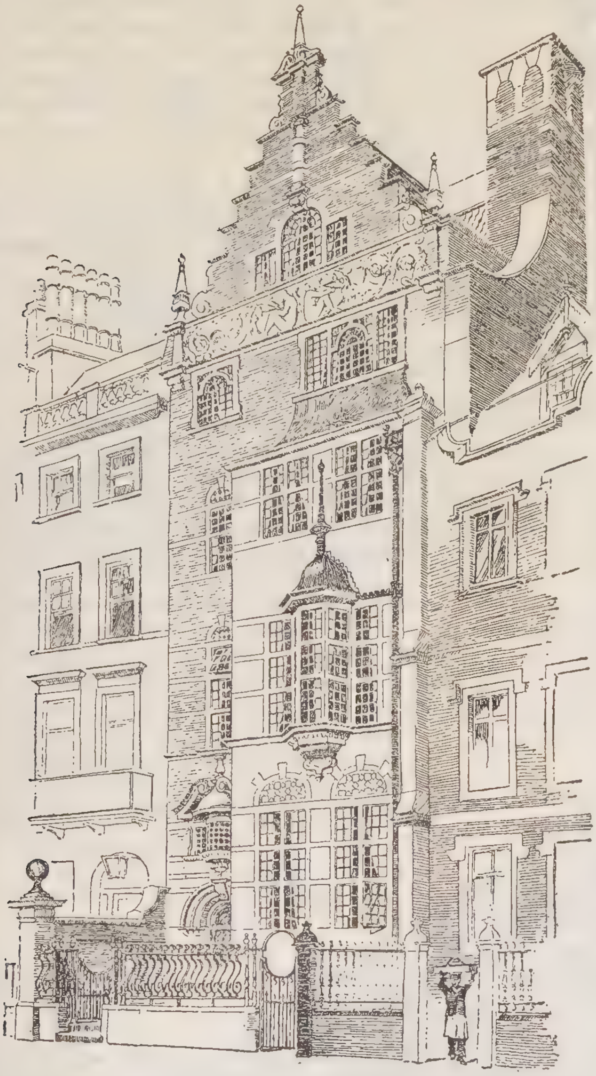

FIG. 107.—House in Buckingham Gate, London. (R. Blomfield.)

The competition for the Queen Victoria Memorial, consisting of a processional road from Whitehall to Buckingham Palace, culminating in a sculptural trophy in front of the palace, attracted a great deal of attention in 1901. Of the five invited competitors—Sir Aston Webb (b. 1849), T. G. Jackson, Ernest George (b. 1839), Sir Thomas Drew (b. 1838), and Sir Rowand Anderson (b. 1834) the two latter representing Ireland and Scotland respectively,—Sir Aston Webb's design was selected, and unquestionably showed the best and most effective manner of laying out the road, as well as a very pleasing architectural treatment of the semicircular forecourt in front of the palace, with pavilions and fountain-basins symmetrically spaced; but some of this was subsequently sacrificed on grounds of economy. The building, a triumphal arch flanked by pavilions, forming the entry to the processional road from Whitehall, is a dignified design.

Recent French architecture.

In France, still the leading artistic nation of the world, the art of architecture has been in a most flourishing and most active state in the most recent period. It is true that there is not the same variety as in modern English architecture, nor have there been the same discussions and experiments in regard to the true aim and course of architecture which have excited so much interest in England; because the French architects, unlike the English, know exactly what they want. They have a "school" of architecture; they adhere to the scholastic or academic theory of architecture as an art founded on the study of classic models; and on this basis their architects receive the most thorough training of any in the world. This predominance of the academic theory deprives their architecture, no doubt, of a good deal of the element of variety and picturesqueness; a French architect *pur sang*, in fact, never attempts the picturesque, unless in a country residence, and then the results are such that one wishes the attempt had not been made. But, on the other hand, modern French architecture at its best has a dignity and style about it which no other nation at present reaches, and which goes far to atone for a certain degree of sameness and repetition in its motives; and living under a government which recognizes the importance of national architecture, and is willing to spend public money liberally on it (with the full approbation of its public), the French architects have opportunities which English ones but seldom enjoy—the predominant aim with a British government being to see how little they can spend on a public building. The two great Paris exhibitions of 1889 and 1900 may be regarded as important events in connexion with architecture, for even the temporary buildings erected for them showed an amount of architectural interest and originality which could be met with nowhere else, and which in each case left its mark behind it, though with a difference; for while in the 1889 exhibition the main object was to treat temporary structures—iron and concrete and terra-cotta—in an undisguised but artistic manner, in those of the 1900 exhibition the effort was to create an architectural *coup d'œil* of apparently monumental structures of which the actual construction was disguised. In spite of some eccentricities the amount of invention and originality shown in these temporary buildings was most remarkable; but fortunately the exhibition left something more permanent behind it in the shape of the two art-palaces and the new bridge over the Seine. The two palaces are triumphs of modern classic architecture; the larger one (by MM. Thomas, Louvet and Deglane) is to some extent spoiled by the apparently unavoidable glass roof; the smaller one, by M. Girault, escapes this drawback, and, still more refined than its greater opposite, is one of the most beautiful buildings of modern times; the central portion is shown in Plate XIV., fig. 130. The architectural pylons, with their accompanying sculpture, which flank the entries to the bridge, are worthy of the best period of French Renaissance. Thus much, at least, has the 1900 exhibition done for architecture.

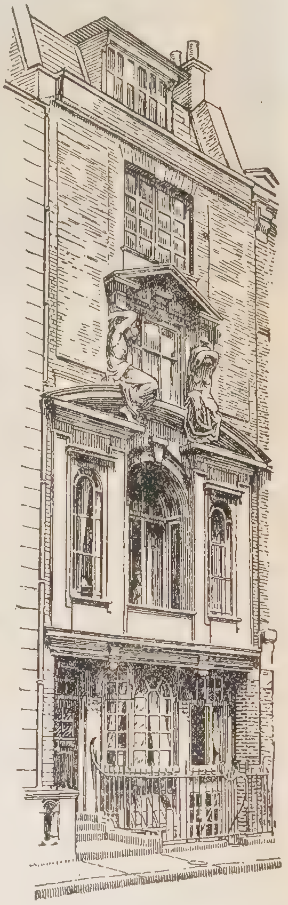

FIG. 108.—House in Margaret Street, London. (Beresford Pite.)

At the beginning of the last quarter of the 19th century stands one of the most important of modern French buildings, the Paris hôtel de ville, commenced shortly after the war, from the designs of MM. Ballu and Deperthes, planned on an immense scale, and on the stateliest and most monumental lines: the plan is given in fig. 109. The central block is, externally, a restoration of the old hôtel de ville, the remainder carried out in an analogous but somewhat more modern style. The interior has been the scene of sumptuous pictorial decoration, in which all the first artists of the day were employed—unfortunately in too scattered a manner and on no predominant or consistent scheme. One of the most characteristic architectural efforts of the French has consisted in the erection of the various smaller hôtels-de-ville or mairies, in the city and suburban districts of the capital; as at Pantin, Lilas, Suresnes and in various arrondissements within the city proper (Plate XIII., fig. 127). Nothing shows the quality of modern French architecture better, or perhaps more favourably, than this series of district town halls; all have a distinctly municipal character and a certain family resemblance of style amid their diversity of details; all are refined specimens of pre-eminently civilized architecture. Among the greater architectural efforts of France is the immense block of the new Sorbonne, by M. Nénot, a building sufficient in itself for an architectural reputation. Among smaller French buildings of peculiar merit may be mentioned the Musée Galliera, in the Trocadéro quarter of Paris, designed by M. Ginain—a work of pure art in architecture such as we should nowadays look for in vain out of France; the École de Médecine, by the same refined architect (fig. 110); and the chapel in rue Jean Goujon (Guilbert), erected as a memorial to the victims of the bazaar fire, again a notable instance of a work of pure thought in architecture—a new conception out of old materials. The new Opéra Comique (Bernier) should also be mentioned, the rather disappointing result of a competition which excited great interest at the time. Street architecture has been carried out of late in Paris in a sumptuous style, with great stone fronts and a profusion of carved ornament, such as we know nothing of in England; and though there is a rather monotonous repetition of the same style and character throughout the new or newly built streets, it is impossible to deny the effect of palatial dignity they impart to the city. In the matter of country houses the French architect is less fortunate; when he attempts what he regards as the rural picturesque, his good taste seems entirely to desert him, and the *maison de campagne* is generally a mere riot of gimcrack bargeboards and finials. In Paris, the taste for the contortions of what is called *art nouveau* has led to the erection, here and there, of ugly and eccentric fronts with preposterous ornamental details; but the invasion of this element is only partial and will probably not prove other than a passing phase.

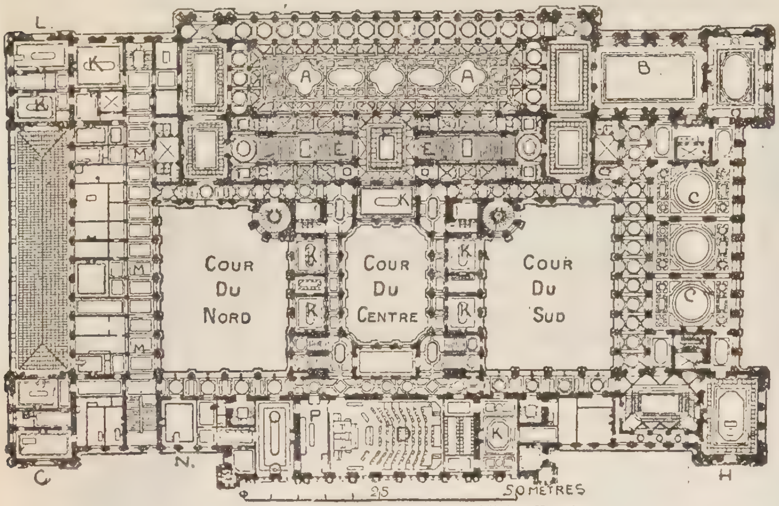

FIG. 109.—Plan of Hôtel de Ville, Paris.

A, Salle des Fêtes.
B, Salle à manger.
C, Salons de Réception.
D, Council Chamber.
E, Grand Staircase.
F, Salle des Cariatides.
G, General Secretary.
H, Prefect.
K, Committee Rooms.
L, Public Works.
M, Corridor.
N, President of Council.
O, Library.
P, Refreshment Room.

Germany.

The great military success of Germany in 1870, and the founding of the German empire, gave, as is usual in such crises, a decided impetus to public architecture, of which the central and most important visible sign is the German Houses of Parliament (Plate IX., fig. 117), by Paul Wallot (b. 1841), whose design was selected in a competition. There is something essentially German in the quality of this national building; classic architecture minus its refinement. The detail is coarse; the finish of the end pavilions of the principal front absolutely unmeaning—mere architectural rodomontade; the central cupola of glass and iron, on a square plan, probably the ugliest central feature on any great building in Europe; and yet there is undeniable power about the whole thing; it is the characteristic product of a conquering nation not reticent in its triumph. The new cathedral at Berlin, by Julius Raschdorff (b. 1823), is the other most important German work of the period (fig. 111); a building very striking and unusual in plan, but absolutely commonplace in its architectural detail; school classic of the most ordinary type, without even any of those elements of originality which are to be found in the Houses of Parliament. A curious feature in the plan (fig. 112) is that the building, alone of any cathedral we can recall, has its principal general entrance at the side, the end entrance being reserved for a special imperial cortège on special occasions, the cathedral also serving the second purpose of an imperial mausoleum. Theatre building has been carried on very largely in Germany, and among its productions the Lessing theatre at Berlin (fig. 113) (Hermann von der Hude and Julius Hennicke, d. 1892) is a favourable example of German

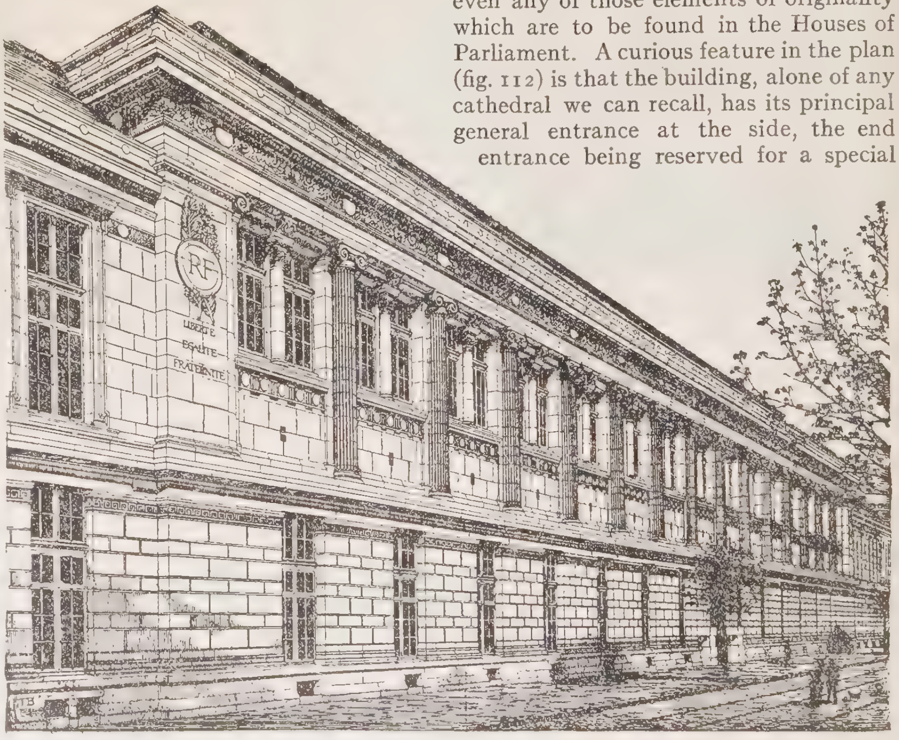

FIG. 110.—École de Médecine, Paris. (Ginain.)

classic at its best, besides being, like most modern German theatres, very well planned (fig. 114). Hamburg has had its new municipal buildings (Grotjan), a florid Renaissance building with a central tower, showing in its general effect and grouping a good deal of Gothic feeling. Mention may also be made of the Imperial law courts (Reichsgerichtsgebäude) at Leipzig, designed by Ludwig Hoffmann (b. 1852) and finished in 1895, a building with no more charm about it, externally, than the Berlin Parliament Houses, but with some good interior effects. The new post offices in Germany have been an important undertaking, and are, at all events, buildings of more mark than those in England. There has also been a great deal of new development in street architecture, which shows an immense variety, and a constantly evident determination to do something striking; but we find in it neither the dignity of Parisian street architecture nor the refinement of modern London work; there is an element of the bombastic about it.

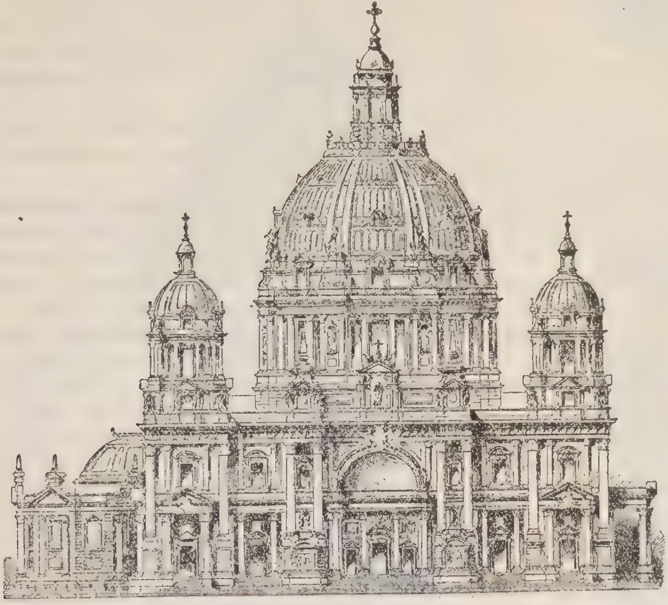

Fig. 111.—Cathedral at Berlin. (Raschdorff.)

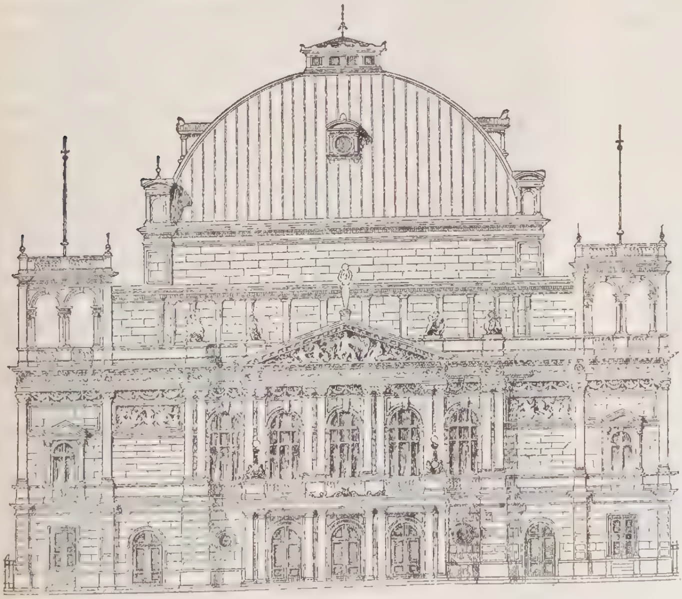

Fig. 113.—Lessing Theatre, Berlin. (Von der Hude and Hennicke.)

Other countries.

No modern building on the European continent is more remarkable than the Brussels law courts (Plate XI., fig. 121) from the designs of Joseph Poelaert (1816–1879), an original genius in architecture, who had the good fortune to be appreciated and given a free hand by his government. The design is based on classic architecture, but with a treatment so completely individual as to remove it almost entirely from the category of imitative or revival architecture; somewhat fantastic it may be, but as an original architectural creation it stands almost alone among modern public buildings. In Vienna the scholastic classic style has been retained with much more purity and refinement than in the German capital, and the Parliament Houses (Plate IX., fig. 116), by Theophil Hansen (1813–1891), if they show no originality of detail, have the merit of original and very effective grouping. Budapest, on the other hand, which has almost sprung into existence since 1875 as the rival of the Austrian capital, has erected a great Parliament building of florid character (Plate IX., fig. 115), in a style in which the Gothic element is prevalent, though the central feature is a dome. The plan (see fig. 92) is obviously based on that of the Westminster building; the exterior design, however, has the merit of clearly indicating the position of the two Chambers as part of the architectural design, the want of which is the one serious defect of Barry's noble structure. In Italy modern architecture is at a very low ebb; the one great work of this period was the building of the façade to the Duomo at Florence, from the design of de Fabris, who did not live to see its completion. As the completion in modern times of a building of world-wide fame, it is a work of considerable interest, and, on the whole, not unworthy of its position; that it should harmonize quite satisfactorily with the ancient structure was hardly to be expected. It was probably the completion of this façade which led the city of Milan to start a great architectural competition, in the early 'eighties, for the erection of a new façade to its celebrated cathedral, not because the façade had never been completed, but because it had been spoiled and patched with bad 18th century work. The ambition was a legitimate one, and the competition, open to all the world, excited the greatest interest; but the young Italian architect, Brentano, to whom the first premium

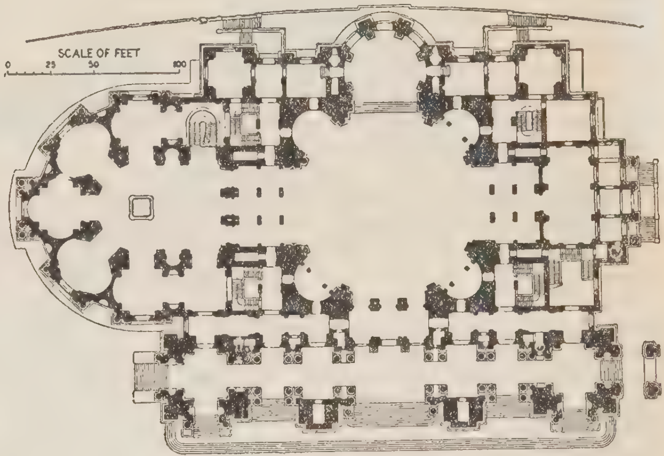

Fig. 112.—Plan of Cathedral at Berlin.

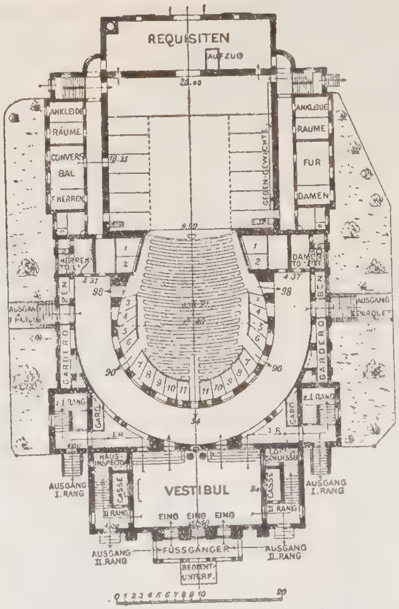

Fig. 114.—Plan of Lessing Theatre, Berlin.

was awarded, died shortly afterwards, and other causes, partly financial, led to the postponement of the scheme, though it is understood that there is still an intention of carrying out Brentano's design under the direction of the official architectural department of the city.

Conclusion.

In summing up the present position of modern architecture, it may be said that architecture is now a more cosmopolitan art than it has been at any previous period. The separate development of a national style has become in the present day almost an impossibility. Increased means of communication have brought all civilized nations into close touch with each other's tastes and ideas, with the natural consequence that the treatment of a special class of building in any one country will not differ very materially from its treatment in another; though there are nuances of local taste in detail, in manner of execution, in the materials used. And the civilized countries have almost with one consent returned, in the main, to the adoption of a school of architecture based on classic types. The taste for medievalism is dying out even in Great Britain, which has been its chief stronghold.

What course the future of modern architecture will take it is not easy to prophesy. What is quite certain is that it is now an individual art, each important building being the production, not of an unconsciously pursued national style, but of a personal designer. As far as there is a ruling consensus in architectural taste, this will tend to become, like dress and manners, more and more cosmopolitan; and it seems probable that it will be based more or less on the types left us by Classic and Renaissance architecture. There are, however, two influences which may have a definite effect on the architecture of the near future. One of these is the possible greater *rapprochement* between architecture and engineering, of which there are already some signs to be seen; architects will learn more of the kind of structural problems which are now almost the exclusive province of the engineer, and there will be a demand that engineering works shall be treated, as they well may be, with some of the refinement and expression of architecture. The other influence lies in the closer connexion, which is already taking place, between architecture and the allied arts, so that an important building will be regarded and treated as a field for the application of decorative sculpture and painting of the highest class, and as being incomplete without these. It is in this closer union of architecture with the other arts that there lies the best hope for the architecture of the future.

Authorities.—The literature of architecture as a modern art is limited, the most important publications of recent times being mainly devoted to the study and illustration of ancient architecture. The following, however, may be named:—James Fergusson, *History of Modern Architecture* (2nd ed., London, 1873); T. G. Jackson, *Modern Gothic Architecture* (London, 1873); J. T. Micklethwaite, *Modern Parish Churches* (London, 1874); E. R. Robson, *School Architecture* (London, 1874); J. J. Stevenson, *House Architecture* (London, 1880); E. E. Viollet-le-Duc, *How to Build a House* (London, 1874); *Lectures on Architecture* (London, 1881); H. C. Burdett, *Hospitals and Asylums of the World* (London, 1892–1893); Professor Oswald Kuhn, *Krankenhäuser* (Stuttgart, 1897); E. O. Sachs, *Modern Opera-Houses and Theatres* (London, 1897–1899); E. Wyndham Tarn, *The Mechanics of Architecture* (London, 1893); R. Norman Shaw, R.A., T. G. Jackson, R.A., and others, *Architecture, a Profession or an Art* (London, 1892); W. H. White, *The Architect and his Artists* (London, 1892); *Architecture and Public Buildings in Paris and London* (London, 1884); H. H. Statham, *Architecture for General Readers* (London, 1895); *Modern Architecture* (London, 1898); Herrmann Muthesius, *Die englische Baukunst der Gegenwart* (Berlin and Leipzig, 1900); Der Architekten Verein zu Berlin, *Berlin und Seine Bauten* (Berlin, 1896). The real literature of modern architecture, however, is to be found mainly in the articles and illustrations in the best periodical architectural publications of various countries. Among these Italy has none worth mention, and France, with all her architectural enthusiasm, has had no first-class architectural periodical since the extinction, about 1890, of the *Revue générale de l'architecture*, conducted for more than fifty years by the late César Daly, and in its day the first periodical of its class in the world. Among the best periodical publications are: *The Architectural Record* (quarterly), (New York); *The Architectural Review* (monthly), (Boston); the *Allgemeine Bauzeitung* (quarterly), (Vienna); the *Berlin Architekturwelt* (monthly), (Berlin); *The Builder* (weekly), (London); *La Construction moderne* (weekly), (Paris). (H. H. S.)

ARCHITRAVE (from Lat. *arcus*, an arch, and *trabs*, *trabem*, a beam), an architectural term for the chief beam which carries the superstructure and rests immediately on the columns. In the ordinary entablature it is the lowest of the three divisions, the other two being the frieze and the cornice (see Order). The term is also applied to the moulded frame of a doorway.

ARCHIVE (Lat. *archivum*, a transliteration of Gr. *ἀρχεῖον*, an official building), a term (generally used in the plural "archives"), properly denoting the building in which are kept the records, charters and other papers belonging to any state, community or family, but now generally applied to the documents themselves (see Record).

ARCHIVOLT (from Lat. *arcus*, an arch, and *volta*, a vault), an architectural term applied to the mouldings of an architrave, when carried round an arched opening.

ARCHON (ἄρχων, ruler), the title of the highest magistrate in many ancient Greek states. It is only in Athens that we have any detailed knowledge of the office, and even in this one case the evidence presents problems of the first importance which are incapable of decisive solution. There is no doubt that the archons represented the ancient kings, whose absolutism, under conditions which we can only infer, yielded in process of time to the power of the noble families, supported no doubt by the fighting force of the state. As to the process by which this change was effected there are two accounts. Traditionally, the monarchy after the death of Codrus (?1068 B.C.) gave place to the life archon whose tenure of office was limited afterwards to ten years and then to one year. Aristotle's *Constitution of Athens* (*q.v.*) speaks of five stages: (1) the institution of the polemarch who took over the military duties of the king; (2) the institution of *the* archon to relieve the king of his civil duties; (3) the tenure of office was reduced to ten years (? 752 B.C.); (4) the office was taken from the "royal" clan and thrown open to all Eupatridae (? 712 B.C.); (5) office was made annual, and to the existing three offices were added the six thesmothetae whose duty it was to record judicial decisions. The value of this latter account is, of course, debatable, but it is at least compatible with the general trend of development from hereditary absolutism, civil, military and religious, in the person of the "king," to a constitutional oligarchy. The change was clearly effected by the devolution of the military and civil powers of the king to the polemarch and the archon, while the archon basileus (or king) retained control of state religion. It is equally clear that owing to the predominating importance of civil affairs, *the* archon became the chief state official and gave his name to the year (hence archon eponymus). It should be noticed that the analogy which has often been suggested between the early history of the archonship at Athens, and such cases as the mayors of the palace in French history, or the tycoon (shogun) and mikado in Japanese history, is misleading. In these cases it is the old royal house that retains the royal title and the semblance of power, while the real authority passes into new hands. In Athens, the new civil office is vested in the old royal family, while the old title along with its religious functions is transferred. The early history of the thesmothetae is not clear, but this much is certain that there is no adequate reason for supposing, as many historians do, that in early times, they, with the three chief archons, constituted a collective or collegiate magistracy. It is true Thucydides (i. 126) states that, in the time of the Cylonian conspiracy (? 632 B.C.), "the nine archons were (*i.e.* collectively) the principal officials," but at the same time the responsibility for the action then taken attached to the Alcmaeonidae alone, because one of their number, Megacles, was at that time *the* archon (*i.e.* responsibility was personal, not collective). Again, the *Constitution of Athens* says that down to Solon's time the archons had no official residence, but that afterwards they used the Thesmotheteion. It is a reasonable inference from this statement that the thesmothetae had previously sat together apart from the superior archons and that it was only after Solon that collegiate responsibility began.

Evolution of the Office.—The history of the democratization of the archonship is beset with equal difficulty. In the early days,

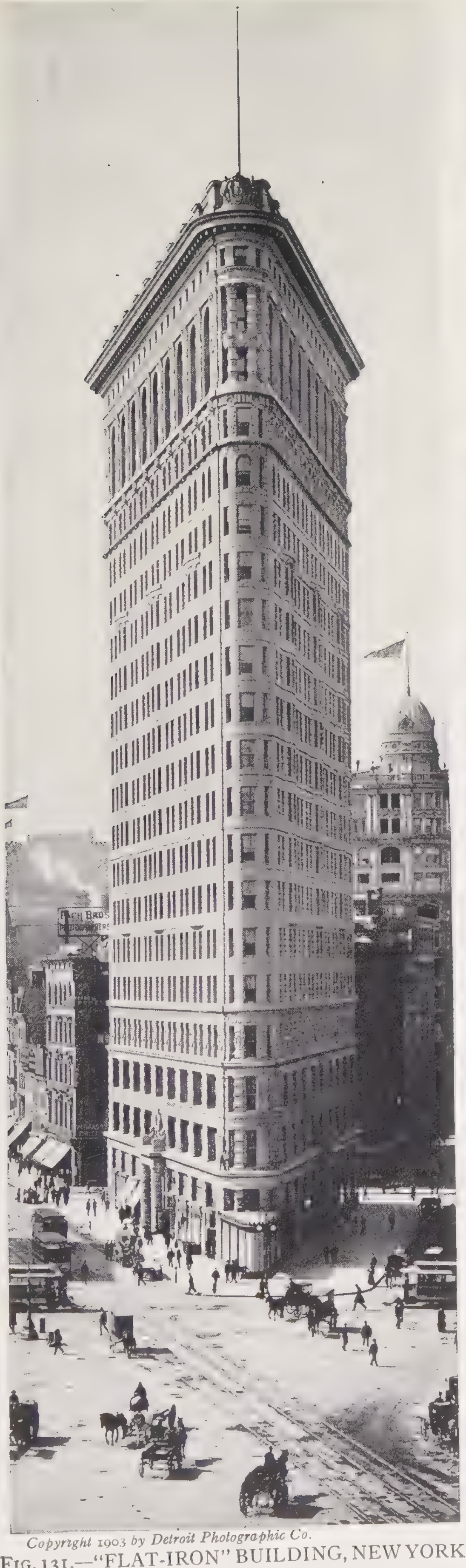

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FIG. 131.—"FLAT-IRON" BUILDING, NEW YORK.

(For method of construction, see STEEL CONSTRUCTION, and Plate II., Fig. 4, of that article.)

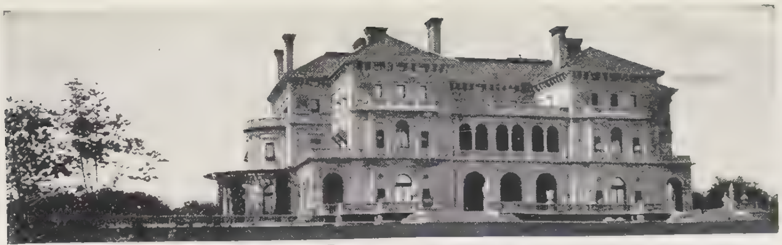

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FIG. 132.—A NEWPORT, R.I., "COTTAGE": "THE BREAKERS."

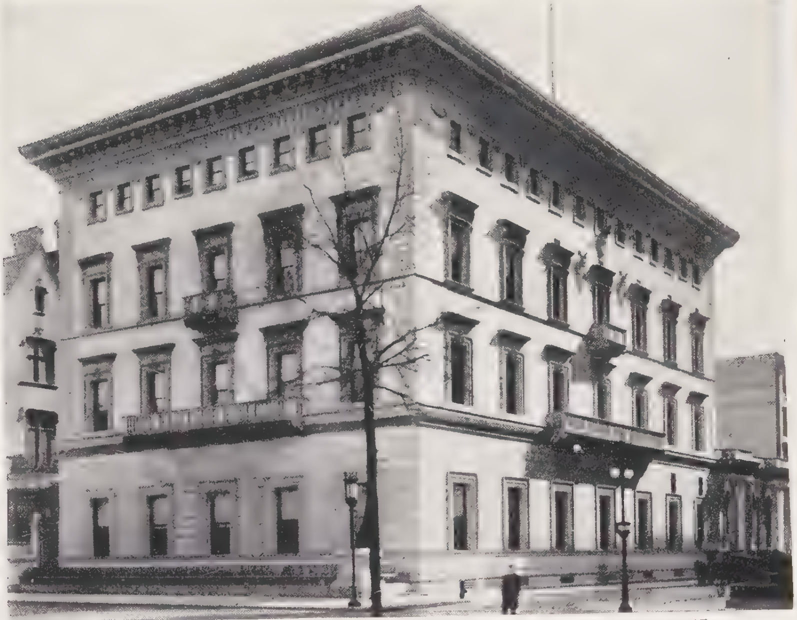

FIG. 133.—THE METROPOLITAN CLUB, NEW YORK.

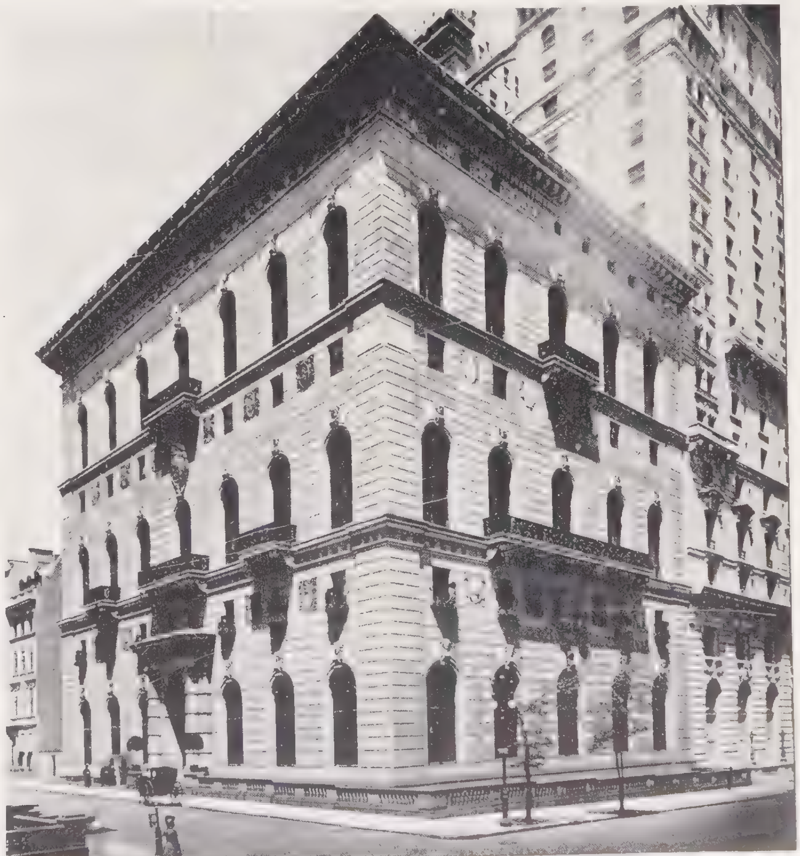

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FIG. 134.—THE UNIVERSITY CLUB, NEW YORK.

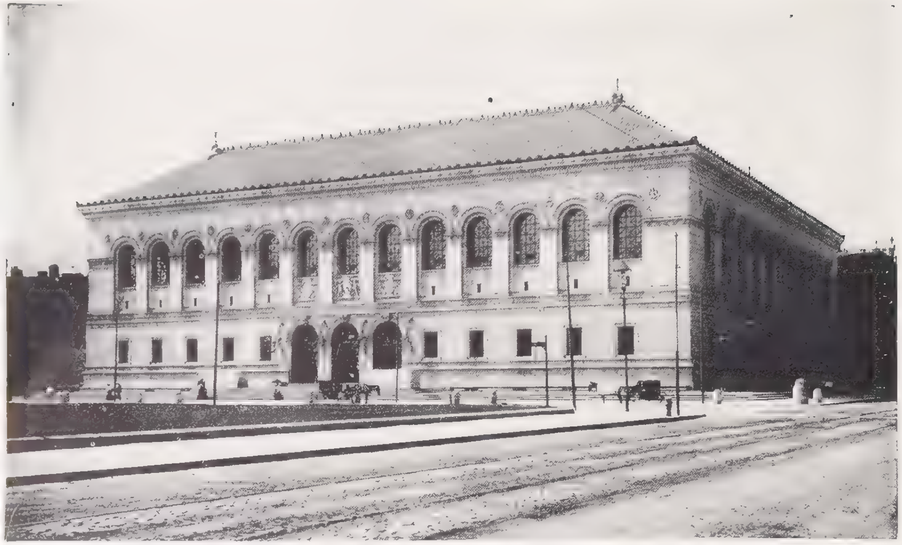

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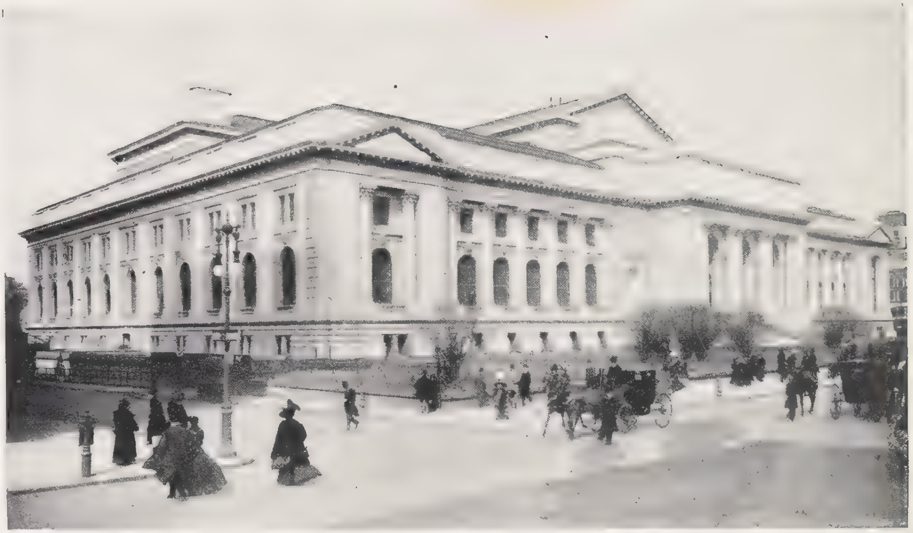
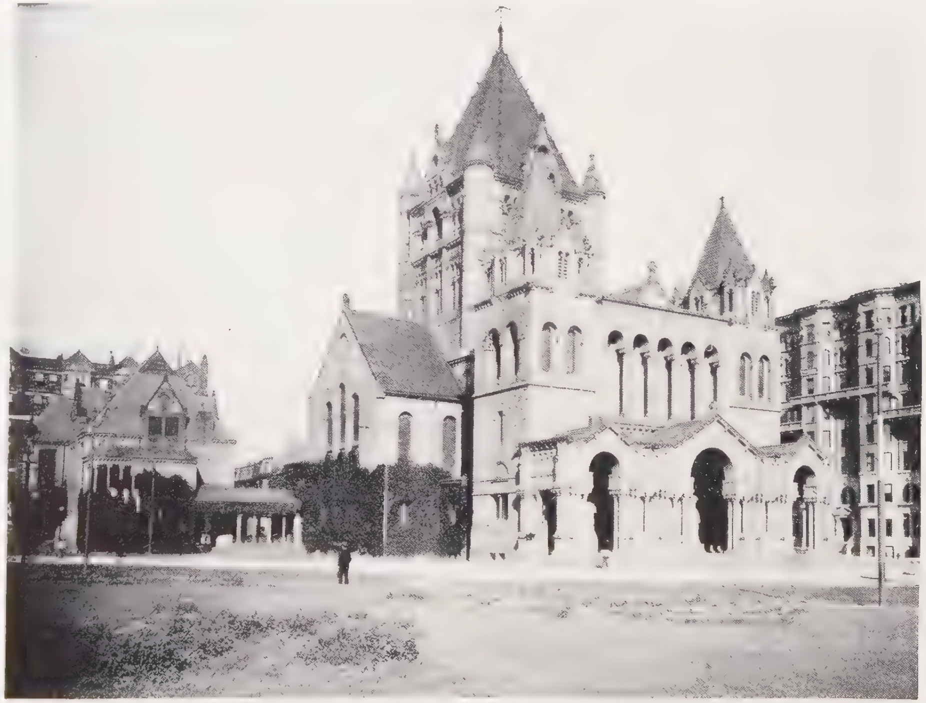
FIG. 135.—PUBLIC LIBRARY, BOSTON. (McKIM, MEAD & WHITE.)



Photo, Geo. P. Hall & Son.

FIG. 136.—PUBLIC LIBRARY, NEW YORK. (CARRÈRE & HASTINGS.)



Photo, Elmer Chickering.

FIG. 137.—TRINITY CHURCH, BOSTON. (H. H. RICHARDSON.)

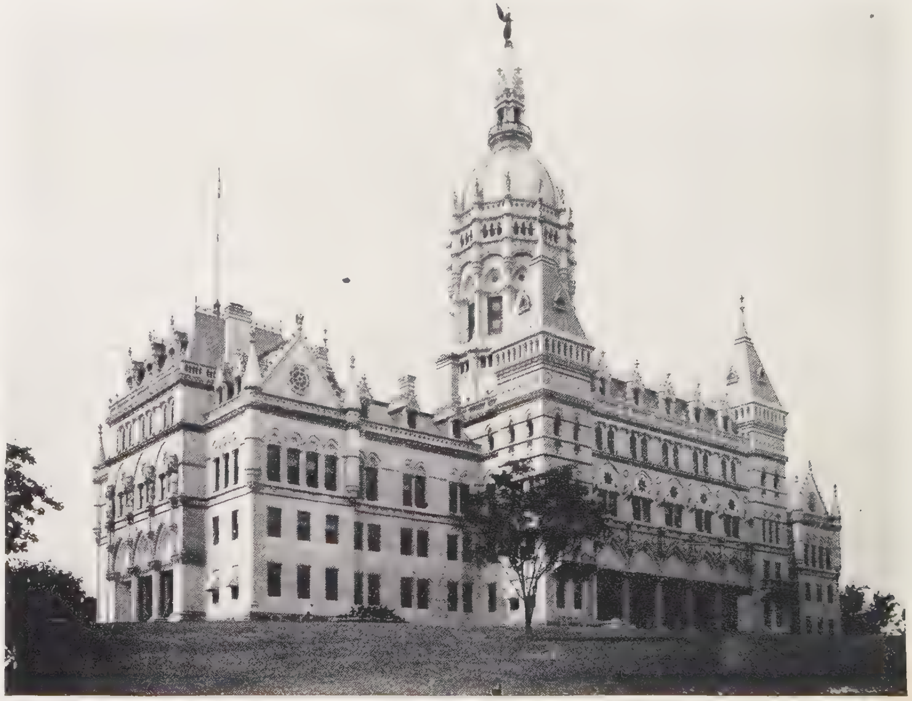


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FIG. 138.—STATE CAPITOL, HARTFORD, CONNECTICUT.

the importance of the office (confined as it was to the highest class) must have been immense; there was no audit, no written law, no executive council. The popular assembly was ill-organized and probably summoned by the archons themselves. The only control came from the Areopagus which elected them and would generally be favourably disposed, and from the fact that the military and civil powers were not vested in the same hands. Although the institution of the popular courts by Solon had within it the germ of democratic supremacy, it is clear that the immediate result was small; thus, in the next decade *anarchia* was continuous and Damasias held the archonship for more than two years in defiance of the new constitution; the prolonged dissension in this matter shows that the office of archon still retained its supreme importance. Gradually, however, the archonship lost its power, especially in judicial matters, until it retained merely the right of holding the preliminary investigation and the formal direction of the popular courts. Its administrative powers, save those wielded by the polemarch (see below and cf. STRATEGUS), dwindled away into matters of routine. We know that Peisistratus ruled by controlling the archonship, which was always held by members of his family, and the archonship of Isagoras was clearly an important party victory; we know further the names of three important men who held the office between Cleisthenes' reform and the Persian War (Hipparchus, Themistocles (*q.v.*), Aristides) from which we infer that the office was still the prize of party competition. On the other hand, after 487 B.C. the list of archons contains no name of importance. Presumably this is due to the growing importance of the Strategus and to the institution of sortition (see below), which, whether as cause or effect, is presumably by the 5th century indicative of diminished importance. There can, on these assumptions, be no doubt that, from the early years of the 5th century B.C., the archonship was of practically no importance. Furthermore we find that (probably after the Persian War) the office is thrown open to the second class, and finally in 457 B.C. we meet an archon, Mnesitheides, of the third, or Zeugite, class. Plutarch (*Aristides*, 22) says that after the great struggle of the Persian War Aristides threw open the office to all the citizens. But in fact the members of the fourth class were not formally admitted even in the 4th century (though by a fiction they were allowed to pose for the time as Zeugites). Furthermore it is not till 457 that even a Zeugite archon is known, according to the *Constitution of Athens* (*c.* 26), which dates the change as five years after the death of Ephialtes and does not connect it with Aristides.

Sortition.—The next question constitutes perhaps the most important problem in Greek political development. At what date was election by lot, or sortition, introduced for the archonship? From the *Constitution of Athens* (*c.* 22) we gather that from the fall of the Tyranny to 487 B.C. the archons were αἱρετοί, not κληρωτοί (*i.e.* chosen by vote, not by lot), and that in 487, limited sortition was introduced, whereby fifty candidates were elected by each tribe, and from these the archons and their "secretary" were chosen by lot. But against this must be set the statement by the same authority that this double method was part of the Solonian reform. The solution of the dilemma is a matter of inference. Three indications favour the former view: (1) the "anarchia" which occurred so often between Solon and Peisistratus shows that the office was at that time a question of party (*i.e.* elective); (2) the statement that Solon invented sortition for the office is put as the basis of a comparison (ὅθεν, σημεῖον) and, therefore, may fairly be regarded as a hypothesis; (3) there is no indication that the change made in 487 B.C. was a return to an obsolete method, and on the same argument it is odd that Solon's alleged system should not have been revived at the end of the Tyranny. On the other hand Herodotus (vi. 109) states that, in 490, before the battle of Marathon, the polemarch was chosen by lot. If this be true, it follows that the office of polemarch must have lost its military importance, which was not the case, inasmuch as the polemarch at Marathon gave the casting vote in favour of immediate battle. Whether, therefore, Solon or Aristides was the first to introduce sortition, it is perfectly clear that the lot was not used between the Tyranny and 487 B.C. and that after 487 the lot was always used (see J. E. Sandys, *Constitution of Athens* c. 8 note 1, c. 22 § 5, note); in fact, at a date not known the mixed system of Aristides gave place to double sortition, in which the first nomination also was by lot. To enter here into the theory of the lot is impossible. It should, however, be observed that in the somewhat material atmosphere of constitutional Athens the religious significance of the lot had vanished; no important office in the 5th and 4th centuries was entrusted to its decision. The real effect of sortition was to equalize the chances of rich and poor without civil strife. Now it is perfectly clear that it could not have been this object which impelled Solon to introduce sortition; for in his time the archonship was not open to the lower classes, and, therefore, election was more democratic than sortition, whereas later the case was reversed. It should further be mentioned that, before the discovery of the Aristotelian *Constitution* in 1891, Grote, C. F. Hermann, Busolt and others had maintained that the lot was not used in Athens before the time of Cleisthenes; and in spite of the treatise, it must be admitted that there is no satisfactory evidence, historical or inferential, that their theory was unsound.

Qualifications and Functions.—It remains to give a brief analysis of the qualifications and functions of the archons after the year 487 B.C. After election (in the time of Aristotle in the month Anthesterion; in the 3rd century in Munychion) a short time had to elapse before entering on office to allow of the *dokimasia* (examination of fitness). In this the whole life of the nominee was investigated, and each had to prove that he was physically without flaw. Failure to pass the scrutiny involved a certain loss of civic rights (*e.g.* that of addressing the people). The successful candidate had to take an oath to the people (that he would not take bribes, &c.) and to go through certain preliminary rites. Any citizen could bring an impeachment (*eisangelia*) against the archons. Any delinquency involved a trial before the Heliaea. Finally an examination took place at the end of the year of office, when each archon had to answer for his actions with person and possessions; till then he could not leave the country, be adopted into another family, dispose of his property, nor receive any "crown of honour." A similar investigation took place with regard to the assessors (*paredri*) whom the three senior archons chose to assist them. The archons at the end of their year of office (some say on entering upon office) became members of the Areopagus, which was, therefore, a body composed of ex-archons of tried probity and wisdom. The archons as a body retained some duties such as the appointment of jurymen, the sortition of the *athlothetae*, &c. (but see Gilbert's *Antiquities*, Eng. trans., p. 251, n. 1). On entering upon office the archon (archon eponymus) made proclamation by his herald that he would not interfere with private property. His official residence was the Prytaneum where he presided over all questions of family, *e.g.* the protection of parents against children and *vice versa*, protection of widows, wardship of heiresses and orphans, divorce; in religious matters he superintended the Dionysia, the Thargelia, the processions in honour of Zeus the Saviour and Asclepius. The archon basileus superintended the holy places, the mysteries, the Lampadephoria (Torch race), &c., questions of national religion and certain cases of bloodguiltiness. His official residence was the Stoa Basileios, and his wife, as officially representing the wife of Dionysus, was called Basilinna. The polemarch, who was at any rate titular commander down to about 487 B.C. (see above; and Herod. vi. 109, ἑνδέκατος ψηφιδοφόρος), became in the 5th century a sort of consul who watched over the rights of resident aliens (*metoeci*) in their family and legal affairs. He offered sacrifices to Artemis Agrotera and Enyalios, superintended *epitaphia* and arranged for the annual honours paid to the tyrannicides. His official residence was the Epilyceum (formerly called the Polemarcheion).

BIBLIOGRAPHY.—G. Gilbert, *Constitutional Antiquities* (Eng. trans., 1895); Eduard Meyer's *Geschichte des Alterthums*, ii. sect. 228; A. H. J. Greenidge, *Handbook of Greek Constitutional Hist.* (1895); J. W. Headlam, *Election by Lot in Athens* (Camb., 1891); and authorities quoted under GREECE: *History, ancient*, and ATHENS: *History*.

(J. M. M.)

ARCHPRIEST (Lat. *archipresbyter*, Gr. ἀρχιπρεσβύτερος), in the Christian Church, originally the title of the chief of the priests in a diocese. The office appears as early as the 4th century as that of the priest who presided over the presbyters of the diocese and assisted the bishop in matters of public worship, much as the archdeacon helped him in administrative affairs. Where, as in Germany, the dioceses were of vast extent, these were divided into several archpresbyterates. Out of these developed the rural deaneries, the office of archpriest being ultimately merged in that of rural dean, with which it became synonymous. It thus became strictly subordinate to the jurisdiction of the archdeacon. In Rome itself, as the office of archdeacon grew into that of cardinal-camerlengo, so that of archpriest of St Peter's developed into that of the cardinal-vicar. In England from 1598 until the appointment of a vicar-apostolic in 1623 the Roman Catholic clergy were placed by the pope under an "archpriest" as superior of the English mission. In the Lutheran Church in Germany the title archpriest (*Erzpriester*) was in some cases long retained as the equivalent of that of superintendent, sometimes also still called dean (*Dechant*), his functions being much the same as those of the rural dean.

ARCHYTAS (*c.* 428–347 B.C.), of Tarentum, Greek philosopher and scientist of the Pythagorean school, famous as the intimate friend of Plato, was the son of Mnesagoras or Histiaeus. Equally distinguished in natural science, philosophy and the administration of civic affairs, he takes a high place among the versatile savants of the ancient Greek world. He was a man of high character and benevolent disposition, a fine flute-player, and a generous master to his slaves, for whose children he invented the rattle. He took a prominent part in state affairs, and, contrary to precedent, was seven times elected commander of the army. Under his leadership, Tarentum fought with unvarying success against the Messapii, Lucania and even Syracuse. After a life of high intellectual achievement and uninterrupted public service, he was drowned (according to a tradition suggested by Horace, *Odes*, i. 28) on a voyage across the Adriatic, and was buried, as we are told, at Matinum in Apulia. He is described as the eighth leader of the Pythagorean school, and was a pupil (not the teacher, as some have maintained) of Philolaus. In mathematics, he was the first to draw up a methodical treatment of mechanics with the aid of geometry; he first distinguished harmonic progression from arithmetical and geometrical progressions. As a geometer he is classed by Eudemus, the greatest ancient authority, among those who "have enriched the science with original theorems, and given it a really sound arrangement." He evolved an ingenious solution of the duplication of the cube, which shows considerable knowledge of the generation of cylinders and cones. The theory of proportion, and the study of acoustics and music were considerably advanced by his investigations. He was said to be the inventor of a kind of flying-machine, a wooden pigeon balanced by a weight suspended from a pulley, and set in motion by compressed air escaping from a valve.[1] Fragments of his ethical and metaphysical writings are quoted by Stobaeus, Simplicius and others. To portions of these Aristotle has been supposed to have been indebted for his doctrine of the categories and some of his chief ethical theories. It is, however, certain that these fragments are mainly forgeries, attributable to the eclecticism of the 1st or 2nd century A.D., of which the chief characteristic was a desire to father later doctrines on the old masters. Such fragments as seem to be authentic are of small philosophical value. It is important to notice that Archytas must have been famous as a philosopher, inasmuch as Aristotle wrote a special treatise (not extant) *On the Philosophy of Archytas*. Some positive idea of his speculations may be derived from two of his observations: the one in which he notices that the parts of animals and plants are in general rounded in form, and the other dealing with the sense of hearing, which, in virtue of its limited receptivity, he compares with vessels, which when filled can hold no more. Two important principles are illustrated by these thoughts, (1) that there is no absolute distinction between the organic and the inorganic, and (2) that the argument from final causes is no explanation of phenomena. Archytas may be quoted as an example of Plato's perfect ruler, the philosopher-king, who combines practical sagacity with high character and philosophic insight.

See G. Hartenstein, *De Arch. Tar. frag.* (Leipzig, 1833); O. F. Gruppe, *Über d. Frag. d. Arch.* (1840); F. Beckmann, *De Pythag. reliq.* (Berlin, 1844, 1850); Egger, *De Arch. Tar. vit., op. phil.*; Ed. Zeller, *Phil. d. Griech.*; Theodor Gomperz, *Greek Thinkers*, ii. 259 (Eng. trans. G. G. Berry, Lond., 1905); G. J. Allman, *Greek Geometry from Thales to Euclid* (1889); Florian Cajori, *History of Mathematics* (New York, 1894); M. Cantor, *Gesch. d. gr. Math.* (1894 foll.). The mathematical fragments are collected by Fr. Blass, *Mélanges Graux* (Paris, 1884). For Pythagorean mathematics see further PYTHAGORAS.

ARCIS-SUR-AUBE, a town of eastern France, capital of an arrondissement in the department of Aube, on the left bank of the Aube, 23 m. N. of Troyes on the Eastern railway to Châlons-sur-Marne. Pop. (1906) 2803. Fires in 1719, 1727 and 1814 destroyed the ancient buildings, and it is now a town built in modern style with wide and regular streets. A château of the 18th century occupies the site of an older one in which Diana of Poitiers, mistress of Henry II., resided. The only other building of interest is the church, which dates from the 15th century. In front of it there is a statue of Danton, a native of the town. Arcis-sur-Aube has a tribunal of first instance. Its industries include important hosiery manufactures, and it carries on trade in grain and coal. The town communicates with Paris by means of the Aube, which becomes navigable at this point.

A battle was fought here on the 20th and 21st of March 1814 between Napoleon and the Austro-Russian army under Schwarzenberg (see NAPOLEONIC CAMPAIGNS).

ARCOLA, a village of northern Italy, 16 m. E.S.E. of Verona, on the Alpone stream, near its confluence with the Adige below Verona. The village gives its name to the three days' battle of Arcola (15th, 16th and 17th of November 1796), in which the French, under General Napoleon Bonaparte, defeated the Austrians commanded by Allvintzy (see FRENCH REVOLUTIONARY WARS).

ARCOS DE LA FRONTERA, a town of southern Spain, in the province of Cadiz; on the right bank of the river Guadalete, which flows past Santa Maria into the Bay of Cadiz. Pop. (1900) 13,926. The town occupies a ridge of sandstone, washed on three sides by the river, and commanding fine views of the lofty peak of San Cristobál, on the east, and the fertile Guadalete valley, celebrated in ancient Spanish ballads for its horses. At the highest point of the ridge is a Gothic church with a fine gateway, and a modern tower overlooking the town. The fame of its ten bells dates from the wars between Spaniards and Moors in which "Arcos of the Frontier" received its name. After its capture by Alphonso the Wise of Castile (1252–1284), the town was a Christian stronghold on the borders of Moorish territory. Another church contains several Moorish banners, taken in 1483 at the battle of Záhara, a neighbouring village. The ruined citadel, the theatre, and the palace of the dukes of Arcos are the only other noteworthy buildings. Roman remains have been found in the vicinity, and the ridge of Arcos is honeycombed with rock-hewn chambers, said to be ancient cave-dwellings.

See *Galeria de Arcobricenses illustres* (Arcos, 1892), and *Riqueza y cultura de Arcos de la Frontera* (Arcos, 1898); both by M. Mancheño y Olivares.

ARCOSOLIUM (from Lat. *arcus*, arch, and *solium*, a sarcophagus), an architectural term applied to an arched recess used as a burial place in a catacomb (*q.v.*).

ARCOT, the name of a city and two districts of British India in the presidency of Madras. Arcot city is the principal town in the district of North Arcot. It occupies a very prominent place in the history of the British conquest of India, but it has now lost its manufactures and trade and preserves only a few mosques and tombs as traces of its former grandeur. It is a station on the line of railway from Madras to Beypur, but has ceased to be a military cantonment. The most famous episode in its history is the capture and defence of Arcot by Clive. In the middle of the 18th century, during the war between the rival claimants to the throne of the Carnatic, Mahommed Ali and Chanda Sahib, the English supported the claims of the former and the French those of the latter. In order to divert the attention of Chanda Sahib and his French auxiliaries from the siege of Trichinopoly, Clive suggested an attack upon Arcot and offered to command the expedition. His offer was accepted; but the only force which could be spared to him was 200 Europeans and 300 native troops to attack a fort garrisoned by 1100 men. The place, however, was abandoned without a struggle and Clive took possession of the fortress. The expedition produced the desired effect; Chanda Sahib was obliged to detach a large force of 10,000 men to recapture the city, and the pressure on the English garrison at Trichinopoly was removed. Arcot was afterwards captured by the French; but in 1760 was retaken by Colonel Coote after the battle of Wandiwash. It was also taken by Hyder Ali when that invader ravaged the Carnatic in 1780, and held by him for some time. The town of Arcot, together with the whole of the territory of the Carnatic, passed into the hands of the British in 1801, upon the formal resignation of the government by the nawab, Azim-ud-daula, who received a liberal pension.

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[1] If this be the proper translation of Aulus Gellius, *Noctes Atticae*, x. 12. 9, "... simulacrum columbae e ligno ... factum; ita erat scilicet libramentis suspensum et aura spiritus inclusa atque occulta concitum." (See AERONAUTICS.)

The district of North Arcot is bounded on the N. by the districts of Cuddapah and Nellore; on the E. by the district of Chingleput; on the S. by the districts of South Arcot and Salem; and on the W. by the Mysore territory. The area of North Arcot is 7386 sq. m., and the population in 1901 was 2,207,712, showing an increase of 4% in the decade. The aspect of the country, in the eastern and southern parts, is flat and uninteresting; but the western parts, where it runs along the foot of the Eastern Ghats, as well as all the country northwards from Trivellam to Tripali and the Karkambadi Pass, are mountainous, with an agreeable diversity of scenery. The elevated platform in the west of the district is comparatively cool, being 2000 ft. above the level of the sea, with a mean maximum of the thermometer in the hottest weather of 88°. The hills are composed principally of granite and syenite, and have little vegetation. Patches of stunted jungle here and there diversify their rugged and barren aspect; but they abound in minerals, especially copper and iron ores. The narrow valleys between the hills are very fertile, having a rich soil and an abundant water-supply even in the driest seasons. The principal river in the district is the Palar, which rises in Mysore, and flows through North Arcot from west to east past the towns of Vellore and Arcot, into the neighbouring district of Chingleput, eventually falling into the sea at Sadras. Although a considerable stream in the rainy season, and often impassable, the bed is dry or nearly so during the rest of the year. Other smaller rivers of the district are the Paini, which passes near Chittore and falls into the Palar, the Sonamukhi and the Chayaur. These streams are all dry during the hot season, but in the rains they flow freely and replenish the numerous tanks and irrigation channels. The administrative headquarters are at Chittore, but the largest towns are Vellore (the military station), Tirupati (a great religious centre), and Wallajapet and Kalahasti (the two chief places of trade).

The district of South Arcot is bounded on the N. by the districts of North Arcot and Chingleput; on the E. by the French territory of Pondicherry and the Bay of Bengal; on the S. by the British districts of Tanjore and Trichinopoly; and on the W. by the British district of Salem. It contains an area of 5217 sq. m.; and its population in 1901 was 2,349,894, showing an increase of 9% in the decade. The aspect of the district resembles that of other parts of the Coromandel coast. It is low and sandy near the sea, and for the most part level till near the western border, where ranges of hills form the boundary between this and the neighbouring district of Salem. These ranges are in some parts about 5000 ft. high, with solitary hills scattered about the district. In the western tracts, dense patches of jungle furnish covert to tigers, leopards, bears and monkeys. The principal river is the Coleroon which forms the southern boundary of the district, separating it from Trichinopoly. This river is abundantly supplied with water during the greater part of the year, and two irrigating channels distribute its waters through the district. The other rivers are the Vellar, Pennar, and Gadalum, all of which are used for irrigation purposes. Numerous small irrigation channels lead off from them, by means of which a considerable area of waste land has been brought under cultivation. Under the East India Company, a commercial resident was stationed at Cuddalore, and the Company's weavers were encouraged by many privileges. The manufacture and export of native cloth have now been almost entirely superseded by the introduction of European piece goods. The chief seaport of the district of South Arcot is Cuddalore, close to the site of Fort St David. The principal crops in both districts are rice, millet, other food grains, oil-seeds and indigo.

ARCTIC (Gr. Ἄρκτος, the Bear, the northern constellation of *Ursa Major*), the epithet applied to the region round the North Pole, covering the area (both ocean and lands) where the characteristic polar conditions of climate, &c., obtain. The Arctic Circle is drawn at 66° 30′ N. (see POLAR REGIONS).

ARCTINUS, of Miletus, one of the earliest poets of Greece and contributors to the epic cycle. He flourished probably about 744 B.C. (Ol. 7). His poems are lost, but an idea of them can be gained from the *Chrestomathy* written by Proclus the Neo-Platonist of the 5th century or by a grammarian of the same name in the time of the Antonines. The *Aethiopis* (Αἰθιοπίς), in five books, was so called from the Aethiopian Memnon, who became the ally of the Trojans after the death of Hector. As the opening shows, it took up the narrative from the close of the *Iliad*. It begins with the famous deeds and death of the Amazon Penthesileia, and concludes with the death and burial of Achilles and the dispute between Ajax and Odysseus for his arms. The title thus only applied to part of the poem. The *Sack of Troy* (Ἰλίου Πέρσις) gives the stories of the wooden horse, Sinon, and Laocoon, the capture of the city, and the departure of the Greeks under the wrath of Athene at the outrage of Ajax on Cassandra. The *Little Iliad* (Ἰγιὰς μικρά) of Lesches formed the transition between the *Aethiopis* and the *Sack of Troy*.

Kinkel, *Epicorum Graecorum Fragmenta* (1877); Welcker, *Der epische Cyclus*; Müller, *History of the Literature of Ancient Greece*; Lang, *Homer and the Epic* (1893); Monro, *Journal of Hellenic Studies* (1883); T. W. Allen in *Classical Quarterly*, April 1908, pp. 82 foll.

ARCTURUS, the brightest star in the northern hemisphere, situated in the constellation Boötes (*q.v.*) in an almost direct line with the tail (ζ and η) of the constellation Ursa Major (Great Bear); hence its derivation from the Gr. ἄρκτος, bear, and οὖρος, guard. Arcturus has been supposed to be referred to in various passages of the Hebrew Bible; the Vulgate reads Arcturus for stars mentioned in Job ix. 9, xxxvii. 9, xxxviii. 31, as well as Amos v. 8. Other versions, as also modern authorities, have preferred, *e.g.*, Orion, the Pleiades, the Scorpion, the Great Bear (cf. *Amos* in the "International Critical Comment." series, and G. Schiaparelli, *Astronomy in the O.T.*, Eng. trans., Oxford, 1905, ch. iv.). According to one of the Greek legends about Arcas, son of Lycaon, king of Arcadia, he was killed by his father and his flesh was served up in a banquet to Zeus, who was indignant at the crime and restored him to life. Subsequently Arcas, when hunting, chanced to pursue his mother Callisto, who had been transformed into a bear, as far as the temple of Lycaean Zeus; to prevent the crime of matricide Zeus transported them both to the heavens (Ovid, *Metam.* ii. 410), where Callisto became the constellation Ursa Major, and Arcas the star Arcturus (see LYCAON and CALLISTO).

ARCUEIL, a town of northern France, in the department of Seine, on the Bièvre, 2½ m. N.E. of Sceaux on the railway from Paris to Limours. Pop. (1906) 8660. The town has an interesting church dating from the 13th to the 15th century. It takes its name from a Roman aqueduct, the *Arcus Juliani* (Arculi), some traces of which still remain. In 1613–1624 a bridge-aqueduct over 1300 ft. long was constructed to convey water from the spring of Rungis some 4 m. south of Arcueil, across the Bièvre to the Luxembourg palace in Paris. In 1868–1872 another aqueduct, still longer, was superimposed above that of the 17th century, forming part of the system conveying water from the river Vanne to Paris. The two together reach a height of about 135 ft. Bleaching, and the manufacture of bottle capsules, patent leather and other articles are carried on at Arcueil; and there are important stone-quarries.

ARCULF, a Gallican bishop and pilgrim-traveller, who visited the Levant about 680, and was the earliest Christian traveller and observer of any importance in the Nearer East after the rise of Islam. On his return he was driven by contrary winds to Britain, and so came to Iona, where he related his experiences to his host, the abbot Adamnan (679-704). This narrative, as written out by Adamnan, was presented to Aldfrith the Wise, last of the great Northumbrian kings, at York about 701, and came to the knowledge of Bede, who inserted a brief summary of the same in his *Ecclesiastical History of the English Nation*, and also drew up a separate and longer digest which obtained great popularity throughout the middle ages as a standard guide-book (the so-called *Libellus de locis sanctis*) to the Holy Places of Syria. Arculf is the first to mention the column at Jerusalem, which claimed to mark the exact centre of the Inhabited Earth, and later became one of the favourite Palestine wonders. Besides a valuable account of the principal sacred sites of Judaea, Samaria and Galilee as they existed in the 7th century, he also gives important information as to Alexandria and Constantinople, briefly describes Damascus and Tyre, the Nile and the Lipari volcanoes, and refers to the caliph Moawiya I. (A.D. 661–680), whom he pictures as befriending Christians and rescuing the "sudarium" of Christ from the Jews. Arculf's record is especially useful from its plans, drawn from personal observation by the traveller himself, of the churches of the Holy Sepulchre and of Mount Sion in Jerusalem, of the Ascension on Olivet and of Jacob's well at Sichem. It is also a useful witness to the prosperity and trade of Alexandria after the Moslem conquest: it tells us how the Pharos was still lit up every night; and it gives us (from Constantinople) the first form of the story of St George which ever seems to have attracted notice in Britain.

Thirteen MSS. of the original Arculf-Adamnan narrative exist, and fully 100 of Bede's abridgment: of the former, the most important, containing all the plans, are (1) Bern, Canton Library, 582, of 9th cent.; (2) Paris, National Library, Lat. 13,048, of 9th cent.; a third MS., London, B. Mus., Cotton, Tib. D. V., of 8th–9th cents., though damaged by fire and lacking the illustrations, is of value for the text, being the oldest of all. Among editions the first is of 1619, by Gretser; the best, that of 1877, by Tobler, in *Itinera et Descriptiones Terrae Sanctae*; we may also mention that of 1870, by Delpit, in his *Essai sur les anciens pèlerinages à Jérusalem*; see also Delpit's remarks upon Arculf in the same work, pp. 260-304; Beazley, *Dawn of Modern Geography*, i. 131-40 (1897).

ARDASHIR, the modern form of the Persian royal name Artaxerxes (*q.v.*), "he whose empire is excellent." After the three Achaemenian kings of this name, it occurs in Armenia, in the shortened form Artaxias (Armenian, Artashes or Artaxes), and among the dynasts of Persia who maintained their independence during the Parthian period (see Persis). One of these, (1) Artaxerxes or Ardashir I. (in his Greek inscriptions he calls himself Artaxares, and the same form occurs in Agathias ii. 25, iv. 24), became the founder of the New-Persian or Sassanian empire. Of his reign we have only very scanty information, as the Greek and Roman authors mention only his victory over the Parthians and his wars with Rome. A trustworthy tradition about the origin of his power, from Persian sources, has been preserved by the Arabic historian Tabari (Th. Nöldeke, *Geschichte der Perser und Araber zur Zeit der Sasaniden, aus der arabischen Chronik des Tabari*, 1879). He was the second son of Pāpak (Bābek), the offspring of Sassan (Sāsān), after whom the dynasty is named. Pāpak had made himself king of the district of Istakhr (in the neighbourhood of Persepolis, which had fallen to ruins). After the death of Pāpak and his oldest son Shapur (Shāhpuhr, Sapores), Ardashir made himself king (probably A.D. 212), put his other brothers to death and began war against the neighbouring dynasts of Persis. When he had conquered a great part of Persis and Carmania, the Parthian king Artabanus IV. interfered. But he was defeated in three battles and at last killed (A.D. 226). Ardashir now considered himself sovereign of the whole empire of the Parthians and called himself "King of Kings of the Iranians." But his aspirations went farther. In Persis the traditions of the Achaemenian empire had always been alive, as the name of Ardashir himself shows, and with them the national religion of Zoroaster. Ardashir, who was a zealous worshipper of Ahuramazda and in intimate connexion with the magian priests, established the orthodox Zoroastrian creed as the official religion of his new kingdom, persecuted the infidels, and tried to restore the old Persian empire, which under the Achaemenids had extended over the whole of Asia from the Aegean Sea to the Indus. At the same time he put down the local dynasts and tried to create a strong concentrated power. His empire is thus quite different in character from the Parthian kingdom of the Arsacids, which had no national and religious basis but leant towards Hellenism, and whose organization had always been very loose. Ardashir extirpated the whole race of the Arsacids, with the exception of those princes who had found refuge in Armenia, and in many wars, in which, however, as the Persian tradition shows, he occasionally suffered heavy defeats, he succeeded in subjugating the greater part of Iran, Susiana and Babylonia. The Parthian capital Ctesiphon (*q.v.*) remained the principal residence of the Sassanian kingdom, by the side of the national metropolis Istakhr, which was too far out of the way to become the centre of administration. Opposite to Ctesiphon, on the right bank of the Tigris, Ardashir restored Seleucia under the name of Weh-Ardashir. The attempt to conquer Mesopotamia, Armenia and Cappadocia led to a war with Rome, in which he was repelled by Alexander Severus (A.D. 233). Before his death (A.D. 241) Ardashir associated with himself on the throne his son Shapur, who successfully continued his work.

Under the tombs of Darius I. at Persepolis, on the surface of the rock, Ardashir has sculptured his image and that of the god Ahuramazda (Ormuzd or Ormazd). Both are on horseback; the god is giving the diadem to the king. Under the horse of the king lies a defeated enemy, the Parthian king Artaban; under the horse of Ormuzd, the devil Ahriman, with two snakes rising from his head. In the bilingual inscription (Greek and Pahlavi), Ardashir I. calls himself "the Mazdayasnian [*i.e.* "worshipper of Ahuramazda"] god Artaxares, king of the kings of the Arianes (Iranians), of godly origin, son of the god Papak the king." (See Sir R. Ker Porter, *Travels* (1821–1822), i. 548 foll.; Flandin et Coste, *Voyage en Perse*, iv. 182; F. Stolze and J. C. Andreas, *Persepolis*, pl. 116; Marcel Dieulafoy, *L'Art antique de la Perse*, 1884–1889, v. pl. 14). A similar inscription and sculpture is on a rock near Gur (Firuzabad) in Persia. On his coins he has the same titles (in Pahlavi). We see that he, like his father and his successors, were worshipped as gods, probably as incarnations of a secondary deity of the Persian creed.

Like the history of the founder of the Achaemenian empire, that of Ardashir has from the beginning been overgrown with legends; like Cyrus he is the son of a shepherd, his future greatness is predicted by dreams and visions, and by the calculations of astronomers he becomes a servant at the court of King Artabanus and then flies to Persia and begins the rebellion; he fights with the great dragon, the enemy of god, &c. A Pahlavi text, which contains this legend, has been translated by Nöldeke (*Geschichte des Artachshīr i Pāpakān*, 1879). On the same tradition the account of Firdousi in the Shahnama is based; it occurs also, with some variations, in Agathias ii. 26 f. Another work, which contained religious and moral admonitions which were put into the mouth of the king, has not come down to us. On the other hand the genealogy of Ardashir has of course been connected with the Achaemenids, on whose behalf he exacts vengeance from the Parthians, and with the legendary kings of old Iran.

(2) Ardashir II. (379–383). Under the reign of his brother Shapur II. he had been governor (king) of Adiabene, where he persecuted the Christians. After Shapur's death, he was raised to the throne by the magnates, although more than seventy years old. Having tried to make himself independent from the court,

and having executed some of the grandees, he was deposed after a reign of four years.

(3) Ardashir III. (628–630), son of Kavadh II., was raised to the throne as a boy of seven years, but was killed two years afterwards by his general, Shahrbaraz. (Ed. M.)

ARDEA, a town of the Rutuli in Latium, 3 m. from the S.W. coast, where its harbour (*Castrum Inui*) lay, at the mouth of the stream now known as Fosso dell' Incastro, and 23 m. S. of Rome by the Via Ardeatina. It was founded, according to legend, either by a son of Odysseus and Circe, or by Danae, the mother of Perseus. It was one of the oldest of the coast cities of Latium, and a place of considerable importance; according to tradition the Ardeatines and Zacynthians joined in the foundation of Saguntum in Spain. It was the capital of Turnus, the opponent of Aeneas. It was conquered by Tarquinius Superbus, and appears as a Roman possession in the treaty with Carthage of 509 B.C., though it was later one of the thirty cities of the Latin league. In 445 B.C. an unfair decision by the Romans in a frontier dispute with Aricia led, according to the Roman historians, to a rising; the town became a Latin colony 442 B.C., and shortly afterwards it appears as the place of exile of Camillus. It had the charge of the common shrine of Venus in Lavinium. It was devastated by the Samnites, was one of the 12 Latin colonies that refused in 209 B.C. to provide more soldiers, and was in 186 used as a state prison, like Alba and Setia. In imperial times the unhealthiness of the place led to its rapid decline, though it remained a colony. In the forests of the neighbourhood the imperial elephants were kept. A road, the Via Ardeatina, led to Ardea direct from Rome; the gate by which it left the Servian wall was the Porta Naevia; a large tomb behind the baths of Caracalla lay on its course. The gate by which it left the Aurelian wall has been obliterated by the bastion of Antonio da Sangallo (Ch. Hülsen in *Römische Mitteilungen*, 1894, 320).

The site of the primitive city, which later became the citadel, is occupied by the modern town; it is situated at the end of a long plateau between two valleys, and protected by perpendicular tufa cliffs some 60 ft. high on all sides except the north-east, where it joins the plateau. Here it is defended by a fine wall of *opus quadratum* of tufa, in alternate courses of headers and stretchers. Within its area are scanty remains of the podium of a temple and of buildings of the imperial period. The road entering it from the south-west is deeply cut in the rock. The area of the place was apparently twice extended, a further portion of the narrow plateau, which now bears the name of Civita Vecchia, being each time taken in and defended by a mound and ditch; the nearer and better-preserved is about $\frac{1}{2}$ m. from the city and measures some 2000 ft. long, 133 ft. wide and 66 ft. high, the ditch being some 80 ft. wide. The second, $\frac{1}{2}$ m. farther north-east, is smaller. In the cliffs below the plateau to the north are early rock habitations, and upon the plateau primitive Latin pottery has been found. In 1900 a group of tombs cut in the rock was examined; they are outside the farther mound and ditch, and belong, therefore, to the period after the second extension of the city.

See O. Richter, in *Annali dell' Istituto* (1884), 90; J. H. Parker in *Archaeologia*, xlix. 169 (1885); A. Pasqui, in *Notizie degli scavi*, (1900) 53. (T. As.)

ARDEBIL, or Ardabil, chief town of a district, or sub-province, of same name, of the province of Azerbaïjan in north-western Persia, in lat. 38° 14′ N., and long. 48° 21′ E., and at an elevation of 4500 ft. It is situated on the Baluk Su (Fish river), a tributary of the Kara Su (Black river), which flows northwards to the Aras, and in a fertile plain bounded on the west by Mount Savelan, a volcanic cone with an altitude of 15,792 ft. (Russian triangulation), and on the east by the Talish mountains (9000 ft.). Ardebil has a population of about 10,000, and post and telegraph offices. Its trade, principally in the hands of Armenians, is still important, but is chiefly a transit trade between Russia and Persia by way of Astara, a port on the Caspian 30 m. north-east of Ardebil. It is surrounded by a ruinous mud wall flanked by towers; a quarter of a mile east of it stands a mud fort, 180 yds. square, constructed according to European system of fortification. Inside the city are the famous sepulchres and shrines of Shaikh Safi ud-din and his descendant Shah Ismaïl I. (1502–1524) the first Shiah shah of Persia and founder of the Safavi dynasty. Plans and photographs of the shrines were taken in 1897 by Dr F. Sarre of Berlin and published in 1901 (*Denkmäler Persischer Baukunst;* 65 large folio plates).

European and Chinese merchants resided at Ardebil in the middle ages, and for a long time the city was a great emporium for central Asian and Indian merchandise, which was forwarded to Europe via Tabriz, Trebizond and the Black Sea, and also by way of the Caucasus and the Volga. Since the beginning of the 16th century, when Persia fell under the sway of the Safavis, the place has been much frequented by pilgrims who come to pay their devotions at the shrine of Shaikh Safi. This shrine is a richly endowed establishment with mosques and college attached, and had a fine library containing many rare and valuable MSS. presented by Shah Abbas I. at the beginning of the 17th century, and mostly carried off by the Russians in 1828 and placed in the library at St Petersburg. The grand carpet which had covered the floor of one of the mosques for three centuries was purchased by a traveller about 1890 for £100, and was finally acquired by the South Kensington Museum for many thousands. This beautiful carpet measures 34 ft. by 17 ft. 6 in., and contains 380 hand-tied knots in the square inch, which gives over 32,500,000 knots to the whole carpet (W. Griggs, *Asian Carpet Designs*). (A. H.-S.)

ARDÈCHE, an inland department of south-eastern France, formed in 1790 from the Vivarais, a district of Languedoc. Pop. (1906) 347,140. Area, 2145 sq. m. It is bounded N.W. by the department of Loire, E. by the Rhone which divides it from Isère and Drôme, S. by Gard and W. by Lozère and Haute-Loire. The surface of Ardèche is almost entirely covered by the Cévennes mountains, the main chain, continued in the Boutières mountains, forming its western boundary. Its centre is traversed from south-east to north-west by the Coiron range which extends from the Rhone to the Mont Mézenc (5755 ft.), the highest point in the department, and the oldest of its many volcanoes. These mountains separate the southern half of the department, which comprises the basin of the Ardèche, from the northern half which is watered by numerous smaller tributaries of the Rhone, the chief of which are the Érieux and the Doux. A few rivers belong to the Atlantic side of the watershed, the chief being the Loire, which rises on the western borders of the department, and the Allier, which for a short distance separates it from Lozère. Nearly all the rivers of the department are of torrential swiftness and subject to sudden floods. The scenery through which they flow is often of great beauty and grandeur. Natural curiosities are the Pont d'Arc, over the Ardèche, and the Chaussée des Géants, near Vals. The climate in the valley of the Rhone is, in general, warm, and sometimes very hot; but westward, as the elevation increases, the cold becomes more intense and the winters longer. Some districts, especially in summer, are liable to sudden alterations in the temperature. Rye, wheat and potatoes are the chief crops cultivated. Good red and white wines are grown in the hilly region bordering the Rhone valley, the white wine of St Péray being highly esteemed. The principal fruits are the chestnut, which is largely exported, the olive and the walnut. In the rearing of silk-worms, Ardèche ranks second to Gard among French departments, and great numbers of mulberry trees are grown for the purposes of this industry. The many goats and sheep of Ardèche make it one of the chief sources of supply of skins for glove-making. Mines of coal, iron, lead and zinc are worked, and the quarries furnish hydraulic lime (Le Teil) and other products. Besides flour-mills, distilleries and saw-mills, there are important silk-mills and leather-works and paper-factories. Annonay is the principal industrial town. The department exports wine, cattle, lime, mineral waters, silk, paper, &c. Hot springs are numerous, and some of them, as those of Vals, St Laurent-les-Bains Celles and Neyrac, are largely resorted to. Ardèche is served by the Paris-Lyon-Méditerranée railway and has some 43 m.

of navigable waterway. The department is divided into the arrondissements of Privas, Largentière and Tournon, with 31 cantons and 342 communes. It forms the diocese of Viviers and part of the archiepiscopal province of Avignon. It is in the region of the XV. army corps, and within the circumscription of the *académie* (educational division) of Grenoble. Its court of appeal is at Nîmes. Privas, the capital, Annonay, Aubenas, Largentière and Tournon are the principal towns. Bourg-St Andéol, Thines, Mélas and Cruas have interesting Romanesque churches. Mazan has remains of a Cistercian abbey founded in the 12th century to which its vast church belongs. Viviers is an old town with a church of various styles of architecture and several old houses.

ARDEE, a market-town of Co. Louth, Ireland, in the south parliamentary division, on the river Dee, 48 m. N. by W. from Dublin on a branch of the Great Northern railway. Pop. (1901) 1883. It has some trade in grain and basket-making. The town is of high antiquity, and its name (Ather-dee) is taken to signify the ford of the Dee. A form Ath-Firdia, however, is connected with the ancient story of the warrior Cuchullain of Ulster, who, while defending the ford against the men of Connaught, was forced to slay many with whom he was on friendly terms, and among them the warrior Firdia, whom he regarded with special affection. A castle of the lords of the manor was built early in the 14th century, and remains, as does another adjacent fortified building of the same period. Roger de Peppart, lord of the manor early in the 13th century, founded the present Protestant church and a house of Crutched Friars. There was also a house of Carmelite Friars, but neither of these remains. Ardee received its first recorded charter in 1377. It had a full share in the several Irish wars, being sacked by Edward Bruce (1315) and by O'Neill (1538); and it was taken by the Irish and recaptured by the English in the wars of 1641, and was occupied later by the forces of James II. and of William III. It returned two members to the Irish parliament. A large rath, or encampment, with remains of fortifications, stands to the south of the town.

ARDEN, FOREST OF, a district in the north of Warwickshire, England, the "woodland" as opposed to the "felden," or "fielden," *i.e.* open country, in the south, the river Avon separating the two. Originally it was part of a forest tract of far wider extent than that within the confines of the county, and now, though lacking the true character of a forest, it is still unusually well wooded. The undulating surface ranges for the most part from 250 to 500 ft. in elevation. Wide lands in this district were held in the time of Edward the Confessor by Alwin, whose son Thurkill of Warwick, or "of Arden," founded the family of the Warwickshire Ardens who in Queen Elizabeth's time still held several of the manors ascribed to Thurkill in *Domesday*. Shakespeare, whose mother Mary Arden claimed to be of this family, knew the district well, living as he did at Stratford; and its natural characteristics, then still unchanged, inspired his pictures of forest life in *As You Like It*. The name of the Forest of Arden, besides remaining a convenient designation of a well-marked physical area, is preserved in such place-names as Henley-in-Arden and Hampton-in-Arden.

ARDENNES, a district covering some portion of the ancient forest of Ardenne, and extending over the Belgian province of Luxemburg, part of the grand duchy, and the French department of Ardennes. Bruzen Lamartinière states in his *Dictionnaire Géographique* that the Gauls and Bretons called it by a word signifying "the forest," which was turned into Latin as *Arduenna silva*, and he thinks it quite probable that the name was really derived from the Celtic word *ardu* (dark, obscure). The Arduenna Silva was the most extensive forest of Gaul, and Caesar (*Bello Gallico*, lib. vi. cap. 29) describes it as extending from the Rhine and the confines of the Treviri as far as the limits of the Nervii. In book v. the Roman conqueror describes his campaign against Indutiomarus and the Treviri in the Ardenne forest. Strabo gave it still greater extent, treating it as covering the whole region from the Rhine to the North Sea. It is safer to give it the more reasonable dimensions of Caesar, and to accept the verdict of later commentators that it never extended west of the Scheldt. At the division of the empire of Charlemagne between the three sons of Louis the Débonnaire, effected by the pact of Verdun in 843, the forest had become a district and is called therein *pagus Arduensis*. It was part of the division that fell to Lothair, and several of the charters of 843 expressly specify certain towns as being situated in this *pagus*. In the 10th century the district had become a *comitatus*, subject to the powerful count of Verdun, who changed his style to that of count of Ardenne.

The Belgian Ardennes may be said now to extend from the Meuse above Dinant on the west to the grand duchy of Luxemburg and Rhenish Prussia as far north as the Baraque de Michel on the east, and from a line drawn eastward from Dinant through Marche, Durbuy and Stavelot to the Hautes Fagnes on the north, to the French frontier roughly marked by the Semois valley in the south. Within these limits there are still some of the finest woods in Europe, which seem to have come down to us almost intact from the days of the Arduenna of Caesar. Notable among these portions of the great forest are the woods of St Hubert, the woods round La Roche, and those of the Amerois, Herbeumont, and Chiny on the Semois. In the grand duchy the forest has almost entirely disappeared, but owing to the compulsory law of replanting in Belgium this fate does not seem likely to attend the Belgian Ardennes.

In addition to being a forest the Ardennes is a plateau, and it offers to the geologist a most interesting field of investigation. The greater part of the Ardennes is occupied by a large area of Devonian beds, through which rise the Cambrian masses of Rocroi and Stavelot, and a few others of smaller size. Upon the folded slates and schists which constitute these inliers the Devonian rests with marked unconformity; but north of the ridge of Condroz Ordovician and Silurian beds make their appearance. Near Dinant carboniferous beds are infolded among the Devonian. Along the northern margin lies the intensely folded belt which constitutes the coalfield of Namur, and, beneath the overlying Mesozoic beds, is continued to the Boulonnais, Dover and beyond. The southern boundary of this belt is formed by a great thrust-plane, the *faille du midi*, along which the Devonian beds of the south have been thrust over the carboniferous beds of the coalfield.

The Ardennes are the holiday ground of the Belgian people, and much of this region is still unknown except to the few persons who by a happy chance have discovered its remoter and hitherto well-guarded charms. There is still an immense quantity of wild game to be found in the Ardennes, including red and roe deer, wild boar, &c. The shooting is preserved either by the few great landed proprietors left in the country, or by the communes, who let the right of shooting to individuals. Occasionally it is still stated in the press that wolves have been seen in the Ardennes, but this is a mere fiction. The last wolf was destroyed there in the 18th century.

ARDENNES, a department of France on the N.E. frontier, deriving its name from that of the forest, and formed in 1790 from parts of Champagne, Picardy and Hainault. Pop. (1906) 317,505. Area, 2028 sq. m. It is bounded N. and N.E. by Belgium, E. by the department of Meuse, S. by that of Marne, and W. by that of Aisne. In shape it is quadrilateral with a cape-like prolongation into Belgium on the north. The slope of the department is from north-east to south-west, though its longest river, the Meuse, entering it in the south-east, pursues a winding course of 111 m. in a north-westerly, and afterwards through deep gorges in a northerly, direction. The other principal river, the Aisne, crosses the southern border and takes a northerly, then a westerly course, separating the region known as Champagne Pouilleuse from the more elevated plateau of Argonne which forms the central zone of the department and stretches to the left bank of the Meuse. The highest points of the department are found in the wooded highlands of the Ardennes which, with an altitude varying between 980 and 1640 ft., cover the north and north-east. The climate is comparatively mild in the south-west, but becomes colder and more rainy towards the north and north-east. Agriculture is carried on to most advantage in the Champagne and Argonne. Wheat and oats are the predominant cereals. Potatoes, rye, lucerne and other kinds of forage are also important crops. Pasturage is found chiefly on the banks of the Aisne and Meuse and on the plateau of Rocroi in the north. Horse-raising is carried on in the neighbourhood of Buzancy in the south, and at Bourg-Fidèle in the north. Fruit-growing is confined to the west and central districts. The working of slate is very important, especially in the neighbourhood of Fumay, and quarries producing freestone, lime-stone and other minerals are found in several places. Flour-mills, saw-mills, sugar-works, distilleries and leather-works are scattered over the department, but iron-founding and various branches of metal-working which are active along the valley of the Meuse (Nouzon, &c.) are the chief industries. To these may be added wool-weaving, centred at Sedan, and minor industries such as the manufacture of basket-work, wooden shoes, &c. Coal and raw wool are prominent imports, while iron goods, cloth, timber, live-stock, alcohol and the products of the soil are exported. Various branches of the Eastern railway traverse the department. The Meuse is canalized within the department, and the Canal des Ardennes, uniting that river with the Aisne, and the lateral canal of the Aisne are together about 65 m. long. Ardennes is divided into five arrondissements: Mézières, Rocroi, Rethel, Vouziers and Sedan, with 31 cantons and 503 communes. The department forms part of the ecclesiastical province of Reims and of the circumscriptions of the appeal-court of Nancy and the VI. army corps. In educational matters, it is included in the *académie* (educational area) of Lille. Mézières, the capital, Charleville, Rocroi, Sedan and Rethel are the chief towns. Outside them its finest examples of architecture are the churches of Mouzon (13th century) and Vouziers (15th century).

ARDGLASS (" Green Height "), a small town of Co. Down, Ireland, in the east parliamentary division, at the head of a rocky bay, in a picturesque situation between two hills, 32 m. S. by E. of Belfast on a branch of the Belfast & Co. Down railway. Pop. (1901) 501. Soon after the Norman invasion it became of the first importance as a port, a fact attested by the remains of no fewer than five castles in close proximity, which give the town a picturesque aspect. There are also an ancient church crowning the eastern hill, and a curious fortified warehouse (called the New Works), dating probably from the 14th century, when a trading company was established here under a grant from Henry IV. Ardglass was a royal burgh and sent a representative to the Irish parliament. The chief industry is the herring fishery. Ships of 500 tons may enter the harbour at all times. In summer Ardglass is a frequented resort of visitors; good bathing and a golf links contribute to its attractions.

ARDITI, LUIGI (1822–1903), Italian musical composer and conductor, was born in Piedmont, and studied music at the Conservatoire in Milan, starting professionally as a violinist, and touring with Bottesini, the double-bass player, in the United States in 1847. He began composing at an early age, and in 1840 produced an overture, followed by an opera *I Briganti* in 1841, and other works. He paid frequent visits to America, conducting the opera in New York, where he produced his *La Spia* in 1856. In 1858 he became conductor of the opera at Her Majesty's theatre in London, and both in London and abroad he became famous in this capacity, having the reputation of being Madame Patti's favourite conductor. His vocal waltz *Il Bacio* was often sung by her. In 1896 he published his *Reminiscences*, and after a long and active musical life he died at Brighton on the 1st of May 1903.

ARDMORE, a township and the county-seat of Carter county, Oklahoma, U. S. A., just S. of the Arbuckle Mountains, about 120 m. S. by E. of Guthrie. Pop. (1900) 5681; (1907) 8759 (2122 being negroes, and 108 Indians); (1910) 8618. It is served by the Chicago, Rock Island & Pacific, the St Louis & San Francisco, and the Gulf, Colorado & Santa Fé railways. Ardmore is the market-town and distributing point for the surrounding agricultural region, which is the home of a large part of the Chickasaw and Choctaw nations. It is situated 890 ft. above the sea in a cotton and grain producing region, in which cattle are raised and fruit and vegetables grown; coal, oil, natural gas and rock asphalt (which is used for paving the streets of Ardmore) are found in the vicinity. Ardmore is an important cotton market, and has cotton gins, a cotton compress, machine shops, bridge works, foundries, bottling works and manufactories of cotton-seed oil, brick, concrete, flour, brooms, mattresses and dressed lumber. At Ardmore are the Saint Agnes Academy, a Catholic school for girls, and Saint Agnes College for boys, a conservatory of music, Hargrove College, and the Selvidge Commercial College. Near Ardmore is a summer school on the Chautauqua (*q.v.*) system. Ardmore was founded in 1887, and was incorporated in 1898.

ARDRES, a town of northern France in the department of Pas-de-Calais, 10½ m. by rail S.S.E. of Calais, with which it is also connected by a canal. Pop. (1906) 1269. The " Field of the Cloth of Gold," where Henry VIII. of England and Francis I. of France met in 1520, was at Balinghem in the immediate neighbourhood. The town is an important market for cattle.

ARDROSSAN, a seaport, burgh of barony, and police burgh of Ayrshire, Scotland, 32 m. from Glasgow by the Glasgow & South-Western railway, and 29½ m. by the Lanarkshire & Ayrshire branch of the Caledonian railway. Pop. (1901) 6077. The rise of Ardrossan was due to the enterprise of Hugh, 12th earl of Eglinton, who began the construction of the present town and harbour in 1806. The harbour was intended to be in connexion with a canal from Glasgow to Ardrossan, but this was only completed as far as Johnstone. Owing to the costliness of the undertaking, and the death of the earl in 1819, the works were suspended after an outlay of £100,000, but his successor completed the scheme on a reduced scale at an expense of another £100,000. The dock accommodation has since been considerably extended, and the town enjoys great prosperity. Steamers run every week-day to Arran and Belfast, and during summer there is a service also to Douglas in the Isle of Man. The exports consist principally of coal and iron from collieries and iron-works in the neighbourhood; and the imports of timber, ores and general goods. Shipbuilding thrives and the fisheries are important. The town is governed by a provost and council.

Saltcoats (pop. 8120), a mile to the south, is a popular seaside resort, with a brisk trade, due to its proximity to Ardrossan and Stevenston; the making of salt, once a leading industry, has ceased.

Ardrossan dates from an early period. The name Arthur of Ardrossan is found in connexion with a charter dated 1226; and Sir Fergus of Ardrossan accompanied Edward Bruce in his Irish expedition in 1316, and in 1320 signed the appeal to the pope, made by the barons of Scotland, against the aggressions of England. The family of Ardrossan is now merged, by marriage, in that of the earl of Eglinton and Winton. The castle where Wallace surprised the English garrison and threw their corpses into the dungeon, grimly styled " Wallace's Larder," was finally destroyed by Cromwell, who is said to have used part of its masonry for the construction of the fort at Ayr; but its ruins still exist.

AREA, a Latin word, originally meaning a threshing-floor, namely a raised space in a field exposed on all sides to the wind; now applied in English (1) to a plot of ground on which a structure is to be erected, (2) to the court or sunk space in the front or rear of a building, (3) to the superficial space covered by a district, country, &c., or by a building or court.

ARECIBO, a city and port on the north coast of Porto Rico, at the mouth of a small stream called the Rio Grande de Arecibo, and contiguous to one of the most fertile regions of the island. Pop. (1899) 8008; of the tributary district, about 30,000; (1910) 9612. It is connected with San Juan, Mayaguez and Ponce by railway. It is a well-built and active commercial city, and has a large export trade in coffee and sugar. The harbour is an open roadstead, very dangerous to shipping in northerly winds, and the discharge and loading of cargoes is effected by means of lighters at considerable risk and expense. Arecibo was founded in 1788.

AREMBERG, or ARENBERG, formerly a German duchy of the Holy Roman Empire in the circle of the Rhine Palatinate, between Jülich and Cologne, and now belonging to the Prussian administrative district of Coblenz. The hamlet of Aremberg is at the foot of a basalt hill 2067 ft. high, on the summit of which are the ruins of the castle which was the original seat of the family of Aremberg.

The lords of Aremberg first appear early in the 12th century, but had died out in the male line by 1279. From the marriage of the heiress Mathilda (1282–1299) with Engelbert II., count of La Marck (d. 1328), sprang two sons. The elder of these, Adolf II, (d. 1347), inherited the countship of La Marck; the second, Engelbert III. (d. 1387), the lordship of Aremberg, which he increased by his marriage with Marie de Looz, heiress of Lumain. The lordship of Aremberg remained in his family till 1547, when it passed, by his marriage with Margaret, sister of the childless Robert III., to John of Barbançon, of the great house of Ligne, who assumed the name and arms of Aremberg, and was created a count of the Empire by Charles V. He was governor of Friesland, and for a while commanded the Spanish and Catholic forces against the "beggars," falling at the battle of Heiligerlee in 1568. His son Charles (d. 1618) greatly increased the possessions of the house by his marriage with Ann of Croy, heiress of Croy and of Chimay-Aerschot, and in 1576 was made prince of the Empire by Maximilian II. His grandson, Philip Francis, was made duke in 1644 by the emperor Ferdinand III., and was succeeded by his brother Charles Eugene (d. 1681), who married Marie Henriette de Vergy de Cusance, heiress of Perwez (d. 1700). Their son, Duke Philip Charles Francis, was killed in 1691 fighting against the Turks, and was succeeded by Leopold (1754), a distinguished soldier of the War of the Spanish Succession, and patron of Rousseau and Voltaire. His son Charles (d. 1778) was an Austrian field-marshal during the Seven Years' War, and married Louise Margaret of La Marck-Lumain, heiress of the countship of Schleiden and lordship of Saffenberg. By the peace of Luneville (February 1801), the next duke, Louis Engelbert, lost the greater part of his ancestral domain, but received in compensation Meppen and Recklinghausen. On the establishment of the confederation of the Rhine, his son Prosper Louis (to whom, becoming blind, he had ceded his domains in 1803) became a member (1806), and showed great devotion to the interests of France; but in 1810 he lost his sovereignty, Napoleon incorporating Meppen with France and Recklinghausen with the grand-duchy of Berg, and indemnifying him by a rent of 240,702 francs. In 1815 he received back his possessions, which were mediatized by the congress of Vienna, Recklinghausen falling to Prussia and Meppen to Hanover. On account of the one portion he became a peer of the Westphalian estates, and by the other a member of the upper house in Hanover. George IV. of England (9th May 1826) elevated the duke's Hanoverian possessions to a dukedom under the title of Aremberg Meppen. His brother Auguste Raymond, Comte de la Marck (1753–1833), became famous during the early stages of the French Revolution for his friendship with Mirabeau (*q.v.*). Duke Prosper Louis died in 1861, and was succeeded by his son Engelbert (d. 1875), who was followed in his turn by his son Engelbert (b. 1872).

The duke of Aremberg is one of the wealthiest of the great continental nobles. His feudal domain in Germany covers an area of over 1100 sq. m., besides which he has large estates in Belgium and France. The duke has residences in Brussels, where he has a famous collection of pictures, and at the château of Klemenswerth near Meppen.

ARENA (Lat. for "sand"), the central area of an amphitheatre on which the gladiatorial displays took place, its name being derived from the sand with which it was covered. The word is applied sometimes to any level open space on which spectacles take place.

ARENDAL, a seaport of Norway, in Nedenaes *amt* (county), on the south coast, 46 m. N.E. from Christiansand. Pop. (1900) 11,155. It rises picturesquely above the mouth of the river Nid, with a good harbour protected by an island from the open waters of the Skagerrack. The town itself occupies several islets, and some of the houses are supported above the water on piles. The chief exports are timber (very largely exported to Great Britain), wood-pulp, sealskins and felspar. In 1879 Arendal ranked second (after Christiania) as a ship-owning port; in 1899 it had dropped to the fifth place. In and near the town are factories for wood-pulp, paper, cotton and joinery; and at Fevig, 8 m. north-east, a shipbuilding yard and engineering works. The neighbourhood is remarkable for the number of beautiful and rare minerals found there; one of these, a variety of epidote, was formerly called Arendalite. Louis Philippe stayed here for some time during his exile.

ARENIG GROUP, in geology, the name now applied by British geologists to the lowest stage of the Ordovician System in Britain. The term was first used by Adam Sedgwick in 1847 with reference to the "Arenig Ashes and Porphyries" in the neighbourhood of Arenig Fawr, in Merioneth, North Wales.

The rock-succession in the Arenig district has been recognized by W. G. Fearnsides ("On the Geology of Arenig Fawr and Moel Llanfnant," *Q.J.G.S.* vol. lxi., 1905, pp. 608–640, with maps) as follows:—

Ordovician	Caradoc	*Dicranograptus*—shales.		
		Derfel or *Orthis*—limestone.		
	Llandeilo Group	Rhyolitic ashes	=Upper	Upper Ashes of Arenig.
		Massive ashes	=Middle	
		Acid andesitic ashes	=Lower	
		Daerfawr Shales.		Zone of *Didymograptus Murchisoni.*
		Platy ashes		Lower Ashes of Arenig (Hypersthene Andesites).
		Great Agglomerate		
	Arenig Group	Olchfa or *Bifidus*—shales (*Didymograptus bifidus*).		
		Filltirgerig or *Hirundo* Beds		*Didymograptus hirundo.*
		Erwent or *Ogygia*—limestone		
		Henllan or *Calymene*—ashes		*Didymograptus extensus.*
		Llyfnant or *Extensus*—flags		
		Basal Grit		

(unconformity)

The above succession is divisible into: (1) a lower series of gritty and calcareous sediments, the "Arenig Series," as it is now understood; (2) a middle series, mainly volcanic, with shales, the "Llandeilo Series"; and (3) the shales and limestones of the Bala or Caradoc Stage. It was to the middle series (2) that Sedgwick first applied the term "Arenig."

In the typical region and in North Wales generally the Arenig series appears to be unconformable upon the Cambrian rocks; this is not the case in South Wales. The Arenig series is represented in North Wales by the Garth grit and Ty-Obry beds, by the Shelve series of the Corndon district, the Skiddaw slates of the Lake District, the Ballantrae group of Ayrshire, and by the Ribband series of slates and shales in Wicklow and Wexford. It may be mentioned here that the "Llanvirn" Series of H. Hicks was equivalent to the *bifidus*-shales and the Lower Llandeilo Series.

REFERENCES.—Adam Sedgwick, *Synopsis of the Classification of the British Palaeozoic Rocks* (1885); Sir A. Ramsay, "North Wales," *Geol. Survey Memoir*, vol. iii.; C. Lapworth, *Ann. Mag. Nat. Hist.* vol. vi., 1880; G. A. J. Cole and C. V. Jennings, *Q.J.G.S.* vol. xlv., 1889; C. V. Jennings and G. J. Williams, *ibid.* vol. xlvii., 1891; Messrs Crosfield and Skeat, *ibid.* vol. lii., 1896; G. L. Elles, *Geol. Mag.*, 1904; J. E. Marr and T. Roberts, *Q.J.G.S.*, 1885; H. Hicks, *ibid.* vol. xxxi., 1875. See also ORDOVICIAN. (J. A. H.)

AREOI, or AREOITI, a secret society which originated in Tahiti and later extended its influence to other South Pacific islands. To its ranks both sexes were admitted. The society was primarily of a religious character. Members styled themselves descendants of Oro-Tetifa, the Polynesian god, and were divided into seven or more grades, each having its characteristic tattooing. Chiefs were at once qualified for the highest grade, but ordinary members attained promotion only through initiatory rites. The Areois enjoyed great privileges, and were considered as depositaries of knowledge and as mediators between God and man. They were feared, too, as ministers of the taboo and were entitled to pronounce a kind of excommunication for offences against its rules. The chief religious purpose of the society was the worship of the generative powers of nature, and the ritual and ceremonies of initiation were grossly licentious. But the

Areois were also a social force. They aimed at communism in all things. The women members were common property; the period of cohabitation was limited to three days, and the female Areois were bound by oath at initiation to strangle at birth any child born to them. If, however, the infant was allowed to survive half an hour only, it was spared; but to have the right of keeping it the mother must find a male Areoi willing to adopt it. The Areois travelled about, devoting their whole time to feasting, dancing (the chief dance of the women being the grossly indecent *Timorodee* mentioned by Captain Cook), and debauchery, varied by elaborate realistic stage presentments of the lives and loves of gods and legendary heroes.

AREOPAGUS (Ἄρειος Πάγος), a bare, rocky hill, 370 ft. high, immediately west of the northern rim of the acropolis of Athens. The ancients interpreted the name as "Hill of Ares." Though accepted by some modern scholars, this derivation of the word is rendered improbable by the fact that Ares was not worshipped on the Areopagus. A more reasonable explanation connects the name with *Arae*, "Curses," commonly known as *Semnae*, "Awful Goddesses," whose shrine was a cave at the foot of the hill, of which they were the guardian deities (Aeschyl. *Eumen.* 417, 804; Schol. on Lucian, vol. iii. p. 68, ed. Jacobitz; Paus. i. 28. 6).

The Boulē, or Council, of the Areopagus (ἡ ἐν Ἀρείῳ Πάγῳ βουλή), named after the hill, is to be compared in origin and fundamental character with the council of chiefs or elders which we find among the earliest Germans, Celts, Romans, and other primitive peoples. Under the kings of Athens it must have closely resembled the Boulē of elders described by Homer; and there can be no doubt that it was the chief factor in the work of transforming the kingship into an aristocracy, in which it was to be supreme. It was composed of ex-archons. Aristotle attributes to it for the period of aristocracy the appointment to all offices (*Ath. Pol.* viii. 2), the chief work of administration, and the right to fine or otherwise punish in cases, not only of violation of laws, but also of immorality (*ibid.* iii. 6; cf. Isoc. vii. 46; Androtion and Philochorus, in Müller, *Frag. Hist. Graec.* i. 387. 17, 394. 60).[1] This evidence is corroborated by the remnants of political power left to it in later time, after its importance had been greatly curtailed, and by the designation Boulē, which in itself indicates that the body so termed was once a state council. In a passage bearing incidentally upon the early constitution of Athens, Thucydides (i. 126. 8) informs us that at the time of the Cylonian insurrection the Athenians, we may suppose in their assembly (Ἐκκλησία), commissioned the archons with absolute power to deal with the trouble at their discretion. From this passage, if we accept the Aristotelian view as to the early supremacy of the Areopagitic council, we must infer that a modification of the aristocracy in a popular direction had at that time already taken place.

In addition to its political functions, the council from the time of Draco, if not earlier, exercised jurisdiction in certain cases of homicide (see below, *ad fin.*). The assumption that in their criminal jurisdiction the Areopagites were called Ephetae till after the legislation of Draco (cf. Philoch. 58, in Müller, *ibid.* 394) would explain the otherwise obscure circumstances that, according to Plutarch (*Sol.* 19), Draco (*q.v.*) in his laws mentioned only the Ephetae, and that Pollux (viii. 125) included the Areopagus among the localities in which sat the Ephetae.[2] The same assumption would supply a reason for the notion entertained by many writers of later time that the Areopagitic council was instituted by Solon (*q.v.*)—a notion partly explained also by the desire of political thinkers to ascribe to Solon the making of a complete constitution. Conformably with the view here presented we may suppose that the name "Boulē of the Areopagus" developed from the simple term "Boulē" in order to distinguish it from the new Boulē (*q.v.*), or Council of Four Hundred. The popular reforms of Solon (594 B.C.), so far as they were carried into effect, tended practically to limit the Council of the Areopagus, though constitutionally it retained all its earlier powers and functions, augmented by the right to try persons accused of conspiracy against the state (Arist. *Ath. Pol.* viii. 4). In the exercise of its duty as the protector of the laws it must have had power to inhibit in the Four Hundred, or in the Ecclesia, a measure which it judged unconstitutional or in any way prejudicial to the state, and in the levy of fines for violation of law or moral usage it remained irresponsible. As censor of the conduct of citizens it inquired into every man's source of income and punished the idle (Plut. *Sol.* 22).

The tyrants (560–510 B.C.) left to the council its cognizance of murder cases (Demosth. xxiii. 66; Arist. *Ath. Pol.* xvi. 8) and probably the nominal enjoyment of all its prerogatives; but their method of filling the archonship with their own kinsmen and creatures gradually converted the Areopagites into willing supporters of tyranny. Though hostile, therefore, to the policy of Cleisthenes, their council seems to have suffered no direct abridgment of power from his reforms. After his legislation it gradually changed character and political sentiment by the annual admission of ex-archons who had held office under a popular constitution. In 487 B.C., however, the introduction of the lot as a part of the process of filling the archonship (see ARCHON) began to undermine its ability. This deterioration was necessarily slow; it could not have advanced far in 480 B.C., when on the eve of the battle of Salamis, as we are informed (Arist. *Polit.* viii. 4, p. 1304a, 17; *Ath. Pol.* xxiii. 25; Plut. *Them.* 10; Cic. *Off.* i. 22, 75), the council of the Areopagus succeeded in manning the fleet by providing pay for the seamen, thereby regaining the confidence and respect of the people. The patriotic action of the council and its attendant popularity enabled it to recover considerable administrative control, which it continued to exercise for the next eighteen years, although its deterioration in ability, becoming every year more noticeable, as well as the rapid rise of democratic ideas, prevented it from fully re-establishing the supremacy which Aristotle, with some exaggeration, attributes to it for this period. Its prestige was seriously undermined by the conduct of individual members, whose corrupt use of power was exposed and punished by Ephialtes, the democratic leader. Following up this advantage, Ephialtes (462 B.C.), and less prominently Archestratus and Pericles (*q.v.*), proposed and carried measures for the transfer of most of its functions to the Council of Five Hundred, the Ecclesia, and the popular courts of law (Arist. *Ath. Pol.* xxv. 2, xxvii. 1, xxxv. 2; Plut. *Per.* 9). Among these functions were probably jurisdiction in cases of impiety, the supervision of magistrates and the censorship of the morals of citizens, the inhibition of illegal and unconstitutional resolutions in the Five Hundred and the Ecclesia, the examination into the fitness of candidates for office, and the collection of rents from the sacred property (cf. Wilamowitz-Möllendorff, *Arist. u. Ath.* ii. 186-197; Busolt, *Griech. Gesch.* (2nd ed.) iii. 269-294; G. Gilbert, *Const. Antiq. of Sparta and Athens*, Eng. trans., 154 f.). It retained jurisdiction in cases of homicide and the care of sacred olive trees. From this time to the establishment of the Thirty (462–404 B.C.) the Areopagitic council, degraded still further by the opening of the archonship to the Zeugitae (457 B.C.) and by the absolute use of the lot in filling the office, was a political nullity. The first indication of a revival of its prestige is to be traced in the action attributed to it by Lysias during the siege of Athens (404 B.C.) (in *Eratosth.* 69: *πραττούσης μὲν τῆς ἐν Ἀρείῳ Πάγῳ βουλῆς σωτηρία*). After the surrender of Athens and the appointment of the Thirty, the repeal of the laws of Ephialtes and Archestratus prepared the way for the rehabilitation of the council as guardian of the constitution by the restored democracy (Arist. *Ath. Pol.* xxxv. 2; decree of Tisamenus, in Andoc. i. 84; cf. Din. i. 9). Although under the new conditions the Areopagites could not hope to recover their full supremacy, they did exercise considerable political influence, especially in crises. In the time of Demosthenes, accordingly, we find them annulling the election of individuals to offices for which they were unfit (Plut. *Phoc.* 16), exercising during a crisis a disciplinary power extending to life and death over all the Athenians "in conformity with ancestral law," procuring the banishment of one, the racking of another, and the infliction of capital punishment on several of the citizens. This authority seems to have been delegated to them by the assembly with reference either to individual cases or temporarily to the whole body of Athenians (Din. i. 10, 62 f.; Aeschin. iii. 252; Lyc. *Leoc.* 52; Demosth. xviii. 132 f.; Plut. *Demosth.* 14). Religion, too, was their care (Pseud. Demosth. lix. 80 f.). Lycurgus (*ibid.*) even goes so far as to claim that by their action during the crisis after Chaeroneia they had saved the state. After the period of the great orators their influence continued to grow. Demetrius of Phalerum empowered them to assist the *gynaeconomi* in supervising festivals held in private houses (*Philoch.* in Müller, *ibid.* i. 408. 143). Under Roman supremacy in addition to earlier functions they had jurisdiction in cases of forgery, tampering with the standard measures, and probably other high crimes, the supervision of buildings, and the care of religion and of education (Cic. *Fam.* xiii. 1; *Att.* v. 9; Tac. *Ann.* ii. 55; Plut. *Cic.* 24; *C.I.G.* i. 123. 9; *C.I.A.* ii. 476; iii. 703, 714, 716; Acts xvii. 19). Their council acquired, too, in conjunction with the assembly, with or without the co-operation of the Five Hundred (or Six Hundred), the right to pass decrees and to represent their city in foreign relations (*C.I.A.* iii. 10, 31, 40, 41, 454, 457, 458). From the overthrow of the Thirty to the end of their history they enjoyed a high reputation for ability and integrity (Isoc. vii.; Demosth. xxiii. 65 f.; Val. Max. viii. 1. *Amb.* 2; Gell. xii. 7; Lucian, *Bis Acc.* iv. 12. 14). About A.D. 400 their council came to an end (Theodoret, *Curat.* ix. 55).

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[1] Neither Herodotus nor Thucydides tells us anything as to its powers; but their silence on this point need not surprise us, as they had no especial occasion for referring to the subject, and in general it may be said that before the 4th century B.C. writers took little interest in the constitutional history of the remote past. The statement of Thucydides (i. 126. 8) that at the time of the Cylonian insurrection the nine archons attended to a great part of the business of government does not contradict the Aristotelian view, for their administration may well have been under Areopagitic supervision (see also ARCHON); and, as is stated in the text, the supremacy of the council may have already suffered considerable limitation. The *Eumenides* of Aeschylus is a glorification of the institution, though for obvious reasons it is there represented as an essentially judicial body.

[2] It is possible also to explain the alleged absence of reference to the Areopagitic council in the Draconian laws by the supposition that Solon, while leaving untouched the Draconian laws concerned with the cases of homicide which came before the Ephetae, substituted a law of his own regarding wilful murder, which fell within the jurisdiction of the Areopagites. This view finds strong support in the circumstance that the copy of the Draconian laws (*C.I.A.* i. 61), made in pursuance of a decree of the people of the year 409–408 B.C., does not contain the provision for cases of premeditated homicide; cf. G. de Sanctis, Ἀτθίς, 135. The relation of the Ephetae to the court of the Areopagus is obscure; cf. Philippi, *Der Areopag und die Epheten* (Berlin, 1874); Busolt, *Griechische Geschichte* (2nd ed.), ii. 138 ff.

With regard to the jurisdiction of the council in cases of homicide, the procedure, so far as it may be gathered from the orators and other sources, was as follows:—accusations were brought by relatives within the circle of brothers' and sisters' children, supported by the wider kin and the phratry (Demosth. xliii. 57). On receiving the accusation the king-archon by proclamation warned the accused to keep away from temples and other places forbidden to such persons. He made three investigations of the case in the three successive months, and brought it to trial in the fourth month. As he was forbidden to hand a case over to his successor, it resulted that in the last three months of the year no accusations of homicide could be brought (Ant. vi. 42). After the examination he assigned the case to the proper court, and presided over it during the trial, which took place in the open air, that the judges and the accuser might not be polluted by being brought under the same roof with the offender (Ant. v. 11). The accuser and the accused, standing on two white stones termed "Relentlessness" (Ἀναίδεια) and "Outrage" (Ὕβρις) respectively (Paus. i. 28. 5), bound themselves to the truth by most solemn oaths (Demosth. xxiii. 68). Each was allowed two speeches, and the trial lasted three days. After the first speech the accused, unless charged with parricide, was at liberty to withdraw into exile (Poll. viii. 117). If condemned, he lost his life, and his property was confiscated. A tie vote acquitted (Aeschyl. *Eumen.* 735; Ant. v. 51; Aeschin. iii. 252). See further Greek Law.

Authorities.—Among other works may be mentioned E. Dugit, *Étude sur l'Aréopage athénien* (Paris, 1867); E. Caillemer, "Areopagus," in Daremberg et Saglio, *Dict. d. Antiq. grecq. et rom.* (Paris, 1873) i. 395-404; A. Philippi, *Areopag und Epheten* (Berlin, 1874). The discovery of the Aristotelian "Constitution of Athens" (*Ath. Pol.*) has largely rendered obsolete all works published before 1891. See Hermann-Thumser, *Griechische Staatsaltertümer* (6th ed., Freiburg, 1892), 365-371, 387-391, 788; U. von Wilamowitz-Möllendorff, *Aristoteles und Athen* (Berlin, 1893), ii. 186-200; J. J. Terwen, *De Areopago Atheniensium Quaestiones Variae* (Utrecht, 1894); G. Gilbert, *Constitutional Antiquities of Athens and Sparta* (Eng. trans., London and New York, 1895), 114, 122, 137, 154, 282; F. Cauer, "Aischylos und der Areopag," in *Rhein. Mus.* (1895), N.F. i. 348-356; Wachsmuth and Thalheim, *s.v.* "Areios pagos" in Pauly-Wissowa, *Realencycl. d. kl. Altertumswiss.* (Stuttgart, 1896), ii. 627-633; G. de Sanctis, *Ἀτθίς, Storia della Repubblica Ateniese* (Rome, 1898); L. Ziehen, "Drakontische Gesetzgebung," in *Rhein. Mus.* (1899), N.F. liv. 321-344. See also Cleisthenes; Pericles and Athens. (G. W. B.)

AREQUIPA, a coast department of southern Peru, bounded N. by the departments of Ayacucho and Cuzco, E. by Puno and Moquegua, S. and W. by Moquegua and the Pacific. It is divided into seven provinces. Area, 21,947 sq. m.; pop. (1896) 229,007. It is traversed by an important railway line from Mollendo (Islay) to Puno, on Lake Titicaca, 325 m. long, with extensions to Santa Rosa, Peru and La Paz, Bolivia. The highest point reached by this line is 14,660 ft. The department includes an arid, sand-covered region on the coast traversed by deep gorges formed by river courses, and a partly barren, mountainous region inland composed of the high Cordillera and its spurs toward the coast, between which are numerous highly fertile valleys watered by streams from the snow-clad peaks. These produce cotton, rice, sugar-cane, wheat, coffee, Indian corn, barley, potatoes and fruit. The mountainous region is rich in minerals, and there is a valuable deposit of borax near the capital, Arequipa.

AREQUIPA, a city of southern Peru, capital of the department of the same name, about 90 m. N.E. by N. of its seaport Mollendo (107 m. by rail), and near the south-west foot of the volcano Misti which rises to a height of 19,029 ft. above sea-level. The population was estimated at 35,000 in 1896. The city is provided with a tram line, and is connected with the coast at Mollendo (Islay) by a railway 107 m. long. and with Puno, on Lake Titicaca, by an extension of the same line 218 m. long. The city occupies a green, fertile valley of the Rio Chile, 7753 ft. above the sea, surrounded by an arid, barren desert. It is built on the usual rectangular plan and the streets are wide and well paved. The edifices in general are low, and are massively built with thick walls and domed ceilings to resist earthquakes, and lessen the danger from falling masonry. The material used is a soft, porous magnesian limestone, which is well adapted to the purpose in view. Arequipa is the seat of a bishopric created in 1609–1612, and possesses a comparatively modern cathedral, its predecessor having been destroyed by fire in 1849. It has several large churches, and formerly possessed five monasteries and three nunneries, which have been closed and their edifices devoted to educational and other public purposes. The religious element has always been a dominating factor in the life of the city. A university, founded in 1825, three colleges, one of them dating from colonial times, a medical school, and a public library, founded in 1821, are distinguishing features of the city, which has always taken high rank in Peru for its learning and liberalism, as well as for its political restlessness. The city's water-supply is derived from the Chile river and is considered dangerous to new arrivals because of the quantity of saline and organic matter contained. The climate is temperate and healthy, and the fertile valley (10 m. long by 5 m. wide) surrounding the city produces an abundance of cereals, fruits and vegetables common to both hot and temperate regions. Pears and strawberries grow side by side with oranges and granadillas, and are noted for their size and flavour. The trade of the city is principally in Bolivian products—mineral ores, alpaca wool, &c.—but it also receives and exports the products of the neighbouring

Peruvian provinces, and the output of the borax deposits in the neighbourhood. Arequipa was founded by Pizarro in 1540, and has been the scene of many events of importance in the history of Peru. It was greatly damaged in the earthquakes of 1582, 1609, 1784 and 1868, particularly in the last. It was captured by the Chileans in 1883, near the close of the war between Chile and Peru.

ARES, in ancient Greek mythology, the god of war, or rather of battle, son of Zeus and Hera. (For the Roman god, identified with Ares, see MARS.) As contrasted with Athena, who added to her other attributes that of being the goddess of well-conducted military operations, he personifies brute strength and the wild rage of conflict. His delight is in war and bloodshed; he loves fighting for fighting's sake, and takes the side of the one or the other combatant indifferently, regardless of the justice of the cause. His quarrelsomeness was regarded as inherited from his mother, and it may have been only as an illustration of the perpetual strife between Zeus and Hera that Ares was accounted their son. According to a later tradition, he was the son of Hera (Juno) alone, who became pregnant by touching a certain flower (Ovid, *Fasti*, v. 255). All the gods, even Zeus, hate him, but his bitterest enemy is Athena, who fells him to the ground with a huge stone. Splendidly armed, he goes to battle, sometimes on foot, sometimes in the war chariot made ready by his sons Deimos and Phobos (Panic and Fear) by whom he is usually accompanied. In his train also are found Enyo, the goddess of war who delights in bloodshed and the destruction of cities; his sister, Eris, goddess of fighting and strife; and the Keres, goddesses of death, whose function it is especially to roam the battle-field, carrying off the dead to Hades. In later accounts (and even in the *Odyssey*) Ares' character is somewhat toned down; thus, in the "Homeric" hymn to Ares, he is addressed as the assistant of Themis (Justice), the enemy of tyrants, and leader of the just. It is to be noted, however, that in this little poem he is to some extent confounded with the planet named after him (Ares, or Mars).

The primitive character of Ares has been much discussed. He is a god of storms; a god of light or a solar god; a chthonian god, one of the deities of the subterranean world, who could bring prosperity as well as ruin upon men, although in time his destructive qualities obscured the others. In this last aspect he was one of the chief gods of the Thracians, amongst whom his home was placed even in the time of Homer. In Scythia an old iron sword served as the symbol of the god, to which yearly sacrifices of cattle and horses were made, and in earlier times (as apparently also at Sparta) human victims, selected from prisoners of war, were offered. Thus Ares developed into the god of war, in which character he made his way into Greece. This theory may have been nothing more than an instance of the Greek tendency to assign a northern or "hyperborean" home to deities in whose character something analogous to the stormy elements of nature was found. But it appears that the Thracians and Scythians in historical times (Herodotus i. 59) worshipped chiefly a war god, and that certain Thracian settlements, formed in Greece in prehistoric times, left behind them traces of the worship of a god whom the Greeks called Ares. The story of his imprisonment for thirteen months by the Aloïdae (*Iliad*, v. 385) points to the conquest of this chthonian destroyer of the fields by the arts of peace, especially agriculture, of which the grain-fed sons of Aloeus (the thresher) are the personification.

In Homer Ares is the lover of Aphrodite, the wife of Hephaestus, who catches them together in a net and holds them up to the ridicule of the gods. In what appears to be a very early development of her character, Aphrodite also was a war goddess, known under the name of Areia; and in Thebes, the most important seat of the worship of Ares, she is his wife, and bears him Eros and Anteros, Deimos and Phobos, and Harmonia, wife of Cadmus, the founder of the city (Hesiod, *Theog.* 933). In the legend of Cadmus and his family Ares plays a prominent part. His worship was not so widely spread over Greece as that of other gods, although he was honoured here and there with festivals and sacrifices. Thus, at Sparta, under the name of Theritas, he was offered young dogs and even human beings. The Dioscuri were said to have brought his image from Colchis to Laconia, where it was set up in an old sanctuary on the road from Sparta to Therapnae. At Athens, he had a temple at the foot of the Areopagus, with a statue by Alcamenes. It was here, according to the legend, that he was tried and acquitted by a council of the gods for the murder of Halirrhothius, who had violated Alcippe, the daughter of Ares by Agraulos. The figure of Ares appears in various stories of ancient mythology. Thus, he engages in combat with Heracles on two occasions to avenge the death of his son Cycnus; once Zeus separates the combatants by a flash of lightning, but in the second encounter he is severely wounded by his adversary, who has the active support of Athena; maddened by jealousy, he changes himself into the boar which slew Adonis, the favourite of Aphrodite; and stirs up the war between the Lapithae and Centaurs. His attributes were the spear and the burning torch, symbolical of the devastation caused by war (in ancient times the hurling of a torch was the signal for the commencement of hostilities). The animals sacred to him were the dog and the vulture.

The worship of Ares being less general throughout Greece than that of the gods of peace, the number of statues of him is small; those of Ares-Mars, among the Romans, are more frequent. Previous to the 5th century B.C. he was represented as full-bearded, grim-featured and in full armour. From that time, apparently under the influence of Athenian sculptors, he was conceived as the ideal of a youthful warrior, and was for a time associated with Aphrodite and Eros. He then appears as a vigorous youth, beardless, with curly hair, broad head and stalwart shoulders, with helmet and chlamys. In the Villa Ludovisi statue (after the style of Lysippus) he appears seated, in an attitude of thought; his arms are laid aside, and Eros peeps out at his feet. In the Borghese Ares (also taken for Achilles) he is standing, his only armour being the helmet on his head. He also appears in many other groups, with Aphrodite, in marble and on engraved gems of Roman times. But before this grouping had recommended itself to the Romans, with their legend of Mars and Rhea Silvia, the Greek Ares had again become under Macedonian influence a bearded, armed and powerful god.

AUTHORITIES.—H. D. Müller, *Ares* (1848), H. W. Stoll, *Über die ursprüngliche Bedeutung des A. und der Athene* (1881); F. A. Voigt, "Beiträge zur Mythologie des Ares und Athena" in *Leipziger Studien*, iv. 1881; W. H. Roscher, *Studien zur vergleichenden Mythologie*, i., 1873; C. Tümpel, *Ares und Aphrodite* (1880); articles in Pauly-Wissowa's *Realencyclopädie*, Roscher's *Lexikon der Mythologie*, and Daremberg and Saglio's *Dictionnaire des Antiquités* (*s.v.* MARS); Preller, *Griechische Mythologie*.

ARETAEUS, of Cappadocia, a Greek physician, who lived at Rome in the second half of the 2nd century A.D. We possess two treatises by him, each in four books, in the Ionic dialect: *On the Causes and Indications of Acute and Chronic Diseases*, and *On their Treatment*. His work was founded on that of Archigenes; like him, he belonged to the eclectic school, but did not ignore the theories of the "Pneumatics," who made the heart the seat of life and of the soul.

Editions by Kühn (1828), Ermerius (1848). English translations: Wigan (1723); Moffat (1786); Reynolds (1837); Adams (1856). See Locher, *Aretaeus aus Kappadocien* (1847).

ARETAS (Arab. Hāritha), the Greek form of a name borne by kings of the Nabataeans resident at Petra in Arabia. (1) A king in the time of Antiochus IV. Epiphanes (2 Macc. v. 8). (2) The father-in-law of Herod Antipas (Jos. *Ant.* xviii. 5. 1, 3). In 2 Cor. xi. 32 he is described as ruler of Damascus (*q.v.*) at the time of Paul's conversion. Herod Antipas had married a daughter of Aretas, but afterwards discarded her in favour of Herodias. This led to a war with Aretas in which Antipas was defeated.

An Aretas is mentioned in 1 Macc. xv. 22, but the true reading is probably Ariarathes (king of Cappadocia). See NABATAEANS.

ARÊTE (O. Fr. *areste*, Lat. *arista*, ear of corn, fish-bone or spine), a ridge or sharp edge; a French term used in Switzerland to denote the sharp bayonet-like edge of a mountain (such as the Matterhorn), that slopes steeply upward with two precipitous sides meeting in a long ascending ridge. Hence the word has passed into common use to denote any sharp mountain edge denuded by frost action above the snowline, where the consequent angular ridges give the characteristic "house-roof structure" of these altitudes.

ARETHAS (*c.* 860–940), Byzantine theological writer and scholar, archbishop of Caesarea in Cappadocia, was born at Patrae. He was the author of a Greek commentary on the Apocalypse, avowedly based upon that of Andrew, his predecessor in the archbishopric. In spite of its author's modest estimate, Arethas's work is by no means a slavish compilation; it contains additions from other sources, and especial care has been taken in verifying the references. His interest was not, however, confined to theological literature; he annotated the margins of his classical texts with numerous scholia (many of which are preserved), and had several MSS. copied at his own expense, amongst them the Codex Clarkianus of Plato (brought to England from the monastery of St John in Patmos), and the Dorvillian MS. of Euclid (now at Oxford).

Most divergent opinions have been held as to the time in which Arethas lived; the reasons for the dates given above will be found succinctly stated in the article "Aretas," by A. Jülicher in Pauly-Wissowa's *Realencyclopädie der klassischen Altertumswissenschaft* (1896). The text of the commentary is given in Migne, *Patrologia Graeca*, cvi.; see also O. Gebhardt and A. Harnack, *Texte und Untersuchungen zur Geschichte der altchristlichen Litt.* i. pp. 36-46 (1882), and *Vita Euthymii* (patriarch of Constantinople, d. 917), ed. C. de Boor (1888); H. Wace, *Dictionary of Christian Biography*, i.; C. Krumbacher, *Geschichte der byzantinischen Litteratur* (1897); G. Heinrici in Herzog-Hauck, *Realencyklopädie* (1897).

ARETHUSA, in Greek mythology, a nymph who gave her name to a spring in Elis and to another in the island of Ortygia near Syracuse. According to Pausanias (v. 7. 2), Alpheus, a mighty hunter, was enamoured of Arethusa, one of the retinue of Artemis; Arethusa fled to Ortygia, where she was changed into a spring; Alpheus, in the form of a river, made his way beneath the sea, and united his waters with those of the spring. In Ovid (*Metam.* v. 572 foll.), Arethusa, while bathing in the Alpheus, was seen and pursued by the river god in human form; Artemis changed her into a spring, which, flowing underground, emerged at Ortygia. In the earlier form of the legend, it is Artemis, not Arethusa, who is the object of the god's affections, and escapes by smearing her face with mire, so that he fails to recognize her (see L. R. Farnell, *Cults of the Greek States*, ii. p. 428). The probable origin of the story is the part traditionally taken in the foundation of Syracuse by the Iamidae of Olympia, who identified the spring Arethusa with their own river Alpheus, and the nymph with Artemis Alpheiaia, who was worshipped at Ortygia. The subterranean passage of the Alpheus in the upper part of its course (confirmed by modern explorers), and the freshness of the water of Arethusa in spite of its proximity to the sea, led to the belief that it was the outlet of the river. Further, according to Strabo (vi. p. 270), during the sacrifice of oxen at Olympia the waters of Arethusa were disturbed, and a cup thrown into the Alpheus would reappear in Ortygia. In Virgil (*Ecl.* x. 1) Arethusa is addressed as a divinity of poetical inspiration, like one of the Muses, who were themselves originally nymphs of springs.

For Arethusa on Syracusan coins, see B. V. Head, *Historia Numorum*, pp. 151, 155.

ARETINO, PIETRO (1492–1556), Italian author, was born in 1492 at Arezzo in Tuscany, from which place he took his name. He is said to have been the natural son of Luigi Bacci, a gentleman of the town. He received little education, and lived for some years poor and neglected, picking up such scraps of information as he could. When very young he was banished from Arezzo on account of a satirical sonnet which he composed against indulgences. He went to Perugia, where for some time he worked as a bookbinder, and continued to distinguish himself by his daring attacks upon religion. After some years' wandering through parts of Italy he reached Rome, where his talents, wit and impudence commended him to the papal court. This favour, however, he lost in 1523 by writing a set of obscene sonnets, to accompany an equally immoral series of drawings by the great painter, Giulio Romano. He left Rome and was received by Giovanni de' Medici, who introduced him at Milan to Francis I. of France. He gained the good graces of that monarch, and received handsome presents from him. Shortly after this Aretino attempted to regain the favour of the pope, but, having come to Rome, he composed a sonnet against a rival in some low amour, and in return was assaulted and severely wounded. He could obtain no redress from the pope, and returned to Giovanni de' Medici. On the death of the latter in December 1526, he withdrew to Venice, where he afterwards continued to reside. He spent his time here in writing comedies, sonnets, licentious dialogues, and a few devotional and religious works. He led a profligate life, and procured funds to satisfy his needs by writing sycophantish letters to all the nobles and princes with whom he was acquainted. This plan proved eminently successful, for large sums were given him, apparently from fear of his satire. So great did Aretino's pride grow, that he styled himself the "divine," and the "scourge of princes." He died in 1556, according to some accounts by falling from his chair in a fit of laughter caused by hearing some indecent story of his sisters. The reputation of Aretino in his own time rested chiefly on his satirical sonnets or burlesques; but his comedies, five in number, are now considered the best of his works. His letters, of which a great number have been printed, are also commended for their style. The dialogues and the licentious sonnets have been translated into French, under the title *Académie des Dames*.

AREZZO (anc. *Arretium*), a town and episcopal see of Tuscany, Italy, the capital of the province of Arezzo, 54 m. S.E. of Florence by rail. Pop. (1901) town, 16,780; commune, 46,926. It is an attractive town, situated on the slope of a hill 840 to 970 ft. above sea-level, in a fertile district. The walls by which it is surrounded were erected in 1320 by Guido Tarlati di Pietramala, its warlike bishop, who died in 1327, and is buried in the cathedral; they were reconstructed by Cosimo I. de' Medici between 1541 and 1568, on which occasion the bronze statues of Pallas and the Chimaera, now at Florence, were discovered. The town itself is fan-shaped, the streets, which contain some fine old houses with projecting eaves and many towers, radiating from the citadel (Fortezza), which was constructed in 1502, and dismantled by the French in 1800. The cathedral, close by, is a fine specimen of Italian Gothic begun in 1277, but not completed internally until 1511, while the façade was not begun until 1880. The interior is spacious and contains some fine 14th-century sculptures, those of the high altar, which contains the tomb of St Donatus, the patron saint of Arezzo, being the best; very good stained-glass windows of the beginning of the 16th century by Guillaume de Marcillat, and some terra-cotta reliefs by Andrea della Robbia. Another fine church is S. Maria della Pieve, having a campanile and a façade of 1216, the latter with three open colonnades running for its whole length above the doors. The interior was restored to its original style in 1863–1865. The Romanesque choir and apse belong to the 11th century, the rest of the interior is contemporary with the façade. In the square behind the church is a colonnade designed by Vasari. In the cloisters of S. Bernardo, on the site of the ancient amphitheatre, is a remarkable view of medieval Rome. S. Francesco contains famous frescoes by Piero de' Franceschi, representing scenes from the legend of the Holy Cross, and others by Spinello Aretino, a pupil of Giotto. There are several other frescoes by the latter in S. Domenico. Among the Renaissance buildings the churches of S. Maria delle Grazie and the Santissima Annunziata may be noted. The collection of majolica in the municipal museum is very fine, and so is that of the Funghini family. In the middle ages Arezzo was generally on the Ghibelline side; it succumbed to Florence in 1289 at the battle of Campaldino, but at the end of the century recovered its strength under the Tarlati family. In 1336 it became subject to Florence for six years, and after intestine struggles, finally came under her rule in 1384. Among the natives of Arezzo the most famous are the Benedictine monk Guido of Arezzo, the inventor of the modern system of musical notation (died *c.* 1050), the poet Petrarch, Pietro Aretino, the satirist (1492–1556), and Vasari, famous for his lives of Italian painters. The town never possessed a distinct school of artists.

See C. Signorini, *Arezzo, Città y Provincia, Guida illustrata* (Arezzo, 1904). (T. As.)

ARGALI, the Tatar name of the great wild sheep, *Ovis ammon,* of the Altai and other parts of Siberia. Standing as high as a large donkey, the argali is the finest of all the wild sheep, the horns of the rams, although of inferior length, being more massive than those of *Ovis poli* of the Pamirs. There are several local races of argali, among which *O. ammon hodgsoni* of Ladak and Tibet is one of the best known. There are likewise several nearly related central Asian species, such as *O. sairensis* and *O. littledalei.* (See Sheep.)

ARGAO, a town on the east coast of Cebu, Philippine Islands, 36 m. S.S.W. of the town of Cebu. Pop. (1903) 35,448. Large quantities of a superior quality of cacao are produced in the vicinity, and rice and Indian corn are other important products. A limited amount of cotton is raised and woven into cloth. The language is Cebu-Visayan. Argao was founded in 1608.

ARGAUM, a village of British India in the Akola district of the Central Provinces, 32 m. north of Akola. The village is memorable for an action which took place on the 28th of November 1803 between the British army, commanded by Major-General Wellesley (afterwards duke of Wellington), and the Mahrattas under Sindhia and the raja of Berar, in which the latter were defeated with great loss. A medal struck in England in 1851 commemorates the victory.

ARGEI, the name given by the ancient Romans to a number of rush puppets (24 or 27 according to the reading of Varro, *de Ling. lat.* vii. 44, or 30 according to Dionysius i. 38) resembling men tied hand and foot, which were taken down to the ancient bridge over the Tiber (*pons sublicius*) on the 14th of May by the pontifices and magistrates, with the flaminica Dialis in mourning guise, and there thrown into the Tiber by the Vestal virgins. There were also in various parts of the four Servian regions of the city a number of *sacella Argeorum* (chapels), round which a procession seems to have gone on the 17th of March (Varro, *L.L.* v. 46-54; Jordan, *Röm. Topogr.* vol. ii. 603), and it has been conjectured that the puppets were kept in these chapels until the time came for them to be cast into the river. The Romans had no historical explanation of these curious rites, and neither the theories of their scholars nor the beliefs of the common people, who fancied that the puppets were substitutes for old men who used at one time to be sacrificed to the river, are worth serious consideration. Recently two explanations have been given: (1) that of W. Mannhardt, who by comparing numerous examples of similar customs among other European peoples arrived at the conclusion that the rite was of extreme antiquity and of dramatic rather than sacrificial character, and that its object was possibly to procure rain; (2) that of Wissowa, who refuses to date it farther back than the latter half of the 3rd century B.C., and sees in it the yearly representation of an original sacrifice of twenty-seven captive Greeks (taking Argei as a Latin form of Ἀργεῖοι) by drowning in the Tiber. This second theory is, however, not borne out by any Roman historical record.

See Wissowa's arguments in the article "Argei" in his edition of Pauly's *Realencyclopädie.* For the other view see W. Mannhardt, *Antike Wald und Feldkulte,* 178 foll.; W. W. Fowler, *Roman Festivals,* pp. 111 foll. (W. W. F.*)

ARGELANDER, FRIEDRICH WILHELM AUGUST (1799–1875), German astronomer, was born at Memel on the 22nd of March 1799. He studied at the university of Königsberg, and was attracted to astronomy by F. W. Bessel, whose assistant he became (October 1, 1820). His treatise on the path of the great comet of 1811 appeared in 1822; he was, in 1823, entrusted with the direction of the observatory at Åbo; and he exchanged it for a similar charge at Helsingfors in 1832. His admirable investigation of the sun's motion in space was published in 1837; and in the same year he was appointed professor of astronomy in the university of Bonn, where he died on the 17th of February 1875. He also published *Observationes Astronomicae Aboae Factae* (3 vols., 1830–1832); *DLX Stellarum Fixarum Positiones Mediae* (1835); and the first seven volumes of *Astronomische Beobachtungen auf der Sternwarte zu Bonn* (1846–1869), containing his observations of northern and southern star-zones, and his great *Durchmusterung* (vols. iii.-v., 1859–1862) of 324,198 stars, from the north pole to −2° Dec. The corresponding atlas was issued in 1863. His observations (begun in 1838) and discussions of variable stars were embodied in vol. vii. of the same series.

See E. Schönfeld in *Vierteljahrsschrift der Astronomischen Gesellschaft,* x. pp. 150-178.

ARGENS, JEAN BAPTISTE DE BOYER, Marquis d' (1704–1771), was born at Aix in Provence on the 24th of June 1704. He entered the army at the age of fifteen, and after a dissipated and adventurous youth settled for a time at Amsterdam, where he wrote some historical compilations and began his more famous *Lettres juives* (The Hague, 6 vols., 1738–1742), *Lettres chinoises* (The Hague, 6 vols., 1739–1472), and *Lettres cabalistiques* (2nd ed., 7 vols., 1769); also the *Mémoires secrets de la république des lettres* (7 vols., 1743–1478), afterwards revised and augmented as *Histoire de l'esprit humain* (Berlin, 14 vols., 1765–1768). He was invited by Prince Frederick (afterwards Frederick the Great) to Potsdam, and received high honours at court; but Frederick was bitterly offended by his marrying a Berlin actress, Mlle Cochois. Argens returned to France in 1769, and died near Toulon on the 11th of January 1771.

ARGENSOLA, LUPERCIO LEONARDO DE (1559–1613), Spanish dramatist and poet, was baptized at Barbastro on the 14th of December 1559. He was educated at the universities of Huesca and Saragossa, becoming secretary to the duke de Villahermosa in 1585. He was appointed historiographer of Aragon in 1599, and in 1610 accompanied the count de Lemos to Naples, where he died in March 1613. His tragedies—*Filis, Isabela* and *Alejandra*—are said by Cervantes to have "filled all who heard them with admiration, delight and interest"; *Filis* is lost, and *Isabela* and *Alejandra,* which were not printed till 1772, are ponderous imitations of Seneca. Argensola's poems were published with those of his brother in 1634; they consist of excellent translations from the Latin poets, and of original satires. His "echoing sonnets"—such as *Despuês que al mundo el rey divino vino*—lend themselves to parody; but his diction is singularly pure.

His brother, Bartolomé Leonardo de Argensola (1562–1631), Spanish poet and historian, was baptized at Barbastro on the 26th of August 1562, studied at Huesca, took orders, and was presented to the rectory of Villahermosa in 1588. He was attached to the suite of the count de Lemos, viceroy of Naples, in 1610, and succeeded his brother as historiographer of Aragon in 1613. He died at Saragossa on the 4th of February 1631. His principal prose works are the *Conquista de las Islas Molucas* (1609), and a supplement to Zurita's *Anales de Aragón,* which was published in 1630. His poems (1634), like those of his elder brother, are admirably finished examples of pungent wit. His commentaries on contemporary events, and his *Alteraciones populares,* dealing with a Saragossa rising in 1591, are lost. An interesting life of this writer by Father Miguel Mir precedes a reprint of the *Conquista de las Islas Molucas,* issued at Saragossa in 1891.

ARGENSON, the name, derived from an old hamlet situated in what is now the department of Indre-et-Loire, of a French family which produced some prominent statesmen, soldiers and men of letters.

René de Voyer, seigneur d'Argenson (1596–1651), French statesman, was born on the 21st of November 1596. He was a lawyer by profession, and became successively *avocat,* councillor at the parlement of Paris, *maître des requêtes,* and councillor of state. Cardinal Richelieu entrusted him with several missions as inspector and intendant of the forces. In 1623 he was appointed intendant of justice, police and finance in Auvergne, and in 1632 held similar office in Limousin, where he remained till 1637. After the death of Louis XIII. (1643) he retained his administrative posts, was intendant of the forces at Toulon

(1646), commissary of the king at the estates of Languedoc (1647), and intendant of Guienne (1648), and showed great capacity in defending the authority of the crown against the rebels of the Fronde. After his wife's death he took orders (February 1651), but did not cease to take part in affairs of state. In 1651 he was appointed by Mazarin ambassador at Venice, where he died on the 14th of July 1651.

His son, Marc René de Voyer, comte d'Argenson (1623–1700), was born at Blois on the 13th of December 1623. He also was a lawyer, being councillor at the parlement of Rouen (1642) and *maître des requêtes*. He attended his father in all his duties and succeeded him at the embassy at Venice. In 1655 he returned from his embassy ruined, and lost favour with Mazarin, who removed him from his office of councillor of state. He then gave up public affairs and retired to his estates, where he occupied himself with good works. In September 1656 he entered the Company of the Holy Sacrament, a secret society for the diffusion of the Catholic religion. Besides writing the *Annals* of the society, he composed many pious works, which were destroyed in the fire at the Louvre in 1871. Some of his correspondence with the once famous letter-writer, Jean Louis Guez de Balzac (1597–1654), has been published. He died in May 1700, leaving two sons, Marc René (see below), and François Élie (1656–1728), who became archbishop of Bordeaux.

See Fr. Rabbe, "Compagnie du Saint-Sacrement," in the *Revue historique* (Nov. 1899); Beauchet-Filleau, *Les Annales de la compagnie du Saint-Sacrement* (Paris, 1900); R. Allier, *La Cabale des dévots* (Paris, 1902).

Marc René de Voyer, marquis de Paulmy and marquis d'Argenson (1652–1721), son of the preceding, was born at Venice on the 4th of November 1652. He became *avocat* in 1669, and lieutenant-general in the *sénéchaussée* of Angoulême (1679). After the death of Colbert, who disliked his family, he went to Paris and married Marguerite Lefèvre de Caumartin, a kinswoman of the comptroller-general Pontchartrain. This was the beginning of his fortunes. He became successively *maître des requêtes* (1694), member of the *conseil des prises* (prize court) (1695), *procureur-général* of the commission of inquest into false titles of nobility (1696), and finally lieutenant-general of police (1697). This last office, which had previously been filled by N. G. de la Reynie, was very important. It not only gave him the control of the police, but also the supervision of the corporations, printing press, and provisioning of Paris. All contraventions of the police regulations came under his jurisdiction, and his authority was arbitrary and absolute. Fortunately, he had, in Saint-Simon's phrase, "a nice discernment as to the degree of rigour or leniency required for every case that came before him, being ever inclined to the mildest measures, but possessed of the faculty of making the most innocent tremble before him; courageous, bold, audacious in quelling *émeutes*, and consequently the master of the people." During the twenty-one years that he exercised this office he was a party to every private and state secret; in fact, he had a share in every event of any importance in the history of Paris. He was the familiar friend of the king, who delighted in scandalous police reports; he was patronized by the duke of Orleans; he was supported by the Jesuits at court; and he was feared by all. He organized the supply of food in Paris during the severe winter of 1709, and endeavoured, but with little success, to run to earth the libellers of the government. He directed the destruction of the Jansenist monastery of Port Royal (1709), a proceeding which provoked many protests and pamphlets. Under the regency, the Chambre de Justice, assembled to inquire into the malpractices of the financiers, suspected d'Argenson and arrested his clerks, but dared not lay the blame on him. On the 28th of January 1718 he voluntarily resigned the office of lieutenant-general of police for those of keeper of the seals—in the place of the chancellor d'Aguesseau—and president of the council of finance. He was appointed by the regent to suppress the resistance of the parlements and to reorganize the finances, and was in great measure responsible for permitting John Law to apply his financial system, though he soon quarrelled with Law and intrigued to bring about his downfall. The regent threw the blame for the outcome of Law's schemes on d'Argenson, who was forced to resign his position in the council of finance (January 1720). By way of compensation he was created inspector-general of the police of the whole kingdom, but had to resign his office of keeper of the seals (June 1720). He died on the 8th of May 1721, the people of Paris throwing taunts and stones at his coffin and accusing him of having ruined the kingdom. In 1716 he had been created an honorary member of the Académie des Sciences and, in 1718, a member of the French Academy.

See the contemporary memoirs, especially those of Saint-Simon (de Boislisle's ed.), Dangeau and Math. Marais; Barbier's *Journal*; "Correspondance administrative sous Louis XIV." in *Coll. des doc. inéd. sur l'histoire de France*, edited by G. B. Depping (1850–1855); *Correspondance des contrôleurs-généraux des finances*, pub. by de Boislisle (1873–1900); *Correspondance de M. de Marville avec M. de Maurepas* (1896–1897); *Rapports de police de René d'Argenson*, pub. by P. Cottin (Paris, undated); P. Clément, *La police sous Louis XIV.* (1873).

René Louis de Voyer de Paulmy, marquis d'Argenson (1694–1757), eldest son of the preceding, was a lawyer, and held successively the posts of councillor at the parlement (1716), *maître des requêtes* (1718), councillor of state (1719), and intendant of justice, police and finance in Hainaut. During his five years' tenure of the last office he was mainly employed in provisioning the troops, who were suffering from the economic confusion resulting from Law's system. He returned to court in 1724 to exercise his functions as councillor of state. At that time he had the reputation of being a conscientious man, but ill adapted to intrigue, and was nicknamed "la bête." He entered into relations with the philosophers, and was won over to the ideas of reform. He was the friend of Voltaire, who had been a fellow-student of his at the Jesuit college Louis-le-grand, and frequented the Club de l'Entresol, the history of which he wrote in his memoirs. It was then that he prepared his *Considérations sur le gouvernement de la France*, which was published posthumously by his son. He was also the friend and counsellor of the minister G. L. de Chauvelin. In May 1744 he was appointed member of the council of finance, and in November of the same year the king chose him as secretary of state for foreign affairs, his brother, the comte d'Argenson (see below), being at the same time secretary of state for war. France was at that time engaged in the War of the Austrian Succession, and the government had been placed by Louis XV. virtually in the hands of the two brothers. The marquis d'Argenson endeavoured to reform the system of international relations. He dreamed of a "European Republic," and wished to establish arbitration between nations in pursuance of the ideas of his friend the abbé de Saint-Pierre. But he failed to realize any part of his projects. The generals negotiated in opposition to his instructions; his colleagues laid the blame on him; the intrigues of the courtiers passed unnoticed by him; whilst the secret diplomacy of the king neutralized his initiative. He concluded the marriage of the dauphin to the daughter of Augustus III., king of Poland, but was unable to prevent the election of the grand-duke of Tuscany as emperor in 1745. On the 10th of January 1747 the king thanked him for his services. He then retired into private life, eschewed the court, associated with Voltaire, Condillac and d'Alembert, and spent his declining years in working at the Académie des Inscriptions, of which he was appointed president by the king in 1747, and revising his *Mémoires*. Voltaire, in one of his letters, declared him to be "the best citizen that had ever tasted the ministry." He died on the 26th of January 1757.

He left a large number of manuscript works, of which his son, Antoine René (1722-1787), known as the marquis de Paulmy, published the *Considérations sur le gouvernement de France* (Amsterdam, 1764) and *Essais dans le goût de ceux de Montaigne* (*ib.* 1785). The latter, which contains many useful biographical notes and portraits of his contemporaries, was republished in 1787 as *Loisirs d'un ministre d'état*. Argenson's most important work, however, is his *Mémoires*, covering in great detail the years 1725 to 1756, with an introductory part giving his recollections since the year 1696. They are, as they were intended to be, valuable "materials for the history of his time." There are two important editions, the first, with some letters, not elsewhere published, by the marquis d'Argenson, his great-grand-nephew (5 vols., Paris, 1857 et seq.); the second, more correct, but less complete, published by J. B. Rathery, for the Société de l'Histoire de France (9 vols., Paris, 1859 et seq.). The other works of the marquis d'Argenson, in MS., were destroyed in the fire at the Louvre library in 1871.

See Sainte-Beuve, *Causeries du lundi* (vols. xii. and xiv.); Levasseur, "Le Marquis d'Argenson" in the *Mémoires de l'Académie des Sciences Morales et Politiques* (vol. lxxxvii., 1868); and, especially, E. Zevort, *Le Marquis d'Argenson et le ministère des affaires étrangères* (Paris, 1880). See also G. de R. de Flassan, *Histoire de la diplomatie française* (2nd ed., 1811); Voltaire, *Siècle de Louis XV.*; E. Boutaric, *Correspondance secrète inédite de Louis XV.* (1866); E. Champion, "Le Marquis d'Argenson," in the *Révolution française* (vol. xxxvi., 1899); A. Alem, *D'Argenson économiste* (Paris, 1899); Arthur Ogle, *The Marquis d'Argenson* (1893).

Marc Pierre de Voyer de Paulmy, comte d'Argenson (1696–1764), younger brother of the preceding, was born on the 16th of August 1696. Following the family tradition he studied law and was councillor at the parlement of Paris. He succeeded his father as lieutenant-general of police in Paris, but held the post only five months (January 26 to June 30, 1720). He then received the office of intendant of Tours, and resumed the lieutenancy of police in 1722. On the 2nd of January 1724 he was appointed councillor of state. He gained the confidence of the regent Orleans, administering his fortune and living with his son till 1737. During this period he opened his salon to the philosophers Chaulieu, la Fare and Voltaire, and collaborated in the legislative labours of the chancellor d'Aguesseau. In March 1737 d'Argenson was appointed director of the censorship of books, in which post he showed sufficiently liberal views to gain the approval of writers—a rare thing in the reign of Louis XV. He only retained this post for a year. He became president of the grand council (November 1738), intendant of the *généralité* of Paris (August 1740), was admitted to the king's council (August 1742), and in January 1743 was appointed secretary of state for war in succession to the baron de Breteuil. As minister for war he had a heavy task; the French armies engaged in the War of the Austrian Succession were disorganized, and the retreat from Prague had produced a disastrous effect. After consulting with Marshal Saxe, he began the reform of the new armies. To assist recruiting, he revived the old institution of local militias, which, however, did not come up to his expectation. In the spring of 1744 three armies were able to resume the offensive in the Netherlands, Germany and Italy, and in the following year France won the battle of Fontenoy, at which d'Argenson was present. After the peace in 1748 he occupied himself with the important work of recasting the French army on the model of the Prussian. He unified the types of cannon, grouped the grenadiers into separate regiments, and founded the École Militaire for the training of officers (1751). An edict of the 1st of November 1751 granted patents of nobility to all who had the rank of general officer. In addition to his duties as minister of war he had the supervision of the printing, postal administration and general administration of Paris. He was responsible for the arrangement of the promenade of the Champs Élysées and for the plan of the present Place de la Concorde. He was exceedingly popular, and, although the court favourites hated him, he had the support of the king. Nevertheless, after the attempt of R. F. Damiens to assassinate the king, Louis abandoned d'Argenson to the machinations of the court favourites and dismissed both him and his colleague, J. B. de Machault d'Arnouville (February 1757). D'Argenson was exiled to his estates at Les Ormes near Saumur, but he had previously found posts for his brother, the marquis d'Argenson, as minister of foreign affairs, for his son Marc René as master of the horse, and for his nephew Marc Antoine René as commissary of war. From the time of his exile he lived in the society of savants and philosophers. He had been elected member of the Académie des Inscriptions in 1749. Diderot and d'Alembert dedicated the *Encyclopédie* to him, and Voltaire, C. J. F. Hénault, and J. F. Marmontel openly visited him in his exile. After the death of Madame de Pompadour he obtained permission to return to Paris, and died a few days after his return, on the 22nd of August 1764.

Marc Antoine René de Voyer, marquis de Paulmy d'Argenson (1722–1787), nephew of the preceding and son of René Louis, was born at Valenciennes on the 22nd of November 1722. Appointed councillor at the parlement (1744), and *maître des requêtes* (1747), he was associated with his father in the ministry of foreign affairs and with his uncle in the ministry of war, and, in recognition of this experience, was commissioned to inspect the troops and fortifications and sent on embassy to Switzerland (1748). In 1751 his uncle recognized him as his deputy and made over to him the reversion of the secretariate of war. He then worked on the great reform of the army, and after the dismissal of his uncle became minister of war (February 1757). But the outbreak of the Seven Years' War made this post exceedingly difficult to hold, and he resigned on the 23rd of March 1758. He was ambassador to Poland from 1762 to 1764, but failed to procure the nomination of the French candidate to that throne. From 1766 to 1770 he was ambassador at Venice. Failing to obtain the embassy at Rome, he retired at the age of forty-eight and devoted the rest of his life to indulging his tastes for history and biography. He brought together a large library, very rich in French poetry and romance, and undertook various publications with the help of his librarian. In 1775 he began his *Bibliothèque universelle des romans*, of which forty volumes appeared within three years, but subsequently handed over the publication to other editors. His great work, *Mélanges tirés d'une grande bibliothèque*, was published in 65 volumes (Paris, 1779–1788). At his death he forbade his library to be dispersed: it was bought by the comte d'Artois (afterwards Charles X.) and formed the nucleus of the present Bibliothèque de l'Arsenal at Paris (the marquis having been governor of the arsenal). He died on the 13th of August 1787.

See contemporary memoirs; also Dacier's eulogium in the *Académie des Inscriptions et Belles-Lettres* (November 1788); and Sainte-Beuve, *Causeries du lundi* (vol. xii.).

Marc René, marquis de Voyer de Paulmy d'Argenson (1721–1782), known as the marquis de Voyer, son of Marc Pierre de Voyer, the minister of war, was born in Paris on the 20th of September 1721. He served in the army of Italy and the army of Flanders in the War of the Austrian Succession, and was *mestre de camp* (proprietary colonel) of the regiment of Berry cavalry at the battle of Fontenoy (May 10, 1745), where he was promoted brigadier. He was associated with his father in his work of reorganizing the army, was made inspector of cavalry and dragoons (1749), and succeeded his father as master of the horse (1752). He introduced English horses into France. He was lieutenant-general of Upper Alsace in 1753 and governor of Vincennes in 1754, and served afterwards under Soubise in the Seven Years' War. He was wounded at Crefeld in 1758, and was promoted lieutenant-general (1759). He followed his father into exile at Les Ormes (1763), and in the last years of the reign of Louis XV. sided with the malcontents headed by Choiseul; but on the rupture with England he rejoined the service of the king (1775). He was appointed inspector of the sea-board, and put the roadstead of the island of Aix in a state of defence during the American War of Independence. He caught marsh-fever while attempting to drain the marshes of Rochefort, and died at Les Ormes on the 18th of September 1782.

Marc René Marie de Voyer de Paulmy, marquis d'Argenson (1771–1842), son of the preceding, was born in Paris in September 1771. He was brought up by his father's cousin, the marquis de Paulmy, governor of the arsenal, and was made lieutenant of dragoons in 1789. Although, at the age of eighteen, he had succeeded to several estates and a large fortune, he embraced the revolutionary cause, joining the army of the North as Lafayette's aide-de-camp and remaining with it even after Lafayette's defection. Leaving France to take one of his sisters to England, he was denounced on his return as a royalist conspirator, on the charge of having in his possession portraits of the royal family. He then went to live in Touraine, married the widow of Prince Victor de Broglie, and saved her and her children from proscription. He introduced new agricultural instruments and processes on his estates, and installed machinery imported from England in his ironworks in Alsace. He was an enthusiastic adherent of Napoleon, by whom he was appointed in May 1809 prefect of Deux-Nèthes. He helped to repel the English invasion of the islands of South Beveland and Walcheren (August 1809), and afterwards directed the defence works of Antwerp, but resigned this post (March 1813) in consequence of the complaints of the inhabitants and the exacting demands of the emperor. In May 1814 he refused the prefecture of Marseilles offered to him by the Bourbons, but was elected deputy from Belfort in 1815 during the Hundred Days. On the 5th of July 1815 he took part in the declaration protesting against any tampering with the immutable rights of the nation. He was a member of the *Chambre introuvable*, where he became one of the orators of the democratic party. He was one of the founders of the journal *Le censeur européen* and of the *Club de la liberté de la presse*, and was an uncompromising opponent of reaction. Not re-elected in 1824 on account of his liberal ideas, he returned to the chamber under the Martignac ministry (1828), and resolutely persisted in his championship of the liberty of the press and of public worship. On the death of his wife he voluntarily renounced his mandate (July 1829), and hailed the revolution of 1830 with great satisfaction. On the 3rd of November 1830 he was elected to the chamber as deputy from Châtellerault, and took the oath, adding, however, the reservation "subject to the progress of the public reason." His independent attitude resulted in his defeat in the following year at the Châtellerault election, but he was returned for Strassburg. He wished the incidence of the taxes to be arranged according to social condition, and advocated a single tax proportionate to income like the English income tax. He harped incessantly on this idea in his speeches and articles (see his letters in *La Tribune* of June 20, 1832). Although he was a proprietor of ironworks he opposed the protectionist laws, which he considered injurious to the workmen. He became the mouthpiece of the advanced ideas; subsidized the opposition newspapers, especially the *National*; received into his house F. M. Buonarroti, who in 1796 had been implicated in the conspiracy of "Gracchus" Babeuf (*q.v.*); and became a member of the committee of the Society of the Rights of Man. He was even sued in the courts for a pamphlet called *Boutade d'un homme riche à sentiments populaires*, and delivered a speech to the jury in which he displayed very daring social theories. But he gradually grew discouraged and retired from public affairs, refusing even municipal office, and living in seclusion at La Grange in the forest of Guerche, where he devoted his inventive faculty to devising agricultural improvements. He subsequently returned to Paris, where he died on the 1st of August 1842.

Charles Marc René de Voyer, marquis d'Argenson (1796–1862), son of the preceding, was born at Boulogne-sur-Seine on the 20th of April 1796. He concerned himself little with politics. He was, however, a member of the council-general of Vienne for six years, but was expelled from it in 1840 in consequence of his advanced ideas and his relations with the Opposition. In 1848 he was elected deputy from Vienne to the Constituent Assembly by 12,000 votes. He was an active member of the Archaeological Society of Touraine and the Society of Antiquaries of the West, and wrote learned works for these bodies. He collaborated in preparing the archives of the scientific congress at Tours in 1847; brought out two editions of the MSS. of his great-grand-uncle, the minister of foreign affairs under Louis XV., under the title *Mémoires du marquis d'Argenson*, one in 1825, and the other, in 5 vols., in 1857–1858; and published *Discours et opinions de mon père, M. Voyer d'Argenson* (2 vols., 1845). He died on the 31st of July 1862.

ARGENTAN, a town of north-western France, capital of an arrondissement in the department of Orne, 27 m. N.N.W. of Alençon on the railway from Le Mans to Caen. Pop. (1906) 5072. It is situated on the slope of a hill on the right bank of the Orne at its confluence with the Ure. The town has remains of old fortifications, among them the Tour Marguerite, and a château, now used as a law-court, dating from the 15th century. The church of St Germain (15th, 16th and 17th centuries) has several features of architectural beauty, notably the sculptured northern portal, and the central and western towers. The church of St Martin, dating from the 15th century, has good stained glass. The handsome modern town-hall contains among other institutions the tribunal of commerce, the museum and the library. Argentan is the seat of a sub-prefect, has a tribunal of first instance and a communal college. Leather-working and the manufacture of stained glass are leading industries. There are quarries of limestone in the vicinity. Argentan was a viscounty from the 11th century onwards; it was often taken and pillaged. During the Religious Wars it remained attached to the Catholic party. François Eudes de Mézeray, the historian, was born near the town, and a monument has been erected to his memory.

ARGENTEUIL, a town of northern France in the department of Seine-et-Oise, on the Seine, 5 m. N.W. of the fortifications of Paris by the railway from Paris to Mantes. Pop. (1906) 17,330. Argenteuil grew up round a monastery, which, dating from A.D. 656, was by Charlemagne changed into a nunnery; it was afterwards famous for its connexion with Héloïse (see Abelard), and on her expulsion in 1129 was again turned into a monastery. Asparagus, figs, and wine of medium quality are grown in the district; and heavy iron goods, chemical products, clocks and plaster are among the manufactures.

ARGENTINA, or the Argentine Republic (officially, *Republica Argentina*), a country occupying the greater part of the southern extremity of South America. It is of wedge shape, extending from 21° 55′ S. to the most southerly point of the island of Tierra del Fuego in 55° 2′ 30″ S., while its extremes of longitude are 53° 40′ on the Brazilian frontier and 73° 17′ 30″ W. on the Chilean frontier. Its length from north to south is 2285 statute miles, and its greatest width about 930 m. It is the second largest political division of the continent, having an area of 1,083,596 sq. m. (Gotha measurement). It is bounded N. by Bolivia and Paraguay, E. by Paraguay, Brazil, Uruguay and the Atlantic, W. by Chile, and S. by the converging lines of the Atlantic and Chile.

Boundaries.—At different times Argentina has been engaged in disputes over boundary lines with every one of her neighbours, that with Chile being only settled in 1902. Beginning at the estuary of the Rio de la Plata, the boundary line ascends the Uruguay river, on the eastern side of the strategically important island of Martin Garcia, to the mouth of the Pequiry, thence under the award of President Grover Cleveland in 1894 up that small river to its source and in a direct line to the source of the Santo Antonio, a small tributary of the Iguassú, thence down the Santo Antonio and Iguassú to the upper Paraná, which forms the southern boundary of Paraguay. From the confluence of the upper Paraná and Paraguay the line ascends the latter to the mouth of the Pilcomayo, which river, under the award of President R. B. Hayes in 1878, forms the boundary between Argentina and Paraguay from the Paraguay river north-west to the Bolivian frontier. In accordance with the Argentine-Bolivian treaty of 1889 the boundary line between these republics continues up the Pilcomayo to the 22nd parallel, thence west to the Tarija river, which it follows down to the Bermejo, thence up the latter to its source, and westerly through the Quiaca ravine and across to a point on the San Juan river opposite Esmoraca. From this point it ascends the San Juan south and west to the Cerro de Granadas, and thence south-west to Cerro Incahuasi and Cerro Zapalegui on the Chilean frontier. The boundary with Chile, extending across more than 32° lat., had been the cause of disputes for many years, which at times led to costly preparations for war. The debts of the two nations resulted largely from this one cause. In 1881 a treaty was signed which provided that the boundary line should follow the highest crests of the Andes forming the watershed as far south as the 52nd parallel, thence east to the 70th meridian and south-east to Cape Dungeness at the eastern entrance to the Straits of Magellan. Crossing the Straits the line should follow the meridian of 68° 44′, south to Beagle Channel, and thence east to the Atlantic, giving Argentina the eastern part of the Tierra del Fuego and Staten Island. By this agreement Argentina was confirmed in the possession of the greater part of Patagonia, while Chile gained control of the Straits of Magellan, much adjacent territory on the north, the larger part of Tierra del Fuego and all the neighbouring islands south and west.

When the attempt was made to mark this boundary the commissioners were unable to agree on a line across the Puna de Atacama in the north, where parallel ranges enclosing a high arid plateau without any clearly defined drainage to the Atlantic or Pacific, gave an opportunity for conflicting claims. In the south the broken character of the Cordillera, pierced in places by large rivers flowing into the Pacific and having their upper drainage basins on the eastern side of the line of highest crests, gave rise to unforeseen and very difficult questions. Finally, under a convention of the 17th of April 1896, these conflicting claims were submitted to arbitration. In 1899 a mixed commission with Hon. W. I. Buchanan, United States minister at Buenos Aires, serving as arbitrator, reached a decision on the Atacama line north of 26° 52′ 45″ S. lat., which was a compromise though it gave the greater part of the territory to Argentina. The line starts at the intersection of the 23rd parallel with the 67th meridian and runs south-westerly and southerly to the mountain and volcano summits of Rincón, Socompa, Llullaillaco, Azufre, Aguas Blancas and Sierra Nevada, thence to the initial point of the British award. (See *Geogr. Jour.*, 1899, xiv. 322-323.) The line south of 26° 52′ 45″ S. lat. had been located by the commissioners of the two republics with the exception of four sections. These were referred to the arbitration of Queen Victoria, and, after a careful survey under the direction of Sir Thomas H. Holdich, the award was rendered by King Edward VII. in 1902. (See *Geogr. Jour.*, 1903, xxi. 45-50.) In the first section the line starts from a pillar erected in the San Francisco pass, about 26° 50′ S. lat., and follows the water-parting southward to the highest peak of the Tres Cruces mountains in 27° 0′ 45″ S. lat., 68° 49′ 5″ W. long. In the second, the line runs from 40° 2′ S. lat., 71° 40′ 36″ W. long., along the water-parting to the southern termination of the Cerro Perihueico in the valley of the Huahum river, thence across that river, 71° 40′ 36″ W. long., and along the water-parting around the upper basin of the Huahum to a junction with the line previously determined. In the third and longest section, the line starts from a pillar erected in the Perez Rosales pass, near Lake Nahuel-Huapi, and follows the water-parting southward to the highest point of Mt. Tronador, and thence in a very tortuous course along local water-partings and across the Chilean rivers Manso, Puelo, Fetaleufu, Palena, Pico and Aisen, and the lakes Buenos Aires, Pueyrredón and San Martin, to avoid the inclusion of Argentine settlements within Chilean territory, to the Cerro Fitzroy and continental water-parting north-west of Lake Viedma, between 49° and 50° S. lat. The northern half of this line does not run far from the 72nd meridian, except in 44° 30′ S. where it turns eastward nearly a degree to include the upper valley of the Frias river in Chilean territory, but south of the 49th parallel it curves westward to give Argentina sole possession of lakes Viedma and Argentino. The fourth section, which was made particularly difficult of solution by the extension inland of the Pacific coast inlets and sounds and by the Chilean colonies located there, was adjusted by running the line eastward from the point of divergence in 50° 50′ S. lat. along the Sierra Baguales, thence south and south-east to the 52nd parallel, crossing several streams and following the crests of the Cerro Cazador. The Chilean settlement of Ultima Esperanza (Last Hope), over which there had been much controversy, remains under Chilean jurisdiction.

Physical Geography.—For purposes of surface description, Argentina may be divided primarily into three great divisions—the mountainous zone and tablelands of the west, extending the full length of the republic; the great plains of the east, extending from the Pilcomayo to the Rio Negro; and the desolate, arid steppes of Patagonia. The first covers from one-third to one-fourth of the width of the country between the Bolivian frontier and the Rio Negro, and comprises the elevated Cordilleras and their plateaus, with flanking ranges and spurs toward the east. In the extreme north, extending southward from the great Bolivian highlands, there are several parallel ranges, the most prominent of which are: the Sierra de Santa Catalina, from which the detached Cachi, Gulumpaji and Famatina ranges project southward; and the Sierra de Santa Victoria, south of which are the Zenta, Aconquija, Ambato and Ancaste ranges. These minor ranges, excepting the Zenta, are separated from the Andean masses by comparatively low depressions and are usually described as distinct ranges; topographically, however, they seem to form a continuation of the ranges running southward from the Santa Victoria and forming the eastern rampart of the great central plateau of which the Puna de Atacama covers a large part. The elevated plateaus between these ranges are semi-arid and inhospitable, and are covered with extensive saline basins, which become lagoons in the wet season and morasses or dry salt-pans in the dry season. These saline basins extend down to the lower terraces of Córdoba, Mendoza and La Pampa. Flanking this great widening of the Andes on the south-east are the three short parallel ranges of Córdoba, belonging to another and older formation. North of them is the great saline depression, known as the "salinas grandes," 643 ft. above sea-level, where it is crossed by a railway; north-east is another extensive saline basin enclosing the "Mar Chiquita" (of Córdoba) and the morasses into which the waters of the Rio Saladillo disappear; and on the north are the more elevated plains, partly saline, of western Córdoba, which separate this isolated group of mountains from the Andean spurs of Rioja and San Luis. The eastern ranges parallel to the Andes are here broken into detached extensions and spurs, which soon disappear in the elevated western pampas, and the Andes contract south of Aconcagua to a single range, which descends gradually to the great plains of La Pampa and Neuquen. The lower terrace of this great mountainous region, with elevations ranging from 1000 to 1500 ft., is in reality the western margin of the great Argentine plain, and may be traced from Oran (1017 ft.) near the Bolivian frontier southward through Tucumán (1476 ft.), Frias (1129 ft.), Córdoba (1279 ft.), Rio Cuarto (1358 ft.), Paunero (1250 ft.), and thence westward and southward through still unsettled regions to the Rio Negro at the confluence of the Neuquen and Limay.

The Argentine part of the great La Plata plain extends from the Pilcomayo south to the Rio Negro, and from the lower terraces of the Andes eastward to the Uruguay and Atlantic. In the north the plain is known as the Gran Chaco, and includes the country between the Pilcomayo and Salado del Norte and an extensive depression immediately north of the latter river, believed to be the undisturbed bottom of the ancient Pampean sea. The northern part of the Gran Chaco is partly wooded and swampy, and as the slope eastward is very gentle and the rivers much obstructed by sand bars, floating trees and vegetation, large areas are regularly flooded during rainy seasons. South of the Bermejo the land is more elevated and drier, though large depressions covered with marshy lagoons are to be found, similar to those farther north. The forests here are heavier. Still farther south and south-west there are open grassy plains and large areas covered with salt-pans. The general elevation of the Chaco varies from 600 to 800 ft. above sea-level. The Argentine "mesopotamia," between the Paraná and Uruguay rivers, belongs in great measure to this same region, being partly wooded, flat and swampy in the north (Corrientes), but higher and undulating in the south (Entre Rios). The Misiones territory of the extreme north-east belongs to the older highlands of Brazil, is densely wooded, and has ranges of hills sometimes rising to a height of 1000 to 1300 ft.

The remainder of the great Argentine plain is the treeless, grassy *pampa* (Quichua for "level spaces"), apparently a dead level, but in reality rising gradually from the Atlantic westward toward the Andes. Evidence of this is to be found in the altitudes of the stations on the Buenos Aires and Pacific railway running a little north of west across the pampas to Mendoza. The average elevation of Buenos Aires is about 65 ft.; of Mercedes, 70 m. westward, 132 ft.; of Junín (160 m.), 267 ft.; and of Paunero (400 m.) it is 1250 ft., showing an average rise of about 3 ft. in a mile. The apparently uniform level of the pampas is much broken along its southern margin by the Tandil and Ventana sierras, and by ranges of hills and low mountains in the southern and western parts of the territory of La Pampa. Extensive depressions also are found, some of which are subject to inundations, as along the lower Salado in Buenos Aires and along the lower courses of the Colorado and Negro. In the extreme west, which is as yet but slightly explored and settled, there is an extensive depressed area, largely saline in character, which drains into lakes and morasses, having no outlet to the ocean. The rainfall is under 6 in. annually, but the drainage from the eastern slopes of the Andes is large enough to meet the loss from evaporation and keep these inland lakes from drying up. At an early period this depressed area drained southward to the Colorado, and the bed of the old outlet can still be traced. The rivers belonging to this inland drainage system are the Vermejo, San Juan and Desaguadero, with their affluents, and their southward flow can be traced from about 28° S. lat. to the great lagoons and morasses between 36° and 37° S. lat. in the western part of La Pampa territory. Some of the principal affluents are the Vinchina and Jachal, or Zanjon, which flow into the Vermejo, the Patos, which flows into the San Juan, and the Mendoza, Tunuyan and Diamante which flow into the Desaguadero, all of these being Andean snow-fed rivers. The Desaguadero also receives the outflow of the Laguna Bebedero, an intensely saline lake of western San Luis. The lower course of the Desaguadero is known as the Salado because of the brackish character of its water. Another considerable river flowing into the same great morass is the Atuel, which rises in the Andes not far south of the Diamante. (A description of the Patagonian part of Argentina will be found under PATAGONIA.)

Rivers and Lakes.—The hydrography of Argentina is of the simplest character. The three great rivers that form the La Plata system—the Paraguay, Paraná and Uruguay—have their sources in the highlands of Brazil and flow southward through a great continental depression, two of them forming eastern boundary lines, and one of them, the Paraná, flowing across the eastern part of the republic. The northern part of Argentina, therefore, drains eastward from the mountains to these rivers, except where some great inland depression gives rise to a drainage having no outlet to the sea, and except, also, in the "mesopotamia" region, where small streams flow westward into the Paraná and eastward into the Uruguay. The largest of the rivers through which Argentina drains into the Plata system are the Pilcomayo, which rises in Bolivia and flows south-east along the Argentine frontier for about 400 m.; the Bermejo, which rises on the northern frontier and flows south-east into the Paraguay; and the Salado del Norte (called Rio del Juramento in its upper course), which rises on the high mountain slopes of western Salta and flows south-east into the Paraná. Another river of this class is the Carcarañal, about 300 m. long, formed by the confluence of the Tercero and Cuarto, whose sources are in the Sierra de Córdoba; it flows eastward across the pampas, and discharges into the Paraná at Gaboto, about 40 m. above Rosario. Other small rivers rising in the Córdoba sierras are the Primero and Segundo, which flow into the lagoons of north-east Córdoba, and the Quinto, which flows south-easterly into the lagoons and morasses of southern Córdoba. The Luján rises near Mercedes, province of Buenos Aires, is about 150 m. long, and flows north-easterly into the Paraná delta. Many smaller streams discharge into the Paraguay and Paraná from the west, some of them wholly dependent upon the rains, and drying up during long droughts. The Argentine "mesopotamia" is well watered by a large number of small streams flowing north and west into the Paraná, and east into the Uruguay. The largest of these are the Corrientes, Feliciano and Gualeguay of the western slope, and the Aguapey and Miriñay of the eastern. None of the tributaries of the La Plata system thus far mentioned is navigable except the lower Pilcomayo and Bermejo for a few miles. These Chaco rivers are obstructed by sand bars and snags, which could be removed only by an expenditure of money unwarranted by the present population and traffic. In the southern pampa region there are many small streams, flowing into the La Plata estuary and the Atlantic; most of these are unknown by name outside the republic. The largest and only important river is the Salado del Sud, which rises in the north-west corner of the province of Buenos Aires and flows south-east for a distance of 360 m. into the bay of Samborombon. On the southern margin of the pampas are the Colorado and Negro, both large, navigable rivers flowing entirely across the republic from the Andes to the Atlantic. Many of the rivers of Argentina, as implied by their names (Salado and Saladillo), are saline or brackish in character, and are of slight use in the pastoral and agricultural industries of the country. The lakes of Argentina are exceptionally numerous, although comparatively few are large enough to merit a name on the ordinary general map. They vary from shallow, saline lagoons in the north-western plateaus, to great, picturesque, snow-fed lakes in the Andean foothills of Patagonia. The province of Buenos Aires has more than 600 lakes, the great majority small, and some brackish. The La Pampa territory also is dotted with small lakes. The Bebedero, in San Luis, and Porongos, in Córdoba, and others, are shallow, saline lakes which receive the drainage of a considerable area and have no outlet. The large saline Mar Chiquita, of Córdoba, is fed from the Sierra de Córdoba and has no outlet. In the northern part of Corrientes there is a large area of swamps and shallow lagoons which are believed to be slowly drying up.

Harbours.—Although having a great extent of coast-line, Argentina has but few really good harbours. The two most frequented by ocean-going vessels are Buenos Aires and Ensenada (La Plata), both of which have been constructed at great expense to overcome natural disadvantages. Perhaps the best natural harbour of the republic is that of Bahia Blanca, a large bay of good depth, sheltered by islands, and 534 m. by sea south of Buenos Aires; here the government is building a naval station and port called Puerto Militar or Puerto Belgrano, and little dredging is needed to render the harbour accessible to the largest ocean-going vessels. About 100 m. south of Bahia Blanca is the sheltered bay of San Blas, which may become of commercial importance, and between the 42nd and 43rd parallels are the land-locked bays of San José and Nueva (Golfo Nuevo)—the first as yet unused; on the latter is Puerto Madryn, 838 m. from Buenos Aires, the outlet for the Welsh colony of Chubut. Other small harbours on the lower Patagonian coast are not prominent, owing to lack of population. An occasional Argentine steamer visits these ports in the interests of colonists. The best-known among them are Puerto Deseado (Port Desire) at the mouth of the Deseado river (1253 m.), Santa Cruz, at the mouth of the Santa Cruz river (1481 m.), and Ushuaia, on Beagle Channel, Tierra del Fuego. North of Buenos Aires, on the Paraná river, is the port of Rosario, the outlet for a rich agricultural district, ranking next to the federal capital in importance. Other river ports, of less importance, are Concordia on the Uruguay river, San Nicolás and Campana on the Paraná river, Santa Fé on the Salado, a few miles from the Paraná, the city of Paraná on the Paraná river, and Gualeguay on the Gualeguay river.

Geology.—The Pampas of Argentina are generally covered by loess. The Cordillera, which bounds them on the west, is formed of folded beds, while the Sierras which rise in their midst, consist mainly of gneiss, granite and schist. In the western Sierras, which are more or less closely attached to the main chain of the Cordillera, Cambrian and Silurian fossils have been found at several places. These older beds are overlaid, especially in the western part of the country, by a sandstone series which contains thin seams of coal and many remains of plants. At Bajo de Velis, in San Luis, the plants belong to the "Glossopteris flora," which is so widely spread in South Africa, India and Australia, and the beds are correlated with the Karharbári series of India (Permian or Permo-Carboniferous). Elsewhere the plants generally indicate a higher horizon and are considered to correspond with the Rhaetic of Europe. Jurassic beds are known only in the Cordillera itself, and the Cretaceous beds, which occur in the west of the country, are of freshwater origin. As far west, therefore, as the Cordillera, there is no evidence that any part of the region was ever beneath the sea in Mesozoic times, and the plant-remains indicate a land connexion with Africa. This view is supported by Neumayr's comparison of Jurassic faunas throughout the world. The Lower Tertiary consists largely of reddish sandstones resting upon the old rocks of the Cordillera and of the Sierras. Towards the east they lie at a lower level; but in the Andes they reach a height of nearly 10,000 ft., and are strongly folded, showing that the elevation of the chain was not completed until after their deposition. The marine facies of the later Tertiaries is confined to the neighbourhood of the coast, and was probably formed after the elevation of the Andes; but inland, freshwater deposits of this period are met with, especially in Patagonia. Contemporaneous volcanic rocks are associated with the Ordovician beds and with the Rhaetic sandstones in several places. During the Tertiary period the great volcanoes of the Andes were formed, and there were smaller eruptions in the Sierras. The principal rocks are andesites, but trachytes and basalts are also common. Great masses of granite, syenite and diorite were intruded at this period, and send tongues even into the andesitic tuffs.

Silver, gold, lead and copper ores occur in many localities. They are found chiefly in the neighbourhood of the eruptive masses of the hilly regions. (See also ANDES.)[1]

Climate.—The great extent of Argentina in latitude—about 33°—and its range in altitude from sea-level westward to the permanently snow-covered peaks of the Andes, give it a highly diversified climate, which is further modified by prevailing winds and mountain barriers. The temperature and rainfall are governed by conditions different from those in corresponding latitudes of the northern hemisphere. Southern Patagonia and Tierra del Fuego, for instance, although they correspond in latitude to Labrador, are made habitable and an excellent sheep-grazing country by the southerly equatorial current along the continental coast. The climate, however, is colder than the corresponding latitudes of western Europe, because of the prevailing westerly winds, chilled in crossing the Andes. In the extreme north-west an elevated region, whose aridity is caused by the "blanketing" influence of the eastern Andean ranges, extends southward to Mendoza. The northern part of the republic, east of the mountains, is subject to the oscillatory movements of the south-east trade winds, which cause a division of the year into wet and dry seasons. Farther south, in Patagonia, the prevailing wind is westerly, in which case the Andes again "blanket" an extensive region and deprive it of rain, turning it into an arid desolate steppe. Below this region, where the Andean barrier is low and broken, the moist westerly winds sweep over the land freely and give it a large rainfall, good pastures and a vigorous forest growth. If the republic be divided into sections by east and west lines, diversities of climate in the same latitude appear. In the extreme north a little over a degree and a half of territory lies within the torrid zone, extending from the Pilcomayo about 500 m. westward to the Chilean frontier; its eastern end is in the low, wooded plain of the Gran Chaco, where the mean annual temperature is 73° F., and the annual rainfall is 63 in.; but on the arid, elevated plateau at its western extremity the temperature falls below 57° F., and the rainfall has diminished to 2 in. The character of the soil changes from the alluvial lowlands of the Gran Chaco, covered with forests of palms and other tropical vegetation, to the sandy, saline wastes of the Puna de Atacama, almost barren of vegetation and overshadowed by permanently

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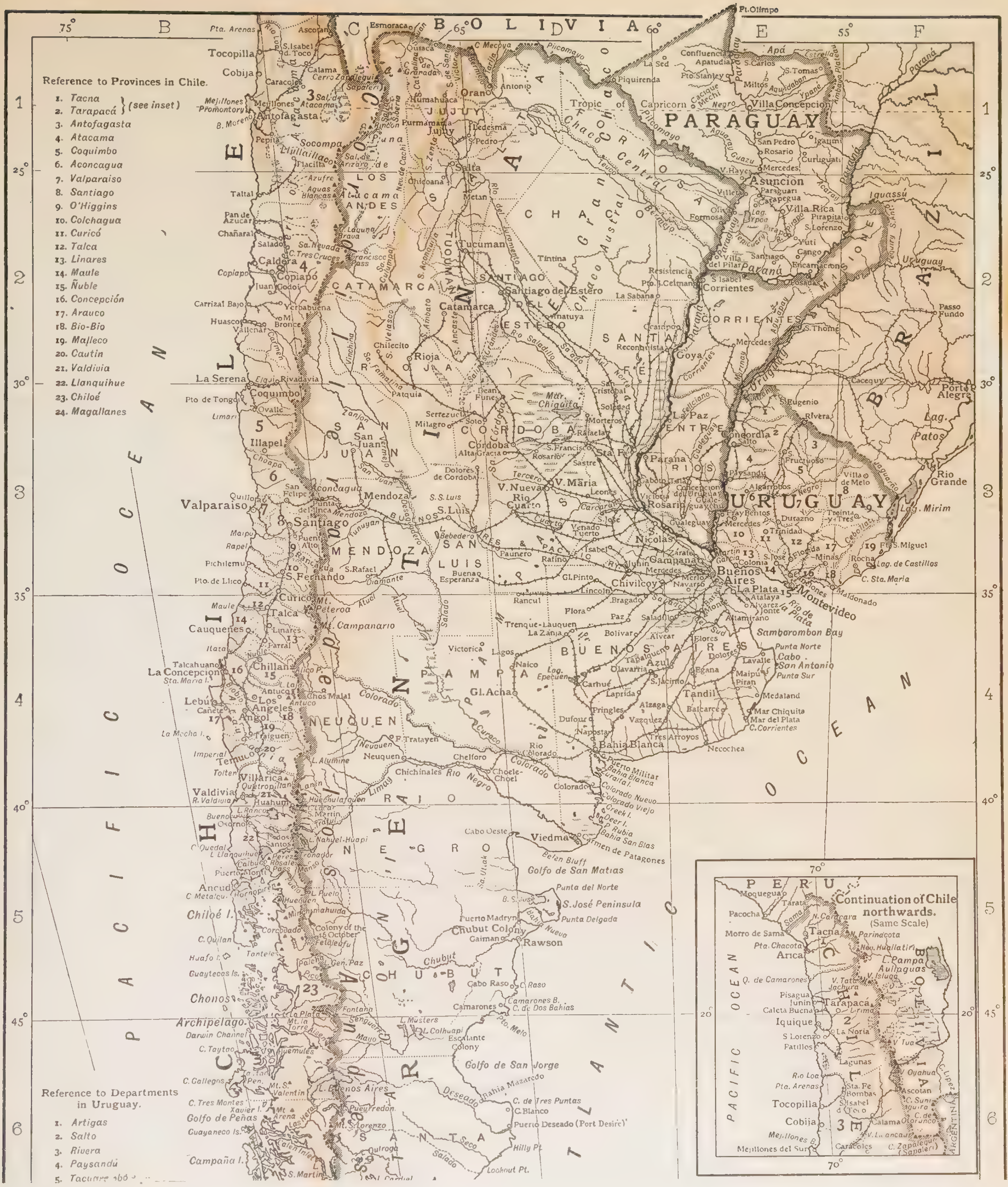
[1] For the geology of Argentina, see Stelzner, *Beiträge zur geologie der argentinischen Republik* (Cassel and Berlin, 1885); Brackebusch, *Mapa geológico del Interiore de la República Argentina* (Gotha, 1892); Valentin, *Bosquejo geológico de la Argentina* (Buenos Aires, 1897); Hauthal, "Beiträge zur Geologie der argentinischen Provinz Buenos Aires," *Peterm. Mitt.* vol. l., 1904, pp. 83-92, 112-117, pl. vi.


B O L I V I A
P A R A G U A Y
B R A Z I L
U R U G U A Y
C H I L E
A R G E N T I N A
PACIFIC OCEAN
ATLANTIC OCEAN
Reference to Provinces in Chile.
1. Tacna } (see inset)
2. Tarapacá }
3. Antofagasta
4. Atacama
5. Coquimbo
6. Aconcagua
7. Valparaiso
8. Santiago
9. O'Higgins
10. Colchagua
11. Curicó
12. Talca
13. Linares
14. Maule
15. Ñuble
16. Concepción
17. Arauco
18. Bio-Bio
19. Malleco
20. Cautin
21. Valdivia
22. Llanquihue
23. Chiloé
24. Magallanes
Reference to Departments in Uruguay.
1. Artigas
2. Salto
3. Rivera
4. Paysandú
5. Tacuarembó
Continuation of Chile northwards. (Same Scale)
PERU
Tacna
Arica
Tarapacá
Iquique
Tocopilla
Cobija
Antofagasta
Taltal
Copiapó
Caldera
La Serena
Coquimbo
Valparaiso
Santiago
Talca
La Concepcion
Valdivia
Chiloé I.
Chonos Archipelago
Golfo de Peñas
Campaña I.
JUJUY
Salta
Tucuman
Catamarca
Rioja
SAN JUAN
MENDOZA
SAN LUIS
CORDOBA
SANTIAGO DEL ESTERO
CHACO
FORMOSA
CORRIENTES
SANTA FE
ENTRE RIOS
Rosario
Paraná
Buenos Aires
La Plata
Montevideo
Asuncion
BUENOS AIRES
PAMPA
NEUQUEN
RIO NEGRO
CHUBUT
SANTA CRUZ
Bahia Blanca
Golfo de San Matias
Golfo de San Jorge
Tropic of Capricorn
75°
65°
60°
55°
70°
25°
30°
35°
40°
45°
20°
B
C
D
E
F
1
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4
5
6

snow-crowned peaks. Between the 30th and 31st parallels, a region essentially sub-tropical in character, the temperature ranges from 66° on the eastern plains to 62·5° in Córdoba and 64° F. on the higher, arid, sun-parched tablelands of San Juan. The rainfall, which varies between 39 and 47 in. in Entre Rios, decreases to 27 in. in Córdoba and 2 in. in San Juan. The republic has a width of about 745 m. at this point, three-fourths of which is a comparatively level alluvial plain, and the remainder an arid plateau broken by mountain ranges. In the vicinity of Buenos Aires the climatic conditions vary very little from those of the pampa region; the mean annual temperature is about 63° (maximum 104°; minimum 32°), and the annual rainfall is 34 in.; snow is rarely seen. South of the pampa region, on the 40th parallel, the mean temperature varies only slightly in the 370 m. from the mouth of the Colorado to the Andes, ranging from 57° to 55°; but the rainfall increases from 8 in. on the coast to 16 in. on the east slope of the Cordillera. This section is near the northern border of the arid Patagonian steppes. In Tierra del Fuego (lat. 53° to 55°), the climatic conditions are in strong contrast to those of the north. Here the mean temperature is between 46° and 48° in summer and 36° and 38° in winter, rains are frequent, and snow falls every month in the year. The central and southern parts of the island and the neighbouring Staten Island are exceptionally rainy, the latter having 251½ rainy days in the year. The precipitation of rain, snow and hail is about 55 in.

The prevailing winds through this southern region are westerly, being moist below the 52nd parallel, and dry between it and the 40th parallel. In the north and on the pampas the north wind is hot and depressing, while the south wind is cool and refreshing. The north wind usually terminates with a thunderstorm or with a *pampero*, a cold south-west wind from the Andes which blows with great violence, causes a fall in temperature of 15° to 20°, and is most frequent from June to November—the southern winter and spring. In the Andean region, a dry, hot wind from the north or north-west, called the *Zonda*, blows with great intensity, especially in September–October, and causes much discomfort and suffering. It is followed by a cold south wind which often lowers the temperature 25°. The climate of the pampas is temperate and healthy, and is admirably suited to agricultural and pastoral pursuits. Its greatest defect is the cold southerly and westerly storms, which cause great losses in cattle and sheep. The Patagonian coast-line and mountainous region are also healthy, having a dry and bracing climate. In the north, however, the hot lowlands are malarial and unsuited to north European settlement, while the dry, elevated plateaus are celebrated for their healthiness, those of Catamarca having an excellent reputation as a sanatorium for sufferers from pulmonary and bronchial diseases.

Flora.—The flora of Argentina should be studied according to natural zones corresponding to the physical divisions of the country —the rich tropical and sub-tropical regions of the north, the treeless pampas of the centre, the desert steppes of the south, and the arid plateaus of the north-west. The vegetation of each region has its distinctive character, modified here and there by elevation, irrigation from mountain streams, and by the saline character of the soil. In the extreme south, where an Arctic vegetation is found, the pastures are rich, and the forests, largely of the Antarctic beech (*Fagus antarctica*), are vigorous wherever the rainfall is heavy. The greater part of Patagonia is comparatively barren and has no arboreal growth, except in the well-watered valleys of the Andean foothills. The water-courses and depressions of the shingly steppes afford pasturage sufficient for the guanaco, and in places support a thorny vegetation of low growth and starved appearance. The Antarctic beech and Winter's bark (*Drimys Winteri*) are found at intervals along the Andes to the northern limits of this zone. The pampas, which cover so large a part of the republic, have no native trees whatever, and no woods except the scrubby growth of the delta islands of the Paraná, and a fringe of low thorn-bushes along the Atlantic coast south to Mar Chiquita and south of the Tandil sierra, which, strictly speaking, does not belong to this region. The great plains are covered with edible grasses, divided into two classes, *pasto duro* (hard grass) and *pasto blando*, or *tierno* (soft grass)—the former tall, coarse, nutritious and suitable for horses and cattle, and the latter tender grasses and herbs, including clovers, suitable for sheep and cattle. The so-called "pampas-grass" (*Gynerium argenteum*) is not found at all on the dry lands, but in the wet grounds of the south and south-west. The *pasto duro* is largely composed of the genera *Stipa* and *Melica*. In the dry, saline regions of the west and north-west, where the rainfall is slight, there are large thickets of low-growing, thorny bushes, poor in foliage. The predominating species is the chañar (*Gurliaca decorticans*), which produces an edible berry, and occurs from the Rio Negro to the northern limits of the republic. Huge cacti are also characteristic of this region. On the lower slopes of the Andes are found oak, beech, cedar, Winter's bark, pine (*Araucaria imbricata*), laurel and calden (*Prosopis algarobilla*). The provinces of Santa Fé, Córdoba and Santiago del Estero are only partially wooded; large areas of plains are intermingled with scrubby forests of algarrobo (*Prosopis*), quebracho-blanco (*Aspido-sperma quebracho*), tala (*Celtis tala, Sellowiana, acuminata*), acacias and other genera. In Tucumán and eastern Salta the same division into forests and open plains exists, but the former are of denser growth and contain walnut, cedar, laurel, tipa (*Machaerium fertile*) and quebracho-colorado (*Loxopterygium Lorentzii*). The territories of the Gran Chaco, however, are covered with a characteristic tropical vegetation, in which the palm predominates, but intermingled south of the Bermejo with heavy growths of algarrobo, quebracho-colorado, urunday (*Astronium fraxinifolium*), lapacho (*Tecoma curialis*) and palosanto (*Guayacum officinalis*), all esteemed for hardness and fineness of grain. Other palms abound, such as the pindó (*Cocos australis*), mbocaya (*Cocos sclerocarpa*) and the yatai (*Cocos yatai*), but the predominating species north of the Bermejo is the caranday or Brazilian wax-palm (*Copernicia cerifera*), which has varied uses. The forest habit in this region is close association of species, and there are "palmares," "algarrobales," "chañarales," &c., and among these open pasture lands, giving to a distant landscape a park-like appearance. In the "mesopotamia" region the flora is similar to that of the southern Chaco, but in the Misiones it approximates more to that of the neighbouring Brazilian highlands. Among the marvellous changes wrought in Argentina by the advent of European civilization, is the creation of a new flora by the introduction of useful trees and plants from every part of the world. Indian corn, quinoa, mandioca, possibly the potato, cotton and various fruits, including the strawberry, were already known to the aborigines, but with the conqueror came wheat, barley, oats, flax, many kinds of vegetables, apples, peaches, apricots, pears, grapes, figs, oranges and lemons, together with alfalfa and new grasses for the plains. The Australian eucalyptus is now grown in many places, and there are groves of the paradise or paraiso tree (*Melia azedarach*) on the formerly treeless pampa. The cereals of Europe are a source of increasing wealth to the nation, and alfalfa promises new prosperity for pastoral industries.

Fauna.—The Argentine fauna, like its flora, has been greatly influenced by the character and position of the pampas. Whatever it may have been in remote geological periods, it is now extremely limited both in size and numbers. Of the indigenous fauna, the tapir of the north and the guanaco of the west and south are the largest of the animals. The pampas were almost destitute of animal life before the horses and cattle of the Spanish invaders were there turned out to graze, and the puma and jaguar never came there until the herds of European cattle attracted them. The timid viscacha (*Lagostomus trichodactylus*), living in colonies, often with the burrowing owl, and digging deep under ground like the American prairie dog, was almost the only quadruped to be seen upon these immense open plains. The fox, of which several species exist, probably never ventured far into the plain, for it afforded him no shelter. Immense flocks of gulls were probably attracted to it then as now by its insect life, and its lagoons and streams teemed with aquatic birds. The occupation of this region by Europeans, and the introduction of horses, asses, cattle, sheep, goats and swine, have completely changed its aspect and character. On the Patagonian steppes there are comparatively few species of animals. Among them are the puma (*Felis concolor*), a smaller variety of the jaguar (*Felis onça*), the wolf, the fox, the Patagonian hare (*Dolichotis patagonica*) and two species of wild cat. The huge glyptodon once inhabited this region, which now possesses the smallest armadillo known, the "quirquincho" or *Dasypus minutus*. The guanaco (*Auchenia*), which ranges from Tierra del Fuego to the Bolivian highlands, finds comparative safety in these uninhabitable solitudes, and is still numerous. The "ñandú" or American ostrich (*Rhea americana*), inhabiting the pampas and open plains of the Chaco, has in Patagonia a smaller counterpart (*Rhea Darwinii*), which is never seen north of the Rio Negro. On the arid plateaus of the north-west, the guanaco and vicuña are still to be found, though less frequently, together with a smaller species of viscacha (*Lagidium cuvieri*). The greatest development of the Argentine fauna, however, is in the warm, wooded regions of the north and north-east, where many animals are of the same species as those in the neighbouring territories of Brazil. Several species of monkeys inhabit the forests from the Paraná to the Bolivian frontier. Pumas, jaguars and one or two species of wild cat are numerous, as also the Argentine wolf and two or three species of fox. The coatí, marten, skunk and otter (*Lutra paranensis*) are widely distributed. Three species of deer are common. In the Chaco the tapir or anta (*Tapir americanus*) still finds a safe retreat, and the peccary (*Dycotyles torquatus*) ranges from Córdoba north to the Bolivian frontier. The capybara (*Hydrochoerus capybara*) is also numerous in this region. Of birds the number of species greatly exceeds that of the mammals, including the rhea of the pampas and condor of the Andes, and the tiny, brilliant-hued humming-birds of the tropical North. Vultures and hawks are well represented, but perhaps the most numerous of all are the parrots, of which there are six or seven species. The reptilians are represented in the Paraná by the jacaré (*Alligator sclerops*), and on land by the "iguana" (*Teius teguexim, Podinema teguixin*), and some species of lizard. Serpents are numerous, but only two are described as poisonous, the cascavel (rattlesnake) and the "vibora de la cruz" (*Trigonocephalus alternatus*).[1]

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[1] Interesting details of the Argentine fauna may be found in Darwin's *Voyage of the Beagle*; W. H. Hudson's *Idle Days in Patagonia*, and *Naturalist in the La Plata*; G. Pelleschi's *Eight Months on the Gran Chaco*; R. Napp's *Argentine Republic*; and de Moussy's *Confédération argentine*.

Population.—In population Argentina ranks second among the republics of South America, having outstripped, during the last quarter of the 19th century, the once more populous states of Colombia and Peru. During the first half of the 19th century civil war and despotic government seriously restricted the natural growth of the country, but since the definite organization of the republic in 1860 and the settlement of disturbing political controversies, the population had increased rapidly. Climate and a fertile soil have been important elements in this growth. According to the first national census of 1869 the population was 1,830,214. The census of 1895 increased this total to 3,954,911, exclusive of wild Indians and a percentage for omissions customarily used in South American census returns. In 1904 official estimates, based on immigration and emigration returns and upon registered births and deaths, both of which are admittedly defective, showed a population increased to 5,410,028, and a small diminution in the rate of annual increase from 1895 to 1904 as compared with 1869–1895. The birth-rate is exceptionally high, largely because of the immigrant population, the greater part of which is concentrated in or near the large cities. In the rural districts of the northern provinces, the increase in population is much less than in the central provinces, the conditions of life being less favourable. According to the official returns,[1] the over-sea immigration for the forty-seven years 1857–1903 aggregated 2,872,588, while the departure of emigrants during the same period was 1,066,480, showing a net addition to the population of 1,806,108. A considerable percentage of these arrivals and departures represents seasonal labourers, who come out from Europe solely for the Argentine wheat harvest and should not be classed as immigrants. Unfavourable political and economic conditions of a temporary character influence the emigration movement. During the years 1880–1889, when the country enjoyed exceptional prosperity, the arrivals numbered 1,020,907 and the departures only 175,038, but in 1890–1899, a period of financial depression following the extravagant Celman administration, the arrivals were 928,865 and the departures 552,175. Another disturbing influence has been the high protective tariffs, adopted during the closing years of the century, which increased the costs of living more rapidly than the wages for labour, and compelled thousands of immigrants to seek employment elsewhere. The influence of such legislation on unsettled immigrant labourers may be seen in the number of Italians who periodically migrate from Argentina to Brazil, and *vice versa*, seeking to better their condition. Of the immigrant arrivals for the forty-seven years given, 1,331,536 were Italians, 414,973 Spaniards, 170,293 French, 37,953 Austrians, 35,435 British, 30,699 Germans, 25,775 Swiss, 19,521 Belgians, and the others of diverse nationalities, so that Argentina is in no danger of losing her Latin character through immigration.[1] This large influx of Europeans, however, is modifying the population by reducing the Indian and *mestizo* elements to a minority, although they are still numerous in the mesopotamian, northern and north-western provinces. The language is Spanish.

Science and Literature.—Though the university of Córdoba is the oldest but one in South America, it has made no conspicuous contribution to Argentine literature beyond the historical works of its famous rector, Gregorio Funes (1749–1830). This university was founded in 1621 and the university of Buenos Aires in 1821, but although Bonpland and some other European scientists were members of the faculty of Buenos Aires in its early years, neither there nor at Córdoba was any marked attention given to the natural sciences until President Sarmiento (official term, 1868–1874) initiated scientific instruction at the university of Córdoba under the eminent German naturalist, Dr Hermann Burmeister (1807–1892), and founded the National Observatory at Córdoba and placed it under the direction of the noted American astronomer, Benjamin Apthorp Gould (1824–1896). Both of these men made important contributions to science, and rendered an inestimable service to the country, not only through their publications but also through the interest they aroused in scientific research. A bureau of meteorology was afterwards created at Córdoba which has rendered valuable service. Dr Burmeister was afterwards placed in charge of the provincial museum of Buenos Aires, and devoted himself to the acquisition of a collection of fossil remains, now in the La Plata museum, which ranks among the best of the world. Not only has scientific study advanced at the university of Buenos Aires, but scientific research is promoting the development of the country; examples are the geographical explorations of the Andean frontier, and especially of the Patagonian Andes, by Francisco P. Moreno. In literature Argentina is still under the spell of Bohemianism and dilettanteism. Exceptions are the admirable biographies of Manuel Belgrano (d. 1820) and San Martin, important contributions to the history of the country and of the war of independence, by ex-President Bartolomé Mitre (1821–1906). Buenos Aires has some excellent daily journals, but the tone of the press in general is sensational. The number of newspapers published is large, especially in Buenos Aires, where in 1902 the total, including sundry periodicals, was 183.

Political Divisions and Towns.—The chief political divisions of the republic consist of one federal district, 14 provinces and 10 territories, the last in great part dating from the settlement of the territorial controversies with Chile. For purposes of local administration the provinces are divided into departments. The names, area and population of the provinces and territories are as follows:—

Administrative Divisions.	Area, sq. m.	Pop. 1895.	Pop. est. for 1904.
Provinces—			
Federal Capital	72	663,854	979,235
Buenos Aires	117,778	921,168	1,312,953
Santa Fé	50,916	397,188	640,755
Entre Rios	28,784	292,019	367,006
Corrientes	32,580	239,618	299,479
Córdoba	62,160	351,223	465,464
San Luis	28,535	81,450	97,458
Santiago del Estero	39,764	161,502	186,206
Mendoza	56,502	116,136	159,780
San Juan	33,715	84,251	99,955
Rioja	34,546	69,502	82,099
Catamarca	47,531	90,161	103,082
Tucumán	8,926	215,742	263,079
Salta	62,184	118,015	136,059
Jujuy	18,977	49,713	55,450
Territories—			
Misiones	11,282	33,163	38,755
Formosa	41,402	4,829	6,094
Chaco	52,741	10,422	13,937
Pampa	56,320	25,914	52,150
Neuquen	42,345	14,517	18,022
Rio Negro	75,924	9,241	18,648
Chubut	93,427	3,748	9,060
Santa Cruz	109,142	1,058	1,793
Tierra del Fuego	8,299	477	1,411
Los Andes	21,989	..	2,095
Total	1,135,840	3,954,911	5,410,028
Gotha computations of 1902 with corrections for boundary changes	1,083,596		

The principal towns, with estimated population for 1905, are as follows: Buenos Aires (1,025,653), Rosario (129,121), La Plata (85,000), Tucumán (55,000), Córdoba (43,000), Sante Fé (33,200), Mendoza (32,000), Paraná (27,000), Salta (18,000), Corrientes (18,000), Chivilcoy (15,000), Gualeguaychú (13,300), San Nicolás (13,000), Concordia (11,700), San Juan (11,500), Río Cuarto (10,800), San Luis (10,500), Barracas al Sud (10,200).

Communications.—The development of railways in Argentina, which dates from 1857 when the construction of the Buenos Aires Western was begun, was at first slow and hesitating, but after 1880 it went forward rapidly. Official corruption and speculation have led to some unsound ventures, but in the great majority of cases the lines constructed have been beneficial and productive. The principal centres of the system are Buenos Aires, Rosario and Bahia Blanca, with La Plata as a secondary centre to the former, and from these the lines radiate westward and northward. The creation of a commercial port at Bahia Blanca and the development of the territories of La Pampa, Rio Negro and Neuquen, have given an impetus to railway construction in that region, and new lines are being extended toward the promising districts among the Andean foothills. Beginning with 6 m. in 1857, the railway mileage of the republic increased to 1563 m. in 1880, 5865 m. in 1890, 7752 m. in 1891, 10,304 m. in 1901, and 12,274 m. in 1906, with 1794 m. under construction. The greater development of railway construction between 1885 and 1891 was due, principally, to the dubious concessions of interest guarantees by the Celman administration, and also to the fever of speculation. Some of these lines resulted disastrously. The Transandine line, designed to open railway communication between Buenos Aires and Valparaiso, was so far completed early in 1909 that on the Argentine side only the summit tunnel, 2 m. 127 yds. long, remained to be finished. The piercing was completed in Nov. 1909, but in the meantime passengers were conveyed by road over the pass. The gauge is broken at Mendoza, the Buenos Aires and Pacific having a gauge of 5 ft. 6 in. and the Transandine of one metre.

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[1] There are two distinct statistical offices compiling immigration returns and their totals do not agree, owing in part to the traffic between Buenos Aires and Montevideo. Another report gives the arrivals in 1904 as 125,567 and the departures 38,923. Of the arrivals 67,598 were Italians and 39,851 Spaniards. The total for the years 1859–1904 was 3,166,073 and the departures 1,239,064, showing a net gain of 1,927,009.

Tramway lines, which date from 1870, are to be found in all important towns. Those of Buenos Aires, Rosario and La Plata are owned by public companies. According to the census returns of 1895, the total mileage was 496 m., representing a capital expenditure of $84,044,581 paper. Electric traction was first used in Buenos Aires in 1897, since when nearly all the lines of that city have been reconstructed to meet its requirements, and subways are contemplated to relieve the congested street traffic of the central districts; the companies contribute 6 % of their gross receipts to the municipality, besides paying $50 per annum per square on each single track in paved streets, 5 per thousand on the value of their property, and 33 % of the cost of street repaving and renewals.

The telegraph lines of Argentina are subject to the national telegraph law of 1875, the international telegraph conventions, and special conventions with Brazil and Uruguay. In 1902 the total length of wires strung was 28,125 m.; in 1906 it had been increased to 34,080 m. The national lines extend from Buenos Aires north to La Quiaca on the Bolivian frontier (1180 m.), and south to Cape Virgenes (1926 m.), at the entrance to the Straits of Magellan. Telegraphic communication with Europe is effected by cables laid along the Uruguayan and Brazilian coasts, and by the Brazilian land lines to connect with transatlantic cables from Pernambuco. Communication with the United States is effected by land lines to Valparaiso, and thence by a cable along the west coast. The service is governed by the international telegraph regulations, but is subject to local inspection and interruption in times of political disorder.

The postal and telegraph services are administered by the national government, and are under the immediate supervision of the minister of the interior. Argentina has been a member of the Postal Union since 1878. Owing to the great distances which must be covered, and also to the defective means of communication in sparsely settled districts, the costs of the postal service in Argentina are unavoidably high in relation to the receipts.

Shipping.—Although Argentina has an extensive coast-line, and one of the great fluvial systems of the world, the tonnage of steamers and sailing vessels flying her flag is comparatively small. In 1898 the list comprised only 1416 sailing vessels of all classes, from 10 tons up, with a total tonnage of 118,894 tons, and 222 steamships, of 36,323 tons. There has been but slight improvement since that date. There are excellent fishing grounds on the coast, but they have had no appreciable influence in developing a commerical marine. The steamships under the national flag are almost wholly engaged in the traffic between Buenos Aires and Montevideo, the river traffic, and port services.

Live stock, &c.

Agriculture.—In 1878 the production of wheat was insufficient for home consumption, the amount of Indian corn grown barely covered local necessities, and the only market for live stock was in the slaughtering establishments, where the meat was cut into strips and cured, making the so-called "jerked beef" for the Brazilian and Cuban markets. But three years later a new economic development began. In 1881 President Roca offered for public purchase by auction the lands in the south-west of the province of Buenos Aires, the Pampa Central, and the Neuquen district, these lands having been rendered habitable after the campaign of 1878 against the Indians. The upset (reserve) price was £80 sterling per square league of 6669 acres, and, as the lands were quickly sold, an expansion of the pastoral industry immediately ensued. The demand for animals for stock-breeding purposes sent up prices, and this acted as a stimulus to other branches of trade, so that, as peace under the Roca régime seemed assured, a steady flow of immigration from Italy set in. The development of the pastoral industry of Argentina from that time to the end of the century was remarkable. In 1878 the number of cattle was 12,000,000; of sheep, 65,000,000; and of horses, 4,000,000; in 1899 the numbers were—cattle, 25,000,000; sheep, 89,000,000; and horses, about 4,500,000. Originally the cattle were nearly all of the long-horned Spanish breed and of little value for their meat, except to the saladero establishments. Gradually Durham, Shorthorn, Hereford and other stock were introduced to improve the native breeds, with results so satisfactory that now herds of three-quarters-bred cattle are to be found in all parts of the country. Holstein, Jersey and other well-known dairy breeds were imported for the new industries of butter- and cheese-making. Not only has the breed of cattle been improved, but the system of grazing has completely altered. Vast areas of land have been ploughed and sown with lucerne (alfalfa); magnificent permanent pasturage has been created where there were coarse and hard grasses in former days, and Argentina has been able to add baled hay to her list of exports. In 1889 the first shipment of Argentine cattle, consisting altogether of 1930 steers, was sent to England. The results of these first experiments were not encouraging, owing mainly to the poor class of animals, but the exporters persevered, and the business steadily grew in value and importance, until in 1898 the number of live cattle shipped was 359,296, which then decreased to 119,189 in 1901, because of the foot-and-mouth disease. In 1906 the export of live stock was prohibited for that reason. Large quantities of frozen and preserved meat are exported, profitable prices being realized. Dairy-farming is making rapid strides, and the development of sheep-farming has been remarkable. In 1878, 65,000,000 sheep yielded 230,000,000 ℔ weight of wool, or an average per sheep of about 3½ ℔. In the season of 1899–1900 the wool exports weighed 420,000,000 ℔, and averaged more than 5 ℔ per sheep. The extra weight of fleece was owing to the large importation of better breeds. The export, moreover, of live sheep and of frozen mutton to Europe has become an important factor in the trade of Argentina. In 1892 the number of live sheep shipped for foreign ports was 40,000; in 1898 the export reached a total of 577,813, which in 1901 fell off to 25,746. In 1892 the frozen mutton exported was 25,500 tons, and this had increased in 1901 to 63,013 tons.

Crops.

The advance made in agricultural industry also is of very great importance. In 1872 the cultivated area was about 1,430,000 acres; in 1895, 12,083,000 acres; in 1901, 17,465,973 acres. In 1899 the wheat exports exceeded 50,000,000 bushels, and the Indian corn 40,000,000 bushels. The area under wheat in 1901 was 8,351,843 acres; Indian corn, 3,102,140 acres; linseed, 1,512,340 acres; alfalfa, 3,088,929 acres. The farming industry is not, however, on a satisfactory basis. No national lands in accessible districts are available for the application of a homestead law, and the farmer too often has no interest in the land beyond the growing crops, a percentage of the harvest being the rent charged by the owner of the property. This system is mischievous, since, if a few consecutive bad seasons occur, the farmer moves to some more favoured spot; while, on the other hand, a succession of good years tends to increase rents. The principal wheat and Indian corn producing districts lie in the provinces of Santa Fé, Buenos Aires, Córdoba and Entre Rios, and the average yield of wheat throughout the country is about 12 bushels to the acre. Little attention is paid to methods of cultivation, and the farmer has no resources to help him if the cereal crops fail. In the Andean provinces of Mendoza, San Juan, Catamarca and Rioja viticulture attracts much attention, and the area in vineyards in 1901 was 109,546 acres, only 18 % of which was outside the four provinces named. Wine is manufactured in large quantities, but the output is not sufficient to meet the home demand. In the provinces of Tucumán, Salta and Jujuy the main industry is sugar growing and manufacture. In 1901 the production of sugar was 151,639 tons, of which 58,000 tons were exported. The sugar manufacture, however, is a protected and bounty-fed industry, and the 51 sugar mills in operation in 1901 are a heavy tax upon consumers and taxpayers. Other products are tobacco, olives, castor-oil, peanuts, canary-seed, barley, rye, fruit and vegetables.

The pastoral and agricultural industries have been hampered by fluctuations in the value of the currency, farm products being sold at a gold value for the equivalent in paper, while labourers are paid in currency. The existing system of taxation also presses heavily upon the provinces, as may be seen from the fact that the national, provincial and municipal exactions together amount to £7 per head of population, while the total value of the exports in 1898 was only £6 in round numbers. The *guia* tax on the transport of stock from one province to another, which has been declared unconstitutional in the courts, is still enforced, and is a vexatious tax upon the stock-raiser, while the consumption, or octroi, tax in Buenos Aires and other cities is a heavy burden upon small producers.

Manufactures.—Manufacturing enterprise in Argentina, favoured by the protection of a high tariff, made noticeable progress in the national capital during the closing years of the last century, especially in those small industries which commanded a secure market. The principal classes of products affected are foods, wearing apparel, building materials, furniture, &c., chemical products, printing and allied trades, and sundry others, such as cigars, matches, tanning, paints, &c. In some manufactures the raw material is imported partly manufactured, such as thread for weaving. The lack of coal in Argentina greatly increases the difficulty and cost of maintaining these industries, and high prices of the products result. Electric power generated by steam is now commonly used in Buenos Aires and other large cities for driving light machinery.

Commerce.—The rapid development of the foreign trade of the republic since 1881 is due to settled internal conditions and to the prime necessity to the commercial world of many Argentine products, such as beef, mutton, hides, wool, wheat and Indian corn. Efforts to hasten this development have created some serious financial and industrial crises, and have burdened the country with heavy debts and taxes. During the decade 1881–1890 great sums of European capital were invested in railways and other undertakings, encouraged by the grant of interest guarantees and by state mortgage bank loans in the form of *cedulas*, nominally secured on landed property. In 1890 the crisis came, the mortgage banks failed, credits were contracted, the value of property declined, defaults were common, imports decreased, and the losses to the country were enormous. The constant fluctuations in the value of the currency, then much depreciated, intensified the distress and complicated the situation. Recovery required years, although made easier by the sound and steady development of the pastoral and agricultural industries, which were slightly affected by the crisis; and the steadily increasing volume of exports, mainly foodstuffs and other staples, saved the situation. There have been some changes in commercial methods since 1890, the retailer, and sometimes the consumer, importing direct to save intermediate commission charges. Such transactions are made easy by the foreign banks established in all the large cities of the republic. The conversion law of 1899, which gave a fixed gold value to the currency (44 centavos gold for each 100 centavos paper), has had beneficial influence on commercial transactions, through the elimination of daily fluctuations in the value of the currency, and the commercial and financial situation has been steadily improved, notwithstanding heavy taxation and tariff restrictions. The import trade shows the largest totals in foodstuffs, wines and liquors, textiles and raw materials for their manufacture, wood and its manufactures, iron and its manufactures, paper and cardboard, glass and ceramic wares. The official valuation of imports, which is arbitrary and incorrect, was $164,569,884 gold in 1889, fell off to $67,207,780 in 1891, but gradually increased to $205,154,420 in 1905. The exports, which are almost wholly of agricultural and pastoral products, increased from $103,219,000 in 1891 to $322,843,841 in 1905.

Government.—The present constitution of Argentina dates from the 25th of September 1860. The legislative power is vested in a congress of two chambers—the senate, composed of 30 members (two from each province and two from the capital), elected by the provincial legislatures and by a special body of electors in the capital for a term of nine years; and the chamber of deputies, of 120 members (1906), elected for four years by direct vote of the people, one deputy for every 33,000 inhabitants. To the chamber of deputies exclusively belongs the initiation of all laws relating to the raising of money and the conscription of troops. It has also the exclusive right to impeach the president, vice-president, cabinet ministers, and federal judges before the senate. The executive power is exercised by the president, elected by presidential electors from each province chosen by direct vote of the people. The president and vice-president are voted for by separate tickets. The system closely resembles that followed in the United States. The president must be a native citizen of Argentina, a Roman Catholic, not under thirty years of age, and must have an annual income of at least $2000. His term of office is six years, and neither he nor the vice-president is eligible for the next presidential term. All laws are sanctioned and promulgated by the president, who is invested with the veto power, which can be overruled only by a two-thirds vote. The president, with the advice and consent of the senate, appoints judges, diplomatic agents, governors of territories, and officers of the army and navy above the rank of colonel. All other officers and officials he appoints and promotes without the consent of the senate. The cabinet is composed of eight ministers—the heads of the government departments of the interior, foreign affairs, finance, war, marine, justice, agriculture, and public works. They are appointed by and may be removed by the president.

Justice is administered by a supreme federal court of five judges and an attorney-general, which is also a court of appeal, four courts of appeal, with three judges each, located in Buenos Aires, La Plata, Paraná and Córdoba, and by a number of inferior and local courts. Each province has also its own judicial system. Trial by jury is established by the constitution, but never practised. Civil and criminal courts are both corrupt and dilatory. In May 1899 the minister of justice stated in the chamber of deputies that the machinery of the courts in the country was antiquated, unwieldy and incapable of performing its duties; that 50,000 cases were then waiting decision in the minor courts, and 10,000 in the federal division; and that a reconstruction of the judiciary and the judicial system had become necessary. In June 1899 he sent his project for the reorganization of the legal procedure to congress, but no action was then taken beyond referring the bill to a committee for examination and report. The proceedings are, with but few exceptions, written, and the procedure is a survival of the antiquated Spanish system.

Under the constitution, the provinces retain all the powers not delegated to the federal government. Each province has its own constitution, which must be republican in form and in harmony with that of the nation. Each elects its governor, legislators and provincial functionaries of all classes, without the intervention of the federal government. Each has its own judicial system, and enacts laws relating to the administration of justice, the distribution and imposition of taxes, and all matters affecting the province. All the public acts and judicial decisions of one province have full legal effect and authority in all the others. In cases of armed resistance to a provincial government, the national government exercises the right to intervene by the appointment of an interventor, who becomes the executive head of the province until order is restored. The territories are under the direct control of the national government.

Army.—The military service of the republic was reorganized in 1901, and is compulsory for all citizens between the ages of 20 and 45. The army consists of: (1) The Line, comprising the Active and Reserve, in which all citizens 20 to 28 years of age are obliged to serve; (2) the National Guard, comprising citizens of 28 to 40 years; (3) the Territorial Guard, comprising those 40 to 45 years. Conscripts of 20 years of age have to serve two years, three months each year. The active or standing army comprises 18 battalions of infantry, 12 regiments of cavalry, 8 regiments of artillery, and 4 battalions of engineers. A military school, with 125 cadets, is maintained at San Martin, near the national capital, and a training school for non-commissioned officers in the capital itself. Compulsory attendance of young men at national guard drills is enforced for at least two months of the year, under penalty of enforced service in the Line. In 1906 the president announced that permission had been given by the German emperor for 30 Argentine officers to enter the German army each year and to serve eighteen months, and also for five officers to attend the Berlin Military Academy. The equipment of the standing army is thoroughly modern, the infantry being provided with Mauser rifles and the artillery with Krupp batteries.

Navy.—The disputes with Chile during the closing years of the 19th century led to a large increase in the navy, but in 1902 a treaty between the two countries provided for the restriction of further armaments for the next four years. The naval vessels then under construction were accordingly sold, but in 1906 both countries, influenced apparently by the action of Brazil, gave large orders in Europe for new vessels. At the time when further armaments were suspended, the effective strength of the Argentine navy consisted of 3 ironclads, 6 first-class armoured cruisers, 2 monitors (old), 4 second-class cruisers, 2 torpedo cruisers, 3 destroyers, 3 high-sea torpedo boats, 14 river torpedo boats, 1 training ship, 5 transports, and various auxiliary vessels. Two of these first-class cruisers were sold to Japan. The armament included 394 guns of all calibres, 6 of which were of 250 millimetres, 4 of 240, and 12 of 200. There are about 320 officers in active service, and the total personnel ranges from 5000 to 6000 men. The service is not popular, and it is recruited by means of conscription from the national guard, the term of service being two years. These conscripts number about 2000 a year. In addition, there is a corps of coast artillery numbering 450 men, from which garrisons are drawn for the military port, Zárate arsenal and naval prison. The government maintains a naval school at Flores, a school of mechanics in Buenos Aires, an artillery school on the cruiser "Patagonia," and a school for torpedo practice at La Plata. The naval arsenal is situated on the "north basin" of the Buenos Aires port, and the military port at Bahia Blanca is provided with a dry dock of the largest size, and extensive repair shops. There is also a dockyard and torpedo arsenal at La Plata, an artillery depot at Zárate, above Buenos Aires, and naval depots on the island of Martin Garcia and at Tigre, on the Luján river.

Education.—Primary education is free and secular, and is compulsory for children of 6 to 14 years. In the national capital and territories it is supervised by a national council of education with the assistance of local school boards; in the 14 provinces it is under provincial control. Secondary instruction is also free, but is not compulsory. It is under the control of the national government, which in 1902 maintained 19 colleges. Of these colleges four are in Buenos Aires, one in each province, and one in Concepción del Uruguay. For the instruction of teachers the republic has 28 normal schools, as follows: three in the national capital; one in Paraná, three (regional) in Corrientes, San Luis and Catamarca; 14 for female teachers in the provincial capitals; and seven for either sex in the larger towns of the provinces of Buenos Aires, Santa Fé, Córdoba and San Luis. The normal schools, maintained by the state on a secular basis, were founded by President Sarmiento, who engaged experienced teachers in the United States to direct them; their work is excellent; notably, their model primary schools. For higher and professional education there are two national universities at Buenos Aires and Córdoba, and three provincial universities, at La Plata, Santa Fé and Paraná, which comprise faculties of law, medicine and engineering, in addition to the usual courses in arts and science. To meet the needs of technical and industrial education there are a school of mines at San Juan, a school of viticulture at Mendoza, an agronomic and veterinary school at La Plata, several agricultural and pastoral schools, and commercial schools in Buenos Aires, Rosario, Bahia Blanca and Concordia. Schools of art and conservatories of music are also maintained in the large cities, where there are, besides, many private schools. Secular education has been vigorously opposed by strict churchmen, and efforts have been made to maintain separate schools under church control. The national government has founded several scholarships (some in art) for study abroad. The total school population of Argentina in 1900 (6 to 14 years) was 994,089, of which 45 % attended school, and 13 % of those not attending were able to read and write. The illiterate school population was about 41 %, and of those of 15 years and over 54 % were illiterate. Of the whole population over 6 years, 50·5 % were illiterate.

Religion.—The Argentine constitution recognizes the Roman Catholic religion as that of the state, but tolerates all others. The state controls all ecclesiastical appointments, decides on the passing or rejection of all decrees of the Holy See, and provides an annual subsidy for maintenance of the churches and clergy. Churches and chapels are founded and maintained by religious orders and private gift as well. At the head of the Argentine hierarchy are one archbishop and five suffragan bishops, who have five seminaries for the education of the priesthood. From statistics of 1895 it appears that in each 1000 of population 991 are Roman Catholics, 7 Protestants, and 2 Jews, the Jews being entirely of Russian origin, sent into the republic since 1891 by the Jewish Colonization Association under the provisions of the Hirsch legacy; from 1895 to 1908 the number of Jews in Argentina increased from 6085 to about 30,000.

Finance.—The revenue of the republic is derived mainly from customs and excise, and the largest item of expenditure is the service of the public debt. Since 1891 the national budgets have been calculated in both gold and currency, and both receipts and expenditures have been carried out in this dual system. The collection of a part of the import duties in gold has served to give the government the gold it requires for certain expenditures, but it has complicated returns and accounts and increased the burden of taxation. According to a compilation of statistical returns published by Dr Francisco Latzina in 1901, the national revenues and expenditures for the 37 years from 1864 to 1900, inclusive, reduced to a common standard, show a total deficit for that period of $408,260,795 gold, which has been met by external and internal loans, and by a continued increase in the scope and rate of taxation. The growth of the annual budget is shown by a comparison of the following years:—

	Total Revenue.	Total Expenditure.
1864	$7,005,328 gold.	$7,119,931 gold.
1880	19,594,306 ,,	26,919,295 ,,
1890	73,150,856 ,,	95,363,854 ,,
1900	62,045,458 paper. 37,998,704 gold.	104,501,614 paper. 23,644,543 gold.
1905	63,439,000 paper. 43,461,324 gold.	105,581,680 paper. 24,865,016 gold.

The bane of Argentine finance has been the extravagant and unscrupulous use of national credit for the promotion of schemes calculated to benefit individuals rather than the public. The large increase in military expenditures during the disputes with Chile also proved a heavy burden, and in the continued strife with Brazil for naval superiority this burden could not fail to be increased greatly. A very considerable percentage of Argentina's population of five to six millions is hopelessly poor and unprogressive, and cannot be expected to bear its share of the burden. To meet these expenditures there are a high tariff on imported merchandise, and excise and stamp taxes of a far-reaching and often vexatious character. Nothing is permitted to escape taxation, and duplicated taxes on the same thing are frequent. In Argentina these burdens bear heavily upon the labouring classes, and in years of depression they send away by thousands immigrants unable to meet the high costs of living. For the year 1900 the total expenditures of the national government, 14 provincial governments, and 16 principal cities, were estimated to have been $208,811,925 paper, which is equivalent to $91,877,247 gold, or (at $5.04 per pound stg.) to £18,229,612, 10s. The population that year was estimated to be 4,794,149, from which it is seen that the annual costs of government were no less than £3, 16s. for each man, woman, and child in the republic. About 71 % of this charge was on account of national expenditures, and 29 % provincial and municipal expenditures. Had the expenses of all the small towns and rural communities been included, the total would be in excess of $20 gold, or £4, *per capita*.

In 1889 the public debt of the republic amounted to about £24,000,000, but the financial difficulties which immediately followed that year, and the continuance of excessive expenditures, forced the debt up to approximately £128,000,000 during the next ten years. In the year 1905 the outstanding and authorized debt of the republic was as follows:—

External debt (July 31, 1905):		
National loans		£42,297,050
Provincial loans and others, assumed		30,395,916
National cedulas		11,763,923
Total		£84,456,889
Consolidated Internal debt (Dec. 31, 1904):		
Gold	$16,544,000	
Paper	79,174,400	
		£10,178,718
Total service on funded debt, 1905, $24,375,067 gold, and $15,914,335 paper		£6,225,669
Floating debt	£259,170	
Treasury bills (Apr. 30, 1905)	275,220	
Unpaid bills, $3,332,594, paper	288,560	
		£822,950

The paper currency forms an important part of the internal debt, and has been a fruitful source of trouble to the country. Few countries have suffered more from a depreciated currency than Argentina. During the era of so-called "prosperity" between 1881 and 1890 an enormous amount of bank notes were issued under various authorizations, especially that of the "free banking law" of 1887. During this period the bank-note circulation was increased to $161,700,000, and two mortgage banks—the National Hypothecary Bank and the Provincial Mortgage Bank (of Buenos Aires)—flooded the country with $509,000,000 of *cedulas* (hypothecary bonds). When the crash came and the national treasury was found to be without resources to meet current expenses, further issues of $110,000,000 in currency were made. The free-banking law which permitted the issue of notes by provincial banks was primarily responsible for this situation. Under the provisions of this law the provinces were authorized to borrow specie abroad and deposit the same with the national government as security for their issues. These loans aggregated £27,000,000. The Celman administration, in violation of the trust, then sold the specie and squandered the proceeds, leaving the provincial bank notes without guarantee and value. The national government has since assumed responsibility for all these provincial loans abroad. As on previous occasions, the great depreciation in the value of the currency has led to a repudiation of part of its nominal value. This depreciation reached its maximum in October 1891 ($460.82 paper for $100 gold), and remained between that figure and $264 during the next six years. To check these prejudicial fluctuations and to prevent too great a fall in the price of gold (to repeat a popular misconception), a conversion law was adopted on the 31st of October 1899, which provided that the outstanding circulation should be redeemed at the rate of 44 centavos gold for each 100 centavos paper, the official rate for gold being 227·27. Provisions were also made for the creation of a special conversion fund in specie to guarantee the circulation, which fund reached a total of $100,000,000 in March 1906. These measures have served to give greater stability to the value of the circulating medium, and to prevent the ruinous losses caused by a constant fluctuation in value, but the rate established prevents the further appreciation of the currency. On the 18th of January 1906 the currency in circulation amounted to $502,420,485, which is more than $95 *per capita*. (A. J. L.)

HISTORY

The first Europeans who visited the river Plate were a party of Spanish explorers in search of a south-west passage to the East Indies. Their leader, Juan Diaz de Solis, landing incautiously in 1516 on the north coast with a few attendants to parley with a body of Charrua Indians, was suddenly attacked by them and was killed, together with a number of his followers. This untoward disaster led to the abandonment of the expedition, which forthwith returned to Spain, bringing with them the news of the discovery of a fresh-water sea. Four years later (1520) the Portuguese seaman, Ferdinand Magellan, entered the estuary in his celebrated voyage round the world, undertaken in the service of the king of Spain (Charles I., better known as the emperor Charles V.). Magellan, as soon as he had satisfied himself that there was no passage to the west, left the river without landing.

Cabot.

The first attempt to penetrate by way of the river Plate and its affluents inland, with a view to effecting settlements in the interior, was made in 1526 by Sebastian Cabot. This great navigator had already won renown in the service of Henry VII. of England by his voyage to the coast of North America in company with his father, Giovanni Caboto or Cabot (see CABOT, JOHN). Sebastian Cabot had in 1519 deserted England for Spain, and had received from King Charles the post of pilot-major formerly held by Juan de Solis. In 1526 he was sent out in command of an expedition fitted out for the purpose of determining by astronomical observations the exact line of demarcation, under the treaty of Tordesillas, between the colonizing spheres of Spain and Portugal, and of conveying settlers to the Moluccas. Arrived in the river Plate in 1527, rumours reached Cabot of mineral wealth and a rich and civilized empire in the far interior, and he resolved to abandon surveying for exploration. He built a fort a short distance up the river Uruguay, and despatched one of his lieutenants, Juan Alvarez Ramón, with a separate party upon an expedition up stream. This expedition was assailed by the Charruas and forced to return on foot, their leader himself being killed. Cabot, with a large following, entered the Paraná and established a settlement just above the mouth of the river Carcarañal, to which he gave the name of San Espiritù, among the Timbú Indians, with whom he formed friendly relations. He continued the ascent of the Paraná as far as the rapids of Apipé, and finding his course barred in this direction, he afterwards explored the river Paraguay, which he mounted as far as the mouth of the affluent called by the Indians Lepeti, now the river Bermejo. His party was here fiercely attacked by the Agaces or Payaguá Indians, and suffered severely. Cabot in his voyage had seen many silver ornaments in the possession of the Timbú and Guarani Indians. Some specimens of these trinkets he sent back to Spain with a report of his discoveries. The arrival of these first-fruits of the mineral wealth of the southern continent gained for the estuary of the Paraná the name which it has since borne, that of Rio de la Plata, the silver river. As Cabot was descending the stream to his settlement of San Espiritù, he encountered an expedition which had been despatched from Spain for the express purpose of exploring the river discovered by Solis, under the command of Diego Garcia. Finding that he had been forestalled, Garcia resolved to return home. Cabot himself, after an absence of more than three years, came back in 1530, and applied to Charles V. for means to open up communications with Peru by way of the river Bermejo. The emperor's resources were, however, absorbed by his struggle for European supremacy with Francis I. of France, and he was obliged to leave the enterprise of South American discoveries to his wealthy nobles. Cabot's colony at San Espiritù did not long survive his departure; an attempt of the chief of the Timbús to gain possession of one of the Spanish ladies of the settlement led to a treacherous massacre of the garrison.

Mendoza.

Buenos Aires.

Two years after the return of Cabot, the news of Francisco Pizarro's marvellous conquest of Peru reached Europe (1532), and stirred many an adventurous spirit to strive to emulate his good fortune. Among these was Pedro de Mendoza, a Basque nobleman. He obtained from Charles V. a grant (*asiento*) of two hundred leagues of the coast from the boundary of the Portuguese possessions southward towards the Straits of Magellan, and the inland country which lay behind it. Mendoza undertook to conquer and settle the territory at his own charges, certain profits being reserved to the crown. In August 1534 the *adelantado*, or governor, sailed from San Lucar, at the head of the largest and wealthiest expedition that had ever left Europe for the New World. In January 1535 he entered the river Plate, where he followed the northern shore to the island of San Gabriel, and then crossing over he landed by a little stream, still called Riachuelo. The name of Buenos Aires was given to the country by Sancho del Campo, brother-in-law of the *adelantado*, who first stepped ashore. Here, on the 2nd of February, Mendoza laid the foundations of a settlement which in honour of the day he named Santa Maria de Buenos Aires. Mendoza, after some fierce encounters with the Indians, now proceeded up the Paraná, and built a fort, which he called Corpus Christi, near the site of Cabot's former settlement of San Espiritù. The expedition, which originally numbered 2500 men, was reduced by deaths at the hands of the Indians, by disease and privation, within a year to less than 500 men. From Corpus Christi, Mendoza sent out various bodies to explore the interior in the direction of Peru, but without much success, and at length, thoroughly discouraged and broken in health, he abandoned his enterprise, and returned to Spain in 1537.

Asunción.

A portion of one of the expeditions he despatched, under Juan de Ayolas, pushing up the Paraguay, is said to have reached the south-east districts of Peru, but while returning laden with booty, was attacked by the Payaguá Indians, and every man perished. The other portion, which had stayed behind as a reserve under Domingos Iralá, had better fortunes. Finding their comrades did not return, Iralá and his companions determined to descend the river, and on their downward journey opposite the mouth of the river Pilcomayo, finding a suitable site for colonizing, they founded (1536) what proved to be the first permanent Spanish settlement in the interior of South America, the future city of Asunción (15th August 1536).

Iralá.

In the meantime the colony at Buenos Aires had been dragging on a miserable existence, and after terrible sufferings from famine and from the ceaseless attacks of the Indians, the remaining settlers abandoned the place and made their way up the river first to Corpus Christi, then to Asunción. Here, by the emperor's orders, the assembled Spaniards proceeded to the election of a captain-general, and their choice fell almost unanimously on Domingos Martinez de Iralá, who was proclaimed captain-general of the Rio de la Plata (August 1538). In 1542 the settlement of Buenos Aires was re-established by an expedition sent for the purpose from Spain, under a tried *adelantado*, Cabeza de Vaca. This able leader, eager to reach Asunción as quickly as possible, sent on his ships to the river Plate, but himself with a small following marched overland from Santa Catherina on the coast of Brazil to join Iralá. His doings at Asunción belong, however, not to the history of Argentina, but of Paraguay. Suffice it to say that differences with Iralá eventually led to his arrest, and to his being sent back to Spain to answer to the charges brought against him for maladministration. The second settlement made by his expedition at Buenos Aires was even less successful and long-lived than the first. Exposed to the incessant attacks of the savages, the place was a second time abandoned, February 1543.

Juan de Garay.

Forty years were now to elapse before any further efforts were made by the Spaniards to colonize any part of the territory of the river Plate and lower Paraná. In 1573 Juan de Garay, at the head of an expedition despatched from Asunción, founded the city of Santa Fé near the abandoned settlements of San Espiritù and Corpus Christi. Seven years later (1580), when the new colony had been firmly established, Juan de Garay proceeded southwards, and made the third attempt to build a city on the site of Buenos Aires; and despite the determined hostility of the Querendi Indians he succeeded in finally gaining a complete mastery over them. In a desperate battle, the natives were defeated with great slaughter, and the territory surrounding the town was divided into ranches, in which the conquered natives had to labour. The new town received from Garay the name of *Ciudad de la Santissima Trinidad*, while its port retained the old appellation of Santa Maria de Buenos Aires. It was endowed by its founder with a *cabildo* (corporation) and full Spanish municipal privileges. Garay, when on his way to Santa Fé, was unfortunately murdered by a party of Indians, Minuas (Mimas), three years later, while incautiously sleeping on the river bank near the ruins of San Espiritù. The new settlement, however, continued to prosper, and the cattle and horses brought from Europe multiplied and spread over the plains of the Pampas.

In the meantime the Spaniards had penetrated into the interior of what is now the Argentine Republic, and established themselves on the eastern slopes of the Andes. In 1553 an expedition from Peru made their way through the mountain region and founded the city of Santiago del Estero, that of Tucumán in 1565, and that of Córdoba in 1573. Another expedition from Chile, under Garcia Hurtado de Mendoza, crossed the Cordillera in 1559, and having defeated the Araucanian Indians, made a settlement which from the name of the leader was called Mendoza. In 1620 Buenos Aires was separated from the authority of the government established at Asunción, and was made the seat of a government extending over Mendoza, Santa Fé, Entre Rios and Corrientes, but at the same time remained like the government of Paraguay at Asunción, and that of the province of Tucumán, which had Córdoba as its capital, subject to the authority of the viceroyalty of Peru.

Evils of Spanish colonial system.

Thus at the opening of the 17th century, after many adventurous efforts, and the expenditure of many lives and much treasure, the Spaniards found themselves securely established on the river Plate, and had planted a number of centres of trade and colonization in the interior. Unfortunately, in no part of the Spanish oversea possessions did the restrictive legislation of the home government operate more harshly or disadvantageously to the interests of the colony; it was a more effective hindrance to the development of its resources and the spread of civilization over the country, than the hostility of the Indians. Cabot had urged the feasibility of opening an easier channel for trade with the interior of Peru through the river Plate and its tributaries, than that by way of the West Indies and Panama; and now that his views were able to be realized, the interests of the merchants of Seville and of Lima, who had secured a monopoly of the trade by the route of the isthmus, were allowed to destroy the threatened rivalry of that by the river Plate. Never in the history of colonization has a mother country pursued so relentlessly a policy more selfish and short-sighted. Spanish legislation was not satisfied with endeavouring to exclude all European nations except Spain from trading with the West Indies, but it sought to limit all commerce to one particular route, and it forbade any trade being transacted by way of the river Plate, thus enacting the most flagrant injustice towards the people it had encouraged to settle in the latter country. The strongest protests were raised, but the utmost they could effect was that, in 1618, permission was granted to export from Buenos Aires two shiploads of produce a year. But the Spanish government was not content with the prohibition of sea-borne commerce. To prevent internal trade with Peru a custom-house was set up at Córdoba to levy a duty of 50 % on everything in transit to and from the river Plate. In 1665 the relaxation of this system was brought about by the continual remonstrances of the people; but for more than a century afterwards (until 1776) the policy of exclusion was enforced. This naturally led to a contraband trade of considerable dimensions. The English, after the treaty of Utrecht (1715) held the contract (*asiento*) for supplying the Spanish-American colonies with negro slaves. Among other places the slave ships regularly visited Buenos Aires, and despite the efforts of the Spanish authorities, contrived both to smuggle in and carry away a quantity of goods. This illicit commerce went on steadily till 1739, when it led to an outbreak of war between England and Spain, which put an end to the *asiento*. The Portuguese were even worse offenders, for in 1680 they made a settlement on the north of the river Plate, right opposite to Buenos Aires, named Colonia, which with one or two short intervals, remained in their hands till 1777. From this port foreign merchandise found its way duty free into the Spanish provinces of Buenos Aires, Tucumán and Paraguay, and even into the interior of Peru. The continual encroachments of the Portuguese at length led the Spanish government to take the important step of making Buenos Aires the seat of a viceroyalty with jurisdiction over the territories of the present republics of Bolivia, Paraguay, Uruguay and the Argentine Confederation (1776). At the same time all this country was opened to Spanish trade even with Peru, and the development of its resources, so long thwarted, was allowed comparatively free play. Pedro de Zeballos, the first viceroy, took with him from Spain a large military force with which he finally expelled the Portuguese from the banks of the river Plate.

Asiento question.

Effects of French war.

The wars of the French Revolution, in which Spain was allied with France against Great Britain, interrupted the growing prosperity of Buenos Aires. On the 17th of June 1806 General William Beresford landed with a body of troops from a British fleet under the command of Sir Home Popham, and obtained possession of Buenos Aires. But a French officer, Jacques de Liniers, gathered together a large force with which he enclosed the British within the walls, and finally, on the 12th of August, by a successful assault, forced Beresford and his troops to surrender. In July 1807 another British force of eight thousand men under General Whitelock endeavoured to regain possession of Buenos Aires, but strenuous preparations had been made for resistance, and after fierce street fighting the invading army, after suffering severe losses, was compelled to capitulate. The colonists, who had achieved their two great successes without any aid from the home government, were naturally elated, and began to feel a new sense of self-reliance and confidence in their own resources. The successful defence of Buenos Aires accentuated the growing feeling of dissatisfaction with the Spanish connexion, which was soon to lead to open insurrection. The establishment of the Napoleonic dynasty at Madrid was the actual cause which brought about the disturbances which were to end in separation. Liniers was viceroy on the arrival of the news of the crowning of Joseph Bonaparte as king of Spain, but as a Frenchman he was distrusted and was deposed by the adherents of Ferdinand VII. The central junta at Seville, acting in the name of Ferdinand, appointed Balthasar de Cisneros to be viceroy in his place. He entered upon the duties of his office on the 19th of July 1809, and at first he gained popularity by acceding to the urgent appeals of the people and throwing open the trade of the country to all nations. But his measures speedily gave dissatisfaction to the Argentine or Creole party, who had long chafed under the disabilities of Spanish rule, and who now felt themselves no longer bound by ties of loyalty to a country which was in the possession of the French armies.

On the 25th of May 1810 a great armed assembly met at Buenos Aires and a provisional junta was formed to supersede the authority of the viceroy and carry on the government. The acts of the new government ran in the name of Ferdinand VII.,

Struggle for Independence.

but the step taken was a revolutionary one, and the 25th of May has ever since been regarded as the birthday of Argentine independence. The most prominent leader of the junta was its secretary Mariano Moreno (1778–1811), who with a number of other active supporters of the patriot cause succeeded in raising a considerable force of Buenos Aireans to maintain, arms in hand, their nationalist and anti-Spanish doctrines. An attempt of the Spanish party to make Balthasar de Cisneros president of the junta failed, and the ex-viceroy retired to Montevideo. A sanguinary struggle between the party of independence and the adherents of Spain spread over the whole country, and was carried on with varying fortune. Foremost among the leaders of the revolutionary armies were Manuel Belgrano, and after March 1812 General José de San Martin, an officer who had gained experience against the French in the Peninsular War. A state of disorder, almost of anarchy, reigned in the provinces, but on the 25th of March 1816 a congress of deputies was assembled at Tucumán, who named Don Martin Pueyrredón supreme director, and on the 9th of July the separation of the united provinces of the Rio de la Plata was formally proclaimed, and comparative order was re-established in the country; Buenos Aires was declared the seat of the government. The jealousy of the provinces, however, against the capital led to a series of disturbances, and for many years continual civil war devastated every part of the country. Bolivia, Paraguay and Uruguay rose in armed revolt, and finally established themselves as separate republics, whilst the city of Buenos Aires itself was torn with faction and the scene of many a sanguinary fight.

Republic established.

From 1816, however, the independence of the Argentine Republic was assured, and success attended the South Americans in their contest with the royal armies. The combined forces of Buenos Aires and Chile defeated the Spaniards at Chacabuco in 1817, and at Maipú in 1818; and from Chile the victorious general José de San Martin led his troops into Peru, where on the 9th of July 1821, he made a triumphal entry into Lima, which had been the chief stronghold of the Spanish power, having from the time of its foundation by Pizarro been the seat of government of a viceroyalty which at one time extended to the river Plate. A general congress was assembled at Buenos Aires on the 1st of March 1822, of representatives from all the liberated provinces, and a general amnesty was decreed, though the war was not over until the 9th of December 1824, when the republican forces gained the final victory of Ayacucho, in the Peruvian border-land. The Spanish government did not, however, formally acknowledge the independence of the country until the year 1842. On the 23rd of January 1825, a national constitution for the federal states, which formed the Argentine Republic, was decreed; and on the 2nd of February of the same year Sir Woodbine Parish, acting under the instructions of George Canning, signed a commercial treaty in Buenos Aires, by which the British government acknowledged the independence of the country. It had already been recognized by the United States of America two years previously.

Unitarians and Federalists.

In 1826 Bernardo Rivadavia was elected president of the confederation. His policy was to establish a strong central government, and he became the head of a party known as Unitarians in contradistinction to their opponents, who were styled Federalists, their aim being to maintain to the utmost the local autonomy of the various provinces. Under the government of Rivadavia the people of Buenos Aires became involved, practically single-handed, in a war with Brazil in defence of the Banda Oriental, which had been seized by the imperial forces (see Uruguay). The Brazilians were defeated, notably at Ituzaingo, and in 1827 the war issued in the independence of Uruguay. Rivadavia's term of office was likewise memorable for the constitution of the 24th of December 1826, passed by the constituent congress of all the provinces, by which the bonds which united the confederated states of the Argentine Republic were strengthened. This project of closer union met, however, with much opposition both at Buenos Aires and the provinces. Rivadavia resigned, and Vicente Lopez, a Federalist, was elected to succeed him, but was speedily displaced by Manuel Dorrego (1827), another representative of the same party. The carrying out of Federalist principles led, however, to the formation in the republic of a number of quasi-independent military states, and Dorrego only ruled in Buenos Aires. After the conclusion of the peace with Brazil, the Unitarians placed themselves under the leadership of General Juan de Lavalle, the victor of Ituzaingo. Lavalle, at the head of a division of troops, drove Dorrego from Buenos Aires, pursued him into the interior, and captured him. He was shot (December 9, 1828), by the order of Lavalle, and during the year 1828 the country was given up to the horrors of civil war.

Rosas dictator.

On the death of Dorrego, a remarkable man, Juan Manuel de Rosas, became the Federalist chief. In 1829 he defeated Lavalle, made himself master of Buenos Aires, and in the course of the next three years made his authority recognized after much fighting throughout the provinces. The Unitarians were relentlessly hunted down and a veritable reign of terror ensued. Rosas gradually concentrated all power in his own hands, and was hailed by the populace as a saviour of the state. In 1835, with the title of governor and captain-general, he acquired dictatorial powers, and all public authority passed into his hands. This dictatorship of Rosas continued until 1852. In every department of administration and of government he was supreme. He was exceedingly jealous of foreign interference, and quarrelled with France on questions connected with the rights of foreign residents. Buenos Aires was in 1838 blockaded by a French fleet; but Rosas stood firm. A formidable revolt took place in 1839 under General Lavalle, who had returned to the country accompanied by a number of banished Unitarians. In 1840 he invaded Buenos Aires at the head of troops raised chiefly in the province of Entre Rios; but he was defeated at Santa Fé, then at Luján, and finally was captured in Jujuy and shot, 1841. The rule of Rosas was now one of tyranny and almost incessant bloodshed in Buenos Aires, while his partisans, foremost amongst whom was General Ignacio Oribe, endeavoured to exterminate the Unitarians throughout the provinces. The scene of slaughter was extended to the Banda Oriental by the attempt of Oribe, with the support of Rosas, and of Justo José de Urquiza, governor of Entre Rios, to establish himself as president of that republic (see Uruguay), where the existing government was hostile to Rosas and sheltered all political refugees from the country under his despotic rule. The siege of Montevideo led to a joint intervention of England and France. Buenos Aires was blockaded by the combined English and French fleets, September 1845, which landed a force to open the passage up the Paraná to Paraguay, which had been declared closed to foreigners by Rosas. A convention was signed in 1849, which secured the free navigation of the Paraná and the independence of the Banda Oriental. The downfall of Rosas was at last brought about by the instrumentality of Justo José de Urquiza, who as governor of Entre Rios, had for many years been one of his strongest supporters. The breach between the two men which led to open collision took place in 1846. The first efforts of Urquiza to rouse the country against the oppressor were unsuccessful, but in 1851 he concluded an alliance with Brazil, to which Uruguay afterwards adhered. A large army of twenty-four thousand men was collected at Montevideo, and on the 8th of January 1852 the allied forces crossed the Paraná and the road to Buenos Aires lay open before them. Rosas met the allies at the head of a body of troops fully equal in numbers to their own, but was crushingly routed, February 3rd, at Monte Caseros, about 10 m. from the capital. The dictator fled for refuge to the British legation, from whence he was conveyed on board H.B.M.S. "Locust," which carried him into exile.

Urquiza president.

A provisional government was formed under Urquiza, and the Brazilian and Uruguayan troops withdrew. He summoned all the provincial governors at San Nicolás in the province of Buenos Aires, and on the 31st of May they proclaimed a new constitution, with Urquiza as provisional director of the Argentine nation. A constituent congress, in which each province had equal representation, was duly

Buenos Aires and the provinces.

elected, and in order to provide against the predominance of Buenos Aires, it was determined that Sante Fé should be the place of session. But this did not suit the *porteños*, as the people of Buenos Aires were called, and the province refused to take any part in the congressional proceedings. But Urquiza was a man of different temperament from Rosas, and when he found that Buenos Aires refused to submit to his authority, he declined to use force. The congress had (May 1, 1853) appointed Urquiza president of the confederation, and he established the seat of government at Paraná. The province of Buenos Aires was recognized as an independent state, and under the enlightened administration of Doctor Obligado made rapid strides in commercial prosperity. The two sections of the Argentine nation contrived to exist as separate governments without an open breach of the peace until 1859, when the long-continued tension led to the outbreak of hostilities. The army of the *porteños*, commanded by Colonel Bartolomé Mitre, was defeated at Cepeda by the confederate forces under Urquiza, and Buenos Aires agreed to re-enter the confederation (November 11, 1859). Urquiza at this juncture resigned the presidency, and Doctor Santiago Derqui was elected president of the fourteen provinces with the seat of government at Paraná; while Urquiza became once more governor of Entre Rios, and Mitre was appointed governor of Buenos Aires.

Mitre president.

Paraguay war.

The struggle for supremacy between Buenos Aires and the provinces had, however, to be fought out, and hostilities once more broke out in 1861. The armies of the opposing parties, under Generals Mitre and Urquiza respectively, met at Pavón in the province of Santa Fé (September 17). The battle ended in the disastrous defeat of the provincial forces; General Mitre used his victory in a spirit of moderation and sincere patriotism. He was elected president of the Argentine confederation and did his utmost to settle the questions which had led to so many civil wars, on a permanent and sound basis. The constitution of 1853 was maintained, but Buenos Aires became the seat of federal government without ceasing to be a provincial capital. Causes of friction still remained, but they did not develop into open quarrels, for Mitre was content to leave Urquiza in his province of Entre Rios, and the other administrators (*caudillos*) in their several governments, a large measure of autonomy, trusting that the position and growing commercial importance of Buenos Aires would inevitably tend to make the federal capital the real centre of power of the republic. In 1865 the Argentines were forced into war with Paraguay through the overbearing attitude of the president Francisco Solano Lopez. The dictator of Paraguay had quarrelled with Brazil for its intervention in the internal affairs of Uruguay, and he demanded free passage for his troops across the Argentine province of Corrientes. This Mitre refused, and alliance was formed between Argentina, Brazil and Uruguay, for joint action against Lopez. General Mitre became commander-in-chief of the combined armies for the invasion of Paraguay and was absent for several years in the field. The struggle was severe and attended by heavy losses, and it was not until 1870 that the Paraguayans were conquered, Lopez killed, and peace concluded (see PARAGUAY). Meanwhile, disturbances had broken out in the interior of Argentina (1867), which compelled Mitre to relinquish his command in Paraguay, and to call back a large part of the Argentine forces to suppress the insurrection. The rebels had hoped for assistance from Urquiza, but the powerful governor of Entre Rios maintained the peace in his province, which under his firm and beneficent rule had greatly prospered, and the revolutionary movement was quickly subdued.

Sarmiento president.

In 1868 the term of General Mitre came to an end, and Doctor Domingo Faustino Sarmiento, a native of San Juan, was quietly elected to succeed him. His conduct of affairs was broad-minded and upright, and was characterized by earnest efforts to promote education and to develop the resources of the country. His period of office was marked by the rapid advance of Buenos Aires in population and prosperity, and by an expansion of trade that was unfortunately accompanied by financial extravagance. The war with Paraguay left a legacy of disputes concerning boundaries which almost led to war between the two victorious allies, Argentina and Brazil, but by the exertions of Mitre, who was sent at the close of 1872 as special envoy to Rio, a settlement was arrived at and friendly relations restored. The month of April 1870 saw an insurrection in Entre Rios headed by the *caudillo*, Lopez Jordan. Urquiza was assassinated, and the provincial legislature, through fear, at once proclaimed Lopez Jordan governor. The federal government refused to acknowledge the new governor, and troops were despatched by Sarmiento against Entre Rios. The contest lasted with varying success for more than a year, but finally Lopez Jordan was completely defeated and driven into exile.

Avellaneda president.

The Tiro Nacional.

The presidential election of 1874 resolved itself, as so often before, into a struggle between the provincials and the *porteños* (Buenos Aires). The candidate of the former, Dr Nicolas Avellaneda, triumphed over General Mitre, not without suspicions of tampering with the returns; and the unsuccessful party appealed to arms. The new president, however, who was installed in office on the 12th of October, took active steps to suppress the revolution, which never assumed a really serious character. The government troops gained two decisive victories over the insurgents under Generals Mitre and Arredondo, and they were compelled to surrender at discretion. But though peace was for a time restored, the old causes of soreness and dissension remained unappeased, and as the time for the next presidential election began to draw near, it became more and more evident that a critical struggle was at hand, and that the people of Buenos Aires, supported by the province of Corrientes, were determined to bring to an issue the question as to what position Buenos Aires was to hold for the future with regard to the remaining provinces of the confederation. It was evident that the president intended to use all the influence which the party in power could exercise, to secure the return of General Julio Roca, who had distinguished himself in 1878 by a successful campaign against the warlike Indian tribes bordering on the Andes. The *porteños* on their part were determined to resist this policy to the utmost. Mass meetings were held, and a committee was appointed for the purpose of considering what action should be taken to defeat the ambitious designs of the provincials. Under the direction of this committee, the association known as the "Tiro Nacional" was formed, with the avowed object of training the able-bodied citizens of Buenos Aires in military exercises and creating a volunteer army, ready for service if called upon, to withstand by force the pretensions of their opponents. The establishment of the Tiro Nacional was enthusiastically received by all classes in Buenos Aires, the men turning out regularly to drill, and the women aiding the movement by collecting subscriptions for the purpose of armament and other necessaries. On the 13th of February 1880, the minister of war, Dr Carlos Pellegrini, summoned the principal officers connected with the Tiro Nacional, General Bartolomé Mitre, his brother Emilio, Colonel Julio Campos, Colonel Hilario Lagos and others, and warned them that as officers of the national army they owed obedience to the national government, and would be severely punished if concerned in any revolutionary outbreak against the constituted authorities. The reply to this threat was the immediate resignation of their commissions by all the officers connected with the Tiro Nacional. Two days later, the national government occupied, with a strong force of infantry and artillery, the parade ground at Palermo used by the Buenos Aires volunteers for drill purposes. A great meeting of citizens was then called and marched through the streets. President Avellaneda was frightened at the results of his action, and to avoid a collision ordered the troops to be withdrawn. Negotiations were now opened by the government with the provincial authorities for the disarmament of the city and province of Buenos Aires, but they led to nothing. Matters became still further strained on account of the outrages committed by the national troops, and such was the bitterness of feeling developed between the two factions, that an appeal to arms became inevitable.

Appeal to arms.

In the month of June 1880, President Avellaneda and his ministers left Buenos Aires, and this act was considered by the *porteño* leaders equivalent to a declaration of war. The national government and the twelve provinces forming the Córdoba League, were ranged on one side; the city and province of Buenos Aires and the province of Corrientes on the other. The national troops were well armed with Remington rifles, provided with abundant ammunition, equipped with artillery and supported by the fleet. In the city and province of Buenos Aires, plenty of volunteers offered their services, and an army of some twenty-five thousand men was quickly raised, but they were armed with old-fashioned weapons and there was only a limited supply of ammunition. Feverish attempts were made to remedy the lack of warlike stores, but difficulty was experienced on account of the fleet blockading the entrance to the river. After several skirmishes, the national army commanded by General Roca, containing many troops seasoned in Indian campaigns, assaulted the *porteños* posted before Buenos Aires, and after two days' hard fighting (20th and 21st July) forced its way into the town. On 23rd July the surrender of the city was demanded and obtained. The terms of the surrender were that all the leaders of the revolution should be removed from positions of authority, all government employees implicated in the movement dismissed, and the force in the province and city of Buenos Aires at once disarmed and disbanded. The power of Buenos Aires was thus completely broken and at the mercy of the Córdoba League. The *porteños* were no longer in a position to nominate a candidate in opposition to General Julio Roca, who was duly elected. He assumed office in October 1880.

Fall of Buenos Aires.

Roca president.

Hitherto General Roca had been regarded only in his capacity as a soldier, and not from the point of view of an administrator. In the campaigns against the Indians in the south-west of the province of Buenos Aires and the valley of the Rio Negro he had gained much prestige; the victory over Buenos Aires added to his fame, and secured his authority in the outlying provincial centres. One of the first notable acts of the Roca administration was to declare the city of Buenos Aires the property of the national government. This separation of the city from the province, and its federalization had been one of the chief aims of the Córdoba League, and was the natural consequence of the crushing defeat inflicted on the *porteños*. As a sequel to this step, in 1884 the town of La Plata was declared to be the capital of the province of Buenos Aires, and the provincial administration was moved to that place. This federalization of the capital has proved to be a most important factor in binding together the different parts of the confederation, and in promoting the evolution of an Argentine nation out of a loosely cemented union of a number of semi-independent states.

Considering the circumstances in which General Roca assumed office, it must be admitted that he showed great moderation and used the practically absolute power that he possessed to establish a strong central government, and to initiate a national policy, which aimed at furthering the prosperity and development of the whole country. He was able by the influence he exerted to keep down the internal dissensions and insurrectionary outbreaks which had so greatly impeded for many years the development of the vast natural resources of the republic. With this object he had promoted the extension of railways so as to link the provinces with the great port of Buenos Aires, and to provide at the same time facilities for the rapid despatch of military forces to disturbed districts. Unfortunately the last two years of Roca's term of office were marked by two grave errors, which subsequently caused widespread suffering and distress throughout the country. The first of these mistakes was a measure making (January 1885) the currency inconvertible for a period of two years. This act, which was only decided upon after much hesitation, had a most deleterious effect upon the national credit. The second was the nomination of Dr Miguel Juarez Celman for the presidential term commencing in October 1886. The nomination was brought about by the Córdoba clique, and Roca lacked the moral courage to oppose the decision of this group, though he was well aware that Celman, who was his brother-in-law, was neither intellectually nor morally fitted for the post.

Celman president.

No sooner had President Juarez Celman come into power towards the close of 1886, than the respectable portion of the community began to feel alarmed at the methods practised by the new president in his conduct of public affairs. At first it was hoped that the influence of General Roca would serve to check any serious extravagance on the part of Celman. This hope, however, was doomed to disappointment, and before many months had elapsed it was clear that the president would listen to no prudent counsels from Roca or from any one else. The men of the old Córdoba League became dominant in all branches of the government, and carpet-bagging politicians occupied every official post. In their hurry to obtain wealth, this crowd of office-mongers from the provinces lent themselves to all kinds of bribery and corruption. The public credit was pledged at home and abroad to fill the pockets of the adventurers, and the wildest excesses were committed under the guise of administrative acts. What followed in the second and third years of the Celman administration can only adequately be described as a debauchery of the national honour, of the national resources, of the rights of Argentines as citizens of the republic. Buenos Aires was still prostrate under the crushing blow of the misfortunes of 1880, and lacked strength and power of organization necessary to raise any effective protest against the proceedings of Celman and his friends when the true character of these proceedings was first understood. The conduct of public affairs, however, at length became so scandalous, that action on the part of the more sober-minded and conservative sections was seen to be absolutely imperative if the country was to be saved from speedy and certain ruin. In 1889 the association of the "Union Civica" was founded, and the organization undertaken by Dr Leandro Alem, Dr Aristobulo del Valle, Dr Bernardo Irigoyen, Dr Vicente Lopez, Dr Lucio Lopez, Dr Oscar Lilliedale and other leading citizens. The untiring energy and zeal of Leandro Alem fitted him for being the chief organizer of a movement into which he threw himself heart and soul. Mass meetings were held in Buenos Aires, and it fell specially to the lot of Dr del Valle, who was an able orator as well as a sincere patriot, to expose the irresponsible and corrupt character of the administration, and the terrible dangers that threatened the republic through its reckless extravagance and financial improvidence. Subsidiary clubs affiliated to the central administration were formed throughout the length and breadth of the country, and millions of leaflets and pamphlets were distributed broadcast to explain the importance of the movement. President Celman underrated the strength of the new opposition, and relied upon his armed forces promptly to suppress any signs of open hostility. No change was made in official methods, and the condition of affairs drifted from bad to worse, until the temper of the people, so long and so sorely tried, showed plainly that the situation had become insufferable. The Union Civica then decided to make a bold bid for freedom by attempting forcibly to eject Celman and his clique from office.

The Union Civica.

On the night of the 26th of July 1890 the Union Civica called its members to arms. It was joined by some regiments of the regular army and received the support of the fleet. Barricades were thrown up in the principal streets, and the surrounding houses were occupied by the insurgents. Two days of desultory street fighting ensued, during which the fleet began to bombard the city, but was compelled to desist by the interference of foreign men-of-war, on the ground that the bombardment was causing unnecessary damage to the life and property of non-combatants. A suspension of hostilities then took place, and negotiations were opened between the contending parties. Celman, acting upon the advice of General Roca, who recognized the strength of public opinion in the outbreak, placed his resignation in the hands of congress on the 31st of July. A scene of intense enthusiasm followed, and Buenos Aires was *en fête* for the following three days. The vice-president of the confederation, Carlos Pellegrini, who had been minister of war under presidents Avellaneda and Roca and had had much administrative experience, succeeded without opposition to the vacant post.

Pellegrini president.

Much satisfaction was shown in Europe at the fall of President Celman, for investors had suffered heavily by the way in which the resources of Argentina had been dissipated by a corrupt government, and hopes were entertained that the uprising of public opinion against his financial methods signified a more honest conduct of the national affairs in the future. Great expectations were entertained of the ability of President Pellegrini to establish a sound administration, and he succeeded in forming a ministry which gave general satisfaction throughout the country. General Roca was induced to undertake the duties of minister of the interior, and his influence in the provinces was sufficient to check any attempts to stir up disturbances at Córdoba or elsewhere. The most onerous post of all, that of minister of finance, was confided to Dr Vicente Lopez, who, though he was not of marked financial ability, was at least a man of untiring industry and of a personal integrity that was above suspicion. But the economic and financial situation was one of almost hopeless embarrassment and confusion, and Pellegrini proved himself incapable of grappling with it. Instead of facing the difficulties, the president preferred to put off the day of reckoning by flooding the country with inconvertible notes, with the result that the financial crisis became more and more aggravated. Through the rapid depreciation of Argentine credit, the great firm of Baring Brothers, the financial agents of the government in London, became so heavily involved that they were forced into liquidation, November 1890. The consequences of this catastrophe were felt far and wide, and in the spring of 1891 both the Banco Nacional and the Banco de la provincia de Buenos Aires were unable to meet their obligations. Amidst this sea of financial troubles the government drifted helplessly on, without showing any inclination or capacity to initiate a strong policy of reform in the methods of administration which had done so much to ruin the country.

It is little wonder that, in these circumstances, the choice of a successor to Pellegrini, whose term of office expired in 1892, should have been felt to possess peculiar importance. General Bartolomé Mitre was proposed by the *porteños* as their candidate. He had been absent from Argentina on a journey to Europe, and on his return in April 1891, a popular reception was given to him at which 50,000 persons attended. A petition was presented to him begging him to be a candidate for the presidency, and with some reluctance the veteran leader gave his consent. His partisans, however, found themselves confronted by a compact provincial party, who proposed to put forward the other strong man of the republic, General Roca, to oppose him. But the two generals were equally averse to a contest *à outrance*, which could only end in civil war. They met accordingly at a conference known as *El Acuerdo*, and it was arranged that both should withdraw, and that a non-party candidate should be selected who should receive the support of them both. The choice fell upon Dr Saenz Peña, a judge of the supreme court, and a man universally respected, who had never taken any part in political life. This compact aroused the bitter enmity of Dr Leandro Alem, who did his utmost to stir up the Union Civica to a campaign against the neutral candidate. Finding that the more conservative section of the union would not follow him, Alem formed a new association to which he gave the name of Union Civica Radical. Such was his energy, that soon a network of branches of the Union Civica Radical was organized throughout the republic, and Dr Bernardo Irigoyen was put forward as a rival candidate to Dr Saenz Peña. But Alem was not content with constitutional opposition to the Acuerdo, and his movement soon assumed the character of a revolutionary propaganda against the national government. His violence gave Pellegrini the opportunity of taking active steps to preserve the peace. In April 1892 Alem and his chief colleagues were arrested and sent into exile.

In the following month (May), the presidential elections were held; Dr Saenz Peña was declared duly elected, and Dr José Uriburu, the minister in Chile, was chosen as vice-president.

Saenz Peña president.

The idea of Dr Saenz Peña was to conduct the government on common sense and non-partisan lines, in fact to translate into practical politics the principles which underlay the compromise of the Acuerdo. He was a straightforward and honourable man, who tried his best to do his duty in a position that had been forced upon him, and was in no sense of the word his own seeking. No sooner, however, was he installed in office than difficulties began to crop up on all sides, and he quickly discovered that to attempt to govern without the aid of a majority in congress was practically impossible. He had had no experience of political life, and he refused to create the support he needed by using his presidential prerogative to build up a political majority. Obstruction met his well-meant efforts to promote the general good, and before twelve months of the presidential term had run public affairs were at a deadlock. Dr Alem, who had been permitted to return from exile, was not slow to profit by the occasion. Embittered by his treatment in 1892, he openly preached the advisability of an armed rising to overthrow the existing administration. Public opinion had been outraged by the immunity with which the governors of certain provinces, and more particularly Dr Julio Costa, the governor of the province of Buenos Aires, had been allowed to maintain local forces, by the aid of which they exacted the payment of illegal taxes and exercised other acts of injustice and oppression. A number of officers of the army and navy agreed to lend assistance to a revolutionary outbreak, and towards the end of July 1893 matters came to a head. The population of Buenos Aires assembled in armed bodies with the avowed intention of ejecting the governor from office, and electing in his stead a man who would give them a just administration. The president was for some time in doubt whether he had any right to intervene in provincial affairs, but eventually troops were despatched to La Plata. There was no serious fighting. Negotiations were soon opened which quickly led to the resignation of Costa, and the return of the insurgents to their homes. While these disturbances were taking place in the province of Buenos Aires, another revolutionary rising was in progress in Santa Fé. Here the efforts of Dr Alem succeeded in supplying a large body of rebels with arms and ammunition, and he was able, by a bold attack, to seize the town of Rosario and there establish the revolutionary headquarters. This capture so alarmed the national government that a force was sent under the command of Roca to put down the insurrection. The revolt speedily collapsed before this redoubtable commander, and Alem and the other leaders surrendered. They were sentenced to banishment in Staten Island at the pleasure of the federal government.

But the suppression of disorder did not relieve the tension between the congress and the executive. During the whole of the 1894 session, the attitude of senators and deputies alike was one of pronounced hostility to the president. All his acts were opposed, legislation was at a standstill and every effort was made to force Dr Saenz Peña to resign. But although he experienced the utmost difficulty in forming a cabinet, the president was obstinate in his determination to retain office without identifying himself with any party. A definite issue was therefore sought by the congress on which to join battle, and it arose out of the death sentences which had been pronounced on certain naval and military officers who had been implicated in the Santa Fé outbreak. The president had made up his mind that the sentence must be carried out; the congress by a great majority were resolved not to permit the death penalty to be inflicted. It was a one-sided struggle, for without the consent of the congress the president could not raise any money for supplies, and congress refused to vote the budget. But heavy expenses had been incurred in putting down revolutionary movements in various parts of the provinces, and war with Chile was threatened upon the question of a dispute concerning the boundaries between the two republics. In January 1895 a special session of congress was summoned to take into consideration the financial proposals of the government, which included an increase in the naval and military estimates. Congress, however, had now got their opportunity, and they used the time of national stress to bring increased pressure to bear upon the president. On the 21st of January Dr Saenz Peña at last perceived that his position was untenable, and he handed in his resignation. It was accepted at once by the chambers, and the vice-president, Dr José Uriburu, became president of the republic for the three years and nine months of Peña's term which remained unexpired.

Uriburu president.

Uriburu was neither a politician nor a statesman, but had spent the greater portion of his life abroad in the diplomatic service. His knowledge of foreign affairs was, however, peculiarly useful at a juncture when boundary questions were the subjects that chiefly attracted public attention. After disputes with Brazil, extending over fifteen years, about the territory of "Misiones," the matter had been submitted to the arbitration of the president of the United States. In March 1895 President Cleveland gave his decision, which was wholly favourable to the contention of Brazil. The Argentine government, though disappointed at the result, accepted the award loyally. The boundary dispute with Chile, to which reference has already been made, was of a more serious character. The dispute was of old standing. Already in 1884 a protocol had been signed between the contending parties, by which it was agreed that the frontier should follow the line where "the highest peaks of the Andine ranges divide the watershed." This definition unfortunately ignored the fact that the Andes do not run from north to south in one continuous line, but are separated into cordilleras with valleys between them, and covering in their total breadth a considerable extent of country. Difference of opinion, therefore, arose as to the interpretation of the protocol, the Argentines insisting that the boundary should run from highest peak to highest peak, the Chileans that it should follow the highest points of the watershed. The quarrel at length became acute, and on both sides the populace clamoured from time to time for an appeal to arms, and the resources of both countries were squandered in military and naval preparations for a struggle. Nevertheless despite these obstacles, President Uriburu did something during his term of office to relieve the nation's financial difficulties. In 1896 a bill was passed by congress, which authorized the state by the issue of national bonds to assume the provincial external indebtedness. This proof of the desire of the Argentine government to meet honestly all its obligations did much to restore its credit abroad. Uriburu found in 1897 the financial position so far improved that he was able to resume cash payments on the entire foreign debt.

Roca president.

In 1898 there was another presidential election. Public opinion, excited by the prospect of a war with Chile, naturally supported the candidature of General Roca, and he was elected without opposition (12th October 1898). The first question which he had to handle was the Chilean boundary dispute. During the last months of President Uriburu's administration, matters had reached a climax, especially in connexion with the delimitation in a district known as the Puña de Atacama. In August an ultimatum was received from Chile demanding arbitration. After some hesitation, on the advice of Roca the Argentines agreed to the demand, and peace was maintained. The principle of arbitration being accepted, the conditions were quickly arranged. The question of the Puña de Atacama was referred to a tribunal composed of the United States minister to Argentina and of one Argentine and one Chilean delegate; that of the southern frontier in Patagonia to the British crown. One of the first steps of President Roca, after his accession to office, was to arrange a meeting with the president of Chile at the Straits of Magellan. At their conference all difficulties were discussed and settled, and an undertaking was given on both sides to put a stop to warlike preparations. The decision of the representative of the United States was given in April 1899. Although the Chileans professed dissatisfaction, no active opposition was raised, and the terms were duly ratified. In his message to congress, on the 1st of May 1899, General Roca spoke strongly of the immediate necessity of a reform in the methods of administering justice, the expediency of a revision of the electoral law, and the imperative need of a reconstruction of the department of public instruction. The administration of justice, he declared, had fallen to so low an ebb as to be practically non-existent. By the powerful influence of the president, government measures were sanctioned by the legislature dealing with the abuses which had been condemned. On the 31st of August of the same year a series of proposals upon the currency question was submitted to congress by the president, whose real object was to counteract the too rapid appreciation of the inconvertible paper money. The official value of the dollar was fixed at 44 cents gold for all government purposes. The violent fluctuations in the value of the paper dollar, which caused so much damage to trade and industry, were thus checked. In October 1900 Dr Manuel Campos Salles, president of Brazil, paid a visit to Buenos Aires, and was received with great demonstrations of friendliness. The aggressive attitude of Chile towards Bolivia was causing considerable anxiety, and Argentina and Brazil wished to show that they were united in opposing a policy which aimed at acquiring an extension of territory by force of arms. The feeling of enmity between Chile and Argentina was indeed anything but extinct. The delay of the arbitration tribunal in London in giving its decision in the matter of the disputed boundary in Patagonia led to a crop of wild rumours being disseminated, and to a revival of animosity between the two peoples. In December 1901 warlike preparations were being carried on in both states, and the outbreak of active hostilities appeared to be imminent. At the critical moment the British government, urged to move in the matter by the British residents in both countries, who feared that war would mean the financial ruin of both Chile and Argentina, used its utmost influence both at Santiago and Buenos Aires to allay the misunderstandings; and negotiations were set on foot which ended in a treaty for the cessation of further armaments being signed, June 1902. The award of King Edward VII. upon the delimitation of the boundary was given a few months later, and was received without controversy and ratified by both governments.

Quintana and Alcorta presidents.

To the calm resourcefulness and level-headedness of President Roca at a very difficult and critical juncture must be largely ascribed the preservation of peace, and the permanent removal of a dispute that had aroused so much irritation. His term of office came to an end in 1904, when Dr Manuel Quintana was elected president and Dr José Figueroa Alcorta vice-president, both having Roca's support. Dr Quintana at the time of his election was sixty-four years of age. He proved a hard-working progressive president, who did much for the development of communications and the opening up of the interior of the country. He died amidst general regret in March 1906, and was succeeded by Dr Alcorta for the remaining years of his term. (G. E.)

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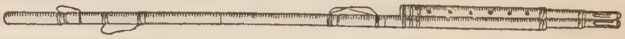
ARGENTINE, a former city of Wyandotte county, Kansas, U. S. A., since 1910 a part of Kansas City, on the S. bank of the Kansas river, just above its mouth. Pop. (1890) 4732; (1900) 5878, of whom 623 were foreign-born and 603 of negro descent; (1905, state census) 6053. It is served by the Atchison, Topeka & Santa Fé railway, which maintains here yards and machine shops. The streets of the city run irregularly up the steep face of the river bluffs. Its chief industrial establishment is that of the United Zinc and Chemical Company, which has here one of the largest plants of its kind in the country. There are large grain interests. The site was platted in 1880, and the city was first incorporated in 1882 and again, as a city of the second class, in 1889.

ARGENTITE, a mineral which belongs to the galena group, and is cubic silver sulphide (Ag_2S). It is occasionally found as uneven cubes and octahedra, but more often as dendritic or earthy masses, with a blackish lead-grey colour and metallic lustre. The cubic cleavage, which is so prominent a feature in galena, is here present only in traces. The mineral is perfectly sectile and has a shining streak; hardness 2·5, specific gravity 7·3. It occurs in mineral veins, and when found in large masses, as in Mexico and in the Comstock lode in Nevada, it forms an important ore of silver. The mineral was mentioned so long ago as 1529 by G. Agricola, but the name argentite (from the Lat. *argentum*, "silver") was not used till 1845 and is due to W. von Haidinger. Old names for the species are Glaserz, silver-glance and vitreous silver. A cupriferous variety, from Jalpa in Tabasco, Mexico, is known as jalpaite. Acanthite is a supposed dimorphous form, crystallizing in the orthorhombic system, but it is probable that the crystals are really distorted crystals of argentite. (L. J. S.)

ARGENTON, a town of western France, in the department of Indre, on the Creuse, 19 m. S.S.W. of Châteauroux on the Orléans railway. Pop. (1906) 5638. The river is crossed by two bridges, and its banks are bordered by picturesque old houses. There are numerous tanneries, and the manufacture of boots and shoes and linen goods is carried on. The site of the ancient *Argentomagus* lies a little to the north.

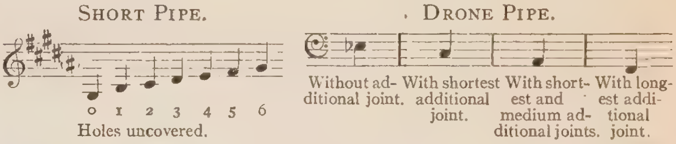
ARGHANDAB, a river of Afghanistan, about 250 m. in length. It rises in the Hazara country north-west of Ghazni, and flowing south-west falls into the Helmund 20 m. below Girishk. Very little is known about its upper course. It is said to be shallow, and to run nearly dry in height of summer; but when its depth exceeds 3 ft. its great rapidity makes it a serious obstacle to travellers. In its lower course it is much used for irrigation, and the valley is cultivated and populous; yet the water is said to be somewhat brackish. It is doubtful whether the ancient Arachotus is to be identified with the Arghandab or with its chief confluent the Tarnak, which joins it on the left about 30 m. S. W. of Kandahar. The two rivers run nearly parallel, inclosing the backbone of the Ghilzai plateau. The Tarnak is much the shorter (length about 200 m.) and less copious. The ruins at Ulân Robât, supposed to represent the city Arachosia, are in its basin; and the lake known as Ab-i-Istâda, the most probable representative of Lake Arachotus, is near the head of the Tarnak, though not communicating with it. The Tarnak is dammed for irrigation at intervals, and in the hot season almost exhausted. There is a good deal of cultivation along the river, but few villages. The high road from Kabul to Kandahar passes this way (another reason for supposing the Tarnak to be Arachotus), and the people live off the road to avoid the onerous duties of hospitality.



(From Edward William Lane's *An Account of the Manners and Customs of the Modern Egyptians.*)

Modern Arghoul, 3 ft. 2½ in. long.

ARGHOUL, ARGHOOL, or ARGHUL (in the Egyptian hieroglyphs, AS or AS-IT),[1] an ancient and modern Egyptian and Arab wood-wind instrument, with cylindrical bore and single reed mouthpiece of the clarinet type. The arghoul consists of two reed pipes of unequal lengths bound together by means of waxed thread, so that the two mouthpieces lie side by side, and can be taken by the performer into his mouth at the same time. The mouthpiece consists of a reed having a small tongue detached by means of a longitudinal slit which forms the beating reed, as in the clarinet mouthpiece. The shorter pipe has six holes on which the melody is played; the three upper holes being covered by the fingers of the right hand, and the lower by those of the left hand. The longer pipe has no lateral holes; it is a drone pipe with one note only, which, however, can be varied by the addition of extra lengths of reed. In the illustration all three lengths are shown in use. An arghoul belonging to the collection of the Conservatoire Royal at Brussels, described by Victor Mahillon in his catalogue[2] (No. 113), gives the following scale:—


SHORT PIPE.
DRONE PIPE.
0 1 2 3 4 5 6
Holes uncovered.
Without additional joint.
With shortest additional joint.
With shortest and medium additional joints.
With longest additional joint.

The total length of the shorter pipe, including the mouthpiece, is 0·435 m.; of the longer pipe, without additional joints, 0·555 m. An Egyptian arghoul,[3] presented by the khedive to the Victoria and Albert Museum, measures 4 ft. 8½ in.

For further information see Victor Loret, *L'Egypte au temps des Pharaons* (Paris, 1889), 8vo, pp. 139, 143, 144; G. A. Villoteau, *Description historique technique et littéraire des instruments de musique des orientaux* (*Description de l'Egypte*, Paris, 1823, tome xiii. pp. 456–473). (K. S.)

ARGOL, the commercial name of crude tartar (*q.v.*). It is a semi-crystalline deposit which forms on wine vats, and is generally grey or red in colour.

ARGON (from the Gr. ἀ-, privative, and ἔργον, work; hence meaning "inert"), a gaseous constituent of atmospheric air. For more than a hundred years before 1894 it had been supposed that the composition of the atmosphere was thoroughly known. Beyond variable quantities of moisture and traces of carbonic acid, hydrogen, ammonia, &c., the only constituents recognized were nitrogen and oxygen. The analysis of air was conducted by determining the amount of oxygen present and assuming the remainder to be nitrogen. Since the time of Henry Cavendish no one seemed even to have asked the question whether the residue was, in truth, all capable of conversion into nitric acid.

The manner in which this condition of complacent ignorance came to be disturbed is instructive. Observations undertaken mainly in the interest of Prout's law, and extending over many years, had been conducted to determine afresh the densities of the principal gases—hydrogen, oxygen and nitrogen. In the latter case, the first preparations were according to the convenient method devised by Vernon Harcourt, in which air charged with ammonia is passed over red-hot copper. Under the influence of the heat the atmospheric oxygen unites with the hydrogen of the ammonia, and when the excess of the latter is removed with sulphuric acid, the gas properly desiccated should be pure nitrogen, derived in part from the ammonia, but principally from the air. A few concordant determinations of density having been effected, the question was at first regarded as disposed of, until the thought occurred that it might be desirable to try also the more usual method of preparation in which the oxygen is removed by actual oxidation of copper without the aid of ammonia. Determinations made thus were equally concordant among themselves, but the resulting density was about $\frac{1}{1000}$ part greater than that found by Harcourt's method (Rayleigh, *Nature*, vol. xlvi. p. 512, 1892). Subsequently when *oxygen* was substituted for air in the first method, so that all (instead of about one-seventh part) of the nitrogen was derived from ammonia, the difference rose to $\frac{1}{2}$ %. Further experiment only brought out more clearly the diversity of the gases hitherto assumed to be identical. Whatever were the means employed to rid air of accompanying oxygen, a uniform value of the density was arrived at, and this value was $\frac{1}{2}$ % greater than that appertaining to nitrogen extracted from compounds such as nitrous oxide, ammonia and ammonium nitrite. No impurity, consisting of any known substance, could be discovered capable of explaining an excessive weight in the one case, or a deficiency in the other. Storage for eight months did not disturb the density of the chemically extracted gas, nor had the silent electric discharge any influence upon either quality. ("On an Anomaly encountered in determining the Density of Nitrogen Gas," *Proc. Roy. Soc.*, April 1894.)

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[1] See Victor Loret, "Les flûtes égyptiennes antiques," *Journal Asiatique*, 8ème série, tome xiv., Paris, 1889, pp. 129, 130 and 132.

[2] *Catalogue descriptif et analytique du musée du Conservatoire Royal de Bruxelles* (Ghent, 1880), p. 141.

[3] *A Descriptive Catalogue of the Musical Instruments in the South Kensington Museum*, by Carl Engel (London, 1874), p. 143.

At this stage it became clear that the complication depended upon some hitherto unknown body, and probability inclined to the existence of a gas in the atmosphere heavier than nitrogen, and remaining unacted upon during the removal of the oxygen —a conclusion afterwards fully established by Lord Rayleigh and Sir William Ramsay. The question which now pressed was as to the character of the evidence for the universally accepted view that the so-called nitrogen of the atmosphere was all of one kind, that the nitrogen of the air was the same as the nitrogen of nitre. Reference to Cavendish showed that he had already raised this question in the most distinct manner, and indeed, to a certain extent, resolved it. In his memoir of 1785 he writes:—

> "As far as the experiments hitherto published extend, we scarcely know more of the phlogisticated part of our atmosphere than that it is not diminished by lime-water, caustic alkalies, or nitrous air; that it is unfit to support fire or maintain life in animals; and that its specific gravity is not much less than that of common air; so that, though the nitrous acid, by being united to phlogiston, is converted into air possessed of these properties, and consequently, though it was reasonable to suppose, that part at least of the phlogisticated air of the atmosphere consists of this acid united to phlogiston, yet it may fairly be doubted whether the whole is of this kind, or whether there are not in reality many different substances confounded together by us under the name of phlogisticated air. I therefore made an experiment to determine whether the whole of a given portion of the phlogisticated air of the atmosphere could be reduced to nitrous acid, or whether there was not a part of a different nature to the rest which would refuse to undergo that change. The foregoing experiments indeed, in some measure, decided this point, as much the greatest part of air let up into the tube lost its elasticity; yet, as some remained unabsorbed, it did not appear for certain whether that was of the same nature as the rest or not. For this purpose I diminished a similar mixture of dephlogisticated [oxygen] and common air, in the same manner as before [by sparks over alkali], till it was reduced to a small part of its original bulk. I then, in order to decompound as much as I could of the phlogisticated air [nitrogen] which remained in the tube, added some dephlogisticated air to it and continued the spark until no further diminution took place. Having by these means condensed as much as I could of the phlogisticated air, I let up some solution of liver of sulphur to absorb the dephlogisticated air; after which only a small bubble of air remained unabsorbed, which certainly was not more than $\frac{1}{120}$ of the bulk of the dephlogisticated air let up into the tube; so that, if there be any part of the dephlogisticated air of our atmosphere which differs from the rest, and cannot be reduced to nitrous acid, we may safely conclude that it is not more than $\frac{1}{120}$ part of the whole."

Although, as was natural, Cavendish was satisfied with his result, and does not decide whether the small residue was genuine, it is probable that his residue was really of a different kind from the main bulk of the "phlogisticated air," and contained the gas afterwards named argon.

The announcement to the British Association in 1894 by Rayleigh and Ramsay of a new gas in the atmosphere was received with a good deal of scepticism. Some doubted the discovery of a new gas altogether, while others denied that it was present in the atmosphere. Yet there was nothing inconsistent with any previously ascertained fact in the asserted presence of 1 % of a non-oxidizable gas about half as heavy again as nitrogen. The nearest approach to a difficulty lay in the behaviour of liquid air, from which it was supposed, as the event proved erroneously, that such a constituent would separate itself in the solid form. The evidence of the existence of a new gas (named Argon on account of its chemical inertness), and a statement of many of its properties, were communicated to the Royal Society (see *Phil. Trans.* clxxxvi. p. 187) by the discoverers in January 1895. The isolation of the new substance by removal of nitrogen from air was effected by two distinct methods. Of these the first is merely a development of that of Cavendish. The gases were contained in a test-tube A (fig. 1) standing over a large quantity of weak alkali B, and the current was conveyed in wires insulated by U-shaped glass tubes CC passing through the liquid and round the mouth of the test-tube. The inner platinum ends DD of the wire may be sealed into the glass insulating tubes, but reliance should not be placed upon these sealings. In order to secure tightness in spite of cracks, mercury was placed in the bends. With a battery of five Grove cells and a Ruhmkorff coil of medium size, a somewhat short spark, or arc, of about 5 mm. was found to be more favourable than a longer one. When the mixed gases were in the right proportion, the rate of absorption was about 30 c.c. per hour, about thirty times as fast as Cavendish could work with the electrical machine of his day. Where it is available, an alternating electric current is much superior to a battery and break. This combination, introduced by W. Spottiswoode, allows the absorption in the apparatus of fig. 1 to be raised to about 80 c.c. per hour, and the method is very convenient for the purification of small quantities of argon and for determinations of the amount present in various samples of gas, *e.g.* in the gases expelled from solution in water. A convenient adjunct to this apparatus is a small voltameter, with the aid of which oxygen or hydrogen can be introduced at pleasure. The gradual elimination of the nitrogen is tested at a moment's notice with a miniature spectroscope. For this purpose a small Leyden jar is connected as usual to the secondary terminals, and if necessary the force of the discharge is moderated by the insertion of resistance in the primary circuit. When with a fairly wide slit the yellow line is no longer visible, the residual nitrogen may be considered to have fallen below 2 or 3 %. During this stage the oxygen should be in considerable excess. When the yellow line of nitrogen has disappeared, and no further contraction seems to be in progress, the oxygen may be removed by cautious introduction of hydrogen. The spectrum may now be further examined with a more powerful instrument. The most conspicuous group in the argon spectrum at atmospheric pressure is that first recorded by A. Schuster (fig. 2). Water vapour and excess of oxygen in moderation do not interfere seriously with its visibility. It is of interest to note that the argon spectrum may be fully developed by operating upon a miniature scale, starting with only 5 c.c. of air (*Phil. Mag.* vol. i. p. 103, 1901).

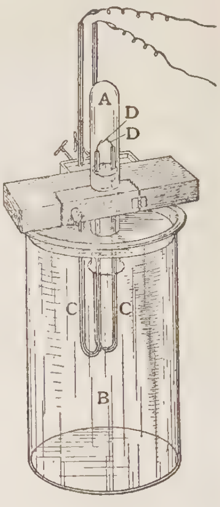

FIG. 1.

The development of Cavendish's method upon a large scale involves arrangements different from what would at first be expected. The transformer working from a public supply should give about 6000 volts on open circuit, although when the electric flame is established the voltage on the platinums is only from 1600 to 2000. No sufficient advantage is attained by raising the pressure of the gases above atmosphere, but a capacious vessel is necessary. This may consist of a glass sphere of 50 litres' capacity, into the neck of which, presented downwards, the necessary tubes are fitted. The whole of the interior surface is washed with a fountain of alkali, kept in circulation by means of a small centrifugal pump. In this apparatus, and with about one horse-power utilized at the transformer, the absorption of gas is 21 litres per hour ("The Oxidation of Nitrogen Gas," *Trans. Chem. Soc.*, 1897).

In one experiment, specially undertaken for the sake of measurement, the total air employed was 9250 c.c., and the oxygen consumed, manipulated with the aid of partially deaërated water, amounted to 10,820 c.c. The oxygen contained in the air would be 1942 c.c.; so that the quantities of atmospheric nitrogen and of total oxygen which enter into combination would be 7308 c.c. and 12,762 c.c. respectively. This corresponds to $N+1{\cdot}75\ O$, the oxygen being decidedly in excess of the proportion required to form nitrous acid. The argon ultimately found was 75·0 c.c., or a little more than 1 % of the atmospheric nitrogen used. A subsequent determination over mercury by A. M. Kellas (*Proc. Roy. Soc.* lix. p. 66, 1895) gave 1·186 c.c. as the amount of argon present in 100 c.c. of mixed atmospheric nitrogen and argon. In the earlier stages of the inquiry, when it was important to meet the doubts which had been expressed as to the presence of the new gas in the atmosphere, blank experiments were executed in which air was replaced by nitrogen from ammonium nitrite. The residual argon, derived doubtless from the water used to manipulate the gases, was but a small fraction of what would have been obtained from a corresponding quantity of air.

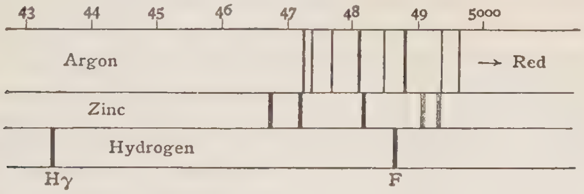

FIG. 2.

The other method by which nitrogen may be absorbed on a considerable scale is by the aid of magnesium. The metal in the form of thin turnings is charged into hard glass or iron tubes heated to a full red in a combustion furnace. Into this air, previously deprived of oxygen by red-hot copper and thoroughly dried, is led in a continuous stream. At this temperature the nitrogen combines with the magnesium, and thus the argon is concentrated. A still more potent absorption is afforded by calcium prepared *in situ* by heating a mixture of magnesium dust with thoroughly dehydrated quick-lime. The density of argon, prepared and purified by magnesium, was found by Sir William Ramsay to be 19·941 on the O=16 scale. The volume actually weighed was 163 c.c. Subsequently large-scale operations with the same apparatus as had been used for the principal gases gave an almost identical result (19·940) for argon prepared with oxygen.

Argon is soluble in water at 12° C. to about 4·0%, that is, it is about 2½ times more soluble than nitrogen. We should thus expect to find it in increased proportion in the dissolved gases of rain-water. Experiment has confirmed this anticipation. The weight of a mixture of argon and nitrogen prepared from the dissolved gases showed an excess of 24 mg. over the weight of true nitrogen, the corresponding excess for the atmospheric mixture being only 11 mg. Argon is contained in the gases liberated by many thermal springs, but not in special quantity. The gas collected from the King's Spring at Bath gave only ½%, *i.e.* half the atmospheric proportion.

The most remarkable physical property of argon relates to the constant known as the ratio of specific heats. When a gas is warmed one degree, the heat which must be supplied depends upon whether the operation is conducted at a constant volume or at a constant pressure, being greater in the latter case. The ratio of specific heats of the principal gases is 1·4, which, according to the kinetic theory, is an indication that an important fraction of the energy absorbed is devoted to rotation or vibration. If, as for Boscovitch points, the whole energy is translatory, the ratio of specific heats must be 1·67. This is precisely the number found from the velocity of sound in argon as determined by Kundt's method, and it leaves no room for any sensible energy of rotatory or vibrational motion. The same value had previously been found for mercury vapour by Kundt and Warburg, and had been regarded as confirmatory of the monatomic character attributed on chemical grounds to the mercury molecule. It may be added that helium has the same character as argon in respect of specific heats (Ramsay, *Proc. Roy. Soc.* l. p. 86, 1895).

The refractivity of argon is ·961 of that of air. This low refractivity is noteworthy as strongly antagonistic to the view at one time favoured by eminent chemists that argon was a condensed form of nitrogen represented by N_3. The viscosity of argon is 1·21, referred to air, somewhat higher than for oxygen, which stands at the head of the list of the principal gases ("On some Physical Properties of Argon and Helium," *Proc. Roy. Soc.* vol. lix. p. 198, 1896).

The spectrum shows remarkable peculiarities. According to circumstances, the colour of the light obtained from a Plücker vacuum tube changes "from red to a rich steel blue," to use the words of Crookes, who first described the phenomenon. A third spectrum is distinguished by J. M. Eder and Edward Valenta. The red spectrum is obtained at moderately low pressures (5 mm.) by the use of a Ruhmkorff coil without a jar or air-gap. The red lines at 7056 and 6965 (Crookes) are characteristic. The blue spectrum is best seen at a somewhat lower pressure (1 mm. to 2·5 mm.), and usually requires a Leyden jar to be connected to the secondary terminals. In some conditions very small causes effect a transition from the one spectrum to the other. The course of electrical events attending the operation of a Ruhmkorff coil being extremely complicated, special interest attaches to some experiments conducted by John Trowbridge and T. W. Richards, in which the source of power was a secondary battery of 5000 cells. At a pressure of 1 mm. the red glow of argon was readily obtained with a voltage of 2000, but not with much less. After the discharge was once started, the difference of potentials at the terminals of the tube varied from 630 volts upwards.

The introduction of a capacity between the terminals of the Geissler tube, for example two plates of metal 1600 sq. cm. in area separated by a glass plate 1 cm. thick, made no difference in the red glow so long as the connexions were good and the condenser was quiet. As soon as a spark-gap was introduced, or the condenser began to emit the humming sound peculiar to it, the beautiful blue glow so characteristic of argon immediately appeared. (*Phil. Mag.* xliii. p. 77, 1897.)

The behaviour of argon at low temperatures was investigated by K. S. Olszewski (*Phil. Trans.*, 1895, p. 253). The following results are extracted from the table given by him:—

Name.	Critical Temperature, Cent.	Critical Pressure, Atmos.	Boiling Point, Cent.	Freezing Point, Cent.
Nitrogen . .	−146·0	35·0	−194·4	−214·0
Argon . .	−121·0	50·6	−187·0	−189·6
Oxygen . .	−118·8	50·8	−182·7	?

The smallness of the interval between the boiling and freezing points is noteworthy.

From the manner of its preparation it was clear at an early stage that argon would not combine with magnesium or calcium at a red heat, nor under the influence of the electric discharge with oxygen, hydrogen or nitrogen. Numerous other attempts to induce combination also failed. Nor does it appear that any well-defined compound of argon has yet been prepared. It was found, however, by M. P. E. Berthelot that under the influence of the silent electric discharge, a mixture of benzene vapour and argon underwent contraction, with formation of a gummy product from which the argon could be recovered.

The facts detailed in the original memoir led to the conclusion that argon was an element or a mixture of elements, but the question between these alternatives was left open. The behaviour on liquefaction, however, seemed to prove that in the latter case either the proportion of the subordinate constituents was small, or else that the various constituents were but little contrasted. An attempt, somewhat later, by Ramsay and J. Norman Collie to separate argon by diffusion into two parts, which should have different densities or refractivities, led to no distinct effect. More recently Ramsay and M. W. Travers have obtained evidence of the existence in the atmosphere of three new gases, besides helium, to which have been assigned the names of neon, krypton and xenon. These gases agree with argon in respect of the ratio of the specific heats and in being non-oxidizable under the electric spark. As originally defined, argon included small proportions of these gases, but it is now preferable to limit the name to the principal constituent and to regard the newer gases as "companions of argon." The physical constants associated with the name will scarcely be changed, since the proportion of the "companions" is so small. Sir William Ramsay considers that probably the volume of all of them taken together does not exceed $\frac{1}{400}$th part of that of the argon. The physical properties of these gases are given in the following table (*Proc. Roy. Soc.* lxvii. p. 331, 1900):—

	Helium.	Neon.	Argon.	Krypton.	Xenon.
Refractivities (air = 1)	·1238	·2345	·968	1·449	2·364
Densities (O = 16)	1·98	9·97	19·96	40·88	64
Boiling points at 760 mm.	c. 6°[1] abs.	?	86·9° abs.	121·33° abs.	163·9° abs.
Critical temperatures	?	below 68° abs.	155·6° abs.	210·5° abs.	287·7° abs.
Critical pressures	?	?	40·2 metres.	41·24 metres.	43·5 metres.
Weight of 1 c.c. of liquid	?	?	1·212 gm.	2·155 gm.	3·52 gm.

The glow obtained in vacuum tubes is highly characteristic, whether as seen directly or as analysed by the spectroscope.

Now that liquid air is available in many laboratories, it forms an advantageous starting-point in the preparation of argon. Being less volatile than nitrogen, argon accumulates relatively as liquid air evaporates. That the proportion of oxygen increases at the same time is little or no drawback. The following analyses (Rayleigh, *Phil. Mag.*, June 1903) of the *vapour* arising from liquid air at various stages of the evaporation will give an idea of the course of events:—

Percentage of Oxygen.	Percentage of Argon.	Argon as a Percentage of the Nitrogen and Argon.
30	1·3	1·9
43	2·0	3·5
64	2·0	5·6
75	2·1	8·4
90	2·0	20·0

(R.)

ARGONAUTS (Ἀργοναῦται, the sailors of the "Argo"), in Greek legend a band of heroes who took part in the Argonautic expedition under the command of Jason, to fetch the golden fleece. This task had been imposed on Jason by his uncle Pelias (*q.v.*), who had usurped the throne of Iolcus in Thessaly, which rightfully belonged to Jason's father Aeson. The story of the fleece was as follows. Jason's uncle Athamas had two children, Phrixus and Helle, by his wife Nephele, the cloud goddess. But after a time he became enamoured of Ino, the daughter of Cadmus, and neglected Nephele, who disappeared in anger. Ino, who hated the children of Nephele, persuaded Athamas, by means of a false oracle, to offer Phrixus as a sacrifice, as the only means of alleviating a famine which she herself had caused by ordering the grain to be secretly roasted before it was sown. But before the sacrifice the shade of Nephele appeared to Phrixus, bringing a ram with a golden fleece on which he and his sister Helle endeavoured to escape over the sea. Helle fell off and was drowned in the strait, which after her was called the Hellespont. Phrixus, however, reached the other side in safety, and proceeding by land to Aea in Colchis on the farther shore of the Euxine Sea, sacrificed the ram, and hung up its fleece in the grove of Ares, where it was guarded by a sleepless dragon.

Jason, having undertaken the quest of the fleece, called upon the noblest heroes of Greece to take part in the expedition. According to the original story, the crew consisted of the chief members of Jason's own race, the Minyae. But when the legend became common property, other and better-known heroes were added to their number—Orpheus, Castor and Polydeuces (Pollux), Zetes and Calaïs, the winged sons of Boreas, Meleager, Theseus, Heracles. The crew was supposed to consist of fifty, agreeing in number with the fifty oars of the "Argo," so called from its builder Argos, the son of Phrixus, or from ἀργός (swift). It was a larger vessel than had ever been seen before, built of pine-wood that never rotted from Mount Pelion. The goddess Athena herself superintended its construction, and inserted in the prow a piece of oak from Dodona, which was endowed with the power of speaking and delivering oracles. The outward course of the "Argo" was the same as that of the Greek traders, whose settlements as early as the 6th century B.C. dotted the southern shores of the Euxine. The first landing-place was the island of Lemnos, which was occupied only by women, who had put to death their fathers, husbands and brothers. Here the Argonauts remained some months, until they were persuaded by Heracles to leave. It is known from Herodotus (iv. 145) that the Minyae had formed settlements at Lemnos at a very early date. Proceeding up the Hellespont, they sailed to the country of the Doliones, by whose king, Cyzicus, they were hospitably received. After their departure, being driven back to the same place by a storm, they were attacked by the Doliones, who did not recognize them, and in a battle which took place Cyzicus was killed by Jason. After Cyzicus had been duly mourned and buried, the Argonauts proceeded along the coast of Mysia, where occurred the incident of Heracles and Hylas (*q.v.*). On reaching the country of the Bebryces, they again landed to get water, and were challenged by the king, Amycus, to match him with a boxer. Polydeuces came forward, and in the end overpowered his adversary, and bound him to a tree, or according to others, slew him. At the entrance to the Euxine, at Salmydessus on the coast of Thrace, they met Phineus, the blind and aged king whose food was being constantly polluted by the Harpies. He knew the course to Colchis, and offered to tell it, if the Argonauts would free him from the Harpies. This was done by the winged sons of Boreas, and Phineus now told them their course, and that the way to pass through the Symplegades or Cyanean rocks—two cliffs which moved on their bases and crushed whatever sought to pass—was first to fly a pigeon through, and when the cliffs, having closed on the pigeon, began to retire to each side, to row the "Argo" swiftly through. His advice was successfully followed, and the "Argo" made the passage unscathed, except for trifling damage to the stern. From that time the rocks became fixed and never closed again. The next halting-places were the country of the Maryandini, where the helmsman Tiphys died, and the land of the Amazons on the banks of the Thermodon. At the island of Aretias they drove away the Stymphalian birds, who used their feathers of brass as arrows. Here they found and took on board the four sons of Phrixus who, after their father's death, had been sent by Aeetes, king of Colchis, to fetch the treasures of Orchomenus, but had been driven by a storm upon the island. Passing near Mount Caucasus, they heard the groans of Prometheus and the flapping of the wings of the eagle which gnawed his liver. They now reached their goal, the river Phasis, and the following morning Jason repaired to the palace of Aeetes, and demanded the golden fleece. Aeetes required of Jason that he should first yoke to a plough his bulls, given him by Hephaestus, which snorted fire and had hoofs of brass, and with them plough the field of Ares. That done, the field was to be sown with the dragons' teeth brought by Phrixus, from which armed men were to spring. Successful so far by means of the mixture which Medea, daughter of Aeetes, had given him as proof against fire and sword, Jason was next allowed to approach the dragon which watched the fleece; Medea soothed the monster with another mixture, and Jason became master of the fleece. Then the voyage homeward began, Medea accompanying Jason, and Aeetes pursuing them. To delay him and obtain escape, Medea dismembered her young brother Absyrtus, whom she had taken with her, and cast his limbs about in the sea for his father to pick up. Her plan succeeded, and while Aeetes was burying the remains of his son at Tomi, Jason and Medea escaped. In another account Absyrtus had grown to manhood then, and met his death in an encounter with Jason, in pursuit of whom he had been sent. Of the homeward course various accounts are given. In the oldest (Pindar) the "Argo" sailed along the river Phasis into the eastern Oceanus, round Asia to the south coast of Libya, thence to the mythical lake Tritonis, after being carried twelve days over land through Libya, and thence again to Iolcus. Hecataeus of Miletus (Schol. Apollon. Rhod. iv. 259) suggested that from the Oceanus it may have sailed into the Nile, and so to the Mediterranean. Others, like Sophocles, described the return voyage as differing from the outward course only in taking the northern instead of the southern shore of the Euxine. Some (pseudo-Orpheus) supposed that the Argonauts had sailed up the river Tanaïs, passed into another river, and by it reached the North Sea, returning to the Mediterranean by the Pillars of Hercules. Again, others (Apollonius Rhodius) laid down the course as up the Danube (Ister), from it into the Adriatic by a supposed mouth of that river, and on to Corcyra, where a storm overtook them. Next they sailed up the Eridanus into the Rhodanus, passing through the country of the Celts and Ligurians to the Stoechades, then to the island of Aethalia (Elba), finally reaching the Tyrrhenian Sea and the island of Circe, who absolved them from the murder of Absyrtus. Then they passed safely through Scylla and Charybdis, past the Sirens, through the Planctae, over the island of the Sun, Trinacria and on to Corcyra again, the land of the Phaeacians, where Jason and Medea held their nuptials. They had sighted the coast of Peloponnesus when a storm overtook them and drove them to the coast of Libya, where they were saved from a quicksand by the local nymphs. The "Argo" was now carried twelve days and twelve nights to the Hesperides, and thence to lake Tritonis (where the seer Mopsus died), whence Triton conducted them to the Mediterranean. At Crete the brazen Talos, who would not permit them to land, was killed by the Dioscuri. At Anaphe, one of the Sporades, they were saved from a storm by Apollo. Finally, they reached Iolcus, and the "Argo" was placed in a groove sacred to Poseidon on the isthmus of Corinth. Jason's death, it is said, was afterwards caused by part of the stern giving way and falling upon him.

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[1] Sir James Dewar, *Compt. Rend.* (1904), 139, 261 and 241.

The story of the expedition of the Argonauts is very old. Homer was acquainted with it and speaks of the "Argo" as well known to all men; the wanderings of Odysseus may have been partly founded on its voyage. Pindar, in the fourth Pythian ode, gives the oldest detailed account of it. In Greek, there are also extant the *Argonautica* of Apollonius Rhodius and the pseudo-Orpheus (4th century A.D.), and the account in Apollodorus (i. 9), based on the best extant authorities; in Latin, the imitation of Apollonius (a free translation or adaptation of whose *Argonautica* was made by Terentius Varro Atacinus in the time of Cicero) by Valerius Flaccus. In ancient times the expedition was regarded as a historical fact, an incident in the opening up of the Euxine to Greek commerce and colonization. Its object was the acquisition of gold, which was caught by the inhabitants of Colchis in fleeces as it was washed down the rivers. Suidas says that the fleece was a book written on parchment, which taught how to make gold by chemical processes. The rationalists explained the ram on which Phrixus crossed the sea as the name or ornament of the ship on which he escaped. Several interpretations of the legend have been put forward by modern scholars. According to C. O. Müller, it had its origin in the worship of Zeus Laphystius; the fleece is the pledge of reconciliation; Jason is a propitiating god of health, Medea a goddess akin to Hera; Aeetes is connected with the Colchian sun-worship. Forchhammer saw in it an old nature symbolism; Jason, the god of healing and fruitfulness, brought the fleece—the fertilizing rain-cloud—to the western land that was parched by the heat of the sun. Others treat it as a solar myth; the ram is the light of the sun, the flight of Phrixus and the death of Helle signify its setting, the recovery of the fleece its rising again.

There are numerous treatises on the subject: F. Vater, *Der Argonautenzug* (1845); J. Stender, *De Argonautarum Expeditione* (1874); D. Kennerknecht, *De Argonautarum Fabula* (1886); M. Groeger, *De Argonautarum Fabularum Historia* (1889); see also Grote, *History of Greece*, part i. ch. 13; Preller, *Griechische Mythologie*; articles in Pauly-Wissowa's *Realencyclopädie*, Roscher's *Lexikon der Mythologie*, and Daremberg and Saglio's *Dictionnaire des Antiquités*.

ARGONNE, a rocky forest-clad plateau in the north-east of France, extending along the borders of Lorraine and Champagne, and forming part of the departments of Ardennes, Meuse and Marne. The Argonne stretches from S.S.E. to N.N.W., a distance of 63 m. with an average breadth of 19 m., and an average height of 1150 ft. It forms the connecting-link between the plateaus of Haute Marne and the Ardennes, and is bounded E. by the Meuse and W. by the Ante and the Aisne, which rises in its southern plateau. The valleys of the Aire and other rivers traverse it longitudinally, a fact to which its importance as a bulwark of north-eastern France is largely due. Of the numerous forests which clothe both slopes of the plateau, the chief is that of Argonne, which extends for 25 m. between the Aire and the Aisne.

For Dumouriez's Argonne campaign in 1792, see FRENCH REVOLUTIONARY WARS.

ARGOS, the name of several ancient Greek cities or districts, but specially appropriated in historic times to the chief town in eastern Peloponnese, whence the peninsula of Argolis derives its name. The Argeia, or territory of Argos proper, consisted of a shelving plain at the head of the Gulf of Argolis, enclosed between the eastern wall of the Arcadian plateau and the central highlands of Argolis. The waters of this valley (Inachus, Charadrus, Erasinus), when properly regulated, favoured the growth of excellent crops, and the capital standing only 3 m. from the sea was well placed for Levantine trade. Hence Argos was perhaps the earliest town of importance in Greece; the legends indicate its high antiquity and its early intercourse with foreign countries (Egypt, Lycia, &c.). Though eclipsed in the Homeric age, when it appears as the seat of Diomedes, by the later foundation of Mycenae, it regained its predominance after the invasion of the Dorians (*q.v.*), who seem to have occupied this site in considerable force. In accordance with the tradition which assigned the portion to the eldest-born of the Heracleid conquerors, Argos was for some centuries the leading power in Peloponnesus. There is good evidence that its sway extended originally over the entire Argolis peninsula, the land east of Parnon, Cythera, Aegina and Sicyon. Under King Pheidon the Argive empire embraced all eastern Peloponnesus, and its influence spread even to the western districts.

This supremacy was first challenged about the 8th century by Sparta. Though organized on similar lines, with a citizen population divided into three Dorian tribes (and one containing other elements), with a class of Perioeci (neighbouring dependents) and of serfs, the Argives had no more constant foe than their Lacedaemonian kinsmen. In a protracted struggle for the possession of the eastern seaboard of Laconia in spite of the victory at Hysiae (apparently in 669), they were gradually driven back, until by 550 they had lost the whole coast strip of Cynuria. A later attempt to retrieve this loss resulted in a crushing defeat near Tiryns at the hands of King Cleomenes I. (probably in 495), which so weakened the Argives that they had to open the franchise to their Perioeci. By this time they had also lost control over the other cities of Argolis, which they never succeeded in recovering. Partly in consequence of its defeat, partly out of jealousy against Sparta, Argos took no part in the war against Xerxes. Indeed on this, as on later occasions, its relations with Persia seem to have been friendly. About 470 the conflict with Sparta was renewed in concert with the Arcadians, but all that the Argives could achieve was to destroy their revolted dependencies of Mycenae and Tiryns (468 or 464). In 461 they contracted an alliance with Athens, thus renewing a connexion established by Peisistratus (*q.v.*). In spite of this league Argos made no headway against Sparta, and in 451 consented to a truce. A more important result of Athenian intervention was the substitution of the democratic government for the oligarchy which had succeeded the early monarchy; at any rate forty years later we find that Argos possessed complete democratic institutions.

During the early Peloponnesian War Argos remained neutral; after the break-up of the Spartan confederacy consequent upon the peace of Nicias the alliance of this state, with its unimpaired resources and flourishing commerce, was courted on all sides. By throwing in her lot with the Peloponnesian democracies and Athens, Argos seriously endangered Sparta's supremacy, but the defeat of Mantineia (418) and a successful rising of the Argive oligarchs spoilt this chance. The speedily restored democracy put little heart into the conflict, and beyond sending mercenary detachments, lent Athens no further help in the war (see Peloponnesian War).

At the outset of the 4th century, Argos, with a population and resources equalling those of Athens, took a prominent part in the Corinthian League against Sparta. In 394 the Argives helped to garrison Corinth, and the latter state seems for a while to have been annexed by them. But the peace of Antalcidas (*q.v.*) dissolved this connexion, and barred Argive pretensions to control all Argolis. After the battle of Leuctra Argos experienced a political crisis; the oligarchs attempted a revolution, but were put down by their opponents with such vindictiveness that 1200 of them are said to have been executed (370). The democracy consistently supported the victorious Thebans against Sparta, figuring with a large contingent on the decisive field of Mantineia (362). When pressed in turn by their old foes the Argives were among the first to call in Philip of Macedon, who reinstated them in Cynuria after becoming master of Greece. In the Lamian War Argos was induced to side with the patriots against Macedonia; after its capture by Cassander from Polyperchon (317) it fell in 303 into the hands of Demetrius Poliorcetes. In 272 the Argives joined Sparta in resisting the ambition of King Pyrrhus of Epirus, whose death ensued in an unsuccessful night attack upon the city. They passed instead into the power of Antigonus Gonatas of Macedonia, who maintained his control by means of tyrants. After several unavailing attempts Aratus (*q.v.*) contrived to win Argos for the Achaean League (229), in which it remained save during a brief occupation by the Spartans Cleomenes III. (*q.v.*) and Nabis (224 and 196).

The Roman conquest of Achaea enhanced the prosperity of Argos by removing the trade competition of Corinth. Under the Empire, Argos was the headquarters of the Achaean synod, and continued to be a resort of Roman merchants. Though plundered by the Goths in A.D. 267 and 395 it retained some of its commerce and culture in Byzantine days. The town was captured by the Franks in 1210; after 1246 it was held in fief by the rulers of Athens. In later centuries it became the scene of frequent conflicts between the Venetians and the Turks, and on two occasions (1397 and 1500) its population was massacred by the latter. Repeopled with Albanian settlers, Argos was chosen as seat of the Greek national assembly in the wars of independence. Its citadel was courageously defended by the patriots (1822); in 1825 the city was burnt to the ground by Ibrahim Pasha. The present town of 10,000 inhabitants is a purely agricultural settlement. The Argive plain, though not yet sufficiently reclaimed, yields good crops of corn, rice and tobacco.

In the early days of Greece the Argives enjoyed high repute for their musical talent. Their school of bronze sculpture, whose first famous exponent was Ageladas (Hagelaidas), the reputed master of Pheidias, reached its climax towards the end of the 5th century in the atelier of Polyclitus (*q.v.*) and his pupils. To this period also belongs the new Heraeum (see below), one of the most splendid temples of Greece.

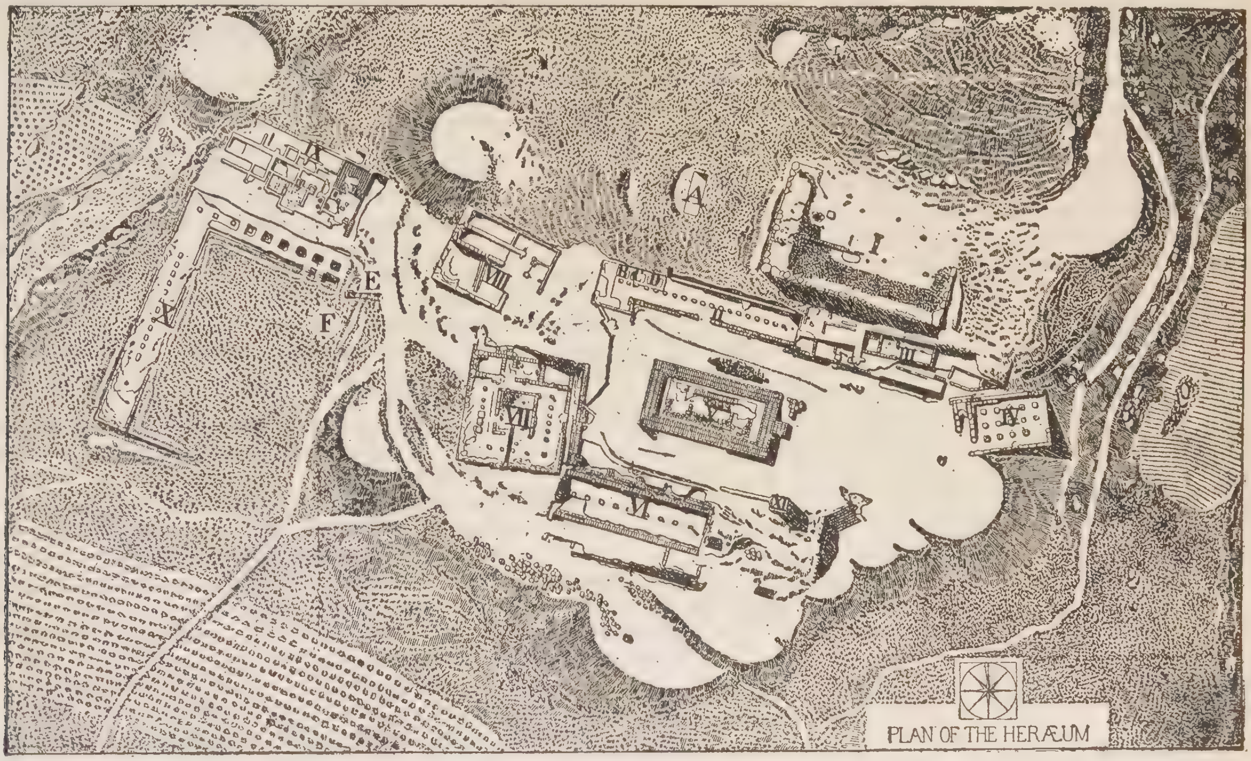
Remains of the early city are still visible on the Larissa acropolis, which towers 900 ft. high to the north-west of the town. A few courses of the ancient ramparts appear under the double enceinte of the surviving medieval fortress. An aqueduct of Greek times is represented by some fragments on the south-western edge. In the slope above the town was hewn a theatre equalling that of Athens in size. The Aspis or smaller citadel to the north-east has revealed traces of an early Mycenaean settlement; the Deiras or ridge connecting the two heights contains a prehistoric cemetery.

Authorities.—Herodotus, Thucydides, Xenophon; Plutarch, *Pyrrhus*, 30-34; Strabo pp. 373-374; Pausanias ii. 15-24; W. M. Leake, *Travels in the Morea* (London, 1835), ii. chs. 19-22; E. Curtius, *Peloponnesos* (Gotha, 1851), ii. 350-364; H. F. Tozer, *Geography of Greece* (London, 1873), pp. 292-294; J. K. Kophiniotis, *Ἱστορία τοῦ Ἄργους* (Athens, 1892–1893); W. Vollgraff in *Bulletin de Correspondance Hellénique* (1904, pp. 364-399; 1906, pp. 1-45; 1907, pp. 139-184). (M. O. B. C.)

The Argive Heraeum.—Since 1892 investigation has added considerably to our knowledge concerning the Argive Heraeum or Heraion, the temple of Hera, which stood, according to Pausanias, "on one of the lower slopes of Euboea." The term Euboea did not designate the eminence upon which the Heraeum is placed, or the mountain-top behind the Heraeum only, but, as Pausanias distinctly indicates, the group of foothills of the hilly district adjoining the mountain. When once we admit that this designated not only the mountain, which is 1730 ft. high, but also the hilly district adjoining it, the general scale of distance for this site grows larger. The territory of the Heraeum was divided into three parts, namely Euboea, Acraea and Prosymna. Pausanias tells us that the Heraeum is 15 stadia from Mycenae. Strabo, on the other hand, says that the Heraeum was 40 stadia from Argos and 10 from Mycenae. Both authors underestimate the distance from Mycenae, which is about 25 stadia, or a little more than 3 m., while the distance from Argos is 45 stadia, or a little more than 5 m. The distance from the Heraeum to the ancient Midea is slightly greater than to Mycenae, while that from the Heraeum to Tiryns is about 6 m. The Argive Heraeum was the most important centre of Hera and Juno worship in the ancient world; it always remained the chief sanctuary of the Argive district, and was in all probability the earliest site of civilized life in the country inhabited by the Argive people. In fact, whereas the site of Hissarlik, the ancient Troy, is not in Greece proper, but in Asia Minor, and can thus not furnish the most direct evidence for the earliest Hellenic civilization as such; and whereas Tiryns, Mycenae, and the city of Argos, each represent only one definite period in the successive stages of civilization, the Argive Heraeum, holding the central site of early civilization in Greece proper, not only retained its importance during the three periods marked by the supremacy of Tiryns, Mycenae and the city of Argos, but in all probability antedated them as a centre of civilized Argive life. These conditions alone account for the extreme archaeological importance of this ancient sanctuary.

According to tradition the Heraeum was founded by Phoroneus at least thirteen generations before Agamemnon and the Achaeans ruled. It is highly probable that before it became important merely as a temple, it was the fortified centre uniting the Argive people dwelling in the plain, the citadel which was superseded in this function by Tiryns. There is ample evidence to show that it was the chief sanctuary during the Tirynthian period. When Mycenae was built under the Perseïds it was still the chief sanctuary for that centre, which superseded Tiryns in its dominance over the district, and which this temple clearly antedated in construction. According to the *Dictys Cretensis*, it was at this Heraeum that Agamemnon assembled the leaders before setting out for Troy. In the period of Dorian supremacy, in spite of the new cults which were introduced by these people, the Heraeum maintained its supreme importance: it was here that the tablets recording the succession of priestesses were kept which served as a chronological standard for the Argive people, and even far beyond their borders; and it was here that Pheidon deposited the ὀβελίσκοι when he introduced coinage into Greece.

We learn from Strabo that the Heraeum was the joint sanctuary for Mycenae and Argos. But in the 5th century the city of Argos vanquished the Mycenaeans, and from that time onwards the city of Argos becomes the political centre of the district, while the Heraeum remains the religious centre. And when in the year 423 B.C., through the negligence of the priestess Chryseis, the old temple was burnt down, the Argives erected a splendid new temple, built by Eupolemos, in which was placed the great gold and ivory statue of Hera, by the sculptor Polyclitus, the contemporary and rival of Pheidias, which was one of the most perfect works of sculpture in antiquity. Pausanias describes the temple and its contents (ii. 17), and in his time he still saw the ruins of the older burnt temple above the temple of Eupolemos.



Plan of the Heraeum (*surveyed and drawn by Edward L. Tilton*).

I. Old Temple.
II. Stoa.
III. Stoa.
IV. East Building.
V. 5th-Century Temple.
VI. South Stoa.
VII. West Building.
VIII. North-West Building.
IX. Roman Building.
X. Lower Stoa.
XI. Phylakeion.
A, B, C, D, E, F, Cisterns.

All these facts have been verified and illustrated by the excavations of the American Archaeological Institute and School of Athens, which were carried on from 1892 to 1895. In 1854 A. R. Rhangabé made tentative excavations on this site, digging a trench along the north and east sides of the second temple. Of these excavations no trace was to be seen when those of 1892 were begun. The excavations have shown that the sanctuary, instead of consisting of but one temple with the ruins of the older one above it, contained at least eleven separate buildings, occupying an area of about 975 ft. by 325.

On the uppermost terrace, defined by the great Cyclopean supporting wall, exactly as described by Pausanias, the excavations revealed a layer of ashes and charred wood, below which were found numerous objects of earliest date, together with some remains of the walls resting on a polygonal platform—all forming part of the earliest temple. Immediately adjoining the Cyclopean wall and below it were found traces of small houses of the rudest, earliest masonry which are pre-Mycenaean, if not pre-Cyclopean.

We then descend to the second terrace, in the centre of which the substructure of the great second temple was revealed, together with so much of the walls, as well as the several architectural members forming the superstructure, that it has been possible for E. L. Tilton to design a complete restoration of the temple. On the northern side of this terrace, between the second temple and the Cyclopean supporting wall, a long stoa or colonnade runs from east to west abutting at the west end in structures which evidently contained a well-house and waterworks; while at the eastern end of this stoa a number of chambers were erected against the hill, in front of which were placed statues and inscriptions, the bases for which are still extant. At the easternmost end of this second terrace a large hall with three rows of columns in the interior, with a porch and entrance at the west end facing the temple, is built upon elaborate supporting walls of good masonry.

Below the second terrace at the south-west end a large and complicated building, with an open courtyard surrounded on three sides by a colonnade and with chambers opening out towards the north, may have served as a gymnasium or a sanatorium. It is of good early Greek architecture, earlier than the second temple. A curious, ruder building to the north of this and to the west of the second terrace is probably of much earlier date, perhaps of the Mycenaean period, and may have served as propylaea.

Immediately below the second temple at the foot of the elevation on which this temple stands, towards the south, and thus facing the city of Argos, a splendid stoa or colonnade, to which large flights of steps lead, was erected about the time of the building of the second temple. It is a part of the great plan to give worthy access to the temple from the city of Argos. To the east of this large flights of steps lead up to the temple proper.

At the western extremity of the whole site, immediately beside the river-bed, we again have a huge stoa running round two sides of a square, which was no doubt connected with the functions of this sanctuary as a health resort, especially for women, the goddess

Hera presiding over and protecting married life and childbirth. Finally, immediately to the north of this western stoa there is an extensive house of Roman times also connected with baths.

While the buildings give archaeological evidence for every period of Greek life and history from the pre-Mycenaean period down to Roman times, the topography itself shows that the Heraeum must have been constructed before Mycenae and without any regard to it. The foothills which it occupies form the western boundary to the Argive plain as it stretches down towards the sea in the Gulf of Nauplia. While it was thus probably chosen as the earliest site for a citadel facing the sea, its second period points towards Tiryns and Midea. It could not have been built as the sanctuary of Mycenae, which was placed farther up towards the north-west in the hills, and could not be seen from the Heraeum, its inhabitants again not being able to see their sanctuary. The west building, the traces of bridges and roads, show that at one time it did hold some relation to Mycenae; but this was long after its foundation or the building of the huge Cyclopean supporting wall which is coeval with the walls of Tiryns, these again being earlier than those of Mycenae. There are, moreover, traces of still more primitive walls, built of rude small stones placed one upon the other without mortar, which are in character earlier than those of Tiryns, and have their parallel in the lowest layers of Hissarlik.

Bearing out the evidence of tradition as well as architecture, the numerous finds of individual objects in terra-cotta figurines, vases, bronzes, engraved stones, &c., point to organized civilized life on this site many generations before Mycenae was built, *a fortiori* before the life as depicted by Homer flourished—nay, before, as tradition has it, under Proetus the walls of Tiryns were erected. We are aided in forming some estimate of the chronological sequence preceding the Mycenaean age, as suggested by the finds of the Heraeum, in the new distribution which Dörpfeld has been led to make of the chronological stratification of Hissarlik. For the layer, which he now assigns to the Mycenaean period, is the sixth stratum from below. Now, as some of the remains at the Heraeum correspond to the two lowest layers of Hissarlik, the evidence of the Argive temple leads us far beyond the date assigned to the Mycenaean age, and at least into the second millennium B.C. (see also AEGEAN CIVILIZATION). As to its chronological relation to the Cretan sites—Cnossus, Phaestus, &c., and the "Minoan" civilization as determined by Dr A. Evans, see the discussion under CRETE.

This sanctuary still holds a position of central importance as illustrating the art of the highest period in Greek history, namely, the art of the 5th century B.C. under the great sculptor Polyclitus. Though the excavations in the second temple have clearly revealed the outlines of the base upon which the great gold and ivory statue of Hera stood, it is needless to say that no trace of the statue itself has been found. From Pausanias we learn that "the image of Hera is seated and is of colossal size: it is made of gold and ivory, and is the work of Polyclitus." Based on the computations made by the architect of the American excavations, E. L. Tilton, on the ground of the height of the nave, the total height of the image, including the base and the top of the throne, would be about 26 ft., the seated figure of the goddess herself about 18 ft. It is probable that the face, neck, arms and feet were of ivory, while the rest of the figure was draped in gold. Like the Olympian Zeus of Pheidias, Hera was seated on an elaborately decorated throne, holding in her left hand the sceptre, surmounted in her case by the cuckoo (as that of Zeus had an eagle), and in her right, instead of an elaborate figure of Victory (such as the Athena Parthenos and the Olympian Zeus held), simply a pomegranate. The crown was adorned with figures of Graces and the Seasons. A Roman imperial coin of Antoninus Pius shows us on a reduced scale the general composition of the figure; while contemporary Argive coins of the 5th century give a fairly adequate rendering of the head. A further attempt has been made to identify the head in a beautiful marble bust in the British Museum hitherto known as Bacchus (Waldstein, *Journal of Hellenic Studies*, vol. xxi., 1901, pp. 30 seq.)

We also learn from Pausanias that the temple was decorated with "sculptures over the columns, representing some the birth of Zeus and the battle of the gods and giants, others the Trojan War and the taking of Ilium." It was formerly supposed that the phrase "over the columns" pointed to the existence of sculptured metopes, but no pedimental groups. Finds made in the excavations, however, have shown that the temple also had pedimental groups. Besides numerous fragments of nude and draped figures belonging to pedimental statues, a well-preserved and very beautiful head of a female divinity, probably Hera, as well as a draped female torso of excellent workmanship, both belonging to the pediments, have been discovered. Of the metopes also a great number of fragments have been found, together with two almost complete metopes, the one containing the torso of a nude warrior in perfect preservation, as well as ten well-preserved heads. These statues bear the same relation to the sculptor Polyclitus which the Parthenon marbles hold to Pheidias; and the excavations have thus yielded most important material for the illustration of the Argive art of Polyclitus in the 5th century B.C.

See Waldstein, *The Argive Heraeum* (vol. i., Boston and New York, 1902; vol. ii., the Vases by J. C. Hoppin, the Bronzes by H. F. de Cosa, 1905); *Excavations of the American School of Athens at the Heraion of Argos* (1892); and numerous reports and articles in the *American Archaeological Journal* since 1892. (C. W.*)

ARGOSTOLI (anc. *Cephallenia*), the capital of Cephalonia (one of the Ionian islands), and the seat of a bishop of the Greek church. Pop. about 10,000. It possesses an excellent harbour, a quay a mile in length, and a fine bridge. Shipbuilding and silk-spinning are carried on. Near at hand are the ruins of Cranii, which afford fine examples of Greek military architecture; and at the west side of the harbour there is a curious stream, flowing *from* the sea, and employed to drive mills before losing itself in caverns inland.

See Sir C. Fellows's *Journal of an Excursion in Asia Minor* in 1838, and Wiebel's *Die Insel Kephalonia und die Meermühlen von Argostoli* (Hamburg, 1873).

ARGOSY (a corruption, by transposition of letters, of the name of the seaport Ragusa), the term originally for a carrack or merchant ship from Ragusa and other Adriatic ports, now used poetically of any vessel carrying rich merchandise. In English writings of the 16th century the seaport named is variously spelt Ragusa, Aragouse or Aragosa, and ships coming thence were named Ragusyes, Arguzes and Argosies; the last form surviving and passing into literature. The incorrect derivation from Jason's ship, the "Argo," is of modern origin.

ARGUIN, an island (identified by some writers with Hanno's Cerne), off the west coast of Africa, a little south of Cape Blanco, in 20° 25′ N., 16° 37′ W. It is some 4 m. long by 2½ broad, produces gum-arabic, and is the seat of a lucrative turtle-fishery. Off the island, which was discovered by the Portuguese in the 15th century, are extensive and very dangerous reefs. Arguin was occupied in turn by Portuguese, Dutch, English and French; and to France it now belongs. The aridity of the soil and the bad anchorage prevent a permanent settlement. The fishery is mostly carried on by inhabitants of the Canary Isles. In July 1816 the French frigate "Medusa," which carried officers on their way to Senegal to take possession of that country for France, was wrecked off Arguin, 350 lives being lost.

ARGUMENT, a word meaning "proof," "evidence," corresponding in English to the Latin word *argumentum*, from which it is derived; the originating Latin verb *arguere*, to make clear, from which comes the English "argue," is from a root meaning bright, appearing in Greek ἀργής, white. From its primary sense are derived such applications of the word as a chain of reasoning, a fact or reason given to support a proposition, a discussion of the evidence or reasons for or against some theory or proposition and the like. More particularly "argument" means a synopsis of the contents of a book, the outline of a novel, play, &c. In logic it is used for the middle term in a syllogism, and for many species of fallacies, such as the *argumentum ad hominem*, *ad baculum*, &c. (see FALLACY). In mathematics the term has received special meanings; in mathematical tables the "argument" is the quantity upon which the other quantities in the table are made to depend; in the theory of complex variables, *e.g.* such as $a+ib$ where $i=\sqrt{-1}$, the "argument" (or "amplitude") is the angle θ given by $\tan\theta = b/a$. In astronomy, the term is used in connexion with the Ptolemaic theory to denote the angular distance on the epicycle of a planet from the true apogee of the epicycle; and the "equation to the argument" is the angle subtended at the earth by the distance of a planet from the centre of the epicycle.

ARGUS, in ancient Greek mythology, the son of Inachus, Agenor or Arestor, or, according to others, an earth-born hero (autochthon). He was called Panoptes (all-seeing), from having eyes all over his body. After performing several feats of valour, he was appointed by Hera to watch the cow into which Io had been transformed. While doing this he was slain by Hermes, who stoned him to death, or put him to sleep by playing on the flute and then cut off his head. His eyes were transferred by Hera to the tail of the peacock. Argus with his countless eyes originally denoted the starry heavens (Apollodorus ii. 1; Aeschylus, *P. V.* 569; Ovid, *Metam.* i. 264).

Another ARGUS, the old dog of Odysseus, who recognized his master on his return to Ithaca, figures in one of the best-known incidents in Homer's *Odyssey* (xvii. 291-326).

ARGYLL, EARLS AND DUKES OF. The rise of this family of Scottish peers, originally the Campbells of Lochow, and first ennobled as Barons Campbell, is referred to in the article ARGYLLSHIRE.

ARCHIBALD CAMPBELL, 5th earl of Argyll (1530–1573), was the elder son of Archibald, 4th earl of Argyll (d. 1558), and a grandson of Colin, the 3rd earl (d. 1530). His great-grandfather was the 2nd earl, Archibald, who was killed at Flodden in 1513, and this nobleman's father was Colin, Lord Campbell (d. 1493), the founder of the greatness of the Campbell family, who was created earl of Argyll in 1457. With Lord James Stuart, afterwards the regent Murray, the 5th earl of Argyll became an adherent of John Knox about 1556, and like his father was one of the most influential members of the party of religious reform, signing what was probably the first "godly band" in December 1557. As one of the "lords of the congregation" he was one of James Stuart's principal lieutenants during the warfare between the reformers and the regent, Mary of Lorraine; and later with Murray he advised and supported Mary queen of Scots, who regarded him with great favour. It was about this time that William Cecil, afterwards Lord Burghley, referred to Argyll as "a goodly gentleman universally honoured of all Scotland." Owing to his friendship with Mary, Argyll was separated from the party of Knox, but he forsook the queen when she determined to marry Lord Darnley; he was, however, again on Mary's side after Queen Elizabeth's refusal to aid Murray in 1565. Argyll was probably an accomplice in the murder of Rizzio; he was certainly a consenting party to that of Darnley, and then separating himself from Murray he commanded Mary's soldiers after her escape from Lochleven, and by his want of courage and resolution was partly responsible for her defeat at Langside in May 1568. Soon afterwards he made his peace with Murray, but it is possible that he was accessory to the regent's murder in 1570. After this event Argyll became lord high chancellor of Scotland, and he died on the 12th of September 1573. His first wife was an illegitimate daughter of James V., and he was thus half-brother-in-law to Mary and to Murray. His relations with her were not harmonious; he was accused of adultery, and in 1568 he performed a public penance at Stirling.

He left no children, and on his death his half-brother Colin (d. 1584) became 6th earl of Argyll. This nobleman, whose life was partly spent in feuds with the regent Morton, died in October 1584. He was succeeded as 7th earl by his young son Archibald (1576–1638), who became a Roman Catholic, fought for Philip III. of Spain in Flanders, whither he had gone to avoid his creditors, and, having entrusted the care of his estates to his son, died in London.

ARCHIBALD CAMPBELL, 1st marquess and 8th earl of Argyll (1607–1661), eldest son of Archibald, 7th earl, by his first wife, Lady Anne Douglas, daughter of William, 1st earl of Morton, was born in 1607[1] and educated at St Andrews University, where he matriculated on the 15th of January 1622. He had early in life, as Lord Lorne, been entrusted with the possession of the Argyll estates when his father renounced Protestantism and took service with Philip of Spain; and he exercised over his clan an authority almost absolute, disposing of a force of 20,000 retainers, and being, according to Baillie, "by far the most powerful subject in the kingdom." On the outbreak of the religious dispute between the king and Scotland in 1637 his support was eagerly desired by Charles I. He had been made a privy councillor in 1628, and in 1638 the king summoned him, together with Traquair and Roxburgh, to London; but he refused to be won over, openly and courageously warned Charles against his despotic ecclesiastical policy, and showed great hostility towards Laud. In consequence a secret commission was given to the earl of Antrim to invade Argyllshire and stir up the Macdonalds against the Campbells, a wild and foolish project which completely miscarried. Argyll, who inherited the title by the death of his father in 1638, had originally no preference for Presbyterianism, but now definitely took the side of the Covenanters in defence of the national religion and liberties. He continued to attend the meetings of the Assembly after its dissolution by the marquess of Hamilton, when Episcopacy was abolished. In 1639 he sent a statement to Laud, and subsequently to the king, defending the Assembly's action; and raising a body of troops he seized Hamilton's castle of Brodick in Arran. After the pacification of Berwick he carried a motion, in opposition to Montrose, by which the estates secured to themselves the election of the lords of the articles, who had formerly been nominated by the king, a fundamental change in the Scottish constitution, whereby the management of public affairs was entrusted to a representative body and withdrawn from the control of the crown. An attempt by the king to deprive him of his office as justiciary of Argyll and Tarbet failed, and on the prorogation of the parliament by Charles, in May 1640, Argyll moved that it should continue its sittings and that the government and safety of the kingdom should be secured by a committee of the estates, of which, though not a member, he was himself the guiding spirit. In June he was entrusted with a "commission of fire and sword" against the royalists in Atholl and Angus, which, after succeeding in entrapping the earl of Atholl, he carried out with completeness and some cruelty. It was on this occasion that took place the burning of "the bonnie house of Airlie." By this time the personal rivalry and difference in opinion between Montrose and Argyll had led to an open breach. The former arranged that on the occasion of Charles's approaching visit to Scotland, Argyll should be accused of high treason in the parliament. The plot, however, was disclosed, and Montrose with others was imprisoned. Accordingly when the king arrived he found himself deprived of every remnant of influence and authority. It only remained for Charles to make a series of concessions. He transferred the control over judicial and political appointments to the parliament, created Argyll a marquess (1641) with a pension of £1000 a year, and returned home, having in Clarendon's words "made a perfect deed of gift of that kingdom." Meanwhile the king's policy of peace and concession had, as usual, been rudely and treacherously interrupted by a resort to force, an unsuccessful attempt, known as the "incident," being made to kidnap Argyll, Hamilton and Lanark. Argyll was mainly instrumental at this crisis in keeping the national party faithful to what was to him evidently the common cause, and in accomplishing the alliance with the Long Parliament in 1643. In January 1644 he accompanied the Scottish army into England as a member of the committee of both kingdoms and in command of a troop of horse, but was soon in March compelled to return to suppress royalist movements in the north and to defend his own territories. He compelled Huntly to retreat in April, and in July advanced to meet the Irish troops now landed in Argyllshire, which were acting in conjunction with Montrose, who had put himself at the head of the royalist forces in Scotland. A campaign followed in the north in which neither general succeeded in obtaining any advantage over the other, or even in engaging battle. Argyll then returned to Edinburgh, threw up his commission, and retired to Inveraray Castle. Thither Montrose unexpectedly followed him in December, compelled him to flee to Roseneath, and devastated his territories. On the 2nd of February 1645, when following Montrose northwards, Argyll was surprised by him at Inverlochy and witnessed from his barge on the lake, to which he had retired owing to a dislocated arm, a fearful slaughter of his troops, which included 1500 of the Campbells. He arrived at Edinburgh on the 12th of February and was again present at Montrose's further great victory on the 15th of August at Kilsyth, whence he escaped to Newcastle. Argyll was at last delivered from his formidable antagonist by Montrose's final defeat at Philiphaugh on the 12th of September. In 1646 he was sent to negotiate with the king at Newcastle after his surrender to the Scottish army, when he endeavoured to moderate the demands of the parliament and at the same time to persuade the king to accept them. On the 7th of July 1646 he was appointed a member of the Assembly of Divines.

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[1] The date of 1598, previously accepted, is shown by Willcock to be incorrect.

Up to this point the statesmanship of Argyll had been highly successful. The national liberties and religion of Scotland had been defended and guaranteed, and the power of the king in Scotland reduced to a mere shadow. In addition, these privileges had been still further secured by the alliance with the English opposition, and by the subsequent triumph of the parliament and Presbyterianism in the neighbouring kingdom. The sovereign himself, after vainly contending in arms, was a prisoner in their midst. But Argyll's influence could not survive the rupture of the alliance between the two nations on which his whole policy was constructed. He opposed in vain the secret treaty now concluded between the king and the Scots against the parliament, and while Hamilton marched into England and was defeated by Cromwell at Preston, Argyll, after a narrow escape from a surprise at Stirling, joined the Whiggamores, a body of Covenanters at Edinburgh; and, supported by Loudon, Leven and Leslie, he established a new government, which welcomed Cromwell on his arrival there on the 4th of October. This alliance, however, was at once destroyed by the execution of Charles I., which excited universal horror in Scotland. In the series of tangled incidents which followed, Argyll lost control of the national policy. He describes himself at this period as "a distracted man . . . in a distracted time" whose "remedies . . . had the quite contrary operation." He supported the invitation from the Covenanters to Charles II. to land in Scotland, gazed upon the captured Montrose, bound on a cart on his way to execution at Edinburgh, and subsequently, when Charles II. came to Scotland, having signed the Covenant and repudiated Montrose, Argyll remained at the head of the administration. After the defeat of Dunbar, Charles retained his support by the promise of a dukedom and the Garter, and an attempt was made by Argyll to marry the king to his daughter. On the 1st of January 1651 he placed the crown on Charles's head at Scone. But his power had now passed to the Hamilton party. He strongly opposed, but was unable to prevent, the expedition into England, and in the subsequent reduction of Scotland, after having held out in Inveraray Castle for nearly a year, was at last surprised in August 1652 and submitted to the Commonwealth. His ruin was then complete. His policy had failed, his power had vanished. In his estate he was hopelessly in debt, and on terms of such violent hostility with his eldest son as to be obliged to demand a garrison in his house for his protection. During his visit to Monk at Dalkeith in 1654 to complain of this, he was subjected to much personal insult from his creditors, and on visiting London in September 1655 to obtain money due to him from the Scottish parliament, he was arrested for debt, though soon liberated. In Richard Cromwell's parliament of 1659 Argyll sat as member for Aberdeenshire. At the Restoration he presented himself at Whitehall, but was at once arrested by order of Charles and placed in the Tower (1660), being sent to Edinburgh to stand his trial for high treason. He was acquitted of complicity in the death of Charles I., and his escape from the whole charge seemed imminent, but the arrival of a packet of letters written by Argyll to Monk showed conclusively his collaboration with Cromwell's government, particularly in the suppression of Glencairn's royalist rising in 1652. He was immediately sentenced to death, his execution by beheading taking place on the 27th of May 1661, before even the death warrant had been signed by the king. His head was placed on the same spike upon the west end of the Tolbooth on which that of Montrose had previously been exposed, and his body was buried at the Holy Loch, where the head was also deposited in 1664. A monument was erected to his memory in St Giles's church in Edinburgh in 1895.

While imprisoned in the Tower he wrote *Instructions to a Son* (1661; reprinted in 1689 and 1743). Some of his speeches, including the one delivered on the scaffold, were published and are printed in the *Harleian Miscellany*. He married Lady Margaret Douglas, daughter of William, 2nd earl of Morton, and had two sons and four daughters.

See also the *Life and Times of Archibald Marquis of Argyll* (1903), by John Willcock, who prints for the first time the six incriminating letters to Monk; *Eng. Hist. Review*, xviii. 369 and 624; *Scottish History Society*, vol. xvii. (1894); *Charles II. and Scotland in 1650*, ed. by S. R. Gardiner, and vol. xviii. (1895); *History of Scotland*, by A. Lang, vol. iii. (1904).

Archibald Campbell, 9th earl of Argyll (1629–1685), eldest son of the 8th earl, studied abroad, and at the age of thirteen was appointed captain in the Scottish regiment serving in France under his uncle the earl of Irvine. He returned home at the close of 1649, and was made captain of Charles II.'s life guards on the king's arrival in Scotland in 1650. He declared himself a royalist in opposition to his father, with the view, as some said, of securing the family estates in any event. He fought at Dunbar on the 3rd of September 1650, and after the battle of Worcester joined Glencairn in the Highlands. Bitter disputes arose, and on the 2nd of January 1654 Lorne, quitting his troops, fled to avoid arrest. In 1655 he submitted to Monk. He appears, however, to have maintained communications with Charles, and on his refusal to take the oath renouncing allegiance to the Stuarts in 1657 he was imprisoned, remaining in confinement probably till a short time before the Restoration. He was then well received at court by Charles II. After the execution of his father, he endeavoured to obtain the restitution of his forfeited estates and title, but having incautiously attacked certain members of the government in letters which were made public, he was indicted at Edinburgh on the capital charge of "leasing-making" and was sentenced to death on the 26th of August. He remained a prisoner in Edinburgh Castle till the 4th of June 1663, when the sentence was cancelled and he was re-created earl and restored to his estates. He disapproved of the severities practised upon the Covenanters in the west, and in 1671 pleaded for milder methods. His staunch Protestantism rendered him exceedingly obnoxious to James, duke of York, who in 1680 arrived as high commissioner in Scotland and at once expressed his jealousy of Argyll's immense territorial influence. Argyll moved the re-enactment of "all the acts against popery" omitted on James's account, and opposed the exemption of the royal family from the test, though allowing it in the case of James. In signing the test himself, in its final form both ambiguous and self-contradictory, he made the reservation "so far as consistent with itself and the Protestant faith," and declined to engage himself not to promote any alteration of advantage in church or state. On his refusal to record his oath in writing and to sign it, he was dismissed from the Scottish privy council, and on the 9th of November 1681 was accused of treason, a charge which Halifax declared openly in England "they would not hang a dog upon." A trial followed, a scandalous exhibition of illegality and injustice, at the close of which Argyll was sentenced to death and to the forfeiture of his estates. Shortly afterwards, through the instrumentality of his step-daughter, Sophia Lindsay, he succeeded in making his escape, and after some adventures retired to Holland. His subsequent movements are uncertain, but he appears to have again visited London, and was in correspondence with the Rye House plotters and proposing to head a rebellion in Scotland in 1683. In 1685 he joined the conspiracy in Holland to set Monmouth on the throne instead of James II., arriving in Orkney on the 6th of May and making his way to his own country. But his clansmen refused to join him, and whatever small chances of success remained were destroyed by constant and paralysing disputes. His ships and ammunition were captured, and after some aimless wanderings he found himself deserted, with but one companion, Major Fullerton. On the 18th of June he was taken prisoner at Inchinnan and arrived at Edinburgh on the 20th, where he was paraded through the streets and put in irons in the castle. James ordered his summary execution on the 29th, and it was carried out by beheading on the following day, on the old charge of 1681. His head was exposed on the west side of the Tolbooth, where his father's and Montrose's had also been exhibited, his body finding its final place of burial at Inveraray.

By his first wife, Lady Mary Stewart, daughter of the 4th earl of Moray (Murray), he had four sons and three daughters.

See *Argyll Papers* (1834); *Letters from Archibald, 9th Earl of Argyle, to the Duke of Lauderdale* (1829); *Hist. MSS. Comm.* vi. Rep. 606; *Life of Mr Donald Cargile*, by P. Walker, pp. 45 et seq.; *The 3rd Part of the Protestant Plot . . . and a Brief Account of the Case of the Earl of Argyle* (1682); Sir George Mackenzie's *Hist. of Scotland*, p. 70; and J. Willcock, *A Scots Earl in Covenanting Times* (1908).

Archibald Campbell, 1st duke of Argyll (?1651–1703), was the eldest son of the 9th earl. He tried to get his father's attainder reversed by seeking the king's favour, but being unsuccessful he went over to the Hague and joined William of Orange as an active promoter of the revolution of 1688. In spite of the attainder, he was admitted in 1689 to the convention of the Scottish estates as earl of Argyll, and he was deputed, with Sir James Montgomery and Sir John Dalrymple, to present the crown to William III. in its name, and to tender him the coronation oath. In 1690 an act was passed restoring his title and estates, and it was in connexion with the refusal of the Macdonalds of Glencoe to join in the submission to him that he organized the terrible massacre which has made his name notorious. In 1696 he was made a lord of the treasury, and his political services were rewarded in 1701 by his being created duke of Argyll. He had two sons by his wife Elizabeth, daughter of Sir Lionel Talmash, John (the 2nd duke) and Archibald (the 3rd duke).

John Campbell, 2nd duke of Argyll and duke of Greenwich (1678–1743), was born on the 10th of October 1678. He entered the army in 1694, and in 1701 was promoted to the command of a regiment. On the death of his father in 1703, he was appointed a member of the privy council, and at the same time colonel of the Scotch horse guards, and one of the extraordinary lords of session. In return for his services in promoting the Union, he was created (1705) a peer of England, by the titles of baron of Chatham and earl of Greenwich, and in 1710 was made a knight of the Garter. He first distinguished himself in a military capacity at the battle of Oudenarde (1708), where he served as a brigadier-general; and was afterwards present under the duke of Marlborough at the sieges of Lille, Ghent, Bruges and Tournay, and did remarkable service at the battle of Malplaquet in 1709. He was very popular with the troops, and his rivalry with Marlborough on this account is thought to have been the cause of the enmity shown by Argyll afterwards to his old commander. In 1711 he was sent to take command in Spain; but being seized with a violent fever at Barcelona, and disappointed of supplies from home, he returned to England. Having a seat in the House of Lords, and being gifted with an extraordinary power of oratory, he censured the measures of the ministry with such freedom that all his places were disposed of to other noblemen; but at the accession of George I. he recovered his influence. On the breaking out of the rebellion in 1715 he was appointed commander-in-chief of the forces in North Britain, and was principally instrumental in effecting the total extinction of the rebellion in Scotland without much bloodshed. He arrived in London early in March 1716, and at first stood high in the favour of the king, but in a few months was stripped of his offices. This disgrace, however, did not deter him from the discharge of his parliamentary duties; he supported the bill for the impeachment of Bishop Atterbury, and lent his aid to his countrymen by opposing the bill for punishing the city of Edinburgh for the Porteous riot. In the beginning of the year 1719 he was again admitted into favour, appointed lord steward of the household, and, in April following, created duke of Greenwich; he held various offices in succession, and in 1735 was made a field marshal. He continued in the administration till after the accession of George II., when, in April 1740, a violent speech against the government led again to his dismissal from office. He was soon restored on a change of the ministry, but disapproving the measures of the new administration, and apparently disappointed at not being given the command of the army, he shortly resigned all his posts, and spent the rest of his life in privacy and retirement. He died on the 4th of October 1743. A monument by Roubillac was erected to his memory in Westminster Abbey. He was twice married, and by his second wife, Jane Warburton, had five daughters; his Scottish titles passed to his brother, but his English titles became extinct, and though his eldest daughter was created baroness of Greenwich in 1767 this title also became extinct on her death in 1794.

Archibald Campbell, 3rd duke of Argyll (1682–1761), was born at Ham House in Surrey, in June 1682. On his father being created a duke, he joined the army, and served for a short time under the duke of Marlborough. In 1705 he was appointed treasurer of Scotland, and in the following year was one of the commissioners for treating of the Union; on the consummation of which, having been raised to the peerage of Scotland as earl of Islay, he was chosen one of the sixteen peers for Scotland in the first parliament of Great Britain. In 1711 he was called to the privy council, and commanded the royal army at the battle of Sheriffmuir in 1715. He was appointed keeper of the privy seal in 1721, and was afterwards entrusted with the principal management of Scottish affairs to an extent which caused him to be called "king of Scotland." In 1733 he was made keeper of the great seal, an office which he held till his death. He succeeded to the dukedom in 1743. Both as earl of Islay and as duke of Argyll he was prominently connected (with Duncan Forbes of Culloden) with the movement for consolidating Scottish loyalty by the formation of locally recruited highland regiments. The duke was eminent not only for his political abilities, but also for his literary accomplishments, and he collected one of the most valuable private libraries in Great Britain. He died suddenly on the 15th of April 1761. He was married but had no legitimate issue, and his English property was left to a Mrs Williams, by whom he had a son, William Campbell.

The succession now passed to the descendants of the younger son of the 9th earl, the Campbells of Mamore; the 4th duke died in 1770, and was succeeded by his son John, the 5th duke (1723–1806). He was a soldier who had fought at Dettingen and Culloden, and became colonel of the 42nd regiment (Black Watch), and eventually a field marshal. He sat in the House of Commons for Glasgow from 1744 to 1761, when on his father's succession to the dukedom he became legally disqualified, as courtesy marquess of Lorne, for a Scottish constituency; he could sit, however, for an English one, and was returned for Dover, which he represented till 1766, when he was created an English peer as Baron Sundridge, the title by which till 1892 the dukes of Argyll sat in the House of Lords. The 5th duke was an active landlord, and was the first president of the Highland and Agricultural Society. In 1759 he had married the widowed duchess of Hamilton (the beautiful Elizabeth Gunning), by whom he had two sons and two daughters. The eldest of his sons, George (d. 1841), became 6th duke, and on his death was succeeded as 7th duke by his brother John (1777–1847), who from 1799–1822 sat in parliament as member for Argyllshire. He was thrice married, and by his second wife, Joan Glassell (d. 1828), had two sons, the eldest of whom (b. 1821) died in 1837, and two daughters, the second of whom died in infancy.

George John Douglas Campbell, 8th duke (1823–1900), the second son of the 7th duke, was born on the 30th of April 1823, and succeeded his father in April 1847. He had already obtained notice as a writer of pamphlets on the disruption of the Church of Scotland, which he strove to avert, and he rapidly became prominent on the Liberal side in parliamentary politics. He was a frequent and eloquent speaker in the House of Lords, and sat as lord privy seal (1852) and postmaster-general (1855) in the cabinets of Lord Aberdeen and Lord Palmerston. In Mr Gladstone's cabinet of 1868 he was secretary of state for India, and somewhat infelicitously signalized his term of office by his refusal, against the advice of the Indian government, to promise the amir of Afghanistan support against Russian aggression, a course which threw that ruler into the arms of Russia and was followed by the second Afghan War. His eminence alike as a great Scottish noble, and as a British statesman, was accentuated in 1871 when his son, the marquess of Lorne, married Princess Louise, the fourth daughter of Queen Victoria; but in the political world few memorable acts on his part call for record except his resignation of the office of lord privy seal, which he held in Mr Gladstone's administration of 1880, from his inability to assent to the Irish land legislation of 1881. He opposed the Home Rule Bill with equal vigour, though Mr Gladstone subsequently stated that, among all the old colleagues who dissented from his course, the duke was the only one whose personal relations with him remained entirely unchanged. Detached from party, the duke took an independent position, and for many years spoke his mind with great freedom in letters to *The Times* on public questions, especially such as concerned the rights or interests of landowners. He was no less active on scientific questions in their relation to religion, which he earnestly strove to reconcile with the progress of discovery. With this aim he published *The Reign of Law* (1866), *Primeval Man* (1869), *The Unity of Nature* (1884), *The Unseen Foundations of Society* (1893), and other essays. He also wrote on the Eastern question, with especial reference to India, the history and antiquities of Iona, patronage in the Church of Scotland, and many other subjects. The duke (to whose Scottish title was added a dukedom of the United Kingdom in 1892) died on the 24th of April 1900. He was thrice married: first (1844) to a daughter of the second duke of Sutherland (d. 1878); secondly (1881) to a daughter of Bishop Claughton of St Albans (d. 1894); and thirdly (1895) to Ina Erskine M'Neill. Few men of the duke's era displayed more versatility of intellect, and he was remarkable among the men of his time for his lofty eloquence.

He was succeeded as 9th duke by his eldest son John Douglas Sutherland Campbell (1845–), whose marriage in 1871 to H.R.H. Princess Louise gave him a special prominence in English public life. He was governor-general of Canada from 1878 to 1883; member of parliament for South Manchester, in the Unionist interest, 1895 to 1900; and he also became known as a writer both in prose and verse. In 1907 he published his reminiscences, *Pages from the Past*.

See the *Autobiography and Memoirs* of the 8th duke, edited by his widow (1906), which is full of interesting historical and personal detail. (P. C. Y.; H. Ch.)

ARGYLLSHIRE, a county on the west coast of Scotland, the second largest in the country, embracing a large tract of country on the mainland and a number of the Hebrides or Western Isles. The mainland portion is bounded N. by Inverness-shire; E. by Perth and Dumbarton, Loch Long and the Firth of Clyde; S. by the North Channel (Irish Sea); and W. by the Atlantic. Its area is 1,990,471 acres or 3110 sq. m. The principal districts are Ardnamurchan on the Atlantic, Ardnamurchan Point being the most westerly headland of Scotland; Morven or Morvern, bounded by Loch Sunart, the Sound of Mull and Loch Linnhe; Appin, on Loch Linnhe, with piers at Ballachulish and Port Appin; Benderloch, lying between Loch Creran and Loch Etive; Lorne, surrounding Loch Etive and giving the title of marquess to the Campbells; Argyll, in the middle of the shire, containing Inveraray Castle and furnishing the titles of earl and duke to the Campbells; Cowall, between Loch Fyne and the Firth of Clyde, in which lie Dunoon and other favourite holiday resorts; Knapdale between the Sound of Jura and Loch Fyne; and Kintyre or Cantyre, a long narrow peninsula (which, at the isthmus of Tarbert, is little more than 1 m. wide), the southernmost point of which is known as the Mull, the nearest part of Scotland to the coast of Ireland, only 13 m. distant.

There are no navigable rivers. The two principal mountain streams are the Orchy and Awe. The Orchy flows from Loch Tulla through Glen Orchy, and falls into the north-eastern end of Loch Awe; and the Awe drains the loch at its north-western extremity, discharging into Loch Etive. Among other streams are the Add, Aray, Coe or Cona, Creran, Douglas, Eachaig, Etive, Euchar, Feochan, Finart, Fyne, Kinglass, Nell, Ruel, Shiel, Shira, Strae and Uisge-Dhu. The county is remarkable for the numerous sea-lochs which deeply indent the coast, the principal being Loch Long (with its branches Loch Goil and the Holy Loch), Loch Striven (Rothesay's "weather glass"), Loch Riddon, Loch Fyne (with Loch Gilp and Loch Gair), Lochs Tarbert, Killisport, Swin, Crinan, Craignish, Melfort, Feochan, Etive, Linnhe (with its branches Loch Creran, Loch Leven and Loch Eil) and Sunart. There are also a large number of inland lakes, the total area of which is about 25,000 acres. Of these the principal are Lochs Awe, Avich, Eck, Lydoch and Shiel. The principal islands are Mull, Islay, Jura, Colonsay, Lismore, Tyree, Coll, Gigha, Luing and Kerrera. Besides these there are the two small but interesting islands of Staffa and Iona. The mountains are so many as to give the shire a markedly rugged character. Some of them are among the loftiest in the kingdom, as Ben Cruachan with its summit of twin pyramids (3689 ft.), Ben More, in Mull (3172), Ben Ima (3318), Buachaille Etive (3345), Ben Bui (3106), Ben Lui (or Loy), on the confines of the shires of Perth and Argyll (3708), Ben Starav near the head of Loch Etive (3541), and Ben Arthur, called from its shape "The Cobbler" (2891), on the borders of Dumbartonshire. There are many picturesque glens, of which the best-known are Glen Aray, Glen Croe, Glen Etive, Glendaruel, Glen Lochy ("the wearisome glen"—some 10 m. of bare hills and boulders—between Tyndrum and Dalmally), Glen Strae, Hell's Glen (off Loch Goil) and Glencoe, the scene of the massacre in 1692. The waterfalls of Cruachan are beautiful; and those of Connel, which are more in the nature of rapids, caused by the rush of the ebbing tide over the rocky bar at the narrowing mouth of Loch Etive, have been made celebrated by Ossian, who called them "the Falls of Lora." In several of the glens, as Glen Aray, small falls may be seen, enhanced in beauty when the rivers are in flood. Pre-eminently Argyll is the shire of the sportsman. The lovely Western Isles provide endless enjoyment for the yachtsman; the lochs and rivers abound with salmon and trout; the deer forests and grouse moors are second to none in Scotland.

Geology.—The mainland portion of the county consists chiefly of the metamorphic rocks of the Eastern Highlands, nearly all the subdivisions of that series (see Scotland: *Geology*) being represented. They form parallel belts of varying width trending north-east and south-west. The slates and phyllites referred to the lowest group occur along the shore at Dunoon, and are followed by the Beinn Bheula grits and albite schists, forming nearly all the highest ground in Cowall between Loch Fyne and the Firth of Clyde and the greater part of Kintyre. The green beds, Glensluan mica-schists and Loch Tay limestones are developed in Glendaruel, and have been traced north-east to Glen Fyne and at intervals south-west to Campbeltown. The next prominent zone is that of the Ardrishaig phyllites, with quartzites in the lower portion and soft phyllites in the upper part, which cover a belt from 3 to 6 m. across, stretching from Glen Shira by Inveraray and Ardrishaig to south Knapdale.

Next in order come the Easdale slates, phyllites with thin dark limestone, the main limestone of Loch Awe and the pebbly quartzite (Schiehallion), which are repeated by innumerable folds and spread northwards to Loch Linnhe and westwards to Jura and Islay. The slates of this horizon have been largely quarried at Easdale and Ballachulish, and this main limestone is typically developed near Loch Awe, near Kilmartin, on the islands of Lismore and Shuna, and in Islay between Bridgend and Portaskaig. The quartzites of this series form the highest hills in the south of Islay, occupy nearly the whole of Jura, and are continued in the mainland, where, by means of the rapid isoclinal folding, they form lenticular masses. In Islay and at various localities on the mainland a conglomerate occurs at or near the base of the quartzites, which contains fragments of the underlying rocks and boulders of granite not now found in place in that region.

On the mainland, on the north side of the compound synclinal folding of Loch Awe, the Ardrishaig phyllites reappear at Craignish near Kilmartin, and the quartzites of this group are supposed to come to the surface again in Glencoe, not far from the outcrop of the Schiehallion quartzite.

The metamorphic rocks are associated with bands of epidiorite which have shared in the folding and metamorphism of the region. These are largely developed near Loch Awe, in Knapdale, and on the south-east coast of Islay. They have been usually regarded as intrusive, but south of Tayvallich on the mainland, lavas and tuffs, which have escaped deformation, occur in the Easdale slates and the pebbly limestone.

The Lower Old Red Sandstone, chiefly composed of volcanic rocks—lavas and tuffs—rests unconformably on the metamorphic series. These rocks cover a wide area in Lorne between Loch Melfort, Oban and the Pass of Brander, and they reappear in the lofty mountains on both sides of Glencoe. Representatives of this formation are found in Kintyre, south of Campbeltown, where the sediments prevail. The intrusive igneous rocks belonging to this period are widely distributed and form conspicuous features. The plutonic masses are represented by the granite of Ben Cruachan, by the diorite of Gleann Domhainn, and by the kentallenite (a basic rock related to the monzonites), near Ballachulish. Throughout the Lorne volcanic plateau there are numerous dykes of porphyrite which likewise traverse the schists and part of the Ben Cruachan granite. Sheets of quartz-porphyry, lamprophyre and diorite are also represented, the first of these types being quarried at Crarae on the north shore of Loch Fyne.

The Upper Old Red Sandstone forms isolated patches resting unconformably on all older rocks, on the west coast of Kintyre, and between Campbeltown and Southend. In the district of Campbeltown these red sandstones and cornstones are followed by the volcanic rocks of the Calciferous Sandstone series, which lie to the south of the depression at Machrihanish, and are succeeded by the lower limestones and coals of the Carboniferous Limestone series.

On the north and south shores of the promontory of Ardnamurchan there are small patches of Jurassic strata ranging from the Lower Lias to the Oxford Clay, and in Morvern on the shores of Loch Aline representatives of the Upper Greensand are covered by the basaltic lavas of Tertiary age. The acid and basic plutonic rocks (gabbros and granophyres) of Tertiary time occur in Ardnamurchan. A striking geological feature of the county is the number of dolerite and basalt dykes trending in a north-west direction, which are referred to the same period of intrusion. There is, however, another group of dolerite dykes running east and west near Dunoon and elsewhere, which are cut by the former and are probably of older date.

Lead veins occur at Strontian which have yielded a number of minerals, including sphalerite, fluorite, strontianite, harmotone, brewsterite and pilolite. Near Inveraray, nickeliferous ore has been obtained at two localities.

Climate.—The rainfall is very abundant. At Oban, the average annual amount is 64·18 in.; in Glen Fyne, 104·11 in.; at the bridge of Orchy, 113·62 in., and at Upper Glencoe 127·65. The prevailing winds, as observed near Crinan, are south-west and south-east, and next in frequency are the north-west and north-east. The average yearly temperature is 48° F.

Agriculture.—Argyllshire was formerly partly covered with natural forests, remains of which, consisting chiefly of oak, ash, pine and birch, are still visible in the mosses; but, owing to the clearance of the ground for the introduction of sheep, and to past neglect of planting, the county is now remarkable for its lack of wood, except in the neighbourhood of Inveraray, where there are extensive and flourishing plantations, and a few other places. Replanting, however, has been carried on. Most of the county is unfitted for agriculture; but many districts afford fine pasturage for mountain sheep; and some of the valleys, such as Glendaruel, are very fertile. The chief crop is oats; there is a little barley, but no wheat. The shire is one of those where the crofting system exists, but it is by no means universal. It is predominant in Tyree and the western district of the mainland, but elsewhere farms of moderate size are the rule. The cattle, though small, are equal to any other breed in the kingdom, and are marketed in large numbers in the south. Dairy farming is carried on to some extent in the southern parts of Kintyre, where there is a large proportion of arable land. In the higher tracts sheep have taken the place of cattle with excellent results. The black-faced is the species most generally reared.

Industries.—Whisky is manufactured at Campbeltown, in Islay, at Oban, Ardrishaig and elsewhere. Gunpowder is made at Kames (Kyles of Bute), Melfort and Furnace. Coarse woollens are made for home use; but fishing is the most important industry, Loch Fyne being famous for its herrings. The season lasts from June to January, but white fishing is carried on at one or other of the ports all the year round. Slate and granite quarrying and some coal-mining are the only other industries of any consequence.

Communications.—Owing partly to the paucity of trading industries and partly to the fact that, owing to its greatly indented coast-line, no place in the shire is more than 12 m. from the sea, the railway mileage in the county is very small. The Tyndrum to Oban section of the Caledonian railway company's system is within the county limits; a small portion of the track of the North British railway company's line to Mallaig skirts the extreme west of the shire, and the Caledonian line from Oban to Ballachulish serves the northern coast districts of the Argyllshire mainland. In connexion with this last route mention should be made of the cantilever bridge crossing the Falls of Lora with a span of 500 ft. at a height of 125 ft. above the water-way. The chief means of communication is by steamers, which maintain regular intercourse between Glasgow and various parts of the coast. In order to avoid the circuitous passage round the Mull of Kintyre the Crinan Canal, across the isthmus from Ardrishaig to Loch Crinan, a distance of 9 m., was constructed in 1793–1801, at a cost of £142,000. It has 15 locks, an average depth of 10 ft., a surface width of 66 ft., and bottom width of 30 ft., is navigable by vessels of 200 tons, and runs through a district of remarkable beauty. Another canal unites Campbeltown with Dalavaddy. In summer the mails for the islands and the great bulk of the tourist traffic by the MacBrayne fleet is conveyed through the Crinan Canal, transhipment being effected at Ardrishaig and Crinan. Throughout the year goods traffic between the Clyde and elsewhere and the West Highland ports is conveyed by deep-sea steamers round the Mull. Before the advent of railways the shire contained many famous coaching routes, but now coaches only run during the tourist season, either in connexion with train and steamer, or in districts still not served by either.

Population and Government.—Owing to emigration, chiefly to Canada, the population has declined, almost without a break, since 1831, when it was 100,973, to 74,085 in 1891 and 73,642 in 1901, in which year there were 24 persons to the sq. m. In 1901 the number of Gaelic-speaking persons was 34,224, of whom 3313 spoke Gaelic only. The chief towns are Campbeltown (population in 1901, 8286), Dunoon (6779) and Oban (5427), with Ardrishaig (1285), Ballachulish (1143), Lochgilphead (1313) and Tarbert (1697). The county returns a member to parliament. Inveraray, Campbeltown and Oban belong to the Ayr district group of parliamentary burghs. Argyllshire is a sheriffdom, and there are resident sheriffs-substitute at Inveraray, Campbeltown and Oban; courts are held also at Tobermory, Lochgilphead, Bowmore in Islay, and Dunoon. Both Presbyterian bodies are strongly represented; there are Roman Catholic and (Anglican) Episcopal bishops of Argyll and the Isles, and there is a Roman Catholic pro-cathedral at Oban. Campbeltown, Dunoon and Oban have secondary schools, Tarbert public school has a secondary department, and several other schools earn grants for giving higher education. Part of the "residue" grant is spent by the county council on classes of navigation and other subjects in various schools, short courses in agriculture for farmers, and in providing bursaries.

History.—The early history of Argyll (Airergaidheal) is very obscure. At the close of the 5th century Fergus, son of Erc, a descendant of Conor II., *airdrigh* or high king of Ireland, came over with a band of Irish Scots and established himself in Argyll and Kintyre. Nothing more is known till, in the days of Conall I., the descendant of Fergus in the fourth generation, St Columba appears. Conall died in 574, and Columba was mainly instrumental in establishing his first cousin, Aidan, founder of the Dalriad kingdom and ancestor of the royal house of Scotland, in power. In the 8th century Argyll, with the Western Islands and Man, fell under the power of the Norsemen until, in the 12th century, Somerled (or Somhairle), a descendant of Colla-Uais, *airdrigh* of Ireland (327–331), succeeded in ousting them and established his authority, not only as thane of Argyll, but also in Kintyre and the Western Islands. Somerled died in 1164 and his descendants maintained themselves in Argyll and the islands, between the conflicting claims of the kings of Scotland, Norway and Man, until the end of the 15th century.

Up to 1222 Argyll had formed an independent Celtic princedom; but in that year it was reduced by Alexander II., the Scottish king, to a sheriffdom, and was henceforth regarded as an integral part of Scotland. Among the various clans in Argyll, the Campbells of Loch Awe, a branch of the clan McArthur, now began to come to the fore, though the mainland was still chiefly in the possession of the MacDougals. The position of the lords of the house of Somerled was now curious, since they were feudatories of the king of Norway for the isles and of the king of Scotland for Argyll. Their policy in the wars between the two powers was a masterly neutrality. Thus, during the expedition of Alexander II. to the Western Isles in 1249, Ewan (Eoghan), lord of Argyll, refused to fight against the Norwegians; in 1263 the same Ewan refused to join Haakon of Norway in attacking Alexander III. Forty years later the clansmen of Argyll, mainly MacDougals, were warring on the side of Edward of England against Robert Bruce, by whom they were badly beaten on Loch Awe in 1309. The clansmen of the house of Somerled in the isles, on the other hand, the MacDonalds, remained loyal to Scotland in spite of the persuasions of John of Argyll, appointed admiral of Edward II.'s western fleet; and, under their chief Angus Og, they contributed much to the victory of Bannockburn. The alliance of John, earl of Ross and lord of the Isles, with Edward IV. of England in 1461 led to the breaking of the power of the house of Somerled, and in 1478 John was forced to resign Ross to the crown and, two years later, his lordships of Knapdale and Kintyre as well. In Argyll itself the Campbells had already made the first step to supremacy through the marriage of Colin, grandson of Sir Duncan Campbell of Lochow, first Lord Campbell, with Isabel Stewart, eldest of the three co-heiresses of John, third lord of Lorne. He acquired the greater part of the lands of the other sisters by purchase, and the lordship of Lorne from Walter their uncle, the heir in tail male, by an exchange for lands in Perthshire. In 1457 he was created, by James II., earl of Argyll. He died on the 10th of May 1493. From him dates the greatness of the house of the earls and dukes of Argyll (*q.v.*), whose history belongs to that of Scotland. The house of Somerled survives in two main branches—that of Macdonald of the Isles, Alexander Macdonald (d. 1795) having been raised to the peerage in 1776, and that of the Macdonnells, earls of Antrim in Ireland. The principal clans in Argyll, besides those already mentioned, were the Macleans, the Stewarts of Appin, the Macquarries and the Macdonalds of Glencoe, and the Macfarlanes of Glencroe. The Campbells are still very numerous in the county.

Argyllshire men have made few contributions to English literature. For long the natives spoke Gaelic only and their bards sang in Gaelic (see Celt: *Literature*: Scottish). Near Inistrynich on the north-eastern shore of Loch Awe stands the monumental cairn erected in honour of Duncan Ban McIntyre (1724–1812), the most popular of modern Gaelic bards. But the romantic beauty of the country has made it a favourite setting for the themes of many poets and story-tellers, from "Ossian" and Sir Walter Scott to Robert Louis Stevenson, while not a few men distinguished in affairs or in learning have been natives of the county.

The antiquities comprise monoliths, circles of standing stones, crannogs and cairns. In almost all the burying-grounds—as at Campbeltown, Keil, Soroby, Kilchousland, Kilmun—there are specimens of sculptured crosses and slabs. Besides the famous ecclesiastical remains at Iona (*q.v.*), there are ruins of a Cistercian priory in Oronsay, and of a church founded in the 12th century by Somerled, thane of Argyll, at Saddell. Among castles may be mentioned Dunstaffnage, Ardtornish, Skipness, Kilchurn (beloved of painters), Ardchonnel, Dunolly, Stalker, Dunderaw and Carrick.

Authorities.—The (Eighth) Duke of Argyll, *Commercial Principles Applied to the Hire of Land* (London, 1877); *Crofts and Farms in the Hebrides* (Edinburgh, 1883); *Iona* (Edinburgh, 1889); *Scotland as it Was and Is* (Edinburgh, 1887); *House of Argyll* (Glasgow, 1871); A. Brown, *Memorials of Argyllshire* (Greenock, 1889); Harvie-Brown and Buckley, *Vertebrate Fauna of Argyll and the Inner Hebrides* (Edinburgh, 1892); D. Clerk, "On the Agriculture of the County of Argyll" (*Trans. of H. and A. Soc.*, 1878); T. Gray, *Week at Oban* (Edinburgh, 1881); Stewart, *Collection of Views of Campbeltown.* For antiquities see *The Sculptured Stones of Scotland*, vol. ii., published by the Spalding Club, and Capt. T. P. White's *Archaeological Sketches in Kintyre* and *Proc. Antiq. Soc. of Scotland*, vols. iv., v., viii.

ARGYRODITE, a mineral which is of interest as being that in which the element germanium was discovered by C. Winkler in 1886. It is a silver sulpho-germanate, Ag_8GeS_6, and crystallizes in the cubic system. The crystals have the form of the octahedron or rhombic dodecahedron, and are frequently twinned. The botryoidal crusts of small indistinct crystals first found in a silver mine at Freiberg in Saxony were originally thought to be monoclinic, but were afterwards proved to be identical with the more distinctly developed crystals recently found in Bolivia. The colour is iron-black with a purplish tinge, and the lustre metallic. There is no cleavage; hardness $2\frac{1}{2}$, specific gravity 6·2. It is of interest to note that the Freiberg mineral was long ago imperfectly described by A. Breithaupt under the name *Plusinglanz*, and that the Bolivian crystals were incorrectly described in 1849 as crystallized brongniardite. The name argyrodite is from the Greek ἀργυρώδης, rich in silver.

Isomorphous with argyrodite is the corresponding tin compound Ag_8SnS_6, also found in Bolivia as cubic crystals, and known by the name canfieldite. Other Bolivian crystals are intermediate in composition between argyrodite and canfieldite. (L. J. S.)

ARGYROKASTRO, or Argyrocastron (Turkish, *Ergeri*; Albanian, *Ergir Castri*), a town of southern Albania, Turkey, in the vilayet of Iannina. Pop. (1900) about 11,000. Argyrokastro is finely situated 1060 ft. above sea-level, on the eastern slopes of the Acroceraunian mountains, and near the left bank of the river Dhrynos, a left-hand tributary of the Viossa. It is the capital of a sanjak bearing the same name, and was formerly important as the headquarters of the local Moslem aristocracy, partly owing to the mountainous and easily defensible nature of the district. It contains the ruins of an imposing castellated fort. A fine kind of snuff, known as *fuli*, is manufactured here. Argyrokastro has been variously identified with the ancient Hadrianopolis and Antigonea. In the 18th century it is said to have contained 20,000 inhabitants, but it was almost depopulated by plague in 1814. Albanian Moslems constitute the greater part of the population.

ARGYROPULUS, or Argyropulo, **JOHN** (*c.* 1416–1486), Greek humanist, one of the earliest promoters of the revival of learning in the West, was born in Constantinople, and became a teacher there, Constantine Lascaris being his pupil. He then appears to have crossed over to Italy, and taught in Padua in 1434, being subsequently made rector of the university. About 1441 he returned to Constantinople, but after its capture by the Turks, again took refuge in Italy. About 1456 he was invited to Florence by Cosimo de' Medici, and was there appointed professor of Greek in the university. In 1471, on the outbreak of the plague, he removed to Rome, where he continued to act as a teacher of Greek till his death. Among his scholars were Angelus Politianus and Johann Reuchlin. His principal works were translations of the following portions of Aristotle,—*Categoriae*, *De Interpretatione*, *Analytica Posteriora*, *Physica*, *De Caelo*, *De Anima*, *Metaphysica*, *Ethica Nicomachea*, *Politica*;

and an *Expositio Ethicorum Aristotelis.* Several of his writings exist still in manuscript.

See Humphrey Hody, *De Graecis Illustribus*, 1742, and Smith's *Dictionary of Greek and Roman Biography, s.v.* Joannes.

ARIA (Ital. for "air"), a musical term, equivalent to the English "air," signifying a melody apart from the harmony, but especially a musical composition for a single voice or instrument, with an accompaniment of other voices or instruments.

The aria originally developed from the expansion of a single vocal melody, generally on the lines of what is known as binary form (see SONATA and SONATA FORMS). Accordingly, while the germs of aria form may be traceable in the highest developments of folk-song, the aria as a definite art-form could not exist before the middle of the 17th century; because up to that time the whole organization of music was based upon polyphonic principles which left no room for the development of melody for melody's sake. When at the beginning of the 17th century the Monodists (see HARMONY and MONTEVERDE) inaugurated a new era and showed in their first experiments the enormous possibilities latent in their new art of accompanying single voices by instruments, it was natural that for many years the mere suggestiveness and variety of their experiments should suffice to retain the attention of contemporary listeners, without any real artistic coherence in the works as wholes. But, even at the outset, mere novelty of harmony, however poignant its emotional expression, was felt by the profounder spirits of the new art to be an untrustworthy guide to progress. And Monteverde's famous lament of the deserted Ariadne is one of many early examples that appeal to an elementary sense of form by making the last phrase identical with the first. As instrumental music grew, and the modern sense of key became strong and consistent, composers felt themselves more and more able to appeal to that sense of harmonically consistent melody which has asserted itself in folk-music before the history of harmonic music may be said to have begun. The technique of solo singers grew as rapidly as that of solo players, and composers soon found their chief musical interest in doing justice to both. In Sir Hubert Parry's work, *The Music of the 17th Century* (*Oxford History of Music*, vol. iii.), will be found numerous illustrations of the early development of aria forms, from their first indications in Monteverde's instinctive struggles after coherence, to their complete maturity in the works of Alessandro Scarlatti.

By Scarlatti's time it was thoroughly established that the binary form of melody was that which could best be expanded into a form which should do justice both to singers and to the players who accompanied them. Thus the aria became on a small scale the prototype of the Concerto; and under that heading will accordingly be found all that need be said as to the relation between the instrumental *ritornello* and the material of the voice part in an aria.

So far we have spoken only of the main body of the aria; but the addition of a middle section with a *da Capo*, which constitutes the universal 18th-century *da Capo* form of aria, adds a very simple new principle to the essential scheme without really modifying it. A typical aria of the Scarlatti or Handelian type is a very large melody in binary form, delivered by the voice, which expands it with florid perorations before each cadence (and sometimes also with florid preludes); while relief is given to the voice, further spaciousness to the form, and justice done to the accompaniment, by the addition of an instrumental ritornello containing the gist of the melody not only at the beginning and end, but also in suitable shorter forms at the principal intermediate cadences in foreign keys. A smaller scheme of the same kind in a new group of related keys, but generally without much new material, is then appended as a middle section after which follows the main section *da Capo*. The result is generally a piece of music of considerable length, in a form which cannot fail to be effective and coherent; and there is little cause for wonder in the extent to which it dominated 18th-century music. It was not, however, invariable. In the *Cavatina* we find a form too small for the *da Capo*; and in the oratorios of Handel and the choral works of Bach we find a majority of arias in a larger form which evades the possibility of exact repetition.

The aria forms are profoundly influenced by the difference between the Sonata style and the style of Bach and Handel. But the scale of the form is inevitably small, and in any opera an aria is hardly possible except in a situation which is a tableau rather than an action. Consequently there is no such difference between the form of the classical operatic aria of Mozart and that of the Handelian type as there is between sonata music and suite music. The scale, however, has become too large for the *da Capo*, which was in any case too rigid to survive in music designed to intensify a dramatic situation instead of to distract attention from it. The necessary change of style was so successfully achieved that, until Wagner succeeded in devising music that moved absolutely *pari passu* with his drama, the aria remained as the central formal principle in dramatic music; and few things in artistic evolution are more interesting than the extent to which Mozart's predecessor, the great dramatic reformer Gluck, profited by the essential resources of his pet aversion, the aria style, when he had not only purged it of what had become the stereotyped ideas of ritornellos and vocal flourishes, but animated it by the new sense of dramatic climax to which the sonata style appealed.

In modern opera the aria is almost always out of place, and the forms in which definite melodies nowadays appear are rather those of the song in its limited sense as that of a poem in formal stanzas all set to the same music. In other words, a song in a modern opera tends to be something which would be sung even if the drama had to be performed as a play without music; whereas a classical aria would in non-musical drama be a soliloquy. This can be shown by works at such opposite poles of musical and dramatic technique as Bizet's *Carmen* and the later works of Wagner. In *Carmen* the librettist has so managed that, if his work were performed as a play, almost the whole of it would have to be sung; and the one exception of musical importance is the developed soliloquy of Micaëla in the third act, which, although treated in no old-fashioned or commonplace spirit by the composer, is the one thing in the opera which sounds "operatic."

In the later works of Wagner those passages in which we can successfully detach complete melodies from their context have, one and all, dramatically the aspect of songs and not of soliloquies. Siegmund sings the song of Spring to his sister-bride; Mime teaches Siegfried lessons of gratitude in nursery rhymes; and the whole story of the *Meistersinger* is a series of opportunities for song-singing.

The distinctions and gradations between aria and song are of great aesthetic importance, but their history would carry us too far. The distinction is obviously of the same importance as that between dramatic and lyric poetry. Beethoven's *Adelaïde* is a famous example of what is called a song when it is really entirely in aria style; while the operas of Mozart and Weber naturally contain in appropriate situations many numbers which really are songs. The composers themselves generally give appropriate names. Thus Mozart, in *Figaro*, calls "Non so piu cosa son" an aria, because of its free style, though Cherubino actually sings it as a song he has just invented; while "Voi che sapete," being more purely lyric, is called *Canzona*.

The term *aria form* is applied, generally most inaccurately, to all kinds of slow cantabile instrumental music of which the general design can be traced to the operatic aria. Mozart, for example, is very fond of slow movements in large binary form without development, and this is constantly called aria-form, though the term ought certainly to be restricted to such examples as have some traits of the aria style, such as the first slow movement in the great serenade in B flat. At all events, until writers on music have agreed to give the term some more accurate use, it is as well to avoid it and its cognate version, *Lied-form*, altogether in speaking of instrumental music.

The *air* or *aria* in a suite is a short binary movement in a flowing rhythm in common or duple time and by no means of the broadly tunelike quality which its name would seem to imply. (D. F. T.)

ARIADNE (in Greek mythology), was the daughter of Minos, king of Crete, and Pasiphae, the daughter of Helios the Sun-god. When Theseus landed on the island to slay the Minotaur (*q.v.*), Ariadne fell in love with him, and gave him a clue of thread to guide him through the mazes of the labyrinth. After he had slain the monster, Theseus carried her off, but, according to Homer (*Odyssey*, xi. 322) she was slain by Artemis at the request of Dionysus in the island of Dia near Cnossus, before she could reach Athens with Theseus. In the later legend, she was abandoned, while asleep on the island of Naxos, by Theseus, who had fallen a victim to the charms of Aegle (Plutarch, *Theseus*, 20; Diodorus, iv. 60, 61). Her abandonment and awakening are celebrated in the beautiful *Epithalamium* of Catullus. On Naxos she is discovered by Dionysus on his return from India, who is enchanted with her beauty, and marries her when she awakes. She receives a crown as a bridal gift, which is placed amongst the stars, while she herself is honoured as a goddess (Ovid, *Metam.* viii. 152, *Fasti*, iii. 459).

The name probably means "very holy" = *ἀρι-αγνη*; another (Cretan) form 'Αριδήλα (=*φανερά*) indicates the return to a "bright" season of nature. Ariadne is the personification of spring. In keeping with this, her festivals at Naxos present a double character; the one, full of mourning and sadness, represents her death or abandonment by Theseus, the other, full of joy and revelry, celebrates her awakening from sleep and marriage with Dionysus. Thus nature sleeps and dies during winter, to awake in springtime to a life of renewed luxuriance. With this may be compared the festivals of Adonis and Osiris and the myth of Persephone. Theseus himself was said to have founded a festival at Athens in honour of Ariadne and Dionysus after his return from Crete. The story of Dionysus and Ariadne was a favourite subject for reliefs and wall-paintings. Most commonly Ariadne is represented asleep on the shore at Naxos, while Dionysus, attended by satyrs and bacchanals, gazes admiringly upon her; sometimes they are seated side by side under a spreading vine. The scene where she is holding the clue to Theseus occurs on a very early vase in the British Museum. There is a statue of the sleeping Ariadne in the Vatican Museum.

Kanter, *De Ariadne* (1879); Pallat, *De Fabula Ariadnea* (1891).

ARIANO DI PUGLIA, a town and episcopal see, which, despite its name, now belongs to Campania, Italy, in the province of Avellino, 1509 ft. above sea-level, on the railway between Benevento and Foggia, 24 m. E. of the former by rail. Pop. (1901) town, 8384; commune, 17,653. It lies in the centre of a fertile district, but has no buildings of importance, as it has often been devastated by earthquakes. A considerable part of the population still dwells in caves. It has been supposed to occupy the site of Aequum Tuticum, an ancient Samnite town, which became a post-station on the Via Traiana[1] in Roman times; but this should probably be sought at S. Eleuterio 5½ m. north. It was a military position of some importance in the middle ages. Thirteen miles south-south-east is the Sorgente Mefita, identical with the pools of Ampsanctus (*q.v.*). (T. As.)

ARIAS MONTANO, BENITO (1527–1598), Spanish Orientalist and editor of the Antwerp Polyglot, was born at Fregenal de la Sierra, in Estremadura, in 1527. After studying at the universities of Seville and Alcala, he took orders about the year 1559 and in 1562 he was appointed consulting theologian to the council of Trent. He retired to Peña de Aracena in 1564, wrote his commentary on the minor prophets (1571), and was sent to Antwerp by Philip II. to edit the polyglot Bible projected by Christopher Plantin. The work appeared in 8 volumes folio, between 1568 and 1573. León de Castro, a professor at Salamanca, thereon brought charges of heresy against Arias Montano, who was finally acquitted after a visit to Rome in 1575–1576. He was appointed royal chaplain, but withdrew to Peña de Aracena from 1579 to 1583; he resigned the chaplaincy in 1584, and went into complete seclusion at Santiago de la Espada in Seville, where he died in 1598.

He is the subject of an *Elogio histórico* by Tomás Gonzalez Carvajal in the *Memorias de la Real Academia de la Historia* (Madrid, 1832), vol. vii.

ARICA (San Marcos de Arica), a town and port of the Chilean-governed province of Tacna, situated in 18° 28′ 08″ S. lat. and 70° 20′ 46″ W. long. It is the port for Tacna, the capital of the province, 38 m. distant, with which it is connected by rail, and is the outlet for a large and productive mining district. Arica at one time had a population of 30,000 and enjoyed much prosperity, but through civil war, earthquakes and conquest, its population had dwindled to 2853 in 1895 and 2824 in 1902. The great earthquake of 1868, followed by a tidal wave, nearly destroyed the town and shipping. Arica was captured, looted and burned by the Chileans in 1880, and in accordance with the terms of the treaty of Ancon (1883) should have been returned to Peru in 1894, but this was not done. Late in 1906 the town again suffered severely from an earthquake.

ARICIA (mod. *Ariccia*), an ancient city of Latium, on the Via Appia, 16 m. S.E. of Rome. The old town, or at any rate its acropolis, now occupied by the modern town, lay high (1350 ft. above sea-level) above the circular Valle Aricciana, which is probably an extinct volcanic crater; some remains of its fortifications, consisting of a mound of earth supported on each side by a wall of rectangular blocks of peperino stone, have been discovered (D. Marchetti, in *Notizie degli scavi*, 1892, 52). The lower town was situated on the north edge of the valley, close to the Via Appia, which descended into the valley from the modern Albano, and re-ascended partly upon very fine substructions of *opus quadratum*, some 200 yds. in length, to the modern Genzano. Remains of the walls of the lower town, of the *cella* of a temple built of blocks of peperino, and also of later buildings in brickwork and *opus reticulatum*, connected with the post-station (Aricia being the first important station out of Rome, cf. Horace, *Sat.* i. 5. 1, *Egressum magna me excepit Aricia Roma hospitio modico*) on the highroad, may still be seen (cf. T. Ashby in *Mélanges de l'école française de Rome*, 1903, 399). Aricia was one of the oldest cities of Latium, and appears as a serious opponent of Rome at the end of the period of the kings and beginning of the republic. In 338 B.C. it was conquered by C. Maenius and became a *civitas sine suffragio*, but was soon given full rights. Even in the imperial period its chief magistrate was styled *dictator*, and its council *senatus*, and it preserved its own calendar of festivals. Its vegetables and wine were famous, and the district is still fertile. (T. As.)

ARICINI, the ancient inhabitants of Aricia (*q.v.*), the form of the name ranking them with the Sidicini, Marrucini (*q.v.*), &c., as one of the communities belonging probably to the earlier or Volscian stratum of population on the west side of Italy, who were absorbed by the Sabine or Latin immigrants. Special interest attaches to this trace of their earlier origin, because of the famous cult of Diana Nemorensis, whose temple in the forest close by Aricia, beside the *lacus Nemorensis*, was served by "the priest who slew the slayer, and shall himself be slain"; that is to say, the priest, who was called *rex Nemorensis*, held office only so long as he could defend himself from any stronger rival. This cult, which is unique in Italy, is picturesquely described in the opening chapter of J. G. Frazer's *Golden Bough* (2nd ed., 1900) where full references will be found. Of these references the most important are, perhaps, Strabo v. 3. 12; Ovid, *Fasti*, iii. 263-272; and Suetonius, *Calig.* 35, whose wording indicates that the old-world custom was dying out in the 1st century A.D. It is a reasonable conjecture that this extraordinary relic of barbarism was characteristic of the earlier stratum of the population who presumably called themselves *Arici*.

On the anthropological aspect of the cult, see also A. B. Cook, *Class. Rev.* xvi., 1902, p. 365, where the whole evidence is very fully collected; and Frazer's *Studies in the Early History of Kingship* (1907), where he accepts Cook's criticism of his own earlier theory. (R. S. C.)

ARIÈGE, an inland department of southern France, bounded S. by Spain, W. and N. by the department of Haute-Garonne, N.E. and E. by Aude, and S.E. by Pyrénées-Orientales. It embraces the old countship of Foix, and a portion of Languedoc and Gascony. Area, 1893 sq. m. Pop. (1906) 205,684. Ariège is for the most part mountainous. Its southern border is occupied by the snow-clad peaks of the eastern Pyrenees, the highest of which within the department is the Pic de Montcalm (10,512 ft.). Communication with Spain is afforded by a large number of *ports* or *cols*, which are, however, for the most part difficult paths, and only practicable for a few months in the year. Farther to the north two lesser ranges running parallel to the main chain traverse the centre of the department from south-east to north-west. The more southerly, the Montagne de Tabe, contains, at its south-eastern end, several heights between 7200 and 9200 ft., while the Montagnes de Plantaurel to the north of Foix are of lesser altitude. These latter divide the fertile alluvial plains of the north from the mountains of the centre and south. The department is intersected by torrents belonging to the Garonne basin—the Salat, the Arize, which, near Mas d'Azil, flows through a subterranean gallery, the Ariège and the Hers. The climate is mild in the south, but naturally very severe among the mountains. Generally speaking, the arable land, which is chiefly occupied by small holdings, is confined to the lowlands. Wheat, maize and potatoes are the chief crops. Good vineyards and market gardens are found in the neighbourhood of Pamiers in the north. Flax and hemp are also cultivated. The mountains afford excellent pasture, and a considerable number of cattle, sheep and swine are reared. Poultry- and bee-farming flourish. Forests cover more than one-third of the department and harbour wild boars and even bears. Game, birds of prey and fish are plentiful. There is abundance of minerals, including lead, copper, manganese and especially iron. Grindstones, building-stone, talc, gypsum, marble and phosphates are also produced. Warm mineral springs of note are found at Ax, Aulus and Ussat. Pamiers and St Girons are the most important industrial towns. Iron founding and forging, which have their chief centre at Pamiers, are principal industries. Flour-milling, paper-making and cloth-weaving may also be mentioned. Ariège is served by the Southern railway. It forms the diocese of Pamiers and belongs to the ecclesiastical province of Toulouse. It is within the circumscriptions of the académie (educational division) and of the court of appeal of Toulouse and of the XVII. army corps. Its capital is Foix; it comprises the arrondissements of Foix, St Girons and Pamiers, with 20 cantons and 338 communes. Foix, Pamiers, St Girons and St Lizier-de-Couserans are the more noteworthy towns. Mention may also be made of Mirepoix, once the seat of a bishopric, and possessing a cathedral (15th and 16th centuries) with a remarkable Gothic spire.

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[1] This has generally been supposed to be the place referred to by Horace (*Sat.* i. 5. 87), as one which the metre would not allow him to mention by name; but H. Nissen (*Halische Landeskunde*, Berlin, 1902, ii. 845) proposes Ausculum instead.

ARIES ("The Ram"), in astronomy, the first sign of the zodiac (*q.v.*), denoted by the sign ♈, in imitation of a ram's head. The name is probably to be associated with the fact that when the sun is in this part of the heavens (in spring) sheep bring forth their young; this finds a parallel in *Aquarius*, when there is much rain. It is also a constellation, mentioned by Eudoxus (4th century B.C.) and Aratus (3rd century B.C.); Ptolemy catalogued eighteen stars, Tycho Brahe twenty-one, and Hevelius twenty-seven. According to a Greek myth, Nephele, mother of Phrixus and Helle, gave her son a ram with a golden fleece. To avoid the evil designs of Hera, their stepmother, Phrixus and Helle fled on the back of the ram, and reaching the sea, attempted to cross. Helle fell from the ram and was drowned (hence the *Hellespont*); Phrixus, having arrived in Colchis and been kindly received by the king, Aeetes, sacrificed the ram to Zeus, to whom he also dedicated the fleece, which was afterwards carried away by Jason. Zeus placed the ram in the heavens as the constellation.

ARIKARA, or ARICARA (from *ariki*, horn), a tribe of North American Indians of Caddoan stock. They are now settled with the Hidatsas and the Mandans on the Fort Berthold Reservation, North Dakota. They originally lived in the Platte Valley, Nebraska, with the Pawnees, to whom they are related. They number about 400.

See *Handbook of American Indians*, ed. F. W. Hodge (Washington, 1907.)

ARIMASPI, an ancient people in the extreme N.E. of Scythia (*q.v.*), probably the eastern Altai. All accounts of them go back to a poem by Aristeas of Proconnesus, from whom Herodotus (iii. 116, iv. 27) drew his information. They were supposed to be one-eyed (hence their Scythian name), and to steal gold from the griffins that guarded it. In art they are usually represented as richly dressed Asiatics, picturesquely grouped with their griffin foes; the subject is often described by poets from Aeschylus to Milton. They are so nearly mythical that it is impossible to insist on the usual identification with the ancestors of the Huns. Their gold was probably real, as gold still comes from the Altai.

ARIMINUM (mod. *Rimini*), a city of Aemilia, on the N.E. coast of Italy, 69 m. S.E. of Bononia. It was founded by the Umbrians, but in 268 B.C. became a Roman colony with Latin rights. It was reached from Rome by the Via Flaminia, constructed in 220 B.C., and from that time onwards was the bulwark of the Roman power in Cisalpine Gaul, to which province it even gave its name. Its harbour was of some importance, but is now silted up, the sea having receded. The remains of its moles were destroyed in 1807–1809. Ariminum became a place of considerable traffic owing to the construction of the Via Aemilia (187 B.C.) and the Via Popilia (132 B.C.), and is frequently mentioned by ancient authors. In 90 B.C. it acquired Roman citizenship, but in 82 B.C. having been held by the partisans of Marius, it was plundered by those of Sulla (who probably made the Rubicon the frontier of Italy instead of the Aesis), and a military colony settled there. Caesar occupied it in 49 B.C. after his crossing of the Rubicon. It was one of the eighteen richest cities of Italy which the triumviri selected as a reward for their troops. In 27 B.C. Augustus planted new colonists there, and divided the city into seven *vici* after the model of Rome, from which the names of the *vici* were borrowed. He also restored the Via Flaminia (*Mon. Ancyr.* c. 20) from Rome to Ariminum. At the entrance to the latter the senate erected, in his honour, a triumphal arch which is still extant—a fine simple monument with a single opening. At the other end of the *decumanus maximus* or main street (3000 Roman ft. in length) is a fine bridge over the Ariminus (mod. Marecchia) begun by Augustus and completed by Tiberius in A.D. 20. It has five wide arches, the central one having a span of 35 ft., and is well preserved. Both it and the arch are built of Istrian stone. The present Piazza Giulio Cesare marks the site of the ancient forum. The remains of the amphitheatre are scanty; many of its stones have gone to build the city wall, which must, therefore, at the earliest belong to the end of the classical period. In A.D. 1 Augustus's grandson Gaius Caesar had all the streets of Ariminum paved. In A.D. 69 the town was attacked by the partisans of Vespasian, and was frequently besieged in the Gothic wars. It was one of the five seaports which remained Byzantine until the time of Pippin. (See RIMINI.)

See A. Tonini, *Storia della Città di Rimini* (Rimini, 1848–1862). (T. As.)

ARIOBARZANES, the name of three ancient kings or satraps of Pontus, and of three kings of Cappadocia and a Persian satrap.

Of the Pontic rulers two are most famous. (1) The son of Mithradates I., who revolted against Artaxerxes in 362 B.C. and may be regarded as the founder of the kingdom of Pontus (*q.v.*). According to Demosthenes he and his three sons received from the Athenians the honour of citizenship. (2) The son of Mithradates III., who reigned *c.* 266–240 B.C., and was one of those who enlisted the help of the invading Gauls (see GALATIA).

Of the Cappadocian rulers the best-known one ("Philo-Romaeus" on the coins) reigned nominally from 93 to 63 B.C., but was three times expelled by Mithradates the Great and as often reinstated by Roman generals. Soon after the third occasion he formally abdicated in favour of his son Ariobarzanes "Philopator," of whom we gather only that he was murdered some time before 51. His son Ariobarzanes, called "Eusebes" and "Philo-Romaeus," earned the gratitude of Cicero during his proconsulate in Cilicia, and fought for Pompey in the civil wars, but was afterwards received with honour by Julius Caesar, who subsequently reinstated him when expelled by Pharnaces of Pontus. In 42 B.C. Brutus and Cassius declared him a traitor, invaded his territory and put him to death.

The Persian satrap of this name unsuccessfully opposed Alexander the Great on his way to Persepolis (331 B.C.).

ARION, of Methymna, in Lesbos, a semi-legendary poet and musician, friend of Periander, tyrant of Corinth. He flourished about 625 B.C. Several of the ancients ascribe to him the invention of the dithyramb and of dithyrambic poetry; it is probable, however, that his real service was confined to the organization of that verse, and the conversion of it from a mere drunken song, used in the Dionysiac revels, to a measured antistrophic hymn, sung by a trained body of performers. The name Cycleus given to his father indicates the connexion of the son with the "cyclic" or circular chorus which was the origin of tragedy. According to Suidas he composed a number of songs and proems; none of these is extant; the fragment of a hymn to Poseidon attributed to him (Aelian, *Hist. An.* xii. 45) is spurious and was probably written in Attica in the time of Euripides. Nothing is known of the life of Arion, with the exception of the beautiful story first told by Herodotus (i. 23) and elaborated and embellished by subsequent writers. According to Herodotus, Arion being desirous of exhibiting his skill in foreign countries left Corinth, and travelled through Sicily and parts of Italy, where he gained great fame and amassed a large sum of money. At Taras (Tarentum) he embarked for his homeward voyage in a Corinthian vessel. The sight of his treasure roused the cupidity of the sailors, who resolved to possess themselves of it by putting him to death. In answer to his entreaties that they would spare his life, they insisted that he should either die by his own hand on shipboard or cast himself into the sea. Arion chose the latter, and as a last favour begged permission to sing a parting song. The sailors, desirous of hearing so famous a musician, consented, and the poet, standing on the deck of the ship, in full minstrel's attire, sang a dirge accompanied by his lyre. He then threw himself overboard; but instead of perishing, he was miraculously borne up in safety by a dolphin, supposed to have been charmed by the music. Thus he was conveyed to Taenarum, whence he proceeded to Corinth, arriving before the ship from Tarentum. Immediately on his arrival Arion related his story to Periander, who was at first incredulous, but eventually learned the truth by a stratagem. Summoning the sailors, he demanded what had become of the poet. They affirmed that he had remained behind at Tarentum; upon which they were suddenly confronted by Arion himself, arrayed in the same garments in which he had leapt overboard. The sailors confessed their guilt and were punished. Arion's lyre and the dolphin were translated to the stars. Herodotus and Pausanias (iii. 25. 7) both refer to a brass figure at Taenarum which was supposed to represent Arion seated on the dolphin's back. But this story is only one of several in which the dolphin appears as saving the lives of favoured heroes. For instance, it is curious that Taras, the mythical founder of Tarentum, is said to have been conveyed in this manner from Taenarum to Tarentum. On Tarentine coins a man and dolphin appear, and hence it may be thought that the monument at Taenarum represented Taras and not Arion. At the same time the connexion of Apollo with the dolphin must not be forgotten. Under this form the god appeared when he founded the celebrated oracle at Delphi, the name of which commemorates the circumstance. He was also the god of music, the special preserver of poets, and to him the lyre was sacred.

Among the numerous modern versions of the story, particular mention may be made of the pretty ballad by A. W. Schlegel; see also Lehrs, *Populäre Aufsätze aus dem Alterthum* (1844–1846); Clement, *Arion* (1898).

ARIOSTO, LODOVICO (1474–1533) Italian poet, was born at Reggio, in Lombardy, on the 8th of September 1474. His father was Niccolo Ariosto, commander of the citadel of Reggio. He showed a strong inclination to poetry from his earliest years, but was obliged by his father to study the law—a pursuit in which he lost five of the best years of his life. Allowed at last to follow his inclination, he applied himself to the study of the classics under Gregorio da Spoleto. But after a short time, during which he read the best Latin authors, he was deprived of his teacher by Gregorio's removal to France as tutor of Francesco Sforza. Ariosto thus lost the opportunity of learning Greek, as he intended. His father dying soon after, he was compelled to forego his literary occupations to undertake the management of the family, whose affairs were embarrassed, and to provide for his nine brothers and sisters, one of whom was a cripple. He wrote, however, about this time some comedies in prose and a few lyrical pieces. Some of these attracted the notice of the cardinal Ippolito d'Este, who took the young poet under his patronage and appointed him one of the gentlemen of his household. This prince usurped the character of a patron of literature, whilst the only reward which the poet received for having dedicated to him the *Orlando Furioso*, was the question, "Where did you find so many stories, Master Ludovic?" The poet himself tells us that the cardinal was ungrateful; deplores the time which he spent under his yoke; and adds, that if he received some niggardly pension, it was not to reward him for his poetry, which the prelate despised, but to make some just compensation for the poet's running like a messenger, with the risk of his life, at his eminence's pleasure. Nor was even this miserable pittance regularly paid during the period that the poet enjoyed it. The cardinal went to Hungary in 1518, and wished Ariosto to accompany him. The poet excused himself, pleading ill health, his love of study, the care of his private affairs and the age of his mother, whom it would have been disgraceful to leave. His excuses were not received, and even an interview was denied him. Ariosto then boldly said, that if his eminence thought to have bought a slave by assigning him the scanty pension of 75 crowns a year, he was mistaken and might withdraw his boon—which it seems the cardinal did.

The cardinal's brother, Alphonso, duke of Ferrara, now took the poet under his patronage. This was but an act of simple justice, Ariosto having already distinguished himself as a diplomatist, chiefly on the occasion of two visits to Rome as ambassador to Pope Julius II. The fatigue of one of these hurried journeys brought on a complaint from which he never recovered; and on his second mission he was nearly killed by order of the violent pope, who happened at the time to be much incensed against the duke of Ferrara. On account of the war, his salary of only 84 crowns a year was suspended, and it was withdrawn altogether after the peace; in consequence of which Ariosto asked the duke either to provide for him, or to allow him to seek employment elsewhere. A province, situated on the wildest heights of the Apennines, being then without a governor, Ariosto received the appointment, which he held for three years. The office was no sinecure. The province was distracted by factions and banditti, the governor had not the requisite means to enforce his authority and the duke did little to support his minister. Yet it is said that Ariosto's government satisfied both the sovereign and the people confided to his care; and a story is added of his having, when walking out alone, fallen in with a party of banditti, whose chief, on discovering that his captive was the author of *Orlando Furioso*, humbly apologized for not having immediately shown him the respect which was due to his rank. Although he had little reason to be satisfied with his office, he refused an embassy to Pope Clement VII. offered to him by the secretary of the duke, and spent the remainder of his life at Ferrara, writing comedies, superintending their performance as well as the construction of a theatre, and correcting his *Orlando Furioso*, of which the complete edition was published only a year before his death. He died of consumption on the 6th of June 1533.

That Ariosto was honoured and respected by the first men of his age is a fact; that most of the princes of Italy showed him great partiality is equally true; but it is not less so that their patronage was limited to kind words. It is not known that he ever received any substantial mark of their love for literature; he lived and died poor. He proudly wrote on the entrance of a house built by himself,

"Parva, sed apta mihi, sed nulli obnoxia, sed non
Sordida, parta meo sed tamen aere domus;"

which serves to show the incorrectness of the assertion of flatterers, followed by Tiraboschi, that the duke of Ferrara built that house for him. The only one who seems to have given anything to Ariosto as a reward for his poetical talent was the marquess del Vasto, who assigned him an annuity of 100 crowns on the revenues of Casteleone in Lombardy; but it was only paid, if ever, from the end of 1531. That he was crowned as poet by Charles V. seems untrue, although a diploma may have been issued to that effect by the emperor.

The character of Ariosto seems to have been fully and justly delineated by Gabriele, his brother:—

"Ornabat pietas et grata modestia Vatem,
Sancta fides, dictique memor, munitaque recto
Justitia, et nullo patientia victa labore,
Et constans virtus animi, et clementia mitis,
Ambitione procul pulsa, fastusque tumore."

His satires, in which we see him before us such as he was, show that there was no flattery in this portrait. In these compositions we are struck with the noble independence of the poet. He loved liberty with a most jealous fondness. His disposition was changeable withal, as he himself very frankly confesses in his Latin verses, as well as in the satires.

"Hoc olim ingenio vitales hausimus auras,
Multa cito ut placeant, displicitura brevi.
Non in amore modo mens haec, sed in omnibus impar
Ipsa sibi longa non retinenda mora."

Hence he never would bind himself, either by going into orders, or by marrying, till towards the end of his life, when he espoused Alessandra, widow of Tito Strozzi. He had no issue by his wife, but he left two natural sons by different mothers.

His Latin poems do not perhaps deserve to be noticed: in the age of Flaminio, Vida, Fracastoro and Sannazaro, better things were due from a poet like Ariosto. His lyrical compositions show the poet, although they do not seem worthy of his powers. His comedies, of which he wrote four, besides one which he left unfinished, are avowedly imitated from Plautus and Terence; and although native critics may admire in them the elegance of the diction, the liveliness of the dialogue and the novelty of some scenes, few will feel interest either in the subject or in the characters, and it is hard to approve the immoral passages by which they are disfigured, however grateful these might be to the audiences and patrons of theatrical representations in Ariosto's own day.

Of all the works of Ariosto, the most solid monument of his fame is the *Orlando Furioso*, the extraordinary merits of which have cast into oblivion the numberless romance poems which inundated Italy during the 15th, 16th and 17th centuries.

The popularity which an earlier poem on the same theme, *Orlando Innamorato*, by Boiardo, enjoyed in Ariosto's time, cannot be well conceived, now that the enthusiasm of the crusades, and the interest which was attached to a war against the Moslems, have passed away. Boiardo wrote and read his poem at the court of Ferrara, but died before he was able to finish it. Many poets undertook the difficult task of its completion; but it was reserved for Ariosto both to finish and to surpass, his original. Boiardo did not, perhaps, yield to Ariosto either in vigour or in richness of imagination, but he lived in a less refined age, and died before he was able to recast or even finish the poetical romance which he had written under the impulse of his exuberant fancy. Ariosto, on the other hand, united to a powerful imagination an elegant and cultivated taste. He began to write his great poem about 1503, and after having consulted the first men of the age of Leo X., he published it in 1516, in only 40 cantos (extended afterwards to 46); and up to the moment of his death never ceased to correct and improve both the subject and the style. It is in this latter quality that he excels, and for which he had assigned him the name of *Divino Lodovico*. Even when he jests, he never compromises his dignity; and in pathetic description or narrative he excites the reader's deepest feelings. In his machinery he displays a vivacity of fancy with which no other poet can vie; but he never lets his fancy carry him so far as to omit to employ, with an art peculiar to himself, those simple and natural pencil-strokes which, by imparting to the most extraordinary feats a colour of reality, satisfy the reason without disenchanting the imagination. The death of Zerbino, the complaints of Isabella, the effects of discord among the Saracens, the flight of Astolfo to the moon, the passion which causes Orlando's madness, teem with beauties of every variety. The supposition that the poem is not connected throughout is wholly unfounded; there is a connexion which, with a little attention, will become evident. The love of Ruggero and Bradamante forms the main subject of the *Furioso*; every part of it, except some episodes, depend upon this subject; and the poem ends with their marriage.

The first complete edition of the *Orlando Furioso* was published at Ferrara in 1532, as noted above. The edition of Morali (Milan, 1818) follows the text of the 1532 edition with great correctness. Of editions published in England, those of Baskerville (Birmingham, 1773) and Panizzi (London, 1834) are the most important. The indifferent translations into English of Sir John Harrington (1591) and John Hoole (1783) have been superseded by the spirited rendering of W. Stewart Rose (1823). See also E. Gardner, *Ariosto: the Prince of Court Poets* (1906).

ARISTAENETUS, Greek epistolographer, flourished in the 5th or 6th century A.D. He was formerly identified with Aristaenetus of Nicaea (the friend of Symmachus), who perished in an earthquake at Nicomedia, A.D. 358, but internal evidence points to a much later date. Under his name two books of love stories, in the form of letters, are extant; the subjects are borrowed from the erotic elegies of such Alexandrian writers as Callimachus, and the language is a patchwork of phrases from Plato, Lucian, Alciphron and others. The stories are feeble and insipid, and full of strange and improbable incidents.

Text: Boissonade (1822); Hercher, *Epistolographi Graeci* (1873). English translations: Boyer (1701); Thomas Brown (1715); R. B. Sheridan and Halked (1771 and later).

ARISTAEUS, a divinity whose worship was widely spread throughout ancient Greece, but concerning whom the myths are somewhat obscure. The account most generally received connects him specially with Thessaly. Apollo carried off from Mount Pelion the nymph Cyrene, daughter or granddaughter of the river-god Peneus, and conveyed her to Libya, where she gave birth to Aristaeus. From this circumstance the town of Cyrene took its name. The child was at first handed over to the care of the Hours, or the nymph Melissa and the centaur Cheiron. He afterwards left Libya and went to Thebes, where he received instruction from the Muses in the arts of healing and prophecy, and married Autonoe, daughter of Cadmus, by whom he had several children, among others, the unfortunate Actaeon. He is said to have visited Ceos, where, by erecting a temple to Zeus Icmaeus (the giver of moisture), he freed the inhabitants from a terrible drought. The islanders worshipped him, and occasionally identified him with Zeus, calling him Zeus Aristaeus. After travelling through many of the Aegean islands, through Sicily, Sardinia and Magna Graecia, everywhere conferring benefits and receiving divine honours, Aristaeus reached Thrace, where he was initiated into the mysteries of Dionysus, and finally disappeared near Mount Haemus. While in Thrace he is said to have caused the death of Eurydice, who was bitten by a snake while fleeing from him. Aristaeus was essentially a benevolent deity; he was worshipped as the first who introduced the cultivation of bees (Virgil, *Georg.* iv. 315-558), and of the vine and olive; he was the protector of herdsmen and hunters; he warded off the evil effects of the dog-star; he possessed the arts of healing and prophecy. He was often identified with Zeus, Apollo and Dionysus. In ancient sculptures and coins he is represented as a young man, habited like a shepherd, and sometimes carrying a sheep on his shoulders. Coins of Ceos exhibit the head of Aristaeus and Sirius in the form of a dog crowned with rays.

Pindar, *Pythia*, ix. 5-65; Apollonius Rhodius, schol. on ii. 498, 500; Diodorus, iv. 81.

ARISTAGORAS (d. 497 B.C.), brother-in-law and cousin of Histiaeus, tyrant of Miletus. While Histiaeus was practically a prisoner at the court of Darius, he acted as regent in Miletus.

In 500 B.C. he persuaded the Persians to join him in an attack upon Naxos, but he quarrelled with Megabates, the Persian commander, who warned the inhabitants of the island, and the expedition failed. Finding himself the object of Persian suspicion, Aristagoras, instigated by a message from Histiaeus, raised the standard of revolt in Miletus, though it seems likely that this step had been under consideration for some time (see IONIA). After the complete failure of the Ionian revolt he emigrated to Myrcinus in Thrace. Here he fell in battle (497), while attacking Ennea Hodoi (afterwards Amphipolis) on the Strymon, which belonged to the Edonians, a Thracian tribe. The aid given to him by Athens and Eretria, and the burning of Sardis, were the immediate cause of the invasion of Greece by Darius.

See Herodotus v. 30-51, 97-126; Thucydides iv. 102; Diodorus xii. 68; for a more favourable view see G. B. Grundy, *Great Persian War* (London, 1901).

ARISTANDER, of Telmessus in Lycia, was the favourite soothsayer of Alexander the Great, who consulted him on all occasions. After the death of the monarch, when his body had lain unburied for thirty days, Aristander procured its burial by foretelling that the country in which it was interred would be the most prosperous in the world. He is frequently mentioned by the historians who wrote about Alexander, and was probably the author of a work on prodigies, which is referred to by Pliny (*Nat. Hist.* xvii. 38) and Lucian.

Philopatris, 21; Arrian, *Anabasis*, ii. 26, iii. 2, iv. 4; Plutarch, *Alexander*; Curtius iv. 2, 6, 15, vii. 7.

ARISTARCHUS, of Samos, Greek astronomer, flourished about 250 B.C. He is famous as having been the first to maintain that the earth moves round the sun. On this account he was accused of impiety by the Stoic Cleanthes, just as Galileo, in later years, was attacked by the theologians. His only extant work is a short treatise (with a commentary by Pappus) *On the Magnitudes and Distances of the Sun and Moon.* His method of estimating the relative lunar and solar distances is geometrically correct, though the instrumental means at his command rendered his data erroneous. Although the heliocentric system is not mentioned in the treatise, a quotation in the *Arenarius* of Archimedes from a work of Aristarchus proves that he anticipated the great discovery of Copernicus. Further, Copernicus could not have known of Aristarchus's doctrine, since Archimedes's work was not published till after Copernicus's death. Aristarchus is also said to have invented two sun-dials, one hemispherical, the so-called *scaphion*, the other plane.

Editio princeps by Wallis (1688); Fortia d'Urban (1810); Nizze (1856). See Bergk-Hinrichs, *Aristarchus von Samos* (1883); Tannery, *Aristarque de Samos*; also ASTRONOMY.

ARISTARCHUS, of Samothrace (*c.* 220–143 B.C.), Greek grammarian and critic, flourished about 155. He settled early in Alexandria, where he studied under Aristophanes of Byzantium, whom he succeeded as librarian of the museum. On the accession of the tyrant Ptolemy Physcon (his former pupil), he found his life in danger and withdrew to Cyprus, where he died from dropsy, hastened, it is said, by voluntary starvation, at the age of 72. Aristarchus founded a school of philologists, called after him "Aristarcheans," which long flourished in Alexandria and afterwards at Rome. He is said to have written 800 commentaries alone, without reckoning special treatises. He edited Hesiod, Pindar, Aeschylus, Sophocles and other authors; but his chief fame rests on his critical and exegetical edition of Homer, practically the foundation of our present recension. In the time of Augustus, two Aristarcheans, Didymus and Aristonicus, undertook the revision of his work, and the extracts from these two writers in the Venetian scholia to the *Iliad* give an idea of Aristarchus's Homeric labours. To obtain a thoroughly correct text, he marked with an obelus the lines he considered spurious; other signs were used by him to indicate notes, varieties of reading, repetitions and interpolations. He arranged the *Iliad* and the *Odyssey* in twenty-four books as we now have them. As a commentator his principle was that the author should explain himself, without recourse to allegorical interpretation; in grammar, he laid chief stress on analogy and uniformity of usage and construction. His views were opposed by Crates of Mallus, who wrote a treatise Περὶ Ἀνωμαλίας, especially directed against them.

See Lehrs, *De Aristarchi Stud. Homericis* (3rd ed., 1882); Ludwich, *Aristarchs homerische Textcritik* (1884); especially Sandys, *Hist. of Class. Schol.* (ed. 1906), vol. i. with authorities; also HOMER.

ARISTEAS, a somewhat mythical personage in ancient Greece, said to have lived in the time of Cyrus and Croesus, or, according to some, *ca.* 690 B.C. We are chiefly indebted to Herodotus (iv. 13-15) for our knowledge of him and his poem *Arimaspeia.* He belonged to a noble family of Proconnesus, an island colony from Miletus in the Propontis, and was supposed to be inspired by Apollo. He travelled through the countries north and east of the Euxine, and visited the Hyperboreans, Issedonians and Arimaspians, who fought against the gold-guarding griffins. An important historical fact which seems to be indicated in his poem is the rush of barbarian hordes towards Europe under pressure from their neighbours. Twelve lines of the poem are preserved in Tzetzes and Longinus. Wonderful stories are told of Aristeas. At Proconnesus, he fell dead in a shop; simultaneously a traveller declared he had spoken with him near Cyzicus; his body vanished; six years afterwards, he returned. Again disappearing, 240 years later he was at Metapontum, and commanded the inhabitants to raise a statue to himself and an altar to Apollo, whom he had accompanied in the form of a raven, at the founding of the city. According to Suidas, Aristeas also wrote a prose theogony. The genuineness of his works is disputed by Dionysius of Halicarnassus.

See Tournier, *De Aristea Proconneso*(1863); Macan, *Hdt.* iv. 14 note.

ARISTEAS, the pseudonymous author of a famous *Letter* in which is described, in legendary form, the origin of the Greek translation of the Old Testament known as the Septuagint (*q.v.*). Aristeas represents himself as a Gentile Greek, but was really an Alexandrian Jew who lived under one of the later Ptolemies. Though the *Letter* is unauthentic, it is now recognized as a useful source of information concerning both Egyptian and Palestinian affairs in the 2nd and possibly in the 3rd century B.C.

An English translation, based on a critical Greek text, was published by H. St J. Thackeray in the *Jewish Quarterly Review*, vol. xv. There are two modern editions of the Greek, one by the last named (in Swete's *Introduction to the Old Testament in Greek*, Cambridge, 1900), the other by P. Wendland (Leipzig, 1900).

ARISTIDES [Ἀριστείδης] (*c.* 530–468 B.C.), Athenian statesman, called "the Just," was the son of Lysimachus, and a member of a family of moderate fortune. Of his early life we are told merely that he became a follower of the statesman Cleisthenes and sided with the aristocratic party in Athenian politics. He first comes into notice as strategus in command of his native tribe Antiochis at Marathon, and it was no doubt in consequence of the distinction which he then achieved that he was elected chief archon for the ensuing year (489–488). In pursuance of his conservative policy which aimed at maintaining Athens as a land power, he was one of the chief opponents of the naval policy of Themistocles (*q.v.*). The conflict between the two leaders ended in the ostracism of Aristides, at a date variously given between 485 and 482. It is said that, on this occasion, a voter, who did not know him, came up to him, and giving him his sherd, desired him to write upon it the name of Aristides. The latter asked if Aristides had wronged him. "No," was the reply, "and I do not even know him, but it irritates me to hear him everywhere called *the just.*"

Early in 480 Aristides profited by the decree recalling the post-Marathonian exiles to help in the defence of Athens against the Persian invaders, and was elected strategus for the year 480–479. In the campaign of Salamis he rendered loyal support to Themistocles, and crowned the victory by landing Athenian infantry on the island of Psyttaleia and annihilating the Persian garrison stationed there (see SALAMIS). In 479 he was re-elected strategus, and invested with special powers as commander of the Athenian contingent at Plataea; he is also said to have judiciously suppressed a conspiracy among some oligarchic malcontents in the army, and to have played a prominent part in arranging for the celebration of the victory. In 478 or 477 Aristides was in command of the Athenian squadron off Byzantium, and so far won the confidence of the Ionian allies that, after revolting from the Spartan admiral Pausanias, they offered him the chief command and left him with absolute discretion in fixing the contributions of the newly formed confederacy (see DELIAN LEAGUE). His assessment was universally accepted as equitable, and continued as the basis of taxation for the greater part of the league's duration; it was probably from this that he won the title of "the Just." Aristides soon left the command of the fleet to his friend Cimon (*q.v.*), but continued to hold a predominant position in Athens. At first he seems to have remained on good terms with Themistocles, whom he is said to have helped in outwitting the Spartans over the rebuilding of the walls of Athens. But in spite of statements in which ancient authors have represented Aristides as a democratic reformer, it is certain that the period following the Persian wars during which he shaped Athenian policy was one of conservative reaction. (For the theory based on Plutarch, *Aristid.* 22, that Aristides after Plataea threw open the archonship to all the citizens, see ARCHON.)

He is said by some authorities to have died at Athens, by others on a journey to the Euxine sea. The date of his death is given by Nepos as 468; at any rate he lived to witness the ostracism of Themistocles, towards whom he always displayed a generous conduct, but had died before the rise of Pericles. His estate seems to have suffered severely from the Persian invasions, for apparently he did not leave enough money to defray the expenses of his burial, and it is known that his descendants even in the 4th century received state pensions. (See ATHENS; THEMISTOCLES.)

AUTHORITIES.—Herodotus viii. 79-81, 95; ix. 28; "Constitution of Athens" (*Ath. Pol.*), 22-24, 41; Plutarch, *Aristides*; Cornelius Nepos, *Vita Aristidis*. See also E. Meyer, *Geschichte des Altertums* (Stuttgart, 1901), iii. pp. 481, 492. In the absence of positive information the 4th-century writers (on whom Plutarch and Nepos mainly rely) seized upon his surname of "Just," and wove round it a number of anecdotes more picturesque than historical. Herodotus is practically our only trustworthy authority. (M. O. B. C.)

ARISTIDES, of Miletus, generally regarded as the father of Greek prose romance, flourished 150–100 B.C. He wrote six books of erotic *Milesian Tales* (Μιλησιακὰ), which enjoyed great popularity, and were subsequently translated into Latin by Cornelius Sisenna (119–67 B.C.). They are lost, with the exception of a few fragments, but the story of the Ephesian matron in Petronius gives an idea of their nature. They have been compared with the old French *fabliaux* and the tales of Boccaccio.

Plutarch, *Crassus*, 32; Ovid, *Tristia*, ii. 413, 443; Müller, *Fragmenta Historicorum Graecorum*, iv.

ARISTIDES, of Thebes, a Greek painter of the 4th century B.C. He is said to have excelled in expression. For example, a picture of his representing a dying mother's fear lest her infant should suck death from her breast was much celebrated. He also painted one of Alexander's battles. One of his pictures is said to have been bought by King Attalus for 100 talents (more than £20,000).

ARISTIDES, AELIUS, surnamed THEODORUS, Greek rhetorician and sophist, son of Eudaemon, a priest of Zeus, was born at Hadriani in Mysia, A.D. 117 (or 129). He studied under Herodes Atticus of Athens, Polemon of Smyrna, and Alexander of Cotyaeum, in whose honour he composed a funeral oration still extant. In the practice of his calling he travelled through Greece, Italy, Egypt and Asia, and in many places the inhabitants erected statues to him in recognition of his talents. In 156 he was attacked by an illness which lasted thirteen years, the nature of which has caused considerable speculation. However, it in no way interfered with his studies; in fact, they were prescribed as part of his cure. Aristides' favourite place of residence was Smyrna. In 178, when it was destroyed by an earthquake, he wrote an account of the disaster to Aurelius, which deeply affected the emperor and induced him to rebuild the city. The grateful inhabitants set up a statue in honour of Aristides, and styled him the "builder" of Smyrna. He refused all honours from them except that of priest of Asclepius, which office he held till his death, about 189. The extant works of Aristides consist of two small rhetorical treatises and fifty-five declamations, some not really speeches at all. The treatises are on *political* and *simple speech*, in which he takes Demosthenes and Xenophon as models for illustration; some critics attribute these to a later compiler (Spengel, *Rhetores Graeci*). The six *Sacred Discourses* have attracted some attention. They give a full account of his protracted illness, including a mass of superstitious details of visions, dreams and wonderful cures, which the god Asclepius ordered him to record. These cures, from his account, offer similarities to the effects produced by hypnotism. The speeches proper are epideictic or show speeches—on certain gods, panegyrics of the emperor and individual cities (Smyrna, Rome); justificatory—the attack on Plato's *Gorgias* in defence of rhetoric and the four statesmen, Thucydides, Miltiades, Pericles, Cimon; symbouleutic or political, the subjects being taken from the past history of free Greece—the Sicilian expedition, peace negotiations with Sparta, the political situation after the battle of Leuctra. The *Panathenaicus* and *Encomium of Rome* were actually delivered, the former imitated from Isocrates. The *Leptinea*—the genuineness of which is disputed—contrast unfavourably with the speech of Demosthenes. Aristides' works were highly esteemed by his contemporaries; they were much used for school instruction, and distinguished rhetoricians wrote commentaries upon them. His style, formed on the best models, is generally clear and correct, though sometimes obscured by rhetorical ornamentation; his subjects being mainly fictitious, the cause possessed no living interest, and his attention was concentrated on form and diction.

Editio princeps (52 declamations only) (1517); Dindorf (1829); Keil (1899); Sandys, *Hist. of Class. Schol.* i. 312 (ed. 1906).

ARISTIDES, QUINTILIANUS, the author of an ancient treatise on music, who lived probably in the third century A.D. According to Meibomius, in whose collection (*Antiq. Musicae Auc. Septem*, 1652) this work is printed, it contains everything on music that is to be found in antiquity. (See Pauly-Wissowa, *Realencyc.* ii. 894.)

ARISTIDES, APOLOGY OF. Until 1878 our knowledge of the early Christian writer Aristides was confined to the statement of Eusebius that he was an Athenian philosopher, who presented an apology "concerning the faith" to the emperor Hadrian. In that year, however, the Mechitharists of S. Lazzaro at Venice published a fragment in Armenian[1] from the beginning of the apology; and in 1889 Dr Rendel Harris found the whole of it in a Syriac version on Mount Sinai. While his edition was passing through the press, it was observed by the present writer that all the while the work had been in our hands in Greek, though in a slightly abbreviated form, as it had been imbedded as a speech in a religious novel written about the 6th century, and entitled "The Life of Barlaam and Josaphat." The discovery of the Syriac version reopened the question of the date of the work. For although its *title* there corresponds to that given by the Armenian fragment and by Eusebius, it begins with a formal inscription to "the emperor Titus Hadrianus Antoninus Augustus Pius"; and Dr R. Harris is followed by Harnack and others in supposing that it was only through a careless reading of this inscription that the work was supposed to have been addressed to Hadrian. If this be the case, it must be placed somewhere in the long reign of Antoninus Pius (138–161). There are, however, no internal grounds for rejecting the thrice-attested dedication to Hadrian his predecessor, and the picture of primitive Christian life which is here found points to the earlier rather than to the later date. It is possible that the Apology was read to Hadrian in person when he visited Athens, and that the Syriac inscription was prefixed by a scribe on the analogy of Justin's Apology, a mistake being made in the amplification of Hadrian's name.

The Apology opens thus: "I, O king, by the providence of God came into the world; and having beheld the heaven, and the earth, and the sea, the sun and moon, and all besides, I marvelled at their orderly disposition; and seeing the world and all things in it, that it is moved by compulsion, I understood that He that moveth and governeth it is God. For whatsoever moveth is stronger than that which is moved, and whatsoever governeth is stronger than that which is governed." Having briefly spoken of the divine nature in the terms of Greek philosophy, Aristides proceeds to ask which of all the races of men have at all partaken of the truth about God. Here we have the first attempt at a systematic comparison of ancient religions. For the purpose of his inquiry he adopts an obvious threefold division into idolaters, Jews and Christians. Idolaters, or, as he more gently terms them in addressing the emperor, "those who worship what among you are said to be gods," he subdivides into the three great world-civilizations—Chaldeans, Greeks and Egyptians. He chooses this order so as to work up to a climax of error and absurdity in heathen worship. The direct nature-worship of the Chaldeans is shown to be false because its objects are works of the Creator, fashioned for the use of men. They obey fixed laws and have no power over themselves. "The Greeks have erred worse than the Chaldeans . . . calling those gods who are no gods, according to their evil lusts, in order that having these as advocates of their wickedness they may commit adultery, and plunder and kill, and do the worst of deeds." The gods of Olympus are challenged one by one, and shown to be either vile or helpless, or both at once. A heaven of quarrelling divinities cannot inspire a reasonable worship. These gods are not even respectable; how can they be adorable? "The Egyptians have erred worse than all the nations; for they were not content with the worships of the Chaldeans and Greeks, but introduced, moreover, as gods even brute beasts of the dry land and of the waters, and plants and herbs. . . . Though they see their gods eaten by others and by men, and burned, and slain, and rotting, they do not understand concerning them that they are no gods."

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[1] *Codex Venet. ann.*, 081, and *Codex Etchmiaz.* of the 11th century.

Throughout the whole of the argument there is strong common-sense and a stern severity unrelieved by conscious humour. Aristides is engaged in a real contest; he strikes hard blows, and gives no quarter. He cannot see, as Justin and Clement see, a striving after truth, a feeling after God, in the older religions, or even in the philosophies of Greece. He has no patience with attempts to find a deeper meaning in the stories of the gods. "Do they say that one nature underlies these diverse forms? Then why does god hate god, or god kill god? Do they say that the histories are mythical? Then the gods themselves are myths, and nothing more."

The Jews are briefly treated. After a reference to their descent from Abraham and their sojourn in Egypt, Aristides praises them for their worship of the one God, the Almighty Creator; but blames them as worshipping angels, and observing "sabbaths and new moons, and the unleavened bread, and the great fast, and circumcision, and cleanness of meats." He then proceeds to the description of the Christians. He begins with a statement which, when purged of glosses by a comparison of the three forms in which it survives, reads thus: "Now the Christians reckon their race from the Lord Jesus Christ; and He is confessed to be the Son of God Most High. Having by the Holy Spirit come down from heaven, and having been born of a Hebrew virgin, He took flesh and appeared unto men, to call them back from their error of many gods; and having completed His wonderful dispensation, He was pierced by the Jews, and after three days He revived and went up to heaven. And the glory of His coming thou canst learn, O king, from that which is called among them the evangelic scripture, if thou wilt read it. He had twelve disciples, who after His ascent into heaven went forth into the provinces of the world and taught His greatness; whence they who at this day believe their preaching are called Christians." This passage contains striking correspondences with the second section of the Apostles' Creed. The attribution of the Crucifixion to the Jews appears in several 2nd-century documents; Justin actually uses the words "He was pierced by you" in his dialogue with Trypho the Jew.

"These are they," he proceeds, "who beyond all the nations of the earth have found the truth: for they know God as Creator and Maker of all things, and they worship no other god beside Him; for they have His commandments graven on their hearts, and these they keep in expectation of the world to come. . . . . Whatsoever they would not should be done unto them, they do not to another. . . . He that hath supplieth him that hath not without grudging: if they see a stranger they bring him under their roof, and rejoice over him, as over a brother indeed, for they call not one another brethren after the flesh, but after the spirit. They are ready for Christ's sake to give up their own lives; for His commandments they securely keep, living holily and righteously, according as the Lord their God hath commanded them, giving thanks to Him at all hours, over all their food and drink, and the rest of their good things." This simple description is fuller in the Syriac, but the additional details must be accepted with caution: for while it is likely that the monk who appropriated the Greek may have cut it down to meet the exigencies of his romance, it is the habit of certain Syriac translators to elaborate their originals. After asserting that "this is the way of truth," and again referring for further information to "the writings of the Christians," he says: "And truly this is a new race, and there is something divine mingled with it." At the close we have a passage which is found only in the Syriac, but which is shown by internal evidence to contain original elements: "The Greeks, because they practise foul things . . . turn the ridicule of their foulness upon the Christians." This is an allusion to the charges of Thyestean banquets and other immoralities, which the early apologists constantly rebut. "But the Christians offer up prayers for them, that they may turn from their error; and when one of them turns, he is ashamed before the Christians of the deeds that were done by him, and he confesses to God saying: 'In ignorance I did these things'; and he cleanses his heart, and his sins are forgiven him, because he did them in ignorance in former time, when he was blaspheming the true knowledge of the Christians."

These last words point to the use in the composition of this Apology of a lost apocryphal work of very early date, *The Preaching of Peter*. This book is known to us chiefly by quotations in Clement of Alexandria: it was widely circulated, and at one time claimed a place within the Canon. It was used by the Gnostic Heracleon and probably by the unknown writer of the epistle to Diognetus. From the fragments which survive we see that it contained: (1) a description of the nature of God, which closely corresponds with Arist. i., followed by (2) a warning not to worship according to the Greeks, with an exposure of various forms of idolatry; (3) a warning not to worship according to the Jews—although they alone think they know the true God—for they worship angels and are superstitious about moons and sabbaths, and feasts, comp. Arist. xiv.; (4) a description of the Christians as being "a third race," and worshipping God in "a new way" through Christ; (5) a proof of Christianity from Jewish prophecy; (6) a promise of forgiveness to Jews and Gentiles who should turn to Christ, because they had sinned "in ignorance" in the former time. Now all these points, except the proof from Jewish prophecy, are taken up and worked out by Aristides with a frequent use of the actual language of *The Preaching of Peter*. A criterion is thus given us for the reconstruction of the Apology, where the Greek which we have has been abbreviated, and we are enabled to claim with certainty some passages of the Syriac which might otherwise be suspected as interpolations.

The style of the Apology is exceedingly simple. It is curiously misdescribed by Jerome, who never can have seen it, as "Apologeticum pro Christianis contextum philosophorum sententiis." Its merits are its recognition of the helplessness of the old heathenism to satisfy human aspiration after the divine, and the impressive simplicity with which it presents the unfailing argument of the lives of Christians.

The student may consult *The Apology of Aristides*, Syriac text and translation (J. R. Harris), with an appendix containing the Greek text, *Texts and Studies*, i. 1 (1891), and a critical discussion by R. Seeberg in Zahn's *Forschungen*, v. 2 (1893); also, brief discussions by A. Harnack, *Altchristl. Litteratur*, i. 96 ff., *Chronologie*, i. 271 ff., where references to other writers may be found. The *Epistola ad omnes philosophos* and the *Homily on the Penitent Thief*, ascribed by Armenian tradition to Aristides, are really of 5th-century origin. Trans. of *Apology* by W. S. Walford (1909). (J. A. R.)

ARISTIPPUS (*c.* 435–356 B.C.), Greek philosopher, the founder of the Cyrenaic school, was the son of Aritadas, a merchant of Cyrene. At an early age he came to Athens, and was induced to remain by the fame of Socrates, whose pupil he became. Subsequently he travelled through a number of Grecian cities, and finally settled in Cyrene, where he founded his school. His philosophy was eminently practical (see Cyrenaics). Starting from the two Socratic principles of virtue and happiness, he emphasized the second, and made pleasure the criterion of life. That he held to be good which gives the maximum of pleasure. In pursuance of this he indulged in all forms of external luxury. At the same time he remained thoroughly master of himself and had the self-control to refrain or to enjoy. Diogenes Laertius (ii. 65), quoting Phanias the peripatetic, says that he received money for his teaching, and Aristotle (*Met.* ii. 2) expressly calls him a sophist. Diogenes further states that he wrote several treatises, but none have survived. The five letters attributed to him are undoubtedly spurious. His daughter Arete, and her son Aristippus (μητροδίδακτος, " pupil of his mother "), carried on the school after his death. A cosmopolitan on principle, and a convinced disbeliever in the ethics of his day, he comes very near to modern empiricism and especially to the modern Hedonist school.

ARISTO or Ariston, of Chios (*c.* 250 B.C.), a Stoic philosopher and pupil of Zeno. He differed from Zeno on many points, and approximated more closely to the Cynic school. He was eloquent (hence his nickname " the Siren ") but controversial in tone. He despised logic, and rejected the philosophy of nature as beyond the powers of man. Ethics alone he considered worthy of study, and in that only general and theoretical questions. He rejected Zeno's doctrine of desirable things, intermediate between virtue and vice. There is only one virtue—a clear, intelligent, healthy state of mind (*hygeia*). Aristo is frequently confounded with another philosopher of the same name, Ariston of Iulis, in Ceos, who, about 230 B.C., succeeded Lyco as scholarch of the Peripatetics. (See Stoics.)

ARISTO, of Pella, a Jewish Christian writer of the middle of the 2nd century, who like Hegesippus (*q.v.*) represents a school of thought more liberal than that of the Pharisaic and Essene Ebionites to which the decline of Jewish Christianity mainly led. Aristo is cited by Eusebius (*Hist. Eccl.* iv. 6. 3) for a decree of Hadrian respecting the Jews, but he is best known as the writer of a *Dialogue* (between Papiscus, an Alexandrian Jew, and Jason, who represents the author) on the witness of prophecy to Jesus Christ, which was approvingly defended by Origen against the reproaches of Celsus. The little book was perhaps used by Justin Martyr in his own *Dialogue with Trypho*, and probably also by Tertullian and Cyprian, but it has not been preserved.

The literature is cited in G. Krüger's *Early Christian Literature*, pp. 104 f.

ARISTOBULUS, of Cassandreia, Greek historian, accompanied Alexander the Great on his campaigns, of which he wrote an account, mainly geographical and ethnological. His work was largely used by Arrian.

Müller, *Historicorum Graecorum Fragmenta*; Schöne, *De Rerum Alexandri Magni Scriptoribus* (1870).

ARISTOBULUS, of Paneas (*c.* 160 B.C.), a Jewish philosopher of the Peripatetic school. Gercke places him in the time of Ptolemy X. Philometor (end of 2nd century), Anatolius in that of Ptolemy II. Philadelphus, but the middle of the 2nd century is more probable. He was among the earliest of the Jewish-Alexandrian philosophers whose aim was to reconcile and identify Greek philosophical conceptions with the Jewish religion. Only a few fragments of his work, apparently entitled *Commentaries on the Writings of Moses*, are quoted by Clement, Eusebius and other theological writers, but they suffice to show its object. He endeavoured to prove that early Greek philosophers had borrowed largely from certain parts of Scripture, and quoted from Linus, Orpheus, Musaeus and others, passages which strongly resemble the Mosaic writings. These passages, however, were obvious forgeries. It is suggested that the name Aristobulus was taken from 2 Macc. i. 10. The hypothesis (Schlatter, *Das neugefundene hebräische Stück des Sirach*) that it was from Aristobulus that the philosophy of *Ecclesiasticus* was derived is not generally accepted.

See E. Schürer, *History of the Jewish People* (Eng. trans., 1890–1891), ii. 237 seq.; article Alexandrian School: *Philosophy*; and *s.v.* " Aristobulus " in *Jewish Encyclopedia* (Paul Wendland).

ARISTOCRACY (Gr. ἄριστος, best; κρατία, government), etymologically, the " rule of the best," a form of government variously defined and appreciated at different times and by different authorities. In Greek political philosophy, aristocracy is the government of those who most nearly attain to the ideal of human perfection. Thus Plato in the *Republic* advocates the rule of the " philosopher-king " who, in the social scheme, is analogous to Reason in the intellectual, and alone is qualified to control the active principles, *i.e.* the fighting population and the artisans or workers. Aristocracy is thus the government by those who are superior both morally and intellectually, and, therefore, govern directly in the interests of the governed, as a good doctor works for the good of his patient. Aristotle classified good governments under three heads—monarchy, aristocracy and commonwealth (πολιτεία), to which he opposed the three perverted forms—tyranny or absolutism, oligarchy and democracy or mob-rule. The distinction between aristocracy and oligarchy, which are both necessarily the rule of the few, is that whereas the few ἄριστοι will govern unselfishly, the oligarchs, being the few wealthy (" plutocracy " in modern terminology), will allow their personal interests to predominate. While Plato's aristocracy might be the rule of the wise and benevolent despot, Aristotle's is necessarily the rule of the few.

Historically aristocracy develops from primitive monarchy by the gradual progressive limitation of the regal authority. This process is effected primarily by the nobles who have hitherto formed the council of the king (an excellent example will be found in Athenian politics, see Archon), whose triple prerogative—religious, military and judicial—is vested, *e.g.*, in a magistracy of three. These are either members of the royal house or the heads of noble families, and are elected for life or periodically by their peers, *i.e.* by the old royal council (cf. the Areopagus at Athens, the Senate at Rome), now the sovereign power. In practice this council depends primarily on a birth qualification, and thus has always been more or less inferior to the Aristotelian ideal; it is, by definition, an " oligarchy " of birth, and is recruited from the noble families, generally by the addition of emeritus magistrates. From the earliest times, therefore, the word " aristocracy " became practically synonymous with " oligarchy," and as such it is now generally used in opposition to democracy (which similarly took the place of Aristotle's πολιτεία), in which the ultimate sovereignty resides in the whole citizen body.

The aristocracy of which we know most in ancient Greece was that of Athens prior to the reforms of Cleisthenes, but all the Greek city-states passed through a period of aristocratic or oligarchic government. Rome, between the regal and the imperial periods, was always more or less under the aristocratic government of the senate, in spite of the gradual growth of democratic institutions (the Lat. *optimates* is the equivalent of ἄριστοι). There is, however, one feature which distinguishes these aristocracies from those of modern states, namely, that they were all slave-owning. The original relation of the slave-population, which in many cases outnumbered the free citizens, cannot always be discovered. But in some cases we know that the slaves were the original inhabitants who had been overcome by an influx of racially different invaders (cf. Sparta with its Helots); in others they were captives taken in war. Hence even the most democratic states of antiquity were so far aristocratic that the larger proportion of the inhabitants had no voice in the government. In the second place this relation gave rise to a philosophic doctrine, held even by Aristotle, that there were peoples who were inferior by nature and adapted to submission (φύσει δοῦλοι); such people had no "virtue" in the technical civic sense, and were properly occupied in performing the menial functions of society, under the control of the ἄριστοι. Thus, combined with the criteria of descent, civic status and the ownership of the land, there was the further idea of intellectual and social superiority. These qualifications were naturally, in course of time, shared by an increasingly large number of the lower class who broke down the barriers of wealth and education. From this stage the transition is easy to the aristocracy of wealth, such as we find at Carthage and later at Venice, in periods when the importance of commerce was paramount and mercantile pursuits had cast off the stigma of inferiority (in Gr. βαναυσία).

It is important at this stage to distinguish between aristocracy and the feudal governments of medieval Europe. In these it is true that certain power was exercised by a small number of families, at the expense of the majority. But under this system each noble governed in a particular area and within strict limitations imposed by his sovereign; no sovereign authority was vested in the nobles collectively.

Under the conditions of the present day the distinction of aristocracy, democracy and monarchy cannot be rigidly maintained from a purely governmental point of view. In no case does the sovereign power in a state reside any longer in an aristocracy, and the word has acquired a social rather than a political sense as practically equivalent to "nobility," though the distinction is sometimes drawn between the "aristocracy of birth" and the "aristocracy of wealth." Modern history, however, furnishes many examples of government in the hands of an aristocracy. Such were the aristocratic republics of Venice, Genoa and the Dutch Netherlands, and those of the free imperial cities in Germany, Such, too, in practice though not in theory, was the government of Great Britain from the Revolution of 1689 to the Reform Bill of 1832. The French nobles of the *Ancien Régime*, denounced as "aristocrats" by the Revolutionists, had no share as such in government, but enjoyed exceptional privileges (*e.g.* exemption from taxation). This privileged position is still enjoyed by the heads of the German mediatized families of the "High Nobility." In Great Britain, on the other hand, though the aristocratic principle is still represented in the constitution by the House of Lords, the "aristocracy" generally, apart from the peers, has no special privileges.

ARISTODEMUS (8th century B.C.), semi-legendary ruler of Messenia in the time of the first Messenian War. Tradition relates that, after some six years' fighting, the Messenians were forced to retire to the fortified summit of Ithome. The Delphic oracle bade them sacrifice a virgin of the house of Aepytus. Aristodemus offered his own daughter, and when her lover, hoping to save her life, declared that she was no longer a maiden, he slew her with his own hand to prove the assertion false. In the thirteenth year of the war, Euphaes, the Messenian king, died. As he left no children, popular election was resorted to, and Aristodemus was chosen as his successor, though the national soothsayers objected to him as the murderer of his daughter. As a ruler he was mild and conciliatory. He was victorious in the pitched battle fought at the foot of Ithome in the fifth year of his reign, a battle in which the Messenians, reinforced by the entire Arcadian levy and picked contingents from Argos and Sicyon, defeated the combined Spartan and Corinthian forces. Shortly afterwards, however, led by unfavourable omens to despair of final success, he killed himself on his daughter's tomb. Though little is known of his life and the chronology is uncertain, yet Aristodemus may fairly be regarded as a historical character. His reign is dated 731–724 B.C. by Pausanias, and this may be taken as approximately correct, though Duncker (*History of Greece*, Eng. trans., ii. p. 69) inclines to place it eight years later.

Pausanias iv. 9-13 is practically our only authority. He followed as his chief source the prose history of Myron of Priene, an untrustworthy writer, probably of the 2nd century B.C.; hence a good deal of his story must be regarded as fanciful, though we cannot distinguish accurately between the true and the fictitious. (M. N. T.)

ARISTOLOCHIA (Gr. ἄριστος, best, λοχεία, child-birth, in allusion to its repute in promoting child-birth), a genus of shrubs or herbs of the natural order Aristolochiaceae, often with climbing stems, found chiefly in the tropics. The flower forms a tube inflated at the base. *A. Clematitis*, birthwort, is a central and southern European species, found sometimes in England apparently wild on ruins and similar places, but not a native. *A. Sipho*, Dutchman's pipe, or pipe vine, is a climber, native in the woods of the Atlantic United States, and grown in Europe as a garden plant. The flower is bent like a pipe.

A member of the same order is the *asarabacca* (*Asarum europaeum*), a small creeping herb with kidney-shaped leaves and small purplish bell-shaped flowers. It is a native of the woods of Europe and north temperate Asia, and occurs wild in some English counties. It was formerly grown for medicinal purposes, the underground stem having cathartic and emetic properties. An allied species, *A. canadense*, is the Canadian snake-root, a native of Canada and the Atlantic United States.

ARISTOMENES, of Andania, the semi-legendary hero of the second Messenian war. He was a member of the Aepytid family, the son of Nicomedes (or, according to another version, of Pyrrhus) and Nicoteleia, and took a prominent part in stirring up the revolt against Sparta and securing the co-operation of Argos and Arcadia. He showed such heroism in the first encounter, at Derae, that the crown was offered him, but he would accept only the title of commander-in-chief. His daring is illustrated by the story that he came by night to the temple of Athene "of the Brazen House" at Sparta, and there set up his shield with the inscription, "Dedicated to the goddess by Aristomenes from the Spartans." His prowess contributed largely to the Messenian victory over the Spartan and Corinthian forces at "The Boar's Barrow" in the plain of Stenyclarus, but in the following year the treachery of the Arcadian king Aristocrates caused the Messenians to suffer a crushing defeat at "The Great Trench." Aristomenes and the survivors retired to the mountain stronghold of Eira, where they defied the Spartans for eleven years. On one of his raids he and fifty of his companions were captured and thrown into the Caeadas, the chasm on Mt. Taygetus into which criminals were cast. Aristomenes alone was saved, and soon reappeared at Eira: legend told how he was upheld in his fall by an eagle and escaped by grasping the tail of a fox, which led him to the hole by which it had entered. On another occasion he was captured during a truce by some Cretan auxiliaries of the Spartans, and was released only by the devotion of a Messenian girl who afterwards became his daughter-in-law. At length Eira was betrayed to the Spartans (668 B.C. according to Pausanias), and after a heroic resistance Aristomenes and his followers had to evacuate Messenia and seek a temporary refuge with their Arcadian allies. A desperate plan to seize Sparta itself was foiled by Aristocrates, who paid with his life for his treachery. Aristomenes retired to Ialysus in Rhodes, where Damagetus, his son-in-law, was king, and died there while planning a journey to Sardis and Ecbatana to seek aid from the Lydian and Median sovereigns (Pausanias iv. 14-24). Another tradition represents him as captured and slain by the Spartans during the war (Pliny, *Nat. Hist.* xi. 187; Val. Maximus i. 8, 15; Steph. Byzant. *s.v.* Ἀνδανία). Though there seems to be no conclusive reason for doubting the existence of Aristomenes, his history, as related by Pausanias, following mainly the *Messeniaca* of the Cretan epic poet Rhianus (about 230 B.C.), is evidently largely interwoven with fictions. These probably arose after the foundation of Messene in 369 B.C. Aristomenes' statue was set up in the stadium there: his bones were fetched from Rhodes and placed in a tomb surmounted by a column (Paus. iv. 32. 3, 6); and more than five centuries later we still find heroic honours paid to him, and his exploits a popular subject of song (*ib.* iv. 14. 7; 16. 6).

For further details see Pausanias iv.; Polyaenus ii. 31; G. Grote, *History of Greece*, pt. ii. chap. vii.; M. Duncker, *History of Greece*, Eng. trans., book iv. chap. viii.; A. Holm, *History of Greece*, Eng. trans., vol. i. chap. xvi. (M. N. T.)

ARISTONICUS, of Alexandria, Greek grammarian, lived during the reigns of Augustus and Tiberius. He taught at Rome and wrote commentaries and grammatical treatises. His chief work was *Περὶ Σημείων Ὁμήρου*, in which he gave an account of the "critical marks" inserted by Aristarchus in the margin of his recension of the text of the *Iliad* and *Odyssey*. Important fragments are preserved in the scholia of the Venetian Codex A of the *Iliad*.

Friedländer, *Aristonici* Περὶ *Σημείων ’Ιλιάδος reliquiae* (1853); Carnuth, *Aristonici* Περὶ *Σημείων ’Οδυσσείας reliquiae* (1869).

ARISTOPHANES (*c.* 448–385 B.C.[1]), the great comic dramatist and poet of Athens. His birth-year is uncertain. He is known to have been about the same age as Eupolis, and is said to have been "almost a boy" when his first comedy (*The Banqueters*) was brought out in 427 B.C. His father Philippus was a landowner in Aegina. Aristophanes was an Athenian citizen of the tribe Pandionis, and the deme Cydathene. The stories which made him a native of Camirus in Rhodes, or of the Egyptian Naucratis, had probably no other foundation than an indictment for usurpation of civic rights (*ξενίας γραφή*) which appears to have been more than once laid against him by Cleon. His three sons—Philippus, Araros and Nicostratus—were all comic poets. Philippus, the eldest, was a rival of Eubulus, who began to exhibit in 376 B.C. Araros brought out two of his father's latest comedies—the *Cocalus* and the *Aeolosicon*, and in 375 began to exhibit works of his own. Nicostratus, the youngest, is assigned by Athenaeus to the Middle Comedy, but belongs, as is shown by some of the names and characters of his pieces, to the New Comedy also.

Although tragedy and comedy had their common origin in the festivals of Dionysus, the regular establishment of tragedy at Athens preceded by half a century that of comedy. The Old Comedy may be said to have lasted about eighty years (470–390 B.C.), and to have flourished about fifty-six (460–404 B.C.). Of the forty poets who are named as having illustrated it the chief were Cratinus, Eupolis and Aristophanes. The Middle Comedy covers a period of about seventy years (390–320 B.C.), its chief poets being Antiphanes, Alexis, Theopompus and Strattis. The New Comedy was in vigour for about seventy years (320–250 B.C.), having for its foremost representatives Menander, Philemon and Diphilus. The Old Comedy was possible only for a thorough democracy. Its essence was a satirical censorship, unsparing in personalities, of public and of private life—of morality, of statesmanship, of education, of literature, of social usage—in a word, of everything which had an interest for the city or which could amuse the citizens. Preserving all the freedom of banter and of riotous fun to which its origin gave it an historical right, it aimed at associating with this a strong practical purpose—the expression of a democratic public opinion in such a form that no misconduct or folly could altogether disregard it. That licentiousness, that grossness of allusion which too often disfigures it, was, it should be remembered, exacted by the sentiment of the Dionysiac festivals, as much as a decorous cheerfulness is expected at the holiday times of other worships. This was the popular element. Without this the entertainment would have been found flat and unseasonable. But for a comic poet of the higher calibre the consciousness of a recognized power which he could exert, and the desire to use this power for the good of the city, must always have been the uppermost feelings. At Athens the poet of the Old Comedy had an influence analogous, perhaps, rather to that of the journalist than to that of the modern dramatist. But the established type of Dionysiac comedy gave him an instrument such as no public satirist has ever wielded. When Molière wished to brand hypocrisy he could only make his Tartuffe the central figure of a regular drama, developed by a regular process to a just catastrophe. He had no choice between touching too lightly and using sustained force to make a profound impression. The Athenian dramatist of the Old Comedy worked under no such limitations of form. The wildest flights of extravagance were permitted to him. Nothing bound him to a dangerous emphasis or a wearisome insistence. He could deal the keenest thrust, or make the most earnest appeal, and at the next moment—if his instinct told him that it was time to change the subject—vary the serious strain by burlesque. He had, in short, an incomparable scope for trenchant satire directed by sure tact.

Aristophanes is for us the representative of the Old Comedy. But his genius, while it includes, also transcends the genius of the Old Comedy. He can denounce the frauds of a Cleon, he can vindicate the duty of Athens to herself and to her allies, with a stinging scorn and a force of patriotic indignation which makes the poet almost forgotten in the citizen. He can banter Euripides with an ingenuity of light mockery which makes it seem for the time as if the leading Aristophanic trait was the art of seeing all things from their prosaic side. Yet it is neither in the denunciation nor in the mockery that he is most individual. His truest and highest faculty is revealed by those wonderful bits of lyric writing in which he soars above everything that can move laughter or tears, and makes the clear air thrill with the notes of a song as free, as musical and as wild as that of the nightingale invoked by his own chorus in the *Birds*. The speech of Dikaios Logos in the *Clouds*, the praises of country life in the *Peace*, the serenade in the *Ecclesiazusae*, the songs of the Spartan and Athenian maidens in the *Lysistrata*, above all, perhaps, the chorus in the *Frogs*, the beautiful chant of the Initiated,—these passages, and such as these, are the true glories of Aristophanes. They are the strains, not of an artist, but of one who warbles for pure gladness of heart in some place made bright by the presence of a god. Nothing else in Greek poetry has quite this wild sweetness of the woods. Of modern poets Shakespeare alone, perhaps, has it in combination with a like richness and fertility of fancy.

Fifty-four[2] comedies were ascribed to Aristophanes. Forty-three of these are allowed as genuine by Bergk. Eleven only are extant. These eleven form a running commentary on the outer and the inner life of Athens during thirty-six years. They may be ranged under three periods. The first, extending to 420 B.C., includes those plays in which Aristophanes uses an absolutely unrestrained freedom of political satire. The second ends with the year 405. Its productions are distinguished from those of the earlier time by a certain degree of reticence and caution. The third period, down to 388 B.C., comprises two plays in which the transition to the character of the Middle Comedy is well marked, not merely by disuse of the parabasis, but by general self-restraint.

I. *First Period.* (1) 425 B.C. *The Acharnians.*—Since the defeat in Boeotia the peace party at Athens had gained ground, and in this play Aristophanes seeks to strengthen their hands. Dicaeopolis, an honest countryman, is determined to make peace with Sparta on his own account, not deterred by the angry men of Acharnae, who crave vengeance for the devastation of their vineyards. He sends to Sparta for samples of peace; and he is so much pleased with the flavour of the Thirty Years' sample that he at once concludes a treaty for himself and his family. All the blessings of life descend on him; while Lamachus, the leader of the war party, is smarting from cold, snow and wounds.

(2) 424 B.C. *The Knights.*—Three years before, in his *Babylonians*, Aristophanes had assailed Cleon as the typical demagogue. In this play he continues the attack. The Demos, or State, is represented by an old man who has put himself and his household into the hands of a rascally Paphlagonian steward. Nicias and Demosthenes, slaves of Demos, contrive that the Paphlagonian shall be supplanted in their master's favour by a sausage-seller. No sooner has Demos been thus rescued than his youthfulness and his good sense return together.

(3) 423 B.C. *The Clouds* (the first edition; a second edition was brought out in 422 B.C.).—This play would be correctly described as an attack on the new spirit of intellectual inquiry and culture rather than on a school or class. Two classes of

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[1] [The dates in the text, as given by Jebb, are retained. According to R. G. Kent, *Classical Review* (April 1905, April 1906), Aristophanes was born in 455, and died in 375 B.C.]

[2] [Or "forty-four" (reading *μδ'* for *νδ'* in Suidas).]

thinkers or teachers are, however, specially satirized under the general name of "Sophist" (v. 331)—1. The Physical Philosophers—indicated by allusions to the doctrines of Anaxagoras, Heraclitus and Diogenes of Apollonia. 2. The professed teachers of rhetoric, belles lettres, &c., such as Protagoras and Prodicus. Socrates is taken as the type of the entire tendency. A youth named Pheidippides—obviously meant for Alcibiades—is sent by his father to Socrates to be cured of his dissolute propensities. Under the discipline of Socrates the youth becomes accomplished in dishonesty and impiety. The conclusion of the play shows the indignant father preparing to burn up the philosopher and his hall of contemplation.

(4) 422 B.C. *The Wasps.*—This comedy, which suggested *Les Plaideurs* to Racine, is a satire on the Athenian love of litigation. The strength of demagogy, while it lay chiefly in the ecclesia, lay partly also in the paid dicasteries. From this point of view the *Wasps* may be regarded as supplementing the *Knights.* Philocleon (admirer of Cleon), an old man, has a passion for lawsuits—a passion which his son, Bdelycleon (detester of Cleon) fails to check, until he hits upon the device of turning the house into a law-court, and paying his father for absence from the public suits. The house-dog steals a Sicilian cheese; the old man is enabled to gratify his taste by trying the case, and, by an oversight, acquits the defendant. In the second half of the play a change comes over the dream of Philocleon; from litigation he turns to literature and music, and is congratulated by the chorus on his happy conversion.

(5) 421 B.C.[1] *The Peace.*—In its advocacy of peace with Sparta, this play, acted at the Great Dionysia shortly before the conclusion of the treaty, continues the purpose of the *Acharnians.* Trygaeus, a distressed Athenian, soars to the sky on a beetle's back. There he finds the gods engaged in pounding the Greek states in a mortar. In order to stop this, he frees the goddess Peace from a well in which she is imprisoned. The pestle and mortar are laid aside by the gods, and Trygaeus marries one of the handmaids of Peace.

II. *Second Period.* (6) 414 B.C. *The Birds.*—Peisthetaerus, an enterprising Athenian, and his friend Euelpides persuade the birds to build a city—"Cloud-Cuckoo-borough"—in mid-air, so as to cut off the gods from men. The plan succeeds; the gods send envoys to treat with the birds; and Peisthetaerus marries Basileia, daughter of Zeus. Some have found in the *Birds* a complete historical allegory of the Sicilian expedition; others, a general satire on the prevalence at Athens of headstrong caprice over law and order; others, merely an aspiration towards a new and purified Athens—a dream to which the poet had turned from his hope for a revival of the Athens of the past. In another view, the piece is mainly a protest against the religious fanaticism which the incident of the Hermae had called forth.

(7) 411 B.C. *The Lysistrata.*—This play was brought out during the earlier stages of those intrigues which led to the revolution of the Four Hundred. It appeared shortly before Peisander had arrived in Athens from the camp at Samos for the purpose of organizing the oligarchic policy. The *Lysistrata* expresses the popular desire for peace at any cost. As the men can do nothing, the women take the question into their own hands, occupy the citadel, and bring the citizens to surrender.

(8) 411 B.C. *The Thesmophoriazusae* (Priestesses of Demeter).—This came out three months later than the *Lysistrata*, during the reign of terror established by the oligarchic conspirators, but before their blow had been struck. The political meaning of the play lies in the absence of political allusion. Fear silences even comedy. Only women and Euripides are satirized. Euripides is accused and condemned at the female festival of the Thesmophoria.

(9) 405 B.C. *The Frogs.*—This piece was brought out just when Athens had made her last effort in the Peloponnesian War, eight months before the battle of Aegospotami, and about fifteen months before the taking of Athens by Lysander. It may be considered as an attempt to distract men's minds from public affairs. It is a literary criticism. Aeschylus and Euripides were both lately dead. Athens is beggared of poets; and Dionysus goes down to Hades to bring back a poet. Aeschylus and Euripides contend in the under-world for the throne of tragedy; and the victory is at last awarded to Aeschylus.

III. *Third Period.*[2] (10) 393 B.C.[2] *The Ecclesiazusae* (women in parliament).—The women, disguised as men, steal into the ecclesia, and succeed in decreeing a new constitution. At this time the demagogue Agyrrhius led the assembly; and the play is, in fact, a satire on the general demoralization of public life.

(11) 388 B.C. *The Plutus* (Wealth).—The first edition of the play had appeared in 408 B.C., being a symbolical representation of the fact that the victories won by Alcibiades in the Hellespont had brought back the god of wealth to the treasure-chamber of the Parthenon. In its extant form the *Plutus* is simply a moral allegory. Chremylus, a worthy but poor man, falls in with a blind and aged wanderer, who proves to be the god of wealth. Asclepius restores eyesight to Plutus; whereupon all the just are made rich and all the unjust are reduced to poverty.

Among the lost plays, the following are the chief of which anything is known:—

1. *The Banqueters* (Δαιταλεῖς), 427 B.C.—A satire on young Athens. A father has two sons; one is brought up in the good old school, another in the tricky subtleties of the new; and the contrast of results is the chief theme.

2. *The Babylonians*, 426 B.C.—Under this name the subject-allies of Athens are represented as "Babylonians"—barbarian slaves, employed to grind in the mill. The oppression of the allies by the demagogues—a topic often touched elsewhere—was, then, the main subject of the piece, in which Aristophanes is said to have attacked especially the system of appointing to offices by lot. The comedy is memorable as opening that Aristophanic war upon Cleon which was continued in the *Knights* and the *Wasps.*

The Merchantmen, *The Farmers*, *The Preliminary Contest* (*Proagon*), and possibly the *Old Age* (*Geras*), belonged to the First Period. The *Geras* is assigned by Süvern to 422 B.C., and is supposed to have been a picture of dotage similar to that in the *Knights.* A comedy called *The Islands* is conjectured to have dealt with the sufferings imposed by the war on the insular tributaries. The *Triphales* was probably a satire on Alcibiades; the *Storks*, on the tragic poet Patrocles.

In the *Aeolosicon*—produced by his son Araros in 387 B.C.—Aristophanes probably parodied the *Aeolus* of Euripides. The *Cocalus* is thought to have been a parody of the legend, according to which a Sicilian king of that name slew Minos.

A sympathetic reader of Aristophanes can hardly fail to perceive that, while his political and intellectual tendencies are well marked, his opinions, in so far as they colour his comedies, are too indefinite to reward, or indeed to tolerate, analysis. Aristophanes was a natural conservative. His ideal was the Athens of the Persian wars. He disapproved the policy which had made Athenian empire irksome to the allies and formidable to Greece; he detested the vulgarity and the violence of mob-rule; he clave to the old worship of the gods; he regarded the new ideas of education as a tissue of imposture and impiety. How far he was from clearness or precision of view in regard to the intellectual revolution which was going forward, appears from the *Clouds*, in which thinkers and literary workers who had absolutely nothing in common are treated with sweeping ridicule as prophets of a common heresy. Aristophanes is one of the men for whom opinion is mainly a matter of feeling, not of reason. His imaginative susceptibility gave him a warm and loyal love for the traditional glories of Athens, however dim the past to which they belonged; a horror of what was ugly or ignoble in the present; a keen perception of what was offensive or absurd in pretension. The broad preferences and dislikes thus generated were enough not only to point the moral of comedy, but to make him, in many cases, a really useful censor for the city. The service which he could render in this way was, however, only negative. He could hardly be, in any positive sense, a political or a moral teacher for Athens. His rooted antipathy to intellectual progress, while it affords easy and wide scope for his wit, must after all, lower his intellectual rank. The great minds are not the enemies of ideas. But as a mocker—to use the word which seems most closely to describe him on this side—he is incomparable for the union of subtlety with riot of the comic imagination. As a poet, he is immortal. And, among Athenian poets, he has it for his distinctive characteristic that he is inspired less by that Greek genius which never allows fancy to escape from the control of defining, though spiritualizing, reason, than by such ethereal rapture of the unfettered fancy as lifts Shakespeare or Shelley above it,—

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[1] See E. Curtius, *Hist. of Greece*, iii. (Eng. trans. p. 275).

[2] [The date is uncertain; others give 392 and 389.]

> "Pouring his full heart
> In profuse strains of unpremeditated art.'

Bibliography.—Editio princeps (Aldine, Venice, 1498), by Marcus Musurus (not including the *Lysistrata* and *Thesmophoriazusae*); S. Bergler (ed. P. Burmann, 1760); Invernizi-Beck-Dindorf (1794–1834); I. Bekker (1829); H. A. Holden (expurgated text, 1868), with *Onomasticon* (new ed., 1902); F. H. M. Blaydes (1880–1893), and critical edition (1886); J. van Leeuwen (1893 foll.); F. W. Hall and E. M. Geldart (text, 1900–1901), with the fragment (from the Oxyrhynchus papyri) of a dialogue between two women concerning a leathern phallus, perhaps from Aristophanes. There is a complete edition of the valuable scholia by F. Dübner (1842, Didot series), with the anonymous biographies of the poet; of the Ravenna MS. by A. Martin (1883), and W. G. Rutherford (1896–1905). Among English translations mention may be made of those of W. J. Hickie (prose, in Bohn's *Classical Library*); (verse) J. Hookham Frere, five plays; T. Mitchell, four plays; and, above all, B. B. Rogers, a brilliant work of exceptional merit. There is a concordance to the plays and fragments by H. Dunbar (1883). On Aristophanes generally see H. Müller-Strübing, *Aristophanes und die historische Kritik* (1873); the article by G. Kaibel in Pauly-Wissowa's *Realencyclopädie*, ii. 1 (1896); A. Couat, *Aristophane et l'ancienne comédie attique* (1889); E. Deschanel, *Études sur Aristophane* (3rd ed., 1892); G. Dantu, *Opinions et critiques d'Aristophane sur le mouvement politique et intellectuel à Athènes* (Paris, 1907). For the numerous editions and translations of separate plays in English and other languages see the introductions to Blaydes's edition, and, for the literature, the introduction to W. J. M. Starkie's edition of the *Wasps* (1897); W. Engelmann, *Scriptores Graeci* (1880); and "Bericht über die Literatur der griechischen Komödie aus den Jahren 1892–1901" in C. Bursian's *Jahresbericht über die Fortschritte der classischen Altertumswissenschaft*, cxvi. (1904). (R. C. J.)

ARISTOPHANES, of Byzantium, Greek critic and grammarian, was born about 257 B.C. He removed early to Alexandria, where he studied under Zenodotus and Callimachus. At the age of sixty he was appointed chief librarian of the museum. He died about 185–180 B.C. Aristophanes chiefly devoted himself to the poets, especially Homer, who had already been edited by his master Zenodotus. He also edited Hesiod, the chief lyric, tragic and comic poets, arranged Plato's dialogues in trilogies, and abridged Aristotle's *Nature of Animals*. His arguments to the plays of Aristophanes and the tragedians are in great part preserved. His works on Athenian courtesans, masks and proverbs were the results of his study of Attic comedy. He further commented on the Πίνακες of Callimachus, a sort of history of Greek literature. As a lexicographer, Aristophanes compiled collections of foreign and unusual words and expressions, and special lists (words denoting relationship, modes of address). As a grammarian, he founded a scientific school, and in his *Analogy* systematically explained the various forms. He introduced critical signs—except the obelus; punctuation prosodiacal, and accentual marks were probably already in use. The foundation of the so-called Alexandrian "canon" was also due to his impulse (Sandys, *Hist. Class. Schol.*, ed. 1906, i. 129 f.).

Nauck, *Aristophanis Byzantii Grammatici Fragmenta* (1848).

ARISTOTLE (384–322 B.C.), the great Greek philosopher, was born at Stagira, on the Strymonic Gulf, and hence called "the Stagirite." Dionysius of Halicarnassus, in his *Epistle on Demosthenes and Aristotle* (chap. 5), gives the following sketch of his life:—Aristotle (Ἀριστοτέλης) was the son of Nicomachus, who traced back his descent and his art to Machaon, son of Aesculapius; his mother being Phaestis, a descendant of one of those who carried the colony from Chalcis to Stagira. He was born in the 99th Olympiad in the archonship at Athens of Diotrephes (384–383), three years before Demosthenes. In the archonship of Polyzelus (367–366), after the death of his father, in his eighteenth year, he came to Athens, and having joined Plato spent twenty years with him. On the death of Plato (May 347) in the archonship of Theophilus (348–347) he departed to Hermias, tyrant of Atarneus, and, after three years' stay, during the archonship of Eubulus (345–344) he moved to Mitylene, whence he went to Philip of Macedon in the archonship of Pythodotus (343–342), and spent eight years with him as tutor of Alexander. After the death of Philip (336), in the archonship of Euaenetus (335–334), he returned to Athens and kept a school in the Lyceum for twelve years. In the thirteenth, after the death of Alexander (June 323) in the archonship of Cephisodorus (323–322), having departed to Chalcis, he died of disease (322), after a life of three-and-sixty years.

I. Aristotle's Life

This account is practically repeated by Diogenes Laertius in his *Life of Aristotle*, on the authority of the *Chronicles* of Apollodorus, who lived in the 2nd century B.C. Starting then from this tradition, near enough to the time, we can confidently divide Aristotle's career into four periods: his youth under his parents till his eighteenth year; his philosophical education under Plato at Athens till his thirty-eighth year; his travels in the Greek world till his fiftieth year; and his philosophical teaching in the Lyceum till his departure to Chalcis and his death in his sixty-third year. But when we descend from generals to particulars, we become less certain, and must here content ourselves with few details.

Aristotle from the first profited by having a father who, being physician to Amyntas II., king of Macedon, and one of the Asclepiads who, according to Galen, practised their sons in dissection, both prepared the way for his son's influence at the Macedonian court, and gave him a bias to medicine and biology, which certainly led to his belief in nature and natural science, and perhaps induced him to practise medicine, as he did, according to his enemies, Timaeus and Epicurus, when he first went to Athens. At Athens in his second period for some twenty years he acquired the further advantage of balancing natural science by metaphysics and morals in the course of reading Plato's writings and of hearing Plato's unwritten dogmas (cf. ἐν τοῖς λεγομένοις ἀγράφοις δόγμασιν, Ar. *Physics*, iv. 2, 209 b 15, Berlin ed.). He was an earnest, appreciative, independent student. The master is said to have called his pupil the intellect of the school and his house a reader's. He is also said to have complained that his pupil spurned him as colts do their mothers. Aristotle, however, always revered Plato's memory (*Nic. Ethics*, i. 6), and even in criticizing his master counted himself enough of a Platonist to cite Plato's doctrines as what "we say" (cf. φαμέν, *Metaphysics*, i. 9, 990 b 16). At the same time, he must have learnt much from other contemporaries at Athens, especially from astronomers such as Eudoxus and Callippus, and from orators such as Isocrates and Demosthenes. He also attacked Isocrates, according to Cicero, and perhaps even set up a rival school of rhetoric. At any rate he had pupils of his own, such as Eudemus of Cyprus, Theodectes and Hermias, books of his own, especially dialogues, and even to some extent his own philosophy, while he was still a pupil of Plato.

Well grounded in his boyhood, and thoroughly educated in his manhood, Aristotle, after Plato's death, had the further advantage of travel in his third period, when he was in his prime. The appointment of Plato's nephew, Speusippus, to succeed his uncle in the Academy induced Aristotle and Xenocrates to leave Athens together and repair to the court of Hermias. Aristotle admired Hermias, and married his friend's sister or niece, Pythias, by whom he had his daughter Pythias. After the tragic death of Hermias, he retired for a time to Mitylene, and in 343–342 was summoned to Macedon by Philip to teach Alexander, who was then a boy of thirteen. According to Cicero (*De Oratore*, iii. 41), Philip wished his son, then a boy of thirteen, to receive from Aristotle "agendi praecepta et eloquendi." Aristotle is said to have written on monarchy and on colonies for Alexander; and the pupil is said to have slept with his master's edition of Homer under his pillow, and to have respected him, until from hatred of Aristotle's tactless relative, Callisthenes, who was done to death in 328, he turned at last against Aristotle himself. Aristotle had power to teach, and Alexander to learn. Still we must not exaggerate the result. Dionysius must have spoken too strongly when he says that Aristotle was tutor of Alexander for eight years; for in 340, when Philip went to war with Byzantium, Alexander became regent at home, at the age of sixteen. From this date Aristotle probably spent much time at his paternal house in his native city at Stagira as a patriotic citizen. Philip had sacked it in 348: Aristotle induced him or his son to restore it, made for it a new constitution, and in return was celebrated in a festival after his death. All these vicissitudes made him a man of the world, drew him out of the philosophical circle at Athens, and gave him leisure to develop his philosophy. Besides Alexander he had other pupils: Callisthenes, Cassander, Marsyas, Phanias, and Theophrastus of Eresus, who is said to have had land at Stagira. He also continued the writings begun in his second period; and the Macedonian kings have the glory of having assisted the Stagirite philosopher with the means of conducting his researches in the *History of Animals*.

At last, in his fourth period, after the accession of Alexander, Aristotle at fifty returned to Athens and became the head of his own school in the Lyceum, a gymnasium near the temple of Apollo Lyceius in the suburbs. The master and his scholars were called Peripatetics (*οἱ ἐκ τοῦ περιπάτου*), certainly from meeting, like other philosophical schools, in a walk (*περίπατος*), and perhaps also, on the authority of Hermippus of Smyrna, from walking and talking there, like Protagoras and his followers as described in Plato's *Protagoras* (314 E, 315 C). Indeed, according to Ammonius, Plato too had talked as he walked in the Academy; and all his followers were called Peripatetics, until, while the pupils of Xenocrates took the name "Academics," those of Aristotle retained the general name. Aristotle also formed his Peripatetic school into a kind of college with common meals under a president (*ἄρχων*) changing every ten days; while the philosopher himself delivered lectures, in which his practice, as his pupil Aristoxenus tells us (*Harmonics*, ii. *init.*), was, avoiding the generalities of Plato, to prepare his audience by explaining the subject of investigation and its nature. But Aristotle was an author as well as a lecturer; for the hypothesis that the Aristotelian writings are notes of his lectures taken down by his pupils is contradicted by the tradition of their learning while walking, and disproved by the impossibility of taking down such complicated discourses from dictation. Moreover, it is clear that Aristotle addressed himself to readers as well as hearers, as in concluding his whole theory of syllogisms he says, "There would remain for all of you or for our hearers (*πάντων ὑμῶν ἢ τῶν ἠκροαμένων*) a duty of according to the defects of the investigation consideration, to its discoveries much gratitude" (*Sophistical Elenchi*, 34, 184 b 6). In short, Aristotle was at once a student, a reader, a lecturer, a writer and a book collector. He was, says Strabo (608), the first we knew who collected books and taught the kings in Egypt the arrangement of a library. In his library no doubt were books of others, but also his own. There we must figure to ourselves the philosopher, constantly referring to his autograph rolls; entering references and cross-references; correcting, rewriting, collecting and arranging them according to their subjects; showing as well as reading them to his pupils; with little thought of publication, but with his whole soul concentrated on being and truth.

On his first visit to Athens, during which occurred the fatal battle of Mantineia (362 B.C.), Aristotle had seen the confusion of Greece becoming the opportunity of Macedon under Philip; and on his second visit he was supported at Athens by the complete domination of Macedon under Alexander. Having witnessed the unjust exactions of a democracy at Athens, the dwindling population of an oligarchy at Sparta, and the oppressive selfishness of new tyrannies throughout the Greek world, he condemned the actual constitutions of the Greek states as deviations (*παρεκβάσεις*) directed merely to the good of the government; and he contemplated a right constitution (*ὀρθὴ πολιτεία*), which might be either a commonwealth, an aristocracy or a monarchy, directed to the general good; but he preferred the monarchy of one man, pre-eminent in virtue above the rest, as the best of all governments (*Nicomachean Ethics*, viii. 10; *Politics*, Γ 14-18). Moreover, by adding (*Politics*, H 7, 1327 b 29-33) that the Greek race could govern the world by obtaining one constitution (*μιᾶς τυγχάνον πολιτείας*), he indicated some leaning to a universal monarchy under such a king as Alexander. On the whole, however, he adhered to the Greek city-state (*πόλις*), partly perhaps out of patriotism to his own Stagira. Averse at all events to the Athenian democracy, leaning towards Macedonian monarchy, and resting on Macedonian power, he maintained himself in his school at Athens, so long as he was supported by the friendship of Antipater, the Macedonian regent in Alexander's absence. But on Alexander's sudden death in 323, when Athens in the Lamian war tried to reassert her freedom against Antipater, Aristotle found himself in danger. He was accused of impiety on the absurd charge of deifying the tyrant Hermias; and, remembering the fate of Socrates, he retired to Chalcis in Euboea. There, away from his school, in 322 he died. (A tomb has been found in our time inscribed with the name of Biote, daughter of Aristotle. But is this *our* Aristotle?)

Such is our scanty knowledge of Aristotle's life, which seems to have been prosperous by inheritance and position, and happy by work and philosophy. His will, which was quoted by Hermippus, and, as afterwards quoted by Diogenes Laertius, has come down to us, though perhaps not complete, supplies some further details, as follows:—Antipater is to be executor with others. Nicanor is to marry Pythias, Aristotle's daughter, and to take charge of Nicomachus his son. Theophrastus is to be one of the executors if he will and can, and if Nicanor should die to act instead, if he will, in reference to Pythias. The executors and Nicanor are to take charge of Herpyllis, "because," in the words of the testator, "she has been good to me," and to allow her to reside either in the lodging by the garden at Chalcis or in the paternal house at Stagira. They are to provide for the slaves, who in some cases are to be freed. They are to see after the dedication of four images by Gryllion of Nicanor, Proxenus, Nicanor's mother and Arimnestus. They are to dedicate an image of Aristotle's mother, and to see that the bones of his wife Pythias are, as she ordered, taken up and buried with him. On this will we may remark that Proxenus is said to have been Aristotle's guardian after the death of his father, and to have been the father of Nicanor; that Herpyllis of Stagira was the mother of Nicomachus by Aristotle; and that Arimnestus was the brother of Aristotle, who also had a sister, Arimneste. Every clause breathes the philosopher's humanity.

II. DEVELOPMENT FROM PLATONISM

Turning now from the man to the philosopher as we know him best in his extant writings (see *Aristoteles*, ed. Bekker, Berlin, 1831, the pages of which we use for our quotations), we find, instead of the general dialogues of Plato, special didactic treatises, and a fundamental difference of philosophy, so great as to have divided philosophers into opposite camps, and made Coleridge say that everybody is born either a Platonist or an Aristotelian. Platonism is the doctrine that the individuals we call things only become, but a thing is always one universal form beyond many individuals, *e.g.* one good beyond seeming goods; and that without supernatural forms, which are models of individuals, there is nothing, no being, no knowing, no good. Aristotelianism is the contrary doctrine: a thing is always a separate individual, a *substance* (*οὐσία*), natural such as earth or supernatural such as God; and without these individual substances, which have attributes and universals belonging to them, there is nothing, to be, to know, to be good. Philosophic differences are best felt by their practical effects: philosophically, Platonism is a philosophy of universal forms, Aristotelianism a philosophy of individual substances: practically, Plato makes us think first of the supernatural and the kingdom of heaven, Aristotle of the natural and the whole world.

So diametrical a difference could not have arisen at once. For, though Aristotle was different from Plato, and brought with him from Stagira a Greek and Ionic but colonial origin, a medical descent and tendency, and a matter-of-fact worldly kind of character, nevertheless on coming to Athens as pupil of Plato he must have begun with his master's philosophy. What then in more detail was the philosophy which the pupil learnt from the master? When Aristotle at the age of eighteen came to Athens, Plato, at the age of sixty-two, had probably written all his dialogues except the *Laws*; and in the course of the remaining twenty years of his life and teaching, he expounded "the so-called unwritten dogmas" in his lectures on the Good. There was therefore a written Platonism for Aristotle to read, and an unwritten Platonism which he actually heard.

To begin with the written philosophy of the Dialogues. Individual so-called things neither are nor are not, but become: the real thing is always one universal form beyond the many individuals, *e.g.* the one beautiful beyond all beautiful individuals; and each form (*ἰδέα*) is a model which causes individuals by participation to become like, but not the same as, itself. Above all forms stands the form of the good, which is the cause of all other forms being, and through them of all individuals becoming. The creator, or the divine intellect, with a view to the form of the good, and taking all forms as models, creates in a receptacle (*ὑποδοχή*, Plato, *Timaeus*, 49 A) individual impressions which are called things but really change and become without attaining the permanence of being. Knowledge resides not in sense but in reason, which, on the suggestion of sensations of changing individuals, apprehends, or (to be precise) is reminded of, real universal forms, and, by first ascending from less to more general until it arrives at the form of good and then descending from this unconditional principle to the less general, becomes science and philosophy, using as its method the dialectic which gives and receives questions and answers between man and man. Happiness in this world consists proximately in virtue as a harmony between the three parts, rational, spirited and appetitive, of our souls, and ultimately in living according to the form of the good; but there is a far higher happiness, when the immortal soul, divesting itself of body and passions and senses, rises from earth to heaven and contemplates pure forms by pure reason. Such in brief is the Platonism of the written dialogues; where the main doctrine of forms is confessedly advanced never as a dogma but always as a hypothesis, in which there are difficulties, but without which Plato can explain neither being, nor truth nor goodness, because throughout he denies the being of individual things. In the unwritten lectures of his old age, he developed this formal into a mathematical metaphysics. In order to explain the unity and variety of the world, the one universal form and the many individuals, and how the one good is the main cause of everything, he placed as it were at the back of his own doctrine of forms a Pythagorean mathematical philosophy. He supposed that the one and the two, which is indeterminate, and is the great and little, are opposite principles or causes. Identifying the form of the good with the one, he supposed that the one, by combining with the indeterminate two, causes a plurality of forms, which like every combination of one and two are numbers but peculiar in being incommensurate with one another, so that each form is not a mathematical number (*μαθηματικὸς ἀριθμός*), but a formal number (*εἰδητικὸς ἀριθμός*). Further he supposed that in its turn each form, or formal number, is a limited one which, by combining again with the indeterminate two, causes a plurality of individuals. Hence finally he concluded that the good as the one combining with the indeterminate two is directly the cause of all forms as formal numbers, and indirectly through them all of the multitude of individuals in the world.

Aristotle knew Plato, was present at his lectures on the Good, wrote a report of them (*περὶ τἀγαθοῦ*), and described this latter philosophy of Plato in his *Metaphysics*. Modern critics, who were not present and knew neither, often accuse Aristotle of misrepresenting Plato. But Heracleides and Hestiacus, Speusippus and Xenocrates were also present and wrote similar reports. What is more, both Speusippus and Xenocrates founded their own philosophies on this very Pythagoreanism of Plato. Speusippus as president of the Academy from 347 to 339 taught that the one and the many are principles, while abolishing forms and reducing the good from cause to effect. Xenocrates as president from 339 onwards taught that the one and many are principles, only without distinguishing mathematical from formal numbers. Aristotle's critics hardly realize that for the rest of his life he had to live and to struggle with a formal and a mathematical Platonism, which exaggerated first universals and attributes and afterwards the quantitative attributes, one and many, into substantial things and real causes.

Aristotle had no sympathy with the unwritten dogmas of Plato. But with the written dialogues of Plato he always continued to agree almost as much as he disagreed. Like Plato, he believed in real universals, real essences, real causes; he believed in the unity of the universal, and in the immateriality of essences; he believed in the good, and that there is a good of the universe; he believed that God is a living being, eternal and best, who is a supernatural cause of the motions and changes of the natural world, and that essences and matter are also necessary causes; he believed in the divine intelligence and in the immortality of our intelligent souls; he believed in knowledge going from sense to reason, that science requires ascent to principles and is descent from principles, and that dialectic is useful to science; he believed in happiness involving virtue, and in moral virtue being a control of passions by reason, while the highest happiness is speculative wisdom. All these inspiring metaphysical and moral doctrines the pupil accepted from his master's dialogues, and throughout his life adhered to the general spirit of realism without materialism pervading the Platonic philosophy. But what he refused to believe with Plato was that reality is not here, but only above; and what he maintained against Plato was that it is both, and that universals and forms, one and many, the good, are real but not separate realities. This deep metaphysical divergence was the prime cause of the transition from Platonism to Aristotelianism.

Fragmenta Aristotelis.—Aristotle's originality soon asserted itself in early writings, of which fragments have come down to us, and have been collected by Rose (see the Berlin edition of Aristotle's works, or more readily in the Teubner series, which we shall use for our quotations). Many, no doubt, are spurious; but some are genuine, and a few perhaps cited in Aristotle's extant works. Some are dialogues, others didactic works. A special interest attaches to the dialogues written after the manner of Plato but with Aristotle as principal interlocutor; and some of these, *e.g.* the *περὶ ποιητῶν* and the *Eudemus*, seem to have been published. It is not always certain which were dialogues, which didactic like Aristotle's later works; but by comparing those which were certainly dialogues with their companions in the list of Aristotle's books as given by Diogenes Laertius, we may conclude with Bernays that the books occurring first in that list were dialogues. Hence we may perhaps accept as genuine the following:—

1. Dialogues:—
    - *περὶ δικαιοσύνης*: On justice.
    - *περὶ ποιητῶν*: On poets (perhaps cited in *Poetics*, 15, 1454 b 18, *ἐν τοῖς ἐκδεδομένοις λόγοις*).
    - *περὶ φιλοσοφίας*: On philosophy (perhaps cited in *Physics*, ii. 2, 194 a 35–36).
    - *περὶ πολιτικοῦ*: A politician.
    - *περὶ ῥητορικῆς ἢ Γρύλλος*: On rhetoric.
    - *προτρεπτικός*: An exhortation to philosophy (probably in dialogue, because it is the model of Cicero's dialogue *Hortensius*).
    - *Εὔδημος ἢ περὶ Ψυχῆς*: On soul (perhaps cited in *De Anima*, i. 4, 407 b 29, *καὶ τοῖς ἐν κοινῷ γενομένοις λόγοις*).
2. Didactic writings:—
    - (1) Metaphysical:—
        - *περὶ τἀγαθοῦ*: On the good (probably not a dialogue but a report of Plato's lectures).
        - *περὶ ἰδεῶν*: On forms.
    - (2) Political:—
        - *περὶ βασιλείας*: On monarchy.
        - *Ἀλέξανδρος ἢ ὑπὲρ ἀποίκων*: On colonies.

(3) Rhetorical:—
- *τέχνης τῆς Θεοδέκτου συναγωγή*: The *Theodectea* (cited in the Preface to the *Rhetoric to Alexander* (chap. i.), and as *τὰ Θεοδέκτεια* in the *Rhetoric* (iii. 9, 1410 b 2),
- *τεχνῶν συναγωγή*: A historical collection of arts of rhetoric.

Difficult as it is to determine when Aristotle wrote all these various works, some of them indicate their dates. Gryllus, celebrated in the dialogue on rhetoric, was Xenophon's son who fell at Mantineia in 362; and Eudemus of Cyprus, lamented in the dialogue on soul, died in Sicily in 352. These then were probably written before Plato died in 347; and so probably were most of the dialogues, precisely because they were imitations of the dialogues of Plato. Among the didactic writings, the *περὶ τἀγαθοῦ* would probably belong to the same time, because it was Aristotle's report of Plato's lectures. On the other hand, the two political works, if written for Alexander, would be after 343–342 when Philip made Aristotle his tutor. So probably were the rhetorical works, especially the *Theodectea*; since both politics and oratory were the subjects which the father wanted the tutor to teach his son, and, when Alexander came to Phaselis, he is said by Plutarch (*Alexander*, 17) to have decorated the statue of Theodectes in honour of his association with the man through Aristotle and philosophy. On the whole, then, it seems as if Aristotle began with dialogues during his second period under Plato, but gradually came to prefer writing didactic works, especially in the third period after Plato's death, and in connexion with Alexander.

These early writings show clearly how Aristotle came to depart from Plato. In the first place as regards style, though the Stagirite pupil Aristotle could never rival his Attic master in literary form, yet he did a signal service to philosophy in gradually passing from the vague generalities of the dialogue to the scientific precision of the didactic treatise. The philosophy of Plato is dialogue trying to become science; that of Aristotle science retaining traces of dialectic. Secondly as regards subject-matter, even in his early writings Aristotle tends to widen the scope of philosophic inquiry, so as not only to embrace metaphysics and politics, but also to encourage rhetoric and poetics, which Plato tended to discourage or limit. Thirdly as regards doctrines, the surpassing interest of these early writings is that they show the pupil partly agreeing, partly disagreeing, with his master. The *Eudemus* and *Protrepticus* are with Plato; the dialogues *on Philosophy* and the treatise *on Forms* are against Plato.

The *Eudemus*, on the soul (*Fragmenta*, 37 seq.), must have been in style and thought the most Platonic of all the Aristotelian writings. Plato's theory of the soul and its immortality was not the ordinary Greek view derived from Homer, who regarded the body as the self, the soul as a shade having a future state but an obscure existence, and stamped that view on the hearts of his countrymen, and affected Aristotle himself. After Homer there had come to Greece the new view that the soul is more real than the body, that it is imprisoned in the carcase as a prison-house, that it is capable of enjoying a happier life freed from the body, and that it can transmigrate from body to body. This strange, exotic, ascetic view was adopted by some philosophers, and especially by the Pythagoreans, and so transmitted to Plato. Aristotle in the *Eudemus*, written about 352, when he was thirty-two, also believed in it. Accordingly, the soul of Eudemus, when it left his body, is said to be returning home: the soul is made subject to the casting of lots, and in coming from the other world to this it is supposed to forget its former visions: but its disembodied life is regarded as its natural life in a better world. The *Eudemus* also contained a celebrated passage, preserved by Plutarch (*Consolat. ad Apoll.* 27; *Fragm.* 44). Here we can read the young Aristotle, writing in the form of the dialogue like Plato, avoiding hiatus like Isocrates, and justifying the praises accorded to his style by Cicero, Quintilian and Dionysius. It shows how nearly the pupil could imitate his master's dialogues, and still more how exactly he at first embraced his master's doctrines. It makes Silenus, captured by Midas, say that the best of all things is not to have been born, and the next best, having been born, to die as soon as possible. Nothing could be more like Plato's *Phaedo*, or more unlike Aristotle's later work *on the Soul*, which entirely rejects transmigration and allows the next life to sink into the background.

Hardly less Platonic is the *Protrepticus* (*Fragm.* 50 seq.), an exhortation to philosophy which, according to Zeno the Stoic, was studied by his master Crates. It is an exhortation, whose point is that the chief good is philosophy, the contemplation of the universe by divine and immortal intellect. This is indeed a doctrine of Platonic ethics from which Aristotle in his later days never swerved. But in the *Protrepticus* he goes on to say that seeming goods, such as strength, size, beauty, honours, opinions, are mere illusion (*σκιαγραφία*), worthless and ridiculous, as we should know if we had Lyncean eyes to compare them with the vision of the eternal. This indifference to goods of body and estate is quite Platonic, but is very different from Aristotle's later ethical doctrine that such goods, though not the essence, are nevertheless necessary conditions of happiness. Finally, in the spirit of Plato's *Phaedo* and the dialogue *Eudemus*, the *Protrepticus* holds that the soul is bound to the sentient members of the body as prisoners in Etruria are bound face to face with corpses; whereas the later view of the *De Anima* is that the soul is the vital principle of the body and the body the necessary organ of the soul.

Thus we find that at first, under the influence of his master, Aristotle held somewhat ascetic views on soul and body and on goods of body and estate, entirely opposed both in psychology and in ethics to the moderate doctrines of his later writings. This perhaps is one reason why Cicero, who had Aristotle's early writings, saw no difference between the Academy and the Peripatetics (*Acad. Post*, i. 4, 17-18).

On the other hand, the dialogue *on Philosophy* (*περὶ φιλοσοφίας*, *Fragm.* 1 seq.) strikingly exhibits the origin of Aristotle's divergence from Platonism, and that too in Plato's lifetime. The young son of a doctor from the colonies proved too fond of this world to stomach his Athenian master's philosophy of the supernatural. Accordingly in this dialogue he attacked Plato's fundamental position, both in its written and in its unwritten presentment, as a hypothesis both of forms and of formal numbers. First, he attacked the hypothesis of forms (*τὴν τῶν ἰδεῶν ὑπόθεσιν*, *Fragm.* 8), exclaiming in his dialogues, according to Proclus, that he could not sympathize with the dogma even if it should be thought that he was opposing it out of contentiousness; while Plutarch says that his attacks on the forms by means of his exoteric dialogues were thought by some persons more contentious than philosophical, as presuming to disdain Plato's philosophy: so far was he, says Plutarch, from following it. Secondly, in the same dialogue (*Fragm.* 9), according to Syrianus, he disagreed with the hypothesis of formal numbers (*τοῖς εἰδητικοῖς ἀριθμοῖς*). If, wrote Aristotle, the forms are another sort of number, not mathematical, there would be no understanding of it. Lastly, in the same dialogue (*Fragm.* 18 seq.) he revealed his emphasis on nature by contending that the universe is uncreate and indestructible. According to Plato, God caused the natural world to become: according to Aristotle it is eternal. This eternity of the world became one of his characteristic doctrines, and subsequently enabled him to explain how essences can be eternal without being separate from this world which is also eternal (cf. *Metaph.* Z 8). Thus early did Aristotle begin, even in Plato's lifetime, to oppose Plato's hypothesis of supernatural forms, and advance his own hypothesis of the eternity of the world.

He made another attack on Platonism in the didactic work *περὶ ἰδεῶν* (*Fragm.* 185 seq.), contending that the Platonic arguments prove not forms (*ἰδέαι*) but only things common (*τὰ κοινά*). Here, according to Alexander the commentator, he first brought against Plato the argument of "the third man" (*ὁ τρίτος ἄνθρωπος*); that, if there is the form, one man beyond many men, there will be a third man predicated of both man and men, and a fourth predicated of all three, and so on to infinity (*Fragm.* 188). Here, too, he examined the hypothesis of Eudoxus that things are caused by mixture of forms, a hypothesis which formed a kind of transition to his own later views, but failed to satisfy him on account of its difficulties. Lastly, in the didactic work *περὶ τἀγαθοῦ* (*Fragm.* 27 seq.), containing his report of Plato's lectures on the Good, he was dealing with the same mathematical metaphysics which in his dialogue *on Philosophy* he criticized for converting forms into formal numbers. Aristoxenus, at the beginning of the second book of the *Harmonics*, gives a graphic account of the astonishment caused by these lectures of Plato, and of their effect on the lectures of Aristotle. In contending, as Aristotle's pupil, that a teacher should begin by proposing his subject, he tells us how Aristotle used to relate that most of Plato's hearers came expecting to get something about human goods and happiness, but that when the discourses turned out to be all about mathematics, with the conclusion that good is one, it appeared to them a paradox, which some despised and others condemned. The reason, he adds, was that they were not informed by Plato beforehand; and for this very reason, Aristotle, as he told Aristoxenus himself, used to prepare his hearers by informing them of the nature of the subject. From this rare personal reminiscence we see at a glance that the mind of Plato and the mind of Aristotle were so different, that their philosophies must diverge; the one towards the supernatural, the abstract, the discursive, and the other towards the natural, the substantial, the scientific.

Aristotle then even in the second period of his life, while Plato was still alive, began to differ from him in metaphysics. He rejected the Platonic hypothesis of forms, and affirmed that they are not separate but common, without however as yet having advanced to a constructive metaphysics of his own; while at the same time, after having at first adopted his master's dialectical treatment of metaphysical problems, he soon passed from dialogues to didactic works, which had the result of separating metaphysics from dialectic. The all-important consequence of this first departure from Platonism was that Aristotle became and remained primarily a metaphysician. After Plato's death, coming to his third period he made a further departure from Platonism in his didactic works on politics and rhetoric, written in connexion with Alexander and Theodectes. Those on politics (*Fragm.* 646-648) were designed to instruct Alexander on monarchy and on colonization; and in them Aristotle agreed with Plato in assigning a moral object to the state, but departed from him by saying that a king need not be a philosopher, as Plato had said in the *Republic*, but does need to listen to philosophers. Still more marked was his departure from Plato as regards rhetoric. Plato in the *Gorgias*, (501 A) had contended that rhetoric is not an art but an empirical practice (τριβὴ καὶ ἐμπειρία); Aristotle in the *Gryllus* (*Fragm.* 68-69), written in his second period, took according to Quintilian a similar view. But in his third period, in the *Theodectea* (*Fragm.* 125 seq.), rhetoric is treated as an art, and is laid out somewhat in the manner of his later *Art of Rhetoric*; while he also showed his interest in the subject by writing a history of other arts of rhetoric called τεχνῶν συναγωγή (*Fragm.* 136 seq.). Further, in treating rhetoric as an art in the *Theodectea* he was forced into a conclusion, which carried him far beyond Plato's rigid notions of proof and of passion: he concluded that it is the work of an orator to use persuasion, and to arouse the passions (τὸ τὰ πάθη διαγεῖραι), *e.g.* anger and pity (*ib.* 133-134). Nor could he treat poetry as he is said to have done without the same result.

On the whole then, in his early dialectical and didactic writings, of which mere fragments remain, Aristotle had already diverged from Plato, and first of all in metaphysics. During his master's life, in the second period of his own life, he protested against the Platonic hypothesis of forms, formal numbers and the one as the good, and tended to separate metaphysics from dialectic by beginning to pass from dialogues to didactic works. After his master's death, in the third period of his own life, and during his connexion with Alexander, but before the final construction of his philosophy into a system, he was tending to write more and more in the didactic style; to separate from dialectic, not only metaphysics, but also politics, rhetoric and poetry; to admit by the side of philosophy the arts of persuasive language; to think it part of their legitimate work to rouse the passions; and in all these ways to depart from the ascetic rigidity of the philosophy of Plato, so as to prepare for the tolerant spirit of his own, and especially for his ethical doctrine that virtue consists not in suppressing but in moderating almost all human passions. In both periods, too, as we shall find in the sequel, he was already occupied in composing some of the extant writings which were afterwards to form parts of his final philosophical system. But as yet he had given no sign of system, and—what is surprising—no trace of logic. Aristotle was primarily a metaphysician against Plato; a metaphysician before he was a logician; a metaphysician who made what he called primary philosophy (πρώτη φιλοσοφία) the starting-point of his philosophical development, and ultimately of his philosophical system.

III. Composition of his Extant Works

The system which was taught by Aristotle at Athens in the fourth period of his life, and which is now known as the Aristotelian philosophy, is contained not in fragments but in extant books. It will be best then to give at once a list of these extant works, following the traditional order in which they have long been arranged, and marking with a dagger (†) those which are now usually considered not to be genuine, though not always with sufficient reason.

A. Logical

1. Κατηγορίαι: *Categoriae*: On simple expressions signifying different kinds of things and capable of predication [probably an early work of Aristotle, accepting species and genera as "secondary substances" in deference to Plato's teaching].

2. περὶ Ἑρμηνείας: *De interpretatione*: On language as expression of mind, and especially on the enunciation or assertion (ἀπόφανσις, ἀποφαντικὸς λόγος) [rejected by Andronicus according to Alexander; but probably an early work of Aristotle, based on Plato's analysis of the sentence into noun and verb].

3. Ἀναλυτικὰ πρότερα: *Analytica Priora*: On syllogism, with a view to demonstration.

4. Ἀναλυτικὰ ὕστερα: *Analytica Posteriora*: On demonstration, or demonstrative or scientific syllogism (ἀπόδειξις, ἀποδεικτικὸς ἢ ἐπιστημονικὸς συλλογισμός).

5. Τοπικά: *Topica*: On dialectical syllogism (διαλεκτικὸς συλλογισμός), so called from consisting mainly of commonplaces (τόποι, *loci*), or general sources of argument.

6. Σοφιστικοὶ ἔλεγχοι: *Sophistici Elenchi*: On sophistic (σοφιστικὸς) or eristic syllogism (ἐριστικὸς συλλογισμός), so called from the fallacies used by sophists in refutation (ἔλεγχος) of their opponents.

[Numbers 1-6 were afterwards grouped together as the *Organon*.]

B. Physical

1. Φυσικὴ ἀκρόασις: *Physica Auscultatio*: On Nature as cause of change, and the general principles of natural science.

2. περὶ οὐρανοῦ: *De coelo*: On astronomy, &c.

3. περὶ γενέσεως καὶ φθορᾶς: *De generatione et corruptione*: On generation and destruction in general.

4. Μετεωρολογικά: *Meteorologica*: On sublunary changes.

5.† περὶ κόσμου: *De mundo*: On the universe. [Supposed by Zeller to belong to the latter half of the 1st century B.C.]

6. περὶ ψυχῆς: *De anima*: On soul, conjoined with organic body.

7. περὶ αἰσθήσεως καὶ αἰσθητῶν: *De sensu et sensili*: On sense and objects of sense.

8. περὶ μνήμης καὶ ἀναμνήσεως: *De memoria et reminiscentia*: On memory and recollection.

9. περὶ ὕπνου καὶ ἐγρηγόρσεως: *De somno et vigilia*: On sleep and waking.

10. περὶ ἐνυπνίων: *De insomniis*: On dreams.

11. περὶ τῆς καθ' ὕπνον μαντικῆς, or περὶ μαντικῆς τῆς ἐν τοῖς ὕπνοις: *De divinatione per somnum*: On prophecy in sleep.

12. περὶ μακροβιότητος καὶ βραχυβιότητος: *De longitudine et brevitate vitae*: On length and shortness of life.

13. περὶ νεότητος καὶ γήρως καὶ περὶ ζωῆς καὶ θανάτου: *De juventute et senectute et de vita et morte*: On youth and age, and on life and death.

14. περὶ ἀναπνοῆς: *De respiratione*: On respiration.

[Numbers 7-14 are grouped together as *Parva naturalia*.]

15.† περὶ πνεύματος: *De spiritu*: On innate spirit (*spiritus vitalis*).

16. περὶ τὰ ζῷα ἱστορίαι: *Historia animalium*: Description of facts about animals, *i.e.* their organs, &c.

17. περὶ ζῴων μορίων: *De partibus animalium*: Philosophy of the causes of the facts about animals, *i.e.* their functions.

18. † περὶ ζῴων κινήσεως: *De animalium motione*: On the motion of animals. [Ascribed to the school of Theophrastus and Strato by Zeller.]

19. περὶ ζῴων πορείας: *De animalium incessu*: On the going of animals.

20. περὶ ζῴων γενέσεως: *De animalium generatione*: On the generation of animals.

21.† περὶ χρωμάτων: *De coloribus*: On colours. [Ascribed to the school of Theophrastus and Strato by Zeller.]

22.† περὶ ἀκουστῶν: *De audibilibus*. [Ascribed to the school of Theophrastus and Strato by Zeller.]

23.† Φυσιογνωμονικά: *Physiognomonica*: On physiognomy, and the sympathy of body and soul.

24.† περὶ φυτῶν: *De plantis*: On plants. [Not Aristotle's work on this subject.]

25.† περὶ θαυμασίων ἀκουσμάτων: *De mirabilibus auscultationibus*: On phenomena chiefly connected with natural history.

26.† Μηχανικά: *Quaestiones mechanicae*: Mechanical questions.

C. Miscellaneous

1.† Προβλήματα: *Problemata*: Problems on various subjects [gradually collected by the Peripatetics from partly Aristotelian materials, according to Zeller].

2.† περὶ ἀτομῶν γραμμῶν: *De insecabilibus lineis*: On indivisible lines. [Ascribed to Theophrastus, or his time, by Zeller.]

3.† ἀνέμων θέσεις καὶ προσηγορίαι: *Ventorum situs et appellationes*: A fragment on the winds.

4.† περὶ Ξενοφάνους, περὶ Ζήνωνος, περὶ Γοργίου: *De Xenophane, Zenone et Gorgia*: On Xenophanes, Zeno and Gorgias.

D. Primary Philosophy or Theology or Wisdom

τὰ μετὰ τὰ φυσικά: *Metaphysica*: On being as being and its properties, its causes and principles, and on God as the motive motor of the world.

E. Practical

1. Ἠθικὰ Νικομάχεια: *Ethica Nicomachea*: On the good of the individual.

2.† Ἠθικὰ μεγάλα: *Magna Moralia*: On the same subject. [According to Zeller, an abstract of the *Nicomachean* and the *Eudemian Ethics*, tending to follow the latter, but possibly an early draft of the *Nicomachean Ethics*.]

3.† Ἠθικὰ Εὐδήμια or πρὸς Εὔδημον: *Ethica ad Eudemum*: On the same subject. [Usually supposed to be written by Eudemus, but possibly an early draft of the *Nicomachean Ethics*.]

4.† περὶ ἀρετῶν καὶ κακιῶν: *De virtutibus et vitiis*: On virtues and vices. [An eclectic work of the 1st century B.C., half Academic and half Peripatetic, according to Zeller.]

5. Πολιτικά: *De re publica*: Politics, on the good of the state.

6.† Οἰκονομικά: *De cura rei familiaris*: Economics, on the good of the family. [The first book a work of the school of Theophrastus or Eudemus, the second later Peripatetic, according to Zeller.]

F. Art

1. *τέχνη Ῥητορική*: *Ars rhetorica*: On the art of oratory.
2. † *Ῥητορικὴ πρὸς*: *Ἀλέξανδρον*: *Rhetorica ad Alexandrum*: On the same subject. [Ascribed to Anaximenes of Lampsacus (fl. 365, Diodorus xv. 76) by Petrus Victorius, and Spengel, but possibly an earlier rhetoric by Aristotle.]
3. *περὶ Ποιητικῆς*: *De poetica*: On the art of poetry [fragmentary].

G. Historical

Ἀθηναίων πολιτεία: *De republica Atheniensium*: On the Constitution of Athens. [One of the Πολιτεῖαι, said to have been 158 at least, the genuineness of which is attested by the defence which Polybius (xii.) makes of Aristotle's history of the Epizephyrian Locrians against Timaeus, Aristotle's contemporary and critic. Hitherto, only fragments have come down to us (cf. *Fragm.* 381-603). The present treatise, without however its beginning and end, written on a papyrus discovered in Egypt and now in the British Museum, was first edited by F. G. Kenyon 1890–1891.] (See the article Constitution of Athens.)

The Difficulty.—The genuineness of the Aristotelian works, as Leibnitz truly said (*De Stilo Phil. Nizolii*, xxx.), is ascertained by the conspicuous harmony of their theories, and by their uniform method of swift subtlety. Nevertheless difficulties lurk beneath their general unity of thought and style. In style they are not quite the same: now they are brief and now diffuse: sometimes they are carelessly written, sometimes so carefully as to avoid hiatus, *e.g.* the *Metaphysics* A, and parts of the *De Coelo* and *Parva Naturalia*, which in this respect resemble the fragment quoted by Plutarch from the early dialogue *Eudemus* (*Fragm.* 44). They also appear to contain displacements, interpolations, prefaces such as that to the *Meteorologica*, and appendices such as that to the *Sophistical Elenchi*, which may have been added. An Aristotelian work often goes on continuously at first, and then becomes disappointing by suddenly introducing discussions which break the connexion or are even inconsistent with the beginning; as in the *Posterior Analytics*, which, after developing a theory of demonstration from necessary principles, suddenly makes the admission, which is also the main theory of science in the *Metaphysics*, that demonstration is about either the necessary or the contingent, from principles either necessary or contingent, only not accidental. At times order is followed by disorder, as in the *Politics*. Again, there are repetitions and double versions, *e.g.* those of the *Physics*, vii., and those of the *De Anima*, ii., discovered by Torstrik; or two discussions of the same subject, *e.g.* of pleasure in the *Nicomachean Ethics*, vii. and x.; or several treatises on the same subject very like one another, viz. the *Nicomachean Ethics*, the *Eudemian Ethics* and the *Magna Moralia*; or, strangest of all, a consecutive treatise and other discourses amalgamated, *e.g.* in the *Metaphysics*, where a systematic theory of being running through several books (Β, Γ, Ε, Ζ, Η, Θ) is preceded, interrupted and followed by other discussions of the subject. Further, there are frequently several titles of the same work or of different parts of it. Sometimes diagrams (διαγραφαί or ὑπογραφαί) are mentioned, and sometimes given (*e.g.* in *De Interp.* 13, 22 a 22; *Nicomachean Ethics*, ii. 7; *Eudemian Ethics*, ii. 3), but sometimes only implied (*e.g.* in *Hist. An.* i. 17, 497 a 32; iii. 1, 510 a 30; iv. 1, 525 a 9). The different works are more or less connected by a system of references, which give rise to difficulties, especially when they are cross-references: for example, the *Analytics* and *Topics* quote one another: so do the *Physics* and the *Metaphysics*; the *De Vita* and *De Respiratione* and the *De Partibus Animalium*; this latter treatise and the *De Animalium Incessu*; the *De Interpretatione* and the *De Anima*. A late work may quote an earlier; but how, it may be asked, can the earlier reciprocally quote the later?

Besides these difficulties in and between the works there are others beyond them. On the one hand, there is the curious story given partly by Strabo (608-609) and partly in Plutarch's *Sulla* (c. 26), that Aristotle's successor Theophrastus left the books of both to their joint pupil, Neleus of Scepsis, where they were hidden in a cellar, till in Sulla's time they were sold to Apellicon, who made new copies, transferred after Apellicon's death by Sulla to Rome, and there edited and published by Tyrannio and Andronicus On the other hand, there are the curious and puzzling catalogues of Aristotelian books, one given by Diogenes Laertius, another by an anonymous commentator (perhaps Hesychius of Miletus) quoted in the notes of Gilles Ménage on Diogenes Laertius, and known as "Anonymus Menagii," and a third copied by two Arabian writers from Ptolemy, perhaps King Ptolemy Philadelphus, son of the founder of the library at Alexandria. (See Rose, *Fragm.* pp. 1-22.) But the extraordinary thing is that, without exactly agreeing among themselves, the catalogues give titles which do not agree well with the Aristotelian works as we have them. A title in some cases suits a given work or a part of it; but in other cases there are no titles for works which exist, or titles for works which do not exist.

These difficulties are complicated by various hypotheses concerning the composition of the Aristotelian works. Zeller supposes that, though Aristotle may have made preparations for his philosophical system beforehand, still the properly didactic treatises composing it almost all belong to the last period of his life, *i.e.* from 335–334 to 322; and from the references of one work to another Zeller has further suggested a chronological order of composition during this period of twelve years, beginning with the treatises on Logic and Physics, and ending with that on Metaphysics. There is a further hypothesis that the Aristotelian works were not originally treatises, but notes of lectures either for or by his pupils. This easily passes into the further and still more sceptical hypothesis that the works, as we have them, under Aristotle's name, are rather the works of the Peripatetic school, from Aristotle, Theophrastus and Eudemus downwards. "We cannot assert with certainty," says R. Shute in his *History of the Aristotelian Writings* (p. 176), "that we have even got throughout a treatise in the exact words of Aristotle, though we may be pretty clear that we have a fair representation of his thought. The unity of style observable may belong quite as much to the school and the method as to the individual." This sceptical conclusion, the contrary of that drawn by Leibnitz from the harmony of thought and style pervading the works, shows us that the Homeric question has been followed by the Aristotelian question.

The Solution.—Such hypotheses attend to Aristotle's philosophy to the neglect of his life. He was really, as we have seen, a prolific writer from the time when he was a young man under Plato's guidance at Athens; beginning with dialogues in the manner of his master, but afterwards preferring to write didactic works during the prime of his own life between thirty-eight and fifty (347–335-334), and with the further advantage of leisure at Atarneus and Mitylene, in Macedonia and at home in Stagira. When at fifty he returned to Athens, as head of the Peripatetic school, he no doubt wrote much of his extant philosophy during the twelve remaining years of his life (335–322). But he was then a busy teacher, was growing old, and suffered from a disease in the stomach for a considerable time before it proved fatal at the age of sixty-three. It is therefore improbable that he could between fifty and sixty-three have written almost the whole of the many books on many subjects constituting that grand philosophical system which is one of the most wonderful works of man. It is far more probable that he was previously composing them at his leisure and in the vigour of manhood, precisely as his contemporary Demosthenes composed all his great speeches except the *De Corona* before he was fifty.

Turning to Aristotle's own works, we immediately light upon a surprise: Aristotle began his extant scientific works during Plato's lifetime. By a curious coincidence, in two different works he mentions two different events as contemporary with the time of writing, one in 357 and the other in 356. In the *Politics* (E 10, 1312 b 10), he mentions as now (*νῦν*) Dion's expedition to Sicily which occurred in 357. In the *Meteorologica* (iii. 1, 371 a 30), he mentions as now (*νῦν*) the burning of the temple at Ephesus, which occurred in 356. To save his hypothesis of late composition, Zeller resorts to the vagueness of the word "now". (*νῦν*). But Aristotle is graphically describing isolated events, and could hardly speak of events of 357 and 356 as happening "now" in or near 335. Moreover, these two works contain further proofs that they were both begun earlier than this date. The *Politics* (B 10) mentions as having happened lately (*νεωστί*) the expedition of Phalaecus to Crete, which occurred towards the end of the Sacred War in 346. The *Meteorologica* (Γ 7) mentions the comet of 341. It is true that the *Politics* also mentions much later events, *e.g.* the assassination of Philip which took place in 336 (E 10, 1311 b 1-3). Indeed, the whole truth about this great work is that it remained unfinished at Aristotle's death. But what of that? The logical conclusion is that Aristotle began writing it as early as 357, and continued writing it in 346, in 336, and so on till he died. Similarly, he began the *Meteorologica* as early as 356 and was still writing it in 341. Both books were commenced some years before Plato's death: both were works of many years: both were destined to form parts of the Aristotelian system of philosophy. It follows that Aristotle, from early manhood, not only wrote dialogues and didactic works, surviving only in fragments, but also began some of the philosophical works which are still parts of his extant writings. He continued these and no doubt began others during the prime of his life. Having thus slowly matured his separate writings, he was the better able to combine them more and more into a system, in his last years. No doubt, however, he went on writing and rewriting well into the last period of his life; for example, the recently discovered *'Αθηναίων πολιτεία* mentions on the one hand (c. 54) the archonship of Cephisophon (329–328), on the other hand (c. 46) triremes and quadriremes but without quinqueremes, which first appeared at Athens in 325–324; and as it mentions nothing later it probably received its final touches between 329 and 324. But it may have been begun long before, and received additions and changes. However early Aristotle began a book, so long as he kept the manuscript, he could always change it. Finally he died without completing some of his works, such as the *Politics*, and notably that work of his whole philosophic career and foundation of his whole philosophy—the *Metaphysics*—which, projected in his early criticism of Plato's philosophy of universal forms, gradually developed into his positive philosophy of individual substances, but remained unfinished after all.

On the whole, then, Aristotle was writing his extant works very gradually for some thirty-five years (357–322), like Herodotus (iv. 30) contemplated additions, continued writing them more or less together, not so much successively as simultaneously, and had not finished writing at his death.

There is a curious characteristic connected with this gradual composition. An Aristotelian treatise frequently has the appearance of being a collection of smaller discourses (*λόγοι*), as, *e.g.*, K. L. Michelet has remarked.

This is obvious enough in the *Metaphysics*: it has two openings (Books A and α); then comes a nearly consecutive theory of being (B, Γ, E, Z, H, Θ), but interrupted by a philosophical lexicon Δ; afterwards follows a theory of unity (I); then a summary of previous books and of doctrines from the *Physics* (K); next a new beginning about being, and, what is wanted to complete the system, a theory of God in relation to the world (Λ); finally a criticism of mathematical metaphysics (M, N), in which the argument against Plato (A 9) is repeated almost word for word (M 4-5). The *Metaphysics* is clearly a compilation formed from essays or discourses; and it illustrates another characteristic of Aristotle's gradual method of composition. It refers back to passages "in the first discourses" (*ἐν τοῖς πρώτοις λόγοις*)—an expression not uncommon in Aristotelian writings. Sometimes the reference is to the beginning of the whole treatise; *e.g. Met.* B 2,997 b 3-5, referring back to A 6 and 9 about Platonic forms. Sometimes, on the other hand, the reference only goes back to a previous part of a given topic, *e.g. Met.* Θ1, 1045 b 27-32, referring back to Z 1, or at the earliest to Γ 2. On either alternative, however, "the first discourses" mentioned may have originally been a separate discourse; for Book Γ begins quite fresh with the definition of the science of being, long afterwards called "Metaphysics," and Book Z begins Aristotle's fundamental doctrine of substance.

Another indication of a treatise having arisen out of separate discourses is its consisting of different parts imperfectly connected. Thus the *Nicomachean Ethics* begins by identifying the good with happiness (*εὐδαιμονία*), and happiness with virtuous action. But when it comes to the moral virtues (Book iii. 6), a new motive of the "honourable" (*τοῦ καλοῦ ἕνεκα*) is suddenly introduced without preparation, where one would expect the original motive of happiness. Then at the end of the moral virtues justice is treated at inordinate length, and in a different manner from the others, which are regarded as means between two vices, whereas justice appears as a mean only because it is of the middle between too much and too little. Later, the discussion on friendship (Books viii.–ix.) is again inordinate in length, and it stands alone. Lastly, pleasure, after having been first defined (Book vii.) as an activity, is treated over again (Book x.) as an end beyond activity, with a warning against confusing activity and pleasure. The probability is that the *Nicomachean Ethics* is a collection of separate discourses worked up into a tolerably systematic treatise; and the interesting point is that these discourses correspond to separate titles in the list of Diogenes Laertius (*περὶ καλοῦ*, *περὶ δικαίων*, *περὶ φιλίας*, *περὶ ἡδονῆς*, and *περὶ ἡδονῶν*). The same list also refers to tentative notes (*ὑπομνήματα ἐπιχειρηματικά*), and the commentators speak of ethical notes (*ἠθικὰ ὑπομνήματα*). Indeed, they sometimes divide Aristotle's works into notes (*ὑπομνηματικά*) and compilations (*συνταγματικά*). How can it be doubted that in the gradual composition of his works Aristotle began with notes (*ὑπομνήματα*) and discourses (*λόγοι*), and proceeded to treatises (*πραγματεῖαι*)? He would even be drawn into this process by his writing materials, which were papyrus rolls of some magnitude; he would tend to write discourses on separate rolls, and then fasten them together in a bundle into a treatise.

If then Aristotle was for some thirty-five years gradually and simultaneously composing manuscript discourses into treatises and treatises into a system, he was pursuing a process which solves beforehand the very difficulties which have since been found in his writings. He could very easily write in different styles at different times, now avoiding hiatus and now not, sometimes writing diffusely and sometimes briefly, partly polishing and partly leaving in the rough, according to the subject, his own state of health or humour, his age, and the degree to which he had developed a given topic; and all this even in the same manuscript as well as in different manuscripts, so that a difference of style between different parts of a work or between different works, explicable by one being earlier than another, does not prove either to be not genuine. As he might write, so might he think differently in his long career. To put one extreme case, about the soul he could think at first in the *Eudemus* like Plato that it is imprisoned in the body, and long afterwards in the *De Anima* like himself that it is the immateriate essence of the material bodily organism. Again, he might be inconsistent; now, for example, calling a universal a substance in deference to Plato, and now denying that a universal can be a substance in consequence of his own doctrine that every substance is an individual; and so as to contradict himself in the same treatise, though not in the same breath or at the same moment of thinking. Again, in developing his discourses into larger treatises he might fall into dislocations; although it must be remembered that these are often inventions of critics who do not understand the argument, as when they make out that the treatment of reciprocal justice in the *Ethics* (v. 5-6) needs rearrangement through their not noticing that, according to Aristotle, reciprocal justice, being the fairness of a commercial bargain, is not part of absolute or political justice, but is part of analogical or economical justice. Or he might make repetitions, as in the same book, where he twice applies the principle, that so far as the agent does the patient suffers, first to the corrective justice of the law court (*Eth.* v. 4) in order to prove that in a wrong the injurer gains as much as the injured loses, and immediately afterwards to the reciprocal justice of commerce (*ib.* 5) in order to prove that in a bargain a house must be exchanged for as many shoes as equal it in value. Or he might himself, without double versions, repeat the same argument with a different shade of meaning; as when in the *Nic. Ethics* (vii. 4) he first argues that incontinence about such natural pleasures as that of gain is only modified incontinence, a sign (as *causa cognoscendi*) of which is that it is not so bad as incontinence about carnal pleasures, and then argues that, because (as *causa essendi*) it is only modified incontinence, therefore it is not so bad. Or he might return again and again to the same point with a difference: there is a good instance in his conclusion that the speculative life is the highest happiness; which he first infers because it is the life of man's highest and divine faculty, intelligence (1176 b-1178 a 8), then after an interval infers a second time because our speculative life is an imitation of that of God (1178 b 7-32), and finally after another interval infers a third time, because it will make man most dear to God (1179 a 22-32). Or, extending himself as it were still more, he might write two drafts, or double versions of his own, on the same subject; *e.g.* *Physics*, vii. and *De Anima*, ii. Or he might, going still further, in his long literary career write two or more treatises on the same subject, different and even more or less inconsistent with each other, as we shall find in the sequel. Finally, having a great number of discourses and treatises, containing all those small blemishes, around him in his library, and determined to collect, consolidate and connect them into a philosophical system, he would naturally be often taking them down from their places to consult and compare one with another, and as naturally enter in them references one to the other, and cross-references between one another. Thus he would enter in the *Metaphysics* a reference to the *Physics*, and in the *Physics* a reference to the *Metaphysics*, precisely because both were manuscripts in his library. For the same purpose of connexion he would be tempted to add a preface to a book like the *Meteorologica*. In order to refer back to the *Physics*, the *De Coelo*, and the *De Generatione*, this work begins by stating that the first causes of all nature and all natural motion, the stars ordered according to celestial motion and the bodily elements with their transmutations, and generation and corruption have all been discussed; and by adding that there remains to complete this investigation, what previous investigators called meteorology. To suppose this preface, presupposing many sciences, to have been written in 356, when the *Meteorologica* had been already commenced, would be absurd; but equally absurd would it be to reject that date on account of the preface, which even a modern author often writes long after his book. Nor is it at all absurd to suppose that, long after he began the *Meteorologica*, Aristotle himself added the preface in the process of gathering his general treatises on natural science into a system. So he might afterwards add the preface to the *De Interpretatione*, in order to connect it with the *De Anima*, though written afterwards, in order to connect his treatises on mind and on its expression. So also he might add the appendix to the *Sophistical Elenchi*, long after he had written that book, and perhaps, to judge from its being a general claim to have discovered the syllogism, when the founder of logic had more or less realized that he had written a number of connected treatises on reasoning.

The Question of Publication.—There is still another point which would facilitate Aristotle's gradual composition of discourses into treatises and treatises into a system; there was no occasion for him to publish his manuscripts beyond his school. Printing has accustomed us to publication, and misled us into applying to ancient times the modern method of bringing out one book after another at definite dates by the same author. But Greek authors contemplated works rather than books. Some of the greatest authors were not even writers: Homer, Aesop, Thales, Socrates. Some who were writers were driven to publish by the occasion; and after the orders of government, which were occasionally published to be obeyed, occasional poems, such as the poems of Solon, the odes of Pindar and the plays of the dramatists, which all had a political significance, were probably the first writings to be published or, rather, recited and acted, from written copies. With them came philosophical poems, such as those of Xenophanes and Empedocles; the epical history of Herodotus; the dramatic philosophy of Plato. On a larger scale speeches written by orators to be delivered by litigants were published and encouraged publication; and, as the Attic orators were his contemporaries, publication had become pretty common in the time of Aristotle, who speaks of many bundles (δέσμας) of judicial speeches by Isocrates being hawked about by the booksellers (*Fragm.* 140).

No doubt then Aristotle's library contained published copies of the works of other authors, as well as the autographs of his own. It does not follow that his own works went beyond his library and his school. Publication to the world is designed for readers, who at all times have demanded popular literature rather than serious philosophy such as that of Aristotle. Accordingly it becomes a difficult question, how far Aristotle's works were published in his lifetime. In answering it we must be careful to exclude any evidence which refers to Aristotle as a man, not as a writer, or refers to him as a writer but does not prove publication while he was alive.

Beginning then with his early writings, which are now lost, the dialogues *On Poetry* and the *Eudemus* were probably the published discourses to which Aristotle himself refers (*Poetics*, 15; *De Anima*, i. 4); and the dialogue *Protrepticus* was known to the Cynic Crates, pupil of Diogenes and master of Zeno (*Fragm.* 50), but not necessarily in Aristotle's lifetime, as Crates was still alive in 307. Again, Aristotle's early rhetorical instructions and perhaps writings, as well as his opinion that a collection of proverbs is not worth while, must have been known outside Aristotle's rhetorical school to the orator Cephisodorus, pupil of Isocrates and master of Demosthenes, for him to be able to write in his *Replies to Aristotle* (ἐν ταῖς πρὸς 'Αριστοτέλην ἀντιγραφαῖς) an admired defence of Isocrates (Dionys. H. *De Isoc.* 18). But this early dialectic and rhetoric, being popular, would tend to be published. History comes nearer to philosophy; and Aristotle's *Constitutions* were known to his enemy Timaeus, who attacked him for disparaging the descent of the Locrians of Italy, according to Polybius (xii.), who defended Aristotle. But as Timaeus brought his history down to 264 B.C. (Polyb. i. 5), and therefore might have got his information after Aristotle's death, we cannot be sure that any of the *Constitutions* were published in the author's lifetime. We are equally at a loss to prove that Aristotle published his philosophy. He had, like all the great, many enemies, personal and philosophical; but in his lifetime they attacked the man, not his philosophy. In the Megarian school, first Eubulides quarrelled with him and calumniated him (Diog. Laert. ii. 109) in his lifetime; but the attack was on his life, not on his writings: afterwards Stilpo wrote a dialogue ('Αριστοτέλης), which may have been a criticism of the Aristotelian philosophy from the Megarian point of view; but he outlived Aristotle thirty years. In the absence of any confirmation, "the current philosophemata" (τὰ ἐγκύκλια φιλοσοφήματα), mentioned in the *De Coelo* (i. 9, 279 a 30), are sometimes supposed to be Aristotle's published philosophy, to which he is referring his readers. But the example there given, that the divine is unchangeable, is precisely such a religious commonplace as might easily be a current philosopheme of Aristotle's day, not of Aristotle; and this interpretation suits the parallel passage in the *Nic. Ethics* (i. 5, 1096 a 3) where opinions about the happiness of political life are said to have been sufficiently treated "even in current discussions" (καὶ ἐν τοῖς ἐγκυκλίοις).

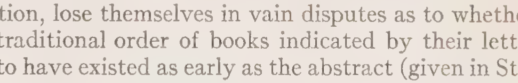
There is therefore no contemporary proof that Aristotle published any part of his mature philosophical system in his lifetime. It is true that a book of Andronicus, as reported by Aulus Gellius (xx. 5), contained a correspondence between Alexander and Aristotle in which the pupil complained that his master had published his "acroatic discourses" (τοὺς ἀκροατικοὺς τῶν λόγων). But ancient letters are proverbially forgeries, and in the three hundred years which elapsed between the supposed correspondence and the time of Andronicus there was plenty of time for the forgery of these letters. But even if the correspondence is genuine, "acroatic discourses" must be taken to mean what Alexander would mean by them in the time of Aristotle, and not what they had come to mean by the time of Andronicus. Alexander meant those discourses which Aristotle, when he was his tutor, intended for the ears of himself and his fellow-pupils; such as the early political works on *Monarchy* and on *Colonies*, and the early rhetorical works, the *Theodectea*, the *Collection of*

Arts, and possibly the *Rhetoric to Alexander*, in the preface to which the writer actually says to Alexander: "You wrote to me that nobody else should receive this book." These few early works may have been published, and contrary to the wishes of Alexander, without affecting Aristotle's later system. But even so, Alexander's complaint would not justify writers three centuries later in taking Alexander to have referred to mature scientific writings, which were not addressed, and not much known, to him, the conqueror of Asia; although by the times of Andronicus and Aulus Gellius, Aristotle's scientific writings were all called acroatic, or acroamatic, or sometimes esoteric, in distinction from exoteric—a distinction altogether unknown to Aristotle, and therefore to Alexander. In the absence of any contemporary evidence, we cannot believe that Aristotle in his lifetime published any, much less all, of his scientific books. The conclusion then is that Aristotle on the one hand to some extent published his early dialectical and rhetorical writings, because they were popular, though now they are lost, but on the other hand did not publish any of the extant historical and philosophical works which belong to his mature system, because they were best adapted to his philosophical pupils in the Peripatetic school. The object of the philosopher was not the applause of the public but the truth of things. Now this conclusion has an important bearing on the composition of Aristotle's writings and on the difficulties which have been found in them. If he had like a modern author brought out each of his extant philosophical works on a definite day of publication, he would not have been able to change them without a second edition, which in the case of serious writings so little in demand would not be worth while. But as he did not publish them, but kept the unpublished manuscripts together in his library and used them in his school, he was able to do with them as he pleased down to the very end of his life, and so gradually to consolidate his many works into one system.

While Aristotle did not publish his philosophical works to the world, he freely communicated them to the Peripatetic school. They are not mere lectures; but he used them for lectures: he allowed his pupils to read them in his library, and probably to take copies from them. He also used diagrams, which are sometimes incorporated in his works, but sometimes are only mentioned, and were no doubt used for purposes of teaching. He also availed himself of his pupils' co-operation, as we may judge from his description in the *Ethics* (x. 7) of the speculative philosopher who, though he is self-sufficing, is better having co-operators (συνεργοὺς ἔχων). From an early time he had a tendency to address his writings to his friends. For example, he addressed the *Theodectea* to his pupil Theodectes; and even in ancient times a doubt arose whether it was a work of the master or the pupil. It was certainly by Aristotle, because it contained the triple grammatical division of words into noun, verb and conjunction, which the history of grammar recognized as his discovery. But we may explain the share of Theodectes by supposing that he had a hand in the work (cf. Dionys. H. *De Comp. Verb.* 2; Quintilian i. 4. 18). Similarly in astronomy, Aristotle used the assistance of Eudoxus and Callippus. Indeed, throughout his writings he shows a constant wish to avail himself of what is true in the opinions of others, whether they are philosophers, or poets or ordinary people expressing their thoughts in sayings and proverbs. With one of his pupils in particular, Theophrastus, who was born about 370 and therefore was some fifteen years younger than himself, he had a long and intimate connexion; and the work of the pupil bears so close a resemblance to that of his master, that, even when he questions Aristotle's opinions (as he often does), he seems to be writing in an Aristotelian atmosphere; while he shows the same acuteness in raising difficulties, and has caught something of the same encyclopaedic genius. Another pupil, Eudemus of Rhodes, wrote and thought so like his master as to induce Simplicius to call him the most genuine of Aristotle's companions (ὁ γνησιώτατος τῶν Ἀριστοτέλους ἑταίρων). It is probable that this extraordinary resemblance is due to the pupils having actually assisted their master; and this supposition enables us to surmount a difficulty we feel in reading Aristotle's works. How otherwise, we wonder, could one man writing alone and with so few predecessors compose the first systematic treatises on the psychology of the mental powers and on the logic of reasoning, the first natural history of animals, and the first civil history of one hundred and fifty-eight constitutions, in addition to authoritative treatises on metaphysics, biology, ethics, politics, rhetoric and poetry; in all penetrating to the very essence of the subject, and, what is most wonderful, describing more facts than any other man has ever done on so many subjects?

The Uncompleted Works.—Such then was the method of composition by which Aristotle began in early manhood to write his philosophical works, continued them gradually and simultaneously, combined shorter discourses into longer treatises, compared and connected them, kept them together in his library without publishing them, communicated them to his school, used the co-operation of his best pupils, and finally succeeded in combining many mature writings into one harmonious system. Nevertheless, being a man, he did not quite succeed. He left some unfinished; such as the *Categories*, in which the main part on categories is not finished, while the last part, afterwards called postpredicaments, is probably not his, the *Politics* and the *Poetics*. He left others imperfectly arranged, and some of the most important, the *Metaphysics*, the *Politics* and the logical writings. Of the imperfect arrangement of the *Metaphysics* we have already spoken; and we shall speak of that of his logical writings when we come to the order of his whole system. At present the *Politics* will supply us with a conspicuous example of the imperfect arrangement of some, as well as of the gradual composition of all, of Aristotle's extant writings.

The *Politics* was begun as early as 357, yet not finished in 322. It betrays its origin from separate discourses. First comes a general theory of constitutions, right and wrong (Books A,B,Γ); and this part is afterwards referred to as "the first discourses" ἐν τοῖς πρώτοις λόγοις). Then follows the treatment of oligarchy, democracy, commonwealth and tyranny, and of the various powers of government (Δ), and independent investigation of revolution, and of the means of preserving states (E), and a further treatment of democracy and oligarchy, and of the different offices of the state (Z), and finally a return to the discussion of the right form of constitution (H, Θ). But Δ and Z are a group interrupted by E, and H and Θ are another group unconnected with the previous group and with E, and are also distinguished in style by avoiding hiatus. Further, the group (Δ, Z) and the group (H, Θ) are both unfinished. Finally the group (Δ, Z), the book (E) and the group (H, Θ), though unconnected with one another, are all connected though imperfectly with "the first discourses" (A,B,Γ). This complicated arrangement may be represented in the following diagram:—



The simplest explanation is that Aristotle began by writing separate discourses, four at least, on political subjects; that he continued to write them and perhaps tried to combine them; but that in the end he failed and left the *Politics* unfinished and in disorder. But modern commentators, possessed by the fallacy that Aristotle like a modern author must from the first have comtemplated a whole treatise in a regular order for definite publication, lose themselves in vain disputes as to whether to go by the traditional order of books indicated by their letters and known to have existed as early as the abstract (given in Stobaeus, *Ecl.* ii. 7) ascribed to Didymus (1st century A.D.), or to put the group H, Θ, as more connected with A, B, Γ, before the group Δ, Z, and this group before the book E. It is agreed, says Zeller, that the traditional order contradicts the original plan. But what right have we to say that Aristotle had an original plan?

The incomplete state in which Aristotle left the *Metaphysics*, the *Politics* and his logical works, brings us to the hard question how much he did, and how much his Peripatetic followers did to his writings after his death. To answer it we should have to go far beyond Aristotle. But two corollaries follow from our present investigation of his extant writings; the first, that it was the long continuance of the Peripatetic school which gradually caused the publication, and in some cases the forgery, of the separate writings; and the second, that his Peripatetic successors arranged and edited some of Aristotle's writings, and gradually arrived by the time of Andronicus, the eleventh from Aristotle, at an order of the whole body of writings forming the system. Now, it is probable that the arrangement of the works which we are considering was done by the Peripatetic successors of Aristotle. There is nothing indeed in the *Metaphysics* to show whether he left it in isolated treatises or in its present disorder; and nothing in the *Politics*. On the other hand, in the case of logic, it is certain that he did not combine his works on the subject into one whole, but that the Peripatetics afterwards put them together as organic, and made them the parts of logic as an organon, as they are treated by Andronicus. Perhaps something similar occurred to the *Metaphysics*, as Alexander imputed its redaction to Eudemus, and the majority of ancient commentators attributed its second opening (Book α) to Pasicles, nephew of Eudemus. Again, it is not unlikely that the *Politics* was arranged in the traditional order of books by Theophrastus, and that this is the meaning of the curious title occurring in the list of Aristotle's works as given by Diogenes Laertius, πολιτικῆς ἀκροάσεως ὡς ἡ Θεοφράστου α'β'γ'δ'ε'ς'ζ'η', which agrees with the *Politics* in having eight books. Although, however, we may concede that such great works as the *Metaphysics*, the *Politics* and the logical writings did not receive their present form from Aristotle himself, that concession does not deprive Aristotle of the authorship, but only of the arrangement of those works. On the contrary, Theophrastus and Eudemus, his immediate followers, both wrote works presupposing Aristotle's *Metaphysics* and his logical works, and Dicaearchus, their contemporary, used his *Politics* for his own *Tripoliticus*. It was Aristotle himself then who wrote these works, whether he arranged them or not; and if he wrote the incomplete works, then *a fortiori* he wrote the completed works except those which are proved spurious, and practically consummated the Aristotelian system, which, as Leibnitz said, by its unity of thought and style evinces its own genuineness and individuality. We must not exaggerate the school and underrate the individual, especially such an individual. What he mainly wanted was the time, the leisure and the labour, which we have supposed to have been given to the gradual composition of the extant Aristotelian writings. Aristotle, asked where dwell the Muses, answered, "In the souls of those who love work."

IV. Earlier and Later Writings

Aristotle's quotations of his other books and of historical facts only inform us at best of the dates of isolated passages, and cannot decide the dates and sequences of whole philosophical books which occupied him for many years. Is there then any way of discriminating between early and late works? There is the evidence of the influences under which the books were written. This evidence applies to the whole Aristotelian literature including the fragments. As to the fragments, we are safe in saying that the early dialogues in the manner of Plato were written under the influence of Plato, and that the subsequent didactic writings connected with Alexander were written more under the influence of Philip and Alexander. Turning to the extant writings, we find that some are more under the influence of Plato, while others are more original and Aristotelian. Also some writings are more rudimentary than others on the same subject; and some have the appearance of being first drafts of others. By these differences we can do something to distinguish between earlier and later philosophical works; and also vindicate as genuine some works, which have been considered spurious because they do not agree in style or in matter with his most mature philosophy. In thirty-five years of literary composition, Aristotle had plenty of time to change, because any man can differ from himself at different times.

On these principles, we regard as early genuine philosophical works of Aristotle, (1) the *Categories*; (2) the *De Interpretatione*; (3) the *Eudemian Ethics* and *Magna Moralia*; (4) the *Rhetoric to Alexander*.

1. The *Categories* (κατηγορίαι).—This short discourse turns on Aristotle's fundamental doctrine of individual substances, without which there is nothing. He arrives at it from a classification of categories, by which he here means "things stated in no combination" (τὰ κατὰ μηδεμίαν συμπλοκὴν λεγόμενα) or what we should call "names," capable of becoming predicates (κατηγορούμενα, κατηγορίαι). "Every name," says he (chap. 4), "signifies either substance or something quantitative, or qualitative, or relative, or somewhere, or sometimes, or that it is in a position, or in a condition, or active or passive." He immediately adds that, by the combination of these names with one another, affirmation or negation arises. The categories then are names signifying things capable of becoming predicates in a proposition. Next he proceeds to substances (οὐσίαι), which he divides into primary (πρῶται) and secondary (δεύτεραι). "Substance," says he (chap. 5), "which is properly, primarily and especially so called, is that which is neither a predicate of a subject nor inherent in a subject; for example, a particular man, or a particular horse. Secondary substances so called are the species in which are the primarily called substances, and the genera of these species: for example, a particular man is in a species, man, the genus of which is animal: these then are called secondary substances, man and animal." Having made these subdivisions of substance, he thereupon reduces secondary substances and all the rest of the categories to belongings of individual or primary substances. "All other things," says he, "are either predicates of primary substances as subjects" (καθ' ὑποκειμένων τῶν πρώτων οὐσιῶν) "or inherent in them as subjects" (ἐν ὑποκειμέναις αὐταῖς). He explains that species and genus are predicates of, and that other categories (*e.g.* the quality of colour) are inherent in, some individual substance such as a particular man. Then follows his conclusion: "without primary substances it is impossible for anything to be" (μὴ οὐσῶν οὖν τῶν πρώτων οὐσιῶν ἀδύνατον τῶν ἄλλων τι εἶναι. *Cat.* 5, 2 b 5–6).

Things are individual substances, without which there is nothing—this is the fundamental point of Aristotelianism, as against Platonism, of which the fundamental point is that things are universal forms without which there becomes nothing. The world, according to Aristotle, consists of substances, each of which is a separate individual, this man, this horse, this animal, this plant, this earth, this water, this air, this fire; in the heavens that moon, that sun, those stars; above all, God. On the other hand, a universal species or genus of substances is a predicate which, as well as everything else in all the other categories, always belongs to some individual substance or other as subject, and has no separate being. In full, then, a substance is a separate individual, having universals, and things in all other categories, inseparably belonging to it. The individual substance Socrates, for example, is a man and an animal (οὐσία), tall, (ποσόν), white (ποιόν), a husband (πρός τι), in the market (ποῦ), yesterday (πότε), sitting (κεῖσθαι), armed (ἔχειν), talking (ποιεῖν), listening (πάσχειν). Aristotelianism is this philosophy of substantial things.

The doctrine that all things are substances which are separate individuals, stated in the *Categories*, is expanded in the *Metaphysics*. Both works arrive at it from the classification of categories, which is the same in both; except that in the former the categories are treated rather as a logical classification of names signifying things, in the latter rather as a metaphysical classification of things. In neither, however, are they a grammatical classification of words by their structure; and in neither are they a psychological classification of notions or general conceptions (νοήματα), such as they afterwards became in Kant's *Critique* and the post-Kantian idealism. Moreover, even in the *Categories* as names signifying distinct things they imply distinct things; and hence the *Categories*, as well as the *Metaphysics*, draws the metaphysical conclusion that individual substances are the things without which there is nothing else, and thereby lays the positive foundation of the philosophy running through all the extant Aristotelian writings.

Again, according to both works, an individual substance is a subject, a universal its predicate; and they have in common the Aristotelian metaphysics, which differs greatly from the modern logic of subject and predicate. Subject (ὑποκείμενον) originally meant a real thing which is the basis of something, and was used by Aristotle both for a thing to which something belongs and for a name of which another is asserted: accordingly "predicate" (κατηγορούμενον) came with him to mean something really belonging (ὑπάρχον) to a substance as real subject, as well as a name capable of being asserted of a name as a nominal subject. In other words, to him subject meant real as well as nominal subject, and predicate meant real as well as nominal predicate; whereas modern logic has gradually reduced both to the nominal terms of a proposition. Accordingly, when he said that a substance is a subject, he meant a real subject; and when he said that a universal species or genus is a predicate, he meant that it is a real predicate belonging to a real subject, which is always some individual substance of the kind. It follows that Aristotelianism in the *Categories* and in the *Metaphysics* is a realism both of individuals and of universals; of individual substances as real subjects, and of universals as real predicates.

Lastly, the two works agree in reducing the *Categories* to substance and its belongings (ὑπάρχοντα). According to both, it is always some substance, such as Socrates, which is quantitative, qualitative, relative, somewhere, some time, placed, conditioned, active, passive; so that all things in all other categories are attributes which are belongings of substances. There are therefore two kinds of belongings, universals and attributes; and in both cases belonging in the sense of having no being but the being of the substance.

In brief then the common ground of the *Categories* and the *Metaphysics* is the fundamental position that all things are substances having belonging to them universals and attributes, which have no separate being as Plato falsely supposed.

This essential agreement suffices to show that the *Categories* and the *Metaphysics* are the result of one mind. Nevertheless, there is a deep difference between them in detail, which may be expressed by saying that the *Categories* is nearer to Platonism. We have seen how anxious Aristotle was to be considered one of the Platonists, how reluctant he was to depart from Plato's hypothesis of forms, and how, in denying the separability, he retained the Platonic belief in the reality and even in the unity of the universal. We have now to see that, in writing the *Categories*, on the one hand he carried his differences from his master further than he had done in his early criticisms by insisting that individual substances are not only real, but are the very things which sustain the universal; but on the other hand, he clung to further relics of the Platonic theory, and it is those which differentiate the *Categories* and the *Metaphysics*.

In the first place, in the *Categories* the belonging of things in other categories to individual substances in the first category is not so well developed. A distinction (chap. 2) is drawn between things which are predicates of a subject (καθ' ὑποκείμενον) and things which inhere in a subject (ἐν ὑποκειμένῳ); and, while universals are called predicates of a subject, things in a subordinate category, *i.e.* attributes such as colour (χρῶμα) in the qualitative, are said to inhere in a subject. It is true that the work gives only a negative definition of the inherent, namely, that it does not inhere as a part and cannot exist apart from that in which it inheres (1 a 24-25), and it admits that what is inherent may sometimes also be a predicate (chap. 5, 2 a 27-34). The commentators explain this to mean that an attribute as individual is inherent, as universal is a predicate. But even so the *Categories* concludes that everything is either a predicate of, or inherent in, a substance; and the view that this colour belongs to this substance only in the sense of being in it, not of it, leaves the impression that, like a Platonic form, it is an entity rather in than of an individual substance, though even in the *Categories* Aristotle is careful to deny its separability. The hypothesis of inherence gives an inadequate account of the dependence of an attribute on a substance, and is a kind of half-way house between separation and predication.

On the other hand, in the *Metaphysics*, the distinction between inherence and predication disappears; and what is more, the relation of an attribute to a substance is regarded as so close that an attribute is merely the substance modified. "The thing itself and the thing affected," says Aristotle, "are in a way the same; *e.g.* Socrates and Socrates musical" (*Met.* Δ 29, 1024 b 30-31). Consequently, all attributes, as well as universals, belong as predicates of individual substances as subjects, according to the *Metaphysics*, and also according to the most authoritative works of Aristotle, such as the *Posterior Analytics*, where (cf. i. 4, 22) an attribute (συμβεβηκός) is said to be only by being the substance possessing it, and any separation of an attribute from a substance is held to be entirely a work of human abstraction (ἀφαίρεσις). At this point, Plato and Aristotle have become very far apart: to the master beauty appears to be an independent thing, and really separate, to the pupil at his best only something beautiful, an attribute which is only mentally separable from an individual substance. The first difference then between the *Categories* and the *Metaphysics* is in the nature of an attribute; and the theory of inherence in the *Categories* is nearer to Plato and more rudimentary than the theory of predication in the *Metaphysics*. The second difference is still nearer to Plato and more rudimentary, and is in the nature of substance. For though both works rest on the reality of individual substances, the *Categories* (chap. 5) admits that universal species and genera can be called substances, whereas the *Metaphysics* (Z 13) denies that a universal can be a substance at all.

It is evident that in the category of substance, as Aristotle perceived, substance is predicate of substance, *e.g.* Socrates (οὐσία) is a man (οὐσία), and an animal (οὐσία). The question then arises, what sort of substance can be predicate; and in the *Categories* Aristotle gave an answer, which would have been impossible, if he had not, under Plato's influence, accepted both the unity and the substantiality of the universal. What he said in consequence was that the substance in the predicate is not an individual substance, *e.g.* this man or this animal, because such a primary substance is not a predicate; but that the species man or the genus animal is the substance which is the predicate of Socrates the subject (*Cat.* 5, 3 a 36 seq.). Finding then that substances are real predicates, and supposing that in that case they must be species or genera, he could not avoid the conclusion that some substances are species or genera, which were therefore called by him "secondary substances," and by his Latin followers *substantiae universales*. It is true that this conclusion gave him some misgivings, because he recognized that it is a characteristic of a substance to signify an individual (τόδε τι), which a species or a genus does not signify (*ib.* 5, 3 b 10-21). Nevertheless, in the *Categories*, he did not venture to deny that in the category of substance a universal species (*e.g.* man), or genus (*e.g.* animal), is itself a substance. On the other hand, in the *Metaphysics* (Z 13), he distinctly denies that any universal can be a substance, on the ground that a substance is a subject, whereas a universal is a predicate and a belonging of a subject, from which it follows as he says that no universal is a substance, and no substance universal. Here again the *Categories* forms a kind of transition from Platonism to the *Metaphysics* which is the reverse: to call universals "secondary substances" is half way between Plato's calling them the only substances and Aristotle's denial in the *Metaphysics* that they are substances at all.

What conclusion are we to draw from these differences between the *Categories* and the *Metaphysics*? The only logical conclusion is that the *Categories*, being nearer to Plato on the nature of attributes, and still nearer on the relation of universals to substances, is earlier than the *Metaphysics*. There are difficulties no doubt in drawing this conclusion; because the *Metaphysics*, though it denies that universals can be substances, and does not allow species and genera to be called "secondary substances," nevertheless falls itself into calling a universal essence (τὸ τί ἦν εἶναι) a substance—and that too in the very book where it is proved that no universal can be a substance. But this lapse only shows how powerful a dominion Plato exercised over Aristotle's soul to the last; for it arises out of the pupil still accepting from his master the unity of the universal though now applying it, not to classes, but to essences. The argument about essences in the *Metaphysics* is as follows:—Since a separate individual, *e.g.* Socrates, is a substance, and he is essentially a rational animal, then his essence, being what he is, is a substance; for we cannot affirm that Socrates is a substance and then deny that this rational animal is a substance (*Met.* Z 3). Now, according to the unity of a universal asserted by Plato and accepted by Aristotle, the universal essence of species, being one and the same for all individuals of the kind, is the same as the essence of each individual: *e.g.* the rational animal in the human species and in Socrates is one and the same; "for the essence is indivisible" (ἄτομον γὰρ τὸ εἶδος, *Met.* Z 8, 1034 *a* 8). It follows that we must call this selfsame essence, at once individual and universal, substance—a conclusion, however, which Aristotle never drew in so many words, though he continued always to call essence substance, and definition a knowledge of substance.

There is therefore a history of Aristotle's metaphysical views, corresponding to his gradual method of composition. It is as follows:—

(1) Negative rejection of Plato's hypothesis of forms and formal numbers, and reduction of forms to the common in the early dialogue περὶ φιλοσοφίας and in the early work περὶ ἰδεῶν.

(2) Positive assertion of the doctrine that things are individual substances in the *Categories*, but with the admission that attributes sometimes inhere in substance without being predicates of it, and that universal species and genera are "secondary substances."

(3) Expansion of the doctrine that things are individual substances in the *Metaphysics*, coupled with the reduction of all attributes to predicates, and the direct denial of universal substances; but nevertheless calling the universal essence of a species of substances substance, because the individual essence of an individual substance really is that substance, and the universal essence of the whole species is supposed to be indivisible and therefore identical with the individual essence of any individual of the species.

2. *The De Interpretatione*.—Another example of Aristotle's gradual desertion of Plato is exhibited by the *De Interpretatione* as compared with the *Prior Analytics*, and it shows another gradual history in Aristotle's philosophy, namely, the development of subject, predicate and copula, in his logic.

The short discourse on the expression of thought by language (περὶ Ἑρμηνείας, *De Interpretatione*) is based on the Platonic division of the sentence (λόγος) into noun and verb (ὄνομα and ῥῆμα). Its point is to separate the enunciative sentence, or that in which there is truth or falsity, from other sentences; and then, dismissing the rest to rhetoric or poetry (where we should say grammar), to discuss the enunciative sentence (ἀποφαντικὸς λόγος), or enunciation (ἀποφανσίς), or what we should call the proposition (*De Int.* chap. 4). Here Aristotle, starting from the previous grammar of sentences in general, proceeded, for the first time in philosophical literature, to disengage the logic of the proposition, or that sentence which can alone be true or false, whereby it alone enters into reasoning. But in spite of this great logical achievement, he continued throughout the discourse to accept Plato's grammatical analysis of all sentences into noun and verb, which indeed applies to the proposition as a sentence but does not give its particular elements. The first part of the work confines itself strictly to noun and verb, or the form of proposition called *secundi adjacentis*. Afterwards (chap. 10) proceeding to the opposition of propositions, he adds the form called *tertii adjacentis*, in a passage which is the first appearance, or rather adumbration, of the verb of being as a copula. In the form *secundi adjacentis* we only get oppositions, such as the following:—

man is—man is not
not-man is—not-man is not

In the form *tertii adjacentis* the oppositions, becoming more complex, are doubled, as follows:—

man is just—man is not just
man is non-just—man is not non-just
not-man is just—not-man is not just
not-man is non-just—not-man is not non-just.

The words introducing this form (ὅταν δὲ τὸ ἔστι τρίτον προσκατηγορῆται, chap. 10, 19 b 19), which are the origin of the phrase *tertii adjacentis*, disengage the verb of being (ἔστι) partially but not entirely, because they still treat it as an extra part of the predicate, and not as a distinct copula. Nor does the work get further than the analysis of some propositions into noun and verb with "is" added to the predicated verb; an analysis, however, which was a great logical discovery and led Aristotle further to the remark that "is" does not mean "exists"; *e.g.* "Homer is a poet" does not mean "Homer exists" (*De Int.* chap. 11).

How then did Aristotle get further in the logical analysis of the proposition? Not in the *De Interpretatione*, but in the *Prior Analytics*. The first adumbration was forced upon him in the former work by his theory of opposition; the complete appearance in the latter work by his theory of syllogism. In analysing the syllogism, he first says that a premiss is an affirmative or negative sentence, and then that a term is that into which a premiss is dissolved, *i.e.* predicate and subject, combined or divided by being and not being (*Pr. An.* i. 1). Here, for the first time in logical literature, subject and predicate suddenly appear as terms, or extremes, with the verb of being (τὸ εἶναι) or not being (τὸ μὴ εἶναι) completely disengaged from both, but connecting them as a copula. Why here? Because the crossing of terms in a syllogism requires it. In the syllogism "Every man is mortal and Socrates is a man," if in the minor premiss the copula "is" were not disengaged from the predicate "man," there would not be one middle term "man" in the two premisses. It is not necessary in every proposition, but it is necessary in the arrangement of a syllogism, to extricate the terms of its propositions from the copula; *e.g.* mortal—man—Socrates.

This important difference between the *De Interpretatione* and the *Prior Analytics* can only be explained by supposing that the former is the earlier treatise. It is nearer to Plato's analysis of the sentence, and no logician would have gone back to it, after the *Prior Analytics*. It is not spurious, as some have supposed, nor later than the *De Anima*, as Zeller thought, but Aristotle in an earlier frame of mind.

Moreover we can make a history of Aristotle's thought and gradual composition thus:

(1) Earlier acceptance in the *De Interpretatione* of Plato's grammatical analysis of the sentence into noun and verb (*secundi adjacentis*) but gradually disengaging the proposition, and afterwards introducing the verb of being as a third thing added (*tertium adjacens*) to the predicated verb, for the purpose of opposition.

(2) Later logical analysis in the *Prior Analytics* of the proposition as premiss into subject, predicate and copula, for the purpose of syllogism; but without insisting that the original form is illogical.

3. The *Eudemian Ethics* and *Magna Moralia* in relation to the *Nicomachean Ethics.*—Under the name of Aristotle, three treatises on the good of man have come down to us, 'Ηθικὰ Νικομάχεια (πρὸς Νικόμαχον, Porphyry), 'Ηθικὰ Εὐδήμια (πρὸς Εὔδημον, Porphyry), and 'Ηθικὰ μεγάλα; so like one another that there seems no tenable hypothesis except that they are the manuscript writings of one man. Nevertheless, the most usual hypothesis is that, while the *Nicomachean Ethics* (*E.N.*) was written by Aristotle to Nicomachus, the *Eudemian* (*E.E.*) was written, not to, but by, Eudemus, and the *Magna Moralia* (*M.M.*) was written by some early disciple before the introduction of Stoic and Academic elements into the Peripatetic school. The question is further complicated by the fact that three Nicomachean books (*E.N.* v.–vii.) and three Eudemian (*E. E.* Δ–Z) are common to the two treatises, and by the consequent question whether, on the hypothesis of different authorship, the common books, as we may style them, were written for the *Nicomachean* by Aristotle, or for the *Eudemian Ethics* by Eudemus, or some by one and some by the other author. Against the "Chorizontes," who have advanced various hypotheses on all these points without convincing one another, it may be objected that they have not considered Aristotle's method of gradual and simultaneous composition of manuscripts within the Peripatetic school. We have to remember the traces of his separate discourses, and his own double versions; and that, as in ancient times Simplicius, who had two versions of the *Physics*, Book vii., suggested that both were early versions of Book viii. on the same subject, so in modern times Torstrik, having discovered that there were two versions of the *De Anima*, Book ii., suggested that both were by Aristotle. Above all, we must consider our present point that Platonic influence is a sign of earliness in an Aristotelian work; and generally, the same man may both think and write differently at different times, especially if, like Aristotle, he has been a prolific author.

These considerations make it probable that the author of all three treatises was Aristotle himself; while the analysis of the treatises favours the hypothesis that he wrote the *Eudemian Ethics* and the *Magna Moralia* more or less together as the rudimentary first drafts of the mature *Nicomachean Ethics.*

As the Platonic philosophy was primarily moral, and its metaphysics a theory of the moral order of the universe, Aristotle from the first must have mastered the Platonic ethics. At first he adopted the somewhat ascetic views of his master about soul and body, and about goods of body and estate; but before Plato's death he had rejected the hypothesis of forms, formal numbers and the form of the good identified with the one, by which Plato tried to explain moral phenomena; while his studies and teaching on rhetoric and poetry soon began to make him take a more tolerant view than Plato did of men's passions. Throughout his whole subsequent life, however, he retained the fundamental doctrine, which he had learnt from Plato, and Plato from Socrates, that virtue is essential to happiness. Twice over this tenet, which makes Socrates, Plato and Aristotle one ethical school, inspired Aristotle to attempt poetry: first, in the Elegy to Eudemus of Cyprus, in which, referring to either Socrates or Plato, he praises the man who first showed clearly that a good and happy man are the same (*Fragm.* 673); and secondly, in the Hymn in memory of Hermias, beginning "Virtue, difficult to the human race, noblest pursuit in life" (*ib.* 675). Moreover, the successors of Plato in the Academy, Speusippus and Xenocrates, showed the same belief in the essentiality of virtue. The question which divided them was what the good is. Speusippus took the ascetic view that the good is a perfect condition of neutrality between two contrary evils, pain and pleasure. Xenocrates took the tolerant view that it is the possession of appropriate virtue and noble actions, requiring as conditions bodily and external goods. Aristotle was opposed to Speusippus, and nearly agreed with Xenocrates. According to him, the good is activity of soul in accordance with virtue in a mature life, requiring as conditions bodily and external goods of fortune; and virtue is a mean state of the passions. It is probable that when, after Plato's death and the accession of Speusippus in 347, Aristotle with Xenocrates left Athens to visit his former pupil Hermias, the three discussed this moderate system of Ethics in which the two philosophers nearly agreed. At any rate, it was adopted in each of the three moral treatises which pass under the name of Aristotle.

The three treatises are in very close agreement throughout, and in the following details. The good of Ethics is human good; and human good is happiness, not the universal good or form of the good to which Plato subordinated human happiness. Happiness is activity of soul according to virtue in a mature life: it requires other goods only as conditions. The soul is partly irrational, partly rational; and therefore there are two kinds of virtue. Moral virtue, which is that of the irrational desires so far as they are obedient to reason, is a purposive habit in the mean. The motive of the moral virtues is the honourable (*τὸ καλόν*, *honestum*). As the rational is either deliberative or scientific, either practical or speculative intellect, there are two virtues of the intellect—prudence of the deliberative or practical, and wisdom of the scientific or speculative, intellect. The right reason by which moral virtue is determined is prudence, which is determined in its turn by wisdom. Pleasure is a psychical state, and is not a generation in the body supplying a defect and establishing a natural condition, but an activity of a natural condition of the soul. It should be specially noted that this doctrine like the rest is common to the three treatises: in Book vii. of the *Nicomachean*, which is Z of the *Eudemian*, pleasure is defined as *ἐνέργεια τῆς κατὰ φύσιν ἕξεως ἀνεμπόδιστος* (chap. 12, 1153 a 14-15); and in the *Magna Moralia* as *ἡ κίνησις αὐτοῦ καὶ ἡ ἐνέργεια* (ii. 7, 1204 b 28; cf. 1205 b 20-28). It is plain from the context that in the former definition "the natural condition" (*ἡ κατὰ φύσιν ἕξις*) refers to the soul which, while the body is regenerated, remains unimpaired (cf. 1152 b 35 seq., 1154 b 15 seq.); and in the latter definition the thing (*αὐτοῦ*), whose "motion, that is activity" is spoken of, is the part of the soul with which we feel pleased.

Down then to their common definition of pleasure as activity the three treatises present a harmonious system of morals, consistently with one another, and with the general philosophy of Aristotle. In particular, the theory that pleasure is activity (*ἐνέργεια*) is the theory of two of his most authoritative works. In the *De Anima* (iii. 7, 431 a 10-12), being pleased and pained are defined by him as acting *τὸ* (*ἐνεργεῖν*) by a sensitive mean in relation to good or evil as such. In the *Metaphysics* (Λ 7, 1072 b 16), in discussing the occupation of God, he says "his pleasure is activity," or "his activity is pleasure," according to a difference of readings which makes no difference to the identification of pleasure and activity (*ἐνέργεια*). As then we find this identification of pleasure with activity in the *Metaphysics* and in the *De Anima*, as well as in the *Nicomachean Ethics*, the *Eudemian Ethics* and the *Magna Moralia*, the only logical conclusion, from which there is no escape, is that, so far as the treatment of pleasure goes, any Aristotelian treatise which defines it as activity is genuine. There is no reason for doubting that the *Nicomachean Ethics* to the end of Book vii., the *Eudemian Ethics* to the end of Book Z, and the *Magna Moralia* as far as Book ii. chap. 7, were all three written by Aristotle.

Why then doubt at all? It is because the *Nicomachean Ethics* contains a second discourse on pleasure (x. 1-5), in which the author, while agreeing with the previous treatment of the subject that pleasure is not a bodily generation, even when accompanied by it, but something psychical, nevertheless defines it (x. 4, 1174 b 31-33) not as an activity, but as a supervening end (*ἐπιγιγνόμενόν τι τέλος*) perfecting an activity (*τελειοῖ τὴν ἐνέργειαν*). He allows indeed that activity and pleasure are very closely related; that a pleasure of sense or thought perfects an act of sensation or of thinking, depends on it, and is so inseparably conjoined with it as to raise a doubt whether pleasure is end of life or life end of pleasure, and even whether the activity is the same as the pleasure. But he disposes of this doubt in a very emphatic and significant manner. "Pleasure," says he, "does not seem to be thinking or perceiving; for it is absurd: but on account of not being separated from them, it appears to some persons to be the same." Now it is not likely that Aristotle either, after having so often identified pleasure with activity, would say that the identification is absurd though it appears true to some persons, of whom he would in that case be one, or, having once disengaged the pleasure of perceiving and thinking from the acts of perceiving and thinking, would go backwards and confuse them. It is more likely that Aristotle identified pleasure with activity in the *De Anima*, the *Metaphysics* and the three moral treatises, as we have seen; but that afterwards some subsequent Peripatetic, considering that the pleasure of perceiving or thinking is not the same as perceiving or thinking, declared the previous identification of pleasure with activity absurd. At any rate, if we are to choose, it is the identification that, is Aristotle's, and the distinction not Aristotle's. Moreover, the distinction between activity and pleasure in the tenth book is really fatal to the consistency of the whole *Nicomachean Ethics*, which started in the first book with the identification of happiness and virtuous activity. For if the pleasure of virtuous activity is a supervening end beyond the activity, it becomes a supervening end beyond the happiness of virtuous activity, which thus ceases to be the final end. Nevertheless, the distinction between activity and pleasure is true. Some unknown Peripatetic detected a flaw in the *Nicomachean Ethics* when he said that pleasure is a supervening end beyond activity, and, if he had gone on to add that happiness is also a supervening end beyond the virtuous activities which are necessary to produce it, he would have destroyed the foundation of his own founder's Ethics.

It is further remarkable that the *Nicomachean Ethics* proceeds to a different conclusion. After the intrusion of this second discourse on pleasure, it goes on (*E.N.* x. 6-fin.) to the famous theory that the highest happiness is the speculative life of intellect or wisdom as divine, but that happiness as human also includes the practical life of combining prudence and moral virtue; and that, while both lives need external goods as necessaries, the practical life also requires them as instruments of moral action. The treatise concludes with the means of making men virtuous; contending that virtue requires habituation, habituation law, law legislative art, and legislative art politics: Ethics thus passes into Politics. The *Eudemian Ethics* proceeds to its conclusion (*E.E.* H 13-15) differently, with the consideration of (1) good fortune (*εὐτυχία*), and (2) gentlemanliness (*καλοκἀγαθία*). Good fortune it divides into two kinds, both irrational; one divine, according to impulse, and more continuous; the other contrary to impulse and not continuous. Gentlemanliness it regards as perfect virtue, containing all particular virtues, and all goods for the sake of the honourable. Finally, it concludes with the limit (*ὅρος*) of goods. First it finds the limit of goods of fortune in that desire and possession of them which will conduce to the contemplation of God, whereas that which prevents the service and contemplation of God is bad. Then it adds that the best limit of the soul is as little as possible to perceive the other part of the soul (*i.e.* desire). Finally, the treatise concludes with saying that the limit of gentlemanliness has thus been stated, meaning that its limit is the service and contemplation of God and the control of desire by reason. The *Magna Moralia* (*M.M.* ii. 8-10) on these points is unlike the *Nicomachean*, and like the *Eudemian Ethics* in discussing good fortune and gentlemanliness, but it discusses them in a more worldly way. On good fortune (ii. 8), after recognizing the necessity of external goods to happiness, it denies that fortune is due to divine grace, and simply defines it as irrational nature (*ἄλογος φύσις*). Gentlemanliness (ii. 9) it regards as perfect virtue, and defines the gentleman as the man to whom really good things are good and really honourable things honourable. It then adds (ii. 10) that acting according to right reason is when the irrational part of the soul does not hinder the rational part of intellect from doing its work. Thereupon it proceeds to a discourse on friendship, which in the *Nicomachean* and *Eudemian Ethics* is discussed in an earlier position, but breaks off unfinished.

On the whole, the three moral treatises proceed on very similar lines down to the common identification of pleasure with activity, and then diverge. From this point the *Eudemian Ethics* and the *Magna Moralia* become more like one another than like the *Nicomachean Ethics*. They also become less like one another than before: for the treatment of good fortune, gentlemanliness, and their limit is more theological in the *Eudemian Ethics* than in the *Magna Moralia*.

How are the resemblances and differences of the three to be explained? By Aristotle's gradual method of composition. All three are great works, contributing to the origin of the independent science of Ethics. But the *Eudemian Ethics* and the *Magna Moralia* are more rudimentary than the *Nicomachean Ethics*, which as it were seems to absorb them except in the conclusion. They are, in short, neither independent works, nor mere commentaries, but Aristotle's first drafts of his Ethics.

In the *Ethics to Eudemus*, as Porphyry properly called the *Eudemian Ethics*, Aristotle in the first four books successively investigates happiness, virtue, the voluntary and the particular moral virtues, in the same order and in the same letter and spirit as in his *Ethics to Nicomachus*. But the investigations are never so good. They are all such rudiments as Aristotle might well polish into the more developed expositions in the first four books of the *Nicomachean Ethics*. On the other hand, nobody would have gone back afterwards on his masterly treatment of happiness, in the first book, or of virtue in the second, or of the voluntary in the third, or of the particular virtues in the third and fourth, to write the sketchy accounts of the *Eudemian Ethics*.

Again, these sketches are rough preparations for the subsequent books common to the two treatises. It is true, as Dr Henry Jackson has pointed out, though with some exaggeration, that the Eudemian agrees in detail rather better than the Nicomachean treatment of the voluntary with the subsequent discussion of injury (*E.E.* Δ = *E.N.* v. 8); and, as Th. H. Fritzsche remarks, the distinction between politics, and economics, and prudence in the *Eudemian Ethics* (A 8) is a closer anticipation of the subsequent triple distinction of practical science (*E.E.* E = *E.N.* vi 8). On the other hand, there are still more fundamental points in which the first three books of the *Eudemian Ethics* are a very inadequate preparation for the common books. Notably its treatment of prudence (φρόνησις) is a chaos. At first, prudence appears as the operation of the philosophical life and connected with the speculative philosophy of Anaxagoras (*E.E.* A 1-5): then it is brought into connexion with the practical philosophy of Socrates (*ib.* 5) and co-ordinated with politics and economics (*ib.* 8): then it is intruded into the diagram of moral virtues as a mean between villainy (πανουργία) and simplicity (εὐήθεια) (*E.E.* B 33, 1221 a 12): finally, a distinction between virtue by nature and virtue with prudence (μετὰ φρονήσεως) is promised (*E.E.* Τ 7, 1234 a 4). In addition to all this confusion of speculative and practical knowledge, prudence is absent when it ought to be present; *e.g.* from the division of virtues into moral and intellectual (*E.E.* B 1, 1220 a 4-13), and from the definition of moral virtue (*ib.* 5, 10); while, in a passage (B 11) anticipating the subsequent discussion of the relation between prudence and moral virtue (*E.E.* E = *E.N.* vi. 12-13), it is stated that in purpose the end is made right by moral virtue, the means by another power, reason, without this right reason being stated to be prudence. After this, it can never be said that the earlier books of the *Eudemian Ethics* are so good a preparation as those of the *Nicomachean Ethics* for the distinction between prudence (φρόνησις) and wisdom (σοφία), which is the main point of the common books, and one of Aristotle's main points against Plato's philosophy.

Curiously enough, although little is made of it, this distinction, absent from the earlier books, is present in the final book H of the *Eudemian Ethics* (cf. 1246 b 4 seq., 1248 a 35, 1249 b 14); and probably therefore this part was a separate discourse. Meanwhile, however, the truth about the *Eudemian Ethics* in general is that it was an earlier rudimentary sketch written by Aristotle, when he was still struggling, without quite succeeding, to get over Plato's view that there is one philosophical knowledge of universal good, by which not only the dialectician and mathematician must explain the being and becoming of the world, but also the individual and the statesman guide the life of man. Indeed, the final proof that the *Eudemian Ethics* is earlier than the *Nicomachean* is the very fact that it is more under Platonic influence. In the first place, the reason why the account of prudence begins by confusing the speculative with the practical is that the *Eudemian Ethics* starts from Plato's *Philebus*, where, without differentiating speculative and practical knowledge, Plato asks how far good is prudence (φρόνησις), how far pleasure (ἡδονή); and in the *Eudemian Ethics* Aristotle asks the same question, adding virtue (ἀρετή) in order to correct the Socratic confusion of virtue with prudence. Secondly, the *Eudemian Ethics*, while not agreeing with Plato's *Republic* that the just can be happy by justice alone, does not assign to the external goods of good fortune (εὐτυχία) the prominence accorded to them in the *Nicomachean Ethics* as the necessary conditions of all virtue, and the instruments of moral virtue. Thirdly, the emphasis of the *Eudemian Ethics* on the perfect virtue of gentlemanliness (καλοκἀγαθία) is a decidedly old-fashioned trait, which descended to Aristotle from the Greek notion of a gentleman who does his duty to his state (cf. Herodotus i. 30, Thucydides iv. 40) and to his God (Xenophon, *Symp.* iv. 49) through Plato, who in the *Gorgias* (470 E) says that the gentleman is happy, and in the *Republic* (489 E) imputes to him the love of truth essential to philosophy. Moreover, when Plato goes on (*ib.* 505 B) to identify the form of good, without which nothing is good, with the gentlemanly thing (καλὸν καὶ ἀγαθόν), without which any possession is worthless, he inspired into the author of the *Eudemian Ethics* the very limit (ὅρος) of good fortune and gentlemanliness with which it concludes, only without Plato's elevation of the good into the form of the good. In the *Nicomachean Ethics* the old notion, we gladly see, survives (cf. i. 8): virtuous actions are gentlemanly actions, and happiness accordingly is being at our best and noblest and pleasantest (ἄριστον καὶ κάλλιστον καὶ ἥδιστον). But gentlemanliness is no longer called perfect virtue, as in the *Eudemian Ethics*: its place has been taken by justice, which is perfect virtue to one's neighbour, by prudence which unites all the moral virtues, and by wisdom which is the highest virtue. Accordingly, in the end the old ideal of gentlemanliness is displaced by the new ideal of the speculative and practical life.

Lastly, the *Eudemian Ethics* derives from Platonism a strong theological bias, especially in its conclusion (H 14-15). The opposition of divine good fortune according to impulse to that which is contrary to impulse reminds us of Plato's point in the *Phaedrus* that there is a divine as well as a diseased madness. The determination of the limit of good fortune and of gentlemanliness by looking to the ruler, God, who governs as the end for which prudence gives its orders, and the conclusion that the best limit is the most conducive to the service and contemplation of God, presents the Deity and man's relation to him as a final and objective standard more definitely in the *Eudemian* than in the *Nicomachean Ethics*, which only goes so far as to say that man's highest end is the speculative wisdom which is divine, like God, dearest to God.

Because, then, it is very like, but more rudimentary and more Platonic, we conclude that the *Eudemian* is an earlier draft of the *Nicomachean Ethics*, written by Aristotle when he was still in process of transition from Plato's ethics to his own.

The *Magna Moralia* contains similar evidence of being earlier than the *Nicomachean Ethics*. It treats the same subjects, but always in a more rudimentary manner; and its remarks are always such as would precede rather than follow the masterly expositions of the *Nicomachean Ethics*. This inferiority applies also to its treatment not only of the early part (i. 1-33 corresponding to *E.N.* i.-iv.), but also of the middle part (i. 34-ii. 7 corresponding to *E.N.* v.-vii. = *E.E.* Δ-Z). In dealing with justice, it does not make it clear, as the *Nicomachean Ethics* (Book v.) does, that even universal justice is virtue towards another (*M.M.* i. 34, 1193 b 1-15), and it omits altogether the division into distributive and corrective justice. In dealing with what the *Nicomachean Ethics* (Book vi.) calls intellectual virtues, but the *Magna Moralia* (i. 5, 35) virtues of the rational part of the soul, and right reason, it distinguishes (i. 35, 1196 b 34-36) science, prudence, intelligence, wisdom, apprehension (ὑπόληψις), in a rough manner very inferior to the classification of science, art, prudence, intelligence, wisdom, all of which are co-ordinate states of attaining truth, in the *Nicomachean Ethics* (vi. 3). It distinguishes prudence (φρόνησις) and wisdom (σοφία) as the respective virtues of deliberative and scientific reason; and on the whole its account of prudence (cf. *M.M.* i. 5) is more consistent than that of the *Eudemian Ethics*. In these points it is a better preparation for the *Nicomachean Ethics*. But it falls into the confusion of first saying that praise is for moral virtues, and not for virtues of the reason, whether prudence or wisdom (*M.M.* i. 5, 1185 b 8-12), and afterwards arguing that prudence is a virtue, precisely because it is praised (i. 35, 1197 a 16-18). In dealing with continence and incontinence, the same doubts and solutions occur as in the *Nicomachean Ethics* (Book vii. = *E.E.* Z), but sometimes confusing doubts and solutions together, instead of first proposing all the doubts and then supplying the solutions as in the *Nicomachean Ethics*. Such rudimentary and imperfect sketches would be quite excusable in a first draft, but inexcusable and incredible after the *Nicomachean Ethics* had been written.

It has another characteristic which points to its being an early work of Aristotle, when he was still under the influence of Plato's style; namely its approximation to dialogue. It asks direct questions (*e.g.* διὰ τί; *M.M.* i. 1 repeatedly, 12; ii. 6, 7), incorporates direct statements of others (*e.g.* φησί, i. 12, 13; ii. 3, 6, 7), alternates direct objections and answers (i. 34), and introduces conversations between the author and others, expressed interrogatively, indicatively and even imperatively (ἀλλ' ἐρεῖ μοι, τὰ ποῖα διασάφησον ὑγιεινά ἐστιν. i. 35, 1196 b 10; cf. ii. 10, 1208 a 20-22). The whole treatise inclines to run into dialogue. It is also Platonic, like the *Endemian Ethics*, in making little of external goods in the account of good fortune (ii. 8), and in emphasizing the perfect virtue of gentlemanliness (ii. 9). Indeed, in some respects it is more like the *Eudemian*, though in the main more like the *Nicomachean Ethics*. In the first book, it has the Eudemian distinction between prudence, virtue and pleasure (i. 3, 1184 b 5-6); but does not make so much of it as the distinction between prudence and wisdom blurred in the *Eudemian* but defined in the *Nicomachean Ethics*. In the second book, it runs parallel to the *Eudemian Ethics* in placing good fortune and gentlemanliness (ii. 8-9), where the *Nicomachean Ethics* places the speculative and the practical life; but it omits the theological element by denying that good fortune is divine grace, and by submitting gentlemanliness to no standard but that of right reason, when the irrational part of the soul does not hinder the rational part, or intellect (νοῦς), from doing its work.

Because, then, the *Magna Moralia* is very like the *Nicomachean Ethics*, but more rudimentary, nearer to the Platonic dialogues in style and to a less degree in matter, and also like the *Eudemian Ethics*, we conclude that it is also like that treatise in having been written as an earlier draft of the *Nicomachean Ethics* by Aristotle himself.

The hypothesis that the *Eudemian Ethics*, and by consequence the *Magna Moralia*, are later than Aristotle has arisen from a simple misconception, continued in a Scholium attributed to Aspasius, who lived in the 2nd century A.D. Nicomachean means "addressed to Nicomachus," and Eudemian "addressed to Eudemus"; but, as Cicero thought that the *Nicomachean Ethics* was written by Nicomachus, so the author of the Scholium thought that the *Eudemian Ethics*, at least so far as the first account of pleasure goes, was written by Eudemus. He only thought so, however, because Aristotle could not have written both accounts of pleasure; and, taking for granted that Aristotle had written the second account of pleasure in the *Nicomachean Ethics* (Book x.), he concluded that the first account (Book vii.) was not the work of Aristotle, but of Eudemus (*Comm. in Ar.* (Berlin) xix. p. 151). We have seen reason to reverse this argument: Aristotle did write the first account in Book vii., because it contains his usual theory; and, if we must choose, he did not write the second account in Book x. In this way, too, we get a historical development of the theory of pleasure: Plato and Speusippus said it is generation (cf. Plato's *Philebus*): Aristotle said it is psychical activity sometimes requiring bodily generation, sometimes not (*E.N.* vii. = *E.E.* Z): Aristotle, or some Aristotelian, afterwards said that it is a supervening end completing an activity (*E.N.* x.). Secondly, some modern commentators, starting from the false conclusion that the definition of pleasure as activity (*E.N.* vii. = *E.E.* Z) is by Eudemus, and supposing without proof that he was also author of the first three books of the *Eudemian Ethics*, have further asserted that these are a better introduction than the first four books of the *Nicomachean Ethics* to the books common to both treatises (*E.N.* Books v.–vii. = *E.E.* Books Δ–Z), and have concluded that Eudemus wrote these common books. But we have seen that Aristotle wrote the first three books of the *Eudemian* as an earlier draft of the *Nicomachean Ethics*; so that, even so far as they form a better introduction, this will not prove the common books to be by Eudemus. Again, those first three books are a better introduction only in details; whereas in regard to the all-important subject of prudence as distinct from wisdom, they are so bad an introduction that the common book which discusses that subject at large (*E.N.* Book vi. = *E.E.* Book E) must be rather founded on the first four books of Aristotle's *Nicomachean Ethics*. Further, as Aristotle wrote both the first three Eudemian and the first four Nicomachean books, there is no reason why sometimes one, sometimes the other, should not be the best introduction to the common books by the same author. Finally, the common books are so integral a part of the Aristotelian system of philosophy that they cannot be disengaged from it: the book on justice (*E.N.* v.) quotes and is quoted in the *Politics* (cf. 1130 b 28, 1280 a 16, 1261 a 30); the book on intellectual virtues (*E.N.* vi.) quotes (vi. 3) the *Posterior Analytics*, i. 2, and is quoted in the *Metaphysics* (A 1); and we have seen that the book (*E.N.* vii.) which defines pleasure as activity is simply stating an Aristotelian commonplace. Thirdly, in order to prove that the *Eudemian Ethics* was by Eudemus, it is said that in its first part it contemplates that there must be a limit (ὅρος) for virtue as a mean (*E.E.* B 5, 1222 b 7-8), in its middle part it criticizes the *Nicomachean Ethics* for not being clear about this limit (*E.E.* E 1), and in the end it alone assigns this limit, in the service and contemplation of God (*E.E* H 15, 1249 b 16 seq.). This argument is subtle, but over-subtle. The *Eudemian* and the *Nicomachean* treatments of this subject do not really differ. In the *Nicomachean* as in the *Eudemian Ethics* the limit above moral virtue is right reason, or prudence, which is right reason on such matters; and above prudence wisdom, for which prudence gives its orders; while wisdom is the intelligence and science of the most venerable objects, of the most divine, and of God. After this agreement, there is a shade of difference. While the *Eudemian Ethics* in a more theological vein emphasizes God, the object of wisdom as the end for which prudence gives its orders, the *Nicomachean Ethics* in a more humanizing spirit emphasizes wisdom itself, the speculative activity, as that end, and afterwards as the highest happiness, because activity of the divine power of intellect, because an imitation of the activity of God, because most dear to God. This is too fine a distinction to found a difference of authorship. Beneath it, and behind the curious hesitation which in dealing with mysteries Aristotle shows between the divine and the human, his three moral treatises agree that wisdom is a science of things divine, which the *Nicomachean Ethics* (vi. 7) defines as science and intelligence of the most venerable things, the *Magna Moralia* (i. 35) regards as that which is concerned with the eternal and the divine, and the *Eudemian Ethics* (H 15) elevates into the service and contemplation of God.

Aristotle then wrote three moral treatises, which agree in the fundamental doctrines that happiness requires external fortune, but is activity of soul according to virtue, rising from morality through prudence to wisdom, or that science of the divine which constitutes the theology of his *Metaphysics*. Surely, the harmony of these three moral gospels proves that Aristotle wrote them, and wrote the *Eudemian Ethics* and the *Magna Moralia* as preludes to the *Nicomachean Ethics*. When did he begin? We do not know; but there is a pathetic suggestiveness in a passage in the *Magna Moralia* (i. 35), where he says, "Clever even a bad man is called; as Mentor was thought clever, but prudent he was not." Mentor was the treacherous contriver of the death of Hermias (345–344 B.C.). Was this passage written when Aristotle was mourning for his friend?

4. *The Rhetoric to Alexander*.—This is one of a series of works emanating from Aristotle's early studies in rhetoric, beginning with the *Gryllus*, continuing in the *Theodectea* and the *Collection of Arts*, all of which are lost except some fragments; while among the extant Aristotelian writings as they stand we still possess the *Rhetoric to Alexander* (Ῥητορικὴ πρὸς Ἀλέξανδρον) and the *Rhetoric* (Τέχνη Ῥητορική). But the *Rhetoric to Alexander* was considered spurious by Erasmus, for the inadequate reasons that it has a preface and is not mentioned in the list of Diogenes Laertius, and was assigned by Petrus Victorius, in his preface to the *Rhetoric*, to Anaximenes. It remained for Spengel to entitle the work *Anaximenis Ars Rhetorica* in his edition of 1847, and thus substitute for the name of the philosopher Aristotle that of the sophist Anaximenes on his title-page. We have therefore to ask, first who was the author, and secondly what is the relation of the *Rhetoric to Alexander* to the *Rhetoric*, which nowadays alone passes for genuine.

After a dedicatory epistle to Alexander (chap. 1) the opening of the treatise itself (chap. 2) is as follows:—"There are three genera of political speeches; one deliberative, one declamatory, one forensic: their species are seven; hortative, dissuasive, laudatory, vituperative, accusatory, defensive, critical." This brief sentence is enough to prove the work genuine, because it was Aristotle who first distinguished the three genera (cf. *Rhet.* i. 3; Quintilian iii. 4, 1. 7, 1), by separating the declamatory (ἐπιδεικτικόν) from the deliberative (δημηγορικόν, συμβουλευτικόν) and judicial (δικανικόν); whereas his rival Isocrates had considered that laudation and vituperation, which Aristotle elevated into species of declamation, run through every kind (Quintilian iv. 4), and Anaximenes recognized only the deliberative and the judicial (Dionys. H. *de Isaeo*, 19). In order, however, to impute the whole work to Anaximenes, Spengel took one of the most inexcusable steps ever taken in the history of scholarship. Without any manuscript authority he altered the very first words "three genera" (τρία γένη) into "two genera" (δύο γένη), and omitted the words "one declamatory" (τὸ δὲ ἐπιδεικτικόν). Quintilian (iii. 4) imputes to Anaximenes two genera, deliberative and judicial, and seven species, "hortandi, dehortandi, laudandi, vituperandi, accusandi, defendendi, exquirendi, quod ἐξεταστικὸν dicit." But the author of this rhetoric most certainly recognized three genera (τρία γένη), since, besides the deliberative and judicial, the declamatory genus constantly appears in the work (chaps. 2 *init.*, 4, 7, 18, 36, cf. οὐκ ἀγῶνος ἀλλ' ἐπιδείξεως ἕνεκα 1440 *b* 13); and, if the terms for it are not always the same, this is just what one would expect in a new discovery. Moreover, he could recognize seven species in the *Rhetoric to Alexander*, though he recognized only six in the *Rhetoric*, provided the two works were not written at the same time; and as a matter of fact even in the *Rhetoric to Alexander* the seventh or critical species (ἐξεταστικόν) is in process of disappearing (cf. chap. 37). As then Anaximenes did not, but Aristotle did, recognize three genera, and as Aristotle could as well as Anaximenes recognize seven species, the evidence is overwhelming that the *Rhetoric to Alexander* is the work not of Anaximenes, but of Aristotle; on the condition that its date is not that of Aristotle's confessedly genuine *Rhetoric*.

There is a second and even stronger evidence that the *Rhetoric to Alexander* is a genuine work of Aristotle. It divides (chap. 8) evidences (πίστεις) into two kinds (1) evidence from arguments, actions and men (αἱ μὲν ἐξ αὐτῶν τῶν λόγων καὶ τῶν πράξεων καὶ τῶν ἀνθρώπων); (2) adventitious evidences (αἱ δ' ἐπίθετοι τοῖς λεγομένοις καὶ τοῖς πραττομένοις). The former are immediately enumerated as probabilities (εἰκότα), examples (παραδείγματα), proofs (τεκμήρια), considerations (ἐνθυμήματα), maxims (γνῶμαι), signs (σημεῖα), refutations (ἔλεγχοι); the latter as opinion of the speaker (δόξα τοῦ λεγοντος), witnesses (μαρτυρίαι), tortures (βάσανοι), oaths (ὅρκοι). It is confessed by Spengel himself that these two kinds of evidences are the two kinds recognized in Aristotle's *Rhetoric* as (1) artificial (ἐντέχνοι πίστεις) and (2) inartificial (ἀτέχνοι πίστεις). Now, from the outset of his *Rhetoric* Aristotle himself claims to be the first to distinguish between artificial evidences from arguments and other evidences which he regards as mere additions; and he complains that the composers of arts of speaking had neglected the former for the latter. In particular, rhetoricians appeared to him to have neglected argument in comparison with passion. No doubt, rational evidences had appeared in books of rhetoric, as we see from Plato's *Phaedrus*, 266-267, where we find proofs, probabilities, refutation and maxim, but mixed up with other evidences. The point of Aristotle was to draw a line between rational and other evidences, to insist on the former, and in fact to found a logic of rhetoric. But if in the *Rhetoric to Alexander*, not he, but Anaximenes, had already performed this great achievement, Aristotle would have been the meanest of mankind; for the logic of rhetoric would have been really the work of Anaximenes the sophist, but falsely claimed by Aristotle the philosopher. As we cannot without a tittle of evidence accept such a consequence, we conclude that Aristotle formulated the distinction between argumentative and adventitious, artificial and inartificial evidences, both in the *Rhetoric to Alexander* and in the *Rhetoric*; and that the former as well as the latter is a genuine work of Aristotle, the founder of the logic of rhetoric.

What is the relation between these two genuine Rhetorics? The last event mentioned in the *Rhetoric to Alexander* occurred in 340, the last in the *Rhetoric* is the common peace (κοινὴ εἰρήνη) made between Alexander and the Greeks in 336 (*Rhet.* ii. 23, 1399 b 12). The former treatise (chap. 9), under the head of examples (παραδείγματα), gives historical examples of the unexpected in war for the years 403, 371, 358, concluding with the year 340, in which the Corinthians, coming with nine triremes to the assistance of the Syracusans, defeated the Carthaginians who were blockading Syracuse with 150 ships. Spengel, indeed, tries to bring the latest date in the book down to 330; but it is by absurdly supposing that the author could not have got the commonplace, "one ought to criticize not bitterly but gently," except from Demosthenes, *De Corona* (§ 265). We may take it then that the last date in the *Rhetoric to Alexander* is 340; and by a curious coincidence 340 was the year when, on Philip's marching against Byzantium, Alexander was left behind as regent and keeper of the seal, and distinguished himself so greatly that Philip was only too glad that the Macedonians called Alexander king (Plutarch, *Alexander*, 9). It is possible then that Aristotle may have written the dedication to Alexander about 340 and treated him as if he were king in the dedicatory epistle. At the same time, as such prefaces are often forgeries, not prejudicing the body of the treatise, it does not really matter whether Aristotle actually dedicated his work to Alexander in that epistle about that year or not. If he did, then the *Rhetoric to Alexander* in 340 was at least four years prior to the *Rhetoric*, which was as late as 336. If he did not, the question still remains, what is the internal relation between these two genuine Rhetorics? It will turn out most important.

The relation between the two Rhetorics turns on their treatment of rational, argumentative, artificial evidences. Each of them, the probability (chap. 8), the example (chap. 9), the proof (chap. 10), the consideration (chap. 11), the maxim (chap. 12), the sign (chap. 13), the refutation (chap. 14), though very like what it is in the *Rhetoric*, receives in the *Rhetoric to Alexander* a definition slightly different from the definition in the *Rhetoric*, which it must be remembered is also the definition in the *Prior Analytics*. Strange as this point is, it is still stranger that not one of these internal evidences is brought into relation with induction and deduction. Example (παράδειγμα) is not called rhetorical induction, and consideration (ἐνθύμημα) is not called rhetorical syllogism, as they are in the *Rhetoric*, and in the *Analytics*. Induction (ἐπαγωγή) and syllogism (συλλογισμός), the general forms of inference, do not occur in the *Rhetoric to Alexander*. In fact, this interesting treatise contains a rudimentary treatment of rational evidences in rhetoric and is therefore earlier than the *Rhetoric*, which exhibits a developed analysis of these rational evidences as special logical forms. Together, the earlier and the later *Rhetoric* show us the logic of rhetoric in the making, going on about 340, the last date of the *Rhetoric to Alexander*, and more developed in or after 336 B.C., the last date of the *Rhetoric*.

Nor is this all: the earlier *Rhetoric to Alexander* and the later *Rhetoric* show us logic itself in the making. We have already said that Aristotle was primarily a metaphysician. He gradually became a logician out of his previous studies: out of metaphysics, for with him being is always the basis of thinking, and common principles, such as that of contradiction, are axioms of things before axioms of thought, while categories are primarily things signified by names; out of the mathematics of the Pythagoreans and the Platonists, which taught him the nature of demonstration; out of the physics, of which he imbibed the first draughts from his father, which taught him induction from sense and the modification of strict demonstration to suit facts; out of the dialectic between man and man which provided him with beautiful examples of inference in the Socratic dialogues of Xenophon and Plato; out of the rhetoric addressed to large audiences, which with dialectic called his attention to probable inferences; out of the grammar taught with rhetoric and poetics which led him to the logic of the proposition. We cannot write a history of the varied origin of logic, beyond putting the rudimentary logic of the proposition in the *De Interpretatione* before the less rudimentary theory of categories as significant names capable of becoming predicates in the *Categories*, and before the maturer analysis of the syllogism in the *Analytics*. But at any rate the process was gradual; and Aristotle was advanced in metaphysics, mathematics, physics, dialectics, rhetoric and poetics, before he became the founder of logic.

V. ORDER OF THE PHILOSOPHICAL WRITINGS

Some of Aristotle's philosophical writings then are earlier than others; because they show more Platonic influence, and are more rudimentary; *e.g.* the *Categories* earlier than some parts of the *Metaphysics*, because under the influence of Platonic forms it talks of inherent attributes, and allows secondary substances which are universal; the *De Interpretatione* earlier than the *Analytics*, because in it the Platonic analysis of the sentence into noun and verb is retained for the proposition; the *Eudemian Ethics* and the *Magna Moralia* earlier than the *Nicomachean Ethics*, because they are rudimentary sketches of it, and the one written rather in the theological spirit, the other rather in the dialectical style, of Plato; and the *Rhetoric to Alexander* earlier than the *Rhetoric*, because it contains a rudimentary theory of the rational evidences afterwards developed into a logic of rhetoric in the *Rhetoric* and *Analytics*.

It is tempting to think that we can carry out the chronological order of the philosophical writings in detail. But in the gradual process of composition, by which a work once begun was kept going with the rest, although a work such as the *Politics* (begun in 357) was begun early, and some works more rudimentary came earlier than others, the general body of writings was so kept together in Aristotle's library, and so simultaneously elaborated and consolidated into a system that it soon becomes impossible to put one before another.

Zeller, indeed, has attempted an exact order of succession:—

1. The logical treatises.
2. The *Physics*, *De Coelo*, *De Generatione et Corruptione*, *Meteorologica*.
3. *Historia Animalium*, *De Anima*, *Parva Naturalia*, *De Partibus Animalium*, *De Animalium Incessu*, *De Generatione Animalium*.
4. *Ethics* and *Politics*.
5. *Poetics* and *Rhetoric*.
6. *Metaphysics* (unfinished).

But Zeller does not give enough weight either to the evidence of early composition contained in the *Politics* and *Meteorology*, or to the evidence of subsequent contemporaneous composition contained in the cross-references, *e.g* between the *Physics* and the *Metaphysics*. On the other hand he gives too much weight to the references from one book to another, which Aristotle could have entered into his manuscripts at any time before his death. Moreover, the arrangement sometimes breaks down: for example, though on the whole the logical books are quoted without quoting the rest, the *De Interpretatione* (chap. 1) quotes the *De Anima*, and therefore is falsely taken by Zeller against its own internal evidence to be subsequent to it and consequently to the other logical books. Again, the *Meteorologica* (iii. 2, 372 b 9) quotes the *De Sensu* (c. 3), and therefore, on Zeller's arguments, ought to follow one of the *Parva Naturalia*. Lastly, though the *Metaphysics* often quotes the *Physics*, and is therefore regarded as being subsequent, it is itself quoted in the *Physics* (i. 8, 191 b 29), and therefore ought to be regarded as antecedent. Zeller tries to get over this difficulty of cross-reference by detaching *Metaphysics*, Book Δ, from the rest and placing it before the *Physics*. But this violent and arbitrary remedy is only partial. The truth is that the *Metaphysics* both precedes and follows the *Physics*, because it had been all along occupying Aristotle ever since he began to differ from Plato's metaphysical views and indeed forms a kind of presupposed basis of his whole system. So generally, the references backwards and forwards, and the cross-references, are really evidences that Aristotle mainly wrote his works not successively but simultaneously, and entered references as and when he pleased, because he had not published them.

There are two kinds of quotations in Aristotle's extant works, the quotation of another book, and the quotation of a historical fact. While the former is useless to determine the sequence of books written simultaneously, the latter is insufficient to determine a complete chronological order. When Aristotle, *e.g.* in the *Politics*, quotes an event as now (νῦν), he was writing about it at that time; and when he quotes another event as lately (νεωστί) he was writing about it shortly after that time; but he might have been writing the rest of the *Politics* both before and after either event. When he quotes the last event mentioned in the book, *e.g.* in the *Rhetoric* (ii. 23, 1399 b 12) the "common peace" of Greece under Alexander in 336, he was writing as late as that date, but he might also have been writing the *Rhetoric* both before it and after it. When he quotes what persons used to say in the past, *e.g.* Plato and Speusippus in the *Ethics*, Eudoxus and Callippus in the *Metaphysics*, he was writing these passages after the deaths of these persons; but he might have been also writing the *Ethics* and the *Metaphysics* both beforehand and afterwards. Lastly, when he is silent about a historical fact, the argument from silence is evidence only when he could not have failed to mention it; as, for example, in the *Constitution of Athens*, when he could not have failed to mention quinqueremes and other facts after 325–324. But this is in a historical work; whereas the argument from silence about historical facts in a philosophical work can seldom apply.

The chronological order therefore is not sufficiently detailed to be the real order of Aristotelian writings. Secondly, the traditional order, which for nearly 2000 years has descended from the edition of Andronicus to the Berlin edition, is satisfactory in details, but unsatisfactory in system. It gives too much weight to Aristotle's logic, and too little to his metaphysics, on account of two prejudices of the commentators which led them to place both logic and physics before metaphysics. Aristotle rightly used all the sciences of his day, and especially his own physics, as a basis of his metaphysics. For example, at the very outset he refers to the *Physics* (ii. 2) for his use of the four causes, material, efficient, formal and final, in the *Metaphysics* (A 2). This and other applications of the science of nature to the science of all being induced the commentators to adopt this order, and entitle the science of being the *Sequel to the Physics* (τὰ μετὰ τὰ φυσικά). But Aristotle knew nothing of this title, the first known use of which was by Nicolaus Damascenus, a younger contemporary of Andronicus, the editor of the Aristotelian writings, and Andronicus was probably the originator of the title, and of the order. On the other hand, Aristotle entitles the science of all being "Primary Philosophy" (πρώτη φιλοσοφία), and the science of physical being "Secondary Philosophy" (δεύτερα φιλοσοφία), which suggests that his order is from Metaphysics to Physics, the reverse of his editor's order from Physics to Metaphysics. Thus the traditional order puts Physics before Metaphysics without Aristotle's authority. With some more show of authority it puts Logic before Metaphysics. Aristotle, on introducing the principle of contradiction (*Met.* Γ 3), which belongs to Metaphysics as an axiom of being, says that those who attempt to discuss the question of accepting this axiom, do so on account of their ignorance of *Analytics*, which they ought to know beforehand (προεπισταμένους). He means that the logical analysis of demonstration in the *Analytics* would teach them beforehand that there cannot be demonstration, though there must be induction, of an axiom, or any other principle; whereas, if they are not logically prepared for metaphysics, they will expect a demonstration of the axiom, as Heraclitus, the Heraclitean Cratylus and the Sophist Protagoras actually did,—and in vain. Acting on this hint, not Aristotle but the Peripatetics inferred that all logic is an instrument (ὄργανον) of all sciences; and by the time of Andronicus, who was one of them and sometimes called "the eleventh from Aristotle," the order, Logic-Physics-Metaphysics, had become established pretty much as we have it now. It is, however, not the real order for studying the philosophy of Aristotle, because there is more Metaphysics in his Physics than Physics in his Metaphysics, and more Metaphysics in his Logic than Logic in his Metaphysics. The commentators themselves were doubtful about the order: Boethus proposed to begin with Physics, and some of the Platonists with Ethics or Mathematics; while Andronicus preferred to put Logic first as Organon (*Scholia*, 25 b 34 seq.). None of the parties to the dispute had the authority of Aristotle. What do we find in his works? Primary philosophy, Metaphysics, the science of being, is the solid foundation of all parts of his philosophical system; not only in the *Physics*, but also in the *De Coelo* (i. 8, 277 b 10), in the *De Generatione* (i. 3, 318 a 6; ii. 10, 336 b 29), in the *De Anima* (i. 1, 403 a 28, cf. b 16), in the *De Partibus Animalium* (i. 1, 641 a 35), in the *Nicomachean Ethics* (i. 6, 1096 b 30), in the *De Interpretatione* (5, 17 a 14); and in short throughout his extant works. The reason is that Aristotle was primarily a metaphysician half for and half against Plato, occupied himself with metaphysics all his philosophical life, made the science of things the universal basis of all sciences without destroying their independence, and so gradually brought round philosophy from universal forms to individual substances. The traditional order of the Aristotelian writings, still continued in the Berlin edition, beginning with the logical writings on page 1, proceeding to the physical writings on page 184, and postponing the *Metaphysics* to page 980, is not the real order of Aristotle's philosophy.

The real order of Aristotle's philosophy is that of Aristotle's mind, revealed in his writings, and by the general view of thinking, science, philosophy and all learning therein contained. He classified thinking (*Met.* E 1) and science (*Topics*, vi. 6) by the three operations of speculation (θεωρία), practice (πρᾶξις) and production (ποίησις), and made the following subdivisions:—

I. Speculative: about things; subdivided (*Met.* E 1; *De An.* i. 1) into:—
  i. Primary Philosophy, Theology, also called Wisdom, about things as things.
  ii. Mathematical Philosophy, about quantitative things in the abstract.
  iii. Physical Philosophy, about things as changing, and therefore about natural substances or bodies, composed of matter and essence.

II. Practical or Political Philosophy, or philosophy of things human (cf. *E.N.* x. 9-fin.): about human good; subdivided (*E.N.* vi. 8, cf. *E.E.* A 8, 1218 b 13) into:—
  i. Ethics, about the good of the individual.
  ii. Economics, about the good of the family.
  iii. Politics, about the general good of the state.

III. Productive, or Art (τέχνη): about works produced; subdivided (*Met.* A. 1, 981 b 17-20) into:—
  i. Necessary (πρὸς τἀναγκαῖα), *e.g.* medicine.
  ii. Fine (πρὸς διαγωγήν), *e.g.* poetry.

Aristotle calls all these investigations sciences (ἐπιστῆμαι): but he also uses the term "sciences" in a narrower sense in consequence of a classification of their objects, which pervades his writings, into things necessary and things contingent, as follows:—

(A) The necessary (τὸ μὴ ἐνδεχόμενον ἄλλως ἔχειν), what must be; subdivided into:—
  (1) Absolutely (ἁπλῶς), *e.g.* the mathematical.
  (2) Hypothetically (ἐξ ὑποθέσεως), *e.g.* matter necessary as means to an end.

(B) The contingent (τὸ ἐνδεχόμενον ἄλλως ἔχειν), what may be; subdivided into:—
  (1) The usual (τὸ ὡς ἐπὶ τὸ πολύ) or natural (τὸ φυσικόν), *e.g.* a man grows grey.
  (2) The accidental (τὸ κατὰ συμβεβηκός), *e.g.* a man sits or not.

Now, according to Aristotle, science in the narrow sense is concerned only with the absolutely necessary (*E.N.* iii. 3), and in the classification would stop at mathematics, which we still call exact science: in the wide sense, on the other hand, it extends to the whole of the necessary and to the usual contingent, but excludes the accidental (*Met.* E 2), and would in the classification include not only metaphysics and mathematics, but also physics, ethics, economics, politics, necessary and fine art; or in short all speculative, practical and productive thinking of a systematic kind. Hence the *Posterior Analytics*, which is Aristotle's authoritative logic of science, is of peculiar interest because, after beginning by defining science as investigating necessary objects from necessary principles (i. 4), it proceeds to say that it is either of the necessary or of the usual though not of the accidental (i. 29), and to admit that its principles are some necessary and some contingent (i. 32, 88 b 7). Philosophy (φιλοσοφία) also is used by him in a similar manner. Though occasionally he means by it primary philosophy (*Met.* Γ 2-3, K 3), more frequently he extends it to all three speculative philosophies (E 1, 1026 a 18, τρεῖς ἂν εἶεν φιλοσοφίαι θεωρητικαί, μαθηματική, φυσική, θεολογική), and to all three practical philosophies, as we see from the constant use of the phrase "political philosopher" in the *Ethics;* and in short applies it to all sciences except productive science or art. With him, as with the Greeks generally, the problems of philosophy are the nature and origin of being and of good: it is not as with too many of us a mere science of mind.

Aristotle's view of thinking in science and philosophy is essentially comprehensive; but it is not so wide as to become indefinite. According to him, science at its widest selects a special subject, *e.g.* number in arithmetic, magnitude in geometry, stars in astronomy, a man's good in ethics; concentrates itself on the causes and appropriate principles of its subject, especially the definition of the subject and its species by their essences or formal causes; and after an inductive intelligence of those principles proceeds by a deductive demonstration from definitions to consequences: philosophy is simply a desire of this definite knowledge of causes and effects. Beyond philosophy, not beyond science, there is art; and beyond philosophy and science there is history, the description of facts preparatory to philosophy, the investigation of causes (cf. *Pr. An.* i. 30); and this may be natural history, preparatory to natural philosophy, as in the *History of Animals* preparatory to the *De Partibus Animalium*, or what we call civil history, preparatory to political philosophy, as in the 158 Constitutions more or less preparatory to the *Politics.*

Wide as is all his knowledge of facts and causes, it does not appear to Aristotle to be the whole of learning and the show of it. Beyond knowledge lies opinion, beyond discovery disputation, beyond philosophy and science dialectic between man and man, which was much practised by the Greeks in the dialogues of Socrates, Plato, the Megarians and Aristotle himself in his early manhood. With Plato, who thought that the interrogation of man is the best instrument of truth, dialectic was exaggerated into a universal science of everything that is. Aristotle, on the other hand, learnt to distinguish dialectic (διαλεκτική) from science (ἐπιστήμη); in that it has no definite subject, else it would not ask questions (*Post. An.* i. 11, 77 a 31-33); in that for appropriate principles it substitutes the probabilities of authority (τὰ ἔνδοξα) which are the opinions of all, or of the majority, or of the wise (*Top.* i. 1, 100 b 21-23); and in that it is not like science a deduction from true and primary principles of a definite subject to true consequences, but a deduction from opinion to opinion, which may be true or false. Sophistry appeared to him to be like it, except that it is a fallacious deduction either from merely apparent probabilities in its matter or itself merely apparently syllogistic in its form (cf. *Topics*, i. 1). Moreover, he compared dialectic and sophistry, on account of their generality, with primary philosophy in the *Metaphysics* (Γ 2, 1004 b 17-26); to the effect that all three concern themselves with all things, but that about everything metaphysics is scientific, dialectic tentative, sophistry apparent, not real. He means that a sophist like Protagoras will teach superficially anything as wisdom for money; and that even a dialectician like Plato will write a dialogue, such as the *Republic*, nominally about justice, but really about all things from the generality of the form of good, instead of from appropriate moral principles; but that a primary philosopher selects as a definite subject all things as such without interfering with the special sciences of different things each in its kind (*Met.* Γ 1), and investigates the axioms or common principles of things as things (*ib.* 3), without pretending, like Plato, to deduce from any common principle the special principles of each science (*Post. An.* i. 9, 32). Aristotle at once maintains the primacy of metaphysics and vindicates the independence of the special sciences. He is at the same time the only Greek philosopher who clearly discriminated discovery and disputation, science and dialectic, the knowledge of a definite subject from its appropriate principles and the discussion of anything whatever from opinions and authority. On one side he places science and philosophy, on the other dialectic and sophistry.

Such is the great mind of Aristotle manifested in the large map of learning, by which we have now to determine the order of his extant philosophical writings, with a view to studying them in their real order, which is neither chronological nor traditional, but philosophical and scientific. Turning over the pages of the Berlin edition, but passing over works which are perhaps spurious, we should put first and foremost speculative philosophy, and therein the primary philosophy of his *Metaphysics* (980 a 21-1093 b 29); then the secondary philosophy of his *Physics*, followed by his other physical works, general and biological, including among the latter the *Historia Animalium* as preparatory to the *De Partibus Animalium*, and the *De Anima* and *Parva Naturalia*, which he called "physical" but we call "psychological" (184 a 10-967 b 27); next, the practical philosophy of the *Ethics*, including the *Eudemian Ethics* and the *Magna Moralia* as earlier and the *Nicomachean Ethics* as later (1094-1249 b 25), and of the *Politics* (1252-1342), with the addition of the newly discovered *Athenian Constitution* as ancillary to it; finally, the productive science, or art, of the *Rhetoric*, including the earlier *Rhetoric to Alexander* and the later *Rhetorical Art*, and of the *Poetics*, which was unfinished (1354-end). This is the real order of Aristotle's system, based on his own theory and classification of sciences.

But what has become of Logic, with which the traditional order of Andronicus begins Aristotle's works (1-148 b 8)? So far from coming first, Logic comes nowhere in his classification of science. Aristotle was the founder of Logic; because, though others, and especially Plato, had made occasional remarks about reason (λόγος), Aristotle was the first to conceive it as a definite subject of investigation. As he says at the end of the *Sophistical Elenchi* on the syllogism, he had no predecessor, but took pains and laboured a long time in investigating it. Nobody, not even Plato, had discovered that the process of deduction is a combination of premisses (συλλογισμός) to produce a new conclusion. Aristotle, who made this great discovery, must have had great difficulty in developing the new investigation of reasoning processes out of dialectic, rhetoric, poetics, grammar, metaphysics, mathematics, physics and ethics; and in disengaging it from other kinds of learning. He got so far as gradually to write short discourses and long treatises, which we, not he, now arrange in the order of the *Categories* or names; the *De Interpretatione* on propositions; the *Analytics*, *Prior* on syllogism, *Posterior* on scientific syllogism; the *Topics* on dialectical syllogism; the *Sophistici Elenchi* on eristical or sophistical syllogism; and, except that he had hardly a logic of induction, he covered the ground. But after all this original research he got no further. First, he did not combine all these works into a system. He may have laid out the sequence of syllogisms from the *Analytics* onwards; but how about the *Categories* and the *De Interpretatione*? Secondly, he made no division of logic. In the *Categories* he distinguished names and propositions for the sake of the classification of names; in the *De Interpretatione* he distinguished nouns and verbs from sentences with a view to the enunciative sentence: in the *Analytics* he analysed the syllogism into premisses and premisses into terms and copula, for the purpose of syllogism. But he never called any of these a division of all logic. Thirdly, he had no one name for logic. In the *Posterior Analytics* (i. 22, 84 a 7-8) he distinguishes two modes of investigation, analytically (ἀναλυτικῶς) and logically (λογικῶς). But "analytical" means scientific inference from appropriate principles, and "logical" means dialectical inference from general considerations; and the former gives its name to the *Analytics*, the latter suits the *Topics*, while neither analytic nor logic is a name for all the works afterwards called logic. Fourthly, and consequently, he gave no place to any science embracing the whole of those works in his classification of science, but merely threw out the hint that we should know analytics before questioning the acceptance of the axioms of being (*Met.* Γ 3).

It is a commentator's blunder to suppose that the founder of logic elaborated it into a system, and then applied it to the sciences. He really left the Peripatetics to combine his scattered discourses and treatises into a system, to call it logic, and logic *Organon*, and to put it first as the instrument of sciences; and it was the Stoics who first called logic a science, and assigned it the first place in their triple classification of science into logic, physics, ethics. Would Aristotle have consented? Would he not rather have given the first place to primary philosophy?

Dialectic was distinguished from science by Aristotle. Is logic, then, according to him, not science but dialectic? The word logically (λογικῶς) means the same as dialectically (διαλεκτικῶς). But the general discussion of opinions, signified by both words, is only a subordinate part of Aristotle's profound investigation of the whole process of reasoning. The *Analytics*, the most important part, so far from being dialectic or logic in that narrow sense, is called by him not logic but analytic science (ἀναλυτικὴ ἐπιστήμη, *Rhet.* i. 4, 1359 b 10; cf, 1356 b 9, 1357 a 30, b 25); and in the *Metaphysics* he evidently refers to it as "the science which considers demonstration and science," which he distinguishes from the three speculative sciences, mathematics, physics and primary philosophy (*Met.* K 1, 1059 b 9-21). The *Analytics* then, which from the beginning claims to deal with science, is a science of sciences, without however forming any part of the classification. On the other hand, it does not follow that Aristotle would have regarded the *Topics*, which he calls "the investigation" and "the investigation of dialectic" (ἡ πραγματεία, *Top*, i. 1, ἡ πραγματεία ἡ περὶ τὴν διαλεκτικήν, Pr. *An.* i. 30, 46 a 30), or the *De Interpretatione*, which he calls "the present theory" (τῆς νῦν θεωρίας, *De Int.* 6, 17 a 7), as science. In fact, as to the *Categories* as well as the *De Interpretatione*, we are at a complete loss. But about the *Topics* we may venture to make the suggestion that, as in describing consciousness Aristotle says we perceive that we perceive, and understand that we understand, and as he calls *Analytics* a science of sciences, so he might have called the *Topics* a dialectical investigation of dialectic. Now, this suggestion derives support from his own description of the allied art of Rhetoric. "Rhetoric is counterpart to dialectic" is the first sentence of the *Rhetoric*; and the reason is that both are concerned with common objects of no definite science. Afterwards dialectic and rhetoric are said to differ from other arts in taking either side of a question (i. 1, 1355 a 33-35); rhetoric, since its artificial evidences involve characters, passions and reasoning, is called a kind of offshoot of dialectic and morals, and a copy of dialectic, because neither is a science of anything definite, but both faculties (δυνάμεις) of providing arguments (i. 2, 1356 a 33); and, since rhetorical arguments are examples and enthymemes analysed in the *Analytics*, rhetoric is finally regarded as a compound of analytic science and of morals, while it is like dialectical and sophistic arguments (i. 4, 1359 b 2-17).

As then Aristotle himself regarded rhetoric as partly science and partly dialectic, perhaps he would have said that his works on reasoning are some science and others not, and that, while the investigation of syllogism with a view to scientific syllogism in the *Analytics* is analytic science, the investigation of dialectical syllogism, in the *Topics*, with its abuse, eristical syllogism, in the *Sophistici Elenchi*, is dialectic. At any rate, these miscellaneous works on reasoning have no right to stand first in Aristotle's writings under any one name, logic or *Organon*. As he neither put them together, nor on any one definite plan, we are left to convenience; and the most convenient place is with the psychology of the *De Anima*.

As for dialectic itself, it would have been represented by Aristotle's early dialogues, had they not been lost except a few fragments. But none of his extant writings is so much dialectic, like a Platonic dialogue. They contain however many relics of dialectic. The *Rhetoric* is declared by him to be partly dialectic. The *Topics* is at least an investigation of dialectic, which has had an immense influence on the method of argument. The *Magna Moralia* almost runs into dialogue. Besides, all the extant works, though apparently didactic, are full of dialectical matter in the way of opinions (λεγόμενα), difficulties and doubts (ἀπορήματα, ἀπορίαι), solutions (λύσεις), and of dialectical style in the way of conversational expressions. It is probable also that the "extraneous discourses" (οἱ ἐξωτερικοὶ λόγοι) sometimes mentioned in them here mean dialectical discussions of a subject from opinions extraneous to its nature, as opposed to scientific deduction from its appropriate principles. From the eight passages, which refer to the extraneous discourses, we find (1) that Platonic forms were made by them matters of common talk (τεθρύληται, *Met.* M 1, 1076 a 28); (2) that time was made by them matter of doubts, which in this case are Aristotle's own doubts (*Phys.* iv. 10, 217 b 31-218 a 30); (3) that the discussions of Platonic forms in them and in philosophical discourses were different (*E.E.* i. 8, 1217 b 22); (4) that the ordinary distinction between goods of mind, body and estate is one which we make (διαιρούμεθα) in them (*E.E.* ii. 1, 1218 b 34); (5) that in them appeared the division of soul into irrational and rational, used by Aristotle (*E.N.* i. 13, 1102 a 26), and attributed to Plato; (6) that the distinction between action and production accepted by Aristotle appeared in them (*E.N.* vi. 4, 1140 a 3); (7) that a distinction between certain kinds of rule is one which we make often (διοριζόμεθα . . . πολλάκις) in them (*Pol.* Γ 6, 1278 b 31); (8) that a discussion about the best life, used by Aristotle, was made in them (*Pol.* H 1, 1323 a 22). On the whole, the interpretation which best suits all the passages is that extraneous discourses mean any extra-scientific dialectical discussions, oral or written, occurring in dialogues by Plato, or by Aristotle, or by anybody else, or in ordinary conversation, on any subject under the sun.

Among all the eight passages mentioned above, the most valuable is that from the *Eudemian Ethics* (A 8), which discriminates extraneous discourses and philosophical (καὶ ἐν τοῖς ἐξωτερικοῖς λόγοις καὶ ἐν τοῖς κατὰ φιλοσοϲφίαν, 1217 b 22-23); and it is preceded (A 6, 1216 b 35-37 a 17), by a similar distinction between foreign discourses (ἀλλοτρίοι λόγοι) and discourses appropriate to the thing (οἰκεῖοι λόγοι τοῦ πράγματος), which marks even better the opposition intended between dialectic and philosophy. Now, as in all eight passages Aristotle speaks, somewhat disparagingly, of "even (καὶ) extraneous discourses," and as these include his own early dialogues, they must be taken to mean that though he might quote them, he no longer wished to be judged by his early views, and therefore drew a strong line of demarcation between his early dialogues and the mature treatises of his later philosophical system. Now, both were in the hands of his readers in the time of Andronicus. Therefore his contemporary, Cicero, who knew the early dialogues on *Philosophy*, the *Eudemus* and the *Protrepticus*, and also among the mature scientific writings the *Topics, Rhetoric, Politics, Physics* and *De Coelo*, to some extent, was justified by Aristotle's example and precept in drawing the line between two kinds of books, one written popularly, called exoteric, the other more accurately (Cic. *De Finibus*, v. 5). But there was no doubt a tendency to extend the term "exoteric" from the dialectical to the more popular of the scientific writings of Aristotle, to make a new distinction between exoteric and acroamatic or esoteric, and even to make out that Aristotle was in the habit of teaching both exoterically and acroamatically day by day as head of the Peripatetic school at Athens. Aulus Gellius in the 2nd century A.D. supplies the best proof of this growth of tradition in his *Noctes Atticae* (xx. 5). He says that Aristotle (1) divided his *commentationes* and arts taught to his pupils into ἐξωτερικά and ἀκροατικά; (2) taught the latter in the morning walk (ἑωθινὸν περίπατον), the former in the evening walk (δειλινὸν περίπατον); (3) divided his books in the same manner; (4) defended himself against Alexander's letter, complaining that it was not right to his pupils to have published his acroamatic works, by replying in a letter that they were published and not published, because they are intelligible only to those who heard them. Gellius then quotes this correspondence, also given by Plutarch, and quotes it *ex Andronici philosophi libro*. The answer to the first three points is that Aristotle did not make any distinction between exoteric and acroamatic, and was not likely to have any longer taught his exoteric dialogues when he was teaching his mature philosophy at Athens, but may have alternated the teaching of the latter between the more abstruse and the more popular parts which had gradually come to be called "exoteric." As regards the last point, the authority of Andronicus proves that he at all events did not exaggerate his own share in publishing Aristotle's works; but it does not prove either that this correspondence between Alexander and Aristotle took place, or that Aristotle called his philosophical writings acroamatic, or that he had published them wholesale to the world.

The literary career of Aristotle falls into three periods. (1) The early period; when he was writing and publishing exoteric dialogues, but also tending to write didactic works, and beginning his scientific writings, *e.g.* the *Politics* in 357, the *Meteorologica* in 356. (2) The immature period; when he was continuing his didactic and scientific works, and composing first drafts, *e.g.* the *Categories*, the *Eudemian Ethics*, the *Magna Moralia*, the *Rhetoric to Alexander*. (3) The mature period; when he was finishing his scientific works, completing his system, and not publishing it but teaching it in the Peripatetic school; when he would teach not his early dialogues, nor his immature writings and first drafts, but mature works, *e.g.* the *Metaphysics*, the *Nicomachean Ethics*, the *Rhetoric;* and above all teach his whole system as far as possible in the real order of his classification of science.

VI. The Aristotelian Philosophy

We have now (1) sketched the life of Aristotle as a reader and a writer from early manhood; (2) have watched him as a Platonist, partly imitating but gradually emancipating himself from his master to form a philosophy of his own; (3) have traced the gradual composition of his writings from Plato's time onwards; (4) have distinguished earlier, more Platonic and rudimentary, from later, more independent and mature, writings; (5) have founded the real order of his writings, not on chronology, nor on tradition, but on his classification of science and learning. It remains to answer the final question:—What is the Aristotelian philosophy, which its author gradually formed with so much labour? Here we have only room for its spirit, which we shall try to give as if he were himself speaking to us, as head of the Peripatetic school at Athens, and holding no longer the early views of his dialogues, or the immature views of such treatises as the *Categories*, but only his mature views, such as he expresses in the *Metaphysics*. Aristotle was primarily a metaphysician, a philosopher of things, who uses the objective method of proceeding from being to thinking. We shall begin therefore with that primary philosophy which is the real basis of his philosophy, and proceed in the order of his classification of science to give his chief doctrines on:—

(1) Speculative philosophy, metaphysical and physical, including his psychology, and with it his logic.
(2) Practical philosophy, ethics and politics.
(3) Productive science, or art.

Things are substances (οὐσίαι), each of which is a separate individual (χωριστόν, τόδε τι, καθ' ἕκαστον) and is variously affected as quantified, qualified, related, active, passive and so forth, in categories of things which are attributes (συμβεβηκότα), different from the category of substance, but real only as predicates belonging to some substance, and are in fact only the substance itself affected (αὐτὸ πεπονθός). The essence of each substance, being what it is (τὸ τί ἐστι, τὸ τί ἦν εἶναι), is that substance; *e.g.* this rational animal, Socrates. Substances are so similar that the individuals of a species are even the same in essence or substance, *e.g.* Callias and Socrates differ in matter but are the same in essence, as rational animals. The universal (τὸ καθόλου) is real only as one predicate belonging to many individual substances: it is therefore not a substance. There are then no separate universal forms, as Plato supposed. There are attributes and universals, real as belonging to individual substances, whose being is their being. The mind, especially in mathematics, abstracts numbers, motions, relations, causes, essences, ends, kinds; and it over-abstracts things mentally separate into things really separate. But reality consists only of individual substances, numerous, moving, related, active as efficient causes, passive as material causes, essences as formal causes, ends as final causes, and in classes which are real universals only as real predicates of individual substances. Such is Aristotle's realism of individuals and universals, contained in his primary philosophy, as expressed in the *Metaphysics*, especially in Book Z, his authoritative pronouncement on being and substance.

The individual substances, of which the universe is composed, fall into three great irreducible kinds: nature, God, man.

I. *Nature.*—The obvious substances are natural substances or bodies (*φυσικαὶ οὐσίαι, σώματα*), *e.g.* animals, plants, water, earth, moon, sun, stars. Each natural substance is a compound (*σύνθετον, συνθέτη οὐσία*) of essence and matter; its essence (*εἶδος, μορφή, τὸ τί ἐστι, τὸ τί ἦν εἶναι*) being its actual substance, its matter (*ὕλη*) not; its essence being determinate, its matter not; its essence being immateriate, its matter conjoined with the essence; its essence being one in all individuals of a species, its matter different in each individual; its essence being cause of uniformity, its matter cause of accident. At the same time, matter is not nothing, but something, which, though not substance, is potentially substance; and it is either proximate to the substance, or primary; proximate, as a substance which is potentially different, *e.g.* wood potentially a table; primary, as an indeterminate something which is a substratum capable of becoming natural substances, of which it is always one; and it is primarily the matter of earth, water, air, fire, the four simple bodies (*ἁπλᾶ σώματα*) with natural rectilineal motions in the terrestrial world (*De Gen. et Cor.* ii. 1 seq.); while aether (*αἰθήρ*) is a fifth simple body, with natural circular motion, being the element of the stars (*τὸ τῶν ἄστρων στοιχεῖον*) in the celestial world. Each natural substance is a formal cause, as being what it is; a material cause, as having passive power to be changed; an efficient cause, as having active power to change, by communicating the selfsame essence into different matter so as to produce therein a homogeneous effect in the same species; and a final cause, as an end to be realized. Moreover, though each natural substance is corruptible (*φθαρτόν*), species is eternal (*ἀΐδιον*), because there was always some individual of it to continue its original essence (expressed by the imperfect tense in *τὸ τί ἦν εἶναι*), which is ungenerated and incorruptible; the natural world therefore is eternal; and nature is for ever aiming at an eternal propagation, by efficient acting on matter, of essence as end. For even nature does nothing in vain, but aims at final causes, which she uniformly realizes, except so far as matter by its spontaneity (*ἀπὸ τοῦ αὐτομάτου*) causes accidental effects; and the ends of nature are no form of good, nor even the good of man, but the essences of natural substances themselves, and, above them all, the good God Himself. Such is Aristotle's natural realism, pervading his metaphysical and physical writings.

II. *God.*—Nature is but one kind of being (*ἓν γάρ τι γένος τοῦ ὄντος ἡ φύσις*, *Met.* Γ 3, 1005 a 34). Above all natural substances, the objects of natural science, there stands a supernatural substance, the object of metaphysics as theology. Nature's boundary is the outer sphere of the fixed stars, which is eternally moved day after day in a uniform circle round the earth. Now, an actual cause is required for an actual effect. Therefore, there must be a prime mover of that prime movable, and equally eternal and uniform. That prime mover is God, who is not the creator, but the mover directly of the heavens, and indirectly through the planets of sublunary substances. But God is no mechanical mover. He moves as motive (*κινεῖ δὲ ὡς ἐρώμενον*, *Met.* Λ 7, 1072 b 3); He is the efficient only as the final cause of nature. For God is a living being, eternal, very good (*ζῷον ἀΐδιον ἄριστον*, *ib.* 1072 b 29). While nature aims at Him as design, as an end, a motive, a final cause, God's occupation (*διαγωγή*) is intelligence (*νόησις*); and since essence, not indeed in all being, but in being understood, becomes identical with intelligence, God in understanding essence is understanding Himself; and in short, God's intelligence is at once intelligence of Himself, of essence and of intelligence,—*καὶ ἔστιν ἡ νόησις νοήσεως νόησις* (*Met.* Λ 7, 1074 b 34). But at the same time the essence of good exists not only in God and God's intelligence on the one hand, but also on the other hand on a declining scale in nature, as both in a general and in his army; but rather in God, and more in some parts of nature than in others. Thus even God is a substance, a separate individual, whose differentiating essence is to be a living being, eternal and very good; He is however the only substance whose essence is entirely without matter and unconjoined with matter; and therefore He is a substance, not because He has or is a substratum beneath attributes, but wholly because He is a separate individual, different both from nature and men, yet the final good of the whole universe. Such is Aristotle's theological realism without materialism and the origin of all spiritualistic realism, contained in his *Metaphysics* (Λ 6-end).

III. *Man.*—There is a third kind of substance, combining something both of the natural and of the divine: we men are that privileged species. Each man is a substance, like any other, only because he is a separate individual. Like any natural substance, he is composed of matter and immateriate essence. But natural substances are inorganic and organic; and a man is an organic substance composed of an organic body (*ὀργανικὸν σῶμα*) as matter, and a soul (*ψυχή*) as essence, which is the primary actuality of an organic body capable of life (*ζωή*). Still a man is not the only organism; and every organism has a soul, whose immediate organ is the spirit (*πνεῦμα*), a body which—analogous to a body diviner than the four so-called elements, namely the aether, the element of the stars—gives to the organism its non-terrestrial vital heat, whether it be a plant or an animal. In an ascending scale, a plant is an organism with a nutritive soul; an animal is a higher organism with a nutritive, sensitive, orectic and locomotive soul; a man is the highest organism with a nutritive, sensitive, orectic, locomotive and rational soul. What differentiates man from other natural and organic substances, and approximates him to a supernatural substance, God, is reason (*λόγος*), or intellect (*νοῦς*). Now, though only one of the powers of the soul, intellect alone of these powers has no bodily organ; it alone is immortal: it alone is divine. While the soul is propagated, like any other essence, by the efficient, which is the seed, to the matter, which is the germ, of the embryo man, intellect alone enters from without (*θύραθεν*), and is alone divine (*θεῖον*, not *θεός*), because its activity communicates with no bodily activity (*De Gen.* ii. 3, 736-737). A man then is a third kind of substance, like a natural substance in bodily matter, like a supernatural substance in divine reason or intellect. Such is Aristotle's dual, or rather triple, realism, continued in his *De Anima* and other biological writings, especially *De Generatione Animalium*, ii.

There are three points about a man's life which both connect him with, and distinguish him from, God. God's occupation is speculative; man's is speculation, practice and production.

1. *Speculation* (*θεωρία*).—Since things are individuals, and there is nothing, and nothing universal, beyond them, there are two kinds of knowledge (*γνῶσις*), sense (*αἴσθησις*) of individuals, intellect (*νοῦς*) of universals. Both powers know by being passively receptive of essence propagated by an efficient cause; but, while in sense the efficient cause is an external object (*ἔξωθεν*), in intelligence it is active intellect (*νοῦς τῷ ποιεῖν*) propagating its essence in passive intellect (*νοῦς παθητικός*). Nevertheless, without sense there is no knowledge. Sense receives from the external world an essence, *e.g.* of white, which is really universal as well as individual, but apprehends it only as individual, *e.g.* this white substance: intellect thereupon discovers the universal essence but only in the individuals of sense. This intellectual discovery requires sensation and retention of sensation; so that sense (*αἴσθησις*) receives impressions, imagination (*φαντασία*) retains them as images, intellect (*νοῦς*) generalizes the universal, and, when it is intelligence of essence, is always true.

This is the origin of knowledge, psychologically regarded (in the *De Anima*). Logically regarded, the origin of all teaching and learning of an intellectual kind is a process of induction (*ἐπαγωγή*) from particulars to universal, and of syllogism (*συλλογισμός*) from universal to further particulars; induction, whenever it starts from sense, becomes the origin of scientific knowledge (*ἐπιστήμη*); while there is also a third process of example (*παράδειγμα*) from particular to particular, which produces only persuasion. In acquiring scientific knowledge, syllogism cannot start from universals without induction, nor induction acquire universals without sense. At the same time, there are three species of syllogism, scientific, dialectical and eristical or sophistical; and in consequence there are different ways of acquiring premisses. In order to acquire the knowledge of the true and primary principles of scientific knowledge, and especially the intelligence of the universal essence of the subject, which is always true, the process of knowledge consists of (1) sense (αἴσθησις), which receives the essence as individual, (2) memory (μνήμη), which is a retention of sensible impression, (3) experience (ἐμπειρία), which consists of a number of similar memories, (4) induction (ἐπαγωγή), which infers the universal as a fact (τὸ ὅτι), (5) intellect (νοῦς), which apprehends the principle (ἀρχή); because it is a true apprehension that the universal induced is the very essence and formal cause of the subject: thereupon, scientific syllogism (ἐπιστημονικὸς συλλογισμός), making the definition (ὁρισμός) of this essence the middle term (τὸ μέσον), becomes a demonstration (ἀπόδειξις) of the consequences which follow from the essence in the conclusion. Such then is science. In order to acquire the probabilities (τὰ ἔνδοξα) of opinion (δόξα), which are the premisses of dialectical syllogism, the process is still induction, as in science, but dialectical induction by interrogation from the opinions of the answerers until the universal is conceded: thereupon the dialectical syllogism (διαλεκτικὸς συλλογισμός) deduces consequent opinions in the conclusion. Nor does the process of acquiring the premisses of eristical syllogism, which is fallacious either in its premisses or in its process, differ, except that, when the premisses are fallacious, the dialectical interrogations must be such as to cause this fallacy. Hence, as science and dialectic are different, so scientific induction and syllogism must be distinguished from dialectical induction and syllogism. Dialectic is useful, for exercise, for conversation and for philosophical sciences, where by being critical it has a road to principles. But it is by a different process of sense, memory, experience, induction, intelligence, syllogism, that science becomes knowledge of real causes, of real effects, and especially of real essences from which follow real consequences, not beyond, but belonging to real substances. So can we men, not, as Plato thought, by having in our souls universal principles innate but forgotten, but by acquiring universal principles from sense, which is the origin of knowledge, arrive at judgments which are true, and true because they agree with the things which we know by sense, by inference and by science. Such is Aristotle's psychological and logical realism, contained in the *De Anima* and logical treatises.

2. *Practice* (πρᾶξις).—In this natural world of real substances, human good is not an imitation of a supernatural universal form of the good, but is human happiness; and this good is the same both of the individual as a part and of the state as a whole. Ethics then is a kind of Politics. But in Ethics a man's individual good is his own happiness; and his happiness is no mere state, but an activity of soul according to virtue in a mature life, requiring as conditions moderate bodily and external goods of fortune; his virtue is (1) moral virtue, which is acquired by habituation, and is a purposive habit of performing actions in the mean determined by right reason or prudence; requiring him, not to exclude, but to moderate his desires; and (2) intellectual virtue, which is either prudence of practical, or wisdom of speculative intellect; and his happiness is a kind of ascending scale of virtuous activities, in which moral virtue is limited by prudence, and prudence by wisdom; so that the speculative life of wisdom is the happiest and most divine, and the practical life of prudence and moral virtue secondary and human. Good fortune in moderation is also required as a condition of his happiness. Must we then, on account of misfortunes, look with Solon at the end, and call no man happy till he is dead? Or is this altogether absurd for us who say that happiness is an activity? Virtuous activities determine happiness, and a virtuous man is happy in this life, in spite of misfortunes unless they be too great; while after death he will not feel the misfortunes of the living so much as to change his happiness. Still, for perfect happiness a man should prefer the speculative life of divine intellect, and immortalize (ἀθανατίζειν) as far as possible. For intellect is what mainly makes a man what he is, and is divine and immortal.

To turn from Ethics to Politics, the good of the individual on a small scale becomes on a large scale the good of the citizen and the state, whose end should be no far-off form of good, and no mere guarantee of rights, but the happiness of virtuous action, the life according to virtue, which is the general good of the citizen. Hence, the citizen of the best state is he who has the power and the purpose to be governed and govern for the sake of the life according to virtue.

A right government is one which aims at the general good, whereas any government which aims at its own good is a deviation. Hence governments are to be arranged from best to worst in the following order:—

I. Right governments (ὀρθαὶ πολιτεῖαι), aiming at the general good:—
    i. Monarchy, of one excelling in virtue:
    ii. Aristocracy, of a class excelling in virtue:
    iii. Commonwealth, of the majority excelling in virtue.
II. Deviations (παρεκβάσεις), aiming at the good of the government:—
    i. Democracy, aiming at the good of the majority:
    ii. Oligarchy, aiming at the good of the few:
    iii. Tyranny, aiming at the good of one.

Such is Aristotle's practical philosophy, contained in his matured *Nicomachean Ethics*, and his unfinished *Politics*.

3. *Production* (ποίησις).—Production differs from practice in being an activity (ἐνέργεια; *e.g.* building) which is always a means to a work (ἔργον; *e.g.* a house) beyond itself. Productive science, or art, is an intellectual habit of true reasoning from appropriate principles, acquired from experiences, and applied to the production of the work which is the end of the art. All the arts are therefore at once rational and productive. They are either for necessity (*e.g.* medicine) or for occupation (*e.g.* poetry), the former being inferior to the latter. Rhetoric is a faculty on any subject of investigating what may be persuasive (πιθανόν), which is the work of no other art; its means are artificial and inartificial evidences (πίστεις), and, among artificial evidences, especially the logical arguments of example and enthymeme. Poetry is the art of producing representations; (1) in words, rhythm and harmony (ἁρμονία, "harmony" in the original sense); (2) of men like ourselves, or better as in tragedy, or worse as in comedy; (3) by means of narrative as in epic, or by action as in the drama. The cause of poetry is man's instinct of representation and his love of representations caused by the pleasure of learning. Comedy is representation of men inferior in being ludicrous: epic is like tragedy a representation of superior men, but by means of narrative and unlimited in time: tragedy is a representation of an action superior and complete, in a day if possible, by means of action, and accomplishing by pity and fear the purgation of such passions (*Poetics*, 1449 b 24). Music is a part of moral education; and for this end we should use the most moral harmonies. But music has also other ends and uses, and on the whole four; namely amusement, virtue, occupation and purgation of the affections; for some men are liable more than others to pity and fear and enthusiasm, but from sacred melodies we see them, when they have heard those which act orgiastically on the soul, becoming settled by a kind of medicine and purgation (κάθαρσις), and being relieved with pleasure. Finally, art is not morality, because its end is always a work of art, not virtuous action: on the other hand, art is subordinate to morality, because all the ends of art are but means to the end of life, and therefore a work of art which offends against morality is opposed to the happiness and the good of man. Such is Aristotle's productive science or art, contained in his *Rhetoric* and *Poetics*, compared with his *Ethics* and *Politics*.

Aristotle, even in this sketch of his system, shows himself to be the philosopher of facts, who can best of all men bear criticism; and indeed it must be confessed that he retained many errors of Platonism and laid himself open to the following objections. Two substances, being individuals, *e.g.* Socrates and Callias, are in no way the same, but only similar, even in essence, *e.g.* Socrates is one rational animal, Callias another. A universal, *e.g.* the species man, is not predicate of many individuals (ἓν κατὰ πολλῶν, *Post. An.* i. 11), but a whole number of similar individuals, *e.g.* all men; and not a whole species, but only an individual, is a predicate of such individual, *e.g.* Socrates is a man, not all men, and one white thing, not all white things. Consequently, a species or genus is not a substance, as Aristotle says it is in the *Categories* (inconsistently with his own doctrine of substances), but a whole number of substances, *e.g.* all men, all animals. Similarly, the universal essence of a species is not one and the same as each individual essence, but is the whole number of similar individual essences of the similar individuals of the species, *e.g.* all rational animals. Consequently, the universal essence of a species of substances is not one and the same eternal essence in all the individuals of a species but only similar, and is not substance as Aristotle calls it in the *Metaphysics*, inconsistently with his own doctrine of substance, but is a whole number of similar substances, *e.g.* all rational animals which are what all men are. Hence again, the natural world of species and essences is not eternal, but only endures as long as there are individual substances. Hence, moreover, a natural substance or body as an efficient cause or force causes an effect on another, not by propagating one eternal essence of a species into the matter of the other, but so far as we really understand force, by their reciprocally preventing one another from occupying the same place at the same moment on account of the mutual resistance of any two bodies. The essence of a natural substance, *e.g.* wood, is not immateriate, but is the whole body as what it is. The matter of a natural substance is not a primary matter which is one indeterminate substratum of all natural substances, but is only one body as able to be changed by a force which is another substance able to change it, *e.g.* a seed becoming wood, wood becoming coal, &c. A natural substance or body, therefore, is not a heterogeneous compound of essence and matter, but is essence as what it is, matter as able passively to be changed, force as able actively to change. The simple bodies which are the matter of the rest are not terrestrial earth, water, air, fire, and a different celestial aether, but whatever elementary bodies natural science, starting anew from mechanics and chemistry, may determine to be the matter of all other bodies whatever. Nature does not aim at God as end, but God, thinking and willing ends, produces and acts on nature. Soul is not an immateriate essence of an organic body capable, but an immateriate conscious substance within an organic body. Sensation is not the reception of the selfsame essence of an external body, but one's perception of one's sentient organism as affected, and especially of its organs resisting one another, *e.g.* one's lips, hands, &c., preventing one another from occupying the same place at the same moment within one's organism. Intelligence does not differ from sense by having no bodily organ, but the nervous system is the bodily organ of both. Intelligence is not active intellect propagating universal essence in passive intellect, but only logical inference starting from sense, and both requiring nervous body and conscious soul. It is not always a true apprehension of essence, but often, especially in physical matter, such as sound or heat or light, takes superficial effects to be the essence of the thing. Aristotle did not altogether solve the question, What is, and scarcely solved at all the question, How do we know the external world?

We might continue to object. But at bottom there remains the fundamental position of Aristotelianism, that all things are substances, individuals separate though related; that some things are attributes, real only as being some individual substance somehow affected, or, as we should say, modified or determined; and that without individual substances there is nothing, and nothing universal apart from individuals. There remains too the consequence that there are different substances, separate from but related to one another; and these substances of three irreducible kinds, natural, supernatural, human. Aristotelianism has to be considered against the philosophy which preceded it and against the philosophy which has since followed it. Platonism preceded it, and was the metaphysical doctrine that all things are supernatural—forms, gods, souls. Idealism has since followed it, and is the metaphysical doctrine that all things are mind and states of mind. Aristotelianism intervenes between ancient Platonism and modern Idealism, and is the metaphysical doctrine that all things are substances, natural and supernatural and human. It is a philosophy of substantial things, standing as a *via media* between a philosophy of the supernatural and a philosophy of mind. There are three alternatives, which may be put as questions which every thinker must ask himself. Are the things which surround me in what I call the environment,—the men, the animals, the plants, the ground, the stones, the water, the air, the moon, the sun, the stars and God—are they shadows, unsubstantial things, as formerly Platonism made all things to be except the supernatural world of forms, gods and souls? Or are they, as modern Idealism says, mind and states of mind? Or are they really substances separate from, though related to, myself, who am also a substance? The Aristotelian answer is —"Yes, all things are substances, but not all supernatural, nor all mental; for some are natural substances, or bodies"; and by that answer Aristotelianism stands or falls.

LITERATURE.—The Aristotelian philosophy is to be studied, first in Aristotle's works, which are the best commentaries on one another; the best complete edition is the Berlin edition (1831–1870), by Bekker and Brandis, in which also are the fragments collected by V. Rose, the scholia collected by Brandis, and the index compiled by Bonitz. After reading the remains of the Peripatetic school, the Greek commentators should be further studied in this edition. The Latin commentators, the Arabians and the schoolmen show how Aristotle has been the chief author of modern culture; while the vindication of modern independence comes out in his critics, the greatest of whom were Roger and Francis Bacon. Since the modern discovery of the science of motion by Galileo which changed natural science, and the modern revolution of philosophy by Descartes which changed metaphysics, the study of Aristotle has become less universal; but it did not die out, and received a fresh stimulus especially from Julius Pacius, who going back through G. Zabarella to the Arabians, and himself gifted with great logical powers, always deserves study in his editions of the *Organon* and the *Physics*, and in his *Doctrinae Peripateticae*. In more recent times, as part of the growing conviction of the essentiality of everything Greek, Aristotle has received marked attention. In France there are the works of Cousin (1835), Félix Ravaisson, who wrote on the *Metaphysics* (1837–1846), and Barthélemy St Hilaire, who translated the *Organon* and other works (1844 seq.). In Germany there has been a host of commentaries, among which we may mention the *Organon* edited (1844–1846) by F. Th. Waitz (not so well as by Pacius), the *De Anima* edited (1833) by F. A. Trendelenburg and later by A. Torstrik, the *Historia Animalium* by H. Aubert and F. Wimmer (1868), the *Ethics* by K. L. Michelet (1827), the *Metaphysics* by A. Schwegler (1847) and (best of all) by H. Bonitz (1848), who is the most faithful of all commentators, because to great industry and acumen he adds the rare gift of confessing when he does not understand, and when he does not know what Aristotle might have thought. With Aristotle's works before one, with the *Index Aristotelicus*, and the edition and translation of the *Metaphysics* by Bonitz on one side, and Zeller's *Die Philosophie der Griechen*, ii. 2, "Aristoteles" (trans. by Costelloe and Muirhead), on the other side, one can go a considerable way towards understanding the foundations of Aristotelianism.

In England scholars tend to take up certain parts of Aristotle's philosophy. Grote indeed intended to write a general account of Aristotle like that of Plato; but his *Aristotle* went little further than the logical writings. From Cambridge we have J. W. Blakesley's *Life of Aristotle*, E. M. Cope's *Rhetoric*, Dr Henry Jackson's *Nicomachean Ethics*, v., S. H. Butcher's *Poetics*, Hicks's *De Anima*, J. E. Sandys's *Athenian Constitution*, Jebb's *Rhetoric* (ed. Sandys). Oxford in particular, since the beginning of the 19th century, has kept alive the study of Aristotle. E. Cardwell in his edition of the *Nicomachean Ethics* (1828) had the wisdom to found his text on the Laurentian Manuscript (Kb); E. Poste wrote translations of the *Posterior Analytics* and *Sophistici Elenchi*; R. Congreve edited the *Politics*; A. Grant edited the *Nicomachean Ethics*; E. Wallace translated and annotated the *De Anima*; B. Jowett translated the *Politics*; W. L. Newman has edited the *Politics* in four volumes; Dr Ogle has translated the *De Partibus Animalium*, with notes; R. Shute wrote a *History of the Aristotelian Writings*; Professor J. A. Stewart has written *Notes on the Nicomachean Ethics*; Professor J. Burnet has issued an annotated edition of the *Nicomachean Ethics*, and W. D. Ross has translated the *Metaphysics*. All these are, or were, Oxford men; and it remains to mention two others: I. Bywater, who as an Aristotelian scholar has done much for the improvement of Bekker's text, especially of the *Nicomachean Ethics* and the *Poetics*; and F. G. Kenyon, who has the proud distinction of having been the first modern editor of the Ἀθηναίων πολιτεία. (T. CA.)

ARISTOXENUS, of Tarentum (4th century B.C.), a Greek peripatetic philosopher, and writer on music and rhythm. He was taught first by his father Spintharus, a pupil of Socrates, and later by the Pythagoreans, Lamprus of Erythrae and Xenophilus, from whom he learned the theory of music. Finally he studied under Aristotle at Athens, and was deeply annoyed, it is said, when Theophrastus was appointed head of the school on Aristotle's death. His writings, said to have numbered four hundred and fifty-three, were in the style of Aristotle, and dealt with philosophy, ethics and music. The empirical tendency of his thought is shown in his theory that the soul is related to the body as harmony to the parts of a musical instrument. We have no evidence as to the method by which he deduced this theory (cf. T. Gomperz, *Greek Thinkers*, Eng. trans. 1905, vol. iii. p. 43). In music he held that the notes of the scale are to be judged, not as the Pythagoreans held, by mathematical ratio, but by the ear. The only work of his that has come down to us is the three books of the *Elements of Harmony* (ῥυθμικὰ στοιχεῖα), an incomplete musical treatise. Grenfell and Hunt's *Oxyrhynchus Papyri* (vol. i., 1898) contains a five-column fragment of a treatise on metre, probably this treatise of Aristoxenus.

The best edition is by Paul Marquard, with German translation and full commentary, *Die harmonischen Fragmente des Aristoxenus* (Berlin, 1868). The fragments are also given in C. W. Müller, *Frag. Hist. Graec.*, ii. 269 sqq.; and R. Westphal, *Melik und Rhythmik d. klass. Hellenenthums* (2nd vol. edited by F. Saran, Leipzig, 1893). Eng. trans. by H. S. Macran (Oxford, 1902). See also W. L. Mahne, *Diatribe de Aristoxeno* (Amsterdam, 1793); B. Brill, *Aristoxenus' rhythmische und metrische Messungen* (1871); R. Westphal, *Griechische Rhythmik und Harmonik* (Leipzig, 1867); L. Laloy, *Aristoxène de Tarente et la musique de l'antiquité* (Paris, 1904). See PERIPATETICS, PYTHAGORAS (*Music*) and art. "Greek Music" in Grove's *Dict. of Music* (1904). For the Oxyrhynchus fragment see *Classical Review* (January 1898), and C. van Jan in Bursian's *Jahresbericht*, civ. (1901).

ARISUGAWA, the name of one of the royal families of Japan, going back to the seventh son of the mikado Go-Yozei (d. 1638). After the revolution of 1868, when the mikado Mutsu-hito was restored, his uncle, Prince Taruhito Arisugawa (1835–1895), became commander-in-chief, and in 1875 president of the senate.

After his suppression of the Satsuma rebellion he was made a field-marshal, and he was chief of the staff in the war with China (1894–95). His younger brother, Prince Takehito Arisugawa (b. 1862), was from 1879 to 1882 in the British navy, serving in the Channel Squadron, and studied at the Naval College, Greenwich. In the Chino-Japanese War of 1894–95 he was in command of a cruiser, and subsequently became admiral-superintendent at Yokosuka. Prince Arisugawa represented Japan in England together with Marquis Ito at the Diamond Jubilee (1897), and in 1905 was again received there as the king's guest.

ARITHMETIC (Gr. *ἀριθμητική, sc. τέχνη*, the art of counting, from *ἀριθμός*, number), the art of dealing with numerical quantities in their numerical relations.

1. Arithmetic is usually divided into *Abstract Arithmetic* and *Concrete Arithmetic*, the former dealing with numbers and the latter with concrete objects. This distinction, however, might be misleading. In stating that the sum of 11d. and 9d. is 1s. 8d. we do not mean that nine pennies when added to eleven pennies produce a shilling and eight pennies. The sum of money corresponding to 11d. may in fact be made up of coins in several different ways, so that the symbol "11d." cannot be taken as denoting any definite concrete objects. The arithmetical fact is that 11 and 9 may be regrouped as 12 and 8, and the statement "11d.+9d.=1s. 8d." is only an arithmetical statement in so far as each of the three expressions denotes a numerical quantity (§ 11).

2. The various stages in the study of arithmetic may be arranged in different ways, and the arrangement adopted must be influenced by the purpose in view. There are three main purposes, the practical, the educational, and the scientific; *i.e.* the subject may be studied with a view to technical skill in dealing with the arithmetical problems that arise in actual life, or for the sake of its general influence on mental development, or as an elementary stage in mathematical study.

3. The practical aspect is an important one. The daily activities of the great mass of the adult population, in countries where commodities are sold at definite prices for definite quantities, include calculations which have often to be performed rapidly, on data orally given, and leading in general to results which can only be approximate; and almost every branch of manufacture or commerce has its own range of applications of arithmetic. Arithmetic as a school subject has been largely regarded from this point of view.

4. From the educational point of view, the value of arithmetic has usually been regarded as consisting in the stress it lays on accuracy. This aspect of the matter, however, belongs mainly to the period when arithmetic was studied almost entirely for commercial purposes; and even then accuracy was not found always to harmonize with actuality. The development of physical science has tended to emphasize an exactly opposite aspect, viz. the impossibility, outside a certain limited range of subjects, of ever obtaining absolute accuracy, and the consequent importance of not wasting time in attempting to obtain results beyond a certain degree of approximation.

5. As a branch of mathematics, arithmetic may be treated logically, psychologically, or historically. All these aspects are of importance to the teacher: the logical, in order that he may know the end which he seeks to attain; the psychological, that he may know how best to attain this end; and the historical, for the light that history throws on psychology.

The logical arrangement of the subject is not the best for elementary study. The division into abstract and concrete, for instance, is logical, if the former is taken as relating to number and the latter to numerical quantity (§ 11). But the result of a rigid application of this principle would be that the calculation of the cost of 3 ℔ of tea at 2s. a ℔ would be deferred until after the study of logarithms. The psychological treatment recognizes the fact that the concrete precedes the abstract and that the abstract is based on the concrete; and it also recognizes the futility of attempting a strictly continuous development of the subject.

On the other hand, logical analysis is necessary if the subject is to be understood. As an illustration, we may take the elementary processes of addition, subtraction, multiplication and division. These are still called in text-books the "four simple rules"; but this name ignores certain essential differences. (i) If we consider that we are dealing with numerical quantities, we must recognize the fact that, while addition and subtraction might in the first instance be limited to such quantities, multiplication and division necessarily introduce the idea of pure number. (ii) If on the other hand we regard ourselves as dealing with pure number throughout, then, as multiplication is continued addition, we ought to include in our classification involution as continued multiplication. Or we might say that, since multiplication is a form of addition, and division a form of subtraction, there are really only two fundamental processes, viz. addition and subtraction. (iii) The inclusion of the four processes under one general head fails to indicate the essential difference between addition and multiplication, as direct processes, on the one hand, and subtraction and division, as inverse processes, on the other (§ 59).

6. The present article deals mainly with the principles of the subject, for which a logical arrangement is on the whole the more convenient. It is not suggested that this is the proper order to be adopted by the teacher.

I. Number

7. *Ordinal and Cardinal Numbers.*—One of the primary distinctions in the use of number is between ordinal and cardinal numbers, or rather between the ordinal and the cardinal aspects of number. The usual statement is that *one, two, three,* . . . are cardinal numbers, and *first, second, third,* . . . are ordinal numbers. This, however, is an incomplete statement; the words one, two, three, . . . and the corresponding symbols 1, 2, 3, . . . or I, II, III, . . . are used sometimes as ordinals, *i.e.* to denote the place of an individual in a series, and sometimes as cardinals, *i.e.* to denote the total number since the commencement of the series.

On the whole, the ordinal use is perhaps the more common. Thus "100" on a page of a book does not mean that the page is 100 times the page numbered 1, but merely that it is the page after 99. Even in commercial transactions, in dealing with sums of money, the statement of an amount often has reference to the last item added rather than to a total; and geometrical measurements are practically ordinal (§ 26).

For ordinal purposes we use, as symbols, not only figures, such as 1, 2, 3, . . . but also letters, as *a,b,c,* . . . Thus the pages of a book may be numbered 1, 2, 3, . . . and the chapters I, II, III, . . . but the sheets are lettered A, B, C, ... Figures and letters may even be used in combination; thus 16 may be followed by 16*a* and 16*b*, and these by 17, and in such a case the ordinal 100 does not correspond with the total (cardinal) number up to this point.

Arithmetic is supposed to deal with cardinal, not with ordinal numbers; but it will be found that actual numeration, beyond about three or four, is based on the ordinal aspect of number, and that a scientific treatment of the subject usually requires a return to this fundamental basis.

One difference between the treatment of ordinal and of cardinal numbers may be noted. Where a number is expressed in terms of various denominations, a cardinal number usually begins with the largest denomination, and an ordinal number with the smallest. Thus we speak of one thousand eight hundred and seventy-six, and represent it by MDCCCLXXVI or 1876; but we should speak of the third day of August 1876, and represent it by 3. 8. 1876. It might appear as if the writing of 1876 was an exception to this rule; but in reality 1876, when used in this way, is partly cardinal and partly ordinal, the first three figures being cardinal and the last ordinal. To make the year completely ordinal, we should have to describe it as the 6th year of the 8th decade of the 9th century of the 2nd millennium; *i.e.* we should represent the date by 3. 8. 6. 8. 9. 2, the total number of years, months and days completed being 1875. 7. 2.

In using an ordinal we direct our attention to a term of a series, while in using a cardinal we direct our attention to the interval between two terms. The total number in the series is the sum of the two cardinal numbers obtained by counting up to any interval from the beginning and from the end respectively; but if we take the ordinal numbers from the beginning and from the end we count one term twice over. Hence, if there are 365 days in a year, the 100th day from the beginning is the 266th, not the 265th, from the end.

8. *Meaning of Names of Numbers.*—What do we mean by any particular number, *e.g.* by *seven*, or by *two hundred and fifty-three?* We can define *two* as *one and one*, and *three* as *one and one and one;* but we obviously cannot continue this method for ever. For the definition of large numbers we may employ either of two methods, which will be called the *grouping* method and the *counting* method.

(i) *Method of Grouping.*—The first method consists in defining the first few numbers, and forming larger numbers by groups or aggregates, formed partly by multiplication and partly by addition. Thus, on the denary system (§ 16) we can give independent definitions to the numbers up to ten, and then regard (*e.g.*) fifty-three as a composite number made up of five tens and three ones. Or, on the quinary-binary system, we need only give independent definitions to the numbers up to five; the numbers *six, seven*,. . . can then be regarded as *five and one*, *five and two*, . . . , a fresh series being started when we get to *five and five* or *ten*. The grouping method introduces multiplication into the definition of large numbers; but this, from the teacher's point of view, is not now such a serious objection as it was in the days when children were introduced to millions and billions before they had any idea of elementary arithmetical processes.

(ii) *Method of Counting.*—The second method consists in taking a series of names or symbols for the first few numbers, and then repeating these according to a regular system for successive numbers, so that each number is defined by reference to the number immediately preceding it in the series. Thus *two* still means *one and one*, but *three* means *two and one*, not *one and one and one*. Similarly *two hundred and fifty-three* does not mean two hundreds, five tens and three ones, but *one* more than *two hundred and fifty-two;* and the number which is called one hundred is not defined as ten tens, but as one more than ninety-nine.

9. *Concrete and Abstract Numbers.*—Number is concrete or abstract according as it does or does not relate to particular objects. On the whole, the grouping method refers mainly to concrete numbers and the counting method to abstract numbers. If we sort objects into groups of ten, and find that there are five groups of ten with three over, we regard the five and the three as names for the actual sets of groups or of individuals. The three, for instance, are regarded as a whole when we name them *three*. If, however, we count these three as one, two, three, then the number of times we count is an abstract number. Thus number in the abstract is the number of times that the act of counting is performed in any particular case. This, however, is a description, not a definition, and we still want a definition for "number" in the phrase "number of times."

10. *Definition of "Number."*—Suppose we fix on a certain sequence of names "one," "two," "three," . . . , or symbols such as 1, 2, 3, . . . ; this sequence being always the same. If we take a set of concrete objects, and name them in succession "one," "two," "three," . . . , naming each once and once only, we shall not get beyond a certain name, *e.g.* "six." Then, in saying that the number of objects is six, what we mean is that the name of the last object named is six. We therefore only require a definite law for the formation of the successive names or symbols. The symbols 1, 2, . . . 9, 10, . . . , for instance, are formed according to a definite law; and in giving 253 as the *number* of a set of objects we mean that if we attach to them the symbols 1, 2, 3, . . . in succession, according to this law, the symbol attached to the last object will be 253. If we say that this act of attaching a symbol has been performed 253 times, then 253 is an *abstract* (or *pure*) *number*.

Underlying this definition is a certain assumption, viz. that if we take the objects in a different order, the last symbol attached will still be 253. This, in an elementary treatment of the subject, must be regarded as axiomatic; but it is really a simple case of mathematical induction. (See ALGEBRA.) If we take two objects A and B, it is obvious that whether we take them as A, B, or as B, A, we shall in each case get the sequence 1, 2. Suppose this were true for, say, eight objects, marked 1 to 8. Then, if we introduce another object anywhere in the series, all those coming after it will be displaced so that each will have the mark formerly attached to the next following; and the last will therefore be 9 instead of 8. This is true, whatever the arrangement of the original objects may be, and wherever the new one is introduced; and therefore, if the theorem is true for 8, it is true for 9. But it is true for 2; therefore it is true for 3; therefore for 4, and so on.

11. *Numerical Quantities.*— If the term *number* is confined to number in the abstract, then number in the concrete may be described as *numerical quantity*. Thus £3 denotes £1 taken 3 times. The £1 is termed the *unit*. A numerical quantity, therefore, represents a certain *unit*, taken a certain *number of times*. If we take £3 twice, we get £6; and if we take 3s. twice, we get 6s., *i.e.* 6 times 1s. Thus arithmetical processes deal with numerical quantities by dealing with numbers, provided the unit is the same throughout. If we retain the unit, the arithmetic is concrete; if we ignore it, the arithmetic is abstract. But in the latter case it must always be understood that there is some unit concerned, and the results have no meaning until the unit is reintroduced.

II. NOTATION, NUMERATION AND NUMBER-IDEATION

12. *Terms used.*—The representation of numbers by spoken sounds is called *numeration;* their representation by written signs is called *notation*. The systems adopted for numeration and for notation do not always agree with one another; nor do they always correspond with the idea which the numbers subjectively present. This latter presentation may, in the absence of any accepted term, be called *number-ideation;* this word covering not only the perception or recognition of particular numbers, but also the formation of a number-concept.

13. *Notation of Numbers.*—The system which is now almost universally in use amongst civilized nations for representing cardinal numbers is the Hindu, sometimes incorrectly called the Arabic, system. The essential features which distinguish this from other systems are (1) the limitation of the number of different symbols, only ten being used, however large the number to be represented may be; (2) the use of the *zero* to indicate the absence of number; and (3) the principle of local value, by which a symbol in effect represents different numbers, according to its position. The symbols denoting a number are called its *digits*.

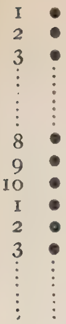
A brief account of the development of the system will be found under NUMERAL. Here we are concerned with the principle, the explanation of which is different according as we proceed on the grouping or the counting system.

(i) On the grouping system we may in the first instance consider that we have separate symbols for numbers from "one" to "nine," but that when we reach ten objects we put them in a group and denote this group by the symbol used for "one," but printed in a different type or written of a different size or (in teaching) of a different colour. Similarly when we get to ten tens we denote them by a new representation of the figure denoting one. Thus we may have:

ones	1	2	3	4	5	6	7	8	9
tens	1	2	3	4	5	6	7	8	9
hundreds,	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
&c.			&c.			&c.			

On this principle 24 would represent twenty-four, 24 two hundred and forty, and **24** two hundred and four. To prevent confusion the *zero* or "nought" is introduced, so that the successive figures, beginning from the right, may represent ones, tens, hundreds, . . . We then have, *e.g.*, 240 to denote two hundreds and four tens; and we may now adopt a uniform type for all the figures, writing this 240.

(ii) On the counting system we may consider that we have a series of objects (represented in the adjoining diagram by dots), and that we attach to these objects in succession the symbols 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, repeating this series indefinitely. There is as yet no distinction between the first object marked 1 and the second object marked 1. We can, however, attach to the 0's the same symbols, 1, 2, . . . 0 in succession, in a separate column, repeating the series indefinitely; then do the same with every 0 of this new series; and so on. Any particular object is then defined completely by the combination of the symbols last written down in each series; and this combination of symbols can equally be used to denote the number of objects up to and including the last one (§ 10).



In writing down a number in excess of 1000 it is (except where the number represents a particular year) usual in England and America to group the figures in sets of three, starting from the right, and to mark off the sets by commas. On the continent of Europe the figures are taken in sets of three, but are merely spaced, the comma being used at the end of a number to denote the commencement of a decimal.

The zero, called "nought," is of course a different thing from the letter O of the alphabet, but there may be a historical connexion between them (§ 79). It is perhaps interesting to note that the latter-day telephone operator calls 1907 "nineteen O seven" instead of "nineteen nought seven."

14. *Direction of the Number-Series.*—There is no settled convention as to the direction in which the series of symbols denoting the successive numbers one, two, three, . . . is to be written.

(i) If the numbers were written down in succession, they would naturally proceed from left to right, thus:—1, 2, 3, . . . This system, however, would require that in passing to "double figures" the figure denoting tens should be written either above or below the figure denoting ones, *e.g.*

$$1, 2, \ldots, 8, 9, \overset{1}{0}, 1, 2, \ldots \text{ or } 1, 2, \ldots, 8, 9, \underset{1}{0}, 1, 2, \ldots$$

The placing of the tens-figure to the left of the ones-figure will not seem natural unless the number-series runs either up or down.

(ii) In writing down any particular number, the successive powers of ten are written from right to left, *e.g.* 5,462,198 is

$$\overset{(6)}{5}\quad\overset{(5)}{4}\quad\overset{(4)}{6}\quad\overset{(3)}{2}\quad\overset{(2)}{1}\quad\overset{(1)}{9}\quad\overset{(0)}{8}$$

the small figures in brackets indicating the successive powers. On the other hand, in writing decimals, the sequence (of negative powers) is from left to right.

(iii) In making out lists, schedules, mathematical tables (*e.g.* a multiplication-table), statistical tables, &c., the numbers are written vertically downwards. In the case of lists and schedules the numbers are only ordinals; but in the case of mathematical or statistical tables they are usually regarded as cardinals, though, when they represent values of a continuous quantity, they must be regarded as ordinals (§§ 26, 93).

(iv) In graphic representation measurements are usually made upwards; the adoption of this direction resting on certain deeply rooted ideas (§ 23).

This question of direction is of importance in reference to the development of useful number-forms (§ 23); and the existence of the two methods mentioned under (iii) and (iv) above produces confusion in comparing numerical tabulation with graphical representation. It is generally accepted that the horizontal direction of increase, where a horizontal direction is necessary, should be from left to right; but uniformity as regards vertical direction could only be attained either by printing mathematical tables upwards or by taking "downwards," instead of "upwards," as the "positive" direction for graphical purposes.

The downwards direction will be taken in this article as the normal one for succession of numbers (*e.g.* in multiplication), and, where the arrangement is horizontal, it is to be understood that this is for convenience of printing. It should be noticed that, in writing the components of a number 253 as 200, 50 and 3, each component beneath the next larger one, we are really adopting the downwards principle, since the figures which make up 253 will on this principle be successively 2, 5 and 3 (§ 13 (ii)).

$$\begin{array}{r} 200 \\ 50 \\ 3 \\ \hline 253 \\ \hline\hline \end{array}$$

15. *Roman Numerals.*—Although the Roman numerals are no longer in use for representing cardinal numbers, except in certain special cases (*e.g.* clock-faces, milestones and chemists' prescriptions), they are still used for ordinals.

The system differs completely from the Hindu system. There are no single symbols for two, three, &c.; but numbers are represented by combinations of symbols for one, five, ten, fifty, one hundred, five hundred, &c., the numbers which have single symbols, viz. I, V, X, L, C, D, M, proceeding by multiples of five and two alternately. Thus 1878 is MDCCCLXXVIII, *i.e.* thousand five-hundred hundred hundred hundred fifty ten ten five one one one.

The system is therefore essentially a cardinal and grouping one, *i.e.* it represents a number as the sum of sets of other numbers. It is therefore remarkable that it should now only be used for ordinal purposes, while the Hindu system, which is ordinal in its nature, since a single series is constantly repeated, is used almost exclusively for cardinal numbers. This fact seems to illustrate the truth that the counting principle is the fundamental one, to which the interpretation of grouped numbers must ultimately be referred.

The normal process of writing the larger numbers on the left is in certain cases modified in the Roman system by writing a number in front of a larger one to denote subtraction. Thus *four*, originally written IIII, was later written IV. This may have been due to one or both of two causes; a primitive tendency to refer numbers, in numeration, to the nearest large number (§ 24 (iv)), and the difficulty of perceiving the number of a group of objects beyond about three (§ 22). Similarly IX, XL and XC were written for nine, forty and ninety respectively. These, however, were later developments.

16. *Scales of Notation.*—In the Hindu system the numbering proceeds by tens, tens of tens, &c.; thus the figure in the fifth place, counting from the right, denotes the product of the corresponding number by four tens in succession. The notation is then said to be in the *scale* of which ten is the *base*, or in the *denary scale.* The Roman system, except for the use of symbols for five, fifty, &c., is also in the denary scale, though expressed in a different way. The introduction of these other symbols produces a compound scale, which may be called a *quinary-binary*, or, less correctly, a *quinary-denary* scale.

The figures used in the Hindu notation might be used to express numbers in any other scale than the denary, provided new symbols were introduced if the base of the scale exceeded ten. Thus 1878 in the *quinary-binary* scale would be 1131213, and 1828 would be 1130213; the meaning of these is seen at once by comparison with MDCCCLXXVIII and MDCCCXXVIII. Similarly the number which in the denary scale is 215 would in the quaternary scale (base 4) be 3113, being equal to $3.4.4.4+1.4.4+1.4+3$.

The use of the denary scale in notation is due to its use in numeration (§ 18); this again being due (as exemplified by the use of the word *digit*) to the primitive use of the fingers for counting. If mankind had had six fingers on each hand and six toes on each foot, we should be using a *duodenary scale* (base twelve), which would have been far more convenient.

17. *Notation of Numerical Quantities.*—Over a large part of the civilized world the introduction of the metric system (§ 118) has caused the notation of all numerical quantities to be in the denary scale. In Great Britain and her colonies, however, and in the United States, other systems of notation still survive, though there is none which is consistently in one scale, other than the denary. The method is to form quantities into groups, and these again into larger groups; but the number of groups making one of the next largest groups varies as we proceed along the scale. The successive groups or units thus formed are called *denominations.* Thus twelve pennies make a shilling, and twenty shillings a pound, while the penny is itself divided into four farthings (or

two halfpennies). There are, therefore, four denominations, the bases for conversion of one denomination into the next being successively four (or two), twelve and twenty. Within each denomination, however, the denary notation is employed exclusively, *e.g.* "twelve shillings" is denoted by 12s.

The diversity of scales appears to be due mainly to four causes: (i) the tendency to group into scores (§ 20); (ii) the tendency to subdivide into twelve; (iii) the tendency to subdivide into two or four, with repetitions, making subdivision into sixteen or sixty-four; and (iv) the independent adoption of different units for measuring the same kind of magnitude.

Where there is a division into sixteen parts, a binary scale may be formed by dividing into groups of two, four or eight. Thus the weights ordinarily in use for measuring from $\frac{1}{4}$ oz. up to 2 lb give the basis for a binary scale up to not more than eight figures, only 0 and 1 being used. The points of the compass might similarly be expressed by numbers in a binary scale; but the numbers would be ordinal, and the expressions would be analogous to those of decimals rather than to those of whole numbers.

In order to apply arithmetical processes to a quantity expressed in two or more denominations, we must first express it in terms of a single denomination by means of a varying scale of notation. Thus £254, 13s. 6d. may be written $£254 \overset{(20)}{''}\ 13\text{s.} \overset{(12)}{''}\ 6\text{d.}$; each of the numbers in brackets indicating the number of units in one denomination that go to form a unit in the next higher denomination. To express the quantity in terms of £, it ought to be written $£254 \overset{(20)}{''}\ 13 \overset{(12)}{''}\ 6$; this would mean $£254\,\frac{13\frac{6}{12}}{20}$ or $£(254+\frac{13}{20}+\frac{6}{20\cdot 12})$, and therefore would involve a fractional number.

A quantity expressed in two or more denominations is usually called a *compound number* or *compound quantity*. The former term is obviously incorrect, since a quantity is not a number; and the latter is not very suggestive. For agreement with the terminology of fractional numbers (§ 62) we shall describe such a quantity as a *mixed quantity*. The letters or symbols descriptive of each denomination are usually placed after or (in actual calculations) above the figures denoting the numbers of the corresponding units; but in a few cases, *e.g.* in the case of £, the symbol is placed before the figures. There would be great convenience in a general adoption of this latter method; the combination of the two methods in such an expression as £123, 16s. $4\frac{1}{2}$d. is especially awkward.

18. *Numeration.*—The names of numbers are almost wholly based on the denary scale; thus eighteen means eight and ten, and twenty-four means twice ten and four. The words *eleven* and *twelve* have been supposed to suggest etymologically a denary basis (see, however, NUMERAL).

Two exceptions, however, may be noted.

(i) The use of *dozen*, *gross* (=dozen dozen), and *great gross* (=dozen gross) indicates an attempt at a duodenary basis. But the system has never spread; and the word "dozen" itself is based on the denary scale.

(ii) The *score* (twenty) has been used as a basis, but to an even more limited extent. There is no essential difference, however, between this and the denary basis. As the latter is due to finger-reckoning, so the use of the fingers and the toes produced a vigesimal scale. Examples of this are given in § 20; it is worthy of notice that the vigesimal (or, rather, quinary-quaternary) system was used by the Mayas of Yucatan, and also, in a more perfect form, by the Nahuatl (Aztecs) of Mexico.

The number ten having been taken as the basis of numeration, there are various methods that might consistently be adopted for naming large numbers.

(i) We might merely name the figures contained in the number. This method is often adopted in practical life, even as regards mixed quantities; thus £57,593, 16s. 4d. would be read as *five seven, five nine three, sixteen and four pence.*

(ii) The word *ten* might be introduced, *e.g.* 593 would be *five ten ten ninety* (=nine ten) *and three.*

(iii) Names might be given to the successive powers of ten, up to the point to which numeration of ones is likely to go. Partial applications of this method are found in many languages.

(iv) A compromise between the last two methods would be to have names for the series of numbers, beginning with ten, each of which is the "square" of the preceding one. This would in effect be analysing numbers into components of the form $a.\,10^b$ where a is less than 10, and the index b is expressed in the binary scale, *e.g.* 7,000,000 would be $7.10^4.10^2$, and 700,000 would be $7.10^4.10^1$.

The British method is a mixture of the last two, but with an index-scale which is partly ternary and partly binary. There are separate names for ten, ten times ten (=*hundred*), and ten times ten times ten (=*thousand*); but the next single name is *million*, representing a thousand times a thousand. The next name is *billion*, which in Great Britain properly means a million million, and in the United States (as in France) a thousand million.

19. *Discrepancies between Numeration and Notation.*—Although numeration and notation are both ostensibly on the denary system, they are not always exactly parallel. The following are a few of the discrepancies.

(i) A set of written symbols is sometimes read in more than one way, while on the other hand two different sets of symbols (at any rate if denoting numerical quantities) may be read in the same way. Thus 1820 might be read as *one thousand eight hundred and twenty* if it represented a number of men, but it would be read as *eighteen hundred and twenty* if it represented a year of the Christian era; while 1s. 6d. and 18d. might both be read as *eighteenpence.* As regards the first of these two examples, however, it would be more correct to write 1,820 for the former of the two meanings (cf. § 13).

(ii) The symbols 11 and 12 are read as *eleven* and *twelve*, not (except in elementary teaching) as *ten-one* and *ten-two.*

(iii) The names of the numbers next following these, up to 19 inclusive, only faintly suggest a *ten.* This difficulty is not always recognized by teachers, who forget that they themselves had to be told that *eighteen* means *eight-and-ten.*

(iv) Even beyond twenty, up to a hundred, the word *ten* is not used in numeration, *e.g.* we say *thirty-four*, not *three ten four.*

(v) The rule that the greater number comes first is not universally observed in numeration. It is not observed, for instance, in the names of numbers from 13 to 19; nor was it in the names from which *eleven* and *twelve* are derived. Beyond twenty it is usually, but not always, observed; we sometimes instead of *twenty-four* say *four and twenty.* (This latter is the universal system in German, up to 100, and for any portion of 100 in numbers beyond 100.)

20. *Other Methods of Numeration and Notation.*—It is only possible here to make a brief mention of systems other than those now ordinarily in use.

(i) *Vigesimal Scale.*—The system of counting by twenties instead of by tens has existed in many countries; and, though there is no corresponding notation, it still exhibits itself in the names of numbers. This is the case, for instance, in the Celtic languages; and the Breton or Gaulish names have affected the Latin system, so that the French names for some numbers are on the vigesimal system. This system also appears in the Danish numerals. In English the use of the word *score* to represent twenty—*e.g.* in "threescore and ten" for seventy—is superimposed on the denary system, and has never formed an essential part of the language. The word, like *dozen* and *couple*, is still in use, but rather in a vague than in a precise sense.

(ii) *Roman System.*—The Roman notation has been explained above (§ 15). Though convenient for exhibiting the composition of any particular number, it was inconvenient for purposes of calculation; and in fact calculation was entirely (or almost entirely) performed by means of the abacus (*q.v.*). The numeration was in the denary scale, so that it did not agree absolutely with the notation. The principle of subtraction from a higher number, which appeared in notation, also appeared in numeration, but not for exactly the same numbers or in exactly the same way; thus XVIII was two-from-twenty, and the next number was one-from-twenty, but it was written XIX, not IXX.

(iii) *Other Systems of Antiquity.*—The Egyptian notation was purely denary, the only separate signs being those for 1, 10, 100, &c. The ordinary notation of the Babylonians was denary, but they also used a sexagesimal scale, *i.e.* a scale whose base was 60. The Hebrews had a notation containing separate signs (the letters of the alphabet) for numbers from 1 to 10, then for multiples of 10 up to 100, and then for multiples of 100 up to 400, and later up to 1000.

The earliest Greek system of notation was similar to the Roman, except that the symbols for 50, 500, &c., were more complicated. Later, a system similar to the Hebrew was adopted, and extended by reproducing the first nine symbols of the series, preceded by accents, to denote multiplication by 1000.

On the island of Ceylon there still exists, or existed till recently, a system which combines some of the characteristics of the later Greek (or Semitic) and the modern European notation; and it is conjectured that this was the original Hindu system.

For a further account of the above systems see NUMERAL, and the authorities quoted at the end of the present article.

21. *The Number-Concept.*—It is probable that very few people have any definite mental presentation of individual numbers (*i.e.* numbers proceeding by differences of *one*) beyond 100, or at any rate beyond 144. Larger numbers are grasped by forming numbers into groups or by treating some large number as a unit. A person would appreciate the difference between 93,000,000 m. and 94,000,000 m. as the distance of the centre of the sun from the centre of the earth at a particular moment; but he certainly would not appreciate the relative difference between 93,000,000 m. and 93,000 001 m. In order to get an idea of 93,000,000, he must take a million as his unit. Similarly, in the metric system he cannot mentally compare two units, one of which is 1000 times the other. The metre and the kilometre, for instance, or the metre and the millimetre, are not directly comparable; but the metre can be conceived as containing 100 centimetres.

On the other hand, it would seem that, for most educated people, sixteen and seventeen or twenty-six and twenty-seven, and even eighty-six and eighty-seven, are single numbers, just as six and seven are, and are not made up of groups of tens and ones. In other words, the denary scale, though adopted in notation and in numeration, does not arise in the corresponding mental concept until we get beyond 100.

Again, in the use of decimals, it is unusual to give less than two figures. Thus 3·142 or 3·14 would be quite intelligible; but 3·1 does not convey such a good idea to most people as either $3\frac{1}{10}$ or 3·10, *i.e.* as an expression denoting a fraction or a percentage.

There appears therefore to be a tendency to use some larger number than ten as a basis for grouping into new units or for subdivision into parts. The Babylonians adopted 60 for both these purposes, thus giving us the sexagesimal division of angles and of time.

This view is supported, not only by the intelligibility of percentages to ordinary persons, but also by the tendency, noted above (§ 19), to group years into centuries, and to avoid the use of thousands. Thus 1876 is not 1 thousand, 8 hundred, 7 tens and 6, but 18 hundred and 76, each of the numbers 18 and 76 being named as if it were a single number. It is also in accordance with what is so far known about number-forms (§ 23).

If there is this tendency to adopt 100 as a basis instead of 10, the teaching of decimals might sometimes be simplified by proceeding from percentages to percentages of percentages, *i.e.* by commencing with *centesimals* instead of with *decimals.*

22. *Perception of Number.*—In using material objects as a basis for developing the number-concept, it must be remembered that it is only when there are a few objects that their number can be perceived without either counting or the performance of some arithmetical process such as addition. If four coins are laid on a table, close together, they can (by most adults) be seen to be four, without counting; but seven coins have to be separated mentally into two groups, the numbers of which are added, or one group has to be seen and the remaining objects counted, before the number is known to be seven.

The actual limit of the number that can be "seen"—*i.e.* seen without counting or adding—depends for any individual on the shape and arrangement of the objects, but under similar conditions it is not the same for all individuals. It has been suggested that as many as six objects can be seen at once; but this is probably only the case with few people, and with them only when the objects have a certain geometrical arrangement. The limit for most adults, under favourable conditions, is about four. Under certain conditions it is less; thus IIII, the old Roman notation for *four,* is difficult to distinguish from III, and this may have been the main reason for replacing it by IV (§ 15).

In the case of young children the limit is probably two. That this was also the limit in the case of primitive races, and that the classification of things was into one, two and many, before any definite process of counting (*e.g.* by the fingers) came to be adopted, is clear from the use of the "dual number" in language, and from the way in which the names for three and four are often based on those for one and two. With the individual, as with the race, the limit of the number that can be seen gradually increases up to four or five.

The statement that a number of objects can be seen to be three or four is not to be taken as implying that there is a simultaneous perception of all the objects. The attention may be directed in succession to the different objects, so that the perception is rhythmical; the distinctive rhythm thus aiding the perception of the particular number.

In consequence of this limitation of the power of perception of number, it is practically impossible to use a pure denary scale in elementary number-teaching. If a quinary-binary system (such as would naturally fit in with counting on the fingers) is not adopted, teachers unconsciously resort to a binary-quinary system. This is commonly done where cubes are used; thus seven is represented by three pairs of cubes, with a single cube at the top.

23. *Visualization of the Series.*—A striking fact, in reference to ideas of number, is the existence of number-forms, *i.e.* of definite arrangements, on an imagined plane or in space, of the mental representations of the successive numbers from 1 onwards. The proportion of persons in whom number-forms exist has been variously estimated; but there is reason to believe that the forms arise at a very early stage of childhood, and that they did at some time exist in many individuals who have afterwards forgotten them. Those persons who possess them are also apt to make spatial arrangements of days of the week or the month, months of the year, the letters of the alphabet, &c.; and it is practically certain that only children would make such arrangements of letters of the alphabet. The forms seem to result from a general tendency to visualization as an aid to memory; the letter-forms may in the first instance be quite as frequent as the number-forms, but they vanish in early childhood, being of no practical value, while the number-forms continue as an aid to arithmetical work.

The forms are varied, and have few points in common; but the following tendencies are indicated.

(i) In the majority of cases the numbers lie on a continuous (but possibly zigzag) line.

(ii) There is nearly always (at any rate in English cases) a break in direction at 12. From 1 to 12 the numbers sometimes lie in the circumference of a circle, an arrangement obviously suggested by a clock-face; in these cases the series usually mounts upwards from 12. In a large number of cases, however, the direction is steadily upwards from 1 to 12, then changing. In some cases the initial direction is from right to left or from left to right; but there are very few in which it is downwards.

(iii) The multiples of 10 are usually strongly marked; but special stress is also laid on other important numbers, *e.g.* the multiples of 12.

(iv) The series sometimes goes up to very high numbers, but sometimes stops at 100, or even earlier. It is not stated, in most cases, whether all the numbers within the limits of the series have definite positions, or whether there are only certain numbers which form an essential part of the figure, while others only exist potentially. Probably the latter is almost universally the case.

These forms are developed spontaneously, without suggestion from outside. The possibility of replacing them by a standard form, which could be utilized for performing arithmetical operations, is worthy of consideration; some of the difficulties in the way of standardization have already been indicated (§ 14). The general tendency to prefer an upward direction is important; and our current phraseology suggests that this is the direction which increase is naturally regarded as taking. Thus we speak of counting *up* to a certain number; and similarly mathematicians speak of *high* and *ascending* powers, while engineers speak of high pressure, high speed, high power, &c. This tendency is probably aided by the use of bricks or cubes in elementary number-teaching.

24. *Primitive Ideas of Number.*—The names of numbers give an idea of the way in which the idea of number has developed. Where civilization is at all advanced, there are usually certain names, the origin of which cannot be traced; but, as we go farther back, these become fewer, and the names are found to be composed on certain systems. The systems are varied, and it is impossible to lay down any absolute laws, but the following seem to be the main conclusions.

(i) Amongst some of the lowest tribes, as (with a few exceptions) amongst animals, the only differentiation is between one and many, or between one, two and many, or between one, two, three and many. As it becomes necessary to use higher but still small numbers, they are formed by combinations of one and two, or perhaps of three with one or two. Thus many of the Australasian and South American tribes use only one and two; seven, for instance, would be two two two one.

(ii) Beyond ten, and in many cases beyond five, the names have reference to the use of the fingers, and sometimes of the toes, for counting; and the scale may be quinary, denary or vigesimal, according as one hand, the pair of hands, or the hands and feet, are taken as the new unit. *Five* may be signified by the word for hand; and either *ten* or *twenty* by the word for *man*. Or the words signifying these numbers may have reference to the completion of some act of counting. Between five and ten, or beyond ten, the names may be due to combinations, *e.g.* 16 may be 10+5+1; or they may be the actual names of the fingers last counted.

(iii) There are a few, but only a few, cases in which the number 6 or 8 is named as twice 3 or twice 4; and there are also a few cases in which 7, 8 and 9 are named as 6+1, 6+2 and 6+3. In the large majority of cases the numbers 6, 7, 8 and 9 are 5+1, 5+2, 5+3 and 5+4, being named either directly from their composition in this way or as the fingers on the second hand.

(iv) There is a certain tendency to name 4, 9, 14 and 19 as being one short of 5, 10, 15 and 20 respectively; the principle being thus the same as that of the Roman IV, IX, &c. It is possible that at an early stage the number of the fingers on one hand or on the two hands together was only thought of vaguely as a large number in comparison with 2 or 3, and that the number did not attain definiteness until it was linked up with the smaller by insertion of the intermediate ones; and the linking up might take place in both directions.

(v) In a few cases the names of certain small numbers are the names of objects which present these numbers in some conspicuous way. Thus the word used by the Abipones to denote 5 was the name of a certain hide of five colours. It has been suggested that names of this kind may have been the origin of the numeral words of different races; but it is improbable that direct visual perception would lead to a name for a number unless a name based on a process of counting had previously been given to it.

25. *Growth of the Number-Concept.*—The general principle that the development of the individual follows the development of the race holds good to a certain extent in the case of the number-concept, but it is modified by the existence of language dealing with concepts which are beyond the reach of the child, and also, of course, by the direct attempts at instruction. One result is the formation of a number-series as a mere succession of names without any corresponding ideas of number; the series not being necessarily correct.

When numbering begins, the names of the successive numbers are attached to the individual objects; thus the numbers are originally ordinal, not cardinal.

The conception of number as cardinal, *i.e.* as something belonging to a group of objects as a whole, is a comparatively late one, and does not arise until the idea of a whole consisting of its parts has been formed. This is the *quantitative* aspect of number.

The development from the name-series to the quantitative conception is aided by the numbering of material objects and the performance of elementary processes of comparison, addition, &c., with them. It may also be aided, to a certain extent, by the tendency to find rhythms in sequences of sounds. This tendency is common in adults as well as in children; the strokes of a clock may, for instance, be grouped into fours, and thus eleven is represented as two fours and three. Finger-counting is of course natural to children, and leads to grouping into fives, and ultimately to an understanding of the denary system of notation.

26. *Representation of Geometrical Magnitude by Number.*—The application of arithmetical methods to geometrical measurement presents some difficulty. In reality there is a transition from a cardinal to an ordinal system, but to an ordinal system which does not agree with the original ordinal system from which the cardinal system was derived. To see this, we may represent ordinal numbers by the ordinary numerals 1, 2, 3, . . . and cardinal numbers by the Roman I, II, III, . . . Then in the earliest stage each object counted is indivisible; either we are counting it as a whole, or we are not counting it at all. The symbols 1, 2, 3, . . . then refer to the individual objects, as in fig. 1; this is the primary ordinal stage. Figs. 2 and 3 represent the cardinal stage; fig. 2 showing how the I, II, III, . . . denote the successively larger groups of objects, while fig. 3 shows how the name II of the whole is determined by the name 2 of the last one counted.

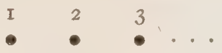


FIG. 1.

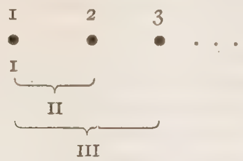


FIG. 2.

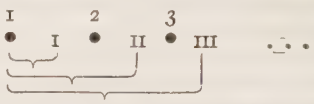


FIG. 3.

When now we pass to geometrical measurement, each "one" is a thing which is itself divisible, and it cannot be said that at any moment we are counting it; it is only when one is completed that we can count it. The names 1, 2, 3, . . . for the individual objects cease to have an intelligible meaning, and measurement is effected by the cardinal numbers I, II, III, . . . , as in fig. 4. These cardinal numbers have now, however, come to denote individual points in the line of measurement, *i.e.* the points of separation of the individual units of length. The point III in fig. 4 does not include the point II in the same way that the number III includes the number II in fig. 2, and the points must therefore be denoted by the ordinal numbers 1, 2, 3, . . . as in fig. 5, the zero 0 falling into its natural place immediately before the commencement of the first unit.

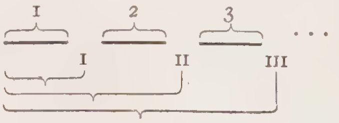


FIG. 4.

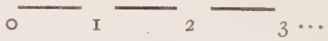


FIG. 5.

Thus, while arithmetical numbering refers to units, geometrical numbering does not refer to units but to the intervals between units.

III. ARITHMETIC OF INTEGRAL NUMBERS

(i.) *Preliminary*

27. *Equality and Identity.*—There is a certain difference between the use of words referring to equality and identity in

arithmetic and in algebra respectively; what is an *equality* in the former becoming an *identity* in the latter. Thus the statement that 4 times 3 is equal to 3 times 4, or, in abbreviated form, $4 \times 3 = 3 \times 4$ (§ 28), is a statement not of identity but of equality; *i.e.* 4×3 and 3×4 mean different things, but the operations which they denote produce the same result. But in algebra $a \times b = b \times a$ is called an identity, in the sense that it is true whatever a and b may be; while $n \times X = A$ is called an equation, as being true, when n and A are given, for one value only of X. Similarly the numbers represented by $\frac{6}{12}$ and $\frac{1}{2}$ are not identical, but are equal.

28. *Symbols of Operation.*— The failure to observe the distinction between an identity and an equality often leads to loose reasoning; and in order to prevent this it is important that definite meanings should be attached to all symbols of operation, and especially to those which represent elementary operations. The symbols − and ÷ mean respectively that the first quantity mentioned is to be reduced or divided by the second; but there is some vagueness about + and ×. In the present article $a+b$ will mean that a is taken first, and b added to it; but $a \times b$ will mean that b is taken first, and is then multiplied by a. In the case of numbers the × may be replaced by a dot; thus $4 \cdot 3$ means 4 times 3. When it is necessary to write the multiplicand before the multiplier, the symbol >< will be used, so that b><a will mean the same as $a \times b$.

29. *Axioms.*—There are certain statements that are sometimes regarded as axiomatic; *e.g.* that if equals are added to equals the results are equal, or that if A is greater than B then $A+X$ is greater than $B+X$. Such statements, however, are capable of logical proof, and are generalizations of results obtained empirically at an elementary stage; they therefore belong more properly to the laws of arithmetic (§ 58).

(ii.) *Sums and Differences.*

30. *Addition and Subtraction.* — *Addition* is the process of expressing (in numeration or notation) a whole, the parts of which have already been expressed; while, if a whole has been expressed and also a part or parts, *subtraction* is the process of expressing the remainder.

Except with very small numbers, addition and subtraction, on the grouping system, involve analysis and rearrangement. Thus the sum of 8 and 7 cannot be expressed as ones; we can either form the whole, and regroup it as 10 and 5, or we can split up the 7 into 2 and 5, and add the 2 to the 8 to form 10, thus getting $8+7=8+(2+5)=(8+2)+5=10+5=15$. For larger numbers the rearrangement is more extensive; thus $24+31=(20+4)+(30+1)=(20+30)+(4+1)=50+5=55$, the process being still more complicated when the ones together make more than ten. Similarly we cannot subtract 8 from 15, if 15 means 1 ten + 5 ones; we must either write $15-8=(10+5)-8=(10-8)+5=2+5=7$, or else resolve the 15 into an inexpressible number of ones, and then subtract 8 of them, leaving 7.

Numerical quantities, to be added or subtracted, must be in the same denomination; we cannot, for instance, add 55 shillings and 100 pence, any more than we can add 3 yards and 2 metres.

31. *Relative Position in the Series.*—The above method of dealing with addition and subtraction is synthetic, and is appropriate to the grouping method of dealing with number. We commence with processes, and see what they lead to; and thus get an idea of sums and differences. If we adopted the counting method, we should proceed in a different way, our method being analytic.

One number is less or greater than another, according as the symbol (or ordinal) of the former comes earlier or later than that of the latter in the number-series. Thus (writing ordinals in light type, and cardinals in heavy type) 9 comes after 4, and therefore **9** is greater than **4**. To find how much greater, we compare two series, in one of which we go up to 9, while in the other we stop at 4 and then recommence our counting. The series are shown below, the numbers being placed horizontally for convenience of printing, instead of vertically (§ 14):—

1	2	3	4	5	6	7	8	9
1	2	3	4	1	2	3	4	5

This exhibits **9** as the sum of **4** and **5**; it being understood that the sum of **4** and **5** means that we add **5** to **4**. That this gives the same result as adding **4** to **5** may be seen by reckoning the series backwards.

It is convenient to introduce the zero; thus

0	1	2	3	4	5	6	7	8	9
				0	1	2	3	4	5

indicates that after getting to 4 we make a fresh start from 4 as our zero.

To subtract, we may proceed in either of two ways. The subtraction of **4** from **9** may mean either "What has to be added to **4** in order to make up a total of **9**," or "To what has **4** to be added in order to make up a total of **9**." For the former meaning we count forwards, till we get to 4, and then make a new count, parallel with the continuation of the old series, and see at what number we arrive when we get to 9. This corresponds to the concrete method, in which we have **9** objects, take away **4** of them, and recount the remainder. The alternative method is to retrace the steps of addition, *i.e.* to count backwards, treating 9 of one (the standard) series as corresponding with 4 of the other, and finding which number of the former corresponds with 0 of the latter. This is a more advanced method, which leads easily to the idea of negative quantities, if the subtraction is such that we have to go behind the 0 of the standard series.

32. *Mixed Quantities.*—The application of the above principles, and of similar principles with regard to multiplication and division, to numerical quantities expressed in any of the diverse British denominations, presents no theoretical difficulty if the successive denominations are regarded as constituting a varying scale of notation (§17). Thus the expression 2 ft. 3 in. implies that in counting inches we use 0 to eleven instead of 0 to 9 as our first repeating series, so that we put down 1 for the next denomination when we get to twelve instead of when we get to ten. Similarly 3 yds. 2 ft. means

yds.	0			1			2			3		
ft.	0	1	2	0	1	2	0	1	2	0	1	2

The practical difficulty, of course, is that the addition of two numbers produces different results according to the scale in which we are for the moment proceeding; thus the sum of 9 and 8 is 17, 15, 13 or 11 according as we are dealing with shillings, pence, pounds (avoirdupois) or ounces. The difficulty may be minimized by using the notation explained in § 17.

(iii.) *Multiples, Submultiples and Quotients.*

33. *Multiplication* and *Division* are the names given to certain numerical processes which have to be performed in order to find the result of certain arithmetical operations. Each process may arise out of either of two distinct operations; but the terminology is based on the processes, not on the operations to which they belong, and the latter are not always clearly understood.

34. *Repetition and Subdivision.*—*Multiplication* occurs when a certain number or numerical quantity is treated as a *unit* (§ 11), and is taken a certain *number* of times. It therefore arises in one or other of two ways, according as the unit or the number exists first in consciousness. If pennies are arranged in groups of five, the total amounts arranged are successively once 5d., twice 5d., three times 5d., . . .; which are written 1×5d., 2×5d., 3×5d., . . . (§ 28). This process is *repetition*, and the quantities 1×5d., 2×5d., 3×5d., . . . are the successive *multiples* of 5d. If, on the other hand, we have a sum of 5s., and treat a shilling as being equivalent to twelve pence, the 5s. is equivalent to 5 × 12d.; here the multiplication arises out of a *subdivision* of the original unit 1s. into 12d.

Although multiplication may arise in either of these two ways, the actual process in each case is performed by commencing with the unit and taking it the necessary number of times. In the above case of subdivision, for instance, each of the 5 shillings is separately converted into pence, so that we do in fact find in succession once 12d., twice 12d., . . . ; *i.e.* we find the multiples of 12d. up to 5 times.

The result of the multiplication is called the *product* of the unit by the number of times it is taken.

35. *Diagram of Multiplication.*—The process of multiplication is performed in order to obtain such results as the following:—

If 1 boy receives 7 apples,
then 3 boys receive 21 apples;

or

If 1s. is equivalent to 12d.,
then 5s. is equivalent to 60d.

The essential portions of these statements, from the arithmetical point of view, may be exhibited in the form of the diagrams A and B:—

A

1 boy	7 apples
3 boys	21 apples

B

1s.	12d.
5s.	60d.

or more briefly, as in C or C′ and D or D′:—

C

1	7 apples
3	21 apples

C′

	7 apples
3	21 apples

D

1	12d.
5	60d.

D′

	12d.
5	60d.

the general arrangement of the diagram being as shown in E or E′:—

E

1	Unit
Number	Product

E′

	Unit
Number	Product

Multiplication is therefore equivalent to completion of the diagram by entry of the product.

36. *Multiple-Tables.*—The diagram C or D of § 35 is part of a complete table giving the successive multiples of the particular unit. If we take several different units, and write down their successive multiples in parallel columns, preceded by the number-series, we obtain a *multiple-table* such as the following:—

1	1	2	9	1s.	5d.	3 yds. 2 ft.	17359	.....
2	2	4	18	2s.	10d.	7 yds. 1 ft.	34718	.....
3	3	6	27	4s.	3d.	11 yds. 0 ft.	52077	.....
4	4	8	36	5s.	8d.	14 yds. 2 ft.	69436	.....
5	5	10	45	7s.	1d.	18 yds. 1 ft.	86795	.....
.	.	.	.	.		.	.	.....
.	.	.	.	.		.	.	.....
.	.	.	.	.		.	.	.....
.	.	.	.	.		.	.	.....

It is to be considered that each column may extend downwards indefinitely.

37. *Successive Multiplication.*—In multiplication by repetition the unit is itself usually a multiple of some other unit, *i.e.* it is a product which is taken as a new unit. When this new unit has been multiplied by a number, we can again take the product as a unit for the purpose of another multiplication; and so on indefinitely. Similarly where multiplication has arisen out of the subdivision of a unit into smaller units, we can again subdivide these smaller units. Thus we get successive multiplication; but it represents quite different operations according as it is due to repetition, in the sense of § 34, or to subdivision, and these operations will be exhibited by different diagrams. Of the two diagrams below, A exhibits the successive multiplication of £3 by 20, 12 and 4, and B the successive reduction of £3 to shillings, pence and farthings. The principle on which the diagrams are constructed is obvious from § 35. It should be noticed that in multiplying £3 by 20 we find the value of 20.3, but that in reducing £3 to shillings, since each £ becomes 20s., we find the value of 3.20.

A

		1	£3
	1	20	£60
1	12		£720
4			£2880

B

		1d.	4f.
	1s.	12d.	
£1	20s.		
£3	60s.	720d.	2880f.

38. *Submultiples.*—The relation of a unit to its successive multiples as shown in a multiple-table is expressed by saying that it is a submultiple of the multiples, the successive submultiples being *one-half*, *one-third*, *one-fourth*, . . . Thus, in the diagram of § 36, 1s. 5d. is one-half of 2s. 10d., one-third of 4s. 3d., one-fourth of 5s. 8d., . . . ; these being written "$\frac{1}{2}$ of 2s. 10d.," "$\frac{1}{3}$ of 4s. 3d.," "$\frac{1}{4}$ of 5s. 8d.," . . .

The relation of submultiple is the converse of that of multiple; thus if a is $\frac{1}{5}$ of b, then b is 5 times a. The determination of a submultiple is therefore equivalent to completion of the diagram E or E′ of § 35 by entry of the unit, when the number of times it is taken, and the product, are given. The operation is the converse or repetition; it is usually called *partition*, as representing division into a number of equal shares.

39. *Quotients.*—The converse of subdivision is the formation of units into groups, each constituting a larger unit; the number of the groups so formed out of a definite number of the original units is called a *quotient*. The determination of a quotient is equivalent to completion of the diagram by entry of the number when the unit and the product are given. There is no satisfactory name for the operation, as distinguished from partition; it is sometimes called *measuring*, but this implies an equality in the original units, which is not an essential feature of the operation.

40. *Division.*—From the commutative law for multiplication, which shows that 3×4d.=4×3d.=12d., it follows that the number of pence in one-fourth of 12d. is equal to the quotient when 12 pence are formed into units of 4d.; each of these numbers being said to be obtained by *dividing* 12 by 4. The term *division* is therefore used in text-books to describe the two processes described in §§ 38 and 39; the product mentioned in § 34 is the *dividend*, the number or the unit, whichever is given, is called the *divisor*, and the unit or number which is to be found is called the *quotient*. The symbol ÷ is used to denote both kinds of division; thus A ÷ n denotes the unit, n of which make up A, and A÷B denotes the number of times that B has to be taken to make up A. In the present article this confusion is avoided by writing the former as $\frac{1}{n}$ of A.

Methods of division are considered later (§§ 106-108).

41. *Diagrams of Division.*—Since we write from left to right or downwards, it may be convenient for division to interchange the rows or the columns of the multiplication-diagram. Thus the uncompleted diagram for partition is F or G, while for measuring it is usually H; the vacant compartment being for the unit in F or G, and for the number in H. In some cases it may be convenient in measuring to show both the units, as in K.

F

1	
Number	Product

G

Number	Product
1	

H

Unit	1
Product	

K

12d.	1s.
60d.	

42. *Successive Division* may be performed as the converse of successive multiplication. The diagrams A and B below are the converse (with a slight alteration) of the corresponding diagrams

in § 37; A representing the determination of $\frac{1}{20}$ of $\frac{1}{12}$ of $\frac{1}{4}$ of 2880 farthings, and B the conversion of 2880 farthings into £.

A

		4	2880f.
	12	1	720f.
20	1		60f.
1			3f.

B

		20s.	£1
	12d.	1s.	
4f.	1d.		
2880f.	720d.	60s.	£3

(iv.) *Properties of Numbers.*

(A) Properties not depending on the Scale of Notation.

43. *Powers, Roots and Logarithms.*—The standard series 1, 2, 3, . . . is obtained by successive additions of 1 to the number last found. If instead of commencing with 1 and making successive additions of 1 we commence with any number such as 3 and make successive multiplications by 3, we get a series 3, 9, 27, . . . as shown below the line in the margin. The first member of the series is 3; the second is the product of two numbers, each equal to 3; the third is the product of three numbers, each equal to 3; and so on. These are written 3^1 (or 3), 3^2, 3^3, 3^4, . . . where n^p denotes the product of p numbers, each equal to n. If we write $n^p = N$, then, if any two of the three numbers n, p, N are known, the third is determinate. If we know n and p, p is called the *index*, and n, n^2, . . . n^p are called the *first power*, *second power*, . . . *pth power* of n, the series itself being called the *power-series*. The *second power* and *third power* are usually called the *square* and *cube* respectively. If we know p and N, n is called the *pth root* of N, so that n is the *second* (or *square*) *root* of n^2, the *third* (or *cube*) *root* of n^3, the *fourth root* of n^4, . . . If we know n and N, then p is the *logarithm* of N to *base n*.

0	$1=3^0$		n^0
1	$3=3^1$		n^1
2	$9=3^2$		n^2
3	$27=3^3$		n^3
4	$81=3^4$		n^4
:	:	:	:
:	:	:	:

The calculation of powers (*i.e.* of N when n and p are given) is *involution*; the calculation of roots (*i.e.* of n when p and N are given) is *evolution*; the calculation of logarithms (*i.e.* of p when n and N are given) has no special name.

Involution is a direct process, consisting of successive multiplications; the other two are inverse processes. The calculation of a logarithm can be performed by successive divisions; evolution requires special methods.

The above definitions of logarithms, &c., relate to cases in which n and p are whole numbers, and are generalized later.

44. *Law of Indices.*—If we multiply n^p by n^q, we multiply the product of p n's by the product of q n's, and the result is therefore n^{p+q}. Similarly, if we divide n^p by n^q, where q is less than p, the result is n^{p-q}. Thus multiplication and division in the power-series correspond to addition and subtraction in the index-series, and vice versa.

If we divide n^p by n^p, the quotient is of course 1. This should be written n^0. Thus we may make the power-series commence with 1, if we make the index-series commence with 0. The added terms are shown above the line in the diagram in § 43.

45. *Factors, Primes and Prime Factors.*—If we take the successive multiples of 2, 3, . . . as in § 36, and place each multiple opposite the same number in the original series, we get an arrangement as in the adjoining diagram. If any number N occurs in the vertical series commencing with a number n (other than 1) then n is said to be a *factor* of N. Thus 2, 3 and 6 are factors of 6; and 2, 3, 4, 6 and 12 are factors of 12.

1	. .	. .	. .	. .	. .	. .	. .
2	2	. .	. .	. .	. .	. .	. .
3	. .	3	. .	. .	. .	. .	. .
4	4	. .	4	. .	. .	. .	. .
5	. .	. .	. .	5	. .	. .	. .
6	6	6	. .	. .	6	. .	. .
7	. .	. .	. .	. .	. .	7	. .
8	8	. .	8	. .	. .	. .	8
9	. .	9	. .	. .	. .	. .	. .
10	10	. .	. .	10	. .	. .	. .
11	. .	. .	. .	. .	. .	. .	. .
12	12	12	12	. .	12	. .	. .
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.

A number (other than 1) which has no factor except itself is called a *prime number*, or, more briefly, a *prime*. Thus 2, 3, 5, 7 and 11 are primes, for each of these occurs twice only in the table. A number (other than 1) which is not a prime number is called a *composite* number.

If a number is a factor of another number, it is a factor of any multiple of that number. Hence, if a number has factors, one at least of these must be a prime. Thus 12 has 6 for a factor; but 6 is not a prime, one of its factors being 2; and therefore 2 must also be a factor of 12. Dividing 12 by 2, we get a submultiple 6, which again has a prime 2 as a factor. Thus any number which is not itself a prime is the product of several factors, each of which is a prime, *e.g.* 12 is the product of 2, 2 and 3. These are called *prime factors*.

The following are the most important properties of numbers in reference to factors:—

(i) If a number is a factor of another number, it is a factor of any multiple of that number.

(ii) If a number is a factor of two numbers, it is a factor of their sum or (if they are unequal) of their difference. (The words in brackets are inserted to avoid the difficulty, at this stage, of saying that every number is a factor of 0, though it is of course true that $0.\ n = 0$, whatever n may be.)

(iii) A number can be resolved into prime factors in one way only, no account being taken of their relative order. Thus $12 = 2\times2\times3 = 2\times3\times2 = 3\times2\times2$, but this is regarded as one way only. If any prime occurs more than once, it is usual to write the number of times of occurrence as an index; thus $144 = 2\times2\times2\times2\times3\times3 = 2^4\ 3^2$.

The number 1 is usually included amongst the primes; but, if this is done, the last paragraph requires modification, since 144 could be expressed as $1.\ 2^4.\ 3^2$, or as $1^2.\ 2^4.\ 3^2$, or as $1^p.\ 2^4.\ 3^2$, where p might be anything.

If two numbers have no factor in common (except 1) each is said to be *prime to* the other.

The multiples of 2 (including 1.2) are called *even* numbers; other numbers are *odd* numbers.

46. *Greatest Common Divisor.*—If we resolve two numbers into their prime factors, we can find their *Greatest Common Divisor* or *Highest Common Factor* (written G.C.D. or G.C.F. or H.C.F.), *i.e.* the greatest number which is a factor of both. Thus $144 = 2^4.\ 3^2$, and $756 = 2^2.\ 3^3.\ 7$, and therefore the G.C.D. of 144 and 756 is $2^2.\ 3^2 = 36$. If we require the G.C.D. of two numbers, and cannot resolve them into their prime factors, we use a process described in the text-books. The process depends on (ii) of § 45, in the extended form that, if x is a factor of a and b, it is a factor of $pa-qb$, where p and q are any integers.

The G.C.D. of three or more numbers is found in the same way.

47. *Least Common Multiple.*—The *Least Common Multiple*, or L.C.M., of two numbers, is the least number of which they are both factors. Thus, since $144 = 2^4.\ 3^2$, and $756 = 2^2.\ 3^3.\ 7$, the L.C.M. of 144 and 756 is $2^4.\ 3^3.\ 7$. It is clear, from comparison with the last paragraph, that the product of the G.C.D. and the L.C.M. of two numbers is equal to the product of the numbers themselves. This gives a rule for finding the L.C.M. of two numbers. But we cannot apply it to finding the L.C.M. of three or more numbers; if we cannot resolve the numbers into their prime factors, we must find the L.C.M. of the first two, then the L.C.M. of this and the next number, and so on.

(B) Properties depending on the Scale of Notation.

48. *Tests of Divisibility.*—The following are the principal rules for testing whether particular numbers are factors of a given number. The number is divisible—

(i) by 10 if it ends in 0;

(ii) by 5 if it ends in 0 or 5;

(iii) by 2 if the last digit is even;

(iv) by 4 if the number made up of the last two digits is divisible by 4;

(v) by 8 if the number made up of the last three digits is divisible by 8;

(vi) by 9 if the sum of the digits is divisible by 9;

(vii) by 3 if the sum of the digits is divisible by 3;

(viii) by 11 if the difference between the sum of the 1st, 3rd, 5th, . . . digits and the sum of the 2nd, 4th, 6th, . . . is zero or divisible by 11.

(ix) To find whether a number is divisible by 7, 11 or 13, arrange the number in groups of three figures, beginning from the end, treat each group as a separate number, and then find the difference between the sum of the 1st, 3rd, . . . of these numbers and the sum of the 2nd, 4th, . . . Then, if this difference is zero or is divisible by 7, 11 or 13, the original number is also so divisible; and conversely. For example, 31521 gives 521−31 =490, and therefore is divisible by 7, but not by 11 or 13.

49. *Casting out Nines* is a process based on (vi) of the last paragraph. The remainder when a number is divided by 9 is equal to the remainder when the sum of its digits is divided by 9. Also, if the remainders when two numbers are divided by 9 are respectively a and b, the remainder when their product is divided by 9 is the same as the remainder when $a.b$ is divided by 9. This gives a rule for testing multiplication, which is found in most text-books. It is doubtful, however, whether such a rule, giving a test which is necessarily incomplete, is of much educational value.

(v.) *Relative Magnitude.*

50. *Fractions.*—A *fraction* of a quantity is a submultiple, or a multiple of a submultiple, of that quantity. Thus, since 3×1s. 5d.=4s. 3d., 1s. 5d. may be denoted by $\frac{1}{3}$ of 4s. 3d.; and any multiple of 1s. 5d., denoted by n×1s. 5d., may also be denoted by $\frac{n}{3}$ of 4s. 3d. We therefore use "$\frac{n}{a}$ of A" to mean that we find a quantity X such that a×X=A, and then multiply X by n.

It must be noted (i) that this is a definition of "$\frac{n}{a}$ of," not a definition of "$\frac{n}{a}$," and (ii) that it is not necessary that n should be less than a.

51. *Subdivision of Submultiple.*—By $\frac{5}{7}$ of A we mean 5 times the unit, 7 times which is A. If we regard this unit as being 4 times a lesser unit, then A is 7.4 times this lesser unit, and $\frac{5}{7}$ of A is 5.4 times the lesser unit. Hence $\frac{5}{7}$ of A is equal to $\frac{5\cdot 4}{7\cdot 4}$ of A; and, conversely, $\frac{5\cdot 4}{7\cdot 4}$ of A is equal to $\frac{5}{7}$ of A. Similarly each of these is equal to $\frac{5\cdot 3}{7\cdot 3}$ of A. Hence the value of a fraction is not altered by substituting for the numerator and denominator the corresponding numbers in any other column of a multiple-table (§ 36). If we write $\frac{5\cdot 4}{7\cdot 4}$ in the form $\frac{4\cdot 5}{4\cdot 7}$ we may say that the value of a fraction is not altered by multiplying or dividing the numerator and denominator by any number.

52. *Fraction of a Fraction.*—To find $\frac{11}{4}$ of $\frac{5}{7}$ of A we must convert $\frac{5}{7}$ of A into 4 times some unit. This is done by the preceding paragraph. For $\frac{5}{7}$ of A$=\frac{5\cdot 4}{7\cdot 4}$ of A$=\frac{4\cdot 5}{7\cdot 4}$ of A; *i.e.* it is 4 times a unit which is itself 5 times another unit, 7.4 times which is A. Hence, taking the former unit 11 times instead of 4 times,

$$\tfrac{11}{4} \text{ of } \tfrac{5}{7} \text{ of A} = \frac{11\cdot 5}{7\cdot 4} \text{ of A.}$$

A fraction of a fraction is sometimes called a *compound fraction.*

53. *Comparison, Addition and Subtraction of Fractions.*—The quantities $\frac{3}{4}$ of A and $\frac{5}{7}$ of A are expressed in terms of different units. To compare them, or to add or subtract them, we must express them in terms of the same unit. Thus, taking $\frac{1}{28}$ of A as the unit, we have (§ 51)

$$\tfrac{3}{4} \text{ of A} = \tfrac{21}{28} \text{ of A; } \tfrac{5}{7} \text{ of A} = \tfrac{20}{28} \text{ of A.}$$

Hence the former is greater than the latter; their sum is $\frac{41}{28}$ of A; and their difference is $\frac{1}{28}$ of A.

Thus the fractions must be reduced to a *common denominator.* This denominator must, if the fractions are in their lowest terms (§ 54), be a multiple of each of the denominators; it is usually most convenient that it should be their L.C.M. (§ 47).

54. *Fraction in its Lowest Terms.*—A fraction is said to be *in its lowest terms* when its numerator and denominator have no common factor; or to be reduced to its lowest terms when it is replaced by such a fraction. Thus $\frac{8}{22}$ of A is said to be reduced to its lowest terms when it is replaced by $\frac{4}{11}$ of A. It is important always to bear in mind that $\frac{4}{11}$ of A is not the *same as* $\frac{8}{22}$ of A, though it is *equal to* it.

55. *Diagram of Fractional Relation.*—To find $\frac{10}{24}$ of 14s. we have to take 10 of the units, 24 of which make up 14s. Hence the required amount will, in the multiple-table of § 36, be opposite 10 in the column in which the amount opposite 24 is 14s.; the quantity at the head of this column, representing the unit, will be found to be 7d. The elements of the multiple-table with which we are concerned are shown in the diagram in the margin. This diagram serves equally for the two statements that (i) $\frac{10}{24}$ of 14s. is 5s. 10d., (ii) $\frac{24}{10}$ of 5s. 10d. is 14s. The two statements are in fact merely different aspects of a single relation, considered in the next section.

1	7d.
10	5s. 10d.
24	14s.

56. *Ratio.*—If we omit the two upper compartments of the diagram in the last section, we obtain the diagram A. This diagram exhibits a relation between the two amounts 5s. 10d. and 14s. on the one hand, and the numbers 10 and 24 of the standard series on the other, which is expressed by saying that 5s. 10d. is to 14s. in the *ratio* of 10 to 24, or that 14s. is to 5s. 10d. in the ratio of 24 to 10. If we had taken 1s. 2d. instead of 7d. as the unit for the second column, we should have obtained the diagram B. Thus we must regard the ratio of a to b as being the same as the ratio of c to d, if the fractions $\frac{a}{b}$ and $\frac{c}{d}$ are equal. For this reason the ratio of a to b is sometimes written $\frac{a}{b}$, but the more correct method is to write it $a:b$.

A

10	5s. 10d.
24	14s.

B

5	5s. 10d.
12	14s.

If two quantities or numbers P and Q are to each other in the ratio of p to q, it is clear from the diagram that p times Q= q times P, so that Q$=\frac{q}{p}$ of P.

57. *Proportion.*—If from any two columns in the table of § 36 we remove the numbers or quantities in any two rows, we get a diagram such as that here shown. The pair of compartments on either side may, as here, contain numerical quantities, or may contain numbers. But the two pairs of compartments will correspond to a single pair of numbers, *e.g.* 2 and 6, in the standard series, so that, denoting them by M, N and P, Q respectively, M will be to N in the same ratio that P is to Q. This is expressed by saying that M is to N as P to Q, the relation being written M : N :: P : Q; the four quantities are then said to be *in proportion* or to be *proportionals.*

2s. 10d.	7 yds. 1 ft.
8s. 6d.	22 yds.

M	P
N	Q

This is the most general expression of the relative magnitude of two quantities; *i.e.* the relation expressed by proportion includes the relations expressed by multiple, submultiple, fraction and ratio.

If M and N are respectively m and n times a unit, and P and Q are respectively p and q times a unit, then the quantities are in proportion if $mq=np$; and conversely.

IV. LAWS OF ARITHMETIC

58. *Laws of Arithmetic.*—The arithmetical processes which we have considered in reference to positive integral numbers are subject to the following laws:—

(i) *Equalities and Inequalities.*—The following are sometimes called *Axioms* (§ 29), but their truth should be proved, even if at an early stage it is assumed. The symbols "$>$" and "$<$" mean respectively "is greater than" and "is less than." The numbers represented by a, b, c, x and m are all supposed to be positive.

(*a*) If $a=b$, and $b=c$, then $a=c$;
(*b*) If $a=b$, then $a+x=b+x$, and $a-x=b-x$;
(*c*) If $a>b$, then $a+x>b+x$, and $a-x>b-x$;
(*d*) If $a<b$, then $a+x<b+x$, and $a-x<b-x$;
(*e*) If $a=b$, then $ma=mb$, and $a\div m=b\div m$;
(*f*) If $a>b$, then $ma>mb$, and $a\div m>b\div m$;
(*g*) If $a<b$, then $ma<mb$, and $a\div m<b\div m$.

(ii) *Associative Law for Additions and Subtractions.*—This law includes the *rule of signs*, that $a-(b-c)=a-b+c$; and it states that, subject to this, successive operations of addition or subtraction may be grouped in sets in any way; *e.g.* $a-b+c+d+e-f=a-(b-c)+(d+e-f)$.

(iii) *Commutative Law for Additions and Subtractions*, that additions and subtractions may be performed in any order; *e.g.* $a-b+c+d=a+c-b+d=a+d+c-b$.

(iv) *Associative Law for Multiplications and Divisions.*—This law includes a rule, similar to the rule of signs, to the effect that $a\div(b\div c)=a\div b\times c$; and it states that, subject to this, successive operations of multiplication or division may be grouped in sets in any way; *e.g.* $a\div b\times c\times d\times e\div f=a\div(b\div c)\times(d\times e\div f)$.

(v) *Commutative Law for Multiplications and Divisions*, that multiplications and divisions may be performed in any order: *e.g.* $a\div b\times c\times d=a\times c\div b\times d=a\times d\times c\div b$.

(vi) *Distributive Law*, that multiplications and divisions may be distributed over additions and subtractions, *e.g.* that $m(a+b-c)=m.a+m.b-m.c$, or that $(a+b-c)\div n=(a\div n)+(b\div n)-(c\div n)$.

In the case of (ii), (iii) and (vi), the letters $a, b, c, \ldots$ may denote either numbers or numerical quantities, while m and n denote numbers; in the case of (iv) and (v) the letters denote numbers only.

59. *Results of Inverse Operations.*—Addition, multiplication and involution are direct processes; and, if we start with positive integers, we continue with positive integers throughout. But, in attempting the inverse processes of subtraction, division, and either evolution or determination of index, the data may be such that a process cannot be performed. We can, however, denote the result of the process by a symbol, and deal with this symbol according to the laws of arithmetic. In this way we arrive at (i) negative numbers, (ii) fractional numbers, (iii) surds, (iv) logarithms (in the ordinary sense of the word).

60. *Simple Formulae.*—The following are some simple formulae which follow from the laws stated in § 58.

(i) $(a+b+c+\ldots)(p+q+r+\ldots)=(ap+aq+ar+\ldots)+(bp+bq+br+\ldots)+(cp+cq+cr+\ldots)+\ldots$; *i.e.* the product of two or more numbers, each of which consists of two or more parts, is the sum of the products of each part of the one with each part of the other.

(ii) $(a+b)(a-b)=a^2-b^2$; *i.e.* the product of the sum and the difference of two numbers is equal to the difference of their squares.

(iii) $(a+b)^2=a^2+2ab+b^2=a^2+(2a+b)b$.

V. NEGATIVE NUMBERS

61. *Negative Numbers* may be regarded as resulting from the commutative law for addition and subtraction. According to this law, $10+3+6-7=10+3-7+6=3+6-7+10=$ &c. But, if we write the expression as $3-7+6+10$, this means that we must first subtract 7 from 3. This cannot be done; but the result of the subtraction, if it could be done, is something which, when 6 is added to it, becomes $3-7+6=3+6-7=2$. The result of $3-7$ is the same as that of $0-4$; and we may write it "-4," and call it a *negative number*, if by this we mean something possessing the property that $-4+4=0$.

This, of course, is unintelligible on the grouping system of treating number; on the counting system it merely means that we count backwards from 0, just as we might count inches backwards from a point marked 0 on a scale. It should be remembered that the counting is performed with something as unit. If this unit is A, then what we are really considering is -4A; and this means, not that A is multiplied by -4, but that A is multiplied by 4, and the product is taken negatively. It would therefore be better, in some ways, to retain the unit throughout, and to describe -4A as a *negative quantity*, in order to avoid confusion with the "negative numbers" with which operations are performed in formal algebra.

The positive quantity or number obtained from a negative quantity or number by omitting the "$-$" is called its *numerical value.*

VI. FRACTIONAL AND DECIMAL NUMBERS

62. *Fractional Numbers.*—According to the definition in § 50 the quantity denoted by $\frac{3}{6}$ of A is made up of a number, 3, and a unit, which is one-sixth of A. Similarly $\frac{p}{n}$ of A, $\frac{q}{n}$ of A, $\frac{r}{n}$ of A, . . . mean quantities which are respectively p times, q times r times, . . . the unit, n of which make up A. Thus any arithmetical processes which can be applied to the numbers p, q, r, . . . can be applied to $\frac{p}{n}, \frac{q}{n}, \frac{r}{n}, \ldots$, the denominator n remaining unaltered.

If we denote the unit $\frac{1}{n}$ of A by X, then A is n times X, and $\frac{p}{n}$ of n times X is p times X; *i.e.* $\frac{p}{n}$ of n times is p times.

Hence, so long as the denominator remains unaltered, we can deal with $\frac{p}{n}, \frac{q}{n}, \frac{r}{n}, \ldots$ exactly as if they were numbers, any operations being performed on the numerators. The expressions $\frac{p}{n}, \frac{q}{n}, \frac{r}{n}, \ldots$ are then *fractional numbers*, their relation to ordinary or *integral* numbers being that $\frac{p}{n}$ times n times is equal to p times.

Ones.	Sixths.
0	0
	1
	2
	3
	4
	5
1	0
	1
	2
	3
	4
	5
2	0
	1
	.
	.
	.

This relation is of exactly the same kind as the relation of the successive digits in numbers expressed in a scale of notation whose base is n. Hence we can treat the fractional numbers which have any one denominator as constituting a number-series, as shown in the adjoining diagram. The result of taking 13 sixths of A is then seen to be the same as the result of taking twice A and one-sixth of A, so that we may regard $\frac{13}{6}$ as being equal to $2\frac{1}{6}$. A fractional number is called a *proper fraction* or an *improper fraction* according as the numerator is or is not less than the denominator; and an expression such as $2\frac{1}{6}$ is called a *mixed number.* An improper fraction is therefore equal either to an integer or to a mixed number. It will be seen from § 17 that a mixed number corresponds with what is there called a *mixed quantity.* Thus £3, 17s. is a mixed quantity, being expressed in pounds and shillings; to express it in terms of pounds only we must write it £$3\frac{17}{20}$.

63. *Fractional Numbers with different Denominators.*—If we divided the unit into halves, and these new units into thirds, we should get sixths of the original unit, as shown in A; while, if we divided the unit into thirds, and these new units into halves, we should again get sixths, but as shown in B. The series of halves in the one case, and of thirds in the other, are entirely different series of fractional numbers, but we can compare them by putting each in its proper position in relation to the series of sixths. Thus $\frac{3}{2}$ is equal to $\frac{9}{6}$, and $\frac{5}{3}$ is equal to $\frac{10}{6}$, and conversely; in other words, any fractional number is equivalent to the fractional number obtained by multiplying or dividing the numerator and denominator by any integer. We can thus find fractional numbers equivalent to the sum or difference of any two fractional numbers. The process is the same as that of finding the sum or difference of 3 sixpences and 5 fourpences, we cannot subtract 3 sixpenny-bits from 5 fourpenny-bits, but we can express each as an equivalent number of

A

Ones.	Halves.	Sixths.
0	0	0
		1
		2
	1	0
		1
		2
1	0	0
		.
		.
		.

B

Ones.	Thirds.	Sixths.
0	0	0
		1
	1	0
		1
	2	0
		1
1	0	0
		.
		.
		.

pence, and then perform the subtraction. Generally, to find the sum or difference of two or more fractional numbers, we must replace them by other fractional numbers having the same denominator; it is usually most convenient to take as this denominator the L.C.M. of the original fractional numbers (cf. § 53).

64. *Complex Fractions.*—A fraction (or fractional number), the numerator or denominator of which is a fractional number, is called a *complex* fraction (or fractional number), to distinguish it from a *simple* fraction, which is a fraction having integers for numerator and denominator. Thus $\frac{5\frac{2}{3}}{11\frac{1}{3}}$ of A means that we take a unit X such that $11\frac{1}{3}$ times X is equal to A, and then take $5\frac{2}{3}$ times X. To simplify this, we take a new unit Y, which is $\frac{1}{3}$ of X. Then A is 34 times Y, and $\frac{5\frac{2}{3}}{11\frac{1}{3}}$ of A is 17 times Y, *i.e.* it is $\frac{1}{2}$ of A.

65. *Multiplication of Fractional Numbers.*—To multiply $\frac{8}{3}$ by $\frac{5}{7}$ is to take $\frac{5}{7}$ times $\frac{8}{3}$. It has already been explained (§ 62) that $\frac{5}{7}$ times is an operation such that $\frac{5}{7}$ times 7 times is equal to 5 times. Hence we must express $\frac{8}{3}$, which itself means $\frac{8}{3}$ times, as being 7 times something. This is done by multiplying both numerator and denominator by 7; *i.e.* $\frac{8}{3}$ is equal to $\frac{7.8}{7\cdot3}$, which is the same thing as 7 times $\frac{8}{7\cdot3}$. Hence $\frac{5}{7}$ times $\frac{8}{3}=\frac{5}{7}$ times 7 times $\frac{8}{7\cdot3}=5$ times $\frac{8}{7\cdot3}=\frac{5.8}{7\cdot3}$. The rule for multiplying a fractional number by a fractional number is therefore the same as the rule for finding a fraction of a fraction.

66. *Division of Fractional Numbers.*—To divide $\frac{8}{3}$ by $\frac{5}{7}$ is to find a number (*i.e.* a fractional number) x such that $\frac{5}{7}$ times x is equal to $\frac{8}{3}$. But $\frac{7}{5}$ times $\frac{5}{7}$ times x is, by the last section, equal to x. Hence x is equal to $\frac{7}{5}$ times $\frac{8}{3}$. Thus to divide by a fractional number we must multiply by the number obtained by interchanging the numerator and the denominator, *i.e.* by the *reciprocal* of the original number.

If we divide 1 by $\frac{5}{7}$ we obtain, by this rule, $\frac{7}{5}$. Thus the reciprocal of a number may be defined as the number obtained by dividing 1 by it. This definition applies whether the original number is integral or fractional.

By means of the present and the preceding sections the rule given in § 63 can be extended to the statement that a fractional number is equal to the number obtained by multiplying its numerator and its denominator by any fractional number.

67. *Negative Fractional Numbers.*—We can obtain negative fractional numbers in the same way that we obtain negative integral numbers; thus $-\frac{5}{7}$ or $-\frac{5}{7}$A means that $\frac{5}{7}$ or $\frac{5}{7}$A is taken negatively.

68. *Genesis of Fractional Numbers.*—A fractional number may be regarded as the result of a measuring division (§ 39) which cannot be performed exactly. Thus we cannot divide 3 in. by 11 in. exactly, *i.e.* we cannot express 3 in. as an integral multiple of 11 in.; but, by extending the meaning of "times" as in § 62, we can say that 3 in. is $\frac{3}{11}$ times 11 in., and therefore call $\frac{3}{11}$ the quotient when 3 in. is divided by 11 in. Hence, if p and n are numbers, $\frac{p}{n}$ is sometimes regarded as denoting the result of dividing p by n, whether p and n are integral or fractional (mixed numbers being included in fractional).

The idea and properties of a fractional number having been explained, we may now call it, for brevity, a *fraction*. Thus "$\frac{2}{3}$ of A" no longer means two of the units, three of which make up A; it means that A is multiplied by the fraction $\frac{2}{3}$, *i.e.* it means the same thing as "$\frac{2}{3}$ times A."

69. *Percentage.*—In order to deal, by way of comparison or addition or subtraction, with fractions which have different denominators, it is necessary to reduce them to a common denominator. To avoid this difficulty, in practical life, it is usual to confine our operations to fractions which have a certain standard denominator. Thus (§ 79) the Romans reckoned in twelfths, and the Babylonians in sixtieths; the former method supplied a basis for division by 2, 3, 4, 6 or 12, and the latter for division by 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, or 60. The modern method is to deal with fractions which have 100 as denominator; such fractions are called *percentages.* They only apply accurately to divisions by 2, 4, 5, 10, 20, 25 or 50; but they have the convenience of fitting in with the denary scale of notation, and they can be extended to other divisions by using a mixed number as numerator. One-fortieth, for instance, can be expressed as $\frac{2\frac{1}{2}}{100}$, which is called $2\frac{1}{2}$ *per cent.*, and usually written $2\frac{1}{2}$ %. Similarly $3\frac{1}{3}$ % is equal to one-thirtieth.

If the numerator is a multiple of 5, the fraction represents twentieths. This is convenient, *e.g.* for expressing *rates in the pound*; thus 15 % denotes the process of taking 3s. for every £1, *i.e.* a rate of 3s. in the £.

In applications to money "per cent." sometimes means "per £100." Thus "£3, 17s. 6d. per cent." is really the complex fraction $\frac{3\frac{17\frac{6}{12}}{20}}{100}$.

70. *Decimal Notation of Percentage.*—An integral percentage, *i.e.* a simple fraction with 100 for denominator, can be expressed by writing the two figures of the numerator (or, if there is only one figure, this figure preceded by 0) with a dot or "point" before them; thus ·76 means 76 %, or $\frac{76}{100}$. If there is an integral number to be taken as well as a percentage, this number is written in front of the point; thus 23·76 × A means 23 times A, with 76 % of A. We might therefore denote 76 % by 0·76.

If as our unit we take $X=\frac{1}{100}$ of A = 1 % of A, the above quantity might equally be written 2376 X = $\frac{2376}{100}$ of A; *i.e.* 23·76×A is equal to 2376 % of A.

71. *Approximate Expression by Percentage.*—When a fraction cannot be expressed by an integral percentage, it can be so expressed approximately, by taking the *nearest* integer to the numerator of an equal fraction having 100 for its denominator. Thus $\frac{1}{7}=\frac{14\frac{2}{7}}{100}$, so that $\frac{1}{7}$ is approximately equal to 14 %; and $\frac{2}{7}=\frac{28\frac{4}{7}}{100}$, which is approximately equal to 29 %. The difference between this approximate percentage and the true value is less than $\frac{1}{2}$ %, *i. e.* is less than $\frac{1}{200}$.

If the numerator of the fraction consists of an integer and $\frac{1}{2}$—*e.g.* in the case of $\frac{3}{8}=\frac{37\frac{1}{2}}{100}$—it is uncertain whether we should take the next lowest or the next highest integer. It is best in such cases to retain the $\frac{1}{2}$; thus we can write $\frac{3}{8}=37\frac{1}{2}$ %$=\cdot37\frac{1}{2}$.

72. *Addition and Subtraction of Percentages.*—The sum or difference of two percentages is expressed by the sum or difference of the numbers expressing the two percentages.

73. *Percentage of a Percentage.*—Since 37 % of 1 is expressed by 0·37, 37 % of 1 % (*i.e.* of 0·01) might similarly be expressed by 0·00·37. The second point, however, is omitted, so that we write it 0·0037 or ·0037, this expression meaning $\frac{37}{100}$ of $\frac{1}{100}=\frac{37}{10000}$. On the same principle, since 37 % of 45 % is equal to $\frac{37}{100}$ of $\frac{45}{100}$ $=\frac{1665}{10000}=\frac{16}{100}+(\frac{65}{100}$ of $\frac{1}{100})$, we can express it by ·1665; and 3 % of 2 % can be expressed by ·0006. Hence, to find a percentage of a percentage, we multiply the two numbers, put 0's in front if necessary to make up four figures (not counting fractions), and prefix the point.

74. *Decimal Fractions.*—The percentage-notation can be extended to any fraction which has any power of 10 for its denominator. Thus $\frac{153}{1000}$ can be written ·153 and $\frac{15300}{100000}$ can be written ·15300. These two fractions are equal to each other, and also to ·1530. A fraction written in this way is called a *decimal fraction*; or we might define a decimal fraction as a fraction having a power of 10 for its denominator, there being a special notation for writing such fractions.

A mixed number, the fractional part of which is a decimal fraction, is expressed by writing the integral part in front of the point, which is called the *decimal point.* Thus $27\frac{1530}{10000}$ can be written 27·1530. This number, expressed in terms of the fraction $\frac{1}{10000}$ or ·0001, would be 271530. Hence the successive figures after the decimal point have the same relation to each other and to the figures before the point as if the point did not exist. The point merely indicates the *denomination* in which the number is expressed: the above number, expressed in terms of $\frac{1}{10}$, would be 271·530, but expressed in terms of 100 it would be ·271530.

Fractions other than decimal fractions are usually called *vulgar fractions.*

75. *Decimal Numbers.*—Instead of regarding the ·153 in 27·153 as meaning $\frac{153}{1000}$, we may regard the different figures in the expression as denoting numbers in the successive orders of submultiples of 1 on a denary scale. Thus, on the grouping system, 27·153 will mean $2.10+7+1/10+5/10^2+3/10^3$, while on the counting system it will mean the result of counting through the tens to 2, then through the ones to 7, then through tenths to 1, and so on. A number made up in this way may be called a *decimal number*, or, more briefly, a *decimal.* It will be seen that the definition includes integral numbers.

76. *Sums and Differences of Decimals.*—To add or subtract decimals, we must reduce them to the same denomination, *i.e.* if one has more figures after the decimal point than the other, we must add sufficient 0's to the latter to make the numbers of figures equal. Thus, to add 5·413 to 3·8, we must write the latter as 3·800. Or we may treat the former as the sum of 5·4 and ·013, and recombine the ·013 with the sum of 3·8 and 5·4.

77. *Product of Decimals.*—To multiply two decimals *exactly*, we multiply them as if the point were absent, and then insert it so that the number of figures after the point in the product shall be equal to the sum of the numbers of figures after the points in the original decimals.

In actual practice, however, decimals only represent approximations, and the process has to be modified (§ 111).

78. *Division by Decimal.*—To divide one decimal by another, we must reduce them to the same denomination, as explained in § 76, and then omit the decimal points. Thus $5{\cdot}413 \div 3{\cdot}8 = \frac{5413}{1000} \div \frac{3800}{1000} = 5413 \div 3800$.

79. *Historical Development of Fractions and Decimals.*—The fractions used in ancient times were mainly of two kinds: unit-fractions, *i.e.* fractions representing aliquot parts (§ 103), and fractions with a definite denominator.

The Egyptians as a rule used only unit-fractions, other fractions being expressed as the sum of unit-fractions. The only known exception was the use of $\frac{2}{3}$ as a single fraction. Except in the case of $\frac{2}{3}$ and $\frac{1}{2}$, the fraction was expressed by the denominator, with a special symbol above it.

The Babylonians expressed numbers less than 1 by the numerator of a fraction with denominator 60; the numerator only being written. The choice of 60 appears to have been connected with the reckoning of the year as 360 days; it is perpetuated in the present subdivision of angles.

The Greeks originally used unit-fractions, like the Egyptians; later they introduced the sexagesimal fractions of the Babylonians, extending the system to four or more successive subdivisions of the unit representing a degree. They also, but apparently still later and only occasionally, used fractions of the modern kind. In the sexagesimal system the numerators of the successive fractions (the denominators of which were the successive powers of 60) were followed by ′, ″, ‴, ⁗, the denominator not being written. This notation survives in reference to the minute (′) and second (″) of angular measurement, and has been extended, by analogy, to the foot (′) and inch (″). Since ξ represented 60, and *o* was the next letter, the latter appears to have been used to denote absence of one of the fractions; but it is not clear that our present sign for zero was actually derived from this. In the case of fractions of the more general kind, the numerator was written first with ′, and then the denominator, followed by ″, was written twice. A different method was used by Diophantus, accents being omitted, and the denominator being written above and to the right of the numerator.

The Romans commonly used fractions with denominator 12; these were described as *unciae* (ounces), being twelfths of the *as* (pound).

The modern system of placing the numerator above the denominator is due to the Hindus; but the dividing line is a later invention. Various systems were tried before the present notation came to be generally accepted. Under one system, for instance, the continued sum $\frac{4}{5}+\frac{1}{7\times5}+\frac{3}{8\times7\times5}$ would be denoted by $\frac{3\ \ 1\ \ 4}{8\ \ 7\ \ 5}$; this is somewhat similar in principle to a decimal notation, but with digits taken in the reverse order.

Hindu treatises on arithmetic show the use of fractions, containing a power of 10 as denominator, as early as the beginning of the 6th century A.D. There was, however, no development in the direction of decimals in the modern sense, and the Arabs, by whom the Hindu notation of integers was brought to Europe, mainly used the sexagesimal division in the ′ ″ ‴ notation. Even where the decimal notation would seem to arise naturally, as in the case of approximate extraction of a square root, the portion which might have been expressed as a decimal was converted into sexagesimal fractions. It was not until A.D. 1585 that a decimal notation was published by Simon Stevinus of Bruges. It is worthy of notice that the invention of this notation appears to have been due to practical needs, being required for the purpose of computation of compound interest. The present decimal notation, which is a development of that of Stevinus, was first used in 1617 by H. Briggs, the computer of logarithms.

80. *Fractions of Concrete Quantities.*—The British systems of coinage, weights, lengths, &c., afford many examples of the use of fractions. These may be divided into three classes, as follows:—

(i) The fraction of a concrete quantity may itself not exist as a concrete quantity, but be represented by a token. Thus, if we take a shilling as a unit, we may divide it into 12 or 48 smaller units; but corresponding coins are not really portions of a shilling, but objects which help us in counting. Similarly we may take the farthing as a unit, and invent smaller units, represented either by tokens or by no material objects at all. Ten marks, for instance, might be taken as equivalent to a farthing; but 13 marks are not equivalent to anything except one farthing and three out of the ten acts of counting required to arrive at another farthing.

(ii) In the second class of cases the fraction of the unit quantity is a quantity of the same kind, but cannot be determined with absolute exactness. Weights come in this class. The ounce, for instance, is one-sixteenth of the pound, but it is impossible to find 16 objects such that their weights shall be exactly equal and that the sum of their weights shall be exactly equal to the weight of the standard pound.

(iii) Finally, there are the cases of linear measurement, where it is theoretically possible to find, by geometrical methods, an exact submultiple of a given unit, but both the unit and the submultiple are not really concrete objects, but are spatial relations embodied in objects.

Of these three classes, the first is the least abstract and the last the most abstract. The first only involves number and counting. The second involves the idea of *equality* as a necessary characteristic of the units or subunits that are used. The third involves also the idea of *continuity* and therefore of unlimited subdivision. In weighing an object with ounce-weights the fact that it weighs more than 1 ℔ 3 oz. but less than 1 ℔ 4 oz. does not of itself suggest the necessity or possibility of subdivision of the ounce for purposes of greater accuracy. But in measuring a distance we may find that it is "between" two distances differing by a unit of the lowest denomination used, and a subdivision of this unit follows naturally.

VII. APPROXIMATION

81. *Approximate Character of Numbers.*—The numbers (integral or decimal) by which we represent the results of arithmetical operations are often only approximately correct. All numbers, for instance, which represent physical measurements, are limited in their accuracy not only by our powers of measurement but also by the accuracy of the measure we use as our unit. Also most fractions cannot be expressed exactly as decimals; and this is also the case for surds and logarithms, as well as for the numbers expressing certain ratios which arise out of geometrical relations

Even where numbers are supposed to be exact, calculations based on them can often only be approximate. We might, for instance, calculate the exact cost of 3 ℔ 5 oz. of meat at $9\frac{1}{2}$d. a ℔, but there are no coins in which we could pay this exact amount.

When the result of any arithmetical operation or operations is represented approximately but not exactly by a number, the excess (positive or negative) of this number over the number which would express the result exactly is called the *error*.

82. *Degree of Accuracy.*—There are three principal ways of expressing the degree of accuracy of any number, *i.e.* the extent to which it is equal to the number it is intended to represent.

(i) A number can be *correct to* so many *places of decimals.* This means (cf. § 71) that the number differs from the true value by less than one-half of the unit represented by 1 in the last place of decimals. For instance, ·143 represents $\frac{1}{7}$ correct to 3 places of decimals, since it differs from it by less than ·0005. The final figure, in a case like this, is said to be *corrected.*

This method is not good for comparative purposes. Thus ·143 and 14·286 represent respectively $\frac{1}{7}$ and $\frac{100}{7}$ to the same number of places of decimals, but the latter is obviously more exact than the former.

(ii) A number can be correct to so many *significant figures.* The significant figures of a number are those which commence with the first figure other than zero in the number; thus the significant figures of 13·027 and of ·00013027 are the same.

This is the usual method; but the relative accuracy of two numbers expressed to the same number of significant figures depends to a certain extent on the magnitude of the first figure. Thus ·14286 and ·85714 represent $\frac{1}{7}$ and $\frac{6}{7}$ correct to 5 significant figures; but the latter is relatively more accurate than the former. For the former shows only that $\frac{1}{7}$ lies between ·142855 and ·142865, or, as it is better expressed, between $\cdot 14285\frac{1}{2}$ and $\cdot 14286\frac{1}{2}$; but the latter shows that $\frac{6}{7}$ lies between $\cdot 85713\frac{1}{2}$ and $\cdot 85714\frac{1}{2}$, and therefore that $\frac{1}{7}$ lies between $\cdot 14285\frac{7}{12}$ and $\cdot 14285\frac{9}{12}$.

In either of the above cases, and generally in any case where a number is known to be within a certain limit on each side of the stated value, the *limit of error* is expressed by the sign ±. Thus the former of the above two statements would give $\frac{1}{7} = \cdot 14286 \pm \cdot 000005$. It should be observed that the numerical value of the error is to be subtracted from or added to the stated value according as the error is positive or negative.

(iii) The limit of error can be expressed as a fraction of the number as stated. Thus $\frac{1}{7} = \cdot 143 \pm \cdot 0005$ can be written $\frac{1}{7} = \cdot 143(1 \pm \frac{1}{286})$.

83. *Accuracy after Arithmetical Operations.*—If the numbers which are the subject of operations are not all exact, the accuracy of the result requires special investigation in each case.

Additions and subtractions are simple. If, for instance, the values of a and b, correct to two places of decimals, are 3·58 and 1·34, then 2·24, as the value of $a-b$, is not necessarily correct to two places. The limit of error of each being ±·005, the limit of error of their sum or difference is ±·01.

For multiplication we make use of the formula (§ 60 (i)) $(a' \pm \alpha)(b' \pm \beta) = a'b' + \alpha\beta \pm (a'\beta + b'\alpha)$. If a' and b' are the stated values, and $\pm\alpha$ and $\pm\beta$ the respective limits of error, we ought strictly to take $a'b' + \alpha\beta$ as the product, with a limit of error $\pm (a'\beta + b'\alpha)$. In practice, however, both $\alpha\beta$ and a certain portion of $a'b'$ are small in comparison with $a'\beta$ and $b'\alpha$, and we therefore replace $a'b' + \alpha\beta$ by an approximate value, and increase the limit of error so as to cover the further error thus introduced. In the case of the two numbers given in the last paragraph, the product lies between $3\cdot 575 \times 1\cdot 335 = 4\cdot 772625$ and $3\cdot 585 \times 1\cdot 345 = 4\cdot 821825$. We might take the product as $(3\cdot 58 \times 1\cdot 34) + (\cdot 005)^2 = 4\cdot 797225$, the limits of error being $\pm \cdot 005(3\cdot 58 + 1\cdot 34) = \pm \cdot 0246$; but it is more convenient to write it in such a form as 4·797±·025 or 4·80±·03.

If the number of decimal places to which a result is to be accurate is determined beforehand, it is usually not necessary in the actual working to go to more than two or three places beyond this. At the close of the work the extra figures are dropped, the last figure which remains being corrected (§ 82 (i)) if necessary.

VIII. Surds and Logarithms

84. *Roots and Surds.*—The pth root of a number (§43) may, if the number is an integer, be found by expressing it in terms of its prime factors; or, if it is not an integer, by expressing it as a fraction in its lowest terms, and finding the pth roots of the numerator and of the denominator separately. Thus to find the cube root of 1728, we write it in the form $2^6.3^3$, and find that its cube root is $2^2.3 = 12$; or, to find the cube root of 1·728, we write it as $\frac{1728}{1000} = \frac{216}{125} = \frac{2^3.3^3.}{5^3}$ and find that the cube root is $\frac{2.3}{5} = 1\cdot 2$. Similarly the cube root of 2197 is 13. But we cannot find any number whose cube is 2000.

It is, however, possible to find a number whose cube shall approximate as closely as we please to 2000. Thus the cubes of 12·5 and of 12·6 are respectively 1953·125 and 2000·376, so that the number whose cube differs as little as possible from 2000 is somewhere between 12·5 and 12·6. Again the cube of 12·59 is 1995·616979, so that the number lies between 12·59 and 12·60. We may therefore consider that there is some number x whose cube is 2000, and we can find this number to any degree of accuracy that we please.

A number of this kind is called a *surd*; the surd which is the pth root of N is written $\sqrt[p]{N}$, but if the index is 2 it is usually omitted, so that the square root of N is written $\sqrt{N}$.

85. *Surd as a Power.*—We have seen (§§ 43,44) that, if we take the successive powers of a number N, commencing with 1, they may be written $N^0, N^1, N^2, N^3, \ldots$, the series of indices being the standard series; and we have also seen (§ 44) that multiplication of any two of these numbers corresponds to addition of their indices. Hence we may insert in the power-series numbers with fractional indices, provided that the multiplication of these numbers follows the same law. The number denoted by $N^{\frac{1}{3}}$ will therefore be such that $N^{\frac{1}{3}} \times N^{\frac{1}{3}} \times N^{\frac{1}{3}} = N^{\frac{1}{3}+\frac{1}{3}+\frac{1}{3}} = N$; *i.e.* it will be the cube root of N. By analogy with the notation of fractional numbers, $N^{\frac{2}{3}}$ will be $N^{\frac{1}{3}+\frac{1}{3}} = N^{\frac{1}{3}} \times N^{\frac{1}{3}}$; and, generally, $N^{\frac{p}{q}}$ will mean the product of p numbers, the product of q of which is equal to N. Thus $N^{\frac{2}{6}}$ will not mean the *same* as $N^{\frac{1}{3}}$, but will mean the square of $N^{\frac{1}{6}}$; but this will be *equal* to $N^{\frac{1}{3}}$, *i.e.* $(\sqrt[6]{N})^2 = \sqrt[3]{N}$.

86. *Multiplication and Division of Surds.*—To add or subtract fractional numbers, we must reduce them to a common denominator; and similarly, to multiply or divide surds, we must express them as power-numbers with the same index. Thus $\sqrt[3]{2} \times \sqrt{5} = 2^{\frac{1}{3}} \times 5^{\frac{1}{2}} = 2^{\frac{2}{6}} \times 5^{\frac{3}{6}} = 4^{\frac{1}{6}} \times 125^{\frac{1}{6}} = 500^{\frac{1}{6}} = \sqrt[6]{500}$.

87. *Antilogarithms.*—If we take a fixed number, *e.g.* 2, as base, and take as indices the successive decimal numbers to any particular number of places of decimals, we get a series of *antilogarithms* of the indices to this base. Thus, if we go to two places of decimals, we have as the integral series the numbers 1, 2, 4, 8, . . . which are the values of $2^0, 2^1, 2^2, \ldots$ and we insert within this series the successive powers of x, where x is such that $x^{100} = 2$. We thus get the numbers $2^{\cdot 01}, 2^{\cdot 02}, 2^{\cdot 03}, \ldots$, which are the antilogarithms of ·01, ·02, ·03, . . . to base 2; the first antilogarithm being $2^{\cdot 00} = 1$, which is thus the antilogarithm of 0 to this (or any other) base. The series is formed by successive multiplication, and any antilogarithm to a larger number of decimal places is formed from it in the same way by multiplication. If, for instance, we have found $2^{\cdot 31}$, then the value of $2^{\cdot 316}$ is found from it by multiplying by the 6th power of the 1000th root of 2.

For practical purposes the number taken as base is 10; the convenience of this being that the increase of the index by an integer means multiplication by the corresponding power of 10, *i.e.* it means a shifting of the decimal point. In the same way, by dividing by powers of 10 we may get negative indices.

88. *Logarithms.*—If N is the antilogarithm of p to the base a, *i.e.* if $N = a^p$, then p is called the logarithm of N to the base a, and is written $\log_a N$. As the table of antilogarithms is formed by successive multiplications, so the logarithm of any given

number is in theory found by successive divisions. Thus, to find the logarithm of a number to base 2, the number being greater than 1, we first divide repeatedly by 2 until we get a number between 1 and 2; then divide repeatedly by $\sqrt[10]{2}$ until we get a number between 1 and $\sqrt[10]{2}$; then divide repeatedly by $\sqrt[100]{2}$; and so on. If, for instance, we find that the number is approximately equal to $2^3 \times (\sqrt[10]{2})^5 \times (\sqrt[100]{2})^7 \times (\sqrt[1000]{2})^4$, it may be written $2^{3.574}$, and its logarithm to base 2 is 3·574.

For a further explanation of logarithms, and for an explanation of the treatment of cases in which an antilogarithm is less than 1, see LOGARITHM.

For practical purposes logarithms are usually calculated to base 10, so that $\log_{10} 10 = 1$, $\log_{10} 100 = 2$, &c.

IX. UNITS

89. *Change of Denomination* of a numerical quantity is usually called *reduction*, so that this term covers, *e.g.*, the expression of £153, 7s. 4d. as shillings and pence and also the expression of 3067s. 4d. as £, s. and d.

The usual statement is that to express £153, 7s. as shillings we multiply 153 by 20 and add 7. This, as already explained (§37), is incorrect. £153 denotes 153 units, each of which is £1 or 20s.; and therefore we must multiply 20s. by 153 and add 7s., *i.e.* multiply 20 by 153 (the unit being now 1s.) and add 7. This is the expression of the process on the grouping method. On the counting method we have a scale with every 20th shilling marked as a £; there are 153 of these 20's, and 7 over.

The simplest case, in which the quantity can be expressed as an integral number of the largest units involved, has already been considered (§§ 37, 42). The same method can be applied in other cases by regarding a quantity expressed in several denominations as a fractional number of units of the largest denomination mentioned; thus 7s. 4d. is to be taken as meaning $7\frac{4}{12}$s., but £0, 7s. 4d. as £$0\frac{7\frac{4}{12}}{20}$ (§17). The reduction of £153, 7s. 4d. to pence, and of 36808d. to £, s. d., on this principle, is shown in diagrams A and B above.

A

	1s.	12d.
£1	20s.	
£153, 7s. 4d.	3067s. 4d.	36808d.

B

	20s.	£1
12d.	1s.	
36808d.	3067s. 4d.	£153, 7s. 4d.

For reduction of pounds to shillings, or shillings to pounds, we must consider that we have a multiple-table (§ 36) in which the multiples of £1 and of 20s. are arranged in parallel columns; and similarly for shillings and pence.

90. *Change of Unit.*—The statement "£153 = 3060s." is not a statement of *equality* of the same kind as the statement "153 × 20 = 3060," but only a statement of *equivalence* for certain purposes; in other words, it does not convey an absolute truth. It is therefore of interest to see whether we cannot replace it by an absolute truth.

To do this, consider what the ordinary processes of multiplication and division mean in reference to concrete objects. If we want to give, to 5 boys, 4 apples each, we are said to multiply 4 apples by 5. We cannot multiply 4 apples by 5 boys, for then we should get 20 "boy-apples," an expression which has no meaning. Or, again, to distribute 20 apples amongst 5 boys, we are not regarded as dividing 20 apples by 5 boys, but as dividing 20 apples by the number 5. The multiplication or division here involves the omission of the unit "boy," and the operation is incomplete. The complete operation, in each case, is as follows.

(i) In the case of multiplication we commence with the conception of the number "5" and the unit "boy"; and we then convert this unit into 4 apples, and thus obtain the result, 20 apples. The conversion of the unit may be represented as multiplication by a factor $\frac{4\text{ apples}}{1\text{ boy}}$, so that the operation is $\frac{4\text{ apples}}{1\text{ boy}} \times 5\text{ boys} = 5 \times \frac{4\text{ apples}}{1\text{ boy}} \times 1\text{ boy} = 5 \times 4\text{ apples} = 20\text{ apples}$. Similarly, to convert £153 into shillings we must multiply it by a factor $\frac{20\text{s.}}{£1}$, so that we get

$$\frac{20\text{s.}}{£1} \times £153 = 153 \times \frac{20\text{s.}}{£1} \times £1 = 153 \times 20\text{s.} = 3060\text{s.}$$

Hence we can only regard £153 as being equal to 3060s. if we regard this converting factor as unity.

(ii) In the case of partition we can express the complete operation if we extend the meaning of division so as to enable us to divide 20 apples by 5 boys. We thus get $\frac{20\text{ apples}}{5\text{ boys}} = \frac{4\text{ apples}}{1\text{ boy}}$, which means that the distribution can be effected by distributing at the rate of 4 apples per boy. The converting factor mentioned under (i) therefore represents a *rate*; and partition, applied to concrete cases, leads to a rate.

In reference to the use of the sign × with the converting factor, it should be observed that "$\frac{7\text{ ℔}}{4\text{ ℔}}\times$" symbolizes the replacing of so many times 4 ℔ by the same number of times 7 ℔, while "$\frac{7}{4}\times$" symbolizes the replacing of 4 times something by 7 times that something.

X. ARITHMETICAL REASONING

91. *Correspondence of Series of Numbers.*— In §§ 33-42 we have dealt with the parallelism of the original number-series with a series consisting of the corresponding multiples of some unit, whether a number or a numerical quantity; and the relations arising out of multiplication, division, &c., have been exhibited by diagrams comprising pairs of corresponding terms of the two series. This, however, is only a particular case of the correspondence of two series. In considering addition, for instance, we have introduced two parallel series, each being the original number-series, but the two being placed in different positions. If we add 1,2,3, . . . to 6, we obtain a series 7,8,9, . . . , the terms of which correspond with those of the original series 1,2,3, . . .

Again, in §§61-75 and 84-88 we have considered various kinds of numbers other than those in the original number-series. In general, these have involved two of the original numbers, *e.g.* 5^3 involves 5 and 3, and $\log_2 8$ involves 2 and 8. In some cases, however, *e.g.* in the case of negative numbers and reciprocals, only one is involved; and there might be three or more, as in the case of a number expressed by $(a+b)^n$. If all but one of these constituent elements are settled beforehand, *e.g.* if we take the numbers 5, 5^2, 5^3, . . . , or the numbers $\sqrt[3]{1}$, $\sqrt[3]{2}$, $\sqrt[3]{3}$, . . . or $\log_{10} 1{\cdot}001$, $\log_{10} 1{\cdot}002$, $\log_{10} 1{\cdot}003$ . . . we obtain a series in which each term corresponds with a term of the original number-series.

This correspondence is usually shown by *tabulation*, *i.e.* by the formation of a table in which the original series is shown in one column, and each term of the second series is placed in a second column opposite the corresponding term of the first series, each column being headed by a description of its contents. It is sometimes convenient to begin the first series with 0, and even to give the series of negative numbers; in most cases, however, these latter are regarded as belonging to a different series, and they need not be considered here. The diagrams, A, B, C are simple forms of tables; A giving a sum-series, B a multiple-series, and C a series of square roots, calculated approximately.

A

n	$6+n$
0	6
1	7
2	8
3	9
.	.
.	.
.	.

B

n	$4n$
0	0
1	4
2	8
3	12
.	.
.	.
.	.

C

n	$\sqrt{n}$
0	·000
1	1·000
2	1·414
3	1·732
.	.
.	.
.	.

92. *Correspondence of Numerical Quantities.*—Again, in § 89, we have considered cases of multiple-tables of numerical quantities, where each quantity in one series is *equivalent* to the corresponding quantity in the other series. We might extend this principle to cases in which the terms of two series, whether of numbers or

of numerical quantities, merely *correspond* with each other, the correspondence being the result of some relation. The volume of a cube, for instance, bears a certain relation to the length of an edge of the cube. This relation is not one of proportion; but it may nevertheless be expressed by tabulation, as shown at D.

D

Length of edge in inches.	Volume of cube.
0	*Nil.*
1	1 cub. in.
2	8 cub. in.
3	27 cub. in.
.	.
.	.
.	.

93. *Interpolation.*—In most cases the quantity in the second column may be regarded as increasing or decreasing continuously as the number in the first column increases, and it has intermediate values corresponding to intermediate (*i.e.* fractional or decimal) numbers not shown in the table. The table in such cases is not, and cannot be, complete, even up to the number to which it goes. For instance, a cube whose edge is $1\frac{1}{2}$ in. has a definite volume, viz. $3\frac{3}{8}$ cub. in. The determination of any such intermediate value is performed by *Interpolation* (*q.v.*).

In treating a fractional number, or the corresponding value of the quantity in the second column, as *intermediate*, we are in effect regarding the numbers 1, 2, 3, . . . , and the corresponding numbers in the second column, as denoting points between which other numbers lie, *i.e.* we are regarding the numbers as *ordinal*, not cardinal. The transition is similar to that which arises in the case of geometrical measurement (§ 26), and it is an essential feature of all reasoning with regard to continuous quantity, such as we have to deal with in real life.

94. *Nature of Arithmetical Reasoning.*—The simplest form of arithmetical reasoning consists in the determination of the term in one series corresponding to a given term in another series, when the relation between the two series is given; and it implies, though it does not necessarily involve, the establishment of each series as a whole by determination of its unit. A method involving the determination of the unit is called a *unitary* method. When the unit is not determined, the reasoning is algebraical rather than arithmetical. If, for instance, three terms of a proportion are given, the fourth can be obtained by the relation given at the end of § 57, this relation being then called the *Rule of Three*; but this is equivalent to the use of an algebraical formula.

More complicated forms of arithmetical reasoning involve the use of series, each term in which corresponds to particular terms in two or more series jointly; and cases of this kind are usually dealt with by special methods, or by means of algebraical formulae. The old-fashioned problems about the amount of work done by particular numbers of men, women and boys, are of this kind, and really involve the solution of simultaneous equations. They are not suitable for elementary purposes, as the arithmetical relations involved are complicated and difficult to grasp.

XI. Methods of Calculation

(i.) *Exact Calculation.*

95. *Working from Left.*—It is desirable, wherever possible, to perform operations on numbers or numerical quantities from the left, rather than from the right. There are several reasons for this. In the first place, an operation then corresponds more closely, at an elementary stage, with the concrete process which it represents. If, for instance, we had one sum of £3, 15s. 9d. and another of £2, 6s. 5d., we should add them by putting the coins of each denomination together and commencing the addition with the £. In the second place, this method fixes the attention at once on the larger, and therefore more important, parts of the quantities concerned, and thus prevents arithmetical processes from becoming too abstract in character. In the third place, it is a better preparation for dealing with approximate calculations. Finally, experience shows that certain operations in which the result is written down at once—*e.g.* addition or subtraction of two numbers or quantities, and multiplication by some small numbers—are with a little practice performed more quickly and more accurately from left to right.

96. *Addition.*—There is no difference in principle between addition (or subtraction) of numbers and addition (or subtraction) of numerical quantities. In each case the grouping system involves rearrangement, which implies the commutative law, while the counting system requires the expression of a quantity in different denominations to be regarded as a notation in a varying scale (§§ 17, 32). We need therefore consider numerical quantities only, our results being applicable to numbers by regarding the digits as representing multiples of units in different denominations.

When the result of addition in one denomination can be partly expressed in another denomination, the process is technically called *carrying*. The name is a bad one, since it does not correspond with any ordinary meaning of the verb. It would be better described as *exchanging*, by analogy with the "changing" of subtraction. When, *e.g.*, we find that the sum of 17s. and 18s. is 35s., we take out 20 of the 35 shillings, and exchange them for £1.

To add from the left, we have to look ahead to see whether the next addition will require an exchange. Thus, in adding £3, 17s. 0d. to £2, 18s. 0d., we write down the sum of £3 and £2 as £6, not as £5, and the sum of 17s. and 18s. as 15s., not as 35s.

When three or more numbers or quantities are added together, the result should always be checked by adding both upwards and downwards. It is also useful to look out for pairs of numbers or quantities which make 1 of the next denomination, *e.g.* 7 and 3, or 8d. and 4d.

97. *Subtraction.*—To subtract £3, 5s. 4d. from £9, 7s. 8d., on the grouping system, we split up each quantity into its denominations, perform the subtractions independently, and then regroup the results as the "remainder" £6, 2s. 4d. On the counting system we can count either forwards or backwards, and we can work either from the left or from the right. If we count forwards we find that to convert £3, 5s. 4d. into £9, 7s. 8d. we must successively add £6, 2s. and 4d. if we work from the left, or 4d., 2s. and £6 if we work from the right. The intermediate values obtained by the successive additions are different according as we work from the left or from the right, being £9, 5s. 4d. and £9, 7s. 4d. in the one case, and £3, 5s. 8d. and £3, 7s. 8d. in the other. If we count backwards, the intermediate values are £3, 7s. 8d. and £3, 5s. 8d. in the one case, and £9, 7s. 4d. and £9, 5s. 4d. in the other.

The determination of each element in the remainder involves reference to an addition-table. Thus to subtract 5s. from 7s. we refer to an addition-table giving the sum of any two quantities, each of which is one of the series 0s., 1s., . . . 19s.

Subtraction by counting forward is called *complementary addition.*

To subtract £3, 5s. 8d. from £9, 10s. 4d., on the grouping system, we must *change* 1s. out of the 10s. into 12d., so that we subtract £3, 5s. 8d. from £9, 9s. 16d. On the counting system it will be found that, in determining the number of shillings in the remainder, we subtract 5s. from 9s. if we count forwards, working from the left, or backwards, working from the right; while, if we count backwards, working from the left, or forwards, working from the right, the subtraction is of 6s. from 10s. In the first two cases the successive values (in direct or reverse order) are £3, 5s. 8d., £9, 5s. 8d., £9, 9s. 8d. and £9, 10s. 4d.; while in the last two cases they are £9, 10s. 4d., £3, 10s. 4d., £3, 6s. 4d. and £3, 5s. 8d.

In subtracting from the left, we look ahead to see whether a 1 in any denomination must be reserved for changing; thus in subtracting 274 from 637 we should put down 2 from 6 as 3, not as 4, and 7 from 3 as 6.

98. *Multiplication-Table.*—For multiplication and division we use a *multiplication-table*, which is a multiple-table, arranged as explained in § 36, and giving the successive multiples, up to 9 times or further, of the numbers from 1 (or better, from 0) to 10, 12 or 20. The column (vertical) headed 3 will give the multiples of 3, while the row (horizontal) commencing with 3 will give the values of 3×1, 3×2, . . . To multiply by 3 we use the row. To divide by 3, in the sense of partition, we also use the row; but to divide by 3 as a unit we use the column.

99. *Multiplication by a Small Number.*—The idea of a large

multiple of a small number is simpler than that of a small multiple of a large number, but the calculation of the latter is easier. It is therefore convenient, in finding the product of two numbers, to take the smaller as the multiplier.

To find 3 times 427, we apply the distributive law (§ 58 (vi)) that $3.427=3(400+20+7)=3.400+3.20+3.7$. This, if we regard 3.427 as $427+427+427$, is a direct consequence of the commutative law for addition (§ 58 (iii)), which enables us to add separately the hundreds, the tens and the ones. To find 3.400, we treat 100 as the unit (as in addition), so that $3.400=3.4.100=12.100=1200$; and similarly for 3.20. These are examples of the associative law for multiplication (§ 58 (iv)).

100. *Special Cases.*—The following are some special rules:—

(i) To multiply by 5, multiply by 10 and divide by 2. (And conversely, to divide by 5, we multiply by 2 and divide by 10.)

(ii) In multiplying by 2, from the left, add 1 if the next figure of the multiplicand is 5, 6, 7, 8 or 9.

(iii) In multiplying by 3, from the left, add 1 when the next figures are not less than 33 . . . 334 and not greater than 66 . . . 666, and 2 when they are 66 . . . 667 and upwards.

(iv) To multiply by 7, 8, 9, 11 or 12, treat the multiplier as 10-3, 10-2, 10-1, 10+1 or 10+2; and similarly for 13, 17, 18, 19, &c.

(v) To multiply by 4 or 6, we can either multiply from the left by 2 and then by 2 or 3, or multiply from the right by 4 or 6; or we can treat the multiplier as $5-1$ or $5+1$.

101. *Multiplication by a Large Number.*—When both the numbers are large, we split up one of them, preferably the multiplier, into separate portions. Thus $231.4273=(200+30+1)\ 4273=200.4273+30.4273+1.4273$. This gives the *partial products*, the sum of which is the complete product. The process is shown fully in A below,—and more concisely in B. To multiply 4273 by 200, we use the commutative law, which gives $200.4273=2\times100\times4273=2\times4273\times100=8546\times100=854600$; and similarly for 30.4273. In B the terminal 0's of the partial products are omitted. It is usually convenient to make out a preliminary table of multiples up to 10 times; the table being checked at 5 times (§ 100) and at 10 times.

A

	4273
200	854600
30	128190
1	4273
231	987063

B

	4273
	8546
231	12819
	4273
	987063

C

1 – 04273
2 – 08546
3 – 12819
. .
. .
. .
10 – 042730

The main difficulty is in the correct placing of the curtailed partial products. The first step is to regard the product of two numbers as containing as many digits as the two numbers put together. The table of multiples will then be as in C. The next step is to arrange the multiplier and the multiplicand above the partial products. For elementary work the multiplicand may come immediately after the multiplier, as in D; the last figure of each partial product then comes immediately under the corresponding figure of the multiplier. A better method, which leads up to the multiplication of decimals and of approximate values of numbers, is to place the first figure of the multiplier under the first figure of the multiplicand, as in E; the first figure of each partial product will then come under the corresponding figure of the multiplier.

D

	4273	*231*
	0854	6
231	128	19
	04	273
	0987	063

E

	4273 *231*
	08546
231	12819
	04273
	0987063

102. *Contracted Multiplication.*—The partial products are sometimes omitted; the process saves time in writing, but is not easy. The principle is that, *e.g.*, $(a.\ 10^2+b.\ 10+c)\ (p.\ 10^2+q.\ 10+r)=ap.\ 10^4+(aq+bp)10^3+(ar+bq+cp)\ 10^2+(br+cq)\ 10+cr.$ Hence the digits are multiplied in pairs, and grouped according to the power of 10 which each product contains. A method of performing the process is shown here for the case of 162.427. The principle is that $162.427=100.427+60.427+2.427=1.42700+6.4270+2.427$; but, instead of writing down the separate products, we (in effect) write 42700, 4270 and 427 in separate rows, with the multipliers 1, 6, 2 in the margin, and then multiply each number in each column by the corresponding multiplier in the margin, making allowance for any figures to be "carried." Thus the second figure (from the right) is given by $1+2.2+6.7=47$, the 1 being carried.

1	427
6	427
2	427
	69174

103. *Aliquot Parts.*—For multiplication by a proper fraction or a decimal, it is sometimes convenient, especially when we are dealing with mixed quantities, to convert the multiplier into the sum or difference of a number of fractions, each of which has 1 as its numerator. Such fractions are called *aliquot parts* (from Lat. *aliquot*, some, several). This can usually be done in a good many ways. Thus $\frac{5}{6}=1-\frac{1}{6}$, and also $=\frac{1}{2}+\frac{1}{3}$, and $15\%=\cdot15=\frac{1}{10}+\frac{1}{20}=\frac{1}{6}-\frac{1}{60}=\frac{1}{8}+\frac{1}{40}$. The fractions should generally be chosen so that each part of the product may be obtained from an earlier part by a comparatively simple division. Thus $\frac{1}{2}+\frac{1}{20}-\frac{1}{60}$ is a simpler expression for $\frac{8}{15}$ than $\frac{1}{2}+\frac{1}{30}$.

The process may sometimes be applied two or three times in succession; thus $\frac{8}{15}=\frac{4}{5}\cdot\frac{2}{3}=(1-\frac{1}{5})\ (1-\frac{1}{3})$, and $\frac{33}{40}=\frac{3}{4}\cdot\frac{11}{10}=(1-\frac{1}{4})\ (1+\frac{1}{10})$.

104. *Practice.*—The above is a particular case of the method called *practice*, but the nomenclature of the method is confusing. There are two kinds of practice, *simple practice* and *compound practice*, but the latter is the simpler of the two. To find the cost of 2 ℔ 8 oz. of butter at 1s. 2d. a ℔, we multiply 1s. 2d. by $2\frac{8}{16}=2\frac{1}{2}$. This straightforward process is called "compound" practice. "Simple" practice involves an application of the commutative law. To find the cost of *n* articles at £*a*, *b*s. *c*d. each, we express £*a*, *b*s. *c*d. in the form £$(a+f)$, where *f* is a fraction (or the sum of several fractions); we then say that the cost, being $n\times$£$(a+f)$, is equal to $(a+f)\times$£n, and apply the method of compound practice, *i.e.* the method of aliquot parts.

105. *Multiplication of a Mixed Number.*—When a mixed quantity or a mixed number has to be multiplied by a large number, it is sometimes convenient to express the former in terms of one only of its denominations. Thus, to multiply £7, 13s. 6d. by 469, we may express the former in any of the ways £7·675, $\frac{307}{40}$ of £1, $153\frac{1}{2}$s., 153·5s., 307 sixpences, or 1842 pence. Expression in £ and decimals of £1 is usually recommended, but it depends on circumstances whether some other method may not be simpler.

A sum of money cannot be expressed exactly as a decimal of £1 unless it is a multiple of $\frac{3}{4}$d. A rule for approximate conversion is that 1s. = ·05 of £1, and that $2\frac{1}{2}$d. = ·01 of £1. For accurate conversion we write ·1£ for each 2s., and ·001£ for each farthing beyond 2s., their number being first increased by one twenty-fourth.

F

	4273
x	0987063
200	0854600
x – 200	132463
30	128190
x – 230	04273
1	04273
x – 231	0000

106. *Division.*—Of the two kinds of division, although the idea of partition is perhaps the more elementary, the process of measuring is the easier to perform, since it is equivalent to a series of subtractions. Starting from the dividend, we in theory keep on subtracting the unit, and count the number of subtractions that have to be performed until nothing is left. In actual practice, of course, we subtract large multiples at a time. Thus, to divide 987063 by 427, we reverse the procedure of § 101, but with intermediate stages. We first construct the multiple-table C, and then subtract successively 200 times, 30 times and 1 times; these numbers being the *partial quotients*. The theory of the process is shown fully in F. Treating *x* as the unknown quotient corresponding to the original dividend,

we obtain successive dividends corresponding to quotients $x-200$, $x-230$ and $x-231$. The original dividend is written as 0987063, since its initial figures are greater than those of the divisor; if the dividend had commenced with (*e.g.*) 3 . . . it would not have been necessary to insert the initial 0. At each stage of the division the number of digits in the reduced dividend is decreased by one. The final dividend being 0000, we have $x-231=0$, and therefore $x=231$.

107. *Methods of Division.*—What are described as different methods of division (by a single divisor) are mainly different methods of writing the successive figures occurring in the process. In *long division* the divisor is put on the left of the dividend, and the quotient on the right; and each partial product, with the remainder after its subtraction, is shown in full. In *short division* the divisor and the quotient are placed respectively on the left of and below the dividend, and the partial products and remainders are not shown at all. The *Austrian* method (sometimes called in Great Britain the *Italian* method) differs from these in two respects. The first, and most important, is that the quotient is placed above the dividend. The second, which is not essential to the method, is that the remainders are shown, but not the partial products; the remainders being obtained by working from the right, and using complementary addition. It is doubtful whether the brevity of this latter process really compensates for its greater difficulty.

The advantage of the Austrian arrangement of the quotient lies in the indication it gives of the true value of each partial quotient. A modification of the method, corresponding with D of § 101, is shown in G; the fact that the partial product 08546 is followed by two blank spaces shows that the figure 2 represents a partial quotient 200. An alternative arrangement, corresponding to E of § 101, and suited for more advanced work, is shown in H.

G

	4273	*2*
	0987063	
	08546	

H

	4273
	2
	0987063
	08546

108. *Division with Remainder.*—It has so far been assumed that the division can be performed exactly, *i.e.* without leaving an ultimate remainder. Where this is not the case, difficulties are apt to arise, which are mainly due to failure to distinguish between the two kinds of division. If we say that the division of 41d. by 12 gives quotient 3d. with remainder 5d., we are speaking loosely; for in fact we only distribute 36d. out of the 41d., the other 5d. remaining undistributed. It can only be distributed by a subdivision of the unit; *i.e.* the true result of the division is $3\frac{5}{12}$d. On the other hand, we can quite well express the result of dividing 41d. by 1s (=12d.) as 3 with 5d. (not "5") over, for this is only stating that 41d.=3s. 5d.; though the result might be more exactly expressed as $3\frac{5}{12}$s.

Division with a remainder has thus a certain air of unreality, which is accentuated when the division is performed by means of factors (§ 42). If we have to divide 935 by 240, taking 12 and 20 as factors, the result will depend on the fact that, in the notation of § 17, $935=3\overset{(20)}{''}17\overset{(12)}{''}11$. In incomplete partition the quotient is 3, and the remainders 11 and 17 are in effect disregarded; if, after finding the quotient 3, we want to know what remainder would be produced by a direct division, the simplest method is to multiply 3 by 240 and subtract the result from 935. In complete partition the successive quotients are $77\frac{11}{12}$ and $3\frac{17\frac{11}{12}}{20}=3\frac{215}{240}$. Division in the sense of measuring leads to such a result as 935d.=£3, 17s. 11d.; we may, if we please, express the 17s. 11d. as 215d., but there is no particular reason why we should do so.

109. *Division by a Mixed Number.*—To divide by a mixed number, when the quotient is seen to be large, it usually saves time to express the divisor as either a simple fraction or a decimal of a unit of one of the denominations. Exact division by a mixed number is not often required in real life; where approximate division is required (*e.g.* in determining the rate of a "dividend"), approximate expression of the divisor in terms of the largest unit is sufficient.

110. *Calculation of Square Root.*—The calculation of the square root of a number depends on the formula (iii) of § 60. To find the square root of N, we first find some number a whose square is less than N, and subtract a^2 from N. If the complete square root is $a+b$, the remainder after subtracting a^2 is $(2a+b)b$. We therefore guess b by dividing the remainder by $2a$, and form the product $(2a+b)\ b$. If this is equal to the remainder, we have found the square root. If it exceeds the square root, we must alter the value of b, so as to get a product which does not exceed the remainder. If the product is less than the remainder, we get a new remainder, which is $N-(a+b)^2$; we then assume the full square root to be c, so that the new remainder is equal to $(2a+2b+c)\ c$, and try to find c in the same way as we tried to find b.

An analogous method of finding cube root, based on the formula for $(a+b)^3$, used to be given in text-books, but it is of no practical use. To find a root other than a square root we can use logarithms, as explained in § 113.

(ii.) *Approximate Calculation.*

111. *Multiplication.*—When we have to multiply two numbers, and the product is only required, or can only be approximately correct, to a certain number of significant figures, we need only work to two or three more figures (§ 83), and then correct the final figure in the result by means of the superfluous figures.

A common method is to reverse the digits in one of the numbers; but this is only appropriate to the old-fashioned method of writing down products from the right. A better method is to ignore the positions of the decimal points, and multiply the numbers as if they were decimals between ·1 and 1·0. The method E of § 101 being adopted, the multiplicand and the multiplier are written with a space after as many digits (of each) as will be required in the product (on the principle explained in §101); and the multiplication is performed from the left, two extra figures being kept in. Thus, to multiply 27·343 by 3·1415927 to one decimal place, we require 2+1+1=4 figures in the product. The result is 085·9=85·9, the position of the decimal point being determined by counting the figures before the decimal points in the original numbers.

	2734	3
	3141	*59*
	0820	29
	027	34
	10	94
	0	27
		14
		2
	0859	

112. *Division.*—In the same way, in performing approximate division, we can at a certain stage begin to abbreviate the divisor, taking off one figure (but with correction of the final figure of the partial product) at each stage. Thus, to divide 85·9 by 3·1415927 to two places of decimals, we in effect divide ·0859 by ·31415927 to four places of decimals. In the work, as here shown, a 0 is inserted in front of the 859, on the principle explained in § 106. The result of the division is 27·34.

	3141	5927
	2734	
	0859	00
	0628	32
	230	68
	219	91
	10	77
	9	42
	1	35
	1	26

113. *Logarithms.*—Multiplication, division, involution and evolution, when the results cannot be exact, are usually most simply performed, at any rate to a first approximation, by means of a table of logarithms. Thus, to find the square root of 2, we have $\log\sqrt{2}=\log(2^{\frac{1}{2}})=\frac{1}{2}\log 2$. We take out log 2 from the table, halve it, and then find from the table the number of which this is the logarithm. (SEE LOGARITHM.) The *slide-rule* (see CALCULATING MACHINES) is a simple apparatus for the mechanical application of the methods of logarithms.

When a first approximation has been obtained in this way, further approximations can be obtained in various ways. Thus, having found $\sqrt{2}=1{\cdot}414$ approximately, we write $\sqrt{2}=1{\cdot}414+\theta$, whence $2=(1{\cdot}414)^2+(2{\cdot}818)\theta+\theta^2$. Since θ^2 is less than $\frac{1}{4}$ of

$(\cdot 001)^2$, we can obtain three more figures approximately by dividing $2-(1\cdot 414)^2$ by $2\cdot 818$.

114. *Binomial Theorem.*—More generally, if we have obtained a as an approximate value for the pth root of N, the binomial theorem gives as an approximate formula $\sqrt[p]{N}=a+\theta$, where $N=a^p+pa^{p-1}\theta$.

115. *Series.*—A number can often be expressed by a series of terms, such that by taking successive terms we obtain successively closer approximations. A decimal is of course a series of this kind, *e.g.* $3\cdot 14159$ . . . means $3+1/10+4/10^2+1/10^3+5/10^4+9/10^5+$ . . . A series of aliquot parts is another kind, *e.g.* $3\cdot 1416$ is a little less than $3+\frac{1}{7}-\frac{1}{800}$.

Recurring Decimals are a particular kind of series, which arise from the expression of a fraction as a decimal. If the denominator of the fraction, when it is in its lowest terms, contains any other prime factors than 2 and 5, it cannot be expressed exactly as a decimal; but after a certain point a definite series of figures will constantly recur. The interest of these series is, however, mainly theoretical.

116. *Continued Products.*—Instead of being expressed as the sum of a series of terms, a number may be expressed as the product of a series of factors, which become successively more and more nearly equal to 1. For example,

$$3\cdot 1416=3\times\tfrac{10472}{10000}=3\times\tfrac{1309}{1250}=3\times\tfrac{22}{21}\times\tfrac{2499}{2500}=3(1+\tfrac{1}{21})(1-\tfrac{1}{2500}).$$

Hence, to multiply by $3\cdot 1416$, we can multiply by $3\frac{1}{7}$, and subtract $\frac{1}{2500}$ $(=\cdot 0004)$ of the result; or, to divide by $3\cdot 1416$, we can divide by 3, then subtract $\frac{1}{22}$ of the result, and then add $\frac{1}{2499}$ of the new result.

117. *Continued Fractions.*—The theory of *continued fractions* (*q.v.*) gives a method of expressing a number, in certain cases, as a continued product. A continued fraction, of the kind we are considering, is an expression of the form $a+\cfrac{1}{b+\cfrac{1}{c+\cfrac{1}{d+}}}$ &c.

where $b, c, d,$ . . . are integers, and a is an integer or zero. The expression is usually written, for compactness, $a+\frac{1}{b+}\,\frac{1}{c+}\,\frac{1}{d+}$ &c. The numbers $a, b, c, d,$ . . . are called the *quotients*.

Any exact fraction can be expressed as a continued fraction, and there are methods for expressing as continued fractions certain other numbers, *e.g.* square roots, whose values cannot be expressed exactly as fractions.

The successive values $\frac{a}{1}$, $\frac{ab+1}{b}$, . . . , obtained by taking account of the successive quotients, are called *convergents*, *i.e.* convergents to the true value. The following are the main properties of the convergents.

(i) If we precede the series of convergents by $\frac{0}{1}$ and $\frac{1}{0}$, then the numerator (or denominator) of each term of the series $\frac{0}{1}, \frac{1}{0}, \frac{a}{1}, \frac{ab+1}{b}$ . . . , after the first two, is found by multiplying the numerator (or denominator) of the last preceding term by the corresponding quotient and adding the numerator (or denominator) of the term before that. If a is zero, we may regard $\frac{1}{b}$ as the first convergent, and precede the series by $\frac{1}{0}$ and $\frac{0}{1}$.

(ii) Each convergent is a fraction in its lowest terms.

(iii) The convergents are alternately less and greater than the true value.

(iv) Each convergent is nearer to the true value than any other fraction whose denominator is less than that of the convergent.

(v) The difference of two successive convergents is the reciprocal of the product of their denominators; *e.g.* $\frac{ab+1}{b}-\frac{a}{1}=\frac{1}{1.b}$, and $\frac{abc+c+a}{bc+1}-\frac{ab+1}{b}=\frac{-1}{b(bc+1)}$.

It follows from these last three properties that if the successive convergents are $\frac{p_1}{1}, \frac{p_2}{q_2}, \frac{p_3}{q_3}$, . . . the number can be expressed in the form $p_1\,(1+\frac{1}{p_1q_2})\,(1-\frac{1}{p_2q_3})\,(1+\frac{1}{p_3q_4})$ . . . , and that if we go up to the factor $1\pm\frac{1}{p_nq_{n+1}}$ the product of these factors differs from the true value of the number by less than $\pm\frac{1}{q_nq_{n+1}}$.

In certain cases two or more factors can be combined so as to produce an expression of the form $1\pm\frac{1}{k}$, where k is an integer. For instance, $3\cdot 1415927=3(1+\frac{1}{3\cdot 7})(1-\frac{1}{22\cdot 106})(1+\frac{1}{333\cdot 113})$ . . .; but the last two of these factors may be combined as $(1-\frac{1}{22\cdot 113})$. Hence $3\cdot 1415927=\frac{3}{1}\cdot\frac{22}{21}\cdot\frac{2485}{2486}$ . . .

XII. Applications

(i.) *Systems of Measures.*[1]

118. *Metric System.*—The metric system was adopted in France at the end of the 18th century. The system is decimal throughout. The principal units of length, weight and volume are the *metre*, *gramme* (or *gram*) and *litre*. Other units are derived from these by multiplication or division by powers of 10, the names being denoted by prefixes. The prefixes for multiplication by 10, 10^2, 10^3 and 10^4 are *deca-*, *hecto-*, *kilo-* and *myria-*, and those for division by 10, 10^2 and 10^3 are *deci-*, *centi-* and *milli-*; the former being derived from Greek, and the latter from Latin. Thus *kilogramme* means 1000 grammes, and *centimetre* means $\frac{1}{100}$ of a metre. There are also certain special units, such as the *hectare*, which is equal to a square hectometre, and the *micron*, which is $\frac{1}{1000}$ of a millimetre.

The metre and the gramme are defined by standard measures preserved at Paris. The litre is equal to a cubic decimetre. The gramme was intended to be equal to the weight of a cubic centimetre of pure water at a certain temperature, but the equality is only approximate.

The metric system is now in use in the greater part of the civilized world, but some of the measures retain the names of old disused measures. In Germany, for instance, the *Pfund* is $\frac{1}{2}$ kilogramme, and is approximately equal to $1\frac{1}{10}$℔ English.

119. *British Systems.*—The British systems have various origins, and are still subject to variations caused by local usage or by the usage of particular businesses. The following tables are given as illustrations of the arrangement adopted elsewhere in this article; the entries in any column denote multiples or submultiples of the unit stated at the head of the column, and the entries in any row give the expression of one unit in term of the other units.

Length

Inch.	Foot.	Yard.	Chain.	Furlong.	Mile.
1	$\frac{1}{12}$	$\frac{1}{36}$	$\frac{1}{792}$	$\frac{1}{7920}$	$\frac{1}{63360}$
12	1	$\frac{1}{3}$	$\frac{1}{66}$	$\frac{1}{660}$	$\frac{1}{5280}$
36	3	1	$\frac{1}{22}$	$\frac{1}{220}$	$\frac{1}{1760}$
792	66	22	1	$\frac{1}{10}$	$\frac{1}{80}$
7920	660	220	10	1	$\frac{1}{8}$
63360	5280	1760	80	8	1

Weight (Avoirdupois)

Ounce.	Pound.	Stone.	Quarter.	Hundred-weight.	Ton.
1	$\frac{1}{16}$	$\frac{1}{224}$	$\frac{1}{448}$	$\frac{1}{1792}$	$\frac{1}{35840}$
16	1	$\frac{1}{14}$	$\frac{1}{28}$	$\frac{1}{112}$	$\frac{1}{2240}$
224	14	1	$\frac{1}{2}$	$\frac{1}{8}$	$\frac{1}{160}$
448	28	2	1	$\frac{1}{4}$	$\frac{1}{80}$
1792	112	8	4	1	$\frac{1}{20}$
35840	2240	160	80	20	1

(Also 7000 grains = 1℔ avoirdupois.)

120. *Change of System.*—It is sometimes necessary, when a quantity is expressed in one system, to express it in another,

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[1] See also Weights and Measures.

The following are the ratios of some of the units; each unit is expressed approximately as a decimal of the other, and their ratio is shown as a continued product (§ 116), a few of the corresponding convergents to the continued fraction (§ 117) being added in brackets. It must be remembered that the number expressing any quantity in terms of a unit is *inversely proportional* to the magnitude of the unit, *i.e.* the number of new units is to be found by multiplying the number of old units by the ratio of the old unit to the new unit.

$$\frac{\text{Yard}}{\text{Metre}} = \frac{9144}{10000} = \frac{10000}{10936} = \frac{11}{12} \cdot \frac{384}{385} \cdot \frac{8225}{8224} \cdots \left(\frac{11}{12}, \frac{32}{35} = \frac{8}{7} \cdot \frac{4}{5}, \frac{235}{257}\right).$$

$$\frac{\text{Inch}}{\text{Centimetre}} = \frac{25400}{10000} = \frac{10000}{3937} = \frac{5}{2} \cdot \frac{66}{65} \cdot \frac{1651}{1650} \cdots \left(\frac{5}{2}, \frac{33}{13}, \frac{127}{50}\right).$$

$$\frac{\text{Mile}}{\text{Kilometre}} = \frac{16093}{10000} = \frac{10000}{6214} = \frac{8}{5} \cdot \frac{185}{184} \cdot \frac{2369}{2368} \cdots \left(\frac{8}{5}, \frac{37}{23}, \frac{103}{64}\right).$$

$$\frac{\text{Square yard}}{\text{Square metre}} = \frac{8361}{10000} = \frac{10000}{11960} = \frac{5}{6} \cdot \frac{306}{305} \cdot \frac{15250}{15249} \cdots \left(\frac{5}{6}, \frac{51}{61}, \frac{250}{299}\right).$$

$$\frac{\text{Acre}}{\text{Hectare}} = \frac{4047}{10000} = \frac{10000}{24711} = \frac{2}{5} \cdot \frac{85}{84} \cdot \frac{5320}{5321} \cdots \left(\frac{2}{5}, \frac{17}{42}, \frac{380}{939}\right).$$

$$\frac{\text{Quart}}{\text{Litre}} = \frac{11365}{10000} = \frac{10000}{8799} = \frac{8}{7} \cdot \frac{175}{176} \cdot \frac{8976}{8975} \cdots \left(\frac{8}{7}, \frac{25}{22}, \frac{408}{359}\right).$$

$$\frac{\text{Pound}}{\text{Kilogramme}} = \frac{4536}{10000} = \frac{10000}{22046} = \frac{1}{2} \cdot \frac{10}{11} \cdot \frac{484}{485} \cdot \frac{29391}{29392} \cdots \left(\frac{1}{2}, \frac{5}{11}, \frac{44}{97}, \frac{303}{668}\right).$$

(ii.) *Special Applications.*

121. *Commercial Arithmetic.*—This term covers practically all dealings with money which involve the application of the principle of proportion. A simple class of cases is that which deals with equivalence of sums of money in different currencies; these cases really come under § 120. In other cases we are concerned with a proportion stated as a *numerical percentage*, or as a *money percentage* (*i.e.* a sum of money per £100), or as a *rate* in the £ or the shilling. The following are some examples. Percentage: *Brokerage, commission, discount, dividend, interest, investment, profit and loss.* Rate in the £: *Discount, dividend, rates, taxes.* Rate in the shilling: *Discount.*

Text-books on arithmetic usually contain explanations of the chief commercial transactions in which arithmetical calculations arise; it will be sufficient in the present article to deal with interest and discount, and to give some notes on percentages and rates in the £. *Insurance* and *Annuities* are matters of general importance, which are dealt with elsewhere under their own headings.

122. *Percentages and Rates in the £.*—In dealing with percentages and rates it is important to notice whether the sum which is expressed as a percentage of a rate on another sum is a part of or an addition to that sum, or whether they are independent of one another. Income tax, for instance, is calculated on income, and is in the nature of a deduction from the income; but local rates are calculated in proportion to certain other payments, actual or potential, and could without absurdity exceed 20s. in the £.

It is also important to note that if the increase or decrease of an amount A by a certain percentage produces B, it will require a different percentage to decrease or increase B to A. Thus, if B is 20% less than A, A is 25% greater than B.

123. *Interest* is usually calculated yearly or half-yearly, at a certain rate per cent. on the principal. In legal documents the rate is sometimes expressed as a certain sum of money "per centum per annum"; here "centum" must be taken to mean "£100."

Simple interest arises where unpaid interest accumulates as a debt not itself bearing interest; but, if this debt bears interest, the total, *i.e.* interest and interest on interest, is called *compound interest.* If $100r$ is the rate per cent. per annum, the simple interest on £A for n years is £nrA, and the compound interest (supposing interest payable yearly) is £$[(1+r)^n - 1]$A. If n is large, the compound interest is most easily calculated by means of logarithms.

124. *Discount* is of various kinds. Tradesmen allow discount for ready money, this being usually at so much in the shilling or £. Discount may be allowed twice in succession off quoted prices; in such cases the second discount is off the reduced price, and therefore it is not correct to add the two rates of discount together. Thus a discount of 20%, followed by a further discount of 25%, gives a total discount of 40%, not 45%, off the original amount. When an amount will fall due at some future date, the *present value* of the debt is found by deducting discount at some rate per cent. for the intervening period, in the same way as interest to be added is calculated. This discount, of course, is not equal to the interest which the present value would produce at that rate of interest, but is rather greater, so that the present value as calculated in this way is less than the theoretical present value.

125. Applications to *Physics* are numerous, but are usually only of special interest. A case of general interest is the measurement of *temperature.* The graduation of a thermometer is determined by the freezing-point and the boiling-point of water, the interval between these being divided into a certain number of degrees, representing equal increases of temperature. On the Fahrenheit scale the points are respectively 32° and 212°; on the Centigrade scale they are 0° and 100°; and on the Réaumur they are 0° and 80°. From these data a temperature as measured on one scale can be expressed on either of the other two scales.

126. *Averages* occur in statistics, economics, &c. An average is found by adding together several measurements of the same kind and dividing by the number of measurements. In calculating an average it should be observed that the addition of any numerical quantity (positive or negative) to each of the measurements produces the addition of the same quantity to the average, so that the calculation may often be simplified by taking some particular measurement as a new zero from which to measure.

AUTHORITIES.—For the history of the subject, see W. W. R. Ball, *Short History of Mathematics* (1901), and F. Cajori, *History of Elementary Mathematics* (1896); or more detailed information in M. Cantor, *Vorlesungen über Geschichte der Mathematik* (1894–1901). L. C. Conant, *The Number-Concept* (1896), gives a very full account of systems of numeration. For the latter, and for systems of notation, reference may also be made to Peacock's article "Arithmetic" in the *Encyclopaedia Metropolitana*, which contains a detailed account of the Greek system. F. Galton, *Inquiries into Human Faculty* (1883), contains the first account of number-forms; for further examples and references see D. E. Phillips, "Genesis of Number-Forms," *American Journal of Psychology*, vol. viii. (1897). There are very few works dealing adequately but simply with the principles of arithmetic. Homersham Cox, *Principles of Arithmetic* (1885), is brief and lucid, but is out of print. *The Psychology of Number*, by J. A. McLellan and J. Dewey (1895), contains valuable suggestions (some of which have been utilized in the present article), but it deals only with number as the measure of quantity, and requires to be read critically. This work contains references to Grube's system, which has been much discussed in America: for a brief explanation, see L. Seeley, *The Grube Method of Teaching Arithmetic* (1890). On the teaching of arithmetic, and of elementary mathematics generally, see J. W. A. Young, *The Teaching of Mathematics in the Elementary and the Secondary School* (1907); D. E. Smith, *The Teaching of Elementary Mathematics* (1900), also contains an interesting general sketch; W. P. Turnbull, *The Teaching of Arithmetic* (1903), is more elaborate. E. M. Langley, *A Treatise on Computation* (1895), has notes on approximate and abbreviated calculation. Text-books on arithmetic in general and on particular applications are numerous, and any list would soon be out of date. Recent English works have been influenced by the brief *Report on the Teaching of Elementary Mathematics*, issued by the Mathematical Association (1905); but this is critical rather than constructive. The Association has also issued a *Report on the Teaching of Mathematics in Preparatory Schools* (1907). In the United States of America the *Report of the Committee of Ten* on secondary school studies (1893) and the *Report of the Committee of Fifteen* on elementary education (1893–1894), both issued by the United States Bureau of Education, have attracted a good deal of attention. Sir O. Lodge, *Easy Mathematics, chiefly Arithmetic* (1905), treats the subject broadly in its practical aspects. The student who is interested in elementary teaching should consult the annual bibliographies in the *Pedagogical Seminary*; an article by D. E. Phillips in vol. v. (October 1897) contains references to works dealing with the psychological aspect of number. For an account of German methods, see W. King, *Report on Teaching of Arithmetic and Mathematics in the Higher Schools of Germany* (1903). (W. F. SH.)

ARIUS (Ἄρειος), a name celebrated in ecclesiastical history, not so much on account of the personality of its bearer as of the "Arian" controversy which he provoked. Our knowledge of Arius is scanty, and nothing certain is known of his birth or of his early training. Epiphanius of Salamis, in his well-known treatise against eighty heresies (*Haer.* lxix. 3), calls him a Libyan by birth, and if the statement of Sozomen, a church historian of the 5th century, is to be trusted, he was, as a member of the Alexandrian church, connected with the Meletian schism (see

Meletius of Lycopolis), and on this account excommunicated by Peter of Alexandria, who had ordained him deacon. After the death of Peter (November 25, 311), he was received into communion by Peter's successor, Achillas, elevated to the presbytery, and put in charge of one of the great city churches, Baucalis, where he continued to discharge his duties with apparent faithfulness and industry after the accession of Alexander. This bishop also held him in high repute. Theodoret (*Hist. Eccl.* i. 2) indeed does not hesitate to say that Arius was chagrined because Alexander, instead of himself, had been appointed to the see of Alexandria, and that the beginning of his heretical attitude is, in consequence, to be attributed to discontent and envy. But this must be rejected, for it is a common explanation of heretical movements with the early church historians, and there is no evidence for it in the original sources. However, Arius was ambitious. Epiphanius, using older documents, describes him as a man inflamed with his own opinionativeness, of a soft and smooth address, calculated to persuade and attract, especially women: "in no time he had drawn away seven hundred virgins from the church to his party." When the controversy broke out, Arius was an old man.

The real causes of the controversy lay in differences as to dogma. Arius had received his theological education in the school of the presbyter Lucian of Antioch, a learned man, and distinguished especially as a biblical scholar. The latter was a follower of Paul of Samosata, bishop of Antioch, who had been excommunicated in 269, but his theology differed from that of his master in a fundamental point. Paul, starting with the conviction that the One God cannot appear substantially (οὐσιωδῶς) on earth, and, consequently, that he cannot have become a person in Jesus Christ, had taught that God had filled the man Jesus with his Logos (σοφία) or Power (δύναμις). Lucian, on the other hand, presisted in holding that the Logos became a person in Christ. But since he shared the above-mentioned belief of his master, nothing remained for him but to see in the Logos a second essence, created by God before the world, which came down to earth and took upon itself a human body. In this body the Logos filled the place of the intellectual or spiritual principle. Lucian's Christ, then, was not "perfect man," for that which constituted in him the personal element was a divine essence; nor was he "perfect God," for the divine essence having become a person was other than the One God, and of a nature foreign to him. It is this idea which Arius took up and interpreted unintelligently. His doctrinal position is explained in his letters to his patron Eusebius, bishop of the imperial city of Nicomedia, and to Alexander of Alexandria, and in the fragments of the poem in which he set forth his dogmas, which bears the enigmatic title of "Thalia" (θάλεια), used in Homer, in the sense of "a goodly banquet," most unjustly ridiculed by Athanasius as an imitation of the licentious style of the drinking-songs of the Egyptian Sotades (270 B.C.). From these writings it can even nowadays be seen clearly that the principal object which he had in view was firmly to establish the unity and simplicity of the eternal God. However far the Son may surpass other created beings, he remains himself a created being, to whom the Father before all time gave an existence formed out of not being (ἐξ οὐκ ὄντων); hence the name of *Exoukontians* sometimes given to Arius's followers. On the other hand, Arius affirmed of the Son that he was "perfect God, only-begotten" (πλήρης θεὸς μονογενής); that through him God made the worlds (αἰῶνες, ages); that he was the product or offspring of the Father, and yet not as one among things made (γέννημα ἀλλ' οὐχ ὡς ἓν τῶν γεγενημένων). In his eyes it was blasphemy when he heard that Alexander proclaimed in public that "as God is eternal, so is his Son,—when the Father, then the Son,—the Son is present in God without birth (ἀγεννήτως), ever-begotten (ἀειγενής), an unbegotten-begotten (ἀγεννητογενής)." He detected in his bishop Gnosticism, Manichaeism and Sabellianism, and was convinced that he himself was the champion of pure doctrine against heresy. He was quite unconscious that his own monotheism was hardly to be distinguished from that of the pagan philosophers, and that his Christ was a demi-god.

For years the controversy may have been fermenting in the college of presbyters at Alexandria. Sozomen relates that Alexander only interfered after being charged with remissness in leaving Arius so long to disturb the faith of the church. According to the general supposition, the negotiations which led to the excommunication of Arius and his followers among the presbyters and deacons took place in 318 or 319, but there are good reasons for assigning the outbreak of the controversy to the time following the overthrow of Licinius by Constantine, *i.e.* to the year 323. In any case, from this time events followed one another to a speedy conclusion. Arius was not without adherents, even outside Alexandria. Those bishops who, like him, had passed through the school of Lucian were not inclined to let him fall without a struggle, as they recognized in the views of their fellow-student their own doctrine, only set forth in a somewhat radical fashion. In addressing to Eusebius of Nicomedia a request for his help, Arius ended with the words: "Be mindful of our adversity, thou faithful comrade of Lucian's school (συλλουκιανιστής)"; and Eusebius entered the lists energetically on his behalf. But Alexander too was active; by means of a circular letter he published abroad the excommunication of his presbyter, and the controversy excited more and more general interest.

It reached even the ears of Constantine. Now sole emperor, he saw in the one Catholic church the best means of counteracting the movement in his vast empire towards disintegration; and he at once realized how dangerous dogmatic squabbles might prove to its unity. His letter, preserved by the imperial biographer, Eusebius of Caesarea, is a state document inspired by a wisely conciliatory policy; it made out both parties to be equally in the right and in the wrong, at the same time giving them both to understand that such questions, the meaning of which would be grasped only by the few, had better not be brought into public discussion; it was advisable to come to an agreement where the difference of opinion was not fundamental. This well-meaning attempt at reconciliation, betraying as it did no very deep understanding of the question, came to nothing. No course was left for the emperor except to obtain a general decision. This took place at the fist oecumenical council, which was convened in Nicaea (*q.v.*) in 325. After various turns in the controversy, it was finally dicided, against Arius, that the Son was "of the same substance" (ὁμοούσιος) with the Father, and all thought of his being created or even subordinate had to be excluded. Constantine accepted the decision of the council and resolved to uphold it. Arius and the two bishops of Marmarica Ptolemais, who refused to subscribe the creed, were excommunicated and banished to Illyria, and even Eusebius of Nicomedia, who accepted the creed, but not its anathemas, was exiled to Gaul. Alexander returned to his see triumphant, but died soon after, and was succeeded by Athanasius (*q.v.*), his deacon, with whose indomitable fortitude and strange vicissitudes the further course of the controversy is bound up.

It only remains for us here to sketch what is known of the future career of Arius and the Arians. Although defeated at the council of Nicaea, the Arians were by no means subdued. Constantine, while strongly disposed at first to enforce the Nicene decrees, was gradually won to a more conciliatory policy by the influence especially of Eusebius of Caesarea and Eusebius of Nicomedia, the latter of whom returned from exile in 328 and won the ear of the emperor, whom he baptized on his death-bed. In 330 even Arius was recalled from banishment. Athanasius, on the other hand, was banished to Trêves in 335. During his absence Arius returned to Alexandria, but even now the people are said to have raised a fierce riot against the heretic. In 336 the emperor was forced to summon him to Constantinople. Bishop Alexander reluctantly assented to receive him once more into the bosom of the church, but before the act of admission was completed, Arius was suddenly taken ill while walking in the streets, and died in a few moments. His death seems to have exercised no influence worth speaking of on the course of events. His theological radicalism had in any case never found many convinced adherents. It was mainly the opposition to the Homoousios, as a formula open to heretical misinterpretation, and not borne out by Holy Writ, which kept together the large party known as Semiarians, who under the leadership of the two Eusebiuses carried on the strife against the Nicenes and especially Athanasius. Under the sons of Constantine Christian bishops in numberless synods cursed one another turn by turn. In the western half of the empire Arianism found no foothold, and even the despotic will of Constantius, sole emperor after 351, succeeded only for the moment in subduing the bishops exiled for the sake of their belief. In the east, on the other hand, the Semiarians had for long the upper hand. They soon split up into different groups, according as they came to stand nearer to or farther from the original position of Arius. The actual centre was formed by the *Homoii*, who only spoke generally of a likeness (ὁμοιότης) of the Son to the Father; to the left of them were the *Anomoii*, who, with Arius, held the Son to be unlike (ἀνόμοιος) the Father; to the right, the *Homoiousians* who, taking as their catchword "likeness of nature" (ὁμοιότης κατ' οὐσίαν), thought that they could preserve the religious content of the Nicene formula without having to adopt the formula itself. Since this party in the course of years came more and more into sympathy with the representatives of the Nicene party, the *Homoousians*, and notably with Athanasius, the much-disputed formula became more and more popular, till the council summoned in 381 at Constantinople, under the auspices of Theodosius the Great, recognized the Nicene doctrine as the only orthodox one. Arianism, which had lifted up its head again under the emperor Valens, was thereby thrust out of the state church. It lived to flourish anew among the Germanic tribes at the time of the great migrations. Goths, Vandals, Suebi, Burgundians and Langobardi embraced it; here too as a distinctive national type of Christianity it perished before the growth of medieval Catholicism, and the name of Arian ceased to represent a definite form of Christian doctrine within the church, or a definite party outside it.

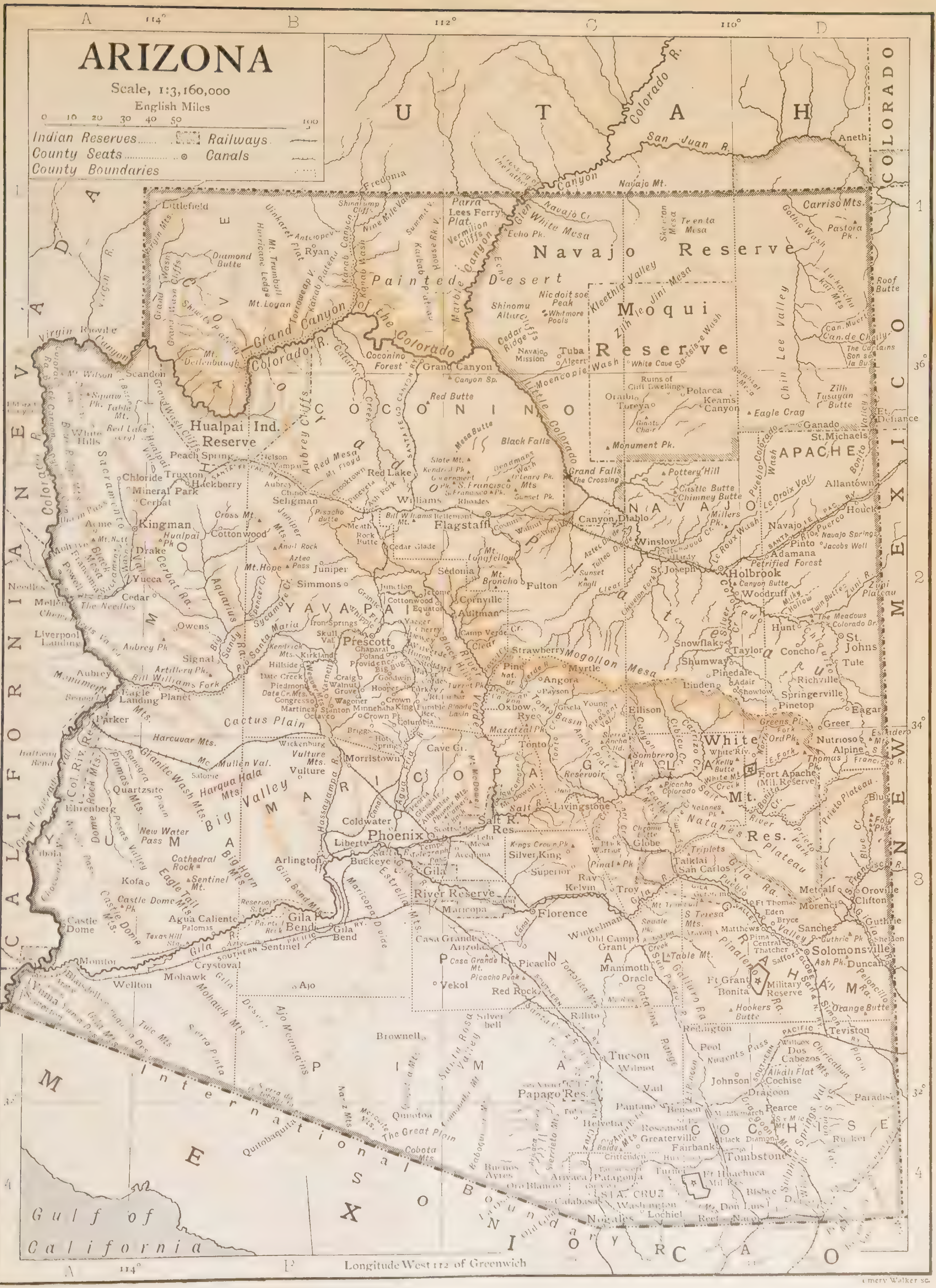
The best account of the proceedings, both political and theological, may be found in the following books:—H. M. Gwatkin, *Studies of Arianism* (2nd edit., Cambridge, 1900); A. Harnack, *History of Dogma* (Eng. trans., 1894–1899); J. F. Bethune-Baker, *An Introduction to the Early History of Christian Doctrine* (London, 1903); W. Bright, *The Age of the Fathers* (London, 1903). Cardinal Newman's celebrated *Arians of the Fourth Century* is interesting more from the controversial than from the historical point of view. See also Paavo Snellman, *Der Anfang des arianischen Streites* (Helsingfors, 1904); Sigismund Rogala, *Die Anfänge des arianischen Streites* (Paderborn, 1907). (G. K.)

ARIZONA (from the Spanish-Indian *Arizonac*, of unknown meaning,—possibly "few springs,"—the name of an 18th-century mining camp in the Santa Cruz valley, just S. of the present border of Arizona), a state on the S.W. border of the United States of America, lying between 31° 20′ and 37° N. lat. and 109° 2′ and 114° 45′ W. long. It is bounded N. by Utah, E. by New Mexico, S. by Mexico and W. by California and Nevada, the Colorado river separating it from California and in part from Nevada. On the W. is the Great Basin. Arizona itself is mostly included in the great arid mountainous uplift of the Rocky Mountain region, and partly within the desert plain region of the Gulf of California, or Open Basin region. The whole state lies on the south-western exposure of a great roof whose crest, along the continental divide in western New Mexico, pitches southward. Its altitudes vary from 12,800 ft. to less than 100 ft. above the sea. Of its total area of 113,956 sq. m. (water surface, 116 sq. m.), approximately 39,000 lie below 3000 ft., 27,000 from 3000 to 5000 ft., and 47,000 above 5000 ft.

Physical Features.—Three characteristic physiographic regions are distinctly marked: first the great Colorado Plateau, some 45,000 sq. m. in area, embracing all the region N. and E. of a line drawn from the Grand Wash Cliffs in the N.W. corner of the state to its E. border near Clifton; next a broad zone of compacted mountain ranges with a southern limit of similar trend; and lastly a region of desert plains, occupying somewhat more than the S.W. quarter of the state. The plateau region has an average elevation of 6000-8000 ft. eastward, but it is much broken down in the west. The plateau is not a plain. It is dominated by high mountains, gashed by superb canyons of rivers, scarred with dry gullies and washes, the beds of intermittent streams, varied with great shallow basins, sunken deserts, dreary levels, bold buttes, picturesque mesas, forests and rare verdant bits of valley. In the N.W. there is a giddy drop into the tremendous cut of the Grand Canyon (*q.v.*) of the Colorado river. The surface in general is rolling, with a gentle slope northward, and drains through the Little Colorado (or Colorado Chiquito), Rio Puerco and other streams into the Grand Canyon. Along the Colorado is the Painted Desert, remarkable for the bright colours—red, brown, blue, purple, yellow and white—of its sandstones, shales and clays. Within the desert is a petrified forest, the most remarkable in the United States. The trees are of mesozoic time, though mostly washed down to the foot of the mesas in which they were once embedded, and lying now amid deposits of a later age. Blocks and logs of agate, chalcedony, jasper, opal and other silicate deposits lie in hundreds over an area of 60 sq. m. The forest is now protected as a national reserve against vandalism and commercialism. Everywhere are evidences of water and wind erosion, of desiccation and differential weathering. This is the history of the mesas, which are the most characteristic scenic feature of the highlands. The marks of volcanic action, particularly lava-flows, are also abundant and widely scattered.

Separating the plateau from the mountain region is an abrupt transition slope, often deeply eroded, crossing the entire state as has been indicated. In localities the slope is a true escarpment falling 150 and even 250 ft. per mile. In the Aubrey Cliffs and along the Mogollon mesa, which for about 200 m. parts the waters of the Gila and the Little Colorado, it often has an elevation of 1000 to 2000 ft., and the ascent is impracticable through long distances to the most daring climber. It is not of course everywhere so remarkable, or even distinct, and especially after its trend turns southward W. of Clifton, it is much broken down and obscured by erosion and lava deposits. The mountain region has a width of 70 to 150 m., and is filled with short parallel ranges trending parallel to the plateau escarpment. Many of the mountains are extinct volcanoes. In the San Francisco mountains, in the north central part of the state, three peaks rise to from 10,000 to 12,794 ft.; three others are above 9000 ft.; all are eruptive cones, and among the lesser summits are old cinder cones. The S.E. corner of Arizona is a region of greatly eroded ranges and gentle aggraded valleys. This mountain zone has an average elevation of not less than 4000 ft., while in places its crests are 5000 ft. above the plains below. The line dividing the two regions runs roughly from Nogales on the Mexican border, past Tucson, Florence and Phoenix to Needles (California), on the W. boundary. These plains, the third or desert region of the state, have their mountains also, but they are lower, and they are not compacted; the plains near the mountain region slope toward the Gulf of California across wide valleys separated by isolated ranges, then across broad desert stretches traversed by rocky ridges, and finally there is no obstruction to the slope at all. Small parts of the desert along the Mexican boundary are shifting sand.

Climate.—As may be inferred from the physical description, Arizona has a wide variety of local climates. In general it is characterized by wonderfully clear air and extraordinarily low humidity. The scanty rainfall is distributed from July to April, with marked excess from July to September and a lesser maximum in December. May and June are very dry. Often during a month, sometimes for several months, no rain falls over the greatest part of Arizona. Very little rain comes from the Pacific or the Gulf of California, the mountains and desert, as well as the adverse winds, making it impossible. Rain and snow fall usually from clouds blown from the Gulf of Mexico and not wholly dried in Texas. The mountainous areas are the only ones of adequate precipitation; the northern slope of the Colorado Plateau is almost destitute of water; the region of least precipitation is the "desert" region. The mean annual rainfall varies from amounts of 2 to 5·5 in. at various points in the lower gulf valley, and on the western border to amounts of 25 to


ARIZONA
Scale, 1:3,160,000
English Miles
0 10 20 30 40 50 100
Indian Reserves
Railways
County Seats
Canals
County Boundaries
A
B
C
D
114°
112°
110°
1
2
3
4
36°
34°
32°
U T A H
N E V A D A
C A L I F O R N I A
N E W M E X I C O
COLORADO
M E X I C O
Gulf of California
International Boundary
Longitude West 112 of Greenwich
M O H A V E
C O C O N I N O
Y A V A P A I
Y U M A
M A R I C O P A
P I N A L
P I M A
G I L A
N A V A J O
A P A C H E
G R A H A M
C O C H I S E
STA. CRUZ
Navajo Reserve
Moqui Reserve
Hualpai Ind. Reserve
Gila River Reserve
Papago Res.
White Mt.
Painted Desert
Grand Canyon of the Colorado
Colorado R.
Little Colorado
Gila R.
Salt R.
San Juan R.
Mogollon Mesa
Flagstaff
Prescott
Phoenix
Tucson
Yuma
Tombstone
Kingman
Holbrook
St. Johns
Florence
Globe
Nogales
Solomonsville
Clifton
Williams
Winslow
Tempe
Mesa
Bisbee
Benson
Willcox
Fort Apache
Ft. Huachuca
Ft. Grant
Ft. Defiance

Emery Walker sc.

30 in. in the mountains. The highest recorded maximum in Arizona is 35 in. The proportion of perfectly clear days in the year varies at different points from a half to two-thirds; of the rest not more than half are without brilliant sunshine part of the day. Local thunderstorms and cloud-bursts are a characteristic phenomenon, inundating limited areas and transforming dried-up streams into muddy torrents carrying boulders and débris. Often in the plateau country the dry under-air absorbs the rain as it falls; and rarely in the Hopi country do flooded gullies "run through" to the Little Colorado. The country of the cliff-dwellers in the N.E. is desert-like. Only points high in altitude catch much rain. Mountain snows feed the Gila, the Little Colorado, and the Colorado rivers. The Colorado, apart from the Gila, draws little water from Arizona. The mountain zone W. of Prescott drains into the Colorado, and to the S. and E. into the Gila; and the latter is by far the heavier drainage in volume. The floods come in May and June, and during the wet season the rivers, all with steep beds in their upper courses, wash along detritus that lower down narrows, and on smaller streams almost chokes, their courses. These gradients enable the inconstant streams tributary to the Colorado to carve their canyons, some of which are in themselves very remarkable, though insignificant beside the Grand Canyon. Many streams that are turned in spring or by summer cloud-bursts into torrents are normally mere water films or dry gulches. Even the Gila is dry in its bed part of the year at its mouth near Yuma. From the Gila to the southern boundary the parched land gives no water to the sea, and the international boundary runs in part through a true desert. In the hot season there is almost no surface water. Artesian wells are used in places, as in the stock country of the Baboquivari valley.

The temperature of Arizona is somewhat higher than that of points of equal latitude on the Atlantic and Gulf of Mexico coasts. In the mountains on the plateau it ranges from that of the temperate zone to that of regions of perpetual snow; S. of the mountains it ranges from temperate heats in the foothills to semi-tropic heat in the lower valleys of the Gila and Colorado. The average annual temperature over the region N. of 34° N. is about 55°; that of the region S. is about 68°. The warmest region is the lower Gila valley. Here the hottest temperature of the year hovers around 130°, the mean for the hottest month (July) is about 98°, and the mean for the year is from 68.9°–74.4° F. at different points. Some parts of the Santa Cruz valley are equally hot. In the hottest (western) portions of the true desert on the Mexican border the daily maximum temperature is about 110° F.; but owing to the rapid radiation in the dry, clear, cloudless air the temperature frequently falls 40–50° in the night. The coldest points on the high plateau have annual means as low as 45–48°, and a mean for the coldest month at times below 20° F. The range from high to low extreme on the plateau may be as great as 125°, but in the S.W. it is only about 70–80° F. The daily variation (not uncommonly 60° F.) is of course greatest in the most arid regions, where radiation is most rapid. And of all Arizona it should be said that owing to the extreme dryness of the air, evaporation from moist surfaces is very rapid,[1] so that the high temperatures here are decidedly less oppressive than much lower temperatures in a humid atmosphere. The great difference between absolute and sensible temperature is a very important climatic characteristic of Arizona. Generally speaking, during two-thirds of the year the temperature is really delightful; the nights are cool, the mornings bracing, the days mild though splendid. Intense heat prevails in July, August and September. In lowness of humidity (mean annual relative humidity at Yuma about 39, at Phoenix 36.7, at Tucson 37.8) and clarity of atmosphere, southern Arizona rivals Upper Egypt and other famous arid health resorts.

Fauna and Flora.—Within the borders of Arizona are areas representative of every life zone save the humid tropical. From the summit of the San Francisco Mountains one may pass rapidly through all these down into the Painted Desert. The Boreal-Canadian, Transition and Upper Sonoran embrace the highlands. Coyotes are very common; wild cats and mountain lions are fairly plentiful. Deer and antelope are represented by various species. Prairie-dogs, jack-rabbits, crows and occasional ravens, quail, grouse, pheasants and wild turkeys are also noteworthy in a rather scant animal life. Characteristic forms of the Upper Sonoran zone are the burrowing owl, Nevada sage-thrush, sage-thrasher and special species of orioles, kangaroo rats, mice, rabbits and squirrels. The Lower Sonoran covers the greatest part of southern and western Arizona, as well as the immediate valleys of the Colorado and Little Colorado rivers. Its animal life is in the main distinguished in species only from that of the Upper Sonoran belt, including among birds, the desert sparrow, desert thrasher, mocking-bird, hooded oriole; and among mammals small nocturnal species of kangaroo rats, pocket mice, mice and bats. Jaguars occasionally stray into Arizona from Mexico. Lizards and toads are conspicuous in the more desert areas. Snakes are not numerous. The Gila-monster, tarantula, the scorpion and thelyphonus, scolopender and julus occur in some localities in the rainy season. The Arid-Tropical zone is represented by a narrow belt along the lower Colorado river, with a short arm extending into the valley of the Gila. The country is so arid that it supports only desert birds and mammals. Camels were very successfully employed as pack animals on the Tule desert in the palmy days of Virginia City, Nevada, before the advent of railways.

The general conditions of distribution of the fauna of Arizona are shown even more distinctly by the flora. There are firs and spruces on the mountains, characteristic of the Boreal zone; pines characteristic of the Transition zone; piñon juniper, greasewood and the universally conspicuous sage-brush, characteristic of the Upper Sonoran zone. In the Lower Sonoran belt, soapweed, acacias (Palo Verde or *Parkinsonia torreyana*), agaves, yuccas and dasylirions, the creosote bush and mesquite tree, candle wood, and about seventy-five species of cactuses—among them omnipresent opuntiae and great columnar "Chayas"—make up a striking vegetation, which in its colours of dull grey and olive harmonizes well with the rigidity and forbidding barrenness of the plains. It has exercised profound influence upon the industries, arts, faiths and general culture of the Indians. In places the giant cactus grows in groves, attaining a height of 40 and even 50 ft. The mesquite varies in size from a tangled thorny shrub to a spreading tree as much as 3 ft. in diameter and 50 ft. high; it is normally perhaps half as high, and 6–8 in. in diameter. Enduring hardily great extremes of heat and moisture, it is throughout the arid South-west the most important, and in many localities the only important, native tree. From the great juicy, leafless, branchless stalk of the yucca, soap is prepared, and strong fibres useful in making paper, rope and fabrics. The fibre of the agave is also made into rope and its juice into pulque. The canaigre grows wild and is also cultivated. It is easy to exaggerate greatly the barrenness of an arid country. There are fine indigenous grasses that spring up over the mesas after the summer rains, furnishing range for live-stock; some are extraordinarily independent of the rainfall. In the most arid regions there is a small growth of green in the rainy season, and a rich display of small wild-flowers, as well as the enormous flower clusters of the yucca, and blooms in pink and orange, crimson, yellow and scarlet of the giant cactus and its fellows. Even in the Mexican border, desert oak, juniper and manzanita cover the mountains, and there is a vigorous though short-lived growth of grasses and flower from July to October. The cliff-dweller country supports a scant vegetation—a few cottonwood in the washes, a few cedars on the mesas.

Continuous forest areas are scant. A fair variety of trees—cottonwood, sycamore, ash, willow, walnut and cherry—grow in thickets in the canyons, and each mountain range is a forest area. Rainfall varying with the altitude, the lower timber line below which precipitation is insufficient to sustain a growth of trees is about 7000 ft., and the upper timber line about 11,500 ft.

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[1] At Yuma, Phoenix and Tucson, the records of twenty-six, eighteen and fifteen years respectively show a rate of evaporation 35·2, 12·7, and 7·7 times as great as the mean annual rainfall, which was 2·84 in., 7·06 in. and 11·7 in. for the places named.

Oaks, juniper, piñon, cedars, yellow pine, fir and spruce grow on the mountains and over large areas of the plateau country.[1] The Coconino forest is one of the largest unbroken pine forests (about 6000 sq. m.) in the United States. Since 1898 about 86% of the wooded lands have been made reservations, and work has been done also to preserve the forest areas in the mountains in the south-east, from which there are few streams of permanent flow to the enclosing arid valleys.

Soil.—The soils in the southern part of Arizona are mainly sandy loams, varying from light loam to heavy, close adobe; on the plateaus is what is known as "mesa" soil; and along the rivers are limited overflow plains of fine sediment—especially along the Colorado and the river Verde. These soils are in general rich, but deficient in nitrogen and somewhat in humus; and in limited areas white alkaline salts are injuriously in excess. Virgin soils are densely compact. By far the most useful crops are leguminous green manures, especially alfalfa, which grows four to seven cuttings in a year and as a soil flocculator and nitrogen-storer has proved of the greatest value. The greatest obstacle to agriculture is lack of water. Artesian wells are much used in the south-east. For the reservation of the water-partings—in the past considerably denuded by lumbermen and ranchmen—the increase of the forest areas, and the creation of reservoirs along the rivers, to control their erratic flow[2] and impound their flood waste for purposes of irrigation, much has been done by the national government. The irrigated areas are only little spots along the permanent streams. In 1900 the farm area was only 2.7% of the total area of the state and only 0·31% was actually improved (including Indian reservations, 0·35%; in 1906, 0·92% was cultivated); of the land actually under crops, 88·5% was irrigated. The improved acreage more than quintupled from 1880 to 1900. The total irrigated area in 1900 was 185,000 acres and in 1902, 247,250 acres. The increase in land values by irrigation from 1890 to 1900 is estimated at $3,500,000. A reservoir was begun in 1904 just below the junction of the Tonto and the Salt with capacity to store 1,330,000 acre-ft. for irrigation, and develop also an electric power sufficient to pump underground water for an additional 50,000 acres at the lowest estimate[3] of lands lying too high for supply by gravity. Another important undertaking begun about the same time was the throwing of an East Indian weir dam (the only one in the United States) across the Colorado near Yuma, and the confinement of both sides of the lower Gila and Colorado with levees.

Agriculture.—Strawberries and Sahara dates; alfalfa, wheat, barley, corn and sorghum; oranges, lemons, wine grapes, limes, olives, figs, dates, peanuts and sweet potatoes; yams and sugar beets, show the range of agricultural products. The date palm fruits well; figs grow luxuriantly, though requiring much irrigation; almonds do well if protected from spring frosts; sea-island cotton grows in the finest grades, but is not of commercial importance. The country about Yuma is particularly suited to subtropical fruits. Temperate fruits—peaches, pears, apples, apricots and small fruits—do excellently; as do all important vegetables. The fruit industry is becoming more and more important. Farming is very intensive, and crop follows crop in swift succession; in 1905 the yield of barley per acre, 44 bushels, was greater than in any other state or territory, as was the farm price per bushel on the 1st of December, 81 cents; the average yield per acre of hay was the highest in the Union in 1903, 3·46 tons, the general average being 1·54 tons, was fourth in 1904, 2·71 tons (Utah 3·54, Idaho 3·07, Nevada 3·04), the general average being 1·52 tons, and was highest in 1905, 3·75 tons, the general average for the country being 1·54 tons; and in the same three years the average value per acre of hay was greater in Arizona than in any other state of the Union, being $35·78 in 1903, $40·22 in 1904, and $46·39 in 1905, the general averages for the country being $13·93, $13·23 and $13·11 respectively, for the three years. Of the total farm acreage of the state 97·6% were held in 1900 by the whites; and of these 80·2% owned in whole or in part the land they cultivated.

Stock-raising is a leading industry, but it has probably attained its full development. The over-stocking of the ranges has caused much loss in the past, and the almost total eradication of fine native grasses over extended areas. Of the neat cattle (7,042,635) almost 98%, and of the sheep (861,761) almost 100%, were in 1900 pastured wholly or in part upon the public domain. The extension of national forest reserves and the regulations enforced by the United States government for the preservation of the ranges have put limits to the industry. In 1900 the value of live-stock represented 15·7% of the capital invested in agriculture; the value of animals sold or slaughtered for food ($3,204,758) was half the total value of all farm products ($6,997,097). Ostrich farms have been successfully established in the Salt river valley since 1893; in 1907 there were six farms in the Salt river valley, on which there were about 1354 birds; the most successful food for the ostrich is alfalfa.

Minerals.—Mining is the leading industry of Arizona. Contrary to venerable traditions there is no evidence that mining was practised beyond the most inconsiderable extent by aborigines, Spanish *conquistadores*, or Jesuits. In 1738 an extraordinary deposit of silver nuggets, quickly exhausted (1741), was discovered at Arizonac. At the end of the 18th century the Mexicans considerably developed the mines in the south-east. The second half of the 19th century witnessed several great finds; first, of gold placers on the lower Gila and Colorado (1858–1869); later, of lodes at Tombstone, which flourished from 1879–1886, then decayed, but in 1905 had again become the centre of important mining interests; and still later the development of copper mines at Jerome and around Bisbee. Several of the Arizona copper mines are among the greatest of the world. The Copper Queen at Bisbee from 1880–1902 produced 378,047,210 ℔ of crude copper, which was practically the total output of the territory till after 1900, when other valuable mines were opened; the Globe, Morenci and Jerome districts are secondary to Bisbee. Important mines of gold and silver, considerable deposits of wolframite, valuable ores of molybdenum and vanadium, and quarries of onyx marble, are also worked. Low-grade coal deposits occur in the east central part of the state and near the junction of the Gila and San Pedro rivers. Some fine gems of peridot, garnet and turquoise have been found. The mineral products of Arizona for 1907 were valued at $56,753,650; of which $51,355,687 (more than that of any other state) was the value of copper; $2,664,000, gold; and $1,916,000, silver. In 1907 the legislature passed an elaborate act providing for the taxation of mines, its principal clause being that the basis of valuation for taxation in each year be one-fourth of the output of the mines in question for the next preceding year.

Manufactures.—The manufacturing industries are of relatively slight importance, though considerable promise attends the experiments with canaigre as a source of tannin. The Navaho and Moqui Indians make woollen blankets and rugs and the Pimas baskets. Onyx marbles of local source are polished at Phoenix. The capital invested in manufacturing industries increased from $9,517,573 in 1900 to $14,395,654 in 1905, or 51·3%, and the value of products from $20,438,987 in 1900 to $28,083,192 in 1905, or 37·4%. Of the total product in 1905 the product of the principal industry, the smelting and refining of copper ($22,761,981), represented 81·1%; it was 9·4% of all the smelting and refining of copper done in the United States in that year. The other manufactures were of much less importance, the principal ones being cars and general shop construction, including repairs by steam railway companies ($1,329,308), lumber and timber products ($960,778), and flour and grist mill products ($743,124).

Two transcontinental railway systems, the Southern Pacific and Santa Fé, were built across Arizona in 1878–1883. They are connected by one line, and a feeder runs S. into Sonora.

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[1] The San Francisco yellow pine forest, with an area of some 4700 sq. m., is the finest forest of the arid south-west.

[2] The combined flow of the Salt and Verde varies from 100 to more than 10,000 cub. ft. per second.

[3] The dam locks a narrow canyon. The height is 284 ft., the water rising 230 ft. against it. The storage capacity is exceeded by probably but one reservoir in the world—the Wachusett reservoir near Boston.

The railway mileage of Arizona on the 1st of January 1908 was 1935·35 m.

Population.—The population of Arizona in 1880 was 40,440; in 1890, 59,620; in 1900, 122,931 (including 28,623 reservation Indians not counted before); in 1910, 204,354. The native population is of the most diverse origin; the foreign element is equally heterogeneous, but more than half (in 1900, 14,172 out of 24,283 foreign-born) are Mexicans, many of whom are not permanent residents; after 1900, immigrants were largely mine labourers, and included Slavonians and Italians. The largest towns in 1900 were Tucson, Phoenix, which is the capital, Prescott (pop. 3559), Jerome (pop. 1890, 250; in 1900, 2861); Winslow (pop. 1890, 363; in 1900, 1305), Nogales (pop. 1900, 1761), and Bisbee. The last was an insignificant mining camp in 1880, still unincorporated in 1900, but with an estimated population of 6000 in 1904. It is crowded picturesquely into several narrow confluent ravines. Railway connexion with El Paso was established in 1902. Douglas is another growing camp.

Over thirty Indian tribes are represented in the Indian schools of Arizona. The more important are the Hualapais or Apache-Yumas; the Mohaves; the Yavapais or Apache-Mohaves; the Yumas, whose lesser neighbours on the lower Colorado are the most primitive Indians of the United States in habits; the Maricopas; the Pimas and Papagoes, who figure much in early Arizona history, and who are superior in intelligence, adaptability, application and character; the Hopis or Moquis, possessed of the same good qualities and notably temperate and provident, famous for their prehistoric culture (Tusuyan); the Navaho, and the kindred Apaches, perhaps the most relentless and savage of Indian warriors. All the Indians of Arizona live on reservations save the few non-tribal Indians taxed and treated as active citizens. Even the Apaches after being whipped by relentless war into temporary submission have been bound by treaties which the gifts, vices and virtues of the reservation system have tempted them to observe. The Pimas and Papagoes were early converted by the Spaniards, and retain to-day a smattering of Christianity plentifully alloyed with paganism. Apaches, Pimas, Papagoes have been employed by the United States on great irrigation works, and have proved industrious and faithful labourers. In 1900 there were 1836 taxed Indians, 26,480 reservation Indians not taxed, and in addition many friendly Papagoes unenumerated.

In 1906 the Indian population was estimated as being 14 % of the whole population of Arizona, and that they are singularly law-abiding is argued from the fact that in the same year the Indians furnished only 3 % of the convicts in the territorial prison.

Government and Education.—Arizona became a territory of the first (or practically autonomous) class in 1863. Her organic law thereafter until 1910 consisted of various sections of the Revised Statutes of the United States. From the beginning she had a territorial legislature. Congress retained ultimately direct control of all government, administration being in the hands of resident officials appointed by the president and Senate. Special mention must be made of the secret police, the Arizona Rangers, organized in 1901 to police the cattle ranges; they are "fearless men, trained in riding, roping, trailing and shooting," a force whose *personnel* is not known to the general public. The legislature repealed the law licensing public gambling in 1907; enacted a law requiring the payment of $300 per annum as licence fee by retail liquor dealers; and provided for juvenile courts and probationary control of children. In 1907 the total tax valuation of property was $77,705,251; the net debt of the territory $1,022,972, and that of counties and towns $3,123,275. The receipts of the territorial treasury for the year ending on the 30th of June 1907 were $687,386, and the disbursements for the same period were $601,568. A homestead provision (1901) exempts from liability for debts (except mortgages or liens placed before the homestead claim) any homestead belonging to the head of a family, existing in one compact body and valued at not more than $2500; such a homestead a married man may not sell, lease or put a lien on without his wife's consent. Personal property to the value of $500 is exempt from the same liability. The public school system was established in 1871. A compulsory attendance law applies to children between 6 and 14 years of age, but it is not generally obeyed by the Mexican element of population. In 1907 there was an enrolment of 24,962 out of 33,167 children of school age; there were six high schools—three new in 1906; and the average number of school days was 128·4. In the fiscal year ending June 1907, the total receipts for schools were $697,762, and the expenditures were $701,102. Illiteracy is high, amounting in 1900 to 23·1 % of native males, above 21 years of age, and 30·5 % of foreign males, principally because of the large number of Indians, Chinese, Japanese and Mexicans in the state. There are two normal schools at Tempe (1886) and Flagstaff (1899), a university at Tucson with an agricultural experiment station that has done much for the industries of Arizona; there is a considerable number of Indian schools, the largest of which are maintained by the national government, and the funds of the university come largely from the same source. The first juvenile reform school, called the Territorial Industrial school, was opened in 1903 at Benson. The territorial prison, formerly at Yuma, was abandoned for a modern building at Florence, Pinal county; and a hospital for the insane is 3 m. from Phoenix.

History.—The history of the South-west is full of interest to the archaeologist. A prehistoric culture widely distributed has left abundant traces. Pueblo ruins are plentiful in the basins of the Gila and Colorado rivers and their tributaries. Geographical conditions and a hard struggle against nature fixed the character of this "aridian" culture, and determined its migrations; the onslaughts of nomad Indians determined the sedentary civilization of the cliff dwellers. A co-operative social economy is evidenced by the traces of great public works, such as canals many miles in length. The pueblos of the Gila valley are held to be older than those of the Colorado. Casa Grande, 15 m. S.E. of a railway station of the same name on the Southern Pacific railway, is the most remarkable of plain ruins in the South-west, the only one of its type in the United States. It resembles the Casa Grande ruin of Chihuahua, Mexico, with its walls of sun-dried puddled clay, and its area of rooms, courts and plazas, surrounded by a wall. It was already a ruin when discovered in 1694 by the Jesuit father Kino. John Russel Bartlett described it in 1854, and in 1889 Congress voted that it be protected as a government reservation; in 1892 it was set apart by the government. Excavations were made there in 1906–1907 by Dr J. Walter Fewkes. Migration was northward. The valleys of the Salt river and its affluents, the Agua Fria, Verde and Tonto, are strewn with aboriginal remains; but especially important in migrations of culture was the Little Colorado. A very considerable population must have lived once in this valley. It is represented to-day by the still undeserted habitats of Zuñi (in New Mexico) and Tusayan; the Moquis, after the Zuñis, are in customs and traditions the best survival of the ancient civilization.

Arizona north of the Gila, save for a very limited and intermittent missionary effort and for scant exploring expeditions, was practically unknown to the whites until well after the beginning of American rule. The Santa Cruz valley, however, has much older annals of a past that charms by its picturesque contrasts with the present. Arizona history begins with the arrival in Sonora in 1536 of Alvar Nuñez Cabeza de Vaca, who, although he had not entered Arizona or New Mexico, had heard of them, and by his stories incited the Spaniards to explore the unknown north in hope of wealth. Marcos de Niza, a Franciscan friar to whom the first reconnaissance was entrusted, was the first Spaniard to enter the limits of Arizona. He crossed the south-eastern corner to Zuñi in 1539, passing through the Santa Cruz valley; and F. V. de Coronado (*q.v.*) was led by Fray Marcos over the same route in 1540; while Hernando Alarcon explored the Gulf of California and the lower Colorado river. Members of Coronado's expedition explored the Moqui country and reached the Grand Canyon, and after this a succession of remarkable and heroic explorations followed through the century; which however accomplished little for geography, further confusing and embellishing rather than clearing up its mysteries. All this has left traces in still living myths about the early history of the South-west. Early in the 17th century considerable progress had been made in Christianizing the Pimas, Papagoes and Moquis. Following 1680 came a great Indian revolt in New Mexico and Arizona, and thereafter the Moquis remained independent of Spanish and Christian domination, although visited fitfully by rival Jesuits and Franciscans. In 1732 (possibly in 1720) regular Jesuit missions were founded at Bac (known as an Indian rancheria since the 17th century) and at Guevavi. The region south of the Gila had already been repeatedly explored. In the second half of the century there was a presidio at Tubac (whose name first appears 1752) and some half-dozen pueblos de visita, including the Indian settlement of Tucson.

A few errors should be corrected and some credit given with reference to this early period. The Inquisition never had any jurisdiction whatever over the Indians; compulsory labour by the Indians was never legalized except on the missions, and the law was little violated; they were never compelled to work mines; of mining by the Indians for precious metals there is no evidence; nor by the Jesuits (expelled in 1767, after which their missions and other properties were held by the Franciscans), except to a small extent about the presidio of Tubac, although they did some prospecting. Persistent traditions have greatly exaggerated the former prosperity of the old South-west. The Spaniards probably provoked some inter-tribal intercourse among the Indians, and did something among some tribes for agriculture. Their own farms and settlements, save in the immediate vicinity of the presidio, were often plundered and abandoned, and such settlement as there was was confined to the Santa Cruz valley. From about 1790 to 1822 was a period of peace with the Apaches and of comparative prosperity for church and state. The fine Indian mission church at Bac, long abandoned and neglected, dates from the last decade of the 18th century. The establishment of a presidio at Tucson in 1776 marks its beginning as a Spanish settlement.

The decay of the military power of the presidios during the Mexican war of independence, the expulsion of loyal Spaniards—notably friars—and the renewal of Apache wars, led to the temporary abandonment of all settlements except Tubac and Tucson. The church practically forsook the field about 1828.

American traders and explorers first penetrated Arizona in the first quarter of the 19th century. As a result of the Mexican War, New Mexico, which then included all Arizona north of the Gila, was ceded to the United States. California gold discoveries drew particular attention to the country south of the Gila, which was wanted also for a transcontinental railway route. This strip, known as the " Gadsden Purchase " (see GADSDEN, JAMES), was bought in 1854 by the United States, which took possession in 1856. This portion was also added to New Mexico. The Mexicans, pressed by the Apaches, had, in 1848, abandoned even Tubac and Tamacácori, first a visita of Guevavi, and after 1784 a mission. The progress of American settlement was interrupted by the Civil War, which caused the withdrawal of the troops and was the occasion for the outbreak of prolonged Indian wars.

Meanwhile a convention at Tucson in 1856 sent a delegate to Congress and petitioned for independent territorial government. This movement and others that followed were ignored by Congress owing to its division over the general slavery question, and especially the belief of northern members that the control of Arizona was an object of the pro-slavery party. A convention held in April 1860 at Tucson undertook to " ordain and establish," of its own motion, a provisional constitution until Congress should " organize a territorial government." This provisional territory constituted all New Mexico south of 34° 40′ N. Officials were appointed and New Mexican legislation for the Arizona counties ignored, but nothing further was done. In 1861 it was occupied by a Texan force, declared for the Confederacy, and sent a delegate (who was not admitted) to the Confederate congress. That body in January 1862 passed a formal act organizing the territory, including in it New Mexico, but in May 1862 the Texans were driven out by a Union force from California. By act of the 24th of February 1863 Congress organized Arizona territory as the country west of 109° W. long. In December an itinerant government sent out complete from Washington crossed the Arizona line and effected a formal organization. The territorial capital was first at Prescott (1863–1867), then at Tucson (1867–1877), again at Prescott (1877–1889), and finally at Phoenix (since 1889).

There have been boundary difficulties with every contiguous state or territory. The early period of American rule was extremely unsettled. The California gold discoveries and overland travel directed many prospecting adventurers to Arizona. For some years there was considerable sentiment favouring filibustering in Sonora. The Indian wars, breeding a habit of dependence on force, and the heterogeneous elements of cattle thieves, Sonoran cowboys, mine labourers and adventurers led to one of the worst periods of American border history. But since about 1880 there is nothing to chronicle but a continued growth in population and prosperity. Agitation for statehood became prominent in territorial politics for some years. In accordance with an act of Congress, approved on the 16th of June 1906, the inhabitants of Arizona and New Mexico voted on the 6th of November 1906 on the question of uniting the territories into a single state to be called Arizona; the vote of New Mexico was favourable to union and statehood, but these were defeated by the vote of Arizona (16,265 against, and 3141 for statehood). In June 1910 the President approved an enabling act providing for the admission of Arizona and New Mexico as separate states.

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ARJUNA, in Hindu mythology, a semi-divine hero of the *Mahabharata*. He was the third son of Pandu, son of Indra. His character as sketched in the great epic is of the noblest kind. He is the central figure of that portion of the epic known as the *Bhagwad-gita*, where he is represented as horrified at the impending slaughter of a battle and as being comforted by Krishna.

ARK (a word common to Teutonic languages, cf. Ger. *Arche*, adapted from the Lat. *arca*, chest, cf. *arcere*, to shut up, enclose), a chest, basket or box. The Hebrew word *tebah*, translated in the A.V. by " ark," is used in the Old Testament (1) of the box made of bulrushes in which Pharaoh's daughter found the infant Moses (Exodus ii. 3), and (2) of the great vessel or ship in which Noah took refuge during the flood (Genesis vi.–ix.).

Noah's Ark.— According to the story in Genesis, Noah's ark was large enough to contain his family and representatives of each kind of animal. Its dimensions are given as 300 cubits long, 50 cubits broad and 30 cubits high (cubit = 18–22 in.). It was made of "gopher" wood, which has been variously identified with cypress, pine and cedar. Before the days of the "higher criticism" and the rise of the modern scientific views as to the origin of species, there was much discussion among the learned, and many ingenious and curious theories were advanced, as to the number of the animals and the space necessary for their reception, with elaborate calculations as to the subdivisions of the ark and the quantities of food, &c., required to be stored. It may be interesting to recall the account given in the first edition of the *Encyclopaedia Britannica* (1771), which contained a summary of some of these various views (substantially repeated up to the publication of the eighth edition, 1853). "Some have thought the dimensions of the ark as given by Moses too scanty . . . and hence an argument has been drawn against the authority of the relation. To solve this difficulty many of the ancient Fathers and the modern critics have been put to miserable shifts. But Buteo and Kircher have proved geometrically that, taking the cubit of a foot and a half, the ark was abundantly sufficient for all the animals supposed to be lodged in it. Snellius computes the ark to have been above half an acre in area . . . and Dr Arbuthnot computes it to have been 81,062 tuns . . . if we come to a calculation the number of species of animals will be found much less than is generally imagined, not amounting to a hundred species of quadrupeds, nor to two hundred of birds. . . . Zoologists usually reckon but an hundred and seventy species in all." The progress of the "higher criticism," and the gradual surrender of attempts to square scientific facts with a literal interpretation of the Bible, are indicated in the shorter account given in the eighth edition, which concludes as follows:—"the insuperable difficulties connected with the belief that all the existing species of animals were provided for in the ark, are obviated by adopting the suggestion of Bishop Stillingfleet, approved by Matthew Poole, Pye Smith, le Clerc, Rossenmüller and others, that the deluge did not extend beyond the region of the earth then inhabited, and that only the animals of that region were preserved in the ark." The first edition also gives an engraving of the ark (repeated in the editions up to the fifth), in shape like a long roofed box, floating on the waters; the animals are seen in separate stalls. By the time of the ninth edition (1875) precise details are no longer considered worthy of inclusion; and the age of scientific comparative mythology has been reached.

For a comparative study of the occurrence of the ark in the various deluge myths, in the present edition, see DELUGE; COSMOGONY; BABYLONIA AND ASSYRIA.

The *Ark of the Law*, in the Jewish synagogue, is a chest or cupboard containing the scrolls of the Torah (Pentateuch), and is placed against or in the wall in the direction of Jerusalem. It forms one of the most decorative features of the synagogue, and often takes an architectural design, with columns, arches and a dome. There is a fine example in the synagogue at Great St Helens, London. (X.)

Ark of the Covenant, *Ark of the Revelation*, *Ark of the Testimony*, are the full names of the sacred chest of acacia wood overlaid with gold which the Israelites took with them on their journey into Palestine. The Biblical narratives reveal traces of a considerable development in the traditions regarding this sacred object, and those which furnish the most complete detail are of post-exilic date when the original ark had been lost. The fuller titles of the ark originate in the belief that it contained the "covenant" (*bĕrīth*) or "testimony" (*'ēdūth*), the technical terms for the Decalogue (*q.v.*); primarily, however, it would seem to have been called "the ark of Yahweh" (or "Elohim"), or simply "the ark." The word itself (*ārōn*) designates an ordinary chest (cp. Gen. l. 26; 2 Kings xii. 10), and the (late) description of its appearance represents it as an oblong box $2\frac{1}{2}$ cubits long, $1\frac{1}{2}$ cubits in breadth and height (roughly 1·2 by ·75 metres). It was lined within and without with gold, and through four golden rings were placed staves of acacia wood, by means of which it was carried. A slab of the same metal (the so-called "mercy-seat," *kappōreth*, Gr. *hilastērion*) covered the top, and this was surmounted by two Cherubim (Ex. xxv. 10-22, xxxvii. 1-9). The latter, however, are not mentioned in earlier passages (Deut. x. 1, 3), and would naturally increase the weight of the ark, which, according to 2 Sam. xv. 29, could be carried by two men.

The ark was borne by the Levites (Deut. x. 8), and the latest narratives amplify the statement with a wealth of detail characteristic of the post-exilic interest in this order. (See LEVITES.) An interesting passage relating the commencement of an Israelite journey vividly illustrates the power of the sacred object. As the ark started, it was hailed with the cry, "Arise, Yahweh, let thine enemies be scattered, let them that hate thee flee from before thee," and when it came to rest, the cry again rang out, "Return, O Yahweh, to the myriads of families of Israel" (Num. x. 33-36). This saying appears to imply a settled life in Canaan, but both affirm the warlike significance of Yahweh and the ark. Thus it is the permanent pledge of Yahweh's gracious presence; it guides the people on their journey and leads them to victory. It is no mere receptacle, but a sacrosanct object as much to be feared as Yahweh himself. To presume to fight without it was to invite defeat, and on one notable occasion the Israelites attempted to attack their enemy north of Kadesh without its aid, and were defeated (Num. xiv. 44 sq.). There are many gaps in its history, and although at the crossing of the Jordan and at the fall of Jericho the ark figures prominently (Josh. iii. sq., vi. sq.), it is unaccountably missing in stories of greater national moment. Once it is found at Bethel (Judges xx. 27 sq.). It is met with again at Shiloh, where it is under the care of Eli and his sons, descendants of an ancient family of priests (1 Sam. ii. 28; cp. Josh. xviii. 1). After a great defeat of Israel by the Philistines it was brought into the field, but was captured by the enemy. The trophy was set up in the Philistine temple of Ashdod, but vindicated its superiority by overthrowing the god Dagon. A plague smote the city, and when it was removed to Ekron, pestilence followed in its wake. After taking counsel the Philistines placed the ark with a votive offering upon a new cart drawn by two cows. The beasts went of their own accord to Beth-shemesh, where it remained in the field of a certain Joshua. Again a disaster happened through some obscure cause, and seventy of the sons of Jeconiah were smitten (1 Sam. vi. 19, R.V., margin). Thence it was removed to the house of Abinadab of Kirjath-jearim, who consecrated his son to its service (1 Sam. iv.–vii. 1). For many years the ark remained untouched—apparently forgotten. Shiloh disappears from history; neither Saul nor even Samuel, whose youth had been spent with it, takes any further thought of it. After a remarkable period of obscurity, the ark enters suddenly into the history of David (2 Sam. vi.). Some time after the capture of Jerusalem the ark was brought from Baal-Judah, but at the threshing-floor of Nacon (an unintelligible name) Abinadab's son Uzzah laid hands upon it and was struck down for his impiety. On this account the place is said to have received the name Perez-Uzzah ("breach of Uzzah"). It was taken into the house of Obed-edom the Gittite (*i.e.* of Gath), and brought a blessing upon his house during the three months that it remained there. Finally the king had it conveyed to the city of David, where a tent was prepared to shelter it. Once at Jerusalem, it seems to have lost its unique value as the token of Yahweh's presence; its importance was apparently merged with that of the Temple which Solomon built. The foundation of the capital would pave the way for the belief that the national god had taken a permanent dwelling-place in the royal seat. The prophets themselves lay no weight upon the ark as the central point of Jerusalem's holiness. The real Deuteronomic code does not mention it, and to Jeremiah (iii. 16) it was a thing of no consequence. Later, in the age of the priestly schools, the ark received much attention, although it must obviously be very doubtful how far a true recollection of its history has survived. But nowhere is any light thrown upon its fate. The invasion of Shishak, the capture of Jerusalem by Joash (2 Kings xiv. 13,14), the troublous reign of Manasseh, the destruction of Jerusalem by Nebuçhadrezzar, have found each its supporters. The wild legends of its preservation at the taking of Jerusalem (2 Macc. ii. and elsewhere) only show that the popular mind was unable to share the view that the ark was an obsolete relic. More poetical is the tradition that the ark was raised to heaven, there to remain till the coming of the Messiah, a thought which embodies the spiritual idea that a heavenly pledge of God's covenant and faithfulness had superseded the earthly symbol.[1]

A critical examination of the history of the Israelite ark renders it far from certain that the object was originally the peculiar possession of all Israel. Many different traditions have gathered around the story of the Exodus, and the ark was not the only divinely sent guide or forerunner which led the Israelites. Its presence at Shiloh, and its prominence in the life of Joshua, support the view that it was the palladium of the Joseph tribes, but the traditions in question conflict with others. The account of the commencement of the ark's journey associates it with Moses and his kin (Num. x. 29 sqq.)—that is, with the south Palestinian clans with which the term "Levites" appears to be closely connected. (See LEVITES.) A distinct movement direct into Judah is implied by certain old traditions (see CALEB), but this is subordinated to the more comprehensive account of the journey round by the east of the Jordan. (See EXODUS, THE.) The narratives in 1 Sam. iv.–vi. stand on a plane by themselves, and the gap between them and 2 Sam. vi. has not been satisfactorily fixed. But it is not certain that the two belong to the same cycle of tradition; Kirjath-jearim and Baal-Judah are identified only in later writings, and the behaviour of Saul's daughter (2 Sam. vi. 15 sqq.) may conceivably imply that the ark was an unknown object to Benjamites. It is of course possible that the ark was originally the sacred shrine of the clans which came direct to Judah, and that the traditions in 1 Sam. iv.–vi., Josh. iii. sqq. are of secondary origin, and are to be associated with its appearance at Shiloh, the fall of which place, although attributed to the time of Samuel, is apparently regarded by Jeremiah (xxvi. 6) as a recent event. Of these two divergent traditions, it would seem that the one which associates it with the kin of Moses and David may be traced farther in those late narratives which connect the ark closely with the Levites and even attribute its workmanship to Bezalel, a Calebite (Ex. xxxi. 2; 1 Chron. ii. 19 sqq.). The tradition in Psalms cxxxii. 6 of the search for the ark at Jaar (Kirjath-jearim) and Ephratah is not clear; but a comparison with 1 Chron. ii. 50 seems to show that it recognized the "Calebite" origin of the ark.

See, on this, S.A. Cook, *Critical Notes on O. T. History* (*Index* s.v.), and, for other views, Kosters, *Theol. Tijd.* xxvii. 361 sqq.; Cheyne, *Encyc. Bib.* "Ark"; G. Westphal, *Yahwes Wohnstätten*, pp. 55 sqq., 85 sqq. (Giessen, 1908).

Whether the ark originally contained some symbol of Yahweh or not has been the subject of much discussion. Thus, it has been held that it contained stone fetishes (meteoric stones and the like) from Yahweh's original abode on Sinai or Horeb. As the palladium of the Joseph tribes, it has even been suggested that the bones of Joseph were treasured in the ark. Others have regarded it as an empty portable throne,[2] or as a receptacle for sacred serpents (analogies in Frazer, *Pausanias*, iv. pp. 292, 344). That it contained the tables of the law (Deut. x. 2; 1 Kings viii. 9) was the later Israelite view, and the subsequent development is illustrated in Heb. ix. 4. It is enough to decide that the ark represented in some way or other the presence of Yahweh and that the safety of his followers depended upon its security (analogies in Frazer, *Paus.* x. p. 283). The Semitic world affords many examples of the belief that a man's religion was part of his political connexion and that the change of nationality involved change of cult. He who leaves his land to enter another, leaves his god and is influenced by the religion of his new home (1 Sam. xxvi. 19; Ruth i. 16 sqq.), but strangers know not "the cult of the God of the land" (2 Kings xvii. 26). No nation willingly changes its god (Jer. ii. 11), and there are means whereby the follower of Yahweh may continue his worship even when outside Yahweh's land (2 Kings v. 17). When a people migrate they may take with them their god, and if they conceive him to be a spiritual being who cannot be represented by an image, they may desire a symbolical expression of or, rather, a substitute for his presence. Accordingly the conception of the ark must be based in the first instance upon the beliefs of the particular clans or tribes whose sacred object it was.

See further, W. R. Smith, *Religion of the Semites*, p. 37; Schwally, *Kriegsaltertümer*, i. p. 9; *Revue biblique* (1903), pp. 249 sqq.; and on the ark, generally, in addition to the literature already cited, Kautzsch, Hastings' *Dict. Bible*, v. p. 628; A. R. S. Kennedy, *Century Bible: Samuel* (*Appendix*); E. Meyer, *Die Israeliten*, *Index* s.v. "*Lade*,"; and R. H. Kennett, *Enc. of Rel. and Ethics.* (S. A. C.)

ARKANSAS, a river of the United States of America, rising in the mountains of central Colorado, near Leadville, in lat. 39° 20′ N., long. 106° 15′ W., and emptying into the Mississippi, at Napoleon, Arkansas, in lat. 33° 40′ N. Its total length is about 2000 m., and its drainage basin (greater than that of the Upper Mississippi) about 185,000 sq. m. It is the greatest western affluent of the Missouri-Mississippi system. It rises in a pocket of lofty peaks at an altitude of 10,400 ft. on a sharply sloping plateau, down which it courses as a mountain torrent, dropping 4625 ft. in 120 m. At Canyon City it passes out of the Rockies through the Grand Canyon of the Arkansas; then turning eastward, and soon a turbid, shallow stream, depositing its mountain detritus, it flows with steadily lessening gradient and velocity in a broad, meandering bed across the prairies and lowlands of eastern Colorado, Kansas, Oklahoma and Arkansas, shifting its direction sharply to the south-east in central Kansas. The Arkansas ordinarily receives little water from its tributaries save in time of floods. In topography and characteristics and in the difficulties of its regulation the Arkansas is in many ways typical of the rivers in the arid regions of the western states. The gradient below the mountains averages 7·5 ft. per mile between Canyon City and Wichita, Kansas (543 m.), about 1·5 ft. between Wichita and Little Rock (659 m.), and 0·65 of a foot from Little Rock to the mouth (173 m.). The shores are sand, clay or loam throughout some 1300 m., with very rare rock ridges or rapids, and the banks rise low above ordinary water. The waters are constantly rising and falling, and almost never is the discharge at any point uniform. Every year there are, normally, two distinct periods of high water; one an early freshet due mainly to the heavy winter rainfall on the lower river, when the upper river is still frozen hard; the other in the late spring, due to the setting in of rains along the upper courses also, and to the melting of the snow in the mountains. The lowest waters are from August to December. In the summer there are sometimes violent floods due to cloud-bursts. Everywhere along the river there is a never-ending variation of velocity and discharge, and an equally ceaseless transformation of the river's bed and contour. These changes become revolutionary in times of flood. All these characteristics are accentuated below Little Rock. The depth of water at this point has been known to vary from 27 ft. to only half-a-foot, and the discharge to fall to 1170 cub. ft. per second. There is often no more than 1·5 ft. of water, and far below Little Rock a depth of 3 ft. on crossings is not infrequent. In many places there are different channels for high and low water, the latter being partly filled by each freshet, and recut after each subsidence; and the river meanders tortuously through the alluvial bottom in scores of great bends, loops and cut-offs. It is estimated that the eating and caving of the shore below Little Rock averages 7·64 acres per mile every year (as against 1·99 acres above Little Rock). By way of the White river cut-off the Arkansas finds an additional outlet through the valley of that river in times of high water, and the White, when the current in its natural channel is deadened by the backwaters of the Mississippi, finds an outlet by the same cut-off through the valley of the Arkansas. This backwater, where it meets and checks the current of the Arkansas, occasions the precipitation of enormous alluvial deposits, and vast quantities of snags. The banks are disintegrated along this part of the river and built up again on the opposite side to their original height in the extraordinarily short time of two or three years, the channel remaining all the while narrow. At the mouth of the White, the Arkansas and the Mississippi the level of recurrent floods is 6 or 8 ft. above the timber-bearing soil along the banks, and all along the lower river the country is liable to overflow; and as the land backward from the stream slopes downward from the banks heaped up by successive flood-deposits, each overflow creates along the river a fringe of swamps. These features, although exaggerated in the portion of the river now in question, are qualitatively characteristic of its entire course below the mountains.

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[1] Cp. Rev. xi. 19, and W. R. Smith, *Old Test. in Jew. Church*, *Index*. For later traditional material, see Buxtorf, *De Arca Foederis* (Basel, 1659).

[2] But see Budde, *Expos. Times* (1898), pp. 398 sqq.; *Theolog. Stud. u. Krit.* (1906), pp. 489-507. The possibility must be conceded that there were several arks in the course of Hebrew history and that separate tribes or groups of tribes had their own sacred object.

Up to the 30th of June 1907 the government of the United States expended $2,384,557 on improvements along the Arkansas. Almost half of this sum was required for snagging operations alone. There is a considerable traffic on the river within the borders of Arkansas in miscellaneous freights, and a slight passenger movement. The river is rarely navigable above Fort Smith, and during a considerable part of the year not above Pine Bluff. Steamer service is maintained the year round between this point and Memphis. Ordinarily there are some 400 m. of channel open to steamers part of the year, and in time of high flood considerably more. To the mouth of the Grand river (460 m.) the river is open about four months in a year for vessels of 4 ft. draft and about eight months for vessels of 2 ft. draft.

BIBLIOGRAPHY.—General descriptions of different portions of the river are indicated in the Index to the *Reports of the Chief of Engineers, U. S. Army* (many volumes, 1879–1900). See also H. Gannett, *Profiles of Rivers in the U. S.* (U. S. Geolog. Survey, 1901); Greenleaf, "Western Floods," in *Engin. Mag.* xii. 945-958; U. S. Geolog. Survey, *Bull.* 140; I. C. Russell, *Rivers of North America* (1898); T. J. Vivian, *Transportation, Rivers of the Miss. Valley* (U. S. Census, 1890, special Rp.).

ARKANSAS, one of the South Central states of the United States of America, situated between 89° 40′ N. and 94° 42′ W., bounded N. by Missouri, E. by the Mississippi river, separating it from Tennessee and Mississippi, and W. by Texas and Oklahoma. Its area is 53,335 sq. m., of which 810 are water surface.

Arkansas lies in the drainage basin of the lower Mississippi, and has a remarkable river system. The Arkansas bisects the state from W. to E.; along its valley lie the oldest and largest settlements of the state. Nine other considerable streams drain the state; of these, the Red, the Ouachita, the White and the St Francis are the most important. There are a number of swamps and bayous in the eastern part.

Physical Features.—The surface of Arkansas is the most diversified of that of any state in the central Mississippi valley. It rises, sloping upward toward the N.W., from an average elevation of less than 300 ft. in the south-east to heights of 2000 ft. and more in the north-western quarter. There are four physiographic regions: two of highlands; one of river valley plain separating the two highland areas; while the fourth is a region of hills, lowlands and scanty prairie. The last covers the E. half of the state, and is part of the Gulf or coastal plain province of the United States. If a line be drawn from the point where the Red river cuts the western boundary to where the Black cuts the northern, E. of it is the Gulf plain and W. of it are the highlands (over 500 ft.) and the mineral regions of the state. They are divided by the valley of the Arkansas river into two regions, which are also structurally different. South of the river are the Ouachita Mountains, and north of it are the Boston Mountains. The Ouachita Mountains are characterized by close folding and faulting. Their southern edge is covered with cretaceous deposits, and their eastern edge is covered as well with the tertiary deposits of the Gulf plains. The Arkansas valley is marked by wide and open folding. The Boston Mountains are substantially a continuation of the Ozark dome of Missouri. Their northern border is marked by an escarpment of 500 to 700 ft. in height. The trend is from E. to W. between Batesville and Wagoner, Oklahoma. In structure they are monoclinical, their rocks—sandstones and shales—being laid southward and blending on that side with the Arkansas valley region. The entire region is very much dissected by streams, and the topography is characteristically of a terrace and escarpment type. In the highlands N. of the Arkansas the country is very irregularly broken; S. of the river the hills lie less capriciously in short, high ranges, with low, fertile valleys between them. The Ouachitas extend 200 m., from within Oklahoma (near Atoka) to central Arkansas, near Little Rock. They are characterized by long, low ridges bearing generally W.–E., with wide, flat valleys. Near the western boundary of the state they attain a maximum altitude of 2900 ft. above the sea, and 2000 ft. above the valleys of the Arkansas and Red river; falling in elevation eastward (as westward) to 500–700 ft. at their eastern end. Five peaks rise above 2000 ft. Magazine Mountain, 2833 ft. above the sea-level and 2350 ft. above the surrounding country, is the highest point between the Alleghanies and the Rockies. Altitudes of 2250 ft. are attained in the Boston Mountains, which are the highest portion of the Ozark uplift, and the most picturesque. The streams are vigorous, and in their lower courses flow in deep-cut gorges, 500 to 1000 ft. deep, almost deserving the name of canyons. The main streams are tortuous, and their dendritic tributaries have cut the region into ridges. The mountains do not fill the N.W. quarter of the state, and are separated from a lower, greatly eroded highland region on their N. by a bold escarpment 500 to 1000 ft. in height. Along the upper course of the White river in the Bostons and in the country about Hot Springs in the Ouachitas is found the most beautiful scenery of the highlands; few regions are more beautiful. The valley region embraces the bottom-lands along the Mississippi, and up the Arkansas as far as Pine Bluff, and the cypress swamp country of the St Francis.

Climate.—The climate of the state is "southern," owing to the influence of the Gulf of Mexico. The mean temperatures for the different seasons are normally about 41·6°, 61·1°, 78·8° and 61·9° F. for winter, spring, summer and autumn respectively. The normal mean precipitations are about 11·7, 14·5, 10·5 and 10.2 in. for the same seasons. The extreme range of the monthly isotherms crossing the state is from about 35° in winter to 81° F. in summer, and the range of annual isotherms from about 54° to 60° F. That is, the variation of mean annual temperatures for different parts of the state is only 6° F. The variation of the mean annual temperature for the entire state is only 4° (from 59° to 63° F.). The variation of precipitation is as great as 30 in. (from 34 to 64 in.) according to locality. There is little snow, no severe winter cold, and no summer drought. Sheltered valleys in the interior produce spring crops three or four weeks earlier than is usual in Kansas. The climate is generally healthy.

Flora.—Arkansas lies in the humid, or Austroriparian, area of the Lower Austral life-zone, except the highlands of the Ozark uplift and Ouachita Mountains, which belong to the humid, or Carolinian, area of the Upper Austral. The state possesses a rich fauna and flora. From an economic standpoint its forests deserve special mention. The forest lands of the state include four-fifths of its area, and three-fourths are actually covered by standing timber. Valuable trees are of great variety: cottonwood, poplar, catalpa, red cedar, sweet-gum, birch-eye, sassafras, persimmon, ash, elm, sycamore, maple, a variety of pines, pecan, locust, dogwood, hickory, various oaks, beech, walnut and cypress are all abundant. There are one hundred and twenty-nine native species of trees. The yellow pine, the white oak and the cypress are the most valuable growths. The northern woods are mainly hard; the yellow pine is most characteristic of the heavy woods of the south central counties; and magnificent cypress abounds in the north-east. Hard woods grow even on the alluvial lands. "The hard-wood forests of the state are hardly surpassed in variety and richness, and contain inestimable bodies of the finest oak, walnut, hickory and ash timber" (U.S. Census, 1870 and 1900). The growth on the alluvial bottoms and the lower uplands in the E. is extraordinarily vigorous. The leading species of the Appalachian woodland maintain their full vigour of growth nearer to the margin of forest growth in this part of the Mississippi valley than in any other part of the United States; and some species, such as the holly, the osage orange and the pecan, attain their fullest growth in Arkansas (Shaler). There are two Federal forest reserves (4968 sq. m.).

Soil.—The soils of Arkansas are of peculiar variety. That of the highlands is mostly but a thin covering, and their larger portion is relatively poorly fitted for agriculture. The uplands are generally fertile. Their poor soils are distinctively sandy, those of the lowlands clayey; but these elements are usually found combined in rich loams characterized by the predominance of one or the other constituent. Finally the alluvial bottoms are of wonderful richness.

Agriculture.—This variety of soils, a considerable range of moderate altitudes and favourable factors of heat and moisture promote a rich diversity in agriculture. Arkansas is predominantly an agricultural state. The farm area of 1860 was only 28·2 % of the whole area of the state, that of 1900 (16,636,719 acres) was 49 %; and while only a fifth of this farm area was actually improved in 1860, two-fifths were improved in 1900; thus, the part of the state's area actually cultivated approximately quadrupled in four decades. The value of products in 1900 ($79·6 millions) was 44 % of the total farm values ($181·4 millions). The rise in average value of farm lands since 1870 has not been a fifth of the increase of the aggregate value of all farm property.

The Civil War wrought a havoc from which a full recovery was hardly reached before 1890. The economic evolution of the state since Reconstruction has been in the main that common to all the old slave states developing from the plantation system of ante-bellum days, somewhat diversified and complicated by the special features of a young and border community. The farms of Arkansas increased in number 357·8 %, in area 73·7 % and in total true (as distinguished from tax) valuation about 53·8 % between 1860 and 1900; the decade of most extraordinary growth being that of 1870–1880. Thus Arkansas has shared that fall in the average size of farms common to all sections of the Union (save the north central) since 1850, but especially marked since the Civil War in the "Cotton States," owing to the subdivision of large holdings with the introduction of the tenant system. The rapidity of the movement has not been exceptional in Arkansas, but the size of its average farm, less in 1850 than that of the other cotton states, was in 1900, 93·1 acres (108·8 for white farmers alone, 49·0 for blacks alone), which was even less than that of the North Atlantic states (96·5 acres, the smallest sectional unit of the Union). The percentage of farms worked by owners fell from 69·1 % in 1880 to 54·6 % in 1900; the difference of the balances or 14·5 % indicates the increase of tenant holdings, two-thirds of these being for shares.

It is interesting to compare in this matter the whites and the negroes. In actual numbers the white farmers heavily predominate, whether as owners, tenants for cash or tenants on shares; but if we look at the numbers within each race holding by these respective tenures (65·0, 8·7 and 26·3 % respectively for whites; 25·6, 33·7 and 40·7 % for negroes, in 1900), we see the lesser independence of the negro farmer. The cotton counties, which are the counties of densest coloured habitancy, exemplify this fact with great clearness. The few negroes in the white counties of the uplands are much better off than those in the cotton lowlands; more than three times as large a part of them owners; the poorer element is segregated in the cotton region. In Arkansas, as elsewhere in the south, negro tenants, like white tenants, are more efficient than owners working their own lands. The black farmer is in bondage to cotton; for him still "Cotton is King." He gives it four-fifths of his land; while his white rival allows it only a quarter of his, less by half than the area he gives to live-stock, dairying, hay and grains. At Sunnyside, on the west bank of the Mississippi, negro tenant farmers have been practically forced out of business by Italians, who produced in 1899–1904 more than twice as much lint cotton per working hand, and 70 % more per acre. The general place of the negro in agriculture is shown also by the fact that more than four-fifths of the farm acreage and farm values of the state are in the hands of the whites. The white farmer gives an outlay in labour and fertilizers on his farm greater by 61·4 % than the black, gathers a produce greater by 22·5 %, and possesses a farm of a value 53·5 % greater (Census, 1900).

Cotton is the leading product. It absorbs about a third of the area under crops, and its returns ($28,000,000 in 1899) are about a half of the value of all crops. A part of the cotton lands of Arkansas are among the richest in the south. Other distinctively southern products (tobacco, &c.) are of no importance in Arkansas. Cereals are given more than twice as much acreage as cotton, but yield only a third as great aggregate returns, Indian corn being much the most remunerative; about three-fourths of the cereal acreage are given to its cultivation, and it ranks after cotton in value of harvest.[1] For all the other staple agricultural products of the central states the showing of Arkansas is uniformly good, but not noteworthy. But its rank as a fruit-growing country is exceptional. Plums, prunes, peaches, pears and grapes are cultivated very generally over the western half of the state (grapes in the east also), but with greatest success in the south-west; apples prosper best in the north-west. Small berries are a very important product. All fruits are of the finest quality. For apples the state makes probably a finer showing than that of any other state except Oregon. About ninety varieties are habitually entered in national competitions. The fruit industry generally has developed with extreme rapidity.

Manufactures.—Although Arkansas is rich in minerals and in forests, in 1900 only 2 % of its population were engaged in manufacturing. But the development has been rapid; the value of products multiplied seven times, the wages paid nine, and the capital invested twelve, in the years 1880–1900; and the increase in the same categories from 1900–1905 was 35, 42·8 and 82·4 % respectively.[2] It must be noted as characteristic of the state that of the total manufactures in 1905, 80·3 % were produced in rural districts (83·7 in 1900). About two-thirds of the increase between 1890 and 1900 was in the lumber industry which was of slight importance before the former year; it represented more than half the total value of the manufactures of the state in 1905 (output, 1905, $28,065,171 and of mill products $3,786,772 additional); in the value of lumber and timber products the state ranked sixth among the states of the United States in 1900, and seventh in 1905. After the lumber and timber industry ranked in 1905 the manufacture of cotton-seed oil and cake ($4,939,919) and flour and grist milling. Cotton ginning increased 739 % from 1890 to 1900.

Minerals.—The progress of coal-mining has been a striking feature of the state's economy since 1880. The field extends from Oklahoma eastward to central Arkansas, along both sides of the Arkansas river. A production of 5000 tons (short) in 1882 became 542,000 tons in 1891 and 2,229,172 tons in 1903—a maximum for the state up to 1905; in 1907 the yield was 2,670,438 tons, valued at $4,473,693; the value of the product increased more than eight-fold in 1886–1900. The United States Geological Survey estimates that three-fourths of the coal area (over 1700 sq. m.) can made commercially productive. Apart from coal the great and varied mineral wealth of the state has been only slightly utilized. The great zinc and lead area along the northern border in the plateau portion of the Ozark region has proved a disappointment in development; the iron areas have hardly been touched, and the product of the exceptionally promising deposits of manganese lost ground after 1890 before

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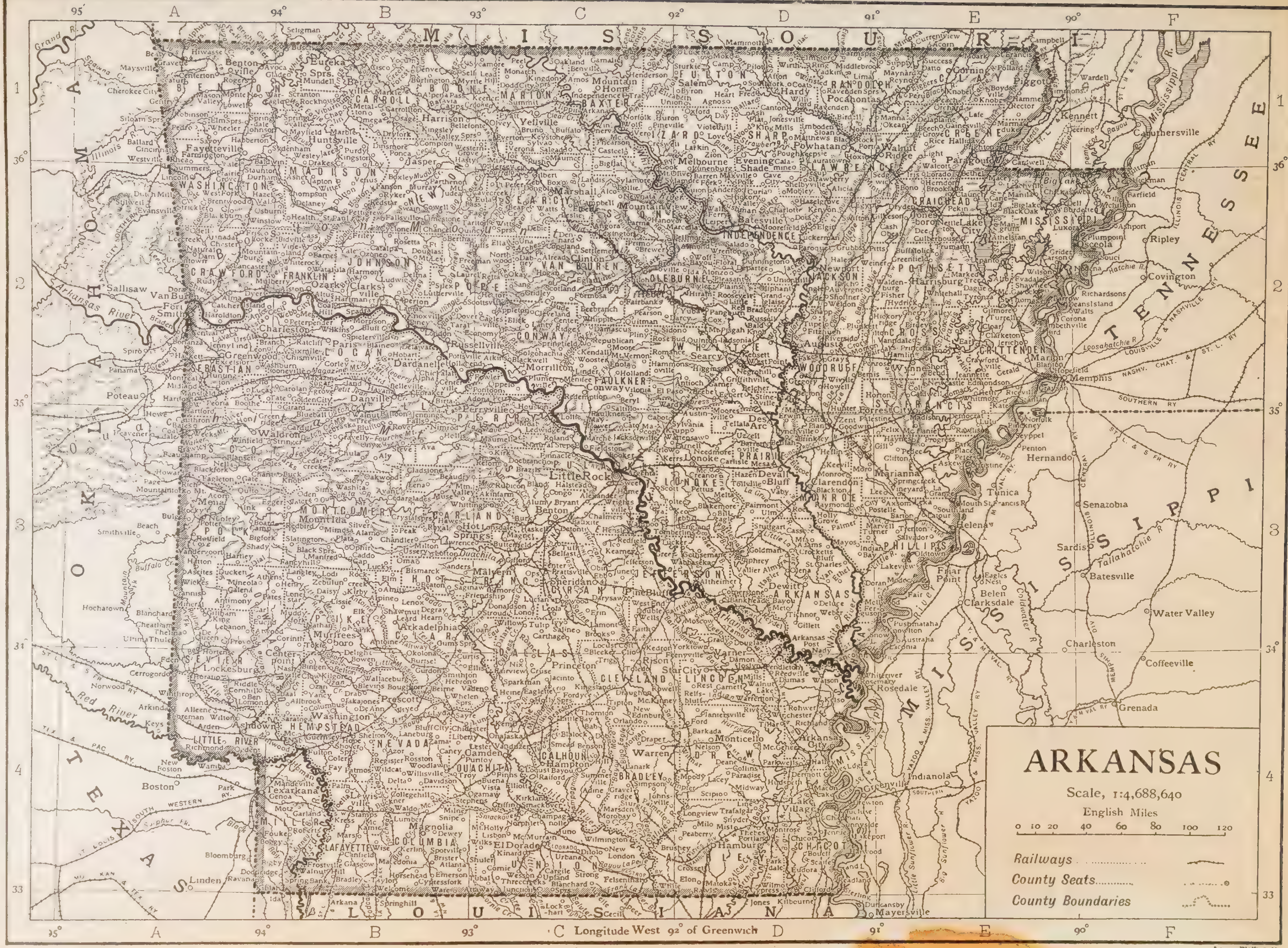
[1] For 1906 the *Yearbook* of the U. S. Department of Agriculture reported the following statistics for Arkansas:—Indian corn, 52,802,659 bu., valued at $24,817,207; oats 3,783,706 bu., valued at $1,589,157; wheat, 1,915,250 bu., valued at $1,436,438; rice, 131,440 bu., valued at $111,724; rye, 23,652 bu., valued at $19,631; potatoes, 1,666,960 bu., valued at $1,116,863; hay, 113,491 tons, valued at $1,123,561.

[2] The special census of the manufacturing industry for 1905 was concerned only with the establishment conducted under the so-called "factory system"; for purposes of comparison the figures for 1900 have been reduced to the same standard, and this fact should be borne in mind with regard to the percentages of increase given above.


ARKANSAS
Scale, 1:4,688,640
English Miles
0 10 20 40 60 80 100 120
Railways
County Seats
County Boundaries
MISSOURI
TENNESSEE
MISSISSIPPI
LOUISIANA
TEXAS
OKLAHOMA
Longitude West 92° of Greenwich
95° 94° 93° 92° 91° 90°
36° 35° 34° 33
A B C D E F
1 2 3 4
Little Rock
Emery Walker sc.

the output of Virginia and Georgia. Among the products of the rich stone quarries of the state, only that of abrasive stones is important in the markets of the Union; the novaculites of Arkansas are among the finest whetstones in the world. Deposits of true chalk are utilized in the manufacture of Portland cement for local markets. The chalk region lies in the S. E. part of the state, S. of the Ouachita Mountains. Bauxite was discovered in the state in 1887, and the product increased from 5045 long tons in 1899 to 50,267 long tons in 1906, the production for the whole country in 1899 being 35,280 long tons and in 1906 75,332 long tons. The only other states in which bauxite was produced during the period were Alabama and Georgia, which in this respect have greatly declined in importance relatively to Arkansas. Extremely valuable and varied marls, kaolins and clays, fuller's earth, asphaltum and mineral waters show special promise in the state's industry. In 1906 diamonds were found in a peridotite dike in Pike county 2½ m. S. E. of Murfreesboro; this is the first place in North America where diamonds have been found *in situ*, and not in glacial deposit or in river gravel.

Communications.—The rivers afford for light craft (of not over 3 ft. draft) about 3000 m. of navigable waters, a river system unequalled in extent by that of any other state. The labours of the United States government have much extended and very greatly improved this navigation, materially lessening also the frequency and havoc of floods along the rich bottom-lands through which the rivers plough a tortuous way in the eastern and southern portions of the state. As a result of these improvements land and timber values have markedly risen, and great impetus has been given to traffic on the rivers, which carry a large part of the cotton, lumber, coal, stone, hay and miscellaneous freights of the state. The greatest of these internal improvements is the St Francis levee, from New Madrid, Missouri, to the mouth of the St Francis, 212 m. along the Mississippi; an area of 3500 sq. m., of exceptional fertility, is here reclaimed at a cost of about $1500 per sq. m. (as compared with $10,000 per sq. m. for the 2500 sq. m. reclaimed by the Nile works at Assuan and Assiut). Whether with regard to area or population, Arkansas is also relatively well supplied with railways (4,472·8 m. at the end of 1907). A state railway commission controls transportation rates, which are also somewhat checked by the competition of river freights. There is also a considerable passenger traffic on the Arkansas.

Population.—The population in 1910 was 1,574,449. The growth in 1880–1900 is shown by the following table:—

Census Year.	Total Pop.	%White Pop.	%Negro Pop.	Average per sq. m.	% Increase by decades.		
					Total.	Whites.	Negroes.
1880	802,525	73·7	26·3	15·1	65·6	63·3	72·4
1890	1,128,211	72·6	27·4	21·5	40·6	38·4	46·6
1900	1,311,564	72·0	28·0	25·0	16·3	15·4	18·7

In 1900 the rank of the state in total population was twenty-fifth, and in negro population tenth. The proportion of the coloured element steadily rose from 11 % in 1820 to 28 % in 1900, at which time there were more than a dozen counties along the border of the Mississippi and lower Arkansas in which the negroes numbered 50 to 89 % of the total. They have never been a large element in the highland counties; it was these counties which were most strongly Unionist at the time of the Civil War, and which to-day are the region of diversified industry. About a ninth of the state's population is gathered into towns of more than 2000 inhabitants. Fort Smith (pop. 11,587 in 1900), Little Rock, the state capital (38,307), and Pine Bluff (11,496) lie in the valley of the Arkansas. In 1900 a dozen other towns had a population exceeding 2500, the most important being Hot Springs (9973), Helena (5550), Texarkana (4914), Jonesboro (4508), Fayetteville (4061), Eureka Springs (3572), Mena (3423) and Paragould (3324). Foreign blood has only very slightly permeated the state; negroes and native whites of native parents make up more than 95 % of its population. Immigration is almost entirely from other southern states. The strongest religious sects are the Methodists and Baptists.

Government.—The present constitution of the state dates from 1874 (with amendments). Few features mark it off from the usual type of such documents. The governor holds office for two years; he has the pardoning and veto power, but his veto may be overridden by a simple majority in each house of the whole number elected to that house (a provision unusual among the state constitutions of the Union). There is no lieutenant-governor. The legislature is bicameral, senators holding office for four years, representatives (about thrice as numerous) for two. The length of the regular biennial legislative sessions is limited to sixty days, but by a vote of two-thirds of the members elected to each house the length of any session may be extended. Special sessions may be called by the governor. A majority of the members elected to each of the two houses suffices to propose a constitutional amendment, which the people may then accept by a mere majority of all votes cast at an election for the legislature (an unusually democratic provision); no more than three amendments, however, can be proposed or submitted at the same time. The supreme court has five members, elected by the people for eight years; they are re-eligible. The population of the state entitles it to seven representatives in the national House of Representatives, and to nine votes in the Electoral College (census of 1900). Elections of members of the state legislature and of Congress are not held at the same time—a very unusual provision. Elections are by Australian ballot; the constitution prescribes that no law shall " be enacted whereby the right to vote at any election shall be made to depend upon any previous registration of the elector's name " (extremely unusual). The qualifications for suffrage include one year's residence in the state, six months in the county, and one month in the voting district, next before election; idiots, insane persons, convicts, Indians not taxed, minors and women are disqualified; aliens who have declared their intention to become citizens of the United States vote on the same terms as actual citizens. An amendment of 1893 requires the exhibition of a poll-tax receipt by every voter (except those " who make satisfactory proof that they have attained the age of twenty-one years since the time of assessing taxes next preceding " the election). There is nothing in the constitution or laws of Arkansas with any apparent tendency to disfranchise the negroes; there are statutory provisions (1866–1867) against intermarriage of the races and constitutional and statutory (1886–1887) provisions for separate schools, a " Jim Crow " law (1891) requires railways to provide separate cars for negroes, and a law (1893) provides for separate railway waiting-rooms for negroes. Giving or accepting a challenge to a duel bars from office, but this survival of the ante-bellum social life is to-day only reminiscent. Declared atheists are similarly disqualified. There is no constitutional provision for a census. Marriage is pronounced a civil contract. A law for compulsory education was passed in 1909.

Finance.—The constitution makes 1 % on the assessed valuation of property a maximum limit of state taxation for ordinary expenses, but by an amendment of 1906 the legislature may levy three mills on the dollar per annum for common schools; and may " authorize school districts to levy by a vote of the qualified electors of such district a tax not to exceed seven mills on the dollar in any year for school purposes." The state debt in 1874 was $12,108,247, of which about $9,370,000 was incurred after the Civil War for internal improvement schemes. This new debt was practically repudiated in 1875 by a decision of the supreme court, and completely set aside in 1884 by constitutional amendment. Until 1900, when an adjustment of the matter was reached, there was also another disputed debt to the national government, owing to the collapse in 1839 of a so-called Real Estate Bank of Arkansas, in which the state had invested more than $500,000 paid to it by the United States in exchange for Arkansas bonds to be held as an investment for the Smithsonian Institution, on which bonds the state defaulted after 1839. If the unacknowledged debt be included (as it often is; and hence the necessity of reference to it), very few states—and those all western or southern—have a heavier burden per capita. But the acknowledged debt was in 1907 only $1,250,500, and this is not a true debt, being a permanent school fund that is not to be paid off; of this total in 3 % bonds, $1,134,500 is held by the common schools and $116,000 by the state university. In net combined state and local debt, Arkansas ranks very low among the states of the Union. The hired labourer suffers from the "truck" system, taking his pay in board and living, in goods, in trade on his employer's credit at the village store; the independent farmer suffers in his turn from unlimited credit at the same store, where he secures everything on the credit of his future crops; and if he is reduced to borrow money, he secures it by vesting the title to his property temporarily in his creditor. His legal protections under such "title bonds" are much slighter than under mortgages. Homesteads belonging to the head of a family and containing 80 to 160 acres (according to value) if in the country, or a lot of ¼ to one acre (according to value), if in town, village or city, are exempt from liability for debts, excepting liens for purchase money, improvements or taxes. A married man may not sell or mortgage a homestead without his wife's consent.

Education.—The legal beginnings of a public school system date from 1843; in 1867 the first tax was imposed for its support. Only white children were regarded by the laws before Reconstruction days. There are now separate race schools, with terms of equal length, and offering like facilities; the number of white and coloured teachers employed is approximately in the same proportion to the number of attending children of the respective races; in negro districts two out of three school directors are usually negroes. "The coloured race as a whole go to the schools as regularly and as numerously in proportion as do the whites" (Shinn). Of the current expenses of the common schools about three-fourths is borne by the localities; the state distributes its contribution annually among the counties. There is also a permanent school fund derived wholly from land grants from the national government. The total expenditure for the schools is creditable to the state; but before 1909 hardly half the school population attended; and in general the rural conditions of the state, the shortness of the school terms and the dependence of the schools primarily upon local funds and local supervision, make the schools of inadequate and quite varying excellence. The average expenditure in 1906 for tuition per child enrolled was $4·93, and the average length of the school term was only eighty-one days. In June 1906 there were 1102 school houses in the state valued at $100 or less. In 1905–1906 the Peabody Board gave $2000 to aid rural schools, and in general it has done much for the improvement of country public schools throughout the state. In 1906 an amendment to the state constitution, greatly increasing the tax resources available for educational work, was passed by a large popular vote. The University of Arkansas was opened at Fayetteville in 1872. The law and medical faculties are at Little Rock. A branch normal school, established 1873–1875 at Pine Bluff, provides for coloured students, who enjoy the same opportunities for work, and are accorded the same degrees, as the students at Fayetteville; they are about a fourth as numerous. In 1905–1906 there were 497 students in the college of liberal arts, sciences and engineering, 548 in the preparatory school and 26 in the conservatory of music and arts, all in Fayetteville; 171 in the medical school and 46 in the law school in Little Rock; and 240 in the branch normal college at Pine Bluff. The university and the normal school are supported by the Morrill Fund and by state appropriations. The state still suffered in 1906 from the lack of a separate and special training school for teachers; but in 1907 the legislature voted to establish a state normal school. Of the Morrill Fund (see MORRILL, JUSTIN SMITH), three-elevenths goes to the normal school. The agricultural experiment station of the university dates from 1887. The financial support of the university has been light, about three-fifths coming from the United States government. Besides the university there are about a score of denominational colleges or academies, of which half-a-dozen are for coloured students. Among the large denominational colleges are Philander Smith College, Little Rock (Methodist Episcopal, 1877); Ouachita College, Arkadelphia (Baptist, 1886); Hendrix College, Conway (Methodist Episcopal, South, 1884); and Arkansas College, Batesville (Presbyterian, 1872). There are few libraries in Arkansas. In this matter her showing has long been among the very poorest in the Union relatively to her population. Daily papers are few in number. The state charitable institutions—insane asylum, deaf-mute and blind institutes—and the penitentiary, are at Little Rock.

Local government is of the ordinary southern county type, without noteworthy variations. Municipal corporations rest upon a general state law, not upon individual charters. The liquor question is left by the state to county (*i.e.* including "local," or town) option, and prohibition is the most common county law, the alternative being high-licence.

History.—The first settlement by Europeans in Arkansas was made in 1686 by the French at Arkansas Post (later the residence of the French and Spanish governors, important as a trading post in the earlier days of the American occupation, and the first territorial capital, 1819–1820). In 1720 a grant on the Arkansas was made to John Law. In 1762 the territory passed to Spain, in 1780 back to France, and in 1803 to the United States as a part of the "Louisiana Purchase." Save in the beginnings of western frontier trade, and in a great mass of litigation left to the courts of later years by the curious and uncertain methods of land delimitation that prevailed among the French and Spanish colonists, the pre-American period of occupation has slight connexions with the later period, and scant historical importance.

From 1804 to 1812 what is now Arkansas was part of the district (and then the territory) of Louisiana, and from 1812 to 1819 of the territory of Missouri. Its earliest county organizations date from this time. It was erected successively into a territory of the first and second class by acts of Congress of the 2nd of March 1819 and the 21st of April 1820. By act of the 15th of June 1836 it was admitted into the Union as a slave state.

There is little of general interest in the history of ante-bellum days. Economic life centred in the slave plantation, and there was remarkable development up to the Civil War. The decade 1819–1829 saw the first newspaper (1819), the beginning of steamboating on Arkansas rivers, and the first weekly mail from the east. Trade was largely confined to the rivers and freighting for Sante Fé and Salt Lake before the war, but the first railway entered the state in 1853. Social life was sluggish in some ways and wild in others. An unhappy propensity to duelling, the origin in Arkansas of the bowie-knife,—from an alleged use of which Arkansas received the nickname, which it has always retained, of the "toothpick state,"—and other backwoods associations gave the state a reputation which to some extent has survived in spite of many years of sober history. The questions of the conduct of territorial affairs do not seem to have been contested systematically on national party lines until about 1825. The government of Arkansas before the Civil War was always in the hands of a few families closely intermarried. From the beginning the state has been unswervingly Democratic, save in the Reconstruction years, though often with heavy Whig or Republican minorities.

In February 1861 the people of Arkansas voted to hold a convention to consider the state of public affairs. The convention assembled on the 4th of March. Secession resolutions were defeated, and it was voted to submit to the people the question whether there should be "co-operation" through the Lincoln government, or "secession." The plan was endorsed of holding a convention of all the states to settle the slavery question, and delegates were chosen to the proposed Border State Convention that was to meet at Frankfort, Kentucky, on the 27th of May. Then came the fall of Fort Sumter and the proclamation of President Lincoln calling for troops to put down rebellion. The governor of Arkansas curtly refused its quota. A quick surge of ill-feeling, all the bitterer on account of the divided sentiments of the people, chilled loyalty to the Union. The convention reassembled on call of the governor, and on the 6th of May, with a single dissentient voice, passed an ordinance of secession. It then repealed its former vote submitting the question of secession to the people. On the 16th of May Arkansas became one of the Confederate States of America.

In the years of war that followed, a very large proportion of the able-bodied men of the state served in the armies of the Confederacy; several regiments, some of coloured troops, served the Union. Union sentiment was strongest in the north. In 1862–1863 various victories threw more than half the state, mainly the north and east, under the Federal arms. Accordingly, under a proclamation of the president, citizens within the conquered districts were authorized to renew allegiance to the Union, and a special election was ordered for March 1864, to reorganize the state government. But meanwhile, a convention of delegates chosen mainly at polls opened at the army posts, assembled in January 1864, abolished slavery, repudiated secession and the secession war debt, and revised in minor details the constitution of 1836, restricting the suffrage to whites. This new fundamental law was promptly adopted by the people, *i.e.* by its friends, who alone voted. But the representatives of Arkansas under this constitution were never admitted to Congress.

The Federal and Confederate forces controlled at this time different parts of the state; there was some ebb and flow of military fortune in 1864, and for a short time two rival governments. Chaotic conditions followed the war. The fifteenth legislature (April 1864 to April 1865) ratified the Thirteenth Amendment, and passed laws against "bush-whacking," a term used in the Civil War for guerilla warfare, especially as carried on by pretended neutrals. Local militia, protecting none who refused to join in the common defence, and all serving "not as soldiers but as farmers mutually pledged to protect each other from the depredations of outlaws who infest the state," strove to secure such public order as was necessary to the gathering of crops, so as "to prevent the starvation of the citizens" (governor's circular, 1865). Struggling in these difficulties, the government of the state was upset by the first Reconstruction Act. The governor in these years (1865–1868) was a Republican, the caster of the single Union vote in the convention of 1861; but the sixteenth legislature (1866–1867) was largely Democratic. It undertook to determine the rights of persons of African descent, and regrettable conflicts followed. The first Reconstruction Act having declared that "no legal state government or adequate protection for life or property" existed in the "rebel states," Arkansas was included in one of the military districts established by Congress. A registration of voters, predominantly whites, was at once carried through, and delegates were chosen for another constitutional convention, which met at Little Rock in January 1868. The secessionist element was voluntarily or perforce excluded. This convention ratified the Fourteenth Amendment, and framed the third constitution of the state, which was adopted by a small majority at a popular election, marred by various irregularities, in March 1868. By its provisions negroes secured full political rights, and all whites who had been excluded from registration for the election of delegates to the convention were now practically stripped of political privileges. The organization of Arkansas being now acceptable to Congress, a bill admitting it to the Union was passed over President Johnson's veto, and on the 22nd of June 1868 the admission was consummated.

Arkansas now became for several years Republican, and suffered considerably from the rule of the "carpet-baggers." The debt of the state was increased about $9,375,000 from 1868 to 1874, largely for railroad and levee schemes; much of the money was misappropriated, and in a case involving the payment of railway aid bonds the action of the legislature in pledging the credit of the state was held nugatory by the state supreme court in 1875 on the ground that, contrary to the constitution, the bond issue had never been referred to popular vote. An amendment to the constitution approved by a popular vote in 1884 provided that the General Assembly should "have no power to levy any tax, or make any appropriation, to pay" any of the bonds issued by legislative action in 1868, 1869 and 1871. The current expenses of the state in the years of Reconstruction were also enormously increased. The climax of the Reconstruction period was the so-called Baxter-Brooks war.

Elisha Baxter (1827–1899) was the regular Republican candidate for governor in 1872. He was opposed by a disaffected Republican faction known as "brindletails," or, as they called themselves, "reformers," led by Joseph Brooks (1821–1877), and supported by the Democrats. Baxter was irregularly elected. The election was contested, and his choice was confirmed by the legislature, the court of last resort in such cases. He soon showed a willingness to rule as a non-partisan, and favoured the re-enfranchisement of white citizens. This would have put the Democrats again in power, and they rallied to Baxter, while the Brooks party now assumed the name of "regulars," and received the support of the "carpet-bag" and negro elements. After Baxter had been a year in office Brooks received a judgment of *ouster* against him from a state circuit judge, and got possession of the public buildings (April 1874). The state flew to arms. The legislature called for Federal intervention (May 1874), and Federal troops maintained neutrality while investigations were conducted by a committee sent out by Congress. As a result, President Grant pronounced for Baxter, and the Brooks forces disbanded.

The chief result was another convention. In 1873 the article of the constitution which had disfranchised the whites was repealed, and the Democrats thus regained power. By an overwhelming majority the people now voted for another convention, which (July to October 1874) framed the present constitution. It removed all disfranchisement, and embraced equitable amnesty and exemption features. It also took away all patronage from the governor, reduced his term to two years, forbade him to proclaim martial law or suspend the writ of *habeas corpus*, and abolished all registration laws: all these provisions being reflections of Reconstruction struggles. The people ratified the new constitution on the 13th of October 1874. After Reconstruction the state again became Democratic, and the main interest of its history has been the progress of economic development.

The following is a list of the territorial and state governors of Arkansas:—

Territorial.

James Miller[1]	1819–1825	
George Izard	1825–1828	
John Pope[2]	1829–1835	
William S. Fulton	1835–1836	

State.

James S. Conway	1836–1840	Democrat
Archibald Yell[3]	1840–1844	,,
Thomas S. Drew[4]	1844–1849	,,
John S. Roane	1849–1852	,,
Elias N. Conway	1852–1860	,,
Henry M. Rector[5]	1860–1862	,,
Harris Flannigan[6]	1862–1865	,,
Isaac Murphy[7]	1864–1868	Republican
C. H. Smith[8]	1867–1868	,,
Powell Clayton	1868–1871	,,
Ozra A. Hadley[9]	1871–1873	,,
Elisha Baxter	1873–1874	,,
August H. Garland	1874–1877	Democrat
William R. Miller	1877–1881	,,
Thomas J. Churchill	1881–1883	,,
James H. Berry	1883–1885	,,
Simon P. Hughes	1885–1889	,,
James P. Eagle	1889–1893	,,

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[1] During this period Robert Crittenden, the secretary of the territory, was frequently the acting governor.

[2] Robert Crittenden was acting governor in 1828–1829.

[3] Samuel Adams was acting governor from the 29th of April to the 9th of November 1844.

[4] R. C. Byrd was acting governor from the 11th of January to the 19th of April 1849.

[5] Thomas Fletcher was acting governor from the 4th to the 15th of November 1862.

[6] Confederate governor.

[7] Union governor.

[8] United States military (sub) governor.

[9] Acting governor.

State—continued.

William M. Fishback	1893–1895	Democrat
James P. Clarke	1895–1897	,,
Daniel W. Jones	1897–1901	,,
Jefferson Davis	1901–1907	,,
John S. Little	1907–1908	,,
X. O. Pindall, Acting Gov. . . .	1908	,,
George W. Donaghey	1909	,,

Bibliography.—Information regarding the resources, climate, population and industries of Arkansas should be sought in the volumes of the United States Census, United States Department of Agriculture and the United States Geological Survey (for the last two there are various bibliographical guides); consult also the publications of the Arkansas (Agricultural) Experiment Station (at Fayetteville), the reports of the state horticulturist, the biennial reports of the state treasurer, of the auditor, and of the Bureau of Mines, Manufactures and Agriculture (all published at Little Rock). The constitutional documents may best be consulted in the latest compiled *Statutes* of the state. See also J. H. Shinn, *Education in Arkansas* (U.S. Bur. of Education, 1900); W. F. Pope, *Early Days in Arkansas* (Little Rock, 1895); and F. Hempstead, *Pictorial History of Arkansas* (St Louis, 1890). Similar to the last in popular character, vast in bulk and loose in method, are a series of *Biographical and Pictorial Histories*, covering the different sections of the state (1 vol. by J. Hallum, Albany, 1887; four others compiled anonymously, Chicago, 1889–1891). For the Reconstruction period see especially the Poland Report in House Rp. No. 2, 43 Cong. 2 Sess., vol. i. (1874), and John M. Harrell's *The Brooks and Baxter War: A History of the Reconstruction Period in Arkansas* (St Louis, Missouri, 1893), which is frankly in favour of Baxter; also a paper by B. S. Johnson in vol. ii. (1908) of the *Publications of the Arkansas Historical Association.*

ARKANSAS CITY, a city of Cowley county, Kansas, U.S.A., situated near the S. boundary of the state, in the fork of the Arkansas and Walnut rivers. Pop. (1890) 8347; (1900) 6140, of whom 302 were negroes; (1905) 7634; (1910) 7508. The city is served by the Atchison, Topeka & Santa Fé, the Missouri Pacific, the St Louis & San Francisco, the Midland Valley and the Kansas South-Western railways. To the south is the Chilocco Indian school (in Key county, Oklahoma), established by the U.S. government in 1884. A canal joining the Arkansas and Walnut rivers furnishes good water power. The manufactories include flour mills, packing establishments, a creamery and a paint factory. The city is situated in the midst of a rich agricultural region and is a supply centre for southern Kansas and Oklahoma, with large jobbing interests. The municipality owns and operates the waterworks. Arkansas City, first known as Creswell, was settled in 1870, was chartered as a city under its present name in 1872 and was rechartered in 1880.

ARKLOW, a seaport and market town of Co. Wicklow, Ireland, in the east parliamentary division, 49 m. S. of Dublin, by the Dublin & South-Eastern railway. Pop. (1901) 4944. Sea-fisheries are prosecuted, and there are oyster-beds on the coast, but the produce requires to be freed from a peculiar flavour by the purer waters of the Welsh and English coast before it is fit for food. The produce of the copper and lead mines of the Vale of Avoca is shipped from the port. There are cordite and explosives works, established by Messrs Kynoch of Birmingham, England. In 1882 an act was passed providing for the improvement of the harbour and for the appointment of harbour commissioners. The town hall and the Protestant church (1899) were gifts of the earl of Carysfort, in whose property the town is situated. There are slight ruins of an ancient castle of the Ormondes, demolished in 1649 by Cromwell. On the 9th of June 1798 the Irish insurgents, attacking the town, were defeated by the royal troops near Arklow Bridge, and their leader, Father Michael Murphy, was killed.

ARKWRIGHT, SIR RICHARD (1732–1792), English inventor, was born at Preston in Lancashire, on the 23rd of December 1732, of parents in humble circumstances. He was the youngest of thirteen children, and received but a very indifferent education. After serving his apprenticeship in his native town, he established himself as a barber at Bolton about 1750, and later amassed a little property from dealing in human hair and dyeing it by a process of his own. This business he gave up about 1767 in order to devote himself to the construction of the spinning frame. The spinning jenny, which was patented by James Hargreaves (d. 1778), a carpenter of Blackburn, Lancashire, in 1770, though he had invented it some years earlier, gave the means of spinning twenty or thirty threads at once with no more labour than had previously been required to spin a single thread. The thread spun by the jenny could not, however, be used except as weft, being destitute of the firmness or hardness required in the longitudinal threads or warp. Arkwright supplied this deficiency by the invention of the spinning-frame, which spins a vast number of threads of any degree of fineness and hardness.

The precise date of the invention is not known; but in 1767 he employed John Kay, a watchmaker at Warrington, to assist him in the preparation of the parts of his machine, and he took out a patent for it in 1769. The first model was set up in the parlour of the house belonging to the free grammar school at Preston. This invention having been brought to a fairly advanced stage, he removed to Nottingham in 1768, accompanied by Kay and John Smalley of Preston, and there erected his first spinning mill, which was worked by horses. But his operations were at first greatly fettered by want of capital, until Jedediah Strutt (*q.v.*), having satisfied himself of the value of the machines, entered with his partner, Samuel Need, into partnership with him, and enabled him in 1771 to build a second factory, on a much larger scale, at Cromford in Derbyshire, the machinery of which was turned by a water-wheel. A fresh patent, taken out in 1775, covered several additional improvements in the processes of carding, roving and spinning. As the value of his processes became known, he began to be troubled with infringements of his patents, and in 1781 he took action in the courts to vindicate his rights. In the first case, against Colonel Mordaunt, who was supported by a combination of manufacturers, the decision was unfavourable to him, on the sole ground that the description of the machinery in the specification was obscure and indistinct. In consequence he prepared a "case," which he at one time intended to lay before parliament, as the foundation of an application for an act for relief. But this intention was subsequently abandoned; and in a new trial (*Arkwright* v. *Nightingale*) in February 1785, the presiding judge having expressed himself favourably with respect to the sufficiency of the specification, a verdict was given for Arkwright. On this, as on the former trial, nothing was stated against the originality of the invention.

In consequence of these conflicting verdicts, the whole matter was brought, by a writ of *scire facias*, before the court of King's Bench, to have the validity of the patent finally settled, and it was not till this third trial, which took place in June 1785, that Arkwright's claim to the inventions which formed the subject of the patent was disputed. To support this new allegation, Arkwright's opponents brought forward, for the first time, Thomas Highs, or Hayes, a reed-maker at Bolton, who stated that he had invented a machine for spinning by rollers previously to 1768, and that he had employed the watchmaker Kay to make a model of that machine. Kay himself was produced to prove that he had communicated that model to Arkwright, and that this was the real source of all his pretended inventions. Having no idea that any attempt was to be made to overturn the patent on this new ground, Arkwright's counsel were not prepared with evidence to repel this statement, and the verdict went against him. On a motion for a new trial on the 10th of November of the same year it was stated that he was furnished with affidavits contradicting the evidence that had been given by Kay and others with respect to the originality of the invention; but the court refused to grant a new trial, on the ground that, whatever might be the fact as to the question of originality, the deficiency in the specification was enough to sustain the verdict, and the cancellation of the patents was ordered a few days afterwards. His fortunes, however, were not thereby seriously affected, for by this time his business capacity and organizing skill had enabled him to consolidate his position, in spite of the difficulties he had encountered not only from rival manufacturers but also from the working classes, who in 1779 displayed their antipathy to labour-saving appliances by destroying a large mill he had erected near Chorley.

Though a man of great personal strength, Arkwright never enjoyed good health, and throughout his career of invention and discovery he laboured under a severe asthmatic affection. A complication of disorders at length terminated his life on the 3rd of August 1792, at his works at Cromford. He was knighted in 1786 when he presented a congratulatory address from the wapentake of Wirksworth to George III., on his escape from the attempt on his life by Margaret Nicholson.

ARLES, a town of south-eastern France, capital of an arrondissement in the department of Bouches-du-Rhône, 54 m. N.W. of Marseilles by rail. Pop. (1906) 16,191. A canal unites Arles with the harbour of Bouc on the Mediterranean. Arles stands on the left bank of the Rhone, just below the point at which the river divides to form its delta. A tubular bridge unites it with the suburb of Trinquetaille on the opposite bank. The town is hemmed in on the east by the railway line from Lyons to Marseilles, on the south by the Canal de Craponne. Its streets are narrow and irregular, and, away from the promenades which border it on the south, there is little animation. In the centre of the town stand the Place de la République, a spacious square overlooked by the hôtel de ville, the museum, and the old cathedral of St Trophime, the finest Romanesque church in Provence. Founded in the 7th century, St Trophime has been several times rebuilt, and was restored in 1870. Its chief portal, which dates from the 12th century, is a masterpiece of graceful arrangement and rich carving. The interior, plain in itself, contains interesting sculpture. The choir opens into a beautiful cloister, the massive vaulting of which is supported on heavy piers adorned with statuary, between which intervene slender columns arranged in pairs and surmounted by delicately carved capitals. Two of the galleries are Romanesque, while two are Gothic. Arles has two other churches of the Romanesque period, and others of later date. The hôtel de ville, a building of the 17th century, contains the library. Its clock tower, surmounted by a statue of Mars, dates from the previous century. The museum, occupying an old Gothic church, is particularly rich in Roman remains and in early Christian sarcophagi; there is also a museum of Provençal curiosities. The tribunal of commerce and the communal college are the chief public institutions. Arles is not a busy town and its port is of little importance. There are, however, flour mills, oil and soap works, and the Paris-Lyon-Méditerranée Railway Company have large workshops. Sheep-breeding is a considerable industry in the vicinity. The women of Arles have long enjoyed a reputation for marked beauty, but the distinctive type is fast disappearing owing to their intermarriage with strangers who have immigrated to the town.

Arles still possesses many monuments of Roman architecture and art, the most remarkable being the ruins of an amphitheatre (the *Arênes*), capable of containing 25,000 spectators, which, in the 11th and 12th centuries, was flanked with massive towers, of which three are still standing. There are also a theatre, in which, besides the famous Venus of Arles, discovered in 1651, many other remains have been found; an ancient obelisk of a single block, 47 ft. high, standing since 1676 in the Place de la République; the ruins of the palace of Constantine, the forum, the thermae and the remains of the Roman ramparts and of aqueducts. There is, besides, a Roman cemetery known as the Aliscamps (*Elysii Campi*), consisting of a short avenue once bordered by tombs, of which a few still remain.

The ancient town, *Arelate*, was an important place at the time of the invasion of Julius Caesar, who made it a settlement for his veterans. It was pillaged in A.D. 270, but restored and embellished by Constantine, who made it his principal residence, and founded what is now the suburb of Trinquetaille. Under Honorius, it became the seat of the prefecture of the Gauls and one of the foremost cities in the western empire. Its bishopric founded by St Trophimus in the 1st century, was in the 5th century the primatial see of Gaul; it was suppressed in 1790. After the fall of the Roman empire the city passed into the power of the Visigoths, and rapidly declined. It was plundered in 730 by the Saracens, but in the 10th century became the capital of the kingdom of Arles (see below). In the 12th century it was a free city, governed by a *podesta* and *consuls* after the model of the Italian republics, which it also emulated in commerce and navigation. In 1251 it submitted to Charles I. of Anjou, and from that time onwards followed the fortunes of Provence. A number of ecclesiastical synods have been held at Arles, as in 314 (see below), 354, 452 and 475.

See V. Clair, *Monuments d'Arles* (1837); J. J. Estrangin, *Description de la ville d'Arles* (1845); F. Beissier, *Le Pays d'Arles* (1889); Roger Peyre, *Nîmes, Arles, Orange* (1903). (R. Tr.)

Synod of Arles (314).—As negotiations held at Rome in October 313 had failed to settle the dispute between the Catholics and the Donatists, the emperor Constantine summoned the first general council of his western half of the empire to meet at Arles by the 1st of August following. The attempt of Seeck to date the synod 316 presupposes that the emperor was present in person, which is highly improbable. Thirty-three bishops are included in the most authentic list of signatures, among them three from Britain,—York, London and "Colonia Londinensium" (probably a corruption of Lindensium, or Lincoln, rather than of Legionensium or Caerleon-on-Usk). The twenty-two canons deal chiefly with the discipline of clergy and people. Husbands of adulterous wives are advised not to remarry during the lifetime of the guilty party. Reiteration of baptism in the name of the Trinity is forbidden. For the consecration of a bishop at least three bishops are required. It is noteworthy that British representatives assented to Canon I., providing that Easter be everywhere celebrated on the same day: the later divergence between Rome and the Celtic church is due to improvements in the *supputatio Romana* adopted at Rome in 343 and subsequently.

For the canons see Mansi ii. 471 ff.; Bruns ii. 107 ff.; Lauchert 26 ff. See also W. Smith and S. Cheetham, *Dictionary of Christian Antiquities* (Boston, 1875), i. 141 ff. (contains also notices of later synods at Arles); W. Bright, *Chapters of Early English Church History* (2nd edition, Oxford, 1888), 9 f.; Herzog-Hauck, *Realencyklopädie* (3rd edition), ii. 59, x. 238 ff.; W. Möller, *Kirchengeschichte* (2nd edition by H. von Schubert, Tübingen, 1902), i. 417. For full titles see COUNCIL. (W. W. R.*)

ARLES, KINGDOM OF, the name given to the kingdom formed about 933 by the union of the old kingdoms of Provence (*q.v*) or Cisjurane Burgundy, and Burgundy (*q.v.*) Transjurane, and bequeathed in 1032 by its last sovereign, Rudolph III., to the emperor Conrad II. It comprised the countship of Burgundy (*Franche-Comté*), part of which is now Switzerland (the dioceses of Geneva, Lausanne, Sion and part of that of Basel), the Lyonnais, and the whole of the territory bounded by the Alps, the Mediterranean and the Rhone; on the right bank of the Rhone it further included the Vivarais. It is only after the end of the 12th century that the name "kingdom of Arles" is applied to this district; formerly it was known generally as the kingdom of Burgundy, but under the Empire the name of Burgundy came to be limited more and more to the countship of Burgundy, and the districts lying beyond the Jura. The authority of Rudolph III. over the chief lords of the land, the count of Burgundy and the count of Maurienne, founder of the house of Savoy, was already merely nominal, and the Franconian emperors (1039-1125), whose visits to the country were rare and of short duration, did not establish their power any more firmly. During the first fifty years of their domination they could rely on the support of the ecclesiastical feudatories, who generally favoured their cause, but the investiture struggle, in which the prelates of the kingdom of Arles mostly sided with the pope, deprived the Germanic sovereigns even of this support. The emperors, on the other hand, realized early that their absence from the country was a grave source of weakness; in 1043 Henry III. conferred on Rudolph, count of Rheinfelden (afterwards duke of Swabia), the title of *dux et rector Burgundiae*, giving him authority over the barons of the northern part of the kingdom of Arles. Towards the middle of the 12th century Lothair II. revived this system, conferring the rectorate on Conrad of Zähringen, in whose family it remained hereditary up to the death of the last representative of the house, Berthold V., in 1218; and it was the lords of Zähringen who were foremost in defending the cause of the Empire against its chief adversaries, the counts of Burgundy. In the time of the Swabian emperors, the Germanic sovereignty in the kingdom of Arles was again, during almost the whole period, merely nominal, and it was only in consequence of fortuitous circumstances that certain of the heads of the Empire were able to exercise a real authority in these parts. Frederick I., by his marriage with Beatrix (1156), had become uncontested master of the countship of Burgundy; Frederick II., who was more powerful in Italy than his predecessors had been, and was extending his activities into the countries of the Levant, found Provence more accessible to his influence, thanks to the commercial relations existing between the great cities of this country and Italy and the East. Moreover, the heretics and enemies of the church, who were numerous in the south, upheld the emperor in his struggle against the pope. Henry VII. also, thanks to his good relations with the princes of Savoy, succeeded in exercising a certain influence over a part of the kingdom of Arles. The emperors further tried to make their power more effective by delegating it, first to a viceroy, William of Baux, prince of Orange (1215), then to an imperial vicar, William of Montferrat (1220), who was succeeded by Henry of Revello and William of Manupello. In spite of this, the history of the kingdom of Arles in the 13th century, and still more in the 14th, is distinguished particularly by the decline of the imperial authority and the progress of French influence in the country. In 1246 the marriage of Charles, the brother of Saint Louis, with Beatrice, the heiress to the countship of Provence, caused Provence to pass into the hands of the house of Anjou, and many plans were made to win the whole of the kingdom for a prince of this house. At the beginning of the 14th century the bishops of Lyons and Viviers recognized the suzerainty of the king of France, and in 1343 Humbert II., dauphin of Viennois, made a compact with the French king Philip VI. that on his death his inheritance should pass to a son or a grandson of the French king. Humbert, who was perhaps the most powerful noble in Arles, was induced to take this step as he had just lost his only son, and Philip had already cast covetous eyes on his lands. Then in 1349, being in want of money, he agreed to sell his possessions outright, and thus Viennois, or Dauphiné, passed into the hands of Philip's grandson, afterwards King Charles V. The emperor Charles IV. took an active part in the affairs of the kingdom, but without any consistent policy, and in 1378 he, in turn, ceded the imperial vicariate of the kingdom to the dauphin, afterwards King Charles VI. This date may be taken as marking the end of the history of the kingdom of Arles, considered as an independent territorial area.

See the monumental work of P. Fournier, *Le Royaume d'Arles et de Vienne* (Paris, 1890); Leroux, *Recherches critiques sur les relations politiques de la France avec l'Allemagne de 1292 à 1378* (Paris, 1882). For the early history of the kingdom, L. Jacob, *Le Royaume de Bourgogne sous les empereurs franconiens (1038–1129)*, (Paris, 1906). The question of the nature and extent of the rights of the Empire over the kingdom of Arles has given rise, ever since the 16th century, to numerous juridical polemics; the chief dissertations published on this subject are indicated in A. Leroux, *Bibliographie des conflits entre la France et l'Empire* (Paris, 1902). (R. Po.)

ARLINGTON, HENRY BENNET, EARL OF (1618–1685), English statesman, son of Sir John Bennet of Dawley, Middlesex, and of Dorothy Crofts, was baptized at Little Saxham, Suffolk, in 1618, and was educated at Westminster school and Christ Church, Oxford. He gained some distinction as a scholar and a poet, and was originally destined for holy orders. In 1643 he was secretary to Lord Digby at Oxford, and was employed as a messenger between the queen and Ormonde in Ireland. Subsequently he took up arms for the king, and received a wound in the skirmish at Andover in 1644, the scar of which remained on his face through life.[1] And after the defeat of the royal cause he travelled in France and Italy, joined the exiled royal family in 1650, and in 1654 became official secretary to James on Charles's recommendation, who had already been attracted by his "pleasant and agreeable humour."[2] In March 1657 he was knighted, and the same year was sent as Charles's agent to Madrid, where he remained, endeavouring to obtain assistance for the royal cause, till after the Restoration. On his return to England in 1661 he was made keeper of the privy purse, and became the prime favourite. One of his duties was the procuring and management of the royal mistresses, in which his success gained him great credit. Allying himself with Lady Castlemaine, he encouraged Charles's increasing dislike to Clarendon; and he was made secretary of state in October 1662 in spite of the opposition of Clarendon, who had to find him a seat in parliament. He represented Callington from 1661 till 1665, but appears never to have taken part in debate. He served subsequently on the committees for explaining the Irish Act of Settlement and for Tangiers. In 1663 he obtained a peerage as Baron Arlington of Arlington, or Harlington, in Middlesex, and in 1667 was appointed one of the postmasters-general. The control of foreign affairs was entrusted to him, and he was chiefly responsible for the attack on the Smyrna fleet and for the first Dutch War. In 1665 he advised Charles to grant liberty of conscience, but this was merely a concession to gain money during the war; and he showed great activity later in oppressing the nonconformists. On the death of Southampton, whose administration he had attacked, his great ambition, the treasurership, was not satisfied; and on the fall of Clarendon, against whom he had intrigued, he did not, though becoming a member of the Cabal ministry, obtain the supreme influence which he had expected; for Buckingham first shared, and soon surpassed him, in the royal favour. With Buckingham a sharp rivalry sprang up, and they only combined forces when endeavouring to bring about some evil measure, such as the ruin of the great Ormonde, who was an opponent of their policy and their schemes. Another object of jealousy to Arlington was Sir William Temple, who achieved a great popular success in 1668 by the conclusion of the Triple Alliance; Arlington endeavoured to procure his removal to Madrid, and entered with alacrity into Charles's plans for destroying the whole policy embodied in the treaty, and for making terms with France. He refused a bribe from Louis XIV., but allowed his wife to accept a gift of 10,000 crowns[3]; in 1670 he was the only minister besides the Roman Catholic Clifford to whom the first secret treaty of Dover (May 1670), one clause of which provided for Charles's declaration of his conversion to Romanism, was confided (see CHARLES II.); and he was the chief actor in the deception practised upon the rest of the council.[4] He supported several other pernicious measures—the scheme for rendering the king's power absolute by force of arms; the "stop of the exchequer," involving a repudiation of the state debt in 1672; and the declaration of indulgence the same year, "that we might keep all quiet at home whilst we are busy abroad."[5] On the 22nd of April 1672 he was created an earl, and on the 15th of June obtained the Garter; the same month he proceeded with Buckingham on a mission, first to William at the Hague, and afterwards to Louis at Utrecht, endeavouring to force upon the Dutch terms of peace which were indignantly refused. But Arlington's support of the court policy was entirely subordinate to personal interests; and after the appointment of Clifford in November 1672 to the treasurership, his jealousy and mortification, together with his alarm at the violent opposition aroused in parliament, caused him to veer over to the other side. He advised Charles in March 1673 to submit the legality of the declaration of indulgence to the House of Lords, and supported the Test Act of the same year, which compelled Clifford to resign. He joined the Dutch party, and in order to make his peace with his new allies, disclosed the secret treaty of Dover to the staunch Protestants Ormonde and Shaftesbury.[6] Arlington had, however, lost the confidence of all parties, and these efforts to procure support met with little success. On the 15th of January 1674 he was impeached by the Commons, the specific charges being "popery," corruption and the betrayal of his trust—Buckingham in his own defence having accused him the day before of being the chief instigator of the French and anti-Protestant policy, of the scheme of governing by the army, of responsibility for the Dutch War, and of embezzlement. But the motion for his removal, owing chiefly to the influence of his brother-in-law, the popular Lord Ossory, was rejected by 166 votes to 127. His escape could not, however, prevent his fall, and he resigned the secretaryship on the 11th of September 1674, being appointed lord chamberlain instead. In 1675 he made another attempt to gain favour with the parliament by supporting measures against France and against the Roman Catholics, and by joining in the pressure put upon Charles to remove James from the court. In November he went on a mission to the Hague, with the popular objects of effecting a peace and of concluding an alliance with William and James's daughter Mary. In this he entirely failed, and he returned home completely discredited. He had again been disappointed of the treasurership when Danby succeeded Clifford; Charles having declared "that he had too much kindness for him to let him have it, for he was not fit for the office."[1] His intrigues with discontented persons in parliament to stir up an opposition to his successful rival came to nothing. From this time, though lingering on at court, he possessed no influence, and was treated with scanty respect. It was safe to ridicule his person and behaviour, and it became a common jest for "some courtier to put a black patch upon his nose and strut about with a white staff in his hand in order to make the king merry at his expense."[2] He was appointed a commissioner of the treasury in March 1679, was included in Sir William Temple's new modelled council the same year, and was a member of the inner cabinet which was almost immediately formed. In 1681 he was made lord lieutenant of Suffolk. He died on the 28th of July 1685, and was buried at Euston, where he had bought a large estate and had carried out extensive building operations. His residence in London was Goring House, on the site of which was built the present Arlington Street.

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[1] See his portrait in the earl of Arlington's *Letters to Sir W. Temple*, by Tho. Babington (1701).

[2] Clarendon's *Life and Continuation*, 397.

[3] *Memoirs of Great Britain and Ireland*, by Sir John Dalrymple (1790), i. 125.

[4] *Ibid.* 114 et seq.

[5] Arlington to Sir B. Gascoyn, in J. T. Brown's *Miscellanea Aulica* (1702), 66.

[6] On the authority of Colbert, 20th November 1673; Dalrymple's *Memoirs*, i. 131.

Arlington was a typical statesman of the Restoration, possessing outwardly an attractive personality, and according to Sir W. Temple "the greatest skill of court and the best turns of art in particular conversation,"[3] but thoroughly unscrupulous and self-seeking, without a spark of patriotism, faithless even to a bad cause, and regarding public office solely as a means of procuring pleasure and profit. His knowledge of foreign affairs and of foreign languages, gained during his residence abroad, was considerable, but long absence from England had also taught him a cosmopolitan indifference to constitutions and religions, and a careless disregard for English public opinion and the essential interests of the country. According to Clarendon, he "knew no more of the constitution and laws of England than he did of China, nor had he in truth a care or tenderness for church or state, but believed France was the best pattern in the world."[4] He was one of the chief promoters of the attempt to reintroduce into England arbitrary government after the French model, not because he imagined an absolute monarchy essential to the well-being and security of the state, but because under such an administration the favourites of a king enjoyed far greater privileges and profits than under a constitutional government. Of the same egotistical character was his religion, towards which his attitude was similar to that of Charles II. himself. He was credited with having inclined the king towards Romanism. Before the Restoration he had attended mass with the king abroad, and in opposition to Lord Bristol had urged Charles to declare publicly his conversion in order to obtain the long-expected succour from the foreign powers. But his religion sat lightly upon him as it did upon his master, and it was often convenient to disguise it. Like the king he continued to profess and practise Protestantism, and spent large sums in restoring the church at Euston; and, unlike Clifford, he took the Test in 1673 and remained in office, successfully concealing his faith till on his deathbed, when he declared himself an adherent of Roman Catholicism.[5]

He married Isabella of Beerwaert, daughter of Louis of Nassau, by whom he had one daughter, Isabella, who married Henry, duke of Grafton, the natural son of Charles II. and Lady Castlemaine.

AUTHORITIES.—In addition to those mentioned above, see *Biographia Britannica* (Kippis), accurate and careful, but too partial, and written without complete knowledge of Arlington's career; Wood's *Fasti Oxonienses* (Bliss), ii. 274; *Hist. of Great Britain* by J. Macpherson (1776), i. 132-133; *Lauderdale Papers* (Camden Soc. N.S., vols. 34, 36, 38), and MSS. in Brit. Mus.; *Original Letters of Sir R. Fanshaw* (1724); *Letters from the Secretaries of State to Francis Parry* (1817); *Add. MSS. Brit. Mus.* indexes; *Cal. of State Pap. Dom.*, and *Hist. MSS. Comm.—MSS. of Marquis of Ormonde, and Duke of Buccleugh at Montagu House*, ii. 49. (P. C. Y.)

ARLINGTON, a township of Middlesex county in E. Massachusetts, U.S.A. Pop. (1890) 5629; (1900) 8603, of whom 2387 were foreign-born; (1910 census) 11,187 Area, 5½ sq. m. It is served by the Boston & Maine railway. It has pleasant residential villages (Arlington, Arlington Heights, &c.) with attractive environs, and there is an excellent public library (the Robbins library). At Arlington Heights there are several well-known sanatoriums. Spy Pond (about 100 acres) is one of the prettiest bodies of water in the vicinity of Boston. Arlington is an important centre for market-gardening (in hot-houses), and along Mill Brook, in the township, are several factories, including chrome works, a large mill and a manufactory of pianoforte cases. In 1762 Arlington was made a "precinct" of Cambridge (of which it was a part from 1635 to 1807) under the name of Menotomy. In 1807 it became a separate township under the name (retained until 1867) of West Cambridge.

See B. and W. R. Cutter, *History of the Town of Arlington . . . 1637–1879* (Boston, 1880); and C. S. Parker, *The Town of Arlington, Past and Present* (Arlington, 1907).

ARLON, the chief town of the Belgian province of Luxemburg, situated on a hill about 1240 ft. above the sea. Pop. (1904) 10,894. It is a very ancient town, and in the time of the Romans was called Orolaunum, being a station on the Antoninian way connecting Reims and Trèves. Authorities dispute as to the origin of the name, some tracing it to *Ara Lunae*, a temple of Diana having been erected here, while others more plausibly derive it from the Celtic words *ar* (mount) and *lun* (wooded). Nowadays the woods have disappeared, and Arlon is chiefly notable for the extensive views obtainable from the church of St Donat which crowns the peak. Arlon is no longer fortified. When Vauban by order of Louis XIV. turned it into a fortress in 1671 great damage was done to the old Roman wall, the foundations of which were practically intact. In the local museum are many Roman antiquities collected on the spot, including several large sculptural stones similar to the celebrated monument at Igel near Trèves. In the middle ages Arlon was the seat of a powerful countship (later marquisate), held after 1235 by the dukes of Luxemburg. As an important strategic position it was several times seized by the French, *e.g.* in 1647 and 1651.

ARM (a common Teutonic word; the Indo-European root is *ar*, to join or fit; cf. the Lat. *armus*, shoulder, and the plural word *arma*, weapons, Gr. ἀρμός, joint, and the reduplicated ἀραρίσκειν, to join), the human upper limb from the shoulder to the wrist, and the fore limb of an animal. (See ANATOMY: *Superficial and Artistic*, and SKELETON: *Appendicular*.) The word is also used of any projecting limb, as of a crane, or balance, of a branch of a tree, and so, in a transferred sense, of the branch of a river or a nerve. Through the Fr. *armes*, from the Lat. *arma*, and so in English usually in the plural "arms," comes the use of the word for weapons of offence and defence, and in many expressions such as "men-at-arms," "assault-at-arms," and the like, and for the various branches, artillery, cavalry, infantry, of which an army is composed, the "arms of the service." "Arms" or "armorial bearings" are the heraldic devices displayed by knights in battle on the defensive armour or embroidered on the surcoat worn over the armour and hence called "coats of arms." These became hereditary and thus are borne by families, and similar insignia are used by nations, cities, episcopal sees and corporations generally. (See HERALDRY.)

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[1] James's statement in Macpherson's *Orig. Pap.* i. 67.

[2] Eachard's *History of England* (1720), 911.

[3] *Memoirs of W. Temple*, ed. by T. P. Courtenay, ii. 27.

[4] *Life and Con.* 404.

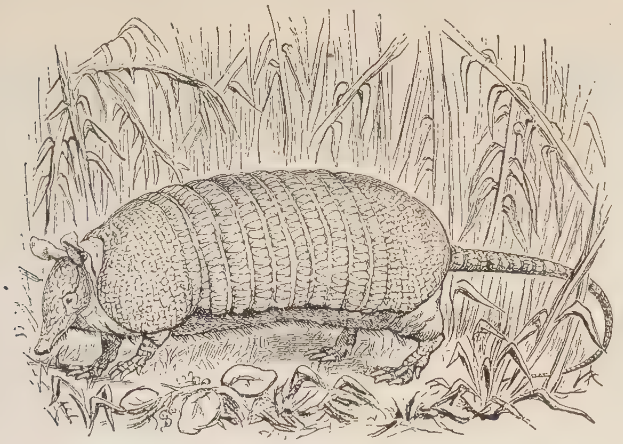
[5] Cf. North's *Examen*, 26; Dalrymple's *Mem.* (1790) i. 40; Pepys's *Diary* (Feb. 17, 1663); *Cal. of Clarendon St. Pap.* iii. 295; T. Carte's *Life of the Duke of Ormonde* (1851), iv. 109.

ARMADA, THE. The Spanish or Invincible Armada was the great fleet (in Spanish, *armada*) sent against England by Philip II. in 1588. The marquis of Santa Cruz, to whom the command had first been given, died on the 9th of February 1588 (according to the Gregorian calendar then used by Spain; on the 31st of January by the Julian calendar used in England; the other dates given in this article will be in Old Style, or Julian calendar). Santa Cruz was succeeded by Don Alonso Perez de Guzman, duke of Medina Sidonia, a noble of large estate, but of no experience or capacity, who took the command unwillingly, and only on the reiterated order of the king. The fleet was collected at Lisbon, after many delays, and sailed on the 20th of May 1588. Its nominal strength was 132 vessels, of 59,190 tons, carrying 21,621 soldiers and 8066 sailors. But from a third to a half of the vessels were transports, galleys or very small boats, and some of them never reached the Channel. The effective force was far below the paper strength. On the 10th of June, when the Armada had rounded Cape Finisterre, it was scattered by squalls. Some of the vessels went on to the appointed rendezvous at the Scilly Isles, but the majority anchored on the north coast of Spain. Medina Sidonia, who found many defects in his fleet, did not finally sail till the 12th of July. On the English side all the royal navy, and such armed merchant ships as could be obtained from the ports, had been collected under the command of the lord high admiral Howard of Effingham, who had with him Hawkins, Drake and Frobisher as subordinate admirals. The number of vessels is put at 197, but the majority were very small. It is impossible to state with confidence what were the relative numbers of guns carried by the two fleets. The Spaniards had more pieces, but their gunnery was inferior. The English fleet carried 16,000 or 17,000 men, of whom the large majority were sailors. About 100 of their ships were at Plymouth with the lord high admiral. The others were in the Downs with Lord Henry Seymour and Sir William Winter, to co-operate with a Dutch squadron under Justinus of Nassau in blockading the Flemish ports, then occupied by the Spanish army of the duke of Parma. The object was to prevent the proposed junction of the forces of Medina Sidonia and Parma. On the 20th of July the Armada was seen off the Lizard. It sailed past Plymouth, and was followed by the English fleet. The Spaniards, who were heavy sailers, and were hampered by the transports, were much harassed by the more active English, and were defeated in all their attempts to board, which it was their wish to do in order to make use of their superior numbers of men. The flagship of the squadron of Andalucia, "Nuestra Señora del Rosario," commanded by Don Pedro de Valdes, was crippled, fell behind and had to surrender. On the 25th of July, when the fleets were near the Isle of Wight, a shift of the wind offered the Spaniards a chance of bringing on a close action, but it soon changed again. The English fleet, of which part had been in some danger, escaped uninjured, and the Spaniards stood on. They anchored on the 26th of July at Calais. The duke of Medina Sidonia now sent an officer to Parma, calling on him to come to sea and join in a landing on the shore of England. But Parma could not leave port in face of Justinus of Nassau's squadron. While these messages were going and coming, Lord Howard had been joined by Lord Henry Seymour and Sir William Winter from the Downs. A council of war was held, to decide on the measures to be taken to assail the Spaniards at Calais. The course taken was to send fireships among them. On the night of the 28th of July the fireships were sent in, and produced an utter panic in the Armada. Most of the Spanish vessels slipped their cables and ran to sea. Others weighed anchor, and escaped in a more orderly style. One great vessel ran ashore and was taken possession of by the English, who were however compelled to give her up by the French governor of Calais. On the 29th of July the scattered Spaniards, who were quite unable to restore order, were attacked by the English off Gravelines. The engagement was hot, and, though the English did not succeed in taking any of the Spaniards, they destroyed some of them, and their superiority in sailing force and gunnery was now so obvious that the duke of Medina Sidonia lost heart. His large vessels were indeed so helpless that only a timely shift of the wind saved many of them from drifting on to the banks of Flanders. Officers and men alike were completely discouraged. It was now recognized that an invasion of England could not be carried out in face of the more active English fleet and the proved impossibility of bringing about the proposed union with Parma's army. Suggestions were made that the Armada should sail to Hamburg, refit there, and renew the attack. But by this time the Spanish force was incapable of energetic action. Medina Sidonia and his council could think of nothing but of a return to Spain. As the wind was westerly, and the English fleet barred the way, it was impossible to sail down the Channel. The only alternative was to take the route between the north of Scotland and Norway. So the Armada sailed to the north. Lord Howard followed, after detaching Lord Henry Seymour to remain in the Downs. He watched the Spaniards to the Firth of Forth. The English had at that time little knowledge of the seas beyond the Firth, and they were beginning to run short of food and ammunition. On the 2nd of August, therefore, they gave up the pursuit. Medina Sidonia continued to the north, till his pilots told him that it was safe to turn to the west. Up to this time the loss of the Spaniards in ships had not been considerable. If the weather had been that of a normal summer, they would probably have reached home with no greater loss of men than was usually inflicted on all fleets of the age by scurvy and fever. But the summer of 1588 was marked by a succession of gales of unprecedented violence. The damaged and weakened Spanish ships, which were from the first greatly undermanned in sailors, were unable to contend with the storms. It is not possible to give the details of the disasters which overtook them. Nineteen of them are known to have been wrecked on the coasts of Scotland and Ireland. The crews who fell into the hands of the English officers in Ireland were put to the sword. Many more of them disappeared at sea. Of the total number of the vessels originally collected for the invasion of England one-half, if not more, perished, and the crews of those which escaped were terribly diminished by scurvy and starvation.

The failure of the Armada was mainly due to its own interior weakness, and as a military operation the English victory was less glorious than some other less renowned achievements of the British fleet. But the repulse of the great Spanish armament was an event of the first historical importance. It marked the final failure of King Philip II. of Spain to establish the supremacy of the Habsburg dynasty and of the Church of Rome, which he considered as being in a peculiar sense his charge, in Europe. From that time forward no serious attempt to invade England was, or could be, made. It became therefore the unconquerable supporter of that part of Europe which had thrown off the authority of the pope. The Armada had much of the character of a crusade. Though Philip II. had political reasons for hostility to Queen Elizabeth, they were so intimately bound up with the struggle between the Reformation and the Counter Reformation that the secular and the religious elements of the conflict cannot be separated from one another. The struggle was therefore not one between armed forces in national rivalry alone. It was a trial of strength between two widely different conceptions of life and of the state—between the medieval and the modern worlds. The volunteers of all ranks who came forward in large numbers on both sides were fighting for a religious cause as well as for the interests of their respective peoples.

Authorities.—The English side of the story of the Armada can best be studied in the *State Papers relating to the Defeat of the Spanish Armada*, edited by Sir J. K. Laughton, and printed for the Navy Records Society (London, 1894). The Spanish side will be found in *La Armada Invencible*, by Captain Cesareo Fernandez Duro (Madrid, 1884). Froude summarized the work of Captain Fernandez Duro in his brilliant *Spanish Story of the Armada* (London, 1892). (D. H.)

ARMADILLO, the Spanish designation for the small mail-clad Central and South American mammals of the order Edentata, constituting the family *Dasypodidae*. The armature consists of a bony case, partly composed of solid buckler-like plates, and partly of movable transverse bands, the latter differing in number with the species, and giving to the body a considerable degree of flexibility. The bony plates are overlain by horny scales. Armadillos are omnivorous, feeding on roots, insects, worms, reptiles and carrion, and are mostly, though not universally, nocturnal. They are harmless and inoffensive creatures, offering no resistance when caught; their principal means of escape being the extraordinary rapidity with which they burrow in the ground, and the tenacity with which they retain their hold in their subterranean retreats. Notwithstanding the shortness of their limbs they run with rapidity. Most of the species are esteemed good eating by the natives of the countries in which they live. They are all inhabitants of the open plains or the forests of the tropical and temperate parts of South America, with the exception of a few species which range as far north as Texas. The largest species is the giant armadillo (*Priodon gigas*), measuring nearly a yard long, from the forests of Surinam and Brazil; while one of the smallest is *Dasypus minutus*, a near ally of the larger *D. sexcinctus*. The peba (*Tatusia novemcincta*) represents a group with a large number of movable bands in the armour; while the apar (*Tolypeutes tricinctus*) and the other members of the same genus are remarkable for their power of rolling themselves up into balls. For the distinctive characters of these and the other genera see EDENTATA.


Peba Armadillo (*Tatusia novemcincta*).

ARMAGEDDON, a name occurring in the Authorized Version of the English Bible in Rev. xvi. 16. The Revised Version has Harmagedon. The form is commonly regarded as the Greek equivalent of the Hebrew *har megiddōn*, the mountain district of Megiddo. The writer is describing the place where the last decisive battle was to be fought at the Day of Judgment, and Harmagedon may have been chosen as the name because the district about Megiddo had been on several occasions the scene of great battles (cf. Judg. iv. 6 ff., v. 19). It has, however, been suggested in the *Zeitschrift für die Alttestamentliche Wissenschaft*, vii. 170 (1887), that the name is for *har migdo*, " his fruitful mountain "—the mountain land of Israel. Prof. Cheyne (*Encyc. Bibl.* s.v.) again, following suggestions of H. Gunkel, H. Zimmern and P. Jensen, compares the dragon of the Apocalypse with the Babylonian Tiāmat, thinks that some myth is referred to, and finds the μαγεδων of 'Αρμαγεδων in the divine name ‛Υεσεμμιγαδων, a Babylonian god of the underworld. The name of the place where Tiāmat was defeated by Marduk perhaps included that of a god of the underworld. (See ANTICHRIST.) From the application of the word Armageddon to the great battle of the End of Time comes the use of the phrase " an Armageddon " to express any great slaughter or final conflict.

ARMAGH, an inland county of Ireland, in the province of Ulster, bounded N. by Lough Neagh, E. by Co. Down, S. by Louth and W. by Monaghan and Tyrone. The area is 327,704 acres, or about 512 sq. m. The general surface of the county is gently undulating and pleasantly diversified; but in the northern extremity, on the borders of Lough Neagh, there is a considerable tract of low, marshy land, and the southern border of the county is occupied by a barren range of hills, the highest of which, Slieve Gullion, attains an elevation of 1893 ft. In the western portion of the county are the Few Mountains, a chain of abrupt hills mostly incapable of cultivation. The county is well watered by numerous streams. The principal are the Callan, the Tynan and the Tallwater, flowing into the Blackwater, which, after forming the boundary between this county and Tyrone, empties itself into the south-western angle of Lough Neagh. The Tara and Newtown-Hamilton, the Creggan and the Fleury, flow into the bay of Dundalk. The Cam or Camlin joins the Bann, which, crossing the north-western corner of the county, falls into Lough Neagh to the east of the Blackwater. The Newry Canal, communicating with Carlingford Lough at Warrenpoint, 6 m. below Newry, proceeds northward through Co. Armagh for about 21 m., joining the Bann at Whitecoat. The Ulster Canal begins at Charlemont on the river Blackwater, near its junction with Lough Neagh, proceeding through the western border of the county, and passing thence to the south-west by Monaghan and Clones into Upper Lough Erne, after a course of 48 m. Part of Lough Neagh is in the county, and there are many small loughs, such as Gullion, Cam and Ross.

Geology.—The flat shore of Lough Neagh in the north is due to the thick deposit of pale-coloured clays with lignites, which are probably of Pliocene age, and indicate a reduction of the area of the lake in still later times. Between this lowland and Armagh city, the early Cainozoic basalts form slightly higher ground, while on the west a strip of Trias appears, overlying Carboniferous Limestone. A rough conglomerate containing blocks of this latter rock forms the hills on which Armagh itself is built; this outlier is probably Permian. The Carboniferous Limestone beneath it and around it is red-brown instead of grey, and is famous for its richness in fish remains. A hummocky irregular country spreads southward, where the Silurian axis is encountered, in continuation of the southern uplands of Scotland. Slates and fine-grained sandstones appear here freely through the glacial drift. In the south the granite core of this upland is revealed, and is quarried extensively about Bessbrook. It is penetrated by far younger intrusive masses at Slieve Gullion and Forkill. These rocks, which include some highly siliceous lavas, form part of the Eocene series that is so conspicuously displayed above Carlingford in Co. Louth. Lead-veins have been worked in various parts of the county from time to time.

Industries.—The soil of the northern portion of the county is a rich brown loam, on a substratum of clay or gravel. Towards Charlemont there is much reclaimable bog resting on a limestone substratum. The eastern portion of the county is generally of a light friable soil; the southern portion rocky and barren, with but little bog except in the neighbourhood of Newtown-Hamilton. The climate of Armagh is considered to be one of the most genial in Ireland, and less rain is supposed to fall in this than in any other county. Only about one-twentieth of the land is naturally barren, and Armagh offers a relatively large area of cultivable soil. Agriculture, however, is not far advanced, yet owing to the linen industry the inhabitants are generally in circumstances of comparative comfort. The principal crops are oats and potatoes, but all grain crops are decreasing, and flax, formerly grown to a considerable extent, is now practically neglected. The acreage under pasture slightly exceeds that of tillage. Cattle, sheep, pigs and poultry show a general increase in numbers. The principal manufacture, and that which has given a peculiar tone to the character of the population, is that of linen, though it has somewhat declined in modern times. It is not necessary to the promotion of this manufacture that the spinners and weavers should be congregated in large towns, or united in crowded and unwholesome factories. On the contrary, most of its branches can be carried on in the cottages of the peasantry. The men devote to the loom those hours which are not required for the cultivation of their little farms; the women spin and reel the yarn during the intervals of their other domestic occupations. Smooth lawns, pure springs and the open sky are necessary for perfecting the bleaching process. Hence the numerous bleachers dwell in the country with their assistants and machinery. Such is the effect of this combination of agricultural occupations with domestic manufactures that the farmers are more than competent to supply the resident population of the county with vegetable, though not with animal food; and some of the less crowded and less productive parts of Ulster receive from Armagh a considerable supply of oats, barley and flour. Apples are grown in such quantities as to entitle the county to the title applied to it, the orchard of Ireland.

Communications are monopolized by the Great Northern railway company, whose main line from Belfast divides at Portadown, sending off lines to Omagh, to Clones and to Dublin. A branch from Omagh joins the Dublin line to Goraghwood, and from this line there is a branch to Newry in Co. Down. An electric tramway connects Bessbrook, a town with important linen manufactures and granite quarries, with Newry.

Population and Administration.—The population (72,286 in 1891; 65,619 in 1901) shows a heavy decrease, though emigration affects it less seriously than the majority of Irish counties. Of the total about 45% are Roman Catholics, 32% Protestant Episcopalians, and 16% Presbyterians, the Roman Catholic faith prevailing in the mountainous districts and the Protestant in the towns and lowlands. About 74% of the whole constitutes the rural population. The chief towns are Armagh (a city and the county town, pop. 7588), Lurgan (11,782), Portadown (10,092), Tanderagee (1427), Bessbrook (2977) and Keady (1466). Armagh is divided into eight baronies, and contains twenty-five parishes and parts of parishes, the greater number of which are in the Protestant and Roman Catholic dioceses of Armagh, and a few in the Roman Catholic diocese of Dromore. The constabulary has its headquarters at Armagh, the county being divided into five districts. Assizes are held at Armagh, and quarter sessions at Armagh, Ballybot, Lurgan, Markethill and Newtown-Hamilton. The parliamentary divisions are three: mid, north and south, each returning one member.

History and Antiquities.—Armagh, together with Louth, Monaghan and some smaller districts, formed part of a territory called Orgial or Urial, which was long subject to the occasional incursions of the Danes. The county was made shire ground in 1586, and called Armagh after the city by Sir John Perrott. When James I. proceeded to plant with English and Scottish colonists the vast tracts escheated to the crown in Ulster, the whole of the arable and pasture land in Armagh, estimated at 77,800 acres, was to have been allotted in sixty-one portions. Nineteen of these, comprising 22,180 acres, were to have been allotted to the church, and forty-two, amounting to 55,620 acres, to English and Scottish colonists, servitors, native Irish and four corporate towns—the swordsmen to be dispersed throughout Connaught and Munster. This project was not strictly adhered to in Co. Armagh, nor were the Irish swordsmen or soldiers transplanted into Connaught and Munster from this and some other counties. The antiquities consist of cairns and tumuli; the remains of the fortress of Emain near the city of Armagh (*q.v.*), once the residence of the kings of Ulster; and Danes Cast, an extensive fortification in the south-east of the county, near Poyntzpass, extending into Co. Down. Spears, battle-axes, collars, rings, amulets, medals of gold, ornaments of silver, jet and amber, &c., have also been found in various places. The religious houses were at Armagh, Killevy, Kilmore, Stradhailloyse and Tahenny. Of military antiquities the most remarkable are Tyrone's ditches, near Poyntzpass; and the pass of Moyry, the entry into the county from the south, which was fiercely contested by the Irish in 1595 and 1600, is defended by a castle. The summit of Slieve Gullion is crowned by a large cairn, which forms the roof of a singular cavern of artificial construction, probably an early burial-place.

ARMAGH, a city and market town, and the county town of Co. Armagh, Ireland, in the mid parliamentary division, 89½ m. N.N.W. of Dublin by the Great Northern railway, at the junction of the Belfast-Clones line. Pop. (1901) 7588. It is said to derive its name of *Ard-macha*, the Hill of Macha, from Queen Macha of the Golden Hair, who flourished in the middle of the 4th century B.C., but earlier it was named from its situation on the sides of a steep hill called Drumsailech, or the Hill of Sallows, which rises in the midst of a fertile plain near the Callan stream. Of high antiquity, and, like many other Irish towns, claiming (with considerable probability) to have been founded by St Patrick in the 5th century, it long possessed the more important distinction of being the metropolis of Ireland; and, as the seat of a flourishing college, was greatly frequented by students from other lands, among whom the English and Scots were said to have been so numerous as to give the name of Trian-Sassanagh, or Saxon Street, to one of the quarters of the city. St Patrick's bell, long preserved at Armagh, the oldest Irish relic of its kind, is now, with its shrine of the year 1091, preserved in the museum of the Royal Irish Academy at Dublin. Of a synod that was held at Armagh as early as 448, there is an interesting memorial in the *Book of Armagh*, an Irish MS. dating about A.D. 800. Exposed to the successive calamities of the Danish incursions, the English conquest and the English wars, and at last deserted by its bishops, who retired to Drogheda, the venerable city sank into an insignificant collection of cabins, with a dilapidated cathedral. From this state of decay, however, it was raised, in the second half of the 18th century, by the unwearied exertions of Archbishop Richard Robinson, 1st Lord Rokeby (1709–1794), which, seconded by similar devotion on the part of succeeding archbishops of the Beresford family, notably Archbishop Lord John George Beresford (1773–1862), made of Armagh one of the best built and most respectable towns in the country. As the ecclesiastical metropolis and seat of an archbishop (Primate of all Ireland) in both the Protestant and Roman organizations, it possesses two cathedrals and two archiepiscopal palaces. As the county town Armagh has a court-house, a prison, a lunatic asylum and a county infirmary. Besides these there is a fever hospital, erected by Lord John George Beresford; a college, which Primate Robinson was anxious to raise to the rank of a university; a public library founded by him, an observatory, which has become famous from the efficiency of its astronomers; a number of churches and schools, and barracks. Almost all the buildings are built of the limestone of the district, but the Anglican cathedral is of red sandstone. It stands boldly on the top of the hill, a cruciform structure dating from the 13th, but practically rebuilt in the 18th century, in accordance with its original plan. The Roman Catholic cathedral is in the Decorated style, and was consecrated in 1873. Armagh was a parliamentary borough until 1885; and, having been incorporated in 1613, so remained until 1835. The administration is in the hands of an urban district council. Two miles W. of Armagh is Emain, Emania, or Navan Fort, with large entrenchments and mounds, the site of a royal palace of Ulster, founded by that Queen Macha who gave her name to the city. In A.D. 335 it was destroyed during the inroad on the defeat of the king of Ulster by the three brothers Colla, cousins of Muredach, king of Ireland. Armagh itself fell before the king Brian Boroime, who was buried here; and before Edward Bruce in 1315, while previous to the English war after the Reformation, it had witnessed the struggles of Shane O'Neill (1564).

ARMAGNAC, formerly a province of France and the most important fief of Gascony, now wholly comprised in the department of Gers (*q.v.*). In the 15th century, when it attained its greatest extent, it included, besides Armagnac, the neighbouring territories of Fezensac, Fezensaguet, Pardiac, Pays de Gaure, Rivière Basse, Eauzan and Lomagne, and stretched from the Garonne to the Adour. Armagnac is a region of hills ranging to a height of 1000 ft., watered by the river Gers and other rivers which descend fanwise from the plateau of Lannemezan. On the slope of its hills grow the grapes from which the famous Armagnac brandy is made. In Roman Gaul this territory formed part of the diocese of Auch (*civitas Ausciorum*), which corresponded roughly with the later duchy of Gascony (*q.v.*). About the end of the 9th century Fezensac (*comitatus Fedentiacus*), in circumstances of which no trustworthy record remains, was erected into an hereditary countship. This latter was in its turn divided, the south-western portion becoming, about 960, the countship of Armagnac (*pagus Armaniacus*). The domain of this countship, at first very limited in extent, continued steadily to increase in size, and about 1140 Count Gerald III. added the whole of Fezensac to his possessions. Under the English rule the counts of Armagnac were turbulent and untrustworthy vassals; and the administration of the Black Prince, tending to favour the towns of Aquitaine at the expense of the nobles, drove them to the side of France. The complaint against the English prince which Count John I., in defiance of the treaty of Brétigny, himself carried to Paris, was the principal cause of the resumption of hostilities of 1369, and of the incessant defeats sustained by the English until the accession of their king Henry V.

At that moment Count Bernard VII. was all-powerful at the French court; and Charles of Orleans, in order to be able to avenge his father, Louis of Orleans, who had been assassinated in 1407 by John the Fearless, duke of Burgundy, married Bonne, Bernard's daughter. This was the origin of the political party known as "the Armagnacs." With the object of combating the duke of Burgundy's preponderant influence, a league was formed at Gien, including the duke of Orleans and his father-in-law, the dukes of Berry, Bourbon and Brittany, the count of Alençon and all the other discontented nobles. Bernard VII. ravaged the environs of Paris; and the treaty of Bicêtre (November 2, 1410) only suspended hostilities for a few months, war breaking out afresh in the spring of 1411. Paris sided with the duke of Burgundy, and at his instigation Charles VII. collected an army to besiege the allies in Bourges. The peace of Bourges, confirmed at Auxerre on the 22nd of August, put an end to the war. Paris was dominated at that time by the party of the "butchers," or *Cabochiens*, which had been organized and armed by the count of Saint-Pol, brother-in-law of John the Fearless. But their excesses, and in particular the Cabochien ordinance of the 25th of May 1413, aroused public indignation; a reaction took place, and in the month of August the Armagnacs in their turn became masters of the government and of the king. The duke of Burgundy, besieged in Arras, only obtained peace (treaty of Arras, September 4, 1414), on condition of not returning to Paris.

Several months later Henry V. declared war against France; and when, in August 1415, the English landed in Normandy, the Armagnacs and Burgundians united against them, but were defeated in the battle of Agincourt (October 25, 1415). John the Fearless then began negotiations with the English, while Bernard VII., appointed constable in place of the count of Saint-Pol, who had been killed at Agincourt, returned to defend Paris. However, the excesses committed by the Armagnacs incensed the populace, and John the Fearless, who was ravaging the surrounding districts, re-entered the capital on the 29th of May 1418, in consequence of the treason of Perrinet Leclerc. On the 12th of June Bernard VII. and the members of his party were massacred. From this time onward the Armagnac party, with the dauphin, afterwards King Charles VII., at its head, was the national party, while the Burgundians united with the English. This division in France continued until the treaty of Arras, on the 21st of September 1435. The rivalry of the Burgundians and Armagnacs brought terrible disasters upon France, and for many years afterwards the name of "Armagnacs" was bestowed upon the bands of adventurers who were as much to be feared as the *Grandes Compagnies* of the preceding age.

In 1444–45 the emperor Frederick III. of Germany obtained from Charles VII. a large army of Armagnacs to enforce his laims in Switzerland, and the war which ensued took the name of the Armagnac war (*Armagnakenkrieg*). In Germany the name of the foreigners, who were completely defeated in the battle of St Jakob on the Birs, not far from Basel, was mockingly corrupted into *Arme Jacken*, Poor Jackets, or *Arme Gecken*, Poor Fools.

On the death of Charles of Armagnac, in 1497, the countship was united to the crown by King Charles VII., but was again bestowed on Charles, the nephew of that count, by Francis I., who at the same time gave him his sister Margaret in marriage. After the death of her husband, by whom she had no children, she married Henry of Albret, king of Navarre; and thus the countship of Armagnac came back to the French crown along with the other dominions of Henry IV. In 1645 Louis XIV. erected a countship of Armagnac in favour of Henry of Lorraine, count of Harcourt, in whose family it continued till the Revolution. James of Armagnac, grandson of Bernard VII., was made duke of Nemours in 1462, and was succeeded in the dukedom by his second son, John, who died without issue, and his third son, Louis, in whom the house of Armagnac became extinct in 1503.

In 1789 Armagnac was a province forming part of the *Gouvernement-général* of Guienne and Gascony; it was divided into two parts, High or White Armagnac, with Auch for capital, and Low or Black Armagnac. At the Revolution the whole of the original Armagnac was included in the department of Gers.

For authorities see U. Chevalier, *Répertoire des sources hist. du moyen âge*, s. Armagnac (Montbéliard, 1894). For the Armagnacs see Paul Dognon, "Les Armagnacs et les Bourguignons, le comte de Foix et le dauphin en Languedoc" (1416–1420) in *Annales du Midi* (1889); Rameau, "Guerre des Armagnacs dans le Mâconnais" (1418–1435) in the *Rév. soc. lit. de l'Ain* (1884); Berthold Zeller, *Les Armagnacs et les Bourguignons, la Commune de 1413*; E. Wülcker, *Urkunden und Schreiben betreffend den Zug der Armagnaken* (Frankfort, 1873); Witte, *Die Armagnaken im Elsass, 1439–1445* (Strassburg, 1889).

ARMATOLES (Gr. ἀρματωλός, a man-at-arms), the name given to some Greeks who discharged certain military and police functions under the Turkish government. When the Turks under Sultan Mahommed II. conquered Greece in the 15th century, many of the Greeks fled into the mountainous districts of Macedonia and northern Greece, and maintained a harassing warfare with the conquerors of their country. These men were called *Klephts* (modern Gr. κλέφτης, ancient κλέπτης, a thief, a brigand), and during the 16th century the Turkish pashas came to terms with some of them, and these men were allowed to retain their local customs, and were confirmed in the possession of certain districts, while in return they undertook some duties, such as the custody of the highroads. Those who accepted these terms were called *armatoles*, and the districts in which they lived *armatoliks*. Strengthened by a considerable number of Christian Albanians, they rendered good service in defending Greece, and to some extent repressed the ravages of the *Klephts*; but their power and independence were disliked by the Turks. After the peace of Belgrade in 1739 (between Austria and Turkey), the Turkish government sought to weaken the position of the *armatoles*. Their privileges were restricted, Mahommedan Albanians were introduced into the *armatoliks*, and towards the end of the 18th century their numbers were seriously reduced. Irritated by this policy the *armatoles* rendered considerable service to Ali Pasha of Iannina in his struggle with the Turks in 1820–22, and afforded valuable assistance to their countrymen during the Greek war of independence in 1830.

ARMATURE (from Lat. *armatura*, armour), a covering for defence. In zoology the word is used of the bony shell of the armadillo. In architecture it is applied to the iron stays by which the lead lights are secured in windows. (See Stanchion and Saddle: *Saddle-Bars*.) In magnetism Dr William Gilbert applied the term to the piece of soft iron with which he "armed" or capped the lodestone in order to increase its power. It is also used for the "keeper" or piece of iron which is placed across the poles of a horse-shoe magnet, and held in place by magnetic attraction, in order to complete the magnetic circuit and preserve the magnetism of the steel; and hence, in dynamo-electric machinery, for the portion which is attracted by the electro-magnet, as the moving part of an electric motor, or, by extension, the moving part of a dynamo (*q.v.*).

ARMAVIR. (1) The ruins of the old capital of Armenia, on the S.E. slope of the extinct volcano Ala-geuz, according to legend, built by Armais, a grandson of Haik, in 1980 B.C., and the capital of the Armenian kings till the 2nd century A.D. Now a small village, Tapadibi, occupies its seat. (2) A district town of Russia, northern Caucasia, province of Kuban, on Kuban river, and on the main line of the Caucasian railway, 40 m. by rail west of Stavropol, built in 1848 for the settlement of Armenian mountaineers, and now a well-built, growing town with 8000 inhabitants, the merchants of which carry on a lively trade.

ARMENIA (old Persian *Armina*, Armenian *Hayasdan*, or *Hayq*), the popular modern name of a district south of the Caucasus and Black Sea, which formed part of the ancient Armenian kingdom. The name, which first occurs in the cuneiform inscriptions of Darius Hystaspis, supplanted the earlier Urardhu, or Ararat, but its origin is unknown. In its widest extent Armenia stretched from 37° to 49° E. long., and from 37½° to 41½° N. lat.; but this area was never, or only for a brief period, united under one king. Armenia is now divided between Persia, Russia and Turkey, and the three boundaries have a common point on Little Ararat.

Geographically, Armenia is a continuation westward of the great Iranian plateau. On the north it descends abruptly to the Black Sea; on the south it breaks down in rugged terraces to the lowlands of Mesopotamia; and on the east and west it sinks more gradually to the lower plateaus of Persia and Asia Minor. Above the general level of the plateau, 6000 ft., rise bare ranges of mountains, which run from north-east to south-west at an altitude of 8000–12,000 ft., and culminate in Ararat, 17,000 ft. Between the ranges are broad elevated valleys, through which the rivers of the plateau flow before entering the rugged gorges that convey their waters to lower levels. Geologically, Armenia consists of archaic rocks upon which, towards the north, are superimposed Palaeozoic, and towards the south later sedimentary rocks. The last have been pierced by volcanic outbursts that extend southward to Lake Van. Amongst the higher mountains are the two Ararats; Ala-geuz Dagh, north of the Aras; Bingeul Dagh, south of Erzerum; and the peaks near Lake Van. The rivers are the Euphrates, Tigris, Aras, Churuk Su (Chorokh) and Kelkit Irmak, all rising on the plateau. The more important lakes are Van, 5100 ft., about twice the size of the Lake of Geneva, and Urmia, 4000 ft., both salt; Gokcha or Sevan, 5870 ft., discharging into the Aras; and Chaldir, into the Kars Chai. The aspect of the plateau is dreary and monotonous. The valleys are wide expanses of arable land, and the hills are for the most part grass-covered and treeless. But the gorges of the Euphrates and Tigris, and their tributaries, cannot be surpassed in wildness and grandeur. The climate is varied. In the higher districts the winter is long and the cold severe; whilst the summer is short, dry and hot. In Erzerum the temperature ranges from −22° to 84° F., and snow sometimes falls in June. In the valley of the Aras, and in the western and southern districts, the climate is more moderate. Most of the towns lie high, from 4000 to 6000 ft. The villages are usually built on gentle slopes, in which the houses are partially excavated as a protection against the severity of the weather. Many of the early towns were on or near the Araxes, and amongst their ruins are the remains of churches which throw light on the history of Christian architecture in the East. Armenia is rich in mineral wealth, and there are many hot and cold mineral springs. The vegetation varies according to the locality. Cereals and hardy fruits grow on the higher ground, whilst rice is cultivated in the hot, well-watered valley of the Araxes. The summer is so hot that the vine grows at much higher altitudes than it does in western Europe, and the cotton tree and all southern fruit trees are cultivated in the deeper valleys. On the fine pasture lands which now support the flocks of the Kurds, the horses and mules, so celebrated in ancient times, were reared. Trout are found in the rivers, and a small herring in Lake Van. The country abounds in romantic scenery; that of the district of Ararat especially has been celebrated by patriotic historians like Moses of Chorene and Lazarus of Pharb.

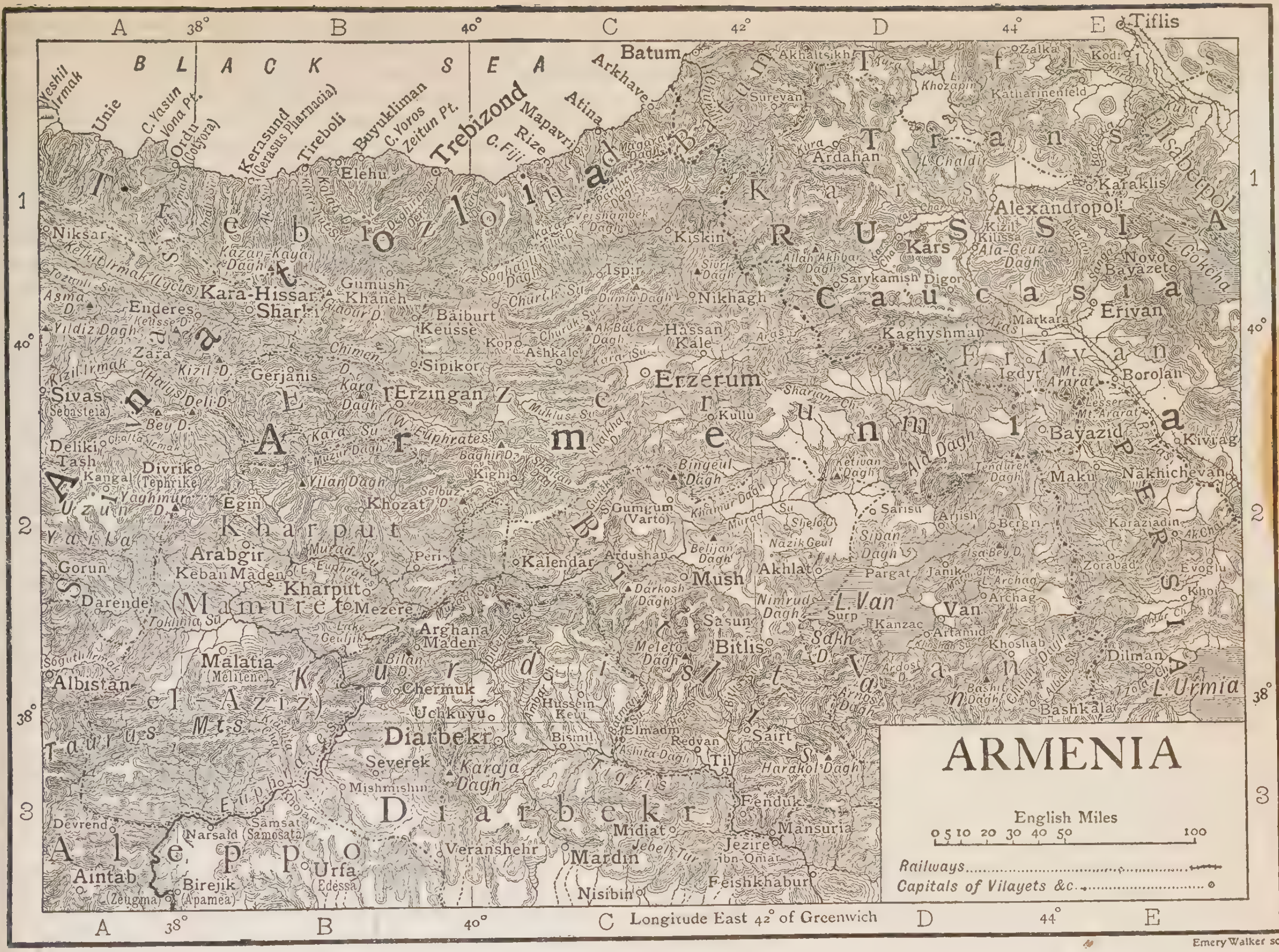
Population.—Accurate statistics cannot be obtained; but it is estimated that in the nine vilayets, which include Turkish Armenia, there are 925,000 Gregorian, Roman Catholic and Protestant Armenians, 645,000 other Christians, 100,000 Jews, Gypsies, &c., and 4,460,000 Moslems. The Armenians, taking the most favourable estimate, are in a majority in nine kazas or sub-districts only (seven near Van, and two near Mush) out of 159. In Russian Armenia there are 960,000 Armenians, and in Persian Armenia 130,000. According to an estimate made by General Zelenyi for the Caucasus Geographical Society (*Zapiski*, vol. xviii., Tiflis, 1896, with map), the population of the nine Turkish vilayets, Erzerum, Van, Bitlis, Kharput (Mamuret-el-Aziz), Diarbekr, Sivas, Aleppo, Adana and Trebizond, was 6,000,000 (Armenians, 913,875, or 15 %; other Christians, 632,875, or 11 %; and Moslems, 4,453,250, or 74 %). In the first five vilayets which contain most of the Armenians, the population was 2,642,000 (Armenians, 633,250, or 24 %; other Christians, 179,875, or 7 %; and Moslems, 1,828,875, or 69 %); and in the seven Armenian kazas the population was 282,375 (Armenians, 184,875, or 65 %; other Christians, 1000, or 0.3 %; and Moslems, 96,500, or 34·7 %). In 1897 there were 970,656 Armenians in Russia, of whom 827,634 were in the provinces of Erivan, Elisavetpol and Tiflis.

The total number of Armenians is estimated at 2,900,000 (in Turkey, 1,500,000; Russia, 1,000,000; Persia, 150,000; Europe, America and East Indies, 250,000).

History.—The history of Armenia has been largely influenced by its physical features. The isolation of the valleys, especially in winter, encouraged a tendency to separation, which invariably showed itself when the central power was weak. The rugged mountains have always been the home of hardy mountaineers impatient of control, and the sanctuary to which the lowlanders fled for safety in times of invasion. The country stands as an open doorway between the East and the West. Through its long valleys run the roads that connect the Iranian plateau with the fertile lands and protected harbours of Asia Minor, and for its possession nations have contended from the remotest past.

Ethnology.

The original inhabitants of Armenia are unknown, but, about the middle of the 9th century B.C., the mass of the people belonged to that great family of tribes which seems to have been spread over western Asia and to have had a common non-Aryan language. Mixed with these proto-Armenians, there was an important Semitic element of Assyrian and Hebrew origin. In the 7th century B.C., between 640 and 600, the country was conquered by an Aryan people, who imposed their language, and possibly their name, upon the vanquished, and formed a military aristocracy that was constantly recruited from Persia and Parthia. Politically the two races soon amalgamated, but, except in the towns, there was apparently little intermarriage, for the peasants in certain districts closely resemble the proto-Armenians, as depicted on their monuments. After the Arab and Seljuk invasions, there was a large emigration of Aryan and Semitic Armenians to Constantinople and Cilicia; and all that remained of the aristocracy was swept away by the Mongols and Tatars. This perhaps explains the diversity of type and characteristics amongst the modern Armenians. In the recesses of Mount Taurus the peasants are tall, handsome, though somewhat sharp-featured, agile and brave. In Armenia and Asia Minor they are robust, thick-set and coarse-featured, with straight black hair and large hooked noses. They are good cultivators of the soil, but are poor, superstitious, ignorant and unambitious, and they live in semi-subterranean houses as their ancestors did 800 years B.C. The townsmen, especially in the large towns, have more regular features—often of the Persian type. They are skilled artisans, bankers and merchants, and are remarkable for their industry, their quick intelligence, their aptitude for business, and for that enterprising spirit which led their ancestors, in Roman times, to trade with Scythia, China and India. The upper classes are polished and well educated, and many have occupied high positions in the public service in Turkey, Russia, Persia and Egypt. The Armenians are essentially an Oriental people, possessing, like the Jews, whom they resemble in their exclusiveness and widespread dispersion, a remarkable tenacity of race and faculty of adaptation to circumstances. They are frugal, sober, industrious and intelligent, and their sturdiness of character has enabled them to preserve their nationality and religion under the sorest trials. They are strongly attached to old manners and customs, but have also a real desire for progress which is full of promise. On the other hand they are greedy of gain, quarrelsome in small matters, self-seeking and wanting in stability; and they are gifted with a tendency to exaggeration and a love of intrigue which has had an unfortunate influence on their history. They are deeply separated by religious differences, and their mutual jealousies, their inordinate vanity


ARMENIA
English Miles
0 5 10 20 30 40 50 100
Railways
Capitals of Vilayets &c.
Longitude East 42° of Greenwich
BLACK SEA
Tiflis
Batum
Trebizond
Rize
Kerasund
Tireboli
Ordu
Unie
Niksar
Kara-Hissar
Gumush-Khaneh
Baiburt
Ispir
Erzerum
Erzingan
Sivas
Divrik
Egin
Arabgir
Kharput
Mezere
Malatia
Albistan
Diarbekr
Severek
Urfa
Birejik
Aintab
Samsat
Veranshehr
Mardin
Nisibin
Midiat
Jezire
Sairt
Bitlis
Mush
Akhlat
Van
L. Van
L. Urmia
Kars
Alexandropol
Ardahan
Erivan
Bayazid
Mt. Ararat
Nakhichevan
Dilman
Bashkala
Trebizond
Erzerum
Kharput
Mamuret el Aziz
Diarbekr
Aleppo
Bitlis
Van
Kurdistan
Armenia
Anatolia
Russian Caucasia
Persia
Taurus Mts.
Euphrates
Tigris
Aras
Emery Walker sc.

their versatility and their cosmopolitan character must always be an obstacle to the realization of the dreams of the nationalists. The want of courage and self-reliance, the deficiency in truth and honesty sometimes noticed in connexion with them, are doubtless due to long servitude under an unsympathetic government.

Ancient kingdom.

The early history of Armenia, more or less mythical, is partly based on traditions of the Biainian kings (see ARARAT), and is interwoven with the Bible narrative, of which a knowledge was possibly obtained from captive Jews settled in the country by Assyrian and Babylonian monarchs. The legendary kings are but faint echoes of the kings of Biainas; the story of Semiramis and Ara is but another form of the myth of Venus and Adonis; and tradition has clothed Tigranes, the reputed friend of Cyrus, with the transient glory of the opponent of Lucullus. The fall of the Biainian kingdom, perhaps overthrown by Cyaxares, was apparently soon followed by an immigration of Aryan (Medo-Persian) races, including the progenitors of the Armenians. But they spread slowly, for the "Ten Thousand," when crossing the plateau to Trebizond, 401–400 B.C., met no Armenians after leaving the villages four days' march beyond the Teleboas, now Kara Su. Under the Medes and Persians Armenia was a satrapy governed by a member of the reigning family; and after the battle of Arbela, 331 B.C., it was ruled by Persian governors appointed by Alexander and his successors. Ardvates, 317–284 B.C., freed himself from Seleucid control; and after the defeat of Antiochus the Great by the Romans, 190 B.C., Artaxias (Ardashes), and Zadriades, the governors of Armenia Major and Armenia Minor, became independent kings, with the concurrence of Rome. (See TIGRANES.) Artaxias established his capital at Artaxata on the Araxes, and his most celebrated successor was Tigranes (Dikran), 94–56 B.C., the son-in-law of Mithradates VI., the Great. Tigranes founded a new capital, Tigranocerta, in northern Mesopotamia, which he modelled on Nineveh and Babylon, and peopled with Greek and other captives. Here, and at Antioch, he played the part of "great king" in Asia until his refusal to surrender his father-in-law involved him in war with Rome. Defeated, 69 B.C., by Lucullus beneath the walls of his capital, he surrendered his conquests to Pompey, 66 B.C., who had driven Mithradates across the Phasis, and was permitted to hold Armenia as a vassal state of Rome.

Under later Empire.

The campaigns of Lucullus and Pompey brought Rome into delicate relations with Parthia. Armenia, although politically dependent upon Rome, was connected with Parthia by geographical position, a common language and faith, intermarriage and similarity of arms and dress. It had never been Hellenized, as the provinces of Asia Minor had been; the Roman provincial system was never applied to it; and the policy of Rome towards it was never consistent. The country became the field upon which the East and West contended for mastery, and the struggle ended for a time in the partition of Armenia, A.D. 387, between Rome and Persia. The Roman portion was soon added to the Diocesis Pontica. The Persian portion, Pers-Armenia, remained a vassal state under an Arsacid prince until 428. It was afterwards governed by Persian and Armenian noblemen selected by the "great king," and entitled *marzbans*. Before the partition, Tiridates, converted by St Gregory, "the Illuminator," had established Christianity as the religion of the state, and set an example followed later by Constantine. After the partition, the invention of the Armenian alphabet, and the translation of the Bible into the vernacular, 410, drew the Armenians together, and the discontinuance of

Greek in the Holy Offices relaxed the ecclesiastical dependence on Constantinople, which ceased entirely when the Patriarch, 491, refused to accept the decrees of the council of Chalcedon. The rule of the *marzbans* was marked by relentless persecution of the Christians, forced conversions to Magism, frequent insurrections and the rise to importance of the great families founded by men of Assyrian, Parthian, Persian, Syrian and Jewish origin, and in some cases of royal blood, who had been governors of districts, or holders of fiefs under the Arsacids. Amongst the *marzbans* were Jewish Bagratids and Persian Mamegonians; and one of the latter family, Vartan, made himself independent (571–578), with Byzantine aid. In 632 the victories of Heraclius restored Armenia to the Byzantines; but the war that followed the Arab invasion, 636, left the country in the hands of the caliphs, who set over it Arab and Armenian governors (*ostikans*). One of the governors, the Bagratid Ashod I., was crowned king of Armenia by the caliph Motamid, 885, and founded a dynasty which ended with Kagig II. in 1079. A little later the Ardzrunian Kagig, governor of Vaspuragan or Van, was crowned king of that province by the caliph Moktadir, 908, and his descendants ruled at Van and Sivas until 1080. The Bagratids founded dynasties at Kars, 962–1080, and in Georgia, which they held until its absorption, 1801, by Russia. From 984 to 1085 the country from Diarbekr to Melasgerd was ruled under the suzerainty first of Arabs then of Byzantines and Seljuks, by the Mervanid dynasty of Kurds, called princes of Abahuni ('Απαχουνῆς). The Arab invasion drove many Armenian noblemen to Constantinople, where they intermarried with the old Roman families or became soldiers of fortune. Artavasdes, an Arsacid, usurped the Byzantine throne for two years; Leo V., an Ardzrunian, and John Zimisces, became emperors; whilst Manuel, the Mamegonian, and others were amongst the best generals of the empire. In 991, and again in 1021, Basil II. invaded Armenia, and in the latter year Senekherim, king of Vaspuragan, exchanged his kingdom for Sivas and its territory, where he settled down with many Armenian emigrants. Basil's policy was to make the great Armenian fortresses, garrisoned by imperial troops, the first line of defence on his eastern frontier; but it failed in the hands of his feeble successors, who thought more of converting heretical Armenia than of defending its frontier. The king of Ani, Kagig II., was compelled to exchange his kingdom for estates in Cappadocia. The country was raided by Seljuks and harried by Byzantine soldiers, and the miseries of the people were regarded as gain to the Orthodox church. After the defeat and capture of Romanus IV. by Alp Arslan, 1071, Armenia formed part of the Seljuk empire until it split up, 1157, into petty states, ruled by Arabs, Kurds and Seljuks, who were in turn swept away by the Mongol invasion, 1235.

Medieval partition.

For more than three centuries after the appearance of the Seljuks, Armenia was traversed by a long succession of nomad tribes whose one aim was to secure good pasturage for their flocks on their way to the richer lands of Asia Minor. The cultivators were driven from the plains, agriculture was destroyed, and the country was seriously impoverished when its ruin was completed by the ravages and wholesale butcheries of Timur. Many Armenians fled to the mountains, where they embraced Islam, and intermarried with the Kurds, or purchased security by paying blackmail to Kurdish chiefs. Others migrated to Cappadocia or to Cilicia, where the Bagratid Rhupen had founded, 1080, a small principality which, gradually extending its limits, became the kingdom of Lesser Armenia. This Christian kingdom in the midst of Moslem states, hostile to the Byzantines, giving valuable support to the leaders of the crusades, and trading with the great commercial cities of Italy, had a stormy existence of about 300 years. Internal disorders, due to attempts by the later Lusignan kings to make their subjects conform to the Roman Church, facilitated its conquest by Egypt, 1375. The memory of Kiligia (Cilicia) is enshrined in a popular song, and at Zeitun, in the recesses of Mount Taurus, a small Armenian community has hitherto maintained almost complete independence. After the death of Timur, Armenia formed part of the territories of the Turkoman dynasties of Ak- and Kara-Kuyunli, and under their milder rule the seat of the Catholicus, which, during the Seljuk invasion, had been moved first to Sivas, and then to Lesser Armenia, was re-established, 1441, at Echmiadzin.

Under Turkey.

In 1514, the Persian campaign of Selim I. gave Armenia to the Osmanli Turks, and its reorganization was entrusted to Idris, the historian, who was a Kurd of Bitlis. Idris found the rich arable lands almost deserted, and the mountains bristling with the castles of independent chieftains, of Kurd, Arab and Armenian descent, between whom there were long-standing feuds. He compelled the Kurds to settle on the vacant lands, and divided the country into small sanjaks which in the plains were governed by Turkish officials, and in the mountains by local chiefs. This policy gave rest to the country, but favoured the growth of Kurd influence and power, which by 1534 had spread westwards to Angora. Armenia was invaded by the Persians in 1575, and again in 1604, when Shah Abbas transplanted many thousand Armenians from Julfa to his new capital Isfahan. In 1639, the province of Erivan, which included Echmiadzin, was assigned by treaty to Persia, and it remained in her hands until it passed to Russia, 1828, under the treaty of Turkman-chai. The Turko-Russian War of 1828–29, which advanced the Russian frontier to the Arpa Chai, was followed by a large emigration of Armenians from Turkish to Russian territory, and a smaller exodus took place after the war of 1877–78, which gave Batum, Ardahan and Kars to Russia. In 1834 the independent power of the Kurds in Armenia was greatly curtailed; and risings under Bedr Khan Bey in 1843, and Sheik Obeidullah in 1880, were firmly suppressed.

Gregorian Armenians.

After the capture of Constantinople, 1453, Mahommed II. organized his non-Moslem subjects in communities, or *millets*, under ecclesiastical chiefs to whom he gave absolute authority in civil and religious matters, and in criminal offences that did not come under the Moslem religious law. Under this system the Armenian bishop of Brusa, who was appointed patriarch of Constantinople by the sultan, became the civil, and practically the ecclesiastical head of his community (*Ermeni millet*), and a recognized officer of the imperial government with the rank of vizier. He was assisted by a council of bishops and clergy, and was represented in each province by a bishop. This *imperium in imperio* secured to the Armenians a recognized position before the law, the free enjoyment of their religion, the possession of their churches and monasteries, and the right to educate their children and manage their municipal affairs. It also encouraged the growth of a community life, which eventually gave birth to an intense longing for national life. On the other hand it degraded the priesthood. The priests became political leaders rather than spiritual guides, and sought promotion by bribery and intrigue. Education was neglected and discouraged, servility and treachery were developed, and in less than a century the people had become depraved and degraded to an almost incredible extent. After the issue, 1839, of the *hatt-i-sherif* of Gül-khaneh, the tradesmen and artisans of the capital freed themselves from clerical control. Under regulations, approved by the sultan in 1862, the patriarch remained the official representative of the community, but all real power passed into the hands of clerical and lay councils elected by a representative assembly of 140 members. The "community," which excluded Roman Catholics and Protestants, was soon called the "nation," "domestic" became "national" affairs, and the "representative" the "national" assembly.

Roman Catholics.

The connexion of "Lesser Armenia" with the Western powers led to the formation, 1335, of an Armenian fraternity, "the Unionists," which adopted the dogmas of the Roman church, and at the council of Florence, 1439, was entitled the "United Armenian Church." Under the millet system the unionists were frequently persecuted by the patriarchs, but this ended in 1830, when, at the intervention of France, they were made a community (*Katoluk millet*), with their own ecclesiastical head. The Roman Catholics, through the works issued by the Mechitharists at Venice, have greatly promoted the progress of education and the development of Armenian literature. They are most numerous at Constantinople, Angora and Smyrna.

Protestants.

The Protestant movement, initiated at Constantinople by American missionaries in 1831, was opposed by the patriarchs and Russia. In 1846 the patriarch anathematized all Armenians with Protestant sympathies, and this led to the formation of the "Evangelical Church of the Armenians," which was made, after much opposition from France and Russia, a community (*Protestant millet*), at the instance of the British ambassador. The missionaries afterwards founded colleges on the Bosporus, at Kharput, Marsivan and Aintab, to supply the needs of higher university education, and they opened good schools for both sexes at all their stations. Everywhere they supplied the people with pure, wholesome literature, and represented progress and religious liberty.

Modern Armenian question.

When Abd-ul-Hamid came to the throne of Turkey in 1876, the condition of the Armenians was better than it had ever been under the Osmanlis; but with the close of the war of 1877–78 came the "Armenian Question." By the treaty of San Stefano, Turkey engaged to Russia to carry out reforms "in the provinces inhabited by the Armenians, and to guarantee their security against the Kurds and Circassians." By the treaty of Berlin, 13th of July 1878, a like engagement to the six signatory powers was substituted for that to Russia. By the Cyprus convention, 4th of June 1878, the sultan promised Great Britain to introduce necessary reforms "for the protection of the Christians and other subjects of the Porte" in the Turkish territories in Asia. The Berlin treaty encouraged the Armenians to look to the powers, and not to Russia for protection; and the convention, which did not mention the Armenians, was regarded as placing them under the special protection of Great Britain. This impression was strengthened by the action of England at Berlin in insisting that Russia should evacuate the occupied territory before reforms were introduced, and so removing the only security for their introduction. The presentation of identic and collective notes to the Porte by the powers, in 1880, produced no result, and in 1882 it was apparent that Turkey would only yield to compulsion. In 1881 a circular note from the British ministry to the five powers was evasively answered, and in 1883 Prince Bismarck intimated to the British government that Germany cared nothing about Armenian reforms and that the matter had better be allowed to drop. Russia had changed her policy towards the Armenians, and the other powers were indifferent. The so-called "Concert of Europe" was at an end, but British ministries continued to call the attention of the sultan to his obligations under the treaty of Berlin.

Russian policy.

Russia began to interest herself in the Armenians when she acquired Georgia in 1801; but it was not until 1828–1829 that any appreciable number of them became her subjects. She found them necessary to the development of her new territories, and allowed them much freedom. They were permitted, within certain limits, to develop their national life; many became wealthy, and many rose to high positions in the military and civil service of the state. After the war of 1877–78 the Russian consuls in Turkey encouraged the formation of patriotic committees in Armenia, and a project was formed to create a separate state, under the supremacy of Russia, which was to include Russian, Persian and Turkish Armenia. The project was favoured by Loris-Melikov, then all-powerful in Russia, but in 1881 Alexander II. was assassinated, and shortly afterwards a strongly anti-Armenian policy was adopted. The schools were closed, the use of the Armenian language was discouraged, and attempts were made to Russify the Armenians and bring them within the pale of the Russian Church. All hope of practical self-government under Russian protection now ceased, and the Armenians of Tiflis turned their attention to Turkish Armenia. They had seen the success of the Slav committees in treating disturbances in the Balkans, and became the moving spirit in the attempts to produce similar troubles in Armenia. Russia made no real effort to check the action of her Armenian subjects, and after 1884 she steadily opposed any active interference by Great Britain in favour of the Turkish Armenians. When Echmiadzin passed to Russia, in 1828, the Catholicus began to claim spiritual jurisdiction over the whole Armenian Church, and the submission of the patriarch of Constantinople was obtained by Russia when she helped the sultan against Mehemet Ali. Subsequently Russia secured the submission of the independent catholicus of Sis, and thus acquired a power of interference in Armenian affairs in all parts of the world. During 1900 Russia showed renewed interest in Turkish Armenia by securing the right to construct all railways in it, and in the Armenians by pressing the Porte to restore order and introduce reforms.

Revolutionary movement.

The Berlin treaty was a disappointment to the Gregorian Armenians, who had hoped that Armenia and Cilicia would have been formed into an autonomous province administered by Christians. But the formation of such a province was impossible. The Gregorians were scattered over the empire, and, except in a few small districts, were nowhere in a majority. Nor were they bound together by any community of thought or sentiment. The Turkish-speaking Armenians of the south could scarcely converse with the Armenian-speaking people of the north; and the ignorant mountaineers of the east had nothing in common, except religion, with the highly educated townsmen of Constantinople and Smyrna. After the change in Russian policy and the failure of the powers to secure reforms, the advanced party amongst the Armenians, some of whom had been educated in Europe and been deeply affected by the free thought and Nihilistic tendencies of the day, determined to secure their object by the production of disturbances such as those that had given birth to Bulgaria. Societies were formed at Tiflis and in several European capitals for the circulation of pamphlets and newspapers, and secret societies, such as the Huntchagist, were instituted for more revolutionary methods. An active propaganda was carried on in Turkish Armenia by emissaries, who tried to introduce arms and explosives, and represented the ordinary incidents of Turkish misrule to Europe as serious atrocities. The revolutionary movement was joined by some of the younger men, who formed local committees on the Nihilist plan, but it was strongly opposed by the Armenian clergy and the American missionaries, who saw the impossibility of success; and its irreligious tendency and the self-seeking ambition of its leaders made it unacceptable to the mass of the people. Exasperated at their failure, the emissaries organized attacks on individuals, wrote threatening letters, and at last posted revolutionary placards, 5th of January 1893, at Yuzgat, and on the walls of the American College at Marsivan. In the last case the object of the Huntchagists was to compromise the missionaries, and in this they succeeded. The Americans were accused of issuing the placards; two Armenian professors were imprisoned; and the girls' school was burned down. Outbreaks, easily suppressed, followed at Kaisaríeh and other places.

One of the revolutionary dreams was to make the ancient Daron the centre of a new Armenia. But the movement met with no encouragement, either amongst the prosperous peasants on the rich plain of Mush or in the mountain villages of Sasun. In the summer of 1893, an emissary was captured near Mush, and the governor, hoping to secure others, ordered the Kurdish Irregular Horse to raid the mountain district. The Armenians drove off the Kurds,[1] and, when attacked in the spring of 1894, again held their own. The vali now called up regular troops from Erzingan; and the sultan issued a firman calling upon all loyal subjects to aid in suppressing the revolt. A massacre of a most brutal character, in which Turkish soldiers took part, followed; and aroused deep indignation in Europe. In November 1894 a Turkish commission of inquiry was sent to Armenia, and was accompanied by the consular delegates of Great Britain, France and Russia, who elicited the fact that there had been no attempt at revolt to justify the action of the authorities. Throughout 1894 the state of the country bordered upon anarchy, and during the winter of 1894–1895 the British government, with lukewarm support from France and Russia, pressed for administrative reforms in the vilayets of Erzerum, Van, Bitlis, Sivas, Memuret-el-Aziz (Kharput) and Diarbekr. The Porte made counter-proposals, and officials concerned in the Sasun massacres were decorated and rewarded. On the 11th of May 1895 the three powers presented to the sultan a complicated scheme of reforms which was more calculated to increase than to lessen the difficulties connected with the government of Armenia; but it was the only one to which Russia would agree. The sultan delayed his answer. Great Britain was in favour of coercion, but Russia, when sounded, replied that she "would certainly not join in any coercive measures" and she was supported by France. At this moment, 21st of June 1895, Lord Rosebery's cabinet resigned, and when Lord Salisbury's government resumed the negotiations in August, the sultan appealed to France and Russia against England. During the negotiations the secret societies had not been inactive. Disturbances occurred at Tarsus; Armenians who did not espouse the "national" cause were murdered; the life of the patriarch was threatened; and a report was circulated that the British ambassador wished some Armenians killed to give him an excuse for bringing the fleet to Constantinople. On the 1st of October 1895 a number of Armenians, some armed, went in procession with a petition to the Porte and were ordered by the police to disperse. Shots were fired, and a riot occurred in which many Armenian and some Moslem lives were lost. The British ambassador now pressed the scheme of reforms upon the sultan, who accepted it on the 17th of October. Meanwhile there had been a massacre at Trebizond (October 8), in which armed men from Constantinople took part, and it had become evident that no united action on the part of the powers was to be feared. The sultan refused to publish the scheme of reforms, and massacre followed massacre in Armenia in quick succession until the 1st of January 1896. Nothing was done. Russia refused to agree to any measure of coercion, and declared (December 19) that she would take no action except such as was needed for the protection of foreigners. Great Britain was not prepared to act alone. In the summer of 1896 (June 14–22) there were massacres at Van, Egin, and Niksar; and on the 26th of August the Imperial Ottoman Bank at Constantinople was seized by revolutionists as a demonstration against the Christian powers who had left the Armenians to their fate. The project was known to the Porte, and the rabble, previously armed and instructed, were at once turned loose in the streets. Two days' massacre followed, during which from 6000 to 7000 Gregorian Armenians perished.

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[1] The Armenians and Kurds have lived together from the earliest times. The adoption of Islam by the latter, and by many Armenians, divided the people sharply into Christian and Moslem, and placed the Christian in a position of inferiority. But the relations between the two sects were not unfriendly previously to the Russian campaigns in Persia and Turkey. After 1829 the relations became less friendly; and later, when the Armenians attracted the sympathies of the European powers after the war of 1877-78, they became bitterly hostile.

The massacres.

The massacres were apparently organized and carried out in accordance with a well-considered plan. They occurred, except in six places, in the vilayets to which the scheme of reforms was to apply. At Trebizond they took place just before the sultan accepted that scheme, and after his acceptance of it they spread rapidly. They were confined to Gregorian and Protestant Armenians. The Roman Catholics were protected by France, the Greek Christians by Russia. The massacre of Syrians, Jacobites and Chaldees at Urfa and elsewhere formed no part of the original plan. Orders were given to protect foreigners, and in some cases guards were placed over their houses. The damage to the American buildings at Kharput was due to direct disobedience of orders. The attacks on the bazars were made without warning, during business hours, when the men were in their shops and the women in their houses. Explicit promises were given, in some instances, that there would be no danger to those who opened their shops, but they were deliberately broken. Nearly all those who, from their wealth, education and influence, would have had a share in the government under the scheme of reforms, were killed and their families ruined by the destruction of their property. Where any attempt at defence was made the slaughter was greatest. The only successful resistance was at Zeitun, where the people received honourable terms after three months' fighting. In some towns the troops and police took an active part in the massacres. At Kharput artillery was used. In some the slaughter commenced and ended by bugle-call, and in a few instances the Armenians were disarmed beforehand. Wherever a superior official or army officer intervened the massacre at once ceased, and wherever a governor stood firm there was no disturbance. The actual perpetrators of the massacres were the local Moslems, aided by Lazis, Kurds and Circassians. A large majority of the Moslems disapproved of the massacres, and many Armenians were saved by Moslem friends. But the lower orders were excited by reports that the Armenians, supported by the European powers, were plotting the overthrow of the sultan; and their cupidity was aroused by the prospect of wiping out their heavy debts to Armenian pedlars and merchants. No one was punished for the massacres, and many of those implicated in them were rewarded. In some districts, especially in the Kharput vilayet, the cry of "Islam or death" was raised. Gregorian priests and Protestant pastors were tortured, but preferred death to apostasy. Men and women were killed in prison and in churches in cold blood. Churches, monasteries, schools and houses were plundered and destroyed. In some places there was evidence of the previous activity of secret societies, in others none. The number of those who perished, excluding Constantinople, was 20,000 to 25,000.[1] Many were forced to embrace Islam, and numbers were reduced to poverty. The destruction of property was enormous, the hardest-working and best tax-paying element in the country was destroyed, or impoverished, and where the breadwinners were killed the women and children were left destitute. Efforts by Great Britain and the United States to alleviate the distress were opposed by the authorities, but met with some success. After the massacres the number of students in the American schools and colleges increased, and many Gregorian Armenians became Roman Catholics in order to obtain the protection of France.

The Armenian revolutionary societies continued their propaganda down to the granting of the Turkish constitution in 1908; and meanwhile further massacres occurred here and there, notably at Mush (1904) and Van (1908).

See Abich, *Geologie d. armenischen Hochlandes* (Wien, 1882); Bishop, *Journeys in Persia and Kurdistan* (Lond., 1891); Bliss, *Turkey and the Armenian Atrocities* (Lond., 1896); Bryce, *Transcaucasia and Ararat* (4th ed., Lond., 1896); De Coursous, *La Rébellion arménienne* (Paris, 1895); Lepsius, *Armenia and Europe* (Lond., 1897); Murray, *Handbook for Asia Minor* (Lond., 1895); Parly. Papers, *Turkey*, I. (1895); *Turkey*, I., II. (1896); Supan, "Die Verbreitung d. Armenier in der asiatischen Turkei, u. in Transkaukasien," in Pet. *Mitt.* vol. xlii. (1896); Tozer, *Turkish Armenia and Eastern Asia Minor* (Lond., 1881); Cholet, *Arménie, Kurdistan, et Mésopotamie* (1892); Lynch, *Armenia* (2 vols., 1901).
(C. W. W.)

ARMENIAN CHURCH. No trustworthy account exists of the evangelization of Armenia, for the legend of King Abgar's correspondence with Christ, even if it contained any historical truth, only relates to Edessa and Syriac Christianity. That the Armenians appropriated from the Syrians this, as well as the stories of Bartholomew and Thaddeus (the Syriac *Addai*), was merely an avowal on their part that Edessa was the centre from which the faith radiated over their land. In the 4th century and later the liturgy was still read in Syriac in parts of Armenia, and the New Testament, the history of Eusebius, the homilies of Aphraates, the works of St Ephraem and many other early books were translated from Syriac, from which tongue most of their ecclesiological terms were derived. The earliest notice of an organized church in Armenia is in Eusebius, *H. E.* vi. 46, to the effect that Dionysius of Alexandria *c.* 250 sent a letter to Meruzanes, bishop of the brethren in Armenia. There were many Christians in Melitene at the time of the Decian persecution in A.D. 250, and two bishops from Great Armenia were present at the council of Nice in 325. King Tiridates (*c.* A.D. 238–314) had already been baptized some time after 261 by Gregory the Illuminator. The latter was ordained priest and appointed *catholicus* or exarch of the church of Great Armenia by Leontius, bishop of Caesarea in Cappadocia. This one fact is certain amidst the fables which soon obscured the history of this great missionary.

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[1] According to some estimates the number killed was 50,000 or more.

Thus the church of Great Armenia began as a province of the Cappadocian see. But there was a tradition of a line of bishops earlier than Gregory in Siuniq, a region east of Ararat along the Araxes (Aras), which in early times claimed to be independent of the catholicus. The Adoptianist bishop Archelaus, who opposed the entry of Mani into Armenia under Probus *c.* 277, was also perhaps a Syriac-speaking bishop of Pers-Armenia. Almost the earliest document revealing anything of the inner organization and condition of the Armenian church in the Nicene age is the epistle of Macarius, bishop of Jerusalem, to the Armenian bishop Verthanes, written between 325 and 335 and preserved in Armenian. Its genuineness has been unreasonably suspected. It insists on the erection of fonts; on distinction of grades among the ordained clergy; on not postponing baptism too long; on bishops and priests alone, and not deacons, being allowed to baptize and lay hands on or confirm the baptized; on avoiding communion with Arians; on the use of unleavened bread in the Sacrament, &c. We learn from it that the bishop of Basen and Bagrevand was an Arian at that time. By the year 450 these two districts already had separate bishops of their own. The letter of Macarius, therefore, if a forgery, must be a very early one.[1] The Armenians must, like the Georgians a little later, have set store by the opinion of the bishop of Jerusalem, or they would not have sent to consult him. It was equally from Jerusalem that they subsequently adopted their lectionary and arrangement of the Christian year; and a 9th-century copy of this lectionary in the Paris library preserves to us precious details of the liturgical usages of Jerusalem in the 4th century. We can trace the presence of Armenian convents on the Mount of Olives as early as the 5th century.

Tradition represents the conversion of Great Armenia under Gregory and Tiridates as a sort of triumphant march, in which the temples of the demons and their records were destroyed wholesale, and their undefended sites instantly converted into Christian churches. The questions arise: how was the transition from old to new effected? and what was the type of teaching dominant in the new church? Armenian tradition, confirmed by nearly contemporary Greek sources, answers the first question. The old order went on, but under new names. The priestly families, we learn, hearing that the God preached by Gregory needed not sacrifice, sent to the king a deputation and asked how they were to live, if they became Christians; for until then the priests and their families had lived off the portions of the animal victims and other offerings reserved to them by pagan custom. Gregory replied that, if they would join the new religion, not only should the sacrifices continue, but they should have larger perquisites then ever. The priestly families then went over *en masse*. How far the older sacrificial rules resembled the levitical law we do not know, but in the canons of Sahak, *c.* 430, the priests already receive the levitical portions of the victims; and we find that animals are being sacrificed every Sunday, on the feast days which at first were few, in fulfilment of private vows, in expiation of the sins of the living, and still more of those of the dead. No one might kill his own meat and deprive the priest of his due; but this rule did not apply to the chase. The earliest Armenian rituals contain ample services for the conduct of an *agapē* (*q.v.*) or love feast held in the church off sacrificial meat. The victim was slaughtered by the priest in the church porch before the crucifix, after it had been ritually wreathed and given the holy salt, by licking which it appropriated a sacramental purity or efficacy previously conveyed into the salt by exorcisms and consecration. In the canons of Sahak the priest is represented as eating the sins of the people in these repasts.

It is easy to underrate the importance in religion of a change of names. The old sacrificial hymns were probably obscene and certainly nonsensical, and the substitution for them of the psalms, and of lections of the prophets and New Testament, was an enormous gain. We do not know precisely how the eucharistic rite was adjusted to these sacrificial meals; but, in the canons of Sahak, 1 Cor. xi. 17-34 is interpreted of these meals, which were known as the Dominical (suppers). The Eucharist was, therefore, long associated with the *matal* or animal victim, and only in the 8th century do we hear of an interval of time being left between the fleshly and the spiritual sacrifices, as the two rites were then called. The Basilian service of the Eucharist was used in the 5th century, but superseded later on by a Byzantine rite which will be found translated in F. E. Brightman's *Eastern Liturgies*. The Eucharist was no doubt the one important sacrifice in the minds of the clergy who had attended the schools of Constantinople and Alexandria; yet the heart of the people remained in their ancient blood-offerings, and as late as the 12th century they were prone to deny that the mass could expiate the sins of the dead unless accompanied by the sacrifice of an animal. Perhaps even to-day the worst fate that can befall a villager after death is to be deprived, not of commemoration in the mass, but of the victim slain for his sins. The keenest spiritual weapon of the Armenian priest was ever a threat not to offer the *matal* for a man when he died.

Another survival in the Armenian church was the hereditary priesthood. None but a scion of a priestly family could become a deacon, elder or bishop. Accordingly the primacy remained in the family of Gregory until about 374, when the king Pap or Bab murdered Nerses, who had been ordained by Eusebius of Caesarea (362–370) and was over-zealous in implanting in Armenia the canons about celibacy, marriage, fasting, hospices and monastic life which Basil had established in Cappadocia. It may be remarked that Gregory's own family was a cadet branch of the Arsacid kin which had occupied the thrones of Persia, Bactria, Armenia and Georgia. His primacy therefore was in itself a survival of an earlier age when king and priest were one. He was in fact a *rex sacrificulus*, and later on, when the Arsacid dynasty fell in Armenia *c.* A.D. 428, the Armenian catholicus became the symbol of national unity and the rallying-point of patriotism. The line of Gregory was restored in 390 in the person of Isaac or Sahak, son of Nerses, and his patriarchate was the golden age of Armenian literature. But by this time the autonomy of the Armenian church was thoroughly established. On the death of Nerses the right of saying grace at the royal meals, which was the essence of the catholicate, was transferred by the king, in despite of the Greeks, to the priestly family of Albianus, and thenceforth no Armenian catholicus went to Caesarea for ordination. The ties with Greek official Christendom were snapped for ever, and in subsequent ages the doctrinal preferences of the Armenians were usually determined more by antagonism to the Greeks than by reflection. If they accepted the council of Ephesus in 430 and joined in the condemnation of Nestorius, it was rather because the Sassanid kings of Persia, who thirsted for the reconquest of Armenia, favoured Nestorianism, a form of doctrine current in Persia and rejected in Byzantium. But later on, about 480, and throughout the following centuries, the Armenians rejected the decrees of Chalcedon and held that the assertion of two natures in Christ was a relapse into the heresy of Nestor. From the close of the 5th century the Armenians have remained monophysite, like the Copts and Abyssinians, and have only broken the record with occasional short interludes of orthodoxy, as when in 633 the emperor Heraclius forced reunion on them, under a catholicus named Esdras, at a council held in Erzerum. Even then all parties were careful not to mention Chalcedon. The march of Arab conquest kept the Armenians friendly to Byzantium for a few years; but in 718 the catholicus John of Odsun ascended the throne and at the council of Manazkert in 728 repeated and confirmed the anathemas against Chalcedon and the tome of Leo, that had been first pronounced by the catholicus Babken in 491 at a synod held in Valarshapat by the united Armenian, Georgian or Iberian, and Albanian churches.

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[1] If a forgery, why should this letter have been assigned to Macarius, a comparatively obscure person whose name is not even found in the menaea of the Eastern church? But convincing proof of its authenticity lies in Macarius' reference to himself as merely archbishop of Jerusalem, and his avowal that he was unwilling to advise the Armenians, "being oppressed by the weakness of the authority conceded him by the weighty usages of the church." Jerusalem was only allowed to rank as a patriarchate in 451, and the seventh canon of Nice subordinated the see to that of Caesarea in Palestine. To this decree Macarius somewhat bitterly alludes.

The Armenians marked their complete disruption with the Greeks by starting an era of their own at the synod of Dvin. The era began on the 11th of July 552, and their year is vague, that is to say, it does not intercalate a day in February every fourth year, like the Julian calendar.

The two churches of Iberia and Albania at first depended on the Armenian for ordination of their primates or *catholici*, and in large part owed their first constitution to Armenian missionaries sent by Gregory the Illuminator. The Iberians still reverence as saints the Armenian doctors of the 5th century, but as early as 552 they began to resent the dictatorial methods of the Armenians, as well might a proud race of mountaineers who never wholly lost their political independence; and they broke off their allegiance to the Armenian see very soon afterwards, accepted Chalcedon and joined the Byzantine church. The Albanians of the Caucasus were also converted in the age of Gregory, early in the 4th century, and were loyal to the Armenians in the great struggle against Mazdaism in the 5th; but broke away for a time towards 600, and chose a patriarch without sending him to Armenia for ordination. Eventually this interesting church was engulfed by the rising tide of Mahommedan conquest, but not before one of their bishops, named Israel, had converted (677–703) the Huns who lay to the north of the Caspian and had translated the Bible and liturgies into their language. If the Albanian and Hunnish versions could be found, they would be of the greatest linguistic importance.

The mother church of Armenia was established by Gregory at Ashtishat in the province of Taron, on the site of the great temple of Wahagn, whose festival on the seventh of the month Sahmi was reconsecrated to John the Baptist and Athenogenes, an Armenian martyr and Greek hymn writer. The first of Navasard, the Armenian new year's day, was the feast of a god Vanatur or Wanadur (who answered to Ζεὺς ξένιος) in the holy pilgrim city of Bagawan. His day was reconsecrated to the Baptist, whose relics were brought to Bagawan. The feast of Anahite, the Armenian Venus and spouse of the chief god Aramazd, was in the same way rededicated to the Virgin Mary, who for long was not very clearly distinguished by the Armenians from the virgin mother church. The old cult of sacred stones and trees by an easy transition became cross-worship, but a cross was not sacred until the Christ had been, by priestly prayer and invocation, transferred into it.

What was the earliest doctrine of the churches of Armenia? If we could believe the fathers of the 5th and succeeding centuries Nicene orthodoxy prevailed in their country from the first; and in the 5th century they certainly chose for translation the works of orthodox fathers alone, such as Chrysostom, Basil, Gregory of Nyssa and Gregory Nazianzen, Cyril of Jerusalem and Cyril of Alexandria, Athanasius, Julius of Rome, Hippolytus, Irenaeus, avoiding Origen and other fathers who were becoming suspect. However, we do hear of versions of Nestorian writers like Diodore of Tarsus being in circulation, and the *Disputation* of Archelaus proves that the current orthodoxy of eastern Armenia was Adoptianist, if not Ebionite in tone. The Persian Armenians as late as the 6th century had not heard of the faith of Nicaea, and only then received it from the catholicus Babken. They sent a copy of their old creed to Babken, and it closely resembles the Adoptianist creed of Archelaus, the gist of which was that Jesus, until his thirtieth year, was a man mortal like other men; then, because he was righteous above all others, he was promoted to the honour and name of Son of God. He received the title by grace, but was not equal to God the Father. Because the Spirit worked with him, he was able to vanquish Satan and all desires, and because of his righteousness and good works he was made worthy of grace and became a Temple of God the Word, which came down from heaven in Jordan, dwelt in him and through him wrought miracles. From such a standpoint the baptism of Jesus was the moment of the divine incarnation. The man righteous above all others was then reborn of the Spirit, was illuminated, was spiritually anointed, became the Christ and Son of God. In effect the fathers of the Armenian church often fell back into such language, far removed as it is from orthodoxy; and they emphasized the importance of the baptismal feast of the Epiphany on the 6th of January by refusing to accept the feast of the physical birth of the 25th of December. As late as 1165 their patriarch Nerses defends the Armenian custom of keeping Christmas on the 6th of January on the express ground that as he was born after the flesh from the Virgin, *so he was born by way of baptism from the Jordan.* The custom from the first, he says, had been to feast on one and the same day the two births, much as they differed in sacramental import and in point of time. We see how deep the early Adoptianism had struck its roots, when a primate of the 12th century could still appeal to the baptismal regeneration of Jesus. The same Nerses held that the second Adam, Jesus Christ, received a new body and nature and the sevenfold grace of the Spirit *in the Jordan.* The Armenian doctors also taught that John by laying hands on Jesus and ordaining him at his baptism sacramentally transferred to him the three graces or *charismata* of kingship, prophecy and priesthood which had belonged to ancient Israel. After baptism, if not before, the flesh of Christ was incorruptible. It consisted of ethereal fire, and he was not subject to the ordinary phenomena of digestion, secretions and evacuations.

Monastic institutions were hardly introduced in Armenia before the 5th century, though Christian rest-houses had been erected along the high-roads long before and are mentioned in the *Disputation* of Archelaus. The Armenians called them *wanq*, and out of them grew the monasteries. The monks were, strictly speaking, penitents wearing the cowl, and not allowed to take a part in church government. This belonged to the elders. At first there was no separate episcopal ordination, and the one rite of elder or priest (Armen. *Qahanay*, Heb. *cohen*) sufficed. There were also deacons, half-deacons and readers. Besides these there was a class of *wardapets* or teachers, answering to the *didascalos* of the earliest church, whose province it was to guard the doctrine and for whom no rite of ordination is found in the older rituals.

A few other peculiarities of Armenian church usage or belief deserve notice. In baptism the rubric ordains that the baptized be plunged three times in the font in commemoration of the entombment during three days of the Lord. In the West trine immersion was generally held to be symbolic of the triune name of "Father, Son and Holy Ghost." This name the Armenians have used, at least since the year 700; before which date their fathers often speak of baptism into the death of Christ as the one essential. As late as about 1300 a traveller hostile to the Armenians reported to the pope that he had witnessed baptisms without any trinitarian invocation in as many as three hundred parish churches.

The paschal lamb is now eaten on Sunday, but until the 11th century, and even later, it was eaten with the Eucharist at a Lord's Supper celebrated on the evening of Maundy Thursday after the rite of *pedilavium* or washing of feet. On the morning of the same day the penitents were released from their fast.

The rite of extreme unction was introduced in the crusading epoch, although it was already usual to anoint the bodies of dead priests. The worship of images never seems to have taken root among Armenians; indeed they supplied the Greek world with iconoclast soldiers and emperors. The worship of crosses into which the Spirit or Christ had been inserted by the priest must have satisfied the religious needs of a people who, save in architecture, showed little artistic faculty. In their older rituals we find a rite for blessing a painted church, but no word of statues. Frescoes in their churches are rare, and mostly too high up for veneration to be paid to them.

On certain days the cross was washed, and the water in which it had been washed was a sovereign charm for curing sickness in men and animals and for bringing fertility to the land.

In the older rituals we find a rite of *exhomologesis*, for restoring those who had sinned after baptism. It was a medicine of sin that could only be used once and not a second time. In form it is a rehearsal of the first baptismal rite, but with omission of the water. It involved like the first rite open confession and repentance, and absolution by the church. In a later and less rigorous age this rite was abridged and adjusted to constant repetition, in such wise that a sinner could be restored to grace not once only, but as often as the clergy chose to accept his repentance and confession. Thus the whole development of the penitentiary system is traceable in the MSS.

The confession of a dying man might be taken by any layman present, and written down in order to be shown to the priest when he arrived. It then was the duty of the latter to supplicate for his forgiveness, and administer to him the Eucharist.

The clergy of all grades were originally married. The parish priests, or white clergy, are so still, except some of the Latinizing ones. But since the 12th century, or even earlier, the higher clergy, *i.e.* patriarchs and bishops, have taken monkish vows and worn the cowl.

There were abortive attempts to unite the Armenian church with the Byzantine in the 9th century under the patriarch Photius, and again late in the 12th under the emperor Manuel Comnenus, when a joint council met at Romkla, near Tarsus, but ended in nothing (A.D. 1179). Neither could the Armenians keep on good terms even with the Syriac monophysites. From the age of the crusades on, the Armenians of Cilicia, whose patriarch sat at Sis, improved their acquaintance with Rome; and more than one of their patriarchs adopted the Roman faith, at least in words. Dominican missions went to Armenia, and in 1328 under their auspices was formed a regular order called the United Brethren, the forerunners of the Uniats of the present day, who have convents at Venice and Vienna, a college in Rome and a numerous following in Turkey. They retain their Armenian liturgies and rites, pruned to suit the Vatican standards of orthodoxy, and they recognize the pope as head of the church.

The patriarchs of Great Armenia first resided at Ashtishat, on the Araxes. From 478 to 931 they occupied Dvin in the same neighbourhood, then Aghthamar, an island in the Lake of Van, 931–967, the city of Ani, 992–1054, where are still visible the magnificent ruins of their churches and palaces. Since 1441 the chief catholicus has sat at Echmiadzin, the convent of Valarshapat, now part of Russian Armenia. A rival catholicus, with a small following, still has his cathedral and see at Sis. The catholicus of Valarshapat is nominally chosen by all Armenians. A synod of bishops, monks and doctors meets regularly to transact under his eye the business of the convent and the oecumenical affairs of the church; but its decisions are subject to the veto of a Russian procurator. There are Armenian patriarchs, subject to the spiritual jurisdiction of Echmiadzin, in Constantinople and Jerusalem. In the latter place the Armenians occupy a convent on Mount Sion, and keep up in the churches of the Sepulchre and of Bethlehem their own distinct rites and feasts, the only ones there which at all resemble those of the 4th century.

The following list of councils was compiled by John, catholicus about the year 728, and read at the council of Manazkert, when the dogmatic and disciplinary attitude of the Armenian church was defined once and for all:—

1. In twentieth year of catholicate of Gregory and thirty-seventh of Trdat, the king, on return of Aristaces from council of Nice, bringing the Nicene creed and canons.

2. Council held by St Nerses on his return from the council of the 150 fathers at Constantinople against Macedonius.

3. Held by St Sahak and Mesrop on receipt of letters from Proclus and Cyril after the council of Ephesus, when the "Glory in the Highest" was adopted. Held against Nestorianism.

4. Held by Joseph, disciple of Mashdotz (Mesrop) and St Sahak, in Shahapiwan in the sixth year of King Yazkert (*i.e.* Yazdegerd) of Persia, for the regulation of the church. Forty bishops present. (The Massalians were anathematized.)

5. Held by Babken, catholicus, in the City-plain (*i.e.* Dvin), in the 18th year of King Kavat (*i.e.* Kavadh), against the heresy of Acacius and Barsuma (Bar-sauma), the friends of Nestorius. The true (Nicene) faith was sent to the Armenians of the farther East (shortly afterwards a slightly different creed was adopted, identical with a pseudo-Athanasian symbol used by Evagrius of Pontus and given in Greek in Patr. Gr. xxvi. Col. 1232).

6. At the beginning of the Armenian era, held by Nerses in Dvin, in the fourth year of his catholicate, in the fourteenth of Chosroes' reign and in the fourteenth of Justinian Caesar. Held against Chalcedon, uniting the Baptism and Christmas feasts on the 6th of January (Epiphany), declaring for monophysitism, and adopting in the *Trisagion* the words "who wast crucified for us." This settlement lasted for about seventy-four years.

7. After the retaking of Jerusalem and recovery of the Cross from the Persians in the eighteenth year of his reign, Heraclius called a mixed council at Karin (Theodosiopolis) of Greeks and Armenians under Ezr (Esdras), catholicus, at which the preceding council of Dvin was cursed, its reforms repudiated and the confession of Chalcedon adopted. This remained the official attitude of the Armenian church until the catholicate of Elias (703–717). John, catholicus, denies to Ezr's meeting the name of council, and so makes his own the seventh.

8. Under John, catholicus, in Manazkert, in the one hundred and seventieth year of the Armenian era (=A.D. 728) under the presidency of Gregory Asharuni Chorepiscopos (Gregory Asheruni). All the Armenian bishops attended, as also the metropolitan of Urhha (Edessa), Jacobite bishops of Gartman, of Nfrkert, Amasia, by command of the archbishop of Antioch. Chalcedon was repudiated afresh, union with the Jacobites instituted, use of water and leaven in the Eucharist condemned, the five days' preliminary fast before Lent restored, Saturday as well as Sunday made a day of feasting and synaxis, any but the orthodox excluded from the Maundy Thursday Communion, the first communion of the new catechumens; union of the Baptismal and Christmas feasts was restored, and the faithful forbidden to fast on Fridays from Easter until Pentecost. In general these rules have been observed in the Armenian church ever since.

For list of authorities on the Armenian church see the works enumerated at the end of ARMENIAN LANGUAGE AND LITERATURE. For the relations of the Armenian church to the Persian kings see PERSIA: *Ancient History*, section viii. §§ 2 and 3. (F. C. C.)

ARMENIAN LANGUAGE AND LITERATURE. The Armenian language belongs to the group called Indo-European, of which the Iranic and Indic tongues formed one branch, and Greek, Albanian, Italian, Celtic, Germanic and Baltic-Slavonic dialects the other great branch. Unlike most of these, Armenian lost its genders long before the year A.D. 400, when the existing literature begins. Modern Persian similarly has lost gender; and in both cases the liberation must have been due to attrition of other tongues which had a different system of gender or none at all. So the Armenians were ever in contact on the north with the Iberians of the Caucasus who had none, and with the Semitic races on the south and east which had other ways of forming genders than the Indo-European tongues.

Language.

From the original Armenian stock can be readily distinguished a mass of Old and Middle Persian loan-words. These are so numerous that for a time Armenian was classed as an Iranian tongue. For more than a thousand years, say until A.D. 640, Armenia was an appanage of the realm of the Persians and Parthians. Until A.D. 428 the Armenian throne was occupied by a younger branch of the Arsacid dynasty that ruled in Persia until the advent of the Sassanids (*c.* A.D. 226), and the internal polity and court administration of Armenia were modelled on the Persian or Parthian. Accordingly over 200 proper and personal names in Armenia were Old Persian, as well as 700 names of things. If we count in the derivative forms of these words we get at least 2000 Old Persian words. Often the same Persian word was borrowed twice over in an earlier and later form at an interval of centuries, just as in English we inherit a word direct or have taken it from Latin, and have also assimilated from French a later form of the same. The Persian influence in Armenian was already strong as early as 400 B.C., when Xenophon used a Persian interpreter to converse. In some of the Armenian villages they answered him in Persian. The Persian loan-words already present in Armenian as early as A.D. 400 mirror the earlier political and social life of Armenia. Thus many of their kings and nobles had Persian names; Persian also were most words used in connexion with horses and the chase, with war and army, with dress, trade and coinage, calendar, weights and measures, with court and political institutions, with music, medicine, school, education, literature and the arts. Many everyday words were of the same origin, *e.g.* the words for village, desert, building and build, need, rich or liberal, arm (of body), rod or goad, face, opposite, wicked, unfriendly, discontented, difficult, daughter, eulogy, a youth, wary, enjoy, unhappy, volition, voluntary, unwilling, blind, cautious, blood-kin, coquet with, slumber, humble, mad, grace or favour, memory or attention, grandfather, old woman, prepared, duty, necessary, end, endless, superior, confident, mistake, warmth, heat, glory. The language of their old religion was mainly Persian, but in the 4th century they derived numerous ecclesiological words from the Syrians, from whom by way of Edessa and Nisibis Christianity penetrated eastern Armenia. The language of the garden and the names of plants were also Persian. They had their own numerals, but the words for one thousand and for ten thousand are Persian.

Yet more indicative of the extent of the Persian influence is the adoption of the adjectival ending *-akan* and *-zan*, added to purely Armenian words; also of the preposition *ham*, answering to *con* in "conjoin," "conspire," added to purely Armenian words, as in *hambarnam*, I take away, and *hamboir*, a kiss, a word which, strange to say, the Iberians in turn borrowed from the Armenians. From Persia also the Armenians took their names for surrounding races, *e.g. Tatshik* or *Tajik*, first for Arab and then for Turk, *Ariq* for Persians, *Kapkoh* for Caucasus, *Hrazdan*, *Vaspuragan*, &c. The Armenians call themselves *Hay*, plural *Hayq*; their country *Hayasdan*. The Iberians they called *Virq* or *Wirq* (where *q* marks the plural), the Medes *Marq*, the Cappadocians *Gamirq* (Cimmerians), the Greeks *Yûnes* or Ionians; Ararat they call *Masis*, the Euphrates the *Aradsan*, the Tigris *Teglath*, Erzerum is *Karin*, Edessa *Urhha*, Nisibis *Mdsbin*, Ctesiphon *Tizbon*, &c.

When the Persian and other loan-words are removed, a stock remains of native words and forms governed by other phonetic laws than those which govern the Aryan, *i.e.* Indian and Iranic, branch of the Indo-European tongues. Armenian appears to be a half-way dialect between the Aryan branch and Slavo-lettic. Much, however, in Armenian philology remains unexplained. For example the plural of nouns, pronouns and the first and second persons plural of verbs are all formed by adding a *q* or *k*, which has no parallel in any Indo-Germanic tongue. The genitive plural again is formed by adding a *tz* or *c*, and the same consonant characterizes the composite aorist and the conjunctive. In all three cases it is unexplained. In the verbs the termination *m* for the first singular at once explains itself, and the *n* of the third plural is the Indo-Germanic *nti*. But not so the second person singular ending in *s*, *e.g. berem*, I bear, *beres*, thou bearest. This has a superficial likeness to the I.-G. *esi* in *bheresi*, "thou bearest." Yet we should expect the *s* between vowels to vanish, and give us in Armenian *berê*. Perhaps, therefore, an old variant of *esi*, similar to the Greek ἐσσί, lies behind the Armenian *es*, thou art, and the *es* in *beres*, thou bearest. In any case it is clear that many of the oldest forms which Armenian shared with other Indo-Germanic dialects were lost and replaced by forms of which the origin is obscure. Perhaps a closer study of Mingrelian and Georgian will explain some of these peculiarities, for these and their cognate tongues must have had a wider range in the 7th and 8th centuries B.C. than they had later when clear history begins. The attempts made by S. Bugge to assimilate Old Armenian to Etruscan, and by P. Jensen to explain from it the Hittite inscriptions, appear to be fanciful. There is a large Semitic influence traceable in Armenian due to their early contact with the Syriac-speaking peoples to the south and east of them, and later to the Arab conquest. Much remains to be done in the way of collecting Armenian dialects, for which task there are written materials as far back as the 12th century over and above the work to be done by an intelligent traveller armed with a phonograph. Two main dialects of Armenian are distinguishable to-day, that of Ararat and Tiflis, and that of Stambul and the coast cities of Asia Minor. The latter is much overlaid with Tatar or Turkish words, and the Tatar order of words distinguishes the modern Armenian sentence from the ancient.

It remains to say that classical Armenian resembles rather the modern idiom of Van than of western Armenia. It was a plastic and noble language, capable of rendering faithfully, yet not servilely, the Greek Bible and Greek fathers. Often the Armenian translators, and especially after the 5th century, rendered word for word, preserving the order of the Greek. This literalness, though unpleasing from a literary standpoint, gives to many of their ancient versions the value almost of a Greek codex of the age in which the version was made. The same literalness also characterizes their translations from Syriac.

Literature.

The Armenians had a temple literature of their own, which was destroyed in the 4th and 5th centuries by the Christian clergy, so thoroughly that barely twenty lines of it survive in the history of Moses of Khoren (Chorene). Their Christian literature begins about 400 with the invention of the Armenian alphabet by Mesrop. This was probably an older alphabet to which Mesrop merely added vowels; but, in order to pacify the Greek ecclesiastics and the emperor Theodosius the Less, the Armenians concocted a story that it had been divinely revealed. Once their alphabet perfected, the catholicus Sahak formed a school of translators who were sent to Edessa, Athens, Constantinople, Alexandria, Antioch, Caesarea in Cappadocia, and elsewhere, to procure codices both in Syriac and Greek and translate them. From Syriac were made the first version of the New Testament, the version of Eusebius' History and his Life of Constantine (unless this be from the original Greek), the homilies of Aphraates, the Acts of Gurias and Samuna, the works of Ephrem Syrus (partly published in four volumes by the Mechitharists of Venice). They include the commentaries on the *Diatessaron* and the Paulines, Laboubna and History of Addai, the Syriac canons of the Apostles.

From the original Greek were rendered in the 5th century the following authors and works. An asterisk is prefixed to those which have been printed:—*Eusebius' *Chronicon*; *Philo's lost commentaries on Genesis and Exodus, and his lost treatises on Providence and Animals, as well as a great number of his works still preserved in Greek; *the entire Bible (the New Testament is a recension after Antiochene Greek texts of an older version made from the oldest Syriac text); *the Alexander romance of the pseudo-Callisthenes; **Epistles* and *Acts* of Ignatius of Antioch; *many homilies of Gregory Thaumaturgus; *Athanasius (a large number of works, many of them wrongly attributed); Irenaeus, *Adversus Haereses* and *Ad Marcianum* (recently found); *Hippolytus' commentaries on the Song of Songs and Daniel, and many fragments; *Timotheus' life of Athanasius; Theophilus of Alexandria, various homilies; *Eusebius of Gabala or Severianus, fifteen Homilies; *Cyril of Jerusalem, *Catecheses* and *Letter to Constantine*; **Wisdom of Ahikar*; *the *Apology* of Aristides; Gregory of Nazianzus, thirty-four Homilies; *Nonnus' work on Gregory (perhaps a version of 6th century); Basil of Caesarea, **Hexaëmeron*, fifteen Homilies on faith, epistle to Terentius, ascetic writings and canons, on the Holy Spirit, to Cledonius, &c. Helladius of Caesarea's life of Basil; Gregory of Nyssa's treatise on the Beatitudes, and many other homilies, Commentaries on Song of Songs, *On Human Nature (Nemesius), panegyrics on sundry Martyrs, and other works (but some of these versions belong to the beginning of the 8th century); Epiphanius of Salamis, Commentary on the Gospels, **On weights and measures*, **Physiologus*, canons and many homilies; Evagrius of Pontus, Homilies and Ascetic works, Letters to Melania, &c.; John Chrysostom, *Homilies and Prayers, in very beautiful language; *Proclus, patriarch of Constantinople, many homilies; *Nilus the Ascete, *On the Eight Spirits of Evil*; *Josephus, *On the Jewish War*; Dionysius of Alexandria, **Against Paul of Samosata* and other fragments Acacius, bishop of Melitene, **Letters* to Sahak; Julius of Rome (fragments); Zenobius, Homilies (? from Syriac); the *History* of Julius Africanus was perhaps also translated in this century, but it is lost. To the 5th century belong the versions of the

Nicene canons, of which the Armenian text as preserved is barely intelligible, of the eucharistic rites called of *Basil, *Chrysostom, *Ignatius and others; also the *Hours or Breviary, the *Rites of Ordination, Baptism, of the making and release of Penitents, of Epiphany, and perhaps the many rites of animal sacrifice, for these are partly originals, partly versions of lost Greek texts. A mass of martyrs' acts were also rendered in this century, including parts of the lost collection made by Eusebius. Among these the **Acts and Apology* of Apollonius restore a lost 2nd-century text. The **Canons* of Sahak also purport to be translated from a Greek original about the year 330.

The Armenians were so busy in this century translating Greek and Syriac fathers that they have left little that is original. Still a number of historical works survive: *Faustus of Byzantium relates the events of the period A.D. 344–392 in a work instinct with life and racy of the soil. It was perhaps first composed in Greek, but it gives a faithful picture of the court of the petty sovereigns of Armenia, of the political organization, of the blood feuds of the clans, of the planting of Christianity. Procopius preserves some fragments of the Greek.

The **History of Taron*, by Zenobius of Glak, is a somewhat legendary account of Gregory the Illuminator, and may have been written in Syriac in the 5th, though it was only Armenized in a later century.

*Elisaeus Wardapet wrote a history of Wardan (Vardan), and of the war waged for their faith by the Armenians against the Sassanids. He was an eye-witness of this struggle, and gives a good account of the contemporary Mazdaism which the Persians tried to force on the Armenians. *Lazar of Pharp wrote a history embracing the events of the 5th century up to the year 485, as a continuation of the work of Faustus.

*A history of St Gregory and of the conversion of Armenia by Agathangelus is preserved in Greek, Armenian and Arabic. The Arabic edited by Professor Marr of St Petersburg seems to be the oldest form of text. The Greek is a rendering of the Armenian. It is a compilation, and the second part which contains the *Acts* of Gregory and of St Rhipsima seems wholly legendary. The Greek and Armenian texts were edited together by Lagarde.

*The *History of Armenia* by Moses of Khoren (Chorene) relates events up to about the year 450. It is a compilation, devoid of historical method, value or veracity, from all sorts of previous authors, mostly from those which already existed in an Armenian dress. Some critics put down the date of composition as low as about 700, and it was certainly retouched in the late 6th century.

*A long volume of rhetorical exercises, based on Aphthonius, is also ascribed to Moses of Khoren, and appears to be of the 5th century. The *geography which passes under his name may belong to the 7th century. Various homilies of Moses survive, as also of Elisaeus.

Gorium wrote in this century a **Life of Mesrop*, and Eznik a **Refutation of the Sects*, based largely on antecedent Greek works. The sects in question are Paganism, Mazdaism, Greek Philosophy and Manicheism. A volume of *homilies under the name of Gregory the Illuminator, but not his, also belongs to this century, and a series of ascetic discourses attributed to John Mandakuni, who was patriarch 478–500.

Of the 6th and 7th centuries few works survive except anonymous versions of the **Acts of Thomas* (perhaps from the Syriac), of the **Acts of Peter and Paul*, *of John (pseudo-Prochorus), *of Bartholomew, and of other apostles; also of *the Acts of Paul and Thekla, *of Titus, *of the Protevangel, *of the Testaments of the patriarchs, of the **Gospel of Nicodemus*, or *Acts of Pilate*, of the **Book of Adam*, of the **Deaths of the Prophets*, of the **History of Baruch*, of the *Apocalypses of Paul and of the Virgin Mary, of the *Acts of Sylvester, and of an enormous number of other similar apocryphs. Some of these may be of the 5th century. Two volumes of these apocryphs of the Old and New Testaments have recently been published at Venice. To these centuries belong also the versions of the Acts of the council of Ephesus, of Gangra, Laodicea and of other councils. To the late 7th century belong the *calendarial works of Ananiah of Shirak, who also has left a **chronicon* compiled from Eusebius, Andreas of Crete, Hippolytus and other sources. In the **Letter-book of the Patriarchs*, lately printed at Tiflis, are to be found a number of controversial monophysite tracts of these and the succeeding three centuries, important for church history. It includes a mass of documents relative to the churches of Iberia and Albania. The chief literary monument of the 7th century is the history of the wars of Heraclius and of the early Mahommedan conquests in Asia Minor, by the bishop Sebeos, who was an eye-witness. The *history of the Albanians of the Caucasus, by Moses Kalankatuatzi, also belongs to the end of this century. To the middle of the 7th century also belong the translations of Aristotle's treatises **On the Categories*, and **On Interpretation*, and of *Porphyry's *Isagogē*, as well as of voluminous Greek commentaries on these books; the version of the *Grammar of Dionysius Thrax and an incomplete Euclid. The translator was one David called the Invincible, who also wrote monophysite tracts. At the end of this 7th century one Philo of Tirak is supposed to have made the version of the *History of Socrates, unless indeed it was made earlier. To this century also seems to belong the Armenian version of a *history of the Iberians, by Djuansher, a work full of valuable information.

The early 8th century was a time of great literary activity. Gregory Asheruni wrote an important *commentary on the Jerusalem Lectionary, and his friend *John the catholicus (717–728) commentaries on the other liturgical works of his church; he also collected all existing canon law, Greek or Armenian, respected in his church, wrote *against the Paulicians and Docetae, and composed many beautiful hymns. *Leoncius the priest has left a history of the first caliphs, and Stephanus, bishop of Siunik, translated the *controversial works of Cyril of Alexandria (whose *Glaphyra* and commentaries, however, seem to have been translated at an earlier period). He also translated the works of Dionysius the Areopagite, commented on the Armenian breviary and wrote hymns.

In the 9th century Zachariah, catholicus, the correspondent of Photius, wrote many eloquent homilies for the various church feasts. Shapuh Bagratuni wrote a history of his age, now lost. Mashtotz, catholicus, collected in one volume the Armenian rituals.

In the 10th century (*c.* 925) the catholicus John VI. issued his *history of Armenia, and Thomas Artsruni a *history of his clan carried up to the year 936. Ananias of Mok (943–965) wrote a great work against the Paulicians, unfortunately lost. Chosroes wrote a *commentary on the eucharistic rites and breviary, *Mesrop a history of Nerses the Great; *Stephen of Asolik wrote a history of the world, and a commentary on Jeremiah; *Gregory of Narek his famous meditations and hymns; Samuel Kamrdjtsoretzi a commentary on the Lectionary based on Gregory Asheruni.

In the 11th century the catholicus Gregory translated many Acts of Martyrs, and John Kozerhn wrote a history, now lost, as well as a work on the Armenian calendar; Stephen Asolik a *history of Armenia up to the year 1004; *Aristaces of Lastiverd a valuable history of the conquest of Armenia by the Seljuk caliphs. We may also mention a *monophysite work against the Greek doctor Theopistus by Paul of Taron; *letters and poems of Gregory Magistros, who also was the translator of the **Laws*, *Timaeus* and other dialogues of Plato.

The 12th century saw many remarkable writers, mostly in Cilician Armenia, viz. Nerses the Graceful (d. 1165), author of an **Elegy* on the taking of Edessa, of *voluminous hymns, of long *Pastoral Letters and Synodal orations of value for the historian of eastern churches. *Samuel of Ani composed a chronicle up to 1179. Nerses of Lambron, archbishop of Tarsus, left a *Synodal oration, a *Commentary on the liturgy, &c., and his contemporary Gregory of Tlay an **Elegy* on the capture of Jerusalem, and various *dogmatic works. In this century the *history of Michael the Syrian was translated; Ignatius and Sargis composed *commentaries on Luke and *the catholic epistles, and *Matthew of Edessa a valuable history of the years 952–1136, continued up to 1176 by Gregory the priest. Mechithar (Mekhitar) Kosh (d. 1207) wrote an elegant **Book of Fables*, and compiled a *corpus of civil and canon law (partly from Byzantine codes).

In the 13th century the following works or authors are to be noticed:—*history of Kiriakos of Ganzak, which contains much about the Mongols, Georgians and Albanians; *Malakia the monk's history of the Tatars up to 1272; *Chronicle of Mechithar of Ani (fragmentary); *Vahram's rhymed chronicle of the kings of Lesser Armenia; *history of the world, by Vartan, up to 1269. In this century mostly falls the redaction of a large fable literature, recently edited in three volumes by Professor Marr of St Petersburg.

14th century: *history of Siunik, by Stephen Orbelian, archbishop of that province 1287–1304; *Sempat's chronicle of Lesser Armenia (952–1274), carried on by a continuator to 1331; *Mechithar of Airivanq, a chronography; *Hethoum's account of the Tatars, and chronography of the years 1076–1307. John of Orotn (d. 1388) compiled commentaries on John's gospel and the Paulines, and wrote homilies and monophysite works; his disciple Gregory of Dathev (b. 1340) compiled a **Summa theologiae* called the *Book of Questions*, in the style of the *Summa* of Aquinas, which had been translated into Armenian *c.* 1330, as were a little later the **Summa* of Albertus and works of other schoolmen.

15th century: **History of Tamerlane*, by Thomas of Medsoph, carried up to 1447.

17th century, Araqel of Tabriz wrote a *history of the Persian invasions of Armenia in the years 1602–1661.

In the above list are not included a number of medical, astrological, calendarial and philological or lexicographic works, mostly written during or since the Cilician or crusading epoch. The hymns used in Armenian worship rarely go back to the 5th century; and they were still few in number and brief in length when Nerses the Graceful and his contemporaries more than doubled their number and bulk in the 12th century. Most Armenian poems embody acrostics, and their poets began to rhyme in the 8th century or thereabouts. Since the 15th century a certain number of profane poets have arisen, whose work is less jejune on the whole than that of the hymn and canticle writers of an earlier age. Gregory Magistros (d. 1058) abridged the whole of the Old and New Testaments in a *rhyming poem, and set a fashion to later writers. Such works as **Barlaam and Josaphat*, the **History of the Seven Sages*, the **Wisdom of Ahikar*, the **Tale of the City of Bronze*, were freely turned into verse in the 13th and following centuries.

It will be realized from the above enumeration of works written in each century that Armenian literature was purely monkish. There was no epic or romance literature; although this was not lacking in the contiguous country of Georgia, where there seem to have always been knights and ladies willing to read and keep alive a literature of poetry and narrative, not altogether suitable for monks, and more akin to Persian literature.

Other forms of faith than the orthodox had a hold in Armenia, particularly the Nestorian and the Manichean. Sundry works of Mani were translated in the year 588, but are lost. Perhaps certain works of Diodore of Tarsus survive, but the orthodox monks were so vigilant that there is little chance of finding any other monuments than those of the stereotyped orthodoxy.

The 16th century saw the first books printed in Armenian. A press was set up at Venice in 1565, and the psalms and breviary were printed. In 1584 the Roman propaganda began its issue of Armenian books with a Gregorian calendar. In the 17th century presses were working at Lembourg, Milan, Paris, Isfahan (where in 1640 a large folio of the *Lives of the Fathers of the Desert* appeared), in Leghorn, Amsterdam (where in 1664 the first edition of the Hymn-book, in 1666 the first Bible, and in 1667 the first Ritual were printed), Marseilles, Constantinople, Leipzig and Padua.

The press which has done most in printing Armenian authors is that of the Mechitharists of Venice. Here in 1836 was issued a magnificent thesaurus of the Armenian language, with the Latin and Greek equivalents of each word. At that time there was no dictionary of any language and literature to be compared with this for exhaustiveness and accuracy. There are now Armenian presses all over the world, reprinting old books or issuing new works, often translations of modern writers, English, French, Russian and German.

The chief collections of old Armenian MSS. are: at the convent of *Echmiadzin at Valarshapat; at Stambul in the library of the fathers of St Anthony; at Venice in the Mechitharist convent of San Lazaro; at the *Mechitharist convent in Vienna; in the *Royal library at Vienna; in the *Paris Bibliothèque Nationale; in the Vatican library; in the British Museum; in the *Bodleian; in the Rylands library; in the *Berlin and *Munich libraries; *in Tübingen; in St Petersburg, and in the *Lazarev institute at Moscow; at New Joulfa, the Armenian suburb of Isfahan. Private collections have been made by Mr Rendel Harris in Birmingham (presented to the university of Leiden); at Parham and elsewhere. A printed catalogue exists of those marked with an asterisk.

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ARMENTIÈRES, a town of northern France, in the department of Nord, on the Lys, 13 m. W.N.W. of Lille on the Northern railway from that city to Dunkirk. Pop. (1906) 25,408. The chief building is the hôtel de ville with a 17th-century belfry. There are communal colleges for girls and boys, a board of trade-arbitrators, a chamber of commerce and a national technical school. The town is an important centre for the spinning and weaving of flax and cotton; bleaching, dyeing and the manufacture of machinery are among the other industries. Its industrial prosperity dates from the middle ages, when, however, woollen, not cotton, goods were the staple product.

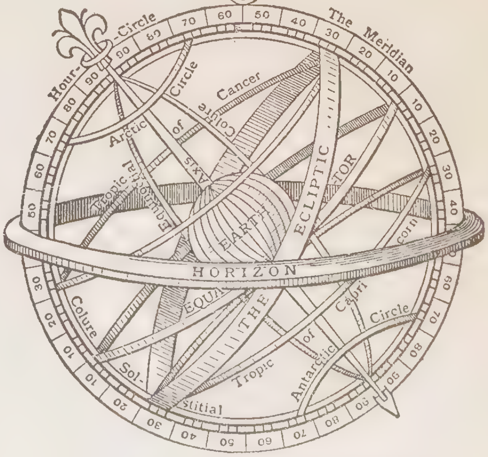
ARMET (diminutive of Fr. *arme*), a form of helmet, which was developed out of existing forms in the latter part of the 15th century. It was round in shape, and often had a narrow ridge or comb along the top. It had a pivoted or hinged vizor and nose-piece, and complete chin, neck and cheek protection, closely connected with the gorget. It is distinguished from the basinet by its roundness, and by the fact that it protects the neck and chin by strong plates, instead of a "camail" or loose collar of mail; from the salade and heaume by its close fit and skull-cap shape; and from the various forms of vizored burgonets by the absence of the projecting brim. It remained in use until the final abandonment of the complete closed head-piece.

ARMFELT, GUSTAF MAURITZ, COUNT (1757–1814), son of Charles II.'s general, Carl Gustaf Armfelt, was born in Finland on the 31st of March 1757. In 1774 he became an ensign in the guards, but his frivolity provoked the displeasure of Gustavus III. and he thought it prudent to go abroad. Subsequently, however, (1780) he met the king again at Spa and completely won the monarch's favour by his natural amiability, intelligence and brilliant social gifts. Henceforth his fortune was made. At first he was the *maître des plaisirs* of the Swedish court, but it was not long before more serious affairs were entrusted to him. He took part in the negotiations with Catherine II. (1783) and with the Danish government (1787), and during the Russian war of 1788–90 he was one of the king's most trusted and active counsellors. He also displayed great valour in the field. In 1788 when the Danes unexpectedly invaded Sweden and threatened Gothenburg, it was Armfelt who under the king's directions organized the Dalecarlian levies and led them to victory. He remained absolutely faithful to Gustavus when nearly the whole of the nobility fell away from him; brilliantly distinguished himself in the later phases of the Russian war; and was the Swedish plenipotentiary at the conclusion of the peace of Verelā. During the last years of Gustavus III. his influence was paramount, though he protested against his master's headstrong championship of the Bourbons. On his deathbed Gustavus III. (1792) committed the care of his infant son to Armfelt and appointed him a member of the council of regency; but the anti-Gustavian duke-regent Charles sent Armfelt as Swedish ambassador to Naples to get rid of him. From Naples Armfelt communicated with Catherine II., urging her to bring about by means of a military demonstration a change in the Swedish government in favour of the Gustavians. The plot was discovered by the regent's spies, and Armfelt only escaped from the man-of-war sent to Naples to seize him, with the assistance of Queen Caroline. He now fled to Russia, where he was interned at Kaluga, while at home he was condemned to confiscation and death as a traitor, and his unjustly accused mistress Magdalena Rudenschöld was publicly whipped to gratify an old grudge of the regent's. When Gustavus IV. attained his majority, Armfelt was completely rehabilitated and sent as Swedish ambassador to Vienna (1802), but was obliged to quit that post two years later for sharply attacking the Austrian government's attitude towards Bonaparte. From 1805 to 1807 he was commander-in-chief of the Swedish forces in Pomerania, where he displayed great ability and retarded the conquest of the duchy as long as it was humanly possible. On his return home, he was appointed commander-in-chief on the Norwegian frontier, but could do nothing owing to the *ordres, contre-ordres et désordres* of his lunatic master. He would have nothing to say to the revolutionaries who in 1809 deposed Gustavus IV. and his whole family. Armfelt was the most courageous of the supporters of the crown prince Gustavus, and when Bernadotte was elected resolved to retire to Finland. His departure was accelerated by a decree of expulsion as a conspirator (1811). Over the impressionable Alexander I. of Russia, Armfelt exercised almost as great an influence as Czartoryski, especially as regards Finnish affairs. He contributed more than any one else to the erection of the grand-duchy into an autonomous state, and was its first and best governor-general. The plan of the Russian defensive campaigns is, with great probability, also attributed to him, and he gained Alexander over to the plan of uniting Norway with Sweden. He died at Tsarskoe Selo on the 19th of August 1814.

See Robert Nisbet Bain, *Gustavus III.* vol. ii. (London, 1895); Elof Tegner, *Gustaf Mauritz Armfelt* (Stockholm, 1883–1887). (R. N. B.)

ARMIDALE, a town in Sandon county, New South Wales, Australia, 313 m. by rail N. of Sydney. Pop. (1901) 4249. It lies at an elevation of 3313 ft., in a picturesque mountainous district, for the most part pastoral and agricultural, though it contains some alluvial gold diggings. Antimony is found in large quantities near the town. Armidale is a cathedral town, being the seat of a Roman Catholic bishop and belonging to the joint Anglican diocese of Grafton; Armidale St Peter's, the Anglican cathedral, and St Mary's, the Roman Catholic, are both fine buildings. The town is the centre of great educational activity, its schools including the New England girls' school, St Patrick's college, the high school, the Ursuline convent and state schools. Armidale became a municipality in 1863.

ARMILLA, ARMIL or ARMILLARY SPHERE (from the Lat. *armilla*, a bracelet), an instrument used in astronomy. In its simplest form, consisting of a ring fixed in the plane of the equator, the *armilla* is one of the most ancient of astronomical instruments. Slightly developed, it was crossed by another ring fixed in the plane of the meridian. The first was an equinoctial, the second a solstitial armilla. Shadows were used as indices of the sun's position, in combination with angular divisions. When several rings or circles were combined representing the great circles of the heavens, the instrument became an armillary sphere. Armillae are said to have been in early use in China. Eratosthenes (276–196 B.C.) used most probably a solstitial armilla for measuring the obliquity of the ecliptic. Hipparchus (160–125 B.C.) probably used an armillary sphere of four rings. Ptolemy (*c.* A.D. 107–161) describes his instrument in the *Syntaxis* (book v. chap. i.), and it is of great interest as an example of the armillary sphere passing into the spherical astrolabe. It consisted of a graduated circle inside which another could slide, carrying two small tubes diametrically opposite, the instrument being kept vertical by a plumb-line.



From M. Blundeville's *Treatise of the first principles of Cosmography and specially of the Spheare.*

Armillary Sphere. A.D. 1636.

No material advance was made on Ptolemy's instrument until Tycho Brahe, whose elaborate armillary spheres passing into astrolabes are figured in his *Astronomiae Instauratae Mechanica*.

The armillary sphere survives as useful for teaching, and may be described as a skeleton celestial globe, the series of rings representing the great circles of the heavens, and revolving on an axis within a horizon. With the earth as centre such a sphere is known as Ptolemaic; with the sun as centre, as Copernican.

The designer of the instrument shown no doubt thought that the north pole might suitably have the same ornament as was used to mark N. on the compass card, and so surmounted it with the *fleur-de-lys*, traditionally chosen for that purpose on the compass by Flavio Gioja in honour of Charles of Anjou, king of Sicily and Naples.

Armillary spheres occur in many old sculptures, paintings and engravings; and from these sources we know that they were made for suspension, for resting on the ground or on a table, for holding by a short handle, or either for holding or for resting on a stand.

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ARMINIUS, the Latinized form of the name of HERMANN, or more probably ARMĪN (17 B.C.–A.D. 21), the German national hero. He was a son of a certain Segimer, a prince of the tribe of the Cherusci, and in early life served with distinction as an officer in the Roman armies. Returning to his own people he found them chafing under the yoke of the Roman governor, Quintilius Varus; he entertained for them hopes of freedom, and cautiously inducing neighbouring tribes to join his standard he led the rebellion which broke out in the autumn of A.D. 9. Heavily laden with baggage the troops of Varus were decoyed into the fastnesses of the Teutoburger Wald, and there attacked, the completeness of the barbarian victory being attested by the virtual annihilation of three legions, by the voluntary death of Varus, and by the terror which reigned in Rome when the news of the defeat became known, a terror which found utterance in the emperor's despairing cry: "Varus, give me back my legions!" Then in A.D. 15 Germanicus Caesar led the Romans against Arminius, and captured his wife, Thusnelda. An indecisive battle was fought in the Teutoburger Wald, where Germanicus narrowly escaped the fate of Varus, and in the following year Arminius was defeated. The hero's later years were spent in fighting against Marbod, prince of the Marcomanni, and in disputes with his own people occasioned probably by his desire to found a powerful kingdom. He was murdered in A.D. 21.

In 1875 a great monument to Arminius was completed. This stands on the Grotenburg mountain near Detmold. Klopstock and other poets have used his exploits as material for dramas.

Much discussion has taken place with regard to the exact spot in the Teutoburger Wald where the great battle between Arminius and Varus was fought. There is an immense literature on this subject, and the following may be consulted:—T. Mommsen, *Die Ortlichkeit der Varusschlacht* (1885); E. Meyer, *Untersuchungen über die Schlacht im Teutoburger Walde* (1893); A. Wilms, *Die Schlacht im Teutoburger Walde* (1899); F. Knoke, *Das Schlachtfeld im Teutoburger Walde* (1899); E. Dünzelmann, *Der Schauplatz der Varusschlacht* (1889); and P. Höfer, *Die Varusschlacht* (1888). For more general accounts of Arminius see: Tacitus, *Annals*, edited by H. Furneaux (1884–1891); O. Kemmer, *Arminius* (1893); F. W. Fischer, *Armin und die Römer* (1893); W. Uhl, *Das Portrait des Arminius* (1898); and F. Knoke, *Die Kriegszüge des Germanicus in Deutschland* (1887).

ARMINIUS, JACOBUS (1560–1609), Dutch theologian, author of the modified reformed theology that receives its name of Arminian from him, was born at Oudewater, South Holland, on the 10th of October 1560. Arminius is a Latinized form of his patronymic Hermanns or Hermansen. His father, Hermann Jakobs, a cutler, died while he was an infant, leaving a widow and three children. Theodorus Aemilius, a priest, who had turned Protestant, adopting Jakob, sent him to school at Utrecht, but died when his charge was in his fifteenth year. Rudolf Snellius (Snel van Roijen, 1546–1613), the mathematician, a native of Oudewater, then a professor at Marburg, happening at the time to visit his early home, met the boy, saw promise in him and undertook his maintenance and education. But hardly was he settled at Marburg when the news came that the Spaniards had besieged and taken Oudewater, and murdered its inhabitants almost without exception. Arminius hurried home, but only to find all his relatives slain. In February the same year (1575), the university of Leiden had been founded, and thither, by the kindness of friends, Arminius was sent to study theology. The six years he remained at Leiden (1576–1582) were years of active and innovating thought in Holland. The War of Independence had started conflicting tendencies in men's minds. To some it seemed to illustrate the necessity of the state tolerating only one religion, but to others the necessity of the state tolerating all. Dirck Coornhert argued, in private conferences and public disputations, that it was wrong to punish heretics, and his great opponents were, as a rule, the ministers, who maintained that there was no room for more than one religion in a state. Caspar Koolhaes, the heroic minister of Leiden—its first lecturer, too, in divinity—pleaded against a too rigid uniformity, for such an agreement on "fundamentals" as had allowed Reformed, Lutherans and Anabaptists to unite. Leiden had been happy, too, in its first professors. There taught in theology Guillaume Feuguières or Feuguereius (d. 1613), a mild divine, who had written a treatise on persuasion in religion, urging that as to it "men could be led, not driven"; Lambert Danaeus, who deserves remembrance as the first to discuss Christian ethics scientifically, apart from dogmatics; Johannes Drusius, the Orientalist, one of the most enlightened and advanced scholars of his day, settled later at Franeker; Johann Kolmann the younger, best known by his saying that high Calvinism made God "both a tyrant and an executioner." Snellius, Arminius's old patron, now removed to Leiden, expounded the Ramist philosophy, and did his best to start his students on the search after truth, unimpeded by the authority of Aristotle. Under these men and influences, Arminius studied with signal success; and the promise he gave induced the merchants' gild of Amsterdam to bear the further expenses of his education. In 1582 he went to Geneva, studied there awhile under Theodore Beza, but had soon, owing to his active advocacy of the Ramist philosophy, to remove to Basel. After a short but brilliant career there he turned to Geneva, studied for three years, travelled, in 1586, in Italy, heard Giacomo Zarabella (1533–1589) lecture on philosophy in Padua, visited Rome, and, open-minded enough to see its good as well as its evil, was suspected by the stern Dutch Calvinists of "popish" leanings. Next year he was called to Amsterdam, and there, in 1588, was ordained. He soon acquired the reputation of being a good preacher and faithful pastor. He was commissioned to organize the educational system of the city, and is said to have done it well. He greatly distinguished himself by fidelity to duty during a plague that devastated Amsterdam in 1602. In 1603 he was called, in succession to Franz Junius, to a theological professorship at Leiden, which he held till his death on the 19th of October 1609.

Arminius is best known as the founder of the anti-Calvinistic school in Reformed theology, which created the Remonstrant Church in Holland (see REMONSTRANTS), and contributed to form the Arminian tendency or party in England. He was a man of mild and liberal spirit, broadened by varied culture, constitutionally averse from narrow views and enforced uniformity. He lived in a period of severe systematizing. The Reformed strengthened itself against the Roman Catholic theology by working itself, on the one hand, into vigorous logical consistency, and supporting itself, on the other, on the supreme authority of the Scriptures. Calvin's first principle, the absolute sovereignty of God, had been so applied as to make the divine decree determine alike the acts and the destinies of men; and his formal principle had been so construed as to invest his system with the authority of the source whence it professed to have been drawn. Calvinism had become, towards the close of the 16th century, supreme in Holland, but the very rigour of the uniformity it exacted provoked a reaction. Coornhert could not plead for the toleration of heretics without assailing the dominant Calvinism, and so he opposed a conditional to its unconditional predestination. The two ministers of Delft, who had debated the point with him, had, the better to turn his arguments, descended from the supralapsarian to the infralapsarian position, *i.e.* made the divine decree, instead of precede and determine, succeed the Fall. This seemed to the high Calvinists of Holland a grave heresy. Arminius, fresh from Geneva, familiar with the dialectics of Beza, appeared to many the man able to speak the needed word, and so, in 1589, he was simultaneously invited by the ecclesiastical court of Amsterdam to refute Coornhert, and by Martin Lydius, professor at Franeker, to combat the two infralapsarian ministers of Delft. Thus led to confront the questions of necessity and free will, his own views became unsettled, and the further he pursued his inquiries the more he was inclined to assert the freedom of man and limit the range of the unconditional decrees of God. This change became gradually more apparent in his preaching and in his conferences with his clerical associates, and occasioned much controversy in the ecclesiastical courts where, however, he successfully defended his position. The controversy was embittered and the differences sharpened by his appointment to the professorship at Leiden. He had as colleague Franz Gomarus, a strong supralapsarian, perfervid, irrepressible; and their collisions, personal, official, political, tended to develop and define their respective positions.

Arminius died, worn out by uncongenial controversy and ecclesiastical persecution, before his system had been elaborated into the logical consistency it attained in the hands of his celebrated successor, Simon Episcopius; but though inchoate in detail, it was in its principles clear and coherent enough. These may be thus stated:

1. The decree of God is, when it concerns His own actions, absolute, but when it concerns man's, conditional, *i.e.* the decree relative to the Saviour to be appointed and the salvation to be provided is absolute, but the decree relative to the persons saved or condemned is made to depend on the acts—belief and repentance in the one case, unbelief and impenitence in the other—of the persons themselves.
2. The providence or government of God, while sovereign, is exercised in harmony with the nature of the creatures governed, *i.e.* the sovereignty of God is so exercised as to be compatible with the freedom of man.
3. Man is by original nature, through the assistance of divine grace, free, able to will and perform the right; but is in his fallen state, of and by himself, unable to do so; he needs to be regenerated in all his powers before he can do what is good and pleasing to God.
4. Divine grace originates, maintains and perfects all the good in man, so much so that he cannot, though regenerate, conceive, will or do any good thing without it.
5. The saints possess, by the grace of the Holy Spirit, sufficient strength to persevere to the end in spite of sin and the flesh, but may so decline from sound doctrine as to cause divine grace to be ineffectual.
6. Every believer may be assured of his own salvation.
7. It is possible for a regenerate man to live without sin.

Arminius's works are mostly occasional treatises drawn from him by controversial emergencies, but they everywhere exhibit a calm, well-furnished, undogmatic and progressive mind. He was essentially an amiable man, who hated the zeal for an impossible orthodoxy that constrained "the church to institute a search after crimes which have not betrayed an existence, yea, and to drag into open contentions those who are meditating no evil." His friend Peter Bertius, who pronounced his funeral oration, closed it with these words: "There lived a man whom it was not possible for those who knew him sufficiently to esteem; those who entertained no esteem for him are such as never knew him well enough to appreciate his merits."

The works of Arminius (in Latin) were published in a single quarto volume at Leiden in 1629, at Frankfort in 1631 and 1635. Two volumes of an English translation, with copious notes, by James Nichols, were published at London, 1825–1828; three volumes (complete) at Buffalo, 1853. A life was written by Caspar Brandt, son of Gerard Brandt, the historian of the Dutch reformation, and published in 1724; republished and annotated by J. L. Mosheim in 1725; and translated into English by the Rev. John Guthrie, 1854. James Nichols also wrote a life (London, 1843).

ARMISTICE (from Lat. *arma*, arms, and *sistere*, to stop), a suspension of hostilities by mutual agreement between two nations at war, or their respective forces. An armistice may be either general or particular; in the first case there is a complete cessation of hostile operations in every part of the dominions of the belligerent powers; in the second there is merely a temporary truce between two contending armies, or between a besieged fortress and the force besieging it. Such a temporary truce, when for a very limited period and for a special purpose, *e.g.* the collection of the wounded and the burial of the dead, is termed a *suspension of arms.* A general armistice cannot be concluded by the commanders-in-chief unless special authority has been previously delegated to them by their respective governments; otherwise any arrangement entered into by them requires subsequent ratification by the supreme powers of the states. A partial truce may be concluded by the officers of the respective powers, without any special authority from their governments, wherever, from the nature and extent of the commands they exercise, their duties could not be efficiently discharged without their possession of such a power. The conduct of belligerent parties during an armistice is usually regulated in modern warfare by express agreement between the parties, but where this is not the case the following general conditions may be laid down. (1) Each party may do, within the limits prescribed by the truce, whatever he could have done in time of peace. For example, he can raise troops, collect stores, receive reinforcements and fortify places that are not actually in a state of siege. (2) Neither party can take advantage of the armistice to do what he could not have done had military operations continued. Thus he cannot throw provisions or reinforcements into a besieged town, and neither besiegers nor besieged are at liberty to repair their fortifications or erect new works. (3) All things contained in places the possession of which was contested, must remain in the state in which they were before the armistice began. Any infringement by either party of the conditions of the truce entitles the other to recommence hostile operations without previous intimation.

ARMOIRE, the French name (cf. ALMERY) given to a tall movable cupboard, or "wardrobe," with one or more doors. It has varied considerably in shape and size, and the decoration of its doors and sides has faithfully represented mutations of fashion and modifications of use. It was originally exceedingly massive and found its chief decoration in elaborate hinges and locks of beaten iron. The finer ecclesiastical armoires or aumbries which have come down to us—used in churches for the safe custody of vestments, eucharistic vessels, reliquaries and other precious objects—are usually painted, sometimes even upon the interior, with sacred subjects or with incidents from the lives of the saints. The cathedrals of Bayeux and Noyon contain famous examples; the most typical English one is in York minster. By the end of the 14th century, when the carpenter and the wood-carver had acquired a better mastery of their material, the taste for painted surfaces appears to have given place to the vogue of carving, and the simple rectangular panels gradually became sculptured with a simple motive, such as the linen-fold or parchment patterns. In the treasury of St Germain l'Auxerrois the ends of the 15th-century armoires are treated in this way. In that and the two following centuries the keys and the escutcheons of the locks became highly ornamental; usually in forged iron, they were occasionally made of more precious metals. By slow degrees the shape of this receptacle changed—from breadth was evolved height, and the tall form of armoire became characteristic. The Renaissance exercised a notable effect upon this, as upon so many other varieties of furniture. It became less obviously and aggressively a thing of utility; its proportions shrank from the massive to the elegant; its artistic effectiveness was vastly enhanced by its division into an upper and a lower part. Enriched with columns and pilasters, its panels carved with mythology, its canopied niches filled with sculptured statuettes, and terminating with a rich cornice and perhaps a broken pediment, it was widely removed in appearance, if not in purpose, from the uncompromising iron-mounted receptacle of earlier generations. During the 16th century, when the surging impulses of the Renaissance had died away, the armoire relapsed into plainness, its proportions increased, and it was again constructed in one piece. Ere long, however, it grew more sumptuous than ever. Boulle encrusted it with marqueterie from designs by Bérain; it glowed with *amorini*, with the torches and arrows of Cupid, with the garlands which he weaves for his captives, and when allusiveness left a corner vacant, it was filled with arabesques in ebony or ivory, in brass or white metal. While the royal palaces and the hôtels of the great nobility were filled with those costly splendours, the ordinary cabinetmaker continued to construct his modest pieces, and by the middle of the 18th century the armoire was found in every French house, ample in width and high in proportion to the lofty rooms of the period. It is not to be supposed that so useful a piece of furniture was confined to France. It was used, more or less, throughout a considerable part of Europe, but it was distinctively Gallic nevertheless, and never became thoroughly acclimatized elsewhere until about the beginning of the 19th century, when it developed into the glass-fronted wardrobe which is now an essential detail in the plenishing of the bed-chamber, not merely in France and England, but in many other countries. The *armoire à glace* was known and occasionally made in France as far back as the middle of the 18th century, and almost the earliest mention of it connects it with the scandalous relations of the Maréchal de Richelieu and the beautiful *fermière générale*, Mme de la Popelinière, who had one made to mask a secret door. In the conventional and not very attractive wardrobe of commerce it is difficult to descry the gracious characteristics of the armoire of the Renaissance or the 17th century, and it is not altogether surprising that Théodore de Banville should have condemned one of the most solidly useful of household necessaries as a "hideous monster."

ARMORICA (AREMORICA), the Roman name, derived from two Celtic words meaning the "seaside" (*ar*, on, and *mor*, sea), for the land of the Armorici, roughly the peninsula of Brittany. At the time of the Roman advance on Gaul there were five principal tribes in Armorica, the Namneti, the Veneti, the Osismii, the Curiosolitae and the Redones. It was subdued by Caesar, who entirely destroyed the seafaring tribe of its south coast, the Veneti. Under the Empire it formed part of the province of Gallia Lugudunensis (Lugdunensis). It contained hardly any towns, though many large country houses, and was perhaps less Romanized than the rest of Gaul. In and after the later part of the 5th century it received many Celtic immigrants from the British Isles, fleeing (it is said) from the Saxons; and the Celtic dialect which the Bretons still speak is thought to owe its origin to these immigrants. (See further BRITTANY.)

ARMOUR, PHILIP DANFORTH (1832–1901), American merchant and philanthropist, was born in Stockbridge, New York, on the 16th of May 1832. He was educated at Cazenovia Academy, Cazenovia, N.Y., worked for several years on his father's farm, and in 1852 with a small party went overland to California, a large part of the journey being made on foot. Here during the next four years he laid the foundations of his fortune. In 1856 he became associated with his friend, Frederick S. Miles, in a wholesale grocery and commission business at Milwaukee. In 1863 he became the head of the firm of Armour, Plankington & Co., pork packers, whose headquarters were at Milwaukee. He also obtained a large interest in the firm H. O. Armour & Co., which was founded by his brother, Herman Ossian Armour (1837–1901), and which, starting as a grain commission business, in 1868 established also a large pork-packing plant. Of this firm, the name of which was changed to Armour & Co. in 1870, he became the head in 1875, and thereafter the business made such rapid progress that in 1901 as many as 11,000 hands were employed. Besides contributing to many charitable enterprises, Armour founded the Armour Institute of Technology at Chicago in 1892 and the Armour Flats in Chicago, built for the purpose of supplying at a low rental good homes for working men and their families. He also contributed liberally to the Armour Mission in Chicago, which was founded in 1881 by his brother, Joseph Armour. At the time of his death, on the 6th of January 1901, Philip D. Armour's private fortune was supposed to exceed $50,000,000.

Defence for ships.

History.

ARMOUR PLATES. The earliest recorded proposal to employ armour for ships of war (for body armour, &c., see ARMS AND ARMOUR) appears to have been made in England by Sir William Congreve in 1805. In *The Times* of the 20th of February of that year reference is made to Congreve's designs for an armoured floating mortar battery which the inventor considered would be proof against artillery fire. Among Congreve's unpublished papers there is also a suggestion for armour-plating the embrasures of casemates. Nothing, however, seems to have come of these proposals, and a similar lack of appreciation befell the next advocate of armour, John Stevens of New Jersey, U.S.A., who submitted the plans of an armoured vessel to Congress in 1812. The Stevens family, however, continued to work at the subject, and by 1841 had determined by actual experiment the thickness of wrought-iron armour which was proof against the projectiles then in use. The necessity for armouring ships as a protection against shell fire was again pointed out by General Paixhans in 1841, and in 1845 Dupuy de Lôme had prepared the designs of an armoured frigate for the French government. During the period between 1827 and 1854, experiments in connexion with the proposed application of armour to both ships and forts were carried out in England, the United States and France, but the question did not get beyond the experimental stage until the latter year, when armoured floating batteries were laid down in all three countries, probably as the immediate outcome of the destruction of the Turkish fleet by shell fire at Sinope on the 30th of November 1853.

Three of the French floating batteries were in action at the bombardment of Kinburn in 1855, where they achieved a conspicuous success, silencing the Russian forts after a four hours' engagement, during which they themselves, although frequently struck, were practically uninjured, their loss in personnel being but trifling. To quote Very: "This comparatively insignificant action, which had little if any effect upon the course of the Crimean War, changed the whole condition of armour for naval use from one of speculation to one of actual and constant necessity." The military application of armour for the protection of guns mounted in permanent fortifications followed. Its development, however, took rather a different course, and the question of armour generally is of less importance for the military engineer than for the naval constructor. For the employment of armour in ship construction and in permanent works on land, see the articles SHIPBUILDING; FORTIFICATION AND SIEGECRAFT; the present article is concerned solely with the actual armour itself.

Construction and testing.

The earliest armour, both for ships and forts, was made of wrought iron, and was disposed either in a single thickness or in successive layers sandwiched with wood or concrete. Such armour is now wholly obsolete, though examples of it may still be found in a few forts of early date. The chief application of armour in modern land defences is in the form of shields for the protection of guns mounted *en barbette*. Examples of such shields are shown in figs. 1 and 2. Fig. 1 shows a 4·5-in. steel shield for the U.S.A. government, face-hardened by the Harvey process, to which reference is made below. It was attacked by 5-in. and 6-in. armour-piercing shot, and proved capable of keeping out the 5-in. up to a striking velocity of nearly 1800 ft. per second, but was defeated by a 6-in. capped A.P. shot with a striking velocity of 1842 ft. per second. The mounting was not seriously damaged by the firing, but could be operated after the impact of one 3·2-in., five 5-in. and three 6-in. projectiles. Fig. 2 shows a gun-shield, manufactured by Messrs Hadfield of Sheffield, after attack by 4·1-in., 4·7-in. and 6-in. armour-piercing and other projectiles. The limit of the shield's resistance was just reached by an uncapped 4·7-in. A.P. shell with a striking velocity of 2128 ft. per second. The shield (the average maximum thickness of which was 5·8 in.) showed great toughness, and although subjected to a severe battering, and occasionally outmatched by the attacking projectiles, developed no visible crack. It is chiefly remarkable for the fact that it was cast and not forged. As is evident from the fringing around the hole made by the 6-in. A.P. shell, the shield was not face-hardened. A more highly developed form of the gun-shield is to be found in the armoured cupola, which has been employed to a very considerable extent in permanent fortifications, and whose use is still strongly advocated by continental European military engineers. The majority of the cupolas to be found in continental forts are not, however, of very recent date, those erected in 1894 at Molsheim near Strassburg being comparatively modern instances. Any cupolas constructed nowadays would be of steel, either forged or cast, and would probably be face-hardened, but a large number of those extant are of compound or even of iron armour. Many of those on sea-fronts are made of chilled cast iron. Such armour, which was introduced by Gruson of Magdeburg in 1868, is extremely hard, and cannot be perforated, but must be destroyed by fracture. It is thus the antithesis of wrought iron, which, when of good quality, does not break up under the impact of the shot but yields by perforation. Armour of the Gruson type is well adapted for curved surfaces such as cupolas, which on account of their shape are scarcely liable to receive a direct hit, except at distant ranges, and its extreme hardness would greatly assist it to throw off shot striking obliquely, which have naturally a tendency to glance. Chilled iron, on account of its liability to break up when subjected to a continuous bombardment by the armour-piercing steel projectiles of guns of even medium calibre, was usually considered unsuitable for employment in inland forts, where wrought iron, mild steel or compound armour was preferred. On the other hand, as pointed out by the late Captain C. Orde Browne, R.A., it was admirably adapted to resist the few rounds that the heavy guns of battleships might be expected to deliver during an attack of comparatively limited duration.

Chilled iron was never employed for naval purposes, and warship armour continued to be made exclusively of wrought iron until 1876 when steel was introduced by Schneider. In an important trial at Spezzia in that year the superiority in resisting power of steel to wrought iron was conclusively proved, but, on the other hand, steel showed a great tendency to through-cracking, a defect which led Messrs Cammell of Sheffield in 1877 to introduce compound armour consisting of a steel surface in intimate union with a wrought-iron foundation plate. In Cammell plates, which were made by the Wilson process, the steel face was formed by running molten steel on to a white-hot foundation plate of iron, while in the compound plates, made by Messrs John Brown & Co. according to the patent of J. D. Ellis, a thin steel surface plate was cemented on to the wrought-iron foundation by running in molten steel between. Compound armour possessed the advantages of a harder face than was then possible in a homogeneous steel plate, while, on the other hand, the back was softer and less liable to crack. Its weak point was the liability of the surface plate to crack through under fire and become detached from its iron backing. The manufacture of steel, however, continued to improve, so that in 1890 we find steel plates being made which were comparatively free from liability to through-cracking, while their power to resist perforation was somewhat greater than that of the best compound. The difference, however, was at no time very marked, and between 1880 and 1890 the resistance to perforation of either steel or compound as compared with wrought iron may be taken as about 1·3 to 1.

Compound armour required to be well backed to bring out its best qualities, and there is a case on record in 1883 when a 12-in. Cammell plate weighing 10½ tons, backed by granite, stopped a 16-in. Palliser shot with a striking energy of nearly 30,000 foot tons and a calculated perforation of 25 inches of wrought iron. As steel improved, efforts were made to impart an even greater hardness to the actual surface or skin of compound armour, and, with this object in view, Captain T. J. Tresidder, C.M.G., patented in 1887 a method of chilling the heated surface of a plate by means of jets of water under pressure. By this method it was found possible to obtain a degree of hardness which was prevented in ordinary plunging by the formation of a layer of steam between the water and the heated surface of the plate. Compound plates face-hardened on this system gave excellent results, and forged-steel armour-piercing projectiles were in some cases broken up on their surfaces as if they had been merely chilled iron. Attempts were also made to increase the toughness of the back by the substitution of mild nickel steel for wrought iron. The inherent defect of compound armour, however—its want of homogeneity,—remained, and in the year 1891 H. A. Harvey of Newark, N.J., introduced a process whereby an all steel plate could be face-hardened in such a way that the advantages of the compound principle were obtained in a homogeneous plate. The process in question consisted in carburizing or cementing the surface of a steel plate by keeping it for a fortnight or so at a high temperature in contact with finely divided charcoal, so that the heated surface absorbed a certain amount of carbon, which penetrated to a considerable depth, thus causing a difference in chemical composition between the front and back of the plate. After it had been left a sufficient time in the cementation furnace, the plate was withdrawn and allowed to cool slowly until it reached a dull red heat, when it was suddenly chilled by the application of water, but by a less perfect method than that employed by Tresidder. Steel plates treated by the Harvey and Tresidder processes, which shortly became combined, possessed about twice the resisting power of wrought iron. The figure of merit, or resistance to penetration as compared with wrought iron, varied with the thickness of the plate, being rather more than 2 with plates from 6 to 8 in. thick and rather less for the thicker plates. In 1889 Schneider introduced the use of nickel in steel for armour plates, and in 1891 or 1892 the St Chamond works employed a nickel steel to which was added a small percentage of chromium.

All modern armour contains nickel in percentages varying from 3 to 5, and from 1·0 to 2·0% of chromium is also employed as a general rule. Nickel in the above quantities adds greatly to the toughness as well as to the hardness of steel, while chromium enables it to absorb carbon to a greater depth during cementation, and increases its susceptibility to tempering, besides conducing to a tough fibrous condition in the body of a plate. Alloy steels of this nature appear to be very susceptible to thermal treatment, by suitable variation of which, with or without oil quenching, the physical condition of the same steel may be made to vary to an extraordinary extent, a peculiarity which is turned to good account in the manufacture of the modern armour plate.

The principal modern process is that introduced by Krupp in 1893. Although it is stated that a few firms both in Great Britain and in other countries use special processes of their own, it is probable that they differ only in detail from the Krupp process, which has been adopted by the great majority of makers. Krupp plates are made of nickel-chrome steel and undergo a special heat treatment during manufacture which is briefly described below. They can either be cemented or, as was usual in England until about 1902 in the case of the thinner plates (4 in. and under) and those used for curved structures such as casemates, non-cemented. They are in either case face-hardened by chilling. Messrs Krupp have, however, cemented plates of 3 in. and upward since 1895. Although the full process is now applied to plates of as little as 2 in. in thickness, there is some difference of opinion between manufacturers as to the value of cementing these very thin plates. The simple Harvey process is still employed to some extent in the case of plates between 5 and 3 in. in thickness, and excellent results are also stated to have been obtained with plates from 2 to 4 in. in thickness, manufactured from a special steel by the process patented by M. Charpy of the St Jacques steel works at Montluçon. A Krupp cemented (K.C.) plate is not perhaps harder as regards surface than a good Harveyed plate, but the depth of hard face is greater, and the plate is very much tougher in the back, a quality which is of particular importance in the thicker plates. The figure of merit varies, as in Harveyed plates, with the thickness of the armour, being about 2·7 in the case of good 6-in. plates while for the thicker plates the value gradually falls off to about 2·3 in the case of 12-in. armour. This figure of merit is as against uncapped armour-piercing shot of approximately the same calibre as the thickness of the plate. The resisting power of the non-cemented Krupp plates is usually regarded as being considerably less than that of the cemented plates, and may be taken on an average to be 2·25 times that of wrought iron.

Figs. 3, 4 and 5 are illustrations of good cemented plates of the Krupp type. Fig. 3 shows an 11·8-in. plate, tried by Messrs Krupp in 1895, after attack by three 12-in. steel armour-piercing projectiles of from 712·7 to 716·1 ℔ in weight. In the third round the striking velocity of the projectile was 1993 ft. per second, the calculated perforation of wrought iron by Tresidder's formula being 25·9 in. The attack was successfully resisted, all the projectiles being broken up without effecting perforation, while there were no serious cracks. The figure of merit of the plate was thus well in excess of 2·2. The great toughness of the plate is perhaps even more remarkable than its hardness; its width was only 6·28 ft., so that each shot head formed a wedge of approximately one-sixth of its width. The excellence of the metal which is capable of withstanding such a strain is apparent.

Fig. 4 is of a 9-in. K.C. plate, made by Messrs Armstrong, Whitworth & Co. for the Japanese government, after undergoing an unusually severe official test. The fourth round was capable of perforating 22 in. of wrought iron, so that the figure of merit of the plate must have been considerably in excess of 2·45, as there were no through-cracks, and the limit of resistance was far from being reached.

Fig. 5 shows the front of an excellent 6-in. cemented plate of Messrs Beardmore's manufacture, tried at Eskmeals on the 11th of October 1901. It withstood the attack of four armour-piercing 6-in. shot of 100 ℔ weight, with striking velocities varying from 1996 to 2177 ft. per second. Its limit of resistance was just passed by the fifth round in which the striking velocity was no less than 2261 ft. per second. The projectile, which broke up in passing through the plate, did not get through the skin plate behind the wood backing, and evidently had no surplus energy left. The figure of merit of this plate was between 2·6 and 2·8, but was evidently much closer to the latter than to the former figure. A sixth round fired with a Johnson capped shot weighing 105·9 ℔ easily perforated both plate and backing with a striking velocity of 1945 ft. per second, thus reducing the figure of merit of the plate to below 2·2 and illustrating very clearly the advantage given by capping the point of an armour-piercing projectile. There were no through-cracks in the plate after this severe trial, the back being evidently as tough as the face was hard.

Fig. 6 shows a 3-in. K.N.C. plate of Messrs Vickers, Sons & Maxim's manufacture, tested privately by the firm in November 1905. It proved to be of unusual excellence, its limit of resistance being just reached by a 12½-℔ armour-piercing shell of 3 in. calibre with a striking velocity of 2558 ft. per second, a result which, even if the projectiles used were not relatively of the same perforating power as those used in the proof of 6-in. and thicker plates, shows that its resisting power was very great. At a low estimate its figure of merit against 3-in. A.P. *shot* may be taken as about 2·6, which is exceptionally high for a non-cemented, or indeed for any but the best K.C. plates.

The plate also withstood the attack of a 4·7-in. service pattern steel armour-piercing shell of 45 ℔ weight striking the unbacked portion with a velocity of 1599 ft. per second, and was only just beaten by a similar shell with a velocity of 1630 ft. per second. The effect of all the above-mentioned rounds is shown in the photograph. The same plate subsequently kept out two 6-in. common shell filled up to weight with salt and plugged, with striking velocities of 1412 and 1739 ft. per second respectively, the former being against the unbacked and the latter against the backed half of the plate,—the only effect on the plate being that round 6 caused a fragment of the right-hand top corner of the plate to break off, and round 7 started a few surface cracks between the points of impact of rounds 1, 2 and 3.

Within the limitations referred to below, the resisting power of all hard-faced plates is very much reduced when the armour-piercing projectiles used in the attack are capped, the average figure of merit of Krupp cemented plates not being more than 2, against capped shot as compared with about 2·5 against uncapped. So long ago as 1878 it was suggested by Lt.-Col. (then Captain) T. English, R.E., that armour-piercing projectiles would be assisted in attacking compound plates if caps of wrought iron could be fitted to their points. Experiments at Shoeburyness, however, did not show that any advantage was gained by this device, and nothing further was heard of the cap until 1894, when experiments carried out in Russia with so-called "magnetic" shot against plates of Harveyed steel showed that the perforating power of an armour-piercing projectile was considerably augmented where hard-faced plates were concerned, if its point were protected by a cap of wrought iron or mild steel. The conditions of the Russian results (and of subsequent trials in various parts of the world which have confirmed them) differed considerably from the earlier English ones. The material of both projectiles and plates differed, as did also the velocities employed—the low velocities in the earlier trials probably contributing in large measure to the non-success of the cap. The cap, as now used, consists of a thimble of comparatively soft steel of from 3 to 5 % of the weight of the projectile, attached to the point of the latter either by solder or by being pressed hydraulically or otherwise into grooves or indentations in the head. Its function appears to be to support the point on impact, and so to enable it to get unbroken through the hard face layers of the plate. Once through the cemented portion with its point intact, a projectile which is strong enough to remain undeformed, will usually perforate the plate by a true boring action if its striking velocity be high enough. In the case of the uncapped projectile, on the other hand, the point is almost invariably crushed against the hard face and driven back as a wedge into the body of the projectile, which is thus set up so that, instead of boring, it acts as a punch and dislodges or tends to dislodge a coned plug or disk of metal, the greatest diameter of which may be as much as four times the calibre of the projectile. The disproportion between the maximum diameter of the disk and that of the projectile is particularly marked when the calibre of the latter is much in excess of the thickness of the plate. When plate and projectile are equally matched, *e.g.* 6″ versus 6″, the plug of metal dislodged may be roughly cylindrical in shape, and its diameter not greatly in excess of that of the projectile. In all cases the greatest width of the plug or disk is at the back of the plate.

A stout and rigid backing evidently assists a plate very much more against this class of attack than against the perforating attack of a capped shot. Fig. 7 shows the back of a 6-in. plate attacked in 1898, and affords an excellent illustration of the difference in action of capped and uncapped projectiles. In round 7 the star-shaped opening made by the point of a capped shot boring its way through is seen, while rounds 2, 3, 4 and 5 show disks of plate partially dislodged by uncapped projectiles. The perforating action of capped armour-piercing projectiles is even better shown in fig. 8, which shows a 250-mm. (9·8 in.) Krupp plate after attack by 150-mm. (5·9 in.) capped A.P. shot. In rounds 5 and 6 the projectiles, with striking velocities of 2302 and 2281 ft. per second, perforated. Round 7, with a striking velocity of 2244 ft. per second, just got its point through and rebounded, while round 8, with a striking velocity of 2232, lodged in the plate. In many cases a capped projectile punches out a plug, usually more or less cylindrical in shape and of about the same diameter as the projectile, from a plate, and does not defeat it by a true boring action. In such cases it will probably be found that the projectile has been broken up, and that only the head, set up and in a more or less crushed condition, has got through the plate. This peculiarity of action can best be accounted for by attributing either abnormal excellence to the plate or to that portion of it concerned—for plates sometimes vary considerably and are not of uniform hardness throughout,—or comparative inferiority to the projectile. Whichever way it may be, what has happened appears to be that after the cap has given the point sufficient support to get it through the very hard

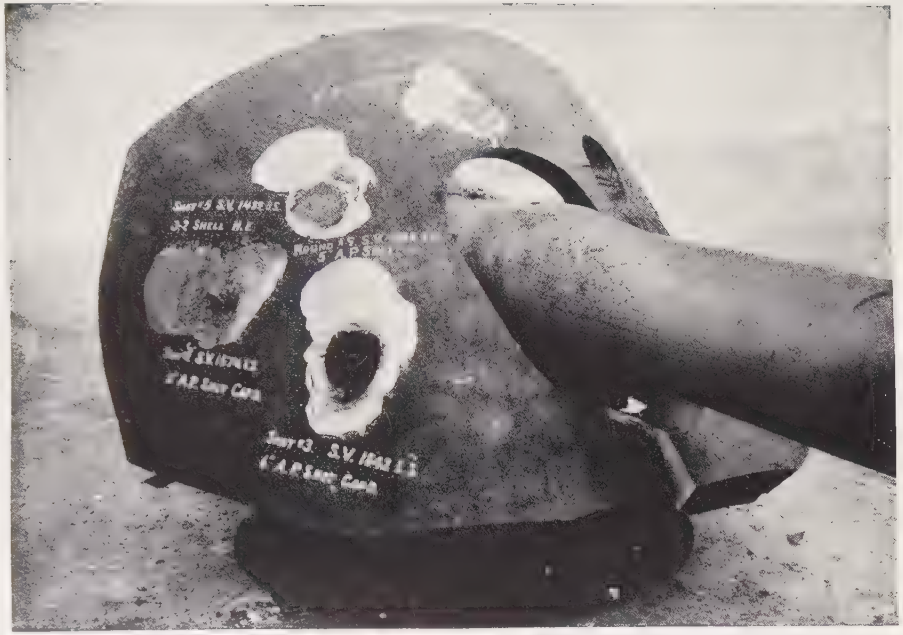


FIG. 1.—HARVEYIZED SHIELD, 4·5 INCHES THICK, ON 6-INCH PEDESTAL MOUNT, AFTER ATTACK BY 5-INCH AND 6-INCH CAPPED ARMOUR-PIERCING SHOT.

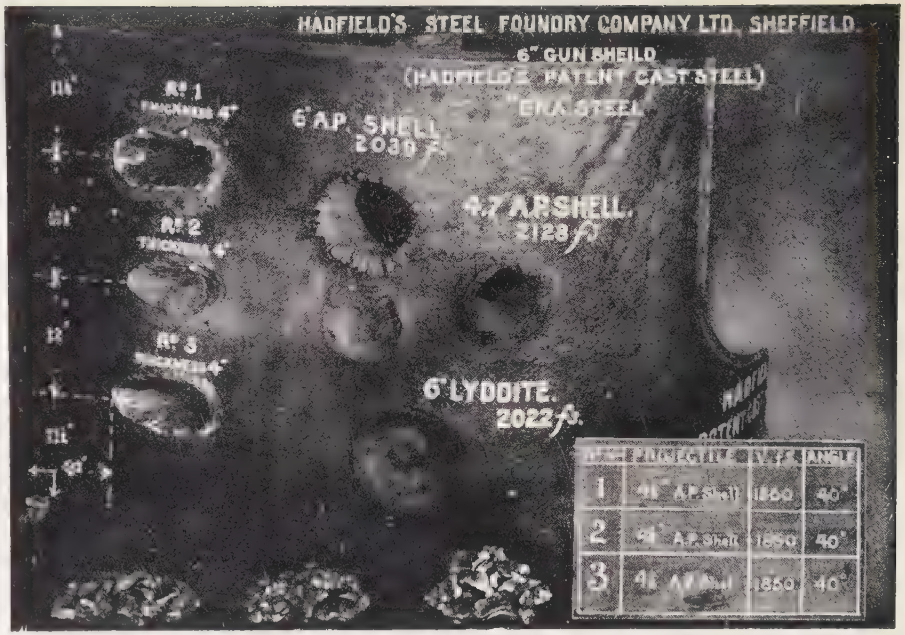

HADFIELD'S STEEL FOUNDRY COMPANY LTD. SHEFFIELD.
6" GUN SHEILD
(HADFIELD'S PATENT CAST STEEL)
"ERA STEEL"
No. 1
No. 2
No. 3
6" A.P. SHELL. 2030 f/s
4.7 A.P. SHELL. 2128 f/s
6" LYDDITE. 2022 f/s.
PROJECTILE
V. f.s.
ANGLE
1
2
3
A.P. Shell
1850
40°

FIG. 2.—GUN SHIELD, 6 INCHES THICK, AFTER ATTACK. (HADFIELD.)

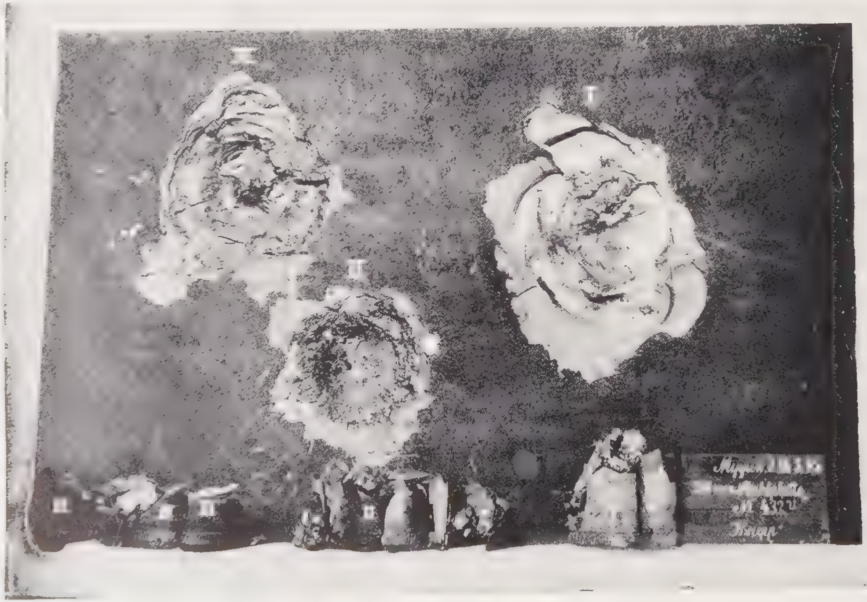


FIG. 3.—KRUPP-CEMENTED PLATE, 11·8 INCHES THICK, AFTER ATTACK. (KRUPP, MEPPEN.)

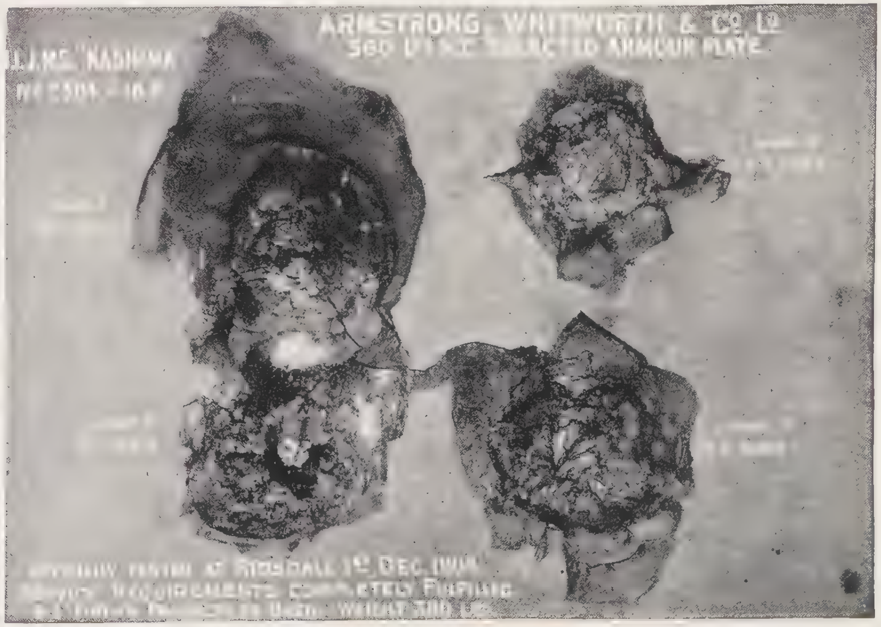

ARMSTRONG, WHITWORTH & Co. Ld
H.J.M.S. "KASHIMA"

FIG. 4.—KRUPP-CEMENTED PLATE, 9 INCHES THICK, AFTER ATTACK. (ARMSTRONG, WHITWORTH & CO.)

ARMOUR PLATES

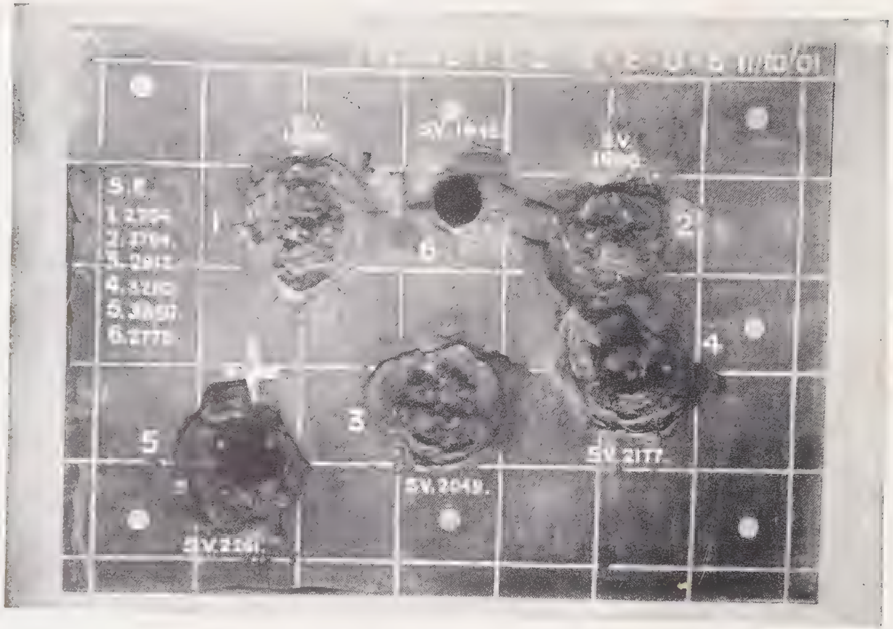

S.F.
1
2
3
4
5
6
SV.2177
SV.2049.

FIG. 5.—BEARDMORE CEMENTED PLATE, 6 INCHES THICK, AFTER ATTACK BY 6-INCH SHOT.
(From Brassey's Naval Annual, 1902, by permission.)

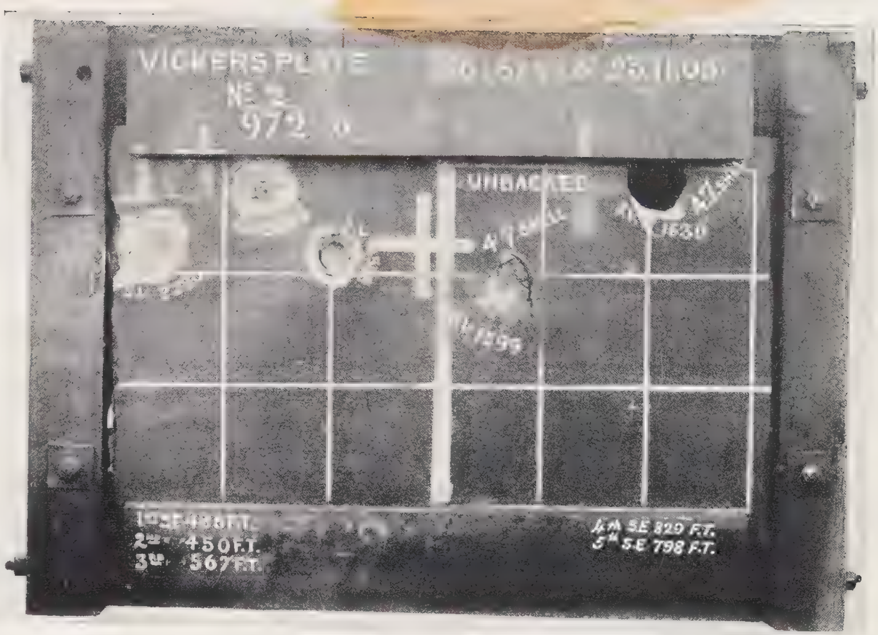

VICKERS PLATE
No. 2
972
UNBACKED
2nd 450 F.T.
3rd 567 F.T.
4th S.E. 829 F.T.
5th S.E. 798 F.T.

FIG. 6.—KRUPP-CEMENTED PLATE, 3 INCHES THICK, AFTER ATTACK. (VICKERS, SONS & MAXIM.)

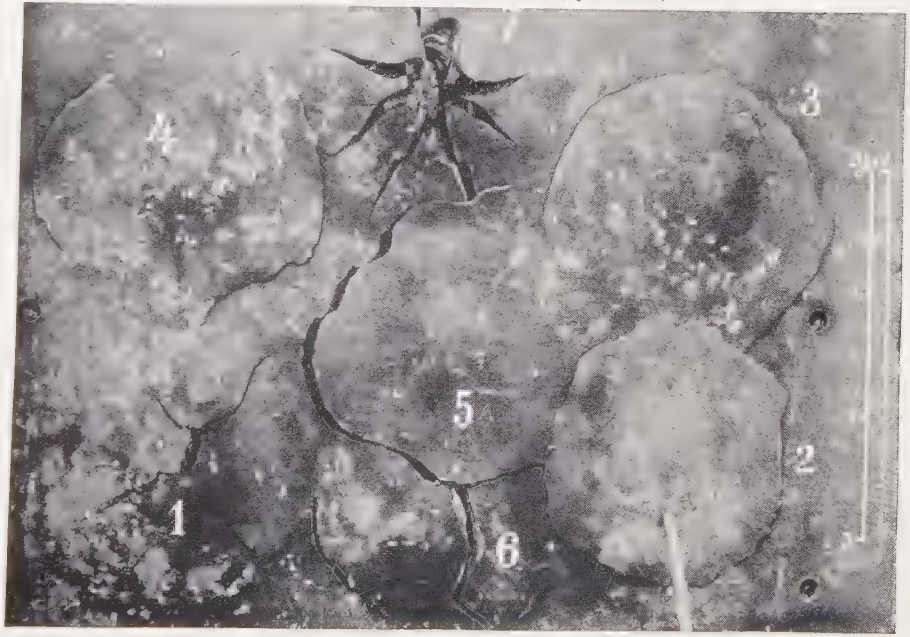


FIG. 7.—BACK OF A 6-INCH PLATE SHOWING ACTION OF CAPPED AND UNCAPPED PROJECTILES.

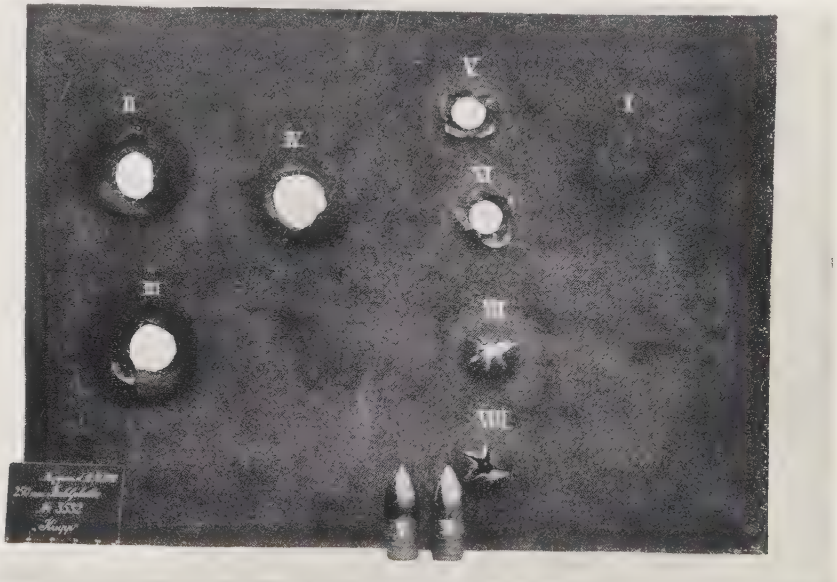

II
IV
V
I
VI
III
VII
VIII
Krupp

FIG. 8.—BACK OF KRUPP PLATE 9·8 INCHES THICK, AFTER ATTACK, WITH CAPPED PROJECTILE. (KRUPP, MEPPEN.)
(From Brassey's Naval Annual, by permission.)

surface layers, the point has been flattened in the region of extreme hardness and toughness combined, which exists immediately behind the deeply carburized surface. The action from this point becomes a punching one, and the extra strain tends to break up the projectile, so that the latter gets through wholly or partially, in a broken condition, driving a plug of plate in front of it. At low striking velocities, probably in the neighbourhood of 1700 ft. per second, the cap fails to act, and no advantage is given by it to the shot. This is probably because the velocity is sufficiently low to give the cap time to expand and so fail to grip the point as the latter is forced into it. The cap also fails as a rule to benefit the projectile when the angle of incidence is more than 30° to the normal.

Laws of resistance.

The laws governing the resistance of armour to perforation have been the subject of investigation for many years, and a considerable number of formulae have been put forward by means of which the thickness of armour perforable by any given projectile at any given striking velocity may be calculated. Although in some cases based on very different theoretical considerations, there is a general agreement among them as far as perforation proper is concerned, and Tresidder's formula for the perforation of wrought iron, $t^2 = wv^3/d\text{A}$, may be taken as typical. Here t represents the thickness perforable in inches, w the weight of the projectile in pounds, v its velocity in foot seconds, d its diameter in inches and A the constant given by log A = 8·8410.

For the perforation of Harveyed or Krupp cemented armour by capped armour-piercing shot, this formula may be employed in conjunction with a suitable constant according to the nature of armour attacked. In the case of K. C. armour the formula becomes $t^2 = wv^3/4d\text{A}$. A useful rough rule is $t/d = v/1900$.

Hard armour, such as chilled cast iron, cannot be perforated but must be destroyed by fracture, and its destruction is apparently dependent solely upon the striking energy of the projectile and independent of its diameter. The punching of hard-faced armour by uncapped projectiles is intermediate in character between perforation and cracking, but approaches the former more nearly than the latter. The formula most used in England in this case is Krupp's formula for K.C., viz. $t^2 = wv^2/d\text{A}^1$, where t,w,v and d are the same as before, and log $\text{A}^1 = 6{\cdot}3532$. This, if we assume the sectional density (w/d^3) of projectiles to be constant and equal to 0·46, reduces to the very handy rule of thumb $t/d = v/2200$, which, within the limits of striking velocity obtainable under service conditions, is sufficiently accurate for practical purposes. For oblique attack up to an angle of 30° to the normal, the same formula may be employed, $t \sec\theta$ being substituted for t, where θ is the angle of incidence and t the normal thickness of the plate attacked. More exact results would be obtained, however, by the use of Tresidder's W.I. formula, given above, in conjunction with a suitable figure of merit, according to the nature and thickness of the plate. It should be remembered in this connexion that the figure of merit of a plate against a punching attack falls off very much when the thickness of the plate is considerably less than the calibre of the attacking projectile. For example, the F.M. of a 6-in. plate may be 2·6 against 6-in. uncapped A.P. projectiles, but only 2·2 against 9·2-in. projectiles of the same character. In the case of the perforating action of capped projectiles, on the other hand, the ratio of d and t does not appear to affect the F.M. to any great extent, though according to Tresidder, the latter is inclined to fall when d is considerably less than t, which is the exact opposite of what happens with punching.

Another method of measuring the quality of armour, which is largely employed upon the continent of Europe, is by the ratio, r, between the velocity requisite to perforate any given plate and that needed to pierce a plate of mild steel of the same thickness, according to the formula of Commandant Jacob de Marre, viz. $v = \text{A}e^{0{\cdot}7}a^{0{\cdot}75}/p^{0{\cdot}5}$ where e = the thickness of the plate in centimetres, a = the calibre of the projectile in centimetres, p = the weight of the projectile in kilogrammes, v = the striking velocity of the projectile in metres per second, and log A = 1·7347. Converted into the usual English units and notation, this formula becomes $v = \text{A}^1 t^{0{\cdot}7} d^{0{\cdot}75}/w^{0{\cdot}5}$, in which log $\text{A}^1 = 3{\cdot}0094$; in this form it constitutes the basis of the ballistic tests for the acceptance of armour plates for the U.S. navy.

Common shell, which are not strong enough to remain undeformed on impact, derive little benefit from the cap and usually defeat a plate by punching rather than by perforation. Their punching power may be taken roughly as about ⅔ that of an uncapped armour-piercing shot. Shells filled with high explosives, unless special arrangements are made to deaden the bursting charge and so obviate detonation upon impact, are only effective against the thinnest armour.

Manufacture.

With regard to manufacture, a brief account of the Krupp process as applied in one of the great English armour plate works (omitting confidential details of temperature, &c.) will illustrate the great complexity of treatment which the modern armour plate has to undergo before its remarkable qualities of combined hardness and toughness can be developed. The composition of the steel probably differs slightly with the manufacturer, and also with the thickness of the armour, but it will usually contain from 3 to 4 % of nickel, from 1·0 to 2·0 % of chromium and about 0·25 to 0·35 % of carbon, together with from 0·3 to 0·7 % of manganese. After being cast, the ingot is first heated to a uniform degree of temperature throughout its mass and then generally forged under the hydraulic forging press. It is then reheated and passed through the rolls. After rolling, the plate is allowed to cool, and is then subjected to a thermal treatment preparatory to surfacing and cutting. Its surface is then freed from scale and planed. After planing, the plate is passed into the cementation furnace, where its face remains for some weeks in contact with specially prepared carbon, the temperature being gradually raised to that required for cementation and as gradually lowered after that is effected. After cementation the plate is heated to a certain temperature and is then plunged into an oil bath in order to toughen it. After withdrawal from the oil bath, the plate is cooled, reheated to a lower temperature, quenched again in water, reheated and passed to the bending press, where it is bent to shape while hot, proper allowance being made for the slight change of curve which takes place on the final chilling. After bending it is again heated and then allowed to get cold, when the final machining, drilling and cutting are carried out. The plate is now placed in a furnace and differentially heated so that the face is raised to a higher temperature than the back. After being thus heated for a certain period the plate is withdrawn, and both back and face are douched simultaneously with jets of cold water under pressure, the result being that the face is left glass-hard while the back is in the toughest condition possible for such hard steel.

The cast-steel armour made by Hadfield has already been alluded to. That made by Krupp (the only other maker at present of this class of armour) is of face-hardened nickel steel. A 5·9-in. plate of this material tried in 1902 had a figure of merit of more than 2·2 against uncapped 5·9-in. armour-piercing projectiles of 112 ℔ in weight. The main advantage of cast armour is that it is well adapted to armoured structures of complicated design and of varying thickness, which it would be difficult or impossible to forge in one piece. It should also be cheaper than forged armour, and, should time be a consideration, could probably be turned out more quickly; on the other hand, it is improbable that heavy castings such as would be required could be as regular in quality and as free from flaws as is possible when forged material is used, and it is unlikely that the average resistance to attack of cast-steel armour will ever be equal to that of the best forged steel.

Defence against small-arms.

Of recent years there has been a considerable demand for thin steel plating proof against small-arm bullets at close ranges. This class of steel is used for field-gun shields and for sap shields, to afford cover for men in field-works, for armoured trains, motor-cars and ambulances, and also very largely for armouring shallow-draught river-gunboats. Holtzer made chrome steel breastplates in 1890, 0·158 in. of which was proof against the 0·43-in. hard lead bullet of the Gras rifle at 10 metres range, while 0·236 in. was proof against the 0·32-in. 231-grain Lebel bullet at the same distance, the striking velocities being approximately 1490 and 2070 ft. per second respectively. The bullet-proof steel made by Messrs Cammell, Laird & Co. in Great Britain may be taken as typical of that produced by the best modern manufacturers. It is proof against the 215-grain Lee-Enfield bullet of 0·303 in. calibre striking directly, as under:

Range.	Thickness of Plate.	Striking Velocity.
10 yards	0·187 inch	2050 f.s.
100 „	0·167 „	1865 „
560 „	0·080 „	1080 „

The weight of the 0·08-in. plating is only 3·2 ℔ per sq. ft. The material is stated to be readily adaptable to the ordinary operation of bending, machining, drilling, &c., and is thus very suitable for the purposes indicated above. (W. E. E.)

ARMS AND ARMOUR (Lat. *arma*, from the Aryan root *ar*, to join or fit; cf. Gr. ἀρμός, joint; the form *armour*, from Lat. *armatura*, should strictly be *armure*). Under this heading are included weapons of offence (arms) and defensive equipment (armour). The history of the development of arms and armour begins with that of the human race; indeed, combined with domestic implements, the most primitive weapons which have been found constitute the most important, if not the only, tangible evidence on which the history of primitive man is based. It is largely from the materials and characteristics of the weapons and utensils found in caves, tombs and various strata of the earth's crust, coupled with geological considerations, that the ethnological and chronological classifications of prehistoric man have been deduced. For a detailed account of this classification and the evidence see ARCHAEOLOGY; BRONZE AGE; FLINT IMPLEMENTS, &c., and articles on special weapons.

Classification.

Offensive weapons may be classified roughly, according to their shape (*i.e.* the kind of blow or wound which they are intended to inflict), and the way in which they are used, as follows:—(1) Arms which are wielded by hand at close quarters. These are subdivided into (*a*) *cleaving* weapons, *e.g.* axes; (*b*) *crushing*, *e.g.* clubs, maces and all hammer-like arms; (*c*) *thrusting*, *e.g.* pointed swords and daggers; (*d*) *cutting*, *e.g.* sabres (such weapons frequently combine both the cut and the thrust, *e.g.* swords with both edge and point); (*e*) those weapons represented by the spear, lance, pike, &c., which deal a thrusting blow but are distinguished from (*c*) by their greater length. (2) Purely missile weapons, *e.g.* darts, javelins and spears. Frequently these weapons are used also at close quarters as thrusting weapons; the typical example of these is the medium-length spear of not more than about 6 ft. in length. (3) Arms which discharge missiles, *e.g.* bows, catapults and fire-arms generally. (See ARCHERY and section *Fire-arms* below.) The weapons in (2) and (3) are designed to avoid hand-to-hand fighting.

Weapons are also classified in a variety of other ways. Thus we have *small-arms*, *i.e.* all weapons in classes (1) and (2) with those in (3) which do not require carriages. *Side-arms* are those which, when not in use, are worn at the side, *e.g.* daggers, swords, bayonets. *Armes blanches* is a term used for offensive weapons of iron and steel which are used at close quarters.

Defensive armour consists of body armour, protections for the head and the limbs, and various types of shield.

History.

1. *Stone Age.*—One of the chief problems which have perplexed archaeologists is that of finding a criterion which will enable them to distinguish the most primitive products of human skill from similar objects whose form is due to the forces of nature. It is often impossible to say precisely whether a rough piece of flint is to be regarded as a weapon (except so far as it could be used as a missile) or merely as a fragment of rock. Passing over these doubtful cases, we come first to indubitable examples of weapons deliberately fashioned in stone for offensive purposes. The use of stone weapons appears to have been universally characteristic of the earliest races of mankind, as it is still distinctive of those savage races which are most nearly allied to primitive man. These weapons were naturally simple in form and structure. The earliest examples (Palaeolithic) found in river-drift gravel in various parts of Europe are merely chipped flints, celts, &c. Later on we find polished implements (Neolithic) progressively more elaborate in design and workmanship, such as socketed stones with wooden handles and knives or daggers of flaked flint with handles. Besides flint the commonest materials are diorite, greenstone, serpentine and indurated clay-slate; there are also weapons of horn and bone (daggers and spear-heads). Spear-heads and arrow-points (leaf-shaped, lozenge-shaped, tanged and triangular) were chipped in flint with such skill as to be little inferior to their metal successors. They have accurately flaked barbs and tangs, and in some cases their edges are minutely chipped. The heads appear to have been fastened to the shafts by vegetable fibre and bitumen. Knife-daggers of flint, though practically of one single type, exhibit much variety of form. They vary in size also, but seldom exceed 12 in. in length. They are sometimes obtuse-edged like a scraping-tool, sometimes delicately chipped to a straight edge, while the flakes are so regularly removed from the convex part of the blade as to give a wavy surface, and the corners of the handle are delicately crimped. The daggers attain their highest perfection in the short, leaf-shaped form,—the precursor of the leaf-shaped sword which is peculiarly characteristic of the Bronze Age,—and the curved knives found especially in Great Britain and Russia, and also in Egypt. The precise object of the sharpening of both convex and concave edges in the curved variety is not clear. There have also been found sling-stones, and, in Scotland and Ireland, balls of stone with their "surfaces divided into a number of more or less projecting circles with channels between them." These latter, Sir John Evans suggests, were attached to a thong which passed through the surface channels, and used like the *bolas* of South America. The weapon could thus deal a blow at close quarters, or could be thrown so as to entangle the limbs of an enemy. Of defensive armour of stone there is none. The only approximation is to be found in the small rectangular plates of slate, &c., perforated with holes at the corners, which are supposed to have been bound on to the arm to protect it from the recoil of the bow-string. Similar wristlets or bracers are in use among the Eskimos (of bone) and in India (of ivory). These plates measure generally about 4 in. by $1\frac{1}{2}$ in.

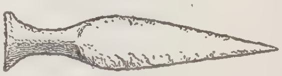


FIG. 1.—Leaf-shaped Flint Dagger.

2. *Bronze Age.*—It is impossible to assign any date as the beginning of the Bronze Age; indeed, archaeology has shown that the adoption of metal for weapons was very gradual. The stone weapon perseveres alongside the bronze, and there exist stone axes which, by their shape, suggest that they have been copied from metal axes. In the earliest interments in which the weapons deposited with the dead are of other materials than stone, a peculiar form of bronze dagger occurs. It consists of a well-finished, thin, knife-like blade, usually about 6 in. in length, broad at the hilt and tapering to the point, and attached to the handle by massive rivets of bronze. It has been found associated with stone celts, both of the roughly chipped and the highly polished kind, showing that these had not been entirely disused when bronze became available. A later type of bronze dagger is a broad, heavy, curved weapon, usually from 9 to 15 in. in length, with massive rivets for attachment to an equally massive handle. The leaf-shaped sword, however, is the characteristic weapon of the Bronze Age. It is found all over Europe, from Lapland to the Mediterranean. No warlike weapon of any period is more graceful in form or more beautifully finished. The finish seems to have been given in the mould without the aid of hammer or file, the edge being formed by suddenly reducing the thickness of the metal, so as to produce a narrow border of extreme thinness along

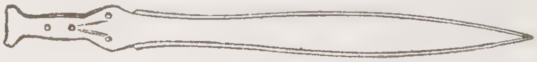


FIG. 2.—Leaf-shaped Bronze Sword.

both sides of the blade from hilt to point. The handle-plate and blade were cast in one piece, and the handle itself was formed by side plates of bone, horn or wood, riveted through the handle-plates. There was no guard, and the weapon, though short, was well balanced, but more fitted for stabbing and thrusting than for cutting with the edge. The Scandinavian variety is not so decidedly leaf-shaped, and is longer and heavier than the common British form; and instead of a handle-plate, it was furnished with a tang on which a round, flat-topped handle was fastened, like that of the modern Highland dirk, sometimes surmounted by a crescent-like ornament of bronze. A narrow, rapier-shaped variety, tapering from hilt to point, was made without a handle-plate, and attached to the hilt by rivets like the bronze daggers already mentioned. This form is more common in the British Isles than in Scandinavia, and is most abundant in Ireland. The spear-heads of the Bronze Age present a considerable variety of form, though the leaf-shaped predominates, and barbed examples are extremely rare. Some British weapons of this form occasionally reach a length of 27 in. The larger varieties are often beautifully designed, having segmental openings on both sides of the central ridge of the blade, and elaborately ornamented with chevron patterns of chased or inlaid work both on the socket and blade. Arrow-points are much rarer in bronze than in flint. In all probability the flint arrow-point (which was equally effective and much more easily replaced when lost) continued to be used throughout the Bronze Age. Shields of bronze, circular, with hammered-up bosses, concentric ridges and rows of studs, were held in the hand by a central handle underneath the boss. The transition period between the Bronze and Iron Ages in central Europe is well defined by the occurrence of iron swords, which are simple copies of the leaf-shaped weapon, sometimes with flat handle-plate of bronze. These have been found associated with articles assigned to the 3rd or 4th century B.C.

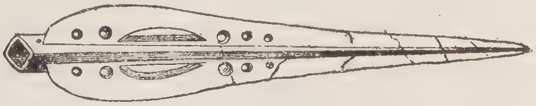


FIG. 3.—Bronze Spear-Head, length 19 inches.

Hallstatt weapons.

An important distinction between the characteristic bronze swords peculiar to southern peoples and the swords both of iron and of bronze found together in the Hallstatt cemeteries (in the Salzkammergut, Austria, ancient Noricum) is that whereas the former invariably have short handles (2¼ to 2½ in.), the latter are provided with handles from 3 to 3½ in. long, terminating in a round or oval pommel; the grip of one of the bronze swords even reaches a length of 4 in. The hilts are decorated with ivory, amber, wood, bronze, horn, and the decoration of blade and scabbard is often elaborate. The length of these swords is sometimes as much as 30 to 33 in. Again at La Tène on Lake Neuchâtel iron swords have been found to the number of one hundred, with handles of 4 to 7½ in. long and a total length varying from 30 to 38 in. Similar remains have been found in France at Bibracte and Alesia, and even in Ireland (cf. Munro, *The Lake-dwellings of Europe*, pp. 282, 383).

The occurrence at Hallstatt of bronze swords together with iron, having the characteristic long handle, has led to the hypothesis that the graves are those of an immigrant (probably Celtic) people of northern extraction which had conquered and overlaid a smaller-framed Bronze Age people, and had introduced the use of iron while continuing to use the bronze of their predecessors with the necessary modifications. This theory derived from tangible remains is corroborated by literary evidence. Thus Polybius (ii. 33, iii. 114) describes the Celtic peoples as fighting with a long pointless iron sword, which easily bent and was in any case too large to be used easily in a mêlée.

The graves at Hallstatt yielded in addition to these important swords a much larger number of spears. Of these two only were of bronze, the head of the larger being 7½ in. long. The much more numerous iron heads range up to as much as 2 ft. in length, and are all fastened to the shaft by rivets. All the arrow-heads found are of bronze, while of the axes the great majority are of iron; a few have iron edges fitted in a bed of bronze.

These examples are sufficient to show that the transition from bronze to iron was very slow. The fact that they were found in a district which is known to have been directly in the line of march pursued by invaders from the north tends to confirm the theory that the introduction of iron was the work of such invaders.

See Sir John Evans, *Ancient Stone Implements* (2nd. ed., 1897), *Bronze Implements*; W. Ridgeway, *Early Age of Greece*; and works quoted under ARCHAEOLOGY.

Mycenaean and Homeric.

3. *Early Greek Weapons.*—The character of the weapons used by the early peoples of the Aegean in the periods known as Minoan, Mycenaean and Homeric is a problem which has given rise of recent years to much discussion. The controversy is an important part of the Homeric question as a whole, and the various theories of the weapons used in the Trojan War hinge on wider theories as to the date and authorship of the Homeric poems. One widely accepted hypothesis, based on the important monograph by Dr Wolfgang Reichel, *Über homerische Waffen. Archäologische Untersuchungen* (Vienna, 1894), is that the Homeric heroes, like those who created the civilization known as Mycenaean, had no defensive armour except the Mycenaean shield, and used weapons of bronze. This view is derived to a great extent from the Homeric poems themselves, in which the metal most frequently mentioned is χαλκός (bronze), and involves the assumption that all passages which describe the use of corslets, breastplates, small shields and greaves are later interpolations. It is maintained on the other hand (*e.g.* by Prof. W. Ridgeway, *Early Age of Greece*, i. chap. 3), that the Homeric Achaeans (whom he regards as the descendants of the central European peoples, the makers of the Hallstatt iron swords) were far advanced into the Iron Age, and that the use of bronze weapons is merely another instance of the fact that the introduction of a new element does not necessarily banish the older. This theory would separate the Homeric from the Mycenaean altogether, and is part of a much more comprehensive ethnological hypothesis. According to another hypothesis, the Homeric poems are true descriptions of a single age, or, in other words, the weapons of the Homeric age were far more diverse and elaborate than is supposed by Reichel.

Very few traces of iron have been found in the Mycenaean settlements, nor have any examples of body armour been found except the ceremonial gold breastplates at Mycenae. The Mycenaean soldiers carried apparently a bronze spear, a bronze sword and a bow and arrows. The arrow-heads are first of obsidian and later of bronze. It would appear that only the chief warriors used spear and shield, while the majority fought with bows. The swords found at Mycenae are two-edged, of rigid bronze, and as long as 3 ft. or even more; from representations of battles it would seem that they were perhaps used for thrusting mainly. They are highly ornamented and some have hilts of wood, bone or ivory, or even gold mounting. Later swords became shorter and of a type like that of early iron swords found in Greece. Moreover in a few cases there have been found in pre-Mycenaean (late Minoan III.) tombs a few examples of short iron swords together with bronze remains. All Mycenaean spears are of bronze and, apparently, their shafts, unlike the Homeric, had no butt-piece. In the absence of any metal helmets in the tombs we may perhaps assume that the Mycenaean helmet was a leather cap, possibly strengthened with tusks, such as appears in Homer (*Iliad*, x.) also. The Mycenaean shield (generally, perhaps, made of leather) has given rise to much controversy, which hinges largely on the interpretation of the evidence provided by the representation on the Warrior Vase and the Painted Stele from Mycenae and pottery found at Tiryns. Professor Ridgeway regards these as describing post-Mycenaean conditions, and maintains that the true Mycenaean shield was always long (from neck to feet), and that it was either in the form of a figure-of-eight targe, or rectangular and sometimes incurved like the section of a cylinder; whereas the Homeric shield was round (*e.g.* κυκλότερος, εὔκυκλος, &c.). Dr Reichel's followers believe that the Homeric shield was long ("like a tower") and incurved in the centre like the Mycenaean, that Homer knew nothing of the small round shield, and that the epithets implying roundness used in the poems are to be explained as meaning "well-balanced" or as late interpolations. On the whole we must conclude that the Mycenaean age is by no means a single homogeneous whole (see Aegean Civilization), and that the weapons are not exclusively of bronze, nor of any single type.

The Homeric warrior in full armour, according to the Homeric poems, wore: (1) shield (ἀσπίς, σάκος), (2) greaves (κνημῖδες), (3) band (ζῶμα), (4) belt (ζωστήρ)and *mitrē*, (5) tunic (χιτών), (6) helmet (κορύς), (7) breastplate (θώρηξ), (8) sword (ξίφος). The λαισήϊον was a protection worn by the archers in place of a shield. According to the usual view, the Homeric shield was, as we have seen, bent in about half way up each side (in the form of a figure-of-eight) to give freedom to the arms, and large enough to protect the whole body. The two curves were held rigid by two wooden (probably) staves inside. It was composed of layers of ox-hide overlaid with bronze, forming a boss in the centre, and sometimes had studs upon it. Reichel's view is that it was the weight of these huge shields which led to the use of the chariot as a means of going rapidly from one part of the field to another (though Professor Ridgeway and others contest this, and Helbig mentions more than one case of long journeys on foot under shield), and further that the round shield is entirely unknown to Homer. This large shield was clearly the natural protection against showers of missiles, rather than against enemies fighting with the sword.

The greaves were, no doubt, generally of hide, protected the leg all round, and were fastened at the knee with cords. On the other hand Mycenaean bronze greaves have been found at Enkomi (Cyprus) and at Glassinatz (Glasinac), and therefore it is not necessary, following Reichel, to cut out Homer's references to the "bronze-greaved" Achaeans (*Iliad*, vii. 41), a phrase which has been taken as evidence for regarding the passage as spurious. The tin greaves of Achilles are obviously exceptional.

The *thorex* again is the subject of controversy. Reichel, arguing that the great shield rendered any breastplate unnecessary, regarded the word as a general term for body clothing, but Ridgeway strongly maintains the older theory that it was a bronze breastplate, and Andrew Lang points out that, on Reichel's theory, a word which originally meant the "breast" was transferred to mean "loin-cloth" (which, to judge from the artistic representations, was all that the Mycenaean warrior wore), and subsequently in historic times returned to its natural use for the breastplate—a most unlikely evolution. The passages in Homer which describe it as a breastplate are regarded by Reichel's school as later interpolations. Gilbert Murray thinks that the Homeric poems must be regarded as belonging to different periods of development, and therefore attributes the more elaborate armour to the "surface" (late Ionian) stratum. The *zoma* was probably a loin-cloth, and the *mitrē* a metal band about a foot wide in front and narrow behind to protect the lower part of the body. As a matter of fact, however, the big shield does not exclude the use of body armour, and it is quite likely that the Homeric warrior wore a bronze corslet, *i.e.* a somewhat improved form of the λινοθώρηξ, or stiffened shirt. On the other hand, it is probable, as we gather from the poems, that this corslet was not strong enough to do more than stop a spent spear. The *chiton* was worn over the *mitrē*, and reached the knees; it was held to the body by the *zostēr*, a metal-plated belt. Helmets were both of metal on leather, and of leather throughout; the crests were of horsehair (not of metal like the later Greek helmets) and there were no cheek-pieces.

The sword has already been mentioned. Ridgeway, in spite of the almost invariable mention of bronze as the material of the Homeric weapons, believes that it was generally of iron, but, while the presence of iron in the Homeric age is admitted in the case of implements, it is generally held that weapons were all of bronze. Except for one arrow-head (*Iliad*, iv. 123), and the mace of Areithoüs, mentioned as a unique example by Nestor (*Iliad*, vii. 141), no reference to an iron weapon proper occurs in the Homeric poems. But the sword was used only when the favourite spear or javelin had failed to decide the contest.

It must be admitted that the problem of pre-Homeric armour and Homeric armour must always be largely a matter of inference, based on a comparative study of the evidence literary and archaeological. Unless we are prepared to adopt the theory that the Homeric poems consist of a mosaic of interpolation informed by an archaizing editor, we must assume that they describe a single period of transition intermediate between the Mycenaean prime and the dawn of history proper. In this case we shall believe that the Homeric warrior has so far adapted to changing conditions the simple appliances of the Mycenaean that he has evolved a feeble corslet with minor pieces of body armour, while retaining the big double-bellied shield as a protection against the arrows which are still the chief weapon of the rank and file and are even used on occasion by the chiefs. If we further believe that the iron at his disposal was similar to that used by the Celts of Polybius, it is natural to believe also that he preferred the harder bronze for his weapons, though iron was common for domestic and other implements.

On early Greek arms in general see, besides Reichel and Ridgeway *op. cit.*: A. Lang, *Homer and his Age* (London, 1906; and criticisms in *Classical Review*, February 1907); G. G. A. Murray, *The Rise of the Greek Epic* (Oxford, 1907), chap. vi.; R. M. Burrows, *Discoveries in Crete* (2nd ed., London, 1907); Leaf and Bayfield, *Iliad*, i.–xii. Appendix A (follows Reichel); W. Helbig, *Homerische Epos* (1884 and 1899), and *La Question mycénienne* (1896); C. Robert, *Studien zur Ilias* (Berlin, 1901); Chr. Tsountas and J. I. Manatt, *The Mycenaean Age* (1897); V. Bérard, *Les Phéniciens et l'Odyssée* (Paris, 1902); Cauer, *Grundfrager d. Homerkritik* (Leipzig, 1895); much valuable discussion will be found in articles in *Journ. Hell, Stud.*, *Classical Rev.* and *Journ. of Anthropol. Instit.*; see also editions of *Iliad* and *Odyssey* (espec. D. B. Monro), and works quoted under Aegean Civilization; Homer; Mycenae.

4. *Greek, Historical.*—The equipment does not differ generically from that described in the Homeric poems, except when we come to the reforms of the Macedonians. The hoplites, who formed the main army, wore helmet, body armour, greaves and shield, and fought with pike and sword. The helmets were (1) the Corinthian, which covered the face to the chin, with slits for the eyes, and often had no plume or crest; (2) the Athenian, which did not cover the face (though sometimes it had cheek-plates which could be turned up if necessary), had crests, sometimes triple, with plumes of feathers, horsehair or leather; (3) a steel cap (πῖλος) without crest, plumes or cheek-plates. The last seems to have been most common in the Spartan army. The body armour consisted of breast and back plates fastened together by thongs or straps and buckles; sometimes poverty compelled a man to be content with a leather jerkin (σπολάς) partly strengthened by metal plates, or even a quilted linen or stuffed shirt. Greaves were of pliant bronze fastened at the back above the ankle and below the knee. Shields were of the small round or oval type, adapted to the new conditions in which the bow and arrow had given place to hand-to-hand fighting. They were held by means of two handles (ὄχανα), the left hand being thrust through the first and grasping the second. In the 5th and 4th centuries the shield bore a device or initial representing the state and also the individual's own crest. The hoplite's pike, about 8 ft. long, unlike the Homeric weapon, was hardly ever thrown. In the Macedonian phalanx a pike (σάρισσα), certainly 18 ft., and perhaps later in the 3rd and 2nd centuries even 24 ft. long, was introduced. The sword was straight, sharp-pointed, short, sometimes less than 20 in., and rarely more than 2 ft. long. It was double-edged and used for both cut and thrust. A less common type was the μάχαιρα or curved sabre used by the Spartans, with one sharp edge. The hoplite had no other offensive weapons.

The cavalry were heavy-armed like the hoplites except that they carried a smaller shield, or, more usually, none at all. They were armed with a lance which they wielded freely (*i.e.* not "in rest") and occasionally threw. The Macedonian cavalry had a σάρισσα. The light-armed (γυμνῆτες, ψιλοί) were (1) ἀκοντισταί, armed with a javelin (3 to 5 ft. long) and a small shield; (2) τοξόται, archers; and (3) σφενδονῆται, slingers, whose missiles were balls of lead, stones and hardened clay pellets. Between the heavy and the light armed were the peltasts. The *pelta*, from which they took the name, was a light shield or target, made of skin or leather on a wooden or wickerwork frame. The Athenian Iphicrates armed them with linen corslet and a larger spear and sword than those of the hoplites; he also invented a new footgear (called after him *iphicratides*) to replace the older greaves.

5. *Roman.*—The equipment of the Roman soldier, like the organization of the army (see Roman Army), passed through a great number of changes, and it is quite impossible to summarize it as a single subject. In the period of the kings the legion was the old Greek phalanx with Greek armour; the front ranks wore the Greek panoply and fought with long spears and the circular Argolic shield. The early Roman sword, like that of the Greeks, Egyptians and Etruscans, was of bronze. We have no direct statement as to its form, but in all probability it was of the ordinary leaf-shape. We gather from the monuments that, in the 1st century B.C., the Roman sword was short, worn on the right side (except by officers, who carried no shield), suspended from a shoulder-belt (*balteus*) or a waist-belt (*cingulum*), and reaching from the hollow of the back to the middle of the thigh, thus representing a length of from 22 in. to 2 ft. The blade was straight, double-edged, obtusely-pointed. On the Trajan column (A.D. 114) it is considerably longer, and under the Flavian emperors the long, single-edged *spatha* appears frequently along with the short sword.

The second period ending with the Punic wars witnessed a change. The *hastati* and the *principes* are both heavily armed, but the round shield has given way to the oblong (*scutum*), except for one-third of the *hastati* who bore only the spear and the light javelin (*gaesa*). The third period—that described by Polybius—is characterized by greater complexity of armour, due no doubt in part to the experience gained in conflicts with a wider range of peoples, and in part to the assimilation of the methods peculiar to the new Italian allies. Thus we find the skirmishers (*velites*) armed with a light javelin 3 ft. long and $\frac{3}{4}$ in. thick, with an iron point 9 in. long; this point was so fragile that it was rendered useless by the first cast. For defence they wore a hide-covered headpiece and a round buckler 3 ft. in diameter. The heavy-armed carried a *scutum* formed of two boards glued together, covered with canvas and skin, and incurved into the shape of a half-cylinder; its upper and lower edges were strengthened with iron rims and its centre with a boss (*umbo*). A greave was worn on the right leg, and the helmet was of bronze with a crest of three feathers. The wealthier soldiers wore the full cuirass of chain armour (*lorica*), the poorer a brass plate 9 in. square. For offence they carried a sword and two javelins. The former was the Spanish weapon, straight, double-edged and pointed, for both thrust and cut, in place of the old Greek sword.

The characteristic weapon, however, was the *pilum* (Gr. ὑσσός). The form of this weapon and the mode of using it have been minutely described by Polybius (vi. 23), but his description has been much misunderstood in consequence of the rarity of representations or remains of the *pilum*. It is shown on a monument of St Rémy, in Provence, assigned to the age of the first emperors, and in a bas-relief at Mainz, on the grave-stone of Quintus Petilius Secundus, a soldier of the 15th legion. A specimen of the actual weapon is in the museum at Wiesbaden. It is a javelin with a stout iron head (7 in.), carried on an iron rod, about 20 in. in length, which terminates in a tang for insertion in the wooden shaft. As represented on the monuments, the iron part of the weapon is about one-third of its entire length ($6\frac{3}{4}$ ft.). It was used primarily as a missile. When the point pierced the shield the weight of the stave pulled the shield downwards and rendered it useless. At close quarters it answered all the purposes, offensive and defensive, of the modern bayonet when "fixed." Vegetius, in his *Rei militaris instituta*, describes it in a modified form as used in the armies of the lower empire, and in a still more modified form it reappears as the "argon" of the Franks. This equipment was characteristic of *hastati*, *principes* and *triarii* (save that the latter used the *hasta* instead of the *pilum*). We thus see how great is the change from the time when the *hastati* were the light-armed (from *hasta*) of the Greek phalanx.

The cavalry, which had originally been protected only by a light ox-hide shield and the most fragile spears, adopted, about Polybius's time, the full Greek equipment of buckler, strong spear and breastplate.

In the last period of the republic the *pilum* became the universal weapon of the heavy-armed, while the auxiliaries (all foreigners, the *velites* having disappeared) used the *hasta* and the long single-edged sword (*spatha*). Under the empire the heavy-armed, according to Josephus, had helmet, cuirass, a long sword worn on the left side, and a dagger on the right, *pilum* and *scutum*. The special detachment detailed to attend the commander had a round shield (*clipeus*) and a long spear. The cavalry wore armour like that of the infantry, with a broadsword, a buckler slung from the horse's side, a long pole for thrusting, and several javelins, almost as large as spears, in a sheath or quiver. Arrian, writing of a period some fifty years later, gives further particulars from which we gather that of the cavalry some were bowmen, some polemen, while others wielded lances and axes.

For the arms and armour of other peoples of antiquity see *e.g.* Persia: *History, Ancient*, section v. "The Persian Empire of the Achaemenids"; Britain, *Anglo-Saxon*, section v. "Warfare"; Etruria; Egypt, &c. (J. M. M.)

6. *English from the Norman Conquest.*—It is unnecessary here to trace in detail the history of European armour in the middle ages and after, but its use and fashion in England may illustrate the broad lines of the gradual perfection and the hurried abandonment of the ancient war-harness. Each country gave its armour something of the national character, the Spanish harness being touched with the Moorish taste, the Italian with the classical note borrowed from the monuments of old time, and the German with the Teutonic feeling for the grotesque.

11th century Bayeux tapestry.

To understand the development of English arms and armour it is well for us to consider carefully the fashion of these things at the time of that landmark of history, the Norman Conquest. Poets, chroniclers and law-makers give us material for their description, and in the great embroidery of Bayeux, with its more than six hundred lively figures, we have pictured all the circumstances of war. We find that weapons and war gear have advanced little or nothing beyond the age which saw the Dacian warrior armed from crown to foot. A knight is reckoned fully armed if he have helmet, hawberk and shield; his weapons are sword and lance, although he sometimes carries axe or mace and, more rarely, a bow. The coat of fence, which the Norman called *hawberk* and the English *byrnie*, hangs from neck to knee, the sleeves loose and covering the elbow only, the skirt slit before and behind for ease in the saddle. The Bayeux artists (see fig. 4) commonly show these skirts as though they were short breeches, the hawberk taking the fashion at first sight of a man's swimming dress, but other authorities set us right, and towards the end of the tapestry we see men stripping hawberks from the slain by pulling them over the head. Back and front are so much alike that he who armed Duke William for the fight slipped on the armour hind side before, an omen that he should change his state of a duke for that of a king. The hawberk might be mail of woven rings, of rings sewn upon leather or cotton, of overlapping scales of leather, horn or iron, of that jazerant work which was formed of little plates sewn to canvas or linen, or of thick cotton and old linen padded and quilted in lozenges, squares or lines. There are indications that the

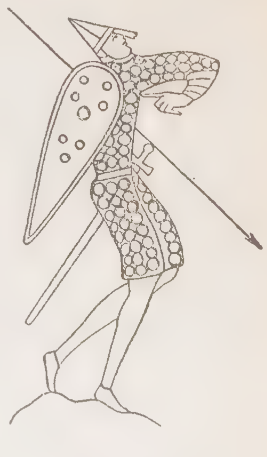


Fig. 4.—From the Bayeux Tapestry.

hawberk was sometimes reinforced at the breast probably by a small oblong plate fastened underneath. Its weight is shown in the scene where William's men carry arms to the ships, each hawberk being borne between two men upon a pole thrust through the sleeves.

The helmet is a brimless and pointed cap, either all of metal or of leather or even wood framed and strengthened with metal. Its characteristic piece is the guard which protects the nose and brow from swinging cuts, so disguising the knight that William must needs take off his helmet to show his men that he had not fallen. Such a nasal appears in a 10th-century illumination; at the time of the Conquest it was all but universal. It grows rare and all but disappears in the 13th century, although examples are found to the end of the middle ages. The helmet is laced under the chin, and under it the knight often wore a hood of mail or quilting which covered the top of the head, the ears and neck, but left the chin free—in two or three cases he has this hood without the helmet. A close coif was probably worn beneath it when it was of ringed mail, to spare the fretting of the metal on the head.

The knights' legs are shown in most cases as unprotected save by stout hose or leg-bands: only in two or three instances does the tapestry picture a warrior with armed legs, and it is perhaps significant of the rarity of this defence that the duke is so armed. The feet are covered only by the leather boot, the heels having prick spurs.

Broad-bladed swords with cross-hilts of straight or drooping quills are fastened with a strap and buckle girdle to the left side. They have a short grip, and the blade would seem to be from 2½ to 3 ft. in length. The chieftain unarmed in his house is often seen with unbuckled and sheathed sword sceptre-wise in his hands, carrying it as an Indian raja will nurse his sheathed tulwar. The ash spears brandished or couched by the knights as they charge seem from 7 to 8 or 9 ft. in length. In a few cases a three-forked pennon flutters at the end. The axe, a weapon which the Normans, in spite of their Norse ancestry, do not carry in the battle, is of the type called the Danish axe, long-shafted, the large blade boldly curved out. Maces, such as that with which the bishop of Bayeux rallies his young men, seem knotted clubs of simple form. Short and strong bows are drawn to the breast by the Norman archers.

Of the shields in the fight, four or five borne by the English are of the old English form—large, round bucklers of linden-wood, bossed and ribbed with iron. For the rest the horsemen bear the Norman shield, kite-shaped, with tapering foot, and long enough to carry a dead warrior from the field. On the inner side are straps for the hand to grip and a long strap allowed the knight to hang the shield from his neck. Let us note that although wyvern-like monsters, crosses, roundels and other devices appear on these shields, none of them has any indication of true armory, whose origins must be placed in the next century.

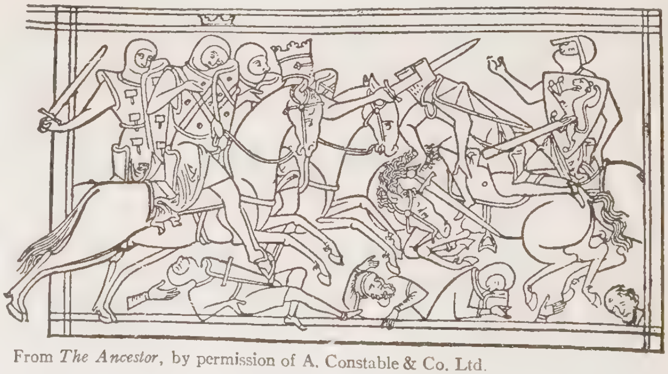
12th century.

The 12th century, although an age of riding and warring, affects but little the fashion of armour. The picture of a king on his seal may well stand for the full-armed knight of his age, but Henry Beauclerc, Stephen and Henry II. are shown in harness not much unlike that of the Bayeux needlework. But the sleeve of the hawberk goes to the wrist, and the kite shield grows less, Stephen's shield being 30 in. long at the most. On Stephen's second seal the mail hood is drawn over the point of the chin, and Henry II.'s seals show the chin covered to the lips. At least one seal of this king has the legs and feet armed with hose of ringed mail, probably secured by lacing at the back of the leg as a modern boot is laced. The first seal of Richard Lionheart marks an important movement. His hawberk, hood and hose clothe him, like his father, from crown to toe, and to this equipment he adds gloves of mail. Under the hawberk flows out to the heels the skirt of a long gown slit in front. But helm and shield are the most remarkable points. The shield has become flatter at the top, and at last the shield of an English king bears those armorial devices whose beginnings are seen elsewhere a generation before. The earlier seal has the shield with a rampant lion ramping to the sinister side and closely resembling that on the shield of Philip of Alsace, long believed to be the earliest example of true armory. But the shield in the second seal bears the three leopards which have been ever since the arms of the kings of England, and from this time to the end of the middle ages armorial devices become the common decorations of the knight's shield, coat, saddle and horse-trapper. The helmet of the first seal is a high thimble-topped cap, without a nasal guard, but the second has the king's head covered with the great helm, barrel-shaped and reinforced in front with a flat ventaile pierced in slits for the sight. This helm is crested with a semicircular ridge from which spring two wings, or rows of feathers fan-wise. On its side the ridge bears a single leopard, the forerunner of the coming crests.

13th century.

For 13th-century arms, although but poor scraps remain of original material, we have authority in plenty—pictures, seals and carving, and, above all, the effigies in stone or brass which give us each visible link, strap and ornament. All these have for a commentary chronicles, poems and account books, so that the history of armour may be followed in detail.

The long, sleeveless surcoat seen over King John's mail on his broad seal goes through the century and is often embroidered with arms. The shield becomes flat-topped the better to receive armorial charges. The great helm is common, although many knights on the day of battle like better the freedom of the mail hood with a steel cap worn over or under its crown, keeping for the tourney-yard the great helm which towards the century-end begins to carry its towering crest. Great variety is seen in the forms of the flat or round-topped helm, some being in one piece, pierced for sight and air, others having hinged or movable ventailes. At the end of the century a sugar-loaf type is the established form. The knight's hawberk is worn over a gambeson of linen, quilted linen or cotton, which lesser men wear with a steel cap for all defence. Breast and back plates also are sometimes borne under the hawberk, and the first plates in sight at last appear in those knee-cops which protect the joining of the upper and lower hose, and in a few examples of bainbergs or greaves of metal or leather. At the end of Henry III.'s reign we have the admirable illustrations of a manuscript of Matthew Paris's *Lives of the Offas*, with many pictures of knights. (See fig 5.) Here we see knights with knee-cop and greave and a plenty of curious headpieces, the plain mail hood and mail hoods with a plate ventaile to cover the face, barrel-helms and round-topped helms and even round-topped helmets with the Norman nose-guard.



From *The Ancestor*, by permission of A. Constable & Co. Ltd.

Fig. 5.—Knights' Armour, *c.* 1250.

In the last half of the 13th century appears the curious defence known as *alettes*. This name is given to a pair of leather plates generally oblong in form and tagged to the back of the shoulder. As a rule they are borne to display the wearer's arms, but being sometimes plain they may have had some slight defensive value, covering a weak spot at the armpit and turning a sweeping sword-cut at the neck. They disappear in the earlier years of Edward III.

Surcoat, shield and trapper have the arms of their owner. The rowel-spur makes a rare appearance. Weapons change little, although the sword is often longer and heavier. Richard I. had favoured the cross-bow, in spite of papal denunciations of that weapon hateful to God, and its use is common through all the 13th century, after which it makes way for the national weapon of the long-bow.

14th century.

In the 14th century, the high-day of chivalry, the age of Creçy and Poitiers, of the Black Prince and Chandos, the age which saw enrolled the noble company of the Garter, the art of the armourer and weapon-smith strides forward. At its beginning we see many knights still clad in chain mail with no visible plate. At its end the knight is often locked in plates from head to foot, no chainwork showing save the camail edge under the helm and the fringe of the mail skirt or hawberk.

Before the first quarter of the 14th century is past many of these plates are in common use. Sir John de Creke's brass, about 1325–1330, is a fair example (fig. 6). His helmet is a basinet, pointed at the top, probably worn over a complete hood of mail flowing to the mid-breast. This hood was soon to lose its crown, the later basinets having the camail, a defence of mail covering neck, cheeks and chin and secured to the basinet with eyelet holes and loops through which a lace was passed. A rerebrace of plate defends the outer side of the upper arm, plain elbow-cops the elbow, and round bosses in the form of leopard heads guard the shoulder and the crook of the elbow. The fore-arm is covered with the plates of a vambrace which appears from under the hawberk sleeve. Large and decorated knee-cops cover the knees, ridged greaves the shins, and the upper part of the foot from pointed toe to ankle is fenced with those articulated and overlapping plates the perfection of which in the next century enabled the full-harnessed knight to move his body as freely as might an unarmed man. Under the plates the mail hose show themselves and the heels have rowelled spurs. He has a hawberk of mail whose front skirt ends in a point between the knees, the loose sleeves between wrist and elbow. Under this is a haketon of some soft material whose folds fall to a line above the height of the knee. Over the hawberk is a garment, perhaps of leather with a dagged skirt-edge, and over this again is a sleeveless gambeson or pourpoint of leather or quilted work, studded and enriched. Over all is the sleeveless surcoat, the skirt before cut squarely off at the height of the fork of the leg, the skirt behind falling to below the knee. The loose folds of this surcoat are gathered at the waist by a narrow belt, the sword hanging from a broader belt carried across the hip. Before 1350 the long surcoat of the 13th century was still further shortened, the tails being cut off squarely with the front. The fate of Sir John Chandos, who in 1369 stumbled on a slippery road, his long coat "armed with his arms" becoming tangled with his legs, points to the fact that an old soldier might cling to an old fashion.

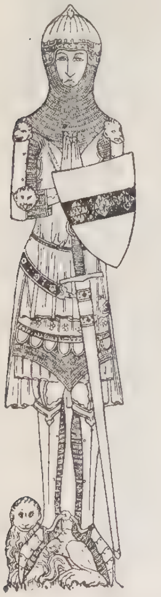


FIG. 6.—Brass of Sir John de Creke.
From Waller's *Monumental Brasses.*

The desire for a better defence than a steel cap and camail and a less cumbrous one than the great helm, in which the knight rode half stifled and half blind, brought in as a fighting headpiece the basinet with a movable viser. This is found throughout this century, disappearing in the next when the salet and its varieties displaced it. But there were many knights who still fought with the great helm covering basinet and camail, a fact which speaks eloquently of the mighty blows given in this warlike age. The many monumental brasses of the last half of the 14th century show us for the most part knights in basinet and camail with the face exposed, but their heads are commonly pillowed on the great helm and in any case the viser would hinder the artist's desire to show the knight's features.

The fully-armed man of the latter half of the 14th century seems to have worn a rounded breastplate and a back-plate over his chain hawberk. Chaucer's Sir Thopas must always be cited for the defences of this age, the hero wearing the quilted haketon next his shirt, and over that the habergeon, a lesser hawberk of chain mail. His last defence is a fine hawberk "full strong of plate" showing that "hawberk" sometimes served as a word for the body plates. Over all this is the "cote-armure" or surcoat. Many passages from the chroniclers show that the three coats of fence one over the other were in common use in the field, and Froissart tells a tale of a knight struck by a dart in such wise that the head pierced through his plates, his coat of mail and his haketon stuffed with twisted silk. The surcoat in the age of Edward III. became a scanty garment sitting tightly to the body, laced up the back or sides, the close skirts ending at the fork of the leg with a dagged or slittered edge. The waistbelt is rarely in sight, but the broad belt across the hips, on which the dagger comes to hang as a balance to the sword, grows richer and heavier, the best work of the goldsmith or silversmith being spent upon it. Arms and legs and feet become cased in plate of steel or studded leather, and before the mid-century the shoulder-plates, like the steel shoes, are of overlapping pieces and the elbow also moves easily under the same defence. (See fig. 7.)

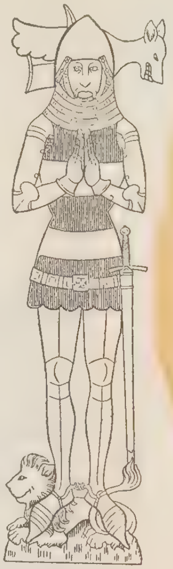


FIG. 7.—Brass of Sir John dé Foxley.
From Waller's *Monumental Brasses.*

15th century.

Such harness, ever growing more beautiful in its rich details, serves our champions until the beginning of the 15th century, when the fashion begins to turn. The scanty surcoat tends to disappear. It may be that during the bitter feuds and fierce slaughters of the Wars of the Roses men were unwilling to display on their breasts the bearings by which their mortal foe might know them afar. The horseman's shield went with the surcoat, its disuse hastened by the perfection of armour, and the banners of leaders remained as the only armorial signs commonly seen in war. But at jousts and tourneys, where personal distinction was eagerly sought, the loose tabard, which, after the middle of the century, bore the arms of the wearer on back, front and both sleeves, was still to be seen, with the crest of parchment or leather towering above a helm whose mantle, from the ribbon-like strip of the early 13th century, had grown into a fluttering cloak with wildly slittered edge streaming out behind the charging knight.

When a score of years of this 15th century had run we find the knight closed in with plates, no edge of chain mail remaining in sight. The surcoat being gone we see him armed in breast and back plate, his loins covered by a skirt of "tonlets," as the defence of overlapping horizontal bands comes to be named (fig. 8). The chain camail has gone out of fashion, the basinet continuing itself with a chin and cheek plate which joins a gorget of plate covering the collar-bone, a movable viser shutting in the whole head with steel. The gussets of chain mail sewn into the leathern or fustian doublet worn below the body armour are unseen even at the gap at the hollow of the arm where the plates must be allowed to move freely, for a little plate, round, oval or oblong, is tagged to each side to fence the weak point. These plates often differ in size and shape one from the other, the sword-arm side carrying the smaller one.

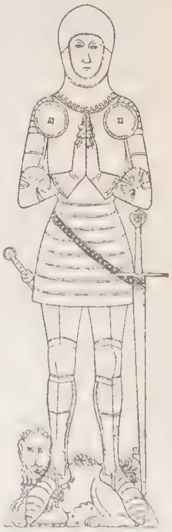


FIG. 8.—Brass of Sir John Lisle at Thruxton.

Soon after this the six or eight "tonlets" grow fewer, being continued on the lower edge by the so-called tuilles, small plates strapped to the tonlets and swinging with the movement of the legs. A fine suit of armour is shown in the monument of Count Otto IV. of Henneberg (fig. 9). Knightly armour takes perhaps its last expression of perfection in such a noble harness as that worn by Richard Beauchamp, earl of Warwick, whose armed effigy was wrought between 1451 and 1454 (fig. 10). In this we see the characteristic feature of the great elbow-cops, whose channelled and fluted edges overlapping vambrace and rerebrace become monstrous fan-like shapes in the brass of Richard Quartremayns, graven about 1460. At this time the harness of the left shoulder is often notably reinforced, as compared with that of the sword-arm shoulder. Towards the latter part of the century chain mail reappears as a skirt or breech of mail, showing itself under the diminished tonlets, and, when helm and gorget are removed, as a high-standing collar. The articulation by overlapping plates extends even to the breastplate, whose front is thus in two or more pieces. Very long-necked rowel-spurs are often found, and the toes of the sabbatons or steel shoes are sharply pointed. The characteristic helmet of the latter half of the century is the salet or salade, a large steel cap, whose edge is carried out from the brows and still more boldly at the back of the neck.

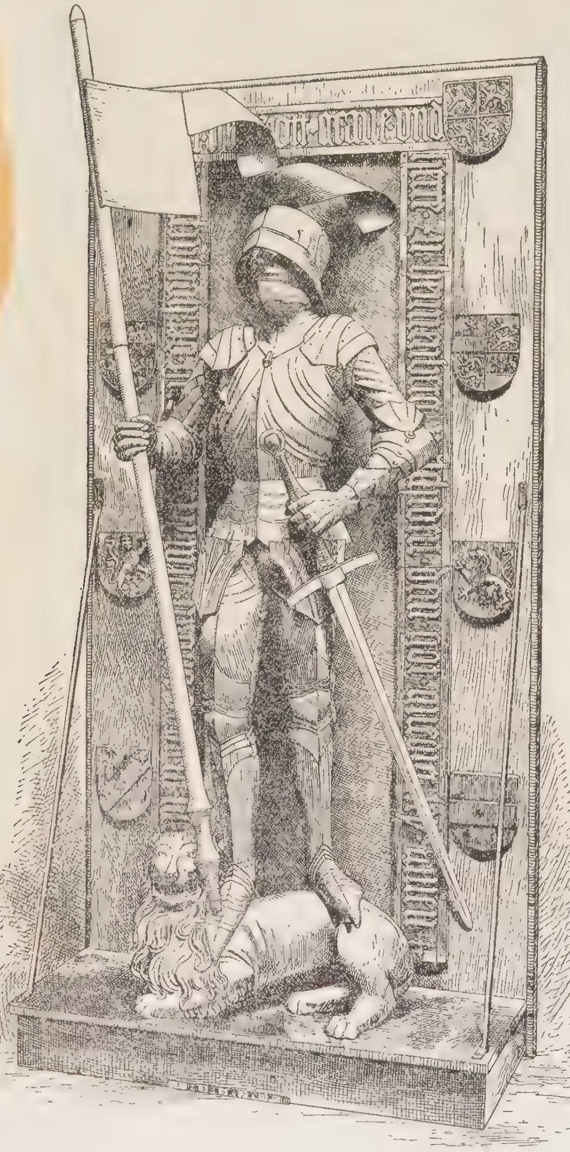


FIG. 9.—Gothic Style of Armour. Monument of Count Otto IV. of Henneberg.

Knights abandon the great helm in war, but it is perfected for use in the tilt-yard, taking for that purpose an enormous size, to enable two good inches of stuffing to come between head or face and the steel plate. Such a helm sits well down on the shoulders, to which it is locked before and behind by strong buckles or rivets. The note of the 15th century in armour is that of fantastically elaborate forms boldly outlined and a splendour of colour which gained much from the custom of wearing over the full harness short cloaks or rich coats turned up with furs, or from another fashion of covering the body plates or brigandines with rich velvets studded with gold. The details of the harness take a thousand curious shapes, and even amongst the simpler jacks and steel caps of the archers the same glorious variety is seen.

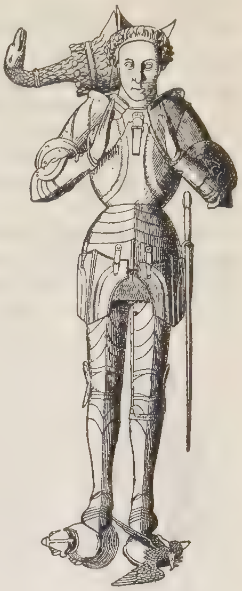
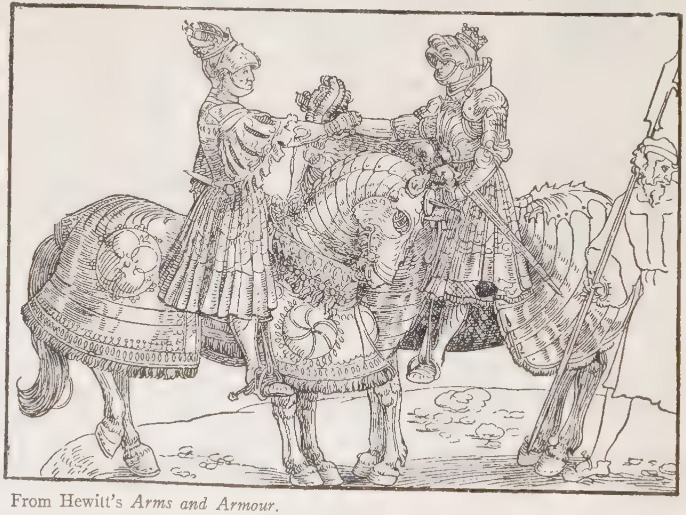


FIG. 10.—Brass of Richard Beauchamp, earl of Warwick.

From Stothard's *Monumental Effigies*.

16th century.

If the note of the 15th century be variety of form, that of the 16th century, the last important chapter in the history of armour, is surface decoration, the harness of great folk atoning in some measure for loss of the beautiful medieval sense of line by elaborate enrichment. Plain engraving, niello, russet work, golden inlay and beaten ornament are common methods of enrichment. The great plume of ostrich feathers flows from the helmet crown of leaders in war. As in the reign of Edward III., costume's fashion affects the forms of armour, the broad toe of the Henry VIII. shoe being imitated in steel, as the wide fluted skirts of the so-called Maximilian armour imitate the German fashion in civil dress which the Imperial host popularized through northern Europe (fig. 11). These skirts have been called "lamboys" by modern writers on military antiquities, but the word seems an antiquarianism of no value, apparently a misreading of the word "jambeis" in some early document. So many notable examples of the armour of this 16th century are accessible in European collections, other illustrations occurring in great plenty, that its details call for little discussion; a fine and characteristic suit is that by the famous English armourer, Jacob Topf (fig. 12), which belonged to Sir Christopher Hatton. Into this century the arquebusier marches, demanding a chief place in the line of battle, although it is a common error that the improvement in fire-arms drove out the fully armed warrior, whose plates gave him no protection. Until the rifle came to the soldier's hands, plate armour could easily be made shot-proof.



From Hewitt's *Arms and Armour*.

FIG. 11.—Meeting of Henry VIII. and Maximilian.

It was driven from the field by the new strategy which asked for long marches and rapid movements of armies. This century's armour for the tilt-yard gives such protection to the champion, with its many reinforcing pieces, that unless the caged helm were used—the same which cost Henry II. of France his life—the risks of the tilt-yard must have fallen much below those of the polo-field. The horse with crinet, chafron and bards of steel was as well covered from harm.

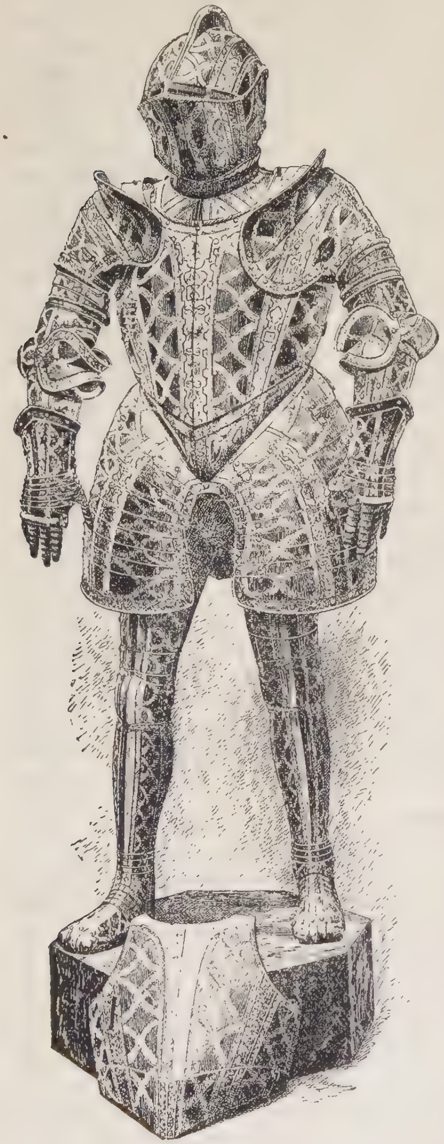


Fig. 12.—Suit by Jacob Topf, nearly complete; the gorget does not belong to it. Below is the placcate.

Before the end of the 16th century the full suit of war harness is an antique survival. Long boots take the place of greaves and steel shoes, and early in the 16th century the military pedants are heard to bewail the common laying aside of other pieces. The mounted cavalier—cuirassier or pistolier—might take the field, even as late as the Great Rebellion, armed at all points save the backs of the thighs and the legs below the knee; but a combed and brimmed cap, breast and back plate and tassets equipped the pikeman, and the musketeer would march without any metal on him save his headpiece, for it was soon found that heavily armed musketeers, after a long trudge through summer dust or winter mud, were readier to rest than to shoot. Everywhere there was revolt against the burden of plates, and as early as 1593 Sir Richard Hawkins found that his adventurers would not use even the light corslets provided by him, "esteeming a pot of wine a better defence." Gervase Markham, in his *Souldier's Accidence* of 1645, asks that at least the captain of cuirassiers should be armed "at all peeces, cap a pee," but he would have found few such captains, and Markham is a great praiser of noble old custom. The famous figure of a pikeman of 1668 (fig. 13) in Elton's *Art Military* has steel cap, corslet and tassets, but he stands for a fashion dead or dying. The last noteworthy helmet was what is now termed the lobster-tail helmet, a headpiece with round top, flat brim before, a broad articulated brim behind, cheek-pieces hanging by straps and a grate of upright bars to cover the face, some having in place of the grate a movable nose-guard to be raised or lowered at will. The close resemblance of this helmet to that worn by the Japanese, with whom the Dutch were then trading, is worth remark, although each of the two pieces seems to have had its separate origin. Thus, save for a steel cap here and a corslet there, especially to be found amongst the guards of sovereigns who must cling to something of antique tradition, armour departs out of the civilized world.

Survival of armour.

When in the reign of Queen Victoria her mounted guardsmen were given back their breast and back plates, the last piece of body armour had been the tiny gilt crescent worn at the throat by officers of foot, which crescent was the shrunken symbol of that great gorget of plate that came in with the 15th century. The shining plates of the Guards are parade pieces only, but a curious revival of an old defence was carried by English cavalry in the field at the end of the 19th century, when small gussets of chain mail were attached to the shoulders of certain cavalrymen as a defence against sword cuts. Through all the age of modern warfare inventors have pressed the claims of various bullet-proof breastplates, but where they have been effective against rifle fire their weight has made them too heavy an addition to the soldier's burden. (See, however, Armour Plates, *ad fin.*) Last of all we may reckon those secret coats of mail which are said to be worn on occasion by modern rulers in dread of the assassin. The London detective department has such coats of fence in its armoury; and on the other side it may be remembered that the Kelly gang of bushrangers, driven to bay, were found to have forged suits of plate for themselves out of sheets of boiler-iron.

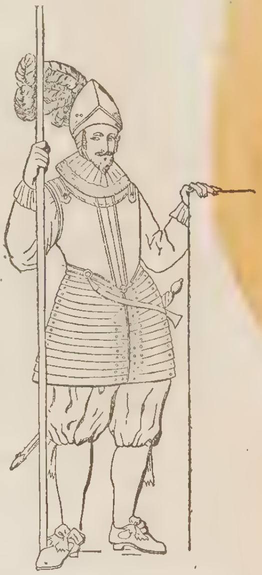


Fig. 13.—Pikeman.
From *The Compleat Body of the Art Military*, by Lieut.-Col. Elton (1668).

Collections.

Ancient arms and armour are now eagerly sought by European and American collectors, and high prices are paid down for every noteworthy piece. The supply is assisted by the efforts of many forgers of false pieces, the most cunning of whom bring all archaeological skill to their aid, and few great national or private collections are free from some example of this industry. For the genuine pieces competition runs high. Suits of plate of the earliest period may be sought in vain, and the greatest collectors may hardly hope for such a panoply of the late Gothic period as that which is the ornament of the Wallace collection. Even this famous harness is not wholly free from suspicion of restoration. Armour of the latter half of the 16th century, however, often appears in the salerooms and is found in many private collections, although the "ancestral armour" which decorates so many ancient halls in England is generally the plates and pots which served the pikemen of the 17th-century militia.

It is not hard to understand this scarcity of ancient pieces. In the first place it must be remembered that the fully armed man was always a rare figure in war, and only the rich could engage in the costly follies of the later tournaments. The novelists have done much to encourage the belief that most men of gentle rank rode to the wars lance in hand, locked up in full harness of plate; but the country gentleman, serving as light horseman or mounted archer, would hold himself well armed had he a quilted jack or brigandine and a basinet or salet. Men armed *cap a pee* crowd the illuminations of chronicle books, the artists having the same tastes as the boy who decorates his Latin grammar with battles which are hand-to-hand conflicts of epauletted generals. Monuments and brasses also show these fully armed men, but here again we must recognize the tendency which made the last of the cheap miniaturists endow their clients lavishly with heavy watch-chains and rings. As late as the 18th century the portrait painters drew their military or naval sitters in the breastplates and pauldrons, vambraces and rerebraces of an earlier age. Ancient wills and inventories, save those of great folk or military adventurers, have scanty reference to complete harnesses. Ringed hauberks, in a damp northern climate, will not survive long neglect, and many of them must have been cut in pieces for burnishers or for the mail skirts and gussets attached to the later arming doublets. As the fashion of plate armour changed, the smith might adapt an old harness to the new taste, but more often it would be cast aside. Men to whom the sight of a steel coat called up the business of their daily life wasted no sentimentality over an obsolete piece. The early antiquaries might have saved us many priceless things, but it was not until a few *virtuosi* of the 18th century were taken with the Gothic fancy that popular archaeology dealt with aught but Greek statuary and Roman inscriptions. The 19th century was well advanced before an interest in medieval antiquities became common amongst educated men, and for most contemporaries of Dr Johnson a medieval helm was a barbarous curiosity exciting the same measure of mild interest as does the Zulu knobkerry seen by us as we pass a pawnbroker's window. (O. Ba.)

7. *Fire-arms.* (For the development of cannon, see Artillery and Ordnance.)—Hand-cannons appear almost simultaneously with the larger *bombards.* They were made by the Flemings in the 14th century. An early instance of the use of hand fire-arms in England is the siege of Huntercombe Manor in 1375. These were simply small cannon, provided with a stock of wood, and fired by the application of a match to the touch-hole. During the 15th century the hand-gun was steadily improved, and its use became more general. Edward IV., landing in England in 1471 to reconquer his throne, brought with him a force of Burgundian hand-gun men (mercenaries), and in 1476 the Swiss at Morat had no less than 6000 of their men thus armed. The prototype of the modern military weapon is the *arquebus* (*q.v.*), a form of which was afterwards called in England the *caliver.* Various dates are given for the introduction of the arquebus, which owed many of its details to the perfected cross-bow which it superseded. The Spanish army in the Italian wars at the beginning of the 16th century was the first to make full and effective use of the new weapon, and thus to make the fire action of infantry a serious factor in the decision of battles. The Spaniards also took the next step in advance. The *musket* (*q.v.*) was heavier and more powerful than the arquebus, and, in the hands of the duke of Alva's army in the Netherlands, so conclusively proved its superiority that it at once replaced its rival in the armies of Europe. Both the arquebus and the musket had a touch-hole on the right side of the barrel, with a pan for the priming; with which a lighted quick match was brought in contact by pressing a trigger. The musket, on account of its weight, was provided with a long rest, forked in the upper part and furnished with a spike to stick in the ground. The *matchlock* (long-barrelled matchlocks are still used by various uncivilized peoples, notably in India) was the typical weapon of the soldier for two centuries. The class of hand fire-arms provided with an arrangement for striking a spark to ignite the powder charge begins with the *wheel-lock.* This lock was invented at Nuremberg in 1515, but was seldom applied to the arquebus and musket on account of the costliness of its mechanism and the uncertainty of its action. The early forms of flint-lock (*snaphance*) were open to the same objections, and the *fire-lock* (as the flint-lock was usually called) remained for many years after its introduction the armament of special troops only, till about the beginning of the 18th century it finally superseded the old matchlock. Thenceforward the fire-lock (called familiarly in England "Brown Bess") formed with the bayonet (*q.v.*) the armament of all infantry, and the fire-arms carried by other troops were constructed on the same principle. Flint-lock muskets were supplanted about 1830–1840 by the percussion musket, in which a fulminate cap was used. A Scottish clergyman, Alexander Forsyth, invented this method of ignition in 1807, but it was not till 1820 that it began to come into general use. (See Gun.) The system of firing the charge by a fulminate was followed by the invention of the needle-gun (*q.v.*). The muzzle-loading rifle, employed by special troops since about 1800, came into general use in the armies of Europe about 1854–1860. It was superseded, as a result of the success of the needle-gun in the war of 1866, by the breech-loading rifle, this in its turn giving way to the magazine rifle about 1886–1890. (See Rifle.) Neither breech-loaders nor revolvers, however, are inventions of modern date. Both were known in Germany as early as the close of the 15th century. There are in the Musée d'Artillerie at Paris wheel-lock arquebuses of the 16th century which are breech-loaders; and there is, in the Tower armoury, a revolver with the old matchlock, the date of which is about 1550. A German arquebus of the 16th century, in the museum of Sigmaringen, is a revolver of seven barrels. Nor is rifling a new thing in fire-arms, for there was a rifled arquebus of the 15th century, in which the balls were driven home by a mallet, and a patent was taken out in England for rifling in 1635. All these systems were thus known at an early period in the history of fire-arms, but for want of the minutely accurate workmanship required and, above all, of a satisfactory firing arrangement, they were left in an undeveloped state until modern times. The earliest pistols were merely shorter hand-guns, modified for mounted men, and provided with a straight stock which was held against the breastplate (poitrinal or petronel). The long-barrelled pistol was the typical weapon of the cavalry of the 16th century. (See Cavalry.) With the revival of shock tactics initiated by Gustavus Adolphus the length of the pistol barrel became less and less, and its stock was then shaped for the hand alone. (See Pistol.) (C. F. A.)

ARMSTEAD, HENRY HUGH (1828–1905), English sculptor, was first trained as a silversmith, and achieved the highest excellence with the "St George's Vase" and the "Outram Shield." He rose to the front rank among contemporary sculptors, his chief works being the external sculptural decorations of the colonial office in Whitehall, the sculptures on the southern and eastern sides of the podium of the Albert Memorial, the large fountain at King's College, Cambridge, and numerous effigies, such as "Bishop Wilberforce" at Winchester, and "Lord John Thynne" at Westminster, with smaller portraiture and much ideal work. His sense of style and nobility was remarkable; and he was besides gifted with a fine power of design and draughtsmanship, which he put to good use in his early years for book illustration. He was elected associate of the Royal Academy in 1875 and a full member in 1880.

ARMSTRONG, ARCHIBALD (d. 1672), court jester, called "Archy," was a native of Scotland or of Cumberland, and according to tradition first distinguished himself as a sheep-stealer; afterwards he entered the service of James VI., with whom he became a favourite. When the king succeeded to the English throne, Archy was appointed court jester. In 1611 he was granted a pension of two shillings a day, and in 1617 he accompanied James on his visit to Scotland. His influence was considerable and he was greatly courted and flattered, but his success appears to have turned his head. He became presumptuous, insolent and mischievous, excited foolish jealousies between the king and Henry, prince of Wales, and was much disliked by the members of the court. In 1623 he accompanied Prince Charles and Buckingham in their adventure into Spain, where he was much caressed and favoured by the Spanish court and, according to his own account, was granted a pension. His conduct here became more intolerable than ever. He rallied the infanta on the defeat of the Armada and censured the conduct of the expedition to Buckingham's face. Buckingham declared he would have him hanged, to which the jester replied that "dukes had often been hanged for insolence but never fools for talking." On his return he gained some complimentary allusions from Ben Jonson by his attacks upon the Spanish marriage. He retained his post on the accession of Charles I., and accumulated a considerable fortune, including the grant by the king of 1000 acres in Ireland. After the death of Buckingham in 1628, whom he declared "the greatest enemy of three kings," the principal object of his dislike and rude jests was Laud, whom he openly vilified and ridiculed. He pronounced the following grace at Whitehall in Laud's presence: "Great praise be given to God and little *laud* to the devil," and after the news of the rebellion in Scotland in 1637 he greeted Laud on his way to the council chamber at Whitehall with: "Who's fool now? Does not your

Grace hear the news from Stirling about the liturgy?" On Laud's complaint to the council, Archy was sentenced the same day "to have his coat pulled over his head and be discharged the king's service and banished the king's court." He settled in London as a money-lender, and many complaints were made to the privy council and House of Lords of his sharp practices. In 1641 on the occasion of Laud's arrest, he enjoyed a mean revenge by publishing *Archy's Dream; sometimes Jester to his Majestie, but exiled the Court by Canterburie's malice.* Subsequently he resided at Arthuret in Cumberland, according to some accounts his birthplace, where he possessed an estate, and where he died in 1672, his burial taking place on the 1st of April. He was twice married, his second wife being Sybilla Bell. There is no record of any legal offspring, but the baptism of a "base son" of Archibald Armstrong is entered in the parish register of the 17th of December 1643. *A Banquet of Jests: A change of Cheare*, published about 1630, a collection chiefly of dull, stale jokes, is attributed to him, and with still less reason probably *A choice Banquet of Witty Jests . . . Being an addition to Archee's Jests, taken out of his Closet but never published in his Lifetime* (1660).

ARMSTRONG, JOHN (1709–1779), British physician and writer, was born about 1709 at Castletown, Roxburghshire, where his father was parish minister. He graduated M.D. (1732) at Edinburgh University, and soon afterwards settled in London, where he paid more attention to literature than to medicine. He was, in 1746, appointed one of the physicians to the military hospital behind Buckingham House; and, in 1760, physician to the army in Germany, an appointment which he held till the peace of 1763, when he retired on half-pay. For many years he was closely associated with John Wilkes, but quarrelled with him in 1763. He died on the 7th of September 1779. Armstrong's first publication, an anonymous one, entitled *An Essay for Abridging the Study of Physic* (1735), was a satire on the ignorance of the apothecaries and medical men of his day. This was followed two years after by the *Economy of Love*, a poem the indecency of which damaged his professional practice. In 1744 appeared his *Art of Preserving Health*, a very successful didactic poem, and the one production on which his literary reputation rests. His *Miscellanies* (1770) contains some shorter poems displaying considerable humour.

ARMSTRONG, JOHN (1758–1843), American soldier, diplomatist and political leader, born at Carlisle, Pennsylvania, on the 25th of November 1758. His father, also named John Armstrong (1725–1795), a native of the north of Ireland, who had emigrated to the Pennsylvania frontier between 1745 and 1748, served successively as a brigadier-general in the Continental army (1776–77), as brigadier-general and then major-general of the Pennsylvania militia (1777–83), during the War of Independence, and was a member of the Continental Congress in 1779–1780 and again in 1787–1788. The son studied for a time at the College of New Jersey (now Princeton University), and served as a major in the War of Independence. In March 1783, while the Continental army was stationed at Newburgh (*q.v.*), New York, he wrote and issued, anonymously, the famous "Newburgh Addresses." In 1784 he led a force of Pennsylvania militia against the Connecticut settlers in Wyoming Valley, and treated them in such a high-handed manner as to incur the disapproval even of the Pennsylvania legislature. In 1789 he married the sister of Chancellor Robert R. Livingston of New York, and removed to New York city, where his own ability and his family connexion gave him great political influence. In 1801-2 and again in 1803–4 he was a member of the United States Senate. From 1804 to 1810 he was the United States minister to France, and in March 1806 he was joined with James Bowdoin as a special minister to treat through France with Spain concerning the acquisition of Florida, Spanish spoliations of American commerce, and the "Louisiana" boundary. During the War of 1812, he was a brigadier-general in the United States army from July 1812 until January 1813, and from then until August 1814 secretary of war in the cabinet of President Madison, when his unpopularity forced him to resign. "In spite of Armstrong's services, abilities and experience," says Henry Adams, "something in his character always created distrust. He had every advantage of education, social and political connexion, ability and self-confidence; . . . but he suffered from the reputation of indolence and intrigue." Nevertheless, he "introduced into the army an energy wholly new," an energy the results of which were apparent "for half a century." After his resignation he lived in retirement at Red Hook, New York, where he died on the 1st of April 1843. He published *Notices of the War of 1812* (2 vols., 1836; new ed., 1840), the value of which is greatly impaired by its obvious partiality.

The best account of Armstrong's career as minister to France and as secretary of war may be found in Henry Adams's *History of the United States, 1801–1817* (9 vols., New York, 1889–1890).

ARMSTRONG, SAMUEL CHAPMAN (1839–1893), American soldier, philanthropist and educator, was born on Maui, one of the Hawaiian Islands, on the 30th of January 1839, his parents Richard and Clarissa Armstrong, being American missionaries. He was educated at the Punahou school in Honolulu, at Oahu College, into which the Punahou school developed in 1852, and at Williams College, Williamstown, Massachusetts, where he graduated in 1862. He served in the Civil War, on the Union side, from 1862 to 1865, rising in the volunteer service to the regular rank of colonel and the brevet rank of brigadier-general, and, after December 1863, acted as one of the officers of the coloured troops commanded by General William Birney. In November 1865 he was honourably mustered out of the volunteer service. His experience as commander of negro troops had added to his interest, always strong, in the negroes of the south, and in March 1866 he became superintendent of the Ninth District of Virginia, under the Freedman's Bureau, with headquarters near Fort Monroe. While in this position he became convinced that the only permanent solution of the manifold difficulties which the freedmen encountered lay in their moral and industrial education. He remained in the educational department of the Bureau until this work came to an end in 1872; though five years earlier, at Hampton, Virginia, near Fort Monroe, he had founded, with the aid principally of the American Missionary Association, an industrial school for negroes, Hampton Institute, which was formally opened in 1868, and at the head of which he remained until his death, there, on the 11th of May 1893. After 1878 Indians were also admitted to the Institute, and during the last fifteen years of his life Armstrong took a deep interest in the "Indian question." Much of his time after 1868 was spent in the Northern and Eastern states, whither he went to raise funds for the Institute. See *Samuel Chapman Armstrong, a Biographical Study* (New York, 1904), by his daughter, Edith Armstrong Talbot.

His brother, WILLIAM N. ARMSTRONG, was attorney-general in the cabinet of the Hawaiian king Kalakaua I. He accompanied that monarch on a prolonged foreign tour in 1881, visiting Japan, China, Siam, India, Europe and the United States, and in 1904 published an amusing account of the journey, called *Round the World with a King.*

ARMSTRONG, WILLIAM GEORGE ARMSTRONG, BARON (1810–1900), British inventor, founder of the Elswick manufacturing works, was born on the 26th of November 1810, at Newcastle-on-Tyne, and was educated at a school in Bishop Auckland. The profession which he adopted was that of a solicitor, and from 1833 to 1847 he was engaged in active practice in Newcastle as a member of the firm of Donkin, Stable & Armstrong. His sympathies, however, were always with mechanical and scientific pursuits, and several of his inventions date from a time anterior to his final abandonment of the law. In 1841–1843 he published several papers on the electricity of effluent steam. This subject he was led to study by the experience of a colliery engineman, who noticed that he received a sharp shock on exposing one hand to a jet of steam issuing from a boiler with which his other hand was in contact, and the inquiry was followed by the invention of the "hydro-electric" machine, a powerful generator of electricity, which was thought worthy of careful investigation by Faraday. The question of the utilization of water-power had engaged his attention even earlier, and in 1839 he invented an improved rotary water motor. Soon afterwards he designed a hydraulic crane, which contained the germ of all the hydraulic machinery for which he and Elswick were subsequently to become famous. This machine depended simply on the pressure of water acting directly in a cylinder on a piston, which was connected with suitable multiplying gear. In the first example, which was erected on the quay at Newcastle in 1846, the necessary pressure was obtained from the ordinary water mains of the town; but the merits and advantages of the device soon became widely appreciated, and a demand arose for the erection of cranes in positions where the pressure afforded by the mains was insufficient. Of course pressure could always be obtained by the aid of special reservoirs, but to build these was not always desirable, or even practicable. Hence, when in 1850 a hydraulic installation was required for a new ferry station at New Holland, on the Humber estuary, the absence of water mains of any kind, coupled with the prohibitive cost of a special reservoir owing to the character of the soil, impelled him to invent a fresh piece of apparatus, the "accumulator," which consists of a large cylinder containing a piston that can be loaded to give any desired pressure, the water being pumped in below it by a steam-engine or other prime mover. This simple device may be looked upon as the crown of the hydraulic system, since by its various modifications the installation of hydraulic power became possible in almost any situation. In particular, it was rendered practicable on board ship, and its application to the manipulation of heavy naval guns and other purposes on warships was not the least important of Armstrong's achievements.

The Elswick works were originally founded for the manufacture of this hydraulic machinery, but it was not long before they became the birthplace of a revolution in gunmaking; indeed, could nothing more be placed to Armstrong's credit than their establishment, his name would still be worthy of remembrance. Modern artillery dates from about 1855, when Armstrong's first gun made its appearance. This weapon embodied all the essential features which distinguish the ordnance of to-day from the cannon of the middle ages—it was built up of rings of metal shrunk upon an inner steel barrel; it was loaded at the breech; it was rifled; and it threw, not a round ball, but an elongated projectile with ogival head. The guns constructed on this principle yielded such excellent results, both in range and accuracy, that they were adopted by the British government in 1859, Armstrong himself being appointed engineer of rifled ordnance and receiving the honour of knighthood. At the same time the Elswick Ordnance Company was formed to manufacture the guns under the supervision of Armstrong, who, however, had no financial interest in the concern; it was merged in the Elswick Engineering Works four years later. Great Britain thus originated a principle of gun construction which has since been universally followed, and obtained an armament superior to that possessed by any other country at that time. But while there was no doubt as to the shooting capacities of these guns, defects in the breech mechanism soon became equally patent, and in a few years caused a reversion to muzzle-loading. Armstrong resigned his position in 1863, and for seventeen years the government adhered to the older method of loading, in spite of the improvements which experiment and research at Elswick and elsewhere had during that period produced in the mechanism and performance of heavy guns. But at last Armstrong's results could no longer be ignored; and wire-wound breech-loading guns were received back into the service in 1880. The use of steel wire for the construction of guns was one of Armstrong's early ideas. He perceived that to coil many turns of thin wire round an inner barrel was a logical extension of the large hooped method already mentioned, and in conjunction with I. K. Brunel, was preparing to put the plan to practical test when the discovery that it had already been patented caused him to abandon his intention, until about 1877. This incident well illustrates the ground of his objection to the British system of patent law, which he looked upon as calculated to strifle invention and impede progress; the patentees in this case did not manage to make a practical success of their invention themselves, but the existence of prior patents was sufficient to turn him aside from a path which conducted him to valuable results when afterwards, owing to the expiry of those patents, he was free to pursue it as he pleased.

Lord Armstrong, who was raised to the peerage in 1887, was the author of *A Visit to Egypt* (1873), and *Electric Movement in Air and Water* (1897), besides many professional papers. He died on the 27th of December 1900, at Rothbury, Northumberland. His title became extinct, but his grand-nephew and heir, W. H. A. F. Watson-Armstrong (b. 1863), was in 1903 created Baron Armstrong of Bamburgh and Cragside.

ARMY (from Fr. *armée*, Lat. *armata*), a considerable body of men armed and organized for the purpose of warfare on land (Ger. *Armee*), or the whole armed force at the disposal of a state or person for the same purpose (Ger. *Heer*=host). The application of the term is sometimes restricted to the permanent, active or regular forces of a state. The history of the development of the army systems of the world is dealt with in this article in sections 1 to 38, being followed by sections 39 to 59 on the characteristics of present-day armies. The remainder of the article is devoted to sections on the history of the principal armies of Europe, and that of the United States. For the Japanese Army see JAPAN, and for the existing condition of the army in each country see under the country heading.

GENERAL HISTORY

1. *Early Armies.*—It is only with the evolution of the specially military function in a tribe or nation, expressed by the separation of a warrior-class, that the history of armies (as now understood) commences. Numerous savage tribes of the present day possess military organizations based on this system, but it first appears in the history of civilization amongst the Egyptians. By the earliest laws of Egypt, provision was made for the support of the warriors. The exploits of her armies under the legendary Sesostris cannot be regarded as historical, but it appears certain that the country possessed an army, capable of waging war in a regular fashion, and divided thus early into separate arms, these being chariots, infantry and archers. The systems of the Assyrians and Babylonians present no particular features of interest, save that horsemen, as distinct from charioteers, appear on the scene. The first historical instance of a military organization resembling those of modern times is that of the Persian empire.

2. *Persia.*—Drawn from a hardy and nomadic race, the armies of Persia at first consisted mainly of cavalry, and owed much of their success to the consequent ease and rapidity of their movements. The warlike Persians constantly extended their power by fresh conquests, and for some time remained a distinctly conquering and military race, attaining their highest power under Cyrus and Cambyses. Cyrus seems to have been the founder of a comprehensive military organization, of which we gather details from Xenophon and other writers. To each province was allotted a certain number of soldiers as standing army. These troops, formed originally of native Persians only, were called the king's troops. They comprised two classes, the one devoted exclusively to garrisoning towns and castles, the other distributed throughout the country. To each province was appointed a military commander, responsible for the number and efficiency of the troops in his district, while the civil governor was answerable for their subsistence and pay. Annual musters were held, either by the king in person or by generals deputed for the purpose and invested with full powers. This organization seems to have fully answered its original purpose, that of holding a vast empire acquired by conquest and promptly repelling inroads or putting down insurrections. But when a great foreign war was contemplated, the standing army was augmented by a levy throughout the empire. The extent of the empire made such a levy a matter of time, and the heterogeneous and unorganized mass of men of all nations so brought together was a source of weakness rather than strength. Indeed, the vast hosts over which the Greeks gained their victories comprised

but a small proportion of the true Persians. The cavalry alone seems to have retained its national character, and with it something of its high reputation, even to the days of Alexander.

3. *Greece.*—The Homeric armies were tribal levies of foot, armed with spear, sword, bow, &c., and commanded by the chiefs in their war-chariots. In historic times all this is changed. Greece becomes a congeries of city-states, each with its own citizen-militia. Federal armies and permanent troops are rare, the former owing to the centrifugal tendency of Greek politics, the latter because the "tyrannies," which must have relied very largely on standing armies to maintain themselves, had ultimately given way to democratic institutions. But the citizen-militia of Athens or Sparta resembled rather a modern "nation in arms" than an auxiliary force. Service was compulsory in almost all states, and as the young men began their career as soldiers with a continuous training of two or three years, Hellenic armies, like those of modern Europe, consisted of men who had undergone a thorough initial training and were subsequently called up as required. Cavalry, as always in the broken country of the Peloponnesus, was not of great importance, and it is only when the theatre of Greek history is extended to the plains of Thessaly that the mounted men become numerous. In the 4th century the mainstay of Greek armies was the *hoplite* (ὁπλίτης), the heavy-armed infantryman who fought in the *corps de bataille*; the light troops were men who could not provide the full equipment of the hoplite, rather than soldiers trained for certain special duties such as skirmishing. The fighting formation was that of the *phalanx*, a solid corps of hoplites armed with long spears. The armies were recruited for each war by calling up one or more classes of men in reserve according to age. It was the duty and privilege of the free citizen to bear arms; the slaves were rarely trusted with weapons.

4. *Sparta.*—So much is common to the various states. In Sparta the idea of the nation in arms was more thoroughly carried out than in any other state in the history of civilization. In other states the individual citizen often lived the life of a soldier, here the nation lived the life of a regiment. Private homes resembled the "married quarters" of a modern army; the unmarried men lived entirely in barracks. Military exercises were only interrupted by actual service in the field, and the whole life of a man of military age was devoted to them. Under these circumstances, the Spartans maintained a practically unchallenged supremacy over the armies of other Greek states; sometimes their superiority was so great that, like the Spanish regulars in the early part of the Dutch War of Independence, they destroyed their enemies with insignificant loss to themselves. The surrender of a Spartan detachment, hopelessly cut off from all assistance, and the victory of a body of well-trained and handy light infantry over a closed battalion of Spartiates were events so unusual as seriously to affect the course of Greek history.

5. *Greek Mercenaries.*—The military system of the 4th century was not called upon to provide armies for continuous service on distant expeditions. When, after the earlier campaigns of the Peloponnesian War, the necessity for such expeditions arose, the system was often strained almost to breaking point, (*e.g.* in the case of the Athenian expedition to Syracuse), and ultimately the states of Greece were driven to choose between unprofitable expenditure of the lives of citizens and recruiting from other sources. Mercenaries serving as light troops, and particularly as *peltasts* (a new form of disciplined "light infantry") soon appeared. The *corps de bataille* remained for long the old phalanx of citizen hoplites. But the heavy losses of many years told severely on the resources of every state, and ultimately non-national recruits—adventurers and soldiers of fortune, broken men who had lost their possessions in the wars, political refugees, runaway slaves, &c.—found their way even into the ranks of the hoplites, and Athens at one great crisis (407) enlisted slaves, with the promise of citizenship as their reward. The Arcadians, like the Scots and the Swiss in modern history, furnished the most numerous contingent to the new professional armies. A truly national army was indeed to appear once more in the history of the Peloponnesus, but in the meantime the professional soldier held the field. The old bond of strict citizenship once broken, the career of the soldier of fortune was open to the adventurous Greek. Taenarum and Corinth became regular *entrepôts* for mercenaries. The younger Cyrus raised his army for the invasion of Persia precisely as the emperors Maximilian and Charles V. raised regiments of *Landsknechte*—by the issue of recruiting commissions to captains of reputation. This army became the famous Ten Thousand. It was a marching city-state, its members not desperate adventurers, but men with the calm self-respect of Greek civilization. On the fall of its generals, it chose the best officers of the army to command, and obeyed implicitly. Cheirisophus the Spartan and Xenophon the Athenian, whom they chose, were not plausible demagogues; they were line officers, who, suddenly promoted to the chief command under circumstances of almost overwhelming difficulty, proved capable of achieving the impossible. The merit of choosing such leaders is not the least title to fame of the Ten Thousand mercenary Greek hoplites. About the same time Iphicrates with a body of mercenary *peltasts* destroyed a *mora* or corps of Spartan hoplites (391 B.C.).

6. *Epaminondas.*—Not many years after this, Spartan oppression roused the Theban revolt, and the Theban revolt became the Theban hegemony. The army which achieved this under the leadership of Epaminondas, one of the great captains of history, had already given proofs of its valour against Xenophon and the Cyreian veterans. Still earlier it had won the great victory of Delium (424 B.C.).

It was organized, as were the professional armies, on the accepted model of the old armies, viz. the phalangite order, but the addition of peltasts now made a Theban army, unlike the Spartans, capable of operating in broken country as well as in the plain. The new tactics of the phalanx, introduced by Epaminondas, embodied, for the first time in the history of war, the modern principle of local superiority of force, and suggested to Frederick the Great the famous "oblique order of battle." Further, the cavalry was more numerous and better led than that of Peloponnesian states. The professional armies had well understood the management of cavalry; Xenophon's handbook of the subject is not without value in the 20th century. In Greek armies the dearth of horses and the consequent numerical weakness of the cavalry prevented the bold use of the arm on the battlefield (see CAVALRY). But Thebes had always to deal with nations which possessed numerous horsemen. Jason of Pherae, for instance, put into the field against Thebes many thousands of Thessalian horse; and thus at the battle of Tegyra in 375 the Theban cavalry under Pelopidas, aided by the *corps d'élite* of infantry called the Sacred Band, carried all before them. At Leuctra Epaminondas won a glorious victory by the use of his "oblique order" tactics; the same methods achieved the second great victory of Mantineia (362 B.C.) at which Epaminondas fell. Pelopidas had already been slain in a battle against the Thessalians, and there was no leader to carry on their work. But the new Greek system was yet to gain its greatest triumphs under Alexander the Great.

7. *Alexander.*—The reforms of Alexander's father, Philip of Macedon, may most justly be compared to those of Frederick William I. in Prussia. Philip had lived at Thebes as a hostage, and had known Iphicrates, Epaminondas and Pelopidas. He grafted the Theban system of tactics on to the Macedonian system of organization. That the latter—a complete territorial system—was efficient was shown by the fact that Philip's blow was always struck before his enemies were ready to meet it. That the new Greek tactics, properly used, were superior to the old was once more demonstrated at Chaeronea (338 B.C.), where the Macedonian infantry militia fought in phalanx, and the cavalry, led by the young Alexander, delivered the last crushing blow. On his accession, like Frederick the Great, Alexander inherited a well-trained and numerous army, and was not slow to use it. The invasion of Asia was carried out by an army of the Greek pattern, formed both of Hellenes and of

non-Hellenes on an exceedingly strong Macedonian nucleus. Alexander's own guard was composed of picked horse and foot. The infantry of the line comprised Macedonian and Greek hoplites, the Macedonians being subdivided into heavy and medium troops. These fought in a grand phalanx, which was subdivided into units corresponding to the modern divisions, brigades and regiments, the fighting formation being normally a line of battalion masses. The arm of the infantry was the 18-foot pike (*sarissa*). The peltasts, Macedonian and Greek, were numerous and well trained, and there was the usual mass of irregular light troops, bowmen, slingers, &c. The cavalry included the Guard (ἄγημα), a body of heavy cavalry composed of chosen Macedonians, the line cavalry of Macedonia (ἑταῖροι) and Thessaly, the numerous small contingents of the Greek states, mercenary corps and light lancers for outpost work. The final blow and the gathering of the fruits of victory were now for the first time the work of the mounted arm. The solid phalanx was almost unbreakable in the earlier stages of the battle, but after a long infantry fight the horsemen had their chance. In former wars they were too few and too poorly mounted to avail themselves of it, and decisive victories were in consequence rarely achieved in battles of Greek versus Greek. Under Epaminondas, and still more under Philip and Alexander, the cavalry was strong enough for its new work. Battles are now ended by the shock action of mounted men, and in Alexander's time it is noted as a novelty that the cavalry carried out the pursuit of a beaten army. There were further, in Alexander's army, artillerymen with a battering train, engineers and departmental troops, and also a medical service, an improvement attributed to Jason of Pherae. The victories of this army, in close order and in open, over every kind of enemy and on every sort of terrain, produced the Hellenistic world, and in that achievement the history of Greek armies closes, for after the return of the greater part of the Europeans to their homes the armies of Alexander and his successors, while preserving much of the old form, become more and more orientalized.

The decisive step was taken in 323, when a picked contingent of Persians, armed mainly with missile weapons, was drafted into the phalanx, in which henceforward they formed the middle ranks of each file of sixteen men. But, like the third rank of Prussian infantry up to 1888, they normally fought as skirmishers in advance, falling into their place behind the pikes of the Macedonian file-leaders only if required for the decisive assault. The new method, of course, depended for success on the steadiness of the thin three-deep line of Macedonians thus left as the line of battle. Alexander's veterans were indeed to be trusted, but as time went on, and little by little the war-trained Greeks left the service, it became less and less safe to array the Hellenistic army in this shallow and articulated order of battle. The purely formal organization of the phalanx sixteen deep became thus the actual tactical formation, and around this solid mass of 16,384 men gathered the heterogeneous levies of a typical oriental army. Pyrrhus, king of Epirus, retained far more of the tradition of Alexander's system than his contemporaries farther east, yet his phalanx, comparatively light and mobile as it was, achieved victories over the Roman legion only at the cost of self-destruction. Even elephants quickly became a necessary adjunct to Hellenistic armies.

8. *Carthage.*—The military systems of the Jews present few features of unusual interest. The expedient of calling out successive contingents from the different tribes, in order to ensure continuity in military operations, should, however, be noticed. David and Solomon possessed numerous permanent troops which served as guards and garrisons; in principle this organization was identical with that of the Persians, and that of Europe in the 16th and 17th centuries. Particular interest attaches to the Carthaginian military forces of the 3rd century B.C. Rarely has any army achieved such renown in the short space of sixty years (264–202 B.C.). Carthage produced a series of great generals, culminating in Hannibal, who is marked out, even by the little that is known of him, as the equal of Napoleon. But Napoleon was supported by a national army, Hannibal and his predecessors were condemned to work with armies of mercenaries. For the first time in the world's history war is a matter with which the civil population has no concern. The merchants of Carthage fought only in the last extremity; the wars in which their markets were extended were conducted by non-national forces and directed by the few Carthaginian citizens who possessed military aptitudes. The civil authorities displayed towards their instruments a spirit of hatred for which it is difficult to find a parallel. Unsuccessful leaders were crucified, the mercenary soldiers were cheated of their pay, and broke out into a mutiny which shook the empire of Carthage to its foundations. But the magnetism of a leader's personality infused a corporate military spirit into these heterogeneous Punic armies, and history has never witnessed so complete an illustration of the power of pure and unaided *esprit de corps* as in the case of Hannibal's army in Italy, which, composed as it was of Spaniards, Africans, Gauls, Numidians, Italians and soldiers of fortune of every country, was yet welded by him into thorough efficiency. The army of Italy was as great in its last fight at Zama as the army of Spain at Rocroi; its victories of the Trebia, Trasimene and Cannae were so appalling that, two hundred years later, the leader to whom these soldiers devoted their lives was still, to a Roman, the "dire" Hannibal.

In their formal organization the Carthaginian armies resembled the new Greek model, and indeed they were created in the first instance by Xanthippus, a Spartan soldier in the service of Carthage, who was called upon to raise and train an army when the Romans were actually at the gates of Carthage, and justified his methods in the brilliant victory of Tunis (255 B.C.). For the solid Macedonian phalanx of 16,000 spears Xanthippus substituted a line of heavy battalions equal in its aggregate power of resistance to the older form, and far more flexible. The triumphs of the cavalry arm in Hannibal's battles far excelled those of Alexander's horsemen. Hannibal chose his fighting ground whenever possible with a view to using their full power, first to defeat the hostile cavalry, then to ride down the shaken infantry masses, and finally to pursue *au fond*. At Cannae, the greatest disaster ever suffered by the Romans, the decisive blow and the slaughter were the work of Hannibal's line cavalry, the relentless pursuit that of his light horse. But a professional long-service army has always the greatest difficulty in making good its losses, and in the present case it was wholly unable to do so. Even Hannibal failed at last before the sustained efforts of the citizen army of Rome.

9. *Roman Army under the Republic.*—The earliest organization of the Roman army is attributed to Romulus, who formed it on the tribal principle, each of the three tribes contributing its contingent of horse and foot. But it was to Servius Tullius that Rome owed, traditionally, the complete classification of her citizen-soldiers. For the details of the Roman military system, see ROMAN ARMY. During the earlier period of Roman history the army was drawn entirely from the first classes of the population, who served without pay and provided their own arms and armour. The wealthiest men (*equites*) furnished the cavalry, the remainder the infantry, while the poorer classes either fought as light troops or escaped altogether the privilege and burden of military service. Each "legion" of 3000 heavy foot was at first formed in a solid phalanx. The introduction of the elastic and handy three-line formation with intervals (similar in many respects to Alexander's) was brought about by the Gallic wars, and is attributed to M. Furius Camillus, who also, during the siege of Veii, introduced the practice of paying the soldiers, and thus removed the chief obstacle to the employment of the poorer classes. The new order of battle was fully developed in the Pyrrhic Wars, and the typical army of the Republic may be taken as dating from the latter part of the 3rd century B.C. The legionary was still possessed of a property qualification, but it had become relatively small. An annual levy was made at Rome to provide for the campaign of the year. Discipline was severe, and the rewards appealed as much to the soldier's honour as to his desire of gain. A legion now consisted of three lines (*Hastati*, *Principes*, *Triarii*), each line composed of men of

similar age and experience, and was further subdivided into thirty "maniples," each of two "centuries." The normal establishment of 300 cavalry, 3000 heavy and 1200 light infantry was still maintained, though in practice these figures were often exceeded. In place of the old light-armed and somewhat inferior *rorarii*, the new *velites* performed light infantry duties (211 B.C.), at the same time retaining their place in the maniples, of which they formed the last ranks (compare the Macedonian phalanx as reorganized in 323, § 7 above). The 300 cavalry of the legion were trained for shock action. But the strength of the Roman army lay in the heavy legionary infantry of citizens. The thirty maniples of each legion stood in three lines of battle, but the most notable point of their formation was that each maniple stood by itself on its own small manœuvre-area, free to take ground to front or flank. To the Roman legion was added a legion of allies, somewhat differently organized and possessing more cavalry, and the whole force was called a "double legion" or briefly a "legion." A consul's army consisted nominally of two double legions, but in the Punic wars military exigencies rather than custom dictated the numbers of the army, and the two consuls at Cannae (216 B.C.) commanded two double consular armies, or eight double legions.

10. *Characteristics of the Roman Army.*—Such in outline was the Roman military organization at the time when it was put to the severe test of the Second Punic War. Its elements were good, its military skill superior to that of any other army of ancient history, while its organization was on the whole far better than any that had gone before. The handy formation of maniples at open order was unique in the ancient world, and it did not reappear in history up to the advent of Gustavus Adolphus. In this formation, in which everything was entrusted to the skill of subordinates and the individual courage of the rank and file, the Romans met and withstood with success every type of impact, from the ponderous shock of the Macedonian phalanx and the dangerous rush of Celtic savages to the charge of elephants. Yet it was no particular virtue in the actual form employed that carried the Roman arms to so many victories. There would have been positive danger in thus articulating the legion had it been composed of any but the most trustworthy soldiers. To swiftness and precision of manœuvre they added a dogged obstinacy over which nothing but overwhelming disaster prevailed. It is, therefore, not unnatural to ask wherein the system which produced these soldiers failed, as it did within a century after the battle of Zama. The greatest defect was the want of a single military command. The civil magistrates of Rome were *ex officio* leaders of her armies, and though no Roman officer lacked military training, the views of a consul or praetor were almost invariably influenced by the programme of his political party. When, as sometimes happened, the men under their command sided in the political differences of their leaders, all real control came to an end. The soldiers of the Republic hardly ever forgot that they were citizens with voting powers; they served as a rule only during a campaign; and, while there could be little question as to their patriotism and stubbornness, they lacked almost entirely that *esprit de corps* which is found only amongst the members of a body having a permanent corporate existence. Thus they had the vices as well as the virtues of a nation in arms, and they fell still further short of the ideal because of the dubious and precarious tenure of their generals' commands. The great officers were usually sent home at the end of a campaign, to be replaced by their elected successors, and they showed all the hesitation and fear of responsibility usually found in a temporary commander. Above all, when two armies, each under its own consul or praetor, acted together, the command was either divided or exercised on alternate days.

11. *Roman Empire.*—The essential weaknesses of militia forces and the accidental circumstances of that under consideration led, even in earlier times, to the adoption of various expedients which for a time obviated the evils to which allusion has been made. But a change of far greater importance followed the final exploits of the armies of the old system. The increasing dominions of the Republic, the spread of wealth and luxury, the gradual decadence of the old Roman ideas, all tended to produce an army more suited to the needs of the newer time than the citizen militia of the 3rd century. Permanent troops were a necessity; the rich, in their newly acquired dislike of personal effort, ceased to bear their share in the routine life of the army, and thus the proletariat began to join the legions with the express intention of taking to a military career. The actual change from the old *régime* to the new was in the main the work of Gaius Marius. The urgent demand for men at the time of the Teutonic invasions caused the service to be thrown open to all Roman citizens irrespective of *census*. The new territories furnished cavalry, better and more numerous than the old *equites*, and light troops of various kinds to replace the *velites*. Only the heavy foot remained a purely Italian force, and the spread of the Roman citizenship gradually abolished the distinction between a Roman and an allied legion. The higher classes had repeatedly shown themselves unwilling to serve under plebeians (*e.g.* Varro and Flaminius); Marius preferred to have as soldiers men who did not despise him as an inferior. Under all these influences for good or for evil, the standing army was developed in the first half of the 1st century B.C. The tactical changes in the legion indicate its altered character. The small maniples gave way to heavy "cohorts," ten cohorts forming the legion; as in the Napoleonic wars, light and handy formations became denser and more rigid with the progressive decadence in *moral* of the rank and file. It is more significant still that in the days of Marius the annual oath of allegiance taken by the soldier came to be replaced by a personal vow, taken once and for all, of loyalty to the general. *Ubi bene, ibi patria* was an expression of the new spirit of the army, and Caesar had but to address his men as *quirites* (civilians) to quell a mutiny. *Hastati*, *principes* and *triarii* were now merely expressions in drill and tactics. But perhaps the most important of all these changes was the growth of regimental spirit and tradition. The legions were now numbered throughout the army, and the Tenth Legion has remained a classic instance of a "crack" corps. The *moral* of the Roman army was founded no longer on patriotism, but on professional pride and *esprit de corps*.

With this military system Rome passed through the era of the Civil Wars, at the end of which Augustus found himself with forty-five legions on his hands. As soon as possible he carried through a great reorganization, by which, after ruthlessly rejecting inferior elements, he obtained a smaller picked force of twenty-five legions, with numerous auxiliary forces. These were permanently stationed in the frontier provinces of the Empire, while Italy was garrisoned by the Praetorian cohorts, and thus was formed a regular long-service army, the strength of which has been estimated at 300,000 men. But these measures, temporarily successful, produced in the end an army which not only was perpetually at variance with the civil populations it was supposed to protect, but frequently murdered the emperors to whom it had sworn allegiance when it raised them to the throne. The evil fame of the Italian cohorts has survived in the phrase "praetorianism" used to imply a venal military despotism. The citizens gradually ceased to bear arms, and the practice of self-mutilation became common. The inevitable *dénouement* was delayed from time to time by the work of an energetic prince. But the ever-increasing inefficiency and factiousness of the legions, and the evanescence of all military spirit in the civil population, made it easy for the barbarians, when once the frontier was broken through, to overrun the decadent Empire. The end came when the Gothic heavy horse annihilated the legions of Valens at Adrianople (A.D. 378).

There was now no resource but to take the barbarians into Roman pay. Under the name of *foederati*, the Gothic mercenary cavalry played the most conspicuous part in the succeeding wars of the Empire, and began the reign of the heavy cavalry arm, which lasted for almost a thousand years. Even so soon as within six years of the death of Valens twenty thousand Gothic horse decided a great battle in the emperor's favour. These men, however, became turbulent and factious, and it was not until the emperor Leo I. had regenerated the native Roman soldier that the balance was maintained between the national and the hired warrior. The work of this emperor and of his successors found eventual expression in the victories of Belisarius and Narses, in which the Romans, in the new rôle of horse-archers, so well combined their efforts with those of the *foederati* that neither the heavy cavalry of the Goths nor the phalanx of Frankish infantry proved to be capable of resisting the imperial forces. At the battle of Casilinum (553) Roman foot-archers and infantry bore no small part of the work. It was thus in the Eastern Empire that the Roman military spirit revived, and the Byzantine army, as evolved from the system of Justinian, became eventually the sole example of a fully organized service to be found in medieval history.

12. *The "Dark Ages."*—In western Europe all traces of Roman military institutions quickly died out, and the conquerors of the new kingdoms developed fresh systems from the simple tribal levy. The men of the plains were horsemen, those of marsh and moor were foot, and the four greater peoples retained these original characteristics long after the conquest had been completed. In organization the Lombards and Franks, Visigoths and English scarcely differed. The whole military population formed the mass of the army, the chiefs and their personal retainers the *élite*. The Lombards and the Visigoths were naturally cavalry; the Franks and the English were, equally naturally, infantry, and the armies of the Merovingian kings differed but little from the English *fyrd* with which Offa and Penda fought their battles. But in these nations the use of horses and armour, at first confined to kings and great chiefs, gradually spread downwards to the ever-growing classes of *thegns*, *comites*, &c. Finally, under Charlemagne were developed the general lines of the military organization which eventually became feudalism. For his distant wars he required an efficient and mobile army. Hence successive "capitularies" were issued dealing with matters of recruiting, organization, discipline and field service work. Very noticeable are his system of forts (*burgi*) with garrisons, his military train of artillery and supplies, and the reappearance of the ancient principle that three or four men should equip and maintain one of themselves as a warrior. These and other measures taken by him tended to produce a strong veteran army, very different in efficiency from the tumultuary levy, to which recourse was had only in the last resort. While war (as a whole) was not yet an art, fighting (from the individual's point of view) had certainly become a special function; after Charlemagne's time the typical feudal army, composed of well-equipped cavalry and ill-armed peasantry serving on foot, rapidly developed. Enemies such as Danes and Magyars could only be dealt with by mounted men who could ride round them, compel them to fight, and annihilate them by the shock of the charge; consequently the practice of leaving the infantry in rear, and even at home, grew up almost as a part of the feudal system of warfare. England, however, sought a different remedy, and thus diverged from the continental methods. This remedy was the creation of a fleet, and, the later Danish wars being there carried out, not by bands of mounted raiders, but by large armies of military settlers, infantry retained its premier position in England up to the day of Hastings. Even the *thegns*, who there, as abroad, were the mainstay of the army, were heavy-armed infantry. The only contribution made by Canute to the military organization of England was the retention of a picked force of *hus carles* (household troops) when the rest of the army with which he had conquered his realm was sent back to Scandinavia. At Hastings, the forces of Harold consisted wholly of infantry. The English array was composed of the king and his personal friends, the *hus carles*, and the contingents of the *fyrd* under the local *thegns*; though better armed, they were organized after the manner of their forefathers. On that field there perished the best infantry in Europe, and henceforward for three centuries there was no serious rival to challenge the predominance of the heavy cavalry.

13. *The Byzantines* (cf. article ROMAN EMPIRE, LATER).—While the west of Europe was evolving feudalism, the Byzantine empire was acquiring an army and military system scarcely surpassed by any of those of antiquity and not often equalled up to the most modern times. The *foederati* disappeared after the time of Justinian, and by A.D. 600 the army had become at once professional and national. For generations, regiments had had a corporate existence. Now brigades and divisions also appeared in war, and, somewhat later, in peace likewise. With the disappearance of the barbarians, the army became one homogeneous service, minutely systematized, and generally resembling an army in the modern sense of the word. The militia of the frontier districts performed efficiently the service of surveillance, and the field forces of disciplined regulars were moved and employed in accordance with well-reasoned principles of war; their maintenance was provided for by a scutage, levied, in lieu of service, on the central provinces of the empire. Later, a complete territorial system of recruiting and command was introduced. Each "theme" (military district) had its own regular garrison, and furnished a field division of some 5000 picked troopers for a campaign in any theatre of war. Provision having been made in peace for a depot system, all weakly men and horses could be left behind, and local duties handed over to second line troops; thus the field forces were practically always on a war footing. Beside the "themes" under their generals, there were certain districts on the frontiers, called "clissuras," placed under chosen officers, and specially organized for emergency service. The corps of officers in the Byzantine army was recruited from the highest classes, and there were many families (*e.g.* that from which came the celebrated Nicephorus Phocas) in which soldiering was the traditional career. The rank and file were either military settlers or men of the yeoman class, and in either case had a personal interest in the safety of the theme which prevented friction between soldiers and civilians. The principal arm was, of course, cavalry, and infantry was employed only in special duties. Engineer, train and medical services were maintained in each theme. Of the *ensemble* of the Byzantine army it has been said that "the art of war as it was understood at Constantinople . . . was the only system of real merit existing. No western nation could have afforded such a training to its officers till the 16th or . . . 17th century." The vitality of such an army remained intact long after the rest of the empire had begun to decay, and though the old army practically ceased to exist after the great disaster of Manzikert (1071), the barbarians and other mercenaries who formed the new service were organized, drilled and trained to the same pitch of military efficiency. Indeed the greatest tactical triumph of the Byzantine system (Calavryta, 1079) was won by an army already largely composed of foreigners. But mercenaries in the end developed praetorianism, as usual, and at last they actually mutinied, in the presence of the enemy, for higher pay (Constantinople, 1204).

14. *Feudalism.*—From the military point of view the change under feudalism was very remarkable. For the first time in the history of western Europe there appears, in however rough a form, a systematized obligation to serve in arms, regulated on a territorial basis. That army organization in the modern sense—organization for tactics and command—did not develop in any degree commensurate with the development of military administration, was due to the peculiar characteristics of the feudal system, and the virtues and weaknesses of medieval armies were its natural outcome. Personal bravery, the primary virtue of the soldier, could not be wanting in the members of a military class, the *métier* of which was war and manly exercises. Pride of caste, ambition and knightly emulation, all helped to raise to a high standard the individual efficiency of the feudal cavalier. But the gravest faults of the system, considered as an army organization, were directly due to this personal element. Indiscipline, impatience of superior control, and dangerous knight-errantry, together with the absence of any chain of command, prevented the feudal cavalry from achieving results at all proportionate to the effort expended and the potentialities of a force with so many soldierly qualities. If such defects were habitually found in the best elements of the army—the feudal tenants and subtenants who formed the heavy cavalry arm—

little could be expected of the despised and ill-armed foot-soldiery of the levy. The swift raids of the Danes and others (see above) had created a precedent which in French and German wars was almost invariably followed. The feudal levy rarely appeared at all on the battlefield, and when it was thus employed it was ridden down by the hostile knights, and even by those of its own party, without offering more than the feeblest resistance. Above all, one disadvantage, common to all classes of feudal soldiers, made an army so composed quite untrustworthy. The service which a king was able to exact from his feudatories was so slight (varying from one month to three in the year) that no military operation which was at all likely to be prolonged could be undertaken with any hope of success.

15. *Medieval Mercenaries.*—It was natural, therefore, that a sovereign who contemplated a great war should employ mercenaries. These were usually foreigners, as practically all national forces served on feudal terms. While the greater lords rode with him on all his expeditions, the bulk of his army consisted of professional soldiers, paid by the levy of *scutage* imposed upon the feudal tenantry. There had always been soldiers of fortune. William's host at Hastings contained many such men; later, the Flemings who invaded England in the days of Henry I. sang to each other—

> "Hop, hop, Willeken, hop! England is mine and thine,"—

and from all the evidence it is clear that in earlier days the hired soldiers were adventurers seeking lands and homes. But these men usually proved to be most undesirable subjects, and sovereigns soon began to pay a money wage for the services of mercenaries properly so called. Such were the troops which figured in English history under Stephen. Such troops, moreover, formed the main part of the armies of the early Plantagenets. They were, as a matter of course, armed and armoured like the knights, with whom they formed the men-at-arms (*gendarmes*) of the army. Indeed, in the 11th and 12th centuries, the typical army of France or the Empire contains a relatively small percentage of "knights," evidence of which fact may be found even in so fanciful a romance as *Aucassin and Nicolete*. It must be noted, however, that not all the mercenaries were heavy cavalry; the Brabançon pikeman and the Italian crossbowman (the value of whose weapon was universally recognized) often formed part of a feudal army.

16. *Infantry in Feudal Times.*—These mercenary foot soldiers came as a rule from districts in which the infantry arm had maintained its ancient predominance in unbroken continuity. The cities of Flanders and Brabant, and those of the Lombard plain, had escaped feudal interference with their methods of fighting, and their burgher militia had developed into solid bodies of heavy-armed pikemen. These were very different from those of the feudal levy, and individual knightly bravery usually failed to make the slightest impression on a band of infantry held together by the stringent corporate feeling of a trade-gild. The more adventurous of the young men, like those of the Greek cities, took service abroad and fought with credit in their customary manner. The reign of the "Brabançon" as a mercenary was indeed short, but he continued, in his own country, to fight in the old way, and his successor in the profession of arms, the Genoese crossbowman, was always highly valued. In England, moreover, the infantry of the old *fyrd* was not suffered to decay into a rabble of half-armed countrymen, and in France a burgher infantry was established by Louis VI. under the name of the *milice des communes*, with the idea of creating a counterpoise to the power of the feudatories. Feudalism, therefore, as a military system, was short-lived. Its limitations had always necessitated the employment of mercenaries, and in several places a solid infantry was coming into existence, which was drawn from the sturdy and self-respecting middle classes, and in a few generations was to prove itself a worthy opponent not only to the knight, but to the professional man-at-arms.

17. *The Crusades.*—It is an undoubted fact that the long wars of the Crusades produced, directly, but slight improvement in the feudal armies of Europe. In the East large bodies of men were successfully kept under arms for a considerable period, but the application of crusading methods to European war was altogether impracticable. In the first place, much of the permanent force of these armies was contributed by the military orders, which had no place in European political activities. Secondly, enthusiasm mitigated much of the evil of individualism. In the third place, there was no custom to limit the period of service, since the Crusaders had undertaken a definite task and would merely have stultified their own purpose in leaving the work only half done. There were, therefore, sharp contrasts between crusading and European armies. In the latter, systematization was confined to details of recruiting; in the armies of the Cross, men were from time to time obtained by the accident of religious fervour, while at the same time continuous service produced a relatively high system of tactical organization. Different conditions, therefore, produced different methods, and crusading unity and discipline could not have been imposed on an ordinary army, which indeed with its paid auxiliaries was fairly adequate for the somewhat desultory European wars of that time. The statement that the Crusaders had a direct influence on the revival of infantry is hardly susceptible of convincing demonstration, but it is at any rate beyond question that the social and economic results of the Crusades materially contributed to the downfall of the feudal knight, and in consequence to a rise in the relative importance of the middle classes. Further, not only were the Crusading knights compelled by their own want of numbers to rely on the good qualities of the foot, but the foot themselves were the "survivors of the fittest," for the weakly men died before they reached the Holy Land, and with them there were always knights who had lost their horses and could not obtain remounts. Moreover, when "simple" and "gentle" both took the Cross there could be no question of treating Crusaders as if they were the mere feudal levy. But the little direct influence of the whole of these wars upon military progress in Europe is shown clearly enough by the fact that at the very close of the Crusades a great battle was lost through knight-errantry of the true feudal type (Mansurah).

18. *The Period of Transition* (1290–1490).—Besides the infantry already mentioned, that of Scotland and that of the German cities fought with credit on many fields. Their arm was the pike, and they were always formed in solid masses (called in Scotland, *schiltrons*). The basis of the medieval commune being the suppression of the individual in the social unit, it was natural that the burgher infantry should fight "in serried ranks and in better order" than a line of individual knights, who, moreover, were almost powerless before walled cities. But these forces lacked offensive power, and it was left for the English archers, whose importance dates from the latter years of the 13th century, to show afresh, at Creçy, Poitiers and Agincourt, the value of missile action. When properly supported by other arms, they proved themselves capable of meeting both the man-at-arms and the pikeman. The greatest importance attaches to the evolution of this idea of mutual support and combination. Once it was realized, war became an art, and armies became specially organized bodies of troops of different arms. It cannot be admitted, indeed, as has been claimed, that the 14th century had a scientific system of tactics, or that the campaign of Poitiers was arranged by the French "general staff." Nevertheless, during this century armies were steadily coming to consist of expert soldiers, to the exclusion of national levies and casual mercenaries. It is true that, by his system of "indents," Edward III. of England raised national armies of a professional type, but the English soldier thus enrolled, when discharged by his own sovereign, naturally sought similar employment elsewhere. This system produced, moreover, a class of unemployed soldiers, and these, with others who became adventurers from choice or necessity, and even with foreign troops, formed the armies which fought in the Wars of the Roses—armies which differed but slightly from others of the time. The natural result of these wars was to implant a hatred of soldiery in the heart of a nation which had formerly produced the best fighting men in Europe, a hatred which left a deep imprint on the constitutional and social life of the people. In

France, where Joan of Arc passed like a meteor across the military firmament, the idea of a national regular army took a practical form in the middle of the 15th century. Still, the forces thus brought into existence were not numerous, and the soldier of fortune, in spite of such experiences of his methods as those of the Wars of the Roses, was yet to attain the zenith of his career.

19. *The Condottieri.*— The immediate result of this confused period of destruction and reconstruction was the *condottiere*, who becomes important about 1300. In Italy, where the *condottieri* chiefly flourished, they were in demand owing to the want of feudal cavalry, and the inability of burgher infantry to undertake wars of aggression. The "free companies" (who served in great numbers in France and Spain as well as in Italy) were "military societies very much like trade-gilds," which (so to speak) were hawked from place to place by their managing directors, and hired temporarily by princes who needed their services. Unlike the older hirelings, they were permanently organized, and thus, with their experience and discipline, became the best troops in existence. But the carrying on of war "in the spirit of a handicraft" led to bloodless battles, indecisive campaigns, and other unsatisfactory results, and the reign of the *condottieri* proper was over by 1400, subsequent free companies being raised on a more strictly national basis. With all their defects, however, they were the pioneers of modern organization. In the inextricable tangle of old and new methods which constitutes the military system of the 15th century, it is possible to discern three marked tendencies. One is the result of a purely military conception of the now special art of war, and its exposition as an art by men who devote their whole career to it. The second is the idea of a national army, resulting from many social, economical and political causes. The third is the tendency towards minuter organization and subdivision within the army. Whereas the individual feudatories had disliked the close supervision of a minor commander, and their army had in consequence remained always a loosely-knit unit, the men who made war into an art belonged to small bands or corps, and naturally began their organization from the lower units. Herein, therefore, was the germ of the regimental system of the present day.

20. *The Swiss.*—The best description of a typical European army at the opening of the new period of development is that of the French army in Italy in 1494, written by Paolo Giovio. He notes with surprise that the various corps of infantry and cavalry are distinct, the usual practice of the time being to combine one lancer, one archer, one groom, &c., into a small unit furnished and commanded by the lancer. There were Swiss and German infantry, armed with pike and halbert, with a few "shot," who marched in good order to music. There were the heavy men-at-arms (*gendarmes*), accompanied as of old by mounted archers, who, however, now fought independently. There were, further, Gascon slingers and crossbowmen, who had probably acquired, from contact with Spain, some of the lightness and dash of their neighbours. The artillery train was composed of 140 heavy pieces and a great number of lighter guns; these were then and for many generations thereafter a special arm outside the military establishments (see ARTILLERY). In all this the only relic of the days of Creçy is the administrative combination of the men-at-arms and the horse archers, and even this is no longer practised in action. The most important element in the army is the heavy infantry of Swiss and Germans. The Swiss had for a century past gradually developed into the most formidable troops of the day. The wars of Žižka (*q.v.*) in Bohemia (1420) materially assisted in the downfall of the heavy cavalry; and the victories of the Swiss, beginning with Sempach (1382), had by 1480 proved that their solid battalions, armed with the long pike and the halberd, were practically invulnerable to all but missile and shock action combined. By fortune of war, they never met the English, who had shown the way to deal with the *schiltron* as early as Falkirk. So great was their confidence against ordinary troops, that on one occasion (1444) they detached 1600 men to engage 50,000. It was natural that a series of victories such as Granson, Morat and Nancy should place them in the forefront of the military nations of Europe. The whole people devoted itself thereupon to professional soldiering, particularly in the French service, and though their monopoly of mercenary employment lasted a short time only, they continued to furnish regiments to the armies of France, Spain and the Pope up to the most modern times. But their efficiency was thoroughly sapped by the growth of a mutinous and insubordinate spirit, the memory of which has survived in the proverb *Point d'argent, point de Suisse*, and inspired Machiavelli with the hatred of mercenaries which marks every page of his work on the art of war. One of their devices for extorting money was to appear at the muster with many more soldiers than had been contracted for by their employers, who were forced to submit to this form of blackmail. At last the French, tired of these caprices, inflicted on the Swiss the crushing defeat of Marignan (*q.v.*), and their tactical system received its death-blow from the Spaniards at Pavia (1525).

21. *The Landsknechts.*—The modern army owes far more of its organization and administrative methods to the Landsknechts ("men of the country," as distinct from foreigners) than to the Swiss. As the latter were traditionally the friends of France, so these Swabians were the mainstay of the Imperial armies, though both were mercenaries. The emperor Maximilian exerted himself to improve the new force, which soon became the model for military Europe. A corps of Landsknechts was usually raised by a system resembling that of "indents," commissions being issued by the sovereign to leaders of repute to enlist men. A "colour" (*Fähnlein*) numbered usually about 400 men, a corps consisted of a varying number of colours, some corps having 12,000 men. From these troops, with their intense pride, *esprit de corps* and comradeship, there has come down to modern times much of present-day etiquette, interior economy and "regimental customs"— in other words, nearly all that is comprised in the "regimental" system. Amongst the most notable features of their system were the functions of the provost, who combined the modern offices of provost-marshal, transport and supply officer, and canteen manager; the disciplinary code, which admitted the right of the rank and file to judge offences touching the honour of the regiment; and the women who, lawfully or unlawfully attached to the soldiers, marched with the regiment and had a definite place in its corporate life. The conception of the regiment as the home of the soldier was thus realized in fact.

22. *The Spanish Army.*— The tendencies towards professional soldiering and towards subdivision had now pronounced themselves. At the same time, while national armies, as dreamed of by Machiavelli, were not yet in existence, two at least of the powers were beginning to work towards an ideal. This ideal was an army which was entirely at the disposal of its own sovereign, trained to the due professional standard, and organized in the best way found by experience to be applicable to military needs. On these bases was formed the old Spanish army which, from Pavia (1525) to Rocroi (1643), was held by common consent to be the finest service in existence. Almost immediately after emerging from the period of internal development, Spain found herself obliged to maintain an army for the Italian wars. In the first instance this was raised from amongst veterans of the war of Granada, who enlisted for an indefinite time. Probably the oldest line regiments in Europe are those descended from the famous *tercios*, whose formation marks the beginning of military establishments, just as the Landsknechts were the founders of military manners and customs. The great captains who led the new army soon assimilated the best points of the Swiss system, and it was the Spanish army which evolved the typical combination of pike and musket which flourished up to 1700. Outside the domain the tactics, it must be credited with an important contribution to the science of army organization, in the depot system, whereby the *tercios* in the field were continually "fed" and kept up to strength. The social position of the soldier was that of a gentleman, and the young nobles (who soon came to prefer the *tercios* to the cavalry service) thought it no shame,

when their commands were reduced, to "take a pike" in another regiment. The provost and his gallows were as much in evidence in a Spanish camp as in one of Landsknechts, but the comradeship and *esprit de corps* of a *tercio* were the admiration of all contemporary soldiers. With all its good qualities, however, this army was not truly national; men soon came from all the various nations ruled by the Habsburgs, and the soldier of fortune found employment in a *tercio* as readily as elsewhere. But it was a great gain that corps, as such, were fully recognized as belonging to the government, however shifting the *personnel* might be. Permanence of regimental existence had now been attained, though the universal acceptance and thorough application of the principle were still far distant. During the 16th century, the French regular army (originating in the *compagnies d'ordonnance* of 1445), which was always in existence, even when the Swiss and *gendarmes* were the best part of the field forces, underwent a considerable development, producing amongst other things the military terminology of the present day. But the wars of religion effectually checked all progress in the latter part of the century, and the European reputation of the French army dates only from the latter part of the Thirty Years' War.

23. *The Sixteenth Century.*—The battle of St Quentin (1557) is usually taken as the date from which the last type of a purely mercenary *arm* (as distinct from *corps*) comes into prominence. "Brabançon" or "Swiss" implied pikemen without further qualification, the new term "Reiter" similarly implied mercenary cavalry fighting with the pistol. Heavy cavalry could disperse arquebusiers and musketeers, but it was helpless against solid masses of pikemen; the Reiters solved the difficulty by the use of the pistol. They were well armoured and had little to fear from musket-balls. Arrayed in deep squadrons, therefore, they rode up to the pikes with impunity, and fired methodically *dans le tas*, each rank when it had discharged its pistols filing to the rear to reload. These Reiters were organized in squadrons of variable strength, and recruited in the same manner as were the Landsknechts. They were much inferior, however, to the latter in their discipline and general conduct, for cavalry had many more individual opportunities of plunder than the foot, and the rapacity and selfishness of the Reiters were consequently in marked contrast to the good order and mutual helpfulness in the field and in quarters which characterized the regimental system of the Landsknechts.

24. *Dutch System.*—The most interesting feature of the Dutch system, which was gradually evolved by the patriots in the long War of Independence, was its minute attention to detail. In the first years of the war, William the Silent had to depend, for field operations, on mutinous and inefficient mercenaries and on raw countrymen who had nothing but devotion to oppose to the discipline and skill of the best regular army in the world. Such troops were, from the point of view of soldiers like Alva, mere *canaille*, and the ludicrous ease with which their armies were destroyed (as at Jemmingen and Mookerheyde), at the cost of the lives of perhaps a dozen Spanish veterans, went far to justify this view. But, fortunately for the Dutch, their fortified towns were exceedingly numerous, and the individual bravery of citizen-militia, who were fighting for the lives of every soul within their walls, baffled time after time all the efforts of Alva's men. In the open, Spanish officers took incredible liberties with the enemy; once, at any rate, they marched for hours together along submerged embankments with hostile vessels firing into them from either side. Behind walls the Dutch were practically a match for the most furious valour of the assailants.

The insurgents' first important victory in the open field, that of Rymenant near Malines (1577), was won by the skill of "Bras de Fer," de la Noue, a veteran French general, and the stubbornness of the English contingent of the Dutch army—for England, from 1572 onwards, sent out an ever-increasing number of volunteers. This battle was soon followed by the great defeat of Gembloux (1578), and William the Silent was not destined to see the rise of the Dutch army. Maurice of Nassau was the real organizer of victory. In the wreck of all feudal and burgher military institutions, he turned to the old models of Xenophon, Polybius, Aelian and the rest. Drill, as rigid and as complicated as that of the Macedonian phalanx, came into vogue, the infantry was organized more strictly into companies and regiments, the cavalry into troops or cornets. The *Reiter* tactics of the pistol were followed by the latter, the former consisted of pikes, halberts and "shot." This form was generally followed in central Europe, as usual, without the spirit, but in Holland it was the greater trustworthiness of the rank and file that allowed of more flexible formations, and here we no longer see the foot of an army drawn up, as at Jemmingen, in one solid and immovable "square." In their own country and with the system best suited thereto, the Dutch, who moreover acquired greater skill and steadiness day by day, maintained their ground against all the efforts of a Parma and a Spinola. Indeed, it is the best tribute to the vitality of the Spanish system that the inevitable *débâcle* was so long delayed. The campaigns of Spinola in Germany demonstrated that the "Dutch" system, as a system for general use, was at any rate no better than the system over which it had locally asserted its superiority, and the spirit, and not the form, of Maurice's practice achieved the ultimate victory of the Netherlanders. In the Thirty Years' War, the unsuccessful armies of Mansfeld and many others were modelled on the Dutch system,—the forces of Spinola, of Tilly and of Wallenstein, on the Spanish. In other words, these systems as such meant little; the discipline and spirit behind them, everything. Yet the contribution made by the Dutch system to the armies of to-day was not small; to Maurice and his comrades we owe, first the introduction of careful and accurate drill, and secondly the beginnings of an acknowledged science of war, the groundwork of both being the theory and practice of antiquity. The present method of "forming fours" in the British infantry is ultimately derived from Aelian, just as the first beats of the drums in a march represent the regimental calls of the Landsknechts, and the depots and the drafts for the service battalions date from the Italian wars of Spain.

25. *The Thirty Years' War.*—Hitherto all armies had been raised or reduced according to the military and political situation of the moment. Spain had indeed maintained a relatively high effective in peace, but elsewhere a few personal guards, small garrisons, and sometimes a small regular army to serve as a nucleus, constituted the only permanent forces kept under arms by sovereigns, though, in this era of perpetual wars, armies were almost always on a war footing. The expense of maintenance at that time practically forbade any other system than this, called in German *Werbe-system*, a term for which in English there is no nearer equivalent than "enlistment" or "levy" system. It is worth noticing that this very system is identical in principle with that of the United States at the present day, viz., a small permanent force, inflated to any required size at the moment of need. The exceptional conditions of the Dutch army, indeed, secured for its regiments a long life; yet when danger was finally over, a large portion of the army was at once reduced. The history of the British army from about 1740 to 1820 is a most striking, if belated, example of the *Werbe-system* in practice.[1] But the Thirty Years' War naturally produced an unusual continuity of service in corps raised about 1620–1630, and fifty years later the principle of the standing army was universally accepted. It is thus that the senior regiments of the Prussian and Austrian armies date from about 1630. At this time an event took place which was destined to have a profound influence on the military art. Gustavus Adolphus of Sweden landed in Germany with an army better organized, trained and equipped than any which had preceded it. This army, by its great victory of Breitenfeld (1631), inaugurated the era of "modern" warfare, and it is to the system of Gustavus that the student must turn for the initial point of the progressive development which has produced the armies of to-day. Spanish and Dutch methods at once became as obsolete as those of the Landsknechts.

26. *The Swedish Army.*—The Swedish army was raised by a carefully regulated system of conscription, which was "preached in every pulpit in Sweden." There were indeed enlisted regiments of the usual type, and it would seem that Gustavus

obtained the best even of the soldiers of fortune. But the national regiments were raised on the *Indelta* system. Each officer and man, under this scheme, received a land grant within the territorial district of his corps, and each of these districts supplied recruits in numbers proportionate to its population. This curious mixture of feudal and modern methods produced the best elements of an army, which, aided by the tactical and technical improvements introduced by Gustavus, proved itself incomparably superior to its rivals. Of course the long and bloody campaigns of 1630–34 led to the admission of great numbers of mercenaries even into the Swedish corps; and German, Scottish and other regiments figured largely, not only in the armies of Duke Bernhard and his successors, but in the army of Gustavus' own lifetime. As early as 1632 one brigade of the army was distinguished by the title "Swedish," as alone containing no foreigners. Yet the framework was much the same as it had been in 1630. The battle-organization of two lines and two wings, which was typical of the later "linear" tactics, began to supplant the system of the *tercios*. How cumbrous the latter had become by 1630 may be judged from any battle-plan of the period, and notably from that of Lützen. Gustavus' cavalry fought four or three deep only, and depended as little as possible on the pistol. The work of riding down the pikes was indeed rendered easier by the improved tactical handiness of the musketeers, but it was fiery leading which alone compelled victory, for there were relatively few Swedish horse and many squadrons of Germans and others, who in themselves were far less likely to charge boldly than the "Pappenheimers" and other crack corps of the enemy. The infantry was of the highest class, and only on that condition could loose and supple lines be trusted to oppose the solid *tercios* of Tilly and Wallenstein. Cumbrous indeed these were, but by long practice they had acquired no small manœuvring power, of which Breitenfeld affords a striking example. The Swedes, however, completely surpassed them. The progress thus made may be gauged from the fact that under Gustavus the largest closed body of infantry was less than 300 strong. Briefly, the genius of a great commander, the ardour of a born cavalry leader, better arms and better organization, carried the Swedes to the end of their career of victory, but how personal was the *vis viva* which inspired the army was quickly noticeable after the death of Gustavus. Even a Bernhard could, in the end, evoke no more heroism from a Swedish army than from any other, and the real Swedish troops fought their last battle at Nördlingen (1634). After this, little distinguished the "Swedish" forces from the general mass of the armies of the time, save their system, to which, and to its influence on the training of such leaders as Banér, Torstensson and Wrangel, all their later victories were due. So much of Gustavus' work survived even the carnage of Nördlingen, and his system always obtained better results, even with the heterogeneous troops of this later period, than any other of the time.

27. *The English Civil War* (see GREAT REBELLION).—The armies on either side which, about the same time, were fighting out the constitutional quarrel in England were essentially different from all those of the continent, though their formal organization was similar to that of the Swedes. The military expression of a national conscience had appeared rarely indeed in the Thirty Years' War, which was a means of livelihood for, rather than an assertion of principle by, those who engaged in it. In England, on the other hand, there were no mercenaries, and the whole character of the operations was settled by the burning desire of a true "nation in arms" to decide at once, by the arbitrament of battle, the vital points at issue. A German critic (Fritz Hoenig) has indicated Worcester as the prototype of Sedan; at any rate, battles of this kind invariably resulted in failure when entrusted to a "standing" army of the 18th century. But the national armies disappeared at the end of the struggle; after the Restoration, English political aims became, so far as military activity was concerned, similar in scope and execution to those of the continent; and the example of Cromwell and the "New Model," which might have revolutionized military Europe, passed away without having any marked influence on the armies of other nations.

28. *Standing Armies.*—Nine years after Nördlingen, the old Spanish army fought its last and most honourable battle at Rocroi. Its conquerors were the new French troops, whose victory created as great a sensation as Pavia and Creçy had done. Infusing a new military spirit into the formal organization of Gustavus' system, the French army was now to "set the fashion" for a century. France had been the first power to revive regular forces, and the famous "Picardie" regiment disputed for precedence even with the old *tercios*. The country had emerged from the confusion of the past century with the foreign and domestic strength of a practically absolute central power. The Fronde continued the military history of the army from the end of the Thirty Years' War; and when the period of consolidation was finally closed, all was prepared for the introduction of a "standing army," practically always at war strength, and entirely at the disposal of the sovereign. The reorganization of the military establishments by Louvois may be taken as the formal date at which standing armies came into prominence (see historical sketch of the French army below). Other powers rapidly followed the lead of France, for the defects of enlisted troops had become very clear, and the possession of an army always ready for war was an obvious advantage in dynastic politics. The French proprietary system of regiments, and the general scheme of army administration which replaced it, may be taken as typical of the armies of other great powers in the time of Louis XIV.

29. *Character of the Standing Armies.*—A peculiar character was from the first imparted to the new organizations by the results of the Thirty Years' War. A well-founded horror of military barbarity had the effect of separating the soldier from the civilian by an impassable gulf. The drain of thirty years on the population, resources and finances of almost every country in middle Europe, everywhere limited the size of the new armies; and the decision in 1648 of all questions save those of dynastic interest dictated the nature of their employment. The best soldiers of the time pronounced in favour of small field armies, for in the then state of communications and agriculture large forces proved in practice too cumbrous for good work. In every country, therefore, the army took the form of a professional body, nearly though not quite independent of extra recruits for war, set apart entirely from all contact with civil life, rigidly restricted as to conduct in peace and war, and employed mostly in the "maintenance" of their superiors' private quarrels. Iron discipline produced splendid tenacity in action, and wholesale desertion at all times. In the Seven Years' War, for instance, the Austrians stated one-fifth of their total loss as due to desertion, and Thackeray's *Barry Lyndon* gives no untrue picture of the life of a soldier under the old régime. Further, since men were costly, rigid economy of their lives in action, and minute care for their feeding and shelter on the march, occupied a disproportionate amount of the attention of their generals. Armies necessarily moved slowly and remained concentrated to facilitate supply and to check desertion, and thus, when a commander had every unit of his troops within a short ride of his headquarters, there was little need for intermediate general officers, and still less for a highly trained staff.

30. *Organization in the 18th Century.*—All armies were now almost equal in fighting value, and war was consequently reduced to a set of rules (not principles), since superiority was only to be gained by methods, not by men. Soldiers such as Marlborough, who were superior to these jejune prescriptions, met indeed with uniform success. But the methods of the 18th century failed to receive full illustration, save by the accident of a great captain's direction, even amidst the circumstances for which they were designed. It is hardly to be wondered at, therefore, that they failed, when forced by a new phase of development to cope with events completely beyond their element. The inner organization was not markedly altered. Artillery was still outside the normal organization of the line of battle, though in the period 1660–1740 much was done in all countries to improve

the material, and above all to turn the *personnel* into disciplined soldiers. Cavalry was organized in regiments and squadrons, and armed with sabre and pistol. Infantry had by 1703 begun to assume its three-deep line formation and the typical weapons of the arm, musket and bayonet. Regiments and battalions were the units of combat as well as organization. In the fight the company was entirely merged in the higher unit, but as an administrative body it still remained. As for the higher organization, an army consisted simply of a greater or less number of battalions and squadrons, without, as a rule, intermediate commands and groupings. The army was arrayed as a whole in two lines of battle, with the infantry in the centre and the cavalry on the flanks, and an advanced guard; the so-called reserve consisting merely of troops not assigned to the regular commands. It was divided, for command in action, into right and left wings, both of cavalry and infantry, of each line. This was the famous "linear" organization, which in theory produced the maximum effort in the minimum time, but in practice, handled by officers whose chief care was to avoid the expenditure of effort, achieved only negative results. To see its defects one need only suppose a battalion of the first line hard pressed by the enemy. A battalion of the second line was directly behind it, but there was no authority, less than that of the wing commander, which could order it up to support the first. All the conditions of the time were opposed to tactical subdivision, as the term is now understood. That the 18th century did not revive *schiltrons* was due to the new fire tactics, to which everything but control was sacrificed. This "control," as has been said, implied not so much command as police supervision. But far beyond any faults of organization and recruiting, the inherent vice of these armies was, as Machiavelli had pointed out two centuries previously, and as Prussia was to learn to her cost in 1806, that once they were thoroughly defeated, the only thing left to be done was to make peace at once, since there was no other armed force capable of retrieving a failure.

31. *Frederick the Great.*—The military career of Frederick the Great is very different from those of his predecessors. With an army organized on the customary system, and trained and equipped, better indeed, but still on the same lines as those of his rivals, the king of Prussia achieved results out of all proportion to those imagined by contemporary soldiers. It is to his campaigns, therefore, that the student must refer for the real, if usually latent, possibilities of the army of the 18th century. The prime secret of his success lay in the fact that he was his own master, and responsible to no superior for the uses to which he put his men. This position had never, since the introduction of standing armies, been attained by any one, even Eugene and Leopold of Dessau being subject to the common restriction; and with this extraordinary advantage over his opponents, Frederick had further the firmness and ruthless energy of a great commander. Prussia, moreover, was more strictly organized than other countries, and there was relatively little of that opposition of local authorities to the movement of troops which was conspicuous in Austria. The military successes of Prussia, therefore, up to 1757, were not primarily due to the system and the formal tactics, but were the logical outcome of greater energy in the leading, and less friction in the administration, of her armies. But the conditions were totally different in 1758–1762, when the full force of the alliance against Prussia developed itself in four theatres of war. Frederick was driven back to the old methods of making war, and his men were no longer the soldiers of Leuthen and Hohenfriedberg. If discipline was severe before, it was merciless then; the king obtained men by force and fraud from every part of Germany, and had both to repress and to train them in the face of the enemy. That under such conditions, and with such men, the weaker party finally emerged triumphant, was indeed a startling phenomenon. Yet its result for soldiers was not the production of the national army, though the dynastic forces had once more shown themselves incapable of compassing decisive victories, nor yet the removal of the barrier between army and people, for the operations of Frederick's recruiting agents made a lasting impression, and, further, large numbers of men who had thought to make a profession of arms were turned adrift at the end of the war. On the contrary, all that the great and prolonged *tour de force* of these years produced was a tendency, quite in the spirit of the age, to make a formal science out of the art of war. Better working and better methods were less sought after than systematization of the special practices of the most successful commanders. Thus Frederick's methods, since 1758 essentially the same as those of others, were taken as the basis of the science now for the first time called "strategy," the fact that his opponents had also practised it without success being strangely ignored. Along with this came a mania for imitation. Prussian drill, uniforms and hair-powder were slavishly copied by every state, and for the next twenty years, and especially when the war-trained officers and men had left active service, the purest pedantry reigned in all the armies of Europe, including that of Prussia. One of the ablest of Frederick's subordinates wrote a book in which he urged that the cadence of the infantry step should be increased by one pace per minute. The only exceptions to the universal prevalence of this spirit were in the Austrian army, which was saved from atrophy by its Turkish wars, and in a few British and French troops who served in the American War of Independence. The British regiments were sent to die of fever in the West Indies; when the storm of the French Revolution broke over Europe, the Austrian army was the only stable element of resistance.

32. *The French Revolution.*—Very different were the armies of the Revolution. Europe, after being given over to professional soldiers for five hundred years, at last produced the modern system of the "nation in arms." The French volunteers of 1792 were a force by which the routine generals of the enemy, working with instruments and by rules designed for other conditions, were completely puzzled, and France gained a short respite. The year 1793 witnessed the most remarkable event that is recorded in the history of armies. Raw enthusiasm was replaced, after the disasters and defections which marked the beginning of the campaign, by a systematic and unsparing conscription, and the masses of men thus enrolled, inspired by ardent patriotism and directed by the ferocious energy of the Committee of Public Safety, met the disciplined formalists with an opposition before which the attack completely collapsed. It was less marvellous in fact than in appearance that this should be so. Not to mention the influence of pedantry and senility on the course of the operations, it may be admitted that Frederick and his army at their best would have been unable to accomplish the downfall of the now thoroughly roused French. Tactically, the fire of the regulars' line caused the Revolutionary levies to melt away by thousands, but men were ready to fill the gaps. No complicated supply system bound the French to magazines and fortresses, for Europe could once more feed an army without convoys, and roads were now good and numerous. No fear of desertion kept them concentrated under canvas, for each man was personally concerned with the issue. If the allies tried to oppose them on an equal front, they were weak at all points, and the old organization had no provision for the working of a scattered army. While ten victorious campaigns had not carried Marlborough nearer to Paris than some marches beyond the Sambre, two campaigns now carried a French army to within a few miles of Vienna. It was obvious that, before such forces and such mobility, the old system was doomed, and with each successive failure the old armies became more discouraged. Napoleon's victories finally closed this chapter of military development, and by 1808 the only army left to represent it was the British. Even to this the Peninsular War opened a line of progress, which, if different in many essentials from continental practice, was in any case much more than a copy of an obsolete model.

33. *The Conscription.*—In 1793, at a moment when the danger to France was so great as to produce the rigorous emergency methods of the Reign of Terror, the combined enemies of the Republic had less than 300,000 men in the field between Basel and Dunkirk. On the other hand, the call of the "country in

danger" produced more than four times this number of men for the French armies within a few months. Louis XIV., even when all France had been awakened to warlike enthusiasm by a similar threat (1709), had not been able to put in the field more than one-fifth of this force. The methods of the great war minister Carnot were enforced by the ruthless committee, and when men's lives were safer before the bayonets of the allies than before the civil tribunals at home, there was no difficulty in enlisting the whole military spirit of France. There is therefore not much to be said as to the earliest application of the conscription, at least as regards its formal working, since any system possessing elasticity would equally have served the purpose. In the meanwhile, the older plans of organization had proved inadequate for dealing with such imposing masses of men. Even with disciplined soldiers they had long been known as applicable only to small armies, and the deficiencies of the French, with their consequences in tactics and strategy, soon produced the first illustrations of modern methods. Unable to meet the allies in the plain, they fought in broken ground and on the widest possible front. This of course produced decentralization and subdivision; and it became absolutely necessary that each detachment on a front of battle 30 m. long (*e.g.* Stokach) should be properly commanded and self-sufficing. The army was therefore constituted in a number of *divisions*, each of two or more brigades with cavalry and artillery sufficient for its own needs. It was even more important that each divisional general, with his own staff, should be a real commander, and not merely the supervisor of a section of the line of battle, for he was almost in the position that a commander-in-chief had formerly held. The need of generals was easily supplied when there was so wide a field of selection. For the allies the mere adoption of new forms was without result, since it was contrary both to tradition and to existing organization. The attempts which were made in this direction did not tend to mitigate the evils of inferior numbers and *moral*. The French soon followed up the divisional system with the further organization of groups of divisions under specially selected general officers; this again quickly developed into the modern army corps.

34. *Napoleon.*—Revolutionary government, however, gave way in a few years to more ordinary institutions, and the spirit of French politics had become that of aggrandizement in the name of liberty. The ruthless application of the new principle of masses had been terribly costly, and the disasters of 1799 reawakened in the mass of the people the old dislike of war and service. Even before this it had been found necessary to frame a new act, the famous law proposed by General Jourdan (1798). With this the conscription for general service began. The legal term of five years was so far exceeded that the service came to be looked upon as a career, or servitude, for life; it was therefore both unavoidable and profitable to admit substitutes. Even in 1806 one quarter of Napoleon's conscripts failed to come up for duty. The *Grande Armée* thus from its inception contained elements of doubtful value, and only the tradition of victory and the 50% of veterans still serving aided the genius of Napoleon to win the brilliant victories of 1805 and 1806. But these veterans were gradually eliminated by bloodshed and service exposure, and when, after the peace of Tilsit, "French" armies began to be recruited from all sorts of nations, decay had set in. As early as 1806 the emperor had had to "anticipate" the conscription, that is, call up the conscripts before their time, and by 1810 the percentage of absentees in France had grown to about 80, the remainder being largely those who lacked courage to oppose the authorities. Finally, the armies of Napoleon became masses of men of all nations fighting even more unwillingly than the armies of the old régime. Little success attended the emperor's attempt to convert a "nation in arms" into a great dynastic army. Considered as such, it had even fewer elements of solidity than the standing armies of the 18th century, for it lacked the discipline which had made the regiments of Frederick invincible. After 1812 it was attacked by huge armies of patriots which possessed advantages of organization and skilful direction that the *levée en masse* of 1793 had lacked. Only the now fully developed genius and magnificent tenacity of Napoleon staved off for a time the *débâcle* which was as inevitable as had been that of the old régime.

35. *The Grande Armée.*—In 1805–1806, when the older spirit of the Revolution was already represented by one-half only of French soldiers, the actual steadiness and manœuvring power of the *Grande Armée* had attained its highest level. The army at this time was organized into brigades, divisions and corps, the last-named unit being as a rule a marshal's command, and always completed as a small army with all the necessary arms and services. Several such corps (usually of unequal strength) formed the army. The greatest weakness of the organization, which was in other respects most pliant and adaptable, was the want of good staff-officers. The emperor had so far cowed his marshals that few of them could take the slightest individual responsibility, and the combatant staff-officers remained, as they had been in the 18th century, either confidential clerks or merely gallopers. No one but a Napoleon could have managed huge armies upon these terms; in fact the marshals, from Berthier downwards, generally failed when in independent commands. Of the three arms, infantry and cavalry regiments were organized in much the same way as in Frederick's day, though tactical methods were very different, and discipline far inferior. The greatest advance had taken place in the artillery service. Field and horse batteries, as organized and disciplined units, had come into general use during the Revolutionary wars, and the division, corps and army commanders had always batteries assigned to their several commands as a permanent and integral part of the fighting troops. Napoleon himself, and his brilliant artillery officers Sénarmont and Drouot, brought the arm to such a pitch of efficiency that it enabled him to win splendid victories almost by its own action. As a typical organization we may take the III. corps of Marshal Davout in 1806. This was formed of the following troops:—

Cavalry brigade—General Vialannes—three regiments, 1538 men. Corps artillery, 12 guns.
1st Division—General Morand—five infantry regiments in three brigades, 12 guns, 10,820 men.
2nd Division—General Friant—five regiments in three brigades, 8 guns, 8758 men.
3rd Division—General Gudin—four regiments in three brigades, 12 guns, 9077 men.

A comparison of this *ordre de bataille* with that of a modern army corps will show that the general idea of corps organization has undergone but slight modification since the days of Napoleon. More troops allotted to departmental duties, and additional engineers for the working of modern scientific aids, are the only new features in the formal organization of a corps in the 20th century. Yet the spirit of 1806 and that of 1906 were essentially different, and the story of the development of this difference through the 19th century closes for the present the history of progress in tactical organization.

36. *The Wars of Liberation.*—The Prussian defeat at Jena was followed by a national surrender so abject as to prove conclusively the eternal truth, that a divorce of armies from national interests is completely fatal to national well-being. But the oppression of the victors soon began to produce a spirit of ardent patriotism which, carefully directed by a small band of able soldiers, led in the end to a national uprising of a steadier and more lasting kind than that of the French Revolution. Prussia was compelled, by the rigorous treaty of peace, to keep a small force only under arms, and circumstances thus drove her into the path of military development which she subsequently followed. The stipulation of the treaty was evaded by the *Krümper* system, by which men were passed through the ranks as hastily as possible and dismissed to the reserve, their places being taken by recruits. The regimental establishments were therefore mere *cadres*, and the *personnel*, recruited by universal service with few exemptions, ever-changing. This system depended on the willingness of the reserves to come up when called upon, and the arrogance of

the French was quite sufficient to ensure this. The *dénouement* of the Napoleonic wars came too swiftly for the full development of the armed strength of Prussia on these lines; and at the outbreak of the Wars of Liberation a newly formed *Landwehr* and numerous volunteer corps took the field with no more training than the French had had in 1793. Still, the principles of universal service (*allgemeine Wehrpflicht*) and of the army reserve were, for the first time in modern history, systematically put into action, and modern military development has concerned itself more with the consolidation of the *Krümper* system than with the creation of another. The début of the new Prussian army was most unsuccessful, for Napoleon had now attained the highest point of soldierly skill, and managed to inflict heavy defeats on the allies. But the Prussians were not discouraged; like the French in 1793 they took to broken ground, and managed to win combats against all leaders opposed to them except Napoleon himself. The Russian army formed a solid background for the Prussians, and in the end Austria joined the coalition. Reconstituted on modern lines, the Austrian army in 1813, except in the higher leading, was probably the best-organized on the continent. After three desperate campaigns the Napoleonic régime came to an end, and men felt that there would be no such struggle again in their lifetime. Military Europe settled down into grooves along which it ran until 1866. France, exhausted of its manhood, sought a field for military activities in colonial wars waged by long-service troops. The conscription was still in force, but the citizens served most unwillingly, and substitution produced a professional army, which as usual became a dynastic tool. Austria, always menaced with foreign war and internal disorder, maintained the best army in Europe. The British army, though employed far differently, retained substantially the Peninsular system.

37. *European Armies 1815–1870.*—The events of the period 1815–1859 showed afresh that such long-service armies were incomparably the best form of military machine for the purpose of giving expression to a hostile "view" (not "feeling"). Austrian armies triumphed in Italy, French armies in Spain, Belgium, Algeria, Italy and Russia, British in innumerable and exacting colonial wars. Only the Prussian forces retained the characteristics of the levies of 1813, and the enthusiasm which had carried these through Leipzig and the other great battles was hardly to be expected of their sons, ranged on the side of despotism in the troubled times of 1848–1850. But the principle was not permitted to die out. The Bronnzell-Olmütz incident of 1850 (see SEVEN WEEKS' WAR) showed that the organization of 1813 was defective, and this was altered in spite of the fiercest opposition of all classes. Soon afterwards, and before the new Prussian army proved itself on a great battlefield, the American Civil War, a fiercer struggle than any of those which followed it in Europe, illustrated the capabilities and the weaknesses of voluntary-service troops. Here the hostile "view" was replaced by a hostile "feeling," and the battles of the disciplined enthusiasts on either side were of a very different kind from those of contemporary Europe. But, if the experiences of 1861–1865 proved that armies voluntarily enlisted "for the war" were capable of unexcelled feats of endurance, they proved further that such armies, whose discipline and training in peace were relatively little, or indeed wholly absent, were incapable of forcing a swift decision. The European "nation in arms," whatever its other failings, certainly achieved its task, or failed decisively to do so, in the shortest possible time. Only the special characteristics of the American theatre of war gave the Union and Confederate volunteers the space and time necessary for the creation of armies, and so the great struggle in North America passed without affecting seriously the war ideas and preparations of Europe. The weakness of the staff work with which both sides were credited helped further to confirm the belief of the Prussians in their system, and in this instance they were justified by the immense superiority of their own general staff to that of any army in existence. It was in this particular that a corps of 1870 differed so essentially from a corps of Napoleon's time. The formal organization had not been altered save as the varying relative importance of the separate arms had dictated. The almost intangible spirit which animates the members of a general staff, causes them not merely to "think"—that was always in the quartermaster-general's department—but to "think alike," so that a few simple orders called "directives" sufficed to set armies in motion with a definite purpose before them, whereas formerly elaborate and detailed plans of battle had to be devised and distributed in order to achieve the object in view. A comparison of the number of orders and letters written by a marshal and by his chief of staff in Napoleon's time with similar documents in 1870 indicates clearly the changed position of the staff. In the *Grande Armée* and in the French army of 1870 the officers of the general staff were often absent entirely from the scene of action. In Prussia the new staff system produced a far different result—indeed, the staff, rather than the Prussian military system, was the actual victor of 1870. Still, the system would probably have conquered in the end in any case, and other nations, convinced by events that their departure from the ideal of 1813, however convenient formerly, was no longer justified, promptly copied Prussia as exactly, and, as a matter of fact, as slavishly, as they had done after the Seven Years' War.

38. *Modern Developments.*—Since 1870, then, with the single exception of Great Britain, all the major European powers have adopted the principle of compulsory short service with reserves. Along with this has come the fullest development of the territorial system (see below). The natural consequence therefore of the heavy work falling upon the shoulders of the Prussian officer, who had to instruct his men, was, in the first place, a general staff of the highest class, and in the second, a system of distributing the troops over the whole country in such a way that the regiments were permanently stationed in the district in which they recruited and from which they drew their reserves. Prussia realized that if the reservists were to be obtained when required the unit must be strictly localized; France, on the contrary, lost much time and spent much trouble, in the mobilization of 1870, in forwarding the reservists to a regiment distant, perhaps, 300 m. The Prussian system did not work satisfactorily at first, for until all the district staff-officers were trained in the same way there was great inequality in the efficiency of the various army corps, and central control, before the modern development of railways, was relatively slight. Further, the mobilization must be completed, or nearly so, before concentration begins, and thus an active professional army, always at war strength, might annihilate the frontier corps before those in the interior were ready to move. But the advantages far outweighed the defects of the system, and, such professional armies having after 1870 disappeared, there was little to fear. Everywhere, therefore, save in Great Britain (for at that time the United States was hardly counted as a great military power, in spite of its two million war-trained veterans in civil life), the German model was followed, and is now followed, with but slight divergence. The period of reforms after the Prussian model (about 1873–1890) practically established the military systems which are treated below as those of the present day. The last quarter of the century witnessed a very great development of military forces, without important organic changes. The chief interest to the student of this period lies in the severe competition between the great military powers for predominance in numbers, expressed usually in the reduction of the period of service with the colours to a minimum. The final results of this cannot well be predicted: it is enough to say that it is the *Leitmotiv* in the present stage in the development of armies. Below will be found short historical sketches of various armies of the present day which are of interest in respect of their historical development. Details of existing forces are given in articles dealing with the several states to which they belong. Historical accounts of the armies of Japan and of Egypt will be found in the articles on these states. The Japanese wars of 1894–95, and 1904–5 contributed little to the history of military organization as a pure science. The

true lessons of this war were the demonstration of the wide applicability of the German methods, upon which exclusively the Japanese army had formed itself, and still more the first illustration of the new moral force of nationalities as the decisive factor. The form of armies remained unaltered. Neither the events of the Boer War of 1899–1902 nor the Manchurian operations were held by European soldiers to warrant any serious modifications in organization. It is to the moral force alluded to above, rather than to mere technical improvements, that the best soldiers of Europe, and notably those of the French general staff (see the works of General H. Bonnal), have of late years devoted their most earnest attention.

PRESENT-DAY ARMIES

39. The main principles of all military organization as developed in history would seem to be national recruiting and allegiance, distinctive methods of training and administration, continuity of service and general homogeneity of form. The method of raising men is of course different in different states. In this regard armies may conveniently be classed as voluntarily enlisted, levied or conscript, and militia, represented respectively by the forces of Great Britain, Germany and Switzerland. It must not be forgotten, however, that voluntary troops may be and are maintained even in states in which the bulk of the army is levied by compulsion, and the simple militia obligation of defending the country is universally recognized.

40. *Compulsory Service.*—Universal liability to service (*allgemeine Wehrpflicht*) draws into the active army all, or nearly all, the men of military age for a continuous period of short service, after which they pass successively to the reserve, the second and the third line troops (*Landwehr*, *Landsturm*, &c.). In this way the greatest number of soldiers is obtained at the cheapest rate and the number of trained men in reserve available to keep the army up to strength is in theory that of the able-bodied manhood of the country. In practice the annual levy is, however, not exhaustive, and increased numerical strength is obtained by reducing the term of colour-service to a minimum. This may be less in a hard-worked conscript army than in one which depends upon the attractions of the service to induce recruits to join. In conscript armies, training for war is carried out with undeviating rigour. In these circumstances the recruits are too numerous and the time available is too limited for the work of training to be committed to a few selected instructors, and every officer has therefore to instruct his own men. The result is usually a corps of officers whose capacity is beyond question, while the general staff is composed of men whose ability is above a high general average. As to the rank and file, the men taken for service are in many respects the best of the nation, and this superiority is progressively enhanced, since increase of population is not often accompanied by a corresponding increase in the military establishments. In Germany in 1905, it is stated, nearly half the contingent was excused from serving in peace time, over and above the usual numbers exempted or medically rejected. The financial aspect of compulsory service may be summed up in a few words. The state does not offer a wage, the pay of the soldier is a mere trifle, and, for a given expenditure, at least three times as many men may be kept under arms as under any known "voluntary" system. Above all, the state has at its disposal for war an almost inexhaustible supply of trained soldiers. This aspect of compulsory service has indeed led its admirers sometimes to sacrifice quality to quantity; but, provided always that the regular training is adequate, it may be admitted that there is no limit to the numbers which are susceptible of useful employment. There are, however, many grave defects inherent in all armies raised by compulsory levy (see CONSCRIPTION, for a discussion of the chief economical and social questions involved). Most of the advantages of universal service result, not from the compulsory enlistment, but from the principle of short service and reserves. But the cost of maintaining huge armies of the modern European type on the voluntary system would be entirely prohibitive, and those nations which have adopted the *allgemeine Wehrpflicht* have done so with full cognizance of the evil as well as of the good points of the system.

The chief of these evils is the doubtful element which exists in all such armies. Under the merciless discipline of the old régime the most unwilling men feared their officers more than the enemy. Modern short service, however, demands the good-will of all ranks and may fail altogether to make recalcitrants into good soldiers, and it may be taken for granted that every conscript army contains many men who cannot be induced to fight. Herein lies the justification of the principle of "masses," and of reduced colour-service; by drawing into the ranks the maximum number of men, the government has an eventual residuum of the bravest men in the nation left in the ranks. What has been said of the officers of these armies cannot be applied to the non-commissioned officers. Their promotion is necessarily rapid, and the field of selection is restricted to those men who are willing to re-engage, *i.e.* to serve beyond their compulsory term of two or three years. Many men do so to avoid the struggles of civil life, and such "fugitive and cloistered virtue" scarcely fosters the moral strength required for command. As the best men return to civil life, there is no choice but to promote inferior men, and the latter, when invested with authority, not infrequently abuse it. Indeed in some armies the soldier regards his officer chiefly as his protector from the rapacity or cruelty of his sergeant or corporal. A true short-service army is almost incapable of being employed on peace service abroad; quite apart from other considerations, the cost of conveying to and from home annually one-third or one-half of the troops would be prohibitive. If, as must be the case, a professional force is maintained for oversea service many men would join it who would otherwise be serving as non-commissioned officers at home and the prevailing difficulty would thus be enhanced. When colonial defence calls for relatively large numbers of men, *i.e.* an army, home resources are severely strained.

41. *Conscription* in the proper sense, *i.e.* selection by lot of a proportion of the able-bodied manhood of a country, is now rarely practised. The obvious unfairness of selection by lot has always had the result of admitting substitutes procured by those on whom the lot has fallen; hence the poorer classes are unduly burdened with the defence of the country, while the rich escape with a money payment. In practice, conscription invariably produces a professional long-service army in which each soldier is paid to discharge the obligations of several successive conscripts. Such an army is therefore a voluntary long-service army in the main, *plus* a proportion of the unwilling men found in every forced levy. The gravest disadvantage is, however, the fact that the bulk of the nation has not been through the regular army at all; it is almost impossible to maintain a large and costly standing army and at the same time to give a full training to auxiliary forces. The difference between a "national guard" such as that of the siege of Paris in 1870–71 and a *Landwehr* produced under the German system, was very wide. Regarded as a compromise between universal and voluntary service, conscription still maintains a precarious existence in Europe. As the cardinal principle of recruiting armies, it is completely obsolete.

42. *Voluntary Service.*—Existing voluntary armies have usually developed from armies of the old régime, and seem to owe their continued existence either to the fact that only comparatively small armaments are maintained in peace, other and larger armies being specially recruited during a war (a modification of the "enlistment system"), or to the necessities of garrisoning colonial empires. The military advantages and disadvantages of voluntary service are naturally the faults and merits of the opposite system. The voluntary army is available for general service. It includes few unwilling soldiers, and its resultant advantage over an army of the ordinary type has been stated to be as high as 30%. At all events, we need only examine military history to find that with conscript armies wholesale shirking is far from unknown. That loss from this cause does not paralyse operations as it paralysed those of the 18th century.

is due to the fact that such fugitives do not desert to the enemy, but reappear in the ranks of their own side; it must not therefore be assumed that men have become braver because the "missing" are not so numerous. In colonial and savage warfare the superior personal qualities of the voluntary soldier often count for more than skill on the part of the officers. These would be diminished by shortening the time of service, and this fact, with the expense of transport, entails that a reasonably long period must be spent with the colours. On the other hand, the provision of the large armies of modern warfare requires the maintenance of a reserve, and no reserve is possible if the whole period for which men will enlist is spent with the colours. The demand for long service in the individual, and for trained men in the aggregate, thus produces a compromise. The principle of long service, *i.e.* ten years or more with the colours, is not applicable to the needs of the modern *grande guerre*; it gives neither great initial strength nor great reserves. The force thus produced is costly and not lightly to be risked; it affords relatively little opportunity for the training of officers, and tends to become a class apart from the rest of the population. On the other hand, such a force is the best possible army for foreign and colonial service. A state therefore which relies on voluntary enlistment for its forces at home and abroad, must either keep an army which is adaptable to both functions or maintain a separate service for each.

In a state where relatively small armaments are maintained in peace, voluntary armies are infinitely superior to any that could be obtained under any system of compulsion. The state can afford to give a good wage, and can therefore choose its recruits carefully. It can thus have either a few incomparable veteran soldiers (long-service), or a fairly large number of men of superior physique and intelligence, who have received an adequate short-service training. Even the youngest of such men are capable of good service, while the veterans are probably better soldiers than any to be found in conscript armies. This is, however, a special case. The raw material of any but a small voluntary army usually tends to be drawn from inferior sources; the cost of a larger force, paid the full wages of skilled labourers, would be very great, and numbers commensurate with those of an army of the other model could only be obtained at an exorbitant price. The short-service principle is therefore accepted. Here, however, as recruiting depends upon the good-will of the people, it is impossible to work the soldiers with any degree of rigour. Hence the voluntary soldier must serve longer than a conscript in order to attain the same proficiency. The reserve is thus weakened, and the total trained regular force diminished. Moreover, as fewer recruits are required annually, there is less work for the officers to do. In the particular case of Great Britain it is practically certain that in future, reliance will be placed upon the auxiliary forces and the civil population for the provision of the enormous reserves required in a great war; this course is, however, only feasible in the case of an insular nation which has time to collect its strength for the final and decisive blow overseas. The application of the same principle to a continental military power depends on the capacity for stern and unflagging resistance displayed by the *corps de couverture* charged with the duty of gaining the time necessary for the development and concentration of the national masses. In Great Britain (except in the case of a surprise invasion) the place of this corps would be taken by "command of the sea." Abroad, the spirit of the exposed regiments themselves furnishes the only guarantee, and this can hardly be calculated with sufficient certainty, under modern conditions, to justify the adoption of this new "enlistment system." Voluntary service, therefore, with all its intrinsic merits, is only applicable to the conditions of a great war when the war reserve can be trained *ad hoc*.

43. The militia idea (see Militia) has been applied most completely in Switzerland, which has no regular army, but trains almost the whole nation as a militia. The system, with many serious disadvantages, has the great merit that the maximum number of men receives a certain amount of training at a minimum cost both to the state and to the individual. Mention should also be made of the system of augmenting the national forces by recruiting "foreign legions." This is, of course, a relic of the *Werbe-system;* it was practised habitually by the British governments of the 18th and early 19th centuries. "Hessians" figured conspicuously in the British armies in the American War of Independence, and the "King's German Legion" was only the best and most famous of many foreign corps in the service of George III. during the Revolutionary and Napoleonic wars. A new German Legion was raised during the Crimean War, but the almost universal adoption of the *Krümper* system has naturally put an end to the old method, for all the best recruits are now accounted for in the service of their own countries.

Army Organization

44. *Arms of the Service.*—Organization into "arms" is produced by the multiplicity of the weapons used, their functions and their limitations. The "three arms"—a term universally applied to infantry (*q.v.*), cavalry (*q.v.*) and artillery (*q.v.*)—coexist owing to the fact that each can undertake functions which the others cannot properly fulfil. Thus cavalry can close with an enemy at the quickest pace, infantry can work in difficult ground, and artillery is effective at great ranges. Infantry indeed, having the power of engaging both at close quarters and at a distance, constitutes the chief part of a fighting force. Other "arms," such as mounted infantry, cyclists, engineers, &c., are again differentiated from the three chief arms by their proper functions. In deciding upon the establishment in peace, or the composition of a force for war, it is therefore necessary to settle beforehand the relative importance of these functions in carrying out the work in hand. Thus an army operating in Essex would be unusually strong in infantry, one on Salisbury Plain would possess a great number of guns, and an army operating on the South African veldt would consist very largely of mounted men. The normal European war has, however, naturally been taken as the basis upon which the relative proportions of the three arms are calculated. At the battle of Kolin (1757) the cavalry was more than half as strong as the infantry engaged. At Borodino (1812) there were 39 cavalry to 100 of other arms, and 5 guns per 1000 men. In 1870 the Germans had at the outset 7 cavalrymen to every 100 men of other arms, the French 10. As for guns, the German artillery had 3, the French 3½ per 1000 men. In more modern times the proportions have undergone some alteration, the artillery having been increased, and the cavalry brought nearer to the Napoleonic standard. Thus the relative proportions, in peace time, now stand at 5 or 6 guns per 1000 men, and 16 cavalry soldiers to 100 men of other arms. It must be borne in mind that cavalry and artillery are maintained in peace at a higher effective than infantry, the strength of the latter being much inflated in war, while cavalry and artillery are not easily extemporized. Thus in the Manchurian campaign these proportions were very different. The Russian army on the eve of the battle of Mukden (20th of February 1905) consisted of 370 battalions, 142 squadrons and 153 field batteries (1200 guns), with, in addition, over 200 heavy guns. The strength of this force, which was organized in three armies, was about 300,000 infantry and 18,000 cavalry and Cossacks, with 3½ guns per 1000 men of other arms. The Japanese armies consisted of 300,000 infantry, 11,000 cavalry, 900 field and 170 heavy guns, the proportion of field artillery being 2½ guns per 1000 men.

It is perhaps not superfluous to mention that all the smaller units in a modern army consist of one arm only. Formerly several dissimilar weapons were combined in the same unit. The knight with his four or five variously armed retainers constituted an example of this method of organization, which slowly died out as weapons became more uniform and their functions better defined.

45. *Command.*—The first essential of a good organization is to ensure that each member of the organized body, in his own sphere of action, should contribute his share to the achievement of the common object. Further, it is entirely beyond the power

of one man, or of a few, to control every action and provide for every want of a great number of individuals. The modern system of command, therefore, provides for a system of grades, in which, theoretically, officers of each grade control a group of the next lower units. A lieutenant-colonel, for instance, may be in charge of a group of eight companies, each of which is under a captain. In practice, all armies are permanently organized on these lines, up to the colonel's or lieutenant-colonel's command, and most of them are permanently divided into various higher units under general officers, the brigade, division and army corps. The almost invariable practice is to organize *infantry* into companies, battalions and regiments. *Cavalry* is divided into troops, squadrons and regiments. *Artillery* is organized in batteries, these being usually grouped in various ways. The other arms and departments are subdivided in the same general way. The commands of general officers are the *brigade* of infantry, cavalry, and in some cases artillery, the *division* of two or more infantry brigades and a force of artillery and mounted troops, or of cavalry and horse artillery, and the *army corps* of two or more divisions and " corps troops." *Armies* of several corps, and *groups of armies* are also formed.

46. A *brigade* is the command of a brigadier or major-general, or of a colonel. It consists almost invariably of one arm only. In armies of the old régime it was not usual to assign troops of all arms to the subordinate generals. Hence the brigade is a much older form of organization than the division of all arms, and in fact dates from the 16th century. The infantry brigade consists, in the British service, of the brigadier and his staff, four battalions of infantry, and adminstrative and medical units, the combatant strength being about 4000 men. In Germany and France the brigade is composed of the staff, and two regiments (6 battalions) with a total of over 6000 combatants at war strength. The cavalry brigade is sometimes formed of three, sometimes of two regiments; the number of squadrons to a regiment on service is usually four, exceptionally three, and rarely five and six. The " brigade " of artillery in Great Britain is a lieutenant-colonel's command, and the term here corresponds to the *Abtheilung* of the German, and the *groupe* of the French armies (see Artillery). In Germany and France, however, an artillery brigade consists of two or more regiments, or twelve batteries at least, under the command of an artillery general officer.

47. A *division* is an organization containing troops of all arms. Since the virtual abolition of the " corps artillery " (see Artillery), the force of field artillery forming part of an infantry division is sometimes as high as 72 guns (Germany); in Great Britain the augmented division of 1906 has 54 field guns, 12 field howitzers, and 4 heavy guns, a total of 70. The term " infantry " division is, in strictness, no longer applicable, since such a unit is a miniature army corps of infantry, artillery and cavalry, with the necessary services for the supply of ammunition, food and forage, and for the care of the sick and wounded. A more exact title would be " army " division. In general it is composed, so far as combatants are concerned, of the divisional commander and his staff, two or more infantry brigades, a number of batteries of field artillery forming a regiment, brigade or group, a small force, varying from a squadron to a regiment, of cavalry (divisional cavalry), with some engineers. The force of the old British division (1905) may be taken, on an average, as 10,000 men, increased in the 1906 reorganization to about 15,000 combatants. In other armies the fighting force of the division amounts to rather more than 14,000. The *cavalry division* (see Cavalry) is composed of the staff, two or three cavalry brigades, horse artillery, with perhaps mounted infantry, cyclists, or even light infantry in addition. In many, if not most, armies cavalry divisions are formed only in war. In the field the cavalry division is usually an independent unit with its own commander and staff. " Cavalry corps " of several divisions have very rarely been formed in the past, a division having been regarded as the largest unit capable of being led by one man. There is, however, a growing tendency in favour of the corps organization, at any rate in war.

48. *Army Corps.*—The " corps " of the 18th century was simply a large detachment, more or less complete in itself, organized for some particular purpose (*e.g.* to cover a siege), and placed for the time being under some general officer other than the chief commander. The modern army corps is a development from the division of all arms, which originated in the French Revolutionary wars. It is a unit of considerable strength, furnished with the due proportion of troops of all arms and of the auxiliary and medical services, and permanently placed under the command of one general. The corps organization (though a *corps d'armée* was often spoken of as an *armée*) was used in Napoleon's army in all the campaigns of the Empire. It may be mentioned, as a curious feature of Napoleon's methods, that he invariably constituted each *corps d'armée* of a different strength, so that the enemy would not be able to estimate his force by the simple process of counting the corps flags which marked the marshals' headquarters. Thus in 1812 he constituted one corps of 72,000 men, while another had but 18,000. After the fall of Napoleon a further advance was made. The adoption of universal service amongst the great military nations brought in its train the territorial organization, and the corps, representing a large district, soon became a unit of peace formation. For the smooth working of the new military system it was essential that the framework of the war army should exist in peace. The Prussians were the first to bring the system to perfection; long before 1866 Prussia was permanently divided into army corps districts, all the troops of the III. army corps being Brandenburgers, all those of the VI. Silesians, and so on, though political reasons required, and to some extent still require, modifications of this principle in dealing with annexed territory (*e.g.* Hanover and Alsace-Lorraine). The events of 1866 and of 1870–71 caused the almost universal adoption of the army corps regional system. In the case of the British army, operating as it usually did in minor wars, and rarely having more than sixty or seventy thousand men on one theatre even in continental wars, there was less need of so large a unit as the corps. Not only was a British army small in numbers, but it preserved high traditions of discipline, and was sufficiently well trained to be susceptible as a unit to the impulse given by one man. Even where the term " corps " does appear in Peninsular annals, the implication is of a corps in the old sense of a grand detachment. Neither cavalry nor artillery was assigned to any of the British " corps " at Waterloo.

49. *Constitution of the Army Corps.*—In 1870–71 the III. German army corps (with which compare Marshal Davout's *ordre de bataille* above) consisted of the following combatant units: (*a*) staff; (*b*) two infantry divisions (4 brigades, 8 regiments or 24 battalions), with, in each division, a cavalry regiment, 4 batteries of artillery or 24 guns, and engineers; (*c*) corps troops, artillery (6 field batteries), pioneer battalion (engineers), train battalion (supply and transport). A rifle battalion was attached to one of the divisions.

This *ordre de bataille* was followed more or less generally by all countries up to the most modern times, but between 1890 and 1902 came a very considerable change in the point of view from which the corps was regarded as a fighting unit. This change was expressed in the abolition of the corps artillery. Formerly the corps commander controlled the greater part of the field artillery, as well as troops of other arms; at the present time he has a mere handful of troops. Unless battalions are taken from the divisions to form a corps reserve, the direct influence of the corps organization on the battle is due almost solely to the fact that the commander has at his disposal the special natures of artillery and also some horse artillery. Thus the (augmented) division is regarded by many as the fighting unit of the 20th, as the corps was that of the 19th century. In Europe there is even a tendency to substitute the ancient phrase " reserve artillery " for " corps artillery," showing that the rôle to be played by the corps batteries is subordinated to the operations of the masses of divisional artillery, the whole being subject, of course, to the technical supervision of the artillery general officer who accompanies the corps headquarters. Thus limited, the army corps has now come to consist of the staff, two or more divisions, the corps or reserve artillery (of special batteries), a small force of "corps" cavalry, and various technical and departmental troops. The cavalry is never very numerous, owing to the demands of the independent cavalry divisions on the one hand and those of the divisional cavalry on the other. The engineers of an army corps include telegraph, balloon and pontoon units. Attached to the corps are reserves of munitions and supplies in ammunition columns, field parks, supply parks, &c. The term and the organization were discontinued in England in 1906, on the augmentation of the divisions and the assignment of certain former "corps troops" to the direct control of the army commanders. It should be noticed that the Japanese, who had no corps organization during the war of 1904–5, afterwards increased the strength of their divisions from 15,000 to 20,000; the augmented "division," with the above *peace* strength, becomes to all intents and purposes a corps, and the generals commanding divisions were in 1906 given the title of generals-in-chief.

50. *Army.*—The term "army" is applied, in war time, to any command of several army corps, or even of several divisions, operating under the orders of one commander-in-chief. The army in this sense (distinguished by a number or by a special title) varies, therefore, with circumstances. In the American Civil War, the Army of the Ohio consisted in 1864 only of the army staff and the XXIII. corps. At the other extreme we find that the German II. Army in 1870 consisted of seven army corps and two cavalry divisions, and the III. Army of six army corps and two cavalry divisions. The term "army" in this sense is therefore very elastic in its application, but it is generally held that large groups of corps operating in one theatre of war should be subdivided into armies, and that the strength of an army should not exceed about 150,000 men, if indeed this figure is reached at all. This again depends upon circumstances. It might be advisable to divide a force of five corps into two armies, or on the other hand it might be impossible to find suitable leaders for more than two armies when half a million men were present for duty. In France, organization has been carried a step further. The bulk of the national forces is, in case of war, organized into a "group of armies" under a commander, usually, though incorrectly, called the *generalissimo*. This office, of course, does not exist in peace, but the insignia, the distinctive marks of the headquarters flag, &c., are stated in official publications, and the names of the generalissimo and of his chief of staff are known. Under the generalissimo would be four or five army commanders, each with three or four army corps under him. Independent of this "group of armies" there would be other and minor "armies" where required.

51. *Chief Command.*—The leading of the "group of armies" referred to above does not, in France, imply the supreme command, which would be exercised by the minister of war in Paris. The German system, on the other hand, is based upon the leadership of the national forces by the sovereign in person, and even though the headquarters of the "supreme war lord" (*Oberste Kriegsherr*) are actually in the field in one theatre of operations, he directs the movements of the German armies in all quarters. Similarly, in 1864, General Grant accompanied and controlled as a "group" the Armies of the Potomac and the James, supervising at the same time the operations of other groups and armies. In the same campaign a subordinate general, Sherman, commanded a "group" consisting of the Armies of the Tennessee, the Cumberland and the Ohio. The question as to whether the supreme command and the command of the principal group of armies should be in the same hands is very difficult of solution. In practice, the method adopted in each case usually grows out of the military and political conditions. The advantage of the German method is that the supreme commander is in actual contact with the troops, and can therefore form an accurate judgment of their powers. Under these conditions the risk of having cabinet strategy forced upon the generals is at its minimum, and more especially so if the supreme commander is the head of the state. On the other hand, his judgment is very liable to be influenced unduly by facts, coming under his own notice, which may in reality have no more than a local significance. Further, the supreme commander is at the mercy of distant subordinates to a far greater degree than he would be if free to go from one army to another. Thus, in 1870 the king of Prussia's headquarters before Paris were subjected to such pressure from subordinate army commanders that on several occasions selected staff-officers had to be sent to examine, for the king's private information, the real state of things at the front. The conduct of operations by one group commander in the campaign of 1864 seemed, at a distance, so eccentric and dangerous that General Grant actually left his own group of armies and went in person to take over command at the threatened point. Balanced judgment is thus often impossible unless the supreme command is independent of, and in a position to exercise general supervision over, each and every group or army. At the other end of the scale is the system of command employed by the Turks in 1877, in which four armies, three of them being actually on the same theatre of war, were directed from Constantinople. This system may be condemned unreservedly. It is recognized that, once the armies on either side have become seriously engaged, a commander-in-chief on the spot must direct them. Thus in 1904, while the Japanese and Russian armies were under the supreme command of their respective sovereigns, General Kuropatkin and Marshal Oyama personally commanded the chief groups of armies in the field. This is substantially the same as the system of the French army. It is therefore permissible to regard the system pursued by the Germans in 1870, and by the Union government in 1864, more as suited to special circumstances than as a general rule. As has been said above, the special feature of the German system of command is the personal leadership of the German emperor, and this brings the student at once to the consideration of another important part of the "superior leading."

52. The *Chief of the General Staff* is, as his title implies, the chief staff officer of the service, and as such, he has duties of the highest possible importance, both in peace and war. For the general subject of staff duties see Staff. Here we are concerned only with the peculiar position of the chief of staff under a system in which the sovereign is the actual commander-in-chief. It is obvious in the first place that the sovereign may not be a great soldier, fitted by mental gifts, training and character to be placed at the head of an army of, perhaps, a million men. Allowing that it is imperative that, whatever he may be in himself, the sovereign should *ex officio* command the armies, it is easy to see that the ablest general in these armies must be selected to act as his adviser, irrespective of rank and seniority. This officer must therefore be assigned to a station beyond that of his army rank, and his orders are in fact those of the sovereign himself. Nor is it sufficient that he should occupy an unofficial position as adviser, or *ad latus.* If he were no more than this, the sovereign could act without his adviser being even aware of the action taken. As the staff is the machinery for the transmission of orders and despatches, all orders of the commander-in-chief are signed by the chief of staff as a matter of course, and this position is therefore that in which the adviser has the necessary influence. The relations between the sovereign and his chief military adviser are thus of the first importance to the smooth working of the great military machine, and never have the possibilities of this apparently strange system been more fully exploited than by King William and his chief of staff von Moltke in 1866 and in 1870–71. It is not true to say that the king was the mere figurehead of the German armies, or that Moltke was the real commander-in-chief. Those who have said this forget that the sole responsibility for the consequences of every order lay with the king, and that it is precisely the fear of this responsibilty that has made so many brilliant subordinates fail when in chief command. The characters of the two men supplemented each other, as also in the case of Blücher and Gneisenau and that of Radetzky and Hess. Under these circumstances, the German system of command works, on the whole, smoothly. Matters would, however, be different if either of the two officers failed to realize their mutual interdependence, and the system is in any

case only required when the self-sufficing great soldier is not available for the chief executive command.

53. *First and Second Lines.*—The organization into arms and units is of course maintained in peace as well as for war. Military forces are further organized, in peace, into active and reserve troops, first and second lines, &c., according to the power possessed by the executive over the men. Broadly speaking, the latter fall into three classes, regulars, auxiliary forces and irregular troops. The regulars or active troops are usually liable to serve at all times and in any country to which they may be sent. Auxiliary forces may be defined as all troops which undergo actual military training without being constantly under arms, and in Great Britain these were until 1908 represented by the Militia, the Yeomanry and the Volunteers, and now by the Territorial Force and the Special Reserve. In a country in which recruiting is by voluntary enlistment the classification is, of course, very different from that prevailing in a conscript army. The various "lines" are usually composed of separate organizations; the men are recruited upon different engagements, and receive a varying amount of training. Of the men not permanently embodied, only the reserve of the active army has actually served a continuous term with the colours. Other troops, called by various appellations, of which "militia" may be taken as generic, go through their military training at intervals. The general lines of army organization in the case of a country recruiting by universal service are as follows:—The male population is divided into classes, by ages, and the total period of liability to service is usually about 25 years. Thus at any given time, assuming two years' colour-service, the men of 20 and 21 years of age would constitute the active army serving with the colours, those of, say, 22 and 23, the reserve. The *Landwehr* or second line army would consist of all men who had been through the active army and were now aged 24 to 36. The third line would similarly consist of men whose ages were between 36 and 44. Assuming the same annual levy, the active army would consist of 200,000 men, its reserve 200,000, the second line of 1,300,000, and the third of 800,000. Thus of 2,500,000 men liable to, and trained for, military service, 200,000 only would be under arms at any given time. The simple system here outlined is of course modified and complicated in practice owing to re-engagements by non-commissioned officers, the speedy dismissal to the reserve of intelligent and educated men, &c.

54. *War Reserves.*—In war, the reserves increase the field armies to 400,000 men, the whole or part of the second line is called up and formed into auxiliary regiments, brigades and divisions, and in case of necessity the third line is also called upon, though usually this is only in the last resort and for home defence only. The proportion of reservists to men with the colours varies of course with the length of service. Thus in France or Germany, with two years' service in force, half of the rank and file of a unit in war would be men recalled from civil life. The true military value of reservists is often questioned, and under certain circumstances it is probable that units would take the field at peace strength without waiting for their reservists. The frontier guards of the continental military powers, which are expected to move at the earliest possible moment after hostilities have begun, are maintained at a higher effective than other units, and do not depend to any great extent on receiving reservists. The peace footing of cavalry and artillery units is similarly maintained at an artificial level. An operation of the nature of a *coup de main* would in any case be carried out by the troops available at the moment, however large might be the force required—twenty weak battalions would, in fact, be employed instead of ten strong ones. There is another class of troops, which may be called depot troops. These consist of officers and men left behind when the active corps completed with reserves takes the field, and they have (*a*) to furnish drafts for the front—and (*b*) to form a nucleus upon which all later formations are built up. The troops of the second line undertake minor work, such as guarding railways, and also furnish drafts for the field army. Later, when they have been for some time under arms, the second line troops are often employed by themselves in first line. A year's training under war conditions should bring such troops to the highest efficiency. As for irregulars, they have real military value only when the various permanent establishments do not take up the whole fighting strength of the nation, and thus states having universal service armies do not, as a rule, contemplate the employment of combatants other than those shown on the peace rolls. The status of irregulars is ill defined, but it is practically agreed that combatants, over whose conduct the military authorities have no disciplinary power, should be denied the privileges of recognized soldiers, and put to death if captured. So drastic a procedure is naturally open to abuse and is not always expedient. Still, it is perfectly right that the same man shall not be allowed, for example, to shoot a sentry at one moment, and to claim the privileges of a harmless civilian at the next. The division into first, second and third lines follows generally from the above. The first line troops, in a conscript army, are the "active army" or regulars, permanently under arms in peace time, and its reserves, which are used on the outbreak of war to complete the existing units to full strength. The German terms *Landwehr* and *Landsturm* are often applied to armies of the second and the third lines.

55. The military characteristics of the various types of regular troops have been dealt with in considering the advantages and disadvantages of the several forms of recruiting. It only remains to give some indication of the advantages which such forces (irrespective of their time of service) possess over troops which only come up for training at intervals. Physically, the men with the colours are always superior to the rest, owing to their constant exercise and the regularity and order under which they live; as soldiers, they are more under the control of their officers, who are their leaders in daily life, in closer touch with army methods and discipline, and, as regards their formal training, they possess infinitely greater power of strategic and tactical manœuvre. Their steadiness under fire is of course more to be relied upon than that of other troops. Wellington, speaking of the contrast between old and young soldiers (regulars), was of opinion that the chief difference lay in the greater hardiness, power of endurance, and general campaigning qualities given by experience. This is of course more than ever true in respect of regular and auxiliary troops, as was strikingly demonstrated in the Spanish-American War. On the whole, it is true to say that only a regular army can endure defeat without dissolution, and that volunteers, reservists or militiamen fresh from civil life may win a victory but cannot make the fullest use of it when won. At the same time, when they have been through one or two arduous campaigns, raw troops become to all intents and purposes equal to any regulars. On the other hand, the greatest military virtue of auxiliary forces is their enthusiasm. With this quality were won the great victories of 1792–94 in France, those of 1813 in Germany, and the beginnings of Italian unity at Calatafimi and Palermo. The earlier days of the American Civil War witnessed desperate fighting, of which Shiloh is the best example, between armies which had had but the slightest military training. In the same war the first battle of Bull Run illustrated what has been said above as to the weaknesses of unprofessional armies. Both sides, raw and untrained, fought for a long time with the greatest determination, after which the defeated army was completely dissolved in rout and the victors quite unable to pursue. So far it is the relative military value of the professional soldier and the citizen-soldier that has been reviewed. A continental army of the French or German stamp is differently constituted. It is, first of all, clear that the drilled citizen-soldier combines the qualities of training and enthusiasm. From this it follows that a hostile "feeling" as well as a hostile "view" must animate such an army if it is to do good service. If a modern "nation in arms" is engaged in a purely dynastic quarrel against a professional army of inferior strength, the result will probably be victory for the latter. But the active army of France or Germany constitutes but a small part of the "nation in arms," and the army for war is

composed in addition of men who have at some period in the past gone through a regular training. Herein lies the difference between continental and British auxiliary forces. In the French army, an ex-soldier during his ten years of reserve service was by the law of 1905 only liable for two months' training, and for the rest of his military career for two weeks' service only. The further reduction of this liability was proposed in 1907 and led to much controversy. The question of the value of auxiliary forces, then, as between the continous work of, say, English territorials, and the permanent though dwindling influence of an original period of active soldiering, is one of considerable importance. It is largely decided in any given case by the average age of the men in the ranks.

56. The transfer of troops from the state of peace to that of war is called *mobilization*. This is, of course, a matter which primarily depends on good administration, and its minutest details are in all states laid down beforehand. Reservists have to be summoned, and, on arrival, to be clothed and equipped out of stores maintained in peace. Officers and men of the regular army on leave have to be recalled, the whole medically examined for physical fitness to serve, and a thousand details have to be worked out before the unit is ready to move to its concentration station. The concentration and the strategic deployment are, of course, dependent upon the circumstances of each war, and the peace organization ceases to be applicable. But throughout a war the depots at home, the recruiting districts of second-line troops, and above all the various arsenals, manufactories and offices controlled by the war department are continually at work in maintaining the troops in the field at proper strength and effectiveness.

57. *Territorial System.*—The feudal system was of course a territorial system in principle. Indeed, as has been shown above, a feudal army was chiefly at fault owing to the dislocation of the various levies. Concentration was equally the characteristic of the professional armies which succeeded those of feudalism, and only such militia forces as remained in existence preserved a local character. The origin of territorial recruiting for first-line troops is to be found in the " cantonal " system, said to have been introduced by Louis XIV., but brought to the greatest perfection in Prussia under Frederick William I. But long service and the absence of a reserve vitiated the system in practice, since losses had to be made good by general recruiting, and even the French Revolution may hardly be said to have produced the territorial system as we understand it to-day. It was only in the deliberate preparation of the Prussian army on short-service lines that we find the beginning of the " territorial system of dislocation and command." This is so intimately connected with the general system of organization that it cannot be considered merely as a method of recruiting by districts. It may be defined as a system whereby, for purposes of command in peace, recruiting, and of organization generally, the country is divided into districts, which are again divided and subdivided as may be required. In a country in which universal service prevails, an army corps district is divided into divisional districts, these being made up of brigade and of regimental districts. Each of these units recruits, and is in peace usually stationed, in its own area; the artillery, cavalry and special arms are recruited for the corps throughout the whole allotted area, and stationed at various points within the same. Thus in the German army the III. army corps is composed entirely of Brandenburgers. The infantry of the corps is stationed in ten towns, the cavalry in four and the artillery in five. In countries which adhere to voluntary recruiting, the system, depending as it does on the calculable certainty of recruiting, is not so fully developed, but in Great Britain the auxiliary forces have been reorganized in divisions of all arms on a strictly territorial basis. The advantage of the system as carried into effect in Germany is obvious. Training is carried out with a minimum of friction and expense, as each unit has an ample area for training. Whilst the brigadiers can exercise general control over the colonels, and the divisional generals over the brigadiers, there is little undue interference of superior authority in the work of each grade, and the men, if soldiers by compulsion, at any rate are serving close to their own homes. Most of the reservists required on mobilization reside within a few miles of their barracks. Living in the midst of the civil population, the troops do not tend to become a class apart. Small garrisons are not, as formerly, allowed to stagnate, since modern communications make supervision easy. Further, it must be borne in mind that the essence of the system is the organization and training for war of the whole military population. Now so great a mass of men could not be administered except through this decentralization of authority, and the corollary of short service universally applied is the full territorial system, in which the whole enrolled strength of the district is subjected to the authority of the district commander. Practice, however, falls short of theory, and the dangers of drawing whole units from disaffected or unmilitary districts are often foreseen and discounted by distributing the recruits, non-regionally, amongst more or less distant regiments.

58. *Army Administration.*—The existing systems of command and organization, being usually based upon purely military considerations, have thus much, indeed almost all, in common. *Administration* differs from them in one important respect. While the methods of command and organization are the result of the accumulated experience of many armies through many hundred years, the central administration in each case is the product of the historical evolution of the particular country, and is dependent upon forms of government, constitutions and political parties. Thus France, after 1870, remodelled the organization of her forces in accordance with the methods which were presumed to have given Germany the victory, but the head-quarters staff at Paris is very different in all branches from that of Berlin. Great Britain adopted German tactics, and to some extent even uniform, but the Army Council has no counterpart in the administration of the German emperor's forces.

The first point for consideration, therefore, is, what is the ultimate, and what is the proximate, authority supervising the administration? The former is, in most countries, the people or its representatives in parliament, for it is in their power to stop supplies, and without money the whole military fabric must crumble. The constitutional chief of the army is the sovereign, or, in republics, the president, but in most countries the direct control of army matters by the representatives of the people extends over all affairs into which the well-being of the civil population, the expenditure of money, alleged miscarriages of military justice, &c., enter, and it is not unusual to find grand strategy, and even the technical deficiencies of a field-gun or rifle, the subject of interpellation and debate. The peculiar influence of the sovereign is in what may be termed patronage (that is, the selection of officers to fill important positions and the general supervision of the officer-corps), and in the fact that loyalty is the foundation of the discipline and soldierly honour which it is the task of the officers to inculate into their men. In all cases the head of the state is *ipso facto* the head of the army. The difference between various systems may then be held to depend on the degree of power allowed to or held by him. This reacts upon the central administration of the army, and is the cause of the differences of system alluded to. For the civil chief of the executive is not necessarily a soldier, much less an expert and capable soldier; he must, therefore, be provided with technical advisers. The chief of the general staff is often the principal of these, though in some cases a special commander-in-chief, or the minister for war, or, as in France and England, a committee or council, has the duty of advising the executive on technical matters.

59. *Branches of Administration.* In these circumstances the only general principle of army administration common to all systems is the division of the labour between two great branches. Military administration, in respect of the troops and material which it has to control, is divided between the departments of the *War Office* and the *General Staff*. In the staff work of subordinate units, *e.g.* army corps and divisions, the same classification of duties is adopted, " general staff " duties being performed by one set of officers, " routine staff " duties by another.

The work of a *General Staff* may be taken as consisting in preparation for war, and this again, both in Great Britain and abroad, consists of military policy in all its branches, staff duties in war, the collection of intelligence, mobilization, plans of operations and concentration, training, military history and geography, and the preparation of war regulations. These subjects are usually subdivided into four or five groups, each of which is dealt with by a separate section of the general staff, the actual division of the work, of course, varying in different countries. Thus, the second section of the French staff deals with "the organization and tactics of foreign armies, study of foreign theatres of war, and military missions abroad." A *War Office* is concerned with peace administration and with the provision of men and material in war. Under the former category fall such matters as "routine" administration, finance, justice, recruiting, promotion of officers (though not always), barracks and buildings generally, armament, equipment and clothing, &c., in fact all matters not directly relevant to the training of the troops for and the employment of the troops in war. In war, some of the functions of a war office are suspended, but on the other hand the work necessary for the provision of men and material to augment the army and to make good its losses is vastly increased. In 1870 the minister of war, von Roon, accompanied the headquarters in the field, but this arrangement did not work well, and will not be employed again. The chief duties other than those of the general staff fall into two classes, the "routine staff," administration or adjutant-general's branch, which deals with all matters affecting *personnel*, and the quartermaster-general's branch, which supervises the provision and issue of supplies, stores and *matériel* of all kinds. Over and above these, provision has to be made for control of all the technical parts of administration, such as artillery and engineer services (in Great Britain, this, with a portion of the quartermaster-general's department, is under the master-general of the ordnance), and for military legislation, preparation of estimates, &c. These are, of course, special subjects, not directly belonging to the general administrative system. It is only requisite that the latter should be sufficiently elastic to admit of these departments being formed as required. However these subordinate offices may be multiplied, the main work of the war office is in the two departments of the adjutant-general (*personnel*) and the quartermaster-general (*matériel*). Beyond and wholly distinct from these is the general staff, the creation of which is perhaps the most important contribution of the past century to the pure science of military organization.

COMPARATIVE STRENGTH OF VARIOUS ARMIES
(*a*) *Compulsory Service* (1906).

	France.	Germany.	Russia.	Austria-Hungary.	Italy.
Annual Contingent for the Colours	230,000	222,000	254,000	128,000	83,000
Medically unfit and exempt	90,000	127,000	120,000	57,000	110,000
Excused from Service in Peace, able-bodied	..	291,000	606,000	285,000	122,000
Total of Men becoming liable for Service in 1907	320,000	540,000	980,000	470,000	315,000
Total Permanent Armed Force in Peace	610,000 (not including colonial troops)	610,000	1,226,000	356,000	269,000
First-Line Troops, war-strength (estimated)	1,350,000	1,675,000	2,187,000	950,000	800,000
Second-Line Troops, war-strength (estimated)	3,000,000	2,275,000	1,429,000	1,450,000	1,150,000
Numbers available in excess of these (estimated)	450,000	3,950,000	9,384,000	5,000,000	1,200,000
Total War Resources of all kinds	4,800,000	7,900,000	13,000,000	7,400,000	3,150,000
Annual Military Expenditure—total	£27,720,000	£32,228,000	£36,080,000	£15,840,000	£11,280,000
Annual Military Expenditure—per head of population (approximate)	13s. 9d.	10s. 9d.	5s. 3d.	6s. 8d.	6s. 5d.

(*b*) *Authorized Establishments and Approximate Military Resources of the British Empire* (1906–1907).

	British Regular Army.	Reserves for Regular Army.	Auxiliary Forces.	Native Troops (Regular, Reserve, &c.).	Colonial Forces (various).	Total.
Great Britain	117,000	120,000	500,000	..	..	737,000
Channel Islands, Malta, Bermuda, Colonies and Dependencies	65,000	..	6,000	..	30,000	101,000
India	75,000	..	30,000	202,000	..	307,000
Canadian Forces	..	..	46,000	..	59,000 (reserves)	105,000
Australian Forces (including New Zealand)	..	..	70,000 (appr.)	..	..	70,000
South African Forces	..	..	20,000 (appr.)	..	..	20,000
Totals	257,000	120,000	672,000	202,000	89,000	1,340,000

Note.—Ex-soldiers of regular and auxiliary forces, still fit for service, and estimated *levées en masse*, are not counted. Enlistment chiefly voluntary.

(*c*) The Regular Army of the United States has a maximum authorized establishment (1906) of 60,000 enlisted men; the Organized Militia was at the same date 110,000 strong. Voluntary enlistment throughout. (See UNITED STATES.) In 1906–1907 the total numbers available for a *levée en masse* were estimated at 13,000,000.

BRITISH ARMY

60. Prior to the Norman Conquest the armed force of England was essentially a national militia. Every freeman was bound to bear arms for the defence of the country, or for the maintenance of order. To give some organization and training to the levy, the several sheriffs had authority to call out the contingents of their shires for exercise. The "fyrd," as the levy was named, was available for home service only, and could not be moved even from its county except in the case of emergency; and it

was principally to repel oversea invasions that its services were required. Yet even in those days the necessity of some more permanent force was felt, and bodies of paid troops were maintained by the kings at their own cost. Thus Canute and his successors, and even some of the great earls kept up a household force (*huscarles*). The English army at Hastings consisted of the *fyrd* and the corps of *huscarles*.

The English had fought on foot; but the mailed horseman had now become the chief factor in war, and the Conqueror introduced into England the system of tenure by knight-service familiar in Normandy. This was based on the unit of the feudal host, the *constabularia* of ten knights, the Conqueror granting lands in return for finding one or more of these units (in the case of great barons) or some fraction of them (in the case of lesser tenants). The obligation was to provide knights to serve, with horse and arms, for forty days in each year at their own charges. This obligation could be handed on by sub-enfeoffment through a whole series of under-tenants. The system being based, not on the duty of personal service, but on the obligation to supply one or more knights (or it might be only the fraction of a knight), it was early found convenient to commute this for a money payment known as "scutage" (see KNIGHT SERVICE and SCUTAGE). This money enabled the king to hire mercenaries, or pay such of the feudal troops as were willing to serve beyond the usual time. From time to time proclamations and statutes were issued reminding the holders of knights' fees of their duties; but the immediate object was generally to raise money rather than to enforce personal service, which became more and more rare. The feudal system had not, however, abrogated the old Saxon levies, and from these arose two national institutions—the *posse comitatus*, liable to be called out by the sheriff to maintain the king's peace, and later the *militia* (*q.v.*). The *posse comitatus*, or power of the county, included all males able to bear arms, peers and spiritual men excepted; and though primarily a police force it was also bound to assist in the defence of the country. This levy was organized by the Assize of Arms under Henry II. (1181), and subsequently under Edward I. (1285) by the so-called "Statute of Winchester," which determined the numbers and description of weapons to be kept by each man according to his property, and also provided for their periodical inspection. The early Plantagenets made free use of mercenaries. But the weakness of the feudal system in England was preparing, through the 12th and 13th centuries, a nation in arms absolutely unique in the middle ages. The Scottish and Welsh wars were, of course, fought by the feudal levy, but this levy was far from being the mob of unwilling peasants usual abroad, and from the *fyrd* came the English archers, whose fame was established by Edward I.'s wars, and carried to the continent by Edward III. Edward III. realized that there was better material to be had in his own country than abroad, and the army with which he invaded France was an army of national mercenaries, or, more simply, of English soldiers. The army at Creçy was composed exclusively of English, Welsh and Irish. From the pay list of the army at the siege of Calais (1346) it appears that all ranks, from the prince of Wales downward, were paid, no attempt being made to force even the feudal nobles to serve abroad at their own expense. These armies were raised mainly by contracts entered into "with some knight or gentleman expert in war, and of great revenue and livelihood in the country, to serve the king in war with a number of men." Copies of the indentures executed when Henry V. raised his army for the invasion of France in 1415 are in existence. Under these the contracting party agreed to serve the king abroad for one year, with a given number of men equipped according to agreement, and at a stipulated rate of pay. A certain sum was usually paid in advance, and in many cases the crown jewels and plate were given in pledge for the rest. The profession of arms seems to have been profitable. The pay of the soldier was high as compared with that of the ordinary labourer, and he had the prospect of a share of plunder in addition, so that it was not difficult to raise men where the commander had a good military reputation. Edward III. is said to have declined the services of numbers of foreign mercenaries who wished to enrol under him in his wars against France.

The funds for the payment of these armies were provided partly from the royal revenues, partly from the fines paid in lieu of military service, and other fines arbitrarily imposed, and partly by grants from parliament. As the soldier's contract usually ended with the war, and the king had seldom funds to renew it even if he so wished, the armies disbanded of themselves at the close of each war. To secure the services of the soldier during his contract, acts were passed (18 Henry VI. c. 19; and 7 Henry VII. c. 1) inflicting penalties for desertion; and in Edward VI.'s reign an act "touching the true service of captains and soldiers" was passed, somewhat of the nature of a Mutiny Act.

61. It is difficult to summarize the history of the army between the Hundred Years' War and 1642. The final failure of the English arms in France was soon followed by the Wars of the Roses, and in the long period of civil strife the only national force remaining to England was the Calais garrison. Henry VIII. was a soldier-king, but he shared the public feeling for the old bow and bill, and English armies which served abroad did not, it seems, win the respect of the advanced professional soldiers of the continent. In 1519 the Venetian ambassador described the English forces as consisting of 150,000 men whose peculiar, though not exclusive, weapon was the long bow (Fortescue i. 117). The national levy made in 1588 to resist the Armada and the threat of invasion produced about 750 lancers (heavy-armed cavalry), 2000 light horse and 56,000 foot, beside 20,000 men employed in watching the coasts. The small proportion of mounted men is very remarkable in a country in which Cromwell was before long to illustrate the full power of cavalry on the battlefield. It is indeed not unfair to regard this army as a miscellaneous levy of inferior quality.

It was in cavalry that England was weakest, and by three different acts it was sought to improve the breed of horses, though the light horse of the northern counties had a good reputation, and even won the admiration of the emperor Charles V. Perhaps the best organized force in England at this time was the London volunteer association which ultimately became the Honourable Artillery Company. At Flodden the spirit of the old English yeomanry triumphed over the outward form of continental battalions which the Scots had adopted, and doubtless the great victory did much to retard military progress in England. The chief service of Henry VIII. to the British army was the formation of an artillery train, in which he took a special interest. Before he died the forces came to consist of a few permanent troops (the bodyguard and the fortress artillery service), the militia or general levy, which was for home, and indeed for county, service only, and the paid armies which were collected for a foreign war and disbanded at the conclusion of peace, and were recruited on the same principle of indents which had served in the Hundred Years' War. In the reign of Mary, the old Statute of Winchester was revised (1553), and the new act provided for a readjustment of the county contingents and in some degree for the rearmament of the militia. But, from the fall of Calais and the expedition to Havre up to the battle of the Dunes a century later, the intervention of British forces in foreign wars was always futile and generally disastrous. During this time, however, the numerous British regiments in the service of Holland learned, in the long war of Dutch independence, the art of war as it had developed on the continent since 1450, and assimilated the regimental system and the drill and armament of the best models. Thus it was that in 1642 there were many hundreds of trained and war-experienced officers and sergeants available for the armies of the king and the parliament. By this time bows and bills had long disappeared even from the militia, and the Thirty Years' War, which, even more than the Low Countries, offered a career for the adventurous man, contributed yet more trained officers and soldiers to the English and Scottish forces. So closely indeed was war now studied by Englishmen that the respective adherents of the Dutch and the Swedish systems quarrelled on the eve of the battle of Edgehill. Francis and Horace Vere, Sir John Norris, and other Englishmen had become generals of European reputation. Skippon, Astley, Goring, Rupert, and many others soon to be famous were distinguished as company and regimental officers in the battles and sieges of Germany and the Low Countries.

The home forces of England had, as has been said, little or nothing to revive their ancient renown. Instead, they had come to be regarded as a menace to the constitution. In Queen Elizabeth's time the demands of the Irish wars had led to frequent forced levies, and the occasional billeting of the troops in England also gave rise to murmurs, but the brilliancy and energy of her reign covered a great deal, and the peaceful policy of her successor removed all immediate cause of complaint. But after the accession of Charles I. we find the army a constant and principal source of dispute between the king and parliament, until under William III. it is finally established on a constitutional footing. Charles, wishing to support the Elector Palatine in the Thirty Years' War, raised an army of 10,000 men. He was already encumbered with debts, and the parliament refused all grants, on which he had recourse to forced loans. The army was sent to Spain, but returned without effecting anything, and was not disbanded, as usual, but billeted on the inhabitants. The billeting was the more deeply resented as it appeared that the troops were purposely billeted on those who had resisted the loan. Forced loans, billeting and martial law—all directly connected with the maintenance of the army— formed the main substance of the grievances set forth in the Petition of Right. In accepting this petition, Charles gave up the right to maintain an army without consent of parliament; and when in 1639 he wished to raise one to act against the rebellious Scots, parliament was called together, and its sanction obtained, on the plea that the army was necessary for the defence of England. This army again became the source of dispute between the king and parliament, and finally both sides appealed to arms.

62. The first years of the Great Rebellion (*q.v.*) showed primarily the abundance of good officers produced by the wars on the continent, and in the second place the absolute inadequacy of the military system of the country; the commissions of array, militia ordinances, &c., had at last to give way to regular methods of enlistment and a central army administration. It was clear, at the same time, that when the struggle was one of principles and not of dynastic politics, excellent recruits, far different from the wretched levies who had been gathered together for the Spanish war, were to be had in any reasonable number. These causes combined to produce the "New Model" which, originating in Cromwell's own cavalry and the London trained bands of foot, formed of picked men and officers, severely disciplined, and organized and administered in the right way, quickly proved its superiority over all other armies in the field, and in a few years raised its general to supreme civil power. The 15th of February 1645 was the birthday of the British standing army, and from its first concentration at Windsor Park dates the scarlet uniform. The men were for the most part voluntarily enlisted from existing corps, though deficiencies had immediately to be made good by impressment.

Four months later the New Model decided the quarrel of king and parliament at Naseby. When Cromwell, the first lieutenant-general and the second captain-general of the army, sent his veterans to take part in the wars of the continent they proved themselves a match for the best soldiers in Europe. On the restoration of the monarchy in 1660 the army, now some 80,000 strong, was disbanded. It had enforced the execution of Charles I., it had dissolved parliament, and England had been for years governed under a military régime. Thus the most popular measure of the Restoration was the dissolution of the army. Only Monk's regiment of foot (now the Coldstream Guards) survived to represent the New Model in the army of to-day. At the same time the troops (now regiments) of household cavalry, and the regiment of foot which afterwards became the Grenadier Guards, were formed, chiefly from Royalists, though the disbanded New Model contributed many experienced recruits. The permanent forces of the crown came to consist once more of the "garrisons and guards," maintained by the king from the revenue allotted to him for carrying on the government of the country. The "garrisons" were commissioned to special fortresses—the Tower of London, Portsmouth, &c. The "guards" comprised the sovereign's bodyguards ("the yeomen of the guard" and "gentlemen-at-arms," who had existed since the times of Henry VII. and VIII.), and the regiments mentioned above. Even this small force, at first not exceeding 3000 men, was looked on with jealousy by parliament, and every attempt to increase it was opposed. The acquisition of Tangier and Bombay, as part of the dower of the infanta of Portugal, led to the formation of a troop of horse (now the 1st Royal Dragoons) and a regiment of infantry (the 2nd, now Queen's R.W. Surrey, regiment) for the protection of the former; and a regiment of infantry (afterwards transferred to the East India Company) to hold the latter (1661). These troops, not being stationed in the kingdom, created no distrust; but whenever, as on several occasions during Charles's reign, considerable armies were raised, they were mostly disbanded when the occasion ceased. Several regiments, however, were added to the permanent force, including Dumbarton's regiment (the 1st or Royal Scots, nicknamed Pontius Pilate's Bodyguard)—which had a long record of service in the armies of the continent, and represented the Scots brigade of Gustavus Adolphus's army—and the 3rd Buffs, representing the English regiments of the Dutch army and through them the volunteers of 1572, and on Charles's death in 1685 the total force of "guards and garrisons" had risen to 16,500, of whom about one-half formed what we should now call the standing army.

63. James II., an experienced soldier and sailor, was more obstinate than his predecessor in his efforts to increase the army, and Monmouth's rebellion afforded him the opportunity. A force of about 20,000 men was maintained in England, and a large camp formed at Hounslow. Eight cavalry and twelve infantry regiments (the senior of which was the 7th "Royal" Fusiliers, formed on a new French model) were raised, and given the numbers which, with few exceptions, they still bear. James even proposed to disband the militia, which had not distinguished itself in the late rebellion, and further augment the standing army; and although the proposal was instantly rejected, he continued to add to the army till the Revolution deprived him of his throne. The army which he had raised was to a great extent disbanded, the Irish soldiers especially, whom he had introduced in large numbers on account of their religion, being all sent home.

The condition of the army immediately engaged the attention of parliament. The Bill of Rights had definitely established that "the raising or keeping of a standing army within the kingdom, unless it be by the consent of parliament, is against the law," and past experience made them very jealous of such a force. But civil war was imminent, foreign war certain; and William had only a few Dutch troops, and the remains of James's army, with which to meet the storm. Parliament therefore sanctioned a standing army, trusting to the checks established by the Bill of Rights and Act of Settlement, and by placing the pay of the army under the control of the Commons. An event soon showed the altered position of the army. A regiment mutinied and declared for James. It was surrounded and compelled to lay down its arms; but William found himself without legal power to deal with the mutineers. He therefore applied to parliament, and in 1689 was passed the first Mutiny Act, which, after repeating the provisions regarding the army inserted in the Bill of Rights, and declaring the illegality of martial law, gave power to the crown to deal with the offences of mutiny and desertion by courts-martial. From this event is often dated the history of the standing army as a constitutional force (but see Fortescue, *British Army*, i. 335).

64. Under William the army was considerably augmented. The old regiments of James's army were reorganized, retaining, however, their original numbers, and three of cavalry and eleven of infantry (numbered to the 28th) were added. In 1690 parliament sanctioned a force of 62,000 men, further increased to

65,000 in 1691; but on peace being made in 1697 the Commons immediately passed resolutions to the effect that the land forces be reduced to 7000 men in England and 12,000 in Ireland. The War of the Spanish Succession quickly obliged Great Britain again to raise a large army, at one time exceeding 200,000 men; but of these the greater number were foreign troops engaged for the continental war. Fortescue (*op. cit.* i. 555) estimates the British forces at home and abroad as 70,000 men at the highest figure. After the peace of Utrecht the force was again reduced to 8000 men in Great Britain and 11,000 in the plantations (*i.e.* colonies) and abroad. From that time to the present the strength of the army has been determined by the annual votes of parliament, and though frequently the subject of warm debates in both houses, it has ceased to be a matter of dispute between the crown and parliament. The following table shows the fluctuations from that time onward—the peace years showing the average peace strength, the war years the maximum to which the forces were raised:—

PEACE.		WAR.	
Year.	Number.	Year.	Number.
1750	18,857	1745	74,187
1793	17,013	1761	67,776
1822	71,790	1777	90,734
1845	100,011	1812	245,996
1857	156,995	1856	275,079
1866	203,404	1858	222,874

Note.—Prior to 1856 the British forces serving in India are not included.

During William's reign the small English army bore an honourable part in the wars against Louis XIV., and especially distinguished itself under the king at Steinkirk, Neerwinden and Namur. Twenty English regiments took part in the campaign of 1694. In the great wars of Queen Anne's reign the British army under Marlborough acquired a European reputation. The cavalry, which had called forth the admiration of Prince Eugene when passed in review before him after its long march across Germany (1704), especially distinguished itself in the battle of Blenheim, and Ramillies, Oudenarde and Malplaquet were added to the list of English victories. But the army as usual was reduced at once, and even the cadres of old regiments were disbanded, though the alarm of Jacobite insurrections soon brought about the re-creation of many of these. During the reign of the first and second Georges an artillery corps was organized, and the army further increased by five regiments of cavalry and thirty-five of infantry. Fresh laurels were won at Dettingen (1743), in which battle twenty English regiments took part; and though Fontenoy (*q.v.*) was a day of disaster for the English arms, it did not lower their reputation, but rather added to it. Six regiments of infantry won the chief glory of Prince Ferdinand's victory of Minden (*q.v.*) in 1759, and throughout the latter part of the Seven Years' War the British contingent of Ferdinand's army served with almost unvarying distinction in numerous actions. About this time the first English regiments were sent to India, and the 39th shared in Clive's victory at Plassey. During the first half of George III.'s reign the army was principally occupied in America; and though the conquest of Canada may be counted with pride among its exploits, this page in its history is certainly the darkest. English armies capitulated at Saratoga and at Yorktown, and the war ended by the evacuation of the revolted states of America and the acknowledgment of their independence.

65. Before passing to the great French Revolutionary wars, from which a fresh period in the history of the army may be dated, it will be well to review the general condition of the army in the preceding century, injured as it was by the distrust of parliament and departmental weakness and corruption which went far to neutralize the good work of the duke of Cumberland as commander-in-chief and of Pitt as war administrator. Regiments were raised almost as in the days of the Edwards. The crown contracted with a distinguished soldier, or gentleman of high position, who undertook to raise the men, receiving a certain sum as bounty-money for each recruit. In some cases, in lieu of money, the contractor received the nomination of all or some of the officers, and recouped himself by selling the commissions. This system—termed "raising men for rank"—was retained for many years, and originally helped to create the "purchase system" of promotion. For the maintenance of the regiment the colonel received an annual sum sufficient to cover the pay of the men, and the expenses of clothing and of recruiting. The colonel was given a "beating order," without which no enlistment was legal, and was responsible for maintaining his regiment at full strength. "Muster masters" were appointed to muster the regiments, and to see that the men for whom pay was drawn were really effective. Sometimes, when casualties were numerous, the allowance was insufficient to meet the cost of recruiting, and special grants were made. In war time the ranks were also filled by released debtors, pardoned criminals, and impressed paupers and vagrants. Where the men were raised by voluntary enlistment, the period of service was a matter of contract between the colonel and the soldier, and the engagement was usually for life; but exceptional levies were enlisted for the duration of war, or for periods of three or five years. As for the officers, the low rate of pay and the purchase system combined to exclude all but men of independent incomes. Appointments (except when in the gift of the colonel) were made by the king at home, and by the commander-in-chief abroad; even in Ireland the power of appointment rested with the local commander of the forces until the Union. The soldier was clothed by his colonel, the charge being defrayed from the "stock fund." The army lived in barracks, camps or billets. The barrack accommodation in Great Britain at the beginning of the 18th century only sufficed for five thousand men; and though it had gradually risen to twenty thousand in 1792, a large part of the army was constantly in camps and billets—the latter causing endless complaints and difficulties.

66. The first efforts of the army in the long war with France did not tend to raise its reputation amongst the armies of Europe. The campaigns of allied armies under the duke of York in the Netherlands, in which British contingents figured largely, were uniformly unsuccessful (1793–94 and 1799), though in this respect they resembled those of almost all soldiers who commanded against the "New French" army. The policy of the younger Pitt sent thousands of the best soldiers to unprofitable employment, and indeed to death, in the West Indies. At home the administration was corrupt and ineffective, and the people generally shared the contemptuous feeling towards the regular army which was then prevalent in Europe. But a better era began with the appointment of Frederick Augustus, duke of York, as commander-in-chief of the army. He did much to improve its organization, discipline and training, and was ably seconded by commanders of distinguished ability. Under Abercromby in Egypt, under Stuart at Maida, and under Lake, Wellesley and others in India, the British armies again attached victory to their standards, and made themselves feared and respected. Later, Napoleon's threat of invading England excited her martial spirit to the highest pitch to which it had ever attained. Finally, her military glory was raised by the series of successful campaigns in the Peninsula, until it culminated in the great victory of Waterloo; and the army emerged from the war with the most solidly founded reputation of any in Europe.

The events of this period belong to the history of Europe, and fall outside the province of an article dealing only with the army. The great augmentations required during the war were effected partly by raising additional regiments, but principally by increasing the number of battalions, some regiments being given as many as four. On the conclusion of peace these battalions were reduced, but the regiments were retained, and the army was permanently increased from about twenty thousand, the usual peace establishment before the war, to an average of eighty thousand. The duke of York, on first appointment to the command, had introduced a uniform drill throughout the army, which was further modified according to Sir David Dundas's system in 1800; and, under the direction of Sir John Moore and others, a high perfection of drill was attained. At the beginning of the war, the infantry, like that of the continental powers, was formed in three ranks; but a two-rank formation had been introduced in America and in India and gradually became general, and in 1809 was finally approved. In the Peninsula the army was permanently organized in divisions, usually consisting of two brigades of three or four battalions each, and one or two batteries of artillery. The duke of Wellington had also brought the commissariat and the army transport to a high pitch of perfection, but in the long peace which followed these establishments were reduced or broken up.

67. The period which elapsed between Waterloo and the Crimean War is marked by a number of Indian and colonial wars, but by no organic changes in the army, with perhaps the single exception of the Limited Service Act of 1847, by which enlistment for ten or twelve years, with power to re-engage to complete twenty-one, was substituted for the life enlistments hitherto in force. The army went to sleep on the laurels and recollections of the Peninsula. The duke of Wellington, for many years commander-in-chief, was too anxious to hide it away in the colonies in order to save it from further reductions or utter extinction, to attempt any great administrative reforms. The force which was sent to the Crimea in 1854 was an agglomeration of battalions, individually of the finest quality, but unused to work together, without trained staff, administrative departments or army organization of any kind. The lesson of the winter before Sevastopol was dearly bought, but was not thrown away. From that time successive war ministers and commanders-in-chief have laboured perseveringly at the difficult task of army organization and administration. Foremost in the work was Sidney Herbert (Lord Herbert of Lea), the soldier's friend, who fell a sacrifice to his labours (1861), but not before he had done much for the army. The whole system of administration was revised. In 1854 it was inconceivably complicated and cumbersome. The "secretary of state for war and colonies," sitting at the Colonial Office, had a general but vague control, practically limited to times of war. The "secretary at war" was the parliamentary representative of the army, and exercised a certain financial control, not extending, however, to the ordnance corps. The commander-in-chief was responsible to the sovereign alone in all matters connected with the discipline, command or patronage of the army, but to the secretary at war in financial matters. The master-general and board of ordnance were responsible for the supply of material on requisition, but were otherwise independent, and had the artillery and engineers under them. The commissariat department had its headquarters at the treasury, and until 1852 the militia were under the home secretary. A number of minor subdepartments, more or less independent, also existed, causing endless confusion, correspondence and frequent collision. In 1854 the business of the colonies was separated from that of war, and the then secretary of state, the duke of Newcastle, assumed control over all the other administrative officers. In the following year the secretary of state was appointed secretary at war also, and the duties of the two offices amalgamated. The same year the commissariat office was transferred to the war department, and the Board of Ordnance abolished, its functions being divided between the commander-in-chief and the secretary of state. The minor departments were gradually absorbed, and the whole administration divided under two great chiefs, sitting at the war office and Horse Guards respectively. In 1870 these two were welded into one, and the war office now existing was constituted.

Corresponding improvements were effected in every branch. The system of clothing the soldiers was altered, the contracts being taken from the colonels of regiments, who received a money allowance instead, and the clothing supplied from government manufactories. The pay, food and general condition of the soldier were improved; reading and recreation rooms, libraries, gymnasia and facilities for games of all kinds being provided. Barracks (*q.v.*) were built on improved principles, and a large permanent camp was formed at Aldershot, where considerable forces were collected and manœuvred together. Various educational establishments were opened, a staff college was established for the instruction of officers wishing to qualify for the staff, and regimental schools were improved.

68. The Indian Mutiny of 1857, followed by the transference of the government of India, led to important changes. The East India Company's white troops were amalgamated with the Queen's army, and the whole reorganized (see *Indian Army* below).

The fact that such difficulties as those of 1854 and 1857, not to speak of the disorders of 1848, had been surmounted by the weak army which remained over from the reductions of forty years, coupled with the instantaneous and effective rejoinder to the threats of the French colonels in 1859—the creation of the Volunteer Force—certainly lulled the nation and its representatives into a false sense of security. Thus the two obvious lessons of the German successes of 1866 and 1870—the power of a national army for offensive invasion, and the rapidity with which such an army when thoroughly organized could be moved—created the greatest sensation in England. The year 1870 is, therefore, of prime importance in the history of the regular forces of the crown. The strength of the home forces at different times between 1815 and 1870 is given as follows (Biddulph, *Lord Cardwell at the War Office*):—

	Regulars.	Auxiliaries.	Field Guns.
1820	64,426	60,740	22
1830	50,876	34,614	30
1840	53,379	20,791	30
1850	68,538	29,868	70
1860	100,701	229,501	180
1870	89,051 (later 109,000)	281,692	180

69. The period of reform commences therefore with 1870, and is connected indissolubly with the name of Edward, Lord Cardwell, secretary of state for war 1869–1874. In the matter of organization the result of his labours was seen in the perfectly arranged expedition to Ashanti (1874); as for recruiting, the introduction of short service and reserve enlistment together with many rearrangements of pay, &c., proved so far popular that the number of men annually enlisted was more than trebled (11,742 in 1869; 39,971 in 1885; 40,729 in 1898), and so far efficient that "Lord Cardwell's . . . system, with but small modification, gave us during the Boer War 80,000 reservists, of whom 96 or 97 % were found efficient, and has enabled us to keep an army of 150,000 regulars in the field for 15 months" (Rt. Hon. St John Brodrick, House of Commons, 8th of March 1901). The localization of the army, subsequently completed by the territorial system of 1882, was commenced under Cardwell's régime, and a measure which encountered much powerful opposition at the time, the abolition of the purchase of commissions, was also effected by him (1871). The machinery of administration was improved, and autumn manœuvres were practised on a scale hitherto unknown in England. In 1871 certain powers over the militia, formerly held by lords-lieutenant, were transferred to the crown, and the auxiliary forces were placed directly under the generals commanding districts. In 1881 came an important change in the infantry of the line, which was entirely remodelled in two-battalion regiments bearing territorial titles. This measure (the "linked battalion" system) aroused great opposition; it was dictated chiefly by the necessity of maintaining the Indian and colonial garrisons at full strength, and was begun during Lord Cardwell's tenure of office, the principle being that each regiment should have one battalion at home and one abroad, the latter being fed by the former, which in its turn drew upon the reserve to complete it for war. The working of the system is to be considered as belonging to present practice rather than to history, and the reader is therefore referred to the article United Kingdom. On these general lines the army progressed up to 1899, when the Boer War called into the field on a distant theatre of war all the resources of the regular army, and in addition drew largely upon the existing auxiliary forces, and even upon wholly untrained civilians, for the numbers required to make war in an area which

comprised nearly all Africa south of the Zambezi. As the result of this war (see TRANSVAAL) successive schemes of reform were undertaken by the various war ministers, leading up to Mr Haldane's "territorial" scheme (1908), which put the organization of the forces in the United Kingdom (*q.v.*) on a new basis.

Innovations had not been unknown in the period immediately preceding the war; as a single example we may take the development of the mounted infantry (*q.v.*) It was natural that the war itself, and especially a war of so peculiar a character, should intensify the spirit of innovation. The corresponding period in the German army lasted from 1871 to 1888, and such a period of unsettlement is indeed the common, practically the universal, result of a war on a large scale. Much that was of value in the Prussian methods, faithfully and even slavishly copied by Great Britain as by others after 1870, was temporarily forgotten, but the pendulum swung back again, and the Russo-Japanese War led to the disappearance, so far as Europe was concerned, of many products of the period of doubt and controversy which followed the struggle in South Africa. Side by side with continuous discussions of the greater questions of military policy, amongst these being many well-reasoned proposals for universal service, the technical and administrative efficiency of the service has undergone great improvement, and this appears to be of more real and permanent value than the greater part of the solutions given for the larger problems. The changes in the organization of the artillery afford the best evidence of this spirit of practical and technical reform. In the first place the old "royal regiment" was divided into two branches. The officers for the field and horse artillery stand now on one seniority list for promotion, the garrison, heavy and mountain batteries on another. In each branch important changes of organization have been also made. In the field branch, both for Royal Field and Royal Horse Artillery, the battery is no longer the one unit for all purposes. A lieutenant-colonel's command, the "brigade," has been created. It consists of a group, in the horse artillery of two, in the field artillery of three batteries. For the practical training of the horse and field artillery a large area of ground on the wild open country of Dartmoor, near Okehampton, has for some years been utilized. A similar school has been started at Glen Imaal in Ireland, and a new training ground has been opened on Salisbury Plain. Similarly, with the Royal Garrison Artillery a more perfect system has been devised for the regulation and practice of the fire of each fortress, in accordance with the varying circumstances of its position, &c. A practice school for the garrison artillery has been established at Lydd, but the various coast fortresses themselves carry out regular practice with service ammunition.

Indian Army

70. Historically, the Indian army grew up in three distinct divisions, the Bengal, Madras and Bombay armies. This separation was the natural result of the original foundation of separate settlements and factories in India; and each retains to the present day much of its old identity.

Bengal.—The English traders in Bengal were long restricted by the native princes to a military establishment of an ensign and 30 men; and this force may be taken as the germ of the Indian army. In 1681 Bengal received the first reinforcement from Madras, and two years later a company was sent from Madras, raising the little Bengal army to a strength of 250 Europeans. In 1695 native soldiers were first enlisted. In 1701–1702 the garrison of Calcutta consisted of 120 soldiers and seamen gunners. In 1756 occurred the defence of Calcutta against Suraj-ud-Dowlah, and the terrible tragedy of the Black Hole. The work of reconquest and punishment was carried out by an expedition from Madras, and in the little force with which Clive gained the great victory of Plassey the Bengal army was represented by a few hundred men only (the British 39th, now Dorsetshire regiment, which was also present, was the first King's regiment sent to India, and bears the motto *Primus in Indis*); but from this date the military power of the Company rapidly increased. A company of artillery had been organized in 1748; and in 1757, shortly before Plassey, the 1st regiment of Bengal native infantry was raised. Next, in 1759 the native infantry was augmented, in 1760 dragoons were raised, and in 1763 the total forces amounted to 1500 Europeans and 12 battalions of native infantry (11,500 men). In 1765 the European infantry was divided into 3 regiments, and the whole force was organized in 3 brigades, each consisting of 1 company of artillery, 1 regiment European infantry, 1 troop of native cavalry, and 7 battalions of sepoys. In 1766, on the reduction of some money allowances, a number of officers of the Bengal army agreed to resign their commissions simultaneously. This dangerous combination was promptly put down by Clive, to whom the Bengal army may be said to owe its existence.

The constant wars and extensions of dominion of the next thirty years led to further augmentations; the number of brigades and of European regiments was increased to 6; and in 1794 the Bengal army numbered about 3500 Europeans and 24,000 natives.

71. *Madras.*—The first armed force in the Madras presidency was the little garrison of Armegon on the Coromandel coast, consisting of 28 soldiers. In 1644 Fort St George was built and garrisoned, and in 1653 Madras became a presidency. In 1745 the garrison of Fort St George consisted of 200 Europeans, while a similar number, with the addition of 200 "Topasses" (descendants of the Portuguese), garrisoned Fort St David. In 1748 the various independent companies on the Coromandel coast and other places were consolidated into the Madras European regiment. From this time the military history of the Madras army was full of incident, and it bore the principal part in Clive's victories of Arcot, Kavaripak and Plassey. In 1754 the 39th regiment of the Royal army was sent to Madras. In 1758 three others followed. In 1772 the Madras army numbered 3000 European infantry and 16,000 natives, and in 1784 the number of native troops had risen to 34,000.

72. *Bombay.*—The island of Bombay formed part of the marriage portion received by Charles II. with the infanta of Portugal, and in 1662 the Bombay regiment of Europeans was raised to defend it. In 1668 the island was granted to the Company, and the regiment at the same time transferred to them. In 1708 Bombay became a presidency, but it did not play so important a part as the others in the early extension of British power, and its forces were not so rapidly developed. It is said, however, to have been the first to discipline native troops, and Bombay sepoys were sent to Madras in 1747, and took part in the battle of Plassey in 1757. In 1772 the Bombay army consisted of 2500 Europeans and 3500 sepoys, but in 1794, in consequence of the struggles with the Mahratta power, the native troops had been increased to 24,000.

73. *Consolidation of the Army.*—In 1796 a general reorganization took place. Hitherto the officers in each presidency had been borne on general "lists," according to branches of the service. These lists were now broken up and cadres of regiments formed. The colonels and lieutenant-colonels remained on separate lists, and an establishment of general officers was created, while the divisional commands were distributed between the royal and Company's officers. Further augmentations took place, consequent on the great extension of British supremacy. In 1798 the native infantry in India numbered 122 battalions. In 1808 the total force in India amounted to 24,500 Europeans and 154,500 natives.

The first half of the 19th century was filled with wars and annexations and the army was steadily increased. Horse artillery was formed, and the artillery in general greatly augmented. "Irregular cavalry" was raised in Bengal and Bombay, and recruited from a better class of troopers, who received high pay and found their own horses and equipment. "Local forces" were raised in various parts from time to time, the most important being the Punjab irregular force (raised after the annexation of the Punjab in 1849), consisting of 3 field batteries, 5 regiments of cavalry, and 5 of infantry, and the Nagpur and Oudh irregular forces. Another kind of force, which had been gradually formed, was that called "contingents"—troops raised by the protected native states. The strongest of these was that of Hyderabad, originally known as the nizam's army. Changes were also made in the organization of the army. Sanitary improvements were effected, manufacturing establishments instituted or increased, and the administration generally improved.

74. *The Army before the Mutiny.*—The officering and recruiting of the three armies were in all essentials similar. The officers were mainly supplied by the Company's military college at Addiscombe in Surrey (established in 1809), and by direct appointments. The Bengal army was recruited from Hindustan, the infantry being mostly drawn from Oudh and the great Gangetic plains. The soldiers were chiefly high-caste Hindus, a sixth being Mahommedans. The cavalry was composed mainly of Mahommedans, recruited from Rohilkhand and the Gangetic Doab. The only other elements in the army were four Gurkha regiments, enlisted from Nepal, and the local Punjab irregular force. The Madras army was chiefly recruited from that presidency, or the native states connected with it, and consisted of Mahommedans, Brahmans, and of the Mahratta, Tamil and Telugu peoples. The Bombay army was recruited from its own presidency, with some Hindustanis, but chiefly formed of Mahrattas and Mahommedans; the Bombay light cavalry mainly from Hindustan proper.

Including the local and irregular troops (about 100,000 strong), the total strength amounted to 38,000 Europeans of all arms, with 276 field guns, and 348,000 native troops, with 248 field guns,—truly a magnificent establishment, and, outwardly, worthy of the great empire which England had created for herself in the East, but inwardly unsound, and on the very verge of the great mutiny of 1857.

In 1856 the establishment in the several presidencies was as follows:—

	Bengal.	Madras.	Bombay.	Total.
British Cavalry Regiments .	2	1	1	4
British Infantry Battalions .	15	3	4	22
Company's European Battalions	3	3	3	9
European and Native Artillery Battalions	12	7	5	24
Native Infantry Battalions .	74	52	29	155
Native Cavalry Regiments .	28	8	3	39

An account of the events of 1857–58 will be found under Indian Mutiny. After the catastrophe the reorganization of the military forces on different lines was of course unavoidable. Fortunately, the armies of Madras and Bombay had been almost wholly untouched by the spirit of disaffection, and in the darkest days the Sikhs, though formerly enemies of the British, had not only remained faithful to them, but had rendered them powerful assistance.

75. *The Reorganization.*—By the autumn of 1858 the mutiny was virtually crushed, and the task of reorganization commenced. On the 1st of September 1858 the East India Company ceased to rule, and Her Majesty's government took up the reins of power. On the important question of the army, the opinions and advice of the most distinguished soldiers and civilians were invited. Masses of reports and evidence were collected in India, and by a royal commission in England. On the report of this commission the new system was based. The local European army was abolished, and its *personnel* amalgamated with the royal army. The artillery became wholly British, with the exception of a few native mountain batteries. The total strength of the British troops, all of the royal army, was largely increased, while that of the native troops was largely diminished. Three distinct native armies—those of Bengal, Madras and Bombay—were still maintained. The reduced Indian armies consisted of cavalry and infantry only, with a very few artillery, distributed as follows:—

	Battalions Infantry.	Regiments Cavalry.
Bengal	49	19
Madras	40	4
Bombay	30	7
Punjab Force . . .	12	6
Total . . .	131	36

There were also three sapper battalions, one to each army.

The Punjab force, which had 5 batteries of native artillery attached to it, continued under the Punjab government. In addition, the Hyderabad contingent of 4 cavalry, 6 infantry regiments and 4 batteries, and a local force in central India of 2 regiments cavalry and 6 infantry, were retained under the government of India. After all the arrangements had been completed the army of India consisted of 62,000 British and 125,000 native troops.

76. *The Modern Army.*—The college at Addiscombe was closed in 1860, and the direct appointment of British officers to the Indian local forces ceased in 1861. In that year a staff corps was formed by royal warrant in each presidency "to supply a body of officers for service in India, by whom various offices and appointments hitherto held by officers borne on the strength of the several corps in the Indian forces shall in future be held." Special rules were laid down. The corps was at first recruited partly from officers of the Company's service and partly from the royal army, holding staff appointments (the new regimental employment being considered as staff duty) and all kinds of political and civil posts; for the system established later see India: *Army*. The native artillery and sappers and miners were to be officered from the Royal Artillery and Royal Engineers. The only English warrant and non-commissioned officers now to be employed in the native army were to be those of the Royal Engineers with the sappers and miners.

A radical change in the regimental organization of all the native armies was effected in 1863. The Punjab Frontier Force was from the first organized on the irregular system, which was there seen at its best, as also were the new regiments raised during the Mutiny. This system was now applied to the whole army, each regiment and battalion having seven British officers attached to it for command and administrative duties, the immediate command of troops and companies being left to the native officers. Thus was the system reverted to, which was initiated by Clive, of a few British officers only being attached to each corps for the higher regimental duties of command and control. Time had shown that this was more effective than the regular system instituted in 1796 of British officers commanding troops and companies.

A new spirit was breathed into the army. The supremacy of the commandant was the main principle. He was less hampered by the unbending regulations enjoined upon the old regular regiments, had greater powers of reward and punishment, was in a position to assume larger responsibility and greater freedom of action, and was supported in the full exercise of his authority. The system made the officers.

Up to 1881 the native army underwent little change, but in that year 18 regiments of infantry and 4 of cavalry were broken up, almost the same total number of men being maintained in fewer and stronger regiments. The only reduction made in the British troops was in the Royal Artillery, which was diminished by 11 batteries. The events of 1885, however, on the Russo-Afghan frontier, led to augmentations. The 11 batteries Royal Artillery were brought back from England; each of the 9 British cavalry regiments in India received a fourth squadron; each of the British infantry battalions was increased by 100 men, and 3 battalions were added. The native cavalry had a fourth squadron added to each regiment; three of the four regiments broken up in 1881 were re-raised, while the native infantry was increased in regimental strength, and 9 new battalions raised composed of Gurkhas, Sikhs and Punjabis. The addition in all amounted to 10,600 British and 21,200 native troops. In 1890 the strength of the army of India was 73,000 British and, including irregulars, 147,500 native troops. For the Indian volunteers, see Volunteers.

Many important changes took place between 1885 and 1904. Seven Madras infantry regiments were converted into regiments for service in Burma, composed of Gurkhas and hardy races from northern India; six Bengal and Bombay regiments were similarly converted into regiments of Punjabis, Pathans and Gurkhas; the native mountain batteries have been increased to ten; a system of linked battalions has been introduced with the formation of regimental centres for mobilization; and reserves for infantry and mountain artillery have been formed. The number of British officers with each regiment has been increased to nine, and the two wing commands in battalions have been converted into 4 double-company commands of 250 men each, under a British commander, who is responsible to the commandant for their training and efficiency, the command of the companies being left to the native officers. This system, which is analogous to the squadron command in the cavalry, admits of closer individual attention to training, and distributes among the senior British regimental officers effective responsibility of a personal kind.

An addition (at the imperial expense) of five battalions of Sikhs, Punjabi Mahommedans, Jats and hillmen in northern India was made in 1900, as the result of India being called upon to furnish garrisons for Mauritius and other stations overseas.

The unification of the triplicate army departments in the different presidential armies was completed in 1891, all being brought directly under the supreme government; and the three separate staff corps of Bengal, Madras and Bombay were fused into one in 1891 as the Indian Staff Corps. The term "Indian Staff Corps" was in turn replaced by that of "Indian Army" in 1903. These measures prepared the way for the new system of army organization which, by authority of parliament, abolished divided control and placed the whole army of India under the governor-general and the commander-in-chief in India.

Canadian Forces

77. In the earliest European settlements in Canada, the necessity of protection against Indians caused the formation of a militia, and in 1665 companies were raised in every parish. The military history of the Canadian forces under French rule is full of incident, and they served not only against Indian raiders but also against the troops of Great Britain and of her North American colonies. Six militia battalions took part in the defence of Quebec in 1759, and even the transfer of Canada from the French to the British crown did not cause the disbandment of the existing forces. The French Canadians distinguished themselves not less than the British settlers in the War of American Independence, and in particular in the defence of Quebec against Montgomery and Arnold. In 1787 an ordinance was made whereby three battalions of the militia were permanently embodied, each contingent serving for two years, at the end of which time a fresh contingent relieved it, and after this a succession of laws and regulations were made with a view to complete organization of the force. The brunt of the fighting on the American frontier in the war of 1812 was borne very largely by the permanent force of three battalions and the fresh units called out, all these being militia corps. Up to 1828 a distinction had been made between the British and the French regiments: this was then abolished. The militia was again employed on active service during the disturbances of 1837, and the "Active Militia" in 1863 had grown to a strength of 25,000 men. The Fenian troubles of 1864 and 1866 caused the embodiment of the Canadian forces once more. In 1867 took place the unification of Canada, after which the whole force was completely organized on the basis of a militia act (1868). A department of Militia and Defence with a responsible minister was established, and the strength of the active militia of all arms was fixed at 40,000 rank and file. Two years later the militia furnished 6000 men to deal with the Fenian Raid of 1870, and took part in Colonel (Lord) Wolseley's Red River expedition. In 1871 a permanent force, serving the double purpose of a regular nucleus and an instructional cadre, was organized in two troops of cavalry, two batteries of artillery and one regiment of infantry, and in 1876 the Royal Military College of Canada was founded at Kingston. In 1885 the Riel rebellion was dealt with, and the important action of Batoche won, by the militia, without assistance from regular

troops. In the same year Canada contributed a force of *voyageurs* to the Nile expedition of Lord Wolseley; the experience of these men was admittedly of great assistance in navigating the Rapids. The militia sent contingents of all arms to serve in the South African War, 1899–1902, including "Strathcona's Horse," a special corps, recruited almost entirely from the Active Militia and the North-west Mounted Police. The latter, a permanent constabulary of mounted riflemen, was formed in 1873.

After the South African War an extensive scheme of reorganization was taken in hand, the command being exercised for two years (1902–1904) by Major-General Lord Dundonald, and subsequently by a militia council (Militia Act 1904), similar in constitution to the home Army Council. For details of the present military strength of Canada, see the article CANADA.

AUSTRIAN ARMY

78. The *Landsknecht* infantry constituted the mainstay of the imperial armies in the 16th century. Maximilian I. and Charles V. are recorded to have marched and carried the "long pike" in their ranks. Maximilian also formed a corps of *Kyrisser*, who were the origin of the modern cuirassiers. It was not, however, until much later that the Austrian army came into existence as a permanent force. Rudolph II. formed a small standing force about 1600, but relied upon the "enlistment" system, like other sovereigns of the time, for the bulk of his armies. The Thirty Years' War produced the permanence of service which led in all the states of Europe to the rise of standing armies. In the Empire it was Wallenstein who first raised a distinctly imperial army of soldiers owing no duty but to the sovereign; and it was the suspicion that he intended to use this army, which was raised largely at his own expense, to further his own ends, that led to his assassination. From that time the regiments belonged no longer to their colonels, but to the emperor; and the oldest regiments in the present Austrian army date from the Thirty Years' War, at the close of which Austria had 19 infantry, 6 cuirassier and 1 dragoon regiments. The almost continuous wars of Austria against France and the Turks (from 1495 to 1895 Austrian troops took part in 7000 actions of all sorts) led to a continuous increase in her establishments. The wars of the time of Montecucculi and of Eugene were followed by that of the Polish Succession, the two Turkish wars, and the three great struggles against Frederick the Great. Thus in 1763 the army had been almost continuously on active service for more than 100 years, in the course of which its organization had been modified in accordance with the lessons of each war. This, in conjunction with the fact that Austria took part in other Turkish campaigns subsequently, rendered this army the most formidable opponent of the forces of the French Revolution (1792). But the superior leading, organization and numbers of the emperor's forces were totally inadequate to the magnitude of the task of suppressing the Revolutionary forces, and though such victories as Neerwinden were sufficient proof of the efficiency and valour of the Austrians, they made no headway. In later campaigns, in which the enemy had acquired war experience, and the best of their officers had come to the front, the tide turned against the Imperialists even on the field of battle. The archduke Charles's victories of 1796 were more than counterbalanced by Bonaparte's Italian campaign, and the temporary success of 1799 ended at Marengo and Hohenlinden.

79. The Austrians, during the short peace which preceded the war of 1805, suffered, in consequence of all this, from a feeling of distrust, not merely in their leaders, but also in the whole system upon which the army was raised, organized and trained. This was substantially the same as that of the Seven Years' War time. Enlistment being voluntary and for long service, the numbers necessary to cope with the output of the French conscription could not be raised, and the inner history of the Austrian headquarters in the Ulm campaign shows that the dissensions and mutual distrust of the general officers had gone far towards the disintegration of an army which at that time had the most *esprit de corps* and the highest military qualities of any army in Europe. But the disasters of 1805 swept away good and bad alike in the abolition of the old system. Already the archduke Charles had designed a "nation in arms" after the French model, and on this basis the reconstruction was begun. The conscription was put in force and the necessary numbers thus obtained; the administration was at the same time reformed and the organization and supply services brought into line with modern requirements. The war of 1809 surprised Austria in the midst of her reorganization, yet the new army fought with the greatest spirit. The invasion of Bavaria was by no means so leisurely as it had been in 1805, and the archduke Charles obtained one signal victory over Napoleon in person. Aspern and Wagram were most desperately contested, and though the archduke ceased to take part in the administration after 1809 the work went on steadily until, in 1813, the Austrian armies worthily represented the combination of discipline with the "nation in arms" principle. Their intervention in the War of Liberation was decisive, and Austria, in spite of her territorial losses of the past years, put into the field well-drilled armies far exceeding in numbers those which had appeared in the wars of the Revolution. After the fall of Napoleon, Austria's hold on Italy necessitated the maintenance of a large army of occupation. This army, and in particular its cavalry, was admittedly the best in Europe, and, having to be ready to march at a few days' notice, it was saved from the deadening influence of undisturbed peace which affected every other service in Europe from 1815 to 1850.

80. The Austrian system has conserved much of the peculiar tone of the army of 1848, of which English readers may obtain a good idea from George Meredith's *Vittoria*. It was, however, a natural result of this that the army lost to some considerable extent the spirit of the "nation in arms" of 1809 and 1813. It was employed in dynastic wars, and the conscription was of course modified by substitution; thus, when the war of 1859 resulted unfavourably to the Austrians, the army began to lose confidence, precisely as had been the case in 1805. Once more, in 1866, an army animated by the purely professional spirit, which was itself weakened by distrust, met a "nation in arms," and in this case a nation well trained in peace and armed with a breechloader. Bad staff work, and tactics which can only be described as those of pique, precipitated the disaster, and in seven weeks the victorious Prussians were almost at the gates of Vienna.

The result of the war, and of the constitutional changes about this time, was the re-adoption of the principles of 1806–1813, the abolition of conscription and long service in favour of universal service for a short term, and a thorough reform in the methods of command and staff work. It has been said of the Prussian army that "discipline is—the officers." This is more true of the "K.K." army[1] than of any other in Europe; the great bond of union between the heterogeneous levies of recruits of many races is the spirit of the corps of officers, which retains the personal and professional characteristics of the old army of Italy.

FRENCH ARMY

81. The French army (see for further details FRANCE: *Law and Institutions*) dates from the middle of the 15th century, at which time Charles VII. formed, from mercenaries who had served him in the Hundred Years' War, the *compagnies d'ordonnance*, and thus laid the foundation of a national standing army. But the armies that followed the kings in their wars still consisted mainly of mercenaries, hired for the occasion; and the work of Charles and his successors was completely undone in the confusion of the religious wars. Louvois, was minister of Louis XIV., was the true creator of the French royal army. The organization of the first standing army is here given in some detail, as it served as a model for all armies for more than a century, and is also followed to some extent in our own times. Before the advent of Louvois, the forces were royal only in name. The army was a fortuitous concourse of regiments of horse and foot, each of which was the property of its colonel. The companies similarly

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[1] The phrase "K. und K." (*Kaiserlich und Königlich*) is applied to all services common to the Austrian and Hungarian armies. "K.-K." (*Kaiserlich-Königlich*) refers strictly only to the troops of Austria, the Hungarian army being known as the "K.Ung." (Royal Hungarian) service.

belonged to their captains, and, the state being then in no condition to buy out these vested interests, superior control was almost illusory. Indeed, all the well-known devices for eluding such control, for instance, showing imaginary men on the pay lists, can be traced to the French army of the 16th century. A further difficulty lay in the existence of the offices called Colonel-General, Marshal-General and Grand Master of Artillery, between whom no common administration was possible. The grand master survived until 1743, but Louvois managed to suppress the other offices, and even to put one of his own subordinates into the office of grand master. Thus was assured direct royal control, exercised through the war minister. Louvois was unable indeed to overthrow the proprietary system, but he made stringent regulations against abuses, and confined it to the colonels (*mestre de camp* in the cavalry) and the captains. Henceforward the colonel was a wealthy noble, with few duties beyond that of spending money freely and of exercising his court influence on behalf of his regiment. The real work of the service was done by the lieutenant-colonels and lieutenants, and the king and the minister recognized this on all occasions. Thus Vauban was given, as a reward for good service, a company in the "Picardie" regiment without purchase. Promotions from the ranks were very rare but not unknown, and all promotions were awarded according to merit except those to captain or colonel. One of the captains in a regiment was styled major, and acted as adjutant. This post was of course filled by selection and not by purchase. The grades of general officers were newly fixed by Louvois—the *brigadier*, *maréchal de camp*, lieutenant-general and marshal of France. The general principle was to give command, but not promotion, according to merit. The rank and file were recruited by voluntary enlistment for four years' service. The infantry company was maintained in peace at an effective of 60, except in the guards and the numerous foreign corps, in which the company was always at the war strength of 100 to 200 men. This arm was composed, in 1678, of the *Gardes françaises*, the Swiss guards, the old (*vieux* and *petits vieux*) regiments of the line, of which the senior, "Picardie," claimed to be the oldest regiment in Europe, and the regiments raised under the new system. The *régiment du roi*, which was deliberately made the model of all others and was commanded by the celebrated Martinet, was the senior of these latter. The whole infantry arm in 1678 numbered 320,000 field and garrison troops. The cavalry consisted of the *Maison du Roi* (which Louvois converted from a "show" corps to one of the highest discipline and valour), divided into the *Gardes du Corps* and the *Mousquetaires*, the *Gendarmerie* (descended from the old feudal cavalry and the *ordonnance* companies) and the line cavalry, the whole being about 55,000 strong. There were also 10,000 dragoons. In addition to the regular army, the king could call out, in case of need, the ancient *arrière-ban* or levy, as was in fact done in 1674. On that occasion, however, it behaved badly, and it was not again employed. In 1688 Louvois organized a militia raised by ballot. This numbered 25,000 men and proved to be better, at any rate, than the *arrière-ban*. Many infantry regiments of the line were, as has been said, foreign, and in 1678 the foreigners numbered 30,000, the greater part of these being Swiss.

82. The artillery had been an industrial concern rather than an arm of the service. In sieges a sum of money was paid for each piece put in battery, and the grand master was not subordinated to the war office. A nominee of Louvois, as has been said, filled the post at this time, and eventually Louvois formed companies of artillerymen, and finally the regiment of "Fusiliers" which Vauban described as the "finest regiment in the world." The engineer service, as organized by Vauban, was composed of engineers "in ordinary," and of line officers especially employed in war. Louvois further introduced the system of magazines. To ensure the regular working of supply and transport, he instituted direct control by the central executive, and stored great quantities of food in the fortresses, thereby securing for the French armies a precision and certainty in military operations which had hitherto been wanting. The higher administration of the army, under the minister of war, fell into two branches, that of the commissaries and that of the inspecting officers. The duties of the former resembled those of a modern "routine" staff—issue of equipment, checking of returns, &c. The latter exercised functions analogous to those of a general staff, supervising the training and general efficiency of the troops. Louvois also created an excellent hospital service, mobile and stationary, founded the Hôtel des Invalides in Paris for the maintenance of old soldiers, established cadet schools for the training of young officers, and stimulated bravery and good conduct by reviving and creating military orders of merit.

83. The last half of the 17th century is a brilliant period in the annals of the French armies. Thoroughly organized, animated by the presence of the king, and led by such generals as Condé, Turenne, Luxembourg, Catinat and Vendôme, they made head against coalitions which embraced nearly all the powers of Europe, and made France the first military nation of Europe. The reverses of the later part of Louis XIV.'s reign were not of course without result upon the tone of the French army, and the campaigns of Marlborough and Eugene for a time diminished the repute in which the troops of Louis were held by other powers. Nevertheless the War of the Spanish Succession closed with French victories, and generals of the calibre of Villars and Berwick were not to be found in the service of every prince. The war of the Polish Succession in Germany and Italy reflected no discredit upon the French arms; and the German general staff, in its history of the wars of Frederick the Great, states that "in 1740 the French army was still regarded as the first in Europe." Since the death of Louvois very little had changed. The army was still governed as it had been by the great war minister, and something had been done to reduce evils against which even he had been powerless. A royal regiment of artillery had come into existence, and the engineers were justly regarded as the most skilful in Europe. Certain alterations had been made in the organization of both the guard and the line, and the total strength of the French in peace was somewhat less than 200,000. Relatively to the numbers maintained in other states, it was thus as powerful as before. Indeed, only one feature of importance differentiated the French army from its contemporaries—the proportion of officers to men, which was one to eleven. In view of this, the spirit of the army was necessarily that of its officers, and these were by no means the equals of their predecessors of the time of Turenne or Luxembourg. Louvois' principle of employing professional soldiers for command and wealthy men for colonelcies and captaincies was not deliberately adopted, but inevitably grew out of the circumstances of the time. The system answered fairly whilst continual wars gave the professional soldiers opportunities for distinction and advancement. But in a long peace the captains of eighteen and colonels of twenty-three blocked all promotion, and there was no work save that of routine to be done. Under these conditions the best soldiers sought service in other countries, the remainder lived only for pleasure, whilst the titular chiefs of regiments and companies rarely appeared on parade. Madame de Genlis relates how, when young courtiers departed to join their regiments for a few weeks' duty, the ladies of the court decked them with favours, as if proceeding on a distant and perilous expedition.

On the other hand, the fact that the French armies required large drafts of militia to bring up their regular forces to war strength gave them a vitality which was unusual in armies of the time. Even in the time of Louis XIV. the military spirit of the country had arisen at the threat of invasion, and the French armies of 1709 fought far more desperately, as the casualty lists of the allies at Malplaquet showed, than those of 1703 or 1704. In the time of the Revolution the national spirit of the French army formed a rallying-point for the forces of order, whereas Prussia, whose army was completely independent of the people, lost all power of defending herself after a defeat in the field. It is difficult to summarize the conduct of the royal armies in the wars of 1740–63. With a few exceptions the superior leaders proved themselves incompetent, and in three great battles, at least, the troops suffered ignominious defeat (Dettingen 1743, Rossbach 1757, Minden 1759). On the other hand, Marshal Saxe and others of the younger generals were excellent commanders, and Fontenoy was a victory of the first magnitude. The administration, however, was corrupt and inefficient, and the general reputation of the French armies fell so low that Frederick the Great once refused an important command to one of his generals on the ground that his experience had been gained only against French troops.

Under Louis XVI. things improved somewhat; the American War and the successes of Lafayette and Rochambeau revived a more warlike spirit. Instruction was more carefully attended to, and a good system of drill and tactics was elaborated at the camp of St Omer. Attempts were made to reform the administration. Artillery and engineer schools had come into existence, and the intellectual activity of the best officers was remarkable (see Max Jähns, *Gesch. der Kriegswissenschaften*, vol. iii. passim). But the Revolution soon broke over France, and the history of the royal army was henceforward carried on by that revolutionary army, which, under a new flag, was destined to raise the military fame of France to its greatest height.

84. If Louis was the creator of the royal army, Carnot was so of the revolutionary army. At the outbreak of the Revolution the royal army consisted of 224 infantry battalions, 7 regiments of artillery, and 62 regiments of cavalry, numbering about 173,000 in all, but capable of augmentation on war strength to 210,000. To this might be added about 60,000 militia (see Chuquet, *Première invasion prussienne*).

The first step of the Constituent Assembly was the abrogation of an edict of 1781 whereby men of non-noble birth had been denied commissioned rank (1790). Thus, when many of the officers emigrated along with their fellows of the *noblesse*, trained non-commissioned officers, who would already have been officers save for this edict, were available to fill their places. The general scheme of reform (see CONSCRIPTION) was less satisfactory, but the formation of a National Guard, comprising in theory the whole military population, was a step of the highest importance. At this time the titles of regiments were abandoned in favour of numbers, and the costly and dangerous *Maison du Roi* abolished. But voluntary enlistment soon failed; the old corps, which kept up their discipline, were depleted, and the men went to the volunteers, where work was less exacting and promotion more rapid. "*Aussi fut-on*," says a French writer, "*réduit bientôt à forcer l'engagement volontaire et à imposer le choix du corps*." The "first invasion" (July 1792) put an end to half-measures, and the country was declared "in danger." Even these measures, however, were purely designed to meet the emergency, and, after Valmy, enthusiasm waned to such a degree that, of a paper strength of 800,000 men (December 1792), only 112,000 of the line and 290,000 volunteers were actually present. The disasters of the following spring once more called for extreme energy, and 300,000 national guards were sent to the line, a step which was followed by a compulsory *levée en masse*; one million men were thus assembled to deal with the manifold dangers of civil and foreign war. France was saved by mere numbers and the driving energy of the Terrorists, not by discipline and organization. The latter was chaotic, and almost every element of success was wanting to the tumultuary levies of the year 1793 save a ferocious energy born of liberty and the guillotine. But under the Terrorist régime the army became the rallying-point of the nation, and when Lazare Carnot (*q.v.*) became minister of war a better organization and discipline began to appear. The amalgamation of the old army and the volunteers, which had been commenced but imperfectly carried out, was effected on a different and more thorough principle. The infantry was organized in demi-brigades of three battalions (usually one of the old army to two of volunteers). A permanent organization in divisions of all arms was introduced, and the ablest officers selected for the commands. Arsenals and manufactories of warlike stores were created, schools of instruction were re-established; the republican forces were transformed from hordes to armies, well disciplined, organized and equipped. Later measures followed the same lines, and the artillery and engineers, which in 1790 were admittedly the best in Europe and which owing to the *roturier* element in their officer cadres had not been disorganized by the emigration, steadily improved. The infantry, and in a less degree the cavalry, became good and trustworthy soldiers, and the glorious campaigns of 1794, 1795 and 1796, which were the direct result of Carnot's administration, bore witness to the potentialities of the essentially modern system. But, great as was the triumph of 1796-97, the exhaustion of years of continuous warfare had made itself felt: the armies were reduced to mere skeletons, and no sufficient means existed of replenishing them, till in 1798 the *conscription* was introduced. From that time the whole male population of France was practically at her ruler's disposal; and Napoleon had full scope for his genius in organizing these masses. His principal improvements were effected in the interval between the peace of Amiens and the war with the third coalition, while threatening the invasion of England. His armies were collected in large camps on the coasts of the Channel, and there received that organization which, with minor variations, they retained during all his campaigns, and which has since been copied by all European nations. The divisions had already given place to the army corps, and Napoleon completed the work of his predecessors. He withdrew the whole of the cavalry and a portion of the artillery from the divisions, and thus formed "corps troops" and cavalry and artillery reserves for the whole army. The grade of marshal of France was revived at Napoleon's coronation. At the same time, the operation of Jourdan's law, acquiesced in during times of national danger and even during peace, soon found opposition when the conscripts realized that long foreign wars were to be their lot. It was not the actual losses of the field armies, great as these undoubtedly were, which led Napoleon in the full tide of his career to adopt the fatal practice of "anticipating" the conscription, but the steady increase in the number of *réfractaires*, men who refused to come up for service. To hunt these men down, no less than forty thousand picked soldiers were engaged within the borders of France, and the actual French element in the armies of Napoleon grew less and less with every extension of the empire. Thus, in the Grand Army of 1809, about one-third of the corps of all arms were purely German, and in 1812 the army which invaded Russia, 467,000 strong, included 280,000 foreigners. In other words, the million of men produced by the original conscription of 1793 had dwindled to about half that number (counting the various subsidiary armies in Spain, &c.), and one hundred thousand of the best and sturdiest Frenchmen were engaged in a sort of civil war in France itself. The conscription was "anticipated" even in 1806, the conscripts for 1807 being called up before their time. As the later wars of the Empire closed one by one the foreign sources of recruiting, the conscription became more terrible every year, with the result that more *réfractaires* and more trusted soldiers to hunt them down were kept in non-effective employment. Finally the capacity for resistance was exhausted, and the army, from the marshals downward, showed that it had had enough.

85. One of the first acts of the Restoration was to abolish the conscription, but it had again to be resorted to within three years. In 1818 the annual contingent was fixed at 40,000, and the period of service at six years; in 1824 the contingent was increased to 60,000, and in 1832 to 80,000. Of this, however, a part only, according to the requirements of the service, were enrolled; the remainder were sent home on leave or furlough. Up to 1855 certain exemptions were authorized, and substitution or exchange of lots amongst young men who had drawn was permitted, but the individual drawn was obliged either to serve personally or find a substitute. The long series of Algerian wars produced further changes, and in 1855 the law of "dotation" or exemption by payment was passed, and put an end to personal substitution. The state now undertook to provide substitutes for all who paid a fixed sum, and did so by high bounties to volunteers or to soldiers for re-engaging. Although the price of exemption was fixed as high as £92, on an average 23,000 were claimed annually, and in 1859 as many as 42,000 were granted. Thus gradually the conscription became

rather subsidiary to voluntary enlistment, and in 1866, out of a total establishment of 400,000, only 120,000 were conscripts. Changes had also taken place in the constitution of the army. On the Restoration its numbers were reduced to 150,000, the old regiments broken up and recast, and a royal guard created in place of the old imperial one. When the revolution of July 1830 had driven Charles X. from his throne, the royal guard, which had made itself peculiarly obnoxious, was dissolved; and during Louis Philippe's reign the army was augmented to about 240,000 with the colours. Under the Provisional Government of 1848 it was further increased, and in 1854, when France allied herself with England against Russia, the army was raised to 500,000 men. The imperial guard was re-created, and every effort made to revive the old Napoleonic traditions in the army. In 1859 Napoleon III. took the field as the champion and ally of Italy, and the victories of Montebello, Magenta and Solferino raised the reputation of the army to the highest pitch, and for a time made France the arbiter of Europe. But the campaign of 1866 suddenly made the world aware that a rival military power had arisen, which was prepared to dispute that supremacy.

Marshal Niel (*q.v.*), the then war minister, saw clearly that the organization which had with difficulty maintained 150,000 men in Italy, was no match for that which had within a month thrown 250,000 into the very heart of Austria, while waging a successful war on the Main against Bavaria and her allies. In 1867, therefore, he brought forward a measure for the reorganization of the army. This was to have been a true "nation in arms" based on universal service, and Niel calculated upon producing a first-line army 800,000 strong—half with the colours, half in reserve—with a separate army of the second line. But many years must elapse before the full effect of this principle of recruiting can be produced, as the army is incomplete in some degree until the oldest reservist is a man who has been through the line training. Niel himself died within a year, and 1870 witnessed the complete ruin of the French army. The law of 1868 remained therefore no more than an expression of principle.

86. At the outbreak of the Franco-German War (*q.v.*) the French field troops consisted of 368 battalions, 252 squadrons, and 984 guns. The strength of the entire army on peace footing was 393,000 men; on war footing, 567,000. Disasters followed one another in rapid succession, and the bulk of this war-trained long-service army was captive in Germany within three months of the opening battle. But the spirit of the nation rose to the occasion as it had done in 1793. The next year's contingent of recruits was called out and hastily trained. Fourth battalions were formed from the depot cadres, and organized into *régiments de marche*. The *gardes mobiles* (Niel's creation) were mobilized, and by successive decrees and under various names nearly all the manhood of the country called to arms.

The regular troops raised as *régiments de marche*, &c., amounted to 213,000 infantry, 12,000 cavalry and 10,000 artillery. The *garde mobile* exceeded 300,000, and the mobilized national guard exceeded 1,100,000—of whom about 180,000 were actually in the field and 250,000 in Paris; the remainder preparing themselves in camps or depots for active work. Altogether the new formations amounted to nearly 1,700,000. Though, in the face of the now war-experienced well-led and disciplined Germans, their efforts failed, this cannot detract from the admiration which must be felt by every soldier for the patriotism of the people and the creative energy of their leaders, of whom Gambetta and Freycinet were the chief. After the war every Frenchman set himself to solve the army problem not less seriously than had every Prussian after Jena, and the reformed French army (see FRANCE) was the product of the period of national reconstruction. The adoption of the "universal service" principle of active army, reserves and second-line troops, the essential feature of which is the *line* training of every man, was almost as a matter of course the basis of the reorganization, for the want of a trained reserve was the most obvious cause of the disasters of "the terrible year."

GERMAN ARMY

87. The German army, strictly speaking, dates only from 1871, or at earliest 1866. Before the unification of the German empire or confederation, the several states possessed distinct armies, federal armies when required being formed from the contingents which the members of the union, like those of an ordinary alliance, engaged to furnish. The armies of the Holy Roman Empire were similarly formed from "single," "double," or "treble" contingents under the supreme command of specially appointed field marshals of the Empire. In the troubles of 1848 there was witnessed the curious spectacle of half of a victorious army being unable to pursue the enemy; this, being composed of "Prussian" as distinct from "federal contingent" troops, had to stop at the frontier of another state. The events of 1866 and 1870 put an end to all this, and to a very great extent to the separate armies of the old confederation, all being now remodelled on Prussian lines. The Prussian army therefore is at once the most important and historically the most interesting of the forces of the German empire. Its *début* (about 1630) was not satisfactory, and in the Thirty Years' War troops of Sweden, of the Emperor, of the League, &c., plundered Brandenburg unharmed. The elector, when appealed to for protection, could but answer, "Que faire? Ils ont des canons." The humiliations of this time, were, however, avenged by the troops of the next ruler of Brandenburg, called the Great Elector. The supposed invincibility of the Swedes did not prevent him from inflicting upon them a severe defeat at Fehrbellin, and thereafter the Prussian contingents which took part in the many European wars of the time acquitted themselves creditably. One of their generals was the famous Leopold of Anhalt-Dessau, and the reckless gallantry of this leader was conspicuous on many fields, from Blenheim to Malplaquet. But Leopold's greatest work was done in the years of peace (1715–40), during which Prussia was preparing the army with which Frederick the Great won his battles. He had introduced (about 1700) iron ramrods into the infantry service, and for over twenty years the Prussian infantry was drilled to a perfection which gave it a superiority of five to three over the best-drilled troops of the Austrian service, and still greater predominance over the French, which was then accounted the best in Europe. Frederick William I., king of Prussia, directed and supervised the creation of the new Prussian army, and Leopold was his principal assistant. In organization and methods of recruiting, as well as in tactical efficiency, the army of 1740 was equally pre-eminent. Then came the wars of Frederick the Great. It is not too much to say that the infantry won his earlier battles; the cavalry had been neglected both by Frederick William and by Leopold, and Frederick wrote that "it was not worth the devil's while to fetch it away." But the predominance of the infantry was so far indisputable that Frederick was able to devote himself to the reorganization of the mounted arm, with results which appeared in the splendid victories of Hohenfriedberg, Rossbach, Leuthen and Zorndorf. But long before the close of the Seven Years' War the incomparable infantry of the old army had disappeared, to be replaced by foreigners, deserters and vagabonds of all kinds, not to mention the unwilling Saxon and other recruits forced into the king's service. The army of 200,000 men which Frederick bequeathed to his successor was indeed superb, and deserved to be the model of Europe. But with Frederick's death the genius which had animated it, and which alone gave value to such heterogeneous materials, was gone. The long peace had the customary effect of sapping the efficiency of the long-service troops. They still retained their imposing appearance and precision of movement, and overweening self-confidence. But in 1806, after two crushing defeats and a series of humiliating surrenders, Prussia found herself at the feet of the conqueror, shorn of half her territory, obliged to receive French troops in all her towns and fortresses, and only existing on sufferance. But in these very disasters were laid the seeds of her future greatness. By the treaty of Tilsit the Prussian army was limited to 43,000 men. This limitation suggested

to Scharnhorst "universal service" on the *Krümper*[1] system already described (see § 36 above).

88. The bitter humiliation and suffering endured under the French yoke aroused a national spirit which was capable of any sacrifices. The civilian became eager to be trained to fight against the oppressor of his country; and when Prussia rose in 1813, the armies she poured into the field were no longer professional, but national armies, imperfectly trained and organized, but animated by a spirit which more than compensated for these defects. At the close of the war her rulers, with far-seeing sagacity, at once devoted themselves to organize on a permanent footing the system which had sprung up under the necessities and enthusiasm of the moment. Universal compulsory service, and a three years' term in the ranks, with further periods in the reserve and *Landwehr*, were then introduced; and though variations have subsequently been made in the distribution of time, the principles were substantially the same as those now in force. By the law of 1814 the periods of service were fixed at three years in the army, two in the reserve and fourteen in the *Landwehr*, and the annual contingent at 40,000 men. As the population increased, it was felt that the service was unequally distributed, pressing unnecessarily heavily on some, while others escaped altogether. Further, the experiences of Bronnzell and Olmütz in 1850, and of 1859, when Prussia armed in anticipation of a war with France, aroused great doubts as to the efficiency of the *Landwehr*, which then formed the bulk of Prussia's forces, and of whom many had been as long as ten years away from the colours. At this time the French remark that the Prussian army was "a sort of militia" was by no means untrue. Accordingly, by the law of 1860 the annual contingent was fixed at 63,000, the period in the reserve was increased from two to four years, and that in the *Landwehr* reduced from fourteen to five. The total armed force thus remained nearly the same (12 contingents of 63,000, in place of 19 of 40,000), but the army and its reserves were more than doubled (increased from 5 × 40,000 to 7 × 63,000) while the *Landwehr* was proportionately reduced.

This change was not effected without great opposition, and led to a prolonged struggle between the king, guided by Bismarck, and the parliament. It required the victories of 1866 and 1870, and the position thereby won for Prussia, to reconcile the nation to the new law. The military alliance (1866) of Prussia with the other German states gave place in 1871 to the union of all the armies into the German army as it is to-day. Some retained their old peculiarities of uniform, and even more than this was allowed to Bavaria and to Saxony, but the whole army, which has been increased year by year to its present strength, is modelled on the Prussian part of it. The Prussian army corps are the Guard, and the line numbered I. to XI., and XV. to XVIII.

89. The *Saxon Army* formerly played a prominent part in all the wars of northern Europe, chiefly in connexion with Poland. In the War of the Austrian Succession the Saxon army played a prominent part, but in the end it suffered a heavy defeat in the battle of Kesselsdorf (1745). In the Seven Years' War Saxony was overrun by the Prussians almost without resistance, and the military forces of the country under Field Marshal Rutowski were forced to surrender *en masse* at Pirna (1756); the men were compelled by Frederick the Great to join the Prussian army, and fought, though most unwillingly, through the remainder of the war as Prussian soldiers. A few outlying regiments which had not been involved in the catastrophe served with the Austrians, and on one occasion at least, at Kolin, inflicted a severe blow on the Prussians. At the outbreak of the wars of the French Revolution the Saxon army was over 30,000 strong. It took part in the campaign of Jena on the side of the Prussians, and during the Napoleonic domination in Germany Saxony furnished strong contingents to the armies of Napoleon, who in return recognized her elector as king, and largely increased his territories. The newly made king remained faithful to Napoleon even in his reverses; but the army was too German in feeling to fight willingly under the French flag. Their defection at Leipzig contributed not a little to the results of that bloody day. After the peace the king was shorn of a great part of his dominions, and the army was reconstituted on a smaller scale. In 1866 Saxony sided with Austria, and her army shared in the disasters of the brief campaign and the crowning defeat at Königgrätz. Under the crown prince's leadership, however, the Saxons distinguished themselves by their courage and steadiness wherever they were engaged. After the war Saxony became part of the North German Confederation, and in 1870–1871 her troops, under the command of the crown prince, formed the XII. corps of the great German army. They were assigned to the II. army of Prince Frederick Charles, and delivered the decisive attack on the French right at Gravelotte. Subsequently a IV. army was formed under the command of the crown prince, in which the XII. corps, now under Prince George of Saxony, served with unvarying credit in the campaign of Sedan and the siege of Paris. The Saxon army is now organized in every respect on Prussian lines, and forms two army corps (XII. at Dresden and XIX. at Leipzig) of the German army. The German emperor, in concert with the king of Saxony, names the officers for the higher commands. Saxony retains, however, her separate war ministry, budget, &c.; and appointments and promotion to all but the highest commands are made by the king. The colours of the older Saxon forces, and especially the green of the tunics, are retained in many of the uniforms of the present day.

90. The *Bavarian Army* has perhaps the most continuous record of good service in the field of any of the minor German armies. The oldest regiments date from the Thirty Years' War, in which the veteran army of the Catholic league, commanded by Count Tilly and formed on the nucleus of the Bavarian army, played a conspicuous part. Later in the war the Bavarian general, Count Mercy, proved himself a worthy opponent of Turenne and Condé. Henceforward the Bavarians were engaged in almost every war between France and Austria, taking part successively in the wars of the Grand Alliance, the Spanish Succession (in which they came into conflict with the English), and the Polish and Austrian Succession wars. In pursuance of the traditional anti-Austrian policy, the troops of Bavaria, led by a distinguished Bavarian, Marshal (Prince) Wrede, served in the campaigns of 1805 to 1813 side by side with the French, and Napoleon made the electorate into a kingdom. But in 1813 Bavaria joined the Alliance, and Wrede tried to intercept the French on their retreat from Leipzig. Napoleon, however, inflicted a severe defeat on his old general at Hanau, and opened his road to France. In 1866 the Bavarians took part against Prussia, but owing to their dilatoriness in taking the field, the Prussians were able to beat them in detail. In 1870, reorganized to some extent on Prussian lines, they joined their former enemy in the war against France, and bore their full share in the glories and losses of the campaign, the II. Bavarian corps having suffered more heavily than any but the III. Prussian corps. The I. Bavarian corps distinguished itself very greatly at Sedan and on the Loire. Bavaria still retains her separate war office and special organization, and the troops have been less affected by the Prussian influence than those of the other states. The Bavarian corps are numbered separately (I. Bav., Munich; II. Bav., Würzburg; III. Bav., Nuremberg), and the old light blue uniforms and other distinctive peculiarities of detail are still maintained.

91. *Württemberg* furnishes one army corps (XIII.; headquarters, Stuttgart), organized, clothed and equipped in all respects like the Prussian army. Like the Bavarians, the Württembergers fought against the Prussians in 1866, but in 1870 made common cause with them against the French, and by the convention entered into the following year placed their army permanently under the command of the Prussian king as emperor. The emperor nominates to the highest commands, but the king of Württemberg retains the nomination and appointment of officers in the lower grades.

92. The old *Hanoverian Army* disappeared, of course, with the annexation of Hanover to Prussia in 1866, but it is still represented officially by certain regiments of the X. army corps, and, in one case at least, battle honours won by the King's German Legion in the British service are borne on German colours of to-day. The *Hessian Army* is now represented by the XXV. (Grand-ducal Hessian) division, which forms part of the XVIII. army corps.

ITALIAN ARMY

93. The old conscription law of the kingdom of Sardinia is the basis of the military organization of Italy, as its constitution is of that of the modern Italian kingdom. The Piedmontese have long borne a high reputation for their military qualities, a

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[1] From *Krümperpferde* (cast horses attached to batteries, &c., for odd jobs), applied to the recruits in jest.

reputation shared by the rulers of the house of Savoy (*q.v.*), many of whom showed special ability in preserving the independence of their small kingdom between two such powerful neighbours as France and Austria. During the wars of the French Revolution Piedmont was temporarily absorbed into the French republic and empire. The Italian troops who fought under Napoleon proved themselves, in many if not most cases, the best of the French allies, and Italy contributed large numbers of excellent general officers to the *Grande Armée*.

After 1815 various causes combined to place Piedmont (Sardinia) at the head of the national movement which agitated Italy during the ensuing thirty years, and bring her in direct antagonism to Austria. Charles Albert, her then ruler, had paid great attention to the army, and when Italy rose against Austria in 1848 he took the field with an excellent force of nearly 70,000 men. At the outset fortune favoured the arms of Italy; but the genius and energy of Radetzky, the veteran Austrian commander, turned the tide, and in the summer of 1849 after many battles the Piedmontese army was decisively defeated at Novara, and her king compelled to sue for peace. Charles Albert abdicated in favour of his son Victor Emanuel, a prince who had already distinguished himself by his personal gallantry in the field. Under his care the army soon recovered its efficiency, and the force which joined the allied armies in the Crimea attracted general admiration from the excellence of its organization, equipment and discipline. In 1859 Piedmont again took up arms against Austria for the liberation of Italy; but this time she had the powerful assistance of France, and played but a subordinate part herself. In this campaign the Sardinian army was composed of one cavalry and five infantry divisions, and numbered about 60,000 combatants. By the peace of Villafranca, Italy, with the exception of Venetia, was freed from the Austrians, and Lombardy was added to Piedmont. The revolutionary campaign of Garibaldi in the following year united the whole peninsula under the rule of Victor Emanuel, and in 1866, when Italy for the third time took up arms against Austria—this time as the ally of Prussia—her forces had risen to nearly 450,000, of whom about 270,000 actually took the field. But in quality these were far from being equal to the old Piedmontese army; and the northern army, under the personal command of the king, was decisively defeated at Custozza by the archduke Albert of Austria.

The existing organization of the Italian army is determined by the laws of 1873, which made universal liability to service the basis of recruiting. The territorial system has not, however, been adopted at the same time, the materials of which the Italian army is composed varying so much that it was decided to blend the different types of soldiers so far as possible by causing them to serve together. The colonial wars in which Italian troops have taken part have been marked with great disasters, but relieved by the gallantry of the officers and the rank and file.

RUSSIAN ARMY

94. The history of the Russian army begins with the abolition of the Strelitz (*q.v.*) by Peter the Great in 1698, the nucleus of the new forces being four regiments of foot, two of which are well known to-day under their old titles of Preobrazhenski and Semenovski. Throughout the 18th century Russian military progress obeyed successive dynasties of western European models—first those of Prussia, then those of France. In the earlier part of the 19th century the army, used chiefly in wars against the revolutionary spirit, became, like others of that time, a dynastic force; subsequently the "nation in arms" principle reasserted itself, and on this basis has been carried out the reorganization of Russia's military power. The enormous development of this since 1874 is one of the most striking phenomena in recent military history. In 1892, in expectation of a general European war, whole armies were massed in the districts of Warsaw and Vilna, three-fifths of the entire forces being in position on the German and Austrian frontiers.

The Russo-Japanese War of 1904–5 is generally held to have proved that the fighting power of the Russian has in no way diminished in intrinsic value from that of the days of Zorndorf, Borodino and Sevastopol. The proverbial stubbornness of the rank and file is the distinctive quality of the armies of the tsar, and in view of the general adoption of two-years' service in other countries it is a matter for grave consideration whether, against European forces and in defence of their own homes, the Russians would not prove more than formidable antagonists to the men of more highly individualized races who are their probable opponents. Equally remarkable is the new power of redistribution possessed by Russia. Formerly it was usual to count upon one campaign at least elapsing before Russia could intervene effectively in European wars; much, in fact the greater part, of her losses in the Crimean War was due to the enormous distances which had to be traversed on foot. Nowadays the original equal distribution of the army over the country has been modified in accordance with the political needs of each moment. In 1892 the centre of gravity was shifted to Poland and Kiev, in 1904 the performances of the trans-Siberian railway in transporting troops to the seat of war in Manchuria excited the admiration of military Europe. The attitude of the army in the troubles which followed upon the Japanese War belongs to the history of Russia, not to that of military organization, and it will be sufficient to say that the conduct of the "nation in arms" at times of political unrest may vary between the extremes of unquestioning obedience to authority and the most dangerous form of licence, examples of both being frequent in the history of nearly all national armies. A remarkable innovation in the modern history of this army is the conversion of the whole of the cavalry, except a few *élite* regiments, into dragoons of the old type. After the war of 1904-5, however, this policy was reversed and the cavalry reformed on the usual model. The Cossacks still retain to a large extent the peculiarities of the light troops of the 18th century.

SPANISH ARMY

95. The feudal sovereignties of medieval Spain differed but little, in their military organization, from other feudal states. As usual, mercenaries were the only forces on which reliance was placed for foreign wars. These troops called *almugávares* (Arabic = scouts) won a great reputation on Italian and Greek battlefields of the 13th century, and with many transformations in name and character appeared from time to time up to the Peninsular War. Castile, however, had a military system very different from the rest. The forces of the kingdom were composed of local contingents similar to the English *fyrd*, professional soldiers who were paid followers of the great lords, and the heavy cavalry of the military orders. The groups of cities called *Hermandades*, while they existed, also had permanent forces in their pay. At the union of Castile and Aragon the Castilian methods received a more general application. The new *Hermandad* was partly a light cavalry, partly a police, and was organized in the ratio of one soldier to every hundred families. In the conquest of Grenada (1482–92) *mesnadas* or contingents were furnished by the crown, the nobles and the cities, and permanently kept in the field. The *Hermandad* served throughout the war as a matter of course. From the veterans of this war was drawn the army which in the Italian wars won its reputation as the first army in Europe.

In 1596 the home defence of Spain was reorganized and the *ordenanza*, or militia, which was then formed of all men not belonging to the still extant feudal contingents, was generally analogous to the system of "assizes at arms" in England. This *ordenanza* served in the Peninsular War.

96. With the Italian wars of the early 16th century came the development of the regular army; a brief account of its place in the evolution of armies has been given above. Discipline, the feeling of comradeship and soldierly honour were the qualities which marked out the Spanish army as the model for others to follow, and for more than a century the Spanish army maintained its prestige as the first in Europe. The oldest regiments of the present Spanish army claiming descent from the *tercios* date from 1535. An officer whose regiment was reduced commonly took a pike in some other corps (*e.g.* Tilly), the *señor soldado* was counted as a gentleman, and his wife and family received state allowances. Nor was this army open only to Spaniards. Walloons, Italians, Burgundians and other nationalities ruled over by the Habsburgs all contributed their quotas. But the career of the old army came to an end at Rocroi (1643), and after this the forces of the monarchy began more and more to conform to the French model.

97. The military history of Spain from 1650 to 1700 is full of incident, and in the long war of the Spanish Succession both the army and the *ordenanza* found almost continuous employment. They were now organized, as were most other armies of Europe, on the lines of the French army, and in 1714 the old *tercios*, which had served in the Spanish Netherlands under Marlborough, were brought to Spain. The king's regiment "Zamora" of the present army descends from one of these which, as the *tercio* of Bovadilla, had been raised in 1580. The army underwent few changes of importance during the 18th century, and it is interesting to note that there were never less than three Irish regiments in the service. In 1808 the *Irlanda*, *Ultonia* (= Ulster) and *Hibernia* regiments had come to consist (as had similar corps in the French service before the Revolution) largely of native soldiers. At that time the Spanish army consisted of 119 Spanish and foreign (Swiss, Walloon and Irish) battalions, with 24 cavalry regiments and about 8000 artillery and engineers. There were further 51 battalions of militia, and the

total forces numbered actually 137,000. The part played by the Spanish standing army in the Peninsular War was certainly wholly insignificant relatively to these figures. It must be borne in mind, however, that only continued wars can give real value to long-service troops of the old style, and this advantage the Spanish regulars did not possess. Further, the general decadence of administration reacted in the usual way, the appointment of court favourites to high command was a flagrant evil, and all that can be urged is that the best elements of the army behaved as well as did the Prussians of 1806, that the higher leading and the administration of the army in the field were both sufficiently weak to have ruined most armies, and that the men were drawn from the same country and the same classes which furnished the *guerrilleros* whom it became fashionable to exalt at the expense of the soldiers. In the later campaigns of Wellington, Spanish divisions did good service, and the corps of La Romaña (a picked contingent of troops which had been sent before the war to Denmark at Napoleon's instance), though often defeated, always retained some cohesion and discipline. But the result of this war, the second French invasion, and the continued civil wars of the 19th century was the destruction of the old army, and the present army of Spain still bears traces of the confusion out of which it arose.

The most important changes were in 1870, when conscription was introduced, and in 1872, when universal service was proposed in its place. The military virtues of the rank and file and the devotion of the officers were conspicuously displayed in the Spanish-American War of 1898, and it cannot be claimed even for the Germans of 1870 that they fired so coolly and accurately as did the defenders of S. Juan and El Caney.

Turkish Army

98. The writers who have left the most complete and trustworthy contemporary accounts of the Turkish army in the 14th and 15th centuries, when it reached the height of its most characteristic development, are Bertrandon de la Brocquière, equerry to Philip the Good, duke of Burgundy, and Francesco Filelfo of Tolentino. Bertrandon, a professional soldier, visited Palestine in 1432, and returned overland in 1433, traversing the Balkan Peninsula by the main trade-route from Constantinople to Belgrade. He wrote an account of his journey for Philip: see *Early Travels in Palestine*, translated and edited by T. Wright (London, 1848). Filelfo served as secretary to the Venetian *baylo* at Constantinople, and recorded his observations in a series of letters (see FILELFO). Both ascribe the military superiority of the Turks over the nations of western Europe to two facts—firstly to their possession of a well-organized standing army, an institution unknown elsewhere, and secondly to their far stricter discipline, itself a result of their military organization and of the moral training afforded by Islam.

The regular troops comprised the Janissaries (*q.v.*), a corps of infantry recruited from captured sons of Christians, and trained to form a privileged caste of scientific soldiers and religious fanatics; and the Spahis, a body of cavalry similarly recruited, and armed with scimitar, mace and bow. Celibacy was one of the rules of this standing army, which, in its semi-monastic ideals and constitution, resembled the knightly orders of the West in their prime. The Janissaries numbered about 12,000, the Spahis about 8000. A second army of some 40,000 men, mostly mounted and armed like the Spahis, was feudal in character, and consisted chiefly of the personal followers of the Moslem nobility; more than half its numbers were recruited in Europe. This force of 60,000 trained soldiers was accompanied by a horde of irregulars, levied chiefly among the barbarous mountaineers of the Balkans and Asia Minor, and very ill-armed and ill-disciplined. Their numbers may be estimated at 140,000, for Bertrandon gives 200,000 as the total of the Turkish forces. Many 15th and 16th century writers give a smaller total, but refer only to the standing and feudal armies. Others place the total higher. Laonicus Chalcocondylas in his *Turcica Historia* states that at the siege of Constantinople in 1453 the sultan commanded 400,000 troops, but most other eye-witnesses of the siege give a total varying from 150,000 to 300,000. Many Christian soldiers of fortune enlisted with the Turks as artillerists or engineers, and supplied them at Constantinople with the most powerful cannon of the age. Other Christians were compelled to serve as engineers or in the ranks. As late as 1683 a corps of Wallachians was forced to join the Turkish army before Vienna, and entrusted with the task of bridging the Danube. But in the 18th and early 19th centuries the introduction of Christians tended to weaken the *moral* of the army already sapped by defeat; it was found impossible to maintain the discipline of the Janissaries, whose privileges had become a source of danger; and the feudal nobility became more and more independent of the sultan's authority. These three causes contributed to make reorganization inevitable.

The destruction of the Janissaries in 1826 marked the close of the history of the old Turkish army; already the re-creation of the service on the accepted models of western Europe had been commenced. This was still incomplete when the new force was called upon to meet the Russians in 1828, and though the army displayed its accustomed bravery, its defective organization and other causes led to its defeat. Since then the army has been almost as constantly on active service as the British; the Crimean War, the Russo-Turkish War of 1877 and the Greco-Turkish War of 1897 witnessed the employment of a large proportion of the sultan's available forces, while innumerable local revolts in different parts of the empire called for great exertions, and often for fierce fighting on the part of the troops locally in garrison and those sent up from the nearest provinces.

United States Army

99. The regular army of the United States has always been small. From the first it has been a voluntary force, and until 1898 its chief work in peace was to furnish numerous small posts on the frontier and amongst the Indians, and to act as a reserve to the civil power in the great cities. In war-time the regular army, if, as was usually the case, it was insufficient in numbers for the task of subduing the enemy, formed the nucleus of large armies raised "for the war." In 1790 the rank and file of the army, as fixed by act of Congress, amounted to 1216 men; and in 1814 an English expedition of only 3500 men was able to seize and burn Washington, the capital of a country which even then numbered eight millions of inhabitants. In 1861, at the beginning of the Civil War, the whole regular force amounted to about 15,300 men. In April of that year the president called out 75,000 volunteers for three months; and in May a further call for 42,000 was made. In July a call for 500,000 men was authorized by Congress, and as even this vast force proved insufficient it was found necessary to use a system of drafts. In October 1863 a levy of 300,000 men was ordered, and in February 1864 a further call of 500,000 was made. Finally, in the beginning of 1865 two further levies, amounting in all to 500,000 men, were ordered, but were only partially carried out in consequence of the cessation of hostilities. The total number of men called under arms by the government of the United States, between April 1861 and April 1865, amounted to 2,759,049, of whom 2,656,053 were actually embodied in the armies. If to these be added the 1,100,000 men embodied by the South during the same time, the total armed forces reach the enormous amount of nearly four millions, drawn from a population of only 32 millions—figures before which the celebrated uprising of the French nation in 1793, or the efforts of France and Germany in the Franco-German War, sink into insignificance. These 2,700,000 Federals were organized into volunteer regiments bearing state designations. The officers, except general and staff officers, were appointed by the governors of the respective states. The maximum authorized strength of the regular army never, during the war, exceeded 40,000 men; and the number in the field, especially towards the close of the war, was very much less. The states, in order to obtain men to fill their quotas, offered liberal bounties to induce men to enlist, and it therefore became very difficult to obtain recruits for the regular army, for which no bounties were given. The regular regiments accordingly dwindled away to skeletons. The number of officers present was also much reduced, since many of them, while retaining their regular commissions, held higher rank in the volunteer army. After the close of the Civil War the volunteers were mustered out; and by the act of Congress of the 28th of July 1866 the line of the army was made to consist of 10 regiments of cavalry of 12 troops each, 5 regiments of artillery of 12 batteries each and 45 regiments of infantry of 10 companies. The actual strength in August 1867 was 53,962. The act of the 3rd of March 1869 reduced the number of infantry regiments to 25 and the enlisted strength of the army to 35,036. The numbers were further reduced, without change in organization, to 32,788 in 1870 and to 25,000 in 1874. The latter number remained the maximum for twenty-four years.

In March 1898, in view of hostilities with Spain, the artillery was increased by 2 regiments, and, in April, 2 companies were added to each infantry regiment, giving it

3 battalions of 4 companies each. The strength of batteries, troops and companies was increased, the maximum enlisted strength reached during 1898 being over 63,000. A volunteer army was also organized. Of this army, 3 regiments of engineer troops, 3 of cavalry and 10 of infantry were United States volunteers, all the officers being commissioned by the president. The other organizations came from the states, the officers being appointed by the respective governors. As fast as they were organized and filled up, they were mustered into the service of the United States. The total number furnished for the war with Spain was 10,017 officers and 213,218 enlisted men. All general and staff officers were appointed by the president. Three hundred and eighty-seven officers of the regular army received volunteer commissions. After the conclusion of hostilities with Spain, the mustering out of the volunteers was begun, and by June 1899 all the volunteers, except those in the Philippines, were out of the service. The latter, as well as those serving elsewhere, having enlisted only for the war, were brought home and mustered out as soon as practicable.

The act of the 2nd of March 1899 added 2 batteries to each regiment of artillery. On the 2nd of February 1901 Congress passed an important bill providing for the reorganization and augmentation (max. 100,000) of the regular army, and other measures followed in the next years. (See UNITED STATES.)

MINOR ARMIES

100. *Dutch and Belgian Armies.*—The military power of the "United Provinces" dates its rise from the middle of the 16th century, when, after a long and sanguinary struggle, they succeeded in emancipating themselves from the yoke of Spain; and in the following century it received considerable development in consequence of the wars they had to maintain against Louis XIV. In 1702 they had in their pay upwards of 100,000 men, including many English and Scottish regiments, besides 30,000 in the service of the Dutch East India Company. But the slaughter of Malplaquet deprived the republic of the flower of the army. Its part in the War of the Austrian Succession was far from being as creditable as its earlier deeds, a Prussian army overran Holland in 1787 almost without opposition, and at the beginning of the wars of the French Revolution the army had fallen to 36,000 men. In 1795 Holland was conquered by the French under Pichegru, and in the course of the changes which ensued the army was entirely reorganized, and under French direction bore its share in the great wars of the empire.

With the fall of Napoleon and the reconstitution of the Netherlands, the Dutch-Belgian army, formed of the troops of the now united countries, came into existence. The army fought at Waterloo, but was not destined to a long career, for the revolution of 1830 brought about the separation of Belgium. A Dutch garrison under Baron Chassé, a distinguished veteran of the Napoleonic wars, defended Antwerp against the French under Marshal Gérard, and the Netherlands have been engaged in many arduous colonial wars in the East Indies. The Belgian army similarly has contributed officers and non-commissioned officers to the service of the Congo Free State.

101. *Swiss Army.*—The inhabitants of Switzerland were always a hardy and independent race, but their high military reputation dates from the middle of the 15th century, when the comparatively ill-armed and untrained mountaineers signally defeated Charles the Bold of Burgundy and the flower of the chivalry of Europe in the battles of Granson, Morat and Nancy. The Swabian war, towards the end of that century, and the Milanese war, at the beginning of the following one, added to the fame of the Swiss infantry, and made it the model on which that arm was formed all over Europe. The wealthier countries vied with each other in hiring them as mercenaries, and the poor but warlike Swiss found the profession of arms a lucrative one.

A brief account of the Swiss mercenaries will be found earlier in this article. Their fall was due in the end to their own indiscipline in the first place, and the rise of the Spanish standing army and its musketeers in the second. Yet it does not seem that the military reputation of the Swiss was discredited, even by reverses such as Marignan. On the contrary, they continued all through the 17th and 18th centuries to furnish whole regiments for the service of other countries, notably of France, and individuals, like Jomini in a later age, followed the career of the soldier of fortune everywhere. The most notable incident in the later military history of the Swiss, the heroic faithfulness of Louis XVI.'s Swiss guard, is proverbial, and has been commemorated with just pride by their countrymen. The French Revolutionary armies overran Switzerland, as they did all the small neighbouring states, and during Napoleon's career she had to submit to his rule, and furnish her contingent to his armies. On the fall of Napoleon she regained her independence, and returned to her old trade of furnishing soldiers to the sovereigns and powers of Europe. Charles X. of France had at one time as many as 17,000 Swiss in his pay; Naples and Rome had each four regiments. The recruiting for these foreign services was openly acknowledged and encouraged by the government. The young Swiss engaged usually for a period of four or six years; they were formed in separate regiments, officered by countrymen of their own, and received a higher rate of pay than the national regiments; and at the close of their engagement returned with their earnings to settle down on their paternal holdings. A series of revolutions, however, expelled them from France and Italy, and recently the advance of liberal ideas, and the creation of great national armies based on the principle of personal service, has destroyed their occupation. Switzerland is now remarkable in a military sense as being the only country that maintains no standing army (see Militia).

102. The *Swedish Army* can look back with pride to the days of Gustavus Adolphus and of Charles XII. The contributions made by it to the military science of the 17th century have been noticed above. The triumphs of the small and highly disciplined army of Charles were often such as to recall the similar victories of the Greeks under Alexander. The then nebulous armies of Russia and Poland resembled indeed the forces of Darius in the 4th century B.C., but Peter the Great succeeded at last in producing a true army, and the resistance of the Swedes collapsed under the weight of the vastly superior numbers then brought against them.

The *Danish Army* has a long and meritorious record of good service dating from the Thirty Years' War.

103. The existing Army of *Portugal* dates from the Peninsular War, when a considerable force of Portuguese, at one time exceeding 60,000 men, was organized under Marshal Beresford. Trained and partly officered by English officers, it proved itself not unworthy of its allies, and bore its full share in the series of campaigns and battles by which the French were ultimately expelled from Spain. At the peace the army numbered about 50,000 infantry and 5000 cavalry, formed on the English model, and all in the highest state of efficiency. This force was reduced in 1821, under the new constitutional government, to about one-half.

104. The *Rumanian*, *Bulgarian* and *Servian* armies are the youngest in Europe. The conduct of the Rumanians before Plevna in 1877 earned for them the respect of soldiers of all countries. Servia and Bulgaria came to war in 1885, and the Bulgarian soldiers, under the most adverse conditions, achieved splendid victories under the leadership of their own officers. In the crisis following the Austrian annexation of Bosnia-Herzegovina (1908-9), it seemed likely that the Servian forces might play an unexpectedly active part in war even with a strong power.

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ARNAL, ÉTIENNE (1794–1872), French actor, was born at Meulan, Seine-et-Oise, on the 1st of February 1794. After serving in the army, and working in a button factory, he took to the stage. His first appearance (1815) was in tragedy, and for some time he was unsuccessful; it was not until 1827 that he showed his real ability in comedy parts, especially in plays by Félix August Duvert (1795–1876) and Augustin Théodore Lauzanne (1805–1877), whose *Cabinets particuliers* (1832), *Le Mari de la dame de chœurs* (1837), *Passé minuit*, *L'Homme blasé* (1843), *La Clef dans le dos* (1848), &c., contained parts written for him. He was twenty years at the Vaudeville, and completed at the various Parisian theatres a stage career of nearly half a century. Arnal was the author of *Epître à bouffé* (1840), which is reprinted in his volume of poetry, *Boutades en vers* (1861).

ARNALDUS DE VILLA NOVA, also called ARNALDUS DE VILLANUEVA, ARNALDUS VILLANOVANUS or ARNAUD DE VILLENEUVE (*c.* 1235–1313), alchemist, astrologer and physician, appears to have been of Spanish origin, and to have studied chemistry, medicine, physics, and also Arabian philosophy. After having lived at the court of Aragon, he went to Paris, where he gained a considerable reputation; but he incurred the enmity of the ecclesiastics and was forced to flee, finally finding an asylum in Sicily. About 1313 he was summoned to Avignon by Pope Clement V., who was ill, but he died on the voyage. Many alchemical writings, including *Thesaurus Thesaurorum* or *Rosarius Philosophorum*, *Novum Lumen*, *Flos Florum*, and *Speculum Alchimiae*, are ascribed to him, but they are of very doubtful authenticity. Collected editions of them were published at Lyons in 1504 and 1532 (with a biography by Symphorianus Campegius), at Basel in 1585, at Frankfort in 1603, and at Lyons in 1686. He is also the reputed author of various medical works, including *Breviarium Practicae*.

See J. B. Hauréau in the *Histoire littéraire de la France* (1881), vol. 28; E. Lalande, *Arnaud de Villeneuve, sa vie et ses œuvres* (Paris, 1896). A list of writings is given by J. Ferguson in his *Bibliotheca Chemica* (1906). See also U. Chevalier, *Repertoire des sources hist., &c., Bio-bibliographie* (Paris, 1903).

ARNAUD, HENRI (1641–1721), pastor and general of the Vaudois or Waldensians of Piedmont, was born at Embrun. About 1650 his family returned to their native valley of Luserna, where Arnaud was educated at La Tour (the chief village), later visiting the college at Basel (1662 and 1668) and the Academy at Geneva (1666). He then returned home, and seems to have been pastor in several of the Vaudois valleys before attaining that position at La Tour (1685). He was thus the natural leader of his co-religionists after Victor Amadeus expelled them (1686) from their valleys, and most probably visited Holland, the ruler of which, William of Orange, certainly gave him help and money. Arnaud occupied himself with organizing his 3000 countrymen who had taken refuge in Switzerland, and who twice (1687–1688) attempted to regain their homes. The English revolution of 1688, and the election of William to the throne, encouraged the Vaudois to make yet another attempt. Furnished with detailed instructions from the veteran Josué Janavel (prevented by age from taking part in the expedition) Arnaud, with about 1000 followers, started (August 17, 1689) from near Nyon on the Lake of Geneva for the *glorieuse rentrée*. On the 27th of August, the valiant band, after many hardships and dangers, reached the Valley of St Martin, having passed by Sallanches and crossed the Col de Very (6506 ft.), the Enclave de la Fenêtre (7425 ft.), the Col du Bonhomme (8147 ft.), the Col du Mont Iseran (9085 ft.), the Grand Mont Cenis (6893 ft.), the Petit Mont Cenis (7166 ft.), the Col de Clapier (8173 ft.), the Col de Côteplane (7589 ft.), and the Col du Piz (8550 ft.). They soon took refuge in the lofty and secure rocky citadel of the Balsille, where they were besieged (October 24, 1689 to May 14, 1690) by the troops (about 4000 in number) of the king of France and the duke of Savoy. They maintained this natural fortress against many fierce attacks and during the whole of a winter. In particular, on the 2nd of May, one assault was defeated without the loss of a single man of Arnaud's small band. But another attack (May 14) was not so successful, so that Arnaud withdrew his force, under cover of a thick mist, and led them over the hills to the valley of Angrogna, above La Tour. A month later the Vaudois were received into favour by the duke of Savoy, who had then abandoned his alliance with France for one with Great Britain and Holland. Hence for the next six years the Vaudois helped Savoy against France, though suffering much from the repeated attacks of the French troops. But by a clause in the treaty of peace of 1696, made public in 1698, Victor Amadeus again became hostile to the Vaudois, about 3000 of whom, with Arnaud, found a shelter in Protestant countries, mainly in Württemberg, where Arnaud became the pastor of Dürrmenz-Schönenberg, N.W. of Stuttgart (1699). Once again (1704–1706) the Vaudois aided the duke against France. Arnaud, however, took no part in the military operations, though he visited England (1707) to obtain pecuniary aid from Queen Anne. He died at Schönenberg (which was the church hamlet of the parish of Dürrmenz) in 1721. It was during his retirement that he compiled from various documents by other hands his *Histoire de la glorieuse rentrée des Vaudois dans leurs vallées*, which was published (probably at Cassel) in 1710, with a dedication to Queen Anne. It was translated into English (1827) by H. Dyke Acland, and has also appeared in German and Dutch versions. A part of the original MS. is preserved in the Royal Library in Berlin.

See K. H. Klaiber, *Henri Arnaud, ein Lebensbild* (Stuttgart, 1880); A. de Rochas d'Aiglun, *Les Vallées vaudoises* (Paris, 1881); various chapters in the *Bulletin du bicentenaire de la glorieuse rentrée* (Turin, 1889). (W. A. B. C.)

ARNAULD, the surname of a family of prominent French lawyers, chiefly remembered in connexion with the Jansenist troubles of the 17th century. At their head was ANTOINE ARNAULD (1560–1619), a leader of the Paris bar; in this capacity he delivered a famous philippic against the Jesuits in 1594, accusing them of gross disloyalty to the newly converted Henry IV. This speech was afterwards known as the original sin of the Arnaulds.

Of his twenty children several grew up to fight the Jesuits on more important matters. Five gave themselves up wholly to the church. HENRI ARNAULD (1597–1692), the second son, became bishop of Angers in 1649, and represented Jansenism on the episcopal Bench for as long as forty-three years. The youngest son, ANTOINE (1612–1694), was the most famous of Jansenist theologians (see below). The second daughter, ANGÉLIQUE (1591–1661), was abbess and reformer of Port Royal; here she was presently joined by her sister AGNES (1593–1671) and two younger sisters, both of whom died early.

Only two of Antoine's children married—ROBERT ARNAULD D'ANDILLY (1588–1674), the eldest son, and CATHERINE LEMAISTRE (1590–1651), the eldest daughter. But both of these ended their lives under the shadow of the abbey. Andilly's five daughters all took the veil there; the second, ANGÉLIQUE DE ST JEAN ARNAULD D'ANDILLY (1624–1684) rose to be abbess, was a writer of no mean repute, and one of the most remarkable figures of the second generation of Jansenism. One of Andilly's sons became a hermit at Port Royal; the eldest, ANTOINE (1615–1699), was first a soldier, afterwards a priest. As the Abbé Arnauld, he survives as author of some interesting *Memoirs* of his time. The second son, SIMON ARNAULD DE POMPONNE (1616–1699), early entered public life. After holding various embassies, he rose to be foreign secretary to Louis XIV., and was created marquis de Pomponne. Lastly Madame Lemaistre and two of her sons became identified with Port Royal. On her husband's death she took the veil there. Her eldest son, ANTOINE LEMAISTRE (1608–1658), became the first of the *solitaires*, or hermits of Port Royal. There he was joined by his younger brother, ISAAC LEMAISTRE DE SACI (1613–1684), who presently took holy orders, and became confessor to the hermits.

The Arnaulds' connexion with Port Royal (*q.v.*)—a convent of Cistercian nuns in the neighbourhood of Versailles—dated back to 1599, when the original Antoine secured the abbess's chair for his daughter Angélique, then a child of eight. About 1608 she started to reform her convent in the direction of its original Rule; but about 1623 she made the acquaintance of du Vergier (*q.v.*) and thenceforward began to move in a Jansenist direction. Her later history is entirely bound up with the fortunes of that revival. Angélique's strength lay chiefly in her character. Her sister and collaborator, Agnes, was also a graceful writer; and her *Letters*, edited by Prosper Feugère (2 vols., Paris, 1858), throw most valuable light on the inner aims and aspirations of the Jansenist movement. The first relative to join their projects of reform was their nephew, Antoine Lemaistre, who threw up brilliant prospects at the bar to settle down at the Abbey gates (1638). Here he was presently joined by his brother, de Saci, and other hermits, who led an austere semi-monastic existence, though without taking any formal vow. In 1646 they were joined by their uncle, Arnauld d'Andilly, hitherto a personage of some importance at court and in the world; he was a special favourite of the queen regent, Anne of Austria, and had held various offices of dignity in the government. Uncle and nephews passed their time partly in ascetic exercises—though Andilly never pretended to vie in austerity with the younger men—partly in managing the convent estates, and partly in translating religious classics. Andilly put Josephus, St Augustine's *Confessions*, and many other works, into singularly delicate French. Lemaistre attacked the lives of the saints; in 1654 Saci set to work on a translation of the Bible. His labours were interrupted by the outbreak of persecution. In 1661 he was forced to go into hiding; in 1666 he was arrested, thrown into the Bastille, and kept there more than two years. Meanwhile his friends printed his translation of the New Testament—really in Holland, nominally at Mons in the Spanish Netherlands (1667). Hence it is usually known as the *Nouveau Testament de Mons*. It found enthusiastic friends and violent detractors. Bossuet approved its orthodoxy, but not its over-elaborate style; and it was destructively criticized by Richard Simon, the founder of Biblical criticism in France. On the other hand it undoubtedly did much to popularize the Bible, and was bitterly attacked by the Jesuits on that ground.

Le grand Arnauld.

By far the most distinguished of the family, however, was Antoine—*le grand* Arnauld, as contemporaries called him—the twentieth and youngest child of the original Antoine. Born in 1612, he was originally intended for the bar; but decided instead to study theology at the Sorbonne. Here he was brilliantly successful, and was on the high-road to preferment, when he came under the influence of du Vergier, and was drawn in the direction of Jansenism. His book, *De la fréquente Communion* (1643), did more than anything else to make the aims and ideals of this movement intelligible to the general public. Its appearance raised a violent storm, and Arnauld eventually withdrew into hiding; for more than twenty years he dared not make a public appearance in Paris. During all this time his pen was busy with innumerable Jansenist pamphlets. In 1655 two very outspoken *Lettres à un duc et pair* on Jesuit methods in the confessional brought on a motion to expel him from the Sorbonne. This motion was the immediate cause of Pascal's *Provincial Letters*. Pascal, however, failed to save his friend; in February 1656 Arnauld was solemnly degraded. Twelve years later the tide of fortune turned. The so-called peace of Clement IX. put an end to persecution. Arnauld emerged from his retirement, was most graciously received by Louis XIV., and treated almost as a popular hero. He now set to work with Nicole (*q.v.*) on a great work against the Calvinists: *La Perpétuité de la foi catholique touchant l'eucharistie.* Ten years later, however, another storm of persecution burst. Arnauld was compelled to fly from France, and take refuge in the Netherlands, finally settling down at Brussels. Here the last sixteen years of his life were spent in incessant controversy with Jesuits, Calvinists and misbelievers of all kinds; here he died on the 8th of August 1694. His inexhaustible energy is best expressed by his famous reply to Nicole, who complained of feeling tired. "Tired!" echoed Arnauld, "when you have all eternity to rest in?" Nor was this energy by any means absorbed by purely theological questions. He was one of the first to adopt the philosophy of Descartes, though with certain orthodox reservations; and between 1683 and 1685 he had a long battle with Malebranche on the relation of theology to metaphysics. On the whole, public opinion leant to Arnauld's side. When Malebranche complained that his adversary had misunderstood him, Boileau silenced him with the question: "My dear sir, whom do you expect to understand you, if M. Arnauld does not?" And popular regard for Arnauld's penetration was much increased by his *Art de penser*, commonly known as the *Port-Royal Logic*, which has kept its place as an elementary text-book until quite modern times. Lastly a considerable place has quite lately been claimed for Arnauld among the mathematicians of his age; a recent critic even describes him as the Euclid of the 17th century. In general, however, since his death his reputation has been steadily on the wane. Contemporaries admired him chiefly as a master of close and serried reasoning; herein Bossuet, the greatest theologian of the age, was quite at one with d'Aguesseau, the greatest lawyer. But a purely controversial writer is seldom attractive to posterity. Anxiety to drive home every possible point, and cut his adversary off from every possible line of retreat, makes him seem intolerably prolix. "In spite of myself," Arnauld once said regretfully, "my books are seldom very short." And even lucidity may prove a snare to those who trust to it alone, and scornfully refuse to appeal to the imagination or the feelings. It is to be feared that, but for his connexion with Pascal, Arnauld's name would be almost forgotten—or, at most, live only in the famous epitaph Boileau consecrated to his memory—

> "Au pied de cet autel de structure grossière
> Gît sans pompe, enfermé dans une vile bière
> Le plus savant mortel qui jamais ait écrit."

Full details as to the lives and writings of the Arnaulds will be found in the various books mentioned at the close of the article on Port Royal. The most interesting account of Angélique will be found in *Mémoires pour servir à l'histoire de Port-Royal* (3 vols., Utrecht, 1742). Three volumes of her correspondence were also published at the same time and place. There are excellent modern lives of her in English by Miss Frances Martin (*Angélique Arnauld*, 1873) and by A. K. H. (*Angélique of Port Royal*, 1905). Antoine Arnauld's complete works—thirty-seven volumes in forty-two parts—were published in Paris, 1775–1781. No modern biography of him exists; but there is a study of his philosophy in Bouillier, *Histoire de la philosophie cartésienne* (Paris, 1868); and his mathematical achievements are discussed by Dr Bopp in the 14th volume of the *Abhandlungen zur Geschichte der mathematischen Wissenschaften* (Leipzig, 1902). The memoirs of Arnauld d'Andilly and of his son, the abbé Arnauld, are reprinted both in Petitot's and Poujoulat's collections of memoirs illustrative of the 17th century. (St. C.)

ARNAULT, ANTOINE VINCENT (1766–1834), French dramatist, was born in Paris in January 1766. His first play, *Marius à Minturnes* (1791), immediately established his reputation. A year later he followed up his first success with a second republican tragedy, *Lucrèce.* He left France during the Terror and on his return was arrested by the revolutionary authorities, but was liberated through the intervention of Fabre d'Eglantine and others. He was commissioned by Bonaparte in 1797 with the reorganization of the Ionian Islands, and was nominated to the Institute and made secretary general of the university. He was faithful to his patron through his misfortunes, and after the Hundred Days remained in exile until 1819. In 1829 he was re-elected to the Academy and became perpetual secretary in 1833. Others of his plays are *Blanche et Montcassin, ou les Vénitiens* (1798); and *Germanicus* (1816), the performance of which was the occasion of a disturbance in the *parterre* which threatened serious political complications. His tragedies are perhaps less known now than his *Fables* (1813, 1815 and 1826), which are written in very graceful verse. Arnault collaborated in a *Vie politique et militaire de Napoléon* (1822), and wrote some very interesting *Souvenirs d'un sexagénaire* (1833), which contain much out-of-the-way information about the history of the years previous to 1804. Arnault died at Goderville on the 16th of September 1834.

His eldest son, Émilien Lucien (1787–1863), wrote several tragedies, the leading rôles in which were interpreted by Talma.

See Sainte-Beuve, *Causeries du lundi*, vol. 7. Arnault's *Œuvres complètes* (4 vols.) were published at the Hague and Paris in 1818–1819, and again (8 vols.) at Paris in 1824.

ARNDT, ERNST MORITZ (1769–1860), German poet and patriot, was born on the 26th of December 1769 at Schoritz in the island of Rügen, which at that time belonged to Sweden. He was the son of a prosperous farmer, and emancipated serf of the lord of the district, Count Putbus; his mother came of well-to-do German yeoman stock. In 1787 the family removed into the neighbourhood of Stralsund, where Arndt was enabled to attend the academy. After an interval of private study he went in 1791 to the university of Greifswald as a student of theology and history, and in 1793 removed to Jena, where he fell under the influence of Fichte. On the completion of his university course he returned home, was for two years a private tutor in the family of Ludwig Kosegarten (1758–1818), pastor of Wittow and poet, and having qualified for the ministry as a "candidate of theology," assisted in the church services. At the age of twenty-eight he renounced the ministry, and for eighteen months he led a wandering life, visiting Austria, Hungary, Italy, France and Belgium. Returning homewards up the Rhine, he was moved by the sight of the ruined castles along its banks to intense bitterness against France. The impressions of this journey he later described in *Reisen durch einen Theil Teutschlands, Ungarns, Italiens und Frankreichs in den Jahren 1798 und 1799* (1802–1804). In 1800 he settled in Greifswald as *privat-docent* in history, and the same year published *Über die Freiheit der alten Republiken.* In 1803 appeared *Germanien und Europa*, "a fragmentary ebullition," as he himself called it, of his views on the French aggression. This was followed by one of the most remarkable of his books, *Versuch einer Geschichte der Leibeigenschaft in Pommern und Rügen* (Berlin, 1803), a history of serfdom in Pomerania and Rügen, which was so convincing an indictment that King Gustavus Adolphus IV. in 1806 abolished the evil. Arndt had meanwhile risen from *privat-docent* to extraordinary professor, and in 1806 was appointed to the chair of history at the university. In this year he published the first part of his *Geist der Zeit*, in which he flung down the gauntlet to Napoleon and called on his countrymen to rise and shake off the French yoke. So great was the excitement it produced that Arndt was compelled to take refuge in Sweden to escape the vengeance of Napoleon. Settling in Stockholm, he obtained government employment, but devoted himself to the great cause which was nearest his heart, and in pamphlets, poems and songs communicated his enthusiasm to his countrymen. Schill's heroic death at Stralsund impelled him to return to Germany and, under the disguise of "Almann, teacher of languages," he reached Berlin in December 1809. In 1810 he returned to Greifswald, but only for a few months. He again set out on his adventurous travels, lived in close contact with the first men of his time, such as Blücher, Gneisenau and Stein, and in 1812 was summoned by the last named to St Petersburg to assist in the organization of the final struggle against France. Meanwhile, pamphlet after pamphlet, full of bitter hatred of the French oppressor, came from his pen and his stirring patriotic songs, such as *Was ist das deutsche Vaterland? Der Gott, der Eisen wachsen liess*, and *Was blasen die Trompeten?* were on all lips. When, after the peace, the university of Bonn was founded in 1818, Arndt was appointed to the chair of modern history. In this year appeared the fourth part of his *Geist der Zeit*, in which he criticized the reactionary policy of the German powers. The boldness of his demands for reform offended the Prussian government, and in the summer of 1819 he was arrested and his papers confiscated. Although speedily liberated, he was in the following year, at the instance of the Central Commission of Investigation at Mainz, established in accordance with the Carlsbad Decrees, arraigned before a specially constituted tribunal. Although not found guilty, he was forbidden to exercise the functions of his professorship, but was allowed to retain the stipend. The next twenty years he passed in retirement and literary activity. In 1840 he was reinstated in his professorship, and in 1841 was chosen rector of the university. The revolutionary outbreak of 1848 rekindled in the venerable patriot his old hopes and energies, and he took his seat as one of the deputies to the National Assembly at Frankfort. He formed one of the deputation that offered the imperial crown to Frederick William IV., and indignant at the king's refusal to accept it, he retired with the majority of von Gagern's adherents from public life. He continued to lecture and to write with freshness and vigour, and on his 90th birthday received from all parts of Germany good wishes and tokens of affection. He died at Bonn on the 29th of January 1860. Arndt was twice married, first in 1800, his wife dying in the following year; a second time in 1817.

Arndt's untiring labour for his country rightly won for him the title of "the most German of all Germans." His lyric poems are not, however, all confined to politics. Many among the Gedichte (1803–1818; complete edition, 1860) are religious pieces of great beauty. Among his other works are *Reise durch Schweden* (1797); *Nebenstunden, eine Beschreibung und Geschichte der schottländischen Inseln und der Orkaden* (1820); *Die Frage über die Niederlande* (1831); *Erinnerungen aus dem äusseren Leben* (an autobiography, and the most valuable source of information for Arndt's life, 1840); *Rhein- und Ahrwanderungen* (1846), *Wanderungen und Wandlungen mit dem Reichsfreiherrn von Stein* (1858), and *Pro populo Germanico* (1854), which was originally intended to form the fifth part of the *Geist der Zeit*. Arndt's *Werke* have been edited by H. Rösch and H. Meisner in 8 vols. (not complete) (1892–1898). Biographies have been written by E. Langenberg (1869) and Wilhelm Baur (5th ed., 1882); see also H. Meisner and R. Geerds, *E. M. Arndt, ein Lebensbild in Briefen* (1898), and R. Thiele, *E. M. Arndt* (1894). There are monuments to his memory at Schoritz, his birthplace, and at Bonn, where he is buried.

ARNDT, JOHANN (1555–1621), German Lutheran theologian, was born at Ballenstedt, in Anhalt, and studied in several universities. He was at Helmstadt in 1576; at Wittenberg in 1577. At Wittenberg the crypto-Calvinist controversy was then at its height, and he took the side of Melanchthon and the crypto-Calvinists. He continued his studies in Strassburg, under the professor of Hebrew, Johannes Pappus (1549–1610), a zealous Lutheran, the crown of whose life's work was the forcible suppression of Calvinistic preaching and worship in the city, and who had great influence over him. In Basel, again, he studied theology under Simon Sulzer (1508–1585), a broad-minded divine of Lutheran sympathies, whose aim was to reconcile the churches of the Helvetic and Wittenberg confessions. In 1581 he went back to Ballenstedt, but was soon recalled to active life by his appointment to the pastorate at Badeborn in 1583. After some time his Lutheran tendencies exposed him to the anger of the authorities, who were of the Reformed Church. Consequently, in 1590 he was deposed for refusing to remove the pictures from his church and discontinue the use of exorcism in baptism. He found an asylum in Quedlinburg (1590), and afterwards was transferred to St Martin's church at Brunswick (1599). Arndt's fame rests on his writings. These were mainly of a mystical and devotional kind, and were inspired by St Bernard, J. Tauler and Thomas à Kempis. His principal work, *Wahres Christentum* (1606–1609), which has been translated into most European languages, has served as the foundation of many books of devotion, both Roman Catholic and Protestant. Arndt here dwells upon the mystical union between the believer and Christ, and endeavours, by drawing attention to Christ's life *in* His people, to correct the purely forensic side of the Reformation theology, which paid almost exclusive attention to Christ's death *for* His people. Like Luther, Arndt was very fond of the little anonymous book, *Deutsche Theologie*. He published an edition of it and called attention to its merits in a special preface. After *Wahres Christentum*, his best-known work is *Paradiesgärtlein aller christlichen Tugenden*, which was published in 1612. Both these books have been translated into English; *Paradiesgärtlein* with the title the *Garden of Paradise*. Several of his sermons are published in R. Nesselmann's *Buch der Predigten* (1858). Arndt has always been held in very high repute by the German Pietists. The founder of Pietism, Philipp Jacob Spener, repeatedly called attention to him and his writings, and even went so far as to compare him with Plato (cf. Karl Scheele, *Plato und Johann Arndt, Ein Vortrag*, &c., 1857).

A collected edition of his works was published in Leipzig and Görlitz in 1734. A valuable account of Arndt is to be found in C. Aschmann's *Essai sur la vie, &c., de J. Arndt*. See further, Herzog-Hauck, *Realencyklopädie*.

ARNE, THOMAS AUGUSTINE (1710–1778), English musical composer, was born in London on the 12th of March 1710, his father being an upholsterer. Intended for the legal profession, he was educated at Eton, and afterwards apprenticed to an attorney for three years. His natural inclination for music, however, proved irresistible, and his father, finding from his performance at an amateur musical party that he was already a skilful violinist, furnished him with the means of educating himself in his favourite art. On the 7th of March 1733 he produced his first work at Lincoln's Inn Fields theatre, a setting of Addison's *Rosamond*, the heroine's part being performed by his sister, Susanna Maria, who afterwards became celebrated as Mrs Cibber. This proving a success was immediately followed by a burletta, entitled *The Opera of Operas*, based on Fielding's *Tragedy of Tragedies*. The part of Tom Thumb was played by Arne's young brother, and the opera was produced at the Haymarket theatre. On the 19th of December 1733 Arne produced at the same theatre the masque *Dido and Aeneas*, a subject of which the musical conception had been immortalized for Englishmen more than half a century earlier by Henry Purcell. Arne's individuality of style first distinctly asserted itself in the music to Dr Dalton's adaptation of Milton's *Comus*, which was performed at Drury Lane in 1738, and speedily established his reputation. In 1740 he wrote the music for Thomson and Mallet's *Masque of Alfred*, which is noteworthy as containing the most popular of all his airs—"Rule, Britannia!" In 1740 he also wrote his beautiful settings of the songs, "Under the greenwood tree," "Blow, blow, thou winter wind" and "When daisies pied," for a performance of Shakespeare's *As You Like It*. Four years before this, in 1736, he had married Cecilia, the eldest daughter of Charles Young, organist of All Hallows Barking. She was considered the finest English singer of the day and was frequently engaged by Handel in the performance of his music. In 1742 Arne went with his wife to Dublin, where he remained two years and produced his oratorio *Abel*, containing the beautiful melody known as the Hymn of Eve, the operas *Britannia*, *Eliza* and *Comus*, and where he also gave a number of successful concerts. On his return to London he was engaged as leader of the band at Drury Lane theatre (1744), and as composer at Vauxhall (1745). In this latter year he composed his successful pastoral dialogue, *Colin and Phoebe*, and in 1746 the song, "Where the bee sucks." In 1759 he received the degree of doctor of music from Oxford. In 1760 he transferred his services to Covent Garden theatre, where on the 28th of November he produced his *Thomas and Sally*. Here, too, on the 2nd of February 1762 he produced his *Artaxerxes*, an opera in the Italian style with recitative instead of spoken dialogue, the popularity of which is attested by the fact that it continued to be performed at intervals for upwards of eighty years. The libretto, by Arne himself, was a very poor translation of Metastasio's *Artaserse*. In 1762 also was produced the ballad-opera *Love in a Cottage*. His oratorio *Judith*, of which the first performance was on the 27th of February 1761 at Drury Lane, was revived at the chapel of the Lock hospital, Pimlico, on the

29th of February 1764, in which year was also performed his setting of Metastasio's *Olimpiade* in the original language at the King's theatre in the Haymarket. At a later performance of *Judith* at Covent Garden theatre on the 26th of February 1773 Arne for the first time introduced female voices into oratorio choruses. In 1769 he wrote the musical parts for Garrick's ode for the Shakespeare jubilee at Stratford-on-Avon, and in 1770 he gave a mutilated version of Purcell's *King Arthur*. One of his last dramatic works was the music to Mason's *Caractacus*, published in 1775. Though inferior to Purcell in intensity of feeling, Arne has not been surpassed as a composer of graceful and attractive melody. There is true genius in such airs as "Rule, Britannia!" and "Where the bee sucks," which still retain their original freshness and popularity. As a writer of glees he does not take such high rank, though he deserves notice as the leader in the revival of that peculiarly English form of composition. He was author as well as composer of *The Guardian outwitted*, *The Rose*, *The Contest of Beauty and Virtue*, and *Phoebe at Court*. Dr Arne died on the 5th of March 1778, and was buried at St Paul's, Covent Garden.

See also the article in Grove's *Dictionary* (new ed.); and two interesting papers in the *Musical Times*, November and December 1901.

ARNETH, ALFRED, Ritter von (1819–1897), Austrian historian, born at Vienna on the 10th of July 1819, was the son of Joseph Calasanza von Arneth (1791–1863), a well-known historian and archaeologist, who wrote a history of the Austrian empire (Vienna, 1827) and several works on numismatics. Alfred Arneth studied law, and became an official of the Austrian state archives, of which in 1868 he was appointed keeper. He was a moderate liberal in politics and a supporter of the ideal of German unity. As such he was elected to the Frankfort parliament in 1848. In 1861 he became a member of the Lower Austrian diet and in 1869 was nominated to the Upper House of the Austrian Reichsrath. In 1879 he was appointed president of the *Kaiserliche Akademie der Wissenschaften* (Academy of Sciences) at Vienna, and in 1896 succeeded von Sybel as chairman of the historical commission at Munich. He died on the 30th of July 1897.

Arneth was an indefatigable worker, and, as director of the archives, his broad-minded willingness to listen to the advice of experts, as well as his own sound sense, did much to promote the more scientific treatment and use of public records in most of the archives of Europe. His scientific temper and the special facilities which he enjoyed for drawing from original sources give to his numerous historical works a very special value.

Among his publications may be mentioned: *Leben des Feldmarschalls Grafen Guido Starhemberg* (Vienna, 1863); *Prinz Eugen von Savoyen* (3 vols., *ib.* 1864); *Gesch. der Maria Theresa* (10 vols., *ib.* 1863–1879); *Maria Theresa u. Marie Antoinette, ihr Briefwechsel* (*ib.* 1866); *Marie Antoinette, Joseph II. und Leopold II., ihr Briefwechsel* (1866); *Maria Theresa und Joseph II., ihre Korrespondenz samt Briefen Josephs an seinen Bruder Leopold* (3 vols., 1867); *Beaumarchais und Sonnenfels* (1868); *Joseph II. und Katharina von Russland, ihr Briefwechsel* (1869); *Johann Christian Barthenstein und seine Zeit* (1871); *Joseph II. und Leopold von Toskana, ihr Briefwechsel* (2 vols., 1872); *Briefe der Kaiserin Maria Theresa an ihre Kinder und Freunde* (4 vols., 1881); *Marie Antoinette: Correspondance secrète entre Marie-Thérèse et le comte de Mercy-Argenteau* (3 vols., Paris, 1875), in collaboration with Auguste Geffroy; *Graf Philipp Cobenzl und seine Memoiren* (1885); *Correspondance secrète du comte de Mercy-Argenteau avec l'empereur Joseph II. et Kaunitz* (2 vols., 1889–1891), in collaboration with Jules Flammermont; *Anton Ritter von Schmerling. Episoden aus seinem Leben 1835, 1848–1849* (1895); *Johann Freiherr von Wessenberg, ein österreichischer Staatsmann des 19. Jahrh.* (2 vols., 1898). Arneth also published in 1893 two volumes of early reminiscences under the title of *Aus meinem Leben*.

ARNHEM, or Arnheim, the capital of the province of Gelderland, Holland, on the right bank of the Rhine (here crossed by a pontoon bridge), and a junction station 35 m. by rail E.S.E. of Utrecht. Pop. (1900) 57,240. It is connected by tramway with Zutphen and Utrecht, and there is a regular service of steamers to Cologne, Amsterdam, Nijmwegen, Tiel, 's Hertogenbosch and Rotterdam. Arnhem is a gay and fashionable town prettily situated at the foot of the Veluwe hills, and enjoys a special reputation for beauty on account of its wooded and hilly surroundings, which have attracted many wealthy people to its neighbourhood. The Groote Kerk of St Eusebius, built in the third quarter of the 15th century, contains the marble monument to Charles (d. 1538), the last duke of Gelderland of the Egmont dynasty. High up against the wall is an effigy of the same duke in his armour. The fine lofty tower contains a chime of forty-five bells. The Roman Catholic church of St Walburgis is of earlier date, and a new Roman Catholic church dates from 1894. The town hall was built as a palace by Maarten van Rossum, Duke Charles's general, at the end of the 15th century, and was only converted to its present use in 1830. Its grotesque external ornamentation earned for it the name of Duivelshuis, or devil's house. The provincial government house occupies the site of the former palace of the dukes of Gelderland. Other buildings are the court-house, a public library containing many old works, a theatre, a large concert-hall, a museum of antiquities (as well as a separate collection of Spanish antiquities), a gymnasium, a teachers' and art school, a building (1880) to contain the provincial archives, a hospital (1889) and barracks. On account of its proximity to the fertile Betuwe district and its situation near the confluence of the Rhine and Ysel, the markets and shipping of Arnhem are in a flourishing condition. A wharf for building and repairing iron steamers was constructed in 1889. The manufactures include woollen and cotton goods, paper, earthenware, soap, carriages, furniture and tobacco, which is cultivated in the neighbourhood. Woolcombing and dyeing are also carried on, and there are oil and timber mills.

The environs of Arnhem are much admired. Following either the Zutphen or the Utrecht road, numerous pleasing views of the Rhine valley present themselves, and country houses and villas appear among the woods on every side. At Bronbeek, a short distance east of the town, is a hospital endowed by King William III. for soldiers of the colonial army. Beyond is the popular summer resort of Velp, with the castle of Biljoen built by Charles, duke of Gelderland, in 1530, and the beautiful park of the ancient castle of Rozendaal in the vicinity. The origin of the castle of Rozendaal is unknown. The first account of it is in connexion with a tournament given there by Reinald I., count of Gelderland, in the beginning of the 14th century, and it ever after remained the favourite residence of the counts and dukes of Gelderland. About the beginning of the 18th century fountains and lanes in the style of those at Versailles were laid out in the park, and soon after the castle itself, of which only the round tower remained (and is still standing), was rebuilt. The park is open to the public, and is famous for the beauty of the beech avenues and fir woods. Beyond this is De Steeg, another popular resort, whence stretches the famous Middachten Allee of beech trees to Dieren. On the Apeldoorn road is Sonsbeek, with a wooded park and small lakes, formerly a private seat and now belonging to the municipality. On the west of Arnhem is another pleasure ground, called the Reeberg, with a casino, and the woods of Heienoord. Close by is the ancient and well-preserved castle of Doornwerth with its own chapel. It was the seat of an independent lordship until 1402, after which time it was held in fief from the dukes of Gelderland. Beyond Doornwerth, at Renkum, is the royal country seat called Oranje-Nassau's Oord, which was bought by the crown in 1881.

History.—Arnhem, called *Arnoldi Villa* in the middle ages, is, according to some, the *Arenacum* of the Romans, and is first mentioned in a document in 893. In 1233 Otto II., count of Gelderland, chose this spot as his residence, conferred municipal rights on the town, and fortified it. At a later period it entered the Hanseatic League. In 1473 it was captured by Charles the Bold of Burgundy. In 1505 it received the right of coining from Philip, son of the emperor Maximilian I. In 1514 Charles of Egmont, duke of Gelderland, took it from the Spaniards; but in 1543 it fell to the emperor Charles V., who made it the seat of the council of Gelderland. It joined the union of Utrecht in 1579, and came finally under the effective government of the states-general in 1585, all the later attacks of the Spaniards being repulsed. In 1586 Sir Philip Sidney died in the town from the effects of his wound received before Zutphen. The French took the town in 1672, but left it dismantled in 1674. It was refortified by the celebrated Dutch general of engineers, Coehoorn, in the beginning of the 18th century. In 1795 it was again stormed by the French, and in 1813 it was taken from them by the Prussians under Bülow. Gardens and promenades have now taken the place of the old ramparts, the last of which was levelled in 1853.

ARNICA, a genus of plants belonging to the natural order Compositae, and containing 18 species, mostly north-west American. The most important species is *Arnica montana* (mountain tobacco), a perennial herb found in upland meadows in northern and central Europe (but not extending to Britain), and on the mountains of western and central Europe. A closely allied species (*A. angustifolia*), with very narrow leaves, is met with in Arctic Asia and America. The heads of flowers are large, 2 to $2\frac{1}{2}$ in. across, orange-yellow in colour, and borne on the summit of the stem or branches; the outer ray-flowers are an inch in length. The achenes (fruits) are brown and hairy, and are crowned by a tuft of stiffish hairs (pappus). The rootstock of *A. montana* is tough, slender, of a dark brown colour and an inch or two in length. It gives off numerous simple roots from its under side, and shows on its upper side the remains of rosettes of leaves. It yields an essential oil in small quantity, and a resinous matter called arnicin, $C_{12}H_{22}O_2$, a yellow crystalline substance with an acrid taste. The tincture prepared from it is an old remedy which has a popular reputation in the treatment of bruises and sprains. The plant was introduced into English gardens about the middle of the 18th century, but is not often grown; it is a handsome plant for a rockery.

ARNIM, ELISABETH (BETTINA) VON (1785–1859), German authoress, sister of Klemens Brentano, was born at Frankfort-on-Main on the 4th of April 1785. After being educated at a convent school in Fritzlar, she lived for a while with her grandmother, the novelist, Sophie Laroche (1731–1807), at Offenbach, and from 1803 to 1806 with her brother-in-law, Friedrich von Savigny, the famous jurist, at Marburg. In 1807 she made at Weimar the acquaintance of Goethe, for whom she entertained a violent passion, which the poet, although entering into correspondence with her, did not requite, but only regarded as a harmless fancy. Their friendship came to an abrupt end in 1811, owing to "Bettina's" insolent behaviour to Goethe's wife. In this year she married Ludwig Achim von Arnim (*q.v.*), by whom she had seven children. After her husband's death in 1831, her passion for Goethe revived, and in 1835 she published her remarkable book, *Goethes Briefwechsel mit einem Kinde*, which purported to be a correspondence between herself and the poet. Regarded at first as genuine, it was afterwards for many years looked upon as wholly fictitious, until the publication in 1879 of G. von Loeper's *Briefe Goethes an Sophie Laroche und Bettina Brentano, nebst dichterischen Beilagen*, which proved it to be based on authentic material, though treated with the greatest poetical licence. Equally fantastic is her correspondence *Die Günderode* (1840), with her unhappy friend, the poet, Karoline von Günderode (1780–1806), who committed suicide, and that with her brother Klemens Brentano, under the title *Klemens Brentanos Frühlingskranz* (1844). She also published *Dies Buch gehört dem König* (1843), in which she advocated the emancipation of the Jews, and the abolition of capital punishment. Among her other works may be mentioned *Ilius Pamphilius und die Ambrosia* (1848), also a supposititious correspondence. In all her writings she showed real poetical genius, combined with evidence of an unbalanced mind and a mannerism which becomes tiresome. She died at Berlin on the 20th of January 1859. Part of a design by her for a colossal statue of Goethe, executed in marble by the sculptor Karl Steinhäuser (1813–1878), is in the museum at Weimar.

Her collected works (*Sämtliche Schriften*) were published in Berlin in 11 vols., 1853. Goethe's *Briefwechsel mit einem Kinde* has been edited by H. Grimm (4th ed., Berlin, 1890). See also C. Alberti, *B. von Arnim* (Leipzig, 1885); Moritz Carriere, *Bettina von Arnim* (Breslau, 1887), and the literature cited under Ludwig von Arnim.

ARNIM, HARRY KARL KURT EDUARD VON, COUNT (1824–1881), German diplomatist, was a member of one of the most numerous and most widely spread families of the Prussian nobility. He was born in Pomerania on the 3rd of October 1824, and brought up by his uncle Heinrich von Arnim, who was Prussian ambassador at Paris and foreign minister from March to June 1848, while Count Arnim-Boytzenburg, whose daughter Harry von Arnim afterwards married, was minister-president. It is noticeable that the uncle was brought before a court of justice and fined for publishing a pamphlet directed against the ministry of Manteuffel. After holding other posts in the diplomatic service Arnim was in 1864 appointed Prussian envoy (and in 1867 envoy of the North German Confederation) at the papal court. In 1869 he proposed that the governments should appoint representatives to be present at the Vatican council, a suggestion which was rejected by Bismarck, and foretold that the promulgation of papal infallibility would bring serious political difficulties. After the recall of the French troops from Rome he attempted unsuccessfully to mediate between the pope and the Italian government. He was appointed in 1871 German commissioner to arrange the final treaty with France, a task which he carried out with such success that in 1871 he was appointed German envoy at Paris, and in 1872 received his definite appointment as ambassador, a post of the greatest difficulty and responsibility. Differences soon arose between him and Bismarck; he wished to support the monarchical party which was trying to overthrow Thiers, while Bismarck ordered him to stand aloof from all French parties; he did not give that implicit obedience to his instructions which Bismarck required. Bismarck, however, was unable to recall him because of the great influence which he enjoyed at court and the confidence which the emperor placed in him. He was looked upon by the Conservative party, who were trying to overthrow Bismarck, as his successor, and it is said that he was closely connected with the court intrigues against the chancellor. In the beginning of 1874 he was recalled and appointed to the embassy at Constantinople, but this appointment was immediately revoked. A Vienna newspaper published some correspondence on the Vatican council, including confidential despatches of Arnim's, with the object of showing that he had shown greater foresight than Bismarck. It was then found that a considerable number of papers were missing from the Paris embassy, and on the 4th of October Arnim was arrested on the charge of embezzling state papers. This recourse to the criminal law against a man of his rank, who had held one of the most important diplomatic posts, caused great astonishment. His defence was that the papers were not official, and he was acquitted on the charge of embezzlement, but convicted of undue delay in restoring official papers and condemned to three months' imprisonment. On appeal the sentence was increased to nine months. Arnim avoided imprisonment by leaving the country, and in 1875 published anonymously at Zürich a pamphlet entitled "Pro nihilo," in which he attempted to show that the attack on him was caused by Bismarck's personal jealousy. For this he was accused of treason, insult to the emperor, and libelling Bismarck, and in his absence condemned to five years' penal servitude. From his exile in Austria he published two more pamphlets on the ecclesiastical policy of Prussia, "Der Nunzius kommt!" (Vienna, 1878), and "Quid faciamus nos?" (*ib.* 1879). He made repeated attempts, which were supported by his family, to be allowed to return to Germany in order to take his trial afresh on the charge of treason; his request had just been granted when he died on the 19th of May 1881.

In 1876 Bismarck carried an amendment to the criminal code making it an offence punishable with imprisonment or a fine up to £250 for an official of the foreign office to communicate to others official documents, or for an envoy to act contrary to his instructions. These clauses are commonly spoken of in Germany as the "Arnim paragraphs." (J. W. HE.)

ARNIM, LUDWIG ACHIM (JOACHIM) VON (1781–1831), German poet and novelist, was born at Berlin on the 26th of January 1781. He studied natural science at Halle and

Göttingen, and published one or two essays on scientific subjects; but his bent was from the first towards literature. From the earlier writings of Goethe and Herder he learned to appreciate the beauties of German traditional legends and folk-songs; and, forming a collection of these, published the result (1806–1808), in collaboration with Klemens Brentano (*q.v.*) under the title *Des Knaben Wunderhorn*. From 1810 onward he lived with his wife Bettina, Brentano's sister, alternately at Berlin and on his estate at Wiepersdorf, near Dahme in Brandenburg, where he died on the 21st of January 1831. Arnim was a prolific and versatile writer, gifted with a sense of humour and a refined imagination—qualities shown in the best-known of his works, *Des Knaben Wunderhorn*, deficient as this is in the philological accuracy and faithfulness to original sources which would now be expected of such a compilation. In general, however, his writings, full as they are of the exaggerated sentiment and affectations of the romantic school, make but little appeal to modern taste. There are possible exceptions, such as the short stories *Fürst Ganzgott und Sänger Halbgott* and *Der tolle Invalide auf dem Fort Ratonneau* and the unfinished romance *Die Kronenwächter* (1817), which promised to develop into one of the finest historical romances of the 19th century. Among Arnim's other works may be mentioned *Hollins Liebesleben* (1802), *Der Wintergarten* (1809), a collection of tales; *Armut, Reichtum Schuld, und Busse der Gräfin Dolores* (1810), a novel; *Halle und Jerusalem* (1811), a dramatic romance; and one or two smaller novels, such as *Isabella von Ägypten* (1812).

Arnim's *Sämtliche Werke* were edited by his widow and published in Berlin in 1839–1840; second edition in 22 vols., 1853–1856. Selections have been edited by J. Dohmke (1892); M. Koch, *Arnim, Klemens und Bettina Brentano, Görres* (1893). *Des Knaben Wunderhorn* has been frequently republished, the best edition being that of A. Birlinger and W. Crecelius (2 vols., 1872–1876). See R. Steig, *Achim von Arnim und Klemens Brentano* (1894).

ARNIM-BOYTZENBURG, HANS GEORG VON (1581–1641), German general and diplomatist, was born in 1581 at Boytzenburg in Brandenburg. From 1613 to 1617 he served in the Swedish army under Gustavus Adolphus, took part in the Russian War, and afterwards fought against the Turks in the service of the king of Poland. In 1626, though a Protestant, he was induced by Wallenstein to join the new imperial army, in which he quickly rose to the rank of field marshal, and won the esteem of his soldiers as well as that of his commander, whose close friend and faithful ally he became. This attachment to Wallenstein, and a spirit of religious toleration, were the leading motives of a strange career of military and political inconstancy. Thus the dismissal of Wallenstein and the perilous condition of German Protestantism after the edict of Restitution combined to induce Arnim to quit the imperial service for that of the elector of Saxony. He had served under Gustavus many years before, and later he had defeated him in the field, when in command of a Polish army; the fortune of war now placed Arnim at the head of the Saxon army which fought by the side of the Swedes at Breitenfeld (1631), and indeed the alliance of these two Protestant powers in the cause of their common religion was largely his work. The reappearances of Wallenstein, however, caused him to hesitate and open negotiations, though he did not attempt to conceal his proceedings from the elector and Gustavus. During the Lützen campaign, Arnim was operating with success at the head of an allied army in Silesia. In the following year he was under the hard necessity of opposing his old friend in the field, but little was done by either; the complicated political situation which followed the death of Gustavus at Lützen led him into a renewal of the private negotiations of the previous year, though he did nothing actually treasonable in his relations with Wallenstein. In 1634 Wallenstein was assassinated, and Arnim began at once more active operations. He won an important victory at Liegnitz in May 1634, but from this time he became more and more estranged from the Swedes. The peace of Prague followed, in which Arnim's part, though considerable, was not all-important (1635). Soon after this event he refused an offer of high command in the French army and retired from active life. From 1637 to 1638 he was imprisoned in Stockholm, having been seized at Boytzenburg by the Swedes on suspicion of being concerned in various intrigues. He made his escape ultimately, and returned to Saxony. Arnim died suddenly at Dresden in 1641, whilst engaged in raising an army to free German soil from foreign armies of all kinds. (See THIRTY YEARS' WAR.)

See K. G. Helbig, "Wallenstein und Arnim" (1850) and "Der Prager Friede," in Raumer's *Historisches Taschenbuch* (1858); also E. D. M. Kirchner, *Das Schloss Boytzenburg, &c.* (1860) and *Archiv für die sächsische Geschichte*, vol. viii. (1870).

ARNO, ARN or AQUILA (*c.* 750–821), bishop and afterwards archbishop of Salzburg, entered the church at an early age, and after passing some time at Freising became abbot of Elnon, or St Amand as it was afterwards called, where he made the acquaintance of Alcuin. In 785 he was made bishop of Salzburg and in 787 was employed by Tassilo III., duke of the Bavarians, as an envoy to Charlemagne at Rome. He appears to have attracted the notice of the Frankish king, through whose influence in 798 Salzburg was made the seat of an archbishopric; and Arno, as the first holder of this office, became metropolitan of Bavaria and received the pallium from Pope Leo III. The area of his authority was extended to the east by the conquests of Charlemagne over the Avars, and he began to take a prominent part in the government of Bavaria. He acted as one of the *missi dominici*, and spent some time at the court of Charlemagne, where he was known by the assembled scholars as Aquila, and his name appears as one of the signatories to the emperor's will. He established a library at Salzburg, furthered in other ways the interests of learning, and presided over several synods called to improve the condition of the church in Bavaria. Soon after the death of Charlemagne in 814, Arno appears to have withdrawn from active life, although he retained his archbishopric until his death on the 24th of January 821. Aided by a deacon named Benedict, Arno drew up about 788 a catalogue of lands and proprietary rights belonging to the church in Bavaria, under the title of *Indiculus* or *Congestum Arnonis*. An edition of this work, which is of considerable value to historical students, was published at Munich in 1869 with notes by F. Keinz. Many other works were produced under the protection of Arno, among them a Salzburg consuetudinary, an edition of which appears in *Quellen und Erörterungen zur bayrischen und deutschen Geschichte*, Band vii., edited by L. Rockinger (Munich, 1856). It has been suggested by W. von Giesebrecht that Arno was the author of an early section of *Annales Laurissenses majores*, which deals with the history of the Frankish kings from 741 to 829, and of which an edition appears in *Monumenta Germaniae historica. Scriptores*, Band i. pp. 128-131, edited by G. H. Pertz (Hanover, 1826). If this supposition be correct, Arno was the first extant writer to apply the name *Deutsch* (*theodisca*) to the German language.

ARNO (anc. *Arnus*), a river of Italy which rises from the Monte Falterona, about 25 m. E.N.E. of Florence, 4265 ft. above the sea. It first runs S.S.E. through a beautiful valley, the Casentino; near Arezzo it turns W., and at Montevarchi N.N.W.; 10 m. below it forces its way through the limestone rock at Incisa and 10 m. farther on, at Pontassieve, it is joined by the Sieve. Thence it runs westward to Florence and through the gorge of Golfolina onwards to Empoli and Pisa, receiving various tributaries in its course, and falls into the sea 7½ m. west of Pisa, after a total course of 155 m. In prehistoric times the river ran straight on along the valley of the Chiana and joined the Tiber near Orvieto; and there was a great lake, the north end of which was at Incisa and the south at the lake of Chiusi. The distance from Pisa to the mouth in the time of Strabo was only 2½ m. The Serchio (anc. *Auser*), which joined the Arno at Pisa in ancient times, now flows into the sea independently. The Arno is navigable for barges as far as Florence; but it is liable to sudden floods, and brings down with it large quantities of earth and stones, so that it requires careful regulation. The most remarkable inundations were those of 1537 and 1740; in the former year the water rose to 8 ft. in the streets of Florence. The valley between Incisa and Arezzo contains accumulations of fossil bones of the deer, elephant, rhinoceros, mastodon, hippopotamus, bear, tiger, &c.

ARNOBIUS (called *Afer*, and sometimes "the Elder"), early Christian writer, was a teacher of rhetoric at Sicca Venerea in proconsular Africa during the reign of Diocletian. His conversion to Christianity is said by Jerome to have been occasioned by a dream; and the same writer adds that the bishop to whom Arnobius applied distrusted his professions, and asked some proof of them, and that the treatise *Adversus Gentes* was composed for this purpose. But this story seems rather improbable; for Arnobius speaks contemptuously of dreams, and besides, his work bears no traces of having been written in a short time, or of having been revised by a Christian bishop. From internal evidence (bk. iv. 36) the time of composition may be fixed at about A.D. 303. Nothing further is known of the life of Arnobius. He is said to have been the author of a work on rhetoric, which, however, has not been preserved. His great treatise, in seven books, *Adversus Gentes* (or *Nationes*), on account of which he takes rank as a Christian apologist, appears to have been occasioned by a desire to answer the complaint then brought against the Christians, that the prevalent calamities and disasters were due to their impiety and had come upon men since the establishment of their religion. In the first book Arnobius carefully discusses this complaint; he shows that the allegation of greater calamities having come upon men since the Christian era is false; and that, even if it were true, it could by no means be attributed to the Christians. He skilfully contends that Christians who worship the self-existent God cannot justly be called less religious than those who worship subordinate deities, and concludes by vindicating the Godhead of Christ. In the second book Arnobius digresses into a long discussion on the soul, which he does not think is of divine origin, and which he scarcely believes to be immortal. He even says that a belief in the soul's immortality would tend to remove moral restraint, and have a prejudicial effect on human life. In the concluding chapters he answers the objections drawn from the recent origin of Christianity. Books iii., iv. and v. contain a violent attack on the heathen mythology, in which he narrates with powerful sarcasm the scandalous chronicles of the gods, and contrasts with their grossness and immorality the pure and holy worship of the Christian. These books are valuable as a repertory of mythological stories. Books vi. and vii. ably handle the questions of sacrifices and worship of images. The confusion of the final chapter points to some interruption. The work of Arnobius appears to have been written when he was a recent convert, for he does not possess a very extensive knowledge of Scripture. He knows nothing of the Old Testament, and only the life of Christ in the New, while he does not quote directly from the Gospels. He is also at fault in regard to the Jewish sects. He was much influenced by Lucretius and had read Plato. His statements concerning Greek and Roman mythology are based respectively on the *Protrepticus* of Clement of Alexandria, and on Antistius Labeo, who belonged to the preceding generation and attempted to restore Neoplatonism. There are some pleasing passages in Arnobius, but on the whole he is a tumid and a tedious author.

Editions.—Migne, *Patr. Lat.* iv. 349; A. Reifferscheich in the *Vienna Corpus Script. Eccles. Lat.* (1875).

Translations.—A. H. Bryce and H. Campbell in *Ante-Nicene Fathers*, vi.

Literature.—H. C. G. Moule in *Dict. Chr. Biog.* i.; Herzog-Hauck, *Realencyklopädie*; and G. Kruger, *Early Chr. Lit.* p. 304 (where full bibliographies are given).

ARNOBIUS ("the younger"), Christian priest or bishop in Gaul, flourished about 460. He is the author of a mystical and allegorical commentary on the Psalms, first published by Erasmus in 1522, and by him attributed to the elder Arnobius. It has been frequently reprinted, and in the edition of De la Barre, 1580, is accompanied by some notes on the Gospels by the same author. To him has sometimes been ascribed the anonymous treatise, *Arnobii catholici et Serapionis conflictus de Deo trino et uno . . . de gratiae liberi arbitrii concordia*, which was probably written by a follower of Augustine. The opinions of Arnobius, as appears from the commentary, are semi-Pelagian.

ARNOLD, known as "Arnold of Brescia" (d. 1155), one of the most ardent adversaries of the temporal power of the popes. He belonged to a family of importance, if not noble, and was born probably at Brescia, in Italy, towards the end of the 11th century. He distinguished himself in his monastic studies, and went to France about 1115. He studied theology in Paris, but there is no proof that he was a pupil of Abelard. Returning to Italy he became a canon regular. His life was rigidly austere, St Bernard calling him "homo neque manducans neque bibens." He at once directed his efforts against the corruption of the clergy, and especially against the temporal ambitions of the high dignitaries of the church. During the schism of Anacletus (1131–1137) the town of Brescia was torn by the struggles between the partisans of Pope Innocent II. and the adherents of the anti-pope, and Arnold gave effect to his abhorrence of the political episcopate by inciting the people to rise against their bishop, and, exiled by Innocent II., went to France. St Bernard accused him of sharing the doctrines of Abelard (see *Ep.* 189, 195), and procured his condemnation by the council of Sens (1140) at the same time as that of the great scholastic. This was perhaps no more than the outcome of the fierce polemical spirit of the abbot of Clairvaux, which led him to include all his adversaries under a single anathema. It seems certain that Arnold professed moral theology in Paris, and several times reprimanded St Bernard, whom he accused of pride and jealousy. St Bernard, as a last resort, begged King Louis VII. to take severe measures against Arnold, who had to leave France and take refuge at Zürich. There he soon became popular, especially with the lay nobility; but, denounced anew by St Bernard to the ecclesiastical authorities, he returned to Italy, and turned his steps towards Rome (1145). It was two years since, in 1143, the Romans had rejected the temporal power of the pope. The urban nobles had set up a republic, which, under forms ostensibly modelled on antiquity (*e.g.* patriciate, *senatus populusque romanus*, &c.), concealed but clumsily a purely oligarchical government. Pope Eugenius III. and his adherents had been forced after a feeble resistance to resign themselves to exile at Viterbo. Arnold, after returning to Rome, immediately began a campaign of virulent denunciation against the Roman clergy, and, in particular, against the Curia, which he stigmatized as a "house of merchandise and den of thieves." His enemies have attributed to him certain doctrinal heresies, but their accusations do not bear examination. According to Otto of Freising (*Lib. de gestis Friderici*, bk. ii. chap. xx.) the whole of his teaching, outside the preaching of penitence, was summed up in these maxims:—"Clerks who have estates, bishops who hold fiefs, monks who possess property, cannot be saved." His eloquence gained him a hearing and a numerous following, including many laymen, but consisting principally of poor ecclesiastics, who formed around him a party characterized by a rigid morality and not unlike the Lombard Patarenes of the 11th century. But his purely political action was very restricted, and not to be compared with that of a Rienzi or a Savonarola. The Roman revolution availed itself of Arnold's popularity, and of his theories, but was carried out without his aid. His name was associated with this political reform solely because his was the only vigorous personality which stood out from the mass of rebels, and because he was the principal victim of the repression that ensued. On the 15th of July 1148 Eugenius III. anathematized Arnold and his adherents; but when, a short time afterwards, the pope, through the support of the king of Naples and the king of France, succeeded in entering Rome, Arnold remained in the town unmolested, under the protection of the senate. But in 1152 the German king Conrad III., whom the papal party and the Roman republic had in vain begged to intervene, was succeeded by Frederick I. Barbarossa. Frederick, whose authoritative temper was at once offended by the independent tone of the Arnoldist party, concluded with the pope a treaty of alliance (October 16, 1152) of such a nature that the Arnoldists were at once put in a minority in the Roman government; and when the second successor of Eugenius III., the energetic and austere Adrian IV. (the

Englishman, Nicholas Breakspear), placed Rome under an interdict, the senate, already rudely shaken, submitted, and Arnold was forced to fly into Campania (1155). At the request of the pope he was seized by order of the emperor Frederick, then in Italy, and delivered to the prefect of Rome, by whom he was condemned to death. In June 1155 Arnold was hanged, his body burnt, and the ashes were thrown into the Tiber. His death produced but a feeble sensation in Rome, which was already pacified, and passed almost unnoticed in Italy. The adherents of Arnold do not appear actually to have formed, either before or after his death, a heretical sect. It is probable that his adherents became merged in the communities of the Lombard Waldenses, who shared their ideas on the corruption of the clergy. Legend, poetry, drama and politics have from time to time been much occupied with the personality of Arnold of Brescia, and not seldom have distorted it, through the desire to see in him a hero of Italian independence and a modern democrat. He was before everything an ascetic, who denied to the church the right of holding property, and who occupied himself only as an accessory with the political and social consequences of his religious principles.

The bibliography of Arnold of Brescia is very vast and of very unequal value. The following works will be found useful: W. von Giesebrecht, *Arnold von Brescia* (Munich, 1873); G. Gaggia, *Arnaldo da Brescia* (Brescia, 1882); and notices by Vacandard in the *Revue des questions historiques* (Paris, 1884), pp. 52-114, by R. Breyer in the *Histor. Taschenbuch* (Leipzig, 1889), vol. viii. pp. 123-178, and by A. Hausrath in *Neue Heidelberg. Jahrb.* (1891), Band i. pp. 72-144. (P. A.)

ARNOLD, BENEDICT (1741–1801), American soldier, born in Norwich, Connecticut, on the 14th of January 1741. He was the great-grandson of Benedict Arnold (1615–1678), thrice colonial governor of Rhode Island between 1663 and 1678; and was the fourth in direct descent to bear the name. He received a fair education but was not studious, and his youth was marked by the same waywardness which characterized his whole career. At fifteen he ran away from home and took part in an expedition against the French, but, restless under restraint, he soon deserted and returned home. In 1762 he settled in New Haven, where he became the proprietor of a drug and book shop; and he subsequently engaged successfully in trade with the West Indies. Immediately after the battle of Lexington Arnold led the local militia company, of which he was captain, and additional volunteers to Cambridge, and on the 29th of April 1775 he proposed to the Massachusetts Committee of Safety an expedition against Crown Point and Ticonderoga. After a delay of four days the offer was accepted, and as a colonel of Massachusetts militia he was directed to enlist in the west part of Massachusetts and in the neighbouring colonies the men necessary for the undertaking. He was forestalled, however, by Ethan Allen (*q.v.*), acting on behalf of some members of the Connecticut Assembly. Under him, reluctantly waiving his own claim to command, Arnold served as a volunteer; and soon afterwards, Massachusetts having yielded to Connecticut, and having angered Arnold by sending a committee to make an inquiry into his conduct, he resigned and returned to Cambridge. He was then ordered to co-operate with General Richard Montgomery in the invasion of Canada, which he had been one of the first to suggest to the Continental Congress. Starting with 1100 men from Cambridge on the 17th of September 1775, he reached Gardiner, Maine, on the 20th, advanced through the Maine woods, and after suffering terrible privations and hardships, his little force, depleted by death and desertion, reached Quebec on the 13th of November. The garrison had been forewarned, and Arnold was compelled to await the coming of Montgomery from Montreal. The combined attack on the 31st of December 1775 failed; Montgomery was killed, and Arnold was severely wounded. Arnold, who had been commissioned a brigadier-general in January 1776, remained in Canada until the following June, being after April in command at Montreal.

Some time after the retreat from Canada, charges of misconduct and dishonesty, growing chiefly out of his seizure from merchants in Montreal of goods for the use of his troops, were brought against him; these charges were tardily investigated by the Board of War, which in a report made on the 23rd of May 1777, and confirmed by Congress, declared that his "character and conduct" had been "cruelly and groundlessly aspersed." Having constructed a flotilla on Lake Champlain, Arnold engaged a greatly superior British fleet near Valcour Island (October 11, 1776), and after inflicting severe loss on the enemy, made his escape under cover of night. Two days later he was overtaken by the British fleet, which however he, with only one war-vessel, and that crippled, delayed long enough to enable his other vessels to make good their escape, fighting with desperate valour and finally running his own ship aground and escaping to Crown Point. The engagement of the 11th was the first between British and American fleets. Arnold's brilliant exploits had drawn attention to him as one of the most promising of the Continental officers, and had won for him the friendship of Washington. Nevertheless, when in February 1777 Congress created five new major-generals, Arnold, although the ranking brigadier, was passed over, partly at least for sectional reasons—Connecticut had already two major-generals—in favour of his juniors. At this time it was only Washington's urgent persuasion that prevented Arnold from leaving the service. Two months later while he was at New Haven, Governor Tryon's descent on Danbury took place; and Arnold, who took command of the militia after the death of General Wooster, attacked the British with such vigour at Ridgefield (April 27, 1777) that they escaped to their ships with difficulty.

In recognition of this service Arnold was now commissioned major-general (his commission dating from 17th February) but without his former relative rank. After serving in New Jersey with Washington, he joined General Philip Schuyler in the Northern Department, and in August 1777 proceeded up the Mohawk Valley against Colonel St Leger, and raised the siege of Fort Stanwix (or Schuyler). Subsequently, after Gates had superseded Schuyler (August 19), Arnold commanded the American left wing in the first battle of Saratoga (September 19, 1777). His ill-treatment at the hands of General Gates, whose jealousy had been aroused, led to a quarrel which terminated in Arnold being relieved of command. He remained with the army, however, at the urgent request of his brother officers, and although nominally without command served brilliantly in the second battle of Saratoga (October 7, 1777), during which he was seriously wounded. For his services he was thanked by Congress, and received a new commission giving him at last his proper relative rank.

In June 1778 Washington placed him in command of Philadelphia. Here he soon came into conflict with the state authorities, jealous of any outside control. In the social life of Philadelphia, largely dominated by families of Loyalist sympathies, Arnold was the most conspicuous figure; he lived extravagantly, entertained lavishly, and in April 1779 took for his second wife, Margaret Shippen (1760–1804), the daughter of Edward Shippen (1729–1806), a moderate Loyalist, who eventually became reconciled to the new order and was in 1799-1805 chief-justice of the state. Early in February 1779 the executive council of Pennsylvania, presided over by Joseph Reed, one of his most persistent enemies, presented to Congress eight charges of misconduct against Arnold, none of which was of any great importance. Arnold at once demanded an investigation, and in March a committee of Congress made a report exonerating him; but Reed obtained a reconsideration, and in April 1779 Congress, though throwing out four charges, referred the other four to a court-martial. Despite Arnold's demand for a speedy trial, it was December before the court was convened. It was probably during this period of vexatious delay that Arnold, always sensitive and now incited by a keen sense of injustice, entered into a secret correspondence with Sir Henry Clinton with a view to joining the British service. On the 26th of January 1780 the court, before which Arnold had ably argued his own case, rendered its verdict, practically acquitting him of all intentional wrong, but, apparently in deference to the Pennsylvania authorities, directing Washington to reprimand him for two trivial and very venial offences. Arnold, who had confidently expected absolute acquittal, was inflamed with a burning anger that even Washington's kindly reprimand, couched almost in words of praise, could not subdue.

It was now apparently that he first conceived the plan of betraying some important post to the British. With this in view he sought and obtained from Washington (August 1780) command of West Point, the key to the Hudson River Valley. Arnold's offers now became more explicit, and, in order to perfect the details of the plot, Clinton's adjutant-general, Major John André, met him near Stony Point on the night of the 21st of September. On the 23rd, while returning by land, André with incriminating papers was captured, and the officer to whom he was entrusted unsuspectingly sent information of his capture to Arnold, who was thus enabled to escape to the British lines. Arnold, commissioned a brigadier-general in the British army, received £6315 in compensation for his property losses, and was employed in leading an expedition into Virginia which burned Richmond, and in an attack upon New London (*q.v*) in September 1781. In December 1781 he removed to London and was consulted on American affairs by the king and ministry, but could obtain no further employment in the active service. Disappointed at the failure of his plans and embittered by the neglect and scorn which he met in England, he spent the years 1787–1791 at St John, New Brunswick, once more engaging in the West India trade, but in 1791 he returned to London, and after war had broken out between Great Britain and France, was active in fitting out privateers. Gradually sinking into melancholia, worn down by depression, and suffering from a nervous disease, he died at London on the 14th of June 1801.

Arnold had three sons—Benedict, Richard and Henry—by his first wife, and four sons—Edward Shippen, James Robertson, George and William Fitch—by his second wife; five of them, and one grandson, served in the British army. Benedict (1768–1795) was an officer of the artillery and was mortally wounded in the West Indies. Edward Shippen (1780–1813) became lieutenant of the Sixth Bengal Cavalry and later paymaster at Muttra, India. James Robertson (1781–1854) entered the corps of Royal Engineers in 1798, served in the Napoleonic wars, in Egypt and in the West Indies, and rose to the rank of lieutenant-general, was an aide-de-camp to William IV., and was created a knight of the Hanoverian Guelphic order and a knight of the Crescent. George (1787–1828) was a lieutenant-colonel in the Second Bengal Cavalry at the time of his death. William Fitch (1794–1828) became a captain in the Nineteenth Royal Lancers; his son, William Trail (1826–1855) served in the Crimean War as captain of the Fourth Regiment of Foot and was killed during the siege of Sevastopol.

BIBLIOGRAPHY.—Jared Sparks' *Life and Treason of Benedict Arnold* (Boston, 1835), in his "Library of American Biography," is biassed and unfair. The best general account is Isaac Newton Arnold's *Life of Benedict Arnold* (Chicago, 1880), which, while offering no apologies or defence of his treason, lays perhaps too great emphasis on his provocations. Charles Burr Todd's *The Real Benedict Arnold* (New York, 1903) is a curious attempt to make Arnold's wife wholly responsible for his defection. François de Barbé-Marbois's *Complot d' Arnold et de Sir H. Clinton contre les États-Unis* (Paris, 1816) contains much interesting material, but is inaccurate. Two good accounts of the Canadian Expedition are Justin H. Smith's *Arnold's March from Cambridge to Quebec* (New York, 1903), which contains a reprint of Arnold's journal of the expedition; and John Codman's *Arnold's Expedition to Quebec* (New York, 1901). Arnold's *Letters on the Expedition to Canada* were printed in the Maine Historical Society's *Collections* for 1831 (repr. 1865). See also William Abbatt, *The Crisis of the Revolution* (New York, 1899); *The Northern Invasion of 1780* (Bradford Club Series, No. 6, New York, 1866); "The Treason of Benedict Arnold" (letters of Sir Henry Clinton to Lord George Germaine) in *Pennsylvania Magazine of History and Biography*, vol. xxii. (Philadelphia, 1898); and *Proceedings of a General Court Martial for the Trial of Major-General Arnold* (Philadelphia, 1780; reprinted with introduction and notes, New York, 1865).

ARNOLD, SIR EDWIN (1832–1904), British poet and journalist, was born on the 10th of June 1832, and was educated at the King's school, Rochester; King's College, London; and University College, Oxford, where in 1852 he gained the Newdigate prize for a poem on Belshazzar's feast. On leaving Oxford he became a schoolmaster, and went to India as principal of the government Sanskrit College at Poona, a post which he held during the mutiny of 1857, when he was able to render services for which he was publicly thanked by Lord Elphinstone in the Bombay council. Returning to England in 1861 he worked as a journalist on the staff of the *Daily Telegraph*, a newspaper with which he continued to be associated for more than forty years. It was he who, on behalf of the proprietors of the *Daily Telegraph* in conjunction with the *New York Herald*, arranged for the journey of H. M. Stanley to Africa to discover the course of the Congo, and Stanley named after him a mountain to the north-east of Albert Edward Nyanza. Arnold must also be credited with the first idea of a great trunk line traversing the entire African continent, for in 1874 he first employed the phrase "a Cape to Cairo railway" subsequently popularized by Cecil Rhodes. It was, however, as a poet that he was best known to his contemporaries. *The Light of Asia* appeared in 1879 and won an immediate success, going through numerous editions both in England and America. It is an Indian epic, dealing with the life and teaching of Buddha, which are expounded with much wealth of local colour and not a little felicity of versification. The poem contains many lines of unquestionable beauty; and its immediate popularity was rather increased than diminished by the twofold criticism to which it was subjected. On the one hand it was held by Oriental scholars to give a false impression of Buddhist doctrine; while, on the other, the suggested analogy between Sakyamuni and Christ offended the taste of some devout Christians. The latter criticism probably suggested to Arnold the idea of attempting a second narrative poem of which the central figure should be the founder of Christianity, as the founder of Buddhism had been that of the first. But though *The Light of the World* (1891), in which this idea took shape, had considerable poetic merit, it lacked the novelty of theme and setting which had given the earlier poem much of its attractiveness; and it failed to repeat the success attained by *The Light of Asia*. Arnold's other principal volumes of poetry were *Indian Song of Songs* (1875), *Pearls of the Faith* (1883), *The Song Celestial* (1885), *With Sadi in the Garden* (1888), *Potiphar's Wife* (1892) and *Adzuma* (1893). In his later years Arnold resided for some time in Japan, and his third wife was a Japanese lady. In *Seas and Lands* (1891) and *Japonica* (1892) he gives an interesting study of Japanese life. He received the order of C.S.I. on the occasion of the proclamation of Queen Victoria as empress of India in 1877, and in 1888 was created K.C.I.E. He also possessed decorations conferred by the rulers of Japan, Persia, Turkey and Siam. Sir Edwin Arnold died on the 24th of March 1904.

ARNOLD, GOTTFRIED (1666–1714), German Protestant divine, was born at Annaberg, in Saxony, where his father was a schoolmaster. In 1682 he went to the Gymnasium at Gera, and three years later to the university of Wittenberg. Here he made a special study of theology and history, and afterwards, through the influence of P. J. Spener, "the father of pietism," he became tutor in Quedlinburg. His first work, *Die Erste Liebe zu Christo*, to which in modern times attention was again directed by Leo Tolstoy, appeared in 1696. It went through five editions before 1728, and gained the author much reputation. In the year after its publication he was invited to Giessen as professor of church history. The life and work here, however, proved so distasteful to him that he resigned in 1698, and returned to Quedlinburg. In 1699 he began to publish his largest work, described by Tolstoy (*The Kingdom of God is within You*, chap. iii.) as "remarkable, although little known," *Unparteiische Kirchen- und Ketzerhistorie*, in which he has been thought by some to show more impartiality towards heresy than towards the Church (cp. Otto Pfleiderer, *Development of Theology*, p. 277). His next work, *Geheimniss der göttlichen Sophia*, published in 1700, seemed to indicate that he had developed a form of mysticism. Soon afterwards, however, his acceptance of a pastorate marked a change, and he produced a number of noteworthy works on practical theology. He was also known as the author of sacred poems. Gottfried Arnold has rightly been classed with the pietistic section of Protestant historians (*Bibliotheca Sacra*, 1850).

See Calwer-Zeller, *Theologisches Handwörterbuch*, and the account of him in Albert Knapp's new edition of *Die erste Liebe zu Christo* (1845).

ARNOLD, MATTHEW (1822–1888), English poet, literary critic and inspector of schools, was born at Laleham, near Staines, on the 24th of December 1822. When it is said that he was the son of the famous Dr Arnold of Rugby, and that Winchester, Rugby and Balliol College, Oxford, contributed their best towards his education, it seems superfluous to add that, in estimating Matthew Arnold and his work, training no less than original endowment has to be considered. A full academic training has its disadvantages as well as its gains. In the individual no less than in the species the history of man's development is the history of the struggle between the impulse to express original personal force and the impulse to make that force bow to the authority of custom. Where in any individual the first of these impulses is stronger than usual, a complete academic training is a gain; but where the second of these impulses is the dominant one, the effect of the academic habit upon the mind at its most sensitive and most plastic period is apt to be crippling. In regard to Matthew Arnold, it would be a bold critic of his life and his writings who should attempt to say what his work would have been if his training had been different. In his judgments on Goethe, Wordsworth, Byron, Shelley and Hugo, it may be seen how strong was his impulse to bow to authority. On the other hand, in Arnold's ingenious reasoning away the conception of Providence to "a stream of tendency not ourselves which makes for righteousness," we see how strong was his natural impulse for taking original views. The fact that the very air Arnold breathed during the whole of the impressionable period of his life was academic is therefore a very important fact to bear in mind.

In one of his own most charming critical essays he contrasts the poetry of Homer, which consists of "natural thoughts in natural words," with the poetry of Tennyson, which consists of "distilled thoughts in distilled words." "Distilled" is one of the happiest words to be found in poetical criticism, and may be used with equal aptitude in the criticism of life. To most people the waters of life come with all their natural qualities—sweet or bitter—undistilled. Only the ordinary conditions of civilization, common to all, flavoured the waters of life to Shakespeare, to Cervantes, to Burns, to Scott, to Dumas, and those other great creators whose minds were mirrors—broad and clear—for reflecting the rich drama of life around them. To Arnold the waters of life came distilled so carefully that the wonder is that he had any originality left. A member of the upper stratum of that "middle class" which he despised, or pretended to despise—the eldest son of one of the most accomplished as well as one of the most noble-tempered men of his time—Arnold from the moment of his birth drank the finest distilled waters that can be drunk even in these days. Perhaps, on the whole, the surprising thing is how little he suffered thereby. Indeed those who had formed an idea of Arnold's personality from their knowledge of his "culture," and especially those who had been delighted by the fastidious and feminine delicacy of his prose style, used to be quite bewildered when for the first time they met him at a dinner-table or in a friend's smoking-room. His prose was so self-conscious that what people expected to find in the writer was the Arnold as he was conceived by certain "young lions" of journalism whom he satirized—a somewhat over-cultured *petit-maître*—almost, indeed, a coxcomb of letters. On the other hand, those who had been captured by his poetry expected to find a man whose sensitive organism responded nervously to every uttered word as an aeolian harp answers to the faintest breeze. What they found was a broad-shouldered, manly—almost burly—Englishman with a fine countenance, bronzed by the open air of England, wrinkled apparently by the sun, wind-worn as an English skipper's, open and frank as a fox-hunting squire's and yet a countenance whose finely chiselled features were as high-bred and as commanding as Wellington's or Sir Charles Napier's. The voice they heard was deep-toned, fearless, rich and frank, and yet modulated to express every *nuance* of thought, every movement of emotion and humour. In his prose essays the humour he showed was of a somewhat thin-lipped kind; in his more important poems he showed none at all. It was here, in this matter of humour, that Arnold's writings were specially misleading as to the personality of the man. Judged from his poems, it was not with a poet like the writer of "The Northern Farmer," or a poet like the writer of "Ned Bratts," that any student of poetry would have dreamed of classing him. Such a student would actually have been more likely to class him with two of his contemporaries between whom and himself there were but few points in common, the "humourless" William Morris and the "humourless" Rossetti. For, singularly enough, between him and them there was this one point of resemblance: while all three were richly endowed with humour, while all three were the very lights of the sets in which they moved, the moment they took pen in hand to write poetry they became sad. It would almost seem as if, like Rossetti, Arnold actually held that poetry was not the proper medium for humour. No wonder, then, if the absence of humour in his poetry did much to mislead the student of his work as to the real character of the man.

After a year at Winchester, Matthew Arnold entered Rugby school in 1837. He early began to write and print verses. His first publication was a Rugby prize poem, *Alaric at Rome*, in 1840. This was followed in 1843, after he had gone up to Oxford in 1840 as a scholar of Balliol, by his poem *Cromwell*, which won the Newdigate prize. In 1844 he graduated with second-class honours, and in 1845 was elected a fellow of Oriel College, where among his colleagues was A. H. Clough, his friendship with whom is commemorated in that exquisite elegy *Thyrsis*. From 1847 to 1851 he acted as private secretary to Lord Lansdowne; and in the latter year, after acting for a short time as assistant-master at Rugby, he was appointed to an inspectorship of schools, a post which he retained until two years before his death. He married, in June 1851, the daughter of Mr Justice Wightman. Meanwhile, in 1849, appeared *The Strayed Reveller, and other Poems, by A*, a volume which gained a considerable esoteric reputation. In 1852 he published another volume under the same initial, *Empedocles on Etna, and other Poems*. *Empedocles* is as undramatic a poem perhaps as was ever written in dramatic form, but studded with lyrical beauties of a very high order. In 1853 Arnold published a volume of *Poems* under his own name. This consisted partially of poems selected from the two previous volumes. A second series of poems, which contained, however, only two new ones, was published in 1855. So great was the impression made by these in academic circles, that in 1857 Arnold was elected professor of poetry at Oxford, and he held the chair for ten years. In 1858 he published his classical tragedy, *Merope*. Nine years afterwards his *New Poems* (1867) were published. While he held the Oxford professorship he published several series of lectures, which gave him a high place as a scholar and critic. The essays[1] *On Translating Homer: Three Lectures given at Oxford*, published in 1861, supplemented in 1862 by *On Translating Homer: Last Words*, a fourth lecture given in reply to F. W. Newman's *Homeric Translation in Theory and Practice* (1861), and *On the Study of Celtic Literature*, published in 1867, were full of subtle and brilliant if not of profound criticism. So were the two series of *Essays in Criticism*, the first of which, consisting of articles reprinted from various reviews, appeared in 1865. The essay on "A Persian Passion Play" was added in the editions of 1875; and a second series, edited by Lord Coleridge, appeared in 1888.

Arnold's poetic activity almost ceased after he left the chair of poetry at Oxford. He was several times sent by government to make inquiries into the state of education in France, Germany, Holland and other countries; and his reports, with their thorough-going and searching criticism of continental methods, as contrasted with English methods, showed how conscientiously he had devoted some of his best energies to the work. His fame as a poet and a literary critic has somewhat overshadowed the fact that he was during thirty-five years of his life—from 1851 to 1886—employed in the Education Department as one of H.M. inspectors of schools, while his literary work was achieved in such intervals of leisure as could be spared from the public service. At the time of his appointment the government, by arrangement with the religious bodies, entrusted the inspection of schools connected with the Church of England to clergymen, and agreed also to send Roman Catholic inspectors to schools managed by members of that communion. Other schools—those of the British and Foreign Society, the Wesleyans, and undenominational schools generally—were inspected by laymen, of whom Arnold was one. There were only three or four of these officers at first, and their districts were necessarily large. It is to the experience gained in intercourse with Nonconformist school managers that we may attribute the curiously intimate knowledge of religious sects which furnished the material for some of his keen though good-humoured sarcasms. The Education Act of 1870, which simplified the administrative system, abolished denominational inspection, and thus greatly reduced the area assigned to a single inspector. Arnold took charge of the district of Westminster, and remained in that office until his resignation, taking also an occasional share in the inspection of training colleges for teachers, and in conferences at the central office. His letters, *passim*, show that some of the routine which devolved upon him was distasteful, and that he was glad to entrust to a skilled assistant much of the duty of individual examination and the making up of schedules and returns. But the influence he exerted on schools, on the department, and on the primary education of the whole country, was indirectly far greater than is generally supposed. His annual reports, of which more than twenty were collected into a volume by his friend and official chief, Sir Francis (afterwards Lord) Sandford, attracted, by reason of their freshness of style and thought, much more of public attention than is usually accorded to blue-book literature; and his high aims, and his sympathetic appreciation of the efforts and difficulties of the teachers, had a remarkable effect in raising the tone of elementary education, and in indicating the way to improvement. In particular, he insisted on the formative elements of school education, on literature and the "humanities," as distinguished from the collection of scraps of information and "useful knowledge"; and he sought to impress all the young teachers with the necessity of broader mental cultivation than was absolutely required to obtain the government certificate. In his reports also he dwelt often and forcibly on the place which the study of the Bible, not the distinctive formularies of the churches, ought to hold in English schools. He urged that besides the religious and moral purposes of Scriptural teaching, it had a literary value of its own, and was the best instrument in the hands even of the elementary teacher for uplifting the soul and refining and enlarging the thoughts of young children.

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[1] These essays were edited in 1905 with an introduction by W. H. D. Rouse.

On three occasions Arnold was asked to assist the government by making special inquiries into the state of education in foreign countries. These duties were especially welcome to him, serving as they did as a relief from the monotony of school inspection at home, and as opportunities for taking a wider survey of the whole subject of education, and for expressing his views on principles and national aims as well as administrative details. In 1859, as foreign assistant commissioner, he prepared for the duke of Newcastle's commission to inquire into the subject of elementary education a report (printed 1860) which was afterwards reprinted (1861) in a volume entitled *The Popular Education of France, with Notices of that of Holland and Switzerland*. In 1865 he was again employed as assistant-commissioner by the Schools Inquiry Commission under Lord Taunton; and his report on this subject, *On Secondary Education in Foreign Countries* (1866), was subsequently reprinted under the title *Schools and Universities on the Continent* (1868). Twenty years later he was sent by the Education Department to make special inquiries on certain specified points, *e.g.* free education, the status and training of teachers, and compulsory attendance at schools. The result of this investigation appeared as a parliamentary paper, *Special Report on certain points connected with Elementary Education in Germany, Switzerland and France*, in 1886. He also contributed the chapter on "Schools" (1837–1887) to the second volume of Mr Humphry Ward's *Reign of Queen Victoria*. Part of his official writings may be studied in *Reports for Elementary Schools* (1852–1882), edited by Sir F. Sandford in 1889.

All these reports form substantial contributions to the history and literature of education in the Victorian age. They have been quoted often, and have exercised marked influence on subsequent changes and controversies. One great purpose underlies them all. It is to bring home to the English people a conviction that education ought to be a national concern, that it should not be left entirely to local, or private, or irresponsible initiative, that the watchful jealousy so long shown by Liberals, and especially by Nonconformists, in regard to state action was a grave practical mistake, and that in an enlightened democracy, animated by a progressive spirit and noble and generous ideals, it was the part of wisdom to invoke the collective power of the state to give effect to those ideals. To this theme he constantly recurred in his essays, articles and official reports. "*Porro unum est necessarium*. One thing is needful; organize your secondary education."

In 1883 a pension of £250 was conferred on Arnold in recognition of his literary merits. In the same year he went to the United States on a lecturing tour, and again in 1886, his subjects being "Emerson" and the "Principles and Value of Numbers." The success of these lectures, though they were admirable in matter and form, was marred by the lecturer's lack of experience in delivery. It is sufficient, further, to say that *Culture and Anarchy: an Essay in Political and Social Criticism*, appeared in 1869; *St Paul and Protestantism, with an Introduction on Puritanism and the Church of England* (1870); *Friendship's Garland: being the Conversations, Letters and Opinions of the late Arminius Baron von Thunder-ten-Tronckh* (1871); *Literature and Dogma: an Essay towards a Better Apprehension of the Bible* (1873); *God and the Bible: a Review of Objections to Literature and Dogma* (1875); *Last Essays on Church and Religion* (1877); *Mixed Essays* (1879); *Irish Essays and Others* (1882); *Discourses in America* (1885). Such essays as the first of these, embodying as they did Arnold's views of theological and polemical subjects, attracted much attention at the time of their publication, owing to the state of the intellectual atmosphere at the moment; but it is doubtful, perhaps, whether they will be greatly considered in the near future. Many severe things have been said, and will be said, concerning the inadequacy of poets like Coleridge and Wordsworth when confronting subjects of a theological or philosophical kind. Wordsworth's High Church Pantheism and Coleridge's disquisitions on the Logos seem farther removed from the speculations of to-day than do the dreams of Lucretius. But these two great writers lived before the days of modern science. Arnold, living only a few years later, came at a transition period when the winds of tyrannous knowledge had blown off the protecting roof that had covered the centuries before, but when time and much labour were needed to build another roof of new materials—a period when it was impossible for the poet to enjoy either the quietism of High Church Pantheism in which Wordsworth had basked, or the sheltering protection of German metaphysics under which Coleridge had preached—a period, nevertheless, when the wonderful revelations of science were still too raw, too cold and hard, to satisfy the yearnings of the poetic soul. Objectionable as Arnold's rationalizing criticism was to contemporary orthodoxy, and questionable as was his equipment in point of theological learning, his spirituality of outlook and ethical purpose were not to be denied. Yet it is not Arnold's views that have become current coin so much as his literary phrases—his craving for "culture" and "sweetness and light," his contempt for "the dissidence of Dissent and the Protestantism of the Protestant religion," his "stream of tendency not ourselves making for righteousness," his classification of "Philistines and barbarians"—and so forth. His death at Liverpool, of heart failure on the 15th of April 1888, was sudden and quite unexpected.

Arnold was a prominent figure in that great galaxy of Victorian poets who were working simultaneously—Tennyson, Browning, Rossetti, William Morris and Swinburne—poets between whom there was at least this connecting link, that the quest of all of them was the old-fashioned poetical quest of the beautiful. Beauty was their watchword, as it had been the watchword of their immediate predecessors—Wordsworth, Coleridge, Keats, Shelley and Byron. That this group of early 19th-century poets might be divided into two—those whose primary quest was physical beauty, and those whose primary quest was moral beauty—is no doubt true. Still, in so far as beauty was their quest they were all akin. And so with the Victorian group to which Arnold belonged. As to the position which he takes among them opinions must necessarily vary. On the whole, his place in the group will be below all the others. The question as to whether he was primarily a poet or a *prosateur* has been often asked. If we were to try to answer that question here, we should have to examine his poetry in detail—we should have to inquire whether his primary impulse of expression was to seize upon the innate suggestive power of words, or whether his primary impulse was to rely upon the logical power of the sentence. In nobility of temper, in clearness of statement, and especially in descriptive power, he is beyond praise. But intellect, judgment, culture and study of great poets may do much towards enabling a prose-writer to write what must needs be called good poetry. What they cannot enable him to do is to produce those magical effects which poets of the rarer kind can achieve by seizing that mysterious, suggestive power of words which is far beyond all mere statement. Notwithstanding the exquisite work that Arnold has left behind him, some critics have come to the conclusion that his primary impulse in expression was that of the poetically-minded *prosateur* rather than that of the born poet. And this has been said by some who nevertheless deeply admire poems like "The Scholar Gypsy," "Thyrsis," "The Forsaken Merman," "Dover Beach," "Heine's Grave," "Rugby Chapel," "The Grande Chartreuse," "Sohrab and Rustum," "The Sick King in Bokhara," "Tristram and Iseult," &c. It would seem that a man may show all the endowments of a poet save one, and that one the most essential—the instinctive mastery over metrical effects.

In all literary expression there are two kinds of emphasis, the emphasis of sound and the emphasis of sense. Indeed the difference between those who have and those who have not the true rhythmic instinct is that, while the former have the innate faculty of making the emphasis of sound and the emphasis of sense meet and strengthen each other, the latter are without that faculty. But so imperfect is the human mind that it can rarely apprehend or grasp simultaneously these two kinds of emphasis. While to the born *prosateur* the emphasis of sense comes first, and refuses to be more than partially conditioned by the emphasis of sound, to the born poet the emphasis of sound comes first, and sometimes will, even as in the case of Shelley, revolt against the tyranny of the emphasis of sense. Perhaps the very origin of the old quantitative metres was the desire to make these two kinds of emphasis meet in the same syllable. In manipulating their quantitative metrical system the Greeks had facilities for bringing one kind of emphasis into harmony with the other such as are unknown to writers in accentuated metres. This accounts for the measureless superiority of Greek poetry in verbal melody as well as in general harmonic scheme to all the poetry of the modern world. In writers so diverse in many ways as Homer, Æschylus, Sophocles, Pindar, Sappho, the harmony between the emphasis of sound and the emphasis of sense is so complete that each of these kinds of emphasis seems always begetting, yet always born of the other. When in Europe the quantitative measures were superseded by the accentuated measures a reminiscence was naturally and inevitably left behind of the old system; and the result has been, in the English language at least, that no really great line can be written in which the emphasis of accent, the emphasis of quantity and the emphasis of sense do not meet on the same syllable. Whenever this junction does not take place the weaker line, or lines, are always introduced, not for makeshift purposes, but for variety, as in the finest lines of Milton and Wordsworth. Wordsworth no doubt seems to have had a theory that the accent of certain words, such as "without," "within," &c., could be disturbed in an iambic line; but in his best work he does not act upon his theory, and endeavours most successfully to make the emphasis of accent, of quantity and of sense meet. It might not be well for a poem to contain an entire sequence of such perfect lines as

> "I thought of Chatterton, the marvellous boy,"

or

> "Thy soul was like a star and dwelt apart,"

for then the metricist's art would declare itself too loudly and weaken the imaginative strength of the picture. But such lines should no doubt form the basis of the poem, and weaker lines—lines in which there is no such combination of the three kinds of emphasis—should be sparingly used, and never used for makeshift purposes. Now, neither by instinct nor by critical study was Arnold ever able to apprehend this law of prosody. If he does write a line of the first order, metrically speaking, he seems to do so by accident. Such weak lines as these are constantly occurring—

> "The poet, to whose mighty heart
> Heaven doth a quicker pulse impart,
> Subdues that energy to scan
> Not his own course, but that of man."

Much has been said about what is called the "Greek temper" of Matthew Arnold's muse. A good deal depends upon what it meant by the Hellenic spirit. But if the Greek temper expresses itself, as is generally supposed, in the sweet acceptance and melodious utterance of the beauty of the world as it is, accepting that beauty without inquiring as to what it means and as to whither it goes, it is difficult to see where in Arnold's poetry this temper declares itself. Surely it is not in *Empedocles on Etna*, and surely it is not in *Merope*. If there is a poem of his in which one would expect to find the joyous acceptance of life apart from questionings about the civilization in which the poet finds himself environed (its hopes, its fears, its aspirations and its failures)—such questionings, in short, as were for ever vexing Arnold's soul—it would be in "The Scholar Gypsy," a poem in which the poet tries to throw himself into the mood of a "Romany Rye." The great attraction of the gypsies to Englishmen of a certain temperament is that they alone seem to feel the joyous acceptance of life which is supposed to be specially Greek. Hence it would have been but reasonable to look, if anywhere, for the expression of Arnold's Greek temper in a poem which sets out to describe the feelings of the student who, according to Glanville's story, left Oxford to wander over England with the Romanies. But instead of this we got the old fretting about the unsatisfactoriness of modern civilization. Glanville's Oxford student, whose story is glanced at now and again in the poem, flits about in the scenery like a cloud-shadow on the grass; but the way in which Arnold contrives to avoid giving us the faintest idea either dramatic or pictorial of the student about whom he talks so much, and the gypsies with whom the student lived, is one of the most singular feats in poetry. The reflections which come to a young Oxonian lying on the grass and longing to escape life's fitful fever without shuffling off this mortal coil, are, no doubt, beautiful reflections beautifully expressed, but the temper they show is the very opposite of the Greek. To say this is not in the least to disparage Arnold. "A man is more like the age in which he lives," says the Chinese aphorism, "than he is like his own father and mother," and Arnold's polemical writings alone are sufficient to show that the waters of life he drank were from fountains distilled, seven times distilled, at the topmost slope of 19th-century civilization. Mr George Meredith's "Old Chartist" exhibits far more of the temper of acceptance than does any poem by Matthew Arnold.

His most famous critical dictum is that poetry is a "criticism of life." What he seems to have meant is that poetry is the crowning fruit of a criticism of life; that just as the poet's metrical effects are and must be the result of a thousand semi-conscious generalizations upon the laws of cause and effect in metric art, so the beautiful things he says about life and the beautiful pictures he paints of life are the result of his generalizations upon life as he passes through it, and consequently that the value of his poetry consists in the beauty and the truth of his generalizations. But this is saying no more than is said in the line—

> " Rien n'est beau que le vrai; le vrai seul est aimable "—

or in the still more famous lines—

> " 'Beauty is truth, truth beauty,'—that is all
> Ye know on earth, and all ye need to know."

To suppose that Arnold confounded the poet with the writer of *pensées* would be absurd. Yet having decided that poetry consists of generalizations on human life, in reading poetry he kept on the watch for those generalizations, and at last seemed to think that the less and not the more they are hidden behind the dramatic action, and the more unmistakably they are intruded as generalizations, the better. For instance, in one of his essays he quotes those lines from the " Chanson de Roland " of Turoldus, where Roland, mortally wounded, lays himself down under a pine-tree with his face turned towards Spain and the enemy, and begins to " call many things to remembrance; all the lands which his valour conquered, and pleasant France, and the men of his lineage, and Charlemagne, his liege lord, who nourished him "—

> " De plusurs choses à remembrer li prist,
> De tantes teres cume li bers cunquist,
> De dulce France, des humes de sun ligu,
> De Carlemagne sun seignor ki l'nurrit."

" That," says Arnold, " is primitive work, I repeat, with an undeniable poetic quality of its own. It deserves such praise, and such praise is sufficient for it." Then he contrasts it with a famous passage in Homer—that same passage which is quoted in the article POETRY, for the very opposite purpose to that of Arnold's, quoted indeed to show how the epic poet, leaving the dramatic action to act as chorus, weakens the ἀπάτη of the picture—the passage in the *Iliad* (iii. 243-244) where the poet, after Helen's pathetic mention of her brother's comments on the causes of their absence, " criticizes life " and generalizes upon the impotence of human intelligence, the impotence even of human love, to pierce the darkness in which the web of human fate is woven. He appends Dr Hawtrey's translation:—

> Ὣς φάτο· τοὺς δ' ἤδη κάτεχεν φυσίζοος αἶα
> ἐν Λακεδαίμονι αὖθι, φίλῃ ἐν πατρίδι γαίῃ.

> " So said she; they long since in Earth's soft arms were reposing
> There, in their own dear land, their fatherland, Lacedaemon."

" We are here," says Arnold, " in another world, another order of poetry altogether; here is rightly due such supreme praise as that which M. Vitel gives to the *Chanson de Roland*. If our words are to have any meaning, if our judgments are to have any solidity, we must not heap that supreme praise upon poetry of an order immeasurably inferior." He does not see that the two passages cannot properly be compared at all. In the one case the poet gives us a dramatic picture; in the other, a comment on a dramatic picture.

Perhaps, indeed, the place Arnold held and still holds as a critic is due more to his exquisite felicity in expressing his views than to the penetration of his criticism. Nothing can exceed the easy grace of his prose at the best. It is conversational and yet absolutely exact in the structure of the sentences; and in spite of every vagary, his distinguishing note is urbanity. Keen-edged as his satire could be, his writing for the most part is as urbane as Addison's own. His influence on contemporary criticism and contemporary ideals was considerable, and generally wholesome. His insistence on the necessity of looking at " the thing in itself," and the need for acquainting oneself with " the best that has been thought and said in the world," gave a new stimulus alike to originality and industry in criticism; and in his own selection of subjects—such as *Joubert*, or the *de Guérins*—he opened a new world to a larger class of the better sort of readers, exercising in this respect an awakening influence in his own time akin to that of Walter Pater a few years afterwards. The comparison with Pater might indeed be pressed further, and yet too far. Both were essentially products of Oxford. But Arnold, whose description of that " home of lost causes, and forsaken beliefs, and unpopular names, and impossible loyalties," is in itself almost a poem, had a classical austerity in his style that savoured more intimately of Oxford tradition, and an ethical earnestness even in his most flippant moments which kept him notably aloof from the more sensuous school of aesthetics.

The first collected edition of Arnold's poems was published in 1869 in two volumes, the first consisting of *Narrative and Elegiac Poems*, and the second of *Dramatic and Lyric Poems*. Other editions appeared in 1877, 1881; a library edition (3 vols., 1885); a one-volume reprint of the poems printed in the library edition with one or two additions (1890). Publications by Matthew Arnold not mentioned in the foregoing article include: *England and the Italian Question* (1859), a pamphlet; *A French Eton; or, Middle Class Education and the State* (1864); *Higher Schools and Universities in Germany* (1874), a partial reprint from *Schools and Universities on the Continent* (1868); *A Bible Reading for Schools; The Great Prophecy of Israel's Restoration*, an arrangement of *Isaiah*, chs. xl.-lxvi. (1872), republished with additions and varying titles in 1875 and 1883; an edition of the *Six Chief Lives from Johnson's Lives of the Poets* (1878); editions of the *Poems of Wordsworth* (1879), and the *Poetry of Byron* (1881), for the Golden Treasury Series, with prefatory essays reprinted in the second series of *Essays in Criticism*; an edition of *Letters, Speeches and Tracts on Irish Affairs by Edmund Burke* (1881); and many contributions to periodical literature. *The Letters of Matthew Arnold* (1848–1888) were collected and arranged by George W. E. Russell in 1895, reprinted 1901. *Matthew Arnold's Note Books, with a Preface by the Hon. Mrs Wodehouse*, appeared in 1902. A complete and uniform edition of *The Works of Matthew Arnold* (15 vols., 1904–1905) includes the letters as edited by Mr Russell. Vol. iii. contains a complete bibliography of his works, many of the early editions of which are very valuable, by Mr T. B. Smart, who published a separate bibliography in 1892. A valuable note on the rather complicated subject of Arnold's bibliography is given by Mr H. Buxton Forman in Arnold's *Poems, Narrative, Elegiac and Lyric* (Temple Classics, 1900).

It was Arnold's expressed desire that his biography should not be written, and before his letters were published they underwent considerable editing at the hands of his family. There are, however, monographs on Matthew Arnold (1899) in *Modern English Writers* by Prof. Saintsbury, and by Mr H. W. Paul (1902), in the English Men of Letters Series. These two works are supplemented by Mr G. W. E. Russell, who, as the editor of Arnold's letters, is in a sense the official biographer, in *Matthew Arnold* (1904, Literary Lives Series). There are also studies of Arnold in Mr J. M. Robertson's *Modern Humanists* (1891), and in W. H. Hudson's *Studies in Interpretation* (1896), in Sir J. G. Fitch's *Thomas and Matthew Arnold* (1897), and a review of some of the works above mentioned in the *Quarterly* for January 1905 by T. H. Warren. (T. W.-D.; J. G. F.)

ARNOLD, SAMUEL (1740–1802), English composer, was born at London on the 10th of August 1740. He received a thorough musical education at the Chapel Royal, and when little more than twenty years of age was appointed composer at Covent Garden theatre. Here, in 1765, he produced his popular opera, *The Maid of the Mill*, many of the songs in which were selected from the works of Italian composers. In 1776 he transferred his services to the Haymarket theatre. In 1783 he was made composer to George III. Between 1765 and 1802 he wrote as many as forty-three operas, after-pieces and pantomimes, of which the best were *The Maid of the Mill*, *Rosamond*, *Inkle and Yarico*, *The Battle of Hexham*, *The Mountaineers*. His oratorios included *The Cure of Saul* (1767), *Abimelech* (1768), *The Resurrection* (1773), *The Prodigal Son* (1777) and *Elisha* (1795). In 1783 he became organist to the Chapel Royal. In 1786 he began an edition of Handel's works, which extended to 40 volumes, but was never completed. In 1793 he became organist of Westminster Abbey, where he was buried after his death on the 22nd of October 1802. Arnold is chiefly remembered now for the publication of his *Cathedral Music, being a collection in score of the most valuable and useful compositions for that service by the several English masters of the last 200 years* (1790).

ARNOLD, THOMAS (1795–1842), English clergyman and headmaster of Rugby school, was born at West Cowes, in the Isle of Wight, on the 13th of June 1795. He was the son of William and Martha Arnold, the former of whom occupied the situation of collector of customs at Cowes. His father died suddenly of spasm in the heart in 1801, and his early education was confided by his mother to her sister, Miss Delafield. From her tuition he passed to that of Dr Griffiths, at Warminster, in Wiltshire, in 1803; and in 1807 he was removed to Winchester, where he remained until 1811, having entered as a commoner, and afterwards become a scholar of the college. In after life he retained a lively feeling of interest in Winchester school, and remembered with admiration and profit the regulative tact of Dr Goddard, and the preceptorial ability of Dr Gabell, who were successively head-masters during his stay there.

From Winchester he removed to Oxford in 1811, where he became a scholar at Corpus Christi College; in 1815 he was elected fellow of Oriel College; and there he continued to reside until 1819. This interval was diligently devoted to the pursuit of classical and historical studies, to preparing himself for ordination, and to searching investigations, under the stimulus of continual discussion with a band of talented and congenial associates, of the profoundest questions in theology, ecclesiastical polity and social philosophy. The authors he most carefully studied at this period were Thucydides and Aristotle, and for their writings he formed an attachment which remained to the close of his life, and exerted a powerful influence upon his mode of thought and opinions, as well as upon his literary occupations in subsequent years. Herodotus also came in for a considerable share of his regard, but more, apparently, for recreation than for work. Accustomed freely and fearlessly to investigate whatever came before him, and swayed by a scrupulous dread of insincerity, he was doomed to long and anxious hesitation concerning some of the fundamental points of theology before arriving at a firm conviction of the truth of Christianity. Once satisfied, however, his faith remained clear and firm; and thenceforward his life became that of a supremely *religious* man.

To the name of Christ he was prepared to "surrender his whole soul," and to render before it "obedience, reverence without measure, intense humility, most unreserved adoration" (*Sermons*, vol. iv. p. 210). He did not often talk about religion; he had not much of the accredited phraseology of piety even when he discoursed on spiritual topics; but more than most men he was directed by religious principle and feeling in all his conduct. He left Oxford in 1819 and settled at Laleham, near Staines, where he took pupils for the university. His spare time was devoted to the prosecution of studies in philology and history, more particularly to the study of Thucydides, and of the new light which had been cast upon Roman history and upon historical method in general by the researches of Niebuhr. He was also occasionally engaged in preaching, and it was whilst here that he published the first volume of his sermons. Shortly after he settled at Laleham, he married Mary, youngest daughter of the Rev. John Penrose, rector of Fledborough, Nottinghamshire. After nine years spent at Laleham he was induced to offer himself as a candidate for the vacant head-mastership of Rugby; and though he entered somewhat late upon the contest, and though none of the electors was personally known to him, he was elected in December 1827. In June 1828 he received priest's orders; in April and November of the same year he took his degrees of B.D. and D.D., and in August entered on his new office.

In one of the testimonials which accompanied his application to the trustees of Rugby, the writer stated it as his conviction that "if Mr Arnold were elected, he would change the face of education all through the public schools of England." This somewhat hazardous pledge was nobly redeemed. Under Arnold's superintendence the school became not merely a place where a certain amount of classical or general learning was to be obtained, but a sphere of intellectual, moral and religious discipline, where healthy characters were formed, and men were trained for the duties, and struggles and responsibilities of life. His energies were chiefly devoted to the business of the school; but he found time also for much literary work, as well as for an extensive correspondence. Five volumes of sermons, an edition of Thucydides, with English notes and dissertations, a History of Rome in three vols. 8vo, beside numerous articles in reviews, journals, newspapers and encyclopaedias, are extant to attest the untiring activity of his mind, and his patient diligence during this period. His interest also in public matters was incessant, especially ecclesiastical questions, and such as bore upon the social welfare and moral improvement of the masses.

In 1841, after fourteen years at Rugby, Dr Arnold was appointed by Lord Melbourne, then prime minister, to the chair of modern history at Oxford. On the 2nd of December 1841 he delivered his inaugural lecture. Seven other lectures were delivered during the first three weeks of the Lent term of 1842. When the midsummer vacation arrived, he was preparing to set out with his family to Fox How in Westmoreland, where he had purchased some property and built a house. But he was suddenly attacked by angina pectoris, and died on Sunday, the 12th of June 1842. His remains were interred on the following Friday in the chancel of Rugby chapel, immediately under the communion table.

The great peculiarity and charm of Dr Arnold's nature seemed to lie in the supremacy of the moral and the spiritual element over his whole being. He was not a notable scholar, and he had not much of what is usually called tact in his dealings either with the juvenile or the adult mind. What gave him his power, and secured for him so deeply the respect and veneration of his pupils and acquaintances, was the intensely religious character of his whole life. He seemed ever to act from a severe and lofty estimate of duty. To be just, honest and truthful, he ever held to be the first aim of his being.

His *Life* was written by Dean Stanley (1845).

ARNOTT, NEIL (1788–1874), Scottish physician, was born at Arbroath on the 15th of May 1788. He studied medicine first at Aberdeen, and subsequently in London under Sir Everard Home (1756–1832), through whom he obtained, while yet in his nineteenth year, the appointment of full surgeon to an East Indiaman. After making two voyages to China he settled in 1811 to practise in London, and speedily acquired high reputation in his profession. Within a few years he was made physician to the French and Spanish embassies, and in 1837 he became a physician extraordinary to the queen. From his earliest youth Arnott had an intense love of natural philosophy, and to this was added an inventiveness which served him in good stead in his profession and yielded the "Arnott water-bed," the "Arnott ventilator," the "Arnott stove," &c. He was the author of several works bearing on physical science or its applications, the most important being his *Elements of Physics* (1827), which went through six editions in his lifetime. In 1838 he published a treatise on *Warming and Ventilating*, and, in 1855, one on the *Smokeless Fireplace*. He was a strong advocate of scientific, as opposed to purely classical, education; and he manifested his interest in natural philosophy by the gift of £2000 to each of the four universities of Scotland and to the university of London, to promote its study in the experimental and practical form. He died in London on the 2nd of March 1874.

ARNOULD-PLESSY, JEANNE SYLVANIE (1819–1897), French actress, was born in Metz on the 7th of September 1819, the daughter of a local actor named Plessy. She was a pupil of Samson at the Conservatoire in 1829, and made her *début* as Emma at the Comédie Française in 1834 in Alexandre Duval's *La Fille d'honneur*. She had an immense success, and Mlle Mars, to whom the public already compared her, took her up. Until 1845 she had prominent parts in all the plays, new and old, at the Théâtre Français, when suddenly at the height of her success, she left Paris and went to London, marrying the dramatic author, J. F. Arnould (d. 1854), a man much older than herself. The Comédie Française, after having tried in vain to bring her back, brought a suit against her, and obtained heavy damages. In the meantime Madame Arnould-Plessy accepted an engagement at the French theatre at St Petersburg, where she played for nine years. In 1855 she returned to Paris and was re-admitted to the Comédie Française, as *pensionnaire* with an engagement for eight years. This second part of her career was even more brilliant than the first. She revived some of her old rôles, but began to abandon the *jeunes premières* for the "lead," in which she had a success unequalled since the retirement of Mlle Mars. Her later triumphs were especially associated with new plays by Émile Augier, *Le Fils de Giboyer* and *Maître Guerin*. Her last appearance was in Edouard Cadol's *La Grand-maman*; she retired in 1876, and died in 1897.

ARNSBERG, a town of Germany, in the Prussian province of Westphalia, romantically situated on an eminence almost surrounded by the river Ruhr, 44 m. S.E. of Münster and 58 m. E.N.E. of Düsseldorf by rail. Pop. (1900) 8490. It is the seat of the provincial authorities, and has three churches, a court of appeal, a Roman Catholic gymnasium, which was formerly the Benedictine abbey of Weddinghausen, a library, a normal school and a chamber of commerce. Weaving, brewing and distilling are carried on, and there are manufactories of white lead, shot and paper, works for the production of railway plant, and saw-mills. Near the town are the ruins of the castle of the counts of Arnsberg, the last of whom, Gottfried, sold his countship, in 1368, to the archbishop of Cologne. The countship was incorporated by the archbishops in their duchy of Westphalia, which in 1802 was assigned to Hesse-Darmstadt and in 1815 to Prussia. The town, which had received its first charter in 1237 and later joined the Hanseatic League, became the capital of the duchy.

ARNSTADT, a town in the principality of Schwarzburg-Sondershausen, Germany, on the river Gera, 11 m. S. of Erfurt, with which it is connected by rail. Pop. (1900) 14,413. There are five churches, four Protestant and one Catholic. The Evangelical Liebfrauenkirche, a Romanesque building (mainly 12th-century), has two octagonal towers and a 10th-century porch. The palace contains collections of pictures and porcelain, and attached to it is a magnificent tower, all that remains of the castle built in 1560. The town hall dates from 1561. The industries of Arnstadt include iron and other metal founding, the manufacture of leather, cloth, tobacco, weighing-machines, paper, playing-cards, chairs, gloves, shoes, iron safes, and beer, and market-gardening and trade in grain and wood are carried on. There are copper-mines in the neighbourhood, as well as tepid saline springs, the waters of which are used for bathing, and are much frequented in summer. Arnstadt dates back to the 8th century. It was bought in 1306 by the counts of Schwarzburg, who lived here till 1716.

ARNSWALDE, a town of Germany, in the kingdom of Prussia, in a marshy district between four lakes, 20 m. S.W. of Stargard and on the main line between that place and Posen. Besides the Gothic church there are no noteworthy public buildings. Its industries include iron founding, machinery, and manufactures of cloth, matches and starch. Pop. (1900) 8665.

ARNULF (*c.* 850–899), Roman emperor, illegitimate son of Carloman, king of Bavaria and Italy, was made margrave of Carinthia about 876, and on his father's death in 880 his dignity and possessions were confirmed by the new king of the east Franks, Louis III. The failure of legitimate male issue of the later Carolingians gave Arnulf a more important position than otherwise he would have occupied; but he did homage to the emperor Charles the Fat in 882, and spent the next few years in constant warfare with the Slavs and the Northmen. In 887, however, Arnulf identified himself with the disgust felt by the Bavarians and others at the incapacity of Charles the Fat. Gathering a large army, he marched to Tribur; Charles abdicated and the Germans recognized Arnulf as their king, a proceeding which L. von Ranke describes as "the first independent action of the German secular world." Arnulf's real authority did not extend far beyond the confines of Bavaria, and he contented himself with a nominal recognition of his supremacy by the kings who sprang up in various parts of the Empire. Having made peace with the Moravians, he gained a great and splendid victory over the Northmen near Louvain in October 891, and in spite of some opposition succeeded in establishing his illegitimate son, Zwentibold, as king of the district afterwards called Lorraine. Invited by Pope Formosus to deliver him from the power of Guido III., duke of Spoleto, who had been crowned emperor, Arnulf went to Italy in 894, but after storming Bergamo and receiving the homage of some of the nobles at Pavia, he was compelled by desertions from his army to return. The restoration of peace with the Moravians and the death of Guido prepared the way for a more successful expedition in 895 when Rome was stormed by his troops; and Arnulf was crowned emperor by Formosus in February 896. He then set out to establish his authority in Spoleto, but on the way was seized with paralysis. He returned to Bavaria, where he died on the 8th of December 899, and was buried at Regensburg. He left, by his wife Ota, a son Louis surnamed the Child. Arnulf possessed the qualities of a soldier, and was a loyal supporter of the church.

See "Annales Fuldenses" in the *Monumenta Germaniae historica. Scriptores*, Band i. (Hanover and Berlin, 1826); E. Dümmler, *Geschichte des ostfränkischen Reichs* (Leipzig, 1887–1888); M. J. L. de Gagern, *Arnulfi imperatoris vita* (Bonn, 1837); E. Dümmler, *De Arnulfo Francorum rege* (Berlin, 1852); W. B. Wenck, *Die Erhebung Arnulfs und der Zerfall des karolingischen Reiches* (Leipzig, 1852); O. Dietrich, *Beiträge zur Geschichte Arnolfs von Kärnthen und Ludwigs des Kindes* (Berlin, 1890); E. Mühlbacher, *Die Regesten des Kaiserreichs unter den Karolingern* (Innsbruck, 1881).

AROIDEAE (Arum family), a large and wide-spread botanical order of Monocotyledons containing about 1000 species in 105 genera. It is generally distributed in temperate and tropical regions, but especially developed in warm countries. The common British representative of the order, *Arum maculatum* (cuckoo-pint, lords and ladies, or wake robin), gives a meagre idea of its development. The plants are generally herbaceous, often, however, reaching a gigantic size, but are sometimes shrubby, as in *Pothos*, a genus of shrubby climbing plants, chiefly Malayan. *Monstera* is a tropical American genus of climbing shrubs, with large often much-perforated leaves; the fruiting spikes of a Mexican species, *M. deliciosa*, are eaten. The roots of the climbing species are of interest in their adaptation

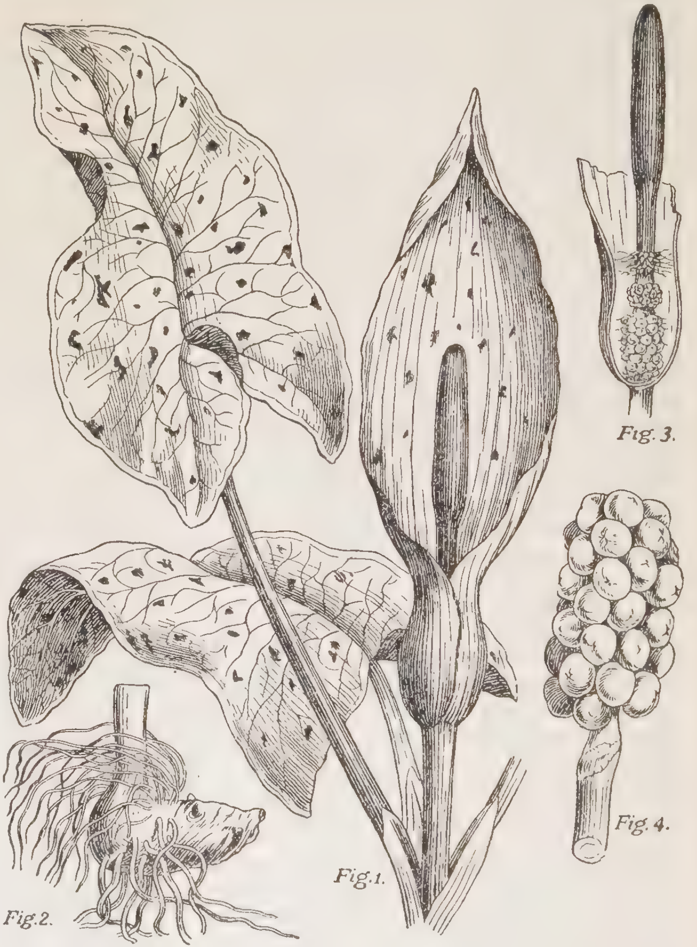
Fig. 3.
Fig. 4.
Fig.1.
Fig.2.

Arum maculatum, Cuckoo-pint.

1. Leaves and inflorescence.
2. Underground root-stock.
3. Lower part of spathe cut open.
4. Spike of fruits. Showing in succession (from below) female flowers, male flowers, and sterile flowers forming a ring of hairs borne on the spadix.

to the mode of life of the plant. For instance, some species of *Philodendron* have a growth like that of ivy, with feeding roots penetrating the soil and clasping roots which fix the plant to its support. In other species of the genus the seed germinates on a branch, and the seedling produces clasping roots, and roots which grow downwards hanging like stout cords, and ultimately reaching the ground. The leaves, which show great variety in size and form, are generally broad and net-veined, but in sweet-flag (*Acorus Calamus*) are long and narrow with parallel veins. In *Arum* the blade is simple, as also in the so-called arum-lily (*Richardia*), a South African species common in Britain as a greenhouse plant, and in *Caladium*, a tropical South American genus, and *Alocasia* (tropical Asia), species of which are favourite warm-greenhouse plants on account of their variegated leaves. In other genera the leaves are much divided and sometimes very large; those of *Dracontium* (tropical America) may be 15 ft. high, with a long stem-like stalk and a much-branched spreading blade. The East Indian genus *Amorphophallus* has a similar habit. A good series of tropical aroids is to be seen in the aroid house at Kew. The so-called water cabbage (*Pistia Stratiotes*) is a floating plant widely distributed in the tropics, and consisting of rosettes of broadish leaves several inches across and a tuft of roots hanging in the water.

The small flowers are densely crowded on thick fleshy spikes, which are associated with, and often more or less enveloped by, a large leaf (bract), the so-called spathe, which, as in cuckoo-pint, where it is green in colour, *Richardia*, where it is white, creamy or yellow, *Anthurium*, where it is a brilliant scarlet, is often the most striking feature of the plant. The details of the structure of the flower show a wide variation; the flowers are often extremely simple, sometimes as in *Arum*, reduced to a single stamen or pistil. The fruit is a berry—the scarlet berries of the cuckoo-pint are familiar objects in the hedges in late summer. The plants generally contain an acrid poisonous juice. The underground stems (rhizomes or tubers) are rich in starch; from that of *Arum maculatum* Portland arrowroot was formerly extensively prepared by pounding with water and then straining; the starch was deposited from the strained liquid.

The order is represented in Britain by *Arum maculatum*, a low herbaceous plant common in woods and hedgerows in England, but probably not wild in Scotland. It grows from a whitish root-stock which sends up in the spring a few long-stalked, arrow-shaped leaves of a polished green, often marked with dark blotches. These are followed by the inflorescence, a fleshy spadix bearing in the lower part numerous closely crowded simple unisexual flowers and continued above into a purplish or yellowish appendage; the spadix is enveloped by a leafy spathe, constricted in the lower part to form a chamber, in which are the flowers. The mouth of this chamber is protected by a ring of hairs pointing downwards, which allow the entrance but prevent the escape of small flies; after fertilization of the pistils the hairs wither. The insects visit the plant in large numbers, attracted by the foetid smell, and act as carriers of the pollen from one spathe to another. As the fruit ripens the spathe withers, and the brilliant red berries are exposed.

The sweet-flag *Acorus Calamus* (*q.v.*), which occurs apparently wild in England in ditches, ponds, &c., is supposed to have been introduced.

AROLSEN, a town of Germany, capital of the principality of Waldeck, 25 m. N.W. of Cassel, with which it is connected by rail via Warburg. Pop. 3000. It lies in a pleasant undulating country at an elevation of 900 ft. above the sea. The Evangelical parish church contains some fine statues by Christian Rauch, and the palace (built 1710–1720), in addition to a valuable library of 30,000 vols., a collection of coins and pictures, among the latter several by Angelica Kauffmann. Arolsen is the birthplace of the sculptor C. Rauch and of the painters Wilhelm and Friedrich Kaulbach.

ARONA, a town of Piedmont, Italy, in the province of Novara, on the W. bank of Lake Maggiore, 3 m. from its S. extremity, 23 m. N. of Novara, and 42 m. N.W. of Milan by rail. Pop. (1901) 4700. It is a railway centre of some importance on the Simplon line, and is also the southern terminus of the steamers which ply on Lake Maggiore. The church of S. Maria contains a fine altar-piece by Gaudenzio Ferrari. On a hill to the north of the town stands a colossal bronze statue of S. Carlo Borromeo (born here in 1538), erected in 1697. The pedestal, of red granite, is 42 ft. high, and the statue 70 ft. high; the latter is hollow, and can be ascended from within.

ARPEGGIO (from Ital. *arpeggiare*, to play upon the harp), in music, the notes of a chord, played in rapid succession as on a harp, and not together.

ARPI (Gr. Ἀργόριππα), an ancient city of Apulia, 20 m. W. of the sea coast, and 5 m. N. of the modern Foggia. The legend attributes its foundation to Diomedes, and the figure of a horse, which appears on its coins, shows the importance of horse-breeding in early times in the district. Its territory extended to the sea, and Strabo says that from the extent of the city walls one could gather that it had once been one of the greatest cities of Italy. As a protection against the Samnites Arpi became an ally of Rome, and remained faithful until after the battle of Cannae, but Fabius captured it in 213 B.C., and it never recovered its former importance. It lay on a by-road from Luceria to Sipontum. No Roman inscriptions have, indeed, been found here, and remains of antiquity are scanty. Foggia is its medieval representative. (T. As.)

ARPINO (anc. *Arpinum*), a town of Campania, Italy, in the province of Caserta, 1475 ft. above sea-level; 12 m. by rail N.W. of Roccasecca, a station on the railway from Naples to Rome. Pop. (1901) 10,607. Arpino occupies the lower part of the site of the ancient Volscian town of Arpinum, which was finally taken from the Samnites by the Romans in 305 B.C. It became a *civitas sine suffragio*, but received full privileges (*civitas cum suffragio*) in 188 B.C. with Formiae and Fundi; it was governed as a *praefectura* until the Social War, and then became a *municipium*. The ancient polygonal walls, which are still finely preserved, are among the best in Italy. They are built of blocks of pudding-stone, originally well jointed, but now much weathered. They stand free in places to a height of 11 ft., and are about 7 ft. wide at the top. A single line of wall, with medieval round towers at intervals, runs on the north side from the present town to Civitavecchia (2055 ft.), on the site of the ancient citadel. Here is the Porta dell' Arco, a gate of the old wall, with an aperture 15 ft. high, formed by the gradual inclination of the two sides towards one another. Below Arpino, in the valley of the Liris, between the two arms of its tributary the Fibrenus, and ¾ m. north of Isola del Liri, lies the church of S. Domenico, which marks the site of the villa in which Cicero was born and frequently resided. Near it is an ancient bridge, of a road which crossed the Liris to Cereatae (modern Casamari). The painter Giuseppe Cesari (1560–1640), more often known as the Cavaliere d' Arpino, was also born here.

See O. E. Schmidt, *Arpinum, eine topographisch-historische Skizze* (Meissen, 1900). (T. As.)

ARQUÀ PETRARCA, a village of Venetia, Italy, in the province of Padua, 3 m. to the S.W. of Battaglia. Pop. (1901) 1573. It is chiefly famous as the place where Petrarch lived his last few years and died in 1374. His house still exists, and his tomb, a sarcophagus supported by four short columns of red marble, stands in front of the church. Near Arquà, on the banks of the small Lago della Costa, is the site of a prehistoric lake village, excavations in which have produced interesting results.

See A. Moschetti and F. Cordenone in *Bollettino del Museo Civico di Padova*, iv. (1901), 102 seq.

ARQUEBUS (also called harquebus, hackbut, &c.), a firearm of the 16th century, the immediate predecessor of the musket. The word itself is certainly to be derived from the German *Hakenbühse* (mod. *Hakenbüchse*, cf. Eng. *hackbut* and *hackbush*), "hook gun." The "hook" is often supposed to refer to the bent shape of the butt, which differentiated it from the straight-stocked hand gun, but it has also been suggested that the original arquebus had a metal hook near the muzzle, which was used to grip the wall (or other fixed object) so as to steady the aim and take up the force of recoil, that from this the name *Hakenbühse* spread till it became the generic name for small arms, and that the original form of the weapon then took the name of *arquebus à croc*. The French form *arquebuse* and Italian *arcobugio*, *archibugio*, often and wrongly supposed to indicate the hackbut's affinity with the crossbow (" hollow bow " or " mouthed bow "), are popular corruptions, the Italian being apparently the earlier of the two and supplanting the first and purest French form *haquebut*. Previous to the French wars in Italy, hand-gun men and even arbalisters seem to have been called arquebusiers, but in the course of these wars the arquebus or hackbut came into prominence as a distinct type of weapon. The Spanish arquebusiers, who used it with the greatest effect in the Italian wars, notably at Bicocca (1522) and Pavia (1525), are the originators of modern infantry fire action. Filippo Strozzi made many improvements in the arquebus about 1530, and his weapons were effective up to four and five hundred paces. He also standardized the calibres of the arquebuses of the French army, and from this characteristic feature of the improved weapon arose the English term " caliver." In the latter part of the 16th century (*c.* 1570) the arquebus began to be displaced by the musket.

ARQUES-LA-BATAILLE, a village of France, in the department of Seine-Inférieure, 4 m. S.E. of Dieppe by the Western railway. Pop. (1906) 1250. Arques is situated near the confluence of the rivers Varenne and Bethune; the forest of Arques stretches to the north-east. The interest of the place centres in the castle dominating the town, which was built in the 11th century by William of Arques; his nephew, William the Conqueror, regarding it as a menace to his own power, besieged and occupied it. After frequently changing hands, it came into the possession of the English, who were expelled in 1449 after an occupation of thirty years. In 1589 its cannon decided the battle of Arques in favour of Henry IV. Since 1869 the castle has been state property. The first line of fortification was the work of Francis I.; the second line and the donjon date back to the 11th century. The church of Arques, a building of the 16th century, preserves a fine stone rood screen, statuary, stained glass and other relics of the Renaissance period.

ARRACK, Rack or Rak, a generic name applied to a variety of spirituous liquors distilled in the Far East. According to some authorities the word is derived from the Arabic *arak* (perspiration), but according to others (see Morewood's *History of Inebriating Liquors*, 1834, p. 140) it is derived from the *areca-nut*, a material from which a variety of arrack was long manufactured, and is of Indian origin. The liquor to which this or a similar name is applied is (or was, since the introduction of European spirits and methods of manufacture is gradually causing the native spirit industries on the old lines to decay) manufactured in India, Ceylon, Siam, Java, Batavia, China, Corea, &c., and its manufacture still constitutes a considerable industry. The term arrack as designating a distilled liquor does not, however, appear to have been confined to the Far East, as, in Timkowski's *Travels*, it is stated that a spirit distilled from koumiss (*q.v.*) by the Tatars, Mongols and presumably the Caucasian races generally, is called *arrack*, *araka* or *ariki*. In Ceylon arrack is distilled chiefly from palm toddy, which is the fermented juice drawn from the unexpanded flower-spathes of various palms, such as the Palmyra palm (*Borassus flabelliformis*) and the cocoa palm (*Cocos nucifera*). At the beginning of the 19th century the arrack industry of Ceylon was of considerable dimensions, whole woods being set apart for no other purpose than that of procuring toddy, and the distillation of the spirit took place at every village round the coast. The land rents in 1831 included a sum of £35,573 on the cocoa-nut trees, and the duties on the manufacture and retail of the spirit amounted to over £30,000. On the Indian continent arrack is made from palm toddy, rice and the refuse of the sugar refineries, but mainly from the flowers of the muohwa or mahua tree (*Bassia latifolia*). The mahua flowers are very rich in sugar, and may, according to H. H. Mann, contain as much as 58 % of fermentable sugar, calculated on the total solids. Even at the present day the process of manufacture is very primitive, the fermentation as a rule being carried on in so concentrated a liquid that complete fermentation rarely takes place. According to Mann, the total sugar in the liquor ready for fermentation may reach 20 %. The ferment employed (it is so impure that it can scarcely be called yeast) is obtained from a previous fermentation, and, as the latter is never vigorous, it is not surprising that the resulting spirit contains, compared with the more scientifically prepared European spirits, a very high proportion of by-products (acid, fusel oil, &c.). The injurious nature of these native spirits has long been known and has been frequently set down to the admixture of drugs, such as hemp (*ganga*), but a recent investigation of this question appears to show that this is not generally the case. The chemical constitution of these liquors alone affords sufficient proof of their inferior and probably injurious character.

See H. H. Mann, *The Analyst* (1904).

ARRAH, a town of British India, headquarters of Shahabad district, in the Patna division of Bengal, situated on a navigable canal connecting the river Sone with the Ganges. It is a station on the East Indian railway, 368 m. from Calcutta. In 1901 the population was 40,170. Arrah is famous for an incident in the Mutiny, when a dozen Englishmen, with 50 Sikhs, defended an ordinary house against 2000 Sepoys and a multitude of armed insurgents, perhaps four times that number. A British regiment, despatched to their assistance from Dinapur, was disastrously repulsed; but they were ultimately relieved, after eight days' continuous fighting, by a small force under Major (afterwards Sir Vincent) Eyre.

ARRAIGNMENT (from Lat. *ad*, to, and *rationare*, to reason, call to account), a law term, properly denoting the calling of a person to answer in form of law upon an indictment. After a true bill has been found against a prisoner by the grand jury, he is called by name to the bar, the indictment is read over to him, and he is asked whether he be guilty or not of the offence charged. This is the arraignment. Formerly, it was usual to require the prisoner to hold up his hand, in order to identify him the more completely, but this practice is now obsolete, as well as that of asking him how he will be tried. His plea in answer to the charge is then entered, or a plea of not guilty is entered for him if he stands mute of malice and refuses to plead. If a person is mute by the visitation of God (*i.e.* deaf and dumb), it will be no bar to an arraignment if intelligence can be conveyed to him by signs or symbols. If he pleads guilty, sentence may be passed forthwith; if he pleads not guilty, he is then given in charge to a jury of twelve men to inquire into the truth of the indictment. He may also plead in abatement, or to the jurisdiction, or demur on a point of law. Several defendants, except those entitled to the privilege of peerage, charged on the same indictment, are arraigned together.

In Scots law the term for arraignment is *calling the diet*.

The *Clerk of Arraigns* is a subordinate officer attached to assize courts and to the Old Bailey. He is appointed by the clerk of assize (see Assize) and acts as his deputy. He assists at the arraignment of prisoners, and puts the formal questions to the jury when delivering their verdict.

ARRAN, EARLS OF. The extinct Scottish title of the earls of Arran (not to be confused with the modern Irish earls of Arran—from the Arran or Aran Islands, Galway—a title created in 1762) was borne by some famous characters in Scottish history. Except the first earl, Thomas Boyd (see Arran), and James Stewart, all the holders of this title were members of the Hamilton family.

James Hamilton, 1st earl of Arran of the new creation (*c.* 1475–1529), son of James, 1st Lord Hamilton, and of Mary Stewart, daughter of James II. of Scotland, was born about 1475, and succeeded in 1479 to his father's titles and estates. In 1489 he was made sheriff of Lanark, was appointed a privy councillor to James IV., and in 1503 negotiated in England the marriage between the king and Margaret Tudor. Hamilton excelled in the knightly exercises of the day, and the same year on the 11th of August, after distinguishing himself in a famous tournament, he was created earl and justiciary of Arran. In

1504 as lieutenant-general of the realm he was employed in reducing the Hebrides, and about the same time in an expedition with 10,000 men in aid of John, king of Denmark. In 1507 he was sent ambassador to France, and on his return through England was seized and imprisoned by Henry VII. After the accession of Henry VIII., Arran, in 1509, signed the treaty of peace between the two countries, and later, when hostilities began, was given command of a great fleet equipped for the aid of France in 1513. The expedition proved a failure, Arran wasting time by a useless attack on Carrickfergus, lingering for months on the Scottish coast, and returning with a mere remnant of his fleet, the larger ships having probably been purchased by the French government. During his absence the battle of Flodden had been lost, and Arran found his rival Angus, who enjoyed Henry's support, married to the queen dowager and in control of the government. Arran naturally turned to the French party and supported the regency of the duke of Albany. Later, however, becoming impatient of the latter's monopoly of power, he entered into various plots against him, and on Albany's departure in 1517 he was chosen president of the council of regency and provost of Edinburgh. The same year he led an expedition to the border to punish the murderers of the French knight La Bastie. In September, however, after a temporary absence with the young king, the gates of Edinburgh were shut against him by the Douglases, and on the 30th of April 1520 the fierce fight of "Cleanse the Causeway" took place in the streets between the two factions, in which the Hamiltons were worsted. The quarrel, however, between Angus and his wife, the queen-mother, with whom Arran now allied himself, gave the latter another opportunity of regaining power, which he held from 1522, after Albany's return to France, till 1524, when he was forced to include Angus in the government. In 1526, on the refusal of the latter to give up his control of the king on the expiry of his term of office, Arran took up arms, but retreated before Angus's forces, and having made terms with him, supported him in his close custody of the king, in September defeating the earl of Lennox, who was marching to Edinburgh to liberate James. On the proscription of Angus and the Douglases, Arran joined the king at Stirling. He died in 1529. His eldest son James succeeded him.

JAMES HAMILTON, 2nd earl of Arran and duke of Châtelherault (*c.* 1515–1575), accompanied James V. in 1536 to France, and on the latter's death in 1542 was, in consequence of his position as next successor to the throne after the infant Mary, proclaimed protector of the realm and heir-presumptive of the crown, in 1543. He was a zealous supporter of the reformation, authorized the translation and reading of the Scriptures in the vulgar tongue, and at first supported the English policy in opposition to Cardinal Beaton, whom he arrested on the 27th of January 1543, arranging the treaty with England and the marriage of Mary with Prince Edward in July, and being offered by Henry the hand of the princess Elizabeth for his son. But on the 3rd of September he suddenly joined the French party, met Beaton at Stirling, and abjured his religion for Roman Catholicism. On the 13th of January 1544, with Angus, Lennox and others, he signed a bond repudiating the English alliance. In 1544 an attempt was made to transfer the regency from him to Mary of Lorraine, but Arran fortified Edinburgh and her forces retired; in March 1545 a truce was arranged by which each had a share in the government. Meanwhile, immediately on the repudiation of the treaty, war had broken out with England, and Arran was unable either to maintain order within the realm or defend it from outside aggression, the Scots being defeated at Pinkie on the 10th of September 1547. He reluctantly agreed in July 1548 to the marriage of the dauphin with Mary, whom he had designed for his son, to the appeal for French aid, and to the removal of Mary for security to France, and on the 5th of February 1549 was created duke of Châtelherault in Poitou, his eldest son James being henceforth commonly styled earl of Arran. In June 1548 he had also been made a knight of the order of St Michael in France. On the 12th of April 1554 he abdicated in favour of the queen-mother, whose government he supported till after the capture of Edinburgh in October 1559 by the lords of the congregation, when he declared himself on their side and took the Covenant. The same month he was one of the council of the Protestant lords, joined them in suspending Mary of Lorraine from the regency, and was made provisionally one of the governors of the kingdom. In order to discredit him with the English government a letter was forged by his enemies, in which Arran declared his allegiance to Francis II., but the plot was exposed. On the 27th of February 1560 he agreed to the treaty of Berwick with Elizabeth, which placed Scotland under her protection. The death the same year of Francis II. renewed his hopes of a union between his son and Mary, but disappointment drove him into an attitude of hostility to the court. In 1562 he was accused by his son, probably already insane, of plots against Mary's person, and he was obliged to give up Dumbarton Castle. Lennox claimed precedence over Arran in the succession to the throne, on the plea of the latter's supposed illegitimacy, and his restoration to favour in 1564, together with the project of Mary's marriage with Darnley, still further embittered Arran; he refused to appear at court, was declared a traitor, and fled to England, where on his consent to go into exile for five years he received a pardon from Mary. In 1566 he went to France, where he made vain attempts to regain his confiscated duchy. After the murder of Darnley in 1567 he was nominated by Mary on her abdication one of the regents, and he returned to Scotland in 1569 as a strong supporter of her cause. In March in an assembly of nobles called by Murray, he acknowledged James as king, but on the 5th of April he was arrested for not fulfilling the compact, and continued in confinement till April 1570. After Murray's assassination in January 1570, the regency in July was given to Lennox, and in June 1571 Arran assembled a parliament, when it was declared that Mary's abdication was obtained by fear, and the king's coronation was annulled. On the 28th of August he was declared a traitor and "forfeited," but he continued to support Mary's hopeless cause and to appeal for help to France and Spain, in spite of the pillage of his houses and estates, till February 1573, when he acknowledged James's authority and laid down his arms. He died on the 22nd of January 1575. He was by general consent a weak, fickle man, whose birth alone called him to high office. He married Margaret, daughter of James Douglas, 3rd earl of Morton, and had, besides several daughters, four sons: James, who succeeded him as 3rd earl of Arran, John, 1st marquess of Hamilton, David, and Claud, Lord Paisley, ancestor of the dukes of Abercorn.

JAMES HAMILTON, 3rd earl (*c.* 1537–1609), was styled earl of Arran after the creation of his father as duke of Châtelherault in 1549; the latter title did not descend to him, having been resumed by the French crown. His father's ambition destined him for the hand of Mary queen of Scots, and his union with the princess Elizabeth was proposed by Henry VIII. as the price of his father's adherence to the English interest. He was early involved in the political troubles in which Scotland was then immersed. In 1546 he was seized as a hostage at St Andrews by the murderers of Cardinal Beaton and released in 1547. In 1550 he went to France, was given the command of the Scots guards, and in 1557 distinguished himself in the defence of St Quentin. He became a strong adherent of the reformed doctrine. His arrest was ordered by Henry II. in 1559, Mary (probably in consequence of his projected union with Elizabeth which would have raised the Hamiltons higher than the Stuarts) declaring her wish that he should be "used as an arrant traitor." He, however, escaped to Geneva and then to England, and had an interview with Elizabeth in August. He returned to Scotland in September, where he supported his father's adherence to the lords of the Congregation against Mary of Lorraine, upheld the alliance with Elizabeth, and became one of the leaders of the Protestant party in the subsequent fighting, in particular organizing, together with Lord James Stuart (afterwards earl of Murray), in 1560, a stubborn resistance to the French at Dysart, and saving Fife. In November 1559 he had declined Bothwell's challenge to single combat. Subsequently he signed the treaty of Berwick, became one of the lords of the Congregation, and was appointed a visitor for the destruction of the religious houses. The same year proposals were again made for his marriage with Elizabeth, which were rejected by the latter in 1561; and subsequently after the death of Francis II. (in December 1560), he became, with the strong support of the Protestants and Hamiltons, a suitor for Mary, also without success. He was chosen a member of her council on her arrival in Scotland in 1561, but took up a hostile attitude to the court in consequence of the practice of the Roman Catholic religion. He now showed marked signs of insanity, and was confined in Edinburgh Castle, where he remained till May 1566. He had then lost the power of speech, and from 1568 he lived in retirement with his mother at Craignethan Castle, while his estates were administered by his brother John, afterwards 1st marquess of Hamilton. In 1579, at the time of the fresh prosecution of the Hamiltons, when the helpless Arran was also included in the attainder of his brothers and his titles forfeited, the castle was besieged on the pretence of delivering him from unlawful confinement, and Arran and his mother were brought to Linlithgow, while the charge of his estates was taken over by the government. In 1580 James Stewart (see below) was appointed his guardian, and in 1581 acquired the earldom; but his title and estates were restored after Stewart's disgrace in 1586, when the forfeiture was repealed. Arran died unmarried in March 1609, the title devolving on his nephew James, 2nd marquess of Hamilton.

James Stewart (d. 1595), the rival earl of Arran above referred to, was the son of Andrew Stewart, 2nd Lord Ochiltree. He served in his youth with the Dutch forces in Holland against the Spanish, and returned to Scotland in 1579. He immediately became a favourite of the young king, and in 1580 was made gentleman of the bedchamber and tutor of his cousin, the 3rd earl of Arran. The same year he was the principal accuser of the earl of Morton, and in 1581 was rewarded for having accomplished the latter's destruction by being appointed a member of the privy council, and by the grant the same year, to the prejudice of his ward, of the earldom of Arran and the Hamilton estates, on the pretence that the children of his grandmother's father, the 1st earl of Arran, by his third wife, from whom sprang the succeeding earls of Arran, were illegitimate. He claimed the position of second person in the kingdom as nearest to the king by descent. The same year he married Elizabeth, daughter of John Stewart, earl of Atholl, and wife of the earl of March, after both had been compelled to undergo the discipline of the kirk on account of previous illicit intercourse. He became the rival of Lennox for the chief power in the kingdom, but both were deprived of office by the raid of Ruthven on the 22nd of August 1582, and Arran was imprisoned till September under the charge of the earl of Gowrie. In 1583, however, he assembled a force of 12,000 men against the new government; the Protestant lords escaped over the border, and Arran, returning to power, was made governor of Stirling Castle and in 1584 lord chancellor. The same year Gowrie was captured through Arran's treachery and executed after the failure of the plot of the Protestant lords against the latter's government. He now obtained the governorship of Edinburgh Castle and was made provost of the city and lieutenant-general of the king's forces. Arran induced the English government to refrain from aiding the banished lords, and further secured his power by the forfeitures of his opponents. His tyranny and insolence, however, stirred up a multitude of enemies and caused his rapid fall from power. His agent in England, Patrick, Master of Gray, was secretly conspiring against him at Elizabeth's court. On account of the murder of Lord Russell on the border in July 1585, of which he was accused by Elizabeth, he was imprisoned at the castle of St Andrews, and subsequently the banished lords with Elizabeth's support entered Scotland, seized the government and proclaimed Arran a traitor. He fled in November, and from this time his movements are furtive and uncertain. In 1586 he was ordered to leave the country, but it is doubtful whether he ever quitted Scotland. He contrived secretly to maintain friendly communications with James, and in 1592 returned to Edinburgh, and endeavoured unsuccessfully to get reinstated in the court and kirk. Subsequently he is reported as making a voyage to Spain, probably in connexion with James's intrigues with that country. His unscrupulous and adventurous career was finally terminated towards the close of 1595 by his assassination near Symontown in Lanarkshire at the hands of Sir James Douglas (nephew of his victim the earl of Morton), who carried his head in triumph on the point of a spear through the country, while his body was left a prey to the dogs and swine. He had three sons, the eldest of whom became Lord Ochiltree.

ARRAN, the largest island of the county of Bute, Scotland, at the mouth of the Firth of Clyde. Its greatest length, from the Cock of Arran to Bennan Head, is about 20 m., and the greatest breadth—from Drumadoon Point to King's Cross Point—is 11 m. Its area is 105,814 acres or 165 sq. m. In 1891 its population was 4824, in 1901, 4819 (or 29 persons to the sq. m.). In 1901 there were 1900 persons who spoke English and Gaelic and nine Gaelic only. There is daily winter communication with Brodick and Lamlash by steamer from Ardrossan, and in summer by many steamers which call not only at these piers, but at Corrie, Whiting Bay and Loch Ranza.

The chief mountains are in the north. The highest is Goatfell (2866 ft., the name said to be a corruption of the Gaelic *Goadh Bhein*, " mountain of the winds "). Others are Caistel Abhail (2735 ft., " peaks of the castles "), Beinn Tarsuinn (2706 ft.), Cir Mhor (2618 ft.) and Beinn Nuis (2597 ft.). In the south Tighvein (1497 ft.) and Cnoc Dubh (1385 ft.) are the most important. Owing to the mountainous character of the island, glens are numerous. Glen Rosa and Glen Sannox are remarkable for their wild beauty, and among others are Iorsa, Catacol, Chalmadale, Cloy, Shant, Shurig, Tuie, Clachan, Monamore, Ashdale (with two cascades) and Scorrodale. Excepting Loch Tanna, the inland lakes are small. Loch Ranza, an arm of the sea, is one of the most beautiful in Scotland. The streams, or " waters " as they are called, are nearly all hill burns, affording good fishing.

The oldest rocks, consisting of slate, mica-schists and grits, which have been correlated with the metamorphic series of the eastern Highlands, form an incomplete ring round the granite in the north of the island and occupy the whole of the west coast from Loch Ranza south to Dougrie. On the east side in North Glen Sannox Burn, they are associated with cherts, grits and dark schists with pillowy lavas, tuffs and agglomerates which, on lithological grounds, have been regarded as probably of the same age as the Arenig cherts and volcanic rocks in the south of Scotland. The Lower Old Red Sandstone strata are separated from the foregoing series by a fault and form a curving belt extending from Corloch on the east coast south by Brodick Castle to Dougrie on the west shore. Consisting of red sandstones, mudstones and conglomerates, they are inclined at high angles usually away from the granite massif and the encircling metamorphic rocks. They are associated with a thin band of lava visible on the west side of the island near Auchencar and traceable inland to Garbh Thorr. The Upper Old Red Sandstone, composed of red sandstone and conglomerates, is only sparingly developed. The strata occur on the east shore between the Fallen Rocks and Corrie, and they appear along a narrow strip to the east and south of the lower division of the system, between Sannox Bay and Dougrie. On the north side of North Glen Sannox they rest unconformably on the Lower Old Red rocks. Contemporaneous lavas, highly decomposed, are intercalated with this division on the north side of North Glen Sannox where the band is highly faulted. The Carboniferous rocks of Arran include representatives of the Calciferous Sandstone, the three subdivisions of the Carboniferous Limestone series, and to a small extent the Coal Measures, and are confined to the north part of the island. They appear on the east coast between the Fallen Rocks and the Cock of Arran, where they form a strip about a quarter of a mile broad, bounded on the west by a fault. Here there is an ascending sequence from the Calciferous Sandstone, through the Carboniferous Limestone with thin coals formerly worked, to the Coal Measures, the strata being inclined at high angles to the north. On the south side of a well-marked anticline in the Upper Old Red Sandstone at North Sannox, the Carboniferous strata reappear on the coast with a south dip showing a similar ascending sequence for about half a mile. The lower limestones are well seen at Corrie, but the thin coals are not there represented. From Corrie they can be traced southwards and inland to near the head of Ben Lister Glen. The small development of Upper Carboniferous strata, visible on the shore south of Corrie and in Ben Lister Glen, consists of sandstones, red and mottled clays and purple shales, which yield plant-remains of Upper Carboniferous facies. These may represent partly the Millstone Grit and partly the Coal Measures. Contemporaneous volcanic rocks, belonging to three stages of the Carboniferous formation, occur in Arran. The lowest group is on the horizon of the Calciferous Sandstone series, being visible at Corrie where it underlies the Corrie limestone, and is traceable southwards beyond Brodick. The second is represented by a thin lava, associated with the Upper Limestone group of the Carboniferous Limestone series, and the highest is found in Ben Lister Glen intercalated with the Upper Carboniferous strata, and may be the equivalent of the volcanic series which, in Ayrshire, occupies the position of the Millstone Grit. The Triassic rocks are arranged in two groups, a lower, composed of conglomerates and sandstones, and an upper one consisting of red and mottled shales and marls with thin sandstones and nodular limestones. In the extreme north at the Cock of Arran, there is a small development of these beds; they also occupy the whole of the east coast south of Corrie, and they spread over the south part of the island south of a line between Brodick Bay and Machrie Bay on the west. At Corrie and the Cock of Arran they rest on Upper Carboniferous strata; in Ben Lister Glen, on the lower limestone group of the Carboniferous Limestone series; and on the west coast they repose on the Old Red Sandstone. There is, therefore, a clear discordance between the Trias and all older strata in Arran. The former extension of Rhaetic, Liassic and Cretaceous formations in the island is indicated by the presence of fragments of these strata in a large volcanic vent on the plateau, on the south side of the road leading from Brodick to Shiskine. The fossils from the Rhaetic beds belong to the *Avicula contorta* zone, those from the Lias to the *Ammonites angulatus* zone, while the blocks of limestone with chert contain *Inoceramus*, Cretaceous foraminifera and other organisms. The materials yielding these fossils are embedded in a course volcanic agglomerate which gives rise to crags and is pierced by acid and basic igneous rocks. One of the striking features in the geology of Arran is the remarkable series of intrusive igneous rocks of Tertiary age which occupy nearly one-half of the area and form the wildest and grandest scenery in the island. Of these the most important is the great oval mass of granite in the North, composed of two varieties; one, coarse-grained and older, forms the outside rim, while the fine-grained and newer type occurs in the interior. Another granite area appears on the south side of the road between Brodick and Shiskine, where it is associated with granophyre and quartz-diorite and traverses the volcanic vent of post-Cretaceous or Tertiary age already described. In the south of the island there are sills and dykes of felsite, quartz-porphyry, rhyolite, trachyte and pitchstone. The felsite sheets are well represented in Holy Island. It is worthy of note that the dykes and sheets of felsite are seldom pierced by the basalt dykes and are probably about the most recent of the intrusive rocks. The best example of the basic sills forms the Clauchland Hills and runs out to sea at Clauchland Point. Finally the basic dykes of dolerite, basalt and augite-andesite are abundant and traverse the various sedimentary formations and the granite.

The chief crops are oats and potatoes. Cattle and sheep are raised in considerable numbers. The game, which is abundant, consisting of blackcock and grouse, is strictly preserved. A few red deer still occur in the wilder hilly district. The fisheries are of some value, Loch Ranza being an important station.

Standing stones, cairns and other memorials of a remote antiquity occur near Tormore, on Machrie Bay, Lamlash, and other places. The Norse raiders found a home in Arran for a long period until the defeat of Haakon V. at Largs (1263) compelled them to retire. The chief name in the island's history is that of Robert Bruce, who found shelter in the King's Caves on the western coast. One was reputed to be his kitchen, another his cellar, a third his stable, while the hill above was styled the King's Hill. From a point still known as King's Cross he crossed over to Carrick, in answer to the signal which warned him that the moment for the supreme effort for his country was come. In Glen Cloy the ruins of a fort bear the name of Bruce's Castle, in which his men lay concealed, and on the southern arm of Loch Ranza stands a picturesque ruined castle which is said to have been his hunting-seat. Kildonan Castle, near the south-easternmost point, is a fine ruin of the 14th century, once a royal stronghold. The island gave the title of earl to Thomas Boyd, who married the elder sister of James III., a step so unpopular with his peers that he had to fly the country, and the title soon afterwards passed to the Hamiltons. Brodick Castle, the ancestral seat of the dukes of Hamilton, is a splendid mansion on the northern shore of Brodick Bay.

Brodick is the chief village in Arran, but most of the dwelling-houses have been built at Invercloy, close to the pier. Three m. south (by road) is Lamlash, on a fine bay so completely sheltered by Holy Island as to form an excellent harbour for ships of all sizes. Four m. to the north lies the village of Corrie which takes its name from a rugged hollow in the hill of Am Binnein (2172 ft.) which overshadows it. Daniel Macmillan (1813–1857), the founder of the publishing firm of Macmillan & Co., was a native of Corrie.

About a mile and a half east of Lamlash village lies Holy Island, which forms a natural breakwater to the bay. It is 1¾ m. long, nearly ¾ m. wide, and its finely-marked basaltic cone rises to a height of 1030 ft. The island takes its name from the fact that St Molios, a disciple of St Columba, founded a church near the north-western point. In the saint's cave on the shore may be seen the rocky shelf on which he made his bed, but his remains were interred in the hamlet of Clachan, some 2 m. from Blackwaterfoot. Off the south-eastern coast, ¾ m. from Port Dearg, lies the pear-shaped isle of Pladda, which serves as the telegraph station from which the arrival of vessels in the Clyde is notified to Glasgow and Greenock.

ARRANT (a variant of "errant," from Lat. *errare*, to wander), a word at first used in its original meaning of wandering, as in "knight-errant," thus an arrant or itinerant preacher, an arrant thief, one outlawed and wandering at large; the meaning easily passed to that of self-declared, notorious, and by the middle of the 16th century was confined, as an intensive adjective, to words of opprobrium and abuse, an arrant coward meaning thus a self-declared, downright coward.

ARRAS, a city of northern France, chief town of the department of Pas-de-Calais, 38 m. N.N.E. of Amiens on the Northern railway between that city and Lille. Pop. (1906) 20,738. Arras is situated in a fertile plain on the right and southern bank of the Scarpe, at its junction with the Crinchon which skirts the town on the south and east. Of the fortifications erected by Vauban in the 17th century, only a gateway and the partially dismantled citadel, nicknamed *la Belle Inutile*, are left. The most interesting quarter lies in the east of the town, where the lofty houses which border the spacious squares known as the Grande and the Petite Place are in the Flemish style. They are built with their upper storeys projecting over the footway and supported on columns so as to form arcades; beneath these are deep cellars extending under the squares themselves. The celebrated hôtel de ville of the 16th century overlooks the Petite Place; its belfry, which contains a fine peal of bells, rises to a height of 240 ft. The decoration is in the richest Gothic style, and is especially admirable in the case of the windows. Of the numerous ecclesiastical buildings the cathedral, a church of the 18th century possessing some good pictures, is the most important. It occupies the site of the church of the abbey of St Vaast, the buildings of which adjoin it and contain the bishop's palace, the ecclesiastical seminary, a museum of antiquities, paintings and sculptures, and a rich library.

Arras is the seat of a prefect and of a bishop. It has tribunals of first instance and of commerce, a chamber of commerce, a branch of the Bank of France, a communal college, training colleges, and a school of military engineering. Its industrial establishments include oil-works, dye-works and breweries, and manufactories of hosiery, railings and other iron-work, and of oil-cake. For the tapestry manufacture formerly flourishing at Arras see Tapestry. It has a very important market for cereals and oleaginous grains. The trade of the town is facilitated by the canalization of the Scarpe, the basin of which forms the port.

Before the opening of the Christian era Arras was known as *Nemetacum*, or *Nemetocenna*, and was the chief town of the Atrebates, from which the word Arras is derived. Passing under the rule of the Romans, it became a place of some importance, and traces of the Roman occupation have been found. In 407 it was destroyed by the Vandals, and having been partially rebuilt, came into the hands of the Franks. Christianity was introduced by St Vedast (Vaast), who founded a bishopric at Arras about 500. This was soon transferred to Cambrai, but brought back to its original seat about 1100. As the chief town of the province of Artois, Arras passed to Baldwin I., count of Flanders, in 863, and about 880 was ravaged by the Normans. During this troubled period it retained some vestiges of its former trade, and the woollen manufacture was established here at an early date. Early in the 12th century a commune was established here, but the earliest known charter only dates from about 1180; owing to the importance of Arras, this soon became a model for many neighbouring communes. At this time the city appears to have been divided into two parts, one dependent upon the bishop, and the other upon the count. When Philip Augustus, king of France, married Isabella, niece of Philip, count of Flanders, Arras came under the rule of the French king, who confirmed its privileges in 1194. As part of Artois it came in 1237 to Robert, son of Louis VIII., king of France, and in 1384 to Philip the Bold, duke of Burgundy, who promised to respect its privileges. Anxious to recover the city for France, Louis XI. placed a garrison therein after the death of Charles the Bold, duke of Burgundy, in 1477. This was driven out by the inhabitants, and Louis then stormed Arras, razed the walls, deported the citizens, whose places were taken by Frenchmen, and changed the name to *Franchise*. The successor of Louis, Charles VIII., restored the city to its former name and position, and as part of the inheritance of Mary, daughter and heiress of Charles the Bold, it was contended for by the French king, and his rival, the German king, Maximilian I. The peace of Senlis in 1493 gave Arras to Maximilian, and in spite of attacks by the French, it remained under the rule of the Habsburgs until 1640. Taken in this year by the French, this capture was ratified by the peace of the Pyrenees in 1659, and henceforward it remained part of France. It suffered severely during the French Revolution, especially from Joseph Lebon, who, like the brothers Maximilien and Augustin Robespierre, was a native of the town. Owing to its position and importance, Arras has been the scene of various treaties. In 1414 the peace between the Armagnacs and the Burgundians was made here, and in 1435 a congress met here to make peace between the English and their Burgundian allies on the one side, and the French on the other, and after the English representatives had withdrawn, a treaty was signed on the 20th of September between France and Burgundy. In 1482 Louis XI. made a treaty here with the estates and towns of Flanders about the inheritance of Mary of Burgundy, wife of the German king Maximilian I.

See E. Lecesne, *Histoire d'Arras jusqu'en 1789* (Arras, 1880); *Arras sous la Révolution* (Arras, 1882–1883).

ARRAY (from the O. Fr. *areyer*, Med. Lat. *arredare*, to get ready), an orderly arrangement, particularly the drawing up of an army in position of battle. From the 13th century onwards in England "Commissions of Array" issued from the king for the levy of military forces (see Militia). In English law the term is used for the setting in order, name by name, of the panel of a jury, which may be challenged as a whole, "to the array," or individually, "to the polls."

ARRENOTOKOUS, ARRENOTOKY (from Gr. ἄρρην, male, and τόκος, from τίκτειν, to beget), biological terms proposed by Leuckart and Eduard von Siebold to denote those parthenogenetic females which produce male young, while "thelytokous" and "thelytoky" would denote their producing female young.

ARREST (Fr. *arrester*, *arrêter*, to stop or stay), the restraint of a man's person, for the purpose of compelling him to be obedient to the law. It is defined to be the execution of the command of some court of record or officer of justice.

Arrests in England are either in civil or in criminal cases.

I. *In Civil Cases.*—The arrest must be by virtue of a precept or order out of some court, and must be effected by corporal seizing or touching the defendant's body, or as directed by the writ, *capias et attachias*, take and catch hold of. And if the defendant make his escape it is a *rescous*, or rescue, and attachment may be had against him, and the bailiff may then justify the breaking open of the house in which he is, to carry him away.

Arrests on mesne process (see Process), before judgment obtained, were abolished by the Debtors Act 1869, s. 6; an exception, however, is made in cases in which the plaintiff proves, at any time before final judgment, by evidence on oath to the satisfaction of a judge of one of the superior courts, that he has a good cause of action to the amount of £50, that the defendant is about to quit the country, and that his absence will materially prejudice the plaintiff in prosecuting his action. In such cases an order for arrest may be obtained till security to the amount of the claim be found.

Formerly a judgment creditor might arrest his debtor under a writ of *capias ad satisfaciendum*, but since 1869 imprisonment for debt has been abolished in England, except in certain cases, and in these the period of detention must not exceed one year.

The following persons are privileged from arrest, viz., 1st, members of the royal family and the ordinary servants of the king or queen regnant, chaplains, lords of the bedchamber, &c. This privilege does not extend to servants of a consort queen or dowager. 2nd, peers of the realm, peeresses by birth, creation or marriage, Scottish and Irish peers and peeresses. 3rd, members of the House of Commons during the session of parliament, and for a convenient time (forty days) before and after it. Members of Convocation appear to have the same privilege. 4th, foreign ambassadors and their "domestics and domestic servants." Temporary privilege from arrest in civil process is enjoyed by barristers travelling on circuit, by parties, witnesses or attorneys connected with a cause, and by clergymen whilst performing divine service.

The arrest of any privileged person is irregular *ab initio*, and the party may be discharged on motion. The only exception is as to indictable crimes, such as treason, felony and breach of the peace.

There are no longer any places where persons are privileged from arrest, such as the Mint, Savoy, Whitefriars, &c., on the ground of their being ancient palaces.

Except in cases of treason, felony or breach of the peace, an arrest cannot be made on a Sunday, and if made it is void (Sunday Observance Act 1677); but it may be made in the night as well as in the day.

II. *In Criminal Cases.*—All persons whatsoever are, without distinction, equally liable to this arrest, and any man may arrest without warrant or precept, and outer doors may be broken open for that purpose. The arrest may be made,—1st, by warrant; 2nd, by an officer without warrant; 3rd, by a private person without warrant; or, 4th, by a hue and cry.

1. Warrants are ordinarily granted by justices of the peace on information or complaint in writing and upon oath, and they must be indorsed when it is intended they should be executed in another county by a magistrate of that county (see Indictable Offences Act 1848). A warrant issued by a metropolitan police magistrate can be executed anywhere by a metropolitan police officer. Warrants are also granted in cases of treason or other offence affecting the government by the privy council, or one of the secretaries of state, and also by the chief or other justice of the court of king's bench (*bench-warrant*) in cases of felony,

misdemeanour or indictment found, or criminal information granted in that court. Every warrant ought to specify the offence charged, the authority under which the arrest is to be made, the person who is to execute it and the person who is to be arrested. A warrant remains in force till executed or discharged by order of a court. An officer may break open doors in order to execute a warrant in cases of treason, felony or indictable offences, provided that, on demand, admittance cannot otherwise be obtained. (See WARRANT.)

2. The officers who may arrest without warrant are,—justices of the peace, for felony or breach of the peace committed in their presence; the sheriff and the coroner in their county, for felony; constables, for treason, felony or breach of the peace committed in their view,—and within the metropolitan police district they have even larger powers (Metropolitan Police Acts 1829–1895).

3. A private person is bound to arrest for a felony committed in his presence, under penalty of fine and imprisonment. By the Prevention of Offences Act 1851, a private person is allowed to arrest any one whom he finds committing an indictable offence by night, and under the Malicious Damage Act 1861, any person committing an offence against that act may be arrested without warrant by the owner of the property damaged, or his servants, or persons authorized by him. So, too, by the Coinage Offences Act 1861, s. 31, any person may arrest any one whom he shall find committing any offence relating to the coin, or other offence against that act.

A person arrested without warrant must not be detained in private custody but must be taken with all convenient speed to a police station or justice and there charged (Summary Jurisdiction Act 1879).

4. The arrest by hue and cry is where officers and private persons are concerned in *pursuing* felons, or such as have dangerously wounded others. By the Fugitive Offenders Act 1881, provision was made for the arrest in the United Kingdom of persons committing treason, and felony in any of the British colonies and vice versa; as to the arrest of fugitives in foreign countries see EXTRADITION.

The remedy for a wrongful arrest is by an action for false imprisonment.

In Scotland the law of arrest in criminal procedure has a general constitutional analogy with that of England, though the practice differs with the varying character of the judicatories. Colloquially the word arrest is used in compulsory procedure for the recovery of debt; but the technical term applicable in that department is *caption*, and the law on the subject is generically different from that of England. There never was a practice in Scottish law corresponding with the English arrest in mesne process; but by old custom a warrant for caption could be obtained where a creditor made oath that he had reason to believe his debtor meditated flight from the country, and the writ so issued is called a warrant against a person *in meditatione fugae*. Imprisonment of old followed on ecclesiastical cursing, and by fiction of law in later times it was not the creditor's remedy, but the punishment of a refractory person denounced rebel for disobedience to the injunctions of the law requiring fulfilment of his obligation. The system was reformed and stripped of its cumbrous fictions by an act of the year 1837. Although the proceedings against the person could only follow on completed process, yet, by a peculiarity of the Scottish law, documents executed with certain formalities, and by special statute bills and promissory notes, can be registered in the records of a court for execution against the person as if they were judgments of the court.

The general principles as to the law of arrest in most European countries correspond more or less exactly to those prevailing in England.

An *arrest of a ship*, which is the method of enforcing the admiralty process *in rem*, founded either on a maritime lien or on a claim against the ship, is dealt with under ADMIRALTY JURISDICTION.

See also article ATTACHMENT.

Arrest of Judgment is the assigning just reason why judgment should not pass, notwithstanding verdict given, either in civil or in criminal cases, and from intrinsic causes arising on the face of the record.

United States.—The law of arrest assimilates to that existing in England. Actual manual touching is not necessary (*Pike* v. *Hanson*, 9 N.H. 491; *Hill* v. *Taylor*, 50 Mich. 549); words of arrest by the officer, not protested against and no resistance offered, are sufficient (*Emery* v. *Chesley*, 18 N.H. 198; *Goodell* v. *Tower*, 1904, 58 Am. Rep. 790). Words of arrest, staying over night at prisoner's house, going with him before the magistrate next day constitute arrest (*Courtery* v. *Dozier*, 20 Ga. 369). Restraining a person in his own house is arrest.

In civil cases in most of the states arrest for debt is abolished, except in cases of fraud or wilful injury to persons or property by constitutional provision or by statute. One arrested under process of a federal court cannot be arrested under that of a state court for the same cause. There is no provision in the United States constitution as to imprisonment for debt, but congress has enacted (in Rev. Stat., s. 990) that all the provisions of the law of any state applicable to such imprisonment shall apply to the process of federal courts in that state. A woman can be arrested in New York for wilful injury to person, character or property, and in certain other cases (Code, s. 553). The president, federal officials, governors of states, members of congress and of state legislatures (during the session), marines, soldiers and sailors on duty, voters while going to and from the polls, judges, court officials (1904, 100 N.W. 591), coroners and jurors while attending upon their public duties, lawyers, parties and witnesses while going to, attending or returning from court, and generally married women without separate property, are exempt from arrest.

In criminal cases a bench-warrant in New York may be served in any county without being backed by a magistrate (Code Crim. Proc., s. 304). In Nebraska one found violating the law may be arrested and detained until a legal warrant can be issued (Crim. Code, s. 283). A bail may lawfully recapture his principal (1905) 121 Georgia Rep. 594. Foreign ambassadors and ministers and their servants are exempt from arrest. Exemption from arrest is a privilege, not of the court, as in England, but of the person, and can be waived (*Petrie* v. *Fitzgerald*, 1 Daly 401).

ARRESTMENT, in Scots law, the process by which a creditor detains the goods or effects of his debtor in the hands of third parties till the debt due to him shall be paid. It is divided into two kinds: (1) Arrestment in security, used when proceedings are commencing, or in other circumstances where a claim may become, but is not yet, enforceable; and (2) Arrestment in execution, following on the decree of a court, or on a registered document, under a clause or statutory power of registration, according to the custom of Scotland. By the process of arrestment the property covered is merely retained in place; to realize it for the satisfaction of the creditor's claim a further proceeding called "furthcoming" is necessary. By old practice, alimentary funds, *i.e.* those necessary for subsistence, were not liable to arrestment. By the Wages Arrestment Limitation (Scotland) Act 1870, the wages of all labourers, farm-servants, manufacturers, artificers and work-people are not arrestable except (1) in so far as they exceed 20s. per week; but the expense of the arrestment is not to be charged against the debtor unless the sum recovered exceed the amount of the said expense; or (2) under decrees for alimentary allowances and payments, or for rates and taxes imposed by law.

ARRETIUM (mod. *Arezzo*), an ancient city of Etruria, in the upper valley of the Arno, situated on the Via Cassia, 50 m. S.E. of Florentia. The site of the original city is not quite certain; some writers place it on the isolated hill called Poggio di S. Cornelio, 2½ m. to the S.E., where remains of a fortified *enceinte* still exist (cf. F. Noack in *Römische Mitteilungen*, 1897, p. 186); while others maintain, and probably rightly, that it occupied the hill at the summit of the modern town, where the medieval citadel (*fortezza*) was erected, and which was enclosed by an ancient wall. Numerous Etruscan tombs have been discovered within the lower portion of the area of the modern town, which appears to correspond in site with the Roman (*C.I.L.* xi. p. 1082; G. Gamurrini in *Notizie degli scavi*, 1883, 262; 1887, 437). Vitruvius (ii. 8. 9) and Pliny (*Nat. Hist.* xxxv. 173) speak of the strength of its walls of bricks, but these have naturally disappeared. Many remains of Roman buildings have been discovered within the modern town, and the amphitheatre is still visible in the southern angle. Arretium appears as one of the cities which aided the Tarquins after their expulsion. It was an opponent of Rome at the end of the 4th and beginning of the 3rd century B.C., but soon sought for help against the attacks of the Gauls, against whom it was almost a frontier fortress. It was an important Roman base during the Hannibalic wars (though at one time it threatened defection—Livy xxvii. 21-24); and in 205 B.C. was able to furnish Scipio with a considerable quantity of arms and provisions (Livy xxviii. 45). In 187 B.C. the high road was extended as far as Bononia. Arretium took the part of Marius against Sulla, and the latter settled some of his veterans there as colonists. Caesar, or Octavian, added others, so that there are three classes, *Arretini veteres*, *Fidentiores*, and *Iulienses*. A considerable contingent from Arretium joined Catiline and in 49 B.C. Caesar occupied it. C. Maecenas[1] was perhaps a native of Arretium. Its fertility was famous in ancient times, and still more the red pottery made of the local clay, with its imitation of chased silver. The reliefs upon it are sometimes of considerable beauty, and large quantities of it, and the sites of several of the kilns, have been discovered in and near Arretium. It was also considerably exported. See *Corp. Inscrip. Lat.* xi. (Berlin, 1901) p. 1081, and *Notizie degli scavi*, *passim* (especially, 1884, 369, for the discovery of a fine group of the moulds from which these vases were made). The museum contains a very fine collection of these and a good collection of medieval majolica. (T. As.)

ARRHENIUS, SVANTE AUGUST (1859-), Swedish physicist and chemist, was born on the 19th of February 1859, at Schloss Wijk, near Upsala. He studied at Upsala from 1876 to 1881 and at Stockholm from 1881 to 1884, then returning to Upsala as privat-docent in physical chemistry. He spent two years from 1886 to 1888 in travelling, and visited Riga Polytechnic and the universities of Würzburg, Graz, Amsterdam and Leipzig. In 1891 he was appointed lecturer in physics at Stockholm and four years later became full professor. Arrhenius is specially associated with the development of the theory of electrolytic dissociation, and his great paper on the subject, *Recherches sur la conductibilité galvanique des électrolytes*—(1) *conductibilité galvanique des solutions aqueuses extrêmement diluées*, (2) *théorie chimique des électrolytes*, was presented to the Stockholm Academy of Sciences in 1883. He was subsequently continuously engaged in extending the applications of the doctrine of electrolytic conduction in relation not only to the problems of chemical action but also, on the supposition that in certain conditions the air conducts electrolytically, to the phenomena of atmospheric electricity. In 1900 he published a *Lärobok i teoretik elektrokemi*, which was translated into German and English, and his *Lehrbuch der kosmischen Physik* appeared in 1903. In 1904 he delivered at the university of California a course of lectures, the object of which was to illustrate the application of the methods of physical chemistry to the study of the theory of toxins and antitoxins, and which were published in 1907 under the title *Immunochemistry*. In his *Worlds in the Making* (1908), an English translation of *Das Werden der Welten* (1907), he combated the generally accepted doctrine that the universe is tending to what Clausius termed *Wärmetod* through exhaustion of all sources of heat and motion, and suggested that by virtue of a mechanism which maintains its available energy it is self-renovating, energy being "degraded" in bodies which are in the solar state, but "elevated" or raised to a higher level in bodies which are in the nebular state. He further put forward the conception that life is universally diffused, constantly emitted from all habitable worlds in the form of spores which traverse space for years or ages, the majority being ultimately destroyed by the heat of some blazing star, but some few finding a resting-place on bodies which have reached the habitable stage.

ARRIA, in Roman history, the heroic wife of Caecina Paetus. When her husband was implicated in the conspiracy of Scribonianus against the emperor Claudius (A.D. 42), and condemned to death, she resolved not to survive him. She accordingly stabbed herself with a dagger, which she then handed to him with the words, "Paetus, it does not hurt" (*Paete, non dolet*; see Pliny, *Epp.* iii. 16; Martial i. 14; Dio Cassius lx. 16). Her daughter, also called Arria, was the wife of Thrasea Paetus. When he was condemned to death by Nero, she would have imitated her mother's example, but was dissuaded by her husband, who entreated her to live for the sake of their children. She was sent into banishment (Tacitus, *Annals*, xvi. 34).

ARRIAN (FLAVIUS ARRIANUS), of Nicomedia in Bithynia, Greek historian and philosopher, was born about A.D. 96, and lived during the reigns of Hadrian, Antoninus Pius and Marcus Aurelius. In recognition of his abilities, he received the citizenship of both Athens and Rome. He was greatly esteemed by Hadrian, who appointed him governor (*legatus*) of Cappadocia (131–137), in which capacity he distinguished himself in a campaign against the Alani. This is the only instance before the 3rd century in which a first-rate Roman military command was given to a Greek. Arrian spent a considerable portion of his time at Athens, where he was archon 147–148. With his retirement or recall from Cappadocia his official career came to an end. In his declining years, he retired to his native place, where he devoted himself to literary work. He died about 180. His biography, by Dio Cassius, is lost.

When young, Arrian was the pupil and friend of Epictetus, who had probably withdrawn to Nicopolis, when Domitian expelled all philosophers from Rome. He took verbatim notes of his teacher's lectures, which he subsequently published under the title of *The Dissertations* (Διατριβαί), in eight books, of which the first four are extant and constitute the chief authority for Stoic ethics, and *The Encheiridion* (*i.e.* Manual) *of Epictetus*, a handbook of moral philosophy, for many years a favourite instruction book with both Christians and pagans. It was adapted for Christian use by St Nilus of Constantinople (5th century), and Simplicius (about 550) wrote a commentary on it which we still possess.

The most important of Arrian's original works is his *Anabasis of Alexander*, in seven books, containing the history of Alexander the Great from his accession to his death. Arrian's chief authorities were, as he tells us, Aristobulus of Cassandreia and Ptolemy, son of Lagus (afterwards king of Egypt), who both accompanied Alexander on his campaigns. In spite of a too indulgent view of his hero's defects, and some over-credulity, Arrian's is the most complete and trustworthy account of Alexander that we possess.

Other extant works of Arrian are: *Indica*, a description of India in the Ionic dialect, including the voyage of Nearchus, intended as a supplement to the *Anabasis*; *Acies Contra Alanos*, a fragment of importance for the knowledge of Roman military affairs; *Periplus of the Euxine*, an official account written (131) for the emperor Hadrian; *Tactica*, attributed by some to Aelianus, who wrote in the reign of Trajan; *Cynegeticus*, a treatise on the chase, supplementing Xenophon's work on the same subject; the *Periplus of the Erythraean Sea*, attributed to him, is by a later compiler. Amongst his lost works may be mentioned: Τὰ μετ' Ἀλέξανδρον, a history of the period succeeding Alexander, of which an epitome is preserved in Photius; histories of Bithynia, the Alani and the Parthian wars under Trajan; the lives of Timoleon of Syracuse, Dion of Syracuse and a famous brigand named Timoleon. Arrian's style is simple, lucid and manly; but his language, though pure, presents some peculiarities. He was called "Xenophon the younger" from his imitation of that writer, and he even speaks of himself as Xenophon.

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[1] The name Cilnius was apparently never borne by Maecenas himself, though he is so described, *e.g.* by Tacitus, *Ann.* vi. 11, cf. Macrob. ii. 4, 12. The Cilnii with whom Maecenas was connected were a noble Etruscan family.

Complete works ed. F. Dübner (1846); *Anabasis*, C. Abicht (1889); with notes, C. W. Krüger (1835), C. Sintenis (1867), C. Abicht (1875); *Scripta Minora*, R. Hercher and A. Eberhard (1885); A. J. Roos, i., containing the *Anabasis* (Teubner series, 1907). English translations: *Anabasis*, Rooke (1812); *Anabasis* and *Indica*, E. J. Chinnock (1893); *Voyage of Nearchus* with the spurious *Periplus*, W. Vincent (1807), J. W. M'Crindle (Calcutta, 1879); *Periplus of the Euxine*, W. Falconer (1805); *Cynegeticus* [W. Dansey] (1831). See also E. Bolla, *Arriano di Nicomedia* (1890); E. Schwartz in Pauly-Wissowa's *Realencyclopädie der classischen Altertumswissenschaft* (1896); H. F. Pelham, "Arrian as Legate of Cappadocia," in *English Historical Review*, October 1896; article GREECE: *History, ancient*, "Authorities."

ARRIS (Fr. *areste*, or *arête*), in architecture, the sharp edge or angle in which two sides or surfaces meet.

ARRONDISSEMENT (from *arrondir*, to make round), an administrative subdivision of a department in France. Dating nominally from 1800, the arrondissement was really a re-creation of the "district" of 1790. It comprises within itself the canton and the commune. It differs from the department and from the commune in being merely an administrative division and not a complete legal personality with power to acquire and possess. The purposes for which it exists are, again, unlike those of the department and the commune, comparatively limited. It is the electoral district for the chamber of deputies, each arrondissement returning one member; if the population is in excess of 100,000 it is divided into two or more constituencies. It is also a judicial district having a court of first instance. It is under the control of a sub-prefect. There are 362 arrondissements in the 87 departments. Each arrondissement has a council, with as many members as there are cantons, whose function is to subdivide among the communes their *quota* of the direct taxes charged to the arrondissement by the general council of the department. (See FRANCE.) Somewhat different from the arrondissements of the department are the arrondissements (20 in number) into which Paris is divided. They bear a certain resemblance to the sub-municipalities created in London by the London Government Act 1899, and each forms a local administrative unit (see PARIS).

France is also subdivided, for purposes of defence, into five *maritime* divisions, termed arrondissements. Instituted originally under the Consulate, they were suppressed in 1815, but re-established again in 1826. They are under the direction of maritime prefects, who, by a decree of 1875, must be vice-admirals in the navy.

ARROWROOT. A large proportion of the edible starches obtained from the rhizomes or root-stocks of various plants are known in commerce under the name of arrowroot. Properly the name should be restricted to the starch yielded by two or three species of *Maranta* (nat. ord. Marantaceae), the chief of which is *M. arundinacea*; and when genuine or West Indian arrowroot is spoken of, it is understood that this is the variety meant. *Maranta arundinacea* is probably a native of Guiana and western Brazil, but it has long been cultivated in the West Indian Islands, and has now spread to most tropical countries. The plant is a herbaceous perennial with a creeping root-stock which gives off fleshy cylindrical branches or tubers, covered with pale brown or white scales and afterwards ringed with their scars. It is at the period when these tubers are gorged with starch, immediately before the season of rest, that it is ripe for use. In addition to about 25% of starch, the tubers contain a proportion of woody tissue, vegetable albumen and various salts. The arrowroot may be separated on a small scale in the same manner as potato-starch is frequently prepared, that is, by peeling the root and grating it in water, when the starch falls to the bottom. The liquor is then drained off, and the starch purified by repeated washings till it is ready for drying. On a large scale the manufacture of arrowroot is conducted with specially arranged machinery. The rhizomes when dug up are washed free of earthy impurities and afterwards skinned. Subsequently, according to Pereira's *Materia Medica*, "the carefully skinned tubers are washed, then ground in a mill, and the pulp washed in tinned-copper cylindrical washing-machines. The fecula (dim. of Lat. *faex*, dregs, or sediment) is subsequently dried in drying-houses. In order to obtain the fecula free from impurity, pure water must be used, and great care and attention paid in every step of the process. The skinning or peeling of the tubers must be performed with great nicety, as the cuticle contains a resinous matter which imparts colour and a disagreeable flavour to the starch. German-silver palettes are used for skinning the deposited fecula, and shovels of the same metal for packing the dried fecula. The drying is effected in pans, covered with white gauze to exclude dust and insects."

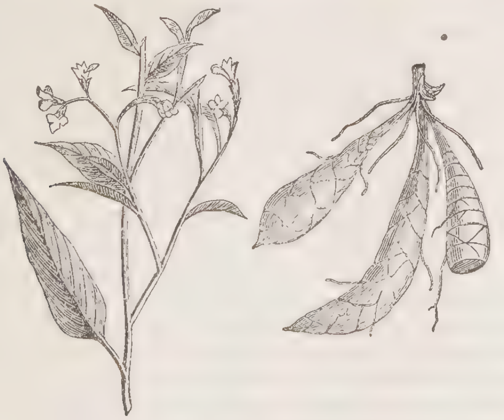
FIG. 1. FIG. 2.

Arrowroot Plant (*Maranta arundinacea*).—Fig. 1, stem, leaves and flowers; fig. 2, tubers.

Arrowroot is distinguished by the granules agglomerating into small balls, by slightly crepitating when rubbed between the fingers, and by yielding with boiling water a fine, transparent, inodorous and pleasant-tasting jelly. In microscopic structure the granules present an ovoid form, marked with concentric lines very similar to potato-starch, but readily distinguished by having a "hilum" marking at the thick extremity of the granule, while in potato-starch the same appearance occurs at the thin end (compare figs. 3 and 4 below). In addition to the West Indian supplies, arrowroot is found in the commerce of Brazil, the East Indies, Australia, Cape Colony and Natal.

The name "arrowroot" is derived from the use by the Mexican Indians of the juice of the fresh root as an application to wounds produced by poisoned arrows. Sir Hans Sloane refers to it in his *Catalogue of Jamaica Plants* (1696), and it is said to have been introduced into England by William Houston about 1732. It is grown as a stove-plant in botanic gardens. The slender, much-branched stem is 5 or 6 ft. high, and bears numerous leaves with long, narrow sheaths and large spreading ovate blades, and a few short-stalked white flowers.

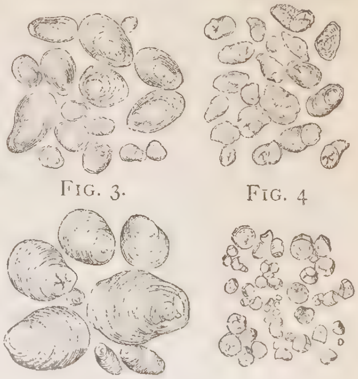
FIG. 3. FIG. 4

FIG. 5. FIG. 6.

Starch Granules magnified.

Fig. 3. Potato. Fig. 4. Arrowroot.
Fig. 5. Tous-les-mois. Fig. 6. Manihot.

Tous-les-mois, or Tulema arrowroot, also from the West Indies, is obtained from several species of *Canna*, a genus allied to *Maranta*, and cultivated in the same manner. The granules of *tous-les-mois* are readily distinguishable by their very large size (fig. 5). East Indian arrowroot is obtained from the root-stocks of several species of the genus *Curcuma* (nat. ord. Zingiberaceae), chiefly *C. angustifolia*, a native of central India. Brazilian arrowroot is the starch of the cassava plant, a species of Manihot (fig. 6), which when agglutinated on hot plates forms the tapioca of commerce. The cassava is cultivated in the East Indian Archipelago as well as in South America. *Tacca*, or *Otaheite* arrowroot, is the produce of *Tacca pinnatifida*, the pia plant of the South Sea Islands. Portland arrowroot was formerly prepared on the Isle of Portland from the tubers of the common cuckoo-pint, *Arum maculatum*. Various other species of arum yield valuable food-starches in hot countries. Under the name of British arrowroot the farina of potatoes is sometimes sold, and the French excel in the preparation of imitations of the more costly starches from this source. The chief use, however, of potato-farina as an edible starch is for adulterating other and more costly preparations. This falsification can readily be detected by microscopic examination, and the accompanying drawings exhibit the appearance under the microscope of the principal starches we have described. Although these starches agree in chemical composition, their value as articles of diet varies considerably, owing to different degrees of digestibility and pleasantness of taste. Arrowroot contains about 82% of starch, and about 1% of proteid and mineral matter. Farina, or British arrowroot, at about one-twelfth the price, is just as useful and pleasant a food.

ARROWSMITH, the name of an English family of geographers. The first of them, Aaron Arrowsmith (1750–1823), migrated to London from Winston in Durham when about twenty years of age, and was employed by John Cary, the engraver. In 1790 he made himself famous by his large chart of the world on Mercator's projection. Four years later he published another large map of the world on the globular projection, with a companion volume of explanation. The maps of North America (1796) and Scotland (1807) are the most celebrated of his many later productions. He left two sons, Aaron and Samuel, the elder of whom was the compiler of the *Eton Comparative Atlas*, of a Biblical atlas, and of various manuals of geography. They carried on the business in company with John Arrowsmith (1790–1873), nephew of the elder Aaron. In 1834 John published his *London Atlas*, the best set of maps then in existence. He followed up the atlas with a long series of elaborate and carefully executed maps, those of Australia, America, Africa and India being especially valuable. In 1863 he received the gold medal of the Royal Geographical Society, of which body he was one of the founders.

ARROYO (O. Sp. *arrogio*, Lat. *arrogium*, a rivulet or stream), the channel of a stream cut in loose earth, found often at the head of a gully, where the water flows only at certain seasons of the year.

ARSACES, a Persian name, which occurs on a Persian seal, where it is written in cuneiform characters. The most famous Arsaces was the chief of the Parni, one of the nomadic Scythian or Dahan tribes in the desert east of the Caspian Sea. A later tradition, preserved by Arrian, derives Arsaces I. and Tiridates from the Achaemenian king Artaxerxes II., but this has evidently no historical value. Arsaces, seeking refuge before the Bactrian king Diodotes, invaded Parthia, then a province of the Seleucid empire, about 250 B.C. (Strabo xi. p. 515, cf. Arrian p. 1, Müller, in Photius, *Cod.* 58, and Syncellus p. 284). After two years (according to Arrian) he was killed, and his brother Tiridates, who succeeded him and maintained himself for a short time in Parthia, during the dissolution of the Seleucid empire by the attacks of Ptolemy III. (247 ff.), was defeated and expelled by Seleucus II. (about 238). But when this king was forced, by the rebellion of his brother, Antiochus Hierax, to return to the west, Tiridates came back and defeated the Macedonians (Strabo xi. pp. 513, 515; Justin xli. 4; Appian, *Syr.* 65; Isidorus of Charax 11). He was the real founder of the Parthian empire, which was of very limited extent until the final decay of the Seleucid empire, occasioned by the Roman intrigues after the death of Antiochus IV. Epiphanes (165 B.C.), enabled Mithradates I. and his successors to conquer Media and Babylonia. Tiridates adopted the name of his brother Arsaces, and after him all the other Parthian kings (who by the historians are generally called by their proper names), amounting to the number of about thirty, officially wear only the name Arsaces. With very few exceptions only the name ΑΡΣΑΚΗΣ (with various epithets) occurs on the coins of the Parthian kings, and the obverse generally shows the seated figure of the founder of the dynasty, holding in his hand a strung bow. The Arsacidian empire was overthrown in A.D. 226 by Ardashir (Artaxerxes), the founder of the Sassanid empire, whose conquests began about A.D. 212. The name Arsaces of Persia is also borne by some kings of Armenia, who were of Parthian origin. (See PERSIA and PARTHIA.) (ED. M.)

ARS-AN-DER-MOSEL, a town of Germany, in the imperial province Alsace-Lorraine, 5 m. S. of Metz on the railway to Novéant. It has a handsome Roman Catholic church and extensive foundries. In the vicinity are the remains of a Roman aqueduct, which formerly spanned the valley. Pop. 5000.

ARSCHOT, PHILIPPE DE CROY, DUKE OF (1526–1595), governor-general of Flanders, was born at Valenciennes, and inherited the estates of the ancient and wealthy family of Croy. Becoming a soldier, he was made a knight of the order of the Golden Fleece by Philip II., king of Spain, and was afterwards employed in diplomatic work. He took part in the troubles in the Netherlands, and in 1563 refused to join William the Silent and others in their efforts to remove Cardinal Granvella from his post. This attitude, together with Arschot's devotion to the Roman Catholic Church, which he expressed by showing his delight at the massacre of St Bartholomew, led Philip of Spain to regard him with still greater favour, which, however, was withdrawn in consequence of Arschot's ambiguous conduct when welcoming the new governor, Don John of Austria, to the Netherlands in 1576. In spite, however, of his being generally distrusted by the inhabitants of the Netherlands, he was appointed governor of the citadel of Antwerp when the Spanish troops withdrew in 1577. After a period of vacillation he deserted Don John towards the end of that year. Jealous of the prince of Orange, he was then the head of the party which induced the archduke Matthias (afterwards emperor) to undertake the sovereignty of the Netherlands, and soon afterwards was appointed governor of Flanders by the state council. A strong party, including the burghers of Ghent, distrusted the new governor; and Arschot, who was taken prisoner during a riot at Ghent, was only released on promising to resign his office. He then sought to regain the favour of Philip of Spain, and having been pardoned by the king in 1580 again shared in the government of the Netherlands; but he refused to serve under the count of Fuentes when he became governor-general in 1594, and retired to Venice, where he died on the 11th of December 1595.

See J. L. Motley, *The Rise of the Dutch Republic*.

ARSENAL, an establishment for the construction, repair, receipt, storage and issue of warlike stores; details as to *matériel* will be found under AMMUNITION, ORDNANCE, &c. The word "arsenal" appears in various forms in Romanic languages (from which it has been adopted into Teutonic), *i.e.* Italian *arzanale*, Spanish *arsenal*, &c.; Italian also has *arzana* and *darsena*, and Spanish a longer form *atarazanal*. The word is of Arabic origin, being a corruption of *daraṣ-ṣinā'ah*, house of trade or manufacture, *dar*, house, *al*, the, and *ṣina'ah*, trade, manufacture, *ṣana'a*, to make. Such guesses as *arx navalis*, naval citadel, *arx senatus* (*i.e.* of Venice, &c.), are now entirely rejected.

A first-class arsenal, which can renew the *matériel* and equipment of a large army, embraces a gun factory, carriage factory, laboratory and small-arms ammunition factory, small-arms factory, harness, saddlery and tent factories, and a powder factory; in addition it must possess great store-houses. In a second-class arsenal the factories would be replaced by workshops. The situation of an arsenal should be governed by strategical considerations. If of the first class, it should be situated at the base of operations and supply, secure from attack, not too near a frontier, and placed so as to draw in readily the resources of the country. The importance of a large arsenal is such that its defences would be on the scale of those of a large fortress. The usual subdivision of branches in a great arsenal is into A, Storekeeping; B, Construction; C, Administration. Under A we should have the following departments and stores:—Departments of issue and receipt, pattern room, armoury department, ordnance or park, harness, saddlery and accoutrements, camp equipment, tools and instruments, engineer store, magazines, raw material store, timber yard, breaking-up store, unserviceable store. Under B—Gun factory, carriage factory, laboratory, small-arms factory, harness and tent factory, powder factory, &c. In a second-class arsenal there would be workshops instead of these factories. C—Under the head of administration would be classed the chief director of the arsenal, officials military and civil, non-commissioned officers and military artificers, civilian foremen, workmen and labourers, with the clerks and writers necessary for the office work of the establishments. In the manufacturing branches are required skill, and efficient and economical work, both executive and administrative; in the storekeeping part, good arrangement, great care, thorough knowledge of all warlike stores, both in their active and passive state, and scrupulous exactness in the custody, issue and receipt of stores. For fuller details the reader is referred to papers by Sir E. Collen, R.A., in vol. viii., and Lieut. C. E. Grover, R.E., in vol. vi. *Proceedings of R. Artillery Institution.* In England the Royal Arsenal, Woolwich, manufactures and stores the requirements of the army and navy (see Woolwich).

ARSENIC (symbol As, atomic weight 75·0), a chemical element, known to the ancients in the form of its sulphides. Aristotle gave them the name *σανδαράκη*, and Theophrastus mentions them under the name *ἀρσενικόν*. The oxide known as white arsenic is mentioned by the Greek alchemist Olympiodorus, who obtained it by roasting arsenic sulphide. These substances were all known to the later alchemists, who used minerals containing arsenic in order to give a white colour to copper. Albertus Magnus was the first to state that arsenic contained a metal-like substance, although later writers considered it to be a bastard or semi-metal, and frequently called it *arsenicum rex.* In 1733 G. Brandt showed that white arsenic was the calx of this element, and after the downfall of the phlogiston theory the views concerning the composition of white arsenic were identical with those which are now held, namely that it is an oxide of the element.

Arsenic is found in the uncombined condition in various localities, but more generally in combination with other metals and sulphur, in the form of more or less complex sulphides. Native arsenic is usually found as granular or curvilaminar masses, with a reniform or botryoidal surface. These masses are of a dull grey colour, owing to surface tarnish; only on fresh fractures is the colour tin-white with metallic lustre. The hardness is 3·5 and the specific gravity 5·63–5·73. Crystals of arsenic belong to the rhombohedral system, and have a perfect cleavage parallel to the basal plane; natural crystals are, however, of rare occurrence, and are usually acicular in habit. Native arsenic occurs usually in metalliferous veins in association with ores of antimony, silver, &c.; the silver mines of Freiberg in Saxony, St Andreasberg in the Harz, and Chañarcillo in Chile being well-known localities. Attractive globular aggregates of well-developed radiating crystals have been found at Akatani, a village in the province Echizen, in Japan.

Arsenic is a constituent of the minerals arsenical iron, arsenical pyrites or mispickel, tin-white cobalt or smaltite, arsenical nickel, realgar, orpiment, pharmacolite and cobalt bloom, whilst it is also met with in small quantities in nearly all specimens of iron pyrites. The ordinary commercial arsenic is either the naturally occurring form, which is, however, more or less contaminated with other metals, or is the product obtained by heating arsenical pyrites, out of contact with air, in earthenware retorts which are fitted with a roll of sheet iron at the mouth, and an earthenware receiver. By this method of distillation the arsenic sublimes into the receiver, leaving a residue of iron sulphide in the retort. For further purification, it may be sublimed, after having been previously mixed with a little powdered charcoal, or it may be mixed with a small quantity of iodine and heated. It can also be obtained by the reduction of white arsenic (arsenious oxide) with carbon. An electro-metallurgical process for the extraction of arsenic from its sulphides has also been proposed (German Patent, 67,973). These compounds are brought into solution by means of polysulphides of the alkali metals and the resultant liquor run into the cathode compartment of a bath, which is divided by diaphragms into a series of anode and cathode chambers; the anode divisions being closed and gas-tight, and containing carbon or platinum electrodes. The arsenic solution is decomposed at the cathode, and the element precipitated there.

Arsenic possesses a steel-grey colour, and a decided metallic lustre; it crystallizes on sublimation and slow condensation in rhombohedra, isomorphous with those of antimony and tellurium. It is very brittle. Its specific gravity is given variously from 5·395 to 5·959; its specific heat is 0·083, and its coefficient of linear expansion 0·00000559 (at 40° C.). It is volatile at temperatures above 100° C. and rapidly vaporizes at a dull red heat. It liquefies when heated under pressure, and its melting point lies between 446° C. and 457° C. The vapour of arsenic is of a golden yellow colour, and has a garlic odour. The vapour density is 10·6 (air=1) at 564° C., corresponding to a tetratomic molecule As_4; at a white heat the vapour density shows a considerable lowering in value, due to the dissociation of the complex molecule.

By condensing arsenic vapour in a glass tube, in a current of an indifferent gas, such as hydrogen, amorphous arsenic is obtained, the deposit on the portion of the tube nearest to the source of heat being crystalline, that farther along (at a temperature of about 210° C.) being a black amorphous solid, while still farther along the tube a grey deposit is formed. These two latter forms possess a specific gravity of 4·710 (14° C.) [A. Bettendorff, *Annalen*, 1867, 144, p. 110], and by heating at about 358°–360° C. pass over into the crystalline variety. Arsenic burns on heating in a current of oxygen, with a pale lavender-coloured flame, forming the trioxide. It is easily oxidized by heating with concentrated nitric acid to arsenic acid, and with concentrated sulphuric acid to arsenic trioxide; dilute nitric acid only oxidizes it to arsenious acid. It burns in an atmosphere of chlorine forming the trichloride; it also combines directly with bromine and sulphur on heating, while on fusion with alkalis it forms arsenites.

Arsenic and most of its soluble compounds are very poisonous, and consequently the methods used for the detection of arsenic are very important. For full accounts of methods used in detecting minute traces of arsenic in foods, &c., see "Report to Commission to Manchester Brewers' Central Association," the *Analyst*, 1900, 26, p. 8; "Report of Conjoint Committee of Society of Chemical Industry and Society of Public Analysts," the *Analyst*, 1902, 27, p. 48; T. E. Thorpe, *Journal of the Chemical Society*, 1903, 83, p. 774; O. Hehner and others, *Journal of Society of Chemical Industry*, 1902, 21, p. 94; also Adulteration.

Arsenic and arsenical compounds generally can be detected by (*a*) *Reinsch's test*: A piece of clean copper is dipped in a solution of an arsenious compound which has been previously acidified with pure hydrochloric acid. A grey film is produced on the surface of the copper, probably due to the formation of a copper arsenide. The reaction proceeds better on heating the solution. On removing, washing and gently drying the metal and heating it in a glass tube, a white crystalline sublimate is formed on the cool part of the tube; under the same conditions antimony does not produce a crystalline sublimate.

(*b*) *Fleitmann's test* and *Marsh's test* depend on the fact that arsenic and its compounds, when present in a solution in which hydrogen is being generated, are converted into arseniuretted hydrogen, which can be readily detected either by its action on silver nitrate solution or by its decomposition on heating. In Fleitmann's test, the solution containing the arsenious compound is mixed with pure potassium hydroxide solution and a piece of pure zinc or aluminium foil dropped in and the whole then heated. A piece of bibulous paper, moistened with silver nitrate, is held over the mouth of the tube, and if arsenic be present, a grey or black deposit is seen on the paper, due to the silver nitrate being reduced by the arseniuretted hydrogen. Antimony gives no reaction under these conditions, so that the method can be used to detect arsenic in the presence of antimony, but the test is not so delicate as either Reinsch's or Marsh's method.

In the Marsh test the solution containing the arsenious compounds is mixed with pure hydrochloric acid and placed in an apparatus in which hydrogen is generated from pure zinc and pure sulphuric acid. The arseniuretted hydrogen produced is passed through a tube containing lead acetate paper and soda-lime, and finally through a narrow glass tube, constricted at various points, and heated by a very small flame. As the arseniuretted hydrogen passes over the heated portion it is decomposed and a black deposit formed. Instead of heating the tube, the gas may be ignited at the mouth of the tube and a cold surface of porcelain or platinum placed in the flame, when a black deposit is formed on the surface. This may be distinguished from the similar antimony deposit by its ready solubility in a solution of sodium hypochlorite. A blank experiment should always be carried out in testing for small quantities of arsenic, to ensure that the materials used are quite free from traces of arsenic. It is to be noted that the presence of nitric acid interferes with the Marsh test; and also that if the arsenic is present as an *arsenic* compound it must be reduced to the *arsenious* condition by the action of sulphurous acid. Arsenic compounds can be detected in the dry way by heating in a tube with a mixture of sodium carbonate and charcoal when a deposit of black amorphous arsenic is produced on the cool part of the tube, or by conversion of the compound into the trioxide and heating with dry sodium acetate when the offensive odour of the extremely poisonous cacodyl oxide is produced. In the wet way, arsenious oxide and arsenites, acidified with hydrochloric acid, give a yellow precipitate of arsenic trisulphide on the addition of sulphuretted hydrogen; this precipitate is soluble in solutions of the alkaline hydroxides, ammonium carbonate and yellow ammonium sulphide. Under like conditions arsenates only give a precipitate on long-continued boiling.

Arsenic is usually estimated either in the form of magnesium pyroarsenate or as arsenic sulphide. For the pyroarsenate method it is necessary that the arsenic should be in the *arsenic* condition, if necessary this can be effected by heating with nitric acid; the acid solution is then mixed with "magnesia mixture" and made strongly alkaline by the addition of ammonia. It is then allowed to stand twenty-four hours, filtered, washed with dilute ammonia, dried, ignited to constant weight and weighed, the filter paper being incinerated separately after moistening with nitric acid. From the weight of magnesium pyroarsenate obtained the weight of arsenic can be calculated.

In the sulphide method, the arsenic should be in the *arsenious* form. Sulphuretted hydrogen is passed through the liquid until it is thoroughly saturated, the excess of sulphuretted hydrogen is expelled from the solution by a brisk stream of carbon dioxide, and the precipitate is filtered on a Gooch crucible and washed with water containing a little sulphuretted hydrogen and dried at 100° C.; it is then well washed with small quantities of pure carbon disulphide to remove any free sulphur, again dried and weighed. Arsenic can also be estimated by volumetric methods; for this purpose it must be in the *arsenious* condition, and the method of estimation consists in converting it into the *arsenic* condition by means of a standard solution of iodine, in the presence of a cold saturated solution of sodium bicarbonate.

The atomic weight of arsenic has been determined by many different chemists. J. Berzelius, in 1818, by heating arsenious oxide with excess of sulphur obtained the value 74·3; J. Pelouze (*Comptes rendus*, 1845, 20, p. 1047) titrated arsenic chloride with silver solution and obtained 75·0; and F. Kessler (*Pogg. Ann.* 1861, 113, p. 134) by converting arsenic trisulphide in hydrochloric acid solution into arsenic pentasulphide also obtained 75·0.

Compounds.—Arsenic forms two hydrides:—The *dihydride*, As_2H_2, is a brown velvety powder formed when sodium or potassium arsenide is decomposed by water. It is a somewhat unstable substance, decomposing on being heated, with liberation of hydrogen. Arsenic *trihydride* (arsine or arseniuretted hydrogen), AsH_3, is formed by decomposing zinc arsenide with dilute sulphuric acid; by the action of nascent hydrogen on arsenious compounds, and by the electrolysis of solutions of arsenious and arsenic acids; it is also a product of the action of organic matter on many arsenic compounds. It is a colourless gas of unpleasant smell, excessively poisonous, very slightly soluble in water. It easily burns, forming arsenious oxide if the combustion proceeds in an excess of air, or arsenic if the supply of air is limited; it is also decomposed into its constituent elements when heated. It liquefies at −40° C. and becomes solid at −118·9° C. (K. Olszewski). Metals such as tin, potassium and sodium, when heated in the gas, form arsenides, with liberation of hydrogen; and solutions of gold and silver salts are reduced by the gas with precipitation of metallic gold and silver. Chlorine, bromine and iodine decompose arsine readily, the action being most violent in the case of chlorine.

Arsenic tribromide, $AsBr_3$, is formed by the direct union of arsenic and bromine, and subsequent distillation from the excess of arsenic; it forms colourless deliquescent prisms which melt at 20°–25° C., and boil at 220° C. Water decomposes it, a small quantity of water leading to the formation of the *oxybromide*, $AsOBr$, whilst a large excess of water gives arsenious oxide, As_4O_6.

Arsenic certainly forms two, or possibly three iodides. The *di-iodide*, As_2I_4 or AsI_2, which is prepared by heating one part of arsenic with two parts of iodine, in a sealed tube to 230° C., forms dark cherry-red prisms, which are easily oxidized, and are readily decomposed by water. The *tri-iodide*, AsI_3, prepared by subliming arsenic and iodine together in a retort, by leading arsine into an alcoholic iodine solution, or by boiling powdered arsenic and iodine with water, filtering and evaporating, forms brick-red hexagonal tables, of specific gravity 4·39, soluble in alcohol, ether and benzene, and in a large excess of water; in the presence of a small quantity of water, it is decomposed with formation of hydriodic acid and an insoluble basic salt of the composition $4AsOI \cdot 3As_4O_6 \cdot 24H_2O$. It combines with alkaline iodides to form very unstable compounds. The *penta-iodide*, AsI_5, appears to be formed when a mixture of one part of arsenic and seven parts of iodine is heated to 190° C., but on dissolving the resulting product in carbon bisulphide and crystallizing from this solvent, only the tri-iodide is obtained.

Arsenic trichloride, $AsCl_3$, is prepared by distilling white arsenic with concentrated sulphuric acid and common salt, or by the direct union of arsenic with chlorine, or from the action of phosphorus pentachloride on white arsenic. It is a colourless oily heavy liquid of specific gravity 2·205 (0° C.), which, when pure and free from chlorine, solidifies at −18° C., and boils at 132° C. It is very poisonous and decomposes in moist air with evolution of white fumes. With a little water it forms arsenic oxychloride, $AsOCl$, and with excess of water it is completely decomposed into hydrochloric acid and white arsenic. It combines directly with ammonia to form a solid compound variously given as $AsCl_3 \cdot 3NH_3$, or $2AsCl_3 \cdot 7NH_3$, or $AsCl_3 \cdot 4NH_3$.

Arsenic trifluoride, AsF_3, is prepared by distilling white arsenic with fluorspar and sulphuric acid, or by heating arsenic tribromide with ammonium fluoride; it is a colourless liquid of specific gravity 2·73, boiling at 63° C.; it fumes in air, and in contact with the skin produces painful wounds. It is decomposed by water into arsenious and hydrofluoric acids, and absorbs ammonia forming the compound $2AsF_3 \cdot 5NH_3$. By the action of gaseous ammonia on arsenious halides at −30° C. to −40° C., *arsenamide*, $As(NH_2)_3$, is formed. Water decomposes it into arsenious oxide and ammonia, and when heated to 60° it loses ammonia and forms *arsenimide*, $As_2(NH)_3$ (C. Hugot, *Compt. rend.* 1904, 139, p. 54). For AsF_5, see *Ber.*, 1906, 39, p. 67.

Two oxides of arsenic are definitely known to exist, namely the trioxide (white arsenic), As_4O_6, and the pentoxide, As_2O_5, while the existence of a suboxide, $As_2O(?)$, has also been mooted. Arsenic trioxide has been known from the earliest times, and was called *Hüttenrauch* (furnace-smoke) by Basil Valentine. It occurs naturally in the mineral claudetite, and can be artificially prepared by burning arsenic in air or oxygen. It is obtained commercially by roasting arsenical pyrites in either a Brunton's or Oxland's rotatory calciner, the crude product being collected in suitable condensing chambers, and afterwards refined by resublimation, usually in reverberatory furnaces, the foreign matter being deposited in a long flue leading to the condensing chambers. White arsenic exists in two crystalline forms (octahedral and prismatic) and one amorphous form; the octahedral form is produced by the rapid cooling of arsenic vapour, or by cooling a warm saturated solution in water, or by crystallization from hydrochloric acid, and also by the gradual transition of the amorphous variety, this last phenomenon being attended by the evolution of heat. Its specific gravity is 3·7; it is only slightly soluble in cold water, but is more soluble in hot water, the solution reacting faintly acid. The prismatic variety of the oxide can be obtained by crystallization from a saturated boiling solution in potassium hydroxide, or by the crystallization of a solution of silver arsenite in nitric acid. Its specific gravity is 4·15. In the amorphous condition it can be obtained by condensing the vapour of the oxide at as high a temperature as possible, when a vitreous mass is produced, which melts at 200° C., has a specific gravity of 3·68–3·798, and is more soluble in water than the crystalline variety.

Arsenious oxide is very poisonous. It acts as a reducing agent; it is not convertible into the pentoxide by the direct action of oxygen; and its solution is reduced by many metals (*e.g.* zinc, tin and cadmium) with precipitation of arsenic and formation of arseniuretted hydrogen. The solution of arsenious oxide in water reacts acid towards litmus and contains tribasic arsenious acid, although on evaporation of the solution the trioxide is obtained and not the free acid. The salts of the acid are, however, very stable, and are known as arsenites. Of these salts several series are known, namely the ortho-arsenites, which are derivatives of the acid H_3AsO_3, the meta-arsenites, derivatives of $HAsO_2$, and the pyro-arsenites, derivatives of $H_4As_2O_5$. The arsenites of the alkali metals are soluble in water, those of the other metals are insoluble in water, but are readily soluble in acids. A neutral solution of an arsenite gives a yellow precipitate of silver arsenite, Ag_3AsO_3, with silver nitrate solution, and a yellowish-green precipitate (Scheele's green) of cupric hydrogen arsenite, $CuHAsO_3$, with copper sulphate solution. By the action of oxidizing agents such as nitric acid, iodine solution, &c., arsenious acid is readily converted into arsenic acid, in the latter case the reaction proceeding according to the equation $H_3AsO_3 + I_2 + H_2O = H_3AsO_4 + 2HI$. Arsenic pentoxide, As_2O_5, is most easily obtained by oxidation of a solution of arsenious acid with nitric acid; the solution on concentration deposits the compound $2H_3AsO_4 \cdot H_2O$ (below 15° C.), which on being heated to a dark red heat loses its water of crystallization and leaves a white vitreous mass of the pentoxide. This substance dissolves slowly in water, forming arsenic acid; by heating to redness it decomposes into arsenic and oxygen. It deliquesces in moist air, and is easily reduced to arsenic by heating with carbon.

Arsenic acid, H_3AsO_4, is prepared as shown above, the compound $2H_3AsO_4 \cdot H_2O$ on being heated to 100° C. parting with its water of crystallization and leaving a residue of the acid, which crystallizes in needles. On heating to 180° C. it loses water and yields pyro-arsenic acid, $H_4As_2O_7$, which at 200° C. loses more water and leaves a crystalline mass of meta-arsenic acid, $HAsO_3$. These latter two acids are only stable in the solid state; they dissolve readily in water with evolution of heat and immediate transformation into the ortho-arsenic acid. The salts of arsenic acid, termed arsenates, are isomorphous with the phosphates, and in general character and reactions resemble the phosphates very closely; thus both series of salts give similar precipitates with "magnesia mixture" and with ammonium molybdate solution, but they can be distinguished by their behaviour with silver nitrate solution, arsenates giving a reddish-brown precipitate, whilst phosphates give a yellow precipitate.

There are three known compounds of arsenic and sulphur, namely, realgar As_2S_2, orpiment As_2S_3, and arsenic pentasulphide As_2S_5. Realgar occurs native in orange prisms of specific gravity 3·5; it is prepared artificially by fusing together arsenic and sulphur, but the resulting products vary somewhat in composition; it is readily fusible and sublimes unchanged, and burns on heating in a current of oxygen, forming arsenic trioxide and sulphur dioxide.

Orpiment (*auri pigmentum*) occurs native in pale yellow rhombic prisms, and can be obtained in the amorphous form by passing a current of sulphuretted hydrogen gas through a solution of arsenious oxide or an arsenite, previously acidified with dilute hydrochloric acid. It melts easily and volatilizes. It burns on heating in air, and is soluble in solutions of alkaline hydroxides and carbonates, forming thioarsenites, $As_2S_3+4KHO=K_2HAsO_3+K_2HAsS_3+H_2O$. On acidifying the solution so obtained with hydrochloric acid, the whole of the arsenic is reprecipitated as trisulphide, $K_2HAsO_3+K_2HAsS_3+4HCl=4KCl+3H_2O+As_2S_3$. Arsenic pentasulphide, As_2S_5, can be prepared by fusing the trisulphide with the requisite amount of sulphur; it is a yellow easily-fusible solid, which in absence of air can be sublimed unchanged; it is soluble in solutions of the caustic alkalis, forming thioarsenates, which can also be obtained by the action of alkali polysulphides on orpiment. The thioarsenites and thioarsenates of the alkali metals are easily soluble in water, and are readily decomposed by the action of mineral acids. Arsenic compounds containing selenium and sulphur are known, such as arsenic seleno-sulphide, $AsSeS_2$, and arsenic thio-selenide, $AsSSe_2$. Arsenic phosphide, AsP, results when phosphine is passed into arsenic trichloride, being precipitated as a red-brown powder.

Many organic arsenic compounds are known, analogous to those of nitrogen and phosphorus, but apparently the primary and secondary arsines, $AsH_2{\cdot}CH_3$ and $AsH(CH_3)_2$, do not exist, although the corresponding chlorine derivatives, $AsCl_2{\cdot}CH_3$, methyl arsine chloride, and $AsCl(CH_3)_2$, dimethyl arsine chloride, are known. The tertiary arsines, such as $As(CH_3)_3$, trimethyl arsine, and the quaternary arsonium iodides and hydroxides, $(CH_3)_4AsI$ and $(CH_3)_4As{\cdot}OH$, tetramethyl arsonium iodide and hydroxide, have been obtained. The arsines and arsine chlorides are liquids of overpowering smell, and in some cases exert an extremely irritating action on the mucous membrane. They do not possess basic properties; the halogen in the chlorine compounds is readily replaced by oxygen, and the oxides produced behave like basic oxides. The chlorides $AsCl_2{\cdot}CH_3$ and $AsCl(CH_3)_2$ as well as $As(CH_3)_3$ are capable of combining with two atoms of chlorine, the arsenic atom apparently changing from the tri- to the penta-valent condition, and the corresponding oxygen compounds can also be oxidized to compounds containing one oxygen atom or two hydroxyl groups more, forming acids or oxides. The compounds of the type AsX_5, *e.g.* $AsCl_4{\cdot}CH_3$, $AsCl_3(CH_3)_2$, on heating break down, with separation of methyl chloride and formation of compounds of the type AsX_3; the breaking down taking place more readily the fewer the number of methyl groups in the compound. The dimethyl arsine (or cacodyl) compounds have been most studied. On distillation of equal parts of dry potassium acetate and arsenious oxide, a colourless liquid of unbearable smell passes over, which is spontaneously inflammable and excessively poisonous. It is sometimes called Cadet's fuming liquid, and its composition was determined by R. Bunsen, who gave it the name cacodyl oxide (κακώδης, stinking); its formation may be shown thus:

$$As_4O_6+8CH_3CO_2K=2[(CH_3)_2As]_2O+4K_2CO_3+4CO_2.$$

The liquid is spontaneously inflammable owing to the presence of free cacodyl, $As_2(CH_3)_4$, which is also obtained by heating the oxide with zinc clippings in an atmosphere of carbon dioxide; it is a liquid of overpowering odour, and boils at 170° C. Cacodyl oxide boils at 150° C., and on exposure to air takes up oxygen and water and passes over into the crystalline cacodylic acid, thus:

$$[(CH_3)_2As]_2O+H_2O+O_2=2(CH_3)_2As{\cdot}O{\cdot}OH.$$

Pharmacology.—Of arsenic and its compounds, arsenious acid (dose $\frac{1}{60}$—$\frac{1}{15}$ gr.) and its preparation liquor arsenicalis, Fowler's solution (dose 2–8 ♏), are in very common use. The iodide of arsenic (dose $\frac{1}{20}$—$\frac{1}{5}$ gr.) is one of the ingredients of Donovan's solution (see MERCURY); and iron arsenate (dose $\frac{1}{16}$—$\frac{1}{4}$ gr. in a pill), a mixture of ferrous and ferric arsenates with some iron oxide, is of great use in certain cases. Sodium arsenate ($\frac{1}{40}$—$\frac{1}{10}$ gr.) is somewhat less commonly prescribed, though all the compounds of this metal have great value in experienced hands.

Externally, arsenious acid is a powerful caustic when applied to raw surfaces, though it has no action on the unbroken skin. Internally, unless the dose be extremely small, all preparations are severe gastro-intestinal irritants. This effect is the same however the drug be administered, as, even after subcutaneous injection, the arsenic is excreted into the stomach after absorption, and thus sets up gastritis in its passage through the mucous membrane. In minute doses it is a gastric stimulant, promoting the flow of gastric juice. It is quickly absorbed into the blood, where its presence can be demonstrated especially in the white blood corpuscles. In certain forms of anaemia it increases the number of the red corpuscles and also their haemoglobin content. None of these known effects of arsenic is sufficient to account for the profound change that a course of the drug will often produce in the condition of a patient. It has some power of affecting the general metabolism, but no wholly satisfactory explanation is forthcoming. According to Binz and Schultz its power is due to the fact that it is an oxygen-carrier, arsenious acid withdrawing oxygen from the protoplasm to form arsenic acid, which subsequently yields up its oxygen again. It is thus vaguely called an alterative, since the patient recovers under its use. It is eliminated chiefly by the urine, and to a less extent by the alimentary canal, sweat, saliva, bile, milk, tears, hair, &c., but it is also stored up in the body mainly in the liver and kidneys.

Therapeutics.—Externally arsenious acid has been much used by quack doctors to destroy morbid growths, &c., a paste or solution being applied, strong enough to kill the mass of tissue and make it slough out quickly. But many accidents have resulted from the arsenic being absorbed, and the patient thereby poisoned. Internally it is useful in certain forms of dyspepsia, but as some patients are quite unable to tolerate the drug, it must always be administered in very small doses at first, the quantity being slowly increased as tolerance is shown. Children as a rule bear it better than adults. It should never be given on an empty stomach, but always after a full meal. Certain cases of anaemia which do not yield to iron are often much improved by arsenic, though in other apparently similar ones it appears to be valueless. It is the routine treatment for pernicious anaemia and Hodgkin's disease, though here again the drug may be of no avail. For the neuralgia and anaemia following malaria, for rheumatoid arthritis, for chorea and also asthma and hay fever, it is constantly prescribed with excellent results. Certain skin diseases, as psoriasis, pemphigus and occasionally chronic eczema, are much benefited by its use, though occasionally a too prolonged course will produce the very lesion for which under other circumstances it is a cure. A recent method of using the drug is in the form of sodium cacodylate by subcutaneous injection, and this preparation is said to be free from the cumulative effects sometimes arising after the prolonged use of the other forms. Other organic derivatives employed are sodium metharsenite and sodium anilarsenate or atoxyl; hypodermic injections of the latter have been used in the treatment of sleeping sickness. Occasionally, as among the Styrians, individuals acquire the habit of arsenic-eating, which is said to increase their weight, strength and appetite, and clears their complexion. The probable explanation is that an antitoxin is developed within them.

Toxicology and Forensic Medicine.—The commonest source of arsenical poisoning is the arsenious acid or white arsenic, which in one form is white and opaque, like flour, for which it has been mistaken with fatal results. Also, as it has little taste and no colour it is easily mixed with food for homicidal purposes. When combined with potash or soda it is used to saturate fly-papers, and strong solutions can be obtained by soaking these in water; this fact has also been used with criminal intent. Copper arsenite (or Scheele's green) used to be much employed as a pigment for wall-papers and fabrics, and toxic effects have resulted from their use. Metallic arsenic is probably not poisonous, but as it usually becomes oxidized in the alimentary canal, the usual symptoms of arsenical poisoning follow its use.

In acute poisoning the interval between the reception of the poison and the onset of symptoms ranges from ten minutes, or even less, if a strong solution be taken on an empty stomach, to twelve or more hours if the drug be taken in solid form and the stomach be full of food. The usual period, however, is from half an hour to an hour. In a typical case a sensation of heat developing into a burning pain is felt in the throat and stomach. This is soon followed by uncontrollable vomiting, and a little later by severe purging, the stools being first of all faecal but later assuming a rice water appearance and often containing blood. The patient suffers from intense thirst, which cannot be relieved, as drinking is immediately followed by rejection of the swallowed fluid. There is profound collapse, the features are sunken, the skin moist and cyanosed. The pulse is feeble and irregular, and respiration is difficult. The pain in the stomach is persistent, and cramps in the calves of the legs add to the torture. Death may be preceded by coma, but consciousness is often maintained to the end. The similarity of the symptoms to those of cholera is very marked, but if the suspicion arises it can soon be cleared up by examining any of the secretions for arsenic. More rarely the poison seems to centre itself on the nerve centres, and gastro-intestinal symptoms may be almost or quite absent. In such cases the acute collapse occurs in company with both superficial and deep anaesthesia of the limbs, and is soon followed by coma terminating in death. In criminal poisoning repeated doses are usually given, so that such cases may not be typical, but will present some of the aspects of acute and some of chronic arsenical poisoning. As regards treatment, the stomach must be washed out with warm water by means of a soft rubber tube, an emetic being also administered. Then, if available, freshly precipitated ferric hydrate must be given, which can be prepared by adding a solution of ammonia to one of iron perchloride. The precipitate is strained off, and the patient can swallow it suspended in water. While this is being obtained, magnesia, castor oil or olive oil can be given; or failing all these, copious draughts of water. The collapse must be treated with hot blankets and bottles, and subcutaneous injections of brandy, ether or strychnine. The pain can be lessened by injections of morphia.

Arsenic may be gradually absorbed into the system in very small quantities over a prolonged period, the symptoms of chronic poisoning resulting. The commonest sources used to be wall-papers, fabrics, artificial flowers and toys: also certain trades, as in the manufacture of arsenical sheep-dipping. But at the present time cases arising from these causes occur very rarely. In 1900 an outbreak of "peripheral neuritis" with various skin affections occurred in Lancashire, which was traced to beer made from glucose and invert sugar, in the preparation of which sulphuric acid contaminated with arsenic was said to have been used. But the nature of the disease in this case was decidedly obscure. The symptoms so closely resembled those of *beri-beri* that it has also been suggested that the illness was the same, and was caused by the manufacture of the glucose from mouldy rice (see BERI-BERI), though no proof of this was possible. The earliest symptoms are slight gastric disorders, loss of appetite and general malaise, followed later by colicky pains, irritation of eyelids and skin eruptions. But sooner or later peripheral neuritis develops, usually beginning with sensory disturbances, tingling, numbness, formication and occasionally cutaneous anaesthesia. Later the affected muscles become exquisitely tender, and then atrophy, while the knee-jerk or other reflex is lost. Pigmentation of the skin may occur in the later stages. Recovery is very slow, and in fatal cases death usually results from heart failure.

After acute poisoning, the stomach at a *post-mortem* presents signs of intense inflammation, parts or the whole of its mucous membrane being of a colour varying from dark red to bright vermilion and often corrugated. Submucous haemorrhages are usually present, but perforation is rare. The rest of the alimentary canal exhibits inflammatory changes in a somewhat lesser degree. After chronic poisoning a widely spread fatty degeneration is present. Arsenic is found in almost every part of the body, but is retained in largest amount by the liver, secondly by the kidneys. After death from chronic poisoning it is found present even in the brain and spongy bone. The detection of arsenic in criminal cases is effected either by Reinsch's test or by Marsh's test, the urine being the secretion analysed when available. But Reinsch's test cannot be used satisfactorily for a quantitative determination, nor can it be used in the presence of chlorates or nitrates. And Marsh's test is very unmanageable with organic liquids on account of the uncontrollable frothing that takes place. But in such cases the organic matter can be first destroyed by one of the various methods, usually the moist method devised by Fresenius being chosen.

ARSENIUS (*c.* 354–450), an anchorite, said to have been born of a noble Roman family, who achieved a high reputation for his knowledge of Greek and Roman literature. He was appointed by Theodosius the Great, tutor of the young princes Arcadius and Honorius, but at the age of forty he retired to Egypt, where for forty years he lived in monastic seclusion at Scetis in the Thebais, under the spiritual guidance of St John the Dwarf. He is said to have gained the admiration of his fellows by the extreme rigour of his asceticism. The remainder of his life he spent at Canopus, and Troë near Memphis, where he died at the age of ninety-five. Of his writings two collections of admonitory maxims are extant: the first, *Διδασκαλία καὶ παραίνεσις*, containing instructions for monks, is published with a Latin version by Fr. Combefis in *Auctarium biblioth. patr. novissim.* (Paris, 1672), pp. 301 f.; the second is a collection of forty-four wise sayings put together by his friends under the title of *Ἀποφθέγματα* (see Cotelerius, *Eccl. graec. monum.*, 1677, i. pp. 353-372). In the Roman Catholic Church his festival is on the 19th of July, in the Orthodox Eastern Church on the 8th of May. His biography by Simeon Metaphrastes is largely fiction.

ARSENIUS AUTORIANUS (13th century), patriarch of Constantinople, lived about the middle of the 13th century. He received his education in Nicaea at a monastery of which he later became the abbot, though not in orders. Subsequently he gave himself up to a life of solitary asceticism in a Bithynian monastery, and is said, probably wrongly, to have remained some time in a monastery on Mount Athos. From this seclusion he was in A.D. 1255 called by Theodore II. Lascaris to the position of patriarch at Nicaea, and four years later, on that emperor's death, became joint guardian of his son John. His fellow-guardian Georgios Mouzalon was immediately murdered by Michael Palaeologus, who assumed the position of tutor. Arsenius then took refuge in the monastery of Paschasius, retaining his office of patriarch but refusing to discharge its duties. Nicephorus of Ephesus was appointed in his stead. In 1261 Michael, having recovered Constantinople, induced Arsenius again to undertake the office of patriarch, but soon incurred his severe censure by ordering the young prince John to be blinded. Arsenius went so far as to excommunicate the emperor, who, having vainly sought for pardon, took refuge in false accusations against Arsenius and caused him to be banished to Proconnesus, where some years afterwards (according to Fabricius in 1264; others say in 1273) he died. Throughout these years he declined to remove the sentence of excommunication which he had passed upon Michael, and after his death, when the new patriarch Josephus gave absolution to the emperor, the quarrel was carried on between the "Arsenites" and the "Josephists." The "Arsenian schism" lasted till 1315, when reconciliation was effected by the patriarch Niphon (see Gibbon, *Decline and Fall of the Roman Empire*, ed. J. B. Bury, 1898, vol. vi. 467 foll.). Arsenius is said to have prepared from the decisions of the councils and the works of the Fathers a summary of divine laws under the title *Synopsis Canonum*. This was published (Greek original and Latin version) by G. Voël and H. Justel in *Bibliotheca Jur. Canon. Vet.* (Paris, 1661), 749 foll. Some hold that the *Synopsis* was the work of another Arsenius, a monk of Athos (see L. Petit in Vacant's *Dict. théol. cathol.* i. col. 1904); the ascription depends on whether the patriarch Arsenius did or did not sojourn at Mount Athos.

See Georgius Pachymeres ii. 15, iii. *passim*, iv. 1-16; Nicephorus Gregoras iii. 1, iv. 1; for the will of Arsenius see Cotelerius, *Monumenta*, ii. 168.

ARSES, Persian king, youngest son of Artaxerxes III., was raised to the throne in 338 B.C. by Bagoas (*q.v.*), who had murdered his father and all his brothers. But when the young king tried to make himself independent, Bagoas killed him too, with all his children, in the third year of his reign (336) (Diod. 17.5; Strabo 15. 736; Trogus, Prol. x., Alexander's despatch to Darius III.; Arrian ii. 14. 5, and the chronographers). In Plutarch, *De fort. Alex.* ii. 3. 5, he is called *Oarses*; in Johannes Antioch. p. 38, *Arsamos*; in the canon of Ptolemy, *Aroges* (by Elias of Nisibis, *Pīrūz*); in a chronological tablet from Babylon (Brit. Mus. Sp. ii. 71, *Zeitschrift für Assyriologie*, viii. 176, x. 64) he is abbreviated into *Ar.* See Persia: *Ancient History*. (Ed. M.)

ARSINOË, the name of four Egyptian princesses of the Ptolemaic dynasty. The name was introduced into the Ptolemaic dynasty by the mother of Ptolemy I. This Arsinoë was originally a mistress of Philip II. of Macedon, who presented her to a Macedonian soldier Loqus shortly before Ptolemy was born. It was, therefore, assumed by the Macedonians that the Ptolemaic house was really descended from Philip (see Ptolemies).

1. Daughter of Lysimachus, king of Thrace, first wife of Ptolemy II. Philadelphus (285–247 B.C.). Accused of conspiring against her husband, who perhaps already contemplated marriage with his sister, also named Arsinoë, she was banished to Coptos, in Upper Egypt. Her son Ptolemy was afterwards king under the title of Euergetes. It is supposed by some (*e.g.* Niebuhr, *Kleine Schriften*; cf. Ehrlichs, *De Callimachi hymnis*) that she is to be identified with the Arsinoë who became wife of Magas, king of Cyrene, and that she married him after her exile to Coptos. But this hypothesis is apparently without foundation. Magas before his death had betrothed his daughter Berenice to the son of his brother Ptolemy II. Philadelphus, but Arsinoë, disliking the projected alliance, induced Demetrius the Fair, son of Demetrius Poliorcetes, to accept the throne of Cyrene as husband of Berenice. She herself, however, fell in love with the young prince, and Berenice in revenge formed a conspiracy, and, having slain Demetrius, married Ptolemy's son (see Berenice, 3).

2. Daughter of Ptolemy I. Soter and Berenice. Born about 316 B.C., she married Lysimachus, king of Thrace, who made over to her the territories of his divorced wife, Amastris. To secure the succession for her own children she brought about the murder of her stepson Agathocles. Lysandra, the wife of Agathocles, took refuge with Seleucus, king of Syria, who made war upon Lysimachus and defeated him (281). After her husband's death Arsinoë fled to Ephesus and afterwards to Cassandreia in Macedonia. Seleucus, who had seized Lysimachus's kingdom, was murdered in 281 by Ptolemy Ceraunus (half-brother of Arsinoë), who thus became master of Thrace and Macedonia. To obtain possession of Cassandreia, he offered his hand in marriage to Arsinoë, and being admitted into the town, killed her two younger sons and banished her to Samothrace. Escaping to Egypt, she became the wife of her full brother Ptolemy II., the first instance of the practice (afterwards common) of the Greek kings of Egypt marrying their sisters. She was a woman of a masterful character and won great influence. Her husband, though she bore him no children, was devoted to her and paid her all possible honour after her death in 271. He gave her name to a number of cities, and also to a district (nome) of Egypt.[1] It is related that he ordered the architect Dinochares to build a temple in her honour in Alexandria; in order that her statue, made of iron, might appear to be suspended in the air, the roof was to consist of an arch of loadstones (Pliny, *Hist. Nat.* xxxiv. 42). Coins were also struck, showing her crowned and veiled on the obverse, with a double cornucopia on the reverse. She was worshipped as a goddess under the title of Θεὰ φιλάδελφος, and she and her husband as Θεοὶ ἄδελφοι (Justin xxiv. 2, 3; Pausanias i. 7).

See von Prott, *Rhein. Mus.* liii. (1898), pp. 460 f.

3. Daughter of Ptolemy III. Euergetes, sister and wife of Ptolemy IV. Philopator. She seems to be erroneously called Eurydice by Justin (xxx. 2), and Cleopatra by Livy (xxvii. 4). Her presence greatly encouraged the troops at the battle of Raphia (217), in which Antiochus the Great was defeated. Her husband put her to death to please his mistress Agathocleia, a Samian dancer (between 210 and 205). She was worshipped as Θεὰ φιλοπάτωρ; she and her husband as Θεοὶ φιλοπάτορες (Polybius v. 83, 84, xv. 25-33).

4. Youngest daughter of Ptolemy XIII. Auletes, and sister of the famous Cleopatra. During the siege of Alexandria by Julius Caesar (48) she was recognized as queen by the inhabitants. her brother, the young Ptolemy, being then held captive by Caesar. Caesar took her with him to Rome as a precaution. After Caesar's triumph she was allowed to return to Alexandria. After the battle of Philippi she was put to death at Miletus (or in the temple of Artemis at Ephesus) by order of Mark Antony, at the request of her sister Cleopatra (Dio Cassius xlii. 39; Caesar, *Bell. civ.* iii. 112; Appian, *Bell. civ.* v. 9).

Authorities.—For general authorities see article Ptolemies. The article "Arsinoë" in Pauly-Wissowa's *Realencyclopädie* contains a full list of those who bore the name, and also of the numerous towns which were called after the various princesses.

ARSINOITHERIUM (so called from the Egyptian queen Arsinoë), a gigantic horned mammal from the Middle Eocene beds of the Fayum, Egypt, representing a sub-order of Ungulata, called Barypoda. The skull is remarkable for carrying a huge pair of horn-cores above the muzzle, which seem to be the enlarged nasal bones, and a rudimentary pair farther back; the front horn-cores, like the rest of the skull, consist of a mere shell of bone, and were probably clothed in life with horny sheaths. The teeth form a continuous even series, the small canines being crowded between the incisors and premolars; the crowns of the cheek-series are tall (hypsodont), with a distinctive pattern of their own. Although the brain is relatively larger, the bones of the limbs, especially the short, five-toed feet, approximate to those of the Amblypoda and Proboscidea; but in the articulation of the astragalus with both the navicular and cuboid *Arsinoitherium* is nearer the former than the latter group.

It is probable, however, that these resemblances are mainly due to parallelism in development, and are in all three cases adaptations necessary to support the enormous weight of the body. On the other hand, the marked resemblance of the structure of the tarsus is probably indicative of descent from nearly allied condylarthrous ancestors (see Phenacodus). No importance can be attached to the presence of horns as an indication of affinity between *Arsinoitherium* and the Amblypoda; and there are important differences in the structure of the skulls of the two, notably in the external auditory meatus, the occiput, the premaxillae, the palatal foramina and the lower jaw.

From the Proboscidea *Arsinoitherium* differs broadly in skull structure, in the form of the cheek-teeth, and in the persistence of the complete dental series of forty-four without gaps or enlargement of particular teeth. Whether there is any relationship with the Hyracoidea cannot be determined until we are acquainted with the forerunners of *Arsinoitherium*, which is evidently a highly specialized type.

It may be added that as the name Barypoda has been used at an earlier date for another group of animals, the alternative title Embrithopoda has been suggested in case the former should be considered barred.

See C. W. Andrews, *Descriptive Catalogue of the Tertiary Vertebrata of the Fayum, British Museum* (1906). (R. L.*)

ARSON (from Lat. *ardere*, to burn), a crime which has been described as the malicious and voluntary burning of the house of another (3 Co. *Inst.* 66). At common law in England it is an offence of the degree of felony. In the Roman civil law arson was punishable by death. It appears early in the history of English law, being known in ancient laws by the term of *boernet*. It is mentioned by Cnut as one of the bootless crimes, and under the Saxon laws was punishable by death. The sentence of death for arson was, says Stephen (*Commentaries*, iv. 80), in the reign of Edward I. executed by a kind of *lex talionis*, for the incendiaries were burnt to death; a punishment which was inflicted also under the Gothic institutions. Death continued to be the penalty at least down to the reign of King John, according to a reported case (Gloucester Pleas, pl. 216), but in course of time the penalty became that of other common-law felonies, death by the gallows. It is one of the earliest crimes in which the *mens rea*, or criminal intent, was taken special notice of. Bracton deals at length with the *mala conscientia*, which he says is necessary for this crime, and contrasts it with *negligentia* (f. 146 b), while in many early indictments malice aforethought (*malitia praecogitata*) appears. Arson was deprived of "benefit of clergy" under the Tudors, while an act of 8 Henry VI. c. 6 (1429) made the wilful burning of houses, under particular circumstances, high treason, but acts of 1 Ed. VI. c. 12 (1547) and 1 Mary (1553) reduced it to an ordinary felony. The English law concerning arson was consolidated by 7 & 8 Geo. IV. c. 30, which was repealed and re-enacted by the Malicious Damage Act 1861.

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[1] The appendix to pt. ii. of the Tebtunis series of papyri (Grenfell, Hunt and Goodspeed, 1907) contains a lengthy account of the topography of the Arsinoite nome.

The common-law offence of arson (which has been greatly enlarged by the act of 1861) required some part of the house to be actually burnt; neither a bare intention nor even an actual attempt by putting fire in or towards it will constitute the offence, if no part was actually burnt, but the burning of any part, however trifling, is sufficient, and the offence is complete even if the fire is put out or goes out of itself. The burning must be malicious and wilful, otherwise it is only a trespass. If a man by wilfully setting fire to his own house burn the house of his neighbour also, it will be a felony, even though the primary intention of the party was to burn his own house only. The word *house*, in the definition of the offence at common law, extends not only to dwelling-houses, "but to all out-houses which are parcel thereof, though not adjoining thereto." Barns with corn and hay in them, though distant from a house, are within the definition.

The different varieties of the offence are specified in the Malicious Damage Act 1861. The following crimes are thereby made felonies: (1) setting fire to any church, chapel, meeting-house or other place of divine worship; (2) setting fire to a dwelling-house, any person being therein; (3) setting fire to a house, out-house, manufactory, farm-building, &c., with intent to impose and defraud any person; (4) setting fire to buildings appertaining to any railway, port, dock or harbour; or (5) setting fire to any public building. In these cases the act provides that the person convicted shall be liable, at the discretion of the court, to be kept in penal servitude for life, or for any term not less than three years (altered to *five* years by the Penal Servitude Acts Amendment Act 1864), or to be imprisoned for any time not exceeding two years, with or without hard labour, and, if a male under sixteen years of age, with or without whipping. Setting fire to other buildings, and setting fire to goods in buildings under such circumstances that, if the building were thereby set fire to, the offence would amount to felony, are subject to the punishments last enumerated, with this exception that the period of penal servitude is limited to fourteen years. The attempt to set fire to any building, or any matter or thing not enumerated above, is punishable as a felony. Russell says (*Crimes*, p. 1781) that the term building is no doubt very indefinite, but it was used in 9 & 10 Vict. c. 25, s. 2; and it was thought much better to adopt this term and leave it to be interpreted as each case might arise, than to attempt to define; as any such attempt would probably have failed in producing any expression more certain than the term "building" itself. In *R.* v. *Manning*, 1872 (L.R. 1 C.C.R. 338), it was held that an unfinished house was a building within the meaning of the act. The setting fire to crops of hay, grass, corn, &c., is punishable by penal servitude for any period not exceeding fourteen years, but setting fire to stacks of the same, or any cultivated vegetable produce, or to peat, coals, &c., is regarded as a more serious offence, and the penal servitude may be for life. For the attempt to commit the last two offences penal servitude is limited to seven years. Setting fire to mines of coal, anthracite or other mineral fuel is visited with the full measure of penalty, and in the case of an attempt the penal servitude is limited to fourteen years. By the Dockyards, &c., Protection Act 1772 it is a felony punishable by death wilfully and maliciously to set fire to any of His Majesty's ships or vessels of war, or any of His Majesty's arsenals, magazines, dockyards, rope-yards, victualling offices or buildings therein, or any timber, material, stores or ammunition of war therein or in any part of His Majesty's dominions. If the person guilty of the offence is a person subject to naval discipline, he is triable by court-martial, and if found guilty, a sentence of capital punishment may be passed. The Malicious Damage Act 1861, s. 43, also includes as a felony the setting fire to any ship or vessel, with intent to prejudice any owner or part owner of the vessel, or of any goods on the same, or any person who has underwritten any policy of insurance on the vessel, or upon any goods on board the same.

In Scotland the offence equivalent to arson in England is known by the more expressive name of fire-raising. The crime was punishable capitally by old consuetudinary law, but it is now no longer capital, and may be tried in the sheriff court (50 & 51 Vict. c. 35, s. 56). Formerly the public prosecutor had the privilege of declining to demand capital punishment, and he invariably did so. *Wilful fire-raising*, which is the most heinous form of the crime, requires the raising of fire, without any lawful object, but with the deliberate intention of destroying certain premises or things, whether directly by the application of fire thereto, or indirectly by its application to something contained in or forming part of or communicating with them; also the intention to destroy premises or things of a certain description (much as mentioned above); and such premises or things must be the property of another than the accused. *Wicked, culpable and reckless fire-raising* differs from wilful fire-raising in that the fire is raised *without* the deliberate intention of destroying premises or things, but while the accused was engaged in some unlawful act, or while he was in such a state of passion, excitement or recklessness as not to care what results might follow from his acts.

United States.—The same general principles apply to this crime in American law. In some states by statute the intent to injure or defraud must be shown, *e.g.* when the property is insured. In New York one who wilfully burns property (including a vessel or its cargo) with intent to defraud or prejudice the insurer thereof, though the offence of arson is not committed, is punishable by imprisonment for not more than five years (N.Y. Pen. Code, ss. 575, 578). There must be an intent to destroy the building (*ibid.* s. 490; California Code, s. 447). An agreement to commit arson is conspiracy (*ibid.* s. 171). Killing a person in committing the crime of arson is murder in the first degree (*ibid.* s. 183); this is so in California, even where the crime is merely an attempt to commit arson (Cal. Pen. Code, s. 189). Explosion of a house by gunpowder or dynamite is arson (Texas Pen. Code, art. 761), but a charge of arson by "burning" will not be sustained by proof of exploding by dynamite, even though part of the building is burnt by the explosion (*Landers* v. *State* [Tex.], 47 S.W. 1008).

AUTHORITIES.—W. S. Holdsworth, *History of English Law*, vol. iii.; Pollock and Maitland, *History of English Law*; Stephen, *History of Criminal Law*, vol. iii.; Stephen, *Commentaries*; Russell on *Crimes*.

ARSONVAL, a village of France in the department of Aube, lies on the right bank of the Aube, about 30 m. east of Troyes. It has a church dating from the 12th century. Pop. 434.

ARSOT, the name of a forest in France, in the immediate neighbourhood of Belfort. It has an area of about 1500 acres, is almost encircled by a small stream, the Eloie, and is about 1400 ft. above the sea. On the east it is continued by the forest of Denney, which contains the fortress of Roppe, dominating the road from Colmar into France.

ARSUF, a town on the coast of Palestine, 12 m. N.N.E. of Jaffa, famous as the scene of a victory of the crusaders under Richard I. of England over the army of Saladin. After the capture of Acre on the 12th of July 1191, the army of the crusaders, under Richard Cœur-de-Lion and the duke of Burgundy, opened their campaign for the recovery of Jerusalem by marching southward towards Jaffa, from which place it was intended to move direct upon the holy city. The march was along the sea-shore, and, the forces of Saladin being in the vicinity, the army moved in such a formation as to be able to give battle at any moment. Richard thus moved slowly, but in such compact order as to arouse the admiration even of the enemy. The right column of baggage and supplies, guarded by infantry, was nearest the sea, the various corps of heavy cavalry, one behind the other, formed the central column, and on the exposed left flank was the infantry, well closed up, and "level and firm as a wall," according to the testimony of Saracen authors. The columns were united into a narrow rectangle by the advanced and rear guards. The whole march was a running fight between untiring horse-archers and steady infantry. Only once did the column open out, and the opportunity was swiftly seized by the Saracens, yet so rapid was the rally of the crusaders that little damage was done (August 25). The latter maintained for many days an absolutely passive defence, and could not be tempted to fight; Richard and his knights made occasional charges, but quickly withdrew, and on the 7th of September this irregular skirmishing, in which the crusaders had scarcely suffered at all, culminated in the battle of Arsuf. Saladin had by now decided that the only hope of success lay in compelling the rear of the Christians' column to halt—and thus opening a gap, should the van be still on the move. Richard, on the other hand, had prepared for action by closing up still more, and as the crusaders were now formed a simple left turn brought them into two lines of battle, infantry in first line, cavalry in second line. Near Arsuf the road entered a defile between the sea and a wooded range of hills; and from the latter the whole Moslem army suddenly burst forth. The weight of the attack fell upon the rear of Richard's column, as Saladin desired. The column slowly continued its march, suffering heavily in horses, but otherwise unharmed. The first assault thus made no impression, but a fierce hand-to-hand combat followed, in which the Hospitallers, who formed the rear of the Christian army, were hard pressed. Their grand master, like many other subordinates in history, repeatedly begged to be allowed to charge, but Richard, who on this occasion showed the highest gift of generalship, that of feeling the pulse of the fight, waited for the favourable moment. Almost as he gave the signal for the whole line to charge, the sorely pressed Hospitallers rode out upon the enemy on their own initiative. At once the whole of the cavalry followed suit. The head (or right wing) and centre were not closely engaged, and their fleeter opponents had time to ride off, but the rear of the column carried all before it in its impetuous onset, and cut down the Saracens in great numbers. A second charge, followed by a third, dispersed the enemy in all directions. The total loss of the Saracens was more than tenfold that of the Christians, who lost but seven hundred men. The army arrived at Jaffa on the 10th of September.

See Oman, *Hist. of the Art of War*, ii. 303-317.

ARSURE, a village of France in the department of Jura, has some stone quarries and extensive layers of peat in its neighbourhood. Its church has a choir dating from the 11th century. Pop. 370.

ARSURES, a village of France in the department of Jura, situated on a small stream, the Lurine. It is surrounded by vineyards, from which excellent wine is produced. Pop. 233.

ART, a word in its most extended and most popular sense meaning everything which we distinguish from Nature. Art and Nature are the two most comprehensive genera of which the human mind has formed the conception. Under the genus Nature, or the genus Art, we include all the phenomena of the universe. But as our conception of Nature is indeterminate and variable, so in some degree is our conception of Art. Nor does such ambiguity arise only because some modes of thought refer a greater number of the phenomena of the universe to the genus Nature, and others a greater number to the genus Art. It arises also because we do not strictly limit the one genus by the other. The range of the phenomena to which we point, when we say Art, is never very exactly determined by the range of the other phenomena which at the same time we tacitly refer to the order of Nature. Everybody understands the general meaning of a phrase like Chaucer's "Nature ne Art ne koude him not amende," or Pope's "Blest with each grace of nature and of art." In such phrases we intend to designate familiarly as Nature all which exists independently of our study, forethought and exertion—in other words, those phenomena in ourselves or the world which we do not originate but find; and we intend to designate familiarly as Art all which we do not find but originate—or, in other words, the phenomena, which we add by study, forethought and exertion to those existing independently of us. But we do not use these designations consistently. Sometimes we draw an arbitrary line in the action of individuals and societies, and say, Here Nature ends and Art begins—such a law, such a practice, such an industry even, is natural, and such another is artificial; calling those natural which happen spontaneously and without much reflection, and the others artificial. But this line different observers draw at different places. Sometimes we adopt views which waive the distinction altogether. One such view is that wherein all phenomena are regarded as equally natural, and the idea of Nature is extended so as to include "all the powers existing in either the outer or the inner world, and everything which exists by means of those powers." In this view Art becomes a part of Nature. It is illustrated in the familiar passage of Shakespeare, where Polixenes reminds Perdita that

> "Nature is made better by no mean,
> But nature makes that mean: so, over that art
> Which, you say, adds to nature, is an art
> That nature makes." . . .
> "This is an art
> Which does mend nature, change it rather, but
> The art itself is nature."

A posthumous essay of John Stuart Mill contains a full philosophical exposition and defence of this mode of regarding the relations of Nature and Art. Defining Nature as above, and again as a "collective name for all facts, actual and possible," that writer proceeds to say that such a definition

> "is evidently inapplicable to some of the modes in which the word is familiarly employed. For example, it entirely conflicts with the common form of speech by which Nature is opposed to Art, and natural to artificial. For in the sense of the word Nature which has thus been defined, and which is the true scientific sense, Art is as much Nature as anything else; and everything which is artificial is natural—Art has no independent powers of its own: Art is but the employment of the powers of Nature for an end. Phenomena produced by human agency, no less than those which, as far as we are concerned, are spontaneous, depend on the properties of the elementary forces, or of the elementary substances and their compounds. The united powers of the whole human race could not create a new property of matter in general, or of any one of its species. We can only take advantage for our purposes of the properties we find. A ship floats by the same laws of specific gravity and equilibrium as a tree uprooted by the wind and blown into the water. The corn which men raise for food grows and produces its grain by the same laws of vegetation by which the wild rose and the mountain strawberry bring forth their flowers and fruit. A house stands and holds together by the natural properties, the weight and cohesion of the materials which compose it. A steam engine works by the natural expansive force of steam, exerting a pressure upon one part of a system of arrangements, which pressure, by the mechanical properties of the lever, is transferred from that to another part, where it raises the weight or removes the obstacle brought into connexion with it. In these and all other artificial operations the office of man is, as has often been remarked, a very limited one; it consists of moving things into certain places. We move objects, and by doing this, bring some things into contact which were separate, or separate others which were in contact; and by this simple change of place, natural forces previously dormant are called into action, and produce the desired effect. Even the volition which designs, the intelligence which contrives, and the muscular force which executes these movements, are themselves powers of Nature."

Another mode of thought, in some sort complementary to the last, is based on the analogy which the operations of forces external to a man bear to the operations of man himself. Study, forethought and exertion are assigned to Nature, and her operations are called operations of Art. This view was familiar to ancient systems of philosophy, and especially to that of the Stoics. According to the report of Cicero, Nature as conceived by Zeno was a fire, and at the same time a voluntary agent having the power or art of creating things with regularity and design ("naturam esse ignem artificiosum ad gignendum progredientem via"). To this fire not merely creative force and systematic action were ascribed, but actual personality. Nature was "non artificiosa solum, sed plane artifex." "That which in the works of human art is done by hands, is done with much greater art by Nature, that is, by a fire which exercises an art and is the teacher of other arts." This conception of Nature as an all-generating fire, and at the same time as a personal artist both teaching and including in her own activity all the human arts, on the one hand may be said, with Polixenes and J. S. Mill, to merge Art in Nature; but on the other hand it finds the essence of Nature in the resemblance of her operations to those of Art. "It is the *proprium* of art," according to the same system, "to create and beget," and the reasoning proceeds—Nature creates and begets, therefore Nature is an artist or Demiurgus. A kindred view is set forth by Sir Thomas Browne in the *Religio Medici*, when he declares that "all things are artificial; for Nature is the Art of God."

But these modes of thought, according to which, on the one hand, the processes of Art are included among processes of Nature, or on the other the processes of Nature among the processes of Art, are exceptional. In ordinary use the two conceptions, each of them somewhat vague and inexact, are antithetical. Their antithesis was what Dr Johnson had chiefly in his mind when he defined Art as "the power of doing something which is not taught by Nature or by instinct." But this definition is insufficient, because the abstract word Art, whether used of all arts at once or of one at a time, is a name not only for the power of doing something, but for the exercise of the power; and not only for the exercise of the power, but for the rules according to which it is exercised; and not only for the rules, but for the result. Painting, for instance, is an art, and the word connotes not only the power to paint, but the act of painting; and not only the act, but the laws for performing the act rightly; and not only all these, but the material consequences of the act or the thing painted. So of agriculture, navigation and the rest. Exception might also be taken to Dr Johnson's definition on the ground that it excludes all actions of instinct from the genus Art, whereas usage has in more languages than one given the name of Art to several of those ingenuities in the lower animals which popular theory at the same time declares to be instinctive. Dante, for instance, speaks of boughs shaken by the wind, but not so violently as to make the birds forgo their Art—

"Non però dal lor esser dritto sparte
Tanto, che gl' augelletti per le cime
Lasciasser d' operar ogni lor *arte*."

And Fontenelle, speaking in the language not of poetry but of science:—"Most animals—as, for instance, bees, spiders and beavers—have a kind of art peculiar to themselves; but each race of animals has no more than one art, and this one has had no first inventor among the race. Man, on the other hand, has an infinity of different arts which were not born with his race, and of which the glory is his own." Dr Johnson might reply that those properties of variety and of originality or individual invention, which Fontenelle himself alleges in the ingenuities of man but not in those of the lower animals, are sufficient to make a generic difference, and to establish the impropriety of calling a honeycomb or a spider's web a work of Art. It is not our purpose to trespass on ground so debateable as that of the nature of consciousness in the lower animals. Enough that when we use the term Art of any action, it is because we are thinking of properties in the action from which we infer, whether justly or not, that the agent voluntarily and designedly puts forth skill for known ends and by regular and uniform methods. If, then, we were called upon to frame a general definition of Art, giving the word its widest and most comprehensive meaning, it would run thus:—*Every regulated operation or dexterity by which organized beings pursue ends which they know beforehand, together with the rules and the result of every such operation or dexterity.*

Here it will be well to consider very briefly the natural history of the name which has been given to this very comprehensive conception by the principal branches of civilized mankind. Our own word Art the English language has taken, as all the Romance languages of modern Europe have taken theirs, directly from the Latin. The Latin *ars*, according to the prevailing opinion of philologists, proceeds from a root AR, of which the primitive signification was to put or fit things together, and which is to be found in a large family of Greek words. The Greek *τέχνη*, the name both for arts in the particular and art in the abstract, is by its root related both to *τέκ-των* and *τέκ-νον*, and thus contains the allied ideas of making and begetting. The *proprium* of art in the logic of the Stoics, "to create and beget," was strictly in accordance with this etymology. The Teutonic *Kunst* is formed from *können*, and *können* is developed from a primitive *Ich kann*. In *kann* philology is inclined to recognize a preterite form of a lost verb, of which we find the traces in *Kin-d*, a child; and the form *Ich kann* thus meaning originally "I begot," contains the germ of the two several developments,—*können*, "to be master," "to be able," and *kennen*, "to know." We thus see that the chief Indo-European languages have with one consent extended a name for the most elementary exercise of a constructive or productive power, till that name has covered the whole range of the skilled and deliberate operations of sentient beings.

In proportion as men left out of sight the idea of creation, of constructing or producing, "artificiosum esse ad gignendum," which is the primitive half of this extended notion, and attended only to the idea of skill, of proceeding by regular and disciplined methods, "progredi via," which is the superadded half, the whole notion Art, and the name for it, might become subject to a process of thought which, if analysed, would be like this:—What is done by regular and disciplined methods is Art; facts are observed and classified, and a systematic view of the order of the universe obtained, by regular and disciplined methods; the observing and classifying of facts, and obtaining a systematic view of the order of the universe, is therefore Art. To a partial extent this did unconsciously take place. Science, of which the essence is only in knowledge and theory, came to be spoken of as Art, of which the essence is all in practice and production. Cicero, notwithstanding his citation of the Stoical dictum that practice and production were of the essence of Art, elsewhere divides Art into two kinds—one by which things are only contemplated in the mind, another by which something is produced and done. ("Quumque artium aliud eiusmodi sit, ut tantummodo rem cernat; aliud, ut moliatur aliquid et faciat."—*Acad.* ii. 7.) Of the former kind his instance is geometry; of the latter the art of playing on the lyre. Now geometry, understanding by geometry an acquisition of the mind, that is, a collected body of observations and deductions concerning the properties of space and magnitude, is a science and not an art; although there is an art of the geometer, which is the skill by which he solves any given problem in his science, and the rules of that skill, and his exertion in putting it forth. And so every science has its instrumental art or practical discipline; and in as far as the word Art is used only of the practical discipline or dexterity of the geometer, the astronomer, the logician, the grammarian, or other person whose business it is to collect and classify facts for contemplation, in so far the usage is just. The same justification may be extended to another usage, whereby in Latin, and some of its derivative languages, the name Art came to be transferred in a concrete sense to the body of rules, the written code or manual, which lays down the discipline and regulates the dexterity; as *ars grammatica*, *ars logica*, *ars rhetorica* and the rest. But when the word is stretched so as to mean the sciences, as theoretical acquisitions of the mind, that meaning is illegitimate. Whether or not Cicero, in the passage above quoted, had in his mind the science of geometry as a collected body of observations and deductions, it is certain that the Ciceronian phrase of the *liberal arts*, the *ingenuous arts*, both in Latin and its derivatives or translations in modern speech, has been used currently to denote the sciences themselves, and not merely the disciplines instrumental to them. The *trivium* and the *quadrivium* (grammar, logic and rhetoric—geometry, astronomy, music and arithmetic) have been habitually called arts, when some of them have been named in that sense in which they mean not arts but sciences, "only contemplating things in the mind." Hence the nomenclature, history and practical organization, especially in Britain, of one great division of university studies: the division of "arts," with its "faculty," its examinations, and its degrees.

In the German language the words for Art and Science have in general been loosely interchanged. The etymology of the word for Art secured a long continuance for this ambiguity. *Kunst* was employed indiscriminately in both the senses of the primitive *Ich kann*, to signify what I know, or Science, and what I can do, or Art. It was not till the end of the 17th century that a separate word for Science, the modern *Wissenschaft*, came into use. On the other hand, the Greek word τέχνη, with its distinct suggestion of the root signification to make or get, acted probably as a safeguard against this tendency. The distinction between τέχνη, Art or practice, and ἐπιστήμη, knowledge or Science, is observed, though not systematically, in Greek philosophy. But for our present purpose, that of making clear the true relation between the one conception and the other, further quotation is rendered superfluous by the discussion the subject has received at the hands of the modern writer already quoted. Between Art, of which we practise the rules, and Science, of which we entertain the doctrines, J. S. Mill establishes the difference in the simplest shape, by pointing out that one grammatical mood is proper for the conclusions of Science, and another for those of Art. Science enunciates her conclusions in the indicative mood, whereas "the imperative is the characteristic of Art, as distinguished from Science." And as Art utters her conclusions in her own form, so she supplies the substance of her own major premise.

> "Every art has one first principle, or general major premise, not borrowed from science, that which enunciates the object aimed at, and affirms it to be a desirable object. The builder's art assumes that it is desirable to have buildings; architecture (as one of the fine arts) that it is desirable to have them beautiful and imposing. The hygienic and medical arts assume, the one that the preservation of health, the other that the cure of disease, are fitting and desirable ends. These are not propositions of science. Propositions of science assert a matter of fact—an existence, a co-existence, a succession, or a resemblance. The propositions now spoken of do not assert that anything is, but enjoin or recommend that something should be. They are a class by themselves. A proposition of which the predicate is expressed by the words *ought* or *should be* is generically different from one which is expressed by *is* or *will be*."

And the logical relation of Art and Science, in other words, the manner of framing the intermediate member between the general major premise of Art and its imperative conclusion, is thus defined:—

> "The Art [in any given case] proposes to itself an end to be attained, defines the end, and hands it over to the Science. The Science receives it, considers it as a phenomenon or effect to be studied, and having investigated its causes and conditions, sends it back to Art with a theorem of the causes and combinations by which it could be produced. Art then examines these combinations of circumstances, and according as any of them are or are not in human power, pronounces the end attainable or not. The only one of the premises, therefore, which Art supplies, is the original major premise, which asserts that the attainment of the given end is desirable. Science, then, lends to Art the proposition (obtained by a series of inductions or deductions) that the performance of certain actions will attain the end. From these premises Art concludes that the performance of these actions is desirable, and finding it also practicable, converts the theorem into a rule or precept. . . . The grounds, then, of every rule of Art are to be found in the theorems of Science. An Art, or a body of Art, consists of the rules, together with as much of the speculative propositions as comprises the justification of these rules. The complete Art of any matter includes a selection of such a portion from the Science as is necessary to show on what conditions the effects, which the Art aims at producing, depend. And Art in general consists of the truths of Science arranged in the most convenient order for practice, instead of the order which is most convenient for thought. Science groups and arranges its truths so as to enable us to take in at one view as much as possible of the general order of the universe. Art, though it must assume the same general laws, follows them only into such of their detailed consequences as have led to the formation of rules of conduct, and brings together from parts of the field of Science most remote from one another, the truths relating to the production of the different and heterogeneous causes necessary to each effect which the exigencies of practical life require to be produced."—(Mill's *Logic*, vol. ii. pp. 542-549).

The whole discussion may be summed up thus. Science consists in knowing, Art consists in doing. What I must do in order to know, is Art subservient to Science: what I must know in order to do, is Science subservient to Art.

Art, then, is defined by two broad distinctions: first, its popular distinction from Nature; and next, its practical and theoretic distinction from Science. Both of these distinctions are observed in the terms of our definition given above. Within the proper limits of this definition, the conception of Art, and the use of the word for it, have undergone sundry variations. These variations correspond to certain vicissitudes or developments in the order of historical facts and in society. The requirements of society, stimulating the ingenuity of its individual members, have led to the invention of arts and groups of arts, constantly progressing, with the progress of civilization, in number, in complexity, and in resource. The religious imagination of early societies, who find themselves in possession of such an art or group of arts, forgets the history of the invention, and assigns it to the inspiration or special grace of some god or hero. So the Greeks assigned the arts of agriculture to Triptolemus, those of spinning and navigation to Athena, and of music to Apollo. At one stage of civilization one art or group of arts is held in higher esteem, another at another. In societies, like most of those of the ancient world, where slaves were employed in domestic service, and upon the handicrafts supplying the immediate utilities of life—food, shelter and clothing—these constituted a group of servile arts. The arts of husbandry or agriculture, on the other hand, have alternately been regarded as servile and as honourable according as their exercise has been in the hands of a subject class, as under feudal institutions, or, as under the Roman republic, of free cultivators. Under feudal institutions, or in a society in a state of permanent war, the allied arts of war and of government have been held the only honourable class. In commercial states, like the republics of Italy, the arts of gain, or of production (other than agricultural) and distribution, have made good their title to equal estimation and greater power beside the art of captains. But among peaceful arts, industries or trades, some have always been held to be of higher and others of lower rank; the higher rank being assigned to those that required larger operations, higher training, or more thoughtful conduct, and yielded ampler returns—the lower rank to those which called for simple manual exercise, especially if such exercise was of a disagreeable or degrading kind. In the cities of Italy, where both commerce and manufactures were for the first time organized on a considerable scale, the name *arte*, Art, was retained to designate the gilds or corporations by which the several industries were exercised; and, according to the nature of the industry, the art was classed as higher or lower (*maggiore* and *minore*).

The arts of which we have hitherto spoken have arisen from positive requirements, and supply what are strictly utilities, in societies; not excluding the art of war, at least so far as concerns one-half of war, the defensive half. But war continued to be an honourable pursuit, because it was a pursuit associated with birth, power and wealth, as well as with the virtue of courage, in cases where it had no longer the plea of utility, but was purely aggressive or predatory; and the arts of the chase have stood in this respect in an analogous position to those of war.

There are other arts which have not had their origin in positive practical needs, but have been practised from the first for pleasure or amusement. The most primitive human beings of whom we have any knowledge, the cave-dwellers of the palaeolithic period, had not only the useful art of chipping stones into spear-heads, knife-heads and arrow-heads, and making shafts or handles of these implements out of bone; they had also the ornamental art of scratching upon the bone handle the outlines of the animals they saw—mammoth, rhinoceros or reindeer—or of carving such a handle into a rude resemblance of one of these animals. Here we have a skill exercised, in the first case, for pure fancy or pleasure, and in the second, for adding an element of fancy or pleasure to an element of utility. Here, therefore, is the germ of all those arts which produce imitations of natural objects for purposes of entertainment or delight, as painting, sculpture, and their subordinates; and of all those which fashion useful objects in one way rather than another because the one way gives pleasure and the other does not, as architecture and the subordinate decorative arts of furniture, pottery and the rest. Arts that work in a kindred way with different materials are those of dancing and music. Dancing works with the physical movements of human beings. Music works with sound. Between that imitative and plastic group, and the group of these which only produce motion or sound and pass away, there is the intermediate group of eloquence and the drama, which deal with the expression of human feeling in spoken words and acted gestures. There is also the comprehensive art of poetry, which works with the material of written words, and can ideally represent the whole material of human life and experience. Of all these arts the end is not use but pleasure, or pleasure before use, or at least pleasure and use conjointly. In modern language, there has grown up a usage which has put them into a class by themselves under the name of the Fine Arts, as distinguished from the Useful or Mechanical Arts. (See Aesthetics and Fine Arts.) Nay more, to them alone is often appropriated the use of the generic word Art, as if they and they only were the arts κατ' ἐξοχήν. And further yet, custom has reduced the number which the class-word is meant to include. When Art and the works of Art are now currently spoken of in this sense, not even music or poetry is frequently denoted, but only architecture, sculpture and painting by themselves, or with their subordinate and decorative branches. In correspondence with this usage, another usage has removed from the class of *arts*, and put into a contrasted class of *manufactures*, a large number of industries and their products, to which the generic term Art, according to our definition, properly applies. The definition covers the *mechanical* arts, which can be efficiently exercised by mere trained habit, rote or calculation, just as well as the fine arts, which have to be exercised by a higher order of powers. But the word Art, becoming appropriated to the fine arts, has been treated as if it necessarily carried along with it, and as if works to be called works of art must necessarily possess, the attributes of free individual skill and invention, expressing themselves in ever new combinations of pleasurable contrivance, and seeking perfection not as a means towards some ulterior practical end but as an ideal end in itself. (S. C.)

ARTA (*Narda, i.e.* ἐν Ἄρδα, or *Zarta, i.e.* εἰς Ἄρτα), a town of Greece, in the province of Arta, 59 m. N.N.W. of Mesolonghi. Pop. about 7000. It is built on the site of the ancient Ambracia (*q.v.*), its present designation being derived from a corruption of the name of the river Arachthus (Arta) on which it stands. This enters the Gulf of Arta some distance south of the town. The river forms the frontier between Greece and Turkey, and is crossed by a picturesque bridge, which is neutral ground. There are a few remains of old cyclopean walls. The town contains also a Byzantine castle, built on the lofty site of the ancient citadel; a palace belonging to the Greek metropolitan; a number of mosques, synagogues and churches, the most remarkable being the church of the Virgin of Consolation, founded in 819. The streets of the town were widened and improved in 1869. Manufacture of woollens, cottons, Russia leather and embroidery is carried on, and there is trade in cattle, wine, tobacco, hemp, hides and grain. Much of the neighbouring plain is very fertile, and the town is surrounded with gardens and orchards, in which orange, lemon and citron come to great perfection. In 1083 Arta was taken by Bohemund of Tarentum; in 1449 by the Turks; in 1688 by the Venetians. In 1797 it was held by the French, but in the following year, 1798, Ali Pasha of Iannina captured it. During the Greek War of Independence it suffered severely, and was the scene of several conflicts, in which the ultimate success was with the Turks. An insurrection in 1854 was at once repressed. It was ceded to Greece in 1881. In the Greco-Turkish War of 1897 the Greeks gained some temporary successes at Arta during April and May.

ARTA, GULF OF (anc. *Sinus Ambracius*), an inlet of the Ionian Sea, 25 m. long and 10 broad, most of the northern shores of which belong to Turkey, the southern and eastern to Greece. Its only important affluent, besides the Arta, is the Luro (anc. *Charadra*), also from the north. The gulf abounds with mullets, soles and eels. Around its shores are numerous ruins of ancient cities: Actium at the entrance, where the famous battle was fought in 31 B.C.; Nicopolis, Argos, Limnaea and Olpae; and several flourishing towns, such as Preveza, Arta (anc. *Ambracia*), Karavasara or Karbasaras, and Vonitza.

The river Arta (anc. *Arachthus* or *Aratthus*, in Livy xxxviii. 3, *Aretho*) is the chief river of Epirus, and is said to have been navigable in ancient times as far as Ambracia. Below this town it flows through a marshy plain, consisting mainly of its own alluvium; its upper course is through the territory of the Molossians; its total length is about 80 m.

ARTABANUS, the name of a number of Persian princes, soldiers and administrators. The most important are the following:—

1. Brother of Darius I., and, according to Herodotus, the trusted adviser of his nephew Xerxes. Herodotus makes him a principal figure in epic dialogues: he warns Darius not to attack the Scythians (iv. 83; cf. also iv. 143), and predicts to Xerxes his defeat by the Greeks (vii. 10 ff., 46 ff.); Xerxes sent him home to govern the empire during the campaign (vii. 52, 53).

2. Vizier of Xerxes (Ctesias, *Pers.* 20), whom he murdered in 465 B.C. According to Aristotle, *Pol.* v. 1311 b, he had previously killed Xerxes' son Darius, and was afraid that the father would avenge him; according to Ctesias, *Pers.* 29, Justin iii. 1, Diod. xi. 69, he killed Xerxes first and then pretended that Darius had murdered him, and instigated his brother Artaxerxes to avenge the parricide. At all events, during the first months of the reign of Artaxerxes I., he was the ruling power in the state (therefore the chronographers wrongly reckon him as king, with a reign of seven months), until Artaxerxes, having learned the truth about the murder of his father and his brother, overwhelmed and killed Artabanus and his sons in open fight.

3. A satrap of Bactria, who revolted against Artaxerxes I., but was defeated in two battles (Ctes. *Pers.* 31).

The name was borne also by four Parthian kings. The Parthian king Arsaces, who was attacked by Antiochus III. in 209, has been called Artabanus by some modern authors without any reason.

4. Artabanus I., successor of his nephew Phraates II. about 127 B.C., perished in a battle against the Tochari, a Mongolian tribe, which had invaded the east of Iran (Justin xli. 2). He is perhaps identical with the Artabanus mentioned in Trogus, Prol. xlii.

5. Artabanus II. *c.* A.D. 10–40, son of an Arsacid princess (Tac. *Ann.* vi. 48), lived in the East among the Dahan nomads. He was raised to the throne by those Parthian grandees who would not acknowledge Vonones I., whom Augustus had sent from Rome (where he lived as hostage) as successor of his father Phraates IV. The war between the two pretenders was long and doubtful; on a coin Vonones mentions a victory over Artabanus. At last Artabanus defeated his rival completely and occupied Ctesiphon; Vonones fled to Armenia, where he was acknowledged as king, under the protection of the Romans. But when Artabanus invaded Armenia, Vonones fled to Syria, and the emperor Tiberius thought it prudent to support him no longer. Germanicus, whom he sent to the East, concluded a treaty with Artabanus, in which he was recognized as king and friend of the Romans. Armenia was given (A.D. 18) to Zeno, the son of the king of Pontus (Tac. *Ann.* ii. 3 f., 58; Joseph. *Ant.* 18. 24).

Artabanus II., like all Parthian princes, was much troubled by the opposition of the grandees. He is said to have been very cruel in consequence of his education among the Dahan barbarians (Tac. *Ann.* vi. 41). To strengthen his power he killed all the Arsacid princes whom he could reach (Tac. *Ann.* vi. 31). Rebellions of the subject nations may have occurred also. We learn that he intervened in the Greek city Seleucia in favour of the oligarchs (Tac. *Ann.* vi. 48), and that two Jewish brigands maintained themselves for years in Neerda in the swamps of Babylonia, and were acknowledged as dynasts by Artabanus (Jos. *Ant.* 18. 9). In A.D. 35 he tried anew to conquer Armenia, and to establish his son Arsaces as king there. A war with Rome seemed inevitable. But that party among the Parthian magnates which was hostile to Artabanus applied to Tiberius for a king of the race of Phraates. Tiberius sent Phraates's grandson, Tiridates III., and ordered L. Vitellius (the father of the emperor) to restore the Roman authority in the East. By very dexterous military and diplomatic operations Vitellius succeeded completely. Artabanus was deserted by his followers and fled to the East. Tiridates, who was proclaimed king, could no longer maintain himself, because he appeared to be a vassal of the Romans; Artabanus returned from Hyrcania with a strong army of Scythian (Dahan) auxiliaries, and was again acknowledged by the Parthians. Tiridates left Seleucia and fled to Syria. But Artabanus was not strong enough for a war with Rome; he therefore concluded a treaty with Vitellius, in which he gave up all further pretensions (A.D. 37). A short time afterwards Artabanus was deposed again, and a certain Cinnamus was proclaimed king. Artabanus took refuge with his vassal, the king Izates of Adiabene; and Izates by negotiations and the promise of a complete pardon induced the Parthians to restore Artabanus once more to the throne (Jos. *Ant.* 20. 3). Shortly afterwards Artabanus died, and was succeeded by his son, Vardanes, whose reign was still more turbulent than that of his father.

6. ARTABANUS III. reigned a short time in A.D. 80 (on a coin of this year he calls himself Arsaces Artabanus) and the following years, and supported a pretender who rose in Asia Minor under the name of Nero (Zonaras xi. 18), but could not maintain himself against Pacorus II.

7. ARTABANUS IV., the last Parthian king, younger son of Vologaeses IV., who died A.D. 209. He rebelled against his brother Vologaeses V. (Dio Cass. vii. 12), and soon obtained the upper hand, although Vologaeses V. maintained himself in a part of Babylonia till about A.D. 222. The emperor Caracalla, wishing to make use of this civil war for a conquest of the East in imitation of his idol, Alexander the Great, attacked the Parthians in 216. He crossed the Tigris, destroyed the towns and spoiled the tombs of Arbela; but when Artabanus advanced at the head of an army, he retired to Carrhae. There he was murdered by Macrinus in April 217. Macrinus was defeated at Nisibis and concluded a peace with Artabanus, in which he gave up all the Roman conquests, restored the booty, and paid a heavy contribution to the Parthians (Dio Cass. lxxviii. 26 f.). But at the same time, the Persian dynast Ardashir (*q.v.*) had already begun his conquests in Persia and Carmania. When Artabanus tried to subdue him his troops were defeated. The war lasted several years; at last Artabanus himself was vanquished and killed (A.D. 226), and the rule of the Arsacids came to an end.

See further PERSIA: *History*, § ancient, and works there quoted. (ED. M.)

ART AND PART, a term used in Scots law to denote the aiding or abetting in the perpetration of a crime,—the being an accessory before or at the perpetration of the crime. There is no such offence recognized in Scotland as that of being an accessory after the fact.

ARTAPHERNES, more correctly ARTAPHRENES, brother of Darius Hystaspis, and satrap of Sardis. It was he who received the embassy from Athens sent probably by Cleisthenes (*q.v.*) in 507 B.C., and subsequently warned the Athenians to receive back the "tyrant" Hippias. Subsequently he took an important part in suppressing the Ionian revolt (see IONIA, ARISTAGORAS, HISTIAEUS), and after the war compelled the cities to make agreements by which all differences were to be settled by reference. He also measured out their territories in parasangs and assessed their tributes accordingly (Herod. vi. 42). In 492 he was superseded in his satrapy by Mardonius (Herodotus v. 25, 30-32, 35, &c.; Diod. Sic. x. 25). His son, of the same name, was appointed (490), together with Datis, to take command of the expedition sent by Darius to punish Athens and Eretria for their share in the Ionian revolt. After the defeat of Marathon he returned to Asia. In the expedition of Xerxes, ten years later, he was in command of the Lydians and Mysians (Herod. vi. 94, 119; vii. 74, Aesch. *Persae*, 21).

Aeschylus in his list of Persian kings (*Persae*, 775 ff.), which is quite unhistorical, mentions two kings with the name Artaphrenes, who may have been developed out of these two Persian commanders. (ED. M.)

ARTAXERXES, a name representing Pers. *Artakhshatra*, "he whose empire is well-fitted" or "perfected", Heb. *Artakhshasta*, Bab. *Artakshatsu*, Susian *Irtakshashsha* (and variants), Gr. Ἀρταξέρξης, Ἀρτοξέρξης, and in an inscription of Tralles (Dittenberger, *Sylloge*, 573) Ἀρταξέσσης; Herodotus (vi. 98) gives the translation μέγας ἀρήιος, and considers the name as a compound of Xerxes, showing thereby that he knew nothing of the Persian language; the later Persian form is *Ardashir*, which occurs in the form Artaxias (Artaxes) as the name of some kings of Armenia. It was borne by three kings of the Achaemenian dynasty of ancient Persia; though, so long as its meaning was understood, it can have been adopted by the kings only after their accession to the throne.

1. ARTAXERXES I., surnamed *Macrocheir*, *Longimanus*, "Long-hand," because his right hand was longer than his left (Plut. *Artax.* i.). He was the younger son of Xerxes, and was raised to the throne in 465 by the vizier Artabanus, the murderer of his father. After a few months he became aware of the crimes of the vizier, and slew him and his sons in a hand-to-hand fight in the palace. His reign was, on the whole, peaceful; the empire had reached a period of stagnation. Plutarch (*Artax.* i.) says that he was famous for his mild and magnanimous character, Nepos (*de Reg.* i.) that he was exceedingly beautiful and valiant. From the authentic report of his cup-bearer Nehemiah we see that he was a kind, good-natured, but rather weak monarch, and he was undoubtedly much under the baneful influence of his mother Amestris (for whose mischievous character cf. Herod. ix. 109 ff.) and his sister and wife Amytis. The peacefulness of his rule was interrupted by several insurrections. At the very beginning the satrap Artabanus raised a rebellion in Bactria, but was defeated in two battles. More dangerous was the rebellion of Egypt under Inarus (Inarōs), which was put down by Megabyzus only after a long struggle against the Egyptians and the Athenians (460–454). Out of it sprang the rebellion of Megabyzus, who was greatly exasperated because, though he had persuaded Inarus to surrender by promising that his life would be spared, Artaxerxes, yielding to the entreaties of his wife Amytis, who wanted to take revenge on Inarus for the death of her brother Achaemenes, the satrap of Egypt, had surrendered him to her for execution.

In spite of his weakness, Artaxerxes I. was not unsuccessful in his polity. In 448 the war with Athens was terminated by the treaty concluded by Callias (but see CALLIAS and CIMON), by which the Athenians left Cyprus and Egypt to the Persians, while Persia gave up nothing of her rights, but promised not to make use of them against the Greek cities on the Asiatic coast, which had gained their liberty (Ed. Meyer, *Forschungen zur alt. Gesch.* ii. 71 ff.). In the Samian and the Peloponnesian wars, Artaxerxes remained neutral, in spite of the attempts made by both Sparta and Athens to gain his alliance.

During the reign of Artaxerxes I. the Jewish religion was definitely established and sanctioned by law in Jerusalem, on the basis of a firman granted by the king to the Babylonian priest Ezra in his seventh year, 458 B.C., and the appointment of his cup-bearer Nehemiah as governor of Judaea in his twentieth year, 445 B.C. The attempts which have been made to deny the authenticity of those parts of the books of Ezra and Nehemiah which contain an account of these two men, taken from their own memoirs, or to place them in the reign of Artaxerxes II., are not convincing (cf. Ed. Meyer, *Die Entstehung des Judentums*, 1896; see further JEWS, §§ 10, 21, 22; EZRA AND NEHEMIAH).

Artaxerxes I. died in December 425, or January 424 (Thuc. iv. 50). To his reign must belong the famous quadrilingual alabaster vases from Egypt (on which his name is written in Persian, Susian and Babylonian cuneiform characters and in hieroglyphics), for Artaxerxes II. and III. did not possess Egypt. A great many tablets, dated from his reign, have been found in Nippur (published by H. von Hilprecht and Clay, *The Babylonian Expedition of the University of Pennsylvania*, series A, vol. ix.), and a few others at other places in Babylonia. Inscriptions of the king himself are not extant; his grandson mentions his buildings in Susa. For the suggested identification of Artaxerxes I. with the Biblical Ahasuerus, see AHASUERUS.

2. ARTAXERXES II., surnamed *Mnemon*, the eldest son of Darius II., whom he succeeded in the spring of 404. According to Ctesias (*Pers.* 57; Plut. *Artax.* i.) he was formerly called Arsaces or Arsikas, whereas Dinon (Plut. *Artax.* i.) calls him Oarses. This is corroborated by a Babylonian tablet with observations of the moon (Brit. Mus. Sp. ii. 749; *Zeitsch. f. Assyriologie*, vii. 223), which is dated from the 26th year of "Arshu, who is Artakshatsu," *i.e.* 379 B.C. (cp. Ed. Meyer, *Forschungen zur alten Geschichte*, ii. 466 ff.). When Artaxerxes II. mounted the throne, the power of Athens had been broken by Lysander, and the Greek towns in Asia were again subjects of the Persian empire. But his whole reign is a time of continuous decay; the original force of the Persians had been exhausted in luxury and intrigues, and the king, though personally brave and good-natured, was quite dependent upon his favourites and his harem, and especially upon his mother Parysatis. In the beginning of his reign falls the rebellion of his brother Cyrus, who was secretly favoured by Parysatis and by Sparta. Although Cyrus was defeated at Cunaxa, this rebellion was disastrous inasmuch as it opened to the Greeks the way into the interior of the empire, and demonstrated that no oriental force was able to withstand a band of well-trained Greek soldiers. Subsequently Greek mercenaries became indispensable not only to the king but also to the satraps, who thereby gained the means for attempting successful rebellions, into which they were provoked by the weakness of the king, and by the continuous intrigues between the Persian magnates. The reign is, therefore, a continuous succession of rebellions. Egypt soon revolted anew and could not be subdued again. When in 399 war broke out between Sparta and Persia, the Persian troops in Asia Minor were quite unable to resist the Spartan armies. The active and energetic Persian general Pharnabazus succeeded in creating a fleet by the help of Evagoras, king of Salamis in Cyprus, and the Athenian commander Conon, and destroyed the Spartan fleet at Cnidus (August 394). This victory enabled the Greek allies of Persia (Thebes, Athens, Argos, Corinth) to carry on the Corinthian war against Sparta, and the Spartans had to give up the war in Asia Minor. But it soon became evident that the only gainers by the war were the Athenians, who in 389, under Thrasybulus, tried to found their old empire anew (see DELIAN LEAGUE). At the same time Evagoras attempted to conquer the whole of Cyprus, and was soon in open rebellion. The consequence was that, when in 388 the Spartan admiral Antalcidas (*q.v.*) came to Susa, the king was induced to conclude a peace with Sparta by which Asia fell to him and European Greece to Sparta. After the peace, Evagoras was attacked. He lost his conquests, but had to be recognized as independent king of Salamis (380 B.C.). Two expeditions against Egypt (385–383 and 374–372) ended in complete failure. At the same period there were continuous rebellions in Asia Minor; Pisidia, Paphlagonia, Bithynia and Lycia, threw off the Persian yoke and Hecatomnus, the satrap of Caria, obtained an almost independent position. Similar wars were going on against the mountain tribes of Armenia and Iran, especially against the Cadusians on the Caspian Sea. In this war Artaxerxes is said to have distinguished himself personally (380 B.C.), but got into such difficulties in the wild country that he was glad when Tiribazus succeeded in concluding a peace with the Cadusian chieftains.

By the peace of Antalcidas the Persian supremacy was proclaimed over Greece; and in the following wars all parties, Spartans, Athenians, Thebans, Argives continually applied to Persia for a decision in their favour. After the battle of Leuctra, when the power of Thebes was founded by Epaminondas, Pelopidas went to Susa (367) and restored the old alliance between Persia and Thebes. The Persian supremacy, however, was not based upon the power of the empire, but only on the discord of the Greeks. Shortly after the edict by which the king had proclaimed his alliance with Thebes, and the conditions of the general peace which he was going to impose upon Greece, his weakness became evident, for since 366 all the satraps of Asia Minor (Datames, Ariobarzanes, Mausolus, Orontes, Artabazus) were in rebellion again, in close alliance with Athens, Sparta and Egypt. The king could do little against them; even Autophradates, satrap of Lydia, who had remained faithful, was forced for some time to unite himself with the rebels. But every one of the allies mistrusted all the others; and the sole object of every satrap was to improve his condition and his personal power, and to make a favourable peace with the king, for which his neighbours and former allies had to pay the costs. The rebellion was at last put down by a series of treacheries and perfidious negotiations. Some of the rebels retained their provinces; others were punished, as opportunity offered. Mithradates betrayed his own father Ariobarzanes, who was crucified, and murdered Datames, to whom he had introduced himself as a faithful ally. When the long reign of Artaxerxes II. came to its close in the autumn of 359 the authority of the empire had been restored almost everywhere.

Artaxerxes himself had done very little to obtain this result. In fact, in the last years of his reign he had sunk into a perfect dotage. All his time was spent in the pleasures of his harem, the intrigues of which were further complicated by his falling in love with and marrying his own daughter Atossa (according to the Persian religion a marriage between the nearest relations is no incest). At the same time, his sons were quarrelling about the succession; one of them, Ochus, induced the father by a series of intrigues to condemn to death three of his older brothers, who stood in his way. Shortly afterwards, Artaxerxes II. died.

In this reign an important innovation took place in the Persian religion. Berossus (in Clemens Alex. *Protrept.* i. 5. 65) tells us that the Persians knew of no images of the gods until Artaxerxes II. erected images of Anaitis in Babylon, Susa, Ecbatana, Persepolis, Bactra, Damascus, Sardis. This statement is proved correct by the inscriptions; all the former kings name only Auramazda (Ahuramazda), but Artaxerxes II. in his building inscriptions from Susa and Ecbatana invokes Ahuramazda, Anahita and Mithra. These two gods belonged to the old popular religion of the Iranians, but had until then been neglected by the true Zoroastrians; now they were introduced into the official worship much in the way in which the cult of the saints came into the Christian religion. About the history of Artaxerxes II. we are comparatively well informed from Greek sources; for the earlier part of his reign from Ctesias and Xenophon (*Anabasis*), for the later times from Dinon of Ephesus, the historian of the Persians (from whom the account of Justin is derived), from Ephorus (whose account is quoted by Diodorus) and others. Upon these sources is based the biography of the king by Plutarch.

3. ARTAXERXES III. is the title adopted by Ochus, the son of Artaxerxes II., when he succeeded his father in 359. The chronographers generally retain the name Ochus, and in the Babylonian inscriptions he is called "Umasu, who is called Artakshatsu." The same form of the name (probably pronounced Uvasu) occurs in the Syrian version of the canon of Ptolemy by Elias of Nisibis (Amōs).

Artaxerxes III. was a cruel but an energetic ruler. To secure his throne he put to death almost all his relatives, but he suppressed the rebellions also. In 356 he ordered all the satraps to dismiss their mercenaries. Most of them obeyed; Artabazus of Phrygia, who tried to resist and was supported by his brothers-in-law, Mentor and Memnon of Rhodes, was defeated and fled to Philip of Macedon. Athens, whose general Chares had supported Artabazus, was by the threatening messages of the king forced to conclude peace, and to acknowledge the independence of its rebellious allies (355 B.C.). Then the king attempted to subjugate Egypt, but two expeditions were unsuccessful, and, in consequence, Sidon and the other Phoenician towns, and the princes of Cyprus, rebelled against Persia and defeated the Persian generals. After great preparations the king came in person, but again the attack on Egypt was repelled by the Greek generals of Nectanebus (346). One or two years later Artaxerxes, at the head of a great army, began the siege of Sidon. The Sidonian king Tennes considered resistance hopeless, and betrayed the town to the Persian king, assisted by Mentor, who had been sent with Greek troops from Egypt to defend the town. Artaxerxes repressed the rebellion with great cruelty and destroyed the town. The traitor Tennes was put to death, but Mentor rose high in the favour of the king, and entered into a close alliance with the eunuch Bagoas, the king's favourite and vizier. They succeeded in subjecting the other rebels, and, after a hard fight at Pelusium, and many intrigues, conquered Egypt (343); Nectanebus fled to Ethiopia. Artaxerxes used his victory with great cruelty; he plundered the Egyptian temples and is said to have killed the Apis. After his return to Susa, Bagoas ruled the court and the upper satrapies, while Mentor restored the authority of the empire everywhere in the west. He deposed or killed many Greek dynasts, among them the famous Hermias of Atarneus, the protector of Aristotle, who had friendly relations with Philip (342 B.C.). When Philip attacked Perinthus and Byzantium (340), Artaxerxes sent them support, by which they were enabled to withstand the Macedonians; Philip's antagonists in Greece, Demosthenes and his party, hoped to get subsidies from the king, but were disappointed.

In 338 Artaxerxes III., with his older sons, was killed by Bagoas, who raised his youngest son Arses to the throne. Artaxerxes III. is said never to have entered the country of Persia proper, because, being a great miser, he would not pay the present of a gold piece for every Persian woman, which it was usual to give on such occasions (Plut. *Alex.* 69). But we have a building inscription from Persepolis, which contains his name and genealogy, and invocations of Ahuramazda and Mithra.

For the relations of Artaxerxes I.–III. with the Jews see JEWS, §§19-21. For bibliographical references see PERSIA: *Ancient History*.

The name Artaxerxes was adopted by Bessus when he proclaimed himself king after the assassination of Darius III. It was borne by several dynasts of Persis, when it formed an independent kingdom in the time of the Parthian empire (on their coins they call themselves Artakhshathr; one of them is mentioned by Lucian, *Macrobii*, 15), and by three kings of the Sassanid dynasty, who are better known under the modern form Ardashir (*q.v.*). (Ed. M.)

ARTEDI, PETER (1705–1735), Swedish naturalist, was born in the province of Angermania, in Sweden, on the 22nd of February 1705. Intending to become a clergyman, he went, in 1724, to study theology at Upsala, but he turned his attention to medicine and natural history, especially ichthyology, upon the study of which he exercised great influence (see ICHTHYOLOGY). In 1728 his countryman Linnaeus arrived in Upsala, and a lasting friendship was formed between the two. In 1732 both left Upsala, Artedi for England, and Linnaeus for Lapland; but before parting they reciprocally bequeathed to each other their manuscripts and books in the event of death. He was accidentally drowned on the 27th of September 1735 at Amsterdam, where he was engaged in cataloguing the collections of Albert Seba, a wealthy Dutchman, who had formed what was perhaps the richest museum of his time. According to agreement, his manuscripts came into the hands of Linnaeus, and his *Bibliotheca Ichthyologica* and *Philosophia Ichthyologica*, together with a life of the author, were published at Leiden in the year 1738.

ARTEGA, a tribe of African "Arabs," said to be descendants of a sheik of that name who came from Hadramut in pre-Islamic days, settling near Tokar. The name is said to be "patrician," and the Artega may be regarded as the most ancient stock in the Suakin district. They are now an inferior race. They were all followers of the mahdi and khalifa in the Sudan wars (1883–1898).

See *Anglo-Egyptian Sudan*, edited by Count Gleichen (London, 1905).

ARTEL (Russ. for "gang"), the name for the co-operative associations in Russia. Originally, the artels were true examples of productive co-operation, bodies of working-men associating together for the purpose of jointly undertaking some piece of work, and dividing the profits. This original form of artel still survives among the fishermen of Archangel. Artels have come, however, to be little more than trade gilds, with mutual responsibility. (For details see RUSSIA.)

ARTEMIDORUS. (1) A geographer "of Ephesus" who flourished about 100 B.C. After studying at Alexandria, he travelled extensively and published the results of his investigations in a large work on general geography (Τὰ γεωγραφούμενα) in eleven books, much used by Strabo and others. The original work is lost, but we possess many small fragments and larger fragments of an abridgment made by Marcianus of Heracleia (5th century), which contains the periplus of the Euxine and accounts of Bithynia and Paphlagonia. (See Müller, *Geographi Graeci Minores*; Bunbury, *History of Ancient Geography*; Stiehle, "Der Geograph Artemidoros von Ephesos," in *Philologus*, xi., 1856). (2) A soothsayer and interpreter of dreams, who flourished in the 2nd century A.D., during the reigns of Hadrian and the Antonines. He called himself Daldianus from his mother's birthplace, Daldis in Lydia, in order to make its name known to the world. His 'Ονειροκριτικά, or interpretation of dreams, was said to have been written by command of Apollo Daldianus, whose initiated votary he was. It is in four books, with an appendix containing a collection of prophetic dreams which had been realized. The first three books, addressed to Cassius Maximus, a Phoenician rhetorician (perhaps identical with Maximus of Tyre), treat of dreams and divination generally; the fourth—with a reply to his critics—and the appendix are dedicated to his son, also named Artemidorus and an interpreter of dreams. Artemidorus boasts of the trouble expended on his work; he had read all the authorities on dreams, travelled extensively, and conversed with all who had studied the subject. The work is valuable as affording an insight into ancient superstitions. According to Suidas, Artemidorus also wrote on augurs and cheiromancy, but all trace of these works is lost. (Editions: Reiff, 1805, Hercher, 1864; translation and notes, Krauss, 1881; English translation by Wood, 1644, and later editions.)

ARTEMIS, one of the principal goddesses in Greek mythology, the counterpart of the Roman Diana. The suggested etymologies of the name (see O. Gruppe, *Griechische Mythologie*, ii. p. 1267, note 2), as in the case of most of the Olympian deities, are unsatisfactory, and throw no light upon her significance and characteristics. The Homeric and later conception of Artemis, though by no means the original one, may be noticed first. She is the daughter of Zeus and Leto, twin-sister and counterpart of Apollo. She is said to have been born a day before him (on the 6th of the month) and tradition assigns them different birthplaces—Delos to Apollo, Ortygia to Artemis. But Ortygia ("home of quails") applies still to Delos, and may well have been a synonym for that island. In its original sense it does not apply either to the island of Ortygia at Syracuse, or to Ortygia near Ephesus, which also claimed the honour of having been the birthplace of the goddess. Artemis is the goddess of chastity, an aspect of her character which gradually assumed more and more importance—the protectress of young men and maidens, who defies and contemns the power of Aphrodite. Her resemblance to her brother is shown in many ways. Like him, armed with bow and arrows, she deals death to mortals, sometimes gently and suddenly, especially to women, but also as a punishment for offences against herself or morality. With him she takes part in the combat with Python and with Tityus, in the slaughter of the children of Niobe, while alone she executes vengeance on Orion. Although Apollo has nothing to do with the earlier cult of Artemis, nor Artemis with that of Delphi, their association was a comparatively early one, and probably originated in Delos. Here the connexion of Artemis with the Hyperborean legend (see APOLLO) is shown in the names of the maidens (Opis, Hecaerge) who were supposed to have brought offerings from the north to Delos, where they were buried. Both Opis (or Oupis) and Hecaerge are names of Artemis, the latter being the feminine of Hecaergos, an epithet of Apollo. Like her brother, she is not only a goddess who deals death, but she is also a healing and a purifying divinity, *οὐλία* ("the healer," cf. Apollo Oulios), *λύη*, *λυαία* ("purifier,") and *σώτειρα*, "she who saves from all evils" (cf. Apollo *ἀποτρόπαιος*). Her connexion with the prophetic art is doubtful, although mention is made of an Artemis Sibylla. To her association with Apollo are certainly to be referred the names Delphinia and Pythia, and the titles referring to state and family life—*προστατηρία*, *πατριῶτις*, *βουλαία*. It probably accounts for her appearance as a goddess of seafarers, the bestower of fair weather and prosperous voyages. At Phigalia in Arcadia, Eurynome, represented as half woman and half fish, was probably another form of Artemis. To the same association may be traced her slight connexion with music, song and dance.

It is in the Arcadian and Athenian rites and legends, however, which are certainly earlier than Homer, that the original conception of the goddess is to be found. These tend to show that Artemis was first and foremost a nature goddess, whose cult shows numerous traces of totemism. As a goddess of fertilizing moisture, lakes, rivers, springs, and marshy lowlands are brought into close connexion with her. Thus she is *λιμναία*, *δέσποινα λίμνης* (" lady of the lake "), *ἑλεία* (" of marshes "), *ποταμία* (" of rivers," especially of the Cladaus and Alpheus, whence her name *Ἀλφειαία*). Her influence is very active in promoting the increase of the fruits of the field, hence she is specially a goddess of agriculture. She drives away the mice (cf. Apollo Smintheus) and slays the Aloidae, the corn spirits; she is the friend of the reapers, and requires her share of the first fruits. Her character as a harvest goddess is clearly shown in the legend of the Calydonian boar, sent by her to ravage the fields out of resentment at not having received a harvest offering from Oeneus (see MELEAGER). As *ἐπιμύλιος* and *ἐπικλιβάνιος* ("presiding over the mill and the oven ") she extends her protection over the further development of the grain for the use of man.

Artemis was naturally also a goddess of trees and vegetation. Near Orchomenus her wooden image stood in a large cedar-tree —an indication that her worship was originally that of the tree itself (*κεδρεᾶτις*, " the cedar goddess "); at Caryae there was an image of Artemis *καρυᾶτις* (" the nut-tree goddess "). Two curious epithets in this connexion deserve notice: *λυγοδέσμα* ("bound with withies "), derived from the legend that the image of Artemis Orthia was found in a thicket of withies, which twined round it and kept it upright (*λύγος* is the *agnus castus*, and points to Artemis in her relation to women); and *ἀπαγχομένη* (" the suspended "), probably a reference to the custom of hanging the mask or image of a vegetation-divinity on a tree to obtain fertility (Farnell, *Cults of the Greek States*, ii. p. 429; cf. the "swing" festival (*αἰώρα*) of the Greeks, and the *oscilla* of the Romans).

The functions of the goddess extended from the vegetable to the animal world, to the inhabitants of the woods and mountains. This is clearly expressed in the cult of Artemis Laphria (possibly connected with *λάφυρα*, " spoils "), at whose festivals all kinds of animals, both wild and tame, as well as fruits, were thrown together on a huge wood fire. Her general name in this connexion was *ἀγροτέρα* (" roaming the wilds," not necessarily " goddess of the chase," an aspect less familiar in the older religion), to whom five hundred goats were offered every year by the Athenians as a thanksgiving in commemoration of the victory at Marathon. Numerous animals were sacred to her, and at Syracuse all kinds of wild beasts, including a lioness, were carried in procession in her honour. It has been observed that she is rather the patroness of the wild beasts of the field than of the more agricultural or domestic animals (Farnell, *Cults*, ii. p. 431), although the epithet *ἡμερασία* ("the tamer," according to others, the "gentle" goddess of healing) seems to refer to her connexion with the latter. The bear was especially associated with her in Arcadia, and in her worship as Artemis Brauronia at Brauron in Attica. According to the legend, Callisto, an Arcadian nymph, became by Zeus the mother of Arcas, the eponymous hero of the Arcadians. Zeus, to conceal the amour, changed Callisto into a she-bear; Hera, however, discovered it, and persuaded Artemis to slay Callisto, who was placed amongst the stars as *ἄρκτος* (" the bear "). There is no doubt that Callisto is identical with Artemis; her name is an obvious variation of *καλλίστη*, a frequent epithet of the goddess, to whom a temple was erected on the hill where Callisto was supposed to be buried. It is suggested by M. Kraus in *Classical Review*, February 1908, that Aphaea, the cult-name of Artemis at Aegina, is of Semitic origin and means " beautiful. " Closely connected with this legend is the worship of Artemis Brauronia. The accounts of its institution, which differ in detail, agree that it was intended to appease the wrath of the goddess at the killing of a bear. A number of young girls, between five and ten years of age, wearing a bear-skin (afterwards a saffron-coloured robe) danced a bear-dance, called *ἀρκτεία*, the girls themselves being called *ἄρκτοι*. In one account, a maiden was ordered to be sacrificed to the bear Artemis, but a certain man who had a goat called it his daughter and offered it up in secret, just as at Munychium a fawn dressed up as a girl was sacrificed to the goddess. In place of the goat or fawn a bear might have been expected, but the choice may have been influenced by the animal totem of the tribe into whose hands the ritual fell. The whole is a reminiscence of earlier times, when the goddess herself was a bear, to whom human sacrifice was offered. Callisto was originally a bear-goddess worshipped in Arcadia, identified with Artemis, when nothing remained of the original animal-worship but name and ritual. The worship of Callisto being merged in that of the greater divinity, she became the handmaid and companion of Artemis. A stone figure of a bear found on the Acropolis seems to point to the worship of Artemis Brauronia. Her death at the hands of the latter was explained by the wrath of the goddess—in her later aspect as goddess of chastity—at Callisto's amour with Zeus (see A. Lang, *Myth, Ritual and Religion*, ii.; Farnell, *Cults*, ii. p. 437). The custom of flogging youths at the altar of Artemis Orthia[1] at Limnaeum in Laconia, and the legend of Iphigeneia (*q.v.*), herself another form of Artemis, connected with Artemis Taurica of the Tauric Chersonese, are usually supposed to point to early human sacrifice (but see Farnell). Various explanations have been given of the epithet *ὀρθία*: (1) that it refers to the primitive type of the " erect " wooden idol; (2) that it means " she who safely rears children after birth," or "heals the sick " (cf. *ὄρθιος* applied to Asclepius); (3) that it has a phallic significance (Schreiber in Roscher's *Lexikon*). Scholars differ as to whether Artemis Taurica is identical with Artemis Tauropolos, worshipped chiefly at Samos with a milder ritual, but it is more probable that *ταυροπόλος* simply means " protectress of bulls."

The protecting influence of Artemis was extended, like that of Apollo, to the highest animal, man. She was especially concerned in the bringing up of the young. Boys were brought by their nurses to the temple of Artemis *κορυθαλία* (=*κουροτρόφος*) and there consecrated to her; at the Apaturia, on the day called *κουρεῶτις*, boys cut off and dedicated their hair to her. Girls as well as boys were under her protection. Her function as a goddess of marriage is less certain, and the cult-titles adduced in support of it are hardly convincing; such are *ἡγεμόνη*, interpreted as " she who leads home the bride," *σελασφόρος*, " bearer of light," that is, of torches at the marriage procession. On the other hand, her connexion with childbirth is clearly shown: in many places she is even called Eilithyia, who in the earlier poets was regarded as distinct from her. In one version of the story of her birth she is said to have been born a day before Apollo, in order to assist Leto at his birth; women in childbirth invoked her aid, and after delivery offered up their clothes or a lock of hair. As already noticed, in Homer Artemis appears as a goddess of death; closely akin to this is the conception of her as a goddess of war. As such she is *νικηφόρος* (" bringer of victory "); the title *κολαινίς* is possibly connected with κολεός (“sword-sheath”); and λαφρία (see above) may refer to the spoils of war as well as the chase.

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[1] The site of the temple of Artemis Orthia was excavated by the British School of Archaeology at Athens (see *Annual*, 1906). The flogging (*διαμαστίγωσις*) is explained by R. C. Bosanquet as a late institution of decadent Sparta, an exaggeration of an old ritual practice of whipping away boys who tried to steal cheeses from the altar (see *The Year's Work in Classical Studies*, ed. W. H. D. Rouse, 1907).

The idea of Artemis as a virgin goddess, the “queen and huntress, chaste and fair,” which obtained great prominence in early times, and seems inconsistent with her association with childbirth, is generally explained as due to her connexion with Apollo, but it is suggested by Farnell that παρθένος originally meant “unmarried,” and that “Ἄρτεμις παρθένος may have been originally the goddess of a people who had not yet the advanced Hellenic institutions of settled marriage . . . and when society developed the later family system the goddess remained celibate, though not opposed to childbirth.”

Another view of the original character of Artemis, which has found much support in modern times, is that she was a moon-goddess. But there is no trace of Artemis as such in the epic period, and the Homeric hymn knows nothing of her identification with Selene. The attribute of the torch will apply equally well to the goddess of the chase, and epithets such as φωσφόρος, σελασφόρος, αἰθοπία, although applicable, are by no means convincing. The idea dates from the 5th century, and was due to her connexion with Hecate and Apollo. When the latter came to be identified by philosophical speculation with the sun-god Helios, it was natural that his sister and counterpart should be identified with the moon-goddess Selene. But she is nowhere recognized in cult as such (see Gruppe, *Griechische Mythologie*, ii. p. 1297, note 2).

It has been mentioned that Callisto, Iphigeneia, Eilithyia, are only Artemis under different names; to these may be added Adrasteia, Atalanta, Helen, Leto and others (see Wernicke in Pauly-Wissowa's *Realencyclopädie*).

Again, various non-Hellenic divinities were identified with Artemis, and their cult gradually amalgamated with hers. The most important of these was Artemis of Ephesus, whose seat was in the marshy valley of the Caystrus. Like the Greek Artemis, she was essentially a nature goddess, the great foster-mother of the vegetable and animal kingdom. A number of officials were engaged in the performance of her temple service. Her eunuch priests, μεγάβυζοι (a name which points to a Persian origin), were under the control of a high priest called Essen (according to others, there was a body of priests called Essenes). There were also three classes of priestesses, Mellierae, Hierae, Parierae; there is no evidence that they were called Melissae (“bees”), although the bee is a frequent symbol on the coins of the city. Her chief festival, Ephesia or Artemisia, was held in the spring, at which games and various contests took place after the Greek fashion, although the ritual continued to be of a modified oriental, orgiastic type. This goddess is closely connected with the Amazons (*q.v.*), who are said to have built her temple and set up her image in the trunk of a tree. The Greeks of Ephesus identified her with their own Artemis, and claimed that her birthplace Ortygia was near Ephesus, not in Delos. She has much in common with the oriental prototype of Aphrodite, and the Cappadocian goddess Ma, another form of Cybele. The usual figure of the Ephesian Artemis, which was said in the first instance to have fallen from heaven, is in the form of a female with many breasts, the symbol of productivity or a token of her function as the all-nourishing mother. From the waist to the feet her image resembles a pillar, narrowing downwards and sculptured all round with rows of animals (lions, rams and bulls).

Mention may also be made of the following non-Hellenic representatives of Artemis. Leucophryne (or Leucophrys), whose worship was brought by emigrants from Magnesia in Thessaly to Magnesia on the Maeander, was a nature goddess, and her representation on coins exactly resembles that of the Ephesian Artemis. Her cult, however, from the little that is known of it appears to have been more Hellenic. There was an altar and temple of Artemis Pergaea at Perga in Pamphylia, where a yearly festival was held in her honour. As in the case of Cybele, mendicant priests were attached to her service. Similar figures were Artemis Coloēnē, worshipped at Lake Coloē near Sardis; Artemis Cordax, celebrated in wanton dances on Mount Sipylus; the Persian Artemis, identical with Anaitis Bendis, was a Thracian goddess of war and the chase, whose cult was introduced into Attica in the middle of the 5th century B.C. by Thracian metics. At her festival called Bendidea, held at the Peiraeus, there was a procession of Thracians who were settled in the district, and a torch-race on horseback. (For Britomartis see separate article.)

Among the chief attributes of Artemis are: the hind, specially regarded as her sacred animal; the bear, the boar and the goat; the zebu (Artemis Leucophrys); the lion, one of her oldest animal symbols; bow and arrows, as goddess of the chase and death; a mural crown, as the protectress of cities; the torch, originally an attribute of the goddess of the chase or marriage, but, like the crescent (originally an attribute of the Asiatic nature goddesses), transferred to Artemis, when she came to be regarded as a moon-goddess. The Greek Artemis was usually represented as a huntress with bow and quiver, or torch in her hand, in face very like Apollo, her drapery flowing to her feet, or, more frequently, girt high for speed. She is accompanied often by a deer or a dog. Perhaps the finest existing statue of her is the Diana of Versailles from Hadrian's Villa (now in the Louvre), in which she wears a short tunic drawn in at the waist and sandals on her feet; her hair is bound up into a knot at the back of her head, with a band over the forehead. With her left hand she holds a stag, while drawing an arrow from the quiver on her shoulder with the right. Another famous statue is one from Gabii, in which she is finishing her toilet and fastening the chlamys over her tunic. In older times her figure is fuller and stronger, and the clothing more complete; certain statues discovered at Delos, imitated from wooden models (ξόανα), are supposed to represent Artemis; they are described as stiff and rigid, the limbs as it were glued to the body without life or movement, garments closely fitting, the folds of which fall in symmetrical parallel lines. As a goddess of the moon she wears a long robe, carries a torch, and her head is surmounted by a crescent. On the coins of Arcadia, Aetolia, Crete and Sicily, are to be seen varied and beautiful representations of her head as conceived by the Greek artists in the best times.

Authorities.—Articles in Pauly-Wissowa's *Realencyclopädie*; Roscher's *Lexikon der Mythologie*, and Daremberg and Saglio's *Dictionnaire des antiquités* (*s.v.* Diana, with well-arranged bibliography); L. Preller, *Griechische Mythologie* (4th ed. by C. Robert); L. R. Farnell, *The Cults of the Greek States*, ii. (1896); O. Gruppe, *Griechische Mythologie und Religions-Geschichte*, ii. (1906); A. Claus, *De Dianae antiquissima apud Graecos natura* (Breslau, 1880). In the article Greek Art, fig. 11 (a gold ornament from Camirus) represents the Oriental goddess identified by the Greeks with Artemis.

For the Roman goddess identified with Artemis see Diana.

(J. H. F.)

ARTEMISIA, daughter of Lygdamis, was queen of Halicarnassus and Cos about 480 B.C. Being a dependent of Persia, she took part in person in the expedition of Xerxes against the Greeks, and fitted out five ships, with which she distinguished herself in the sea-fight near Salamis (480). When closely pursued by the Athenians she escaped by the stratagem of attacking one of the Persian vessels, whereupon the Athenians concluded that she was an ally, and gave up the pursuit (Herod. vii. 99, viii. 68). After the battle Xerxes declared that the men had fought like women, and the women like men. By her advice he did not risk another battle, but at once retired from Greece. She is said to have loved a young man named Dardanus, of Abydos, and, enraged at his neglect of her, to have put out his eyes while he was asleep. The gods, as a punishment for this, ordered her, by an oracle, to take the famous but rather mythical *lover's leap* from the Leucadian promontory (Photius, *Cod.* 153*a*).

ARTEMISIA, the sister and wife of Mausolus (or Maussollus), king of Caria, was sole ruler from about 353 to 350 B.C. She has immortalized herself by the honours paid to the memory of her husband. She built for him, in Halicarnassus, a very magnificent tomb, called the Mausoleum, which was one of the seven wonders of the world, and from which the name mausoleum was afterwards given to all tombs remarkable for their grandeur. She appointed panegyrics to be composed in his honour, and offered valuable prizes for the best oratorical and tragic compositions. She also erected a monument, or trophy, in Rhodes, to commemorate her conquest of that island. When the Rhodians regained their freedom they built round this trophy so as to render it inaccessible, whence it was known as the *Abaton*. There are statues of Mausolus and Artemisia in the British Museum.

Vitruvius ii. 8; Diodorus Siculus xvi. 36; Cicero, *Tusc.* iii. 31; Val. Max. iv. 6.

ARTEMON (fl. *c.* A.D. 230), a prominent Christian teacher at Rome, who held Adoptianist (see Adoptianism), or humanitarian views, of the same type as his elder contemporaries the Theodotians, though perhaps asserting more definitely than they the superiority of Christ to the prophets in respect of His supernatural birth and sinlessness. He was excommunicated by Zephyrinus, despite his remarkable claim that all that bishop's predecessors in the see of Rome had held the humanitarian position. (See also Monarchianism.)

ARTENA, a village of Italy, in the province of Rome, situated at the N.N.W. extremity of the Volscian Mountains; it is 36 m. S.E. by rail, and 24 m. direct from Rome. Pop. (1901) 5016. On the mountain above it (2073 ft.) are the fine remains of the fortifications of a city built in a very primitive style, in cyclopean blocks of local limestone; within the walls are traces of buildings, and a massive terrace which supported some edifice of importance. The name of this city is quite uncertain; Ecetra is a possible suggestion. The modern village, which was called Monte Fortino until 1870, owes its present name to an unwarrantable identification of the site with the ancient Volscian Artena, destroyed in 404 B.C. Another Artena, which belonged to the district of Caere, and lay between it and Veii, was destroyed in the period of the kings, and its site is quite unknown.

See T. Ashby and G. J. Pfeiffer in *Supplementary Papers of the American School in Rome*, i. 87 seq.

ARTERIES (Gr. ἀρτηρία, probably from αἴρειν, to raise, but popularly connected by the ancients with ἀήρ, air), in anatomy, the elastic tubes which carry the blood away from the heart to the tissues. As, after death, they are always found empty, the older anatomists believed that they contained air, and to this belief they owe the name, which was originally given to the windpipe (*trachea*). Two great trunks, the aorta and pulmonary artery, leave the heart and divide again and again until they become minute vessels to which the name of arterioles is given. The larger trunks are fairly constant in position and receive definite names, but as the smaller branches are reached there is an increasing inconstancy in their position, and anatomists are still undecided as to the normal, *i.e* most frequent, arrangement of many of the smaller arteries. From a common-sense point of view it is probably of greater importance to realize how variable the distribution of small arteries is than to remember the names of twigs which are of neither surgical nor morphological importance. Arteries adapt themselves more quickly than most other structures to any mechanical obstruction, and many of the differences between the arterial systems of Man and other animals are due to the assumption of the erect position. Many arteries are tortuous, especially when they supply movable parts such as the face or scalp, but when one or two sharp bends are found they are generally due to the artery going out of its way to give off a constant and important branch. Small arteries unite or anastomose with others near them very freely, so that when even a large artery is obliterated a collateral circulation is carried on by the rapid increase in size of the communications between the branches coming off above and below the point of obstruction. Some branches, however, such as those going to the basal ganglia of the brain and to the spleen, are known as "end arteries," and these do not anastomose with their neighbours at all; thus, if one is blocked, arterial blood is cut off from its area of supply. As a rule, there is little arterial anastomosis across the middle line of the body near the surface, though the scalp, lips and thyroid body are exceptions.

The distribution of the pulmonary artery is considered in connexion with the anatomy of the lungs (see Respiratory System). That of the aorta will now be briefly described.

Aorta.

The *Aorta* lies in the cavities of the thorax and abdomen, and arises from the base of the left ventricle of the heart. It ascends forward, upward, and to the right as far as the level of the second right costal cartilage, then runs backward, and to the left to reach the left side of the body of the 4th thoracic vertebra, and then descends almost vertically. It thus forms the *arch of the aorta*, which arches over the root of the left lung, and which has attached to its concave surface a fibrous cord, known as the obliterated *ductus arteriosus*, which connects it with the left branch of the pulmonary artery. The aorta continues its course downward in close relation to the bodies of the thoracic vertebrae, then passes through an opening in the diaphragm (*q.v.*), enters the abdomen, and descends in front of the bodies of the lumbar vertebrae as low as the 4th, where it usually divides into two terminal branches, the common iliac arteries. Above and behind the angle of bifurcation, however, a long slender artery, called the *middle sacral*, is prolonged downward in front of the sacrum to the end of the coccyx.

It will be convenient to describe the distribution of the arteries under the following headings:—(1) Branches for the head, neck and upper limbs; (2) branches for the viscera of the thorax and abdomen; (3) branches for the walls of the thorax and abdomen; (4) branches for the pelvis and lower limbs.

The branches for the head, neck and upper limbs arise as three large arteries from the transverse part of the aorta; they are named *innominate, left common carotid* and *left subclavian*. The innominate artery is the largest and passes upward and to the right, to the root of the neck, where it divides into the right common carotid and the right subclavian. The carotid arteries supply the two sides of the head and neck; the subclavian arteries the two upper extremities.

Carotid system.

The *common carotid* artery runs up the neck by the side of the windpipe, and on a level with the upper border of the thyroid cartilage divides into the internal and external carotid arteries.

The *internal carotid* artery ascends through the carotid canal in the temporal bone into the cranial cavity. It gives off an *ophthalmic* branch to the eyeball and other contents of the orbit, and then divides into the *anterior* and *middle cerebral* arteries. The middle cerebral artery extends outward into the Sylvian fissure of the brain, and supplies the island of Reil, the orbital part, and the outer face of the frontal lobe, the parietal lobe, and the temporo-sphenoidal lobe; it also gives a choroid branch to the choroid plexus of the velum interpositum. The anterior cerebral artery supplies the inner face of the hemisphere from the anterior end of the frontal lobe as far back as the internal parieto-occipital fissure. At the base of the brain not only do the two internal carotids anastomose with each other through the *anterior communicating* artery, which passes between their anterior cerebral branches, but the internal carotid on each side anastomoses with the posterior cerebral branch of the basilar, by a *posterior communicating* artery. In this manner a vascular circle, the *circle of Willis*, is formed, which permits of freedom of the arterial circulation by the anastomoses between arteries not only on the same side, but on opposite sides of the mesial plane. The vertebral and internal carotid arteries, which are the arteries of supply for the brain, are distinguished by lying at some depth from the surface in their course to the organ, by having curves or twists in their course, and by the absence of large collateral branches.

The *external carotid* artery ascends through the upper part of the side of the neck, and behind the lower jaw into the parotid gland, where it divides into the internal maxillary and superficial temporal branches. This artery gives off the following branches:—(*a*) *Superior thyroid* to the larynx and thyroid body; (*b*) *Lingual* to the tongue and sublingual gland; (*c*) *Facial* to the face, palate, tonsil and submaxillary gland; (*d*) *Occipital* to the sterno-mastoid muscle and back of the scalp; (*e*) *Posterior auricular* to the back of the ear and the adjacent part of the scalp; (*f*) *Superficial temporal* to the scalp in front of the ear, and by its *transverse facial* branch to the back part of the face; (*g*) *Internal maxillary*, giving *muscular* branches to the muscles of mastication, *meningeal* branches to the dura mater, *dental* branches to the teeth, and other branches to the nose, palate and tympanum; (*h*) *Ascending pharyngeal*, which gives branches to the pharynx, palate, tonsils and dura mater.

Subclavian system.

The *subclavian* artery is the commencement of the great arterial trunk for the upper limb. It passes across the root of the neck and behind the clavicle, where it enters the armpit, and becomes the *axillary* artery; by that name it extends as far as the posterior fold of the axilla, where it enters the upper arm, takes the name of *brachial*, and courses as far as the bend of the elbow; here it bifurcates into the *radial* and *ulnar* arteries. From the subclavian part of the trunk the following branches arise:—(*a*) *Vertebral*, which enters the foramen at the root of the transverse process of the 6th cervical vertebra, ascends through the corresponding foramina in the vertebrae above, lies in a groove on the arch of the atlas, and enters the skull through the foramen magnum, where it joins its fellow to form the *basilar* artery; it gives off *muscular* branches to the deep muscles of the neck, *spinal* branches to the spinal cord, *meningeal* branches to the dura mater, and an *inferior cerebellar* branch to the under surface of the cerebellum. The *basilar* artery, formed by the junction of the two vertebrals, extends from the lower to the upper border of the pons Varolii; it gives off *transverse* branches to the pons, *auditory* branches to the internal ear, *inferior cerebellar* branches to the under surface of the cerebellum, whilst it breaks up into four terminal branches, viz. two *superior cerebellar* to the upper surface of the cerebellum, and two *posterior cerebral* which supply the tentorial and mesial aspects of the temporo-sphenoidal lobes, the occipital lobes, and the posterior convolutions of the parietal lobes. (*b*) *Thyroid axis*, which immediately divides into the *inferior thyroid*, the *supra-scapular*, and the *transverse cervical* branches; the *inferior thyroid* supplies the thyroid body, and gives off an *ascending cervical* branch to the muscles of the neck; the *supra-scapular* supplies the muscles on the dorsum scapulae; the *transverse cervical* supplies the trapezius and the muscles attached to the vertebral border of the scapula. (*c*) *Internal mammary* supplies the anterior surface of the walls of the chest and abdomen, and the upper surface of the diaphragm. (*d*) *Superior intercostal* supplies the first intercostal space, and by its deep *cervical* branch the deep muscles of the back of the neck.

The *axillary* artery supplies *thoracic* branches to the wall of the chest, the pectoral muscles, and the fat and glands of the axilla; an *acromio-thoracic* to the parts about the acromion; *anterior* and *posterior circumflex* branches to the shoulder joint and deltoid muscle; a *subscapular* branch to the muscles of the posterior fold of the axilla.

The *brachial* artery supplies *muscular* branches to the muscles of the upper arm; a *nutrient* branch to the humerus; *superior* and *inferior profunda* branches and an *anastomotic* to the muscles of the upper arm and the region of the elbow joint.

The *ulnar* artery extends down the ulnar side of the front of the fore-arm to the palm of the hand, where it curves outward toward the thumb, and anastomoses with the superficial volar or other branch of the radial artery to form the *superficial palmar arch*. In the fore-arm the ulnar gives off the *interosseous* arteries, which supply the muscles of the fore-arm and give *nutrient* branches to the bones; two *recurrent* branches to the region of the elbow; *carpal* branches to the wrist joint: in the hand it gives a *deep* branch to the deep muscles of the hand, and from the superficial arch arise *digital* branches to the sides of the little, ring, and middle fingers, and the ulnar border of the index finger.

The *radial* artery extends down the radial side of the front of the fore-arm, turns round the outer side of the wrist to the back of the hand, passes between the 1st and 2nd metacarpal bones to the palm, where it joins the deep branch of the ulnar, and forms the *deep palmar arch*. In the fore-arm it gives off a *recurrent* branch to the elbow joint; *carpal* branches to the wrist joint; and *muscular* branches, one of which, named superficial volar, supplies the muscle of the thumb and joins the ulnar artery: in the hand it gives off a branch to the thumb, and one to the radial side of the index, *interosseous* branches to the interosseous muscles, *perforating* branches to the back of the hand, and *recurrent* branches to the wrist.

The branches of the aorta which supply the viscera of the thorax are the coronary, the oesophageal, the bronchial and the pericardiac.

Visceral branches.

The *coronary* arteries, two in number, are the first branches of the aorta, and arise opposite the anterior and left posterior segments of the semilunar valve, from the wall of the aorta, where it dilates into the sinuses of Valsalva. They supply the tissue of the heart.

The *oesophageal*, *bronchial* and *pericardiac* branches are sufficiently described by their names.

The branches of the aorta which supply the viscera of the abdomen arise either singly or in pairs. The single arteries are the coeliac axis, the superior mesenteric, and the inferior mesenteric, which arise from the front of the aorta; the pairs are the capsular, the two renal, and the two spermatic or ovarian, which arise from its sides. The single arteries supply viscera which are either completely or almost completely invested by the peritoneum, and the veins corresponding to them are the roots of the vena portae. The pairs of arteries supply viscera developed behind the peritoneum, and the veins corresponding to them are rootlets of the inferior vena cava.

The *coeliac axis* is a thick, short artery, which almost immediately divides into the gastric, hepatic and splenic branches. The *gastric* gives off oesophageal branches and then runs along the lesser curvature of the stomach. The *hepatic* artery ends in the substance of the liver; but gives off a *cystic* branch to the gall bladder, a *pyloric* branch to the stomach, a *gastro-duodenal* branch, which divides into a *superior pancreatico-duodenal* for the pancreas and duodenum, and a *right gastro-epiploic* for the stomach and omentum. The *splenic* artery ends in the substance of the spleen; but gives off *pancreatic* branches to the pancreas, *vasa brevia* to the left end of the stomach, and a *left gastro-epiploic* to the stomach and omentum.

The *superior mesenteric* artery gives off an *inferior pancreatico-duodenal* branch to the pancreas and duodenum; about twelve *intestinal* branches to the small intestines, which form in the substance of the mesentery a series of arches before they end in the wall of the intestines; an *ileocolic* branch to the end of the ileum, the caecum, and beginning of the colon; a *right colic* branch to the ascending colon; and a *middle colic* branch to the transverse colon.

The *inferior mesenteric* artery gives off a *left colic* branch to the descending colon, a *sigmoid* branch to the iliac and pelvic colon, and ends in the *superior haemorrhoidal* artery, which supplies the rectum. The arteries which supply the coats of the alimentary tube from the oesophagus to the rectum anastomose freely with each other in the wall of the tube, or in its mesenteric attachment, and the anastomoses are usually by the formation of arches or loops between adjacent branches.

The *capsular arteries*, small in size, run outward from the aorta to end in the supra-renal capsules.

The *renal* arteries pass one to each kidney, in which they for the most part end, but in the substance of the organ they give off small *perforating* branches, which pierce the capsule of the kidney, and are distributed in the surrounding fat. Additional renal arteries are fairly common.

The *spermatic* arteries are two long slender arteries, which descend, one in each spermatic cord, into the scrotum to supply the testicle. The corresponding ovarian arteries in the female do not leave the abdomen.

Parietal branches

The branches of the aorta which supply the walls of the thorax, abdomen and pelvis, are the intercostal, the lumbar, the phrenic, and the middle sacral.

The *intercostal* arteries arise from the back of the thoracic aorta, and are usually nine pairs. They run round the sides of the vertebral bodies as far as the commencement of the intercostal spaces, where each divides into a *dorsal* and a *proper intercostal* branch; the dorsal branch passes to the back of the thorax to supply the deep muscles of the spine; the proper intercostal branch (AB.) runs outward in the intercostal space to supply its muscles, and the lower pairs of intercostals also give branches to the diaphragm and wall of the abdomen. Below the last rib a subcostal artery runs.

The *lumbar* arteries arise from the back of the abdominal aorta, and are usually four pairs. They run round the sides of the lumbar vertebrae, and divide into a *dorsal* branch which supplies the deep muscles of the back of the loins, and an *abdominal* branch which runs outward to supply the wall of the abdomen. The distribution of the lumbar and intercostal arteries exhibits a transversely segmented arrangement of the vascular system, like the transversely segmented arrangement of the bones, muscles and nerves met with in these localities, but more especially in the thoracic region.

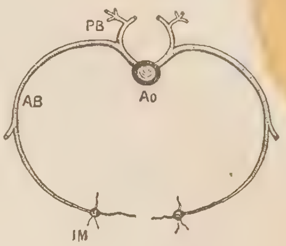

Fig. 1.—Diagram of a pair of intercostal arteries.

Ao, The aorta transversely divided, giving off at each side an intercostal artery.
PB, The posterior or dorsal branch.
AB, The anterior or proper intercostal branch.
IM, A transverse section through the internal mammary artery.

The *phrenic* arteries, two in number, pass to supply the under surface of the diaphragm.

The *middle sacral* artery, as it runs down the front of the sacrum, gives branches to the back of the pelvic wall.

Injections made by Sir W. Turner have shown that, both in the thoracic and abdominal cavities, slender anastomosing communications exist between the visceral and parietal branches.

The arteries to the pelvis and hind limbs begin at the bifurcation of the aorta into the two common iliacs.

Iliac system.

The *common iliac* artery, after a short course, divides into the internal and external iliac arteries. The *internal iliac* enters the pelvis and divides into branches for the supply of the pelvic walls and viscera, including the organs of generation, and for the great muscles of the buttock. The *external iliac* descends behind Poupart's ligament into the thigh, where it takes the name of *femoral* artery. The femoral descends along the front and inner surface of the thigh, gives off a *profunda* or deep branch, which, by its *circumflex* and *perforating* branches, supplies the numerous muscles of the thigh; most of these extend to the back of the limb to carry blood to the muscles situated there. The femoral artery then runs to the back of the limb in the ham, where it is called *popliteal* artery. The popliteal divides into two branches, of which one, called *anterior tibial*, passes between the bones to the front of the leg, and then downward to the upper surface of the foot; the other, *posterior tibial*, continues down the back of the leg to the sole of the foot, and divides into the *internal* and *external plantar* arteries; branches proceed from the external plantar artery to the sides of the toes, and constitute the *digital* arteries. From the large arterial trunks in the leg many branches proceed, to carry blood to the different structures in the limb.

Structure of arteries.

The wall of an artery consists of several coats (see fig. 2). The outermost is the *tunica adventitia*, composed of connective tissue; immediately internal to this is the *yellow elastic* coat; within this again the *muscular coat*, formed of involuntary muscular tissue, the contractile fibre-cells of which are for the most part arranged transversely to the long axis of the artery; in the larger arteries the elastic coat is much thicker than the muscular, but in the smaller the muscular coat is relatively strong; the vaso-motor nerves terminate in the muscular coat. In the first part of the aorta, pulmonary artery and arteries of the retina there is no muscular coat. Internal to the muscular coat is the *elastic fenestrated coat*, formed of a smooth elastic membrane perforated by small apertures. Most internal of all is a layer of *endothelial cells*, which form the free surface over which the blood flows. The arteries are not nourished by the blood which flows through them, but by minute vessels, *vasa vasorum*, distributed in their external, elastic and muscular coats.

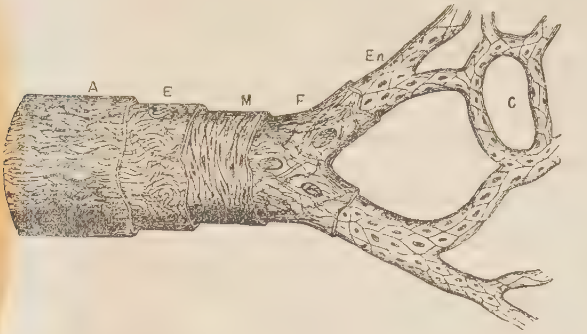

FIG. 2.—Diagram of the structure of an artery. A, tunica adventitia; E, elastic coat; M, muscular coat; F, fenestrated coat; En, endothelium continuous with the endothelial wall of C, the capillaries.

EMBRYOLOGY

The earliest appearance of the blood vessels is dealt with under VASCULAR SYSTEM. Here will be briefly described the fate of the main vessel which carries the blood away from the truncus arteriosus of the developing heart (*q.v.*). This ventral aorta, if traced forward, soon divides into two lateral parts, the explanation being that there were originally two vessels, side by side, which fused to form the heart, but continued separately anteriorly. The two parts run for a little distance toward the head of the embryo, ventral to the alimentary canal, and then turn toward the dorsum, passing one on either side of that tube to form the first aortic arch. Having reached the dorsum they turn backward toward the tail end and form the dorsal aortae; here, according to A. H. Young (*Studies in Anatomy*, Owens College, 1891 and 1900) they again turn toward the ventral side and become, after a transitional stage, the *hypogastric, placental, allantoic* or *umbilical* arteries. This authority does not believe that the middle sacral artery of the adult is the real continuation of the single median dorsal aorta into which the two parallel dorsal vessels just mentioned soon coalesce, though until recently it has always been so regarded. The anterior loop between the ventral and dorsal aortae already described as the first aortic arch is included in the *maxillary* or *first visceral arch* of the soft parts (see fig. 3, *1*). Later, four other well-marked aortic arches grow behind this in the more caudal visceral arches, so that there are altogether five arterial arches on each side of the pharynx, through which the blood can pass from the ventral to the dorsal aorta. Of these arches the first soon disappears, but is probably partly represented in the adult by the *internal maxillary* artery, one branch of which, the *infraorbital*, is enclosed in the upper jaw, while another, the *inferior dental*, is surrounded by the lower jaw. Possibly the ophthalmic artery also belongs to this arch. The second arch also disappears, but the *posterior auricular* and *occipital* arteries probably spring from it, and at an early period it passed through the stapes as the transitory stapedial artery. The third arch forms the beginning of the internal carotid. The fourth arch becomes the arch of the adult aorta, between the origins of the left carotid and left subclavian, on the left side, and the first part of the right subclavian artery on the right. The apparent fifth arch on the left side (fig. 3, *6*) remains all through foetal life as the *ductus arteriosus*, and, as the lungs develop, the *pulmonary* arteries are derived from it. J. E. V. Boas and W. Zimmermann have shown that this arch is in reality the sixth, and that there is a very transitory true fifth arch in front of it (fig. 3, *5*). The part of the ventral aorta from which this last arch rises is a single median vessel due to the same fusion of the two primitive ventral aortae which precedes the formation of the heart, but a spiral septum has appeared in it which divides it in such a way that while the anterior or cephalic arches communicate with the left ventricle of the heart, the last one communicates with the right (see HEART). The fate of the ventral and dorsal longitudinal vessels must now be followed. The fused part of the two ventral aortae, just in front of the heart, forms the ascending part of the adult aortic arch, and where this trunk divides between the fifth and fourth arches (strictly speaking, the sixth and fifth), the right one forms the *innominate* (fig. 3, In.) and the left one a very short part of the *transverse arch* of the aorta until the fourth arch comes off (see fig. 4). From this point to the origin of the third arch is *common carotid*, and after that, to the head, *external carotid* on each side. The *dorsal longitudinal* arteries on the head side of the junction with the third arch form the *internal carotids*. Between the third and fourth arches they are obliterated, while on the caudal side of this, until the point of fusion is reached on the dorsal side of the heart, the left artery forms the upper part of the dorsal aorta while the right entirely disappears. Below this point the *thoracic* and *abdominal aortae* are formed by the two *primitive dorsal aortae* which have fused to form a single median vessel. As the limbs are developed, vessels bud out in them. The *subclavian* for the arm comes from the fourth aortic arch on each side, while in the leg the main artery is a branch of the *caudal arch* which is curving ventralward to form the umbilical artery. From the convexity of this arch the internal iliac and sciatic at first carry the blood to the limb, as they do permanently in reptiles, but later the external iliac and femoral become developed, and, as they are on the concave side of the bend of the hip, while the sciatic is on the convex, they have a mechanical advantage and become the permanent main channel.

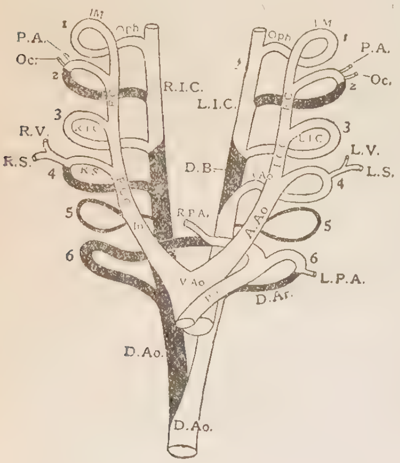

FIG. 3.—Diagram of the Embryonic Arterial Arches. 1, 2, 3, 4, 5, 6, point to the six arches. (The black parts are obliterated in the adult human subject.)

V.Ao. Ventral Aorta.
A.Ao. Arch of Aorta.
D.Ar. Ductus Arteriosus.
In. Innominate Artery.
R.I.C.-L.I.C. Right and Left Internal Carotid Arteries.
D.B. Duct of Botalli.
R.S.-L.S. Right and Left Subclavian Arteries.
R.V.-L.V. Right and Left Vertebral Arteries.
P.A. Posterior Auricular Artery.
Oph. Ophthalmic Artery.
D.Ao. Dorsal Aorta.
P.T. Pulmonary trunk.
R.P.A.-L.P.A. Right and Left Pulmonary Arteries.
R.C.C.-L.C.C. Right and Left Common Carotid Arteries.
E.C. External Carotid Artery.
Oc. Occipital Artery.
I.M. Internal Maxillary Artery.

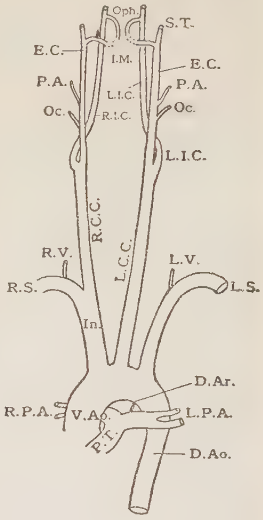

FIG. 4.—Diagram of the Human Aorta and its branches. S.T., Superficial Temporal Artery.

For further details see O. Hertwig, *Handbuch der vergleichenden und experimentellen Entwickelungslehre der Wirbeltiere* (Jena, 1905).

COMPARATIVE ANATOMY

In the Acrania the lancelet (Amphioxus) shows certain arrangements of its arteries which are suggestive of the embryonic stages of the higher vertebrates and Man. There is a median ventral aorta below the pharynx, from which branchial arteries run up on each side between the branchial clefts, where the blood is aerated, to join two dorsal aortae which run back side by side until the hind end of the pharynx is reached; here they fuse to form a median vessel from which branches are distributed to the straight intestine. There is no heart, but the ventral aorta is contractile, and the blood is driven forward in it and backward in the dorsal aortae. The branchial arteries are very numerous, and cannot be homologized closely with the five (originally six) pairs of aortic arches in Man.

In the fish the ventral aorta gives rise to five afferent branchial arteries carrying the blood to the gills, though these may not all come off as independent trunks from the aorta. From the gills the afferent branchials carry the blood to the median dorsal aorta. As pectoral and pelvic fins are now developed, subclavian and iliac arteries are found rising from the dorsal aorta, though the aorta itself is continued directly backward as the caudal artery into the tail. In the Dipnoi or mud fish, in which the swim bladder is converted into a functional lung, the hindmost afferent branchial artery corresponding to the fifth (strictly speaking the sixth) aortic arch of the human embryo, gives off on each side a pulmonary artery to that structure.

The arrangement of the branchial aortic arches in the tailed Amphibia (Urodela), and in the tadpole stage of the tailless forms (Anura), makes it probable that the generalized vertebrate has six (if not more) pairs of these instead of the five which are evident in the human embryo. Four pairs of arches are present, the first of which is the carotid and corresponds to the third of Man; the second is the true aortic arch on each side; the third undergoes great reduction or disappears when the gills atrophy, and is very transitory in the Mammalia (fig. 3, *5*), while the fourth is the one from which the pulmonary artery is developed when the lungs appear, and corresponds to the nominal fifth, though really the sixth arch, of the higher forms (fig. 3, *6*). The dorsal part of this sixth arch remains as a pervious vessel in the Urodela, joining the pulmonary arch to the dorsal aorta. In the ventral part of the carotid arch the vessel breaks up into a plexus, for a short distance forming the so-called carotid gland, which has an important effect upon the adult circulation of the Amphibia. In the Reptilia the great arteries are arranged on the same plan as in the adult Amphibia, but the carotid arch retains its dorsal communication with the systematic aortic arch on each side, and this communication is known as the duct of Botalli (fig. 3, D.B.). In this class, as in the Amphibia, one great artery, the coeliaco-mesenteric, usually supplies the liver, spleen, stomach and anterior part of the intestines; this is a point of some interest when it is noticed how very close together the coeliac axis and superior mesenteric arteries rise from the abdominal aorta in Man.

In the Birds the right fourth arch alone remains as the aorta, the dorsal part of the left corresponding arch being obliterated. From the arch of the aorta rise two symmetrical innominates, each of which divides later into a carotid and subclavian. The blood path from the aorta to the hind limb in the Amphibia, Reptilia and Aves, is a dorsal one, and passes through the internal iliac and sciatic to the back of the thigh, and so to the popliteal space; the external iliac is, if it is developed at all, only a small branch to the pelvis.

In the Mammalia the fourth left arch becomes the aorta, the corresponding right one being obliterated, but several cases have been recorded in Man in which both arches have persisted, as they do in the reptiles (H. Leboucq, *Ann. Sci. Med. Gand*, 1894, p. 7). Examples have also been found of a right aortic arch, as in birds, while a very common human abnormality is that in which the dorsal part of the fourth right arch persists, and from it the right subclavian artery arises (see fig. 3).

The commonest arrangement of the great branches of the aortic arch in Mammals is that in which the innominate and left carotid arise by a single short trunk, while the left subclavian comes off later; this is also Man's commonest abnormality. Sometimes, especially among the Ungulata, all the branches may rise from one common trunk; at other times two innominate arteries may be present; this is commonest in the Cheiroptera, Insectivora and Cetacea. It is extremely rare to find all four large arteries rising independently from the aorta, though it has been seen in the Koala (F. G. Parsons, "Mammalian Aortic Arch," *Journ. of Anat.* vol. xxxvi. p. 389). The human arrangement of the common iliacs is not constant among mammals, for in some the external and internal iliacs rise independently from the aorta, and this is probably the more primitive arrangement. The middle sacral artery has already been referred to. A. H. Young and A. Robinson believe, on embryological grounds, that this artery in mammals is not homologous with the caudal artery of the fish, and is not the direct continuation of the aorta; it is an artery which usually gives off two or more collateral branches, and sometimes, as in the Ornithorynchus and some edentates, breaks up into a network of branches which reunite and so form what is known as a *rete mirabile*. These retia mirabilia are often found in other parts of the mammalian body, though their function is still not satisfactorily explained. The way in which the blood is carried to the foot in the pronograde mammals differs from that of Man; a large branch called the internal saphenous comes off the common femoral in the lower third of the thigh, and this runs down the inner side of the leg to the foot. This arrangement is quite convenient as long as the knee is flexed, but when it comes to be extended, as in the erect posture, the artery is greatly stretched, and it is much easier for the blood to pass to the foot through the anterior and posterior tibials. A vestige of this saphenous artery, however, remains in Man as the anastomotica magna.

The literature of the Comparative Anatomy of the Arteries up to 1902 will be found in R. Wiedersheim's *Vergleichende Anatomie der Wirbeltiere* (Jena, 1902). The morphology of the Iliac Arteries is described by G. Levi, *Archivio Italiano di Anat. ed Embriol.*, vol. i. (1902). (F. G. P.)

ARTERN, a town of Germany, in Prussian Saxony, on the Unstrut, at the influx of the Helme, at the junction of railways to Erfurt, Naumburg and Sangerhausen, 8 m. S. of the last named. Pop. 5000. It has an Evangelical church, an agricultural college and some manufactures of machinery, sugar and boots. Its brine springs, known as early as the 15th century, are still frequented.

ARTESIAN WELLS, the name properly applied to water-springs rising above the surface of the ground by natural hydrostatic pressure, on boring a small hole down through a series of strata to a water-carrying bed enclosed between two impervious layers; the name is, however, sometimes loosely applied to any deep well, even when the water is obtained by pumping. In Europe this mode of well-boring was first practised in the French province of Artois, whence the name of Artesian is derived. At Aire, in that province, there is a well from which the water has continued steadily to flow to a height of 11 feet above the ground for more than a century; and there is, within the old Carthusian convent at Lillers, another which dates from the 12th century, and which still flows. But unmistakable traces of much more ancient bored springs appear in Lombardy, in Asia Minor, in Persia, in China, in Egypt, in Algeria, and even in the great desert of Sahara. (See Well.)

ARTEVELDE, JACOB VAN (*c.* 1290–1345), Flemish statesman, was born at Ghent about 1290. He sprang from one of the wealthy commercial families of this great industrial city, his father's name being probably William van Artevelde. His brother John, a rich cloth merchant, took a leading part in public affairs during the first decades of the 14th century. Jacob, who according to tradition was a brewer by trade, spent three years in amassing quietly a large fortune. He was twice married, the second time to Catherine de Coster, whose family was of considerable influence in Ghent. Not till 1337, when the outbreak of hostilities between France and England threatened to injure seriously the industrial welfare of his native town, did Jacob van Artevelde make his first appearance as a political leader. As the Flemish cities depended upon England for the supply of the wool for their staple industry of weaving, he boldly came forward, as a tribune of the people, and at a great meeting at the monastery of Biloke unfolded his scheme of an alliance of the Flemish towns with those of Brabant, Holland and Hainaut, to maintain an armed neutrality in the dynastic struggle between Edward III. and Philip VI. of France. His efforts were successful. Bruges, Ypres and other towns formed a league with Ghent, in which town Artevelde, with the title of captain-general, henceforth until his death exercised almost dictatorial authority. His first step was to conclude a commercial treaty with England. The efforts of the count of Flanders to overthrow the power of Artevelde by force of arms completely failed, and he was compelled at Bruges to sign a treaty (June 21, 1338) sanctioning the federation of the three towns, Ghent, Bruges and Ypres, henceforth known as the "Three members of Flanders." This was the first of a series of treaties, made during the year 1339–1340, which gradually brought into the federation all the towns and provinces of the Netherlands. The policy of neutrality, however, proved impracticable, and the Flemish towns, under the leadership of Artevelde, openly took the side of the English king, with whom a close alliance was concluded. Artevelde now reached the height of his power, concluding alliances with kings, and publicly associating with them on equal terms. Under his able administration trade flourished, and Ghent rose rapidly in wealth and importance. His well-nigh despotic rule awoke at last among his compatriots jealousy and resentment. The proposal of Artevelde to disown the sovereignty of Louis, count of Flanders, and to recognize in its place that of Edward, prince of Wales (the Black Prince), gave rise to violent dissatisfaction. A popular insurrection broke out in Ghent, and Artevelde fell into the hands of the crowd and was murdered on the 24th of July 1345.

The great services that he rendered to Ghent and to his country have in later times been recognized. A statue was erected in his native town on the Marché du Vendredi, and was unveiled by Leopold I., king of the Belgians, on the 13th of September 1863.

See J. Hutten, *James and Philip van Artevelde* (London, 1882); W. J. Ashley, *James and Philip van Artevelde* (London, 1883); P. Namèche, *Les van Artevelde et leur époque* (Louvain, 1887); L. Vanderkindere, *Le Siècle des Arteveldes* (Brussels, 1879).

ARTEVELDE, PHILIP VAN (*c.* 1340–1382), youngest son of the above, and godson of Queen Philippa of England, who held him in her arms at his baptism, lived in retirement until 1381. The Ghenters had in that year risen in revolt against the oppression of the count of Flanders, and Philip, now forty years of age, and without any military or political experience, was offered the supreme command. His name awakened general enthusiasm. At first his efforts were attended by considerable success. He defeated Louis de Mâle, count of Flanders, before Bruges, entered that city in triumph, and was soon master of all Flanders.

But France took up the cause of the Flemish count, and a splendid French army was led across the frontier by the young king Charles VI. in person. Artevelde advanced to meet the enemy at the head of a burgher army of some 50,000 Flemings. The armies met at Roosebeke near Courtrai, with the result that the Flemings were routed with terrible loss, Philip himself being among the slain. This happened on the 27th of November 1382.

The brief but stirring career of this popular leader is admirably treated in Sir Henry Taylor's drama, *Philip van Artevelde.*

ART GALLERIES. An art gallery (by which, as distinguished from more general Museums of Art, *q.v.*, is here meant one specially for pictures) epitomizes so many phases of human thought and imagination that it connotes much more than a mere collection of paintings. In its technical and aesthetic aspect the gallery shows the treatment of colour, form and composition. In its historical aspect we find the true portraits of great men of the past; we can observe their habits of life, their manners, their dress, the architecture of their times, and the religious worship of the period in which they lived. Regarded collectively, the art of a country epitomizes the whole development of the people that produced it. Most important of all is the emotional aspect of painting, which must enter less or more into every picture worthy of notice. To take examples from the British National Gallery: pathos in its most intense degree will be found in Francia's "Pietà"; dignity in Velasquez' portrait of Admiral Pareja; homeliness in Van Eyck's portrait of Jan Arnolfini and his wife; the interpretation of the varying moods of nature in the work of Turner or Hobbema; nothing can be more devotional than the canvases of Bellini or his Umbrian contemporaries. So also the ruling sentiments of mankind—mysticism, drama and imagination—are the keynotes of other great conceptions of the artist. All this may be at the command of those who visit the art gallery; but without patience, care and study the higher meaning will be lost to the spectator. The picture which "tells its own story" is often the least didactic, for it has no inner or deeper lesson to reveal; it gives no stimulus or training to the eye, quick as that organ may be—*segnius irritant animos*—to translate sight into thought. In brief, the painter asks that his ἦθος may be shared as much as possible by the man who looks at the painting—the art above all others in which it is most needful to share the master's spirit if his work is to be fully appreciated. So, too, the art gallery, recalling the gentler associations of the past amidst surroundings of harmonious beauty and its attendant sense of comfort, is essentially a place of rest for the mind and eye. In the more famous galleries where the wealth of paintings allows a grouping of pictures according to their respective schools, one may choose the country, the epoch, the style or even the emotion best suited to one's taste. According to this theory, though imperfectly realized owing to the paucity of examples, the philosophic influence of art galleries is becoming more widely extended; and in its further development will be found an ever-growing source of interest, instruction and scholarship to the community. The most suitable method of describing art galleries is to classify them by their types and contents rather than by the various countries to which they belong. Thus the great representative galleries of the world which possess works of every school are grouped together, followed by state galleries which are not remarkable for more than one school of national art. Municipal galleries are divided into those which have general collections, and those which are notable for special collections. Churches which have good paintings, together with those which are now secularized, are treated separately; while the collections in the Vatican and private houses are described together. The remaining galleries, such as the Salon or the Royal Academy, are periodical or commercial in character, and are important in the development of modern art.

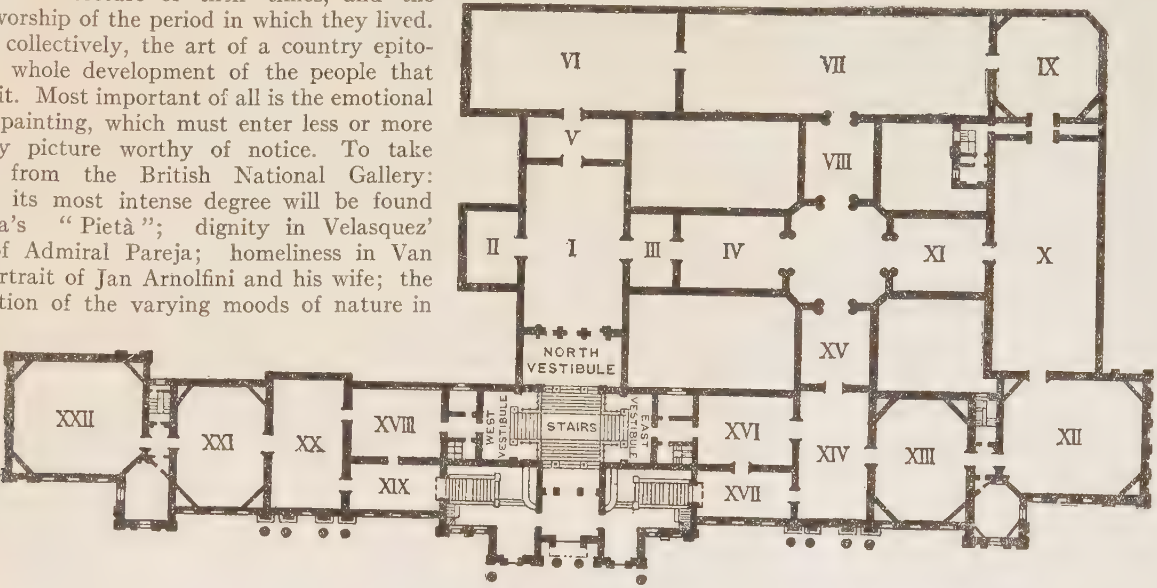

Fig. 1.—Plan of the National Gallery, London.

North Vestibule, Early Italian Schools:
I. Tuscan School (15th and 16th centuries).
II. Sienese School, &c.
III. Tuscan School.
IV. Lombard School.
V. Ferrarese and Bolognese Schools.
VI. Umbrian School, &c.
VII. Venetian and Brescian Schools.
VIII. Paduan and Early Venetian Schools.
IX. Later Venetian School.
X. Flemish School.
XI. Early Dutch and Flemish Schools.
XII. Dutch and Flemish Schools.
XIII. Flemish School.
XIV. Spanish School.
XV. German Schools.
XVI. French School.
XVII. French School.
XVIII. British School.
XIX. Old British School.
XX. British School.
XXI. British School.
XXII. Turner Collection.
Octagonal Hall: Miscellaneous.
East Vestibule: British School.
West Vestibule: Italian School.

State galleries of international schools.

The collections most worthy of attention are the state galleries representative of international schools. Among these the British National Gallery holds a high place. The collection was founded in 1824 by the acquisition of the Angerstein pictures. Its accessions are mainly governed by the parliamentary grant of £5000 to £10,000 a year, a sum which has occasionally been enlarged to permit special purchases. Thus, in 1871, the Peel collection of seventy-seven pictures was bought for £75,000, and in 1885 the Ansidei Madonna (Raphael) and Van Dyck's portrait of Charles I. were bought, the one for £70,000 and the other for £17,500. In 1890 the government gave £25,000 to meet a gift of £30,000 made by three gentlemen to acquire three portraits by Moroni, Velazquez and Holbein. The most important private gifts were the Vernon gift in 1847, the Turner bequest in 1856 and the Wynne-Ellis legacy in 1876. Since 1905 the Art Collections Fund, a society of private subscribers, has also been responsible for important additions to the gallery, notably the Venus of Velazquez (1907). The gallery contains very few poor works and all schools are well represented, with the sole exception of the French school. This, however, can be amply studied at Hertford House (Wallace Collection), which, besides Dutch, Spanish and British pictures of the highest value, contains twenty examples of Greuze, fifteen by Pater, nineteen by Boucher, eleven by Watteau and fifteen by Meissonier. The national gallery of pictures at Berlin (Kaiser Friedrich Museum), like the British National Gallery, is remarkable for its variety of schools and painters, and for the select type of pictures shown. During the last twenty-five years of the 19th century, the development of this collection was even more striking than that of the English gallery. Italian and Dutch examples are specially numerous, though every school but the British (here as elsewhere) is really well seen. The purchase grant is considerable, and is well applied. Two other German capitals have collections of international importance—Dresden and Munich. The former is famous for the Sistine Madonna by Raphael, a work of such supreme excellence that there is a tendency to overlook other Italian pictures of celebrity by Titian, Giorgione and Correggio. Munich (Old Pinakothek) has examples of all the best masters, the South German school being particularly noticeable. The arrangement is good, and the methods of exhibition make this one of the most pleasant galleries on the continent. Vienna has the Imperial Gallery, a collection which in point of number cannot be considered large, as there are not more than 1700 pictures. This, however, is in itself a safeguard, like the wise provision in a statute of 1856 for enabling the English authorities to dispose of pictures "unfit for the collection, or not required." It avoids the undue multiplication of canvases, and the overcrowding so noticeable in many Italian galleries where first-rate pictures hang too high to be examined. Thus the Viennese gallery, besides the intrinsic value of its pictures (Albert Dürer's chief work is there), is admirably adapted for study. The best gallery in Russia (St Petersburg, Hermitage) was made entirely by royal efforts, having been founded by Peter the Great, and much enlarged by the empress Catherine. It contains the collections of Crozat, Brühl and Walpole. There are about 1800 works, the schools of Flanders and Italy being of signal merit; and there are at least thirty-five genuine examples by Rembrandt. The French collection (Louvre Palace, Paris) is one of the most important of all. In 1880 it was undoubtedly the first gallery in Europe, but its supremacy has since been menaced by other establishments where acquisitions are made more frequently and with greater care, and where the system of classification is such that the value of the pictures is enhanced rather than diminished by their display. In 1900 it was partly rearranged with great effect. The feature of the Louvre is the Salon Carré, a room in which the supposed finest canvases in the collection are kept together, pictures of world-wide fame, representing all schools. It is now generally accepted that this system of selection not only lowers the standard of individual schools elsewhere by withdrawing their best pictures, but does not add to the aesthetic or educational value of the masterpieces themselves. In Florence the Tribuna room of the Uffizi gallery is a similar case in point. Probably the two most widely known

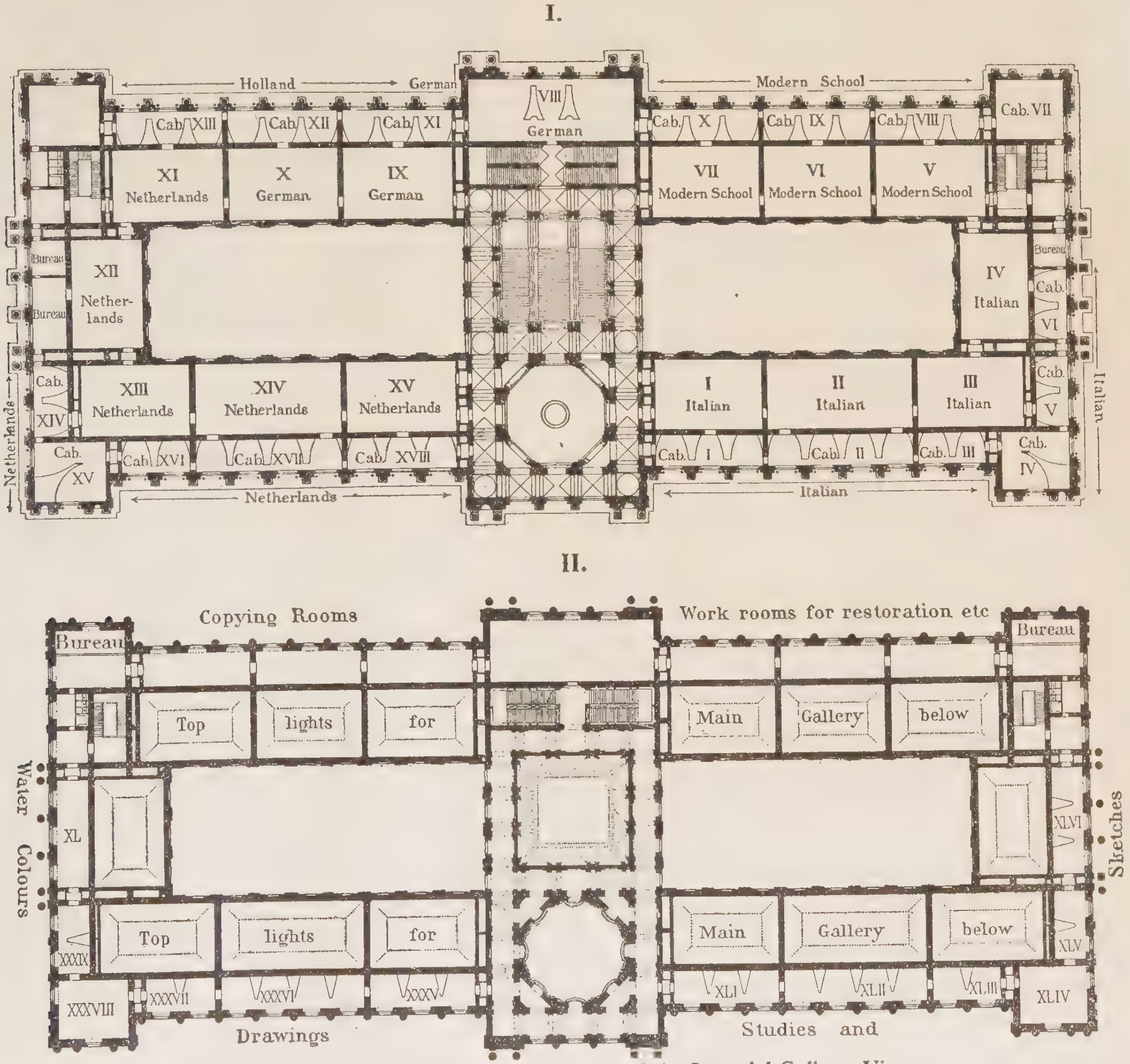
I.
Holland
German
Modern School
Cab. XIII
Cab. XII
Cab. XI
VIII German
Cab. X
Cab. IX
Cab. VIII
Cab. VII
XI Netherlands
X German
IX German
VII Modern School
VI Modern School
V Modern School
Bureau
Bureau
XII Netherlands
IV Italian
Cab. VI
Cab. XIV
XIII Netherlands
XIV Netherlands
XV Netherlands
I Italian
II Italian
III Italian
Cab. V
Cab. XV
Cab. XVI
Cab. XVII
Cab. XVIII
Cab. I
Cab. II
Cab. III
Cab. IV
Netherlands
Netherlands
Italian
Italian
II.
Copying Rooms
Work rooms for restoration etc
Bureau
Bureau
Top lights for
Main Gallery below
Water Colours
XL
XLVI
Sketches
Top lights for
Main Gallery below
XXXIX
XLV
XXXVIII
XXXVII
XXXVI
XXXV
XLI
XLII
XLIII
XLIV
Drawings
Studies and

Fig. 2.—Plan of the first and second floors of the Imperial Gallery, Vienna.

pictures in the Louvre are Watteau's second "Embarquement pour Cythère," and the "Monna Lisa," a portrait by Leonardo da Vinci, but each school has many unique examples. The original drawings should be noted, being of equal importance to the collection preserved at the British Museum. The last collection to be mentioned under this heading is that known as the Royal Galleries in Florence, housed in the Pitti and Uffizi palaces. In some ways this collection does not represent general painting sufficiently to justify its inclusion with the galleries of Berlin, Paris and London. On the other hand, the great number of Italian pictures of vital importance to the history of international art makes this one of the finest existing collections. The two great palaces, dating from the 15th and 16th centuries, are joined together and contain the Medici pictures. They form the largest gallery in the world, and though many of the rooms are small and badly lighted, and although many paintings have suffered from thoughtless restoration, they have a charm and attraction which certainly make them the most popular galleries in Europe. The Pitti has ten Raphaels and excellent examples of Andrea del Sarto, Giorgione and Perugino. The Uffizi is more representative of non-Italian schools, but is best known for its works by Botticelli, Leonardo da Vinci, Michelangelo and Sodoma, the schools of Tuscany and Umbria forming the bulk of both collections. Admission to the galleries is by payment, and the small income derived from this source is devoted to maintaining and enlarging the collections.

As to the ground plans of the National Gallery, London (fig. 1), and of the Imperial Gallery at Vienna (fig. 2), it will be observed that while the former has the advantage of uniform top-light, the galleries at Vienna possess the most ample facilities for minute classification, small rooms or "cabinets" opening from each large room. Special rooms are also provided for drawings and water-colours, while special ranges of rooms are used by copyists and those responsible for the repair and preservation of the pictures.

State galleries of national schools.

Though not so comprehensive as the great collections just described, the state galleries showing national schools of painting and little else are of striking interest. In England the National Gallery of British Art (known as the Tate Gallery) contains British pictures. The corresponding collection of modern French art is at Paris (Luxembourg Palace), Berlin, Rome, Dresden, Vienna and Madrid having analogous galleries. The Victoria and Albert Museum has also numerous British pictures, especially in water-colour, and the National Portrait Gallery, founded in 1856, and since 1896 housed in its permanent home, is instructive in this connexion, though many of its pictures are the work of foreign artists. The national collections at Dublin and Edinburgh may be mentioned here, though most schools are represented. Brussels and Antwerp are remarkable for fine examples of Flemish art—Matsys, Memlinc and Van Eyck of the primitive schools, Rubens and Van Dyck of the later period. The collections at Amsterdam (Ryks Museum) and the Hague (Mauritshuis) are a revelation to those who have only studied Rembrandt, Franz Hals, Van der Helst, and other Dutch portrait painters outside Holland; and in the former gallery especially, the pictures are arranged in a manner showing them to the best advantage. The Museo del Prado is even more noteworthy, for the fifty examples of Velasquez (outrivalling the Italian pictures, important as they are) make a visit to Madrid imperative to those who wish to realize the achievements of Spanish art. Christiania, Stockholm and Copenhagen have large collections of Scandinavian art, and the cities of Budapest and Basel have galleries of some importance. In Italy the state maintains twelve collections, mainly devoted to pictorial art. Of these the best are situated at Bologna, Lucca, Parma, Venice, Modena, Turin and Milan. In each case the local school of painting is fully represented. In Rome the Corsini and Borghese Galleries, the latter being the most catholic in the city, contain superb examples, some of them accepted masterpieces of Italian art; there are also good foreign pictures, but their number is limited. The Accademia at Florence should also be noted as the most important state gallery of early Italian art. The central Italian Renaissance can be more adequately studied here than in the Pitti. The "Primavera" of Botticelli, and the "Last Judgment" by Fra Angelico are perhaps the best-known works. The large statue of David by Michelangelo is also in this gallery, which, on the whole, is one of the most remarkable in Italy. Speaking broadly, these national galleries scattered throughout the country are not well arranged or classified; and though some are kept in fine old buildings, beautiful in themselves, the lighting is often indifferent, and it is with difficulty that the pictures can be seen. In nearly every case admission fees are charged every day, festivals and Sundays excepted; few pictures are bought, acquisitions being chiefly made by removing pictures from churches.

Municipal galleries of special schools.

Many towns own collections of well-merited repute. In Italy such galleries are common, and among them may be noted Siena, with Sodoma and his school; Venice with Tintoretto (Doge's Palace); Genoa, with the great palaces Balbi and Rosso; Vicenza (Montagna and school), Ferrara (Dosso and school), Bergamo and Milan (north Italian schools). Other civic collections of Italian art are maintained at Verona, Pisa, Rome, Perugia and Padua. In Holland, Haarlem, Leiden, Rotterdam and the Hague have galleries supplemental to those of the state, and are remarkable in showing the brilliance of artists like Grebber, de Bray and Ravesteyn, who are usually ignored. Birmingham and Manchester have good examples of modern British art. Moscow (Tretiakoff collection) has modern Russian pictures, and contemporary German and French work will be found in all the galleries of these two countries included in the municipal group. Collections of French work are found at Amiens, Rouen, Nancy, Tours, Le Mans and Angers, but large as these civic collections are, sometimes containing six and eight hundred canvases, few of their pictures are really good, many being the enormous patriotic canvases marked "Don de l'État," which do not confer distinction on the galleries. Cologne has the central collection of the early Rhenish school; Nuremberg is remarkable for early German work (Wohlgemut, &c.). Stuttgart, Cassel (Dutch) and Hamburg (with a considerable number of British pictures) are also noteworthy, together with Brunswick, Hanover, Augsburg, Darmstadt and Düsseldorf, where German and Dutch art preponderate. Seville is famous for twenty-five examples of Murillo, and there are old Spanish paintings at Valencia, Cordova and Cadiz.

Municipal galleries of general schools.

In Great Britain the best of the municipal galleries of general schools are at Liverpool (early Flemish and British), and at Glasgow (Scottish painters, Rembrandt, Van der Goes and Venetian schools). In France there are very large galleries at Tours, Montpellier, Lyons (Perugino, Rubens), Dijon and Grenoble (Italian), Valenciennes (Watteau and school), while Rennes, Lille and Marseilles have first-rate collections. Nantes, Orleans, Besançon, Cherbourg and Caen have also many paintings, French for the most part, but with occasional foreign pictures of real importance, presented by the state during the Napoleonic conquests, and not returned on the declaration of peace as were the works of art amassed in Paris. Some of the American collections have in recent years made a great advance in their acquisition of good pictures. At Boston (Museum of Fine Arts) all schools are represented, so too at the Metropolitan Museum of Art in New York, which is strong in Italian and Dutch works. Modern French and Flemish art is a feature of the Academy at Philadelphia, at the Lenox Library (New York), and at Chicago, where there are good examples of Millet, Constable and Rembrandt. The Corcoran bequest at Washington is of minor importance. The best civic collection in Germany of this class is the Städel Institute at Frankfort (Van Eyck, Christus, early Flemish and Italian).

Churches.

As the great bulk of religious painting was executed for church decoration, there are still numberless churches which may be considered picture galleries. Thus at Antwerp cathedral the Rubens paintings are remarkable; at Ghent, Van Eyck; at Bruges (hospital of St John), Memlinc;

at Pisa, the Campo Santo (early Tuscan schools); at Sant' Apollinare, Ravenna, primitive Italo-Byzantine mosaics; at Siena, Pinturichio. Examples could be multiplied indefinitely—in Italy alone there are 80,000 churches and chapels, in all of which pictorial art has been employed. In Italy, besides the church "galleries" still used for religious services, there are some which have been secularized and are now used as museums, *e.g.* Certosa at Pavia, and San Vitale at Ravenna (mosaics); at Florence, the Scalzo (Andrea del Sarto); San Marco (Fra Angelico); the Riccardi and Pazzi chapels (Gozzoli and Perugino); at Milan, in the Santa Maria delle Grazie, the "Last Supper," by Leonardo, and at Padua, the famous Arena chapel (Giotto).

Private and semi-private galleries.

The Vatican galleries, though best known for their statuary, have fine examples of painting, chiefly of the Italian school; the most famous easel picture is Raphael's "Transfiguration," but the Stanze, apartments entirely decorated by painting, are even more famous. In England three royal palaces are open to the public—Hampton Court (Mantegna), Windsor (Van Dyck, Zuccarelli), and Kensington (portraits). At Buckingham Palace the Dutch pictures are admirable, and Queen Victoria lent the celebrated Raphael cartoons to the Victoria and Albert Museum. Semi-private collections belong to Dulwich College (Velasquez and Watteau), Oxford University (Italian drawings), the Soane Museum (Hogarth and English school), and the Royal Academy (Leonardo). Among private collections the most important are the Harrach, and Prince Liechtenstein (Vienna), J. Pierpont Morgan (including miniatures), Mrs J. Gardner of Boston (Italian), Prince Corsini (Florence). In Great Britain there are immense riches in private houses, though many collections have been dispersed. The most noteworthy (1909) belong to the dukes of Devonshire and Westminster, Lord Ellesmere, Captain Holford (including the masterpiece of Cuyp), Ludwig Mond, Lord Lansdowne, Miss Rothschild. The finest private collection is at Panshanger, formerly the seat of Lord Cowper, the gallery of Van Dyck's work being quite the best in the world.

Periodical and commercial.

Many galleries are devoted to periodical exhibitions in London; the Royal Academy is the leading agency of this character, having held exhibitions since 1769. Its loan exhibitions of Old Masters are most important. Similar enterprises are the New Gallery, opened in 1888, the Grafton Gallery, and others. There are also old-established societies of etchers, water-colourists, &c. A feature common to these exhibitions is that the public always pays for admission, though they differ from the commercial exhibitions, becoming more common every year, in which the work of a single school or painter is shown for profit. But the annual exhibitions at the Guildhall, under the auspices of the corporation, are free. The great periodical exhibition of French art is known as the Salon, and for some years it has had a rival in the Champ de Mars exhibition. These two societies are now respectively housed in the Grand Palais and Petit Palais, in the Champs Elysées, which were erected in connexion with the Paris Exhibition of 1900, but with the ultimate object of being devoted to the service of the two Salons. Berlin, Rome, Vienna and other Continental towns have regular exhibitions of original work.

The best history of art galleries is found in their official and other catalogues, see article MUSEUMS. See also L. Viardot, *Les Musées d'Italie*, &c. (3 vols., Paris, 1842, 1843, 1844); Annual Reports, official, of National Portrait Gallery, National Galleries of England, Ireland and Scotland; Civil Service Estimates, class iv. official. See also the series edited by Lafenestre and E. Richtenberger: *Le Louvre, La Belgique, Le Hollande, Florence, Belgique*; A. Lavice, *Revue des musées de France, . . . d'Allemagne, . . . d'Angleterre, . . . d'Espagne, . . . d'Italie, . . . de Belgique, de Hollande et de Russie* (Paris, 1862-1872); E. Michel, *Les Musées d'Allemagne* (Paris, 1886); Kate Thompson, *Public Picture Galleries of Europe* (1880); C. L. Eastlake, *Notes on Foreign Picture Galleries*; Lord Ronald Gower, *Pocket Guide to Art Galleries (public and private) of Belgium and Holland* (1875); and many works, albums, and so forth, issued mainly for the sake of the illustrations. (B.)

ARTHRITIS (from Gr. ἄρθρον, a joint), inflammation of the joints, in various forms of what are generally called gout and rheumatism (*qq.v.*).

ARTHROPODA, a name, denoting the possession by certain animals of jointed limbs, now applied to one of the three sub-phyla into which one of the great phyla (or primary branches) of coelomocoelous animals—the Appendiculata—is divided; the other two being respectively the Chaetopoda and the Rotifera. The word "Arthropoda" was first used in classification by Siebold and Stannius (*Lehrbuch der vergleich. Anatomie*, Berlin, 1845) as that of a primary division of animals, the others recognized in that treatise being Protozoa, Zoophyta, Vermes, Mollusca and Vertebrata. The names Condylopoda and Gnathopoda have been subsequently proposed for the same group. The word refers to the jointing of the chitinized exo-skeleton of the limbs or lateral appendages of the animals included, which are, roughly speaking, the Crustacea, Arachnida, Hexapoda (so-called "true insects"), Centipedes and Millipedes. This primary group was set up to indicate the residuum of Cuvier's Articulata when his class Annélides (the modern Chaetopoda) was removed from that *embranchement*. At the same time C. T. E. von Siebold and H. Stannius renovated the group Vermes of Linnaeus, and placed in it the Chaetopods and the parasitic worms of Cuvier, besides the Rotifers and Turbellarian worms.[1]

The result of the knowledge gained in the last quarter of the 19th century has been to discredit altogether the group Vermes (see WORM), thus set up and so largely accepted by German writers even at the present day. We have, in fact, returned very nearly to Cuvier's conception of a great division or branch, which he called Articulata, including the Arthropoda and the Chaetopoda (Annélides of Lamarck, a name adopted by Cuvier), and differing from it only by the inclusion of the Rotifera. The name Articulata, introduced by Cuvier, has not been retained by subsequent writers. The same, or nearly the same, assemblage of animals has been called Entomozoaria by de Blainville (1822), Arthrozoa by Burmeister (1843), Entomozoa or Annellata by H. Milne-Edwards (1855), and Annulosa by Alexander M‘Leay (1819), who was followed by Huxley (1856). The character pointed to by all these terms is that of a ring-like segmentation of the body. This, however, is not the character to which we now ascribe the chief weight as evidence of the genetic affinity and monophyletic (uni-ancestral) origin of the Chaetopods, Rotifers and Arthropods. It is the existence in each ring of the body of a pair of hollow *lateral appendages* or *parapodia*, moved by intrinsic muscles and penetrated by blood-spaces, which is the leading fact indicating the affinities of these great sub-phyla, and uniting them as blood-relations. The parapodia (fig. 8) of the marine branchiate worms are the same things genetically as the "legs" of Crustacea and Insects (figs. 10 and 11). Hence the term Appendiculata was introduced by Lankester (preface to the English edition of Gegenbaur's *Comparative Anatomy*, 1878) to indicate the group. The relationships of the Arthropoda thus stated are shown in the subjoined table:—

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[1] The group Arthropoda itself, thus constituted, was precisely identical in its area with the Insecta of Linnaeus, the Entoma of Aristotle. But the word "Insect" had become limited since the days of Linnaeus to the Hexapod Pterygote forms, to the exclusion of his Aptera. Lamarck's penetrating genius is chiefly responsible for the shrinkage of the word Insecta, since it was he who, forty years after Linnaeus's death, set up and named the two great classes Crustacea and Arachnida (included by Linnaeus under Insecta as the order "Aptera"), assigning to them equal rank with the remaining Insecta of Linnaeus, for which he proposed the very appropriate class-name "Hexapoda." Lamarck, however, appears not to have insisted on this name Hexapoda, and so the class of Pterygote Hexapods came to retain the group-name Insecta, which is, historically or etymologically, no more appropriate to them than it is to the classes Crustacea and Arachnida. The tendency to retain the original name of an old and comprehensive group for one of the fragments into which such group becomes divided by the advance of knowledge—instead of keeping the name for its logical use as a comprehensive term, including the new divisions, each duly provided with a new name—is most curiously illustrated in the history of the word physiology. Cicero says, "Physiologia naturae ratio," and such was the meaning of the name *Physiologus*, given to a cyclopaedia of what was known and imagined about earth, sea, sky, birds, beasts and fishes, which for a thousand years was the authoritative source of information on these matters, and was translated into every European tongue. With the revival of learning, however, first one and then another special study became recognized—anatomy, botany, zoology, mineralogy, until at last the great comprehensive term physiology was bereft of all its once-included subject-matter, excepting the study of vital processes pursued by the more learned members of the medical profession. Professional tradition and an astute perception on their part of the omniscience suggested by the terms, have left the medical men in English-speaking lands in undisturbed but illogical possession of the words physiology, physic and physician.

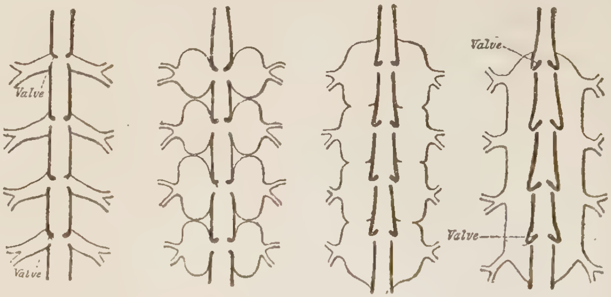
Phylum—Appendiculata . { Sub-phylum 1. Rotifera.
" 2. Chaetopoda.
" 3. Arthropoda.

The Rotifera are characterized by the retention of what appears in Molluscs and Chaetopods as an embryonic organ, the velum or ciliated prae-oral girdle, as a locomotor and food-seizing apparatus, and by the reduction of the muscular parapodia to a rudimentary or non-existent condition in all present surviving forms except *Pedalion.* In many important respects they are degenerate—reduced both in size and elaboration of structure.

The Chaetopoda are characterized by the possession of horny epidermic chaetae embedded in the integument and moved by muscles. Probably the chaetae preceded the development of parapodia, and by their concentration and that of the muscular bundles connected with them at the sides of each segment, led directly to the evolution of the parapodia. The parapodia of Chaetopoda are never coated with dense chitin, and are, therefore, never converted into jaws; the primitive "head-lobe" or prostomium persists, and frequently carries eyes and sensory tentacles. Further, in all members of the sub-phylum Chaetopoda the relative position of the prostomium, mouth and peristomium or first ring of the body, retains its primitive character. We do not find in Chaetopoda that parapodia, belonging to primitively post-oral rings or body-segments (called "somites," as proposed by H. Milne-Edwards), pass in front of the mouth by adaptational shifting of the oral aperture. (See, however, 8.)

The Arthropoda might be better called the "Gnathopoda," since their distinctive character is, that one or more pairs of appendages behind the mouth are densely chitinized and turned (fellow to fellow on opposite sides) towards one another so as to act as jaws. This is facilitated by an important general change in the position of the parapodia; their basal attachments are all more ventral in position than in the Chaetopoda, and tend to approach from the two sides towards the mid-ventral line. Very usually (but not in the Onychophora = *Peripatus*) all the parapodia are plated with chitin secreted by the epidermis, and divided into a series of joints—giving the "arthropodous" or hinged character.

There are other remarkable and distinctive features of structure which hold the Arthropoda together, and render it impossible to conceive of them as having a polyphyletic origin, that is to say, as having originated separately by two or three distinct lines of descent from lower animals; and, on the contrary, establish the view that they have been developed from a single line of primitive Gnathopods which arose by modification of parapodiate annulate worms not very unlike some of the existing Chaetopods. These additional features are the following—(1) All existing Arthropoda have an ostiate heart and have undergone "phleboedesis," that is to say, the peripheral portions of the blood-vascular system are not fine tubes as they are in the Chaetopoda and as they were in the hypothetical ancestors of Arthropoda, but are swollen so as to obliterate to a large extent the coelom, whilst the separate veins entering the dorsal vessel or heart have coalesced, leaving valvate ostia (see fig. 1) by which the blood passes from a pericardial blood-sinus formed by the fused veins into the dorsal vessel or heart (see Lankester's *Zoology*, part ii., introductory chapter, 1900). The only exception to this is in the case of minute degenerate forms where the heart has disappeared altogether. The rigidity of the integument caused by the deposition of dense chitin upon it is intimately connected with the physiological activity and form of all the internal organs, and is undoubtedly correlated with the total disappearance of the circular muscular layer of the body-wall present in Chaetopods. (2) In all existing Arthropoda the region in front of the mouth is no longer formed by the primitive prostomium or head-lobe, but one or more segments, originally post-oral, with their appendages have passed in front of the mouth (prosthomeres). At the same time the prostomium and its appendages cease to be recognizable as distinct elements of the head. The brain no longer consists solely of the nerve-ganglion-mass proper to the prostomial lobe, as in Chaetopoda, but is a composite (syncerebrum) produced by the fusion of this and the nerve-ganglion-masses proper to the prosthomeres or segments which pass forwards, whilst their parapodia (= appendages) become converted into eye-stalks, and antennae, or more rarely grasping organs. (3) As in Chaetopoda, coelomic funnels (coelomoducts) *may* occur right and left as pairs in each ring-like segment or somite of the body, and some of these are in all cases retained as gonoducts and often as renal excretory organs (green glands, coxal glands of Arachnida, *not* crural glands, which are epidermal in origin); but true nephridia, genetically identical with the nephridia of earthworms, do not occur (on the subject of coelom, coelomoducts and nephridia, see the introductory chapter of part ii. of Lankester's *Treatise on Zoology*).



After Lankester, *Q. J. Mic. Sci.* vol. xxxiv., 1893.

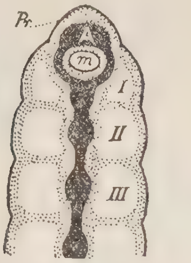
Fig. 1.—Diagram to show the gradual formation of the Arthropod pericardial blood-sinus and "ostiate" heart by the swelling up (phleboedesis) of the veins entering the dorsal vessel or heart of a Chaetopod-like ancestor. The figure on the left represents the condition in a Chaetopod, that on the right the condition in an Arthropod, the other two are hypothetical intermediate forms.

Tabular Statement of the Grades, Classes and Sub-classes of the Arthropoda.—It will be convenient now to give in the clearest form a statement of the larger subdivisions of the Arthropoda which it seems necessary to recognize at the present day. The justification of the arrangement adopted will form the substance of the rest of the present article. The orders included in the various classes are not discussed here, but are treated of under the following titles:—Peripatus (Onychophora), Centipede and Millipede (Myriapoda), Hexapoda (Insecta), Arachnida and Crustacea.

Sub-Phylum ARTHROPODA (of the Phylum Appendiculata).
Grade A. **Hyparthropoda** (hypothetical forms connecting ancestors of Chaetopoda with those of Arthropoda).
Grade B. **Protarthropoda.**
  Class Onychophora.
    Ex.—*Peripatus.*
Grade C. **Euarthropoda.**
  Class 1. Diplopoda.
    Ex.—*Julus.*
  Class 2. Arachnida.
    Grade *a.* Anomomeristica.
      Ex.—*Phacops.*
    Grade *b.* Nomomeristica.
    (*a*) Pantopoda.
      Ex.—*Pycnogonum.*
      (*b*) Euarachnida.
        Ex.—*Limulus, Scorpio, Mygale, Acarus.*
  Class 3. Crustacea.
    Grade *a.* Entomostraca.
      Ex.—*Apus, Branchipus, Cyclops, Balanus.*
    Grade *b.* Malacostraca.
      Ex.—*Nebalia, Astacus, Oniscus, Gammarus.*
  Class 4. Chilopoda.
    Ex.—*Scolopendra.*
  Class 5. Hexapoda (syn. Insecta Pterygota).
    Ex.—*Locusta, Phryganea, Papilio, Apis, Musca, Cimex, Lucanus, Machilis.*
Incertae sedis—Tardigrada, Pentastomidae (degenerate forms).

The Segmentation of the Body of Arthropoda.—The body of the Arthropoda is more or less clearly divided into a series of rings, segments, or somites which can be shown to be repetitions one of another, possessing identical parts and organs which may be larger or smaller, modified in shape or altogether suppressed in one somite as compared with another. A similar constitution of the body is more clearly seen in the Chaetopod worms. In the Vertebrata also a repetition of units of structure (myotomes, vertebrae, &c.)—which is essentially of the same nature as the repetition in Arthropods and Chaetopods, but in many respects subject to peculiar developments—is observed. The name "metamerism" has been given to this structural phenomenon because the "meres," or repeated units, follow one another in line. Each such "mere" is often called a "metamere." A satisfactory consideration of the structure of the Arthropods demands a knowledge of what may be called the laws of metamerism, and reference should be made to the article under that head.

The Theory of the Arthropod Head.—The Arthropod head is a tagma or group of somites which differ in number and in their relative position in regard to the mouth, in different classes. In a simple Chaetopod (fig. 2) the head consists of the first somite only; that somite is perforated by the mouth, and is provided with a prostomium or prae-oral lobe. The prostomium is essentially a part or outgrowth of the first somite, and cannot be regarded as itself a somite. It gives rise to a nerve-ganglion mass, the prostomial ganglion. In the marine Chaetopods (the Polychaeta) (fig. 3), we find the same essential structure, but the prostomium may give rise to two or more tactile tentacles, and to the vesicular eyes. The somites have well-marked parapodia, and the second and third, as well as the first, may give rise to tentacles which are directed forward, and thus contribute to form "the head." But the mouth remains as an inpushing of the wall of the first somite.



From Goodrich, *Q. J. Micr. Sci.* vol. xi. p. 247.

FIG. 2.—Diagram of the head and adjacent region of an Oligochaet Chaetopod.
Pr, The prostomium.
m, The mouth.
A, The prostomial ganglion-mass or archi-cerebrum.
I, II, III, coelom of the first, second and third somites.

The Arthropoda are all distinguished from the Chaetopoda by the fact that the head consists of one or more somites which lie *in front of the mouth* (now called prosthomeres), as well as of one or more somites behind it (opisthomeres). The first of the post-oral somites invariably has its parapodia modified so as to form a pair of hemignaths (mandibles). About 1870 the question arose for discussion whether the somites in front of the mouth are to be considered as derived from the prostomium of a Chaetopod-like ancestor. Milne-Edwards and Huxley had satisfied themselves with discussing and establishing, according to the data at their command, the number of somites in the Arthropod head, but had not considered the question of the *nature* of the prae-oral somites. Lankester (2) was the first to suggest that (as is actually the fact in the Nauplius larva of the Crustacea) the prae-oral somites or prosthomeres and their appendages were ancestrally post-oral, but have become prae-oral "by adaptational shifting of the oral aperture." This has proved to be a sound hypothesis and is now accepted as the basis upon which the Arthropod head must be interpreted (see Korschelt and Heider (3)). Further, the morphologists of the 'fifties appear, with few exceptions, to have accepted a preliminary scheme with regard to the Arthropod head and Arthropod segmentation generally, which was misleading and caused them to adopt forced conclusions and interpretations. It was conceived by Huxley, among others, that the same number of cephalic somites would be found to be characteristic of all the diverse classes of Arthropoda, and that the somites, not only of the head but of the various regions of the body, could be closely compared in their numerical sequence in classes so distinct as the Hexapods, Crustaceans and Arachnids.

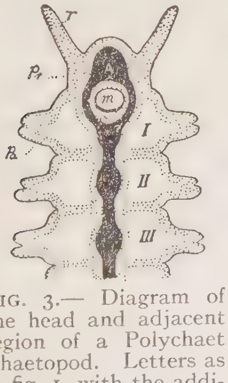


FIG. 3.—Diagram of the head and adjacent region of a Polychaet Chaetopod. Letters as in fig. 1, with the addition of T, prostomial tentacle; *Pa*, parapodium. (From Goodrich.)

The view which it now appears necessary to take is, on the contrary, this—viz. that all the Arthropoda are to be traced to a common ancestor resembling a Chaetopod worm, but differing from it in having lost its chaetae and in having a prosthomere in front of the mouth (instead of prostomium only) and a pair of hemignaths (mandibles) on the parapodia of the buccal somite. From this ancestor Arthropods with heads of varying degrees of complexity have been developed characteristic of the different classes, whilst the parapodia and somites of the body have become variously modified and grouped in these different classes. The resemblances which the members of one class often present to the members of another class in regard to the form of the limb-branches (rami) of the parapodia, and the formation of tagmata (regions) are not hastily to be ascribed to common inheritance, but we must consider whether they are not due to homoplasy—that is, to the moulding of natural selection acting in the different classes upon fairly similar elements under like exigencies.

The structure of the head in Arthropods presents *three* profoundly separated grades of structure dependent upon the number of prosthomeres which have been assimilated by the prae-oral region. The classes presenting these distinct plans of head-structure cannot be closely associated in any scheme of classification professing to be natural. Peripatus, the type-genus of the class Onychophora, stands at the base of the series with only a single prosthomere (fig. 4). In Peripatus the prostomium of the Chaetopod-like ancestor is atrophied, but it is possible that two processes on the front of the head (FP) represent in the embryo the dwindled prostomial tentacles. The single prosthomere carries the retractile tentacles as its "parapodia." The second somite is the buccal somite (II, fig. 4); its parapodia have horny jaws on their ends, like the claws on the following legs (fig. 9), and act as hemignaths (mandibles). The study of sections of the embryo establishes these facts beyond doubt. It also shows us that the neuromeres, no less than the embryonic coelomic cavities, point to the existence of one, and only one, prosthomere in Peripatus, of which the "protocerebrum," P, is the neuromere, whilst the deuterocerebrum, D, is the neuromere of the second or buccal somite. A brief indication of these facts is given by saying that the Onychophora are "deuterognathous"—that is to say, that the buccal somite carrying the mandibular hemignaths is the second of the whole series.

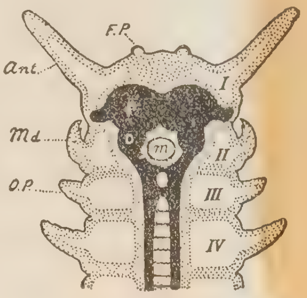


FIG 4.—Diagram of the head and adjacent region of *Peripatus*. Monoprosthomerous.
m, Mouth.
I, Coelom of the first somite which carries the antennae and is in front of the mouth.
II, Coelom of the second somite which carries the mandibles (hence deuterognathous).
III and IV, Coelom of the third and fourth somites.
FP, Rudimentary frontal processes perhaps representing the prostomial tentacles of Polychaeta.
Ant, Antenna or tactile tentacle.
Md, Mandible.
Op, Oral papilla.
P, Protocerebrum or foremost cerebral mass belonging to the first somite.
D, Deuterocerebrum, consisting of ganglion cells belonging to the second or mandibular somite.
(After Goodrich.)

What has become of the nerve-ganglion of the prostomial lobe of the Chaetopod in Peripatus is not clearly ascertained, nor is its fate indicated by the study of the embryonic head of other Arthropods so far. Probably it is fused with the protocerebrum, and may also be concerned in the history of the very peculiar paired eyes of Peripatus, which are like those of Chaetopods in structure—viz. vesicles with an intra-vesicular lens, whereas the eyes of all other Arthropods have essentially another structure, being "cups" of the epidermis, in which a knob-like or rod-like thickening of the cuticle is fitted as refractive medium.

In Diplopoda (*Julus*, &c.) the results of embryological study point to a composition of the front part of the head exactly similar to that which we find in Onychophora. They are deuterognathous.

The Arachnida present the first stage of progress. Here embryology shows that there are two prosthomeres (fig. 5), and that the gnathobases of the chelae which act as the first pair of hemignaths are carried by the third somite. The Arachnida are therefore tritognathous. The two prosthomeres are indicated by their coelomic cavities in the embryo (I and II, fig. 5), and by two neuromeres, the protocerebrum and the deuterocerebrum. The appendages of the first prosthomere are not present as tentacles, as in Peripatus and Diplopods, but are possibly represented by the eyes or possibly altogether aborted. The appendages of the second prosthomere are the well-known chelicerae of the Arachnids, rarely, if ever, antenniform, but modified as "retroverts" or clasp-knife fangs in spiders

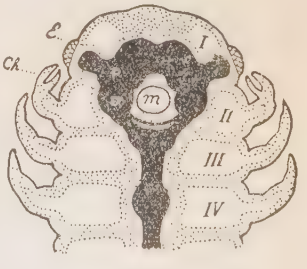


FIG. 5.—Diagram of the head and adjacent region of an Arachnid. Diprosthomerous in the adult condition, though embryologically the appendages of somite II and the somite itself are, as here drawn, not actually in front of the mouth.
E, Lateral eye.
Ch Chelicera.
m, Mouth.
P, Protocerebrum
D, Deuterocerebrum.
I, II III, IV, Coelom of the first, second, third and fourth somites.
(After Goodrich.)

The Crustacea (fig. 6) and the Hexapoda (fig. 7) agree in having three somites in front of the mouth, and it is probable, though not ascertained, that the Chilopoda (Scolopendra, &c.) are in the same case. The three prosthomeres or prae-oral somites of Crustacea due to the sinking back of the mouth one somite farther than in Arachnida are not clearly indicated by coelomic cavities in the embryo, but their existence is clearly established by the development and position of the appendages and by the neuromeres.

The eyes in some Crustacea are mounted on articulated stalks, and from the fact that they can after injury be replaced by antenna-like appendages it is inferred that they represent the parapodia of the most anterior prosthomere. The second prosthomere carries the first pair of antennae and the third the second pair of antennae. Sometimes the pair of appendages has not a merely tactile jointed ramus, but is converted into a claw or clasper. Three neuromeres—a proto-, deutero-, and trito-cerebrum—corresponding to those three prosthomeres are sharply marked in the embryo. The fourth somite is that in which the mouth now opens, and which accordingly has its appendages converted into hemignathous mandibles. The Crustacea are tetartognathous.

The history of the development of the head has been carefully worked out in the Hexapod insects. As in Crustacea and Arachnida, a first prosthomere is indicated by the paired eyes and the protocerebrum; the second prosthomere has a well-marked coelomic cavity, carries the antennae, and has the deuterocerebrum for its neuromere. The third prosthomere is represented by a well-marked pair of coelomic cavities and the tritocerebrum (III, fig. 7), but has no appendages. They appear to have aborted. The existence of this third prosthomere corresponding to the third prosthomere of the Crustacea is a strong argument for the derivation of the Hexapoda, and with them the Chilopoda, from some offshoot of the Crustacean stem or class. The buccal somite, with its mandibles, is in Hexapoda, as in Crustacea, the fourth: they are tetartognathous.

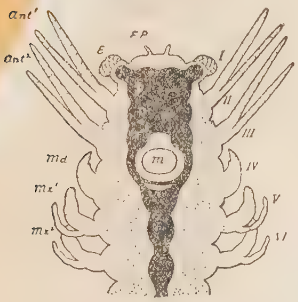


FIG. 6.—Diagram of the head of a Crustacean. Triprosthomerous.

FP, Frontal processes (observed in Cirrhiped nauplius-larvae) probably representing the prostomial tentacles of Chaetopods.
e, Eye.
Ant^1, First pair of antennae.
Ant^2, Second pair of antennae.
md, Mandible.
mx^1, mx^2, First and second pairs of maxillae.
m, Mouth.
I, II, and III, The three prosthomeres.
IV, V, VI, The three somites following the mouth.
P, Protocerebrum.
D, Deuterocerebrum.
T, Tritocerebrum.
(After Goodrich.)

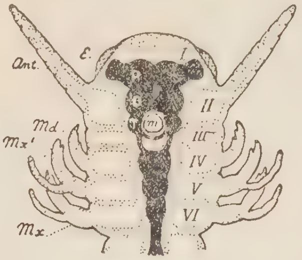


FIG. 7.—Diagram of the head of a Hexapod insect.

e, Eye.
ant, Antenna.
md, Mandible.
mx^1, First maxilla.
mx^2, Second maxilla.
m, Mouth.
I, Region of the first or eye-bearing prosthomere.
II, Coelom of the second antenna-bearing prosthomere.
III, Coelom of the third prosthomere devoid of appendages.
IV, V, and VI, Coelom of the fourth, fifth and sixth somites.
P, Protocerebrum belonging to the first prosthomere.
D, Deuterocerebrum belonging to the second prosthomere.
T, Tritocerebrum belonging to the third prosthomere.
(After Goodrich.)

The adhesion of a greater or less number of somites to the buccal somite posteriorly (opisthomeres) is a matter of importance, but of minor importance, in the theory and history of the Arthropod head. In Peripatus no such adhesion or fusion occurs. In Diplopoda two opisthomeres—that is to say, one in addition to the buccal somite—are united by a fusion of their terga with the terga of the prosthomeres. Their appendages are respectively the mandibles and the gnathochilarium.

In Arachnida the highest forms exhibit a fusion of the tergites of five post-oral somites to form one continuous carapace united with the terga of the two prosthomeres. The five pairs of appendages of the post-oral somites of the head or prosoma thus constituted all primitively carry gnathobasic projections on their coxal joints, which act as hemignaths: in the more specialized forms the mandibular gnathobases cease to develop.

In Crustacea the fourth or mandibular somite never has less than the two following somites associated with it by the adaptation of their appendages as jaws, and the ankylosis of their terga with that of the prosthomeres. But in higher Crustacea the cephalic "tagma" is extended, and more somites are added to the fusion, and their appendages adapted as jaws of a kind.

The Hexapoda are not known to us in their earlier or more primitive manifestations; we only know them as possessed of a definite number of somites arranged in definite numbers in three great tagmata. The head shows two jaw-bearing somites besides the mandibular somite (V, VI, in fig. 7)—thus six in all (as in some Crustacea), including prosthomeres, all ankylosed by their terga to form a cephalic shield. There is, however, good embryological evidence in some Hexapods of the existence of a seventh somite, the supra-lingual, occurring between the somite of the mandibles and the somite of the first maxillae (4). This segment is indicated embryologically by its paired coelomic cavities. It is practically an excalated somite, having no existence in the adult. It is probably not a mere coincidence that the Hexapod, with its two rudimentary somites devoid of appendages, is thus found to possess twenty-one somites, including that which carries the anus, and that this is also the number present in the Malacostracous Crustacea.

The Segmental Lateral Appendages or Limbs of Arthropoda.—It has taken some time to obtain any general acceptance of the view that the parapodia of the Chaetopoda and the limbs of Arthropoda are genetically identical structures; yet if we compare the parapodium of Tomopteris or of Phyllodoce with one of the foliaceous limbs of Branchipus or Apus, the correspondences of the two are striking. An erroneous view of the fundamental morphology of the Crustacean limb, and consequently of that of other Arthropoda, came into favour owing to the acceptance of the highly modified limbs of Astacus as typical. Protopodite, endopodite, exopodite, and epipodite were considered to be the morphological units of the crustacean limb. Lankester (5) has shown (and his views have been accepted by Professors Korschelt and Heider in their treatise on *Embryology*) that the limb of the lowest Crustacea, such as Apus, consists of a corm or axis which may be jointed, and gives rise to outgrowths, either leaf-like or filiform, on its inner and outer margins (endites and exites). Such a corm (see figs. 10 and 11), with its outgrowths, may be compared to the simple parapodia of Chaetopoda with cirrhi and branchial lobe (fig. 8). It is by the specialization of two "endites" that the endopodite and exopodite of higher Crustacea are formed, whilst a flabelliform exite is the homogen or genetic equivalent of the epipodite (see Lankester, "Observations and Reflections on Apus Cancriformis," *Q. J. Micr. Sci.*). The reduction of the outgrowth-bearing "corm" of the parapodium of either a Chaetopod or an Arthropod to a simple cylindrical stump, devoid of outgrowths, is brought about when mechanical conditions favour such a shape. We see it in certain Chaetopods (*e.g.* Hesione) and in the Arthropod Peripatus (fig. 9). The conversion of the Arthropod's limb into a jaw, as a rule, is effected by the development of an endite near its base into a hard, chitinized, and often toothed gnathobase (see figs. 10 and 11, *en'*). It is not true that all the biting processes of the Arthropod limb are thus produced—for instance, the jaws of Peripatus are formed by the axis or corm itself, whilst the poison-jaws of Chilopods, as also their maxillae, appear to be formed rather by the apex or terminal region of the ramus of the limb; but the opposing jaws (=hemignaths) of Crustacea, Arachnida and Hexapoda are gnathobases, and not the axis or corm. The endopodite (corresponding to the fifth endite of the limb of Apus, see fig. 10) becomes in Crustacea the "walking leg" of the mid-region of the body; it becomes the palp or jointed process of anterior segments. A second ramus, the "exopodite," often is also retained in the form of a palp or feeler. In Apus, as the figure shows, there are four of these "antenna-like" palps or filaments on the first thoracic limb. A common modification of the chief ramus of the Arthropod parapodium is the chela or nipper formed by the elongation of the penultimate joint of the ramus, so that the last joint **works on it—**

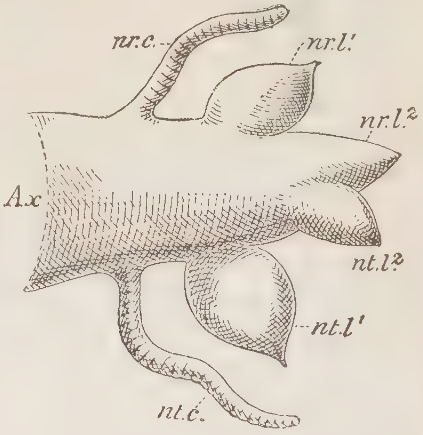


FIG. 8.—Diagram of the somite-appendage or parapodium of a Polychaet Chaetopod. The chaetae are omitted.

Ax, The axis.
nr.c, Neuropodial cirrhus.
$nr.l^1$, $nr.l^2$, Neuropodial lobes or endites.
nt.c. Notopodial cirrhus.
$nt.l^1$, $nt.l^2$, Notopodial lobes or exites.

The parapodium is represented with its neural or ventral surface uppermost. (Original).

as, for instance, in the lobster's claw. Such chelate rami or limb-branches are independently developed in Crustacea and in Arachnida, and are carried by somites of the body which do not correspond in position in the two groups. The range of modification of which the rami or limb-branches of the limbs of Arthropoda are capable is very large, and in allied orders or even families or genera we often find what is certainly the palp of the same appendage (as determined by numerical position of the segments)—in one case antenniform, in another chelate, in another pediform, and in another reduced to a mere stump or absent altogether. Very probably the power which the appendage of a given segment has of assuming the perfected form and proportions previously attained by the appendage of another segment must be classed as an instance of "homoeosis," not only where such a change is obviously due to abnormal development or injury, but also where it constitutes a difference permanently established between allied orders or smaller groups, or between the two sexes.

The most extreme disguise assumed by the Arthropod parapodium or appendage is that of becoming a mere stalk supporting an eye—a fact which did not obtain general credence until the experiments of Herbst in 1895, who found, on cutting off the eye-stalk of Palaemon, that a jointed antenna-like appendage was regenerated in its place. Since the eye-stalks of Podophthalmate Crustacea represent appendages, we are forced to the conclusion that the sessile eyes of other Crustacea, and of other Arthropoda generally, indicate the position of appendages which have atrophied.[1]

From what has been said, it is apparent that we cannot, in attempting to discover the affinities and divergences of the various forms of Arthropoda, attach a very high phylogenetic value to the coincidence or divergence in form of the appendages belonging to the somites compared with one another.

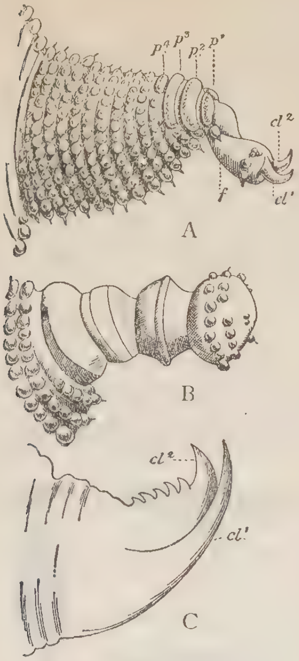


FIG. 9.—Three somite-appendages or parapodia of *Peripatus*.

A, A walking leg; p^1 to p^4, the characteristic "pads"; *f*, the foot; cl^1, cl^2, the two claws.

B, An oral papilla, one of the second pair of post-oral appendages.

C, One of the first post-oral pair of appendages or mandibles; cl^1, cl^2, the greatly enlarged claws. (Compare A.)

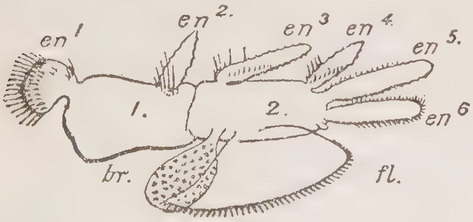
The appendages are represented with the neural or ventral surface uppermost. Original.

The principal forms assumed by the Arthropod parapodium and its rami may be thus enumerated:—

(1) Axial corm well developed, unsegmented or with two to four segments; lateral endites and exites (rami) numerous and of various lengths (certain limbs of lower Crustacea).

(2) Corm, with short unsegmented rami, forming a flattened foliaceous appendage, adapted to swimming and respiration (trunk-limbs of Phyllopods).

(3) Corm alone developed; with no endites or exites, but provided with terminal chitinous claws (ordinary leg of Peripatus), with terminal jaw teeth (jaw of Peripatus), or with blunt extremity (oral papilla of same) (see fig. 9).



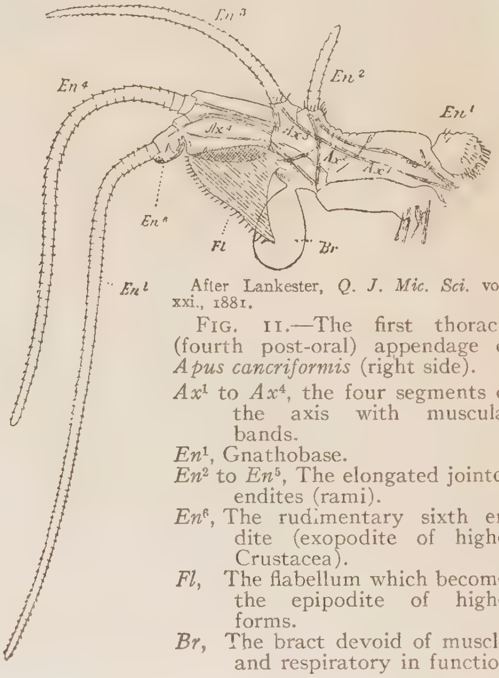
After Lankester, *Q. J. Mic. Sci.* vol. xxi., 1881.

FIG. 10.—The second thoracic (fifth post-oral) appendage of the left side of *Apus cancriformis*, placed with its ventral or neural surface uppermost to compare with figs. 8 and 9.

1, 2, The two segments of the axis.
en^1, The gnathobase.
en^2 to en^6, The five following "endites."
fl, The flabellum or anterior exite.
br, The bract or posterior exite.

(4) Three of the rami of the primitive limb (endites 5 and 6, and exite 1) specially developed as endopodite, exopodite, and epipodite—the first two often as firm and strongly chitinized, segmented, leg-like structures; the original axis or corm reduced to a basal piece, with or without a distinct gnathobase (endite 1)—typical tri-ramose limb of higher Crustacea.

(5) One ramus (the endopodite) alone developed—the original axis or corm serving as its basal joint with or without gnathobase. This is the usual uni-ramose limb found in the various classes of Arthropoda. It varies as to the presence or absence of the jaw-process and as to the stoutness of the segments of the ramus, their number (frequently six, plus the basal corm), and the modification of the free end. This may be filiform or brush-like or lamellate when it is an antenna or palp; a simple spike (walking leg of Crustacea, of other aquatic forms, and of Chilopods and Diplopods); the terminal joint flattened (swimming leg of Crustacea and Gigantostraca); the terminal joint provided with two or with three recurved claws (walking leg of many terrestrial forms—*e.g.* Hexapoda and Arachnida); the penultimate joint with a process equal in length to the last joint, so as to form a nipping organ (chelae of Crustaceans and Arachnids); the last joint reflected and movable on the penultimate, as the blade of a clasp-knife on its handle (the retrovert, toothed so as to act as a biting jaw in the Hexapod *Mantis*, the Crustacean *Squilla* and others); with the last joint produced into a needle-like stabbing process in spiders.



After Lankester, *Q. J. Mic. Sci.* vol. xxi., 1881.

FIG. 11.—The first thoracic (fourth post-oral) appendage of *Apus cancriformis* (right side).

Ax^1 to Ax^4, the four segments of the axis with muscular bands.
En^1, Gnathobase.
En^2 to En^5, The elongated jointed endites (rami).
En^6, The rudimentary sixth endite (exopodite of higher Crustacea).
Fl, The flabellum which becomes the epipodite of higher forms.
Br, The bract devoid of muscles and respiratory in function.

(6) Two rami developed (usually, but perhaps not always, the equivalents of the endopodite and exopodite) supported on the somewhat elongated corm (basal segment). This is the typical "bi-ramose limb" often found in Crustacea. The rami may be flattened for swimming, when it is "a bi-ramose swimmeret," or both or only one may be filiform and finely annulate; this is the form often presented by the antennae of Crustacea, and rarely by prae-oral appendages in other Arthropods.

(7) The endopoditic ramus is greatly enlarged and flattened, without or with only one jointing, the corm (basal segment) is evanescent; often the plate-like endopodites of a pair of such appendages unite in the middle line with one another or by the intermediary of a sternal up-growth and form a single broad plate. These are the plate-like swimmerets and opercula of Gigantostraca and Limulus among Arachnids and of Isopod Crustaceans. They may have rudimentary exopodites, and may or may not have branchial filaments or lamellae developed on their posterior faces. The simplest form to which they may be reduced is seen in the genital operculum of the scorpion.

(8) The gnathobase becomes greatly enlarged and not separated by a joint from the corm; it acts as a hemignath or half jaw working against its fellow of the opposite side. The endopodite may be retained as a small segmented palp at the side of the gnathobase or disappear (mandible of Crustacea, Chilopoda and Hexapoda).

(9) The corm becomes the seat of a development of a special visual organ, the Arthropod eye (as opposed to the Chaetopod eye). Its jointing (segmentation) may be retained, but its rami disappear (Podophthalmous Crustacea). Usually it becomes atrophied, leaving the eye as a sessile organ upon the prae-oral region of the body

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[1] H. Milne-Edwards, who was followed by Huxley, long ago formulated the conclusion that the eye-stalks of Crustacea are modified appendages, basing his argument on a specimen of Palinurus (figured in Bateson's book (1), in which the eye-stalk of one side is replaced by an antenniform palp. Hofer (6) in 1894 described a similar case in Astacus.

(the eye-stalk and sessile lateral eyes of Arthropoda generally, exclusive of Peripatus).

(10) The forms assumed by special modification of the elements of the parapodium in the maxillae, labium, &c., of Hexapods, Chilopods, Diplopods, and of various Crustacea, deserve special enumeration, but cannot be dealt with without ample space and illustration.

It may be pointed out that the most radical difference presented in this list is that between appendages consisting of the corm alone without rami (Onychophora) and those with more or less developed rami (the rest of the Arthropoda). In the latter class we should distinguish three phases: (*a*) those with numerous and comparatively undeveloped rami; (*b*) those with three, or two highly developed rami, or with only one—the corm being reduced to the dimensions of a mere basal segment; (*c*) those reduced to a secondary simplicity (degeneration) by overwhelming development of one segment (*e.g.* the isolated gnathobase often seen as "mandible" and the genital operculum).

There is no reason to suppose that any of the forms of limb observed in Arthropoda may not have been independently developed in two or more separate diverging lines of descent.

Branchiae.—In connexion with the discussion of the limbs of Arthropods, a few words should be devoted to the gill-processes. It seems probable that there are branchial plumes or filaments in some Arthropoda (some Crustacea) which can be identified with the distinct branchial organs of Chaetopoda, which lie dorsal of the parapodia and are not part of the parapodium. On the other hand, we cannot refuse to admit that any of the processes of an Arthropod parapodium may become modified as branchial organs, and that, as a rule, branchial out-growths are easily developed, *de novo*, in all the higher groups of animals. Therefore, it seems to be, with our present knowledge, a hopeless task to analyse the branchial organs of Arthropoda and to identify them genetically in groups.

A brief notice must suffice of the structure and history of the *Eyes*, the *Tracheae* and the so-called *Malpighian tubes* of Arthropoda, though special importance attaches to each in regard to the determination of the affinities of the various animals included in this great sub-phylum.

The Eyes.—The Arthropod eye appears to be an organ of special character developed in the common ancestor of the Euarthropoda, and distinct from the Chaetopod eye, which is found only in the Onychophora where the true Arthropod eye is absent. The essential difference between these two kinds of eye appears to be that the Chaetopod eye (in its higher developments) is a vesicle enclosing the lens, whereas the Arthropod eye is a pit or series of pits into which the heavy chitinous cuticle dips and enlarges knobwise as a lens. Two distinct forms of the Arthropod eye are observed—the monomeniscous (simple) and the polymeniscous (compound). The nerve-end-cells, which lie below the lens, are part of the general epidermis. They show in the monomeniscous eye (see article ARACHNIDA, fig. 26) a tendency to group themselves into "retinulae," consisting of five to twelve cells united by vertical deposits of chitin (rhabdoms). In the case of the polymeniscous eye (fig. 23, article ARACHNIDA) a single retinula or group of nerve-end-cells is grouped beneath each associated lens. A further complication occurs in each of these two classes of eye. The monomeniscous eye is rarely provided with a single layer of cells beneath its lens; when it is so, it is called monostichous (simple lateral eye of Scorpion, fig. 22, article ARACHNIDA). More usually, by an infolding of the layer of cells in development, we get three layers under the lens; the front layer is the corneagen layer, and is separated by a membrane from the other two which, more or less, fuse and contain the nerve-end-cells (retinal layer). These eyes are called diplostichous, and occur in Arachnida and Hexapoda (fig. 24, article ARACHNIDA).

On the other hand, the polymeniscous eye undergoes special elaboration on its lines. The retinulae become elongated as deep and very narrow pits (fig. 12 and explanation), and develop additional cells near the mouth of the narrow pit. Those nearest to the lens are the corneagen cells of this more elaborated eye, and those between the original retinula cells and the corneagen cells become firm and transparent. They are the crystalline cells or vitrella (see Watase, 7). Each such complex of cells underlying the lenticle of a compound eye is called an "ommatidium"; the entire mass of cells underlying a monomeniscous eye is an "ommataeum." The ommataeum, as already stated, tends to segregate into retinulae which correspond potentially each to an ommatidium of the compound eye. The ommatidium is from the first segregate and consists of few cells. The compound eye of the king-crab (Limulus) is the only recognized instance of ommatidia in their simplest state. Each can be readily compared with the single-layered lateral eye of the scorpion. In Crustacea and Hexapoda of all grades we find compound eyes with the more complicated ommatidia described above. We do not find them in any Arachnida.

It is difficult in the absence of more detailed knowledge as to the eyes of Chilopoda and Diplopoda to give full value to these facts in tracing the affinities of the various classes of Arthropods. But they seem to point to a community of origin of Hexapods and Crustacea in regard to the complicated ommatidia of the compound eye, and to a certain isolation of the Arachnida, which are, however, traceable, so far as the eyes are concerned, to a distant common origin with Crustacea and Hexapoda through the very simple compound eyes (monostichous, polymeniscous) of Limulus.

The Tracheae.—In regard to tracheae the very natural tendency of zoologists has been until lately to consider them as having once developed and once only, and therefore to hold that a group "Tracheata" should be recognized, including all tracheate Arthropods. We are driven by the conclusions arrived at as to the derivation of the Arachnida from branchiate ancestors, independently of the other tracheate Arthropods, to formulate the conclusion that tracheae have been independently developed in the Arachnidan class. We are also, by the isolation of Peripatus and the impossibility of tracing to it all other tracheate Arthropoda, or of regarding it as a degenerate offset from some one of the tracheate classes, forced to the conclusion that the tracheae of the Onychophora have been independently acquired. Having accepted these two conclusions, we formulate the generalization that tracheae can be independently acquired by various branches of Arthropod descent in adaptation to a terrestrial as opposed to an aquatic mode of life. A great point of interest therefore exists in the knowledge of the structure and embryology of tracheae in the different groups. It must be confessed that we have not such full knowledge on this head as could be wished for. Tracheae are essentially tubes like blood-vessels—apparently formed from the same tissue elements as blood-vessels—which contain air in place of blood, and usually communicate by definite orifices, the tracheal stigmata, with the atmosphere. They are lined internally by a cuticular deposit of chitin. In Peripatus and the Diplopods they consist of bunches of fine tubes which do not branch but diverge from one another; the chitinous lining is smooth. In the Hexapods and Chilopods, and the Arachnids (usually), they form tree-like branching structures, and their finest branches are finer than any blood-capillary, actually in some cases penetrating a single cell and supplying it with gaseous oxygen. In these forms the chitinous lining of the tubes is thickened by a close-set spiral ridge similar to the spiral thickening of the cellulose wall of the spiral vessels of plants. It is a noteworthy fact that other tubes in these same terrestrial Arthropoda—namely, the ducts of glands—are similarly strengthened by a chitinous cuticle, and that a spiral or annular thickening of the cuticle is developed in them also. Chitin is *not* exclusively an ectodermal product, but occurs also in cartilaginous skeletal plates of mesoblastic origin (connective tissue). The immediate cavities or pits into which the tracheal stigmata open appear to be in many cases ectodermic in sinkings, but there seems to be no reason (based on embryological observation) for regarding the tracheae as an ingrowth of the ectoderm. They appear, in fact, to be an air-holding modification of the vasifactive connective tissue. Tracheae are abundant just in proportion as blood-vessels become suppressed. They are reciprocally exclusive. It seems not improbable that they are two modifications of the same tissue-elements. In Peripatus the stigmatic pits at which the tracheae communicate with the atmosphere are scattered and not definite in their position. In other cases the stigmata are definitely paired and placed in a few segments or in several. It seems that we have to suppose that the vasifactive tissue of Arthropoda can readily take the form of air-holding instead of blood-holding tubes, and that this somewhat startling change in its character has taken place independently in several instances—viz. in the Onychophora, in more than one group of Arachnida, in Diplopoda, and again in the Hexapoda and Chilopoda.

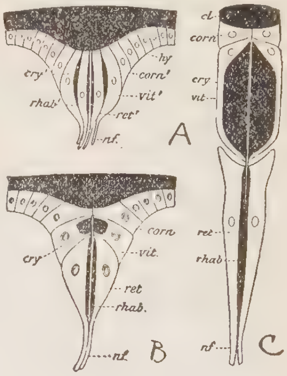

FIG. 12.—Diagram to show the derivation of the unit or "ommatidium" of the compound eye of Crustacea and Hexapoda, C, from a simple monomeniscous monostichous eye resembling the lateral eye of a scorpion, A, or the unit of the compound lateral eye of Limulus (see article ARACHNIDA, figs. 22 and 23). B represents an intermediate hypothetical form in which the cells beneath the lens are beginning to be superimposed as corneagen, vitrella and retinula, instead of standing side by side in horizontal series. The black represents the cuticular product of the epidermal cells of the ocular area, taking the form either of lens, *cl*, of crystalline body, *cry*, or of rhabdom, *rhab*; *hy*, hypodermis or epidermal cells; *corn*^{1}, laterally-placed cells in the simpler stage, A, which like the nerve-end cells, *vit*^{1} and *ret*^{1}, are corneagens or lens-producing; *corn*, specialized corneagen or lens-producing cells; *vit*^{1}, potential vitrella cells with *cry*^{1}, potential crystalline body now indistinguishable from retinula cells and rhabdomeres; *vit*, vitrella cell with *cry*, its contained cuticular product, the crystalline cone or body; *ret*^{1}, *rhab*^{1}, retinula cells and rhabdom of scorpion undifferentiated from adjacent cells, *vit*^{1}; *ret*, retinula cell; *rhab*, rhabdom; *nf*, optic nerve-fibres. (Modified from Watase.)

The Malpighian Tubes.—This name is applied to the numerous fine caecal tubes of noticeable length developed from the proctodaeal invert of ectodermal origin in Hexapods. These tubes are shown to excrete nitrogenous waste products similar to uric acid. Tubes of renal excretory function in a like position occur in most terrestrial Arthropoda—viz. in Chilopoda, Diplopoda and Arachnida. They are also found in some of the semi-terrestrial and purely aquatic Amphipod Crustaceans. But the conclusion that all such tubes are identical in essential character seems to be without foundation. The Malpighian tubes of Hexapods are outgrowths of the proctodaeum, but those of Scorpion and the Amphipod Crustacea are part of the metenteron or endodermal gut, though originating near its junction with the proctodaeum. Hence the presence or absence of such tubes cannot be used as an argument as to affinity without some discrimination. The Scorpion's so-called Malpighian tubes are *not* the same organs as those so named in the other Tracheata. Such renal caecal tubes seem to be readily evolved from either metenteron or proctodaeum when the conditions of the out-wash of nitrogenous waste-products are changed by the transference from aquatic to terrestrial life. The absence of such renal caeca in Limulus and their presence in the terrestrial Arachnida is precisely on a parallel with their absence in aquatic Crustacea and their presence in the feebly branchiate Amphipoda.

Group Characters.—We shall now pass the groups of the Arthropoda in review, attempting to characterize them in such a way as will indicate their probable affinities and genetic history.

Sub-Phylum ARTHROPODA.—The characters of the sub-phylum and those of the associated sub-phyla Chaetopoda and Rotifera have been given above, as well as the general characters of the phylum Appendiculata which comprises these great sub-phyla.

Grade A.—**Hyparthropoda.**

Hypothetical forms.

Grade B.—**Protarthropoda.**

(*a*) The integument is covered by a delicate soft cuticle (not firm or plated) which allows the body and its appendages great range of extension and contraction.

(*b*) The paired claws on the ends of the parapodia and the fang-like modifications of these on the first post-oral appendages (mandibles) are the only hard chitinous portions of the integument.

(*c*) The head is deuterognathous—that is to say, there is only one prosthomere, and accordingly the first and only pair of hemignaths is developed by adaptation of the appendages of the second somite.

(*d*) The appendages of the third somite (second post-oral) are clawless oral papillae.

(*e*) The rest of the somites carry equi-formal simple appendages, consisting of a corm or axis tipped with two chitinous claws and devoid of rami.

(*f*) The segmentation of the body is anomomeristic, there being no fixed number of somites characterizing all the forms included.

(*g*) The pair of eyes situated on the prosthomere are not of the Euarthropod type, but resemble those of Chaetopods (hence Nereidophthalmous).

(*h*) The muscles of the body-wall and gut do not consist of transversely-striped muscular fibre, but of the unstriped tissue observed also in Chaetopoda.

(*i*) A pair of coelomoducts is developed in every somite including the prosthomere, in which alone it atrophies in later development.

(*j*) The ventral nerve-cords are widely separated—in fact, lateral in position.

(*k*) There are no masses of nerve-cells forming a ganglion (neuromere) in each somite. (In this respect the Protarthropoda are at a lower stage than most of the existing Chaetopoda.)

(*l*) The genital ducts are formed by the enlargement of the coelomoducts of the penultimate somite.

Class (Unica).—Onychophora.

With the characters of the grade: add the presence within the body of fine unbranched tracheal tubes, devoid of spiral thickening, opening to the exterior by numerous irregularly scattered tracheal pits.

Genera—Eoperipatus, Peripatopsis, Opisthopatus, &c. (See Peripatus.)

Grade C (of the Arthropoda).—**Euarthropoda.**

(*a*) Integument heavily plated with firm chitinous cuticle, allowing no expansion and retraction of regions of the body nor change of dimensions, except, in some cases, a dorso-ventral bellows movement. The separation of the heavier plates of chitin by grooves of delicate cuticle results in the hinging or jointing of the body and its appendages, and the consequent flexing and extending of the jointed pieces.

(*b*) Claws and fangs are developed on the branches or rami of the parapodia, not on the end of the axis or corm.

(*c*) The head is either deuterognathous, tritognathous, or tetartognathous.

(*d*) Rarely only one, and usually at least two, of the somites following the mandibular somite carry appendages modified as jaws (with exceptions of a secondary origin).

(*e*) The rest of the somites may all carry appendages, or only a limited number may carry appendages. In all cases the appendages primarily develop rami or branches which form the limbs, the primitive axis or corm being reduced and of insignificant size. In the most primitive stock all the post-oral appendages had gnathobasic outgrowths.

(*f*) The segmentation of the body is anomomeristic in the more archaic members of each class, nomomeristic in the higher members.

(*g*) The two eyes of Chaetopod structure have disappeared, and are replaced by the Euarthropod eyes.

(*h*) The muscles in all parts of the body consist of striped muscular fibre, never of unstriped muscular tissue.

(*i*) The coelomoducts are suppressed in most somites, and retained only as the single pair of genital ducts (very rarely more numerous) and in some also as the excretory glands (one or two pairs).

(*j*) The ventral nerve-cords approach one another in the mid-ventral line behind the mouth.

(*k*) The nerve-cells of the ventral nerve cords are segregated as paired ganglia in each somite, often united by meristic dislocation into composite ganglia.

(*l*) The genital ducts may be the coelomoducts of the penultimate or antepenultimate or adjacent somite, or of a somite placed near the middle of the series, or of a somite far forward in the series.

Class 1 (of the Euarthropoda).—Diplopoda.

The head has but one prosthomere (monoprosthomerous), and is accordingly deuterognathous. This carries short-jointed antennae (in one case bi-ramose) and eyes, the structure and development of which require further elucidation. Only one somite following the first post-oral or mandibular segment has its appendages modified as jaws.

The somites of the body, except in Pauropus, either fuse after early development and form double somites with two pairs of appendages (Julus, &c.), or present legless and leg-bearing somites alternating.

Somites, anomomeristic, from 12 to 150 in the post-cephalic series.

The genital ducts open in the fourth, or between the fourth and fifth post-oral somite.

Terrestrial forms with small-jointed legs formed by adaptation of a single ramus of the appendage. Tracheae are present.

Note.—The Diplopoda include the Juliformia, the Symphyla (Scolopendrella), and Pauropoda (Pauropus). They were until recently classified with the Chilopoda (Centipedes), with which they have no close affinity, but only a superficial resemblance. (Compare the definition of the class Chilopoda.)

The movement of the legs in Diplopoda is like that of those of Peripatus, of the Phyllopod Crustacea, and of the parapodia of Chaetopoda, symmetrical and identical on the two sides of the body. The legs of Chilopoda move in alternating groups on the two sides of the body. This implies a very much higher development of nerves and muscles in the latter. (See Millipede.)

Class 2 (of the Euarthropoda).—Arachnida.

Head tritognathous and diprosthomerous—that is to say, with two prosthomeres, the first bearing typical eyes, the second a pair of appendages reduced to a single ramus, which is in more primitive forms antenniform, in higher forms chelate or retrovert. The ancestral stock was pantognathobasic—*i.e.* had a gnathobase or jaw process on every parapodium. As many as six pairs of appendages following the mouth may have an enlarged gnathobase actually functional as a jaw or hemignath, but a ramus is well developed on each of these appendages either as a simple walking leg, a palp or a chela. In the more primitive forms the appendage of every post-oral somite has a gnathobase and two rami; in higher specialized forms the gnathobases may be atrophied in every appendage, even in the first post-oral.

The more primitive forms are anomomeristic; the higher forms nomomeristic, showing typically three groups or tagmata of six somites each.

The genital apertures are placed on the first somite of the second tagma or mesosoma. Their position is unknown in the more primitive forms. The more primitive forms have branchial respiratory processes developed on a ramus of each of the post-oral appendages. In higher specialized forms these branchial processes become first of all limited to five segments of the mesosoma, then sunk beneath the surface as pulmonary organs, and finally atrophied, their place being taken by a well-developed tracheal system.

A character of great diagnostic value in the more primitive Arachnida is the tendency of the chitinous investment of the tergal surface of the telson to unite during growth with that of the free somites in front of it, so as to form a pygidial shield or posterior carapace, often comprising as many as fifteen somites (Trilobites, Limulus).

A pair of central monomeniscous diplostichous eyes is often present on the head. Lateral eyes also are often present which are monostichous with aggregated lenses (*Limulus*) or with isolated lenses (Scorpio), or are diplostichous with simple lens (*Pedipalpi*, Araneae, &c.).

Class 3 (of the Euarthropoda).—Crustacea.

Head tetartognathous and triprosthomerous—that is to say, with three prosthomeres; the first bearing typical eyes, the second a pair of antenniform appendages (often bi-ramose), the third a pair of appendages usually antenniform, sometimes claw-like. The ancestral stock was (as in the Arachnida) pantognathobasic, that is to say, had a gnathobase or jaw-process on the base of every post-oral appendage.

Besides the first post-oral or mandibular pair, at least two succeeding pairs of appendages are modified as jaws. These have small and insignificant rami, or none at all, a feature in which the Arachnida differ from them. The appendages of four or more additional following somites may be turned upwards towards the mouth and assist in the taking of food.

The more primitive forms (Entomostraca) are anomomeristic, presenting great variety as to number of somites, form of appendages, and tagmatic grouping; the higher forms (Malacostraca) are nomomeristic, showing in front of the telson twenty somites, of which the six hinder carry swimmerets and the five next in front ambulatory limbs. The genital apertures are neither far forward nor far backward in the series of somites, *e.g.* on the fourteenth post-oral in Apus, on the ninth post-oral in female Astacus and in Cyclops.

With rare exceptions, branchial plates are developed either by modification of a ramus of the limbs or as processes on a ramus, or upon the sides of the body. No tracheate Crustacea are known, but some terrestrial Isopoda develop pulmonary in-sinkings of the integument. A characteristic, comparable in value to that presented by the pygidial shield of Arachnida, is the frequent development of a pair of long appendages by the penultimate somite, which with the telson form a trifid, or, when that is small, a bifid termination to the body.

The lateral eyes of Crustacea are polymeniscous, with highly specialized retinulae like those of Hexapoda, and unlike the simpler compound lateral eyes of lower Arachnida. Monomeniscous eyes are rarely present, and when present, single, minute, and central in position.

Note.—The Crustacea exhibit a longer and more complete series of forms than any other class of Arthropoda, and may be regarded as preserving the most completely represented line of descent.

Class 4.—CHILOPODA.

Head triprosthomerous [1] and tetartognathous. The two somites following the mandibular or first post-oral or buccal somite carry appendages modified as maxillae. The fourth post-oral somite has its appendages converted into very large and powerful hemignaths, which are provided with poison-glands. The remaining somites carry single-clawed walking legs, a single pair to each somite. The body is anomomeristic, showing in different genera from 17 (inclusive of the anal and genital) to 175 somites behind that which bears the poison jaws. No tagmata are developed. The genital ducts open on the penultimate somite.

Tracheae are developed which are dendriform and with spiral thickening of their lining. Their trunks open at paired stigmata placed laterally in each somite of the trunk or in alternate somites. Usually the tracheae open by paired stigmata placed upon the sides of a greater or less number of the somites, but never quite regularly on alternating somites. At most they are present on all the pedigerous somites excepting the first and the last. In *Scutigera* there are seven unpaired dorsal stigmata, each leading into a sac whence a number of air-holding tubes project into the pericardial blood-sinus.

Renal caecal tubes (Malpighian tubes) open into the proctodaeum. (See CENTIPEDE.)

Class 5.—HEXAPODA.

Head shown by its early development to be triprosthomerous and consequently tetartognathous. The first prosthomere has its appendages represented by the compound eyes and a protocerebrum, the second has the antennae for its appendages and a deutocerebral neuromere, the third has suffered suppression of its appendages (which corresponded to the second pair of antennae of Crustacea), but has a tritocerebrum and coelomic chamber. The mandibular somite bears a pair of gnathobasic hemignaths without rami or palps, and is followed by two jaw-bearing somites (maxillary and labial). This enumeration would give six somites in all to the head—three prosthomeres and three opisthomeres. Recent investigations (Folsom, **4**) show the existence in the embryo of a prae-maxillary or supra-lingual somite which is suppressed during development. This gives seven somites to the Hexapod's head, the tergites of which are fused to form a cephalic carapace or box. The number is significant, since it agrees with that found in Edriophthalmous Crustacea, and assigns the labium of the Hexapod to the same somite numerically as that which carries the labium-like maxillipedes of those Crustacea.

The somites following the head are strictly nomomeristic and nomotagmic. The first three form the thorax, the appendages of which are the walking legs, tipped with paired claws or ungues (compare the homoplastic claws of Scorpio and Peripatus). Eleven somites follow these, forming the abdominal "tagma," giving thus twenty-one somites in all (as in the higher Crustacea). The somites of the abdomen all may carry rudimentary appendages in the embryo, and some of the hinder somites may retain their appendages in a modified form in adult life. Terminal telescoping of the abdominal somites and excalation may occur in the adult, reducing the obvious abdominal somites to as few as eight. The genital apertures are median and placed far back in the series of somites, viz. the female on the seventh abdominal (seventeenth of the whole series) and the male on the ninth or ante-penultimate abdominal (nineteenth of the whole series). The appendages of the eighth and tenth abdominal somites are modified as gonapophyses. The eleventh abdominal segment is the telson, usually small and soft; it carries the anus.

The Hexapoda are not only all confined to a very definite disposition of the somites, appendages and apertures, as thus indicated, but in other characters also they present the specialization of a narrowly-limited highly-developed *order* of such a *class* as the Crustacea rather than a range from lower more generalized to higher more specialized forms such as that group and also the Arachnida present. It seems to be a legitimate conclusion that the most primitive Hexapoda were provided with wings, and that the term Pterygota might be used as a synonym of Hexapoda. Many Hexapoda have lost either one pair or both pairs of wings; cases are common of wingless genera allied to ordinary Pterygote genera. Some Hexapods which are very primitive in other respects happen to be also Apterous, but this cannot be held to prove that the possession of wings is not a primitive character of Hexapods (compare the case of the Struthious Birds). The wings of Hexapoda are lateral expansions of the terga of the second and third thoracic somites. They appear to be serial equivalents (homogenous meromes) of the tracheal gills, which develop in a like position on the abdominal segments of some aquatic Hexapods.

The Hexapoda are all provided with a highly developed tracheal system, which presents considerable variation in regard to its stigmata or orifices of communication with the exterior. In some a serial arrangement of stigmata comparable to that observed in Chilopoda is found. In other cases (some larvae) stigmata are absent; in other cases again a single stigma is developed, as in the smaller Arachnida and Chilopoda, in the median dorsal line or other unexpected position. When the facile tendency of Arthropoda to develop tracheal air-tubes is admitted, it becomes probable that the tracheae of Hexapods do not all belong to one original system, but may be accounted for by new developments within the group. Whether the primitive tracheal system of Hexapoda was a closed one or open by serial stigmata in every somite remains at present doubtful, but the intimate relation of the system to the wings and tracheal gills cannot be overlooked.

The lateral eyes of Hexapoda, like those of Crustacea, belong to the most specialized type of "compound eye," found only in these two classes. Simple monomeniscous eyes are also present in many Hexapods.

Renal excretory caeca (Malpighian tubes) are developed from the proctodaeum (not from mesenteron as in scorpion and Amphipoda).

Concluding Remarks on the Relationships to one another of the Classes of the Arthropoda.—Our general conclusion from a survey of the Arthropoda amounts to this, that whilst Peripatus, the Diplopoda, and the Arachnida represent *terrestrial* offshoots from successive lower grades of primitive *aquatic* Arthropoda which are extinct, the Crustacea alone present a fairly full series of representatives leading upwards from unspecialized forms. The latter were not very far removed from the aquatic ancestors (Trilobites) of the Arachnida, but differed essentially from them by the higher specialization of the head. We can gather no indication of the forefathers of the Hexapoda or of the Chilopoda less specialized than they are, whilst possessing the essential characteristics of these classes. Neither embryology nor palaeontology assists us in this direction. On the other hand, the facts that the Hexapoda and the Chilopoda have triprosthomerous heads, that the Hexapoda have the same total number of somites as the nomomeristic Crustacea, and the same number of opisthomeres in the head as the more terrestrial Crustacea, together with the same adaptation of the form of important appendages in corresponding somites, and that the compound eyes of both Crustacea and Hexapoda are extremely specialized and elaborate in structure and identical in that structure, all lead to the suggestion that the Hexapoda, and with them, at no distant point, the Chilopoda, have branched off from the Crustacean main stem as specialized terrestrial lines of descent. And it seems probable that in the case of the Hexapoda, at any rate, the point of departure was subsequent to the attainment of the nomomeristic character presented by the higher grade of Crustacea. It is on the whole desirable to recognize such affinities in our schemes of classification.

We may tabulate the facts as to head-structure in Chaetopoda and Arthropoda as follows:—

Grade *x* (below the Arthropoda).—AGNATHA, APROSTHOMERA.

Without parapodial jaws; without the addition of originally post-oral somites to the prae-oral region, which is a simple prostomial lobe of the first somite; the first somite is perforated by the mouth and its parapodia are not modified as jaws.

=CHAETOPODA.

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[1] Embryological evidence of this is still wanting. In the other classes of Arthropoda we have more or less complete embryological evidence on the subject. It appears from observation of the embryo that whilst the first prosthomere of Centipedes has its appendages reduced and represented only by eye-patches (as in Arachnida, Crustacea and Hexapoda), the second has a rudimentary antenna, which disappears, whilst the third carries the permanent antennae, which accordingly correspond to the second antennae of Crustacea, and are absent in Hexapoda.

Grade 1 (of the Arthropoda).—MONOGNATHA, MONOPROSTHOMERA. With a single pair of parapodial jaws carried by the somite which is perforated by the mouth; this is not the first somite, but the second. The first somite has become a prosthomere, and carries a pair of extensile antennae.

=ONYCHOPHORA (*Peripatus, &c.*).

Grade 2 (of the Arthropoda).—DIGNATHA, MONOPROSTHOMERA. The third somite as well as the second develops a pair of parapodial jaws; the first somite is a prosthomere carrying jointed antennae.

=DIPLOPODA.

Grade 3 (of the Arthropoda).—PANTOGNATHA, DIPROSTHOMERA. A gnathobase is developed (in the primitive stock) on every pair of post-oral appendages; two prosthomeres present, the second somite as well as the first having passed in front of the mouth, but only the second has appendages.

=ARACHNIDA.

Grade 4 (of the Arthropoda).—PANTOGNATHA, TRIPROSTHOMERA. The original stock, like that of the last grade, has a gnathobase on every post-oral appendage, but three prosthomeres are now present, in consequence of the movement of the oral aperture from the third to the fourth somite. The later eyes are polymeniscous, with specialized vitrellae and retinulae of a definite type peculiar to this grade.

=CRUSTACEA, CHILOPODA, HEXAPODA.

According to older views the increase of the number of somites in front of the mouth would have been regarded as a case of intercalation by new somite-budding of new prae-oral somites in the series. We are prohibited by a general consideration of metamerism in the Arthropoda from adopting the hypothesis of intercalation of somites. However strange it may seem, we have to suppose that one by one in the course of long historical evolution somites have passed forwards and the mouth has passed backwards. In fact, we have to suppose that the actual somite which in grades 1 and 2 bore the mandibles lost those mandibles, developed their rami as tactile organs, and came to occupy a position in front of the mouth, whilst its previous jaw-bearing function was taken up by the next somite in order, into which the oral aperture had passed. A similar history must have been slowly brought about when this second mandibulate somite in its turn became agnathous and passed in front of the mouth. The mandibular parapodia may be supposed during the successive stages of this history to have had, from the first, well-developed rami (one or two) of a palp-like form, so that the change required when the mouth passed away from them would merely consist in the suppression of the gnathobase. The solid palpless mandible such as we now see in some Arthropoda is, necessarily, a late specialization. Moreover, it appears probable that the first somite never had its parapodia modified as jaws, but became a prosthomere with tactile appendages before parapodial jaws were developed at all, or rather *pari passu* with their development on the second somite. It is worth while bearing in mind a second possibility as to the history of the prosthomeres, viz. that the buccal gnathobasic parapodia (the mandibles) were in each of the three grades of prosthomerism only developed after the recession of the mouth and the addition of one, of two, or of three post-oral somites to the prae-oral region had taken place. In fact, we may imagine that the characteristic adaptation of one or more pairs of post-oral parapodia to the purposes of the mouth as jaws did not occur until after ancestral forms with one, with two, and with three prosthomeres had come into existence. On the whole the facts seem to be against this supposition, though we need not suppose that the gnathobase was very large or the rami undeveloped in the buccal parapodia which were destined to lose their mandibular features and pass in front of the mouth.

REFERENCES.—**1.** Bateson, *Materials for the Study of Variation* (Macmillan, 1894), p. 85; **2.** Lankester, "Primitive Cell-layers of the Embryo" *Annals and Mag. Nat. Hist.* (1873), p. 336; **3.** Korschelt and Heider, *Entwickelungsgeschichte* (Jena, 1892), cap. xv. p. 389; **4.** Folsom, "Development of the Mouth Parts of Anurida," *Bulletin Mus. Comp. Zool. Harvard College*, vol. xxxvi. No. 5 (1900), pp. 142-146; **5.** Lankester, "Observations and Reflections on the Appendages and Nervous System of Apus Cancriformis," *Quart. Journ. Micr. Sci.* vol. xxi. (1881); **6.** Hofer, "Ein Krebs mit einer Extremität statt eines Stielauges," *Verhandl. d. deutschen zool. Gesellsch.* (1894); **7.** Watase, "On the Morphology of the Compound Eyes of Arthropods," *Studies from the Biol. Lab. of the Johns Hopkins University*, vol. iv. pp. 287-334; **8.** Benham describes backward shifting of the oral aperture in certain Chaetopods, *Proc. Zoolog. Soc. London* (1900), No. lxiv. p. 976. *N. B.*—References to the early literature concerning the group Arthropoda will be found in Carus, *Geschichte der Zoologie*. The more important literature up to 1892 is given in the admirable treatise on Embryology by Professors Korschelt and Heider. Detailed references will be found under the articles on the separate groups of Arthropoda. (E. R. L.)

ARTHUR (Fr. *Artus*), the central hero of the cycle of romance known as the *Matière de Bretagne* (see ARTHURIAN LEGEND). Whether there was an historic Arthur has been much debated; undoubtedly for many centuries after the appearance of Geoffrey of Monmouth's *Historia Britonum* (circ. 1136), the statements therein recorded of a mighty monarch, who ruled over Britain in the 5th–6th centuries, and carried his conquests far afield, even to the gates of Rome, obtained general, though not universal, credence. Even in the 12th century there were some who detected, and derided, the fictitious character of Geoffrey's "History." As was naturally to be expected, the pendulum swung to the other extreme, and in a more critical age the existence of Arthur was roundly denied. The truth probably lies midway between the two. The words of Wace, the Norman poet who translated the *Historia* into verse, are here admirably to the point. Speaking of the tales told of Arthur, he says:—

> "Ne tot mençunge, ne tot veir,
> Ne tot fable, ne tot saveir,
> Tant ont li contéor conté,
> Et li fabléor tant fablé
> Por lor contes embeleter
> Que tout ont fait fable sembler."[1]

The opinion now generally accepted by scholars is that the evidence of Nennius, whose *Historia Britonum* preceded that of Geoffrey by some 400 years, is in the main to be relied on. He tells us that Arthur was *Dux bellorum*, and led the armies of the British kings against the Saxon invaders, whom he defeated in twelve great battles. *Tunc Arthur pugnabat cum regibus Britonum, sed ipse dux erat bellorum.*

The traditional site of these battles covers a very wide area, and it is supposed that Arthur held a post analogous to that of the general who, under the Roman occupation, was known as *Comes Britanniae*, and held a roving commission to defend the island wherever attacked, in contradistinction to the *Dux Britanniarum*, who had charge of the forces in the north, and the *Comes Littoris Saxonici*, whose task it was to defend the south-east line. The Welsh texts never call Arthur *gwledig* (prince), but *amheradawr* (Latin *imperator*) or emperor, a title which would be bestowed on the highest official in the island. The truth thus appears to be that, while there was never a *King* Arthur, there was a noted chieftain and general of that name. If we say that he carried on a successful war against the Saxons, was probably betrayed by his wife and a near kinsman, and fell in battle, we have stated all which can be claimed as an historical nucleus for his legend. It is now generally admitted that the representation of Arthur as world conqueror, *Welt-Kaiser*, is due to the influence of the Charlemagne cycle. In the 12th century the *Matière de France* was waning, the *Matière de Bretagne* waxing in popularity, and public opinion demanded that the central figure of the younger cycle (for whatever the date of the subject matter, as a literary cycle the Arthurian is the younger) should not be inferior in dignity and importance to that of the earlier. When we add to this the fact that the writers of the 12th century represented the personages and events of the 6th in the garb, and under the conditions, of their own time, we can understand the reason of the manifold difficulties which beset the study of the cycle.

But into the figure of Arthur as we know him, other elements have entered; he is not merely an historic personality, but at the same time a survival of pre-historic myth, a hero of romance, and a fairy king; and all these threads are woven together in one fascinating but bewildering web. It is only possible here to summarize the leading features which may be claimed as characteristic of each phase.

Mythic.—Certain elements of the story point to Arthur as a culture hero; as such his name has been identified with the *Mercurius Artaius* of the Gauls. In this rôle he slays monsters, the boar Twrch Trwyth, the giant of Mont St Michel and the Demon Cat of Losanne (André de Coutances tells us that Arthur was really vanquished and carried off by the Cat, but that one durst not tell that tale before Britons!). He never, it should be

[1] Nor all a lie, nor all true, nor all fable, nor all known, so much have the story-tellers told, and the fablers fabled, in order to embellish their tales, that they have made all seem fable.

noted, rides on purely chivalric ventures, such as aiding distressed damsels, seeking the Grail, &c. His expeditions are all more or less warlike. The story of his youth belongs, as Alfred Nutt (*Folk-lore*, vol. iv.) has shown, to the group of tales classified as the *Aryan Expulsion and Return* formula, found in all Aryan lands. Numerous parallels exist between the Arthurian and early Irish heroic cycles, notably the Fenian or Ossianic. This Fenian cycle is very closely connected with the Tuatha de Danaan, the Celtic deities of vegetation and increase; recent research has shown that two notable features of the Arthurian story, the Round Table and the Grail, can be most reasonably accounted for as survivals of this Nature worship, and were probably parts of the legend from the first.

Romantic.—The character of Arthur as a romantic hero is, in reality, very different from that which, mainly through the popularity of Tennyson's *Idylls*, English people are wont to suppose. In the earlier poems he is practically a lay figure, his court the point of departure and return for the knights whose adventures are related in detail, but he himself a passive spectator. In the prose romances he is a monarch, the splendour of whose court, whose riches and generosity, are the admiration of all; but morally he is no whit different from the knights who surround him; he takes advantage of his *bonnes fortunes* as do others. He has two sons, neither of them born in wedlock; one, Modred, is alike his son and his nephew. In certain romances, the *Perlesvaus* and *Diu Crône*, he is a veritable *roi fainéant*, overcome by sloth and luxury. Certain traits of his story appear to show the influence of Northern romance. Such is the story of his begetting, where Uther takes upon him the form of Gorlois to deceive Yguerne, even as Siegfried changed shapes with Gunther to the undoing of Brünnhilde. The sword in the perron (stone pillar or block), the withdrawal of which proves his right to the kingdom, is the sword of the Branstock. Morgain carries him off, mortally wounded, to Avalon, even as the Valkyr bears the Northern hero to Valhal. Morgain herself has many traits in common with the Valkyrie; she is one of nine sisters, she can fly through the air as a bird (Swan maiden); she possesses a marvellous ointment (as does Hilde, the typical Valkyr). The idea of a slumbering hero who shall awake at the hour of his country's greatest need is world-wide, but the most famous instances are Northern, *e.g.* Olger Danske and Barbarossa, and depend ultimately on an identification with the gods of the Northern Pantheon, notably Thor. W. Larminie cited an instance of a rhyme current in the Orkneys as a charm against nightmare, which confuses Arthur with Siegfried and his winning of the Valkyr.

Fairy.—We find that at Arthur's birth (according to Layamon, who here differs from Wace), three ladies appeared and prophesied his future greatness. This incident is also found in the first continuation to the *Perceval*, where the prediction is due to a lady met with beside a forest spring, clearly here a water fairy. In the late romance of *La Bataille de Loquifer* Avalon has become a purely fairy kingdom, where Arthur rules in conjunction with Morgain. In *Huon de Bordeaux* he is Oberon's heir and successor, while in the romance of *Brun de la Montagne*, preserved in a unique MS. of the Bibliothèque Nationale, we have the curious statement that all fairy-haunted places, wherever found, belong to Arthur:—

> "Et touz ces lieux faés
> Sont Artus de Bretagne."

This brief summary of the leading features of the Arthurian tradition will indicate with what confused and complex material we are here dealing. (See also Arthurian Legend, Grail, Merlin, Round Table; and Celt: *Celtic literature.*)

Texts. Historic:—Nennius, *Historia Britonum*; H. Zimmer, *Nennius Vindicatus* (Berlin, 1893), an examination into the credibility of Nennius; Geoffrey of Monmouth, *Historia Britonum* (translations of both histories are in Bohn's Library); Wace, the *Brut* (ed. by Leroux de Lincey); Layamon (ed. by Sir Fred. Madden).

Romantic:—*Merlin*—alike in the Ordinary, or Vulgate (ed. Sommer), the *Suite* or "Huth" *Merlin*, the 13th century *Merlin* (ed. by G. Paris and J. Ulrich), and the unpublished and unique version of *Bibl. nat. fonds français*, 337 (cf. Freymond's analysis in *Zeitschrift für franz. Sprache*, xxii.)—devotes considerable space to the elaboration of the material supplied by the chronicles, the beginning of Arthur's reign, his marriage and wars with the Saxons. The imitation of the Charlemagne romances is here evident; the Saxons bear names of Saracen origin, and camels and elephants appear on the scene. The *Morte Arthur*, or *Mort au roi Artus*, a metrical romance, of which a unique English version exists in the Thornton collection (ed. for Early English Text Society), gives an expanded account of the passing of Arthur; in the French prose form it is now always found incorporated with the *Lancelot*, of which it forms the concluding section. The remains of the Welsh tradition are to be found in the *Mabinogion* (cf. Nutt's edition, where the stories are correctly classified), and in the Triads. Professor Rhys' *Studies in the Arthurian Legend* are largely based on Welsh material, and may be consulted for details, though the conclusions drawn are not in harmony with recent research. These are the only texts in which Arthur is the central figure; in the great bulk of the romances his is but a subordinate rôle. (J. L. W.)

ARTHUR I. (1187–1203), duke of Brittany, was the posthumous son of Geoffrey, the fourth son of Henry II. of England, and Constance, heiress of Conan IV., duke of Brittany. The Bretons hoped that their young prince would uphold their independence, which was threatened by the English. Henry II. tried to seize Brittany, and in 1187 forced Constance to marry one of his favourites, Randulph de Blundevill, earl of Chester (d. 1232). Henry, however, died soon afterwards (1189). The new king of England, Richard Cœur de Lion, claimed the guardianship of the young Arthur, but in 1190 Richard left for the Crusade. Constance profited by his absence by governing the duchy, and in 1194 she had Arthur proclaimed duke of Brittany by an assembly of barons and bishops. Richard invaded Brittany in 1196, but was defeated in 1197 and became reconciled to Constance. On his death in 1189, the nobles of Anjou, Maine and Touraine refused to recognize John of England, and did homage to Arthur, who declared himself the vassal of Philip Augustus. In 1202 war was resumed between the king of England and the king of France. The king of France recognized Arthur's right to Brittany, Anjou, Maine and Poitou. While Philip Augustus was invading Normandy, Arthur tried to seize Poitou. But, surprised at Mirebeau, he fell into the hands of John, who sent him prisoner to Falaise. In the following year he was transferred to Rouen, and disappeared suddenly. It is thought that John killed him with his own hand. After this murder John was condemned by the court of peers of France, and stripped of the fiefs which he possessed in France.

See Ralph of Coggeshall, "Chronicon Anglicanum," in the *Monumenta Britanniae historica*; Dom Lobineau, *Histoire de Bretagne* (1702); Dom Morice, *Histoire de Bretagne* (1742–1756); A. de la Borderie, *Histoire de Bretagne*, vol. iii. (1899); Bémont, "De la condamnation de Jean-sans-Terre par la Cour des Pairs de France," in the *Revue historique* (1886), vol. xxxii.

ARTHUR III. (1393–1458), earl of Richmond, constable of France, and afterwards duke of Brittany, was the third son of John IV., duke of Brittany, and Joan of Navarre, afterwards the wife of Henry IV. of England. His brother, John V., gave him his earldom of Richmond in England. While still very young, he took part in the civil wars which desolated France during the reign of Charles VI. From 1410 to 1414 he served on the side of the Armagnacs, and afterwards entered the service of Louis the dauphin, whose intimate friend he became. He profited by his position at court to obtain the lieutenancy of the Bastille, the governorship of the duchy of Nemours, and the confiscated territories of Jean Larchevêque, seigneur of Parthenay. His efforts to reduce the latter were, however, interrupted by the necessity of marching against the English. At Agincourt he was wounded and captured, and remained a prisoner in England from 1415 to 1420. Released on parole, he gained the favour of King Henry V. by persuading his brother, the duke of Brittany, to conclude the treaty of Troyes, by which France was handed over to the English king. He was rewarded with the countship of Ivry.

In 1423 Arthur married Margaret of Burgundy, widow of the dauphin Louis, and became thus the brother-in-law of Philip the Good of Burgundy, and of the regent, the duke of Bedford. Offended, however, by Bedford's refusal to give him a high command, he severed his connexion with the English, and in March 1425 accepted the constable's sword from King Charles VII.

He now threw himself with ardour into the French cause, and persuaded his brother, John V. of Brittany, to conclude with Charles VII. the treaty of Saumur (October 7, 1425). But though he saw clearly enough the measures necessary for success, he lacked the means to carry them out. In the field he met with a whole series of reverses; and at court, where his rough and overbearing manners made him disliked, his influence was overshadowed by that of a series of incompetent favourites. The peace concluded between the duke of Brittany and the English in September 1427 led to his expulsion from the court, where Georges de la Trémoille, whom he himself had recommended to the king, remained supreme for six years, during which Richmond tried in vain to overthrow him. In the meantime, in June 1429, he joined Joan of Arc at Orleans, and fought in several battles under her banner, till the influence of La Trémoille forced his withdrawal from the army. On the 5th of March 1432 Charles VII. concluded with him and with Brittany the treaty of Rennes; but it was not until June of the following year that La Trémoille was overthrown. Arthur now resumed the war against the English, and at the same time took vigorous measures against the plundering bands of soldiers and peasants known as *routiers* or *écorcheurs*. On the 20th of September 1435, mainly as a result of his diplomacy, was signed the treaty of Arras between Charles VII. and the duke of Burgundy, to which France owed her salvation.

On the 13th of April 1436, Arthur took Paris from the English; but he was ill seconded by the king, and hampered by the necessity for leading frequent expeditions against the *écorcheurs*; it was not till May 1444 that the armistice of Tours gave him leisure to carry out the reorganization of the army which he had long projected. He now created the *compagnies d'ordonnance*, and endeavoured to organize the militia of the *francs archers*. This reform had its effect in the struggles that followed. In alliance with his nephew, the duke of Brittany, he reconquered, during September and October 1449, nearly all the Cotentin; on the 15th of April 1450 he gained over the English the battle of Formigny; and during the year he recovered for France the whole of Normandy, which for the next six or seven years it was his task to defend from English attacks. On the death of his nephew Peter II., on the 22nd of September 1457, he became duke of Brittany, and though retaining his office of constable of France, he refused, like his predecessors, to do homage to the French king for his duchy. He reigned little more than a year, dying on the 26th of December 1458, and was succeeded by his nephew Francis II., son of his brother Richard, count of Étampes.

Arthur was three times married: (1) to Margaret of Burgundy, duchess of Guienne (d. 1442); (2) to Jeanne d'Albret, daughter of Charles II. of Albret (d. 1444); (3) to Catherine of Luxemburg, daughter of Peter of Luxemburg, count of St Pol, who survived him. He left no legitimate children.

AUTHORITIES.—The main source for the life of Duke Arthur III. is the chronicle of Guillaume Gruel (*c.* 1410–1474–1482). Gruel entered the service of the earl of Richmond about 1425, shared in all his campaigns, and lived with him on intimate terms. The chronicle covers the whole period of the duke's life, but the earlier part, up to 1425, is much less full and important than the later, which is based on Gruel's personal knowledge and observation. In spite of a perhaps exaggerated admiration for his hero, Gruel displays in his work so much good faith, insight and originality that he is accepted as a thoroughly trustworthy authority. It was first published at Paris in 1622. Of the numerous later editions, the best is that of Achille le Vavasseur, *Chronique d'Arthur de Richemont* (Paris, 1890). See also E. Cosneau, *Le Connétable de Richemont* (Paris, 1886); G. du Fresne de Beaucourt, *Histoire de Charles VII.* (Paris, 1881, seq.).

ARTHUR, CHESTER ALAN (1830–1886), twenty-first president of the United States, was born in Fairfield, Vermont, on the 5th of October 1830. His father, William Arthur (1796–1875), when eighteen years of age, emigrated from Co. Antrim, Ireland, and, after teaching in various places in Vermont and Lower Canada, became a Baptist minister. William Arthur had married Malvina Stone, an American girl who lived at the time of the marriage in Canada, and the numerous changes of the family residence afforded a basis for allegations in 1880 that the son Chester was born not in Vermont, but in Canada, and was therefore ineligible for the presidency. Chester entered Union College as a sophomore, and graduated with honour in 1848. He then became a schoolmaster, at the same time studying law. In 1853 he entered a law office in New York city, and in the following year was admitted to the bar. His reputation as a lawyer began with his connexion with the famous "Lemmon slave case," in which, as one of the special counsel for the state, he secured a decision from the highest state courts that slaves brought into New York while in transit between two slave states were *ipso facto* free. In another noted case, in 1855, he obtained a decision that negroes were entitled to the same accommodations as whites on the street railways of New York city. In politics he was actively associated from the outset with the Republican party. When the Civil War began he held the position of engineer-in-chief on Governor Edwin D. Morgan's staff, and afterwards became successively acting quartermaster-general, inspector-general, and quartermaster-general of the state troops, in which capacities he showed much administrative efficiency. At the close of Governor Morgan's term, on the 31st of December 1862, General Arthur resumed the practice of his profession, remaining active, however, in party politics in New York city. In November 1871 he was appointed by President U. S. Grant collector of customs for the port of New York. The custom-house had long been conspicuous for the most flagrant abuses of the "spoils system"; and though General Arthur admitted that the evils existed and that they rendered efficient administration impossible, he made no extensive reforms. In 1877 President Rutherford B. Hayes began the reform of the civil service with the New York custom-house. A non-partisan commission, appointed by Secretary John Sherman, recommended sweeping changes. The president demanded the resignation of Arthur and his two principal subordinates, George H. Sharpe, the surveyor, and Alonzo B. Cornell, the naval officer, of the Port. General Arthur refused to resign on the ground that to retire "under fire" would be to acknowledge wrong-doing, and claimed that as the abuses were inherent in a widespread system he should not be made to bear the responsibility alone. His cause was espoused by Senator Roscoe Conkling, for a time successfully; but on the 11th of July 1878, during a recess of the Senate, the collector was removed, and in January 1879, after another severe struggle, this action received the approval of the Senate. In 1880 General Arthur was a delegate at large from New York to the Republican national convention. In common with the rest of the "Stalwarts," he worked hard for the nomination of Gen. U. S. Grant for a third term. Upon the triumph of James A. Garfield, the necessity of conciliating the defeated faction led to the hasty acceptance of Arthur for the second place on the ticket. His nomination was coldly received by the public; and when, after his election and accession, he actively engaged on behalf of Conkling in the great conflict with Garfield over the New York patronage, the impression was widespread that he was unworthy of his position. Upon the death of President Garfield, on the 19th of September 1881, Arthur took the oath as his successor. Contrary to the general expectation, his appointments were as a rule unexceptionable, and he earnestly promoted the Pendleton law for the reform of the civil service. His use of the veto in 1882 in the cases of a Chinese Immigration Bill (prohibiting immigration of Chinese for twenty years) and a River and Harbour Bill (appropriating over $18,000,000, to be expended on many insignificant as well as important streams) confirmed the favourable impression which had been made. The most important events of his administration were the passage of the Tariff Act of 1883 and of the "Edmunds Law" prohibiting polygamy in the territories, and the completion of three great trans-continental railways—the Southern Pacific, the Northern Pacific, and the Atchison, Topeka & Santa Fé. His administration was lacking in political situations of a dramatic character, but on all questions that arose his policy was sane and dignified. In 1884 he allowed his name to be presented for renomination in the Republican convention, but he was easily defeated by the friends of James G. Blaine.

At the expiration of his term he resumed his residence in New York city, where he died on the 18th of November 1886.

For an account of his administration see UNITED STATES: *History*.

ARTHURIAN LEGEND. By the "Arthurian legend," or *Matière de Bretagne*, we mean the subject-matter of that important body of medieval literature known as the Arthurian cycle (see ARTHUR). The period covered by the texts in their present form represents, roughly speaking, the century 1150–1250. The *History* of Nennius is, of course, considerably earlier, and that of Geoffrey of Monmouth somewhat antedates 1150 (1136), but with these exceptions the dates above given will be found to cover the composition of all our extant texts.

As to the origin of this *Matière de Bretagne*, and the circumstances under which it became a favourite theme for literary treatment, two diametrically opposite theories are held. One body of scholars, headed by Professor Wendelin Förster of Bonn, while admitting that, so far as any historic basis can be traced, the events recorded must have happened on insular ground, maintain that the knowledge of these events, and their romantic development, are due entirely to the Bretons of the continent. The British who fled before the Teutonic and Scandinavian invasions of the 6th and 8th centuries, had carried with them to Armorica, and fondly cherished, the remembrance of Arthur and his deeds, which in time had become interwoven with traditions of purely Breton origin. On the other side of the Channel, *i.e.* in Arthur's own land, these memories had died out, or at most survived only as the faint echo of historic tradition. Through the medium of French-speaking Bretons these tales came to the cognizance of Northern French poets, notably Chrétien de Troyes, who wove them into romances. According to Professor Förster there were no Arthurian romances previous to Chrétien, and equally, of course, no insular romantic tradition. This theory reposes mainly on the supposed absence of pre-Chrétien poems, and on the writings of Professor H. Zimmer, who derives the Arthurian names largely from Breton roots. This represents the prevailing standpoint of German scholars, and may be called the "continental" theory. In opposition to this the school of which the late Gaston Paris was the leading, and most brilliant, representative, maintains that the Arthurian tradition, romantic equally with historic, was preserved in Wales through the medium of the bards, was by them communicated to their Norman conquerors, worked up into poems by the Anglo-Normans, and by them transmitted to the continental poets. This, the "insular" theory, in spite of its inherent probability, has hitherto been at a disadvantage through lack of positive evidence, but in a recently acquired MS. of the British Museum, Add. 36614, we find the first continuator of the *Perceval*, Wauchier de Denain, quoting as authority for stories of Gawain a certain Bleheris, whom he states to have been "born and bred in Wales." The identity of this Bleheris with the Bledhericus mentioned by Giraldus Cambrensis as *Famosus ille fabulator*, living at a bygone and unspecified date, and with the Bréri quoted by Thomas as authority for the *Tristan* story, has been fully accepted by leading French scholars. Further, on the evidence of certain MSS. of the *Perceval*, notably the Paris MS. (Bibl. Nat. 1450), it is clear that Chrétien was using, and using freely, the work of a predecessor, large fragments of which have been preserved by the copyists who completed his unfinished work. The evidence of recent discoveries is all in favour of the insular, or French, view.

So far as the character, as distinguished from the *provenance*, of this subject-matter is concerned, it is largely of folk-lore origin, representing the working over of traditions, in some cases (as *e.g.* in the account of Arthur's birth and upbringing) common to all the Aryan peoples, in others specifically Celtic. Thus there are a number of parallels between the Arthurian and the Irish heroic cycles, the precise nature of which has yet to be determined. So far as Arthur himself is concerned these parallels are with the Fenian, or Ossianic, cycle, in the case of Gawain with the Ultonian.

In its literary form the cycle falls into three groups:—pseudo-historic: the *Histories* of Nennius and Geoffrey, the *Brut* of Wace and Layamon (see ARTHUR); poetic: the works of Chrétien de Troyes, Thomas, Raoul de Houdenc and others (see GAWAIN, PERCEVAL, TRISTAN, and the writers named above); prose: the largest and most important group (see GRAIL, LANCELOT, MERLIN, TRISTAN). Of these three branches the prose romances offer the most insuperable problems; none can be dated with any certainty; all are of enormous length; and all have undergone several redactions. Of not one do we as yet possess a critical and comparative text, and in the absence of such texts the publication of any definite and detailed theory as to the evolution and relative position of the separate branches of the Arthurian cycle is to be deprecated. The material is so vast in extent, and in so chaotic a condition, that the construction of any such theory is only calculated to invite refutation and discredit.

The best general study of the cycle is to be found in Gaston Paris's manual *La Littérature française au moyen âge* (new and revised edition, 1905). See also the introduction to vol. xxx. of *Histoire littéraire de la France*. For the theories as to origin, see the Introductions to Professor Förster's editions of the poems of Chrétien de Troyes, notably that to vol. iv., *Der Karrenritter*, which is a long and elaborate restating of his position. Also Professor H. Zimmer's articles in *Göttingische gelehrte Anzeigen*, 12 and 20. For the Insular view, Ferd. Lot's "Études sur la provenance du cycle arthurien," *Romania*, vols. xxiv.–xxviii., are very valuable. For a popular treatment of the subject, cf. Nos. i. and iv. of *Popular Studies in Romance and Folk-lore* (Nutt). Robert Huntington Fletcher's "The Arthurian Matter in the Chronicles" (vol. x. of *Harvard Studies and Notes in Philology and Literature*), is a most useful summary. (J. L. W.)

ARTICHOKE. The common artichoke, *Cynara, scolymus*, is a plant belonging to the natural order Compositae, having some resemblance to a large thistle. It has long been esteemed as a culinary vegetable; the parts chiefly employed being the immature receptacle or floret disk, with the lower part of the surrounding leaf-scales, which are known as "artichoke bottoms." In Italy the receptacles, dried, are largely used in soups; those of the cultivated plant as *Carciofo domestico*, and of the wild variety as *Carciofo spinoso*.

The Jerusalem artichoke, *Helianthus tuberosus*, is a distinct plant belonging to the same order, cultivated for its tubers. It closely resembles the sunflower, and its popular name is a corruption of the Italian *Girasole Articiocco*, the sunflower artichoke. It is a native of Canada and the north-eastern United States, and was cultivated by the aborigines. The tubers are rich in the carbohydrate inulin and in sugar.

The name is derived from the northern Italian *articiocco*, or *arciciocco*, modern *carciofo*; these words come, through the Spanish, from the Arabic *al-kharshūf*. False etymology has corrupted the word in many languages: it has been derived in English from "choke," and "heart," or the Latin *hortus*, a garden; and in French, the form *artichaut* has been connected with *chaud*, hot, and *chou*, a cabbage.

ARTICLE (from Lat. *articulus*, a joint), a term primarily for that which connects two parts together, and so transferred to the parts thus joined; thus the word is used of the separate clauses or heads in contracts, treaties or statutes and the like; of a literary composition on some specific subject in a periodical; or of particular commodities, as in "articles of trade and commerce." It appears also in the phrase "in the article of death" to translate *in articulo mortis*, at the moment of death. In grammar the term is used of the adjectives which state the extension of a substantive, *i.e.* the number of individuals to which a name applies; the indefinite article denoting one or any of a particular class, the definite denoting a particular member of a class.

ARTICLES OF ASSOCIATION, in English company law, the regulations for the internal management of a joint stock company registered under the Companies Acts. They are, in fact, the terms of the partnership agreed upon by the shareholders among themselves. They regulate such matters as the transfer and forfeiture of shares, calls upon shares, the appointment and qualification of directors, their powers and proceedings, general meetings of the shareholders, votes, dividends, the keeping and audit of accounts, and other such matters. In regard to these internal regulations the legislature has left the company free to adopt whatever terms of association it chooses. It has furnished in the schedule to the Companies Act 1862 (Table A), a model or specimen set of regulations, but their adoption, wholly or in part, is optional; only if a company does not register articles of its own these statutory regulations are to apply. When, as is commonly the case, a company decides to have articles of its own framing, such articles must be expressed in separate paragraphs, numbered arithmetically, and signed by the subscribers of the memorandum of association. They must also be printed, stamped like a deed, and attested. When so perfected, they are to be delivered, with the memorandum of association, to the registrar of joint stock companies, who is to retain and register them. The articles of association thereupon become a public document, which any person may inspect on payment of a fee of one shilling. This has important consequences, because every person dealing with the company is presumed to be acquainted with its constitution, and to have read its articles. The articles, also, upon registration, bind the company and its members to the same extent as if each member had subscribed his name and affixed his seal to them. (See also Memorandum of Association; Company; Incorporation.)

In the United States, articles of association are any instrument in writing which sets forth the purposes, the terms and conditions upon which a body of persons have united for the prosecution of a joint enterprise. When this instrument is duly executed and filed, the law gives it the force and effects of a charter of incorporation.

ARTICULATA, a zoological name now obsolete, applied by Cuvier to animals, such as insects and worms, in which the body displays a jointed structure. (See Arthropoda.)

ARTICULATION (from Lat. *articulare*, to divide into joints), the act of joining together; in anatomy the junction of the bones (see Joints); in botany the point of attachment and separation of the deciduous parts of a plant, such as a leaf. The word is also used for division into distinct parts, as of human speech by words or syllables.

ARTILLERY (the O. Fr. *artiller*, to equip with engines of war, probably comes from Late Lat. *articulum*, dim. of *ars*, art, cf. "engine" from *ingenium*, or of *artus*, joint), a term originally applied to all engines for discharging missiles, and in this sense used in English in the early 17th century. In a more restricted sense, artillery has come to mean all firearms not carried and used by hand, and also the *personnel* and organization by which the power of such weapons is wielded. It is, however, not usual to class *machine guns* (*q.v.*) as artillery. The present article deals with the development and contemporary state of the artillery arm in land warfare, in respect of its organization, *personnel* and special or "formal" employment. For the *matériel*—the guns, their carriages and their ammunition—see Ordnance and Ammunition. For *ballistics*, see that heading, and for the work of artillery in combination with the other arms, see Tactics.

Artillery, as distinct from ordnance, is usually classified in accordance with the functions it has to perform. The simplest division is that into *mobile* and *immobile* artillery, the former being concerned with the handling of all weapons so mounted as to be capable of more or less easy movement from place to place, the latter with that of weapons which are installed in fixed positions. Mobile artillery is subdivided, again chiefly in respect of its employment, into *horse* and *field* batteries, *heavy field* or *position* artillery, *field howitzers*, *mountain artillery* and *siege trains*, adapted to every kind of terrain in which field troops may be employed, and work they may have to do. Immobile artillery is used in fixed positions of all kinds, and above all in permanent fortifications; it cannot, therefore, be classified as above, inasmuch as the *raison d'être*, and consequently the armament of one fort or battery may be totally distinct from that of another. "Fortress," "Garrison" and "Foot" artillery are the usual names for this branch. The dividing line, indeed, in the case of the heavier weapons, varies with circumstances; guns of position may remain on their ground while elaborate fortifications grow up around them, or the deficiencies of a field army in artillery may be made good from the *matériel*, more frequently still from the *personnel*, of the fortress artillery. Thus it may happen that mobile artillery becomes immobile and vice versa. But under normal circumstances the principle of classification indicated is maintained in all organized military forces.

Historical Sketch

1. *Early Artillery.*—Mechanical appliances for throwing projectiles were produced early in the history of organized warfare, and "engines invented by cunning men to shoot arrows and great stones" are mentioned in the Old Testament. These were continually improved, and, under the various names of *catapulta*, *balista*, *onager*, *trébuchet*, &c., were employed throughout the ancient and medieval periods of warfare. The machines finally produced were very powerful, and, even when a propelling agent so strong as gunpowder was discovered and applied, the supersession of the older weapons was not effected suddenly nor without considerable opposition. The date of the first employment of cannon cannot be established with any certainty, but there is good evidence to show that the Germans used guns at the siege of Cividale in Italy (1331). The terms of a commission given (1414) by Henry V. to his *magister operationum, ingeniarum, et gunnarum ac aliarum ordinationum*, one Nicholas Merbury, show that the organization of artillery establishments was grafted upon that which was already in existence for the service of the old-fashioned machines. Previously to this it is recorded that of some 340 men forming the ordnance establishment of Edward III. in 1344 only 12 were artillerymen and gunners. Two years later, at Creçy, it is said, the English brought guns into the open field for the first time. At the siege of Harfleur (1415) the ordnance establishment included 25 "master gunners" and 50 "servitour gunners." The "gunner" appears to have been the captain of the gun, with general charge of the guns and stores, and the special duty of laying and firing the piece in action.

2. *The Beginnings of Field Artillery.*—It is clear, from such evidence as we possess, that the chief and almost the only use of guns at this time was to batter the walls of fortifications, and it is not until later in the 15th century that their employment in the field became general (see also Cavalry). The introduction of field artillery may be attributed to John Žižka, and it was in his Hussite wars (1419–1424) that the *Wagenburg*, a term of more general application, but taken here as denoting a cart or vehicle armed with several small guns, came into prominence. This device allowed a relatively high manœuvring power to be attained, and it is found occasionally in European wars two centuries later, as for instance at Wimpfen in 1622 and Cropredy Bridge in 1644. In an act of attainder passed by the Lancastrian party against the Yorkists (1459), it is stated that the latter were "traiterously ranged in bataill . . . their cartes with gonnes set before their batailles" (Rot. Parl. 38 Henry VI., v. 348). In the London fighting of 1460, small guns were used to clear the streets, heavy ordnance to batter the walls of the Tower. The battle of Lose Coat Field (1469) was decided almost entirely by Edward IV.'s field guns, while at Blackheath (1497) "some cornets of horse, and bandes of foot, and good store of artillery wheeling about" were sent to "put themselves beyond" the rebel camp (Bacon, *Henry VII.*). The greatest example of artillery work in the 15th century was the siege of Constantinople in 1453, at which the Turks used a large force of artillery, and in particular some monster pieces, some of which survived to engage a British squadron in 1807, when a stone shot weighing some 700 ℔ cut the mainmast of Admiral (Sir) J. T. Duckworth's flagship in two, and another killed and wounded sixty men. For siege purposes the new weapon was indeed highly effective, and the castles of rebellious barons were easily knocked to pieces by the prince who owned, or succeeded in borrowing, a few pieces of ordnance (cf. Carlyle, *Frederick the Great*, book iii. chap. i.).

3. *The 16th Century.*—In the Italian wars waged by Charles

VIII., Louis XII. and Francis I. of France, artillery played a most conspicuous part, both in siege and field warfare. Indeed, cannon did excellent service in the field before hand firearms attained any considerable importance. At Ravenna (1512) and Marignan (1515) field artillery did great execution, and at the latter battle "the French artillery played a new and distinguished part, not only by protecting the centre of the army from the charges of the Swiss phalanxes, and causing them excessive loss, but also by rapidly taking up such positions from time to time . . . as enabled the guns to play upon the flanks of the attacking columns" (Chesney, *Observations on Firearms*, 1852). In this connexion it must, however, be observed that, when the arquebus and other small arms became really efficient (about 1525), less is heard of this small and handy field artillery, which had hitherto been the only means of breaking up the heavy masses of the hostile pikemen. We have seen that artillery was not ignored in England; but, in view of the splendid and unique efficiency of the archers, there was no great opportunity of developing the new arm. In the time of Henry VIII., the ordnance in use in the field consisted in the main of heavy *culverins* and other guns of position, and of lighter field pieces, termed *sakers*, *falcons*, &c. It is to be noticed that already the lightest pieces had disappeared, the smallest of the above being a 2-pounder. In the earlier days of field artillery, the artillery train was a miscellaneous congeries of pontoon, supply, baggage and tool wagons, heavy ordnance and light guns in carts. With the development of infantry fire the use of the last-named weapons died out, and it is largely due to this fact that "artillery" came to imply cumbrous and immobile guns of position. Little is, therefore, heard of smart manœuvring, such as that at Marignan, during the latter part of the 16th century. The guns now usually come into action in advance of the troops, but, from their want of mobility, could neither accompany a farther advance nor protect a retreat, and they were generally captured and recaptured with every changing phase of the fight. Great progress was in the meanwhile made in the adaptation of ordnance to the attack and defence of fortresses and, in particular, vertical fire came into vogue. A great Turkish gun, carrying a 600-lb stone shot, was used in the siege of Constantinople, apparently in this way, since Gibbon records that at the range of a mile the shot buried itself a fathom deep in earth, a fact which implies that a high angle of elevation was given. In the celebrated siege of Malta in 1565 artillery played a conspicuous part.

4. *The Thirty Years' War.*—Such, in its broadest outlines, is the history of artillery work during the first three centuries of its existence. Whilst the material had undergone a very considerable improvement, the organization remained almost unchanged, and the tactical employment of guns had become restricted, owing to their slowness and difficulty of movement on the march and immobility in action. In wars of the type of the War of Dutch Independence and the earlier part of the Thirty Years' War, this heavy artillery naturally remained useful enough, and the *Wagenburg* had given place to the musketry initiated by the Spaniards at Bicocca and Pavia, which since 1525 had steadily improved and developed. It is not, therefore, until the appearance of a captain whose secret of success was vigour and mobility that the first serious attempt was made to produce field artillery in the proper sense of the word, that is, a gun of good power, and at the same time so mounted as to be capable of rapid movement. The "carte with gonnes" had been, as is the modern machine gun, a mechanical concentration of musketry rather than a piece of artillery. Maurice of Nassau, indeed, helped to develop the field gun, and the French had invented the limber, but Gustavus Adolphus was the first to give artillery its true position on the battlefield. At the first battle of Breitenfeld (1631) Gustavus had twelve heavy and forty-two light guns engaged, as against Tilly's heavy 24-pounders, which were naturally far too cumbrous for field work. At the Lech (1632) Gustavus seems to have obtained a local superiority over his opponent owing to the handiness of his field artillery even more than by its fire-power. At Lützen (1632) he had sixty guns to Wallenstein's twenty-one. His field pieces were not the celebrated "leather" guns (which were indeed a mere makeshift used in Gustavus' Polish wars) but iron 4-pounders. These were distributed amongst the infantry units, and thus began the system of "battalion guns" which survived in the armies of Europe long after the conditions requiring it had vanished. The object of thus dispersing the guns was doubtless to ensure in the first place more certain co-operation between the two arms, and in the second to exercise a military supervision over the lighter and more useful field pieces which it was as yet impossible to exercise over the *personnel* of the heavy artillery.

5. *Personnel and Classification.*—More than 300 years after the first employment of ordnance, the men working the guns and the transport drivers were still civilians. The actual commander of the artillery was indeed, both in Germany and in England, usually a soldier, and Lennart Torstensson, the commander of Gustavus' artillery, became a brilliant and successful general. But the transport and the drivers were still hired, and even the gunners were chiefly concerned for the safety of their pieces, the latter being often the property, not of the king waging war, but of some "master gunner" whose services he had secured, and the latter's apprentices were usually in entire charge of the material. These civilian "artists," as they were termed, owed no more duty to the prince than any other employés, and even Gustavus, it would appear, made no great improvement in the matter of the reorganization of artillery trains. Soldiers as drivers do not appear until 150 years later, and in the meanwhile companies of "firelocks" and "fusiliers" (*q.v.*) came into existence, as much to prevent the gunners and drivers from running away as to protect them from the enemy. A further cause of difficulties, in England at any rate, was the age of the "gunners." In the reign of Elizabeth, some of the Tower gunners were over ninety years of age. Complaints as to the inefficiency of these men are frequent in the years preceding the English Civil War. Gustavus, however, has the merit of being the first to make the broad classification of artillery, as mobile or non-mobile, which has since been almost universally in force. In his time the 12-pounder was the heaviest gun classed as mobile, and the "feildpeece" *par excellence* was the 9-pounder or *demi-culverin*. After the death of Gustavus at Lützen (1632), his principles came universally into practice, and amongst them were those of the employment of field artillery.

6. *The English Civil War.*—Even in the English Civil War (Great Rebellion), in which artillery was hampered by the previous neglect of a century, its field work was not often contemptible, and on occasion the arm did excellent service. But in the campaigns of this war, fought out by men whose most ardent desire was to decide the quarrel swiftly, the marching and manœuvring were unusually rapid. The consequence of this was that the guns were sometimes either late in arriving, as at Edgehill, or absent altogether, as at Preston. The *rôle* of guns was further reduced by the fact that there were few fortresses to be reduced, and country houses, however strong, rarely required to be battered by a siege train. The New Model army usually sent for siege guns only when they were needed for particular service. On such occasions, indeed, the heavy ordnance did its work so quickly and effectually that the assault often took place one or two days after the guns had opened fire. Cromwell in his sieges made great use of shells, 12-inch and even larger mortars being employed. The castle of Devizes, which had successfully resisted the Parliamentary battering guns, succumbed at once to vertical fire. It does not, however, appear certain that there was any separation of field from siege ordnance, although the Swedish system was followed in almost all military matters.

7. *Artillery Progress, 1660–1740.*—Cromwell's practice of relegating heavy guns to the rear, except when a serious siege operation was in view, and in very rapid movements leaving even the field pieces far behind, was followed to some extent in the campaigns of the age of Louis XIV. The number of ammunition wagons, and above all of horses, required for each gun was four or five times as great as that required even for a modern quick-firer. In the days of Turenne heavy guns were much employed,

as the campaigns of the French were directed as a rule to the methodical conquest of territory and fortified towns. Similarly, Marlborough, working amidst the fortresses of the Netherlands in 1706, had over 100 pieces of artillery (of which 60 were mortars) to a force of some 11,000 men, or about 9 pieces per 1000 men. On the other hand, in his celebrated march to the Danube in 1704, he had but few guns, and the allied armies at Blenheim brought into the field only 1 piece per 1000 men. At Oudenarde "from the *rapidity of the march* . . . the battle was fought with little aid from artillery on either side" (Coxe, *Marlborough*). There was less need now than ever before for rapid manœuvres of mobile artillery, since the pike finally disappeared from the scene about 1700, and infantry fire-power had become the decisive factor in battles. In the meantime, artillery was gradually ceasing to be the province of the skilled workman, and assuming its position as an arm of the military service. In the 17th century, when armies were as a rule raised only "for the war," and disbanded at the conclusion of hostilities, there had been no very pressing need for the maintenance in peace of an expensive *personnel* and material. Gunners therefore remained, as civilians, outside the regular administration of the forces, until the general adoption of the "standing army" principle in the last years of the century (see Army). From this time steps were taken, in all countries, to organize the artillery as a military force. After various attempts had been made, the "Royal Regiment of Artillery" came into existence in England in 1716. It is, however, stated that the English artillery did not "begin to assume a military appearance until the Flanders campaigns" of the War of the Austrian Succession. Even in the War of American Independence a dispute arose as to whether a general officer, whose regimental service had been in the Royal Artillery, was entitled to command troops of all arms, and the artillery drivers were not actually soldiers until 1793 at the earliest. French artillery officers received military rank only in 1732.

8. *Artillery in the Wars of Frederick the Great.*—By the time of Frederick the Great's first wars, artillery had thus been divided into (*a*) those guns moving with an army in the field, and (*b*) those which were either wholly stationary or were called upon only when a siege was expected. The *personnel* was gradually becoming more efficient and more amenable to discipline; the transport arrangements, however, remained in a backward state. Siege and fortress artillery was now organized and employed in accordance with the system of the "formal attack" as finally developed by Vauban. For details of this, as involving the tactical procedure of artillery in the attack and defence of fortresses, the reader is referred to Fortification and Siegecraft. We are concerned here more especially with the progress of field artillery. The part played by this arm began now to vary according to the circumstances of each action, and the "moral" support of guns was calculated as a factor in the dispositions. In the early Silesian wars, heavy or reserve guns protected the deployment of the army and endeavoured to prepare for the subsequent advance by firing upon the hostile troops; the battalion guns remained close to the infantry, accompanied its movements and assisted in the fire fight. Their support was not without value, and the heavy guns often provoked the enemy into a premature advance, as at Mollwitz. But the infantry or the cavalry forced the decision. It has been mentioned that with the final disappearance of the pike, about 1700, infantry fire-power ruled the battlefield. Throughout the 18th century, it will be found, when the infantry is equal to its work the guns have only a subordinate part in the fighting of pitched battles. At Kunersdorf (1759) the first dashing charge of the Prussian grenadiers captured 72 guns from the Russian army. Later the total of captured ordnance reached 180, yet the Russians, then almost wholly in flight, were not cut to pieces, for only a few light guns of the Prussian army could get to the front; their heavy pieces, though twelve horses were harnessed to each, never came into action. This example will serve to illustrate the difference between the artillery of 1760 and that of fifty years later. According to Tempelhof, who was present, Kunersdorf was the finest opportunity for field artillery that he had ever seen. Yet the field artillery of the 18th century was, if anything, more powerful than that of Napoleon's time; it was the want of mobility alone which prevented the Prussians from turning to good account an opportunity fully as favourable as that of the German artillery at Sedan. That Frederick made more use of his guns in the later campaigns of the Seven Years' War is accounted for by the fact that his infantry and cavalry were no longer capable of forcing a decision, and also by changes in the general character of the operations. These were fought in and about broken country and entrenched positions, and the mobility of the other arms sank to that of the artillery. Thus power came to the front again, and the heavier weapons regained their former supremacy. In a *bataille rangée* in the open field the proportion of guns to men had been, in 1741, 2 per 1000. At Leuthen (1757) heavy fortress guns were brought to the front for a special purpose. At Kunersdorf the proportion was 4 and 5 per 1000 men, with what degree of effectiveness we have seen. In the later campaigns the Austrian artillery, which was, throughout the Seven Years' War, the best in Europe, placed its numerous and powerful ordnance (an "amphitheatre of 400 guns," as Frederick said) in long lines of field works. The combination of guns and obstacles was almost invariably too formidable to offer the slightest chance of a successful assault. It was at this stage that Frederick, in 1759, introduced horse artillery to keep pace with the movements of cavalry, a proof, if proof were needed, of the inability of the field artillery to manœuvre. The field howitzer, the weapon *par excellence* for the attack of field works, has never perhaps been more extensively employed than it was by the Prussians at that time. At Burkersdorf (1762) Frederick placed 45 howitzers in one battery. In those days the mobile artillery was always formed in groups or "batteries" of from 10 to 20 pieces. England too was certainly abreast of other countries in the organization of the field artillery arm. About the middle of the 18th century the guns in use consisted of 24-pounders, 12-pounders, 6-pounders and 3-pounders. The guns were divided into "brigades" of four, five and six guns respectively, and began to be separated into "heavy" and "light" brigades. Each field gun was drawn by four horses, the two leaders being ridden by artillerymen, and had 100 rounds of shot and 30 rounds of grape. The British artillery distinguished itself in the latter part of the Seven Years' War. Foreign critics praised its lightness, its elegance and the good quality of its materials. At Marburg (1760) "the English artillery could not have been better served; it followed the enemy with such vivacity, and maintained its fire so well, that it was impossible for the latter to re-form," says Tempelhof, the Prussian artillery officer who records the lost opportunity of Kunersdorf. The merits and the faults of the artillery had been made clear, and nowhere was the lesson taken to heart more than in France, where General Gribeauval, a French officer who had served in the war with the Austrian artillery, initiated reforms which in the end led to the artillery triumphs of the Napoleonic era. While Frederick had endeavoured to employ, as profitably as possible, the existing heavy equipments, Gribeauval sought improvement in other directions.

9. *Gribeauval's Reforms.*—At the commencement of the 18th century, French artillery had made but little progress. The carriages and wagons were driven by wagoners on foot, and on the field of battle the guns were dragged about by ropes or remained stationary. Towards the middle of the century some improvements were made. Field guns and carriages were lightened, and the guns separated into brigades. Siege carriages were introduced. From 1765 onwards, however, Gribeauval strove to build up a complete system both of *personnel* and *matériel*, creating a distinct *matériel* for field, siege, garrison and coast artillery. Alive to the vital importance of mobility for field artillery, he dismissed to other branches all pieces of greater calibre than 12-pounders, and reduced the weight of those retained. His reforms were resisted, and for a time successfully; but in 1776 he became first inspector-general of artillery, and was able to put his ideas into force. The field artillery of the new system included 4-pounder regimental guns,

and for the reserve 8- and 12-pounders, with 6-inch howitzers. For siege and garrison service Gribeauval adopted the 16-pounder and 12-pounder guns, 8-inch howitzer and 10-inch mortar, 12-, 10- and 8-inch mortars being introduced in 1785.

The carriages were constructed on a uniform model and technically improved. The horses were harnessed in pairs, instead of in file as formerly, but the manner in which the teams were driven remained much the same. The *prolong* (a sort of tow-rope) was introduced, to unite the trail of the gun and the limber in slow retiring movements. Siege carriages differed from those of field artillery only in details. Gribeauval also introduced new carriages for garrison and coast service. The great step made was in a uniform construction being adopted for all *matériel*, and in making the parts interchangeable so far as possible. In 1765 the *personnel* of the French artillery was reorganized. The corps or reserve artillery was organized in divisions of eight guns. The battery or division was thus made a unit, with guns, munitions and gunners complete, the horses and drivers being added at a later date. Horse artillery was introduced into the French army in 1791. The last step was made in 1800, when the establishment of a driver corps of soldiers put an end to the old system of horsing by contract.

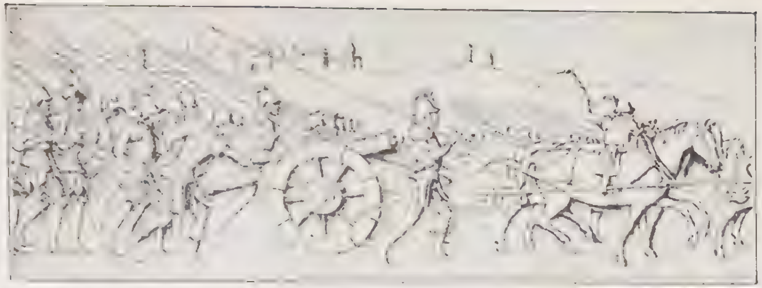
10. *British Artillery, 1793–1815.*—Meanwhile the numbers of the English artillery had increased to nearly 4000 men. For some five centuries the word "artillery" in England meant entirely garrison artillery; the field artillery only existed in time of war. When war broke out, a train of artillery was organized, consisting of a certain number of field (or siege) guns, manned by garrison gunners; and when peace was proclaimed the train was disbanded, the *matériel* being returned into store, and the gunners reverting to some fort or stronghold. In 1793 the British artillery was anything but efficient. Guns were still dispersed among the infantry, mobility had declined again since the Seven Years' War, and the American war had been fought out by the other arms. The drivers were mere carters on foot with long whips, and the whole field equipment was scarcely able to break from a foot-pace. Prior to the Peninsular War, however, the exertions of an able officer, Major Spearman, had done much to bring about improvement. Horse artillery had been introduced in 1793, and the driver corps established in 1794. Battalion guns were abolished in 1802, and field "brigades of six guns" were formed, horse artillery batteries being styled "troops." Military drivers were introduced, and the horses teamed in pairs. The drivers were mounted on the near horses, the gunners either rode the off horses or were carried on the limbers and wagons. The equipment was lightened, and a new system of manœuvres introduced. A troop of horse artillery and a field brigade each had five guns and one howitzer. The "driver corps," raised in 1794, was divided into troops, the addition of one of which to a company of foot artillery converted it into a field brigade. The horse artillery possessed both drivers and horses, and required very limited assistance from the driver corps.

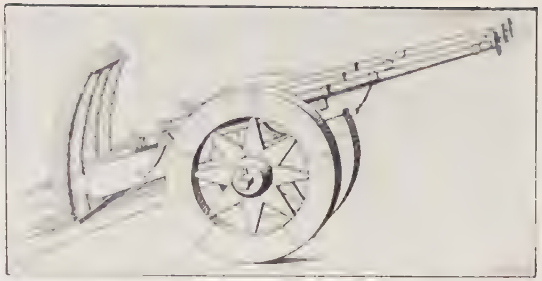
11. *French Revolutionary Wars.*—During the long wars of the French Revolution and Empire the artillery of the field army by degrees became field artillery as we know it to-day. The development of musketry in the 16th century had taken the work of preparing an assault out of the hands of the gunners. *Per contra*, the decadence of infantry fire-power in the latter part of the Seven Years' War had reinstated the artillery arm. A similar decadence of the infantry arm was destined to produce, in 1807, artillery predominance, but this time with an important difference, viz. *mobility*, and when mobility is thus achieved we have the first modern field artillery. The new tactics of the French in the Revolutionary wars, forced upon them by circumstances, involved an almost complete abandonment of the fire-tactics of Frederick's day, and the need for artillery was, from the first fight at Valmy onwards, so obvious that its moral support was demanded even in the outpost line of the new French armies. St Cyr (*Armies of the Rhine*, p. 112) quotes a case in which "right in the very farthest outpost line" the original 4-pounder guns were replaced by 8-, 16-, and in the end by 24-pounders. The cardinal principle of massing batteries was not, indeed, forgotten, notwithstanding the weakness of raw levies. But though, as we have seen, the *matériel* had already been greatly improved, and the artillery was less affected by the Revolution than other arms of the service, circumstances were against it, and we rarely find examples of artillery work in the Revolutionary wars which show any great improvement upon older methods. The field guns were however, at last organized in batteries each complete in itself, as mentioned above. The battalion gun disappeared; it was a relic of days in which it was thought advisable, both for other reasons and also because the short range of guns forbade any attempt at concentration of fire from several positions at one target, to have some force of artillery at any point that might be threatened. Though it was officially retained in the regulations of the French army, "officers and men combined to reject it" (Rouquerol, *Q. F. Field Artillery*, p. 121), and its last appearances, in 1809 and in 1813, were due merely to an endeavour on the part of Napoleon to give cohesion thereby to the battalions of raw soldiers which then constituted his army. But, with the development of mobility, it was probably found that sufficient guns could be taken to any threatened point, and no one had ever denied the principle of massed batteries, although, in practice, dispersion had been thought to be unavoidable.

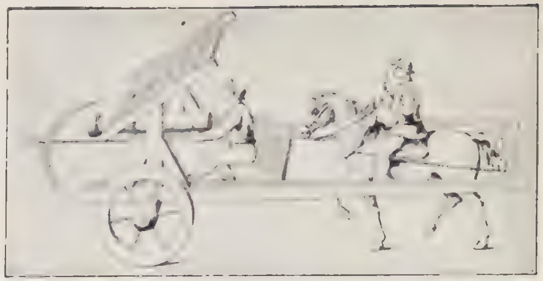
12. *Napoleon's Artillery Tactics.*—During the war the French artillery steadily improved in manœuvring power. But many years elapsed before perfection was attained. Meanwhile, the infantry, handled without regard to losses in every fight, had in consequence deteriorated. The final production of the field artillery battle, usually dated as from the battle of Friedland (June 14, 1807), therefore saved the situation for the French. Henceforward Napoleon's battles depend for their success on an "artillery preparation," the like of which had never been seen. Napoleon's own maxim illustrates the typical tactics of 1807–1815. "When once the *mêlée* has begun," he says, "the man who is clever enough to bring up an unexpected force of artillery, without the enemy knowing it, is sure to carry the day." The guns no longer "prepared" the infantry advance by slowly disintegrating the hostile forces. Still less was it their business merely to cover a deployment. On the contrary, they now went in to the closest ranges and, by actually *annihilating* a portion of the enemy's line with case-shot fire, "covered" the assault so effectively that columns of cavalry and infantry reached the gap thus created without striking a blow. It is unnecessary to give examples. Every one of Napoleon's later battles illustrates the principle. The most famous case is that of the great battery of 100 guns at Wagram (*q.v.*) which preceded the final attack of the centre. When Napoleon at Leipzig saw the allied guns forming up in long lines to prepare the assault, he exclaimed, "At last they have learned something." This "case-shot preparation," of course, involved a high degree of efficiency in manœuvre, as the guns had to gallop forward far in front of the infantry. The want of this quality had retarded the development of field artillery for 300 years, during which it had only been important relatively to the occasional inferiority of other troops. After Napoleon's time the art of tactics became the art of *combining the three arms.*

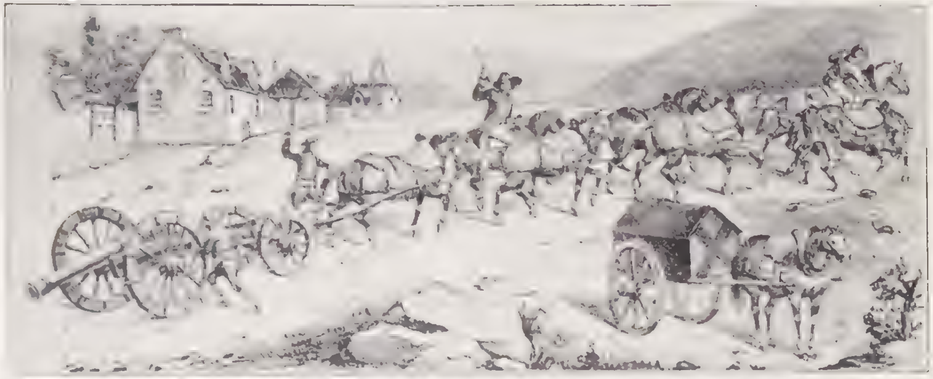
13. *Artillery, 1815–1865.*—Henceforward, therefore, the history of artillery becomes the history of its technical effectiveness, particularly in relation to infantry fire, and of improvements or modifications in the method of putting well-recognized principles into action. Infantry fire, however, being more variable in its effectiveness than that of artillery, the period 1815–1870 saw many changes in the relations of the two arms. In the time of Napoleon, infantry fire never equalled that of the Seven Years' War, and after the period of the great wars the musket was less and less effectively used. Economy was, however, practised to excess in every army of Europe during the period 1815–1850, and even if there had been great battles at this time, the artillery, which was maintained on a minimum strength of guns, men and horses, would not have repeated the exploits of Sénarmont and Drouot in the Napoleonic wars. The principle was well understood, but under such conditions the practice was impossible. It was at this stage that the general

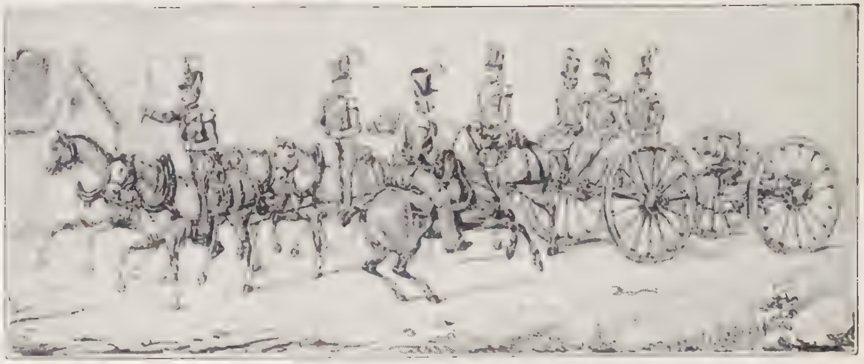
ARTILLERY

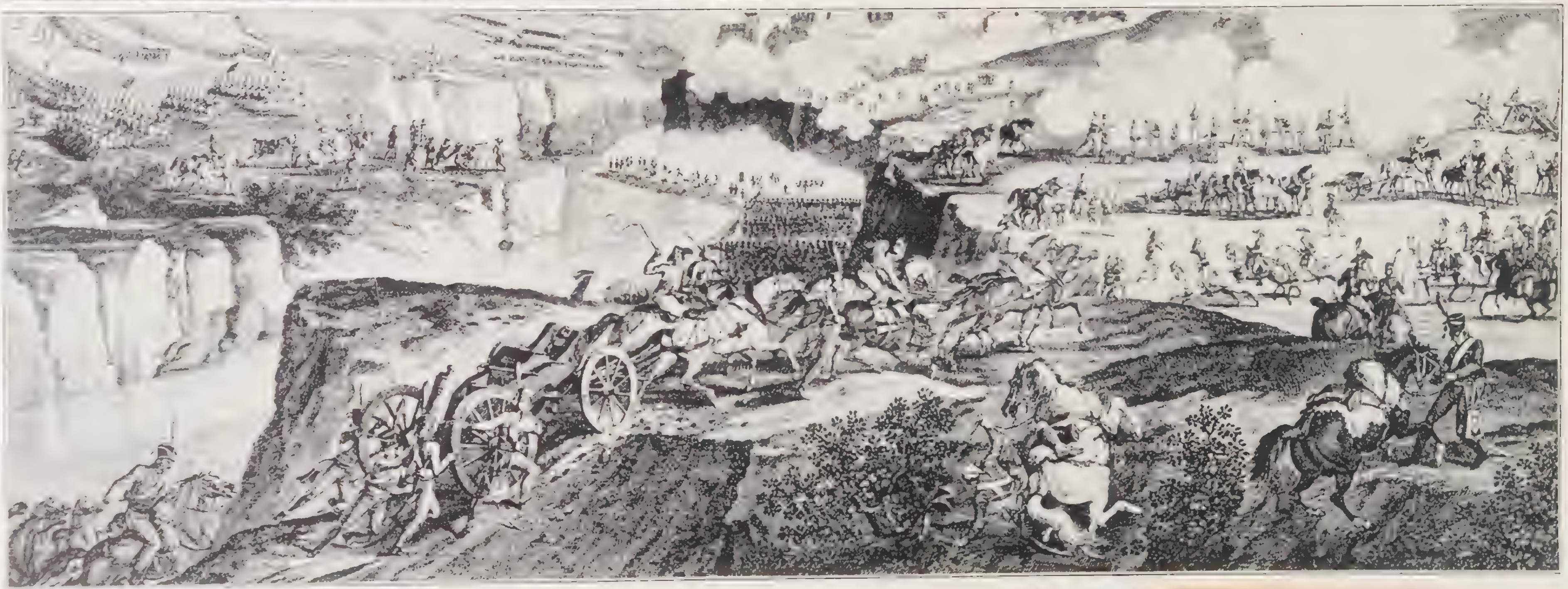






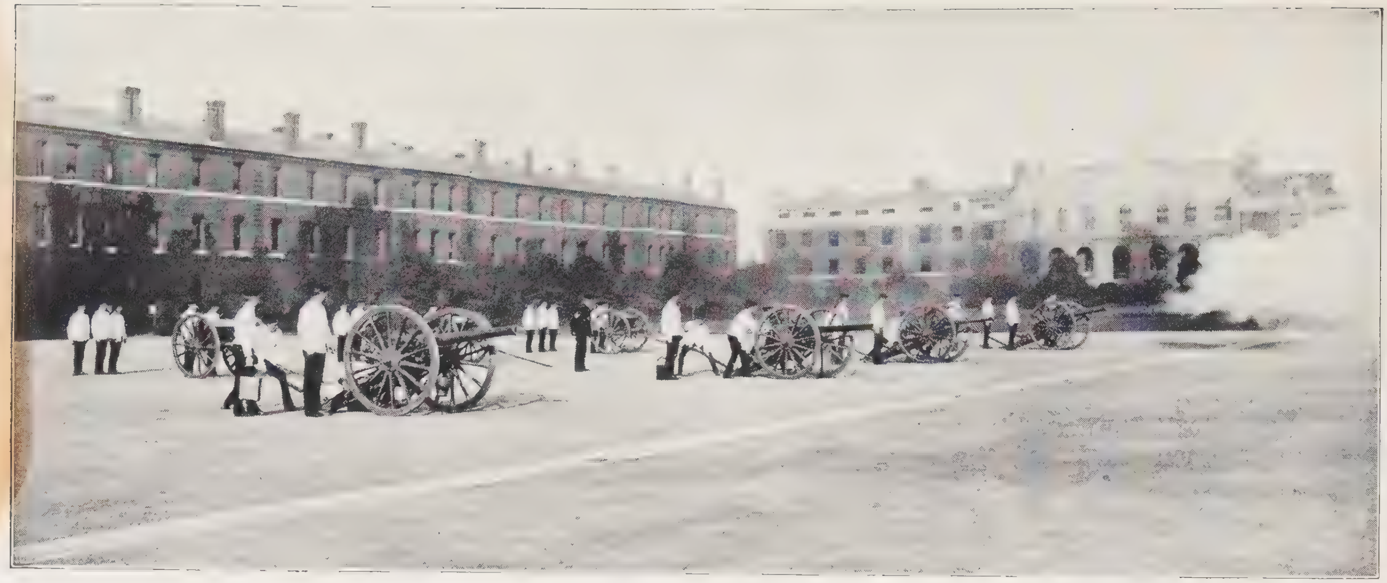






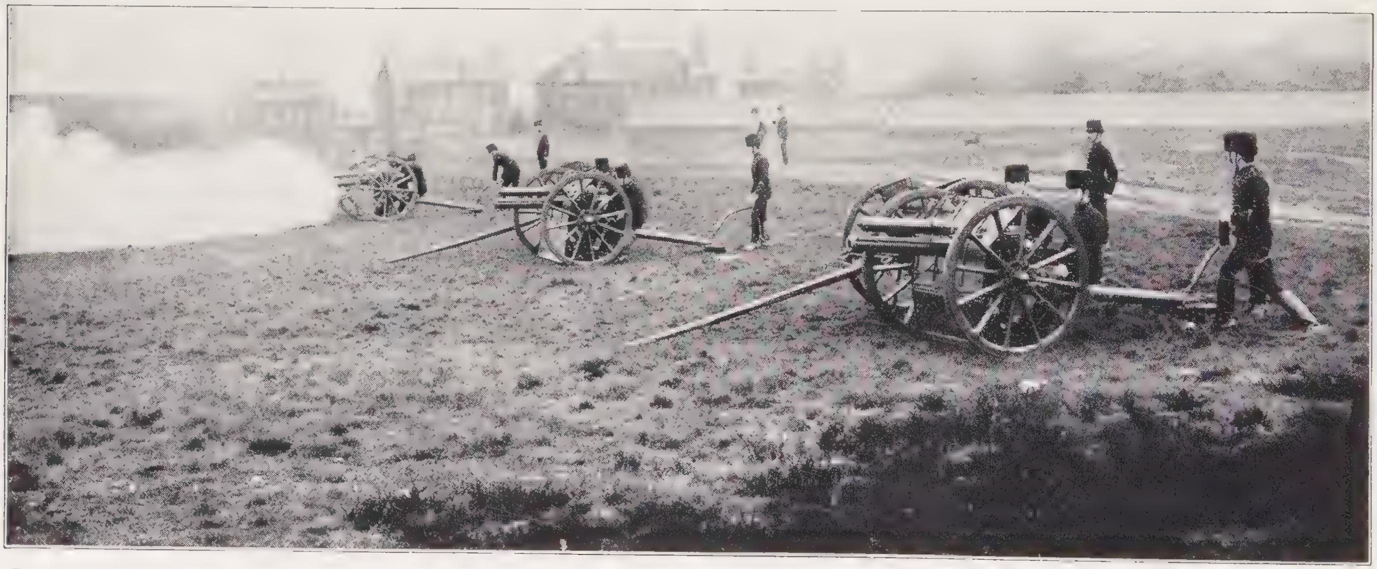
FIGS. 1 and 2.—15th Century Field Artillery (Napoleon III.). FIG. 3.—Field Artillery. 1525 (Napoleon III.). FIG. 4.—French Artillery, 1735 (*Journal d'Armée*, 1835). FIG. 5.—French Field Artillery, 1835 (*Journal d'Armée*, 1835).
FIG. 6.—Artillery in Action, Roveredo, 1796 (C. Vernet).

ARTILLERY



Photo, Gale & Polden.

BREACH LOADING FIELD BATTERY (15-PR. B.L.).



Photo, Gale & Polden.

QUICK-FIRING HORSE ARTILLERY (ROYAL HORSE ARTILLERY, 13-PR. Q.F.).

Photo, Gale & Polden

Q.F. FIELD ARTILLERY (18-PR. Q.F., R.F.A.).

Photo, Topical Press.

FRENCH (75-MM. Q.F.) FIELD ARTILLERY MANŒUVRING.

introduction of the rifled musket put an end, once for all, to the artillery tactics of the smooth-bore days. Infantry, armed with a far-ranging rifle, as in the American Civil War, kept the guns beyond case-shot range, compelling them to use only round shot or common shell. In that war, therefore, attacking infantry met, on reaching close quarters, not regiments already broken by a *feu d'enfer*, but the full force of the defenders' artillery and infantry, both arms fresh and unshaken, and the full volume of their case shot and musketry. At Fredericksburg the Federal infantry attacked, unsupported by a single field piece; at Gettysburg the Federal artillery general Hunt was able to reserve his ammunition to meet Lee's assault, although the infantry of his own side was meanwhile subjected to the fire of 137 Confederate guns. Thus, in both these cases the assault became one of infantry against unshaken infantry and artillery. On many occasions, indeed, the batteries on either side went into close ranges, as the traditions of the old United States army dictated, but their losses were then totally out of proportion to their effectiveness. Indeed, the increased range at which battles were now fought, and the ineffectiveness of the projectiles necessarily used by the artillery at these ranges, so far neutralized even rifled guns that artillery generals could speak of "idle cannonades" as the "besetting sin" of some commanders.

14. *The Franco-German War, 1870–71.*—In the next great war, that of 1866 (Bohemia), guns were present on both sides in great numbers, the average for both sides being three guns per 1000 men. Artillery, however, played but a small part in the Prussian attacks, this being due to the inadequate training then afforded, and also to the mixture of rifled guns and smooth-bores in their armament. In Prussia, however, the exertions of General v. Hindersin, the improvement of the *matériel*, and above all the better tactical training of the batteries, were rewarded four years later by success on the battlefield almost as decisive as Napoleon's. In 1870 the French artillery was invariably defeated by that of the Germans, who were then free to turn their attention to the hostile infantry. At first, indeed, the German infantry was too impatient to wait until the victorious artillery had prepared the way for them by disintegrating the opposing line of riflemen. Thus the attack of the Prussian Guards at St Privat (August 18, 1870) melted away before the unbroken fire-power of the French, as had that of the Federals at Fredericksburg and that of the Confederates at Gettysburg. But such experiences taught the German infantry commanders the necessity of patience, and at Sedan the French army was enveloped by the fire of nearly 600 guns, which did their work so thoroughly that the Germans annihilated the Imperial army at the cost of only 5 % of casualties.

15. *Results of the War.*—The tactical lessons of the war, so far as field artillery is concerned, may be briefly summarized as (*a*) employment of great masses of guns; (*b*) forward position of guns in the order of march, in order to bring them into action as quickly as possible; (*c*) the so-called "artillery duel," in which the assailant subdues the enemy's artillery fire; and (*d*) when this is achieved, and not before, the thorough preparation of all infantry attacks by artillery bombardment. This theory of field artillery action has not, even with the almost revolutionary improvements of the present period, entirely lost its value, and it may be studied in detail in the well-known work of von Schell, *Taktik der Feldartillerie* (1877), later translated into English by Major-General Sir A. E. Turner (*Tactics of Field Artillery*, 1900). In one important matter, however, the precepts of Schell and his contemporaries no longer hold good. "It is absolutely necessary that the object of the infantry's attack should be cannonaded before it advances. To accomplish this, sufficient time should be given to the artillery, and on no account should the infantry be ordered to advance until the fire of the guns has produced the desired effect." This, the direct outcome of the slaughter at St Privat, represents the best possibilities of breechloading guns with common shell—no more than a slow disintegration of the enemy's power of resistance by a thorough and lengthy "artillery preparation." Against troops sheltered behind works (as in the Russo-Turkish War of 1877–78) the common shell usually failed to give satisfactory results, if for no other reason, because the "preparation" consumed an inordinate time, and in any case the hostile artillery had first of all to be subdued in the artillery duel.

16. *Quick-firing Field Guns.*—In 1891, a work by General Wille of the German army (*The Field Gun of the Future*) and in 1892 another by Colonel Langlois of the French service (*Field Artillery with the other Arms*) foreshadowed many revolutionary changes in *matériel* and tactics which have now taken place. The new ideas spread rapidly, and the quick-firing gun came by degrees to be used in every army. The original designs have been greatly improved upon (see ORDNANCE: *Field artillery equipments*), but the principles of these designs have not undergone serious modification. These are, briefly, the mechanical absorption of the recoil, by means of brakes or buffers, and the development of "time shrapnel" as the projectile of field artillery. The absorption of recoil of itself permits of a higher rate of fire, since the gun does not require to be run up and relaid after every shot. Formerly such an advantage was illusory (since aim could not be taken through the thick bank of smoke produced by rapid fire), but the introduction of smokeless powder removed this objection. Artillerists, no longer handicapped, at once turned their attention to the increase of the rate of fire. At the same time a shield was applied to the gun, for the protection of the detachment. This advantage is solely the result of the non-recoiling carriage. The gunners had formerly to stand clear of the recoiling gun, and a shield was therefore of but slight value.

17. *Time Shrapnel.*—The power of modern artillery owes even more to the improvement of the projectile than to that of the gun (see AMMUNITION). The French, always in the forefront of artillery progress, were the first nation to realize the new significance of the time-fuze and the shrapnel shell. These had been in existence for many years; to the British army are due both the invention and the development of the shrapnel, which made its first appearance in European warfare at Vimeira in 1808. But, up to the introduction of rifled pieces, the Napoleonic case-shot attack was universally and justly considered the best method of fighting, and in the transition stage of the *matériel* many soldiers continued to put faith in the old method,—hence the Prussian artillery in 1866 had many smooth-bore batteries in the field,—and between 1860 and 1870 gunners, now convinced of the superiority of the new equipments, undoubtedly sought to turn to account the minute accuracy of the rifled weapons in unnecessarily fine shooting. Thus, in 1870 the French time-fuze was only graduated for two ranges, and the Germans used percussion fuzes only. But this phase has passed, and General Langlois has summarized the tactics of the newest field artillery in one phrase: "It results in transferring to 3000 yds. the point-blank and case-shot fire of the smooth-bore." The meaning of this will be discussed later; here it will be sufficient to say that it is claimed for the modern gun and the modern shell that the Napoleonic method[1] of annihilating by a rain of bullets has been revived, with the distinction that the shell, and not the gun, fires the bullets close up to the enemy. In the Boer War, Pieter's Hill furnished a notable example of this "covering," as distinct from "preparation," of an assault by artillery fire.

18. *Heavy Field, Siege and Garrison Artillery.*—Amongst other results of this war was a recrudescence of the idea of "dispersion." This will be noticed later; the more material result of the Boer War, and of the generally increasing specialization in the various functions of the artillery arm, has been the reintroduction of heavy ordnance into field armies. The field howitzer reappeared some time before the outbreak of that war, and the British howitzers had illustrated their shell-power in the Sudan campaign of 1898. During the latter part of the 19th century, siege and fortress artillery underwent a development hardly less remarkable than that of field artillery in the same time. Rifled guns, "long" and "short" for direct and curved fire, formed the siege artillery of the Germans in 1870–71, and

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[1] Napoleon's maxim, quoted above, reappears in spirit in the British *F. A. Training* of 1906 (p. 225).

with the reduction of the old-fashioned fortresses of France began a new era in siegecraft (see Fortification and Siegecraft). At the present time howitzers[1] (B.L. rifled) are the principal siege weapons, while heavy direct-fire guns (see Ordnance *passim*) still retain a part of the work formerly assigned to the artillery of the attack. For an account of a siege with modern artillery see Macalik and Länger, *Kampf um eine Festung*, which describes an imaginary siege of Königgrätz. On the whole, it may be said that modern artillery has caused a revolution in methods of fortification and siegecraft, which is little less far-reaching than the original change from the trébuchet to the bombard.

Organization

19. *Field Artillery Organization.*—A *battery* of field artillery comprises three elements, viz. *matériel*,—guns, carriages, ammunition and stores; *personnel*,—officers, non-commissioned officers, gunners, drivers and artificers; and *transport*,—almost invariably horses, though other animals, and also motor and mechanical transport, are used under special circumstances. As for the *matériel*, the guns used by field artillery in almost all countries are quick-firers, throwing shells of 13 to 18 pounds; details of these will be found in the article Ordnance. The number of guns in a battery varies in different countries between four and eight; by far the most usual number is six. With the introduction of the quick-firing gun, the tendency towards small batteries (of four guns) has become very pronounced, the ruling motives being (*a*) better control of fire in action, and (*b*) more horses available to draw the increased number of ammunition wagons required. "Mixed" batteries of guns and howitzers were formerly employed on occasion, and were supposed to be adapted to every kind of work. However, the difference between the gun and the howitzer was so great that at all times one part of the armament was idle, while the general increase in the artillery arm has permitted batteries and brigades of howitzers to be formed, separately, as required. Machine guns (*q.v.*) are not treated in Great Britain as being artillery weapons, though abroad they are often organized in batteries. During, and subsequent to the Boer War, heavier machine guns, called pompoms, came into use. The rocket (*q.v.*), formerly a common weapon of the artillery, is now used, if at all, only for mountain and forest warfare against savages.

20. *Ammunition.*—The vehicles of a battery include (besides guns and limbers) ammunition wagons, store and provision carts or wagons and forage wagons. On the amount of ammunition that should be carried with a field battery there was formerly a considerable diversity of opinion. The greater the amount a battery carries with it, the more independent it is; on the other hand, every additional wagon makes the battery more cumbrous and, by lengthening out the column, keeps back the combatant troops marching in rear. But since the introduction of the Q.F. gun it has been universally recognized that the gun must have a very liberal supply of ammunition present with it in action, and the old standard allowance of one wagon per gun has been increased to that of two and even three. Formerly batteries were further hampered by having to carry the reserve of small-arm ammunition for infantry and cavalry. But the greater distances of modern warfare accentuate the difficulties of such a system, and the reserve ammunition for all arms is now carried in special "ammunition columns" (see Ammunition), the *personnel* and transport of which is furnished by the artillery.

21. *Interior Economy.*—The organization and interior economy of a battery is much the same in all field artillery. In England the command is held by a major, the second in command is a captain. The battery is divided into three "sections" of two guns each, each under a subaltern officer, who is responsible for everything connected with his section—men, horses, guns, carriages, ammunition and stores. Each section again consists of two sub-sections, each comprising one gun and its wagons, men and horses, and at the head of each is the "No. 1" of the gun detachment—usually a sergeant—who is immediately responsible to the section commander for his sub-section.

The No. 1 rides with the gun, there is also another mounted non-commissioned officer who rides with the first wagon, and the gunners are seated on the gun-carriage, wagon and limbers. The increased number of wagons now accompanying the gun has, however, given more seating accommodation to the detachment, and this distribution has in some cases been altered. The three drivers ride the near horses of their respective pairs, each gun and each wagon being drawn by six horses. On the march, the gun is attached to the limber, a two-wheeled carriage drawn by the gun team; the wagon consists likewise of a "body" and a limber. A battery has also a number of non-combatant carriages, such as forge and baggage wagons. In addition to the gunners and drivers, there are men specially trained in range-taking, signalling, &c., in all batteries.

22. *Special Natures of Field Artillery.*—*Horse Artillery* differs from field in that the whole gun detachment is mounted, and the gun and wagon therefore are freed from the load of men and their equipment. The organization of a battery of horse artillery differs but slightly from that of a field battery; it is somewhat stronger in rank and file, as horse-holders have to be provided for the gunners in action. Horse artillery is often lightened, moreover, by sacrificing power (see Ordnance). The essential feature of *Mountain Artillery* in general is the carrying of the whole equipment on the backs of mules or other animals. The total weight is usually distributed in four or five mule-loads. For action the loads are lifted off the saddles and "assembled," and the time required to do this is, in well-trained batteries, only one minute. For the technical questions connected with the gun and its carriage, see Ordnance. The weight of a shell in a mountain gun rarely exceeds 12 ℔., and is usually less. In most armies the *field howitzer* has, after an eclipse of many years, reasserted its place. The weapons used are B.L. or Q.F. howitzers on field carriages; the calibre varies from about 4 to 5 in. In Great Britain the field howitzer batteries are organized as, and form part of, the Royal Field Artillery, two batteries of six howitzers each forming a brigade.

23. *Heavy Ordnance.*—*Heavy Field Artillery*, officially defined as "all artillery equipped with mobile guns of 4-in. calibre and upwards," is usually composed, in Great Britain, of 5-in. or 4·7-in. Q.F. guns on field carriages. 6-in. Q.F. guns have also been used. A battery (4 guns) is attached to the divisional artillery of each division, a company of the Royal Garrison Artillery furnishing the *personnel*. The four guns are divided into two sections, each section under an officer and each sub-section under a non-commissioned officer, as in the horse and field batteries. *Siege* and *garrison artillery* have not usually the complete and permanent organization that distinguishes field artillery. For siege trains the *matériel* is usually kept in store, and the *personnel* and transport are supplied from other sources according to requirement. In garrison artillery, the guns mounted in fortresses and batteries, or stored in arsenals for the purpose, furnish the *matériel*, and the companies of garrison artillery the *personnel*. In Great Britain, the Royal Garrison Artillery finds the mountain batteries and the heavy field artillery in addition to its own units. The siege trains are, as has been said, organized *ad hoc* on each particular occasion (see Fortification and Siegecraft). In Great Britain, the guns and howitzers manned by the R.G.A. would be 6-in. and 8-in. howitzers, 4·7-in. and 6-in. guns, and still heavier howitzers, as well as the field and heavy batteries belonging to the divisions making the siege.

24. *Higher Organization of Artillery.*—The higher units, in almost every country except Great Britain, are the regiment, and, sometimes, the brigade of two or more regiments. These units are distributed to army corps, divisions and districts, in the same way as units of other arms (see Army). In Great Britain the Royal Regiment of Artillery still comprises the whole *personnel* of the arm, being divided into the Royal Horse, Royal Field and Royal Garrison Artillery; to each branch Special

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[1] The old smooth-bore mortar for high-angle fire has of course disappeared, but the name "mortar" is still applied in some countries to short rifled howitzers.

Reserve and Territorial artillery are affiliated. Over and above the military command of these higher units, provision is usually made for technical control of the *matériel*, and a variety of training and experimental establishments, such as schools of gunnery, are maintained in all countries. The more special unit of organization in mobile artillery is the *brigade*, formerly called brigade-division (German, *Abteilung*; French *groupe*). The brigade is in Great Britain the administrative and tactical unit. Mountain artillery is not organized in brigades in the British empire. The unit consists, in the case of guns, of three batteries (18 guns, heavy artillery 12), in the case of field howitzers of two batteries (12 howitzers), and in the horse artillery of two batteries (12 guns), and is commanded by a lieutenant-colonel. To each brigade is allotted an ammunition column. The necessity for such a grouping of batteries will be apparent if the reader notes that 54 field guns, 12 howitzers and 4 heavy field guns form the artillery of a single British division of about 15,000 combatants.

25. *Grouping of the Artillery.*—The "corps artillery" (formerly the "reserve artillery") now consists only of the howitzer and heavy brigades, with a brigade of horse artillery. The latter is held at the disposal of the corps commander for the swift reinforcement of a threatened point; the howitzers and the heavy guns have, of course, functions widely different from those of the mass of guns. As the field artillery is required to come into action at the earliest possible moment, it has now been distributed amongst the infantry divisions, and marches almost at the head of the various combatant columns, instead of being relegated perhaps to the tail of the centre column. The redistribution of the British army (1907) on a divisional basis is a remarkable example of this; even the special natures of artillery (except horse artillery) are distributed amongst the divisions. In Germany two "regiments" (each of 2 *Abteilungen*=6 batteries) form a brigade, under an artillery general in each division who thus disposes of 72 field guns, and the howitzers, with such horse artillery batteries as remain over after the cavalry has been supplied, still form a corps or reserve artillery. In 1903 the French, after long hesitation, assigned the whole of the field artillery to the various divisions, but later (for reasons stated in the article TACTICS) arranged to reconstitute the old-fashioned corps artillery in war. (See also ARMY, § 49).

TACTICAL WORK

26. *General Characteristics of Field Artillery Action.*—The duty of field artillery in action is to fire with the greatest effect on the target which is for the moment of the greatest tactical importance. This definition of field artillery tactics brings the student at once to questions of combined tactics, for which consult the article TACTICS. The purpose of the present article is to indicate the methods employed by the gunners to give effect to their fire at the targets mentioned. For this purpose the artillery has at its disposal two types of projectile, common (or rather, high explosive) shell and shrapnel, and two fuzes, "time" and "percussion" (see AMMUNITION). The actual process of coming into action may be described in a few words. The gun is, at or near its position in action, "unlimbered" and the gun limber and team sent back under cover. Ammunition for the gun is first taken from the wagon that accompanies it, as it is very desirable to keep the limbers full as long as possible, in case of emergencies such as that of a temporary separation from the wagon. Limber supply is, however, allowed in certain circumstances. The wagon is now placed as a rule by the side of the gun, an arrangement which immensely simplifies the supply of ammunition, this being done under cover of the armour on the wagon and of the gun-shield and also without fatigue to the men. The older method of placing the wagon at some distance behind the gun is still occasionally used, especially in the case of unshielded equipments. No horses are allowed, in any case, to be actually with the line of guns. According to the British *Field Artillery Training* of 1906, a battery in action would be thus distributed: first, the "fighting battery" consisting of the six guns, each with its wagon alongside, and the limbers of the two flank guns; then, under cover in rear, the "first line of wagons" comprising the teams of the fighting battery, the four remaining gun limbers, and six more wagons. The non-combatant vehicles form the "second line of wagons."

27. *Occupation of a Position.*—This depends primarily upon considerations of tactics, for the accurate co-operation of the guns is the first essential to success in the general task. In details, however, the choice of position varies to some extent with the nature of the equipment: for instance, an elevated position is better adapted than a low one for high velocity guns firing over the heads of their own infantry, and again, the "spade" with which nearly all equipments are furnished (see ORDNANCE) should have soil in which it can find a hold. Cover for the gun and its detachment cannot well be obtained from the configuration of the ground, because, if the gun can shoot over the covering mass of earth, the hostile shells can of course do likewise. Sufficient protection is given by the shield, and thus "cover" for field-guns simply means concealment. Cover for the "first line of wagons" is, however, a very serious consideration. As to concealment, it is stated that "the broad white flash from a gun firing smokeless powder is visible" to an enemy "unless the muzzle is at least 10 ft. below the covering crest" (Bethell, *Modern Guns and Gunnery*, 1907, p. 147). Concealment therefore, means only the skilful use of ground in such a way as to make the enemy's ranging difficult. This frequently involves the use of retired positions, on reverse slopes, in low ground, &c., and in all modern artillery the greatest stress is laid on practice in firing by indirect means. Controversy has, however, arisen as to whether inability to see the foreground is not a drawback so serious that direct fire from a crest position, in spite of its exposure, must be taken as the normal method. The latter is of course immensely facilitated by the introduction of the shield. A great advantage of retired positions is that, provided unity of direction is kept, an overwhelming artillery surprise (see *F. A. Training*, 1906, p. 225) is carried out more easily than from a visible position. The extent of *front* of a battery in action is governed by the rule that no two gun detachments should be exposed to being hit by the bullets of one shell, and also by the necessity of having as many guns as possible at work. These two conditions are met by the adoption of a 20-yards interval between the muzzles of the guns. At the present time the gun and its wagon are placed as close together as possible, to obtain the full advantage of the armoured equipment. The *shield*, behind which the detachments remain at all times covered from rifle (except at very short range) and shrapnel bullets,[1] enables the artillery commander to handle his batteries far more boldly than formerly was the case. General Langlois says "the shield-protected carriage is the corollary to the quick-firing gun." Armour on the wagon, enabling ammunition supply as well as the service of the gun, to be carried on under cover, soon followed the introduction of the shield. The disadvantage of extra weight and consequently increased difficulty of "man-handling" the equipment is held to be of far less importance than the advantages obtained by the use of armour.

28. *Laying.*—"Elevation" may be defined as the vertical inclination of the gun, "direction" as the horizontal inclination to the right or left, necessary to direct the path of the projectile to the object aimed at. "Laying" the gun, in the case of most modern equipments, is divided, by means of the device called the independent line of sight (see ORDNANCE), into two processes, performed simultaneously by different men, the adjustment of the sights and that of the gun. The first is the act of finding the "line of sight," or line joining the sights and the point aimed at; for this the equipment has to be "traversed" right or left so as to point in the proper direction, and also adjusted in the vertical plane. The simplest form of laying for direction, or "line," is called the "direct" method. If the point aimed at is the target, and it can be seen by the layer, he has merely to look over the "open" sights. But the point aimed at is rarely the target itself. In war, the target, even if visible, is often indistinct,

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[1] Though not of course against the direct impact of shrapnel or H.E. shells.

and in this case, as also when the guns are under cover or engaging a target under cover, an "aiming point" or "auxiliary mark," a conspicuous point quite apart and distinct from the target, has to be employed ("indirect" method). In the Russo-Japanese War the sun was sometimes used as an aiming point. When the guns are behind cover and the foreground cannot be seen, an artificial aiming point is often made by placing a line of "aiming posts" in the ground. If an aiming point can be found which is in line with the target, as would be the case when aiming posts are laid out, the laying is simple, but it is as often as not out of the line. Finding the "line" in this case involves the calculation, from a distant observing point, of the angle at which the guns must be laid in order that, when the sights are directed upon the aiming point, the shell will strike the target. It is further necessary to find the "angle of sight" or inclination of the line of sight to the horizontal plane. If aim be taken over the open sights at the target, the line of sight naturally passes through the target, but in any other case it may be above or below it. Then the point where the projectile will meet the line of sight, which should coincide with the target, is beyond it if the line of sight is below or angle of sight is too small, and short of it if the line of sight is too high—that is, range and fuze will be wrong. The process of indirect laying for elevation therefore is, first, the measurement of the angle of sight, and secondly, the setting of the sights to that angle by means of a clinometer; this is called clinometer laying. In all cases the actual elevation of the gun to enable the shell to strike the target is a purely mechanical adjustment, performed independently; the gun is moved relatively to the sights, which have been previously set as described. Frequently the battery commander directs the guns from a point at some distance, communication being maintained by signallers or by field telephone. This is the normal procedure when the guns are firing from cover. Instruments of precision and careful calculations are, of course, required to fight a battery in this manner, many allowances having to be made for the differences in height, distance and angle between the position of the battery commander and that of the guns.

29. *Ranging*[1] (except on the French system alluded to below) is, first, finding the range (*i.e.* elevation required), and secondly, correcting the standard length of fuze for that range in accordance with the circumstances of each case. To find the elevation required, it is necessary to observe the bursts of shells "on graze" with reference to the target. The battery commander orders two elevations differing by 300 yds., *e.g.* "2500, 2800," and tells off a "ranging section" of two guns. These proceed to fire percussion shrapnel at the two different elevations, in order to obtain bursts "over" (+) and "short" (−). When it is certain that this "long bracket" is obtained, the "100 yds. bracket" is found, the elevations in the given case being, perhaps, 2600 and 2700 yds. "Verifying" rounds are then fired, to make certain of the 100 yds. bracket. The old "short bracket" (50 yds.) is not now required except at standing targets. Circumstances may, of course, shorten the process; for instance, a hit upon the target itself could be "verified" at once. The determination of the fuze (by time shrapnel) follows. The fuze has a standard length for the ascertained range, but the proper correction of this standard length to suit the atmospheric conditions has to be made. The commander has therefore already given out a series of corrector[2] lengths, his object being to secure bursts both in air and on graze. When he is finally satisfied he opens fire "for effect."

30. An example of the ordinary method of ranging, adapted from *Field Artillery Training*, 1906, is given below.

Battery commander gives target, &c., and orders: "Right section ranging section; remainder corrector 150 increase 10, 4400–4700," for the long bracket.

No. 1 gun fires, elevation 4400 yds., P.S., round observed −
No. 2 " " " 4700 " " " " +
B.C. orders "4500–4600."
No. 1 gun fires, elevation 4500 yds., P.S., round observed −
No. 2 " " " 4600 " " " " +

The 100 yds. bracket appears to be 4500–4600. B.C. orders: "Remainder 4500 time shrapnel," and gives the ranging section 4500–4600 to "verify." Guns 3, 4, 5, 6 set fuzes for 4500 with correctors 150, 160, 170, 180.

No. 1 gun fires, elevation 4500 yds., P.S., round observed −
No. 2 " " " 4600 " " " " +

B.C. orders: "Remainder 4500, one round gun fire, 3 seconds."

No. 3 elevation 4500 yds. T. S. corrector 150 air
No. 4 " " " " " 160 air
No. 5 " " " " " 170 graze
No. 6 " " " " " 180 "

B.C. selects corrector 160 and goes to "section fire."

The battery now begins to fire "for effect."

No. 1 elevation 4500 yds. T.S. corrector 160 air
No. 3 " " " " " " "

followed by Nos. 5, 2, 4 and 6.

There is another method of ranging, viz. with time shrapnel only. In this the principle is that several shells, fired with the same corrector setting, but at different elevations, will burst in air at different points along one line. Bursts high in the air cannot be judged, and it is therefore necessary to bring down the line of bursts to the target, so that the bursts in air appear directly in front or directly in rear of it. Rounds are therefore fired (in pairs owing to possible imperfections in the fuzes) to ascertain the corrector which gives the best line of observation. This found, the target is bracketed by bursts low in the air observed + and −, as in the ordinary method with percussion shrapnel.

The operations of finding the "line of fire" and the proper elevation may be combined, as the shells in ranging can be made to "bracket" for direction as well as for elevation. The line can be changed towards a new target in any kind of direct and indirect laying, in the latter case by observing the angle made with it by the original line of fire and giving deflection to the guns accordingly. Further, the fire of several dispersed batteries may be concentrated, distributed, or "switched" from one target to another on a wide front, at the will of the commander.

31. *Observation of Fire*, on the accuracy of which depends the success of ranging, may be done either by the battery commander himself or by a special "observing" party. In either case the shooting is carefully observed throughout, and corrections ordered at any time, whether during the process of ranging or during fire for effect. The difficulties of observation vary considerably with the ground, &c., for instance, the light may be so bad that the target can hardly be seen, or again, if there be a hollow in front of the target, a shell may burst in it so far below that the smoke appears thin, the round being then judged "over" instead of "short." On the other hand, a hollow behind the target may cause a round to be lost altogether. Ranging with time shrapnel has the merit of avoiding most of these "traps." The "French system of fire discipline," referred to below, has this method as the usual procedure.

32. *Fire.*—Field Artillery ranges are classed in the British service as: "distant," 6000 to 4500 yds.; "long," 4500 to 3500; "effective," 3500 to 2000; and "decisive," 2000 and

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[1] Finding the line is also an integral part of ranging. When an aiming point is used, the angle at which the guns must be laid with reference to it is calculated and given out by the battery commander. The modern goniometric sight permits of a wide angle (in England 180° right or left) being given. "Deflection" is a small angular correction applied to individual guns.

[2] The "corrector" is an adjustment on the sights of the gun used to determine the correct fuze. In the British Q.F. equipment, a graduated dial or drum shows the elevation of the gun above the line of sight. The fuze lengths are marked on a movable scale opposite the range graduations to which they apply, and the "corrector" moves this fuze scale so as to bring different fuze lengths opposite the range graduation. For example, a certain corrector setting gives $11\frac{1}{2}$ on the fuze scale opposite 4000 yds. on the range scale, and if the shells set to $11\frac{1}{2}$ burst too high, a new corrector setting is taken, the fuze length 12 is now opposite to the 4000 range graduation, and this length gives bursts closer up and lower. In the German service a corrector (*Aufsatzschieber*) alters the real elevation given to the gun, so that while throughout the battery all guns have the same (nominal or ordered) elevation shown on the sights, the real elevations of individual guns vary according to the different corrector settings. Thus bursts at different heights and distances from the target are obtained by shifting the trajectory of the shell. The fuze, being set for the nominal elevation common to all the guns, burns for the same time in each case, and thus the burst will be lower and closer to the target with a less (real) elevation, and higher and farther from it with a greater.

under. The actual methods of fire employed are matters of detail; it will be sufficient to say that "section fire," in which the two guns of a section are fired alternately at a named interval, usually 30 seconds, and "rapid fire," in which two, three or more rounds as ordered are fired by each gun as quickly as possible, are the normal methods. Each battery usually engages a portion of the objective equal in length to its own front, owing to the spread of the cone of shrapnel bullets (see below). The fire is, of course, almost always frontal, though enfilade and oblique fire, when opportunities occur for their employment, are more deadly than ever, because of the depth of the cone. As for the general conduct of an artillery action, accurate fire for effect, at a medium rate, is used in most armies, but in the French and, since 1906, in the British services a new method has arisen, in consequence of the introduction of the modern quick-firer and the perfection of the time shrapnel. The French battery (1900 Q.F. equipment) consists of four guns and twelve wagons. The gun is shielded, as also are the wagons; the high velocity and flat trajectory give a maximum depth to the cone of shrapnel bullets. In the hope of obtaining a rapid and overwhelming fire, the French artillery ranges only for a long bracket, and once this bracket is found, the ground within its limits is swept from end to end in a burst of rapid fire. This is termed a *rafale* (squall or gust), and technically signifies "a series of eight rounds per gun, each two rounds being laid with 100 metres more elevation than the last pair, the whole fired off as rapidly as possible." The cone of time shrapnel being assumed as 300 yds. (or metres), it is clear that four pairs of rounds, bursting, say, at 1000, 1100, 1200 and 1300 yds. (adding, for the last, 300 yds. for its forward effect), sweep the whole ground between 1000 and 1600 yds. from the guns. The maximum depth would, of course, be obtained with four elevations differing by the depth of the cone; in such a case the space from 1000 to 2200 yds. would be covered, though much less effectively, since the same number of bullets are distributed over a larger area. On the other hand, the *rafale*, at a minimum, covers 300 yds., all the guns in this case being laid at the same elevation throughout. Here the maximum number of bullets is obtained for every square yard attacked. Between these extremes, a skilful artillery officer can vary the *rafale* to the needs of each several case almost indefinitely. "Sweeping" fire is a series of three rounds per gun, one in the original line, one to the right and one to the left of it; this is significantly called "mowing" (*tir fauchant*). A further refinement in both services is the combined "search and sweep." Forty-eight rounds, constituting in the French army a series of this last kind, can, it is said, be fired in 1 minute and 15 seconds, without setting fuzes beforehand, to cover an area of 600 × 200 metres. The result of such a series, worked out mathematically, is that 19 % of all men and 75 % of all horses, in the area and not under cover, should be hit by separate bullets (Bethell, *Modern Guns and Gunnery*, 1907). Even allowing a liberal deduction for imperfect distribution of bullets, we may feel certain that nothing but shielded guns could live long in the fire-swept zone. This is, of course, a rate of fire which could not be kept up for any length of time by the same battery. A French battery, firing at the maximum rate, would expend every available round in 13 minutes.

33. *Projectiles Employed.*—"Time shrapnel," say the German Field Artillery regulations, "is the projectile *par excellence* . . . against all animate targets which are not under cover." It achieves its purpose, as has been said, by sending a shower of bullets over an area of ground in such quantity that this is swept from end to end. These bullets are propelled, in a cone, forward from the point of burst of the shell, and the effective depth of this cone at medium ranges with a fairly high velocity gun may be taken at 300 yds. Further, the corrector enables the artillery commander to burst his shells at any desired point; for example, a long fuze may be given, to burst them close up when firing upon a deep target (such as troops in several lines, one behind the other), and thereby to obtain the maximum searching effect, or to obtain direct hits on shielded guns, while a short corrector, bursting the shell well in front of the enemy, allows the maximum lateral spread of the bullets, and therefore sweeps the greatest front. The number of bullets in the shell is such that troops in the open under effective shrapnel fire must suffer very heavily, and may be almost annihilated. If the enemy is close behind good cover, the bullets, indeed, pass harmlessly overhead. This, however, leads to a very important fact, viz. that artillery can keep down the fire of hostile infantry, "blind" the enemy, in Langlois' phrase, by *pinning it down* to cover. Under cover the men are safe, but if they raise their heads to take careful aim, they will almost certainly be hit. Their fire under such conditions is therefore unaimed and wild at the best, and may be wholly ineffective. *Common* shell and *high-explosive* shell (see AMMUNITION) belong to another class of projectile. The former is now not often used, but a certain proportion of H.E. shell is carried by the field artillery in many armies (see table in ORDNANCE: *Field Equipments*). This has a very violent local effect within a radius of 20 to 25 yds. of the point of burst (see AMMUNITION, fig. 10). It therefore covers far less ground than shrapnel, and is naturally used either (*a*) against troops under substantial cover or (*b*) to wreck cover and buildings. In the former case the shell is supposed to send a rain of splinters vertically downwards. This it will do, provided the fuze is minutely accurate, and a burst is thus obtained exactly over the heads of the enemy, but this is now generally held to be unlikely, and in so far as effect against *personnel* is concerned the H.E. shell is not thought to be of much value. Indeed, in the British and several other services, no H.E. shells at all are carried by field batteries, reliance being placed upon percussion shrapnel in attacking localities, buildings, &c., and for ranging. Experiments have been made towards producing a "H.E. shrapnel," which combines the characteristics of both types (see, for a description, AMMUNITION). For the projectiles used in attacking shielded guns, see section on "field howitzers" below. *Case shot* is now rarely employed. In the war of 1870–71 Prince Kraft von Hohenlohe-Ingelfingen, who commanded the Prussian Guard artillery, reported the expenditure of only one round of case, and even that was merely "broken in transport." The close-quarters projectile of to-day is more usually shrapnel with the fuze set at zero. Langlois, however, calls case shot "the true projectile for critical moments, which nothing can replace."

34. *Tactics of Field Artillery.*—On the march, the position and movement of the guns are regulated by the necessity of coming quickly into action; the usual place for the arm is at or near the heads of the combatant columns, *i.e.* as far forward as is consistent with safety. Safety is further provided for by an "escort," or, if such be not detailed, by the nearest infantry or cavalry. In attack, the rôle of the field artillery is usually (1) to assist if necessary the advanced guard in the preliminary fighting—for this purpose a battery is usually assigned to that corps of troops, other batteries also being sent up to the front as required, (2) to prepare, and (3) to support or cover the infantry attack. "Preparation" consists chiefly in engaging and subduing the hostile artillery. This is often spoken of as the "artillery duel," and is not a meaningless bombardment, but an essential preliminary to the advance. Massed guns with modern shrapnel would, if allowed to play freely upon the attack, infallibly stop, and probably annihilate, the troops making it. The task of the guns, then, is to destroy the opposing guns and artillerymen, a task which will engage almost all the resources of the assailant's artillery in the struggle for artillery superiority. Shielded guns, enhanced rate of fire, perfection in indirect laying apparatus, and many other factors, have modified the lessons of 1870, and complicated the work of achieving victory in the artillery duel so far that the simple "hard pounding" of former days has given way to a variety of expedients for inflicting the desired loss and damage, as to which opinions differ in and within every army. One point is, however, clear and meets with universal acceptance. "The whole object of the duel is to enable the artillery subsequently to devote all available resources to its principal task, which is the material and moral support of the infantry during each succeeding stage of the fight" (French regulations). One side must be victorious in the end, and when, and not until, the hostile artillery is beaten out of action, the

victor has acquired the power of pressing home the attack. The British regulations (1906), indeed, deal with the steps to be taken when, though the artillery of the attack is beaten, the infantry advance is continued, but only so as to order the guns to "reopen at all costs," in other words, as a forlorn hope. The second part of the preparation, the gradual disintegration of the opposing line of infantry, has practically disappeared from the drill books. The next task of the guns, and that in which modern artillery asserts its power to the utmost, is the *support* of the infantry attack. The artillery and infantry co-operate, "the former by firing rapidly when they see their own infantry . . . press forward, and the latter by making full use of the periods of intense artillery fire to gain ground" (British *F.A. Training*, 1906). Thus aided, the infantry closes in to decisive ranges, and as it gains ground to the front, every gun "must be at once turned upon the points selected . . . the most effective support afforded to the attacking infantry by the concentrated fire of guns and field howitzers. The former tie the defenders to their entrenchments (for retreat is practically impossible over ground swept by shrapnel bullets), distract their attention and tend to make them keep their heads down, while the shell from the field howitzers searches out the interior of the trenches, the reverse slopes of the position, and checks the movement of reinforcements towards the threatened point." In these words the British Field Artillery drill-book of 1902 summarizes the act of "covering" the infantry advance. Unofficial publications are still more emphatic. The advance of the infantry to decisive range would often be covered by a mass of one hundred or more field guns, firing shrapnel at the rate of ten rounds per gun per minute at the critical moment. Against such a storm of fire the defending infantry, even supposing that its own guns had refitted and were again in action, would be powerless. It is in recognition of the appalling power of field artillery (which has increased in a ratio out of all proportion to the improvements of modern rifles) that the French system has been elaborated to the perfection which it has now attained.

With modern guns and modern tactics artillery almost invariably fires over the heads of its own infantry. The German regulations indeed say that it should be avoided as far as possible, but, as a matter of fact, if the numerous guns of a modern army (at Königgrätz there were 1550 guns on the field, at Gravelotte 1252, at Mukden 3000) were to be given a clear front, there would be no room for deploying the infantry. Consequently the French regulations, in which the power of the artillery is given the greatest possible scope, say that "it almost always fires over the heads of its own infantry." With field guns and on level ground it is considered dangerous that infantry in front of the guns should be less than 600 yds. distant—not for fear of the shells striking the infantry, but because the fragments resulting from a "premature" burst are dangerous up to that distance. The question of distance is more important in connexion with the "covering" of the assault. Up to a point, the artillery enables the attacking infantry to advance with a minimum of loss and exhaustion, and thus to close with the enemy at least on equal terms, if not with a serious advantage, for the fire of the guns may shake, perhaps almost destroy the enemy's power of resistance. But when the infantry approaches the enemy the guns can no longer fire upon the latter's front line without risk of injuring their friends. All that they can do, when the opposing infantries can see the whites of each other's eyes, is to lengthen the fuze, raise the trajectory and sweep the ground where the enemy's supports are posted. Under these circumstances it is practically agreed that the risk should be taken without hesitation at so critical a moment as that of a decisive infantry assault which must be pushed home at whatever cost. "It will be better for the infantry to chance a few friendly shells than to be received at short range with a fresh outburst of hostile rifle fire" (Rouquerol, *Tactical Employment of Quick-firing Field Artillery*). Thus, the distance at which direct support ceases, formerly 600 yds., has been diminished to 100, and even to 50 yds. Howitzers can, of course, maintain their fire almost up to the very last stage, and, in general, high-explosive shell, owing to its purely local effect, may be employed for some time after it has become unsafe to use shrapnel.

35. Field artillery in *defence*, which would presumably be inferior to that of the attack, must, of course, act according to circumstances. We are here concerned not with the absolute strength or weakness of the passive defensive, which is a matter of tactics (*q.v.*), but with the tactical procedure of artillery, which, relatively to other methods, is held to offer the best chance of success, so far as success is attainable. On the defensive in a prepared position, which in European warfare at any rate will be an unusually favourable case for the defender—the guns have two functions, that of engaging and holding the hostile artillery, and that of meeting the infantry assault. The dilemma is this, that on the one hand a position in rear of the line of battle, with modern improvements in communicating and indirect laying apparatus, is well suited for engaging the hostile guns, but not for meeting the assault; and on the other, guns on the forward slope of the defender's ridge or hill can fire direct, but are quickly located and overwhelmed, for they can hardly remain silent while their own infantry bears the fire of the assailant's shrapnel. Thus the defender's guns would, as a rule, have to be divided. One portion would seek to fight from rearward concealed positions, and use every device to delay the victory of the enemy's guns and the development of the battle until it is too late in the day for a serious infantry attack. Further, the enemy's mistakes and the "fortune of war" may give opportunities of inflicting severe losses; such opportunities have always occurred and will do so again. In the possible (though very far from probable) case of the defender not merely baffling, but crushing his opponent in the artillery duel, he may, if he so desires, himself assume the rôle of assailant, and at any rate he places a veto on the enemy's attack.

The portion told off to meet the infantry assault would be entrenched on the forward slope and would take no part in the artillery duel. Very exceptionally, this advanced artillery might fire upon favourable targets, but its paramount duty is to remain intact for the decisive moment. Here again the defender is confronted with grave difficulties. It is true that his advanced batteries may be of the greatest possible assistance at the crisis of the infantry assault, yet even so the covering fire of the hostile guns, as soon as the hostile infantry had found them their target, may be absolutely overwhelming; moreover, once the fight has begun, the guns cannot be withdrawn, nor can their positions easily be modified to meet unexpected developments. The proportion of the whole artillery force which should be committed to the forward position is disputed. Colonel Bethell (*Journal Royal Artillery*, vol. xxxiii. p. 67) holds that all the mountain guns, and two-thirds of the field guns, should be in the forward, all the howitzers and heavy guns and one-third of the field guns in the retired position. But in view of the facts that if once the advanced guns are submerged in the tide of the enemy's assault, they will be irrecoverable, and that a modern Q.F. gun, with plenty of ammunition at hand, may use "rapid fire" freely, artillery opinion, as a whole, is in favour of having fewer guns and an abnormal ammunition supply in the forward entrenchments, and the bulk of the artillery (with the ammunition columns at hand) in rear. But the purely passive defensive is usually but a preliminary to an active counter-stroke. This counter-attack would naturally be supported to the utmost by the offensive tactics of the artillery, which might thus at the end of a battle achieve far greater results than it could have done at the beginning of the day. In *pursuit*, it is universally agreed that the action of the artillery may be bold to the verge of rashness. The employment of field artillery in *advanced* and *rear guard actions* varies almost indefinitely according to circumstances; with *outposts*, guns would only be employed exceptionally.

36. *Marches*.—The importance of having the artillery well up at the front of a marching column is perhaps best expressed in the phrase of Prince Kraft von Hohenlohe-Ingelfingen, "save hours and not minutes." The Germans in 1870 so far acted up to the principle that Prince Hohenlohe, when asked, at the beginning

of the battle of Sedan, for a couple of guns, was able to reply, "You shall have ninety" (see, for details of the march of the Guard artillery, his *Letters on Artillery*, 6th letter). The German regulations for field service say, very plainly, "the horses have not done their work until they have got the guns into action, even at the cost of utter exhaustion." A notable march was made by the 62nd battery, R.F.A., in the South African War. On the day of the battle of Modder River, the battery marched 32 m. (mostly through deep sand) arriving in time to take part in the action. Such forced marches, if rare, are nowadays expected to be within the power of field artillery to accomplish. Horse artillery is capable of more than this, and as to pace, manœuvring at the cavalry rate. Heavy guns are the least mobile, and would rarely be able to keep pace with infantry in a forced march. Field artillery walks 4, trots 9, and gallops at the rate of 15 m. an hour. A fair marching pace (trot and walk) is 4 m. an hour for field, 5 for horse batteries. A march of 14 m. would, according to the German regulations, be performed by

a field battery in 5 hours,
a horse battery in 4 hours,

under favourable circumstances (Bronsart von Schellendorf).

37. *Power and Mobility.*—It will have been made clear that every gun represents a compromise between these two requirements, and that each type of artillery has been evolved in accordance with the relative requirements of these conditions in respect of the work to be performed. The classification which has been followed in this article represents the practically unanimous decision of every important military state. Still, there has always been controversy between the individual adherents of each side, and the Boer War experiences raised the question as to whether field artillery, as the term is usually understood, should not be abolished, with a view to having only heavy guns and horse artillery with a field army.

38. *Concentration and Dispersion.*—The use of their artillery made by the Boers in the South African War led to the revival of the idea of "dispersing" guns instead of "concentrating" them. It would be more accurate to say that military thinkers had, after the introduction of the quick-firing gun, challenged every received principle, and amongst others the employment of artillery in masses, which, as a result of the war of 1870, "had become almost an article of faith." The idea was to make use of the increased power of the guns to gain equally great results with the employment of less material than formerly. Thus the dispersion of guns is bound up with the passive defensive. The first editions of the British *Field Artillery Training* and *Combined Training*, strongly influenced as they were by South African experience, did not legislate, even in dealing with defence, for "dispersion" in the Boer manner, but only for adaptability (see *Field Artillery Training*, 1902, p. 15). In the Boer War, whilst the Boers nearly always scattered their guns, almost the only occasion upon which their artillery played a decisive part was at Spion Kop, where its fire was concentrated upon the point of assault. At Pieter's Hill, the fire of seventy guns covered the British infantry assault in the Napoleonic manner. On the whole it may be accepted as a general truth that guns are safe, and may be locally effective, when dispersed, but that they cannot produce decisive effect except when used in masses. It must, however, be clearly understood that a "mass" in this sense means a large number of guns, under one command, and susceptible of being handled as a unit, so far as the direction and effectiveness of their fire is concerned. *This being secured*, and on that condition only, it does not matter whether the actual gun positions are scattered over a few square miles, or are closed in one long line and using direct fire—they are still a mass, and capable of acting effectively as such. While there are undoubtedly grave dangers in using the indirect method too freely, technical improvements in laying, telephones, &c., have had much to do with the possibility, at any rate under favourable circumstances, of a concentration which may be described as one of shells rather than of guns, and the reader is reminded in this connexion that the work formerly done by the gun is now performed by the shell.

39. *Horse Artillery* is to be regarded as field artillery of great mobility and manœuvring power. Its value may be said, in general terms, to lie in augmenting the weak fire-power of the mounted troops, and in facilitating their work as much as possible. Thus, when cavalry meets serious opposition in reconnoitring, the guns may be able to break down the enemy's resistance without calling for assistance from the main body of the cavalry, and, in the action of cavalry *versus* cavalry, the "paramount duty of the horse artillery is to shatter the enemy's cavalry" (*Field Artillery Training*, 1906), *i.e.* to "prepare" the success of the cavalry charge by breaking up as far as possible the enemy's power of meeting it. In the cavalry battle, covering fire is practically impossible, owing both to the short distances separating the combatants and to the rapidity of their movements, but steps are taken "to enable all the guns to bear on the enemy's cavalry at the points of collision." The ideal position for the horse artillery is out to a flank, the cavalry manœuvring so as to draw the enemy's cavalry under enfilade fire, and at the same time to force them to mask the fire of their own horse artillery. Another and a most important function of the horse batteries is to reinforce, with the greatest possible speed, any point in the general line of battle which is in need of artillery support. For this reason the corps artillery generally includes horse batteries.

40. *Field Howitzers* are somewhat less mobile than field guns; they have, however, far greater shell power. The special features of the weapon are, of course, the product of the special requirements which have called it into existence. These are, briefly (*a*) the necessity of being able to "search" the interior of earthworks, a task which, as has been said, is beyond the power of high-velocity field guns, and (*b*) demolition work, which is equally beyond the power of even a H.E. shell of field-gun calibre. The first of these conditions implies a steep "angle of descent," which again implies a high angle of elevation. The second requires great shell power but does not call for high velocity. The howitzer, therefore, is a short gun, firing a heavy shell at high angles of elevation. Howitzers almost always are laid by the indirect method of fire from under cover, since it is clear that, with high angles of elevation, the gun may be brought close up to the covering mass, and still fire over it. Ranging must be done very accurately and yet economically, as but few of their heavy shells can be carried in the wagons and limbers, and the shells descending upon an enemy almost vertically lose the long sweeping effect of the field shrapnel which neutralizes minor errors of ranging. The projectiles employed are high explosive and shrapnel, the latter for use against *personnel* under cover, the former for demolition of field works, casemates or buildings. It is very generally held that howitzer time shrapnel is the best form of projectile for the attack of shielded guns. Here it may be said that no completely satisfactory method of dealing with these has yet been discovered. The best procedure with field guns is said to be lengthening the fuze to obtain a high percentage of bursts on graze. A shell striking the face of the shield will penetrate it, and should kill some at least of the gun detachment behind. The high-explosive shrapnel alluded to above is designed primarily for the attack of shielded guns.

41. *Heavy Field Artillery*, alternatively called *Artillery of Position*, as has been said, includes all guns of 4-in. calibre and upwards, mounted on travelling carriages. In South Africa, where firm soil was usually to be found, 6-in. guns were employed as heavy field guns, but in Europe even the 5-in. (British Service) is liable to sink into the ground. In Great Britain, guns only are used by this branch; abroad, the "heavy artillery of the field army," the "light siege train," &c., as it is variously called, is as a rule composed of howitzers of a heavier calibre than the field howitzer, the 15-cm. (6-in.) howitzer being most commonly met with. This artillery has, however, a different tactical rôle from the heavy field artillery of the British service; and it is always with a view to the attack of permanent or semi-permanent fortifications that the *matériel* is organized. In Great Britain, heavy batteries armed with the 5-in. gun are considered as "an auxiliary to the horse and field artillery" (*Heavy Artillery Training*). Ranging is conducted with greater

deliberation than ranging with the lighter guns, though upon the same general lines. Parts of the process may, however, be omitted in certain circumstances. Heavy guns use high-explosive (lyddite) shells and time shrapnel, the former for ranging and for demolishing cover, the latter against *personnel*. Laying is usually indirect. The tactical principles upon which heavy artillery does its work are based, in the main, on the long range (up to 10,000 yds.) and great shell-power of the guns. This power enables the artillery to reach with effect targets which are beyond the range of lighter ordnance, and it is, therefore, considered possible to disperse the guns in batteries, and even in sections of two guns, along the front of the army, without forfeiting the power of concentrating their fire on any point—a power which otherwise they would not possess owing to their want of mobility. At the same time it is not forbidden to bring them into line with the rest of the artillery, in order to achieve a decisive result. In the *attack*, beside the general task of supplementing the effect of other natures of ordnance, heavy artillery may demolish cover, buildings, &c., held by the enemy, and during the infantry assault they may do excellent service in sweeping a great depth of ground, their smaller angle of descent, and the greater remaining velocity and heavier driving charge of their shrapnel, as compared with field guns, enabling them to do this effectively. In the *defence*, long-range fire has great value, especially in sweeping approaches which the enemy must use. In *pursuit*, the heavy artillery may be able to shell the main body of the enemy during its retreat, even if it has left a rearguard. In *retreat*, the want of mobility of these guns militates against their employment in exposed positions, such as rearguards usually have to take up.

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A complete bibliography and criticism of the artillery works of the 14th, 15th and 16th centuries will be found in Max Jähns, *Geschichte der Kriegswissenschaften*, pp. 221-236, 382-424, 621, 658 and 747-752. For the early 17th century, Diego Ufano, *Tratado de la Artilleria* (1613) is a standard treatise of the time, but the mystery preserved by artillerists in regard to their arm is responsible for an astonishing dearth of artillery literature even in the time of the Thirty Years' War. In 1650 appeared Casimir Simienowicz' *Ars magnae artilleriae*, an English translation of which was published in London in 1729, and in 1683 Michael Mieth published *Artilleriae Recentior Praxis*. The first edition of Surirey de S. Remy, *Mémoires d'Artillerie*, appeared in Paris in 1697. 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(C. F. A.)

ARTIODACTYLA (from Gr. *ἄρτιος*, even, and *δάκτυλος*, a finger or toe, "even-toed"), the suborder of ungulate mammals in which the central (and in some cases the only) pair of toes in each foot are arranged symmetrically on each side of a vertical line running through the axes of the limbs. As contrasted with the Perissodactyla living, and in a great degree extinct, Artiodactyla are characterized by the following structural features. The upper premolar and molar teeth are not alike, the former being single and the latter two-lobed; and the last lower molar of both first and second dentition is almost invariably three-lobed. Nasal bones not expanded posteriorly. No alisphenoid canal. Dorsal and lumbar vertebrae together always nineteen, though the former may vary from twelve to fifteen. Femur without third trochanter. Third and fourth digits of both feet almost equally developed, and their terminal phalanges flattened on their inner or contiguous surfaces, so that each is not symmetrical in itself, but when the two are placed together they form a figure symmetrically disposed to a line drawn between them. Or, in other words, the axis or median line of the whole foot is a line drawn between the third and fourth digits (fig. 1). Lower articular surface of the astragalus divided into two nearly equal facets, one for the navicular and a second for the cuboid bone. The calcaneum with an articular facet for the lower end of the fibula. Stomach almost always more or less complex. Colon convoluted. Caecum small. Placenta diffused or cotyledonary. Teats either few and inguinal, or numerous and abdominal.

Artiodactyla date from the Eocene period, when they appear to have been less numerous than the Perissodactyla, although at the present day they are immeasurably ahead of that group, and form indeed the dominant ungulates. As regards the gradual specialization and development of the modern types, the following features are noteworthy.

1. As regards the teeth, we have the passage of a simply tubercular, or bunodont (*βουνός*, a hillock) type of molar into one in which the four main tubercles, or columns, have assumed a crescentic form, whence this type is termed selenodont (*σελήνη*, the new moon). Further, there is the modification of the latter from a short-crowned, or brachyodont type, to one in which the columns are tall, constituting the hypsodont, or hypsiselenodont, type. It is noteworthy, however, that in some instances there appears to have been a retrograde modification from the selenodont towards the bunodont type, the hippopotamus being a case in point. Other modifications are the loss of the upper incisors;

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[1] Most of the works named deal with technical questions of equipment, ammunition, ballistics, &c.

the development of the canines into projecting tusks; and the loss of the anterior premolars.

2. As regards the limbs. Reduction of the ulna from a complete and distinct bone to a comparatively rudimentary state in which it coalesces more or less firmly with the radius. Reduction of the fibula till nothing but its lower extremity remains. Reduction and final loss of outer pair of digits (second and fifth), with coalescence of the metacarpal and metatarsal bones of the two middle digits to form a cannon-bone. Union of the navicular and cuboid, and sometimes the ectocuneiform bone, of the tarsus.

3. Change of form of the odontoid process of the second or axis vertebrae from a cone to a hollow half-cylinder.

4. Development of horns or antlers on the frontal bones, and gradual complication of form of antlers.

5. By inference only, increasing complication of stomach with ruminating function superadded. Modification of placenta from simple diffused to cotyledonary form.

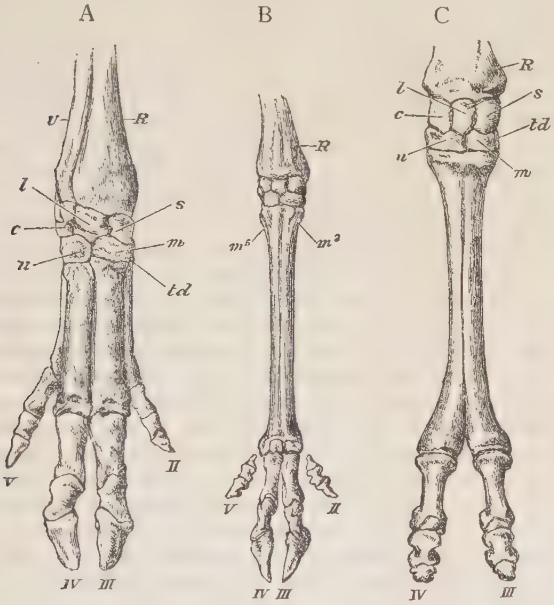

FIG. 1.—Bones of Right Fore Feet of existing Artiodactyla.

A, Pig (*Sus scrofa*).
B, Red deer (*Cervus elaphus*).
C, Camel (*Camelus bactrianus*).

U, Ulna.
R, Radius.
c, Cuneiform.
l, Lunar.
s, Scaphoid.
u, Unciform.
m, Magnum.
td, Trapezoid.

In the Sheep and the Camel the long compound bone, supporting the two main (or only) toes is the cannon-bone.

The primitive Artiodactyla thus probably had the typical number (44) of incisor, canine and molar teeth, brachyodont molars, conical odontoid process, four distinct toes on each foot, with metacarpal, metatarsal and all the tarsal bones distinct, and no frontal appendages.

Pecora.

As regards classification, the first group is that of the Pecora, or Cotylophora, in which the cheek-teeth are selenodont, but there are no upper incisors or canine-like premolars, while upper canines are generally absent, though sometimes largely developed. Inferior incisors, three on each side with an incisiform canine in contact with them. Cheek-teeth consisting of *p.*$\frac{3}{3}$, *m.*$\frac{3}{3}$, in continuous series. Auditory bulla simple and hollow within. Odontoid process of second vertebra in the form of a crescent, hollow above. Lower extremity of the fibula represented by a distinct malleolar bone articulating with the outer surface of the lower end of the tibia. Third and fourth metacarpals and metatarsals confluent into cannon-bones (fig. 1 B), and the toes enclosed in hoofs. Outer toes small and rudimentary, or in some cases entirely suppressed; their metacarpal or metatarsal bones never complete. Navicular and cuboid bones of tarsus united. The skull generally lacks a sagittal crest; and the condyle of the lower jaw is transversely elongated. Horns or antlers usually present, at least in the male sex. Left brachial artery arising from a common innominate trunk, instead of coming off separately from the aortic arch. Stomach with four complete cavities. Placenta cotyledonous. Teats 2 or 4.

The group at the present day is divided into *Giraffidae* (giraffe and okapi), *Cervidae* (deer), *Antilocapridae* (prongbuck), and *Bovidae* (oxen, sheep, goats, antelopes, &c.). (See PECORA.)

Tylopoda.

The second group is represented at the present day by the camels (*Camelus*) of the Old, and the llamas (*Lama*) of the New World, collectively constituting the family *Camelidae*. They derive their name of Tylopoda (" boss-footed ") from the circumstance that the feet form large cushion-like pads, supporting the weight of the body, while the toes have broad nails on their upper surface only, instead of being encased in hoofs. The cheek-teeth are selenodont, and one pair of upper incisors is retained, while some of the anterior premolars assume a canine-like shape, and are separated from the rest of the cheek-series. Auditory bulla filled with honeycombed bony tissue Odontoid process of second vertebra semi-cylindrical; skull with a sagittal crest; and the condyle of the lower jaw rounded. Third and fourth metacarpals and metatarsals (which are alone present) fused into cannon-bones for the greater part of their length, but diverging inferiorly (fig. 1, C) and with their articular surfaces for the toes smooth, instead of ridged as in the Pecora. Navicular and cuboid bones of tarsus distinct. No horns or antlers. Stomach, although complex, differing essentially from that of the Pecora. Placenta diffuse, without cotyledons. Teats few. (See TYLOPODA.)

In the same sectional group is included the North American family of oreodonts (*Oreodontidae*), which are much more primitive ruminants, with shorter necks and limbs, the full series of 44 teeth, all in apposition, and the metacarpal and metatarsal bones separate, and the toes generally of more normal type, although sometimes claw-like. (See OREODON.) The Eocene American genus *Homacodon* is regarded as representing a third family group, the *Homacodontidae* (= *Pantolestidae*), in which the molars were of a bunodont type, and approximate to those of the Condylarthra from which this family appears to have sprung, and to have given origin on the one hand to the *Oreodontidae*, and on the other to the *Camelidae*. The family is represented in the Lower, or Wasatch, Eocene by *Trigonolestes*, in the Middle (Bridger) Eocene by *Homacodon* (Pantolestes), and in the Upper (Uinta) Eocene by *Bunomeryx*.

Tragulina.

The third group is that represented by the chevrotains or mouse-deer, forming the family *Tragulidae*, with *Tragulus* in south-eastern Asia and *Dorcatherium* (or *Hyomoschus*) in equatorial Africa. The cheek-teeth are selenodont, as in the two preceding groups; there are no upper incisors, but there are long, narrow and pointed upper canines, which attain a large size in the males; the lower canines are incisor-like, as in the Pecora, and there are no caniniform premolars in either jaw. Cheek-teeth in a continuous series consisting of *p.*$\frac{3}{3}$, *m.*$\frac{3}{3}$. Odontoid process of axis conical. Fibula complete. Four complete toes on each foot. The middle metacarpals and metatarsals generally confluent, the outer ones (second and fifth) slender but complete, *i.e.* extending from the carpus or tarsus to the digit. Navicular, cuboid and ectocuneiform bones of tarsus united. Auditory bulla of skull filled with cancellar tissue. No frontal appendages. Ruminating, but the stomach with only three distinct compartments, the maniplies or third cavity of the stomach of the Pecora being rudimentary. Placenta diffused. (See CHEVROTAIN.)

Anoplotherina.

In this place must be mentioned the extinct Oligocene European group typified by the well-known genus *Anoplotherium* of the Paris gypsum-quarries, and hence termed Anoplotherina, although the alternative title Dichobunoidea has been suggested. It includes the two families *Anoplotheriidae* and *Dichobunidae*, of which the first died out with the Oligocene, while the second may have given origin to the Tragulina and perhaps the Pecora. There is the full series of 44 teeth, generally without any gaps, and most of the bones of the skeleton are separate and complete; while, in many instances at any rate, the tail was much longer than in any existing ungulates, and the whole bodily form approximated to that of a carnivore. The upper molars, which may be either selenodont or buno-selenodont, carry five cusps each, instead of the four characteristic of all the preceding groups; and they are all very low-crowned, so as to expose the whole of the valleys between the cusps. In *Anoplotherium*, some of the species of which were larger than tapirs, there were either two or three toes, the latter number being almost unique among the Artiodactyla. Allied genera are *Diplobune* and *Dacrytherium*.

The *Dichobunidae* include the genus *Dichobune*, of which the species were small animals with buno-selenodont molars. *Xiphodon* and *Dichodon* represent another type with cutting premolars and selenodont molars; while *Caenotherium* and *Plesiomeryx* form yet another branch, with resemblances to the ruminants. The most interesting genera are, however, the Upper Oligocene and Lower Miocene *Gelocus* and *Prodremotherium*, which have perfectly selenodont teeth, and the third and fourth metacarpal and metatarsal bones respectively fused into an imperfect cannon-bone, with the reduction of the lateral metacarpals and metatarsals to mere remnants of their upper and lower extremities. While *Gelocus* exhibits a marked approximation to the *Tragulidae*, *Prodremotherium* comes nearer to the *Cervidae*, of which it not improbably indicates the ancestral type. The *Dichobunidae* may be regarded as occupying a position analogous to that of the *Homacodontidae* in the Tylopoda, and like the latter, are probably the direct descendants of Condylarthra.

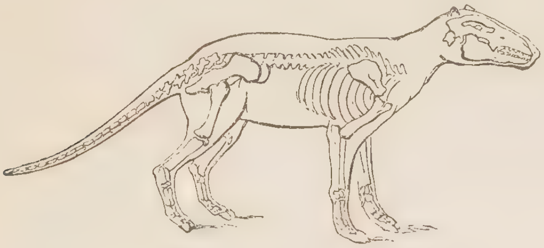

FIG 2.—Restoration of *Anoplotherium commune*.

Suina.

The last section of the Artiodactyla is that of the Suina, represented at the present day by the pigs (*Suidae*), and the hippopotamuses (*Hippopotamidae*), and in past times by the *Anthracotheriidae*, in which may probably be included the *Elotheriidae*. In the existing members of the group the cheek-teeth approximate to the bunodont type, although showing signs of being degenerate modifications of the selenodont modification. There is at least one pair of upper incisors, while the full series of 44 teeth may be present. The metacarpals and metatarsals are generally distinct (fig. 1 A), and never fuse into a complete cannon-bone; and the navicular and cuboid bones of the tarsus are separate. The odontoid process of the second vertebra is pig-like: and the tibia and fibula and radius and ulna are severally distinct. The stomach is simple or somewhat complex, and the placenta diffused. The *Suidae* include the Old World pigs (*Suinae*) and the American peccaries (*Dicotylinae*), and are characterized by the snout terminating in a fleshy disk-like expansion, in the midst of which are perforated the nostrils; while the toes are enclosed in sharp hoofs, of which the lateral ones do not touch the ground. There is a caecum. The *Dicotylinae* differ from the *Suinae* in that the upper canines are directed downwards (instead of curving upwards) and have sharp cutting-edges, while the toes are four in front and three behind (instead of four on each foot), and the stomach is complex instead of simple. In the Old World a large number of fossil forms are known, of which the earliest is the Egyptian Eocene *Geniohyus*. Originally the family was an Old World type, but in the Miocene it gained access into North America, where the earliest form is *Bothriolabis*, an ancestral peccary showing signs of affinity with the European Miocene genus *Palaeochoerus*. (See SWINE and PECCARY.)

The *Hippopotamidae* are an exclusively Old World group, in which the muzzle is broad and rounded and quite unlike that of the *Suidae*, while the crowns of the cheek-teeth form a distinctly trefoil pattern, when partially worn, which is only foreshadowed in those of the latter. The short and broad teeth terminate in four subequal toes, protected by short rounded hoofs, and all reaching the ground. The hinder end of the lower jaw is provided with a deep descending flange. Both incisors and canines are devoid of roots and grow throughout life, the canines, and in the typical species one pair of lower incisors, growing to an immense size. The stomach is complex; but there is no caecum. Although now exclusively African, the family (of which all the representatives may be included in the single genus *Hippopotamus*, with several subgeneric groups) is represented in the Pliocene of Europe and the Lower Pliocene of northern India. Its place of origin cannot yet be determined.

The extinct *Anthracotheriidae* were evidently nearly allied to the *Hippopotamidae*, of which they are in all probability the ancestral stock. They agree, for instance, with that family in the presence of a descending flange at the hinder end of each side of the lower jaw; but their dentition is of a more generalized type, comprising the full series of 44 teeth, among which the incisors and canines are of normal form, but specially enlarged, and developing roots in the usual manner. The molars are partially selenodont in the typical genus *Anthracotherium*, with five cusps, or columns, on the crowns of those of the upper jaw, which are nearly square. The genus has a very wide distribution, extending from Europe through Asia to North America, and occurring in strata which are of Oligocene and Miocene age. In *Ancodon* (*Hyopotamus*) the cusps on the molars are taller, so that the dentition is more decidedly selenodont; the distribution of this genus includes not only Europe, Asia and North Africa, but also Egypt where it occurs in Upper Eocene beds in company with the European genus *Rhagatherium*, which is nearer *Anthracotherium*. On the other hand, in *Merycopotamus*, of the Lower Pliocene of India and Burma, the upper molars have lost the fifth intermediate cusp of *Ancodon*; and thus, although highly selenodont, might be easily modified, by a kind of retrograde development, into the trefoil-columned molars of *Hippopotamus*. In the above genera, so far as is known, the feet were four-toed, although with the lateral digits relatively small; but in *Elotherium* (or *Entelodon*), from the Lower Miocene of Europe and the Oligocene of North America, the two lateral digits in each foot had disappeared. This is the more remarkable seeing that *Elotherium* may be regarded as a kind of bunodont *Anthracotherium*. It shows the characteristic hippopotamus-flange to the lower jaw, but has also a large descending process from the jugal bone of the zygomatic arch of the skull. Finally, we have in the Pliocene of India the genus *Tetraconodon*, remarkable for the enormous size attained by the bluntly conical premolars; as the molars are purely bunodont, this genus seems to be a late and specialized survivor of a primitive type. (R. L.*)

ARTISAN, or ARTIZAN, a mechanic; a handicraftsman in distinction to an artist. The English word (from Late Lat. *artitianus*, instructed in arts) at one time meant "artist," but has been restricted to signify the operative workman only.

ARTOIS, an ancient province of the north of France, corresponding to the present department of Pas de Calais, with the exclusion of the arrondissements of Boulogne and Montreuil, which belonged to Picardy. It is a rich and well-watered country, producing abundance of grain and hops, and yielding excellent pasture for cattle. The capital of the province was Arras, and the other important places were Saint-Omer, Béthune, Aire, Hesdin, Bapaume, Lens, Lillers, Saint-Pol and Saint-Venant. The name Artois (still more corrupted in "Arras") is derived from the Atrebates, who possessed the district in the time of Caesar. From the 9th to the 12th century Artois belonged to the counts of Flanders. It was bestowed in 1180 on Philip Augustus of France by Philip of Alsace, as the dowry of his niece Isabella of Hainaut. At her death in 1190, Baldwin IX., count of Flanders (d. 1206), and then his son-in-law, Ferrand (Ferdinand) of Portugal, count of Flanders, disputed the possession of the country with the king of France, Ferrand being in the coalition which was overthrown by Philip Augustus at Bouvines (1214). In 1237 Artois, which was raised to a countship the following year, was conferred as an appanage by Saint Louis on his brother

Robert, who died on crusade in 1250. His son, Robert II., took part in the wars in Navarre, Sicily, Guienne and Flanders, and was killed at the battle of Courtrai in 1302. After his death, his son Philip having predeceased him (1298), Artois was adjudged to his daughter Mahaut, or Matilda, as against her nephew Robert, son of Philip, who attempted to support his claim to the countship by forged titles. Banished from France for this crime (1322), Robert of Artois took refuge in England, where he became earl of Richmond, and incited Edward III. to make war upon Philip of Valois. His descendants, the counts of Eu (*q.v.*), continued to style themselves counts of Artois. By the marriage of Mahaut (d. 1329) with Otto IV., Artois passed to the house of Burgundy, in whose possession it remained till the marriage of Mary, the daughter of Charles the Bold, to the archduke Maximilian brought it to the house of Austria. Louis XI., however, occupied portions of Artois, and the claims of Austria were contested by France until the treaty of Senlis (1493). The emperor Charles V. established the council of Artois, with sovereign authority. At the end of the Thirty Years' War Artois was again conquered by the French, and the conquest was ratified in the treaty of the Pyrenees (1659) by Spain, to whom the province had fallen in 1634. During the war between France and Holland (1672–77) and that of the Spanish Succession, Artois was invaded again, but the treaties of Nijmwegen (1678) and of Utrecht (1713) confirmed the sovereignty of France. The title of count of Artois was borne by Charles X. of France before his accession to the throne. This new creation became extinct on the death of the comte de Chambord in 1883.

ART SALES. The practice of selling objects of art by auction in England dates from the latter part of the 17th century, when in most cases the names of the auctioneers were suppressed. Evelyn (under date June 21, 1693) mentions a "great auction of pictures (*Lord Melford's*) in the Banquetting House, Whitehall," and the practice is frequently referred to by other contemporary and later writers. Before the introduction of regular auctions the practice was, as in the case of the famous collection formed by Charles I., to price each object and invite purchasers, just as in other departments of commerce. But this was a slow process, especially in the case of pictures, and lacked the incentive of excitement. The first really important art collection to come under the hammer was that of Edward, earl of Oxford, dispersed by Cock, under the Piazza, Covent Garden, on 8th March 1741/2 and the five following days, six more days being required by the coins. Nearly all the leading men of the day, including Horace Walpole, attended or were represented at this sale, and the prices varied from five shillings for an anonymous bishop's "head" to 165 guineas for Vandyck's group of "Sir Kenelm Digby, lady, and son." The next great dispersal was Dr Richard Mead's extensive collection, of which the pictures, coins and gems, &c., were sold by Langford in February and March 1754, the sale realizing the total, unprecedented up to that time, of £16,069. The thirty-eight days' sale (1786) of the Duchess of Portland's collection is very noteworthy, from the fact that it included the celebrated Portland vase, now in the British Museum. Many other interesting and important 18th-century sales might be mentioned. High prices did not become general until the Calonne, Trumbull (both 1795) and Bryan (1798) sales. As to the quality of the pictures which had been sold by auction up to the latter part of the 18th century, it may be assumed that this was not high. The importation of pictures and other objects of art had assumed extensive proportions by the end of the 18th century, but the genuine examples of the Old Masters probably fell far short of 1%. England was felt to be the only safe asylum for valuable articles, but the home which was intended to be temporary often became permanent. Had it not been for the political convulsions on the continent, England, instead of being one of the richest countries in the world in art treasures, would have been one of the poorest. This fortuitous circumstance had, moreover, another effect, in that it greatly raised the critical knowledge of pictures. Genuine works realized high prices, as, for example, at Sir William Hamilton's sale (1801), when Beckford paid 1300 guineas for the little picture of "A Laughing Boy" by Leonardo da Vinci; and when at the Lafontaine sales (1807 and 1811) two Rembrandts each realized 5000 guineas, "The Woman taken in Adultery," now in the National Gallery, and "The Master Shipbuilder," now at Buckingham Palace. The Beckford sale of 1823 (41 days, £43,869) was the forerunner of the great art dispersal of the 19th century; Horace Walpole's accumulation at Strawberry Hill, 1842 (24 days, £33,450), and the Stowe collection, 1848 (41 days, £75,562), were also celebrated. They comprised every phase of art work, and in all the quality was of a very high order. They acted as a most healthy stimulus to art collecting, a stimulus which was further nourished by the sales of the superb collection of Ralph Bernal in 1855 (32 days, £62,690), and of the almost equally fine but not so comprehensive collection of Samuel Rogers, 1856 (18 days, £42,367). Three years later came the dispersal of the 1500 pictures which formed Lord Northwick's gallery at Cheltenham (pictures and works of art, 18 days, £94,722).

Towards the latter part of the first half of the 19th century an entirely new race of collectors gradually came into existence; they were for the most part men who had made, or were making, large fortunes in the various industries of the midlands and north of England and other centres. They were untrammelled by "collecting" traditions, and their patronage was almost exclusively extended to the artists of the day. The dispersals of these collections began in 1863 with the Bicknell Gallery, and continued at irregular intervals for many years, *e.g.* Gillott (1872), Mendel (1875), Wynn Ellis and Albert Levy (1876), Albert Grant (1877) and Munro of Novar (1878). These patrons purchased at munificent prices either direct from the easel or from the exhibitions not only pictures in oils but also water-colour drawings. As a matter of investment their purchases frequently realized far more than the original outlay; sometimes, however, the reverse happened, as, for instance, in the case of Landseer's "Otter Hunt," for which Baron Grant is said to have paid £10,000 and which realized shortly afterwards only 5650 guineas. One of the features of the sales of the 'seventies was the high appreciation of water-colour drawings. At the Gillott sale (1872) 160 examples realized £27,423, Turner's "Bamborough Castle" fetching 3150 gns.; at the Quilter sale (1875) David Cox's "Hayfield," for which a dealer paid him 50 gns. in 1850, brought 2810 gns. The following are the most remarkable prices of later years. In 1895 Cox's "Welsh Funeral" (which cost about £20) sold for 2400 gns., and Burne-Jones's "Hesperides" for 2460 gns. In 1908, 13 Turner drawings fetched £12,415 (Acland-Hood sale) and 7 brought £11,077 (Holland sale), the "Heidelberg" reaching 4200 gns. For Fred Walker's "Harbour of Refuge" 2580 gns. were paid (Tatham sale) and 2700 gns. for his "Marlow Ferry" (Holland). The demand for pictures by modern artists, whose works sold at almost fabulous prices in the 'seventies, has somewhat declined; but during all its *furore* there was still a small band of collectors to whom the works of the Old Masters more especially appealed. The dispersal of such collections as the Bredel (1875), Watts Russell (1875), Foster of Clewer Manor (1876), the Hamilton Palace (17 days, £397,562)—the greatest art sale in the annals of Great Britain—Bale (1882), Leigh Court (1884), and Dudley (1892) resulted, as did the sale of many minor collections each season, in many very fine works of the Old Masters finding eager purchasers at high prices. A striking example of the high prices given was the £24,250 realized by the pair of Vandyck portraits of a Genoese senator and his wife in the Peel sale, 1900.

Since the last quarter of the 19th century the chief feature in art sales has been the demand for works, particularly female portraits, by Reynolds, his contemporaries and successors. This may be traced to the South Kensington Exhibitions of 1867 and 1868 and the annual winter exhibitions at Burlington House, which revealed an unsuspected wealth and charm in the works of many English artists who had almost fallen into oblivion. A few of the most remarkable prices for such pictures may be quoted: Reynolds's "Lady Betty Delmé" (1894), 11,000 gns.; Romney's "The Ladies Spencer" (1896), 10,500 gns.;

Gainsborough's "Duchess of Devonshire" (1876), 10,100 gns. (for the history of its disappearance see GAINSBOROUGH, THOMAS), "Maria Walpole," 12,100 gns. (Duke of Cambridge's sale, 1904); Constable's "Stratford Mill" (1895), 8500 gns.; Hoppner's "Lady Waldegrave" (1906), 6000 gns.; Lawrence's "Childhood's Innocence" (1907), 8000 gns.; Raeburn's "Lady Raeburn" (1905), 8500 gns. Here may also be mentioned the 12,600 gns. paid for Turner's "Mortlake Terrace" in 1908 (Holland sale).

The "appreciation" of the modern continental schools, particularly the French, has been marked since 1880; of high prices paid may be mentioned Corot's "Danse des Amours" (1898), £7200; Rosa Bonheur's "Denizens of the Highlands" (1888), 5550 gns.; Jules Breton's "First Communion," £9100 in New York (1886); Meissonier's "Napoleon I. in the Campaign of Paris," 12¼ in. by 9¼ in. (1882), 5800 gns., and "The Sign Painter" (1891), 6450 gns. High prices are also fetched by pictures of Daubigny, Fortuny, Gallait, Gérôme, Troyon and Israëls. The most marked feature of late has been the demand for the 18th-century painters Watteau, Boucher, Fragonard, Pater and Lancret; thus "La Ronde Champêtre" of the last named brought £11,200 at the Say Sale in 1908, and Fragonard's "Le Reveil de Vénus" £5520 at the Sedelmeyer sale, 1907.

"Specialism" is the one important development in art collecting which has manifested itself since the middle of the 19th century. This accounts for and explains the high average quality of the Wellesley (1866), the Buccleuch (1888) and the Holford (1893) collections of drawings by the Old Masters; for the Sibson Wedgwood (1877), the Duc de Forli Dresden (1877), the Shuldham blue and white porcelain (1880), the Benson collection of antique coins (1909), and for the objects of art at the Massey-Mainwaring and Lewis-Hill sales of 1907. Very many other illustrations in nearly every department of art collecting might be quoted—the superb series of Marlborough gems (1875 and 1899) might be included in this category but for the fact that it was formed chiefly in the 18th century. The appreciation—commercially at all events—of mezzotint portraits and of portraits printed in colours, after masters of the early English school, was one of the most remarkable features in art sales during the last years of the 19th century. The shillings of fifty years before were then represented by pounds. The Fraser collection (December 4 to 6, 1900) realized about ten times the original outlay, the mezzotint of the "Sisters Frankland," after Hoppner, by W. Ward, selling for 290 guineas as against 10 guineas paid for it about thirty years previously. The H. A. Blyth sale (March 11 to 13, 1901, 346 lots, £21,717: 10s.) of mezzotint portraits was even more remarkable, and as a collection it was the choicest sold within recent times, the engravings being mostly in the first state. The record prices were numerous, and, in many cases, far surpassed the prices which Sir Joshua Reynolds received for the original pictures; *e.g.* the exceptionally fine example of the first state of the "Duchess of Rutland," after Reynolds, by V. Green, realized 1000 guineas, whereas the artist received only £150 for the painting itself. Even this unprecedented price for a mezzotint portrait was exceeded on the 30th of April 1901, when an example of the first published state of "Mrs Carnac," after Reynolds, by J. R. Smith, sold for 1160 guineas. At the Louis Huth sale (1905) 83 lots brought nearly £10,000, Reynolds's "Lady Bampfylde" by T. Watson, first state before letters, unpublished, fetching 1200 guineas. Such prices as these and many others which might be quoted are exceptional, but they were paid for objects of exceptional rarity or quality.

It is not necessary to pursue the chronicle of recent sales, which have become a feature of every season. It is worth mentioning, however, that the Holland sale, in June 1908, realized £138,118 (432 lots), a "record" sum for a collection of pictures mainly by modern artists; and that for the Rodolphe Kann collection (Paris) of pictures and objects of art, including 11 magnificent Rembrandts, Messrs Duveen paid £1,000,000 in 1907. In every direction there has been a tendency to increase prices for really great artistic pieces, even to a sensational extent. The competition has become acute, largely owing to American and German acquisitiveness. The demand for the finest works of art of all descriptions is much greater than the supply. As an illustration of the magnitude of the art sale business it may be mentioned that the "turnover" of one firm in London alone has occasionally exceeded £1,000,000 annually.

BIBLIOGRAPHY.—The chief compilations dealing with art sales in Great Britain are: G. Redford, *Art Sales* (1888); and W. Roberts, *Memorials of Christie's* (1897); whilst other books containing much important matter are W. Buchanan, *Memoirs of Painting*; *The Year's Art* (1880 and each succeeding year); F. S. Robinson, *The Connoisseur*; and L. Soullié, *Les Ventes de tableaux, dessins et objets d'art au XIX^e siècle* (chiefly French).

ARTS AND CRAFTS, a comprehensive title for the arts of decorative design and handicraft—all those which, in association with the mother-craft of building (or architecture), go to the making of the house beautiful. Accounts of these will be found under separate headings. "Arts and crafts" are also associated with the movement generally understood as the English revival of decorative art, which began about 1875. The title itself only came into general use when the Arts and Crafts Exhibition Society was founded, and held its first exhibition at the New Gallery, London, in the autumn of 1888, since which time arts and crafts exhibitions have been common all over Great Britain. The idea of forming a society for the purpose of showing contemporary work in design and handicraft really arose out of a movement of revolt or protest against the exclusive view of art encouraged by the Royal Academy exhibitions, in which oil paintings in gilt frames claimed almost exclusive attention—sculpture, architecture and the arts of decorative design being relegated to quite subordinate positions. In 1886, out of a feeling of discontent among artists as to the inadequacy of the Royal Academy exhibitions, considered as representing the art of Great Britain, a demand arose for a national exhibition to include all the arts of design. One of the points of this demand was for the annual election of the hanging committee by the whole body of artists. After many meetings the group representing the arts and crafts (who belonged to a larger body of artists and craftsmen called the Art-workers' Guild, founded in 1884),[1] perceiving that the painters, especially the leading group of a school not hitherto well represented in the Academy exhibitions, only cherished the hope of forcing certain reforms on the Academy, and were by no means prepared to lose their chances of admission to its privileges, still less to run any risk in the establishment of a really comprehensive national exhibition of art, decided to organize an exhibition themselves in which artists and craftsmen might show their productions, so that contemporary work in decorative art should be displayed to the public on the same footing, and with the same advantages as had hitherto been monopolized by pictorial art. For many years previously there had been great activity in the study and revival in the practice of many of the neglected decorative handicrafts. Amateur societies and classes were in existence, like the Home Arts and Industries Association, which had established village classes in wood-carving, metal work, spinning and weaving, needlework, pottery and basket-work, and the public interest in handicraft was steadily growing. The machine production of an industrial century had laid its iron hands upon what had formerly been the exclusive province of the handicraftsman, who only lingered on in a few obscure trades and in forgotten corners of England for the most part. The ideal of mechanical perfection dominated British workmen, and the factory system, first by extreme division of labour, and then by the further specialization of the workman under machine production, left no room for individual artistic feeling among craftsmen trained and working under such conditions. The demand of the world-market ruled the character and quality of production, and to the few who would seek some humanity, simplicity of construction or artistic feeling in their domestic decorations and furniture, the only choice was that of the tradesman or salesman, or a plunge into costly and doubtful experiments in original design. From the 'forties onward there had been much research and study of medieval art in England; there had been many able designers, architects and antiquaries, such as the Pugins and Henry Shaw (1800–1873) and later William Burges (1827–1881), William Butterfield (1814–1900) and G. E. Street and others. The school of pre-Raphaelite painters, by their careful and thorough methods, and their sympathy with medieval design, were among the first to turn attention to beauty of design, colour and significance in the accessories of daily life, and artists like D. G. Rossetti, Ford Madox Brown, and W. Holman Hunt themselves designed and painted furniture. The most successful and most practical effort indeed towards the revival of sounder ideas of construction and workmanship may be said to have arisen out of the work of this group of artists, and may be traced to the workshop of William Morris and his associates in Queen Square, London. William Morris, whose name covers so large a field of artistic as well as literary and social work, came well equipped to his task of raising the arts of design and handicraft, of changing the taste of his countrymen from the corrupt and vulgar ostentation of the Second Empire, and its cheap imitations, which prevailed in the 'fifties and 'sixties, and of winning them back, for a time at least, to the massive simplicity of plain oak furniture, or the delicate beauty of inlays of choice woods, or the charm of painted work, the richness and frank colour of formal floral and heraldic pattern in silk textiles and wall-hangings and carpets, the gaiety and freshness of printed cotton, or the romantic splendour of arras tapestry. Both William Morris and his artistic comrade and life-long friend, Edward Burne-Jones, were no doubt much influenced at the outset by the imaginative insight, the passionate artistic feeling, and the love of medieval romance and colour of Dante Gabriel Rossetti, who remains so remarkable a figure in the great artistic and poetic revival of the latter half of the 19th century. To William Morris himself, in his artistic career, it was no small advantage to gain the ear of the English public first by his poetry. His verse-craft helped his handicraft, but both lived side by side. The secret of Morris's great influence in the revival was no doubt to be attributed to his way of personally mastering the working details and handling of each craft he took up in turn, as well as to his power of inspiring his helpers and followers. He was painter, designer, scribe, illuminator, wood-engraver, dyer, weaver and finally printer and papermaker, and having mastered these crafts he could effectively direct and criticize the work of others. His own work and that of Burne-Jones were well known to the public, and in high favour long before the Arts and Crafts Exhibition Society was formed, and though largely helped and inspired by the work of these two artists, the aims and objects of the society rather represented those of a younger generation, and were in some measure a fresh development both of the social and the artistic ideas which were represented by Ruskin, Rossetti and Morris, though the society includes men of different schools. Other sources of influence might be named, such as the work of Norman Shaw and Philip Webb in architecture and decoration, of Lewis Day in surface pattern, and William de Morgan in pottery. The demand for the acknowledgment of the personality of each responsible craftsman in a co-operative work was new, and it had direct bearing upon the social and economic conditions of artistic production. The principle, too, of regarding the material, object, method and purpose of a work as essential conditions of its artistic expression, the form and character of which must always be controlled by such conditions, had never before been so emphatically stated, though it practically endorsed the somewhat vague aspirations current for the unity of beauty with utility. Again, a very notable return to extreme simplicity of design in furniture and surface decoration may be remarked; and a certain reserve in the use of colour and ornament, and a love of abstract forms in decoration generally, which are characteristic of later taste. Not less remarkable has been the new development in the design and workmanship of jewelry, gold- and silversmiths' work, and enamels, with which the names of Alexander Fisher, Henry Wilson, Nelson Dawson and C. R. Ashbee are associated. Among the arts and crafts of design which have blossomed into new life in recent years—and there is hardly one which has not been touched by the new spirit—book-binding must be named as having attained a fresh and tasteful development through the work of Mr Cobden-Sanderson and his pupils. The art and craft of the needle also must not be forgotten, and its progress is a good criterion of taste in design, choice of colour and treatment. The work of Mrs Morris, of Miss Burden (sometime instructress at the Royal School of Art Needlework, which has carried on its work from 1875), of Miss May Morris, of Miss Una Taylor, of Miss Buckle, of Mrs Walter Crane, of Mrs Newbery, besides many other skilled needlewomen, has been frequently exhibited. Good work is often seen in the national competition works of the students of the English art schools, shown at South Kensington in July. The increase of late years in these exhibitions of designs worked out in the actual material for which they were intended is very remarkable, and is an evidence of the spread of the arts and crafts movement (fostered no doubt by the increase of technical schools, especially of the type of the Central School of Arts and Crafts under the Technical Education Board of the London County Council), of which it may be said that if it has not turned all British craftsmen into artists or all British artists into craftsmen, it had done not a little to expand and socialize the idea of art, and (perhaps it is not too much to say) has made the tasteful English house with its furniture and decorations a model for the civilized world. (W. Cr.)

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[1] Whose members, comprehending as they do the principal living designers, architects, painters and craftsmen of all kinds, have played no inconsiderable part in the English revival.

ART SOCIETIES. In banding themselves into societies and associations artists have always been especially remarkable. The fundamental motive of such leaguing together is apparent, for, by the establishment of societies, it becomes possible for the working members of these to hold exhibitions and thereby to obtain some compensation or reward for their labours. With the growth of artistic practice and public interest, however, art societies have been instituted where this primary object is either absent or is allied to others of more general scope. The furtherance of a cult and the specializing of work have also given rise to many new associations in Great Britain, besides the Royal Academy (see Academy, Royal). At the outset, therefore, it will be well to mention the leading art societies thus described. The (now Royal) Society of Painters in Water Colours, founded in 1804, and the (now Royal) Society of British Artists (1823), are typical of those societies which exist merely for purposes of holding exhibitions and conferring diplomas of membership. The British Institution (for the encouragement of British artists) was started in 1806 on a plan formed by Sir Thomas Bernard; and in the gallery, erected by Alderman Boydell to exhibit the paintings executed for his edition of Shakespeare, were from time to time exhibited pictures by the old masters, deceased British artists and others, till 1867, when the lease of the premises expired. A fund of £16,200, then in the hands of trustees, had accumulated to £24,610 in 1884. The Artists' Society, formed in 1830, has for its object the providing of facilities to enable its members to perfect themselves in their art. To this end there is a good library of works on art, and abundant opportunities are afforded for general study from the life. In the furtherance of a cult the Japan Society, devoted to the encouragement of the study of the arts and industries of Japan, is a typical example; and the Society of Mezzotint Engravers is representative of those bodies formed in the interests of particular groups of workers. One of the remarkable features in the history of art in Great Britain has been the rapid increase of the artistic rank and file. Taking the number of exhibitors at the principal London and provincial exhibitions, it is found that in the period 1885–1900 the ranks were doubled. At the end of the 19th century it was estimated that there were quite 7000 practising artists. Coincident with this astonishing development there has been a corresponding addition of new art societies and the enlargement of older bodies. For instance, the membership of the Royal Society of British Artists advanced in the period mentioned from 80 to 150. Similar extensions can be noted in other societies, or in such a case as that of the Royal Institute of Painters in Water Colours, where the membership is limited to 100, it is to be noticed that more space is given to the works of outsiders. But the expansion of older exhibiting societies has not proved sufficient. Portrait painters, pastellists, designers, miniaturists and women artists have felt the necessity of forming separate coteries. Interesting though these movements from within may be, the growth of societies originating in the spirit of altruism associated with such names as Ruskin and Kyrle is equally instructive. Nearly all these are the products of the last quarter of the 19th century, and include the Sunday Society, which in 1896 secured the Sunday opening of the national museums and galleries in the metropolis.

The specializing of study and work has also given rise to much artistic endeavour. For a long time archaeology—British and Egyptian—claimed almost exclusive attention. Latterly the arts of India and Japan have engaged much notice, and societies have been organized to further their study. Finally, bands of workers in particular branches of art have felt the need of clubbing together in order to protect their special interests. A slight suspicion of trade-unionism is attached to some of these; but on the whole the establishment of such bodies as the Society of Illustrators, the Society of Designers, and the Society of Mezzotint Engravers has been with a view to advancing the public knowledge of the merits of these branches of artistic enterprise.

Exhibiting Societies.—(*a*) Old Established.—These in London are: The Royal Academy, the Royal Water Colour Society, the Royal Institute of Painters in Water Colours, the Society of Oil Painters, and the Royal Society of British Artists. In the provinces, the Birmingham Royal Society of Artists has been in existence since 1825, and has a life academy with professors attached. (*b*) Modern.—In this category are many which reflect the new spirit which came into artistic life in the last quarter of the 19th century. The New English Art Club, founded in 1885 as a protest against academic art, achieves its purpose by exhibition only. The International Society of Painters and Engravers, again, represents the wider ideas of the 20th century. The Royal Society of Painter-Etchers and Engravers, consisting of fellows and associates, not exceeding 150 in all, conserves the interests of a numerous body of workers, and, in addition to holding exhibitions, confers diplomas (R.E. and A.R.E.) on the exhibitors of meritorious etchings or engravings. The Society of Women Artists (formerly the Society of Lady Artists) is wholly devoted to the display of works by female artists, and in 1891 the Society of Portrait Painters was formed to carry out the object conveyed in its title. Two associations advance the art of the miniature-painter, and the Pastel Society, formed in 1898, holds displays of members' work at the Royal Institute Galleries. In Scotland there is the Royal Scottish Academy. The Royal Scottish Society of Painters in Water Colours (Glasgow) grants the title R.S.W. to its members, and the Society of Scottish Artists (Edinburgh), founded in 1891, has a membership of nearly 500 young artists. Other exhibiting societies which call for mention are: The Yorkshire Union of Artists (Leeds), which consolidates many local societies; the Nottingham Society of Artists, which also encourages drawing from the living model; and the Liverpool Sketching Club, founded in 1870, which holds an annual exhibition.

Societies of Instruction and Popular Encouragement.—It is under this head that the chief evidence of the modern art revival will be found. First it should be noted that there are very few societies designed for the artistic improvement of artists. The Artists' Society has already been mentioned; and the Art Workers' Guild, which meets at Clifford's Inn Hall, provides meetings, from which the public is excluded, where profitable discussions take place on questions of craft and design. But, as a rule, the art society, of which only artists are members, is organized for exhibition purposes or for the protection of interests. With regard to those societies of popular and educational intention the old Society of Arts in the Adelphi, founded in 1754, enjoys a good record. Numerous lectures on art subjects have from time to time been given, and in 1887 a scheme was devised by which awards are made to student-workers in design. The Society for the Encouragement of the Fine Arts (Conduit Street) has also laboured since its foundation in 1858 to increase a technical knowledge, its members holding conversazioni at various picture galleries. The Artists' and Amateurs' Conversazione, instituted in 1831, which used to meet at the Piccadilly Galleries and is now defunct, carried out a similar plan. Two other societies, now obsolete, should be mentioned whose method were directly educational. The Arundel Society, which fo many years promoted the knowledge of art by copying an publishing important works of ancient masters, issued to it members on payment of annual subscriptions, was eventually wound up on the last day of 1897. The Arundel Club, founded in 1904, continues the aim, but with a wider scope, reproducing works of art rendered somewhat inaccessible by being in private collections. The International Chalcographical Society, formed for the study of the early history of engraving, also did useful work. Another association of painters, sculptors, architects and engravers, the Graphic Society, ceased on the 29th of October 1890. This was one of the most interesting of societies, rare works of art being exhibited and discussed at its meetings. A very active educational body, originated in 1888, namely the Royal Drawing Society, has for its definite object the teaching of drawing as a means of education. The methods of instruction are based on the facts that very young children try to draw before they can write, and that they have very keen perception and retentive memory. The society aims, therefore, at using drawing as a means of developing these innate characteristics of the young, and already nearly 300 important schools follow out its system. Lord Leighton, Sir John Millais, and Sir Edward Burne-Jones took an active part in the society's labours. The Art for Schools Association, founded in 1883, has also done steady work in endeavouring to provide schools with works of art. These are chiefly reproductions of standard works of art or of historical and natural subjects. The wave of enthusiasm aroused by Mr Ruskin's teachings caused Societies of the Rose to be founded in London, Manchester, Sheffield, Birmingham, Aberdeen and Glasgow; but some of these eventually ceased active work, to be revived again, however, by the Ruskin Union, formed in the year of the great writer's death (1900). Most of these societies were formed in 1879; but it should not be forgotten that two years earlier the Kyrle Society was started with the object of bringing the refining and cheering influences of natural and artistic beauty to the homes of the people. Under the presidency of Earl Brownlow, the Home Arts and Industries Association continues a work which was started in 1884, and anticipated much of the present system of technical education. Voluntary teachers organize classes for working people, at which a practical knowledge of art handiwork is taught. Training classes for voluntary teachers are held at the studios at the Albert Hall, as well as an annual exhibition. An interesting type of society has been established in Bolton, Lancashire. Under the title of an Arts Guild the members, numbering over 200, devote themselves to the advancement of taste in municipal improvements.

Societies of Special Study, Practice and Protection.—Under this head should be placed those associations which affect a cult, or are composed of particular workers, or which protect public or private interests. Perhaps the chief of the first kind is the Japan Society, which, since its inception in 1892, has been joined by over 1350 members interested in matters relating to Japanese art and industries. The Dürer Society, formed in 1897, has for its main object the reproduction of works by Albrecht Dürer, and his German and Italian contemporaries. The Vasari Society, founded in 1905, works in harmony with the Arundel Club and the Dürer Society, reproducing drawings by the Old Masters. In this category of special study may also be placed the Society for the Encouragement and Preservation of Indian Art, the Egypt Exploration Fund, and the Society for the Promotion of Hellenic Studies. Of the societies of special practice it has already been noticed that some are purely exhibiting associations, such as the Portrait Painters, the Pastel Society, and the two miniature bodies. The formation of the Society of Mezzotint

Engravers in 1898 is an example of the leaguing together of particular workers to call attention to their interests. Original and translator engravers, together with collectors and connoisseurs, comprise the membership. The decaying art of wood engraving is also fostered by the International Society of Wood Engravers, and the Society of Designers, founded in 1896, safeguards the interests of professional designers for applied art, without holding exhibitions. Special practice and protection are also considered by the Society of Illustrators, composed of artists who work in black and white for the illustrated press. This society was inaugurated in 1894, and fifteen of the members of the committee must be active workers in illustration. As an instance of the tendency of art workers to combine, the Society of Art Masters is a good illustration. This is an association of teachers of art schools, controlled by the art branch of the Board of Education, and has a membership of over 300. Good work of another kind occupies the National Trust for Places of Historic Interest or Natural Beauty. The council of the Trust includes representatives of such bodies as the National Gallery, the Royal Academy, the Royal Society of Painters in Water Colours, the Society of Antiquaries, the Royal Institute of British Architects, the Universities, Kyrle Society, Society for the Protection of Ancient Buildings and the Selborne Society.

Foreign Art Societies.—The following are brief particulars of the chief art societies elsewhere than in Great Britain:—

Austria.—Vienna, *Vereinigung bildender Künstler Österreichs* (Society of Austrian Painters) and the *Wiener Künstlergenossenschaft* (Association of Viennese Artists).

Belgium.—Brussels, *Société des beaux-arts*, the *Libre Esthétique*, *Société des aquarellistes et pastellistes*, *Société royale belge des aquarellistes*, and numerous private societies (*cercles*) in Brussels, Antwerp, Liége, Ghent and other cities.

France.—Paris, the *Société des artistes français* (The Salon), *Société nationale des beaux-arts* (The New Salon), *Société des aquarellistes*. Exhibiting societies are the *Société des artistes indépendants*, *Société des orientalistes*, and *Salon des pastellistes*.

Germany.—The small local societies are affiliated to one large parent body, the *Deutsche Künstlergenossenschaft*, in Berlin under the presidency of Anton von Werner. The *Deutsche Illustratorenverband* watches over the interests of illustrators and designers. In Munich there are two bodies—the *Künstlergenossenschaft* (old society of artists), holding its exhibitions in the Glaspalast, and the *Verein bildender Künstler*, the Secessionists.

Italy.—Four exhibiting societies: Rome, *Società in Arte Libertas*, *Scuola degli Aquarellisti*; Milan, *Famiglia Artistica*, *Società degli Artiste*; Florence, *Circolo Artistico*; Naples, *Instituti di Belli Arti*.

Portugal.—*Sociedade promotora das Bellas-Artes* and *Gremio Artistico*.

Russia.—There is no exclusively art society of importance, but there is at St Petersburg the *Société littéraire et artistique*.

Spain.—Madrid, *L'Association des artistes espagnols*.

Sweden.—Stockholm, *Svenska Konstuareruas Forening*.

Switzerland.—Berne, *La Société des peintres et sculpteurs suisses*.

United States.—New York, National Academy of Design, American Water Color Society, and National Sculpture Society.

(A. C. R. C.)

ART TEACHING. It is the tendency of all departments of the human mind to outgrow their original limits. Traditions of teaching are long-lived, especially in art, and new ideas only slowly displace the old, so that art teaching as a whole is seldom abreast of the ideas and practice of the more advanced artists. The old academic system adapted to the methods and aims in art in the 18th century, which has been carried on in the principal art schools of Great Britain with but slight changes of method, consisted chiefly of a course of drawing from casts of antique statues in outline, and in light and shade without backgrounds, of anatomical drawings, perspective, and drawing and painting from the living model. Such a training seems to be more or less a response to Lessing's definition of painting as "the imitation of solid bodies upon a plane surface." It seems to have been influenced more by the sculptor's art than any other. Indeed, the academic teaching from the time of the Italian Renaissance was no doubt principally derived from the study of antique sculpture; the proportions of the figure, the style, pose, and sentiment being all taken from Graeco-Roman and Roman sculptures, discovered so abundantly in Italy from the 16th century onwards. As British ideas of art were principally derived from Italy, British academics endeavoured to follow the methods of teaching in vogue there in later times, and so the art student in Great Britain has had his intention and efforts directed almost exclusively to the representations of the abstract human form in abstract relief. Traditions in art, however, may sometimes prove helpful and beneficial, and preservative of beauty and character, as in the case of certain decorative and constructive arts and handicrafts in common use, such as those of the rural waggon-maker and wheelwright, and horse-harness maker.

Some schools of painting, sculpture and architecture have preserved fine and noble traditions which yet allowed for individuality. Such traditions may be said to have been characteristic of the art of the middle ages. It often happens, too, when many streams of artistic influence meet, there may be a certain domination or ascendancy of the traditions of one art over the others, which is injurious in its effects on those arts and diverts them from their true path. The domination of individualistic painting and sculpture over the arts of design during the last century or two is a case in point.

With the awakening of interest in industrial art—sharply separated by pedantic classification from fine art—which began in England about the middle of the 19th century, schools of design were established which included more varied studies. Even as early as 1836 a government grant was made towards the opening of public galleries and the establishment of a normal school of design with a museum and lectures, and in 1837 the first school of design was opened at Somerset House. In 1840 grants were made to establish schools of the same kind in provincial towns, such as Manchester, Birmingham, Glasgow, Leeds and Paisley. The names of G. Wallis in 1847, and Ambrose Poynter in 1850, are associated with schemes of art instruction adopted in the government art schools, and the year 1851, the year of the Great Exhibition, was also marked by the first public exhibition of students' works, and the first institution of prizes and scholarships. In 1852 "the Department of Practical Art" was constituted, and a museum of objects collected at Marlborough House which afterwards formed the nucleus of the future museum at South Kensington. In 1853 "the Department of Science and Art" was established, and in 1857, under the auspices of Henry Cole, the offices of the department and the National Art Training School were removed from Marlborough House to South Kensington. Classes for instruction in various crafts had been carried on both at Somerset House and Marlborough House, and the whole object of the government schools of design was to give an artistic training to the designer and craftsman, so that he could carry back to his trade or craft improved taste and skill. The schools, however, became largely filled by students of another type—leisured amateurs who sought to acquire some artistic accomplishment, and even in the case of genuine designers and craftsmen who developed pictorial skill in their studies, the attraction and superior social distinction and possibility of superior commercial value accruing to the career of a painter of easel pictures diverted the schools from their original purpose.

For some time after the removal to South Kensington, during the progress of the new buildings, and under the direction of Godfrey Sykes and F. W. Moody, practical decorative work both in modelling and painting was carried out in the National Art Training School; but on the completion of these works, the school relapsed into a more or less academic school on the ordinary lines, and was regarded chiefly as a school for the training of art teachers and masters who were required to pass through certain stereotyped courses and execute a certain series of drawings in order to obtain their certificates. Thus model-drawing, freehand outline, plant-drawing in outline, outline from the cast, light and shade from the cast, drawing of the antique figure, still life, anatomical drawings, drawing and painting from the life, ornamental design, historic studies of ornament, perspective and geometry, were all taken up in a cut-and-dried way, as isolated studies, and with a view solely to obtaining the certificate or passing an examination. This theoretic kind of training, though still in force, and though it enabled the department to turn out certificated teachers for the schools of the country of a certain standard, and to give to students a general theoretic idea of art, has been found wanting, since, in practice, when the student in design leaves his school and desires to take up practical work as a designer or craftsman, he requires *special* knowledge, and specialized skill in design for his work to be of use; and though he may be able to impart to others what he himself has laboriously acquired, the theoretic and general character of his training proves of little or no use, face to face with the ever shifting and changing demands of the modern manufacturer and the modern market.

A growing conviction of the inadequacy of the schools of the Science and Art Department (now the Board of Education), considered as training grounds for practical designers and craftsmen, led to the establishment of new technical schools in the principal towns of Great Britain. The circumstance of certain large sums, diverted from their original purpose of compensation to brewers, being available for educational purposes and at the disposal of the county councils and municipal bodies, provided the means for the building and equipment of these new technical schools, which in many cases are under the same roof as the art school in the provincial towns, and, since the Education Act of 1902, are generally rate-supported. The art schools formerly managed by private committees and supported by private donors, assisted by the government grants, are now, in the principal industrial towns of Great Britain, taken over by the municipality. Birmingham is singularly well organized in this respect, and its art school has long held a leading position. The school is well housed in a new building with class-rooms with every appliance, not only for the drawing, designing and modelling side, but also for the practice of artistic handicrafts such as metal repoussé, enamelling, wood-carving, embroidery, &c. The municipality have also established a jewelry school, so as to associate the practical study of art with local industry. Manchester and other cities are also equipped with well-organized art schools.

The important change involved in the incorporation of the Science and Art Department with the Board of Education also led to a reorganization of the Royal College of Art. A special council of advice on art matters was appointed, consisting of representatives of painting, sculpture, architecture and design, who deal with the Royal College of Art, and appoint the professors who control the teaching in the classes for architecture, design and handicraft, decorative painting and sculpture, modelling and carving. The council decide upon the curriculum, and examine and criticize the work of the college from time to time. They also advise the board in regard to the syllabus issued to the art schools of the country, and act as referees in regard to purchases for the museum.

Of other institutions for the teaching of art, the following may be named: The Royal Drawing Society of Great Britain and Ireland, which was formed principally to promote the teaching of drawing in schools as a means of education. The system therein adopted differs from the ordinary drawing courses, and favours the use of the brush. Brushwork has generally been adopted for elementary work, too, by London County Council teachers, drawing being now a compulsory subject. Remarkable results have been obtained by the Alma Road Council schools in the teaching of boys from eight to twelve by giving them spaces to fill with given forms—leaf shapes—from which patterns are constructed to fill the spaces, brush and water-colour being the means employed. At the Royal Female School of Art in Queen Square, London, classes in drawing and painting from life are held, and decorative design is also studied. There are also the Royal School of Art Needlework and the School of Art Wood-carving, all aided by the London County Council. The City and Guilds of London Institute has two departments for what is termed "applied" art, one at the South London School of Technical Art, and the other at the Art Department in the Technical College, Finsbury. The Slade School of Drawing, Painting and Sculpture, University College, Gower Street, confines itself to drawing and painting from the antique and life, and exercise in pictorial composition. There are also lectures on anatomy and perspective. The Slade professorships at Oxford and Cambridge universities are concerned with the teaching and literature of art, but they do not concern themselves with the practice. There are also, in addition to the schools of art named and those in connexion with the Board of Education and the London County Council in the various districts of London, many and various private clubs and schools, such as the Langham and "Heatherley's," chiefly concerned in encouraging drawing and painting from the life, and for the study of art from the pictorial point of view, or for the preparation of candidates for the Royal Academy or other schools. The polytechnics and technical institutes also provide instruction in a great variety of artistic crafts.

A general survey, therefore, of the various institutions which are established for the teaching of art in Great Britain gives the impression that the study of art is not neglected, although, perhaps, further inquiry might show that, compared with the great educational establishments, the proportion is not excessive. Now that the Education Act 1902 has given the county councils control of elementary and secondary education and charged them with the task of promoting the co-ordination of all forms of education in consultation with the Board of Education, it is probable that an elementary scholar who shows artistic ability will be enabled to pass on from the elementary classes in one school to the higher art and technical schools, secondary and advanced, without retracing his steps, thus escaping the depression of going over old ground.

The general movement of revival of interest in the arts of decorative design and the allied handicrafts, with the desire to re-establish their influence in art-teaching, has been due to many causes, among which the work of the Arts and Crafts Exhibition Society may count as important. From the leading members of this body the London County Council Technical Educational Board, when it was face to face with the problem of organizing its new schools and its technical classes, sought advice and aid. Success has attended their schools, especially the Central School of Arts and Crafts at Morley Hall, Regent Street. The object of the school is to provide the craftsman in the various branches of decorative design with such means of improving his taste and skill as the workshop does not afford. It does not concern itself with the amateur or with theoretic drawing. The main difference in principle adopted in this school in the teaching of design is the absence of teaching design *apart from handicraft*. It is considered that a craftsman thoroughly acquainted with the natural capacities of his material and strictly understanding the conditions of his work, would be able, if he had any feeling or invention, to design appropriately in that material, and no designing can be good apart from a knowledge of the material in which it is intended to be carried out. It should be remembered, too, that graphic skill in representing the appearances of natural objects is one sort of skill, and the executive skill of the craftsman in working out his design, say in wood or metal, is quite another. It follows that the works of drawing or design made by the craftsman would be of quite a different character from a pictorial drawing, and might be quite simple and abstract, while clear and accurate. The training for the pictorial artist and for the craftsman would, therefore, naturally be different.

The character of the art-teaching adopted in any country must of course depend upon the dominant conception of art and its function and purpose. If we regard it as an idle accomplishment for the leisured few, its methods will be amateurish and superficial. If we regard art as an important factor in education, as a language of the intelligence, as an indispensable companion to literature, we shall favour systematic study and a training in the power of direct expression by means of line. We shall value the symbolic drawing of early civilizations like the Egyptian, and symbolic art generally, and in the history of decorative art we shall find the true accompaniment and illustration of human history itself. From this point of view we shall value the acquisition of the power of drawing for the purpose of presenting and explaining the facts and forms of nature. Drawing will be the most direct means at the command of the teacher to explain, to expound, to demonstrate where mere words are not sufficiently definite or explicit. Drawing in this sense is taking a more important place in education, especially in primary education, though there is no need for it to stop there, and one feels it may be destined to take a more important position both as a training for the eye and hand and an aid to the teacher. Then, again, we may regard art more from its social aspect as an essential accompaniment of human life, not only for its illustrative and depicting powers, but also and no less for its pleasure-giving properties, its power of awakening and stimulating the observation and sympathy with the moods of nature, its power of touching the emotions, and above all of appealing to our sense of beauty. We shall regard the study of art from this point of view as the greatest civilizer, the most permeating of social and human forces. Such ideas as these, shared no doubt by all who take pleasure and interest in art, or feel it to be an important element in their lives, are crossed and often obscured by a multitude of mundane considerations, and it is probably out of the struggle for ascendancy between these that our systems of art teaching are evolved. There is the demand of the right to live on the part of the artist and the teacher of art. There is the demand on the part of the manufacturer and salesman for such art as will help him to dispose of his goods. In the present commercial rivalry between nations this latter demand is brought into prominent relief, and art is apt to be made a minister, or perhaps a slave to the market. These are but accidental relationships with art. All who care for art value it as a means of expression, and for the pleasure and beauty it infuses into all it touches, or as essential and inseparable from life itself. Seeing then the importance of art from any point of view, individual, social, commercial, intellectual, emotional, economic, it should be important to us in our systems of art-teaching not to lose sight of the end in arranging the means—not to allow our teaching to be dominated by either dilettantism or commercialism, neither to be feeble for want of technical skill, nor to sacrifice everything to technique. The true object of art-teaching is very much like that of all education—to inform the mind, while you give skill to the hand—not to impose certain rigid rules, or fixed recipes and methods of work, but while giving instruction in definite methods and the use of materials, to allow for the individual development of the student and enable him to acquire the power to express himself through different media without forgetting the grammar and alphabet of design. Practice may vary, but principles remain, and there is a certain logic in art, as well as in reasoning. All art is conditioned in the mode of its expression by its material, and even the most individual kind of art has a convention of its own by the very necessities and means of its existence. Methods of expression, conventions alter as each artist, each age seeks some new interpretation of nature and the imagination—the well-springs of artistic life, and from these reviving streams continually flow new harmonies, new inventions and recombinations, taking form and colour according to the temperaments which give them birth. (W. Cr.)

ARTUSI, GIOVANNI MARIA, Italian composer and musical theorist, was born in Bologna, and died on the 18th of August 1613. He was *canonico regulare* at the church of San Salvatore in his native city. He is chiefly famous in the history of music for his attacks upon Monteverde (*q.v.*) embodied in his *L'Artusi overo d. imp.* (1600). For an exhaustive explanation and a translation of excerpts from these the studies of Dr G. Vogel and O. Riemann should be consulted. These will be found in the *Vierteljahrsschrift für Musikwissenschaft*, Leipzig, vol. 3, pp. 326, 380 and 426.

ARU ISLANDS (Dutch *Aroe*), a group in the residency of Amboyna, Dutch East Indies; between 5° 18′ and 7° 5′ S., and 134° and 135° E.; the member nearest to the south-west coast of New Guinea lying about 70 m. from it. The larger islands (Wokan, Kobrur, Maikor and Trangan), and certain of the lesser ones, are regarded by the Malays as one land mass which they call *tana besar* (" great land "). This is justified inasmuch as its parts are only isolated by narrow creeks of curious form, having the character of rivers. The smaller islands number some eighty; the total land area is 3244 sq. m.; and the population about 22,000. The islands are low, but it is only on the coast that the ground is swampy. The principal formation is coralline limestone; the eastern coast is defended by coral reefs, and the neighbouring sea (extending as far as New Guinea, and thus demonstrating a physical connexion with that land) is shallow, and abounds in coral in full growth. A large part of the surface is covered with virgin forest, consisting of screw-pines, palm trees, tree ferns, canariums, &c. The fauna is altogether Papuan. The natives are also Papuans, but of mixed blood. They are divided into two confederations, the Uli-luna and the Uli-sawa, which are hostile to each other. The houses are remarkable as being built on piles sunk in the solid rock and having two rooms, the one surrounding the other. The people are in manners complete savages. The natives are governed by rajas (*orang kajas*), the Dutch government being represented by a *posthouder*. In the interior is said to exist a tribe—the Korongoeis—with white skins and fair hair, but it has never been seen by travellers. A few villages are nominally Christian, and the Malays have introduced Mahommedanism, but most of the natives have no religion. Dobbo, on a small western island, is the chief place; its resident population is reinforced annually, at the time of the west monsoon, by traders from that quarter, who deal in the tripang, pearl shell, tortoise-shell, and other produce of the islands.

ARUNDEL, EARLDOM OF. This historic dignity, the premier earldom of England, is popularly but erroneously supposed to be annexed to the possession of Arundel Castle. Norman earls were earls of counties, though sometimes styled from their chief residence or from the county town, and Mr J.H. Round has shown that the earldom of " Arundel " was really that of Sussex. Its origin was the grant by Henry I. to his second wife, in dower, of the forfeited " honour " of Arundel, of which the castle was the head, and which comprised a large portion of Sussex. After his death she married William " de Albini " (*i.e.* d'Aubigny), who from about the year 1141 is variously styled earl of Sussex, of Chichester, or of Arundel, or even Earl William " de Albini." His first known appearance as earl is at Christmas 1141, and it has been ascertained that, after acquiring the castle by marriage, he had not thereby become an earl. Henry II., on his accession, " gave " him the castle and honour of Arundel, in fee, together with " the third penny of the pleas of Sussex, of which he is earl." His male line of heirs became extinct on the death of Hugh " de Albini," earl of Arundel, in 1243, who had four sisters and co-heirs. In the partition of his estates, the castle and honour of Arundel were assigned to his second sister's son, John Fitzalan of a Breton house, from which sprang also the royal house of Stuart. It is proved, however, by record evidence, that neither John nor his son and successor were ever earls; but from about the end of 1289, when his grandson Richard came of age, he is styled earl of Arundel. Richard's son Edmund was forfeited and beheaded in 1326, and Arundel was out of possession of the family till 1331, when his son was restored, and regained the castle and also the earldom by separate grants. Both were again lost in 1397 on his son being beheaded and attainted. But the latter's son was restored to both the earldom and the estates by Henry IV. in 1400. He died without issue in 1415.

The castle and estates now passed to the late earl's cousin and heir-male under a family entail, but the representation in blood of the late earl passed to his sisters and co-heirs, of whom the eldest had married Thomas Mowbray, duke of Norfolk. The descent of the earldom remained in doubt, till the heir-male's son and heir successfully claimed it in 1433, in virtue of his tenure of the castle, alleging that it was " a dignity or name united and annexed to the castle and lordship of Arundel for time whereof memory of man was not to the contrary." His claim was opposed on behalf of the Mowbrays, and the allegation on which it was based is discussed and refuted at great length in the *Lords' Reports on the Dignity of a Peer* (i. 404-420). In the descendants of his brother the earldom remained vested till 1580, when the last Fitzalan earl died, leaving as his sole heir his daughter's son Philip Howard, whose father Thomas, duke of Norfolk, had been beheaded and attainted in 1572.

Philip, who was through his father senior representative of the earls of Arundel down to 1415, and through his mother sole representative of the subsequent earls, was summoned to parliament as earl in January 1581, but was attainted in 1589. His son Thomas was restored to the earldom and certain other honours in 1604, and, in 1627, obtained an act of parliament "concerning the title, name and dignity of Earl of Arundel, and for the annexing of the Castle, Honour, Manor and Lordship of Arundel . . . with the titles and dignities of the Baronies of Fitzalan, Clun and Oswaldestre, and Maltravers, . . . to the same title, name and dignity of Earl of Arundel." This act, which was based on the earl's allegation that the title had been "invariably used and enjoyed" by the owners of the castle, "and by reason of the said inheritance and seisin," has been much discussed, especially in the *Lords' Reports* (i. 430-434). There is no doubt that the earl's object was to entail the earldom and the castle strictly on a certain line of heirs, and this was effected by elaborate remainders (passing over the Howards, earls of Suffolk). It is under this act of parliament that the earldom has been held ever since, and that it passed with the castle in 1777 to the heir-male of the Howards, although the representation in blood then passed to heirs general. Thus the castle and the earldom cannot be alienated from the line of heirs on whom it is entailed by the act of 1627; while the heirship in blood of the earlier earls (to 1415) is vested in Lords Mowbray and Petre and the Baroness Berkeley, and that of the later earls (to 1777) in Lords Mowbray and Petre.

The precedence of the earldom was challenged in 1446 by Thomas Courtenay, earl of Devon, owing to the question as to its descent spoken of above, but the king in council confirmed to the earl the precedence of his ancestors "by reason of the Castle, Honour and Lordship of Arundel." In the act of 1627 the "places" and "pre-eminences" belonging to the earldom were secured to it. It would appear, however, that the decision of the dispute with the earl of Devon in 1446 restricts that precedency to such as the earl's ancestors had enjoyed, if indeed it goes farther than to guarantee his precedence over the earl of Devon. But as there is no other existing earldom older than that of Shrewsbury (1442), the present position of Arundel as the premier earldom is beyond dispute.

See *Lords' Reports on the Dignity of a Peer*; Dugdale's *Baronage*; Tierney's *History of Arundel*; G. E. C[okayne]'s *Complete Peerage*; Round's *Geoffrey de Mandeville*; Pike's *Constitutional History of the House of Lords*. (J. H. R.)

ARUNDEL, EARLS OF. According to Cokayne (*Complete Peerage*, i. p. 138, note *a*) there is an old Sussex tradition to the effect that

> "Since William rose and Harold fell
> There have been earls of Arundel."

This, he adds, "is the case if for 'of' we read 'at.'" The questions involved in this distinction are discussed in the preceding article on the earldom of Arundel, now held by the duke of Norfolk. The present article is confined to a biographical sketch of the more conspicuous earls of Arundel, first in the Fitzalan line, and then in the Howard line.

Richard Fitzalan (1267–1302), earl of Arundel, was a son of John, lord of Arundel (1246–1272), and a grandson of another John, lord of Arundel, Clun and Oswaldestre (Oswestry), who took a prominent, if somewhat wavering, part in the troubles during the reign of Henry III., and who died in November 1267. Richard, who was called earl of Arundel about 1289, fought for Edward I. in France and in Scotland, and died on the 9th of March 1302.

He was succeeded by his son, Edmund (1285–1326), who married Alice, sister of John, earl de Warenne. A bitter enemy of Piers Gaveston, Arundel was one of the ordainers appointed in 1310; he declined to march with Edward II. to Bannockburn, and after the king's humiliation he was closely associated with Thomas, earl of Lancaster, until about 1321, when he became connected with the Despensers and sided with the king. He was faithful to Edward to the last, and was executed at Hereford by the partisans of Queen Isabella on the 17th of November 1326.

His son, Richard (*c.* 1307–1376), who obtained his father's earldom and lands in 1331, was a soldier of renown and a faithful servant of Edward III. He was present at the battle of Sluys and at the siege of Tournai in 1340; he led one of the divisions of the English army at Creçy and took part in the siege of Calais; and he fought in the naval battle with the Spaniards off Winchelsea in August 1350. Moreover, he was often employed by Edward on diplomatic business. Soon after 1347 Arundel inherited the estates of his uncle John, earl de Warenne, and in 1361 he assumed the title of earl de Warenne or earl of Surrey. He was regent of England in 1355, and died on the 24th of January 1376, leaving three sons, the youngest of whom, Thomas, became archbishop of Canterbury.

Richard's eldest son, Richard, earl of Arundel and Surrey (*c.* 1346–1397), was a member of the royal council during the minority of Richard II., and about 1381 was made one of the young king's governors. As admiral of the west and south he saw a good deal of service on the sea, but without earning any marked distinction except in 1387 when he gained a victory over the French and their allies off Margate. About 1385 the earl joined the baronial party led by the king's uncle, Thomas of Woodstock, duke of Gloucester, and in 1386 was a member of the commission appointed to regulate the kingdom and the royal household. Then came Richard's rash but futile attempt to arrest Arundel, which was the signal for the outbreak of hostilities. The Gloucester faction quickly gained the upper hand, and the earl was one, and perhaps the most bitter, of the lords appellant. He was again a member of the royal council, and was involved in a quarrel with John of Gaunt, duke of Lancaster, whom he accused in the parliament of 1394. After a personal altercation with the king at Westminster in the same year Arundel underwent a short imprisonment, and in 1397 came the final episode of his life. Suspicious of Richard he refused the royal invitation to a banquet, but his party had broken up, and he was persuaded by his brother, Thomas Arundel, archbishop of Canterbury, to surrender himself and to trust to the king's clemency. At once he was tried, was attainted and sentenced to death, and, bearing himself with great intrepidity, was beheaded on the 21st of September 1397. He was twice married and had three sons and four daughters. The earl founded a hospital at Arundel, and his tomb in the church of the Augustinian Friars, Broad Street, London, was long a place of pilgrimage.

His only surviving son, Thomas (1381–1415), was a ward of John Holand, duke of Exeter, from whose keeping he escaped about 1398 and joined his uncle, Archbishop Thomas Arundel, at Utrecht, returning to England with Henry of Lancaster, afterwards King Henry IV., in 1399. After Henry's coronation he was restored to his father's titles and estates, and was employed in fighting against various rebels in Wales and in the north of England. Having left the side of his uncle, the archbishop, Arundel joined the party of the Beauforts, and was one of the leaders of the English army which went to France in 1411; then after a period of retirement he became lord treasurer on the accession of Henry V. From the siege of Harfleur he returned ill to England and died on the 13th of October 1415. His wife was Beatrix (d. 1439), a natural daughter of John I., king of Portugal, but he left no children, and the lordship of Arundel passed to a kinsman, John Fitzalan, Lord Maltravers (1385–1421), who was summoned as earl of Arundel in 1416.

John's son, John (1408–1435), did not secure the earldom until 1433, when as the "English Achilles" he had already won great distinction in the French wars. He was created duke of Touraine, and continued to serve Henry VI. in the field until his death at Beauvais from the effects of a wound on the 12th of June 1435. The earl's only son, Humphrey, died in April 1438, when the earldom passed to John's brother, William (1417–1488).

Henry Fitzalan, 12th earl of Arundel (*c.* 1517–1580), son of William, 11th earl, by Anne, daughter of Henry Percy, 4th earl of Northumberland, was born about 1517. He entered King Henry's household, attending the latter to Calais in 1532. In 1533 he was summoned to parliament in his father's barony of Maltravers, and in 1540 he was made deputy of Calais, where his vigorous administration was much praised. He returned to England in April 1544 after the death of his father, and was made a knight of the Garter. In July of the same year he commanded with Suffolk the English expedition to France as lord marshal, and besieged and took Boulogne. On his return to England he was made lord chamberlain, an office which he retained after the accession in 1547 of Edward VI., at whose coronation he acted as high constable. He was one of the twelve counsellors nominated in Henry VIII.'s will to assist the executors, but he had little power during the protectorship of Somerset or the ascendancy of Warwick (afterwards duke of Northumberland), and in 1550 by the latter's device he was accused of embezzlement, removed from the council, confined to his house, and fined £12,000—£8000 of this sum being afterwards remitted and the charges never being proved. Subsequently he allied himself with Somerset, and was implicated in 1551 in the latter's plot against Northumberland, being imprisoned in the Tower in November. On the 3rd of December 1552, though he had never been brought to trial, he signed a submission and confession before the privy council, and was liberated after having been again heavily fined. As Edward's reign drew to its close, Arundel's support was desired by Northumberland to further his designs on the throne for his family, and he was accordingly reinstated in the council and discharged of his fine. In June 1553 he opposed Edward's "device" for the succession, which passed over his sisters Mary and Elizabeth as illegitimate, and left the crown to the children of the duchess of Suffolk, and alone of the council refused the "engagement" to support it, though he signed the letters patent. On the death of Edward (July 6, 1553) he ostensibly joined in furthering the duke's plans, but secretly took measures to destroy them, and according to some accounts sent a letter to Mary the same evening informing her of Edward's death and advising her to retreat to a place of security. Meanwhile he continued to attend the meetings of the council, signed the letter to Mary declaring her illegitimacy and Lady Jane Grey's right to the throne, accompanied Northumberland to announce to Jane her accession, and urged Northumberland to leave London and place himself at the head of the forces to attack Mary, wishing him God-speed on his departure. In Northumberland's absence, he gained over his fellow-councillors, and having succeeded with them in getting out of the Tower, called an assembly of the corporation and chief men of the city, denounced Northumberland, and had Mary proclaimed queen, subsequently riding off to join her with the Great Seal at Framlingham. On the 20th of July he secured Northumberland at Cambridge, and returned in triumph with Mary to London on the 3rd of August, riding before her with the sword of state. He was now made a privy councillor and lord steward, and was granted several favours and privileges, acting as high constable at the coronation, and obtaining the right to create sixty knights. He took a prominent part in various public acts of the reign, was a commissioner to treat for the queen's marriage, presided at the trial of the duke of Suffolk, assisted in suppressing Wyatt's rebellion in 1554, was despatched on foreign missions, and in September 1555 accompanied Philip to Brussels. The same year he received, together with other persons, a charter under the name of the Merchant Adventurers of England, for the discovery of unknown lands, and was made high steward of Oxford University, being chosen chancellor in 1559, but resigning his office in the same year. In 1557, on the prospect of the war with France, he was appointed lieutenant-general of the forces for the defence of the country, and in 1558 attended the conference at the abbey of Cercamp for the negotiation of a peace. He returned to England on the death of Mary in November 1558, and is described to Philip II. at that time as "going about in high glee, very smart" and with hopes of marrying the queen, but as "flighty" and of "small ability." He was reinstated in all his offices by Elizabeth, served as high constable at her coronation, and was visited several times by the queen at Nonsuch in Surrey. As a Roman Catholic he violently opposed the arrest of his co-religionists and the war with Scotland, and in 1560 came to blows with Lord Clinton in the queen's presence on a dispute arising on those questions. He incurred the queen's displeasure in 1562 by holding a meeting at his house during her illness to consider the question of the succession and promote the claims of Lady Catherine Grey. In 1564, being suspected of intrigues against the government, he was dismissed from the lord-stewardship and confined to his house, but was restored to favour in December. In March 1566 he went to Padua, but being summoned back by the queen he returned to London accompanied by a large cavalcade on the 17th of April 1567. Next year he served on the commission of inquiry into the charges against Mary, queen of Scots. Subsequently he furthered the marriage of Mary with the duke of Norfolk, his son-in-law, together with the restoration of the Roman Catholic religion and government, and deposition of Elizabeth, in collusion with Spain. He made use of the incident in 1568, of the seizure of treasure at Southampton intended for Philip, as a means of effecting Cecil's overthrow, and urged upon the Spanish government the stoppage of trade. He is described in 1569 to Philip as having "good intentions," "whilst benefiting himself as he was very needy." In January he alarmed Elizabeth by communicating to her a supposed Spanish project for aiding Mary and replacing her on her throne, and put before the queen in writing his own objections to the adoption of extreme measures against her. In June he received with Norfolk and Lumley 6000 crowns from Philip. In September, on the discovery of Norfolk's plot, he was arrested, but not having committed himself sufficiently to incur the charge of treason in the northern rebellion he escaped punishment, was released in March 1570, and was recalled by Leicester to the council with the aim of embarrassing Cecil. He again renewed his treasonable intrigues, which were at length to some extent exposed by the discovery of the Ridolfi plot in September 1571. He was once more arrested, and not liberated till December 1572 after Norfolk's execution. He died on the 24th of February 1580, and was buried in the chapel at Arundel, where a monument was erected to his memory.

He married (1) Catherine, daughter of Thomas Grey, 2nd marquess of Dorset, by whom he had Henry, who predeceased him, and two daughters, of whom Mary married Thomas Howard, 4th duke of Norfolk; and (2) Mary, daughter of Sir John Arundell and dowager countess of Sussex, by whom he had no children. Arundel was the last earl of his family, the title at his death passing through his daughter Mary to the Howards.

Authorities.—MS. Life by a contemporary in *Royal MSS.*, British Museum, 17 A ix., printed with notes in *Gent. Mag.* (1833) (ii.), pp. 11, 118, 210, 490; M. A. Tierney, *Hist. of Arundel*, p. 319; *Chronicle of Queen Jane* (Camden Soc. 1850); *Literary Remains of Edward VI.* (Roxburghe Club, 1857); J. Nichols, *Progresses of Queen Elizabeth* (1823), i. 74; Wood, *Fasti Oxon.* (Bliss), i. 153, 156; *Cal. State Papers, Simancas*, i. 18, ii. 152, &c., *Notes and Queries*, 2 Ser. iv. 84, &c.

Philip Howard, 1st earl[1] of Arundel (1557–1595), eldest son of Thomas Howard, 4th duke of Norfolk, executed for high treason in 1572, and of Lady Mary, daughter and heiress of Henry Fitzalan, 12th earl of Arundel, was born on the 28th of June 1557. He was married in 1571 to Anne, daughter and co-heiress of Thomas Dacre, Lord Dacre (1566), and was educated at Cambridge, being accorded the degree of M.A. in 1576. Subsequently Lord Surrey, as he was styled, came to court, partook in its extravagant gaieties and dissipations, and kept his wife in the background; but he nevertheless failed to secure the favour of Elizabeth, who suspected the Howards generally. On the death of his maternal grandfather in February 1580 he became earl of Arundel and retired from the court. In 1582 his wife joined the church of Rome, and was committed to the charge of Sir Thomas Shirley by the queen. He was himself suspected of disloyalty, and was regarded by the discontented Roman Catholics as the centre of the plots against the queen's government, and even as a possible successor. In 1583 he was with some reason suspected of complicity in Throgmorton's plot and prepared to escape to Flanders, but his plans were interrupted by a visit from Elizabeth at his house in London, and by her order subsequently to confine himself there. In September 1584 he became a Roman Catholic, dissembling his conversion and attempting next year once more to escape abroad; but having been brought back he was placed in the Tower on the 25th of April 1585, and charged before the Star Chamber with being a Romanist, with quitting England without leave, sharing in Jesuit plots, and claiming the dukedom of Norfolk. He was sentenced to pay £10,000 and to be imprisoned during the queen's pleasure. In July 1586 his liberty was offered to him if he would carry the sword of state before the queen to church. In 1588 he was accused of praying, together with other Romanists, for the success of the Spanish Armada. He was tried for high treason on the 14th of April 1589, found guilty and condemned to death; but lingered in confinement under his sentence, which was never executed, till his death on the 19th of October 1595. He was buried in the Tower, whence his remains were removed in 1624 to Arundel. His career, his later religious constancy and his tragic end have evoked general sympathy, but his conduct gave rise to grave suspicions, and the punishment inflicted upon him was not unwarranted; while the account of the severity of his imprisonment given by his anonymous and contemporary biographer should be compared with his own letters expressing gratitude for favours allowed.[1] There appears no foundation for the belief that he was poisoned, and according to Camden his death was caused by his religious austerities.[2] He was the author of a translation of *An Epistle of Jesus Christ to the Faithful Soule* by Johann Justus (1595, reprinted 1871) and of three MS. treatises *On the Excellence and Utility of Virtue*. Inscriptions carved by his hand are still to be seen in the Tower. He had two children, Elizabeth, who died young, and Thomas, who (restored in blood) succeeded him as 2nd earl of Arundel, and was created earl of Norfolk in 1644.

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[1] *i.e.* in the Howard line.

AUTHORITIES.—Article in the *Dict. of Nat. Biography* and authorities there collected; the contemporary *Lives of Philip Howard, Earl of Arundel and of Anne Dacre his Wife*, ed. by the duke of Norfolk (1857); M. Tierney, *History of Arundel* (1834), p. 357; C. H. Cooper, *Athenae Cantabrigenses* (1861), with bibliography, ii. 187 and 547; H. Howard, *Memoirs of the Howard Family* (1824).

THOMAS HOWARD, 2nd earl of Arundel, and earl of Surrey and of Norfolk (*c.* 1585–1646), son of Philip, 1st earl of Arundel and of Lady Anne Dacre, was born in 1585 or 1586 and educated at Westminster school and at Trinity College, Cambridge. Owing to the attainder of his father he was styled Lord Maltravers, but at the accession of James I. he was restored to his father's earldoms of Arundel and Surrey, and to the baronies of his grandfather, Thomas, 4th duke of Norfolk. He came to court, travelled subsequently abroad, acquiring a taste for art, and was created K.G. on his return in May 1611. In 1613 he escorted Elizabeth, the electress palatine, to Heidelberg, and again visited Italy. On Christmas day 1615 Arundel joined the Church of England, and took office, being appointed a privy councillor in 1616. He supported Raleigh's expedition in 1617, became a member of the New England Plantations Committee in 1620 and planned the colonization of Madagascar. He presided over the House of Lords Committee in April 1621 for investigating the charges against Bacon, whom he defended from degradation from the peerage, and at whose fall he was appointed a commissioner of the great seal. On the 16th of May he was sent to the Tower by the Lords on account of violent and insulting language used by him to Lord Spencer. He incurred Prince Charles's and Buckingham's anger by his opposition to the war with Spain in 1624, and by his share in the duke's impeachment, and on the occasion of his son's marriage to Lady Elizabeth Stewart without the king's approval he was imprisoned in the Tower by Charles I., shortly after his accession, but was released at the instance of the Lords in June 1626, being again confined to his house till March 1628, when he was once more liberated by the Lords. In the debates on the Petition of Right, while approving its essential demands, he supported the retention of some discretionary power by the king in committing to prison. The same year he was reconciled to the king and again made a privy councillor. On the 29th of August 1621 he had been appointed earl marshal, and in 1623 constable of England, in 1630 reviving the earl marshal's court. In 1625 he was made lord-lieutenant of Sussex and in 1635 of Surrey. He was sent to the Hague in 1632 on a mission of condolence to the queen of Bohemia on her husband's death. In 1634 he was made chief justice in eyre of the forests north of the Trent; he accompanied Charles the same year to Scotland on the occasion of his coronation, and in 1636 undertook an unsuccessful mission to the emperor to procure the restitution of the Palatinate to the young elector. In 1638 he supported the king's exactions from the vintners, was entrusted with the charge of the Border forts, and, supporting alone amongst the peers the war against the Scots, was made general of the king's forces in the first Bishops' War, though according to Clarendon "he had nothing martial about him but his presence and looks." He was not employed in the second Bishops' War, but in August 1640 was nominated captain-general south of the Trent. In April he was appointed lord steward of the royal household, and in 1641 as lord high steward presided at the trial of Strafford. This closed his public career. He became again estranged from the court, and in 1641 he escorted home Marie de' Medici, remaining abroad, with the exception of a short visit to England in 1642, for the rest of his life, and taking up permanent residence at Padua. He contributed a sum of £34,000 to the king's cause, and suffered severe losses in the war. On the 6th of June 1644 he was created earl of Norfolk. He died at Padua, when on the point of returning home, on the 14th of September 1646, and was buried at Arundel.

Lord Arundel was a man of high character, an exemplary husband and parent, but reserved and unpopular, and Clarendon ridicules his family pride. His claim to fame rests upon his patronage of arts and learning and his magnificent collections. He employed Hollar, Oughtred, Francis Junius and Inigo Jones; included among his friends Sir Robert Cotton, Spelman, Camden, Selden and John Evelyn, and his portrait was painted by Rubens and Vandyck. He is called the "Father of vertu in England," and was admired by a contemporary as the person to whom "this angle of the world oweth the first sight of Greek and Roman statues."[3] He was the first to form any considerable collection of art in Great Britain. His acquisitions, obtained while on his travels or through agents, and including inscribed marbles, statues, fragments, pictures, gems, coins, books and manuscripts, were deposited at Arundel House, and suffered considerable damage during the Civil War; and, owing to the carelessness and want of appreciation of his successors, nearly half of the marbles were destroyed. After his death the treasures were dispersed. The marbles and many of the statues were given by his grandson, Henry, 6th duke of Norfolk, to the university of Oxford in 1667, became known as the *Arundel* (or Oxford) *Marbles*, and included the famous *Parian Chronicle*, or *Marmor Chronicon*, a marble slab on which are recorded in Greek events in Grecian history from 1582 B.C. to 354 B.C., said to have been executed in the island of Paros about 263 B.C. Its narration of events differs in some respects from the most trustworthy historical accounts, but its genuineness, challenged by some writers, has been strongly supported by Porson and others, and is considered fairly established. Other statues were presented to the university by Henrietta Louisa, countess of Pomfret, in 1755. The cabinets and gems were removed by the wife of Henry, 7th duke of Norfolk, in 1685, and after her death found their way into the Marlborough collection. The pictures and drawings were sold in 1685 and 1691, and Lord Stafford's moiety of the collection in 1720. The coins and medals were bought by Heneage Finch, 2nd earl of Winchelsea, and dispersed in 1696; the library, at the instance of John Evelyn, who feared its total loss, was given to the Royal Society, and a part, consisting of genealogical and heraldic collections, to the College of Heralds, the manuscript portion of the Royal Society's moiety being transferred to the British Museum in 1831 and forming the present Arundel Collection. The famous bust of Homer reached the British Museum after passing through various hands.

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[1] See *Cal. of St. Pap. Dom. 1581–1590*, 611; and *Hist. MSS. Comm. Marq. of Salisbury's MSS.* iii. 253, 414.

[2] Camden's *Elizabeth* in *Hist. of England* (1706), 587.

[3] Peacham in the *Compleat Gentleman* (1634), p. 107, and *Secret Hist. of James I.* (1811), i. 199.

Lord Arundel married in 1606 Lady Alethea, daughter and heir of Gilbert Talbot, 7th earl of Shrewsbury, by whom, besides three sons who died young and one daughter, he had John, who predeceased him, Henry Frederick, who succeeded him as 3rd earl of Arundel and earl of Surrey and of Norfolk, and William, Viscount Stafford, executed in 1680. In 1849 the Arundel Society for promoting artistic knowledge was founded in his memory. Henry Frederick's grandson Thomas, by the reversal (1660) of the attainder of 1572, succeeded to the dukedom of Norfolk, in which the earldom has since then been merged.

AUTHORITIES.—See the article in the *Dict. of Nat. Biography*, and authorities there collected; D. Lloyd, *Memoires* (1668), p. 284; Sir E. Walker, *Historical Discourses* (1705), p. 209 (MS. in Harleian, 6272 f. 152); M. Tierney, *History of Arundel* (1834), p. 414; Sir Thomas Roe's *Negotiations* (1740: letters relating to his collections), 334, 444, 495; W. Crowne, *A True Relation of all the Remarkable Places . . . in the Travels of . . . Thomas, Earl of Arundell: A.D. 1636* (1637); *Die englische Mission des Grafen v. Arundel in Nürnberg* (*archivalische Zeitschrift*: neue Folge, Bd. xi., 1904); H. Howard, *Memorials of the Howard Family* (1834), p. 31; H. K. S. Causton, *The Howard Papers* (1862); *Preface to Catalogue of Arundel MSS.*, Brit. Museum (1840), &c. For publications relating to the Parian Chronicle see *Marmora Arundelliana*, publ. J. Selden (1628); Prideaux's *Marmora Oxoniensia* (1676); Maittaire's variorum edition (1732); Chandler's *Marmora Oxoniensia* (1763 and 1791), G. Roberts; J. Robertson, *The Parian Chronicle* (1788); J. Hewlett, *A Vindication* (1789); R. Porson, "The Parian Chronicle," in *Tracts*, ed. by T. Kidd (1815); *Chronicon Parium*, ed. by C. F. C. Wagner (1832–1833); C. Müller's *Fragmenta Historicorum Graecorum* (1841), i. 533; F. Jacoby, *Das Marmor Parium* (1904).

ARUNDEL, THOMAS (1353–1414), archbishop of Canterbury, was the third son of Richard Fitzalan, earl of Arundel and Warenne, by his second wife, Eleanor, daughter of Henry Plantagenet, earl of Lancaster. His family was an old and influential one, and when Thomas entered the church his preferment was rapid. In 1373 he became archdeacon of Taunton, and in April 1374 was consecrated bishop of Ely. During the early years of the reign of King Richard II. he was associated with the party led by Thomas, duke of Gloucester, Henry, earl of Derby, afterwards King Henry IV., and his own brother Richard, earl of Arundel, and in 1386 he was sent with Gloucester to Eltham to persuade Richard to return to parliament. This mission was successful, and Arundel was made lord chancellor in place of Michael de la Pole, duke of Suffolk, and assisted to make peace between the king and the supporters of the commission of regency. In April 1388 he was made archbishop of York, and, when Richard declared himself of age in 1389, he gave up the office of chancellor, to which, however, he returned in 1391. During his second tenure of this office he removed the courts of justice from London to York, but they were soon brought back to the metropolis. In September 1396 he was translated from York to Canterbury, and again resigned the office of chancellor. He began his new rule by a vigorous attempt to assert his rights, warned the citizens of London not to withhold tithes, and decided appeals from the judgments of his suffragans during a thorough visitation of his province. In November 1396 he had officiated at the marriage of Richard and Isabella, daughter of Charles VI., king of France, and his fall was the sequel of the king's sudden attack upon the lords appellant in 1397. After the arrest of Gloucester, Warwick and Arundel, the archbishop was impeached by the Commons with the king's consent, although Richard, who had not yet revealed his hostility, held out hopes of safety to him. He was charged with assisting to procure the commission of regency in derogation of the royal authority, and sentence of banishment was passed, forty days being given him during which to leave the realm. Towards the end of 1397 he started for Rome, and Pope Boniface IX., at the urgent request of the king, translated him to the see of St Andrews, a step which the pope afterwards confessed he repented bitterly. This translation virtually deprived Arundel of all authority, as St Andrews did not acknowledge Boniface. He then became associated with Henry of Lancaster, but did not return to England before 1399, and the account which Froissart gives telling how he was sent by the Londoners to urge Henry to come and assume the crown is thought to refer to his nephew and namesake, Thomas, earl of Arundel. Landing with Henry at Ravenspur, he accompanied him to the west. He took his place at once as archbishop of Canterbury, witnessed the abdication of Richard in the Tower of London, led the new king, Henry IV., to his throne in presence of the peers, and crowned him on the 13th of October 1399.

The main work of his later years was the defence of the church, and the suppression of heresy. To put down the Lollards, he called a meeting of the clergy, pressed on the statute *de haeretico comburendo*, and passed sentence of degradation upon William Sawtrey. He resisted the attempt of the parliament of 1404 to disendow the church, but failed to induce Henry to pardon Archbishop Scrope in 1405. In 1407 he became chancellor for the fourth time, and in 1408 summoned a council at Oxford, which drew up constitutions against the Lollards. These he published in January 1409, and among them was one forbidding the translation of the Bible into English without the consent of the bishop of the diocese, or of a provincial synod. In 1411 he went on an embassy abroad, and in 1412 became chancellor again, his return to power being accompanied by a change in the foreign policy of Henry IV. In 1397 he had sought to vindicate his right of visitation over the university of Oxford, but the dispute remained unsettled until 1411 when a bull was issued by Pope John XXIII. recalling one issued by Pope Boniface IX., which had exempted the university from the archbishop's authority. In 1413 he took a leading part in the proceedings against Sir John Oldcastle, Lord Cobham, and in the following year he died on the 19th of February, and was buried at Canterbury. A legend of a later age tells how, just before his death, he was struck dumb for preventing the preaching of the word of God.

The chief authorities are T. Walsingham, *Historia Anglicana*, ed. by H. T. Riley (London, 1863–1864); *Eulogium historiarum sive temporis*, ed. by F. S. Haydon (London, 1858–1863); the Monk of Evesham, *Historia vitae et regni Ricardi II.*, ed. by T. Hearne (Oxford, 1729); W. F. Hook, *Lives of the Archbishops of Canterbury*, vol. iv. (London, 1860–1876).

ARUNDEL, a market town and municipal borough in the Chichester parliamentary division of Sussex, England, 58 m. S.S.W. from London by the London, Brighton & South Coast railway. Pop. (1901) 2739. It is pleasantly situated on the slope of a hill above the river Arun, which is navigable for small vessels to Littlehampton at the mouth, 6 m. south. From the summit of the hill rises Arundel Castle, which guarded the passage along the river through the hills. For its connexion with the title of earl of Arundel see ARUNDEL, EARLDOM OF. A castle existed in the time of King Alfred, and at the time of the Conquest it was rebuilt by Roger de Montgomerie, but it was taken from his son, who rebelled against the reigning monarch, Henry I. In 1397 it was the scene of a conspiracy organized by the earl of Arundel, archbishop of Canterbury and duke of Gloucester, to dethrone Richard II. and murder the lords of his council, a plot which was discovered before it could be carried into execution. During the civil wars of the 17th century, the stronghold was frequently assaulted by the contending parties, and consequently greatly damaged; but it was restored by Charles, 11th duke of Norfolk (d. 1815), who made it what it now is, one of the most splendid baronial mansions in England. Extensive reconstruction, in the style of the 13th century, was undertaken towards the close of the 19th century. The town, according to the whimsical etymology shown on the corporation seal, takes its name from *hirondelle* (a swallow). The town hall is a castellated building, presented to the corporation by the duke of Norfolk. The church of St Nicholas, founded about 1375, is Perpendicular with a low tower rising from the centre. In the north aisle of the chancel there are several ancient monuments of the earls of Arundel. The church is otherwise remarkable for its reredos and iron work. The chancel is the property of the duke of Norfolk and is screened from the rest of the building, although in 1880 this exercise of right by the owner was made the subject of an action at law and subsequent appeal. The Roman Catholic church of St Philip Neri was built by the duke of Norfolk (1873). Some remains of a *Maison Dieu*, or hospital, erected in the time of Richard II., still exist. The borough is under a mayor, 4 aldermen and 12 councillors. Area, 2053 acres.

The first mention of Arundel (Harundell) comes as early as 877, when it was left by King Alfred in his will to his nephew Æthelm. In the time of Edward the Confessor the town seems to have consisted of the mill and a fortification or earthwork which was probably thrown up by Alfred as a defence against the Danes; but it had increased in importance before the Conquest, and appears in Domesday as a thriving borough and port. It was granted by the Conqueror to Roger de Montgomery, who built the castle on the site of the ancient earthwork. From very early times markets were held within the borough on Thursday and Saturday, and in 1285 Richard Fitzalan, earl of Arundel, obtained a grant of two annual fairs on the 14th of May and the 17th of December. The borough returned two members to parliament from 1302 to 1832 when the Reform Act reduced the membership to one; in 1868 it was disfranchised altogether. There are no early charters extant, but in 1586 Elizabeth acknowledged the right of the mayor and burgesses to be a body corporate and to hold a court for pleas under forty shillings, two weekly markets and four annual fairs—which rights they claimed to have exercised from time immemorial. James II. confirmed in 1688 a charter given two years before, and incorporated the borough under the title of a mayor, 4 aldermen and 12 burgesses. The town was half destroyed by fire in 1338, but was soon rebuilt. Arundel was formerly a thriving seaport, and in 1813 was connected by canal with London.

See M. A. Tierney, *The History and Antiquities of the Castle and Town of Arundel* (London, 1834); *Victoria County History—Sussex.*

ARUNDELL OF WARDOUR, THOMAS ARUNDELL, 1st Baron (*c.* 1562–1639), son of Sir Mathew Arundell of Wardour Castle in Wiltshire, a member of the ancient family of Arundells of Lanherne in Cornwall, and of Margaret, daughter of Sir Henry Willoughby, was born about 1562. In 1579 he was personally recommended by Queen Elizabeth to the emperor Rudolph II. He greatly distinguished himself while serving with the imperial troops against the Turks in Hungary, and at the siege of Gran or Esztergom on the 13th of August 1595, he captured the enemy's banner with his own hand. He was created by Rudolph II. a count of the Holy Roman Empire in December 1595, and returned to England after suffering shipwreck and barely preserving his life in January 1596. His assumption of the foreign title created great jealousy among the English peers, who were wont to give a precedence by courtesy to foreign nobles, and he incurred the resentment of his father, who objected to his superior rank and promptly disinherited him. The queen, moreover, was seriously displeased, declared that "as chaste wives should have no glances but for their own spouses, so should faithful subjects keep their eyes at home and not gaze upon foreign crowns," and committed him to the Fleet immediately on his arrival, while she addressed a long letter of remonstrance on the subject to the emperor. Arundell remained under arrest till April, when he was liberated after an examination. In April 1597, however, he was again confined, but declared innocent of any charge save that of "practising to contrive the justification of his vain title with Ministers beyond the seas." In December he was liberated and placed under the care of his father, but next year he was again arrested and accused of a conspiracy against the government. His petitions for a licence to undertake an expedition by sea, wherein he declared "his end was honour which some base minds call ambition," were refused, but in 1599 he was apparently again restored to favour. On the 4th of May 1605 he was created by James I. Baron Arundell of Wardour, but fell again under temporary suspicion at the time of the Gunpowder Plot. In 1623 he once more got into trouble by championing the cause of the recusants, of whom he was himself one, on the occasion of the visit of the Spanish envoys, and he was committed to custody, and in 1625 all the arms were removed by the government from Wardour Castle. After the accession of Charles I. he was pardoned, and attended the sittings of the House of Lords. He was indicted in the king's bench about the year 1627 for not paying some contribution, and in 1632 he was accused of harbouring a priest. In 1637 he was declared exempt from the recusancy laws by the king's order, but in 1639 he again petitioned for relief. The same year he paid £500 in lieu of attending the king at York. He died on the 7th of November 1639. Arundell was an earnest Roman Catholic, but the suspicions of the government as to his loyalty were probably unfounded and stifled a career destined by nature for successful adventure. He married (1) Mary, daughter of Henry Wriothesley, 2nd earl of Southampton, by whom besides other children he had Thomas, who succeeded him as 2nd baron; and (2) Anne, daughter of Miles Philipson, by whom he had several daughters.

Henry Arundell, 3rd Baron Arundell of Wardour (*c.* 1607–1694), son of Thomas, 2nd baron, and of Blanche, daughter of Edward, earl of Worcester, was born on the 21st of July 1607, and succeeded on his father's death in 1643 to the family title and estates. A strong royalist and Roman Catholic, he supported the king's cause, and distinguished himself in 1644 by the recapture of his castle at Wardour from the parliamentarians, who had taken it in the previous year in spite of his mother's brave defence of the place. In 1648 he was one of the delinquents exempted from pardon in the proposals sent to Charles in the Isle of Wight. His estates had been confiscated, but he was permitted about 1653 to compound for them in the sum of £35,000. In 1652, in consequence of his being second at a duel in which one of the combatants was killed, he was arrested, and tried in 1653; he pleaded his peerage, but the privilege was disallowed as the House of Lords had been abolished. At the Restoration he regained possession of the family estates, and in 1663 was made master of the horse to Henrietta Maria. He was one of the few admitted to the king's confidence concerning the projects for the restoration of the Roman Catholic religion and the alliance with France. In 1669 he took part in the secret council assembled by Charles II., and in October was sent to France, ostensibly for the funeral of Henrietta Maria, but in reality to negotiate with Louis XIV. the agreement which took shape in 1670 in the treaties of Dover (see Charles II.). In 1676 he was privy to James's negotiations with Rome through Coleman. He was accused in 1678 by Titus Oates of participation in the popish plot, and was one of the five Roman Catholic peers arrested and imprisoned in the Tower in October, found guilty by the Middlesex grand jury of high treason, and impeached subsequently by the parliament. Lord Stafford was found guilty and executed in December 1680, but after the perpetration of this injustice the proceedings were interrupted, and the three surviving peers were released on bail on the 12th of February 1684. On the 22nd of May 1685, after James II.'s accession, the charge was annulled, and on the 1st of June 1685 they obtained their full liberty. In February 1686, with other Roman Catholics, Arundell urged upon the king the removal of his mistress, Lady Dorchester, on account of her strong Protestantism. In spite of his religion he was made a privy councillor in August 1686, and keeper of the privy seal in 1687, being excused from taking the oaths by the king's dispensation. He presented the thanks of the Roman Catholics to James in June 1687 for the declaration of indulgence. His public career ended with the abdication of the king, and he retired to Breamore, the family residence since the destruction of Wardour Castle. He died on the 28th of December 1694. He was the author of five religious poems said to be composed during his confinement in the Tower in 1679, published the same year and reprinted in *A Collection of Eighty-six Loyal Poems* in 1685. His piety and benevolence to his unfortunate co-religionists were conspicuous. Evelyn calls him "very good company" and he was a noted sportsman, the Quorn pack being descended from his pack of hounds at Breamore. He married Cecily, daughter of Sir Henry Compton, by whom besides other children he had Thomas, who succeeded him as 4th baron.

The barony is still held in the Arundell family, which has never ceased to be Roman Catholic. The 14th baron (b. 1859) was a direct descendent of the 6th.

ARUSIANUS MESSIUS, or Messus, Latin grammarian, flourished in the 4th century A.D. He was the author of a small extant work *Exempla Elocutionum*, dedicated to Olybrius and Probinus, consuls for the year 395. It contains an alphabetical list, chiefly of verbs admitting more than one construction, with examples from each of the four writers, Virgil, Sallust, Terence and Cicero. Cassiodorus, the only writer who mentions Arusianus, refers to it by the term Quadriga.

See Keil, *Grammatici Latini*, vii.; Suringar, *Historia Critica Scholiastarum Latinorum* (1834–1835); Van der Hoeven, *Specimen Literarium* (1845).

ARVAL BROTHERS (Fratres Arvales), in Roman antiquities, a college or priesthood, consisting of twelve members, elected for life from the highest ranks in Rome, and always apparently, during the empire, including the emperor. Their chief duty was to offer annually public sacrifice for the fertility of the fields (Varro, *L. L.* v. 85). It is generally held that the college was founded by Romulus (see ACCA LARENTIA). This legend probably arose from the connexion of Acca Larentia, as *mater Larum*, with the Lares who had a part in the religious ceremonies of the Arvales. But apart from this, there is proof of the high antiquity of the college, which was said to have been older than Rome itself, in the verbal forms of the song with which, down to late times, a part of the ceremonies was accompanied, and which is still preserved. It is clear also that, while the members were themselves always persons of distinction, the duties of their office were held in high respect. And yet it is singular that no mention of them occurs in Cicero or Livy, and that altogether literary allusions to them are very scarce. On the other hand, we possess a long series of the *acta* or minutes of their proceedings, drawn up by themselves, and inscribed on stone. Excavations, commenced in the 16th century and continued to the 19th, in the grove of the Dea Dia about 5 m. from Rome, have yielded 96 of these records from A.D. 14 to 241. The brotherhood appears to have languished in obscurity during the republic, and to have been revived by Augustus. In his time the college consisted of a master (*magister*), a vice-master (*promagister*), a *flamen*, and a *praetor*, with eight ordinary members, attended by various servants, and in particular by four chorus boys, sons of senators, having both parents alive. Each wore a wreath of corn, a white fillet and the praetexta. The election of members was by co-optation on the motion of the president, who, with a flamen, was himself elected for one year. The great annual festival which they had to conduct was held in honour of the anonymous Dea Dia, who was probably identical with Ceres. It occupied three days in May. The ceremony of the first day took place in Rome itself, in the house of the magister or his deputy, or on the Palatine in the temple of the emperors, where at sunrise fruits and incense were offered to the goddess. A sumptuous banquet took place, followed by a distribution of doles and garlands. On the second and principal day of the festival the ceremonies were conducted in the grove of the Dea Dia. They included a dance in the temple of the goddess, at which the song of the brotherhood was sung, in language so antiquated that it was hardly intelligible (see the text and translation in Mommsen, *Hist. of Rome*, bk. i. ch. xv.) even to Romans of the time of Augustus, who regarded it as the oldest existing document in their mother-tongue. Especial mention should be made of the ceremony of purifying the grove, which was held to be defiled by the felling of trees, the breaking of a bough or the presence of any iron tools, such as those used by the lapidary who engraved the records of the proceedings on stone. The song and dance were followed by the election of officers for the next year, a banquet and races. On the third day the sacrifice took place in Rome, and was of the same nature as that offered on the first day. The Arvales also offered sacrifice and solemn vows on behalf of the imperial family on the 3rd of January and on other extraordinary occasions. The brotherhood is said to have lasted till the time of Theodosius. The British Museum contains a bust of Marcus Aurelius in the dress of a Frater Arvalis.

Marini, *Atti e Monumenti de' Fratri Arvali* (1795); Hoffmann, *Die A.* (1858); Oldenberg, *De Sacris Fratrum A.* (1875); Bergk, *Das Lied der Arvalbrüder* (1856); Bréal, "Le Chant des Arvals" in *Mém. de la Soc. de Linguistique* (1881); Edon, *Nouvelle Étude sur le Chant Lémural* (1884); *Corpus Inscriptionum Latinarum*, vi. 2023-2119; Henzen, *Acta Fratrum Arvalium* (1874).

ARVALS, ARVELS or ARTHELS (O. Norse *Arfr*, inheritance, and *öl*, A.S. Ale, a banquet), primarily the funeral dinner, and later, especially in the north of England, a thin, light, sweet cake, spiced with cinnamon and nutmeg, served to the poor at such feasts. The funeral meal was called the Arvel-dinner. The custom seems to have been to hold on such occasions an informal inquest, when the corpse was publicly exposed, to exculpate the heir and those entitled to the property of the dead from all accusations of foul play.

ARVERNI, the name of an ancient Gaulish tribe in the Auvergne, which still bears its name. It resisted Caesar longer than most of Gaul; when once vanquished it adopted Roman civilization readily. Its tribal deity, the god of the mountain, the Puy de Dôme, rechristened in Roman phrase Mercurius Dumias, was famous far beyond its territory. Part of his temple has been excavated recently.

ARYAN, a term which has been used in a confusing variety of significations by different philologists. By Max Müller especially it was employed as a convenient short term for the whole body of languages more commonly known as Indo-European (*q.v.*) or Indo-Germanic. In the same way Max Müller used Aryas as a general term for the speakers of such languages, as in his book published in 1888, *Biographies of Words and the Home of the Aryas.* "Aryas are those who speak Aryan languages, whatever their colour, whatever their blood. In calling them Aryas we predicate nothing of them except that the grammar of their language is Aryan" (p. 245). It is to be observed, therefore, that Max Müller is careful to avoid any ethnological signification. The Aryas are those who speak Aryan without regard to the question whether Aryan is their *hereditary* language or not. As he says still more definitely elsewhere in the same work (p. 120), "I have declared again and again that if I say Aryas, I mean neither blood nor bones, nor hair nor skull; I mean simply those who speak an Aryan language. The same applies to Hindus, Greeks, Romans Germans, Celts and Slaves. When I speak of them I commit myself to no anatomical characteristics. The blue-eyed and fair-haired Scandinavians may have been conquerors or conquered, they may have adopted the language of their darker lords or their subjects, or vice versa. I assert nothing beyond their language when I call them Hindus, Greeks, Romans, Germans, Celts and Slaves; and in that sense, and in that sense only, do I say that even the blackest Hindus represent an earlier stage of Aryan speech and thought than the fairest Scandinavians . . . To me an ethnologist who speaks of Aryan race, Aryan blood, Aryan eyes and hair, is as great a sinner as a linguist who speaks of a dolichocephalic dictionary or a brachycephalic grammar."

From the popularity of Max Müller's works on comparative philology this is the use of the word which is most familiar to the general public. The arguments in support of this use are set forth by him in the latter part of lecture vi. of the *Lectures on the Science of Language* (first series) and as an appendix to chap. vii. of the final edition (i. pp. 291 ff.). The Sanskrit usage of the word is fully illustrated by him from the early Sanskrit writings in the article "Aryan" in the ninth edition of this encyclopaedia. From the earliest occurrences of the word it is clear that it was used as a national name not only in India but also in Bactria and Persia (in Sanskrit *árya-* and *ārya-*, in Zend *airya-*, in Old Persian *ariya-*). That it is in any way connected with a Sanskrit word for earth, *ira*, as Max Müller asserts, is far from certain. As Spiegel remarks (*Die arische Periode*, p. 105), though it is easy enough to connect the word with a root *ar-*, there are several roots of that form which have different meanings, and there is no certain criterion whereby to decide to which of them it is related. Nor are the other connexions for the word outside this group free from doubt. It is, however, certain that the connexion with *Erin* (Ireland), which Pictet in his article "Iren and Arier" (Kuhn and Schleicher's *Beiträge*, i. 1858, pp. 81 ff.) sought to establish, is impossible (Whitley Stokes in Max Müller's *Lectures*, 1891, i. pp. 299 f.), though the word may have the same origin as the *Ario-* of names like *Ariovistus*, which is found in both Celtic and Germanic words (Uhlenbeck, *Kurzgefasstes etymologisches Wörterbuch der altindischen Sprache*, s.v.). The name of Armenia (Old Persian *Armina-*), which has often been connected, is of uncertain origin. Within Sanskrit itself probably two words have to be distinguished: (1) *árya*, the origin of Aryan, from which the usual term *ārya* is a derivative; (2) *aryá*, which frequently appears in the *Rig Veda* as an epithet of deities. In many passages, however, *aryás* may equally well be the genitive of *arí*, which is explained as "active, devoted, pious." Even in this word probably two originally separate words have to be distinguished, for the further meanings which Grassmann in his dictionary to the *Rig Veda* attaches to it, viz. "greedy" (for treasure and for battle), "godless," "enemy," seem more appropriately to be derived from the same source as the Greek *ἔρι-ς*, "strife." The word *árya-* is not found as a national name in the *Rig Veda*, but appears in the *Vājasaneyi-saṁhita*, where it is explained by Mahīdhara as *Vaiśya-*, a cultivator or a man of the third among the original four classes of the population. So in the *Atharva Veda* (iv. 20. 4; xix. 62. 1) it is contrasted with the Śudra or fourth class (Spiegel, *Arische Periode*, p. 102). In the *Avesta*, *airya-* is found both as adjective and substantive in the sense of Aryan, but no light is thrown upon the history of the word. Darius describes himself in an inscription as of Aryan stock, *Dāraya*^{h}*va*^{h}*uš ariya*^{h}*čiϑ*^{r}*a*^{h}. In the *Avesta* the derivative *airyana-* is also found in the sense of Aryan. In both India and Persia a word is found (Skt. *aryaman-*; Zend *airyaman-*) which is apparently of the same origin. In both Sanskrit and Zend it means something like "comrade" or "bosom friend," but in Zend is used of the priestly or highest class. In Sanskrit, besides this use in which it is contrasted with the *Dāsa* or *Dāsyu*, the enemies, the earlier inhabitants, the word is often used for the bridegroom's spokesman, and in both languages is also employed as the name of a divine being. In the *Rig Veda*, *Aryaman-* as a deity is most frequently coupled with Mitra and Varuna (Grassmann, *Wörterbuch*, s.v.); in Zend, according to Bartholomae (*Altiranisches Wörterbuch*, s.v.), from the earliest literature, the Gathas, there is nothing definite to be learnt regarding *Airyaman*.

Whatever the origin of *arya-*, however, it is clear that it is a word with dignified associations, by which the peoples belonging to the Eastern section of the Indo-Europeans were proud to call themselves. It is now used uniformly by scholars to indicate the Eastern branch as a whole, a compound, *Indo-Aryan*, being employed for that part of the Eastern branch which settled in India to distinguish them from the Iranians (*Iran* is of the same origin), who remained in Bactria and Persia, while *Aryo-Indian* is sometimes employed to distinguish the Indian people of this stock from the Dravidian and other stocks which also inhabit parts of the Indian peninsula. Of the stages in the occupation of the Iranian table-land by the Aryan people nothing is known, the people themselves having apparently no tradition of a time when they did not hold these territories (Spiegel, *Arische Periode*, p. 319). Though the Hindus have no tradition of their invasion of India, it is certain that they are not an indigenous people, and, if they are not, it is clear that they could have come in no other direction save from the other side of the Hindu Kush. At the period of their earliest literature, which may be assigned roughly to about 1000 B.C., they were still settled in the valley of the Indus, and at this time the separation probably had not long taken place, the Eastern portion of the stock having pushed their way along the Kabul valley into the open country of the Indus. According to Professor E. W. Hopkins (*India Old and New*, 1901, p. 31) the *Rig Veda* was composed in the district about Umballa. He argues that the people must have been then to the west of the great rivers, otherwise the dawn could not be addressed as one who "in shining light, before the wind arises, comes gleaming over the waters, making good paths." The vocabulary is still largely the same; whole sentences can be transliterated from one language to the other merely by making regular phonetic changes and without the variation of a single word (for examples see Bartholomae, *Handbuch der altiranischen Dialekte*, 1883, p. v.; Williams Jackson, *Avesta Grammar*, 1892, pp. xxxi. f.; *Grundriss der iranischen Philologie*, 1895, i. p. 1). It is noteworthy that it is those who remain behind whose language has undergone most change.

By four well-marked characteristics the Aryan group is easily distinguishable from the other Indo-European languages. (1) By the confusion of original *e* and *o*, both long and short, with the original long and short *a* sound; (2) the short schwa-sound *ə* is represented here, and in this group only, by *i* (*pita*, "father," as compared with *πατήρ*, &c.); (3) original *s* after *i*, *u* and some consonants becomes *ṣ*; (4) the genitive plural of stems ending in a vowel has a suffix-*nām* borrowed by analogy from the stems ending in *-n* (Skt. *áśvānām*, "of horses"; Zend *aspānām*; Old Persian *aspānām*). The distinctions between Sanskrit and Iranian are also clear. (1) The Aryan voiced aspirates *gh*, *dh*, *bh*, which survive in Sanskrit, are confused in Iranian with original *g*, *d*, *b*, and further changes take place in the language of the later parts of the Avesta; (2) the Aryan breathed aspirates *kh*, *th*, *ph*, except in combination with certain consonants, become spirants in Iranian; (3) Aryan *s* becomes *h* initially before vowels in Iranian and also in certain cases medially, Iranian in these respects resembling Greek (cf. Skt. *saptá*; Zend *hapta*; Gr. *ἑπτά*, "seven"); (4) in Zend there are many vowel changes which it does not share with Old Persian. Some of these arise from the umlaut or epenthesis which is so prevalent, and which we have already seen in *airya-* as compared with the Skt. *árya*. In other respects the languages are remarkably alike, the only striking difference being in the numeral "one"—Skt. *eka-*; Zend *aeva-*; Old Persian *aiva-*, where the Iranian group has the same stem as that seen in the Greek *οἶ(ϝ)ο-ς*, "alone."

For the subdivisions of the two groups see the articles on PERSIA: *Language*, and INDO-ARYAN LANGUAGES. Dr Grierson has shown in his monograph on "The Piśaca Languages of North-Western India" (Royal Asiatic Society, 1906) that there is good reason for regarding various dialects of the north-western frontier (Kafiristan, Chitral, Gilgit, Dardistan) as a separate group descended from Aryan but independent of either Sanskrit or Iranian.

The history of the separation of the Aryan from the other Indo-European languages is not yet clear (see INDO-EUROPEAN LANGUAGES). Various attempts have been made, with little success, to identify fragments of unknown languages in cuneiform inscriptions with members of this group. The investigation has entered a new and more favourable stage as the result of the discoveries made by German excavators at Boghaz Keui (said to be identical with Herodotus' Pteria in Cappadocia), where treaties between the king of the Hittites and the king of Mitanni, in the beginning of the 14th century B.C., seem almost certainly to contain the names of the gods Mitra, Varuna and Indra, which belong to the early Aryan mythology (H. Winckler, *Mitteilungen der deutschen Orientgesellschaft*, No. 35; E. Meyer, *Sitzungsberichte der Berliner Akademie*, 1908, pp. 14 ff.; *Zeitschrift für vergleichende Sprachforschung*, 42, 1908, pp. 24 ff.). Still further light is to be expected when the vast collections of the German expedition to Turfan (Turkestan) have been sifted. Up to 1909 only a preliminary account had been given of Tocharish, a hitherto unknown Indo-European language, which is reported to be in some respects more akin to the Western groups than to Aryan. But further investigation is still required (see E. Sieg and W. Siegling, "Tocharisch, die Sprache der Indoskythen," in *Sitzungsberichte der Berl. Akad.* (July 1908, pp. 915 ff.). (P. Gi.)

ARYA SAMAJ, a Hindu religious association with reforming tendencies, which was founded by a Guzerati Brahman named Dayanand Saraswati. This man was born of a Saivite family about 1825, but in early manhood grew dissatisfied with idol-worship. He undertook many pilgrimages and studied the Vedic philosophy in the hope of solving the old problem of the Buddha,—how to alleviate human misery and attain final liberation. About 1866, when he had begun to teach and to gather disciples, he first saw the Christian scriptures, which he vehemently assailed, and the *Rig Veda*, which he correspondingly exalted, though in the conception which he ultimately formed of God the former was much more influential than the latter. Dayanand's treatment of the Vedas was peculiar, and consisted of reading into them his own beliefs and modern scientific discoveries. Thus he explains the *Yajna* (sacrificial cult) as "the entertainment of the learned in proportion to their worth, the business of manufacture, the experiment and application of chemistry, physics and the arts of peace; the instruction of the people, the purification of the air, the nourishment of vegetables by the employment of the principles of meteorology, called *Agni-Notri* in Sanskrit." He denied that the *Vedas* warranted the caste system, but wished to retain the four grades as orders of learning to which admission should be won by examination.

These views naturally met with scanty acceptance among the Brahmans to whom he introduced them, and Dayanand turned to the masses and established *Samajes* in various parts of India, the first being at Bombay in 1875. He chose the epithet Arya as being more dignified than the slightly contemptuous term Hindu. After a successful series of tours, during which he debated publicly with orthodox pundits and with Christian missionaries, he died at Ajmere in 1883.

The Arya Samaj is not an eclectic system like the Brahma Samaj, which strives to find the common basis underlying all the great religions, and its narrower scope and corresponding intensity of conviction have won it a greater strength. It seemed to meet the feeling of many educated natives whose faith in current Hinduism was undermined, but who were predisposed against any foreign religious influence. Their patriotic ardour gladly seized on "a view of the original faith of India that seemed to harmonize with all the discoveries of modern science and the ethics of European civilization," and they cheerfully supported their leader's strange polemic with the agnostic and rationalist literature of Europe. By 1890 their numbers had increased to 40,000, by 1900 to over 92,000. Divisions had, however, set in, especially a cleavage into the *Ghasi* or vegetarian, and the *Mansi* or flesh-eating sections. To the latter belong those Rajputs who though generally in sympathy with the movement declined to adhere to the tenet of the *Samaj* which forbade the destruction of animal life and the consumption of animal food. The age of admission to the Samaj is eighteen, and members are expected to contribute to its funds at least 1% of their income.

The ten articles of their creed may be summarized thus:—

1. The source of all true knowledge is God.
2. God is "all truth, all knowledge, all bliss, boundless, almighty, just, merciful, unbegotten, without a beginning, incomparable, the support and Lord of all, all-pervading, omniscient, imperishable, immortal, eternal, holy, and the cause of the universe; worship is due to him alone.
3. The medium of true knowledge is the *Vedas*.
4. and 5. The truth is to be accepted and to become the guiding principle.
6. The object of the Samaj is to benefit the world by improving its physical, social, intellectual and moral conditions.
7. Love and justice are the right guides of conduct.
8. Knowledge must be spread.
9. The good of others must be sought.
10. In general interests members must subordinate themselves to the good of others; in personal interests they should retain independence.

The sixth clause comprehends a wide programme of reform, including abstinence from spirituous liquors and animal food, physical cleanliness and exercise, marriage reform, the promotion of female education, the abolition of caste and of idolatry.

ARYTENOID (or *arytaenoid*; from Gr. ἀρύταινα, a funnel or pitcher), a term, meaning funnel-shaped, applied to cartilages such as those of the larynx.

ARZAMAS, a town of Russia, in the government of, and 76 m. by rail S. of the town of, Nizhniy-Novgorod, on the Tesha river, at its junction with the Arsha. It is an important centre of trade, and has tanneries, oil, flour, tallow, dye, soap and iron works; knitting is an important domestic industry. Sheepskins and sail-cloth are articles of trade. The town has several churches. Pop. (1897) 10,591.

AS, the Roman unit of weight and measure, divided into 12 *unciae* (whence both "ounce" and "inch"); its fractions being deunx $\frac{11}{12}$, dextans $\frac{5}{6}$, dodrans $\frac{3}{4}$, bes $\frac{2}{3}$, septunx $\frac{7}{12}$, semis $\frac{1}{2}$, quincunx $\frac{5}{12}$, triens $\frac{1}{3}$, quadrans $\frac{1}{4}$, sextans $\frac{1}{6}$, sescuncia $\frac{1}{8}$, uncia $\frac{1}{12}$. *As* really denoted any integer or whole; whence the English word "ace." The unit or *as* of weight was the *libra* (pound: =about $11\frac{4}{5}$ oz. avoirdupois); of length, *pes* (foot: =about $11\frac{3}{5}$ in.); of surface, *jugerum* (=about $\frac{2}{3}$ acre); of measure, liquid *amphora* (about $5\frac{3}{5}$ gal.), dry *modius* (about $\frac{9}{10}$ peck). In the same way *as* signified a whole inheritance; whence *heres ex asse*, the heir to the whole estate, *heres ex semisse*, heir to half the estate. It was also used in the calculation of rates of interest.

As was also the name of a Roman coin, which was of different weight and value at different periods (see NUMISMATICS, § *Roman*). The first introduction of coined money is ascribed to Servius Tullius. The old *as* was composed of the mixed metal *aes*, an alloy of copper, tin and lead, and was called *as libralis*, because it nominally weighed 1 ℔ or 12 ounces (actually 10). Its original shape seems to have been an irregular oblong bar, which was stamped with the figure of a sheep, ox or sow. This, as well as the word *pecunia* for money (*pecus*, cattle), indicates the fact of cattle having been the earliest Italian medium of exchange. The value was indicated by little points or globules, or other marks. After the round shape was introduced, the one side was always inscribed with the figure of a ship's prow, and the other with the double head of Janus. The subdivisions of the *as* had also the ship's prow on one side, and on the other the head of some deity. The First Punic War having exhausted the treasury, the *as* was reduced to 2 oz. In the Second Punic War it was again reduced to half this weight, viz. to 1 oz. And lastly, by the Papirian law (89 B.C.) it was further reduced to the diminutive weight of half an ounce. It appears to have been still more reduced under Octavian, Lepidus and Antony, when its value was $\frac{1}{3}$ of an ounce. Before silver coinage was introduced (269 B.C.) the value of the *as* was about 6d., in the time of Cicero less than a halfpenny. In the time of the emperor Severus it was again lowered to about $\frac{5}{24}$ of an ounce. During the commonwealth and empire *aes grave* was used to denote the old *as* in contradistinction to the existing depreciated coin; while *aes rude* was applied to the original oblong coinage of primitive times.

ASA, in the Bible, son (or, perhaps, rather brother) of Abijah, the son of Rehoboam and king of Judah (1 Kings xv. 9-24). Of his long reign, during which he was a contemporary of Baasha, Zimri and Omri of Israel, little is recorded with the exception of some religious reforms and conflicts with the first-named. Baasha succeeded in fortifying Ramah (*er-Rām*), 5 m. north of Jerusalem, and Asa was compelled to use the residue of the temple-funds (cf. 1 Kings xiv. 26) to bribe the king of Damascus to renounce his league with Baasha and attack Israel. Galilee was invaded and Baasha was forced to return; the building material which he had collected at Ramah being used by Asa to fortify Geba, and Mizpah to the immediate north of Jerusalem. The Book of Chronicles relates a story of a sensational defeat of Zerah the "Cushite," and a great religious revival in which Judah and Israel took part (2 Chron. xiv.–xv. 15) (see CHRONICLES). Asa was succeeded by his son Jehoshaphat.

"Cushite" may designate an Ethiopian or, more probably, an Arabian (Cush, the "father" of the Sabaeans, Gen. x. 7). "If by Zerah the Ethiopian or Sabaean prince be meant, the only real difficulty of the narrative is removed. No king Zerah of Ethiopia is known at this period, nor does there seem to be room for such a person" (W. E. Barnes, *Cambridge Bible*, Chronicles, p. xxxi.). The identification with Osorkon I. or II. is scarcely tenable considering Asa's weakness; but inroads by desert hordes frequently troubled Judah, and if the tradition be correct in locating the battle at Mareshah it is probable that the invaders were in league with the Philistine towns. Similar situations recur in the reigns of Ahaz and Jehoram.

See also Wellhausen, *Prolegomena*, 208; S. A. Cook, *Expositor* (June 1906), p. 540 sq. (S. A. C.)

ASAFETIDA (*asa*, Lat. form of Persian *aza*=mastic, and *fetidus*, stinking, so called in distinction to *asa dulcis*, which was a drug highly esteemed among the ancients as *laser cyrenaicum*, and is supposed to have been a gummy exudation from *Thapsis garganica*), a gum-resin obtained principally from the root of *Ferula fetida*, and probably also from one or two other closely allied species of umbelliferous plants. It is produced in eastern Persia and Afghanistan, Herat and Kandahar being centres of the trade. *Ferula fetida* grows to a height of from 5 to 6 ft., and when the plant has attained the age of four years it is ready for yielding asafetida. The stems are cut down close to the root, and the juice flows out, at first of a milky appearance, but quickly setting into a solid resinous mass. Fresh incisions are made as long as the sap continues to flow, a period which varies according to the size and strength of the plant. A freshly-exposed surface of asafetida has a translucent, pearly-white appearance, but it soon darkens in the air, becoming first pink and finally reddish-brown. In taste it is acrid and bitter; but what peculiarly characterizes it is the strong alliaceous odour it emits, from which it has obtained the name asafetida, as well as its German name *Teufelsdreck* (devil's dung). Its odour is due to the presence of organic sulphur compounds. Asafetida is found in commerce in "lump" or in "tear," the latter being the purer form. Medicinally, asafetida is given in doses of 5 to 15 grains and acts as a stimulant to the intestinal and respiratory tracts and to the nervous system. An enema containing it is useful in relieving flatus. It is sometimes useful in hysteria, which is essentially a lack of inhibitory power, as its nasty properties induce sufficient inhibitory power to render its readministration superfluous. It may also be used in an effervescing draught in cases of malingering, the drug "repeating" in the mouth and making the malingering not worth while. The gum-resin is relished as a condiment in India and Persia, and is in demand in France for use in cookery. In the regions of its growth the whole plant is used as a fresh vegetable, the inner portion of the full-grown stem being regarded as a luxury.

ASAF-UD-DOWLAH, nawab wazir of Oudh from 1775 to 1797, was the son of Shuja-ud-Dowlah, his mother and grandmother being the begums of Oudh, whose spoliation formed one of the chief counts in the charges against Warren Hastings. When Shuja-ud-Dowlah died he left two million pounds sterling buried in the vaults of the zenana. The widow and mother of the deceased prince claimed the whole of this treasure under the terms of a will which was never produced. When Warren Hastings pressed the nawab for the payment of debt due to the Company, he obtained from his mother a loan of 26 lakhs of rupees, for which he gave her a *jagir* of four times the value; he subsequently obtained 30 lakhs more in return for a full acquittal, and the recognition of her *jagirs* without interference for life by the Company. These *jagirs* were afterwards confiscated on the ground of the begum's complicity in the rising of Chai Singh, which was attested by documentary evidence. The evidence now available seems to show that Warren Hastings did his best throughout to rescue the nawab from his own incapacity, and was inclined to be lenient to the begums.

See *The Administration of Warren Hastings, 1772–1785*, by G. W. Forrest (1892).

ASAPH, the eponym of the Asaphite gild of singers, one of the hereditary choirs that superintended the musical services of the temple at Jerusalem in post-exilic times. The names occur in the titles of certain Psalms, and the writer of the Book of Chronicles makes Asaph a seer (2 Chron. xxix. 30), contemporary with David and Solomon, and chief of the singers of his time.

ASBESTOS, a fibrous mineral from Gr. ἄσβεστος, unquenchable, by transference, incombustible, in allusion to its power of resisting the action of fire. The word was applied by Dioscorides and other Greek authors to quicklime, but Pliny evidently used it in its modern sense. It was occasionally woven by the ancients into handkerchiefs, and, it has been said, into shrouds which were used in cremation to prevent the ashes of the corpse from mingling with the wood-ashes of the pyre.

In different varieties of asbestos the fibres vary greatly in character. When silky and flexible they are sometimes known as mountain flax. The finer kinds are often termed amianthus (*q.v.*). When the fibres are naturally interwoven, so as to form a felted mass, the mineral passes under such trivial names as mountain leather, mountain cork, mountain paper, &c. The asbestos formerly used in the arts was generally a fibrous form of some kind of amphibole, like tremolite, or anthophyllite, though occasionally perhaps a pyroxene. In recent years, however, most of the asbestos in the market is a fibrous variety of serpentine, known mineralogically as chrysotile, and probably some of the ancient asbestos was of this character (see AMIANTHUS). Both minerals possess similar properties, so far as resistance to heat is concerned. The amphibole-asbestos, or hornblende-asbestos, is usually white or grey in colour, and may present great length of fibre, some of the Italian asbestos reaching exceptionally a length of 5 or 6 ft., but it is often harsh and brittle. The serpentine-asbestos occurs in narrow veins, yielding fibres of only 2 or 3 in. in length, but of great tensile strength: they are usually of a delicate silky lustre, very flexible and elastic, and of yellowish or greenish colour.

The Canadian asbestos, which of all kinds is at present the most important industrially, occurs in a small belt of serpentine in the province of Quebec, principally near Black Lake and Thetford, where it was first recognized as commercially valuable about 1877. The rock is generally quarried, cobbed by hand, dried if necessary, crushed in rock-breakers, and then passed between rollers; it is reduced to a finer state of division by so-called fiberizers, and graded on a shaking screen, where the loosened fibres are sorted. The process varies in different mills.

In the United States asbestos is worked only to a very limited extent. An amphibole-asbestos is obtained from Sall Mountain, Georgia; and asbestos has also been worked in the serpentine of Vermont. It occurs also in South Carolina, Virginia, Massachusetts, Arizona and elsewhere. Dr G. P. Merrill has shown that some asbestos results from a process of shearing in the rocks.

Formerly asbestos was obtained almost exclusively from Italy and Corsica, and a large quantity is still yielded by Italian workings. This is mostly an amphibole. It is in some cases associated with nodules of green garnet known as "seeds"—*Semenze dell' amianto*. Asbestos is widely distributed, but only in a few localities does it occur in sufficient abundance and purity to be worked commercially; it is found, for example, to a limited extent, at many localities in Tirol, Hungary and Russia; Queensland, New South Wales and New Zealand. In the British Isles it is not unknown, being found among the old rocks of North Wales and in parts of Ireland. Byssolite or asbestoid is a blue or green fibrous amphibole from Dauphiny.

The Asbestos Mountains in Griqualand West, Cape Colony, yield a blue fibrous mineral which is worked under the name of Cape asbestos. This is referable to the variety of amphibole called crocidolite (*q.v.*). It occurs in veins in slaty rocks, associated with jaspers and quartzites rich in magnetite and brown iron-ore. Their geological position is in the Griqua Town series, belonging to what are known in South Africa as the Pre-Cape rocks.

Asbestos was formerly spun and woven into fabrics as a rare curiosity. Charlemagne is said to have possessed a tablecloth of this material, which when soiled was purified by being thrown into the fire. At a meeting of the Royal Society in 1676 a merchant from China exhibited a handkerchief of "salamander's wool," or *linum asbesti*. By the Eskimos of Labrador asbestos has been used as a lamp-wick, and it received a similar application in some of the sacred lamps of antiquity. In recent times asbestos has been applied to a great variety of uses in the industrial arts, and its applications are constantly increasing. Its economic value depends not only on its power of withstanding a high temperature, but also on its low thermal conductivity and its partial resistance to the attack of acids: hence it is used for jacketing boilers and steam-pipes, and as a filtering medium for corrosive liquids. It has also come into use as an electric insulator. It is made into yarn, felt, millboard, &c., and is largely employed as packing for joints, glands and stopcocks in machinery. Fire-proof sheathing and felt are used for flooring and roofing; fire-proof curtains have been made for the stage, and even clothing for firemen. Asbestos enters into the composition of fire-proof cements, plasters and paints: it is used for packing safes; and is made into balls with fire-clay for gas-stoves. Various preparations of asbestos with other materials pass in trade under such names as uralite, salamandrite, asbestolith, gypsine, &c. "Asbestic" is the name given to a Canadian product formed by crushing the serpentine rock containing thin seams of asbestos, and mixing the result with lime so as to form a plaster.

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ASBJÖRNSEN, PETER CHRISTEN (1812–1885), and **MOE, JÖRGEN ENGEBRETSEN** (1813–1882), collectors of Norwegian folklore, so closely united in their life's work that it is unusual to name them apart. Asbjörnsen was born in Christiania on the 15th of January 1812; he belonged to an ancient family of the Gudbrandsdal, which is believed to have died with him. He became a student at the university in 1833, but as early as 1832, in his twentieth year, he had begun to collect and write down all the fairy stories and legends which he could meet with. Later he began to wander on foot through the length and breadth of Norway, adding to his stores. Moe, who was born at Mo i Hole parsonage, in Sigdal Ringerike, on the 22nd of April 1813, met Asbjörnsen first when he was fourteen years of age. A close friendship began between them, and lasted to the end of their lives. In 1834 Asbjörnsen discovered that Moe had started independently on a search for the relics of national folklore; the friends eagerly compared results, and determined for the future to work in concert. By this time, Asbjörnsen had become by profession a zoologist, and with the aid of the university made a series of investigating voyages along the coasts of Norway, particularly in the Hardanger fjord. Moe, meanwhile, having left Christiania University in 1839, had devoted himself to the study of theology, and was making a living as a tutor in Christiania. In his holidays he wandered through the mountains, in the most remote districts, collecting stories. In 1842–1843 appeared the first instalment of the great work of the two friends, under the title of *Norwegian Popular Stories* (*Norske Folkeeventyr*), which was received at once all over Europe as a most valuable contribution to comparative mythology as well as literature. A second volume was published in 1844, and a new collection in 1871. Many of the *Folkeeventyr* were translated into English by Sir George Dasent in 1859. In 1845 Asbjörnsen published, without help from Moe, a collection of Norwegian fairy tales (*huldreeventyr og folkesagn*). In 1856 the attention of Asbjörnsen was called to the deforestation of Norway, and he induced the government to take up this important question. He was appointed forest-master, and was sent by Norway to examine in various countries of the north of Europe the methods observed for the preservation of timber. From these duties, in 1876, he withdrew with a pension; he died in Christiania on the 6th of January 1885. From 1841 to 1852 Moe travelled almost every summer through the southern parts of Norway, collecting traditions in the mountains. In 1845 he was appointed professor of theology in the Military School of Norway. He had, however, long intended to take holy orders, and in 1853 he did so, becoming for ten years a resident chaplain in Sigdal, and then (1863) parish priest of Bragernes. He was moved in 1870 to the parish of Vestre Aker, near Christiania, and in 1875 he was appointed bishop of Christiansand. In January 1882 he resigned his diocese on account of failing health, and died on the following 27th of March. Moe has a special claim on critical attention in regard to his lyrical poems, of which a small collection appeared in 1850. He wrote little original verse, but in his slender volume are to be found many pieces of exquisite delicacy and freshness. Moe also published a delightful collection of prose stories for children, *In the Well and the Churn* (*I Bronde og i Kjærnet*), 1851; and *A Little Christmas Present* (*En liden Julegave*), 1860. Asbjörnsen and Moe had the advantage of an admirable style in narrative prose. It was usually said that the vigour came from Asbjörnsen and the charm from Moe, but the fact seems to be that from the long habit of writing in unison they had come to adopt almost precisely identical modes of literary expression. (E. G.)

ASBURY, FRANCIS (1745–1816), American clergyman, was born at Hamstead Bridge in the parish of Handsworth, near Birmingham, in Staffordshire, England, on the 20th of August 1745. His parents were poor, and after a brief period of study in the village school of Barre, he was apprenticed at the age of fourteen to a maker of "buckle chapes," or tongues. It seems probable that his parents were among the early converts of Wesley; at any rate, Francis became converted to Methodism in his thirteenth year, and at sixteen became a local preacher. He was a simple, fluent speaker, and was so successful that in 1767 he was enrolled, by John Wesley himself, as a regular itinerant minister. In 1771 he volunteered for missionary work in the American colonies. When he landed in Philadelphia in October 1771, the converts to Methodism, which had been introduced into the colonies only three years before, numbered scarcely 300. Asbury infused new life into the movement, and within a year the membership of the several congregations was more than doubled. In 1772 he was appointed by Wesley "general assistant" in charge of the work in America, and although superseded by an older preacher, Thomas Rankin (1738–1810), in 1773, he remained practically in control. After the outbreak of the War of Independence, the Methodists, who then numbered several thousands, fell, unjustly, under suspicion of Loyalism, principally because of their refusal to take the prescribed oath; and many of their ministers, including Rankin, returned to England. Asbury, however, feeling his sympathies and duties to be with the colonies, remained at his post, and although often threatened, and once arrested, continued his itinerant preaching. The hostility of the Maryland authorities, however, eventually drove him into exile in Delaware, where he remained quietly, but not in idleness, for two years. In 1782 he was reappointed to supervise the affairs of the Methodist congregations in America. In 1784 John Wesley, in disregard of the authority of the Established Church, took the radical step of appointing the Rev. Thomas Coke (1747–1814) and Francis Asbury superintendents or "bishops" of the church in the United States. Dr Coke was ordained at Bristol, England, in September, and in the following December, in a conference of the churches in America at Baltimore, he ordained and consecrated Asbury, who refused to accept the position until Wesley's choice had been ratified by the conference. From this conference dates the actual beginning of the "Methodist Episcopal Church of the United States of America." To the upbuilding of this church Asbury gave the rest of his life, working with tireless devotion and wonderful energy. In 1785, at Abingdon, Maryland, he laid the corner-stone of Cokesbury College, the project of Dr Coke and the first Methodist Episcopal college in America; the college building was burned in 1795, and the college was then removed to Baltimore, where in 1796, after another fire, it closed, and in 1816 was succeeded by Asbury College, which lived for about fifteen years. Every year Asbury traversed a large area, mostly on horseback. The greatest testimony to the work that earned for him the title of the "Father of American Methodism" was the growth of the denomination from a few scattered bands of about 300 converts and 4 preachers in 1771, to a thoroughly organized church of 214,000 members and more than 2000 ministers at his death, which occurred at Spottsylvania, Virginia, on the 31st of March 1816.

His *Journals* (3 vols., New York, 1852), apart from their importance as a history of his life work, constitute a valuable commentary on the social and industrial history of the United States during the first forty years of their existence. Consult also F. W. Briggs, *Bishop Asbury* (London, 1874); W. P. Strickland, *The Pioneer Bishop; or, The Life and Times of Francis Asbury* (New York, 1858); J. B. Wakeley, *Heroes of Methodism* (New York, 1856); W. C. Larrabee, *Asbury and His Co-Laborers* (2 vols., Cincinnati, 1853); H. M. Du Bose, *Francis Asbury* (Nashville, Tenn., 1909); see also under METHODISM.

ASBURY PARK, a city of Monmouth county, New Jersey, U.S.A., on the Atlantic Ocean, about 35 m. S. of New York City (50 m. by rail). Pop. (1900) 4148; (1905) 4526; (1910) 10,150.

It is served by the Central of New Jersey and the Pennsylvania railways, and by electric railway lines connecting it with other New Jersey coast resorts both north and south. Fresh-water lakes, one of which, Deal Lake, extends for some distance into the wooded country, form the northern and southern boundaries. It is one of the most popular seaside resorts on the Atlantic coast, its numerous hotels and cottages accommodating a summer population that approximates 50,000, and a large transient population in the autumn and winter months. There is an excellent beach, along which extends a board-walk about 1 m. long; the beach is owned and controlled by the municipality. The municipality owns and operates its water-works, water being obtained from artesian wells. Asbury Park was founded in 1869, was named in honour of the Rev. Francis Asbury, was incorporated as a borough in 1874, and was chartered as a city in 1897. In 1906 territory to the west with a population estimated at 6000 was annexed.

ASCALON, now ʽAsḳalān, one of the five chief cities of the Philistines, on the coast of the Mediterranean, 12 m. N. of Gaza. The place is mentioned several times in the Tell el-Amarna correspondence. It revolted from Egypt on two occasions, but was reconquered, and a sculpture at Thebes depicts the storming of the city. Ascalon was a well-fortified town, and the seat of the worship of the fish-goddess Derketo. Though situated in the nominal territory of the tribe of Judah, it was never for any length of time in the possession of the Israelites. The only incident in its history recorded in the Bible (the spoliation by Samson, Judg. xiv. 19) may possibly have actually occurred at another place of the same name, in the hill country of Judaea. Sennacherib took it in 701 B.C. The conquest of Alexander hellenized its civilization, and after his time it became tributary alternately to Syria and Egypt. Herod the Great was a native of the city, and added greatly to its beauty; but it suffered severely in the later wars of the Romans and Jews. In the 4th century it again rose to importance; and till the 7th century, when it was conquered by the Moslems, it was the seat of a bishopric and a centre of learning. During the first crusade a signal victory was gained by the Christians in the neighbouring plain on the 15th of August 1099; but the city remained in the hands of the caliphs till 1157, when it was taken by Baldwin III., king of Jerusalem, after a siege of five months. By Baldwin IV. it was given to his sister Sibylla, on her marriage with William of Montferrat in 1178. When Saladin (1187) had almost annihilated the Christian army in the plain of Tiberias, Ascalon offered but a feeble resistance to the victor. At first he repaired and strengthened its fortifications, but afterwards, alarmed at the capture of St Jean d'Acre (Acre) by Richard Cœur de Lion in 1191, he caused it to be dismantled. It was restored in the following year by the English king, but only to be again abandoned. From this time Ascalon lost much of its importance, and at length, in 1270, its fortifications were almost totally destroyed by Sultan Bibars, and its port was filled up with stones. The place is now a desolate heap of ruins, with remains of its walls and fragments of granite pillars. The surrounding country is well watered and very fertile.

See a paper by Guthe, "Die Ruinen Ascalons," in the *Zeitschrift* of the Deutsche Palästina-Verein, ii. 164 (translated in Palestine Exploration Fund *Quarterly Statement*, 1880, p. 182). See also C. R. Conder in the latter journal, 1875, p. 152. (R. A. S. M.)

ASCANIUS, in Roman legend, the son of Aeneas by Creüsa or Lavinia. From Livy it would appear that tradition recognized two sons of Aeneas called by this name, the one the son of his Trojan, the other of his Latin wife. According to the usual account, he accompanied his father to Italy on his flight from Troy. On the death of Aeneas, the government of Latium was left in the hands of Lavinia, Ascanius being too young to undertake it. After thirty years he left Lavinium, and founded Alba Longa. Ascanius was also called Ilus and Iulus, and the Julian gens claimed to be descended from him. Several more or less contradictory traditions may be found in Dionysius of Halicarnassus, Strabo and other writers.

Virg. *Aen.* ii. 666; Livy i. 3; see also Klausen, *Aeneas und die Penaten* (1840).

ASCENSION, an island in the Atlantic Ocean, between 7° 53′ and 8° S., and 14° 18′ and 14°26′ W., 800 m. N.W. of St Helena, about $7\frac{1}{2}$ m. in length and 6 in breadth, with an area of 38 sq. m. and a circumference of about 22 m. The island lies within the immediate influence of the south-east trade-wind. The lee side of the island is subject to the visitation of "rollers," which break on the shore with very great violence. Ascension is a volcanic mass erected on a submarine platform. Numerous cones exist. Green Mountain, the principal elevation, is a huge elliptical crater, rising 2820 ft. above the sea, while the plains or table-lands surrounding it vary in height from 1200 to 2000 ft. On the north side they sweep gradually down towards the shore, but on the south they terminate in bold and lofty precipices. Steep and rugged ravines intersect the plains, opening into small bays or coves on the shore, fenced with masses of compact and cellular lava; and all over the island are found products of volcanic action. Ascension was originally destitute of vegetation save on the summit of Green Mountain, which owes its verdure to the mists which frequently enshroud it, but the lower hills have been planted with grasses and shrubs. The air is clear and light, and the climate remarkably healthy, notwithstanding the high temperature—the average day temperature on the shore being 85° F., on Green Mountain 75° F. The average rainfall is about 20 in., March and April being the rainy months. Ascension is noted for the number of turtles and turtle eggs found on its shores, the season lasting from December to May or June. The turtles are caught and kept in large ponds. The coasts abound with a variety of fish of excellent quality, of which the most important are the rock-cod, the cavalli, the conger-eel and the "soldier." Numbers of sheep are bred on the island, and there are a few cattle and deer, besides goats and wild cats. Feathered game is abundant. Like St Helena, the island does not possess any indigenous vertebrate land fauna. The "wideawake" birds frequent the island in large numbers, and their eggs are collected and eaten. Beetles and land-shells are well represented. Flies, ants, mosquitoes, scorpions, centipedes and crickets abound. The flora includes purslane, rock roses and several species of ferns and mosses.

The island was discovered by the Portuguese navigator, João da Nova, on Ascension Day 1501, and was occasionally visited thereafter by ships. In 1701 William Dampier was wrecked on its coast, and during his detention discovered the only spring of fresh water the island contains. Ascension remained uninhabited till after the arrival of Napoleon at St Helena (1815), when it was taken possession of by the British government, who sent a small garrison thither. A settlement, named George Town (locally known as Garrison), was made on the north-west coast, water being obtained from "Dampier's" springs in the Green Mountain, 6 m. distant. The island is under the rule of the admiralty, and was likened by Darwin to "a huge ship kept in first-rate order." It is governed by a naval captain borne on the books of the flagship of the admiral superintendent at Gibraltar. A depot of stores for the navy is maintained, but the island is used chiefly as a sanatorium. Ascension is connected by cable with Europe and Africa, and is visited once a month by mail steamers from the Cape. Formerly letters were left by passing ships in a crevice in one of the rocks. The population, about 300, consists of seamen, marines, and Krumen from Liberia.

See *Africa Pilot*, part ii., 5th ed. (London, 1901); C. Darwin, *Geological Observations on the Volcanic Islands visited during the Voyage of H.M.S. "Beagle"* (London, 1844); *Report of the Scientific Results of the Voyage of the "Challenger,"* vol. i. part 2 (London, 1885); and *Six Months in Ascension*, by Mrs Gill (London, 1878), an excellent sketch of the island and its inhabitants. It was at Ascension that Mr, afterwards Sir, David Gill determined, in 1877, the solar parallax.

ASCENSION, FEAST OF THE, one of the oecumenical festivals of the Christian Church, ranking in solemnity with those of Christmas, of Easter and of Pentecost. It is held forty days after Easter, or ten days before Whitsunday, in celebration of Christ's ascension into heaven forty days after the resurrection. It always falls on a Thursday, and the day is known as Ascension Day, or Holy Thursday. The festival is of great antiquity; and though there is no discoverable trace of it before the middle of the 4th century, subsequent references to it assume its long establishment. Thus St Augustine (*Ep.* 54 *ad Januar.*) mentions it as having been kept from time immemorial and as probably instituted by the apostles. Chrysostom, in his homily on the ascension, mentions a celebration of the festival in the church of Romanesia outside Antioch, and Socrates (*Hist. eccles.* vii. 26) records that in the year 390 the people of Constantinople "of old custom" (ἐξ ἔθους) celebrated the feast in a suburb of the city. As these two references suggest, the festival was associated with a professional pilgrimage, in commemoration of the passing of Christ and his apostles to the Mount of Olives; such a procession is described by Adamnan, abbot of Iona, as taking place at Jerusalem in the 7th century, when the feast was celebrated in the church on Mount Olivet (*de loc. sanct.* i. 22). The *Peregrinatio* of Etheria (Silvia), which dates from *c.* A.D. 385, says that the festival was held in the Church of the Nativity at Bethlehem (Duchesne, *Chr. Worship*, p. 515). In the West, however, in the middle ages, the procession with candles and banners outside the church was taken as symbolical of Christ's triumphant entry into heaven.

In the East the festival is known as the ἀνάληψις, "taking up," or ἐπισωζομένη, a term first used in the Cappadocian church, and of which the meaning has been disputed, but which probably signifies the feast "of completed salvation." The word *ascensio*, adopted in the West, implies the ascension of Christ by his own power, in contradistinction to the *assumptio*, or taking up into heaven of the Virgin Mary by the power of God.

In the Roman Catholic Church the most characteristic ritual feature of the festival is now the solemn extinction of the paschal candle after the Gospel at high mass. This candle, lighted at every mass for the forty days after Easter, symbolizes the presence of Christ with his disciples, and its extinction his parting from them. The custom dates from 1263, and was formerly confined to the Franciscans; it was prescribed for the universal church by the Congregation of Rites on the 19th of May 1697. Other customs, now obsolete, were formerly associated with the liturgy of this feast; *e.g.* the blessing of the new beans after the Commemoration of the Dead in the canon of the mass (Duchesne, p. 183). In some churches, during the middle ages, an image of Christ was raised from the altar through a hole in the roof, through which a burning straw figure representing Satan was immediately thrown down.

In the Anglican Church Ascension Day and its octave continue to be observed as a great festival, for which a special preface to the consecration prayer in the communion service is provided, as in the case of Christmas, Easter, Whitsunday, and Trinity Sunday. The celebration of the Feast of the Ascension was also retained in the Lutheran churches as warranted by Holy Scripture.

See Herzog-Hauck, *Realencyklopädie* (1900), s. "*Himmelfahrtsfest*"; L. Duchesne, *Christian Worship* (2nd Eng. ed., London, 1904); *The Catholic Encyclopaedia* (London and New York, 1907).

ASCETICISM, the theory and practice of bodily abstinence and self-mortification, generally religious. The word is derived from the Gr. verb ἀσκέω, "I practise," whence the noun ἄσκησις and the adjective ἀσκητικός; and it embodies a metaphor taken from the ancient wrestling-place or palaestra, where victory rewarded those who had best trained their bodies. Not a few other technical terms of Greek philosophic asceticism, used in the first instance by Cynics and Neo-pythagoreans, and then continued among the Greek Jews and Christians, were metaphors taken from athletic contests—but only metaphors, for all asceticism, worthy of the name, has a moral purport, and is based on the eternal contrast of the proposition, "This is right," with the proposition, "That is pleasant." The ascetic instinct is probably as old as humanity, yet we must not forget that early religious practices are apt to be deficient in lofty spiritual meaning, many things being esteemed holy that are from a modern point of view trifling and even obscene. We may therefore expect in primitive asceticism to find many abstentions and much self-torture apparently valueless for the training of character and discipline of the feelings, which are the essence of any healthy asceticism. Nevertheless these non-moral *taboos* or restraints may have played a part in building up in us that faculty of preferring the larger good to the impulse of the moment which is the note of real civilization. Aristotle in his *Ethics* defines, as the barbarian's ideal of life, "the living as one likes." Yet nothing is less true; for the savage, more than the civilized man, is tied down at every step with superstitious scruples and restrictions barely traceable in higher civilizations except as primitive survivals. It is not that savages are devoid of the ascetic instinct. It is on the contrary over-developed in them, but ill-informed and working in ways unessential or even morally harmful. It is the note of every great religious reformer, Moses, Buddha, Paul, Mani, Mahomet, St Francis, Luther, to enlighten and direct it to higher aims, substituting a true personal holiness for a ritual purity or *taboo*, which at the best was viewed as a kind of physical condition and contagion, inherent as well in things and animals as in man.

It is useful, therefore, in a summary sketch of asceticism, to begin with the facts as they can be observed among less advanced races, or as mere survivals among people who have reached the level of genuine moral reflection; and from this basis to proceed to a consideration of self-denial consciously pursued as a method of ethical perfection. The latter is as a rule less cruel and rigorous than primitive forms of asceticism. Under this head fall the following:—Fasting, or abstention from certain meats and drinks; denial of sexual instinct; subjection of the body to physical discomforts, such as nakedness, vigils, sleeping on the bare ground, tattooing, deformation of skull, teeth, feet, &c., vows of silence to be observed throughout life or during pilgrimages, avoidance of baths, of hair-cutting and of clean raiment, living in a cave; actual self-infliction of pain, by scourging, branding, cutting with knives, wearing of hair shirts, fire-walking, burial alive, hanging up of oneself by hooks plunged into the skin, suspension of weights by such hooks to the tenderer parts of the body, self-mutilation and numerous other, often ingenious, modes of torture. Such customs repose on various superstitions; for example, the self-mutilation of the Galli or priests of Cybele was probably a magical ceremony intended to fertilize the soil and stimulate the crops. Others of the practices enumerated, probably the greater part of them, spring from demonological beliefs.

Fasting (*q.v.*) is used in primitive asceticism for a variety of reasons, among which the following deserve notice. Certain animals and vegetables are *taboo*, *i.e.* too holy, or—what among Semites and others was the same thing—too defiling and unclean, to be eaten. Thus in Leviticus xi. the Jews are forbidden to eat animals other than cloven-footed ruminants; thus the camel, coney, hare and swine were forbidden; so also any water organisms that had not fins and scales, and a large choice of birds, including swan, pelican, stork, heron and hoopoe. All winged creeping things that have four feet were equally abominable. Lastly, the weasel, mouse and most lizards were *taboo*. All or nearly all of these were at one time totem animals among one or another of the Semitic tribes, and were not eaten because primitive men will not eat animals between which and themselves and their gods they believe a peculiar tie of kinship to exist. Men do not eat an animal for which they have a reverential dread, or if they eat it at all, it is only in a sacramental feast and in order to absorb into themselves its life and holy properties. Such abstinences as the above, though based on *taboo*, that is, on a reluctance to eat the totem or sacred animal, are yet ascetic in so far as they involve much self-denial. No flesh is more wholesome or succulent than beef, yet the Egyptians and Phoenicians, says Porphyry (*de Abst.* ii. 11), would rather eat human flesh than that of the cow, and so would two hundred and fifty millions of modern Hindus. The privation involved in abstention from the flesh of the swine, a *taboo* hardly less widespread, is obvious.

Similar prohibitions are common in Africa, where fetish priests are often reduced to a diet of herbs and roots. That such dietary restrictions were merely ceremonial and superstitious, and not intended to prevent the consumption of meats which would revolt modern tastes, is certain from the fact that the Levitical law freely allowed the eating of locusts, grasshoppers, crickets and cockroaches, while forbidding the consumption of rabbits, hares, storks, swine, &c. The Pythagoreans were forbidden to eat beans.

Another widespread reason for avoiding flesh diet altogether was the fear of absorbing the irrational soul of the animal, which especially resided in the blood. Hence the rule not to eat meats strangled, except in sacramental meals when the god inherent in the animal was partaken of. It is equally a soul or spirit in wine which inspires the intoxicated; the old Egyptian kings avoided wine at table and in libations, because it was the blood of rebels who had fought with the gods, and out of whose rotting bodies grew the vines; to drink the blood was to imbibe the soul of these rebels, and the frenzy of intoxication which followed was held to be possession by their spirits. The medieval Jews also held that there is a cardiac demon in wine which takes possession of drunken men; and the Mahommedan prohibition of wine-drinking is based on a similar superstition. The avoidance of wine, therefore, by Rechabites, Nazirites, Arab dervishes and Pythagoreans, and also of leaven in bread, is parallel to and explicable in the same way as abstention from flesh. Porphyry (*de Abst.* i. 19) acquaints us with another widespread scruple against flesh diet. It was this, that the souls of men transmigrated into animals, so that if you ate these, you might consume your own kind, cannibal-wise. Contemporary meat-eaters set themselves to combat this prejudice, and argued that it was a pious duty to kill animals and so release the human souls imprisoned. In the same tract Porphyry relates (ii. 48) how wizards acquired the mantic powers of certain birds, such as ravens and hawks, by swallowing their hearts. The soul of the bird, he explains, enters them with its flesh, and endows them with power of divination. The lover of wisdom, who is priest of the universal God, rather than risk the taking into himself of inferior souls and polluting demons, will abstain from eating animals. Such is Porphyry's argument.

The same fear of imbibing the irrational soul of animals, and thereby reinforcing the lower appetites and instincts of the human being, inspired the vegetarianism of Apollonius of Tyana and of the Jewish Therapeutae, who in their sacred meals were careful to have a table free from blood-containing meats; and the fear of absorbing the animal's psychic qualities equally motived the Jewish and early Christian rule against eating things strangled. It was an early belief, which long survived among the Manichaean sects, that fish, being born in and of the waters, and without any sexual connexion on the part of other fishes are free from the taint which pollutes all animals *quae copulatione generantur.* Fish, therefore, unlike flesh, could be safely eaten. Here we have the origin of the Catholic rule of fasting, seldom understood by those who observe it. The same scruple against flesh-eating is conveyed in the beautiful confession, in the *Cretans* of Euripides, of one who had been initiated in the mysteries of Orpheus and became a "Bacchos." The last lines of this, as rendered by Dr Gilbert Murray, are as follows:—

> "Robed in pure white, I have borne me clean
> From man's vile birth and coffined clay,
> And exiled from my lips alway
> Touch of all meat where life hath been."

This Orphic fast from meat was only broken by an annual sacramental banquet, originally, perhaps, of human, but later of raw bovine flesh.

The Manichaeans held that in every act of begetting, human or otherwise, a soul is condemned afresh to a cycle of misery by imprisonment in flesh—a thoroughly Indian notion, under the influence of which their perfect or elect ones scrupulously abstained from flesh. The prohibition of taking life, which they took over from the Farther East, in itself entailed fasting from flesh. A fully initiated Manichaean would not even cut his own salad, but employed a catechumen to commit on his behalf this act of murder, for which he subsequently shrived him.

We come to a third widespread reason for fasting, common among savages. Famished persons are liable to morbid excitement, and fall into imaginative ecstasies, in the course of which they see visions and spectres, converse with gods and angels, and are the recipients of supernatural revelations. Accordingly King Saul "ate no bread all the day nor all the night" in which the witch of Endor revealed to him the ghost of Samuel. Weak and famished, he hardly wanted to eat the fatted calf when the vision was over. Among the North American Indians ecstatic fasting is regularly practised. A faster writes down his visions and revelations for a whole season. They are then examined by the elders of the tribe, and if events have verified them, he is recognized as a supernaturally gifted being, and rewarded with chieftaincy. All over the world fasting is a recognized mode of evoking, consulting and also of overcoming the spirit world. This is why the Zulus and other primitive races distrust a medicine man who is not an ascetic and lean with fasting. In the Semitic East it is an old belief that a successful fast in the wilderness of forty days and nights gives power over the Djinns. The Indian *yogi* fasts till he sees face to face all the gods of his Pantheon; the Indian magician fasts twelve days before producing rain or working any cure. The Bogomils fasted till they saw the Trinity face to face. From the first, fasting was practised in the church for similar reason. In the *Shepherd of Hermas* a vision of the church rewards frequent fasts and prayer; and it is related in extra-canonical sources that James the Less vowed that he would fast until he too was vouchsafed a vision of the risen Lord. After a long and rigorous fast the Lord appeared to him. Not a few saints were rewarded for their fasting by glimpses of the beatific vision. Dr Tylor writes on this point as follows (*Prim. Cult.* ii. 415): "Bread and meat would have robbed the ascetic of many an angel's visit: the opening of the refectory door must many a time have closed the gates of heaven to his gaze."

Among the Semites and Tatars worshippers lacerate themselves before the god. So in 1 Kings xviii. 28 the priests of Baal engaged in a rain-making ceremony, gashed themselves with knives and lances till the blood gushed out upon them. The Syriac word *ethkashshaph*, which means literally to "cut oneself," is the regular equivalent of to "make supplication." Among Greeks and Arabs, mourners also cut themselves with knives and scratched their faces; the Hebrew law forbade such mourning, and we find the prohibition repeated in many canons of the Eastern churches. At first sight these rites seem intended to call down the pity of heaven on man, but as Robertson Smith points out, their real import was by shedding blood on a holy stone or in a holy place to tie or renew a blood-bond between the God and his faithful ones. We have no clear information about the mind of the Flagellants, who in 1259, and again in 1349, swarmed through the streets of European cities, naked and thrashing themselves, till the blood ran, with leather thongs and iron whips. They were penitents, and no doubt imbued with the ancient belief that without the shedding of blood there is no remission of sins.

Asceticism then in its origin was usually not ascetic in a modern sense, that is, not ethical. It was rather of the nature of the savage *taboo* (*q.v.*), the outcome of totemistic beliefs or a mode of averting the contaminating presence of djinns and demons. Above all, fasting was a mode of preparing oneself for the sacramental eating of a sacred animal, and as such often assisted by use of purgatives and aperients. It was essential in the old Greek rites of averting the *Kêres* or djinns, the ill regulated ghosts who return to earth and molest the living, to abstain from flesh. The Pythagoreans and Orphic *mystae* so abstained all their life long, and Porphyry eloquently insists on such a discipline for all who "are not content merely to talk about Reason, but are really intent on casting aside the body and living through Reason with Truth. Naked and without the tunic of the flesh these will enter the arena and strive in the Olympic contest of the soul."

It is time to pass on to Buddhist asceticism, in its essence a more ethical and philosophical product than some of the forms so far considered. The keynote of Buddhist asceticism is deliverance from life and its inevitable suffering. Once at a village where he rested the Blessed One (Buddha) addressed his brethren and said: “ It is through not understanding and grasping four Noble Truths, O brethren, that we have had to run so long, to wander so long in this weary path of transmigration, both you and I.” These noble truths were about sorrow, its cause, its cessation and the path which leads to that cessation. Once they are grasped the craving for existence is rooted out, that which leads to renewed existence is destroyed, and there is no more birth. The Buddha believed he had a way of Truth, which if an elect disciple possessed he might say of himself, “ Hell is destroyed for me, and rebirth as an animal, or a ghost, or in any place of woe. I am converted, I am no longer liable to be reborn in a state of suffering, and am assured of final salvation.”

Suffering, said the sage in his great sermon at Benares, is inseparable from birth and old age. Sickness is suffering, so is death, so is union with the unloved, and separation from the loved; not to obtain what one desires is suffering; the entire fivefold clinging to the earthly is suffering. Its origin is the thirst for being which leads from birth to birth, together with lust and desire, which find gratification here and there; the thirst for pleasures, for being, for power. This thirst must be extinguished by complete annihilation of desire, by letting it go, expelling it, separating oneself from it, giving it no room. This extinction is achieved in eight ways, namely rectitude of faith, resolve, speech, action, living, effort, thought, self-concentration.

In this gospel we must be done with the outer world, participation in which is not the self, yet means for the self birth and death, appetites, longings, emotions, change and suffering, pleasure and pain. He that has put off all lust and desire, all hope and fear, all will to exist as a sinful, because a sentient, being, has won to the heaven of extinction or Nirvāna. He may still tread the earth, but he is a saint or Brahman, is in heaven, has quitted the transient and enjoys eternity.

Such was the Buddha’s gospel, as his most ancient scriptures enunciate it. Nirvāna is constantly defined in them as supreme happiness. It is not even clear how far, if we interpret it strictly, this philosophy leaves any self to be happy. However this be, its practical expression is the life of the monk who has separated himself from the world. Five commandments must be observed by him who would even approach the higher life of saint and ascetic. They are these: to kill no living thing; not to lay hands on another’s property; not to touch another’s wife; not to speak what is untrue; not to drink intoxicating drinks.

Though couched in the negative, these rules must be interpreted in the amplest and widest sense by all believers. The Order, however, which the would-be ascetic can enter by regular initiation, when he is twenty years of age, entails a discipline much more severe. He has gone forth from home into homelessness, and has not where to lay his head. He must eat only the morsels he gets by begging; must dress in such rags as he can pick up; must sleep under trees. Mendicancy is his recognized way of life. Furthermore, he must abstain all his life from sexual intercourse; he may not take even a blade of grass without permission of the owner; he must not kill even a worm or ant; he must not boast of his perfection. In practice the lives of Buddhist monks are not so squalid as these rules would lead us to suppose. Thanks to the reverent charity of the laymen, they do not live much worse than Benedictine monks; and the prohibition to live in houses does not extend to caves. Everywhere in India and Ceylon they hollowed out cells and churches in the cliffs and rocks, which are the wonder of the European tourist.

But long before the advent of Buddhism, the hermit, or wandering beggar, was a familiar figure in India. No formal initiation was imposed on the would-be ascetic, save (in the case of young men) the duty to live at first in his teacher’s house. One who had thus fulfilled the duties of the student order must “ go forth remaining chaste,” says the *Āpastamba*, ii. 9. 8. He shall then “ live without a fire, without a house, without pleasures, without protection; remaining silent and uttering speech only on the occasion of the daily recitation of the Veda; begging so much food only in the village as will sustain his life, he shall wander about, neither caring for this world nor for heaven. He shall only wear clothes thrown away by others. Some declare that he shall even go naked. Abandoning truth and falsehood, pleasure and pain, the Vedas, this world and the next, he shall seek the Universal Soul, in knowledge of which standeth eternal salvation.”

Such a life was specially recommended for one who has lived the life of a householder, and, having begotten sons according to the sacred law and offered sacrifices, desires in his old age to abandon worldly objects and direct his mind to final liberation. He leaves his wife, if she will not accompany him, and goes forth into the forest, committing her and his house to his sons. He must indeed take with him the sacred fire and implements for domestic sacrifice, but until death overtakes him he must wander silent, alone, possessing no hearth nor dwelling, begging his food in the villages, firm of purpose, with a potsherd for an alms bowl, the roots of trees for a dwelling, and clad in coarse worn-out garments. “ Let him not desire to die, let him not desire to live; let him wait for his appointed time, as a servant waits for the payment of his wages. Let him drink water purified by straining with a cloth, let him utter speech purified by truth, let him keep his heart pure. Let him patiently bear hard words, let him not insult anybody, let him not become any one’s enemy for the sake of this perishable body. . . . Let him reflect on the transmigrations of men, caused by their sinful deeds, on their falling into hell, and on their torments in the world of Yama. . . . A twice-born man who becomes an ascetic thus shakes off sin here below and reaches the highest Brahman ” (*Laws of Manu*, by G. Bühler, vi. 85).

This old-world wisdom of the Hindus, a thousand years before our era, is worthily to be paralleled from the Manichaeism of about the year 400. Augustine has preserved (*contra Faustum*, v. 1) the portraiture of a Manichaean elect as drawn by himself:—

> “ I have given up father and mother, wife, children and all else that the gospel bids us, and do you ask if I accept the gospel? Are you then still ignorant of what the word gospel means? It is nothing else than the preaching and precept of Christ. I have cast away gold and silver, and have ceased to carry even copper in my belt, being content with my daily bread, nor caring for the morrow, nor anxious how my belly shall be filled or my body clothed; and do you ask me if I accept the gospel? You behold in me those beatitudes of Christ which make up the gospel, and you ask me if I accept it. You behold me gentle, a peacemaker, pure of heart, a mourner, hungering, thirsting, bearing persecutions and hatreds for righteousness’ sake, and do you doubt whether I accept the gospel. . . . All that was mine I have given up, father, mother, wife, children, gold, silver, eating, drinking, delights, pleasures. Deem this a sufficient answer to your question and deem yourself on the way to be blessed, if you have not been scandalized in me.”

The Greek Cynics (see CYNICS) played a great part in the history of Asceticism, and they were so much the precursors of the Christian hermits that descriptions of them in profane literature have been mistaken for pictures of early monasticism. In striving to imitate the rugged strength and independence of their master Socrates, they went to such extremes as rather to caricature him. They affected to live like beggars, bearing staff and wallet, owning nothing, renouncing pleasures, riches, honours. For older thinkers like Plato and Aristotle the perfect life was that of the citizen and householder; but the Cynics were individualists, citizens of the world without loyalty or respect for the ancient city state, the decay of which was coincident with their rise. Their zeal for renunciation often extended not to pleasures, marriage and property alone, but to cleanliness, knowledge and good manners as well, and in this respect also they were the forerunners of later monks.

Philo (20 B.C.–A.D. 40) has left us many pictures of the life which to his mind impersonated the highest wisdom, and they are all inspired by the more respectable sort of cynicism, which had taken deep root among Greek Jews of the day. One such picture merits citation from his tract *On Change of Names* (vol. i. 583, ed. Mangey): “ All this company of the good and wise have of their own free will divested themselves of too copious wealth; nay, have spurned the things dear to the flesh. For of good habit and lusty are athletes, since they have fortified against the soul the body which should be its servant; but the disciples of wisdom are pale and wasted, and in a manner reduced to skeletons, because they have sacrificed the whole of their bodily strength to the faculties of the soul."

His own favourite ascetics, the Therapeutae, whose chief centre was in Egypt, had renounced property and all its temptations, and fled, irrevocably abandoning brothers, children, wives, parents, throngs of kinsmen, intimacy of friends, the fatherlands where they were born and bred (see THERAPEUTAE). Here we have the ideal of early Christian renunciation at work, but apart from the influence of Jesus. In the pages of Epictetus the same ideal is constantly held up to us.

In the Christian Church there was from the earliest age a leaning to excessive asceticism, and it needed a severe struggle on the part of Paul, and of the Catholic teachers who followed him, to secure for the baptized the right to be married, to own property, to engage in war and commerce, or to assume public office. One and all of the permanent institutions of society were condemned by the early enthusiasts, especially by those who looked forward to a speedy advent of the millennium, as alien to the kingdom of God and as impediments to the life of grace.

Marriage and property had already been eschewed in the Jewish Essene and Therapeutic sects, and in Christianity the name of Encratite was given to those who repudiated marriage and the use of wine. They did not form a sect, but represented an impulse felt everywhere. In early and popular apocryphal histories the apostles are represented as insisting that their converts should either not contract wedlock or should dissolve the tie if already formed. This is the plot of the *Acts of Thecla*, a story which probably goes back to the first century. Repudiation of the tie by fervent women, betrothed or already wives, occasioned much domestic friction and popular persecution. In the Syriac churches, even as late as the 4th century, the married state seems to have been regarded as incompatible with the perfection of the initiated. Renunciation of the state of wedlock was anyhow imposed on the faithful during the lengthy, often lifelong, terms of penance imposed upon them for sins committed; and later, when monkery took the place, in a church become worldly, partly of the primitive baptism and partly of that rigorous penance which was the rebaptism and medicine of the lapsed, celibacy and virginity were held essential thereto, no less than renunciation of property and money-making.

Together with the rage for virginity went the institution of *virgines subintroductae*, or of spiritual wives; for it was often assumed that the grace of baptism restored the original purity of life led by Adam and Eve in common before the Fall. Such rigours are encouraged in the *Shepherd of Hermas*, a book which emanated from Rome and up to the 4th century was read in church. They were common in the African churches, where they led to abuses which taxed the energy even of a Cyprian. They were still rife in Antioch in 260. We detect them in the Celtic church of St Patrick, and, as late as the 7th century, among the Celtic elders of the north of France. In the Syriac church as late as 340, such relations prevailed between the "Sons and daughters of the Resurrection." It continued among the Albigenses and other dissident sects of the middle ages, among whom it served a double purpose; for their elders were thus not only able to prove their own chastity, but to elude the inquisitors, who were less inclined to suspect a man of the catharism which regarded marriage as the "greater adultery" (*maius adulterium*) if they found him cohabiting (in appearance at least) with a woman. There was hardly an early council, great or small, that did not condemn this custom, as well as the other one, still more painful to think of, of self-emasculation. In the Catholic church, however, common sense prevailed, and those who desired to follow the Encratite ideal repaired to the monasteries.

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(F. C. C.)

ASCHAFFENBURG, a town of Germany, in the kingdom of Bavaria, on the right bank of the Main, at its confluence with the Aschaff, near the foot of the Spessart, 26 m. by rail S.E. of Frankfort-on-Main. Pop. (1900) 18,091; (1905) 25,275. Its chief buildings are the Johannisburg, built (1605–1614) by Archbishop Schweikard of Cronberg, which contains a library with a number of *incunabula*, a collection of engravings and paintings; the *Stiftskirche*, or cathedral, founded in 980 by Otto of Bavaria, but dating in the main from the early 12th and the 13th centuries, in which are preserved various monuments by the Vischers, and a sarcophagus, with the relics of St Margaret (1540); the Capuchin hospital; a theatre, which was formerly the house of the Teutonic order; and several mansions of the German nobility. The town, which has been remarkable for its educational establishments since the 10th century, has a gymnasium, lyceum, seminarium and other schools. There is an archaeological museum in the old abbey buildings. The graves of Klemens Brentano and his brother Christian (d. 1851) are in the churchyard; and Wilhelm Heinse is buried in the town. Coloured and white paper, ready-made clothing, cellulose, tobacco, lime and liqueurs are the chief manufactures, while a considerable export trade is done down the Main in wood, cattle and wine.

Aschaffenburg, called in the middle ages Aschafaburg and also Askenburg, was originally a Roman settlement. The 10th and 23rd Roman legions had their station here, and on the ruins of their *castrum* the Frankish mayors of the palace built a castle. Bonifacius erected a chapel to St Martin, and founded a Benedictine monastery. A stone bridge over the Main was built by Archbishop Willigis in 989. Adalbert increased the importance of the town in various ways about 1122. In 1292 a synod was held here, and in 1474 an imperial diet, preliminary to that of Vienna, in which the concordat was decided which has therefore been sometimes called the *Aschaffenburg Concordat*.

The town suffered greatly during the Thirty Years' War, being held in turn by the various belligerents. In 1842–1849, King Louis built himself to the west of the town a country house, called the *Pompeianum*, from its being an imitation of the house of Castor and Pollux at Pompeii. In 1866 the Prussians inflicted a severe defeat on the Austrians in the neighbourhood.

The principality of Aschaffenburg, deriving its name from the city, comprehended an area of 654 English sq. m. It formed part of the electorate of Mainz, and in 1803 was made over to the archchancellor, Archbishop Charles of Dalberg. In 1806 it was annexed to the grand-duchy of Frankfort; and in 1814 was transferred to Bavaria, in virtue of a treaty concluded on the 19th of June between that power and Austria. With lower Franconia, it now forms a district of the kingdom of Bavaria.

ASCHAM, ROGER (*c.* 1515–1568), English scholar and writer, was born at Kirby Wiske, a village in the North Riding of Yorkshire, near Northallerton, about the year 1515. His name would be more properly spelt Askham, being derived, doubtless, from Askham in the West Riding. He was the third son of John Ascham, steward to Lord Scrope of Bolton. The family name of his mother Margaret is unknown, but she is said to have been well connected. The authority for this statement, as for most others concerning Ascham's early life, is Edward Grant, headmaster of Westminster, who collected and edited his letters and delivered a panegyrical oration on his life in 1576.

Ascham was educated not at school, but in the house of Sir Humphry Wingfield, a barrister, and in 1533 speaker of the House of Commons, as Ascham himself tells us, in the *Toxophilus*, p. 120 (not, as by a mistake which originated with Grant and has been repeated ever since, Sir Anthony Wingfield, who was nephew of the speaker). Sir Humphry "ever loved and used to have many children brought up in his house," where they were under a tutor named R. Bond. Their sport was archery, and Sir Humphry "himself would at term times bring down from London both bows and shafts and go with them himself to the field and see them shoot." Hence Ascham's earliest English work, the *Toxophilus*, the importance which he attributed to archery in educational establishments, and probably the provision for archery in the statutes of St Albans, Harrow and other Elizabethan schools. From this private tuition Ascham was sent "about 1530," at the age, it is said, of fifteen, to St John's College, Cambridge, then the largest and most learned college in either university. Here he fell under the influence of John Cheke, who was admitted a fellow in Ascham's first year, and Sir Thomas Smith. His guide and friend was Robert Pember, "a man of the greatest learning and with an admirable facility in the Greek tongue." On his advice he practised seriously the precept embodied in the saying, "I know nothing about the subject, I have not even lectured on it," and "to learn Greek more quickly, while still a boy, taught Greek to boys." In Latin he specially studied Cicero and Caesar. He became B.A. on the 18th of February 1534/5. Dr Nicholas Metcalfe was then master of the college, "a papist, indeed, and yet if any young man given to the new learning as they termed it, went beyond his fellows," he "lacked neither open praise, nor private exhibition." He procured Ascham's election to a fellowship, "though being a new bachelor of arts, I chanced among my companions to speak against the Pope . . . after grievous rebuke and some punishment, open warning was given to all the fellows, none to be so hardy, as to give me his voice at that election." The day of election Ascham regarded as his "birthday," and "the whole foundation of the poor learning I have and of all the furtherance that hitherto elsewhere I have obtained." He took his M.A. degree on the 3rd of July 1537. He stayed for some time at Cambridge taking pupils, among whom was William Grindal, who in 1544 became tutor to Princess Elizabeth. Ascham himself cultivated music, acquired fame for a beautiful handwriting, and lectured on mathematics. Before 1540, when the Regius professorship of Greek was established, Ascham "was paid a handsome salary to profess the Greek tongue in public," and held also lectures in St John's College. He obtained from Edward Lee, then archbishop of York, a pension of £2 a year, in return for which Ascham translated Oecumenius' Commentaries on the Pauline Epistles. But the archbishop, scenting heresy in some passage relating to the marriage of the clergy, sent it back to him, with a present indeed, but with something like a reprimand, to which Ascham answered with an assurance that he was "no seeker after novelties," as his lectures showed. He was on safer ground in writing in 1542–1543 a book, which he told Sir William Paget in the summer of 1544 was in the press, "on the art of Shooting." This was no doubt suggested partly by the act of parliament 33 Henry VIII. c. 9, "an acte for mayntenaunce of Artyllarie and debarringe of unlawful games," requiring every one under sixty, of good health, the clergy, judges, &c., excepted, "to use shooting in the long bow," and fixing the price at which bows were to be sold. Under the title of *Toxophilus* he presented it to Henry VIII. at Greenwich soon after his triumphant return from the capture of Boulogne, and promptly received a grant of a pension of £10 a year, equal to some £200 a year of our money. A novelty of the book was that the author had "written this Englishe matter in the Englishe tongue for Englishe men," though he thought it necessary to defend himself by the argument that what "the best of the realm think it honest to use" he "ought not to suppose it vile for him to write." It is a Platonic dialogue between Toxophilus and Philologus, and nowadays its chief interest lies in its incidental remarks. It may probably claim to have been the model for Izaak Walton's *Compleat Angler*.

From 1541, or earlier, Ascham acted as letter-writer to the university and also to his college. Perhaps the best specimen of his skill was the letter written to the protector Somerset in 1548 on behalf of Sedbergh school, which was attached to St John's College by the founder, Dr Lupton, in 1525, and the endowment of which had been confiscated under the Chantries Act. In 1546 Ascham was elected public orator by the university on Sir John Cheke's retirement.

Shortly after the beginning of the reign of Edward VI., Ascham made public profession of Protestant opinions in a disputation on the doctrine of the Mass, begun in his own college and then removed for greater publicity to the public schools of the university, where it was stopped by the vice-chancellor. Thereon Ascham wrote a letter of complaint to Sir William Cecil. This stood him in good stead. In January 1548, Grindal, the princess Elizabeth's tutor, died. Ascham had already corresponded with the princess, and in one of his letters says that he returns her pen which he has mended. Through Cecil and at the princess's own wish he was selected as her tutor against another candidate pressed by Admiral Seymour and Queen Katherine. Ascham taught Elizabeth—then sixteen years old—for two years, chiefly at Cheshunt. In a letter to Sturm, the Strassburg schoolmaster, he praises her "beauty, stature, wisdom and industry. She talks French and Italian as well as English: she has often talked to me readily and well in Latin and moderately so in Greek. When she writes Greek and Latin nothing is more beautiful than her handwriting . . . she read with me almost all Cicero and great part of Titus Livius: for she drew all her knowledge of Latin from those two authors. She used to give the morning to the Greek Testament and afterwards read select orations of Isocrates and the tragedies of Sophocles. To these I added St Cyprian and Melanchthon's Commonplaces." In 1550 Ascham quarrelled with Elizabeth's steward and returned to Cambridge. Cheke then procured him the secretaryship to Sir Richard Morrison (Moryson), appointed ambassador to Charles V. It was on his way to join Morrison that he paid his celebrated morning call on Lady Jane Grey at Bradgate, where he found her reading Plato's *Phaedo*, while every one else was out hunting.

The embassy went to Louvain, where he found the university very inferior to Cambridge, then to Innsbruck and Venice. Ascham read Greek with the ambassador four or five days a week. His letters during the embassy, which was recalled on Mary's accession, were published in English in 1553, as a "Report" on Germany. Through Bishop Gardiner he was appointed Latin secretary to Queen Mary with a pension of £20 a year. His Protestantism he must have quietly sunk, though he told Sturm that "some endeavoured to hinder the flow of Gardiner's benevolence on account of his religion." Probably his never having been in orders tended to his safety. On the 1st of June 1554 he married Margaret Howe, whom he described as niece of Sir R. (? J., certainly not, as has been said, Henry) Wallop. By her he had two sons. From his frequent complaints of his poverty then and later, he seems to have lived beyond his income, though, like most courtiers, he obtained divers lucrative leases of ecclesiastical and crown property. In 1555 he resumed his studies with Princess Elizabeth, reading in Greek the orations of Aeschines and Demosthenes' *De Corona*. Soon after Elizabeth's accession, on the 5th of October 1559, he was given, though a layman, the canonry and prebend of Wetwang in York minster. In 1563 he began the work which has made him famous, *The Scholemaster*. The occasion of it was, he tells us (though he is perhaps merely imitating Boccaccio), that during the "great plague" at London in 1563 the court was at Windsor, and there on the 10th of December he was dining with Sir William Cecil, secretary of state, and other ministers. Cecil said he had "strange news; that divers scholars of Eaton be run away from the schole for fear of beating"; and expressed his wish that "more discretion was used by schoolmasters in correction than commonly is." A debate took place, the party being pretty evenly divided between floggers and anti-floggers, with Ascham as the champion of the latter. Afterwards Sir Richard Sackville, the treasurer, came up to Ascham and told him that "a fond schoolmaster" had, by his brutality, made him hate learning, much to his loss, and as he had now a young son, whom he wished to be learned, he offered, if Ascham would name a tutor, to pay for the education of their respective sons under

Ascham's orders, and invited Ascham to write a treatise on "the right order of teaching." *The Scholemaster* was the result. It is not, as might be supposed, a general treatise on educational method, but "a plaine and perfite way of teachyng children to understand, write and speake in Latin tong"; and it was not intended for schools, but "specially prepared for the private brynging up of youth in gentlemen and noblemens houses." The perfect way simply consisted in "the double translation of a model book"; the book recommended by this professional letter-writer being "Sturmius' *Select Letters of Cicero*." As a method of learning a language by a single pupil, this method might be useful; as a method of education in school nothing more deadening could be conceived. The method itself seems to have been taken from Cicero. Nor was the famous plea for the substitution of gentleness and persuasion for coercion and flogging in schools, which has been one of the main attractions of the book, novel. It was being practised and preached at that very time by Christopher Jonson (*c.* 1536–1597) at Winchester; it had been enforced at length by Wolsey in his statutes for his Ipswich College in 1528, following Robert Sherborne, bishop of Chichester, in founding Rolleston school; and had been repeatedly urged by Erasmus and others, to say nothing of William of Wykeham himself in the statutes of Winchester College in 1400. But Ascham's was the first definite demonstration in favour of humanity in the vulgar tongue and in an easy style by a well-known "educationist," though not one who had any actual experience as a schoolmaster. What largely contributed to its fame was its picture of Lady Jane Grey, whose love of learning was due to her finding her tutor a refuge from pinching, ear-boxing and bullying parents; some exceedingly good criticisms of various authors, and a spirited defence of English as a vehicle of thought and literature, of which it was itself an excellent example. The book was not published till after Ascham's death, which took place on the 23rd of December 1568, owing to a chill caught by sitting up all night to finish a New Year's poem to the queen.

His letters were collected and published in 1576, and went through several editions, the latest at Nuremberg in 1611; they were re-edited by William Elstob in 1703. His English works were edited by James Bennett with a life by Dr Johnson in 1771, reprinted in 8vo in 1815. Dr Giles in 1864–1865 published in 4 vols. select letters with the *Toxophilus* and *Scholemaster* and the life by Edward Grant. *The Scholemaster* was reprinted in 1571 and 1589. It was edited by the Rev. J. Upton in 1711 and in 1743, by Prof. J. E. B. Mayor in 1863, and by Prof. Edward Arber in 1870. The *Toxophilus* was republished in 1571, 1589 and 1788, and by Prof. Edward Arber in 1868 and 1902. (A. F. L.)

ASCHERSLEBEN, a town of Germany, in the Prussian province of Saxony, 36 m. by rail N.W. from Halle, and at the junction of lines to Cöthen and Nienhagen. Pop. (1900) 27,245; (1905) 27,876. It contains one Roman Catholic and four Protestant churches, a synagogue, a fine town-hall dating from the 16th century, and several schools. The discovery of coal in the neighbourhood stimulated and altered its industries. In addition to the manufacture of woollen wares, for which it has long been known, there is now extensive production of vinegar, paraffin, potash and especially beetroot-sugar; while the surrounding district, which was formerly devoted in great part to market-gardening, is now turned almost entirely into beetroot fields. There are also iron, zinc and chemical manufactures, and the cultivation of agricultural seeds is carried on. In the neighbourhood are brine springs and a spa (Wilhelmsbad). Aschersleben was probably founded in the 11th century by Count Esico of Ballenstedt, the ancestor of the house of Anhalt, whose grandson, Otto, called himself count of Ascania and Aschersleben, deriving the former part of the title from his castle in the neighbourhood of the town. On the death of Otto III. (1315) Aschersleben passed into the hands of the bishop of Halberstadt, and at the peace of 1648 was, with the bishopric, united to Brandenburg.

ASCIANO, a town of Tuscany, in the province of Siena, 19 m. S.E. of the town of Siena by rail. Pop. (1901) 7618. It is surrounded by walls built by the Sienese in 1351, and has some 14th-century churches with paintings of the same period. Six miles to the south is the large Benedictine monastery of Monte Oliveto Maggiore, founded in 1320, famous for the frescoes by Luca Signorelli (1497–1498) and Antonio Bazzi, called Sodoma (1505), in the cloister, illustrating scenes from the legend of St Benedict; the latter master's work is perhaps nowhere better represented than here. The church contains fine inlaid choir stalls by Fra Giovanni da Verona. The buildings, which are mostly of red brick, are conspicuous against the gray clayey and sandy soil. The monastery is described by Aeneas Sylvius Piccolomini (Pope Pius II.) in his *Commentaria*. Remains of Roman baths, with a fine mosaic pavement, were found within the town in 1898 (G. Pellegrini in *Notizie degli scavi*, 1899, 6).

ASCITANS (or ASCITAE; from ἀσκός, the Greek for a wine-skin), a peculiar sect of 2nd-century Christians (Montanists), who introduced the practice of dancing round a wine-skin at their meetings.

ASCITES (Gr. ἀσκίτης, dropsical, from ἀσκός, bag; *sc.* νόσος, disease), the term in medicine applied to an effusion of non-inflammatory fluid within the peritoneum. It is not a disease in itself, but is one of the manifestations of disease elsewhere—usually in the kidneys, heart, or in connexion with the liver (portal obstruction). Portal obstruction is the commonest cause of well-marked ascites. It is produced by (1) diseases within the liver, as cirrhosis (usually alcoholic) and cancer; (2) diseases outside the liver, as cancer of stomach, duodenum or pancreas, causing pressure on the portal vein, or enlarged glands in the fissure of the liver producing the same effect. Ascites is one of the late symptoms in the disease, and precedes dropsy of the leg, which may come on later, due to pressure on the large veins in the abdominal cavity by the ascitic fluid. In ascites due to heart disease, the dropsy of the feet and legs precedes the ascites, and there will be a history of palpitation, shortness of breath, and perhaps cough. In the ascites of kidney troubles there will be a history of general oedema—puffiness of face and eyes on rising in the morning probably having attracted the attention of the patient or his friends previously. Other less common causes of ascites are chronic peritonitis, either tuberculous in the young, or due to cancer in the aged, and more rarely still pernicious anaemia.

ASCLEPIADES, Greek physician, was born at Prusa in Bithynia in 124 B.C., and flourished at Rome in the end of the 2nd century B.C. He travelled much when young, and seems at first to have settled at Rome as a rhetorician. In that profession he did not succeed, but he acquired great reputation as a physician. He founded his medical practice on a modification of the atomic or corpuscular theory, according to which disease results from an irregular or inharmonious motion of the corpuscles of the body. His remedies were, therefore, directed to the restoration of harmony, and he trusted much to changes of diet, accompanied by friction, bathing and exercise, though he also employed emetics and bleeding. He recommended the use of wine, and in every way strove to render himself as agreeable as possible to his patients. His pupils were very numerous, and the school formed by them was called the Methodical. Asclepiades died at an advanced age.

ASCLEPIADES, of Samos, epigrammatist and lyric poet, friend of Theocritus, flourished about 270 B.C. He was the earliest and most important of the convivial and erotic epigrammatists. Only a few of his compositions are actual "inscriptions"; others sing the praises of the poets whom he specially admired, but the majority of them are love-songs. It is doubtful whether he is the author of all the epigrams (some 40 in number) which bear his name in the Greek Anthology. He possibly gave his name to the Asclepiadean metre.

ASCLEPIODOTUS, Greek military writer, flourished in the 1st century B.C. Nothing is known of him except that he was a pupil of Poseidonius the Stoic (d. 51 B.C.). He is the supposed author of a treatise on Graeco-Macedonian tactics (Τακτικὰ Κεφάλαια), which, however, is probably not his own work, but the skeleton outline of the lectures delivered by his master, who is known to have written a work on the subject.

ASCOLI, GRAZIADIO ISAIA (1829–1907), Italian philologist; of Jewish family, was born at Görz, and at an early age showed a marked linguistic talent. In 1854 he published his *Studii orientali e linguistici*, and in 1860 was appointed professor of philology at Milan. He made various learned contributions to the study of Indo-European and Semitic languages, and also of the gipsy language, but his special field was the Italian dialects. He founded the *Archivio glottologico italiano* in 1873, publishing in it his *Saggi Ladini*, and making it in succeeding years the great organ of original scholarship on this subject. He was universally recognized as the greatest authority on Italian linguistics, and his article in the *Encyclopaedia Britannica* (9th ed., revised for this edition) became the classic exposition in English. (See ITALY: *Language*.)

ASCOLI PICENO[1] (anc. *Asculum*), a town and episcopal see of the Marches, Italy, the capital of the province of Ascoli Piceno, 17 m. W. of Porto d' Ascoli (a station on the coast railway, 56 m. S.S.E. of Ancona), and 53 m. S. of Ancona direct, situated on the S. bank of the Tronto (anc. *Truentus*) at its confluence with the Castellano, 500 ft. above sea-level, and surrounded by lofty mountains. Pop. (1901) town, 12,256; commune, 28,608. The Porta Romana is a double-arched Roman gate; adjacent are remains of the massive ancient city walls, in rectangular blocks of stone 2 ft. in height, and remains of still earlier fortifications have been found at this point (F. Barnabei in *Notizie degli scavi*, 1887, 252). The church of S. Gregorio is built into a Roman tetrastyle Corinthian temple, two columns of which and the *cella* are still preserved; the site of the Roman theatre can be distinguished; and the church and convent of the Annunziata (with two fine cloisters and a good fresco by Cola d' Amatrice in the refectory) are erected upon large Roman substructures of concrete, which must have supported some considerable building. Higher up is the castle, which now shows no traces of fortifications older than medieval; it commands a fine view of the town and of the mountains which encircle it. The town has many good pre-Renaissance buildings; the picturesque colonnaded market-place contains the fine Gothic church of S. Francesco and the original Palazzo del Comune, now the prefecture (Gothic with Renaissance additions). The cathedral is in origin Romanesque,[2] but has been much altered, and was restored in 1888 by Count Giuseppe Sacconi (1855–1905). The frescoes in the dome, of the same date, are by Cesare Mariani. The cope presented to the cathedral treasury by Pope Nicholas IV. was stolen in 1904, and sold to Mr J. Pierpont Morgan, who generously returned it to the Italian government, and it was then placed for greater safety in the Galleria Corsini at Rome. The baptistery still preserves its ancient character; and the churches of S. Vittore and SS. Vincenzo ed Anastasio are also good Romanesque buildings. The fortress of the Malatesta, constructed in 1349, has been in the main destroyed; the part of it which remains is now a prison. The present Palazzo Comunale, a Renaissance edifice, contains a fine museum, chiefly remarkable for the contents of prehistoric tombs found in the district (including good bronze fibulae, necklaces, amulets, &c., often decorated with amber), and a large collection of acorn-shaped lead missiles (*glandes*) used by slingers, belonging to the time of the siege of Asculum during the Social War (89 B.C.). There is also a picture gallery containing works by local masters, Pietro Alamanni, Cola d' Amatrice, Carlo Crivelli, &c. The bridges across the ravines which defend the town are of considerable importance; the Ponte di Porta Cappucina is a very fine Roman bridge, with a single arch of 71 ft. span. The Ponte di Cecco (so named from Cecco d' Ascoli), with two arches, is also Roman and belongs to the Via Salaria; the Ponte Maggiore and the Ponte Cartaro are, on the other hand, medieval, though the latter perhaps preserves some traces of Roman work. Near Ascoli is Castel Trosino, where an extensive Lombard necropolis of the 7th century was discovered in 1895; the contents of the tombs are now exhibited in the Museo Nazionale delle Terme at Rome (*Notizie degli scavi*, 1895, 35).

The ancient Asculum was the capital of Picenum, and it occupied a strong position in the centre of difficult country. It was taken in 268 B.C. by the Romans, and the Via Salaria was no doubt prolonged thus far at this period; the distance from Rome is 120 m. It took a prominent part in the Social War against Rome, the proconsul Q. Servilius and all the Roman citizens within its walls being massacred by the inhabitants in 90 B.C. It was captured after a long siege by Pompeius Strabo in 89 B.C. The leader, Judacilius, committed suicide, the principal citizens were put to death, and the rest exiled. The Roman general celebrated his triumph on the 25th of December of that year. Caesar occupied it, however, as a strong position after crossing the Rubicon; and it received a Roman colony, perhaps under the triumvirs, and became a place of some importance. In A.D. 301 it became the capital of Picenum Suburbicarium. In 545 it was taken by Totila, but is spoken of by Paulus Diaconus as the chief city of Picenum shortly afterwards. From the time of Charlemagne it was under the rule of its bishops, who had the title of prince and the right to coin money, until 1185, when it became a free republic. It had many struggles with Fermo, and in the 15th century came more directly under the papal sway.

See N. Persichetti in *Römische Mitteilungen* (1903), 295 seq. (T. As.)

ASCONIUS PEDIANUS, QUINTUS (9 B.C.–A.D. 76; or A.D. 3–88), Roman grammarian and historian, was probably a native of Patavium (Padua). In his later years he resided at Rome, where he died, after having been blind for twelve years, at the age of eighty-five. During the reigns of Claudius and Nero he compiled for his sons, from various sources—*e.g.* the Gazette (*Acta Publica*), shorthand reports or "skeletons" (*commentarii*) of Cicero's unpublished speeches, Tiro's life of Cicero, speeches and letters of Cicero's contemporaries, various historical writers, *e.g.* Varro, Atticus, Antias, Tuditanus and Fenestella (a contemporary of Livy whom he often criticizes)—historical commentaries on Cicero's speeches, of which only five, viz. *in Pisonem*, *pro Scauro*, *pro Milone*, *pro Cornelio* and *in toga candida*, in a very mutilated condition, are preserved. In a note upon the speech *pro Scauro*, he speaks of Longus Caecina (d. A.D. 57) as still living, while his words imply that Claudius (d. 54) was not alive. This statement, therefore, must have been written between A.D. 54 and 57. These valuable notes, written in good Latin, relate chiefly to legal, historical and antiquarian matters. A commentary, of inferior Latinity and mainly of a grammatical character, on Cicero's Verrine orations, is universally regarded as spurious. Both works were found by Poggio in a MS. at St Gallen in 1416. This MS. is lost, but three transcripts were made by Poggio, Zomini (Sozomenus) of Pistoia and Bartolommeo da Montepulciano. That of Poggio is now at Madrid (Matritensis x. 81), and that of Zomini is in the Forteguerri library at Pistoia (No. 37). A copy of Bartolommeo's transcript exists in Florence (Laur. liv. 5). The later MSS. are derived from Poggio's copy. Other works attributed to Asconius were: a life of Sallust, a defence of Virgil against his detractors, and a treatise (perhaps a symposium in imitation of Plato) on health and long life.

Editions by Kiessling-Schöll (1875), and A. C. Clark (Oxford, 1906), which contains a previously unpublished collation of Poggio's transcript. See also Madvig, *De Asconio Pediano* (1828).

ASCOT, a village in the Wokingham parliamentary division of Berkshire, England, famous for its race-meetings. Pop. of parish of Ascot Heath (1901), 1927. The station on the South-Western railway, 29 m. W.S.W. of London, is called Ascot and Sunninghill; the second name belonging to an adjacent township with a population (civil parish) of 4719. The race-course is on Ascot Heath, and was laid out by order of Queen Anne in 1711, and on the 11th of August in that year the first meeting was held and attended by the queen. The course is almost exactly 2 m. in circumference, and the meetings are held in June. The principal race is that for the Ascot Gold Cup, instituted in 1807. The meeting is one of the most fashionable in England, and is commonly attended by members of the royal family. The royal procession, for which the meeting is peculiarly famous, was initiated by George IV. in 1820.

See R. Herod, *Royal Ascot* (London, 1900).

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[1] The epithet distinguishes it from Ascoli Satriano (anc. *Ausculum*), which lies 19 m. S. of Foggia by rail.

[2] It contains a fine polyptych by Carlo Crivelli (1473).

ASCUS (Gr. ἀσκός, a bag), a botanical term for the membranous sacs containing the reproductive spores in certain lichens and fungi. Various compounds of the word are used, *e.g. ascophorous*, producing asci; *ascospore*, the spore (or sporule) developed in the ascus; *ascogonium*, the organ producing it, &c.

ASELLI [Asellius, or Asellio], **GASPARO** (1581–1626), Italian physician, was born at Cremona about 1581, became professor of anatomy and surgery at Pavia, and practised at Milan, where he died in 1626. To him is due the discovery of the lacteal vessels, published in *De Lactibus* (Milan, 1627).

ASGILL, JOHN (1659–1738), English writer, was born at Hanley Castle, in Worcestershire, in 1659. He was bred to the law, and gained considerable reputation in his profession, increased by two pamphlets—the first (1696) advocating the establishment of some currency other than the usual gold and silver, the second (1698) on a registry for titles of lands. In 1699, when a commission was appointed to settle disputed claims in Ireland, he set out for that country, attracted by the hopes of practice. Before leaving London he put in the hands of the printer a tract, entitled *An Argument proving that, according to the Covenant of Eternal Life revealed in the Scripture, Man may be translated from hence into that Eternal Life without passing through Death* (1700). Coleridge has highly praised the "genuine Saxon English," the "irony" and "humour" of this extraordinary pamphlet, which interpreted the relation between God and man by the technical rules of law, and insisted that, Christ having wiped out Adam's sin, the penalty of death must consequently be illegal for those who claim exemption. How far it was meant seriously was doubted at the time, and may be doubted now. But its fame preceded the author to Ireland, and was of material service in securing his professional success, so that he amassed money, purchased an estate, and married a daughter of the second Lord Kenmare. He was returned both to the Irish and English parliaments, but was expelled from both on account of his "blasphemous" pamphlet. He was also involved in money difficulties, and litigation about his Irish estate, and these circumstances may have had something to do with his trouble in parliament. In 1707 he was arrested for debt, and the remainder of his life was spent in the Fleet prison, or within the rules of the king's bench. He died in 1738. Asgill also wrote in 1714–1715 some pamphlets defending the Hanoverian succession against the claims of the Pretender.

ASH[1] (Ger. *Esche*), a common name (Fr. *frêne*) given to certain trees. The common ash (*Fraxinus excelsior*) belongs to the natural order Oleaceae, the olive family, an order of trees and shrubs which includes lilac, privet and jasmine. The Hebrew word *Oren*, translated "ash" in Isaiah xliv. 14, cannot refer to an ash tree, as that is not a native of Palestine, but probably refers to the Aleppo pine (*Pinus halepensis*). The ash is a native of Great Britain and the greater part of Europe, and also extends to Asia. The tree is distinguished for its height and contour, as well as for its graceful foliage. It attains a height of from 50 to 80 ft., and flowers in March and April, before the leaves are developed. The reddish flowers grow in clusters, but are not showy. They are naked, that is without sepals or petals, and generally imperfect, wanting either stamens or pistil. The large leaves, which are late in appearing, are pinnately compound, bearing four to seven pairs of gracefully tapering toothed leaflets on a slender stalk. The dry winged fruits, the so-called keys, are a characteristic feature and often remain hanging in bunches long after the leaves have fallen in autumn. The leaves fall early, but the greyish twigs and black buds render the tree conspicuous in winter and especially in early spring.

The ash is in Britain next in value to the oak as a timber-tree. It requires a good deep loam with gravelly subsoil, and a situation naturally sheltered, such as the steep banks of glens, rivers or lakes; in cold and wet clay it does not succeed. As the value of the timber depends chiefly on its toughness and elasticity, it is best grown in masses where the soil is good; the trunk is thus drawn up free from large side-branches. The tree is easily propagated from seeds; it throws up strong root shoots. The ash requires much light, but grows rapidly, and its terminal shoots pierce easily through thickets of beech, with which it is often associated. Unmixed ash plantations are seldom satisfactory, because the foliage does not sufficiently cover the ground; but when mixed with beech it grows well, and attains great height and girth. Owing to the dense mass of roots which it sends out horizontally a little beneath the surface of the ground, the ash does much harm to vegetation beneath its shade, and is therefore obnoxious as a hedgerow tree. Coppice shoots yield excellent hop-poles, crates, hoops, whip-handles, &c. The timber is much used for agricultural implements, and by coachbuilders and wheelwrights.

A variety of the common species, known as var. *heterophylla*, has simple leaves. It occurs wild in woods in Europe and England. Another variety of ash (*pendula*) is met with in which the branches are pendulous and weeping. Sometimes this variety is grafted on the tall stem of the common ash, so as to produce a pleasing effect. It is said that the weeping variety was first observed at Gamlingay, in Cambridgeshire. A variety (*crispa*) occurs with curled leaves, and another with warty stems and branches, called *verrucosa*. *F. Ornus* is the manna ash (see Manna), a handsome tree with greenish-white flowers and native in south Europe. In southern Europe there is a small-leaved ash, called *Fraxinus parvifolia*. *F. floribunda*, a large tree with terminal panicles of white flowers, is a native of the Himalayas. In America there are several species—such as *Fraxinus americana*, the white ash; *F. pubescens*, the red ash; and *F. sambucifolia*, the black ash.

The "mountain ash" belongs to a totally different family from the common ash. It is called *Pyrus Aucuparia*, and belongs to the natural order Rosaceae, and the tribe *Pomeae*, which includes also apples, pears, &c. Its common name is probably due to its resemblance to the true ash, in its smooth grey bark, graceful ascending branches, and especially the form of the leaf, which is also pinnately compound but smaller than in the true ash. Its common name in Scotland is the rowan tree; it is well known by its clusters of white blossoms and succulent scarlet fruit. The name of poison ash is given to *Rhus venenata*, the North American poison elder or sumach, belonging to the Anacardiaceae (Cashew family). The bitter ash of the West Indies is *Simaruba excelsa*, which belongs to the natural order Simarubaceae. The Cape ash is *Ekebergia capensis*, belonging to the natural order Meliaceae, a large tree, a native of the Cape of Good Hope. The prickly ash, *Xanthoxylon Clava-Herculis* (nat. ord. Xanthoxyleae), a native of the south-eastern United States, is a small tree, the trunk of which is studded with corky tubercles, while the branches are armed with stout, sharp, brown prickles.

A'SHĀ [Maimūn ibn Qais], Arabian poet, was born before Mahomet, and lived long enough to accept the mission of the prophet. He was born in Manfūha, a village of al-Yemāma in the centre of Arabia, and became a wandering singer, passing through all Arabia from Hadramut in the south to al-Hīra in the north, and naturally frequenting the annual fair at Okaz (Ukāz). His love poems are devoted to the praise of Huraira, a black female slave. Even before the time of Mahomet he is said to have believed in the resurrection and last judgment, and to have been a monotheist. These beliefs may have been due to his intercourse with the bishop of Nejrān (Najrān) and the 'Ibādites (Christians) of al-Hīra. His poems were praised for their descriptions of the wild ass, for the praise of wine, for their skill in praise and satire, and for the varieties of metre employed. His best-known poem is that in praise of Mahomet.

His poems have been collected from various sources in L. Cheikho's *Les Poètes arabes chrétiens* (Jesuit press, Beirut, 1890), pp. 357-399. His eulogy of Mahomet has been edited by H. Thorbecke, *Al Aša's Lobgedicht auf Muhammad* (Leipzig, 1875). (G. W. T.)

ASHANTI, a British possession in West Africa, bounded W. by the (French) Ivory Coast colony, N. by the British Protectorate known as Northern Territories of the Gold Coast (see

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[1] The homonym, ash or (pl.) ashes, the residue (of a body, &c.) after burning, is a common Teutonic word, Ger. *Asche*, connected with the root found in Lat. *ardere*, to burn.

Gold Coast), and E. by the river Volta (which separates it from the German colony of Togoland); the southern frontier is conterminous with the northern frontier of the (British) Gold Coast colony. It forms an irregular oblong, with a triangular projection (the country of the Adansi) southward. It has an area of 23,000 sq. m., and a population estimated (1907) at 500,000.

Physical Features; Flora and Fauna.—A great part of Ashanti is covered with primeval and almost impenetrable forest.[1] Many of the trees, chiefly silk-cotton and hardwood, attain splendid proportions, the bombax reaching a height of over 200 ft., but the monotony is oppressive, and is seldom relieved by the sight of flowers, birds or beasts. Ferns are abundant, and the mimosa rises to heights of from 30 to 60 ft. All over the forest spread lianas, or monkey-ropes, their usual position being that of immense festoons hanging from tree to tree. To these lianas (species of which yield one kind of the rubber of commerce) is due largely the weird aspect of the forest. The country round the towns, however, is cultivated with care, the fields yielding in abundance grain, yams, vegetables and fruits. In the north-eastern districts the primeval forest gives place to park-like country, consisting of plains covered with high coarse grass, and dotted with occasional baobabs, as well as with wild plum, shea-butter, dwarf date, fan palms, and other small trees. Among the wild animals are the elephant (comparatively rare), the leopard, varieties of antelope, many kinds of monkeys and numerous venomous snakes. Crocodiles and two kinds of hippopotami, the ordinary and a pygmy variety, are found in the rivers. Of birds, parrots are the most characteristic. Insect life is abundant.

About 25 m. south-east of Kumasi is Lake Busumchwi, the sacred lake of the Ashanti. It is surrounded by forest-clad hills some 800 ft. high, is nearly circular and has a maximum diameter of 6 m. The Black Volta, and lower down the Volta (*q.v.*), form the northern frontier, and various tributaries of the Volta, running generally in a northerly direction, traverse the eastern portion of the country. In the central parts are the upper courses of the Ofin and of some tributaries of the Prah. Farther west are the Tano and Bia rivers, which empty their waters into the Assini lagoon. In their course through Ashanti, the rivers, apart from the Volta, are navigable by canoes only. The elevation of the country is generally below 2000 ft., but it rises towards the north.

Climate.—The climate, although unsuited to the prolonged residence of Europeans, is less unhealthy than that of the coast towns of West Africa. The water-supply is good and abundant. The rainy season lasts from the end of May until October; storms are frequent and violent. The mean temperature at Kumasi is 76° F., the mean annual rainfall 40 ins.

Inhabitants.—The most probable tradition represents the Ashanti as deriving their origin from bands of fugitives, who in the 16th or 17th century were driven before the Moslem tribes migrating southward from the countries on the Niger and Senegal. Having obtained possession of a region of impenetrable forest, they defended themselves with a valour which, becoming part of their national character, raised them to the rank of a powerful and conquering nation. They are of the pure negro type, and are supposed to be originally of the same race as the Fanti, nearer the coast, and speak the same language. The separation of Fanti and Ashanti has been ascribed to a famine which drove the former south, and led them to live on *fan*, or herbs, while the latter subsisted on *san*, or Indian corn, &c., whence the names Fanti and Santi. The Ashanti are divided into a large number of tribes, of whom a dozen may be distinguished, namely, the Bekwai, Adansi, Juabin, Kokofu, Kumasi, Mampon, Nsuta, Nkwanta, Dadiassi, Daniassi, Ofinsu and Adjisu. Each tribe has its own king, but from the beginning of the 18th century the king of Kumasi was recognized as king paramount, and was spoken of as the king of Ashanti. As paramount king he succeeded to the "golden stool," the symbol of authority among the Ashanti. After the deposition of Prempeh (1896) no king of Kumasi was chosen; Prempeh himself was never "enstooled." The government of Ashanti was formerly a mixture of monarchy and military aristocracy. The confederate tribes were originally organized for purposes of war into six great divisions or clans, this organization developing into the main social fabric of the state. The chiefs of the clans, with a few sub-chiefs having hereditary rights, formed the King's Council, and the king, unless of exceptionally strong character, often exercised less power than the council of chiefs, each of whom kept his little court, making a profuse display of barbaric pomp. Land is held in common by the tribes, lands unallotted being attached to the office of head chief or king and called "stool lands." Polygamy is practised by all who can afford it. It is stated by the early chroniclers that the king of Ashanti was bound to maintain the "fetish" number of 3333 wives; many of these, however, were employed in menial services. The crown descended to the king's brother, or his sister's son, not to his own offspring. The queen mother exercised considerable authority in the state, but the king's wives had no power. The system of human sacrifices, practised among the Ashanti until the closing years of the 19th century, was founded on a sentiment of piety towards parents and other connexions—the chiefs believing that the rank of their dead relatives in the future world would be measured by the number of attendants sent after them. There were two periods, called the great Adai and little Adai, at which human victims, chiefly prisoners of war or condemned criminals, were immolated. There is reason to believe that the extent of this practice was not so great as was currently reported.

There are a few Mahommedans in Ashanti, most of them traders from other countries, and the Basel and Wesleyan missionaries have obtained some converts to Christianity; but the great bulk of the people are spirit-worshippers. Unlike many West African races, the Ashanti in general show a repugnance to the doctrines of Islam.

Towns and Trade.—Besides the capital, Kumasi (*q.v.*), with a population of some 6000, there are few important towns in Ashanti. Obuassi, in the south-west, is the centre of the gold-mining industry. Wam is on the western border, Nkoranza, Atabubu and Kintampo in the north. Kintampo is a town of some size and is about 130 m. north-east of Kumasi. It is the meeting-place of traders from the Niger countries and from the coast. Formerly one of the great slave and ivory marts of West Africa, it is now a centre of the kola-nut commerce and a depot for government stores. The Ashanti are skilful in several species of manufacture, particularly in weaving cotton. Their pottery and works in gold also show considerable skill. A large quantity of silver-plate and goldsmiths' work of great value and considerable artistic elaboration was found in 1874 in the king's palace at Kumasi, not the least remarkable objects being masks of beaten gold. The influence of Moorish art is perceptible.

The vegetable products do not differ greatly from those found on the Gold Coast; the most important commercially is the rubber tree (*Funtumia elastica*). The nut of the kola tree is in great demand, and since 1905 many cocoa plantations have been established, especially in the eastern districts. Tobacco is cultivated in the northern regions. Gum copal is exported. Part of the trade of Ashanti had been diverted to the French port of Assini in consequence of the wars waged between England and the Ashanti, but on the suppression of the revolt of 1900 measures were taken to improve trade between Kumasi and Cape Coast. Kumasi is the distributing centre for the whole of Ashanti and the hinterland. Gold exists in the western districts of the country, and several companies were formed to work the mines in the period 1895–1901. Most of the gold exported from the Gold Coast in 1902 and following years came from the Obuassi mines. The gold output from Ashanti amounted in 1905 to 68,259 oz., valued at £254,790. The railway to Kumasi from Sekondi, which was completed in 1903, passes through the auriferous region. As far as the trade goes through British territory southward, the figures are included in those of the Gold Coast; but Ashanti does also a considerable trade with its French and German neighbours, and northwards with the Niger countries. Its revenue and expenditure are included in those of the Gold Coast. Revenue is obtained principally from caravan taxes, liquor licences, rents from government land and contributions from the gold-mining companies.

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[1] The exact area of dense forest land is unknown, but is estimated at fully 12,000 sq. m.

Communications.—The railway to Kumasi, cut through one of the densest forest regions, is described under Gold Coast. The usual means of communication is by tortuous paths through the forest, too narrow to admit any wheeled vehicle. A wide road, 141 m. long, has been cut through the bush from Cape Coast to Kumasi, and from Kumasi ancient caravan routes go to the chief trading centres farther inland. Where rivers and swamps have to be crossed, ferries are maintained. A favourite mode of travelling in the bush is in a palanquin borne on the heads of four carriers. Telegraph lines connect Kumasi with the coast towns and with the towns in the Northern Territories. There is a well-organized postal service.

Early relations with the British.

History.—The Ashanti first came under the notice of Europeans early in the 18th century, through their successful wars with the kingdoms bordering the maritime territory. Osai Tutu may be considered as the real founder of the Ashanti power. He either built or greatly extended Kumasi; he subdued the neighbouring state of Denkera (1719) and the Mahommedan countries of Gaman (Jaman) and Banna, and extended the empire by conquests both on the east and west. At last he was defeated and slain (1731); but his successor, Osai Apoko, made further acquisitions towards the coast. In 1800, Osai Tutu Quamina, an enterprising and ambitious man, who appears early to have formed the desire of opening a communication with white nations, became king. About 1807, two chiefs of the Assin, whom he had defeated in battle, sought refuge among the Fanti, the ruling people on the coast. On the refusal of the Fanti to deliver up the fugitives, Osai Tutu invaded their country, defeated them and drove them towards the sea. The Ashanti reached the coast near Anamabo, where there was then a British fort. The governor exhorted the townsmen to come to terms and offered to mediate; but they resolved to abide the contest. The result was the destruction of the town, and the slaughter of 8000 of the inhabitants. The Ashanti, who lost over 2000 men, failed, however, to storm the English fort, though the garrison was reduced from twenty-four to eight men. A truce was agreed to, and the king refusing to treat except with the governor of Cape Coast, Colonel G. Torrane (governor 1805–1807) repaired to Anamabo, where he was received with great pomp. Torrane determined to surrender the fugitive Assin chiefs, but one succeeded in escaping; the other, on being given up, was put to death by the Ashanti. Torrane concluded an agreement with the Ashanti, acknowledging their conquest of Fantiland, and delivering up to them half the fugitives in Anamabo fort (most of the remainder were sold by Torrane and the members of his council as slaves). The governor also agreed to pay rent to the Ashanti for Anamabo fort and Cape Coast castle. The character of this man, who died on the coast in 1808, is indicated by Osai Tutu's eulogy of him. "From the hour Governor Torrane delivered up Tchibbu [one of the Assin fugitives] I took the English for my friends," said the king of Ashanti, "because I saw their object was trade only and they did not care for the people. Torrane was a man of sense and he pleased me much."

In consequence of repeated invasions of Fantiland by the Ashanti, the British in 1817 sent Frederick James, commandant of Accra fort, T. E. Bowdich and W. Hutchinson on a mission to Kumasi. After one or two harmonious interviews, the king advanced a claim for the payment of the quit rents for Anamabo fort and Cape Coast castle, rents the major part of which the Fanti had induced the British to pay to them, leaving only a nominal sum for transmission to Kumasi. Mr James, the head of the mission, volunteered no satisfactory explanation, whereupon the king broke into uncontrollable rage, calling the emissaries cheats and liars. Bowdich and Hutchinson, thinking that British interests and the safety of the mission were endangered, took the negotiation into their own hands. Mr James was recalled, and a treaty was concluded, by which the king's demands were satisfied, and the right of the British to control the natives in the coast towns recognized.

Sir Charles M'Carthy's fate.

The government at home, though they demurred somewhat to the course that had been pursued, saw the wisdom of cultivating intercourse with this powerful African kingdom. They sent out, therefore, to Kumasi, as consul, Mr Joseph Dupuis, formerly consul at Mogador, who arrived at Cape Coast in January 1819. By that time fresh difficulties had arisen between the coast natives, who were supported by the British, and the Ashanti. Dupuis set out on the 9th of February 1820, and on the 28th arrived at Kumasi. After several meetings with the king, a treaty was drawn up, which acknowledged the sovereignty of Ashanti over the territory of the Fanti, and left the natives of Cape Coast to the mercy of their enemies. Mr J. Hope Smith, the governor of Cape Coast, disowned the treaty, as betraying the interests of the natives under British protection. Mr Hope Smith was supported by the government in London, which in 1821 assumed direct control of the British settlements. Sir Charles M'Carthy, the first governor appointed by the crown, espoused the cause of the Fanti, but was defeated in battle by the Ashanti, the 21st of January 1824, at a place beyond the Prah called Essamako. The Ashanti had 10,000 men to Sir Charles's 500. Sir Charles and eight other Europeans were killed. The skull of the governor was afterwards used at Kumasi as a royal drinking-cup. It was asserted that Sir Charles lost the battle through his ordnance-keeper bringing up kegs filled with vermicelli instead of ammunition. The fact is that the mistake, if made, only hastened the inevitable catastrophe. On the very day of this defeat Osai Tutu Quamina died and was succeeded by Osai Okoto. A state of chronic warfare ensued, until the Ashanti sustained a signal defeat at Dodowah on the 7th of August 1826. From this time the power of the Ashanti over the coast tribes waned, and in 1831 the king was obliged to purchase peace from Mr George Maclean, then administrator of the Gold Coast, at the price of 600 oz. of gold, and to send his son as a hostage to Cape Coast. The payment of ground rent for the forts held by the British had ceased after the battle of Dodowah, and by the treaty concluded by Maclean the river Prah was fixed as the boundary of the Ashanti kingdom, all the tribes south of it being under British protection.

The king (Kwaka Dua I.), who had succeeded Osai Okoto in 1838, was a peace-loving monarch who encouraged trade, but in 1852 the Ashanti tried to reassert authority over the Fanti in the Gold Coast protectorate, and in 1863 a war was caused by the refusal of the king's demand for the surrender by the British of a fugitive chief and a runaway slave-boy. The Ashanti were victorious in two battles and retired unmolested. The governor, Mr Richard Pine, urged the advisability of an advance on Kumasi, but this the British government would not allow. No further fighting followed, but the prestige of the Ashanti greatly increased. "The white men" (said Kwaka Dua) "bring many cannon to the bush, but the bush is stronger than the cannon." In April 1867 Kwaka Dua died, and after an interval of civil war was succeeded by Kofi Karikari, who on being enstooled swore, "My business shall be war." Thereafter preparations were made throughout Ashanti to attack the Fanti tribes, and the result was the war of 1873–74.

The war of 1873-1874.

Two distinct events were the immediate cause of the war. The principal was the transference of Elmina fort from the Dutch to the British, which took place on the 2nd of April 1872. The Elmina were regarded by the Ashanti as their subjects, and the king of Ashanti held the Elmina "custom-note,"—that is, he received from the Dutch an annual payment, in its origin a ground rent for the fort, but looked upon by the Dutch as a present for trade purposes. The Ashanti greatly resented the occupation by Britain of what they considered Ashanti territory. Another but minor cause of the war was the holding in captivity by the

Ashanti of four Europeans. An Ashanti force invaded Krepi, a territory beyond the Volta, and in June 1869 captured Mr Fritz A. Ramseyer, his wife and infant son (the child died of privation shortly afterwards), and Mr J. Kühne, members of the Basel mission. Monsieur M. J. Bonnat, a French trader, was also captured at another place. The captives were taken to Kumasi. Negotiations for their release were begun, but the Europeans were still prisoners when the sale of Elmina occurred. The Ashanti delayed war until their preparations were complete, whilst the Gold Coast officials appear to have thought the risk of hostilities remote. However, on the 22nd of January 1873 an Ashanti force crossed the Prah and invaded the British protectorate. They defeated the Fanti, stirred up disputes at Elmina, and encamped at Mampon near Cape Coast, to the great alarm of the inhabitants. Measures were taken for the defence of the territory and the punishment of the assailants, which culminated in the despatch of Sir Garnet (afterwards Viscount) Wolseley as British administrator, £800,000 being voted by parliament for the expenses of the expedition. On landing (October 2) at Cape Coast, Wolseley found the Ashanti, who had been decimated by smallpox and fever, preparing to return home. He determined, however, to march to Kumasi, whilst Captain (afterwards Sir) John Glover, R.N., administrator of Lagos, was with a force of native levies to co-operate from the east and take the Ashanti in rear. Meanwhile the enemy broke up camp, and, although harassed by native levies raised by the British, effected an orderly retreat. The Ashanti army re-entered Kumasi on the 22nd of December. Wolseley asked for the help of white troops, and the 2nd battalion Rifle Brigade, the 23rd Fusiliers and 42nd Highlanders were despatched. Seeing the preparations made by his enemy, Kofi Karikari endeavoured to make peace, and in response to General Wolseley's demands the European captives were released (January 1874). Sir Garnet determined that peace must be signed in Kumasi and continued his advance. On the 20th of January the river Prah was crossed by the European troops; on the 24th the Adansi hills were reached; on the 31st there was severe fighting at Amoaful; on the 1st of February Bekwai was captured; and on the evening of the 4th the victorious army was in Kumasi, after seven hours' fighting. The king, who had led his army, fled into the bush when he saw the day was lost. As the 42nd Highlanders pushed forward to Kumasi, the town was found full of Ashanti soldiers, but not a shot was fired at the invaders. Sir Garnet Wolseley sent messengers to the king, but Kofi Karikari refused to surrender. As his force was small, provisions scarce, and the rainy season setting in, and as he was encumbered with many sick and wounded, the British general decided to retire. On the 6th, therefore, the homeward march was commenced; the city being left behind in flames. In the meantime Captain Glover's force had crossed the Prah on the 15th of January, and the Ashanti opposition weakening after the capture of Kumasi, Glover was able to push forward. On the 11th of February, Captain (later General) R. W. Sartorius, who had been sent ahead with twenty Hausa only, found Kumasi still deserted. Captain Sartorius and his twenty men marched 50 m. through the heart of the enemy's country. On the 12th Glover and his force of natives entered the Ashanti capital. The news of Glover's approach induced the king, who feared also the return of the white troops, to sue for peace. On the 9th of February a messenger from Kofi Karikari overtook Sir Garnet, who on the 13th at Fomana received the Ashanti envoys. A treaty was concluded whereby the king agreed, among other conditions, to pay 50,000 oz. of gold, to renounce all claim to homage from certain neighbouring kings, and all pretensions of supremacy over any part of the former Dutch protectorate, to promote freedom of trade, to keep open a road from Kumasi to the Prah, and to do his best to check the practice of human sacrifice. Besides coloured troops, there were employed in this campaign about 2400 Europeans, who suffered severely from fever and otherwise, though the mortality among the men was slight. Seventy-one per cent of the troops were on the sick list, and more than forty officers died—only six from wounds. The success of the expedition was facilitated by the exertions of Captain (afterwards General Sir William) Butler and Captain (afterwards General W. L.) Dalrymple, who effected diversions with very inadequate resources.

A British protectorate established.

One result of the war of 1873–74 was that several states dependent on Ashanti declared themselves independent, and sought British protection. This was refused, and the inaction of the colonial office contributed to the reconsolidation of the Ashanti power.[1] Shortly after the war the Ashanti deposed Kofi Karikari, and placed on the golden stool—the symbol of sovereignty—his brother Mensa. This monarch broke almost every article of the Fomana treaty, and even the payment of the indemnity was not demanded. (In all, only 4000 oz. of gold, out of the 50,000 stipulated for, were paid.) Mensa's rule was tyrannous and stained with repeated human sacrifices. In 1883 a revolution displaced that monarch, who was succeeded by Kwaka Dua II.—a young man who died (June 1884) within a few months of his election. In the same month died the ex-king Kofi Karikari, and disruption threatened Ashanti. At length, after a desolating civil war, Prince Prempeh—who took the name of Kwaka Dua III.—was chosen king (March 26, 1888), the colonial government having been forced to intervene in the dispute owing to the troubles it occasioned in the Gold Coast. The election of Prempeh took place in the presence and with the sanction of an officer of the Gold Coast government. Prempeh defeated his enemies, and for a time peace and prosperity returned to Ashanti. However in 1893 there was fresh trouble between Ashanti and the tribes of the protectorate, and the roads were closed to traders by Prempeh's orders. The British government was forced to interfere, more especially as the country, by international agreement, had been included in the British sphere of influence. A mission was despatched to Prempeh, calling upon him to fulfil the terms of the 1874 treaty, and further, to accept a British protectorate and receive a resident at Kumasi. The king declined to treat with the governor of the Gold Coast, and despatched informal agents to England, whom the secretary of state refused to receive. To the demands of the British mission relative to the acceptance of a protectorate and other matters, Prempeh made no reply in the three weeks' grace allowed, which expired on the 31st of October 1895. To enforce the British demands, to put an end to the misgovernment and barbarities carried on at Kumasi, and to establish law, order and security for trade, an expedition was at length decided upon. The force, placed under Colonel Sir Francis Scott, consisted of the 2nd West Yorkshire regiment, a "special service corps," made up of detachments from various regiments in the United Kingdom, under specially selected officers, the 2nd West India regiment, and the Gold Coast and Lagos Hausa. The composition of the special service corps was much criticized at the time; but as it was not called upon for fighting purposes, no inferences as to its efficiency are possible. The details of the expedition were carefully organized. Before the arrival of the staff and contingent from England (December 1895) the native forces were employed in improving the road from Cape Coast to Prahsu (70 m.), and in establishing road stations to serve as standing camps for the troops. About 12,000 carriers were collected, the load allotted to each being 50 lb. In addition, a force of native scouts, which ultimately reached a total of 860 men, was organized in eighteen companies, and partly armed with Snider rifles, to cover the advance of the main column, which started on the 27th of December, and to improve the road. The king of Bekwai having asked for British protection, a small force was pressed forward and occupied this native town, about 25 m. from Kumasi, on the 4th of January 1896. The advance continued, and at Ordahsu a mission arrived from King Prempeh offering unconditional submission. On the 17th of January Kumasi was occupied, and Colonel Sir F. Scott received the king. Effective measures were taken to prevent his escape, and on the 20th Prempeh made submission to Mr (afterwards Sir W. E.) Maxwell, the governor of Cape Coast, in native fashion. After this act of public humiliation, the king and the queen mother with the principal chiefs were arrested and taken as prisoners to Cape Coast, where they were embarked on board H.M.S. “Racoon” for Elmina. The fetish buildings at Bantama were burned, and on the 22nd of January Bokro, a village 5 m. from Kumasi, and Maheer, the king's summer palace, were visited by the native scouts and found deserted. On the same day, leaving the Hausa at Kumasi, the expedition began the return march of 150 m. to Cape Coast. The complete success of the expedition was due to the excellent organization of the supply and transport services, while the promptitude with which the operations were carried out probably accounts in great measure for the absence of resistance. Although no fighting occurred, a heavy strain was thrown upon all ranks, and fever claimed many victims, among whom was Prince Henry of Battenberg, who had volunteered for the post of military secretary to Colonel Sir F. Scott.

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[1] An attempt was made late in 1875, by the despatch of Dr V. S. Gouldsbury on a mission to Eastern Akim, Juabin and Kumasi, to repair the effects of the previous inaction of the colonial government, but without success.

Prempeh deposed.

Siege and relief of Kumasi.

After the deportation of Prempeh no successor was appointed to the throne of Ashanti. A British resident, Captain Donald W. Stewart, was installed at Kumasi, and whilst the other states of the confederacy retained their king and tribal system the affairs of the Kumasi were administered by chiefs under British guidance. Mr and Mrs Ramseyer (two of the missionaries imprisoned by King Kofi Karikari for four and a half years) returned to Kumasi, and other missionaries followed. A fort was built in Kumasi and garrisoned with Gold Coast constabulary. Though outwardly submissive, the Kumasi chiefs were far from reconciled to British rule, and in 1900 a serious rebellion broke out. The tribes involved were the Kumasi, Adansi and Kokofu; the other tribes of the Ashanti confederation remained loyal. The rebels were, however, able to command a force reported to number 40,000. On the 28th of March, before the rebellion had declared itself, the governor of the Gold Coast, Sir F. Hodgson, in a public palaver at Kumasi, announced that the Ashanti chiefs would have to pay the British government 4000 oz. of gold yearly, and he reproached the chiefs with not having brought to him the golden stool, which the Kumasi had kept hidden since 1896. Three days afterwards the Kumasi warriors attacked a party of Hausa sent with the chief object of discovering the golden stool. (In the previous January a secret attempt to seize the stool had failed.) The Kumasi, who were longing to wipe out the dishonour of having let Prempeh be deported without fighting, next threatened the fort of Kumasi. Mr Ramseyer and the other Basel missionaries, and Sir F. and Lady Hodgson, took refuge in the fort, and reinforcements were urgently asked for. On the 18th of April 100 Gold Coast constabulary arrived. On the 29th the Kumasi attacked in force, but were repulsed. The same day a party of 250 Lagos constabulary reached Kumasi. They had fought their way up, and came in with little ammunition. On the 15th of May Major A. Morris arrived from the British territory north of Ashanti, also with 250 men. The garrison now numbered 700. The 29 Europeans in the fort included four women. Outside the fort were gathered 3000 native refugees. Famine and disease soon began to tell their tale. Sir F. Hodgson sent out a message on the 4th of June (it reached the relieving force on the 12th of June), saying that they could only hold out to the 11th of June. However, it was not till the 23rd of June that the governor and all the Europeans save three, together with 600 Hausa of all ranks, sallied out of the fort. Avoiding the main road, held by the enemy in force, they attacked a weakly held stockade, and succeeded in cutting their way through, with a loss of two British officers mortally wounded, 39 Hausa killed, and double that number wounded or missing. The governor's party reached Cape Coast safely on the 10th of July.

A force of 100 Hausa, with three white men (Captain Bishop, Mr Ralph and Dr Hay), was left behind in Kumasi fort with rations to last three weeks. Meantime a relief expedition had been organized at Cape Coast by Colonel James Willcocks. This officer reached Cape Coast from Nigeria on the 26th of May. The difficulties before him were appalling. Carriers could scarcely be obtained, there were no local food supplies, the rainy season was at its height, all the roads were deep mire, the bush was almost impenetrable, and the enemy were both brave and cunning, fighting behind concealed stockades. It was not until the 2nd of July that Colonel Willcocks was able to advance to Fumsu. On the next day he heard of the escape of the governor and of the straits of the garrison left at Kumasi. He determined to relieve the fort in time, and on the 9th of July reached Bekwai, the king of which place had remained loyal. Making his final dispositions, the colonel spread a report that on the 13th he would attack Kokofu, east of Bekwai, and this drew off several thousands of the enemy from Kumasi. After feinting to attack Kokofu, Colonel Willcocks suddenly marched west. There was smart fighting on the 14th, and at 4.30 P.M. on the 15th, after a march since daybreak through roads “in indescribably bad condition,” the main rebel stockade was encountered. It was carried at the point of the bayonet by the Yoruba troops, who proved themselves fully equal to the Hausa. “The charge could not have been beaten in *élan* by any soldiers.” Kumasi was entered the same evening, a bugler of the war-worn garrison of the fort sounding the “general salute” as the relieving column came in view. Most of the defenders were too weak to stand. Outside the fort nothing was to be seen but burnt-down houses and putrid bodies. The relieving force that marched into Kumasi consisted of 1000 fighting men (all West Africans), with 60 white officers and non-commissioned officers, two 75-millimetre guns, four seven-pounder guns and six Maxims.

Kumasi relieved, there remained the task of crushing the rebellion. Colonel Willcocks's force was increased by Yaos and a few Sikhs from Central Africa to a total of 3368 natives, with 134 British officers and 35 British non-commissioned officers. In addition there were Ashanti levies. On the 30th of September the Kumasi were completely beaten at Obassa. Thereafter many of the rebel chiefs surrendered, and the only two remaining in the field were captured on the 28th of December. Thus 1901 opened with peace restored. The total number of casualties during the campaign (including those who died of disease) was 1007. Nine British officers were killed in action, forty-three were wounded, and six died of disease. The commander, Colonel Willcocks, was promoted and created a K.C.M.G.

Progress under British administration.

By an order in council, dated the 26th of September 1901, Ashanti was formally annexed to the British dominions, and given a separate administration under the control of the governor of the Gold Coast. A chief commissioner represents the governor in his absence, and is assisted by a staff of four commissioners and four assistant commissioners. A battalion of the Gold Coast regiment is stationed in the country with headquarters at Kumasi. The order in council mentioned, which may be described as the first constitution granted Ashanti by its British owners, provides that the governor, in issuing ordinances respecting the administration of justice, the raising of revenue, or any other matter, shall respect any native laws by which the civil relations of any chiefs, tribes or populations are regulated, “except so far as they may be incompatible with British sovereignty or clearly injurious to the welfare of the natives themselves.” After the annexation of the country in 1901 the relations between the governing power and the governed steadily improved. Mr F. C. Fuller, who succeeded Sir Donald Stewart as chief commissioner early in 1905, was able to report in the following year that among the Ashanti suspicion of the “white man's” ulterior motives was speedily losing ground. The marked preference shown by the natives to resort to the civil and criminal courts established by the British demonstrated their faith in the impartial treatment awarded therein. Moreover, the maintenance of the tribal system and the support given to the lawful chiefs did much to win the confidence and respect of a people naturally suspicious, and mindful of their exiled king.

Bibliography.—For a general survey of the country, see *Travels* *in Ashanti and Jaman*, by R. A. Freeman (London, 1898); *Historical Geography of the British Colonies*, vol. iii. "West Africa," by C. P. Lucas (Oxford, 1900); and the *Annual Reports, Ashanti*, issued from 1906 onward by the Colonial Office, London. *The Tshi-speaking Peoples of the Gold Coast*, by Col. A. B. Ellis (London, 1887), deals with ethnology. Of early works on the country the most valuable are *A Mission from Cape Coast Castle to Ashantee*, by T. E. Bowdich (London, 1819); and *Journal of a Residence in Ashantee* (London, 1824), by J. Dupuis. For history generally, see *A History of the Gold Coast of West Africa*, by Col. A. B. Ellis (London, 1893); and *History of the Gold Coast and Asante . . . from about 1500 to 1860*, by C. C. Reindorf, a native pastor of the Basel mission (Basel, 1895).

For the British military campaigns, in addition to the official blue-books, consult: *Narrative of the Ashantee War*, 2 vols., by (Sir) Henry Brackenbury (London, 1874); *The Story of a Soldier's Life* by Viscount Wolseley, vol. ii. chs. xliii.-l. (London, 1903); *Coomassie*, by (Sir) H. M. Stanley, being the story of the 1873–74 expedition (new ed., London, 1896); *Life of Sir John Hawley Glover*, by Lady Glover, chs. iii.-x. (London, 1897); *The Downfall of Prempeh*, by (General) R. S. S. Baden-Powell, an account of the 1895–96 expedition (London, 1896); *From Kabul to Kumassi* (chs. xv. to end), by Sir James Willcocks, (London, 1904); *The Ashanti Campaign of 1900*, by Capt. C. H. Armitage and Lieut.-Col. A. F. Montanaro (London, 1901); *The Relief of Kumasi*, by Capt. H. C. J. Biss (London, 1901). The two books following are by besieged residents in Kumasi: *The Siege of Kumasi*, by Lady Hodgson (London, 1901); *Dark and Stormy Days at Kumasi*, 1900, from the diary of the Rev. Fritz Ramseyer (London, 1901). Many of the works quoted under GOLD COAST deal also with Ashanti. (F. R. C.)

ASHʻARĪ [Abū-l Hasan ʻAli ibn Ismaʻīl ul-Ashʻarī], (873–935), Arabian theologian, was born of pure Arab stock at Baṣra, but spent the greater part of his life at Bagdad. Although belonging to an orthodox family, he became a pupil of the great Muʻtazalite teacher al-Jubbā'ī, and himself remained a Muʻtazalite until his fortieth year. In 912 he returned to the faith of his fathers and became its most distinguished champion, using the philosophical methods he had learned in the school of heresy. His theology, which occupied a mediate position between the extreme views on most points, became dominant among the Shafiʻites. He is said to have written over a hundred works, of which only four or five are known to be extant.

See W. Spitta, *Zur Geschichte Abu 'l-Hasan al Aš'ari's* (Leipzig, 1876); A. F. Mehren, *Exposé de la reforme de l'Islamisme commencée par Abou 'l-Hasan Ali el-Ash'ari* (Leiden, 1878); and D. B. Macdonald's *Muslim Theology* (London, 1903), especially the creed of Ashʻari in Appendix iii. (G. W. T.)

ASHBOURNE, a market-town in the western parliamentary division of Derbyshire, England, 13 m. W.N.W. of Derby, on the London & North-Western and the North Staffordshire railways. Pop. of urban district (1901) 4039. It is pleasantly situated on rising ground between two small valleys opening into that of the Dove, and the most beautiful scenery of Dovedale is not far distant. The church of St Oswald is cruciform, Early English and later; a fine building with a central tower and lofty octagonal spire. Its monuments and brasses are of much interest. The town has a large agricultural trade and a manufacture of corsets. The streams in the neighbourhood are in favour with trout fishermen. Ashbourne Hall, an ancient mansion, has associations with "Prince Charlie," who occupied it both before and after his advance on Derby in 1745. There are also many connexions with Dr Johnson, a frequent visitor here to his friend Dr Taylor, who occupied a house opposite the grammar school.

ASHBURNHAM, JOHN (*c.* 1603–1671), English Royalist, was the son of Sir John Ashburnham of Ashburnham in Sussex. He early entered the king's service. In 1627 he was sent to Paris by his relative the duke of Buckingham to make overtures for peace, and in 1628 he prepared to join the expedition to Rochelle interrupted by the duke's assassination. The same year he was made groom of the bedchamber and elected member of parliament for Hastings, which borough he also represented in the Long Parliament of 1640. In this capacity he rendered services by reporting proceedings to the king. He made a considerable fortune and recovered the Ashburnham estates alienated by his father. He became one of the king's chief advisers and had his full confidence. He attended Charles at York on the outbreak of the war with Scotland. In the Civil War he was made treasurer of the royal army, in which capacity he aroused Hyde's jealousy and remonstrances by infringing on his province as chancellor of the exchequer. In 1644 he was a commissioner at Uxbridge. He accompanied Charles in his flight from Oxford in April 1646 to the Scots, and subsequently escaped abroad, joining the queen at Paris, residing afterwards at Rouen and being sent to the Hague to obtain aid from the prince of Orange. After the seizure of Charles by the army, Ashburnham joined him at Hampton Court in 1647, where he had several conferences with Cromwell and other army officers. When Charles escaped from Hampton Court on the 11th of November, he followed Ashburnham's advice in opposition to that of Sir John Berkeley, who urged the king to go abroad, and took refuge in the Isle of Wight, being placed by Ashburnham in the hands of Robert Hammond, the governor. "Oh, Jack," the king exclaimed when he understood the situation, "thou hast undone me!" when Ashburnham, "falling into a great passion of weeping, offered to go and kill Hammond." By this fatal step Ashburnham incurred the unmerited charge of treachery and disloyalty. Clarendon, however, who censures his conduct, absolves him from any crime except that of folly and excessive self-confidence, and he was acquitted both by Charles I. and Charles II. He was separated with Berkeley from Charles on the 1st of January 1648, waited on the mainland in expectation of Charles's escape, and was afterwards taken and imprisoned at Windsor, and exchanged during the second Civil War for Sir W. Masham and other prisoners. He was one of the delinquents specially exempted from pardon in the treaty of Newport. In November he was allowed to compound for his estates, and declared himself willing to take the covenant. After the king's death he remained in England, an object of suspicion to all parties, corresponded with Charles II., and underwent several terms of imprisonment in the Tower and in Guernsey. At the Restoration he was reinstated in his former place of groom of the bedchamber and was compensated for his losses. He represented Sussex in parliament from 1661 till the 22nd of November 1667, when he was expelled the House for taking a bribe of £500 from French merchants for landing their wines. He died on the 15th of June 1671.

He had eight children, the eldest of whom, William, left a son John (1656–1710), who in 1689 was created Baron Ashburnham. John's second son, John (1687–1737), who became 3rd Baron Ashburnham on his brother's death in 1710, was created Viscount St Asaph and earl of Ashburnham in 1730. The 5th earl (b. 1840) was his direct descendant. Bertram (1797–1878), the 4th earl, was the collector of the famous Ashburnham library, which was dispersed in 1883 and 1884.

A Letter from Mr Ashburnham to a Friend, defending John Ashburnham's conduct with regard to the king, was published in 1648. His longer *Narrative* was published in 1830 by George, 3rd earl of Ashburnham (the latter's championship of his ancestor, however, being entirely uncritical and unconvincing); *A Letter to W. Lenthall* (1647) repudiates the charge brought against the king of violating his parole (*Thomason Tracts*, Brit. Museum, E 418 [4]).

ASHBURTON, ALEXANDER BARING, 1st BARON[1] (1774–1848), English politician and financier, 2nd son of Sir Francis Baring (the founder of the house of Baring Brothers & Co.) and of Harriet, daughter of William Herring, was born on the 27th of October 1774, and was brought up in his father's business. He was sent by the latter to the United States; married Anne, daughter of William Bingham, of Philadelphia, and formed wide connexions with American houses. In 1810, by his father's death, he became head of the firm. He sat in parliament for Taunton (1806–1826), Callington (1826–1831), Thetford (1831–1832), North Essex (1832–1835). He regarded politics from the point of view of the business man, opposed the orders in council, and the restrictions on trade with the United States in 1812, and in 1826 the act for the suppression of small bank-notes. He was a strong antagonist of Reform. He accepted the post of chancellor of the exchequer in the duke of Wellington's projected ministry of 1832; but afterwards, alarmed at the scene in parliament, declared "he would face a thousand devils rather than such a House of Commons," and advised the recall of Lord Grey. In 1834 he was president of the board of trade and master of the mint in Sir Robert Peel's government, and on the latter's retirement was created Baron Ashburton on the 10th of April 1835, taking the title previously held by John Dunning, his aunt's husband. In 1842 he was despatched to America, and the same year concluded the Ashburton or Webster-Ashburton treaty. A compromise was settled concerning the north-east boundary of Maine, the extradition of certain criminals was arranged, each state agreed to maintain a squadron of at least eighty guns on the coast of Africa for the suppression of the slave trade, and the two governments agreed to unite in an effort to persuade other powers to close all slave markets within their territories. Despite his earlier attitude, Lord Ashburton disapproved of Peel's free-trade projects, and opposed the Bank Charter Act of 1844. He was a trustee of the British Museum and of the National Gallery, a privy councillor and D.C.L. of Oxford. He published, besides several speeches, *An Enquiry into the Causes and Consequences of the Orders in Council* (1808), and *The Financial and Commercial Crisis Considered* (1847). He died on the 13th of May 1848, leaving a large family, his eldest son becoming 2nd baron. The 5th baron (b. 1866) succeeded to the title in 1889.

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[1] *i. e.* in the existing line; see below for the earlier creation.

ASHBURTON, JOHN DUNNING, 1st Baron[1] (1731–1783), English lawyer, the second son of John Dunning of Ashburton, Devonshire, an attorney, was born at Ashburton on the 18th of October 1731, and was educated at the free grammar school of his native place. At first articled to his father, he was admitted, at the age of nineteen, to the Middle Temple, and called to the bar in 1756, where he came very slowly into practice. He went the western circuit for several years without receiving a single brief. In 1762 he was employed to draw up a defence of the British East India Company against the Dutch East India Company, which had memorialized the crown on certain grievances, and the masterly style which characterized the document procured him at once reputation and emolument. In 1763 he distinguished himself as counsel on the side of Wilkes, whose cause he conducted throughout. His powerful argument against the validity of general warrants in the case of *Leach* v. *Money* (June 18, 1763) established his reputation, and his practice from that period gradually increased to such an extent that in 1776 he is said to have been in the receipt of nearly £10,000 per annum. In 1766 he was chosen recorder of Bristol, and in December 1767 he was appointed solicitor-general. The latter appointment he held till May 1770, when he retired with his friend Lord Shelburne. In 1771 he was presented with the freedom of the city of London. From this period he was considered as a regular member of the opposition, and distinguished himself by many able speeches in parliament. He was first chosen member for Calne in 1768, and continued to represent that borough until he was promoted to the peerage. In 1780 he brought forward a motion that the "influence of the crown had increased, was increasing, and ought to be diminished," which he carried by a majority of eighteen. He strongly opposed the system of sinecure officers and pensions; but his probity was not strong enough to prevent his taking advantage of it himself. In 1782, when the marquis of Rockingham became prime minister, Dunning was appointed chancellor of the duchy of Lancaster, a rich sinecure; and about the same time he was advanced to the peerage, with the title of Lord Ashburton. Under Lord Shelburne's administration he accepted a pension of £4000 a year. He died at Exmouth on the 18th of August 1783. Though possessed of an insignificant person, an awkward manner and a provincial accent, Lord Ashburton was one of the most fluent and persuasive orators of his time. He had married Elizabeth Baring, and was succeeded as 2nd baron by his son Richard, at whose death in 1823 the title became extinct, being revived in 1835 by Alexander Baring.

Besides the answer to the Dutch memorial, Lord Ashburton is supposed to have assisted in writing a pamphlet on the law of libel, and to have been the author of *A Letter to the Proprietors of East India Stock, on the subject of Lord Clive's Jaghire, occasioned by his Lordship's Letter on that Subject* (1764, 8vo). He was at one time suspected of being the author of the *Letters of Junius*.

ASHBURTON, a river of Western Australia, rising in the mountains west of the Great Sandy Desert, and following a course north-westward for 400 m., into Exmouth Gulf. In its upper reaches it flows through a rich gold-bearing district to which it gives name, and nearer its mouth it traverses a vast tract of fine pastoral country. The outlet for both these districts is the port of Onslow, at the mouth of the river, near which there are several pearl-fishing stations. The river is not navigable.

ASHBURTON, a market-town in the Ashburton parliamentary division of Devonshire, England, 24 m. N.W. by W. of Plymouth, on a branch of the Great Western railway. Pop. of urban district (1901) 2628. It lies in a valley surrounded by hills, at a short distance from the river Dart; the scenery, towards Dartmoor and in the neighbourhood of Buckland and Holne Chase, being unsurpassed in the county. The church of St Andrew is cruciform with a lofty tower. It was built early in the 15th century, and contains a fine old oak roof over the north aisle, and a tablet in memory of John Dunning, solicitor-general and 1st Baron Ashburton (1731–1783). The inscription is by Dr Johnson. Lord Ashburton was educated at the grammar school, which was founded as a chantry in 1314. Serge is manufactured in Ashburton, and there are breweries, paint factories and saw-mills. A large deposit of umber is worked in the neighbourhood. Slate quarries and copper and tin mines were formerly valuable. A neighbouring centre of the serge industry is the urban district of Buckfastleigh (pop. 2520), 3 m. S.S.W. Between the two towns is Buckfast Abbey, said to have been, before the Conquest, a Benedictine house, and refounded for Cistercians in 1137. It was restored to use in 1882 by a French Benedictine community, the fine Perpendicular abbot's tower remaining, while other parts have been rebuilt on the original lines.

Ashburton (Essebretona, Asperton, Ashperton) is a borough by prescription and an ancient stannary town. It was governed by a portreeve and bailiff, elected annually at the court leet held by the lord of the manor. According to Domesday, Ashburton was held in chief by Osbern, bishop of Exeter, and rendered geld for six hides. In 1552, as the two manors of Ashburton Borough and Ashburton Foreign, it was sold by the bishop, and subsequently became crown property. Finally, it was acquired in moieties by the Clinton family, and the present Lord Clinton is joint lord of the manor with Sir Robert Jardine. In 1298 and 1407 Ashburton returned two members, from 1407 until 1640 one member only, and then again two members, until deprived of one by the Reform Act of 1832 and of the other by the Reform Act of 1885. In the reign of Edward II. Bishop Stapledon obtained a Saturday market, and two annual fairs lasting three days at the feasts of St Laurence (August 10) and St Martin in winter (November 11). In 1672 John Ford was granted a Tuesday market for the sale of wool and woollen goods made from English yarn, and in 1705 Andrew Quicke obtained two annual fairs, on the first Thursdays in March and June, for the sale of cattle, corn and merchandise.

ASHBY, TURNER (1824–1862), American cavalry leader in the Confederate army, was born in Fauquier county, Virginia, in 1824. Before the Civil War he was a planter in Markham, Fauquier county, and a local politician. When hostilities began he raised a regiment of cavalry, which he led with conspicuous success in the Valley campaigns of 1861–62, under Joseph Johnston and Stonewall Jackson. He was promoted a brigadier-general shortly before his death, which took place in a cavalry skirmish at Harrisonburg, Va., on the 6th of June 1862. By his early death the Confederates lost one of the best cavalry officers in their service.

ASHBY-DE-LA-ZOUCH, a market-town in the Bosworth parliamentary division of Leicestershire, England; 118 m. N.W. by N. from London by the Midland railway, on the Leicester-Burton branch. Pop. of urban district (1901) 4726. The church of St Helen is a fine Perpendicular building, restored and enlarged (1880); it contains monuments of the Huntingdon family, and an old finger-pillory for the punishment of misbehaviour in church. The Ivanhoe baths, erected in 1826, are frequented for their saline waters, which, as containing bromine, are found useful in scrofulous and rheumatic complaints. The springs are at Moira, 3 m. west. There is a Queen Eleanor cross commemorating the countess of Loudoun, by Sir Gilbert Scott. To the south of the town are the extensive remains of Ashby

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[1] *i.e.* of the first creation; for the present title see above.

Castle. There are extensive coal-mines in the neighbouring district, as at Moira, whence the Ashby-de-la-Zouch canal runs south to the Coventry canal.

At the time of the Domesday survey Ashby-de-la-Zouch formed part of the estates of Hugh de Grentmaisnel. Soon after it was held by Robert Beaumeis, from whom it passed by female descent to the family of la Zouch, whence it derived the adjunct to its name, having been hitherto known as Ashby or Essebi. The earliest record of a grant of market rights is in 1219, when Roger la Zouch obtained a grant of a weekly market and a two days' fair at the feast of St Helen, in consideration of a fine of one palfrey. In the 15th century the manor was held by James Butler, earl of Ormond, after whose attainder it was granted in 1461 to Lord Hastings, who in 1474 obtained royal licence to empark 3000 acres and to build and fortify a castle. At this castle Mary queen of Scots was detained in 1569 under the custody of the earls of Huntingdon and Shrewsbury. During the Civil War Colonel Henry Hastings fortified and held it for the king, and it was visited by Charles in 1645. In 1648, at the close of the war, it was dismantled by order of parliament. It plays a great part in Sir Walter Scott's *Ivanhoe*. In the 18th century Ashby was celebrated as one of the best markets for horses in England, and had besides prosperous factories for woollen and cotton stockings and for hats.

See *Victoria County History—Leicestershire; History of Ashby-de-la-Zouch* (Ashby-de-la-Zouch, 1852).

A-SHE-HO (Manch. *Alchuku*), a town of Manchuria, China, 125 m. N.E. of Kirin, and 30 m. S. of the Sungari. It is governed by a mandarin of the second class. Pop. about 60,000.

ASHER, a tribe of Israel, called after the son of Jacob and Zilpah, Leah's maid. The name is taken by the narrator of Gen. xxx. 12 seq. (J) to mean happy or propitious, possibly an allusion to the fertility of the tribe's territory (with which cf. Gen. xlix. 20, Deut. xxxiii. 24); on the other hand, like Gad, it may have been originally a divine title. The district held by this tribe bordered upon Naphtali, and lay to the north of Issachar and Zebulun, and to the south of Dan. But the boundaries are not definite and the references to its territory are obscure. Asher is blamed for taking no part in the fight against Sisera (Judg. v. 17), and although it shares with Zebulun and Naphtali in Gideon's defeat of the Midianites (Judg. vi. 35, vii. 23), the narrative in question is not the older of the two accounts of the event, and the incorporation of the name is probably due to a late redactor. Lying as it did in the closest proximity to Phoenicians and Aramaeans, its population must have been exceptionally mixed, and the description of the occupation of Palestine in Judg. i. 31 seq. shows that it contained a strong Canaanite element. In the Blessing of Moses it is bidden to defend itself—evidently against invasion (Deut. xxxiii. 25).

Even in the time of Seti I. and Rameses II. (latter half of 14th cent. B.C.) the district to the west of Galilee appears to have been known to the Egyptians as Aser(u), so that it is possible to infer either (*a*) that Asher was an Israelite tribe which, if it ever went down into Egypt, separated itself from its brethren in Egypt and migrated north, "an example which was probably followed by some of the other tribes as well" (Hommel, *Ancient Hebrew Tradition*, p. 228); or (*b*) it was a district which, if never closely bound to Israel, was at least regarded as part of the national kingdom, and treated as Israelite by the genealogical device of making it a "son" of Jacob. It is possible that some of its Israelite population had followed the example of Dan and moved from an earlier home in the south. Two of the clans of Asher, Heber and Malchiel, have been associated with Milk-ili and Habiri, the names of a hostile chief and people in the Amarna Tablets (Jastrow, *Journal Bibl. Lit.* xi. pp. 118 seq., xii. pp. 61 seq., Hommel), but it is scarcely probable that events of about 1400 B.C. should have survived only in this form. This applies also to the suggestion that the name Asher has been derived from a famous Abd-ashirta of the same period (Barton, *ib.* xv. p. 174). Some connexion with the goddess Ashir(t)a, however, is not unlikely.

See further H. W. Hogg, *Ency. Bibl.* col. 327 seq.; E. Meyer, *Israeliten*, pp. 540 sqq. (S. A. C.)

'ASHER BEN YEHIEL (known as *Rosh*), Jewish rabbi and codifier, was born in the Rhine district *c.* 1250, and died in Toledo 1327. Endangered by the persecutions inflicted on the German Jews in the 13th century, 'Asher fled to Spain, where he was made rabbi of Toledo. His enforced exile impoverished him, and from this date begins an important change in the status of medieval rabbis. Before the 14th century, rabbis had obtained a livelihood by the exercise of some secular profession, particularly medicine, and received no salary for performing the rabbinic function. This was now changed. A disciple of Meir of Rothenburg, 'Asher's sole interest was in the Talmud. He was a man of austere piety, profound and narrow. He was a determined opponent of the study of philosophy, and thus was antipathetic to the Spanish spirit. The Jews of Spain continued, nevertheless, devotees of secular sciences as well as of rabbinical lore. 'Asher was the first of the German rabbis to display strong talent for systematization, and his chief work partook of the nature of a compendium of the Talmud. Compiled between 1307 and 1314, 'Asher's *Compendium* resembled, and to a large extent superseded, the work of 'Al-phasi (*q.v.*). 'Asher's *Compendium* is printed in most editions of the Talmud, and it differed from previous Compendia in greater simplicity and in the deference shown to German authorities. 'Asher's son Jacob, who died at Toledo before 1340, was the author of the four *Turim*, a very profound and popular codification of rabbinical law. This work was the standard code until Joseph Qaro directly based on it his widely accepted Code of Jewish law, the *Shulḥan 'Arukh*. (I. A.)

ASHEVILLE, a city and the county-seat of Buncombe county, North Carolina, U.S.A., in the mountainous Blue Ridge region in the west part of the state, about 210 m. W. of Raleigh. Pop. (1890) 10,235; (1900) 14,694, of whom 4724 were negroes; (1910, census) 18,762. Asheville is situated at the junction of three branches of the Southern railway, on a high terrace on the east bank of the French Broad river, at the mouth of the Swannanoa, about 2300 ft. above the sea. The city is best known as one of the most popular health and pleasure resorts in the south, being a summer resort for southerners and a winter resort for northerners. It has a dry and equable climate and beautiful scenery. Among its social clubs are the Albemarle, the Asheville, the Elks, the Tahkeeostee and the Swannanoa Country clubs. An extensive system of city and suburban parks, connected by a series of beautiful drives, adds to the city's attractiveness. There are great forests in the vicinity. Among the public buildings are the city hall, the court house, the Federal building, the public library and an auditorium. In or near Asheville are a normal and collegiate institute for young women (1892), and, occupying the same campus, a home industrial school (1887) for girls, both under the control of the Woman's Board of Home Missions of the Presbyterian Church; the Asheville farm school for boys, an industrial school for negroes; the Asheville school for boys (5 m. west of Asheville); and the Bingham school (1793), founded at Pittsboro, N.C., by William Bingham (d. 1826), and removed to its present site (3 m. north-west of Asheville) in 1891. About 2 m. south-east of the city is Biltmore, the estate of George W. Vanderbilt, its 125,000 acres constituting what is probably the finest country place in the United States. The central feature of the estate is a château (375×150 ft.) of French Renaissance design, after the famous château at Blois, France. In the neighbourhood is a model village, with an elementary school, an industrial school for whites, a hospital and a church, maintained by Mr Vanderbilt. Both the château and the village were designed by Richard M. Hunt; the landscape gardening was done by Frederick Law Olmsted. A collection of woody plants, one of the largest and finest in the world, and a broad forest and hunting preserve, known as Pisgah Forest (100,000 acres), are also maintained by the owner. Asheville is a market for live-stock, dairy products, lumber and fruits, and has various manufactories (in which a good water-power is utilized), including tanneries, cotton mills, brick and tile factories, and a wood-working and veneer plant. The value of the city's factory products increased from $1,300,698 in 1900 to $1,918,362 in 1905, or 47·5%. The city was named in honour of Samuel Ashe (1725–1813), chief-justice of North Carolina from 1777 to 1796, and John Ashe (1720–1781), a North Carolina soldier who distinguished himself in the War of

Independence, was settled about 1790, and was incorporated in 1835. The city's boundaries were enlarged in 1905.

ASHFORD, a market-town in the Southern or Ashford parliamentary division of Kent, England, 56 m. S.E. of London by the South-Eastern & Chatham railway. Pop. of urban district (1901) 12,808. It is pleasantly situated on a gentle eminence near the confluence of the upper branches of the river Stour. It has a fine Perpendicular church dedicated to St Mary, with a lofty, well-proportioned tower and many interesting monuments. The grammar school was founded by Sir Norman Knatchbull in the reign of Charles I. Ashford has agricultural implement works and breweries; and the large locomotive and carriage works of the South-Eastern & Chatham railway are here. At Bethersden, between Ashford and Tenterden, marble quarries were formerly worked extensively, supplying material to the cathedrals of Canterbury and Rochester, and to many local churches. At Charing, north-west of Ashford, the archbishops of Canterbury had a residence from pre-Conquest times, and ruins of a palace, mainly of the Decorated period, remain. On the south-eastern outskirts of Ashford is the populous village of Willesborough (3602).

Ashford (Esselesford, Asshatisforde, Essheford) was held at the time of the Domesday survey by Hugh de Montfort, who came to England with William the Conqueror. A Saturday market and an annual fair were granted to the lord of the manor by Henry III. in 1243. Further annual fairs were granted by Edward III. in 1349 and by Edward IV. in 1466. In 1672 Charles II. granted a market on every second Tuesday, with a court of pie-powder. James I. in 1607, at the petition of the inhabitants of Ashford, gave Sir John Smith, Kt., the right of holding a court of record in the town on every third Tuesday. The fertility of the pasture-land in Romney Marsh to the south and east of Ashford caused the cattle trade to increase in the latter half of the 18th century, and led to the establishment of a stock market in 1784. The town has never been incorporated.

See Edward Hasted, *History and Survey of Kent* (Canterbury, 1778–1799, 2nd ed. 1797–1801); *Victoria County History—Kent.*

'ASHI (352–427), Jewish *'amora*, the first editor of the Talmud, was born at Babylon. He was head of the Sura Academy, and there began the Babylonian Talmud, spending thirty years of his life at it. He left the work incomplete, and it was finished by his disciple Rabina just before the year 500 A.D. (See TALMUD.)

ASHINGTON, an urban district in the Wansbeck parliamentary division of Northumberland, England, 4 m. E. of Morpeth, on the Newbiggin branch of the North Eastern railway. Pop. (1901) 13,956. The district, especially along the river Wansbeck, is not without beauty, but there are numerous collieries, from the existence of which springs the modern growth of Ashington. At Bothal on the river (from which parish that of Ashington was formed) is the castle originally belonging to the Bertram family, of which Roger Bertram probably built the gatehouse, the only habitable portion remaining, in the reign of Edward III. The ruins of the castle are fragmentary, but of considerable extent. The church of St Andrew here has interesting details from Early English to Perpendicular date, and in the neighbouring woods is a ruined chapel of St Mary. The mining centre of Ashington lies 2 m. north-east, on the high ground north of the Wansbeck.

'ASHKENAZI, SEBI (1656–1718), known as Ḥakham Ṣebi, for some time rabbi of Amsterdam, was a resolute opponent of the followers of the pseudo-Messiah, Sabbatai Ṣebi (*q.v.*). He had a chequered career, owing to his independence of character. He visited many lands, including England, where he wielded much influence. His *Responsa* are held in high esteem.

ASHLAND, a city of Boyd county, Kentucky, U.S.A., on the Ohio river, about 130 m. E. by N. of Frankfort. Pop. (1890) 4195; (1900) 6800 (480 negroes); (1910) 8688. It is served by the Chesapeake & Ohio (being a terminal of the Lexington and Big Sandy Divisions) and the Norfolk & Western railways, and is connected with Huntington, West Virginia, by an electric line. The city has a fine natural park (Central Park) of about 30 acres; and Clyffeside Park (maintained by a private corporation), of about 75 acres, just east of the city, is a pleasure resort and a meeting-ground (with a casino seating 3000 people) for the Tri-State "Chautauqua" (for certain parts of Kentucky, Ohio and West Virginia). The surrounding country abounds in coal, iron ore, oil, clay, stone and timber, for which the city is a distributing centre. Ashland has considerable river traffic, and various manufactures, including pig iron, nails, wire rods, steel billets, sheet steel, dressed lumber (especially poplar), furniture, fire brick and leather. Ashland was settled in 1854, and was chartered as a city in 1870.

ASHLAND, a borough of Schuylkill county, Pennsylvania, U.S.A., about 50 m. N.E. of Harrisburg and about 100 m. N.W. of Philadelphia. Pop. (1890) 7346; (1900) 6438 (969 foreign-born); (1910) 6855. It is served by the Lehigh Valley and the Philadelphia & Reading railways, and by the electric lines of the Schuylkill Railway Company and the Shamokin & Mount Carmel Transit Company. The borough is built on the slope of Locust Mountain, about 885 ft. above sea-level. Its chief industry is the mining of anthracite coal at several collieries in the vicinity; and at Fountain Springs, 1 m. south-east, is a state hospital for injured persons of the Anthracite Coal Region of Pennsylvania, opened in 1883. The municipality owns and operates the waterworks. Ashland was laid out as a town in 1847, and was named in honour of Henry Clay's home at Lexington, Ky.; in 1857 it was incorporated.

ASHLAND, a village of Hanover county, Virginia, U.S.A., 17 m. N.W. of Richmond. Pop. (1900) 1147; (1910) 1324. It is served by the Richmond, Fredericksburg & Potomac railway, and is a favourite resort from Richmond. Here is situated the Randolph-Macon College (Methodist Episcopal, South), one of the oldest Methodist Episcopal colleges in the United States. In 1832, two years after receiving its charter, it opened near Boydton, Mecklenburg county, Virginia, and in 1868 was removed to Ashland. The college in 1907–1908 had 150 students and a faculty of 16; it publishes an endowed historical series called *The John P. Branch Historical Papers of Randolph-Macon College*; and it is a part of the "Randolph-Macon System of Colleges and Academies," which includes, besides, Randolph-Macon Academy (1890) at Bedford City, Virginia, and Randolph-Macon Academy (1892) at Front Royal, Virginia, both for boys; Randolph-Macon Woman's College (1893) at Lynchburg, Virginia, which in 1907–1908 had an enrolment of 390; and Randolph-Macon Institute, for girls, Danville, Virginia, which was admitted into the "System" in 1897. These five institutions are under the control of a single board of trustees; the work of the preparatory schools is thus correlated with that of the colleges. About 7 m. out of Ashland is the birthplace of Henry Clay, and about 15 m. distant is the birthplace of Patrick Henry. Ashland was settled in 1845 and was incorporated in 1856.

ASHLAND, a city and the county-seat of Ashland county, Wisconsin, U.S.A., situated about 315 m. N.W. of Milwaukee, and about 70 m. E. of Superior and Duluth, in the N. part of the state, at the head of Chequamegon Bay, an arm of Lake Superior. Pop. (1890) 9956; (1900) 13,074, of whom 4417 were foreign-born; (1910, census) 11,594. It is served by the Chicago & North-Western, the Northern Pacific, the Chicago, St Paul, Minneapolis & Omaha, and the Wisconsin Central railways, and by several steamboat lines on the Great Lakes. The city is attractively situated, has a dry, healthful climate, and is a summer resort. It has a fine Federal building, one of the best high-school buildings in Wisconsin, the Vaughn public library (1895), a Roman Catholic hospital, and the Rinehart hospital, and is the seat of the Northland College and Academy (Congregational). Ashland has an excellent harbour, has large iron-ore and coal docks, and is the principal port for the shipment of iron ore from the rich Gogebic Range, the annual ore shipment approximating 3,500,000 tons, valued at $12,000,000, and it has also an extensive export trade in lumber. Brownstone quarried in the vicinity is also an important export. The lake trade amounts to more than $35,000,000 annually. Ashland has large saw-mills, iron and steel rolling mills, foundries and machine shops, railway repair shops (of the Chicago & North-Western railway), knitting works, and manufactories of dynamite, sulphite fibre, charcoal and wood-alcohol. In 1905 its total factory product was valued at $4,210,265. Settled about 1854, Ashland was incorporated as a village in 1863 and received a city charter in 1887.

ASHLAR, also written ASHLER, ASHELERE, &c. (probably from Lat. *axilla*, diminutive of *axis*, an axle), hewn or squared stone, generally applied to that used for facing walls. In a contract of date 1398 we read—"Murus erit exterius de puro lapide vocato *achilar*, plane incisso, interius vero de lapide fracto vocato *roghwall*." "Clene hewen ashler" often occurs in medieval documents; this no doubt means tooled or finely worked, in contradistinction to rough-axed faces.

An "ashlar piece" in building is an upright piece of timber framed between the common rafters and the wall plate.

ASHLEY, WILLIAM JAMES (1860–   ), English economist, was born in London on the 25th of February 1860. He was educated at St Olave's grammar school and Balliol College, Oxford, and became a fellow of Lincoln College. In 1888 he was appointed professor of political economy and constitutional history in Toronto University, a post which he resigned in 1892, in order to become professor of economic history at Harvard University. In 1901 he was appointed professor of commerce and finance in Birmingham University and in 1902 dean of the faculty of commerce. Professor Ashley became well known for his work on the early history of English industry, and for his prominence among those English economists who supported Mr Chamberlain's tariff reform movement. His most important works are *Early History of the English Woollen Industry* (1887); *Introduction to English Economic History and Theory* (2 parts, 1888–1893); *Surveys, Historic and Economic* (1900); *Adjustment of Wages* (1903); the *Tariff Problem* (2nd ed. 1904); *Progress of the German Working Classes* (1904).

ASHMOLE, ELIAS (1617–1692), English antiquarian, and founder of the Ashmolean Museum at Oxford, was born at Lichfield on the 23rd of May 1617, the son of a saddler. In 1638 he became a solicitor, and in 1644 was appointed commissioner of excise. At Oxford, whither this brought him when the Royalist Parliament was sitting there, he made friends with Captain (afterwards Sir) George Wharton, through whose influence he obtained the king's commission as captain of horse and comptroller of the ordnance. In 1646 he was initiated as a Freemason—the first gentleman, or amateur, to be "accepted." In 1649 he married Lady Mainwaring, some twenty years his senior and a relative of his first wife who had died eight years before. This marriage placed him in a position of affluence that enabled him to devote his whole time to his favourite studies. His interest in astrology, aroused by Wharton, and by William Lilly,—whom with other astrologers he met in London in 1646,—seems, in the following years, to have subsided in favour of heraldry and antiquarian research. In 1657 his wife petitioned for a separation, but failing to gain her case returned to live with him. Between this crisis in his domestic life and the time of her death in 1668, Ashmole was in high favour at court. He was made successively Windsor herald, commissioner, comptroller and accountant-general of excise, commissioner for Surinam and comptroller of the White Office. He afterwards refused the office of Garter king-at-arms in favour of Sir William Dugdale, whose daughter he had married in 1668. In 1672 he published his *Institutions, Laws and Ceremonies of the Order of the Garter*, a work which was practically exhaustive, and is an example of his diligence and years of patient antiquarian research. Five years later he presented the Ashmolean Museum, the first public museum of curiosities in the kingdom, the larger part of which he had inherited from a friend, John Tradescant, to the university of Oxford. He made it a condition that a suitable building should be erected for its reception, and the collection was not finally installed until 1683. Subsequently he made the further gift to the university of his library. He died on the 18th of May 1692.

ASHRAF (SHUREFA, SHERIFS), a small scattered tribe of African "Arabs" settled near Tokar, in the valleys of the Gash and Baraka, and in the Amarar country north of Suakin. They call themselves Beni Hashin, and claim descent from Mahomet; hence their name, *sherif* (plural *ashraf*) being the title applied to descendants of the prophet. In the time of the khalifa Abdulla (1885–1898), Ashraf was the name by which the family and adherents of his late master the mahdi were known, the mahdi's family claiming to be Ashraf. The Ashraf of Tokar remained loyal to Egypt during the Sudan troubles.

See *Anglo-Egyptian Sudan*, edited by Count Gleichen (London, 1905); *Fire and Sword in the Sudan*, by Slatin Pasha (London, 1896); for the Ashraf or Sherifs in Arabia, see ARABIA: *Geography*.

ASHREF, a town of Persia in the province of Mazandaran, about 50 m. W. of Astarabad and 5 m. inland from the Caspian Sea, in 36° 42′ N. and 53° 32′ E. The population is about 6000, comprising descendants of some Georgians introduced by Shah Abbas I. (1587–1629) and a number of Gudars, a peculiar pariah race, probably of Indian origin. The place was without importance until 1612, when Shah Abbas began building and laying out the palaces and gardens in the neighbourhood now collectively known as Bagh i Shah (the garden of the shah). The palaces, completed in 1627, are now in ruins, but the gardens with their luxuriant vegetation and gigantic cypress and orange trees are well worth a visit. There were originally six separate gardens, all contained within one large wall but separated one from another by high walls. The principal palace was the Chehel Situn (forty pillars), destroyed by the Afghans in 1723, and, although rebuilt by Nadir Shah in 1731, already in ruins in 1743. About $\frac{3}{4}$ m. north of the town is the Safi-abad garden, with a palace built by Shah Safi (1629–1642) for his daughter. It is situated on a lovely wooded hill, and was repaired and in part renovated about 1870 by Nāṣiru'd-Din Shah.

ASHTABULA, a city of Ashtabula county, Ohio, U.S.A., in Ashtabula township, on the Ashtabula river and Lake Erie, and 54 m. N.E. of Cleveland. Pop. (1890) 8338; (1900) 12,949, of whom 3688 were foreign-born; (1910, census) 18,266. There is a large Finnish born population in the city and in Ashtabula county, and the *Amerikan Sanomat*, established here in 1897, is one of the most widely read Finnish weeklies in the country. Ashtabula is served by the Pennsylvania, the Lake Shore & Michigan Southern, and the New York, Chicago & St Louis railways, and by inter-urban electric lines. The city is built on the high bank of the river about 75 ft. above the lake, and commands good views of diversified scenery. There is a public library. Ashtabula has an excellent harbour, to and from which large quantities of iron ore and coal are shipped. More iron ore is received at this port annually than at any other port in the country, or, probably, in the world; the ore is shipped thence by rail to Pittsburg, Youngstown and other iron manufacturing centres. In 1907 the port received 7,542,149 gross tons of iron ore, and shipped 2,632,027 net tons of soft coal. Among the city's manufactures are leather, worsted goods, agricultural implements, and foundry and machine shop products; in 1905 the total value of the factory product was $1,895,454, an increase of 114·3 % in five years. There are large green-houses in and near Ashtabula, and quantities of lettuce, cucumbers and tomatoes are raised under glass and shipped to Pittsburg and other large cities. The first settlement here was made about 1801. Ashtabula township was created in 1808, and from it the townships of Kingsville, Plymouth and Sheffield have subsequently been formed. The village of Ashtabula was incorporated in 1831, and received a city charter in 1891. The name *Ashtabula* is an Indian word first applied to the river and said to mean "fish river."

ASHTON-IN-MAKERFIELD, an urban district in the Newton parliamentary division of Lancashire, England, 4 m. S. of Wigan, on the Great Central railway. Pop. (1901) 18,687. The district is rich in minerals, and has large collieries, and a colliery company's institute; iron goods are manufactured.

ASHTON-UNDER-LYNE, a market-town and municipal and parliamentary borough of Lancashire, England, on the river Tame, a tributary of the Mersey, 185 m. N.W. by N. from London and $6\frac{1}{2}$ E. from Manchester. Area, 1346 acres. Pop. (1891) 40,486; (1901) 43,890. It is served by the London & North-Western and the Lancashire & Yorkshire railways (Charlestown station), and by the Great Central (Park Parade station).

The church of St Michael is Perpendicular, but almost wholly rebuilt. In the vicinity are barracks. The Old Hall, or manor house of the Asshetons, remains in an altered form, with an ancient prison adjoining, and the name of Gallows Meadow, still preserved, recalls the summary execution of justice by the lords of the manor. In the vicinity of Ashton a few picturesque old houses remain among the numerous modern residences. Stamford Park, presented by Lord Stamford, is shared by the towns of Ashton and Stalybridge, which extends across the Tame into Cheshire. A technical school, school of art and free library, and several hospitals are maintained. Chief among industries are cotton-spinning, hat-making and iron-founding and machinery works; and there are large collieries in the neighbourhood. The parliamentary borough, which returns one member, extends into Cheshire. The corporation consists of a mayor, 8 aldermen and 24 councillors.

The derivation from the Saxon *æsc* (ash) and *tun* (an enclosed place) accounts for the earliest orthography Estun. The addition *subtus lineam* is found in ancient deeds and is due to the position of the place below the line or boundary of Cheshire, which once formed the frontier between the kingdoms of Northumbria and Mercia. The manor was granted to Roger de Poictou by William I., but before the end of his reign came to the Greslets as part of the barony of Manchester. It was held by the Asshetons from 1335 to 1515, when it passed by marriage to the Booths of Dunham Massey, and is now held by the earl of Stamford, the representative of that family. The lord of the manor still holds the ancient court-leet and court-baron half-yearly in May and November, in which cognizance is taken of breaches of agreement among the tenants, especially concerning the repair of roads and cultivation of lands. The place had long enjoyed the name of borough, but it was not till 1847 that a charter of incorporation was granted. Under the Reform Act (1832) it returns one member. One of the markets dates back to 1436. The ancient industry was woollen, but soon after the invention of the spinning frame the cotton trade was introduced, and as early as 1769 the weaving of ginghams, nankeens and calicoes was carried on, and the weaving of cotton yarn by machinery soon became the staple industry. A chapel or church existed here as early as 1261–1262.

ASH WEDNESDAY, in the Western Church, the first day of Lent (*q.v.*), so called from the ceremonial use of ashes, as a symbol of penitence, in the service prescribed for the day. The custom, which is ultimately based on the penance of "sackcloth and ashes" spoken of by the prophets of the Old Testament, has been dropped in those of the reformed Churches which still observe the fast; but it is retained in the Roman Catholic Church, the day being known as *dies cinerum* (day of ashes) or *dies cineris et cilicii* (day of ash and sackcloth). The ashes, obtained by burning the palms or their substitutes used in the ceremonial of the previous Palm Sunday, are placed in a vessel on the altar before High Mass. The priest, vested in a violet cope, prays that God may send His angel to hallow the ash, that it become a *remedium salubre* for all penitents. After another prayer the ashes are thrice sprinkled with holy water and thrice censed. Then the priest invites those present to approach and, dipping his thumb in the ashes, marks them as they kneel with the sign of the cross on the forehead (or in the case of clerics on the place of tonsure), with the words: *Memento, homo, quia pulvis es et in pulverem reverteris* (Remember, man, that thou art dust and unto dust thou shalt return). The celebrant himself either sprinkles the ash on his own head in silence, or receives it from the priest of highest dignity present.

This ceremony is derived from the custom of public penance in the early Church, when the sinner to be reconciled had to appear in the congregation clad in sackcloth and covered with ashes (cf. Tertullian, *De Pudicitia*, 13). At what date this use was extended to the whole congregation is not known. The phrase *dies cinerum* appears in the earliest extant copies of the Gregorian Sacramentary, and it is probable that the custom was already established by the 8th century. The Anglo-Saxon homilist Ælfric, in his *Lives of the Saints* (996 or 997), refers to it as in common use; but the earliest evidence of its authoritative prescription is a decree of the synod of Beneventum in 1091.

Of the reformed Churches the Anglican Church alone marks the day by any special service. This is known as the Commination service, its distinctive element being the solemn reading of "the general sentences of God's cursing against sinners, gathered out of the seven and twentieth chapter of Deuteronomy, and other places of Scripture." The lections for the day are the same as in the Roman Church (Joel ii. 12, &c., and Matt. vi. 16, &c.). In the American Prayer Book the office of Commination is omitted, with the exception of the three concluding prayers, which are derived from the prayers and anthems said or sung during the blessing and distribution of the ashes according to the Sarum Missal. The ceremonial of the ashes was not proscribed in England at the Reformation; it was indeed enjoined by a proclamation of Henry VIII. (February 26, 1538) and again in 1550 under Edward VI.; but it had fallen into complete disuse by the beginning of the 17th century.

See Wetzer and Welte, *Kirchenlexikon*, and Herzog-Hauck, *Realencyklopädie* (3rd ed.), s. "*Aschermittwoch*"; L. Duchesne, *Christian Worship*, trans. by M. L. McClure (London, 1904).

ASHWELL, LENA (1872–), English actress, was the daughter of Commander Pocock, R.N. In 1896 she married the actor Arthur Playfair, whom she divorced in 1908; later in the latter year she married Dr Simson. In 1895 she played Elaine in Sir Henry Irving's production of *King Arthur* at the Lyceum, and again acted with him in 1903 in *Dante*. She made her first striking success, however, on the London stage in *Mrs Dane's Defence* with Sir Charles Wyndham in 1900, and a few years later her acting in *Leah Kleschna* confirmed her position as one of the leading actresses in London. In 1907 she started under her own management at the Kingsway theatre.

ASIA, the name of one of the great continents into which the earth's surface is divided, embracing the north-eastern portion of the great mass of land which constitutes what is generally known as the Old World, of which Europe forms the north-western and Africa the south-western region.

Much doubt attaches to the origin of the name. Some of the earliest Greek geographers divided their known world into two portions only, Europe and Asia, in which last Libya (the Greek name for Africa) was included. Herodotus, who ranks Libya as one of the chief divisions of the world, separating it from Asia, repudiates as fables the ordinary explanations assigned to the names Europe and Asia, but confesses his inability to say whence they came. It would appear probable, however, that the former of these words was derived from an Assyrian or Hebrew root, which signifies the west or setting sun, and the latter from a corresponding root meaning the east or rising sun, and that they were used at one time to imply the west and the east. There is ground also for supposing that they may at first have been used with a specific or restricted local application, a more extended signification having eventually been given to them. After the word Asia had acquired its larger sense, it was still specially used by the Greeks to designate the country around Ephesus. The idea of Asia as originally formed was necessarily indefinite, and long continued to be so; and the area to which the name was finally applied, as geographical knowledge increased, was to a great extent determined by arbitrary and not very precise conceptions, rather than on the basis of natural relations and differences subsisting between it and the surrounding regions.

GEOGRAPHY

Boundaries.

The northern boundary of Asia is formed by the Arctic Ocean; the coast-line falls between 70° and 75° N., and so lies within the Arctic circle, having its extreme northern point in Cape Sivero-Vostochnyi (*i.e.* north-east) or Chelyuskin, in 78° N. On the south the coast-line is far more irregular, the Arabian Sea, the Bay of Bengal, and the China Sea reaching about to the northern tropic at the mouths of the Indus, of the Ganges and of the Canton river;

while the great peninsulas of Arabia, Hindostan and Cambodia descend to about 10° N., and the Malay peninsula extends within a degree and a half of the equator. On the west the extreme point of Asia is found on the shore of the Mediterranean, at Cape Baba, in 26° E., nor far from the Dardanelles. Thence the boundary passes in the one direction through the Mediterranean, and down the Red Sea to the southern point of Arabia, at the strait of Bab-el-Mandeb, in 45° E.; and in the other through the Black Sea, and along the range of Caucasus, following approximately 40° N. to the Caspian, whence it turns to the north on a line not far from the 60th meridian, along the Ural Mountains, and meets the Arctic Ocean nearly opposite the island of Novaya Zemlya. The most easterly point of Asia is East Cape (Vostochnyi, *i.e.* east, or Dezhnev), in 190° E., at the entrance of Bering Strait. The boundary between this point and the extremity of the Malay Peninsula follows the coast of the Northern Pacific and the China Sea, on a line deeply broken by the projection of the peninsulas of Kamchatka and Korea, and the recession of the Sea of Okhotsk, the Yellow Sea, and the Gulfs of Tongking and Siam.

Islands.

On the east and south-east of Asia are several important groups of islands, the more southern of which link this continent to Australia, and to the islands of the Pacific. The Kurile Islands, the Japanese group, Luchu, Formosa and the Philippines, may be regarded as unquestionable outliers of Asia. Between the islands of the Malay archipelago from Sumatra to New Guinea, and the neighbouring Asiatic continent, no definite relations appear ever to have existed, and no distinctly marked boundary for Asia has been established by the old geographers in this quarter. Modern science, however, has indicated a line of physical separation along the channel between Borneo and Celebes, called the Straits of Macassar, which follows approximately 120° E., to the west of which the flora and fauna are essentially Asiatic in their type, while to the south and east the Australian element begins to be distinctly marked, soon to become predominant. To this boundary has been given the name of Wallace's line, after the eminent naturalist, A. R. Wallace, who first indicated its existence.

Form of continent.

Owing to the great extent of Asia, it is not easy to obtain a correct conception of the actual form of its outline from ordinary maps, the distortions which accompany projections of large spherical areas on a flat surface being necessarily great and misleading. Turning, therefore, to a globe, Asia, viewed as a whole, will be seen to have the form of a great isosceles spherical triangle, having its north-eastern apex at East Cape (Vostochnyi), in Bering Strait; its two equal sides, in length about a quadrant of the sphere, or 6500 m., extending on the west to the southern point of Arabia, and on the east to the extremity of the Malay peninsula; and the base between these points occupying about 60° of a great circle, or 4500 m., and being deeply indented by the Arabian Sea and the Bay of Bengal on either side of the Indian peninsula. A great circle, drawn through East Cape and the southern point of Arabia, passes nearly along the coast-line of the Arctic Ocean, over the Ural Mountains, through the western part of the Caspian, and nearly along the boundary between Persia and Asiatic Turkey. Asia Minor and the north-western half of Arabia lie outside such a great circle, which otherwise indicates, with fair accuracy, the north-western boundary of Asia. In like manner a great circle drawn through East Cape and the extremity of the Malay peninsula, passes nearly over the coasts of Manchuria, China and Cochin-China, and departs comparatively little from the eastern boundary.

General physiography.

Asia is divided laterally along the parallel of 40° north by a depression which, beginning on the east of the desert of Gobi, extends westwards through Mongolia to Chinese Turkestan. To the west of Kashgar the central depression is limited by the meridional range of Sarikol and the great elevation of the Pamir, of which the Sarikol is the eastern face. The level of this depression (once a vast inland sea) between the mountains which enclose the sources of the Hwang-ho and the Sarikol range probably never exceeds 2000 ft. above sea, and modern researches tend to prove that in the central portions of the Gobi (about Lop Nor) it may be actually below sea-level. A vast portion of the continent north of this central line is but a few hundred feet in altitude. Shelving gradually upward from the low flats of Siberia the general continental level rises to a great central water-parting, or divide, which stretches from the Black Sea through the Elburz and the Hindu Kush to the Tian-shan mountains in the Pamir region, and hence to Bering Strait on the extreme north-east. This great divide is not always marked by well-defined ranges facing steeply either to the north or south. There are considerable spaces where the strike, or axis, of the main ranges is transverse to the water-parting, which is then represented by intermediate highlands forming lacustrine regions with an indefinite watershed. Only a part of this great continental divide (including such ranges as the Hindu Kush, Tian-shan, Altai or Khangai) rises to any great height, a considerable portion of it being below 5000 ft. in altitude. South of the divide the level at once drops to the central depression of Gobi, which forms a vast interior, almost waterless space, where the local drainage is lost in deserts or swamps. South of this enclosed depression is another great hydrographic barrier which parts it from the low plains of the Amur, of China, Siam and India, bordered by the shallows of the Yellow Sea and the shoals which enclose the islands of Japan and Formosa, all of them once an integral part of the continent. This second barrier is one of the most mighty upheavals in the world, by reason both of its extent and its altitude. Starting from the Amur river and reaching along the eastern margin of the Gobi desert towards the sources of the Hwang-ho, it merges into the Altyn-tagh and the Kuen-lun, forming the northern face of the vast Tibetan highlands which are bounded on the south by the Himalaya. The Pamir highlands between the base of the Tian-shan mountains and the eastern buttresses of the Hindu Kush unite these two great divides, enclosing the Gobi depression on the west; and they would again be united on the east but for the transverse valley of the Amur, which parts the Khingan mountains from the Yablonoi system to the east of Lake Baikal.

If we consider the whole continent to be divided into three sections, viz. a northern section with an average altitude of less than 5000 ft. above sea, where all the main rivers flow northward to the Mediterranean, the Arctic Sea, or the Caspian; a central section of depression, where the drainage is lost in swamps or *hamūns*, and of which the average level probably does not exceed 2000 ft. above sea; and a southern section divided between highly elevated table-lands from 15,000 to 16,000 ft. in altitude, and lowlands of the Arabian, Indian, Siamese and Chinese peninsulas, with an ocean outlet for its drainage; we find that there is only one direct connexion between northern and southern sections which involves no mountain passes, and no formidable barrier of altitudes. That one is afforded by the narrow valley of the Hari Rud to the west of Herat. From the Caspian to Karachi it is possible to pass without encountering any orographic obstacle greater than the divide which separates the valley of the Hari Rud from the Helmund *hamūn* basin, which may be represented by an altitude of about 4000 ft. above sea-level. This fact possesses great significance in connexion with the development of Asiatic railways.

Hydrography.

If we examine the hydrographic basins of the three divisions of Asia thus indicated we find that the northern division, including the drainage falling into the Arctic Sea, the Aralo-Caspian depression, or the Mediterranean, embraces an area of about 6,394,500 sq. m., as follows:—

	Sq. m.
Area of Arctic river basins	4,367,000
,, Aralo-Caspian basin . . .	1,759,000
,, Mediterranean	268,500
Total . . .	6,394,500

The southern division is nearly equal in extent—

	Sq. m.
Pacific drainage	3,641,000
Indian Ocean	2,873,000
Total . . .	6,514,000

The interior or inland basins, including the lacustrine regions south of the Arctic watershed, the Gobi depression, Tibetan plateau, the Iranian (or Perso-Afghan) uplands, the Syro-Arabian inland basin, and that of Asia Minor, amount to 3,141,500 sq. m. or about half the extent of the other two.

By far the largest Asiatic river basin is that of the Ob, which exceeds 1,000,000 sq. m. in extent. On the east and south the Amur embraces no less than 776,000 sq. m., the Yang-tsze-kiang including 685,000, the Ganges 409,500, and the Indus 370,000 sq. m.[1]

The lakes of Asia are innumerable, and vary in size from an inland sea (such as Lakes Baikal and Balkash) to a highland loch, or the indefinitely extended swamps of Persia. Many of them are at high elevations (Lake Victoria, 13,400 ft., being probably the most elevated), and are undoubted vestiges of an ancient period of glaciation. Such lakes, as a rule, show indications of a gradual decrease in size. Others are relics of an earlier geological period, when land areas recently upheaved from the sea were spread at low levels with alternate inundations of salt and fresh water. Of these Lop Nor and the Helmund *hamūns* are typical. Such lakes (in common with all the plateau *hamūns* of south-west Baluchistan and Persia) change their form and extent from season to season, and many of them are impregnated with saline deposits from the underlying strata. The *kavirs*, or salt depressions, of the Persian desert are more frequently widespread deposits of mud and salt than water-covered areas.

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[1] Authorities differ in their methods and results of computation of these and other similar measurements.

Political divisions. Although for the purposes of geographical nomenclature, boundaries formed by a coast-line—that is, by depressions of the earth's solid crust *below* the ocean level—are most easily recognized and are of special convenience; and although such boundaries, from following lines on which the continuity of the land is interrupted, often necessarily indicate important differences in the conditions of adjoining countries, and of their political and physical relations, yet variations of the elevation of the surface *above* the sea-level frequently produce effects not less marked. The changes of temperature and climate caused by difference of elevation are quite comparable in their magnitude and effect on all organized creatures with those due to differences of latitude; and the relative position of the high and low lands on the earth's surface, by modifying the direction of the winds, the fall of rain, and other atmospheric phenomena, produce effects in no sense less important than those due to the relative distribution of the land and sea. Hence the study of the mountain ranges of a continent is, for a proper apprehension of its physical conditions and characteristics, as essential as the examination of its extent and position in relation to the equator and poles, and the configuration of its coasts.

Himalayan boundary. From such causes the physical conditions of a large part of Asia, and the history of its population, have been very greatly influenced by the occurrence of the mass of mountain above described, which includes the Himalaya and the whole elevated area having true physical connexion with that range, and occupies an area about 2000 m. in length and varying from 100 to 500 m. in width, between 65°and 100°east and between 28° and 35° north. These mountains, which include the highest peaks in the world, rise, along their entire length, far above the line of perpetual snow, and few of the passes across the main ridges are at a less altitude than 15,000 or 16,000 ft. above the sea. Peaks of 20,000 ft. abound along the whole chain, and the points that exceed that elevation are numerous. A mountain range such as this, attaining altitudes at which vegetable life ceases, and the support of animal life is extremely difficult, constitutes an almost impassable barrier against the spread of all forms of living creatures. The mountain mass, moreover, is not less important in causing a complete separation between the atmospheric conditions on its opposite flanks, by reason of the extent to which it penetrates that stratum of the atmosphere which is in contact with the earth's surface and is effective in determining climate. The highest summits create serious obstructions to the movements of nearly three-fourths of the mass of the air resting on this part of the earth, and of nearly the whole of the moisture it contains; the average height of the entire chain is such as to make it an almost absolute barrier to one-half of the air and three-fourths of the moisture; while the lower ranges also produce important atmospheric effects, one-fourth of the air and one-half of the watery vapour it carries with it lying below 9000 ft.

This great mass of mountain, constituting as it does a complete natural line of division across a large part of the continent, will form a convenient basis from which to work, in proceeding, as will now be done, to give a general view of the principal countries contained in Asia.

Tibet. The summit of the great mountain mass is occupied by Tibet, a country known by its inhabitants under the name of *Bod* or *Bodyul*. Tibet is a rugged table-land, narrow as compared with its length, broken up by a succession of mountain ranges, which follow as a rule the direction of the length of the table-land, and commonly rise into the regions of perpetual snow; between the flanks of these lie valleys, closely hemmed in, usually narrow, having a very moderate inclination, but at intervals opening out into wide plains, and occupied either by rivers, or frequently by lakes from which there is no outflow and the waters of which are salt. The eastern termination of Tibet is in the line of snowy mountains which flanks China on the west, between the 27th and 35th parallels of latitude, and about 103° east. On the west the table-land is prolonged beyond the political limits of Tibet, though with much the same physical features, to about 70°east, beyond which it terminates; and the ranges which are covered with perpetual snow as far west as Samarkand, thence rapidly diminish in height, and terminate in low hills north of Bokhara.

The mean elevation of Tibet may be taken as 15,000 ft. above the sea. The broad mountainous slope by which it is connected with the lower levels of Hindostan contains the ranges known as the Himalaya; the name Kuen-lun is generally applied to the northern slope that descends to the central plains of the Gobi, though these mountains are not locally known under those names, Kuen-lun being apparently a Chinese designation.

The extreme rigour of the climate of Tibet, which combines great cold with great drought, makes the country essentially very poor, and the chief portion of it little better than desert. The vegetation is everywhere most scanty, and scarcely anything deserving the name of a tree is to be found unless in the more sheltered spots, and then artificially planted. The population in the lower and warmer valleys live in houses, and follow agriculture; in the higher regions they are nomadic shepherds, thinly scattered over a large area.

China. China lies between the eastern flank of the Tibetan plateau and the North Pacific, having its northern and southern limits about on 40° and 20° N. respectively. The country, though generally broken up with mountains of moderate elevation, possesses none of very great importance apart from those of its western border. It is well watered, populous, and, as a rule, highly cultivated, fertile, and well wooded; the climate is analogous to that of southern Europe, with hot summers, and winters everywhere cold and in the north decidedly severe.

Indo-Chinese region. From the eastern extremity of the Tibetan mountains, between the 95th and 100th meridians, high ranges extend from about 35° N. in a southerly direction, which, spreading outwards as they go south, reach the sea at various points in Cochin-China, the Malay peninsula, and the east flank of Bengal. Between these ranges, which are probably permanently snowy to about 27° N., flow the great rivers of the Indo-Chinese peninsula, the Mekong, the Menam, the Salween, and the Irrawaddy, the valleys of which form the main portions of the states of Cochin-China (including Tongking and Cambodia), of Siam (including Laos) and of Burma. The people of Cochin-China are called Anam; it is probably from a corruption of their name for the capital of Tongking, Kechao, that the Portuguese Cochin has been derived. All these countries are well watered, populous and fertile, with a climate very similar to that of eastern Bengal. The geography of the region in which the mountains of Cochin-China and Siam join Tibet is still imperfectly known, but there is no ground left for doubting that the great river of eastern Tibet, the Tsanpo, supplies the main stream of the Brahmaputra. The two great rivers of China, the Hwang-ho and the Yang-tsze-kiang take their rise from the eastern face of Tibet, the former from the north-east angle, the latter from the south-east. The main stream of this last is called Dichu in Tibet, and its chief feeder is the Ya-lung-kiang, which rises not far from the Hwang-ho, and is considered the territorial boundary between China and Tibet.

British India. British India comprises approximately the area between the 95th and 70th meridians, and between the Tibetan table-land and the Indian Ocean. The Indian peninsula from 25° N. southwards is a table-land, having its greatest elevation on the west, where the highest points rise to over 8000 ft., though the ordinary altitude of the higher hills hardly exceeds 4000 ft.; the general level of the table-land lies between 3000 ft. as a maximum and 1000 ft.

From the delta of the Ganges and Brahmaputra on the east to that of the Indus on the west, and intervening between the table-land of the peninsula and the foot of the Himalayan slope of the Tibetan plateau, lies the great plain of northern India, which rises at its highest point to about 1000 ft., and includes altogether, with its prolongation up the valley of Assam, an area of about 500,000 sq. m., comprising the richest, the most populous and most civilized districts of India. The great plain extends, with an almost unbroken surface, from the most western to the most eastern extremity of British India, and is composed of deposits so finely comminuted, that it is no exaggeration to say that it is possible to go from the Bay of Bengal up the Ganges, through the Punjab, and down the Indus again to the sea, over a distance of 2000 m. and more, without finding a pebble, however small.

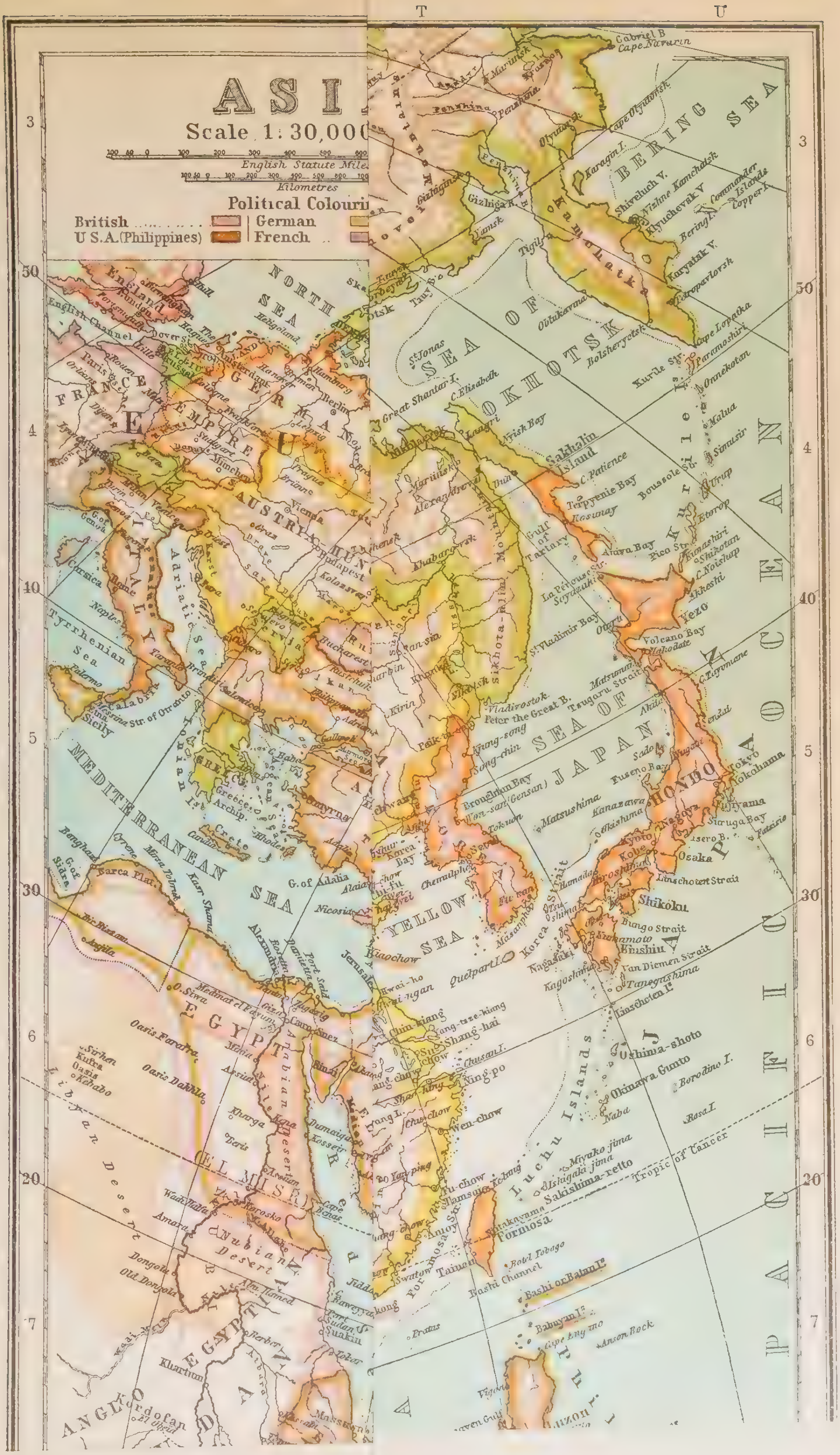
The great rivers of northern India—the Ganges, the Brahmaputra and the Indus—all derive their waters from the Tibetan mountain mass; and it is a remarkable circumstance that the northern water-parting of India should lie to the north of the Himalaya in the regions of central Tibet.

The population of India is very large, some of its districts being among the most densely peopled in the world. The country is generally well cleared, and forests are, as a rule, found only along the flanks of the mountains, where the fall of rain is most abundant. The more open parts are highly cultivated, and large cities abound. The climate is generally such as to secure the population the necessaries of life without severe labour; the extremes of heat and drought are such as to render the land unsuitable for pasture, and the people everywhere subsist by cultivation of the soil or commerce, and live in settled villages or towns.

The island of Ceylon is distinguished from the neighbouring parts of British India by little more than its separate administration and the Buddhistic religion of its population. The highest point in Ceylon rises to about 9000 ft. above the sea, and the mountain slopes are densely covered with forest. The lower levels are in climate and cultivation quite similar to the regions in the same latitude on the Malay peninsula.

Of the islands in the Bay of Bengal the Nicobar and Andaman groups are alone worth notice. They are placed on a line joining the north end of Sumatra and Cape Negrais, the south-western extremity of Burma. They possibly owe their existence to the volcanic agencies which are known to extend from Sumatra across this part of the Indian Ocean.

The Laccadives and Maldives are groups of small coral islands,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EGYPT
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BERING SEA
Kamchatka
Sakhalin Island
Kurile Is.
SEA OF JAPAN
HONDO
Yezo
Shikoku
Kiushiu
YELLOW SEA
Korea
Formosa
Luchu Islands
Tropic of Cancer
PACIFIC OCEAN
Tokyo
Yokohama
Osaka
Kyoto
Vladivostok
Shang-hai
Ning-po
Wen-chow
Amoy
Swatow
Nubian Desert
Libyan Desert
Khartum
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situated along the 73rd meridian, at no great distance from the Indian peninsula, on which they have a political dependency.

The Nearer East.

The portion of Asia west of British India, excluding Arabia and Syria, forms another extensive plateau covering an area as large as that of Tibet, though at a much lower altitude. Its southern border runs along the Arabian Sea, the Persian Gulf, the Tigris, and thence westward to the north-east angle of the Levant; on the north the high land follows nearly 36° N. to the southern shore of the Caspian, and thence to the Black Sea and Sea of Marmora. Afghanistan, Baluchistan, Iran or Persia, Armenia and the provinces of Asia Minor occupy this high region, with which they are nearly conterminous. The eastern flank of this tableland follows a line of hills drawn a short distance from the Indus, between the mouth of that river and the Himalaya, about on the 72nd meridian; these hills do not generally exceed 4000 or 5000 ft. in elevation, but a few of the summits reach 10,000 ft. or more. The southern and south-western face follows the coast closely up the Persian Gulf from the mouth of the Indus, and is formed farther west by the mountain scarp, which, rising in many points to 10,000 ft., flanks the Tigris and the Mesopotamian plains, and extends along Kurdistan and Armenia nearly to the 40th meridian; beyond which it turns along the Taurus range, and the north-eastern angle of the Mediterranean. The north-eastern portion of the Afghan tableland abuts on the Himalaya and Tibet, with which it forms a continuous mass of mountain between the 71st and 72nd meridians, and 34° and 36° N. From the point of intersection of the 71st meridian with the 36th parallel of latitude, an unbroken range of mountain stretches on one side towards the north-east, up to the crest of the northern slope of the Tibetan plateau, and on the other nearly due west as far as the Caspian. The north-eastern portion of this range is of great altitude, and separates the headwaters of the Oxus, which run off to the Aral Sea, from those of the Indus and its Kabul tributary, which, uniting below Peshawar, are thence discharged southward into the Arabian Sea. The western part of the range, which received the name of Paropamisus Mons from the ancients, diminishes in height west of the 65th meridian and constitutes the northern face of the Afghan and Persian plateau, rising abruptly from the plains of the Turkoman desert, which lies between the Oxus and the Caspian. These mountains at some points attain a height of 10,000 or 12,000 ft. Along the south coast of the Caspian this line of elevation is prolonged as the Elburz range (not to be confused with the Elburz of the Caucasus), and has its culminating point in Demavend, which rises to 19,400 ft. above the sea; thence it extends to the north-west to Ararat, which rises to upwards of 17,000 ft., from the vicinity of which the Euphrates flows off to the south-west, across the high lands of Armenia. Below the north-east declivity of this range lies Georgia, on the other side of which province rises the Caucasus, the boundary of Asia and Europe between the Caspian and Black Seas, the highest points of which reach an elevation of nearly 19,000 ft. West of Ararat high hills extend along the Black Sea, between which and the Taurus range lies the plateau of Asia Minor, reaching to the Aegean Sea; the mountains along the Black Sea, on which are the Olympus and Ida of the ancients, rise to 6000 or 7000 ft.; the Taurus is more lofty, reaching 8000 and 10,000 ft.; both ranges decline in altitude as they approach the Mediterranean.

This great plateau, extending from the Mediterranean to the Indus, has a length of about 2500 m. from east to west, and a breadth of upwards of 600 m. on the west and nowhere of less than 250 m. It lies generally at altitudes between 2000 ft. and 8000 ft. above the sea-level. Viewed as a whole, the eastern half of this region, comprising Persia, Afghanistan and Baluchistan, is poor and unproductive. The climate is very severe in the winter and extremely hot in summer. The rainfall is very scanty, and running waters are hardly known, excepting among the mountains which form the scarps of the elevated country. The population is sparse, frequently nomadic and addicted to plunder; progress in the arts and habits of civilization is small. The western part of the area falls within the Turkish empire. Its climate is less hot and arid, its natural productiveness much greater, and its population more settled and on the whole more advanced.

Arabia.

The peninsula of Arabia, with Syria, its continuation to the north-west, has some of the characteristics of the hottest and driest parts of Persia and Baluchistan. Excepting the northern part of this tract, which is conterminous with the plain of Mesopotamia (which at its highest point reaches an elevation of about 700 ft. above the sea), the country is covered with low mountains, rising to 3000 or 4000 ft. in altitude, having among them narrow valleys in which the vegetation is scanty, with exceptional regions of greater fertility in the neighbourhood of the coasts, where the rainfall is greatest. In northern Syria the mountains of Lebanon rise to about 10,000 ft., and with a more copious water supply the country becomes more productive. The whole tract, excepting south-eastern Arabia, is nominally subject to Turkey, but the people are to no small extent practically independent, living a nomadic, pastoral and freebooting life under petty chiefs, in the more arid districts, but settled in towns in the more fertile tracts, where agriculture becomes more profitable and external commerce is established.

Trans-Caspian region and central Asia.

The area between the northern border of the Persian high lands and the Caspian and Aral Seas is a nearly desert low-lying plain, extending to the foot of the north-western extremity of the great Tibeto-Himalayan mountains, and prolonged eastward up the valleys of the Oxus (Amu-Darya) and Jaxartes (Syr-Darya), and northward across the country of the Kirghiz to the south-western border of Siberia. It includes Bokhara, Khiva and Turkestan proper, in which the Uzbeg Turks are dominant, and for the most part is inhabited by nomadic tribes, who are marauders, enjoying the reputation of being the worst among a race of professed robbers. The tribes to the north, subject to Russia, are naturally more peaceable, and have been brought into some degree of discipline. In this tract the rainfall is nowhere sufficient for the purposes of agriculture, which is only possible by help of irrigation; and the fixed population (which contains a non-Turkish element) is comparatively small, and restricted to the towns and the districts near the rivers.

The north-western extremity of the elevated Tibeto-Himalayan mountain plateau is situated about on 73° E. and 39° N. This region is known as Pamir; it has all the characteristics of the highest regions of Tibet, and so far fitly receives the Russian designation of steppe; but it seems to have no special peculiarities, and the reason of its having been so long regarded as a geographical enigma is not obvious. From it the Oxus, or Amu, flows off to the west, and the Jaxartes, or Syr, to the north, through the Turki state of Khokand, while to the east the waters run down past Kashgar to the central desert of the Gobi, uniting with the streams from the northern slope of the Tibetan plateau that traverse the principalities of Yarkand and Khotan, which are also Turki. Here the Tibetan mountains unite with the line of elevation which stretches across the continent from the Pacific, and which separates Siberia from the region commonly spoken of under the name of central Asia.

Manchuria.

A range of mountains, called Stanovoi, rising to heights of 4000 or 5000 ft., follows the southern coast of the eastern extremity of Asia from Kamchatka to the borders of Manchuria, as far as the 135th meridian, in lat. 55° N. Thence the Yablonoi range, continuing in the same direction, divides the waters of the river Lena, which flows through Siberia into the Arctic Sea, from those of the river Amur, which falls into the North Pacific; the basin of this river, with its affluents, constitutes Manchuria. From the north of Manchuria the Khingan range stretches southward to the Chinese frontier near Peking, east of which the drainage falls into the Amur and the Yellow Sea, while to the west is an almost rainless region, the inclination of which is towards the central area of the continent, Mongolia.

Mongolia.

From the western end of the Yablonoi range, on the 115th meridian, a mountainous belt extends along a somewhat irregular line to the extremity of Pamir, known under various names in its different parts, and broken up into several branches, enclosing among them many isolated drainage areas, from which there is no outflow, and within which numerous lakes are formed. The most important of these ranges is the Tian-shan or Celestial Mountains, which form the northern boundary of the Gobi desert; they lie between 40° and 43° N., and between 75° and 95° E., and some of the summits are said to exceed 20,000 ft. in altitude; along the foot of this range are the principal cultivated districts of central Asia, and here too are situated the few towns which have sprung up in this barren and thinly peopled region. Next may be named the Ala-tau, on the prolongation of the Tian-shan, flanking the Syr on the north, and rising to 14,000 or 15,000 ft. It forms the barrier between the Issyk-kul and Balkash lakes, the elevation of which is about 5000 ft. Last is the Altai, near the 50th parallel, rising to 10,000 or 12,000 ft., which separates the waters of the great rivers of western Siberia from those that collect into the lakes of north-west Mongolia, Dzungaria and Kalka. A line of elevation is continued west of the Altai to the Ural Mountains, not rising to considerable altitudes; this divides the drainage of south-west Siberia from the great plains lying north-east of the Aral Sea.

The central area bounded on the north and north-west by the Yablonoi Mountains and their western extension in the Tian-shan, on the south by the northern face of the Tibetan plateau, and on the east by the Khingan range before alluded to, forms the great desert of central Asia, known as the Gobi. Its eastern part is nearly conterminous with south Mongolia, its western forms Chinese or eastern Turkestan. It appears likely that no part of this great central Asiatic desert is less than 2000 ft. above the sea-level. The elevation of the plain about Kashgar and Yarkand is from 4000 to 6000 ft. The more northern parts of Mongolia are between 4000 and 6000 ft., and no portion of the route across the desert between the Chinese frontier and Kiakhta is below 3000 ft. The precise positions of the mountain ridges that traverse this central area are not properly known; their elevation is everywhere considerable, and many points are known to exceed 10,000 or 12,000 ft.

In Mongolia the population is essentially nomadic, its wealth consisting in herds of horned cattle, sheep, horses and camels. The Turki tribes, occupying western Mongolia, are among the least civilized of human beings, and it is chiefly to their extreme barbarity and cruelty that our ignorance of central Asia is due. The climate is very severe, with great extremes of heat and cold. The drought is very great; rain falls rarely and in small quantities. The surface is for the most part a hard stony desert, areas of blown sand occurring but exceptionally. There are few towns or settled villages, except along the slopes of the higher mountains, on which the rain falls more abundantly, or the melting snow supplies streams for irrigation. It is only in such situations that cultivated lands are found, and beyond them trees are hardly to be seen.

Siberia.

The portion of Asia which lies between the Arctic Ocean and the mountainous belt bounding Manchuria, Mongolia and Turkestan on the north is Siberia. It includes an immense high and broken plateau which spreads from south-west to north-east, losing in width and altitude as it advances north-east. It is fringed on either side by high border ridges, which subside on the north-west into a stretch of high plains, 1500 to 2000 ft. high, finally dropping to lowlands a few hundred feet above sea-level. The extremes of heat and cold are very great. The rainfall, though not heavy, is sufficient to maintain such vegetation as is compatible with the conditions of temperature, and the surface is often swampy or peaty. The mountain-sides are commonly clothed with pine-forests, and the plains with grasses or shrubs. The population is very scanty; the cultivated tracts are comparatively small in extent and restricted to the more settled districts. The towns are entirely Russian. The indigenous races are nomadic Mongols, of a peaceful character, but in a very backward state of civilization. The Ural Mountains do not exceed 2000 or 3000 ft. in average altitude, the highest summits not exceeding 6000 ft., and one of the passes being as low as 1400 ft. In the southern half of the range are the chief mining districts of Russia. The Ob, Yenisei and Lena, which traverse Siberia, are among the largest rivers in the world.

Malay Archipelago.

The southern group of the Malay Archipelago, from Sumatra to Java and Timor, extends in the arc of a circle between 95° and 127° E., and from 5° to 10° S. The central part of the group is a volcanic region, many of the volcanoes being still active, the summits frequently rising to 10,000 ft. or more.

Sumatra, the largest of the islands, is but thinly peopled; the greater part of the surface is covered with dense forest, the cultivated area being comparatively small, confined to the low lands, and chiefly in the volcanic region near the centre of the island. Java is the most thickly peopled, best cultivated and most advanced island of the whole Eastern archipelago. It has attained a high degree of wealth and prosperity under the Dutch government. The people are peaceful and industrious, and chiefly occupied with agriculture. The highest of the volcanic peaks rises to 12,000 ft. above the sea. The eastern islands of this group are less productive and less advanced.

Borneo, the most western and the largest of the northern group of islands which extends between 110° and 150° E., as far as New Guinea or Papua, is but little known. The population is small, rude and uncivilized; and the surface is rough and mountainous and generally covered with forest except near the coast, to the alluvial lands on which settlers have been attracted from various surrounding countries. The highest mountain rises to nearly 14,000 ft., but the ordinary elevations do not exceed 4000 or 5000 ft.

Of Celebes less is known than of Borneo, which it resembles in condition and natural characteristics. The highest known peaks rise to 8000 ft., some of them being volcanic.

Pacific Islands.

New Guinea extends almost to the same meridian as the eastern coast of Australia, from the north point of which it is separated by Torres Straits. Very little is known of the interior. The mountains are said to rise to 20,000 ft., having the appearance of being permanently covered with snow; the surface seems generally to be clothed with thick wood. The inhabitants are of the Negrito type, with curly or crisp and bushy hair; those of the west coast have come more into communication with the traders of other islands and are fairly civilized. Eastward, many of the tribes are barbarous savages.

The Philippine Islands lie between 5° and 20° N., between Borneo and southern China. The highest land does not rise to a greater height than 10,250 ft.; the climate is well suited for agriculture, and the islands generally are fertile and fairly cultivated, though not coming up to the standard of Java either in wealth or population.

Formosa, which is situated under the northern tropic, near the coast of China, is traversed by a high range of mountains, reaching nearly 13,000 ft. in elevation. On its western side, which is occupied by an immigrant Chinese population, are open and well-cultivated plains; on the east it is mountainous, and occupied by independent indigenous tribes in a less advanced state.

The islands of Japan, not including Sakhalin, of which half is Japanese, lie between the 30th and 45th parallels. The whole group is traversed by a line of volcanic mountains, some of which are in activity, the highest point being about 13,000 ft. above the sea. The country is generally well watered, fertile and well cultivated. The Japanese people have added to their ancient civilization and their remarkable artistic faculty, an adaptation of Western methods, and a capacity for progress in war and commerce, which single them out among Eastern races as a great modern world-force.

EXPLORATION

The progress of geodetic surveys in Russia had long ago extended across the European half of the great empire, St Petersburg being connected with Tiflis on the southern slopes of the Caucasus by a direct system of triangulation carried out with the highest scientific precision. St Petersburg, again, is connected with Greenwich by European systems of triangulation; and the Greenwich meridian is adopted by Russia as the zero for all her longitude values. But beyond the eastern shores of the Caspian no system of direct geodetic measurements by first-class triangulation has been possible, and the surveys of Asiatic Russia are separated from those of Europe by the width of that inland sea. The arid nature of the trans-Caspian deserts has proved an insuperable obstacle to those rigorous methods of geodetic survey which distinguish Russian methods in Europe, so that Russian geography in central Asia is dependent on other means than that of direct measurement for the co-ordinate values in latitude and longitude for any given point. The astronomical observatory at Tashkent is adopted for the initial starting-point of the trans-Caspian triangulation of Russia; the triangulation ranks as second-class only, and now extends to the Pamir frontier beyond Osh. The longitude of the Tashkent observatory has been determined by telegraph differentially with Pulkova as follows:—

	H.	M.	S.
In 1875 via Ekaterinburg and Omsk .	2	35	52·151
,, 1891 ,, Saratov ,, Orenburg .	2	35	52·228
,, 1895 ,, Kiev ,, Baku . .	2	35	51·997

With these three independent values, all falling within a range of $0^{s}\cdot25$, it is improbable that the mean value has an error as large as $0^{s}\cdot10$.

Extent of exact surveys in Asia.

Exact surveys in Russia, based upon triangulation, extend as far east as Chinese Turkestan in longitude about 75° E. of Greenwich. In India geodetic triangulation furnishes the basis for exact surveys as far east as the eastern boundaries of Burma in longitude about 100° E.

The close of the 19th century witnessed the forging of the final links in the great geodetic triangulation of India, so far as the peninsula is concerned. Further geodetic connexion with the European systems remains to be accomplished. Since 1890 further and more rigorous application of the telegraphic method of determining longitudes differentially with Greenwich has resulted in a slight correction (amounting to about 2″ of arc) to the previous determination by the same method through Suez. This last determination was effected through four arcs as follows:—

I. Greenwich—Potsdam.
II. Potsdam—Teheran.
III. Teheran—Bushire.
IV. Bushire—Karachi.

Each arc was measured with every precaution and a multitude of observations. The only element of uncertainty was caused by the retardation of the current, which between Potsdam and Teheran (3000 m.) took $0^{s}\cdot20$ to travel; but it is probable that the final value can be accepted as correct to within $0^{s}\cdot05$.

The final result of this latest determination is to place the Madras observatory 2′ 27″ to the west of the position adopted for it on the strength of absolute astronomical determinations.

Connexion between Russian and Indian surveys.

But while we have yet to wait for that expansion of principal triangulation which will bring Asia into connexion with Europe by the direct process of earth measurement, a topographical connexion has been effected between Russian and Indian surveys which sufficiently proves that the deductive methods employed by both countries for the determination of the co-ordinate values of fixed points so far agree that, for all practical purposes of future Asiatic cartography, no difficulty in adjustment between Indian and Russian mapping need be apprehended.

Extension of geographical surveys.

In connexion with the Indian triangulation minor extensions carried out on systems involving more or less irregularity have been pushed outwards on all sides. They reach through Afghanistan and Baluchistan to the eastern districts of Persia, and along the coast of Makran to that of Arabia. They have long ago included the farther mountain peaks of Nepal, and they now branch outwards towards western China and into Siam. These far extensions furnish the basis for a vast amount of exploratory survey of a strictly geographical character, and they have contributed largely towards raising the standard of accuracy in Asiatic geographical surveys to a level which was deemed unattainable fifty years ago. There is yet a vast field open in Asia for this class of surveys. While at the close of the 19th century western Asia (exclusive of Arabia) may be said to have been freed from all geographical perplexity, China, Mongolia and eastern Siberia still include enormous areas of which geographical knowledge is in a primitive stage of nebulous uncertainty.

Indian explorers.

Of scientific geographical exploration in Asia (beyond the limits of actual surveys) the modern period has been so prolific that it is only possible to refer in barest outline to some of the principal expeditions, most of which have been directed either to the great elevated tableland of Tibet or to the central depression which exists to the north of it. In southern Tibet the trans-Himalayan explorations of the native surveyors attached to the Indian survey, notably Pundits Nain Singh and Krishna, added largely to our knowledge of the great plateau. Nain Singh explored the sources of the Indus and of the Upper Brahmaputra in the years 1865–1867; and in 1874–1875 he followed a line from the eastern frontiers of Kashmir to the Tengri Nor lake and thence to Lhasa, in which city he remained for some months. Krishna's remarkable journey in 1879–1882 extended from Lhasa northwards through

Tsaidam to Sachu, or Saitu, in Mongolia. He subsequently passed through eastern Tibet to the town of Darchendo, or Tachienlu, on the high road between Lhasa and Peking, and on the borders of China. Failing to reach India through Upper Assam he returned to the neighbourhood of Lhasa, and crossed the Himalayas by a more westerly route. Both these explorers visited Lhasa.

Russian explorers.

In 1871–1873 the great Russian explorer, Nicolai Prjevalsky, crossed the Gobi desert from the north to Kansu in western China. He first defined the geography of Tsaidam, and mapped the hydrography of that remarkable region, from which emanate the great rivers of China, Siam and Burma. He penetrated southwards to within a month's march of Lhasa. In 1876 he visited the Lop Nor and discovered the Altyn Tagh range. In 1879 he followed up the Urangi river to the Altai Mountains, and demonstrated to the world the extraordinary physical changes which have passed over the heart of the Asiatic continent since Jenghiz Khan massed his vast armies in those provinces. He crossed, and named, the Dzungarian extension of the Gobi desert, and then traversed the Gobi itself from Hami to Sachu, which became a point of junction between his journeys and those of Krishna. He visited the sources of the Hwang-ho (Yellow river) and the Salween, and then returned to Russia. His fourth journey in 1883–1885 was to Sining (the great trade centre of the Chinese borderland), and thence through northern Tibet (crossing the Altyn Tagh to Lop Nor), and by the Cherchen-Keriya trade route to Khotan. From Khotan he followed the Tarim to Aksu.

Following Prjevalsky the Russian explorers, Pevtsov and Roborovski, in 1889–1890 (and again in 1894), added greatly to our knowledge of the topography of western Chinese Turkestan and the northern borders of Tibet; all these Russian expeditions being conducted on scientific principles and yielding results of the highest value. Among other distinguished Russian explorers in Asia, the names of Lessar, Annentkov (who bridged the Trans-Caspian deserts by a railway), P. K. Kozlov and Potanin are conspicuous during the 19th century.

Other explorations in central Asia.

Although the establishment of a lucrative trade between India and central Asia had been the dream of many successive Indian viceroys, and much had been done towards improving the approaches to Simla from the north, very little was really known of the highlands of the Pamirs, or of the regions of the great central depression, before the mission of Sir Douglas Forsyth to Yarkand in 1870. Robert Barkley Shaw and George Hayward were the European pioneers of geography into the central dominion of Kashgar, arriving at Yarkand within a few weeks of each other in 1868. Shaw subsequently accompanied Forsyth's mission in 1870, when Henry Trotter made the first maps of Chinese Turkestan. The next great accession to our knowledge of central Asiatic geography was gained with the Russo-Afghan Boundary Commission of 1884–1886, when Afghan Turkestan and the Oxus regions were mapped by Colonel Sir T. H. Holdich, Colonel St George Gore and Sir Adelbert Talbot; and when Ney Elias crossed from China through the Pamirs and Badakshan to the camp of the commission, identifying the great "Dragon Lake," Rangkul, on his way. About the same time a mission, under Captain (afterwards Sir Willaim) Lockhart, crossed the Hindu Kush into Wakhan, and returned to India by the Bashgol valley of Kafiristan. This was Colonel Woodthorpe's opportunity, and he was then enabled to verify the results of W. W. M'Nair's previous explorations, and to determine the conformation of the Hindu Kush. In 1885 Arthur Douglas Carey and Andrew Dalgleish, following more or less the tracks of Prjevalsky, contributed much that was new to the map of Asia; and in 1886 Captain (afterwards Sir Francis) Younghusband completed a most adventurous journey across the heart of the continent by crossing the Muztagh, the great mountain barrier between China and Kashmir.

Tibetan explorations.

It was in 1886–1887 that Pierre G. Bonvalot, accompanied by Prince Henri d'Orléans, crossed the Tibetan plateau from north to south, but failed to enter Lhasa. In 1889–1891 the American traveller, W. W. Rockhill, commenced his Tibetan journeys, and also attempted to reach Lhasa, without success. By his writings, as much as by his explorations, Rockhill has made his name great in the annals of Asiatic research. In 1891 Hamilton Bower made his famous journey from Leh to Peking. He, too, failed to penetrate the jealously-guarded portals of Lhasa; but he secured (with the assistance of a native surveyor) a splendid addition to our previous Tibetan mapping. In 1891–1892–1893 the gallant French explorer, Dutreuil de Rhins, was in the field of Tibet, where he finally sacrificed his life to his work; and the same years saw George N. (afterwards Lord) Curzon in the Pamirs, and St George Littledale on his first great Tibetan journey, accompanied by his wife. Littledale's first journey ended at Peking; his second, in 1894–1895, took him almost within sight of the sacred walls of Lhasa, but he failed to pass inside. Greatest among modern Asiatic explorers (if we except Prjevalsky) is the brave Swede, Professor Sven Hedin, whose travels through the deserts of Takla Makan and Tibet, and whose investigations in the glacial regions of the Sarikol mountains, occupied him from 1894 to 1896. His is a truly monumental record. From 1896 to 1898 we find two British cavalry officers taking the front position in the list of Tibetan travellers—Captain M. S. Wellby of the 18th Hussars and Captain H. Deasy of the 16th Lancers, each striking out a new line, and rendering most valuable service to geography. The latter continued the Pamir triangulation, which had been carried across the Hindu Kush by Colonels Sir T. H. Holdich and R. A. Wahab during the Pamir Boundary Commission of 1895, into the plains of Kashgar and to the sources of the Zarafshan.

Since the beginning of the century the work of Deasy in western Tibet has been well extended by Dr M. A. Stein and Captain C. G. Rawling, who have increased our knowledge of ancient fields of industry and commerce in Turkestan and Tibet. Ellsworth Huntington threw new light on the Tian-shan plateau and the Alai range by his explorations of 1903; and Sven Hedin, between 1899 and 1902, was collecting material in Turkestan and Tibetan fields, and resumed his journeys in 1905–1908, the result being to revolutionize our knowledge of the region north of the upper Tsanpo (see Tibet). The mission of Sir Francis Younghusband to Lhasa in 1904 resulted in an extension of the Indian system of triangulation which finally determined the geographical position of that city, and in a most valuable reconnaissance of the valleys of the Upper Brahmaputra and Indus by Captains C. H. D. Ryder and C. G. Rawling.

Chinese explorations.

Meanwhile, in the Farther East so rapid has been the progress of geographical research since the first beginnings of investigation into the route connexion between Burma and China in 1874 (when the brave Augustus Margary lost his life), that a gradually increasing tide of exploration, setting from east to west and back again, has culminated in a flood of inquiring experts intent on economic and commercial development in China, essaying to unlock those doors to trade which are hereafter to be propped open for the benefit of humanity. Captain William Gill, of the Indian survey, first made his way across China to eastern Tibet and Burma, and subsequently delighted the world with his story of the *River of Golden Sand*. Then followed another charming writer, E. C. Baber, who, in 1877–1878, unravelled the geographic mysteries of the western provinces of the Celestial empire. Mark Bell crossed the continent in 1887 and illustrated its ancient trade routes, following the steps of Archibald Colquhoun, who wandered from Peking to Talifu in 1881. Meanwhile, the acquisition of Burma and the demarcation of boundaries had opened the way to the extension of geographical surveys in directions hitherto untraversed. Woodthorpe was followed into Burmese fields by many others; and amongst the earliest travellers to those mysterious mountains which hide the sources of the Irrawaddy, the Salween and the Mekong, was Prince Henri d'Orléans. Burma was rapidly brought under survey; Siam was already in the map-making hands of James M'Carthy, whilst Curzon and Warrington Smyth added much to our knowledge of its picturesque coast districts. No more valuable contribution to the illustration of western Chinese configuration has been given to the public than that of C. C. Manifold who explored and mapped the upper basin of the Yang-tsze river between the years 1900 and 1904, whilst our knowledge of the geography of the Russo-Chinese borderland on the north-east has been largely advanced by the operations attending the Russo-Japanese war which terminated in 1905.

Indian frontiers—Afghanistan, Baluchistan, Persia.

Turning our attention westwards, no advance in the progress of scientific geography is more remarkable than that recorded on the northern and north-western frontiers of India. Here there is little matter of exploration. It has rather been a wide extension of scientific geographical mapping. The Afghan war of 1878–80; the Russo-Afghan Boundary Commission of 1884–1885; the occupation of Gilgit and Chitral; the extension of boundaries east and north of Afghanistan, and again, between Baluchistan and Persia—these, added to the opportunities afforded by the systematic survey of Baluchistan which has been steadily progressing since 1880—combined to produce a series of geographical maps which extend from the Oxus to the Indus, and from the Indus to the Euphrates.

In these professional labours the Indian surveyors have been assisted by such scientific geographers as General Sir A. Houtum Schindler, Captain H. B. Vaughan and Major Percy M. Sykes in Persia, and by Sir George Robertson and Cockerill in Kafiristan and the Hindu Kush.

Arabia.

In still more western fields of research much additional light has been thrown since 1875 on the physiography of the great deserts and oases of Arabia. The labours of Charles Doughty and Wilfrid S. Blunt in northern Arabia in 1877–1878 were followed by those of G. Schweinfurth and E. Glaser in the south-west about ten years later. In 1884–1885 Colonel S. B. Miles made his adventurous journey through Oman, while Theodore Bent threw searchlights backwards into ancient Semitic history by his investigations in the Bahrein Islands in 1888 and in Hadramut in 1894–1895.

Northern Asia, Siberia, &c.

In northern Asia it is impossible to follow in detail the results of the organized Russian surveys. The vast steppes and forest-clad mountain regions of Siberia have assumed a new geographical aspect in the light of these revelations, and already promise a new world of economic resources to Russian enterprise in the near future. A remarkable expedition by Baron Toll in 1892 through the regions watered by the Lena, resulted in the collection of material which will greatly help to elucidate some of the problems which beset the geological history of the world, proving *inter alia* the primeval existence of a boreal zone of the Jurassic sea round the North Pole.

In no other period of the world's history, of equal length of time, has so much scientific enterprise been directed towards the field of Asiatic inquiry. The first great result of recent geographical research has been to modify pre-existing ideas of the orography of the vast central region represented by Tibet and Mongolia. The great highland plateau which stretches from the Himalaya northwards to Chinese Turkestan, and from the frontier of Kashmir eastwards to China, has now been defined with comparative geographical exactness. The position of Sachu (or Saitu) in Mongolia may be taken as an obligatory point in modern map construction. The longitude value now adopted is 94° 54′ E. of Greenwich, which is the revised value given by Prjevalsky in the map accompanying the account of his fourth exploration into central Asia. Other values are as follows:—

General results of investigation.

Prjevalsky, by his second and third explorations	94° 26′
Krishna	94° 23′
Carey and Dalgleish	94° 48′
Littledale	94° 49′
Kreitner (with Szecheny's expedition)	94° 58′

The longitude of Darchendo, or Tachienlu, on the extreme east, may be accepted as another obligatory point. The adopted value by the Royal Geographical Society is 102° 12″. Krishna gives 102° 15″, Kreitner 102° 5″, Baber 102° 18″.

South and west the bounding territories are well fixed in geographical position by the Indian survey determinations of the value of Himalayan peaks. On the north the Chinese Turkestan explorations are now brought into survey connexion with Kashmir and India.

No longer do we regard the Kuen-lun mountains, which extend from the frontiers of Kashmir, north of Leh, almost due east to the Chinese province of Kansu, as the southern limit of the Gobi or Turkestan depression. This very remarkable longitudinal chain is undoubtedly the northern limit of the Chang Tang, the elevated highland steppes of Tibet; but from it there branches a minor system to the north-east from a point in about 83° E. longitude, which culminates in the Altyn Tagh, and extends eastwards in a continuous water-divide to the Nan Shan mountains, north of the Koko Nor basin. Thus between Tibet and the low-lying sands of Gobi we have, thrust in, a system of elevated valleys (Tsaidam), 8000 to 9000 ft. above sea-level, forming an intermediate steppe between the highest regions and the lowest, east of Lop Nor. All this is comparatively new geography, and it goes far to explain why the great trade routes from Peking to the west were pushed so far to the north.

Russo-Chinese boundary. On the western edge of the Kashgar plains, the political boundary between Russia and China is defined by the meridional range of Sarikol. This range (known to the ancients as Taurus and in medieval times as Bolor) like many others of the most important great natural mountain divisions of the world, consists of two parallel chains, of which the western is the water-divide of the Pamirs, and the eastern (which has been known as the Kashgar or Kandar range) is split at intervals by lateral gorges to allow of the passage of the main drainage from the eastern Pamir slopes.

Indian frontiers—Afghanistan, &c. In western Asia we have learned the exact value of the mountain barrier which lies between Merv and Herat, and have mapped its connexion with the Elburz of Persia. We can now fully appreciate the factor in practical politics which that definite but somewhat irregular mountain system represents which connects the water-divide north of Herat with the southern abutment of the Hindu Kush, near Bamian. Every pass of importance is known and recorded; every route of significance has been explored and mapped; Afghanistan has assumed a new political entity by the demarcation of a boundary; the value of Herat and of the Pamirs as bases of aggression has been assessed, and the whole intervening space of mountain and plain thoroughly examined.

Persia. Although within the limits of western Asiatic states, still under Asiatic government and beyond the active influence of European interests, the material progress of the Eastern world has appeared to remain stationary, yet large accessions to geographical knowledge have at least been made, and in some instances a deeper knowledge of the surface of the country and modern conditions of life has led to the straightening of many crooked paths in history, and a better appreciation of the slow processes of advancing civilization. The steady advance of scientific inquiry into every corner of Persia, backed by the unceasing efforts of a new school of geographical explorers, has left nothing unexamined that can be subjected to superficial observation. The geographical map of the country is fairly complete, and with it much detailed information is now accessible regarding the coast and harbours of the Persian Gulf, the routes and passes of the interior, and the possibilities of commercial development by the construction of trade roads uniting the Caspian, the Karun, the Persian Gulf, and India, via Seistan. Persia has assumed a comprehensible position as a factor in future Eastern politics.

Arabia. In Arabia progress has been slower, although the surveys carried out by Colonel Wahab in connexion with the boundary determined in the Aden hinterland added more exact geographical knowledge within a limited area. Little more is known of the wide spaces of interior desert than has already been given to the world in the works of Sir Richard F. Burton, Wm. Gifford Palgrave and Sir Lewis Pelly amongst Englishmen, and Karsten Niebuhr, John Lewis Burckhardt, Visconte, Joseph Halévy and others, amongst foreign travellers. Charles Doughty and Wilfrid S. Blunt have visited and illustrated the district of Nejd, and described the waning glories of the Wahabi empire. But extended geographical knowledge does not point to any great practical issue. Commercial relations with Arabia remain much as they were in 1875.

Asia Minor, &c. In Asia Minor, Syria and Mesopotamia there is little to record of progress in material development beyond the promises held out by the Euphrates Valley railway concession to a German company. The exact information obtained by the researches of English surveyors in Palestine and beyond Jordan, or by the efforts of explorers in the regions that lie between the Mediterranean and the Caspian, have so far led rather to the elucidation of history than to fresh commercial enterprise or the possible increase of material wealth.

Russia in Asia. Asiatic Russia, especially eastern Siberia and Mongolia, have been brought within the sphere of Russian exploration, with results so surprising as to form an epoch in the history of Asia. Here there has been a development of the resources of the Old World which parallels the best records of the New.

Chinese Turkestan and Oxus basin. The great central depression of the continent which reaches from the foot of the Pamir plateau on the west through the Tarim desert to Lop Nor and the Gobi has yielded up many interesting secrets. The remarkable phenomenon of the periodic shifting of the Lop Nor system has been revealed by the researches of Sven Hedin, and the former existence of highly civilized centres of Buddhist art and industry in the now sand-strewn wastes of the Turkestan desert has been clearly demonstrated by the same great explorer and by Dr M. A. Stein. The depression westward of the Caspian and Aral basins, and the original connexion of these seas, have also come under the close investigation of Russian scientists, with the result that the theory of an ancient connexion between the Oxus and the Caspian has been displaced by the more recent hypothesis of an extension of the Caspian Sea eastwards into Trans-Caspian territory within the post-Pleiocene age. The discovery of shells (now living in the Caspian) at a distance of about 100 m. inland, at an altitude of 140 to 280 ft. above the present level of the Caspian, gives support to this hypothesis, which is further advanced by the ascertained nature of the Kara-kum sands, which appear to be a purely marine formation exhibiting no traces of fluviatile deposits which might be considered as delta deposits of the Oxus.

In the discussion of this problem we find the names of Baron A. Kaulbars, Annentkov, P. M. Lessar, and A. M. Konshin prominent. Further matter of interest in connexion with the Oxus basin was elucidated by the researches of L. Griesbach in connexion with the Russo-Afghan Boundary Commission. He reported the gradual formation of an anticlinal or ridge extending longitudinally through the great Balkh plain of Afghan Turkestan, which effectually shuts off the northern affluents of that basin from actual junction with the river. This evidence of a gradual process of upheaval still in action may throw some light on the physical (especially the climatic) changes which must have passed over that part of Asia since Balkh was the "mother of cities," the great trade centre of Asia, and the plains of Balkh were green with cultivation. In the restoration of the outlines of ancient and medieval geography in Asia Sven Hedin's discoveries of the actual remains of cities which have long been buried under the advancing waves of sand in the Takla Makan desert, cities which flourished in the comparatively recent period of Buddhist ascendancy in High Asia, is of the very highest interest, filling up a blank in the identification of sites mentioned by early geographers and illustrating more fully the course of old pilgrim routes.

Baluchistan and Makran. With the completion of the surveys of Baluchistan and Makran much light has also been thrown on the ancient connexion between east and west; and the final settlement of the southern boundaries of Afghanistan has led to the reopening of one at least of the old trade routes between Seistan and India.

Burma and China. Farther east no part of Asia has been brought under more careful investigation than the hydrography of the strange mountain wilderness that divides Tibet and Burma from China. In this field the researches of travellers already mentioned, combined with the more exact reconnaissance of native surveyors and of those exploring parties which have recently been working in the interests of commercial projects, have left little to future inquiry. We know now for certain that the great Tsanpo of Tibet and the Brahmaputra are one and the same river; that north of the point where the great countermarch of that river from east to west is effected are to be found the sources of the Salween, the Mekong, the Yang-tsze-kiang and the Hwang-ho, or Yellow river, in order, from west to east; and that south of it, thrust in between the extreme eastern edge of the Brahmaputra basin and the Salween, rise the dual sources of the Irrawaddy. From the water-divide which separates the most eastern affluent of the Brahmaputra, eastwards to the deep gorges which enclose the most westerly branch of the upper Yang-tsze-kiang (here running from north to south), is a short space of 100 m.; and within that space two mighty rivers, the Salween and the Mekong, send down their torrents to Burma and Siam. These three rivers flow parallel to each other for some 300 m., deep hidden in narrow and precipitous troughs, amidst some of the grandest scenery of Asia; spreading apart where the Yank-tsze takes its course eastwards, not far north of the parallel of 25°.

The comparatively restricted area which still remains for close investigation includes the most easterly sources of the Brahmaputra, the most northerly sources of the Irrawaddy, and some 300 m. of the course of the upper Salween.

Modern Boundary Demarcation.—The period from about 1880 has been an era of boundary-making in Asia, of defining the politico-geographical limits of empire, and of determining the responsibilities of government. Russia, Persia, Afghanistan, Baluchistan, India and China have all revised their borders, and with the revision the political relations between these countries have acquired a new and more assured basis. See also the articles on the different countries. We are not here concerned with understandings as to "spheres of influence," or with arrangements such as the Anglo-Russian Convention of 1907 concerning Persia.

Southern boundary of Russia in Asia.

The advance of Russia to the Turkoman deserts and the Oxus demanded a definite boundary between her trans-Caspian conquests and the kingdom of Afghanistan. This was determined on the north-west by the Russo-Afghan Boundary Commission of 1884–1886. A boundary was then fixed between the Hari Rud (the river of Herat) and the Oxus, which is almost entirely artificial in its construction. Zulfikar, where the boundary leaves the Hari Rud, is about 70 m. south of Sarakhs, and the most southerly point of the boundary (where it crosses the Kushk) is about 60 m. north of Herat. From the junction of the boundary with the Oxus at Khamiab about 150 m. above the crossing-point of the Russian Trans-Caspian railway at Charjui, the main channel of the Oxus river becomes the northern boundary of Afghanistan, separating that country from Russia, and so continues to its source in Victoria Lake of the Great Pamir. Beyond this point the Anglo-Russian Commission of 1895 demarcated a line to the snowfields and glaciers which overlook the Chinese border. Between the Russian Pamirs and Chinese Turkestan the rugged line of the Sarikol range intervenes, the actual dividing line being still indefinite. Beyond Kashgar the southern boundary of Siberia follows an irregular course to the north-east, partly defined by the Tian-shan and Alatau mountains, till it attains a northerly point in about 53° N. lat. marked by the Sayan range to the west of Irkutsk. It then deflects south-east till it touches the Kerulen affluent of the Amur river at a point which is shown in unofficial maps as about 117° 30′ E. long. and 49° 20′ N. lat. From here it follows this affluent to its junction with the Amur river, and the Amur river to its junction with the Usuri. It follows the Usuri to its head (its direction now being a little west of south), and finally strikes the Pacific coast on about 42° 30′ N. lat. at the mouth of the Tumen river 100 m. south of the Amur bay, at the head of which lies the Russian port of Vladivostok. At two points the Russian boundary nearly approaches that of provinces which are directly under British suzerainty. Where the Oxus river takes its great bend to the north from Ishkashim, the breadth of the Afghan territory intervening between that river and the main water-divide of the Hindu Kush is not more than 10 or 12 m.; and east of the Pamir extension of Afghanistan, where the Beyik Pass crosses the Sarikol range and drops into the Taghdumbash Pamir, there is but the narrow width of the Karachukar valley between the Sarikol and the Muztagh. Here, however, the boundary is again undefined. Eastwards of this the great Kashgar depression, which includes the Tarim desert, separates Russia from the vast sterile highlands of Tibet; and a continuous series of desert spaces of low elevation, marking the limits of a primeval inland sea from the Sarikol meridional watershed to the Khingan mountains on the western borders of Manchuria, divide her from the northern provinces of China. From the Khingan ranges to the Pacific, south of the Amur, stretch the rich districts of Manchuria, a province which connects Russia with the Korea by a series of valleys formed by the Sungari and its affluents—a land of hill and plain, forest and swamp, possessing a delightful climate, and vast undeveloped agricultural resources. Throughout this land of promise Russian influence was destroyed by Japan in the war of 1904. The possession of Port Arthur, and direct political control over Korea, place Japan in the dominant position as regards Manchuria.

Afghan political boundaries.

Coincident with the demarcation of Russian boundaries in Turkestan was that of northern Afghanistan. From the Hari Rud on the west to the Sarikol mountains on the east her northern limits were set by the Boundary Commissions of 1884–1886 and of 1895 respectively. Her southern and eastern boundaries were further defined by a series of minor commissions, working on the basis of the Kabul agreement of 1893, which lasted for nearly four years, terminating with the Mohmand settlement at the close of an expedition in 1897.

The Pamir extension of Afghan territory to the north-east reaches to a point a little short of 75° E., from whence it follows the water-divide to the head of the Taghdumbash Pamir, and is thenceforward defined by the water-parting of the Hindu Kush. It leaves the Hindu Kush near the Dorah Pass at the head of one of the minor Chitral affluents, and passing south-west divides Kafiristan from Chitral and Bajour, separates the sections of the Mohmands who are within the respective spheres of Afghan and British sovereignty, and crosses the Peshawar-Kabul route at Lundi-Khana. It thus places a broad width of independent territory between the boundaries of British India (which have remained practically, though not absolutely, untouched) and Afghanistan; and this independent belt includes Swat, Bajour and a part of the Mohmand territory north of the Kabul river. The same principle of maintaining an intervening width of neutral territory between the two countries is definitely established throughout the eastern borders of Afghanistan, along the full length of which a definite boundary has been demarcated to the point where it touches the northern limits of Baluchistan on the Gomal river. From the Gomal Baluchistan itself becomes an intervening state between British India and Afghanistan, and the dividing line between Baluchistan and Afghanistan is laid down with all the precision employed on the more northerly sections of the demarcation.

Baluchistan.

Baluchistan can no longer be regarded as a distinct entity amongst Asiatic nations, such as Afghanistan undoubtedly is. Baluchistan independence demands qualification. There is British Baluchistan *par excellence*, and there is the rest of Baluchistan which exists in various degrees of independence, but is everywhere subject to British control. British Baluchistan officially includes the districts of Peshin, Sibi and of Thal-Chotiali. As these districts had originally been Afghan, they were transferred to British authority by the treaty of Gandamak in 1879, although nominally they had been handed over to Kalat forty years previously. Now they form an official province of British Baluchistan within the Baluchistan Agency; and the agency extends from the Gomal to the Arabian Sea and the Persian frontier. Within this agency there are districts as independent as any in Afghanistan, but the political status of the province as a whole is almost precisely that of the native states of the Indian peninsula. The agent to the governor-general of India, with a staff of political assistants, practically exercises supreme control.

Kirman.

The increase of Russian influence on the northern Persian border and its extension southwards towards Seistan led to the appointment of a British consul at Kirman, the dominating town of southern Khorasan, directly connected with Meshed on the north; and the acquisition of rights of administration of the Nushki district secured to Great Britain the trade between Seistan and Quetta by the new Helmund desert route.

Boundary between French territory and India.

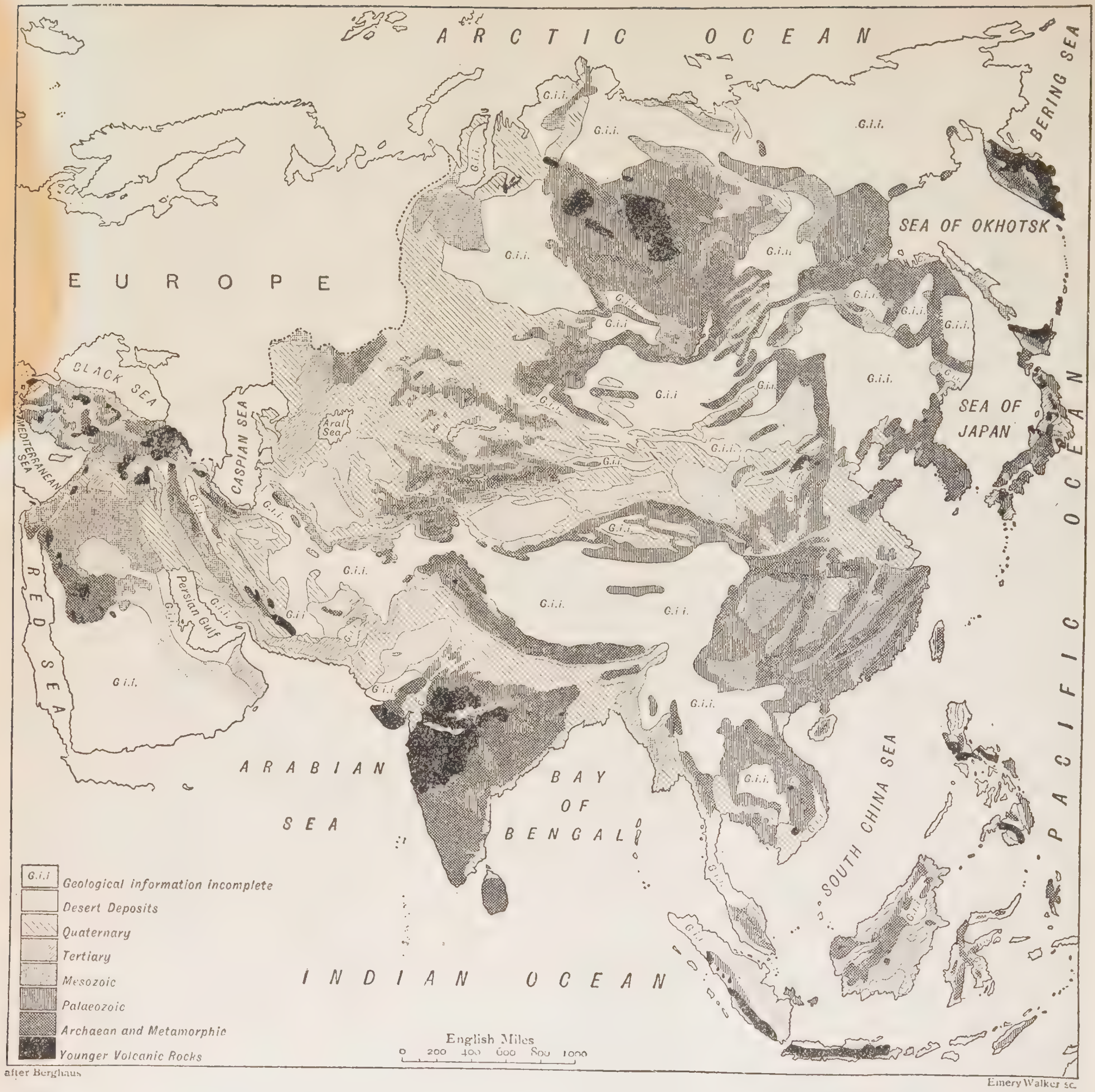
While British India has so far avoided actual geographical contact with one great European power in Asia on the north and west, she has touched another on the east. The Mekong river which limits British interests in Burma limits also those of France in Tongking. The eastern boundaries of Burma are not yet fully demarcated on the Chinese frontier. At a point level in latitude with Mogaung, near the northern termination of the Burmese railway system, this boundary is defined by the eastern watershed of the Nmaikha, the eastern of the two great northern affluents of the Irrawaddy. Then it follows an irregular course southwards to a position south-east of Bhamo in lat. 24°. It next defines the northern edge of the Shan States, and finally strikes the Mekong river in lat. 21° 45′ (approximately). From that point southwards the river becomes the boundary between the Shan States and Tongking for some 200 m., the channel of the river defining the limits of occupation (though not entirely of interest) between French and British subjects. Approximately on the parallel of 20° N. lat. the Burmese boundary leaves the Mekong to run westwards towards the Salween, and thereafter following the eastern watershed of the Salween basin it divides the Lower Burma provinces from Siam.

Area and political division.

The following table shows the areas of territories in Asia (continental and insular) dependent on the various extra-Asiatic powers, and of those which are independent or nominally so:—

Territory.	Sq. m.
Russian	6,495,970
British	1,998,220
Dutch	586,980
French	247,580
U.S.A.	114,370
German	193
Turkish	681,980
Chinese	4,299,600
Japanese	161,110
Other independent territories	2,232,270

The total area of Asia, continental and insular, is therefore somewhat over 16,819,000 sq. m. (but various authorities differ considerably in their detailed estimates). The population may be set down roughly as 823,000,000, of which 330,000,000 inhabit Chinese territory, 302,000,000 British, and 25,000,000 Russian. (T. H. H.*)


ARCTIC OCEAN
BERING SEA
SEA OF OKHOTSK
EUROPE
BLACK SEA
MEDITERRANEAN SEA
CASPIAN SEA
Aral Sea
Persian Gulf
RED SEA
SEA OF JAPAN
PACIFIC OCEAN
ARABIAN SEA
BAY OF BENGAL
SOUTH CHINA SEA
INDIAN OCEAN
G.i.i.
G.i.i Geological information incomplete
Desert Deposits
Quaternary
Tertiary
Mesozoic
Palaeozoic
Archaean and Metamorphic
Younger Volcanic Rocks
English Miles
0 200 400 600 800 1000

after Berghaus

Emery Walker sc.

GEOLOGY

The geology of Asia is so complex and over wide areas so little known that it is difficult to give a connected account of either the structure or the development of the continent, and only the broader features can be dealt with here.

In the south, in Syria, Arabia and the peninsula of India, none but the oldest rocks are folded, and the Upper Palaeozoic, the Mesozoic and the Tertiary beds lie almost horizontally upon them. It is a region of quiescence or of faulting, but not of folding. North of this lies a broad belt in which the Mesozoic deposits and even the lower divisions of the Tertiary system are thrown into folds which extend in a series of arcs from west to east and now form the principal mountain ranges of central Asia. This belt includes Asia Minor, Persia, Afghanistan, Baluchistan, the Himalayas, the Tian-shan, and, although they are very different in direction, the Burmese ranges. The Kuen-lun, Nan-shan and the mountain ranges of southern China are, perhaps, of earlier date, but nevertheless they lie in the same belt. It is not true that throughout the whole width of this zone the beds are folded. There are considerable tracts which are but little disturbed, but these tracts are enclosed within the arcs formed by the folds, and the zone taken as a whole is distinctly one of crumpling. North of the folded belt, and including the greater part of Siberia, Mongolia and northern China, lies another area which is, in general, free from any important folding of Mesozoic or Tertiary age. There are, it is true, mountain ranges which are formed of folded beds; but in many cases the direction of the chains is different from that of the folds, so that the ranges must owe their elevation to other causes; and the folds, moreover, are of ancient date, for the most part Archaean or Palaeozoic. The configuration of the region is largely due to faulting, trough-like or tray-like depressions being formed, and the intervening strips, which have not been depressed, standing up as mountain ridges. Over a large part of Siberia and in the north of China, even the Cambrian beds still lie as horizontally as they were first laid down. In the extreme north, in the Verkhoyansk range and in the mountains of the Taimyr peninsula, there are indications of another zone of folding of Mesozoic or later date, but our information concerning these ranges is very scanty. Besides the three chief regions into which the mainland is thus seen to be divided, attention should be drawn to the festoons of islands which border the eastern side of the continent, and which are undoubtedly due to causes similar to those which produced the folds of the folded belt.

Of all the Asiatic ranges the Himalayan is, geologically, the best known; and the evidence which it affords shows clearly that the folds to which it owes its elevation were produced by an overthrust from the north. It is, indeed, as if the high land of central Asia had been pushed southward against and over the unyielding mass formed by the old rocks of the Indian peninsula, and in the process the edges of the over-riding strata had been crumpled and folded. Overlooking all smaller details, we may consider Asia to consist of a northern mass and a southern mass, too rigid to crumple, but not too strong to fracture, and an intermediate belt of softer rock which was capable of folding. If then by the contraction of the earth's interior the outer crust were forced to accommodate itself to a smaller nucleus, the central softer belt would yield by crumpling; the more rigid masses to the north and south, if they gave way at all, would yield by faulting. It is interesting to observe, as will be shown later, that during the Mesozoic era there was a land-mass in the north of Asia and another in the south, and between them lay the sea in which ordinary marine sediments were deposited. The belt of folding does not precisely coincide with this central sea, but the correspondence is fairly close.

The present outline of the eastern coast and the nearly enclosed seas which lie between the islands and the mainland, are attributed by Richthofen chiefly to simple faulting.

Little is known of the early geological history of Asia beyond the fact that a large part of the continent was covered by the sea during the Cambrian and Ordovician periods. But there is positive evidence that much of the north and east of Asia has been land since the Palaeozoic era, and it has been conclusively proved that the peninsula of India has never been beneath the sea since the Carboniferous period at least. Between these ancient land masses lies an area in which marine deposits of Mesozoic age are well developed and which was evidently beneath the sea during the greater part of the Mesozoic era. The northern land-mass has been named Angaraland by E. Suess; the southern, of which the Indian peninsula is but a fragment, is called Gondwanaland by Neumayr, Suess and others; while the intervening sea is the central Mediterranean sea of Neumayr and the Tethys of Suess. The greater part of western Asia, including the basin of the Obi, the drainage area of the Aral Sea, together with Afghanistan, Baluchistan, Persia and Arabia, was covered by the sea during the later stages of the Cretaceous period; but a considerable part of this region was probably dry land in Jurassic times.

The northern land-mass begins in the north with the area which lies between the Yenisei and the Lena. Here the folded Archean rocks are overlaid by Cambrian and Ordovician beds, which still lie for the most part flat and undisturbed. Upon these rest patches of freshwater deposits containing numerous remains of plants. They consist chiefly of sandstone and conglomerate, but include workable seams of coal. Some of the deposits appear to be of Permian age, but others are probably Jurassic; and they are all included under the general name of the Angara series. Excepting in the extreme north, where marine Jurassic and Cretaceous fossils have been found, there is no evidence that this part of Siberia has been beneath the sea since the early part of the Palaeozoic era. Besides the plant beds extensive outflows of basic lava rest directly upon the Cambrian and Ordovician strata. The date of these eruptions is still uncertain, but they probably continued to a very recent period.

South and east of the Palaeozoic plateau is an extensive area consisting chiefly of Archean rocks, and including the greater part of Mongolia north of the Tian-shan. Here again there are no marine beds of Mesozoic or Tertiary age, while plant-bearing deposits belonging to the Angara series are known. Structurally, the folds of this region are of ancient date; but the area is crossed by a series of depressions formed by faults, and the intervening strips, which have not been depressed to the same extent, now stand up as mountain ranges. Farther south, in the Chinese provinces of Shansi and Shensi, the geological succession is similar in some respects to that of the Siberian Palaeozoic plateau, but the sequence is more complete. There is again a floor of folded Archean rocks overlaid by nearly horizontal strata of Lower Palaeozoic age; but these are followed by marine beds belonging to the Carboniferous period. From the Upper Carboniferous onward, however, no marine deposits are known; and, as in Siberia, plant-bearing beds are met with. Southern China is very different in structure, consisting largely of folded mountain chains, but the geological succession is very similar, and excepting near the Tibetan and Burmese borders, there are no marine deposits of Mesozoic or Tertiary age.

Thus it appears that from the Arctic Ocean there stretches a broad area as far as the south of China, in which no marine deposits of later date than Carboniferous have yet been found, except in the extreme north. Freshwater and terrestrial deposits of Mesozoic age occur in many places, and the conclusion is irresistible that the greater part of this area has been land since the close of the Palaeozoic era. The Triassic deposits of the Verkhoyansk Range show that this land did not extend to the Bering Sea; while the marine Mesozoic deposits of Japan on the east, the western Tian-shan on the west and Tibet on the south give us some idea of its limits in other directions.

In the same way the entire absence of any marine fossils in the peninsula of India, excepting near its borders, and the presence of the terrestrial and freshwater deposits of the Gondwana series, representing the whole of the geological scale from the top of the Carboniferous to the top of the Jurassic, show that this region also has been land since the Carboniferous period. It was a portion of a great land-mass which probably extended across the Indian Ocean and was at one time united with the south of Africa.

But these two land-masses were not connected. Between India and China there is a broad belt in which marine deposits of Mesozoic and Tertiary age are well developed. Marine Tertiary beds occur in Burma; in the Himalayas and in south Tibet there is a nearly complete series of marine deposits from the Carboniferous to the Eocene; in Afghanistan the Mesozoic beds are in part marine and in part fluviatile. The sea in which these strata were deposited seems to have attained its greatest extension in Upper Cretaceous times, when its waters spread over the whole of western Asia and even encroached slightly upon the Indian land. The Eocene sea, however, cannot have been much inferior in extent.

It was after the Eocene period that the main part of the elevation of the Himalayas took place, as is shown by the occurrence of nummulitic limestone at a height of 20,000 ft. The formation of this and of the other great mountain chains of central Asia resulted in the isolation of portions of the former central sea; and the same forces finally led to the elevation of the whole region and the union of the old continents of Angara and Gondwana. Gondwanaland, however, did not long survive, and the portion which lay between India and South Africa sank beneath the waves in Tertiary times.

Leaving out of consideration all evidence of more ancient volcanic activity, each of the three regions, into which, as we have seen, the continent may be divided, has been, during or since the Cretaceous period, the seat of great volcanic eruptions. In the southern region of unfolded beds are found the lavas of the "harras" of Arabia, and in India the extensive flows of the Deccan Trap. In the central folded belt lie the great volcanoes, now mostly extinct, of Asia Minor, Armenia, Persia and Baluchistan. In Burma also there is at least one extinct volcano. In the northern unfolded region great flows of basic lava lie directly upon the Cambrian and Ordovician beds of Siberia, but are certainly in part of Tertiary age. Similar flows on a smaller scale occur in Manchuria, Korea and northern China.

In all these cases, however, the eruptions have now almost ceased; and the great volcanoes of the present day lie in the islands off the eastern and south-eastern coasts.

References.—E. Suess, *Das Antlitz der Erde* (see, especially, vol. iii. part i.); F. V. Richthofen, "Ueber Gestalt und Gliederung einer Grundlinie in der Morphologie Ost-Asiens," *Sitz. k. preuss. Akad. Wiss.* (Berlin, 1900), pp. 888-925, and "Geomorphologische Studien aus Ostasien," *ibid.*, 1901, pp. 782-808, 1902, pp. 944-975, 1903, pp. 867-918. (P. La.)

Climate

Temperature.

Among the places on the globe where the temperature falls lowest are some in northern Asia, and among those where it rises highest are some in southern Asia. The mean temperature of the north coast of eastern Siberia is but a few degrees above the zero of Fahrenheit; the lowest mean temperature anywhere observed is about 4° Fahr., at Melville Island, north of the American continent. The isothermals of mean annual temperature lie over northern Asia on curves tolerably regular in their outline, having their western branches in a somewhat higher latitude than their eastern; a reduction of 1° of latitude corresponds approximately—and irrespective of modifications due to elevation—to a rise of ½° Fahr., as far say as 30° N., where the mean temperature is about 75° Fahr. Farther south the increase is slower, and the highest mean temperature anywhere attained in southern Asia is not much above 82° Fahr.

The variations of temperature are very great in Siberia, amounting near the coast to more than 100° Fahr., between the mean of the hottest and coldest months, and to still more between the extreme temperatures of those months. In southern Asia, and particularly near the sea, the variation between the hottest and coldest monthly means is very much less, and under the equator it is reduced to about 5°. In Siberia the difference between the means of the hottest and coldest months is hardly anywhere less than 60° Fahr. On the Sea of Aral it is 80° Fahr.; and at Astrakhan, on the Caspian, more than 50°. At Tiflis it is 45°. In northern China, at Peking, it is 55°, reduced to 30° at Canton, and to 20° at Manila. In northern India the greatest difference does not exceed 40°; and it falls off to about 15° at Calcutta, and to about 10° or 12° at Bombay and Madras. The temperatures at the head of the Persian Gulf approximate to those of northern India, and those of Aden to Madras. At Singapore the range is less than 5°; and at Batavia in Java, and Galle in Ceylon, it is about the same. The extreme temperatures in Siberia may be considered to lie between 80° and 90° Fahr. for maxima, and between −40° and −70° Fahr. for minima. The extreme of heat near the Caspian and Aral Seas rises to nearly 100° Fahr., while that of cold falls to −20° Fahr. or lower. Compared with these figures, we find in southern Asia 110° or 112° Fahr. as a maximum hardly ever exceeded. The absolute minimum in northern India, in lat. 30°, hardly goes below 32°; at Calcutta it is about 40°, though the thermometer seldom falls to 50°. At Madras it rarely falls as low as 65°, or at Bombay below 60°. At Singapore and Batavia the thermometer very rarely falls below 70°, or rises above 90°. At Aden the minimum is a few degrees below 70°, the maximum not much exceeding 90°.

These figures sufficiently indicate the main characteristics of the air temperatures of Asia. Throughout its northern portion the winter is long and of extreme severity; and even down to the circle of 35° N. lat., the minimum temperature is almost as low as zero of Fahrenheit. The summers are hot, though short in the northern latitudes, the maximum of summer heat being comparatively little less than that observed in the tropical countries farther south. The moderating effect of the proximity of the ocean is felt in an important degree along the southern and eastern parts of Asia, where the land is broken up into islands or peninsulas. The great elevations above the sea-level of the central part of Asia, and of the table-lands of Afghanistan and Persia, tend to exaggerate the winter cold; while the sterility of the surface, due to the small rainfall over the same region, operates powerfully in the opposite direction in increasing the summer heat. In the summer a great accumulation of solar heat takes place on the dry surface soil, from which it cannot be released upwards by evaporation, as might be the case were the soil moist or covered with vegetation, nor can it be readily conveyed away downwards as happens on the ocean. In the winter similar consequences ensue, in a negative direction, from the prolonged loss of heat by radiation in the long and clear nights—an effect which is intensified wherever the surface is covered with snow, or the air little charged with vapour. In illustration of the very slow diffusion of heat in the solid crust of the earth, and as affording a further indication of the climate of northern Asia, reference may here be made to the frozen soil of Siberia, in the vicinity of Yakutsk. In this region the earth is frozen permanently to a depth of more than 380 ft. at which the temperature is still 5° or 6° Fahr. below the freezing point of water, the summer heat merely thawing the surface to a depth of about 3 ft. At a depth of 50 ft. the temperature is about 15° Fahr. below the freezing point. Under such conditions of the soil, the land, nevertheless, produces crops of wheat and other grain from fifteen to forty fold.

The very high summer temperatures of the area north of the tropic of Cancer are sufficiently accounted for, when compared with those observed south of the tropic, by the increased length of the day in the higher latitude, which more than compensates for the loss of heat due to the smaller mid-day altitude of the sun. The difference between the heating power of the sun's rays at noon on the 21st of June, in latitude 20° and in latitude 45°, is only about 2%; while the accumulated heat received during the day, which is lengthened to $15\frac{1}{2}$ hours in the higher latitude, is greater by about 11% than in the lower latitude, where the day consists only of $13\frac{1}{4}$ hours.

Although the foregoing account of the temperatures of Asia supplies the main outline of the observed phenomena, a very important modifying cause, of which more will be said hereafter, comes into operation over the whole of the tropical region, namely, the periodical summer rains. These tend very greatly to arrest the increase of the summer heat over the area where they prevail, and otherwise give it altogether peculiar characteristics.

Pressure and Winds.

The great summer heat, by expanding the air upwards, disturbs the level of the planes of equal pressure, and causes an outflow of the upper strata from the heated area. The winter cold produces an effect of just an opposite nature, and causes an accumulation of air over the cold area. The diminution of barometric pressure which takes place all over Asia during the summer months, and the increase in the winter, are hence, no doubt, the results of the alternate heating and cooling of the air over the continent.

The necessary and immediate results of such periodical changes of pressure are winds, which, speaking generally, blow from the area of greatest to that of least pressure—subject, however, to certain modifications of direction, arising from the absolute motion of the whole body of the air due to the revolution of the earth on its axis from west to east. The south-westerly winds which prevail north of the equator during the hot half of the year, to which navigators have given the name of the south-west monsoon (the latter word being a corruption of the Indian name for season), arise from the great diminution of atmospheric pressure over Asia, which begins to be strongly marked with the great rise of temperature in April and May, and the simultaneous relatively higher pressure over the equator and the regions south of it. This diminution of pressure, which continues as the heat increases till it reaches its maximum in July soon after the solstice, is followed by the corresponding development of the south-west monsoon; and as the barometric pressure is gradually restored, and becomes equalized within the tropics soon after the equinox in October, with the general fall of temperature north of the equator, the south-west winds fall off, and are succeeded by a north-east monsoon, which is developed during the winter months by the relatively greater atmospheric pressure which then occurs over Asia, as compared with the equatorial region.

Although the succession of the periodical winds follows the progress of the seasons as just described, the changes in the wind's direction everywhere take place under the operation of special local influences which often disguise the more general law, and make it difficult to trace. Thus the south-west monsoon begins in the Arabian Sea with west and north-westerly winds, which draw round as the year advances to south-west and fall back again in the autumn by north-west to north. In the Bay of Bengal the strength of the south-west monsoon is rather from the south and south-east, being succeeded by north-east winds after October, which give place to northerly and north-westerly winds as the year advances. Among the islands of the Malay Archipelago the force of the monsoons is much interrupted, and the position of this region on the equator otherwise modifies the directions of the prevailing winds. The southerly summer winds of the Asiatic seas between the equator and the tropic do not extend to the coasts of Java, and the south-easterly trade winds are there developed in the usual manner. The China Sea is fully exposed to both monsoons, the normal directions of which nearly coincide with the centre of the channel between the continent of Asia and the eastern islands.

The south-west monsoon does not generally extend, in its character of a south-west wind, over the land. The current of air flowing in from over the sea is gradually diverted towards the area of least pressure, and at the same time is dissipated and loses much of its original force. The winds which pass northward over India blow as south-easterly and easterly winds over the north-eastern part of the Gangetic plain, and as south winds up the Indus. They seem almost entirely to have exhausted their northward velocity by the time they have reached the northern extremity of the great Indian plain; they are not felt on the table-lands of Afghanistan, and hardly penetrate into the Indus basin or the ranges of the Himalaya, by which mountains, and those which branch off from them into the Malay peninsula, they are prevented from continuing their progress in the direction originally imparted to them.

Among the more remarkable phenomena of the hotter seas of Asia must be noticed the revolving storms or cyclones, which are of frequent occurrence in the hot months in the Indian Ocean and China Sea, in which last they are known under the name of typhoon. The cyclones of the Bay of Bengal appear to originate over the Andaman and Nicobar islands, and are commonly propagated in a north-westward direction, striking the east coast of the Indian peninsula at various points, and then often advancing with an easterly tendency over the land, and passing with extreme violence across the delta of the Ganges. They occur in all the hot months, from June to October, and more rarely in November, and appear to be originated by adverse currents from the north meeting those of the south-west monsoon. The cyclones of the China Sea also occur in the hot months of the year, but they advance from north-east to south-west, though occasionally from east to west; they originate near the island of Formosa, and extend to about the 10th degree of N. lat. They are thus developed in nearly the same latitudes and in the same months as those of the Indian Sea, though their progress is in a different direction. In both cases, however, the storms appear to advance towards the area of greatest heat. In these storms the wind invariably circulates from north by west through south to east.

Rainfall.

The heated body of air carried from the Indian Ocean over southern Asia by the south-west monsoon comes up highly charged with watery vapour, and hence in a condition to release a large body of water as rain upon the land, whenever it is brought into circumstances which reduce its temperature in a notable degree. Such a reduction of temperature is brought about along the greater part of the coasts of India and of the Burmo-Siamese peninsula by the interruption of the wind current by continuous ranges of mountains, which force the mass of air to rise over them, whereby the air being rarefied, its specific capacity for heat is increased and its temperature falls, with a corresponding condensation of the vapour originally held in suspension.

This explanation of the principal efficient cause of the summer rains of south Asia is immediately based on an analysis of the complicated phenomena actually observed, and it serves to account for many apparent anomalies. The heaviest falls of rain occur along lines of mountain of some extent directly facing the vapour-bearing winds, as on the Western Ghats of India and the west coast of the Malay peninsula. The same results are found along the mountains at a distance from the sea, the heaviest rainfall known to occur anywhere in the world (not less than 600 in. in the year) being recorded on the Khasi range about 100 m. north-east of Calcutta, which presents an abrupt front to the progress of the moist winds flowing up from the Bay of Bengal. The cessation of the rains on the southern border of Baluchistan, west of Karachi, obviously arises from the projection of the south-east coast of Arabia, which limits the breadth of the south-west monsoon air current and the length of the coast-line directly exposed to it. The very small and irregular rainfall in Sind and along the Indus is to be accounted for by the want of any obstacle in the path of the vapour-bearing winds, which, therefore, carry the uncondensed rain up to the Punjab, where it falls on the outer ranges of the western Himalaya and of Afghanistan.

The diurnal mountain winds are very strongly marked on the Himalaya, where they probably are the most active agents in determining the precipitation of rain along the chain—the monsoon currents, as before stated, not penetrating among the mountains. The formation of dense banks of cloud in the afternoon, when the up wind is strongest, along the southern face of the snowy ranges of the Himalaya, is a regular daily phenomenon during the hotter months of the year, and heavy rain, accompanied by electrical discharges, is the frequent result of such condensation.

Too little is known of the greater part of Asia to admit of any more being said with reference to this part of the subject, than to mention a few facts bearing on the rainfall. In northern Asia there is a generally equal rainfall of 19 to 29 in. between the Volga and the Lena in Manchuria and northern China, rather more considerable increase in Korea, Siam and Japan. At Tiflis the yearly fall is 22 in.; on the Caspian about 7 or 8 in.; on the Sea of Aral 5 or 6 in. In south-western Siberia it is 12 or 14 in., diminishing as we proceed eastward to 6 or 7 in. at Barnaul, and to 5 or 6 in. at Urga in northern Mongolia. In eastern Siberia it is about 15 to 20 in. In China we find about 23 in. to be the fall at Peking; while at Canton, which lies nearly on the northern tropic and the region of the south-west monsoon is entered, the quantity is increased to 78 in. At Batavia in Java the fall is about 78 in.; at Singapore it is nearly 100 in. The quantity increases considerably on that part of the coast of the Malay peninsula which is not sheltered from the south-west by Sumatra. On the Tenasserim and Burmese coast falls of more than 200 in. are registered, and the quantity is here nowhere less than 75 or 80 in., which is about the average of the eastern part of the delta of the Ganges, Calcutta standing at about 64 in. On the hills that flank Bengal on the east the fall is very great. On the Khasi hills, at an elevation of about 4500 ft., the average of ten years is more than 550 in. As much as 150 in. has been measured in one month, and 610 in. in one year. On the west coast of the Indian peninsula the fall at the sea-level varies from about 75 to 100 in., and at certain elevations on the mountains more than 250 in. is commonly registered, with intermediate quantities at intervening localities. On the east coast the fall is far less, nowhere rising to 50 in., and towards the southern apex of the peninsula being reduced to 25 or 30 in. Ceylon shows from 60 to 80 in. As we recede from the coast the fall diminishes, till it is reduced to about 25 or 30 in. at the head of the Gangetic plain. The tract along the Indus to within 60 or 80 m. of the Himalaya is almost rainless, 6 or 8 in. being the fall in the southern portion of the Punjab. On the outer ranges of the Himalaya the yearly fall amounts to about 200 in. on the east in Sikkim, and gradually diminishes on the west, where north of the Punjab it is about 70 or 80 in. In the interior of the chain the rain is far less, and the quantity of precipitation is so small in Tibet that it can be hardly measured. It is to the greatly reduced fall of snow on the northern faces of the highest ranges of the Himalaya that is to be attributed the higher level of the snow-line, a phenomenon which was long a cause of discussion.

In Afghanistan, Persia, Asia Minor and Syria, winter and spring appear to be the chief seasons of condensation. In other parts of Asia the principal part of the rain falls between May and September, that is, in the hottest half of the year. In the islands under the equator the heaviest fall is between October and February. (R. S.)

FLORA AND FAUNA

The general assemblage of animals and plants found over northern Asia resembles greatly that found in the parts of Europe which are adjacent and have a similar climate. Siberia, north of the 50th parallel, has a climate not much differing from a similarly situated portion of Europe, though the winters are more severe and the summers hotter. The rainfall, though moderate, is still sufficient to maintain the supply of water in the great rivers that traverse the country to the Arctic Sea, and to support an abundant vegetation. A similar affinity exists between the life of the southern parts of Europe and that in the zone of Asia extending from the Mediterranean across to the Himalaya and northern China. This belt, which embraces Asia Minor, northern Persia, Afghanistan, and the southern slopes of the Himalaya, from its elevation has a temperate climate, and throughout it the rainfall is sufficient to maintain a vigorous vegetation, while the summers, though hot, and the winters, though severe, are not extreme. The plants and animals along it are found to have a marked similarity of character to those of south Europe, with which region the zone is virtually continuous.

The extremely dry and hot tracts which constitute an almost unbroken desert from Arabia, through south Persia and Baluchistan, to Sind, are characterized by considerable uniformity in the types of life, which closely approach to those of the neighbouring hot and dry regions of Africa. The region of the heavy periodical summer rains and high temperature, which comprises India, the Indo-Chinese peninsula, and southern China, as well as the western part of the Malay Archipelago, is also marked by much similarity in the plants and animals throughout its extent. The area between the southern border of Siberia and the margin of the temperate alpine zone of the Himalaya and north China, comprising what are commonly called central Asia, Turkestan, Mongolia and western Manchuria, is an almost rainless region, having winters of extreme severity and summers of intense heat. Its animals and plants have a special character suited to the peculiar climatal conditions, more closely allied to those of the adjacent northern Siberian tract than of the other bordering regions. The south-eastern parts of the Malay Archipelago have much in common with the Australian continent, to which they adjoin, though their affinities are chiefly Indian. North China and Japan also have many forms of life in common. Much still remains to be done in the exploration of China and eastern Asia; but it is known that many of the special forms of this region extend to the Himalaya, while others clearly indicate a connexion with North America.

The foregoing brief review of the principal territorial divisions according to which the forms of life are distributed in Asia, indicates how close is the dependence of this distribution on climatic conditions, and this will be made more apparent by a somewhat fuller account of the main features of the flora and fauna.

Northern Asia.

Flora.—The flora of the whole of northern Asia is in essentials the same as that of northern Europe, the differences being due rather to variations of species than of genera. The absence of the oak and of all heaths east of the Ural may be noticed. Pines, larch, birch are the principal trees on the mountains; willow, alders and poplars on the lower ground. The northern limit of the pine in Siberia is about 70° N.

Along the warm temperate zone, from the Mediterranean to the Himalaya, extends a flora essentially European in character. Many European species reach the central Himalaya, though few are known in its eastern parts. The genera common to the Himalaya and Europe are much more abundant, and extend throughout the chain, and to all elevations. There is also a corresponding diffusion of Japanese and Chinese forms along this zone, these being most numerous in the eastern Himalaya, and less frequent in the west.

The truly tropical flora of the hotter and wetter regions of eastern India is continuous with that of the Malayan peninsula and islands, and extends along the lower ranges of the Himalaya, gradually becoming less marked and rising to lower elevations as we go westward, where the rainfall diminishes and the winter cold increases.

The vegetation of the higher and therefore cooler and less rainy ranges of the Himalaya has greater uniformity of character along the whole chain, and a closer general approach to European forms is maintained; an increased number of species is actually identical, among these being found, at the greatest elevations, many alpine plants believed to be identical with species of the north Arctic regions. On reaching the Tibetan plateau, with the increased dryness the flora assumes many features of the Siberian type. Many true Siberian species are found, and more Siberian genera. Some of the Siberian forms, thus brought into proximity with the Indian flora, extend to the rainy parts of the mountains, and even to the plains of upper India. Assemblages of marine plants form another remarkable feature of Tibet, these being frequently met with growing at elevations of 14,000 to 15,000 ft. above the sea, more especially in the vicinity of the many salt lakes of those regions.

The vegetation of the hot and dry region of the south-west of the continent consists largely of plants which are diffused over Africa, Baluchistan and Sind; many of these extend into the hotter parts of India, and not a few common Egyptian plants are to be met with in the Indian peninsula.

Indian region.

The whole number of species of plants indigenous in the region of south-eastern Asia, which includes India and the Malayan peninsula and islands, from about the 65th to the 105th meridian, was estimated by Sir J. D. Hooker at 12,000 to 15,000. The principal orders, arranged according to their numerical importance, are as follows:—Leguminosae, Rubiaceae, Orchidaceae, Compositae, Gramineae, Euphorbiaceae, Acanthaceae, Cyperaceae and Labiatae. But within this region there is a very great variation between the vegetation of the more humid and the more arid regions, while the characteristics of the flora on the higher mountain ranges differ wholly from those of the plains. In short, we have a somewhat heterogeneous assemblage of tropical, temperate and alpine plants, as has been already briefly indicated, of which, however, the tropical are so far dominant as to give their character to the flora viewed as a whole. The Indian flora contains a more general and complete illustration of almost all the chief natural families of all parts of the world than any other country. Compositae are comparatively rare; so also Gramineae and Cyperaceae are in some places deficient, and Labiatae, Leguminosae and ferns in others. Euphorbiaceae and Scrophulariaceae and Orchidaceae are universally present, the last in specially large proportions.

The perennially humid regions of the Malayan peninsula and western portion of the archipelago are everywhere covered with dense forest, rendered difficult to traverse by the thorny cane, a palm of the genus *Calamus*, which has its greatest development in this part of Asia. The chief trees belong to the orders of Terebinthaceae, Sapindaceae, Meliaceae, Clusiaceae, Dipterocarpaceae, Ternstroemiaceae, Leguminosae, laurels, oaks and figs, with Dilleniaceae, Sapotaceae and nutmegs. Bamboos and palms, with *Pandanus* and *Dracaena*, are also abundant. A similar forest flora extends along the mountains of eastern India to the Himalaya, where it ascends to elevations varying from 6000 to 7000 ft. on the east to 3000 or 4000 ft. on the west.

The arboreous forms which least require the humid and equable heat of the more truly tropical and equatorial climates, and are best able to resist the high temperatures and excessive drought of the northern Indian hot months from April to June, are certain Leguminosae, *Bauhinia*, *Acacia*, *Butea* and *Dalbergia*, *Bombax*, *Shorea*, *Nauclea*, *Lagerstroemia*, and *Bignonia*, a few bamboos and palms, with others which extend far beyond the tropic, and give a tropical aspect to the forest to the extreme northern border of the Indian plain.

Of the herbaceous vegetation of the more rainy regions may be noted the Orchidaceae, Orontiaceae, Scitamineae, with ferns and other

Cryptogams, besides Gramineae and Cyperaceae. Among these some forms, as among the trees, extend much beyond the tropic and ascend into the temperate zones on the mountains, of which may be mentioned *Begonia*, *Osbeckia*, various Cyrtandraceae, Scitamineae, and a few epiphytical orchids.

Of the orders most largely developed in south India, and more sparingly elsewhere, may be named Aurantiaceae, Dipterocarpaceae, Balsaminaceae, Ebenaceae, Jasmineae, and Cyrtandraceae; but of these few contain as many as 100 peculiar Indian species. *Nepenthes* may be mentioned as a genus specially developed in the Malayan area, and extending from New Caledonia to Madagascar; it is found as far north as the Khasi hills, and in Ceylon, but does not appear on the Himalaya or in the peninsula of India. The Balsaminaceae may be named as being rare in the eastern region and very abundant in the peninsula. A distinct connexion between the flora of the peninsula and Ceylon and that of eastern tropical Africa is observable not only in the great similarity of many of the more truly tropical forms, and the identity of families and genera found in both regions, but in a more remarkable manner in the likeness of the mountain flora of this part of Africa to that of the peninsula, in which several species occur believed to be identical with Abyssinian forms. This connexion is further established by the absence from both areas of oaks, conifers and cycads, which, as regards the first two families, is a remarkable feature of the flora of the peninsula and Ceylon, as the mountains rise to elevations in which both of them are abundant to the north and east. With these facts it has to be noticed that many of the principal forms of the eastern flora are absent or comparatively rare in the peninsula and Ceylon.

The general physiognomy of the Indian flora is mainly determined by the conditions of humidity of climate. The impenetrable shady forests of the Malay peninsula and eastern Bengal, of the west coast of the Indian peninsula, and of Ceylon, offer a strong contrast to the more loosely-timbered districts of the drier regions of central India and the north-western Himalaya. The forest areas of India include the dense vegetation and luxuriant growth of the Tarai jungles at the foot of the eastern Himalaya, and wide stretches of loosely-timbered country which are a prevailing feature in the Central Provinces and parts of Madras. Where the lowlands are highly cultivated they are adorned with planted wood, and where they are cut off from rain they are nearly completely desert.

The higher mountains rise abruptly from the plains; on their slopes, clothed below almost exclusively with the more tropical forms, a vegetation of a warm temperate character, chiefly evergreen, soon begins to prevail, comprising Magnoliaceae, Ternstroemiaceae, subtropical Rosaceae, rhododendron, oak, *Ilex*, *Symplocos*, Lauraceae, *Pinus longifolia*, with mountain forms of truly tropical orders, palms, *Pandanus*, *Musa*, *Vitis*, *Vernonia*, and many others. On the east the vegetation of the Himalaya is most abundant and varied. The forest extends, with great luxuriance, to an elevation of 12,000 ft., above which the sub-alpine region may be said to begin, in which rhododendron scrub often covers the ground up to 13,000 or 14,000 ft. Only one pine is found below 8000 ft., above which several other Coniferae occur. Plantains, tree-ferns, bamboos, several *Calami*, and other palms, and *Pandanus*, are abundant at the lower levels. Between 4000 and 8000 ft. epiphytal orchids are very frequent, and reach even to 10,000 ft. Vegetation ascends on the drier and less snowy mountain slopes of Tibet to above 18,000 ft. On the west, with the drier climate, the forest is less luxuriant and dense, and the hill-sides and the valleys better cultivated. The warm mountain slopes are covered with *Pinus longifolia*, or with oaks and rhododendron, and the forest is not commonly dense below 8000 ft., excepting in some of the more secluded valleys at a low elevation. From 8000 to 12,000 ft., a thick forest of deciduous trees is almost universal, above which a sub-alpine region is reached, and vegetation as on the east continues up to 18,000 ft. or more. The more tropical forms of the east, such as the tree-ferns, do not reach west of Nepal. The cedar or deodar is hardly indigenous east of the sources of the Ganges, and at about the same point the forms of the west begin to be more abundant, increasing in number as we advance towards Afghanistan.

The cultivated plants of the Indian region include wheat, barley, rice and maize; various millets, *Sorghum*, *Penicillaria*, *Panicum* and *Eleusine*; many pulses, peas and beans; mustard and rape; ginger and turmeric; pepper and capsicum; several Cucurbitaceae; tobacco, *Sesamum*, poppy, *Crotolaria* and *Cannabis*; cotton, indigo and sugar; coffee and tea; oranges, lemons of many sorts; pomegranate, mango, figs, peaches, vines and plantains. The more common palms are *Cocos*, *Phoenix* and *Borassus*, supplying cocoa-nut and toddy. Indian agriculture combines the harvests of the tropical and temperate zones. North of the tropic the winter cold is sufficient to admit of the cultivation of almost all the cereals and vegetables of Europe, wheat being sown in November and reaped early in April. In this same region the summer heat and rain provide a thoroughly tropical climate, in which rice and other tropical cereals are freely raised, being as a rule sown early in July and reaped in September or October. In southern India, and the other parts of Asia and of the islands having a similar climate, the difference of the winter and summer half-years is not sufficient to admit of the proper cultivation of wheat or barley. The other cereals may be seen occasionally, where artificial irrigation is practised, in all stages of progress at all seasons of the year, though the operations of agriculture are, as a general rule, limited to the rainy months, when alone is the requisite supply of water commonly forthcoming.

The trees of India producing economically useful timber are comparatively few, owing to the want of durability of the wood, in the extremely hot and moist climate. The teak, *Tectona grandis*, supplies the finest timber. It is found in greatest perfection in the forests of the west coasts of Burma and the Indian peninsula, where the rainfall is heaviest, growing to a height of 100 or 150 ft., mixed with other trees and bamboos. The sal, *Shorea robusta*, a very durable wood, is most abundant along the skirts of the Himalaya from Assam to the Punjab, and is found in central India, to which the teak also extends. The sal grows to a large size, and is more gregarious than the teak. Of other useful woods found in the plains may be named the babool, *Acacia*; toon, *Cedrela*; and sissoo, *Dalbergia*. The only timber in ordinary use obtained from the Himalaya proper is the deodar, *Cedrus deodara*. Besides these are the sandalwood, *Santalum*, of southern India, and many sorts of bamboo found in all parts of the country. The cinchona has recently been introduced with complete success; and the mahogany of America reaches a large size, and gives promise of being grown for use as timber.

Western Asia.

The flora of the rainless region of south-western Asia is continuous with the desert flora of northern and eastern Africa, and extends from the coast of Senegal to the meridian of 75° E., or from the great African desert to the border of the rainless tract along the Indus and the southern parts of the Punjab. It includes the peninsula of Arabia, the shores of the Persian Gulf, south Persia, and Afghanistan and Baluchistan. On the west its limit is in the Cape Verde Islands, and it is partially represented in Abyssinia.

The more common plants in the most characteristic part of this region in southern Arabia are Capparidaceae, Euphorbiaceae, and a few Leguminosae, a *Reseda* and *Dipterygium*; palms, Polygonaceae, ferns, and other cryptogams, are rare. The number of families relative to the area is very small, and the number of genera and species equally restricted, in very many cases a single species being the only representative of an order. The aspect of the vegetation is very peculiar, and is commonly determined by the predominance of some four or five species, the rest being either local or sparingly scattered over the area. The absence of the ordinary bright green colours of vegetation is another peculiarity of this flora, almost all the plants having glaucous or whitened stems. Foliage is reduced to a minimum, the moisture of the plant being stored up in massive or fleshy stems against the long-continued drought. Aridity has favoured the production of spines as a defence from external attack, sharp thorns are frequent, and asperities of various sorts predominate. Many species produce gums and resins, their stems being encrusted with the exudations, and pungency and aromatic odour is an almost universal quality of the plants of desert regions.

The cultivated plants of Arabia are much the same as those of northern India—wheat, barley, and the common *Sorghum*, with dates and lemons, cotton and indigo. To these must be added coffee, which is restricted to the slopes of the western hills. Among the more mountainous regions of the south-western part of Arabia, known as Arabia Felix, the summits of which rise to 6000 or 7000 ft., the rainfall is sufficient to develop a more luxuriant vegetation, and the valleys have a flora like that of similarly situated parts of southern Persia, and the less elevated parts of Afghanistan and Baluchistan, partaking of the characters of that of the hotter Mediterranean region. In these countries aromatic shrubs are abundant. Trees are rare, and almost restricted to *Pistacia*, *Celtis* and *Dodonaea*, with poplars, and the date palm. Prickly forms of *Statice* and *Astragalus* cover the dry hills. In the spring there is an abundant herbaceous vegetation, including many bulbous plants, with genera, if not species, identical with those of the Syrian region, some of which extend to the Himalaya.

The flora of the northern part of Afghanistan approximates to that of the contiguous western Himalaya. *Quercus Ilex*, the evergreen oak of southern Europe, is found in forests as far east as the Sutlej, accompanied with other European forms. In the higher parts of Afghanistan and Persia Boraginaceae and thistles abound; gigantic Umbelliferae, such as *Ferula*, *Galbanum*, *Dorema*, *Bubon*, *Peucedanum*, *Prangos*, and others, also characterize the same districts, and some of them extend into Tibet.

The flora of Asia Minor and northern Persia differs but little from that of the southern parts of Europe. The mountains are clothed, where the fall of rain is abundant, with forests of *Quercus*, *Fagus*, *Ulmus*, *Acer*, *Carpinus* and *Corylus*, and various Coniferae. Of these the only genus that is not found on the Himalaya is *Fagus*. Fruit trees of the plum tribe abound. The cultivated plants are those of southern Europe.

Eastern Asia.

The vegetation of the Malayan Islands is for the most part that of the wetter and hotter region of India; but the greater uniformity of the temperature and humidity leads to the predominance of certain tropical forms not so conspicuous in India, while the proximity of the Australian continent has permitted the partial diffusion of Australian types which are not seen in India. The liquidambar and nutmeg may be noticed among the former; the first is one of the most conspicuous trees in Java, on the mountains of the eastern part of which the casuarina, one of the characteristic forms of Australia, is also abundant. Rhododendrons occur in Borneo and Sumatra, descending to the level of the sea. On the mountains of Java there appears to be no truly alpine flora; *Saxifraga* is not found. In Borneo some of the temperate forms of Australia appear on the higher mountains. On the other islands similar characteristics are to be observed, Australian genera extending to the Philippines, and even to southern China.

The analysis of the Hong Kong flora indicates that about three-fifths of the species are common to the Indian region, and nearly all the remainder are either Chinese or local forms. The number of species common to southern China, Japan and northern Asia is small. The cultivated plants of China are, with a few exceptions, the same as those of India. South China, therefore, seems, botanically, hardly distinct from the great Indian region, into which many Chinese forms penetrate, as before noticed. The flora of north China, which is akin to that of Japan, shows manifest relation to that of the neighbouring American continent, from which many temperate forms extend, reaching to the Himalaya, almost as far as Kashmir. Very little is known of the plants of the interior of northern China, but it seems probable that a complete botanical connexion is established between it and the temperate region of the Himalaya.

Central Asia.

The vegetation of the dry region of central Asia is remarkable for the great relative number of Chenopodiaceae, *Salicornia* and other salt plants being common; Polygonaceae also are abundant; leafless forms being of frequent occurrence, which gives the vegetation a very remarkable aspect. Peculiar forms of Leguminosae also prevail, and these, with many of the other plants of the southern and drier regions of Siberia, or of the colder regions of the desert tracts of Persia and Afghanistan, extend into Tibet, where the extreme drought and the hot (nearly vertical) sun combine to produce a summer climate not greatly differing from that of the plains of central Asia.

Zoological regions.

Fauna.—The zoological provinces of Asia correspond very closely with the botanical. The northern portion of Asia, as far south as the Himalaya, is not zoologically distinct from Europe, and these two areas, with the strip of Africa north of the Atlas, constitute the Palaearctic region of Dr Sclater, whose zoological primary divisions of the earth have met with the general approval of naturalists. The south-eastern portion of Asia with the adjacent islands of Sumatra, Java, Borneo and the Philippines, form his Indian region. The extreme south-west part of the continent constitutes a separate zoological district, comprising Arabia, Palestine and southern Persia, and reaching, like the hot desert botanical tract, to Baluchistan and Sind; it belongs to what Dr Sclater calls the Ethiopian region, which extends over Africa, south of the Atlas. Celebes, Papua, and the other islands east of Java beyond Wallace's line, fall within the Australian region.

Mammals and birds.

Nearly all the mammals of Europe also occur in northern Asia, where, however, the Palaearctic fauna is enriched by numerous additional species. The characteristic groups belong mostly to forms which are restricted to cold and temperate regions. Consequently the Quadrumana, or monkeys, are nearly unrepresented, a single species occurring in Japan, and one or two others in northern China and Tibet. Insectivorous bats are numerous, but the frugivorous division of this order is only represented by a single species in Japan. Carnivora are also numerous, particularly the frequenters of cold climates, such as bears, weasels, wolves and foxes. Of the Insectivora numerous forms of moles, shrews and hedgehogs prevail. The Rodents are also well represented by various squirrels, mice and hares. Characteristic forms of this order in northern Asia are the marmots (*Arctomys*) and the pikas, or tailless hares (*Lagomys*). The great order of Ungulata is represented by various forms of sheep, as many as ten or twelve wild species of *Ovis* being met with in the mountain chains of Asia; and more sparingly by several peculiar forms of antelope, such as the saiga (*Saiga tatarica*), and the *Gazella gutturosa*, or yellow sheep. Coming to the deer, we also meet with characteristic forms in northern Asia, especially those belonging to the typical genus *Cervus*. The musk deer (*Moschus*) is also quite restricted to northern Asia, and is one of its most peculiar types.

The ornithology of northern Asia is even more closely allied to that of Europe than the mammal fauna. Nearly three-fourths of the well-known species of Europe extend through Siberia into the islands of the Japanese empire. Here again we have an absence of all tropical forms, and a great development of groups characteristic of cold and temperate regions. One of the most peculiar of these is the genus *Phasianus*, of which splendid birds all the species are restricted in their wild state to northern Asia. The still more magnificently clad gold pheasants (*Thaumalea*), and the eared pheasants (*Crossoptilon*), are also confined to certain districts in the mountains of north-eastern Asia. Amongst the *Passeres*, such forms as the larks, stone-chats, finches, linnets and grosbeaks are well developed, and exhibit many species.

The mammal fauna of the Indian region of Asia is much more highly developed than that of the Palaearctic. The Quadrumana are represented by several peculiar genera, amongst which are *Semnopithecus*, *Hylobates* and *Simia*. Two peculiar forms of the Lemurine group are also met with. Both the insectivorous and frugivorous divisions of the bats are well represented. Amongst the Insectivora very peculiar forms are found, such as *Gymnura* and *Tupaia*. The Carnivora are likewise numerous; and this region may be considered as the true home of the tiger, though this animal has wandered far north into the Palaearctic division of Asia. Other characteristic Carnivora are civets, various ichneumons, and the benturong (*Arctictis*). Two species of bears are likewise restricted to the Indian region. In the order of Rodents squirrels are very numerous, and porcupines of two genera are met with. The Indian region is the home of the Indian elephant—one of the two sole remaining representatives of the order Proboscidea. Of the Ungulates, four species of rhinoceros and one of tapir are met with, besides several peculiar forms of the swine family. The Bovidae, or hollow-horned ruminants, are represented by several genera of antelopes, and by species of true *Bos*—such as *B. sondaicus*, *B. frontalis* and *B. bubalus*. Deer are likewise numerous, and the peculiar group of chevrotains (*Tragulus*) is characteristic of the Indian region. Finally, this region affords us representatives of the order Edentata, in the shape of several species of *Manis*, or scaly ant-eater.

The assemblage of birds of the Indian region is one of the richest and most varied in the world, being surpassed only by that of tropical America. Nearly every order, except that of the Struthiones or ostriches, is well represented, and there are many peculiar genera not found elsewhere, such as *Buceros*, *Harpactes*, *Lophophorus*, *Euplocamus*, *Pavo* and *Ceriornis*. The *Phasianidae* (exclusive of true *Phasianus*) are highly characteristic of this region, as are likewise certain genera of barbets (*Megalaema*), parrots (*Palaeornis*), and crows (*Dendrocitta*, *Urocissa* and *Cissa*). The family *Eurylaemidae* is entirely confined to this part of Asia.

The Ethiopian fauna plays but a subordinate part in Asia, intruding only into the south-western corner, and occupying the desert districts of Arabia and Syria, although some of the characteristic species reach still farther into Persia and Sind, and even into western India. The lion and the hunting-leopard, which may be considered as, in this epoch at least, Ethiopian types, extend thus far, besides various species of jerboa and other desert-loving forms.

In the birds, the Ethiopian type is shown by the prevalence of larks and stone-chats, and by the complete absence of the many peculiar genera of the Indian region.

The occurrence of mammals of the Marsupial order in the Molucca Islands and Celebes, while none have been found in the adjacent islands of Java and Borneo, lying on the west of Wallace's line, or in the Indian region, shows that the margin of the Australian region has here been reached. The same conclusion is indicated by the absence from the Moluccas and Celebes of various other Mammals, Quadrumana, Carnivora, Insectivora and Ruminants, which abound in the western part of the Archipelago. Deer do not extend into New Guinea, in which island the genus *Sus* appears to have its eastern limit. A peculiar form of baboon, *Cynopithecus*, and the singular ruminant, *Anoa*, found in Celebes, seem to have no relation to Asiatic animals, and rather to be allied to those in Africa.

The birds of these islands present similar peculiarities. Those of the Indian region abruptly disappear at, and many Australian forms reach but do not pass, the line above spoken of. Species of birds akin to those of Africa also occur in Celebes.

Of the marine orders of Sirenia and Cetacea the Dugong, *Halicore*, is exclusively found in the Indian Ocean; and a dolphin, *Platanista*, peculiar to the Ganges, ascends that river to a great distance from the sea.

Fishes.

Of the sea fishes of Asia, among the Acanthopterygii, or spiny-rayed fishes, the *Percidae*, or perches, are largely represented; the genus *Serranus*, which has only one species in Europe, is very numerous in Asia, and the forms are very large. Other allied genera are abundant, and extend from the Indian seas to eastern Africa. The Squamipennes, or scaly-finned fishes, are principally found in the seas of southern Asia, and especially near coral reefs. The *Mullidae*, or red mullets, are largely represented by genera differing from those of Europe. The *Polynemidae*, which range from the Atlantic through the Indian Ocean to the Pacific, supply animals from which isinglass is prepared; one of them, the mango-fish, esteemed a great delicacy, inhabits the seas from the Bay of Bengal to Siam. The *Sciaenidae* extend from the Bay of Bengal to China, but are not known to the westward. The *Stromateidae*, or pomfrets, resemble the dory, a Mediterranean form, and extend to China and the Pacific. The sword fishes, *Xiphiidae*, the lancet fishes, *Acanthuridae*, and the scabbard fishes, *Trichuridae*, are distributed through the seas of south Asia. Mackerels of various genera abound, as well as gobies, blennies and mullets.

Among the Anacanthini, the cod family so well known in Europe shows but one or two species in the seas of south Asia, though the soles and allied fishes are numerous along the coasts. Of the Physostomi, the siluroids are abundant in the estuaries and muddy waters; the habits of some of these fishes are remarkable, such as that of the males carrying the ova in their mouths till the young are hatched. The small family of *Scopelidae* affords the gelatinous *Harpodon*, or bumalo. The gar-fish and flying-fishes are numerous, extending into the seas of Europe. The *Clupeidae*, or herrings, are most abundant; and anchovies, or sardines, are found in shoals, but at irregular and uncertain intervals. The marine eels, *Muraenidae*, are more numerous towards the Malay Archipelago than in the Indian seas. Forms of sea-horses (*Hippocampus*), pipe-fishes (*Syngnathus*), fife-fishes (*Sclerodermus*), and sun-fish, globe-fish, and other allied forms of *Gymnodontes*, are not uncommon.

Of the cartilaginous fishes, Chondropterygii, the true sharks and hammer-headed sharks, are numerous. The dog-fish also is found, one species extending from the Indian seas to the Cape of Good Hope. The saw-fishes, *Pristidae*, the electrical rays, *Torpedinae*, and ordinary rays and skates, are also found in considerable numbers.

The fresh waters of southern Asia are deficient in the typical forms of the Acanthopterygii, and are chiefly inhabited by carp, siluroids, simple or spined eels, and the walking and climbing fishes. The *Siluridae* attain their chief development in tropical regions. Only one *Silurus* is found in Europe, and the same species extends to southern Asia and Africa. The *Salmonidae* are entirely absent from the waters of southern Asia, though they exist in the rivers that flow into the Arctic Ocean and the neighbouring parts of the northern Pacific, extending perhaps to Formosa; and trout, though unknown in Indian rivers, are found beyond the watershed of the Indus, in the streams flowing into the Caspian. The *Cyprinidae*, or carp, are largely represented in southern Asia, and there grow to a size unknown in Europe; a *Barbus* in the Tigris has been taken of the weight of 300 ℔. The chief development of this family, both as to size and number of forms, is in the mountain regions with a temperate climate; the smaller species are found in the hotter regions and in the low-lying rivers. Of the *Clupeidae*, or herrings, numerous forms occur in Asiatic waters, ascending the rivers many hundred miles; one of the best-known of Indian fishes, the hilsa, is of this family. The sturgeons, which abound in the Black Sea and Caspian, and ascend the rivers that fall into them, are also found in Asiatic Russia, and an allied form extends to southern China. The walking or climbing fishes, which are peculiar to south-eastern Asia and Africa, are organized so as to be able to breathe when out of the water, and they are thus fitted to exist under conditions which would be fatal to other fishes, being suited to live in the regions of periodical drought and rain in which they are found.

Insects.

The insects of all southern Asia, including India south of the Himalaya, China, Siam and the Malayan Islands, belong to one group; not only the genera, but even the species are often the same on the opposite sides of the Bay of Bengal. The connexion with Africa is marked by the occurrence of many genera common to Africa and India, and confined to those two regions, and similarities of form are not uncommon there in cases in which the genera are not peculiar. Of Coleopterous insects known to inhabit east Siberia, nearly one-third are found in western Europe. The European forms seem to extend to about 30° N., south of which the Indo-Malayan types are met with, Japan being of the Europeo-Asiatic group. The northern forms extend generally along the south coast of the Mediterranean up to the border of the great desert, and from the Levant to the Caspian.

Domesticated animals.

Of the domesticated animals of Asia may first be mentioned the elephant. It does not breed in captivity, and is not found wild west of the Jumna river in northern India. The horse is produced, in the highest perfection in Arabia and the hot and dry countries of western Asia. Ponies are most esteemed from the wetter regions of the east, and the hilly tracts. Asses are abundant in most places, and two wild species occur. The horned cattle include the humped oxen and buffaloes of India, and the yak of Tibet. A hybrid between the yak and Indian cattle, called zo, is commonly reared in Tibet and the Himalaya. Sheep abound in the more temperate regions, and goats are universally met with; both of these animals are used as beasts of burden in the mountains of Tibet. The reindeer of northern Siberia call also for special notice; they are used for the saddle as well as for draught.

(R. S.)

ETHNOLOGY

Racial types.

Asia, including its outlying islands, has become the dwelling-place of all the great families into which the races of men have been divided. By far the largest area is occupied by the Mongolian group. These have yellow-brown skins, black eyes and hair, flat noses and oblique eyes. They are short in stature, with little hair on the body and face. In general terms they extend, with modifications of character probably due to admixture with other types and to varying conditions of life, over the whole of northern Asia as far south as the plains bordering the Caspian Sea, including Tibet and China, and also over the Indo-Malayan peninsula and Archipelago, excepting Papua and some of the more eastern islands.

Next in numerical importance to the Mongolians are the races which have been called by Professor Huxley *Melanochroic* and *Xanthochroic*. The former includes the dark-haired people of southern Europe, and extends over North Africa, Asia Minor, Syria to south-western Asia, and through Arabia and Persia to India. The latter race includes the fair-haired people of northern Europe, and extends over nearly the same area as the Melanochroi, with which race it is greatly intermixed. The Xanthochroi have fair skins, blue eyes and light hair; and others have dark skins, eyes and hair, and are of a slighter frame. Together they constitute what were once called the Caucasian races. The Melanochroi are not considered by Huxley to be one of the primitive modifications of mankind, but rather to be the result of the admixture of the Xanthochroi with the Australoid type, next to be mentioned.

The third group is that of the Australoid type. Their hair is dark, generally soft, never woolly. The eyes and skin are dark, the beard often well developed, the nose broad and flat, the lips coarse, and jaws heavy. This race is believed to form the basis of the people of the Indian peninsula, and of some of the hill tribes of central India, to whom the name Dravidian has been given, and by its admixture with the Melanochroic group to have given rise to the ordinary population of the Indian provinces. It is also probable that the Australoid family extends into south Arabia and Egypt.

The last group, the Negroid, is represented by the races to which has been given the name of *Negrito*, from the small size of some of them. They are closely akin to the negroes of South Africa, and possess the characteristic dark skins, woolly but scanty beard and body hair, broad flat noses, and projecting lips of the African; and are diffused over the Andaman Islands, a part of the Malay peninsula, the Philippines, Papua, and some of the neighbouring islands. The Negritos appear to be derived from a mixture of the true Negro with the Australoid type.

Mongolians.

The distribution of the Mongolian group in Asia offers no particular difficulty. There is complete present, and probably previous long-existing, geographical continuity in the area over which they are found. There is also considerable similarity of climate and other conditions throughout the northern half of Asia which they occupy. The extension of modified forms of the Mongolian type over the whole American continent may be mentioned as a remarkable circumstance connected with this branch of the human race.

The Mongolians of the northern half of Asia are almost entirely nomadic, hunters and shepherds or herdsmen. The least advanced of these, but far the most peaceful, are those that occupy Siberia. Farther south the best-known tribes are the Manchus, the Mongols proper, the Moguls and the Turks, all known under the name of Tatars, and to the ancients as Scythians, occupying from east to west the zone of Asia comprised between the 40th and 50th circles of N. lat. The Turks are Mahommedans; their tribes extend up the Oxus to the borders of Afghanistan and Persia, and to the Caspian, and under the name of Kirghiz into Russia, and their language is spoken over a large part of western Asia. Their letters are those of Persia. The Manchus and Mongols are chiefly Buddhist, with letters derived from the ancient Syriac. The Manchus are now said to be gradually falling under the influence of Chinese civilization, and to be losing their old nomadic habits, and even their peculiar language. The predatory habits of the Turkish, Mongolian and Manchu population of northern Asia, and their irruptions into other parts of the continent and into Europe, have produced very remarkable results in the history of the world.

The Chinese branch of the Mongolian family are a thoroughly settled people of agriculturists and traders. They are partially Buddhist, and have a peculiar monosyllabic, uninflected language, with writing consisting of symbols, which represent words, not letters.

The countries lying between India and the Mongolian are occupied by populations chiefly of the Mongolian and Chinese type, having languages fundamentally monosyllabic, but using letters derived from India, and adopting their religion, which is almost everywhere Buddhist, from the Indians. Of these may be named the Tibetans, the Burmese and the Siamese. Cochin-China is more nearly Chinese in all respects. It is known that to the Tibeto-Chinese modifications of the pure Mongolian type all the eastern Burmese tribes—Chins, Kachins, Shans, &c.—belong (as indeed do the Burmese themselves), and that a cognate race occupies the Himalaya to the eastern limits of Kashmir.

Some light has been thrown on the connexion between the Tibetan race and certain tribes of central India, the Bhils and Kols; and it seems more probable that these tribes are the remnants of a Mongolian race which first displaced a yet earlier Negroid population, and was then itself shouldered out by a Caucasian irruption, than that they entered India by any of the northern passages within historic times. Mongolian settlements have lately been found very much farther extended into the border countries of north-west India than has been hitherto recognized. The Mingals, who, conjointly with the Brahuis, occupy the hills south of Kalat to the limits of the Rajput province of Las Bela, claim Mongolian descent, and traces of a Mongolian colony have been found in Makran.

Malays.

The Malays, who occupy the peninsula and most of the islands of the Archipelago called after them, are Mongols apparently modified by their very different climate, and by the maritime life forced upon them by the physical conditions of the region they inhabit. As they are now known to us, they have undergone a process of partial civilization, first at the hands of the Brahminical Indians, from whom they borrowed a religion, and to some extent literature and an alphabet, and subsequently from intercourse with the Arabs, which has led to the adoption of Mahommedanism by most of them.

The name of Aryan has been given to the races speaking languages derived from, or akin to, the ancient form of Sanskrit, who now occupy the temperate zone extending from the Mediterranean, across the highlands of Asia Minor, Persia and Afghanistan, to

Aryans.

India. The races speaking the languages akin to the ancient Assyrian, which are now mainly represented by Arabic, have been called Semitic, and occupy the countries south-west of Persia, including Syria and Arabia, besides extending into North Africa. Though the languages of these races are very different they cannot be regarded as physically distinct, and they are both without doubt branches of the Melanochroi, modified by admixture with the neighbouring races, the Mongols, the Australoids and the Xanthochroi.

The Aryans of India are probably the most settled and civilized of all Asiatic races. This type is found in its purest form in the north and north-west, while the mixed races and the population referred to the Australoid type predominate in the peninsula and southern India. The spoken languages of northern India are very various, differing one from another in the sort of degree that English differs from German, though all are thoroughly Sanskritic in their vocables, but with an absence of Sanskrit grammar that has given rise to considerable discussion. The languages of the south are Dravidian, not Sanskritic. The letters of both classes of languages, which also vary considerably, are all modifications of the ancient Pali, and probably derived from the Dravidians, not from the Aryans. They are written from left to right, exception being made of Urdu or Hindostani, the mixed language of the Mahommedan conquerors of northern India, the character used for writing which is the Persian. From the river Sutlej and the borders of the Sind desert, as far as Burma and to Ceylon, the religion of the great bulk of the people of India is Hindu or Brahminical, though the Mahommedans are often numerous, and in some places even in a majority. West of the Sutlej the population of Asia may be said to be wholly Mahommedan with the exception of certain relatively small areas in Asia Minor and Syria, where Christians predominate. The language of the Punjab does not differ very materially from that of Upper India. West of the Indus the dialects approach more to Persian, which language meets Arabic and Turki west of the Tigris, and along the Turkoman desert and the Caspian. Through the whole of this tract the letters are used which are common to Persian, Arabic and Turkish, written from right to left.

Racial distribution.

Considerable progress has been made in the classification of the various races which occupy the continent to the west of the great Mongolian region. The ancient Sacae, or Scyths, are recognized in the Aryan population, who may be found in great numbers and in their purest form in the more inaccessible mountains and glens of the central highlands. These Tajiks (as they are usually called) form the underlying population of Persia, Baluchistan, Afghanistan and Badakshan, and their language (in the central districts of Asia) is found to contain words of Aryan or Sanskrit derivation which are not known in Persian. They have been for the most part dispossessed of their country by Turkish immigration and conquests, but they still retain their original intellectual superiority over the Turkish and other mixed tribes by which they are surrounded. Uzbegs and Kirghiz have but small affinity with the Mongol element of Asia. They are the representatives of those countless Turkish irruptions which have taken place through all history. Of the two divisions (Kara Kirghiz and Kassak Kirghiz) into which the Kirghiz tribes are divided by Russian authorities, the Kassak Kirghiz is the more closely allied to the Mongol type; the Kara Kirghiz, who are found principally in the valleys of the Tian-shan and Altai mountains, being unmistakably Turkish. The Kipchaks are only a Kirghiz clan. The language of the Kirghiz is Turki and their religion that of Mahomet. As a nomadic people they have great contempt for the Sarts, who represent the town dwellers of the tribe. The Kalmucks are a Buddhist and Mongolian people who originated in a confederacy of tribes dwelling in Dzungaria, migrated to Siberia, and settled on the Lower Volga. From thence they returned late in the 18th century to the reoccupation of their old ground in Kulja under the Chinese. The Turkoman is the purest form of the Turk element, and his language is the purest form of the Turkish tongue, which is represented at Constantinople by a comparatively mongrel, or mixed, dialect. Ethnographers have traced a connexion between the Turkoman of central Asia and the Teutonic races of Europe, based on a similarity of national customs and immemorial usage. Evidence of an original affinity between Turkoman and Rajput has also been found in the mutual possession by these races of a ruddy skin, so that as ethnographical inquiry advances the Turk appears to recede from his Mongolian affinities and to approach the Caucasian. Turks and Mongols alike were doubtless included under the term Scyth by the ancients, and as Tatars by more modern writers, insomuch that the Turkish dynasty at Delhi, founded by Baber, is usually termed the Mogul dynasty, although there can be no distinction traced between the terms Mogul and Mongol. The general results of recent inquiry into the ethnography of Afghanistan is to support the general correctness of Bellew's theories of the origin of the Afghan races. The claim of the Durani Afghan to be a true Ben-i-Israel is certainly in no way weakened by any recent investigation. The influence of Greek culture in northern India is fully recognized, and the distribution of Greek colonies previous to Alexander's time is attested by practical knowledge of the districts they were said to occupy. The *habitat* of the Nysaeana, and the identity of certain tribes of Kafiristan with the descendants of these pre-Alexandrian colonists from the west, are also well established. To this day hymns are unwittingly sung to Bacchus in the dales and glens of Kafiristan. The ethnographical status of the mixed tribes of the mountains that lie between Chitral and the Peshawar plains has been fairly well fixed by John Biddulph, and much patient inquiry in the vast fields of Baluchistan by Major Mockler, G. P. Tate and others has resulted in quite a new appreciation of the tribal origin of the great conglomeration of Baluch peoples.

The result of trans-border surveys to the north and west of India has been to establish the important geographical fact that it is by two gateways only, one on the north-west and one on the west of India, that the central Asiatic tides of immigration have flowed into the peninsula. The Kabul valley indicates the north-western entrance, and Makran indicates that on the west. By the Kabul valley route, which includes at its head the group of passes across the Hindu Kush which extend from the Khawak to the Kaoshan, all those central Asian hordes, be they Sacae, Yue-chi, Jats, Goths or Huns, who were driven towards the rich plains of the south, entered the Punjab. Some of them migrated from districts which belong to eastern Asia, but none of them penetrated into India by eastern passes. Such tides as set towards the Himalaya broke against their farther buttresses, leaving an interesting ethnographical flotsam in the northern valleys; but they never overflowed the Himalayan barrier. Later most of the historic invasions of India from central Asia followed the route which leads directly from Kabul to Peshawar and Delhi.

By the western gates of Makran prehistoric irruptions from Mesopotamia broke into the plains of Lower Sind, and either passed on towards the central provinces of India or were absorbed in the highlands south of Kalat. In later centuries the Arabs from the west reached the valley of the Indus by their western route, and there established a dynasty which lasted for 300 years. The identification of existing peoples with the various Scythic, Persian and Arab races who have passed from High Asia into the Indian borderland, has opened up a vast field of ethnographical inquiry which has hardly yet found adequate workers for its investigation. To such fields may be added the yet more complicated problems of those reflex waves which flowed backwards from India into the border highlands. (T. H. H.*)

History

1. The borders assigned to Asia on the west are somewhat arbitrary. The Urals indicate no real division of races, and in both Greek and Turkish times Asia Minor has been connected with the opposite shores of Europe rather than with the lands lying to the east. A juster view of early history is probably obtained by thinking of the countries round the Mediterranean as interacting on one another than by separating Palestine and Asia Minor as Asiatic.

Asiatic characteristics.

2. The words "Asiatic" and "Oriental" are often used as if they denoted a definite and homogeneous type, but Russians resemble Asiatics in many ways, and Turks, Hindus, Chinese, &c., differ in so many important points that the common substratum is small. It amounts to this, that Asiatics stand on a higher level than the natives of Africa or America, but do not possess the special material civilization of western Europe. As far as any common mental characteristic can be assigned it is also somewhat negative, namely, that Asiatics have not the same sentiment of independence and freedom as Europeans. Individuals are thought of as members of a family, state or religion, rather than as entities with a destiny and rights of their own. This leads to autocracy in politics, fatalism in religion and conservatism in both. Hence, too, Asiatic history has large and simple outlines. Though longer chronologically than the annals of Europe, it is less eventful, less diversified and offers fewer personalities of interest. But the same conditions which render individual eminence difficult procure for it when once attained a more ready recognition, and the conquerors and prophets of Asia have had more power and authority than their parallels in Europe. Jenghiz Khan and Timur covered more ground than Napoleon, and no European has had such an effect on the world as Mahomet.

Religion and civilization.

3. Attention has often been called to the religious character of Asia. Not only the great religions of the world—Buddhism, Christianity, Islam—but those of secondary importance, such as Judaism, Parseeism, Taoism, are all Asiatic. No European race left to itself has developed anything more than an unsystematic paganism. It is true that Greek philosophy advanced far beyond this stage, but it produced nothing sufficiently popular to be called a religion.

On the other hand Christianity, though Asiatic in its origin and essential ideas, has to a large extent taken its present form on European soil, and some of its most important manifestations—notably the Roman Church—are European reconstructions in which little of the Asiatic element remains. Christianity has made little way farther east then Asia Minor. Modern missions have made no great conquests there, and in earlier times the Nestorians and Jacobites who penetrated to central Asia, China and India, received respectful hearing, but never had anything like the success which attended Buddhism and Islam. Yet Buddhism has never made much impression west of India, and Islam is clearly repugnant to Europeans, for even when under Moslem rule (as in Turkey) they refuse to accept it in a far larger proportion than did the Hindus in similar circumstances. Hence there is clearly a deep-seated difference between the religious feelings of the two continents.

Since Asiatic records go back much farther than those of Europe, it is natural that Asia should be thought the birthplace of civilization. But this originality cannot be absolute, for, whatever may have been the relations of Babylonia and the Aryans, the latter brought civilization to India from the west, and it is not always clear whether similarity of government and institutions is the result of borrowing or of parallel development. Both in Europe and in Asia small feudal or aristocratic states tended to consolidate themselves into monarchies, but whereas in Europe from the early days of Rome onwards royalty has often been driven out and replaced temporarily or permanently by popular government, this change seems not to occur in Asia, where revolution means only a change of dynasty. The few cases where the government is not monarchical, as Arabia, seem to represent the persistence of very ancient conditions.

The contemplation of Asia suggests that progress is most rapid when accompanied by the migration of races or the transplantation of ideas and institutions. Thus Greece excelled the Eastern countries from whom she may have derived her civilization, and Buddhism had a far more brilliant career outside India than in it.

General historical outlines.

4. In many parts of southern Asia are found semi-barbarous races representing the earliest known stratum of population, such as the Veddahs of Ceylon, and various tribes in China and the Malay Archipelago. Some of them offer analogies to the Australians. This connexion, if true, must be very ancient, since it apparently goes back to a time when the distribution of land and water was other than at present. In northern Asia are found other aborigines, such as the Ainus of Japan and the so-called hyperborean races (Chukchis, &c.); but no materials are at present forthcoming for their history. There is some record of the migrations of the later races superimposed on these aborigines. The Chinese came from the west, though how far west is unknown: the Hindus and Persians from the north-west: the Burmese and Siamese from the north. We do not know if the Mongols, Turks, &c., had any earlier home than central Asia, but their extensive movements from that region are historical.

The antiquity of Asiatic history is often exaggerated. With the exception of Babylonia and Assyria, we can hardly even conjecture what was the condition of this continent much before 1500 B.C. At that period the Chinese were advancing along the Hwang-ho, and the Aryans were entering India from the north-west. Both were in conflict with earlier races. The influence of Babylonian civilization was probably widespread. Some connexion between Babylonia and China is generally admitted, and all Indian alphabets seem traceable to a Semitic original borrowed in the course of commerce from the Persian Gulf.

Apart from European conquests, the internal history of Asia in the last 2000 years is the result of the interaction of four main influences: (*a*) Chinese, (*b*) Indian, (*c*) Mahommedan, (*d*) Central Asian. Of these the first three represent different types of civilization: the fourth has little originality, but has been of great importance in affecting the distribution of races and political power.

(*a*) China has moulded the civilization of the eastern mainland and Japan, without much affecting the Malay Archipelago. In the sphere of direct influence fall Korea, Japan and Annam; in the outer sphere are Mongolia, Tibet, Siam, Cambodia and Burma, where Indian and Chinese influence are combined, the Indian being often the stronger. These countries, except Japan, have all been at some time at least nominal tributaries of China. Where Chinese influence had full play it introduced Confucianism, a special style in art and the Chinese system of writing. After the Christian era it was accompanied by Chinese Buddhism. The cumbrous Chinese script maintains itself in the Far East, but has not advanced west of China proper and Annam.

(*b*) Indian influence may be defined as Buddhism, if it is understood that Buddhism is not at all periods clearly distinguishable from Hinduism. Its sphere includes Indo-China, much of the Malay Archipelago, Tibet and Mongolia. Moreover, China and Japan themselves may be said to fall within this sphere, in view of the part which Buddhism has played in their development. The Buddhist influence is not merely religious, for it is always accompanied by Indian art and literature, and often by an Indian alphabet. Much of this art is Greek in origin, being derived from the Perso-Greek states on the north-west frontiers of India. Indian alphabets have spread to Tibet, Cambodia, Java and Korea. The history of Indian civilization in Indo-China and the Archipelago is still obscure, in spite of the existence of gigantic ruins, but it would appear that in some parts at least two periods must be distinguished, first the introduction of Hinduism (or mixed Hinduism and Buddhism), perhaps under Indian princes, and secondly a later and more purely ecclesiastical introduction of Sinhalese Buddhism, with its literature and art.

(*c*) Mahommedanism or Islam is perhaps the greatest transforming force which the world has seen. It has profoundly affected and to a large extent subjugated all western Asia including India, all eastern and northern Africa as well as Spain, and all eastern Europe. Its open advocacy of force attracts warlike races, and the intensity of its influence is increased by the fusion of secular and religious power, so that the Moslem Church is a Moslem state characterized by slavery, polygamy, and, subject to the autocracy of the ruler, by the theoretical equality of Moslems, who in political status are superior to non-Moslems. Thus, whenever the population of a Moslem country is of mixed belief, a ruling caste of Moslems is formed, as in Turkey at the present day and India under the Moguls. Islam is paramount in Turkey, Persia, Arabia and Afghanistan. India is the dividing line: Islam is strong in northern and central India, weaker in the south. But only one-fifth of the whole population is Moslem. Beyond India it has spread to Malacca and the Malay Archipelago, where it overwhelmed Hindu civilization, and reached the southern Philippines. But it made no progress in Indo-China or Japan; and though there is a large Moslem population in China the Chinese influence has been stronger, for alone of all Asiatics the Chinese have succeeded in forcing Islam to accept the ordinary limitations of a religion and to take its place as a creed parallel to Buddhism or any other.

Even more than Buddhism Islam has carried with it a special style of art and civilization. It is usually accompanied by the use of the Arabic alphabet, and in the languages of Moslem nations (notably Turkish, Persian, Hindustani and Malay) a large proportion of the vocabulary is borrowed from Arabic. Hindi and Hindustani, two forms of the same language as spoken by Hindus and Mahommedans respectively, are a curious example of how deeply religion may affect culture.

(*d*) The great part which central Asian tribes have played in history is obscured by the absence of any common name for them. Linguistically they can be divided into several groups such as Turks, Mongols and Huns, but they were from time to time united into states representing more than one group, and their armies were recruited, like the Janissaries, from all the military races in the neighbourhood. Soon after the Christian era central Asia began to boil over, and at least seven great invasions and more or less complete conquests can be ascribed to these tribes without counting minor movements. (i.) The early invasions of Europe by the Avars, Huns and Bulgarians.

(ii.) The invasion and temporary subjection of Russia by the Mongols, who penetrated as far west as Silesia. (iii.) The conquests of Timur. (iv.) The conquest of Asia Minor and eastern Europe by the Turks. (v.) The conquest of India by the Moguls. (vi.) The conquest of China by the Mongols under Kublai. (vii.) The later conquest of China by the Manchus. To these may be added numerous lesser invasions of India, China and Persia.

These tribes have a genius for warfare rather than for government, art or literature, and with few exceptions (*e.g.* the Moguls in India) have proved poor administrators. Apart from conquest their most important function has been to keep up communications in central Asia, and to transport religions and civilizations from one region to another. Thus they are mainly responsible for the introduction of Islam with its Arabic or Persian civilization into India and Europe, and in earlier times their movements facilitated the infiltration of Graeco-Bactrian civilization into India, besides maintaining communication between China and the West.

5. *Babylonia and Assyria.*—The movements mentioned above have been the chief factors of relatively modern Asiatic history, but in early times the centre of activity and culture lay farther west, in Babylonia and Assyria. These ancient states began to decline in the 7th century B.C., and on their ruins rose the Persian empire, which with various political metamorphoses continued to be an important power till the 7th century A.D., after which all western Asia was overwhelmed by the Moslem wave, and old landmarks and kingdoms were obliterated.

The materials for the study of their institutions and population are abundant, but lend themselves to discussion rather than to a summary of admitted facts. In the early history of south-western Asia the Semites form the most important ethnic group, which is primarily linguistic but also shares other remarkable characteristics. Two of the greatest religions of the world, Christianity and Islam, are Semitic in origin, as well as Judaism. In politics these races have been less successful in modern times, but the Semitic states of Babylonia and Assyria were once the principal centres for the development and distribution of civilization. It is generally agreed that this civilization can be traced back to an earlier race, the Sumero-Akkadians, whose language seems allied to the agglutinative idioms of central Asia. If this ancient civilized race was really allied to the ancestors of the Turks and Huns, it is a remarkable instance of how civilization thrives best by being transplanted at a certain period of growth. Still less is known of the early non-Aryan races of Asia Minor such as the Hittites and Alorodians. One hypothesis supposes that the shores of the Mediterranean were originally inhabited by a homogeneous race neither Aryan nor Semitic.

The earliest Sumerian records seem to be anterior to 4000 B.C. Shortly after that period Babylonia was invaded by Semites, who became the ruling race. The city of Babylon came to the fore as metropolis about 2285 B.C. under Khammurabi. Assyria was an offshoot of Babylonia lying to the north-west, and apparently colonized before the second millennium. While using the same language as the Babylonians, the Assyrians had an individuality which showed itself in art and religion. In the 9th and 8th centuries B.C. they became the chief power within their sphere and the suzerain of their parent Babylon. But they succumbed before the advance of the Medo-Persian power in 606 B.C., whereas it was not till 555 that Cyrus took Babylon. Assyria, being essentially a military power, disappeared with the destruction of Nineveh, but Babylon continued to exercise an influence on culture and religion for many centuries after the Persian conquest.

6. *China.*—This is the oldest of existing states, though its authentic history does not go back much beyond 1000 B.C. It is generally admitted that there was some connexion between the ancient civilizations of China and Babylonia, but its precise nature is still uncertain. It is clear, however, that the Chinese came from the west, and entered their present territory along the course of the Hwang-ho at an unknown period, possibly about 3000 B.C. In early historical times China consisted of a shifting confederacy of feudal states, but about 220 B.C. the state of Tsin or Chin (whence the name China) came into prominence, and succeeded in forming a homogeneous empire, which advanced considerably towards the south. The subsequent history of China is mainly a record of struggles with various tribes, commonly, but not very correctly, called Tatars. The empire was frequently broken up by successful incursions, or divided between rival dynasties, but at least twice became a great Asiatic power: under the Han dynasty (about 200 B.C.–A.D. 220), and the T'ang (A.D. 618–906). The dominions of the latter extended across central Asia to northern India, but were dismembered by the attacks of the Kitans, whence the name Cathay. China proper, minus these external provinces, was again united under the Sung dynasty (960–1127), but split into the northern (Tatar) and southern (Chinese) kingdoms. In the 13th century arose the Mongol power, and Kublai Khan conquered China. The Mongol dynasty lasted less than a century, but the Ming, the native Chinese dynasty which succeeded it, reigned for nearly 300 years and despatched expeditions which reached India, Ceylon and East Africa. In 1644 the Ming succumbed to the attacks of the Manchus, a northern tribe who captured Peking and founded the present imperial house.

Until the advent of Europeans, the Chinese were always in contact with inferior races. Whether they expanded at the expense of weak aboriginal tribes or were conquered by more robust invaders, Chinese civilization prevailed and assimilated alike the conquered and the conquerors. It is largely to this that we must ascribe the national conservatism and contempt for foreigners. The spirit of the Chinese polity is self-contained, anti-military and anti-sacerdotal. Rank is nominally determined by merit, as tested by competitive examinations. Society is conceived as regulated by mutual obligations, of which the duties of parents and children are the most important. The emperor is head of the state and the high priest, who sacrifices to Heaven on behalf of his people, but he can be deposed, and no divine right is inherent in certain families as in Japan and Turkey. On the contrary there have been 20 dynasties since the Christian era.

The most conspicuous figure in Chinese literature is Confucius (551–475 B.C.). Though he laid no claim to originality and merely sought to collect and systematize the traditions of antiquity, his influence in the Far East has been unbounded, and he must be pronounced one of the most powerful advocates of peace and humanity that have ever existed. Confucianism is an ethical rather than a religious system, and hence was able to co-exist, though not on very friendly terms, with Buddhism, which reached China about the 1st century A.D. and was the chief source of Chinese religious ideas, except the older ancestor worship. But they are not a religious people, and like many Europeans regard the church as a department of the state.

7. *Japan* appears to have been formerly inhabited by the Ainus, who have traditions of an older but unknown population, but was invaded in prehistoric times by a race akin to the Koreans, which was possibly mingled with Malay elements after occupying the southern part of the islands. Authentic history does not begin till about the 6th century A.D., when Chinese civilization and Buddhism were introduced. The government was originally autocratic, but as early as the 7th century the most characteristic feature of Japanese politics—the power of great families who overshadowed the throne—makes its appearance. We hear first of the Fujiwara family, and then of the rivalry between the houses of Taira and Minamoto. The latter prevailed, and in 1192 established the dual system of government under which the emperor or Mikado ruled only in name, and the real power was in the hands of a hereditary military chief called Shogun. Japan has never been invaded in historical times, but an attempt made by Kublai Khan to conquer it was successfully repulsed. The chief power then passed to the Ashikaga dynasty of Shoguns, who retained it for about 200 years and were distinguished for their patronage of the arts. The second half of the 16th century was a period of ferment and anarchy, marked by the arrival of the Portuguese

and the rise of some remarkable adventurers, one of whom, Hideyoshi, conquered Korea and apparently meditated the invasion of China. His plans were interrupted by his death, and his successor, Ieyasu, who shaped the social and political life of Japan for nearly 300 years (1603–1868), definitely decided on a policy of seclusion and isolation. All ideas of external conquest were abandoned, Christianity was forbidden, and Japan closed to foreigners, only the Dutch being allowed a strictly limited commerce. In 1854–1859 the Christian powers, beginning with the United States, successfully asserted their right to trade with Japan. The influx of new ideas provoked civil war, in which the already decadent Shogunate was abolished and the authority of the Mikado restored. Recognizing that their only chance of competing with Europeans was to fight them with their own weapons, the Japanese set themselves deliberately to assimilate the material civilization and to some extent the institutions of Europe, such as constitutional government. Their progress and success are without parallel. In 1895 they defeated the Chinese and ten years later the Russians. Their exceptional status among Asiatic nations has been recognized by treaties which, contrary to the general practice in non-Christian countries, place all foreigners in Japan under Japanese law.

This sudden development of the Japanese is perhaps the most important event of the second half of the 19th century, since it marks the rise of an Asiatic power capable of competing with Europe on equal terms. Their history is so different from that of the rest of Asia that it is not surprising if the result is different. The nation hardly came into existence till China and India had passed their prime, and remained secluded and free from the continual struggle against barbarian invaders, which drained the energies of its neighbours. It was left untouched by Mahommedanism, and for an unprecedentedly long period kept Europeans at bay without wasting its strength in hostilities. The military spirit was evolved, not in raids and massacres of the usual Asiatic type which create little but intense racial hatred, but in feuds between families and factions of the same race, which restrained ferocity and tended to create a temper like that of the feudal chivalry of Europe. On the other hand it is noticeable that the Japanese have little which is original in the way of religion, literature or philosophy. Unlike the Chinese and Indians, they have hitherto not had the smallest influence on the intellectual development of Asia, and though they have in the past sometimes shown themselves intensely nationalist and conservative, they have, compared with India and China, so little which is really their own that their assimilation of foreign ideas is explicable.

8. *Korea* received its civilization and religion from China, but differs in language, and to some extent in customs. An alphabet derived from Indian sources is in use as well as Chinese writing. The country was at most periods independent though nominally tributary to China. In the 16th century the Japanese occupied it for a short period, and in 1894 they went to war with China on account of her claims to suzerainty. In 1895 Korea was declared independent.

9. *India.*—The population of India comprises at least three strata: firstly, uncivilized aborigines, such as the Kols and Santhals, and secondly, the Dravidians (Tamils, Kanarese, &c.), who perhaps represent the earliest northern invaders, and appear to have attained some degree of culture on their own account. The most recent authorities are of opinion that the Kolarians and Dravidians represent a single physical type; but, whatever the historical explanation may be, they certainly have different languages and show different stages of civilization. In prehistoric times they were spread over the whole of India, but were driven to the centre and south of the peninsula by the third stratum of Aryans, and perhaps also by invasions of so-called Mongolian races from the north-west. No historical record has been preserved of these latter, but they appear to have profoundly affected the population of Bengal, which is believed to be Mongolo-Dravidian in composition. The Aryans appear to have been settled to the north of the Hindu Kush, and to have migrated south-eastwards about 1500 B.C. Their original home has been a subject of much discussion, but the view now prevalent is that they arose in southern Russia or Asia Minor, whence a section spread eastwards and divided into two closely related branches—the Hindus and Iranians. There were probably two successive Aryan immigrations, and the tradition of a struggle between them may be preserved in the *Mahābhārata.* The life of the ancient Aryans, as portrayed in their sacred songs, the *Rig Veda*, was quasi-nomadic and in many ways democratic, but by the 6th century B.C. settled states had been formed in the Ganges valley. They were absolute monarchies, but the power of the king was tempered by the extraordinary influence possessed by the hereditary sacerdotal class or Brahmans. The position of this class, which has remained till the present day, is connected with the institution of caste, a division of the population into groups founded partly on racial distinctions. The peaceful progress of Brahmanism was hindered by the doctrine of the Indian prince Gotama, called the Buddha, which grew into one of the greatest religions of the world. For many centuries the culture and development of the Hindus depended mainly on the interaction of the old Brahmanical religion and Buddhism. The latter was finally absorbed, and disappeared in India itself, but has spread Indian influence over the whole of eastern Asia, where it still flourishes.

In 326 B.C. Alexander invaded the Punjab. The immediate result was small, but the establishment of Perso-Greek kingdoms in central Asia had a powerful influence on Indian art and culture. It may also have helped to familiarize the Hindu mind with the idea of an empire, which appeared among them later than in other Asiatic countries. The first empire, called Maurya, reached its greatest extent in the time of Asoka (264–227 B.C.), who ruled from Afghanistan to Madras. He was a zealous Buddhist and gave the first example of a missionary religion, for by his exertions the faith was spread over all India and Ceylon. No Hindu empires have lasted long, and the Maurya dominions broke up fifty years after his death.

In the next period (*c.* 150 B.C.–A.D. 300) India was invaded from the north by tribes partly of Parthian and partly of Turki (Yue-chi, &c.) origin. Owing to the absence of dated records, the chronology of these invasions has not yet been set beyond dispute, but the most important was that of the Kushans, whose king Kanishka founded a state which comprised northern India and Kashmir. They were Buddhists, and it is probable that the Mahāyāna or northern form of Buddhism was due to an amalgamation of Gotama's doctrines with the ideas (largely Greek and Persian) which they brought with them. Much of Sivaism has probably the same origin. Another native empire, known as Gupta, rose on the ruins of the Kushan kingdom, and embraced nearly the whole peninsula, but it broke up in the 5th century, partly owing to the attacks of new northern invaders, the Huns. The Malava dynasty maintained Hindu civilization in the 6th century, and from 606 to 646 Harsha established a brief but brilliant empire in the north with its capital at Kanauj. This epoch is marked by the renaissance of Sanskrit literature and the gradual revival of Hinduism at the expense of Buddhism. But after Harsha Hindu history is lost in a maze of small and transitory states, incapable of resisting the ever advancing Mahommedan peril. As early as 712 the Arabs conquered Sind, and by the end of the 11th century the whole of northern India was in Moslem hands. Two periods may be distinguished, namely the Turki (1200–1526) and the Mogul empire. The former comprised several dynasties of mixed Turki and Iranian race, but was wanting in coherency. In the neighbourhood of the Moslem capitals, Islam spread rapidly, but in such districts as Rajputana and specially Vijayanagar (Mysore) Hindu civilization and religion maintained themselves.

In 1526 the Moguls descended on India from Transoxiana and seized the throne of Delhi. They never subjugated the south, but the empire which they founded in the north was for about two centuries, under such rulers as Akbar and Shah Jehan, one of the most brilliant which Asia has seen. After 1707 it began to decline: the governors became independent: a powerful

Mahratta confederacy arose in central India; Nadir Shah of Persia sacked Delhi; and Ahmed Shah made repeated invasions. A still more formidable danger, the power of the French and English, continued to increase. Amidst such confusion the authority of the Mogul empire rapidly disappeared, but it lasted as a name till the Mutiny (1857).

Indian history until Mahommedan times is marked by the unusual prominence of religious ideas, and is a record of intellectual development rather than of political events. Whatever national unity the Hindu peoples possessed came from the persistent and penetrating influence of the Brahman caste. Kings held a secondary position, and were generally regarded as adventitious tyrants, rather than as the heads and representatives of the nation. Even the great dynasties have left few traces, and it is with difficulty that the patient historian disinters the minor kingdoms from obscurity, but Indian religion, literature and art have influenced all Asia from Persia to Japan.

10. *Persia.*—The Persians, with whom are often coupled the Medes, appear to be pure Aryans in origin, and the earliest form of their language and religion offers remarkable analogies to the Vedas. It is reasonable to suppose that their ancestors and those of the Hindus at one time formed a single tribe somewhere in central Asia. The religion was remodelled by Zoroaster, who seems to be a historical character and to have lived about the 7th century B.C. About the same time they shook off the domination of Assyria. From the 6th century onwards their empire, then known as Median, began to expand at the expense of the surrounding states. They destroyed Nineveh in alliance with the Babylonians, and half a century later Cyrus took Babylon and founded the great dynasty of the Achaemenidae. The substitution of the Persian for the Median power, which took place with the advent of Cyrus, seems to indicate merely the pre-eminence of a particular tribe and not conquest by another race. The power of the Achaemenidae, when at its maximum, extended from the Oxus and Indus in the east to Thrace in the west and Egypt in the south, but fell before Greece, after lasting for rather more than 200 years. Darius and Xerxes were repulsed in their efforts to subjugate the Greek Peninsula, and Alexander the Great conquered their successor Darius III. in 329. But the greater part of the empire continued to exist under new masters, the Seleucids, as a Hellenistic power which was of great importance for the dissemination of Greek culture in the East. Bactria soon became independent under an Indo-Greek dynasty, and the blending of Greek, Persian, central Asiatic and Hindu influences had an important effect on the art and religion of India, and through India on all eastern Asia. About the same period (250 B.C.–A.D. 227) the Parthian empire arose under the Arsacids in Khorasan and the adjacent districts. The Parthians appear to have been a Turanian tribe who had adopted many Persian customs. They successfully withstood the Romans, and at one time their power extended from India to Syria. They succumbed to the Persian dynasty of the Sassanids, who ruled successfully for about four centuries, established the Zoroastrian faith as their state religion, and maintained a creditable conflict with the East Roman empire. But in the 7th century they were defeated by Heraclius, and shortly afterwards were annihilated before the first impetus of the Mahommedan conquest, which established Islam in Persia and the neighbouring lands, sweeping away old civilizations and boundaries. During the greater part of the Mahommedan period Persia has been ruled by troubled and short-lived dynasties. It attained a certain dignity and unity under Abbas Shah (1585–1628), but in later times was distracted and disorganized by Afghan invasions. The present dynasty, which is of Turkoman origin, dates from 1789.

The achievements of the Persians in art, literature and religion are by no means contemptible, but somewhat mixed and cosmopolitan. Owing to its position, the Persian state, when it from time to time became a conquering empire, overlapped Asia Minor, Babylon and India, and hence acted as an intermediary for transmitting art and ideas, sending for instance Greek sculpture to India and the cult of Mithra to western Europe. It is perhaps on account of this intermediate flavour that the literature of Persia—for instance the adaptations of Omar Khayyam—is more appreciated in Europe than that of other Oriental nations. On the other hand, the wars between Persia and Greece were recognized both at the time and afterwards as a struggle between Europe and Asia; the fact that both combatants were Aryans was not felt, and has no importance compared to the difference of continent.

11. *Jews.*—The Israelites appear to have been originally a nomadic tribe akin to the Arabs, whom they resemble in their want of political instinct and in their extraordinary religious genius. Among many remarkable qualities they have been distinguished from the earliest times by a species of commensalism, or power of living among other nations without becoming either socially merged or politically distinct. Their traditional history represents them as migrating to the borders of Egypt and living there for some centuries. After the exodus, which perhaps took place about 1300 B.C., they moved northwards again and founded a state of modest dimensions, which attained a short-lived unity under Solomon, but succumbed to internal dissensions and to the attacks of Assyria and Babylon. Shalmanezer destroyed the northern kingdom or Israel in 720, and following the practice of the times deported the majority of the population, whose traces became lost to history. There is no reason why their descendants should not be found to-day in various tribes, but the physical type commonly called Jewish is characteristic not so much of Israel as of western Asia generally. In 588 Nebuchadrezzar carried off the Jews in captivity, but after the Persian conquest of Babylonia they were allowed to return to Palestine in 538. Their institutions and ideas were probably considerably modified during this period. Babylon long continued to be a Jewish centre whence the Jews radiated to other countries. The restored state of Jerusalem lived for about six centuries in partial independence under Persian, Egyptian, Syrian and Roman rule, often showing an aggressively heroic attachment to its national customs, which brought it into collision with its suzerains, until the temple was destroyed by Titus in A.D. 70, and the country laid waste in the succeeding years. But long before this period the Jews of the Dispersion had become as important as the inhabitants of Palestine. From choice or compulsion large numbers settled in Egypt in the time of the Ptolemies, and added an appreciable element to Alexandrine culture, while gradual voluntary emigration established Jewish communities in Syria, Asia Minor, Greece and Italy, who facilitated the first spread of Christianity. In spite of chronic unpopularity and recurring persecutions they have spread over nearly all Europe. At the end of the 15th century they were expelled from Spain and many of the exiles moved eastwards. At present the largest numbers are to be found in the eastern parts of Europe. It is remarkable that though the Jews live in relative peace with Asiatics, the great majority of them prefer Europe as a residence.

12. *Arabs.*—The Arabs have hardly any history before the rise of Islam, although their name is mentioned by surrounding nations from the 9th century B.C. onwards. They appear to have had few states or kings, but rather tribes and chiefs. Their relationship to the Babylonians and Jews is indicated by linguistic and ethnological data. The language and writing of the Semites who, at an unknown period, settled in what is now Abyssinia, show affinities with those of South Arabia, and these Semites may have been immigrants into Africa from that region. It is plain from early Moslem literature that Persian, Christian and especially Jewish ideas had penetrated into Arabia.

With the rise of Mahommedanism occurred a sudden effervescence of the Arabs, who during some centuries threatened to impose not only their political authority but their civilization and new religion on the whole known world. They successfully invaded India and central Asia in the east, Spain and Morocco in the west. The Caliphate under the Omayyads of Damascus, and then the Abbasids of Bagdad, became the principal power in the nearer East. It had not, however, a sufficiently coherent organization for permanence; parts of it became independent, others were first protected and then absorbed by the Turks. The Arab rule in Spain, which once threatened to overwhelm Europe and was turned back near Tours by Charles Martel, was distinguished by its tolerance and civilization, and lingered on till the 15th century.

The collapse of the political power of the Arabs was singularly complete. The Caliphate, though Arabian, was always geographically outside Arabia, and on its fall Arabia remained as it was before Islam, isolated and inaccessible. It is still one of the least known parts of the globe, and has hardly any political link with the outside, for the Arabs of northern Africa form separate states. But in spite of this total political collapse, Arabic religion and literature are still one of the greatest forces working in the western half of Asia, in northern Africa and to some extent in eastern Europe.

13. *Ceylon*, though geographically an annex of India, has not followed its fortunes historically. According to tradition it was invaded by an Aryan-speaking colony from the valley of the Ganges in the 6th century B.C. It received Buddhism from north India in the time of Asoka, and has had considerable importance as a centre of religious culture which has influenced Burma and Siam. Its medieval history consists of struggles between the native sovereigns and Tamil invaders. A powerful native dynasty reigned in the 12th century, but in 1408 the island was attacked by Chinese, and from 1505 onwards it was distracted by the attacks and squabbles of Europeans. It was partially subjugated, first by the Portuguese and then by the Dutch. In 1796 the Dutch were expelled by the English.

14. *Indo-China.*—This is an appropriate name for Burma, Siam, Cambodia, Annam, &c., for both in position and in civilization they lie between India and China. Indian influence is predominant as far as Cambodia (though with a Chinese tinge), Indian alphabets being employed and the Buddhism being of the Sinhalese type, but in Annam and Tongking the Chinese script and many Chinese institutions are in use. The population belongs to various races, and also comprises little-known wild tribes. (i.) Languages of the group known as Mōn-Annam are spoken in Annam and in Pegu, an ancient kingdom originally distinct from Burma though now confounded with it. This distribution seems to indicate that they once spread over the whole region, and were divided by the later advance of the Siamese and others. Until Annam was taken by the French, its history consisted of a struggle with the Chinese, who alternately asserted and lost their sovereignty. The Annamese are, however, a distinct race. Cochin China was once the seat of a kingdom called Champa, which appears to have had a hinduized Malay civilization and to have been subsequently absorbed by Annam. (ii.) The Burmese are linguistically allied to the Tibetans, and probably entered Burma from the north-west. The early history consists largely of conflicts between the Burmese and Talaings. The kingdom which was annexed by Britain in 1885 was founded about 1750 by Alompra, who united his countrymen and broke the power of the Talaings. He also invaded Siam. (iii.) The Khmers or Cambodians, whose languages appear to belong to the Mōn-Annam group, form a relatively ancient kingdom, much reduced in the last few centuries by the advance of the Siamese and now a French protectorate. Remarkable ruins dating from perhaps A.D. 800 to 1000 attest the former prevalence of strong Hindu influence. (iv.) The Siamese or Thai, who speak a monosyllabic language of the Chinese type, but written in an Indian alphabet, represent a late invasion from southern China, whence they descended about the 13th century.

15. *Malays.*—This widely-scattered race has no political union and its distribution is a puzzle for ethnography. At present it occupies the extremity of the Malay Peninsula, Java, Sumatra, Borneo, the Philippines and other islands of the Malay Archipelago as well as Madagascar, while the inhabitants of most islands in the South Seas, including New Zealand and Hawaii, speak languages which if not Malay have at least undergone a strong Malay influence. It would seem from this distribution that the Malays are not continental, but a seafaring race with exceptional powers of dispersal, who have spread over the ocean from some island centre—perhaps Java. The latest theory, however, is that there is a great linguistic group (which may or may not prove to correspond to an ethnic unity) comprising the Mundā, Mōnkhmer, Malay, Polynesian and Micronesian languages, and that the stream of immigration which distributed them started from the extreme west. Three periods can be traced in the history of the Asiatic Malays. In the first (in which such tribes as the Dyaks have remained) they were semi-barbarous. In the second, Hindu civilization reached the Malay Peninsula, Java, Sumatra and other islands. The presence of Hindu ruins, as well as of numerous Indian words and customs, testifies to the strength of this influence. It was, however, superseded by Islam, which spread to the Malay Archipelago and Peninsula before the 16th century. At the present time the Arabic alphabet is used on the mainland, but Indian alphabets in Java, Sumatra, &c.

16. *Tibet.*—This remote and mountainous country has a peculiar civilization. It has entirely escaped Islam, and though it is a nominal vassal of China, direct Chinese influence has not been strong. The most striking feature is the religion, a corrupt form of late Indian Buddhism, known as Lamaism, which, largely in consequence of the favour shown by Jenghiz Khan and his successors, has attained temporal power and developed into an ecclesiastical state curiously like the papacy.

17. *Mongols.*—Such civilization as the Mongols possess is a mixture of Chinese and Indian, the latter derived chiefly through Tibet, but their alphabet is a curious instance of transplantation. It is an adaptation of the Syriac writing introduced by the early Nestorian missionaries.

Literature, art, science.

18. Almost all Asiatic countries have a literature, but it is often not indigenous and consists of foreign works, chiefly religious, read either in translations or the original. Thus with the exception of a little folklore the literature of Indo-China, Tibet, Mongolia, Korea and Manchuria is mainly Indian or Chinese. The chief original literatures are Chinese, Sanskrit, Pali, Arabic and Persian. The Japanese have produced few books of importance, and their compositions are chiefly remarkable as being lighter and more secular than is usual in Asia, but the older Chinese works take high rank both for their merits and the effect they have had. The extensive Sanskrit literature, which has reached in translations China, Japan and Java, is chiefly theological and poetical, history being conspicuously absent. India has also a considerable medieval and modern literature in various languages. Pali, though only a form of Hindu literature, has a separate history, for it died in India and was preserved in Ceylon, whence it was imported to Burma and Siam as the language of religion. The Pali versions of Buddha's discourses are among the most remarkable products of Asia. The literatures of all Moslem peoples are largely inspired by Arabic, which has produced a voluminous collection of works in prose and poetry. Persian, after being itself transformed by Arabic, has in its turn largely influenced all west Asiatic Moslem literature from Hindustani to Turkish.

If one excepts the Old Testament, which is a product of the extreme west of Asia, it is remarkable how small has been the influence of Asiatic literature on Europe. Though Greek and Slavonic almost ceased to be written languages under Turkish rule, Europeans showed no disposition to replace them by Ottoman or Arabic literature.

Without counting subdivisions there would seem to be three main schools of art in Asia at present—Chinese, Indian and Moslem. The first contains many original elements. It is feeblest in architecture and strongest in the branches demanding skill and care in a limited compass, such as painting, porcelain and enamel. It is the main inspiration of Japanese art, which, however, shows great originality in its treatment of borrowed themes. Both China and Japan have felt through Buddhism the influence of Indian art, which contains at least two elements—one indigenous and the other Greco-Persian. Unlike Chinese art it has a genius for architecture and sculpture rather than painting. Mahommedan art is also largely architectural and has affected nearly all Moslem countries. Except that the use of Arabic inscriptions is one of its principal methods of decoration, it owes little to Arabia and much to Byzantium. The Persian variety of this art is more ornate, and less averse to representations of living beings. Both Moslem and Chinese art are closely connected with calligraphy, but Hindus rarely use writing for ornament.

In both art and literature modern Asia is inferior to the past more conspicuously than Europe.

As for science, astronomy was cultivated by the Babylonians at an early period, and it is probably from them that a knowledge of the heavenly bodies and their movements spread over Asia. Grammar and prosody were studied in India with a marvellous accuracy and minuteness several centuries before Christ. Mathematics were cultivated by the Chinese, Indians and Arabs, but nearly all the sciences based on the observation of nature, including medicine, have remained in a very backward condition. Much the same, however, might have been said of Europe until two centuries ago, and the scientific knowledge of the Arabs under the earlier Caliphates was equal or superior to that of any of their contemporaries. Histories and accounts of travels have been composed both in Arabic and Chinese.

Influence of Asia on other continents.

19. It is only natural that Europe should have chiefly felt the influence of western Asia. Though Europeans may be indebted to China for some mechanical inventions, she was too distant to produce much direct effect, and the influence of India has been mainly directed towards the East. The resemblances between primitive Christianity and Buddhism appear to be coincidences, and though both early Greek philosophy and later Alexandrine ideas suggest Indian affinities, there is no clear connexion such as there is between certain aspects of Chinese thought and India.

Any general statement as to the debt owed by early European civilizations to western Asia would at present be premature, for though important discoveries have been made in Crete and Babylonia the best authorities are chary of positive conclusions as to the relations of Cretan civilization to Egypt and Babylonia. Egyptian influence within the Aegean area seems certain, and the theory that Greek writing and systems for reckoning time are Babylonian in origin has not been disproved, though the history of the alphabet is more complex than was supposed.

In historic times Asia has attempted to assert her influence over Europe by a series of invasions, most of which have been repulsed. Such were the Persian wars of Greece, and perhaps one may add Hannibal's invasion of Italy, if the Carthaginians were Phoenicians transplanted to Africa. The Roman empire kept back the Persians and Parthians, but could not prevent a series of incursions by Avars, Huns, Bulgarians, and later by Mongols and Turks. Islam has twice obtained a footing in Europe, under the Arabs in Spain and under the Turks at Constantinople. The earlier Asiatic invasions were conducted by armies operating at a distance from their bases, and had little result, for the soldiery retired after a time (like Alexander from India), or more rarely (*e.g.* the Bulgarians) settled down without keeping up any connexion with Asia. The Turks, and to some extent the Arabs in Spain, were successful because they first conquered the parts of Asia and Africa adjoining Europe, so that the final invaders were in touch with Asiatic settlements. Though the Turks have profoundly affected the whole of eastern Europe, the result of their conquests has been not so much to plant Asiatic culture in Europe as to arrest development entirely, the countries under their rule remaining in much the same condition as under the moribund Byzantine empire.

In general, Europe has in historic times shown itself decidedly hostile to Asiatic institutions and modes of thought. It is only of recent years that the writings of Schopenhauer and the researches of many distinguished orientalists have awakened some interest in Asiatic philosophy.

The influence of Asia on Africa has been considerable, and until the middle of the 19th century greater than that of Europe. Some authorities hold that Egyptian civilization came from Babylonia, and that the so-called Hamitic languages are older and less specialized members of the Semitic family. The connexion between Carthage and Phoenicia is more certain, and the ancient Abyssinian kingdom was founded by Semites from south Arabia. The traditions of the Somalis derive them from the same region. The theory that the ruins in Mashonaland were built by immigrants from south Arabia is now discredited, but there was certainly a continuous stream of Arab migration to East Africa which probably began in pre-Moslem times and founded a series of cities on the coast. The whole of the north of Africa from Egypt to Morocco has been mahommedanized, and Mahommedan influence is general and fairly strong from Timbuktu to Lake Chad and Wadai. South of the equator, Arab slave-dealers penetrated from Zanzibar to the great lakes and the Congo during the second and third quarters of the 19th century, but their power, though formidable, has disappeared without leaving any permanent traces.

The relation to Asia of the pre-European civilizations of America is another of those questions which admit of no definite answer at present, though many facts support the theory that the semi-civilized inhabitants of Mexico and Central America crossed from Asia by Bering Straits and descended the west coast. Some authorities hold that Peruvian civilization had no connexion with the north and was an entirely indigenous product, but Kechua is in structure not unlike the agglutinative languages of central and northern Asia.

Influence of Europe on Asia.

20. European influence on Asia has been specially strong at two epochs, firstly after the conquests of Alexander the Great, and secondly from the 16th century onwards. Alexander's conquests resulted in the foundation of Perso-Greek kingdoms in Asia, which not only hellenized their own area but influenced the art and religion of India and to some extent of China. Then follows a long period in which eastern Europe was mainly occupied in combating Asiatic invasions, and had little opportunity of Europeanizing the East. Somewhat later the Crusades kept up communication with the Levant, and established there the power of the Roman Church, somewhat to the detriment of oriental Christianity, but intercourse with farther Asia was limited to the voyages of a few travellers. Looking at eastern Europe and western Asia only, one must say that Asiatic influences have on the whole prevailed hitherto (though perhaps the tide is turning), for Islam is paramount in this region and European culture at a low ebb. But the case is quite different if one looks at the two continents as a whole, for improvement in means of communication has brought about strange vicissitudes, and western Europe has asserted her power in middle and eastern Asia.

In the 16th century a new era began with the discovery by the Portuguese of the route to India round the Cape, and the naval powers of Europe started one after another on careers of oriental conquest. The movement was maritime and affected the nations in the extreme west of Europe rather than those nearer Asia, who were under the Turkish yoke. Also the parts of Asia affected were chiefly India and the extreme East. The countries west of India, being less exposed to naval invasion, remained comparatively untouched. It will thus be seen that European (excluding Russian) power in Asia is based almost entirely on improved navigation. There was no attempt to overwhelm whole empires by pouring into them masses of troops, but commerce was combined with territorial acquisition, and a continuity of European interest secured by the presence of merchants and settlers. The course of oriental conquest followed the events of European politics, and the possessions of European powers in the East generally changed hands according to the fortunes of their masters at home. Portugal was first on the scene, and in the 16th century established a considerable littoral empire on the coasts of East Africa, India and China, fragments of which still remain, especially Goa, where Portuguese influence on the natives was considerable. Before the century was out the Dutch appeared as the successful rivals of the Portuguese, but the real struggle for supremacy in southern Asia took place between France and England about 1740-1783. Both entered India as commercial companies, but the disorganized condition of the Mogul empire necessitated the use of military force to protect their interests, and allured them to conquest. The companies gradually undertook the financial control of the districts where they traded and were recognized by the natives as political powers. The ultimate victory of England seems due less to any particular aptitude for dealing with oriental problems than to a better command of the seas and to considerations of European politics. At the end of the Napoleonic wars Portugal had Macao and Goa, Holland Java, Sumatra and other islands, France some odds and ends in India, while England emerged with Hong Kong, Singapore, Ceylon and a free hand in India. Guided by such administrators as Warren Hastings, the East India Company had assumed more and more definitely the functions of government for a great part of India. In 1809 its exclusive trading rights were taken away by Parliament, but its administrative status was thus made clearer, and when after the mutiny of 1857 it was desirable to define British authority in India there seemed nothing unnatural in declaring it to be a possession of the crown.

Another category of European possessions in Asia comprises those acquired towards the end of the 19th century, such as Indo-China (France), Burma and Wei-Hai-Wei (Britain), and Kiao-Chow (Germany). Whereas the earlier conquests were mostly the results of large half-conscious national movements working out their destinies in the East, these later ones were annexations deliberately planned by European cabinets. It seemed to be assumed that Asia was to be divided among the powers of Europe, and each was anxious to get its share or more.

The advance of Russia in Asia is entirely different from that of the other powers, since it has taken place by land and not by sea. Though the geographical extent of Russian territory and influence is enormous, she has always moved along the line of least resistance. She is a moderately strong empire lying to the north of the great Moslem states, and having for neighbours a series of very weak principalities or semi-civilized tribes. The conquest of Siberia and central Asia presented no real difficulties: Persia and Constantinople were left on one side, and Russia was defeated as soon as she was opposed by a vigorous power in the Far East. As the Russian possessions in Asia are continuous with European Russia, it is only natural that they should have been russified far more thoroughly than the British possessions have been anglicized.

There has been great difference of opinion as to the extent to which Alexander's conquests influenced Asia, and it is equally hard to say what is the effect now being produced by Europe. Clearly such alterations as the construction of railways in nearly all parts of the continent, and the establishment of peace over formerly disturbed areas like India, are of enormous importance, and must change the life of the people. But the mental constitution of Asiatics is less easily modified than their institutions, and even Japan has assimilated European methods rather than European ideas. (C. El.)

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ASIA, in a restricted sense, the name of the first Roman province east of the Aegean, formed (133 B.C.) out of the kingdom left to the Romans by the will of Attalus III. Philometor, king of Pergamum. It included Mysia, Lydia, Caria and Phrygia, and therefore, of course, Aeolis, Ionia and the Troad. In 84 B.C., on the close of the Mithradatic War, Sulla reorganized the province, forming 40 *regiones* for fiscal purposes, and it was later divided into *conventus*. From 80 to 50 B.C. the upper Maeander valley and all Phrygia, except the extreme north, were detached and added to Cilicia. In 27 B.C. Asia was made a senatorial province under a pro-consul. As the wealthiest of Roman provinces it had most to gain by the *pax Romana*, and therefore welcomed the empire, and established and maintained the most devout cult of Augustus by means of the organization known as the *Koinon* or Commune, a representative council, meeting in the various *metropoleis*. In this cult the emperor came to be associated with the common worship of the Ephesian Artemis. By the reorganization of Diocletian, A.D. 297, Asia was broken up into several small provinces, and one of these, of which the capital was Ephesus, retained the name of the original province (see Asia Minor).

ASIA MINOR, the general geographical name for the peninsula, forming part of the empire of Turkey, on the extreme west of the continent of Asia, bounded on the N. by the Black Sea, on the W. by the Aegean, and on the S. by the Mediterranean, and at its N.W. extremity only parted from Europe by the narrow straits of the Bosporus and Dardanelles. On the east, no natural boundary separates it from the Armenian plateau; but, for descriptive purposes, it will suffice to take a line drawn from the southern extremity of the Giaour Dagh, east of the Gulf of Alexandretta along the crest of that chain, then along that of the eastern Taurus to the Euphrates near Malatia, then up the river, keeping to the western arm till Erzingan is reached, and finally bending north to the Black Sea along the course of the Churuk Su, which flows out west of Batum. This makes the Euphrates the main eastern limit, with radii to the north-east angle of the Levant and the south-east angle of the Black Sea, and roughly agrees with the popular conception of Asia Minor as a geographical region. But it must be remembered that this term was not used by classical geographers (it is first found in Orosius in the 5th century A.D.), and is not in local or official use now. It probably arose in the first instance from a vague popular distinction between the continent itself and the Roman province of "Asia" (*q.v.*), which at one time included most of the peninsula west of the central salt desert (*Axylon*). The name *Anatolia*, in the form *Anadol*, is used by natives for the western part of the peninsula (*cis Halym*) and not as including ancient Cappadocia and Pontus. Before the reconstitution of the provinces as *vilayets* it was the official title of the principal *eyalet* of Asia Minor, and was also used more generally to include all the peninsular provinces over which the beylerbey of Anadoli, whose seat was at Kutaiah, had the same paramount military jurisdiction which the beylerbey of "Rumili" enjoyed in the peninsular provinces of Europe. The term "Anatolia" appears first in the work of Constantine Porphyrogenitus (10th century).

The greatest length of Asia Minor, as popularly understood, is along its north edge, 720 m. Along the south it is about 650 m. The greatest breadth is 420 m. from C. Kerembé to C. Anamur; but at the waist of the peninsula, between the head of the Gulf of Alexandretta and the southernmost bight of the Black Sea (at Ordu), it is not quite 300 m. The greater portion of Asia Minor consists of a plateau rising gradually from east to west, 2500 ft. to 4500 ft.; east of the Kizil Irmak (Halys), the ground rises more sharply to the highlands of Armenia (*q.v.*). On the south the plateau is buttressed by the Taurus range, which stretches in a broken irregular line from the Aegean to the Persian frontier. On the north the plateau is supported by a range of varying altitude, which follows the southern coast of the Black Sea and has no distinctive name. On the west the edge of the plateau is broken by broad valleys, and the deeply indented coast-line throws out long rocky promontories towards Europe. On the north, excepting the deltas formed by the Kizil and Yeshil Irmaks, there are no considerable coast plains, no good harbours except Sinope and Vona, and no islands. On the west there are narrow coast plains of limited extent, deep gulfs, which offer facilities for trade and commerce, and a fringe of protecting islands. On the south are the isolated plains of Pamphylia and Cilicia, the almost land-locked harbours of Marmarice, Makri and Kekova, the broad bay of Adalia, the deep-seated gulf of Alexandretta (Iskanderun), and the islands of Rhodes with dependencies, Castelorizo and Cyprus.

Mountains.—The Taurus range, perhaps the most important feature in Asia Minor, runs the whole length of the peninsula on the south, springing east of Euphrates in the Armeno-Kurdish highlands, and being prolonged into the Aegean Sea by rocky promontories and islands. It attains in Lycia an altitude of 10,500 ft., and in the Bulgar Dagh (Cilicia) of over 10,000 ft. The average elevation is about 7000 ft. East of the Bulgar Dagh the range is pierced by the Sihun and Jihun rivers, and their tributaries, but its continuity is not broken. The principal passes across the range are those over which Roman or Byzantine roads ran:—(1) from Laodicea to Adalia (Attalia), by way of the Khonas pass and the valley of the Istanoz Chai; (2) from Apamea or from Pisidian Antioch to Adalia, by Isbarta and Sagalassus; (3) from Laranda, by Coropissus and the upper valley of the southern Calycadnus, to Germanicopolis and thence to Anemourium or Kelenderis; (4) from Laranda, by the lower Calycadnus, to Claudiopolis and thence to Kelenderis or Seleucia; (5) from Iconium or Caesarea Mazaca, through the Cilician Gates (Gulek Boghaz, 3300 ft.) to Tarsus; (6) from Caesarea to the valley of the Sarus and thence to Flaviopolis on the Cilician Plain; (7) from Caesarea over Anti-Taurus by the Kuru Chai to Cocysus (Geuksun) and thence to Germanicia (Marash). Large districts on the southern slopes of the Taurus chain are covered with forests of oak and fir, and there are numerous *yailas* or grassy "alps," with abundant water, to which villagers and nomads move with their flocks during the summer months.

Anti-Taurus is a term of rather vague and doubtful application. (*a*) Some have regarded it as meaning the more or less continuous range which buttresses up the central plateau on the north, parallel to the Taurus. (*b*) Others take it to mean the line of heights and mountain peaks which separates the waters running to the Black Sea and the Anatolian plateau from those falling to the Persian Gulf and the Mediterranean. This has its origin in the high land, near the source of the Kizil Irmak, and thence runs south-west towards the volcanic district of Mt. Argaeus, which, however, can hardly be regarded as orographically one with it. After a low interval it springs up again at its southern extremity in the lofty sharp-peaked ridge of Ala Dagh (11,000 ft.), and finally joins Taurus. (*c*) South of Sivas a line of bare hills connects this chain with another range of high forest-clad mountains, which loses itself southwards in the main mass of Taurus, and is held to be the true Anti-Taurus by geographers. It throws off, in the latitude of Kaisarieh, a subsidiary range, the Binboa Dagh, which separates the waters of the Sihun from those of the Jihun. The principal passes are those followed by the old roads:—(1) from Sebasteia to Tephrike and the upper valley of the western Euphrates; (2) from Sebasteia to Melitene, by way of the pass of Delikli Tash and the basin of the Tokhma Su; (3) from Caesarea to Arabissus, by the Kuru Chai and the valley of Cocysus (Geuksun). The range of Amanus (Giaour Dagh) is separated from the mass of Taurus by the deep gorge of the Jihun, whence it runs south-south-west to Ras el-Khanzir, forming the limit between Cilicia and Syria, various parts bearing different names, as Elma Dagh above Alexandretta. It attains its greatest altitude in Kaya Duldul (6500 ft.), which rises abruptly from the bed of the Jihun, and it is crossed by two celebrated passes:—(1) the Amanides Pylae (Baghche Pass), through which ran the road from the Cilician Plain to Apamea-Zeugma, on the Euphrates; (2) the Pylae Syriae or "Syrian Gates" (Beilan Pass), through which passed the great Roman highway from Tarsus to Syria. On the western edge of the plateau several short ranges, running approximately east and west, rise above the general level:—Sultan Dagh (6500 ft.); Salbacus-Cadmus (8000 ft.); Messogis (3600 ft.); Latmus (6000 ft.); Tmolus (5000 ft.); Dindymus (8200 ft.); Ida (5800 ft.); and the Mysian Olympus (7600 ft.). The valleys of the Maeander, Hermus and Caicus facilitate communication between the plateau and the Aegean, and the descent to the Sea of Marmora along the valleys of the Tembris and Sangarius presents no difficulties. The northern border range, though not continuous, rises steadily from the west to its culmination in the Galatian Olympus (Ilkaz Dagh), south of Kastamuni. East of the Kizil Irmak there is no single mountain chain, but there are several short ranges with elevations sometimes exceeding 9000 ft. The best routes from the plateau to the Black Sea were followed by the Roman roads from Tavium and Sebasteia to Sinope and Amisus, and those from Sebasteia to Cotyora and Cerasus-Pharnacia, which at first ascend the upper Halys. Several minor ranges rise above the level of the eastern plateau, and in the south groups of volcanic peaks and cones extend for about 150 m. from Kaisarieh (Caesarea) to Karaman. The most important are Mt. Argaeus (Erjish Dagh, 13,100 ft.) above Kaisarieh itself, the highest peak in Asia Minor; Ali Dagh (6200 ft.); Hassan Dagh (8000 ft.); Karaja Dagh; and Kara Dagh (7500 ft.). On the west of the plateau evidences of volcanic activity are to be seen in the district of Kula (Katakekaumene), coated with recent erupted matter, and in the numerous hot springs of the Lycus, Maeander, and other valleys. Earthquakes are frequent all over the peninsula, but especially in the south-east and west, where the Maeander valley and the Gulf of Smyrna are notorious seismic foci. The centre of the plateau is occupied by a vast treeless plain, the *Axylon* of the Greeks, in which lies a large salt lake, Tuz Geul. The plain is fertile where cultivated, fairly supplied with deep wells, and in many places covered with good pasture. Enclosed between the Taurus and Amanus ranges and the sea are the fertile plains of Cilicia Pedias, consisting in great part of a rich, stoneless loam, out of which rise rocky crags that are crowned with the ruins of Greco-Roman and Armenian strongholds, and of Pamphylia, partly alluvial soil, partly travertine, deposited by the Taurus rivers.

Rivers.—The rivers of Asia Minor are of no great importance. Some do not flow directly to the sea; others find their way to the coast through deep rocky gorges, or are mere torrents; and a few only are navigable for boats for short distances from their mouths. They cut so deep into the limestone formation of the plateau as to over-drain it, and often they disappear into swallow holes (*duden*) to reappear lower down. The most important rivers which flow to the Black Sea are the following:—the Boas (Churuk Su) which rises near Baiburt, and flows out near Batum; the Iris (Yeshil Irmak), with its tributaries the Lycus (Kelkit Irmak), which rises on the Armenian plateau, the Chekerek Irmak, which has its source near Yuzgat, and the Tersakan Su; the Halys (Kizil Irmak) is the longest river in Asia Minor, with its tributaries the Delije Irmak (Cappadox), which flows through the eastern part of Galatia, and the Geuk Irmak, which has its sources in the mountains above Kastamuni. With the exception of Sivas, no town of importance lies in the valley of the Kizil Irmak throughout its course of over 600 m. The Sangarius (Sakaria) rises in the Phrygian mountains and, after many changes of direction, falls into the Black Sea, about 80 m. east of the Bosporus. Its tributaries are the Pursak Su (Tembris), which has its source in the Murad Dagh (Dindymus), and, after running north to Eski-shehr, flows almost due east to the Sakaria, and the Enguri Su, which joins the Sakaria a little below the junction of the Pursak. To the Black Sea, about 40 m. east of Eregli, also flows the Billaeus (Filiyas Chai). Into the Sea of Marmora run the Rhyndacus(Edrenos Chai) and the Macestus (Susurlu Chai), which unite about 12 m. from the sea. The most celebrated streams of the Troad are the Granicus (Bigha Chai) and the Scamander (Menderes Su), both rising in Mt. Ida (Kaz Dagh). The former flows to the Sea of Marmora; the latter to the Dardanelles. The most northerly of the rivers that flow to the Aegean is the Caicus (Bakir Chai), which runs past Soma, and near Pergamum, to the Gulf of Chanderli. The Hermus (Gediz Chai) has its principal sources in the Murad Dagh, and, receiving several streams on its way, runs through the volcanic district of Katakekaumene to the broad fertile valley through which it flows past Manisa to the sea, near Lefke. So recently as about 1880 it discharged into the Gulf of Smyrna, but the shoals formed by its silt-laden waters were so obstructive to navigation that it was turned back into its old bed. Its principal tributaries are—the Phrygius (Kum Chai), which receives the waters of the Lycus (Gürduk Chai), and the Cogamus (Kuzu Chai), which in its upper course is separated from the valley of the Maeander by hills that were crossed by the Roman road from Pergamum to Laodicea. The Caystrus (Kuchuk Menderes) flows through a fertile valley between Mt. Tmolus and Messogis to the sea near Ephesus, where its silt has filled up the port. The Maeander (Menderes Chai) takes its rise in a celebrated group of springs near Dineir, and after a winding course enters the broad valley, through which it "meanders" to the sea. Its deposits have long since filled up the harbours of Miletus, and converted the islands which protected them into mounds in a swampy plain. Its principal tributaries are the Glaucus, the Senarus (Banaz Chai), and the Hippurius, on the right bank. On the left bank are the Lycus (Churuk Su), which flows westwards by Colossae through a broad open valley that affords the only natural approach to the elevated plateau, the Harpasus (Ak Chai), and the Marsyas (China Chai). The rivers that flow to the Mediterranean, with two exceptions, rise in Mt. Taurus, and have short courses, but in winter and spring they bring down large bodies of water. In Lycia are the Indus (Gereniz Chai), and the Xanthus (Eshen Chai). The Pamphylian plain is traversed by the Cestrus (Ak Su), the Eurymedon (Keupri Su), and the Melas (Menavgat Chai), which, where it enters the sea, is a broad, deep stream, navigable for about 6 m. The Calycadnus (Geuk Su) has two main branches which join near Mut and flow south-east, and enter the sea, a deep rapid river, about 12 m. below Selefke. The Cydnus (Tersous or Tarsus Chai) is formed by the junction of three streams that rise in Mt. Taurus, and one of these flows through the narrow gorge known as the Cilician Gates. After passing Tarsus, the river enters a marsh which occupies the site of the ancient harbour. The Cydnus is liable to floods, and its deposits have covered Roman Tarsus to a depth of 20 ft. The Sarus (Sihun) is formed by the junction of the Karmalas (Zamanti Su), which rises in Uzun Yaila, and the Sarus (Saris), which has its sources in the hills to the south of the same plateau. The first, after entering Mt. Taurus, flows through a deep chasm walled in by lofty precipices, and is joined in the heart of the range by the Saris. Before reaching the Cilician Plain the river receives the waters of the Kerkhun Su, which cuts through the Bulgar Dagh, and opens a way for the roads from the Cilician Gates to Konia and Kaisarieh. After passing Adana, to which point small craft ascend, the Sihun runs south-west to the sea. There are, however, indications that at one period it flowed south-east to join the Pyramus. The Pyramus (Jihun) has its principal source in a group of large springs near Albistan; but before it enters Mt. Taurus it is joined by the Sogutli Irmak, the Khurman Su and the Geuk Su. The river emerges from Taurus, about 7 m. west of Marash, and here it is joined by the Ak Su, which rises in some small lakes south of Taurus. The Jihun now enters a remarkable defile which separates Taurus from the Giaour Dagh, and reaches the Cilician Plain near Budrun. From this point it flows west, and then south-west past Missis, until it makes a bend to discharge its waters south of Ayas Bay. The river is navigable as far as Missis. The only considerable tributary of the Euphrates which comes within our region is the Tokhma Su, which rises in Uzun Yaila and flows south-east to the main river not far from Malatia. In the central and southern portions of the plateau the streams either flow into salt lakes, where their waters pass off by evaporation, or into freshwater lakes, which have no visible outlets. In the latter cases the waters find their way beneath Taurus in subterranean channels, and reappear as the sources of rivers flowing to the coast. Thus the Ak Geul supplies the Cydnus, and the Beishehr, Egirdir and Kestel lakes feed the rivers of the Pamphylian plain.

Lakes.—The salt lakes are Tuz Geul (anc. *Tatta*), which lies in the great central plain, and is about 60 m. long and 10 to 30 m. broad in winter, but in the dry season it is hardly more than a saline marsh; Buldur Geul, 2900 ft. above sea-level; and Aji-tuz Geul, 2600 ft. The freshwater lakes are Beishehr Geul (anc. *Karalis*), 3770 ft., a fine sheet of water 30 m. long, which discharges south-east to the Soghla Geul; Egirdir Geul (probably anc. *Limnae*, a name which included the two bays of Hoiran and Egirdir, forming the lake), 2850 ft., which is 30 m. long, but less broad than Beishehr and noted for the abundance and variety of its fish. In the north-west portion of Asia Minor are Isnik Geul (L. Ascania), Abulliont Geul (L. Apollonia), and Maniyas Geul (L. Miletopolis).

Springs.—Asia Minor is remarkable for the number of its thermal and mineral springs. The most important are:—Yalova, in the Ismid sanjak; Brusa, Chitli, Terje and Eskishehr, in the Brusa vilayet; Tuzla, in the Karasi; Cheshme, Ilija, Hierapolis (with enormous alum deposits), and Alashehr, in the Aidin; Terzili Hammam and Iskelib in the Angora; Boli in the Kastamuni; and Khavsa, in the Sivas. Many of these were famous in antiquity and occur in a list given by Strabo. The Maeander valley is especially noted for its hot springs.

Geology.—The central plateau of Asia Minor consists of nearly horizontal strata, while the surrounding mountain chains form a complex system, in which the beds are intensely folded. Around the coast flat-lying deposits of Tertiary age are found, and these often extend high up into the mountain region. The deposits of the central, or Lycaonian, plateau consist of freshwater marls and limestones of late Tertiary or Neogene age. Along the south-eastern margin, in front of the Taurus, stands a line of great volcanoes, stretching from Kara-Dagh to Argaeus. They are now extinct, but were probably active till the close of the Tertiary period. On its southern side the plateau is bounded by the high chains of the Taurus and the Anti-Taurus, which form a crescent with its convexity facing southwards. Devonian and Carboniferous fossils have been found in several places in the Anti-Taurus. Limestones of Eocene or Cretaceous age form a large part of the Taurus, but the interior zone probably includes rocks of earlier periods. The folding of the Anti-Taurus affects the Eocene but not the Miocene, while in the Taurus the Miocene beds have been elevated, but without much folding, to great heights. North of the Lycaonian plateau lies another zone of folding which may be divided into the East Pontian and West Pontian arcs. In the east a well-defined mountain system runs nearly parallel to the Black Sea coast from Batum to Sinope, forming a gentle curve with its convexity facing southwards. Cretaceous limestones and serpentine take a large part in the formation of these mountains, while even the Oligocene is involved in the folds. West of Sinope Cretaceous beds form a long strip parallel to the shore line. Carboniferous rocks occur at Eregli (Heraclea Pontica), where they have been worked for coal. Devonian fossils have been found near the Bosporus and Carboniferous fossils at Balia Maden in Mysia. Triassic, Jurassic and Cretaceous beds form a band south of the Sea of Marmora, probably the continuation of the Mesozoic band of the Black Sea coast. Farther south there are zones of serpentine, and of crystalline and schistose rocks, some of which are probably Palaeozoic. The direction of the folds of this region is from west to east, but on the borders of Phrygia and Mysia they meet the north-westerly extension of the Taurus folds and bend around the ancient mass of Lydia. Marine Eocene beds occur near the Dardanelles, but the Tertiary deposits of this part of Asia Minor are mostly freshwater and belong to the upper part of the system. In western Mysia they are much disturbed, but in eastern Mysia they are nearly horizontal. They are often accompanied by volcanic rocks, which are mainly andesitic, and they commonly lie unconformably upon the older beds. In the western part of Asia Minor there are several areas of ancient rocks about which very little is known. The Taurus folds here meet another system which enters the region from the Aegean Sea.

Climate.—The climate is varied, but systematic observations are wanting. On the plateau the winter is long and cold, and in the northern districts there is much snow. The summer is very hot, but the nights are usually cool. On the north coast the winter is cold, and the winds, sweeping across the Black Sea from the steppes of Russia, are accompanied by torrents of rain and heavy falls of snow. East of Samsun, where the coast is partially protected by the Caucasus, the climate is more moderate. In summer the heat is damp and enervating, and, as Trebizond is approached, the vegetation becomes almost subtropical. On the south coast the winter is mild, with occasional frosts and heavy rain; the summer heat is very great. On the west coast the climate is moderate, but the influence of the cold north winds is felt as far south as Smyrna, and the winter at that place is colder than in corresponding latitudes in Europe. A great feature of summer is the *inbat* or north wind, which blows almost daily, often with the force of a gale, off the sea from noon till near sunset.

Products, &c.—The mineral wealth of Asia Minor is very great, but few mines have yet been opened. The minerals known to exist are—alum, antimony, arsenic, asbestos, boracide, chrome, coal, copper, emery, fuller's earth, gold, iron, kaolin, lead, lignite, magnetic iron, manganese, meerschaum, mercury, nickel, rock-salt, silver sulphur and zinc. The vegetation varies with the climate, soil and elevation. The mountains on the north coast are clothed with dense forests of pine, fir, cedar, oak, beech, &c. On the Taurus range the forests are smaller, and there is a larger proportion of pine. On the west coast the ilex, plane, oak, valonia oak, and pine predominate On the plateau willows, poplars and chestnut trees grow near the streams, but nine-tenths of the country is treeless, except for scrub. On the south and west coasts the fig and olive are largely cultivated. The vine yields rich produce everywhere, except in the higher districts. The apple, pear, cherry and plum thrive well in the north; the orange, lemon, citron and sugar-cane in the south; styrax and mastic in the south-west; and the wheat lands of the Sivas vilayet can hardly be surpassed. The most important vegetable productions are—cereals, cotton, gum tragacanth, liquorice, olive oil, opium, rice, saffron, salep, tobacco and yellow berries. Silk is produced in large quantities in the vicinity of Brusa and Amasia, and mohair from the Angora goat all over the plateau. The wild animals include bear, boar, chamois, fallow red and roe deer, gazelle, hyena, ibex, jackal, leopard, lynx, moufflon, panther, wild sheep and wolf. The native reports of a maneless lion in Lycia (*arslan*) are probably based on the existence of large panthers. Amongst the domestic animals are the buffalo, the Syrian camel, and a mule camel, bred from a Bactrian sire and Syrian mother. Large numbers of sheep and Angora goats are reared on the plateau, and fair horses are bred on the Uzun Yaila; but no effort is made to improve the quality of the wool and mohair or the breed of horses. Good mules can be obtained in several districts, and small hardy oxen are largely bred for ploughing and transport. The larger birds are the bittern, great and small bustard, eagle, francolin, goose; giant, grey and red-legged partridge, sand grouse, pelican, pheasant, stork and swan. The rivers and lakes are well supplied with fish, and the mountain streams abound with small trout.

The principal manufactures are:—Carpets, rugs, cotton, tobacco, mohair and silk stuffs, soap, wine and leather. The exports are:—Cereals, cotton, cotton seed, dried fruits, drugs, fruit, gall nuts, gum tragacanth, liquorice root, maize, nuts, olive oil, opium, rice, sesame, sponges, storax, timber, tobacco, valonia, walnut wood, wine, yellow berries, carpets, cotton yarn, cocoons, hides, leather, mohair, silk, silk stuffs, rugs, wax, wool, leeches, live stock, minerals, &c. The imports are:—Coffee, cotton cloths, cotton goods, crockery, drysalteries, fezzes, glass-ware, haberdashery, hardware, henna, ironware, jute, linen goods, manufactured goods, matches, petroleum, salt, sugar, woollen goods, yarns, &c.

Communications.—There are few metalled roads, and those that exist are in bad repair, but on the plateau light carts can pass nearly everywhere. The lines of railway now open are:—(1) From Haidar Pasha to Ismid, Eski-shehr and Angora; (2) from Mudania to Brusa; (3) from Eski-shehr to Afium-Kara-hissar, Konia and Bulgurli, east of Eregli (the first section of the Bagdad railway). These lines are worked by the German *Gesellschaft der anatolischen Eisenbahnen.* (4) From Smyrna to Manisa, Ala-shehr and Afium Kara-hissar, with a branch line from Manisa to Soma. This line is worked by a French company. (5) From Smyrna to Aidin and Dineir, with branches to Odemish, Tireh, Sokia, Denizli, Ishekli, Seidi Keui and Bouja, constructed and worked by an English company. (6) From Mersina to Tarsus and Adana, an English line under a control mainly French. There are two competing routes for the eastern trade—one running inland from Constantinople (Haidar Pasha), the other from Smyrna. The first is connected by ferry with the European railway system; the second with the great sea routes from Smyrna to Trieste, Marseilles and Liverpool. The right to construct all railways in Armenia and north-eastern Asia Minor has been conceded to Russia, and the Germans have a virtual monopoly of the central plateau.

Ethnology.—None of the conquering races that invaded Asia Minor, whether from the east or from the west, wholly expelled or exterminated the race in possession. The vanquished retired to the hills or absorbed the victors. In the course of ages race distinction has been almost obliterated by fusion of blood; by the complete Hellenization of the country, which followed the introduction of Christianity; by the later acceptance of Islam; and by migrations due to the occupation of cultivated lands by the nomads. It will be convenient here to adopt the modern division into Moslems, Christians and Jews:—(*a*) *Moslems.* The Turks never established themselves in such numbers as to form the predominant element in the population. Where the land was unsuitable for nomad occupation the agricultural population remained, and it still retains some of its original characteristics. Thus in Cappadocia the facial type of the non-Aryan race is common, and in Galatia there are traces of Gallic blood. The Zeibeks of the west and south-west are apparently representatives of the Carians and Lycians; and the peasants of the Black Sea coast range of the people of Bithynia, Paphlagonia and Pontus. Wherever the people accepted Islam they called themselves Turks, and a majority of the so-called "Turks" belong by blood to the races that occupied Asia Minor before the Seljuk invasion. Turkish and Zaza-speaking Kurds (see KURDISTAN) are found in the Angora and Sivas vilayets. There are many large colonies of Circassians and smaller ones of Noghai (Nogais), Tatars, Georgians, Lazis, Cossacks, Albanians and Pomaks. East of Boghaz Keui there is a compact population of Kizilbash, who are partly descendants of Shia Turks transplanted from Persia and partly of the indigenous race. In the Cilician plain there are large settlements of Nosairis who have migrated from the Syrian mountains (see SYRIA). The nomads and semi-nomads are, for the most part, representatives of the Turks, Mongols and Tatars who poured into the country during the 350 years that followed the defeat of Romanus. Turkomans are found in the Angora and Adana vilayets; Avshars, a tribe of Turkish origin, in the valleys of Anti-Taurus; and Tatars in the Angora and Brusa vilayets; Yuruks are most numerous in the Konia vilayet. They speak Turkish and profess to be Moslems, but have no mosques or imams. The Turkomans have villages in which they spend the winter, wandering over the great plains of the interior with their flocks and herds during the summer. The Yuruks on the contrary are a truly nomad race. Their tents are made of black goats' hair and their principal covering is a cloak of the same material. They are not limited to the milder districts of the interior, but when the harvest is over, descend into the rich plains and valleys near the coast. The Chepmi and Takhtaji, who live chiefly in the Aidin vilayet, appear to be derived from one of the early races. (*b*) *Christians.* The Greeks are in places the descendants of colonists from Greece, many of whom, *e.g.* in Pamphylia and the Smyrna district, are of very recent importation; but most of them belong by blood to the indigenous races. These people became "Greeks" as being subjects of the Byzantine empire and members of the Eastern Church. On the west coast, in Pontus and to some extent of late in Cappadocia, and in the mining villages, peopled from the Trebizond Greeks, the language is Romaic; on the south coast and in many inland villages (*e.g.* in Cappadocia) it is either Turkish, which is written in Greek characters, or a Greco-Turkish jargon. In and near Smyrna there are large colonies of Hellenes. Armenians are most numerous in the eastern districts, where they have been settled since the great migration that preceded and followed the Seljuk invasion. There are, however, Armenians in every large town. In central and western Asia Minor they are the descendants of colonists from Persia and Armenia (see ARMENIA). (*c*) The *Jews* live chiefly on the Bosporus; and in Smyrna, Rhodes, Brusa and other western towns. *Gypsies*—some Moslem, some Christian—are also numerous, especially in the south.

History.—Asia Minor owes the peculiar interest of its history to its geographical position. "Planted like a bridge between Asia and Europe," it has been from the earliest period a battle-ground between the East and the West. The central plateau (2500 to 4500 ft.), with no navigable river and few natural approaches, with its monotonous scenery and severe climate, is a continuation of central Asia. The west coast, with its alternation of sea and promontory, of rugged mountains and fertile valleys, its bright and varied scenery, and its fine climate, is almost a part of Europe. These conditions are unfavourable to permanence, and the history of Asia Minor is that of the march of hostile armies, and rise and fall of small states, rather than that of a united state under an independent sovereign. At a very early period Asia Minor appears to have been occupied by non-Aryan tribes or races which differed little from each other in religion, language and social system. During the past generation much light has been thrown upon one of these races—the "Hittites" or "Syro-Cappadocians," who, after their rule had passed away, were known to Herodotus as "White Syrians," and whose descendants can still be recognized in the villages of Cappadocia.[1] The centre of their power is supposed to have been Boghaz Keui (see PTERIA), east of the Halys, whence roads radiated to harbours on the Aegean, to Sinope, to northern Syria and to the Cilician plain. Their strange sculptures and inscriptions have been found at Pteria, Euyuk, Fraktin, Kiz Hissar (Tyana), Ivriz, Bulgar, Muden and other places between Smyrna and the

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[1] The people, Moslem and Christian, are physically one and appear to be closely related to the modern Armenians. This relationship is noticeable in other districts, and the whole original population of Asia Minor has been characterized as Proto-Armenian or Armenoid.

Euphrates (see Hittites). When the great Aryan immigration from Europe commenced is unknown, but it was dying out in the 11th and 10th centuries B.C. In Phrygia the Aryans founded a kingdom, of which traces remain in various rock tombs, forts and towns, and in legends preserved by the Greeks. The Phrygian power was broken in the 9th or 8th century B.C. by the Cimmerii, who entered Asia Minor through Armenia; and on its decline rose the kingdom of Lydia, with its centre at Sardis. A second Cimmerian invasion almost destroyed the rising kingdom, but the invaders were expelled at last by Alyattes, 617 B.C. (see Scythia). The last king, Croesus (? 560–546 B.C.) carried the boundaries of Lydia to the Halys, and subdued the Greek colonies on the coast. The date of the foundation of these colonies cannot be fixed; but at an early period they formed a chain of settlements from Trebizond to Rhodes, and by the 8th century B.C. some of them rivalled the splendour of Tyre and Sidon. Too jealous of each other to combine, and too demoralized by luxury to resist, they fell an easy prey to Lydia; and when the Lydian kingdom ended with the capture of Sardis by Cyrus, 546 B.C. they passed, almost without resistance, to Persia. Under Persian rule Asia Minor was divided into four satrapies, but the Greek cities were governed by Greeks, and several of the tribes in the interior retained their native princes and priest-dynasts. An attempt of the Greeks to regain their freedom was crushed, 500–494 B.C., but later the tide turned and the cities were combined with European Greeks into a league for defence against the Persians. The weakness of Persian rule was disclosed by the expedition of Cyrus and the Ten Thousand Greeks, 402 B.C.; and in the following century Asia Minor was invaded by Alexander the Great (*q.v.*), 334 B.C. (See Greece; Persia; Ionia.)

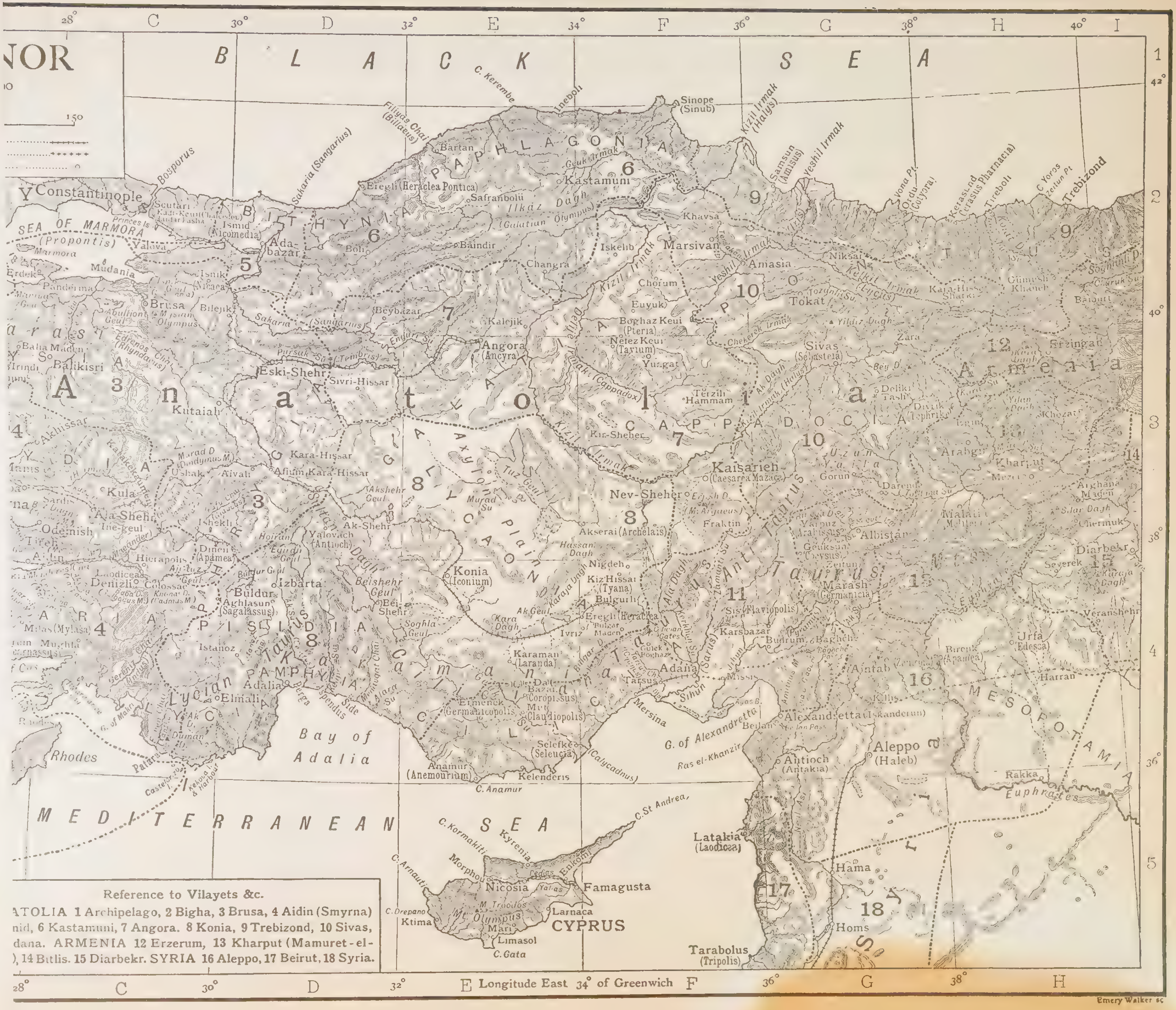
The wars which followed the death of Alexander eventually gave Asia Minor to Seleucus, but none of the Seleucid kings was able to establish his rule over the whole peninsula. Rhodes became a great maritime republic, and much of the south and west coast belonged at one time or another to the Ptolemies of Egypt. An independent kingdom was founded at Pergamum, 283 B.C., which lasted until Attalus III., 133 B.C., made the Romans his heirs. Bithynia became an independent monarchy, and Cappadocia and Paphlagonia tributary provinces under native princes. In southern Asia Minor the Seleucids founded Antioch, Apamea, Attalia, the Laodiceas and Seleuceias, and other cities as centres of commerce, some of which afterwards played an important part in the Hellenization (see Hellenism) of the country, and in the spread of Christianity. During the 3rd century, 278–277 B.C., certain Gallic tribes crossed the Bosporus and Hellespont, and established a Celtic power in central Asia Minor. They were confined by the victories of Attalus I. of Pergamum, *c.* 232 B.C., to a district on the Sangarius and Halys to which the name Galatia was applied; and after their defeat by Manlius, 189 B.C., they were subjected to the suzerainty of Pergamum (see Galatia).

The defeat of Antiochus the Great at Magnesia, 190 B.C., placed Asia Minor at the mercy of Rome; but it was not until 133 that the first Roman province, Asia, was formed to include only western Anatolia, without Bithynia. Errors in policy and in government facilitated the rise of Pontus into a formidable power under Mithradates, who was finally driven out of the country by Pompey, and died 63 B.C. Under the settlement of Asia Minor by Pompey, Bithynia-Pontus and Cilicia became provinces, whilst Galatia and Cappadocia were allowed to retain nominal independence for over half a century more under native kings, and Lycia continued an autonomous League. A long period of tranquillity followed, during which the Roman dominion grew, and all Asia Minor was divided into two provinces. The boundaries were often changed; and about A.D. 297, in Diocletian's reorganization of the empire, the power of the great military commands was broken, and the provinces were made smaller and united in groups called dioceses. A great change followed the introduction of Christianity, which spread first along the main roads that ran north and west from the Cilician Gates, and especially along the great trade route to Ephesus. In some districts it spread rapidly, in others slowly. With its advance the native languages and old religions gradually disappeared, and at last the whole country was thoroughly Hellenized, and the people united by identity of language and religion.

At the close of the 6th century Asia Minor had become wealthy and prosperous; but centuries of peace and over-centralization had affected the *moral* of the people and weakened the central government. During the 7th century the provincial system broke down, and the country was divided into *themes* or military districts. From 616 to 626 Persian armies swept unimpeded over the land, and Chosroes (Khosrau) II. pitched his camp on the shore of the Bosporus. The victories of Heraclius forced Chosroes to retire; but the Persians were followed by the Arabs, who, advancing with equal ease, laid siege to Constantinople, A.D. 668. It almost appeared as if Asia Minor would be annexed to the dominion of the Caliph. But the tide of conquest was stemmed by the iconoclast emperors, and the Arab expeditions, excepting those of Harun al-Rashid, 781 and 806, and of el-Motasim, 838, became simply predatory raids. In the 10th century the Arabs were expelled. They never held more than the districts along the main roads, and in the intervals of peace the country rapidly recovered itself. But a more dangerous enemy was soon to appear on the eastern border.

In 1067 the Seljuk Turks ravaged Cappadocia and Cilicia; in 1071 they defeated and captured the emperor Romanus Diogenes, and in 1080 they took Nicaea. One branch of the Seljuks founded the empire of Rum, with its capital first at Nicaea and then at Iconium. The empire, which at one time included nearly the whole of Asia Minor, with portions of Armenia and Syria, passed to the Mongols when they defeated the sultan of Rum in 1243, and the sultans became vassals of the Great Khan. The Seljuk sultans were liberal patrons of art, literature and science, and the remains of their public buildings and tombs are amongst the most beautiful and most interesting in the country. The marches of the Crusaders across Asia Minor left no permanent impression. But the support given by the Latin princes to the Armenians in Cilicia facilitated the growth of the small warlike state of Lesser Armenia, which fell in 1375 with the defeat and capture of Leo VI. by the Mameluke sultan of Egypt. The Mongols were too weak to govern the country they had conquered, and the vassalage of the last sultan of Rum, who died in 1307, was only nominal. On his death the Turkoman governors of his western provinces drove out the Mongols and asserted their independence. A contest for supremacy followed, which eventually ended in favour of the Osmanli Turks of Brusa. In 1400 Sultan Bayezid I. held all Asia Minor west of the Euphrates; but in 1402 he was defeated and made prisoner by Timur, who swept through the country to the shores of the Aegean. On the death of Timur Osmanli supremacy was re-established after a prolonged struggle, which ended with the annexation by Mahommed II. (1451–1481) of Karamania and Trebizond, and the abandonment of the last of the Italian trading settlements which had studded the coast during the 13th and 14th centuries. The later history of Asia Minor is that of the Turkish empire. The most important event was the advance (1832–1833) of an Egyptian army, under Ibrahim Pasha, through the Cilician Gates to Konia and Kutaiah.

The defeat of the emperor Romanus (1071) initiated a change in the condition of Asia Minor which was to be complete and lasting. A long succession of nomad Turkish tribes, pressing forward from central Asia, wandered over the rich country in search of fresh pastures for their flocks and herds. They did not plunder or ill-treat the people, but they cared nothing for town life or for agricultural pursuits, and as they passed onward they left the country bare. Large districts passed out of cultivation and were abandoned to the nomads, who replaced wheeled traffic by the pack horse and the camel. The peasants either became nomads themselves or took refuge in the towns or the mountains. The Mongols, as they advanced, sacked towns and laid waste the agricultural lands. Timur conducted his campaigns with a ruthless disregard of life and property. Entire Christian communities were massacred, flourishing towns were


NOR
150
BLACK SEA
MEDITERRANEAN SEA
Anatolia
Armenia
MESOPOTAMIA
Syria
CYPRUS
PAPHLAGONIA
BITHYNIA
GALATIA
CAPPADOCIA
LYCAONIA
PISIDIA
PAMPHYLIA
CILICIA
LYCIA
CARIA
LYDIA
Plain
Axylon
Anti Taurus
Taurus
Bay of Adalia
G. of Alexandretta
Constantinople
SEA OF MARMORA (Propontis)
Sinope (Sinub)
Samsun (Amisus)
Trebizond
Angora (Ancyra)
Konia (Iconium)
Kaisarieh (Caesarea Mazaca)
Sivas (Sebasteia)
Aleppo (Haleb)
Antioch (Antakia)
Latakia (Laodicea)
Tarabolus (Tripolis)
Hama
Homs
Adana
Tarsus
Mersina
Adalia
Eski-Shehr
Brusa
Kutaiah
Nicosia
Famagusta
Larnaca
Limasol
Rhodes
Reference to Vilayets &c.
ATOLIA 1 Archipelago, 2 Bigha, 3 Brusa, 4 Aidin (Smyrna)
nid, 6 Kastamuni, 7 Angora. 8 Konia, 9 Trebizond, 10 Sivas,
dana. ARMENIA 12 Erzerum, 13 Kharput (Mamuret-el-
), 14 Bitlis. 15 Diarbekr. SYRIA 16 Aleppo, 17 Beirut, 18 Syria.
Longitude East 34° of Greenwich
Emery Walker sc

completely destroyed, and all Asia Minor was ravaged. From these disasters the country never recovered, and the last traces of Western civilization disappeared with the enforced use of the Turkish language and the wholesale conversions to Islam under the earliest Osmanli sultans. The recent large increase of the Greek population in the western districts, the construction of railways, and the growing interests of Germany and Russia on the plateau seem, however, to indicate that the tide is again turning in favour of the West.

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(C. W. W.; D. G. H.)

ASIENTO, or Assiento (from the verb *asentar*, to place, or establish), a Spanish word meaning a farm of the taxes, or contract. The farmer or contractor is called an *asentista*. The word acquired a considerable notoriety in English and American history, on account of the "Asiento Treaty" of 1713. Until 1702 the Spanish government had given the contract for the supply of negroes to its colonies in America to the Genoese. But after the establishment of the Bourbon dynasty in 1700, a French company was formed which received the exclusive privilege of the Spanish-American slave trade for ten years—from September 1702 to 1712. When the peace of Utrecht was signed the British government insisted that the monopoly should be given to its own subjects. By the terms of the Asiento treaty signed on the 16th of March 1713, it was provided that British subjects should be authorized to introduce 144,000 slaves in the course of thirty years, at the rate of 4800 per annum. The privilege was to expire on the 1st of May 1743. British subjects were also authorized to send one ship of 500 tons per annum, laden with manufactured goods, to the fairs of Porto Bello and La Vera Cruz. Import duties were to be paid for the slaves and goods. This privilege was conveyed by the British government to the South Sea Company, formed to work it. The privilege, to which an exaggerated value was attached, formed the solid basis of the notorious fit of speculative fever called the South Sea Bubble. Until 1739 the trade in blacks went on without interruption, but amid increasingly angry disputes between the Spanish and the British governments. The right to send a single trading ship to the fairs of Porto Bello or La Vera Cruz was abused. Under pretence of renewing her provisions she was followed by tenders which in fact carried goods. Thus there arose what was in fact a vast contraband trade. The Spanish government established a service of revenue boats (*guarda costas*) which insisted on searching all English vessels approaching the shores of the Spanish colonies. There can be no doubt that the smugglers were guilty of many piratical excesses, and that the *guarda costas* often acted with violence on mere suspicion. After many disputes, in which the claims of the British government were met by Spanish counter claims, war ensued in 1739. When peace was made at Aix-la-Chapelle in 1748 Spain undertook to allow the asiento to be renewed for the four years which were to run when war broke out in 1739. But the renewal for so short a period was not considered advantageous, and by the treaty of El Retiro of 1750, the British government agreed to the recession of the Asiento treaty altogether on the payment by Spain of £100,000.

A very convenient account of the Asiento Treaty, and of the trade which arose under it, will be found in Malachy Postlethwayt's *Universal Dictionary of Trade and Commerce* (London, 1751), *s.v.*

ASIR, a district in western Arabia, lying between 17° 30′ and 21° N., and 40° 30′ and 45° E.; bounded N. by Hejaz, E. by Nejd, S. by Yemen and W. by the Red Sea. Like Yemen, it consists of a lowland zone some 20 or 30 m. in width along the coast, and of a mountainous tract, falling steeply on the west and merging into a highland plateau which slopes gradually to the N.E. towards the Nejd steppes. Its length along the coast is about 230 m., and its breadth from the coast to El Besha about 180. The lowland, or Tehama, is hot and barren; the principal places in it are Kanfuda, the chief port of the district, Marsa Hali and El Itwad, smaller ports farther south. The mountainous tract has probably an average altitude of between 6000 and 7000 ft., with a temperate climate and regular rainfall, and is fertile and populous. The valleys are well watered and produce excellent crops of cereals and dates. The best-known are the Wadi Taraba and the W. Besha, both running north-east towards the W. Dawasir in Nejd. Taraba, according to John Lewis Burckhardt, is a considerable town, surrounded by palm groves and gardens, and watered by numerous rivulets, and famous for its long resistance to Mehemet Ali's forces in 1815. Five or six days' journey to the south-east is the district of Besha, the most important position between Sana and Taif. Here Mehemet Ali's army, amounting to 12,000 men, found sufficient provisions to supply it during a fortnight's halt. The Wadi Besha is a broad valley abounding with streams containing numerous hamlets scattered over a tract some six or eight hours' journey in length. Its principal affluent, the W. Shahran, rises 120 m. to the south and runs through the fertile district of Khamis Mishet, the highest in Asir. The Zahran district lies four days west of Besha on the crest of the main range: the principal place is Makhwa, a large town and market, from which grain is exported in considerable quantities to Mecca. Farther south is the district of Shamran. Throughout the mountainous country the valleys are well watered and cultivated, with fortified villages perched on the surrounding heights. Juniper forests are said to exist on the higher mountains. Three or four days' journey east and south east of Besha are the encampments of the Bani Kahtan, one of the most ancient tribes of Arabia; their pastures extend into the adjoining district of Nejd, where they breed camels in large numbers, as well as a few horses.

The inhabitants are a brave and warlike race of mountaineers, and aided by the natural strength of their country they have hitherto preserved their independence. Since the beginning of the 19th century they have been bigoted Wahhabis, though previously regarded by their neighbours as very lax Mahommedans; during Mehemet Ali's occupation of Nejd their constant raids on the Egyptian communications compelled him to send several punitive expeditions into the district, which, however, met with little success. Since the reconquest of Yemen by the Turks, they have made repeated attempts to subjugate Asir, but beyond occupying Kanfuda, and holding one or two isolated points in the interior, of which Ibha and Manadir are the principal, they have effected nothing.

The chief sources of information regarding Asir are the notes made by J. L. Burckhardt at Taif in 1814 and those of the French officers with the Egyptian expeditions into the country from 1814 to 1837. No part of Arabia would better repay exploration.

AUTHORITIES.—J. L. Burckhardt, *Travels in Arabia* (London, 1829); F. Mengin, *Histoire de l'Égypte*, &c. (Paris, 1823); M. O. Tamisier, *Voyage en Arabie* (Paris, 1840). (R. A. W.)

ASISIUM (mod. *Assisi*), an ancient town of Umbria, in a lofty situation about 15 m. E.S.E. of Perusia. As an independent community it had already begun to use Latin as well as Umbrian in its inscriptions (for one of these recording the chief magistrates—*marones*—see *C.I.L.* xi. 5390). It became a *municipium* in 90 B.C., but, though numerous inscriptions (*C.I.L.* xi. 5371-5606) testify to its importance in the Imperial period, it is hardly mentioned by our classical authorities. Scanty traces of the ancient city walls may be seen; within the town the best-preserved building is the so-called temple of Minerva, with six Corinthian columns of travertine, now converted into a church, erected by Gaius and Titus Caesius in the Augustan era. It fronted on to the ancient forum, part of the pavement of which, with a base for the equestrian statues of Castor and Pollux (as the inscription upon it records) has been laid bare beneath the present Piazza Vittorio Emanuele. The remains of the amphitheatre, in *opus reticulatum*, may be seen in the north-east corner of the town; and other ancient buildings have been discovered. Asisium was probably the birthplace of Propertius. (T. As.)

ASKABAD, or ASKHABAD, a town of Russian central Asia, capital of the Transcaspian province, 345 m. by rail S.E. of Krasnovodsk and 594 from Samarkand, situated in a small oasis at the N. foot of the Kopet-dagh range. It has a public library and a technical railway school; also cotton-cleaning works, tanneries, brick-works, and a mineral-water factory. The trade is valued at £250,000 a year. The population, 2500 in 1881, when the Russians seized it, was 19,428 in 1897, one-third Persians, many of them belonging to the Babi sect.

ASKAULES (Gr. ἀσκαύλης [?] from ἀσκός, bag, αὐλός, pipe), probably the Greek word for bag-piper, although there is no documentary authority for its use. Neither it nor ἄσκαυλος (which would naturally mean the bag-pipe) has been found in Greek classical authors, though J. J. Reiske—in a note on Dio Chrysostom, *Orat.* lxxi. *ad fin.*, where an unmistakable description of the bag-pipe occurs ("and they say that he is skilled to write, to work as an artist, and to play the pipe with his mouth, on the bag placed under his arm-pits")—says that ἀσκαύλης was the Greek word for bag-piper. The only actual corroboration of this is the use of *ascaules* for the pure Latin *utricularius* in Martial x. 3. 8. Dio Chrysostom flourished about A.D. 100; it is therefore only an assumption that the bag-pipe was known to the classical Greeks by the name of ἄσκαυλος. It need not, however, be a matter of surprise that among the highly cultured Greeks such an instrument as the bag-pipe should exist without finding a place in literature. It is significant that it is not mentioned by Pollux (*Onomast.* iv. 74) and Athenaeus (*Deipnos.* iv. 76) in their lists of the various kinds of pipes.

See articles AULOS and BAG-PIPE; art. "Askaules" in Pauly-Wissowa, *Realencyclopädie*.

ASKE, ROBERT (d. 1537), English rebel, was a country gentleman who belonged to an ancient family long settled in Yorkshire, his mother being a daughter of John, Lord Clifford. When in 1536 the insurrection called the "Pilgrimage of Grace" broke out in Yorkshire, Aske was made leader; and marching with the banner of St Cuthbert and with the badge of the "five wounds," he occupied York on the 16th of October and on the 20th captured Pontefract Castle, with Lord Darcy and the archbishop of York, who took the oath of the rebels. He caused the monks and nuns to be reinstated, and refused to allow the king's herald to read the royal proclamation, announcing his intention of marching to London to declare the grievances of the commons to the sovereign himself, secure the expulsion of counsellors of low birth, and obtain restitution for the church. The whole country was soon in the hands of the rebels, a military organization with posts from Newcastle to Hull was established, and Hull was provided with cannon. Subsequently Aske, followed by 30,000 or 40,000 men, proceeded towards Doncaster, where lay the duke of Norfolk with the royal forces, which, inferior in numbers, would probably have been overwhelmed had not Aske persuaded his followers to accept the king's pardon, and the promise of a parliament at York and to disband. Soon afterwards he received a letter from the king desiring him to come secretly to London to inform him of the causes of the rebellion. Aske went under the guarantee of a safe-conduct and was well received by Henry. He put in writing a full account of the rising and of his own share in it; and, fully persuaded of the king's good intentions, returned home on the 8th of January 1537, bringing with him promises of a visit from the king to Yorkshire, of the holding of a parliament at York, and of free elections. Shortly afterwards he wrote to the king warning him of the still unquiet state not only of the north but of the midlands, and stating his fear that more bloodshed was impending. The same month he received the king's thanks for his action in pacifying Sir Francis Bigod's rising. But his position was now a difficult and a perilous one, and a few weeks later the attitude of the government towards him was suddenly changed. The new rising had given the court an excuse for breaking off the treaty and sending another army under Norfolk into Yorkshire. Possibly in these fresh circumstances Aske may have given cause for further suspicions of his loyalty, and in his last confession he acknowledged that communications to obtain aid had been opened with the imperial ambassador and were contemplated with Flanders. But it is more probable that the government had from the first treacherously affected to treat him with confidence to secure the secrets of the rebels and to effect his destruction. In March Norfolk congratulated Cromwell on the successful accomplishment of his task, having persuaded Aske to go to London on false assurances of security. He was arrested in April, tried before a commission at Westminster, and sentenced to death for high treason on the 17th of May; and on the 28th of June he was taken back to Yorkshire, being paraded in the towns and country through which he passed. He was hanged at York in July, expressing repentance for breaking the king's laws, but declaring that he had promise of pardon both from Cromwell and from Henry. It is related that his servant, Robert Wall, died of grief at the thought of his master's approaching execution. Aske was a real leader, who gained the affection and confidence of his followers; and his sudden rise to greatness and his choice by the people point to abilities that have not been recorded.

See *Henry VIII. and the English Monasteries*, by F. A. Gasquet (1906); *Letters and Papers of the Reign of Henry VIII.*, vols. xi. and xii.; *English Histor. Review*, v. 330, 550 (account of the rebellion, examination and answers to interrogations); *Chronicle of Henry VIII.*, tr. by M. A. S. Hume (1889); Whitaker's *Richmondshire*, i. 116 (pedigree of the Askes).

ASKEW, or ASCUE, **ANNE** (1521?–1546), English Protestant martyr, born at Stallingborough about 1521, was the second daughter of Sir William Askew (d. 1540) of South Kelsey, Lincoln, by his first wife Elizabeth, daughter of Thomas Wrottesley. Her elder sister, Martha, was betrothed by her parents to Thomas Kyme, a Lincolnshire justice of the peace, but she died before marriage, and Anne was induced or compelled to take her place. She is said to have had two children by Kyme, but religious differences and incompatibility of temperament soon estranged the couple. Kyme was apparently an unimaginative man of the world, while Anne took to Bible-reading with zeal, became convinced of the falsity of the doctrine of transtantiation, and created some stir in Lincoln by her disputatic According to Bale and Foxe her husband turned her out of rs, but in the privy council register she is said to have "refusKyme to be her husband without any honest allegation." ie had as good a reason for repudiating her husband as HerVIII. for repudiating Anne of Cleves. In any case, she cato London and made friends with Joan Bocher, who was alty known for heterodoxy, and other Protestants. She was exned for heresy in March 1545 by the lord mayor, and was coitted to the Counter prison. Then she was examined by Bor, the bishop of London, who drew up a form of recantatwhich he entered in his register. This fact led Parsons and otCatholic historians to state that she actually recanted, but slefused to sign Bonner's form without qualification. Two mhs later, on the 24th of May, the privy council ordered her ar. On the 13th of June 1545, she was arraigned as a sacranarian under the Six Articles at the Guildhall; but no witnespeared against her; she was declared not guilty by the jund discharged after paying her fees.

Thectionary party, which, owing to the absence of Hertford and Land to the presence of Gardiner, gained the upper hand in the ncil in the summer of 1546, were not satisfied with this repulshey probably aimed at the leaders of the reforming party, h as Hertford and possibly Queen Catherine Parr, who were scted of favouring Anne, and on the 18th of June 1546 Anne again arraigned before a commission including the lord mr, the duke of Norfolk, St John, Bonner and Heath. No juvas empanelled and no witnesses were called; she was conderd, simply on her confession, to be burnt. On the same day shas called before the privy council with her husband. Kyme sent home into Lincolnshire, but Anne was committed to Nete, "for that she was very obstinate and heady in reason of matters of religion." On the following day she was taken the Tower and racked; according to Anne's own statem, as recorded by Bale, the lord chancellor, Wriothesley, and thlicitor-general, Rich, worked the rack themselves; but she "d not convert for all the pain" (Wriothesley, *Chronicle* i. 168) Her torture, disputed by Jardine, Lingard and others, is substated not only by her own narrative, but by two contempo chronicles, and by a contemporary letter (*ibid.*; *Narra of the Reformation*, p. 305; Ellis, *Original Letters*, 2nd Ser. ii.). For four weeks she was left in prison, and at length on theh of July, she was burnt at Smithfield in the presence of thehe persecuting dignitaries who had condemned her to death.

AUTITIES.—Bale's two tracts, printed at Marburg in November 1546 anuary 1547, are the basis of Foxe's account. See also *Acts o Privy Council* (1542–1547), pp. 424, 462; Wriothesley's *Chron.* 155, 167-169; *Narratives of the Reformation*, passim; Goughndex to Parker Soc. Publications*; Burnet's *Hist. of the Reformn*; Dixon's *Hist. of the Church of England*; *Dict. Nat. Biogr.* (A. F. P.)

AṢM [Abū Saʿīd ʿAbd ul-Malik ibn Quraib] (*c.* 739–831), Arabicholar, was born of pure Arab stock in Baṣra and was a pupere of Abū ʿAmr ibn ul-ʿAlā. He seems to have been a poor runtil by the influence of the governor of Baṣra he was broughthe notice of Harūn al-Rashīd, who enjoyed his conversatat court and made him tutor of his son. He became wealthnd acquired property in Baṣra, where he again settled for a ; but returned later to Bagdad, where he died in 831. Aṣmaas one of the greatest scholars of his age. From his youthstored up in his memory the sacred words of the Koran, the trions of the Prophet, the verses of the old poets and the storiethe ancient wars of the Arabs. He was also a student of lange and a critic. It was as a critic that he was the great rival oū ʿUbaida (*q.v.*). While the latter followed (or led) the Shuʿū movement and declared for the excellence of all things not Aan, Aṣmaʿī was the pious Moslem and avowed supporter of theeriority of the Arabs over all peoples, and of the freedom eir language and literature from all foreign influence. Somehis scholars attained high rank as literary men. Of Aṣmamany works mentioned in the catalogue known as the *Fihris*nly about half a dozen are extant. Of these the *Book of Dition* has been edited by D. H. Müller (Vienna, 1876); the *Book of the Wild Animals* by R. Geyer (Vienna, 1887); the *Book of the Horse*, by A. Haffner (Vienna, 1895); the *Book of the Sheep*, by A. Haffner (Vienna, 1896).

For life of Aṣmaʿī, see Ibn Khallikān, *Biographical Dictionary*, translated from the Arabic by McG. de Slane (Paris and London, 1842), vol. ii. pp. 123-127. For his work as a grammarian, G. Flügel, *Die grammatischen Schulen der Araber* (Leipzig, 1862), pp. 72-80. (G. W. T.)

ASMARA, the capital of the Italian colony of Eritrea, N.E. Africa. It is built on the Hamasen plateau, near its eastern edge, at an elevation of 7800 ft., and is some 40 m. W.S.W. in a direct line of the seaport of Massawa. Pop. (1904) about 9000, including the garrison of 300 Italian soldiers, and some 1000 native troops. The European civil population numbers over 500; the rest of the inhabitants are chiefly Abyssinians. There is a small Mahommedan colony. The town is strongly fortified. The European quarter contains several fine public buildings, including the residence of the governor, club house, barracks and hospital. Fort Baldissera is built on a hill to the south-west of the town and is considered impregnable.

Asmara, an Amharic word signifying "good pasture place," is a town of considerable antiquity. It was included in the maritime province of northern Abyssinia, which was governed by a viceroy who bore the title of Bahar-nagash (ruler of the sea). By the Abyssinians the Hamasen plateau was known as the plain of the thousand villages. Asmara appears to have been one of the most prosperous of these villages, and to have attained commercial importance through being on the high road from Axum to Massawa. When Werner Munzinger (*q.v.*) became French consul at Massawa, he entered into a scheme for annexing the Hamasen (of which Asmara was then the capital) to France, but the outbreak of the war with Germany in 1870 brought the project to nought (cf. A. B. Wylde, *Modern Abyssinia*, 1901). In 1872 Munzinger, now in Egyptian service, annexed Asmara to the khedivial dominions, but in 1884, owing to the rise of the mahdi, Egypt evacuated her Abyssinian provinces and Asmara was chosen by Ras Alula, the representative of the negus Johannes (King John), as his headquarters. Shortly afterwards the Italians occupied Massawa, and in 1889 Asmara (see ABYSSINIA: *History*). In 1900 the seat of government was transferred from Massawa to Asmara, which in its modern form is the creation of the Italians. It is surrounded by rich agricultural lands, cultivated in part by Italian immigrants, and is a busy trading centre. A railway from Massawa to Asmara was completed as far as Ghinda, at the foot of the plateau, in 1904. At Medrizien, 6 m. north of Asmara, are gold-mines which have been partially worked.

See G. Dainelli, *In Africa. Lettere dall' Eritrea* (Bergamo, 1908); R. Perini, *Di qua dal Mareb* (Florence, 1905).

ASMODEUS, or ASHMEDAI, an evil demon who appears in later Jewish tradition as "king of demons." He is sometimes identified with Beelzebub or Apollyon (Rev. ix. 11). In the Talmud he plays a great part in the legends concerning Solomon. In the apocryphal book of Tobit (iii. 8) occurs the well-known story of his love for Sara, the beautiful daughter of Raguel, whose seven husbands were slain in succession by him on their respective bridal nights. At last Tobias, by burning the heart and liver of a fish, drove off the demon, who fled to Egypt. From the part played by Asmodeus in this story, he has been often familiarly called the genius of matrimonial unhappiness or jealousy, and as such may be compared with Lilith. Le Sage makes him the principal character in his novel *Le Diable boiteux*. Both the word and the conception seem to have been derived originally from the Persian. The name has been taken to mean "covetous." It is in any case no doubt identical with the demon Aēshma of the Zend-Avesta and the Pahlavi texts. But the meaning is not certain. It is generally agreed that the second part of the name Asmodeus is the same as the Zend *daēwa*, *dēw*, "demon." The first part may be equivalent to Aēshma, the impersonation of anger. But W. Baudissin (Herzog-Hauck, *Realencyklopädie*) prefers to derive it from *ish*, to drive, set in motion; whence *ish-mīn*, driving, impetuous.

The legend of Asmodeus is given fully in the *Jewish Encyclopaedia*, s.v. See also the articles in the *Encyclopaedia Biblica*, Hastings' *Dictionary of the Bible*, and Herzog-Hauck, *Realencyklopädie*.

ASMONEUS, or ASAMONAEUS (so Josephus), great-grandfather of Mattathias, the father of Judas Maccabaeus. Nothing more is known of him, and the name is only given by Josephus (not in 1 Macc. ii. 1). But the dynasty was known to Josephus and the Mishna (once) as "the sons (race) of the Asamonaeans (of A.)"; and the Targum of 1 Sam. ii. 4 has "the house of the Hashmoneans who were weak, signs were wrought for them and strength." If not the founder, Asmoneus was probably the home of the family (cf. Heshmon, Jos. xv. 27).

See Schurer, *Geschichte des jüdischen Volkes*, i. 248 N; art. "Maccabees," § 2, in *Ency. Biblica*. (J. H. A. H.)

ASNIÈRES, a town of northern France, in the department of Seine, on the left bank of the Seine, about 1½ m. N.N.W. of the fortifications of Paris. Pop. (1906) 35,883. The town, which has grown rapidly in recent years, is a favourite boating centre for the Parisians. The industries include boat-building and the manufacture of colours and perfumery.

ASOKA, a famous Buddhist emperor of India who reigned from 264 to 228 or 227 B.C. Thirty-five of his inscriptions on rocks or pillars or in caves still exist (see INSCRIPTIONS: *Indian*), and they are among the most remarkable and interesting of Buddhist monuments (see BUDDHISM). Asoka was the grandson of Chandragupta, the founder of the Maurya (Peacock) dynasty, who had wrested the Indian provinces of Alexander the Great from the hands of Seleucus, and he was the son of Bindusāra, who succeeded his father Chandragupta, by a lady from Champā. The Greeks do not mention him and the Brahmin books ignore him, but the Buddhist chronicles and legends tell us much about him. The inscriptions, which contain altogether about five thousand words, are entirely of religious import, and their references to worldly affairs are incidental. They begin in the thirteenth year of his reign, and tell us that in the ninth year he had invaded Kalinga, and had been so deeply impressed by the horrors involved in warfare that he had then given up the desire for conquest, and devoted himself to conquest by "religion." What the religion was is explained in the edicts. It is purely ethical, independent alike of theology and ritual, and is the code of morals as laid down in the Buddhist sacred books for laymen. He further tells us that in the ninth year of his reign he formally joined the Buddhist community as a layman, in the eleventh year he became a member of the order, and in the thirteenth he "set out for the Great Wisdom" (the *Sambodhi*), which is the Buddhist technical term for entering upon the well-known, eightfold path to Nirvana. One of the edicts is addressed to the order, and urges upon its members and the laity alike the learning and rehearsal of passages from the Buddhist scriptures. Two others are proclamations commemorating visits paid by the king, one to the dome erected over the ashes of Konāgamana, the Buddha, another to the birthplace of Gotama, the Buddha (*q.v.*). Three very short ones are dedications of caves to the use of an order of recluses. The rest either enunciate the religion as explained above, or describe the means adopted by the king for propagating it, or acting in accordance with it. These means are such as the digging of wells, planting medicinal herbs, and trees for shade, sending out of missionaries, appointment of special officers to supervise charities, and so on. The missionaries were sent to Kashmir, to the Himalayas, to the border lands on the Indus, to the coast of Burma, to south India and to Ceylon. And the king claims that missions sent by him to certain Greek kingdoms that he names had resulted in the folk there conforming themselves to his religion. The extent of Asoka's dominion included all India from the thirteenth degree of latitude up to the Himalayas, Nepal, Kashmir, the Swat valley, Afghanistan as far as the Hindu Kush, Sind and Baluchistan. It was thus as large as, or perhaps somewhat larger than, British India before the conquest of Burma. He was undoubtedly the most powerful sovereign of his time and the most remarkable and imposing of the native rulers of India. "If a man's fame," says Köppen, "can be measured by the number of hearts who revere his memory, by the number of lips who have mentioned, and still mention him with honour, Asoka is more famous than Charlemagne or Caesar." At the same time it is probable that, like Constantine's patronage of Christianity, his ronage of Buddhism, then the most rising and influential fain India, was not unalloyed with political motives, and it is tain that his vast benefactions to the Buddhist cause were atst one of the causes that led to its decline.

See also *Asoka*, by Vincent Smith (Oxford, 1901); *Iiptions de Piyadasi*, by E. Senart (Paris, 1891); chapters on As in T. W. Rhys Davids's *Buddhism* (20th ed., London, 1903), and *Bhist India* (London, 1903); V. A. Smith, *Edicts of Asoka* (1909). (T. R. D.)

ASOLO (anc. *Acelum*), a town of Venetia, Italy, in province of Treviso, about 19 m. N.W. direct from the town Treviso, and some 10 m. E. of Bassano by road. Pop. (1901) 7. It is well situated on a hill, 690 ft. above sea-level. nains of Roman baths and of a theatre have been discovd in the course of excavation (*Notizie degli scavi*, 1877, 23581, 205; 1882, 289), and the town was probably a *munium*. It became an episcopal see in the 6th century. It wto Asolo that Catherine Cornaro, queen of Cyprus, retired on abdication. Here she was visited by Pietro Bembo, who coved here his *Dialoghi degli Asolani*, and by Andrea Navagero (ugerius). Paulus Manutius was born here. The village of Mas 4½ m. to the E., and near it is the Villa Giacomelli, erected by Pdio, containing frescoes by Paolo Veronese, executed in 1566–1 5or Marcantonio Barbaro of Venice, and ranking among his l works.

ASOR (Hebr. for "ten"), an instrument "of tstrings" mentioned in the Bible, about which authors are agreed. The word occurs only three times in the Bible, and hot been traced elsewhere. In Psalm xxxiii. 2 the reference is' kinnor, nebel and asor"; in Psalm xcii. 3, to "nebel ansor"; in Psalm cxliv. to "nebel-asor." In the English ven *asor* is translated "an instrument of ten strings," with a mnal note "omit" applied to "instrument." In the Septuagihe word being derived from a root signifying "ten," the ek is *ἐν δεκαχορδῷ* or *ψαλτήριον δεκάχορδον*, in the Vulg*in decachordo psalterio*. Each time the word *asor* is used itlows the word *nebel* (see PSALTERY), and probably merely icates a variant of the nebel, having ten strings instead of thstomary twelve assigned to it by Josephus (*Antiquities*, vii. 1).

See also Mendel and Reissmann, *Musikalisches Crsations-Lexikon*, vol. i. (Berlin, 1881); Sir John Stainer, *The ic of the Bible*, pp. 35-37; Forkel, *Allgemeine Geschichte der Mk*, Bd. i. p. 133 (Leipzig, 1788). K. S.)

ASP (*Vipera aspis*), a species of venomous snake, cly allied to the common adder of Great Britain, which itpresents throughout the southern parts of Europe, beinpecially abundant in the region of the Alps. It differs frone adder in having the head entirely covered with scales, sls being absent, and in having the snout somewhat turned up. he term "Asp" (ἀσπίς) seems to have been employed by ek and Roman writers, and by writers generally down to corratively recent times, to designate more than one species serpent; thus the asp, by means of which Cleopatra is said toe ended her life, and so avoided the disgrace of entering Romcaptive, is now generally supposed to have been the cerastes horned viper (*Cerastes cornutus*), of northern Africa and Ara a snake about 15 in. long, exceedingly venomous, and preed with curious horn-like protuberances over each eye, whiive it a decidedly sinister appearance. The snake, howeve which the word "asp" has been most commonly applied is uubtedly the haje of Egypt, the *spy-slange* or spitting snake e Boers (*Naja haje*), one of the very poisonous *Elarinae*, fro to 4 ft. long, with the skin of its neck loose, so as to renderlilatable at the will of the animal, as in the cobra of India, a ies from which it differs only in the absence of the spectacle mark on the back of the neck. Like the cobra, also, the has its fangs extracted by the jugglers of the country, whoerwards train it to perform various tricks. The asp (*Pe*, פֶּתֶן) is mentioned in various parts of the Old Testament. is name is twice translated "adder," but as nothing is told beyond its poisonous character and the intractability of its osition, it is impossible accurately to determine the species.

ASPARAGINE, $C_4H_8N_2O_3$, a naturally occurring , found in plants belonging to the natural orders Legumae and

Crucifer It occurs in two optically active forms, namely, as laevo-as gine and dextro-asparagine. Laevo-asparagine was isolated 05 by L. N. Vauquelin. A. Piutti (*Gazz. chim. Ital.*, 1887, 17 126; 1888, 18, p. 457) synthesized the asparagines from th nomethyl ester of inactive aspartic acid by heating it with olic ammonia. In this way a mixture of the two asparagi was obtained, which were separated by picking out the hem ral crystals.

$$HOOC\cdot CH_2\cdot CH_2\cdot COOC_2H_5 + NH_3 = C_2H_5OH + HOOC\cdot CH\cdot NH_2\cdot CH_2\cdot CONH_2.$$

Laevo-a gine is slightly soluble in cold water and readily soluble ot water. It crystallizes in prisms, containing one molecul water of crystallization, the anhydrous form melting at 235° C. Nitrous acid converts it into malic acid, $HOOC\cdot OH\cdot CH_2\cdot COOH$. It is laevo-rotatory in aqueous or in alka solution, and dextro-rotatory in acid solution (L. Pasteu *n.Chim. Phys.*, 1851 [2], 31, p. 67). Dextro-asparagine was firs nd in 1886 in the shoots of the vetch (Piutti). It forms r bic crystals possessing a sweet taste. It is dextro-rotator aqueous or alkaline solution, and laevo-rotatory in acid ion.

Hydr s by means of acids or alkalis converts the asparagines in partic acid; whilst on heating with water in a sealed tube th re converted into ammonium aspartate. The constitutio the asparagines has been determined by A. Piutti (*Gazz. c Ital.*, 1888, 18, p. 457).

ASPA US, a genus of plants (nat. ord. Liliaceae) containing more t oo species, and widely distributed in the temperate and wa parts of the Old World; it was introduced from Europe America with the early settlers. The name is derived n the Greek ἀσπάραγος or ἀσφάραγος, the origin of whic bscure. *Sperage* or *sparage* was the form in use from the 16th 8th centuries, cf. the modern Italian *sparagio*. The vulgar uption *sparrow-grass* or *sparagrass* was in accepted popula during the 18th century, “asparagus” being considered antic. The plants have a short, creeping, underground from which spring slender, branched, aerial shoots. The le are reduced to minute scales bearing in their axils tufts een, needle-like branches (the so-called *cladodes*), which ate, and perform the functions of, leaves. In one section he genus, sometimes regarded as a distinct genus *Myrsi m*, the cladodes are flattened. The plants often climb ramble, in which they are helped by the development o scale-leaves into persistent spines. The flowers are small, sh and pendulous; the fruit is a berry.

Seve f the climbing species are grown in greenhouses for their te, often feathery branches, which are also valuable fo ting; the South African *Asparagus plumosus* is an especi egant species. The so-called smilax, much used for decora is a species of the *Myrsiphyllum* section, *A. medeoloides*, known as *Myrsiphyllum asparagoides*. The young shoots *paragus officinalis* have from very remote times been in high ute as a culinary vegetable, owing to their delicate flavour diuretic virtues. The plant, which is a native of the north rate zone of the Old World, grows wild on the south coast gland; and on the waste steppes of Russia it is so abund hat it is eaten by cattle like grass. In common with the m allow and some other plants, it contains asparagine or asp acidamide. The roots of asparagus were formerly used aperient medicine, and the fruits were likewise emplo s a diuretic. Under the name of Prussian asparagus, the sp f an allied plant, *Ornithogalum pyrenaicum*, are used in so ces. The diuretic action is extremely feeble, and neithe plant nor asparagine is now used medicinally.

Asp s is grown extensively in private gardens as well as for m The asparagus prefers a loose, light, deep, sandy soil; the d hould be 3 ft., the soil being well trenched, and all surplu er got away. A considerable quantity of well-rotted dung recent seaweed should be laid in the bottom of the trench another top-dressing of manure should be dug in prepa to planting or sowing. The beds should be 3 ft. or 5 ft e, with intervening alleys of 2 ft., the narrower beds taking two rows of plants, the wider ones three rows. The beds should run east and west, so that the sun's rays may strike against the side of the bed. In some cases the plants are grown in equidistant rows 3 to 4 ft. apart. Where the beds are made with plants already prepared, either one-year-old or two-year-old plants may be used, for which a trench should be cut sufficient to afford room for spreading out the roots, the crowns being all kept at about 2 in. below the surface. Planting is best done in April, after the plants have started into growth. To prevent injury to the roots, it is, however, perhaps the better plan to sow the seeds in the beds where the plants are to remain. To experience the finest flavour of asparagus, it should be eaten immediately after having been gathered; if kept longer than one day, or set into water, its finer flavour is altogether lost. If properly treated, asparagus beds will continue to bear well for many years. The asparagus grown at Argenteuil, near Paris, has acquired much notoriety for its large size and excellent quality. The French growers plant in trenches instead of raised beds. The most common method of forcing asparagus is to prepare, early in the year, a moderate hot-bed of stable litter with a bottom heat of 70°, and to cover it with a common frame. After the heat of fermentation has somewhat subsided, the surface of the bed is covered with a layer of light earth or exhausted tan-bark, and in this the roots of strong mature plants are closely placed. The crowns of the roots are then covered with 3 to 6 in. of soil. A common three-light frame may hold 500 or 600 plants, and will afford a supply for several weeks. After planting, linings are applied when necessary to keep up the heat, but care must be taken not to scorch the roots; air must be occasionally admitted. Where there are pits heated by hot water or by the tank system, they may be advantageously applied to this purpose. A succession of crops must be maintained by annually sowing or planting new beds.

The “asparagus-beetle” is the popular name for two beetles, the “common asparagus beetle” (*Crioceris asparagi*) and the “twelve-spotted” (*C. duodecimpunctata*), which feed on the asparagus plant. *C. asparagi* has been known in Europe since early times, and was introduced into America about 1856; the rarer *C. duodecimpunctata* (sometimes called the “red” to distinguish it from the “blue” species) was detected in America in 1881. For an admirable account of these pests see F. H. Chittenden, *Circular 102 of the U. S. Dep. of Agriculture, Bureau of Entomology*, May 1908.

The “asparagus-stone” is a form of apatite, simulating asparagus in colour.

ASPASIA, an Athenian courtesan of the 5th century B.C., was born either at Miletus or at Megara, and settled in Athens, where her beauty and her accomplishments gained for her a great reputation. Pericles, who had divorced his wife (445), made her his mistress, and, after the death of his two legitimate sons, procured the passing of a law under which his son by her was recognized as legitimate. It was the fashion, especially among the comic poets, to regard her as the adviser of Pericles in all his political actions, and she is even charged with having caused the Samian and Peloponnesian wars (Aristoph. *Acharn.* 497). Shortly before the latter war, she was accused of impiety, and nothing but the tears and entreaties of Pericles procured her acquittal. On the death of Pericles she is said to have become the mistress of one Lysicles, whom, though of ignoble birth, she raised to a high position in the state; but, as Lysicles died a year after Pericles (428), the story is unconvincing. She was the chief figure in the dialogue *Aspasia* by Aeschines the Socratic, in which she was represented as criticizing the manners and training of the women of her time (for an attempted reconstruction of the dialogue see P. Natorp in *Philologus*, li. p. 489, 1892); in the *Menexenus* (generally ascribed to Plato) she is a teacher of rhetoric, the instructress of Socrates and Pericles, and a funeral oration in honour of those Athenians who had given their lives for their country (the authorship of which is attributed to Aspasia) is repeated by Socrates; Xenophon (*Oecon.* iii. 14) also speaks of her in favourable terms, but she is not mentioned by Thucydides. In opposition to this view, Wilamowitz-Möllendorff

(*Hermes*, xxxv. 1900) regards her simply as a courtesan, whose personality would readily become the subject of rumour, favourable or unfavourable. There is a bust bearing her name in the Pio Clementino Museum in the Vatican.

See Le Conte de Bièvre, *Les Deux Aspasies* (1736); J. B. Capefigue, *Aspasie et le siècle de Périclès* (1862); L. Becq de Fouquières, *Aspasie de Milet* (1872); H. Houssaye, *Aspasie, Cléopâtre, Théodora* (1899); R. Hamerling, *Aspasia* (a romance; Eng. trans. by M. J. Safford, New York, 1882); J. Donaldson, *Woman* (1907). Also PERICLES.

ASPASIUS, a Greek peripatetic philosopher, and a prolific commentator on Aristotle. He flourished probably towards the close of the 1st century A.D., or perhaps during the reign of Antoninus Pius. His commentaries on the *Categories*, *De Interpretatione*, *De Sensu*, and other works of Aristotle are frequently referred to by later writers, but have not come down to us. Commentaries on Plato, mentioned by Porphyry in his life of Plotinus, have also been lost. Commentaries on books 1–4, 7 (in part), and 8 of the *Nicomachean Ethics* are preserved; that on book 8 was printed with those of Eustratius and others by Aldus Manutius at Venice in 1536. They were partly (2–4) translated into Latin by Felicianus in 1541, and have frequently been republished, but their authenticity has been disputed. The most recent edition is by G. Heylbut in *Commentaria in Aristotelem Graeca*, xix. 1 (Berlin, 1889).

Another ASPASIUS, in the 3rd century A.D., was a Roman sophist and rhetorician, son or pupil of the rhetorician Demetrianus. He taught rhetoric in Rome, and filled the chair of rhetoric founded by Vespasian. He was secretary to the emperor Maximin. His orations, which are praised for their style, are lost.

ASPEN, an important section of the poplar genus (*Populus*) of which the common aspen of Europe, *P. tremula*, may be taken as the type,—a tall fast-growing tree with rather slender trunk, and grey bark becoming rugged when old. The roundish leaves, toothed on the margin, are slightly downy when young, but afterwards smooth, dark green on the upper and greyish green on the lower surface; the long slender petioles, much flattened towards the outer end, allow of free lateral motion by the lightest breeze, giving the foliage its well-known tremulous character. By their friction on each other the leaves give rise to a rustling sound. It is supposed that the mulberry trees (*Becaim*) mentioned in 1 Chronicles xiv. 14, 15 were really aspen trees. The flowers, which appear in March and April, are borne on pendulous hairy catkins, 2–3 in. long; male and female catkins are, as in the other species of the genus, on distinct trees.

The aspen is found in moist places, sometimes at a considerable elevation, 1600 ft. or more, in Scotland. It is an abundant tree in the northern parts of Britain, even as far as Sutherland, and is occasionally found in the coppices of the southern counties, but in these latter habitats seldom reaches any large size; throughout northern Europe it abounds in the forests,—in Lapland flourishing even in 70° N. lat., while in Siberia its range extends to the Arctic Circle; in Norway its upper limit is said to coincide with that of the pine; trees exist near the western coast having stems 15 ft. in circumference. The wood of the aspen is very light and soft, though tough; it is employed by coopers, chiefly for pails and herring-casks; it is also made into butchers' trays, pack-saddles, and various articles for which its lightness recommends it; sabots are also made of it in France, and in medieval days it was valued for arrows, especially for those used in target practice; the bark is used for tanning in northern countries; cattle and deer browse greedily on the young shoots and abundant suckers. Aspen wood makes but indifferent fuel, but charcoal prepared from it is light and friable, and has been employed in gunpowder manufacture. The powdered bark is sometimes given to horses as a vermifuge; it possesses likewise tonic and febrifugal properties, containing a considerable amount of salicin. The aspen is readily propagated either by cuttings or suckers, but has been but little planted of late years in Britain. *P. trepida*, or *tremuloides*, is closely allied to the European aspen, being chiefly distinguished by its more pointed leaves; it is a native of most parts of Canada and the United States, extending northwards as far as Great Slave Lake. The wood is soft and neither strong nor durable; it burns better in the green state than that of most trees, and is often used by the hunters of the North-West as fuel; split into thin layers, it was formerly employed in the United States for bonnet and hat making. It is largely manufactured into wood-pulp for paper-making. The bark is of some value as a tonic and febrifuge. *P. grandidentata*, the large-leaved American aspen, has ovate or roundish leaves deeply and irregularly serrated on the margin. The wood is light, soft and close-grained, but not strong. In northern New England and Canada it is largely manufactured into wood-pulp; it is occasionally used in turnery and for wooden-ware.

ASPENDUS (mod. *Balkis Kalé* , or, more anciently in the native language, ESTVEDYS (whence the adjective *Estvedijys* on coins), an ancient city of Pamphylia, very strongly situated on an isolated hill on the right bank of the Eurymedon at the point where the river issues from the Taurus. The sea is now about 7 m. distant, and the river is navigable only for about 2 m. from the mouth; but in the time of Thucydides ships could anchor off Aspendus. Really of pre-Hellenic date, the place claimed to be an Argive colony. It derived wealth from great *salines* and from a trade in oil and wool, to which the wide range of its admirable coinage bears witness from the 5th century B.C. onwards. There Alcibiades met the satrap Tissaphernes in 411 B.C., and thence succeeded in getting the Phoenician fleet, intended to co-operate with Sparta, sent back home. The Athenian, Thrasybulus, after obtaining contributions from Aspendus in 389, was murdered by the inhabitants. The city bought off Alexander in 333, but, not keeping faith, was forcibly occupied by the conqueror. In due course it passed from Pergamene to Roman dominion, and according to Cicero, was plundered of many artistic treasures by Verres. It was ranked by Philostratus the third city of Pamphylia, and in Byzantine times seems to have been known as Primopolis, under which name its bishop signed at Ephesus in A.D. 431. In medieval times it was evidently still a strong place, but it has now sunk, in the general decay of Pamphylia, to a wretched hamlet.

The ruins still extant are very remarkable, and, with the noble Roman theatre, the finest in the world, have earned for the place (as is the case with certain other great monuments) a legendary connexion with Solomon's Sheban queen. On the summit of the hillock, surrounded by a wall with three gates, lie the remains of the city. The public buildings round the forum can all be traced, and parts of them are standing to a considerable height. They consist of a fine nympheum on the north with a covered theatre behind it, covered market halls on the west, and a peristyle hall and a basilica on the east. In the plain below are large thermae, and ruins of a splendid aqueduct. But all else seems insignificant beside the huge theatre, half hollowed out of the north-east flank of the hill. This was first published by C. F. M. Texier in 1849, and has now been completely planned, &c., by Count Lanckoronski's expedition in 1884. It is built of local conglomerate and is in marvellous preservation. Erected to the honour of the emperors Marcus Aurelius and L. Verus by the architect Zeno, for the heirs of a local Roman citizen (as an inscription repeated over both portals attests), its auditorium has a circuit of 313·17 feet. There are forty tiers of seating, divided by one *diazoma*, and crowned by an arched gallery of rather later date, repaired in places with brick. This auditorium held 7500 spectators. The seats are not perfect, but so nearly so as to appear practically intact. The wooden stage has, of course, perished, but all its supporting structures are in place, and the great scena wall stands to its full height, and produces a magnificent impression whether from within or from without. Inwardly it was decorated with two orders of columns one above the other, with rich entablatures, much of which survives. In the *tympanum* is a relief of Bacchus (wrongly supposed to be of a female, and called the Bal-Kis, *i.e.* "Honey Girl"). The position of the sounding board above the stage is apparent. Under the forepart of the auditorium, built out from the hill, are immense vaults. The whole structure was enclosed within one great wall, pierced with numerous windows. This structure was probably put to some ecclesiastical Byzantine use, as certain mutilated heads of saints appear upon it; and later it became a fortress and received certain additions. It is now under the care of the local *aghá* and not allowed to be plundered for building stone.

See C. Lanckoronski, *Villes de la Pamphylie et de la Pisidie*, i. (1890). (D. G. H.)

ASPER, AEMILIUS, Latin grammarian, possibly lived in the 2nd century A.D. He wrote commentaries on Terence, Sallust and Virgil. Numerous fragments of the last show that as both critic and commentator he possessed good judgment and taste. They are printed in Keil, *Probi in Vergilii Bucolica Commentarius* (1848); see also Suringar, *Historia Critica Scholiastarum Latinorum* (1834); Gräfenhan, *Geschichte der klassischen Philologie im Alterthum*, iv. (1843–1850). Two short grammatical treatises, extant under the name of Asper, and of very little value, have nothing to do with the commentator, but belong to a much later date—the time of Priscian (6th century). Both are printed in Keil, *Grammatici Latini*. See also Schanz, *Geschichte der römischen Litteratur*, § 598.

ASPER, HANS (1499–1571), Swiss painter, was born and died at Zürich. He wrought in a great variety of styles, but excelled chiefly in flower and fruit pieces, and in portrait-painting. Many of his pictures have perished, but his style may be judged from the illustrations to Gessner's *Historia Animalium*, for which he is said to have furnished the designs, and from portraits of Zwingli and his daughter Regula Gwalter, which are preserved in the public library of Zürich. It has been usual to class Asper among the pupils and imitators of Holbein, but an inspection of his works is sufficient to show that this is a mistake. Though Asper was held in high reputation by his fellow-citizens, who elected him a member of the Great Council, and had a medal struck in his honour, he seems to have died in poverty.

ASPERGES ("thou wilt sprinkle," from the Latin verb *aspergere*), the ceremony of sprinkling the people with holy water before High Mass in the Roman Catholic Church, so called from the first word of the verse (Ps. iv. 9) *Asperges me, Domini, hyssopo et mundabor*, with which the priest begins the ceremony. The brush used for sprinkling is an aspergill (*aspergillum*), or aspersoir, and the vessel for this water an *aspersorium*. The act of sprinkling the water is called *aspersion*.

ASPERN-ESSLING, Battle of (1809), a battle fought on the 21st and 22nd of May 1809 between the French and their allies under Napoleon and the Austrians commanded by the archduke Charles (see Napoleonic Campaigns). At the time of the battle Napoleon was in possession of Vienna, the bridges over the Danube had been broken, and the archduke's army was on and about the Bisamberg, a mountain near Korneuburg, on the left bank of the river. The first task of the French was the crossing of the Danube. Lobau, one of the numerous islands which divide the river into minor channels, was selected as the point of crossing, careful preparations were made, and on the night of the 19th-20th of May the French bridged all the channels from the right bank to Lobau and occupied the island. By the evening of the 20th great masses of men had been collected there and the last arm of the Danube, between Lobau and the left bank, bridged. Masséna's corps at once crossed to the left bank and dislodged the Austrian outposts. Undeterred by the news of heavy attacks on his rear from Tirol and from Bohemia, Napoleon hurried all available troops to the bridges, and by daybreak on the 21st, 40,000 men were collected on the Marchfeld, the broad open plain of the left bank, which was also to be the scene of the battle of Wagram. The archduke did not resist the passage; it was his intention, as soon as a large enough force had crossed, to attack it before the rest of the French army could come to its assistance. Napoleon had, of course, accepted the risk of such an attack, but he sought at the same time to minimize it by summoning every available battalion to the scene. His forces on the Marchfeld were drawn up in front of the bridges facing north, with their left in the village of Aspern (Gross-Aspern) and their right in Essling (or Esslingen). Both places lay close to the Danube and could not therefore be turned; Aspern, indeed, is actually on the bank of one of the river channels. But the French had to fill the gap between the villages, and also to move forward to give room for the supports to form up. Whilst they were thus engaged the archduke moved to the attack with his whole army in five columns. Three under Hiller, Bellegarde and Hohenzollern were to converge upon Aspern, the other two, under Rosenberg, to attack Essling. The Austrian cavalry was in the centre, ready to move out against any French cavalry which should attack the heads of the columns. During the 21st the bridges became more and more unsafe, owing to the violence of the current, but the French crossed without intermission all day and during the night.

The battle began at Aspern; Hiller carried the village at the first rush, but Masséna recaptured it, and held his ground with the same tenacity as he had shown at Genoa in 1800. The French infantry, indeed, fought on this day with the old stubborn bravery which it had failed to show in the earlier battles of the year. The three Austrian columns fighting their hardest through the day were unable to capture more than half the village; the rest was still held by Masséna when night fell. In the meanwhile nearly all the French infantry posted between the two villages and in front of the bridges had been drawn into the fight on either flank. Napoleon therefore, to create a diversion, sent forward his centre, now consisting only of cavalry, to charge the enemy's artillery, which was deployed in a long line and firing into Aspern. The first charge of the French was repulsed, but the second attempt, made by heavy masses of cuirassiers, was more serious. The French horsemen, gallantly led, drove off the guns, rode round Hohenzollern's infantry squares, and routed the cavalry of Lichtenstein, but they were unable to do more, and in the end they retired to their old position. In the meanwhile Essling had been the scene of fighting almost as desperate as that of Aspern. The French cuirassiers made repeated charges on the flank of Rosenberg's force, and for long delayed the assault, and in the villages Lannes with a single division made a heroic and successful resistance, till night ended the battle. The two armies bivouacked on their ground, and in Aspern the French and Austrians lay within pistol shot of each other. The latter had fought fully as hard as their opponents, and Napoleon realized that they were no longer the professional soldiers of former campaigns. The spirit of the nation was in them and they fought to kill, not for the honour of their arms. The emperor was not discouraged, but on the contrary renewed his efforts to bring up every available man. All through the night more and more French troops were put across.

At the earliest dawn of the 22nd the battle was resumed. Masséna swiftly cleared Aspern of the enemy, but at the same time Rosenberg stormed Essling at last. Lannes, however, resisted desperately, and reinforced by St Hilaire's division, drove Rosenberg out. In Aspern Masséna had been less fortunate, the counter-attack of Hiller and Bellegarde being as completely successful as that of Lannes and St Hilaire. Meantime Napoleon had launched a great attack on the Austrian centre. The whole of the French centre, with Lannes on the right and the cavalry in reserve, moved forward. The Austrian line was broken through, between Rosenberg's right and Hohenzollern's left, and the French squadrons poured into the gap. Victory was almost won when the archduke brought up his last reserve, himself leading on his soldiers with a colour in his hand. Lannes was checked, and with his repulse the impetus of the attack died out all along the line. Aspern had been lost, and graver news reached Napoleon at the critical moment. The Danube bridges, which had broken down once already, had at last been cut by heavy barges, which had been set adrift down stream for the purpose by the Austrians. Napoleon at once suspended the attack. Essling now fell to another assault of Rosenberg, and though again the French, this time part of the Guard, drove him out, the Austrian general then directed his efforts on the flank of the French centre, slowly retiring on the bridges. The retirement was terribly costly, and but for the steadiness of Lannes the French must have been driven into the Danube, for the archduke's last effort to break down their resistance was made with the utmost fury. Only the complete exhaustion of both sides put an end to the fighting. The French lost 44,000 out of 90,000 successively engaged, and amongst the killed were Lannes and St Hilaire. The Austrians, 75,000 strong, lost 23,360. Even this, the first great defeat of Napoleon, did not shake his resolution. The beaten forces were at last withdrawn safely into the island. On the night of the 22nd the great bridge was repaired, and the army awaited the arrival of reinforcements, not in Vienna, but in Lobau.

See sketch map in article WAGRAM.

ASPHALT, or ASPHALTUM. The solid or semi-solid kinds of bitumen (*q.v.*) were termed ἄσφαλτος by the Greeks; and by some ancient classical writers the name of *pissasphaltum* (πίσσα, pitch) was also sometimes employed. The asphalt of the Dead Sea (known as *Lacus Asphaltites*) received considerable notice from early travellers, and Diodorus the historian states that the inhabitants of the surrounding parts were accustomed to collect it for use in Egypt for embalming. In common with other forms of bitumen, asphalt is very widely distributed geographically and occurs in greater or less quantity in rocks of all ages. There is some divergence in the views expressed as to the precise manner of its production, but it may certainly be said that the principal asphalt deposits are merely the result of the evaporation and oxidation of liquid petroleum which has escaped from outcropping strata. The celebrated Pitch Lake of Trinidad was long regarded as the largest deposit of asphalt in existence, but it is said to be exceeded in area, if not in depth also, by one in Venezuela. The Trinidad "Lake" has an area of 99·3 acres, and is sufficiently firm in places to support a team of horses. The deposit is worked with picks to a depth of a foot or two, and the excavations soon become filled up by the plastic material flowing in from below and hardening. The depth of the deposit is not accurately known. The surface is not level but is composed of irregularly tumescent masses of various sizes, each said to be subject to independent motion, whereby the interior of each rises and flows centrifugally towards the edges. As the spaces between them are always filled with water, these masses are prevented from coalescing. The softer parts of the lake constantly evolve gas, which is stated to consist largely of carbon dioxide and sulphuretted hydrogen, and the pitch, which is honeycombed with gas-cavities, continues to exhibit this action for some time after its removal from the lake. The working of the deposit is in the hands of the New Trinidad Asphalt Company, who hold the concession up to the year 1930 on payment to the government of a minimum royalty of £10,000 a year. A circular line of tramway, supported on palm-leaves, has been laid on the lake to facilitate the removal of the asphalt. Very large quantities are exported for paving and other purposes, the annual shipments amounting to about 130,000 tons from the lake and about 30,000 tons from other properties. The amount of asphalt in the lake has been estimated at 158,400 tons for each foot of depth, and if the average depth be taken at 20 ft. this would give a total of 3,168,000 tons; but in 1908, though 1,885,000 tons had been removed in the previous thirty-five years, there was but little evidence of reduction in the quantity. The Venezuelan deposit already referred to is in the state of Bermudez, and the area of it is reported to be more than 1000 acres. The asphalt of Cuba is a well-known article of commerce, of which 7252 tons was exported to the United States in 1902. The principal deposits are near the harbour of Cardenas (70 ft. thick), in the Pinar del Rio, near Havana (18 ft. thick), at Canas Tomasita (105 ft. thick); and a specially pure variety near Vuelta.

The comparative composition of Trinidad and Cuba asphalt is given in the following table:—

	Refined Trinidad, Melting point 185° F.	Refined Cuba (soft), Melting point 115° F.	Refined Cuba (hard), Melting point 160° F.
Water	0·17	0·13	0·11
Volatile bitumen . .	51·81	64·03	8·34
Sulphur	10·00	8·35	8·92
Ash (earthy matter) .	28·30	19·51	16·60
Fixed carbon . . .	9·72	7·98	66·03
	100·00	100·00	100·00

The chemical composition of Trinidad asphalt has been given as:—

C.	H.	N.	O.	S.
80·32	6·30	0·50	1·40	11·48

The following is a comparison of Trinidad and Venezuela (Bermudez) asphalt:—

	Refined Trinidad.	Refined Bermudez.
Specific gravity at 60° F. . .	1·373	1·071
Bitumen soluble in carbon bisulphide	61·507 %	92·22 %
Mineral matter (ash) . .	34·51 ,,	1·50 ,,
Non-bituminous organic matter .	3·983 ,,	1·28 ,,
Portion of total bitumen soluble in alcohol	8·24 ,,	11·66 ,,
Portion of total bitumen soluble in ether	80·01 ,,	81·63 ,,
Loss at 212° F. . . .	0·65 ,,	1·37 ,,
,, 400° F. in ten hours .	7·98 ,,	17·80 ,,
Loss at 400° on total bitumen .	12·811 ,,	18·308 ,,
Evolution of sulphuretted hydrogen at	410° F.	none at 437° F.
Softening-point . . .	160° F.	,, 113° F.
Flowing-point	192° F.	,, 150° F.

Asphalt in its purest forms is generally black or blackish brown in colour, and is frequently brittle at ordinary temperatures. Apart from its principal use in the manufacture of paving materials, it is largely employed in building as a "damp-course" and as a water-excluding coating for concrete floors, as well as in the manufacture of roofing-felt. It also enters largely into the composition of black varnish. The material chiefly used in the construction of asphalt roadways is an asphaltic or bituminous limestone found in the Val de Travers, canton of Neuchâtel; in the neighbourhood of Seyssel, department of Ain; at Limmer, near the city of Hanover; and elsewhere. The proportion of bitumen present in asphalt rock usually ranges from 7 to 20%, but it is found that rock containing more than 11% cannot be satisfactorily used for street pavements, and it is accordingly customary to mix the richer and poorer varieties in fine powder in such respective quantities that the proportion of bitumen present is from 9 to 10%. The richer rock is utilized as a source of asphalt "mastic," which is employed for footpaths, floors, roofs, &c. Excellent foundations for steam-hammers, dynamos and high-speed engines are made of asphaltic concrete. (B. R.)

ASPHODEL (*Asphodelus*), a genus of the lily order (Liliaceae), containing seven species in the Mediterranean region. The plants are hardy herbaceous perennials with narrow tufted radical leaves and an elongated stem bearing a handsome spike of white or yellow flowers. *Asphodelus albus* and *A. fistulosus* have white flowers and grow from 1½ to 2 ft. high; *A. ramosus* is a larger plant, the large white flowers of which have a reddish-brown line in the middle of each segment. Bog-asphodel (*Narthecium ossifragum*), a member of the same family, is a small herb common in boggy places in Britain, with rigid narrow radical leaves and a stem bearing a raceme of small golden yellow flowers.

In Greek legend the asphodel is the most famous of the plants connected with the dead and the underworld. Homer describes it as covering the great meadow (ἀσφόδελος λειμών), the haunt of the dead (*Od.* xi. 539, 573; xxiv. 13). It was planted on graves, and is often connected with Persephone, who appears crowned with a garland of asphodels. Its general connexion with death is due no doubt to the greyish colour of its leaves and its yellowish flowers, which suggest the gloom of the underworld and the pallor of death. The roots were eaten by the poorer Greeks; hence such food was thought good enough for the shades (cf. Hesiod, *Works and Days*, 41; Pliny, *Nat. Hist.* xxi. 17 [68]; Lucian, *De luctu*, 19). The asphodel was also supposed to be a remedy for poisonous snake-bites and a specific against sorcery; it was fatal to mice, but preserved pigs from disease. The Libyan nomads made their huts of asphodel stalks (cf. Herod. iv. 190).

No satisfactory derivation of the word is suggested. The English word "daffodil" is a perversion of "asphodel," formerly written "affodil." The *d* may come from the French *fleur d'affodille.* It is no part of the word philologically.

See Pauly-Wissowa, *Realencyclopädie*, s.v.; H. O. Lenz, *Botanik der alten Griechen und Römer* (1859); J. Murr, *Die Pflanzenwelt in der griechischen Mythologie* (1890).

ASPHYXIA (Gr. ἀ- priv., σφύξις, a pulse), a term in medicine, literally signifying loss of pulsation, which is applied to describe the arrestment of the function of respiration from some hindrance to the entrance of air into the lungs. (See RESPIRATORY SYSTEM: *Pathology.*)

ASPIC (French, from Lat. *aspis*), an asp or viper found in Egypt whose bite is supposed to cause a swift and easy death, hence poetically a term for any venomous snake. From association, perhaps, with the coldness of the aspic (as in the French proverb, *froid comme un aspic*), the word is used for a savoury jelly containing meat, fish or eggs, &c. It is also the botanical name of the *Lavandula spica*, or spikenard, from which a white, aromatic and highly inflammable oil is distilled, called *huile d'aspic.*

ASPIDISTRA, a small genus of the lily order (Liliaceae), native of the Himalayas, China and Japan. *Aspidistra lurida* is a favourite pot-plant, bearing large green or white-striped leaves on an underground stem, and small dark purplish, cup-shaped flowers close to the ground.

ASPIROTRICHACEAE (O. Bütschli), an order of Ciliate Infusoria, characterized by an investment, general or partial, of nearly uniform cilia, without any distinct adoral wreath, and one or two adoral endoral undulating membranes. With the Gymnostomaceae it formed the Holotricha of Stein.

ASPIROZ, MANUEL DE (1836–1905), Mexican statesman and diplomatist, was born at Puebla, and educated at the university of Mexico, where he took his degree in 1855. He took part in the war against the emperor Maximilian, and in 1867, on the establishment of the republic, was appointed assistant secretary of state for foreign affairs. In 1873 he became Mexican consul at San Francisco, where he remained till his election to the Senate in 1875. He was professor of jurisprudence at the college of Puebla from 1883 to 1890, when he was again appointed assistant secretary of foreign affairs. From 1899 till he died in 1905 he was Mexican ambassador to the United States. Among his writings may be mentioned; *Código de extranjeria de los Estados-Unidos Mexicanos* (1876), and *La liberdad civil como base del derecho internacional privado* (1896).

ASPROMONTE, a mountain of Calabria, Italy, rising behind Reggio di Calabria, the west extremity of the Sila range. The highest point is 6420 ft. and the slopes are clad with forest. Here Garibaldi was wounded and taken prisoner by the Italian troops under Pallavicini in 1862.

ASQUITH, HERBERT HENRY (1852–), English statesman, son of Joseph Dixon Asquith, was born at Morley, Yorkshire, on the 12th of September 1852. He came of a middle-class Yorkshire family of pronounced Liberal and Nonconformist views, and was educated under Dr Edwin Abbott at the City of London school, from which he went as a scholar to Balliol, Oxford; there he had a distinguished career, taking a first-class in classics, winning the Craven scholarship and being elected a fellow of his college. He was president of the Union, and impressed all his contemporaries with his intellectual ability, Dr Jowett himself confidently predicting his signal success in any career he adopted. On leaving Oxford he went to the bar, and as early as 1890 became a K.C. In 1887 he unsuccessfully defended Mr R. B. Cunninghame Graham and Mr John Burns for their share in the riot in Trafalgar Square; and in 1889 he was junior to Sir Charles (afterwards Lord) Russell as counsel for the Irish Nationalists before the Parnell Commission—an association afterwards bitterly commented upon by Mr T. Healy in the House of Commons (March 30, 1908). But though he attained a fair practice at the bar, and was recognized as a lawyer of unusual mental distinction and clarity, his forensic success was not nearly so conspicuous as that of some of his contemporaries. His ambitions lay rather in the direction of the House of Commons. He had taken a prominent part in politics as a Liberal since his university days, especially in work for the Eighty Club, and in 1886 was elected member of parliament for East Fife, a seat which he retained in subsequent elections. Mr Gladstone was attracted by his vigorous ability as a speaker, and his evidence of sound political judgment; and in August 1892, though comparatively unknown to the general public, he was selected to move the vote of want of confidence which overthrew Lord Salisbury's government, and was made home secretary in the new Liberal ministry. At the Home Office he proved his capacity as an administrator; he was the first to appoint women as factory inspectors, and he was responsible for opening Trafalgar Square to Labour demonstrations; but he firmly refused to sanction the proposed amnesty for the dynamiters, and he was violently abused by extremists on account of the shooting of two men by the military at the strike riot at Featherstone in August 1893. It was he who coined the phrase (Birmingham, 1894) as to the government's "ploughing the sands" in their endeavour to pass Liberal legislation with a hostile House of Lords. His Employers' Liability Bill 1893 was lost because the government refused to accept the Lords' amendment as to "contracting-out." His suspensory bill, with a view to the disestablishment of the church in Wales, was abortive (1895), but it served to recommend him to the Welsh Nationalists as well as to the disestablishment party in England and Scotland. During his three years of office he more than confirmed the high opinion formed of his abilities.

The Liberal defeat in 1895 left him out of office for eleven years. He had married Miss Helen Melland in 1877, and was left with a family when she died in 1891; in 1894, however, he had married again, his second wife being the accomplished Miss Margaret ("Margot") Tennant, daughter of the wealthy ironmaster, Sir Charles Tennant, Bart., a lady well known in London society as a member of the côterie known as "Souls," and commonly identified as the original of Mr E. F. Benson's *Dodo* (1893). On leaving the Home Office in 1895, Mr Asquith decided to return to his work at the bar, a course which excited much comment, since it was unprecedented that a minister who had exercised judicial functions in that capacity should take up again the position of an advocate; but it was obvious that to maintain the tradition was difficult in the case of a man who had no sufficient independent means. During the years of Unionist ascendancy Mr Asquith divided his energies between his legal work and politics; but his adhesion to Lord Rosebery (*q.v.*) as a Liberal Imperialist at the time of the Boer War, while it strengthened his position in the eyes of the public, put him in some difficulty with his own party, led as it was by Sir Henry Campbell-Bannerman (*q.v.*), who was identified with the "pro-Boer" policy. He was one of the founders of the Liberal League, and his courageous definiteness of view and intellectual vigour marked him out as Lord Rosebery's chief lieutenant if that statesman should ever return to power. He thus became identified with the Roseberyite attitude towards Irish Home Rule; and, while he continued to uphold the Gladstonian policy in theory, in practice the Irish Nationalists felt that very little could be expected from his advocacy. In spite of his Imperialist views, however, he did much to smooth over the party difficulties, and when the tariff-reform movement began in 1903, he seized the opportunity for rallying the Liberals to the banner of free-trade and championing the "orthodox" English political economy, on which indeed he had been a lecturer in his younger days. During the critical years of Mr Chamberlain's crusade (1903–1906) he made himself the chief spokesman of the Liberal party, delivering a series of speeches in answer to those of the tariff-reform leader; and his persistent following and answering of Mr Chamberlain had undoubted effect. He also made useful party capital out of the necessity for financial retrenchment, owing to the large increase in public expenditure, maintained by the Unionist government even after the Boer War was over;

and his mastery of statistical detail and argument made his appointment as chancellor of the exchequer part of the natural order of things when in December 1905 Mr Balfour resigned and Sir Henry Campbell-Bannerman (*q.v.*) became prime minister.

During Sir Henry Campbell-Bannerman's premiership, Mr Asquith gradually rose in political importance, and in 1907 the prime minister's ill-health resulted in much of the leadership in the Commons devolving on the chancellor of the exchequer. At first the party as a whole had regarded him somewhat coldly. And his unbending common-sense, and sobriety of criticism in matters which deeply interested the less academic Radicals who were enthusiasts for extreme courses, would have made the parliamentary situation difficult but for the exceptional popularity of the prime minister. In the autumn of 1907, however, as the latter's retention of office became more and more improbable, it became evident that no other possible successor had equal qualifications. The session of 1908 opened with Mr Asquith acting avowedly as the prime minister's deputy, and the course of business was itself of a nature to emphasize his claims. After two rather humdrum budgets he was pledged to inaugurate a system of old-age pensions (forming the chief feature of the budget of 1908, personally introduced by him at the beginning of May), and his speech in April on the Licensing Bill was a triumph of clear exposition, though later in the year, after passing the Commons, it was thrown out by the Lords. On the 5th of April it was announced that Sir Henry Campbell-Bannerman had resigned and Mr Asquith been sent for by the king. As the latter was staying at Biarritz, the unprecedented course was followed of Mr Asquith journeying there for the purpose, and on the 8th he resigned the chancellorship of the exchequer and kissed hands as prime minister. The names of the new cabinet were announced on the 13th. The new appointments were: Lord Tweedmouth as lord president of the council (instead of the admiralty); Lord Crewe as colonial secretary (instead of lord president of the council); Mr D. Lloyd George, chancellor of the exchequer (transferred from the Board of Trade); Mr R. McKenna, first lord of the admiralty (instead of minister of education); Mr Winston Churchill, president of the Board of Trade; and Mr Walter Runciman, minister of education. Lord Elgin ceased to be colonial secretary, but Lord Loreburn (lord chancellor), Lord Ripon (lord privy seal), Mr H. Gladstone (Home Office), Sir E. Grey (foreign affairs), Mr Haldane (War Office), Mr Sinclair (secretary for Scotland; created in 1909 Lord Pentland), Mr Burns (Local Government Board), Lord Carrington (Board of Agriculture), Mr Birrell (Irish secretary), Mr S. Buxton (postmaster-general), Mr L. Harcourt (commissioner of works), Mr John Morley (India) and Sir Henry Fowler (duchy of Lancaster) retained their offices, the two latter being created peers. The Budget (see Lloyd George) was the sole feature of political interest in 1909, and its rejection in December by the Lords led to the general election of January 1910, which left the Liberals and Unionists practically equal, with the Labour and Irish parties dominating the situation (L. 275, U. 273, Lab. 40, I. 82). Mr Asquith was in a difficult position, but the ministry remained in office; and he had developed a concentration of forces with a view to attacking the veto of the House of Lords (see Parliament), when the death of the king in May caused a suspension of hostilities. A conference between the leaders on both sides was arranged, to discuss whether any compromise was possible, and controversy was postponed to an autumn session. (H. Ch.)

ASS (O.E. *assa*; Lat. *asinus*), a common name (the synonym "donkey" is supposed to be derived either by analogy from "monkey," or from the Christian name Duncan; cf. Neddy, Jack, Dicky, &c.) for different varieties of the sub-genus *Asinus*, belonging to the horse tribe, and especially for the domestic ass; it differs from the horse in its smaller size, long ears, the character of its tail, fur and markings, and its proverbial dulness and obstinacy. The ancient Egyptians symbolized an ignorant person by the head and ears of an ass, and the Romans thought it a bad omen to meet one. In the middle ages the Germans of Westphalia made the ass the symbol of St Thomas, the incredulous apostle; the boy who was last to enter school on St Thomas' day was called the "Ass Thomas" (Gubernatis's *Zoological Mythology*, i. 362). The foolishness and obstinacy of the ass has caused the name to be transferred metaphorically to human beings; and the fifth proposition of Book i. of Euclid is known as the *Pons Asinorum*, bridge of asses.

ASS, FEAST OF THE, formerly a festival in northern France, primarily in commemoration of the biblical flight into Egypt, and usually held on the 14th of January. A girl with a baby at her breast and seated on an ass splendidly caparisoned was led through the town to the church, and there placed at the gospel side of the altar while mass was said. The ceremony degenerated into a burlesque in which the ass of the flight became confused with Balaam's ass. So scandalous became the popular revels associated with it, that the celebration was prohibited by the church in the 15th century. (See Fools, Feast of.)

ASSAB, a bay and port on the African shore of the Red Sea, 60 m. N. of the strait of Bab-el Mandeb. Assab Bay was the first territory acquired by Italy in Africa. Bought from the sultan of Raheita in 1870, it was not occupied until 1880. (See Eritrea, and Italy: *History*.)

ASSAM, a former province of British India, which was amalgamated in 1905 with "Eastern Bengal and Assam" (*q.v.*). Area 56,243 sq. m.; pop. (1901) 6,126,343. The province of Assam lies on the N.E. border of Bengal, on the extreme frontier of the Indian empire, with Bhutan and Tibet beyond it on the N., and Burma and Manipur on the E. It comprises the valleys of the Brahmaputra and Surma rivers, together with the mountainous watershed which intervenes between them. It is situated between 24° 0′ and 28° 17′ N. lat., and between 89° 46′ and 97° 5′ E. long. It is bounded on the N. by the eastern section of the great Himalayan range, the frontier tribes from west to east being successively Bhutias, Akas, Daphlas, Miris, Abors and Mishmis; on the N.E. by the Mishmi hills, which sweep round the head of the Brahmaputra valley; on the E. by the unexplored mountains that mark the frontier of Burma, by the hills occupied by the independent Naga tribes and by the state of Manipur; on the S. by the Lushai hills, the state of Hill Tippera, and the Bengal district of Tippera; and on the W. by the Bengal districts of Mymensingh and Rangpur, the state of Kuch Behar and Jalpaiguri district.

Natural Divisions.—Assam is naturally divided into three distinct tracts, the Brahmaputra valley, the Surma valley and the hill ranges between the two. The Brahmaputra valley is an alluvial plain, about 450 m. in length, with an average breadth of 50 m., lying almost east and west. To the north is the main chain of the Himalayas, the lower ranges of which rise abruptly from the plain; to the south is the great elevated plateau or succession of plateaus known as the Assam range. The various portions of this range are called by the names of the tribes who inhabit them—the Garo, the Khasi, the Jaintia, the North Cachar and the Naga hills. The range as a whole is joined at its eastern extremity by the Patkai to the Himalayan system, and by the mountains of Manipur to the Arakan Yoma. The highest points in the range are Nokrek peak (4600 ft.) in the Garo hills, Shillong peak (6450 ft.) in the Khasi-Jaintia hills, and Japva peak (nearly 10,000 ft.) in the Naga hills. South of the range comes the third division of the province, the Surma valley, comprising the two districts of Cachar and Sylhet. The Surma valley is much smaller than the Brahmaputra valley, covering only 7506 against 24,283 sq. m.; its mean elevation is much lower and its rivers are more sluggish.

Physical Aspects.—Assam is a fertile series of valleys, with the great channel of the Brahmaputra (literally, *the Son of Brahma*) flowing down its middle, and an infinite number of tributaries and watercourses pouring into it from the mountains on either side. The Brahmaputra spreads out in a sheet of water several miles broad during the rainy season, and in its course through Assam forms a number of islands in its bed. Rising in the Tibetan plateau, far to the north of the Himalayas, and skirting round their eastern passes not far from the Yang-tsze-kiang and the great river of Cambodia, it enters Assam by a series of waterfalls and rapids, amid vast boulders and accumulations of rocks. The gorge, situated in Lakhimpur district, through which the southernmost branch of the Brahmaputra enters, has from time immemorial been held in reverence by the Hindus. It is called the Brahmakunda or Parasuramkunda; and although the journey to it is both difficult and dangerous, it is annually visited by thousands of devotees. After a rapid course westwards down the whole length of the Assam valley, the Brahmaputra turns sharply to the south, spreading itself over the alluvial districts of the Bengal delta, and, after several changes of name, ends its course of 1800 m. in the Bay of Bengal. Its first tributaries in Assam, after crossing the frontier, are the Kundil and the Digaru, flowing from the Mishmi hills on the north, and the Tengapani and Dihing, which take their rise on the Singpho hills to the south-east. Shortly afterwards it receives the Dibang, flowing from the north-east; but its principal confluent is the Dihong, which, deriving its origin, under the name of the Tsangpo, from a spot in the vicinity of the source of the Sutlej, flows in a direction precisely opposite to that river, and traversing the tableland of Tibet, at the back of the great Himalaya range, falls into the Brahmaputra in 27° 48′ N. lat., 95° 26′ E. long., after a course of nearly 1000 m. Doubts were long entertained whether the Dihong could be justly regarded as the continuation of the Tsangpo, but these were practically set at rest by the voyage of F. J. Needham in 1886. Below the confluence, the united stream flows in a south-westerly direction, forming the boundary between the districts of Lakhimpur and Darrang, situated on its northern bank, and those of Sibsagar and Nowgong on the south; and finally bisecting Kamrup, it crosses over the frontier of the province and passes into Bengal. In its course it receives on the left side the Dihing, a river having its rise at the south-eastern angle of the province; and lower down, on the opposite side, it parts with a considerable offset termed the Buri Lohit, which, however, reunites with the Brahmaputra 60 m. below the point of divergence, bearing with it the additional waters of the Subansiri, flowing from Tibet. A second offset, under the name of the Kalang river, rejoins the parent stream a short distance above the town of Gauhati. The remaining rivers are too numerous to be particularized. The streams of the south are not rapid, and have no considerable current until May or June. Among the islands formed by the intersection and confluence of the rivers is Majuli, or the Great Island, as it is called by way of pre-eminence. This island extends 55 m. in length by about 10 in breadth, and is formed by the Brahmaputra on the south-east and the Buri Lohit river on the north-west. In the upper part of the valley, towards the gorge where the Brahmaputra enters, the country is varied and picturesque, walled in on the north and east by the Himalayas, and thickly wooded from the base to the snow-line. On either bank of the Brahmaputra a long narrow strip of plain rises almost imperceptibly to the foot of the hills. Gigantic reeds and grasses occupy the low lands near the banks of the great river; expanses of fertile rice-land come next; a little higher up, dotted with villages encircled by groves of bamboos and fruit trees of great size and beauty, the dark forests succeed, covering the interior table-land and mountains. The country in the vicinity of the large rivers is flat, and impenetrable from dense tangled jungle, with the exception of some very low-lying tracts which are either permanent marshes or are covered with water during the rains. Jungle will not grow on these depressions, and they are covered either with water, reeds, high grasses or rice cultivation. On or near such open spaces are collected all the villages. As the traveller proceeds farther down the valley, the country gradually opens out into wide plains. In the western district of Kamrup the country forms one great expanse, with a few elevated tracts here and there, varying from 200 to 800 ft. in height.

Soils.—The soil is exceedingly rich and well adapted to all kinds of agricultural purposes, and for the most part is composed of a rich black loam reposing on a grey sandy clay, though occasionally it exhibits a light yellow clayey texture. The land may be divided into three great classes. The first division is composed of hills, the largest group within the valley being that of the Mikir Mountains, which stand out upon the plain. Another set of hills project into the valley at Gauhati. But these latter are rather prolongations of spurs from the Khasi chain than isolated groups belonging to the plains. The other hills are all isolated and of small extent. The second division of the lands is the well-raised part of the valley whose level lies above the ordinary inundations of the Brahmaputra. The channels of some of the hill streams, however, are of so little depth that the highest lands in their neighbourhood are liable to sudden floods. On the north bank of the great river, lands of this sort run down the whole length of the valley, except where they are interrupted by the beds of the hill streams. The breadth of these plains is in some places very trifling, whilst in others they comprise a tract of many miles, according to the number and the height of the rocks or hills that protect them from the aberrations of the river. The alluvial deposits of the Brahmaputra and of its tributary streams may be considered as the third general division of lands in Assam. These lands are very extensive, and present every degree of fertility and elevation, from the vast *chars* of pure sand, subject to annual inundations, to the firm islands, so raised by drift-sand and the accumulated remains of rank vegetable matter, as no longer to be liable to flood. The rapidity with which wastes, composed entirely of sand newly washed forward by the current during floods, become converted into rich pasture is astonishing. As the freshets begin to lessen and retire into the deeper channels, the currents form natural embankments on their edges, preventing the return of a small portion of water which is thus left stagnant on the sands, and exposed to the action of the sun's rays. It slowly evaporates, leaving a thin crust of animal and vegetable matter. This is soon impregnated with the seeds of the *Saccharum spontaneum* and other grasses that have been partly brought by the winds and partly deposited by the water. Such places are frequented by numerous flocks of aquatic birds, which resort thither in search of fish and mollusca. As vegetation begins to appear, herds of wild elephants and buffaloes are attracted by the supply of food and the solitude of the newly-formed land, and in their turn contribute to manure the soil.

Geology.—Geographically the Assam hills lie in the angle between the Himalayas and the Burmese ranges, but geologically they belong to neither. The older rocks are like those of Bengal, and the newer beds show no sign of either the Himalayan or the Burmese folding—on the top of the plateau they are nearly horizontal, but along the southern margin they are bent sharply downwards in a simple monoclinal fold. The greater part of the mass is composed of gneiss and schists. The Sylhet traps near the southern margin are correlated with the Rajmahal traps of Bengal. The older rocks are overlaid unconformably by Cretaceous beds, consisting chiefly of sandstones with seams of coal, the whole series thinning rapidly towards the north and thus indicating the neighbourhood of the old shore-line. The fossils are very similar to those of the South Indian Cretaceous, but very different from those of the corresponding beds in the Nerbudda valley. The overlying Tertiary series includes nummulitic beds and valuable seams of coal.

The border ranges of the east and south of Assam belong to the Burmese system of mountain chains (see BURMA), and consist largely of Tertiary beds, including the great coal seams of Upper Assam. The Assam valley is covered by the alluvial deposits of the Brahmaputra.

Of the mineral productions by far the most valuable is coal. Compared with the Gondwana coal of the peninsula of India the Tertiary coal seams of Assam are remarkable for their purity and their extraordinary thickness. The "Thick Seam" of Margherita, in Upper Assam, averages 50 ft., and in some places reaches as much as 80 ft. The average percentage of ash in 27 assays of Assam coal was 3·8 as against 16·3 in 17 assays of Raniganj coal. The coal seams are commonly associated with petroleum springs. Gold is found in the alluvial deposits, but the results of exploration have not been very promising.

Earthquakes.—Assam is liable to earthquakes. There was a severe earthquake in Cachar on the 10th of January 1869, a severe shock in Shillong and Gauhati in September 1875, and one in Silchar in October 1882; but by far the severest shock known is that which occurred on the evening of 12th June 1897. The area of this seismic disturbance extended over north-eastern India, from Manipur to Sikkim; but the focus was in the Khasi and Garo hills. In the station of Shillong every masonry building was levelled to the ground. Throughout the country bridges were shattered, roads were broken up like ploughed fields, and the beds of rivers were dislocated. In the hills there were terrible landslips, which wrecked the little Cherrapunji railway and caused 600 deaths. The total mortality recorded was 1542, including two Europeans at Shillong. The levels of the country were so affected that the towns of Goalpara and Barpeta became almost uninhabitable during the rains.

Fauna.—The zoology of Assam presents some interesting features. Wild elephants abound and commit many depredations, entering villages in large herds, and consuming everything suitable to their tastes. Many are caught by means of female elephants previously tamed, and trained to decoy males into the snares prepared for subjecting them to captivity. A considerable number are tamed and exported from Assam every year. Many are killed every year in the forests for the sake of the ivory which they furnish. The government *keddah* establishment from Dacca captures large numbers of elephants in the province, and the right of hunting is also sold by auction to private bidders. The annual catch of the latter averages about two hundred. The rhinoceros is found in the denser parts of the forests and generally in swampy places. This animal is hunted and killed for its skin and its horn. The skin affords the material for the best shields. The horn is sacred in the eyes of the natives. Contrary to the usual belief, it is stated that, if caught young, the rhinoceros is easily tamed and becomes strongly attached to his keeper. Tigers abound, and though many are annually destroyed for the sake of the government reward, their numbers seem scarcely, if at all, to diminish. Leopards and bears are numerous; and the sand-badger, the *Arctonyx collaris* of Cuvier, a small animal somewhat resembling a bear, but having the snout, eyes and tail of a hog, is found. Among the most formidable animals known is the wild buffalo or *gaur* which is of great size, strength and fierceness. The fox and the jackal exist, and the wild hog is very abundant. Goats, deer of various kinds, hares, and two or three species of antelope are found, as are monkeys in great variety. The porcupine, the squirrel, the civet cat, the ichneumon and the otter are common. The birds are too various to admit of enumeration. Wild game is plentiful; pheasants, partridges, snipe and water-fowl of many descriptions make the country a tempting field for the sportsman. Vultures and other birds of prey are met with.

Crocodiles (commonly called alligators) swarm in all parts of the Brahmaputra, and are very destructive to the fish, of which hundreds of varieties are found, and which supply a valuable article of food. The most destructive of the *ferae naturae*, as regards human life, are, however, the snakes. Of these, several poisonous species exist, including the cobra and karait (*Naja tripudians* and *Bungarus caeruleus*). The bite of a fairly-grown healthy serpent of either of these species is deadly; and it is ascertained that more deaths occur from snake-bite than from all the other wild beasts put together. Among the non-poisonous serpents the python ranks first. This is an enormous boa-constrictor of great length and weight, which drops upon his prey from the branch of a tree, or steals upon it in the thick grass. He kills his victim by rolling himself round the body till he breaks its ribs, or suffocates it by one irresistible convolution round its throat. He seldom or never attacks human beings unless in self-defence, and loss of life from this cause is scarcely ever reported.

Agriculture.—The principal and almost the only food-grain of the plains portion of the province is rice. The production of this staple is carried on generally under the same conditions as in Bengal; but the times of sowing and reaping and the names given to the several crops vary much in different parts of the province. In 1901–1902 out of a total cultivated area of 1,736,000 acres, there were 1,194,000 acres under rice. In addition jute is grown to a considerable extent in Goalpara and Sylhet; cotton is grown in large quantities along the slopes of the Assam range. Rubber is grown in government plantations and is also brought in by the hill tribes; while lac, mustard and potatoes are also produced.

Tea Plantations.—The most important article of commerce produced in Assam is tea. The rice crop covers a very great proportion of the cultivated land, but it is used for local consumption, and the Brahmaputra valley does not produce enough for its own consumption, large quantities being imported for the coolies. The tea plantations are the one great source of wealth to the province, and the necessities of tea cultivation are the chief stimulants to the development of Assam. The plant was discovered in 1823 by Mr Robert Bruce, who had proceeded thither on a mercantile exploration. The country, however, then formed part of the Burmese dominions. But war with this monarchy shortly afterwards broke out, and a brother of the first discoverer, happening to be appointed to the command of a division of gunboats employed in some part of the operations, followed up the pursuit of the subject, and obtained several hundred plants and a considerable quantity of seed. Some specimens were ultimately forwarded to the superintendent of the botanic garden at Calcutta. In 1832 Captain F. Jenkins was deputed by the governor-general of India, Lord William Bentinck, to report upon the resources of the country, and the tea plant was brought to his especial notice by Mr Bruce; in 1834 a minute was recorded by the governor-general on the subject, in which it is stated that his attention had been called to it in 1827 before his departure from England. In accordance with the views of that minute, a committee was appointed to prosecute inquiries, and to promote the cultivation of the plant. Communications were opened with China with a view to obtain fresh plants and seeds, and a deputation, composed of gentlemen versed in botanical studies, was despatched to Assam. Some seeds were obtained from China; but they proved to be of small importance, as it was clearly ascertained by the members of the Assam deputation that both the black and the green tea plants were indigenous here, and might be multiplied to any extent; another result of the Chinese mission, that of procuring persons skilled in the cultivation and manufacture of black tea, was of more material benefit. Subsequently, under Lord Auckland, a further supply of Chinese cultivators and manufacturers was obtained—men well acquainted with the processes necessary for the production of green tea, as the former set were with those requisite for black. In 1838 the first twelve chests of tea from Assam were received in England. They had been injured in some degree on the passage, but on samples being submitted to brokers, and others of long experience and tried judgment, the reports were highly favourable. It was never, however, the intention of government to carry on the trade, but to resign it to private adventure as soon as the experimental course could be fairly completed. Mercantile associations for the culture and manufacture of tea in Assam began to be formed as early as 1839; and in 1849 the government disposed of their establishment, and relinquished the manufacture to the ordinary operation of commercial enterprise. In 1851 the crop of the principal company was estimated to produce 280,000 lb. Since then the enterprise has rapidly developed. Tea is now cultivated in all the plains district of the provinces. When the industry was first established, the land which was supposed to be best for the plant was hill or undulating ground; but now it has been found in the Surma valley that with good drainage the heaviest crops of tea can be raised from low-lying land, even such as formerly supported rice cultivation. At the close of the year 1905 there were 942 gardens in all, with 422,335 acres, and employing 464,912 coolies. The majority of gardens are owned by Europeans, 405,486 acres belonging to them as against 16,849 to Indians. The total out-turn for the province in 1905 was 193,556,047 lb. Between 1893 and 1898 there was a great extension of tea cultivation, with the result that the industry began to suffer from the congestion that follows over-production. Also to meet the requirements of the industry, an enormous number of coolies had to be brought into the province from other parts of India, and in recent years the supply of labour has begun to fall off, causing a rise in the cost of production. For these reasons there was a crisis in the tea industry of Assam, which was relieved to some extent by the reduction of the English duty on tea in 1906.

Tea-Garden Coolies.—The labour required on the tea gardens is almost entirely imported, as the natives of the province are too prosperous to do such work. During the decade 1891–1901, 596,856 coolies were imported, or about a tenth of the total population of the province. The importation of coolies is controlled by an elaborate system of legislation, which provides for the registration of contracts, the medical inspection of coolies during the journey, and supervision over rates of pay, &c., on the gardens. The first labour act was passed in 1863, and since then the law on the subject has been changed by successive enactments. The measure now in force is called Act VI. of 1901. Under this act the maximum term of the labour contract is fixed at four years, and a minimum monthly wage is laid down, the payment of which, however, is contingent on the completion of a daily task by the labourer. Labourers under contract deserting are liable to fine and imprisonment, and, subject to certain restrictions, may be arrested without warrant by their employers. In addition to the labourers engaged under this act, a large number are employed under contract enforceable by Act XIII. of 1859, which provides penalties for breach of the contract, but does not allow of the arrest of deserters without warrant. Neither does this act regulate in any way the terms of the contract, nor contain any special provisions for the protection of the labourer. Many labourers on the conclusion of their first engagement under Act VI. of 1901 enter into renewed contracts under Act XIII. of 1859. In 1905 there were in all 664,296 labourers, and 24,209 fresh importations, of whom 62 % chose the old act.

Railways.—The Assam-Bengal railway runs from the seaport of Chittagong to the Surma valley, and thence across the hills to Dibrugarh, at the head of the Brahmaputra valley, with a branch to Gauhati lower down the Brahmaputra. The hill section of this line was found exceedingly difficult of construction, and extensive damage was done by the earthquake of 1897; but it is now complete. This railway is financed by the government, though worked by a company, and therefore ranks as a state line. At the end of 1904 its open mileage was 576 m. There are several short lines of light railway or tramway in the province. The most important is the Dibru-Sadiya railway, at the head of the Brahmaputra valley, with a branch to the coal-fields.

Trade.—The external trade of Assam is conducted partly by steamer, partly by native boat, and to a small extent by rail. In the Brahmaputra valley steamers carry as much as 86 % of the exports, and 94% of the imports. In the Surma valley native boats carry about 43% of both. In 1904–1905 the total exports were valued at 726 lakhs of rupees. The chief items were tea, rice in the husk, oil-seeds, tea-seed, timber, coal and jute. The imports were valued at 457 lakhs of rupees. The chief items were cotton piece-goods, rice not in the husk, sugar, grain and pulse, salt, iron and steel, tobacco, cotton twist and yarn, and brass and copper. No less than two-thirds of the total trade is conducted with Calcutta. The trans-frontier trade is insignificant; and most of it is conducted with the Bengal state of Hill Tippera. The trade through Chittagong is increasing owing to the opening of the hill-section of the Assam-Bengal railway, which gives direct communication between the districts of Upper Assam and the port of Chittagong, and the incorporation of that port in the new province of Eastern Bengal and Assam.

Inhabitants.—The total population of Assam, according to the census of 1901, was 6,126,343, of whom 3,429,099 were Hindus, 1,581,317 Mahommedans and 1,068,334 Animists. The number of foreigners in the population due to immigration by the tea-garden coolies was 775,844. But in spite of this immigration the rate of increase in the population was only 5·9 % in the decade, and with the immigrants deducted 1·36 %. Amongst native-born Assamese during the decade there was a serious decrease in Nowgong and some other districts, due to *kalaazar* and other diseases. The Assamese are an interesting race, of distinct origin from the neighbouring Bengalis. A large proportion of them derive their origin from tribes who came from the Himalayan ranges, from Burma or from the Chinese frontier. The most important of these are the Ahoms or Ahams, an offshoot of the Shan race of northern Burma. They were the last conquerors of Assam before the Burmese, and they long preserved their ancient traditions, habits and institutions. Hinduism first made its encroachments among their kings and nobility. Several generations ago they gave up eating beef, and they are now completely Hinduized, except in a few remote recesses of Assam. Hinduism has also impressed its language upon the province, and the vernacular Assamese possesses a close affinity to Bengali, with the substitution of *s* for the Bengali *ch*, of a guttural *h* for the Bengali *h* or *sh*, and a few other dialectic changes. Indeed, so close was the resemblance that for a time Bengali was used as the court and official language of the province under British rule. But with the development of the country the Assamese tongue asserted its claims to be treated as a distinct vernacular, and a resolution of government (1873) re-established it as the language of official life and public business.

The Assam peasant, living in a half-populated province, and surrounded by surplus land, is indolent, good-natured and, on the whole, prosperous. He raises sufficient food for his wants with very little labour, and, with the exception of a few religious ceremonies, he has no demand made upon him for money, saving the light rental of his fields. Under the peaceful influences of British rule, he has completely lost his ancient warlike instincts, and forgotten his predatory habits. In complexion he is a shade or two fairer than the Bengali. His person is in general short and robust, but devoid of the grace and flexibility of the Hindu. A flat face, with high cheek-bones, presents a physiognomy resembling the Chinese, and suggests no idea of beauty. His hair is abundant, black, lank and coarse, but the beard is scanty, and usually plucked out, which gives him an effeminate appearance. The women form a striking contrast to the men; there is more of feminine beauty in them than is commonly seen in the women of Bengal, with a form and feature somewhat approaching the European. The habits of life of the Assamese peasantry are pre-eminently domestic. Great respect is paid to old age; when parents are no longer capable of labour they are supported by their children, and scarcely any one is allowed to become a burden to the public. They have also in general a very tender regard for their offspring, and are generous and kind to their relations. They are hospitable to people of their own caste, but to no others. The use of opium is very general.

Hill Tribes.—The hill and frontier tribes of Assam include the Nagas, Singphos, Daphlas, Miris, Khamtis, Mishmis, Abors, &c., nearly all of whom, excepting the Nagas, are found near the frontiers of Lakhimpur district. The principal of these, in point of numbers, are the Nagas, who inhabit the hills and forests along the eastern and south-eastern frontier of Assam. They reside partly in the British district of the Naga hills and partly in independent territory under the political control of the deputy-commissioner of the adjoining districts. They cultivate rice, cotton, yams and Indian corn, and prepare salt from the brine springs in their hills. The different tribes of Nagas are independent of and unconnected with one another, and are often at war with each other. The Singphos are another of the main population of the same race, who occupy in force the hilly country between the Patkai and Chindwin rivers, and are nominally subject to Burma. The Akas, Daphlas, Miris, Abors, Mishmis and Khamtis are described under separate headings. Under regulation V. of 1873, an inner line has been laid down in certain districts, up to which the protection of British authority is guaranteed, and beyond which, except by special permission, it is not lawful for British subjects to go. This inner line has been laid down in Darrang towards the Bhutias, Akas and Daphlas; in Lakhimper towards the Daphlas, Miris, Abors, Mishmis, Khamtis, Singphos and Nagas; and in Sibsagar towards the Nagas. The inner line formerly maintained along the Lushai border has since 1895 been allowed to fall into desuetude, but Lushais visiting Cachar are required to take out passes from the superintendent of the Lushai hills. The line is marked at intervals by frontier posts held by military police and commanding the roads of access to the tract beyond; and any person from the plains who has received permission to cross the line has to present his pass at these posts.

History.—Assam was the province of Bengal which remained most stubbornly outside the limits of the Mogul empire and of the Mahommedan polity in India. Indeed, although frequently overrun by Mussulman armies, and its western districts annexed to the Mahommedan vice-royalty of Bengal, the province maintained an uncertain independence till its invasion by the Burmese towards the end of the 18th century, and its final cession to the British in 1826. It seems to have been originally included, along with the greater part of north-eastern Bengal, in the old Hindu territory of Kamrup. Its early legends point to great religious revolutions between the rival rites of Krishna and Siva as a source of dynastic changes. Its roll of kings extends deep into pre-historic times, but the first rajah capable of indentification flourished about the year 76 A.D. Kamrup, the Pragjotishpur of the ancient Hindus, was the capital of a legendary king Narak, whose son Bhagadatta distinguished himself in the great war of the *Mahābhārata*.

When Hsüan Tsang visited the country in A.D. 640, a prince named Kumar Bhaskara Barman was on the throne. The people are described as being of small stature with dark yellow complexions; they were fierce in appearance, but upright and studious. Hinduism was the state religion, and the number of Buddhists was very small. The soil was deep and fertile, and the towns were surrounded by moats with water brought from rivers or banked-up lakes. Subsequently we read of Pal rulers in Assam. It is supposed that these kings were Buddhist and belonged to the Pal dynasty of Bengal. Although the whole of Kamrup appears from time to time to have been united into one kingdom under some unusually powerful monarch, it was more often split up into numerous petty states; and for several centuries the Koch, the Ahom and the Chutia powers contested for the Assam valley. In the early part of the 13th century the Ahoms or Ahams, from northern Burma and the Chinese frontiers, poured into the eastern districts of Assam, founded a kingdom, and held it firmly for several centuries. The Ahoms were Shans from the ancient Shan kingdom of Pong. Their manners, customs, religion and language were, and for a long time continued to be, different from those of the Hindus; but they found themselves compelled to respect the superior civilization of this race, and slowly adopted its customs and language. The conversion of their king Chuchengpha to Hinduism took place in the year A.D. 1655, and all the Ahoms of Assam gradually followed his example. In medieval history, the Assamese were known to the Mussulman population as a warlike, predatory race, who sailed down the Brahmaputra in fleets of innumerable canoes, plundered the rich districts of the delta, and retired in safety to their forests and swamps. As the Mahommedan power consolidated itself in Bengal, repeated expeditions were sent out against these river pirates of the north-east. The physical difficulties which an invading force had to contend with in Assam, however, prevented anything like a regular subjugation of the country; and after repeated efforts, the Mussulmans contented themselves with occupying the western districts at the mouth of the Assam valley. The following details will suffice for the history of a struggle in which no great political object was attained, and which left the Assamese still the same wild and piratical people as when their fleets of canoes first sallied forth against the Bengal delta. In 1638, during the reign of the emperor Shah Jahan, the Assamese descended the Brahmaputra, and pillaged the country round the city of Dacca; they were expelled by the governor of Bengal, who retaliated upon the plunderers by ravaging Assam. During the civil wars between the sons of Shah Jahan, the king of Assam renewed his predatory incursions into Bengal; upon the termination of the contest, Aurangzeb determined to avenge these repeated insults, and despatched a considerable force for the regular invasion of the Assamese territory (1660–1662). His general, Mir Jumla, defeated the rajah, who fled to the mountains, and most of the chiefs made their submission to the conqueror. But the rains set in with unusual violence, and Mir Jumla's army was almost annihilated by famine and sickness. Thus terminated the last expedition against Assam by the Mahommedans, whose fortunes in this country were never prosperous. A writer of the Mahommedan faith says:—"Whenever an invading army has entered their territories, the Assamese have sheltered themselves in strong posts, and have distressed the enemy by stratagems, surprises and alarms, and by cutting off their provisions. If these means failed, they have declined a battle in the field, but have carried the peasants into the mountains, burned the grain and left the country desert. But when the rainy season has set in upon the advancing enemy, they have watched their opportunity to make excursions and vent their rage; the famished invaders have either become their prisoners or been put to death. In this manner powerful and numerous armies have been sunk in that whirlpool of destruction, and not a soul has escaped." The same writer states that the country was spacious, populous and hard to be penetrated; that it abounded in dangers; that the paths and roads were beset with difficulties; and that the obstacles to conquest were more than could be expressed. The inhabitants, he says, were enterprising, well-armed and always prepared for battle. Moreover, they had lofty forts, numerously garrisoned and plentifully provided with warlike stores; and the approach to them was opposed by thick and dangerous jungles, and broad and boisterous rivers. The difficulties in the way of successful invasion are of course not understated, as it was the object of the writer to exalt the prowess and perseverance of the faithful. He accounts for their temporary success by recording that "the Mussulman hordes experienced the comfort of fighting for their religion, and the blessings of it reverted to the sovereignty of his just and pious majesty." The short-lived triumph of the Mussulmans might, however, have warranted a less ambitious tone. About the middle of the 17th century the chief became a convert to Hinduism. By what mode the conversion was effected does not clearly appear, but whatever were the means employed, it seems that the decline of the country commenced about the same period. Internal dissensions, invasion and disturbances of every kind convulsed the province, and neither prince nor people enjoyed security. Late in the 18th century some interference took place on the part of the British government, then conducted by Lord Cornwallis; but the successor of that nobleman, Sir John Shore, adopting the non-intervention policy, withdrew the British force, and abandoned the country to its fate. Its condition encouraged the Burmese to depose the rajah, and to make Assam a dependency of Ava. The extension of their encroachments on a portion of the territory of the East India Company compelled the British government to take decisive steps for its own protection. Hence arose the series of hostilities with Ava known in Indian history as the first Burmese War, on the termination of which by treaty in February 1826, Assam remained a British possession. In 1832 that portion of the province denominated Upper Assam was formed into an independent native state, and conferred upon Purandhar Singh, the ex-rajah of the country; but the administration of this chief proved unsatisfactory, and in 1838 his principality was reunited with the British dominions. After a period of successful administration and internal development, under the lieutenant-governor of Bengal, it was erected into a separate chief-commissionership in 1874.

In 1886 the eastern Dwars were annexed from Bhutan; and in 1874 the district of Goalpara, the eastern Dwars and the Garo hills were incorporated in Assam. In 1898 the southern Lushai hills were transferred from Bengal to Assam, and the north and south Lushai hills were amalgamated as a district of Assam, and placed under the superintendent of the Lushai hills. Frontier troubles occasionally occur with the Akas, Daphlas, Abors and Mishmis along the northern border, arising out of raids from the independent territory into British districts. In October 1905 the whole province of Assam was incorporated in the new province of Eastern Bengal and Assam.

[1] See E. A. Gait, *The History of Assam* (1906).

ASSAMESE, the Indo-Aryan language spoken in the Assam valley. In 1901 the number of its speakers was 1,350,846. It is closely related to Bengali and Oriya, forming with them and with Bihari the Eastern Group of the Indo-Aryan vernaculars. For further particulars see Bengali.

ASSAROTTI, OTTAVIO GIOVANNI BATTISTA (1753–1829), the founder of schools for the education of deaf-mutes in Italy, was born at Genoa in 1753. After qualifying himself for the church, he entered the society of the Pietists, "Scuole Pie," who devoted themselves to the training of the young. His superior learning caused him to be appointed to lecture on theology to the students of the order. In 1801 he heard of the Abbé Sicard's training of deaf-mutes in Paris, and resolved to try something similar in Italy. He began with one pupil, and had by degrees collected a small number round him, when, in 1805, Napoleon, hearing of his endeavours, ordered a convent to be given him for a school-house, and funds for supporting twelve scholars to be taken from the convent revenues. This order was scarcely attended to till 1811, when it was renewed, and in the following year Assarotti, with a considerable number of pupils, took possession of the new school. Here he continued, with the exception of a short interval in 1814, till his death in 1829. A pension, which had been awarded him by the king of Sardinia, he bequeathed to his scholars.

ASSARY, or Assarion, a Roman copper coin, the "farthing" of Matthew x. 29.

ASSASSIN (properly *Hashīshīn*, from *Hashish*, the opiate made from the juice of hemp leaves), a general term for a secret murderer, originally the name of a branch of the Shiite sect (see Shiites), known as Isma'īlites, founded by Ḥassan (ibn) Ṣabbāḥ at the end of the 11th century, and from that time active in Syria and Persia until crushed in the 13th century by the Mongols under Hulaku (Hulagu) in Persia, and by the Mameluke Bibars in Syria. The father of Ḥassan Ṣabbāḥ, a native of Khorasan, and a Shiite, had been frequently compelled to profess Sunnite orthodoxy, and from prudential motives had sent his son to study under an orthodox doctor at Nishapur. Here Ḥassan made the acquaintance of Nizām-ul-Mulk, afterwards vizier of the sultan Malik-Shah (see Seljuks). During the reign of Alp-Arslan he remained in obscurity, and then appeared at the court of Malik-Shah, where he was at first kindly received by his old friend the vizier. Ḥassan, who was a man of great ability, tried to supplant him in the favour of the sultan, but was outwitted and compelled to take his departure from Persia. He went to Egypt (1078–79), and, on account of his high reputation, was received with great honour by the lodge at Cairo. He soon stood so high in the caliph Mostanṣir's favour as to excite against him the jealousy of the chief general, and a cause of open enmity soon arose. The caliph had nominated first one and then another of his sons as his successor, and in consequence a party division took place among the leading men. Ḥassan, who adopted the cause of Nizār, the eldest son, found his enemies too strong for him, and was forced to leave Egypt. After many adventures he reached Aleppo and Damascus, and after a sojourn there, settled near Kuhistan (Kohistan). He gradually spread his peculiar modification of Isma'īlite doctrine, and, having collected a considerable number of followers, formed them into a secret society. In 1090 he obtained, by stratagem, the strong mountain fortress of Alamūt in Persia, and, removing there with his followers, settled as chief of the famous society afterwards called the Assassins.

The speculative principles of this body were identical with those of the Isma'īlites, but their external policy was marked by one peculiar and distinctive feature—the employment of secret "assassination" against all enemies. This practice was introduced by Ḥassan, and formed the essential characteristic of the sect. In organization they closely resembled the western lodge at Cairo. At the head was the supreme ruler, the *Sheik-al-Jabal* (*Jebel*), *i.e.* Chief, or, as it is commonly translated, Old Man of the Mountains. Under him were three *Dā'i-al-Kirbāl*, or, as they may be called, grand priors, who ruled the three provinces over which the sheik's power extended. Next came the body of *Dā'is*, or priors, who were fully initiated into all the secret doctrines, and were the emissaries of the faith. Fourth were the *Refīqs*, associates or fellows, who were in process of initiation, and who ultimately advanced to the dignity of *dā'is*. Fifth came the most distinctive class, the *Fedais* (*i.e.* the devoted ones), who were the guards or assassins proper. These were all young men, and from their ranks were selected the agents for any deed of blood. They were kept uninitiated, and the blindest obedience was exacted from and yielded by them. When the sheik required the services of any of them, the selected *fedais* were intoxicated with the *hashīsh*. When in this state they were introduced into the splendid gardens of the sheik, and surrounded with every sensual pleasure. Such a foretaste of paradise, only to be granted by their supreme ruler, made them eager to obey his slightest command; their lives they counted as nothing, and would resign them at a word from him. Finally, the sixth and seventh orders were the *Lāsiqs*, or novices, and the common people. Hassan well knew the efficacy of established law and custom in securing the obedience of a mass of people; accordingly, upon all but the initiated, the observances of Islam were rigidly enforced. As for the initiated, they knew the worthlessness of positive religion and morality; they believed in nothing, and scoffed at the practices of the faithful.

The Assassins soon began to make their power felt. One of their first victims was Hassan's former friend, Nizam-ul-Mulk, whose son also died under the dagger of a secret murderer. The death by poison of the sultan Malik-Shah was likewise ascribed to this dreaded society, and contributed to increase their evil fame. Sultan Sinjar, his successor, made war upon them, but he was soon glad to come to terms with enemies against whose operations no precaution seemed available. After a long and prosperous rule Hassan died at an advanced age in 1124. He had previously slain both his sons, one on suspicion of having been concerned in the murder of a *dā‘i* at Kuhistan, the other for drinking wine, and he was therefore compelled to name as his successor his chief *dā‘i*, Kia-Busurg-Omid.

During the fourteen years' reign of this second leader, the Assassins were frequently unfortunate in the open field, and their castles were taken and plundered; but they acquired a stronghold in Syria, while their numerous murders made them an object of dread to the neighbouring princes, and spread abroad their evil renown. A long series of distinguished men perished under the daggers of the *fedais;* even the most sacred dignity was not spared. The caliph Mostarshid was assassinated in his tent, and not long after, the caliph Rāshid suffered a similar fate. Busurg-Omid was succeeded by his son Mahommed I., who, during the long period of twenty-five years, ruthlessly carried out his predecessor's principles. In his time Massiat became the chief seat of the Syrian branch of the society. Mahommed's abilities were not great, and the affections of the people were drawn towards his son Hassan, a youth of great learning, skilled in all the wisdom of the initiated, and popularly believed to be the promised Imam become visible on earth. The old sheik prevented any attempt at insurrection by slaying 250 of Hassan's adherents, and the son was glad to make submission. When, however, he attained the throne, he began to put his views into effect. On the 17th of the month Ramadan, 1164, he assembled the people and disclosed to them the secret doctrines of the initiated; he announced that the doctrines of Islam were now abolished, that the people might give themselves up to feasting and joy. Soon after, he announced that he was the promised Imam, the caliph of God upon earth. To substantiate these claims he gave out that he was not the son of Mahommed, but was descended from Nizār, son of the Egyptian caliph Mostansir, and a lineal descendant of Isma‘īl. After a short reign of four years Hassan was assassinated by his brother-in-law, and his son Mahommed II. succeeded. One of his first acts was to slay his father's murderer, with all his family and relatives; and his long rule, extending over a period of forty-six years, was marked by many similar deeds of cruelty. He had to contend with many powerful enemies, especially with the great Atabeg sultan Nureddīn, and his more celebrated successor, Saladin, who had gained possession of Egypt after the death of the last Fatimite caliph, and against whom even secret assassination seemed powerless. During his reign, also, the Syrian branch of the society, under their *dā‘i*, Sinan, made themselves independent, and remained so ever afterwards. It was with this Syrian branch that the Crusaders made acquaintance; and it appears to have been their emissaries who slew Count Raymund of Tripoli and Conrad of Montferrat.

Mahommed II. died from the effects of poison, administered, it is believed, by his son, Jelaleddīn Hassan III., who succeeded. He restored the old form of doctrine—secret principles for the initiated, and Islam for the people—and his general piety and orthodoxy procured for him the name of the new Mussulman. During his reign of twelve years no assassinations occurred, and he obtained a high reputation among the neighbouring princes. Like his father, he was removed by poison, and his son, ‘Ala-ed-dīn Mahommed III., a child of nine years of age, weak in mind and body, was placed on the throne. Under his rule the mild principles of his father were deserted, and a fresh course of assassination entered on. In 1255, after a reign of thirty years, ‘Ala-ed-dīn was slain, with the connivance of his son, Rukneddīn, the last ruler of the Assassins. In the following year Hulaku (Hulagu), brother of the Tatar, Mangu Khan, invaded the hill country of Persia, took Alamūt and many other castles, and captured Rukneddīn (see MONGOLS). He treated him kindly, and, at his own request, sent him under escort to Mangu. On the way, Rukneddīn treacherously incited the inhabitants of Kirdkuh to resist the Tatars. This breach of good faith was severely punished by the khan, who ordered Rukneddīn to be put to death, and sent a messenger to Hulaku (Hulagu) commanding him to slay all his captives. About 12,000 of the Assassins were massacred, and their power in Persia was completely broken. The Syrian branch flourished for some years longer, till Bibars, the Mamelūke sultan of Egypt, ravaged their country and nearly extirpated them. Small bodies of them lingered about the mountains of Syria, and are believed still to exist there. Doctrines somewhat similar to theirs are still to be met with in north Syria.

See J. von Hammer, *Geschichte der Assassinen* (1818); S. de Sacy, *Mémoires de l'Institut*, iv. (1818), who discusses the etymology fully; *Calcutta Review*, vols. lv., lvi.; A. Jourdain in Michaud's *Histoire des Croisades*, ii. pp. 465-484, and trans. of the Persian historian Mirkhond in *Notices et extraits des manuscrits*, xiii. pp. 143 sq.; cf. R. Dozy, *Essai sur l'histoire de l'Islamisme* (Leiden and Paris, 1879), ch. ix. (G. W. T.)

ASSAULT (from Lat. *ad*, to or on, and *saltare*, to leap), in English law, "an attempt or offer with force or violence to do corporal hurt to another, as by striking at another with a stick or other weapon, or without a weapon, though the party misses his aim." Notwithstanding ancient opinions to the contrary, it is now settled that mere words, be they ever so provoking, will not constitute an assault. Coupled with the attempt or threat to inflict corporal injury, there must in all cases be the means of carrying the threat into effect. A *battery* is more than a threat or attempt to injure the person of another; the injury must have been inflicted, but it makes no difference however small it may be, as the law does not "draw the line between degrees of violence," but "totally prohibits the first and lowest stage of it." Every battery includes an assault. A common assault is a misdemeanour, and is punishable by imprisonment with or without hard labour to the extent of one year, and if it occasions bodily harm, with penal servitude for three years, or imprisonment to the extent of two years, with or without hard labour. There are various different kinds of assaults which are provided against by particular enactments of parliament, such as the Offences against the Person Act 1861, the Prevention of Crimes Act 1871, &c.; and there are also certain aggravated assaults for which the punishment is severer than for common assault, as an assault with intent to murder, with intent to commit a rape, &c. In certain cases an assault and battery is sometimes justifiable, as in the case where a person in authority, as a parent or schoolmaster, inflicts moderate punishment upon a child, or in certain cases of self-defence, or in defence of one's goods and chattels. An assault may be both a tort and a crime, giving a civil action for damages to the person injured, as well as being the subject of a criminal prosecution.

United States.—The general principles applicable throughout the United States are the same as in England. Riding a horse threateningly near a person; or riding a bicycle against another (*Mercer* v. *Corbin*, 117 Indiana Rep. 450); waking one from sleep to present a milk bill (*Richmond* v. *Fiske*, 160 Mass. 34), are assaults. A minor is liable for damages for an assault (*Hildreth* v. *Hancock*, 156 Illinois Rep. 618). In Texas it has been held that an assault with a knife is not necessarily an aggravated assault (*Warren* v. *State*, 3 S.W. 240), and an axe is not necessarily a "deadly weapon" with which to assault (*Gladney* v. *State*, 12 S.W. 868), and the State must prove that it would be likely to produce death or serious bodily injury (*Melton* v. *State*, 17 S.W. 257). Neither a pistol nor brass knuckles are necessarily deadly weapons; the State must show their size or manner of use in making the assault (*Ballard* v. *State*, 13 S.W. 674; *Miles* v. *State*, 5 S.W. 250). But in 1903 a pistol was held by the Texas Supreme Court to be a deadly weapon if not used simply as a club (*Lockland* v. *State*, 73 S.W. 1054), and the same court held in 1904 that a pistol is a deadly weapon (*Pace* v. *State*, 79 S.W. 531), and so the assault was an aggravated assault. In North Carolina it has been held that an axe is *ex vi termini* a "deadly weapon" (*State* v. *Shields*, 110 N.C. 49).

ASSAYE, a village of Hyderabad or the Nizam's Dominions, in southern India, just beyond the Berar frontier. The place is celebrated as the site of a battle fought on the 23rd of September 1803 between the combined Mahratta forces under Sindhia and the rajah of Berar and the British under Major-General Wellesley, afterwards the duke of Wellington. The Mahratta force consisted of 50,000 men, supported by 100 pieces of cannon served by French artillerymen, and entrenched in a strong position. Against this the English had but a force of 4500 men, which, however, after a severe struggle, gained the most complete victory that ever crowned British valour in India. Of the enemy 12,000 were killed and wounded; and General Wellesley lost 1657—one-third of his little force—killed and wounded. Assaye is 261 m. north-west of Hyderabad.

ASSAYING. To "assay" (or "essay"; Fr. *essayer*) is in general to try, or attempt, so to make trial or test. In a restricted sense the term assaying is applied in metallurgy to the determination of the amount of gold or silver in ores or alloys; in this article, however, it will be used in a wider technical signification, and will include a description of the methods for the quantitative determination of those elements in ores which affect their value in metallurgical operations. It would be impossible to give in detail here all the precautions necessary for the successful use of the methods, and the descriptions will therefore be confined to the principles involved and the general manner in which they are applied to secure the desired results.

Gold and Silver.—Ores containing gold or silver are almost invariably assayed in the dry way; that is, by fusion with appropriate fluxes and ultimate separation of the elements in the metallic form. One of the customs which has grown out of our peculiar system of weights is the form of statement of the results of such an assay. Instead of expressing the amounts of gold and silver in percentages of the weight of ore, they are expressed in ounces to the ton, the ounce being the troy ounce and the ton that of 2000 avoirdupois pounds. To simplify calculation and to enable the assayer to use the metric system of weights employed in all chemical calculations, the "assay ton" ("A.T." = 29·166 grammes) has been devised, which bears the same relation to the ton of 2000 ℔ avoirdupois that one milligram does to the troy ounce; when one assay ton of ore is used, each milligram of gold or silver found represents one ounce to the ton.

The assay of an ore for gold or silver consists of two operations. In the first the gold or silver is made to combine or alloy with metallic lead, the other constituents of the ore being separated from the lead as slag. In the second, the lead button containing the gold or silver is cupelled and the resulting gold or silver button is weighed. The first is conducted in one of two ways, known respectively as the crucible method and the scorification method. The crucible method is generally used for ores containing gold in small amounts and for certain classes of silver ores. The amount of ore taken for assay is generally one-half "A.T.," but in very low-grade ores one, two, and sometimes even four "A.T.s" are used. In the scorification method one-tenth of an "A.T." is the amount commonly taken. While in both methods the same result is sought, the means employed are quite different. In the scorification method the ore is mixed in the scorifier (a shallow dish of burned clay) with from ten to twenty times its weight of granulated metallic lead (test lead) and a little borax glass, and heated in a muffle, the front of which is at first closed. When the lead melts and begins to oxidize, the lead oxide, or so-called litharge, combines with or dissolves the non-metallic and readily oxidizable constituents of the ore, while the gold and silver alloy with the lead. As the slag thus formed flows off to the sides of the scorifier, the assay clears and the melted metallic lead forms an "eye" in the middle. The door of the muffle is then opened and the current of air which is drawn over the scorifier rapidly oxidizes the lead, while the melted litharge gradually closes over the metal. When the "eye" has quite disappeared the door is closed and the temperature raised to make the slag very liquid. The scorifier is taken from the muffle in a pair of tongs and the contents poured into a mould, the lead forming a button in the bottom while the slag floats on top. When cold, the contents of the mould are taken out and the lead button hammered into the form of a cube, the slag, which is glassy and brittle, separating readily from the metal, which is then ready for cupellation. In the crucible method the ore is mixed with from once to twice its weight of flux, which varies in composition, but of which the following may be taken as a type:—

Sodium bicarbonate	8 parts.
Potassium carbonate	3 "
Powdered borax	4 "
Flour	1 "
Litharge	9 "

The mixture is charged into a round clay crucible from 100 mm. to 125 mm. high, and heated either in a muffle or in a crucible furnace at a gradually increasing heat for forty or fifty minutes. At the expiration of this time, when the charge should be perfectly liquid and in a tranquil state of fusion, the crucible is removed from the furnace and the contents are poured into a mould. The resulting lead button hammered into shape and carefully cleansed from slag is ready for the cupel. If the button is too large for cupellation, or if it is hard, it may be scorified either alone or mixed with test lead before cupellation. The character and amount of the flux necessarily depend upon the character of the ore, the object being to concentrate in the lead button all the gold and silver while dissolving and carrying off in the slag the other constituents of the ore. Under the most favourable conditions there is a slight loss of gold and silver in the fusion, the scorification and the cupellation, both by absorption in the slag and by actual volatilization and absorption in the cupel. In ores containing much copper, this metal is largely concentrated in the lead button, making it hard, and necessitating repeated scorifications and, in some cases, a preliminary removal of the copper by solution of the ore in nitric acid. This leaves the gold in the insoluble residue, which is filtered off, and the silver in the solution is thrown down by hydrochloric acid. The resulting precipitate of silver chloride is filtered, and the residue and the precipitate are scorified together. Ores containing much arsenic or sulphur are generally roasted at a low heat and the assay is made on the roasted material.

The process of cupellation is briefly as follows:—The gold alloy is fused with a quantity of lead, and a little silver if silver is already present. The resulting alloy, which is called the *lead button*, is then submitted to fusion on a very porous support, made of bone-ash, and called a *cupel*. The fusion being effected in a current of air, the lead oxidizes. The heat is sufficient to keep the resulting lead oxide fused, and the porous cupel has the property of absorbing melted lead oxide without taking up any of the metallic globule, exactly in the same way that blotting-paper will absorb water whilst it will not touch a globule of mercury. The heat being continued, and the current of air always passing over the surface of the melted lead button, and the lead oxide being sucked up by the cupel as fast as it is formed, the metallic globule rapidly diminishes in size until at last all the lead has been got rid of. Now, if this were the only action, little good would have been gained, for we should simply have put lead into the gold alloy, and then taken it out again; but another action goes on whilst the lead is oxidizing in the current of air. Other metals, except the silver and gold, also oxidize, and are carried by the melted litharge into the cupel. If the lead is therefore rightly proportioned to the standard of alloy, the resulting button will consist of only gold and silver, and these are separated by the operation of *parting*, which consists in boiling the alloy (after rolling it to a thin plate) in strong nitric acid, which dissolves the silver and leaves the gold as a coherent sponge. To effect this parting properly, the proportion of silver to gold should be as 3 to 1. The operation by which the alloy is brought to this standard is termed *quartation* or *inquartation*, and consists in fusing the alloy in a cupel with lead and the quantity of fine silver or fine gold necessary to bring it to the desired composition.

Lead.— The " dry " or fire assay for lead is largely used for the valuation of lead ores, although it is being gradually replaced by volumetric methods. One part of the ore is mixed with from three to five parts of a flux of the following composition:—

Potassium carbonate	40·6 %
Sodium bicarbonate	31·3 ,,
Borax	15·6 ,,
Flour	12·5 ,,

The mixture is charged into a clay crucible and heated for twenty minutes at a good red heat. When the mixture has been in a tranquil state of fusion for a few minutes it is poured into a mould. When cold, the button is hammered, cleaned carefully from slag, and weighed. The proportion is calculated from the amount of ore used, and the result is expressed in parts in a hundred or percentage of the ore. Various impurities, such as copper, antimony and sulphur, go into the lead button, so that the result is generally too high. The most accurate method for the determination of lead in ores is the gravimetric method, in which it is weighed as lead sulphate after the various impurities have been separated. Nearly all lead ores contain more or less sulphur; and as in the process of solution in nitric acid this is oxidized to sulphuric acid which unites with the lead to form the very insoluble lead sulphate, it is simpler to add sulphuric acid to convert all the lead into sulphate and then evaporate until the nitric acid is expelled. The salts of iron, copper, &c., are then dissolved in water and filtered from the insoluble silica, lead sulphate, and calcium sulphate, which are washed with dilute sulphuric acid. The insoluble matter is treated with a hot solution of alkaline ammonium acetate, which dissolves the lead sulphate, the other materials being separated by filtration. The lead sulphate, re-precipitated in the filtrate by an excess of sulphuric acid and alcohol, is then filtered on an asbestos felt in a Gooch crucible, washed with dilute sulphuric acid and alcohol, ignited, and weighed. Lead sulphate contains 68·30 % of metallic lead.

There are several volumetric methods for assaying lead ores, but the best known is that based on the precipitation of lead by ammonium molybdate in an acetic acid solution. The lead sulphate, obtained as described above and dissolved in ammonium acetate, is acidulated with acetic acid diluted with hot water and heated to boiling-point. A standardized solution of ammonium molybdate is then added from a burette. As long as the solution contains lead, the addition of the molybdate solution causes a precipitation of white lead molybdate. An excess of the precipitant is shown by a drop of the solution imparting a yellow colour to a solution of tannin, prepared by dissolving one part of tannin in 300 of water; drops of this solution are placed on a white porcelain plate, and as the precipitant is added to the lead solution a drop of the latter is removed from time to time on a glass stirring-rod and added to one of the drops on the porcelain plate. The appearance of a yellow colour shows that all the lead has been precipitated and that the solution contains an excess of molybdate. From the reading of the burette the lead is calculated. The molybdate solution should be of such a strength that 1 cc. will precipitate 0·01 gramme of lead. It is standardized by dissolving a weighed amount of lead sulphate in ammonium acetate and proceeding as described above.

Zinc.—Chemically the ores of zinc consist of the silicates, carbonates, oxides, and sulphides of zinc associated with other metals, some of which complicate the methods of assay. The most modern and the most generally accepted method is volumetric, and is based on the reaction between zinc chloride and potassium ferrocyanide, by which insoluble zinc ferrocyanide and soluble potassium chloride are formed; the presence of the slightest excess of potassium ferrocyanide is shown by a brownish tint being imparted by the solution to a drop of uranium nitrate. The ore (0·5 gramme) is digested with a mixture of potassium nitrate and nitric acid. A saturated solution of potassium chlorate in strong nitric acid is added, and the mass evaporated to dryness. It is then heated with a mixture of ammonium chloride and ammonia, filtered and washed with a hot dilute solution of the same mixture. The filtrate diluted to 200 cc. is carefully neutralized with hydrochloric acid, and excess of 6 cc. of the strong acid is added, and the solution saturated with hydrogen sulphide, which precipitates the copper and cadmium, metals which would otherwise interfere. Without filtering, the standard solution is added from a burette, and from time to time a drop of the solution is removed on the glass stirring-rod and added to a drop or two of a strong solution of uranium nitrate, previously placed on a white porcelain plate. The appearance of a brown tint in one of these tests shows the end of the reaction. When cadmium is not present the copper may be precipitated by boiling the acidulated ammoniacal solution with test lead and titrating, as before described, without removing the lead and copper from the solution. The ferrocyanide solution is standardized by dissolving 1 gramme of pure zinc in 6 cc. of hydrochloric acid, adding ammonium chloride, and titrating as before. This method is modified in practice by the character of the ores, carbonates and silicates free from sulphides being decomposed by hydrochloric acid, with the addition of a little nitric acid.

Copper.— The fire assay for copper ores was abandoned years ago and the electrolytic method took its place; this in turn is now largely replaced by volumetric methods. In the electrolytic method from 0·5 to 5 grammes of ore are treated in a flask or beaker, with a mixture of 10 cc. of nitric and 10 cc. of sulphuric acid, until thoroughly decomposed. When this liquid is cold it is diluted with cold water, heated until all the soluble salts are dissolved, transferred to a tall, narrow beaker, and diluted to about 150 cc. The electrodes are attached to a frame connected with the battery and the beaker is placed on a stool, which can be raised so that the electrodes are immersed in the liquid and reach the bottom of the beaker. The electrodes consist of two cylinders of platinum (placed one inside the other) about 75 mm. high, the smaller of the two 37 mm. and the larger 50 mm. in diameter, both pierced with 10 to 12 holes 5 mm. in diameter, evenly distributed over the surfaces to facilitate diffusion of the liquids. The surfaces of the cylinders are roughened with a sand blast to increase the areas and make the deposited metals adhere more firmly. Each cylinder has a platinum wire fused to the upper circumference to connect with a clamp from which a wire leads to the proper pole of the battery. The smaller cylinder is generally the negative electrode on which the copper is deposited. The framework carrying the clamps is arranged so that a number of determinations may be made at one time, the wires from the clamps running from a rheostat, so arranged that currents of any strength may be used simultaneously. The cylinder, having been carefully weighed, is placed in position, the beaker containing the solution is adjusted, and the current passed until all the copper is precipitated. This generally requires from two to twelve hours. The cylinders are then removed from the solution and washed with distilled water, the one holding the deposited copper being washed with alcohol, dried and weighed; the increase in weight represents the copper contents of the ore. The deposited copper should be firmly adherent and bright rosy red in colour. Silver, arsenic and cadmium, if present, are precipitated with the copper and affect the accuracy of the results; they should be removed by special methods.

Volumetric methods are more expeditious and require less apparatus. The potassium cyanide method is based on the fact that, when potassium cyanide is added to an ammoniacal solution of a salt of copper, the insoluble copper cyanide is formed, the end of the reaction being indicated by the disappearance of the blue colour of the solution. One gramme of the ore is treated in a flask with a mixture of nitric and sulphuric acids and evaporated until all the nitric acid is expelled. After cooling a little, water is added, and then a few grammes of aluminium foil free from copper. On this foil the copper in the solution is all precipitated by electrolytic action in a few minutes, and the aluminium is dissolved by the addition of an excess of sulphuric acid. Water is added, and as soon as the gangue and copper particles have settled the clear solution is decanted, and the residue washed several times in the same way. The copper is then dissolved in 5 cc. of nitric acid; if silver is present a drop or two of hydrochloric acid is added, the solution diluted to about 50 cc., and filtered. To the filtrate (or, if no silver is present, to the diluted nitric acid solution) 10 cc. of ammonia are added, and a standard solution of potassium cyanide is run in from a burette until the blue colour has nearly disappeared. The solution is filtered to get rid of the precipitate, and the titration is finished in the nearly clear filtrate, which should be always about 200 cc. in volume. The titration is complete when the blue colour is so faint that it is almost imperceptible after the flask has been vigorously shaken. The potassium cyanide solution is standardized by dissolving 0·5 gramme of pure copper in 5 cc. of nitric acid, diluting, adding 10 cc. of ammonia, and titrating exactly as described above.

When potassium iodide is added to a solution of cupric acetate, the reaction $(Cu(C_2H_3O_2)_2 + 2KI = CuI + 2K(C_2H_3O_2) + I$ takes place; that is, for each atom of copper one atom of iodine is liberated. If a solution of sodium thiosulphate (hyposulphite) is added to this solution, hydriodic acid, sodium iodide and tetrathionate are formed; and if a little starch solution has been added, the end of the reaction is indicated by the disappearance of the blue colour, due to the iodide of starch. The amount of iodine liberated is therefore a measure of the copper in the solution, and when the sodium thiosulphate has been carefully standardized the method is extremely accurate. The ore is treated as described in the cyanide method until the copper precipitated by the aluminium foil has been washed and dissolved in 5 cc. of nitric acid; then 0·25 gramme of potassium chlorate is added, and the solution boiled nearly dry to oxidize any arsenic present to arsenic acid. The solution is cooled, 50 cc. water added, then 5 cc. ammonia, and the solution is boiled for five minutes. Next 5 cc. of glacial acetic acid are added, the solution cooled, and 5 cc. of a solution of potassium iodide (300 grammes to the litre) and the standard solution of sodium thiosulphate run in from a burette until the brown colour has nearly disappeared. A few drops of starch solution are then added, and when the blue colour has nearly vanished a drop or two of methyl orange makes the end reaction very sharp. The thiosulphate solution is standardized by dissolving 0·3 to 0·5 gramme of pure copper in 3 cc. of nitric acid, adding 50 cc. of water and 5 cc. of ammonia, and titrating as above after the addition of 5 cc. of glacial acetic acid and 5 cc. of the potassium iodide solution.

Iron.—The methods used in the assay for iron are volumetric, and are all based on the property possessed by certain reagents of oxidizing iron from the ferrous to the ferric state. Two salts are in common use for this purpose, potassium permanganate and potassium bichromate. It is necessary in the first place, after the ore is in solution, to reduce all the iron to the ferrous condition; then the carefully standardized solution of the oxidizing reagent is added until all the iron is in the ferric state, the volume of the standard solution used being the measure of the iron contained in the ore. The end of the reaction when potassium permanganate is employed is known by the change in colour of the solution. As the solution of potassium permanganate, which is deep red in colour, is dropped into the colourless iron solution, it is quickly decolorized while the iron solution gradually assumes a yellowish tinge, the first drop of the permanganate solution in excess giving it a pink tint. With potassium bichromate solution, which is yellow, the iron solution becomes green from the chromium chloride or sulphate formed, and the end of the reaction is determined by removing a drop of the solution on the stirring-rod and adding it to a drop of a dilute solution of potassium ferricyanide on a white tile. So long as the solution contains a ferrous salt, the drop on the tile changes to blue; hence the absence of a blue coloration indicates the complete oxidation of all the ferrous salt and the end of the reaction. One gramme of ore is usually taken for assay and treated in a small flask or beaker with 10 cc. of hydrochloric acid. All the iron in the ore generally dissolves upon heating, and a white residue is left. Occasionally this residue contains a small amount of iron in a difficultly soluble form; in that case the solution is slightly diluted with water and filtered into a larger flask. The residue in the filter is ignited and fused with a little sodium carbonate and nitrate, or with sodium peroxide. The product is treated with water, filtered, and the residue dissolved in hydrochloric acid and added to the main solution. This solution, which should not exceed 50 cc. or 75 cc. in volume, contains the iron in the ferric state and is ready for reduction.

In the reduction by metallic zinc, about 3 grammes of granulated or foliated zinc are placed in the flask, which is closed with a small funnel; when the iron is reduced, add 10 cc. of sulphuric acid, and as soon as all the zinc is dissolved the solution is ready for titration. In the reduction by stannous chloride the solution of the ore in the flask is heated to boiling, and a strong solution of stannous chloride is added until the solution is completely decolorized; then 60 cc. of a solution of mercuric chloride (50 grammes to the litre) are run in and the contents of the flask poured into a dish containing 600 cc. of water and 60 cc. of a solution containing 200 grammes of manganous sulphate, 1 litre of phosphoric acid (1·3 sp. gr.), 400 cc. of sulphuric acid, and 1600 cc. of water. The solution is then ready for titration with the standard permanganate solution.

The permanganate or bichromate solution is standardized by dissolving 0·5 of a gramme of pure iron wire in a flask, in hydrochloric acid, oxidizing it with a little potassium chlorate, boiling off all traces of chlorine, deoxidizing by one of the methods described above, and titrating with the solution. As the wire always contains impurities, the absolute amount of iron in the wire must be determined and the correction made accordingly. Pure oxalic acid may also be used, which, in the presence of sulphuric acid, is oxidized by the standard solution according to the reaction:—

$$\begin{aligned}5(H_2C_2O_42H_2O)+3H_2SO_4+2KMnO_4 &= 10CO_2+2MnSO_4\\ &\quad +K_2SO_4+18H_2O\end{aligned}$$

The reaction in case of ferrous sulphate is:—

$$\begin{aligned}10FeSO_4+2KMnO_4+8H_2SO_4 &= 5Fe_2(SO_4)_3+K_2SO_4\\ &\quad +2MnSO_4+8H_2O;\end{aligned}$$

that is, the same amount of potassium permanganate is required to oxidize 5 molecules of oxalic acid that is necessary to oxidize 10 molecules of iron in the form of ferrous sulphate to ferric sulphate, or 63 parts by weight of oxalic acid equal 56 parts by weight of metallic iron. Ammonium ferrous sulphate may also be used; it contains one-seventh of its weight of iron. (A. A. B.)

ASSEGAI, or ASSAGAI (from Berber-Arab *as-zahayah*, through Portuguese *azagaia*), a weapon for throwing or hurling, a light spear or javelin made of wood and pointed with iron, particularly the spear used by the Zulu and other Kaffir tribes of South Africa. In addition to the long-handled assegai there is a shorter weapon for use at close quarters.

ASSELIJN, HANS (1610–1660), Dutch painter, was born at Diepen, near Amsterdam. He received instruction from Esaias Vandevelde (1587–1630), and distinguished himself particularly in landscape and animal painting, though his historical works and battle pieces are also admired. He travelled much in France and Italy, and modelled his style greatly after Bamboccio (Peter Laer). He was one of the first Dutch painters who introduced a fresh and clear manner of painting landscapes in the style of Claude Lorraine, and his example was speedily followed by other artists. Asselijn's pictures were in high estimation at Amsterdam, and several of them are in the museums of that city. Twenty-four, painted in Italy, were engraved.

ASSEMANI, the name of a Syrian Maronite family of famous Orientalists.

1. Joseph Simon, a Maronite of Mount Lebanon, was born in 1687. When very young he was sent to the Maronite college in Rome, and was transferred thence to the Vatican library. In 1717 he was sent to Egypt and Syria to search for valuable MSS., and returned with about 150 very choice ones. The success of this expedition induced the pope to send him again to the East in 1735, and he returned with a still more valuable collection. On his return he was made titular archbishop of Tyre and librarian of the Vatican library. He instantly began to carry into execution most extensive plans for editing and publishing the most valuable MS. treasures of the Vatican. His two great works are the *Bibliotheca Orientalis Clementino-Vaticana rec. manuscr. codd. Syr., Arab., Pers., Turc., Hebr., Samarit., Armen., Aethiop., Graec., Aegypt., Iber., et Malab., jussu et munif. Clem. XI.* (Rome, 1719–1728), 9 vols. folio, and *Ephraemi Syri opera omnia quae extant, Gr., Syr., et Lat.*, 6 vols. folio (Rome, 1737–1746). Of the *Bibliotheca* the first three vols. only were completed. The work was to have been in four parts—(1) Syrian and allied MSS., orthodox, Nestorian and Jacobite; (2) Arabian MSS., Christian and Mahommedan; (3) Coptic, Aethiopic, Persian and Turkish MSS.; and (4) Syrian and Arabian MSS. not distinctively theological; only the first part was completed, but extensive preparations were made for the others. There is a German abridgment by A. F. Pfeiffer.

2. Joseph Aloysius, brother of Joseph Simon, and professor of Oriental languages at Rome. He died in 1782. Besides aiding his brother in his literary labours, he published, in 1749–1760, *Codex Liturgicus Ecclesiae Universae in xv. libris* (this is incomplete), and *Comment. de Catholicis sive Patriarchis Chaldaeorum et Nestorianorum* (Rome, 1775).

3. Stephen Evodius, nephew of Joseph Simon and Joseph Aloysius, was the chief assistant of his uncle Joseph Simon in his work in the Vatican library. He was titular archbishop of Apamea in Syria, and held several rich prebends in Italy. His literary labours were very extensive. His two most important works were a description of certain valuable MSS. in his *Bibliothecae Mediceo-Laurentianae et Palatinae codd. manuscr. Orientalium Catalogus* (Flor. 1742), fol., and his *Acta SS. Martyrum Orientalium.* He made several translations from the Syrian, and in conjunction with his uncle he began the *Bibliothecae Apostol. Vatic. codd. manusc. Catal., in tres partes distributus.* Only three vols. were published, and the fire in the Vatican library in 1768 consumed the manuscript collections which had been prepared for the continuation of the work.

4. Simon, grandnephew of Joseph Simon, was born at Tripoli in 1752, and was professor of Oriental languages in Padua. He died in 1820. He is best known by his masterly detection of the literary imposture of Vella, which claimed to be a history of the Saracens in Syria.

ASSEMBLY, UNLAWFUL, the term used in English law for an assembly of three or more persons with intent to commit a crime by force, or to carry out a common purpose (whether lawful or unlawful), in such a manner or in such circumstances as would in the opinion of firm and rational men endanger the public peace or create fear of immediate danger to the tranquillity of the neighbourhood. In the Year Book of the third year of Henry VII.'s reign assemblies were referred to as not punishable unless *in terrorem populi domini regis.* It has been suggested (Criminal Code Commission, 1879) that legislation first became necessary at a time when it was usual for those landed proprietors who were on bad terms with one another to go to market at the head of bands of armed retainers (Statute of Northampton, 1328, 2 Edw. III. c. 3). An assembly, otherwise lawful, is not made unlawful if those who take part in it know beforehand that there will probably be organized opposition to it, and that it may cause a breach of the peace (*Beatty* v. *Gillbanks*, 1882, 9 Q. B. D. 308). All persons may, and must if called upon to do so, assist in dispersing an unlawful assembly (*Redford* v. *Birley*, 1822, 1 St. Tr. n.s. 1215; *R.* v. *Pinney*, 1831, 3 St. Tr. n.s. 11). An assembly which is lawful cannot be rendered unlawful by proclamation unless the proclamation is one authorized by statute (*R.* v. *Fursey*, 1833, 3 St. Tr. n.s. 543, 567; *R.* v. *O'Connell*, 1831, 2 St. Tr. n.s. 629, 656; see also the Prevention of Crimes [Ireland] Act 1887). Meetings for training or drilling, or military movements, are unlawful assemblies unless held under lawful authority from the crown, the lord-lieutenant, or two justices of the peace (Unlawful Drilling Act 1820, s. 11).

An unlawful assembly which has made a motion towards its common purpose is termed a *rout*, and if the unlawful assembly should proceed to carry out its purpose, *e.g.* begin to demolish a particular enclosure, it becomes a riot (*q.v.*). All three offences are misdemeanours in English law, punishable by fine and imprisonment. The common law as to unlawful assembly extends to Ireland, subject to the special legislation referred to under the title Riot. The law of Scotland includes unlawful assembly under the same head as rioting.

British Dominions Abroad.—The law of the British colonies as a general rule as to unlawful assemblies follows the common law of England. The definitions in the Criminal Codes of Canada (1892, s. 79) and Queensland (1899, s. 61) are substantially the same as the common-law definition above given. Under the Indian Penal Code (s. 141) an assembly of five or more persons is designated an unlawful assembly if the common object of the persons composing that assembly is—(1) to overawe by criminal force, or show of criminal force, the legislative or executive government of India, or the government of any presidency or any lieutenant-governor, or any public servant in the exercise of the lawful power of such public servant; (2) to resist the execution of any law or of any legal process; (3) to commit any mischief or "criminal trespass" or other offence; (4) by means of criminal force or show of criminal force to any person, to take or obtain possession of any property, or to deprive any person of the enjoyment of a right of way, or of the use of water, or other corporeal right of which he is in possession or enjoyment, or to enforce any right or supposed right; or (5) by means of criminal force or show of criminal force, to compel any person to do what he is not legally bound to do, or to omit to do what he is legally entitled to do (see Mayne, *Ind. Cr. Law*, ed. 1896, p. 480). In South Africa and Mauritius the law on this subject is derived from the Roman Dutch and French law (see Riot.)

United States.—The common-law definition of unlawful assembly is accepted in the United States subject to the special legislation of the constituent states. The New York Penal Code (s. 451) declares that whenever three or more persons being assembled attempt or threaten any act tending towards a breach of the peace or injury to person or property, or any unlawful act, such assembly is unlawful (see Bishop, *Amer. Crim. Law*, 8th ed., 1892, vol. i. s. 534, vol. ii. s. 1256).

ASSEN, the capital of the province of Drente, Holland, 16 m. by rail S. of Groningen, at the junction of the two canals which run north and south to Groningen and Meppel respectively. Pop. (1900) 11,329. It is partly surrounded by a small forest belonging to the state. Assen possesses schools (a gymnasium and burgher school), a chamber of commerce, a museum of antiquities and a court-house. Peat-cutting forms a considerable industry. Many prehistoric remains found in the neighbourhood are in the museum at Leiden. Until the 19th century Assen was a small place built round the convent in which Otto II. (of Lippe), bishop of Utrecht, was murdered after being taken prisoner at Koevorden in 1237.

ASSER, or Asserius Menevensis (d. *c.* 910), English bishop, and author of a life of Alfred the Great, was a native of the western part of Wales, and was related to Nobis, bishop of St David's. He became a monk at St David's, and having acquired some reputation for learning, he was invited by King Alfred to his court. The king met the monk at Denu (probably East or West Dean, near Seaford in Sussex), but Asser did not at once accept the invitation of Alfred, and returned to Wales to consult his colleagues. He then agreed to spend six months of each year with the king and six months in his own land; but his first stay at the royal court extended to eight months, and it is probable that the annual visit to Wales was curtailed if not altogether discontinued. It is difficult to fix the date of Asser's arrival in England, but it was probably about 885. He assisted the king in his studies, received from him the monasteries of Congresbury and Banwell, and sometime later "Exeter and its diocese in Saxonland and Cornwall." He became bishop of Sherborne before 900, and his death is recorded in the Anglo-Saxon Chronicle under the date 910, although it is possible that it occurred a year or two earlier. The scanty details of Asser's life are taken from his biography of Alfred, from which it is inferred that he was acquainted with one or two Frankish biographies, and possibly had visited the continent of Europe.

Asser's work, *Annales rerum gestarum Alfredi magni*, was written about 893, and consists of a chronicle of English history from 849 to 887, and an account of Alfred's life, largely drawn from personal knowledge, down to 887. The only manuscript of which there is any record dates from about 1000, and was destroyed by fire in 1731. From this manuscript an edition was printed in 1574 under the direction of Matthew Parker, archbishop of Canterbury; but this contained many interpolations and alterations which were copied by subsequent editors. The text has since been the subject of careful study, and the edition edited by W. H. Stevenson (Oxford, 1904) distinguishes between the original work of Asser and the later additions. Some doubt has been cast upon the authenticity of the work, especially by T. Wright in the *Biographia Britannica literaria* (London, 1842), who ascribes the life to a monk of St Neots; but the latest scholarship regards it as the work of Asser, although all the difficulties which surround the authorship have not been removed. The life was largely used by subsequent chroniclers, among others by Florence of Worcester, Simeon of Durham, Roger of Hoveden, and William of Malmesbury.

See W. H. Stevenson, Introduction to Asser's *Life of King Alfred* (Oxford, 1904); R. Pauli, Introduction to *König Aelfred* (Berlin, 1851).

ASSESSMENT, (from Lat. *assessare*, to sit beside, to judge), a term expressing either an official valuation of income or property for purposes of taxation, or the amount so determined (see TAXATION and VALUATION). It is also applied to the amount of damages fixed by a jury in a court of law (see DAMAGES).

An *assessment committee* is a statutory committee appointed under the Union Assessment Acts 1862, 1880, for the purpose of making out the valuation lists upon which the poor-law rate is based.

An *assessment policy*, in life insurance, is a policy issued at a fixed premium, the excess of which over the portion necessary to meet current claims and expenses goes to form a reserve fund which is devoted to various forms of benefit for the policy-holders. See INSURANCE and FRIENDLY SOCIETIES.

ASSESSOR (Lat. *assessare*, *assidere*, to sit by), a Roman term originally applied to a trained lawyer who sat beside a governor of a province or other magistrate, to instruct him in the administration of the laws (see Roll, *De assessoribus magistratuum Romanorum*, Leipzig, 1872). The system is still exemplified in Scotland, where it is usual in the larger towns for municipal magistrates, in the administration of their civil jurisdiction, to have the aid of professional assessors. In England, by the Judicature Act 1873, the court of appeal and the High Court may in any cause or matter call in the aid of assessors. The Patents Act 1907 makes special provision for assessors in patent and trade-mark cases. By the Supreme Court of Judicature Act 1891 the House of Lords may, in appeals in admiralty actions, call in the aid of assessors, while in the admiralty division of the High Court it is usual for the Elder Brethren of Trinity House to assist as nautical assessors. In admiralty cases in the county courts, too, the judge is frequently assisted by assessors of "nautical skill and experience" (County Court Admiralty Jurisdiction Act 1868). In the ecclesiastical courts assessors assist the bishop in proceedings under the Church Discipline Act 1840, s. 11, while under the Clergy Discipline Act 1892, s. 2, they assist the chancellor in determining questions of fact. By the Appellate Jurisdiction Act 1876, s. 14, the king in council may make rules for the attendance of archbishops and bishops as assessors in the hearing of ecclesiastical cases by the judicial committee of the privy council.

The term "assessor" is also very generally applied to persons appointed to ascertain and fix the value of rates, taxes, &c., and in this sense the word is used in the United States.

In France and in all European countries where the civil law system prevails, the term *assesseur* is applied to those assistant judges who, with a president, compose a judicial court.

In Germany an *Assessor*, or *Beisitzer*, is a member of the legal profession who has passed four years in actual practice and become qualified for the position of a judge.

ASSETS (from the O. Nor. Fr. *assetz*, mod. Fr. *assez*, "enough"), in English law, strictly the property of a debtor in the hands of his representative sufficient for the satisfaction of his creditors or legatees. Thus the property of a bankrupt is termed his assets and is the fund out of which his liabilities must be paid. All property of the debtor is assets, and it is not necessary that it should have been reduced into possession by him.

The creditors of a debtor are either secured or unsecured. A secured creditor, *e.g.* a mortgagee, has a prior claim to be paid his debt out of his security. If on realization of the security there is a balance after paying the debt, such balance becomes assets for the unsecured creditors; if there is a deficit, then the creditor becomes an unsecured creditor for such deficit. The unsecured creditors were formerly divided into creditors by specialty and by simple contract, the first being creditors secured by instrument under seal who ranked in priority to simple contract creditors. But by Hinde Palmer's Act [the Executors Act] 1869 all unsecured creditors rank alike.

Assets are divisible into legal assets and equitable assets, and the former class is again divisible into assets real and personal. These distinctions, though formerly of great importance, have now lost most of their meaning, but it is necessary briefly to describe the nature of these divisions and their consequences. The distinction between assets legal and equitable depends entirely upon the remedy open to the creditor to recover his debt and in no way upon the nature of the property from which the debt is sought to be recovered. If the creditor had to sue the executor of a debtor at law to obtain payment out of the property, that property was legal assets; but if the only remedy open to the creditor to get at the property was to bring an action in chancery for the administration of the estate, then the assets were equitable.

Legal assets, as has been said, were divided into real and personal assets. The personal assets were those which devolved *virtute officii* on the executor or administrator; such assets are since Hinde Palmer's Act available equally for specialty and simple contract creditors. The real assets consisted of those descending to the heir or devised to a devisee, and were at law only liable for specialty debts. However, by the Land Transfer Act 1897 it is provided that the real estate of a deceased shall devolve upon the executor and "shall be administered in the same manner . . . and with the same incidents as if it were personal estate." The distinction, therefore, between assets real and personal has practically ceased to exist, and only continues in regard to such property as is not included in the act, the most important of which is land held in copyhold.

The equitable assets were treated otherwise. In the eyes of equity all unsecured creditors stand upon the same footing, and a creditor suing for administration of the estate sued on behalf of himself and all other creditors of the estate, and the distinction between specialty and simple contract creditors was ignored. Land was not at law liable to satisfy simple contract creditors; but if a testator expressly charged it with payment of his debts or devised it to his executors upon trust to pay his debts, equity treated it as equitable assets and so made it available to satisfy simple contract creditors; and finally by an act of 1833 it was provided that real estate should in all cases be assets to be administered by equity for the benefit of simple contract creditors as well as creditors by specialty. It will be seen therefore that, generally speaking, all creditors have now the same remedies against the executors either at law or in equity. The only property as to which these distinctions at all survive is that not touched by the Land Transfer Act 1897.

The act of 1833 just mentioned does not, however, deal with legacies, which continue to be payable only out of personalty unless they are expressly charged upon the realty by the testator; it has been contended that the effect of the Land Transfer Act 1897 has been to alter this and make the realty assets for the purpose of paying legacies, but this view is believed to be unsound.

It is necessary for the representative so to distribute the assets that any fund primarily liable shall bear its proper burden, and that as far as possible all debts and legacies may be paid; this is said to be "marshalling the assets," and a few examples of the principal cases of marshalling will make this clear. If the personalty is exhausted in satisfying the creditors the legatees are left without a fund from which to be paid. But inasmuch as the creditor could have got paid out of the realty, as well as the personalty, it is not fair that the legatee should suffer by the creditor's choice, and he will therefore get payment from the real estate. So again if one legacy is charged upon the real estate and another is not, then if the former be paid out of the personalty the latter will stand in its place and be paid from the real estate.

Finally it shall be noticed that an insolvent estate may be administered in bankruptcy. In such a case the law of bankruptcy regulates the order in which the assets are divided among the creditors (see BANKRUPTCY), but by the Judicature Act 1875, it is provided that an insolvent estate may be administered in the chancery division, and in such a case "the same rules shall prevail and be observed as to the respective rights of secured and unsecured creditors and as to the debts and liabilities provable and as to the valuation of annuities and future and contingent liabilities respectively as may be in force for the time being under the law of bankruptcy." This clause must be construed strictly, and it is only in the three cases specifically mentioned that the rules of bankruptcy will be imported into the administration of an insolvent estate by the chancery division.

In a less strict sense, the term "assets," or "an asset," is used derivatively as a synonym for any property, or as opposed to "liabilities." Cecil Rhodes once spoke of the British flag as a "great commercial asset" in South Africa, meaning merely that the imperial connexion was a source of strength and credit.

ASSIDEANS (the Anglicized form, derived through the Greek, of the Hebrew *Ḥasidim*, "the pious"), the name of a party or sect which stood out against the Hellenization of the Jews in the 2nd century B.C. After the massacre of those who fled from the forces of Antiochus Epiphanes and would not resist on the sabbath, Mattathias (or Judas) decided to set aside the law and was joined by a company of Assideans, brave men of Israel every one, who offered themselves willingly for the law (1 Macc. ii. 42, cf. 2 Macc. viii. 1). On the appointment of Alcimus (162 B.C.), "a descendant of Aaron" as high-priest, "the Assideans were the first who sought peace" (1 Macc. vii. 13 f.); but the treacherous murder of sixty of them (*ib.* 16) threw them back into the arms of Judas. According to 2 Macc. xiv., Alcimus identified them with the whole party of the rebels, of which they were only one, though the most important, section.

See Schurer, *Geschichte des jüdischen Volkes*, i. 203; art. in *Jewish Encyclopaedia*, s.v. "Ḥasidim" (S. M. Dubnow). (J. H. A. H.)

ASSIGNATS (from Lat. *assignatus*, assigned), a form of paper-money issued in France from 1789 to 1796. Assignats were so termed, as representing land *assigned* to the holders.

The financial strait of the French government in 1789 was extreme. Coin was scarce, loans were not taken up, taxes had ceased to be productive, and the country was threatened with imminent bankruptcy. In this emergency assignats were issued to provide a substitute for a metallic currency. They were originally of the nature of mortgage bonds on the national lands. These lands consisted of the church property confiscated, on the motion of Mirabeau, by the Constituent Assembly on the 2nd of November 1789, and the crown lands, which had been taken over by the nation on the 7th of October (see FRENCH REVOLUTION).

The assignats were first to be paid to the creditors of the state. With these the creditors could purchase national land, the assignats having, for this purpose, the preference over other forms of money. If the creditor did not care to purchase land, it was supposed that he could obtain the face-value for them from those who desired land. Those assignats which were returned to the state as purchase-money were to be cancelled, and the whole issue, it was argued, would consequently disappear as the national lands were distributed.

A first issue was made of 400,000,000 francs' worth of assignats, each note being of 100 francs' value and bearing interest daily at a rate of 5%. They were to be redeemed by the product of the sales, and from certain other sources, at the rate of 120,000,000 francs in 1791, 100,000,000 francs in 1792, 80,000,000 francs in 1793 and 1794, and the surplus in 1795. The success of the issue was undoubted, and, possibly, if the assignats had been restricted, as Mirabeau at first desired, to the extent of one-half the value of the lands sold, they would not have shared the usual fate of inconvertible paper money. Mirabeau was a strenuous advocate of the assignats. "They represent," he said, "real property, the most secure of all possessions, the soil on which we tread." "There cannot be a greater error than the fear so generally prevalent as to the over-issue of assignats . . . reabsorbed progressively in the purchase of the national domains, this paper-money can never become redundant."

In 1790 the interest was reduced to 3%, and as the treasury had again become exhausted, a further issue was decided upon; it was also decreed that the assignats were to be accepted as legal tender, all public departments being instructed to receive them as the equivalent of metallic money. This second issue amounted to 800,000,000 francs and carried no interest. It was solemnly declared in the decree authorizing the issue that the maximum issue was never to exceed twelve hundred millions. This pledge, however, was soon broken, and further issues brought the total up to 3,750,000,000 francs. The consequence of these further issues was instant depreciation, and the note of 100 francs nominal value sank to less than 20 francs coin. Recourse was then had to protective legislation. The first step was to decree the penalty of six years' imprisonment against any person who should sell specie for a more considerable quantity of assignats, or who should stipulate a different price for commodities according as the payment was to be made in specie or in assignats. For the second offence the penalty was to be twenty years' imprisonment (August 1, 1793), for which the death penalty was ultimately substituted (May 10, 1794). This severe provision was, however, repealed after the fall of Robespierre. Notwithstanding these precautions, the value of assignats still declined, till the proportion to specie had become that of six to one. Then came the passing by the Convention on the 3rd of May 1793 of the absurd "maximum." The decree required all farmers and corn-dealers to declare the quantity of corn in their possession and to sell it only in recognized markets. No person was to be allowed to lay in more than one month's supply. A maximum price was fixed, above which no one was to buy or sell under severe penalties. These measures were soon stultified by further issues, and by June 1794 the total number of assignats aggregated nearly 8,000,000,000, of which only 2,464,000,000 had returned to the treasury and been destroyed. The extension of the "maximum" to all commodities only increased the confusion. Trade was paralysed and all manufacturing establishments were closed down. Attempts by the Convention to increase the value of the assignats were of no avail. Too many causes operated in favour of their depreciation: the enormous issue, the uncertainty as to their value if the Revolution should fail, the relation they bore to both specie and commodities, which retained their value and refused to be exchanged for a money of constantly diminishing purchasing power. Even between the assignats themselves there were differences. The royal assignats, which had been issued under Louis XVI., had depreciated less than the republican ones. They were worth from 8 to 15% more, a fact due to the hope that in case of a counter-revolution they would be less likely to be discredited.

The Directory was guilty of even greater abuses in dealing with the assignats. By 1796 the issues had reached the enormous figure of 45,500,000,000 francs, and even this gigantic total was swollen still more by the numerous counterfeits introduced into France from the neighbouring countries. The assignats had now become totally valueless—the abolition of the "maximum" the previous year (1795) had produced no effect, and, though, by various payments into the treasury, the total number had been reduced to about 24,000,000,000 francs, their face-value was about 30 to 1 of coin. At this value they were converted into 800,000,000 francs of land-warrants, or *mandats territoriaux*, which were to constitute a mortgage on all the lands of the republic. These *mandats* were no more successful than the assignats, and even on the day of their issue were at a discount of 82%. They had an existence of six months, and were finally received back by the state at about the seventieth part of their face-value in coin.

AUTHORITIES.—L. A. Thiers, *Histoire de la révolution française*, gives a full and graphic account of the assignats, the causes of their depreciation, &c.; J. Garnier, *Traité des Finances* (1862); J. Bresson, *Histoire financière de la France* (1829); R. Stourm, *Les Finances de l'ancien régime et de la révolution* (1885); F. A. Walker, *Money* (1891); Henry Higgs, in the *Cambridge Modern History*, vol. viii. (1904). (T. A. I.)

ASSIGNMENT, ASSIGNATION, ASSIGNEE (from Lat. *assignare*, to mark out), terms which, as derivatives of the verb "to assign," are of frequent technical use in law. To assign is to make over, and the term is generally used to express a transference by writing, in contradistinction to a transference by actual delivery. In England the usual expression is assignment, in Scotland it is assignation. The person making over is called the *assignor* or *cedent*; the recipient, the *assign* or *assignee*. An assignee may be such either *by deed*, as when a lessee assigns his lease to another, or *in law*, as when property devolves upon an executor. The law as to assignment in connexion with each particular subject, as the assignment of a chose in action, assignment in contract, of dower, of errors, of a lease, &c., will be found under the respective headings. In a colloquial sense, "assignation" means a secretly contrived meeting between lovers.

ASSINIBOIA, a name formerly applied to two districts of Canada, but not now held by any. (1) A district formed in 1835 by the Hudson's Bay Company, having in it Fort Garry at the junction of the Red and Assiniboine rivers in Rupert's Land, North America. It extended over a circular area, with a radius of 50 m. from Fort Garry. It was governed by a local council nominated by the Hudson's Bay Company. It ceased to exist when Rupert's Land was transferred to Canada in 1870. (2) A district of the North-west Territories, which was given definite existence by an act of the Dominion parliament in 1875. Assiniboia extended from the western boundary of Manitoba (99° W. in 1875, and 101° 25′ W. in 1881) to 111° W., and from 49° N. to 52° N. The name was a misnomer, as it barely touched the Assiniboine river. To the north of the district lay the district of Saskatchewan, so that when the two were united by the Dominion act of 1905, they were somewhat changed in boundaries and the name Saskatchewan was given to the new province. The derivation of Assiniboia is from two Ojibway words, *assini* meaning a stone, and the termination "to cook by roasting"; from these came a name first applied to a Dakota or Sioux tribe living on the Upper Red river; afterwards when this tribe separated from the Dakotas, its name was given to the branch of the Red river which the tribe visited, the river being known as the Assiniboine and the tribe as Assiniboin.

ASSINIBOIN ("Stone-Cookers"), a tribe of North American Indians of Siouan stock. Their name (see above) is said to refer to their method of boiling water by dropping red-hot stones into it. Their former range was between the Missouri and the middle Saskatchewan on both sides of the Canadian frontier. In 1904 there were 1234 in the United States, all on reservations in Montana; and in 1902 there were 1371 in Canada.

See *Handbook of American Indians*, ed. F. W. Hodge (Washington, 1907).

ASSISE (from the Fr., derived from Lat. *assidere*, to sit beside), a geological term for two or more beds of rock united by the occurrence of the same characteristic species or genera.

ASSISI (anc. *Asisium*), a town and episcopal see of Umbria, Italy, in the province of Perugia, 15 m. E.S.E. by rail from the town of Perugia. Pop. (1901) town, 5338; commune, 17,240. The town occupies a fine position on a mountain (1345 ft. above sea-level) with a view over the valleys of the Tiber and Topino. It is mainly famous in connexion with St Francis, who was born here in 1182, and returned to die in 1226. The Franciscan monastery and the lower and upper church of St Francis were begun immediately after his canonization in 1228, and completed in 1253, being fine specimens of Gothic architecture. The crypt was added in 1818, when the sarcophagus containing his remains was discovered. The lower church contains frescoes by Cimabue, Giotto and others, the most famous of which are those over the high altar by Giotto, illustrating the vows of the Franciscan order; while the upper church has frescoes representing scenes from the life of St Francis (probably by Giotto and his contemporaries) on the lower portion of the walls of the nave, and scenes from Old and New Testament history by pupils of Cimabue on the upper. The church of Santa Chiara (St Clare), the foundress of the Poor Clares, with its massive lateral buttresses, fine rose-window, and simple Gothic interior, was begun in 1257, four years after her death. It contains the tomb of the saint and 13th-century frescoes and pictures. Santa Maria Maggiore is also a good Gothic church. The cathedral (San Rufino) has a fine façade with three rose-windows of 1140; the interior was modernized in 1572. The town is dominated by the medieval castle (1655 ft.), built by Cardinal Albornoz (1367) and added to by Popes Pius II. and Paul III. Two miles to the east in a ravine below Monte Subasio is the hermitage *delle Carceri* (2300 ft.), partly built, partly cut out of the solid rock, given to St Francis by Benedictine monks as a place of retirement. Below the town to the south-west, close to the station, is the large pilgrimage church of Santa Maria degli Angeli, begun in 1569 by Pope Pius V., with Vignola as architect; but not completed until 1640. It contains the original oratory of St Francis and the cell in which he died. Adjacent is the garden in which the saint's thornless roses bloom in May. Half a mile outside the town to the south-east is the convent of San Damiano, erected by St Francis, of which St Clare was first abbess.

In the early middle ages Assisi was subject to the dukes of Spoleto; but in the 11th century it seems to have been independent. It became involved, however, in the disputes of Guelphs and Ghibellines, and was frequently at war with Perugia. It was sacked by Perugia and the papal troops in 1442, and even after that continued to be the prey of factions. The place is now famous as a resort of pilgrims, and is also important for the history of Italian art. The poet Metastasio was born here in 1698.

See L. Duff-Gordon, *Assisi* ("Mediaeval Towns" series, London, 1900). For ancient history see ASISIUM. (T. As.)

ASSIUT, or SIUT, capital of a province of Upper Egypt of the same name, and the largest and best-built town in the Nile Valley south of Cairo, from which it is distant 248 m. by rail. The population rose from 32,000 in 1882 to 42,000 in 1900. Assiut stands near the west bank of the Nile across which, just below the town, is a barrage, completed in 1902, consisting of an open weir, 2733 ft. long, and over 100 bays or sluices, each 16½ ft. wide, which can be opened or closed at will. At the western end of the barrage begins the Ibrahimia canal, the feeder of the Bahr Yusuf, the largest irrigation canal of Egypt. The Ibrahimia canal is skirted by a magnificent embankment planted with shady trees leading from the river to the town. There are several bazaars, baths and handsome mosques, one noted for its lofty minaret, and here the American Presbyterian mission has established a college for both sexes. Assiut is famous for its red and black pottery and for ornamental wood and ivory work, which find a ready market all over Egypt. It is one of the chief centres of the Copts. Here also is the northern terminus of the caravan route across the desert, which, passing through the Kharga oasis, goes south-west to Darfur. It is known as the Arbain, or forty days road, from the time occupied on the journey. Assiut (properly Asyūt) is the successor of the ancient Lycopolis (Eg. Siöout), capital of the 13th nome of Upper Egypt. Here were worshipped two canine gods (see ANUBIS), Ophoïs (Wepwoi) being the principal god of the city, while Anubis apparently presided over the necropolis. No ruins are visible, the mounds of the old city being for the most part hidden under modern buildings; but the slopes of the limestone hills behind it are pierced with an infinity of rock-cut tombs, some of which were large and decorated with sculptures, paintings and long inscriptions. The archaeological commission of the *Description de l'Egypte* visited them in 1799, when the walls of many of the large tombs were still almost intact; in the first half of the 19th century (and to some extent later) an immense amount of destruction was caused by blasting for stone. Three of the tombs illustrate one of the darkest periods in Egypt's history, when the princes of Siut played a leading part in the struggle between Heracleopolis and Thebes (Dyns. IX.-XI.); another, of the XIIth Dynasty, contains a remarkable inscription detailing the contracts made by the nomarch with the priests of the temples of Ophoïs and Anubis for perpetual services at his tomb (see Breasted, *Ancient Records of Egypt, Historical Documents*, vol. i. pp. 179, 258). Remains of the mummies of dogs and similar animals sacred to these deities are scattered among the debris on the hillside in abundance. Lycopolis was the birthplace of Plotinus, the founder of Neo-Platonism (A.D. 205–270). From the 4th century onwards its grottoes were the dwellings of Christian hermits, amongst whom John of Lycopolis was the most celebrated. (F. LL. G.)

ASSIZE, or ASSISE (Lat. *assidere*, to sit beside; O. Fr. *assire*, to sit, *assis*, seated), a legal term, meaning literally a "session," but in fact, as Littleton has styled it, a *nomen aequivocum*, meaning sometimes a jury, sometimes the sittings of a court, and sometimes the ordinances of a court or assembly.

It originally signified the form of trial by a jury of sixteen persons, which eventually superseded the barbarous judicial combat; this jury was named the grand assize and was sworn to determine the right of seisin of land (see EVIDENCE). The grand assize was abolished in 1833; but the term assize is still applicable to the jury in criminal causes in Scotland.

In the only sense in which the word is not now almost obsolete, assize means the periodical session of the judges of the High Court of Justice, held in the various counties of England, chiefly for the purposes of gaol delivery and trying causes at *nisi prius*. Previous to Magna Carta (1215) writs of assize had all to be tried at Westminster, or to await trial in the locality in which they had originated at the septennial circuit of the justices in eyre; but, by way of remedy for the great consequent delay and inconvenience, it was provided by this celebrated act that the assizes of *mort d'ancestor* and *novel disseisin* should be tried annually by the judges in every county. By successive enactments, the civil jurisdiction of the justices of assize was extended, and the number of their sittings increased, till at last the necessity of repairing to Westminster for judgment in civil actions was almost obviated to country litigants by an act, passed in the reign of Edward I., which provided that the writ summoning the jury to Westminster should also appoint a time and place for hearing such causes within the county of their origin. The date of the alternative summons to Westminster was always subsequent to the former date, and so timed as to fall in the vacation preceding the Westminster term; and thus "*Unless before*," or *nisi prius*, issues came to be dealt with by the judges of assize before the summons to Westminster could take effect. The *nisi prius* clause, however, was not then introduced for the first time. It occurs occasionally in writs of the reign of Henry III. The royal commissions to hold the assizes are—(1) general, (2) special. The general commission is issued twice a year to the judges of the High Court of Justice, and two judges are generally sent on each circuit. It covers commissions—(1) of oyer and terminer, by which they are empowered to deal with treasons, murders, felonies, &c. This is their largest commission; (2) of *nisi prius* (*q.v.*); (3) of gaol delivery, which requires them to try every prisoner in gaol, for whatsoever offence committed; (4) of the peace, by which all justices must be present at their county assizes, or else suffer a fine. Special commissions are granted for inquest in certain causes and crimes. See also the articles CIRCUIT; JURY.

Assizes, in the sense of ordinances or enactments of a court or council of state, as the "assize of bread and ale," the "assize of Clarendon," the "assize of arms," are important in early economic history. As early as the reign of John the observance of the *assisae venalium* was enforced, and for a period of 500 years thereafter it was considered no unimportant part of the duties of the legislature to regulate by fixed prices, for the protection of the lieges, the sale of bread, ale, fuel, &c. (see ADULTERATION). Sometimes in city charters the right to assize such articles is specially conceded. Regulations of this description were beneficial in the repression of fraud and adulteration. Assizes are sometimes used in a wider legislative connexion by early chroniclers and historians—the "assisae of the realme," *e.g.* occasionally meaning the organic laws of the country. For the "assizes of Jerusalem" see CRUSADES.

The term assize, originally applying to an assembly or court, became transferred to actions before the court or the writs by which they were instituted. The following are the more important.

Assize of darrien presentment, or last presentation, was a writ directed to the sheriff to summon an assize or jury to enquire who was the last patron that presented to a church then vacant, of which the plaintiff complained that he was deforced or unlawfully deprived by the defendant. It was abolished in 1833 and the action of *quare impedit* (*q.v.*) substituted. But by the Common Law Procedure Act 1860, no *quare impedit* can be brought, so that an action in the king's bench of the High Court was substituted for it.

Assize of *mort d'ancestor* was a writ which lay where a plaintiff complained of an "abatement" or entry upon his freehold, effected by a stranger on the death of the plaintiff's father, mother, brother, sister, uncle, aunt, &c. It was abolished in 1833.

Assize of *novel disseisin* was an action to recover lands of which the plaintiff had been "disseised" or dispossessed. It was abolished in 1833. See Pollock and Maitland, *Hist. Eng. Law*.

Assize, clerk of, an officer "who writes all things judicially done by the justices of assizes in their circuits." He has charge of the commission, and takes recognizances, records, judgments and sentences, grants certificates of conviction, draws up orders, &c. By the Clerks of Assize Act 1869 he must either have been for three years a barrister or solicitor in actual practice, or have acted for three years in the capacity of subordinate officer of a clerk of assize on circuit.

United States.—There are no assize courts in the United States; it is not the custom for supreme court judges of the states to go on circuit, but the judges of the United States Supreme Court do sit as members of the United States circuit courts in the several states periodically throughout the year. These courts are not assize courts, but are federal as distinguished from state courts, and have a special and limited jurisdiction. In the several states the highest court is divided into departments, in each of which there are courts presided over by supreme court judges residing in that department, thus avoiding the assize court or circuit-going system.

ASSMANNSHAUSEN, a village of Germany, in the Prussian province of Hesse-Nassau, on the right bank of the Rhine and the railway from Frankfort-on-Main to Niederlahnstein. Pop. 1100. It has a lithium spring, baths and a *Kurhaus*, and is famed for its red wine (*Assmannshäuser*), which resembles light Burgundy. From here a railway ascends the Niederwald.

ASSOCIATE (Lat. *associatus*, from *ad*, to, and *sociare* to join), one who is united with another, and so generally a companion. in particular a subordinate member of an institution or society, as an associate of the Royal Academy, or one holding a degree in a learned society lower than that of fellow. In English law the associates are officers of the supreme court, whose duties are to draw up the list of causes, enter verdicts, hand the records to the parties, &c., and generally to conduct the business of trials. By the Judicature (Officers) Act 1879 they were styled masters of the supreme court, but the office is now amalgamated with the crown office department, of which they are clerks.

ASSOCIATION OF IDEAS, or Mental Association, a term used in psychology to express the conditions under which representations arise in consciousness, and also for a principle put forward by an important historical school of thinkers to account generally for the facts of mental life. Modern physiological psychology has so altered the approach to this subject that much of the older discussion has become antiquated, but it may be recapitulated here for historical purposes.

Earlier Theory.—In the long and erudite Note D**, appended by Sir W. Hamilton to his edition of Reid's *Works*, many anticipations of modern statements on association are cited from the works of ancient or medieval thinkers; and for Aristotle, in particular, the glory is claimed of having at once originated the doctrine and practically brought it to perfection.[1] As translated by Hamilton, but without his interpolations, the classical passage from the *De Memoria et Reminiscentia* runs as follows:—

"When, therefore, we accomplish an act of reminiscence, we pass through a certain series of precursive movements, until we arrive at a movement on which the one we are in quest of is habitually consequent. Hence, too, it is that we hunt through the mental train, excogitating from the present or some other, and from similar or contrary or coadjacent. Through this process reminiscence takes place. For the movements are, in these cases, sometimes at the same time, sometimes parts of the same whole, so that the subsequent movement is already more than half accomplished."

The passage is obscure, but it does at all events indicate the various principles commonly termed contiguity, similarity and contrast. Similar principles are stated by Zeno the Stoic, by Epicurus (see Diog. Laert. vii. § 52, x. § 32), and by St Augustine (*Confessions*, x. c. 19). Aristotle's doctrine received a more or less intelligent expansion and illustration from the ancient commentators and the schoolmen, and in the still later period of transition from the age of scholasticism to the time of modern philosophy, prolonged in the works of some writers far into the 17th century, Hamilton adduced not a few philosophical authorities who gave prominence to the general fact of mental association—the Spaniard Ludovicus Vives (1492–1540) especially being most exhaustive in his account of memory.

In Hobbes's psychology much importance is assigned to what he called, variously, the succession, sequence, series, consequence, coherence, train of imaginations or thoughts in mental discourse. But not before Hume is there express question as to what are the distinct principles of association. John Locke had, meanwhile, introduced the phrase "Association of Ideas" as the title of a supplementary chapter incorporated with the fourth edition of his *Essay*, meaning it, however, only as the name of a principle accounting for the mental peculiarities of individuals, with little or no suggestion of its general psychological import. Of this last Hume had the strongest impression; he reduced the principles of association to three—Resemblance, Contiguity in time and place, Cause and (or) Effect. Dugald Stewart put forward Resemblance, Contrariety, and Vicinity in time and place, though he added, as another obvious principle, accidental coincidence in the sounds of words, and further noted three other cases of relation, namely, Cause and Effect, Means and End, Premisses and Conclusion, as holding among the trains of thought under circumstances of special attention. Reid, preceding Stewart, was rather disposed to make light of the subject of association, vaguely remarking that it seems to require no other original quality of mind but the power of habit to explain the spontaneous recurrence of trains of thinking, when become familiar by frequent repetition (*Intellectual Powers*, p. 387).

Hamilton's own theory of mental reproduction, suggestion or association is a development, greatly modified, of the doctrine expounded in his *Lectures on Metaphysics* (vol. ii. p. 223, seq.), which reduced the principles of association first to two—Simultaneity and Affinity, and these further to one supreme principle of Redintegration or Totality. In the ultimate scheme he posits no less than four general laws of mental succession concerned in reproduction: (1) *Associability* or possible co-suggestion (all thoughts of the same mental subject are associable or capable of suggesting each other); (2) *Repetition* or direct remembrance (thoughts coidentical in modification, but differing in time, tend to suggest each other); (3) *Redintegration*, direct remembrance or reminiscence (thoughts once coidentical in time, are, however, different as mental modes, again suggestive of each other, and that in the mutual order which they originally held); (4) *Preference* (thoughts are suggested not merely by force of the general subjective relation subsisting between themselves, they are also suggested in proportion to the relation of interest, from whatever source, in which they stand to the individual mind). Upon these follow, as special laws:—A, Primary—modes of the laws of Repetition and Redintegration—(1) law of Similars (Analogy, Affinity); (2) law of Contrast; (3) law of Coadjacency (Cause and Effect, &c.); B, Secondary—modes of the law of Preference, under the law of Possibility—(1) laws of Immediacy and Homogeneity; (2) law of Facility.

The Associationist School.—This name is given to the English psychologists who aimed at explaining all mental acquisitions, and the more complex mental processes generally under laws not other than those which have just been set out as determining simple reproduction. Hamilton, though professing to deal with reproduction only, formulates a number of still more general laws of mental succession—law of Succession, law of Variation, law of Dependence, law of Relativity or Integration (involving law of Conditioned), and, finally, law of Intrinsic or Objective Relativity—as the highest to which human consciousness is subject; but it is in a sense quite different that the psychologists of the so-called Associationist School intend their appropriation of the principle or principles commonly signalized. As far as can be judged from imperfect records, they were anticipated to some extent by the experientialists of ancient times, both Stoic and Epicurean (cf. Diogenes Laertius, as above). In the modern period, Hobbes is the first thinker of permanent note to whom this doctrine may be traced. Though, in point of fact, he took anything but an exhaustive view of the phenomena of mental succession, yet, after dealing with trains of imagination, or what he called mental discourse, he sought in the higher departments of intellect to explain reasoning as a discourse in words, dependent upon an arbitrary system of marks, each associated with, or standing for, a variety of imaginations; and, save for a general assertion that reasoning is a reckoning—otherwise, a compounding and resolving—he had no other account of knowledge to give. The whole emotional side of mind, or, in his language, the passions, he, in like manner, resolved into an expectation of consequences based on past experience of pleasures and pains of sense. Thus, though he made no serious attempt to justify his analysis in detail, he is undoubtedly to be classed with the associationists of the next century. They, however, were wont to trace their psychological theory no further back than to Locke's *Essay*. Bishop Berkeley was driven to posit expressly a principle of suggestion or association in these terms:— "That one idea may suggest another to the mind, it will suffice that they have been observed to go together, without any demonstration of the necessity of their coexistence, or so much as knowing what it is that makes them so to coexist" (*New Theory of Vision*, § 25); and to support the obvious application of the principle to the case of the sensations of sight and touch before him, he constantly urged that association of sound and sense of language which the later school has always put in the foreground, whether as illustrating the principle in general or in explanation of the supreme importance of language for knowledge. It was natural, then, that Hume, coming after Berkeley, and assuming Berkeley's results, though he reverted to the larger inquiry of Locke, should be more explicit in his reference to association; but he was original also, when he spoke of it as a "kind of attraction which in the mental world will be found to have as extraordinary effects as in the natural, and to show itself in as many and as various forms" (*Human Nature*, i. 1, § 4). Other inquirers about the same time conceived of association with this breadth of view, and set themselves to track, as psychologists, its effects in detail.

David Hartley in his *Observations on Man*, published in 1749 (eleven years after the *Human Nature*, and one year after the better-known *Inquiry*, of Hume), opened the path for all the investigations of like nature that have been so characteristic of English psychology. A physician by profession, he sought to combine with an elaborate theory of mental association a minutely detailed hypothesis as to the corresponding action of the nervous system, based upon the suggestion of a vibratory motion within the nerves thrown out by Newton in the last paragraph of the *Principia*. So far, however, from promoting the acceptance of the psychological theory, this physical hypothesis proved to have rather the opposite effect, and it began to be dropped by Hartley's followers (as F. Priestley, in his abridged edition of the *Observations*, 1775) before it was seriously impugned from without. When it is studied in the original, and not taken upon the report of hostile critics, who would not, or could not understand it, no little importance must still be accorded to the first attempt, not seldom a curiously felicitous one, to carry through that parallelism of the physical and psychical, which since then has come to count for more and more in the science of mind. Nor should it be forgotten that Hartley himself, for all his paternal interest in the doctrine of vibrations, was careful to keep separate from its fortunes the cause of his other doctrine of mental association. Of this the point lay in no mere restatement, with new precision, of a principle of coherence among "ideas," but in its being taken as a clue by which to follow the progressive development of the mind's powers. Holding that mental states could be scientifically understood only as they were analysed, Hartley sought for a principle of synthesis to explain the complexity exhibited not only in trains of representative images, but alike in the most involved combinations of reasonings and (as Berkeley had seen) in the apparently simple phenomena of objective perception, as well as in the varied play of the emotions, or, again, in the manifold conscious adjustments of the motor system. One principle appeared to him sufficient for all, running, as enunciated for the simplest case, thus: "Any sensations A, B, C, &c., by being associated with one another a sufficient number of times, get such a power over the corresponding ideas (called by Hartley also vestiges, types, images) *a*, *b*, *c*, &c., that any one of the sensations A, when impressed alone, shall be able to excite in the mind *b*, *c*, &c., the ideas of the rest." To render the principle applicable in the cases where the associated elements are neither sensations nor simple ideas of sensations, Hartley's first care was to determine the conditions under which states other than these simplest ones have their rise in the mind, becoming the matter of ever higher and higher combinations. The principle itself supplied the key to the difficulty, when coupled with the notion, already implied in Berkeley's investigations, of a coalescence of simple ideas of sensation into one complex idea, which may cease to bear any obvious relation to its constituents. So far from being content, like Hobbes, to make a rough generalization to all mind from the phenomena of developed memory, as if these might be straightway assumed, Hartley made a point of referring them, in a subordinate place of their own, to his universal principle of mental synthesis. He expressly put forward the law of association, endued with such scope, as supplying what was wanting to Locke's doctrine in its more strictly psychological aspect, and thus marks by his work a distinct advance on the line of development of the experiential philosophy.

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[1] There are, however, distinct anticipations of the theory in Plato (*Phaedo*), as part of the doctrine of *ἀνάμνησις*; thus we find the idea of Simmias recalled by the picture of Simmias (similarity), and that of a friend by the sight of the lyre on which he played (contiguity).

The new doctrine received warm support from some, as Law and Priestley, who both, like Hume and Hartley himself, took the principle of association as having the like import for the science of mind that gravitation had acquired for the science of matter. The principle began also, if not always with direct reference to Hartley, yet, doubtless, owing to his impressive advocacy of it, to be applied systematically in special directions, as by Abraham Tucker (1768) to morals, and by Archibald Alison (1790) to aesthetics. Thomas Brown (d. 1820) subjected anew to discussion the question of theory. Hardly less unjust to Hartley than Reid or Stewart had been, and forward to proclaim all that was different in his own position, Brown must yet be ranked with the associationists before and after him for the prominence he assigned to the associative principle in sense-perception (what he called external affections of mind), and for his reference of all other mental states (internal affections) to the two generic capacities or susceptibilities of Simple and Relative Suggestion. He preferred the word Suggestion to Association, which seemed to him to imply some prior connecting process, whereof there was no evidence in many of the most important cases of suggestion, nor even, strictly speaking, in the case of contiguity in time where the term seemed least inapplicable. According to him, all that could be assumed was a general constitutional tendency of the mind to exist successively in states that have certain relations to each other, of itself only, and without any external cause or any influence previous to that operating at the moment of the suggestion. Brown's chief contribution to the general doctrine of mental association, besides what he did for the theory of perception, was, perhaps, his analysis of voluntary reminiscence and constructive imagination—faculties that appear at first sight to lie altogether beyond the explanatory range of the principle. In James Mill's *Analysis of the Phenomena of the Human Mind* (1829), the principle, much as Hartley had conceived it, was carried out, with characteristic consequence, over the psychological field. With a much enlarged and more varied conception of association, Alexander Bain re-executed the general psychological task, while Herbert Spencer revised the doctrine from the new point of view of the evolution-hypothesis. John Stuart Mill made only occasional excursions into the region of psychology proper, but sought, in his *System of Logic* (1843), to determine the conditions of objective truth from the point of view of the associationist theory, and, thus or otherwise being drawn into general philosophical discussion, spread wider than any one before him its repute.

The Associationist School has been composed chiefly of British thinkers, but in France also it has had distinguished representatives. Of these it will suffice to mention Condillac, who professed to explain all knowledge from the single principle of association (*liaison*) of ideas, operating through a previous association with signs, verbal or other. In Germany, before the time of Kant, mental association was generally treated in the traditional manner, as by Wolff. Kant's inquiry into the foundations of knowledge, agreeing in its general purport with Locke's, however it differed in its critical procedure, brought him face to face with the newer doctrine that had been grafted on Locke's philosophy; and to account for the fact of synthesis in cognition, in express opposition to associationism, as represented by Hume, was, in truth, his prime object, starting, as he did, from the assumption that there was that in knowledge which no mere association of experiences could explain. To the extent, therefore, that his influence prevailed, all inquiries made by the English associationists were discounted in Germany. Notwithstanding, under the very shadow of his authority a corresponding, if not related, movement was initiated by J. F. Herbart. Peculiar, and widely different from anything conceived by the associationists, as Herbart's metaphysical opinions were, he was at one with them, and at variance with Kant, in assigning fundamental importance to the psychological investigation of the development of consciousness, nor was his conception of the laws determining the interaction and flow of mental presentations and representations, when taken in its bare psychological import, essentially different from theirs. In F. E. Beneke's psychology also, and in more recent inquiries conducted mainly by physiologists, mental association has been understood in its wider scope, as a general principle of explanation.

The associationists differ not a little among themselves in the statement of their principle, or, when they adduce several principles, in their conception of the relative importance of these. Hartley took account only of Contiguity, or the repetition of impressions synchronous or immediately successive; the like is true of James Mill, though, incidentally, he made an express attempt to resolve the received principle of Similarity, and through this the other principle of Contrast, into his fundamental law—law of Frequency, as he sometimes called it, because upon frequency, in conjunction with vividness of impressions, the strength of association, in his view, depended. In a sense of his own, Brown also, while accepting the common Aristotelian enumeration of principles, inclined to the opinion that "all suggestion may be found to depend on prior co-existence, or at least on such proximity as is itself very probably a modification of coexistence," provided account be taken of "the influence of emotions and other feelings that are very different from ideas, as when an analogous object suggests an analogous object by the influence of an emotion which each separately may have produced before, and which is, therefore, common to both." To the contrary effect, Spencer maintained that the fundamental law of all mental association is that presentations aggregate or cohere with their like in past experience, and that, besides this law, there is in strictness no other, all further phenomena of association being incidental. Thus in particular, he would have explained association by Contiguity as due to the circumstance of imperfect assimilation of the present to the past in consciousness. A. Bain regarded Contiguity and Similarity logically, as perfectly distinct principles, though in actual psychological occurrence blending intimately with each other, contiguous trains being started by a first (it may be, implicit) representation through Similarity, while the express assimilation of present to past in consciousness is always, or tends to be, followed by the revival of what was presented in contiguity with that past.

The highest philosophical interest, as distinguished from that which is more strictly psychological, attaches to the mode of mental association called Inseparable. The coalescence of mental states noted by Hartley, as it had been assumed by Berkeley, was farther formulated by James Mill in these terms:—

"Some ideas are by frequency and strength of association so closely combined that they cannot be separated; if one exists, the other exists along with it in spite of whatever effort we make to disjoin them."—(*Analysis of the Human Mind*, 2nd ed. vol. i. p. 93.)

J. S. Mill's statement is more guarded and particular:—

"When two phenomena have been very often experienced in conjunction, and have not, in any single instance, occurred separately either in experience or in thought, there is produced between them what has been called inseparable, or, less correctly, indissoluble, association; by which is not meant that the association must inevitably last to the end of life—that no subsequent experience or process of thought can possibly avail to dissolve it; but only that as long as no such experience or process of thought has taken place, the association is irresistible; it is impossible for us to think the one thing disjoined from the other."—(*Examination of Hamilton's Philosophy*, 2nd ed. p. 191.)

It is chiefly by J. S. Mill that the philosophical application of the principle has been made. The first and most obvious application is to so-called necessary truths—such, namely, as are not merely analytic judgments but involve a synthesis of distinct notions. Again, the same thinker sought to prove Inseparable Association the ground of belief in an external objective world. The former application, especially, is facilitated, when the experience through which the association is supposed to be constituted is understood as cumulative in the race, and transmissible as original endowment to individuals—endowment that may be expressed either, subjectively, as latent intelligence, or, objectively, as fixed nervous connexions. Spencer, as before suggested, is the author of this extended view of mental association.

Modern Criticism.—Of recent years the associationist theory has been subjected to searching criticism, and it has been maintained by many writers that the laws are both unsatisfactorily expressed and insufficient to explain the facts. Among the most vigorous and comprehensive of these investigations is that of F. H. Bradley in his *Principles of Logic* (1883). Having admitted the psychological fact of mental association, he attacks the theories of Mill and Bain primarily on the ground that they purport to give an account of mental life as a whole, a metaphysical doctrine of existence. According to this doctrine, mental activity is ultimately reducible to particular feelings, impressions, ideas, which are disparate and unconnected, until chance Association brings them together. On this assumption the laws of Association naturally emerge in the following form:—(1) The *law of Contiguity.*—"Actions, sensations and states of feeling, occurring together or in close connexion, tend to grow together, or cohere, in such a way that, when any one of them is afterwards presented to the mind, the others are apt to be brought up in idea" (A. Bain, *Senses and Intellect*, p. 327). (2) The *law of Similarity.*—"Present actions, sensation, thoughts or emotions tend to revive their like among previous impressions or states" (A. Bain, *ibid.* 457. Compare J. S. Mill, *Logic*, ii. p. 440, 9th ed.). The fundamental objection to (1) is that ideas and impressions once experienced do not recur; they are particular existences, and, as such, do not persevere to recur or be presented. So Mill is wrong in speaking of two impressions being "frequently experienced." Bradley claims thus to reduce the law to "When we have experienced (or even thought of) several pairs of impressions (simultaneous or successive), which pairs are like one another; then whenever an idea occurs which is like all the impressions on one side of these pairs, it tends to excite an idea which is like all the impressions on the other side." This statement is destructive of the title of the law, because it appears that what were contiguous (the impressions) are not associated, and what are associated (the ideas) were not contiguous; in other words, the association is not due to contiguity at all.

Proceeding to the law of Similarity (which in Mill's view is at the back of association by contiguity), and having made a similar criticism of its phrasing, Bradley maintains that it involves an even greater absurdity; if two ideas are to be recognized as similar, they must both be present in the mind; if one is to call up the other, one must be absent. To the obvious reply that the similarity is recognized *ex post facto*, and not while the former idea is being called up, Bradley replies simply that such a view reduces the law to the mere statement of a phenomenon and deprives it of any explanatory value, though he hardly makes it clear in what sense this necessarily invalidates the law from a psychological point of view. He further points out with greater force that in point of fact mere similarity is not the basis of ordinary cases of mental reproduction, inasmuch as in any given instance there is more difference than similarity between the ideas associated.

Bradley himself bases association on identity plus contiguity:—"Any part of a single state of mind tends, if reproduced, to re-instate the remainder," or "any element tends to reproduce those elements with which it has formed one state of mind." This law he calls by the name "redintegration," understood, of course, in a sense different from that in which Hamilton used it. The radical difference between this law and those of Mill and Bain is that it deals not with particular units of thoughts but with universals or identity between individuals. In any example of such reproduction the universal appears in a particular form which is more or less different from that in which it originally existed.

Psychophysical Researches.—Bradley's discussion deals with the subject purely from the metaphysical side, and the total result practically is that association occurs only between universals. From the point of view of empirical psychologists Bradley's results are open to the charge which he made against those who impugned his view of the law of similarity, namely that they are merely a statement—not in any real sense an explanation. The relation between the mental and the physical phenomena of association has occupied the attention of all the leading psychologists (see PSYCHOLOGY). William James holds that association is of "objects" not of "ideas," is between "things thought of"—so far as the word stands for an effect. "So far as it stands for a cause it is between processes in the brain." Dealing with the law of Contiguity he says that the "most natural way of accounting for it is to conceive it as a result of the laws of habit in the nervous system; in other words to ascribe it to a physiological cause." Association is thus due to the fact that when a nerve current has once passed by a given way, it will pass more easily by that way in future; and this fact is a physical fact. He further seeks to maintain the important deduction that the only primary or ultimate law of association is that of neural habit.

The objections to the associationist theory are summed up by G. F. Stout (*Analytic Psychol.*, vol. ii. pp. 47 seq.) under three heads. Of these the first is that the theory as stated, *e.g.* by Bain, lays far too much stress on the mere connexion of elements hitherto entirely separate; whereas, in fact, every new mental state or synthesis consists in the development or modification of a pre-existing state or psychic whole. Secondly, it is quite false to regard an association as merely an aggregate of disparate units; in fact, the *form* of the new idea is quite as important as the elements which it comprises. Thirdly, the phraseology used by the associationists seems to assume that the parts that go to form the whole retain their identity unimpaired; in fact, each part or element is *ipso facto* modified by the very fact of its entering into such combination.

The experimental methods now in vogue have to a large extent removed the discussion of the whole subject of association of ideas, depending in the case of the older writers on introspection, into a new sphere. In such a work as E. B. Titchener's *Experimental Psychology* (1905), association is treated as a branch of the study of mental reactions, of which association reactions are one division.

BIBLIOGRAPHY.—See PSYCHOLOGY; and the works of Bradley, Stout, and James, above quoted, and general works on psychology; articles in *Mind* (passim); A. Bain, *Senses and Intellect* (4th ed., 1894), and in *Mind*, xii. (1887) pp. 237-249; John Watson, *An Outline of Philosophy* (1898); H. Höffding, *Hist. of Mod. Philos.* (Eng. trans., Lond., 1900), *Psychologie in Umrissen auf Grundlage der Erfahrung* (2nd ed., Leipzig, 1893); Jas. Sully, *The Human Mind* (1892), and *Outlines of Psych.* (Lond., 1892); E. B. Titchener, *Outline of Psych.* (New York, 1896), and in his trans. of O. Külpe's *Outlines of Psych.* (New York, 1895,); Jas. Ward in *Mind*, viii. (1883), xii. (1887), new series ii. (1893), iii. (1894); G. T. Ladd, *Psychology, Descriptive and Explanatory* (Lond., 1894); C. L. C. Morgan, *Introd. to Comparative Psych.* (Lond., 1894); W. Wundt, *Princip. of Physiol. Psych.* (Eng. trans., 1904), *Human and Animal Psych.* (Eng. trans., 1894), pp. 282-307; *Outlines of Psych.* (Eng. trans., 1897); E. Claparède, *L'Association des idées* (1903). For associationism in Greek philosophy see J. I. Beare, *Greek Theories of Elementary Cognition* (Oxford, 1906), part iii. §§ 14, 43 seq.

ASSONANCE (from Lat. *adsonare* or *assonare*, to sound to or answer to), a term defined, in its prosodical sense, as "the corresponding or riming of one word with another in the accented vowel and those which follow it, but not in the consonants" (*New English Dictionary*, Oxford). In other words, assonance is an improper or imperfect form of rhyme, in which the ear is satisfied with the incomplete identity of sound which the vowel gives without the aid of consonants. Much rustic or popular verse in England is satisfied with assonance, as in such cases as

> "And pray who gave thee that jolly red *nose*?
> Cinnamon, Ginger, Nutmeg and *Cloves*,"

where the agreement between the two *o's* permits the ear to neglect the discord between *s* and *v*. But in English these instances are the result of carelessness or blunted ear. It is not so in several literatures, such as in Spanish, where assonance is systematically cultivated as a literary ornament. It is an error to confound alliteration,—which results from the close juxtaposition of words beginning with the same sound or letter,—and assonance, which is the repetition of the same vowel-sound in a syllable at points where the ear expects a rhyme. The latter is a more complicated and less primitive employment of artifice than the former, although they have often been used to intensify the effect of each other in a single couplet. Assonance appears, nevertheless, to have preceded rhyme in several of the European languages, and to have led the way towards it. It is particularly observable in the French poetry which was composed before the 12th century, and it reached its highest point in the "Chanson de Roland," where the sections are distinguished by the fact that all the lines in a *laisse* or stanza close with the same vowel-sound. When the ear of the French became more delicate, and pure rhyme was introduced, about the year 1120, assonance almost immediately retired before it and was employed no more, until recent years, when several French poets have re-introduced assonance in order to widen the scope of their effects of sound. It held its place longer in Provençal and some other Romance literatures, while in Spanish it has retained its absolute authority over rhyme to the present day. It has been observed that in the Romance languages the ear prefers the correspondence of vowels, while in the Teutonic languages the preference is given to consonants. This distinction is felt most strongly in Spanish, where the satisfaction in *rimas asonantes* is expressed no less in the most elaborate works of the poets and dramatists than in the rough ballads of the people. The nature of the language here permits the full value of the corresponding vowel-sounds to be appreciated, whereas in English—and even in German, where, however, a great deal of assonant poetry exists—the divergence of the consonants easily veils or blunts the similarity of sound. Various German poets of high merit, and in particular Tieck and Heine, have endeavoured to obviate this difficulty, but without complete success. Occasionally they endeavour, as English rhymers have done, to mix pure rhyme with assonance, but the result of this in almost all cases is that the assonances, &c., which make a less strenuous appeal to the ear, are drowned and lost in the stress of the pure rhymes. Like alliteration, assonance is a very frequent and very effective ornament of prose style, but such correspondence in vowel-sound is usually accidental and involuntary, an instinctive employment of the skill of the writer. To introduce it with a purpose, as of course must be done in poetry, has always been held to be a most dangerous practice in prose. Assonance as a conscious art, in fact, is scarcely recognized as legitimate in English literature. (E. G.)

ASSUAN, or ASWAN, a town of Upper Egypt on the east bank of the Nile, facing Elephantine Island below the First Cataract, and 590 m. S. of Cairo by rail. It is the capital of a province of the same name—the southernmost province of Egypt. Population (1907) 16,128. The principal buildings are along the river front, where a broad embankment has been built. Popular among Europeans as a winter health resort and tourist centre, Assuan is provided with large modern hotels (one situated on Elephantine Island), and there is an English church. South-east of the railway station are the ruins of a temple built by Ptolemy Euergetes, and still farther south are the famous granite quarries of Syene. On Elephantine Island are an ancient nilometer and other remains, including a granite gateway built under Alexander the Great at the temple of the local ram-headed god Chnubis or Chnumis (Eg. Khnum), perhaps on account of his connexion with Ammon (*q.v.*); two small but very beautiful temples of the XVIIIth Dynasty were destroyed there about 1820. In the hill on the opposite side of the river are tombs of the VIth to XIIth dynasties, opened by Lord Grenfell in 1885–1886. The inscriptions show that they belonged to frontier-prefects whose expeditions into Nubia, &c., are recorded in them. Three and a half miles above the town, at the beginning of the Cataract, the Assuan Dam stretches across the Nile. This great engineering work was finished in December 1902 (see IRRIGATION: *Egypt*; and NILE). Above the dam the Nile presents the appearance of a vast lake. Consequent on the rise of the water-level several islands have been wholly and others partly submerged, among the latter Philae (*q.v.*). On the east bank opposite Philae is the village of Shellal, southern terminus of the Egyptian railway system and the starting point of steamers for the Sudan.

In ancient times the chief city, called Yēb, capital of the frontier nome, the first of the Upper Country, was on the island of Elephantine, guarding the entrance to Egypt. But, owing to the cataract, the main route for traffic with the south was by land along the eastern shore. Here, near the granite quarries—whence was obtained the material for many magnificent monuments—there grew up another city, at first dependent on and afterwards successor to the island town. This city was called *Swan*, the Mart, whence came the Greek *Syene* and Arabic *Aswan*. Syene is twice mentioned (as Seveneh) in the prophecies of Ezekiel, and papyri, discovered on the island, and dated in the reigns of Artaxerxes and Darius II. (464–404 B.C.), reveal the existence of a colony of Jews, with a temple to Yahu (Yahweh, Jehovah), which had been founded at some time before the conquest of Egypt by Cambyses in 523 B.C. They also mention the great frontier garrison against the Ethiopians, referred to by Herodotus. Syene was one of the bases used by Eratosthenes in his calculations for the measurement of the earth. In Roman times Syene was strongly garrisoned to resist the attacks of the desert tribes. Thither, in virtual banishment, Juvenal was sent as prefect by Domitian. In the early days of Christianity the town became the seat of a bishopric, and numerous ruins of Coptic convents are in the neighbourhood. Syene appears also to have flourished under its first Arab rulers, but in the 12th century was raided and ruined by Bedouin and Nubian tribes. On the conquest of Egypt by the Turks in the 16th century, Selim I. placed a garrison here, from whom, in part, the present townsmen descend. As the southern frontier town of Egypt proper, Assuan in times of peace was the entrepôt of a considerable trade with the Sudan and Abyssinia, and in 1880 its trade was valued at £2,000,000 annually. During the Mahdia (1884–1898) Assuan was strongly garrisoned by Egyptian and British troops. Since the defeat of the khalifa at Omdurman and the fixing (1899) of the Egyptian frontier farther south, the military value of Assuan has declined.

For the Jewish colony see A. H. Sayce and A. E. Cowley, *Aramaic Papyri discovered at Assuan* (Oxford, 1906); E. Sachau, *Drei Aramäische papyrus-Urkunden aus Elephantine* (Berlin, 1907). For the dam see W. Willcocks, *The Nile Reservoir Dam at Assuan* (London, 1901). (F. LL. G.)

ASSUMPSIT ("he has undertaken," from Lat. *assumere*), a word applied to an action for the recovery of damages by reason of the breach or non-performance of a simple contract, either express or implied, and whether made orally or in writing. *Assumpsit* was the word always used in pleadings by the plaintiff to set forth the defendant's undertaking or promise, hence the name of the action. Claims in actions of *assumpsit* were ordinarily divided into (*a*) common or *indebitatus assumpsit*, brought usually on an implied promise, and (*b*) special *assumpsit*, founded on an express promise. *Assumpsit* as a form of action became obsolete after the passing of the Judicature Acts 1873 and 1875. (See further CONTRACT; PLEADING and TORT.)

ASSUMPTION, FEAST OF. The feast of the "Assumption of the blessed Virgin Mary" (Lat. *festum assumptionis, dormitionis, depositionis, pausationis B. V. M.*; Gr. *κοίμησις* or *ἀνάληψις τῆς θεοτόκου*) is a festival of the Christian Church celebrated on the 15th of August, in commemoration of the miraculous ascent into heaven of the mother of Christ. The belief on which this festival rests has its origin in apocryphal sources, such as the *εἰς τὴν κοίμησιν τῆς ὑπεραγίας δεσποίνης* ascribed to the Apostle John, and the *de transitu Mariae*, assigned to Melito, bishop of Sardis, but actually written about A.D. 400. Pope Gelasius I. (492–496) included them in the list of apocryphal books condemned by the *Decretum de libris recipiendis et non recipiendis;* but they were accepted as authentic by the pseudo-Dionysius (*de nominbus divinis c.* 3), whose writings date probably from the 5th century, and by Gregory of Tours (d. 593 or 594). The latter in his *De gloria martyrum* (i. 4) gives the following account of the miracle: As all the Apostles were watching round the dying Mary, Jesus appeared with His angels and committed the soul of His Mother to the Archangel Michael. Next day, as they were carrying the body to the grave, Christ again appeared and carried it with Him in a cloud to heaven, where it was reunited with the soul. This story is much amplified in the account given by St John of Damascus in the homilies *In dormitionem Mariae*, which are still read in the Roman Church as the lesson during the octave of the feast. According to this the patriarchs and Adam and Eve also appear at the death-bed, to praise their daughter, through whom they had been rescued from the curse of God; a Jew who touches the body loses both his hands, which are restored to him by the Apostles; and the body lies three days in the grave without corruption before it is taken up into heaven.

The festival is first mentioned by St Andrew of Crete (*c.* 650), and, according to the Byzantine historian Nicephorus Callistus (*Hist. Eccles.* xvii. 28), was first instituted by the Emperor Maurice in A.D. 582. From the East it was borrowed by Rome, where there is evidence of its existence so early as the 7th century. In the Gallican Church it was only adopted at the same time as the Roman liturgy. But though the festival thus became incorporated in the regular usage of the Western Church, the belief in the resurrection and bodily assumption of the Virgin has never been defined as a dogma and remains a "pious opinion," which the faithful may reject without imperilling their immortal souls, though not apparently—to quote Melchior Cano (*De Locis Theolog.* xii. 10)—without "insolent temerity," since such rejection would be contrary to the common agreement of the Church. By the reformed Churches, including the Church of England, the festival is not observed, having been rejected at the Reformation as being neither primitive nor founded upon any "certain warrant of Holy Scripture."

See Herzog-Hauck, *Realencyklopädie* (ed. 3), s. "Maria"; Mgr. L. Duchesne, *Christian Worship* (Eng. trans., London, 1904); Wetzer and Welte, *Kirchenlexikon*, s. "Marienfeste"; The *Catholic Encyclopaedia* (London and New York, 1907, &c.), s. "Apocrypha," "Assumption."

ASSUR (Auth. Vers. *Asshur*), a Hebrew name, occurring in many passages of the Old Testament, for the land and dominion of Assyria.[1] The *country* of Assyria, which in the Assyro-Babylonian literature is known as *mat Aššur* (*ki*), "land of Assur," took its name from the ancient city of *Aššur*, situated at the southern extremity of Assyria proper, whose territory, soon after the first Assyrian settlement, was bounded on the N. by the Zagros mountain range in what is now Kurdistan and on the S. by the lower Zab river. The kingdom of Assyria, which was the outgrowth of the primitive settlement on the site of the city of Assur, was developed by a probably gradual process of colonization in the rich vales of the middle Tigris region, a district watered by the Tigris itself and also by several tributary streams, the chief of which was the lower Zab.[1]

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[1] The name Assur is not connected with the Asshur of 1 Chron. ii. 24; ii. 45. Note that it is customary to spell the god-name *Ašur* and the country-name *Aššur*.

It seems quite evident that the *city* of Assur was originally founded by Semites from Babylonia at quite an early, but as yet undetermined date. In the prologue to the law-code of the great Babylonian monarch Khammurabi (*c.* 2250 B.C.), the cities of Nineveh and Assur are both mentioned as coming under that king's beneficent influence. Assur is there called *A-usar*(*ki*),[2] in which combination the ending *-ki* ("land territory") proves that even at that early period there was a province of Assur more extensive than the city proper. It is probable that this non-Semitic form *A-usar* means "well watered region,"[3] a most appropriate designation for the river settlements of Assyria. The problem as to the meaning of the name Assur is rendered all the more confusing by the fact that the city and land are also called *Aššur* (as well as *A-usar*), both by the Khammurabi records[4] and generally in the later Assyrian literature. Furthermore, the god- and country-name *Assur* also occurs at a late date in Assyrian literature in the forms *An-šar*, *An-šar* (*ki*), which form[5] was presumably read *Assur*. In the Creation tablet, the heavens personified collectively were indicated by this term *An-šar*, "host of heaven," in contradistinction to the earth = *Ki-šar*, "host of earth." In view of this fact, it seems highly probable that the late writing *An-sar* for *Assur* was a more or less conscious attempt on the part of the Assyrian scribes to identify the peculiarly Assyrian deity *Asur* (see ASSUR, the god, below) with the Creation deity An-sar. On the other hand, there is an epithet *Ašir* or Ashir ("overseer") applied to several gods and particularly to the deity *Ašur*, a fact which introduced a third element of confusion into the discussion of the name *Assur*. It is probable then that there is a triple popular etymology in the various forms of writing the name *Aššur*; viz. *A-usar*,[6] *An-šar* and the stem *ašāru*, all of which is quite in harmony with the methods followed by the ancient Assyro-Babylonian philologists[7]

See also A. H. Layard, *Discoveries in the Ruins of Nineveh and Babylon* (1853); G. Smith, *Assyrian Discoveries* (1875); R. W. Rogers, *History of Babylonia and Assyria*, i. 297; ii. 13; ii. 30, 76, 102; J. F. M'Curdy, *History, Prophecy and the Monuments*, §§ 74, 171 f., 247, 258, 283; 57, 59 f. (on the god). (J. D. Pr.)

ASSUR, the primitive capital of Assyria, now represented by the mounds of Kaleh Sherghat (Qal'at Shergat) on the west bank of the Tigris, nearly midway between the Upper and Lower Zab. It is still doubtful (see discussion on the name in the preceding article) whether the national god of Assyria took his name from that of the city or whether the converse was the case. It is most probable, however, that it was the city which was deified (see Sayce, *Religion of Ancient Egypt and Babylonia*, 1902, pp. 366, 367). Sir A. H. Layard, through his assistant Hormuzd Rassam, devoted two or three days to excavating on the site, but owing to the want of pasturage and the fear of Bedouin attacks he left the spot after finding a broken clay cylinder containing the annals of Tiglath-Pileser I., and for many years no subsequent efforts were made to explore it. In 1904, however, a German expedition under Dr W. Andrae began systematic excavations, which have led to important results. The city originally grew up round the great temple of the god Assur, the foundation of which was ascribed to the High-priest Uspia. For many centuries Assur and the surrounding district, which came accordingly to be called the land of Assur (*Assyria*), were governed by high-priests under the suzerainty of Babylonia. With the decay of the Babylonian power the high-priests succeeded in making themselves independent kings, and Assur became the capital of an important kingdom. It was already surrounded by a wall of crude brick, which rested on stone foundations and was strengthened at certain points by courses of burnt brick. A deep moat was dug outside it by Tukulti-In-aristi or Tukulti-Masu (about 1270 B.C.), and it was further defended on the land side by a *salkhu* or outwork. In the 15th century B.C. it was considerably extended to the south in order to include a "new town" which had grown up there. The wall was pierced by "the gate of Assur," "the gate of the Sun-god," "the gate of the Tigris," &c., and on the river side was a quay of burnt brick and limestone cemented with bitumen. The temples were in the northern part of the city, together with their lofty towers, one of which has been excavated. Besides the temple of Assur there was another great temple dedicated to Anu and Hadad, as well as the smaller sanctuaries of Bel, Ishtar, Merodach and other deities. After the rise of the kingdom, palaces were erected separate from the temples; the sites of those of Hadad-nirari I., Shalmaneser I., and Assur-nazir-pal have been discovered by the German excavators, and about a dozen more are referred to in the inscriptions. Even after the rise of Nineveh as the capital of the kingdom and the seat of the civil power, Assur continued to be the religious centre of the country, where the king was called on to reside when performing his priestly functions. The city survived the fall of Assyria, and extensive buildings as well as tombs of the Parthian age have been found upon the site.

See *Mitteilungen der deutschen Orient-Gesellschaft* (1904–1906). (A. H. S.)

ASSUR, ASUR, or ASHUR, the chief god of Assyria, was originally the patron deity of the city of Assur on the Tigris, the ancient capital of Assyria from which as a centre the authority of the *patesis* (as the rulers were at first called) spread in various directions. The history of Assyria (*q.v.*) can now be traced back approximately to 2500 B.C., though it does not rise to political prominence until *c.* 2000 B.C. The name of the god is identical with that of the city, though an older form A-shir, signifying "leader," suggests that a differentiation between the god and the city was at one time attempted. Though the origin of the form Ashur (or Assur) is not certain, it is probable that the name of the god is older than that of the city (see discussion on the name above).

The title *Ashir* was given to various gods in the south, as Marduk and Nebo, and there is every reason to believe that it represents a direct transfer with the intent to emphasize that Assur is the "leader" or head of the pantheon of the north. He is in fact to all intents and purposes of the north. Originally like Marduk a solar deity with the winged disk—the disk always typifying the sun[8]—as his symbol, he becomes as Assyria develops into a military power a god of war, indicated by the attachment of the figure of a man with a bow to the winged disk. While the cult of the other great gods and goddesses of Babylonia was transferred to Assyria, the worship of Assur so overshadowed that of the rest as to give the impression of a decided tendency towards the absorption of all divine powers by the one god. Indeed, the other gods, Sin, Shamash (Samas), Adad, Ninib and Nergal, and even Ea, take on the warlike traits of Assur in the epithets and descriptions given of them in the annals and votive inscriptions of Assyrian rulers to such an extent as to make them appear like little Assurs by the side of the great one. Marduk alone retains a large measure of his independence as a concession on the part of the Assyrians to the traditions of the south, for which they always manifested a profound respect. Even during the period that the Assyrian monarchs exercised complete sway over the south, they rested their claims to the control of Babylonia on the approval of Marduk, and they or their representatives never failed to perform the ceremony of "taking the hand" of Marduk, which was the formal method of assuming the throne in Babylonia. Apart from this concession, it is Assur who pre-eminently presides over the fortunes of Assyria.[1] In his name, and with his approval as indicated by favourable omens, the Assyrian armies march to battle. His symbol is carried into the thick of the fray, so that the god is actually present to grant assistance in the crisis, and the victory is with becoming humility invariably ascribed by the kings "to the help of Assur." With the fall of Assyria the rule of Assur also comes to an end, whereas it is significant that the cult of the gods of Babylonia—more particularly of Marduk—survives for several centuries the loss of political independence through Cyrus' capture of Babylonia in 539 B.C. The name of Assur's temple at Assur, represented by the mounds of Kaleh Sherghat, was known as E-khar-sag-gal-kur-kurra, *i.e.* "House of the great mountain of the lands." Its exact site has been determined by excavations conducted at Kaleh Sherghat since 1903 by the German Oriental Society. The name indicates the existence of the same conception regarding sacred edifices in Assyria as in Babylonia, where we find such names as E-Kur ("mountain house") for the temple of Bel (*q.v.*) at Nippur, and E-Saggila ("lofty house") for Marduk's (*q.v.*) temple at Babylon and that of Ea (*q.v.*) at Eridu, and in view of the general dependence of Assyrian religious beliefs as of Assyrian culture in general, there is little reason to doubt that the name of Assur's temple represents a direct adaptation of such a name as E-Kur, further embellished by epithets intended to emphasize the supreme control of the god to whom the edifice was dedicated. The foundation of the edifice can be traced back to Uspia (Ushpia), *c.* 2000 B.C., and may turn out to be even older. Besides the chief temple, the capital contained temples and chapels to Anu, Adad, Ishtar, Marduk, Gula, Sin, Shamash, so that we are to assume the existence of a sacred precinct in Assur precisely as in the religious centres of the south. On the removal of the seat of residence of the Assyrian kings to Calah (*c.* 1300 B.C.), and then in the 8th century to Nineveh, the centre of the Assur cult was likewise transferred, though the sanctity of the old seat at Assur continued to be recognized. At Nineveh, which remained the capital till the fall of the Assyrian empire in 606 B.C., Assur had as his rival Ishtar, who was the real patron deity of the place, but a reconciliation was brought about by making Ishtar the consort of the chief god. The combination was, however, of an artificial character, and the consciousness that Ishtar was in reality an independent goddess never entirely died out. She too, like Assur, was viewed as a war deity, and to such an extent was this the case that at times it would appear that she, rather than Assur, presided over the fortunes of the Assyrian armies. (M. JA.)

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[1] Cf. Rassam, *Asshur and the Land of Nimrod*, 250-251, and many other works.

[2] Robert Harper, *Code of Hammurabi*, pp. 6-7, lines 55-58.

[3] Thus already Delitzsch, *Wo lag das Paradies?* p. 252. The element *a* means "water," and in *u-sar* it is probable that *u* also means "water," while *sar* is "park, district." See Prince, *Materials for a Sumerian Lexicon*, s.v. *usar*.

[4] The name appears as *Aš-šur*(*ki*) and *Aš-šu-ur*(*ki*). See King, *Letters and Inscriptions of Hammurabi*, iv. p. 23, obv. 27; and Nägel, *Beiträge zur Assyriologie*, iv. p. 404; also *Cun. Texts from Bab. Tablets*, vi. pl. 19, line 7.

[5] Meissner-Rost, *Bauinschrift Sanheribs*, K. 5413a; K. 1306, rev. 16.

[6] See on this entire subject, Morris Jastrow, Jr., *Journal Amer. Orient. Soc.*, xxiv. pp. 282-311; also *Die Religion Bab. u. Assyr.*, pp. 207 ff.

On the philological methods of the ancient Babylonian priesthood, see Prince, *Materials for a Sumerian Lexicon*, Introduction.

[8] See Prince, *Journ. Bibl. Lit.*, xxii. 35.

ASSUR-BANI-PAL ("Assur creates a son"), the *grand monarque* of Assyria, was the prototype of the Greek Sardanapalus, and appears probably in the corrupted form of Asnapper in Ezra iv. 10. He had been publicly nominated king of Assyria (on the 12th of Iyyar) by his father Esar-haddon, some time before the latter's death, Babylonia being assigned to his twin-brother Samas-sum-yukin, in the hope of gratifying the national feeling of the Babylonians. After Esar-haddon's death in 668 B.C. the first task of Assur-bani-pal was to finish the Egyptian campaign. Tirhakah, who had reoccupied Egypt, fled to Ethiopia, and the Assyrian army spent forty days in ascending the Nile from Memphis to Thebes. Shortly afterwards Necho, the satrap of Sais, and two others were detected intriguing with Tirhakah; Necho and one of his companions were sent in chains to Nineveh, but were there pardoned and restored to their principalities. Tirhakah died 667 B.C., and his successor Tandaman (Tanuat-Amon) entered Upper Egypt, where a general revolt against Assyria took place, headed by Thebes. Memphis was taken by assault and the Assyrian troops driven out of the country. Tyre seems to have revolted at the same time. Assur-bani-pal, however, lost no time in pouring fresh forces into the revolted province. Once more the Assyrian army made its way up the Nile, Thebes was plundered, and its temples destroyed, two obelisks being carried to Nineveh as trophies (see Nahum iii. 8). Meanwhile the siege of insular Tyre was closely pressed; its water-supply was cut off, and it was compelled to surrender. Assur-bani-pal was now at the height of his power. The land of the Mannā (Minni), south-east of Ararat, had been wasted, its capital captured by the Assyrians, and its king reduced to vassalage. A war with Teumman of Elam had resulted in the overthrow of the Elamite army; the head of Teumman was sent to Nineveh, and another king, Umman-igas, appointed by the Assyrians. The kings of Cilicia and the Tabal offered their daughters to the harem of Assur-bani-pal; embassies came from Ararat, and even Gyges of Lydia despatched envoys to "the great king" in the hope of obtaining help against the Cimmerians. Suddenly the mighty empire began to totter. The Lydian king, finding that Nineveh was helpless to assist him, turned instead to Egypt and furnished the mercenaries with whose help Psammetichus drove the Assyrians out of the country and suppressed his brother satraps. Egypt was thus lost to Assyria for ever (660 B.C.). In Babylonia, moreover, discontent was arising, and finally Samas-sum-yukin put himself at the head of the national party and declared war upon his brother. Elamite aid was readily forthcoming, especially when stimulated by bribes, and the Arab tribes joined in the revolt. The resources of the Assyrian empire were strained to their utmost. But thanks in some measure to the intestine troubles in Elam, the Babylonian army and its allies were defeated and driven into Babylon, Sippara, Borsippa and Cutha. One by one the cities fell, Babylon being finally starved into surrender (648 B.C.) after Samas-sum-yukin had burnt himself in his palace to avoid falling into the conqueror's hands. It was now the turn of the Arabs, some of whom had been in Babylon during the siege, while others had occupied themselves in plundering Edom, Moab and the Hauran. Northern Arabia was traversed by the Assyrian forces, the Nabataeans were almost exterminated, and the desert tribes terrorized into order. Elam was alone left to be dealt with, and the last resources of the empire were therefore expended in preventing it from ever being again a thorn in the Assyrian side.

But the effort had exhausted Assyria. Drained of men and resources it was no longer able to make head against the Cimmerian and Scythian hordes who now poured over western Asia. The Cimmerian Dugdammē (Lygdamis in Strabo i. 3, 16), whom Assur-bani-pal calls "a limb of Satan," after sacking Sardis, had been slain in Cilicia, but other Scythian invaders came to take his place. When Assur-bani-pal died in 626 (?) B.C. his empire was already in decay, and within a few years the end came. He was luxurious and indolent, entrusting the command of his armies to others whose successes he appropriated, cruel and superstitious, but a magnificent patron of art and literature. The great library of Nineveh was to a considerable extent his creation, and scribes were kept constantly employed in it copying the older tablets of Babylonia, though unfortunately their patron's tastes inclined rather to omens and astrology than to subjects of more modern interest. The library was contained in the palace that he built on the northern side of the mound of Kuyunjik and lined with sculptured slabs which display Assyrian art at its best. Whether Kandalanu (Kinēladanos), who became viceroy of Babylonia after the suppression of the revolt, was Assur-bani-pal under another name, or a different personage, is still doubtful (see SARDANAPALUS).

AUTHORITIES.—George Smith, *History of Assurbanipal* (1871); S. A. Smith, *Die Keilschrifttexte Asurbanipals* (1887–1889); P. Jensen in E. Schrader's *Keilinschriftliche Bibliothek*, ii. (1889); J. A. Knudtzon, *Assyrische Gebete an den Sonnengott* (1893); C. Lehmann, *Schamashschumukin* (1892). (A. H. S.)

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[1] As essentially a *national* god, he is almost identical in character with the early Yahweh of Israel. See Sayce, Hibbert Lectures, *Religion of Ancient Babylonia*, p. 129.

ASSUS [mod. *Behram*], an ancient Greek city of the Troad, on the Adramyttian Gulf. The situation is one of the most magnificent in all the Greek lands. The natural cleavage of the trachyte into joint planes had already scarped out shelves which it was comparatively easy for human labour to shape; and so, high up this cone of trachyte, the Greek town of Assus was built, tier above tier, the summit of the crag being crowned with a Doric temple of Athena. The view from the summit is very beautiful and of great historical interest. In front is Lesbos, one of whose towns, Methymna, is said to have sent forth the founders of Assus, as early, perhaps, as 1000 or 900 B.C. The whole south coast-line of the Troad is seen, and in the south-east the ancient territory of Pergamum, from whose masters the possession of Assus passed to Rome by the bequest of Attalus III. (133 B.C.). The great heights of Ida rise in the east. Northward the Tuzla is seen winding through a rich valley. This valley was traversed by the road which St Paul must have followed when he came overland from Alexandria Troas to Assus, leaving his fellow-travellers to proceed by sea. The north-west gateway, to which this road led, is still flanked by two massive towers, of Hellenic work. On the shore below, the ancient mole can still be traced by large blocks under the clear water. Assus affords the only harbour on the 50 m. of coast between Cape Lectum and the east end of the Adramyttian Gulf; hence it must always have been the chief shipping-place for the exports of the southern Troad. The great natural strength of the site protected it against petty assailants; but, like other towns in that region, it has known many masters—Lydians, Persians, the kings of Pergamum, Romans and Ottoman Turks. From the Persian wars to about 350 B.C. Assus enjoyed at least partial independence. It was about 348–345 B.C. that Aristotle spent three years at Assus with Hermeas, an ex-slave who had succeeded his former master Eubulus as despot of Assus and Atarneus. Aristotle has left some verses from an invocation to Arete (Virtue), commemorating the worth of Hermeas, who had been seized by Persian treachery and put to death.

Under its Turkish name of Behram, Assus is still the commercial port of the southern Troad, being the place to which loads of valonia are conveyed by camels from all parts of the country. Explorations were conducted at Assus in 1881–1883 by Mr J. T. Clarke for the Archaeological Institute of America. The main object was to clear the Doric temple of Athena, built about 470 B.C. This temple is remarkable for a sculptured architrave which took the place of the ordinary frieze. The scenes are partly mythological (labours of Heracles), partly purely heraldic. Eighteen panels were transported to the Louvre in 1838; other fragments rewarded the Americans, and a scientific ground-plan was drawn. The well-preserved Hellenistic walls were also studied.

See J. T. Clarke, *Assos*, 2 vols., 1882 and 1898 (Papers of Arch. Inst. of America, i. ii.); and authorities under Troad. (D. G. H.)

ASSYRIA. The two great empires, Assyria and Babylon, which grew up on the banks of the Tigris and Euphrates, can be separated as little historically as geographically. From the beginning their history is closely intertwined; and the power of the one is a measure of the weakness of the other. This interdependence of Assyrian and Babylonian history was recognized by ancient writers, and has been confirmed by modern discovery. But whereas Assyria takes the first place in the classical accounts to the exclusion of Babylonia, the decipherment of the inscriptions has proved that the converse was really the case, and that, with the exception of some seven or eight centuries, Assyria might be described as a province or dependency of Babylon. Not only was Babylonia the mother country, as the tenth chapter of Genesis explicitly states, but the religion and culture, the literature and the characters in which it was contained, the arts and the sciences of the Assyrians were derived from their southern neighbours. They were similar in race and language. (See Babylonia and Assyria.)

AST, GEORG ANTON FRIEDRICH (1778–1841), German philosopher and philologist, was born at Gotha. Educated there and at the university of Jena, he became privat-docent at Jena in 1802. In 1805 he became professor of classical literature in the university of Landshut, where he remained till 1826, when it was transferred to Munich. There he lived till his death on the 31st of October 1841. In recognition of his work he was made an aulic councillor and a member of the Bavarian Academy of Sciences. He is known principally for his work during the last twenty-five years of his life on the dialogues of Plato. His *Platon's Leben und Schriften* (1816) was the first of those critical inquiries into the life and works of Plato which originated in the *Introductions* of Schleiermacher and the historical scepticism of Niebuhr and Wolf. Distrusting tradition, he took a few of the finest dialogues as his standard, and from internal evidence denounced as spurious not only those which are generally admitted to be so (*Epinomis*, *Minos*, *Theages*, *Arastae*, *Clitophon*, *Hipparchus*, *Eryxias*, *Letters and Definitions*), but also the *Meno*, *Euthydemus*, *Charmides*, *Lysis*, *Laches*, *First and Second Alcibiades*, *Hippias Major and Minor*, *Ion*, *Euthyphro*, *Apology*, *Crito*, and even (against Aristotle's explicit assertion) *The Laws*. The genuine dialogues he divides into three series:—(1) the earliest, marked chiefly by the poetical and dramatic element, *i.e.* *Protagoras*, *Phaedrus*, *Gorgias*, *Phaedo*; (2) the second, marked by dialectic subtlety, *i.e.* *Theaetetus*, *Sophist*, *Statesman*, *Parmenides*, *Cratylus*; (3) the third group, combining both qualities harmoniously, *i.e.* the *Philebus*, *Symposium*, *Republic*, *Timaeus*, *Critias*. The work was followed by a complete edition of Plato's works (11 vols., 1819–1832) with a Latin translation and commentary. His last work was the *Lexicon Platonicum* (3 vols., 1834–1839), which is both valuable and comprehensive. In his works on aesthetics he combined the views of Schelling with those of Winckelmann, Lessing, Kant, Herder, Schiller and others. His histories of philosophy are marked more by critical scholarship than by originality of thought, though they are interesting as asserting the now familiar principle that the history of philosophy is not the history of opinions, but of reason as a whole; he was among the first to attempt to formulate a principle of the development of thought. Beside his works on Plato, he wrote, on aesthetics, *System der Kunstlehre* (1805) and *Grundriss der Aesthetik* (1807); on the history of philosophy, *Grundlinien der Philosophie* (1807, republished 1809, but soon forgotten), *Grundriss einer Geschichte der Philosophie* (1807 and 1825), and *Hauptmomente der Geschichte der Philosophie* (1829); in philology, *Grundlinien der Philologie* (1808), and *Grundlinien der Grammatik, Hermeneutik und Kritik* (1808).

ASTARA, a port of Russian Transcaucasia, government of Baku, on the Caspian, in 38° 27′ N. lat. and 48° 53′ E. long., on the river of the same name, which forms the frontier between Persia and Russia. Russian merchandize is landed there and forwarded to Azerbáiján and Tabriz via Ardebil.

ASTARABAD, a province of Persia bounded N. by the Caspian Sea and Russian Transcaspian, S. by the Elburz Mountains, W. by Mazandaran, and E. by Khorasan. The country, mountainous in its southern portion, possesses extensive forests, fertile valleys, producing rice, wheat and other grains in abundance, and rich pasturages. The soil, even with little culture, is exceedingly productive, owing to the abundance of water which irrigates and fertilizes it. But while the province in many parts presents a landscape of luxuriant beauty, it is a prey to the ravages of disease, principally malarial fevers due to the extensive swamps formed by waters stagnating in the forests, and to the frequent incursions of the Goklan and Yomut Turkomans, who have their camping-grounds in the northern part of the province, and until about 1890 plundered caravans sometimes at the very gates of Astarabad city, and carried people off into slavery and bondage. The province has a population of about 100,000 and pays a yearly revenue of about £30,000. The inhabitants, notwithstanding the unhealthiness of their climate, are a strong and athletic race, belying their yellow and sickly appearance. The province has the following bulúk (administrative divisions):—(1) Astarabad town; (2) Astarabad rustak (villages); (3) Sadan rustak; (4) Anazan; (5) Katúl; (6) Findarisk, with Kuhsar and Nodeh; (7) Shahkuh Sávar.

Astarabad, the capital of the province, is situated on the Astar, a small tributary of the Kara Su (Black river), which flows into the Caspian Sea 20 m. W. of the city, and about 18 m. S. of the Gurgan river, in 36° 51′ N. lat. and 54° 26′ E. long. It is surrounded by a mud wall about 30 ft. in height and about $3\frac{1}{2}$ m. in circuit, but much of the enclosed space is occupied by gardens, mounds of refuse, and ruins. At one time of greater size, it was reduced by Nadir Shah within its present limits. Astarabad owes its origin to Yazid ibn Mohallab, who occupied the province early in the 8th century for Suleiman, the seventh of the Omayyad caliphs (715–717), and was destroyed by Timur (Tamerlane) in 1384. Jonas Hanway, the philanthropist (d. 1786), visited the place in 1744, and attempted to open a direct trade through it between Europe and central Asia. Owing to the noxious exhalations of the surrounding forests the town is so extremely unhealthy during the hot weather as to have acquired the title of the "Abode of the Plague." It has post and telegraph offices, and a population of about 10,000. Since 1890 the Turkomans who impeded trade by their perpetual raids have been kept more in check, and with the decrease of insecurity the commercial activity of Astarabad has increased considerably.

ASTARTE, a Semitic goddess whose name appears in the Bible as Ashtoreth.[1] She is everywhere the great female principle, answering to the Baal of the Canaanites and Phoenicians[2] and to the Dagon of the Philistines. She had temples at Sidon and at Tyre (whence her worship was transplanted to Carthage), and the Philistines probably venerated her at Ascalon (1 Sam. xxxi. 10). Solomon built a high-place for her at Jerusalem which lasted until the days of King Josiah (1 Kings xi. 5; 2 Kings xxiii. 13), and the extent of her cult among the Israelites is proved as much by the numerous biblical references as by the frequent representations of the deity turned up on Palestinian soil.[3] The Moabites formed a compound deity, Ashtar-Chemosh (see Moab), and the absence of the feminine termination occurs similarly in the Babylonian and Assyrian prototype Ishtar. The old South Arabian phonetic equivalent ʿAthtar is, however, a male deity. Another compound, properly of mixed sex, appears in the Aramaean Atargatis (ʿAt[t]ar-ʿathe), worn down to Derketo, who is specifically associated with sacred pools and fish (Ascalon, Hierapolis-Mabog). (See Atargatis.)

The derivation of the name Ishtar is uncertain, and the original attributes of the goddess are consequently unknown. She assumes various local forms in the old Semitic world, and this has led to consequent fusion and identification with the deities of other nations. As the great nature-goddess, the attributes of fertility and reproduction are characteristically hers, as also the accompanying immorality which originally, perhaps, was often nothing more than primitive magic. As patroness of the hunt, later identification with Artemis was inevitable. Hence the consequent fusion with Aphrodite, Artemis, Diana, Juno and Venus, and the action and reaction of one upon the other in myth and legend. Her star was the planet Venus, and classical writers give her the epithet Caelestis and Urania. Whether Astarte was also a lunar goddess has been questioned. As the female counterpart of the Phoenician Baal (viewed as a sun-god), and on the testimony of late writers (Lucian, Herodian) that she was represented with horns, the place-name Ashteroth-Karnaim in Gilead ("Ashteroth of the horns") has been considered ample proof in favour of the theory. But it is probable that the horns were primarily ram's horns,[4] and that Astarte the moon-goddess is due to the influence of the Egyptian Isis and Hathor. Robertson Smith, too, argues that Astarte was originally a sheep-goddess, and points to the interesting use of "Astartes of the flocks" (Deut. vii. 13, see the comm.) to denote the offspring. To nomads, Astarte may well have been a sheep-goddess, but this, if her earliest, was not her only type, as is clear from the sacred fish of Atargatis, the doves of Ascalon (and of the Phoenician sanctuary of Eryx), and the gazelle or antelope of the goddess of love (associated also with the Arabian Athtar).

The literature is vast; see G. A. Barton, *Amer. Journ. of Sem. Lang.* vols. ix. x., and his *Semitic Origins*; Driver, Hastings' *Dict. Bible*, i. pp. 167-171; Zimmern, *Keilinschr. und das alte Test.*^{3} pp. 420 sqq.; Lagrange, *Études d. Relig. Sem.* pp. 123-140; and the articles Adonis, Aphrodite, Artemis, Baal.

(S. A. C.)

ASTELL, MARY (1668–1731), English author, was born at Newcastle-upon-Tyne. She was instructed by her uncle, a clergyman, in Latin and French, logic, mathematics and natural philosophy. In her twentieth year she went to London, where she continued her studies. She published, in 1697, a work entitled *A Serious Proposal to the Ladies, wherein a Method is offered for the Improvement of their Minds.* With the same end in view she elaborated a scheme for a ladies' college, which was favourably entertained by Queen Anne, and would have been carried out had not Bishop Burnet interfered. The most important of her other works was *The Christian Religion, as professed by a Daughter of the Church of England*, published in 1705.

ASTER (Gr. ἀστήρ, a star), the name of a genus of plants, given from the fact of the flowers having a radiated or star-like appearance (see below). The Greek word also provides many derivatives: *e.g. asterism* (Gr. ἀστερισμός), a constellation (*q.v.*); *asteroid* (Gr. ἀστερο-ειδής, star-like), an alternative name for planetoids or minor planets (see Planet).

The genus of composite plants named aster (natural order *Compositae*) is found largely in North America, and scattered sparingly over Asia, Europe and South America. They are usually herbaceous perennials; their flowers arranged in numerous heads (*capitula*) recall those of the daisy, whence they are popularly known in England as Michaelmas daisies, since many are in bloom about that time. They are valuable plants in a garden, the various species flowering from late summer right on to November or December. The only British species is *Aster Tripolium*, found abundantly in saline marshes near the sea. One of the species, *Aster alpinus*, grows at a considerable height on the mountains of Europe. Some of them, such as *Aster spectabilis* of North America, are very showy. They are mostly easy to cultivate in ordinary garden soil, and are readily propagated by dividing the roots in early spring. The following are some of the better known forms:—*A. alpinus*, barely 1 ft. high, and *A. Amellus*, $1\frac{1}{2}$ ft., with its var. *bessarabicus*, have broadish blunt leaves and large starry bluish flowers; *A. longifolius* var. *formosus*, 2 ft., bright rosy lilac; *A. acris*, 2 to 3 ft., with blue flowers in August; *A. ericoides*, 3 ft., with heath-like leaves and masses of small white flowers; *A. puniceus*, 4 to 6 ft., blue or rosy-lilac; *A. turbinellus*, 2 to 3 ft., mauve-coloured, are showy border plants; and *A. Novae-Angliae*, 5 to 6 ft., rosy-violet; *A. Novi-Belgii*, 3 to 6 ft., pale blue; *A. laevis*, 2 to 6 ft., blue-lilac; and *A. grandiflorus*, 3 ft., violet, are especially useful from their late-flowering habit.

The China aster (*Callistephus chinensis*) is also a member of the order *Compositae.* It is a hardy annual, a native of China, which by cultivation has yielded a great variety of forms. Some of the best for ornamental gardening are the chrysanthemum-flowered, the paeony-flowered, the crown or cockade, the comet, and the globe-quilled. Crown asters have a white centre, and dark crimson or purple circumference, and are very beautiful. The colours range from white and blush through pink and rose to crimson, and from lilac through blue to purple, in various shades. They should be sown early in March in pans, in a gentle heat, the young plants being quickly transferred to a cool pit, and there pricked out in rich soil as soon as large enough, and eventually planted out in the garden in May or June, in soil which has been well worked and copiously manured, where they grow from

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[1] The vocalization suggests the Heb. *bōsheth*, "shame"; see Baal.

[2] Add also the Hittites; for Sutekh, the Egyptian equivalent of the male partner, see W. M. Müller, *Mitt. d. vorderasiat. Gesell.* (1902), v. pp. 11, 38. Astarte was introduced also into Egypt and had her temple at Memphis. See also S. A. Cook, *Religion of Ancient Palestine, Index*, s.v.

[3] Such figurines are in a sense the prototypes of the Venus of Medici. On the influence of her cult upon that of the Virgin Mary, see Rösch, *Studien u. Krit.* (1888), pp. 265 sqq.

[4] A model of an Astarte with ram's horns was unearthed by R. A. S. Macalister at Gezer (*Pal. Explor. Fund, Quart. Statement*, 1903, p. 227 with figure facing).

8 to 18 in. high, and flower towards the end of summer. They also make handsome pot plants for the conservatory.

ASTERIA, or Star-Stone (from Gr. ἀστήρ, star), a name applied to such ornamental stones as exhibit when cut *en cabochon* a luminous star. The typical asteria is the star-sapphire, generally a bluish-grey corundum, milky or opalescent, with a star of six rays. (See Sapphire.) In red corundum the stellate reflexion is less common, and hence the star-ruby occasionally found with the star-sapphire in Ceylon is among the most valued of "fancy stones." When the radiation is shown by yellow corundum, the stone is called star-topaz. Cymophane, or chatoyant chrysoberyl, may also be asteriated. In all these cases the asterism is due to the reflexion of light from twin-lamellae or from fine tubular cavities or thin enclosures definitely arranged in the stone. The *astrion* of Pliny is believed to have been our moonstone, since it is described as a colourless stone from India having within it the appearance of a star shining with the light of the moon. All star-stones were formerly regarded with much superstition.

ASTERID, a group of starfish. They are the starfish proper, and have the typical genus *Asterias* (see Starfish).

ASTERISK (from Gr. ἀστερίσκος, a little star), the sign* used in typography. The word is also used in its literal meaning in old writers, and as a description of an ornamental form (star-shaped) in one of the utensils in the Greek Church.

ASTERIUS, of Cappadocia, sophist and teacher of rhetoric in Galatia, was converted to Christianity about the year 300, and became the disciple of Lucian, the founder of the school of Antioch. During the persecution under Maximian (304) he relapsed into paganism, and thus, though received again into the church by Lucian and supported by the Eusebian party, never attained to ecclesiastical office. He is best known as an able defender of the semi-Arian position, and was styled by Athanasius the "advocate" of the Arians. His chief work was the *Syntagmation*, but he wrote many others, including commentaries on the Gospels, the Psalms, and Romans. He attended many synods, and we last hear of him at the synod of Antioch in 341.

ASTERIUS, bishop of Amasia, in Pontus, *c.* 400. He was partly contemporary with the emperor Julian (d. 363) and lived to a great age. His fame rests chiefly on his *Homilies*, which were much esteemed in the Eastern Church. Most of these have been lost, but twenty-one are given in full by Migne (*Patrol. Ser. Gr.* xl. 164-477), and there are fragments of others in Photius (*Cod.* 271). Asterius was a man of much culture, and his works are a valuable contribution to our knowledge of the history of preaching.

ASTHMA (Gr. ἆσθμα, gasping, whence ἀσθμαίνω, I gasp for breath), a disorder of respiration characterized by severe paroxysms of difficult breathing (*dyspnoea*) usually followed by a period of complete relief, with recurrence of the attacks at more or less frequent intervals. The term is often loosely employed in reference to states of embarrassed respiration, which are plainly due to permanent organic disease of the respiratory organs (see Respiratory System: *Pathology*).

The attacks occur quite suddenly, and in some patients at regular, in others at irregular intervals. They are characterized by extreme difficulty both in inspiration and expiration, but especially in the latter, the chest becoming distended and the diaphragm immobile. In the case of "pure" "idiopathic" or "nervous" asthma, there is no fever or other sign of inflammation. But where the asthma is secondary to disease of some organ of the body, the symptoms will depend largely on that organ and the disease present. Such secondary forms may be bronchitic, cardiac, renal, peptic or thymic.

The mode of onset differs very markedly in different cases. In some the attack begins quite suddenly and without warning, but in others various sensations well known to the patient announce that an attack is imminent. According to the late Dr Hyde Salter the commonest warning is that of an intense desire for sleep, so overpowering that though the patient knows his only chance of warding off the attack is to keep awake, he is yet utterly unable to fight against his drowsiness. Among other patients, however, a condition of unwonted mental excitement presages the attack. Again the secondary forms of the disease may be ushered in by flatulence, constipation and loss of appetite, and a symptom which often attends the onset, though it is not strictly premonitory, is a profuse diuresis, the urine being watery and nearly colourless, as in the condition of hysterical diuresis. In the majority of instances the attack begins during the night, sometimes abruptly but often by degrees. The patient may or may not be aware that his asthma is threatening. A few hours after midnight he is aroused from sleep by a sense of difficult breathing. In some cases this is a slowly increasing condition, not becoming acute for some hour or more. But in others the attack is so sudden, so severe, that the patient springs from his bed and makes his way at once to an open window, apparently struggling for breath. Most asthmatics have some favourite attitude which best enables them to use all the auxiliary muscles of respiration in their struggle for breath, and this attitude they immediately assume, and guard fixedly until the attack begins to subside. The picture is characteristic and a very painful one to watch. The face is pale, anxious, and it may be livid. The veins of the forehead stand out, the eyes bulge, and perspiration bedews the face. The head is fixed in position, and likewise the powerful muscles of the back to aid the attempt at respiration. The breath is whistling and wheezing, and if it becomes necessary for the patient to speak, the words are uttered with great difficulty. If the chest be watched it is seen to be almost motionless, and the respirations may become extraordinarily slowed. Inspiration is difficult as the chest is already over-distended, but expiration is an even far greater struggle. The attack may last any time from an hour to several days, and between the attacks the patient is usually quite at ease. But notwithstanding the intensely distressing character of the attacks, asthma is not one of the diseases that shorten life.

In the child, asthma is usually periodic in its recurrence, but as he ages it tends to become more erratic in both its manifestations and time of appearance. Also, though at first it may be strictly "pure" asthma, later in life it becomes attended by chronic bronchitis, which in its turn gives rise to emphysema.

As to the underlying cause of the disease, one has only to read the many utterly different theories put forward to account for it, to see how little is really known. But it has now been clearly shown that in the asthmatic state the respiratory centre is in an unstable and excitable condition, and that there is a morbid connexion between this and some part of the nasal apparatus. Dr Alexander Francis has shown, however, that the disease is not directly due to any mechanical obstruction of the nasal passages, and that the nose comparatively rarely supplies the immediate exciting cause of the asthmatic attack. Paroxysmal sneezing is another form in which asthma may show itself, and, curiously enough, this form occurs more frequently in women, asthma of the more recognized type in men. In infants and young children paroxysmal bronchitis is another form of the same disease. Dr James Goodhart notes the connexion between asthma and certain skin troubles, giving cases of the alternation of asthma and psoriasis, and also of asthma and eczema. The disease occurs in families with a well-marked neurotic inheritance, and twice as frequently in men as in women. The immediate cause of an attack may be anything or nothing. Dr Hyde Salter notes that 80% of cases in the young date from an attack of whooping cough, bronchitis or measles.

In the general treatment of asthma there are two methods of dealing with the patient, either that of hardening the individual, widening his range of accommodation, and thus making him less susceptible, or that of modifying and adapting the environment to the patient. These two methods correspond to the two methods of drug treatment, tonic or sedative. During the last few years the method of treatment first used by Dr Alexander Francis has come into prominence. His plan is to restore the stability of the respiratory centre, by cauterizing the septal mucous membrane, and combining with this general hygienic measures. In his own words the operation, which is entirely painless and insignificant, is performed as follows:—"After painting one side of the septum nasi with a few drops of cocaine and resorcin, I draw a line with a galvano-cautery point from a spot opposite the middle turbinated body, forwards and slightly downwards for a distance of rather less than half an inch. In about one week's time I repeat the operation on the other side." In his monograph on the subject, he classifies a large number of cases treated in this manner, most of which resulted in complete relief, some in very great improvement, and a very few in slight or no relief.

ASTI (anc. *Hasta*), a town and episcopal see of Piedmont, Italy, in the province of Alessandria, situated on the Tanaro; it is 22 m. W. by rail from Alessandria. Pop. (1901) town, 19,787; commune, 41,047. Asti has still numerous medieval towers, a fine Gothic cathedral of the 14th century, the remains of a Christian basilica of the 6th century, and the octagonal baptistery of S. Pietro (11th century). It was the birthplace of the poet Vittorio Alfieri. In ancient times it manufactured pottery. It is now famous for its sparkling wine (*Asti spumante*), and is a considerable centre of trade.

ASTLEY, JACOB ASTLEY, Baron (1579–1652), royalist commander in the English Civil War, came of a Norfolk family. In 1598 he joined Counts Maurice and Henry of Orange in the Netherlands, where he served with distinction, and afterwards fought under the elector palatine Frederick V. and Gustavus Adolphus in the Thirty Years' War. He was evidently thought highly of by the states-general, for when he was absent, serving under the king of Denmark, his company in the Dutch army was kept open for him. Returning to England with a well-deserved reputation, he was in the employment of Charles I. in various military capacities. As "sergeant-major," or general of the infantry, he went north in 1639 to organize the defence against the expected Scottish invasion. Here his duties were as much diplomatic as military, as the discontent which ended in the Civil War was now coming to a head. In the ill-starred "Bishops' War," Astley did good service to the cause of the king, and he was involved in the so-called "Army Plot." At the outbreak of the Great Rebellion (1642) he at once joined Charles, and was made major-general of the foot. His characteristic battle-prayer at Edgehill has become famous: "O Lord, Thou knowest how busy I must be this day. If I forget Thee, do not forget me. March on, boys!" At Gloucester he commanded a division, and at the first battle of Newbury he led the infantry of the royal army. With Hopton, in 1644, he served at Arundel and Cheriton. At the second battle of Newbury he made a gallant and memorable defence of Shaw House. He was made a baron by the king, and at Naseby he once more commanded the main body of the foot. He afterwards served in the west, and with 1500 men fought stubbornly but vainly the last battle for the king at Stow-on-the-Wold (March 1646). His remark to his captors has become as famous as his words at Edgehill, "You have now done your work and may go play, unless you will fall out amongst yourselves." His scrupulous honour forbade him to take any part in the Second Civil War, as he had given his parole at Stow-on-the-Wold; but he had to undergo his share of the discomforts that were the lot of the vanquished royalists. He died in February 1651/2. The barony became extinct in 1668.

ASTLEY, SIR JOHN DUGDALE, Bart. (1828–1894), English soldier and sportsman, was a descendant of Lord Astley, and son of the 2nd baronet (cr. 1821). From 1848 to 1859 he was in the army, serving in the Crimean War and retiring as lieutenant-colonel. He married an heiress in 1858, and thenceforth devoted himself to horse-racing, pugilism and sport in general. He succeeded to the baronetcy in 1873, and from 1874 to 1880 was Conservative M.P. for North Lincolnshire. He was a popular figure on the turf, being familiarly known as "the Mate," and won and lost large sums of money. Just before his death, on the 10th of October 1894, he published some entertaining reminiscences, under the title of *Fifty Years of my Life*.

ASTON, ANTHONY (fl. 1712–1731), English actor and dramatist, began to be known on the London stage in the early years of the 18th century. He had tried the law and other professions, which he finally abandoned for the theatre. He had some success as a dramatic author, writing *Love in a Hurry*, performed in Dublin about 1709, and *Pastora, or the Coy Shepherdess*, an opera (1712). For many years he toured the English provinces with his wife and son, producing pieces which he himself wrote, or medleys from various plays fitted together with songs and dialogues of his own.

ASTON MANOR, a municipal and parliamentary borough of Warwickshire, England, adjoining Birmingham on the north-east. Pop. (1901) 77,326. There are extensive manufactures, including those of motors and cycles with their accessories, also paper-mills, breweries, &c., and the population is largely industrial. Aston Hall, erected by Sir Thomas Holte in 1618–1635, is an admirable architectural example of its period, built of red brick. It stands in a large park, the whole property being acquired by the corporation of Birmingham in 1864, when the mansion became a museum and art gallery. It contains the panelling of a room from the house of Edmund Hector, which formerly stood in Old Square, Birmingham, where Dr Samuel Johnson was a frequent visitor. Aston Lower Grounds, adjoining the park, contain an assembly hall, and the playing field of the Aston Villa Football Club, where the more important games are witnessed by many thousands of spectators. Aston Manor was incorporated in 1903. The parliamentary borough returns one member. The corporation consists of a mayor, 6 aldermen and 18 councillors. Area, 960 acres.

ASTOR, JOHN JACOB (1763–1848), American merchant, was born at the village of Walldorf, near Heidelberg, Germany, on the 17th of July 1763. Until he was sixteen he worked in the shop of his father, a butcher; he then joined an elder brother in London, and there for four years was employed in the piano and flute factory of an uncle, of the firm of Astor & Broadwood. In 1783 he emigrated to America, and settled in New York, whither one of his brothers had previously gone. On the voyage he became acquainted with a fur-trader, by whose advice he devoted himself to the same business, buying furs directly from the Indians, preparing them at first with his own hands for the market, and selling them in London and elsewhere at a great profit. He was also the agent in New York of the firm of Astor & Broadwood. By his energy, industry and sound judgment he gradually enlarged his operations, did business in all the fur markets of the world, and amassed an enormous fortune,—the largest up to that time made by any American. He devoted many years to carrying out a project for organizing the fur trade from the Great Lakes to the Pacific Ocean, and thence by way of the Hawaiian Islands to China and India. In 1811 he founded at the mouth of the Columbia river a settlement named after him Astoria, which was intended to serve as the central depot; but two years later the settlement was seized and occupied by the English. The incidents of this undertaking are the theme of Washington Irving's *Astoria*. A series of disasters frustrated the gigantic scheme. Astor made vast additions to his wealth by investments in real estate in New York City, and erected many buildings there, including the hotel known as the Astor House. The last twenty-five years of his life were spent in retirement in New York City, where he died on the 29th of March 1848, his fortune then being estimated at about $30,000,000. He made various charitable bequests by his will, and among them a gift of $50,000 to found an institution, opened as the "Astor House" in 1854, for the education of poor children and the relief of the aged and the destitute in his native village in Germany. His chief benefaction, however, was a bequest of $400,000 for the foundation and endowment of a public library in New York City, since known as the Astor library, and since 1895 part of the New York public library.

See Parton's *Life of John Jacob Astor* (New York, 1865).

His eldest son, William Backhouse Astor (1792–1875), inherited the greater part of his father's fortune, and chiefly by judicious investments in real estate greatly increased it. He was sometimes known as the "Landlord of New York." Under his direction the building for the Astor library was erected, and to the library he gave about $550,000, including a bequest of $200,000. His son, John Jacob Astor (1822–1890), was also well known as a capitalist and philanthropist, giving liberally to the Astor library.

The son of the last named, William Waldorf Astor (1848–), served in the New York assembly in 1877, and in the state senate in 1880–81. He was United States minister to Italy from 1882 to 1885. He published two romances, *Valentine* (1885) and *Sforza* (1889). His wealth, arising from property in New York, where also he built the New Netherland hotel and the Waldorf hotel, was enormous. In 1890 he removed to England, and in 1899 was naturalized. In 1893 he became proprietor of the *Pall Mall Gazette*, and afterwards started the *Pall Mall Magazine*.

ASTORGA, EMANUELE D' (1681–1736), Italian musical composer, was born at Naples on the 11th of December 1681. No authentic account of Astorga's life can be successfully constructed from the obscure and confusing evidence that has been until now handed down, although historians have not failed to indulge many pleasant conjectures. According to some of these, his father, a baron of Sicily, took an active part in the attempt to throw off the Spanish yoke, but was betrayed by his own soldiers and publicly executed. His wife and son were compelled to be spectators of his fate; and such was the effect upon them that his mother died on the spot, and Emanuele fell into a state of gloomy despondency, which threatened to deprive him of reason. By the kindness of the princess Ursini, the unfortunate young man was placed in a convent at Astorga, in Leon, where he completed a musical education which is said to have been begun in Palermo under Francesco Scarlatti. Here he recovered his health, and his admirable musical talents were cultivated under the best masters. On the details of this account no reliance can safely be placed, nor is there any certainty that in 1703 he entered the service of the duke of Parma. Equally untrustworthy is the story that the duke, suspecting an attachment between his niece Elizabeth Farnese and Astorga, dismissed the musician. The established facts concerning Astorga are indeed few enough. They are: that the opera *Dafne* was written and conducted by the composer in Barcelona in 1709; that he visited London, where he wrote his *Stabat Mater*, possibly for the society of "Antient Musick"; that it was performed in Oxford in 1713; that in 1712 he was in Vienna, and that he retired at an uncertain date to Bohemia, where he died on the 21st of August 1736, in a castle which had been given to him in the domains of Prince Lobkowitz, in Raudnitz. Astorga deserves remembrance for his dignified and pathetic *Stabat Mater*, and for his numerous chamber-cantatas for one or two voices. He was probably the last composer to carry on the traditions of this form of chamber-music as perfected by Alessandro Scarlatti.

ASTORGA, a city of N.W. Spain, in the province of Leon; situated near the right bank of the river Tuerto, and at the junction of the Salamanca-Corunna and Leon-Astorga railways. Pop. (1900) 5573. Astorga was the Roman Asturica Augusta, a provincial capital, and the meeting-place of four military roads. Though sacked by the Goths in the 5th century, and later by the Moors, it is still surrounded by massive walls of Roman origin. A ruined castle, near the city, recalls its strategic importance in the 8th century, when Asturias, Galicia and Leon were the headquarters of resistance to the Moors. Astorga has been the see of a bishop since the 3rd century, and was formerly known as the City of Priests, from the number of ecclesiastics resident within its walls. Its Gothic cathedral dates from the 15th century. The city confers the title of marquis on the Osorio family, the ruins of whose palace, sacked in 1810 by the French, are still an object of interest.

For the history, especially the ecclesiastical history, of Astorga, see the anonymous *Historia de la ciudad de Astorga* (Valladolid, 1840); with *Fundación de la . . . iglesia . . . de Astorga*, by P. A. Ezpeleta (Madrid, 1634); and *Fundación, nombre y armas de . . . Astorga*, by P. Junco (Pamplona, 1635).

ASTORIA, a city, port of entry, and the county-seat of Clatsop county, Oregon, U.S.A., on the Columbia river, 8 m. from its mouth. Pop. (1890) 6184; (1900) 8381, of whom 3779 were foreign-born (many being Finns,—a Finnish weekly was established here in 1905), and 601 were Chinese; (1910, census) 9599. It is served by the Astoria & Columbia River railroad (Northern Pacific System), and by several coastwise and foreign steamship lines (including that of the Oregon Railway & Navigation Co.). The river here is about 6 m. wide, and the city has a water-front of about 5 m. and a deep, spacious and placid harbour. By dredging and the construction of jetties the Federal government has since 1885 greatly improved the channel at the mouth of the river. The business portion of the city occupies the low ground of the river bottom; the residence portion is on the hillsides overlooking the harbour. Astoria is the port of entry for the Oregon Customs District, Oregon; in 1907 its imports were valued at $21,262, and its exports at $329,103. The city is especially important as a salmon fishing and packing centre (cod, halibut and smaller fish also being abundant); it has also an extensive lumber trade, important lumber manufactories, pressed brick and terra-cotta factories, and dairy interests. In 1905 the value of the factory product was $3,092,628 (of which $1,759,871 was the value of preserved and canned fish), being an increase of 41·8% in five years. Astoria is the oldest American settlement in the Columbia Valley. It was founded in 1811, as a depot for the fur trade, by John Jacob Astor, in whose honour it was named. It was seized by the British in 1813, but was restored in 1818. In 1821, while occupied by the North-West Fur Company, it was burned and practically abandoned, only a few settlers remaining. It was chartered as a city in 1876.

See Washington Irving's *Astoria; or Anecdotes of an Enterprise beyond the Rocky Mountains* (Philadelphia, 1836).

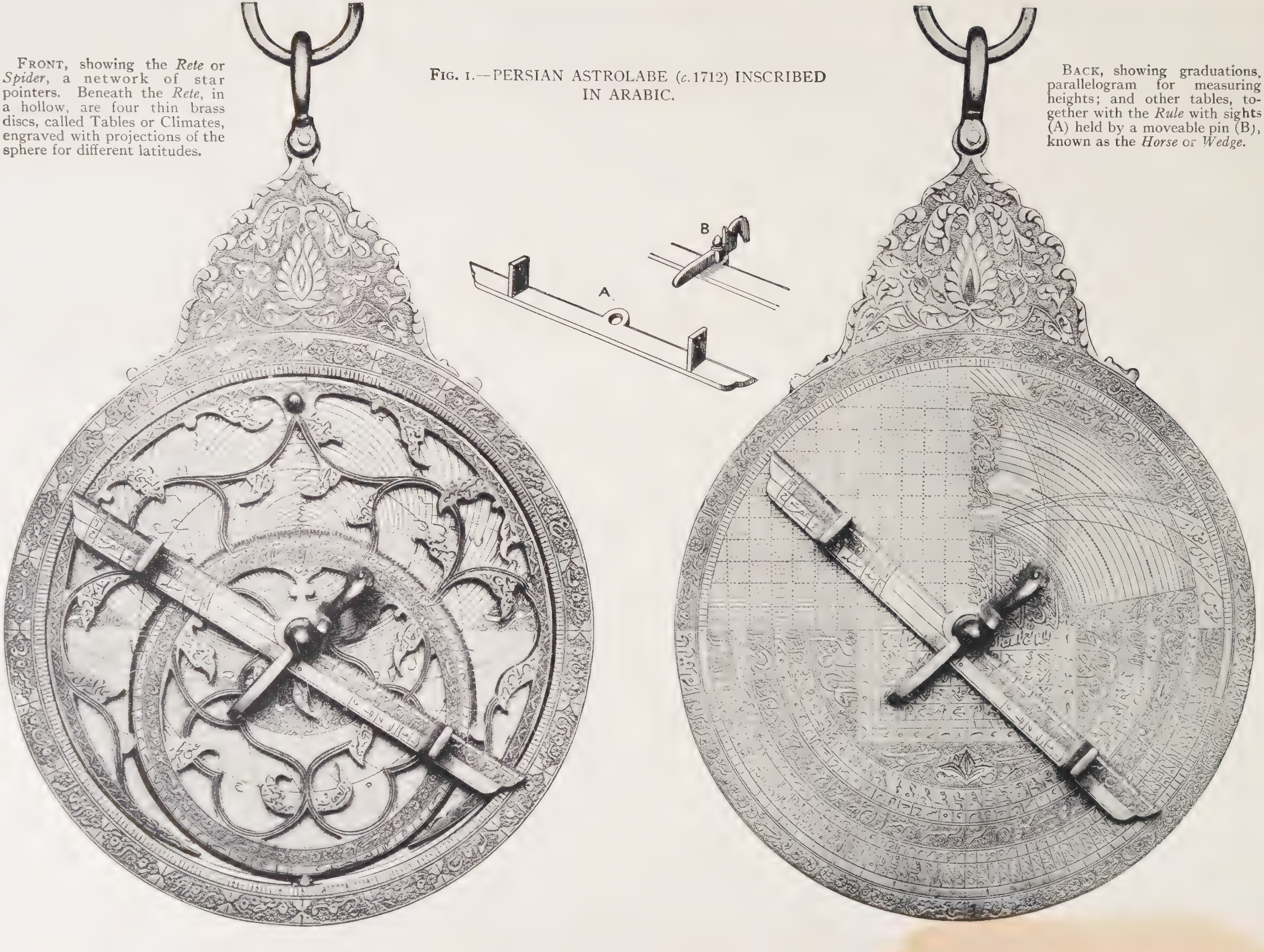
ASTRAEA, in Greek legend, the "star maiden," daughter of Zeus and Themis, or of Astraeus the Titan and Eos, in which case she is identified with Dikē. During the golden age she remained among men distributing blessings, but when the iron (or bronze) age came on, she was forced to withdraw, being the last of the goddesses to quit the earth. In the heavens she is amongst the signs of the zodiac as the constellation Virgo. She is usually represented with a pair of scales and a crown of stars.

Ov. *Met.* i. 150; Juv. vi. 19; Aratus, *Phaenomena*, 96.

ASTRAGAL (from the Gr. ἀστράγαλος, the ankle-joint), an architectural term for a convex moulding. This term is generally applied to small mouldings, "torus" (*q.v.*) to large ones of the same form. The Lesbian astragal referred to by Vitruvius, bk. iv. ch. vi., was in all probability an astragal carved with a bead and reel enrichment.

ASTRAKHAN, a government of S.E. Russia, on the lower Volga, bounded N. by the governments of Samara and Saratov, W. by Saratov and the government of the Don Cossacks, S. by Stavropol and Terek, and E. by the Caspian Sea and the government of the Urals. Area, 91,327 sq. m., of which 6730 sq. m. belong to the delta of the Volga and its brackish lagoons, and 62,290 sq. m. are covered by the Kalmuck and Kirghiz Steppes. The surface is a low-lying plain, except that in the west the Ergeni Hills (500–575 ft.) form the water-parting between the Volga basin and that of the Don. The climate is very hot and dry, the average temperature for the year being 50° Fahr., for January 21°, and for July 78°, rainfall 7·3 in., but often there is no rain at all in the summer. Pop. (1897) 1,005,460, of whom 132,383 were urban. The Kalmucks (138,580 in 1897) and Kirghiz (260,000) are semi-nomads. In addition to them the population includes nearly 44,000 Tatars, 4270 Armenians, with Poles and Jews. Fishing off the mouth of the Volga gives occupation to 50,000 persons; the fish, chiefly herrings and sturgeon, together with the caviare prepared from the latter, are sold for the most part at Nizhniy-Novgorod. Over 300,000 tons of salt are extracted annually from the lakes, principally those of Baskunchak and Elton. Cattle-breeding is an important industry. Market-gardening (mustard, water-melons, fruit) is on the increase; but pure agriculture is relatively not much developed. The government is divided into five districts, the chief towns of which are Astrakhan, Enotayevsk (pop. 2810 in 1897), Krasnyi-yar (4680), Chernyi-yar (5140), and Tsarev

FIG. I.—PERSIAN ASTROLABE (*c.*1712) INSCRIBED IN ARABIC.



FRONT, showing the *Rete* or *Spider*, a network of star pointers. Beneath the *Rete*, in a hollow, are four thin brass discs, called Tables or Climates, engraved with projections of the sphere for different latitudes.

BACK, showing graduations, parallelogram for measuring heights; and other tables, together with the *Rule* with sights (A) held by a moveable pin (B), known as the *Horse* or *Wedge*.

(8900). The Kalmucks and Kirghiz have their own local administrations, and so have the Astrakhan Cossacks (25,600).

ASTRAKHAN, a town of E. Russia, capital of the government of Astrakhan, on the left bank of the main channel of the Volga, 50 m. from the Caspian Sea, in 46° 21′ N. lat. and 48° 5′ E. long. Since the growth of the petroleum industry of Baku and the construction of the Transcaspian railway, Astrakhan has become an important commercial centre, exporting fish, caviare, sugar, metals, naphtha, cottons and woollens, and importing grain, cotton, fruit and timber, to the aggregate value of £8,250,000 with foreign countries and of £14,500,000 with the interior of Russia. The town gives its name to the "fur" called "astrakhan," the skin of the new-born Persian lamb, and so to an imitation in rough woollen cloth. There is some tanning, shipbuilding and brewing, and making of soap, tar and machinery. Astrakhan is the chief port on the Caspian Sea and the headquarters of the Russian Caspian fleet. The city consists of (1) the *kreml* or citadel (1550), crowning a hill, on which stand also the spacious brick cathedral containing the tombs of two Georgian princes, the archbishop's palace and the monastery of the Trinity; (2) the Byelogorod or White Town, containing the administrative offices and the bazaars; and (3) the suburbs, where most of the population resides. The buildings in the first two quarters are of stone, in the third of wood, irregularly arranged along unpaved, dirty streets. The city is the see of a Greek Catholic archbishop and of an Armenian archbishop, and contains a Lamaist monastery, as well as technical schools, an ichthyological museum, the Peter museum, with ethnographical, archaeological and natural history collections, a botanical garden, an ecclesiastical seminary, and good squares and public gardens, one of which is adorned with a statue (1884) of Alexander II. Vineyards surround the city. Astrakhan was anciently the capital of a Tatar state, and stood some 7 m. farther north. After this was destroyed by the Mongol prince Timur the Great in 1395, the existing city was built. The Tatars were expelled about 1554 by Ivan IV. of Russia. In 1569 the city was besieged by the Turks, but they were defeated with great slaughter by the Russians. In 1670 it was seized by the rebel Stenka Razin; early in the following century Peter the Great constructed here a shipbuilding yard and made Astrakhan the base for his hostilities against Persia, and later in the same century Catherine II. accorded the city important industrial privileges. In 1702, 1718 and 1767, it suffered severely from fires; in 1719 was plundered by the Persians; and in 1830 the cholera swept away a large number of its people. In the middle ages the city was known also as Jitarkhan and Ginterkhan. Pop. (1867) 47,839; (1900) 121,580. Eight miles above Astrakhan, on the right bank of the Volga, are the ruins of two ancient cities superimposed one upon the other. In the upper, which may represent the city of Balanjar (Balansar, Belenjer), have been found gold and silver coins struck by Mongol rulers, as well as ornaments in the same metals. The older and scantier underlying ruins are supposed to be those of the once large and prosperous city of Itil or Atel (Etel, Idl) of the Arab geographers, a residence of the khan of the Khazars, destroyed by the Russians in 969. (P. A. K.)

ASTROLABE (from Gr. ἄστρον, star, and λαβεῖν, to take), an instrument used not only for stellar, but for solar and lunar altitude-taking. The principle of the astrolabe is explained in fig. 2. There were two kinds,—spherical and planispheric.

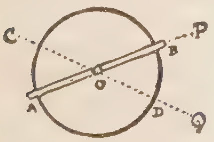
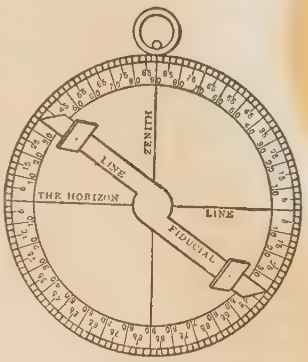


FIG. 2.—Principle of the Astrolabe. If a solid circle be fixed in any one position and a tube be pivoted on its centre so as to move; and if the line C D be drawn upon the circle pointing towards any object Q in the heavens which lies in the plane of the circle, by turning the tube A B towards any other object P in the plane of the circle, the angle B O D will be the angle subtended by the two objects P and Q at the eye.

The earliest forms were "armillae" and spherical. Gradually, from Eratosthenes to Tycho, Hipparchus playing the most important part among ancient astronomers, the complex astrolabe was evolved, large specimens being among the chief observatory instruments of the 15th, 16th and even 17th centuries; while small ones were in use among travellers and learned men, not only for astronomical, but for astrological and topographical purposes. Nearly every one of the modern instruments used for the observations of physical astronomy is a part of the perfected astrolabe. A collection of circles such as is the armillary sphere, if each circle were fitted with a view-tube, might be considered a complete astrolabe. Tycho's armillae were astrolabes. In fact the modern equatorial, and the altitude and azimuth circle are astrolabes in the strictest and oldest meaning of the term; and Tycho in one of his astrolabes came so near the modern equatorial that it may be taken as the first of the kind.

The two forms of the planispheric astrolabe most widely known and used in the 15th, 16th and even 17th centuries were: (1) the *portable astrolabe* shown in fig. 1 (Plate). This originated in the East, and was in early use in India, Persia and Arabia, and was introduced into Europe by the Arabs, who had perfected it —perhaps as early as A.D. 700. It combines the planisphere and armillae of Hipparchus and others, and the theodolite of Theon, and was usually of brass, varying in diameter from a couple of inches to a foot or more. It was used for taking the altitudes of sun, moon and stars; for calculating latitude; for determining the points of the compass, and time; for ascertaining heights of mountains, &c.; and for construction of horoscopes. The instrument was a marvel of convenience and ingenuity, and was called "the mathematical jewel." Nevertheless it passed out of use, because incapable of any great precision.



From *Exercises*, by T. Blundeville.

FIG. 3.—Mariner's Astrolabe, A.D. 1594. Made of brass, or of heavy wood: it varied in size from a few inches to 1 ft. in diameter.

(2) The *mariner's astrolabe*, fig. 3, was adapted from that of astronomers by Martin Behaim, *c.* 1480. This was the instrument used by Columbus. With the tables of the sun's declination then available, he could calculate his latitude by meridian altitudes of the sun taken with his astrolabe. The mariner's astrolabe was superseded by John Hadley's quadrant of 1731.

AUTHORITIES.—Chaucer, *Treatise on the Astrolabe* (Skeat's edition of Chaucer); J. J. Stöffler, *Elucidatio Fabrice ususque Astrolabii*, &c.; Thomas Blundeville, *His Exercises* (1594); F. Ritter, *Astrolabium*; W. H. Morley, *Description of Astrolabe of Shah Husain*; M. L. Huggins, "The Astrolabe" (*Astrophysical Journal*, 1894); *Penny Cyclopaedia*, article "Astrolabe;" R. Grant, *History of Physical Astronomy*. (M. L. H.)

ASTROLOGY, the ancient art or science of divining the fate and future of human beings from indications given by the positions of the stars (sun, moon and planets). The belief in a connexion between the heavenly bodies and the life of man has played an important part in human history. For long ages astronomy and astrology (which might be called astromancy, on the same principle as "chiromancy") were identified; and a distinction is made between "natural astrology," which predicts the motions of the heavenly bodies, eclipses, &c., and "judicial astrology," which studies the influence of the stars on human destiny. Isidore of Seville (d. 636) is one of the first to distinguish between astronomy and astrology; nor did astronomy begin to rid itself of astrology till the 16th century, when, with the system of Copernicus, the conviction that the earth itself is one of the heavenly bodies was finally established. The study of astromancy and the belief in it, as part of astronomy, is found in a developed form among the ancient Babylonians, and directly or indirectly through the Babylonians spread to other nations. It came to Greece about the middle of the 4th century B.C., and reached Rome before the opening of the Christian era. In India and China astronomy and astrology are largely reflections of Greek theories and speculations; and similarly with the introduction of Greek culture into Egypt, both astronomy and astrology were actively cultivated in the region of the Nile during the Hellenistic and Roman periods. Astrology was further developed by the Arabs from the 7th to the 13th century, and in the Europe of the 14th and 15th centuries astrologers were dominating influences at court.

Even up to the present day men of intellectual eminence like Dr Richard Garnett have convinced themselves that astromancy has a foundation of truth, just as there are still believers in chiromancy or other forms of divination. Dr Garnett (" A. G. Trent ") insisted indeed that it was a mistake to confuse astrology with fortune-telling, and maintained that it was a " physical science just as much as geology," depending like them on ascertained facts, and grossly misrepresented by being connected with magic. Dr Garnett himself looked upon the study of biography in relation to the casting of horoscopes as an empirical investigation, but it is difficult in practice to keep the distinction clear, to judge by present-day text-books such as those of Dr Wilde (*Primer of Astrology*, &c.). Dr Wilde insists on there being " nothing incongruous with the laws of nature in the theory that the sun, moon and stars influence men's physical bodies and conditions, seeing that man is made up of a physical part of the earth." There is an obvious tendency, however, for astromancy to be employed, like palmistry, as a means of imposing on the ignorant and credulous. How far the more serious claim is likely to be revived in connexion with the renewal of research into the " occult " sciences generally, it is still too early to speculate; and it has to be recognized that such a point of view is opposed to the generally established belief that astrology is either mere superstition or absolute imposture, and that its former vogue was due either to deception or to the tyranny of an unscientific environment. But if the progress of physical science has not prevented the rehabilitation of much of ancient alchemy by the later researches into chemical change, and if psychology now finds a place for explanations of spiritualism and witchcraft which involve the admission of the empirical facts under a new theory (as in the case of the divining-rod, &c.), it is at least conceivable that some new synthesis might once more justify part at all events of ancient and medieval astromancy, to the extent of admitting the empirical facts where provable, and substituting for the supposed influence of the stars as such, some deeper theory which would be consistent with an application to other forms of prophecy, and thus might reconcile the possibility of dipping into futurity with certain inter-relations of the universe, different indeed from those assumed by astrological theory, but underlying and explaining it. If this is ever accomplished it will need the patient investigation of a number of empirical observations by competent students unbiassed by any *parti pris*—a difficult set of conditions to obtain; and even then no definite results may be achieved.

The history of astrology can now be traced back to ancient Babylonia, and indeed to the earliest phases of Babylonian history, *i.e.* to about 3000 B.C. In Babylonia as well as in Assyria as a direct offshoot of Babylonian culture (or as we might also term it " Euphratean " culture), astrology takes its place in the official cult as one of the two chief means at the disposal of the priests (who were called *bārē* or " inspectors ") for ascertaining the will and intention of the gods, the other being through the inspection of the liver of the sacrificial animal (see OMEN). Just as this latter method of divination rested on a well-defined theory, to wit, that the liver was the seat of the soul of the animal and that the deity in accepting the sacrifice identified himself with the animal, whose " soul " was thus placed in complete accord with that of the god and therefore reflected the mind and will of the god, so astrology is based on a theory of divine government of the world, which in contrast to " liver " divination assumes at the start a more scientific or pseudo-scientific aspect. This theory must be taken into consideration as a factor in accounting for the persistent hold which even at the present day astrology still maintains on many minds. Starting with the indisputable fact that man's life and happiness are largely dependent upon phenomena in the heavens, that the fertility of the soil is dependent upon the sun shining in the heavens as well as upon the rains that come from heaven, that on the other hand the mischief and damage done by storms and inundations, to both of which the Euphratean Valley was almost regularly subject, were to be traced likewise to the heavens, the conclusion was drawn that all the great gods had their seats in the heavens. In that early age of culture known as the " nomadic " stage, which under normal conditions precedes the " agricultural " stage, the moon cult is even more prominent than sun worship, and with the moon and sun cults thus furnished by the " popular " faith it was a natural step for the priests, who correspond to the " scientists " of a later day, to perfect a theory of a complete accord between phenomena observed in the heavens and occurrences on earth.

If moon and sun, whose regular movements conveyed to the more intelligent minds the conception of the reign of law and order in the universe as against the more popular notion of chance and caprice, were divine powers, the same held good of the planets, whose movements, though more difficult to follow, yet in the course of time came to be at least partially understood. Of the planets five were recognized—Jupiter, Venus, Saturn, Mercury and Mars—to name them in the order in which they appear in the older cuneiform literature; in later texts Mercury and Saturn change places. These five planets were identified with the great gods of the pantheon as follows:—Jupiter with Marduk (*q.v.*), Venus with the goddess Ishtar (*q.v.*), Saturn with Ninib (*q.v.*), Mercury with Nebo (*q.v.*), and Mars with Nergal (*q.v.*). The movements of the sun, moon and five planets were regarded as representing the activity of the five gods in question, together with the moon-god Sin (*q.v.*) and the sun-god Shamash (*q.v.*), in preparing the occurrences on earth. If, therefore, one could correctly read and interpret the activity of these powers, one knew what the gods were aiming to bring about. The Babylonian priests accordingly applied themselves to the task of perfecting a system of interpretation of the phenomena to be observed in the heavens, and it was natural that the system was extended from the moon, sun and five planets to the more prominent and recognizable fixed stars. That system involved not merely the movements of the moon, sun and planets, but the observation of their relative position to one another and to all kinds of peculiarities noted at any point in the course of their movements: in the case of the moon, for instance, the exact appearance of the new crescent, its position in the heavens, the conditions at conjunction and opposition, the appearance of the horns, the halo frequently seen with the new moon, which was compared to a " cap," the ring round the full moon, which was called a " stall " (*i.e.* " enclosure "), and more of the like. To all these phenomena some significance was attached, and this significance was naturally intensified in the case of such a striking phenomenon as an eclipse of the moon. Applying the same method of careful observation to the sun and planets, and later to some of the constellations and to many of the fixed stars, it will be apparent that the body of observations noted must have grown in the course of time to large and indeed to enormous proportions, and correspondingly the interpretations assigned to the nearly endless variations in the phenomena thus observed. The interpretations themselves were based (as in the case of divination through the liver) chiefly on two factors:—(1) on the recollection or on written records of what in the past had taken place when the phenomenon or phenomena in question had been observed, and (2) association of ideas—involving sometimes merely a play upon words—in connexion with the phenomenon or phenomena observed. Thus if on a certain occasion the rise of the new moon in a cloudy sky was followed by victory over an enemy or by abundant rain, the sign in question was thus proved to be a favourable one and its recurrence would be regarded as a good omen, though the prognostication would not necessarily be limited to the one or the other of those occurrences, but might be extended to apply to other circumstances. On the other hand, the appearance of the new moon earlier than was expected was regarded as an unfavourable omen—prognosticating in one case defeat, in another death among cattle, in a third bad crops—not necessarily because these events actually took place after such a phenomenon, but by an application of the general principle resting upon association of ideas whereby anything premature would suggest an unfavourable occurrence. A thin halo seen above the new moon was pictured as a cap, and the association between this and the symbol of royalty, which was a conical-shaped cap, led to interpreting the phenomenon as an indication that the ruler would have a successful reign. In this way a mass of traditional interpretation of all kinds of observed phenomena was gathered, and once gathered became a guide to the priests for all times.

Astrology in this its earliest stage is, however, marked by two characteristic limitations. In the first place, the movements and position of the heavenly bodies point to such occurrences as are of public import and affect the general welfare. The individual's interests are not in any way involved, and we must descend many centuries and pass beyond the confines of Babylonia and Assyria before we reach that phase which in medieval and modern astrology is almost exclusively dwelt upon—genethliology or the individual horoscope. In Babylonia and Assyria the cult centred largely and indeed almost exclusively in the public welfare and the person of the king, because upon his well-being and favour with the gods the fortunes of the country were dependent in accordance with the ancient conception of kingship (see J. G. Frazer, *The Early History of Kingship*). To some extent, the individual came in for his share in the incantations and in the purification ritual through which one might hope to rid oneself of the power of the demons and of other evil spirits, but outside of this the important aim of the priests was to secure for the general benefit the favour of the gods, or, as a means of preparing oneself for what the future had in store, to ascertain in time whether that favour would be granted in any particular instance or would be continued in the future. Hence in " liver " divination, as in astrology, the interpretations of the signs noted all have reference to public affairs and events and not to the individual's needs or desires. In the second place, the astronomical knowledge presupposed and accompanying early Babylonian astrology is essentially of an empirical character. While in a general way the reign of law and order in the movements of the heavenly bodies was recognized, and indeed must have exercised an influence at an early period in leading to the rise of a methodical divination that was certainly of a much higher order than the examination of an animal's liver, yet the importance that was laid upon the endless variations in the form of the phenomena and the equally numerous apparent deviations from what were regarded as normal conditions, prevented for a long time the rise of any serious study of astronomy beyond what was needed for the purely practical purposes that the priests as " inspectors " of the heavens (as they were also the " inspectors " of the sacrificial livers) had in mind. True, we have, probably as early as the days of Khammurabi, *i.e. c.* 2000 B.C., the combinations of prominent groups of stars with outlines of pictures fantastically put together, but there is no evidence that prior to 700 B.C. more than a number of the constellations of our zodiac had become part of the current astronomy. The theory of the ecliptic as representing the course of the sun through the year, divided among twelve constellations with a measurement of 30° to each division, is also of Babylonian origin, as has now been definitely proved; but it does not appear to have been perfected until after the fall of the Babylonian empire in 539 B.C. Similarly, the other accomplishments of Babylonian astronomers, such as their system or rather systems of moon calculations and the drawing up of planetary tablets, belong to this late period, so that the golden age of Babylonian astronomy belongs not to the remote past, as was until recently supposed, but to the Seleucid period, *i.e.* after the advent of the Greeks in the Euphrates Valley. From certain expressions used in astrological texts that are earlier than the 7th century B.C. it would appear, indeed, that the beginnings at least of the calculation of sun and moon eclipses belong to the earlier period, but here, too, the chief work accomplished was after 400 B.C., and the defectiveness of early Babylonian astronomy may be gathered from the fact that as late as the 6th century B.C. an error of almost an entire month was made by the Babylonian astronomers in the attempt to determine through calculation the beginning of a certain year.

The researches of Bouché-Leclercq, Cumont and Boll have enabled us to fix with a considerable degree of definiteness the middle of the 4th century B.C. as the period when Babylonian astrology began its triumphal march to the west, invading the domain of Greek and Roman culture and destined to exercise a strong hold on all nations and groups—more particularly in Egypt—that came within the sphere of Greek and Roman influence. It is rather significant that this spread of astrology should have been concomitant with the intellectual impulse that led to the rise of a genuine scientific phase of astronomy in Babylonia itself, which must have weakened to some extent the hold that astrology had on the priests and the people. The advent of the Persians, bringing with them a conception of religion of a far higher order than Babylonian-Assyrian polytheism (see ZOROASTER), must also have acted as a disintegrating factor in leading to the decline of the old faith in the Euphrates Valley, and we thus have the interesting though not entirely exceptional phenomenon of a great civilization bequeathing as a legacy to posterity a superstition instead of a real achievement. "Chaldaean wisdom" became among Greeks and Romans the synonym of divination through the planets and stars, and it is not surprising that in the course of time to be known as a " Chaldaean " carried with it frequently the suspicion of charlatanry and of more or less wilful deception. The spread of astrology beyond Babylonia is thus concomitant with the rise of a truly scientific astronomy in Babylonia itself, which in turn is due to the intellectual impulse afforded by the contact with new forms of culture from both the East and the West.

In the hands of the Greeks and of the later Egyptians both astrology and astronomy were carried far beyond the limits attained by the Babylonians, and it is indeed a matter of surprise to observe the harmonious combination of the two fields—a harmony that seems to grow more complete with each age, and that is not broken until we reach the threshold of modern science in the 16th century. To the Greek astronomer Hipparchus belongs the credit of the discovery (*c.* 130 B.C.) of the theory of the precession of the equinoxes, for a knowledge of which among the Babylonians we find no definite proof; but such a signal advance in pure science did not prevent the Greeks from developing in a most elaborate manner the theory of the influence of the planets upon the fate of the individual. The endeavour to trace the horoscope of the individual from the position of the planets and stars at the time of birth (or, as was attempted by other astrologers, at the time of conception) represents the most significant contribution of the Greeks to astrology. The system was carried to such a degree of perfection that later ages made but few additions of an essential character to the genethliology or drawing up of the individual horoscope by the Greek astrologers. The system was taken up almost bodily by the Arab astronomers, it was embodied in the Kabbalistic lore of Jews and Christians, and through these and other channels came to be the substance of the astrology of the middle ages, forming, as already pointed out, under the designation of " judicial astrology," a pseudo-science which was placed on a perfect footing of equality with " natural astrology " or the more genuine science of the study of the motions and phenomena of the heavenly bodies.

Partly in further development of views unfolded in Babylonia, but chiefly under Greek influences, the scope of astrology was enlarged until it was brought into connexion with practically all of the known sciences, botany, chemistry, zoology, mineralogy, anatomy and medicine. Colours, metals, stones, plants, drugs and animal life of all kinds were associated with the planets and placed under their tutelage. In the system that passes under the name of Ptolemy, Saturn is associated with grey, Jupiter with white, Mars with red, Venus with yellow, while Mercury, occupying a peculiar place in Greek as it did in Babylonian astrology (where it was at one time designated as *the* planet *par excellence*), was supposed to vary its colour according to changing circumstances. The sun was associated with gold, the moon with silver, Jupiter with electrum, Saturn with lead, Venus with copper, and so on, while the continued influence of astrological motives is to be seen in the association of quicksilver, upon its discovery at a comparatively late period, with Mercury, because of its changeable character as a solid and a liquid. In the same way stones were connected with both the planets and the months; plants, by diverse association of ideas, were connected with the planets, and animals likewise were placed under the guidance and protection of one or other of the heavenly bodies. By this curious process of combination the entire realm of the natural sciences was translated into the language of astrology with the single avowed purpose of seeing in all phenomena signs indicative of what the future had in store. The fate of the individual, as that feature of the future which had a supreme interest, led to the association of the planets with parts of the body. Here, too, we find various systems devised, in part representing the views of different schools, in part reflecting advancing conceptions regarding the functions of the organs in man and animals. In one system the seat of Mercury, representing divine intelligence as the source of all knowledge—a view that reverts to Babylonia where Nebo (corresponding to Mercury) was regarded as the divine power to whom all wisdom is due—was placed in the liver as the primeval seat of the soul (see OMEN), whereas in other systems this distinction was assigned to Jupiter or to Venus. Saturn, taking in Greek astrology the place at the head of the planets which among the Babylonians was accorded to Jupiter-Marduk, was given a place in the brain, which in later times was looked upon as the centre of soul-life; Venus, as the planet of the passion of love, was supposed to reign supreme over the genital organs, the belly and the lower limbs; Mars, as the violent planet, is associated with the bile, as well as with the blood and kidneys. Again, the right ear is associated with Saturn, the left ear with Mars, the right eye in the case of the male with the sun and the left eye with the moon, while in the case of the female it was just the reverse. From the planets the same association of ideas was applied to the constellations of the zodiac, which in later phases of astrology are placed on a par with the planets themselves, so far as their importance for the individual horoscope is concerned. The fate of the individual in this combination of planets with the zodiac was made dependent not merely upon the planet which happened to be rising at the time of birth or of conception, but also upon its local relationship to a special sign or to certain signs of the zodiac. The zodiac was regarded as the prototype of the human body, the different parts of which all had their corresponding section in the zodiac itself. The head was placed in the first sign of the zodiac—the Ram; and the feet in the last sign—the Fishes. Between these two extremes the other parts and organs of the body were distributed among the remaining signs of the zodiac, the neck being assigned to the Bull, the shoulders and arms to the Gemini (or twins), the breast to Cancer, the flanks to Leo, the bladder to Virgo, the buttocks to the Balance, the pubis to the Scorpion, the thighs to Sagittarius, the knees to Capricorn, and the limbs to Aquarius. Not content with this, we find the late Egyptian astrologers setting up a correspondence between the thirty-six *decani* recognized by them and the human body, which is thus divided into thirty-six parts; to each part a god was assigned as a controlling force. With human anatomy thus connected with the planets, with constellations, and with single stars, medicine became an integral part of astrology, or, as we might also put it, astrology became the handmaid of medicine. Diseases and distrubances of the ordinary functions of the organs were attributed to the influence of planets or explained as due to conditions observed in a constellation or in the position of a star; and an interesting survival of this bond between astrology and medicine is to be seen in the use up to the present time of the sign of Jupiter ♃, which still heads medicinal prescriptions, while, on the other hand, the influence of planetary lore appears in the assignment of the days of the week to the planets, beginning with Sunday, assigned to the sun, and ending with Saturday, the day of Saturn. Passing on into still later periods, Saturn's day was associated with the Jewish sabbath, Sunday with the Lord's Day, Tuesday with Tiw, the god of war, corresponding to Mars of the Romans and to the Nergal of the Babylonians. Wednesday was assigned to the planet Mercury, the equivalent of the Germanic god Woden; Thursday to Jupiter, the equivalent of Thor; and Friday to Friga, the goddess of love, who is represented by Venus among the Romans and among the Babylonians by Ishtar. Astrological considerations likewise already regulated in ancient Babylonia the distinction of lucky and unlucky days, which passing down to the Greeks and Romans (*dies fasti* and *nefasti*) found a striking expression in Hesiod's *Works and Days*. Among the Arabs similar associations of lucky and unlucky days directly connected with the influence of the planets prevailed through all times, Tuesday and Wednesday, for instance, being regarded as the days for blood-letting, because Tuesday was connected with Mars, the lord of war and blood, and Wednesday with Mercury, the planet of humours. Even in modern times travellers relate how, when an auspicious day has been proclaimed by the astrologers, the streets of Bagdad may be seen running with blood from the barbers' shops.

It is unnecessary here to give a detailed analysis of the methods of judicial astrology as an art, or directions for the casting of a horoscope, or "nativity," *i.e.* a map of the heavens at the hour of birth, showing, according to the Ephemeris, the position of the heavenly bodies, from which their influence may be deduced. Each of the twelve signs of the zodiac (*q.v.*) is credited with its own characteristics and influence, and is the controlling sign of its "house of life." The sign exactly rising at the moment of birth is called the ascendant. The benevolent or malignant influence of each planet, together with the sun and moon, is modified by the sign it inhabits at the nativity; thus Jupiter in one house may indicate riches, fame in another, beauty in another, and Saturn similarly poverty, obscurity or deformity. The calculation is affected by the "aspects," *i.e.* according as the planets are near or far as regards one another (in conjunction, in semi-sextile, semi-square, sextile, quintile, square, trine, sesqui-quadrate, bi-quintile, opposition or parallel acclination). Disastrous signs predominate over auspicious, and the various effects are combined in a very elaborate and complicated manner.

Judicial astrology, as a form of divination, is a concomitant of natural astrology, in its purer astronomical aspect, but mingled with what is now considered an unscientific and superstitious view of world-forces. In the *Janua aurea reserata quatuor linguarum* (1643) of J. A. Comenius we find the following definition:—"*Astronomus siderum meatus seu motus considerat: Astrologus eorundem efficaciam, influxum, et effectum.*" Kepler was more cautious in his opinion; he spoke of astronomy as the wise mother, and astrology as the foolish daughter, but he added that the existence of the daughter was necessary to the life of the mother. Tycho Brahe and Gassendi both began with astrology, and it was only after pursuing the false science, and finding it wanting, that Gassendi devoted himself to astronomy. In their numerous allusions to the subtle mercury, which the one makes when treating of a means of measuring time by the efflux of the metal, and the other in a treatise on the transit of the planet, we see traces of the school in which they served their first apprenticeship. Huygens, moreover, in his great posthumous work, *Cosmotheoros, seu de terris coelestibus*, shows himself a more exact observer of astrological symbols than Kircher himself in his *Iter exstaticum*. Huygens contends that between the inhabitants of different planets there need not be any greater difference than exists between men of different types on the earth. "There are on the earth," continues this rational interpreter of the astrologers and chiromancers, "men of cold temperament who would thrive in Saturn, which is the farthest planet from the sun, and there are other spirits warm and ardent enough to live in Venus."

Those were indeed strange times, according to modern ideas, when astrologers were dominant by the terror they inspired, and sometimes by the martydom they endured when their predictions were either too true or too false. Faith, to borrow their own language, was banished to Virgo, and rarely shed her influence on men. Cardan (1501–1576), for instance, hated Luther, and so changed his birthday in order to give him an unfavourable horoscope. In Cardan's times, as in those of Augustus, it was a common practice for men to conceal the day and hour of their birth, till, like Augustus, they found a complaisant astrologer. But, as a general rule, medieval and Renaissance astrologers did not give themselves the trouble of reading the stars, but contented themselves with telling fortunes by faces. They practised chiromancy (see Palmistry), and relied on afterwards drawing a horoscope to suit. As physiognomists (see Physiognomy) their talent was undoubted, and according to Vanini there was no need to mount to the house-top to cast a nativity. "Yes," he says, "I can read his face; by his hair and his forehead it is easy to guess that the sun at his birth was in the sign of Libra and near Venus. Nay, his complexion shows that Venus touches Libra. By the rules of astrology he could not lie."

A few salient facts may be added concerning the astrologers and their predictions, remarkable either for their fulfilment or for the ruin and confusion they brought upon their authors. We may begin with one taken from Bacon's *Essay of Prophecies*:—"When I was in France, I heard from one Dr Pena, that the queen mother, who was given to curious arts, caused the king her husband's nativitie to be calculated, under a false name; and the astrologer gave a judgment, that he should be killed in a duell; at which the queene laughed, thinking her husband to be above challenges and duels; but he was slaine, upon a course at tilt, the splinters of the staffe of Mongomery going in at his bever." A favourite topic of the astrologers of all countries has been the immediate end of the world. As early as 1186 the earth had escaped one threatened cataclysm of the astrologers. This did not prevent Stöffler from predicting a universal deluge for the year 1524—a year, as it turned out, distinguished for drought. His aspect of the heavens told him that in that year three planets would meet in the aqueous sign of Pisces. The prediction was believed far and wide, and President Aurial, at Toulouse, built himself a Noah's ark—a curious realization, in fact, of Chaucer's merry invention in the *Miller's Tale*.

Tycho Brahe was from his fifteenth year devoted to astrology, and adjoining his observatory at Uranienburg the astronomer-royal of Denmark had a laboratory built in order to study alchemy, and it was only a few years before his death that he finally abandoned astrology. We may here notice one very remarkable prediction of the master of Kepler. That he had carefully studied the comet of 1577 as an astronomer, we may gather from his adducing the very small parallax of this comet as disproving the assertion of the Aristotelians that a solid sphere enveloped the heavens. But besides this, we find him in his character of astrologer drawing a singular prediction from the appearance of this comet. It announced, he tells us, that in the north, in Finland, there should be born a prince who should lay waste Germany and vanish in 1632. Gustavus Adolphus, it is well known, was born in Finland, overran Germany, and died in 1632. The fulfilment of the details of this prophecy suggests that Tycho Brahe had some basis of reason for his prediction. Born in Denmark of a noble Swedish family, a politician, as were all his contemporaries of distinction, Tycho, though no conjuror, could foresee the advent of some great northern hero. Moreover, he was doubtless well acquainted with a very ancient tradition, that heroes generally came from the northern frontiers of their native land, where they are hardened and tempered by the threefold struggle they wage with soil, climate and barbarian neighbours.

Kepler explained the double movement of the earth by the rotation of the sun. At one time the sun presented its friendly side, which attracted one planet, sometimes its adverse side, which repelled it. He also peopled the planets with souls and genii. He was led to his three great laws by musical analogies, just as William Herschel afterwards passed from music to astronomy. Kepler, who in his youth made almanacs, and once prophesied a hard winter, which came to pass, could not help putting an astrological interpretation on the disappearance of the brilliant star of 1572, which Tycho had observed. Theodore Beza thought that this star, which in December 1573 equalled Jupiter in brilliancy, predicted the second coming of Christ. Astronomers were only then beginning to study variable and periodic stars, and disturbances in that part of the heavens, which had till then, on the authority of Aristotle, been regarded as incorruptible, combined with the troubles of the times, must have given a new stimulus to belief in the signs in heaven. Montaigne (*Essais*, lib. i. chap. x.) relates a singular episode in the history of astrology. Charles V. and Francis I., who both bid for the friendship of the infamous Aretino, surnamed the divine, both likewise engaged astrologers to fight their battles. In Italy those who prophesied the ruin of France were sure to be listened to. These prophecies affected the public funds much as telegrams do nowadays. "At Rome," Montaigne tells us, "a large sum of money was lost on the Change by this prognostication of our ruin." The marquis of Saluces, notwithstanding his gratitude to Francis I. for the many favours he had received, including his marquisate, of which the brother was despoiled for his benefit, was led in 1536 to betray his country, being scared by the glorious prophecies of the ultimate success of Charles V. which were then rife. The influence of the Medici made astrologers popular in France. Richelieu, on whose council was Jacques Gaffarel (1601–1681), the last of the Kabbalists, did not despise astrology as an engine of government. At the birth of Louis XIV. a certain Morin de Villefranche was placed behind a curtain to cast the nativity of the future autocrat. A generation back the astrologer would not have been hidden behind a curtain, but have taken precedence of the doctor. La Bruyère dares not pronounce against such beliefs, "for there are perplexing facts affirmed by grave men who were eye-witnesses." In England William Lilly and Robert Fludd were both dressed in a little brief authority. The latter gives us elaborate rules for the detection of a thief, and tells us that he has had personal experience of their efficacy. "If the lord of the sixth house is found in the second house, or in company with the lord of the second house, the thief is one of the family. If Mercury is in the sign of the Scorpion he will be bald, &c." Francis Bacon abuses the astrologers of his day no less than the alchemists, but he does so because he has visions of a reformed astrology and a reformed alchemy. Sir Thomas Browne, too, while he denies the capacity of the astrologers of his day, does not venture to dispute the reality of the science. The idea of the souls of men passing at death to the stars, the blessedness of their particular sphere being assigned them according to their deserts (the metempsychosis of J. Reynaud), may be regarded as a survival of religious astrology, which, even as late as Descartes's day, assigned to the angels the task of moving the planets and the stars. Joseph de Maistre believed in comets as messengers of divine justice, and in animated planets, and declared that divination by astrology is not an absolutely chimerical science. Lastly, we may mention a few distinguished men who ran counter to their age in denying stellar influences. Aristarchus of Samos, Martianus Capella (the precursor of Copernicus), Cicero, Favorinus, Sextus Empiricus, Juvenal, and in a later age Savonarola and Pico della Mirandola, and La Fontaine, a contemporary of the neutral La Bruyère, were all pronounced opponents of astrology.

In England Swift may fairly claim the credit of having given the death-blow to astrology by his famous squib, entitled *Prediction for the Year 1708, by Isaac Bickerstaff, Esq.* He begins, by professing profound belief in the art, and next points out the vagueness and the absurdities of the philomaths. He then, in the happiest vein of parody, proceeds to show them a more excellent way:—"My first prediction is but a trifle, yet I mention it to show how ignorant these sottish pretenders to astrology are in their own concerns: it refers to Partridge the almanac-maker. I have consulted the star of his nativity by my own rules, and find he will infallibly die upon the 29th of March next about eleven at night of a raging fever. Therefore I advise him to consider of it and settle his affairs in time."

Then followed a letter to a person of quality giving a full and particular account of the death of Partridge on the very day and nearly at the hour mentioned. In vain the wretched astrologer protested that he was alive, got a literary friend to write a pamphlet to prove it, and published his almanac for 1709. Swift, in his reply, abused him for his want of manners in giving a gentleman the lie, answered his arguments *seriatim*, and declared that the evidence of the publication of another almanac was wholly irrelevant, "for Gadbury, Poor Robin, Dove and Way do yearly publish their almanacs, though several of them have been dead since before the Revolution." Nevertheless a field is found even to this day for almanacs of a similar type, and for popular belief in them.

To astrological politics we owe the theory of heaven-sent rulers, instruments in the hands of Providence, and saviours of society. Napoleon, as well as Wallenstein, believed in his star. Many passages in the older English poets are unintelligible without some knowledge of astrology. Chaucer wrote a treatise on the astrolabe; Milton constantly refers to planetary influences; in Shakespeare's *King Lear*, Gloucester and Edmund represent respectively the old and the new faith. We still *contemplate* and *consider*; we still speak of men as *jovial*, *saturnine* or *mercurial*; we still talk of the *ascendancy* of genius, or a *disastrous* defeat. In French *heur*, *malheur*, *heureux*, *malheureux*, are all derived from the Latin *augurium*; the expression *né sous une mauvaise étoile*, born under an evil star, corresponds (with the change of *étoile* into *astre*) to the word *malôtru*, in Provençal *malastrue*; and *son étoile pâlit*, his star grows pale, belongs to the same class of illusions. The Latin *ex augurio* appears in the Italian *sciagura*, *sciagurato*, softened into *sciaura*, *sciaurato*, wretchedness, wretched. The influence of a particular planet has also left traces in various languages; but the French and English *jovial* and the English *saturnine* correspond rather to the gods who served as types in chiromancy than to the planets which bear the same names. In the case of the expressions *bien* or *mal luné*, well or ill mooned, *avoir un quartier de lune dans la tête*, to have the quarter of the moon in one's head, the German *mondsüchtig* and the English *moonstruck* or *lunatic*, the fundamental idea lies in the strange opinions formerly held about the moon.

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(M. JA.)

ASTRONOMY (from Gr. ἄστρον, a star, and νέμειν, to classify or arrange). The subject matter of astronomical science, considered in its widest range, comprehends all the matter of the universe which lies outside the limit of the earth's atmosphere. The seeming anomaly of classifying as a single branch of science all that we know in a field so wide, while subdividing our knowledge of things on our own planet into an indefinite number of separate sciences, finds its explanation in the impossibility of subjecting the matter of the heavens to that experimental scrutiny which yields such rich results when applied to matter which we can handle at will. Astronomy is of necessity a science of observation in the pursuit of which experiment can directly play no part. It is the most ancient of the sciences because, before the era of experiment, it was the branch of knowledge which could be most easily systematized, while the relations of its phenomena to day and night, times and seasons, made some knowledge of the subject a necessity of social life. In recent times it is among the more progressive of the sciences, because the new and improved methods of research now at command have found in its cultivation a field of practically unlimited extent, in which the lines of research may ultimately lead to a comprehension of the universe impossible of attainment before our time.

The field we have defined is divisible into at least two parts, that of Astronomy proper, or "Astrometry," which treats of the motions, mutual relations and dimensions of the heavenly bodies; and that of Astrophysics (*q.v.*), which treats of their physical constitution. While it is true that the instruments and methods of research in these two branches are quite different in their details, there is so much in common in the fundamental principles which underlie their application, that it is unprofitable to consider them as completely distinct sciences.

Speaking in the most comprehensive way, and making an exception of the ethereal medium (see AETHER), which, being capable of experimental study, is not included in the subject of astronomy, we may say that the great masses of matter which make up the universe are of two kinds:—(1) incandescent bodies, made visible to us by their own light; (2) dark bodies, revolving round them or round each other. These dark bodies are known to us in two ways: (*a*) by becoming visible through reflecting the light from incandescent bodies in their neighbourhood, (*b*) by their attraction upon such bodies.

The incandescent bodies are of two classes: stars and nebulae. Among the stars our sun is to be included, as it has no properties which distinguish it from the great mass of stars except our proximity to it. The stars are supposed to be generally spherical, like the sun, in form, and to have fairly well-defined boundaries; while the nebulae are generally irregular in outline and have no well-defined limits. It is, however, probable that the one class runs into the other by imperceptible gradations. In the relation of the universe to us there is yet another separation of its bodies into two classes, one comprising the solar system, the other the remainder of the universe. The former consists of the sun and the bodies which move round it. Considered as a part of the universe, our solar system is insignificant in extent, though, for obvious reasons, great in practical importance to us, and in the facility with which we may gain knowledge relating to it.

Referring to special articles, SOLAR SYSTEM, STAR, SUN, MOON, &c. for a description of the various parts of the universe, we confine ourselves, at present, to setting forth a few of the most general modern conceptions of the universe. As to extent, it may be said, in a general way, that while no definite limits can be set to the possible extent of the universe, or the distance of its farthest bodies, it seems probable, for reasons which will be given under STAR, that the system to which the stars that we see belong, is of finite extent.

As the incandescent bodies of the universe are visible by their own light, the problem of ascertaining their existence and position is mainly one of seeing, and our facilities for attacking it have constantly increased with the improvement of our optical appliances. But such is not the case with the dark bodies. Such a body can be made known to us only when in the neighbourhood of an incandescent body; and even then, unless its mass or its dimensions are considerable, it will evade all the scrutiny of our science. The question of the possible number and magnitude of such bodies is therefore one that does not admit of accurate investigation. We can do no more than balance vague estimates of probability. What we do know is that these bodies vary widely in size. Those known to be revolving round certain of the stars are far larger in proportion to their central bodies than our planets are in respect to the sun; for were it otherwise we should never be able to detect their existence. At the other extreme we know that innumerable swarms of minute bodies, probably little more than particles, move round the sun in orbits of every degree of eccentricity, making themselves known to us only in the exceptional cases when they strike the earth's atmosphere. They then appear to us as "shooting stars" (see METEOR).

A general idea of the relation of the solar system to the universe may be gained by reflecting that the average distance between any two neighbouring stars is several thousand times the extent of the solar system. Between the orbit of Neptune and the nearest star known to us is an immense void in which no bodies are yet known to exist, except comets. But although these sometimes wander to distances considerably beyond the orbit of Neptune, it is probable that the extent of the void which separates our system from the nearest star is hundreds of times the distance of the farthest point to which a comet ever recedes.

We may conclude this brief characterization of astronomy with a statement and classification of the principal lines on which astronomical researches are now pursued. The most comprehensive problem before the investigator is that of the constitution of the universe. It is known that, while infinite diversity is found among the bodies of the universe, there are also common characteristics throughout its whole extent. In a certain sense we may say that the universe now presents itself to the thinking astronomer, not as a heterogeneous collection of bodies, but as a unified whole. The number of stars is so vast that statistical methods can be applied to many of the characters which they exhibit—their spectra, their apparent and absolute luminosity, and their arrangement in space. Thus has arisen in recent times what we may regard as a third branch of astronomical science, known as *Stellar Statistics*. The development of this branch has infused life and interest into what might a few years ago have been regarded as the most lifeless mass of figures possible, expressing merely the positions and motions of innumerable individual stars, as determined by generations of astronomical observers. The development of this new branch requires great additions to this mass, the product of perhaps centuries of work on the older lines of the science. To the statistician of the stars, catalogues of spectra, magnitude, position and proper motions are of the same importance that census tables are to the student of humanity. The measurement of the speed with which the individual stars are moving towards or from our system is a work of such magnitude that what has yet been done is scarcely more than a beginning. The discovery by improved optical means, and especially by photography, of new bodies of our system so small that they evaded all scrutiny in former times, is still going on, but does not at present promise any important generalization, unless we regard as such the conclusion that our solar system is a more complex organism than was formerly supposed.

One characteristic of astronomy which tends to make its progress slow and continuous arises out of the general fact that, except in the case of motions to or from us, which can be determined by a single observation with the spectroscope, the motion of a heavenly body can be determined only by comparing its position at two different epochs. The interval required between these two epochs depends upon the speed of the motion. In the case of the greater number of the fixed stars this is so slow that centuries may have to elapse before motion can be deduced. Even in the case of the planets, the variations in the form and position of the orbits are so slow that long periods of observation are required for their correct determination.

The process of development is also made slow and difficult by the great amount of labour involved in deriving the results of astronomical observations. When an astronomer has made an observation, it still has to be "reduced," and this commonly requires more labour than that involved in making it. But even this labour may be small compared with that of the theoretical astronomer, who, in the future, is to use the result as the raw material of his work. The computations required in such work are of extreme complexity, and the labour required is still further increased by the fact that cases are rather exceptional in which the results reached by one generation will not have to be revised and reconstructed by another; processes which may involve the repetition of the entire work. We may, in fact, regard the fabric of astronomical science as a building in the construction of which no stone can be added without a readjustment of some of the stones on which it has to rest. Thus it comes about that the observer, the computer, and the mathematician have in astronomical science a practically unlimited field for the exercise of their powers.

In treating so comprehensive a subject we may naturally distinguish between what we know of the universe and the methods and processes by which that knowledge is acquired. The former may be termed *general*, and the latter *practical*, astronomy. When we descend more minutely into details we find these two branches of the subject to be connected by certain principles, the application of which relates to both subjects. Considering as general or descriptive astronomy a description of the universe as we now understand it, the other branches of the subject generally recognized are as follows:—

Geometrical or *Spherical Astronomy*, by the principles of which the positions and the motions of the heavenly bodies are defined.

Theoretical Astronomy, which may be considered as an extension of geometrical astronomy and includes the determination of the positions and motions of the heavenly bodies by combining mathematical theory with observation. Modern theoretical astronomy, taken in the most limited sense, is based upon *Celestial Mechanics*, the science by which, using purely deductive mechanical methods, the laws of motion of the heavenly bodies are derived by deductive methods from their mutual gravitation towards each other.

Practical Astronomy, which comprises a description of the instruments used in astronomical observation, and of the principles and methods underlying their application.

Spherical or Geometrical Astronomy.

In astronomy, as in analytical geometry, the position of a point is defined by stating its distance and its direction from a point of reference taken as known. The numerical quantities by which the distance and direction, and therefore the position, are defined, are termed *co-ordinates* of the point. The latter are measured or defined with regard to a fixed system of lines and planes, which form the basis of the system.

The following are the fundamental concepts of such a system.

(*a*) An origin or point of reference. The points most generally taken for this purpose in astronomical practice are the following:—

(1) The position of a point of observation on the earth's surface. We conceive its position to be that occupied by an observer. The position of a heavenly body is then defined by its direction and distance from the supposed observer.

(2) The centre of the earth. This point, though it can never be occupied by an observer, is used because the positions of the heavenly bodies in relation to it are more readily computed than they can be from a point on the earth's surface.

(3) The centre of the sun.

(4) In addition to these three most usual points, we may, of course, take the centre of a planet or that of a star in order to define the position of bodies in their respective neighbourhoods.

Co-ordinates referred to a point of observation as the origin are termed "apparent," those referred to the centre of the earth are "geocentric," those referred to the centre of the sun, "heliocentric."

(*b*) The next concept of the system is a fundamental plane, regarded as fixed, passing through the origin. In connexion with it is an axis perpendicular to it, also passing through the origin. We may consider the axis and the plane as a single concept, the axis determining the plane, or the plane the axis. The fundamental concepts of this class most in use are:—

(1) When a point on the earth's surface is taken as the origin, the fundamental axis may be the direction of gravity at that point. This direction defines the vertical line. The fundamental plane which it determines is horizontal and is termed the plane of the horizon. Such a plane is realized in the surface of a liquid, a basin of quicksilver, for example.

(2) When the centre of the earth is taken as origin, the most natural fundamental axis is that of the earth's rotation. This axis cuts the earth's surface at the North and South Poles. The fundamental plane perpendicular to it is the plane of the equator. This plane intersects the earth's surface in the terrestrial equator. Co-ordinates referred to this system are termed equatorial. A system of equatorial co-ordinates may also be used when the origin is on the earth's surface. The fundamental axis, instead of being the earth's axis itself, is then a line parallel to it, and the fundamental plane is the plane passing through the point, and parallel to the plane of the equator.

(3) In the system of heliocentric co-ordinates, the plane in which the earth moves round the sun, which is the plane of the ecliptic, is taken as the fundamental one. The axis of the ecliptic is a line perpendicular to this plane.

(*c*) The third concept necessary to complete the system is a fixed line passing through the origin, and lying in the fundamental plane. This line defines an initial direction from which other directions are counted.

The geometrical concepts just defined are shown in fig. 1. Here O is the origin, whatever point it may be; OZ is the fundamental axis passing through it. In order to represent in the figure the position of the fundamental plane, we conceive a circle to be drawn round O, lying in that plane. This circle, projected in perspective as an ellipse, is shown in the figure. OX is the fixed initial line by which directions are to be defined.

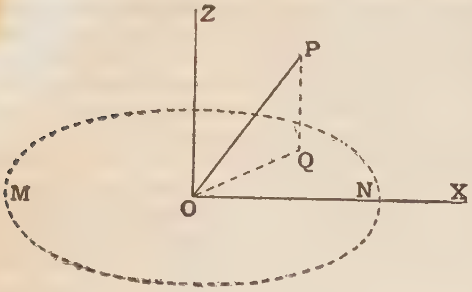

Fig. 1.

Now let P be any point in space, say the centre of a heavenly body. Conceive a perpendicular PQ to be dropped from this point on the fundamental plane, meeting the latter in the point Q; PQ will then be parallel to OZ. The co-ordinates of P will then be the following three quantities:—

(1) The length of the line OP, or the distance of the body from the origin, which distance is called the radius vector of the body.

(2) The angle XOQ which the projection of the radius vector upon the fundamental plane makes with the initial line OX. This angle is called the Longitude, Right Ascension or Azimuth of the body, in the various systems of co-ordinates. We may term it in a general way the longitudinal co-ordinate.

(3) The angle QOP, which the radius vector makes with the fundamental plane. This we may call the latitudinal co-ordinate. Instead of it is frequently used the complementary angle ZOP, known as the polar distance of the body. Since ZOQ is a right angle, it follows that the sum of the polar distance and the latitudinal co-ordinates is always 90°. Either may be used for astronomical purposes.

It is readily seen that the position of a heavenly body is completely defined when these co-ordinates are given.

One of the systems of co-ordinates is familiar to every one, and may be used as a general illustration of the method. It is our system of defining the position of a point on the earth's surface by its latitude and longitude. Regarding O (fig. 1) as the centre of the earth, and P as a point on the earth's surface, a city for example, it will be seen that OZ being the earth's axis, the circle MN will be the equator. The initial line OX then passes through the foot of the perpendicular dropped from Greenwich upon the plane of the equator, and meets the surface at N. The angle QOP is the latitude of the place and the angle NOQ its longitude. The longitudes and latitudes thus defined are geocentric, and the latitude is slightly different from that in ordinary use for geographic purposes. The difference arises from the oblateness of the earth, and need not be considered here.

The conception of the co-ordinates we have defined is facilitated by introducing that of the celestial sphere. This conception is embodied in our idea of the vault of heaven, or of the sky. Taking as origin the position of an observer, the direction of a heavenly body is defined by the point in which he sees it in the sky; that is to say, on the celestial sphere. Imagining, as we may well do, that the radius of this sphere is infinite—then every direction, whatever the origin, may be represented by a point on its surface. Take for example the vertical line which is embodied in the direction of the plumb line. This line, extended upwards, meets the celestial sphere in the zenith. The earth's axis, continued indefinitely upwards, meets the sphere in a point called the Celestial Pole. This point in our middle latitudes is between the zenith and the north horizon, near a certain star of the second magnitude familiarly known as the Pole Star. As the earth revolves from west to east the celestial sphere appears to us to revolve in the opposite direction, turning on the line joining the Celestial Poles as on a pivot.

As we conceive of the sky, it does not consist of an entire sphere but only as a hemisphere bounded by the horizon. But we have no difficulty in extending the conception below the horizon, so that the earth with everything upon it is in the centre of a complete sphere. The two parts of this sphere are the visible hemisphere, which is above the horizon, and the invisible, which is below it. Then the plumb line not only defines the zenith as already shown, but in a downward direction it defines the nadir, which is the point of the sphere directly below our feet. On the side of this sphere opposite to the North Celestial is the South Pole, invisible in the Northern Terrestrial Hemisphere but visible in the Southern one.

The relation of geocentric to apparent co-ordinates depends upon the latitude of the observer. The changes which the aspect of the heaven undergoes, as we travel North and South, are so well known that they need not be described in detail here; but a general statement of them will give a luminous idea of the geometrical co-ordinates we have described. Imagine an observer starting from the North Pole to travel towards the equator, carrying his zenith with him. When at the pole his zenith coincides with the celestial pole, and as the earth revolves on its axis, the heavenly bodies perform their apparent diurnal revolutions in horizontal circles round the zenith. As he travels South, his zenith moves along the celestial sphere, and the circles of diurnal rotation become oblique to the horizon. The obliquity continually increases until the observer reaches the equator. His zenith is then in the equator and the celestial poles are in the North and South horizon respectively. The circles in which the heavenly bodies appear to revolve are then vertical. Continuing his journey towards the south, the north celestial pole sinks below the horizon; the south celestial pole rises above it; or to speak more exactly, the zenith of the observer approaches that pole. The circles of diurnal revolution again become oblique. Finally, at the south pole the circles of diurnal revolution are again apparently horizontal, but are described in a direction apparently (but not really) the reverse of that near the north pole. The reader who will trace out these successive concepts and study the results of his changing positions will readily acquire the notions which it is our subject to define.

We have next to point out the relation of the co-ordinates we have described to the annual motion of the earth around the sun. In consequence of this motion the sun appears to us to describe annually a great circle, called the ecliptic, round the celestial sphere, among the stars, with a nearly uniform motion, of somewhat less than 1° in a day. Were the stars visible in the daytime in the immediate neighbourhood of the sun, this motion could be traced from day to day. The ecliptic intersects the celestial equator at two opposite points, the equinoxes, at an angle of 23° 27′. The vernal equinox is taken as the initial point on the sphere from which co-ordinates are measured in the equatorial and ecliptic systems. Referring to fig. 1, the initial line OX is defined as directed toward the vernal equinox, at which point it intersects the celestial sphere.

The following is an enumeration of the co-ordinates which we have described in the three systems:—

Apparent System.

Latitudinal Co-ordinate; Altitude or Zenith Distance.
Longitudinal ,, Azimuth.

Equatorial System.

Latitudinal Co-ordinate; Declination or Polar Distance.
Longitudinal ,, Right Ascension.

Ecliptic System.

Latitudinal Co-ordinate; Latitude or Ecliptic Polar Distance.
Longitudinal ,, Longitude.

Relation of the Diurnal Motion to Spherical Co-ordinates.—The vertical line at any place being the fundamental axis of the apparent system of co-ordinates, this system rotates with the earth, and so seems to us as fixed. The other two systems, including the vernal equinox, are fixed on the celestial sphere, and so seem to us to perform a diurnal revolution from east towards west. Regarding the period of the revolution as 24 hours, the apparent motion goes on at the rate of 15° per hour. Here we have to make a distinction of fundamental importance between the diurnal motions of the sun and of the stars. Owing to the unceasing apparent motion of the sun toward the east, the interval between two passages of the same star over the meridian is nearly four minutes less than the interval between consecutive passages of the sun. The latter is the measure of the day as used in civil life. In astronomical practice is introduced a day, termed "sidereal," determined, not by the diurnal revolution of the sun, but of the stars. The year, which comprises 365·25 solar days, contains 366·25 sidereal days. The latter are divided into sidereal hours, minutes and seconds as the solar day is. The conception of a revolution through 360° in 24 hours is applicable to each case. The sun apparently moves at the rate of 15° in a solar hour; the stars at the rate of 15° in a sidereal hour. The latter motion leads to the use, in astronomical practice, of time instead of angle, as the unit in which the right ascensions are to be expressed. Considering the position of the vernal equinox, and also of a star on the celestial sphere, it will be seen that the interval between the transits of these two points across the meridian may be used to measure the right ascension of a star, since the latter amounts to

15° for every sidereal hour of this interval. For example, if the right ascension of a star is exactly 15°, it will pass the meridian one sidereal hour after the vernal equinox. For the relations thus arising, and their practical applications, see TIME, MEASUREMENT OF.

Theoretical Astronomy.

Theoretical Astronomy is that branch of the science which, making use of the results of astronomical observations as they are supplied by the practical astronomer, investigates the motions of the heavenly bodies. In its most important features it is an offshoot of celestial mechanics, between which and theoretical astronomy no sharp dividing line can be drawn. While it is true that the one is concerned altogether with general theories, it is also true that these theories require developments and modifications to apply them to the numberless problems of astronomy, which we may place in either class.

Among the problems of theoretical astronomy we may assign the first place to the determination of orbits (*q.v.*), which is auxiliary to the prediction of the apparent motions of a planet, satellite or star. The computations involved in the process, while simple in some cases, are extremely complex in others. The orbit of a newly-discovered planet or comet may be computed from three complete observations by well-known methods in a single day. From the resulting elements of the orbit the positions of the body from day to day may be computed and tabulated in an ephemeris for the use of observers. But when definitive results as to the orbits are required, it is necessary to compute the perturbations produced by such of the major planets as have affected the motions of the body. With this complicated process is associated that of combining numerous observations with a view of obtaining the best definitive result. Speaking in a general way, we may say that computations pertaining to the orbital revolutions of double stars, as well as the bodies of our solar system, are to a greater or less extent of the classes we have described. The principal modification is that, up to the present time, stellar astronomy has not advanced so far that a computation of the perturbations in each case of a system of stars is either necessary or possible, except in exceptional cases.

Celestial Mechanics.

Celestial Mechanics is, strictly speaking, that branch of applied mathematics which, by deductive processes, derives the laws of motion of the heavenly bodies from their gravitation towards each other, or from the mutual action of the parts which form them. The science had its origin in the demonstration by Sir Isaac Newton that Kepler's three laws of planetary motion, and the law of gravitation, in the case of two bodies, could be mutually derived from each other. A body can move round the sun in an elliptic orbit having the sun in its focus, and describing equal areas in equal times, only under the influence of a force directed towards the sun, and varying inversely as the square of the distance from it. Conversely, assuming this law of attraction, it can be shown that the planets will move according to Kepler's laws.

Thus celestial mechanics may be said to have begun with Newton's *Principia*. The development of the science by the successors of Newton, especially Laplace and Lagrange, may be classed among the most striking achievements of the human intellect. The precision with which the path of an eclipse is laid down years in advance cannot but imbue the minds of men with a high sense of the perfection reached by astronomical theories; and the discovery, by purely mathematical processes, of the changes which the orbits and motions of the planets are to undergo through future ages is more impressive the more fully one apprehends the nature of the problem. The purpose of the present article is to convey a general idea of the methods by which the results of celestial mechanics are reached, without entering into those technical details which can be followed only by a trained mathematician. It must be admitted that any intelligent comprehension of the subject requires at least a grasp of the fundamental conceptions of analytical geometry and the infinitesimal calculus, such as only one with some training in these subjects can be expected to have. This being assumed, the hope of the writer is that the exposition will afford the student an insight into the theory which may facilitate his orientation, and convey to the general reader with a certain amount of mathematical training a clear idea of the methods by which conclusions relating to it are drawn. The non-mathematical reader may possibly be able to gain some general idea, though vague, of the significance of the subject.

The fundamental hypothesis of the science assumes a system of bodies in motion, of which the sun and planets may be taken as examples, and of which each separate body is attracted toward all the others according to the law of Newton. The motion of each body is then expressed in the first place by Newton's three laws of motion (see MOTION, LAWS OF, and MECHANICS). The first step in the process shows in a striking way the perfection of the analytic method. The conception of force is, so to speak, eliminated from the conditions of the problem, which is reduced to one of pure kinematics. At the outset, the position of each body, considered as a material particle, is defined by reference to a system of co-ordinate axes, and not by any verbal description. Differential equations which express the changes of the co-ordinates are then constructed. The process of discovering the laws of motion of the particle then consists in the integration of these equations. Such equations can be formed for a system of any number of bodies, but the process of integration in a rigorous form is possible only to a limited extent or in special cases.

The problems to be treated are of two classes. In one, the bodies are regarded as material particles, no account being taken of their dimensions. The earth, for example, may be regarded as a particle attracted by another more massive particle, the sun. In the other class of problems, the relative motion of the different parts of the separate bodies is considered; for example, the rotation of the earth on its axis, and the consequences of the fact that those parts of a body which are nearer to another body are more strongly attracted by it. Beginning with the first branch of the subject, the fundamental ideas which it is our purpose to convey are embodied in the simple case of only two bodies, which we may call the sun and a planet. In this case the two bodies really revolve round their common centre of gravity; but a very slight modification of the equations of motion reduces them to the relative motion of the planet round the sun, regarding the moving centre of the latter as the origin of co-ordinates. The motion of this centre, which arises from the attraction of the planet on the sun, need not be considered.

In the actual problems of celestial mechanics three co-ordinates necessarily enter, leading to three differential equations and six equations of solution. But the general principles of the problem are completely exemplified with only two bodies, in which case the motion takes place in a fixed plane. By taking this plane, which is that of the orbit in which the planet performs its revolution, as the plane of xy, we have only two co-ordinates to consider. Let us use the following notation:

x, y, the co-ordinates of the planet relative to the sun as the origin.

M, m, the masses of the attracting bodies, sun and planet.

r, the distance apart of the two bodies, or the radius vector of m relative to M. This last quantity is analytically defined by the equation—

$$r^2 = x^2 + y^2.$$

t, the time, reckoned from any epoch we choose.

The differential equations which completely determine the changes in the co-ordinates x and y, or the motion of m relative to M, are:—

$$\frac{d^2x}{dt^2} = -\frac{(M+m)x}{r^3} \qquad \text{(1)}$$
$$\frac{d^2y}{dt^2} = -\frac{(M+m)y}{r^3}$$

These formulae are worthy of special attention. They are the expression in the language of mathematics of Newton's first two laws of motion. Their statement in this language may be regarded as perfect, because it completely and unambiguously expresses the naked phenomena of the motion. The equations do this without expressing any conception, such as that of force, not associated with the actual phenomena. Moreover, as a third advantage, these expressions are entirely free from those difficulties and ambiguities which are met with in every attempt to express the laws of motion in ordinary language. They afford yet another great advantage in that the derivation of the results requires only the analytic operations of the infinitesimal calculus.

The power and spirit of the analytic method will be appreciated by showing how it expresses the relations of motion as they were conceived geometrically by Newton and Kepler. It is quite evident that Kepler's laws do not in themselves enable us to determine the actual motion of the planets. We must have, in addition, in the case of each special planet, certain specific facts, viz. the axes and eccentricity of the ellipse, and the position of the plane in which it lies. Besides these, we must have given the position of the planet in the orbit at some specified moment. Having these data, the position of the planet at any other time may be geometrically constructed by Kepler's laws. The third law enables us to compute the time taken by the radius vector to sweep over the entire area of the orbit, which is identical with the time of revolution. The problem of constructing successive radii vectores, the angles of which are measured off from the radius vector of the body at the original given position, is then a geometric one, known as Kepler's problem.

In the analytic process these specific data, called elements of the orbit, appear as arbitrary constants, introduced by the process of integration. In a case like the present one, where there are two differential equations of the second order, there will be four such constants. The result of the integration is that the co-ordinates x and y and their derivatives as to the time, which express the position, direction of motion and speed of the planet at any moment, are found as functions of the four constants and of the time. Putting

$$a,\ b,\ c,\ d,$$

for the constants, the general form of the solution will be

$$\begin{aligned} x &= f_1(a,b,c,d,t) \\ y &= f_2(a,b,c,d,t) \end{aligned} \qquad (2)$$

From these may be derived by differentiation as to t the velocities

$$\begin{aligned} \frac{dx}{dt} &= f'_1(a,b,c,d,t) = x' \\ \frac{dy}{dt} &= f'_2(a,b,c,d,t) = y' \end{aligned} \qquad (3)$$

The symbols x' and y' are used for brevity to mean the velocities expressed by the differential coefficients. The arbitrary constants, a, b, c and d, are the elements of the orbit, or any quantities from which these elements can be obtained. We note that, in the actual process of integration, no geometric construction need enter.

Let us next consider the problem in another form. Conceive that instead of the orbit of the planet, there is given a position P (fig. 2), through which the planet passed at an assigned moment, with a given velocity, and in a given direction, represented by the arrowhead. Logically these data completely determine the orbit in which the planet shall move, because there is only one such orbit passing through P, a planet moving in which would have the given speed. It follows that the elements of the orbit admit of determination when the co-ordinates of the planet at an assigned moment and their derivatives as to time are given. Analytically the elements are determined from these data by solving the four equations just given, regarding a, b, c and d as unknown quantities, and x, y, x', y' and t as given quantities. The solution of these equations would lead to expressions of the form

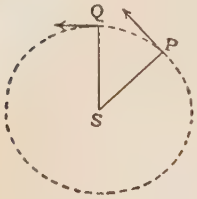

FIG. 2

$$\begin{aligned} a &= \phi_1(x,y,x',y',t) \\ b &= \phi_2(x,y,x',y',t) \\ &\text{\&c.} \qquad \text{\&c.} \end{aligned} \qquad (4)$$

one for each of the elements.

The general equations expressing the motion of a planet considered as a material particle round a centre of attraction lead to theorems the more interesting of which will now be enunciated.

(1) The motion of such a planet may take place not only in an ellipse but in any curve of the second order; an ellipse, hyperbola, or parabola, the latter being the bounding curve between the other two. A body moving in a parabola or hyperbola would recede indefinitely from its centre of motion and never return to it. The ellipse is therefore the only closed orbit.

(2) The motion takes place in accord with Kepler's laws, enunciated elsewhere.

(3) *Whewell's theorem*: if a point R be taken at a distance from the sun equal to the major axis of the orbit of a planet and, therefore, at double the mean distance of the planet, the speed of the latter at any point is equal to the speed which a body would acquire by falling from the point R to the actual position of the planet. The speed of the latter may, therefore, be expressed as a function of its radius vector at the moment and of the major axis of its orbit without introducing any other elements into the expression. Another corollary is that in the case of a body moving in a parabolic orbit the velocity at any moment is that which would be acquired by the body in falling from an infinite distance to the place it occupies at the moment.

(4) If a number of bodies are projected from any point in space with the same velocity, but in various directions, and subjected only to the attraction of the sun, they will all return to the point of projection at the same moment, although the orbits in which they move may be ever so different.

(5) At each distance from the sun there is a certain velocity which a body would have if it moved in a circular orbit at that distance. If projected with this velocity in any direction the point of projection will be at the end of the minor axis of the orbit, because this is the only point of an ellipse of which the distance from the focus is equal to the semi-major axis of the curve, and therefore the only point at which the distance of the body from the sun is equal to its mean distance.

(6) The relation between the periodic time of a planet and its mean distance, approximately expressed by Kepler's third law, follows very simply from the laws of centrifugal force. It is an elementary principle of mechanics that this force varies directly as the product of the distance of the moving body from the centre of motion into the square of its angular velocity. When bodies revolve at different distances around a centre, their velocities must be such that the centrifugal force of each shall be balanced by the attraction of the central mass, and therefore vary inversely as the square of the distance. If M is the central mass, n the angular velocity, and a the distance, the balance of the two forces is expressed by the equation

$$an^2 = M/a^2,$$

whence $a^3n^2 = M$, a constant.

The periodic time varying inversely as n, this equation expresses Kepler's third law. This reasoning tacitly supposes the orbit to be a circle of radius a, and the mass of the planet to be negligible. The rigorous relation is expressed by a slight modification of the law. Putting M and m for the respective masses of the sun and planet, a for the semi-major axis of the orbit, and n for the mean angular motion in unit of time, the relation then is

$$a^3n^2 = M + m.$$

What is noteworthy in this theorem is that this relation depends only on the sum of the masses. It follows, therefore, that were any portion of the mass of the sun taken from it, and added to the planet, the relation would be unchanged. Kepler's third law therefore expresses the fact that the mass of the sun is the same for all the planets, and deviates from the truth only to the extent that the masses of the latter differ from each other by quantities which are only a small fraction of the mass of the sun.

Problem of Three Bodies.—As soon as the general law of gravitation was fully apprehended, it became evident that, owing to the attraction of each planet upon all the others, the actual motion of the planets must deviate from their motion in an ellipse according to Kepler's laws. In the *Principia* Newton made several investigations to determine the effects of these actions; but the geometrical method which he employed could lead only to rude approximations. When the subject was taken up by the continental mathematicians, using the analytical method, the question naturally arose whether the motions of three bodies under their mutual attraction could not be determined with a degree of rigour approximating to that with which Newton had solved the problem of two bodies. Thus arose the celebrated "problem of three bodies." Investigation soon showed that certain integrals expressing relations between the motions not only of three but of any number of bodies could be found. These were:—

First, the law of the conservation of the centre of gravity. This expresses the general fact that whatever be the number of the bodies which act upon each other, their motions are so related that the centre of gravity of the entire system moves in a straight line with a constant velocity. This is expressed in three equations, one for each of the three rectangular co-ordinates.

Secondly, the law of conservation of areas. This is an extension of Kepler's second law. Taking as the radius vector of each body the line from the body to the common centre of gravity of all, the sum of the products formed by multiplying each area described, by the mass of the body, remains a constant. In the language of theoretical mechanics, the moment of momentum of the entire system is a constant quantity. This law is also expressed in three equations, one for each of the three planes on which the areas are projected.

Thirdly, the entire *vis viva* of the system or, as it is now called, the energy, which is obtained by multiplying the mass of each body into half the square of its velocity, is equal to the sum of the quotients formed by dividing the product of every pair of the masses, taken two and two, by their distance apart, with the addition of a constant depending on the original conditions of the system. In the language of algebra putting m_1, m_2, m_3, &c. for the masses of the bodies, $r_{1.2}$ $r_{1.3}$ $r_{2.3}$, &c. for their mutual distances apart; v_1, v_2, v_3, &c., for the velocities with which they are moving at any moment; these quantities will continually satisfy the equation

$$\tfrac{1}{2}(m_1v_1^2 + m_2v_2^2 + \ldots) = \frac{m_1m_2}{r_{1.2}} + \frac{m_1m_3}{r_{1.3}} + \frac{m_2m_3}{r_{2.3}} + \ldots + \text{a constant.}$$

The theorems of motion just cited are expressed by seven integrals, or equations expressing a law that certain functions of the variables and of the time remain constant. It is remarkable that although the seven integrals were found almost from the beginning of the investigation, no others have since been added; and indeed it has recently been shown that no others exist that can be expressed in an algebraic form. In the case of three bodies these do not suffice completely to define the motion. In this case, the problem can be attacked only by methods of approximation, devised so as to meet the special conditions of each case. The special conditions which obtain in the solar system are such as to make the necessary approximation theoretically possible however complex the process may be. These conditions are:—(1) The smallness of the masses of the planets in comparison with that of the sun, in consequence of which the orbit of each planet deviates but slightly from an ellipse during any one revolution; (2) the fact that the orbits of the planets are nearly circular, and the planes of their orbits but slightly inclined to each other. The result of these conditions is that all the quantities required admit of development in series proceeding according to the powers of the eccentricities and inclinations of the orbits, and the ratio of the masses of the several planets to the mass of the sun.

Perturbations of the Planets.—Kepler's laws do not completely express the motion of a planet around a central body, except when no force but the mutual attraction of the two bodies comes into play. When one or more other bodies form a part of the system, their action produces deviations from the elliptic motion, which are called *perturbations.* The problem of determining the perturbations of the heavenly bodies is perhaps the most complicated with which the mathematical astronomer has to grapple; and the forms under which it has to be studied are so numerous that they cannot be easily arranged under any one head. But there is one conception of perturbations of such generality and elegance that it forms the common base of all those methods of determining these deviations which have high scientific interest. This conception is embodied in the method of "variation of elements," originally due to J. L. Lagrange. The simplest method of presenting it starts with the second view of the elliptic motion already set forth.

We have shown that, when the position of a planet and the direction and speed of its motion at a certain instant are given, the elements of the orbit can be determined. We have supposed this to be done at a certain point P of the orbit, the direction and speed being expressed by the variables x, y, x' and y'. Now, consider the values of these same variables expressing the position of the planet at a second point Q, and the speed with which it passes that point. With this position and speed the elements of the orbit can again be determined. Since the orbit is unchanged so long as no disturbing force acts, it follows that the elements determined by means of the two sets of values of the variables are in this case the same. In a word, although the position and speed of the planet and the direction of its motion are constantly changing, the values of the elements determined from these variables remain constant. This fact is fully expressed by the equations (4) where we have constants on one side of the equation equal to functions of the variables on the other. Functions of the variables possessing this property of remaining constant are termed *integrals*.

Now let the planet be subjected to any force additional to that of the sun's attraction,—say to the attraction of another planet. To fix the ideas let us suppose that the additional attraction is only an impulse received at the moment of passing the point P. The first effect will evidently be to change either the velocity or the direction in which the planet is moving at the moment, or both. If, with the changed velocity we again compute the elements they will be different from the former elements. But, if the impulse is not repeated, these new elements will again remain invariable. If repeated, the second impulse will again change the elements, and so on indefinitely. It follows that, if we go on computing the elements a, b, c, d from the actual values of x, y, x' and y', at each moment when the planet is subject to the attraction of another body, they will no longer be invariable, but will slowly vary from day to day and year to year. These ever varying elements represent an ever varying elliptic orbit,—not an orbit which the planet actually describes through its whole course, but an ideal one in which it is moving at each instant, and which continually adjusts itself to the actual motion of the planet at the instant. This is called the *osculating* orbit.

The essential principle of Lagrange's elegant method consists in determining the variations of this osculating ellipse, the co-ordinates and velocities of the planet being ignored in the determination. This may be done because, since the elements and co-ordinates completely determine each other, we may concentrate our attention on either, ignoring the other. The reason for taking the elements as the variables is that they vary very slowly, a property which facilitates their determination, since the variations may be treated as small quantities, of which the squares and products may be neglected in a first solution. In a second solution the squares and products may be taken account of, and so on as far as necessary.

If the problem is viewed from a synthetic point of view, the stages of its solution are as follows. We first conceive of the planets as moving in invariable elliptic orbits, and thus obtain approximate expressions for their positions at any moment. With these expressions we express their mutual action, or their pull upon each other at any and every moment. This pull determines the variations of the ideal elements. Knowing these variations it becomes possible to represent by integration the value of the elements as algebraic expressions containing the time, and the elements with which we started. But the variations thus determined will not be rigorously exact, because the pull from which they arise has been determined on the supposition that the planets are moving in unvarying orbits, whereas the actual pull depends on the actual position of the planets. Another approximation is, therefore, to be made, when necessary, by correcting the expression of the pull through taking account of the variations of the elements already determined, which will give a yet nearer approximation to the truth. In theory these successive approximations may be carried as far as we please, but in practice the labour of executing each approximation is so great that we are obliged to stop when the solution is so near the truth that the outstanding error is less than that of the best observations. Even this degree of precision may be impracticable in the more complex cases.

The results which are required to compare with observations are not merely the elements, but the co-ordinates. When the varying elements are known these are computed by the equations (2) because, from the nature of the algebraic relations, the slowly varying elements are continuously determined by the equations (4), which express the same relations between the elements and the variables as do the equations (2) and (3). This method is, therefore, in form at least, completely rigorous. There are some cases in which it may be applied unchanged. But commonly it proves to be extremely long and cumbrous, and modifications have to be resorted to. Of these modifications the most valuable is one conceived by P. A. Hansen. A certain mean elliptic orbit, as near as possible to the actual varying orbit of the planet, is taken. In this orbit a certain fictitious planet is supposed to move according to the law of elliptic motion. Comparing the longitudes of the actual and the fictitious planet the former will sometimes be ahead of the latter and sometimes behind it. But in every case, if at a certain time t, the actual planet has a certain longitude, it is certain that at a very short interval dt before or after t, the fictitious planet will have this same longitude. What Hansen's method does is to determine a correction dt such that, being applied to the actual time t, the longitude of the fictitious planet computed for the time $t+dt$, will give the longitude of the true planet at the time t. By a number of ingenious devices Hansen developed methods by which dt could be determined. The computations are, as a general rule, simpler, and the algebraic expressions less complex, than when the computations of the longitude itself are calculated. Although the longitude of the fictitious planet at the fictitious time is then equal to that of the true planet at the true time, their radii vectores will not be strictly equal. Hansen, therefore, shows how the radius vector is corrected so as to give that of the true planet.

In all that precedes we have considered only two variables as determining the position of the planet, the latter being supposed to move in a plane. Although this is true when there are any number of bodies moving in the same plane, the fact is that the planets move in slightly different planes. Hence the position of the plane of the orbit of each planet is continually changing in consequence of their mutual action. The problem of determining the changes is, however, simpler than others in perturbations. The method is again that of the variation of elements. The position and velocity being given in all three co-ordinates, a certain osculating plane is determined for each instant in which the planet is moving at that instant. This plane remains invariable so long as no third body acts; when it does act the position of the plane changes very slowly, continually rotating round the radius vector of the planet as an instantaneous axis of rotation.

Secular and Periodic Variations.—When, following the preceding method, the variations of the elements are expressed in terms of the time, they are found to be of two classes, *periodic* and *secular*. The first depend on the mean longitudes of the planets, and always tend back to their original values when the planets return to their original positions in their orbits. The others are, at least through long periods of time, continually progressive.

A luminous idea of the nature of these two classes of variation may be gained by conceiving of the motion of a ship, floating on an ocean affected by a long ground swell. In consequence of the swell, the ship is continually pitching in a somewhat irregular way, the oscillations up and down being sometimes great and sometimes small. An observer on board of her would notice no motion except this. But, suppose the tide to be rising. Then, by continued observation, extended over an hour or more, it will be found that, in the general average, the ship is gradually rising, so that two different kinds of motion are superimposed on each other. The effect of the rising tide is in the nature of a secular variation, while the pitching is periodic.

But the analogy does not end here. If the progressive rise of the ship be watched for six hours or more, it will be found gradually to cease and reverse its direction. That is to say, making abstraction of the pitching, the ship is slowly rising and falling in a total period of nearly twelve hours, while superimposed upon this slow motion is a more rapid motion due to the waves. It is thus with the motions of the planets going through their revolutions. Each orbit continually changes its form and position, sometimes in one direction and sometimes in another. But when these changes are averaged through years and centuries it is found that the average orbit has a secular variation which, for a number of centuries, may appear as a very slow progressive change in one direction only. But when this change is more fully investigated, it is found to be really periodic, so that after thousands, tens of thousands, or hundreds of thousands of years, its direction will be reversed and so on continually, like the rising and falling tide. The orbits thus present themselves to us in the words of a distinguished writer as "Great clocks of eternity which beat ages as ours beat seconds."

The periodic variations can be represented algebraically as the resultant of a series of harmonic motions in the following way: Let L be an angle which is increasing uniformly with the time, and let n be its rate of increase. We put L_0 for its value at the moment from which the time is reckoned. The general expression for the angle will then be

$$L = nt + L_0.$$

Such an angle continually goes through the round of 360° in a definite period. For example, if the daily motion is 5°, and we take the day as the unit of time, the round will be completed in 72 days, and the angle will continually go through the value which it had 72 days before. Let us now consider an equation of the form

$$U = a \sin (nt + L_0).$$

The value of U will continually oscillate between the extreme values $+a$ and $-a$, going through a series of changes in the same period in which the angle $nt+L_0$ goes through a revolution. In this case the variation will be simply periodic.

The value of any element of the planet's motion will generally be represented by the sum of an infinite series of such periodic quantities, having different periods. For example

$$U=a\sin(nt+L_0)+b\sin(mt+L_1)+c\sin(kt+L_2)\ \&c.$$

In this case the motion of U, while still periodic, is seemingly irregular, being much like that of a pitching ship, which has no one unvarying period.

In the problems of celestial mechanics the angles within the parentheses are represented by sums or differences of multiples of the mean longitudes of the planets as they move round their orbits. If l be the mean longitude of the planet whose motion we are considering, and l' that of the attracting planet affecting it, the periodic inequalities of the elements as well as of the co-ordinates of the attracted planet, may be represented by an infinite series of terms like the following:—

$$a\sin(l'-l)+b\sin(2l'-l)+c\sin(l'-2l)+\&c.$$

Here the coefficients of l and l' may separately take all integral values, though as a general rule the coefficients a, b, c, &c. diminish rapidly when these coefficients become large, so that only small values have to be considered.

The most interesting kind of periodic inequalities are those known as "terms of long period." A general idea both of their nature and of their cause will be gained by taking as a special case one celebrated in the history of the subject—the great inequality between Jupiter and Saturn. We begin by showing what the actual fact is in the case of these two planets. Let fig. 3 represent the two orbits, the sun being at C. We know that the period of Jupiter is nearly twelve years, and that of Saturn a little less than thirty years. It will be seen that these numbers are nearly in the ratio of 2 to 5. It follows that the motions of the mean longitudes are nearly in the same proportion reversed. The annual motion of Jupiter is nearly 30°, that of Saturn a little more than 12°. Let us now consider the effect of this relation upon the configurations and relations of the two planets. Let the line CJ represent the common direction of the two planets from the sun when they are in conjunction, and let us follow the motions until they again come into conjunction. This will occur along a line CR_1, making an angle of nearly 240° with CJ. At this point Saturn will have moved 240° and Jupiter an entire revolution+240°, making 600°. These two motions, it will be seen, are in the proportion 5 : 2. The next conjunction will take place along CS_1, and the third after the initial one will again take place near the original position JQ, Jupiter having made five revolutions and Saturn two.

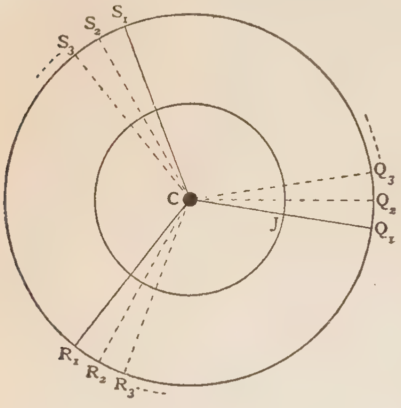

FIG. 3.

The result of these repetitions is that, during a number of revolutions, the special mutual actions of the two planets at these three points of their orbits repeat themselves, while the actions corresponding to the three intermediate arcs are wanting. Thus it happens that if the mutual actions are balanced through a period of a few revolutions only there is a small residuum of forces corresponding to the three regions in question, which repeats itself in the same way, and which, if it continued indefinitely, would entirely change the forms of the two orbits. But the actual mean motions deviate slightly from the ratio 2 : 5, and we have next to show how this deviation results in an ultimate balancing of the forces. The annual mean motions, with the corresponding combinations, are as follows:—

Jupiter:—$n\ =30^\circ{\cdot}349043$
Saturn:—$n'=12\ {\cdot}221133$
$2n=60\ {\cdot}69809$
$5n'=61\ {\cdot}10567$
$5n'-2n=\ 0\ {\cdot}40758$

If we make a more accurate computation of the conjunctions from these data, we shall find that, in the general mean, the consecutive conjunctions take place when each planet has moved through an entire number of revolutions+242·7°. It follows that the third conjunction instead of occurring exactly along the line CQ_1 occurs along CQ_2, making an angle of nearly 8° with CQ_1. The successive conjunctions following will be along CR_2, CS_2, CQ_3, &c., the law of progression being obvious.

The balancing of the series of forces will not be complete until the respective triplets of conjunctions have filled up the entire space between them. This will occur when the angle whose annual motion is $5n'-2n$ has gone through 360°. From the preceding value of $5n'-2n$ we see that this will require a little more than 883 years. The result of the continued action of the two planets upon each other is that during half of this period the motion of one planet is constantly retarded and of the other constantly accelerated, while during the other half the effects are reversed. There is thus in the case of each planet an oscillation of the mean longitude which increases it and then diminishes it to its original value at the end of the period of 883 years.

The longitudes, latitudes and radii vectores of a planet, being algebraically expressed as the sum of an infinite periodic series of the kind we have been describing, it follows that the problem of finding their co-ordinates at any moment is solved by computing these expressions. This is facilitated by the construction of tables by means of which the co-ordinates can be computed at any time. Such tables are used in the offices of the national Ephemerides to construct ephemerides of the several planets, showing their exact positions in the sky from day to day.

We pass now to the second branch of celestial mechanics viz. that in which the planets are no longer considered as particles, but as rotating bodies of which the dimensions are to be taken into account. Such a body, in free space, not acted on by any force except the attraction of its several parts, will go on rotating for ever in an invariable direction. But, in consequence of the centrifugal force generated by the rotation, it assumes a spheroidal form, the equatorial regions bulging out. Such a form we all know to be that of the earth and of the planets rotating on their axes. Let us study the effect of this deviation from the spherical form upon the attraction exercised by a distant body.

We begin with the special case of the earth as acted upon by the sun and moon. Let fig. 4 represent a section of the earth through its axis AB, ECQ being a diameter of the equator. Let the dotted lines show the direction of the distant attracting body. The point E, being more distant than C, will be attracted with less force, while Q will be attracted with a greater force than will the centre C. Were the force equal on every point of the earth it would have no influence on its rotation, but would simply draw its whole mass toward the attracting body. It is therefore only the *difference* of the forces on different parts of the earth that affects the rotation.

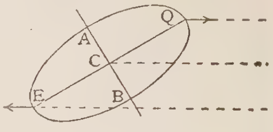

FIG. 4.

Let us, therefore, divide the attracting forces at each point into two parts, one the average force, which we may call F, and which for our purpose may be regarded as equal to the force acting at C; the others the residual forces which we must superimpose upon the average force F in order that the combination may be equal to the actual force. It is clear that at Q this residual force as represented by the arrow will be in the same direction as the actual force. But at E, since the actual force is less than F, the residual force must tend to diminish F, and must, therefore, act toward the right, as shown by the arrow. These residual forces tend to make the whole earth turn round the centre C in a clockwise direction. If nothing modified this tendency the result would be to bring the points E and Q into the dotted lines of the attraction. In other words the equator would be drawn into coincidence with the ecliptic. Here, however, the same action comes into play, which keeps a rotating top from falling over. (See GYROSCOPE and MECHANICS.) For the same reason as in the case of the gyroscope the actual motion of the earth's axis is at right angles to the line joining the earth and the attracting centre, and without going into the details of the mathematical processes involved, we may say that the ultimate mean effect will be to cause the pole P of the earth to move at right angles to the circle joining it to the pole of the ecliptic. Were the position of the latter invariable, the celestial pole would move round it in a circle. Actually the curve in which it moves is nearly a circle; but the distance varies slightly owing to the minute secular variation in the position of the ecliptic, caused by the action of the planets. This motion of the celestial pole results in a corresponding revolution of the equinox around the celestial sphere. The rate of motion is slightly variable from century to century owing to the secular motion of the plane of the ecliptic. Its period, with the present rate of motion, would be about 26,000 years, but the actual period is slightly indeterminate from the cause just mentioned.

The residual force just described is not limited to the case of an ellipsoidal body. It will be seen that the reasoning applies to the case of any one body or system of bodies, the dimensions of which are not regarded as infinitely small compared with the distance of the attracting body. In all such cases the residual forces virtually tend to draw those portions of the body nearest the attracting centre toward the latter, and those opposite the attracting centre away from it. Thus we have a tide-producing force tending to deform the body, the action of which is of the same nature as the force producing precession. It is of interest to note that, very approximately, this deforming force varies inversely as the cube of the distance of the attracting body.

The action of the sun upon the satellites of the several planets and the effects of this action are of the same general nature. For the same reason that the residual forces virtually act in opposite directions upon the nearer and more distant portions of a planet they will virtually act in the case of a satellite. When the latter is between its primary and the sun, the attraction of the latter tends to draw the satellite away from the primary. When the satellite is in the opposite direction from the sun, the same action tends to draw the primary away from the satellite. In both cases, relative to the primary, the action is the same. When the satellite is in quadrature the convergence of the lines of attraction toward the centre of the sun tends to bring the two bodies together. When the orbit of the satellite is inclined to that of the primary planet round the sun, the action brings about a change in the plane of the orbit represented by a rotation round an axis perpendicular to the plane of the orbit of the primary. If we conceive a pole to each of these orbits, determined by the points in which lines perpendicular to their planes intersect the celestial sphere, the pole of the satellite orbit will revolve around the pole of the planetary orbit precisely as the pole of the earth does around the pole of the ecliptic, the inclination of the two orbits remaining unchanged.

If a planet rotates on its axis so rapidly as to have a considerable ellipticity, and if it has satellites revolving very near the plane of the equator, the combined actions of the sun and of the equatorial protuberances may be such that the whole system will rotate almost as if the planes of revolution of the satellites were solidly fixed to the plane of the equator. This is the case with the seven inner satellites of Saturn. The orbits of these bodies have a large inclination, nearly 27°, to the plane of the planet's orbit. The action of the sun alone would completely throw them out of these planes as each satellite orbit would rotate independently; but the effect of the mutual action is to keep all of the planes in close coincidence with the plane of the planet's equator.

Literature.—The modern methods of celestial mechanics may be considered to begin with Joseph Louis Lagrange, whose theory of the variation of elements is developed in his *Mécanique analytique.* The practical methods of computing perturbations of the planets and satellites were first exhaustively developed by Pierre Simon Laplace in his *Mécanique céleste.* The only attempt since the publication of this great work to develop the various theories involved on a uniform plan and mould them into a consistent whole is that of de Pontécoulant in *Théorie analytique du système du monde* (1829–46, Paris). An approximation to such an attempt is that of F. F. Tisserand in his *Traité de mécanique céleste* (4 vols., Paris). This work contains a clear and excellent résumé of the methods which have been devised by the leading investigators from the time of Lagrange until the present, and thus forms the most encyclopaedic treatise to which the student can refer.

Works less comprehensive than this are necessarily confined to the elements of the subject, to the development of fundamental principles and general methods, or to details of special branches. An elementary treatise on the subject is F. R. Moulton's *Introduction to Celestial Mechanics* (London, 1902). Other works with the same general object are H. A. Resal, *Mécanique céleste*; and O. F. Dziobek, *Theorie der Planetenbewegungen.* The most complete and systematic development of the general principles of the subject, from the point of view of the modern mathematician, is found in J. H. Poincaré, *Les Méthodes nouvelles de la mécanique céleste* (3 vols., Paris, 1899, 1892, 1893). Of another work of Poincaré, *Leçons de mécanique céleste*, the first volume appeared in 1905.

Practical Astronomy.

Practical Astronomy, taken in its widest sense, treats of the instruments by which our knowledge of the heavenly bodies is acquired, the principles underlying their use, and the methods by which these principles are practically applied. Our knowledge of these bodies is of necessity derived through the medium of the light which they emit; and it is the development and applications of the laws of light which have made possible the additions to our stock of such knowledge since the middle of the 19th century.

At the base of every system of astronomical observation is the law that, in the voids of space, a ray of light moves in a right line. The fundamental problem of practical astronomy is that of determining by measurement the co-ordinates of the heavenly bodies as already defined. Of the three co-ordinates, the radius vector does not admit of direct measurement, and must be inferred by a combination of indirect measurements and physical theories. The other two co-ordinates, which define the direction of a body, admit of direct measurement on principles applied in the construction and use of astronomical instruments.

In the first system of co-ordinates already described the fundamental axis is the vertical line or direction of gravity at the point of observation. This is not the direction of gravity proper, or of the earth's attraction, but the resultant of this attraction combined with the centrifugal force due to the earth's rotation on its axis. The most obvious method of realizing this direction is by the plumb-line. In our time, however, this appliance is replaced by either of two others, which admit of much more precise application. These are the basin of mercury and the spirit-level. The surface of a liquid at rest is necessarily perpendicular to the direction of gravity, and therefore horizontal. Considered as a curved surface, concentric with the earth, a tangent plane to such a surface is the plane of the horizon. The problem of measuring from an axis perpendicular to this plane is solved on the principle that the incident and reflected rays of light make equal angles with the perpendicular to a reflecting surface. It follows that if PO (fig. 5) is the direction of a ray, either from a heavenly body or from a terrestrial point, impinging at O upon the surface of quicksilver, and reflected in the direction OR, the vertical line is the bisector OZ, of the angle POR. If the point P is so adjusted over the quicksilver that the ray is reflected back on its own path, P and R lying on the same line above O, then we know that the line PO is truly vertical. The zenith-distance of an object is the angle which the ray of light from it makes with the vertical direction thus defined.

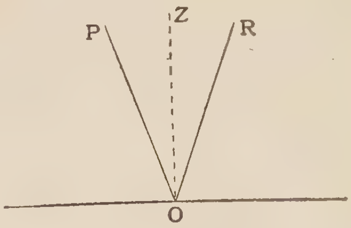

FIG. 5.

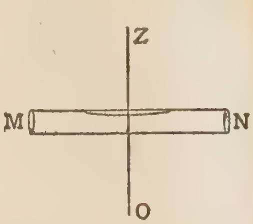

FIG. 6.

To show the principle involved in the spirit-level let MN (fig. 6) be the tube of such a level, fixed to an axis OZ on which it may revolve. If this axis is so adjusted that in the course of a revolution around it the bubble of the level undergoes no change of position, we know that the axis is truly vertical. Any slight deviation from verticality is shown by the motion of the bubble during the revolution, which can be measured and allowed for. The level may not be actually attached to an axis, a revolution of 180° being effected round an imaginary vertical axis by turning the level end for end. The motion of the bubble then measures double the inclination of this imaginary axis, or the deviation of a cylinder on which the level may rest from horizontality.

The problem of determining the zenith distance of a celestial object now reduces itself to that of measuring the angle between the direction of the object and the direction of the vertical line realized in one of these ways. This measurement is effected by a combination of two instruments, the telescope and the graduated circle. Let OF (fig. 7) be a section of the telescope, MN being its object glass. Let the parallel dotted lines represent rays of light emanating from the object to be observed, which, for our purpose, we regard as infinitely distant, a star for example. These rays come to a focus at a point F lying in the focal plane of the telescope. In this plane are a pair of cross threads or spider lines which, as the observer looks into the telescope, are seen as AB and CD (fig. 8). If the telescope is so pointed that the image of the star is seen in coincidence with the cross threads, as represented in fig. 8, then we know that the star is exactly in the line of sight of the telescope, defined as the line joining the centre of the object glass, and the point of intersection of the cross threads. If the telescope is moved around so that the images of two distant points are successively brought into coincidence with the cross threads, we know that the angle between the directions of these points is equal to that through which the telescope has been turned. This angle is measured by means of a graduated circle, rigidly attached to the tube of the telescope in a plane parallel to the line of sight. When the telescope is turned in this plane, the angular motion of the line of sight is equal to that through which the circle has turned.

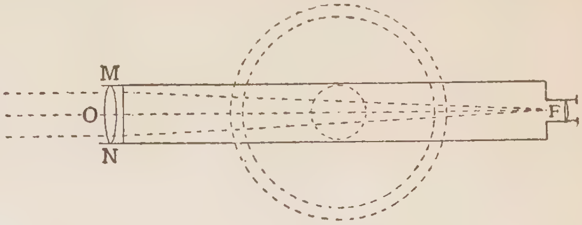

FIG. 7.

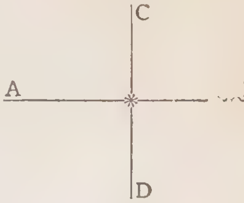

FIG. 8.

Stripped of all unnecessary adjuncts, and reduced to a geometric form, the ideal method by which the zenith distance of a heavenly body is determined by the combination which we have described is as follows:—Let OP (fig. 9) be the direction of a celestial body at which a telescope, supplied with a graduating circle, is pointed. Let OZ be an axis, as nearly vertical as it can easily be set, round which the entire instrument may revolve through 180°. After the image of the body is brought into coincidence with the cross threads, the instrument is turned through 180° on the axis, which results in the line of sight of the telescope pointing in a certain direction OQ, determined by the condition QOZ=ZOP. The telescope is then a second time pointed at the object by being moved through the angle QOP. Either of the angles QOZ and ZOP is then one half that through which the telescope has been turned, which may be measured by a graduated circle, and which is the zenith distance of the object measured from the direction of the axis OZ. This axis may not be exactly vertical. Its deviation from the vertical line is determined by the motion of the bubble of a spirit-level rigidly attached either to the axis, or to the telescope. Applying this deviation to the measured arc, the true zenith distance of the body is found.

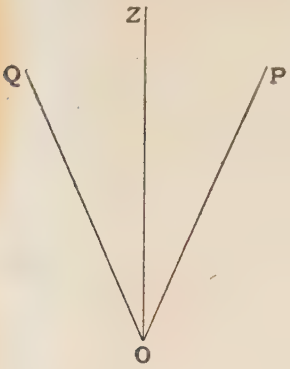

Fig. 9.

When the basin of quicksilver is used, the telescope, either before or after being directed toward P, is pointed directly downwards, so that the observer mounting above it looks through it into the reflecting surface. He then adjusts the instrument so that the cross threads coincide with their images reflected from the surface of the quicksilver. The angular motion of the telescope in passing from this position to that when the celestial object is in the line of sight is the distance (ND) of the body from the nadir. Subtracting 90° from (ND) gives the altitude; and subtracting (ND) from 180° gives the zenith distance.

In the measurement of equatorial co-ordinates, the polar distance is determined in an analogous way. We determine the apparent position of an object near the pole on the celestial sphere at any moment, and again at another moment, twelve hours later, when, by the diurnal motion, it has made half a revolution. The angle through the celestial pole, between these two positions, is double the polar distance. The pole is the point midway between them. This being ascertained by one or more stars near it, may be used to determine by direct measurements the polar distances of other bodies.

The preceding methods apply mainly to the latitudinal co-ordinate. To measure the difference between the longitudinal co-ordinates of two objects by means of a graduated circle the instruments must turn on an axis parallel to the principal axis of the system of co-ordinates, and the plane of the graduated circle must be at right angles to that axis, and, therefore, parallel to the principal co-ordinate plane. The telescope, in order that it may be pointed in any direction, must admit of two motions, one round the principal axis, and the other round an axis at right angles to it. By these two motions the instrument may be pointed first at one of the objects and then at the other. The motion of the graduated circle in passing from one pointing to the other is the measure of the difference between the longitudinal co-ordinates of the two objects.

In the equatorial system this co-ordinate (the right ascension) is measured in a different way, by making the rotating earth perform the function of a graduated circle. The unceasing diurnal motion of the image of any heavenly body relative to the cross threads of a telescope makes a direct accurate measure of any co-ordinate except the declination almost impossible. Before the position of a star can be noted, it has passed away from the cross threads. This troublesome result is utilized and made a means of measurement. Right ascensions are now determined, not by measuring the angle between one star and another, but, by noting the time between the transits of successive stars over the meridian. The difference between these times, when reduced to an angle, is the difference of the right ascensions of the stars. The principle is the same as that by which the distance between two stations may be determined by the time required for a train moving at a uniform known speed to pass from one station to the other. The uniform speed of the diurnal motion is 15° per hour. We have already mentioned that in astronomical practice right ascensions are expressed in time, so that no multiplication by 15 is necessary.

Measures made on the various systems which we have described give the apparent direction of a celestial object as seen by the observer. But this is not the true direction, because the ray of light from the object undergoes refraction in passing through the atmosphere. It is therefore necessary to correct the observation for this effect. This is one of the most troublesome problems in astronomy because, owing to the ever varying density of the atmosphere, arising from differences of temperature, and owing to the impossibility of determining the temperature with entire precision at any other point than that occupied by the observer, the amount of refraction must always be more or less uncertain. The complexity of the problem will be seen by reflecting that the temperature of the air inside the telescope is not without its effect. This temperature may be and commonly is somewhat different from that of the observing room, which, again, is commonly higher than the temperature of the air outside. The uncertainty thus arising in the amount of the refraction is least near the zenith, but increases more and more as the horizon is approached.

The result of astronomical observations which is ordinarily wanted is not the direction of an object from the observer, but from the centre of the earth. Thus a reduction for parallax is required. Having effected this reduction, and computed the correction to be applied to the observation in order to eliminate all known errors to which the instrument is liable, the work of the practical astronomer is completed.

The instruments used in astronomical research are described under their several names. The following are those most used in astrometry:—

The equatorial telescope (*q.v.*) is an instrument which can be directed to any point in the sky, and which derives its appellation from its being mounted on an axis parallel to that of the earth. By revolving on this axis it follows a star in its diurnal motion, so that the star is kept in the field of view notwithstanding that motion.

Next in extent of use are the transit instrument and the meridian circle, which are commonly united in a single instrument, the transit circle (*q.v.*), known also as the meridian circle. This instrument moves only in the plane of the meridian on a horizontal east and west axis, and is used to determine the right ascensions and declinations of stars. These two instruments or combinations are a necessary part of the outfit of every important observatory. An adjunct of prime importance, which is necessary to their use, is an accurate clock, beating seconds.

Use of Photography.—Before the development of photography, there was no possible way of making observations upon the heavenly bodies except by the eye. Since the middle of the 19th century the system of photographing the heavenly bodies has been introduced, step by step, so that it bids fair to supersede eye observations in many of the determinations of astronomy. (See PHOTOGRAPHY: *Celestial.*)

The field of practical astronomy includes an extension which may be regarded as making astronomical science in a certain sense universal. The science is concerned with the heavenly bodies. The earth on which we live is, to all intents and purposes, one of these bodies, and, so far as its relations to the heavens are concerned, must be included in astronomy. The processes of measuring great portions of the earth, and of determining geographical positions, require both astronomical observations proper, and determinations made with instruments similar to those of astronomy. Hence geodesy may be regarded as a branch of practical astronomy. (S. N.)

History of Astronomy.

Origin of the science.

A practical acquaintance with the elements of astronomy is indispensable to the conduct of human life. Hence it is most widely diffused among uncivilized peoples, whose existence depends upon immediate and unvarying submission to the dictates of external nature. Having no clocks, they regard instead the face of the sky; the stars serve them for almanacs; they hunt and fish, they sow and reap in correspondence with the recurrent order of celestial appearances. But these, to the untutored imagination, present a mystical, as well as a mechanical aspect; and barbaric familiarity with the heavens developed at an early age, through the promptings of superstition, into a fixed system of observation. In China, Egypt and Babylonia, strength and continuity were lent to this native tendency by the influence of a centralized authority; considerable proficiency was attained in the arts of observation; and from millennial stores of accumulated data, empirical rules were deduced by which the scope of prediction was widened and its accuracy enhanced. But no genuine science of astronomy was founded until the Greeks sublimed experience into theory.

Chinese astronomy.

Already, in the third millennium B.C., equinoxes and solstices were determined in China by means of culminating stars. This is known from the orders promulgated by the emperor Yao about 2300 B.C., as recorded in the *Shu Chung*, a collection of documents antique in the time of Confucius (550–478 B.C.). And Yao was merely the renovator of a system long previously established. The *Shu Chung* further relates the tragic fate of the official astronomers, Hsi and Ho, put to death for neglecting to perform the rites customary during an eclipse of the sun, identified by Professor S. E. Russell[1] with a partial obscuration visible in northern China 2136 B.C. The date cannot be far wrong, and it is by far the earliest assignable to an event of the kind. There is, however, no certainty that the Chinese were then capable of predicting eclipses. They were, on the other hand, probably acquainted, a couple of millenniums before Meton gave it his name, with the nineteen-year cycle, by which solar and lunar years were harmonized;[1] they immemorially made observations in the meridian; regulated time by water-clocks, and used measuring instruments of the nature of armillary spheres and quadrants. In or near 1100 B.C., Chou Kung, an able mathematician, determined with surprising accuracy the obliquity of the ecliptic; but his attempts to estimate the sun's distance failed hopelessly as being grounded on belief in the flatness of the earth. From of old, in China, circles were divided into 365¼ parts, so that the sun described daily one Chinese degree; and the equator began to be employed as a line of reference, concurrently with the ecliptic, probably in the second century B.C. Both circles, too, were marked by star-groups more or less clearly designated and defined. Cometary records of a vague kind go back in China to 2296 B.C.; they are intelligible and trustworthy from 611 B.C. onward. Two instruments constructed at the time of Kublai Khan's accession in 1280 were still extant at Peking in 1881. They were provided with large graduated circles adapted for measurements of declination and right ascension, and prove the Chinese to have anticipated by at least three centuries some of Tycho Brahe's most important inventions.[2] The native astronomy was finally superseded in the 17th century by the scientific teachings of Jesuit missionaries from Europe.

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[1] *The Observatory*, Nos. 231-234, 1895.

Egyptian astronomy.

Astrolatry was, in Egypt, the prelude to astronomy. The stars were observed that they might be duly worshipped. The importance of their heliacal risings, or first visible appearances at dawn, for the purposes both of practical life and of ritual observance, caused them to be systematically noted; the length of the year was accurately fixed in connexion with the annually recurring Nile-flood; while the curiously precise orientation of the Pyramids affords a lasting demonstration of the high degree of technical skill in watching the heavens attained in the third millennium B.C. The constellational system in vogue among the Egyptians appears to have been essentially of native origin; but they contributed little or nothing to the genuine progress of astronomy.

Babylonian astronomy.

With the Babylonians the case was different, although their science lacked the vital principle of growth imparted to it by their successors. From them the Greeks derived their first notions of astronomy. They copied the Babylonian asterisms, appropriated Babylonian knowledge of the planets and their courses, and learned to predict eclipses by means of the "Saros." This is a cycle of 18 years 11 days, or 223 lunations, discovered at an unknown epoch in Chaldaea, at the end of which the moon very nearly returns to her original position with regard as well to the sun as to her own nodes and perigee. There is no getting back to the beginning of astronomy by the shores of the Euphrates. Records dating from the reign of Sargon of Akkad (3800 B.C.) imply that even then the varying aspects of the sky had been long under expert observation. Thus early, there is reason to suppose, the star-groups with which we are now familiar began to be formed. They took shape most likely, not through one stroke of invention, but incidentally, as legends developed and astrological persuasions became defined.[3] The zodiacal series in particular seem to have been reformed and reconstructed at wide intervals of time (see ZODIAC). Virgo, for example, is referred by P. Jensen, on the ground of its harvesting associations, to the fourth millennium B.C., while Aries (according to F. K. Ginzel) was interpolated at a comparatively recent time. In the main, however, the constellations transmitted to the West from Babylonia by Aratus and Eudoxus must have been arranged very much in their present order about 2800 B.C. E. W. Maunder's argument to this effect is unanswerable.[4] For the space of the southern sky left blank of stellar emblazonments was necessarily centred on the pole; and since the pole shifts among the stars through the effects of precession by a known annual amount, the ascertainment of any former place for it virtually fixes the epoch. It may then be taken as certain that the heavens described by Aratus in 270 B.C. represented approximately observations made some 2500 years earlier in or near north latitude 40°.

In the course of ages, Babylonian astronomy, purified from the astrological taint, adapted itself to meet the most refined needs of civil life. The decipherment and interpretation by the learned Jesuits, Fathers Epping and Strassmeier, of a number of clay tablets preserved in the British Museum, have supplied detailed knowledge of the methods practised in Mesopotamia in the 2nd century B.C.[5] They show no trace of Greek influence, and were doubtless the improved outcome of an unbroken tradition. How protracted it had been, can be in a measure estimated from the length of the revolutionary cycles found for the planets. The Babylonian computers were not only aware that Venus returns in almost exactly eight years to a given starting-point in the sky, but they had established similar periodic relations in 46, 59, 79 and 83 years severally for Mercury, Saturn, Mars and Jupiter. They were accordingly able to fix in advance the approximate positions of these objects with reference to ecliptical stars which served as fiducial points for their determination. In the Ephemerides published year by year, the times of new moon were given, together with the calculated intervals to the first visibility of the crescent, from which the beginning of each month was reckoned; the dates and circumstances of solar and lunar eclipses were predicted; and due information was supplied as to the forthcoming heliacal risings and settings, conjunctions and oppositions of the planets. The Babylonians knew of the inequality in the daily motion of the sun, but misplaced by 10° the perigee of his orbit. Their sidereal year was $4\frac{1}{2}^{\mathrm{m}}$ too long,[6] and they kept the ecliptic stationary among the stars, making no allowance for the shifting of the equinoxes. The striking discovery, on the other hand, has been made by the Rev. F. X. Kugler[7] that the various periods underlying their lunar predictions were identical with those heretofore believed to have been independently arrived at by Hipparchus, who accordingly must be held to have borrowed from Chaldaea the lengths of the synodic, sidereal, anomalistic and draconitic months.

Greek astronomy. Thales.

A steady flow of knowledge from East to West began in the 7th century B.C. A Babylonian sage named Berossus founded a school about 640 B.C. in the island of Cos, and perhaps counted Thales of Miletus (*c.* 639–548) among his pupils. The famous "eclipse of Thales" in 585 B.C. has not, it is true, been authenticated by modern research[8]; yet the story told by Herodotus appears to intimate that a knowledge of the Saros, and of the forecasting facilities connected with it, was possessed by the Ionian sage. Pythagoras of Samos (fl. 540–510 B.C.) learned on his travels in Egypt and the East to identify the morning and evening stars, to recognize the obliquity of the ecliptic, and to regard the earth as a sphere freely poised in space. The tenet of its axial movement was held by many of his followers—in an obscure form by Philolaus of Crotona after the middle of the 5th century B.C., and more explicitly by Ecphantus and Hicetas of Syracuse (4th century B.C.), and by Heraclides of Pontus. Heraclides, who became a disciple of Plato in 360 B.C., taught in addition that the sun, while circulating round the earth, was the centre of revolution to Venus and Mercury.[9] A genuine heliocentric system, developed by Aristarchus of Samos (fl. 280–264 B.C.), was described by Archimedes in his *Arenarius*, only to be set aside

Pythagoras.

Heraclides.

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[1] *Observations of Comets*, translated from the Chinese *Annals* by John Williams, F.S.A. (1871).

[2] J. L. E. Dreyer, *Proc. Roy. Irish Acad.* vol. iii. No. 7 (December 1881).

[3] F. K. Ginzel, "Die astronomischen Kenntnisse der Babylonier," C. F. Lehmann, *Beiträge zur alten Geschichte*, Heft i. p. 6 (1901).

[4] *Knowledge and Scientific News*, vol. i. pp. 2, 228.

[5] *Astronomisches aus Babylon* (Freiburg im Breisgau, 1889).

[6] Ginzel, *loc. cit.* Heft ii. p. 204.

[7] *Die babylonische Mondrechnung*, p. 50 (1900).

[8] S. Newcomb, *Astr. Nach.* No. 3682; P. H. Cowell, *Month. Notices Roy. Astr. Soc.* lxv. 867.

[9] G. V. Schiaparelli, *I Precursori del Copernico*, pp. 23–28, Pubbl. del R. Osservatorio di Brera, No. iii. (1873).

with disapproval. The long-lived conception of a series of crystal spheres, acting as the vehicles of the heavenly bodies, and attuned to divine harmonies, seems to have originated with Pythagoras himself.

Eudoxus.

The first mathematical theory of celestial appearances was devised by Eudoxus of Cnidus (408–355 B.C.).[1] The problem he attempted to solve was so to combine uniform circular movements as to produce the resultant effects actually observed. The sun and moon and the five planets were, with this end in view, accommodated each with a set of variously revolving spheres, to the total number of 27. The Eudoxian or "homocentric" system, after it had been further elaborated by Callippus and Aristotle, was modified by Apollonius of Perga (fl. 250–220 B.C.) into the hypothesis of deferents and epicycles, which held the field for 1800 years as the characteristic embodiment of Greek ideas in astronomy. Eudoxus further wrote two works descriptive of the heavens, the *Enoptron* and *Phaenomena*, which, substantially preserved in the *Phaenomena* of Aratus (fl. 270 B.C.), provided all the leading features of modern stellar nomenclature.

School of Alexandria.

Aristarchus.

Greek astronomy culminated in the school of Alexandria. It was, soon after its foundation, illustrated by the labours of Aristyllus and Timocharis (*c.* 320–260 B.C.), who constructed the first catalogue giving star-positions as measured from a reference-point in the sky. This fundamental advance rendered inevitable the detection of precessional effects. Aristarchus of Samos observed at Alexandria 280–264 B.C. His treatise on the magnitudes and distances of the sun and moon, edited by John Wallis in 1688, describes a theoretically valid method for determining the relative distances of the sun and moon by measuring the angle between their centres when half the lunar disk is illuminated; but the time of dichotomy being widely indeterminate, no useful result was thus obtainable. Aristarchus in fact concluded the sun to be not more than twenty times, while it is really four hundred times farther off than our satellite. His general conception of the universe was comprehensive beyond that of any of his predecessors.

Eratosthenes.

Eratosthenes (276–196 B.C.), a native of Cyrene, was summoned from Athens to Alexandria by Ptolemy Euergetes to take charge of the royal library. He invented, or improved armillary spheres, the chief implements of ancient astrometry, determined the obliquity of the ecliptic at 23° 51′ (a value 5′ too great), and introduced an effective mode of arc-measurement. Knowing Alexandria and Syene to be situated 5000 stadia apart on the same meridian, he found the sun to be 7° 12′ south of the zenith at the northern extremity of this arc when it was vertically overhead at the southern extremity, and he hence inferred a value of 252,000 stadia for the entire circumference of the globe. This is a very close approximation to the truth, if the length of the unit employed has been correctly assigned.[2]

Hipparchus.

Among the astronomers of antiquity, two great men stand out with unchallenged pre-eminence. Hipparchus and Ptolemy entertained the same large organic designs; they worked on similar methods; and, as the outcome, their performances fitted so accurately together that between them they re-made celestial science. Hipparchus fixed the chief data of astronomy—the lengths of the tropical and sidereal years, of the various months, and of the synodic periods of the five planets; determined the obliquity of the ecliptic and of the moon's path, the place of the sun's apogee, the eccentricity of his orbit, and the moon's horizontal parallax; all with approximate accuracy. His loans from Chaldaean experts appear, indeed, to have been numerous; but were doubtless independently verified. His supreme merit, however, consisted in the establishment of astronomy on a sound geometrical basis. His acquaintance with trigonometry, a branch of science initiated by him, together with his invention of the planisphere, enabled him to solve a number of elementary problems; and he was thus led to bestow especial attention upon the position of the equinox, as being the common point of origin for measures both in right ascension and longitude. Its steady retrogression among the stars became manifest to him in 130 B.C., on comparing his own observations with those made by Timocharis a century and a half earlier; and he estimated at not less than 36″ (the true value being 50″) the annual amount of "precession."

The choice made by Hipparchus of the geocentric theory of the universe decided the future of Greek astronomy. He further elaborated it by the introduction of "eccentrics," which accounted for the changes in orbital velocity of the sun and moon by a displacement of the earth, to a corresponding extent, from the centre of the circles they were assumed to describe. This gave the elliptic inequality known as the "equation of the centre," and no other was at that time obvious. He attempted no detailed discussion of planetary theory; but his catalogue of 1080 stars, divided into six classes of brightness, or "magnitudes," is one of the finest monuments of antique astronomy. It is substantially embodied in Ptolemy's *Almagest* (see PTOLEMY).

Ptolemy.

An interval of 250 years elapsed before the constructive labours of Hipparchus obtained completion at Alexandria. His observations were largely, and somewhat arbitrarily, employed by Ptolemy. Professor Newcomb, who has compiled an instructive table of the equinoxes severally observed by Hipparchus and Ptolemy, with their errors deduced from Leverrier's solar tables, finds palpable evidence that the discrepancies between the two series were artificially reconciled on the basis of a year 6^m too long, adopted by Ptolemy on trust from his predecessor. He nevertheless holds the process to have been one that implied no fraudulent intention.

Arab astronomers.

The Ptolemaic system was, in a geometrical sense, defensible; it harmonized fairly well with appearances, and physical reasonings had not then been extended to the heavens. To the ignorant it was recommended by its conformity to crude common sense; to the learned, by the wealth of ingenuity expended in bringing it to perfection. The *Almagest* was the consummation of Greek astronomy. Ptolemy had no successor; he found only commentators, among the more noteworthy of whom were Theon of Alexandria (fl. A.D. 400) and his daughter Hypatia (370–415). With the capture of Alexandria by Omar in 641, the last glimmer of its scientific light became extinct, to be rekindled, a century and a half later, on the banks of the Tigris. The first Arabic translation of the *Almagest* was made by order of Harun al-Rashid about the year 800; others followed, and the Caliph al-Mamun built in 829 a grand observatory at Bagdad. Here Albumazar (805–885) watched the skies and cast horoscopes; here Tobit ben Korra (836–901) developed his long unquestioned, yet misleading theory of the "trepidation" of the equinoxes; Abd-ar-rahman al-Sūf 903–986) revised at first hand the catalogue of Ptolemy;[3] and Abulwefa (939–998), like al-Sūfi, a native of Persia, made continuous planetary observations, but did not (as alleged by L. Sédillot) anticipate Tycho Brahe's discovery of the moon's variation. Ibn Junis (*c.* 950–1008), although the scene of his activity was in Egypt, falls into line with the astronomers of Bagdad. He compiled the Hakimite Tables of the planets, and observed at Cairo, in 977 and 978, two solar eclipses which, as being the first recorded with scientific accuracy,[4] were made available in fixing the amount of lunar acceleration. Nasir ud-din (1201–1274) drew up the Ilkhanic Tables, and determined the constant of precession at 51″. He directed an observatory established by Hulagu Khan (d. 1265) at Maraga in Persia, and equipped with a mural quadrant of 12 ft. radius, besides altitude and azimuth instruments. Ulugh Beg (1394–1449), a grandson of Tamerlane, was the illustrious personification of Tatar astronomy. He founded about 1420 a splendid observatory at Samarkand, in which he re-determined nearly all Ptolemy's stars, while the Tables published by him held the primacy for two centuries.[1]

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[1] G. V. Schiaparelli, *I Precursori del Copernico*, pp. 23–28, Pubbl. del R. Osservatorio di Brera, No. ix.

[2] Marie, *Hist. des sciences*, t. i. p. 79; P. Tannery, *Hist. de l'astronomie ancienne*, ch. v. p. 115.

[3] Published by H. C. Schjellerup in a French translation (St Petersburg, 1874).

[4] Newcomb, *Researches on the Motion of the Moon*, Washington Observations for 1875, Appendix ii. p. 20.

Arab astronomy, transported by the Moors to Spain, flourished temporarily at Cordova and Toledo.

Moorish astronomy.

From the latter city the Toletan Tables, drawn up by Arzachel in 1080, took their name; and there also the Alfonsine Tables, published in 1252, were prepared under the authority of Alphonso X. of Castile. Their appearance signalized the dawn of European science, and was nearly coincident with that of the *Sphaera Mundi*, a text-book of spherical astronomy, written by a Yorkshireman, John Holywood, known as Sacro Bosco (d. 1256).

European astronomy.

It had an immense vogue, perpetuated by the printing-press in fifty-nine editions. In Germany, during the 15th century, a brilliant attempt was made to patch up the flaws in Ptolemaic doctrine.

Purbach.

George Purbach (1423–1461) introduced into Europe the method of determining time by altitudes employed by Ibn Junis. He lectured with applause at Vienna from 1450; was joined there in 1452 by Regiomontanus (*q.v.*); and was on the point of starting for Rome to inspect a manuscript of the *Almagest* when he died suddenly at the age of thirty-eight. His teachings bore fruit in the work of Regiomontanus, and of Bernhard Walther of Nuremberg (1430–1504), who fitted up an observatory with clocks driven by weights, and developed many improvements in practical astronomy.

Walther.

Meantime, a radical reform was being prepared in Italy. Under the searchlights of the new learning, the dictatorship of Ptolemy appeared no more inevitable than that of Aristotle; advanced thinkers like Domenico Maria Novara (1454–1504) promulgated *sub rosa* what were called Pythagorean opinions; and they were eagerly and fully appropriated by Nicolaus Copernicus during his student-years (1496–1505) at Bologna and Padua.

Copernicus.

He laid the groundwork of his heliocentric theory between 1506 and 1512, and brought it to completion in *De Revolutionibus Orbium Coelestium* (1543). The colossal task of remaking astronomy on an inverted design was, in this treatise, virtually accomplished. Its reasonings were solidly founded on the principle of the relativity of motion. A continuous shifting of the standpoint was in large measure substituted for the displacements of the objects viewed, which thus acquired a regularity and consistency heretofore lacking to them. In the new system, the sphere of the fixed stars no longer revolved diurnally, the earth rotating instead on an axis directed towards the celestial pole. The sun too remained stationary, while the planets, including our own globe, circulated round him. By this means, the planetary “retrogradations” were explained as simple perspective effects due to the combination of the earth's revolutions with those of her sister orbs. The retention, however, by Copernicus of the antique postulate of uniform circular motion impaired the perfection of his plan, since it involved a partial survival of the epicyclical machinery. Nor was it feasible, on this showing, to place the sun at the true centre of any of the planetary orbits; so that his ruling position in the midst of them was illusory. The reformed scheme was then by no means perfect. Its simplicity was only comparative; many outstanding anomalies compromised its harmonious working. Moreover, the absence of sensible parallaxes in the stellar heavens seemed inconsistent with its validity; and a mobile earth outraged deep-rooted prepossessions. Under these disadvantageous circumstances, it is scarcely surprising that the heliocentric theory, while admired as a daring speculation, won its way slowly to acceptance as a truth.

The *Tabulae Prutenicae*, calculated on Copernican principles by Erasmus Reinhold (1511–1553), appeared in 1551. Although they represented celestial movements far better than the Alfonsine Tables, large discrepancies were still apparent, and the desirability of testing the novel hypothesis upon which they were based by more refined observations prompted a reform of methods, undertaken almost simultaneously by the landgrave William IV. of Hesse-Cassel (1532–1592), and by Tycho Brahe.

Observatory of Cassel.

The landgrave built at Cassel in 1561 the first observatory with a revolving dome, and worked for some years at a star-catalogue finally left incomplete. Christoph Rothmann and Joost Bürgi (1552–1632) became his assistants in 1577 and 1579 respectively; and through the skill of Bürgi, time-determinations were made available for measuring right ascensions. At Cassel, too, the altitude and azimuth instrument is believed to have made its first appearance in Europe.[2]

Tycho's labours were both more strenuous and more effective. He perfected the art of pre-telescopic observation. His instruments were on a scale and of a type unknown since the days of Nasir ud-din.

Tycho Brahe.

At Augsburg, in 1569, he ordered the construction of a 19-ft. quadrant, and of a celestial globe 5 ft. in diameter; he substituted equatorial for zodiacal armillae, thus definitively establishing the system of measurements in right ascension and declination; and improved the graduation of circular arcs by adopting the method of “transversals.” By these means, employed with consummate skill, he attained an unprecedented degree of accuracy, and as an incidental though valuable result, demonstrated the unreality of the supposed trepidation of the equinoxes.

No more congruous arrangement could have been devised than the inheritance by Johann Kepler of the wealth of materials amassed by Tycho Brahe.

Kepler.

The younger man's genius supplied what was wanting to his predecessor. Tycho's endowments were of the practical order; yet he had never designed his observations to be an end in themselves. He thought of them as means towards the end of ascertaining the true form of the universe. His range of ideas was, however, restricted; and the attempt embodied in his ground-plan of the solar system to revive the ephemeral theory of Heraclides failed to influence the development of thought. Kepler, on the contrary, was endowed with unlimited powers of speculation, but had no mechanical faculty. He found in Tycho's ample legacy of first-class data precisely what enabled him to try, by the touchstone of fact, the successive hypotheses that he imagined; and his untiring patience in comparing and calculating the observations at his disposal was rewarded by a series of unique discoveries. He long adhered to the traditional belief that all celestial revolutions must be performed equably in circles; but a laborious computation of seven recorded oppositions of Mars at last persuaded him that the planet travelled in an ellipse, one focus of which was occupied by the sun. Pursuing the inquiry, he found that its velocity was uniform with respect to no single point within the orbit, but that the areas described, in equal times, by a line drawn from the sun to the planet were strictly equal. These two principles he extended, by direct proof, to the motion of the earth; and, by analogy, to that of the other planets. They were published in 1609 in *De Motibus Stellae Martis*. The announcement of the third of “Kepler's Laws” was made ten years later, in *De Harmonice Mundi*. It states that the squares of the periods of circulation round the sun of the several planets are in the same ratio as the cubes of their mean distances. This numerical proportion, as being a necessary consequence of the law of gravitation, must prevail in every system under its sway. It does in fact prevail among the satellite-families of our acquaintance, and presumably in stellar combinations as well. Kepler's ineradicable belief in the existence of some such congruity was derived from the Pythagorean idea of an underlying harmony in nature; but his arduous efforts for its realization took a devious and fantastic course which seemed to give little promise of their surprising ultimate success. The outcome of his discoveries was, not only to perfect the geometrical plan of the solar system, but to enhance very materially the predicting power of astronomy. The Rudolphine Tables (Ulm, 1627), computed by him from elliptic elements, retained authority for a century, and have in principle never been superseded. He was deterred from research into the orbital relations of comets by his conviction of their perishable nature. He supposed their tails to result from the action of solar rays, which, in traversing their mass, bore off with them some of their subtler particles to form trains directed away from the sun. And through the process of waste thus set on foot, they finally dissolved into the aether, and expired "like spinning insects." (*De Cometis; Opera*, ed. Frisch, t. vii. p. 110.) This remarkable anticipation of the modern theory of light-pressure was suggested to him by his observations of the great comets of 1618.

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[1] F. Baily, *Memoirs Roy. Astr. Society*, vol. xiii. p. 19.

[2] J. L. E. Dreyer, *Life of Tycho Brahe*, p. 321.

The formal astronomy of the ancients left Kepler unsatisfied. He aimed at finding out the cause as well as the mode of the planetary revolutions; and his demonstration that the planes in which they are described all pass through the sun was an important preliminary to a physical explanation of them. But his efforts to supply such an explanation were rendered futile by his imperfect apprehension of what motion is in itself. He had, it is true, a distinct conception of a force analogous to that of gravity, by which cognate bodies tended towards union. Misled, however, into identifying it with magnetism, he imagined circulation in the solar system to be maintained through the material compulsion of fibrous emanations from the sun, carried round by his axial rotation. Ignorance regarding the inertia of matter drove him to this expedient. The persistence of movement seemed to him to imply the persistence of a moving power. He did not recognize that motion and rest are equally natural, in the sense of requiring force for their alteration. Yet his rationale of the tides in *De Motibus Stellae* is not only memorable as an astonishing forecast of the principle of reciprocal attraction in the proportion of mass, but for its bold extension to the earth of the lunar sphere of influence.

Galileo Galilei, Kepler's most eminent contemporary, took a foremost part in dissipating the obscurity that still hung over the very foundations of mechanical science. He had, indeed, precursors and co-operators. Michel Varo of Geneva wrote correctly in 1584 on the composition of forces; Simon Stevin of Bruges (1548–1620) independently demonstrated the principle; and G. B. Benedetti expounded in his *Speculationum Liber* (Turin, 1585) perfectly clear ideas as to the nature of accelerated motion, some years in advance of Galileo's dramatic experiments at Pisa. Yet they were never assimilated by Kepler; while, on the other hand, the laws of planetary circulation he had enounced were strangely ignored by Galileo. The two lines of inquiry remained for some time apart. Had they at once been made to coalesce, the true nature of the force controlling celestial movements should have been quickly recognized. As it was, the importance of Kepler's generalizations was not fully appreciated until Sir Isaac Newton made them the corner-stone of his new cosmic edifice.

Galileo.

Galileo's contributions to astronomy were of a different quality from Kepler's. They were easily intelligible to the general public; in a sense, they were obvious, since they could be verified by every possessor of one of the Dutch perspective-instruments, just then in course of wide and rapid distribution. And similar results to his were in fact independently obtained in various parts of Europe by Christopher Scheiner at Ingolstadt, by Johann Fabricius at Osteel in Friesland, and by Thomas Harriot at Syon House, Isleworth. Galileo was nevertheless by far the ablest and most versatile of these early telescopic observers. His gifts of exposition were on a par with his gifts of discernment. What he saw, he rendered conspicuous to the world. His sagacity was indeed sometimes at fault. He maintained with full conviction to the end of his life a grossly erroneous hypothesis of the tides, early adopted from Andrea Caesalpino; the "triplicate" appearance of Saturn always remained an enigma to him; and in regarding comets as atmospheric emanations he lagged far behind Tycho Brahe. Yet he unquestionably ranks as the true founder of descriptive astronomy; while his splendid presentment of the laws of projectiles in his dialogue of the "New Sciences" (Leiden, 1638) lent potent aid to the solid establishment of celestial mechanics.

Gravitational astronomy.

Bacon.

Descartes.

Newton.

Euler.
Clairault.
D'Alembert.

The accumulation of facts does not in itself constitute science. Empirical knowledge scarcely deserves the name. *Vere scire est per causas scire.* Francis Bacon's prescient dream, however, of a living astronomy by which the physical laws governing terrestrial relations should be extended to the highest heavens, had long to wait for realization. Kepler divined its possibility; but his thoughts, derailed (so to speak) by the false analogy of magnetism, brought him no farther than to the rough draft of the scheme of vortices expounded in detail by René Descartes in his *Principia Philosophiae* (1644). And this was a *cul-de-sac.* The only practicable road struck aside from it. The true foundations of a mechanical theory of the heavens were laid by Kepler's discoveries, and by Galileo's dynamical demonstrations; its construction was facilitated by the development of mathematical methods. The invention of logarithms, the rise of analytical geometry, and the evolution of B. Cavalieri's "indivisibles" into the infinitesimal calculus, all accomplished during the 17th century, immeasurably widened the scope of exact astronomy. Gradually, too, the nature of the problem awaiting solution came to be apprehended. Jeremiah Horrocks had some intuition, previously to 1639, that the motion of the moon was controlled by the earth's gravity, and disturbed by the action of the sun. Ismael Bouillaud (1605–1694) stated in 1645 the fact of planetary circulation under the sway of a sun-force decreasing as the inverse square of the distance; and the inevitableness of this same "duplicate ratio" was separately perceived by Robert Hooke, Edmund Halley and Sir Christopher Wren before Newton's discovery had yet been made public. He was the only man of his generation who both recognized the law, and had power to demonstrate its validity. And this was only a beginning. His complete achievement had a twofold aspect. It consisted, first, in the identification, by strict numerical comparisons, of terrestrial gravity with the mutual attraction of the heavenly bodies; secondly, in the following out of its mechanical consequences throughout the solar system. Gravitation was thus shown to be the sole influence governing the movements of planets and satellites; the figure of the rotating earth was successfully explained by its action on the minuter particles of matter; tides and the precession of the equinoxes proved amenable to reasonings based on the same principle; and it satisfactorily accounted as well for some of the chief lunar and planetary inequalities. Newton's investigations, however, were very far from being exhaustive. Colossal though his powers were, they had limits; and his work could not but remain unterminated, since it was by its nature interminable. Nor was it possible to provide it with what could properly be called a sequel. The synthetic method employed by him was too unwieldy for common use. Yet no other was just then at hand. Mathematical analysis needed half a century of cultivation before it was fully available for the arduous tasks reserved for it. They were accordingly taken up anew by a band of continental inquirers, primarily by three men of untiring energy and vivid genius, Leonhard Euler, Alexis Clairault, and Jean le Rond d'Alembert. The first of the outstanding gravitational problems with which they grappled was the unaccountably rapid advance of the lunar perigee. But the apparent anomaly disappeared under Euler's powerful treatment in 1749, and his result was shortly afterwards still further assured by Clairault. The subject of planetary perturbations was next attacked. Euler devised in 1753 a new method, that of the "variation of parameters," for their investigation, and applied it to unravel some of the earth's irregularities in a memoir crowned by the French Academy in 1756; while in 1757, Clairault estimated the masses of the moon and Venus by their respective disturbing effects upon terrestrial movements. But the most striking incident in the history of the verification of Newton's law was the return of Halley's comet to perihelion, on the 12th of March 1759, in approximate accordance with Clairault's calculation of the delays due to the action of Jupiter and Saturn. Visual proof was thus, it might be said, afforded of the harmonious working of a single principle to the uttermost boundaries of the sun's dominion.

Lagrange.

These successes paved the way for the higher triumphs of Joseph Louis Lagrange and of Pierre Simon Laplace. The subject of the lunar librations was treated by Lagrange with great originality in an essay crowned by the Paris Academy of Sciences in 1764; and he filled up the lacunae in his theory of them in a memoir communicated to the Berlin Academy in 1780. He again won the prize of the Paris Academy in 1766 with an analytical discussion of the movements of Jupiter's satellites (*Miscellanea*, Turin Acad. t. iv.); and in the same year expanded Euler's adumbrated method of the variation of parameters into a highly effective engine of perturbational research. It was especially adapted to the tracing out of "secular inequalities," or those depending upon changes in the orbital elements of the bodies affected by them, and hence progressing indefinitely with time; and by its means, accordingly, the mechanical stability of the solar system was splendidly demonstrated through the successive efforts of Lagrange and Laplace. The proper share of each in bringing about this memorable result is not easy to apportion, since they freely imparted and profited by one another's advances and improvements; it need only be said that the fundamental proposition of the invariability of the planetary major axes laid down with restrictions by Laplace in 1773, was finally established by Lagrange in 1776; while Laplace in 1784 proved the subsistence of such a relation between the eccentricities of the planetary orbits on the one hand, and their inclinations on the other, that an increase of either element could, in any single case, proceed only to a very small extent. The system was thus shown, apart from unknown agencies of subversion, to be constructed for indefinite permanence. The prize of the Berlin Academy was, in 1780, adjudged to Lagrange for a treatise on the perturbations of comets; and he contributed to the Berlin Memoirs, 1781–1784, a set of five elaborate papers, embodying and unifying his perfected methods and their results.

Laplace.

The crowning trophies of gravitational astronomy in the 18th century were Laplace's explanations of the "great inequality" of Jupiter and Saturn in 1784, and of the "secular acceleration" of the moon in 1787. Both irregularities had been noted, a century earlier, by Edmund Halley; both had, since that time, vainly exercised the ingenuity of the ablest mathematicians; both now almost simultaneously yielded their secret to the same fortunate inquirer. Johann Heinrich Lambert pointed out in 1773 that the motion of Saturn, from being retarded, had become accelerated. A periodic character was thus indicated for the disturbance; and Laplace assigned its true cause in the near approach to commensurability in the periods of the two planets, the cycle of disturbance completing itself in about 900 (more accurately $929\frac{1}{2}$) years. The lunar acceleration, too, obtains ultimate compensation, though only after a vastly protracted term of years. The discovery, just one hundred years after the publication of Newton's *Principia*, of its dependence upon the slowly varying eccentricity of the earth's orbit signalized the removal of the last conspicuous obstacle to admitting the unqualified validity of the law of gravitation. Laplace's calculations, it is true, were inexact. An error, corrected by J. C. Adams in 1853, nearly doubled the value of the acceleration deducible from them; and served to conceal a discrepancy with observation which has since given occasion to much profound research (see MOON).

The *Mécanique céleste*, in which Laplace welded into a whole the items of knowledge accumulated by the labours of a century, has been termed the "Almagest of the 18th century" (Fourier). But imposing and complete though the monument appeared, it did not long hold possession of the field. Further developments ensued. The "method of least squares," by which the most probable result can be educed from a body of observational data, was published by Adrien Marie Legendre in 1806, by Carl Friedrich Gauss in his *Theoria Motus* (1809), which described also a mode of calculating the orbit of a planet from three complete observations, afterwards turned to important account for the recapture of Ceres, the first discovered asteroid (see PLANETS, MINOR). Researches into rotational movement were facilitated by S. D. Poisson's application to them in 1809 of Lagrange's theory of the variation of constants; Philippe de Pontécoulant successfully used in 1829, for the prediction of the impending return of Halley's comet, a system of "mechanical quadratures" published by Lagrange in the Berlin Memoirs for 1778; and in his *Théorie analytique du système du monde* (1846) he modified and refined general theories of the lunar and planetary revolutions. P. A. Hansen in 1829 (*Astr. Nach.* Nos. 166-168, 179) left the beaten track by choosing time as the sole variable, the orbital elements remaining constant. A. L. Cauchy published in 1842–1845 a method similarly conceived, though otherwise developed; and the scope of analysis in determining the movements of the heavenly bodies has since been perseveringly widened by the labours of Urbain J. J. Leverrier, J. C. Adams, S. Newcomb, G. W. Hill, E. W. Brown, H. Gyldén, Charles Delaunay, F. Tisserand, H. Poincaré and others too numerous to mention. Nor were these abstract investigations unaccompanied by concrete results. Sir George Airy detected in 1831 an inequality, periodic in 240 years, between Venus and the earth. Leverrier undertook in 1839, and concluded in 1876, the formidable task of revising all the planetary theories and constructing from them improved tables. Not less comprehensive has been the work carried out by Professor Newcomb of raising to a higher grade of perfection, and reducing to a uniform standard, all the theories and constants of the solar system. His inquiries afford the assurance of a nearly exact conformity among its members to strict gravitational law, only the moon and Mercury showing some slight, but so far unexplained, anomalies of movement. The discovery of Neptune in 1846 by Adams and Leverrier marked the first solution of the "inverse problem" of perturbations. That is to say, ascertained or ascertainable effects were made the starting-point instead of the goal of research.

Descriptive and practical astronomy.

Bayer.

Gassendi.

Horrocks.

Huygens.

Gascoigne.

Hevelius.

Observational astronomy, meanwhile, was advancing to some extent independently. The descriptive branch found its principle of development in the growing powers of the telescope, and had little to do with mathematical theory; which, on the contrary, was closely allied, by relations of mutual helpfulness, with practical astronomy, or "astrometry." Meanwhile, the elementary requirement of making visual acquaintance with the stellar heavens was met, as regards the unknown southern skies, when Johann Bayer published at Nuremberg in 1603 a celestial atlas depicting twelve new constellations formed from the rude observations of navigators across the line. In the same work, the current mode of star-nomenclature by the letters of the Greek alphabet made its appearance. On the 7th of November 1631 Pierre Gassendi watched at Paris the passage of Mercury across the sun. This was the first planetary transit observed. The next was that of Venus on the 24th of November (O.S.) 1639, of which Jeremiah Horrocks and William Crabtree were the sole spectators. The improvement of telescopes was prosecuted by Christiaan Huygens from 1655, and promptly led to his discoveries of the sixth Saturnian moon, of the true shape of the Saturnian appendages, and of the multiple character of the "trapezium" of stars in the Orion nebula. William Gascoigne's invention of the filar micrometer and of the adaptation of telescopes to graduated instruments remained submerged for a quarter of a century in consequence of his untimely death at Marston Moor (1644). The latter combination had also been ineffectually proposed in 1634 by Jean Baptiste Morin (1583–1656); and both devices were recontrived at Paris about 1667, the micrometer by Adrien Auzout (d. 1691), telescopic sights (so-called) by Jean Picard (1620–1682), who simultaneously introduced the astronomical use of pendulum-clocks, constructed by Huygens eleven years previously. These improvements were ignored or rejected by Johann Hevelius of Danzig, the author of the last important star-catalogue based solely upon naked-eye determinations.

He, nevertheless, used telescopes to good purpose in his studies of lunar topography, and his designations for the chief mountain-chains and “ seas ” of the moon have never been superseded. He, moreover, threw out the suggestion (in his *Cometographia*, 1668) that comets move round the sun in orbits of a parabolic form.

The Paris observatory.

G. D. Cassini.

Römer.

The establishment, in 1671 and 1676 respectively, of the French and English national observatories at once typified and stimulated progress. The Paris institution, it is true, lacked unity of direction. No authoritative chief was assigned to it until 1771. G. D. Cassini, his son and his grandson were only *primi inter pares*. Claude Perrault's stately edifice was equally accessible to all the more eminent members of the Academy of Sciences; and researches were, more or less independently, carried on there by (among others) Philippe de la Hire (1640–1718), G. F. Maraldi (1665–1729), and his nephew, J. D. Maraldi, Jean Picard, Huygens, Olaus Römer and Nicolas de Lacaille. Some of the best instruments then extant were mounted at the Paris observatory. G. D. Cassini brought from Rome a 17-ft. telescope by G. Campani, with which he discovered in 1671 Iapetus, the ninth in distance of Saturn's family of satellites; Rhea was detected in 1672 with a glass by the same maker of 34-ft. focus; the duplicity of the ring showed in 1675; and, in 1684, two additional satellites were disclosed by a Campani telescope of 100 ft. Cassini, moreover, set up an altazimuth in 1678, and employed from about 1682 a “ parallactic machine,” provided with clockwork to enable it to follow the diurnal motion. Both inventions have been ascribed to Olaus Römer, who used but did not claim them, and must have become familiar with their principles during the nine years (1672–1681) spent by him at the Paris observatory. Römer, on the other hand, deserves full credit for originating the transit-circle and the prime vertical instrument; and he earned undying fame by his discovery of the finite velocity of light, made at Paris in 1675 by comparing his observations of the eclipses of Jupiter's satellites at the conjunctions and oppositions of the planet.

Flamsteed.

The organization of the Greenwich observatory differed widely from that adopted at Paris. There a fundamental scheme of practical amelioration was initiated by John Flamsteed, the first astronomer royal, and has never since been lost sight of. Its purpose is the attainment of so complete a power of prediction that the places of the sun, moon and planets may be assigned without noticeable error for an indefinite future time. Sidereal inquiries, as such, made no part of the original programme in which the stars figured merely as points of reference. But these points are not stationary. They have an apparent precessional movement, the exact amount of which can be arrived at only by prolonged and toilsome enquiries. They have besides “ proper motions,” detected in 1718 by E. Halley in a few cases, and since found to prevail universally. Further, James Bradley discovered in 1728 the annual shifting of the stars due to the aberration of light (see Aberration), and in 1748, the complicating effects upon precession of the “ nutation ” of the earth's axis. Hence, the preparation of a catalogue recording the “ mean ” positions of a number of stars for a given epoch involves considerable preliminary labour; nor do those positions long continue to satisfy observation. They need, after a time, to be corrected, not only systematically for precession, but also empirically for proper motion. Before the stars can safely be employed as route-marks in the sky, their movements must accordingly be tabulated, and research into the method of such movements inevitably follows. We perceive then that the fundamental problems of sidereal science are closely linked up with the elementary and indispensable procedures of celestial measurement.

The history of the Greenwich observatory is one of strenuous efforts for refinement, stimulated by the growing stringency of theoretical necessities. Improved practice, again, reacted upon theory by bringing to notice residual errors, demanding the correction of formulae, or intimating neglected disturbances. Each increase of mechanical skill claims a corresponding gain in the subtlety of analysis; and vice versa. And this kind of interaction has gone on ever since Flamsteed reluctantly furnished the “places of the moon,” which enabled Newton to lay the foundations of lunar theory.

Halley.

Bradley.

Bliss.

Maskelyne.

Pond.

Airy.

Edmund Halley, the second astronomer royal, devoted most of his official attention to the moon. But his plan of attack was not happily chosen; he carried it out with deficient instrumental means; and his administration (1720–1742) remained comparatively barren. That of his successor, though shorter, was vastly more productive. James Bradley chose the most appropriate tasks, and executed them supremely well, with the indispensable aid of John Bird (1709–1776), who constructed for him an 8-ft. quadrant of unsurpassed quality. Bradley's store of observations has accordingly proved invaluable. Those of 3222 stars, reduced by F. W. Bessel in 1818, and again with masterly insight by Dr A. Auwers in 1882, form the true basis of exact astronomy, and of our knowledge of proper motions. Those relating to the moon and planets, corrected by Sir George Airy, 1840–1846, form part of the standard materials for discussing theories of movement in the solar system. The fourth astronomer royal, Nathaniel Bliss, provided in two years a sequel of some value to Bradley's performance. Nevil Maskelyne, who succeeded him in 1764, set on foot, in 1767, the publication of the *Nautical Almanac*, and about the same time had an achromatic telescope fitted to the Greenwich mural quadrant. The invention, perfected by John Dollond in 1757, was long debarred from becoming effective by difficulties in the manufacture of glass, aggravated in England by a heavy excise duty levied until 1845. More immediately efficacious was the innovation made by John Pond (astronomer royal, 1811–1836) of substituting entire circles for quadrants. He further introduced, in 1821, the method of duplicate observations by direct vision and by reflection, and by these means obtained results of very high precision. During Sir George Airy's long term of office (1836–1881) exact astronomy and the traditional purposes of the royal observatory were promoted with increased vigour, while the scope of research was at the same time memorably widened. Magnetic, meteorological, and spectroscopic departments were added to the establishment; electricity was employed, through the medium of the chronograph, for the registration of transits; and photography was resorted to for the daily automatic record of the sun's condition.

Wargentin.

Lacaille.

Tobias Mayer.

Meanwhile, advances were being made in various parts of the continent of Europe. Peter Wargentin (1717–1783), secretary to the Swedish Academy of Sciences, made a special study of the Jovian system. James Bradley had described to the Royal Society on the 2nd of July 1719 the curious cyclical relations of the three inner satellites; and their period of 437 days was independently discovered by Wargentin, who based upon it in 1746 a set of tables, superseded only by those of J. B. J. Delambre in 1792. Among the fruits of the strenuous career of Nicolas Louis de Lacaille were tables of the sun, in which terms depending upon planetary perturbations were, for the first time, introduced (1758); an extended acquaintance with the southern heavens; and a determination of the moon's parallax from observations made at opposite extremities of an arc of the meridian 85° in length. Tobias Mayer of Göttingen (1723–1762) originated the mode of adjusting transit-instruments still in vogue; drew up a catalogue of nearly a thousand zodiacal stars (published posthumously in 1775); and deduced the proper motions of eighty stars from a comparison of their places as given by Olaus Römer in 1706 with those obtained by himself in 1756. He executed besides a chart and forty drawings of the moon (published at Göttingen in 1881), and calculated lunar tables from a skilful development of Euler's theory, for which a reward of £3000 was in 1765 paid to his widow by the British government. They were published by the Board of Longitude, together with his solar tables, in 1770. The material interests of navigation were in these works primarily regarded;

Lalande.

but the imaginative side of knowledge had also potent representatives during the latter half of the 18th century. In France, especially, the versatile activity of J. J. Lalande popularized the acquisitions of astronomy, and enforced its demands; and he had a German counterpart in J. E. Bode.

Distance of the sun.

Between the time of Aristarchus and the opposition of Mars in 1672, no serious attempt was made to solve the problem of the sun's distance. In that year, however, Jean Richer at Cayenne and G. D. Cassini at Paris made combined observations of the planet, which yielded a parallax for the sun of 9·5″, corresponding to a mean radius for the terrestrial orbit of 87,000,000 m. This result, though widely inaccurate, came much nearer to the truth than any previously obtained; and it instructively illustrated the feasibility of concerted astronomical operations at distant parts of the earth. The way was thus prepared for availing to the full of the opportunities for a celestial survey offered by the transits of Venus in 1761 and 1769. They had been signalized by E. Halley in 1716; they were later insisted upon by Lalande; an enthusiasm for co-operation was evoked, and the globe, from Siberia to Otaheite, was studded with observing parties. The outcome, nevertheless, disappointed expectation. The instants of contact between the limbs of the sun and planet defied precise determination. Optical complications fatally impeded sharpness of vision, and the phenomena took place in a debateable borderland of uncertainty. J. F. Encke, it is true, derived from them in 1822–1824 what seemed an authentic parallax of 8·57″, implying a distance of 95,370,000 m.; but the confidence it inspired was finally overthrown in 1854 by P. A. Hansen's announcement of its incompatibility with lunar theory. An appeal then lay to the 19th century pair of transits in 1874 and 1882; but no peremptory decision ensued; observations were marred by the same optical evils as before. Their upshot, however, had lost its essential importance; for a fresh series of investigations based on a variety of principles had already been started. Leverrier, in 1858, calculated a value of 8·95″ for the solar parallax (equivalent to a distance of 91,000,000 m.) from the "parallactic inequality" of the moon; Professor Newcomb, using other forms of the gravitational method, derived in 1895 a parallax of 8·76″. Again, since the constant of aberration defines the ratio between the velocity of light and the earth's orbital speed, the span of the terrestrial circuit, in other words, the distance of the sun, is immediately deducible from known values of the first two quantities. The rate of light-transmission was accordingly made the subject of an elaborate set of experiments by Professor Newcomb in 1880–1882; and the result, taken in connexion with the aberration-constant as determined at Pulkowa, yielded a solar parallax of 8·79″, or a distance (in round numbers) of 93,000,000 m. But the direct or geometrical mode of attack has still the preference over any of the indirect plans. Sir David Gill derived a highly satisfactory value of 8·78″ for the long-sought constant from the opposition of Mars in 1877, and from combined heliometer observations at five observatories in 1888–1889 of the minor planets Iris, Victoria and Sappho, the apparently definitive value of 8·80″ (equivalent distance, 92,874,000 m.). But an unlooked-for fresh opportunity was afforded by the discovery in 1898 of the singularly circumstanced minor planet Eros, which occasionally approaches the earth more nearly than any other heavenly body except the moon. The opposition of November 1900, though only moderately favourable, could not be neglected; an international photographic campaign was organized at Paris with the aid of 58 observatories; and the voluminous collected data imply, so far as they have been discussed, a parallax for the sun a little greater than 8·8″. (See also PARALLAX.)

Reflecting telescopes.

William Herschel.

Sir John Herschel.

Lord Rosse.

The first specimen of a reflecting telescope was constructed by Isaac Newton in 1668. It was of what is still called "Newtonian" design, and had a speculum 2 in. in diameter. Through the skill of John Hadley (1682–1743) and James Short of Edinburgh (1710–1768) the instrument unfolded, in the ensuing century, some of its capabilities, which the labours of William Herschel enormously enhanced. Between 1774 and 1789 he built scores of specula of continually augmented size, up to a diameter of 4 ft., the optical excellence of which approved itself by a crowd of discoveries. Uranus (*q.v.*) was recognized by its disk on the 13th of March 1781; two of its satellites, Oberon and Titania, disclosed themselves on the 11th of January 1787; while with the giant 48-in. mirror, used on the "front-view" plan, Mimas and Enceladus, the innermost Saturnian moons, were brought to view on the 28th of August and the 17th of September 1789. These were incidental trophies; Herschel's main object was the exploration of the sidereal heavens. The task, though novel and formidable, was executed with almost incredible success. Charles Messier (1730–1817) had catalogued in 1781 103 nebulae; Herschel discovered 2500, laid down the lines of their classification, divined the laws of their distribution, and assigned their place in a scheme of development. The proof supplied by him in 1802 that coupled stars mutually circulate threw open a boundless field of research; and he originated experimental inquiries into the construction of the heavens by systematically collecting and sifting stellar statistics. He, moreover, definitively established, in 1783, the fact and general direction of the sun's movement in space, and thus introduced an element of order into the maze of stellar proper motions. Sir John Herschel continued in the northern, and extended to the southern hemisphere, his father's work. The third earl of Rosse mounted, at Parsonstown in 1845, a speculum 6 ft. in diameter, which afforded the first indications of the spiral structure shown in recent photographs to be the most prevalent characteristic of nebulae. Down to near the close of the 19th century, both the use and the improvement of reflectors were left mainly in British hands; but the gift of the "Crossley" instrument in 1895, to the Lick observatory, and its splendid subsequent performances in nebular photography, brought similar tools of research into extensive use among American astronomers; and they are now, for many of the various purposes of astrophysics, strongly preferred to refractors.

Giuseppe Piazzi.

Max Wolf.

Acquaintance with the asteroidal family began as the 19th century opened. On the 1st of January 1801 Giuseppe Piazzi (1746–1826) discovered Ceres, at Palermo, while engaged in collecting materials for his star-catalogues. A prolonged succession of similar events followed. But in the mode of detecting these swarming bodies, a typical change was made on the 22nd of December 1891, when Dr Max Wolf of Heidelberg photographically captured No. 323. Repetitions of the feat are now counted by the score.

Lassell.

Bond.

Hall.

Barnard.

Perrine.

Practical astronomy was only secondarily concerned with the addition of Neptune, on the 23rd of September 1846, to the company of known planets; but William Lassell's discovery of its satellite, on the 10th of October following, was a consequence of the perfect figure and high polish of his 2-ft. speculum. With the same instrument, he further detected, on the 19th of September 1848, Hyperion, the seventh of Saturn's attendants, and, on the 24th of October 1851, Ariel and Umbriel, the interior moons of Uranus. Simultaneously with Lassell, on the opposite shore of the Atlantic, W. C. Bond identified Hyperion; and he perceived, on the 15th of November 1850, Saturn's dusky ring, independently observed, a fortnight later, by W. R. Dawes, at Wateringbury in Kent. With the Washington 26-in. refractor, on the 11th of August 1877, Professor Asaph Hall descried the moons of Mars, Deimos and Phobos; and a minute light-speck, noticed by Professor E. E. Barnard in the close neighbourhood of Jupiter on the 9th of September 1892, proved representative of a small inner satellite, invisible with less perfect and powerful instruments than the Lick 36-in. achromatic. The Jovian system has been reinforced by three remote and extremely faint members, two photographed by Professor C. D. Perrine with the Crossley reflector in 1904–1905, and the third at Greenwich in

W. H. Pickering.

1908; and a pair of Saturnian moons, designated Phoebe and Themis, were tracked out by Professor W. H. Pickering, in 1898 and 1905 respectively, amid the thicket of stars imprinted on negatives taken at Arequipa with the Bruce 24-in. doublet lens. This raises to 26 the number of discovered satellites in the solar system.

Comets.

Meteors.

Cometary science has ramified in unexpected ways during the last hundred years. The establishment of a class of "short-period" comets by the computations of J. F. Encke in 1819, and of Wilhelm von Biela in 1826, led to the theory of their "capture" by the great planets, for which a solid mathematical basis was provided by H. Newton, F. Tisserand and O. Callandreau. An argument for the aboriginal connexion of comets with the solar system, founded by R. C. Carrington in 1860 upon their participation in its translatory movement, was more fully developed by L. Fabry in 1893; and the close orbital relationships of cometary groups, accentuated by the pursuit of each other along nearly the same track by the comets of 1843, 1880 and 1882, singularly illustrated the probable vicissitudes of their careers. The most remarkable event, however, in the recent history of cometary astronomy was its assimilation to that of meteors, which took unquestionable cosmical rank as a consequence of the Leonid tempest of November 1833. The affinity of the two classes of objects became known in 1866 through G. V. Schiaparelli's announcement that the orbit of the bright comet of 1862 agreed strictly with the elliptic ring formed by the circulating Perseid meteors; and three other cases of close coincidence were soon afterwards brought to light. Tebbutt's comet in 1881 was the first to be satisfactorily photographed. The study of such objects is now carried on mainly through the agency of the sensitive plate. The photographic registration of meteor-trails, too, has been lately attempted with partial success. The full realization of the method will doubtless provide adequate data for the detailed investigation of meteoric paths.

Sidereal astronomy.

Star catalogues.

The progress of science during the 19th century had no more distinctive feature than the rapid growth of sidereal astronomy (see STAR). Its scope, wide as the universe, can be compassed no otherwise than by statistical means, and the collection of materials for this purpose involves most arduous preliminary labour. The multitudinous enrolment of stars was the first requisite. Only one "catalogue of precision"—Nevil Maskelyne's of 36 fundamental stars—was available in 1800. J. J. Lalande, however, published in 1801, in his *Histoire céleste*, the approximate places of 47,390 from a reobservation of which the great Paris catalogue (1887–1892) has been compiled. A valuable catalogue of about 7600 stars was issued by Giuseppe Piazzi in 1814; Stephen Groombridge determined 4239 at Blackheath in 1806–1816; while through the joint and successive work of F. W. Bessel and W. A. Argelander, exact acquaintance was made with 90,000, a more general acquaintance with the 324,000 stars recorded in the *Bonn Durchmusterung* (1859–1862). The southern hemisphere was subsequently reviewed on a similar duplicate plan by E. Schönfeld (1828–1891) at Bonn, by B. A. Gould and J. M. Thome at Córdoba. Moreover, the imposing catalogue set on foot in 1865 at thirteen observatories by the German astronomical society has recently been completed; and adjuncts to it have, from time to time, been provided in the publications of the royal observatories at Greenwich and the Cape of Good Hope, and of national, imperial and private establishments in the United States and on the continent of Europe. But in the execution of these protracted undertakings, the human eye has been, to a large and increasing extent, superseded by the camera. Photographic star-charting was begun by Sir David Gill in 1885, and the third and concluding volume of the *Cape Photographic Durchmusterung* appeared in 1900. It gives the co-ordinates of above 450,000 stars, measured by Professor J. C. Kapteyn at Groningen on plates taken by C. Ray Woods at the Cape observatory. And this comprehensive work was merely preparatory to the International Catalogue and Chart, the production of which was initiated by the resolutions of the Paris Photographic Congress of 1887. Eighteen observatories scattered north and south of the equator divided the sky among them; and the outcome of their combined operations aimed at the production of a catalogue of at least 2,000,000 strictly determined stars, together with a colossal map in 22,000 sheets, showing stars to the fourteenth magnitude, in numbers difficult to estimate. (See PHOTOGRAPHY, CELESTIAL.)

Photometric catalogues.

The arrangement of the stars in space can be usefully discussed only in connexion with their apparent light-power, or "magnitude." Photometric catalogues, accordingly, form an indispensable part of stellar statistics; and their construction has been zealously prosecuted. The *Harvard Photometry* of 4260 lucid stars was issued by Professor E. C. Pickering in 1884, the *Uranometria Nova Oxoniensis*, giving the relative lustre of 2784 stars, by C. Pritchard in 1885. The instrument used at Harvard was a "meridian photometer," constructed on the principle of polarization; while the "method of extinctions," by means of a wedge of neutral-tinted glass, served for the Oxford determinations. At Potsdam, some 17,000 stars have been measured by C. H. G. Müller and P. F. F. Kempf with a polarizing photometer; but by far the most comprehensive work of the kind is the Harvard *Photometric Durchmusterung* (1901–1903), embracing all stars to 7·5 magnitude, and extended to the southern pole by measurements executed at Arequipa. The embarrassing subject of photographic photometry has also been attacked by Professor Pickering. The need is urgent of fixing a scale, and defining standards of actinic brightness; but it has not yet been successfully met.

Double stars.

The investigation of double stars was carried on from 1819 to 1850 with singular persistence and ability at Dorpat and Pulkowa by F. G. W. Struve, and by his son and successor, O. W. Struve. The high excellence of the data collected by them was a combined result of their skill, and of the vast improvement in refracting telescopes due to the genius of Joseph Fraunhofer (1787–1826). Among the inheritors of his renown were Alvan Clark and Alvan G. Clark of Cambridgeport, Massachusetts; and the superb definition of their great achromatics rendered practicable the division of what might have been deemed impossibly close star-pairs. These facilities were remarkably illustrated by Professor S. W. Burnham's record of discovery, which roused fresh enthusiasm for this line of inquiry by compelling recognition of the extraordinary profusion throughout the heavens of compound objects. Discoveries with the spectroscope have ratified and extended this conclusion.

Stellar parallax.

Only spurious star-parallaxes had claimed the attention of astronomers until F. W. Bessel announced, in December 1838, the perspective yearly shifting of 61 Cygni in an ellipse with a mean radius of about one-third of a second. Thomas Henderson (1798–1844) had indeed measured the larger displacements of α Centauri at the Cape in 1832–1833, but delayed until 1839 to publish his result. Out of several hundred stars since then examined, seventy or eighty have yielded fairly accurate, though very small parallaxes. But this amount of knowledge, however valuable in itself, is utterly inadequate to the needs of sidereal research; and various attempts have accordingly been made, chiefly by Professors J. C. Kapteyn and Simon Newcomb, to estimate, through the analysis of their proper motions, the "mean parallax" of stars assorted by magnitude. And the data thus arrived at are reassuringly self-consistent. A wide photographic survey, by which parallaxes might be secured wholesale, has further been recommended by Kapteyn; but is unlikely to be undertaken in the immediate future.

Proper motions.

The exhaustive ascertainment of stellar parallaxes, combined with the visible facts of stellar distribution, would enable us to build a perfect plan of the universe in three dimensions. Its perfection would, nevertheless, be undermined by the mobility of all its constituent parts. Their configuration at a given instant supplies no information as to their configuration hereafter unless the mode and laws of their movements have been determined. Hence, one of the leading inducements to the construction of exact and comprehensive catalogues has been to elicit, by comparisons of those for widely separated epochs, the proper motions of the stars enumerated in them. Little was known on the subject at the beginning of the 19th century. William Herschel founded his determination in 1783 of the sun's route in space upon the movements of thirteen stars; and he took into account those of only six in his second solution of the problem in 1805. But in 1837 Argelander employed 390 proper motions as materials for the treatment of the same subject; and L. Struve had at his disposal, in 1887, no less than 2800. From the re-observation of Lalande's stars, after the lapse of not far from a century, J. Bossert was enabled to deduce 2675 proper motions, published at Paris in four successive memoirs, 1887–1902; and the sum-total of those ascertained probably now exceeds 6000. Yet this number, although it represents a portentous expenditure of labour, is insignificant compared with the multitude of the stellar throng; nor had any general tendency been discerned to regulate what seemed casual flittings until Professor Kapteyn, in 1904, adverted to the prevalence among all the brighter stars of opposite stream-flows towards two "vertices" situated in the Milky Way (see STAR). The assured general fact as regards the direction of stellar movements was that they included a common parallactic element due to the sun's translation. And it is by the consideration of this partial accordance in motion that the advance through space of the solar system has been ascertained.

Astro-physics.

Spectrum analysis.

The apex of the sun's way was fixed by Professor Newcomb in 1898 at a point about 4° S. of the brilliant star Vega; but was shifted nearly 7° to the S.W. by J. C. Kapteyn's inquiry in 1901; so that the range of uncertainty as to its position continues unsatisfactorily wide. The speed with which our system progresses is, on the other hand, fairly well known. It cannot differ much from $12\frac{1}{2}$ m. a second, the rate assigned to it by Professor W. W. Campbell in 1902. He employed in his discussion the radial velocities of 280 stars, spectroscopically determined; and the upshot signally exemplified the community of interests between the rising science of astrophysics and the ancient science of astrometry. Their characteristic purposes are, nevertheless, entirely different. The positions of the heavenly bodies in space, and the changes of those positions with time, constitute the primary subject of investigation by the elder school; while the new astronomy concerns itself chiefly with the individual peculiarities of suns and planets, with their chemistry, physical habitudes and modes of luminosity. Its distinctive method is spectrum analysis, the invention and development of which in the 19th century have fundamentally altered the purpose and prospects of celestial inquiries.

Wollaston.

Fraunhofer.

Kirchhoff.

Chemistry of the sun.

A beam of sunlight admitted into a darkened room through a narrow aperture, and there dispersed into a vario-tinted band by the interposition of a prism, is not absolutely continuous. Dr W. H. Wollaston made the experiment in 1802, and perceived the spaces of colour to be interrupted by seven obscure gaps, which took the shape of lines owing to his use of rectangular slit. He thus caught a preliminary glimpse of the "Fraunhofer lines," so called because Joseph Fraunhofer brought them into prominent notice by the diligence and insight of his labours upon them in 1814–1815. He mapped 324, chose out nine, which he designated by the letters of the alphabet, to be standards of measurement for the rest, and ascertained the coincidence in position between the double yellow ray derived from the flame of burning sodium and the pair of dark lines named by him "D" in the solar spectrum. There ensued forty-five years of groping for a law which should clear up the enigma of the solar reversals. Partial anticipations abounded. The vital heart of the matter was barely missed by W. A. Miller in 1845, by L. Foucault in 1849, by A. J. Ångström in 1853, by Balfour Stewart in 1858; while Sir George Stokes held the solution of the problem in the hollow of his hand from 1852 onward. But it was the synthetic genius of Gustav Kirchhoff which first gave unity to the scattered phenomena, and finally reconciled what was elicited in the laboratory with what was observed in the sun. On the 15th of December 1859 he communicated to the Berlin Academy of Sciences the principle which bears his name. Its purport is that glowing vapours similarly circumstanced absorb the identical radiations which they emit. That is to say, they stop out just those sections of white light transmitted through them which form their own special luminous badges. Moreover, if the white light come from a source at a higher temperature than theirs, the sections, or lines, absorbed by them show dark against a continuous background. And this is precisely the case with the sun. Kirchhoff's principle, accordingly, not only afforded a simple explanation of the Fraunhofer lines, but availed to found a far-reaching science of celestial chemistry. Thousands of the dark lines in the solar spectrum agree absolutely in wave-length with the bright rays artificially obtained from known substances, and appertaining to them individually. These substances must then exist near the sun. They are in fact suspended in a state of vapour between our eyes and the photosphere, the dazzling prismatic radiance of which they, to a minute extent, intercept, thus writing their signatures on the coloured scroll of dispersed sunshine. By persistent research, powerfully aided by the photographic camera and by the concave gratings invented by H. A. Rowland (1848–1901) in 1882, about forty terrestrial elements have been identified in the sun. Among them, iron, sodium, magnesium, calcium and hydrogen are conspicuous; but it would be rash to assert that any of the seventy forms of matter provisionally enumerated in text-books are wholly absent from his composition.

Solar eclipses.

Solar physics has profited enormously by the abolition of glare during total eclipses. That of the 8th of July 1842 was the first to be efficiently observed; and the luminous appendages to the sun disclosed by it were such as to excite startled attention. Their investigation has since been diligently prosecuted. The corona was photographed at Königsberg during the totality of the 28th of July 1851; similar records of the red prominences, successively obtained by Father Angelo Secchi and Warren de la Rue, as the shadow-track crossed Spain on the 18th of July 1860, finally demonstrated their solar status. The Indian eclipse of the 18th of August 1868 supplied knowledge of their spectrum, found to include the yellow ray of an exotic gas named by Sir Norman Lockyer "helium." It further suggested, to Lockyer and P. Janssen separately, the spectroscopic method of observing these objects in daylight. Under cover of an eclipse visible in North America on the 7th of August 1869, the bright green line of the corona was discerned; and Professor C. A. Young caught the "flash spectrum" of the reversing layer, at the moment of second contact, at Xerez de la Frontera in Spain, on the 22nd of December 1870. This significant but evanescent phenomenon, which represents the direct emissions of a low-lying solar envelope, was photographed by William Shackleton on the occasion of an eclipse in Novaya Zemlya on the 9th of August 1896; and it has since been abundantly registered by exposures made during the obscurations of 1898, 1900, 1901 and 1905. A singular and unlooked-for result of eclipse-work has been to include the corona within the scope of solar periodicity. Heinrich Schwabe established, in 1851, the cyclical variation, in eleven years, of spot-frequency; terrestrial magnetic disturbances manifestly obeyed the same law; and the peculiar winged aspect of the corona disclosed by the eclipse of the 29th of July 1878, at an epoch of minimum sun-spots, intimated to A. C. Ranyard a theory of coronal types, changing concurrently with the fluctuations of spot-activity. This was amply verified at subsequent eclipses.

Prominence photography.

The photography of prominences was, after some preliminary trials by C. A. Young and others, fully realized in 1801 by Professor George E. Hale at Chicago, and independently by Henri Deslandres at Paris. The pictures were taken, in both cases, with only one quality of light, the violet ray of calcium, the remaining superfluous beams being eliminated by the agency of a double slit. The last-named expedient had been described by Janssen in 1867. Hale devised on the same principle the "spectroheliograph," an instrument by which the sun's disk can be photographed in calcium-light by imparting a rapid movement to its image relatively to the sensitive plate; and the method has proved in many ways fruitful.

Stellar spectroscopy.

The likeness of the sun to the stars has been shown by the spectroscope to be profound and inherent. Yet the general agreement of solar and stellar chemistry does not exclude important diversities of detail. Fraunhofer was the pioneer in this branch. He observed, in 1823, dark lines in stellar spectra which Kirchhoff's discovery supplied the means of interpreting. The task, attempted by G. B. Donati in 1860, was effectively taken in hand, two years later, by Angelo Secchi, William Huggins and Lewis M. Rutherfurd. There ensued a general classification of the stars by Secchi into four leading types, distinguished by diversities of spectral pattern; and the recognition by Huggins of a considerable number of terrestrial elements as present in stellar atmospheres. Nebular chemistry was initiated by the same investigator when, on the 29th of August 1864, he observed the bright-line spectrum of a planetary nebula in Draco. About seventy analogous objects, including that in the Sword of Orion, were found by him to give light of the same quality; and thus after seventy-three years, verification was brought to William Herschel's hypothesis of a "shining fluid" diffused through space, the possible raw material of stars. In 1874, Dr H. C. Vogel published a modification of Secchi's scheme of stellar diversities, and gave it organic meaning by connecting spectral differences with advance in "age." And in 1895, he set apart, as in the earliest stage of growth, a new class of "helium stars," supposed to develop successively into Sirian, solar, Antarian, or alternatively into carbon stars.

Spectra of comets.

On the 5th of August 1864, G. B. Donati analysed the light of a small comet into three bright bands. Sir William Huggins repeated the experiment on Winnecke's comet in 1868, obtained the same bands, and traced them to their origin from glowing carbon-vapour. A photograph of the spectrum of Tebbutt's comet, taken by him on the 24th of June 1881, showed radiations of shorter wave-lengths but identical source, and in addition, a percentage of reflected solar light marked as such by the presence of some well-known Fraunhofer lines. Further experience has generalized these earlier results. The rule that comets yield carbon-spectra has scarcely any exceptions. The usual bands were, however, temporarily effaced in the two brilliant apparitions of 1882 by vivid rays of sodium and iron, emitted during the excitement of perihelion-passage.

Progress in spectrography.

The adoption, by Sir William Huggins in 1876, of gelatine or dry plates in celestial photography was a change of decisive import. For it made long exposures possible; and only with long exposures could autographic impressions be secured of such faint objects as nebulae, telescopic comets, and the immense majority of stars, or of the dim ranges of stellar and nebular spectra. The first conspicuous triumph of the new "spectrographic" art thus established was the record by Huggins in 1879 of the dispersed light of several "white" or Sirian stars, in which the chief traits of absorption were the rhythmical series of hydrogen-lines, then memorably discovered. Again by Sir William Huggins, the spectrum of the Orion nebula was photographed on the 7th of March 1882; and the method has gradually become nearly exclusive in the study of nebular emanations. The "Draper Catalogue" of 10,351 stellar spectra was published by Professor E. C. Pickering in 1890. The materials for it were rapidly accumulated by the use of an objective prism, that is, of a prism placed in front of, instead of behind the object-lens, by which means the spectra of all the stars in the field, to the number often of many score, imprinted themselves simultaneously on the sensitive plate. The progress of this survey was marked by a number of important discoveries of "new" and variable stars and of spectroscopic binaries, mainly through the acumen of Mrs Williamina Paton Fleming of Harvard College in scrutinizing the negatives forming the data for the great catalogue.

Doppler's principle.

The principle that the refrangibility of light is altered by end-on motion was enunciated by Christian Doppler of Prague in 1842. The pitch of a steam-whistle quite obviously rises and falls as the engine to which it is attached approaches and recedes from a stationary auditor; and light-pulses are modified like sound-waves by velocity in the line of sight. They are crowded together and therefore rendered shorter and more frequent by the advance of their source, but drawn apart and lengthened by its recession. These effects vary with the rate of motion, which they consequently serve to measure; and they are produced indifferently by movements of the spectator or of the light-source. But Doppler's idea that they might be detected by colour-change was entirely illusory. It would apply only if the spectrum had no infra-red and ultra-violet extensions. These, however, since they share the general lengthening or shortening of wave-length through motion, are thereby shifted, to a certain definite extent, into visibility, and so produce accurate chromatic compensation. Integrated light, accordingly, tells nothing about velocity; but analysed light does, when it includes bright or dark rays the normal positions of which are known. The distinction was pointed out by Hippolyte Fizeau in 1848. By comparison with their analogues in the laboratory it can be determined whether, in which direction, and how much, lines of recognized origin are displaced in the spectra of the heavenly bodies. This subtle mode of research was made available by Sir William Huggins in 1868. He employed it, with an outcome of striking promise, to measure the radial speed of some of the brighter stars. In the following year, Sir Norman Lockyer was enabled to prove, by its means, the extraordinary vehemence of chromospheric disturbances, the bright prominence-rays in his spectroscope betraying, through their opposite shiftings, movements and counter-movements up to 120 m. a second; while its validity and refinement were, in 1871, vouched for by H. C. Vogel's observations on the 9th of June 1871, of differences due to the sun's rotation in the refrangibility of Fraunhofer lines derived respectively from the east and west limbs. Stellar line-of-sight work, however, made no satisfactory progress until, in 1888, Vogel changed the *venue* from the eye to the camera. A high degree of precision in measurement thus became attainable, and has since been fully attained. Not only the grosser facts concerning radial velocity, but variations in it so small as a mile, or less, per second, have been recorded and interpreted in terms of deep meaning. For the investigation of the general scheme of sidereal structure, the multiplication of results of the kind is indispensable. But as yet, the recessional or approaching movements of only a few hundred stars have been registered; and this store of information is scanty indeed compared with the needs of research. How the stars really move in space, and how the sun travels among them, can be ascertained only with the aid of materials collected by the spectrograph, which has now fortunately been brought to comply with the arduous conditions of exactitude requisite for collaboration with the transit instrument and its allies, the clock and chronograph. And here, to their great mutual advantage, the old and the new astronomies meet and join forces.

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ASTROPALIA (classical *Astypalaea*), an island, with good harbours, in the south part of the Aegean, situated in 36·5° N. and immediately west of 26·5° E. It was colonized by Megara, and its constitution and buildings are known from numerous inscriptions. The Roman emperors recognized it as a free state, and in the middle ages it was called *Stampalia*, and belonged to the noble Venetian family of Quirini. It was taken by the Turks in the 16th century, and is now noted for its sponges. The customs and dress of the people, who speak a patois of romaic origin, are interesting.

ASTROPHYSICS, the branch of astronomical science which treats of the physical constitution of the heavenly bodies. So long as these bodies could be known to men only as points or disks of light in the sky, no such science was possible. Even later, when the telescope was the only instrument of research, knowledge on this subject was confined to the appearances presented by the planets, supplemented by more or less probable inferences as to the nature of their surfaces. When, in the third quarter of the 19th century, spectrum analysis was applied to the light coming to us from the heavenly bodies, a new era in astronomical science was opened up of such importance that the body of knowledge revealed by this method has sometimes been termed the "new astronomy." The development of the method has been greatly assisted by photography, while the application of photometric measurements has been a powerful auxiliary in the work. It has thus come about that astrophysics owes its recent development, and its recognition as a distinct branch of astronomical science, to the combination of the processes involved in the three arts of spectroscopy, photography and photometry. The most general conclusions reached by this combination may be summed up as follows:—

1. The heavenly bodies are composed of like matter with that which we find to make up our globe. The sun and stars are found to contain the more important elements with which chemistry has made us acquainted. Iron, calcium and hydrogen may be especially mentioned as three familiar chemical elements which enter largely into the constitution of all the matter of the heavens. It would be going too far to say that all the elements known to us exist in the sun or the stars; nor is the question whether the rarer ones can or cannot be found there of prime importance. The general fact of identity in the main constituents is the one of most fundamental importance. It would be going too far in the other direction to claim that all the elements which compose the heavenly bodies are found on the earth. There are many lines in the spectra of the stars, as well as of the nebulae, which are not certainly identified with those belonging to any elements known to our chemistry. The recent discoveries growing out of the investigation of newly discovered forms of radiation lead to the conclusion that the question of he forms of matter in the stars has far wider range than the simple question whether any given element is or is not found outside our earth. The question is rather that of the infinity of forms that matter may assume, including that most attenuated form found in the nebulae, which seem to be composed of matter more refined than even the atoms supposed to make up the matter around us.

2. The second conclusion is that, as a general rule, the incandescent heavenly bodies are not masses of solid or liquid matter as formerly assumed, but mainly masses either of gas, or of substances gaseous in their nature, so compressed by the gravitation of their superincumbent parts toward a common centre that their properties combine those of the three forms of matter known to us. We have strong reason to believe that even the sun, though much denser than the general average of the stars, may possibly be characterized as gaseous rather than solid. Probabilities also seem to favour the view that this may, to a certain extent, be true of the four great planets of our system. The case of bodies like our earth and Mars, which are solid either superficially or throughout, is probably confined to the smaller bodies of the universe.

3. A third characteristic which seems to belong to the great bodies of the universe is the very high temperature of their interior. With a modification to be mentioned presently, we may regard them as intensely hot bodies, probably at a temperature higher than any we can produce by artificial means, of which the superficial portions have cooled off by radiation into space. A modification in this proposition which may hereafter be accepted involves an extension of our ideas of temperature, and leads us to regard the interior heat of the heavenly bodies as due to a form of molecular activity similar to that of which radium affords so remarkable an instance. This modification certainly avoids many difficulties connected with the question of the interior heat of the earth, sun, Jupiter and probably all the larger heavenly bodies.

A limit is placed on our knowledge of astrophysics which, up to the present time, we have found no means of overstepping. This is imposed upon us by the fact that it is only when matter is in a gaseous form that the spectroscope can give us certain knowledge as to its physical condition. So long as bodies are in the solid state the light which they emit, though different in different substances, has no characteristic so precisely marked that detailed conclusions can be drawn as to the nature of the substance emitting it. Even in a liquid form, the spectrum of any kind of matter is less characteristic than that of gas. Moreover, a gaseous body of uniform temperature, and so dense as to be non-transparent, does not radiate the characteristic spectrum of the gas of which it is composed. Precise conclusions are possible only when a gaseous body is transparent through and through, so that the gas emits its characteristic rays—or when the rays from an incandescent body of any kind pass through a gaseous envelope at a temperature lower than that of the body itself. In this case the revelations of the spectroscope relate only to the constitution of the gaseous envelope, and not to the body below the envelope, from which the light emanates. The outcome of this drawback is that our knowledge of the chemical constitution of the stars and planets is still confined to their atmospheres, and that conclusions as to the constitution of the interior masses which form them must be drawn by other methods than the spectroscopic one.

When the spectroscope was first applied in astronomy, it was hoped that the light reflected from living matter might be found to possess some property different from that found in light reflected from non-living matter, and that we might thus detect the presence of life on the surface of a planet by a study of its spectrum; but no hope of this kind has so far been realized.

We have, in this brief view of the subject, referred mainly to the results of spectrum analysis. Growing out of, but beyond this method is the beginning of a great branch of research which may ultimately explain many heretofore enigmatical phenomena of nature. The discovery of radio-activity may, by explaining the interior heat of the great bodies of the universe, solve a difficulty which since the middle of the 19th century has been discussed by physicists and geologists—that of reconciling the long duration which geologists claim for the crust of the earth with the period during which physicists have deemed it possible that the sun should have radiated heat. Evidence is also accumulating to show that the sun and stars are radio-active bodies, and that emanations proceeding from the sun, and reaching the earth, have important relations to the phenomena of Terrestrial Magnetism and the Aurora.

The subject of Astrophysics does not admit of so definite a subdivision as that of Astrometry. The conclusions which researches relating to it have so far reached are treated in the articles Star; Sun; Comet; Nebula; Aurora Polaris, &c. (S. N.)

ASTRUC, JEAN (1684–1766), French physician and Biblical critic, was born on the 19th of March 1684 at Sauve, in Languedoc.

He graduated in medicine at Montpellier in 1703, and in 1710 he was appointed to the chair of anatomy at Toulouse, which he retained till 1717, when he became professor of medicine at Montpellier. Subsequently he was appointed successively superintendent of the mineral waters of Languedoc (1721), first physician to the king of Poland (1729), and regius professor of medicine at Paris (1731). He died on the 5th of May 1766 at Paris. Of his numerous works, that on which his fame principally rests is the treatise entitled *De Morbis Venereis libri sex*, 1736. In addition to other medical works he published anonymously *Conjectures sur les mémoires originaux dont il paraît que Moyse s'est servi pour composer le livre de la Genèse*, (1753), in which he pointed out that two main sources can be traced in the book of Genesis; and two dissertations on the immateriality and immortality of the soul, 1755.

See Hauck, *Realencyk. f. prot. Theol.*, 1897, vol. ii. pp. 162-170.

ASTURA, formerly an island, now a peninsula, on the coast of Latium, Italy, 7 m. S.E. of Antium, at the S.E. extremity of the Bay of Antium. The name also belongs to the river which flowed into the sea immediately to the S.E., at the mouth of which there was, according to Strabo, an anchorage. The medieval castle of the Frangipani, in which Conradin of Swabia vainly sought refuge after the battle of Tagliacozza in 1268, is built upon the foundations of a very large villa, of *opus reticulatum* with later additions in brickwork, and with a small harbour attached to it on the south-east. Remains of buildings also exist behind the sand dunes, which possibly mark the line of the channel which separated the island from the mainland, and these may have belonged to the post-station on the Via Severiana. As far as can be seen at present, there are remains of only one villa on the island itself;[1] but along the coast a mile to the north-west a line of villas begins, which continues as far as Antium. To the south-east, on the other hand, remains are almost entirely absent, and this portion of the coast seems to have been as sparsely populated in Roman times as it is now. The island seems to have existed as such in the time of Pope Honorius III. Astura was the site of a favourite villa of Cicero, whither he retired on the death of his daughter Tullia in 45 B.C. It appears to have been unhealthy even in Roman times; according to Suetonius, both Augustus and Tiberius contracted here the illnesses which proved fatal to them.

See T. Ashby, in *Mélanges de l'École Française de Rome* (1905), p. 207. (T. As.)

ASTURIAS, an ancient province and principality of northern Spain, bounded on the N. by the Bay of Biscay, E. by Old Castile, S. by Leon and W. by Galicia. Pop. (1900) 627,069; area, 4205 sq. m. By the division of Spain in 1833, the province took the name of Oviedo, though not to the exclusion, in ordinary usage, of the older designation. A full description of its modern condition is therefore given under the heading OVIEDO; the present article being confined to an account of its physical features, its history, and the resultant character of its inhabitants. Asturias consists of a portion of the northern slope of the Cantabrian Mountains, and is covered in all directions with offshoots from the main chain, by which it is almost completely shut in on the south. The higher summits, which often reach a height of 7000–8000 ft., are usually covered with snow until July or August, and the whole region is one of the wildest and most picturesque parts of Spain. Until the first railway was opened, in the middle of the 19th century, few of the passes across the mountains were practicable for carriages, and most of them are difficult even for horses. A narrow strip of level moorland, covered with furze and rich in deposits of peat, coal and amber, stretches inland, from the edge of the sheer cliffs which line the coast, to the foot of the mountains. The province is watered by numerous streams and rivers, which have hollowed out deep valleys; but owing to the narrowness of the level tract, their courses are short, rapid and subject to floods. The most important is the Nalon or Pravia, which receives the waters of the Caudal, the Trubia and the Narcea, and has a course of 62 m.; after it rank the Navia and the Sella. The estuaries of these rivers are rarely navigable, and along the entire littoral, a distance of 130 m., the only important harbours are at Gijón and Avilés.

A country so rugged, and so isolated by land and sea, naturally served as the last refuge of the older races of Spain when hard pressed by successive invaders. Before the Roman conquest, the Iberian tribe of Astures had been able to maintain itself independent of the Carthaginians, and to extend its territory as far south as the Douro. It was famous for its wealth in horses and gold. About 25 B.C., the Romans subjugated the district south of the Cantabrians, to which they gave the name of Augustana. Their capital was Asturica Augusta, the modern Astorga, in Leon. The warlike mountaineers of the northern districts, known as Transmontana, never altogether abandoned their hostility to the Romans, whose rule was ended by the Visigothic conquest, late in the 5th century. In 713, two years after the defeat and death of Roderick, the last Visigothic king, all Spain, except Galicia and Asturias, fell into the hands of the Moors. One of the surviving Christian leaders, Pelayo the Goth, took refuge with three hundred followers in the celebrated cave of Covadonga, or Cobadonga, near Cangas de Onís, and from this hiding-place undertook the Christian reconquest of Spain. The Asturians chose him as their king in 718, and although Galicia was lost in 734, the Moors proved unable to penetrate into the remoter fastnesses held by the levies of Pelayo. After his death in 737, the Asturians continued to offer the same heroic resistance, and ultimately enabled the people of Galicia, Leon and Castile to recover their liberty. The title of prince of Asturias, conferred on the heir-apparent to the crown of Spain, dates from 1388, when it was first bestowed on a Castilian prince. The title of count of Covadonga is assumed by the kings of Spain. In modern times Asturias formed a captaincy-general, divided into Asturias d'Oviedo, which corresponds with the limits of the ancient principality, and Asturias de Santillana, which now constitutes the western half of Santander.

Owing to their almost entire immunity from any alien domination except that of the Romans and Goths, the Asturians may perhaps be regarded as the purest representatives of the Iberian race; while their dialect (*linguaje bable*) is sometimes held to be closely akin to the parent speech from which modern Castilian is derived. It is free from Moorish idioms, and, like Galician and Portuguese, it often retains the original Latin *f* which Castilian changes into *h*. In physique, the Asturians are like the Galicians, a people of hardy mountaineers and fishermen, finely built, but rarely handsome, and with none of the grace of the Castilian or Andalusian. Unlike the Galicians, however, they are remarkable for their keen spirit of independence, which has been fostered by centuries of isolation. Despite the harsh land-laws and grinding taxation which prevent them, with all their industry and thrift, from securing the freehold of the patch of ground cultivated by each peasant family, the Asturians regard themselves as the aristocracy of Spain. This pride in their land, race and history they preserve even when, as often happens, they emigrate to other parts of the country or to South America, and earn their living as servants, water-carriers, or, in the case of the women, as nurses. They make admirable soldiers and sailors, but lack the enterprise and commercial aptitude of the Basques and Catalans; while they are differentiated from the inhabitants of central and southern Spain by their superior industry, and perhaps their lower standard of culture. It is, on the whole, true that by the exclusion of the Moors they lost their opportunity of playing any conspicuous part in the literary and artistic development of Spain. One class of the Asturians deserving special mention is that of the nomad cattle-drovers known as Baqueros or Vaqueros, who tend their herds on the mountains of Leitariegos in summer, and along the coast in winter; forming a separate caste, with distinctive customs, and rarely or never intermarrying with their neighbours.

For the modern condition of the principality (including climate, fauna and flora), see S. Canals, *Asturias: informacion sobre su presente estado* (Madrid, 1900); and G. Casal, *Memorias de historia*

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[1] Servius, in speaking of it as *oppidum*, must be referring to the post-station.

natural y médica de Asturias (Oviedo, 1900). For the history and antiquities, there is much that is valuable in *Asturias monumental, epigráfica y diplomática*, &c., by C. M. Vigil (Madrid, 1887)—folio, with maps and illustrations. See also F. de Aramburu y Zuloaga, *Monografia de Asturias* (Oviedo, 1899).

ASTYAGES, the last king of the Median empire. In the inscriptions of Nabonidus the name is written Ishtuvegu (cylinder from Abu Habba V R 64, col. 1, 32; Annals, published by Pinches, *Tr. Soc. Bibl. Arch.* vii. col. 2, 2). According to Herodotus, he was the son of Cyaxares and reigned thirty-five years (584–550 B.C.); his wife was Aryenis, the daughter of Alyattes of Lydia (Herod. i. 74). About his reign we know little, as the narrative of Herodotus, which makes Cyrus the grandson of Astyages by his daughter Mandane, is merely a legend; the figure of Harpagus, who as general of the Median army betrays the king to Cyrus, alone seems to contain an historical element, as Harpagus and his family afterwards obtained a high position in the Persian empire. From the inscriptions of Nabonidus we learn that Cyrus, king of Anshan (Susiana), began war against him in 553 B.C.; in 550, when Astyages marched against Cyrus, his troops rebelled, and he was taken prisoner. Then Cyrus occupied and plundered Ecbatana. The captive king was treated fairly by Cyrus (Herod. i. 130), and according to Ctesias (*Pers.* 5, cf. Justin i. 6) made satrap of Hyrcania, where he was afterwards slain by Oebares against the will of Cyrus, who gave him a splendid funeral. Alexander Polyhistor and Abydenus in their excerpts from Berossus, which Eusebius (*Chron.* i. pp. 29 and 37) and Syncellus (p. 396) have preserved, give the name Astyages to the Median king who reigned in the time of the fall of Nineveh (606 B.C.), and became father-in-law of Nebuchadrezzar. This is evidently a mistake; the name ought to be Cyaxares (in the fragments of the Jewish history of Alexander Polyhistor, in Euseb. *Praep. Ev.* ix. 39, the name is converted into Astibaras, who, according to the unhistorical list of Ctesias, was the father of Astyages), and there is no reason to invent an earlier king Astyages I., as some modern authors have done. The Armenian historians render the name Astyages by Ashdahak, *i.e.* Azhi Dahaka (Zohak), the mythical king of the Iranian epics, who has nothing whatever to do with the historical king of the Medes. (ED. M.)

ASTYLAR (from Gr. ἀ-, privative, and στῦλος, a column), an architectural term given to a class of design in which neither columns nor pilasters are used for decorative purposes; thus the Ricardi and Strozzi palaces in Florence are astylar in their design, in contradistinction to Palladio's palaces at Vicenza, which are columnar.

ASUNCIÓN (NUESTRA SEÑORA DE LA ASUNCIÓN), a city and port of Paraguay, and capital of the republic, on the left bank of the Paraguay river in 25° 16′ 04″ S., 57° 42′ 40″ W., and 970 m. above Buenos Aires. Pop. (est. in 1900) 52,000. The port is connected with Buenos Aires and Montevideo by regular lines of river steamers, which are its only means of trade communication with the outer world, and with the inland town of Villa Rica (95 m.) by a railway worked by an English company. The city faces upon a curve in the river bank forming what is called the Bay of Asunción, and is built on a low sandy plain, rising to pretty hillsides overlooking the bay and the low, wooded country of the Chaco on the opposite shore. The general elevation is only 253 ft. above sea-level. Asunción is laid out on a regular plan, the credit for which is largely due to Dictator Francia; the principal streets are paved and lighted by gas and electricity; and telephone and street-car services are maintained. The climate is hot but healthful, the mean annual temperature being about 72° F. The city is the seat of a bishopric dating from 1547, and contains a large number of religious edifices. It has a national college and public library, but no great progress in education has been made. The most prominent edifice in the city is the palace begun by the younger Lopez, which is now occupied by a bank. There are some business edifices and residences of considerable architectural merit, but the greater part are small and inconspicuous, a majority of the residences being thatched, mud-walled cabins. Considerable progress was made during the last two decades of the 19th century, however, notwithstanding misgovernment and the extreme poverty of the people. Asunción was founded by Ayolas in 1535, and is the oldest permanent Spanish settlement on the La Plata. It was for a long time the seat of Spanish rule in this region, and later the scene of a bitter struggle between the church authorities and Jesuits. Soon after the declaration of independence in 1811, the city fell under the despotic rule of Dr Francia, and then under that of the elder and younger Lopez, through which its development was greatly impeded. It was captured and plundered by the Brazilians in 1869, and has been the theatre of several revolutionary outbreaks since then, one of which (1905) resulted in a blockade of several months' duration. (A. J. L.)

ASVINS, in Hindu mythology, twin deities of light. After Indra, Agni and Soma, they are the most prominent divinities in the Rig-Veda, and have more than fifty entire hymns addressed to them. Their exact attributes are obscure. They appear to be the spirits of dawn, the earliest bringers of light in the morning sky; they hasten on in the clouds before Dawn and prepare the way for her. In some hymns they are called sons of the sun; in others, children of the sky; in others, offspring of the ocean. They are youngest of the gods, bright lords of lustre, honey-hued. They are inseparable. The sole purpose of one hymn is to compare them with different twin objects, such as eyes, hands, feet and wings. They have a common wife, Surya. They are physicians, protectors of the weak and old, especially of elderly unmarried women. They are the friends of lovers, and bless marriages and make them fruitful.

See A. A. Macdonell, *Vedic Mythology* (Strassburg, 1897).

ASYLUM (from Gr. ἀ-, privative, and σύλη, right of seizure), a place of refuge. In ancient Greece, an asylum was an "inviolable" refuge for persons fleeing from pursuit and in search of protection. In a general sense, all Greek temples and altars were inviolable, that is, it was a religious crime to remove by force any person or thing once under the protection of a deity. But it was only in the case of a small number of temples that this protecting right of a deity was recognized with common consent. Such were the sanctuaries of Zeus Lycaeus in Arcadia, of Poseidon in the island of Calauria, and of Apollo at Delos; they were, however, numerous in Asia Minor. They guaranteed absolute security to the suppliant within their limits. The right of sanctuary, originally possessed by all temples, appears to have become limited to a few in consequence of abuses of it. Asylums in this sense were peculiar to the Greeks. The asylum of Romulus (Livy i. 8), which was probably the altar of Veiovis, cannot be considered as such. Under Roman dominion, the rights of existing Greek sanctuaries were at first confirmed, but their number was considerably reduced by Tiberius. Under the Empire, the statues of the emperors and the eagles of the legions were made refuges against acts of violence. Generally speaking, the classes of persons who claimed the rights of asylum were slaves who had been maltreated by their masters, soldiers defeated and pursued by the enemy, and criminals who feared a trial or who had escaped before sentence was passed. (See treatises *De Asylis Graecis*, by Förster, 1847; Jaenisch, 1868; Barth, 1888.)

With the establishment of Christianity, the custom of asylum or sanctuary (*q.v.*) became attached to the church or churchyard. In modern times the word asylum has come to mean an institution providing shelter or refuge for any class of afflicted or destitute persons, such as the blind, deaf and dumb, &c., but more particularly the insane. (See INSANITY.)

ASYLUM, RIGHT OF (Fr. *droit d'asile*; Ger. *Asylrecht*), in international law, the right which a state possesses, by virtue of the principle that every independent state is sole master within its boundaries, of allowing fugitives from another country to enter or sojourn upon its territory. Extradition (*q.v.*) treaties are undertakings between states curtailing the exercise of the right of asylum in respect of refugees from justice, but the conditions therein laid down invariably show that nations regard the maintenance of this right of asylum as intimately connected with their right of independent action, however weak as states they may be, on their own soil. The neutral right to grant asylum to belligerent forces is now governed by articles 57, 58 and 59 of the regulations annexed to the Hague Convention of the 29th of July 1899, relating to the Laws and Customs of War on Land. (See WAR.) (T. BA.)

ATACAMA, a province of northern Chile, bounded N. and S. respectively by the provinces of Antofagasta and Coquimbo, and extending from the Pacific coast E. to the Argentine boundary line. It has an area of 30,729 sq. m., lying in great part within the Atacama desert region (see below), and a population (1902) of 71,446. The silver and copper mines of the province are numerous, some of them ranking among the most productive known, but the majority are worked with limited capital and on a small scale. The silver ore was first discovered in 1832 by a shepherd at a place which bears his name, Juan Godoi. The nitrate and borax deposits are extensive and productive, and common salt is a natural product of large areas in the elevated desert regions of the Andes. The exports include copper and silver and their ores, nitrate of soda, borax, guano and other minerals in small quantities. The capital, Copiapó (est. pop. 8991 in 1902), is situated on a small river of the same name 37 m. from the coast and 51 m. south-east by rail from Caldera, the principal port of this great mining district. Before 1842, when guano began to attract notice as an exportable product, Atacama was considered as Bolivian territory, and Coquimbo the extreme northern province of Chile. In that year Chile decided to explore the desert coast, and in 1843 that part of the desert extending north to the 26th parallel was organized into the province of Atacama.

ATACAMA, DESERT OF, an arid, barren and saline region of western South America, covering the greater part of the Chilean provinces of Atacama and Antofagasta, the Argentine territory of Los Andes, and the south-western corner of the Bolivian department of Potosí. The higher elevations are known as the Puna de Atacama, which is practically a continuation southward of the great *puna* region of Peru and Bolivia. It is a broken, mountainous region, volcanic in places, saline in others, and ranges from 7000 to 13,500 ft. in general elevation. Its culminating ridges are marked by an irregular line of peaks and extinct volcanoes extending north by east from about 28° S. into southern Bolivia. On the eastern side, occasional rainfalls occur and streams from the snow-clads peaks produce some slight displays of fertility, but the general aspect of the plateaus, which are dry and cold in winter and in summer are swept by rainstorms and covered by occasional tufts of coarse grass, is barren and forbidding. They are also broken by great saline lagoons and dry salt basins. This region forms the Argentine territory of Los Andes and is habitable in places. On the western slope the land descends gradually to the Pacific, being broken into great basins, or terraces, by mountainous ridges in its higher elevations, widening out into gently-sloping sandy plains below, famous for their nitrate deposits, and terminating on the coast with sharply-sloping bluffs, having an elevation of 800 to 1500 ft., and looking from the sea like a range of flat-topped hills. This desolate region, which is rainless and absolutely barren, and was considered worthless for three and a half centuries, is now a treasure-house of mineral wealth, abounding in copper, silver, lead, nickel, cobalt, iron, nitrates and borax. It is occupied by many mining settlements, and includes some of the most productive copper and silver mines of the world.

See L. Darapsky, "Zur Geographie der Puna de Atacama," *Zeits. Ges. Erdk. zu Berlin*, 1899; G. E. Church, "South America: an Outline of its Physical Geography," *Geographical Journal*, 1901; John Ball, *Notes of a Naturalist in South America* (London, 1887); F. O'Driscoll, "A Journey to the North of the Argentine Republic," *Geographical Journal*, 1904. (A. J. L.)

ATACAMITE, a mineral found originally in the desert of Atacama, and named by D. de Gallizen in 1801. It is a cupric oxychloride, having the formula $CuCl_2.3Cu(OH)_2$, and crystallizing in the orthorhombic system. Its hardness is about 3 and its specific gravity 3·7, while its colour presents various shades of green, usually dark. Atacamite is a comparatively rare mineral, formed in some cases by the action of sea-water on various copper-ores, and occurring also as a volcanic product on Vesuvian lavas. Some of the finest crystals have been yielded by the copper-mines of South Australia, especially at Wallaroo. It occurs also, with malachite, at Bembe, near Ambriz, in West Africa. From one of its localities in Chile, Los Remolinos, it was termed Remolinite by Brooke and Miller. Atacamite, in a pulverulent state, was formerly used as a pounce under the name of "Peruvian green sand," and was known in Chile as arsenillo. (F. W. R.*)

ATAHUALLPA (*atahu*, Lat. *virtus*, and *allpa*, sweet), "the last of the Incas" (or Yncas) of Peru, was the son of the ruler Huayna Capac, by Pacha, the daughter of the conquered sovereign of Quito. His brother Huascar succeeded Huayna Capac in 1527; for, as Atahuallpa was not descended on both sides from the line of Incas, Peruvian law considered him illegitimate. He obtained, however, the kingdom of Quito. A jealous feeling soon sprang up between him and Huascar, who insisted that Quito should be held as a dependent province of his empire. A civil war broke out between the brothers, and, about the time when the Spanish conqueror Pizarro was beginning to move inland from the town of San Miguel, Huascar had been defeated and thrown into prison, and Atahuallpa had become Inca. Pizarro set out in September 1532, and made for Caxamarca, where the Inca was. Messengers passed frequently between them, and the Spaniards on their march were hospitably received by the inhabitants. On the 15th of November, Pizarro entered Caxamarca, and sent his brother and Ferdinando de Soto to request an interview with the Inca. On the evening of the next day, Atahuallpa entered the great square of Caxamarca, accompanied by some five or six thousand men, who were either unarmed or armed only with short clubs and slings concealed under their dresses. Pizarro's artillery and soldiers were planted in readiness in the streets opening off the square. The interview was carried on by the priest Vicente de Valverde, who addressed the Inca through an interpreter. He stated briefly and dogmatically the principal points of the Christian faith and the Roman Catholic policy, and concluded by calling upon Atahuallpa to become a Christian, obey the commands of the pope, give up the administration of his kingdom, and pay tribute to Charles V., to whom had been granted the conquest of these lands. To this extraordinary harangue, which from its own nature and the faults of the interpreter must have been completely unintelligible, the Inca at first returned a very temperate answer. He pointed out what seemed to him certain difficulties in the Christian religion, and declined to accept as monarch of his dominions this Charles, of whom he knew nothing. He then took a bible from the priest's hands, and, after looking at it, threw it violently from him, and began a more impassioned speech, in which he exposed the designs of the Spaniards, and upbraided them with the cruelties they had perpetrated. The priest retired, and Pizarro at once gave the signal for attack. The Spaniards rushed out suddenly, and the Peruvians, astonished and defenceless, were cut down in hundreds. Pizarro himself seized the Inca, and in endeavouring to preserve him alive, received, accidentally, on his hand the only wound inflicted that day on a Spaniard. Atahuallpa, thus treacherously captured, offered an enormous sum of money as a ransom, and fulfilled his engagement; but Pizarro still detained him, until the Spaniards should have arrived in sufficient numbers to secure the country. While in captivity, Atahuallpa gave secret orders for the assassination of his brother Huascar, and also endeavoured to raise an army to expel the invaders. His plans were betrayed, and Pizarro at once brought him to trial. He was condemned to death, and, as being an idolator, to death by fire. Atahuallpa, however, professed himself a Christian, received baptism, and his sentence was then altered into death by strangulation (August 29, 1533). His body was afterwards burned, and the ashes conveyed to Quito. (See also PERU: *History*.)

ATALANTA, in Greek legend, the name of two Greek heroines. (1) The Arcadian Atalanta was the daughter of Iasius or Iasion and Clymene. At her birth, she had been exposed on a hill, her father having expected a son. At first she was suckled by a she-bear, and then saved by huntsmen, among whom she grew up to be skilled with the bow, swift, and fond of the chase, like the virgin goddess Artemis. At the Calydonian boar-hunt her arrows were the first to hit the monster, for which its head and hide were given her by Meleager. At the funeral games of Pelias, she wrestled with Peleus, and won. For a long time she remained true to Artemis and rejected all suitors, but Meilanion at last gained her love by his persistent devotion. She was the mother of Parthenopaeus, one of the Seven against Thebes (Apollodorus iii. 9; Hyginus, *Fab.* 99). (2) The Boeotian Atalanta was the daughter of Schoeneus. She was famed for her running, and would only consent to marry a suitor who could outstrip her in a race, the consequence of failure being death. Hippomenes, before starting, had obtained from Aphrodite three golden apples, which he dropped at intervals, and Atalanta, stopping to pick them up, fell behind. Both were happy at the result; but forgetting to thank the goddess for the apples, they were led by her to a religious crime, and were transformed into lions by the goddess Cybele (Ovid, *Metam.* x. 560; Hyginus, *Fab.* 185). The characteristics of these two heroines (frequently confounded) point to their being secondary forms of the Arcadian Artemis.

ATARGATIS, a Syrian deity, known to the Greeks by a shortened form of the name, Derketo (Strabo xvi. c. 785; Pliny, *Nat. Hist.* v. 23. 81), and as Dea Syria, or in one word Deasura (Lucian, *de Dea Syria*). She is generally described as the "fish-goddess." The name is a compound of two divine names; the first part is a form of the Himyaritic ʽ*Athtar*, the equivalent of the Old Testament *Ashtoreth*, the Phoenician *Astarte* (*q.v.*), with the feminine ending omitted (Assyr. *Ishtar*); the second is a Palmyrene name ʽ*Athe* (*i.e. tempus opportunum*), which occurs as part of many compounds. As a consequence of the first half of the name, Atargatis has frequently, though wrongly, been identified with Astarte. The two deities were, no doubt, of common origin, but their cults are historically distinct. In 2 Macc. xii. 26 we find reference to an Atargateion or Atergateion (temple of Atargatis) at Carnion in Gilead (cf. 1 Macc. v. 43), but the home of the goddess was unquestionably not Palestine, but Syria proper, expecially at Hierapolis (*q.v.*), where she had a great temple. From Syria her worship extended to Greece, Italy and the furthest west. Lucian and Apuleius give descriptions of the beggar-priests who went round the great cities with an image of the goddess on an ass and collected money. The wide extension of the cult is attributable largely to Syrian merchants; thus we find traces of it in the great seaport towns; at Delos especially numerous inscriptions have been found bearing witness to its importance. Again we find the cult in Sicily, introduced, no doubt, by slaves and mercenary troops, who carried it even to the farthest northern limits of the Roman empire. In many cases, however, Atargatis and Astarte are fused to such an extent as to be indistinguishable. This fusion is exemplified by the Carnion temple, which is probably identical with the famous temple of Astarte at Ashtaroth-Karnaim.

Atargatis appears generally as the wife of Hadad (Baal). They are the protecting deities of the community. Atargatis, in the capacity of πολιοῦχος, wears a mural crown, is the ancestor of the royal house, the founder of social and religious life, the goddess of generation and fertility (hence the prevalence of phallic emblems), and the inventor of useful appliances. Not unnaturally she is identified with the Greek Aphrodite. By the conjunction of these many functions, she becomes ultimately a great Nature-Goddess, analogous to Cybele and Rhea (see GREAT MOTHER OF THE GODS); in one aspect she typifies the function of water in producing life; in another, the universal mother-earth (Macrobius, *Saturn*, i. 23); in a third (influenced, no doubt, by Chaldaean astrology), the power of destiny. The legends are numerous and of an astrological character, intended to account for the Syrian dove-worship and abstinence from fish (see the story in Athenaeus viii. 37, where Atargatis is derived from ἄτερ Γάτιδος, "without Gatis,"—a queen who is said to have forbidden the eating of fish). Thus Diodorus Siculus, using Ctesias, tells how she fell in love with a youth who was worshipping at the shrine of Aphrodite, and by him became the mother of Semiramis, the Assyrian queen, and how in shame she flung herself into a pool at Ascalon or Hierapolis and was changed into a fish (W. Robertson Smith in *Eng. Hist. Rev.* ii., 1887). In another story she was hatched from an egg found by some fish in the Euphrates and by them thrust on the bank where it was hatched by a dove; out of gratitude she persuaded Jupiter to transfer the fish to the Zodiac (cf. Ovid, *Fast.* ii. 459-474, *Metam.* v. 331).

See articles *s.v.* in Herzog-Hauck, *Realencyk.* (1897), by W. Baudissin; and Pauly-Wissowa, *Realencyc.*; Fr. Baethgen, *Beiträge zur Semit. Religiongesch.* (1888); R. Pietschmann, *Gesch. der Phönizier* (1889).

ATAULPHUS (the Latinized form of the Gothic Ataulf, "Father-wolf," from *atta*, father, and *vulfs*, wolf; mod. Germ. Adolf, Latinized as Adolphus, the form used by Gibbon for the subject of this article), king of the Goths (d. 415). On the death of Alaric (*q.v.*) his followers acclaimed his brother-in-law Ataulphus as king. In 412 he quitted Italy and led his army across the Alps into Gaul. Here he fought against some of the usurpers who threatened the throne of Honorius; he made some sort of compact with that emperor and, in 414, he married his sister Placidia, who had been since the siege of Rome a captive in the camp of the Goths. The ex-emperor Attalus danced at the marriage festival, which was celebrated with great pomp at Narbonne. In 415 Ataulphus crossed the Pyrenees into Spain and died at Barcelona, being assassinated by a groom. The most important fact in his history is his confession, recorded by Orosius, that he saw the inability of his countrymen to rear a civilized or abiding kingdom, and that consequently his aim should be to build on Roman foundations and blend the two nations into one.

ATAVISM (from Lat. *atavus*, a great-great-great-grandfather or ancestor), the term given in biology to the reproduction in a living person or animal of the characteristics of an ancestor more remote than its parents (see HEREDITY). Loosely used, it connotes a reversion to an earlier type. Individuals reproduce unexpectedly the traits of earlier ancestors, and ethnologists and criminologists frequently explain by "atavism" the occurrence of degenerate species of man; but the whole subject is complicated by other possible explanations of such phenomena, included in the scientific study of normal "variation."

ATBARA (*Bahr-el-Aswad*, or Black River), the most northern affluent of the river Nile, N.E. Africa. It rises in Abyssinia to the N.W. of Lake Tsana, unites its waters with a number of other rivers which also rise in the Abyssinian highlands, and flows north-west 800 m. till its junction at Ed Damer with the Nile (*q.v.*). The battle of the Atbara, fought near Nakheila, a place on the north bank of the river about 30 m. above Ed Damer, on the 8th of April 1898, between the khalifa's forces under Mahmud and Sir Herbert (afterwards Lord) Kitchener's Anglo-Egyptian army, resulted in the complete defeat of the Mahdists and the capture of their leader, and paved the way for the decisive battle of Omdurman on the 2nd of September following (see EGYPT: *Military Operations*).

ATCHISON, a city and the county-seat of Atchison county, Kansas, U.S.A., on the west bank of the Missouri river, which is navigable at this point but is utilized comparatively little for commerce. Pop. (1890) 13,963; (1900) 15,722, of whom 2508 were of negro descent and 1308 were foreign-born; (1910) 16,429. Atchison is served by the Atchison, Topeka & Santa Fé, the Chicago, Burlington & Quincy, the Chicago, Rock Island & Pacific, and the Missouri Pacific railways. The city is the seat of Midland College (Lutheran, 1887), St Benedict's College (Roman Catholic, 1858) for boys, Mt. Scholastica Academy (Roman Catholic) for girls, and Western Theological Seminary (Evangelical-Lutheran, 1893); a state soldiers' orphans' home is also located here. Atchison's situation and transportation facilities make it an important supply-centre, its trade in grains and live-stock being particularly large; it has large railway machine shops, and its principal manufactures are flour, furniture, lumber, hardware and drugs. The value of the city's factory products increased from $2,093,469 in 1900 to $4,052,274 in 1905, or 93·6%. Atchison was founded in 1854 by pro-slavery partisans, and was named in honour of their leader, David Rice Atchison, a United States senator. The city was quickly surpassed by Leavenworth in commercial importance, and during the Kansas struggle was never of great political importance. Its first city charter was granted in 1858. The Atchison *Globe* (established 1878) is one of the best-known of western papers.

ATE, in Greek mythology, the personification of criminal folly, the daughter of Zeus and Eris (Strife). She misled even Zeus to take a hasty oath, whereby Heracles became subject to Eurystheus. Zeus thereupon cast her by the hair out of Olympus, whither she did not return, but remained on earth, working evil and mischief (*Iliad*, xix. 91). She is followed by the Litae (Prayers), the old and crippled daughters of Zeus, who are able to repair the evil done by her (*Iliad*, ix. 502). In later times Ate is regarded as the avenger of sin (Sophocles, *Antigone*, 614, 625).

See J. Girard, *Le Sentiment religieux en Grèce* (1869); J. F. Scherer, *De Graecorum Ates Notione atque Indole* (1858); E. Berch, *Bedeutung der Ate bei Aeschylos* (1876); C. Lehrs, *Populäre Aufsätze aus dem Alterthum* (1875); L. Schmidt, *Die Ethik der alten Griechen* (1882).

ATELLA, an ancient Oscan town of Campania, 9 m. N. of Naples and 9 m. S. of Capua, on the road between the two. It was a member of the Campanian confederation, and shared the fortunes of Capua, but remained faithful to Hannibal for a longer time; the great part of the inhabitants, when they could no longer resist the Romans, were transferred by him to Thurii, and the town was reoccupied in 211 by the Romans, who settled the exiled inhabitants of Nuceria there. The fate of Atella at the end of the war, when the latter were able to return to their own city, is unknown. Cicero was in friendly relations with it, and exerted influence that it might retain its property in Gaul, so that it is obvious that it had then recovered municipal rights. The town is mainly famous as the cradle of early Roman comedy, the *Fabulae Atellanae* (see below). Some remains of the town still exist, including a tower of the city wall in brick.

See J. Beloch, *Campanien* (2nd ed., Breslau, 1890), p. 379.

ATELLANAE FABULAE ("Atellan fables"), the name of a sort of popular comedy amongst the ancient Romans. The name is derived from Atella, an Oscan town in Campania; for this reason, and from their being also called *Osci ludi*, it has been supposed that they were of Oscan origin and introduced at Rome after Campania had been deprived of its independence. It seems highly improbable that they were performed in the Oscan language. Mommsen, however, rejects their Oscan origin altogether; he regards them as purely Latin, the scene merely being laid at Atella to avoid causing offence by placing it at Rome or one of the Latin cities. These plays, or rather sketches, contained humorous descriptions of country as contrasted with town life, and found their subjects amongst the lower classes of the people. The subjects alone were decided upon before the performance began; the dialogue was improvised as it proceeded. The Atellanae contained certain stock characters, like the Italian harlequinades: Maccus (the fool), Bucco (fat-chaps), Pappus (daddy), Dossennus (sharper); monsters and bogeys like Manducus, Pytho, Lamia also made their appearance. The performers were the sons of Roman citizens, who did not lose their rights as citizens, and were allowed to serve in the army: professional actors were excluded. The simple prose dialogues were probably varied by songs in the rude Saturnian metre: the language was that of the common people, accompanied by lively gesticulation and movements. They were characterized by coarseness and obscenity. In the time of Sulla a literary form was given to the Atellanae by Pomponius of Bononia and Novius, who made them regular written comedies. Living persons seem to have been attacked, and even the doings of the gods and heroes of mythology burlesqued. From this time the Atellanae were used as after-pieces and performed by professional actors. In 46 B.C. they were ousted by the mimes, but regained popularity during the reign of Tiberius (chiefly owing to a certain Mummius), until they were definitely superseded by and merged in the mimes. They held their ground in the small towns and villages of Italy during the last days of the empire; they probably lingered on into the middle ages, and were the origin of the Italian *Commedie dell' arte*.

The scanty fragments of Pomponius and Novius are collected in Ribbeck's *Comicorum Romanorum Reliquiae*; see also Munk, *De Fabulis Atellanis* (1840); and art. LATIN LITERATURE.

ATESTE (mod. *Este*, *q.v.*), an ancient town of Venetia, at the southern foot of the Euganean hills, 43 ft. above sea-level; 22 m. S.W. of Patavium (Padua). The site was occupied in very early times, as the discoveries since 1882 show. Large cemeteries have been excavated, which show three different periods from the 8th century B.C. down to the Roman domination. In the first period (Italic) cremation burials closely approximating to the Villanova type are found; in the second[1] (Venetian) the tombs are constructed of blocks of stone, and *situlae* (bronze buckets), sometimes decorated with elaborate designs, are frequently used to contain the cinerary urns; in the third (Gallic), which begins during the 4th century B.C., though cremation continues, the tombs are much poorer, the ossuaries being of badly baked rough clay, and show traces of Gallic influence, and characteristics of the La-Tène civilization. The many important objects found in these excavations are preserved in the local museum. See G. Ghirardini in *Notizie degli Scavi*; *Monumenti dei Lincei*, ii. (1893) 161 seq., vii. (1897) 5 seq., x. (1901) 5 seq.; *Atti del Congresso Internazionale di Scienze Storiche* (Rome, 1904), v. 279 seq. Inscriptions show that the national language asserted its existence even after Ateste came into the hands of the Romans. When this occurred is not known; boundary stones of 135 B.C. exist, which divide the territory of Ateste from that of Patavium and of Vicetia, showing that the former extended from the middle of the Euganean hills to the Atesis (mod. *Adige*, from which Ateste no doubt took its name, and on which it once stood). After the battle of Actium, Augustus settled veterans from various of his legions in this territory, Ateste being thenceforth spoken of as a colony. It appears to have furnished many recruits, especially for the *cohortes urbanae*. It appears but little in history, though its importance is vouched for by numerous inscriptions, the majority of which belong to the early Empire. (T. As.)

ATH, or AATH, an ancient town of the province of Hainaut, Belgium, situated on the left bank of the Dender. Pop. (1890) 9868; (1904) 11,201. Formerly it was fortified, but after the change in the defensive system of Belgium in 1858 the fortress was dismantled and its ramparts superseded by boulevards. Owing to a fire caused by lightning its fine church of St Julien, dating from the 14th century, which had escaped serious injury during many wars, was destroyed in 1817 (since rebuilt). This left the Tour Burbant as its sole relic of the middle ages. This tower formed part of the *donjon* of the fortress erected by Baldwin IV., count of Hainaut, about the year 1150. Near Ath is the fine castle of Beloeil, the ancient seat of the princely family of Ligne. Ath is famous for its gild of archers, whose butts are erected on the plain of the Esplanade in the centre of the town. The town militia has the privilege of being armed with bows and crossbows. Ath is also well known in Hainaut for its annual fête called *le jour de ducasse—ducasse* being the Walloon word for kermesse (fête). On this occasion a procession escorting figures of two giants, Goliath, called locally Goyasse, and Samson, forms the chief feature of the celebration. The emperor Joseph II. stopped it for its "idolatrous" character, but this act was one of the causes of the Brabant revolution of 1789. The procession, revived in 1790, was again stopped by the French republicans five years later, but was revived under the Empire, and has flourished ever since.

ATHABASCA (*Athapescow*), or ELK, a river and lake of the province of Alberta, Canada. The river rises in the Rocky Mountains near the Yellowhead Pass in 52° 10′ N. and 117° 10′ W., and flows north-east as far as Athabasca Landing, and thence north into Lake Athabasca. It is 740 m. long and has a number of important tributaries, including the McLeod, Pembina, Lesser

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[1] This is by some authorities divided into two.

Slave, which drains the lake of that name, and Clearwater. Athabasca lake is 195 m. long, west to east, from 20 to 32 m. wide, has an area of 3085 sq. m., and is 690 ft. above the sea. It discharges its waters northward by Slave river and the Mackenzie system to the Arctic Ocean. On its north shore the country is high and rocky; on the south, sandy and barren. Shallow-draught steamers navigate the lake and river, and Lesser Slave lake and river, with one interruption—at Grand Rapids near the mouth of the Clearwater river.

ATHALARIC (516–534), king of the Ostrogoths, grandson of Theodoric, became king of the Ostrogoths in Italy on his grandfather's death (526). As he was only ten years old, the regency was assumed by his mother Amalasuntha (*q.v.*). The murmurs of the Gothic nobles procured for their young sovereign too early emancipation from the schoolroom. He drank heavily, and indulged in vicious excesses which ruined his constitution. He died on the 2nd of October 534.

ATHALIAH, in the Bible, the daughter of Ahab, and wife of Jehoram, king of Judah. After the death of Ahaziah, her son, she usurped the throne and reigned for six years. She is said to have massacred all the members of the royal house of Judah (2 Kings xi. 1-3), but a similar atrocity is also ascribed to Jehu (2 Kings x. 12-14); with both notices contrast 2 Chron. xxi. 17. The sole survivor Joash was concealed in the temple by his aunt, Jehosheba, wife of the priest Jehoida (2 Chron. xxii. 11). These organized a revolution in favour of Joash, and caused Athaliah and her adherents to be put to death (2 Kings xi.; 2 Chron. xxii. 10-12, xxiii., xxiv. 7).

The story of Athaliah forms the subject of one of Racine's best tragedies. It has been musically treated by Handel and Mendelssohn.

ATHAMAS, in Greek mythology, king of the Minyae in Boeotian Orchomenus, son of Aeolus, king of Thessaly, or of Minyas. His first wife was Nephele, the cloud-goddess, by whom he had two children, Phrixus and Helle (see ARGONAUTS). Athamas and his second wife Ino were said to have incurred the wrath of Hera, because Ino had brought up Dionysus, the son of her sister Semele, as a girl, to save his life. Athamas went mad, and slew one of his sons, Learchus; Ino, to escape the pursuit of her frenzied husband, threw herself into the sea with her other son Melicertes. Both were afterwards worshipped as marine divinities, Ino as Leucothea, Melicertes as Palaemon (*Odyssey* v. 333). Athamas, with the guilt of his son's murder upon him, was obliged to flee from Boeotia. He was ordered by the oracle to settle in a place where he should receive hospitality from wild beasts. This he found at Phthiotis in Thessaly, where he surprised some wolves eating sheep; on his approach they fled, leaving him the bones. Athamas, regarding this as the fulfilment of the oracle, settled there and married a third wife, Themisto. The spot was afterwards called the Athamanian plain (Apollodorus i. 9; Hyginus, *Fab.* 1-5; Ovid, *Metam.* iv. 416, *Fasti*, vi. 485; Valerius Flaccus i. 277).

According to a local legend, Athamas was king of Halos in Phthiotis from the first (Schol. on Apoll. Rhodius ii. 513). After his attempt on the life of Phrixus, which was supposed to have succeeded, the Phthiots were ordered to sacrifice him to Zeus Laphystius, in order to appease the anger of the gods. As he was on the point of being put to death, Cytissorus, a son of Phrixus, suddenly arrived from Aea with the news that Phrixus was still alive. Athamas's life was thus saved, but the wrath of the gods was unappeased, and pursued the family. It was ordained that the eldest born of the race should not enter the council-chamber; if he did so, he was liable to be seized and sacrificed if detected (Herodotus vii. 197). The legend of Athamas is probably founded on a very old custom amongst the Minyae—the sacrifice of the first-born of the race of Athamas to Zeus Laphystius. The story formed the subject of lost tragedies by Aeschylus, Sophocles, Euripides and other Greek and Latin dramatists.

ATHANAGILD (d. 547) became king of the Visigoths (in Spain) in 534, having invoked the aid of the emperor Justinian for his revolt against his predecessor Agila. Athanagild, when himself king, vainly tried to oust his late allies from the footing which they had gained in Spain, nor were the Greeks finally expelled from Spain till seventy years later. Athanagild himself is chiefly remembered for the tragic fortunes of his daughters Brunechildis and Gavleswintha, who married two Frankish brother kings, Sigebert and Chilperic. Athanagild died ("peacefully," as the annalist remarks) in 547.

ATHANARIC (d. 381), a ruler of the Visigoths from about 366 to 380. He bore the title not of king but of judge, a title which may be compared with that of ealdorman among the Anglo-Saxon invaders of Britain. Athanaric waged, from 367 to 369, an unsuccessful war with the emperor Valens, and the peace by which the war was ended was ratified by the Roman and Gothic rulers meeting on a barge in mid-stream of the Danube. Athanaric was a harsh and obstinate heathen, and his short reign was chiefly famous for his brutal persecution of his Christian fellow-countrymen. In 376 he was utterly defeated by the Huns, who a few years before had burst into Europe. The bulk of the Visigothic people sought refuge within the Empire in the region now known as Bulgaria, but Athanaric seems to have fled into Transylvania. Being attacked there by two Ostrogothic chiefs he also, in 381, sought the protection of the Roman emperor. Theodosius I. received him courteously, and he was profoundly impressed by the glories of Constantinople, but on the fifteenth day after his arrival he died, and was honoured by the emperor with a magnificent funeral.

ATHANASIUS (293–373), bishop of Alexandria and saint, one of the most illustrious defenders of the Christian faith, was born probably at Alexandria. Of his family and of his early education nothing can be said to be known. According to the legend, the boy is said to have once baptized some of his playmates and thereupon to have been taken into his house by Bishop Alexander, who recognized the validity of this proceeding. It is certain that Athanasius was young when he took orders, and that he must soon have entered into close relations with his bishop, whom, after the outbreak of the Arian controversy, he accompanied as archdeacon to the council of Nicaea. In the sessions and discussions of the council he could take no part; but in unofficial conferences he took sides vigorously, according to his own evidence, against the Arians, and was certainly not without influence. He had already, before the opening of the Council, defined his personal attitude towards the dogmatic problem in two essays, *Against the Gentiles* and *On the Incarnation*, without, however, any special relation to the Arian controversy.

The essay *On the Incarnation* is the *locus classicus* for the presentation of the teaching of the ancient church on the subject of salvation. In this the great idea that God himself had entered into humanity becomes dominant. The doom of death under which mankind had sighed since Adam's fall could only then be averted, when the immortal Word of God (Λόγος) assumed a mortal body, and, by yielding this to death for the sake of all, abrogated once for all the law of death, of which the power had been spent on the body of the Lord. Thus was rendered possible the leading back of mankind to God, of which the sure pledge lies in the grace of the resurrection of Christ. Athanasius would hear of no questioning of this religious mystery. In the catchword *Homousios*, which had been added to the creed at Nicaea, he too recognized the best formula for the expression of the mystery, although in his own writings he made but sparing use of it. He was in fact less concerned with the formula than with the content. Arians and Semi-Arians seemed to him to be pagans, who worship the creature, instead of the God who created all things, since they teach two gods, one having no beginning, the other having a beginning in Time and therefore of the same nature as the heathen gods, since, like them, he is a creature. Athanasius has no terms for the definition of the Persons in the one "Divine" (τὸ θεῖον), which are in their substance one; and yet he is certain that this "Divine" is not a mere abstraction, but something truly personal: "They are One," so he wrote later in his *Discourses against the Arians*, "not as though the unity were torn into two parts, which outside the unity would be nothing, nor as though the unity bore two names, so that one and the same is at one time Father and then his own Son, as the heretic Sabellius imagined. But they are two, for the Father is Father, and the Son is not the same, but, again, the Son is Son, and not the Father himself. But their Nature (φύσις) is one, for the Begotten is not dissimilar (ἀνόμοιος) to the Begetter, but his image, and everything that is the Father's is also the Son's."

Five months after the return from the council of Nicaea Bishop Alexander died; and on the 8th of February 326 Athanasius, at the age of thirty three, became his successor. The first years of his episcopate were tranquil; then the storms in which the remainder of his life was passed began to gather round him. The council had by no means composed the divisions in the Church which the Arian controversy had provoked. Arius himself still lived, and his friend Eusebius of Nicomedia rapidly regained influence over the emperor Constantine. The result was a demand made by the emperor that Arius should be readmitted to communion. Athanasius stood firm, but many accusers soon rose up against one who was known to be under the frown of the imperial displeasure. He was charged with cruelty, even with sorcery and murder. It was reported that a bishop of the Meletian party (see MELETIUS) in the Thebaid, of the name of Arsenius, had been unlawfully put to death by him. He was easily able to clear himself of these charges ; but the hatred of his enemies was not relaxed, and in the summer of 335 he was peremptorily ordered to appear at Tyre, where a council had been summoned to sit in judgment upon his conduct. There appeared plainly a predetermination to condemn him, and he fled from Tyre to Constantinople to appeal to the emperor himself. Refused at first a hearing, his perseverance was at length rewarded by the emperor's assent to his reasonable request that his accusers should be brought face to face with him in the imperial presence. Accordingly the leaders of the council, the most conspicuous of whom were Eusebius of Nicomedia and his namesake of Caesarea, were summoned to Constantinople. Here they did not attempt to repeat their old charges, but found a more effective weapon to their hands in a new charge of a political kind—that Athanasius had threatened to stop the Alexandrian corn-ships bound for Constantinople. It is very difficult to understand how far there was truth in the persistent accusations made against the prince-bishop of Alexandria. Probably there was in the very greatness of his character and the extent of his popular influence a certain species of dominance which lent a colour of truth to some of the things said against him. On the present occasion his accusers succeeded at once in arousing the imperial jealousy. Without obtaining a hearing, he was banished at the end of 335 to Trèves in Gaul. This was the first banishment of Athanasius, which lasted about one year and a half. It was brought to a close by the death of Constantine, and the accession as emperor of the West of Constantine II., who, in June 337, allowed Athanasius to return to Alexandria.

He reached his see on the 23rd of November 337, and, as he himself has told us, "the people ran in crowds to see his face; the churches were full of rejoicing; thanksgivings were everywhere offered up ; the ministers and clergy thought the day the happiest in their lives." But this period of happiness was destined to be short-lived. His position as bishop of Alexandria placed him, not under his patron Constantine, but under Constantius, another son of the elder Constantine, who had succeeded to the throne of the East. He in his turn fell, as his father had done in later years, under the influence of Eusebius of Nicomedia, who in the latter half of 339 was transferred to the see of Constantinople, the new seat of the imperial court. A second expulsion of Athanasius was accordingly resolved upon. The old accusations against him were revived, and he was further charged with having set at naught the decision of a council. On the 18th of March 339 the exarch of Egypt suddenly confronted Athanasius with an imperial edict, by which he was deposed and a Cappadocian named Gregory was nominated bishop in his place. On the following day, after tumultuous scenes, Athanasius fled, and four days later Gregory was installed by the aid of the soldiery. On the first opportunity, Athanasius went to Rome, to "lay his case before the church." A synod assembled at Rome in the autumn of 340, and the great council—probably that which met at Sardica in 342 or 343, where the Orientals refused to meet the representatives of the Western church—declared him guiltless. This decision, however, had no immediate effect in favour of Athanasius. Constantius continued for some time implacable, and the bold action of the Western bishops only incited the Arian party in Alexandria to fresh severities. But the death of the intruder Gregory, on the 26th of June 345, opened up a way of reconciliation. Constantius decided to yield to the importunity of his brother Constans, who had succeeded Constantine II. in the West; and the result was the restoration of Athanasius for the second time, on the 21st of October 346. Again he returned to Alexandria amid the enthusiastic demonstrations of the populace, which is described by Gregory of Nazianzus, in his panegyric on Athanasius, as streaming forth like "another Nile" to meet him afar off as he approached the city.

The six years of his residence in the West had given Athanasius the opportunity of displaying a momentous activity. He made long journeys in Italy, in Gaul, and as far as Belgium. Everywhere he laboured for the Nicene faith, and the impression made by his personality was so great that to hold fast the orthodox faith and to defend Athanasius were for many people one and the same thing. This was shown when, after the death of the emperor Constans, Constantius became sole ruler of East and West. With the help of counsellors more subtle than discerning, the emperor, with the object of uniting the various parties in the Church at any cost, sought for the most colourless possible formula of belief, which he hoped to persuade all the bishops to accept. As his efforts remained for years fruitless, he used force. "My will is your guiding-line," he exclaimed in the summer of 355 to the bishops who had assembled at Milan in response to his orders. A series of his most defiant opponents had to go into banishment, Liberius of Rome, Hilarius of Poitiers and Hosius of Corduba, the last-named once the confidant of Constantine and the actual originator of the *Homousios*, and now nearly a hundred years old. At length came the turn of Athanasius, now almost the sole upholder of the banner of the Nicene creed in the East. Several attempts to expel him failed owing to the attitude of the populace. On the night of the 8th-9th of February 356, however, when the bishop was holding the Vigils, soldiers and police broke into the church of Theonas. Athanasius himself has described the scene for us : "I was seated upon my chair, the deacon was about to read the psalm, the people to answer, 'For his mercy endureth for ever.' The solemn act was interrupted; a panic arose." The bishop, who was at first unwilling to save himself, until he knew that his faithful followers were in safety, succeeded in escaping, leaving the town and finding a hiding-place in the country. The solitudes of Upper Egypt, where numerous monasteries and hermitages had been planted, seem at this time to have been his chief shelter. In this case, benefit was repayed by benefit, for Athanasius during his episcopate had been a zealous promoter of asceticism and monachism. With Anthony the hermit and Pachomius the founder of monasteries, he had maintained personal relations, and the former he had commemorated in his *Life of Anthony*. During his exile his time was occupied in writing on behalf of his cause, and to this period belong some of his most important works, above all the great *Orations* or *Discourses against the Arians*, which furnish the best exposition of his theological principles.

During his absence the see of Alexandria was left without a pastor. It is true that George of Cappadocia had taken his place; but he could only maintain himself for a short while (February 357–October 358). The great majority of the population remained faithful to the exile. At length, in November 361, the way was opened to him for his return to his see by the death of Constantius. Julian, who succeeded to the imperial throne, professed himself indifferent to the contentions of the Church, and gave permission to the bishops exiled in the late reign to return home. Among others, Athanasius availed himself of this permission, and in February 362 once more seated himself upon his throne, amid the rejoicings of the people. He had begun his episcopal labours with renewed ardour, and assembled his bishops in Alexandria to decide various important questions, when an imperial mandate again—for the fourth time—drove him from his place of power. The faithful gathered around him weeping. "Be of good heart," he said, "it is but a cloud: it will pass." His forecast proved true; for within a few months Julian had closed his brief career of pagan revival. As early as September 363, Athanasius was able to travel to Jovian, the new emperor, who had sent him a letter praising his Christian fidelity and encouraging him to resume his work. He returned to Alexandria on the 20th of February 364. With the emperor he continued to maintain friendly relations; but the period of repose was short. In the spring of 365, after the accession of Valens to the throne, troubles again arose. Athanasius was once more compelled to seek safety from his persecutors in concealment (October 365), which lasted, however, only for four months. In February 366 he resumed his episcopal labours, in which he henceforth remained undisturbed. On the 2nd of May 373, having consecrated one of his presbyters as his successor, he died quietly in his own house.

Athanasius was a man of action, but he also knew how to use his pen for the furtherance of his cause. He left a large number of writings, which cannot of course be compared with those of an Origen, a Basil, or a Gregory of Nyssa. Athanasius was no systematic theologian. All his treatises are occasional pieces, born of controversy and intended for controversial ends. The interest in abstract exposition of clearly formulated theological ideas is everywhere subordinate to the polemical purpose. But all these writings are instinct with a living personal faith, and serve for the defence of the cause; for it was not about words that he was contending. Even those who do not sympathize with the cause which Athanasius steadfastly defended cannot but admire his magnanimous and heroic character. If he was imperious in temper and inflexible in his conception of the Christian faith, he possessed a great heart and a great intellect, inspired with an enthusiastic devotion to Christ. As a theologian, his main distinction was his zealous advocacy of the essential divinity of Christ. Christianity in its Arian conception would have evaporated in a new polytheism. To have set a dam against this process with the whole force of a mighty personality constitutes the importance of Athanasius in the world's history. It is with good reason that the Church honours him as the "Great," and as the "Father of Orthodoxy."

The best edition of the works of Athanasius is the so-called Maurine edition of Bernard de Montfaucon in 3 vols. (Paris, 1698); this was enlarged in the 3rd edition by Giustiniani (4 vols., Padua, 1777), and is printed in this form in Migne's *Patrologia*, vols. xxv.-xxviii. An English translation of selections, with excellent introductions to the several writings, was published by Archibald Robertson in the *Library of the Nicene and Post-Nicene Fathers*, second series, vol. 4 (Oxford and New York, 1892). There is no biography satisfactory from the modern point of view. Studies preliminary to such a biography began to be published by E. Schwartz in his essays, "Zur Geschichte des Athanasius" (in the *Nachrichten der königlichen Gesellschaft der Wissenschaften zu Göttingen*, 1904, &c.). The life of Athanasius, however, is so completely intertwined with the history of his time that it is permissible to refer, for a knowledge of him, to the general descriptions which will be found at the close of the article ARIUS. Of the older literature, Tillemont's *Mémoires pour servir à l'histoire ecclésiastique des six premiers siècles*, vols. vi. and viii., are still a mine of material for the historian. Of the newer literature the following deserve to be read:—Johann Adam Möhler, *Athanasius der Grosse und die Kirche seiner Zeit*, 2 vols. (2nd ed., Mainz, 1844); and Fr. Boehringer, "Arius und Athanasius," *Die Kirche Christi und ihre Zeugen*, vol. i. part 2 (2nd ed., Stuttgart, 1874). (G. K.)

ATHAPASCAN, a widely distributed linguistic stock of North American Indians, the chief tribes included being the Chippewyan, Navajo, Apache, Jicarilla, Lipan, Hupa and Wailaki. The Athapascan family is geographically divided into Northern, Pacific and Southern. The Northern division (Tinneh or Déné) is about Alaska, and the Yukon and Mackenzie rivers,—the eponymous "Athabasca" tribe living round Lake Athabasca, in the province of Alberta in Canada. The Pacific division covers a strip of territory, some 400 m. in length, from Oregon southwards into California. The Southern division includes Arizona and New Mexico, parts of Utah, Colorado, Kansas and Texas, and the northern part of Mexico. The typical tribes are those of the Northern division.

See *Handbook of American Indians* (Washington, 1907).

ATHARVA VEDA, the fourth book of the Vedas, the ancient scriptures of the Brahman religion. Like the other Vedas it is divided into Samhita, Brahmanas and Upanishads, representing the spiritual element and its magical and nationalistic development. The mantras or sayings composing the Samhita of the Atharva Veda differ from those of the other Vedas by being in the form of spells rather than prayers or hymns, and seem to indicate a stage of religion lower than that of the Rig Veda.

ATHEISM (from Gr. ἀ-, privative, and θεός, God), literally a system of belief which denies the existence of God. The term as generally used, however, is highly ambiguous. Its meaning varies (*a*) according to the various definitions of deity, and especially (*b*) according as it is (i.) deliberately adopted by a thinker as a description of his own theological standpoint, or (ii.) applied by one set of thinkers to their opponents. As to (*a*), it is obvious that atheism from the standpoint of the Christian is a very different conception as compared with atheism as understood by a Deist, a Positivist, a follower of Euhemerus or Herbert Spencer, or a Buddhist. But the ambiguities arising from the points of view described in (*b*) are much more difficult both intellectually and in their practical social issues. Thus history shows how readily the term has been used in the most haphazard manner to describe even the most trivial divergence of opinion concerning points of dogma. In other words, "atheism" has been used generally by the orthodox adherents of one religion, or even of a single sect, for all beliefs which are different or even differently expressed. It is in fact in these cases, like "heterodoxy," a term of purely negative significance, and its intellectual value is of the slightest. The distinction between the terms "religion" and "magic" is, in a similar way, often due merely to rivalry between the adherents of two or more mutually exclusive religions brought together in the same community. When the psalmist declares that "the fool hath said in his heart, there is no God," he probably does not refer to theoretical denial, but to a practical disbelief in God's government of human affairs, shown in disobedience to moral laws. Socrates was charged with "not believing in the gods the city believes in." The cry of the heathen populace in the Roman empire against the Christians was "Away with the atheists! To the lions with the Christians!" The ground for the charge was probably the lack of idolatry in all Christian worship. Spinoza, for whom God alone existed, was persecuted as an atheist. A common designation of Knox was "the atheist," although it was to him "matter of satisfaction that our most holy religion is founded on faith, not on reason."

In its most scientific and serious usage the term is applied to that state of mind which does not find deity (*i.e.* either one or many gods) in or above the physical universe. Thus it has been applied to certain primitive savages, who have been thought (*e.g.* by Lord Avebury in his *Prehistoric Times*) to have no religious belief; it is, however, the better opinion that there are no peoples who are entirely destitute of some rudimentary religious belief. In the second place, and most usually, it is applied to a purely intellectual, metaphysical disbelief in the existence of any god, or of anything supernatural. In this connexion it is usual to distinguish three types of atheism:—the *dogmatic*, which denies the existence of God positively; the *sceptical*, which distrusts the capacity of the human mind to discover the existence of God; and the *critical*, which doubts the validity of the theistic argument, the proofs for the existence of God. That the first type of atheism exists, in spite of the denials of those who favour the second or the third, may be proved by the utterances of men like Feuerbach, Flourens or Bradlaugh. "There is no God," says Feuerbach, "it is clear as the sun and as evident as the day that there is no God, and still more that there can be none." With greater passion

Flourens declares "Our enemy is God. Hatred of God is the beginning of wisdom. If mankind would make true progress, it must be on the basis of atheism." Bradlaugh maintained against Holyoake that he would fight until men respected the name "atheist." The answer to dogmatic atheism, that it implies infinite knowledge, has been well stated in John Foster's *Essays*, and restated by Chalmers in his *Natural Theology*, and its force is recognized in Holyoake's careful qualification of the sense in which secularism accepts atheism, "always explaining the term atheist to mean 'not seeing God' visually or inferentially, never suffering it to be taken for anti-theism, that is, hating God, denying God—as *hating* implies personal knowledge as the ground of dislike, and *denying* implies infinite knowledge as the ground of disproof." But dogmatic atheism is rare compared with the sceptical type, which is identical with agnosticism (*q.v.*) in so far as it denies the capacity of the mind of man to form any conception of God, but is different from it in so far as the agnostic merely holds his judgment in suspense, though, in practice, agnosticism is apt to result in an attitude towards religion which is hardly distinguishable from a passive and unaggressive atheism. The third or critical type may be illustrated by *A Candid Examination of Theism* by "Physicus" (G. J. Romanes), in which the writer endeavours to establish the weakness of the proofs for the existence of God, and to substitute for theism Spencer's physical explanation of the universe, and yet admits how unsatisfying to himself the new position is. "When at times I think, as think at times I must, of the appalling contrast between the hallowed glory of that creed which once was mine, and the lonely mystery of existence as now I find it—at such times I shall ever feel it impossible to avoid the sharpest pang of which my nature is susceptible."

Atheism has to meet the protest of the heart as well as the argument of the mind of mankind. It must be judged not only by theoretical but by practical arguments, in its relations either to the individual or to a society. Voltaire himself, speaking as a practical man rather than as a metaphysician, declared that if there were no God it would be necessary to invent one; and if the analysis is only carried far enough it will be found that those who deny the existence of God (in a conventional sense) are all the time setting up something in the nature of deity by way of an ideal of their own, while fighting over the meaning of a word or its conventional misapplication.

ATHELM (d. 923), English churchman, is said to have been a monk of Glastonbury before his elevation in 909 to the see of Wells, of which he was the first occupant. In 914 he became archbishop of Canterbury.

ATHELNEY, a slight eminence of small extent in the low level tract about the junction of the rivers Tone and Parrett in Somersetshire, England. It was formerly isolated by marshes and accessible only by boat or artificial causeway, and under these conditions it gained its historical fame as the retreat of King Alfred in 878–879 when he was unable to withstand the incursions of the Danes. After regaining his throne he founded a monastery here in gratitude for the retreat afforded him by the island; no traces of it exist above ground, but remains have been excavated. There was also found here, in 1693, the celebrated Alfred jewel, bearing his name, and preserved in the Ashmolean Museum at Oxford. An inscribed pillar commemorating the king was set up in 1801. The name of Athelney signifies the Isle of Princes (A.S. *Æthelingaea*). Athelney is a railway station on a branch of the Great Western line.

ATHENA (the Attic form of the Homeric Athene, also called Athenaia, Pallas Athene, Pallas), one of the most important goddesses in Greek mythology. With Zeus and Apollo, she forms a triad which represents the embodiment of all divine power. No satisfactory derivation of the name Athena has been given[1]; Pallas, at first an epithet, but after Pindar used by itself, may possibly be connected with παλλακή ("maiden"). Athena has been variously described as the pure aether, the storm-cloud, the dawn, the twilight; but there is little evidence that she was regarded as representing any of the physical powers of nature, and it is better to endeavour to form an idea of her character and attributes from a consideration of her cult-epithets and ritual. According to the legend, her father Zeus swallowed his wife Metis ("counsel"), when pregnant with Athena, since he had been warned that his children by her might prove stronger than himself and dethrone him. Hephaestus (or Prometheus) subsequently split open his head with a hatchet, and Athena sprang forth fully armed, uttering a loud shout of victory (Hesiod, *Theogony*, 886; Pindar, *Olympia*, vii. 35). In Crete she was said to have issued from a cloud burst asunder by Zeus. According to Roscher, the manner of her birth represents the storm-cloud split by lightning; Farnell (*Cults of the Greek States*, i. p. 285) sees in it an indication that, as the daughter of Metis, Athena was already invested with a mental and moral character, and explains the swallowing of Metis (for which compare the story of Cronus and his children) by the desire to attribute an extraordinary birth to one in whom masculine traits predominated. In another account (as Τριτογένεια) she is the daughter of the river Triton, to which various localities were assigned, and wherever there was a river (or lake) of that name, the inhabitants claimed that she was born there. It is probable that the name originated in Boeotia (C. O. Müller, *Geschichten hellenischer Stämme*, i. pp. 351-357; but see Macan on Herodotus, iv. 180), whence it was conveyed by colonists to Cyrene and thence to Libya, where there was a river Triton. Here some local divinity, a daughter of Poseidon, connected with the water and also of a warlike character, was identified by the colonists with their own Athena. In any case, it is fairly certain that Tritogeneia means "water-born," although an old interpretation derived it from τριτώ, a supposed Boeotian word meaning "head," which further points to the name having originated in Boeotia. Roscher suggests that the localization of her birthplace in the extreme west points to the western sea, the home of cloud and storm.

In Homer Athena already appears as the goddess of counsel, of war, of female arts and industries, and the protectress of Greek cities, this last aspect of her character being the most important and pronounced. Hence she is called πολιάς, πολιοῦχος, in many Greek states, and is frequently associated with Ζεὺς πολιεύς. The most celebrated festival of the city-goddess was the Panathenaea at Athens and other places. Other titles of kindred meaning are ἀρχηγέτις ("founder") and παναχαΐς, the protectress of the Achaean league. At Athens she presided over the phratries or clans, and was known as ἀπατουρία and φρατρία, and sacrifice was offered to her at the festival Apaturia. The title μήτηρ, given her by the inhabitants of Elis, whose women, according to the legend, she had blessed with abundance of children, seems at variance with the generally-recognized conception of her as παρθένος; but μήτηρ may bear the same meaning as κουροτρόφος, the fosterer of the young, in harmony with her aspect as protectress of civic and family life. At Alalcomenae, near the Tritonian lake in Boeotia, she was ἀλαλκομενηΐς ("defender"). Her temple, which was pillaged by Sulla, contained an ivory image, which was said to have fallen from heaven. The inhabitants claimed that the goddess was born there and brought up by a local hero Alalcomeneus. Her images, called Palladia, which guarded the heights (cf. her epithets ἀκρία, κραναία), represented her with shield uplifted, brandishing her spear to keep off the foe. The cult of Athena Itonia, whose earliest seat appears to have been amongst the Thessalians, who used her name as a battle-cry, made its way to Coronea in Boeotia, where her sanctuary was the seat of the Pamboeotian confederacy. The meaning of Itonia is obscure: Dümmler connects it with ἰτεῶνες, the "willow-beds" on the banks of the river Coralios (the river of the maiden, *i.e.* Athena); Jebb (on Bacchylides, *fr.* xi. 2) suggests a derivation from ἱέναι, the goddess of the "onset." At Thebes she was worshipped as Athena Onka or Onga, of equally uncertain derivation (possibly from ὄγκος, "a height"). Peculiar to Arcadia is the title Athena Alea, probably = "warder off of evil," although others explain it as = "warmth," and see in it an allusion to her physical nature as one of the powers of light. Farnell (*Cults*, p. 275) points out that at the same time she is certainly looked upon as in some way connected with the health-divinities, since in her temple she is grouped with Asclepius and Hygieia (see Hygieia).

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[1] O. Gruppe (*Griechische Mythologie*, ii. p. 1194) thinks that it probably means "without mother's milk," either in an active or in a passive sense—"not giving suck," or "unsuckled," in her character as the virgin goddess, or as springing from the head of Zeus. In support of this view he refers to Hesychius (*θήνιον· γάλα*) and a passage in Athenagoras (*Legatio pro Christianis*, 17), where it is stated that Athena was sometimes called Ἀθηλᾶ or Ἀθήλη. For Pallas, he prefers the old etymology from πάλλω (to "shake"), rather in the sense of "earth-shaker" than "lance-brandisher."

She already appears as the goddess of counsel (πολύβουλος) in the *Iliad* and in Hesiod. The Attic bouleutae took the oath by Athena Boulaia; at Sparta she was ἀγοραία, presiding over the popular assemblies in the market-place; in Arcadia μηχανῖτις, the discoverer of devices. The epithet προνοία ("forethought") is due, according to Farnell, to a confusion with προναία, referring to a statue of the goddess standing "before a shrine," and arose later (probably spreading from Delphi), some time after the Persian wars, in which she repelled a Persian attack on the temples "by divine forethought"; another legend attributes the name to her skill in assisting Leto at the birth of Apollo and Artemis. With this aspect of her character may be compared the Hesiodic legend, according to which she was the daughter of Metis. Her connexion with the trial of Orestes, the introduction of a milder form of punishment for justifiable homicide, and the institution of the court τὸ ἐπὶ Παλλαδίῳ, show the important part played by her in the development of legal ideas.

The protectress of cities was naturally also a goddess of war. As such she appears in Homer and Hesiod and in post-Homeric legend as the slayer of the Gorgon and taking part in the battle of the giants. On numerous monuments she is represented as ἀρεία, "the warlike," νικηφόρος, "bringer of victory," holding an image of Nike (*q.v.*) in her outstretched hand (for other similar epithets see Roscher's *Lexikon*). She was also the goddess of the arts of war in general; στοιχεία, she who draws up the ranks for battle, ζωστηρία, she who girds herself for the fray. Martial music (cp. Ἀθήνη σάλπιγξ, "trumpet") and the Pyrrhic dance, in which she herself is said to have taken part to commemorate the victory over the giants, and the building of war-ships were attributed to her. She instructed certain of her favourites in gymnastics and athletics, as a useful training for war. The epithets ἱππία, χαλινῖτις, δαμάσιππος, usually referred to her as goddess of war-horses, may perhaps be reminiscences of an older religion in which the horse was sacred to her. As a war-goddess, she is the embodiment of prudent and intelligent tactics, entirely different from Ares, the personification of brute force and rashness, who is fitly represented as suffering defeat at her hands. She is the patroness and protectress of those heroes who are distinguished for their prudence and caution, and in the Trojan War she sides with the more civilized Greeks.

The goddess of war develops into the goddess of peace and the pursuits connected with it. She is prominent as the promoter of agriculture in Attic legend. The Athenian hero Erechtheus (Erichthonius), originally an earth-god, is her foster-son, with whom she was honoured in the Erechtheum on the Acropolis. Her oldest priestesses, the dew-sisters—Aglauros, Herse, Pandrosos—signify the fertilization of the earth by the dew, and were probably at one time identified with Athena, as surnames of whom both Aglauros and Pandrosos are found. The story of the voluntary sacrifice of the Attic maiden Aglauros on behalf of her country in time of war (commemorated by the ephebi taking the oath of loyalty to their country in her temple), and of the leap of the three sisters over the Acropolis rock (see Erechtheus), probably points to an old human sacrifice. Athena also gave the Athenians the olive-tree, which was supposed to have sprung from the bare soil of the Acropolis, when smitten by her spear, close to the horse (or spring of water) produced by the trident of Poseidon, to which he appealed in support of his claim to the lordship of Athens. She is also connected with Poseidon in the legend of Erechtheus, not as being in any way akin to the former in nature or character, but as indicating the contest between an old and a new religion. This god, whose worship was introduced into Athens at a later date by the Ionian immigrants, was identified with Erechtheus-Erichthonius (for whose birth Athena was in a certain sense responsible), and thus was brought into connexion with the goddess, in order to effect a reconciliation of the two cults. Athena was said to have invented the plough, and to have taught men to tame horses and yoke oxen. Various arts were attributed to her—shipbuilding, the goldsmith's craft, fulling, shoemaking and other branches of industry. As early as Homer she takes especial interest in the occupations of women; she makes Hera's robe and her own peplus, and spinning and weaving are often called "the works of Athena." The custom of offering a beautifully woven peplus at the Panathenaic festival is connected with her character as Ergane the goddess of industry.[1] As patroness of the arts, she is associated with Hephaestus (one of her titles is Ἡφαιστία) and Prometheus, and in Boeotia she was regarded as the inventress of the flute. According to Pindar, she imitated on the flute the dismal wail of the two surviving Gorgons after the death of Medusa. The legend that Athena, observing in the water the distortion of her features caused by playing that instrument, flung it away, probably indicates that the Boeotians whom the Athenians regarded with contempt, used the flute in their worship of the Boeotian Athena. The story of the slaying of Medusa by Athena, in which there is no certain evidence that she played a direct part, explained by Roscher as the scattering of the storm-cloud, probably arose from the fact that she is represented as wearing the Gorgon's head as a badge.

As in the case of Aphrodite and Apollo, Roscher in his *Lexikon* deduces all the characteristics of Athena from a single conception—that of the goddess of the storm or the thunder-cloud (for a discussion of such attempts see Farnell, *Cults*, i. pp. 3, 263). There seems little reason for regarding her as a nature-goddess at all, but rather as the presiding divinity of states and cities, of the arts and industries—in short, as the goddess of the whole intellectual side of human life.

Except at Athens, little is known of the ceremonies or festivals which attended her worship. There we have the following. (1) The ceremony of the *Three Sacred Ploughs*, by which the signal for seed-time was given, apparently dating from a period when agriculture was one of the chief occupations of her worshippers. (2) The *Procharisteria* at the end of winter, at which thanks were offered for the germination of the seed. (3) The *Scirophoria*, with a procession from the Acropolis to the village of Skiron, in the height of summer, the priests who were to entreat her to keep off the summer heat walking under the shade of parasols (σκίρον) held over them; others, however, connect the name with σκῖρος ("gypsum"), perhaps used for smearing the image of the goddess. (4) The *Oschophoria*, at the vintage season, with races among boys, and a procession, with songs in praise of Dionysus and Ariadne. (5) The *Chalkeia* (feast of smiths), at which the birth of Erechtheus and the invention of the plough were celebrated. (6) The *Plynteria* and *Callynteria*, at which her ancient image and peplus in the Erechtheum and the temple itself were cleaned, with a procession in which bunches of figs (frequently used in lustrations) were carried. (7) The *Arrhephoria* or Errephoria (perhaps = *Ersephoria*, "dew-bearing"), at which four girls, between seven and eleven years of age, selected from noble families, carried certain unknown sacred objects to and from the temple of Aphrodite "in the gardens" (see J. E. Harrison, *Classical Review*, April 1889). (8) The *Panathenaea*, at which the new robes for the image of the goddess were carried through the city, spread like a sail on a mast. The reliefs of the frieze of the cella of the Parthenon enable us to form an idea of the procession. Athletic games, open to all who traced their nationality to Athens, were part of this festival. Mention should also be made of the Argive ceremony, at which the *xoanon* (ancient wooden statue) of Athena was washed in the river Inachus, a symbol of her purification after the Gigantomachia.

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[1] According to J. E. Harrison in *Classical Review* (June 1894), Athena Ergane is the goddess of the fruits of the field and the procreation of children.

The usual attributes of Athena were the helmet, the aegis, the round shield with the head of Medusa in the centre, the lance, an olive branch, the owl, the cock and the snake. Of these the aegis, usually explained as a storm-cloud, is probably intended as a battle-charm, like the Gorgon's head on the shield and the faces on the shields of Chinese soldiers; the owl probably represents the form under which she was worshipped in primitive times, and subsequently became her favourite bird (the epithet γλαυκῶπις, meaning "keen-eyed" in Homer, may have originally signified "owl-faced"); the snake, a common companion of the earth deities, probably refers to her connexion with Erechtheus-Erichthonius.

As to artistic representations of the goddess, we have first the rude figure which seems to be a copy of the Palladium; secondly, the still rude, but otherwise more interesting, figures of her, as *e.g.* when accompanying heroes, on the early painted vases; and thirdly, the type of her as produced by Pheidias, from which little variation appears to have been made. Of his numerous statues of her, the three most celebrated were set up on the Acropolis. (1) Athena *Parthenos*, in the Parthenon. It was in ivory and gold, and 30 ft. high. She was represented standing, in a long tunic; on her head was a helmet, ornamented with sphinxes and griffins; on her breast was the aegis, fringed with serpents and the Gorgon's head in centre. In her right hand was a Nike or winged victory, while her left held a spear, which rested on a shield on which were represented the battles of the Amazons with the giants. (2) A colossal statue said to have been formed from the spoils taken at Marathon, the so-called Athena *Promachos*. (3) Athena *Lemnia*, so called because it had been dedicated by the Athenian cleruchies in Lemnos. In this she was represented without arms, as a brilliant type of virgin beauty. The two last statues were of bronze. From the time of Pheidias calm earnestness, self-conscious might, and clearness of intellect were the main characteristics of the goddess. The eyes, slightly cast down, betoken an attitude of thoughtfulness; the forehead is clear and open; the mouth indicates firmness and resolution. The whole suggests a masculine rather than a feminine form.

From Greece the worship of Athena extended to Magna Graecia, where a number of temples were erected to her in various places. In Italy proper she was identified with Minerva (*q.v.*).

See articles in Pauly-Wissowa's *Realencyclopädie*; W. H. Roscher's *Lexikon der Mythologie*; Daremberg and Saglio's *Dictionnaire des antiquités* (*s.v.* "Minerva"); L. Preller, *Griechische Mythologie*; W. H. Roscher, "Die Grundbedeutung der Athene," in *Nektar und Ambrosia* (1883); F. A. Voigt, "Beiträge zur Mythologie des Ares und Athena," in *Leipziger Studien*, iv. (1881); L. R. Farnell, *The Cults of the Greek States*, i. (1896); J. E. Harrison, *Prolegomena to the Study of Greek Religion* (1903), for the festivals especially; O. Gruppe, *Griechische Mythologie*, ii. (1907). In the article GREEK ART, fig. 21 represents Athena in the act of striking a prostrate giant; fig. 38 a statuette of Athena Parthenos, a replica of the work of Pheidias. (J. H. F.)

ATHENAEUM, a name originally applied in ancient Greece (Ἀθήναιον) to buildings dedicated to Athena, and specially used as the designation of a temple in Athens, where poets and men of learning were accustomed to meet and read their productions. The academy for the promotion of learning which the emperor Hadrian built (about A.D. 135) at Rome, near the Forum, was also called the Athenaeum. Poets and orators still met and discussed there, but regular courses of instruction were given by a staff of professors in rhetoric, jurisprudence, grammar and philosophy. The institution, later called Schola Romana, continued in high repute till the 5th century. Similar academies were also founded in the provinces and at Constantinople by the emperor Theodosius II. In modern times the name has been applied to various academies, as those of Lyons and Marseilles, and the Dutch high schools; and it has become a very general designation for literary clubs. It is also familiar as the title of several literary periodicals, notably of the London literary weekly founded in 1828.

ATHENAEUS, of Naucratis in Egypt, Greek rhetorician and grammarian, flourished about the end of the 2nd and the beginning of the 3rd century A.D. Suidas only tells us that he lived "in the times of Marcus"; but the contempt with which he speaks of Commodus (died 192) shows that he survived that emperor. Athenaeus himself states that he was the author of a treatise on the *thratta*—a kind of fish mentioned by Archippus and other comic poets—and of a history of the Syrian kings, both of which works are lost. We still possess the *Deipnosophistae*, which may mean dinner-table philosophers or authorities on banquets, in fifteen books. The first two books, and parts of the third, eleventh and fifteenth, are only extant in epitome, but otherwise we seem to possess the work entire. It is an immense store-house of miscellaneous information, chiefly on matters connected with the table, but also containing remarks on music, songs, dances, games, courtesans. It is full of quotations from writers whose works have not come down to us; nearly 800 writers and 2500 separate writings are referred to by Athenaeus; and he boasts of having read 800 plays of the Middle Comedy alone. The plan of the *Deipnosophistae* is exceedingly cumbrous, and is badly carried out. It professes to be an account given by the author to his friend Timocrates of a banquet held at the house of Laurentius (or Larentius), a scholar and wealthy patron of art. It is thus a dialogue within a dialogue, after the manner of Plato, but a conversation of sufficient length to occupy several days (though represented as taking place in one) could not be conveyed in a style similar to the short conversations of Socrates. Among the twenty-nine guests are Galen and Ulpian, but they are all probably fictitious personages, and the majority take no part in the conversation. If Ulpian is identical with the famous jurist, the *Deipnosophistae* must have been written after his death (228); but the jurist was murdered by the praetorian guards, whereas Ulpian in Athenaeus dies a natural death. The conversation ranges from the dishes before the guests to literary matters of every description, including points of grammar and criticism; and they are expected to bring with them extracts from the poets, which are read aloud and discussed at table. The whole is but a clumsy apparatus for displaying the varied and extensive reading of the author. As a work of art it can take but a low rank, but as a repertory of fragments and morsels of information it is invaluable.

Editio princeps, Aldine, 1524; Casaubon, 1597–1600; Schweighäuser, 1801–1807; Dindorf, 1827; Meineke, 1859–1867; Kaibel, 1887–1890; English translation by Yonge in Bohn's *Classical Library*.

ATHENAGORAS, a Christian apologist of the 2nd century A.D., was, according to an emendator of the Paris Codex 451 of the 11th century, a native of Athens. The only sources of information regarding him are a short notice by Philip of Side, in Pamphylia (*c.* A.D. 420), and the inscription on his principal work. Philip—or rather the compiler who made excerpts from him—says that he was at the head of an Alexandrian school (the catechetical), that he lived in the time of Hadrian and Antoninus, to whom he addressed his *Apology*, and that Clement of Alexandria was his pupil; but these statements are more than doubtful. The inscription on the work describes it as the "Embassy of Athenagoras, the Athenian, a philosopher and a Christian concerning the Christians, to the Emperors Marcus Aurelius Antoninus and Lucius Aurelius Commodus, &c." This statement has given rise to considerable discussion, but from it and internal evidence the date of the *Apology* (Πρεσβεία περὶ Χριστιανῶν) may be fixed at about A.D. 177. Athenagoras is also the author of a discourse on the resurrection of the body, which is not authenticated otherwise than by the titles on the various manuscripts. In the *Apology*, after contrasting the judicial treatment of Christians with that of other accused persons, he refutes the accusations brought against the Christians of atheism, eating human flesh and licentiousness, and in doing so takes occasion to make a vigorous and skilful attack on pagan polytheism and mythology. The discourse on the resurrection answers objections to the doctrine, and attempts to prove its truth from considerations of God's purpose in the creation of man, His justice and the nature of man himself. Athenagoras is a powerful and clear writer, who strives to comprehend his opponents' views and is acquainted with the classical writers. He used the *Apology* of Justin, but hardly the works of Aristides or Tatian. His theology is strongly tinged with Platonism, and this may account for his falling into desuetude. His discussion of the Trinity has some points of speculative interest, but it is not sufficiently worked out; he regards the Son as the Reason or Wisdom of the Father, and the Spirit as a divine effluence. On some other points, as the nature of matter, the immortality of the soul and the principle of sin, his views are interesting.

EDITIONS.—J. C. Th. Eg. de Otto, *Corpus Apol. Christ. Saec.* II. vol. vii. (Jena, 1857); E. Schwartz in *Texte und Untersuchungen*, iv. 2 (Leipzig, 1891).

TRANSLATIONS.—Humphreys (London, 1714); B. P. Pratten (*Ante-Nic. Fathers*, Edinburgh, 1867).

LITERATURE.—A. Harnack, *Gesch. der altchr. Litt.* pp. 526-558, and similar works by O. Bardenhewer and A. Ehrhard; Herzog-Hauck, *Realencyk.*; G. Krüger, *Early Chr. Lit.* p. 130 (where additional literature is cited). In 1559 and 1612 appeared in French a work on *True and Perfect Love*, purporting to be a translation from the Greek of Athenagoras; it is a palpable forgery.

ATHENODORUS, the name of two Stoic philosophers of the 1st century B.C., who have frequently been confounded.

1. ATHENODORUS CANANITES (*c.* 74 B.C.–A.D. 7), so called from his birthplace Canana near Tarsus (not Cana in Cilicia nor Canna in Lycaonia), was the son of one Sandon, whose name indicates Tarsian descent, not Jewish as many have held. He was a personal friend of Strabo, from whom we derive our knowledge of his life. He taught the young Octavian (afterwards Augustus) at Apollonia, and was a pupil of Posidonius at Rhodes. Subsequently he appears to have travelled in the East (Petra and Egypt) and to have made himself famous by lecturing in the great cities of the Mediterranean. Writing in 50 B.C., Cicero speaks of him with the highest respect (cf. *Ep. ad. Att.*, xvi. 11. 4, 14. 4), a fact which enables us to fix the date of his birth as not later than about 74. His influence over Augustus was strong and lasting. He followed him to Rome in 44, and is said to have criticized him with the utmost candour, bidding him repeat the letters of the alphabet before acting on an angry impulse. In later years he was allowed by Augustus to return to Tarsus in order to remodel the constitution of the city after the degenerate democracy which had misgoverned it under Boethus. He succeeded (*c.* 15–10 B.C.) in setting up a timocratic oligarchy in the imperial interest (see TARSUS). Sir W. M. Ramsay is inclined to attribute to the influence of Athenodorus the striking resemblances which can be established between Seneca and Paul, the latter of whom must certainly have been acquainted with his teachings. According to Eusebius and Strabo he was a learned scientist for his day, and some attribute to him a history of Tarsus. He helped Cicero in the composition of the *De Officiis*. His works are not certainly known, and none are extant. (See Sir W. M. Ramsay in the *Expositor*, September 1906, pp. 268 ff.)

2. ATHENODORUS CORDYLION, also of Tarsus, was keeper of the library at Pergamum, and was an old man in 47 B.C. In his enthusiasm for Stoicism he used to cut out from Stoic writings passages which seemed to him unsatisfactory. He also settled in Rome, where he died in the house of the younger Cato.

Among others of the name may be mentioned (3) ATHENODORUS OF TEOS, who played the cithara at the wedding of Alexander the Great and Statira at Susa (324 B.C.); (4) a Greek physician of the 1st century A.D., who wrote on epidemic diseases; and two sculptors, of whom (5) one executed the statues of Apollo and Zeus which the Spartans dedicated at Delphi after Aegospotami; and (6) the other was a son of Alexander of Rhodes, whom he helped in the Laocoon group.

ATHENRY, a market town of county Galway, Ireland, 14 m. inland (E.) from Galway on the Midland Great Western main line. Pop. (1901) 853. Its name is derived from *Ath-na-riogh*, the ford of kings; and it grew to importance after the Anglo-Norman invasion as the first town of the Burgs and Berminghams. The walls were erected in 1211 and the castle in 1238, and the remains of both are noteworthy. A Dominican monastery was founded with great magnificence by Myler de Bermingham in 1241, and was repaired by the Board of Works in 1893. Of the Franciscan monastery of 1464 little is left. The town returned two members to the Irish parliament from the time of Richard II. to the Union; but it never recovered from the wars of the Tudor period, culminating in a successful siege by Red Hugh O'Donnell in 1596.

ATHENS [Ἀθῆναι, *Athenae*, modern colloquial Greek Ἀθῆνα], the capital of the kingdom of Greece, situated in 23° 44′ E. and 37° 58′ N., towards the southern end of the central and principal plain of Attica. The various theories with regard to the origin of the name are all somewhat unconvincing; it is conceivable that, with the other homonymous Greek towns, such as Athenae Diades in Euboea, Ἀθῆναι may be connected etymologically with ἄνθος, a flower (cf. *Firenze*, Florence); the patron goddess, Athena, was probably called after the place of her cult.

I. TOPOGRAPHY AND ANTIQUITIES

The Attic plain, τὸ πεδίον, slopes gently towards the coast of the Saronic Gulf on the south-west; on the east it is overlooked by Mount Hymettus (3369 ft.); on the north-east by Pentelicus or Brilessus (3635 ft.) from which, in ancient and modern times, an immense quantity of the finest marble has been quarried; on the north-west by Parnes (4636 ft.), a continuation of the Boeotian Cithaeron, and on the west by Aegaleus (1532 ft.), which descends abruptly to the bay of Salamis. In the centre of the plain extends from north-east to south-west a series of low heights, now known as Turcovuni, culminating towards the south in the sharply pointed Lycabettus (1112 ft.), now called Hagios Georgios from the monastery which crowns its summit. Lycabettus, the most prominent feature in the Athenian landscape, directly overhung the ancient city, but was not included in its walls; its peculiar shape rendered it unsuitable for fortification. The Turcovuni ridge, probably the ancient Anchesmus, separates the valley of the Cephisus on the north-west from that of its confluent, the Ilissus, which skirted the ancient city on the south-west. The Cephisus, rising in Pentelicus, enters the sea at New Phalerum; in summer it dwindles to an insignificant stream, while the Ilissus, descending from Hymettus, is totally dry, probably owing to the destruction of the ancient forests on both mountains, and the consequent denudation of the soil. Separated from Lycabettus by a depression to the south-west, through which flows a brook, now a covered drain (probably to be identified with the Eridanus), stands the remarkable oblong rocky mass of the Acropolis (512 ft.), rising precipitously on all sides except the western; its summit was partially levelled in prehistoric times, and the flat area was subsequently enlarged by further cutting and by means of retaining walls. Close to the Acropolis on the west is the lower rocky eminence of the Areopagus, Ἄρειος πάγος (377 ft.), the seat of the famous council; the name (see also AREOPAGUS) has been connected with Ares, whose temple stood on the northern side of the hill, but is more probably derived from the Ἀραί or Eumenides, whose sanctuary was formed by a cleft in its north-eastern declivity. Farther west of the Acropolis are three elevations; to the north-west the so-called "Hill of the Nymphs" (341 ft.), on which the modern Observatory stands; to the west the Pnyx, the meeting place of the Athenian democracy (351 ft.), and to the south-west the loftier Museum Hill (482 ft.), still crowned with the remains of the monument of Philópappus. A cavity, a little to the west of the Observatory Hill, is generally supposed to be the ancient Barathron or place of execution. To the south-east of the Acropolis, beyond the narrow valley of the Ilissus, is the hill Ardettus (436 ft.). The distance from the Acropolis to the nearest point of the sea coast at Phalerum is a little over 3 m.

Influence of the geographical position.

The natural situation of Athens was such as to favour the growth of a powerful community. For the first requisites of a primitive settlement—food supply and defence—it afforded every advantage. The Attic plain, notwithstanding the lightness of the soil, furnished an adequate supply of cereals; olive and fig groves and vineyards were cultivated from the earliest times in the valley of the Cephisus, and pasturage for sheep and goats was abundant. The surrounding rampart of mountains was broken towards the north-east by an open tract stretching between Hymettus and Pentelicus towards Marathon, and was traversed by the passes of Decelea, Phylé and Daphné on the north and north-west, but the distance between these natural passages and the city was sufficient to obviate the danger of surprise by an invading land force. On the other hand Athens, like Corinth, Megara and Argos, was sufficiently far from the sea to enjoy security against the sudden descent of a hostile fleet. At the same time the relative proximity of three natural harbours, Peiraeus, Zea and Munychia, favoured the development of maritime commerce and of the sea power which formed the basis of Athenian hegemony. The climate is temperate, but liable to sudden changes; the mean temperature is 63°·1 F., the maximum (in July) 99°·01, the minimum (in January) 31°·55. The summer heat is moderated by the sea-breeze or by cool northerly winds from the mountains (especially in July and August). The clear, bracing air, according to ancient writers, fostered the intellectual and aesthetic character of the people and endowed them with mental and physical energy. For the architectural embellishment of the city the finest building material was procurable without difficulty and in abundance; Pentelicus forms a mass of white, transparent, blue-veined marble; another variety, somewhat similar in appearance, but generally of a bluer hue, was obtained from Hymettus. For ordinary purposes grey limestone was furnished by Lycabettus and the adjoining hills; limestone from the promontory of Acté (the co-called "poros" stone), and conglomerate, were also largely employed. For the ceramic art admirable material was at hand in the district north-west of the Acropolis. For sculpture and various architectural purposes white, fine-grained marble was brought from Paros and Naxos. The main drawback to the situation of the city lay in the insufficiency of its water-supply, which was supplemented by an aqueduct constructed in the time of the Peisistratids and by later water-courses dating from the Roman period. A great number of wells were also sunk and rain-water was stored in cisterns.

Sources for Athenian topography.

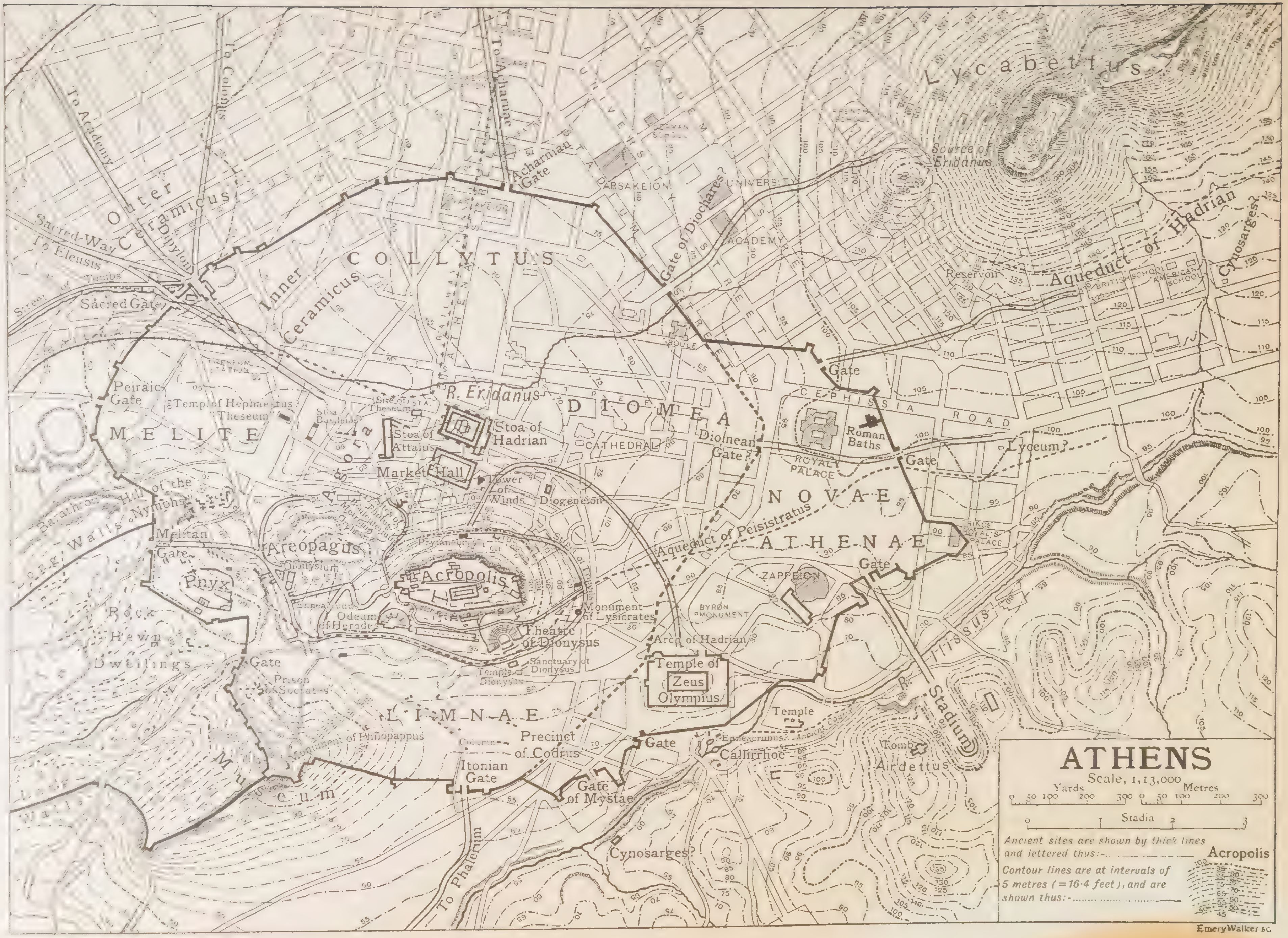
For the purposes of scientific topography observation of the natural features and outlines is followed by exact investigation of the architectural structures or remnants, a process demanding high technical competence, acute judgment and practical experience, as well as wide and accurate scholarship. The building material and the manner of its employment furnish evidence no less important than the character of the masonry, the design and the modes of ornamentation. The testimony afforded by inscriptions is often of decisive importance, especially that of commemorative or votive tablets or of boundary-stones found *in situ*; the value of this evidence is, on the other hand, sometimes neutralized owing to the former removal of building material already used and its incorporation in later structures. Thus sepulchral inscriptions have been found on the Acropolis, though no burials took place there in ancient times. In the next place comes the evidence derived from the whole range of ancient literature and specially from descriptions of the city or its different localities. The earliest known description of Athens was that of Diodorus, ὁ περιηγτής, who lived in the second half of the 4th century B.C. Among his successors were Polemon of Ilium (beginning of 2nd century B.C.), whose great κοσμικὴ περιήγησις gave a minute account of the votive offerings on the Acropolis and the tombs on the Sacred Way; and Heliodorus (second half of the 2nd century) who wrote fifteen volumes on the monuments of Athens. Of these and other works of the earliest topographers only some fragments remain. In the period between A.D. 143 and 159 Pausanias visited Athens at a time when the monuments of the great age were still in their perfection and the principal embellishments of the Roman period had already been completed. The first thirty chapters of his invaluable *Description of Greece* (περιήγησις τῆς Ἑλλάδος) are devoted to Athens, its ports and environs. Pausanias makes no claim to exhaustiveness; he selected what was best worth noticing (τὰ ἀξιολογώτατα). His account, drawn up from notes taken in the main from personal observation, possesses an especial importance for topographical research, owing to his method of describing each object in the order in which he saw it during the course of his walks. His accuracy, which has been called in question by some scholars, has been remarkably vindicated by recent excavations at Athens and elsewhere. The list of ancient topographers closes with Pausanias. The literature of succeeding centuries furnishes only isolated references; the more important are found in the scholia on Aristophanes, the lexicons of Hesychius, Photius and others, and the *Etymologicum Magnum*. The notices of Athens during the earlier middle ages are scanty in the extreme. In 1395 Niccolo da Martoni, a pilgrim from the Holy Land, visited Athens and wrote a description of a portion of the city. Of the work of Cyriac of Ancona, written about 1450, only some fragments remain, which are well supplemented by the contemporaneous description of the capable observer known as the "Anonymus of Milan." Two treatises in Greek by unknown writers belong to the same period. The Dutchman Joannes Meursius (1579–1639) wrote three disquisitions on Athenian topography. The conquest by Venice in 1687 led to the publication of several works in that city, including the descriptions of De la Rue and Fanelli and the maps of Coronelli and others. The systematic study of Athenian topography was begun in the 17th century by French residents at Athens, the consuls Giraud and Chataignier and the Capuchin monks. The visit of the French physician Jacques Spon and the Englishman, Sir George Wheler or Wheeler (1650–1723), fortunately took place before the catastrophe of the Parthenon in 1687; Spon's *Voyage d'Italie, de Dalmatie, de Grèce et du Levant*, which contained the first scientific description of the ruins of Athens, appeared in 1678; Wheler's *Journey into Greece*, in 1682. A period of British activity in research followed in the 18th century. The monumental work of James Stuart and Nicholas Revett, who spent three years at Athens (1751–1754), marked an epoch in the progress of Athenian topography and is still indispensable to its study, owing to the demolition of ancient buildings which began about the middle of the 18th century. To this period also belong the labours of Richard Pococke and Richard Dalton, Richard Chandler, E. D. Clarke and Edward Dodwell. The great work of W. M. Leake (*Topography of Athens and the Demi*, 2nd ed., 1841) brought the descriptive literature to an end and inaugurated the period of modern scientific research, in which German archaeologists have played a distinguished part.

Recent research.

Recent investigation has thrown a new and unexpected light on the art, the monuments and the topography of the ancient city. Numerous and costly excavations have been carried out by the Greek government and by native and foreign scientific societies, while accidental discoveries have been frequently made during the building of the modern town. The museums, enriched by a constant inflow of works of art and inscriptions, have been carefully and scientifically arranged, and afford opportunities for systematic study denied to scholars of the past generation. Improved means of communication have enabled many acute observers to apply the test of scrutiny on the spot to theories and conclusions mainly based on literary evidence; five foreign schools of archaeology, directed by eminent scholars, lend valuable aid to students of all nationalities, and lectures are frequently delivered in the museums and on the more interesting and important sites. The native archaeologists of the present day hold a recognized position in the scientific world; the patriotic sentiment of former times, which prompted their zeal but occasionally warped their judgment, has been merged in devotion to science for its own sake, and the supervision of excavations, as well as the control of the art-collections, is now in highly competent hands. Athens has thus become a centre of learning, a meeting-place for scholars and a basis for research in every part of the Greek world. The attention of many students has naturally been concentrated on the ancient city, the birthplace of European art and literature, and a great development of investigation and discussion in the special domain of Athenian archaeology has given birth to a voluminous literature. Many theories hitherto universally accepted have been called in question or proved to be unsound: the views of Leake, for instance, have been challenged on various points, though many of his conclusions have been justified and confirmed. The supreme importance of a study of Greek antiquities on the spot, long understood by scholars in Europe and in America, has gradually come to be recognized in England, where a close attention to ancient texts, not always adequately supplemented by a course of local study and observation, formerly fostered a peculiarly conservative attitude in regard to the problems of Greek archaeology. Since the foundation of the German Institute in 1874, Athenian topography has to a large extent become a speciality of German scholars, among whom Wilhelm Dörpfeld occupies a pre-eminent position owing to his great architectural attainments and unrivalled local knowledge. Many of his bold and novel theories have provoked strenuous opposition, while others have met with general acceptance, except among scholars of the more conservative type.

The early citadel.

Prehistoric Athens.—Numerous traces of the "Mycenaean" epoch have recently been brought to light in Athens and its neighbourhood. Among the monuments of this age discovered in the surrounding districts are the rock-hewn tombs of Spata, accidentally revealed by a landslip in 1877, and the domed sepulchre at Menidi, near the ancient Acharnae, excavated by Lolling in 1879. Other "Mycenaean" landmarks have been laid bare at Eleusis, Thoricus, Halae and Aphidna. These structures, however, are of comparatively minor importance in point of dimensions and decoration; they were apparently designed as places of sepulture for local chieftains, whose domains were afterwards incorporated in the Athenian realm by the συνοικισμός (synoecism) attributed


ATHENS
Scale, 1,13,000
Yards 0 50 100 200 300
Metres 0 50 100 200 300
Stadia 0 1 2 3
Ancient sites are shown by thick lines and lettered thus:- Acropolis
Contour lines are at intervals of 5 metres (=16·4 feet), and are shown thus:-
Lycabettus
Source of Eridanus
Aqueduct of Hadrian
Cynosarges?
Reservoir
BRITISH SCHOOL
AMERICAN SCHOOL
UNIVERSITY
ACADEMY
ARSAKEION
Gate of Diochares?
To Academy
To Colonus
To Acharnae
Acharnian Gate
Outer Ceramicus
Dipylon
Sacred-Way
To Eleusis
Street of Tombs
Sacred Gate
Inner Ceramicus
COLLYTUS
BOULE
Gate
CEPHISSIA ROAD
Roman Baths
Lyceum?
ROYAL PALACE
Diomean Gate?
DIOMEA
R. Eridanus
CATHEDRAL
Stoa of Hadrian
Stoa of Attalus
Site of Theseum
Stoa Basileios
Peiraic Gate
Temple of Hephaestus "Theseum"
MELITE
Agora
Market Hall
Tower of Winds
Diogeneion
Tholus
Metroum
Barathron
Hill of the Nymphs
Long Walls
Melitan Gate
Areopagus
Dionysium
Prytaneum
Acropolis
Street of Tripods
Monument of Lysicrates
Pnyx
Rock Hewn Dwellings
Enneacrunus
Odeum of Herodes
Theatre of Dionysus
Sanctuary of Dionysus
Temple of Dionysus
Gate
Prison of Socrates
NOVAE ATHENAE
Aqueduct of Peisistratus
PRINCE ROYAL'S PALACE
ZAPPEION
BYRON MONUMENT
Arch of Hadrian
Temple of Zeus Olympius
LIMNAE
Monument of Philopappus
Museum
Column
Precinct of Codrus
Itonian Gate
Gate of Mystae
To Phalerum
Cynosarges?
Temple
Enneacrunus
Ancient Course
Callirrhoe
R. Ilissus
Stadium
Tomb
Ardettus
Emery Walker sc.

to Theseus. The situation of the Acropolis, dominating the surrounding plain and possessing easy communication with the sea, favoured the formation of a relatively powerful state—inferior, however, to Tiryns and Mycenae; the myths of Cecrops, Erechtheus and Theseus bear witness to the might of the princes who ruled in the Athenian citadel, and here we may naturally expect to find traces of massive fortifications resembling in some degree those of the great Argolid cities. Such in fact have been brought to light by the modern excavations on the Acropolis (1885–1889). Remains of primitive polygonal walls which undoubtedly surrounded the entire area have been found at various points a little within the circuit of the existing parapet. The best-preserved portions are at the eastern extremity, at the northern side near the ancient "royal" exit, and at the south-western angle. The course of the walls can be traced with a few interruptions along the southern side. On the northern side are the foundations of a primitive tower and other remains, apparently of dwelling-houses, one of which may have been the πυκινὸς δόμος Ἐρεχθῆος mentioned by Homer (*Od.* vii. 81). Among the foundations were discovered fragments of "Mycenaean" pottery. The various approaches to the citadel on the northern side—the rock-cut flight of steps north-east of the Erechtheum (*q.v.*), the stairs leading to the well Clepsydra, and the intermediate passage supposed to have furnished access to the Persians—are all to be attributed to the primitive epoch. Two pieces of polygonal wall, one beneath the bastion of Nike Apteros, the other in a direct line between the Roman gateway and the door of the Propylaea, are all that remain of the primitive defences of the main entrance.

The Pelasgicum.

These early fortifications of the Acropolis, ascribed to the primitive non-hellenic Pelasgi, must be distinguished from the Pelasgicum or Pelargicum, which was in all probability an encircling wall, built round the base of the citadel and furnished with nine gates from which it derived the name of Enneapylon. Such a wall would be required to protect the clusters of dwellings around the Acropolis as well as the springs issuing from the rock, while the gates opening in various directions would give access to the surrounding pastures and gardens. This view, which is that of E. Curtius, alone harmonizes with the statement of Herodotus (vi. 137) that the wall was "around" (περί) the Acropolis, and that of Thucydides (ii. 17) that it was "beneath" (ὑπό) the fortress. Thus it would appear that the citadel had an outer and an inner line of defence in prehistoric times. The space enclosed by the outer wall was left unoccupied after the Persian wars in deference to an oracular response apparently dictated by military considerations, the maintenance of an open zone being desirable for the defence of the citadel. A portion of the outer wall has been recognized in a piece of primitive masonry discovered near the Odeum of Herodes Atticus; other traces will probably come to light when the northern and eastern slopes of the Acropolis have been completely explored. Leake, whom Frazer follows, assumed the Pelasgicum to be a fortified space at the western end of the Acropolis; this view necessitates the assumption that the nine gates were built one within the other, but early antiquity furnishes no instance of such a construction; Dörpfeld believes it to have extended from the grotto of Pan to the sacred precinct of Asclepius. The well-known passage of Lucian (*Piscator*, 47) cannot be regarded as decisive for any of the theories advanced, as any portion of the old *enceinte* dismantled by the Persians may have retained the name in later times. The Pelasgic wall enclosed the spring Clepsydra, beneath the north-western corner of the Acropolis, which furnished a water-supply to the defenders of the fortress. The spring, to which a staircase leads down, was once more included in a bastion during the War of Independence by the Greek chief Odysseus.

The Pnyx.

To the "Pelasgic" era may perhaps be referred (with Curtius and Milchhöfer) the immense double terrace on the north-eastern slope of the Pnyx (395 ft. by 212), the upper portion of which is cut out of the rock, while the lower is enclosed by a semicircular wall of massive masonry; the theory of these scholars, however, that the whole precinct was a sanctuary of the Pelasgian Zeus cannot be regarded as proved, nor is it easy to abandon the generally received view that this was the scene of the popular assemblies of later times, notwithstanding the apparent unsuitability of the ground and the insufficiency of room for a large multitude. These difficulties are met by the assumption that the semicircular masonry formed the base of a retaining-wall which rose to a considerable height, supporting a theatre-like structure capable of seating many thousand persons. The masonry may be attributed to the 5th century; the chiselling of the immense blocks is not "Cyclopean." Projecting from the upper platform at the centre of the chord of the semicircular area is a cube of rock, 11 ft. square and 5 ft. high, approached on either side by a flight of steps leading to the top; this block, which Curtius supposes to have been the primitive altar of Zeus Ὕψιστος, may be safely identified with the orators' bema, ὁ λίθος ἐν τῇ Πυκνί (Aristoph. *Pax*, 680). Plutarch's statement that the Thirty Tyrants removed the bema so as to face the land instead of the sea is probably due to a misunderstanding. Other cubes of rock, apparently altars, exist in the neighbourhood. There can be little doubt that the Pnyx was the seat of an ancient cult; the meetings of the Ecclesia were of a religious character and were preceded by a sacrifice to Zeus Ἀγοραῖος; nor is it conceivable that, but for its sacred associations, a site would have been chosen so unsuitable for the purposes of a popular assembly as to need the addition of a costly artificial auditorium.

Rock-dwellings and tombs.

The Pnyx, the Hill of the Nymphs and the Museum Hill are covered with vestiges of early settlements which extend to a considerable distance towards the south-east in the direction of Phalerum. They consist of chambers of various sizes, some of which were evidently human habitations, together with cisterns, channels, seats, steps, terraces and quadrangular tombs, all cut in the rock. This neighbourhood was held by Curtius to have been the site of the primeval rock city, κρανάα πόλις (Aristoph. *Ach.* 75), anterior to the occupation of the Acropolis and afterwards abandoned for the later settlement. It seems inconceivable, however, that any other site should have been preferred by the primitive settlers to the Acropolis, which offered the greatest advantages for defence; the Pnyx, owing to its proximity to the centres of civic life, can never have been deserted, and that portion which lay within the city walls must have been fully occupied when Athens was crowded during the Peloponnesian War. Some of the rock chambers originally intended for tombs were afterwards converted, perhaps under pressure of necessity, into habitations, as in the case of the so-called "Prison of Socrates," which consists of three chambers horizontally excavated and a small round apartment of the "beehive" type. The remains on the Pnyx and its neighbourhood cannot all be assigned to one epoch, the prehistoric age. The dwellings do not correspond in size or details with the undoubtedly prehistoric abodes on the Acropolis. In view of the ancient law which forbade burial within the city, the tombs within the circuit of the city walls must either be earlier than the time of Themistocles or several centuries later; in the similar rock-tombs on the neighbouring slopes of the Acropolis and Areopagus both Mycenaean and Dipylon pottery have been found. But the numerous vertically excavated tombs outside the walls are of late date and belong for the most part to the Roman period.

The Areopagus.

The Areopagus is now a bare rock possessing few architectural traces. The legend of its occupation by the Amazons (Aeschylus, *Eum.* 681 seq.) may be taken as indicating its military importance for an attack on the Acropolis; the Persians used it as a *point d'appui* for their assault. The seat of the old oligarchical council and court for homicide was probably on its eastern height. Here were the altar of Athena Areia and two stones, the λίθος Ὕβρεως, on which the accuser, and the λίθος Ἀναιδείας, on which the accused, took their stand. Beneath, at the north-eastern corner, is the cleft which formed the sanctuary of the Σεμναί, or Erinyes. There is no reason for disturbing the associations connected with this spot as the scene of St Paul's address to the Athenians (E. Gardner, *Anc. Athens*, p. 505).

Hellenic Period.—While modern research has added considerably to our knowledge of prehistoric Athens, a still greater light has been thrown on the architecture and topography of the city in the earlier historic or "archaic" era, the subsequent age of Athenian greatness, and the period of decadence which set in with the Macedonian conquest; the first extends from the dawn of history to 480–479 B.C., when the city was destroyed by the Persians; the second, or classical, age closes in 322 B.C., when Athens lost its political independence after the Lamian War; the third, or Hellenistic, in 146 B.C., when the state fell under Roman protection. We must here group these important epochs together, as distinguished from the later period of Roman rule, and confine ourselves to a brief notice of their principal monuments and a record of the discoveries by which they have been illustrated in recent years.

The city in the "archaic" era.

The earliest settlement on the Acropolis was doubtless soon increased by groups of dwellings at its base, inhabited by the dependents of the princes who ruled in the stronghold. These habitations would naturally in the first instance lie in close proximity to the western approach; after the building of the Pelasgicum they seem to have extended beyond its walls towards the south and south-west—towards the sea and the waters of the Ilissus. The district thus occupied sloped towards the sun and was sheltered by the Acropolis from the prevailing northerly winds. The Thesean synoecism led to the introduction of new cults and the foundation of new shrines partly on the Acropolis, partly in the inhabited district at its base both within and without the wall of the Pelasgicum. Some of the shrines in this region are mentioned by Thucydides in a passage which is of capital importance for the topography of the city at this period (ii. 15). By degrees the inhabited area began to comprise the open ground to the north-west, the nearer portion of the later Ceramicus, or "potters' field" (afterwards divided by the walls of Themistocles into the Inner and Outer Ceramicus), and eventually extended to the north and east of the citadel, which, by the beginning of the 5th century B.C., had become the centre of a circular or wheel-shaped city, πόλιος τροχοειδέος ἄκρα κάρηνα (Oracle *apud* Herod. vii. 140). To this enlarged city was applied, probably about the second half of the 6th century, the special designation τὸ ἄστυ, which afterwards distinguished Athens from its port, the Peiraeus; the Acropolis was already ἡ πόλις (Thucyd. ii. 15). The city is supposed to have been surrounded by a wall before the time of Solon, the existence of which may be deduced from Thucydides' account of the assassination of Hipparchus (vi. 57), but no certain traces of such a wall have been discovered; the materials may have been removed to build the walls of Themistocles.

The Agora.

The centre of commercial and civic life of the older group of communities, as of the greater city of the classical age, was the Agora or market. Here were the various public buildings, which, when the power of the princes on the citadel was transferred to the archons, formed the offices of the administrative magistracy. The site of the primitive Agora (ἀρχαία ἀγορά) was probably in the hollow between the Acropolis and the Pnyx, which formed a convenient meeting-place for the dwellers on the north and south sides of the fortress as well as for its inhabitants. In the time of the Peisistratids the Agora was enlarged so as to extend over the Inner Ceramicus on the north-west, apparently reaching the northern declivities of the Areopagus and the Acropolis on the south. After the Persian Wars the northern portion was used for commercial, the southern for political and ceremonial purposes. In the southern were the Orchestra, where the Dionysiac dances took place, and the famous statues of Harmodius and Aristogeiton by Antenor which were carried away by Xerxes; also the Metroum, or temple of the Mother of the Gods, the Bouleuterium, or council-chamber of the Five Hundred, the Prytaneum, the hearth of the combined communities, where the guests of the state dined, the temple of the Dioscuri, and the Tholus, or Skias, a circular stone-domed building in which the Prytaneis were maintained at the public expense; in the northern were the Leocorium, where Hipparchus was slain, the στοὰ βασιλική, the famous στοὰ ποικίλη, where Zeno taught, and other structures. The Agora was commonly described as the "Ceramicus," and Pausanias gives it this name; of the numerous buildings which he saw here scarcely a trace remains; their position, for the most part, is largely conjectural, and the exact boundaries of the Agora itself are uncertain. What are perhaps the remains of the στοὰ βασιλική, in which the Archon Basileus held his court and the Areopagus Council sat in later times, were brought to light in the winter of 1897–1898, when excavations were carried out on the eastern slope of the "Theseum" hill. Here was found a rectangular structure resembling a temple, but with a side door to the north; it possessed a portico of six columns. The north slope of the Areopagus, where a number of early tombs were found, was also explored, and the limits of the Agora on the south and north-west were approximately ascertained. A portion of the main road leading from the Dipylon to the Agora was discovered.

The Enneacrunus.

In 1892 Dörpfeld began a series of excavations in the district between the Acropolis and the Pnyx with the object of determining the situation of the buildings described by Pausanias as existing in the neighbourhood of the Agora, and more especially the position of the Enneacrunus fountain. The Enneacrunus has hitherto been generally identified with the spring Callirrhoe in the bed of the Ilissus, a little to the south-east of the Olympieum; it is apparently, though not explicitly, placed by Thucydides (ii. 15) in proximity to that building, as well as the temple of Dionysus ἐν λίμναις and other shrines, the temples of Zeus Olympius and of Ge and the Pythium, which he mentions as situated mainly to the south of the Acropolis. On the other hand, Pausanias (i. 14. 1), who never deviates without reason from the topographical order of his narrative, mentions the Enneacrunus in the midst of his description of certain buildings which were undoubtedly in the region of the Agora, and unless he is guilty of an unaccountable digression the Enneacrunus which he saw must have lain west of the Acropolis. It is now generally agreed that the Agora of classical times covered the low ground between the hill of the "Theseum," the Areopagus and the Pnyx; and Pausanias, in the course of his description, appears to have reached its southern end. The excavations revealed a main road of surprisingly narrow dimensions winding up from the Agora to the Acropolis. A little to the south-west of the point where the road turns towards the Propylaea was found a large rock-cut cistern or reservoir which Dörpfeld identifies with the Enneacrunus. The reservoir is supplied by a conduit of 6th-century tiles connected with an early stone aqueduct, the course of which is traceable beneath the Dionysiac theatre and the royal garden in the direction of the Upper Ilissus. These elaborate waterworks were, according to Dörpfeld, constructed by the Peisistratids in order to increase the supply from the ancient spring Callirrhoe; the fountain was furnished with nine jets and henceforth known as Enneacrunus. This identification has been hotly contested by many scholars, and the question must still be regarded as undecided. An interesting confirmation of Dörpfeld's view is furnished by the map of Guillet and Coronelli, published in 1672, in which the Enneacrunus is depicted as a well with a stream of running water in the neighbourhood of the Pnyx. The fact that spring water is not now found in this locality is by no means fatal to the theory; recent engineering investigations have shown that much of the surface water of the Attic plain has sunk to a lower level. In front of the reservoir is a small open space towards which several roads converge; close by is a triangular enclosure of polygonal masonry, in which were found various relics relating to the worship of Dionysus, a very ancient wine-press (ληνός) and the remains of a small temple. Built over this early precinct, which Dörpfeld identifies with the Dionysium ἐν λίμναις, or Lenaeum, is a basilica-shaped building of the Roman period, apparently sacred to Bacchus; in this was found an inscription containing the rules of the society of the Iobacchi. There is an obvious difficulty in assuming that λίμναι, in the sense of "marshes," existed in this confined area, but stagnant pools may still be seen here in winter. Dörpfeld's identification of the Dionysium, ἐν λίμναις cannot be regarded as proved; his view that another Pythium and another Olympieum existed in this neighbourhood is still less probable; but the inconclusiveness of these theories does not necessarily invalidate his identification of the Enneacrunus, with regard to the position of which the language of Thucydides is far from clear. Another enclosure, a little to the south, is proved by an inscription to have been a sanctuary of the hitherto unknown hero Amynos, with whose cult those of Asclepius and the hero Dexion were here associated; under the name Dexion, the poet Sophocles is said to have been worshipped after his death. The whole district adjoining the Areopagus was found to have been thickly built over; the small, mean dwelling-houses intersected by narrow, crooked lanes convey a vivid idea of the contrast between the modest private residences and the great public structures of the ancient city.

The Academy and Lyceum.

The age of the Peisistratids (560–511 B.C.) marked an era in the history of Athenian topography. The greatest of their foundations, the temple of Olympian Zeus, will be referred to later. Among the monuments of their rule, in addition to the enlarged Agora and the Enneacrunus, were the Academy and perhaps the Lyceum. The original name of the Academy may have been Hecademia, from Hecademus, an early proprietor (but see ACADEMY, GREEK). The famous seat of the Platonic philosophy was a gymnasium enlarged as a public park by Cimon; it lay about a mile to the north-west of the Dipylon Gate, with which it was connected by a street bordered with tombs. The Lyceum, where Aristotle taught, was originally a sanctuary of Apollo Lyceius. Like the Academy, it was an enclosure with a gymnasium and garden; it lay to the east of the city beyond the Diocharean Gate.

The Acropolis before the Persian wars.

Little was known of the buildings on the Acropolis in the pre-Persian period before the great excavations of 1885–1888, which rank among the most surprising achievements of modern research. The results of these operations, which were conducted by the Archaeological Society under the direction of Kavvadias and Kawerau, must be summarized with the utmost brevity. The great deposits of sculpture and pottery now unearthed, representing all that escaped from the ravages of the Persians and the burning of the ancient shrines, afford a startling revelation of the development of Greek art in the 7th and 6th centuries. Numbers of statues—among them a series of draped and richly-coloured female figures—masterpieces of painted pottery, only equalled by the Attic vases found in Magna Grecia and Etruria, and numerous bronzes, were among the treasures of art now brought to light. All belong to the "archaic" epoch; only a few remains of the greater age were found, including some fragments of sculptures from the Parthenon and Erechtheum. We are principally concerned, however, with the results which add to our knowledge of the topography and architecture of the Acropolis. The entire area of the summit was now thoroughly explored, the excavations being carried down to the surface of the rock, which on the southern side was found to slope outwards to a depth of about 45 ft. In the lower strata were discovered the remnants of Cyclopean or prehistoric architecture already mentioned. Of later date, perhaps, are the limestone polygonal retaining walls on the west front, which extended on either side of the early entrance. Of these a portion may probably be attributed to the Peisistratids, in whose time the Acropolis once more became the stronghold of a despotism. Its fortifications, though not increased, were apparently strengthened by the Tyrants. To its embellishment they probably contributed the older ornamental entrance, facing south-west, the precursor of the greater structure of Mnesicles (see PROPYLAEA) and the colonnade of the "Hecatompedon," or earlier temple of Athena, at this time the only large sacred edifice on the citadel. The name was subsequently applied to the cella, or eastern chamber, of the Parthenon, which is exactly 100 ft. long, and also became a popular designation of the temple itself.

The old temple of Athena.

The ancient Hecatompedon may in all probability be identified with an early temple, also 100 ft. long, the foundations of which were pointed out in 1885 by Dörpfeld on the ground immediately adjoining the south side of the Erechtheum. On this spot was apparently the primitive sanctuary of Athena, the rich temple (πίων νηός) of Homer (*Il.* ii. 549), in which the cult of the goddess was associated with that of Erechtheus; the Homeric temple is identified by Furtwängler with the "compact house of Erechtheus" (*Od.* vii. 81), which, he holds, was not a royal palace, but a place of worship, and traces of it may perhaps be recognized in the fragments of prehistoric masonry enclosed by the existing foundations. The foundations seem to belong to the 7th century, except those of the colonnade, which was possibly added by Peisistratus. According to Dörpfeld, this was the "old temple" of Athena Polias, frequently mentioned in literature and inscriptions, in which was housed the most holy image (ξόανον) of the goddess which fell from heaven; it was burnt, but not completely destroyed, during the Persian War, and some of its external decorations were afterwards built into the north wall of the Acropolis; it was subsequently restored, he thinks, with or without its colonnade—in the former case a portion of the peristyle must have been removed when the Erechtheum was built so as to make room for the porch of the maidens; the building was set on fire in 406 B.C. (Xen. *Hell.* i. 6. 1), and the conflagration is identical with that mentioned by Demosthenes (*In Timocr.* xxiv. 155); its "opisthodomos" served as the Athenian treasury in the 5th and 4th centuries; the temple is the ἀρχαῖος νεὼς τῆς Πολιάδος mentioned by Strabo (ix. 16), and it was still standing in the time of Pausanias, who applies to it the same name (i. 27. 3). The conclusion that the foundations are those of an old temple burnt by the Persians has been generally accepted, but other portions of Dörpfeld's theory—more especially his assumption that the temple was restored after the Persian War—have provoked much controversy. Thus J. G. Frazer maintains the hitherto current theory that the earlier temple of Athena and Erechtheus was on the site of the Erechtheum; that the Erechtheum inherited the name ἀρχαῖος νεώς from its predecessor, and that the "opisthodomos" in which the treasures were kept was the west chamber of the Parthenon; Furtwängler and Milchhöfer hold the strange view that the "opisthodomos" was a separate building at the east end of the Acropolis, while Penrose thinks the building discovered by Dörpfeld was possibly the Cecropeum. E. Curtius and J. W. White, on the other hand, accept Dörpfeld's identification, but believe that only the western portion of the temple or opisthodomos was rebuilt after the Persian War. Admitting the identification, we may perhaps conclude that the temple was repaired in order to provide a temporary home for the venerated image and other sacred objects; no traces of a restoration exist, but the walls probably remained standing after the Persian conflagration. The removal of the ancient temple was undoubtedly intended when the Erechtheum was built, but superstition and popular feeling may have prevented its demolition and the removal of the ξόανον to the new edifice. The temple consisted of an eastern cella with pronaos; behind this was the opisthodomos, divided into three chambers—possibly treasuries—with a portico at the western end. The peristyle, if we compare the measurements of the stylobate with those of the drums built into the wall of the Acropolis, may be concluded to have consisted of six Doric columns at the ends and twelve at the sides. In one of the pediments was a gigantomachy, of which some fragments have been recovered.

The grottoes of Pan and Apollo.

In 1896 excavations with the object of exploring the whole northern and eastern slopes of the Acropolis were begun by Kavvadias. The pathway between the citadel and the Areopagus was found to be so narrow that it is certain the Panathenaic procession cannot have taken this route to the Acropolis. On the north-west rock the caves known as the grottoes of Pan and Apollo were cleared out; these consist of a slight high-arched indentation immediately to the east of the Clepsydra and a double and somewhat deeper cavern a little farther to the east. In the first mentioned are a number of niches in which *πίνακες* (votive tablets) were placed: some of these, inscribed with dedications to Apollo, have been discovered. The whole locality was the seat of the ancient cult of this deity, afterwards styled "Hypacraeus," with which was associated the legend of Creüsa and the birth of Ion. The worship of Pan was introduced after the Persian wars, in consequence of an apparition seen by Pheidippides, the Athenian courier, in the mountains of Arcadia. Another cave more to the west was revealed by the demolition of the bastion of Odysseus. To the east a much deeper and hitherto unknown cavern has been revealed, which Kavvadias identifies with the grotto of Pan. Close to it are a series of steps hewn in the rock which connect with those discovered in 1886 within the Acropolis wall. Farther east is an underground passage leading eastward to a cave supposed to be the sanctuary of Aglaurus where the ephebi took the oath; with this passage is connected a secret staircase leading up through a cleft in the rock to the precinct of the Errephori on the Acropolis. It is conceivable that the priestesses employed this exit when descending on their mysterious errand.

The classical period: the walls of Themistocles.

In the fifty years between the Persian and the Peloponnesian wars architecture and plastic art attained their highest perfection in Athens. The almost complete destruction of the buildings on the Acropolis and in the lower city, among them many temples and shrines which religious sentiment might otherwise have preserved, facilitated the realization of the magnificent architectural designs of Themistocles, Cimon and Pericles, while the rapid growth of the Athenian empire provided the state with the necessary means for the execution of these sumptuous projects. Of the great monuments of this epoch few traces remain except on the Acropolis. After the departure of the Persians the first necessity was the reconstruction of the defences of the city and the citadel. The walls of the city, now built under the direction of Themistocles, embraced a larger area than the previous circuit, with which they seem to have coincided at the Dipylon Gate on the north-west where the Sacred Way to Eleusis was joined by the principal carriage route to the Peiraeus and the roads to the Academy and Colonus. The other more important gates were the Peiraic and Melitan on the west; the Itonian on the south leading to Phalerum, the Diomean and Diocharean on the east, and the Acharnian on the north. The wall, which was strengthened with numerous towers, enclosed the quarters of Collytus on the north, Melite on the west, Limnae on the south-west and south, and Diomea on the east. The scanty traces which remain have not been systematically excavated except in the neighbourhood of the Dipylon; the discovery of sepulchral tablets built into the masonry illustrates the statement of Thucydides with regard to the employment of such material in the hasty construction of the walls. The circuit has been practically ascertained in its general lines, though not in details; it is given by Thucydides (ii. 13. 7) as 43 stades (about 5½ m.) exclusive of the portion between the points of junction with the long walls extending to the Peiraeus, but the whole circumference cannot have exceeded 37 stades. Possibly Thucydides, who in the passage referred to is dealing with the question of defence, included a portion of the contiguous long walls in his measurement; this explanation derives probability from his underestimate of the length of the long walls.

The "Long Walls."

The design of connecting Athens with the Peiraeus by long parallel walls is ascribed by Plutarch to Themistocles. The "Long Walls" (*τὰ μακρὰ τείχη, τὰ σκέλη*) consisted of (1) the "North Wall" (*τὸ βόρειον τεῖχος*), (2) the "Middle" or "South Wall" (*τὸ διὰ μέσου τεῖχος*, Plato, *Gorg.* 555 E; *τὸ νότιον τεῖχος*); and (3) the "Phaleric Wall" (*τὸ Φαληρικὸν τεῖχος*). The north and Phaleric walls were perhaps founded by Cimon, and were completed about 457 B.C. in the early administration of Pericles; the middle wall was built about 445 B.C. The lines of the north and middle walls have been ascertained from the remnants still existing in the 18th century and the scantier traces now visible. The north wall, leaving the city circuit at a point near the modern Observatory, ran from north-east to south-west near the present road to the Peiraeus, until it reached the Peiraeus walls a little to the east of their northernmost bend. The middle wall, beginning south of the Pnyx near the Melitan Gate, gradually approached the northern wall and, following a parallel course at an interval of 550 ft., diverged to the east near the modern New Phalerum and joined the Peiraeus walls on the height of Munychia where they turn inland from the sea. The course of the Phaleric wall has been much disputed. The widely-received view of Curtius that it ran to Cape Kolias (now Old Phalerum) on the east of the Phaleric bay is not accepted by recent topographers. The exigencies of the defensive system planned by Themistocles could only have been satisfied by a juncture of the Phaleric wall with that of the Peiraeus. The existence of any third wall was denied by Leake, according to whose theory the southern parallel wall would be identical with the Phaleric. The language of Thucydides, however, seems decisive with regard to the existence of three walls. The Phaleric wall, branching from the city circuit at some point farther east than the middle or south wall, may have followed the ridge of the Sikelia heights, where some traces of fortifications remain, and then traversed the Phalerum plain till it reached the Peiraeus defences at a point a little to the north-west of their junction with the middle wall. The Phaleric wall, proving indefensible, was abandoned towards the close of the Peloponnesian war; with the other two walls it was completely destroyed after the surrender of the city, and was not rebuilt when they were restored by Conon in 393 B.C. The parallel walls fell into decay, during the Hellenistic period, and according to Strabo (ix. 396) were once more demolished by Sulla.

The Peiraeus.

The great advantages which the Peiraic promontory with its three natural harbours offered for purposes of defence and commerce were first recognized by Themistocles, in whose archonship (493 B.C.) the fortifications of the Peiraeus were begun. Before his time the Athenians used as a port the roadstead of Phalerum at the north-eastern corner of Phalerum bay partly sheltered by Cape Kolias. As soon as the building of the city walls had been completed, Themistocles resumed the construction of the Peiraeus defences, which protected the larger harbour of Cantharus on the west and the smaller ports of Zea and Munychia (respectively south-west and south-east of the Munychia heights), terminating in moles at their entrances and enclosing the entire promontory on the land and sea sides except a portion of the south-west shore of the peninsula of Acte. The walls, built of finely compacted blocks, were about 10 ft. in thickness and upwards of 60 ft. in height, and were strengthened by towers. The town was laid out at great expense in straight, broad streets, intersecting each other at right angles, by the architect Hippodamus of Miletus in the time of Pericles. In the centre was the Agora of Hippodamus; on the western margin of the Cantharus harbour extended the emporium, or Digma, the centre of commercial activity, flanked by a series of porticoes; at its northern end, near the entrance to the inner harbour, was another Agora, on the site of the modern market-place, and near it the *μακρὰ στοά*, the corn depot of the state. This inner and shallower harbour, perhaps the *κωφὸς λιμήν*, was afterwards excluded from the town precinct by the walls of Conon, which traversing its opening on an embankment (*τὸ διὰ μέσου χῶμα*) ran round the outer shore of the western promontory of Eëtionea, previously enclosed, with some space to the north-west, by the wider circuit of Themistocles. In the harbours of Zea and Munychia traces may be seen of the remarkable series of galley-slips in which the Athenian fleet was built and repaired. The galley-slips around Zea were roofed by a row of gables supported by stone columns, each gable sheltering two triremes. Among the other noteworthy buildings of the Peiraeus were the arsenal (*σκευοθήκη*) of Philo and the temples of Zeus Soter, the patron god of the sailors, of the Cnidian Artemis, built by Cimon, and of Artemis Munychia, situated near the fort on the Munychia height; traces of a temple of Asclepius, of two theatres and of a hippodrome remain. The fine marble lion of the classical period which stood at the mouth of the Cantharus harbour gave the Peiraeus its medieval and modern names of Porto Leone and Porto Draco; it was carried away to Venice by Morosini.

The Dipylon and Ceramicus.

In 1870 the Greek Archaeological Society undertook a series of excavations in the Outer Ceramicus, which had already been partially explored by various scholars. The operations, which were carried on at intervals till 1890, resulted in the discovery of the Dipylon Gate, the principal entrance of ancient Athens. The Dipylon consists of an outer and an inner gate separated by an oblong courtyard and flanked on either side by towers; the gates were themselves double, being each composed of two apertures intended for the incoming and outgoing traffic. An opening in the city wall a little to the south-west, supposed to have been the Sacred Gate (ἱερὰ πύλη), was in all probability an outlet for the waters of the Eridanus. This stream, which has hitherto been regarded as the eastern branch of the Ilissus rising at Kaesariane, has been identified by Dörpfeld with a brook descending from the south slope of Lycabettus and conducted in an artificial channel to the north-western end of the city, where it made its exit through the walls, eventually joining the Ilissus. The channel was open in Greek times, but was afterwards covered by Roman arches; it appears to have served as the main drain of the city. Between this outlet and the Dipylon were found a boundary-stone, inscribed ὅρος Κεραμεικοῦ, which remains in its place, and the foundations of a large rectangular building, possibly the Pompeium, which may have been a robing-room for the processions which passed this way. On either side of the Dipylon the walls of Themistocles, faced on the outside by a later wall, have been traced for a considerable distance. The excavation of the outlying cemetery revealed the unique "Street of the Tombs" and brought to light a great number of sepulchral monuments, many of which remain *in situ*. Especially noteworthy are the *stelae* (reliefs) representing scenes of leave-taking, which, though often of simple workmanship, are characterized by a touching dignity and restraint of feeling. In this neighbourhood were found a great number of tombs containing vases of all periods, which furnish a marvellous record of the development of Attic ceramic art. A considerable portion of the district remains unexplored.

The Acropolis of the classical period: its fortifications and area.

The Acropolis had been dismantled as a fortress after the expulsion of Hippias; its defenders against the Persians found it necessary to erect a wooden barricade at its entrance. The fortifications were again demolished by the Persians, after whose departure the existing north wall was erected in the time of Themistocles; many columns, metopes and other fragments from the buildings destroyed by the Persians were built into it, possibly owing to haste, as in the case of the city walls, but more probably with the design of commemorating the great historic catastrophe, as the wall was visible from the Agora. The fine walls of the south and east sides were built by Cimon after the victory of the Eurymedon, 468 B.C.; they extend considerably beyond the old Pelasgic circuit, the intervening space being filled up with earth and the débris of the ruined buildings so as to increase the level space of the summit. On the northern side Cimon completed the wall of Themistocles at both ends and added to its height; the ground behind was levelled up on this side also, the platform of the Acropolis thus receiving its present shape and dimensions. The staircase leading down to the sanctuary of Aglaurus was enclosed in masonry. At the south-western corner, on the right of the approach to the old entrance, a bastion of early masonry was encased in a rectangular projection which formed a base for the temple of Nike. The great engineering works of Cimon provided a suitable area for the magnificent structures of the age of Pericles.

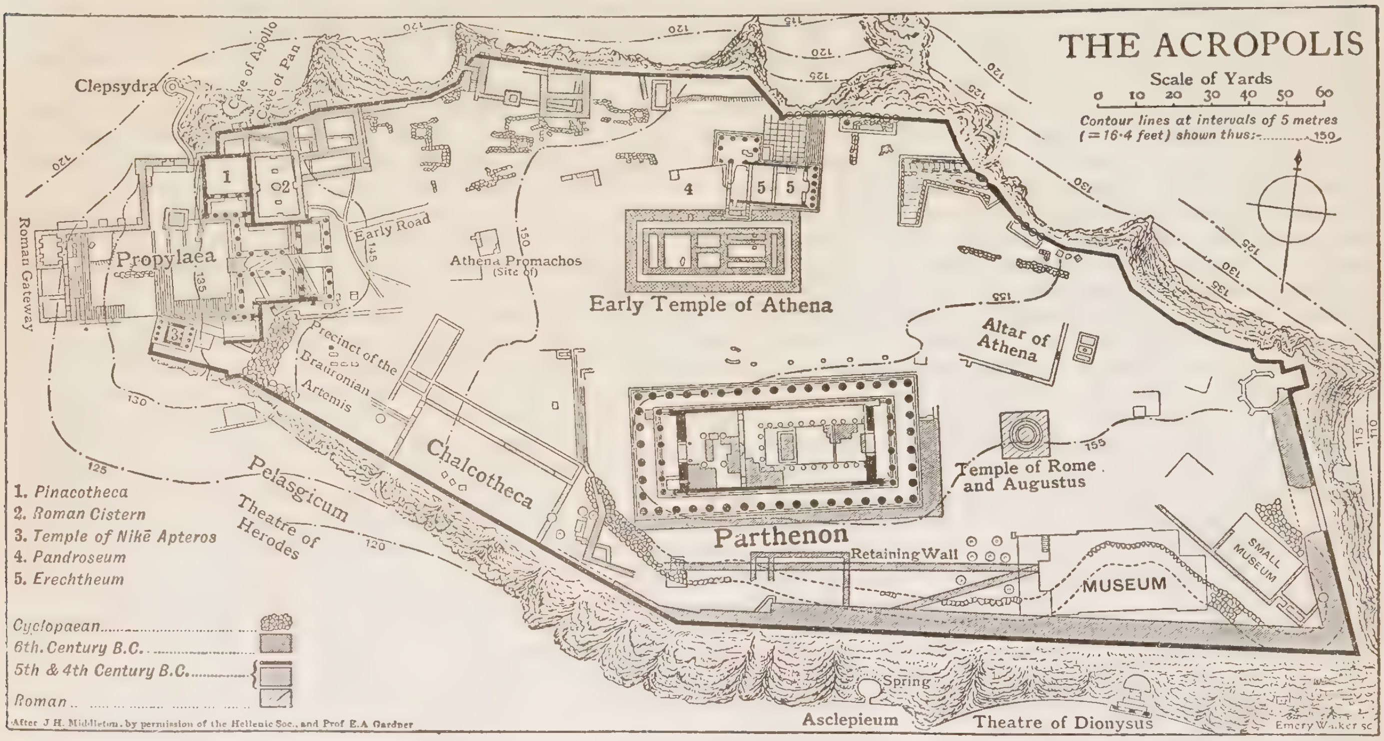
The monuments on the Acropolis.

The greater monuments of the classical epoch on the Acropolis are described in separate articles (see PARTHENON, ERECHTHEUM, PROPYLAEA). Next in interest to these noble structures is the beautiful little temple of Athena Nike, wrongly designated Nike Apteros (Wingless Victory), standing on the bastion already mentioned; it was begun after 450 B.C. and was probably finished after the outbreak of the Peloponnesian War. The temple, which is entirely of Pentelic marble, is amphiprostyle tetrastyle, with fluted Ionic columns, resting on a stylobate of three steps; its length is 27 ft., its breadth 18½ ft., and its total height, from the apex of the pediment to the bottom of the steps, 23 ft. The frieze, running round the entire building, represents on its eastern side a number of deities, on its northern and southern sides Greeks fighting with Persians, and on its western side Greeks fighting with Greeks. Before the east front was the altar of Athena Nike. The irregularly shaped precinct around the temple was enclosed by a balustrade about 3 ft. 2 in. in height, decorated on the outside with beautiful reliefs representing a number of winged Victories engaged in the worship of Athena. The elaborate treatment of the drapery enveloping these female figures suggests an approach to the mannerism of later times; this and other indications point to the probability that the balustrade was added in the latter years of the Peloponnesian War. The temple was still standing in 1676; some eight years later it was demolished by the Turks, and its stones built into a bastion; on the removal of the bastion in 1835 the temple was successfully reconstructed by Ross with the employment of little new material. At either corner of the Propylaea entrance were equestrian statues dedicated by the Athenian knights; the bases with inscriptions have lately been recovered. From the inner exit of the Propylaea a passage led towards the east along the north side of the Parthenon; almost directly facing the entrance was the colossal bronze statue of Athena (afterwards called Athena Promachos) by Pheidias, probably set up by Cimon in commemoration of the Persian defeat. The statue, which was 30 ft. high, represented the goddess as fully armed; the gleam of her helmet and spear could be seen by the mariners approaching from Cape Sunium (Pausanias i. 28). On both sides of the passage were numerous statues, among them that of Athena Hygeïa, set up by Pericles to commemorate the recovery of a favourite slave who was injured during the building of the Parthenon, a colossal bronze image of the wooden horse of Troy, and Myron's group of Marsyas with Athena throwing away her flute. Another statue by Myron, the famous Perseus, stood near the precinct of Artemis Brauronia. In this sacred enclosure, which lay between the south-eastern corner of the Propylaea and the wall of Cimon, no traces of a temple have been found. Adjoining it to the east are the remains of a large rectangular building, which was apparently fronted by a colonnade; this has been identified with the Χαλκοθήκη, a storehouse of bronze implements and arms, which was formerly supposed to lie against the north wall near the Propylaea. Beyond the Parthenon, a little to the north-east, was the great altar of Athena, and near it the statue and altar of Zeus Polieus. With regard to the buildings on the east end of the Acropolis, where the present museums stand, no certainty exists; among the many statues here were those of Xanthippus, the father of Pericles, and of Anacreon. Immediately west of the Erechtheum is the Pandroseum or temenos of Pandrosos, the daughter of Cecrops, the excavation of which has revealed no traces of the temple (ναός) seen here by Pausanias (i. 27). The site of this precinct, in which the sacred olive tree of Athena grew, has been almost certainly fixed by an inscription found in the bastion of Odysseus. At its north-western extremity is a platform of levelled rock which may have supported the altar of Zeus Hypsistus. Farther west, along the north wall of the Acropolis, is the space probably occupied by the abode and playground of the Errephori. Between this precinct and the Propylaea were a number of statues, among them the celebrated heifer of Myron, and perhaps his Erechtheus; the Lemnian Athena of Pheidias, and his effigy of his friend Pericles.

The reconstruction of the city after its demolition by the Persians was not carried out on the lines of a definite plan like that of the Peiraeus. The houses were hastily repaired, and the

The city in the classical period.

narrow, crooked streets remained; the influence of Themistocles, who aimed at transferring the capital to the Peiraeus, was probably directed against any costly scheme of restoration, except on the Acropolis. The period of Cimon's administration, however, especially the interval between his victory on the Eurymedon and his ostracism (468–461 B.C.), was marked by great architectural activity in the lower city as well as on the citadel. To his time may be referred many of the buildings around the Agora (probably rebuilt on the former sites) and elsewhere, and the passage, or δρόμος, from the Agora to the Dipylon flanked by long porticos. The Theseum or temple of Theseus, which lay to the east of the Agora near the Acropolis, was built by Cimon: here he deposited the bones of the national hero which he brought from Scyros about 470 B.C. The only building in the city which can with certainty be assigned to the administration of Pericles is the Odeum, beneath the southern declivity of the Acropolis, a structure mainly of wood, said to have been built in imitation of the tent of Xerxes: it was used for musical contests and the rehearsal of plays. Of the various temples in which statues by Pheidias, Alcamenes and other great sculptors are known to have been placed, no traces have yet been discovered; excavation has not been possible in a large portion of the lower city, which has always been inhabited. The only extant structures of the classical period are the Hephaesteum, the Dionysiac theatre, and the choragic monument of Lysicrates. The remains of a small Ionic temple which were standing by the Ilissus in the time of Stuart have disappeared.


THE ACROPOLIS
Scale of Yards
0 10 20 30 40 50 60
Contour lines at intervals of 5 metres (=16·4 feet) shown thus:- 150
Clepsydra
Cave of Apollo
Cave of Pan
Roman Gateway
Propylaea
Early Road
Athena Promachos (Site of)
Early Temple of Athena
Altar of Athena
Precinct of the Brauronian Artemis
Chalcotheca
Pelasgicum
Theatre of Herodes
Parthenon
Temple of Rome and Augustus
Retaining Wall
MUSEUM
SMALL MUSEUM
Spring
Asclepieum
Theatre of Dionysus
1
2
3
4
5
5
1. Pinacotheca
2. Roman Cistern
3. Temple of Nikē Apteros
4. Pandroseum
5. Erechtheum
Cyclopaean
6th. Century B.C.
5th & 4th Century B.C.
Roman
120
125
130
135
150
155
115
110

After J. H. Middleton, by permission of the Hellenic Soc., and Prof E.A Gardner

Emery Walker sc

The Hephaesteum or Theseum.

The Hephaesteum, the so-called Theseum, is situated on a slight eminence, probably the Colonus Agoraeus, to the west of the Agora. The best preserved Greek temple in the world, it possesses no record of its origin; the style of its sculptures and architecture leads to the conclusion that it was built about the same time as the Parthenon; it seems to have been finished by 421 B.C. It has been known as the Theseum since the middle ages, apparently because some of its sculptures represent the exploits of Theseus, but the Theseum was an earlier sanctuary on the east of the Agora (see above). The building has been supposed by Curtius, Wachsmuth and others to be the Heracleum in Melite, but its identification with the temple of Hephaestus and Athena seen in this neighbourhood by Pausanias (i. 14. 6), though not established, may be regarded as practically certain, notwithstanding the difficulty presented by the subjects of the sculptures, which bear no relation to Hephaestus. The temple is a Doric peripteral hexastyle *in antis*, with 13 columns at the sides; its length is 104 ft., its breadth $45\frac{1}{2}$ ft., its height, to the top of the pediment, 33 ft. The sculptures of the pediments have been completely lost, but their design has been ingeniously reconstructed by Sauer. The frieze of the entablature contains sculptures only in the metopes of the east front and in those of the sides immediately adjoining it; the frontal metopes represent the labours of Heracles, the lateral the exploits of Theseus. As in the Parthenon, there is a sculptured zophoros above the exterior of the cella walls; this, however, extends over the east and west fronts only and the east ends of the sides; the eastern zophoros represents a battle-scene with seated deities on either hand, the western a centauromachia. The temple is entirely of Pentelic marble, except the foundations and lowest step of the stylobate, which are of Peiraic stone, and the zophoros of the cella, which is in Parian marble. The preservation of the temple is due to its conversion into a church in the middle ages.

The Dionysiac theatre and Asclepieum.

The Dionysiac theatre, situated beneath the south side of the Acropolis, was partly hollowed out from its declivity. The representation of plays was perhaps transferred to this spot from the early Orchestra in the Agora at the beginning of the 5th century B.C.; it afterwards superseded the Pnyx as the meeting-place of the Ecclesia. The site, which had been accurately determined by Leake, was explored by Strack in 1862, and the researches subsequently undertaken by the Greek Archaeological Society were concluded in 1879. It was not, however, till 1886 that traces of the original circular Greek orchestra were pointed out by Dörpfeld. The arrangements of the stage and orchestra as we now see them belong to Roman times; the *cavea* or auditorium dates from the administration of the orator Lycurgus (337–323 B.C.), and nothing is left of the theatre in which the plays of Sophocles were acted save a few small remnants of polygonal masonry. These, however, are sufficient to mark out the circuit of the ancient orchestra, on which the subsequently built proscenia encroached. The oldest stage-building was erected in the time of Lycurgus; it consisted of a rectangular hall with square projections (παρασκήνια) on either side; in front of this was built in late Greek or early Roman times a stage with a row of columns which intruded upon the orchestra space; a later and larger stage, dating from the time of Nero, advanced still farther into the orchestra, and this was finally faced (probably in the 3rd century A.D.) by the "bema" of Phaedrus, a platform-wall decorated with earlier reliefs, the slabs of which were cut down to suit their new position. The remains of two temples of Dionysus have been found adjoining the stoa of the theatre, and an altar of the same god adorned with masks and festoons; the smaller and earlier temple probably dates from the 6th century B.C., the larger from the end of the 5th or the beginning of the 4th century.

Immediately west of the theatre of Dionysus is the sacred precinct of Asclepius, which was excavated by the Archaeological Society in 1876–1878. Here were discovered the foundations of the celebrated Asclepieum, together with several inscriptions and a great number of votive reliefs offered by grateful invalids and valetudinarians to the god of healing. Many of the reliefs belong to the best period of Greek art. A Doric colonnade with a double row of columns was found to have extended along the base of the Acropolis for a distance of 54 yds.; behind it in a chamber hewn in the rock is the sacred well mentioned by Pausanias. The colonnade was a place of resort for the patients; a large building close beneath the rock was probably the abode of the priests.

The choragic monument of Lysicrates.

The beautiful choragic monument of Lysicrates, dedicated in the archonship of Euaenetus (335–334 B.C.), is the only survivor of a number of such structures which stood in the "Street of the Tripods" to the east of the Dionysiac theatre, bearing the tripods given to the successful choragi at the Dionysiac festival. It owes its preservation to its former inclusion in a Capuchin convent. The monument consists of a small circular temple of Pentelic marble, 21½ ft. in height and 9 ft. in diameter, with six engaged Corinthian columns and a sculptured frieze, standing on a rectangular base of Peiraic stone. The delicately carved convex roof, composed of a single block, was surmounted by the tripod. The spirited reliefs of the frieze represent the punishment of the Tyrrhenian pirates by Dionysus and their transformation into dolphins. Another choragic monument was that of Thrasyllus, which faced a cave in the Acropolis rock above the Dionysiac theatre. A portion of another, that of Nicias, was used to make the late Roman gate of the Acropolis. In one of these monuments was the famous Satyr of Praxiteles.

The Cynosarges.

The Cynosarges, from earliest times a sanctuary of Heracles, later a celebrated gymnasium and the school of Antisthenes the Cynic, has hitherto been generally supposed to have occupied the site of the Monastery of the Asomati on the eastern slope of Lycabettus; its situation, however, has been fixed by Dörpfeld at a point a little to the south of the Olympieum, on the left bank of the Ilissus. Here a series of excavations, carried out by the British School in 1896–1897 under the direction of Cecil Smith, revealed the foundations of an extensive Greek building, the outlines of which correspond with those of a gymnasium; it possessed a large bath or cistern, and was flanked on two sides by water-courses. An Ionic capital found here possibly belonged to the palaestra. The identification, however, cannot be regarded as certain in the absence of inscriptions.

The Hellenistic period: the Stoa of Attalus.

With the loss of political liberty the age of creative genius in Athenian architecture came to a close. The era of decadence, of honorary statues and fulsome inscriptions, began. The embellishments which the city received during the Hellenistic and Roman periods were no longer the artistic expression of the religious and political life of a great commonwealth; they were the tribute paid to the intellectual renown of Athens by foreign potentates or dilettanti, who desired to add their names to the list of its illustrious citizens and patrons. Among the first of these benefactions was the great gymnasium of Ptolemy, built in the neighbourhood of the Agora about 250 B.C. Successive princes of the dynasty of Pergamum interested themselves in the adornment of the city: Attalus I. set up a number of bronze statues on the Acropolis; Eumenes II. built the long portico west of the Dionysiac theatre, which was excavated and identified in 1877; Attalus II. erected the magnificent Stoa near the Agora, the remains of which were completely laid bare in 1898–1902 and have been identified by an inscription. The Stoa consisted of a series of 21 chambers, probably shops, faced by a double colonnade, the outer columns being of the Doric order, the inner unfluted, with lotus-leaf capitals; it possessed an upper storey fronted with Ionic columns.

The Olympieum.

The greatest monument, however, of the Hellenistic period is the colossal Olympieum or temple of Olympian Zeus, "unum in terris inchoatum pro magnitudine dei" (Livy xli. 20), the remains of which stand by the Ilissus to the south-east of the Acropolis. The foundations of a temple were laid on the site—probably that of an ancient sanctuary—by Peisistratus, but the building in its ultimate form was for the greater part constructed under the auspices of Antiochus IV. Epiphanes, king of Syria, by the Roman architect Cossutius in the interval between 174 B.C. and 164 B.C., the date of the death of Antiochus. The work was then suspended and its proposed resumption in the time of Augustus seems not to have been realized; finally, in A. D. 129, the temple was completed and dedicated by Hadrian, who set up a chryselephantine statue of Zeus in the cella. The substructure was excavated in 1883 by F. C. Penrose, who proved the correctness of Dörpfeld's theory that the building was octostyle; its length was 318 ft., its breadth 132 ft. With the exception of the foundations and two lower steps of the stylobate, it was entirely of Pentelic marble, and possessed 104 Corinthian columns, 56 ft. 7 in. in height, of which 48 stood in triple rows under the pediments and 56 in double rows at the sides; of these, 16 remained standing in 1852, when one was blown down by a storm. Fragments of Doric columns and foundations were discovered, probably intended for the temple begun by Peisistratus, the orientation of which differed slightly from that of the later structure. The peribolos, a large artificial platform supported by a retaining wall of squared Peiraic blocks with buttresses, was excavated in 1898 without important results; it is to be hoped that the stability of the columns has not been affected by the operations.

The Horologium of Andronicus.

The Roman Period.—After 146 B.C. Athens and its territory were included in the Roman province of Achaea. Among the earlier buildings of this period is the Horologium of Andronicus of Cyrrhus (the "Tower of the Winds"), still standing near the eastern end of the Roman Agora. The building may belong to the 2nd or 1st century B.C.; it is mentioned by Varro (*De re rust.* iii. 5. 17), and therefore cannot be of later date than 35 B.C. It is an octagonal marble structure, 42 ft. in height and 26 ft. in diameter; the eight sides, which face the points of the compass, are furnished with a frieze containing inartistic figures in relief representing the winds; below it, on the sides facing the sun, are the lines of a sun-dial. The building was surmounted by a weathercock in the form of a bronze Triton; it contained a water-clock to record the time when the sun was not shining.

Monuments of the Roman period.

The capture and sack of Athens by Sulla (March 1, 86 B.C.) seems to have involved no great injury to its architectural monuments beyond the burning of the Odeum of Pericles; a portion of the city wall was razed, the groves of the Academy and Lyceum were cut down, and the Peiraeus, with its magnificent arsenal and other great buildings, burnt to the ground. After this catastrophe the benefactors of Athens were for the most part Romans; the influence of Greek literature and art had begun to affect the conquering race. The New, or Roman, Agora to the north of the Acropolis, perhaps mainly an oil market, was constructed after the year 27 B.C. Its dimensions were practically determined by excavation in 1890–1891. It consisted of a large open rectangular space surrounded by an Ionic colonnade into which opened a number of shops or storehouses. The eastern gate was adorned with four Ionic columns on the outside and two on the inside, the western entrance being the well-known Doric portico of Athena Archegetis with an inscription recording its erection from donations of Julius Caesar and Augustus. The whole conclave may be compared with the enclosed bazaars or khans of Oriental cities which are usually locked at night. The Agrippeum, a covered theatre, derived its name from Vipsanius Agrippa, whose statue was set up, about 27 B.C., beneath the north wing of the Acropolis propylaea, on the high rectangular base still remaining. At the eastern end of the Acropolis a little circular temple of white marble with a peristyle of 9 Ionic columns was dedicated to Rome and Augustus; its foundations were discovered during the excavations of 1885–1888. The conspicuous monument which crowns the Museum Hill was erected as the mausoleum of Antiochus Philopappus of Commagene, grandson of Antiochus Epiphanes, in A.D. 114–116. Excavations carried out in 1898–1899 showed that the structure was nearly square; the only portion remaining is the slightly curved front, with three niches between Corinthian pilasters; in the central niche is the statue of Philopappus.

Novae Athenae: the buildings of Hadrian.

The emperor Hadrian was the most lavish of all the benefactors of Athens. Besides completing the gigantic Olympieum he enlarged the circuit of the city walls to the east, enclosing the area now covered by the royal and public gardens and the Constitution Square. This was the City of Hadrian (Hadrianapolis) or New Athens (Novae Athenae); a handsome suburb with numerous villas, baths and gardens; some traces remain of its walls, which, like those of Themistocles, were fortified with rectangular towers. An ornamental entrance near the Olympieum, the existing Arch of Hadrian, marked the boundary between the new and the old cities. The arch is surmounted by a triple attic with Corinthian columns; the frieze above the keystone bears, on the north-western side, the inscription *αἵδ’ εἴσ’ Ἀθῆναι, Θησέως ἡ πρὶν πόλις*, and on the south-eastern, *αἵδ’ εἴσ’ Ἁδριανοῦ καὶ οὐχὶ Θησέως πόλις*. One of the principal monuments of Hadrian's munificence was the sumptuous library, in all probability a vast rectangular enclosure, immediately north of the New Agora, the eastern side of which was explored in 1885–1886. A portion of its western front, adorned with monolith unfluted Corinthian columns, is still standing—the familiar "Stoa of Hadrian"; another well-preserved portion, with six pilasters, runs parallel to the west side of Aeolus Street. The interior consisted of a spacious court surrounded by a colonnade of 100 columns, into which five chambers opened at the eastern end. A portico of four fluted Corinthian columns on the western side formed the entrance to the quadrangle. This cloistered edifice may be identified with the library of Hadrian mentioned by Pausanias; the books were, perhaps, stored in a square building which occupied a portion of the central area. Strikingly similar in design and construction is a large quadrangular building, the foundations of which were discovered by the British School near the presumed Cynosarges; this may perhaps be the Gymnasium of Hadrian, which Pausanias tells us also possessed 100 columns. A Pantheon and temples of Hera and Zeus Panhellenius were likewise built by Hadrian; the aqueduct, which he began, was completed by Antoninus Pius (A.D. 138–161); it was repaired in 1861–1869 and is still in use.

The Stadium and Odeum of Herodes Atticus.

The Stadium, in which the Panathenaic Games were held, was first laid out by the orator Lycurgus about 330 B.C. It was an oblong structure filling a natural depression near the left bank of the Ilissus beneath the eastern declivity of the Ardettus hill, the parallel sides and semicircular end, or *σφενδόνη*, around the arena being partially excavated from the adjoining slopes. The immense building, however, which was restored in 1896 and the following years, was that constructed in Pentelic marble about A.D. 143 by Tiberius Claudius Herodes Atticus, a wealthy Roman resident, whose benefactions to the city rivalled those of Hadrian. The seats, rising in tiers, as in a theatre, accommodated about 44,000 spectators; the arena was 670 ft. in length and 109 ft. in breadth. The Odeum, built beneath the south-west slope of the Acropolis after A.D. 161 by Herodes Atticus in memory of his wife Regilla, is comparatively well preserved; it was excavated in 1848 and in 1857–1858. The plan is that of the conventional Roman theatre; the semicircular auditorium, which seated some 5000 persons, is, like that of the Dionysiac theatre, partly hollowed from the rock. The orchestra is paved with marble squares. The façade, in Peiraic stone, displays three storeys of arched windows. The whole building was covered with a cedar roof. The Stadium had been already completed and the Odeum had not yet been built when Pausanias visited Athens; these buildings were the last important additions to the architectural monuments of the ancient city. (J. D. B.)

II. The Modern City

At the conclusion of the Greek War of Independence, Athens was little more than a village of the Turkish type, the poorly built houses clustering on the northern and eastern slopes of the Acropolis. The narrow crooked lanes of this quarter still contrast with the straight, regularly laid-out streets of the modern city, which extends to the north-west, north and east of the ancient citadel. The greater commercial advantages offered by Nauplia, Corinth and Patras were outweighed by the historic claims of Athens in the choice of a capital for the newly founded kingdom, and the seat of government was transferred hither from Nauplia in 1833. The new town was, for the most part, laid out by the German architect Schaubert. It contains several squares and boulevards, a large public garden, and many handsome public and private edifices. A great number of the public institutions owe their origin to the munificence of patriotic Greeks, among whom Andreas Syngros and George Averoff may be especially mentioned. The royal palace, designed by Friedrich von Gärtner (1792–1847), is a tasteless structure; attached to it is a beautiful garden laid out by Queen Amalia, which contains a well-preserved mosaic floor of the Roman period. On the south-east is the newly built palace of the crown prince. The Academy, from designs by Theophil Hansen (1813–1891), is constructed of Pentelic marble in the Ionic style: the colonnades and pediments are richly coloured and gilded, and may perhaps convey some idea of the ancient style of decoration. Close by is the university, with a colonnade adorned with paintings, and the Vallianean library with a handsome Doric portico of Pentelic marble. The observatory, which is connected with the university, stands on the summit of the Hill of the Nymphs; like the Academy, it was erected at the expense of a wealthy Greek, Baron Sina of Vienna. In the public garden is the Zappeion, a large building with a Corinthian portico, intended for the display of Greek industries; here also is a monument to Byron, erected in 1896. The Boulē, or parliament-house, possesses a considerable library. Other public buildings are the Polytechnic Institute, built by contributions from Greeks of Epirus, the theatre, the Arsakeion (a school for girls), the Varvakeion (a gymnasium), the military school (*σχολὴ εὐελπίδων*), and several hospitals and orphanages. The cathedral, a large, modern structure, is devoid of architectural merit, but some of the smaller, ancient, Byzantine churches are singularly interesting and beautiful. Among private residences, the mansion built by Dr Schliemann, the discoverer of Troy, is the most noteworthy; its decorations are in the Pompeian style.

Museums.

The museums of Athens have steadily grown in importance with the progress of excavation. They are admirably arranged, and the remnants of ancient art which they contain have fortunately escaped injudicious restoration. The National Museum, founded in 1866, is especially rich in archaic sculptures and in sepulchral and votive reliefs. A copy of the Diadumenos of Polyclitus from Delos, and temple sculptures from Epidaurus and the Argive Heraeum, are among the more notable of its recent acquisitions. It also possesses the famous collection of prehistoric antiquities found by Schliemann at Tiryns and Mycenae, other "Mycenaean" objects discovered at Nauplia and in Attica, as well as the still earlier remains excavated by Tsountas in the Cyclades and by the British School at Phylakopi in Melos; terra-cottas from Tanagra and Asia

Minor; bronzes from Olympia, Delphi and elsewhere, and numerous painted vases, among them the unequalled white *lekythi* from Athens and Eretria. The Epigraphical Museum contains an immense number of inscriptions arranged by H. G. Lolling and A. Wilhelm of the Austrian Institute. The Acropolis Museum (opened 1878) possesses a singularly interesting collection of sculptures belonging to the "archaic" period of Greek art, all found on the Acropolis; here, too, are some fragments of the pedimental statues of the Parthenon and several reliefs from its frieze, as well as the slabs from the balustrade of the temple of Nike. The Polytechnic Institute contains a museum of interesting objects connected with modern Greek life and history. In the Academy is a valuable collection of coins superintended by Svoronos. Of the private collections those of Schliemann and Karapanos are the most interesting: the latter contains works of art and other objects from Dodona. There is a small museum of antiquities at the Peiraeus.

Scientific institutions. Owing to the numbers and activity of its institutions, both native and foreign, for the prosecution of research and the encouragement of classical studies, Athens has become once more an international seat of learning. The Greek Archaeological Society, founded in 1837, numbers some distinguished scholars among its members, and displays great activity in the conduct of excavations. Important researches at Epidaurus, Eleusis, Mycenae, Amyclae and Rhamnus may be numbered among its principal undertakings, in addition to the complete exploration of the Acropolis and a series of investigations in Athens and Attica. The French École d'Athènes, founded in 1846, is under the scientific direction of the Académie des Inscriptions et Belles-lettres. Among its numerous enterprises have been the extensive and costly excavations at Delos and Delphi, which have yielded such remarkable results. The monuments of the Byzantine epoch have latterly occupied a prominent place in its investigations. The German Archaeological Institute, founded in 1874, has carried out excavations at Thebes, Lesbos, Paros, Athens and elsewhere; it has also been associated in the great researches at Olympia, Pergamum and Troy, and in many other important undertakings. The British School, founded in 1886, has been unable, owing to insufficient endowment, to work on similar lines with the French and German institutions; it has, however, carried out extensive excavations at Megalopolis and in Melos, as well as researches at Abae, in Athens (presumed site of the Cynosarges), in Cyprus, at Naucratis and at Sparta. It has also participated in the exploration of Cnossus and other important sites in Crete. The American School, founded in 1882, is supported by the principal universities of the United States. In addition to researches at Sicyon, Plataea, Eretria and elsewhere, it has undertaken two works of capital importance—the excavation of the Argive Heraeum and of ancient Corinth. An Austrian Archaeological Institute was founded in 1898.

Industry and commerce. Notwithstanding certain disadvantages inherent in its situation, the trade and manufactures of Athens have considerably increased in recent years. Industrial and commercial activity is mainly centred at the Peiraeus, where 8 cloth and cotton mills, 45 cognac distilleries, 14 steam flour mills, 8 soap manufactories, 13 shipbuilding and engineering works, chair manufactories, dye works, chemical works, tanneries and a dynamite factory have been established. The shipbuilding and engineering trades are active and advancing. The export trade is, however, inconsiderable, as the produce of the local industries is mainly absorbed by home consumption. The principal exports are wine, cognac and marble from Pentelicus. As a place of import, the Peiraeus surpasses Patras, Syra and all the other Greek maritime towns, receiving about 53 % of all the merchandise brought into Greece. The principal imports are coal, grain, manufactured articles and articles of luxury. The total value of exports in 1904 was £459,565; of imports, £2,459,278. The number of ships entered and cleared in 1905 was 5020 with a tonnage of 5,796,590 tons, of which 416, with a tonnage of 609,822 tons, were British.

The Peiraeus. The Peiraeus, which had never revived since its destruction by the Romans in 86 B.C., was at the beginning of the 19th century a small fishing village known as Porto Leone. When Athens became the capital in 1833 the ancient name of its port was revived, and since that time piers and quays have been constructed, and spacious squares and broad regular streets have been laid out. The town now possesses an exchange, a large theatre, a gymnasium, a naval school, municipal buildings and several hospitals and charitable institutions erected by private munificence. The harbour, in which ships of all nations may be seen, as well as great numbers of the picturesque sailing craft engaged in the coasting trade, is somewhat difficult of access to larger vessels, but has been improved by the construction of new breakwaters and dry docks. The port and the capital are now connected by railway with Corinth and the principal towns of the Morea; the line opening up communication with northern Greece and Thessaly, when its proposed connexion with the Continental railway system has been effected, will greatly enhance the importance of the Peiraeus, already one of the most flourishing commercial towns in the Levant.

Population. The population of Athens has rapidly increased. In 1834 it was below 5000; in 1870 it was 44,510; in 1879, 63,374; in 1889, 107,251; in 1896, 111,486. The Peiraeus, which in 1834 possessed only a few hundred inhabitants, in 1879 possessed 21,618; in 1889, 34,327; in 1896, 43,848. The total population of Athens in 1907 was 167,479 and of Peiraeus 67,982. (J. D. B.)

III. HISTORY

1. *The Prehistoric Period.*—The history of primitive Athens is involved in the same obscurity which enshrouds the early development of most of the Greek city-states. The Homeric poems scarcely mention Attica, and the legends, though numerous, are rarely of direct historical value. In the Minoan epoch Athens is proved by the archaeological remains to have been a petty kingdom scarcely more important than many other Attic communities, yet enjoying a more unbroken course of development than the leading states of that period. This accords with the cherished tradition which made the Athenians children of the soil, and free from admixture with conquering tribes. Many legends, however, and the later state organization, point to an immigration of an "Ionian" aristocracy in late Mycenaean days. These Ionian newcomers are almost certainly responsible for the absorption of the numerous independent communities of Attica into a central state of Athens under a powerful monarchy (see THESEUS), for the introduction of new cults, and for the division of the people into four tribes whose names—Geleontes, Hopletes, Argadeis and Aegicoreis—recur in several true Ionian towns. This centralization of power (*Synoecism*), to which many Greek peoples never attained, laid the first foundations of Athenian greatness. But in other respects the new constitution tended to arrest development. When the monarchy was supplanted in the usual Greek fashion by a hereditary nobility—a process accomplished, according to tradition, between about 1000 and 683 B.C.—all power was appropriated by a privileged class of Eupatridae (*q.v.*); the Geomori and Demiurgi, who formed the bulk of the community, enjoyed no political rights. It was to their control over the machinery of law that the Eupatridae owed their predominance. The aristocratic council of the Areopagus (*q.v.*) constituted the chief criminal court, and nominated the magistrates, among whom the chief archon (*q.v.*) passed judgment in family suits, controlled admission to the genos or clan, and consequently the acquisition of the franchise. This system was further supported by religious prescriptions which the nobles retained as a corporate secret. Assisted no doubt by their judicial control, the Eupatridae also tended to become sole owners of the land, reducing the original freeholders or tenants to the position of serfs. During this period Athens seems to have made little use of her militia, commanded by the polemarch, or of her navy, which was raised in special local divisions known as Naucraries (see NAUCRARY); hence no military *esprit de corps* could arise to check the Eupatrid

ascendancy. Nor did the commons obtain relief through any commercial or colonial enterprises such as those which alleviated social distress in many other Greek states. The first attack upon the aristocracy proceeded from a young noble named Cylon, who endeavoured to become tyrant about 630 B.C. The people helped to crush this movement; yet discontent must have been rife among them, for in 621 the Eupatrids commissioned Draco (*q.v.*), a junior magistrate, to draft and publish a code of criminal law. This was a notable concession, by which the nobles lost that exclusive legal knowledge which had formed one of their main instruments of oppression.

2. *The Rise of Athens.*—A still greater danger grew out of the widespread financial distress, which was steadily driving many of the agricultural population into slavery and threatened the entire state with ruin. After a protracted war with the neighbouring Megarians had accentuated the crisis the Eupatridae gave to one of their number, the celebrated Solon (*q.v.*), free power to remodel the whole state (594). By his economic legislation Solon placed Athenian agriculture once more upon a sound footing, and supplemented this source of wealth by encouraging commercial enterprise, thus laying the foundation of his country's material prosperity. His constitutional reforms proved less successful, for, although he put into the hands of the people various safeguards against oppression, he could not ensure their use in practice. After a period of disorder and party-feud among the nobles the new constitution was superseded in fact, if not in form, by the autocratic rule of Peisistratus (*q.v.*), and his sons Hippias and Hipparchus. The age of despotism, which lasted, with interruptions, from 560 to 510, was a period of great prosperity for Athens. The rulers fostered agriculture, stimulated commerce and industry (notably the famous Attic ceramics), adorned the city with public works and temples, and rendered it a centre of culture. Their vigorous foreign policy first made Athens an Aegean power and secured connexions with numerous mainland powers. Another result of the tyranny was the weakening of the undue influence of the nobles and the creation of a national Athenian spirit in place of the ancient clan-feeling.

The equalization of classes was already far advanced when towards the end of the century a nobleman of the Alcmaeonid family, named Cleisthenes (*q.v.*), who had taken the chief part in the final expulsion of the tyrants, acquired ascendancy as leader of the commons. The constitution which he promulgated (508/7) gave expression to the change of political feeling by providing a national basis of franchise and providing a new state organization. By making effective the powers of the Ecclesia (Popular Assembly) the Boulē (Council) and Heliaea, Cleisthenes became the true founder of Athenian democracy.

This revolution was accompanied by a conflict with Sparta and other powers. But a spirit of harmony and energy now breathed within the nation, and in the ensuing wars Athens worsted powerful enemies like Thebes and Chalcis (506). A bolder stroke followed in 500, when a force was sent to support the Ionians in revolt against Persia and took part in the sack of Sardis. After the failure of this expedition the Athenians apparently became absorbed in a prolonged struggle with Aegina (*q.v.*). In 493 the imminent prospect of a Persian invasion brought into power men like Themistocles and Miltiades (*qq.v.*), to whose firmness and insight the Athenians largely owed their triumph in the great campaign of 490 against Persia. After a second political reaction, the prospect of a second Persian war, and the naval superiority of Aegina led to the assumption of a bolder policy. In 483 Themistocles overcame the opposition of Aristides (*q.v.*), and passed his famous measure providing for a large increase of the Athenian fleet. In the great invasion of 480–479 the Athenians displayed an unflinching resolution which could not be shaken even by the evacuation and destruction of their native city. Though the traditional account of this war exaggerates the services of Athens as compared with the other champions of Greek independence, there can be no doubt that the ultimate victory was chiefly due to the numbers and efficiency of the Athenian fleet, and to the wise policy of her great statesman Themistocles (see SALAMIS, PLATAEA).

3. *Imperial Athens.*—After the Persian retreat and the reoccupation of their city the Athenians continued the war with unabated vigour. Led by Aristides and Cimon they rendered such prominent service as to receive in return the formal leadership of the Greek allies and the presidency of the newly formed Delian League (*q.v.*). The ascendancy acquired in these years eventually raised Athens to the rank of an imperial state. For the moment it tended to impair the good relations which had subsisted between Athens and Sparta since the first days of the Persian peril. But so long as Cimon's influence prevailed the ideal of "peace at home and the complete humiliation of Persia" was steadily unheld. Similarly the internal policy of Athens continued to be shaped by the conservatives. The only notable innovations since the days of Cleisthenes had been the reduction of the archonship to a routine magistracy appointed partly by lot (487), and the rise of the ten elective strategi (generals) as chief executive officers (see STRATEGUS). But the triumph of the navy in 480 and the great expansion of commerce and industry had definitely shifted the political centre of gravity from the yeoman class of moderate democrats to the more radical party usually stigmatized as the "sailor rabble." Though Themistocles soon lost his influence, his party eventually found a new leader in Ephialtes and after the failure of Cimon's foreign policy (see CIMON) triumphed over the conservatives. The year 461 marks the reversal of Athenian policy at home and abroad. By cancelling the political power of the Areopagus and multiplying the functions of the popular law-courts, Ephialtes abolished the last checks upon the sovereignty of the commons. His successor, Pericles, who commonly ranked as the "completer of the democracy," merely developed the full democracy so as to secure its effectual as well as its theoretical supremacy. The foreign policy of Athens was now directed towards an almost reckless expansion (see PERICLES). The unparalleled success of the Athenian arms at this period extended the bounds of empire to their farthest limits. Besides securing her Aegean possessions and her commerce by the defeat of Corinth and Aegina, her last rivals on sea, Athens acquired an extensive dominion in central Greece and for a time quite overshadowed the Spartan land-power. The rapid loss of the new conquests after 447 proved that Athens lacked a sufficient land-army to defend permanently so extensive a frontier. Under the guidance of Pericles the Athenians renounced the unprofitable rivalry with Sparta and Persia, and devoted themselves to the consolidation and judicious extension of their maritime influence.

The years of the supremacy of Pericles (443–429) are on the whole the most glorious in Athenian history. In actual extent of territory the empire had receded somewhat, but in point of security and organization it now stood at its height. The Delian confederacy lay completely under Athenian control, and the points of strategic importance were largely held by cleruchies (*q.v.*; see also PERICLES) and garrisons. Out of a citizen body of over 50,000 freemen, reinforced by mercenaries and slaves, a superb fleet exceeding 300 sail and an army of 30,000 drilled soldiers could be mustered. The city itself, with its fortifications extending to the port of Peiraeus, was impregnable to a land attack. The commerce of Athens extended from Egypt and Colchis to Etruria and Carthage, and her manufactures, which attracted skilled operatives from many lands, found a ready sale all over the Mediterranean. With tolls, and the tribute of the Delian League, a fund of 9700 talents (£2,300,000) was amassed in the treasury.

Yet the material prosperity of Athens under Pericles was less notable than her brilliant attainments in every field of culture. Her development since the Persian wars had been extremely rapid, but did not reach its climax till the latter part of the century. No city ever adorned herself with such an array of temples, public buildings and works of art as the Athens of Pericles and Pheidias. Her achievements in literature are hardly less great. The Attic drama of the period produced many great masterpieces, and the scientific thought of Europe in the departments of logic, ethics, rhetoric and history mainly owes its origin to a new movement of Greek thought which was largely fostered by the patronage of Pericles himself. Besides producing numerous men of genius herself Athens attracted all the great intellects of Greece. The brilliant summary of the historian Thucydides in the famous Funeral Speech of Pericles (delivered in 430), in which the social life, the institutions and the culture of his country are set forth as a model, gives a substantially true picture of Athens in its greatest days.

This brilliant epoch, however, was not without its darker side. The payment for public service which Pericles had introduced may have contributed to raise the general level of culture of the citizens, but it created a dangerous precedent and incurred the censure of notable Greek thinkers. Moreover, all this prosperity was obtained at the expense of the confederates, whom Athens exploited in a somewhat selfish and illiberal manner. In fact it was the cry of "tyrant city" which went furthest to rouse public opinion in Greece against Athens and to bring on the Peloponnesian War (*q.v.*) which ruined the Athenian empire (431–404). The issue of this conflict was determined less by any intrinsic superiority on the part of her enemies than by the blunders committed by a people unable to carry out a consistent foreign policy on its own initiative, and served since Pericles by none but selfish or short-sighted advisers. It speaks well for the patriotic devotion and discipline of her commons that Athens, weakened by plague and military disasters, should have withstood for so long the blows of her numerous enemies from without, and the damage inflicted by traitors within her walls (see ANTIPHON, THERAMENES).

4. *The Fourth Century.*—After the complete defeat of Athens by land and sea, it was felt that her former services on behalf of Greece and her high culture should exempt her from total ruin. Though stripped of her empire, Athens obtained very tolerable terms from her enemies. The democratic constitution, which had been supplanted for a while by a government of oligarchs, but was restored in 403 after the latter's misrule had brought about their own downfall (see CRITIAS, THERAMENES, THRASYBULUS), henceforth stood unchallenged by the Greeks. Indeed the spread of democracy elsewhere increased the prestige of the Athenian administration, which had now reached a high pitch of efficiency. Athenian art and literature in the 4th century declined but slightly from their former standard; philosophy and oratory reached a standard which was never again equalled in antiquity and may still serve as a model. In the wars of the period Athens took a prominent part with a view to upholding the balance of power, joining the Corinthian League in 395, and assisting Thebes against Sparta after 378, Sparta against Thebes after 369. Her generals and admirals, Conon, Iphicrates, Chabrias, Timotheus, distinguished themselves by their military skill, and partially recovered their country's predominance in the Aegean, which found expression in the temporary renewal of the Delian League (*q.v.*). By the middle of the century Athens was again the leading power in Greece. When Philip of Macedon began to grow formidable she seemed called upon once more to champion the liberties of Greece. This ideal, when put forward by the consummate eloquence of Demosthenes and other orators, created great enthusiasm among the Athenians, who at times displayed all their old vigour in opposing Philip, notably in the decisive campaign of 338. But these outbursts of energy were too spasmodic, and popular opinion repeatedly veered back in favour of the peace-party. With her diminished resources Athens could not indeed hope to cope with the great Macedonian king; however much we may sympathize with the generous ambition of the patriots, we must admit that in the light of hard facts their conduct appears quixotic.

5. *The Hellenistic Period.*—Philip and Alexander, who sincerely admired Athenian culture and courted a zealous co-operation against Persia, treated the conquered city with marked favour. But the people would not resign themselves to playing a secondary part, and watched for every opportunity to revolt. The outbreak headed by Athens after Alexander's death (323) led to a stubborn conflict with Macedonia. After his victory the regent Antipater punished Athens by the loss of her remaining dependencies, the proscription of her chief patriots, and the disfranchisement of 12,000 citizens. The Macedonian garrison which was henceforth stationed in Attic territory prevented the city from taking a prominent part in the wars of the Diadochi. Cassander placed Athens under the virtual autocracy of Demetrius of Phalerum (317–307), and after the temporary liberation by Demetrius Poliorcetes (306–300), secured his interests through a dictator named Lachares, who lost the place again to Poliorcetes after a siege (295). After a vain attempt to expel the garrison in 287, the Athenians regained their liberty while Macedonia was thrown into confusion by the Celts, and in 279 rendered good service against the invaders of the latter nation with a fleet off Thermopylae. When Antigonus Gonatas threatened to restore Macedonian power in Greece, the Athenians, supported perhaps by the king of Egypt, formed a large defensive coalition; but in the ensuing "Chremonidean War" (266–263) a naval defeat off Andros led to their surrender and the imposition of a Macedonian garrison. The latter was finally withdrawn in 229 by the good offices of Aratus (*q.v.*). At this period Athens was altogether overshadowed in material strength by the great Hellenistic monarchies and even by the new republican leagues of Greece; but she could still on occasion display great energy and patriotism. The prestige of her past history had now perhaps attained its zenith. Her democracy was respected by the Macedonian kings; the rulers of Egypt, Syria, and especially of Pergamum, courted her favour by handsome donations of edifices and works of art, to which the citizens replied by unbecoming flattery, even to the extent of creating new tribes named after their benefactors. If Athens lost her supremacy in the fields of science and scholarship to Alexandria, she became more than ever the home of philosophy, while Menander and the other poets of the New Comedy made Athenian life and manners known throughout the civilized world.

6. *Relations with the Roman Republic.*—In 228 Athens entered into friendly intercourse with Rome, in whose interest she endured the desperate attacks of Philip V. of Macedonia (200–199). In return for help against King Perseus she acquired some new possessions, notably the great mart of Delos, which became an Athenian cleruchy (166). By her treacherous attack upon the frontier-town of Oropus (156) Athens indirectly brought about the conflict between Rome and the Achaean League which resulted in the eventual loss of Greek independence, but remained herself a free town with rights secured by treaty. In spite of the favours displayed by Rome, the more radical section of the people began to chafe at the loss of their international importance. This discontent was skilfully fanned by Mithradates the Great at the outset of his Roman campaigns. His emissary, the philosopher Aristion, induced the people to declare war against Rome and to place him in chief command. The town with its port stood a long siege against Sulla, but was stormed in 86. The conqueror allowed his soldiers to loot, but inflicted no permanent punishment upon the people. This war left Athens poverty-stricken and stripped of her commerce: her only importance now lay in the philosophical schools, which were frequented by many young Romans of note (Cicero, Atticus, Horace, &c.). Greek became fashionable at Rome, and a visit to Athens a sort of pilgrimage for educated Romans (cf. Propertius iv. 21: "Magnum iter ad doctas proficisci cogor Athenas"). In the great civil wars Athens sided with Pompey and held out against Caesar's lieutenants, but received a free pardon "in consideration of her great dead." Similarly the triumvirs after Philippi condoned her enthusiasm for the cause of Brutus. Antony repeatedly made Athens his headquarters and granted her several new possessions, including Eretria and Aegina—grants which Octavian subsequently revoked.

7. *The Roman Empire.*—Under the new settlement Athens remained a free and sovereign city—a boon which she repaid by zealous Caesar-worship, for the favours bestowed upon her tended to pauperize her citizens and to foster their besetting sin of calculating flattery. Hadrian displayed his special fondness for the city by raising new buildings and relieving

financial distress. He amended the constitution in some respects, and instituted a new national festival, the Panhellenica. In the period of the Antonines the endowment of professors out of the imperial treasury gave Athens a special status as a university town. Her whole energies seem henceforth devoted to academic pursuits; the military training of her youth was superseded by courses in philosophy and rhetoric; the chief organs of administration, the revived Areopagus and the senior Strategus, became as it were an education office. Save for an incursion by Goths in A.D. 267 and a temporary occupation by Alaric in 395, Athens spent the remaining centuries of the ancient world in quiet prosperity. The rhetorical schools experienced a brilliant revival under Constantine and his successors, when Athens became the *alma mater* of many notable men, including Julian, Libanius, Basil and Gregory of Nazianzus, and in her professors owned the last representatives of a humane and moralized paganism. The freedom of teaching was first curtailed by Theodosius I.; the edict of Justinian (529), forbidding the study of philosophy, dealt the death-blow to ancient Athens.

The authorities for the history of ancient Athens will mostly be found under Greece: *History*, and the various biographies. The following books deal with special periods or subjects only:—(1) *Early Athens*: W. Warde Fowler, *The City-State*, ch. vi. (London, 1893). (2) *The fifth and fourth centuries*: the "Constitution of Athens," ascribed to Xenophon; W. Oncken, *Athen und Hellas* (Leipzig, 1865); U. v. Wilamowitz-Moellendorff, *Aus Kydathen* (Berlin, 1880); L. Whibley, *Political Parties at Athens* (Cambridge, 1889); G. Gilbert, *Beiträge zur inneren Geschichte Athens* (Leipzig, 1877); J. Beloch, *Die attische Politik seit Perikles* (Leipzig, 1884). (3) *The Hellenistic and Roman periods*: J. P. Mahaffy, *Greek Life and Thought*, from 323 to 146 (London, 1887), chs. v., vi., xvii.; A. Holm, *Greek History* (Eng. trans., London, 1898), iv. chs. vi. and xxiii.; Wilamowitz-Moellendorff, *Antigonos von Karystos* (Berlin, 1881), pp. 178-291; W. Capes, *University Life in Ancient Athens* (London, 1877); A. Dumont, *Essai sur l'Ephébie attique* (Paris, 1875). (4) *The Latin rule*: G. Finlay, *History of Greece* (Oxford ed., 1877), vol. iv. ch. vi. (5) *Constitutional History*: The Aristotelian "Constitution of Athens"; U. v. Wilamowitz-Moellendorff, *Aristoteles und Athen* (Berlin and Leipzig, 1893), vol. ii.; G. Gilbert, *Greek Constitutional Antiquities* (Eng. trans., London, 1895), pp. 95-453; A. H. J. Greenidge, *Handbook of Greek Constitutional History* (Oxford, 1896), ch. vi.; J. W. Headlam, *Election by Lot at Athens* (Cambridge, 1891). (6) *Finance and statistics*: A. Boeckh, *The Public Economy of the Athenians* (Eng. trans., London, 1828); Ed. Meyer, *Forschungen zur alten Geschichte* (Halle, 1899), vol. ii. pp. 149-195. (7) *Inscriptions*: *Corpus Inscriptionum Atticarum*, with supplements (Berlin, 1873–1895). (8) *Coins*: B. V. Head, *Historia Numorum* (Oxford, 1887), pp. 309-328. (M. O. B. C.)

8. *Byzantine Period.*—The city now sank into the position of a provincial Byzantine town. Already it had been robbed of many of its works of art, among them the Athena Promachos and the Parthenos of Pheidias, for the adornment of Constantinople, and further spoliation took place when the church of St Sophia was built in A.D. 532. The Parthenon, the Erechtheum, the "Theseum" and other temples were converted into Christian churches and were thus preserved throughout the middle ages. The history of Athens for the next four centuries is almost a blank; the city is rarely mentioned by the Byzantine chronicles of this period. The emperor Constantine II. spent some months here in A.D. 662–663. In 869 the see of Athens became an archbishopric. In 995 Attica was ravaged by the Bulgarians under their tsar Samuel, but Athens escaped; after the defeat of Samuel at Bēlasitza (1014) the emperor Basil II., who blinded 15,000 Bulgarian prisoners, came to Athens and celebrated his triumph by a thanksgiving service in the Parthenon (1018). From the Runic description on the marble lion of the Peiraeus it has been inferred that Harold Hardraada and the Norsemen in the service of the Byzantine emperors captured the Peiraeus in 1040, but this conclusion is not accepted by Gregorovius (bk. i. pp. 170-172). Like the rest of Greece, Athens suffered greatly from the rapacity of its Byzantine administrators. The letters of Acominatus, archbishop of Athens, towards the close of the 12th century, bewail the desolate condition of the city in language resembling that of Jeremiah in regard to Jerusalem.

9. *Period of Latin Rule: 1204–1458.*—After the Latin conquest of Constantinople in 1204, Otho de la Roche was granted the lordship of Athens by Boniface of Montferrat, king of Thessalonica, with the title of Megaskyr (μέγας κύριος = great lord). His nephew and successor, Guy I., obtained the title duke of Athens from Louis IX. of France in 1258. On the death of Guy II., last duke of the house of la Roche, in 1308, the duchy passed to his cousin, Walter of Brienne. He was expelled in 1311 by his Catalonian mercenaries; the mutineers bestowed the duchy "of Athens and Neopatras" on their leader, Roger Deslaur, and, in the following year, on Frederick of Aragon, king of Sicily. The Sicilian kings ruled Athens by viceroys till 1385, when the Florentine Nerio Acciajuoli, lord of Corinth, defeated the Catalonians and seized the city. Nerio, who received the title of duke from the king of Naples, founded a new dynasty. His palace was in the Propylaea; the lofty "Tower of the Franks," which adjoined the south wing of that building, was possibly built in his time. This interesting historical monument was demolished by the Greek authorities in 1874, notwithstanding the protests of Penrose, Freeman and other scholars. The Acciajuoli dynasty lasted till June 1458, when the Acropolis after a stubborn resistance was taken by the Turks under Omar, the general of the sultan Mahommed II., who had occupied the lower city in 1456. The sultan entered Athens in the following month; he was greatly struck by its ancient monuments and treated its inhabitants with comparative leniency.

10. *Period of Turkish Rule: 1458–1833.*—After the Turkish conquest Athens disappeared from the eyes of Western civilization. The principal interest of the following centuries lies in the researches of successive travellers, who may be said to have rediscovered the city, and in the fate of its ancient monuments, several of which were still in fair preservation at the beginning of this period. The Parthenon was transformed into a mosque; the existing minaret at its south-western corner was built after 1466. The Propylaea served as the residence of the Turkish commandant and the Erechtheum as his harem. In 1466 the Venetians succeeded in occupying the city, but failed to take the Acropolis. About 1645 a powder magazine in the Propylaea was ignited by lightning and the upper portion of the structure was destroyed. Under Francesco Morosini the Venetians again attacked Athens in September 1687; a shot fired during the bombardment of the Acropolis caused a powder magazine in the Parthenon to explode, and the building was rent asunder. After capturing the Acropolis the Venetians employed material from its ancient edifices in repairing its walls. They withdrew in the following year, when the Turks set fire to the city. The central sculptures of the western pediment of the Parthenon, which Morosini intended to take to Venice, were unskilfully detached by his workmen, and falling to the ground were broken to pieces. Several ancient monuments were sacrificed to provide material for a new wall with which the Turks surrounded the city in 1778.

During the 18th century many works of art, which still remained *in situ*, fell a prey to foreign collectors. The removal to London in 1812 of most of the remaining sculptures of the Parthenon by Lord Elgin possibly rescued many of them from injury in the period of warfare which followed. In 1821 the Greek insurgents surprised the city, and in 1822 captured the Acropolis. Athens again fell into the hands of the Turks in 1826, who bombarded and took the Acropolis in the following year; the Erechtheum suffered greatly, and the monument of Thrasyllus was destroyed. The Turks remained in possession of the Acropolis till 1833, when Athens was chosen as the capital of the newly established kingdom of Greece; since that date the history of the city forms part of that of modern Greece. (See Greece: *History, modern.*)

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ATHENS, a city and the county-seat of Clarke county, Georgia, U.S.A., in the N.E. part of the state, about 73 m. E. by N. of Atlanta. Pop. (1890) 8639; (1900) 10,245, of whom 5190 were negroes and only 114 were foreign-born; (1910, census) 14,913. It is served by the Georgia, the Central of Georgia, the Southern, the Seaboard Air Line and the Gainesville Midland railways. Athens is an important educational centre. It was founded in 1801 as the seat of the university of Georgia, which had been chartered in 1785. Franklin College, the academic department of the university, was opened in 1801, and afterwards the State College of Agriculture and Mechanic Arts (the School of Science, 1872), the State Normal School (co-educational, 1891), the School of Pharmacy (1903), the University Summer School (1903), the School of Forestry (1906), and the Georgia State College of Agriculture (1906), also branches of the university, were established at Athens, and what had been the Lumpkin Law School (incorporated in 1859) became the law department of the university in 1867. Branches of the university not in Athens are: the North Georgia Agricultural College (established in 1871; became a part of the university in 1872), at Dahlonega; the medical department, at Augusta (1873; founded as the Georgia Medical College in 1829); the Georgia School of Technology (1885), at Atlanta; the Georgia Normal and Industrial College for Girls (1889), at Milledgeville; and the Georgia Industrial College for Colored Youth (1890), near Savannah. At Athens also are several secondary schools, and the Lucy Cobb Institute (for girls), opened in 1858 and named in honour of a daughter of its founder, Gen. T. R. R. Cobb (1823–1862). The city has various manufactures, the most important being fertilizers, cotton goods, and cotton-seed oil and cake; the value of the total factory product in 1905 was $1,158,205, an increase of 70·9% in five years. Athens was chartered as a city in 1872.

ATHENS, a village and the county-seat of Athens county, Ohio, U.S.A., in the township of Athens, on the Hocking river, about 76 m. E.S.E. of Columbus. Pop. (1890) 2620; (1900) 3066; (1910) 5463; of the township (1910) 10,156. It is served by the Baltimore & Ohio Southwestern, the Toledo & Ohio Central (Ohio Central Lines), and the Hocking Valley railways. The village is built on rolling ground rising about 70 ft. above the river (which nearly encircles it), and commands views of some of the most beautiful scenery in the state. There are several ancient mounds in the vicinity. Athens is the seat of Ohio University (co-educational), a state institution established in 1804, and having in 1908 a college of liberal arts, a state normal college (1902), a commercial college, a college of music and a state preparatory school. In 1908 the University had 53 instructors and 1386 students. South of the village, and occupying a fine situation, is a state hospital for the insane. In the vicinity there are many coal mines, and among the manufactures are bricks, furniture, veneered doors, and shirts. The municipality operates the water-works. When the Ohio Company, through Manasseh Cutler, obtained from congress their land in what is now Ohio, it was arranged that the income from two townships was to be set aside "for the support of a literary institution." In 1795 the townships (Athens and Alexander) were located and surveyed, and in 1800 Rufus Putnam and two other commissioners, appointed by the Territorial legislature, laid out a town, which was also called Athens. Settlers slowly came; the town became the county-seat in 1805, was incorporated as a village in 1811, and was re-incorporated in 1828.

ATHERSTONE, WILLIAM GUYBON (1813–1898), British geologist, one of the pioneers in South African geology, was born in 1813, in the district of Uitenhage, Cape Colony. Having qualified as M.D. he settled in early life as a medical practitioner at Grahamstown, subsequently becoming F.R.C.S. In 1839 his interest was aroused in geology, and from that date he "devoted the leisure of a long and successful medical practice" to the pursuit of geological science. In 1857 he published an account of the rocks and fossils of Uitenhage (the latter described more fully by R. Tate, *Quart. Journal Geol. Soc.*, 1867). He also obtained many fossil reptilia from the Karroo beds, and presented specimens to the British Museum. These were described by Sir Richard Owen. Atherstone's identification in 1867 as a diamond of a crystal found at De Kalk near the junction of the Riet and Vaal rivers, led indirectly to the establishment of the great diamond industry of South Africa. He encouraged the workings at Jagersfontein, and he also called attention to the diamantiferous neck at Kimberley. He was one of the founders of the Geological Society of South Africa at Johannesburg in 1895; and for some years previously he was a member of the Cape parliament. He died at Grahamstown, on the 26th of June 1898.

See the obituary by T. Rupert Jones, *Natural Science*, vol. xiv. (January 1899).

ATHERSTONE, a market-town in the Nuneaton parliamentary division of Warwickshire, England, 102½ m. N.W. from London by the London & North-Western railway. Pop. (1901) 5248. It lies in the upper valley of the Anker, under well-wooded hills to the west, and is on the Roman Watling Street, and the Coventry canal. The once monastic church of St Mary is rebuilt, excepting the central tower and part of the chancel. The chief industry is hat-making. On the high ground to the west lie ruins of the Cistercian abbey of Merevale, founded in 1149; they include the gatehouse chapel, part of the refectory and other remains exhibiting beautiful details of the 14th century. Coal is worked at Baxterley, 3 m. west of Atherstone.

Atherstone (*Aderestone*, *Edridestone*, *Edrichestone*), though not mentioned in any pre-Conquest record, is of unquestionably ancient origin. A Saxon barrow was opened near the town in 1824. It is traversed by Watling Street, and portions of the ancient Roman road have been discovered in modern times. Atherstone is mentioned in Domesday among the possessions of Countess Godiva, the widow of Leofric. In the reign of Henry III. it passed to the monks of Bec in Normandy, who in 1246 obtained the grant of an annual fair at the feast of the Nativity of the Virgin, and the next year of a market every Tuesday. This market became so much frequented that in 1319 a toll was levied upon all goods coming into the town, in order to defray the cost of the repair to the roads necessitated by the constant traffic, and in 1332 a similar toll was levied on all goods passing over the bridge called Feldenbrigge near Atherstone. The September fair and Tuesday markets are still continued. In the reign of Edward III. a house of Austin Friars was founded at Atherstone by Ralph Lord Basset of Drayton, which, however, never rose to much importance, and at its dissolution in 1536 was valued at 30 shillings and 3 pence only.

ATHERTON, or CHOWBENT, an urban district in the Leigh parliamentary division of Lancashire, England, 13 m. W.N.W. of Manchester on the London & North-Western and Lancashire & Yorkshire railways. Pop. (1901) 16,211. The cotton factories are the principal source of industry; there are also ironworks and collieries. The manor was held by the local family of Atherton from John's reign to 1738, when it passed by marriage to Robert Gwillym, who assumed that name. In 1797 his eldest daughter and co-heiress married Thomas Powys, afterwards the second Lord Lilford. Up to 1891 the lord of the manor held a court-leet and court-baron annually in November, but in that year Lord Lilford sold to the local board the market tolls, stallages and pickages, and since this sale the courts have lapsed. The earliest manufactures were iron and cotton. Silk-weaving, formerly an extensive industry, has now almost entirely decayed. The first chapel or church was built in 1645. James Wood, who became Nonconformist minister in the chapel at Atherton in 1691, earned fame and the familiar title of "General" by raising a force from his congregation, uncouthly armed, to fight against the troops of the Pretender (1715).

ATHETOSIS (Gr. ἄθετος, "without place"), the medical term applied to certain slow, purposeless, deliberate movements of the hands and feet. The fingers are separately flexed and extended, abducted and adducted in an entirely irregular way. The hands as a whole are also moved, and the arms, toes and feet may be affected. The condition is usually due to some lesion of the brain which has caused hemiplegia, and is especially common in childhood. It is occasionally congenital (so called), and is then due to some injury of the brain during birth. It is more usually associated with hemiplegia, in which condition there is first of all complete voluntary immobility of the parts affected: but later, as there is a return of a certain amount of power over the limbs affected, the slow rhythmic movements of athetosis are first noticed. This never develops, however, where there is no recovery of voluntary power. Its distribution is thus nearly always hemiplegic, and it is often associated with more or less mental impairment. The movements may or may not continue during sleep. They cannot be arrested for more than a moment by will power, and are aggravated by voluntary movements. The prognosis is unsatisfactory, as the condition usually continues unchanged for years, though improvement occasionally occurs in slight cases, or even complete recovery.

ATHIAS, JOSEPH (d. 1700), Jewish rabbi and printer, was born in Spain and settled in Amsterdam. His editions of the Hebrew Bible (1661, 1667) are noted for beauty of execution and the general correctness of the text. He also printed a Judaeo-German edition of the Bible in 1679, a year after the appearance of the edition by Uri Phoebus.

ATHLETE (Gr. ἀθλητής; Lat. *athleta*), in Greek and Roman antiquities, one who contended for a prize (ἆθλον) in the games; now a general term for any one excelling in physical strength. Originally denoting one who took part in musical, equestrian, gymnastic, or any other competitions, the name became restricted to the competitors in gymnastic contests, and, later, to the class of professional athletes. Whereas in earlier times competitors, who were often persons of good birth and position, entered the lists for glory, without any idea of material gain, the professional class, which arose as early as the 5th century B.C., was chiefly recruited from the lower orders, with whom the better classes were unwilling to associate, and took up athletics entirely as a means of livelihood. Ancient philosophers, moralists and physicians were almost unanimous in condemning the profession of athletics as injurious not only to the mind but also to the body. The attack made upon it by Euripides in the fragment of the *Autolycus* is well known. The training for the contests was very rigorous. The matter of diet was of great importance, this was prescribed by the *aleiptes*, whose duty it also was to anoint the athlete's body. At one time the principal food consisted of fresh cheese, dried figs and wheaten bread. Afterwards meat was introduced, generally beef or pork; but the bread and meat were taken separately, the former at breakfast, the latter at dinner. Except in wine, the quantity was unlimited, and the capacity of some of the heavy-weights must have been, if such stories as those about Milo are true, enormous. In addition to the ordinary gymnastic exercises of the palaestra, the athletes were instructed in carrying heavy loads, lifting weights, bending iron rods, striking at a suspended leather sack filled with sand or flour, taming bulls, &c. Boxers had to practise delving the ground, to strengthen their upper limbs. The competitions open to athletes were running, leaping, throwing the discus, wrestling, boxing and the pancratium, or combination of boxing and wrestling. Victory in this last was the highest achievement of an athlete, and was reserved only for men of extraordinary strength. The competitors were naked, having their bodies salved with oil. Boxers wore the *caestus*, a strap of leather round the wrists and forearms, with a piece of metal in the fist, which was sometimes employed with great barbarity. An athlete could begin his career as a boy in the contests set apart for boys. He could appear again as a youth against his equals, and though always unsuccessful, could go on competing till the age of thirty-five, when he was debarred, it being assumed that after this period of life he could not improve. The most celebrated of the Greek athletes whose names have been handed down are Milo of Crotona, Hipposthenes, Polydamas, Promachus and Glaucus. Cyrene, famous in the time of Pindar for its athletes, appears to have still maintained its reputation to at least the time of Alexander the Great; for in the British Museum are to be seen six prize vases carried off from the games at Athens by natives of that district. These vases, found in the tombs, probably, of the winners, are made of clay, and painted on one side with a representation of the contest in which they were won, and on the other side with a figure of Pallas Athena, with an inscription telling where they were gained, and in some cases adding the name of the eponymous magistrate of Athens, from which the exact year can be determined.

Amongst the Romans athletic contests had no doubt taken place from the earliest times, but according to Livy (xxxix. 22) professional Greek athletes were first introduced at Rome by M. Fulvius Nobilior in 186 B.C. After the institution of the Actian games by Augustus, their popularity increased, until they finally supplanted the gladiators. In the time of the empire, gilds or unions of athletes were formed, each with a temple, treasury and exercise-ground of its own. The profession, although it ranked above that of a gladiator or an actor, was looked upon as derogatory to the dignity of a Roman, and it is a rare thing to find a Roman name amongst the athletes on inscriptions. The system was entirely, and the athletes themselves nearly always, Greek. (See also GAMES, CLASSICAL.)

Krause, *Gymnastik und Agonistik der Hellenen* (1841); Friedländer, *Sittengeschichte Roms*, ii.; Reisch, in Pauly-Wissowa, *Realencyc.*

ATHLETIC SPORTS. Various sports were cultivated many hundred years before the Christian era by the Egyptians and several Asiatic races, from whom the early Greeks undoubtedly adopted the elements of their athletic exercises (see ATHLETE), which reached their highest development in the Olympic games, and other periodical meetings of the kind (see GAMES, CLASSICAL). The original Celtic inhabitants of Great Britain were an athletic race, and the earliest monuments of Teutonic literature abound in records of athletic prowess. After the Norman conquest of England the nobles devoted themselves to the chase and to the joust, while the people had their games of ball, running at the quintain, fencing with club and buckler, wrestling and other pastimes on green and river. The chroniclers of the succeeding centuries are for the most part silent concerning the sports of the folk, except such as were regarded as a training for war, as archery, while they love to record the prowess of the kings and their courts. Thus it is told of Henry V. that he "was so swift a runner that he and two of his lords, without bow or other engine, would take a wild buck in a large park." Several romances of the middle ages, quoted by Strutt (*Sports and Pastimes of the People of England*), chronicle the fact that young men of good family were taught to run, leap, wrestle and joust. In spite of the general silence of the historians concerning the sports of the people, it is evident that they were indulged in very largely, since several English sovereigns found it necessary to curtail, and even prohibit, certain popular pastimes, on the ground that they seduced the people from the practice of archery. Thus Edward III. prohibited weight-putting by statute. Nevertheless a variety of this exercise, "casting of the barre," continued to be a popular pastime, and was afterwards one of the favourite sports of Henry VIII., who attained great proficiency at it. The prowess of the same monarch at throwing the hammer is a matter of history, and his reign seems to have been at a time of general athletic revival. We even find his secretary, Richard Pace, advising the sons of noblemen to practise their sports and "leave study and learning to the children of meaner people," and Sir William Forest, in his *Poesye of Princeelye Practice*, thus admonishes his high-born readers:—

"In featis of maistries bestowe some diligence.
Too ryde, runne, lepe, or caste by violence
Stone, barre or plummett, or such other thinge,
It not refuseth any prince or kynge."

Mr Montague Shearman, to whose volume on *Athletics* in the Badminton series the reader is referred, notes that Sir Thomas Elyot, who wrote at about the same period, deprecated too much study and flogging for schoolboys, saying: "A discrete master may with as much or more ease both to himself and his scholler lead him to play at tennis or shoote." Elyot recommends the perusal of Galen's *De sanitate tuenda*, and suggests as suitable athletic exercises within doors "deambulations, labouryng with poyses made of ledde, lifting and throwing the heavy stone or barre, playing at tennis," and dwells upon "rennyng" as a "good exercise and laudable solace." It is probable that the disciples of the "new learning," who had become prominent in Sir Thomas's time, endeavoured to combat the influence of athletic exercises, their point of view being exemplified by the dictum of Roger Ascham, who, in his *Toxophilus*, declares that "running, leaping and quoiting be too vile for scholars."

In the 16th century the great football match played annually at Chester was abolished in favour of a series of foot-races, which took place in the presence of the mayor. A list of the common sports of that time is contained in some verses by Randel Holme, a minstrel of the North country, and makes mention of throwing the sledge, jumping, "wrastling," stool-ball (cricket), running, pitching the bar, shooting, playing loggets, "nine holes or ten pins," "football by the shinnes," leap-frog, morris, shove-groat, leaping the bonfire, stow-ball (golf), and many other outdoor and indoor sports, some of them now obsolete. Shakespeare and the other Elizabethan poets abound in allusions to sport, which formed an important feature in school life and at every fair. The Stuart kings were warm encouragers of sport, the *Basilikon Doron* of James I., written for his son, containing a recommendation to the young prince to practise "running, leaping, wrestling, fencing, dancing, and playing at the caitch, or tennise, archerie, palle-malle, and such like other fair and pleasant field games."

An extraordinary variety of sports has been popular in Great Britain with high and low for the past five centuries, no other country comparing with it in this respect. Nor have Ireland and Scotland lagged behind England in athletic prowess. Indeed, so far as history and legend record, Ireland boasts of by far the most ancient organized sports known, the Tailtin Games, or Lugnasad, traditionally established by Lugaid of the Long Arm, one of the gods of Dia and Ana, in honour of his foster-mother Tailti, some three thousand years ago. For many centuries these games, and others like them, were kept up in Ireland, and though the almost constant wars which harried the country finally destroyed their organization, yet the Irish have always been, and still are, a very important factor in British athletics, as well as in America and the colonies.

The Scottish people have, like the Irish, ever delighted in feats of strength and skill, especially the Celtic highlanders, the character of whose country and mode of life have, however, prevented organized athletics from attaining the same prominence as in England. Nevertheless, the celebrated Highland games held at Braemar, Bridge of Allan, Luss, Aboyne and other places have served to bring into prominence many athletes of the first class, although the records, on account of the roughness of the grounds, have not generally vied with those made farther south.

The Briton does not lose his love of sport upon leaving his native soil, and the development of athletics in the United States and the British colonies has kept step with that of the mother-land. Upon the continent of Europe sports have occupied a more or less prominent place in the life of the nations, but their development has been but an echo of that in Great Britain. A great advance, however, has been made since the institution of the modern Olympic games.

About the year 1812 the Royal Military College at Sandhurst inaugurated regular athletic sports, but the example was not followed until about 1840, when Rugby, Eton, Harrow, Shrewsbury and the Royal Military Academy at Woolwich came to the front, the "Crick Run" at Rugby having been started in 1837. At the two great English universities there were no organized sports of any kind until 1850, when Exeter College, Oxford, held a meeting; this example has been followed, one after the other, by the other colleges of both institutions. The first contest between Oxford and Cambridge occurred at Oxford in 1864, the programme consisting of eight events, of which four were won by each side. The same year saw the first contest of the Civil Servants, still an annual event.

In 1866 the Amateur Athletic Club was formed in London for "gentlemen amateurs," most of its members being old university men. Its first championship meeting, held in that year, was the beginning of a series afterwards continued to the present day by the Amateur Athletic Association, founded in 1880, which has jurisdiction over British athletic sports. The most important individual English athletic organization is the London Athletic Club, which antedated the Amateur Athletic Club, and whose meetings have always been the most important events except the championships.

In America a revival of interest in athletic sports took place about the year 1870. Ten years later was formed the National Association of Amateur Athletes of America, which, in 1888, became the Amateur Athletic Union. This body controls athletics throughout the United States, and is allied with the Canadian Amateur Athletic Association. It is supreme in matters of amateur status, records and licensing of meetings, and has control over the following branches of sport: basket-ball, billiards, boxing, fencing (in connexion with the Amateur Fencers' League of America), gymnastics, hand-ball (fives), running, jumping, walking, weight-putting (hammer, shot, discus, weights), hurdle-racing, lacrosse, pole-vaulting, swimming, tugs-of-war and wrestling. The Amateur Athletic Union has eight sectional groups, and is allied with the Intercollegiate Association of Amateur Athletes of America (founded 1876) and the Western Intercollegiate Association. The first American intercollegiate athletic meeting took place at Saratoga in 1873, only three universities competing, though the next year there were eight and in 1875 thirteen. Professional athletes in America are confined almost entirely to base-ball, boxing, bicycling, wrestling and physical training.

The Canadian athletic championships are held independently of the American. Annual championship meetings are also held in South Africa, New Zealand and the different states of Australia. For the Australasian championships New Zealand joins with Australia.

The organization of university sports in America differs from that at Oxford and Cambridge, where there is no official control on the part of the university authorities, and where a man is eligible to represent his college or university while in residence.

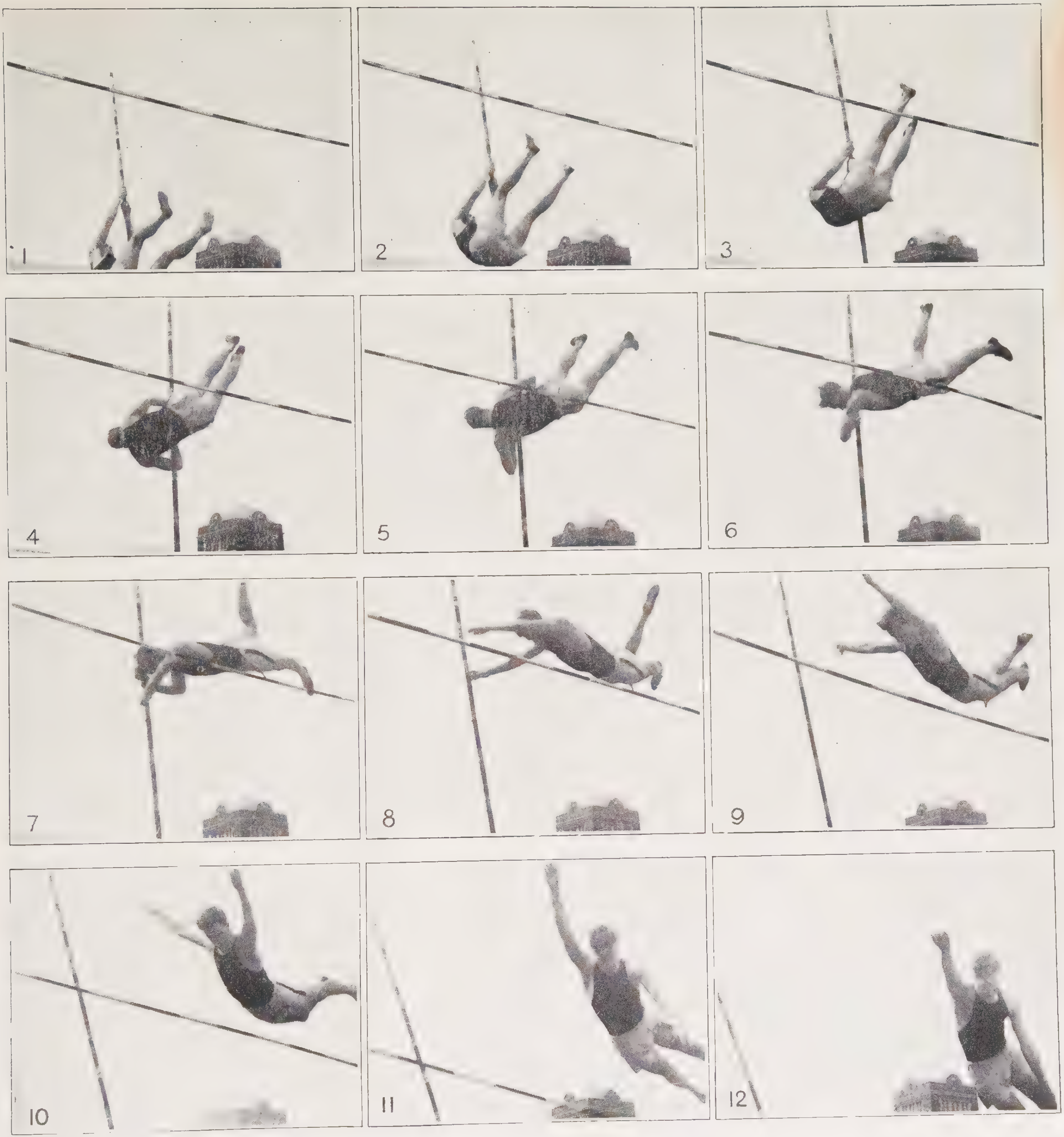
In nearly all American universities and colleges athletic and other sports are under the general control of faculty committees, to which the undergraduate athletic committees are subordinate, and which have the power to forbid the participation of any student who has not attained a certain standard of scholarship. For some years prior to 1906 no student of an American university was allowed to represent his university in any sport for longer than four years. Early in that year, however, many of the most important institutions, including Harvard, Yale, Princeton and Pennsylvania, entered upon a new agreement, that only students who have been in residence one year should play in 'varsity teams in any branch of athletics and that no student should play longer than three years. This, together with many other reformatory changes, was directly due to a widespread outcry against the growing roughness of play exhibited in American football, basket-ball, hockey and other sports, the too evident desire to win at all hazards, the extraordinary luxury of the training equipment, and the enormous gate-receipts of many of the large institutions—the Yale Athletic Association held a surplus of about $100,000 (£20,000) in December 1905, after deducting immense amounts for expenses. The new rule against the participation of freshmen in 'varsity sports was to discourage the practice of offering material advantages of different kinds to promising athletes, generally those at preparatory schools, to induce them to become students at certain universities.

At the present day athletic sports are usually understood to consist of those events recognized in the championship programmes of the different countries. Those in the competitions between Oxford and Cambridge are the 100 yards, 440 yards, 880 yards, 1-mile and 3-mile runs; 120 yards hurdle-race; high and long jumps; throwing the hammer; and putting the weight (shot). To the above list the English A.A.A. adds the 4-mile and 10-mile runs; the 2-mile and 7-mile walking races; the 2-mile steeplechase; and the pole-vault. The American intercollegiate programme is identical with that of the Oxford-Cambridge meeting, except that a 2-mile run takes the place of the 3-mile, and the pole-vault is added. The American A.A.U. programme includes the 100 yards, 220 yards, 440 yards, 880 yards, 1-mile and 5-mile runs; 120 yards high-hurdle race; 220 yards low-hurdle race; high and broad (long) jumps; throwing the hammer; throwing 56-lb weight; putting 16-lb shot; throwing the discus; and pole-vault. Of these the running contests are called "track athletics," and the rest "field" events.

International athletic contests of any importance have, with the exception of the modern Olympic games, invariably taken place between Britons, Americans and Canadians, the continental European countries having as yet produced few track or field athletes of the first class, although the interest in sports in general has greatly increased in Europe during the last ten years. In 1844 George Seward, an American professional runner, visited England and competed with success against the best athletes there; and in 1863 Louis Bennett, called "Deerfoot," a full-blooded Seneca Indian, repeated Seward's triumphs, establishing running records up to 12 miles. In 1878 the Canadian, C. C. McIvor, champion sprinter of America, went to England, but failed to beat his British professional rivals. In 1881 L. E. Myers of New York and E. E. Merrill of Boston competed successfully in England, Myers winning every short-distance championship except the 100-yards, and Merrill all the walking championships save the 7-miles. The same year W. C. Davies of England won the 5-mile championship of America, but, like several other British runners who have had success in America, he competed under the colours of an American club. In 1882 the famous English runner, W. G. George, ran against Myers in America in races of 1 mile, $\frac{3}{4}$ mile and $\frac{1}{2}$ mile, winning over the first two distances. In 1884 Myers again went to England and made new British records over 500, 600, 800 and 1000 yards, and world's records over $\frac{1}{2}$ mile and 1200 yards. The next year he won both the British $\frac{1}{4}$-mile and $\frac{1}{2}$-mile championships. The same year a team of Irish athletes, among them W. J. M. Barry, won several Canadian championships. In 1888 a team of the Manhattan Athletic Club, New York, competed in England with fair success, and during the same season an Irish team from the Gaelic Athletic Association visited America without much success. In 1890 a team from the Salford Harriers was invited to America by the Manhattan Athletic Club, but the evidently commercial character of the enterprise caused its failure. One of the Harriers, E. W. Parry, won the American steeplechase championship. The next year saw another visit to Europe of the Manhattan athletes, who had fair success in England and won every event at Paris. In 1895 the London Athletic Club team competed in New York against the New York Athletic Club, but lost every one of the eleven events, several new records being established. During the previous summer (1894) occurred the first of the international matches between British and American universities which still retain their place as the most interesting athletic event. In that contest, which took place at Queen's Club, London, Oxford beat Yale by $5\frac{1}{2}$ to $3\frac{1}{2}$ events. The next summer Cambridge, as the champion English university, visited America and was beaten by Yale (3 to 8). In 1899 both British universities competed at Queen's Club against the combined athletes of Harvard and Yale, who were beaten by the odd event. The return match took place between the same universities at New York in the summer of 1901, the Americans winning 6 to 3 events. In 1904 Harvard and Yale beat Oxford and Cambridge at Queen's Club by the same score.

Outside Great Britain and America the most important athletic events are undoubtedly the revived Olympic games. They were instituted by delegates from the different nations who met in Paris on the 16th of June 1894, principally at the instigation of Baron Pierre de Coubertin, the result being the formation of an International Olympic Games Committee with Baron de Coubertin at its head, which resolved that games should be held every fourth year in a different country. The first modern Olympiad took place at Athens, 6th to 12th April 1896, in the ancient stadium, which was rebuilt through the liberality of a Greek merchant and seated about 45,000 people. The programme of events included the usual field and track sports, gymnastics, wrestling, pole-climbing, lawn tennis, fencing, rifle and revolver shooting, weight-lifting, swimming, the Marathon race and bicycle racing. Among the contestants were representatives of nearly every European nation, besides Americans and Australians. Great Britain took little direct interest in the occasion and was inadequately represented, but the United States sent five men from Boston and four from Princeton University, who, though none of them held American championships, succeeded in winning every event for which they were entered. The Marathon race of 42 kilometres (26 miles), commemorative of the famous run of the Greek messenger to Athens with the news of the victory of Marathon, was won by a Greek peasant. The second Olympiad was held in Paris in June 1900. Again Great Britain was poorly represented, but American athletes won eighteen of the twenty-four championship events. The third Olympiad was held at St Louis in the summer of 1904 in connexion with the Louisiana Purchase Exposition, its success being due in great measure to James E. Sullivan, the physical director of the Exposition, and Caspar Whitney, the president of the American Olympic Games Committee. The games were much more numerous than at the previous Olympiads, including sports of all kinds, handicaps, inter-club competitions, and contests for aborigines. In the track and field competitions the American athletes won every championship except weight-throwing (56 lb) and lifting the bar. The sports of the savages, among whom were American Indians, Africans of several tribes, Moros, Patagonians, Syrians, Ainus and Filipinos, were disappointing; their efforts in throwing the javelin, shooting with bow and arrow, weight-lifting, running and jumping, proving to be feeble compared with those of white races. The Americanized Indians made the best showing.

The Greeks, however, were not altogether satisfied with the cosmopolitan character of the revival of these celebrated games of their ancestors, and resolved to give the revival a more definitely Hellenic stamp by intercalating an additional series.



(*Grantland Rice Sportlight.*)

THE POLE-VAULT

Pole-vaulting does not seem to have developed into a regular sport in the ancient world. The only form of jumping that had a place in Greek athletic competitions was the broad jump. In the spring of 1926 the excavation of the great theatre at Corinth (of the Roman period) uncovered a wall showing an athlete vaulting with a pole over a charging leopard. Both leopard and acrobat are in the air.

In modern track-meets the pole is of spruce, or better of ash, or best of all of bamboo, with adhesive tape wound around between the bamboo joints. Bamboo is light, resilient, and "gives warning" by splitting, while wood is more apt to break. The pole is commonly from ten to fourteen feet long. (These motion pictures show one of several styles of present-day pole vaulting.)

The vaulter grasps it firmly with his right hand (palm up) about six inches from the top, and with his left hand (palm down) about 30 to 36 inches from the same end. He takes an easy run of about 30 feet, keeping his eye *on the hole* into which the pole is to be inserted, and when he gets to the pre-determined "take-off" he "jabs" his pole in, giving a spring at the same moment. He lifts his feet as high as his hips, and as the pole turns upward, he slips his left hand up to, or nearly up to, his right hand. This slipping of the hand is one of the most difficult and important parts of the whole feat. At the same time, he works his body (anti-clockwise) around the pole until nearly parallel with the cross-bar (fig. 6). At the start he was behind and to the left of the pole. This turning brings him to the right, and then in front of the pole, and again slightly to its left. He was facing up; he has twisted until he is now facing down.

During this time the pole has been rising. Straightening his body and drawing his arms closer to the pole, the athlete then straightens out (figs. 7 and 8) and violently pushes the pole away from him. The reaction from this thrust carries him over the cross-bar (fig. 9).

Both the arms and legs are lifted to prevent striking the cross-bar. Raising his arms and arching his chest (fig. 10) he regains his upright position, and a down and sidewards fling of the left arm brings him fairly to the front, before landing (let us hope) on his feet.

to take place at Athens, in the middle of the quadrennial period. Their action was justified by the success which attended the first of this additional series at Athens in 1906. This success may have been partly due to the personal interest taken in the games by the king and royal family of Greece, and to the presence of King Edward VII., Queen Alexandra, and the prince and princess of Wales; but to whatever cause it should be assigned it was generally acknowledged that neither in France nor in America had the games acquired the same prestige as those held on the classical soil of Greece. In 1906 the governments of Germany, France and the United States made considerable grants of money to defray the expenses of the competitors from those countries. These games aroused much more interest in England than the earlier ones in the series, but though upwards of fifty British competitors took part in the contests, they were by no means representative in all cases of the best British athletics. The American representatives were slightly less numerous, but they were more successful. It was noteworthy that no British or Americans took part in the rowing races in the Bay of Phalerum, nor in the tennis, football or shooting competitions. The Marathon race, by far the most important event in the games, was won in 1906 by a British athlete, M. D. Sherring, a Canadian by birth. The Americans won a total of 75 prizes, the British 39, and the Swedes and Greeks each 28.

The games of the 4th Olympiad (1908) were held in London in connexion with the Franco-British Exhibition of that year. An immense sensation was caused by the finish for the Marathon race from Windsor Castle to the stadium in the Exhibition grounds in London. The first competitor to arrive was the Italian, Dorando Pietri, whose condition of physical collapse was such that, appearing to be on the point of death, he had to be assisted over the last few yards of the course. He was therefore disqualified, and J. Hayes, an American, was adjudged the winner; a special prize was presented to the Italian by Queen Alexandra. In the whole series of contests the United Kingdom made 38 wins, the Americans 22, and the Swedes 7. In the Olympic games proper, British athletes, including two wins by colonials from Canada and Africa, scored 25 successes, and the Americans 18. In the track events 8 wins fell to the British, including two Colonials, and 6 to American athletes; but the latter gained complete supremacy in the field events, of which they won 9, while British competitors secured only two of minor importance.

For records, &c., see the annual *Sporting and Athletic Register*; for the Olympic games see Theodore Andrea Cook's volume, published in connexion with the Olympiad of 1908.

ATHLONE, a market-town of Co. Westmeath, Ireland, on both banks of the Shannon. Pop. of urban district (1901) 6617. The urban district, under the Local Government (Ireland) Act 1900, is wholly in county Westmeath, but the same area is divided by the Shannon between the parliamentary divisions of South Westmeath and South Roscommon. Athlone is 78 m. W. from Dublin by the Midland Great Western railway, and is also served by a branch from Portarlington of the Great Southern & Western line, providing an alternative and somewhat longer route from the capital. The main line of the former company continues W. to Galway, and a branch N.W. serves counties Roscommon and Mayo. The Shannon divides the town into two portions, known as the Leinster side (east), and the Connaught side (west), which are connected by a handsome bridge opened in 1844. There is a swivel railway bridge. The rapids of the Shannon at this point are obviated by means of a lock communication with a basin, which renders the navigation of the river practicable above the town. The steamers of the Shannon Development Company ply on the river, and some trade by water is carried on with Limerick, and with Dublin by the river and the Grand and Royal canals. Athlone is an important agricultural centre, and there are woollen factories. The salmon fishing both provides sport and is a source of commercial wealth. There are two parish churches, St Mary and St Peter, both erected early in the 19th century, of which the first has near it an isolated church tower of earlier date. There are three Roman Catholic chapels, a court-house and other public offices. Early remains include portions of the castle, of the town walls (1576), of the abbey of St Peter and of a Franciscan foundation. On several islands of the picturesque Lough Ree, to the north, are ecclesiastical and other remains.

The military importance of Athlone dates from the erection of the castle and of a bridge over the river by John de Grey, bishop of Norwich and justiciar of Ireland, in 1210. It became the seat of the presidency of Connaught under Elizabeth, and withstood a siege by the insurgents in 1641. In the war of 1688 the possession of Athlone was considered of the greatest importance, and it consequently sustained two sieges, the first by William III. in person, which failed, and the second by General Godart van Ginkel (*q.v.*), who, on the 30th of June 1691, in the face of the Irish, forded the river and took possession of the town, with the loss of only fifty men. Ginkel was subsequently created earl of Athlone, and his descendants held the title till it became extinct in 1844. In 1797 the town was strongly fortified on the Roscommon side, the works covering 15 acres and containing two magazines, an ordnance store, an armoury with 15,000 stands of arms and barracks for 1500 men. The works are now dismantled. Athlone was incorporated by James I., and returned two members to the Irish parliament, and one member to the imperial parliament till 1885.

ATHOL, a township of Worcester county, northern Massachusetts, U.S.A., having an area of 35 sq. m. Pop. (1900) 7061, of whom 986 were foreign-born; (1910 U.S. census) 8536. Its surface is irregular and hilly. The village of Athol is on Miller's river, and is served by the Boston & Albany and the Boston & Maine railways. The streams of the township furnish good water-power, and manufactures of varied character are its leading interests. Athol was first settled in 1735, and was incorporated as a township in 1762. It was named by its largest landowner Col. James Murray, after the ancestral home of the Murrays, dukes of Atholl.

See L. B. Caswell, *Athol, Mass., Past and Present* (Athol, 1899).

ATHOLL, EARLS AND DUKES OF. The Stewart line of the Scottish earls of Atholl, which ended with the 5th Stewart earl in 1595, the earldom reverting to the crown, had originated with Sir John Stewart of Balveny (d. 1512), who was created earl of Atholl about 1457 (new charter 1481). The 5th earl's daughter, Dorothea, married William Murray, earl of Tullibardine (cr. 1606), who in 1626 resigned his earldom in favour of Sir Patrick Murray, on condition of the revival of the earldom of Atholl in his wife and her descendants. The earldom thus passed to the Murray line, and John Murray, their only son (d. 1642), was accordingly acknowledged as earl of Atholl (the 1st of the Murrays) in 1629.

John Stewart, 4th earl of Atholl, in the Stewart line (d. 1579), son of John, 3rd earl, and of Grizel, daughter of Sir John Rattray, succeeded his father in 1542. He supported the government of the queen dowager, and in 1560 was one of the three nobles who voted in parliament against the Reformation and the Confession of Faith, and declared their adherence to Roman Catholicism. Subsequently, however, he joined the league against Huntly, whom with Murray and Morton he defeated at Corrichie in October 1562, and he supported the projected marriage of Elizabeth with Arran. On the arrival of Mary from France in 1561 he was appointed one of the twelve privy councillors, and on account of his religion obtained a greater share of the queen's favour than either Murray or Maitland. He was one of the principal supporters of the marriage with Darnley, became the leader of the Roman Catholic nobles, and with Lennox obtained the chief power in the government, successfully protecting Mary and Darnley from Murray's attempts to regain his ascendancy by force of arms. According to Knox he openly attended mass in the queen's chapel, and was especially trusted by Mary in her project of reinstating Roman Catholicism. The fortress of Tantallon was placed in his keeping, and in 1565 he was made lieutenant of the north of Scotland. He is described the same year by the French ambassador as "très grand catholique hardi et vaillant et remuant, comme l'on dict, mais de nul jugement et expérience." He had no share in the murders of Rizzio or Darnley, and after the latter crime in 1567, he joined the Protestant lords against Mary, appeared as one of the leaders against her at Carberry Hill, and afterwards approved of her imprisonment at Lochleven Castle. In July he was present at the coronation of James, and was included in the council of regency on Mary's abdication. He, however, was not present at Langside in May 1568, and in July became once more a supporter of Mary, voting for her divorce from Bothwell (1569). In March 1570 he signed with other lords the joint letter to Elizabeth asking for the queen's intercession and supporting Mary's claims, and was present at the convention held at Linlithgow in April in opposition to the assembly of the king's party at Edinburgh. In 1574 he was proceeded against as a Roman Catholic and threatened with excommunication, subsequently holding a conference with the ministers and being allowed till midsummer to overcome his scruples. He had failed in 1572 to prevent Morton's appointment to the regency, but in 1578 he succeeded with the earl of Argyll in driving him from office. On the 24th of March James took the government into his own hands and dissolved the regency, and Atholl and Argyll, to the exclusion of Morton, were made members of the council, while on the 29th Atholl was appointed lord chancellor. Subsequently, on the 24th of May, Morton succeeded in getting into Stirling Castle and in regaining his guardianship of James. Atholl and Argyll, who were now corresponding with Spain in hopes of assistance from that quarter, then advanced to Stirling with a force of 7000 men, when a compromise was arranged, the three earls being all included in the government. While on his way from a banquet held on the 20th of April 1579 on the occasion of the reconciliation, Atholl was seized with sudden illness, and died on the 25th, not without strong suspicions of poison. He was buried at St Giles's cathedral in Edinburgh. He married (1) Elizabeth, daughter of George Gordon, 4th earl of Huntly, by whom he had two daughters, and (2) Margaret, daughter of Malcolm Fleming, 3rd Lord Fleming, by whom, besides three daughters, he had John, 5th earl of Atholl, at whose death in 1595 the earldom in default of male heirs reverted to the crown.

John Murray, 1st earl of Atholl in the Murray line (see above), died in 1642. On the outbreak of the civil war he called out the men of Atholl for the king, and was imprisoned by the marquess of Argyll in Stirling Castle in 1640.

John Murray, 2nd earl and 1st marquess of Atholl (1631–1703), son of the 1st earl and of Jean, daughter of Sir Duncan Campbell of Glenorchy, was born on the 2nd of May 1631. In 1650 he joined in the unsuccessful attempt to liberate Charles II. from the Covenanters, and in 1653 was the chief supporter of Glencairn's rising, but was obliged to surrender with his two regiments to Monk on the 2nd of September 1654. At the restoration Atholl was made a privy councillor for Scotland and sheriff of Fife, in 1661 lord justice-general of Scotland, in 1667 a commissioner for keeping the peace in the western Highlands, in 1670 colonel of the king's horseguards, in 1671 a commissioner of the exchequer, and in 1672 keeper of the privy seal in Scotland and an extraordinary lord of session. In 1670 he became earl of Tullibardine by the death of his cousin James, 4th earl, and on the 7th of February 1676 he was created marquess of Atholl, earl of Tullibardine, viscount of Balquhidder, Lord Murray, Balvenie and Gask. He at first zealously supported Lauderdale's tyrannical policy, but after the raid of 1678, called the "Highland Host," in which Atholl was one of the chief leaders, he joined in the remonstrance to the king concerning the severities inflicted upon the Covenanters, and was deprived of his office of justice-general and passed over for the chancellorship in 1681. In 1679, however, he was present at the battle of Bothwell Brig; in July 1680 he was made vice-admiral of Scotland, and in 1681 president of parliament. In 1684 he was appointed lord-lieutenant of Argyll, and invaded the country, capturing the earl of Argyll after his return from abroad in June 1685 at Inchinnan. The excessive severities with which he was charged in this campaign were repudiated with some success by him after the Revolution.[1] The same year he was reappointed lord privy seal, and in 1687 was made a knight of the Thistle on the revival of the order. At the Revolution he wavered from one side to the other, showing no settled purpose but waiting upon the event, but finally in April 1689 wrote to William to declare his allegiance, and in May took part in the proclamation of William and Mary as king and queen at Edinburgh. But on the occasion of Dundee's insurrection he retired to Bath to drink the waters, while the bulk of his followers joined Dundee and brought about in great measure the defeat of the government troops at Killiecrankie. He was then summoned from Bath to London and imprisoned during August. In 1690 he was implicated in the Montgomery plot and subsequently in further Jacobite intrigues. In June 1691 he received a pardon, and acted later for the government in the pacification of the Highlands. He died on the 6th of May 1703. He married Amelia, daughter of James Stanley, 7th earl of Derby (through whom the later dukes of Atholl acquired the sovereignty of the Isle of Man), and had, besides one daughter, six sons, of whom John became 2nd marquess and 1st duke of Atholl; Charles was made 1st earl of Dunmore, and William married Margaret, daughter of Sir Robert Nairne, 1st Lord Nairne, becoming in her right 2nd Lord Nairne.

John Murray, 2nd marquess and 1st duke of Atholl (1660–1724), was born on the 24th of February 1660, and was styled during his father's lifetime Lord Murray, till 1696, when he was created earl of Tullibardine. He was a supporter of William and the Revolution in 1688, taking the oaths in September 1689, but was unable to prevent the majority of his clan, during his father's absence, from joining Dundee under the command of his brother James. In 1693 as one of the commissioners he showed great energy in the examination into the massacre of Glencoe and in bringing the crime home to its authors. In 1694 he obtained a regiment, in 1695 was made sheriff of Perth, in 1696 secretary of state, and from 1696 to 1698 was high commissioner. In the latter year, however, he threw up office and went into opposition. At the accession of Anne he was made a privy councillor, and in 1703 lord privy seal for Scotland. The same year he succeeded his father as 2nd marquess of Atholl, and on the 30th of June he was created duke of Atholl, marquess of Tullibardine, earl of Strathtay and Strathardle, Viscount Balquhidder, Glenalmond and Glenlyon, and Lord Murray, Balvenie and Gask. In 1704 he was made a knight of the Thistle. In 1703–1704 an unsuccessful attempt was made by Simon, Lord Lovat, who used the duke of Queensberry as a tool, to implicate him in a Jacobite plot against Queen Anne; but the intrigue was disclosed by Robert Ferguson, and Atholl sent a memorial to the queen on the subject, which resulted in Queensberry's downfall. But he fell nevertheless into suspicion, and was deprived of office in October 1705, subsequently becoming a strong antagonist of the government, and of the Hanoverian succession. He vehemently opposed the Union during the years 1705–1707, and entered into a project for resisting by force and for holding Stirling Castle with the aid of the Cameronians, but nevertheless did not refuse a compensation of £1000. According to Lockhart, he could raise 6000 of the best men in the kingdom for the Jacobites. On the occasion, however, of the invasion of 1708 he took no part, on the score of illness, and was placed under arrest at Blair Castle. On the downfall of the Whigs and the advent of the Tories to power, Atholl returned to office, was chosen a representative peer in the Lords in 1710 and 1713, in 1712 was an extraordinary lord of session, from 1713 to 1714 was once more keeper of the privy seal, and from 1712 to 1714 was high commissioner. On the accession of George I. he was again dismissed from office, but at the rebellion of 1715, while three of his sons joined the Jacobites, he remained faithful to the government, whom he assisted in various ways, on the 4th of June 1717 apprehending Robert Macgregor (Rob Roy), who, however, succeeded in escaping. He died on the 14th of November 1724. He married (1) Catherine, daughter of William Douglas, 3rd duke of Hamilton, by whom, besides one daughter, he had six sons, of whom John was killed at Malplaquet in 1709, William was marquess of Tullibardine, and James succeeded his father as 2nd duke on account of the share taken by his elder brother in the rebellion; and (2) Mary, daughter of William, Lord Ross, by whom he had three sons and several daughters.

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[1] A. Lang, *Hist. of Scotland*, iii. 407.

The *Atholl Chronicles* have been privately printed by the 7th duke of Atholl (b. 1840). See also S. Cowan, *Three Celtic Earldoms* (1909).

ATHOLL, or Athole, a district in the north of Perthshire, Scotland, covering an area of about 450 sq. m. It is bounded on the N. by Badenoch, on the N.E. by Braemar, on the E. by Forfarshire, on the S. by Breadalbane, on the W. and N.W. by Lochaber. The Highland railway bisects it diagonally from Dunkeld to the borders of Inverness-shire. It is traversed by the Grampian mountains and watered by the Tay, Tummel, Garry, Tilt, Bruar and other streams. Glen Garry and Glen Tilt are the chief glens, and Loch Rannoch and Loch Tummel the principal lakes. The population mainly centres around Dunkeld, Pitlochry and Blair Atholl. The only cultivable soil occurs in the valleys of the large rivers, but the deer-forest and the shootings on moor and mountain are among the most extensive in Scotland. It is said to have been named Athfotla (Atholl) after Fotla, son of the Pictish king Cruithne, and was under the rule of a Celtic *mormaer* (thane or earl) until the union of the Picts and Scots under Kenneth Macalpine in 843. The duke of Atholl's seats are Blair Castle and Dunkeld House. What is called Atholl brose is a compound, in equal parts, of whisky and honey (or oatmeal), which was first commonly used in the district for hoarseness and sore throat.

ATHOS (Gr. Ἄγιον Ὄρος; Turk. *Aineros*; Ital. *Monte Santo*), the most eastern of the three peninsular promontories which extend, like the prongs of a trident, southwards from the coast of Macedonia (European Turkey) into the Aegean Sea. Before the 19th century the name Athos was usually confined to the terminal peak of the promontory, which was itself known by its ancient name, *Acte*. The peak rises like a pyramid, with a steep summit of white marble, to a height of 6350 ft., and can be seen at sunset from the plain of Troy on the east, and the slopes of Olympus on the west. On the isthmus are distinct traces of the canal cut by Xerxes before his invasion of Greece in 480 B.C. The peninsula is remarkable for the beauty of its scenery, and derives a peculiar interest from its unique group of monastic communities with their medieval customs and institutions, their treasures of Byzantine art and rich collections of documents. It is about 40 m. in length, with a breadth varying from 4 to 7 m.; its whole area belongs to the various monasteries. It was inhabited in the earliest times by a mixed Greek and Thracian population; of its five cities mentioned by Herodotus few traces remain; some inscriptions discovered on the sites were published by W. M. Leake (*Travels in N. Greece*, 1835, iii. 140) and Kinch. The legends of the monks attribute the first religious settlements to the age of Constantine (274–337), but the hermitages are first mentioned in historical documents of the 9th century. It is conjectured that the mountain was at an earlier period the abode of anchorites, whose numbers were increased by fugitives from the iconoclastic persecutions (726–842). The "coenobian" rule to which many of the monasteries still adhere was established by St Athanasius, the founder of the great monastery of Laura, in 969. Under a constitution approved by the emperor Constantine Monomachos in 1045, women and female animals were excluded from the holy mountain. In 1060 the community was withdrawn from the authority of the patriarch of Constantinople, and a monastic republic was practically constituted. The taking of Constantinople by the Latins in 1204 brought persecution and pillage on the monks; this reminded them of earlier Saracenic invasions, and led them to appeal for protection to Pope Innocent III., who gave them a favourable reply. Under the Palaeologi (1260–1453) they recovered their prosperity, and were enriched by gifts from various sources. In the 14th century the peninsula became the chosen retreat of several of the emperors, and the monasteries were thrown into commotion by the famous dispute over the mystical Hesychasts.

Owing to the timely submission of the monks to the Turks after the capture of Salonica (1430), their privileges were respected by successive sultans: a tribute is paid to the Turkish government, which is represented by a resident *kaimakam*, and the community is allowed to maintain a small police force. Under the present constitution, which dates from 1783, the general affairs of the commonwealth are entrusted to an assembly (σύναξις) of twenty members, one from each monastery; a committee of four members, chosen in turn, styled *epistatae* (ἐπιστάται), forms the executive. The president of the committee (ὁ πρῶτος) is also the president of the assembly, which holds its sittings in the village of Karyes, the seat of government since the 10th century. The twenty monasteries, which all belong to the order of St Basil, are: Laura (ἡ Λαῦρα), founded in 963; Vatopédi (Βατοπέδιον), said to have been founded by the emperor Theodosius; Rossikon (Ῥωσσικόν), the Russian monastery of St Panteleïmon; Chiliándari (Χιλιαντάριον: supposed to be derived from χίλιοι ἄνδρες or χίλια λεοντάρια), founded by the Servian prince Stephen Nemanya (1159–1195); Iveron (ἡ μονὴ τῶν Ἰβήρων), founded by Iberians, or Georgians; Esphigmenu (τοῦ Ἐσφιγμένου: the name is derived from the confined situation of the monastery); Kutlumush (Κουτλουμούση); Pandocratoros (τοῦ Παντοκράτορος); Philotheu (Φιλοθέου); Caracallu (τοῦ Καρακάλλου); St Paul (τοῦ ἁγίου Παύλου); St Denis (τοῦ ἁγίου Διονυσίου); St Gregory (τοῦ ἁγίου Γρηγορίου); Simópetra (Σιμόπετρα); Xeropotámu (τοῦ Ξηροποτάμου); St Xenophon (τοῦ ἁγίου Ξενοφῶντος); Dochiaríu (Δοχειαρείου); Constamonítu (Κωνσταμονίτου); Zográphu (τοῦ Ζωγράφου); and Stavronikítu (τοῦ Σταυρονικίτου, the last built, founded in 1545). The "coenobian" monasteries (κοινόβια), each under the rule of an abbot (ἡγούμενος), are subjected to severe discipline; the brethren are clothed alike, take their meals (usually limited to bread and vegetables) in the refectory, and possess no private property. In the "idiorrhythmic" monasteries (ἰδιόρρυθμα), which are governed by two or three annually elected wardens (ἐπίτροποι), a less stringent rule prevails, and the monks are allowed to supplement the fare of the monastery from their private incomes. Dependent on the several monasteries are twelve *sketae* (σκῆται) or monastic settlements, some of considerable size, in which a still more ascetic mode of life prevails: there are, in addition, several farms (μετοχία), and many hundred sanctuaries with adjoining habitations (κελλία) and hermitages (ἀσκητήρια). The monasteries, with the exception of Rossikón (St Panteleïmon) and the Serbo-Bulgarian Chiliándari and Zográphu, are occupied exclusively by Greek monks. The large *skete* of St Andrew and some others belong to the Russians; there are also Rumanian and Georgian *sketae*. The great monastery of Rossikón, which is said to number about 3000 inmates, has been under a Russian abbot since 1875; it is regarded as one of the principal centres of the Russian politico-religious propaganda in the Levant. The tasteless style of its modern buildings is out of harmony with the quaint beauty of the other monasteries. Furnished with ample means, the Russian monks neglect no opportunity of adding to their possessions on the holy mountain; their encroachments are resisted by the Greek monks, whose wealth, however, was much diminished by the secularization of their estates in Rumania (1864). The population of the holy mountain numbers from 6000 to 7000; about 3000 are monks (καλόγεροι), the remainder being lay brothers (κοσμικοί). The monasteries, which are all fortified, generally consist of large quadrangles enclosing churches; standing amid rich foliage, they present a wonderfully picturesque appearance, especially when viewed from the sea. Their inmates, when not engaged in religious services, occupy themselves with husbandry, fishing and various handicrafts; the standard of intellectual culture is not high. A large academy, founded by the monks of Vatopedi in 1749, for a time attracted students from all parts of the East, but eventually proved a failure, and is now in ruins. The muniment rooms of the monasteries contain a marvellous series of documents, including chrysobulls of various emperors and princes, *sigilla* of the patriarchs, *typica*, iradés and other documents, the study of which will throw an important light on the political and ecclesiastical history and social life of the

East from the middle of the 10th century. Up to comparatively recent times a priceless collection of classical manuscripts was preserved in the libraries; many of them were destroyed during the War of Greek Independence (1821–1829) by the Turks, who employed the parchments for the manufacture of cartridges; others fell a prey to the neglect or vandalism of the monks, who, it is said, used the material as bait in fishing; others have been sold to visitors, and a considerable number have been removed to Moscow and Paris. The library of Simopetra was destroyed by fire in 1891, and that of St Paul in 1905. There is now little hope of any important discovery of classical manuscripts. The codices remaining in the libraries are for the most part theological and ecclesiastical works. Of the Greek manuscripts, numbering about 11,000, 6618 have been catalogued by Professor Spyridion Lambros of Athens; his work, however, does not include the MSS. in some of the *sketae*, or those in the libraries of Laura and Vatopedi, of which catalogues (hitherto unpublished) have been prepared by resident monks. The canonic MSS. only of Vatopedi and Laura have been catalogued by Benessevich in the supplement to vol. ix. of the *Bizantiyskiy Vremennik* (St Petersburg, 1904). The Slavonic and Georgian MSS. have not been catalogued. Apart from the illuminated MSS., the mural paintings, the mosaics, and the goldsmith's work of Mount Athos are of infinite interest to the student of Byzantine art. The frescoes in general date from the 15th or 16th century: some are attributed by the monks to Panselinos, "the Raphael of Byzantine painting," who apparently flourished in the time of the Palaeologi. Most of them have been indifferently restored by local artists, who follow mechanically a kind of hieratic tradition, the principles of which are embodied in a work of iconography by the monk Dionysius, said to have been a pupil of Panselinos. The same spirit of conservatism is manifest in the architecture of the churches, which are all of the medieval Byzantine type. Some of the monasteries were seriously damaged by an earthquake in 1905.

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ATHY (pronounced Athý), a market-town of Co. Kildare, Ireland, in the south parliamentary division, 45 m. S.W. of Dublin on a branch of the Great Southern & Western railway. Pop. of urban district (1901) 3599. It is intersected by the river Barrow, which is here crossed by a bridge of five arches. The crossing of the river here was guarded and disputed from the earliest times, and the name of the town is derived from a king of Munster killed here in the 2nd century. There are picturesque remains of Woodstock Castle of the 12th or 13th century, and White Castle built in 1506, and rebuilt in 1575 by a member of the family whose name it bears, and still occupied. Both were erected to defend the ford of the Barrow. There are also an old town gate, and an ancient cemetery with slight monastic remains. Previous to the Union Athy returned two members to the Irish parliament. The trade, chiefly in grain, is aided by excellent water communication, by a branch of the Grand Canal to Dublin, and by the river Barrow, navigable from here to Waterford harbour.

ATINA, the name of three ancient towns of Italy.

1. A town (mod. *Àtena*) of Lucania, upon the Via Popillia, 7 m. N. of Tegianum, towards which an ancient road leads, in the valley of the river now known as Diano. Its ancient importance is vouched for by its walls of rough cyclopean work, which may have had a total extent of some 2 m. (see G. Patroni in *Notizie degli scavi*, 1897, 112; 1901, 498). The date of these walls has not as yet been ascertained, recent excavations, which led to the discovery of a few tombs in which the earliest objects showing Greek influence may go back to the 7th century B.C., not having produced any decisive evidence on the point. To the Roman period belong the remains of an amphitheatre and numerous inscriptions.

2. A town (mod. *Atina*) of the Volsci, 12 m. N. of Casinum, and about 14 m. E. of Arpinum, on a hill 1607 ft. above sea-level. The walls, of carefully worked polygonal blocks of stone, are still preserved in parts, and the modern town does not fill the whole area which they enclose. Cicero speaks of it as a prosperous country town, which had not as yet fallen into the hands of large proprietors; and inscriptions show that under the empire it was still flourishing. One of these last is a boundary stone relating to the assignation of lands in the time of the Gracchi, of which six other examples have been found in Campania and Lucania.

3. A town of the Veneti, mentioned by Pliny, *H. N.* iii. 131.

ATITLÁN, or SANTIAGO DE ATITLÁN, a town in the department of Sololá, Guatemala, on the southern shore of Lake Atitlán. Pop. (1905) about 9000, almost all Indians. Cotton-spinning is the chief industry. Lake Atitlán is 24 m. long and 10 m. broad, with 64 m. circumference. It occupies a crater more than 1000 ft. deep and about 4700 ft. above sea-level. The peaks of the Guatemala Cordillera rise round it, culminating near its southern end in the volcanoes of San Pedro (7000 ft.) and Atitlán (11,719 ft.). Although the lake is fed by many small mountain torrents, it has no visible outlet, but probably communicates by an underground channel with one of the rivers which drain the Cordillera. Mineral springs abound in the neighbourhood. The town of Sololá (*q.v.*) is near the north shore of the lake.

ATKINSON, EDWARD (1827–1905), American economist, was born at Brookline, Massachusetts, on the 10th of February 1827. For many years he was engaged in managing various business enterprises, and became, in 1877, president of the Boston Manufacturers' Mutual Fire Insurance Company, a post which he held till his death. He was a strong controversialist and a prolific writer on such economic subjects as banking, railways, cotton manufacture, the tariff and free trade, and the money question. He was appointed in 1887 a special commissioner to report upon the status of bimetallism in Europe. He also made a special study of mill construction and fire prevention, and invented an improved cooking apparatus, called the "Aladdin oven." He was an active supporter of anti-imperialism. He died at Boston on the 11th of December 1905.

His principal works were *Right Methods of Preventing Fires in Mills* (1881); *Distribution of Products* (1885); *Industrial Progress of the Nation* (1889); *Taxation and Work* (1892); *Science of Nutrition* (10th ed., 1898).

ATKINSON, SIR HARRY ALBERT (1831–1892), British colonial statesman, prime minister and speaker of the legislative council, New Zealand, was born at Chester in 1831, and in 1855 emigrated to Taranaki, New Zealand, where he became a farmer. In 1860 the Waitara war broke out, and from its outset Atkinson, who had been selected as a captain of the New Plymouth Volunteers, distinguished himself by his contempt for appearances and tradition, and by the practical skill, energy and courage which he showed in leading his Forest Rangers in the tiresome and lingering bush warfare of the next five years. For this work he was made a major of militia, and thanked by the government. Elected to the house of representatives in 1863, he joined Sir Frederick Weld's ministry at the end of November 1864 as minister of defence, and, during eleven months of office, was identified with the well-known "self-reliance" policy, a proposal to dispense with imperial regulars, and meet the Maori with colonials only. Parliament accepted this principle, but turned out the Weld ministry for other reasons. For four years Atkinson was out of parliament; in October 1873 he re-entered it, and a year later became minister of lands under Sir Julius Vogel.

Ten months later he was treasurer, and such was his aptitude for finance that, except during six months in 1876, he thenceforth held that post whenever his party was in power. From October 1874 to January 1891 Atkinson was only out of office for about five years. Three times he was premier, and he was always the most formidable debater and fighter in the ranks of the Conservative opponents of the growing Radical party which Sir George Grey, Sir Robert Stout and John Ballance led in succession. It was he who was mainly responsible for the abolition of the provinces into which the colony was divided from 1853 to 1876. He repealed the Ballance land-tax in 1879, and substituted a property-tax. He greatly reduced the cost of the public service in 1880, and again in 1888. In both these years he raised the customs duties, amongst other taxes, and gave them a quasi-protectionist character. In 1880 he struck 10% off all public salaries and wages; in 1887 he reduced the salary of the governor by one-third, and the pay and number of ministers and members of parliament. By these resolute steps revenue was increased, expenditure checked, and the colony's finance reinstated. Atkinson was an advocate of compulsory national assurance, and the leasing as opposed to the selling of crown lands. Defeated in the general election of December 1890, he took the appointment of speaker of the legislative council. There, while leaving the council chamber after the sitting of the 28th of June 1892, he was struck down by heart disease and died in a few minutes. Though brusque in manner and never popular, he was esteemed as a vigorous, upright and practical statesman. He was twice married, and had seven children, of whom three sons and a daughter survived him. (W. P. R.)

ATLANTA, the capital and the largest city of Georgia, U.S.A., and the county-seat of Fulton county, situated at an altitude of 1000–1175 ft., in the N.W. part of the state, near the Chattahoochee river. Pop. (1860) 9554; (1880) 37,409; (1890) 65,533; (1900) 89,872, of whom 35,727 were negroes and 2531 were foreign-born; (1910) 154,839. It is served by the Southern, the Central of Georgia, the Georgia, the Seaboard Air Line, the Nashville, Chattanooga & St Louis (which enters the city over the Western & Atlantic, one of its leased lines), the Louisville & Nashville, the Atlanta, Birmingham & Atlantic, and the Atlanta & West Point railways. These railway communications, and the situation of the city (on the Piedmont Plateau) on the water-parting between the streams flowing into the Atlantic Ocean and those flowing into the Gulf of Mexico, have given Atlanta its popular name, the "Gate City of the South." Atlanta was laid out in the form of a circle, the radius being 1¾ m. and the centre the old railway station, the Union Depot (the new station is called the Terminal); large additions have been made beyond this circle, including West End, Inman Park on the east, and North Atlanta. Among the best residence streets are Peachtree and West Peachtree streets to the north, and the older streets to the south of the business centre of the city—Washington Street, Whitehall, Pryor and Capitol Avenues. Among the principal office buildings are the Empire, the Equitable, the Prudential, the Fourth National, the Austell, the Peters, the Century, the English-American and the Candler buildings; and there are many fine residences, particularly in Peachtree and Washington streets, Inman Park and Ponce de Leon Circle. Among prominent public buildings are the State Capitol (completed 1889), containing a law library of about 65,000 volumes and a collection of portraits of famous Georgians, the north-west front of the Capitol grounds containing an equestrian statue (unveiled in 1907) of John Brown Gordon (1832–1904), a distinguished Confederate general in the American Civil War and governor of Georgia in 1887–1890; the court house; the Carnegie library, in which the young men's library, organized in 1867, was merged in 1902; the post office building; and the Federal prison (about 4 m. south of the city). The principal parks are: the Piedmont (189 acres), the site of the Piedmont Exposition of 1887 and of the Cotton States and International Exposition of 1895; the Grant, given to the city by L. P. Grant, an Atlanta railroad builder, in 1882, and subsequently enlarged by the city (in its south-east corner is Fort Walker); the Lakewood, 6 m. south of the city; and Ponce de Leon Park, owned by an electric railway company and having mineral springs and a fine baseball ground. Four miles south of the centre of Atlanta is Fort McPherson, an important United States military post, occupying a reservation of 40 acres and having barracks for the accommodation of 1000 men. In Oakland Cemetery is a large monument to Confederate soldiers; another monument in Oakland, "To the unknown Confederate Dead," is a reproduction of the Lion of Lucerne; in West View Cemetery (4 m. west of the city) is a memorial erected by the United Confederate Veterans. The city obtains its water-supply from the Chattahoochee river (above the mouth of Peachtree Creek), whence the water is pumped by four pumps, which have a daily capacity of 55,000,000 gallons. Atlanta is widely known for its public spirit and enterprise, to which the expositions of 1881, 1887 and 1895 bear witness. The air is bracing, largely because of the city's altitude; the mean annual temperature is 60·8° F. (winter 44·1°, spring 60·5°, summer 77°, autumn 61·5°).

Atlanta is an important educational centre. Its public-school system was organized in 1871. Here are the Georgia School of Technology, founded in 1885 (opened 1888) as a branch of the university of Georgia; the Atlanta College of Physicians and Surgeons (established in 1898 by the union of the Atlanta Medical College, organized in 1855, and the Southern Medical College, organized in 1878); the Atlanta School of Medicine (1905); the Georgia College of Eclectic Medicine; the Atlanta Theological Seminary (1901, Congregational), the only theological school of the denomination in the South in 1908; the Atlanta Dental College; the Southern College of Pharmacy (1903); Washington Seminary (1877) for girls; and the following institutions for negroes—Atlanta University, founded in 1869, which is one of the best institutions in the country for the higher education of negroes, standing particularly for "culture" education (as opposed to industrial training), which has done particularly good work in the department of sociology, under the direction of Prof. W. E. B. du Bois (b. 1868), one of the most prominent teachers of negro descent in the country, and which had in 1908 339 students; Clark University, founded in 1870 by the Freedman's Aid and Southern Educational Society of the Methodist Episcopal Church; the Atlanta Baptist College, founded in 1867; Morris Brown College (African Methodist Episcopal, founded in 1882, and opened in 1885), which has college preparatory, scientific, academic, normal and missionary courses, correspondence courses in English and theology, an industrial department, and departments of law, theology (Turner Theological Seminary), nurse-training, music and art; the Gammon Theological Seminary (Methodist Episcopal, chartered in 1888), which has its buildings just outside the city limits; and the Spelman Seminary for women and girls (Baptist) opened in 1881 as the Atlanta Baptist Female Seminary—the present name being adopted in 1883 in honour of the parents of Mrs John D. Rockefeller—and incorporated in 1888. At Decatur (pop. 1418 in 1900), a residential suburb, 6 m. east-north-east of Atlanta, is the Agnes Scott College (1890) for white girls; connected with the college is a school of music, art and expression, and an academy.

The city's principal charitable institutions are the Grady Memorial hospital (opened in 1892), supported by the city and named in honour of Henry W. Grady; the Presbyterian hospital; the Baptist Tabernacle Infirmary; the Wesley Memorial hospital; St Joseph's infirmary; the Municipal hospital for contagious diseases; the Florence Crittenden home. Three miles south-east of the city is a (state) soldiers' home, for aged, infirm and disabled Confederate veterans. The Associated Charities of Atlanta was organized in 1905.

The principal newspapers are the *Constitution* (morning), edited from 1880 until 1889 by Henry W. Grady (1851–1880),[1] one of the most eloquent of Southern orators, who did much to promote the reconciliation of the North and the South after the

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[1] Grady was succeeded as managing editor by Clark Howell (b. 1863); and Joel Chandler Harris was long a member of the editorial staff.

Civil War, and whose statue stands opposite the post office; the *Journal* (evening), of which Hoke Smith (b. 1855), a prominent political leader, secretary of the interior in President Cleveland's cabinet in 1893–1896, and later governor of Georgia, was long the proprietor; and the *Georgian* (evening), founded in 1906 as a Prohibition organ.

As regards commerce and manufactures, Atlanta ranks first among the cities of Georgia. In 1907 its whosesale and retail trade was estimated at $100,000,000. The city is said to receive two-fifths of the total freight delivered in the state of Georgia. From 1895 to 1907 the bank clearings increased from about $65,000,000 to about $260,000,000. In recognition of the city's financial strength, Atlanta has been designated by the secretary of the treasury as one of the cities whose bonds will be accepted as security for Federal deposits. Atlanta is the Southern headquarters for a number of fire and life insurance companies, and is the third city of the United States in the amount of insurance business written and reported to resident agents, the annual premium receipts averaging about $10,000,000. It is an important horse and mule market, and handles much tobacco.

The development of manufactures has been especially notable. In 1880 the capital invested in manufacturing industries was approximately $2,468,000; in 1890 it was $9,508,962; in 1900 it had increased to $16,045,156; and in 1905, when only establishments under the "factory system" were counted in the census, to $21,631,162. In 1900 the total product was valued at $16,707,027, and the factory product at $14,418,834; and in 1905 the factory product was valued at $25,745,650, an increase of 78·6% in five years. Among the products are cotton goods (the product value of which in 1905 was 14% of the total value of the city's manufactures), foundry and machine-shop products, lumber, patent medicines, confectionery, men's clothing, mattresses, spring-beds and other furniture. Since 1904 part of the power utilized for manufacturing has been obtained from the Chattahoochee river, 15 m. from the city. There are many manufactories just outside the city limits.

History.—Atlanta owes its origin to the development of pioneer railroads of Georgia. In 1836 the Western & Atlantic, the first road built into North Georgia, was chartered, and the present site of Atlanta was chosen as its southern terminal, which it reached in 1843, and which was named "Terminus." The Georgia and the Central of Georgia then projected branches to Terminus in order to connect with the Western & Atlantic, and completed them in 1845 and 1846. The town charter of 1843 changed the name to Marthasville, in honour of the daughter of Governor Wilson Lumpkin; and the city charter of 1847 changed this to Atlanta. The population in 1850 was 2572; in 1860, 9554. Manufacturing interests soon became important, and during the Civil War Atlanta was the seat of Confederate military factories and a depot of supplies. In 1864 it was the objective point of the first stage of General William T. Sherman's invasion of Georgia (see AMERICAN CIVIL WAR), which is therefore generally known as the "Atlanta campaign."

After the battles around Marietta (*q.v.*), and the crossing of the Chattahoochee river on the 8th and 9th of July, Sherman continued his advance against Atlanta. His plan of operations was directed primarily to the seizure of the Decatur railway, by which the Confederate commander, General J. E. Johnston, might receive support from Virginia and the Carolinas. The three Union armies under Sherman's command, outnumbering the Confederates about 3 to 2, began their movement on the 16th of July; the Army of the Cumberland (Gen. G. H. Thomas) on the right marching from Marietta by the fords of the Upper Chattahoochee on Atlanta, the Army of the Ohio (Gen. J. M. Schofield) in the centre direct on Decatur, and the Army of the Tennessee (Gen. J. B. McPherson) still farther east towards Stone Mountain. At the moment of marching out to meet the enemy, Johnston was relieved of his command and was replaced by Gen. J. B. Hood (July 17). Hood at once prepared to attack Thomas as soon as that general should have crossed Peachtree Creek (6 m. north of the city) and thus isolated himself from Schofield and McPherson. Sherman's confidence in Thomas and his troops was, however, justified. Hood's attack (battle of Peachtree Creek, July 20) was everywhere repulsed, and Schofield and McPherson closed up at the greatest speed. Hood had to retire to Atlanta, with a loss of more than 4000 men, and the three Union armies gradually converged on the north and east sides of the city. But Hood, who had been put in command as a fighting general, was soon ready to attack afresh. This time he placed Gen. W. J. Hardee's corps, the largest of his army, to the south of Atlanta, facing the left flank of McPherson's army. As Hardee's attack rolled up the Union army from left to right, the remainder of the Confederate army was to issue from the Atlanta fortifications and join in the battle. Hardee opened his attack at noon on the 22nd of July (battle of Atlanta). The troops of the Army of the Tennessee were swiftly driven back, and their commander, McPherson, killed; but presently the Federals re-formed and a severe struggle ensued, in which most of Hood's army joined. The veterans of the Army of the Tennessee, led by Gen. J. A. Logan, offered a stubborn resistance, however, and Schofield's army now intervened. After prolonged attacks lasting to nightfall, Hood had once more to draw off, with about 10,000 men killed and wounded. The Confederates now abandoned all idea of regaining the Decatur line, and based themselves on Jonesboro' and the Macon railway. Sherman quickly realized this, and the Army of the Tennessee, now commanded by Gen. O. O. Howard, was counter-marched from left to right, until it formed up on the right of the Union line about Ezra Church (about 4 m. west of Atlanta). The railway from Chattanooga to Atlanta, destroyed by Johnston as he fell back in May and June, was now repaired and working up to Thomas's camps. Hood had meanwhile extended his entrenchments southwards to cover the Macon railway, and Howard's movement led to another engagement (battle of Ezra Church, July 28) in which the XV. corps under Logan again bore the brunt of Hood's attack. The Confederates were once more unsuccessful, and the losses were so heavy that the "fighting" policy ordered by the Confederate government was countermanded. Sherman's cavalry had hitherto failed to do serious damage to the railway, and the Federal general now proceeded to manœuvre with his main body so as to cut off Hood from his Southern railway lines (August). Covered by Howard at Ezra Church, Schofield led this advance, but the new Confederate lines baffled him. A bombardment of the Atlanta fortifications was then begun, but it had no material result. Another cavalry raid effected but slight damage to the line, and Sherman now decided to take his whole force to the south side. This apparently dangerous movement (August 25) is a remarkable illustration of Sherman's genius for war, and in fact succeeded completely. Only a small force was left to guard the Chattanooga railway, and the Union forces, Howard on the right, Thomas in the centre, and Schofield on the left, reached the railway after some sharp fighting (action of Jonesboro', September 1). The defence of Atlanta was now hopeless; Hood's forces retreated southward the same evening, and on the 2nd of September the Union detachment left behind on the north side entered Atlanta unopposed.

All citizens were now ordered to leave, the place was turned into a military camp, and when Sherman started on his "March to the Sea," on the 15th of November, a large part of the city was burned. Consequently the present city is a product of the post-bellum development of Georgia. The military government of Georgia was established here in 1865. In 1868 Atlanta was made the capital of the state.

In 1881 an International Cotton Exposition was held in Atlanta. This was American, even local, in character; its inception was due to a desire to improve the cultivation and manufacture of cotton; but it brought to the notice of the whole country the industrial transformation wrought in the Southern states during the last quarter of the 19th century. In 1887 the Piedmont Exposition was held in Atlanta. The Cotton States and International Exposition, also held at Atlanta, in 1895, attracted widespread attention, and had exhibits from thirty-seven states and thirteen foreign countries.

ATLANTIC, a city and the county-seat of Cass county, Iowa, U.S.A., on East Nishnabatna river, about 80 m. W. by S. of Des Moines. Pop. (1890) 4351; (1900) 5046; (1905, state census) 5180 (625 foreign-born); (1910) 4560. It is served by the Chicago, Rock Island & Pacific railway, and by an interurban electric line connecting with Elkhorn and Kimballton, and is the trade centre of a fine agricultural country; among its manufactures are machine-shop products, canned corn, flour, umbrellas, drugs and bricks. The municipality owns the waterworks and electric-lighting plant. Atlantic was chartered as a city in 1869.

ATLANTIC CITY, a city of Atlantic county, New Jersey, U.S.A., on the Atlantic Ocean, 58 m. S.E. of Philadelphia and 137 m. S. by W. of New York. Pop. (1890) 13,055; (1900) 27,838, of whom 6513 were of negro descent and 3189 were foreign-born; (1910 census) 46,150. It is served by the Atlantic City (Philadelphia & Reading) and the West Jersey & Seashore (Pennsylvania system) railways. Atlantic City is the largest and most popular all-the-year-round resort in the United States, and has numerous fine hotels. The city extends for 3 m. along a low sandy island (Absecon Beach), 10 m. long by ¾ m. wide, separated from the mainland by a narrow strip of salt water and 4 or 5 m. of salt marshes, partly covered with water at highest storm tide. There are good bathing, boating, sailing, fishing and wild-fowl shooting. A "Board Walk" stretches along the beach for about 5 m.—the newest part of it is of concrete—and along or near this walk are the largest hotels, and numerous shops, and places of amusement; from the walk into the ocean extend several long piers. Other features of the place are the broad driveway (Atlantic Avenue) and an automobile boulevard. There are several seaside sanitoriums and hospitals, including the Atlantic City hospital, the Mercer Memorial home, and the Children's Seashore home. On the north end of the beach is Absecon Lighthouse, 160 ft. high. The municipality owns the water-works. Oysters are dredged here and are shipped hence in large quantities. There was a settlement of fishermen on the island in the latter part of the 18th century. In 1852 a movement was made to develop it as a seaside resort for Philadelphia, and after the completion of the Camden & Atlantic City railway in 1854 the growth of the place was rapid. A heavy loss occurred by fire on the 3rd of April 1902.

ATLANTIC OCEAN, a belt of water, roughly of an S-shape, between the western coasts of Europe and Africa and the eastern coasts of North and South America. It extends northward to the Arctic Basin and southward to the Great Southern Ocean. For purposes of measurement the polar boundaries are taken to be the Arctic and Antarctic circles, although in discussing the configuration and circulation it is impossible to adhere strictly to these limits. The Atlantic Ocean consists of two characteristic divisions, the geographical equator forming a fairly satisfactory line of division into North and South Atlantic. The North Atlantic, by far the best-known of the main divisions of the hydrosphere, is remarkable for the immense length of its coast-line and for the large number of enclosed seas connected with it, including on the western side the Caribbean Sea and Gulf of Mexico, the Gulf of St Lawrence and Hudson Bay, and on the eastern side the Mediterranean and Black Sea, the North Sea and the Baltic. The North Atlantic is connected with the Arctic Basin by four main channels: (1) Hudson Strait, about 60 m. wide, communicating with the gulfs and straits of the North American Arctic archipelago; (2) Davis Strait, about 200 m. wide, leading to Baffin Bay; (3) Denmark Strait, between Greenland and Iceland, 130 m. wide; and (4) the "Norwegian Sea," about 400 m. wide, extending from Iceland to the Faeroe Islands, the Shetland Islands and the coast of Norway. The width of the North Atlantic in lat. 60°, approximately where it breaks up into the branches just named, is nearly 2000 m.; in about lat. 50° N. the coasts of Ireland and Newfoundland approach to 1750 m.; the breadth then increases rapidly to lat. 40° N., and attains its maximum of 4500 m. in lat. 25° N.; farther south the minimum breadth is reached between Africa and South America, Cape Palmas being only 1600 m. distant from Cape St Roque. In marked contrast to this, the South Atlantic is distinguished by great simplicity of coast-line; inland seas there are none, and it attains its greatest breadth as it merges with the Southern Ocean; in lat. 35° S. the width is 3700 m.

Extent.

The total area of the North Atlantic, not counting inland seas connected with it, is, according to G. Karstens, 36,438,000 sq. kilometres, or 10,588,000 sq. m.; including the inland seas the area is 45,641,000 sq. kilometres or 13,262,000 sq. m. The area of the South Atlantic is 43,455,000 sq. kilometres, or 12,627,000 sq. m. Although not the most extensive of the great oceans, the Atlantic has by far the largest drainage area. The "long slopes" of the continents on both sides are directed towards the Atlantic, which accordingly receives the waters of a large proportion of the great rivers of the world, including the St Lawrence, the Mississippi, the Orinoco, the Amazon, the rivers of the La Plata, the Congo, the Niger, the Loire, the Rhine, the Elbe and the great rivers of the Mediterranean and the Baltic. Sir J. Murray estimates the total area of land draining to the Atlantic to be 13,432,000 sq. m., or with the Arctic area nearly 20,000,000 sq. m., nearly four times the area draining to the Pacific Ocean, and almost precisely four times the area draining to the Indian Ocean. Murray's calculations give the amount of precipitation received on this area at 15,800 cub. m. annually, and the river discharge from it at 3900 cub. m.

Relief of the bed.

The dominant feature of the relief of the Atlantic basin is a submarine ridge running from north to south from about lat. 50° N. to lat. 40° S., almost exactly in the central line, and following the S-shape of the coasts. Over this ridge the average depth is about 1700 fathoms. Towards its northern end the ridge widens and rises to the plateau of the Azores, and in about 50° N. lat. it merges with the "Telegraph Plateau," which extends across nearly the whole ocean from Ireland to Newfoundland. North of the fiftieth parallel the depths diminish towards the north-east, two long submarine ridges of volcanic origin extend north-eastwards to the south-west of Iceland and to the Faeroe Islands, and these, with their intervening valleys, end in a transverse ridge connecting Greenland, through Iceland and the Faeroe Islands, with North-western Scotland and the continental mass of Europe. The mean depth over this ridge is about 250 fathoms, and the maximum depth nowhere reaches 500 fathoms. The main basin of the Atlantic is thus cut off from the Arctic basin, with which the area north of the ridge has complete deep-water communication. This intermediate region, which has Atlantic characteristics down to 300 fathoms, and at greater depths belongs more properly to the Arctic Sea, commonly receives the name of Norwegian Sea. On both sides of the central ridge deep troughs extend southwards from the Telegraph plateau to the Southern Ocean, the deep water coming close to the land all the way down on both sides. In these troughs the depth is seldom much less than 3000 fathoms, and this is exceeded in a series of patches to which Murray has given the name of "Deeps." In the eastern trough the Peake Deep lies off the Bay of Biscay in 20° W. long., Monaco Deep and Chun Deep off the north-west of Africa, Moseley Deep off the Cape Verde Islands, Krech Deep off the Liberian coast, and Buchanan Deep off the mouth of the Congo. The western trough extends northwards into Davis Strait, forming a depression in the Telegraph plateau; to the south of Newfoundland and Nova Scotia are Sigsbee Deep, Libbey Deep and Suhm Deep, each of small area; north-east of the Bahamas Nares Deep forms the largest and deepest depression in the Atlantic, in which a sounding of 4561 fathoms was obtained (70 m. north of Porto Rico) by the U.S. ship "Blake" in 1883. Immediately to the south of Nares Deep lies the smaller Makarov Deep; and off the coast of South America are Tizard Deep and Havergal Deep.

Before the Antarctic expeditions of 1903–1904 our knowledge of the form of the sea bottom south of 40° S. lat. was almost wholly derived from the soundings of the expedition of Sir J. C. Ross in the "Erebus" and "Terror" (1839–1843), and the bathymetrical maps published were largely the result of deductions based on one sounding taken by Ross in 68° 34′ S. lat., 12° 49′ W. long., in which he recorded a depth exceeding 4000 fathoms. The Scottish Antarctic expedition has shown this sounding to be erroneous; the "Scotia" obtained samples of bottom, in almost the same spot, from a depth of 2660 fathoms. Combining the results of recent soundings, Dr W. S. Bruce, the leader of the Scottish expedition, finds that there is a ridge "extending in a curve from Madagascar to Bouvet Island, and from Bouvet Island to the Sandwich group, whence there is a forked connexion through the South Orkneys to Graham's Land, and through South Georgia to the Falkland Islands and the South American continent." Again, the central ridge of the South Atlantic extends a thousand miles farther south than was supposed, joining the east and west ridge, just described, between the Bouvet Islands and the Sandwich group.

The foundations of our knowledge of the relief of the Atlantic basin may be said to have been laid by the work of H.M.S. "Challenger" (1873–1876), and the German ship "Gazelle" (1874–1876), the French expedition in the "Travailleur" (1880), and the U.S. surveying vessel "Blake" (1877 and later). Large numbers of additional soundings have been made in recent years by cable ships, by the expeditions of H.S.H. the prince of Monaco, the German "Valdivia" expedition under Professor Chun (1898), and the combined Antarctic expeditions (1903–1904).

Islands.

The Atlantic Ocean contains a relatively small number of islands. The only continental groups, besides some islands in the Mediterranean, are Iceland, the British Isles, Newfoundland, the West Indies, and the Falklands, and the chief oceanic islands are the Azores, Madeira, the Canaries, the Cape Verde Islands, Ascension, St Helena, Tristan da Cunha and Bouvet Island.

Mean depth, and bottom deposits.

The mean depth of the North Atlantic is, according to G. Karstens, 2047 fathoms. If we include the enclosed seas, the North Atlantic has a mean depth of 1800 fathoms. The South Atlantic has a mean depth of 2067 fathoms.

The greater part of the bottom of the Atlantic is covered by a deposit of Globigerina ooze, roughly the area between 1000 and 3000 fathoms, or about 60% of the whole. At a depth of about 3000 fathoms, *i.e.* in the "Deeps," the Globigerina ooze gradually gives place to red clay. In the shallower tropical waters, especially on the central ridge, considerable areas are covered by Pteropod ooze, a deposit consisting largely of the shells of pelagic molluscs. Diatom ooze is the characteristic deposit in high southern latitudes. The terrigenous deposits consist of blue muds, red muds (abundant along the coast of Brazil, where the amount of organic matter present is insufficient to reduce the iron in the matter brought down by the great rivers to produce blue muds), green muds and sands, and volcanic and coral detritus.

The question of the origin of the Atlantic basin, like that of the other great divisions of the hydrosphere, is still unsettled. Most geologists include the Atlantic with the other oceans in the view they adopt as to its age; but E. Suess and M. Neumayr, while they regard the basin of the Pacific as of great antiquity, believe the Atlantic to date only from the Mesozoic age. Neumayr finds evidence of the existence of a continent between Africa and South America, which protruded into the central North Atlantic, in Jurassic times. F. Kossmat has shown that the Atlantic had substantially its present form during the Cretaceous period.

Distribution of temperature.

In describing the mean distribution of temperature in the waters of the Atlantic it is necessary to treat the northern and southern divisions separately. The heat equator, or line of maximum mean surface temperature, starts from the African coast in about 5° N. lat., and closely follows that parallel to 40° W. long., where it bends northwards to the Caribbean Sea. North of this line, near which the temperature is a little over 80° F., the gradient trends somewhat to the east of north, and the temperature is slightly higher on the western than on the eastern side until, in 45° N. lat., the isothermal of 60° F. runs nearly east and west. Beyond this parallel the gradient is directed towards the north-west, and temperatures are much higher on the European than on the American side. From the surface to 500 fathoms the general form of the isothermals remains the same, except that instead of an equatorial maximum belt there is a focus of maximum temperature off the eastern coast of the United States. This focus occupies a larger area and becomes of greater relative intensity as the depth increases until, at 500 fathoms, it becomes an elongated belt extending right across the ocean in about 30° N. lat. Below 500 fathoms the western centres of maximum disappear, and higher temperatures occur in the eastern Atlantic off the Iberian peninsula and north-western Africa down to at least 1000 fathoms; at still greater depths temperature gradually becomes more and more uniform. The communication between the Atlantic and Arctic basins being cut off, as already described, at a depth of about 300 fathoms, the temperatures in the Norwegian Sea below that level are essentially Arctic, usually below the freezing-point of fresh water, except where the distribution is modified by the surface circulation. The isothermals of mean surface temperature in the South Atlantic are in the lower latitudes of an ∽-shape, temperatures being higher on the American than on the African side. In latitudes south of 30° S. the curved form tends to disappear, the lines running more and more directly east and west. Below the surface a focus of maximum temperature appears off the coast of South America in about 30° S. lat., and of minimum temperature north and north-east of this maximum. This distribution is most marked at about 300 fathoms, and disappears at 500 fathoms, beyond which depth the lines tend to become parallel and to run east and west, the gradient slowly diminishing.

Salinity.

The Atlantic is by far the saltest of the great oceans. Its saltest waters are found at the surface in two belts, one extending east and west in the North Atlantic between 20° and 30° N. lat., and another of almost equal salinity extending eastwards from the coast of South America in 10° to 20° S. lat. In the equatorial region between these belts the salinity is markedly less, especially in the eastern part. North of the North Atlantic maximum the waters become steadily fresher as latitude increases until the channels opening into the Arctic basin are reached. In all of these water of relatively high salinity usually appears for a long distance towards the north on the eastern side of the channel, while on the western side the water is comparatively fresh; but great variations occur at different seasons and in different years. In the higher latitudes of the South Atlantic the salinity diminishes steadily and tends to be uniform from east to west, except near the southern extremity of South America, where the surface waters are very fresh. Our knowledge of the salinity of waters below the surface is as yet very defective, large areas being still unrepresented by a single observation. The chief facts already established are the greater saltness of the North Atlantic compared with the South Atlantic at all depths, and the low salinity at all depths in the eastern equatorial region, off the Gulf of Guinea.

Meteorology.

The wind circulation over the Atlantic is of a very definite character. In the South Atlantic the narrow land surfaces of Africa and South America produce comparatively little effect in disturbing the normal planetary circulation. The tropical belt of high atmospheric pressure is very marked in winter; it is weaker during the summer months, and at that season the greater relative fall of pressure over the land cuts it off into an oval-shaped anticyclone, the centre of which rests on the coolest part of the sea surface in that latitude, near the Gulf of Guinea. South of this anticyclone, from about the latitude of the Cape, we find the region where, on account of the uninterrupted sea surface right round the globe, the planetary circulation is developed to the greatest extent known; the pressure gradient is steep, and the region is swept continuously by strong westerly winds—the "roaring forties."

In the North Atlantic the distribution of pressure and resulting wind circulation are very largely modified by the enormous areas of land and frozen sea which surround the ocean on three sides. The tropical belt of high pressure persists all the year round, but the immense demand for air to supply the ascending currents over the heated land surfaces in summer causes the normal descending movement to be largely reinforced; hence the "North Altantic anticyclone" is much larger, and its circulation more vigorous, in summer than in winter. Again, during the winter months pressure is relatively high over North America, Western Eurasia and the Arctic regions; hence vast quantities of air are brought down to the surface, and circulation must be kept up by ascending currents over the ocean. The Atlantic anticyclone is, therefore, at its weakest in winter, and on its polar side the polar eddy becomes a trough of low pressure, extending roughly from Labrador to Iceland and Jan Mayen, and traversed by a constant succession of cyclones. The net effect of the surrounding land is, in fact, to reverse the seasonal variations of the planetary circulation, but without destroying its type. In the intermediate belt between the two high-pressure areas the meteorological equator remains permanently north of the geographical equator, moving between it and about 11° N. lat.

Currents.

The part of this atmospheric circulation which is steadiest in its action is the trade winds, and this is, therefore, the most effective in producing drift movement of the surface waters. The trade winds give rise, in the region most exposed to their influence, to two westward-moving drifts—the equatorial currents, which are separated in parts of their course by currents moving in the opposite direction along the equatorial belt. These last may be of the nature of "reaction" currents; they are collectively known as the equatorial counter-current. On reaching the South American coast, the southern equatorial current splits into two parts at Cape St Roque: one branch, the Brazil current, is deflected southwards and follows the coast as a true stream current at least as far as the river Plate. The second branch proceeds north-westwards towards the West Indies, where it mingles with the waters of the northern equatorial; and the two drifts, blocked by the <-shape of the land, raise the level of the surface in the Gulf of Mexico, the Caribbean Sea, and in the whole area outside the West Indies. This congestion is relieved by what is probably the most rapid and most voluminous stream current in the world, the Gulf Stream, which runs along the coast of North America, separated from it by a narrow strip of cold water, the "cold wall," to a point off the south-east of Newfoundland. At this point the Gulf Stream water mixes with that from the Labrador current (see below), and a drift current eastwards is set up under the influence of the prevailing westerly winds: this is generally called the Gulf Stream drift. When the Gulf Stream drift approaches the eastern side of the Atlantic it splits into two parts, one going southwards along the north-west coast of Africa, the Canaries current, and another turning northwards and passing to the west of the British Isles. Most of the Canaries current re-enters the northern equatorial, but a certain proportion keeps to the African coast, unites with the equatorial return currents, and penetrates into the Gulf of Guinea. This last feature of the circulation is still somewhat obscure; it is probably to be accounted for by the fact that on this part of the coast the prevailing winds, although to a considerable extent monsoonal, are off-shore winds, blowing the surface waters out to sea, and the place of the water thus removed is filled up by water derived either from lower levels or from "reaction" currents.

The movements of the northern branch of the Gulf Stream drift have been the object of more careful and more extended study than all the other currents of the ocean put together, except, perhaps, the Gulf Stream itself. The cruises of the "Porcupine" and "Lightning," which led directly to the despatch of the "Challenger" expedition, were altogether within its "sphere of influence"; so also was the great Norwegian Atlantic expedition. More recently, the area has been further explored by the German expedition in the ss. "National," the Danish "Ingolf" expedition, and the minor expeditions of the "Michael Sars," "Jackal," "Research," &c., and since 1902 it has been periodically examined by the International Council for the Study of the Sea. Much has also been done by the discussion of observations made on board vessels belonging to the mercantile marine of various countries. It may now be taken as generally admitted that the current referred to breaks into three main branches. The first passes northwards, most of it between the Faeroe and Shetland Islands, to the coast of Norway, and so on to the Arctic basin, which, as Nansen has shown, it fills to a great depth. The second, the Irminger stream, passes up the west side of Iceland; and the third goes up the Greenland side of Davis Strait to Baffin Bay. These branches are separated from one another at the surface by currents moving southwards: one passes east of Iceland; the second, the Greenland current, skirts the east coast of Greenland; and the third, the Labrador current already mentioned, follows the western side of Davis Strait.

The development of the equatorial and the Brazil currents in the South Atlantic has already been described. On the polar side of the high-pressure area a west wind drift is under the control of the "roaring forties," and on reaching South Africa part of this is deflected and sent northwards along the west coast as the cold Benguella current which rejoins the equatorial. In the central parts of the two high-pressure areas there is practically no surface circulation. In the North Atlantic this region is covered by enormous banks of gulf-weed (*Sargassum bucciferum*), hence the name Sargasso Sea. The Sargasso Sea is bounded, roughly, by the lines of 20°–35° N. lat. and 40°–75° W. long.

The sub-surface circulation in the Atlantic may be regarded as consisting of two parts. Where surface water is banked up against the land, as by the equatorial and Gulf Stream drift currents, it appears to penetrate to very considerable depths; the escaping stream currents are at first of great vertical thickness and part of the water at their sources has a downward movement. In the case of the Gulf Stream, which is not much impeded by the land, this descending motion is relatively slight, being perhaps largely due to the greater specific gravity of the water; it ceases to be perceptible beyond about 500 fathoms. On the European-African side the descending movement is more marked, partly because the coast-line is much more irregular and the northward current is deflected against it by the earth's rotation, and partly because of the outflow of salt water from the Mediterranean; here the movement is traceable to at least 1000 fathoms. The northward movement of water across the Norwegian Sea extends down from the surface to the Iceland-Shetland ridge, where it is sharply cut off; the lower levels of the Norwegian Sea are filled with ice-cold Arctic water, close down to the ridge. The south-moving currents originating from melting ice are probably quite shallow. The second part of the circulation in the depth is the slow "creep" of water of very low temperature along the bottom. The North Atlantic being altogether cut off from the Arctic regions, and the vertical circulation being active, this movement is here practically non-existent; but in the South Atlantic, where communication with the Southern Ocean is perfectly open, Antarctic water can be traced to the equator and even beyond.

The tides of the Atlantic Ocean are of great complexity. The tidal wave of the Southern Ocean, which sweeps uninterruptedly round the globe from east to west, generates a secondary wave between Africa and South America, which travels north at a rate dependent only on the depth of the ocean. With this "free" wave is combined a "forced" wave, generated, by the direct action of the sun and moon, within the Atlantic area itself. Nothing is known about the relative importance of these two waves. (H. N. D.)

See also OCEAN AND OCEANOGRAPHY.

ATLANTIS, ATALANTIS, or ATLANTICA, a legendary island in the Atlantic Ocean, first mentioned by Plato in the *Timaeus*. Plato describes how certain Egyptian priests, in a conversation with Solon, represented the island as a country larger than Asia Minor and Libya united, and situated just beyond the Pillars of Hercules (Straits of Gibraltar). Beyond it lay an archipelago of lesser islands. According to the priests, Atlantis had been a powerful kingdom nine thousand years before the birth of Solon, and its armies had overrun the lands which bordered the Mediterranean. Athens alone had withstood them with success. Finally the sea had overwhelmed Atlantis, and had thenceforward become unnavigable owing to the shoals which marked the spot. In the *Critias* Plato adds a history of the ideal commonwealth of Atlantis. It is impossible to decide how far this legend is due to Plato's invention, and how far it is based on facts of which no record remains. Medieval writers, for whom the tale was preserved by the Arabian geographers, believed it true, and were fortified in their belief by numerous traditions of islands in the western sea, which offered various points of resemblance to Atlantis. Such in particular were the Greek Isles of the Blest, or Fortunate Islands, the Welsh Avalon, the Portuguese Antilia or Isle of Seven Cities, and St Brendan's island, the subject of many sagas in many languages. These, which are described in separate articles, helped to maintain the tradition of an earthly paradise which had become associated with the myth of Atlantis; and all except Avalon were marked in maps of the 14th and 15th centuries, and formed the object of voyages of discovery, in one case (St Brendan's island) until the 18th century. In early legends, of whatever nationality, they are almost invariably described in terms which closely resemble Homer's account of the island of the Phaeacians (*Od.* viii.)—a fact which may be an indication of their common origin in some folk-tale current among several races. Somewhat similar legends are those of the island of Brazil (*q.v.*), of Lyonnesse (*q.v.*), the sunken land off the Cornish coast, of the lost Breton city of Is, and of Mayda or Asmaide—the French *Isle Verte* and Portuguese *Ilha Verde* or "Green Island"—which appears in many folk-tales from Gibraltar to the Hebrides, and until 1853 was marked on English charts as a rock in 44° 48′ N. and 26° 10′ W. After the Renaissance, with its renewal of interest in Platonic studies, numerous attempts were made to rationalize the myth of Atlantis. The island was variously identified with America, Scandinavia, the Canaries and even Palestine; ethnologists saw in its inhabitants the ancestors of the Guanchos, the Basques or the ancient Italians; and even in the 17th and 18th centuries the credibility of the whole legend was seriously debated, and sometimes admitted, even by Montaigne, Buffon and Voltaire.

For the theory that Atlantis is to be identified with Crete in the Minoan period, see "The Lost Continent" in *The Times* (London) for the 19th of February 1909. See also "Dissertation sur l'Atlantide" in T. H. Martin's *Études sur le Timée* (1841).

ATLAS, in Greek mythology, the "endurer," a son of the Titan Iapetus and Clymene (or Asia), brother of Prometheus. Homer, in the *Odyssey* (i. 52) speaks of him as "one who knows the depths of the whole sea, and keeps the tall pillars which hold heaven and earth asunder." In the first instance he seems to have been a marine creation. The pillars which he supported were thought to rest in the sea, immediately beyond the most western horizon. But as the Greeks' knowledge of the west increased, the name of Atlas was transferred to a hill in the north-west of Africa. Later, he was represented as a king of that district, rich in flocks and herds, and owner of the garden of the Hesperides, who was turned into a rocky mountain when Perseus, to punish him for his inhospitality, showed him the Gorgon's head (Ovid, *Metam.* iv. 627). Finally, Atlas was explained as the name of a primitive astronomer, who was said to have made the first celestial globe (Diodorus iii. 60). He was the father of the Pleiades and Hyades; according to Homer, of Calypso. In works of art he is represented as carrying the heavens or the terrestrial globe. The Farnese statue of Atlas in the Naples museum is well known.

The plural form Atlantes is the classical term in architecture for the male sculptured figures supporting a superstructure as in the baths at Pompeii, and in the temple at Agrigentum in Sicily. In 18th-century architecture half-figures of men with strong muscular development were used to support balconies (see Caryatides and Telamones).

A figure of Atlas supporting the heavens is often found as a frontispiece in early collections of maps, and is said to have been first thus used by Mercator. The name is hence applied to a volume of maps (see Map), and similarly to a volume which contains a tabular conspectus of a subject, such as an atlas of ethnographical subjects or anatomical plates. It is also used of a large size of drawing paper.

The name "atlas," an Arabic word meaning "smooth," applied to a smooth cloth, is sometimes found in English, and is the usual German word, for "satin."

ATLAS MOUNTAINS, the general name for the mountain chains running more or less parallel to the coast of North-west Africa. They extend from Cape Nun on the west to the Gulf of Gabes on the east, a distance of some 1500 m., traversing Morocco, Algeria and Tunisia. To their south lies the Saharan desert. The Atlas consist of many distinct ranges, but they can be roughly divided into two main chains: (1) the Maritime Atlas, *i.e.* the ranges overlooking the Mediterranean from Ceuta to Cape Bon; (2) the inner and more elevated ranges, which, starting from the Atlantic at Cape Ghir in Sús, run south of the coast ranges and are separated from them by high plateaus. This general disposition is seen most distinctly in eastern Morocco and Algeria. The western inner ranges are the most important of the whole system, and in the present article are described first as *the Moroccan Ranges.* The maritime Atlas and the inner ranges in Algeria and Tunisia are then treated under the heading *Eastern Ranges.*

The Moroccan Ranges.—This section of the Atlas, known to the inhabitants of Morocco by its Berber name, Idráren Dráren or the "Mountains of Mountains," consists of five distinct ranges, varying in length and height, but disposed more or less parallel to one another in a general direction from south-west to north-east, with a slight curvature towards the Sahara.

1. The main range, that known as the Great Atlas, occupies a central position in the system, and is by far the longest and loftiest chain. It has an average height of over 11,000 ft., whereas the loftiest peaks in Algeria do not exceed 8000 ft., and the highest in Tunisia are under 6000 ft. Towards the Dahra district at the north-east end the fall is gradual and continuous, but at the opposite extremity facing the Atlantic between Agadir and Mogador it is precipitous. Although only one or two peaks reach the line of perpetual snow, several of the loftiest summits are snowclad during the greater part of the year. The northern sides and tops of the lower heights are often covered with dense forests of oak, cork, pine, cedar and other trees, with walnuts up to the limit of irrigation. Their slopes enclose well-watered valleys of great fertility, in which the Berber tribes cultivate tiny irrigated fields, their houses clinging to the hill-sides. The southern flanks, being exposed to the hot dry winds of the Sahara, are generally destitute of vegetation.

At several points the crest of the range has been deeply eroded by old glaciers and running waters, and thus have been formed a number of devious passes. The central section, culminating in Tizi n 'Tagharat or Tinzár, a peak estimated at 15,000 ft. high, maintains a mean altitude of 11,600 ft., and from this great mass of schists and sandstones a number of secondary ridges radiate in all directions, forming divides between the rivers Dra'a, Sús, Um-er-Rabíā, Sebú, Mulwíya and Ghír, which flow respectively to the south-west, the west, north-west, north, north-east and south-east. All are swift and unnavigable, save perhaps for a few miles from their mouths. With the exception of the Dra'a, the streams rising on the side of the range facing the Sahara do not reach the sea, but form marshes or lagoons at one season, and at another are lost in the dry soil of the desert.

For a distance of 100 m. the central section nowhere presents any passes accessible to caravans, but south-westward two gaps in the range afford communication between the Tansíft and Sús basins, those respectively of Gindáfi and Bíbâwan. A few summits in the extreme south-west in the neighbourhood of Cape Ghir still exceed 11,000 ft., and although the steadily rising ground from the coast and the prominence of nearer summits detract from the apparent height, this is on an average greater than that of the European Alps. The most imposing view is to be obtained from the plain of Marrákesh, only some 1000 ft. above sea-level, immediately north of the highest peaks. Besides huge masses of old schists and sandstones, the range contains extensive limestone, marble, diorite, basalt and porphyry formations, while granite prevails on its southern slopes. The presence of enormous glaciers in the Ice Age is attested by the moraines at the Atlantic end, and by other indications farther east. The best-known passes are: (1) The Bíbáwan in the upper Wad Sús basin (4150 ft.); (2) the Gindáfi, giving access from Marrákesh to Tárudánt, rugged and difficult, but low; (3) the Tagharat, difficult and little used, leading to the Dra'a valley (11,484 ft.); (4) the Gláwi (7600 ft.); (5) Tizi n 'Tilghemt (7250 ft.), leading to Tafilet (Tafílált) and the Wad Ghír.

2. The lower portion of the Moroccan Atlas (sometimes called the Middle Atlas), extending north-east and east from an undefined point to the north of the Great Atlas to near the frontier of Algeria, is crossed by the pass from Fez to Tafílált. Both slopes are wooded, and its forests are the only parts of Morocco where the lion still survives. From the north this range, which is only partly explored, presents a somewhat regular series of snowy crests.

3. The Anti-Atlas or Jebel Saghru, also known as the Lesser Atlas, running parallel to and south of the central range, is one of the least elevated chains in the system, having a mean altitude of not more than 5000 ft., although some peaks and even passes exceed 6000 ft. At one point it is pierced by a gap scarcely five paces wide with walls of variegated marbles polished by the transport of goods. As to the relation of the Anti-Atlas to the Atlas proper at its western end nothing certain is known.

The two more or less parallel ranges which complete the western system are less important:—(4) the Jebel Bani, south of the Anti-Atlas, a low, narrow rocky ridge with a height of 3000 ft. in its central parts; and (5) the Mountains of Ghaiáta, north of the Middle Atlas, not a continuous range, but a series of broken mountain masses from 3000 to 3500 ft. high, to the south of Fez, Táza and Tlemçen.

The Eastern Ranges.—The eastern division of the Atlas, which forms the backbone of Algeria and Tunisia, is adequately known with the exception of the small portion in Morocco forming the province of Er-Ríf. The lesser range, nearer the sea, known to the French as the Maritime Atlas, calls for little detailed notice. From Ceuta, above which towers Jebel Músa—about 2800 ft.—to Melilla, a distance of some 150 m., the Ríf Mountains face the Mediterranean, and here, as along the whole coast eastward to Cape Bon, many rugged rocks rise boldly above the general level. In Algeria the Maritime Atlas has five chief ranges, several mountains rising over 5000 ft. The Jurjura range, extending through Kabylia from Algiers to Bougie, contains the peaks of Lalla Kedija (7542 ft.), the culminating point of the maritime chains, and Babor (6447 ft.). (See further ALGERIA.) The Mejerda range, which extends into Tunisia, has no heights exceeding 3700 ft. It was in these coast mountains of Algeria that the Romans quarried the celebrated Numidian marbles.

The southern or main range of the Eastern division is known by the French as the Saharan Atlas. On its western extremity it is linked by secondary ranges to the mountain system of Morocco. The Saharan Atlas is essentially one chain, though known under different names: Jebel K'sur and Jebel Amur on the west, and Jebel Aures in the east. The central part, the Záb Mountains, is of lower elevation, the Saharan Atlas reaching its culminating point, Jebel Shellia (7611 ft. above the sea), in the Aures. This range sends a branch northward which joins the Mejerda range of the Maritime Atlas, and another branch runs south by Gafsa to the Gulf of Gabes. Here Mount Sidi Ali bu Musin reaches a height of 5700 ft., the highest point in Tunisia. In the Saharan Atlas the passes leading to or from the desert are numerous, and in most instances easy. Both in the east (at Batna) and the west (at Ain Sefra) the mountains are traversed by railways, which, starting from Mediterranean seaports, take the traveller into the Sahara.

History and Exploration.—The name Atlas given to these mountains by Europeans—but never used by the native races—is derived from that of the mythical Greek god represented as carrying the globe on his shoulders, and applied to the high and distant mountains of the west, where Atlas was supposed to dwell. From time immemorial the Atlas have been the home of Berber races, and those living in the least accessible regions have retained a measure of independence throughout their recorded history. Thus some of the mountain districts of Kabylia had never been visited by Europeans until the French military expedition of 1857. But in general the Maritime range was well known to the Romans. The Jebel Amur was traversed by the column which seized El Aghuat in 1852, and from that time dates the survey of the mountains.

The ancient caravan route from Mauretania to the western Sudan crossed the lower Moroccan Atlas by the pass of Tilghemt and passed through the oasis of Tafílált, formerly known as Sajilmása ["Sigilmassa"], on the east side of the Anti-Atlas. The Moroccan system was visited, and in some instances crossed, by various European travellers carried into slavery by the Salli rovers, and was traversed by René Caillé in 1828 on his journey home from Timbuktu, but the first detailed exploration was made by Gerhard Rohlfs in 1861–1862. Previous to that almost the only special report was the misleading one of Lieut. Washington, attached to the British embassy of 1837, who from insufficient data estimated the height of Mount Tagharat, to which he gave the indefinite name of Miltsin (i.e. *Mul et-Tizin*, "Lord of the Peaks"), as 11,400 ft. instead of about 15,000 ft.

In 1871 the first scientific expedition, consisting of Dr (afterwards Sir) J. D. Hooker, Mr John Ball and Mr G. Maw, explored the central part of the Great Atlas with the special object of investigating its flora and determining its relation to that of the mountains of Europe. They ascended by the Ait Mízan valley to the Tagharat pass (11,484 ft.), and by the Amsmiz valley to the summit of Jebel Tezah (11,972 ft.). In the Tagharat pass Mr Maw was the only one of the party who reached the watershed; but from Jebel Tezah a good view was obtained southward across the great valley of the Sús to the Anti-Atlas, which appeared to be from 9000 to 10,000 ft. high. Dr Oskar Lenz in 1879–1880 surveyed a part of the Great Atlas north of Tárudant, determined a pass south of Iligh in the Anti-Atlas, and penetrated thence across the Sahara to Timbuktu. He was followed in 1883–1884 by Vicomte Ch. de Foucauld, whose extensive itineraries include many districts that had never before been visited by any Europeans. Such were parts of the first and middle ranges, crossed once; three routes over the Great Atlas, which was, moreover, followed along both flanks for nearly its whole length; and six journeys across the Anti-Atlas, with a general survey of the foot of this range and several passages over the Jebel Bani. Then came Joseph Thomson, who explored some of the central parts, and made the highest ascent yet achieved, that of Mount Likimt, 13,150 ft., but broke little new ground, and failed to cross the main range (1888); and Walter B. Harris, who explored some of the southern slopes and crossed the Atlas at two points during his expedition to Tafílált in 1894. In 1901 and again in 1905 the marquis de Segonzac, a Frenchman, made extensive journeys in the Moroccan ranges. He crossed the Great Atlas in its central section, explored its southern border, and, in part, the Middle and Anti-Atlas ranges. A member of his expeditions, de Flotte Rocquevaire, made a triangulation of part of the western portion of the main Atlas, his labours affording a basis for the co-ordination of the work of previous explorers. (See also MOROCCO, ALGERIA, TUNISIA and SAHARA.)

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ATMOLYSIS (Gr. ἀτμός, vapour: λύειν, to loosen), a term invented by Thomas Graham to denote the separation of a mixture of gases by taking advantage of their different rates of diffusion through a porous septum or diaphragm (see Diffusion).

ATMOSPHERE (Gr. ἀτμός, vapour; σφαῖρα, a sphere), the aeriform envelope encircling the earth; also the envelope of a particular gas or gases about any solid or liquid. Meteorological phenomena seated more directly in the atmosphere obtained early recognition; thus Hesiod, in his *Works and Days*, speculated on the origin of winds, ascribing them to the heating effects of the sun on the air. Ctesibius of Alexandria, Hero and others, founded the science of pneumatics on observations on the physical properties of air. Anaximenes made air the primordial substance, and it was one of the Aristotelian elements. A direct proof of its material nature was given by Galileo, who weighed a copper ball containing compressed air.

Before the development of pneumatic chemistry, air was regarded as a distinct chemical unit or element. The study of calcination and combustion during the 17th and 18th centuries culminated in the discovery that air consists chiefly of a mixture of two gases, oxygen and nitrogen. Cavendish, Priestley, Lavoisier and others contributed to this result. Cavendish made many analyses: from more than 500 determinations of air in winter and summer, in wet and clear weather, and in town and country, he discerned the mean composition of the atmosphere to be, oxygen 20·833 % and nitrogen 79·167 % The same experimenter noticed the presence of an inert gas, in very minute amount ; this gas, afterwards investigated by Rayleigh and Ramsay, is now named argon (*q.v.*).

The constancy of composition shown by repeated analyses of atmospheric air led to the view that it was a chemical compound of nitrogen and oxygen; but there was no experimental confirmation of this idea, and all observations tended to the view that it is simply a mechanical mixture. Thus, the gases are not present in simple multiples of their combining weights; atmospheric air results when oxygen and nitrogen are mixed in the prescribed ratio, the mixing being unattended by any manifestation of energy, such as is invariably associated with a chemical action; the gases may be mechanically separated by atmolysis, *i.e.* by taking advantage of the different rates of diffusion of the two gases; the solubility of air in water corresponds with the "law of partial pressures," each gas being absorbed in amount proportional to its pressure and coefficient of absorption, and oxygen being much more soluble than nitrogen (in the ratio of ·04114 to ·02035 at 0°); air expelled from water by boiling is always richer in oxygen.

Various agencies are at work tending to modify the composition of the atmosphere, but these so neutralize each other as to leave it practically unaltered. Minute variations, however, do occur. Bunsen analysed fifteen examples of air collected at the same place at different times, and found the extreme range in the percentage of oxygen to be from 20·97 to 20·84. Regnault, from analyses of the air of Paris, obtained a variation of 20·999 to 20·913; country air varied from 20·903 to 21·000; while air taken from over the sea showed an extreme variation of 20·940 to 20·850. Angus Smith determined London air to vary in oxygen content from 20·857 to 20·95, the air in parks and open spaces showing the higher percentage; Glasgow air showed similar results, varying from 20·887 in the streets to 20·929 in open spaces.

In addition to nitrogen and oxygen, there are a number of other gases and vapours generally present in the atmosphere. Of these, argon and its allies were the last to be definitely isolated. Carbon dioxide is invariably present, as was inferred by Dr David Macbride (1726–1778) of Dublin in 1764, but in a proportion which is not absolutely constant; it tends to increase at night, and during dry winds and fogs, and it is greater in towns than in the country and on land than on the sea. Water vapour is always present; the amount is determined by instruments termed hygrometers (*q.v.*). Ozone (*q.v.*) occurs, in an amount supposed to be associated with the development of atmospheric electricity (lightning, &c.); this amount varies with the seasons, being a maximum in spring, and decreasing through summer and autumn to a minimum in winter. Hydrogen dioxide occurs in a manner closely resembling ozone. Nitric acid and lower nitrogen oxides are present, being formed by electrical discharges, and by the oxidation of atmospheric ammonia by ozone. The amount of nitric acid varies from place to place; rain-water, collected in the country, has been found to contain an average of 0·5 parts in a million, but town rain-water contains more, the greater amounts being present in the more densely populated districts. Ammonia is also present, but in very varying amounts, ranging from 135 to 0·1 parts (calculated as carbonate) in a million parts of air. Ammonia is carried back to the soil by means of rain, and there plays an important part in providing nitrogenous matter which is afterwards assimilated by vegetable life.

The average volume composition of the gases of the atmosphere may be represented (in parts per 10,000) as follows:—

Oxygen	2065·94	Ozone . . .	0·015
Nitrogen	7711·60	Aqueous vapour	140·00
Argon (about) . .	79·00	Nitric acid . .	0·08
Carbon dioxide .	3·36	Ammonia . .	0·005

In addition to these gases, there are always present in the atmosphere many micro-organisms or bacteria (see Bacteriology); another invariable constituent is dust (*q.v.*), which plays an important part in meteorological phenomena.

Reference should be made to the articles Barometer, Climate and Meteorology for the measurement and variation of the pressure of the atmosphere, and the discussion of other properties.

ATMOSPHERIC ELECTRICITY. 1. It was not until the middle of the 18th century that experiments due to Benjamin Franklin showed that the electric phenomena of the atmosphere are not fundamentally different from those produced in the laboratory. For the next century the rate of progress was slow, though the ideas of Volta in Italy and the instrumental devices of Sir Francis Ronalds in England merit recognition. The invention of the portable electrometer and the water-dropping electrograph by Lord Kelvin in the middle of the 19th century, and the greater definiteness thus introduced into observational results, were notable events. Towards the end of the 19th century came the discovery made by W. Linss (6)[1] and by J. Elster and H. Geitel (7) that even the most perfectly insulated conductors lose their charge, and that this loss depends on atmospheric conditions. Hard on this came the recognition of the fact that freely charged positive and negative ions are always present in the atmosphere, and that a radioactive emanation can be collected. Whilst no small amount of observational work has been done in these new branches of atmospheric electricity, the science has still not developed to a considerable extent beyond preliminary stages. Observations have usually been limited to a portion of the year, or to a few hours of the day, whilst the results from different stations differ much in details. It is thus difficult to form a judgment as to what has most claim to acceptance as the general law, and what may be regarded as local or exceptional.

2. *Potential Gradient.*—In dry weather the electric potential in the atmosphere is normally positive relative to the earth, and increases with the height. The existence of *earth currents* (*q. v.*) shows that the earth, strictly speaking, is not all at one potential, but the natural differences of potential between points on the earth's surface a mile apart are insignificant compared to the normal potential difference between the earth and a point one foot above it. What is aimed at in ordinary observations of atmospheric potential is the measurement of the difference of potential between the earth and a point a given distance above it, or of the difference of potential betweeen two points in the same vertical line a given distance apart. Let a conductor, say a metallic sphere, be supported by a metal rod of negligible electric capacity whose other end is earthed. As the whole conductor must be at zero (*i.e.* the earth's) potential, there must be an induced charge on the sphere, producing at its centre a potential equal but of opposite sign to what would exist at the same spot in free air. This neglects any charge in the air

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[1] See *Authorities* below.

displaced by the sphere, and assumes a statical state of conditions and that the conductor itself exerts no disturbing influence. Suppose now that the sphere's earth connexion is broken and that it is carried without loss of charge inside a building at zero potential. If its potential as observed there is −V (volts), then the potential of the air at the spot occupied by the sphere was +V. This method in one shape or another has been often employed. Suppose next that a fixed insulated conductor is somehow kept at the potential of the air at a given point, then the measurement of its potential is equivalent to a measurement of that of the air. This is the basis of a variety of methods. In the earliest the conductor was represented by long metal wires, supported by silk or other insulating material, and left to pick up the air's potential. The addition of sharp points was a step in advance; but the method hardly became a quantitative one until the sharp points were replaced by a flame (fuse, gas, lamp), or by a liquid jet breaking into drops. The matter leaving the conductor, whether the products of combustion or the drops of a liquid, supplies the means of securing equality of potential between the conductor and the air at the spot where the matter quits electrical connexion with the conductor. Of late years the function of the collector is discharged in some forms of apparatus by a salt of radium. Of flame collectors the two best known are Lord Kelvin's portable electrometer with a fuse, or F. Exner's gold leaf electroscope in conjunction with an oil lamp or gas flame. Of liquid collectors the representative is Lord Kelvin's water-dropping electrograph; while Benndorf's is the form of radium collector that has been most used. It cannot be said that any one form of collector is superior all round. Flame collectors blow out in high winds, whilst water-droppers are apt to get frozen in winter. At first sight the balance of advantages seems to lie with radium. But while gaseous products and even falling water are capable of modifying electrical conditions in their immediate neighbourhood, the "infection" produced by radium is more insidious, and other drawbacks present themselves in practice. It requires a radium salt of high radioactivity to be at all comparable in effectiveness with a good water-dropper. Experiments by F. Linke (**8**) indicated that a water-dropper having a number of fine holes, or having a fine jet under a considerable pressure, picks up the potential in about a tenth of the time required by the ordinary radium preparation protected by a glass tube. These fine jet droppers with a mixture of alcohol and water have proved very effective for balloon observations.

3. Before considering observational data, it is expedient to mention various sources of uncertainty. Above the level plain of absolutely smooth surface, devoid of houses or vegetation, the equipotential surfaces under normal conditions would be strictly horizontal, and if we could determine the potential at one metre above the ground we should have a definite measure of the potential gradient at the earth's surface. The presence, however, of apparatus or observers upsets the conditions, while above uneven ground or near a tree or a building the equipotential surfaces cease to be horizontal. In an ordinary climate a building seems to be practically at the earth's potential; near its walls the equipotential surfaces are highly inclined, and near the ridges they may lie very close together. The height of the walls in the various observatories, the height of the collectors, and the distance they project from the wall vary largely, and sometimes there are external buildings or trees sufficiently near to influence the potential. It is thus futile to compare the absolute voltages met with at two stations, unless allowance can be made for the influence of the environment. With a view to this, it has become increasingly common of late years to publish not the voltages actually observed, but values deduced from them for the potential gradient in the open in volts per metre. Observations are made at a given height over level open ground near the observatory, and a comparison with the simultaneous results from the self-recording electrograph enables the records from the latter to be expressed as potential gradients in the open. In the case, however, of many observatories, especially as regards the older records, no data for reduction exist; further, the reduction to the open is at best only an approximation, the success attending which probably varies considerably at different stations. This is one of the reasons why in the figures for the annual and diurnal variations in Tables I., II. and III., the potential has been expressed as percentages of its mean value for the year or the day. In most cases the environment of a collector is not absolutely invariable. If the shape of the equipotential surfaces near it is influenced by trees, shrubs or grass, their influence will vary throughout the year. In winter the varying depth of snow may exert an appreciable effect. There are sources of uncertainty in the instrument itself. Unless the insulation is perfect, the potential recorded falls short of that at the spot where the radium is placed or the water jet breaks. The action of the collector is opposed by the leakage through imperfect insulation, or natural dissipation, and this may introduce a fictitious element into the apparent annual or diurnal variation. The potentials that have to be dealt with are often hundreds and sometimes thousands of volts, and insulation troubles are more serious than is generally appreciated. When a water jet serves as collector, the pressure under which it issues should be practically constant. If the pressure alters as the water tank empties, a discontinuity occurs in the trace when the tank is refilled, and a fictitious element may be introduced into the diurnal variation. When rain or snow is falling, the potential frequently changes rapidly. These changes are often too rapid to be satisfactorily dealt with by an ordinary electrometer, and they sometimes leave hardly a trace on the photographic paper. Again rain dripping from exposed parts of the apparatus may materially affect the record. It is thus customary in calculating diurnal inequalities either to take no account of days on which there is an appreciable rainfall, or else to form separate tables for "dry" or "fine" days and for "all" days. Speaking generally, the exclusion of days of rain and of negative potential comes pretty much to the same thing, and the presence or absence of negative potential is not infrequently the criterion by reference to which days are rejected or are accepted as normal.

TABLE I.—*Annual Variation Potential Gradient.*

Place and Period.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Karasjok (**10**), 1903–1904	143	150	137	94	74	65	70	67	67	87	120	126
Sodankylä (**31**), 1882–1883	94	133	148	155	186	93	53	77	47	72	71	71
Potsdam (**9**), 1904	167	95	118	88	93	72	73	65	97	101	108	123
Kew (**12**), 1898–1904	127	141	113	87	77	70	61	72	76	96	126	153
Greenwich (**13**), 1893–1894, 1896	110	112	127	107	83	71	76	84	83	104	104	139
Florence (**14**), 1883–1886	132	110	98	84	86	81	77	90	89	99	129	125
Perpignan (**15**), 1886–1888	121	112	108	89	91	92	89	82	74	99	122	121
Lisbon (**16**), 1884–1886	104	105	104	92	91	93	87	92	100	99	115	117
Tokyo (**17**), 1897–1898, 1900–1901	165	145	117	86	62	58	41	59	59	97	134	176
Batavia (**18**) (2 m.), 1887–1890	97	115	155	127	129	105	79	62	69	79	90	93
,, (7·8 m.) 1890–1895	100	89	103	120	98	103	85	99	73	101	117	112

4. The potential gradient near the ground varies with the season of the year and the hour of the day, and is largely dependent on the weather conditions. It is thus difficult to form even a rough estimate of the mean value at any place unless hourly readings exist, extending over the whole or the greater part of a year. It is even somewhat precipitate to assume that a mean value deduced from a single year is fairly representative of average conditions. At Potsdam, G. Lüdeling (**9**) found for the mean value for 1904 in volts per metre 242. At Karasjok in the extreme north of Norway G. C. Simpson (**10**) in 1903–1904 obtained 139. At Kremsmünster for 1902 P. B. Zölss (**11**) gives 98. At Kew (**12**) the mean for individual years from 1898 to

1904 varied from 141 in 1900 to 179 in 1899, the mean from the seven years combined being 159. The large difference between the means obtained at Potsdam and Kremsmünster, as compared to the comparative similarity between the results for Kew and Karasjok, suggests that the mean value of the potential gradient may be much more dependent on local conditions than on difference of latitude.

At any single station potential gradient has a wide range of values. The largest positive and negative values recorded are met with during disturbed weather. During thunderstorms the record from an electrograph shows large sudden excursions, the trace usually going off the sheet with every flash of lightning when the thunder is near. Exactly what the potential changes amount to under such circumstances it is impossible to say; what the trace shows depends largely on the type of electrometer. Large rapid changes are also met with in the absence of thunder during heavy rain or snow fall. In England the largest values of a sufficiently steady character to be shown correctly by an ordinary electrograph occur during winter fogs. At such times gradients of +400 or +500 volts per metre are by no means unusual at Kew, and voltages of 700 or 800 are occasionally met with.

5. *Annual Variation.*—Table I. gives the annual variation of the potential gradient at a number of stations arranged according to latitude, the mean value for the whole year being taken in each case as 100. Karasjok as already mentioned is in the extreme north of Norway (69° 17′ N.); Sodankylä was the Finnish station of the international polar year 1882–1883. At Batavia, which is near the equator (6° 11′ S.) the annual variation seems somewhat irregular. Further, the results obtained with the water-dropper at two heights—viz. 2 and 7·8 metres—differ notably. At all the other stations the difference between summer and winter months is conspicuous. From the European data one would be disposed to conclude that

TABLE II.—*Diurnal Variation Potential Gradient.*

Station.	Karasjok.	Sodankylä.	Kew (**19**, **12**).		Greenwich.	Florence.	Perpignan.	Lisbon.	Tokyo.	Batavia.		Cape Horn(**20**).
Period.	1903–4.	1882–83.	1862–1864.	1898–1904.	1893–96.	1883–85.	1886–88.	1884–86.	1897–98. 1900–1.	1887–1890.	1890–1895.	1882–83.
Days.		All.	All.	Quiet.	All.	All.	Fine.	All.	All.	Dry.	Dry.	Pos.
h *l*	5·5	3·0 2·5	3·5 1·0	3·35 1·3	3·0 1·8		8·4 1·5	3·0 0·5	1·7 2·0	2	7·8	3·5 2·0
Hour.												
1	83	91	87	93	97	92	78	84	101	147	125	82
2	73	85	79	88	89	83	72	80	98	141	114	73
3	66	82	74	84	87	77	71	78	97	135	109	85
4	63	84	72	83	86	75	72	81	99	128	102	81
5	60	89	71	85	86	74	77	83	121	127	101	85
6	68	91	77	93	92	82	92	92	154	137	117	95
7	81	97	92	103	100	100	107	101	167	158	147	106
8	87	100	106	112	102	112	114	105	149	104	119	118
9	94	98	107	115	100	113	111	104	117	67	82	119
10	101	102	100	112	101	107	100	104	87	42	55	123
11	99	98	90	101	96	100	96	102	70	35	46	123
Noon.	103	102	92	94	97	95	99	108	61	30	43	115
1	106	105	90	89	96	92	99	111	54	30	42	112
2	108	107	91	87	94	90	97	114	49	30	43	94
3	108	108	92	88	95	89	99	109	53	33	46	89
4	109	108	98	93	97	89	105	108	61	41	53	88
5	110	108	108	99	102	94	113	108	76	67	73	84
6	119	110	121	108	108	113	126	111	95	91	108	110
7	129	102	134	115	111	121	131	116	107	120	145	107
8	136	111	139	118	115	129	129	114	114	137	155	123
9	139	111	138	119	117	132	120	109	119	146	155	112
10	133	104	128	115	117	127	109	102	120	148	147	99
11	121	108	113	108	111	114	97	92	119	151	143	85
12	102	93	99	99	104	100	86	85	112	147	130	98

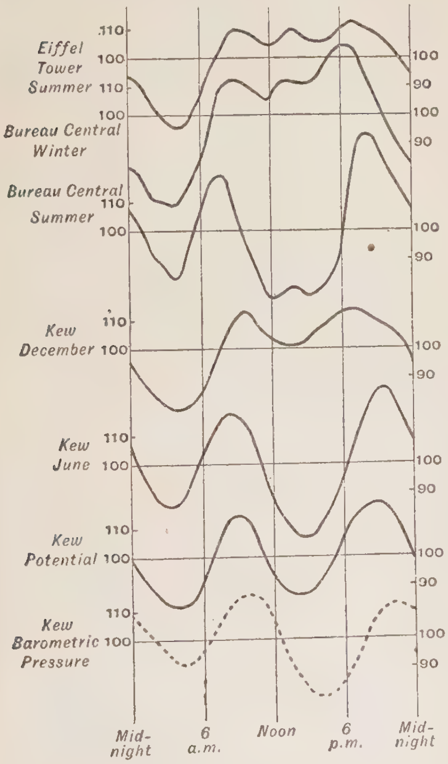
TABLE III.—*Diurnal Variation Potential Gradient.*

Station.	Karasjok.		Sodankylä.		Kew.			Greenwich.		Bureau Central (**21**).		Eiffel Tower(**21**)	Perpignan (**21**).		Batavia. (2 m.)	
Period.	1903–4.		1882–83.		1898–1904.			1894 and '96.		1894–99.		1896–98.	1885–95.		1887–90.	
	Winter.	Summer.	Winter.	Summer.	Winter.	Equinox.	Summer.	Winter.	Summer.	Winter.	Summer.	Summer.	Winter.	Summer.	Winter.	Summer.
Hour.																
1	76	104	90	99	91	93	96	87	110	79	102	90	72	88	145	149
2	66	96	79	84	86	88	90	84	101	71	92	83	67	83	139	142
3	57	89	78	90	82	85	85	76	98	70	88	79	66	81	137	135
4	55	83	74	99	81	84	84	77	96	69	84	76	67	83	131	127
5	50	79	74	111	82	87	90	78	94	75	94	78	72	92	132	123
6	61	83	80	114	86	97	101	82	101	83	106	87	84	107	138	136
7	78	89	86	117	95	109	113	94	107	98	118	97	104	114	166	153
8	82	93	95	122	104	118	120	97	111	111	120	103	122	108	118	92
9	90	93	91	109	111	119	119	98	102	113	106	110	126	100	74	64
10	104	93	106	101	114	110	110	102	98	111	94	109	114	93	43	40
11	102	92	98	97	107	95	97	103	86	108	84	107	98	90	35	36
Noon.	119	90	98	100	102	86	87	107	94	106	77	104	99	95	31	30
1	116	94	116	97	99	81	80	107	85	112	79	107	96	93	29	33
2	118	97	113	97	97	80	76	109	82	112	81	110	94	90	28	32
3	119	100	121	93	99	82	76	111	78	111	78	107	95	88	24	41
4	115	99	111	96	103	88	80	116	81	113	80	105	102	92	30	49
5	120	106	105	106	108	96	87	112	93	120	85	106	115	98	60	74
6	131	104	115	92	111	109	98	114	98	124	97	109	128	110	88	94
7	136	110	118	102	114	120	111	117	99	124	123	113	133	122	119	122
8	134	113	117	106	112	124	123	113	108	116	134	110	131	127	138	135
9	137	125	115	90	111	123	129	111	118	104	130	109	124	125	145	147
10	125	135	112	90	108	118	125	110	124	97	122	105	111	117	148	148
11	114	126	113	103	103	109	116	102	120	90	115	101	96	108	149	152
12	96	111	95	85	96	99	105	93	116	83	108	94	83	95	148	146

the variation throughout the year diminishes as one approaches the equator. It is decidedly less at Perpignan and Lisbon than at Potsdam, Kew and Greenwich, but nowhere is the seasonal difference more conspicuous than at Tokyo, which is south of Lisbon.

At the temperate stations the maximum occurs near mid-winter; in the Arctic it seems deferred towards spring.

6. *Diurnal Variation.*—Table II. gives the mean diurnal variation for the whole year at a number of stations arranged in order of latitude, the mean from the 24 hourly values being taken as 100. The data are some from "all" days, some from "quiet," "fine" or "dry" days. The height, *h*, and the distance from the wall, *l*, where the potential is measured are given in metres when known. In most cases two distinct maxima and minima occur in the 24 hours. The principal maximum is usually found in the evening between 8 and 10 P.M., the principal minimum in the morning from 3 to 5 A.M. At some stations the minimum in the afternoon is indistinctly shown, but at Tokyo and Batavia it is much more conspicuous than the morning minimum.



7. In Table III. the diurnal inequality is shown for "winter" and "summer" respectively. In all cases the mean value for the 24 hours is taken as 100. By "summer" is meant April to September at Sodankylä, Greenwich and Batavia; May to August at Kew, Bureau Central (Paris), Eiffel Tower and Perpignan; and May to July at Karasjok. "Winter" includes October to March at Sodankylä, Greenwich and Batavia; November to February at Kew and Bureau Central; November to January at Karasjok, and December and January at Perpignan. Mean results from March, April, September and October at Kew are assigned to "Equinox."

At Batavia the difference between winter and summer is comparatively small. Elsewhere there is a tendency for the double period, usually so prominent in summer, to become less pronounced in winter, the afternoon minimum tending to disappear. Even in summer the double period is not prominent in the arctic climate of Karasjok or on the top of the Eiffel Tower. The diurnal variation in summer at the latter station is shown graphically in the top curve of fig. 1. It presents a remarkable resemblance to the adjacent curve, which gives the diurnal variation at mid-winter at the Bureau Central. The resemblance between these curves is much closer than that between the Bureau Central's own winter and summer curves. All three Paris curves show three peaks, the first and third representing the ordinary forenoon and afternoon maxima. In summer at the Bureau Central the intermediate peak nearly disappears in the profound afternoon depression, but it is still recognizable. This three-peaked curve is not wholly peculiar to Paris, being seen, for instance, at Lisbon in summer. The December and June curves for Kew are good examples of the ordinary nature of the difference between midwinter and midsummer. The afternoon minimum at Kew gradually deepens as midsummer approaches. Simultaneously the forenoon maximum occurs earlier and the afternoon maximum later in the day. The two last curves in the diagram contrast the diurnal variation at Kew in potential gradient and in barometric pressure for the year as a whole. The somewhat remarkable resemblance between the diurnal variation for the two elements, first remarked on by J. D. Everett (**19**), is of interest in connexion with recent theoretical conclusions by J. P. Elster and H. F. K. Geitel and by H. Ebert.

In the potential curves of the diagram the ordinates represent the hourly values expressed—as in Tables II. and III.—as percentages of the mean value for the day. If this be overlooked, a wrong impression may be derived as to the absolute amplitudes of the changes. The Kew curves, for instance, might suggest that the range (maximum less minimum hourly value) was larger in June than in December. In reality the December range was 82, the June only 57 volts; but the mean value of the potential was 243 in December as against 111 in June. So again, in the case of the Paris curves, the absolute value of the diurnal range in summer was much greater for the Eiffel Tower than for the Bureau Central, but the mean voltage was 2150 at the former station and only 134 at the latter.

8. *Fourier Coefficients.*—Diurnal inequalities such as those of Tables II. and III. and intended to eliminate irregular changes, but they also to some extent eliminate regular changes if the hours of maxima and minima or the character of the diurnal variation alter throughout the year. The alteration that takes place in the regular diurnal inequality throughout the year is best seen by analysing it into a Fourier series of the type

$$c_1 \sin (t+a_1) + c_2 \sin (2t+a_2) + c_3 \sin (3t+a_3) + c_4 \sin (4t+a_4) + \ldots$$

where t denotes time counted from (local) midnight, $c_1, c_2, c_3, c_4, \ldots$ are the amplitudes of the component harmonic waves of periods 24, 12, 8 and 6 hours; a_1, a_2, a_3, a_4, are the corresponding phase angles. One hour of time t is counted as 15°, and a delay of one hour in the time of maximum answers to a diminution of 15° in a_1, of 30° in a_2, and so on. If a_1, say, varies much throughout the year, or if the ratios of $c_2, c_3, c_4, \ldots$ to c_1, vary much, then a diurnal inequality derived from a whole year, or from a season composed of several months, represents a mean curve arising from the superposition of a number of curves, which differ in shape and in the positions of their maxima and minima. The result, if considered alone, inevitably leads to an underestimate of the average amplitude of the regular diurnal variation.

It is also desirable to have an idea of the size of the irregular changes which vary from one day to the next. On stormy days, as already mentioned, the irregular changes hardly admit of satisfactory treatment. Even on the quietest days irregular changes are always numerous and often large.

Table IV. aims at giving a summary of the several phenomena for a single station, Kew, on electrically quiet days. The first line gives the mean value of the potential gradient, the second the mean excess of the largest over the smallest hourly value on individual days. The hourly values are derived from smoothed curves, the object being to get the mean ordinate for a 60-minute period. If the actual crests of the excursions had been measured the figures in the second line would have been even larger. The third line gives the range of the *regular* diurnal inequality, the next four lines the amplitudes of the first four Fourier waves into which the regular diurnal inequality has been analysed. These mean values, ranges and amplitudes are all measured in volts per metre (in the open). The last four lines of Table IV. give the phase angles of the first four Fourier waves.

It will be noticed that the difference between the greatest and least hourly values is, in all but three winter months, actually larger than the mean value of the potential gradient for the day; it bears to the range of the regular diurnal inequality a ratio varying from 2·0 in May to 3·6 in November.

At midwinter the 24-hour term is the largest, but near midsummer it is small compared to the 12-hour term. The 24-hour term is very variable both as regards its amplitude and its phase angle (and so

TABLE IV.—*Absolute Potential Data at Kew* (**12**).

		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Potential Gradient		201	224	180	138	123	111	98	114	121	153	200	243
Mean of individual daily ranges		203	218	210	164	143	132	117	129	141	196	186	213
Range in Diurnal inequality		73	94	83	74	71	57	55	60	54	63	52	82
Amplitudes of Fourier waves	c_1	22	22	17	13	18	9	6	6	9	7	14	30
	c_2	21	33	34	31	22	23	24	26	23	30	17	21
	c_3	7	10	5	5	3	-1	3	2	3	6	5	7
	c_4	2	3	5	6	4	1	4	3	4	3	2	3
		°	°	°	°	°	°	°	°	°	°	°	°
Phase angles of Fourier waves	a_1	206	204	123	72	86	79	48	142	154	192	202	208
	a_2	170	171	186	193	188	183	185	182	199	206	212	175
	a_3	11	9	36	96	100	125	124	107	16	18	38	36
	a_4	235	225	307	314	314	277	293	313	330	288	238	249

its hour of maximum). The 12-hour term is much less variable, especially as regards its phase angle; its amplitude shows distinct maxima near the equinoxes. That the 8-hour and 6-hour waves, though small near midsummer, represent more than mere accidental irregularities, seems a safe inference from the regularity apparent in the annual variation of their phase angles.

9. Table V. gives some data for the 24-hour and 12-hour Fourier coefficients, which will serve to illustrate the diversity between different stations. In this table, unlike Table IV., amplitudes are all expressed as decimals of the mean value of the potential gradient for the corresponding season. "Winter" means generally the four midwinter, and "summer" the four midsummer, months; but at Karasjok three, and at Kremsmünster six, months are included in each season. The results for the Sonnblick are derived from a comparatively small number of days in August and September. At Potsdam the data represent the arithmetic means derived from the Fourier analysis for the individual months comprising the season. The 1862–1864 data from Kew—due to J. D. Everett (**19**)—are based on "all" days; the others, except Karasjok to some extent, represent electrically quiet days. The cause of the large difference between the two sets of data for c_1 at Kew is uncertain. The potential gradient is in all cases lower in summer than winter, and thus the reduction in c_1 in summer would appear even larger than in Table V. if the results were expressed in absolute measure. At Karasjok and Kremsmünster the seasonal variation in α_1 seems comparatively small, but at Potsdam and the Bureau Central it is as large as at Kew. Also, whilst the winter values of α_1 are fairly similar at the several stations the summer values are widely different. Except at Karasjok, where the diurnal changes seem somewhat irregular, the relative amplitude of the 12-hour term is considerably greater in summer than in winter. The values of α_2 at the various stations differ comparatively little, and show but little seasonal change. Thus the 12-hour term has a much greater uniformity than the 24-hour term. This possesses significance in connexion with the view, supported by A. B. Chauveau (**21**), F. Exner (**24**) and others, that the 12-hour term is largely if not entirely a local phenomenon, due to the action of the lower atmospheric strata, and tending to disappear even in summer at high altitudes. Exner attributes the double daily maximum, which is largely a consequence of the 12-hour wave, to a thin layer near the ground, which in the early afternoon absorbs the solar radiation of shortest wave length. This layer he believes specially characteristic of arid dusty regions, while comparatively non-existent in moist climates or where foliage is luxuriant. In support of his theory Exner states that he has found but little trace of the double maximum and minimum in Ceylon and elsewhere. C. Nordmann (**25**) describes some similar results which he obtained in Algeria during August and September 1905. His station, Philippeville, is close to the shores of the Mediterranean, and sea breezes persisted during the day. The diurnal variation showed only a single maximum and minimum, between 5 and 6 P.M. and 4 and 5 A.M. respectively. So again, a few days' observations on the top of Mont Blanc (4810 metres) by le Cadet (**26**) in August and September 1902, showed only a single period, with maximum between 3 and 4 P.M., and minimum about 3 A.M. Chauveau points to the reduction in the 12-hour term as compared to the 24-hour term on the Eiffel Tower, and infers the practical disappearance of the former at no great height. The close approach in the values for c_1 in Table V. from the Bureau Central and the Eiffel Tower, and the reduction of c_2 at the latter station, are unquestionably significant facts; but the summer value for c_2 at Karasjok—a low level station—is nearly as small as that at the Eiffel Tower, and notably smaller than that at the Sonnblick (3100 metres). Again, Kew is surrounded by a large park, not devoid of trees, and hardly the place where Exner's theory would suggest a large value for c_2, and yet the summer value of c_2 at Kew is the largest in Table V.

TABLE V.—*Fourier Series Amplitudes and Phase Angles.*

Place.	Period.	Winter.				Summer.			
		c_1.	c_2.	α_1.	α_2.	c_1.	c_2.	α_1.	α_2.
				°	°			°	°
Kew	1862–64	0·283	0·160	184	193	0·127	0·229	111	179
,, ...	1898–1904	·102	·103	206	180	·079	·213	87	186
Bureau Central .	1894–98	·220	·104	223	206	·130	·200	95	197
Eiffel Tower . .	1896–98	..	..	..	..	·133	·085	216	171
Sonnblick (**22**) .	1902–3	..	..	..	..	·208	·120	178	145
Karasjok . . .	1903–4	·356	·144	189	155	·165	·093	141	144
Kremsmünster (**23**) .	1902	·280	·117	224	194	·166	·153	241	209
Potsdam . . .	1904	·269	·101	194	185	·096	·152	343	185

10. Observations on mountain tops generally show high potentials near the ground. This only means that the equipotential surfaces are crowded together, just as they are near the ridge of a house. To ascertain how the increase in the voltage varies as the height in the free atmosphere increases, it is necessary to employ kites or balloons. At small heights Exner (**27**) has employed captive balloons, provided with a burning fuse, and carrying a wire connected with an electroscope on the ground. He found the gradient nearly uniform for heights up to 30 to 40 metres above the ground. At great heights free balloons seem necessary. The balloon carries two collectors a given vertical distance apart. The potential difference between the two is recorded, and the potential gradient is thus found. Some of the earliest balloon observations made the gradient increase with the height, but such a result is now regarded as abnormal. A balloon may leave the earth with a charge, or become charged through discharge of ballast. These possibilities may not have been sufficiently realized at first. Among the most important balloon observations are those by le Cadet (**1**) F. Linke (**28**) and H. Gerdien (**29**). The following are samples from a number of days' results, given in le Cadet's book. *h* is the height in metres, *P* the gradient in volts per metre.

Aug. 9, 1893	*h*	824	830	1060	1255	1290	1745	1940	2080	2310	2520
	P	37	43	43	41	42	34	25	21	18	16
Sep. 11, 1897	*h*	1140	1378	1630	1914	2370	2786	3136	3364	3912	4085
	P	43	38	33	25	22	21	19	19	14	13

The ground value on the last occasion was 150. From observations during twelve balloon ascents, Linke concludes that below the 1500-metre level there are numerous sources of disturbance, the gradient at any given height varying much from day to day and hour to hour; but at greater heights there is much more uniformity. At heights from 1500 to 6000 metres his observations agreed well with the formula

$$dV/dh = 34 - 0{\cdot}006\,h,$$

V denoting the potential, *h* the height in metres. The formula makes the gradient diminish from 25 volts per metre at 1500 metres height to 10 volts per metre at 4000 metres. Linke's mean value for dV/dh at the ground was 125. Accepting Linke's formula, the potential at 4000 metres is 43,750 volts higher than at 1500 metres. If the mean of the gradients observed at the ground and at 1500 metres be taken as an approximation to the mean value of the gradient throughout the lowest 1500 metres of the atmosphere, we find for the potential at 1500 metres level 112,500 volts. Thus at 4000 metres the potential seems of the order of 150,000 volts. Bearing this in mind, one can readily imagine how close together the equipotential surfaces must lie near the summit of a high sharp mountain peak.

11. At most stations a negative potential gradient is exceptional, unless during rain or thunder. During rain the potential is usually but not always negative, and frequent alternations of sign are not uncommon. In some localities, however, negative potential gradient is by no means uncommon, at least at some seasons, in the absence of rain. At Madras, Michie Smith (**30**) often observed negative potential during bright August and September days. The phenomenon was quite common between 9·30 A.M. and noon during westerly winds, which at Madras are usually very dry and dusty. At Sodankylä, in 1882–1883, K. S. Lemström and F. C. Biese (**31**) found that out of 255 observed occurrences of negative potential, 106 took place in the absence of rain or snow. The proportion of occurrences of negative potential under a clear sky was much above its average in autumn. At Sodankylä rain or snowfall was often unaccompanied by change of sign in the potential. At the polar station Godthaab (**32**) in 1882–1883, negative potential seemed sometimes associated with aurora (see AURORA POLARIS).

Lenard, Elster and Geitel, and others have found the potential gradient negative near waterfalls, the influence sometimes extending to a considerable distance. Lenard (**33**) found that when pure water falls upon water the neighbouring air takes a negative charge. Kelvin, Maclean and Galt (**34**) found the effect greatest in the air near the level of impact. A sensible effect remained, however, after the influence of splashing was eliminated. Kelvin, Maclean and Galt regard this property of falling water as an objection to the use of a water-dropper indoors, though not of practical importance when it is used out of doors.

12. Elster and Geitel (**35**) have measured the charge carried by raindrops falling into an insulated vessel. Owing to observational difficulties, the exact measure of success attained is a little difficult to gauge, but it seems fairly certain that raindrops usually carry a charge. Elster and Geitel found the sign of the charge often fluctuate repeatedly during a single rain storm, but it seemed more often than not opposite to that of the simultaneous potential gradient. Gerdien has more recently repeated the experiments, employing an apparatus devised by him for the purpose. It has been found by C. T. R. Wilson (**36**) that a vessel in which freshly fallen rain or snow has been evaporated to dryness shows radioactive properties lasting for a few hours. The results obtained from equal weights of rain and snow seem of the same order.

13. W. Linss (**6**) found that an insulated conductor charged either positively or negatively lost its charge in the free atmosphere; the potential V after time *t* being connected with its initial value V_0 by a formula of the type $V = V_0 e^{-\alpha t}$ where α is constant. This was confirmed by Elster and Geitel (**7**), whose form of dissipation apparatus has been employed in most recent work. The percentage of the

charge which is dissipated per minute is usually denoted by a_+ or a_- according to its sign. The mean of a_+ and a_- is usually denoted by $a_\pm$ or simply by a, while q is employed for the ratio a_-/a_+. Some observers when giving mean values take $\Sigma(a_-/a_+)$ as the mean value of q, while others take $\Sigma(a_-)/\Sigma(a_+)$. The Elster and Geitel apparatus is furnished with a cover, serving to protect the dissipator from the direct action of rain, wind or sunlight. It is usual to observe with this cover on, but some observers, *e.g.* A. Gockel, have made long series of observations without it. The loss of charge is due to more than one cause, and it is difficult to attribute an absolutely definite meaning even to results obtained with the cover on. Gockel (**37**) says that the results he obtained without the cover when divided by 3 are fairly comparable with those obtained under the usual conditions; but the appropriate divisor must vary to some extent with the climatic conditions. Thus results obtained for a_+ or a_- without the cover are of doubtful value for purposes of comparison with those found elsewhere with it on. In the case of q the uncertainty is much less.

Table VI. gives the mean values of $a_\pm$ and q found at various places. The observations were usually confined to a few hours of the day, very commonly between 11 A.M. and 1 P.M., and in absence of information as to the diurnal variation it is impossible to say how much this influences the results. The first eight stations lie inland; that at Seewalchen (**38**) was, however, adjacent to a large lake. The next five stations are on the coast or on islands. The final four are at high levels. In the cases where the observations were confined to a few months the representative nature of the results is more doubtful.

On mountain summits q tends to be large, *i.e.* a negative charge is lost much faster than a positive charge. Apparently q has also a tendency to be large near the sea, but this phenomenon is not seen at Trieste. An exactly opposite phenomenon, it may be remarked, is seen near waterfalls, q becoming very small. Only Innsbruck and Mattsee give a mean value of q less than unity. Also, as later observations at Innsbruck give more normal values for q, some doubt may be felt as to the earlier observations there. The result for Mattsee seems less open to doubt, for the observer, von Schweidler, had obtained a normal value for q during the previous year at Seewalchen. Whilst the average q in at least the great majority of stations exceeds unity, individual observations making q less than unity are not rare. Thus in 1902 (**51**) the percentage of cases in which q fell short of 1 was 30 at Trieste, 33 at Vienna, and 35 at Kremsmünster; at Innsbruck q was less than 1 on 58 days out of 98.

TABLE VI.—*Dissipation. Mean Values.*

Place.	Period.	Season.	Observer or Authority.	$a_\pm$	q
Karasjok	1903–4	Year	Simpson (**10**)	3·57	1·15
Wolfenbüttel . . .		Year	Elster and Geitel (**39**)	1·33	1·05
Potsdam	1904	Year	Lüdeling (**40**)	1·13	1·33
Kremsmünster . . .	1902	Year	Zölss (**41**)	1·32	1·18
,, ...	1903	Year	Zölss (**42**)	1·35	1·14
Freiburg		Year	Gockel (**43**)	. .	1·41
Innsbruck	1902		Czermak (**44**)	1·95	0·94
,, ...	1905	Jan. to June	Defant (**45**)	1·47	1·17
Mattsee (Salzburg) . .	1905	July to Sept.	von Schweidler (**46**)	. .	0·99
Seewalchen	1904	July to Sept.	von Schweidler (**38**)	. .	1·18
Trieste	1902–3	Year	Mazelle (**47**)	0·58	1·09
Misdroy	1902		Lüdeling (**40**)	1·09	1·58
Swinemünde	1904	Aug. and Sept.	Lüdeling (**40**)	1·23	1·37
Heligoland (sands) . .	1903	Summer	Elster and Geitel (**40**)	1·14	1·71
,, plateau . .	,,	,,	,, ,, (**40**)	3·07	1·50
Juist (Island) . . .		,,	,, ,, (**48**)	1·56	1·56
Atlantic and German Ocean	1904	August	Boltzmann (**49**)	1·83	2·69
Arosa (1800 m.) . . .	1903	Feb. to April	Saake (**50**)	1·79	1·22
Rothhorn (2300 m.) . .	1903	September	Gockel (**43**)	. .	5·31
Sonnblick (3100 m.) . .	1903	September	Conrad (**22**)	. .	1·75
Mont Blanc (4810 m.) .	1902	September	le Cadet (**43**)	. .	10·3

In a long series of observations, individual values of q show usually a wide range. Thus during observations extending over more than a year, q varied from 0·18 to 8·25 at Kremsmünster and from 0·11 to 3·00 at Trieste. The values of a_+, a_- and $a_\pm$ also show large variations. Thus at Trieste a_+ varied from 0·12 to 4·07, and a_- from 0·11 to 3·87; at Vienna a_+ varied from 0·32 to 7·10, and a_- from 0·78 to 5·42; at Kremsmünster $a_\pm$ varied from 0·14 to 5·83.

14. *Annual Variation.*—When observations are made at irregular hours, or at only one or two fixed hours, it is doubtful how representative they are. Results obtained at noon, for example, probably differ more from the mean value for the 24 hours at one season than at another. Most dissipation results are exposed to considerable uncertainty on these grounds. Also it requires a long series of years to give thoroughly representative results for any element, and few stations possess more than a year or two's dissipation data. Table VII. gives comparative results for winter (October to March) and summer at a few stations, the value for the season being the arithmetic mean from the individual months composing it. At Karasjok (**10**), Simpson observed thrice a day; the summer value there is nearly double the winter both for a_+ and a_-. The Kremsmünster (**42**) figures show a smaller but still distinct excess in the summer values. At Trieste (**47**), Mazelle's data from all days of the year show no decided seasonal change in a_+ or a_-; but when days on which the wind was high are excluded the summer value is decidedly the higher. At Freiburg (**43**), q seems decidedly larger in winter than in summer; at Karasjok and Trieste the seasonal effect in q seems small and uncertain.

TABLE VII.—*Dissipation.*

Place.	Winter.				Summer.			
	a_+	a_-	$a_\pm$	q	a_+	a_-	$a_\pm$	q
Karasjok 1903–1904 .	2·28	2·69	2·49	1·18	4·38	4·94	4·65	1·13
Kremsmünster 1903 .	1·14	1·30	1·22	1·14	1·38	1·56	1·47	1·12
Freiburg . . .	. .	. .	. .	1·57	. .	. .	. .	1·26
Trieste 1902–1903 .	0·56	0·59	0·58	1·07	0·55	0·61	0·58	1·13
,, calm days .	. .	. .	0·35	. .	. .	. .	0·48	. .

15. *Diurnal Variation.*—P. B. Zölss (**41, 42**) has published dirunal variation data for Kremsmünster for more than one year, and independently for midsummer (May to August) and midwinter (December to February). His figures show a double daily period in both a_+ and a_-, the principal maximum occurring about 1 or 2 P.M. The two minima occur, the one from 5 to 7 A.M., the other from 7 to 8 P.M.; they are nearly equal. Taking the figures answering to the whole year, May 1903 to 1904, a_+ varied throughout the day from 0·82 to 1·35, and a_- from 0·85 to 1·47. At midsummer the extreme hourly values were 0·91 and 1·45 for a_+, 0·94 and 1·60 for a_-. The corresponding figures at midwinter were 0·65 and 1·19 for a_+, 0·61 and 1·43 for a_-. Zölss' data for q show also a double daily period, but the apparent range is small, and the hourly variation is somewhat irregular. At Karasjok, Simpson found a_+ and a_- both larger between noon and 1 P.M. than between either 8 and 9 A.M. or 6 and 7 P.M. The 6 to 7 P.M. values were in general the smallest, especially in the case of a_+; the evening value for q on the average exceeded the values from the two earlier hours by some 7%.

Summer observations on mountains have shown diurnal variations very large and fairly regular, but widely different from those observed at lower levels. On the Rothhorn, Gockel (**43**) found a_+ particularly variable, the mean 7 A.M. value being 4½ times that at 1 P.M. q (taken as $\Sigma(a_-/a_+)$) varied from 2·25 at 5 A.M. and 2·52 at 9 P.M. to 7·82 at 3 P.M. and 8·35 at 7 P.M. On the Sonnblick, in early September, V. Conrad (**22**) found somewhat similar results for q, the principal maximum occurring at 1 P.M., with minima at 9 P.M. and 6 A.M.; the largest hourly value was, however, scarcely double the least. Conrad found a_- largest at 4 A.M. and least at 6 P.M., the largest value being double the least; a_+ was largest at 5 A.M. and least at 2 P.M., the largest value being fully 2½ times the least. On Mont Blanc, le Cadet (**43**) found q largest from 1 to 3 P.M., the value at either of these hours being more than double that at 11 A.M. On the Patscherkofel, H. von Ficker and A. Defant (**52**), observing in December, found q largest from 1 to 2 P.M. and least between 11 A.M. and noon, but the largest value was only 1½ times the least. On mountains much seems to depend on whether there are rising or falling air currents, and results from a single season may not be fairly representative.

16. Dissipation seems largely dependent on meteorological conditions, but the phenomena at different stations vary so much as to suggest that the connexion is largely indirect. At most stations a_+ and a_- both increase markedly as wind velocity rises. From the observations at Trieste in 1902–1903 E. Mazelle (**47**) deduced an increase of about 3% in a_+ for a rise of 1 km. per hour in wind velocity. The following are some of his figures, the velocity v being in kilometres per hour:—

v	0 to 4.	20 to 24	40 to 49.	60 to 69
a	0·33	0·64	1·03	1·38
q	1·13	1·19	1·00	0·96

For velocities from 0 to 24 km. per hour q exceeded unity in 74 cases out of 100; but for velocities over 50 km. per hour q exceeded unity in only 40 cases out of 100. Simpson got similar results at Karasjok; the rise in a_+ and a_- with increased wind velocity seemed, however, larger in winter than in summer. Simpson observed a fall in q for wind velocities exceeding 2 on Beaufort's scale. On the top of the Sonnblick, Conrad observed a *slight* increase of $a_\pm$ as the wind velocity increased up to 20 km. per hour, but for greater velocities up to 80 km. per hour no further decided rise was observed.

At Karasjok, treating summer and winter independently, Simpson (**10**) found a_+ and a_- both increase in a nearly linear relation with temperature, from below −20° to +15° C. For example, when the temperature was below −20° mean values were 0·76 for a_+ and 0·91 for a_-; for temperatures between −10° and −5° the corresponding means were 2·45 and 2·82; while for temperatures between +10° and +15° they were 4·68 and 5·23. Simpson found no certain temperature effect on the value of q. At Trieste, from 470 days when the wind velocity did not exceed 20 km. per hour, Mazelle (**47**) found somewhat analogous results for temperatures from 0° to 30° C.; a_-, however, increased faster than a_+, i.e. q increased with temperature. When he considered all days irrespective of wind velocity, Mazelle found the influence of temperature obliterated. On the Sonnblick, Conrad (**22**) found $a_\pm$ increase appreciably as temperature rose up to 4° or 5° C.; but at higher temperatures a decrease set in.

Observations on the Sonnblick agree with those at low-level stations in showing a diminution of dissipation with increase of relative humidity. The decrease is most marked as saturation approaches. At Trieste, for example, for relative humidities between 90 and 100 the mean $a_\pm$ was less than half that for relative humidities under 40. With certain dry winds, notably Föhn winds in Austria and Switzerland, dissipation becomes very high. Thus at Innsbruck Defant (**45**) found the mean dissipation on days of Föhn fully thrice that on days without Föhn. The increase was largest for a_+, there being a fall of about 15% in q. In general, a_+ and a_- both tend to be less on cloudy than on bright days. At Kiel (**53**) and Trieste the average value of q is considerably less for wholly overcast days than for bright days. At several stations enjoying a wide prospect the dissipation has been observed to be specially high on days of great visibility when distant mountains can be recognized. It tends on the contrary to be low on days of fog or rain.

The results obtained as to the relation between dissipation and barometric pressure are conflicting. At Kremsmünster, Zölss (**42**) found dissipation vary with the absolute height of the barometer, $a_\pm$ having a mean value of 1·36 when pressure was below the normal, as against 1·20 on days when pressure was above the normal. He also found $a_\pm$ on the average about 10% larger when pressure was falling than when it was rising. On the Sonnblick, Conrad (**22**) found dissipation increase decidedly as the absolute barometric pressure was larger, and he found no difference between days of rising and falling barometer. At Trieste, Mazelle (**47**) found no certain connexion with absolute barometric pressure. Dissipation was above the average when cyclonic conditions prevailed, but this seemed simply a consequence of the increased wind velocity. At Mattsee, E. R. von Schweidler (**46**) found no connexion between absolute barometric pressure and dissipation, also days of rising and falling pressure gave the same mean. At Kiel, K. Kaehler (**53**) found a_+ and a_- both greater with rising than with falling barometer.

V. Conrad and M. Topolansky (**54**) have found a marked connexion at Vienna between dissipation and ozone. Regular observations were made of both elements. Days were grouped according to the intensity of colouring of ozone papers, 0 representing no visible effect, and 14 the darkest colour reached. The mean values of a_+ and a_- answering to 12 and 13 on the ozone scale were both about double the corresponding values answering to 0 and 1 on that scale.

17. A charged body in air loses its charge in more than one way. The air, as is now known, has always present in it ions, some carrying a positive and others a negative charge, and those having the opposite sign to the charged body are attracted and tend to discharge it. The rate of loss of charge is thus largely dependent on the extent to which ions are present in the surrounding air. It depends, however, in addition on the natural mobility of the ions, and also on the opportunities for convection. Of late years many observations have been made of the ionic charges in air. The best-known apparatus for the purpose is that devised by Ebert. A cylinder condenser has its inner surface insulated and charged to a high positive or negative potential. Air is drawn by an aspirator between the surfaces, and the ions having the opposite sign to the inner cylinder are deposited on it. The charge given up to the inner cylinder is known from its loss of potential. The volume of air from which the ions have been extracted being known, a measure is obtained of the total charge on the ions, whether positive or negative. The conditions must, of course, be such as to secure that no ions shall escape, otherwise there is an underestimate. I_+ is used to denote the charge on positive ions, I_- that on negative ions. The unit to which they are ordinarily referred is 1 electrostatic unit of electricity per cubic metre of air. For the ratio of the mean value of I_+ to the mean value of I_-, the letter Q is employed by Gockel (**55**), who has made an unusually complete study of ionic charges at Freiburg. Numerous observations were also made by Simpson (**10**)—thrice a day—at Karasjok, and von Schweidler has made a good many observations about 3 P.M. at Mattsee (**46**) in 1905, and Seewalchen (**38**) in 1904. These will suffice to give a general idea of the mean values met with.

Station.	Authority.	I_+	I_-	Q
Freiburg	Gockel	0·34	0·24	1·41
Karasjok	Simpson	0·38	0·33	1·17
Mattsee	von Schweidler	0·35	0·29	1·19
Seewalchen . . .	,,	0·45	0·38	1·17

Gockel's mean values of I_+ and Q would be reduced to 0·31 and 1·38 respectively if his values for July—which appear abnormal—were omitted. I_+ and I_- both show a considerable range of values, even at the same place during the same season of the year. Thus at Seewalchen in the course of a month's observations at 3 P.M., I_+ varied from 0·31 to 0·67, and I_- from 0·17 to 0·67.

There seems a fairly well marked annual variation in ionic contents, as the following figures will show. Summer and winter represent each six months and the results are arithmetic means of the monthly values.

	Freiburg.			Karasjok.		
	I_+	I_-	Q	I_+	I_-	Q
Winter . .	0·29	0·21	1·49	0·33	0·27	1·22
Summer . .	0·39	0·28	1·34	0·44	0·39	1·13

If the exceptional July values at Freiburg were omitted, the summer values of I_+ and Q would become 0·33 and 1·25 respectively.

18. *Diurnal Variation.*—At Karasjok Simpson found the mean values of I_+ and I_- throughout the whole year much the same between noon and 1 P.M. as between 8 and 9 A.M. Observations between 6 and 7 P.M. gave means slightly lower than those from the earlier hours, but the difference was only about 5% in I_+ and 10% in I_-. The evening values of Q were on the whole the largest. At Freiburg, Gockel found I_+ and I_- decidedly larger in the early afternoon than in either the morning or the late evening hours. His greatest and least mean hourly values and the hours of their occurrence are as follows:—

Winter.				Summer.			
I_+		I_-		I_+		I_-	
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
0·333 2 P.M.	0·193 7 P.M.	0·242 2 P.M.	0·130 8 P.M.	0·430 4 P.M.	0·244 9 to 10 P.M.	0·333 4 P.M.	0·192 9 to 10 P.M.

Gockel did not observe between 10 P.M. and 7 A.M.

19. Ionization seems to increase notably as temperature rises. Thus at Karasjok Simpson found for mean values:—

Temp. less than −20°	−10° to −5°	10° to 15°
$I_+=0·18$, $I_-=0·16$	$I_+=0·36$, $I_-=0·30$	$I_+=0·45$, $I_-=0·43$

Simpson found no clear influence of temperature on Q. Gockel observed similar effects at Freiburg—though he seems doubtful whether the relationship is direct—but the influence of temperature on I_+ seemed reduced when the ground was covered with snow. Gockel found a diminution of ionization with rise of relative humidity. Thus for relative humidities between 40 and 50 mean values were 0·306 for I_+ and 0·219 for I_-; whilst for relative humidities between 90 and 100 the corresponding means were respectively 0·222 and 0·134. At Karasjok, Simpson found a slight decrease in I_- as relative humidity increased, but no certain change in I_+. Specially large values of I_+ and I_- have been observed at high levels in balloon ascents. Thus on the 1st of July 1901, at a height of 2400 metres, H. Gerdien (**29**) obtained 0·86 for I_+ and 1·09 for I_-.

20. In 1901 Elster and Geitel found that a radioactive emanation is present in the atmosphere. Their method of measuring the radioactivity is as follows (**48**): A wire not exceeding 1 mm. in diameter, charged to a negative potential of at least 2000 volts, is supported between insulators in the open, usually at a height of about 2 metres. After two hours' exposure, it is wrapped round a frame supported in a given position relative to Elster and Geitel's dissipation apparatus, and the loss of charge is noted. This loss is proportional to the length of the wire. The radioactivity is denoted by A, and A = 1 signifies that the potential of the dissipation apparatus fell 1 volt in an hour per metre of wire introduced. The loss of the dissipation body due to the natural ionization of the air is first allowed for. Suppose, for instance, that in the absence of the wire the potential falls from 264 to 255 volts in 15 minutes, whilst when the wire (10 metres long) is introduced it falls from 264 to 201 volts in 10 minutes, then

$$10A=(264-201)\times 6-(264-255)\times 4=342;\ \text{or}\ A=34\cdot 2.$$

The values obtained for A seem largely dependent on the station.

At Wolfenbüttel, a year's observations by Elster and Geitel (**56**) made A vary from 4 to 64, the mean being 20. In the island of Juist, off the Friesland coast, from three weeks' observations they obtained only 5·2 as the mean. On the other hand, at Altjoch, an Alpine station, from nine days' observations in July 1903 they obtained a mean of 137, the maximum being 224, and the minimum 92. At Freiburg, from 150 days' observations near noon in 1903–1904, Gockel (**57**) obtained a mean of 84, his extreme values being 10 and 420. At Karasjok, observing several times throughout the day for a good many months, Simpson (**10**) obtained a mean of 93 and a maximum of 432. The same observer from four weeks' observations at Hammerfest got the considerably lower mean value 58, with a maximum of 252. At this station much lower values were found for A with sea breezes than with land breezes. Observing on the pier at Swinemünde in August and September 1904, Lüdeling (**40**) obtained a mean value of 34.

Elster and Geitel (**58**), having found air drawn from the soil highly radioactive, regard ground air as the source of the emanation in the atmosphere, and in this way account for the low values they obtained for A when observing on or near the sea. At Freiburg in winter Gockel (**55**) found A notably reduced when snow was on the ground, I_+ being also reduced. When the ground was covered by snow the mean value of A was only 42, as compared with 81 when there was no snow.

J. C. McLennan (**59**) observing near the foot of Niagara found A only about one-sixth as large as at Toronto. Similarly at Altjoch, Elster and Geitel (**56**) found A at the foot of a waterfall only about one-third of its normal value at a distance from the fall.

21. *Annual and Diurnal Variations.*—At Wolfenbüttel, Elster and Geitel found A vary but little with the season. At Karasjok, on the contrary, Simpson found A much larger at midwinter—notwithstanding the presence of snow—than at midsummer. His mean value for November and December was 129, while his mean for May and June was only 47. He also found a marked diurnal variation, A being considerably greater between 3 and 5 A.M. or 8·30 to 10·30 P.M. than between 10 A.M. and noon, or between 3 and 5 P.M.

At all seasons of the year Simpson found A rise notably with increase of relative humidity. Also, whilst the mere absolute height of the barometer seemed of little, if any, importance, he obtained larger values of A with a falling than with a rising barometer. This last result of course is favourable to Elster and Geitel's views as to the source of the emanation.

22. For a wire exposed under the conditions observed by Elster and Geitel the emanation seems to be almost entirely derived from radium. Some part, however, seems to be derived from thorium, and H. A. Bumstead (**60**) finds that with longer exposure of the wire the relative importance of the thorium emanation increases. With three hours' exposure he found the thorium emanation only from 3 to 5% of the whole, but with 12 hours' exposure the percentage of thorium emanation rose to about 15. These figures refer to the state of the wire immediately after the exposure; the rate of decay is much more rapid for the radium than for the thorium emanation.

23. The different elements—potential gradient, dissipation, ionization and radioactivity— are clearly not independent of one another. The loss of a charge is naturally largely dependent on the richness of the surrounding air in ions. This is clearly shown by the following results obtained by Simpson (**10**) at Karasjok for the mean values of a_+ corresponding to certain groups of values of $I_\pm$. To eliminate the disturbing influence of wind, different wind strengths are treated separately.

TABLE VIII.—*Mean Values of $a_\pm$.*

Wind Strength.	$I_\pm$ 0 to 0·1.	0·1 to 0·2.	0·2 to 0·3	0·3 to 0·4.	0·4 to 0·5.
0 to 1	0·45	0·60	1·26	2·04	3·03
1 ,, 2	0·65	1·08	1·85	2·92	3·83
2 ,, 3	. .	. .	2·70	3·88	5·33

Simspon concluded that for a given wind velocity dissipation is practically a linear function of ionization.

24. Table IX. will give a general idea of the relations of potential gradient to dissipation and ionization.

TABLE IX.—*Potential, Dissipation, Ionization.*

Potential gradients. volts per metre.	q			Karasjok (Simpson (**10**)).				
	Kremsmünster (**41**).	Freiburg (**43**).	Rothhorn (**43**).	a_+	a_-	I_+	I_-	Q
0 to 50	. .	1·12	. .	. .	. .	. .	. .	. .
50 ,, 100	1·14	1·31	. .	4·29	4·67	0·43	0·39	1·11
100 ,, 150	1·24	1·69	. .	3·38	3·93	0·37	0·32	1·15
150 ,, 200	1·48	1·84	. .	1·85	2·58	0·36	0·28	1·28
200 ,, 300	. .	. .	3·21	1·37	1·58	0·26	0·19	1·42
300 ,, 400	. .	. .	4·33	0·60	0·85	. .	. .	. .
400 ,, 500	. .	. .	5·46	. .	. .	. .	. .	. .
500 ,, 700	. .	. .	8·75	. .	. .	. .	. .	. .

If we regard the potential gradient near the ground as representing a negative charge on the earth, then if the source of supply of that charge is unaffected the gradient will rise and become high when the operations by which discharge is promoted slacken their activity. A diminution in the number of positive ions would thus naturally be accompanied by a rise in potential gradient. Table IX. associates with rise in potential gradient a reduced number of both positive and negative ions and a diminished rate of dissipation whether of a negative or a positive charge. The rise in q and Q indicates that the diminished rate of dissipation is most marked for positive charges, and that negative ions are even more reduced then positive.

At Kremsmünster Zölss (**41**) finds a considerable similarity between the diurnal variations in q and in the potential gradient, the hours of the forenoon and afternoon maxima being nearly the same in the two cases.

No distinct relationship has yet been established between potential gradient and radioactivity. At Karasjok Simpson (**10**) found fairly similar mean values of A for two groups of observations, one confined to cases when the potential gradient exceeded +400 volts, the other confined to cases of negative gradient.

At Freiburg Gockel (**55**, **57**) found that when observations were grouped according to the value of A there appeared a distinct rise in both a_- and I_+ with increasing A. For instance, when A lay between 100 and 150 the mean value of a_- was 1·27 times greater than when A lay between 0 and 50; while when A lay between 120 and 150 the mean value of I_+ was 1·53 times larger than when A lay between 0 and 30. These apparent relationships refer to mean values. In individual cases widely different values of a_- or I_+ are associated with the same value of A.

25. If V be the potential, ρ the density of free electricity at a point in the atmosphere, at a distance r from the earth's centre, then assuming statical conditions and neglecting variation oı V in horizontal directions, we have

$$r^{-2}(d/dr)(r^2 dV/dr)+4\pi\rho=0.$$

For practical purposes we may treat r^2 as constant, and replace d/dr by d/dh, where h is height in centimetres above the ground.

We thus find $$\rho=-(1/4\pi)d^2V/dh^2.$$

If we take a tube of force 1 sq. cm. in section, and suppose it cut by equipotential surfaces at heights h_1 and h_2 above the ground, we have for the total charge M included in the specified portion of the tube

$$4\pi M=(dV/dh)h_1-(dV/dh)h_2.$$

Taking Linke's (**28**) figures as given in § 10, and supposing $h_1=0$, $h_2=15\times10^4$, we find for the charge in the unit tube between the ground and 1500 metres level, remembering that the centimetre is now the unit of length, $M=(1/4\pi)$ (125-25)/100. Taking 1 volt equal 1/300 of an electrostatic unit, we find $M=0{\cdot}000265$. Between 1500 and 4000 metres the charge inside the unit tube is much less, only 0·000040. The charge on the earth itself has its surface density given by $\sigma=-(1/4\pi)\times125$ volts per metre, $=0{\cdot}000331$ in electrostatic units. Thus, on the view now generally current, in the circumstances answering to Linke's experiemnts we have on the ground a charge of -331×10^{-6} C.G.S. units per sq. cm. Of the corresponding positive charge, 265×10^{-6} lies below the 1500 metres level, 40×10^{-6} between this and the 4000 metres level, and only 26×10^{-6} above 4000 metres.

There is a difficulty in reconciling observed values of the ionization with the results obtained from balloon ascents as to the variation of the potential with altitude. According to H. Gerdien (**61**), near the ground a mean value for d^2V/dh^2 is $-(1/10)$ volt/(metre)^2. From this we deduce for the charge ρ per cubic centimetre $(1/4\pi)\times10^{-5}$ (volt/cm^2), or $2{\cdot}7\times10^{-9}$ electrostatic units. But taking, for example, Simpson's mean values at Karasjok, we have observed

$$\rho\equiv I_+-I_1=0{\cdot}05\times(\text{cm./metre})^3=5\times10^{-8},$$

and thus (calculated ρ)/(observed ρ) = 0·05 approximately. Gerdien himself makes I_+-I_- considerably larger than Simpson, and concludes that the observed value of ρ is from 30 to 50 times that calculated. The presumption is either that d^2V/dh^2 near the ground is much larger numerically than Gerdien supposes, or else that the ordinary instruments for measuring ionization fail to catch some species of ion whose charge is preponderatingly negative.

26. Gerdien (**61**) has made some calculations as to the probable average value of the vertical electric current in the atmosphere in fine weather. This will be composed of a conduction and a convection current, the latter due to rising or falling air currents carrying ions. He supposes the field near the earth to be 100 volts per metre, or 1/300 electrostatic units. For simplicity, he assumes I_+ and I_- each equal $0{\cdot}25\times10^{-6}$ electrostatic units. The specific velocities of the ions—*i.e.* the velocities in unit field—he takes to be $1{\cdot}3\times300$ for the positive, and $1{\cdot}6\times300$ for the negative. The positive and

negative ions travel in opposite directions, so the total current is $(1/300)(0\cdot25\times10^{-6})(1\cdot3\times300+1\cdot6\times300)$, or 73×10^{-8} in electrostatic measure, otherwise $2\cdot4\times10^{-16}$ amperes per sq. cm. As to the convection current, Gerdien supposes—as in § 25—$\rho=2\cdot7\times10^{-9}$ electrostatic units, and on fine days puts the average velocity of rising air currents at 10 cm. per second. This gives a convection current of $2\cdot7\times10^{-8}$ electrostatic units, or about 1/27 of the conduction current. For the total current we have approximately $2\cdot5\times10^{-16}$ amperes per sq. cm. This is insignificant compared to the size of the currents which several authorities have calculated from considerations as to terrestrial magnetism (*q.v.*). Gerdien's estimate of the convection current is for fine weather conditions. During rainfall, or near clouds or dust layers, the magnitude of this current might well be enormously increased; its direction would naturally vary with climatic conditions.

27. H. Mache (**62**) thinks that the ionization observed in the atmosphere may be wholly accounted for by the radioactive emanation. If this is true we should have $q=\alpha n^2$, where q is the number of ions of one sign made in 1 cc. of air per second by the emanation, α the constant of recombination, and n the number of ions found simultaneously by, say, Ebert's apparatus. Mache and R. Holfmann, from observations on the amplitude of saturation currents, deduce $q=4$ as a mean value. Taking for α Townsend's value $1\cdot2+10^{-6}$, Mache finds $n=1800$. The charge on an ion being $3\cdot4\times10^{-10}$ Mache deduces for the ionic charge, I_+ or I_-, per cubic metre $1800\times3\cdot4\times10^{-10}\times10^6$, or 0·6. This is at least of the order observed, which is all that can be expected from a calculation which assumes I_+ and I_- equal. If, however, Mache's views were correct, we should expect a much closer connexion between I and A than has actually been observed.

28. C. T. R. Wilson (**63**) seems disposed to regard the action of rainfall as the most probable source of the negative charge on the earth's surface. That great separation of positive and negative electricity sometimes takes place during rainfall is undoubted, and the charge brought to the ground seems preponderatingly negative. The difficulty is in accounting for the continuance in extensive fine weather districts of large positive charges in the atmosphere in face of the processes of recombination always in progress. Wilson considers that convection currents in the upper atmosphere would be quite inadequate, but conduction may, he thinks, be sufficient alone. At barometric pressures such as exist between 18 and 36 kilometres above the ground the mobility of the ions varies inversely as the pressure, whilst the coefficient of recombination α varies approximately as the pressure. If the atmosphere at different heights is exposed to ionizing radiation of uniform intensity the rate of production of ions per cc., q, will vary as the pressure. In the steady state the number, n, of ions of either sign per cc. is given by $n=\sqrt{q/\alpha}$, and so is independent of the pressure or the height. The conductivity, which varies as the product of n into the mobility, will thus vary inversely as the pressure, and so at 36 kilometres will be one hundred times as large as close to the ground. Dust particles interfere with conduction near the ground, so the relative conductivity in the upper layers may be much greater than that calculated. Wilson supposes that by the fall to the ground of a preponderance of negatively charged rain the air above the shower has a higher positive potential than elsewhere at the same level, thus leading to large conduction currents laterally in the highly conducting upper layers.

29. *Thunder.*—Trustworthy frequency statistics for an individual station are obtainable only from a long series of observations, while if means are taken from a large area places may be included which differ largely amongst themselves. There is the further complication that in some countries thunder seems to be on the increase. In temperate latitudes, speaking generally, the higher the latitude the fewer the thunderstorms. For instance, for Edinburgh (**64**) (1771 to 1900) and London (**65**) (1763 to 1896) R. C. Mossman found the average annual number of thunderstorm days to be respectively 6·4 and 10·7; while at Paris (1873–1893) E. Renou (**66**) found 27·3 such days. In some tropical stations, at certain seasons of the year, thunder is almost a daily occurrence. At Batavia (**18**) during the epoch 1867–1895, there were on the average 120 days of thunder in the year.

As an example of a large area throughout which thunder frequency appears fairly uniform, we may take Hungary (**67**). According to the statistics for 1903, based on several hundred stations, the average number of days of thunder throughout six subdivisions of the country, some wholly plain, others mainly mountainous, varied only from 21·1 to 26·5, the mean for the whole of Hungary being 23·5. The antithesis of this exists in the United States of America. According to A. J. Henry (**68**) there are three regions of maximum frequency: one in the south-east, with its centre in Florida, has an average of 45 days of thunder in the year; a second including the middle Mississippi valley has an average of 35 days; and a third in the middle Missouri valley has 30. With the exception of a narrow strip along the Canadian frontier, thunderstorm frequency is fairly high over the whole of the United States to the east of the 100th meridian. But to the west of this, except in the Rocky Mountain region where storms are numerous, the frequency steadily diminishes, and along the Pacific coast there are large areas where thunder occurs only once or twice a year.

30. The number of thunderstorm days is probably a less exact measure of the relative *intensity* of thunderstorms than statistics as to the number of persons killed annually by lightning per million of the population. Table X. gives a number of statistics of this kind. The letter M stands for "Midland."

Table X.—*Deaths by Lightning, per annum, per million Inhabitants.*

Hungary	7·7	Upper Missouri and Plains	15
Netherlands	2·8	Rocky Mountains and Plateau	10
England, N.M.	1·8	South Atlantic	8
,, E.	1·3	Central Mississippi	7
,, S.M.	1·2	Upper ,,	7
,, York and W.M.	1·1	Ohio Valley	7
,, N.	1·0	Middle Atlantic	6
Wales	0·9	Gulf States	5
England, S.E.	0·8	New England	4
,, N.W.	0·7	Pacific Coast	<1[1]
,, S.W.	0·6	North and South Dakota	20
London	0·1	California	0

The figure for Hungary is based on the seven years 1897–1903; that for the Netherlands, from data by A. J. Monné (**69**) on the nine years 1882–1890. The English data, due to R. Lawson (**70**), are from twenty-four years, 1857–1880; those for the United States, due to Henry (**68**), are for five years, 1896–1900. In comparing these data allowance must be made for the fact that danger from lightning is much greater out of doors than in. Thus in Hungary, in 1902 and 1903, out of 229 persons killed, at least 171 were killed out of doors. Of the 229 only 67 were women, the only assignable explanation being their rarer employment in the fields. Thus, *ceteris paribus*, deaths from lightning are much more numerous in a country than in an industrial population. This is well brought out by the low figure for London. It is also shown conspicuously in figures given by Henry. In New York State, where the population is largely industrial, the annual deaths per million are only three, but of the agricultural population eleven. In states such as Wyoming and the Dakotas the population is largely rural, and the deaths by lightning rise in consequence. The frequency and intensity of thunderstorms are unquestionably greater in the Rocky Mountain than in the New England states, but the difference is not so great as the statistics at first sight suggest.

31. Even at the same place thunderstorms vary greatly in intensity and duration. Also the times of beginning and ending are difficult to define exactly, so that several elements of uncertainty exist in data as to the seasonal or diurnal variation. The monthly data in Table XI. are percentages of the total for the year. In most cases the figures are based on the number of days of thunder at a particular station, or at the average station of a country; but the second set for Hungary relates to the number of lightning strokes causing fire, and the figures for the United States relate to deaths by lightning. The data for Edinburgh, due to R. C. Mossman (**64**), refer to 130 years, 1771 to 1900. The data for London (1763–1896) are also due to

Table XI.—*Annual Variation of Thunderstorms.*

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Edinburgh	1·8	1·4	1·4	3·8	12·3	20·8	28·2	19·1	7·0	2·3	1·1	0·8
London	0·6	0·5	1·6	6·6	12·7	18·3	25·5	19·2	9·3	3·1	1·7	0·9
Paris	0·2	0·4	2·3	7·5	14·9	21·6	22·0	17·0	9·9	3·5	0·4	0·4
Netherlands	2·2	1·8	3·7	6·5	14·0	14·7	15·6	14·7	10·3	10·1	3·8	2·5
France	2·2	2·8	4·1	8·4	13·8	18·7	14·6	13·5	10·0	6·3	3·1	2·4
Switzerland	0·2	0·3	0·5	4·9	11·9	22·9	29·9	18·0	9·8	1·1	0·3	0·2
Hungary (*a*)	0·0	0·1	1·6	5·7	20·9	25·0	23·2	15·9	5·7	1·3	0·4	0·2
,, (*b*)	0·0	0·0	1·0	3·2	11·8	20·6	30·7	25·3	6·9	0·5	0·0	0·0
United States	0·1	0·1	1·2	4·0	14·3	25·0	27·2	20·4	5·8	1·4	0·3	0·1
Hong-Kong	0·0	2·1	4·3	8·5	12·8	23·4	14·9	21·3	10·6	2·1	0·0	0·0
Trevandrum	3·2	3·8	13·1	20·9	18·6	4·9	1·2	3·5	2·5	12·9	12·0	3·3
Batavia	10·4	9·2	11·1	10·5	7·9	5·5	4·3	3·8	5·4	8·8	12·2	10·9

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[1] Note in case of Pacific Coast, Table X., "<1" means "less than 1."

Mossman (**65**); for Paris (1873–1893) to Renou (**66**); for the Netherlands (1882–1900) to A. J. Monné (**69**); for France(**71**) (1886–1899) to Frou and Hann; for Switzerland to K. Hess (**72**); for Hungary (**67**) (1896–1903) to L. von Szalay and others; for the United States (1890–1900) to A. J. Henry (**68**); for Hong-Kong (**73**) (1894–1903) to W. Doberck. The Trevandrum (**74**) data (1853–1864) were due originally to A. Broun; the Batavia data (1867–1895) are from the Batavia *Observations*, vol. xviii.

Most stations in the northern hemisphere have a conspicuous maximum at midsummer with little thunder in winter. Trevandrum (8° 31′ N.) and Batavia (6° 11′ S.), especially the former, show a double maximum and minimum.

Table XII.—*Diurnal Variation of Thunderstorms.*

Hour.	0–2.	2–4.	4–6.	6–8.	8–10.	10–12.	0′–2′	2′–4′.	4′–6′.	6′–8′.	8′–10′.	10′–12′.
Finland (**76**)	2·3	2·0	2·2	3·0	4·6	12·1	18·9	19·2	16·1	10·1	6·1	3·4
Edinburgh (**64**)	1·7	2·0	1·4	1·7	4·7	14·2	22·4	23·7	11·9	9·2	5·1	2·0
Belgium (**77**)	3·0	2·9	1·7	1·8	2·0	6·4	12·9	21·6	19·4	15·8	8·4	4·1
Brocken (**78**)	1·6	2·5	1·3	1·3	4·2	3·1	12·1	28·6	22·4	10·1	7·2	5·6
Switzerland (**72**)	3·1	2·3	2·1	1·6	2·0	7·3	13·8	20·9	20·8	14·6	8·0	3·5
Italy (**77**)	1·3	1·6	1·4	2·0	3·0	8·5	19·5	26·5	16·6	9·8	8·3	1·5
Hungary (i.) (**67**)	2·1	1·9	1·9	2·1	2·9	11·5	18·1	22·0	17·9	10·7	6·2	2·8
,, (ii.) (**67**)	6·9	4·2	2·3	2·0	2·0	5·0	9·9	16·9	18·2	10·7	11·7	10·0
,, (iii.) (**75**)	2·3	1·9	2·0	2·4	2·7	7·9	16·1	22·1	19·1	12·7	7·6	3·2
,, (iv.) (**75**)	2·6	2·2	1·9	1·9	3·6	13·3	19·9	20·7	15·2	9·2	6·2	3·3
Trevandrum (**74**)	5·6	4·9	4·3	1·3	1·4	2·0	13·3	24·5	15·9	13·3	7·6	5·9
Agustia (**74**)	2·9	2·9	0·3	0·0	1·7	2·9	15·1	36·1	22·2	9·3	4·6	2·0

32. *Daily Variation.*—The figures in Table XII. are again percentages. They are mostly based on data as to the hour of commencement of thunderstorms. Data as to the hour when storms are most severe would throw the maximum later in the day. This is illustrated by the first two sets of figures for Hungary (**67**). The first set relate as usual to the hour of commencement, the second to the hours of occurrence of lightning causing fires. Of the two other sets of figures for Hungary (**75**), (iii.) relates to the central plain, (iv.) to the mountainous regions to north and south of this. The hour of maximum is earlier for the mountains, thunder being more frequent there than in the plains between 8 A.M. and 4 P.M., but less frequent between 2 and 10 P.M. Trevandrum (8° 31′ N., 76° 59′ E., 195 ft. above sea-level) and Agustia (8° 37′ N., 77° 20′ E., 6200 ft. above sea-level) afford a contrast between low ground and high ground in India. In this instance there seems little difference in the hour of maximum, the distinguishing feature being the great concentration of thunderstorm occurrence at Agustia between noon and 6 P.M.

Table XIII.

Year.	Netherlands.	France.	Hungary.	U.S.A.	Year.	Netherlands.	France.	Hungary.	U.S.A.
1882	98	..	141	..	1893	102	288	233	209
1883	117	..	195	..	1894	111	300	333	336
1884	95	..	229	..	1895	119	309	280	426
1885	93	..	192	..	1896	109	266	299	341
1886	102	251	319	..	1897	119	297	350	362
1887	78	292	236	..	1898	95	299	386	367
1888	94	286	232	..	1899	112	299	368	563
1889	126	294	258	..	1900	108	..	401	713
1890	93	299	265	..	1901	..	..	502	..
1891	98	317	302	204	1902	..	..	322	..
1892	86	324	350	251	1903	..	..	256	..

33. Table XIII. gives some data as to the variability of thunder from year to year. The figures for the Netherlands (**69**) and France (**71**) are the number of days when thunder occurred somewhere in the country. Its larger area and more varied climate give a much larger number of days of thunder to France. Notwithstanding the proximity of the two countries, there is not much parallelism between the two. The figures for Hungary (**67**) give the number of lightning strokes causing fire; those for the United States (**68**) give the number of persons killed by lightning. The conspicuous maximum in 1901 and great drop in 1902 in Hungary are also shown by the statistics as to the number of days of thunder. This number at the average station of the country fell from 38·4 in 1901 to 23·1 in 1902. On the whole, however, the number of destructive lightning strokes and of days of thunder do not show a close parallelism.

Table XIV.

Decade ending	1810.	1820.	1830.	1840.	1850.	1860.	1870.	1880.	1890.	1900.
Edinburgh	4·9	5·7	7·7	6·7	5·7	6·5	5·4	10·6	9·4	9·2
London	9·5	8·3	11·5	11·8	10·5	11·9	9·6	15·7	13·0	..
Tilsit	..	..	12·1	12·1	16·1	15·3	11·9	17·6	21·8	..
Germany, South	..	..	..	..	..	49	66	91	143	175
,, West	..	..	..	..	..	92	106	187	244	331
,, North	..	..	..	..	..	124	135	245	288	352
,, East	..	..	..	..	..	102	143	186	210	273
,, Whole	..	..	..	..	..	90	116	189	254	318

34. Table XIV. deals with the variation of thunder over longer periods. The data for Edinburgh (**64**) and London (**65**) due to Mossman, and those for Tilsit, due to C. Kassner (**79**), represent the average number of days of thunder per annum. The data for Germany, due to O. Steffens (**80**), represent the average number of houses struck by lightning in a year per million houses; in the first decade only seven years (1854–1860) are really included. Mossman thinks that the apparent increase at Edinburgh and London in the later decades is to some extent at least real. The two sets of figures show some corroborative features, notably the low frequency from 1860 to 1870. The figures for Germany—representing four out of six divisions of that country—are remarkable. In Germany as a whole, out of a million houses the number struck per annum was three and a half times as great in the decade 1890 to 1900 as between 1854 and 1860. Von Bezold (**81**) in an earlier memoir presented data analogous to Steffens', seemingly accepting them as representing a true increase in thunderstorm destructiveness. Doubts have, however, been expressed by others—*e.g.* A. Gockel, *Das Gewitter*, p. 106—as to the real significance of the figures. Changes in the height or construction of buildings, and a greater readiness to make claims on insurance offices, may be contributory causes.

35. The fact that a considerable number of people sheltering under trees are killed by lightning is generally accepted as a convincing proof of the unwisdom of the proceeding. When there is an option between a tree and an adjacent house, the latter is doubtless the safer choice. But when the option is between sheltering under a tree and remaining in the open it is not so clear. In Hungary (**67**), during the three years 1901 to 1903, 15% of the total deaths by lightning occurred under trees, as against 57% wholly in the open. In the United States (**68**) in 1900, only 10% of the deaths where the precise conditions were ascertained occurred under trees, as against 52% in the open. If then the risk under trees exceeds that in the open in Hungary and the United States, at least five or six times as many people must remain in the open as seek shelter under trees. An isolated tree occupying an exposed position is, it should be remembered, much more likely to be struck than the average tree in the midst of a wood. A good deal also depends on the species of tree. A good many years' data for Lippe (**82**) in Germany make the liability to lightning stroke as follows—the number of each species being supposed the same:—Oak 57, Fir 39, Pine 5, Beech 1. In Styria, according to K. Prohaska (**83**), the species most liable to be struck are oaks, poplars and pear trees; beech trees again are exceptionally safe. It should, however, be borne in mind that the apparent differences between different species may be partly a question of height, exposure or proximity to water. A good deal may also depend on the soil. According to Hellmann, as quoted by Henry (**82**), the liability to lightning stroke in Germany may be put at chalk 1, clay 7, sand 9, loam 22.

36. Numerous attempts have been made to find periodic variations in thunderstorm frequency. Among the periods suggested are the 11-year sunspot period, or half this (cf. v. Szalay (67)). Ekholm and Arrhenius (84) claim to have established the existence of a tropical lunar period, and a 25·929-day period; while P. Polis (85) considers a synodic lunar period probable. A. B. MacDowall (86) and others have advanced evidence in favour of the view that thunderstorms are most frequent near new moon and fewest near full moon. Much more evidence would be required to produce a general acceptance of any of the above periods.

37. *St Elmo's Fire.*—Luminous discharges from masts, lightning conductors, and other pointed objects are not very infrequent, especially during thunderstorms. On the Sonnblick, where the phenomenon is common, Elster and Geitel (87) have found St Elmo's fire to answer to a discharge sometimes of positive sometimes of negative electricity. The colour and appearance differ in the two cases, red predominating in a positive, blue in a negative discharge. The differences characteristic of the two forms of discharge are described and illustrated in Gockel's *Das Gewitter.* Gockel states (*l.c.* p. 74) that during snowfall the sign is positive or negative according as the flakes are large or are small and powdery. The discharge is not infrequently accompanied by a sizzling sound.

38. Of late years many experiments have been made on the influence of electric fields or currents on plant growth. S. Lemström (88), who was a pioneer in this department, found an electric field highly beneficial in some but not in all cases. Attempts have been made to apply electricity to agriculture on a commercial scale, but the exact measure of success attained remains somewhat doubtful. Lemström believed atmospheric electricity to play an important part in the natural growth of vegetation, and he assigned a special rôle to the needles of fir and pine trees.

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ATMOSPHERIC RAILWAY. About 1840–1845 great interest was excited by a method of propelling railway trains through the agency of atmospheric pressure. Various inventors worked at the realization of this idea. On the system worked out in England by Jacob Samuda and S. Clegg, a continuous pipe or main was laid between the rails, and in it a partial vacuum was maintained by means of air pumps. A piston fitting closely in it was connected to the leading vehicle of the train by an iron plate which passed through a longitudinal groove or aperture running the whole length of the pipe. This aperture was covered by a valve consisting of a continuous strip of leather, strengthened on each side with iron plates; one edge was fastened, while the other was free to rise, and was closed against a composition of beeswax and tallow placed in the groove, the surface of which was slightly melted by a heater, carried on each train, in order to secure an air-tight joint. Connected behind the piston was a frame carrying four wheels which lifted and sustained the continuous valve for a distance of about 15 ft. Thus the piston having atmospheric pressure on one side of it and a vacuum equal to 15 or 16 in. of mercury on the other, was forced along the tube, taking the train with it. Various advantages were claimed by the advocates of the system, including cheapness of operation as compared with steam locomotives, and safety from collision, because the main was divided into sections by separating valves and only one train could be in each section at a given time. It was installed on about 2 m. of line between Kingstown and Dalkey (Ireland) in 1843 and worked till 1855; it was also tried on the London and Croydon and on the South Devon lines, but was soon abandoned. The same principle is applied in the system of pneumatic despatch (*q.v.*) to the transmission of small parcels in connexion with postal and telegraph work.

For further particulars see three papers by J. Samuda, P. W. Barlow and G. Berkeley, with reports of the discussions upon them, in *Proc. Inst. C.E.*, 1844 and 1845.

ATOLL (native name *atollon* in the Maldive Islands), a horse-shoe or ring shaped coral reef enclosing a lagoon. The usual shape is that of a partly submerged dish with a broken edge, forming the ring of islands, standing upon a conical pedestal. The dish is formed of coral rock and the shells of various reef-dwelling mollusca, covered, especially at the seaward edges, with a film of living coral polyps that continually extend the fringe, and enlarge the diameter of the atoll. The lagoon tends to deepen when the land is stationary by the death of the coral animals in the still water, and the patchy disintegration of the "hard" coral, while waves and storms tear off blocks of rock and pile them up at the margin, increasing the height of the islands, which become covered by vegetation. The lagoon entrance in the open part of the horse-shoe is always to leeward of prevailing winds, since the coral growth is there slower than where the waves constantly renew the polyps' food supply. The conical pedestal rising from the depths is frequently a submarine volcanic cone or island, though any submerged peak may be crowned by an atoll. For the theory of atoll formation see CORAL-REEFS.

ATOM (Gr. ἄτομος, indivisible, from ἀ- privative, and τέμνειν, to cut), the term given in physical science to the ultimate indivisible particle of matter, and so by analogy to something minutely small in size. If we examine such a substance as sugar we find that it can be broken up into fine grains, and these again into finer, the finest particles still appearing to be of the same nature as sugar. The same is true in the case of a liquid such as water; it can be divided into drops and these again into smaller drops, or into the finest spray the particles of which are too small to be detected by our unaided vision. In fact, so far as the direct evidence of our senses tells us, matter appears to be indefinitely divisible. Moreover, small particles do not seem to exist in the water until it is broken up; so far as we can see, the material of the water is continuous not granular. This conception of matter, *as infinitely divisible and continuous*, was taught by

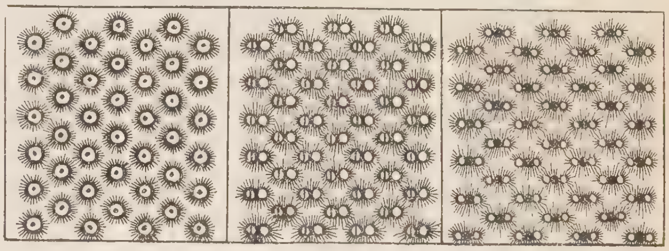
Theories of matter.

Anaxagoras more than four centuries before the Christian era, and in the philosophy of Aristotle the same ideas are found. But some phenomena are difficult to reconcile with this view; for example, a cubic foot of air can be compressed into less than one five-hundredth of a cubic foot, or, if allowed to expand, the air originally occupying the cubic foot can be made to fill, apparently uniformly, a space of a million cubic feet or more. This enormous capacity for expansion and contraction is astonishing if we believe matter to be continuous, but if we imagine air to be made up of little particles separated by relatively large empty spaces the changes in volume are more easily conceivable. Moreover, if we attribute such a structure to gases, we are led to attribute it to liquids and to solids also, since gases can be liquefied without any abrupt change, and many substances usually solid can be converted into gases by heating them. This conception of the *grained* structure of matter is very ancient; traces of it are to be found in Indian philosophy, perhaps twelve centuries before the Christian era, and the Greek philosophers Democritus and Epicurus, in the 3rd and 4th centuries B.C., taught it very definitely. Their view was that "matter is not indefinitely divisible, but that all substances are formed of indivisible particles or atoms which are eternal and unchangeable, that the atoms are separated from one another by void, and that these atoms, by their combinations, form the matter we are conscious of." The Roman poet Lucretius (*De Rerum Natura*) was an eloquent exponent of this theory, but throughout the middle ages, indeed until the 17th century, it was eclipsed by the prestige of Aristotle. In the time, however, of Boyle[1] and Newton, we again find an atomic theory of matter; Newton[2] regarded a gas as consisting of small separate particles which repelled one another, the tendency of a gas to expand being attributed to the supposed repulsion between the particles.

Let us consider some common phenomena in the light of these rival theories as to the nature of matter. When a few lumps of sugar are added to a glass of water and stirred, the sugar soon disappears and we are left with a uniform liquid resembling water, except that it is sweet. What has become of the sugar? Does it still exist? The atomist would say, "Yes, it is broken up into its atoms, and these are distributed throughout the spaces between the particles of water." The rival philosopher, who believes water to be continuous and without spaces between its particles, has a greater difficulty in accounting for the disappearance of the sugar; he would probably say that the sugar, and the water also, had ceased to exist, and that a new continuous substance had been formed from them, but he could offer no picture of how this change had taken place. Or consider a well-marked case of what we are in the habit of calling *chemical combination.* If 127 parts of iodine, which is an almost black solid, and 100 parts of mercury, which is a white liquid metal, be intimately mixed by rubbing them together in a mortar, the two substances wholly disappear, and we obtain instead a brilliant red powder quite unlike the iodine or the mercury; almost the only property that is unchanged is the weight. The question again arises, what has become of the original substances? The atomist has an easy answer; he says that the new body is made up by the juxtaposition of the atoms of iodine and mercury, which still exist in the red powder. His opponent would be disposed to say that the iodine and the mercury ceased to exist when the red powder was formed, that they were *components* but not *constituents* of it. The fact that the two components can be recovered from the compound by destroying it does not decide the question. It is remarkable that pure chemistry, even to-day, has no very conclusive arguments for the settlement of this controversy; but the sister science of physics is steadily accumulating evidence in favour of the atomic conception.

Dalton.

Until the time of John Dalton, the atomic conception remained purely qualitative, and until then it does not appear to have advanced chemistry or to have found further confirmation in the facts of chemistry. Dalton (1803) gave the atomic theory a quantitative form, and showed that, by means of it, a vast number of the facts of chemistry could be predicted or explained. In fact, he did so much to make the atomic theory of matter probable that he is popularly regarded as its originator. Dalton lived in a period marked by great advances in experimental chemistry. Rather before the commencement of the 19th century the work of Lavoisier had rendered it very probable that chemical changes are not accompanied by any change in weight, and this principle of the conservation of matter was becoming universally accepted; chemists were also acquiring considerable skill in chemical analysis, that is, in the determination of the nature and relative amounts of the elements contained in compounds. But Sir H. E. Roscoe and A. Harden, *New View of the Atomic Theory* (1896), have shown, from a study of Dalton's manuscript notes, that we do not owe his atomic theory to such experiments. If their view is correct, the theory appears to be a remarkable example of deductive reasoning. Dalton, who was a mathematical physicist even more than a chemist, had given much thought to the study of gases. Following Newton, he believed a gas to be made up of particles or atoms, separated from one another by considerable spaces. Certain difficulties that he met with in his speculations led him to the conclusion that the particles of any one kind of gas, though all of them alike, must differ from those of another gas both in *size* and *weight.* He thus arrived at the conception of a definite atomic weight peculiar to the particles of each gas, and he thought that he could determine these atomic weights, in terms of one of them, by means of the quantitative analysis of compounds. The conclusion that each element had a definite atomic weight, peculiar to it, was the new idea that made his speculations fruitful, because it allowed of quantitative deduction and verification. He drew simple diagrams, three of which, taken from Dalton's *New System of Chemical Philosophy*, part ii. (1810), are reproduced here, in which gases are represented as composed of atoms. Knowing that the gas which he called "nitrous gas" was composed of oxygen and nitrogen, and believing it to be the simplest compound of these two elements, he naturally represented its atom as formed of an atom of oxygen and an atom of nitrogen in juxtaposition. When two elements form more than one compound, as is the case with oxygen and carbon, he assigned to the compound which he thought the more complex an atom made up of two atoms of the one element and one atom of the other; the diagram for carbonic acid illustrates this, and an extension of the same plan enabled him to represent any compound, however complex its structure. The table here given contains some of Dalton's diagrams of atoms. They are not all considered to be correct at the present time; for example, we now think that the ultimate particle of water is made up of two atoms of hydrogen and one of oxygen, and that that of ammonia contains three atoms of hydrogen to one of nitrogen. But these differences between Dalton's views and our present ones do not impair the accuracy of the arguments which follow.



From Dalton's *New System of Chemical Philosophy*

Hydrogen Gas. Nitrous Gas. Carbonic Acid Gas.

⊙	hydrogen.
○	oxygen.
⦶	nitrogen.
●	carbon.
⊙○	water.
⊙⦶	ammonia.
⊙●	ethylene.
●○	carbon monoxide.
○●○	carbon dioxide.
⦶○	nitric oxide (nitrous gas).
⦶○⦶	nitrous oxide.
○⦶○	nitrogen peroxide.

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[1] Robert Boyle, *The Sceptical Chymist* (1661); *The Usefulness of Natural Philosophy* (1663).

[2] Sir Isaac Newton, *Principia*, bk. ii. prop. 23.

The diagrams show that Dalton formed a very definite conception of the nature of chemical combination; it was the union of a small number of atoms of one kind with a small number of another kind to form a compound atom, or as we now say a "molecule," this identical process being repeated millions of times to form a perceptible amount of a compound. The conceptions of "element," "compound" and "mixture" became more precise than they had been hitherto; in an element all the atoms are alike, in a compound all the molecules are alike, in a mixture there are different kinds of molecules. If we accept the hypothesis that each kind of atom has a specific and invariable weight, we can, with the aid of the above theory, make most important inferences concerning the proportions by weight in which substances combine to form compounds. These inferences are often summarized as the laws of *constant, multiple and reciprocal proportions.*

Law of constant proportions.

The law of *constant proportions* asserts that *when two elements unite to form a compound the weights that combine are in an invariable ratio, a ratio that is characteristic of that compound.* Thus if Dalton's diagram for the molecule, or compound atom, of water be correct, it follows that in all samples of water the total number of the hydrogen atoms is equal to that of the oxygen atoms; consequently, the ratio of the weight of oxygen to that of hydrogen in water is the same as the ratio of the weights of an oxygen and a hydrogen atom, and *this is invariable.* Different samples of water cannot therefore differ ever so little in percentage composition, and the same must be true for every compound as distinguished from a mixture. Apart from the atomic theory there is no obvious reason why this should be so. We give the name bread to a substance containing variable proportions of flour and water. Similarly the substance we call wine is undeniably variable in composition. Why should not the substance we call water also vary more or less? The Aristotelian would find no difficulty in such a variability; it is only the disciple of Dalton to whom it seems impossible. It is evident that we have in this law a definite prediction that can be tested by experiment.

Law of multiple proportions.

The law of *multiple proportions* asserts that *if two elements form more than one compound, then the weights of the one element which are found combined with unit weight of the other in the different compounds, must be in the ratio of two or more whole numbers.* If we compare Dalton's diagrams of the two oxides of carbon or of the three oxides of nitrogen that are given in the preceding table, we at once see the necessity of this law; for the more complex molecule has to be formed from the simpler one by the addition of one or more whole atoms. In the oxides of carbon the same weight of carbon must be combined with weights of oxygen that are as $1:2$, and in the oxides of nitrogen a fixed weight of nitrogen must be in union with weights of oxygen that are as $1:2:\frac{1}{2}$, which are the same ratios as $2:4:1$. This law has been abundantly verified by experiment; for example, five oxides of nitrogen are known, and independent analyses show that, if we consider the same weight of nitrogen in every case, the weights of oxygen combined with it are to one another as $1:2:3:4:5$. The discovery of this law is due to Dalton; it is a direct deduction from his atomic theory. Here again, apart from this theory, there is no obvious reason why the composition of different substances should be related in so simple a way. As Dalton said, "The doctrine of definite proportions appears mysterious unless we adopt the atomic hypothesis." "It appears like the mystical ratios of Kepler which Newton so happily elucidated." The chemists of Dalton's time were not unanimous in accepting these laws; indeed C. L. Berthollet (*Essai de statique chimique*, 1803) expressly controverted them. He maintained that, under varying conditions, two substances could combine in an indefinitely large number of different ratios, that there could in fact be a continuous variation in the combining ratio. This view is clearly inconsistent with the atomic theory, which requires that when the combining ratio of two substances changes it should do so, *per saltum*, to quite another value.

Law of reciprocal proportions.

The law of *reciprocal proportions*, or, as it might well be named, the law of *equivalence*, cannot be adequately enunciated in a few words. The following gives a partial statement of it. *If we know the weights* a *and* b *of two elements that are found in union with unit weight of a third element, then we can predict the composition of the compounds which the first two elements can form with each other; either the weights* a *and* b *will combine exactly, or if not, these weights must be multiplied by integers to obtain the composition of a compound.* To see how this law follows from Dalton's theory let us consider his diagrams for the molecules of water, ethylene and the oxides of carbon. In water and in ethylene experiment shows that 8 parts by weight of oxygen and 6 parts of carbon, respectively, are in union with one part of hydrogen; also, if the diagrams are correct, these numbers must be in the ratio of the atomic weights of oxygen and carbon. We can therefore predict that all oxides of carbon will have compositions represented by the ratio of $8m$ parts of oxygen to $6n$ parts of carbon, where m and n are whole numbers. This prediction is verified by the result of analysis. Similarly, if we know by experiment the composition of water and of ammonia, we can predict the probable composition of the oxides of nitrogen. Experiment shows that, in water and ammonia, we have, respectively, 8 parts of oxygen and 4·67 parts of nitrogen in union with one part of hydrogen; we can therefore infer that the oxides of nitrogen will all have the composition of $8m$ parts of oxygen to $4{\cdot}67n$ parts of nitrogen. Experiment alone can tell us the values of m and n; all that the theory tells us is that they are whole numbers. In this particular case, n turns out to be 3, and m has in succession the values 1, 2, 3, 4, 5.

It is evident that these laws all follow from the idea that a compound molecule can only alter through the addition or subtraction of one or more complete atoms, together with the idea that all the molecules in a pure substance are alike. Fortunately, the compounds at first examined by the chemists engaged in verifying these laws were comparatively simple, so that the whole numbers referred to above were small. The astonishing variety of ratios in which carbon and hydrogen combine was not at first realized. Otherwise Berthollet's position would have been a much stronger one, and the atomic theory might have had to wait a long while for acceptance. Even at the present time, it would be too much to say that all the complex organic substances have been proved by analysis to obey these laws; all we can assert is that their composition and properties can be satisfactorily explained on the assumption that they do so.

The above statement does not by any means exhaust the possible predictions that can be made from the atomic theory, but it shows how to test the theory. If chemical compounds can be proved by experiment to obey these laws, then the atomic theory acquires a high degree of probability; if they are contradicted by experiment then the atomic theory must be abandoned, or very much modified. Dalton himself made many analyses with the purpose of establishing his views, but his skill as an analyst was not very great. It is in the work of the great Swedish chemist J. J. Berzelius, and somewhat later, in the experiments of the Belgian chemist J. S. Stas, that we find the most brilliant and vigorous verification of these laws, and therefore of the atomic theory.

We shall now give an outline of the experimental evidence for the truth of these laws.

Experimental evidence.

The law of the conservation of matter, an important element in the atomic theory, has been roughly verified by innumerable analyses, in which, a given weight of a substance having been taken, each ingredient in it is isolated and its weight separately determined; the total weight of the ingredients is always found to be very nearly equal to the weight of the original substance. But on account of experimental errors in weighing and measuring, and through loss of material in the transfer of substances from one vessel to another, such analyses are rarely trustworthy to more than one part in about 500; so that small changes in weight consequent on the chemical change could not with certainty be proved or disproved. A few experimenters have carried the verification much further. Stas, in his syntheses of silver iodide, weighed the silver and the iodine separately, and after converting them into the compound he weighed this also. In each of a number of experiments he found that the weight of the silver iodide did not differ by one twenty-thousandth of the whole from the sum of the weights of the silver and the iodine used. His analyses of another compound, silver iodate, confirm the law to one part in 78,000. In E. W. Morley's experiments on the synthesis of water the hydrogen, the oxygen and the water that had been formed were separately determined; taking the mean of his results, the sum of the weights of the ingredients is not found to differ from the weight of the product by one part in 10,000. It is evident that if our experiments are solely directed to the verification of this law, they should, if possible, be carried out in a hermetically closed vessel, the vessel and its contents being weighed before and after the chemical change. The extremely careful experiments of this kind, by H. Landolt and others, made it at first appear that the change in weight, if there is any, consequent on a chemical change can rarely exceed one-millionth of the weight of the reacting substances, and that it must often be much less. The small discrepancies found are so easily accounted for by attributing them to experimental errors that, until recently, every chemist would have regarded the law as sufficiently verified. Landolt's subsequent experiments showed, what was already noticed in the earlier ones, that these minute changes in weight are nearly always losses, the products weigh less than the components, while if they had been purely experimental errors, due to weighing, they might have been expected to be as frequently gains as losses. Landolt was disposed to attribute these losses in weight to the containing vessel, which was of glass or quartz, not being absolutely impervious, but in 1908 he showed that, by making allowance for the moisture adsorbed on the vessel, the errors were both positive and negative, and were less than one in ten million. He concluded that *no change of weight can be detected.* Modern researches (see RADIOACTIVITY) on the complex nature of the atom have a little shaken the belief in the absolute permanence of matter. But it seems pretty clear that if there is any change in weight consequent on chemical change, it is *too minute to be of importance to the chemist*, though the methods of modern physics may settle the question. (See ELEMENT.)

The law of constant proportions is easily verified to a moderate degree of accuracy by such experiments as the following. We can prepare, in the laboratory, a white powder that proves to be calcium carbonate, that is, it appears to be wholly composed of carbon dioxide and lime. We find in nature two other unlike substances, marble and Iceland spar, each of which is wholly composed of carbon dioxide and lime. Thus these three substances, unlike in appearance and origin, are composed of the same ingredients: if small variations in the combining ratio of the components were possible, we might expect to find them in such a case as this. But analysis has failed to find such differences; the ratio of the weights of lime and carbon dioxide is found to be the same in all three substances. Such analyses, which do not always admit of great accuracy, have been confirmed by a few carefully planned experiments in which two components were brought together under very varied conditions, and the resulting compound analysed. Stas carried out such experiments on the composition of silver chloride and of ammonium chloride, but he never found a variation of one part in 10,000 in the composition of the substances.

The two laws discussed above were more or less accepted before the promulgation of the atomic theory, but the law of multiple proportions is the legitimate offspring of this theory. Berzelius saw at once that it afforded an admirable test for the correctness of Dalton's views, and he made numerous experiments expressly designed to test the law. One of these experiments may be described. Two chlorides of copper are known, one a highly coloured substance, the other quite white. Berzelius took 8 grams of copper, converted it into the coloured chloride, and sealed up the whole of this in solution, together with a weighed strip of copper. After some time the colour entirely disappeared; the strip of copper was then taken out and reweighed, and it was found to have lost 8·03 grams. Thus the chlorine, which in the coloured compound was in union with 8 grams of copper, appears, in the colourless chloride, to be combined with 16·03 grams, or almost exactly double the amount. It is easy to verify this result. In a series of repetitions of the experiment, by different observers, the following numbers were obtained for the ratio of the copper in the two chlorides; 1·98, 1·97, 2·03, 2·003, the mean value being 1·996. It will be noticed that the ratio found is sometimes above and sometimes below the number 2, which is required by the atomic theory, and therefore the deviations may not unreasonably be attributed to experimental errors. Such experiments—and numerous ones of about this degree of accuracy have been made on a variety of substances—give a high degree of probability to the law, but leave it an open question whether it has the exactitude of the law of the conservation of matter, or whether it is only approximately true. The question is, however, vital to the atomic theory. It is, therefore, worth while to quote a verification of great exactitude from the work of Stas and J. B. A. Dumas[1] on the composition of the two oxides of carbon. From their work it follows that the ratio of the weights of oxygen combined with unit weight of carbon in the two oxides is 1·99995, or with somewhat different data, 1·9996.

The law of reciprocal proportion, of which some examples have been already given, is part of a larger law of equivalence that underlies most of our chemical methods and calculations. One section of the law expresses the fact that the weights of two substances, not necessarily elements, that are equivalent in one reaction, are often found to be equivalent in a number of other reactions. The neutralization of acids by bases affords many illustrations, known even before the atomic theory, of the truth of the statement. It is universally found that the weights of two bases which neutralize the same weight of one acid are equivalent in their power of neutralizing other acids. Thus 5 parts by weight of soda, 7 of potash and 3·5 of quicklime will each neutralize 4·56 parts of hydrochloric acid or 7·875 of nitric or 6·125 parts of sulphuric acid; these weights, in fact, are mutually equivalent to one another. The Daltonian would say that each of these weights represents a certain group of atoms, and that these groups can replace, or combine with, each other, to form new molecules. The change from a binary compound, that is, one containing two elements, to a ternary compound in which these two elements are associated with a third, sometimes affords a very good test for the theory. The atomic theory can picture the change from the binary to the ternary compound simply as the addition of one or more atoms of the third element to the previously existing molecule; in such a case the combining ratio of the first two elements should be absolutely the same in both compounds. Berzelius tested this prediction. He showed that lead sulphide, a black substance containing only lead and sulphur, could be *converted* by oxidation into lead sulphate, a white compound containing oxygen as well as lead and sulphur. The whole of the lead and sulphur of the sulphide was found to be present in the sulphate; in other words, the combining ratio of the lead and sulphur was not altered by the addition of the oxygen. This is found to be a general rule. It was verified very exactly by Stas's experiments, in which he removed the oxygen from the ternary compound silver iodate and found that the whole of the silver and the iodine remained in combination with each other as silver iodide; his results prove, to one part in ten millions, that the combining ratio of the silver and the iodine is unaltered by the removal of the oxygen.

The above gives some idea of the evidence that has been accumulated in favour of the laws of chemical combination, laws which can be deduced from the atomic theory. Whenever any of these laws, or indeed any prediction from the theory, can be tested it has so far proved to be in harmony with experiment. The existence of the periodic law (see ELEMENT), and the researches of physicists on the constitution of matter (*q.v.*), also furnish very strong support to the theory.

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[1] Freund, *The Study of Chemical Composition*.

Atomic weight.

Dalton was of the opinion that it was possible to determine the weights of the elementary atoms in terms of any one by the analysis of compounds. It is evident that this is practicable if the number and kind of atoms contained in the molecule of a compound can be determined. To take the simplest possible case, if Dalton had been correct in assuming that the molecule of water was made up of one atom of oxygen and one of hydrogen, then the experimental fact that water contains eight parts by weight of oxygen to one part of hydrogen, would at once show that the atom of oxygen is eight times as heavy as the atom of hydrogen, or that, taking the atomic weight of hydrogen as the unit, the atomic weight of oxygen is 8. Similarly, Dalton's diagram for ammonia, together with the fact that ammonia contains 4·67 parts of nitrogen to one of hydrogen, at once leads to the conclusion that the atomic weight of nitrogen is 4·67. But, unfortunately, the assumption as to the number of atoms in the molecules of these two compounds was an arbitrary one, based on no valid evidence. It is now agreed that the molecule of water contains two atoms of hydrogen and one of oxygen, so that the atomic weight of oxygen becomes 16, and similarly that the molecule of ammonia contains three atoms of hydrogen and one of nitrogen, and that consequently the atomic weight of nitrogen is 14. On account of this difficulty, the atomic weights published by Dalton, and the more accurate ones of Berzelius, were not always identical with the values now accepted, but were often simple multiples or submultiples of these.

Formulae.

The "symbols" for the elements used by Dalton, apparently suggested by those of the alchemists, have been rejected in favour of those which were introduced by Berzelius. The latter employed the first letter, or the first two letters, of the name of an element as its symbol. The symbol, like that of Dalton, always stands for the atomic weight of the element, that is, while H stands for one part by weight of hydrogen, O stands for 16 parts of oxygen, and so on. The symbols of compounds become very concise, as the number of atoms of one kind in a molecule can be expressed by a sub-index. Thus the symbol or formula H_2O for water expresses the view that the molecule of water consists of one atom of oxygen and two of hydrogen; and if we know the atomic weights of oxygen and hydrogen, it also tells us the composition of water by weight. Similarly, the modern formula for ammonia is NH_3.

The superiority of this notation over that of Dalton is not so obvious when we consider such simple cases as the above, but chemists are now acquainted with very complex molecules containing numerous atoms; cane sugar, for example, has the formula $C_{12}H_{22}O_{11}$. It would be a serious business to draw a Daltonian diagram for such a molecule.

Dalton believed that the molecules of the elementary gases consisted each of one atom; his diagram for hydrogen gas makes the point clear. We now believe that the molecule of an element is frequently made up of two or more atoms; thus the formulae for the gases hydrogen, oxygen and nitrogen are H_2, O_2, N_2, while gaseous phosphorus and sulphur are probably P_4 and S_6, and gaseous mercury is Hg_1,—that is, the molecule of this element is monatomic. This view, as to the frequently complex nature of the elementary molecule, is logically and historically connected with the striking hypothesis of Amadeo Avogadro and A. M. Ampère. These natural philosophers suggested that equal volumes of all gaseous substances must contain, at the same temperature and pressure, the same number of molecules. Their hypothesis explains so many facts that it is now considered to be as well established as the parts of the theory due to Dalton.[1] This principle at once enables the weights of molecules to be compared even when their composition is unknown; it is only necessary to determine the specific gravities of the various gases referred to some one of them, say hydrogen; the numbers so obtained giving the weights of the molecules referred to that of the hydrogen molecule.

Present position of the atomic theory.

The atomic theory has been of priceless value to chemists, but it has more than once happened in the history of science that a hypothesis, after having been useful in the discovery and the co-ordination of knowledge, has been abandoned and replaced by one more in harmony with later discoveries. Some distinguished chemists have thought that this fate may be awaiting the atomic theory, and that in future chemists may be able to obtain all the guidance they need from the science of the transformations of energy. But modern discoveries in radioactivity[2] are in favour of the existence of the atom, although they lead to the belief that the atom is not so eternal and unchangeable a thing as Dalton and his predecessors imagined, and in fact, that the atom itself may be subject to that eternal law of growth and decay of which Lucretius speaks. (F. H. Ne.)

The religious doctrine.

ATONEMENT and **DAY OF ATONEMENT.** "Atone" (originally—see below—"at one") and "atonement" are terms ordinarily used as practically synonymous with satisfaction, reparation, compensation, with a view to reconciliation. As the English technical terms representing a theological doctrine which plays an important part not only in Christianity but in most religions, the underlying ideas require more detailed analysis. A doctrine of atonement makes the following presuppositions. (*a*) There is a natural relation between God and man in which God looks favourably upon man. (*b*) This relation has been disturbed so that God regards man's character and conduct with disapproval, and inflicts suffering upon him by way of punishment. In the higher religions the disturbance is due, as just implied, to unsatisfactory conduct on man's part, *i.e.* sin. (*c*) The normal relation may be restored, *i.e.* sin may be forgiven; and this restoration is the atonement.

The problem of the atonement is the means or condition of the restoration of man to God's favour; this has been variously found (*a*) in the endurance of punishment; (*b*) in the payment of compensation for the wrong done, the compensation consisting of sacrifices and other offerings; (*c*) in the performance of magical or other ritual, the efficacy of the ritual consisting in its being pleasing to or appointed by God, or even in its having a coercive power over the deity; (*d*) in repentance and amendment of life. Most theories of atonement would combine two or more of these, and would include repentance and amendment. Some or all of the conditions of atonement may be fulfilled, according to various views, either by the sinner or vicariously on his behalf by some kinsman; or by his family, clan or nation; or by some one else.

Old Testament.

In the Old Testament, "atonement," "make an atonement" represent the Hebrew *kippur* and its derivatives. It is doubtful whether this root meant originally to "cover" or "wipe out"; but probably it is used as a technical term without any consciousness of its etymology. The Old Testament presents very varied teaching on this subject without attempting to co-ordinate its doctrines in a harmonious system. In some cases there is no suggestion of any forgiveness; sinners are "cut off" from the chosen people; individuals and nations perish in their iniquity.[3] Some passages refer exclusively to the endurance of punishment as a condition of pardon;[4] others to the penitence and amendment of the sinner.[5] In Ezekiel xxxvi. 25-31, repentance is called forth by the divine forgiveness.

Sacrifice and other rites are also spoken of as conditions of the restoration of man to happy relations with God. The Priestly Code (Leviticus and allied passages) seems to confine the efficacy of sacrifice to ritual, venial and involuntary sins,[1] and requires that the sacrifices should be offered at Jerusalem by the Aaronic priests; but these limitations did not belong to the older religion; and even in later times popular faith ascribed a larger efficacy to sacrifice. On the other hand, other passages protest against the ascription of great importance to sacrifice; or regard the rite as a consequence rather than a cause of forgiveness.[2] The Old Testament has no theory of sacrifice; in connexion with sin the sacrifice was popularly regarded as payment of penalty or compensation. Lev. xvii. 11 suggests a mystic or symbolic explanation by its statement "the life of the flesh is in the blood; and I have given it to you upon the altar to make atonement for your lives:[3] for it is the blood that maketh atonement by reason of the life." The Old Testament nowhere explains why this importance is attached to the blood, but the passage is often held to mean that the life of the victim represented the forfeited life of the offerer.

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[1] It will be seen that in the three gas diagrams of Dalton that are reproduced above, equal numbers of molecules are contained in equal volumes, but if Dalton held this view at one time he certainly afterwards abandoned it.

[2] Rutherford, *Radioactivity*.

[3] Cf. Exodus xii. 15, &c.; Josh. vii. 24 (Achan); Jer. li. 62 (Babylon).

[4] 2 Sam. xii. 13, 14 (David); Isaiah xl. 2 (Jerusalem): in such cases, however, the context implies repentance.

[5] Ezek. xviii., Micah vi.

Jewish day of atonement.

The atoning ritual reached its climax on the Day of Atonement יוֹם הַכִּפֻּרִים, ἡμέρα ἐξιλασμοῦ, in the Mishna simply "the Day" *Yōmā*), observed annually on the 10th day of the 7th month (Tisri), in the autumn, about October, shortly before the Feast of Tabernacles or vintage festival. At one time the year began in Tisri. The laws of the Day of Atonement belong to the Priestly Code.[4] There is no trace of this function before the exile; the earliest reference to any such special time of atonement being the proposal of Ezek. xlv. 18-20 to establish two days of atonement, in the first and seventh months.[5] No doubt, however, both the principles and ritual are partly derived from earlier times. The object of the observances was to cleanse the sanctuary, the priesthood and the people from all their sins, and to renew and maintain favourable relations between Yahweh and Israel. The ritual includes features found on other holy days, sacrifices, abstinence from work, &c.; and also certain unique acts. The Day of Atonement is the only fast provided in the Law; it is only on this occasion that (*a*) the Jews are required to "afflict their souls," (*b*) the High Priest enters the Holy of Holies, (*c*) the High Priest offers incense before the mercy seat and sprinkles it with blood, and (*d*) the scapegoat or Azazel is sent away into the wilderness, bearing upon him all the iniquities of the people. In later Judaism, especially from about 100 B.C., great stress was laid on the Day of Atonement, and it is now the most important religious function of the Jews. On that day many attend the synagogues who are seldom or never seen in them at other times.

The idea of vicarious atonement appears in the Old Testament in different forms. The nation suffers for the sin of the individual;[6] and the individual for the sin of his kinsfolk[7] or of the nation.[8] Above all the Servant of Yahweh[9] appears as atoning for sinners by his sufferings and death. Again, the Old Testament speaks of the restoration of heathen nations, and of the salvation of the heathen;[10] but does not formulate any theory of atonement in this connexion. The Old Testament, however, only prepares the way for the Christian doctrine of the atonement; this is clear, inasmuch as its teaching is largely concerned with the nation, and hardly touches on the future life. Moreover, it could not define the relation of Christ to the atonement. Later Judaism emphasized the idea of vicarious atonement for Israel through the sufferings of the righteous, especially the martyrs; but it is very doubtful whether the idea of the atonement through the death of the Messiah is a pre-Christian Jewish doctrine.[11]

New Testament.

In the New Testament, the English version uses "atonement" once, Rom. v. 11, for καταλλαγή (R.V. here and elsewhere "reconciliation"). This Greek word corresponds to the idea suggested by the etymology of at-one-ment, the re-uniting in amity of those at variance, a sense which the word had in the 17th century but has since lost. But the idea which is now usually expressed by "atonement" is rather represented in the New Testament by ἱλασμός and its cognates, *e.g.* 1 John ii. 2 R.V., "He (Jesus) is the propitiation (ἱλασμός) for our sins." But these words are rare, and we read more often of "salvation" (σωτηρία) and "being saved," which includes or involves that restoration to divine favour which is called atonement. The leading varieties of teaching, the Sayings of Jesus, Paul, the Johannine writings, the Epistle to the Hebrews, connect the atonement with Christ especially with His death, and associate it with faith in Him and with repentance and amendment of life.[12]

These ideas are also common to Christian teaching generally. The New Testament, however, does not indicate that its writers were agreed as to any formal dogma of the atonement, as regards the relation of the death of Christ to the sinner's restoration to God's favour; but various suggestions are made as to the solution of the problem. St Paul's teaching connects with the Jewish doctrine of vicarious suffering, represented in the Old Testament by Is. liii., and probably, though not expressly, with the ritual sacrifices. Christ suffering on behalf of sinners satisfies the divine righteousness, which was outraged by their sin.[13] His work is an expression of God's love to man;[14] the redeeming power of Christ's death is also explained by his solidarity with humanity as the second Adam,[15]—the redeemed sinner has "died with Christ."[16] Some atoning virtue seems also attributed to the Resurrection;[17] Christ's sayings connect admission to the kingdom of God with susceptibility to the influence of His personality, faith in Himself and His mission, and the loyalty that springs from faith.[18] In John, Christ is a "propitiation" (ἱλασμός) provided by the love of God that man may be cleansed from sin; He is also their advocate (Παράκλητος) with God that they may be forgiven, for His name's sake.[19] *Hebrews* speaks of Christ as transcending the rites and officials of the law; He accomplishes the realities which they could only foreshadow; in relation to the perfect, heavenly sacrifice which atones for sin, He is both priest and victim.[20]

Later interpretation.

The subsequent development of the Christian doctrine has chiefly shaped itself according to the Pauline formula of vicarious atonement; the sufferings of Christ were accepted as a substitute for the punishment which men deserved, and so the divine righteousness was satisfied—a formula, however, which left much room for controversy. The creeds and confessions are usually vague. Thus the Apostles' Creed, "I believe in the forgiveness of sins"; the Nicene Creed, "I believe in one Lord Jesus Christ . . . who for us men and for our salvation came down from heaven . . . I acknowledge one baptism for the remission of sins"; the Athanasian Creed, "Who (Christ) suffered for our salvation." In the Thirty-nine Articles of the Church of England we have (ii.) "Christ suffered . . . to reconcile his Father to us, and to be a sacrifice, not only for original guilt, but also for all actual sins of men"; and (xxxi.) "The offering of Christ once made is that perfect redemption, propitiation, and satisfaction, for all the sins of the whole world." The council of Trent declared that "*Christus . . . nobis sua sanctissima passione ligno crucis justificationem meruit et pro nobis deo patri satisfecit,*" "Christ earned our justification by His most holy passion and satisfied God the Father for us." The Confession of Augsburg uses words equivalent to the Articles quoted above which were based upon it. The Westminster Confession declares: "The Lord Jesus Christ, by His perfect obedience and sacrifice of Himself, which He through the Eternal Spirit once offered up to God, hath fully satisfied the justice of His Father, and purchased not only reconciliation, but an everlasting inheritance in the kingdom of heaven, for all those whom the Father hath given unto Him."

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[1] Lev. iv. 2, "sin unwittingly" *bishegagā*, *c.* 450 B.C., &c.

[2] Psalm l. 10, li. 16-19; Isaiah i. 11; Micah vi. 6-8.

[3] Heb. *nephesh*, also translated "soul."

[4] Lev. xvi., xxiii. 27-32; Numb. xxix. 7-11.

[5] So Davidson, &c. with LXX. The A.V. with Hebrew text has "seventh day of the month."

[6] *e.g.* Achan, Josh. vii. 10-15.

[7] 2 Sam. xxi. 1-9; Deut. v. 9, 10.

[8] Ezek. xxi. 3, 4.

[9] Isaiah liii.

[10] Isaiah xix. 25, xlix. 6.

[11] Köberle, *Sünde und Gnade*, pp. 592 ff.

[12] Mark x. 45; Matt. xxvi. 28; 1 Cor. xv. 3; John xi. 48-52; Heb. ii. 9.

[13] Rom. iii. 25.

[14] Rom. v. 8.

[15] Rom. v. 15-19.

[16] Rom. vi. 8.

[17] Rom. iv. 25.

[18] Matt. xxv. 34 f.; Mark viii. 34 ff., ix. 36 f., x. 21.

[19] 1 John ii. 1, 2, 12, iii. 5, 8, iv. 10.

[20] Heb. ii. 17, ix. 14.

Individual theologians have sought to define more exactly the points on which the standards are vague. For instance, how was justice satisfied by Christ? The early Fathers, from Irenaeus (d. *c.* 200) to Anselm (d. 1109),[1] held, *inter alia*, that Christ paid a ransom to Satan to induce him to release men from his power. Anselm and the scholastics regarded the atonement as an offering to God of such infinite value as to outweigh men's sins, a view sometimes styled the "Commerical Theory."[2] The leading reformers emphasized the idea that Christ bore the punishment of sin, sufferings equivalent to the punishments deserved by men, a view maintained later on by Jonathan Edwards junior. But the intellectual activity of the Reformation also developed other views; the Socinians, with their humanitarian theory of the Person of Christ, taught that He died only to assure men of God's forgiving love and to afford them an example of obedience—"Forgiveness is granted upon the ground of repentance and obedience."[3] Grotius put forward what has been called the *Governmental* Theory, viz. that the atonement took place not to satisfy the wrath of God, but in the practical interests of the divine government of the world, "The sufferings and death of the Son of God are an exemplary exhibition of God's hatred of moral evil, in connexion with which it is safe and prudent to remit that penalty, which so far as God and the divine attributes are concerned, might have been remitted without it."[4]

Modern views.

The formal legal view continued to be widely held, though it was modified in many ways by various theologians. For instance, it has been held that Christ atoned for mankind not by enduring the penalty of sin, but by identifying Himself with the sinner in perfect sympathy, and feeling for him an "equivalent repentance" for his sin. Thus McLeod Campbell (*q.v.*) held that Christ atoned by offering up to God a perfect confession of the sins of mankind and an adequate repentance for them, with which divine justice is satisfied, and a full expiation is made for human guilt. A similar view was held by F. D. Maurice.[5] Others hold that the effect of the atoning death of Christ is not to propitiate God, but to reconcile man to God; it manifests righteousness, and thus reveals the heinousness of sin; it also reveals the love of God, and conveys the assurance of His willingness to forgive or receive the sinner; thus it moves men to repentance and faith, and effects their salvation; so substantially Ritschl.[6] In England much influence has been exerted by Dr R. W. Dale's *Atonement* (1875), the special point of which is that the death of Christ is not required by the personal demand of God to be propitiated, but by the necessity of honouring an ideal law of righteousness; thus, "the death of Christ is the objective ground on which the sins of men are remitted, because it was an act of submission to the righteous authority of the law by which the human race was condemned . . . and because in consequence of the relation between Him and us—His life being our own—His submission is the expression of ours, and carries ours with it . . . (and) because in His submission to the awful penalty of sin . . . there was a revelation of the righteousness of God, which must otherwise have been revealed in the infliction of the penalties of sin on the human race."[7] This view, however, leads to a dilemma; if the law of righteousness is simply an expression of the divine will, satisfaction to law is equivalent to propitiation offered to God; if the law has an independent position, the view is inconsistent with pure monotheism.

The present position may be illustrated from a work representing the more liberal Anglican theology. Bishop Lyttelton in *Lux Mundi*[8] stated that the death of Christ is propitiatory towards God because it expressed His perfect obedience, it manifested God's righteous wrath against sin, and in virtue of Christ's human nature involved man's recognition of the righteousness of God's condemnation of sin; also because in some mysterious way death has a propitiatory value; and finally because Christ is the representative of the human race. Towards man, the death of Christ has atoning efficacy because it delivers from sin, bestows the divine gift of life and conveys the assurance of pardon. The benefits of the atonement are appropriated by "the acceptance of God's forgiveness in Christ, our self-identification with Christ's atoning attitude, and then working out, by the power of the life bestowed upon us, all the (moral and spiritual) consequence of forgiveness."

At present the belief in an objective atonement is still widely held; whether in the form of penal theories—the old forensic view that the death of Christ atones by paying the penalty of man's sin—or in the form of governmental theories; that the Passion fulfilled a necessity of divine government by expressing and vindicating God's righteousness. But there is also a widespread inclination to minimize, ignore or deny the objective aspect of the atonement, the effect of the death of Christ on God's attitude towards men; and to follow the moral theories in emphasizing the subjective aspect of the atonement, the influence of the Passion on man. There is a tendency to eclectic views embracing the more attractive features of the various theories; and attempts are made to adapt, interpret and qualify the imagery and language of older formulae, in order so to speak, to issue them afresh in new editions, compatible with modern natural science, psychology and historical criticism. Such attempts are necessary in a time of transition, but they involve a measure of obscurity and ambiguity.

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(W. H. BE.)

ATRATO, a river of western Colombia, South America, rising on the slopes of the Western Cordilleras, in 5° 36′ N. lat., and flowing almost due north to the Gulf of Uraba, or Darien, where it forms a large delta. Its length is about 400 m., but owing to the heavy rainfall of this region it discharges no less than 175,000 cub. ft. of water per second, together with a very large quantity of sediment, which is rapidly filling the gulf. The river is navigable to Quibdo (250 m.), and for the greater part of its course for large vessels, but the bars at its mouth prevent the entrance of sea-going steamers. Flowing through the narrow valley between the Cordillera and coast range, it has only short tributaries, the principal ones being the Truando, Sucio and Murri. The gold and platinum mines of Choco were on some of its affluents, and the river sands are auriferous. The Atrato at one time attracted considerable attention as a feasible route for a trans-isthmian canal, which, it was estimated, could be excavated at a cost of £11,000,000.

ATREK, a river which rises in 37° 10′ N. lat. and 59° E., in the mountains of the north-east of the Persian province of Khorasan, and flows west along the borders of Persia and the Russian Transcaspian province, till it falls, after a course of 350 m., into the south-eastern corner of the Caspian, a short distance north north-west of Astarabad.

ATREUS, in Greek legend, son of Pelops and Hippodameia, and elder brother of Thyestes. Having murdered his step-brother Chrysippus, Atreus fled with Thyestes to Mycenae, where he succeeded Eurystheus in the sovereignty. His wife Aërope was seduced by Thyestes, who was driven from Mycenae. To avenge himself, Thyestes sent Pleisthenes (Atreus' son whom Thyestes had brought up as his own) to kill Atreus, but Pleisthenes was himself slain by his own father. After this Atreus, apparently reconciled to his brother, recalled him to Mycenae and invited him to a banquet to eat of his son, whom Atreus had slain. Thyestes fled in horror. Subsequently Atreus married the daughter of Thyestes, Pelopia, who had by her own father a son, Aegisthus, who was adopted by Atreus. Thyestes was found by Agamemnon and Menelaus, the sons of Atreus, and imprisoned at Mycenae. Aegisthus being sent to murder Thyestes, mutual recognition took place, and Atreus was slain by the father and son, who seized the throne, and drove Agamemnon and Menelaus out of the country (Thucydides i. 9; Hyginus, *Fabulae*; Apollodorus). Homer does not speak of the horrors of the story, which are first found in the tragedians; he merely states (*Iliad*, ii. 105) that Atreus at his death left the kingdom to Thyestes.

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[1] Stevens, *Christian Doctrine of Salvation*, p. 138.

[2] *Ibid.* p. 151.

[3] Shedd, *Hist. of Christ. Doctr.* ii. 385 ff.; cf. van Oosterzee, *Christ. Dogmatics*, 611.

[4] Shedd ii. 358 f.

[5] Crawford, *Scripture Doctrine of the Atonement*, pp. 327 ff.

[6] Orr, *Ritschlian Theology*, pp. 149 ff.

[7] Dale, *Atonement*, pp. 430 ff.

[8] Pp. 209, 212, 214, 216, 219, 221, 225.

See T. Voigt in *Dissert. philol. Halenses.* vi. (1886).

ATRI, a town of the Abruzzi, Italy, in the province of Teramo, 6 m. W. of the station of that name on the railway from Ancona to Foggia, and 18 m. due E.S.E. of Teramo, on the site of the ancient *Hadria* (*q.v.*). Pop. (1901) 13,448. Its Gothic cathedral (1285–1305) is remarkably fine; and the interior, though spoilt by restoration in 1657, contains some important frescoes of the end of the 15th century by Andrea di Lecce and his pupils. The crypt was originally a cistern of the Roman period. The palace of the Acquaviva family, who were dukes of Atri from 1398 to 1775, is a massive building situated in the principal square.

ATRIUM (either from *ater*, black, referring to the blackening of the walls from the smoke of the hearth, or from the Greek αἴθριον, open to the sky, or from an Etruscan town, Atria, where the style of building is supposed to have originated), the principal entrance hall or court of a Roman dwelling, giving access and light to the rooms round it. The centre of the roof over the atrium was open to the sky and called the *compluvium*; the rain-water from the roof collected in the gutters was discharged into a marble tank underneath, which was known as the *impluvium*. In the early periods of Roman civilization the atrium was the common public apartment, and was used for the reception of visitors and clients, and for ordinary domestic purposes, as cooking and dining. In it were placed the ancestral pictures, the marriage-couch, the hearth and generally a small altar. At a somewhat later period, and among the wealthy, separate apartments were built for kitchens and dining-rooms, and the atrium was kept as a general reception-room for clients and visitors. There were many varieties of the atrium, depending on the way in which the roof was carried. These are described by Vitruvius under the title of *cavaedium*.

Other buildings, both consecrated and unconsecrated, were called by the term (corresponding to the English "hall"), such as the Atrium Vestae, where the vestal virgins lived, and the Atrium Libertatis, the residence of the censor, where Asinius Pollio established the first public library at Rome.

The word *atrium* in Rome had a second signification, being given to an open court with porticos round, sometimes placed in front of a temple. A similar arrangement was adopted by the early Christians with relation to the Basilica, in front of which there was an open court surrounded by colonnades or arcades. The church of San Clemente at Rome, that of Sant' Ambrogio at Milan and the cathedral of Parenzo in Istria still retain their atria.

ATROPHY (Gr. ἀ- priv., τροφή, nourishment), a term in medicine used to describe a state of wasting due to some interference with the function of healthy nutrition (see PATHOLOGY). In the living organism there are always at work changes involving the waste of its component tissues, which render necessary, in order to maintain and preserve life, the supply and proper assimilation of nutritive material. It is also essential for the maintenance of health that a due relation exist between these processes of waste and repair, so that the one may not be in excess of the other. When the appropriation of nutriment exceeds the waste, hypertrophy (*q.v.*) or increase in bulk of the tissues takes place. When, on the other hand, the supply of nutritive matter is suspended or diminished, or when the power of assimilation is impaired, atrophy or wasting is the result. Thus the whole body becomes atrophied in many diseases; and in old age every part of the frame, with the single exception of the heart, undergoes atrophic change. Atrophy may, however, affect single organs or parts of the body, irrespective of the general state of nutrition, and this may be brought about in a variety of ways. One of the most frequently observed of such instances is atrophy from disuse, or cessation of function. Thus, when a limb is deprived of the natural power of motion, either by paralysis or by painful joint disease, the condition of exercise essential to its nutrition being no longer fulfilled, atrophy of all its textures sooner or later takes place. The brain in imbeciles is frequently observed to be shrivelled, and in many cases of blindness there is atrophy of the optic nerve and optic tract. This form of atrophy is likewise well exemplified in the case of those organs and structures of the body which subserve important ends during foetal life, but which, ceasing to be necessary after birth, undergo a sort of natural atrophy, such as the thymus gland and certain vessels specially concerned in the foetal circulation. The uterus after parturition undergoes a certain amount of atrophy, and the ovaries, after the child-bearing period, become shrunken. Atrophy of a part may also be caused by interruption to its normal blood-supply, as in the case of the ligature or obstruction of an artery. Again, long-standing disease, by affecting the nutrition of an organ and by inducing the deposit of morbid products, may result in atrophy, as frequently happens in affections of the liver and kidneys. Parts that are subjected to continuous pressure are liable to become atrophied, as is sometimes seen in internal organs which have been pressed upon by tumours or other morbid growths, and is well illustrated in the Chinese practice of foot-binding. Atrophy may manifest itself simply by loss of substance; but, on the other hand, it is often found to co-exist with degenerative changes in the textures affected and the formation of adventitious growth, so that the part may not be reduced in bulk although atrophied as regards its proper structure. Thus, in the case of the heart, when affected with fatty degeneration, there is atrophy of the proper muscular texture, but as this is largely replaced by fatty matter, the organ may undergo no diminution in volume, but may, on the contrary, be increased in size. Atrophy is usually a gradual and slow process, but sometimes it proceeds rapidly. In the disease known by the name of *acute yellow atrophy of the liver*, that organ undergoes such rapidly destructive change as results in its shrinking to half, or one-third, of its normal size in the course of a few days. The term *progressive muscular atrophy* (synonyms, *wasting* or *creeping palsy*) is applied to an affection of the muscular system, which is characterized by the atrophy and subsequent paralysis of certain muscles, or groups of muscles, and is associated with morbid changes in the anterior roots of the nerves of the spinal cord. This disease begins insidiously, and is often first observed to affect the muscles of one hand, generally the right. The attention of the sufferer is first attracted by the power of the hand becoming weakened, and then there is found to be a wasting of certain of its muscles, particularly those of the ball of the thumb. Gradually other muscles in the arms and legs become affected in a similar manner, their atrophy being attended with a corresponding diminution in power. Although sometimes arrested, this disease tends to progress, until in course of time the greater part of the muscular system is implicated and a fatal result ensues.

ATROPOS, in Greek mythology, the eldest of the three Fates (see FATE). Her name, the "Unalterable" (ἀ- privative, and τρέπειν, to turn), indicates her function, that of rendering the decisions of her sisters irreversible or immutable. Atropos is most frequently represented with scales, a sun-dial or a cutting instrument, the "abhorred shears," with which she slits the thin-spun thread of life that has been placed on the spindle by Clotho and drawn off by Lachesis.

ATTA, TITUS QUINCTIUS, or QUINTICIUS (d. 77 B.C.), Roman comedy writer, was, like Titinius and Afranius, distinguished as a writer of *fabulae togatae*, national comedies. He had the reputation of being a vivid delineator of character, especially female. He also seems to have published a collection of epigrams. The scanty fragments contain many archaisms, but are lively in style. According to Horace (*Epistles*, ii 1. 79) the plays of Atta were still put on the stage in his time.

Aulus Gellius vii. 9; fragments in Neukirch, *De fabula togata Romanorum* (1833); Ribbeck, *Comicorum Latinorum reliquiae* (1855).

ATTACAPA (Choctaw for "cannibal"), a tribe of North-American Indians, whose home was in south-west Louisiana; they are now practically extinct.

ATTACHMENT,[1] in law, a process from a court of record, awarded by the justices at their discretion, on a bare suggestion, or on their own knowledge, and properly grantable in cases of contempt. It differs from arrest (*q.v.*), in that he who arrests a man carries him to a person of higher power to be forthwith disposed of; but he that attaches keeps the party attached, and presents him in court at the day assigned, as appears by the words of the writ. Another difference is, that arrest is only upon the body of a man, whereas an attachment is often upon his goods. It is distinguished from distress in not extending to lands, as the latter does; nor does a distress touch the body, as an attachment does. Every court of record has power to fine and imprison for contempt of its authority. Attachment being merely a process to bring the defendant before the court, is not necessary in cases of contempt in the presence of the court itself. Attachment will be granted in England against peers and members of parliament only for such gross contempts as rescues, disobedience to the sovereign's writs and the like. Attachment will not lie against a corporation. The county courts in this respect are regulated by acts of 1846 and 1849. They can only punish for contempts committed in presence of the court (see CONTEMPT OF COURT). Attachments are granted on a rule in the first instance to show cause, which must be personally served before it can be made absolute, except for non-payment of costs on a master's allocatur, and against a sheriff for not obeying a rule to return a writ or to bring in the body. The offender is then arrested, and when committed will be compelled to answer interrogatories, exhibited against him by the party at whose instance the proceedings have been had; and the examination when taken is referred to the master, who reports thereon, and on the contempt being reported, the court gives judgment according to its discretion, in the same manner as upon a conviction for a misdemeanour at common law. Sir W. Blackstone observes that "this method of making the defendant answer upon oath to a criminal charge is not agreeable to the genius of the common law in any other instance"; and the elasticity of the legal definitions of contempt of court, especially with respect to comments on judicial proceedings, is the subject of much complaint.

Attachment of Debts.—It was suggested by the common law commissioners in 1853 that a remedy analogous to that of Foreign Attachment (see below) might be made available to creditors, after judgment, against debts due to their debtors. Accordingly, the Common Law Procedure Act 1854 enacted that any creditor, having obtained judgment in the superior courts, should have an order that the judgment debtor might be examined as to any debts due and owing to him before a master of the court. The rules and regulations under the Judicature Act 1873 retained the process for attachment of debts as established by the Procedure Act of 1854. On affidavit that the judgment was still unsatisfied, and that any other person within the jurisdiction was indebted to the judgment debtor, the judge was empowered to attach all debts due from such third person (called the *garnishee*) to the judgment debtor, to answer the judgment debt. This order binds the debts in the hands of the garnishee, and if he does not dispute his liability execution issues against him at once. If he disputes his liability the question must be tried. Payment by the garnishee or execution against him is a complete discharge as against the judgment debtor. These provisions were, by an order in council of the 18th of November 1867, extended to the county courts. By the Wages Attachment Abolition Act 1870 it is enacted that no order for the attachment of the wages of any servant, labourer or workman shall be made by the judge of any court of record or inferior court, and by the Merchant Shipping Act 1894 it is enacted that the wages of a seaman or apprentice are not subject to attachment.

In the United States attachment of debts is a statutory remedy accorded in most of the states in certain circumstances for the security of creditors, by the seizure by the sheriff of the debtor's goods or the imposition of a lien upon his land, before judgment, and sometimes at the very commencement of the action. In some states it is only allowed in special cases, as when the debtor has absconded, or is a non-resident or guilty of fraud; in a few it may be had, as of right, at the commencement of ordinary actions. The common-law courts of the United States (by act of Congress) follow the practice in this regard of the state in which they sit. Such attachments (on mesne process) can generally be dissolved by the substitution of a bond with surety. The body can also be attached in most states on civil actions of tort (for a wrongful or negligent act to the damage of another), but not in actions on contract.

Foreign Attachment is an important custom prevailing in the city of London, whereby a creditor may attach money owing to his debtor, or property belonging to him in the possession of third parties. The person holding the property or owing the money must be within the city at the time of being served with the process, but all persons are entitled to the benefit of the custom. The plaintiff having commenced his action, and made a satisfactory affidavit of his debt, is entitled to issue attachment, which thereupon affects all the money or property of the defendant in the hands of the third party, the garnishee. The garnishee, of course, has as against the attachment all the defences which would be available to him against the defendant, his alleged creditor. The garnishee may plead payment under the attachment, if there has been no fraud or collusion, in bar to an action by the defendant for his debt or property. The court to which this process belongs is the mayor's court of London, the procedure in which is regulated by the Mayor's Court of London Procedure Act 1857. This custom, and all proceedings relating thereto, are expressly exempted from the operation of the Debtor's Act 1869. Similar customs exist in Bristol and a few other towns in England and also in Scotland.

A Writ of Attachment enforces answers and obedience to decrees and orders of the High Court of Justice, and is made out without order upon an affidavit of the due service of the process, &c., with whose requirements compliance is sought. A corporation, however, is proceeded against by distringas and not by attachment. It was formerly competent to the plaintiff to compel the appearance of a defendant in chancery by attachment, but the usual course was to enter appearance for him in case of default. It is one of the modes of execution allowed for the recovery of property other than land or money.

Attachment of the Forest was the proceeding in the courts of attachments, Woodmote, or Forty Days' courts. These courts have fallen into desuetude. They were held before the verderers of the royal forests in different parts of the kingdom once in every forty days, for the purpose of inquiring into all offences against "vert (greensward) and venison." The attachment was by the bodies of the offenders, if taken in the very act of killing venison, or stealing wood, or preparing so to do, or by fresh and immediate pursuit after the act was done; else they must be attached by their goods. These attachments were received by the verderers and enrolled, and certified under their seals to the Swainmote, or Court of Justice-seat, which was the superior of the forest courts.

ATTAINDER (from the O. Fr. *ataindre*, *ateindre*, to attain, *i.e.* to strike, accuse, condemn; Lat. *attingere*, *tangere*, to touch; the meaning has been greatly affected by the confusion with Fr. *taindre*, *teindre*, to taint, stain, Lat. *tingere*, to dye), in English law, was the immediate and inseparable consequence from the common law upon the sentence of death. When it was clear beyond all dispute that the criminal was no longer fit to live he was called *attaint*, and could not, before the Evidence Act 1843, be a witness in any court. This attainder took place after judgment of death, or upon such circumstances as were equivalent to judgment of death, such as judgment of outlawry on a capital crime, pronounced for absconding from justice. Conviction without judgment was not followed by attainder. The consequences of attainder were (1) forfeiture, (2) corruption of blood. On attainder for treason, the criminal forfeited to the crown his lands, rights of entry on lands, and any interest he might have in lands for his own life or a term of years. For murder, the offender forfeited to the crown the profit of his freeholds during life, and in the case of lands held in fee-simple, the lands themselves for a year and a day; subject to this, the lands escheated to the lord of the fee. These forfeitures related back to the time of the offence committed. Forfeitures of goods and chattels ensued not only on attainder, but on conviction for a felony of any kind, or on flight from justice, and had no relation backwards to the time of the offence committed. By *corruption of blood*, "both upwards and downwards," the attainted person could neither inherit nor transmit lands. The lands escheated to the lord of the fee, subject to the crown's right of forfeiture. The doctrine of attainder has, however, ceased to be of much importance. The Forfeiture Act 1870 enacted that henceforth no confession, verdict, inquest, conviction or judgment of or for any treason or felony, or *felo de se*, should cause any attainder or corruption of blood, or any forfeiture or escheat. Sentence of death, penal servitude or imprisonment with hard labour for more than twelve months, after conviction for treason or felony, disqualifies from holding or retaining a seat in parliament, public offices under the crown or otherwise, right to vote at elections, &c., and such disability is to remain until the punishment has been suffered or a pardon obtained. Provision was made for the due administration of convicts' estates, in the interests of themselves and their families. Forfeiture consequent on outlawry was exempted from the provisions of the act. The United States constitution (Art. III. s. 3) says: "The Congress shall have power to declare the punishment of treason, but no attainder of treason shall work corruption of blood, or forfeiture except during the life of the person attainted."

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[1] "To attach" is first used in English in the legal sense of arrest or seizure, and the sense of "fasten to" is comparatively late. The Old French *atachier*, modern *attacher*, from which the English "attach" is derived, is from a word for a peg or nail, in English "tack," which is found in many forms in Scandinavian and Celtic languages, and is ultimately connected with the root seen in Latin *tangere*, to touch. The Italian *attacare*, especially in the phrase *attacare battaglia*, to join battle, gave the French *attaquer*, whence the English "attack," which is therefore by origin a doublet of "attach."

Bills of Attainder, in English legal procedure, were formerly a parliamentary method of exercising judicial authority. They were ordinarily initiated in the House of Lords and the proceedings were the same as on other bills, but the parties against whom they were brought might appear by counsel and produce witnesses in both Houses. In the case of an impeachment (*q.v.*), the House of Commons was prosecutor and the House of Lords judge; but such bills being *legislative* in form, the consent of crown, lords and commons was necessary to pass them. Bishops, who do not exercise but who claim the right to vote in cases of impeachment(*q.v.*), have a right to vote upon bills of attainder, but their vote is not conclusive in passing judgment upon the accused. First passed in 1459, such bills were employed, more particularly during the reigns of the Tudor kings, as a species of extrajudicial procedure, for the direct punishment of political offences. Dispensing with the ordinary judicial forms and precedents, they took away from the accused whatever advantages he might have gained in the courts of law; such evidence only was admitted as might be necessary to secure conviction; indeed, in many cases bills of attainder were passed without any evidence being produced at all. In the reign of Henry VIII. they were much used, through a subservient parliament, to punish those who had incurred the king's displeasure; many distinguished victims who could not have been charged with any offence under the existing laws being by this means disposed of. In the 17th century, during the disputes with Charles I., the Long Parliament made effective use of the same procedure, forcing the sovereign to give his consent. After the Restoration it became less frequent, though the Jacobite movement in Scotland produced several instances of attainder, without, however, the infliction of the extreme penalty of death. The last bill of attainder passed in England was in the case of Lord Edward Fitzgerald, one of the Irish rebel leaders of 1798.

A bill for reversing attainder took a form contrary to the usual rule. It was first signed by the sovereign and presented by a peer to the House of Lords by command of the crown, then passed through the ordinary stages and on to the commons, to whom the sovereign's assent was communicated before the first reading was taken, otherwise the whole proceedings were null and void.

A *Bill of Pains and Penalties* resembles a bill of attainder in object and procedure, but imposes a lesser punishment than death. The most notable instances of the passing of a bill of pains and penalties are those of Bishop Atterbury in 1722, and of Queen Caroline, wife of George IV., in 1820.

The constitution of the United States declares that "no bill of attainder or *ex post facto* law shall be passed."

ATTAINT, WRIT OF, an obsolete method of procedure in English law, for inquiring by a jury of twenty-four whether a false verdict had been given in a trial before an ordinary jury of twelve. If it were found that an erroneous judgment had been given, the wrong was redressed and the original jury incurred infamy, with imprisonment and forfeiture of their goods, which punishments were, however, commuted later for a pecuniary penalty. In criminal cases a writ of attaint was issued at suit of the king, and in civil cases at the suit of either party. In criminal cases it appears to have become obsolete by the end of the 15th century. Procedure by attaint in civil cases had also been gradually giving place to the practice of granting new trials, and after the decision in Bushell's case in 1670 (see JURY) it became obsolete, and was finally abolished by the Juries Act 1825, except as regards jurors guilty of embracery (*q.v.*).

ATTALIA, an ancient city of Pamphylia, which derived its name from Attalus II., king of Pergamum; the modern Adalia (*q.v.*). It was important as the nearest seaport to the rich districts of south-west Phrygia. A much-frequented "half-sea" route led through it to the Lycus and Maeander valleys, and so to Ephesus and Smyrna. This was the natural way from any part of central Asia Minor to Syria and Egypt, and accordingly we hear of Paul and Barnabas taking ship at Attalia for Antioch. Originally the port of Perga, Attalia eclipsed the old Pamphylian capital in early Christian times and became the metropolis. There are extensive remains of the ancient walls, including some portions which go back to the foundation of the Pergamenian city. The most conspicuous monument is the triple Gate of Hadrian, flanked by a tower built by the empress Julia. This lies about half-way round the *enceinte* and formerly admitted the road from Perga.

ATTAR [or OTTO] **OF ROSES** (Pers. *'aṭar*, essence), a perfume consisting of essential oil of roses, prepared by distilling, or, in some districts, by macerating the flowers. The manufacture is chiefly carried out in India, Persia and the Balkans; the last named supplying the bulk of the European demand. It is used by perfumery manufacturers as an ingredient. The genuine attar of roses is costly and it is frequently adulterated.

ATTEMPT (Lat. *adtemptare*, *attentare*, to try), in law, an act done with intent to commit a crime, and forming one of a series of acts which would constitute its actual commission if it were not interrupted. An attempt must proceed beyond mere preparation, but at the same time it must fall short of the ultimate purpose in any part of it. The actual point, however, at which an act ceases to be an attempt, and becomes criminal, depends upon the circumstances of each particular case. A person may be guilty of an attempt to commit a crime, even if its commission in the manner proposed was impossible. Every attempt to commit a treason, felony or indictable misdemeanour is in itself an indictable misdemeanour, punishable by fine or imprisonment, unless the attempt to commit is specifically punishable by statute as a felony, or in a defined manner as a misdemeanour; and a person who has been indicted for a felony or misdemeanour may, if the evidence so warrants, be found guilty only of the attempt, provided that it too is a misdemeanour.

ATTENTION (from Lat. *ad-tendo*, await, expect; the condition of being "stretched" or "tense"), in psychology, the concentration of consciousness upon a definite object or objects. The result is brought about, not by effecting any change in the perceptions themselves, but simply by isolating them from other objects. Since all consciousness involves this isolation, attention may be defined generally as the necessary condition of consciousness. Such a definition, however, throws no light upon the nature of the psychological process, which is partly explained by the general law that the greater the number of objects on which attention is concentrated the less will each receive ("pluribus intentus, minor est ad singula sensus"), and conversely. There are also special circumstances which determine the amount of attention, *e.g.* influences not subject to the will, such as the vividness of the impression (*e.g.* in the case of a shock), strong change in pleasurable or painful sensations. Secondly, an exercise of volition is employed in fixing the mind upon a definite object. This is a purely voluntary act, which can be strengthened by habit and is variable in different individuals; to it the name "attention" is sometimes restricted. The distinction is expressed by the words "reflex" or "passive," and "volitional" or "active." It is important to notice that in every case of attention to an object, there must be in consciousness an implicit apprehension of surrounding objects from which the particular object is isolated. These objects are known as the "psychic fringe," and are essential to the systematic unity of the attention-process. Attempts have been made to examine the attention-process from the physiological standpoint by investigating the muscular and neural changes which accompany it, and even to assign to it a specific local centre. It has, for example, been remarked that uniformity of environment, resulting in practically automatic activity, produces mental equilibrium and the comparative disappearance of attention-processes; whereas the necessity of adapting activity to abnormal conditions produces a comparatively high degree of attention. In other words, attention is absent where there is uniformity of activity in accordance with uniform, or uniformly changing, environment. In spite of the progress made in this branch of study, it has to be remembered that all psycho-physical experiments are to some extent vitiated by the fact that the phenomena can scarcely remain normal under inspection.

See G. F. Stout, *Analytic Psychology* (London, 1896), especially part ii. chap. 2; also PSYCHOLOGY, BRAIN, &c.

ATTERBOM, PER DANIEL AMADEUS (1790–1855), Swedish poet, son of a country parson, was born in the province of Östergötland on the 19th of January 1790. He studied in the university of Upsala from 1805 to 1815, and became professor of philosophy there in 1828. He was the first great poet of the romantic movement which, inaugurated by the critical work of Lorenzo Hammersköld, was to revolutionize Swedish literature. In 1807, when in his seventeenth year, he founded at Upsala an artistic society, called the Aurora League, the members of which included V. F. Palmblad, A. A. Grafström (d. 1870), Samuel Hedborn (d. 1849), and other youths whose names were destined to take a foremost rank in the literature of their generation. Their first newspaper, *Polyfem*, was a crude effort, soon abandoned, but in 1810 there began to appear a journal, *Fosforos*, edited by Atterbom, which lasted for three years and finds a place in classic Swedish literature. It consisted entirely of poetry and aesthetico-polemical essays; it introduced the study of the newly arisen Romantic school of Germany, and formed a vehicle for the early works, not of Atterbom only, but of Hammersköld, Dahlgren, Palmblad and others. Later, the members of the Aurora League established the *Poetisk Kalender* (1812–1822), in which their poems appeared, and a new critical organ, *Svensk Litteraturtidning* (1813–1824). Among Atterbom's independent works the most celebrated is *Lycksalighetens Ö* (*The Fortunate Island*), a romantic drama of extraordinary beauty, published in 1823. Before this he had published a cycle of lyrics, *Blommorna* (*The Flowers*), of a mystical character, somewhat in the manner of Novalis. Of a dramatized fairy tale, *Fågel blå* (*The Blue Bird*), only a fragment, which is among the most exquisite of his writings, is preserved. As a purely lyrical poet he has not been excelled in Sweden, but his more ambitious works are injured by his weakness for allegory and symbolism, and his consistent adoption of the mannerisms of Tieck and Novalis. In his later years he became less violent in literary controversy. He became in 1835 professor of aesthetics and literature at Upsala, and four years later he was admitted to the Swedish Academy. He died on the 21st of July 1855. His *Svenska Siare och Skalder* (6 vols., 1841–1855, supplement, 1864) consists of a series of biographies of Swedish poets and men of letters, which forms a valuable history of Swedish letters down to the end of the "classical" period. Atterbom's works were collected (13 vols., Örebro) in 1854–1870.

ATTERBURY, FRANCIS (1662–1732), English man of letters, politician and bishop, was born in the year 1662, at Milton or Middleton Keynes in Buckinghamshire, a parish of which his father was rector. He was educated at Westminster school and at Christ Church, Oxford, where he became a tutor. In 1682 he published a translation of *Absalom and Ahithophel* into Latin verse; but neither the style nor the versification was that of the Augustan age. In English composition he succeeded much better. In 1687 he published *An Answer to some Considerations on the Spirit of Martin Luther and the Original of the Reformation*, a reply to Obadiah Walker, who, elected master of University College in 1676, had printed in a press set up by him there an attack on the Reformation, written by Abraham Woodhead. Atterbury's treatise, though highly praised by Bishop Burnet, is perhaps more distinguished for the vigour of his rhetoric than for the soundness of his arguments, and the Papists were so much galled by his sarcasms and invectives that they accused him of treason, and of having, by implication, called King James a Judas.

After the Revolution, Atterbury, though bred in the doctrines of non-resistance and passive obedience, readily swore fealty to the new government. He had taken holy orders in 1687, preached occasionally in London with an eloquence which raised his reputation, and was soon appointed one of the royal chaplains. But he ordinarily resided at Oxford, where he was the chief adviser and assistant of Dean Aldrich, under whom Christ Church was a stronghold of Toryism. Thus he became the inspirer of his pupil, Charles Boyle, in the attack (1698) on the Whig scholar, Richard Bentley (*q.v.*), arising out of Bentley's impugnment of the genuineness of the *Epistles of Phalaris*. He was figured by Swift in the *Battle of the Books* as the Apollo who directed the fight, and was, no doubt, largely the author of Boyle's essay. Bentley spent two years in preparing his famous reply, which proved not only that the letters ascribed to Phalaris were spurious, but that all Atterbury's wit, eloquence and skill in controversial fence was only a cloak for an audacious pretence of scholarship.

Atterbury was soon occupied, however, in a dispute about matters still more important and exciting. The rage of religious factions was extreme. High Church and Low Church divided the nation. The great majority of the clergy were on the High Church side; the majority of King William's bishops were inclined to latitudinarianism. In 1700 Convocation, of which the lower house was overwhelmingly Tory, had not been suffered to meet for ten years. This produced a lively controversy, into which Atterbury threw himself with characteristic energy, publishing a series of treatises written with much wit, audacity and acrimony. By the mass of the clergy he was regarded as the most intrepid champion that had ever defended their rights against the oligarchy of Erastian prelates. In 1701 he was rewarded with the archdeaconry of Totnes and a prebend in Exeter cathedral. The lower house of Convocation voted him thanks for his services; the university of Oxford created him a doctor of divinity; and in 1704, soon after the accession of Anne, while the Tories still had the chief weight in the government, he was promoted to the deanery of Carlisle.

Soon after he had obtained this preferment the Whig party came into power. From that party he could expect no favour. Six years elapsed before a change of fortune took place. At length, in the year 1710, the prosecution of Sacheverell produced a formidable explosion of High Church fanaticism. At such a moment Atterbury could not fail to be conspicuous. His inordinate zeal for the body to which he belonged, his turbulent and aspiring temper, his rare talents for agitation and for controversy, were again signally displayed. He bore a chief part in framing that artful and eloquent speech which the accused divine pronounced at the bar of the Lords, and which presents a singular contrast to the absurd and scurrilous sermon which had very unwisely been honoured with impeachment. During the troubled and anxious months which followed the trial, Atterbury was among the most active of those pamphleteers who inflamed the nation against the Whig ministry and the Whig parliament. When the ministry had been changed and the parliament dissolved, rewards were showered upon him. The lower house of Convocation elected him prolocutor, in which capacity he drew up, in 1711, the often-cited *Representation of the State of Religion*; and, in August 1711, the queen, who had selected him as her chief adviser in ecclesiastical matters, appointed him dean of Christ Church on the death of his old friend and patron Aldrich.

At Oxford he was as conspicuous a failure as he had been at Carlisle, and it was said by his enemies that he was made a bishop because he was so bad a dean. Under his administration Christ Church was in confusion, scandalous altercations took place, and there was reason to fear that the great Tory college would be ruined by the tyranny of the great Tory doctor. In 1713 he was removed to the bishopric of Rochester, which was then always united with the deanery of Westminster. Still higher dignities seemed to be before him. For, though there were many able men on the episcopal bench, there was none who equalled or approached him in parliamentary talents. Had his party continued in power it is not improbable that he would have been raised to the archbishopric of Canterbury. The more splendid his prospects the more reason he had to dread the accession of a family which was well known to be partial to the Whigs, and there is every reason to believe that he was one of those politicians who hoped that they might be able, during the life of Anne, to prepare matters in such a way that at her decease there might be little difficulty in setting aside the Act of Settlement and placing the Pretender on the throne. Her sudden death confounded the projects of these conspirators, and, whatever Atterbury's previous views may have been, he acquiesced in what he could not prevent, took the oaths to the house of Hanover, and did his best to ingratiate himself with the royal family. But his servility was requited with cold contempt; and he became the most factious and pertinacious of all the opponents of the government. In the House of Lords his oratory, lucid, pointed, lively and set off with every grace of pronunciation and of gesture, extorted the attention and admiration even of a hostile majority. Some of the most remarkable protests which appear in the journals of the peers were drawn up by him; and, in some of the bitterest of those pamphlets which called on the English to stand up for their country against the aliens who had come from beyond the seas to oppress and plunder her, critics easily detected his style. When the rebellion of 1715 broke out, he refused to sign the paper in which the bishops of the province of Canterbury declared their attachment to the Protestant succession, and in 1717, after having been long in indirect communication with the exiled family, he began to correspond directly with the Pretender.

In 1721, on the discovery of the plot for the capture of the royal family and the proclamation of King James, Atterbury was arrested with the other chief malcontents, and in 1722 committed to the Tower, where he remained in close confinement during some months. He had carried on his correspondence with the exiled family so cautiously that the circumstantial proofs of his guilt, though sufficient to produce entire moral conviction, were not sufficient to justify legal conviction. He could be reached only by a bill of pains and penalties. Such a bill the Whig party, then decidedly predominant in both Houses, was quite prepared to support, and in due course a bill passed the Commons depriving him of his spiritual dignities, banishing him for life, and forbidding any British subject to hold intercourse with him except by the royal permission. In the Lords the contest was sharp, but the bill finally passed by eighty-three votes to forty-three.

Atterbury took leave of those whom he loved with a dignity and tenderness worthy of a better man, to the last protesting his innocence with a singular disingenuousness. After a short stay at Brussels he went to Paris, and became the leading man among the Jacobite refugees there. He was invited to Rome by the Pretender, but Atterbury felt that a bishop of the Church of England would be out of place at the Vatican, and declined the invitation. During some months, however, he seemed to stand high in the good graces of James. The correspondence between the master and the servant was constant. Atterbury's merits were warmly acknowledged, his advice was respectfully received, and he was, as Bolingbroke had been before him, the prime minister of a king without a kingdom. He soon, however, perceived that his counsels were disregarded, if not distrusted. His proud spirit was deeply wounded. In 1728 he quitted Paris, fixed his residence at Montpelier, gave up politics, and devoted himself entirely to letters. In the sixth year of his exile he had so severe an illness that his daughter, Mrs Morice, herself very ill, determined to run all risks that she might see him once more. She met him at Toulouse, received the communion from his hand, and died that night.

Atterbury survived the severe shock of his daughter's death two years. He even returned to Paris and to the service of the Pretender, who had found out that he had not acted wisely in parting with one who, though a heretic, was the most able man of the Jacobite party. In the ninth year of his banishment he published a luminous, temperate and dignified vindication of himself against John Oldmixon, who had accused him of having, in concert with other Christ Church men, garbled the new edition of Clarendon's *History of the Rebellion*. The charge, as respected Atterbury, had not the slightest foundation; for he was not one of the editors of the *History*, and never saw it till it was printed. A copy of this little work he sent to the Pretender, with a letter singularly eloquent and graceful. It was impossible, the old man said, that he should write anything on such a subject without being reminded of the resemblance between his own fate and that of Clarendon. They were the only two English subjects who had ever been banished from their country and debarred from all communication with their friends by act of parliament. But here the resemblance ended. One of the exiles had been so happy as to bear a chief part in the restoration of the royal house. All that the other could now do was to die asserting the rights of that house to the last. A few weeks after this letter was written Atterbury died, on the 22nd of February 1732. His body was brought to England, and laid, with great privacy, under the nave of Westminster Abbey. No inscription marks his grave.

It is agreeable to turn from Atterbury's public to his private life. His turbulent spirit, wearied with faction and treason, now and then required repose, and found it in domestic endearments, and in the society of the most illustrious literary men of his time. Of his wife, Katherine Osborn, whom he married while at Oxford, little is known; but between him and his daughter there was an affection singularly close and tender. The gentleness of his manners when he was in the company of a few friends was such as seemed hardly credible to those who knew him only by his writings and speeches. Though Atterbury's classical attainments were not great, his taste in English literature was excellent; and his admiration of genius was so strong that it overpowered even his political and religious antipathies. His fondness for Milton, the mortal enemy of the Stuarts and of the Church, was such as to many Tories seemed a crime; and he was the close friend of Addison. His favourite companions, however, were, as might have been expected, men whose politics had at least a tinge of Toryism. He lived on friendly terms with Swift, Arbuthnot and Gay. With Prior he had a close intimacy, which some misunderstanding about public affairs at last dissolved. Pope found in Atterbury not only a warm admirer, but a most faithful, fearless and judicious adviser.

See F. Williams, *Memoirs and Correspondence of Atterbury with Notes*, &c. (1869); *Stuart Papers*, vol. i.: *Letters of Atterbury to the Chevalier St George*, &c. (1847); J. Nichols, *Epistolary Correspondence*, &c. (1783–1796); and H. C. Beeching, *Francis Atterbury*, (1909).

ATTESTATION (Lat. *adtestare*, *attestare*, to bear witness, *testis*, a witness), the verification of a deed, will or other instrument by the signature to it of a witness or witnesses, who endorse or subscribe their names under a memorandum, to the effect that it was signed or executed in their presence. The essence of attestation is to show that at the execution of the document there was present some disinterested person capable of giving evidence as to what took place. The clause at the end of the instrument, immediately preceding the signatures of the witnesses to the execution, and stating that they have witnessed it, is known as the attestation clause. In Scots law, the corresponding clause is called the testing-clause (see DEED; WILL OR TESTAMENT; WITNESS).

ATTHIS (an adjective meaning "Attic"), the name given to a monograph or special treatise on the religious and political history, antiquities and topography of Attica and Athens. During the 4th and 3rd centuries B.C., a class of writers arose, who, making these subjects their particular study, were called atthidographi, or compilers of atthides. The first of these was Clidemus or Clitodemus (about 378 B.C.); the last, Ister of Cyrene (died 212 B.C.); the most important was Philochorus (first half of the 3rd century B.C.), of whose work considerable fragments have been preserved. The names of the other atthidographi known to us are Phanodemus, Demon, Androtion, Andron, Melanthius. They laid no claim to literary skill; their style was monotonous and soon became wearisome. They were in fact chroniclers or annalists—not historians. Their only object was to set down, in plain and simple language, all that seemed worthy of note in reference to the legends, history, constitution, religion and civilization of Attica. They followed the order of the olympiads and archons, and their work was supported by the authority of original documents, monuments and inscriptions. Their writings were much used by historians, as well as by the scholiasts and grammarians.

Fragments in Müller, *Fragmenta Historicorum Graecorum*, i.

ATTIC (*i.e.* "in the Attic style"), an architectural term given to the masonry rising above the main cornice of a building, the earliest example known being that of the monument of Thrasyllus at Athens. It was largely employed by the Romans, who in their arches of triumph utilized it for inscriptions or for bas-relief sculpture. It was used also to increase the height of enclosure walls such as those of the Forum of Nerva. By the Italian revivalists it was utilized as a complete storey, pierced with windows, as found in Palladio's work at Vicenza and in Greenwich hospital. The largest attic in existence is that which surmounts the entablature of St Peter's at Rome, which measures 39 ft. in height. The term is also employed in modern terminology to designate an upper storey in a roof, and the feature is sometimes introduced to hide a roof behind.

ATTICA, a district of ancient Greece, triangular in shape, projecting in a south-easterly direction into the Aegean Sea, the base line being formed by the continuous chain of Mounts Cithaeron and Parnes, the apex by the promontory of Sunium. It was washed on two sides by the sea, and the coast is broken up into numerous small bays and harbours, which, however, are with few exceptions exposed to the south wind. The surface of Attica, as of the rest of Greece, is very mountainous, and between the mountain chains lie several plains of no great size, open on one side to the sea. On the west its natural boundary is the Corinthian Gulf, so that it would include Megaris; indeed, before the Dorian invasion, which resulted in the foundation of Megara, the whole country was politically one, in the hands of the Ionian race. This is proved by the column which, as we learn from Strabo, once stood on the Isthmus of Corinth, bearing on one side in Greek the inscription, "This land is Peloponnesus, not Ionia," and on the other, "This land is not Peloponnesus, but Ionia."

The position of Attica was one main cause of its historical importance. Hence in part arose the maritime character of its inhabitants; and when they had once taken to the sea, the string of neighbouring islands, Ceos, Cythnos and others, some of which lay within sight of their coasts, and from one to another of which it was possible to sail without losing sight of land, served to tempt them on to further enterprises. Similarly on land, the post it occupied between northern Greece and the Peloponnese materially influenced its relation to other states, both in respect of its alliances, such as that with Thessaly, towards which it was drawn by mutual hostility to Boeotia, which lay between them; and also in respect of offensive combinations of other powers, as that between Thebes and Sparta, which throughout an important part of Greek history were closely associated in their politics, through mutual dread of their powerful neighbour.

Mountains.

The mountains of Attica, which form its most characteristic feature, are a continuation of that chain which, starting from Tymphrestus at the southern extremity of Pindus, passes through Phocis and Boeotia under the names of Parnassus and Helicon; from this proceeds the range which, as Cithaeron in its western and Parnes in its eastern portion, separates Attica from Boeotia, throwing off spurs southward towards the Saronic Gulf in Aegaleos and Hymettus, which bound the plain of Athens. Again, the eastern extremity of Parnes is joined by another line of hills, which, separating from Mount Oeta, skirts the Euboic Gulf, and, after entering Attica, throws up the lofty pyramid of Pentelicus, overlooking the plain of Marathon, and then sinks towards the sea at Sunium to rise once more in the outlying islands. Finally, at the extreme west of the whole district, Cithaeron is bent round at right angles in the direction of the isthmus, at the northern approach to which it abuts against the mighty mass of Mount Geraneia, which is interposed between the Corinthian and the Saronic Gulf. Both Cithaeron and Parnes are about 4600 ft. high, Pentelicus 3635, and Hymettus 3370, while Aegaleos does not rise higher than 1534 ft. At the present day they are extremely bare, and in this respect almost repellent; but the lack of colour is compensated by the delicacy of the outlines, the minute articulation of the minor ridges and valleys, and the symmetrical grouping of the several mountains.

Soil.

The soil is light and thin, and requires very careful agriculture not only on the rocky mountain sides but to some extent also in the maritime plains. This fact had considerable influence on the inhabitants, both by enforcing industrious habits and by leading them at an early period to take to the sea. Still, the level ground was sufficiently fertile to form a marked contrast to the rest of the district. Thucydides attributes to the nature of the soil (i. 2 τὸ λεπτόγεων), which presented no attraction to invaders, the permanence of the same inhabitants in the country, whence arose the claim to indigenousness on which the Athenians so greatly prided themselves; while at the same time the richer ground fostered that fondness for country life, which is proved by the enthusiastic terms in which it is always spoken of by Aristophanes. That we are not justified in judging of the ancient condition of the soil by the aridity which prevails at the present day, is shown by the fact that out of the 182 demes (see CLEISTHENES) into which Attica was divided, one-tenth were named from trees or plants.

Climate.

The climate of Attica has always been celebrated. In approaching Attica from Boeotia a change of temperature is felt as soon as a person descends from Cithaeron or Parnes, and the sea breeze, which in modern times is called ὁ ἐμβάτης, or that which sets towards shore, moderates the heat in summer. The Attic comedians and Plato speak with enthusiasm of their native climate, and the fineness of the Athenian intellect was attributed to the clearness of the Attic atmosphere. It was in the neighbourhood of Athens itself that the air was thought to be purest. So Euripides describes the inhabitants as "ever walking gracefully through the most luminous ether" (*Med.* 829); and Milton—

> "Where, on the Aegean shore, a city stands,
> Built nobly, pure the air, and light the soil—
> Athens, the eye of Greece."

Or again Xenophon says "one would not err in thinking that this city is placed near the centre of Greece—nay, of the civilized world—because, the farther removed persons are from it, the severer is the cold or heat they meet with" (*Vectigal.* I. 6). The air is so clear that one can see from the Acropolis the lines of white marble that streak the sides of Pentelicus. The brilliant colouring which is so conspicuous in an Athenian sunset is due to the same cause. The epithet "violet-crowned," used of Athens by Pindar, is due either to the blue haze on the surrounding hills, or to the use of violets (or irises) for festal wreaths. This otherwise perfect climate is slightly marred by the prevalence of the north wind. This is expressed on the Horologium of Andronicus Cyrrhestes, called the Temple or Tower of the Winds, at Athens, where Boreas is represented as a bearded man of stern aspect, thickly clad, and wearing strong buskins; he blows into a conch shell, which he holds in his hand as a sign of his tempestuous character.

Vegetation.

Of the flora of Attica, the olive is the most important. This tree, we learn from Herodotus (v. 82), was thought at one time to have been found in that country only; and the enthusiastic praises of Sophocles (*Oed. Col.* 700) teach us that it was the land in which it flourished best. So great was the esteem in which it was held, that in the early legend of the struggle between the gods of sea and land, Poseidon and Athena, for the patronage of the country, the sea-god is represented as having to retire vanquished before the giver of the olive; and at a later period the evidences of this contention were found in an ancient olive tree in the Acropolis, together with three holes in the rock, said to have been made by the trident of Poseidon, and to be connected with a salt well hard by. The fig also found its favourite home in this country, for Demeter was said to have bestowed it as a gift on the Eleusinian Phytalus, *i.e.* "the gardener." Both Cithaeron and Parnes must have been wooded in former times; for on the former are laid the picturesque silvan scenes in the *Bacchae* of Euripides, and it was from the latter that the wood came which caused the neighbouring deme of Acharnae to be famous for its charcoal—the ἄνθρακες Παρνήσιοι of the *Acharnians* of Aristophanes (348). From the thymy slopes of Hymettus came the famous Hymettian honey. Among the other products we must notice the marble—both that of Pentelicus, which afforded a material of unrivalled purity and whiteness for building the Athenian temples, and the blue marble of Hymettus—the *trabes Hymettiae* of Horace—which used to be transported to Rome for the construction of palaces. But the richest of all the sources of wealth in Attica was the silver mines of Laurium, the yield of which was so considerable as to render silver the principal medium of exchange in Greece, so that "a silver piece" (ἀργύριον) was the Greek equivalent term for money. Hence Aeschylus speaks of the Athenians as possessing a "fountain of silver" (*Pers.* 235), and Aristophanes makes his chorus of birds promise the audience that, if they show him favour, owls from Laurium (*i.e.* silver pieces with the emblem of Athens) shall never fail them (*Birds*, 1106). The reputation of these coins for purity of metal and accuracy of weight was so great that they had a very wide circulation, and in consequence it was thought undesirable to make any alteration in the types lest their genuineness should be doubted. This accounts for the somewhat inartistic character which the Athenian coins maintained to the last (see further NUMISMATICS: *Greek*, § Athens). In Strabo's time, though the mines had almost ceased to yield, silver was obtained in considerable quantities from the scoriae; and at the present day a large amount of lead is got in the same way, the work being chiefly carried on by two companies, one of which is French and the other Greek. In the ancient workings, many of which are in the same condition as they were left 1800 years ago, there are in all 2000 shafts and galleries.

Minerals.

Plain of Megara.

It has been already mentioned that the base line of Attica is formed by the chain of Cithaeron and Parnes, running from west to east; and that from this transverse chains run southward, dividing Attica into a succession of plains. The westernmost of these, which is separated from the innermost bay of the Corinthian Gulf, called the Mare Alcyonium, by an offshoot of Cithaeron, and is bounded on the east by a ridge which ends towards the Saronic Gulf in a striking two-horned peak called Kerata, is the plain of Megara. It is only for geographical purposes that we include this district under Attica, for both the Dorian race of the inhabitants, and its dangerous proximity to Athens, caused it to be at perpetual feud with that city; but its position as an outpost for the Peloponnesians, together with the fact of its having once been Ionian soil, sufficiently explains the bitter hostility of the Athenians towards the Megarians. The great importance of Megara arose from its commanding all the passes into the Peloponnese. These were three in number: one along the shores of the Corinthian Gulf, which, owing to the nature of the ground, makes a long detour; the other two starting from Megara, and passing, the one by a lofty though gradual route over the ridge of Geraneia, the other along the Saronic Gulf, under the dangerous precipices of the Scironian rocks.

Plain of Eleusis.

To the east of the plain of Megara lies that of Eleusis, bounded on the one side by the chain of Kerata, and on the other by that of Aegaleos, through a depression in which was the line of the sacred way, where the torchlight processions from Athens used to descend to the coast, the "brightly gleaming shores" (λαμπάδες ἀκταί) of Sophocles (*Oed. Col.* 1049). The deep bay which here runs into the land is bounded on its southern side by the rocky island of Salamis, which was at all times an important possession to the Athenians on account of its proximity to their city; and the winding channel which separates that island from the mainland in the direction of the Peiraeus was the scene of the battle of Salamis, while on the last declivities of Mt. Aegaleos, which here descends to the sea, was the spot where, as Byron wrote—

> "A king sate on the rocky brow
> Which looks o'er sea-born Salamis."

The eastern portion of the plain of Eleusis was called the Thriasian plain, and the city itself was situated in the recesses of the bay just mentioned.

Plain of Athens.

Next in order to the plain of Eleusis came that of Athens, which is the most extensive of all, reaching from the foot of Parnes to the sea, and bounded on the west by Aegaleos, and on the east by Hymettus. Its most conspicuous feature is the broad line of dark green along its western side, formed by the olive-groves of Colonus and the gardens of the Academy, which owe their fertility to the waters of the Cephisus. This river is fed by copious sources on the side of Mt. Parnes, and thus, unlike the other rivers of Attica, has a constant supply of water, which was diverted in classical times, as it still is, into the neighbouring plantations (cf. Sophocles, *Oed. Col.* 685). The position of Colonus itself is marked by two bare knolls of light-coloured earth, which caused the poet in the same chorus to apply the epithet "white" (ἀργῆτα) to that place. On the opposite side of the plain runs the other river, the Ilissus, which rises from two sources on the side of Mt. Hymettus, and skirts the eastern extremity of the city of Athens; but this, notwithstanding its celebrity, is a mere brook, which stands in pools a great part of the year, and in summer is completely dry. The situation of Athens relatively to the surrounding objects is singularly harmonious; for, while it forms a central point, so as to be the eye of the plain, and while the altar-rock of the Acropolis and the hills by which it is surrounded are conspicuous from every point of view, there is no such exactness in its position as to give formality, since it is nearer to the sea than to Parnes, and nearer to Hymettus than to Aegaleos. The most striking summit in the neighbourhood of the city is that of Lycabettus, on the north-eastern side; and the variety is still further increased by the continuation of the ridge which it forms for some distance northwards through the plain. Three roads lead to Athens from the Boeotian frontier over the intervening mountain barrier —the easternmost over Parnes, from Delium and Oropus by Decelea, which was the usual route of the invading Lacedaemonians during the Peloponnesian War; the westernmost over Cithaeron, by the pass of Dryoscephalae, or the "Oakheads," leading from Thebes by Plataea to Eleusis, and so to Athens, which we hear of in connexion with the battle of Plataea, and with the escape of the Plataeans at the time of the siege of that city in the Peloponnesian War; the third, midway between the two, by the pass of Phyle, near the summit of which, on a rugged height overlooking the Athenian plain, is the fort occupied by Thrasybulus in the days of the Thirty Tyrants. On the sea-coast to the south-west of Athens rises the hill of Munychia, a mass of rocky ground, forming the acropolis of the town of Peiraeus. It was probably at one time an island; this was Strabo's opinion, and at the present day the ground which joins it to the mainland is low and swampy, and seems to have been formed by alluvial soil brought down by the Cephisus. On one side of this, towards Hymettus, lay the open roadstead of Phalerum, on the other the harbour of Peiraeus, a completely land-locked inlet, safe, deep and spacious, the approach to which was still further narrowed by moles. The eastern side of the hill was further indented by two small but commodious havens, which were respectively called Zea and Munychia.

Eastern Attica.

The north-eastern boundary of the plain of Athens is formed by the graceful pyramid of Pentelicus, which received its name from the deme of Pentele at its foot, but was far more commonly known as Brilessus in ancient times. This mountain did not form a continous chain with Hymettus, for between them intervenes a level space of ground 2 m. in width, which formed the entrance to the Mesogaea, an elevated undulating plain in the midst of the mountains, reaching nearly to Sunium. At the extremity of Hymettus, where it projects into the Saronic Gulf, was the promontory of Zoster (" the Girdle "), which was so called because it girdles and protects the neighbouring harbour; but in consequence of the name, a legend was attached to it, to the effect that Latona had loosed her girdle there. From this promontory to Sunium there runs a lower line of mountains, and between these and the sea a fertile strip of land intervenes, which was called the Paralia. Beyond Sunium, on the eastern coast, were two safe ports, that of Thoricus, which is defended by the island of Helene, forming a natural breakwater in front of it, and that of Prasiae, now called Porto Raphti (" the Tailor "), from a statue at the entrance to which the natives have given that name. In the north-east corner is the little plain of Marathon (*q.v.*), the scene of the battle against the Persians (490 B.C.). It lies between Parnes, Pentelicus and the sea. The bay in front is sheltered by Euboea, and on the north by a projecting tongue of land, called Cynosura. The mountains in the neighbourhood were the home of the Diacrii or Hyperacrii, who, being poor mountaineers, and having nothing to lose, were the principal advocates of political reform; while, on the other hand, the Pedieis, or inhabitants of the plains, being wealthy landholders, formed the strong conservative element, and the Parali, or occupants of the sea-coast, representing the mercantile interest, held an intermediate position between the two (see CLEISTHENES). Finally, there was one district of Attica, the territory of Oropus, which properly belonged to Boeotia, as it was situated to the north of Parnes; but on this the Athenians always endeavoured to retain a firm hold, because it facilitated their communications with Euboea. The command of that island was of the utmost importance to them; for, if Aegina could rightly be called " the eyesore of the Peiraeus," Euboea was quite as truly a thorn in the side of Attica; for we learn from Demosthenes (*De Cor.* p. 307) that at one period the pirates that made it their headquarters so infested the neighbouring sea as to prevent all navigation.

Excavations.

The place in Attica which has been the chief scene of excavations (independently of Athens and its vicinty) is Eleusis (*q.v.*), where the remains of the sanctuary of Demeter, the home of the Eleusinian Mysteries, together with other buildings in its neighbourhood, were cleared by the Greek Archaeological Society in 1882–1887 and 1895–1896. Of the other classical ruins in Attica the best-known is the temple of Athena at Sunium, which forms a conspicuous object on the headland, to which it gave the name of Cape Colonnae, still used by the peasants. It is in the Doric style, of white marble, and eleven columns of the peristyle and one of the pronaos are now standing. At Thoricus there is a theatre, which was cleared of earth by the archaeologists of the American School in 1886. In the neighbourhood of Rhamnus are the remains of two temples that stood side by side, the larger of which was dedicated to Nemesis, the smaller probably to Themis, of which goddess a fine statue was discovered in its ruins in the course of the excavations of the Greek Archaeological Society in 1890. The same Society, in 1884, 1886 and 1887, excavated the sanctuary of Amphiaraus, 4 m. from Oropus; in ancient times this was the resort of numerous invalids, who came thither to consult the healing divinity. Within it were found a temple of Amphiaraus, a large altar, and a long colonnade, which may have been the dormitory where the patients slept in hope of obtaining counsel in dreams. There were also baths and a small theatre, and numerous inscriptions relating to the arrangement and observances of the sanctuary and oracle. The walls and towers also of the city of Eleutherae and the fortress of Phyle are fine specimens of Hellenic fortifications.

Of the condition of Attica in medieval and modern times little need be said, for it has followed for the most part the fortunes of Athens. The population, however, has undergone a great change, independently of the large admixture of Slavonic blood that has affected the Greeks of the mainland generally, by the immigration of Albanian colonists, who now occupy a great part of the country. The district formed part of the *nome* (administrative division) of Boeotia and Attica until 1899, when it became a separate *nome*.

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(H. F. T.)

ATTIC BASE, the term given in architecture to the base of the Roman Ionic order, consisting of an upper and lower torus, separated by a scotia (*q.v.*) and fillets. It was the favourite base of the Romans, and was employed by them for columns of the Corinthian and Composite orders, and in Byzantine and Romanesque work would seem to have been generally adopted as a model.

ATTICUS, TITUS POMPONIUS (109–32 B.C.), Roman patron of letters, was born at Rome three years before Cicero, with whom he and the younger Marius were educated. His name was Titus Pomponius, that of Atticus, by which he is known, being given him afterwards from his long residence in Athens (86–65) and his intimate acquaintance with the Greek literature and language. His family is said to have been of noble and ancient descent; his father belonged to the equestrian order, and was very wealthy. When Pomponius was still a young man his father died, and he at once took the prudent resolution of transferring himself and his fortune to Athens, in order to escape the dangers of the civil war, in which he might have been involved through his connexion with the murdered tribune, Sulpicius Rufus. Here he lived in retirement, devoting himself entirely to study. On his return to Rome, he took possession of an inheritance left him by his uncle and assumed the name of Quintus Caecilius Pomponianus. From this time he kept aloof from political strife, attaching himself to no particular party, and continuing on intimate terms with men so opposed as Caesar and Pompey, Antony and Octavian. His most intimate friend, however, was Cicero, whose correspondence with him extended over many years, and who seems to have found his prudent counsel and sympathy a remedy for all his many troubles. His private life was tranquil and happy. He did not marry till he was fifty-three years of age, and his only child became the wife of Marcus Vipsanius Agrippa, the distinguished minister of Augustus. In 32, being seized with an illness believed to be incurable, he starved himself to death. Of his writings none is extant, but mention is made of two: a Greek history of Cicero's consulship, and some annals, in Latin, an epitome of the events of Roman history down to the year 54. His most important work was his edition of the letters addressed to him by Cicero. He also formed a large library at Athens, and engaged a staff of slaves to make copies of valuable works.

See Life by Cornelius Nepos; Berwick, *Lives of Messalla Corvinus and T.P.A.* (1813); Fialon, *Thesis in T.P.A.* (1861); Boissier, *Cicéron et ses amis* (1888; Eng. trans. A. D. Jones, 1897); Peter, *Historicorum Romanorum Fragmenta.*

ATTICUS HERODES, TIBERIUS CLAUDIUS (*c.* A.D. 101–177), Greek rhetorician, was born at Marathon in Attica. He belonged to a wealthy and distinguished family, and received a careful education under the most distinguished masters of the time, especially in rhetoric and philosophy. His talents gained him the favourable notice of Hadrian, who appointed him praefect of the free towns in the province of Asia (125). On his return to Athens, he attained great celebrity as an orator and teacher of rhetoric, and was elected to the office of archon. In 140 he was summoned by Antoninus Pius to undertake the education of Marcus Aurelius and Lucius Verus, and received many marks of favour, amongst them the consulship (143). He is principally celebrated, however, for the vast sums he expended on public purposes. He built at Athens a great race-course of Pentelic marble, and a splendid musical theatre, called the Odeum in memory of his wife Regilla, which still exists. At Corinth he built a theatre, at Delphi a stadium, at Thermopylae hot baths, at Canusium in Italy an aqueduct. He even contemplated cutting a canal through the Isthmus of Corinth, but was afraid to carry out his plan because the same thing had been unsuccessfully attempted before by the emperor Nero. Many of the partially ruined cities of Greece were restored by Atticus, and numerous inscriptions testify their gratitude to their benefactor. His latter years were embittered by family misfortune, and having incurred the enmity of the Athenians, he withdrew from Athens to his villa near Marathon, where he died. He enjoyed a very high reputation amongst his contemporaries, and wrote numerous works, of which the only one to come down to us is a rhetorical exercise *On the Constitution* (ed. Hass, 1880), advocating an alliance of the Thebans and Peloponnesians against Archelaus, king of Macedonia. The genuineness of this speech, which is of little merit, has been disputed.

Philostratus, *Vit. Soph.* ii. 1; Fiorillo, *Herodis Attici quae supersunt* (1801); *A Biographical Notice of A.H.* (London, 1832), privately printed; Fuelles, *De Herodis Attici Vita* (1864); Vidal-Lablache, *Hérode Atticus* (1871).

ATTILA (d. 453), king of the Huns, became king in 433, along with his brother Bleda, on the death of his uncle Roua. We hear but little as to Bleda, who died about 445, possibly slain by his brother's orders. In the first eight years of his reign Attila was chiefly occupied in the wars with other barbarian tribes, by which he made himself virtually supreme in central Europe. His own special kingdom comprised the countries which are now called Hungary and Transylvania, his capital being possibly not far from the modern city of Buda-Pest; but having made the Ostrogoths, the Gepidae and many other Teutonic tribes his subject-allies, and having also sent his invading armies into Media, he seems for nearly twenty years to have ruled practically without a rival from the Caspian to the Rhine. Very early in his reign, Honoria, grand-daughter of the emperor Theodosius II., being subjected to severe restraint on account of an amorous intrigue with one of the chamberlains of the palace, sent her ring to the king of the Huns and called on him to be her husband and her deliverer. Nothing came of the proposed engagement, but the wrongs of Honoria, his affianced wife, served as a convenient pretext for some of the constantly recurring embassies with which Attila, fond of trampling on the fallen majesty of Rome, worried and bullied the two courts of Constantinople and Ravenna. Another frequent subject of complaint was found in certain sacred vessels which the bishop of Sirmium had sent as a bribe to the secretary of Attila, and which had been by him, fraudulently, as his master contended, pawned to a silversmith at Rome. There were also frequent and imperious demands for the surrender of fugitives who had sought shelter from the wrath of Attila within the limits of the empire. One of the return embassies from Constantinople, that sent in 448, had the great advantage of being accompanied by a rhetorician named Priscus, whose minute journalistic account of the negotiations, including as it does a vivid picture of the great Hun in his banquet-hall, is by far the most valuable source of information as to the court and camp of Attila. What lends additional interest to the story is the fact that in the ambassador's suite there was an interpreter named Vigilas, who for fifty pounds of gold had promised to assassinate Attila. This base design was discovered by the Hunnish king, but had never been revealed to the head of the embassy or to his secretary. The situations created by this strange combination of honest diplomacy and secret villainy are described by Priscus with real dramatic power.

In 450 Theodosius II., the incapable emperor of the East, died, and his throne was occupied by a veteran soldier named Marcian, who answered the insulting message of Attila in a manlier tone than his predecessor. Accordingly the Hun, who had something of the bully in his nature, now turned upon Valentinian III., the trembling emperor of the West, and demanded redress for the wrongs of Honoria, and one-half of Valentinian's dominions as her dowry. Allying himself with the Franks and Vandals, he led his vast many-nationed army to the Rhine in the spring of 451, crossed that river, and sacked, apparently, most of the cities in Belgic Gaul. Most fortunately for Europe, the Teutonic races already settled in Gaul rallied to the defence of the empire against invaders infinitely more barbarous than themselves. Prominent in this new coalition was Theodoric, king of the Visigoths, whose capital city was Toulouse. His firm fighting alliance with the Roman general Aëtius, with whom he had had many a conflict in previous years, was one of the best auguries for the new Europe that was to arise out of the ruins of the Roman empire. Meanwhile Attila had reached the Loire and was besieging the strong city of Orléans. The citizens, under the leadership of their bishop Anianus, made a heroic defence, but the place was on the point of being taken when, on the 24th of June, the allied Romano-Gothic army was seen on the horizon. Attila, who knew the difficulty that he should have in feeding his immense army if his march was further delayed, turned again to the north-east, was persuaded by the venerable bishop Lupus to spare the city of Troyes, but halted near that place in the Catalaunian plains and offered battle to his pursuers Aëtius and Theodoric. The battle which followed—certainly one of the decisive battles of the world—has been well described by the Gothic historian Jordanes as "ruthless, manifold, immense, obstinate." It lasted for the whole day, and the number of the slain is variously stated at 175,000 and 300,000. All such estimates are, of course, untrustworthy, but there is no doubt that the carnage was terrible. The Visigothic king was slain, but the victory, though hardly earned, remained with his people and his allies. Attila did not venture to renew the engagement on the morrow, but retreated, apparently in good order, on the Rhine, recrossed that river and returned to his Pannonian home. From thence in the spring of 452 he again set forth to ravage or to conquer Italy. Her great champion Aëtius showed less energy in her cause than he had shown in his defence of Gaul. After a stubborn contest, Attila took and utterly destroyed Aquileia, the chief city of Venetia, and then proceeded on his destructive course, capturing and burning the cities at the head of the Adriatic, Concordia, Altinum and Patavium (Padua). The fugitives from these cities, but especially from the last, seeking shelter in the lagoons of the Adriatic, laid the foundations of that which was one day to become the glorious city of Venice. Upon Milan and the cities of western Lombardy the hand of Attila seems to have weighed more lightly, plundering rather than utterly destroying; and at last when Pope Leo I., at the head of a deputation of Roman senators, appeared in his camp on the banks of the Mincio, entreating him not to pursue his victorious career to the gates of Rome, he yielded to their entreaties and consented to cross the Alps, with a menace, however, of future return, should the wrongs of Honoria remain unredressed. As he himself jokingly said: he knew how to conquer men, but the Lion and the Wolf (Leo and Lupus) were too strong for him. No further expeditions to Italy were undertaken by Attila, who died suddenly in 453, in the night following a great banquet which celebrated his marriage with a damsel named Ildico. Notwithstanding some rumours of violence it is probable that his death was natural and due to his own intemperate habits.

Under his name of Etzel, Attila plays a great part in Teutonic legend (see NIBELUNGENLIED) and under that of Atli in Scandinavian Saga, but his historic lineaments are greatly obscured in both. He was short of stature, swarthy and broad-chested, with a large head which early turned grey, snub nose and deep-set eyes. He walked with proud step, darting a haughty glance this way and that as if he felt himself lord of all.

The chief authorities for the life of Attila are Priscus, Jordanes, the *Historia Miscella*, Apollonius Sidonius and Gregory of Tours. (T. H.)

ATTIS, or ATYS, a deity worshipped in Phrygia, and later throughout the Roman empire, in conjunction with the Great Mother of the Gods. Like Aphrodite and Adonis in Syria, Baal and Astarte at Sidon, and Isis and Osiris in Egypt, the Great Mother and Attis formed a duality which symbolized the relations between Mother Earth and her fruitage. Their worship included the celebration of mysteries annually on the return of the spring season. Attis was also known as Papas, and the Bithynians and Phrygians, according to evidence of the time of the late Empire, called him Zeus. He was never worshipped independently, however, though the worship of the Great Mother was not always accompanied by his. He was confused with Pan, Sabazios, Men and Adonis, and there were resemblances between the orgiastic features of his worship and that of Dionysus. His resemblance to Adonis has led to the theory that the names of the two are identical, and that Attis is only the Semitic companion of Syrian Aphrodite grafted on to the Phrygian Great Mother worship (Haakh, *Stuttgarter-Philolog.-Vers.*, 1857, 176 ff.). It is likely, however, that Attis, like the Great Mother, was indigenous to Asia Minor, adopted by the invading Phrygians, and blended by them with a deity of their own.

Legends.—According to Pausanias (vii. 17), Attis was a beautiful youth born of the daughter of the river Sangarius, who was descended from the hermaphroditic Agdistis, a monster sprung from the earth by the seed of Zeus. Having become enamoured of Attis, Agdistis struck him with frenzy as he was about to wed the king's daughter, with the result that he deprived himself of manhood and died. Agdistis in repentance prevailed upon Zeus to grant that the body of the youth should never decay or waste. In Arnobius (v. 5-8) Attis emasculates himself under a pine tree, which the Great Mother bears into her cave as she and Agdistis together wildly lament the death of the youth. Zeus grants the petition as in the version of Pausanias, but permits the hair of Attis to grow, and his little finger to move. The little finger, *digitus*, δάκτυλος, is interpreted as the phallus by Georg Kaibel (*Göttinger Nachrichten*, 1901, p. 513). In Diodorus (iii. 58, 59) the Mother is the carnal lover of Attis, and, when her father the king discovers her fault and kills her lover, roams the earth in wild grief. In Ovid (*Fasti*, iv. 223 ff.) she is inspired with chaste love for him, which he pledges himself to reciprocate. On his proving unfaithful, the Great Mother slays the nymph with whom he has sinned, whereupon in madness he mutilates himself as a penalty. Another form of the legend (Paus. vii. 17), showing the influence of the Aphrodite-Adonis myth, relates that Attis, the impotent son of the Phrygian Caläus, went into Lydia to institute the worship of the Great Mother, and was there slain by a boar sent by Zeus.

See GREAT MOTHER OF THE GODS; J. G. Frazer, *Adonis, Attis, Osiris* (1906). (G. Sn.)

ATTLEBOROUGH, a township of Bristol county, in south-east Massachusetts, U.S.A. Pop. (1890) 7577; (1900) 11,335, of whom 3237 were foreign-born; (1910 census) 16,215 It is traversed by the New York, New Haven & Hartford railway, and by inter-urban electric lines. It has an area of 28 sq. m. The population is largely concentrated in and about the village which bears the name of the township. In Attleborough are the Attleborough Home Sanitarium, and a public library (1885). The principal manufactures of the township are jewelry, silverware, cotton goods, cotton machinery, coffin trimmings, and leather. In 1905 the total value of the township's factory products was $10,050,384, of which $5,544,285 was the value of jewelry, Attleborough ranking fourth among the cities of the country in this industry, and producing 10·4% of the total jewelry product of the United States. Attleborough was incorporated in 1694, though settled soon after 1661 (records since 1672) as part of Rehoboth. In 1887 the township was divided in population, wealth and area by the creation of the township of NORTH ATTLEBOROUGH—pop. (1890) 6727; (1900) 7253, of whom 1786 were foreign-born; (1905, state census) 7878. This township produced manufactured goods in 1900 to the value of $3,990,731, jewelry valued at $2,785,567; it maintains the Richards memorial library.

See J. Daggett, *A Sketch of the History of Attleborough to 1887* (Boston, 1894).

ATTOCK, a town and fort of British India, in the Rawalpindi district of the Punjab, 47 m. by rail from Peshawar, and situated on the eastern bank of the Indus. Pop. (1901) 2822. The place is of both political and commercial importance, as the Indus is here crossed by the military and trade route through the Khyber Pass into Afghanistan. Alexander the Great, Tamerlane and Nadir Shah are believed to have successively crossed the Indus at or about this spot in their respective invasions of India. The river runs past Attock in a deep rapid channel about 200 yds. broad, but is easily crossed in boats or on inflated skins of oxen. The rocky gorges through which it flows, with a distant view of the Hindu Kush, form some of the finest scenery in the world. In 1883 an iron girder bridge of five spans was opened, which carries the North-Western railway to Peshawar, and has also a subway for wheeled traffic and foot passengers. The fort of Attock was built by the emperor Akbar in 1581, on a low hillock beside the river. The walls are of polished stone, and the whole structure is handsome; but from a military point of view it is of little importance, being commanded by a hill, from which it is divided only by a ravine. On the opposite side of the river is the village of Khairabad, with a fort, also erected by Akbar according to some, or by Nadir Shah according to others. The military importance of Attock has diminished, but it still has a small detachment of British troops.

ATTORNEY (from O. Fr. *atorné*, a person appointed to act for another, from *atourner*, legal Lat. *attornare*, attorn, literally to turn over to another or commit business to another), in English law, in its widest sense, any substitute or agent appointed to act in "the turn, stead or place of another." Attorneys are of two kinds, attorneys-in-fact and attorneys-at-law. An attorney-in-fact is simply an agent, the extent of whose capacity to act is bounded only by the powers embodied in his authority, his *power of attorney*. An attorney-at-law was a public officer, conducting legal proceedings on behalf of others, known as his clients, and attached to the supreme courts of common law at Westminster. Attorneys-at-law corresponded to the solicitors of the courts of chancery and the proctors of the admiralty, ecclesiastical, probate and divorce courts. Since the passing of the Judicature Act of 1873, however, the designation "attorney" has become obsolete in England, all persons admitted as solicitors, attorneys or proctors of an English court being henceforth called "solicitors of the supreme court" (see SOLICITOR).

In the United States an attorney-at-law exercises all the functions distributed in England between barristers, attorneys and solicitors, and his full title is "attorney and counsellor-at-law." When acting in a court of admiralty he is styled "proctor" or "advocate." Formerly, in some states, there existed a grade among lawyers of attorneys-at-law, which was inferior to that of counsellors-at-law, and in colonial times New Jersey established a higher rank still—that of serjeant-at-law. Now the term attorney-at-law is precisely equivalent to that of lawyer. Attorneys are admitted by some court to which the legislature confides the power, and on examination prescribed by the court, or by a board of state examiners, as the case may be. The term of study required is generally two or three years, but in some states less. In one no examination is required. College graduates are often admitted to examination after a shorter term of study than that required from those not so educated. In the courts of the United States, admission is regulated by rules of court and based upon a previous admission to the state bar. In almost all states aliens are not admitted as attorneys, and in many states women are ineligible, but during recent years several states have passed statutes permitting them to practise. Since 1879 women have been eligible to practise before the U. S. Supreme Court, if already admitted to practise in some state court, under the same conditions as men. A *state attorney* or *district attorney* is the local public prosecutor. He is either elected by popular vote at the state elections for the district in which he resides and goes out of office with the political party for which he was elected, or he is appointed by the governor of the state for that district and for the same term. He represents the state in criminal prosecutions and also in civil actions within his district. There is a *United States district attorney* in each federal district, similarly representing the federal government before the courts.

An attorney is an officer of the court which admits him to practise, and he is subject to its discipline. He is liable to his client in damages for failure to exercise ordinary care and skill, and he can bring action for the value of his services. He has a lien on his client's papers, and usually on any judgment in favour of his client to secure the payment of his fees. (See also under BAR, THE.)

ATTORNEY-GENERAL, in England, the chief law officer appointed to manage all the legal affairs and suits in which the crown is interested. He is appointed by letters-patent authorizing him to hold office during the sovereign's pleasure. He is *ex officio* the leader of the bar, and only counsel of the highest eminence are appointed to the office. The origin of the office is uncertain, but as far back as 1277 we find an *attornatus regis* appointed to look after the interests of the crown, in proceedings affecting it before the courts. He has precedence in all the courts, and in the House of Lords he has precedence of the lord advocate, even in Scottish appeals, but unlike the lord advocate and the Irish attorney-general he is not necessarily made a privy councillor. He is a necessary party to all proceedings affecting the crown, and has extensive powers of control in matters relating to charities, lunatics' estates, criminal prosecutions, &c. The attorney-general and the solicitor-general are always members of the House of Commons (except for temporary difficulties in obtaining a seat) and of the ministry, being selected from the party in power, and their advice is at the disposal of the government and of each department of the government, while in the House of Commons they defend the legality of ministerial action if called in question. Previously to 1895 there was no restriction placed on the law officers as to their acceptance of private practice, but since that date this privilege has been withdrawn, and the salary of the attorney-general is fixed at £7000 a year and in addition such fees according to the ordinary professional scales as he may receive for any litigious business he may conduct on behalf of the crown. The crown has also as a legal adviser an attorney-general in Ireland. In Scotland he is called lord advocate (*q.v.*). There is also an attorney-general in almost all the British colonies, and his duties are very similar to those of the same officer in England. In the self-governing colonies he is appointed by the administration of the colony, and in the crown colonies by royal warrant under the signet and sign-manual. There is an attorney-general for the duchy of Cornwall and also one for the duchy of Lancaster, each of whom sues in matters relating to that duchy.

The United States has an officer of this name, who has a seat in the cabinet. His duties are in general to represent the federal government before the United States Supreme Court, to advise the president on questions of law, and to advise similarly the heads of the state departments with reference to matters affecting their department. His opinions are published by the government periodically for the use of its officials and they are frequently cited by the courts. Every state but one or two has a similar officer. He represents the state in important legal matters, and is often required to assist the local prosecutor in trials for capital offences. He appears for the public interest in suits affecting public charities. He is generally elected by the people for the same term as the governor and on the same ticket.

ATTORNMENT (from Fr. *tourner*, to turn), in English real property law, the acknowledgment of a new lord by the tenant on the alienation of land. Under the feudal system, the relations of landlord and tenant were to a certain extent reciprocal. So it was considered unreasonable to the tenant to subject him to a new lord without his own approval, and it thus came about that alienation could not take place without the consent of the tenant. Attornment was also extended to all cases of lessees for life or for years. The necessity for attornment was abolished by an act of 1705. The term is now used to indicate an acknowledgment of the existence of the relationship of landlord and tenant. An attornment-clause, in mortgages, is a clause whereby the mortgagor attorns tenant to the mortgagee, thus giving the mortgagee the right to distrain, as an additional security.

ATTRITION (Lat. *attritio*, formed from *atterere*, to rub away), a rubbing away; a term used in pathology and geology. Theologians have also distinguished "attrition" from "contrition" in the matter of sin, as an imperfect stage in the process of repentance; attrition being due to servile fear of the consequences of sin, contrition to filial fear of God and hatred of sin for His sake. It has been held among the Roman Catholics that in the sacrament of penance attrition becomes contrition.

ATTWOOD, THOMAS (1765–1838), English composer, the son of a coal merchant who had musical tastes, was born in London on the 23rd of November 1765. At the age of nine he became a chorister in the Chapel Royal, where he remained for five years. In 1783 he was sent to study abroad at the expense of the prince of Wales (afterwards George IV.), who had been favourably impressed by his skill at the harpsichord. After spending two years at Naples, Attwood proceeded to Vienna, where he became a favourite pupil of Mozart. On his return to London in 1787 he held for a short time an appointment as one of the chamber musicians to the prince of Wales. In 1796 he was chosen organist of St Paul's, and in the same year he was made composer to the Chapel Royal. His court connexion was further confirmed by his appointment as musical instructor to the duchess of York, and afterwards to the princess of Wales. For the coronation of George IV. he composed the anthem, "The King shall rejoice," a work of high merit. The king, who had neglected him for some years on account of his connexion with the princess of Wales, now restored him to favour, and in 1821 appointed him organist to his private chapel at Brighton. Soon after the institution of the Royal Academy of Music in 1823, Attwood was chosen one of the professors. He was also one of the original members of the Philharmonic Society, founded in 1813. He wrote the anthem, "O Lord, grant the King a Long Life," which was performed at the coronation of William IV., and he was composing a similar work for the coronation of Queen Victoria when he died at his house in Cheyne Walk, Chelsea, on the 24th of March 1838. He was buried under the organ in St Paul's cathedral. His services and anthems were published in a collected form after his death by his pupil Walmisley. Of his secular compositions several songs and glees are well known and popular. The numerous operas which he composed in early life are now practically forgotten. Of his songs the most popular was "The Soldier's Dream," and the best of his glees were "In peace Love tunes the shepherd's reed," and "To all that breathe the air of Heaven." Attwood was a friend of Mendelssohn, for whom he professed an admiration at a time when the young German's talent was little appreciated by the majority of English musicians.

ATTWOOD, THOMAS (1783-1856), English political reformer, was born at Halesowen, Worcestershire, on the 6th of October 1783. In 1800 he entered his father's banking business in Birmingham, where he was elected high bailiff in 1811. He took a leading part in the public life of the city, and became very popular with the artisan class. He is now remembered for his share in the movement which led to the carrying of the Reform Act of 1832. He was one of the founders, in January 1830, of the Political Union, branches of which were soon formed throughout England. Under his leadership vast crowds of working-men met periodically in the neighbourhood of Birmingham to demonstrate in favour of reform of the franchise, and Attwood used his power over the multitude to repress any action on their part which might savour of illegality. His successful exertions in favour of reform made him a popular hero all over the country, and he was presented with the freedom of the city of London. After the passing of the Reform Act in 1832 he was elected one of the members for the new borough of Birmingham, for which he sat till 1839. He failed in the House of Commons to maintain the reputation which he had made outside it, for in addition to an eager partisanship in favour of every ultra-democratic movement, he was wearisomely persistent in advocating his peculiar monetary theory. This theory, which became with him a monomania, was that the existing currency should be rectified in favour of state-regulated and inconvertible paper-money, and the adoption of a system for altering the standard of value as prices fluctuated. His waning influence with his constituents led him to retire from parliament in 1837, and, though invited to re-enter political life in 1843, he had by that time become a thoroughly spent force. He died at Great Malvern on the 6th of March 1856.

His grandson, C. M. Wakefield, wrote his life "for private circulation" (there is a copy in the British Museum), and his economic theories are set forth in a little book, *Gemini*, by T. B. Wright and J. Harlow, published in 1844.

ATWOOD, GEORGE (1746–1807), English mathematician, was born in the early part of the year 1746. He entered Westminster school, and in 1759 was elected to a scholarship at Trinity College, Cambridge. He graduated in 1769, with the rank of third wrangler and first Smith's prizeman. Subsequently he became a fellow and a tutor of the college, and in 1776 was elected a fellow of the Royal Society of London. In the year 1784 he left Cambridge, and soon afterwards received from William Pitt the office of a patent searcher of the customs, which required but little attendance, and enabled him to devote a considerable portion of his time to his special studies. He died in July 1807. Atwood's published works, exclusive of papers contributed to the *Philosophical Transactions*, for one of which he obtained the Copley medal, are as follows:—*Analysis of a Course of Lectures on the Principles of Natural Philosophy* (Cambridge, 1784); *Treatise on the Rectilinear Motion and Rotation of Bodies* (Cambridge, 1784), which gives some interesting experiments, by means of which mechanical truths can be ocularly exhibited and demonstrated, and describes the machine, since called by Atwood's name, for verifying experimentally the laws of simple acceleration of motion; *Review of the Statutes and Ordinances of Assize which have been established in England from the 4th year of King John, 1202, to the 37th of his present Majesty* (London, 1801), a work of some historical research; *Dissertation on the Construction and Properties of Arches* (London, 1801), with supplement, pt. i., 1801, pt. ii., 1804, an elaborate work, now completely superseded.

AUBADE (a French word from *aube*, the dawn), the dawn-song of the troubadours of Provence, developed by the Minnesingers (*q.v.*) of Germany into the *Tagelied*, the song of the parting at dawn of lovers at the warning of the watchman. In France in modern times the term is applied to the performance of a military band in the early morning in honour of some distinguished person.

AUBAGNE, a town of south-eastern France, in the department of Bouches-du-Rhône on the Huveaune, 11 m. E. of Marseilles by rail. Pop. (1906) 6039. The town carries on the manufacture of earthenware and pottery, leather, &c. and the cultivation of fruit and wine. There is a fountain to the memory of the statesman, F. Barthélemy (d. 1830), born at Aubagne.

AUBE, a department of north-eastern France, bounded N. by the department of Marne, N.W. by Seine-et-Marne, W. by Yonne, S. by Yonne and Cote-d'Or, and E. by Haute-Marne; it was formed in 1790 from Basse-Champagne, and a small portion of Burgundy. Area, 2326 sq. m. Pop. (1906) 243,670. The department belongs to the Seine basin, and is watered chiefly by the Seine and the Aube. These rivers follow the general slope of the department, which is from south-east, where the Bois du Mont (1200 ft.), the highest point, is situated, to north-west. The southern and eastern districts are fertile and well wooded. The remainder of the department, with the exception of a more broken and picturesque district in the extreme north-west, forms part of the sterile and monotonous plain known as Champagne Pouilleuse. The climate is mild but damp. The annual rainfall over the greater part varies from 24 to 28 in.; but in the extreme south-east it at times reaches a height of 36 in. Aube is an agricultural department; more than one-third of its surface consists of arable land of which the chief products are wheat and oats, and next to them rye, barley and potatoes; vegetables are extensively cultivated in the valleys of the Seine and the Aube. The vine flourishes chiefly on the hills of the south-east; the wines of Les Riceys, Bar-sur-Aube, Bouilly and Laines-aux-Bois are most esteemed. The river valleys abound in natural pasture, and sainfoin, lucerne and other forage crops are largely grown; cattle-raising is an important source of wealth, and the cheeses of Troyes are well known. There are excellent nurseries and orchards in the neighbourhood of Troyes, Bar-sur-Seine, Méry-sur-Seine and Brienne. Chalk, from which *blanc de Troyes* is manufactured, and clay are abundant; and there are peat workings and quarries of building-stone and limestone. The spinning and weaving of cotton and the manufacture of hosiery, of both of which Troyes is the centre, are the main industries of the department; there are also a large number of distilleries, tanneries, oil works, tile and brick works, flour-mills, saw-mills and dye-works. The Eastern railway has works at Romilly, and there are iron works at Clairvaux and wire-drawing works at Plaines; but owing to the absence of coal and iron mines, metal working is of small importance. The exports of Aube consist of timber, cereals, agricultural products, hosiery, wine, dressed pork, &c.; its imports include wool and raw cotton, coal and machinery, especially looms. The department is served by the Eastern railway, of which the main line to Belfort crosses it. The river Aube is navigable for 28 m. (from Arcis-sur-Aube to its confluence with the Seine); the Canal de la Haute-Seine extends beside the Seine from Bar-sur-Seine to Marcilly (just outside the department) a distance of 46 m.; below Marcilly the Seine is canalized.

Aube is divided into 5 arrondissements with 26 cantons and 446 communes. It falls within the educational circumscription (*académie*) of Dijon and the military circumscription of the XX. army corps; its court of appeal is in Paris. It constitutes the diocese of Troyes and part of the archiepiscopal province of Sens. The capital of the department is Troyes; of the arrondissements the capitals are Troyes, Bar-sur-Aube, Arcis-sur-Aube, Bar-sur-Seine and Nogent-sur-Seine. The architecture of the department is chiefly displayed in its churches, many of which possess stained glass of the 16th century. Besides the cathedral and other churches of Troyes, those of Mussy-sur-Seine (13th century), Chaource (16th century) and Nogent-sur-Seine (15th and 16th centuries), are of note. The abbey buildings of Clairvaux are the type of the Cistercian abbey.

AUBENAS, a town of south-eastern France, in the department of Ardèche, 19 m. S.W. of Privas by road. Pop. (1906) 3976 (town), 7064 (commune). Aubenas is beautifully situated on the slope of a hill, on the right bank of the Ardèche, but its streets generally are crooked and narrow. It has a castle of the 13th and 16th centuries, now occupied by several of the public institutions of the town. These include a tribunal and chamber of commerce, and a conditioning-house for silk. Iron and coal mines are worked in the vicinity. As the centre of the silk trade of southern France Aubenas is a place of considerable traffic. It has also a large silk spinning and weaving industry, and carries on tanning and various minor industries together with trade in silk. The district is rich in plantations of mulberries and olives.

AUBER, DANIEL FRANÇOIS ESPRIT (1782–1871), French musical composer, the son of a Paris printseller, was born at Caen in Normandy on the 29th of January 1782. Destined by his father to the pursuits of trade, he was allowed, nevertheless, to indulge his fondness for music, and learnt to play at an early age on several instruments, his first teacher being the Tirolean composer, I. A. Ladurner. Sent at the age of twenty to London to complete his business training, he was obliged to leave England in consequence of the breach of the treaty of Amiens (1804). He had already attempted musical composition, and at this period produced several *concertos pour basse*, in the manner of the violoncellist, Lamarre, in whose name they were published. The praise given to his concerto for the violin, which was played at the Conservatoire by Mazas, encouraged him to undertake the resetting of the old comic opera, *Julie* (1811). Conscious by this time of the need of regular study of his chosen art, he placed himself under the severe training of Cherubini, by which the special qualities of the young composer were admirably developed. In 1813 he made his *début* in an opera in one act, the *Séjour militaire*, the unfavourable reception of which put an end for some years to his attempts as composer. But the failure in business and death of his father, in 1819, compelled him once more to turn to music, and to make that which had been his pastime the serious employment of his life. He produced another opera, the *Testament et les billets-doux* (1819), which was no better received than the former. But he persevered, and the next year was rewarded by the complete success of his *Bergère châtelaine*, an opera in three acts. This was the first in a long series of brilliant successes. In 1822 began his long association with A. E. Scribe, who shared with him, as librettist, the success and growing popularity of his compositions. The opera of *Leicester*, in which they first worked together (1823), is remarkable also as showing evidences of the influence of Rossini. But his own style was an individual one, marked by lightness and facility, sparkling vivacity, grace and elegance, clear and piquant melody—characteristically French. In *La Muette de Portici*, familiarly known as *Masaniello*, Auber achieved his greatest musical triumph. Produced at Paris in 1828, it rapidly became a European favourite, and its overture, songs and choruses were everywhere heard. The duet, "Amour sacré de la patrie," was welcomed like a new *Marseillaise*; sung by Nourrit at Brussels in 1830, it became the signal for the revolution which broke out there. Of Auber's remaining operas (about 50 in all) the more important are: *Le Maçon* (1825), *La Fiancée* (1829), *Fra Diavolo* (1830), *Lestocq* (1834), *Le Cheval de bronze* (1835), *L'Ambassadrice* (1836), *Le Domino noir* (1837), *Le Lac des fées* (1839), *Les Diamants de la couronne* (1841), *Haydée* (1847), *Marco Spada* (1853), *Manon Lescaut* (1856), and *La Fiancée du roi des Garbes* (1864). Official and other dignities testified the public appreciation of Auber's works. In 1829 he was elected member of the Institute, in 1830 he was named director of the court concerts, and in 1842, at the wish of Louis Philippe, he succeeded Cherubini as director of the Conservatoire. He was also a member of the Legion of Honour from 1825, and attained the rank of commander in 1847. Napoleon III. made Auber his Imperial Maître de Chapelle in 1857.

One of Auber's latest compositions was a march, written for the opening of the International Exhibition in London in 1862. His fascinating manners, his witty sayings, and his ever-ready kindness and beneficence won for him a secure place in the respect and love of his fellow-citizens. He remained in his old home during the German siege of Paris, 1870–71, but the miseries of the Communist war which followed sickened his heart, and he died in Paris on the 13th of May 1871.

See Adolph Kohut, "Auber," vol. xvii. of *Musiker Biographien* (Leipzig, 1895).

AUBERGINE (diminutive of Fr. *auberge*, a variant of *alberge*, a kind of peach), or Egg Plant (*Solanum melongena*, var. *ovigerum*), a tender annual widely cultivated in the warmer parts of the earth, and in France and Italy, for the sake of its fruits, which are eaten as a vegetable. The seed should be sown early in February in a warm pit, where the plants are grown till shifted into 8-in. or 10-in. pots, in well-manured soil. Liquid manure should be given occasionally while the fruit is swelling; about four fruits are sufficient for one plant. The French growers sow them in a brisk heat in December, or early in January, and in March plant them out four or eight in a hot-bed with a bottom heat of from 60° to 68°, the sashes being gradually more widely opened as the season advances, until at about the end of May they may be taken off. The two main branches which are allowed are pinched to induce laterals, but when the fruits are set all young shoots are taken off in order to increase their size. The best variety is the large purple, which produces oblong fruit, sometimes reaching 6 or 7 in. in length and 10 or 12 in. in circumference. The fruit of the ordinary form almost exactly resembles the egg of the domestic fowl. It is also grown as an ornamental plant, for covering walls or trellises; especially the black-fruited kind.

AUBERVILLIERS, or Aubervilliers-les-Vertus, a town of northern France, in the department of Seine, on the canal St Denis, 2 m. from the right bank of the Seine and 1 m. N. of the fortifications of Paris. Pop. (1906) 33,358. Its manufactures include cardboard, glue, oils, colours, fertilizers, chemical products, perfumery, &c. During the middle ages and till modern times Aubervilliers was the resort of numerous pilgrims, who came to pay honour to Notre Dame des Vertus. In 1814 the locality was the scene of a stubborn combat between the French and the Allies.

AUBIGNAC, FRANÇOIS HÉDELIN, Abbé d' (1604–1676), French author, was born at Paris on the 4th of August 1604. His father practised at the Paris bar, and his mother was a daughter of the great surgeon Ambroise Paré. François Hédelin was educated for his father's profession, but, after practising for some time at Nemours he abandoned law, took holy orders, and was appointed tutor to one of Richelieu's nephews, the duc de Fronsac. This patronage secured for him the abbey of Aubignac and of Mainac. The death of the duc de Fonsac in 1646 put an end to hopes of further preferment, and the Abbé d'Aubignac retired to Nemours, occupying himself with literature till his death on the 25th of July 1676. He took an energetic share in the literary controversies of his time. Against Gilles Ménage he wrote a *Térence justifié* (1656); he laid claim to having originated the idea of the "*Carte de tendre*" of Mlle de Scudéry's *Clélie*; and after being a professed admirer of Corneille he turned against him because he had neglected to mention the abbé in his *Discours sur le poème dramatique*. He was the author of four tragedies: *La Cyminde* (1642), *La Pucelle d'Orléans* (1642), *Zénobie* (1647) and *Le Martyre de Sainte Catherine* (1650). *Zénobie* was written with the intention of affording a model in which the strict rules of the drama, as understood by the theorists, were observed. In the choice of subjects for his plays, he seems to have been guided by a desire to illustrate the various kinds of tragedy—patriotic, antique and religious. The dramatic authors whom he was in the habit of criticizing were not slow to take advantage of the opportunity for retaliation offered by the production of these mediocre plays. It is as a theorist that D'Aubignac still arrests attention. It has been proved that to Jean Chapelain belongs the credit of having been the first to establish as a practical law the convention of the unities that plays so large a part in the history of the French stage; but the laws of dramatic method and construction generally were codified by d'Aubignac in his *Pratique du théâtre.* The book was only published in 1657, but had been begun at the desire of Richelieu as early as 1640. His *Conjectures académiques sur l'Iliade d'Homère*, which was not published until nearly forty years after his death, threw doubts on the existence of Homer, and anticipated in some sense the conclusions of Friedrich August Wolf in his *Prolegomena ad Homerum* (1795).

The contents of the *Pratique du théâtre* are summarized by F. Brunetière in his notice of Aubignac in the *Grande Encyclopédie.* See also G. Saintsbury, *Hist. of Criticism*, bk. v., and H. Rigault, *Hist. de la querelle des anciens et modernes.* (1859).

AUBIGNÉ, CONSTANT D' [Baron de Surineau] (*c.* 1584–1647), French adventurer, was the son of Théodore Agrippa d'Aubigné, and the father of Madame de Maintenon. Born a Protestant, he became by turns Catholic or Protestant as it suited his interests. He betrayed the Protestants in 1626, revealing to the court, after a voyage to England, the projects of the English upon La Rochelle. He was renounced by his father; then imprisoned by Richelieu's orders at Niort, where he was detained ten years. After having tried his fortunes in the Antilles, he died in Provence, leaving in destitution his wife, Jeanne de Cardillac, whom he had married in 1627. He had two children, Charles, father of the duchess of Noailles, and Françoise, known in history as Madame de Maintenon.

See T. Lavallée, *La Famille d'Aubigné et l'enfance de Madame de Maintenon* (Paris, 1863).

AUBIGNÉ, JEAN HENRI MERLE D' (1794–1872), Swiss Protestant divine and historian, was born on the 16th of August 1794, at Eaux Vives, near Geneva. The ancestors of his father, Aimé Robert Merle d'Aubigné (1755–1799), were French Protestant refugees. Jean Henri was destined by his parents to a commercial life; but at college he decided to be ordained. He was profoundly influenced by Robert Haldane, the Scottish missionary and preacher who visited Geneva. When in 1817 he went abroad to further his education, Germany was about to celebrate the tercentenary of the Reformation; and thus early he conceived the ambition to write the history of that great epoch. At Berlin he received stimulus from teachers so unlike as J. A. W. Neander and W. M. L. de Wette. After presiding for five years over the French Protestant church at Hamburg, he was, in 1823, called to become pastor of a congregation in Brussels and preacher to the court. He became also president of the consistory of the French and German Protestant churches. At the Belgian revolution of 1830 he thought it advisable to undertake pastoral work at home rather than to accept an educational post in the family of the Dutch king. The Evangelical Society had been founded with the idea of promoting evangelical Christianity in Geneva and elsewhere, but it was found that there was also needed a theological school for the training of pastors. On his return to Switzerland, d'Aubigné was invited to become professor of church history in an institution of the kind, and continued to labour in the cause of evangelical Protestantism. In him the Evangelical Alliance found a hearty promoter. He frequently visited England, was made a D.C.L. by Oxford University, and received civic honours from the city of Edinburgh. He died suddenly in 1872.

His principal works are—*Discours sur l'étude de l'histoire de Christianisme* (Geneva, 1832); *Le Luthéranisme et la Réforme* (Paris, 1844); *Germany, England and Scotland, or Recollections of a Swiss Pastor* (London, 1848); *Trois siècles de lutte en Écosse, ou deux rois et deux royaumes; Le Protecteur ou la république d'Angleterre aux jours de Cromwell* (Paris, 1848); *Le Concile et l'infaillibilité* (1870); *Histoire de la Réformation au XVIième siècle* (Paris, 1835–1853; new ed., 1861–1862, in 5 vols.); and *Histoire de la Réformation en Europe au temps de Calvin* (8 vols., 1862–1877).

The first portion of his *Histoire de la Réformation*, which was devoted to the earlier period of the movement in Germany, gave him at once a foremost place amongst modern French ecclesiastical historians, and was translated into most European tongues. The second portion, dealing with reform in the time of Calvin, was not less thorough, and had a subject hitherto less exhaustively treated, but it did not meet with the same success. This part of the subject, with which he was most competent to deal, was all but completed at the time of his death. Among his minor treatises, the most important are the vindication of the character and aims of Oliver Cromwell, and the sketch of the contendings of the Church of Scotland.

Indefatigable in sifting original documents, Aubigné had amassed a wealth of authentic information; but his desire to give in all cases a full and graphic picture, assisted by a vivid imagination, betrayed him into excess of detail concerning minor events, and in a few cases into filling up a narrative by inference from later conditions. Moreover, in his profound sympathy with the Reformers, he too frequently becomes their apologist. But his work is a monument of painstaking sincerity, and brings us into direct contact with the spirit of the period.

AUBIGNÉ, THÉODORE AGRIPPA D' (1552–1630), French poet and historian, was born at St Maury, near Pons, in Saintonge, on the 8th of February 1552. His name Agrippa (*aegre partus*) was given him through his mother dying in childbirth. In his childhood he showed a great aptitude for languages; according to his own account he knew Latin, Greek and Hebrew at six years of age; and he had translated the *Crito* of Plato before he was eleven. His father, a Huguenot who had been one of the conspirators of Amboise, strengthened his Protestant sympathies by showing him, while they were passing through that town on their way to Paris, the heads of the conspirators exposed upon the scaffold, and adjuring him not to spare his own head in order to avenge their death. After a brief residence he was obliged to flee from Paris to avoid persecution, but was captured and threatened with death. Escaping through the intervention of a friend, he went to Montargis. In his fourteenth year he was present at the siege of Orléans, at which his father was killed. His guardian sent him to Geneva, where he studied for a considerable time under the direction of Beza. In 1567 he made his escape from tutelage, and attached himself to the Huguenot army under the prince of Condé. Subsequently he joined Henry of Navarre, whom he succeeded in withdrawing from the corrupting influence of the house of Valois (1576), and to whom he rendered valuable service, both as a soldier and as a counsellor, in the wars that issued in his elevation to the throne as Henry IV. After a furious battle at Casteljaloux, and suffering from fever from his wounds, he wrote his *Tragiques* (1571). He was in the battle of Coutras (1587), and at the siege of Paris (1590). His career at camp and court, however, was a somewhat chequered one, owing to the roughness of his manner and the keenness of his criticisms, which made him many enemies and severely tried the king's patience. In his *tragédie-ballet Circe* (1576) he did not hesitate to indulge in the most outspoken sarcasm against the king and other members of the royal family. Though he more than once found it expedient to retire into private life he never entirely lost the favour of Henry, who made him governor of Maillezais. After the conversion of the king to Roman Catholicism, d'Aubigné remained true to the Huguenot cause, and a fearless advocate of the Huguenot interests. The first two volumes of the work by which he is best known, his *Histoire universelle depuis 1550 jusqu'à l'an 1601*, appeared in 1616 and 1618 respectively. The third volume was published in 1619, but, being still more free and personal in its satire than those which had preceded it, it was immediately ordered to be burned by the common hangman. The work is a lively chronicle of the incidents of camp and court life, and forms a very valuable source for the history of France during the period it embraces. In September 1620 its author was compelled to take refuge in Geneva, where he found a secure retreat for the last ten years of his life, though the hatred of the French court showed itself in procuring a sentence of death to be recorded against him more than once. He devoted the period of his exile to study, and the superintendence of works for the fortifications of Bern and Basel which were designed as a material defence of the cause of Protestantism. He died at Geneva on the 29th of April 1630.

A complete edition of his works according to the original MSS.

was begun by E. Réaume and F. de Caussade (1879). It contains all the literary works, the *Aventures du baron de Faeneste* (1617), and the *Mémoires* (6 vols., 1873–1892). The best edition of the *Histoire universelle* is by A. de Ruble. The *Mémoires* were edited by L. Lalanne (1854).

AUBIN, a town of southern France, in the department of Aveyron on the Enne, 30 m. N.W. of Rodez. In 1906 the urban population was 2229, the communal population 9986. Aubin is the centre of important coal-mines worked in the middle ages, and also has iron-mines, the product of which supplies iron works close to the town. Sheep-breeding is important in the vicinity. The church dates from the 12th century.

AUBREY, JOHN (1626–1697), English antiquary, was born at Easton Pierse or Percy, near Malmesbury, Wiltshire, on the 12th of March 1626, his father being a country gentleman of considerable fortune. He was educated at the Malmesbury grammar school under Robert Latimer, who had numbered Thomas Hobbes among his earlier pupils, and at his schoolmaster's house Aubrey first met the philosopher about whom he was to leave so many curious and interesting details. He entered Trinity College, Oxford, in 1642, but his studies were interrupted by the Civil War. In 1646 he became a student of the Middle Temple, but was never called to the bar. He spent much of his time in the country, and in 1649 he brought into notice the megalithic remains at Avebury. His father died in 1652, leaving to Aubrey large estates, and with them, unfortunately, complicated lawsuits. Aubrey, however, lived gaily, and used his means to gratify his passion for the company of celebrities and for every sort of knowledge to be gleaned about them. Anthony à Wood prophesied that he would one day break his neck while running downstairs after a retreating guest, in the hope of extracting a story from him. He took no active share in the political troubles of the time, but from his description of a meeting of the Rota Club, founded by James Harrington, the author of *Oceana*, he appears to have been a theorizing republican. His reminiscences on this subject date from the Restoration, and are probably softened by considerations of expediency. In 1663 he became a member of the Royal Society, and in the next year he met Joan Somner, "in an ill hour," he tells us. This connexion did not end in marriage, and a lawsuit with the lady complicated his already embarrassed affairs. He lost estate after estate, until in 1670 he parted with his last piece of property, Easton Pierse. From this time he was dependent on the hospitality of his numerous friends. In 1667 he had made the acquaintance of Anthony à Wood at Oxford, and when Wood began to gather materials for his invaluable *Athenae Oxonienses*, Aubrey offered to collect information for him. From time to time he forwarded memoranda to him, and in 1680 he began to promise the "Minutes for Lives," which Wood was to use at his discretion. He left the task of verification largely to Wood. As a hanger-on in great houses he had little time for systematic work, and he wrote the "Lives" in the early morning while his hosts were sleeping off the effects of the dissipation of the night before. He constantly leaves blanks for dates and facts, and many queries. He made no attempt at a fair copy, and, when fresh information occurred to him, inserted it at random. He made some distinction between hearsay and authentic information, but had no pretence to accuracy, his retentive memory being the chief authority. The principal charm of his "Minutes" lies in the amusing details he has to recount about his personages, and in the plainness and truthfulness that he permits himself in face of established reputations. In 1592 he complained bitterly that Wood had destroyed forty pages of his MS., probably because of the dangerous freedom of Aubrey's pen. Wood was prosecuted eventually for insinuations against the judicial integrity of the earl of Clarendon. One of the two statements called in question was certainly founded on information provided by Aubrey. This perhaps explains the estrangement between the two antiquaries and the ungrateful account that Wood gives of the elder man's character. "He was a shiftless person, roving and magotie-headed, and sometimes little better than crased. And being exceedingly credulous, would stuff his many letters sent to A. W. with follies and misinformations, which sometimes would guide him into the paths of errour."[1] In 1673 Aubrey began his "Perambulation" or "Survey" of the county of Surrey, which was the result of many years' labour in collecting inscriptions and traditions in the country. He began a "History of his Native District of Northern Wiltshire," but, feeling that he was too old to finish it as he would wish, he made over his material, about 1695, to Thomas Tanner, afterwards bishop of St Asaph. In the next year he published his only completed, though certainly not his most valuable work, the *Miscellanies*, a collection of stories on ghosts and dreams. He died at Oxford in June 1697, and was buried in the church of St Mary Magdalene.

Beside the works already mentioned, his papers included: "Architectonica Sacra," notes on ecclesiastical antiquities; and "Life of Thomas Hobbes of Malmesbury," which served as the basis of Dr Blackburn's Latin life, and also of Wood's account. His survey of Surrey was incorporated in R. Rawlinson's *Natural History and Antiquities of Surrey* (1719); his antiquarian notes on Wiltshire were printed in *Wiltshire; the Topographical Collections of John Aubrey*, corrected and enlarged by J. E. Jackson (Devizes, 1862); part of another MS. on "The Natural History of Wiltshire" was printed by John Britton in 1847 for the Wiltshire Topographical Society; the *Miscellanies* were edited in 1890 for the *Library of Old Authors*; the "Minutes for Lives" were partially edited in 1813. A complete transcript, *Brief Lives chiefly of Contemporaries set down by John Aubrey between the Years 1669 and 1696*, was edited for the Clarendon Press in 1898 by the Rev. Andrew Clark from the MSS. in the Bodleian, Oxford.

See also John Britton, *Memoir of John Aubrey* (1845); David Masson, in the *British Quarterly Review*, July 1856; Émile Montégut, *Heures de lecture d'un critique* (1891); and a catalogue of Aubrey's collections in *The Life and Times of Anthony Wood . . .*, by Andrew Clark (Oxford, 1891–1900, vol. iv. pp. 191–193), which contains many other references to Aubrey.

AUBURN, a city and the county-seat of Androscoggin county, Maine, U.S.A., on the Androscoggin river, opposite Lewiston (with which it practically forms an industrial unit), in the S.W. part of the state. Pop. (1890) 11,250; (1900) 12,951, of whom 2076 were foreign-born; (1910, census) 15,064. It is served by the Grand Trunk and the Maine Central railways. The river furnishes abundant water-power, and the city ranked fourth in the state as a manufacturing centre in 1905. Boots and shoes are the principal products; in 1905 seven-tenths of the city's wage-earners were engaged in their manufacture, and Auburn's output ($4,263,162 = 66·5 % of the total factory product of the city) was one-third of that of the whole state. Other manufactures are butter, bread and other bakery products, cotton goods, furniture and leather. The municipality owns and operates its waterworks. Auburn was first settled in 1786, and was incorporated in 1842, but the present charter dates only from 1869.

AUBURN, a city and the county-seat of Cayuga county, New York, U.S.A., 25 m. S.W of Syracuse, on an outlet of Owasco Lake. Pop. (1890) 25,858; (1900) 30,345, of whom 5436 were foreign-born, 2084 being from Ireland and 1023 from England; (1910) 34,668. It is served by the Lehigh Valley and the New York Central & Hudson River railways, and by inter-urban electric lines. The city is attractively situated amidst a group of low hills in the heart of the lake country of western New York; the streets are wide, with a profusion of shade trees. Auburn has a city hall, the large Burtis Auditorium, the Auburn hospital, two orphan asylums, and the Seymour library in the Case Memorial building. There is a fine bronze statue of William H. Seward, who made his home here after 1823, and was buried in Fort Hill Cemetery. In Auburn are the Auburn (State) prison (1816), in connexion with which there is a women's prison; the Auburn Theological Seminary (Presbyterian), founded in 1819, chartered in 1820, and opened for students in 1821; the Robinson school for girls; and the Women's Educational and Industrial Union, for the education of working girls, with a building erected in 1907. The city owns its water-supply system, the water being pumped from Owasco Lake, about 2½ m. S.S.E. of the city. There is a good water-power, and the city has important manufacturing interests. The principal manufactures are cordage and twine, agricultural implements, engines, pianos, boots and shoes, cotton and woollen goods, carpets and rugs, rubber goods, flour and machinery. The total factory product in 1905 was valued at $13,420,863; of this $2,890,301 was the value of agricultural implements, in the manufacture of which Auburn ranked fifth among the cities of the United States. There are a number of grey and blue limestone quarries, one of which is owned and operated by the municipality.

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[1] "Life of Anthony à Wood written by Himself" (*Athen. Oxon.*, ed. Bliss)

Settled soon after the close of the War of Independence, Auburn was laid out in 1793 by Captain John L. Hardenburgh, a veteran of the war, and for some years was known as Hardenburgh's Corners. In 1805, when it was made the county-seat, it was renamed Auburn. It was incorporated in 1814, and was chartered as a city in 1848.

See C. Hawley, *Early Chapters of Cayuga History* (Auburn, 1879).

AUBURN (from the Low Lat. *alburnus*, whitish, light-coloured), ruddy-brown; the meaning has changed from the original one of brownish-white or light yellow (*citrinus*, in *Promptorium Parvulorum*), probably through the intensification of the idea of brown caused by the early spelling "abron" or "abrown."

AUBUSSON, PIERRE D' (1423–1503), grand-master of the order of St John of Jerusalem, and a zealous opponent of the Turks, was born in 1423. He belonged to a noble French family, and early devoted himself to the career of a soldier in the service of the emperor Sigismund. Under the archduke Albert of Austria he took part in a campaign against the Turks, and on his return to France sided with the Armagnacs against the Swiss, greatly distinguishing himself at the battle of St Jacob in 1444. He then joined the order of the knights of Rhodes, and successfully conducted an expedition against the pirates of the Levant and an embassy to Charles VII. He soon rose to the most important offices in the order, and in 1476 was elected grand-master. It was the period of the conquests of Mahommed II., who, supreme in the East, now began to threaten Europe. In December 1479 a large Turkish fleet appeared in sight of Rhodes; a landing was effected, and a vigorous attack made upon the city. But in July of the next year, being reinforced from Spain, the knights forced the Mussulmans to retire, leaving behind them 9000 dead. The siege, in which d'Aubusson was seriously wounded, enhanced his renown throughout Europe. Mahommed was furious, and would have attacked the island again but for his death in 1481. His succession was disputed between his sons Bayezid and Jem. The latter, after his defeat by Bayezid, sought refuge at Rhodes under a safe-conduct from the grand-master and the council of the knights. What followed remains a stain on d'Aubusson's memory. Rhodes not being considered secure, Jem with his own consent was sent to France. Meanwhile, in spite of the safe-conduct, d'Aubusson accepted an annuity of 45,000 ducats from the sultan, in return for which he undertook to guard Jem in such a way as to prevent his design of appealing to the Christian powers to aid him against his brother. For six years Jem, in spite of frequent efforts to escape, was kept a close prisoner in various castles of the Rhodian order in France, until in 1489 he was handed over to Pope Innocent VIII., who had been vying with the kings of Hungary and Naples for the possession of so valuable a political weapon. D'Aubusson's reward was a cardinal's hat (1489), and the power to confer all benefices connected with the order without the sanction of the papacy; the order of St John received the wealth of the suppressed orders of the Holy Sepulchre and St Lazarus. The remaining years of his life d'Aubusson spent in the attempt to restore discipline and zeal in his order, and to organize a grand international crusade against the Turks. The age of the Renaissance, with Alexander Borgia on the throne of St Peter, was, however, not favourable to such an enterprise; the death of Jem in 1495 had removed the most formidable weapon available against the sultan; and when in 1501 d'Aubusson led an expedition against Mytilene, dissensions among his motley host rendered it wholly abortive. The old man's last years were embittered by chagrin at his failure, which was hardly compensated by his success in extirpating Judaism in Rhodes, by expelling all adult Jews and forcibly baptizing their children. In the summer of 1503 he died.

See P. Bouhours, *Hist. de Pierre d'Aubusson* (Paris, 1676; Hague, 1793; abridged ed. Bruges, 1887); G. E. Streck, *Pierre d'Aubusson, Grossmeister*, &c. (Chemnitz, 1873); J. B. Bury in *Cambridge Mod. Hist.* vol. i. p. 85, &c. (for relations with Jem).

AUBUSSON, a town of France, capital of an arrondissement in the department of Creuse, picturesquely situated on the river Creuse 24 m. S.E. of Guéret by rail. Pop. (1906) 6475. It has celebrated manufactories of carpets, &c., employing about 2000 workmen, the artistic standard of which is maintained by a national school of decorative arts, founded in 1869. Nothing certain is known as to the foundation of this industry, but it was in full activity at least as far back as 1531. From the 10th to the 13th century Aubusson was the centre of a viscounty, and the viscountess Marguerite, wife of Rainaud VI., was sung by many a troubadour. After the death of the viscount Guy II. (a little later than 1262) Aubusson was incorporated in the countship of La Marche by Hugh XII. of Lusignan, and shared in its fortunes. Louis XIV. revived the title of viscount of Aubusson in favour of François, first marshall de la Feuillade (1686). From the family of the old viscounts was descended Pierre d'Aubusson (*q.v.*). Admiral Sallandrouze de Lamornaix (1840–1902) belonged to a family of tapestry manufacturers established at Aubusson since the beginning of the 19th century. Aubusson was also the native place of the novelists Léonard Sylvain, Julien Sandeau and Alfred Assollant (1827–1886).

See Le Père Anselme, *Hist. généalogique de la maison de France*, vol. v. pp. 318 et seq.; P. Mignaton, *Hist. de la maison d'Aubusson* (Paris, 1886); Cyprien Pérathon, *Hist. d'Aubusson* (Limoges, 1886). (A. T.)

AUCH, a city of south-western France, capital of the department of Gers, 55 m. W. of Toulouse on the Southern railway. Pop. (1906) 9294. Auch is built on the summit and sides of a hill at the foot of which flow the yellow waters of the Gers. It consists of a lower and upper quarter united in several places by flights of steps. The streets are in general steep and narrow, but there is a handsome promenade in the upper town, laid out in the 18th century by the *intendant* Antoine Mégret d'Etigny. Three bridges lead from the left to the right bank of the Gers, on which the suburb of Patte d'Oie is situated. The most interesting part of the town lies in the old quarter around the Place Salinis, a spacious terrace which commands an extensive view over the surrounding country. On its eastern side it communicates with the left bank of the river by a handsome series of steps; on its north side rises the cathedral of Sainte-Marie. This church, built from 1489 to 1662, belongs chiefly to the Gothic style, of which it is one of the finest examples in southern France. The façade, however, with its two square and somewhat heavy flanking towers dates from the 17th century, and is Greco-Roman in architecture. Sainte-Marie contains many artistic treasures, the chief of which are the magnificent stained-glass windows of the Renaissance which light the apsidal chapels, and the 113 choir-stalls of carved oak, also of Renaissance workmanship. The archbishop's palace adjoins the cathedral; it is a building of the 18th century with a Romanesque hall and a tower of the 14th century. Opposite the south side of the cathedral stands the lycée on the site of a former Jesuit college. Only scanty remains are left of the once celebrated abbey of St Orens. The ecclesiastical seminary contains an important library with a collection of manuscripts, and there is a public library in the Carmelite chapel, a building of the 17th century. The former palace of the *intendants* of Gascony is now used as the *préfecture*. Auch is the seat of an archbishopric, a prefect and a court of assizes, and has tribunals of first instance and of commerce, a chamber of commerce, a lycée, training-colleges, a school of design, a branch of the Bank of France and an important lunatic asylum. The manufactures include agricultural implements, leather, vinegar and plaited sandals, and there is a trade in brandy, wine, cattle, poultry and wool; there are quarries of building-stone in the neighbourhood.

Auch (Elimberris) was the capital of a Celtiberian tribe, the Ausci, and under the Roman domination was one of the most important cities in Gaul. In the 4th century this importance was increased by the foundation of its bishopric, and after the destruction of Eauze in the 9th century it became the metropolis of Novempopulana. Till 732, Auch stood on the right bank of the Gers, but in that year the ravages of the Saracens drove the inhabitants to take refuge on the left bank of the river, where a new city was formed. In the 10th century Count Bernard of Armagnac founded the Benedictine abbey of St Orens, the monks of which, till 1308, shared the jurisdiction over Auch with the archbishops—an arrangement which gave rise to constant strife. The counts of Armagnac possessed a castle in the city, which was the capital of Armagnac in the middle ages. During the Religious Wars of the 16th century Auch remained Catholic, except for a short occupation in 1569 by the Huguenots under Gabriel, count of Montgomery. In the 18th century it was capital of Gascony, and seat of a generality. Antoine Mégret d'Etigny, intendant from 1751 to 1767, did much to improve the city and its commerce.

AUCHMUTY, SIR SAMUEL (1756–1822), British general, was born at New York in 1756, and served as a loyalist in the American War of Independence, being given an ensigncy in the royal army in 1777, and in 1778 a lieutenancy in the 45th Foot, without purchase. When his regiment returned to England after the war, having neither private means nor influence, he exchanged into the 52nd, in order to proceed to India. He took part in the last war against Hyder Ali; he was given a staff appointment by Lord Cornwallis in 1790, served in the operations against Tippoo Sahib, and continued in various staff appointments up to 1797, when he returned to England a brevet lieut.-colonel. In 1800 he was made lieut.-colonel and brevet colonel; and in the following year, as adjutant-general to Sir David Baird in Egypt, took a distinguished share in the march across the desert and the capture of Alexandria. On his return to England in 1803 he was knighted, and three years later he went out to the River Plate as a brigadier-general. Auchmuty was one of the few officers who came out of the disastrous Buenos Aires expedition of 1806–7 with enhanced reputation. While General Whitelocke, the commander, was cashiered, Auchmuty was at once re-employed and promoted major-general, and was sent out in 1810 to command at Madras. In the following year he commanded the expedition organized for the conquest of Java, which the governor-general, Lord Minto, himself accompanied. The storming of the strongly fortified position of Meester Cornelis (28th August 1811), stubbornly defended by the Dutch garrison under General Janssens, practically achieved the conquest of the island, and after the action of Samarang (September 8th) Janssens surrendered. Auchmuty received the thanks of parliament and the order of K.C.B. (G.C.B. in 1815), and in 1813, on his return home, was promoted to the rank of lieut.-general. In 1821 he became commander-in-chief in Ireland, and a member of the Irish privy council. He died suddenly on the 11th of August 1822.

AUCHTERARDER (Gaelic, "upper high land"), a police burgh of Perthshire, Scotland, 13¾ m. S.W. of Perth by the Caledonian railway. Pop. (1901) 2276. It is situated on Ruthven Water, a right-hand tributary of the Earn. The chief manufactures are those of tartans and other woollens, and of agricultural implements. At the beginning of the 13th century it obtained a charter from the earl of Strathearn, afterwards became a royal burgh for a period, and was represented in the Scottish parliament. Its castle, now ruinous, was built as a hunting-lodge for Malcolm Canmore, but of the abbey which it possessed as early as the reign of Alexander II. (1198–1249) no remains exist. The ancient church of St Mungo, now in ruins, was a building in the Norman or Early Pointed style. The town was almost entirely burned down by the earl of Mar in 1716 during the abortive Jacobite rising. It was in connexion with this parish that the ecclesiastical dispute arose which led to the disruption in the Church of Scotland in 1843. The estate of Kincardine, 1 m. south, gives the title of earl of Kincardine to the duke of Montrose. The old castle, now in ruins, was dismantled in 1645 by the marquis of Argyll in retaliation for the destruction of Castle Campbell in Dollar Glen on the south side of the Ochils. The old ruined castle of Tullibardine, 2 m. west of the burgh, once belonged to the Murrays of Tullibardine, ancestors of the duke of Atholl, who derives the title of marquis of Tullibardine from the estate. The ancient chapel adjoining, also ruinous, was a burial-place of the Murrays.

AUCHTERMUCHTY (Gaelic, "the high ground of the wild sow"), a royal and police burgh of Fifeshire, Scotland, built on an elevation about 9 m. W. by S. of Cupar, with a station on a branch of the North British railway from Ladybank to Mawcarse Junction. Pop. 1387. The rapid Loverspool Burn divides the town. The principal industries include the weaving of linen and damasks, bleaching, distilling and malting. John Glas, founder of the sect known as Glassites or Sandemanians, was a native of the town. A mile and a half to the south-west is the village of Strathmiglo (pop. 966), on the river Eden, with a linen factory and bleaching works.

AUCKLAND, GEORGE EDEN, Earl of (1784–1849), English statesman, was the second son of the 1st Baron Auckland. He completed his education at Oxford, and was admitted to the bar in 1809. His elder brother was drowned in the Thames in the following year; and in 1814, on the death of his father, he took his seat in the House of Lords as Baron Auckland. He supported the Reform party steadily by his vote, and in 1830 was made president of the Board of Trade and master of the Mint. In 1834 he held office for a few months as first lord of the admiralty, and in 1835 he was appointed governor-general of India. He proved himself to be a painstaking and laborious legislator, and devoted himself specially to the improvement of native schools, and the expansion of the commercial industry of the nation committed to his care. These useful labours were interrupted in 1838 by complications in Afghanistan, which excited the fears not only of the Anglo-Indian government but of the home authorities. Lord Auckland resolved to enter upon a war, and on the 1st of October 1838 published at Simla his famous manifesto dethroning Dost Mahommed. The early operations were crowned with success, and the governor-general received the title of earl of Auckland. But reverses followed quickly, and in the ensuing campaigns the British troops suffered the most severe disasters. Lord Auckland had the double mortification of seeing his policy a complete failure and of being superseded before his errors could be rectified. In the autumn of 1841 he was succeeded in office by Lord Ellenborough, and returned to England in the following year. In 1846 he was made first lord of the admiralty, which office he held until his death, on the 1st of January 1849. He died unmarried, and the earldom became extinct, the barony (see below) passing to his brother Robert.

See S. J. Trotter, *The Earl of Auckland* ("Rulers of India" series), 1893.

AUCKLAND, WILLIAM EDEN, 1st Baron (1745–1814), English statesman, son of Sir Robert Eden, 3rd Bart., of Windlestone Hall, Durham, and of Mary, daughter of William Davison, was born in 1745, educated at Eton and Christ Church, Oxford, and called to the bar at the Middle Temple in 1768. In 1771 he published *Principles of Penal Law*, and was early recognized as an authority on commercial and economic questions, and in 1772 he was appointed an under secretary of state. He represented New Woodstock in the parliaments of 1774 and 1780, and Heytesbury in those of 1784 and 1790. In 1776 he was appointed a commissioner on the board of trade and plantations. In 1778 he carried an act for the improvement of the treatment of prisoners, and accompanied the earl of Carlisle as a commissioner to North America on an unsuccessful mission to settle the disputes with the colonists. On his return in 1779 he published his widely read *Four Letters to the Earl of Carlisle*, and in 1780 became chief secretary for Ireland. He was elected to the Irish House of Commons as member for Dungannon in 1781 and sworn of the Irish privy council, and while in Ireland established the National Bank. He advised the increase of the secret service fund, and was reputed, according to Lord Charlemont (a political opponent), as especially skilful in the arts of corruption and in overcoming political prejudices. He resigned in 1782, but in the following year he took office again as vice-treasurer of Ireland under the coalition ministry, which he had been instrumental in arranging, and was included in the privy council, resigning with the government in December. He opposed strongly Pitt's propositions for free trade between England and Ireland in 1785, but took office with Pitt as a member of the committee on trade and plantations, and negotiated in 1786 and 1787 Pitt's important commercial treaty with France, and agreements concerning the East India Companies and Holland. In 1787 he published his *History of New Holland.* Next year he was sent as ambassador to Spain, and after his return was created (September 1789) Baron Auckland in the Irish peerage. The same year he was sent on a mission to Holland, and represented English interests there with great zeal and prudence during the critical years of 1790 to 1793, obtaining the assistance of the Dutch fleet in 1790 on the menace of a war with Spain, signing the convention relating to the Netherlands the same year, and in 1793 attending the congress at Antwerp. He retired from the public service in the latter year, received a pension of £2300, and was created Baron Auckland of West Auckland, Durham, in the English peerage. During his retirement in the country at Beckenham, he continued his intimacy with Pitt, his nearest neighbour at Holwood, who at one time had thoughts of marrying his daughter; and with Pitt's sanction he published his *Remarks on the Apparent Cicumstances of the War* in 1795, to prepare public opinion for a peace. In 1798 he was included in Pitt's government as joint postmaster-general, and supported strongly the income tax and the Irish Union, assisting in drawing up the act embodying the latter. In 1799 he brought in a bill to check adultery by preventing the marriage of the guilty parties, and the same year took a mischievous part in the cabal against Sir Ralph Abercromby. He severely criticized Pitt's resignation in 1801, from which he had endeavoured to dissuade him, and retained office under Addington. This terminated his friendship with Pitt, who excluded him from his administration in 1804 though he increased his pension. Auckland was included in Granville's ministry of "All the Talents" as president of the board of trade in 1806. He held the appointments of auditor and director of Greenwich hospital, recorder of Grantham, and chancellor of the Marischal College in Aberdeen. He died on the 28th of May 1814.

He had married in 1776 Eleanor, sister of the first Lord Minto, and had a large family. Emily Eden (1797–1869), the novelist, was one of his daughters. On the death of his son George, 2nd baron and earl of Auckland (*q.v.*), the barony passed to the 1st baron's younger son Robert John (1799–1870), bishop of Bath and Wells, from whom the later barons were descended, and who was also the father of Sir Ashley Eden (1831–1887), lieutenant-governor of Bengal. The 1st baron had two distinguished brothers—Morton Eden (1752–1830), a diplomatist, who married Lady Elizabeth Henley, and in 1799 was created 1st Baron Henley (his family, from 1831, taking the name of Henley instead of Eden); and Sir Robert Eden, governor of Maryland, whose son, Sir Frederic Morton Eden (1766–1809), was a well-known economist.

Lord Auckland's *Journal and Correspondence*, published in 1861–1862, throws much light on the political history of the time.

AUCKLAND, a city and seaport on the east coast of North Island, New Zealand, in Eden county; capital of the province of its name, and the seat of a bishop. Pop. (1906) 37,736; including suburbs, 82,101. It is situated at the mouth of an arm of Hauraki Gulf, and is only 6 m. distant from the head of Manukau harbour on the western coast. The situation is extremely beautiful. The Hauraki Gulf, a great square inlet opening northward, is studded with islands of considerable elevation; Rangitoto, which protects the harbour, is a volcanic cone reaching nearly 1000 ft. The isthmus on which the town stands (which position has caused it to be likened to Corinth) can be crossed without surmounting any great elevation, and offers a feasible canal route. A number of small extinct volcanoes, however, appear in all directions. To the west the Titirangi hills exceed 1400 ft. Some of the volcanic soil is barren, but much of the district is clothed in luxuriant vegetation.

Auckland harbour, one of the best in New Zealand, is approachable by the largest vessels at the lowest tide. There are two graving docks. Queen Street, the principal thoroughfare, leads inland from the main dock, and contains the majority of the public buildings. There is a small government house, standing in beautiful grounds, adjoining Albert Park, with plantations of oaks and pines. The government offices, art gallery and exchange, with St Mary's cathedral (Anglican), a building in a combination of native timbers, St Paul's and St Patrick's cathedral (Roman Catholic), are noteworthy buildings. The art gallery and free library contain excellent pictures, and valuable books and MSS. presented by Sir G. Grey. The museum contains one of the best existing collections of Maori art. There are an opera-house and an academy of music. The Auckland University College and the grammar school are the principal educational establishments. The parks are the Domain, with a botanical garden, the Albert Park near the harbour, with a bronze statue of Queen Victoria, the extensive grounds at One Tree Hill on the outskirts, and Victoria Park on Freeman's Bay. The principal thoroughfares are served by electric tramway. Of the suburbs, Newton, Parnell and Newmarket are in reality outlying parts of the town itself. Devonport, Birkenhead and Northcote are beautifully situated on the north shore of the inlet, and are served by steam-ferries. Several other residential suburbs lie among the hills on the mainland, such as Mount Albert, Mount Eden and Epsom. Onehunga is a small port on Manukau harbour, served by rail. In Parnell is the former residence of Bishop Selwyn, who, arriving in the colony in 1842, assisted to draw up the constitution of the Anglican church. There are many associations with his name in the neighbourhood. The prospect over the town and its environs from Mount Eden is justly famous. The hill is terraced with former native fortifications.

Auckland has industries of sugar-refining, ship-building and paper-, rope- and brick-making, and timber is worked. The town was founded as capital of the colony in 1840 by Governor Hobson. There is communication both south and north by rail, and regular steamers serve the ports of the colony, the principal Pacific Islands, Australia, &c. From 1853 to 1876 Auckland was the seat of the provincial government, and until 1865 that of the central government, which was then transferred to Wellington. The first session of the general assembly took place here in 1854. Auckland is under municipal government.

AUCKLAND ISLANDS, a group in the Pacific Ocean, discovered in 1806 by Captain Briscoe, of the English whaler "Ocean," in 50° 24′ S., 166° 7′ E. The islands, of volcanic origin, are very fertile, and are covered with forest. They were granted to the Messrs Enderby by the British government as a whaling station, but the establishment was abandoned in 1852. The islands belong politically to New Zealand.

AUCTION PITCH, a card game which is a popular variation of All Fours (*q.v.*). The name is derived from the rule that the first card played, or *pitched*, is the trump suit, and that the eldest hand has the privilege of pitching it or of selling out to the highest bidder. A full pack is used, and the cards rank as in All Fours, namely from ace down to 2, ace being highest in cutting also. From four to seven may play, each player being provided with seven white counters, and also with red counters in case stakes are played for. Each player receives six cards in every deal, three at a time, no trump being turned. The object is to get rid of the white counters, one of which may be put into the pool either (1) for holding the highest trump played; (2) for having the lowest trump dealt to one; (3) for taking the Jack (knave) of trumps; or (4) for winning the *game*, namely the greatest number of pips that count. In case of a tie of pips no game is scored. If the eldest hand decides to pitch and not to sell out, he may do so, but is obliged to make four points or be set back that number. If he decides to sell, he says "I pass," and the player at his left bids for the privilege of pitching the trump or passes, &c. When a bid has been made the rest must pass or bid higher, and the eldest hand must either accept a bid or undertake to make as many points as the bidder. If no bid is made he pitches the trump himself, without the obligation of making anything. The first card played is the trump suit, the winner of the trick leading again. In trumps a player must follow suit if he can, and the same rule applies in plain suits, excepting that a trump may be played at any time ("follow suit or trump"). In play the highest card wins the trick unless trumped. When the hand is played out each player puts a white counter into the pool for every point won, and the first player to get rid of all his seven white counters wins the pool and takes from it all the red counters, which represent cash. This ends the game. In case two players count out during the same deal, the bidder has the first right to the pool, the rule being "bidder counts out first." If the two players who count out are neither of them bidder, then they go out in regular order, *i.e.* high first, then low, Jack and game. If a bidder fails to make his points he is set back that number. A revoke is punished by the offender being set back the number of points bid and forfeiting a red counter to the pool.

AUCTIONS and **AUCTIONEERS.** An auction (Lat. *auctio*, increase) is a proceeding at which people are invited to compete for the purchase of property by successive offers of advancing sums. The advantages of conducting a sale in this way are obvious, and we naturally find that auctions are of great antiquity. Herodotus describes a custom which prevailed in Babylonian villages of disposing of the maidens in marriage by delivering them to the highest bidders in an assembly annually held for the purpose (Book i. 196). So also among the Romans the quaestor sold military booty and captives in war by auction—*sub hasta*—the spear being the symbol of quiritarian ownership. The familiarity of such proceedings is forcibly suggested by the conduct of the Praetorian Guard when Sulpicianus was treating for the imperial dignity after the murder of Pertinax. Apprehending that they would not obtain a sufficient price by private contract, the Praetorians proclaimed from their ramparts that the Roman world was to be disposed of by public auction to the best bidder. Thereupon Julian proceeded to the foot of the ramparts and outbid his competitor (Gibbon, vol. i. ch. v.). Though, however, auctions were undoubtedly common among the Romans both in public and private transactions, the rules whereby they were governed are by no means clearly enunciated in the *Corpus Juris Civilis*.

In England the method of conducting auctions has varied. In some places it has been usual to set up an inch of lighted candle, the person making the last bid before the fall of the wick becoming the purchaser. By an act of William III. (1698), this method of sale was prescribed for goods and merchandise imported from the East Indies. Lord Eldon speaks of "candlestick biddings," where the several bidders did not know what the others had offered. A "dumb bidding" was the name given to a proceeding at which a price was put by the owner under a candlestick with a stipulation that no bidding should avail if not equal to it. In a "Dutch auction" property is offered at a certain price and then successively at lower prices until one is accepted.

According to the practice now usual in England, a proposed auction is duly advertised, and a printed catalogue in the case of chattels, or particulars of sale in the case of land, together with conditions of sale, are circulated. Sometimes, in sales of goods, the conditions are merely suspended in the auction room. At the appointed time and place, the auctioneer, standing in a desk or rostrum, "puts up" the several lots in turn by inviting biddings from the company present. He announces the acceptance of the last bid by a tap with his hammer and so "knocks down" the lot to the person who has made it. Sometimes property is offered on lease to the highest bidder. "Roup" is the Scottish term for an auction. A bid in itself is only an offer, and may accordingly be retracted at any time before its acceptance by the fall of the hammer or otherwise. Puffing is unlawful. Unless a right to bid is expressly reserved on behalf of the vendor, he must neither bid himself nor employ any one else to bid. When a right to bid has been expressly reserved, the seller or any one person (but no more) on his behalf may bid at the auction. If it is simply announced that the sale is to be subject to a reserved or upset price, no bidding by or on behalf of the seller is permissible: it is only lawful to declare by some appropriate terms that the property is withdrawn. Where a sale is expressed to be without reserve, or where an upset price has been reached, the auctioneer must, after the lapse of a reasonable interval, accept the bid of the highest *bona fide* bidder. By not doing so he would render the vendor liable in damages. The auctioneer must not make a pretence of receiving bids which are not in fact made, as it would be fraudulent to run up the price by such an artifice. A "knock-out" is a combination of persons to prevent competition between themselves at an auction by an arrangement that only one of their number shall bid, and that anything obtained by him shall be afterwards disposed of privately among themselves. Such a combination is not illegal. A "mock auction" is a proceeding at which persons conspire by artifice to make it appear, contrary to the fact, that a *bona fide* sale is being conducted, and so attempt to induce the public to purchase articles at prices far above their value. Those who invite the public to enter the room where the supposed auction is proceeding, or otherwise endeavour to attract bidders, are called "barkers." A conspiracy to defraud in this way is an indictable offence.

American law is in general the same as the English law with regard to auctions. As to bidding by the vendor, however, it is less stringent. For, though puffing or by-bidding, as it is often called, will, under both systems alike, render an auction sale voidable at the option of a purchaser when it amounts to fraud, the weight of authority in the United States is in favour of the view that an owner may, without notice, employ a person to bid for him, if he does so with no other purpose than to prevent a sacrifice of the property under a given price.

By a charter of Henry VII., confirmed by Charles I., the business of selling by auction was confined to an officer called an *outroper*, and all other persons were prohibited from selling goods or merchandise by public claim or outcry (see Henry Blackstone's *Reports*, vol. ii. p. 557). The only qualification now required by an auctioneer is a licence on which a duty of £10 has to be paid, and which must be renewed before the 5th of July in each year. A liability to a penalty of £100 is incurred by acting as an auctioneer without being duly licensed. The duty formerly imposed upon the purchase-money payable by virtue of a sale at auction was abolished by an act of 1845. An auctioneer is bound under a penalty of £20 to see that his full name and address are displayed before the commencement of an auction and during its continuance in the place where he conducts it. He is the agent of the vendor only, except in so far that, after he has knocked down a lot to the highest bidder, he has authority to affix the name of the latter to a memorandum of the transaction, so as to render the contract of sale enforceable where written evidence is necessary. An auctioneer does not, by merely announcing that a sale of certain articles will take place, render himself liable to those who, in consequence, attend at the time and place advertised, if the sale is not in fact proceeded with, provided he acts in good faith. One of the chief risks run by an auctioneer is that of being held liable for the conversion of goods which he has sold upon the instructions of a person whom he believed to be the owner, but who in fact had no right to dispose of them.

The number of auctioneers' licences issued during the year ended the 31st of March 1908 was in England 6639, in Scotland 760, and in Ireland 839. A central organization having its headquarters in London, the Auctioneers' Institute of the United Kingdom, was founded in 1886, in order to elevate the status and further the interests of auctioneers, estate agents and valuers. It has nearly 2000 members. (H. Ha.)

AUCUBA, the Japanese name for a small genus of the Dogwood order (Cornaceae). The familiar Japanese laurel of gardens and shrubberies is *Aucuba japonica*. It bears male and female flowers on distinct plants; the red berries often last till the next season's flowers appear. There are numerous varieties in cultivation, differing in the variegation of their leaves.

AUDAEUS, or AUDIUS, a church reformer of the 4th century, by birth a Mesopotamian. He suffered much persecution from the Syrian clergy for his fearless censure of their irregular lives, and was expelled from the church, thereupon establishing an episcopal monastic community. He was afterwards banished into Scythia, where he worked successfully among the Goths, not living to see the destruction of his labours by Athanaric. The Audaeans celebrated the feast of Easter on the same day as the Jewish Passover, and they were also charged with attributing to the Deity a human shape, an opinion which they appear to have founded on Genesis i. 26. Theodoret groundlessly accuses them of Manichean tendencies.

The main source of information is Epiphanius (*Haer.* 70).

AUDE, a river of south-western France, rising in the eastern Pyrenees and flowing into the Golfe du Lion. Rising in a small lake a short distance east of the Puy de Carlitte, it soon takes a northerly direction and flows for many miles through deep gorges of great beauty as far as the plain of Axat. Beyond Axat its course again lies through defiles which become less profound as the river nears Carcassonne. Below that town it receives the waters of the Fresquel and turns abruptly east. From this point to its junction with the Cesse its course is parallel with that of the Canal du Midi. The river skirts the northern spurs of the Corbières, some distance below which it is joined by the Orbieu and the Cesse. It then divides into two branches, the northernmost of which, the Aude proper, runs east and empties into the Mediterranean some 12 m. east-north-east of Narbonne, while the other branch, the Canal de la Robine, turning south, traverses that town, below which its course to the sea lies between two extensive lagoons, the Étang de Bages et de Sigean and the Étang de Gruissan. The Aude has a length of 140 m. and a basin 2061 sq. m. in extent. There is practically no traffic upon it.

AUDE, a maritime department of southern France, formed in 1790 from part of the old province of Languedoc. Area, 2448 sq. m. Pop. (1906) 308,327. It is bounded E. by the Mediterranean, N. by the departments of Hérault and Tarn, N.W. by Haute-Garonne, W. by Ariège, and S. by Pyrénées-Orientales. The department is traversed on its western boundary from S. to N. by a mountain range of medium height, which unites the Pyrenees with the southern Cévennes; and its northern frontier is occupied by the Montagne Noire, the most westerly portion of the Cévennes. The Corbières, a branch of the Pyrenees, run in a south-west and north-east direction along the southern district. The Aude (*q.v.*), its principal river, has almost its entire length in the department, and its lower course, together with its tributary the Fresquel, forms the dividing line between the Montagne Noire and the Pyrenean system.

The lowness of the coast causes a series of large lagoons, the chief of which are those of Bages et Sigean, Gruissan, Lapalme and Leucate. The climate is warm and dry, but often sudden in its alterations. The wind from the north-west, known as the *cers*, blows with great violence, and the sea-breeze is often laden with pestilential effluvia from the lagoons. The agriculture of the department is in a flourishing condition. The meadows are extensive and well watered, and are pastured by numerous flocks and herds. The grain produce, consisting mainly of wheat, oats, rye and Indian corn, exceeds the consumption, and the vineyards yield an abundant supply of both white and red wines, those of Limoux and the Narbonnais being most highly esteemed. Truffles are abundant. The olive and chestnut are the chief fruits. Mines of iron, manganese, and especially of mispickel, are worked, and there are stone-quarries and productive salt-marshes. Brewing, distilling, cooperage, iron-founding, hat-making and machine construction are carried on, and there are flour-mills, brick-works, saw-mills, sulphur refineries and leather and paper works. The formerly flourishing textile industries are now of small importance. The department imports coal, lime, stone, salt, raw sulphur, skins and timber and exports agricultural and mineral products, bricks and tiles, and other manufactured goods. It is served by the Southern railway. The Canal du Midi, following the courses of the Fresquel and the Aude, traverses it for 76 m.; and a branch, the Canal de la Robine, which passes through Narbonne to the sea, has a length of 24 m. The capital is Carcassonne, and the department is divided into the four arrondissements of Carcassonne, Limoux, Narbonne and Castelnaudary, with 31 cantons and 439 communes. It belongs to the 16th military region, and to the académie (educational division) of Montpellier, where also is its court of appeal. It forms the diocese of Carcassonne. and part of the province of the archbishop of Toulouse. Carcassonne, Narbonne and Castelnaudary are the principal towns. At Alet, which has hot springs of some note, there are ruins of a fine Romanesque cathedral destroyed in the religious wars of the 16th century. The extensive buildings of the Cistercian abbey of Fontfroide, near Bizanet, include a Romanesque church, a cloister, dormitories and a refectory of the 12th century. A curious polygonal church of the 11th century at Rieux-Minervois, the abbey-church at St Papoul, with its graceful cloister of the 14th century, and the remains of the important abbey of St Hilaire, founded in the 6th century and rebuilt from the 12th to the 15th century, are also of antiquarian interest. Rennes-les-Bains has mineral springs of repute.

AUDEBERT, JEAN BAPTISTE (1759–1800), French artist and naturalist, was born at Rochefort in 1759. He studied painting and drawing at Paris, and gained considerable reputation as a miniature-painter. Employed in preparing plates for the *Histoire des coléoptères* of G. A. Olivier (1756–1814), he acquired a taste for natural history. In 1800 appeared his first original work, *L'Histoire naturelle des singes, des makis et des galéopithèques*, illustrated by sixty-two folio plates, drawn and engraved by himself. The colouring in these plates was unusually beautiful, and was applied by a method devised by himself. Audebert died in Paris in 1800, leaving complete materials for another great work, *Histoire des colibris, des oiseaux-mouches, des jacamars et des promérops*, which was published in 1802. Two hundred copies were printed in folio, one hundred in large quarto, and fifteen were printed with the whole text in letters of gold. Another work, left unfinished, was also published after the author's death, *L'Histoire des grimpereaux et des oiseaux de paradis*. The last two works also appeared together in two volumes, *Oiseaux dorés ou à reflets métalliques* (1802).

AUDEFROI LE BATARD, French *trouvère*, flourished at the end of the 12th century and was born at Arras. Of his life nothing is known. The seigneur de Nesles, to whom some of his songs are addressed, is probably the châtelain of Bruges who joined the crusade of 1200. Audefroi was the author of at least five lyric romances: *Argentine*, *Belle Idoine*, *Belle Isabeau*, *Belle Emmelos* and *Béatrix*. These romances follow older *chansons* in subject, but the smoothness of the verse and beauty of detail hardly compensate for the spontaneity of the shorter form.

See A. Jeanroy, *Les Origines de la poésie lyrique en France au moyen âge* (Paris, 1889).

AUDIENCE (from Lat. *audire*, to hear), the act or state of hearing, the term being therefore transferred to those who hear or listen, as in a theatre, at a concert or meeting. In a more technical sense, the term is applied to the right of access to the sovereign enjoyed by the peers of the realm individually and by the House of Commons collectively. More particularly it means the ceremony of the admission of ambassadors, envoys or others to an interview with a sovereign or an important official for the purpose of presenting their credentials. In France, *audience* is the term applied to the sitting of a law court for hearing actions. In Spain, *audiencia* is the name given to certain tribunals which try appeals from minor courts. The Spanish judges were originally known as *oidores*, hearers, from the Spanish *oir*, to hear; but they are now called *ministros*, or *magistrados togados*, robed judges, as the gown of the Spanish judge is called a *toga*. The *audiencia pretorial*, *i.e.* of the praetor, was a court in Spanish America from which there was no appeal to the viceroy, but only to the council of the Indies in Spain. It is not the custom in Spain to speak of *audiencias reales*, royal courts, but of the *audiencias del Reino*, courts of the kingdom.

In England the *Audience-court* was an ecclesiastical court, held by the archbishops of Canterbury and York, in which they once exercised a considerable part of their jurisdiction, dealing with such matters as they thought fit to reserve for their own hearing. It has been long disused and is now merged in the court of arches.

AUDIFFRET-PASQUIER, EDMÉ ARMAND GASTON, Duc d' (1823–1905), French statesman, was the grand-nephew and adopted son of Baron Etienne Denis Pasquier. He was created duke in 1844, and became auditor at the council of state in 1846. After the revolution of 1848 he retired to private life. Under the empire he was twice an unsuccessful candidate for the legislature, but was elected in February 1871 to the National Assembly, and became president of the right centre in 1873. After the fall of Thiers, he directed the negotiations between the different royalist parties to establish a king in France, but as he refused to give up the tricolour for the flag of the old *régime*, the project failed. Yet he retained the confidence of the chamber, and was its president in 1875 when the constitutional laws were being drawn up. Nominated senator under the new constitution, he likewise was president of the senate from March 1876 to 1879 when his party lost the majority. Henceforth he was less prominent in politics. He was distinguished by his moderation and uprightness; and he did his best to dissuade MacMahon from taking violent advisers. In 1878 he was elected to the French Academy, but never published anything.

AUDIT and **AUDITOR.** An audit is the examination of the accounts kept by the financial officers of a state, public corporations and bodies, or private persons, and the certifying of their accuracy. In the United Kingdom the public accounts were audited from very early times, though, until the reign of Queen Elizabeth, in no very systematic way. Prior to 1559 this duty was carried out, sometimes by auditors specially appointed, at other times by the auditors of the land revenue, or by the auditor of the exchequer, an office established as early as 1314. But in 1559 an endeavour was made to systematize the auditing of the public accounts, by the appointment of two auditors of the imprests. These officers were paid by fee and did their work by deputy, but as the results were thoroughly unsatisfactory the offices were abolished in 1785. An audit board, consisting of five commissioners, was appointed in their place, but in order to concentrate under one authority the auditing of the accounts of the various departments, some of which had been audited separately, as the naval accounts, the Exchequer and Audit Act of 1866 was passed. This statute, which sets forth at length the duties of the audit office, empowered the sovereign to appoint a "comptroller and auditor-general," with the requisite staff to examine and verify the accounts prepared by the different departments of the public service. In examining accounts of the appropriation of the several supply grants, the comptroller and auditor-general "ascertains first whether the payments which the account department has charged to the grant are supported by vouchers or proofs of payments; and second, whether the money expended has been applied to the purpose or purposes for which such grant was intended to provide." The treasury may also submit certain other accounts to the audit of the comptroller-general. All public moneys payable to the exchequer (*q.v.*) are paid to the "account of His Majesty's exchequer" at the Bank of England, and daily returns of such payments are forwarded to the comptroller. Quarterly accounts of the income and charge of the consolidated fund are prepared and transmitted to him, and in case of any deficiency in the consolidated fund, he may certify to the bank to make advances.

In the United States the auditing of the Federal accounts is in the charge of the treasury department, under the supervision of the comptroller of the treasury, under whom are six auditors, (1) for the treasury department, (2) for the war, (3) for the interior, (4) for the navy, (5) for the state, &c., (6) for the post office, as well as a register and assistant register, who keep all general receipt and expenditure ledgers; there are official auditors in most of the states and in many cities. In practically all European countries there is a department of the administration, charged with the auditing of the public accounts, as the *cour des comptes* in France, the *Rechnungshof des deutschen Reiches* in Germany, &c. All local boards, large cities, corporations, and other bodies have official auditors for the purpose of examining and checking their accounts and looking after their expenditure. So far as regards the work which auditors discharge in connexion with the accounts of joint-stock companies, building societies, friendly societies, industrial and provident societies, savings banks, &c., the word auditor is now almost synonymous with "skilled accountant," and his duties are discussed in the article Accountants.

In Scotland there is an "auditor" who is an official of the court of session, appointed to tax costs in litigation, and who corresponds to the English taxing-master. In France there are legal officers, called auditors, attached to the *Conseil d'État*, whose duties consist in drawing up briefs and preparing documents. On the continent of Europe, lawyers skilled in military law are called "auditors" (see Military Law).

Auditor is also the designation of certain officials of the Roman curia. The *auditores Rotae* are the judges of the court of the Rota (so called, according to Hinschius, probably from the form of the panelling in the room where they originally met). These were originally ecclesiastics appointed to *hear* particular questions in dispute and report to the pope, who retained the decision in his own hands. In the *Speculum juris* of Durandus (published in 1272 and re-edited in 1287 and 1291) the *auditores palatii domini papae* are cited as permanent officials appointed to instruct the pope on questions as they arose. The court of the Rota appears for the first time under this name in the bull *Romani Pontificis* of Martin V. in 1422, and the auditores by this time had developed into a permanent tribunal to which the definitive decision of certain disputes, hitherto relegated to a commission of cardinals or to the pope himself, was assigned. From this time the powers of the auditores increased until the reform of the curia by Sixtus V., when the creation of the congregations of cardinals for specific purposes tended gradually to withdraw from the Rota its most important functions. It still, however, ranks as the supreme court of justice in the papal curia, and, as members of it, the auditores enjoy special privileges. They are prelates, and, besides the rights enjoyed by these, have others conceded by successive popes, *e.g.* that of holding benefices in plurality, of non-residence, &c. When the pope says mass pontifically the subdeacon is always an auditor. The auditores must be in priest's or deacon's orders, and have always been selected—nominally at least—after severe tests as to their moral and intellectual qualifications. They are twelve in number, and, by the constitution of Pius IV., four of them were to be foreigners: one French, one Spanish, one German and one Venetian; while the nomination of others was the privilege of certain cities. No bishop, unless *in partibus* (see Bishop), may be an auditor. On the other hand, from the auditores, as the intellectual *élite* of the curia, the episcopate, the nunciature and the cardinalate are largely recruited. The *auditor camerae* (*uditore generale della reverenda camera apostolica*) is an official formerly charged with important executive functions. In 1485, by a bull of Innocent VIII., he was given extensive jurisdiction over all civil and criminal causes arising in the curia, or appealed to it from the papal territories. In addition he received the function of watching over the execution of all sentences passed by the curia. This was extended later, by Pius IV., to a similar executive function in respect of all papal bulls and briefs, wherever no special executor was named. This right was confirmed by Gregory XVI. in 1834, and the auditor may still in principle issue letters monitory. In practice, however, this function was at all times but rarely exercised, and, since 1847, has fallen to a prelate *locum tenens*, who also took over the auditor's jurisdiction in the papal states (Hinschius, *Kathol. Kirchenrecht*, i. 409, &c.).

Auditores (listeners), in the early Church, was another name for catechumens (*q.v.*).

AUDLEY, or Audeley, **SIR JAMES** (*c.* 1316–1386), one of the original knights, or founders, of the order of the Garter, was the eldest son of Sir James Audley of Stratton Audley in Oxfordshire. When the order of the Garter was founded, he was instituted as one of the first founders, and his stall in St George's chapel, Windsor, was the eleventh on the side of Edward, the Black Prince. He appears to have served in France in 1346, and in August 1350 took part in the naval fight off Sluys. When hostilities were renewed between England and France in 1354 Sir James was in constant attendance upon the Black Prince, and earned a great reputation for valour. At the battle of Poitiers on the 19th of September 1356 he took his stand in front of the English army, and after fighting for a long time was severely wounded and carried from the fight. After the victory, the prince inquired for Sir James, who was brought to the royal tent, where Edward told him he had been the bravest knight on his side, and granted him an annuity of five hundred marks. Sir James made over this gift to the four esquires who had attended him during the battle, and received from the prince a further pension of six hundred marks. In 1359 he was one of the leaders of an expedition into France, in 1360 he took the fortress of Chaven in Brittany, and was present at Calais when peace was made between England and France in October 1360. He was afterwards governor of Aquitaine and great seneschal of Poitou, and took part in the capture of the town of La-Roche-sur-Yon by Edmund, earl of Cambridge. He died in 1386 at Fontenay-le-Comte, where he had gone to reside, and was buried at Poitiers.

See Jean Froissart, *Chroniques*, translated by T. Johnes (Hafod, 1810); G. F. Beltz, *Memorials of the Most Noble Order of the Garter* (London, 1841).

AUDLEY, THOMAS AUDLEY, Baron (*c.* 1488–1544), lord chancellor of England, whose parentage is unknown, is believed to have studied at Buckingham College, Cambridge. He was educated for the law, entered the Middle Temple (becoming autumn reader in 1526), was town clerk of Colchester, and was on the commission of the peace for Essex in 1521. In 1523 he was returned to parliament for Essex, and represented this constituency in subsequent parliaments. In 1527 he was groom of the chamber, and became a member of Wolsey's household. On the fall of the latter in 1529, he was made chancellor of the duchy of Lancaster, and the same year speaker of the House of Commons, presiding over the famous assembly styled the Black or Long Parliament of the Reformation, which abolished the papal jurisdiction. The same year he headed a deputation of the Commons to the king to complain of Bishop Fisher's speech against their proceedings. He interpreted the king's "moral" scruples to parliament concerning his marriage with Catherine, and made himself the instrument of the king in the attack upon the clergy and the preparation of the act of supremacy. In 1531 he had been made a serjeant-at-law and king's serjeant; and on the 20th of May 1532 he was knighted, and succeeded Sir Thomas More as lord keeper of the great seal, being appointed lord chancellor on the 26th of January 1533. He supported the king's divorce from Catherine and the marriage with Anne Boleyn; and presided at the trial of Fisher and More in 1535, at which his conduct and evident intention to secure a conviction has been generally censured. Next year he tried Anne Boleyn and her lovers, was present on the scaffold at the unfortunate queen's execution, and recommended to parliament the new act of succession. In 1537 he condemned to death as traitors the Lincolnshire and the Yorkshire rebels. On the 29th of November 1538 he was created Baron Audley of Walden; and soon afterwards presided as lord steward at the trials of Henry Pole, Lord Montacute, and of the unfortunate marquess of Exeter. In 1539, though inclining himself to the Reformation, he made himself the king's instrument in enforcing religious conformity, and in the passing of the Six Articles Act. On the 24th of April 1540 he was made a knight of the Garter, and subsequently managed the attainder of Thomas Cromwell, earl of Essex, and the dissolution of Henry's marriage with Anne of Cleves. In 1542 he warmly supported the privileges of the Commons in the case of George Ferrers, member for Plymouth, arrested and imprisoned in London, but his conduct was inspired as usual by subservience to the court, which desired to secure a subsidy, and his opinion that the arrest was a flagrant contempt has been questioned by good authority. He resigned the great seal on the 21st of April 1544, and died on the 30th, being buried at Saffron Walden, where he had prepared for himself a splendid tomb. He received several grants of monastic estates, including the priory of Christ Church in London and the abbey of Walden in Essex, where his grandson, Thomas Howard, earl of Suffolk, built Audley End, doubtless named after him. In 1542 he re-endowed and re-established Buckingham College, Cambridge, under the new name of St Mary Magdalene, and ordained in the statutes that his heirs, "the possessors of the late monastery of Walden," should be visitors of the college *in perpetuum*. *A Book of Orders for the Warre both by Sea and Land* (Harleian MS. 297, f. 144) is attributed to his authorship. He married (1) Christina, daughter of Sir Thomas Barnardiston, and (2) Elizabeth, daughter of Thomas Grey, marquess of Dorset, by whom he had two daughters. His barony became extinct at his death.

AUDOUIN, JEAN VICTOR (1797–1841), French naturalist, was born at Paris on the 27th of April 1797. He began the study of law, but was diverted from it by his strong predilection for natural history, and entered the medical profession. In 1824 he was appointed assistant to P. A. Latreille (1762–1833) in the entomological chair at the Paris museum of natural history, and succeeded him in 1833. In 1838 he became a member of the Academy of Sciences. He died in Paris on the 9th of November 1841. His principal work, *Histoire des insectes nuisibles à la vigne* (1842), was completed after his death by Henry Milne-Edwards and Émile Blanchard. His papers mostly appeared in the *Annales des sciences naturelles*, which, with A. T. Brongniart and J. B. A. Dumas, he founded in 1824, and in the proceedings of the Société Entomologique de France, of which he was one of the founders in 1832.

AUDRAN, the name of a family of French artists and engravers. The first who devoted himself to the art of engraving was Claude Audran, born 1597, and the last was Benoit, Claude's great-grandson, who died in 1772. The two most distinguished members of the family are Gérard and Jean.

Gérard, or Girard, Audran, the most celebrated French engraver, was the third son of Claude Audran, and was born at Lyons in 1640. He was taught the first principles of design and engraving by his father; and, following the example of his brother, went to Paris to perfect himself in his art. He there, in 1666, engraved for Le Brun "Constantine's Battle with Maxentius," his "Triumph," and the "Stoning of Stephen," which gave great satisfaction to the painter, and placed Audran in the very first rank of engravers at Paris. Next year he set out for Rome, where he resided three years, and engraved several fine plates. That great patron of the arts, J. B. Colbert, was so struck with the beauty of Audran's works, that he persuaded Louis XIV. to recall him to Paris. On his return he applied himself assiduously to engraving, and was appointed engraver to the king, from whom he received great encouragement. In the year 1681 he was admitted to the council of the Royal Academy. He died at Paris in 1703. His engravings of Le Brun's "Battles of Alexander" are regarded as the best of his numerous works. "He was," says the Abbé Fontenay, "the most celebrated engraver that ever existed in the historical line. We have several subjects, which he engraved from his own designs, that manifested as much taste as character and facility. But in the 'Battles of Alexander' he surpassed even the expectations of Le Brun himself." Gérard published in 1683 a work entitled *Les Proportions du corps humain mesurées sur les plus belles figures de l'antiquité.*

Jean Audran, nephew of Gérard, was born at Lyons in 1667. After having received instructions from his father, he went to Paris to perfect himself in the art of engraving under his uncle, next to whom he was the most distinguished member of his family. At the age of twenty his genius began to display itself in a surprising manner; and his subsequent success was such, that in 1707 he obtained the title of engraver to the king, Louis XIV., who allowed him a pension, with apartments in the Gobelins; and the following year he was made a member of the Royal Academy. He was eighty years of age before he quitted the graver, and nearly ninety when he died. The best prints of this artist are those which appear not so pleasing to the eye at first sight. In these the etching constitutes a great part; and he has finished them in a bold, rough style. The "Rape of the Sabines," after Poussin, is considered his masterpiece.

AUDRAN, EDMOND (1842–1901), French musical composer, was born at Lyons on the 11th of April 1842. He studied music at the École Niedermeyer, where he won the prize for composition in 1859. Two years later he accepted the post of organist of the church of St Joseph at Marseilles. He made his first appearance as a dramatic composer at Marseilles with *L'Ours et le Pacha* (1862), a musical version of one of Scribe's vaudevilles. This was followed by *La Chercheuse d'Esprit* (1864), a comic opera, also produced at Marseilles. Audran wrote a funeral march on the death of Meyerbeer, which was performed with some success, and made various attempts to win fame as a writer of sacred music. He produced a mass (Marseilles, 1873), an oratorio, *La Sulamite* (Marseilles, 1876), and numerous minor works, but he is known almost entirely as a composer of the lighter forms of opera. His first Parisian success was made with *Les Noces d'Olivette* (1879), a work which speedily found its way to London and (as *Olivette*) ran for more than a year at the Strand theatre (1880–1881). Audran's music has, in fact, met with as much favour in England as in France, and all save a few of his works have been given in a more or less adapted form in London theatres. Besides those already mentioned, the following have been the most undeniably successful of Audran's many comic operas: *Le Grand Mogol* (Marseilles, 1876; Paris, 1884; London, as *The Grand Mogul*, 1884), *La Mascotte* (Paris, 1880; London, as *The Mascotte*, 1881), *Gillette de Narbonne* (Paris, 1882; London, as *Gillette*, 1883), *La Cigale et la Fourmi* (Paris, 1886; London, as *La Cigale*, 1890), *Miss Hélyett* (Paris, 1890; London, as *Miss Decima* 1891), *La Poupée* (Paris, 1896; London, 1897). Audran was one of the best of the successors of Offenbach. He had little of Offenbach's humour, but his music is distinguished by an elegance and a refinement of manner which lift it above the level of opéra bouffe to the confines of genuine opéra comique. He was a fertile if not a very original melodist, and his orchestration is full of variety, without being obtrusive or vulgar. Many of his operas, *La Mascotte* in particular, reveal a degree of musicianship which is rarely associated with the ephemeral productions of the lighter stage. He died in Paris on the 16th of August 1901.

AUDREHEM, ARNOUL D' (*c.* 1305–1370), French soldier, was born at Audrehem, in the present department of Pas de Calais, near St Omer. Nothing is known of his career before 1332, when he is heard of at the court of the king of France. Between 1335 and 1342 he went three times to Scotland to aid King David Bruce in his wars. In 1342 he became captain for the king of France in Brittany; then he seems to have served in the household of the duke of Normandy, and in 1346, as one of the main defenders of Calais, was taken as a prisoner to England by Edward III. From 1349 he holds an important place in the military history of France, first as captain in Angoulême, and from June 1351, in succession to the lord of Beaujeu, as marshal of France. In March 1352 he was appointed lieutenant for the king in the territory between the Loire and the Dordogne, in June 1353 in Normandy, and in 1355 in Artois, Picardy and the Boulonnais. It was Audrehem who arrested Charles the Bad, king of Navarre, and his partisans, at the banquet given by the dauphin at Rouen in 1356. At Poitiers he was one of those who advised King John to attack the English, and, charging in the front line of the French army, was slightly wounded and taken prisoner. From England he was several times given safe-conducts to France, and he took an active part in the negotiations for the treaty of Bretigny, recovering his liberty the same time as King John. In 1361, as the king's lieutenant in Languedoc, he prevented the free companies from seizing the castles, and negotiated the treaty with their chiefs under which they followed Henry, count of Trastamara (later Henry II. of Castile), into Spain. In 1365 he himself joined du Guesclin in the expedition to Spain, was taken prisoner with him by the Black Prince at the battle of Najera (1367), and was unable to pay his ransom until 1369. In 1368, on account of his age, he was relieved of the office of marshal, being appointed bearer of the oriflamme, with a pension of 2000 livres. He was sent to Spain in 1370 by Charles V., to urge his friend du Guesclin to return to France, and in spite of his age he took part in the battle of Pontvallain (December 1370), but fell ill and died, probably at Saumur, in the latter part of December 1370.

See Émile Molinier, "Étude sur la vie d'Arnoul d'Audrehem, maréchal de France," in *Mémoires présentés par divers savants à l'académie des inscriptions et belles-lettres*, 2e série, iv. (1883).

AUDUBON, JOHN JAMES (1780–1851), American naturalist, is said to have been born on the 5th of May 1780 in Louisiana, his father being a French naval officer and his mother a Spanish creole. He was educated in Paris, where he had lessons from the painter, J. L. David. Returning to America in 1798 he settled on a farm near Philadelphia, and gave himself up to the study of natural history, and especially to drawing birds. In 1826 he went to England in the hope of getting his drawings published, and by the following year he had obtained sufficient subscribers to enable him to begin the publication of his *Birds of America*, which on its completion in 1838 consisted of 435 coloured plates, containing 1055 figures of birds the size of life. Cuvier called it "le plus magnifique monument que l'art ait encore élevé à la nature." The descriptive matter to accompany the plates appeared at Edinburgh in 5 vols. from 1831 to 1839 under the title of *American Ornithological Biography*. During the publication of these works Audubon divided his time between Great Britain and America, devoting his leisure to expeditions to various parts of the United States and Canada for the purpose of collecting new material. In 1842 he bought an estate on the Hudson, now Audubon Park in New York City. In 1844 he published in America a popular octavo edition of his *Birds of America*. He also took up the preparation of a new work, *The Quadrupeds of America*, with the collaboration of John Bachman, the publication of which was begun in New York in 1846 and finished in 1853–1854. He died at New York on the 27th of January 1851.

See ORNITHOLOGY; also *Audubon and his Journals* (1897), by his grand-daughter Maria R. Audubon, with notes by Elliot Coues.

AUE, a town of Germany, in the kingdom of Saxony, at the confluence of the Mulde and Schwarzwasser, 21 m. S.W. from Chemnitz on the railway to Adorf. It has a school of lace-making, foundries, and manufactures of machinery, tin-plate and cotton goods. Pop. (1905) 17,102.

AUERBACH, BERTHOLD (1812–1882), German novelist, was born on the 28th of February 1812 at Nordstetten in the Württemberg Black Forest. His parents were Jews, and he was intended for the ministry; but after studying philosophy at Tübingen, Munich and Heidelberg, and becoming estranged from Jewish orthodoxy by the study of Spinoza, he devoted himself to literature. He made a fortunate beginning in a romance on the life of Spinoza (1837), so interesting in itself, and so close in its adherence to fact, that it may be read with equal advantage as a novel or as a biography. *Dichter und Kaufmann* followed in 1839, and a translation of Spinoza's works in 1841, when Auerbach turned to the class of fiction which has made him famous, the *Schwarzwälder Dorfgeschichten* (1843), stories of peasant life in the Black Forest. In these, as well as in *Barfüssele* (1856), *Edelweiss* (1861), and other novels of greater compass, he depicts the life of the south German peasant as "Jeremias Gotthelf" (Albrecht Bitzius) had painted the peasantry of Switzerland, but in a less realistic spirit. When this vein was exhausted Auerbach returned to his first phase as a philosophical novelist, producing *Auf der Höhe* (1865), *Das Landhaus am Rhein* (1869), and other romances of profound speculative tendencies, turning on plots invented by himself. With the exception of *Auf der Höhe*, these works did not enjoy much popularity, and suffer from lack of form and concentration

Auerbach's fame continues to rest upon his *Dorfgeschichten*, although the celebrity of even these has been impaired by the growing demand for a more uncompromising realism. Auerbach died at Cannes on the 8th of February 1882.

The first collected edition of Auerbach's *Schriften* appeared in 22 vols. in 1863–1864; the best edition is in 18 vols. (1892–1895). Auerbach's *Briefe an seinen Freund J. Auerbach* (with a preface by F. Spielhagen) were published in 2 vols. (1884). See E. Zabel, *B. Auerbach* (1882); and E. Lasker, *B. Auerbach, ein Gedenkblatt* (1882).

AUERSPERG, ANTON ALEXANDER, Graf von (1806–1876), Austrian poet, who wrote under the pseudonym of Anastasius Grün, was born on the 11th of April 1806, at Laibach, the capital of the Austrian duchy of Carniola, and was head of the Thurn-am-Hart branch of the Carniolan cadet line of the house of Auersperg. He received his university education first at Graz and then at Vienna, where he studied jurisprudence. In 1830 he succeeded to his ancestral property, and in 1832 appeared as a member of the estates of Carniola on the *Herrenbank* of the diet at Laibach. Here he distinguished himself by his outspoken criticism of the Austrian government, leading the opposition of the duchy to the exactions of the central power. In 1832 the title of "imperial chamberlain" was conferred upon him, and in 1839 he married Maria, daughter of Count Attems. After the revolution of 1848 at Vienna he represented the district of Laibach at the German national assembly at Frankfort-on-the-Main, to which he tried in vain to persuade his Slovene compatriots to send representatives. After a few months, however, disgusted with the violent development of the revolution, he resigned his seat, and again retired into private life. In 1860 he was summoned to the remodelled *Reichsrat* by the emperor, who next year nominated him a life member of the Austrian upper house (*Herrenhaus*), where, while remaining a keen upholder of the German centralized empire, as against the federalism of Slavs and Magyars, he greatly distinguished himself as one of the most intrepid and influential supporters of the cause of liberalism, in both political and religious matters, until his death at Graz on the 12th of September 1876.

Count Auersperg's first publication, a collection of lyrics, *Blätter der Liebe* (1830), showed little originality; but his second production, *Der letzte Ritter* (1830), brought his genius to light. It celebrates the deeds and adventures of the emperor Maximilian I. (1493–1519) in a cycle of poems written in the strophic form of the *Nibelungenlied*. But Auersperg's fame rests almost exclusively on his political poetry; two collections entitled *Spaziergänge eines Wiener Poeten* (1831) and *Schutt* (1835) created a sensation in Germany by their originality and bold liberalism. These two books, which are remarkable not merely for their outspoken opinions, but also for their easy versification and powerful imagery, were the forerunners of the German political poetry of 1840–1848. His *Gedichte* (1837), if anything, increased his reputation; his epics, *Die Nibelungen im Frack* (1843) and *Der Pfaff vom Kahlenberg* (1850), are characterized by a fine ironic humour. He also produced masterly translations of the popular Slovenic songs current in Carniola (*Volkslieder aus Krain*, 1850), and of the English poems relating to "Robin Hood" (1864).

Anastasius Grün's *Gesammelte Werke* were published by L. A. Frankl in 5 vols. (Berlin, 1877); his *Briefwechsel mit L. A. Frankl* (Berlin, 1897). A selection of his *Politische Reden und Schriften* has been published by S. Hock (Vienna, 1906). See P. von Radics, *Anastasius Grün* (2nd ed., Leipzig, 1879).

AUFIDENA, an ancient city of the Samnites Caraceni, the site of which is just north of the modern Alfedena,[1] Italy, a station on the railway between Sulmona and Isernia, 37 m. from the latter. Its remains are fully and accurately described by L. Mariani in *Monumenti dei Lincei* (1901), 225 seq.: cf. *Notizie degli scavi*, 1901, 442 seq.; 1902, 516 seq. The ancient city occupied two hills, both over 3800 ft. above sea-level (in the valley between were found the supposed remains of the later forum), and the walls, of rough Cyclopean work, were over a mile in length. A fortified outpost lay on a still higher hill to the north. Not very much is as yet known of the city itself (though one public building of the 5th century B.C. was excavated in 1901, and a small sanctuary in 1902), attention having been chiefly devoted to the necropolis which lay below it; 1400 tombs had already been examined in 1908, though this number is conjectured to be only a sixteenth of the whole. They are all inhumation burials, of the advanced iron age, and date from the 7th to the 4th century B.C., falling into three classes—those without coffin, those with a coffin formed of stone slabs, and those with a coffin formed of tiles. The objects discovered are preserved in a museum on the spot. In the Roman period we find Aufidena figuring as a post station on the road between Sulmo and Aesernia, which, however, runs past Castel di Sangro, crossing the river by an ancient bridge some 5 m. to the north-east. Castel di Sangro has remains of ancient walls, but these are attributed to a road by Mariani, and in any case the fortified area there was quite small, only one-sixteenth the size of Aufidena. The attempted identification of Castel di Sangro with Aufidena must therefore be rejected, though we must allow that it was probably the Roman post station; the ancient city, since its capture by the Romans in the 3rd century B.C., having lost something of its importance. (T. As.)

AUGEAS, or Augeias, in Greek legend, a son of Helios, the sun-god, and king of the Epeians in Elis. He possessed an immense wealth of herds, including twelve bulls sacred to Helios, and white as swans. Eurystheus imposed upon Heracles the task of clearing out all his stalls unaided in one day. This he did by turning the rivers Alpheus and Peneus through them. Augeas had promised him a tenth of the herd, but refused this, alleging that Heracles had acted only in the service of Eurystheus. Heracles thereupon sent an army against him, and, though at first defeated, finally slew Augeas and his sons.

Apollodorus ii. 5, 7; Pindar, *Olympia*, xi, 24; Diodorus iv. 13; Theocritus, *Idyll* 25.

AUGER (from the O. Eng. *nafu-gár*, nave-borer; the original initial *n* having been lost, as in "adder," through a confusion in the case of a preceding indefinite article), a tool for boring (*q.v.*) or drilling.

AUGEREAU, PIERRE FRANÇOIS CHARLES, duke of Castiglione (1757–1816), marshal of France, was born in Paris in a humble station of life. At the age of seventeen he enlisted in the carabineers and thereafter came into note as a duellist. Having drawn his sword upon an officer who insulted him, he fled from France and roamed about in the Levant. He served in the Russian army against the Turks; but afterwards escaped into Prussia and enlisted in the guards. Tiring of this, he deserted with several others and reached the Saxon frontier. Service in the Neapolitan army and a sojourn in Portugal filled up the years 1788–1791; but the events of the French Revolution brought him back to his native land. He served with credit against the Vendeans and then joined the troops opposing the Spaniards in the south. There he rose rapidly, becoming general of division on the 23rd of December 1793. His division distinguished itself even more when transferred to the army of Italy; and under Bonaparte he was largely instrumental in gaining the battle of Millesimo and in taking the castle of Cosseria and the camp of Ceva. At the battle of Lodi (May 10, 1796), the turning movement of Augereau and his division helped to decide the day. But it was at Castiglione that he rendered the most signal services. Marbot describes him as encouraging even Bonaparte himself in the confused situation that prevailed before that battle, and, though this is exaggerated, there is no doubt that Augereau largely decided the fortunes of those critical days. Bonaparte thus summed up his military qualities: "Has plenty of character, courage, firmness, activity; is inured to war; is well liked by the soldiery; is fortunate in his operations." In 1797 Bonaparte sent him to Paris to encourage the Jacobinical Directors, and it was Augereau and the troops led by him that coerced the "moderates" in the councils and carried through the *coup d'état* of 18 Fructidor (4th of September) 1797. He was then sent to lead the united French forces in Germany; but peace speedily ensued; and he bore a grudge against the Directors and Bonaparte for their treatment of him at that time. He took no part in the *coup d'état* of Brumaire 1799, and did not distinguish himself in the Rhenish campaign which ensued. Nevertheless, owing to his final adhesion to Bonaparte's fortunes, he received a marshal's baton at the beginning of the Empire (May 19, 1804). In the campaign of 1805 he did good service around Constance and Bregenz, and at Jena (October 14, 1806) his corps distinguished itself. Early in 1807 he fell ill of a fever, and at the battle of Eylau he had to be supported on his horse, but directed the movements of his corps with his wonted bravery. His corps was almost annihilated and the marshal himself received a wound from which he never quite recovered. When transferred to Catalonia, he gained some successes but tarnished his name by cruelty. In the campaign of 1812 in Russia and in the Saxon campaign of 1813 his conduct was little more than mediocre. Before the battle of Leipzig (October 16, 18, 19, 1813), Napoleon reproached him with not being the Augereau of Castiglione; to which he replied, "Give me back the old soldiers of Italy, and I will show you that I am." In 1814 he had command of the army of Lyons, and his slackness exposed him to the charge of having come to an understanding with the Austrian invaders. Thereafter he served Louis XVIII., but, after reviling Napoleon, went over to him during the Hundred Days. The emperor repulsed him and charged him with being a traitor to France in 1814. Louis XVIII., when restored to the throne, deprived him of his military title and pension. He died at his estate of La Houssaye on the 12th of June 1816. In person he was tall and commanding, but his loud and vulgar behaviour frequently betrayed the soldier of fortune.

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[1] Two churches here contain paintings of interest in the history of Abruzzese art, and one of them, the Madonna del Campo, contained fragments of a temple of considerable size.

As authorities consult: Kock's *Mémoires de Masséna*; Bouvier, *Bonaparte en Italie*; Count A. F. Andréossi, *La Campagne sur le Mein, 1800–1801*; Baron A. Ducasse, *Précis de la campagne de l'armée de Lyon en 1814*; and the *Memoirs* of Marbot. (J. Hl. R.)

AUGHRIM, or AGHRIM, a small village in Co. Galway, Ireland, 4 m. W. by S. of Ballinasloe. It is rendered memorable by the decisive victory gained here on the 12th of July 1691 by the forces of William III. under General Ginkel, over those of James II. under the French general St Ruth, who fell in the fight. The Irish numbering 25,000, and strongly posted behind marshy ground, at first maintained a vigorous resistance; but Ginkel having penetrated their line of defence, and their general being struck down by a cannon ball at this critical moment, they were at length overcome and routed with terrible slaughter. The loss of the English did not exceed 700 killed and 1000 wounded; while the Irish, in their disastrous flight, lost about 7000 men, besides the whole material of the army. This defeat rendered the adherents of James in Ireland incapable of further efforts, and was speedily followed by the complete submission of the country.

AUGIER, GUILLAUME VICTOR ÉMILE (1820–1889), French dramatist, was born at Valence, Drôme, on the 17th of September 1820. He was the grandson of Pigault Lebrun, and belonged to the well-to-do *bourgeoisie* in principles and in thought as well as by actual birth. He received a good education and studied for the bar. In 1844 he wrote a play in two acts and in verse, *La Ciguë*, refused at the Théâtre Français, but produced with considerable success at the Odéon. This settled his career. Thenceforward, at fairly regular intervals, either alone or in collaboration with other writers—Jules Sandeau, Eugène-Marie Labiche, Éd. Foussier—he produced plays which were in their way eventful. *Le Fils de Giboyer* (1862)—which was regarded as an attack on the clerical party in France, and was only brought out by the direct intervention of the emperor—caused some political excitement. His last comedy, *Les Fourchambault*, belongs to the year 1879. After that date he wrote no more, restrained by an honourable fear of producing inferior work. The Academy had long before, on the 31st of March 1857, elected him to be one of its members. He died in his house at Croissy on the 25th of October 1889. Such, in briefest outline, is the story of a life which Augier himself describes as "without incident"—a life in all senses honourable. Augier, with Dumas *fils* and Sardou, may be said to have held the French stage during the Second Empire. The man respected himself and his art, and his art on its ethical side—for he did not disdain to be a teacher—has high qualities of rectitude and self-restraint. Uprightness of mind and of heart, generous honesty, as Jules Lemaître well said, constituted the very soul of all his dramatic work. *L'Aventurière* (1848), the first of Augier's important works, already shows a deviation from romantic models; and in the *Mariage d'Olympe* (1855) the courtesan is shown as she is, not glorified as in Dumas's *Dame aux Camélias*. In *Gabrielle* (1849) the husband, not the lover, is the sympathetic, poetic character. In the *Lionnes pauvres* (1858) the wife who sells her favours comes under the lash. Greed of gold, social demoralization, ultramontanism, lust of power, these are satirized in *Les Effrontés* (1861), *Le Fils de Giboyer* (1862), *Contagion*, first announced under the title of *Le Baron d'Estrigaud* (1866), *Lions et renards* (1869)—which, with *Le Gendre de M. Poirier* (1854), written in collaboration with Jules Sandeau, reach the high-water mark of Augier's art; in *Philiberte* (1853) he produced a graceful and delicate drawing-room comedy; and in *Jean de Thommeray*, acted in 1873 after the great reverses of 1870, the regenerating note of patriotism rings high and clear. His last two dramas, *Madame Caverlet* (1876) and *Les Fourchambault* (1879), are problem plays. But it would be unfair to suggest that Émile Augier was a preacher only. He was a moralist in the great sense, the sense in which the term can be applied to Molière and the great dramatists—a moralist because of his large and sane outlook on life. Nor does the interest of his dramas depend on elaborate plot. It springs from character and its evolution. His men and women move as personality, that mysterious factor, dictates. They are real, several of them typical. Augier's first drama, *La Ciguë*, belongs to a time (1844) when the romantic drama was on the wane; and his almost exclusively domestic range of subject scarcely lends itself to lyric outbursts of pure poetry. But his verse, if not that of a great poet, has excellent dramatic qualities, while the prose of his prose dramas is admirable for directness, alertness, sinew and a large and effective wit. Perhaps it wanted these qualities to enlist laughter on his side in such a war as he waged against false passion and false sentiment. (F. T. M.)

AUGITE, an important member of the pyroxene (*q.v.*) group of rock-forming minerals. The name (from αὐγή, lustre) has at various times been used in different senses; it is now applied to aluminous pyroxenes of the monoclinic series which are dark-greenish, brownish or black in colour. Like the other pyroxenes it is characterized crystallographically by its distinct cleavages parallel to the prism-faces (*M*), the angle between which is 87°. A typical crystal is represented in fig. 1, whilst fig. 2 shows a crystal twinned on the orthopinacoid (*r′*). Such crystals, of short prismatic habit and black in colour, are common as phenocrysts in many basalts, and are hence known as "basaltic augite": when the containing rock weathers to a clayey material the augite is left as black isolated crystals, and such specimens, usually from Bohemia, are represented in all mineral collections. Though typical of basaltic rocks, augite is also an important constituent of many other kinds of igneous rocks, and a rock composed almost wholly of augite is known as augitite. It also occurs in metamorphic rocks; for example, in the crystalline limestones of the Fassathal in Tirol, where the variety known as fassaite is found as pistachio-green crystals resembling epidote in appearance.

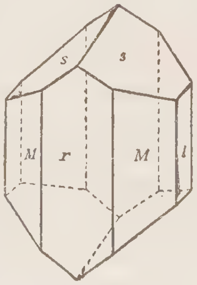

FIG. 1.

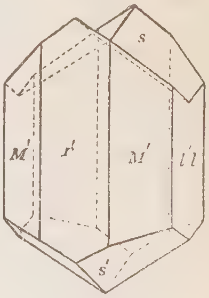

FIG. 2.

Chemically, augite resembles diopside in consisting mainly of $CaMgSi_2O_6$, but it contains in addition alumina and ferric iron as $(Mg, Fe'')\ (Al, Fe''')_2\ SiO_6$; the acmite $(NaFe'''Si_2O_6)$

and jadeite ($NaAlSi_2O_6$) molecules are also sometimes present. Variations in the amount of iron in mixtures of these isomorphous molecules are accompanied by variations in the optical characters of the augite. (L. J. S.)

AUGMENT (Lat. *augere*, to increase), in Sanskrit and Greek grammar the vowel prefixed to indicate the past tenses of a verb; in Greek grammar it is called *syllabic*, when only the ε is prefixed; *temporal*, when it causes an initial vowel in the verb to become a diphthong or long vowel.

AUGMENTATION, or enlargement, a term in heraldry for an addition to a coat of arms; in music, for the imitation in longer notes of an original theme; in biology, an addition to the normal number of parts; in Scots law, an increase of a minister's stipend by an action called "Process of Augmentation." The "Court of Augmentation" in Henry VIII.'s time was established to try cases affecting the suppression of monasteries, and was dissolved in Mary's reign.

AUGSBURG, a city and episcopal see of Germany, in the kingdom of Bavaria, chief town of the district of Swabia. Pop. (1885) 65,905; (1900) 89,109; (1905) 93,882. It lies on a high plateau, 1500 ft. above the sea, between the rivers Wertach and Lech, which unite below the city, 39 m. W.N.W. from Munich, with which, as with Regensburg, Ingolstadt and Ulm, it is connected by main lines of railway. It consists of an upper and a lower town, the old Jakob suburb and various modern suburbs. Its fortifications were dismantled in 1703 and have since been converted into public promenades. Maximilian Street is remarkable for its breadth and architectural beauty. One of its most interesting edifices is the Fugger Haus, of which the entire front is painted in fresco. Among the public buildings of Augsburg most worthy of notice is the town-hall in Renaissance style, one of the finest in Germany, built by Elias Holl in 1616–1620. One of its rooms, called the "Golden Hall," from the profusion of its gilding, is 113 ft. long, 59 broad and 53 high. The palace of the bishops, where the memorable Confession of Faith was presented to Charles V., is now used for government offices. Among the seventeen Roman Catholic churches and chapels, the cathedral, a basilica with two Romanesque towers, dates in its oldest portions from the 10th century. The church of St Ulrich and St Afra, built 1474–1500, is a Late Gothic edifice, with a nave of magnificent proportions and a tower 300 ft. high. The church stands on the spot where the first Christians of the district suffered martyrdom, and where a chapel was erected in the 6th century over the grave of St Afra. There are also a Protestant church, St Anne's, a school of arts, a polytechnic institution, a picture gallery in the former monastery of St Catherine, a museum, observatory, botanical gardens, an exchange, gymnasium, deaf-mute institution, orphan asylum, several remarkable fountains dating from the 16th century, &c. Augsburg is particularly well provided with special and technical schools. The newer buildings, all in the modern west quarter of the city, include law courts, a theatre, and a municipal library with 200,000 volumes. The "Fuggerei," built in 1519 by the brothers Fugger, is a miniature town, with six streets or alleys, three gates and a church, and consists of a hundred and six small houses let to indigent Roman Catholic citizens at a nominal rent. The manufactures of Augsburg are of great importance. It is the chief seat of the textile industry in south Germany, and its cloth, cotton goods and linen manufactories employ about 10,000 hands. It is also noted for its bleach and dye works, its engine works, foundries, paper factories, and production of silk goods, watches, jewelry, mathematical instruments, leather, chemicals, &c. Augsburg is also the centre of the acetylene gas industry of Germany. Copper-engraving, for which it was formerly noted, is no longer carried on; but printing, lithography and publishing have acquired a considerable development, one of the best-known Continental newspapers being the *Allgemeine Zeitung* or *Augsburg Gazette*. On the opposite side of the river, which is here crossed by a bridge, lies the township of Lechhausen.

Augsburg (the *Augusta Vindelicorum* of the Romans) derives its name from the Roman emperor Augustus, who, on the conquest of Rhaetia by Drusus, established here a Roman colony about 14 B.C. In the 5th century it was sacked by the Huns, and afterwards came under the power of the Frankish kings. It was almost entirely destroyed in the war of Charlemagne against Tassilo III., duke of Bavaria; and after the dissolution and division of that empire, it fell into the hands of the dukes of Swabia. After this it rose rapidly into importance as a manufacturing and commercial town, becoming, after Nuremberg, the centre of the trade between Italy and the north of Europe; its merchant princes, the Fuggers and Welsers, rivalled the Medici of Florence; but the alterations produced in the currents of trade by the discoveries of the 15th and 16th centuries occasioned a great decline. In 1276 it was raised to the rank of a free imperial city, which it retained, with many changes in its internal constitution, till 1806, when it was annexed to the kingdom of Bavaria. Meanwhile, it was the scene of numerous events of historical importance. It was besieged and taken by Gustavus Adolphus in 1632, and in 1635 it surrendered to the imperial forces; in 1703 it was bombarded by the electoral prince of Bavaria, and forced to pay a contribution of 400,000 dollars; and in the war of 1803 it suffered severely. Of its conventions the most memorable are those which gave birth to the Augsburg confession (1530) and to the Augsburg alliance (1686).

See Wagenseil, *Geschichte der Stadt Augsburg* (Augs., 1820–1822); Werner, *Geschichte der Stadt Augsburg* (1899); Roth, *Augsburg's Reformationsgeschichte* (1902).

AUGSBURG, CONFESSION OF, the most important Protestant statement of belief drawn up at the Reformation. In summoning a diet for April 1530, Charles V. offered a fair hearing to all religious parties in the Empire. Luther, Justus Jonas, Melanchthon and Johann Bugenhagen were appointed to draw up a statement of the Saxon position. These "Torgau Articles" (March 1530) tell merely why Saxony had abolished certain ecclesiastical abuses. Melanchthon, however, soon found that, owing to attacks by Johann Eck of Ingolstadt ("404 Articles"), Saxony must state its position in doctrinal matters as well. Taking the Articles of Marburg (see MARBURG, COLLOQUY OF) and of Schwabach as the point of departure, he repudiated all connexion with heretics condemned by the ancient church. On the 11th of May he sent the draft to Luther, who approved it, adding that he himself "could not tread so softly and gently." On the 23rd of June the Confession, originally intended as the statement of Electoral Saxony alone, was discussed and signed by a number of other Protestant princes and cities, and read before the diet on the 25th of June. Articles 1-21 attempt to show that the Evangelicals had deviated from current doctrine only in order to restore the pure and original teaching of the church. In spite of significant omissions (the sole authority of scripture; rejection of transubstantiation), the Confession contains nothing contradictory to Luther's position, and in its emphasis on justification by faith alone enunciates a cardinal concept of the Evangelical churches. Articles 22-28 describe and defend the reformation of various "abuses." On the 3rd of August, shorn of much of its original bitterness, the so-called *Confutatio pontificia* was read; it well expresses the views approved in substance by the emperor and all the Catholic party. In answer, Melanchthon was ordered to prepare an Apology of the Confession, which the emperor refused to receive; so Melanchthon enlarged it and published the *editio princeps* of both Confession and Apology in 1531.

As he felt free to make slight changes, the first edition does not represent the exact text of 1530; the edition of 1533 was further improved, while that of 1540, rearranged and in part rewritten, is known as the *Variata*. Dogmatic changes in this seem to have drawn forth no protest from Luther or Brenz, so Melanchthon made fresh alterations in 1542. Later, the *Variata* of 1540 became the creed of the Melanchthonians and even of the Crypto-calvinists; so the framers of the Formula of Concord, promulgated in 1580, returned to the text handed in at the Diet. By mistake they printed from a poor copy and not from the original, from which their German text varies at over 450 places. Their Latin text, that of Melanchthon's *editio princeps*, is more nearly accurate. The *textus receptus* is that of the Formula of Concord, the divergent Latin and German forms being equally binding.

Acceptance of the Confession and Apology was made a condition of membership in the Schmalkalden League. The

Wittenberg Concord (1536) and the Articles of Schmalkalden (1537) reaffirmed them. The Confession was the ultimate source of much of the Thirty-nine Articles. The Religious Peace of Augsburg (1555) recognized no Protestants save adherents of the Confession; this was modified in 1648. To-day the *Invariata* is of symbolical authority among Lutherans generally, while the *Variata* is accepted by the Reformed churches of certain parts of Germany (see Löber, pp. 79-83.)

Editions of the received text: J. T. Müller, *Die symbolischen Bücher der evangelisch-lutherischen Kirche* (10th ed., Gütersloh, 1907), with a valuable historical introduction by Th. Kolde; Theodor Kolde, *Die Augsburgische Konfession* (Gotha, 1896), (contains also the Marburg, Schwabach and Torgau Articles, the *Confutatio* and the *Variata* of 1540). For translations of these, as well as of Zwingli's Reckoning of his Faith, and of the Tetrapolitan Confession, see H. E. Jacobs, *The Book of Concord* (Philadelphia, 1882–83). The texts submitted to the emperor, lost before 1570, are reconstructed and compared with the *textus receptus* by P. Tschackert, *Die unveränderte Augsburgische Konfession* (Leipzig, 1901). For the genesis of the Confession, see Th. Kolde, *Die älteste Redaktion der Augsburger Konfession* (Gütersloh, 1906), also Kolde's article, "Augsburger Bekenntnis," in Herzog-Hauck, *Realencyklopädie* (3rd ed., vol. ii., Leipzig, 1897). The standard commentary is still G. L. Plitt, *Einleitung in die Augustana* (Erlangen, 1867 ff.); compare also J. Ficker, *Die Konfutation des Augsburgischen Bekenntnisses in ihrer ersten Gestalt* (Leipzig, 1891); also A. Petzold, *Die Konfutation des Vierstädtebekenntnisses* (Leipzig, 1900). On its present use see G. Löber, *Die im evangelischen Deutschland geltenden Ordinationsverpflichtungen geschichtlich geordnet* (Leipzig, 1905), 79 ff. (W. W. R.*)

AUGSBURG, WAR OF THE LEAGUE OF, the name applied to the European war of 1688–1697. The league of Augsburg was concluded on the 9th of July 1686 by the emperor, the elector of Brandenburg and other princes, against the French. Spain, Sweden, England and other non-German states joined the league, and formed the Grand Alliance by the treaty of Vienna (July 12, 1689). (See GRAND ALLIANCE, WAR OF THE.)

AUGURS, in ancient Rome, members of a religious college whose duty it was to observe and interpret the signs (auspices) of approval or disapproval sent by the gods in reference to any proposed undertaking. The *augures* were originally called *auspices*, but, while *auspex*[1] fell into disuse and was replaced by *augur*, *auspicium* was retained as the scientific term for the observation of signs.

The early history of the college is obscure. Its institution has been attributed to Romulus or Numa. It probably consisted originally of three members, of whom the king himself was one. This number was doubled by Tarquinius Priscus, but in 300 B.C. it was only four, two places, according to Livy (x. 6), being vacant. The Ogulnian law in the same year increased the number to nine, five plebeian being added to the four patrician members. In the time of Sulla the number was fifteen, which was increased to sixteen by Julius Caesar. This number continued in imperial times; the college itself was certainly in existence as late as the 4th century. The office of augur, which was bestowed only upon persons of distinguished merit and was much sought after by reason of its political importance, was held for life. Vacancies were originally filled by co-optation, but by the Domitian law (104) the selection was made, by seventeen out of the thirty-five tribes chosen by lot, from candidates previously nominated by the college. The insignia of office were the *lituus*, a staff free from knots and bent at the top, and the *trabea*, a kind of toga with bright scarlet stripes and a purple border. The science of augury was contained in various written works, which were consulted as occasion arose: such were the *libri augurum*, a manual of augural ritual, and the *commentarii augurum*, a collection of decrees or answers given by the college to the senate in certain definite cases.

The natural region to look to for signs of the will of Jupiter was the sky, where lightning and the flight of birds seemed directed by him as counsel to men. The latter, however, was the more difficult of interpretation, and upon it, therefore, mainly hinged the system of divination with which the augurs were occupied. It was the duty of the augur, before the auspices properly so called (those from the sky and from birds) were taken, to mark out with his staff the templum or consecrated space within which his observations were intended to be made. The method of procedure was as follows. At midnight, when the sky was clear and there was an absence of wind, the augur, in the presence of a magistrate, took up his position on a hill which afforded a wide view. After prayer and sacrifice, he marked out the templum both in the sky and on the ground and dedicated it. Within its limits he then pitched a tent, in which he sat down with covered head, asked the gods for a sign, and waited for an answer. As the augur looked south he had the east, the lucky quarter, on his left, and therefore signs on the left side were considered favourable, those on the right unfavourable. The practice was the reverse in Greece; the observers of signs looked towards the north, so that signs on the right were regarded as the favourable ones, and this is frequently adopted in the Roman poets. The augur afterwards announced the result of his observations in a set form of words, by which the magistrate was bound. Signs of the will of the gods were of two kinds, either in answer to a request (*auspicia impetrativa*), or incidental (*auspicia oblativa*). Of such signs there were five classes: (1) Signs in the sky (*caelestia auspicia*), consisting chiefly of thunder and lightning, but not excluding falling stars and other phenomena. Lightning from left to right was favourable, from right to left unfavourable; but on its mere appearance, in either direction, all business in the public assemblies was suspended for the day. Since the person charged to take the auspices for a certain day was constitutionally subject to no other authority who could test the truth or falsehood of his statement that he had observed lightning, this became a favourite device for putting off meetings of the public assembly. Restrictions were, however, imposed in later republican times. When a new consul, praetor or quaestor entered on his first day of office and prayed the gods for good omens, it was a matter of custom to report to him that lightning from the left had been seen. (2) Signs from birds (*signa ex avibus*), with reference to the direction of their flight, and also to their singing, or uttering other sounds. To the first class, called *alites*, belonged the eagle and the vulture; to the second, called *oscines*, the owl, the crow and the raven. The mere appearance of certain birds indicated good or ill luck, while others had a reference only to definite persons or events. In matters of ordinary life on which divine counsel was prayed for, it was usual to have recourse to this form of divination. For public affairs it was, by the time of Cicero, superseded by the fictitious observation of lightning. (3) Feeding of birds (*auspicia ex tripudiis*), which consisted in observing whether a bird—usually a fowl—on grain being thrown before it, let fall a particle from its mouth (*tripudium sollistimum*). If it did so, the will of the gods was in favour of the enterprise in question. The simplicity of this ceremony recommended it for very general use, particularly in the army when on service. The fowls were kept in cages by a servant, styled *pullarius*. In imperial times *decuriales pullarii* are mentioned. (4) Signs from animals (*pedestria auspicia*, or *ex quadrupedibus*), *i.e.* observation of the course of, or sounds uttered by, quadrupeds and reptiles within a fixed space, corresponding to the observations of the flight of birds, but much less frequently employed. It had gone out of use by the time of Cicero. (5) Warnings (*signa ex diris*), consisting of all unusual phenomena, but chiefly such as boded ill. Being accidental in their occurrence, they belonged to the *auguria oblativa*, and their interpretation was not a matter for the augurs, unless occurring in the course of some public transaction, in which case they formed a divine veto against it. Otherwise, reference was made for an interpretation to the pontifices in olden times, afterwards frequently to the Sibylline books, or the Etruscan haruspices, when the incident was not already provided for by a rule, as, for example, that it was unlucky for a person leaving his

[1] There is no doubt that *auspex*=*avi-spex* ("observer of birds"), but the derivation of *augur* is still unsettled. The following have been suggested: (1) *augur* (or *augus*) is a substantive originally meaning "increase" (related to *augustus* as *robur* to *robustus*), then transferred to the priest as the giver of increase or blessing; (2)=*avi-gur*, the second part of the word pointing to (*a*) *garrire*, "chatter," or (*b*) *gerere*, the augur being conceived as "carrying" or guiding the flight of the birds; (3) from a lost verb *augo*="tell," "declare." It is now generally agreed that the science of augury is of Italian, not Etruscan, origin.

house to meet a raven, that the sudden death of a person from epilepsy at a public meeting was a sign to break up the assembly.

Among the other means of discovering the will of the gods were the casting of lots, oracles of Apollo (in the hands of the college *sacris faciundis*), but chiefly the examination of the entrails of animals slain for sacrifice (see OMEN). Anything abnormal found there was brought under the notice of the augurs, but usually the Etruscan haruspices were employed for this. The persons entitled to ask for an expression of the divine will on a public affair were the magistrates. To the highest offices, including all persons of consular and praetorian rank, belonged the right of taking *auspicia maxima*; to the inferior offices of aedile and quaestor, the *auspicia minora*; the differences between these, however, must have been small. The subjects for which *auspicia publica* were always taken were the election of magistrates, their entering on office, the holding of a public assembly to pass decrees, the setting out of an army for war. They could only be taken in Rome itself; and in case of a commander having to renew his *auspicia*, he must either return to Rome or select a spot in the foreign country to represent the hearth of that city. The time for observing auspices was, as a rule, between midnight and dawn of the day fixed for any proposed undertaking. In military affairs this course was not always possible, as in the case of taking auspices before crossing a river. The founding of colonies, the beginning of a battle, the calling together an army, the sittings of the senate, decisions of peace or war, were occasions, not always but frequently, for taking auspices. The place where the ceremony was performed was not fixed, but selected with a view to the matter in hand. A spot being selected, the official charged to make the observation pitched his tent there some days before. A matter postponed through adverse signs from the gods could on the following or some future day be again brought forward for the auspices. If an error (*vitium*) occurred in the auspices, the augurs could, of their own accord or at the request of the senate, inform themselves of the circumstances, and decree upon it. A consul could refuse to accept their decree while he remained in office, but on retiring he could be prosecuted. *Auspicia oblativa* referred mostly to the comitia. A magistrate was not bound to take notice of signs reported merely by a private person, but he could not overlook such a report from a brother magistrate. For example, if a quaestor on his entry to office observed lightning and announced it to the consul, the latter must delay the public assembly for the day.

On the subject generally, see A. Bouché-Leclercq, *Histoire de la divination dans l'antiquité* (1879), and his articles, with bibliography, in Daremberg and Saglio's *Dictionnaire des antiquités*; also articles "Augures," "Auspicium," by Wissowa in Pauly's *Realencyclopädie* (II. pt. ii., 1896), and by L. C. Purser (and others) in Smith's *Dictionary of Greek and Roman Antiquities* (3rd ed., 1890). (See also DIVINATION, OMEN, ASTROLOGY, &c.)

AUGUST (originally *Sextilis*), the sixth month in the pre-Julian Roman year, which received its present name from the emperor Augustus. The preceding month, *Quintilis*, had been called "July" after Julius Caesar, and the emperor chose August to be rechristened in his own honour because his greatest good fortune had then happened. In that month he had been admitted to the consulate, had thrice celebrated a triumph, had received the allegiance of the soldiers stationed on the Janiculum, had concluded the civil wars, and had subdued Egypt. As July contained thirty-one days, and August only thirty, it was thought necessary to add another day to the latter month, in order that the month of Augustus might not be in any respect inferior to that of Julius.

AUGUSTA, a city and the county-seat of Richmond county, Georgia, U.S.A., at the head of steamboat navigation on the Savannah river, 132 m. N.W. of Savannah by rail and 240 m. by river course. Pop. (1890) 33,300; (1900) 39,441, of whom 18,487 were negroes and only 995 were foreign-born; (1910 census) 41,040. Augusta is served by the Southern, the Augusta Southern (controlled by the Southern), the Atlantic Coast Line, the Charleston & Western Carolina (controlled by the Atlantic Coast Line), the Georgia and the Central of Georgia railways, by an electric line to Aiken, South Carolina, and by a line of steamers to Savannah. The city extends along the river bank for a distance of more than 3 m., and is connected by a bridge with Hamburg, and with North Augusta, South Carolina, two residential suburbs. Augusta is well known as a winter resort (mean winter temperature, 47° F.), and there are many fine winter homes here of wealthy Northerners. There are good roads, stretching from Augusta for miles in almost every direction. In North Augusta there is a large hotel, and there is another in Summerville (pop. in 1910, 4361), $2\frac{1}{2}$ m. N.W., an attractive residential suburb and winter resort, in which there are a country club and a large United States arsenal, established in 1831. Broad Street is the principal thoroughfare of Augusta, and Greene Street, with a park in the centre and flanking rows of oaks and elms, is the finest residential street. Of historical interest is St Paul's church (Protestant Episcopal); the present building was erected in 1819 and is the third St Paul's church on the same site. The first church was "built by the gentlemen of Augusta" in 1750. In the crypt of the church General Leonidas Polk is buried; and in the churchyard are the graves of George Steptoe Washington, a nephew of George Washington, and of William Longstreet, the inventor. Among the city's principal buildings are the Federal building, the Richmond county court house, the Augusta orphan asylum, the city hospital, the Lamar hospital for negroes, and the buildings of Richmond Academy (incorporated in 1783), of the Academy of the Sacred Heart (for girls), of Paine's Institute (for negroes), of Houghton Institute, endowed in 1852 to be "free to all the children of Augusta," and of the medical school of the university of Georgia, founded in 1829, and a part of the university since 1873. A granite obelisk 50 ft. high was erected in 1861 as a memorial to the signers for Georgia of the Declaration of Independence; beneath it are buried Lyman Hall (1726–1790) and George Walton (1740–1804). There are two Italian marble monuments in honour of Confederate soldiers, and monuments to the Southern poets, Paul Hamilton Hayne and Richard Henry Wilde (1789–1847).

In commerce and manufacturing, Augusta ranks second among the cities of Georgia. As a centre of trade for the "Cotton Belt," it has a large wholesale and retail business; and it is an important cotton market. The principal manufacture is cotton goods; among the other products are lumber, flour, cotton waste, cotton-seed oil and cake, ice, silk, boilers and engines, and general merchandise staples. Water-power for factories is secured by a system of "water-power canals" from a large dam across the Savannah, built in 1847 and enlarged in 1871; the principal canal, owned by the city, is so valuable as nearly to pay the interest on the municipal debt. In 1905 the value of the city's total factory product was $8,829,305, of which $3,832,009, or 43·4 %, was the value of the cotton goods. The principal newspaper is the *Augusta Chronicle*, founded in 1785.

Augusta was established in 1735–1736 by James Edward Oglethorpe, the founder of Georgia, and was named in honour of the princess of Wales. The Carolina colonists had a trading post in its vicinity before the settlement by Oglethorpe. The fort, built in 1736, was first named Fort Augusta, and in 1780, at the time of the British occupation, was enlarged and renamed Fort Cornwallis; its site is now marked by a Memorial Cross, erected by the Colonial Dames of Georgia in the churchyard of St Paul's. Tobacco was the principal agricultural product during the 18th century, and for its culture negro slaves were introduced from Carolina, before the restrictions of the Georgia Trustees on slavery were removed. During the colonial period several treaties with Indians were made at Augusta; by the most important, that of 1763, the Choctaws, Creeks, Chickasaws, Cherokees and Catawbas agreed (in a meeting with the governors of North and South Carolina, Virginia and Georgia) to the terms of the treaty of Paris. At the opening of the American War of Independence, the majority of the people of Augusta were Loyalists. The town was taken by the British under Lieut.-Col. Archibald Campbell (1739–1791) in January 1779, but was evacuated a month later; it was the seat of government of Georgia for almost the entire period from the capture of Savannah in December 1778 until May 1780, and was then abandoned by the Patriots and was occupied chiefly by Loyalists under Lieut.-Col.

Thomas Brown. In September 1780 a force of less than 500 patriots under Col. Elijah Clarke marched against the town in three divisions, and while one division, attacking a neighbouring Indian camp, drew off most of the garrison, the other two divisions entered the town; but British reinforcements arrived before Brown could be dislodged from a building in which he had taken refuge, and Clarke was forced to withdraw. A stronger American force, under Lieut.-Col. Henry Lee, renewed the siege in May 1781 and gained possession on the 5th of June. From 1783 until 1795 Augusta was again the seat of the state government. It was the meeting-place of the Land Court which confiscated the property of the Loyalists of Georgia, and of the convention which ratified for Georgia the Constitution of the United States. In 1798 it was incorporated as a town, and in 1817 it was chartered as a city. Augusta was the home of the inventor, William Longstreet (1759–1814), who as early as 1788 received a patent from the state of Georgia for a steamboat, but met with no practical success until 1808; as early as 1801 he had made experiments in the application of steam to cotton gins and saw-mills at Augusta. Near Augusta, on the site now occupied by the Eli Whitney Country Club, Eli Whitney is said to have first set up and operated his cotton gin; he is commemorated by a mural tablet in the court house. The establishment of a steamboat line to Savannah in 1817 aided Augusta's rapid commercial development. There was a disastrous fire in 1829, an epidemic of yellow fever in 1839, and a flood in 1840, but the growth of the city was not seriously checked; the cotton receipts of 1846 were 212,019 bales, and in 1847 a cotton factory was built. During the Civil War Augusta was the seat of extensive military factories, the tall chimney of the Confederate powder mills still standing as a memorial. The economic development has, since the Civil War, been steady and continuous. An exposition was held in Augusta in 1888, and another in 1893.

AUGUSTA, the capital of Maine, U.S.A., and the county-seat of Kennebec county, on the Kennebec river[1] (at the head of navigation), 44 m. from its mouth, 62 m. by rail N.E. of Portland, and 74 m. S.W. of Bangor. Pop. (1890) 10,527; (1900) 11,683, of whom 2131 were foreign-born; (1910, census) 13,211. It is served by the Maine Central railway, by several electric lines, and by steamboat lines to Portland, Boston and several other ports. It is built on a series of terraces, mostly on the west bank of the river, which is spanned here by a bridge 1100 ft. long. The state house, built of granite quarried in the vicinity, occupies a commanding site along the south border of the city, and in it is the state library. The Lithgow library is a city public library. Near the state house is the former residence of James G. Blaine. On the other side of the river, nearly opposite, is the Maine insane hospital. Among other prominent buildings are the court house, the post office and the city hall. In one of the parks is a soldiers' and sailors' monument. By means of a dam across the river, 17 ft. high and nearly 600 ft. long, good water-power is provided, and the city manufactures cotton goods, boots and shoes, paper, pulp and lumber. A leading industry is the printing and publishing of newspapers and periodicals, several of the periodicals published here having an enormous circulation. The total value of the factory products in 1905 was $3,886,833. Augusta occupies the site of the Indian village, Koussinoc, at which the Plymouth Colony established a trading post about 1628. In 1661 Plymouth sold its interests, and soon afterward the four purchasers abandoned the post. In 1754, however, their heirs brought about the erection here of Fort Western, the main building of which is still standing at the east end of the bridge, opposite the city hall. Augusta was originally a part of the township of Hallowell (incorporated in 1771); in 1797 the north part of Hallowell was incorporated as a separate town and named Harrington; and later in the same year the name was changed to Augusta. It became the county-seat in 1799; was chosen by the Maine legislature as the capital of the state in 1827, but was not occupied as such until the completion of the state house in 1831; and was chartered as a city in 1849.

AUGUSTA, a seaport of the province of Syracuse, Sicily, 19 m. N. of it by rail. Pop. (1901) 16,402. It occupies a part of the former peninsula of Xiphonia, now a small island, connected with the mainland by a bridge. It was founded by the emperor Frederick II. in 1232, and almost entirely destroyed by an earthquake in 1693, after which it was rebuilt. The castle is now a large prison. The fortified port, though unfrequented except as a naval harbour of refuge, is a very fine one. There are considerable saltworks at Augusta. To the south, on the left bank of the Molinello, 1½ m. from its mouth, Sicel tombs and Christian catacombs, and farther up the river a cave village of the early middle ages, have been explored (*Notizie degli Scavi*, 1902, 411, 631; *Römische Quartalschrift*, 1902, 205). Whether there was ever a town bearing the name Xiphonia is doubted by E. A. Freeman (*Hist. of Sic.* i. 583); cf., however, E. Pais, *Atakta* (Pisa, 1891), 55, who attributes its foundation, under the name of Tauromenion (which it soon lost), to the Zancleans of Hybla (afterwards Megara Hyblaea). (T. As.)

AUGUSTA BAGIENNORUM, the chief town of the Ligurian tribe of the Bagienni, probably identical with the modern Bene Vagienna, on the upper course of the Tanaro, about 35 m. due south of Turin. The town retained its position as a tribal centre in the reorganization of Augustus, whose name it bears, and was erected on a systematic plan. Considerable remains of public buildings, constructed in concrete faced with small stones with bands of brick at intervals, an amphitheatre with a major axis of 390 ft. and a minor axis of 305 ft., a theatre with a stage 133 ft. in length, and near it the foundations of what was probably a basilica, an open space (no doubt the forum), an aqueduct, baths, &c., have been discovered by recent excavations, and also one of the city gates, flanked by two towers 22 ft. sq.

See G. Assandria and G. Vacchetta in *Notizie degli Scavi* (1894), 155; (1896), 215; (1897), 441; (1898), 299; (1900), 389; (1901), 413. (T. As.)

AUGUSTAN HISTORY, the name given to a collection of the biographies of the Roman emperors from Hadrian to Carinus (A.D. 117–284). The work professes to have been written during the reigns of Diocletian and Constantine, and is to be regarded as the composition of six authors,—Aelius Spartianus, Julius Capitolinus, Aelius Lampridius, Vulcacius Gallicanus, Trebellius Pollio and Flavius Vopiscus—known as Scriptores Historiae Augustae, writers of Augustan history. It is generally agreed, however, that there is a large number of interpolations in the work, which are referred to the reign of Theodosius; and that the documents inserted in the lives are almost all forgeries. The more advanced school of critics holds that the names of the supposed authors are purely fictitious, as those of some of the authorities which they profess to quote certainly are. The lives, which (with few exceptions) are arranged in chronological order, are distributed as follows:—To Spartianus: the biographies of Hadrian, Aelius Verus, Didius Julianus, Septimius Severus, Pescennius Niger, Caracallus, Geta (?); to Vulcacius Gallicanus: Avidius Cassius; to Capitolinus: Antoninus Pius, Marcus Aurelius Antoninus, Verus, Pertinax, Clodius Albinus, the two Maximins, the three Gordians, Maximus and Balbinus, Opilius Macrinus (?); to Lampridius: Commodus, Diadumenus, Elagabalus, Alexander Severus; to Pollio: the two Valerians, the Gallieni, the so-called Thirty Tyrants or Usurpers, Claudius (his lives of Philip, Decius, and Gallus being lost); to Vopiscus: Aurelian, Tacitus, Florian, Probus, the four tyrants (Firmus, Saturninus, Proculus, Bonosus), Carus, Numerian, Carinus.

The importance of the Augustan history as a repertory of information is very considerable, but its literary pretensions are of the humblest order. The writers' standard was confessedly low. "My purpose," says Vopiscus, "has been to provide materials for persons more eloquent than I." Considering the perverted taste of the age, it is perhaps fortunate that the task fell into the hands of no showy declaimer who measured his success by his skill in making surface do duty for substance, but of homely, matter-of-fact scribes, whose sole concern was to record what they knew. Their narrative is unmethodical and inartificial; their style is tame and plebeian; their conception of biography is that of a collection of anecdotes; they have no notion of arrangement, no measure of proportion, and no criterion of discrimination between the important and the trivial; they are equally destitute of critical and of historical insight, unable to sift the authorities on which they rely, and unsuspicious of the stupendous social revolution comprised within the period which they undertake to describe. Their value, consequently, depends very much on that of the sources to which they happen to have recourse for any given period of history, and on the fidelity of their adherence to these when valuable. Marius Maximus and Aelius Junius Cordus, to whose qualifications they themselves bear no favourable testimony, were their chief authorities for the earlier lives of the series. Marius Maximus, who lived about 165–230, wrote biographies of the emperors, in continuation of those of Suetonius, from Nerva to Elagabalus; Junius Cordus dealt with the less-known emperors, perhaps down to Maximus and Balbinus. The earlier lives, however, contain a substratum of authentic historical fact, which recent critics have supposed to be derived from a lost work by a contemporary writer, described by one of these scholars as "the last great Roman historian." For the later lives the Scriptores were obliged to resort more largely to public records, and thus preserved matter of the highest importance, rescuing from oblivion many imperial rescripts and senatorial decrees, reports of official proceedings and speeches on public occasions, and a number of interesting and characteristic letters from various emperors. Their incidental allusions sometimes cast vivid though undesigned light on the circumstances of the age, and they have made large contributions to our knowledge of imperial jurisprudence in particular. Even their trivialities have their use; their endless anecdotes respecting the personal habits of the subjects of their biographies, if valueless to the historian, are most acceptable to the archaeologist, and not unimportant to the economist and moralist. Their errors and deficiencies may in part be ascribed to the contemporary neglect of history as a branch of instruction. Education was in the hands of rhetoricians and grammarians; historians were read for their style, not for their matter, and since the days of Tacitus, none had arisen worth a schoolmaster's notice. We thus find Vopiscus acknowledging that when he began to write the life of Aurelian, he was entirely misinformed respecting the latter's competitor Firmus, and implying that he would not have ventured on Aurelian himself if he had not had access to the MS. of the emperor's own diary in the Ulpian library. The writers' historical estimates are superficial and conventional, but report the verdict of public opinion with substantial accuracy. The only imputation on the integrity of any of them lies against Trebellius Pollio, who, addressing his work to a descendant of Claudius, the successor and probably the assassin of Gallienus, has dwelt upon the latter versatile sovereign's carelessness and extravagance without acknowledgment of the elastic though fitful energy he so frequently displayed in defence of the empire. The caution of Vopiscus's references to Diocletian cannot be made a reproach to him.

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[1] The Kennebec was first explored to this point in 1607.

No biographical particulars are recorded respecting any of these writers. From their acquaintance with Latin and Greek literature they must have been men of letters by profession, and very probably secretaries or librarians to persons of distinction. There seems no reason to accept Gibbon's contemptuous estimate of their social position. They appear particularly versed in law. Spartianus's reference to himself as "Diocletian's own" seems to indicate that he was a domestic in the imperial household. They address their patrons with deference, acknowledging their own deficiencies, and seem painfully conscious of the profession of literature having fallen upon evil days.

Editio princeps (Milan, 1475); Casaubon (1603) showed great critical ability in his notes, but for want of a good MS. left the restoration of the text to Salmasius (1620), whose notes are a most remarkable monument of erudition, combined with acuteness in verbal criticism and general vigour of intellect. Of recent years considerable attention has been devoted by German scholars to the *History*, especially by Peter, whose edition of the text in the Teubner series (2nd ed., 1884) contains (praef. xxxv.-xxxvii.) a bibliography of works on the subject preceding the publication of his own special treatise. The edition by Jordan-Eyssenhardt (1863) should also be mentioned. Amongst the most recent treatises on the subject are: A. Gemoll, *Die Scriptores Historiae Augustae* (1886); H. Peter, *Die Scriptores Historiae Augustae* (1892); G. Tropea, *Studi sugli Scriptores Historiae Augustae* (1899–1903); J. M. Heer, *Der historische Wert der Vita Commodi in der Sammlung der Scriptores Historiae Augustae* (1901); C. Lécrivain, *Études sur l'histoire Auguste* (1904); E. Kornemann, *Kaiser Hadrian und der letzte grosse Historiker von Rom* (1905), according to whom "the last great historian of Rome" is Lollius Urbicus; O. Schulz, *Das Kaiserhaus der Antonine und der letzte Historiker Roms* (1907). On their style, see C. Paucker, *De Latinitate Scriptorum Historiae Augustae* (1870); special lexicon by C. Lessing (1901–1906). An English translation is included in *The Lives of the Roman Emperors*, by John Bernard (1698). See further ROME: *History* (anc. *ad fin.*), section "Authorities"; M. Schanz, *Geschichte der römischen Litteratur*, iii. p. 69 (for Marius Maximus and Junius Cordus), iv. p. 47; Teuffel-Schwabe, *Hist. of Roman Literature* (Eng. tr.), § 392; H. Peter, bibliography from 1893 to 1905 in Bursian's *Jahresbericht*, cxxix. (1907).

AUGUSTA PRAETORIA SALASSORUM (mod. *Aosta*, *q.v.*), an ancient town of Italy in the district of the Salassi, founded by Augustus about 24 B.C. on the site of the camp of Varro Murena, who subdued this tribe in 25 B.C., and settled with 3000 praetorians. Pliny calls it the last town of Italy on the north-west, and its position at the confluence of two rivers, at the end of the Great and Little St Bernard, gave it considerable military importance, which is vouched for by considerable remains of Roman buildings. The ancient town walls, enclosing a rectangle 793 by 624 yds., are still preserved almost in their entire extent. The walls are 21 ft. high. They are built of concrete faced with small blocks of stone, and at the bottom are nearly 9 ft. thick, and at the top 6 ft. There are towers at the angles of the *enceinte*, and others at intervals, and two at each of the four gates, making a total of twenty towers altogether. They are roughly 32 ft. square, and project 14 ft. from the wall. The Torre del Pailleron on the south and the Torre del Leproso in the west are especially well preserved. The east and south gates exist (the latter, a double gate with three arches flanked by two towers, is the Porta Praetoria, and is especially fine), while the rectangular arrangement of the streets perpetuates the Roman plan, dividing the town into 16 blocks (*insulae*). The main road, 32 ft. wide, divides the city into two equal halves, running from east to west, an arrangement which makes it clear that the guarding of the road was the main *raison d'être* of the city. Some arcades of the amphitheatre (the diameters of which are 282 ft. and 239 ft.), and the south wall of the theatre are also preserved, the latter to a height of over 70 ft., and a market-place some 300 ft. square, surrounded by storehouses on three sides with a temple in the centre, and two on the open (south) side, and the *thermae*, have been discovered. Outside the town is a handsome triumphal arch in honour of Augustus. About 5 m. to the west is a single-arched Roman bridge, the Pondel, which has a closed passage lighted by windows for foot passengers in winter, and above it an open footpath, both being about 3½ ft. in width. There are considerable remains of the ancient road from Eporedia (mod. *Ivrea*) to Augusta Praetoria, up the Valle d' Aosta, which the modern railway follows, notably the Pont St Martin, with a single arch with a span of 116 ft. and a roadway 15 ft. wide, the cutting of Donnaz, and the Roman bridges of Châtillon (Pont St Vincent) and Aosta (Pont de Pierre), &c.

See C. Promis, *Le antichità di Aosta* (Turin, 1862); E. Bérard in *Atti della Società di Archeologia di Torino*, iii. 119 seq.; *Notizie degli Scavi*, passim; A. d'Andrade, *Relazione dell' Ufficio Regionale per la conservazione dei Monumenti del Piemonte e della Liguria* (Turin, 1899), 46 seq.

(T. As.)

AUGUSTI, JOHANN CHRISTIAN WILHELM (1772–1841), German theologian, born at Eschenberga, near Gotha, was of Jewish descent, his grandfather having been a converted rabbi. He was educated at the gymnasium at Gotha and the university of Jena. At Jena he studied oriental languages, of which he became professor there in 1803. Subsequently he became ordinary professor of theology (1812), and for a time rector, at Breslau. In 1819 he was transferred to the university of Bonn, where he was made professor primarius. In 1828 he was appointed chief member of the consistorial council at Coblenz. Here he was afterwards made director of the consistory. He died at Coblenz in 1841. Augusti had little sympathy with the modern philosophical interpretations of dogma, and although he took up a position of free criticism with regard to the Biblical narratives, he held fast to the traditional faith. His works on theology (*Dogmengeschichte*, 1805; 4th ed., 1835) are simple statements of fact; they do not attempt a speculative treatment of their subjects. In 1809 he published in conjunction with W. M. L. de Wette a new translation of the Old Testament. Mention should also be made of his *Grundriss einer historisch-kritischen Einleitung ins Alte Testament* (1806), his *Exegetisches Handbuch des Alten Testaments* (1797–1800), and his edition of *Die Apokryphen des A. T.* (1804). In addition to these, his most important writings are the *Denkwürdigkeiten aus der Christlichen Archäologie*, 12 vols. (1817–1831), a partially digested mass of materials, and the *Handbuch der Christ. Archäologie*, 3 vols. (1836–1837), which gives the substance of the larger work in a more compact and systematic form.

AUGUSTINE, SAINT (354–430), one of the four great fathers of the Latin Church. Augustinus—the *praenomen* Aurelius is used indeed by his disciples Orosius and Prosper, and is found in the oldest Augustine MSS., but is not used by himself, nor in the letters addressed to him—was born at Tagaste, a town of Numidia, now Suk Ahras in Constantine, on the 13th of November 354. His father, Patricius, was a burgess of Tagaste and still a pagan at the time of his son's birth. His mother, Monica, was not only a Christian, but a woman of the most tender and devoted piety, whose beautiful faith and enthusiasm and patient prayer for both her husband and son (at length crowned with success in both cases) have made her a type of womanly saintliness for all ages. She early instructed her son in the faith and love of Jesus Christ, and for a time he seems to have been impressed by her teaching. Falling ill, he wished to be baptized; but when the danger was past, the rite was deferred and, in spite of his mother's admonitions and prayers, Augustine grew up without any profession of Christian piety or any devotion to Christian principles.

Inheriting from his father a passionate nature, he formed while still a mere youth an irregular union with a girl, by whom he became the father of a son, whom in a fit of pious emotion he named Adeodatus (" by God given "), and to whom he was passionately attached. In his *Confessions* he afterwards described this period of his life in the blackest colours; for in the light of his conversion he saw behind him only shadows. Yet, whatever his youthful aberrations, Augustine was from the first an earnest student. His father, noticing his early promise, destined him for the brilliant and lucrative career of a rhetorician, for which he spared no expense in training him. Augustine studied at his native town and afterwards at Madaura and Carthage, especially devoting himself to the works of the Latin poets, many traces of his love for which are to be found in his writings. His acquaintance with Greek literature was much more limited, and, indeed, it has been doubted, though without sufficient reason, whether he could use the Greek scriptures in the original. Cicero's *Hortensius*, which he read in his nineteenth year, first awakened in his mind the spirit of speculation and the impulse towards the knowledge of the truth. But he passed from one phase of thought to another, unable to find satisfaction in any. Manichaeism, that mixed product of Zoroastrian and Christian-gnostic elements, first enthralled him. He became a fervent member of the sect, and was admitted into the class of *auditors* or " hearers." Manichaeism seemed to him to solve the mysteries of the world, and of his own experiences by which he was perplexed. His insatiable imagination drew congenial food from the fanciful religious world of the Manichaeans, decked out as this was with the luxuriant wealth of Oriental myth. His strongly developed sense of a need of salvation sought satisfaction in the contest of the two principles of Good and Evil, and found peace, at least for the moment, in the conviction that the portions of light present in him would be freed from the darkness in which they were immersed. The ideal of chastity and self-restraint, which promised a foretaste of union with God, amazed him, bound as he was in the fetters of sensuality and for ever shaking at these fetters. But while his moral force was not sufficient for the attainment of this ideal, gradually everything else which Manichaeism seemed to offer him dissolved before his criticism. Increasingly occupied with the exact sciences, he learnt the incompatibility of the Manichaean astrology with the facts. More and more absorbed in the problems of psychology, he realized the insufficiency of dualism, which did not solve the ultimate questions but merely set them back. The Manichaean propaganda seemed to him invertebrate and lacking in force, and a discussion which he had with Faustus, a distinguished Manichaean bishop and controversialist, left him greatly disappointed.

Meanwhile nine years had passed. Augustine, after finishing his studies, had returned to Tagaste, where he became a teacher of grammar. He must have been an excellent master, who knew how to influence the whole personality of his pupils. It was then that Alypius, who in the later stages of Augustine's life proved a true friend and companion, attached himself to him. He remained in his native town little more than a year, during which time he lived with his mother, who was comforted by the bishop for the estrangement of her son from the Catholic faith ("a son of so many tears cannot be lost": *Confess.* III. xii. § 21), comforted also, and above all, by the famous vision, which Augustine thus describes: " She saw herself standing on a certain wooden rule, and a shining youth coming towards her, cheerful and smiling upon her the while she grieved, and was consumed with grief: and when he had inquired of her the causes of her grief and daily tears (for the sake, as is their wont, of teaching, not of learning) and she had made answer that she was bewailing my perdition, he bade her be at ease, and advised her to look and observe, ' That where she was, there was I also.' And when she looked there, she saw me standing by her on the same rule " (*Confess.* III. xi.). Augustine now returned for a second time to Carthage, where he devoted himself zealously to work. Thence, probably in the spring of 383, he migrated to Rome. His Manichaean friends urged him to take this step, which was rendered easier by the licentious lives of the students at Carthage. His stay at Rome may have lasted about a year, no agreeable time for Augustine, since his patrons and friends belonged to just those Manichaean circles with which he had in the meantime entirely lost all intellectual touch. He, therefore, accepted an invitation from Milan, where the people were in search of a teacher of rhetoric.

At Milan the conflict within his mind in search of truth still continued. It was now that he separated himself openly from the Manichaean sect. As a thinker he came entirely under the influence of the New Academy; he professed the Sceptic philosophy, without being able to find in it the final conclusion of wisdom. He was, however, not far from the decision. Two things determined his further development. He became acquainted with the Neo-Platonic philosophy; its monism replaced the dualism, its intellectualized world of ideas the materialism of Manichaeism. Here he found the admonition to seek for truth outside the material world, and from created things he learnt to recognize the invisible God; he attained the certainty that this God is, and is eternal, always the same, subject to change neither in his parts nor in his motions. And while thus Augustine's metaphysical convictions were being slowly remodelled, he met, in Ambrose, bishop of Milan, a man in whom complete worldly culture and the nobility of a ripe Christian personality were wonderfully united. He heard him preach; but at first it was the orator and not the contents of the sermons that enchained him. He sought an opportunity of conversation with him, but this was not easily found. Ambrose had no leisure for philosophic discussion. He was accessible to all who sought him, but never for a moment free from study or the cares of duty. Augustine, as he himself tells us, used to enter without being announced, as all persons might; but after staying for a while, afraid of interrupting him, he would depart again. He continued, however, to hear Ambrose preach, and gradually the gospel of divine truth and grace was received into his heart. He was busy with his friend Alypius in studying the Pauline epistles; certain words were driven home with irresistible force to his conscience. His struggle of mind became more and more intolerable, the thought of divine purity fighting in his heart with the love of the world and the flesh. That sensuality was his worst enemy he had long known. The mother of his child had accompanied him to Milan. When he became betrothed he dismissed her; but neither the pain of this parting nor consideration for his not yet marriageable bride prevented him from forming a fresh connexion of the same kind. Meanwhile, the determination to renounce the old life with its pleasures of sense, was ever being forced upon him with more and more distinctness. He then received a visit from a Christian compatriot named Pontitian, who told him about St Anthony and the monachism in Egypt, and also of a monastery near Milan. He was shaken to the depths when he learnt from Pontitian that two young officials, like himself betrothed, had suddenly formed a determination to turn their backs upon the life of the world. He could no longer bear to be inside the house; in terrible excitement he rushed into the garden; and now followed that scene which he himself in the *Confessions* has described to us with such graphic realism. He flung himself under a fig tree, burst into a passion of weeping, and poured out his heart to God. Suddenly he seemed to hear a voice bidding him consult the divine oracle: "Take up and read, take up and read." He left off weeping, rose up, sought the volume where Alypius was sitting, and opening it read in silence the following passage from the Epistle to the Romans (xiii. 13, 14): "Not in rioting and drunkenness, not in chambering and wantonness, not in strife and envying. But put ye on the Lord Jesus Christ, and make not provision for the flesh to fulfil the lusts thereof." He adds: "I had neither desire nor need to read further. As I finished the sentence, as though the light of peace had been poured into the heart, all the shadows of doubt dispersed. Thus hast Thou converted me to Thee, so as no longer to seek either for wife or other hope of the world, standing fast in that rule of faith in which Thou so many years before hadst revealed me to my mother" (*in qua me ante tot annos ei revelaveras*: *Confess*. VIII. xii. § 30).[1]

The conversion of Augustine, as we have been accustomed to call this event, took place in the late summer of 386, a few weeks before the beginning of the vacation. The determination to give up his post was rendered easier by a chest-trouble which was not without danger, and which for months made him incapable of work. He withdrew with several companions to the country estate of Cassisiacum near Milan, which had been lent him by a friend, and announced himself to the bishop as a candidate for baptism. His religious opinions were still to some extent unformed, and even his habits by no means altogether such as his great change demanded. He mentions, for example, that during this time he broke himself of a habit of profane swearing, and in other ways sought to discipline his character and conduct for the reception of the sacred rite. He received baptism the Easter following, in his thirty-third year, and along with him his son Adeodatus and his friend Alypius were admitted to the Church. Monica, his mother, had rejoined him, and at length rejoiced in the fulfilment of her prayers. She died at Ostia, just as they were about to embark for Africa, her last hours being gladdened by his Christian sympathy. In the account of the conversation which he had with his mother before her end, in the narrative of her death and burial (*Confess*. IX. x.-xi., §§ 23-28), Augustine's literary power is displayed at its highest.

The plan of returning home remained for the present unaccomplished. Augustine stayed for a year in Rome, occupied in literary work, particularly in controversy with Manichaeism. It was not until the autumn of 388 that he returned to Tagaste, probably still accompanied by his son, who, however, must have died shortly afterwards. With some friends, who joined him in devotion, he formed a small religious community, which looked to him as its head. Their mode of life was not formally monastic according to any special rule, but the experience of this time of seclusion was, no doubt, the basis of that monastic system which Augustine afterwards sketched and which derived its name from him (see AUGUSTINIANS). As may be imagined, the fame of such a convert in such a position soon spread, and invitations to a more active ecclesiastical life came to him from many quarters. He shrank from the responsibility, but his destiny was not to be avoided. After two and a half years spent in retirement he went to Hippo, to see a Christian friend, who desired to converse with him as to his design of quitting the world and devoting himself to a religious life. The Christian community there being in want of a presbyter and Augustine being present at the meeting, the people unanimously chose him and he was ordained to the presbyterate. A few years afterwards, 395 or 396, he was made coadjutor to the bishop, and finally became bishop of the see.

Henceforth Augustine's life is filled up with his ecclesiastical labours, and is more marked by the series of his numerous writings and the great controversies in which they engaged him than by anything else. His life was spent in a perpetual strife. During the first half this had been against himself; but even when others stepped into his place, it always seems as though a part of Augustine himself were incarnate in them. Augustine had early distinguished himself as an author. He had written several philosophical treatises, and, as teacher of rhetoric at Carthage, he had composed a work *De pulchro et apto*, which is no longer extant. When at Cassisiacum he had combated the scepticism of the New Academy (*Contra Academicos*), had treated of the "blessed life" (*De Vita beata*), of the significance of evil in the order of the world (*De ordine*), of the means for the elucidation of spiritual truths (*Soliloquia*). Shortly before the time of his baptism, he was occupied with the question of the immortality of the soul (*De immortalitate animae*), and in Rome and at Tagaste he was still engaged with philosophical problems, as is evidenced by the writings *De quantitate animae* and *De magistro*. In all these treatises is apparent the influence of the Neo-Platonic method of thought, which for him, as for so many others, had become the bridge to the Christian. While still in Rome, he began to come to a reckoning with the Manichaeans, and wrote two books on the morals of the Catholic Church and of the Manichaeans (*De moribus ecclesiae Catholicae et de moribus Manichaeorum libri duo*). For many years he pursued this controversy in a long series of writings, of which the most conspicuous is the elaborate reply to his old associate and disputant, Faustus of Mileve (*Contra Faustum Manichaeum*, A.D. 400). It was natural that the Manichaean heresy, which had so long enslaved his own mind, should have first exercised Augustine's great powers as a theological thinker and controversialist. He was able from his own experience to give force to his arguments for the unity of creation and of the spiritual life, and to strengthen the mind of the Christian Church in its last struggle with that dualistic spirit which had animated and moulded in succession so many forms of thought at variance with Christianity.

But the time was one of almost universal ecclesiastical and intellectual excitement; and so powerful a mental activity as his was naturally drawn forth in all directions. Following his writings against the Manichaeans came those against the Donatists. The controversy was one which strongly interested him, involving as it did the whole question of the constitution of the Church and the idea of catholic order, to which the circumstances of the age gave special prominence. The Donatist controversy sprang out of the Diocletian persecution in the beginning of the century. A party in the Church of Carthage, fired with fanatic zeal on behalf of those who had courted martyrdom by resistance to the imperial mandates, resented deeply the appointment of a bishop of moderate opinions, whose consecration had been performed, they alleged, by a *traditor*, viz. a bishop who had "delivered" the holy scriptures to the magistrates. They set up, in consequence, a bishop of their own, of the name of Majorinus, succeeded in 315 by Donatus. The party made great pretensions to purity of discipline, and rapidly rose in popular favour, notwithstanding a decision given against them both by the bishop of Rome and by the emperor Constantine. Augustine was strongly moved by the lawlessness of the party and launched forth a series of writings against them, the most important of which survive. Amongst these are "Seven Books on Baptism" (*De baptismo contra Donatistas*, c. A.D. 400) and a lengthy answer, in three books, to Petilian, bishop of Cirta, who was the most eminent theologian amongst the Donatist divines. At a later period, about 417, Augustine wrote a treatise concerning the correction of the Donatists (*De correctione Donatistarum*) "for the sake of those," he says in his *Retractations*, "who were not willing that the Donatists should be subjected to the correction of the imperial laws." In these writings, while vigorously maintaining the validity of the Church as it then stood in the Roman world, and the necessity for moderation in the exercise of church discipline, Augustine yet gave currency, in his zeal against the Donatists, to certain maxims as to the duty of the civil power to control schism, which were of evil omen, and have been productive of much disaster in the history of Christianity.

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[1] The reference is to the vision described above.

The third controversy in which Augustine engaged was the most important, and the most intimately associated with his distinctive greatness as a theologian. As may be supposed, owing to the conflicts through which he had passed, the bishop of Hippo was intensely interested in what may be called the anthropological aspect of the great Christian idea of redemption. He had himself been brought out of darkness into "marvellous light," only by entering into the depths of his own soul, and finding, after many struggles, that there was no power but divine grace, as revealed in the life and death of the Son of God, which could bring rest to human weariness, or pardon and peace for human guilt. He had found human nature in his own case too weak and sinful to find any good for itself. In God alone he had found good. This deep sense of human sinfulness coloured all his theology, and gave to it at once its depth—its profound and sympathetic adaptation to all who feel the reality of sin—and that tinge of darkness and exaggeration which has as surely repelled others. When the expression "Augustinism" is used, it points especially to those opinions of the great teacher which were evoked in the Pelagian controversy, to which he devoted the most mature and powerful period of his life. His opponents in this controversy were Pelagius, from whom it derives its name, and Coelestius and Julianus, pupils of the former. Nothing is certainly known as to the home of Pelagius. Augustine calls him Brito, and so do Marius Mercator and Orosius. Jerome points to his Scottish descent, in such terms, however, as to leave it uncertain whether he was a native of Scotland or of Ireland. He was a man of blameless character, devoted to the reformation of society, full of that confidence in the natural impulses of humanity which often accompanies philanthropic enthusiasm. About the year 400 he came, no longer a young man, to Rome, where he lived for more than a decade, and soon made himself conspicuous by his activity and by his opinions. His pupil Coelestius, a lawyer of unknown origin, developed the views of his master with a more outspoken logic, and, while travelling with Pelagius in Africa, in the year 411, was at length arraigned before the bishop of Carthage for the following, amongst other heretical opinions:— (1) that Adam's sin was purely personal, and affected none but himself; (2) that each man, consequently, is born with powers as incorrupt as those of Adam, and only falls into sin under the force of temptation and evil example; (3) that children who die in infancy, being untainted by sin, are saved without baptism. Views such as these were obviously in conflict with the whole course of Augustine's experience, as well as with his interpretation of the catholic doctrine of the Church. And when his attention was drawn to them by the trial and excommunication of Coelestius, he undertook their refutation, first of all in three books on the punishment and forgiveness of sins and the baptism of infants (*De peccatorum meritis et remissione et de baptismo parvulorum*), addressed to his friend Marcellinus, in which he vindicated the necessity of baptism of infants because of original sin and the grace of God by which we are justified (*Retract.* ii. 23). This was in 412. In the same year he addressed a further treatise to the same Marcellinus on *The Spirit and the Letter* (*De spiritu et littera*). Three years later he composed the treatises on *Nature and Grace* (*De natura et gratia*) and the relation of the human to the divine righteousness (*De perfectione iustitiae hominis*). The controversy was continued during many years in no fewer than fifteen treatises. Upon no subject did Augustine bestow more of his intellectual strength, and in relation to no other have his views so deeply and permanently affected the course of Christian thought. Even those who most usually agree with his theological standpoint will hardly deny that, while he did much in these writings to vindicate divine truth and to expound the true relations of the divine and human, he also, here as elsewhere, was hurried into extreme expressions as to the absoluteness of divine grace and the extent of human corruption. Like his great disciple in a later age—Luther—Augustine was prone to emphasize the side of truth which he had most realized in his own experience, and, in contradistinction to the Pelagian exaltation of human nature, to depreciate its capabilities beyond measure.

In addition to these controversial writings, which mark the great epochs of Augustine's life and ecclesiastical activity after his settlement as a bishop at Hippo, he was the author of other works, some of them better known and even more important. His great work, the most elaborate, and in some respects the most significant, that came from his pen, is *The City of God* (*De civitate Dei*). It is designed as a great apologetic treatise in vindication of Christianity and the Christian Church,— the latter conceived as rising in the form of a new civic order on the crumbling ruins of the Roman empire,—but it is also, perhaps, the earliest contribution to the philosophy of history, as it is a repertory throughout of his cherished theological opinions. This work and his *Confessions* are, probably, those by which he is best known, the one as the highest expression of his thought, and the other as the best monument of his living piety and Christian experience. *The City of God* was begun in 413, and continued to be issued in its several portions for a period of thirteen years, or till 426. The *Confessions* were written shortly after he became a bishop, about 397, and give a vivid sketch of his early career. To the devout utterances and aspirations of a great soul they add the charm of personal disclosure, and have never ceased to excite admiration in all spirits of kindred piety. Something of this charm also belongs to the *Retractations*, that remarkable work in which Augustine, in 427, towards the end of his life, held as it were a review of his literary activity, in order to improve what was erroneous and to make clear what was doubtful in it. His systematic treatise on *The Trinity* (*De Trinitate*) which extends to fifteen books and occupied him for nearly thirty years, must not be passed over. This important work, unlike most of his dogmatic writings, was not provoked by any special controversial emergency, but grew up silently during this long period in the author's mind. This has given it something more of completeness and organic arrangement than is usual with Augustine, if it has also led him into the prolonged discussion of various analogies, more curious than apt in their bearing on the doctrine which he expounds. Brief and concise is the presentation of the Catholic doctrine in the compendium, which, about 421, he wrote at the request of a Roman layman named Laurentius (*Encheiridion, sive de fide spe et caritate*). In spite of its title, the compendious work on Christian doctrine (*De doctrina christiana*), begun as early as 393, but only finished in 426, does not belong to the dogmatic writings. It is a sort of Biblical hermeneutic, in which homiletic questions are also dealt with. His catechetical principles Augustine developed in the charming writing *De catechizandis rudibus* (*c.* 400). A large number of tractates are devoted to moral and theological problems (*Contra mendacium*, *c.* 420; *De bono conjugali*, 401, &c.). A widespread influence was exercised by the treatise *De opere monachorum* (*c.*400), in which, on the ground of Holy Scripture, manual work was demanded of monks. Of less importance than the remaining works are the numerous exegetical writings, among which the commentary on the Gospel of St John deserves a special mention. These have a value owing to Augustine's appreciation of the deeper spiritual meaning of scripture, but hardly for their exegetical qualities. His *Letters* are full of interest owing to the light they throw on many questions in the ecclesiastical history of the time, and owing to his relations with such contemporary theologians as Jerome. They have, however, neither the liveliness nor the varied interest of the letters of Jerome himself. As a preacher Augustine was of great importance. We still possess almost four hundred sermons which may be ascribed to him with certainty. Many others only pass under his celebrated name.

The closing years of the great bishop were full of sorrow. The Vandals, who had been gradually enclosing the Roman empire, appeared before the gates of Hippo, and laid siege to it. Augustine was ill with his last illness, and could only pray for his fellow-citizens. He passed away during the siege, on the 28th of August 430, at the age of seventy-five, and thus was spared the indignity of seeing the city in the hands of the enemy.

The character of Augustine, both as a man and as a theologian, has been briefly indicated in the course of our sketch. None can deny the greatness of Augustine's soul—his enthusiasm, his unceasing search after truth, his affectionate disposition, his ardour, his self-devotion. And even those who may doubt the soundness of his dogmatic conclusions, cannot but acknowledge the depth of his spiritual convictions, and the logical force and penetration with which he handled the most difficult questions, thus weaving all the elements of his experience and of his profound scriptural knowledge into a great system of Christian thought. Of the four great Fathers of the Church he was admittedly the greatest—more profound than Ambrose, his spiritual father, more original and systematic than Jerome, his correspondent, and intellectually far more distinguished than Gregory the Great, his pupil on the papal throne. The theological position and influence of Augustine may be said to be unrivalled. No single name has ever exercised such power over the Christian Church, and no one mind ever made so deep an impression upon Christian thought. In him scholastics and mystics, popes and the opponents of the papal supremacy, have seen their champion. He was the fulcrum on which Luther rested the thoughts by which he sought to lift the past of the Church out of the rut; yet the judgment of Catholics still proclaims the ideas of Augustine as the only sound basis of philosophy.

The best complete edition of Augustine's works is that of the Maurines, in 11 vols. fol. published at Paris, 1679–1700, and reprinted in Migne's *Patrologie* (Paris, 1841–1842). Of the new critical edition in the *Corpus Scriptorum Ecclesiasticorum Latinorum*, issued by the Vienna Academy, thirteen volumes had been published in 1908, including the *Confessions*, the *Retractations*, *De civitate Dei*, and a number of exegetical and of dogmatic polemical works, together with a portion of the *Letters*. An English translation of nearly the whole of Augustine's writings will be found in the *Select Library of the Nicene and post-Nicene Fathers of the Christian Church* (series 1, Buffalo, 1886, &c.). Tillemont, in his *Mémoires pour servir à l'histoire ecclésiastique des VI premiers siècles*, has devoted a quarto volume (vol. xiii.) to Augustine's life and writings. The most complete monographs are those on the Catholic side by Kloth (Aix-la-Chapelle, 1839–1840, 3 vols.) and J. J. F. Poujoulat (7th ed., Paris, 1886, 2 vols.), and on the Protestant side by Bindemann (Berlin, Leipzig, Greifswald, 1844–1869, 3 vols.). There are interesting sketches, from quite different points of view, by von Hertling, *Augustinus* (2nd ed., Mainz, 1904), and Joseph McCabe, *St Augustine and His Age* (London, 1902). See also Nourrisson, *La Philosophie de St Augustin* (2nd ed., Paris, 1866, 2 vols.); H. A. Naville, *St Augustin, étude sur la développement de sa pensée jusqu'à l'époque de son ordination* (Geneva, 1872); Dorner, *Augustinus* (Berlin, 1873); Reuter, *Augustinische Studien* (Gotha, 1886); F. Scheel, *Die Anschauung Augustins über Christi Person und Werk* (Tübingen, 1901); A. Hatzfeld, *Saint Augustin* (6th ed., Paris, 1902); G. von Hertling, *Augustin* (Mainz, 1902); A. Egger, *Der heilige Augustinus* (Kempten, 1904); J. N. Espenberger, *Die Elemente der Erbsünde nach Augustin und der Frühscholastik* (Mainz, 1905); S. Angus, *The Sources of the First Ten Books of Augustine's De Civitate Dei* (Princeton, 1906); and the more modern text-books of the history of dogma, especially Harnack. (G. K.)

AUGUSTINE, SAINT (d. *c.*613), first archbishop of Canterbury, occupied a position of authority in the monastery of St Andrew at Rome, when Gregory I. summoned him to lead a mission to England in A.D. 596. The apprehensions of Augustine's followers caused him to return to Rome, but the pope furnished him with letters of commendation and encouraged him to proceed. He landed in Thanet in A.D. 597, and was favourably received by Æthelberht, king of Kent, who granted a dwelling-place for the monks in Canterbury, and allowed them liberty to preach. Augustine first made use of the ancient church of St Martin at Canterbury, which before his arrival had been the oratory of the Queen Berhta and her confessor Liudhard. Æthelberht upon his conversion employed all his influence in support of the mission. In 601 Augustine received the pallium from Gregory and was given authority over the Celtic churches in Britain, as well as all future bishops consecrated in English territory, including York. Authority over the see of York was not, however, to descend to Augustine's successors. In 603 he consecrated Christ Church, Canterbury, and built the monastery of SS. Peter and Paul, afterwards known as St Augustine's. At the conference of Augustine's Oak he endeavoured in vain to bring over the Celtic church to the observance of the Roman Easter. He afterwards consecrated Mellitus and Justus to the sees of London and Rochester respectively. The date of his death is not recorded by Bede, but MS. F of the Saxon Chronicle puts it in 614, and the *Annales Monasterienses* in 612.

See Bede, *Eccl. Hist.* (ed. by Plummer), i. 23–ii. 3.

AUGUSTINIAN CANONS, a religious order in the Roman Catholic Church, called also Austin Canons, Canons Regular, and in England Black Canons, because their cassock and mantle were black, though they wore a white surplice: elsewhere the colour of the habit varied considerably.

The canons regular (see Canon) grew out of the earlier institute of canonical life, in consequence of the urgent exhortations of the Lateran Synod of 1059. The clergy of some cathedrals (in England, Carlisle), and of a great number of collegiate churches all over western Europe, responded to the appeal; and the need of a rule of life suited to the new régime produced, towards the end of the 11th century, the so-called Rule of St Augustine (see Augustinians). This Rule was widely adopted by the canons regular, who also began to bind themselves by the vows of poverty, obedience and chastity. In the 12th century this discipline became universal among them; and so arose the order of Augustinian canons as a religious order in the strict sense of the word. They resembled the monks in so far as they lived in community and took religious vows; but their state of life remained essentially clerical, and as clerics their duty was to undertake the pastoral care and serve the parish churches in their patronage. They were bound to the choral celebration of the divine office, and in its general tenor their manner of life differed little from that of monks.

Their houses, at first without bonds between them, soon tended to draw together and coalesce into congregations with corporate organization and codes of constitutions supplementary to the Rule. The popes encouraged these centralizing tendencies; and in 1339 Benedict XII. organized the Augustinian canons on the same general lines as those laid down for the Benedictines, by a system of provincial chapters and visitations.

Some thirty congregations of canons regular of St Augustine are numbered. The most important were: (1) the Lateran canons, formed soon after the synod of 1059, by the clergy of the Lateran Basilica; (2) Congregation of St Victor in Paris, *c.* 1100, remarkable for the theological and mystical school of Hugh, Richard and Adam of St Victor; (3) Gilbertines (see Gilbert of Sempringham, St); (4) Windesheim Congregation, *c.* 1400, in the Netherlands and over north and central Germany (see Groot, Gerhard), to which belonged Thomas à Kempis; (5) Congregation of Ste Geneviève in Paris, a reform *c.* 1630. During the later middle ages the houses of these various congregations of canons regular spread all over Europe and became extraordinarily numerous. They underwent the natural and inevitable vicissitudes of all orders, having their periods of depression and degeneracy, and again of revival and reform. The book of Johann Busch, himself a canon of Windesheim, *De Reformatione monasteriorum*, shows that in the 15th century grave relaxation had crept into many monasteries of Augustinian canons in north Germany, and the efforts at reform were only partially successful. The Reformation, the religious wars and the Revolution have swept away nearly all the canons regular, but some of their houses in Austria still exist in their medieval splendour. In England there were as many as 200 houses of Augustinian canons, and 60 of them were among the "greater monasteries" suppressed in 1538–1540 (for list see Tables in

F. A. Gasquet's *English Monastic Life*). The first foundation was Holy Trinity, Aldgate, by Queen Maud, in 1108; Carlisle was an English cathedral of Augustinian canons. In Ireland the order was even more numerous, Christ Church, Dublin, being one of their houses. Three houses of the Lateran canons were established in England towards the close of the 19th century. Most of the congregations of Augustinian canons had convents of nuns, called canonesses; many such exist to this day.

See the works of Amort and Du Molinet, mentioned under CANON. Vol. ii. of Helyot's *Hist. des ordres religieux* (1792) is devoted to canons regular of all kinds. The information is epitomized by Max Heimbucher, *Orden und Kongregationen*, i. (1896), §§ 54-60, where copious references to the literature of the subject are supplied. See also Otto Zöckler, *Askese und Mönchtum*, ii. (1897), p. 422; and Wetzer und Welte, *Kirchenlexicon* (2nd ed.), art. "Canonici Regulares" and "Canonissae." For England see J. W. Clark, *Observances in use at the Augustinian Priory at Barnwell* (1897); and an article in *Journal of Theological Studies* (v.) by Scott Holmes. (E. C. B.)

AUGUSTINIAN HERMITS, or FRIARS, a religious order in the Roman Catholic Church, sometimes called (but improperly) Black Friars (see FRIARS). In the first half of the 13th century there were in central Italy various small congregations of hermits living according to different rules. The need of co-ordinating and organizing these hermits induced the popes towards 1250 to unite into one body a number of these congregations, so as to form a single religious order, living according to the Rule of St Augustine, and called the Order of Augustinian Hermits, or simply the Augustinian Order. Special constitutions were drawn up for its government, on the same lines as the Dominicans and other mendicants—a general elected by chapter, provincials to rule in the different countries, with assistants, definitors and visitors. For this reason, and because almost from the beginning the term "hermits" became a misnomer (for they abandoned the deserts and lived conventually in towns), they ranked among the friars, and became the fourth of the mendicant orders. The observance and manner of life was, relatively to those times, mild, meat being allowed four days in the week. The habit is black. The institute spread rapidly all over western Europe, so that it eventually came to have forty provinces and 2000 friaries with some 30,000 members. In England there were not more than about 30 houses (see Tables in F. A. Gasquet's *English Monastic Life*). The reaction against the inevitable tendencies towards mitigation and relaxation led to a number of reforms that produced upwards of twenty different congregations within the order, each governed by a vicar-general, who was subject to the general of the order. Some of these congregations went in the matter of austerity beyond the original idea of the institute; and so in the 16th century there arose in Spain, Italy and France, Discalced or Barefooted Hermits of St Augustine, who provided in each province one house wherein a strictly eremitical life might be led by such as desired it.

About 1500 a great attempt at a reform of this kind was set on foot among the Augustinian Hermits of northern Germany, and they were formed into a separate congregation independent of the general. It was from this congregation that Luther went forth, and great numbers of the German Augustinian Hermits, among them Wenceslaus Link the provincial, followed him and embraced the Reformation, so that the congregation was dissolved in 1526.

The Reformation and later revolutions have destroyed most of the houses of Augustinian Hermits, so that now only about a hundred exist in various parts of Europe and America; in Ireland they are relatively numerous, having survived the penal times. The Augustinian school of theology (Noris, Berti) was formed among the Hermits. There have been many convents of Augustinian Hermitesses, chiefly in the Barefooted congregations; such convents exist still in Europe and North America, devoted to education and hospital work. There have also been numerous congregations of Augustinian Tertiaries, both men and women, connected with the order and engaged on charitable works of every kind (see TERTIARIES).

See Helyot, *Hist. des ordres religieux* (1792), iii.; Max Heimbucher, *Orden und Kongregationen*, i. (1896), § 61-65; Wetzer und Welte, *Kirchenlexicon* (2nd ed.), art "Augustiner"; Herzog, *Realencyklopädie* (3rd ed.), art. "Augustiner." The chief book on the subject is Th. Kolde, *Die deutschen Augustiner-Kongregationen* (1879). (E. C. B.)

AUGUSTINIANS, in the Roman Catholic Church, a generic name for religious orders that follow the so-called "Rule of St Augustine." The chief of these orders are:—Augustinian Canons (*q.v.*), Augustinian Hermits (*q.v.*) or Friars, Premonstratensians (*q.v.*), Trinitarians (*q.v.*), Gilbertines (see GILBERT OF SEMPRINGHAM, ST). The following orders, though not called Augustinians, also have St Augustine's Rule as the basis of their life: Dominicans, Servites, Our Lady of Ransom, Hieronymites, Assumptionists and many others; also orders of women: Brigittines, Ursulines, Visitation nuns and a vast number of congregations of women, spread over the Old and New Worlds, devoted to education and charitable works of all kinds.

See Helyot, *Ordres religieux* (1792), vols. ii., iii., iv.; Max Heimbucher, *Orden und Kongregationen*, i. (1896), § 66-85; Wetzer und Welte, *Kirchenlexicon*, i., 1665-1667.

St Augustine never wrote a Rule, properly so called; but *Ep.* 211 (*al.* 109) is a long letter of practical advice to a community of nuns, on their daily life; and *Serm.* 355, 356 describe the common life he led along with his clerics in Hippo. When in the second half of the 11th century the clergy of a great number of collegiate churches were undertaking to live a substantially monastic form of life (see CANON), it was natural that they should look back to this classical model for clerics living in community. And so attention was directed to St Augustine's writings on community life; and out of them, and spurious writings attributed to him, were compiled towards the close of the 11th century three Rules, the "First" and "Second" being mere fragments, but the "Third" a substantive rule of life in 45 sections, often grouped in twelve chapters. This Third Rule is the one known as "the Rule of St Augustine." Being confined to fundamental principles without entering into details, it has proved itself admirably suited to form the foundation of the religious life of the most varied orders and congregations, and since the 12th century it has proved more prolific than the Benedictine Rule. In an uncritical age it was attributed to St Augustine himself, and Augustinians, especially the canons, put forward fantastic claims to antiquity, asserting unbroken continuity, not merely from St Augustine, but from Christ and the Apostles.

The three Rules are printed in Dugdale, *Monasticon* (ed. 1846), vi. 42; and in Holsten-Brockie, *Codex Regularum*, ii. 121. For the literature see Otto Zöckler, *Askese und Mönchtum* (1897), pp. 347, 354. (E. C. B.)

AUGUSTOWO, a city of Russian Poland, in the government of Suwalki, 20 m. S. of the town of that name, on a canal (65 m.) connecting the Vistula with the Niemen. It was founded in 1557 by Sigismund II. (Augustus), and is laid out in a very regular manner, with a spacious market-place. It carries on a large trade in cattle and horses, and manufactures linen and huckaback. Pop. (1897) 12,746.

AUGUSTUS (a name[1] derived from Lat. *augeo*, increase, *i.e.* venerable, majestic, Gr. Σεβαστός), the title given by the Roman senate, on the 17th of January 27 B.C., to Gaius Julius Caesar Octavianus (63 B.C.–A.D. 14), or as he was originally designated, Gaius Octavius, in recognition of his eminent services to the state (*Mon. Anc.* 34), and borne by him as the first of the Roman emperors. The title was adopted by all the succeeding Caesars or emperors of Rome long after they had ceased to be connected by blood with the first Augustus.

Gaius Octavius was born in Rome on the 23rd of September 63 B.C., the year of Cicero's consulship and of Catiline's conspiracy. He came of a family of good standing, long settled at Velitrae (Velletri), but his father was the first of the family to obtain a curule magistracy at Rome and senatorial dignity. His mother, however, was Atia, daughter of Julia, the wife of M. Atius Balbus, and sister of Julius Caesar, and it was this connexion with the great dictator which determined his career. In his fifth year (58 B.C.) his father died; about a year later his mother remarried, and the young Octavius passed under her care to that of his stepfather, L. Marcius Philippus. At the age of twelve (51 B.C.) he delivered the customary funeral panegyric on his grandmother Julia, his first public appearance. On the 18th of October 48 (or ? 47) B.C. he assumed the “ toga virilis ” and was elected into the pontifical college, an exceptional honour which he no doubt owed to his great-uncle, now dictator and master of Rome. In 46 B.C. he shared in the glory of Caesar's African triumph, and in 45 he was made a patrician by the senate, and designated as one of Caesar's “ masters of the horse ” for the next year. In the autumn of 45, Caesar, who was planning his Parthian campaign, sent his nephew to study quietly at the Greek colony of Apollonia, in Illyria. Here the news of Caesar's murder reached him and he crossed to Italy. On landing he learnt that Caesar had made him his heir and adopted him into the Julian gens, whereby he acquired the designation of Gaius Julius Caesar Octavianus. The inheritance was a perilous one; his mother and others would have dissuaded him from accepting it, but he, confident in his abilities, declared at once that he would undertake its obligations, and discharge the sums bequeathed by the dictator to the Roman people. Mark Antony had possessed himself of Caesar's papers and effects, and made light of his young nephew's pretensions. Brutus and Cassius paid him little regard, and dispersed to their respective provinces. Cicero, much charmed at the attitude of Antonius, hoped to make use of him, and flattered him to the utmost, with the expectation, however, of getting rid of him as soon as he had served his purpose. Octavianus conducted himself with consummate adroitness, making use of all competitors for power, but assisting none. Considerable forces attached themselves to him. The senate, when it armed the consuls against Antonius, called upon him for assistance; and he took part in the campaign in which Antonius was defeated at Mutina (43 B.C.). The soldiers of Octavianus demanded the consulship for him, and the senate, though now much alarmed, could not prevent his election. He now effected a coalition with Antonius and Lepidus, and on the 27th of November 43 B.C. the three were formally appointed a triumvirate for the reconstitution of the commonwealth for five years. They divided the western provinces among them, the east being held for the republic by Brutus and Cassius. They drew up a list of proscribed citizens, and caused the assassination of three hundred senators and two thousand knights. They further confiscated the territories of many cities throughout Italy, and divided them among their soldiers. Cicero was murdered at the demand of Antonius. The remnant of the republican party took refuge either with Brutus and Cassius in the East, or with Sextus Pompeius, who had made himself master of the seas.

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[1] On the name see Neumann, in Pauly-Wissowa's *Realencyclopädie f. cl. alterth.*, s.v., 2374.

Octavianus and Antonius crossed the Adriatic in 42 B.C. to reduce the last defenders of the republic. Brutus and Cassius were defeated, and fell at the battle of Philippi. War soon broke out between the victors, the chief incident of which was the siege and capture by famine of Perusia, and the alleged sacrifice of three hundred of its defenders by the young Caesar at the altar of his uncle. But peace was again made between them (40 B.C.). Antonius married Octavia, his rival's sister, and took for himself the eastern half of the empire, leaving the west to Caesar. Lepidus was reduced to the single province of Africa. Meanwhile Sextus Pompeius made himself formidable by cutting off the supplies of grain from Rome. The triumvirs were obliged to concede to him the islands in the western Mediterranean. But Octavianus could not allow the capital to be kept in alarm for its daily sustenance. He picked a quarrel with Sextus, and when his colleagues failed to support him, undertook to attack him alone. Antonius, indeed, came at last to his aid, in return for military assistance in the campaign he meditated in the East. But Octavianus was well served by the commander of his fleet, M. Vipsanius Agrippa. Sextus was completely routed, and driven into Asia, where he perished soon afterwards (36 B.C.). Lepidus was an object of contempt to all parties, and Octavianus and Antonius remained to fight for supreme power.

The five years (36–31 B.C.) which preceded the decisive encounter between the two rivals were wasted by Antony in fruitless campaigns, and in a dalliance with Cleopatra which shocked Roman sentiment. By Octavian they were employed in strengthening his hold on the West, and his claim to be regarded as the one possible saviour of Rome and Roman civilization. His marriage with Livia (38 B.C.) placed by his side a sagacious counsellor and a loyal ally, whose services were probably as great as even those of his trusted friend Marcus Agrippa. With their help he set himself to win the confidence of a public still inclined to distrust the author of the proscriptions of 43 B.C. Brigandage was suppressed in Italy, and the safety of the Italian frontiers secured against the raids of Alpine tribes on the north-west and of Illyrians on the east, while Rome was purified and beautified, largely with the help of Agrippa (aedile in 33 B.C.). Meanwhile, indignation at Antony's un-Roman excesses, and alarm at Cleopatra's rumoured schemes of founding a Greco-Oriental empire, were rapidly increasing. In 32 B.C. Antony's repudiation of his wife Octavia, sister of Octavian, and the discovery of his will, with its clear proofs of Cleopatra's dangerous ascendancy, brought matters to a climax, and war was declared, not indeed against Antony, but against Cleopatra.

The decisive battle was fought on the 2nd of September 31 B.C. at Actium on the Epirot coast, and resulted in the almost total destruction of Antony's fleet and the surrender of his land forces. Not quite a year later (Aug. 1, 30 B.C.) followed the capture of Alexandria and the deaths by their own hands of Antony and Cleopatra. On the 11th of January 29 B.C. the restoration of peace was marked by the closing of the temple of Janus for the first time for 200 years. In the summer Octavian returned to Italy, and in August celebrated a three days' triumph. He was welcomed, not as a successful combatant in a civil war, but as the man who had vindicated the sovereignty of Rome against its assailants, as the saviour of the republic and of his fellow-citizens, above all as the restorer of peace.

He was now, to quote his own words, “ master of all things,” and the Roman world looked to him for some permanent settlement of the distracted empire. His first task was the re-establishment of a regular and constitutional government, such as had not existed since Julius Caesar crossed the Rubicon twenty years before. To this task he devoted the next eighteen months (Aug. 29–Jan. 27 B.C.). In the article on ROME: *History* (*q.v.*), his achievements are described in detail, and only a brief summary need be given here. The “ principate,” to give the new form of government its most appropriate name, was a compromise thoroughly characteristic of the combination of tenacity of purpose with cautious respect for forms and conventions which distinguished its author. The republic was restored; senate, magistrates and assembly resumed their ancient functions; and the public life of Rome began to run once more in the familiar grooves. The triumvirate with its irregularities and excesses was at an end. The controlling authority, which Octavian himself wielded, could not indeed be safely dispensed with. But henceforward he was to exercise it under constitutional forms and limitations, and with the express sanction of the senate and people. Octavian was legally invested for a period of ten years with the government of the important frontier provinces, with the sole command of the military and naval forces of the state, and the exclusive control of its foreign relations. At home it was understood that he would year by year be elected consul, and enjoy the powers and pre-eminence attached to the chief magistracy of the Roman state. Thus the republic was restored under the presidency and patronage of its “ first citizen ” (*princeps civitatis*).

In acknowledgment of this happy settlement and of his other services further honours were conferred upon Octavian. On the 13th of January 27 B.C., the birthday of the restored republic, he was awarded the civic crown to be placed over the door of his house, in token that he had saved his fellow-citizens and restored the Republic. Four days later (Jan. 17) the senate conferred upon him the cognomen of Augustus.

But it was not only the machinery of government in Rome that needed repair. Twenty years of civil war and confusion had disorganized the empire, and the strong hand of Augustus, as he must now be called, could alone restore confidence and order. Towards the end of 27 B.C. he left Rome for Gaul, and from that date until October 19 B.C. he was mainly occupied with the reorganization of the provinces and of the provincial administration, first of all in the West and then in the East. It was during his stay in Asia (20 B.C.) that the Parthian king Phraates voluntarily restored the Roman prisoners and standards taken at Carrhae (53 B.C.), a welcome tribute to the respect inspired by Augustus, and a happy augury for the future. In October 19 B.C. he returned to Rome, and the senate ordered that the day of his return (Oct. 12) should thenceforward be observed as a public holiday. The period of ten years for which his *imperium* had been granted him was nearly ended, and though much remained to be done, very much had been accomplished. The pacification of northern Spain by the subjugation of the Astures and Cantabri, the settlement of the wide territories added to the empire by Julius Caesar in Gaul—the "New Gaul," or the "long-haired Gaul" (Gallia Comata) as it was called by way of distinction from the old province of Gallia Narbonensis (see GAUL)—and the re-establishment of Roman authority over the kings and princes of the Near East, were achievements which fully justified the acclamations of senate and people.

In 18 B.C. Augustus's *imperium* was renewed for five years, and his tried friend Marcus Agrippa, now his son-in-law, was associated with him as a colleague. From October of 19 B.C. till the middle of 16 B.C. Augustus's main attention was given to Rome and to domestic reform, and to this period belong such measures as the Julian law "as to the marriage of the orders." In June of 17 B.C. the opening of the new and better age, which he had worked to bring about, was marked by the celebration in Rome of the Secular games. The chief actors in the ceremony were Augustus himself and his colleague Agrippa,—while, as the extant record tells us, the processional hymn, chanted by youths and maidens first before the new temple of Apollo on the Palatine and then before the temple of Jupiter on the Capitol, was composed by Horace. The hymn, the well-known *Carmen Saeculare*, gives fervent expression to the prevalent emotions of joy and gratitude.

In the next year (16 B.C.), however, Augustus was suddenly called away from Rome to deal with a problem which engrossed much of his attention for the next twenty-five years. The defeat of Marcus Lollius, the legate commanding on the Rhine, by a horde of German invaders, seems to have determined Augustus to take in hand the whole question of the frontiers of the empire towards the north, and the effective protection of Gaul and Italy. The work was entrusted to Augustus's step-sons Tiberius and Drusus. The first step was the annexation of Noricum and Raetia (16–15 B.C.), which brought under Roman control the mountainous district through which the direct routes lay from North Italy to the upper waters of the Rhine and the Danube. East of Noricum Tiberius reduced to order for the time the restless tribes of Pannonia, and probably established a military post at Carnuntum on the Danube. To Drusus fell the more ambitious task of advancing the Roman frontier line from the Rhine to the Elbe, a work which occupied him until his death in Germany in 9 B.C. In 13 B.C. Augustus had returned to Rome; his return, and the conclusion of his second period of rule, were commemorated by the erection of one of the most beautiful monuments of the Augustan age, the Ara Pacis Augustae (see ROMAN ART, Pl. II, III). His *imperium* was renewed, again for five years, and in 12 B.C., on the death of his former fellow-triumvir Lepidus, he was elected Pontifex Maximus. But this third period of his *imperium* brought with it losses which Augustus must have keenly felt. Only a few months after his reappointment as Augustus's colleague, Marcus Agrippa, his trusted friend since boyhood, died. As was fully his due, his funeral oration was pronounced by Augustus, and he was buried in the mausoleum near the Tiber built by Augustus for himself and his family. Three years later his brilliant step-son Drusus died on his way back from a campaign in Germany, in which he had reached the Elbe. Finally in 8 B.C. he lost the comrade who next to Agrippa had been the most intimate friend and counsellor of his early manhood, Gaius Cilnius Maecenas, the patron of Virgil and Horace.

For the moment Augustus turned, almost of necessity, to his surviving step-son. Tiberius was associated with him as Agrippa had been in the tribunician power, was married against his will to Julia, and sent to complete his brother Drusus's work in Germany (7–6 B.C.). But Tiberius was only his step-son, and, with all his great qualities, was never a very lovable man. On the other hand, the two sons of Agrippa and Julia, Gaius and Lucius, were of his own blood and evidently dear to him. Both had been adopted by Augustus (17 B.C.). In 6 B.C. Tiberius, who had just received the tribunician power, was transferred from Germany to the East, where the situation in Armenia demanded attention. His sudden withdrawal to Rhodes has been variously explained, but, in part at least, it was probably due to the plain indications which Augustus now gave of his wish that the young Caesars should be regarded as his heirs. The elder, Gaius, now fifteen years old (5 B.C.), was formally introduced to the people as consul-designate by Augustus himself, who for this purpose resumed the consulship (12th) which he had dropped since 23 B.C., and was authorized to take part in the deliberations of the senate. Three years later (2 B.C.) Augustus, now consul for the 13th and last time, paid a similar compliment to the younger brother Lucius. In 1 B.C. Gaius was given proconsular imperium, and sent to re-establish order in Armenia, and a few years afterwards (A.D. 2) Lucius was sent to Spain, apparently to take command of the legions there. But the fates were unkind; Lucius fell sick and died at Marseilles on his way out, and in the next year (A.D. 3) Gaius, wounded by an obscure hand in Armenia, started reluctantly for home, only to die in Lycia. Tiberius alone was left, and Augustus, at once accepting facts, formally and finally declared him to be his colleague and destined successor (A.D. 4) and adopted him as his son.

The interest of the last ten years of Augustus's life centres in the events occurring on the northern frontier. The difficult task of bringing the German tribes between the Rhine and the Elbe under Roman rule, commenced by Drusus in 13 B.C., had on his death been continued by Tiberius (9–6 B.C.). During Tiberius's retirement in Rhodes no decisive progress was made, but in A.D. 4 operations on a large scale were resumed. From Velleius Paterculus, who himself served in the war, we learn that in the first campaign Roman authority was restored over the tribes between the Rhine and the Weser, and that the Roman forces, instead of returning as usual to their headquarters on the Rhine, went into winter-quarters near the source of the Lippe. In the next year (A.D. 5) the Elbe was reached by the troops, while the fleet, after a hazardous voyage, arrived at the mouth of the same river and sailed some way up it. Both feats are deservedly commemorated by Augustus himself in the Ancyran monument. To complete the conquest of Germany and to connect the frontier with the line of the Danube, it seemed that only one thing remained to be done, to break the power of the Marcomanni and their king Maroboduus. In the spring of A.D. 6 preparations were made for this final achievement; the territory of the Marcomanni (now Bohemia) was to be invaded simultaneously by two columns. One, starting apparently from the headquarters of the army of Upper Germany at Mainz, was to advance by way of the Black Forest and attack Maroboduus on the west; the other, led by Tiberius himself, was to start from the new military base at Carnuntum on the Danube and operate from the south-east.

But the attack was never delivered, for at this moment, in the rear of Tiberius, the whole of Pannonia and Dalmatia burst into a blaze of insurrection. The crisis is pronounced by Suetonius to have been more serious than any which had confronted Rome since the Hannibalic war, for it was not merely the loss of a province but the invasion of Italy that was threatened, and Augustus openly declared in the senate that the insurgents might be before Rome in ten days. He himself moved to Ariminum to be nearer the seat of war, recruiting was vigorously carried on in Rome and Italy, and legions were summoned from

Moesia and even from Asia. In the end, and not including the Thracian cavalry of King Rhoemetalces, a force of 15 legions with an equal number of auxiliaries was employed. Even so the task of putting down the insurrection was difficult enough, and it was not until late in the summer of A.D. 9, after three years of fighting, that Germanicus, who had been sent to assist Tiberius, ended the war by the capture of Andetrium in Dalmatia.

Five days later the news reached Rome of the disaster to Varus and his legions, in the heart of what was to have been the new province of Germany beyond the Rhine. The disaster was avowedly due entirely to Varus's incapacity and vanity, and might no doubt have been repaired by leaders of the calibre of Tiberius and Germanicus. Augustus, however, was now seventy-two, the Dalmatian outbreak had severely tried his nerve, and now for the second time in three years the fates seemed to pronounce clearly against a further prosecution of his long-cherished scheme of a Roman Germany reaching to the Elbe.

All that was immediately necessary was done. Recruiting was pressed forward in Rome, and first Tiberius and then Germanicus were despatched to the Rhine. But the German leaders were too prudent to risk defeat, and the Roman generals devoted their attention mainly to strengthening the line of the Rhine.

The defeat of Varus, and the tacit abandonment of the plans of expansion begun twenty-five years before, are almost the last events of importance in the long principate of Augustus. The last five years of his life (A.D. 10–14) were untroubled by war or disaster. Augustus was ageing fast, and was more and more disinclined to appear personally in the senate or in public. Yet in A.D. 13 he consented, reluctantly we are told, to yet one more renewal of his *imperium* for ten years, stipulating, however, that his step-son Tiberius, himself now over fifty, should be associated with himself on equal terms in the administration of the empire. Early in the same year (January 16, A.D. 13) the last triumph of his principate was celebrated. Tiberius was now in Rome, the command on the Rhine having been given to Germanicus, who went out to it immediately after his consulship (A.D. 12), and the time had come to celebrate the Dalmatian and Pannonian triumph, which the defeat of Varus had postponed. Augustus witnessed the triumphal procession, and Tiberius, as it turned from the Forum to ascend the Capitol, halted, descended from his triumphal car, and did reverence to his adopted father.

One last public appearance Augustus made in Rome. During A.D. 13 he and Tiberius conducted a census of Roman citizens, the third taken by his orders; the first having been in 28 B.C. at the very outset of his rule. The business of the census lasted over into the next year, but on the 11th of May, A.D. 14, before a great crowd in the Campus Martius, Augustus took part in the solemn concluding ceremony of burying away out of sight the old age and inaugurating the new. The ceremony had been full of significance in 28 B.C., and now more than forty years later it was given a pathetic interest by Augustus himself. When the tablets containing the vows to be offered for the welfare of the state during the next lustrum were handed to him, he left the duty of reciting them to Tiberius, saying that he would not take vows which he was never destined to perform.

It was apparently at the end of June or early in July that Augustus left Rome on his last journey. Travelling by road to Astura (Torre Astura) at the southern point of the little bay of Antium, he sailed thence to Capri and to Naples. On his way at Puteoli, the passengers and crew of a ship just come from Alexandria cheered the old man by their spontaneous homage, declaring, as they poured libations, that to him they owed life, safe passage on the seas, freedom and fortune.

At Naples, in spite of increasing disease, he bravely sat out a gymnastic contest held in his honour, and then accompanied Tiberius as far as Beneventum on his way to Brundusium and Illyricum. On his return he was forced by illness to stop at Nola, his father's old home. Tiberius was hastily recalled and had a last confidential talk on affairs of state. Thenceforward, says Suetonius, he gave no more thought to such great affairs. He bade farewell to his friends, inquired after the health of Drusus's daughter who was ill, and then quietly expired in the arms of the wife who for more than fifty years had been his most intimate and trusted guide and counsellor, and to whom his last words were an exhortation to "live mindful of our wedded life." He died on the 19th of August, A.D. 14, in the same room in which his father had died before him, and on the anniversary of his entrance upon his first consulship fifty-seven years before (43 B.C.). The corpse was carried to Rome in slow procession along the Appian Way. On the day of the funeral it was borne to the Campus Martius on the shoulders of senators and there burnt. The ashes were reverently collected by Livia, and placed in the mausoleum by the Tiber which her husband had built for himself and his family. The last act was the formal decree of the senate by which Augustus, like his father Julius before him, was added to the number of the gods recognized by the Roman state.

If we except writers like Voltaire who could see in Augustus only the man who had destroyed the old republic and extinguished political liberty, the verdict of posterity on Augustus has varied just in proportion as his critics have fixed their attention, mainly, on the means by which he rose to power, or the use which he made of the power when acquired. The lines of argument followed respectively by friendly and hostile contemporaries immediately after his death (Tac. *Ann.* i. 9, 10) have been followed by later writers with little change. But of late years, our increasing mistrust of the current gossip about him, and our increased knowledge of the magnitude of what he actually accomplished, have conspicuously influenced the judgments passed upon him. We allow the faults and crimes of his early manhood, his cruelties and deceptions, his readiness to sacrifice everything that came between him and the end he had in view. On the other hand, a careful study of what he achieved between the years 38 B.C., when he married Livia, and his death in A.D. 14, is now held to give him a claim to rank, not merely as an astute and successful intriguer, or an accomplished political actor, but as one of the world's great men, a statesman who conceived and carried through a scheme of political reconstruction which kept the empire together, secured peace and tranquillity, and preserved civilization for more than two centuries.

BIBLIOGRAPHY.—The most comprehensive work on Augustus and his age is that of V. Gardthausen, *Augustus und seine Zeit* (2 vols., Leipzig, 1891–1904), which deals with all aspects of Augustus's life, vol. ii. consisting of elaborate critical and bibliographical notes. See also histories of Rome generally, and among special works:—E. S. Shuckburgh, *Augustus* (London, 1903; reviewed by F. T. Richards in *Class. Rev.* vol. xviii.), containing the text of the *Monumentum Ancyranum* (see also Gardthausen, book xiii.); J. B. Firth, *Augustus Caesar* (London, 1903), in "Heroes of the Nations" series; O. Seeck, "Kaiser Augustus" (*Monographien zur Weltgeschichte*, xvii., 1902), nine essays on special problems, *e.g.* the campaigns of Mutina, Perusia and against Sextus Pompeius, "das Augustische Zeitalter"; A. Duméril, "Auguste et la fondation de l'empire romain," in the *Annales de la Fac. des lett. de Bordeaux* (1890); a suggestive monograph on the reforms of Augustus in relation to the decrease of population is Jules Ferlet's *L'Abaissement de la natalité à Rome* (Paris, 1902). (H. F. P.)

AUGUSTUS I. (1526–1586), elector of Saxony, was the younger son of Henry, duke of Saxony, and consequently belonged to the Albertine branch of the Wettin family. Born at Freiberg on the 31st of July 1526, and brought up as a Lutheran, he received a good education and studied at the university of Leipzig. When Duke Henry died in 1541 he decreed that his lands should be divided equally between his two sons, but as his bequest was contrary to law, it was not carried out, and the dukedom passed almost intact to his elder son, Maurice. Augustus, however, remained on friendly terms with his brother, and to further his policy spent some time at the court of the German king, Ferdinand I., in Vienna. In 1544 Maurice secured the appointment of his brother as administrator of the bishopric of Merseburg; but Augustus was very extravagant and was soon compelled to return to the Saxon court at Dresden. Augustus supported his brother during the war of the league of Schmalkalden, and in the policy which culminated in the transfer of the Saxon electorate from John Frederick I., the head of the Ernestine branch of the Wettin family, to Maurice. On the 7th of October 1548 Augustus was married at Torgau to Anna, daughter of Christian III., king of Denmark, and took up his residence at Weissenfels. But he soon desired a more imposing establishment. The result was that Maurice made more generous provision for his brother, who acted as regent of Saxony in 1552 during the absence of the elector. Augustus was on a visit to Denmark when by Maurice's death in July 1553 he became elector of Saxony.

The first care of the new elector was to come to terms with John Frederick, and to strengthen his own hold upon the electoral position. This object was secured by a treaty made at Naumburg in February 1554, when, in return for the grant of Altenburg and other lands, John Frederick recognized Augustus as elector of Saxony. The elector, however, was continually haunted by the fear that the Ernestines would attempt to deprive him of the coveted dignity, and his policy both in Saxony and in Germany was coloured by this fear. In imperial politics Augustus acted upon two main principles: to cultivate the friendship of the Habsburgs, and to maintain peace between the contending religious parties. To this policy may be traced his share in bringing about the religious peace of Augsburg in 1555, his tortuous conduct at the diet of Augsburg eleven years later, and his reluctance to break entirely with the Calvinists. On one occasion only did he waver in his allegiance to the Habsburgs. In 1568 a marriage was arranged between John Casimir, son of the elector palatine, Frederick III., and Elizabeth, a daughter of Augustus, and for a time it seemed possible that the Saxon elector would support his son-in-law in his attempts to aid the revolting inhabitants of the Netherlands. Augustus also entered into communication with the Huguenots; but his aversion to foreign complications prevailed, and the incipient friendship with the elector palatine soon gave way to serious dislike. Although a sturdy Lutheran the elector hoped at one time to unite the Protestants, on whom he continually urged the necessity of giving no cause of offence to their opponents, and he favoured the movement to get rid of the clause in the peace of Augsburg concerning ecclesiastical reservation, which was offensive to many Protestants. His moderation, however, prevented him from joining those who were prepared to take strong measures to attain this end, and he refused to jeopardize the concessions already won.

The hostility between the Albertines and the Ernestines gave serious trouble to Augustus. A preacher named Matthias Flacius held an influential position in ducal Saxony, and taught a form of Lutheranism different from that taught in electoral Saxony. This breach was widened when Flacius began to make personal attacks on Augustus, to prophesy his speedy downfall, and to incite Duke John Frederick to make an effort to recover his rightful position. Associated with Flacius was a knight, William of Grumbach, who, not satisfied with words only, made inroads into electoral Saxony and sought the aid of foreign powers in his plan to depose Augustus. After some delay Grumbach and his protector, John Frederick, were placed under the imperial ban, and Augustus was entrusted with its execution. His campaign in 1567 was short and successful. John Frederick surrendered, and passed his time in prison until his death in 1595; Grumbach was taken and executed; and the position of the elector was made quite secure.

The form of Lutheranism taught in electoral Saxony was that of Melanchthon, and many of its teachers and adherents, who were afterwards called Crypto-Calvinists, were favoured by the elector. When Augustus, freed from the fear of an attack by the Ernestines, became gradually estranged from the elector palatine and the Calvinists, he seemed to have looked with suspicion upon the Crypto-Calvinists, who did not preach the pure doctrines of Luther. Spurred on by his wife the matter reached a climax in 1574, when letters were discovered, which, while revealing a hope to bring over Augustus to Calvinism, cast some aspersions upon the elector and his wife. Augustus ordered the leaders of the Crypto-Calvinists to be seized, and they were tortured and imprisoned. A strict form of Lutheranism was declared binding upon all the inhabitants of Saxony, and many persons were banished from the country. In 1576 he made a serious but unsuccessful attempt to unite the Protestants upon the basis of some articles drawn up at Torgau, which inculcated a strict form of Lutheranism. The change in Saxony, however, made no difference to the attitude of Augustus on imperial questions. In 1576 he opposed the proposal of the Protestant princes to make a grant for the Turkish War conditional upon the abolition of the clause concerning ecclesiastical reservation, and he continued to support the Habsburgs.

Much of the elector's time was devoted to extending his territories. In 1573 he became guardian to the two sons of John William, duke of Saxe-Weimar, and in this capacity was able to add part of the county of Henneberg to electoral Saxony. His command of money enabled him to take advantage of the poverty of his neighbours, and in this way he secured Vogtland and the county of Mansfeld. In 1555 he had appointed one of his nominees to the bishopric of Meissen, in 1561 he had secured the election of his son Alexander as bishop of Merseburg, and three years later as bishop of Naumburg; and when this prince died in 1565 these bishoprics came under the direct rule of Augustus.

As a ruler of Saxony Augustus was economical and enlightened. He favoured trade by encouraging Flemish emigrants to settle in the country, by improving the roads, regulating the coinage and establishing the first posts. He was specially interested in benefiting agriculture, and added several fine buildings to the city of Dresden. His laws were numerous and comprehensive. The constitution of 1572 was his work, and by these laws the church, the universities and the police were regulated, the administration of justice was improved, and the raising of taxes placed upon a better footing (see SAXONY).

In October 1585 the electress Anna died, and a few weeks later Augustus married Agnes Hedwig, a daughter of Joachim Ernest, prince of Anhalt. His own death took place at Dresden on the 21st of January 1586, and he was buried at Freiberg. By his first wife he had fifteen children, but only four of these survived him, among whom was his successor, the elector Christian I. (1560–1591). Augustus was a covetous, cruel and superstitious man, but these qualities were redeemed by his political caution and his wise methods of government. He wrote a small work on agriculture entitled *Künstlich Obst- und Gartenbüchlein*.

See C. W. Böttiger and T. Flathe, *Geschichte Sachsens*, Band ii. (Gotha, 1870); M. Ritter, *Deutsche Geschichte im Zeitalter der Gegenreformation*, Band i. (Stuttgart, 1890); R. Calinich, *Kampf und Untergang des Melanchthonismus in Kursachsen* (Leipzig, 1866); J. Falke, *Geschichte des Kurfürsten August in volkswirtschaftlicher Beziehung* (Leipzig, 1868); J. Janssen, *Geschichte des Deutschen Volks seit dem Ausgang des Mittelalters* (Freiburg, 1885–1894); W. Wenck, *Kurfürst Moritz und Herzog August* (Leipzig, 1874).

AUGUSTUS II., king of Poland, and, as FREDERICK AUGUSTUS I., elector of Saxony (1670–1733), second son of John George III., elector of Saxony, was born at Dresden on the 12th of May 1670. He was well educated, spent some years in travel and in fighting against France, and on account of his immense strength was known as "the Strong." On the death of his brother, John George IV., in 1694, he became elector of Saxony, and in 1695 and 1696 led the imperial troops against the Turks, but without very much success. When John Sobieski died in 1696, Augustus was a candidate for the Polish throne, and in order to further his chances became a Roman Catholic, a step which was strongly resented in Saxony. By a lavish expenditure of money, and by his promptness in entering the country, he secured his election and coronation in September 1697, and his principal rival F. L. de Bourbon, prince of Conti, abandoned the contest and returned to France. Augustus continued the war against the Turks for a time, and being anxious to extend his influence and to find a pretext for retaining the Saxon troops in Poland, made an alliance in 1699 with Russia and Denmark against Charles XII. of Sweden. The Poles would not assist, and at the head of the Saxons Augustus invaded Livonia, but for various causes the campaign was not a success, and in July 1702 he was defeated by Charles at Klissow. Augustus was then deposed in Poland,

and after holding Warsaw for a short time he fled to Saxony. The alliance with Russia was renewed and in reply Charles invaded Saxony in 1706, and compelled the elector to sign the treaty of Altranstädt in September of that year, to recognize Stanislaus Leszczynski as his successor in Poland, and to abandon the Russian alliance. During the War of the Spanish Succession, Augustus fought with the imperialists in the Netherlands, but after the defeat of Charles XII. at Poltawa in July 1709, he turned his attention to the recovery of Poland. Declaring the treaty of Altranstädt void and renewing his alliance with Russia and Denmark, he quickly recovered the Polish crown. He then attacked Swedish Pomerania. He was handicapped by the mutual jealousy of the Saxons and the Poles, and a struggle broke out in Poland which was only ended when the king promised to limit the number of his army in that country to 18,000 men. Peace was made with Sweden in December 1719 at Stockholm after the death of Charles XII., and Augustus was recognized as king of Poland. His remaining years were spent in futile plans to make Poland a hereditary monarchy, to weaken the power of the Saxon nobles, and to gain territory for his sons in various parts of Europe. He was a man of extravagant and luxurious tastes, and, although he greatly improved the city of Dresden, he cannot be called a good ruler. He sought to govern Saxony in an absolute fashion, and, in spite of his declaration that his conversion to Roman Catholicism was personal only, assisted the spread of the teachings of Rome. His wife was Christine Eberhardine, a member of the Hohenzollern family, who left him when he became a Roman Catholic, and died in 1727. Augustus died at Warsaw on the 1st of February 1733, leaving a son Frederick Augustus, who succeeded him in Poland and Saxony, and many illegitimate children, among whom was the famous general, Maurice of Saxony, known as Marshal Saxe (*q.v.*).

See Otwikowski, *History of Poland under Augustus II.* (Cracow, 1849); F. Förster, *Die Höfe und Kabinette Europas im achtzehnten Jahrhundert* (Potsdam, 1839); Jarochowski, *History of Augustus II.* (Posen, 1856–1874); C. W. Böttiger and T. Flathe, *Geschichte des Kurstaates und Königreichs Sachsen* (Gotha, 1867–1873).

AUGUSTUS III., king of Poland, and, as Frederick Augustus II., elector of Saxony (1696–1763), the only legitimate son of Augustus II. ("the Strong"), was born at Dresden on the 17th of October 1696. Educated as a Protestant, he followed his father's example by joining the Roman Catholic Church in 1712, although his conversion was not made public until 1717. In August 1719 he married Maria Josepha, daughter of the emperor Joseph I., and seems to have taken very little part in public affairs until he became elector of Saxony on his father's death in February 1733. He was then a candidate for the Polish crown; and having purchased the support of the emperor Charles VI. by assenting to the Pragmatic Sanction, and that of the czarina Anne by recognizing the claim of Russia to Courland, he was elected king of Poland in October 1733. Aided by the Russians, his troops drove Stanislaus Leszczynski from Poland; Augustus was crowned at Cracow in January 1734, and was generally recognized as king at Warsaw in June 1736. On the death of Charles VI. in October 1740, Augustus was among the enemies of his daughter Maria Theresa, and, as a son-in-law of the emperor Joseph I., claimed a portion of the Habsburg territories. In 1742, however, he was induced to transfer his support to Maria Theresa, and his troops took part in the struggle against Frederick the Great during the Silesian wars, and again when the Seven Years' War began in 1756. Saxony was in that year attacked by the Prussians, and with so much success that not only was the Saxon army forced to capitulate at Pirna in October, but the elector, who fled to Warsaw, made no attempt to recover Saxony, which remained under the dominion of Frederick. When the treaty of Hubertsburg was concluded in February 1763, he returned to Saxony, where he died on the 5th of October 1763. He left five sons, the eldest of whom was his successor in Saxony, Frederick Christian; and five daughters, one of whom was the wife of Louis, the dauphin of France, and mother of Louis XVI. Another daughter was the wife of Charles III., king of Spain, but she predeceased her father. Augustus, who showed neither talent nor inclination for government, was content to leave Poland under the influence of Russia, and Saxony to the rule of his ministers. He took great interest in music and painting, and added to the collection of art treasures at Dresden.

See C. W. Böttiger and T. Flathe, *Geschichte des Kurstaates und Königreichs Sachsen* (Gotha, 1867–1873); R. Röpell, *Polen um die Mitte des 18. Jahrhunderts* (Gotha, 1876).

AUGUSTUSBAD, a watering-place of Germany, in the kingdom of Saxony, 10 m. E. from Dresden, close to Radeberg, in a pleasant valley. Pop. 900. It has five saline chalybeate springs, used both for drinking and bathing, and specific in feminine disorders, rheumatism, paralysis and neuralgia. The spa is largely frequented in summer and has agreeable public rooms and gardens.

AUK, a name commonly given to several species of sea-fowl. A special interest attaches to the great auk (*Alca impennis*), owing to its recent extinction and the value of its eggs to collectors. (See Garefowl; also Guillemot, Puffin, Razorbill.)

AULARD, FRANÇOIS VICTOR ALPHONSE (1849–), French historian, was born at Montbron in Charente in 1849. Having obtained the degree of doctor of letters in 1877 with a Latin thesis upon C. Asinius Pollion and a French one upon Giacomo Leopardi (whose works he subsequently translated into French), he made a study of parliamentary oratory during the French Revolution, and published two volumes upon *Les Orateurs de la constituante* (1882) and upon *Les Orateurs de la législative et de la convention* (1885). With these works, which were reprinted in 1905, he entered a fresh field, where he soon became an acknowledged master. Applying to the study of the French Revolution the rules of historical criticism which had produced such rich results in the study of ancient and medieval history, he devoted himself to profound research in the archives, and to the publication of numerous most important contributions to the political, administrative and moral history of that marvellous period. Appointed professor of the history of the French Revolution at the Sorbonne, he formed the minds of students who in their turn have done valuable work. To him we owe the *Recueil des actes du comité de salut public* (vol. i., 1889; vol. xvi., 1904); *La Société des Jacobins; recueil de documents pour l'histoire du club des Jacobins de Paris* (6 vols., 1889–1897); and *Paris pendant la réaction thermidorienne et sous le directoire, recueil de documents pour l'histoire de l'esprit public à Paris* (5 vols., 1898–1902), which was followed by an analogous collection for *Paris sous le consulat* (2 vols., 1903–1904). For the Société de l'Histoire de la Révolution Française, which brought out under his supervision an important periodical publication called *La Révolution française*, he produced the *Registre des délibérations du consulat provisoire* (1894), and *L'État de la France en l'an VIII et en l'an IX*, with the reports of the prefects (1897), besides editing various works or memoirs written by men of the Revolution, such as J. C. Bailleul, Chaumette, Fournier (called the American), Hérault de Séchelles, and Louvet de Couvrai. But these large collections of documents are not his entire output. Besides a little pamphlet upon Danton, he has written a *Histoire politique de la Révolution française* (1901), and a number of articles which have been collected in volumes under the title *Études et leçons sur la Révolution française* (5 vols., 1893–1908). In a volume entitled *Taine, historien de la Révolution française* (1908), Aulard has submitted the method of the eminent philosopher to a criticism, severe, perhaps even unjust, but certainly well-informed. This is, as it were, the "manifesto" of the new school of criticism applied to the political and social history of the Revolution (see *Les Annales Révolutionnaires*, June 1908).

See A. Mathiez, "M. Aulard, historien et professeur," in the *Revue de la Révolution française* (July 1908). (C. B.*)

AULIC COUNCIL (*Reichshofrat*), an organ of the Holy Roman Empire, originally intended for executive work, but acting chiefly as a judicature, which worked from 1497 to 1806. In the early middle ages the emperor had already his *consiliarii*; but his council was a fluctuating body of personal advisers. In the 14th century there first arose an official council, with permanent and paid members, many of whom were legists. Its business was largely executive, and it formed something of a ministry; but it had also to deal with petitions addressed to the king, and accordingly it acted as a supreme court of judicature. It was thus parallel to the king's council, or *concilium continuum*, of medieval England; while by its side, during the 15th century, stood the *Kammergericht*, composed of the legal members of the council, in much the same way as the Star Chamber stood beside the English council. But the real history of the Aulic Council, as that term was understood in the later days of the Empire, begins with Maximilian I. in 1497–1498. In these years Maximilian created three organs (apparently following the precedent set by his Burgundian ancestors in the Netherlands)—a *Hofrat*, a *Hofkammer* for finance, and a *Hofkanzlei*. Primarily intended for the hereditary dominions of Maximilian, these bodies were also intended for the whole Empire; and the *Hofrat* was to deal with "all and every business which may flow in from the Empire, Christendom at large, or the king's hereditary principalities." It was thus to be the supreme executive and judicial organ, discharging all business except that of finance and the drafting of documents; and it was intended to serve Maximilian as a *point d'appui* for the monarchy against the system of oligarchical committees, instituted by Berthold, archbishop of Mainz. But it was difficult to work such a body both for the Empire and for the hereditary principalities; and under Ferdinand I. it became an organ for the Empire alone (*circ.* 1558), the hereditary principalities being removed from its cognizance. As such an imperial organ, its composition and powers were fixed by the treaty of Westphalia of 1648. (1) It consisted of about 20 members—a president, a vice-president, the vice-chancellor of the Empire, and some 18 other members. These came partly from the Empire at large, partly (and in greater numbers) from the hereditary lands of the emperor. There were two benches, one of the nobles, one of doctors of civil law; six of the members must be Protestants. The council followed the person of the emperor, and was therefore stationed at Vienna; it was paid by the emperor, and he nominated its members, whose office terminated with his life—an arrangement which made the council more dependent than it should have been on the emperor's will. (2) Its powers were nominally both executive and judicial. (*a*) Its executive powers were small: it gradually lost everything except the formal business of investiture with imperial fiefs and the confirmation of charters, its other powers being taken over by the *Geheimräte*. These *Geheimräte*, a narrow body of secret counsellors, had already become a determinate *concilium* by 1527; and though at first only concerned with foreign affairs, they acquired, from the middle of the 16th century onwards, the power of dealing with imperial affairs in lieu of the Aulic Council. (*b*) In its judicial aspect, the Aulic Council, exercising the emperor's judicial powers on his behalf, and thus succeeding, as it were, to the old *Kammergericht*, had exclusive cognizance of matters relating to imperial fiefs, criminal charges against immediate vassals of the Empire, imperial charters, Italian affairs, and cases "reserved" for the emperor. In all other matters, the Aulic Council was a competitor for judicial work with the Imperial Chamber[1] (*Reichskammergericht*, a tribunal dating from the great diet of Worms of 1495: see under IMPERIAL CHAMBER). It was determined in 1648 that the one of these two judicial authorities which first dealt with a case should alone have competence to pursue it. An appeal lay from the decision of the council to the emperor, and judgment on appeal was given by those members of the council who had not joined in the original decision, though in important cases they might be afforced by members of the diet. Neither the council nor the chamber could deal with cases of outlawry, except to prepare such cases for the decision of the diet. To-day the archives of the Aulic Council are in Vienna, though parts of its records have been given to the German states which they concern.

AUTHORITIES.—R. Schröder, *Lehrbuch der deutschen Rechtsgeschichte* (Leipzig, 1904), gives the main facts; S. Adler, *Die Organisation der Centralverwaltung unter Maximilian I.* (Leipzig, 1886), deals with Maximilian's reorganization of the Council; and J. St. Pütter, *Historische Entwickelung der heutigen Staatsverfassung des Teutschen Reichs* (Göttingen, 1798–1799), may be consulted for its development and later form. (E. BR.)

AULIE-ATA, a town and fort of Russian Turkestan, province of Syr-darya, 152 m. N.E. of Tashkent, on the Talas river, at the western end of the Alexander range, its altitude being 5700 ft. The inhabitants are mostly Sarts and Tajiks, trading in cattle, horses and hides. Pop. (1897) 12,006.

AULIS, an ancient Boeotian town on the Euripus, situated on a rocky peninsula between two bays, near the modern village of Vathy, about 3 m. S. of Chalcis. Its fame was due to the tradition that it was the starting-place of the Greek fleet before the Trojan War, the scene of the sacrifice of Iphigenia. The temple of Artemis was still to be seen in the time of Pausanias.

AULNOY (or AUNOY), **MARIE CATHERINE LE JUMEL DE BARNEVILLE DE LA MOTTE,** BARONNE D' (*c.* 1650–1705), French author, was born about 1650 at Barneville near Bourg-Achard (Eure). She was the niece of Marie Bruneau des Loges, the friend of Malherbe and of J. G. de Balzac, who was called the "tenth Muse." She married on the 8th of March 1666 François de la Motte, a gentleman in the service of César, duc de Vendôme, who became Baron d'Aulnoy in 1654. With her mother, who by a second marriage had become marquise de Gudaigne, she instigated a prosecution for high treason against her husband. The conspiracy was exposed, and the two women saved themselves by a hasty flight to England. Thence they went (February 1679) to Spain, but were eventually allowed to return to France in reward for secret services rendered to the government. Mme. d'Aulnoy died in Paris on the 14th of January 1705. She wrote fairy tales, *Contes nouvelles ou les Fées à la mode* (3 vols., 1698), in the manner of Charles Perrault. This collection (24 tales) included *L'Oiseau bleu*, *Finette Cendron*, *La Chatte blanche* and others. The originals of most of her admirable tales are to be found in the *Pentamerone* (1637) of Giovanni Battista Basile. Other works are: *L'Histoire d'Hippolyte, comte de Duglas* (1690), a romance in the style of Madame de la Fayette, though much inferior to its model; *Mémoires de la cour d'Espagne* (1679–1681); and a *Relation du voyage d'Espagne* (1690 or 1691) in the form of letters, edited in 1874–1876 as *La Cour et la ville de Madrid* by Mme. B. Carey; *Histoire de Jean de Bourbon* (1692); *Mémoires sur la cour de France* (1692); *Mémoires de la cour d'Angleterre* (1695). Her historical writings are partly borrowed from existing records, to which she adds much that must be regarded as fiction, and some vivid descriptions of contemporary manners.

The *Diverting Works of the Countess d'Anois*, including some extremely untrustworthy "Memoirs of her own life," were printed in London in 1707. *The Fairy Tales of Madame d'Aulnoy*, with an introduction by Lady Thackeray Ritchie, appeared in 1892. For biographical particulars see M. de Lescure's introduction to the *Contes des Fées* (1881).

AULOS (Gr. *αὐλός*; Lat. *tibia*; Egyptian hieroglyphic, *Ma-it*; medieval equivalents, *shalm*, *chalumeau*, *schalmei*, *hautbois*), in Greek antiquities, a class of wood-wind instruments with single or with double reed mouthpiece and either cylindrical or conical bore, thus corresponding to both oboe and clarinet. In its widest acceptation the *aulos* was a generic term for instruments consisting of a tube in which the air column was set in vibration either directly by the lips of the performer, or through the medium of a mouthpiece containing a single or a double reed. Even the pipes of the pan-pipes (*syrinx polycalamus*,[1] σῦριγξ πολυκάλαμος) were sometimes called *auloi* (αὐλοί). The aulos is also the earliest prototype of the organ, which, by gradual assimilation of the principles of syrinx and bag-pipe, reached the stage at which it became known as the *Tyrrhenian aulos* (Pollux iv. 70) or the *hydraulos*, according to the method of compressing the wind supply (see ORGAN: *Early History*; and SYRINX). The aulos in its earliest form, the reed pipe, during the best classical period had a cylindrical bore (κοιλία) like that of the modern clarinet, and therefore had the acoustic properties of the stopped pipe, whether the air column was set in vibration by means of a single or of a double reed, for the mouthpiece does not affect the harmonic series.[1] To the acoustic properties of open or stopped pipes are due those essential differences which underlie the classification of modern wind instruments. A stopped pipe produces its fundamental tone one octave lower than the tone of an open pipe of corresponding length, and overblows the harmonics of the twelfth, and of the third above the second octave of the fundamental tone, *i.e.* the odd numbers of the series; whereas the open pipe gives the whole series of harmonics, the octave, the twelfth, the double octave, and the third above it, &c.

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[1] The Aulic Council is the private court of the emperor, with its members nominated by him; the Imperial Chamber is the public court of the Empire, with its members nominated by the estates of the Empire.

[1] See Pollux, *Onom.* iv. 69.

To produce the diatonic scale throughout the octaves of its compass, the stopped pipe requires eleven lateral holes in the side of the pipe, at appropriate distances from each other, and from the end of the pipe, whereas the open pipe requires but six. The acoustic properties of the open pipe can only be secured in combination with a reed mouthpiece by making the bore conical. The late Romans (and therefore we may perhaps assume the Greeks also, since the Romans acknowledge their indebtedness to the Greeks in matters relating to musical instruments, and more especially to the cithara and aulos) understood the acoustic principle utilized to-day in making wind instruments, that a hole of small diameter nearer the mouthpiece may be substituted for one of greater diameter in the theoretically correct position. This is demonstrated by the 4th-century grammarian Macrobius, who says (*Comm. in Somn. Scip.* ii. 4, 5): "Nec secus probamus in tibiis, de quarum foraminibus vicinis inflantis ori sonus acutus emittitur, de longinquis autem et termino proximis gravior; item acutior per patentiora foramina, gravior per angusta" (see BASSOON). Aristotle gives directions for boring holes in the aulos, which would apply only to a pipe of cylindrical bore (*Probl.* xix. 23). At first the aulos had but three or four holes; to Diodorus of Thebes is due the credit of having increased this number (Pollux iv. 80). Pronomus, the musician, and teacher of Alcibiades (5th century B.C.), further improved the aulos by making it possible to play on one pair of instruments the three musical scales in use at his time, the Dorian, the Phrygian, and the Lydian, whereas previously a separate pair of pipes had been used for each scale (Pausanias ix. 12. 5; Athenaeus xiv. 31). These three modes would require a compass of a tenth in order to produce the fundamental octave in each.

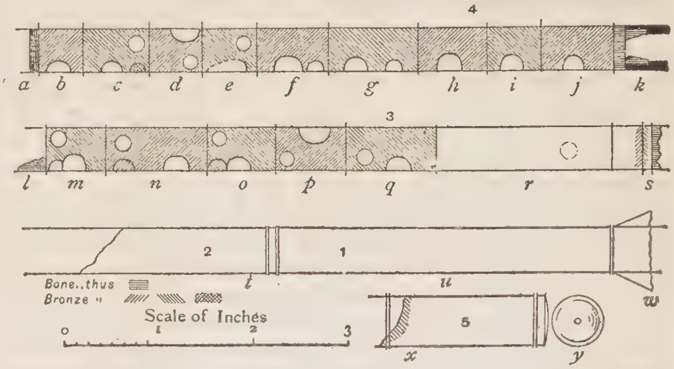
There are two ways in which this increased compass might have been obtained: (1) by increasing the number of holes and covering up those not required, (2) by means of contrivances for lowering the pitch of individual notes as required. We have evidence that both means were known to the Greeks and Romans. The simplest device for closing holes not in use was a band of metal left free to slide round the pipe, and having a hole bored through it corresponding in diameter with the hole in the pipe. Each hole was provided with a band, which was in some cases prevented from slipping down the pipe by narrow fixed rings of metal. The line on fig. 1 between *r* and *s* is thought to have been one of these rings.

Some pipes had two holes pierced through the bands and the bone, in such a manner that only one could be exposed at a time. This is clearly shown in the diagram (fig. 1) of fragments of an aulos from the museum at Candia, for which the writer is greatly indebted to Professor John L. Myres, by whom measured drawings were made from the instrument in 1893. These highly interesting remains, judging from the closed end (5), seem to belong to a side-blown reed-pipe similar to the Maenad pipes in the Castellani collection at the British Museum, illustrated below; they are constructed like modern flutes, but played by means of a reed inserted into the lateral embouchure.

In the Candia pipe, it seems likely that Nos. 1 and 2 represented the bell end, slightly expanded, No. 3 joining the broken end of No. 2 at *l*; there being a possible fit at the other end at *s* with *a* in No. 4 (the drawings must in this case be imagined as reversed for parts 3 and 4), and No. 5 joining on to No. 4 at *k*.

According to Professor Myres there are fragments of a pair of pipes in the Cyprus Museum of precisely the same construction as the one in Candia. In the drawing, the shape and relative position of the holes *on the circumference* is approximate only, but their position lengthways is measured.

Bands of silver were found on the ivory pipes from Pompeii[2] (fig. 2), as well as on two pipes belonging to the Castellani collection (fig. 4) and on one from Halicarnassus, in the British Museum. In order to enable the performer to use these bands conveniently, a contrivance such as a little ring, a horn or a hook termed *keras* (κέρας) was attached to the band.[3]



(From a drawing by Prof. John L. Myres.)

FIG. 1.—Diagram of the Fragments of an *Aulos* (Candia Mus.).

a, Triple wrapping of bronze as well as slide.
b, Slide with hole.
c, Slides with two holes not uncovered together.
d, Slides with two holes not uncovered together, one hole at back.
e, Slide.
f, Slide missing.
g, Slide missing, scars of slide [holes.
h, Slide.
i and *j*, Slide.
k, Socket.
l, Male half of joint.
m, *n o*, Slides, the top hole being in the slide only.
p and *q*, Slides, with two holes; the small hole shown is in the pipe, there being a corresponding hole in the slide at the back.
r, Bronze covering (and slide?).
s, Male joint.
t, The wavy line shows the extreme length of fragment.
u, 13 mm. inside diameter, 14 mm. outside diameter.
w, Engraved lines and conical form of bronze covering.
x, Wavy line shows extreme length of fragment.
y, Stopped end of pipe with engraved lines.

The line between *r* and *s* is either a turned ring or part of bronze cover. The double lines to the right of *t* are engraved lines.

Thirteen of the bands on the Pompeian pipes still have sockets which probably originally contained *kerata*. Pollux (iv. 80) mentions that Diodorus of Thebes, in order to increase the range of the aulos, made lateral channels for the air (πλάγιαι ὁδοί). These consisted of tubes inserted into the holes in the bands for the purpose of lengthening the column of air, and lowering individual notes at will, the sound being then produced at the extremity of the tube, instead of at the surface of the pipe. It is possible that some of the double holes in the slides of the Candia pipe were intended for the reception of these tubes. These lateral tubes form the archetype of the modern crook or piston.[4] The mouthpiece of the aulos was called *zeugos*

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[1] See Friedrich Zamminer, *Die Musik und die musikalischen Instrumente in ihrer Beziehung zu den Gesetzen der Akustik* (Giessen, 1855), p. 305.

[2] These pipes were discovered during the excavations in 1867, and are now in the museum at Naples. Excellent reproductions and descriptions of them are given in "The Aulos or Tibia," by Albert A. Howard, *Harvard Studies*, vol. iv. (Boston, 1893), pl. ii. and pp. 48-55.

[3] For illustrations of *auloi* provided with these contrivances, see illustration (fig. 2) of an aulos from Pompeii; a relief in Vatican, No. 535; Helbig's *Wandgemälde*, Nos. 56, 69, 730, 765, &c.

[4] For illustrations of ὁδοί showing the holes at the ends of the tubes, see *Description des marbres antiques du Musée Campana*, by H. d'Escamps, pl. 25; Wilhelm Froehner's *Catalogue of the Louvre*,

(ζεῦγος),[1] the reed tongue *glossa*[2] or *glotta* (γλῶσσα or γλῶττα), and the socket into which the reed was fixed *glottis*[3] (γλωττίς).

The double reed was probably used at first, being the simplest form of mouthpiece; the word *zeugos*, moreover, signifies a pair of like things. There is, however, no difficulty in accepting the probability that a single beating reed or clarinet mouthpiece was used by the Greeks, since the ancient Egyptians used it with the as-it or arghoul (*q.v.*).

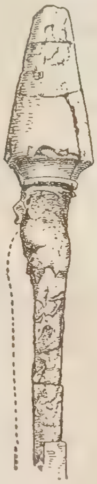
(Drawn from a photo by Brogi.)

FIG. 2.—Roman Ivory Aulos found at Pompeii (Naples Mus.), showing slides and rings.

The beak-shaped mouthpiece of a pipe found at Pompeii (fig. 3) has all the appearance of the beak of the clarinet, having, on the side not shown, the lay on which to fix a single or beating reed.[4] It may, however, have been the cap of a covered reed, or even a whistle mouthpiece in which the lip does not show in the photograph. It is difficult to form a conclusion without seeing the real instrument. On a mosaic of Monnus in Trèves[5] is represented an aulos which also appears to have a beak-shaped mouthpiece.

The upper part of the aulos, as in the Pompeian pipes, frequently had the form of a flaring cup supported on a pear-shaped bulb, respectively identified as the *holmos* (ὅλμος) and the *hypholmion* (ὑφόλμιον), the support of the *holmos*. An explanation of the original nature and construction of the bulb and flaring cup, so familiar in the various representations of the aulos, and in the real instruments found in Pompeii, is provided by an ancient Egyptian flute belonging to the collection of G. Maspero, illustrated and described by Victor Loret.[6] Loret calls the double bulb the beak mouthpiece of the instrument, and describes its construction; it consists of a piece of reed of larger diameter than that of the flute, and eight centimetres long; this reed has been forcibly compressed a little more than half way down by means of a ligature of twine, thus reducing the diameter from 6 mm. to 4 mm. The end of the pipe, covered by rows of waxed thread, fits into the end of the smaller bulb, to which it was also bound by waxed thread exactly as in the Elgin pipe at the British Museum, described below. There is no indication of the manner in which the pipe was sounded, and Loret assumes that there was once a whistle or flageolet mouthpiece. To the present writer, however, it seems probable that the constricted diameter between the two bulbs formed a socket into which the double reed or straw was inserted, and that, in this case at least, the reed was not taken into the mouth, but vibrated in the upper bulb or air-chamber. This simple contrivance was probably also employed in the earliest Greek pipes, and was later copied and elaborated in wood, bone or metal, the upper bulb being made shorter and developing into the flaring cup, in order that the reeds might be taken directly into the mouth. During the best period of Greek music the reeds were taken directly into the mouth[7] and not enclosed in an air-chamber. The two pipes were kept in position while the fingers stopped the holes and turned the bands by means of the φορβεία (Lat. *capistrum*), a bandage encircling mouth and cheeks, and having holes through which the reed-mouthpiece passed into the mouth of the performer; the *phorbeia* also relieved the pressure of the breath on the cheeks and lips,[8] which is felt more especially by performers on oboe and bassoon at the present day.

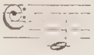
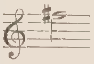
In the pair of wooden pipes belonging to the Elgin collection at the British Museum, one of the bulbs, partly broken, but preserved in the same case as the pipes, was fastened to the pipes by means of waxed thread, the indented lines being still visible on the rim of the bulb. The aulos was kept in a case called *sybene*[9] (συβήνη) or *aulotheke*[10] (αὐλοθήκη), and the little bag or case in which the delicate reeds were carried was known by the name of *glottokomeion*[10] (γλωττοκομεῖον).[11] Two Egyptian flute cases are extant, one in the Louvre,[12] and the other in the museum at Leiden. The latter case is of sycamore wood, cylindrical in shape, with a stopper of the same wood; there is no legend or design upon it. The case contained seven pipes, five pieces of reed without bore or holes, and three pieces of straw suitable for making double-reed mouthpieces.[13]



(From a photo by Brogi.)

FIG. 3.—Beak mouthpiece. Found at Pompeii (Naples Mus.).

Aristoxenus gives the full compass of a single pipe or pair of pipes as over three octaves:—"For doubtless we should find an interval greater than the above mentioned three octaves between the highest note of the soprano clarinet (aulos) and the lowest note of the bass-clarinet (aulos); and again between the highest note of a clarinet player performing with the speaker open, and the lowest note of a clarinet player performing with the speaker closed."[14]

This, according to the tables of Alypius, would correspond to the full range of the Greek scales, a little over three octaves from  to . It is evident that the ancient Greeks obtained this full compass on the aulos by means of the harmonics. Proclus (*Comm. in Alcibiad.* chap. 68) states that from each hole of the pipe at least three tones could be produced. Moreover, classic writers maintain that if the performer press the *zeugos* or the *glottai* of the pipes, a sharper tone is produced.[15] This is exactly how a performer on a modern clarinet or oboe produces the higher harmonics of the instrument.[16] The small bore of the aulos in comparison to its length facilitated the production of the harmonics (cf. Zamminer p. 218), as does also the use of a small hole near the mouthpiece, called in Greek *syrinx* (σῦριγξ) and in the modern clarinet the "speaker," which when open enables the performer to overblow with ease the first harmonic of the lowest fundamental

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No. 378; Glyptothek Museum at Munich, No. 188; Albert A. Howard, "The Aulos or Tibia," *Harvard Studies*, iv. (Boston, 1893), pl. 1, No. 1.

[1] For a description of the reed calamus from which pipe and mouthpiece were made see Theophrastus, *Hist. Plant.* iv. 11.

[2] Aeschines 86. 29; Aristotle, *H.A.* 6, 10, 9, &c.

[3] Lucian, *Harm.* 1.

[4] Cf. article MOUTHPIECE.

[5] See *Antike Denkmäler*, Deutsches archäol. Inst., Berlin, 1891, vol. i. pl. 49.

[6] See "Les Flûtes égyptiennes antiques," *Journal asiatique*, 8th ser. vol. xiv. (Paris, 1889), pp. 212-215.

[7] See Aristotle, *De Audib.* p. 802 b, 18, and p. 804 a; Festus, ed. Mueller, p. 116.

[8] See Albert A. Howard, *op. cit.* p. 29, and Dr Hugo Riemann, *Gesch. d. Musik*, Bd. i. T. 1, p. 111 (Leipzig, 1904).

[9] Pollux, *Onomasticon*, vii. 153.

[10] Hesychius.

[11] Pollux ii. 108, vii. 153, x. 153-154; A. A. Howard, *op. cit.* pp. 26-27. An illustration of the little bag is given in *Denkmäler des klassischen Altertums*, by August Baumeister, vol. i. p. 554, fig. 591.

[12] Two Egyptian pipes now in the Louvre were found in a case ornamented with a painting of a female musician playing a double pipe. See E. de Rougé, *Notice sommaire des monuments égyptiens exposés dans les galeries du Louvre*, p. 87.

[13] See Victor Loret, "Les Flûtes égyptiennes antiques," in *Journal asiatique*, vol. xiv. (Paris, 1889), pp. 199, 200 and 201 (note), pp. 207, 211 and 217, and Conrad Leemans, *Description raisonnée des monuments égyptiens du Musée d'Antiquités de Leyde*, p. 132, No. 489; contents of case Nos. 474-488.

[14] Aristoxenus, *Harm.* bk. i. 20 and 21, H. S. Macran's edition with translation (Oxford, 1902), p. 179.

[15] Aristotle, *De audib.* p. 804 a; Porphyry, ed. Wallis, p. 249; *ibid.* p. 252.

[16] Zamminer, *op. cit.* p. 301.

tones. To Mr Albert A. Howard of Harvard University is due the credit of having identified the *syrinx* of the aulos with the speaker of the clarinet.[1] This assumption is doubtless correct, and is supported by classical grammarians,[2] who state that the *syrinx* was one of the holes of the aulos. It renders quite clear certain passages in Aristoxenus, Aristotle and Plutarch, and a scholion to Pindar's 12th *Pythian*, which before were difficult to understand (see SYRINX).

The aulos or tibia existed in a great number of varieties enumerated by Pollux (*Onomast.* iv. 74 et seq.) and Athenaeus (iv. 76 et seq.). They fall into two distinct classes, the single and the double pipes. There were three principal single pipes, the *monaulos*, the *plagiaulos* and the *syrinx monocalamos*. The double pipes were used by the great musicians of ancient Greece, and notably at the musical contests at Delphi, and what has been said above concerning the construction of the aulos refers mainly to the double pipes. The *monaulos*, a single pipe of Egyptian origin, which, by inference, we assume to have been played from the end by means of a reed, may have been the archetype of the oboe or clarinet. The *plagiaulos photinx* or *tibia obliqua*, invented by the Libyans (Pollux iv. 74), or, according to Pliny (vii. 204), by Midas of Phrygia, was held like the modern flute, but was played by means of a mouthpiece containing a reed. Three of the existing pipes at the British Museum (the two in the Castellani collection, and the pipe from Halicarnassus) belong to this type. The mouthpiece projects from the side of the pipe and communicates with the main bore by means of a slanting passage; the end nearest the mouthpiece is stopped as in the modern flute; in the latter, however, the embouchure is not closed by the lips when playing, and therefore the flute has the acoustic properties of the open pipe, whereas the *plagiaulos* having a reed mouthpiece gave the harmonics of a closed pipe. The double pipes existed in five sizes according to pitch, in the days of Aristoxenus, who, in a treatise on the construction of the auloi (Περὶ αὐλῶν τρήσεως), unfortunately not extant,[3] divides them thus:—

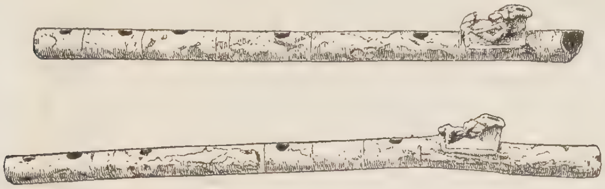

FIG. 4.—The Plagiaulos. Castellani Collection (Maenad Pipes), British Museum.

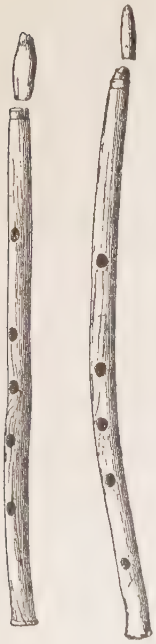

FIG. 5.—Ancient Greek Double Pipes. Elgin Collection, British Museum.

(1) *Parthenioi auloi* (παρθένιοι αὐλοί), the maiden's *auloi*, corresponding to the soprano compass.

(2) *Paidikoi auloi* (παιδικοὶ αὐλοί), the boy's pipes or alto *auloi*, used to accompany boys' songs and also in double pairs at feasts.

(3) *Kitharisterioi auloi* (κιθαριστήριοι αὐλοί), used to accompany the cithara.

(4) *Teleioi auloi*, the perfect aulos, or tenor's pipes; also known as the *pythic auloi* (πυθικοὶ αὐλοί); used for the paeans and for solos at the Pythean games (without chorus). It was the *pythic auloi* and the *kitharisterioi auloi* more especially which were provided with the speaker (syrinx) in order to improve the harmonic notes (see SYRINX).

(5) *Hyperteleioi auloi* (ὑπερτέλειοι αὐλοί) or *andreioi auloi* (ἀνδρεῖοι αὐλοί) (see Athenaeus iv. 79), the bass-auloi.

The Phrygian pipes or *auloi Elymoi*[4] were made of box-wood and were tipped with horn; they were double pipes, but differed from all others in that the two pipes were unequal in length and in the diameter of their bores[5]; sometimes one of the pipes was curved upwards and terminated in a horn bell[6]; they seem to have had a conical bore, if representations on monuments are to be trusted. We may conclude that the archetype of the oboe with conical bore was not unknown to the Greeks; it was frequently used by the Etruscans and Romans, and appears on many bas-reliefs, mural paintings and other monuments. For illustrations see Wilhelm Froehner, *Les Musées de France*, pl. iii., "Marsyas playing the double pipes." There the bore is decidedly conical in the ratio of at least 1 : 4 between the mouthpiece and the end of the instrument; the vase is Roman, from the south of France. See also *Bulletino della Commissione Archeologica Comunale di Roma*, Rome, 1879, vol. vii., 2nd series, pl. vii. and p. 119 et seq., "Le Nozze di Elena e Paride," from a bas-relief in the monastery of S.Antonio on the Esquiline; Wilhelm Zahn, *Die schönsten Ornamente und die merkwürdigsten Gemälde aus Pompeji, Herkulaneum und Stabiae* (German and French), vol. iii., pl. 43 and 51 (Berlin, 1828–1859).

For further information on the aulos, consult Albert A. Howard, "The Aulos or Tibia," *Harvard Studies*, iv., 1893; François A. Gevaert, *Histoire de la musique dans l'antiquité*, vol. ii. p. 273 et seq.; Carl von Jan's article "Flöte" in August Baumeister's *Denkmäler des klassischen Altertums* (Munich, 1884–1888), vol. i.; Dr Hugo Riemann, *Handbuch der Musikgeschichte*, Bd. I. T. 1, pp. 93-112 (Leipzig, 1904); Caspar Bartholinus, *De Tibiis Veterum* (Amsterdam, 1779). (K. S.)

AUMALE, HENRI EUGÈNE PHILIPPE LOUIS D'ORLÉANS, DUC D' (1822–1897), French prince and statesman, fifth son of Louis Philippe, duke of Orleans, afterwards king of the French, and of Marie Amélie, princess of the Two Sicilies, was born at Paris on the 16th of January 1822. While still young he inherited a large fortune from the prince de Condé. Brought up by his parents with great simplicity, he was educated at the college of Henri IV., on leaving which at the age of seventeen he entered the army with the rank of a captain of infantry. He distinguished himself during the conquest of Algeria, and was appointed governor of that colony, in which capacity he received the submission of the amir Abd-el-Kader. After the revolution of 1848 he retired to England and busied himself with historical and military studies, replying in 1861 by a *Letter upon the History of France* to Prince Napoleon's violent attacks upon the house of Orleans. On the outbreak of the Franco-Prussian War he volunteered for service in the French army, but his offer was declined. Elected deputy for the Oise department, he returned to France, and succeeded to the *fauteuil* of the comte de Montalembert in the French Academy. In March 1872 he resumed his place in the army as general of division; and in 1873 he presided over the court-martial which condemned Marshal Bazaine to death. About this period, being appointed commandant of the VII. army corps at Besançon, he retired from political life, and in 1879 became inspector-general of the army. By the act of exception passed in 1883 all members of families that had reigned in France serving in the army were deprived of their military positions; consequently the duc d'Aumale was placed on the unemployed supernumerary list. Subsequently, in 1886, another law was promulgated which expelled from French territory the heads of former reigning families, and provided that henceforward all members of those families should be disqualified for any public position or function, and for election to any public body. The duc d'Aumale protested energetically, and was himself expelled. By his will of the 3rd of June 1884, however, he had bequeathed to the Institute of France his Chantilly estate, with all the art-collection he had gathered there. This generosity led the government to withdraw the decree of exile, and the duke returned to France in 1889.

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[1] *Op. cit.* p. 32-35.

[2] See *Etymologicum magnum* (Augsburg, 1848), *s.v.* "Syrinx."

[3] See Athenaeus xiv. 634, who quotes from Didymus.

[4] Pollux iv. 74.

[5] Servius *ad Aen.* ix. 615.

[6] Tibullus ii. 85; Virg. *Aen.* xi. 735; Ovid, *Met.* iii. 533, *Ex Ponto* i. 1. 39.

He died at Zucco in Sicily on the 7th of May 1897. Of his marriage, contracted in 1844 with his first cousin, Caroline de Bourbon, daughter of the prince of Salerno, were born two sons: the prince de Condé (d. 1866), and the duc de Guise (d. 1872). The duc d'Aumale's principal literary work was an *Histoire des princes de Condé*, which he left unfinished.

See Georges Picot, *M. le duc d'Aumale* (Paris, 1898); Ernest Daudet, *Le duc d'Aumale* (Paris, 1898). (M. P.*)

AUMALE, a town of northern France, in the department of Seine-Inférieure, on the left bank of the Bresle, 47 m. N.E. of Rouen on the Northern railway. Pop. (1906) 1999. The church is an interesting building of the 16th and 17th centuries, and has a portal attributed to Jean Goujon. The town has glass and steel works.

The territory of Aumale (Albemarle, Aubemale, Aumerle; Lat. *Alba Marla*) in Normandy, a dependency of the archbishopric of Rouen, was granted to Odo of Champagne, brother-in-law of William the Conqueror, who founded the first line of counts of Aumale. Hawise (Hadwide, Havoise or Avoie), countess of Aumale, after the death of her first husband William de Mandeville, earl of Essex (d. 1189), married William des Forts (de Fors, or de Fortz; Lat. de Fortibus), a military adventurer who had been one of the commanders of the fleet under Richard I. during his first crusade. He died in 1195, and his widow married Baldwin de Betun, who became count of Aumale in her right. He died in 1213, and in 1214 William de Fortibus, son of Hawise by her second husband, was confirmed by King John in all his mother's lands. Meanwhile, however, the territory of Aumale shared the fate of the rest of Normandy, and was annexed to the French crown by King Philip Augustus; but the title of earl of Albemarle, derived from it, continued to be borne in England by William de Fortibus, and was passed on to his heirs (see ALBEMARLE). Aumale itself was conferred by Philip Augustus as an appanage on his son Philip. It was subsequently granted by Louis VIII. to Simon, count of Dammartin, whose daughter, Jeanne, countess of Dammartin, transferred it, together with the countship of Ponthieu, to the house of Castile, by her marriage with Ferdinand III., king of Castile, called the Saint (1238). It then remained in the possession of a branch of her descendants bearing the name of Ponthieu, until it passed to the house of Harcourt on the marriage of Blanche of Ponthieu with John, count of Harcourt (1340). Marie d'Harcourt (d. 1476), heiress of Aumale, married Anthony of Lorraine, count of Vaudémont, and Aumale was created a duchy in the peerage of France for Claude and Francis of Lorraine in 1547. By the marriage of Anne of Lorraine with the duke of Nemours in 1618 the duchy of Aumale passed to the house of Savoy-Nemours. In 1686 Marie Jeanne Baptiste, duchess of Nemours and of Aumale, and wife of Charles Emmanuel II., duke of Savoy, sold Aumale to Louis XIV., who gave it to his natural son, the duke of Maine. After the death of that prince, the dukedom devolved upon his brother, the count of Toulouse, subsequently passing to the latter's son, the duke of Penthièvre, whose daughter married the duke of Orleans. Since the reign of Louis Philippe, king of the French, the title of duke of Aumale has been borne by a son of the duke of Orleans.

AUMONT, the name of a family which played an important part in French history. The origin of the name is uncertain, but it has usually been derived from Aumont, now a small commune in the department of the Somme. The family was of great antiquity, a Jean, sire d'Aumont, having accompanied Louis IX. on crusade. It was already powerful in the 14th century, and during the English wars of that period its members fought in the armies of the kings of France. Towards the end of the century, the family took the part of the dukes of Burgundy, but returned to the side of France on the death of Charles the Bold. Jean d'Aumont, lieutenant-general to the king of France in the government of Burgundy, rendered important services to Louis XII. and Francis I. Another Jean d'Aumont (d. 1595), a marshal of France and knight of the order of the Holy Ghost since its institution in 1578, fought against the Huguenots under the last of the Valois kings; but he was among the first to recognize Henry IV., and was appointed governor of Champagne and of Brittany, where he had to fight against the League. His grandson Antoine (1601–1669) was also a marshal of France (1651), governor of Paris (1662), duke and peer (1665). Louis Marie Augustin, duc d'Aumont (1709–1782), was a celebrated collector of works of art. Louis Marie Céleste d'Aumont, duc de Piennes, afterwards duc d'Aumont (1762–1831), emigrated during the Revolution and served in the army of the royalists, as also in the Swedish army. During the Hundred Days he effected a descent upon Normandy in the Bourbon interest, and succeeded in capturing Bayeux and Caen.

AUNCEL (from the Anglo-Fr. *auncelle*, a confused derivation from *l'auncelle*, Ital. *lancella*, a little balance), a balance formerly used in England; now, in dialectical use, a term for the weighing of meat by hand instead of by scales.

AUNDH, a native state of India, in the Deccan division of Bombay, ranking as one of the Satara Jagirs. Its area is 447 sq. m.; its population was 63,921 in 1901, showing a decrease of 2% in the decade. Estimated revenue £9422. The chief, whose title is Pant Pratinidhi, is a Brahman by caste. The state has suffered severely from plague. The town of Aundh is situated 26 m. S.E. of Satara. Pop. about 3500.

AUNGERVYLE, RICHARD (1287–1345), commonly known as RICHARD DE BURY, English bibliophile, writer and bishop, was born near Bury St Edmunds, Suffolk, on the 24th of January 1287. He was the son of Sir Richard Aungervyle, who was descended from one of William the Conqueror's soldiers, settled in Leicestershire, where the family came into possession of the manor of Willoughby. His education was undertaken by his uncle, John de Willoughby, and after leaving the grammar school of his native place he was sent to Oxford, where he is said to have distinguished himself in philosophy and theology. John Pits[1] says, but apparently without authority, that he became a Benedictine monk. He was made tutor to Prince Edward of Windsor (afterwards Edward III.), and, according to Dibdin, inspired him with some of his own love of books. He was mixed up with the sordid intrigues which preceded the deposition of Edward II., and supplied Queen Isabella and Mortimer in Paris with money in 1325 from the revenues of Guienne, of which province he was treasurer. For some time he had to hide in Paris from the officers sent by Edward II. to apprehend him. On the accession of Edward III. his services were rewarded by rapid promotion. He was cofferer to the king, treasurer of the wardrobe and afterwards clerk of the privy seal. The king, moreover, repeatedly recommended him to the pope, and twice sent him, in 1330 and 1333, as ambassador to the papal court, then in exile at Avignon. On the first of these visits he made the acquaintance of a fellow bibliophile in Petrarch, who records his impression (*Epist. Famil.* lib. iii. Ep. 1) of the Englishman as "not ignorant of literature and . . . from his youth up curious beyond belief of hidden things." He asked him for information about Thule, but Aungervyle, who promised information when he should once more be at home among his books, never sent any answer, in spite of repeated enquiries. The pope, John XXII., made him his principal chaplain, and presented him with a rochet in earnest of the first vacant bishopric in England.

During his absence from England he was made (1333) dean of Wells. In September of the same year the see of Durham fell vacant, and the king overruled the choice of the monks, who had elected and actually installed their sub-prior, Robert de Graystanes, in favour of Aungervyle. In February 1334 he was made lord treasurer, an appointment he exchanged later in the year for that of lord chancellor. This charge he resigned in the next year, and, after making arrangements for the protection of his northern diocese from an expected inroad of the Scots, he proceeded in July 1336 to France to attempt a settlement of the claims in dispute between Edward and Philip. In the next year he served on three commissions for the defence of the northern counties. In June 1338 he was once more sent abroad to secure peace, but within a month of his appointment

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[1] *De Ill. Angl. Script.* (1619, p. 467).

Edward himself landed in Flanders to procure allies for his approaching campaign. Aungervyle accompanied him to Coblenz to his meeting with the emperor Louis IV., and in the next year was sent to England to raise money. This seems to have been his last visit to the continent. In 1340 and 1342 he was again engaged in trying to negotiate peace with the Scots, but from this time his life appears to have passed quietly in the care of his diocese and in the accumulation of a library.

He sent far and wide in search of manuscripts, rescuing many treasures from the charge of ignorant and neglectful monks. "No dearness of price," he says, "ought to hinder a man from the buying of books, if he has the money demanded for them, unless it be to withstand the malice of the seller or to await a more favourable opportunity of buying." It is to be supposed that Richard de Bury sometimes brought undue pressure to bear on the owners, for it is recorded that an abbot of St Albans bribed him to secure his influence for the house by four valuable books, and that de Bury, who procured certain coveted privileges for the monastery, bought from him thirty-two other books, for fifty pieces of silver, far less than their normal price. The record of his passion for books, his *Philobiblon*, was completed on his fifty-eighth birthday, the 24th of January 1345, and he died on the 14th of April (May, according to Adam Murimuth) of that year. He gives an account (chapter viii.) of the unwearied efforts made by himself and his agents to collect books. In the eighteenth chapter he records his intention of founding a hall at Oxford, and in connexion with it a library of which his books were to form the nucleus. He even details the rules to be observed for the lending and care of the books, and he had already taken the preliminary steps for the foundation. The bishop died, however, in great poverty, and it seems likely that his collection was dispersed immediately after his death. But the traditional account is that the books were sent to the Durham Benedictines at Oxford, and that on the dissolution of the foundation by Henry VIII. they were divided between Duke Humphrey of Gloucester's library, Balliol College and Dr George Owen. Only two of the volumes are known to be in existence; one is a copy of John of Salisbury's works in the British Museum, and the other some theological treatises by Anselm and others in the Bodleian.

The chief authority for the bishop's life is William de Chambre (printed in Wharton's *Anglia Sacra*, 1691, and in *Historiae Dunelmensis scriptores tres*, Surtees Soc. 1839), who describes him as an amiable and excellent man, charitable in his diocese, and the liberal patron of many learned men, among these being Thomas Bradwardine, afterwards archbishop of Canterbury, Richard Fitzralph, afterwards archbishop of Armagh, the enemy of the mendicant orders, Walter Burley, who translated Aristotle, John Mauduit the astronomer, Robert Holkot and Richard de Kilvington. John Bale[1] and Pits[2] mention other works of his, *Epistolae Familiares* and *Orationes ad Principes*. The opening words of the *Philobiblon* and the *Epistolae* as given by Bale represent those of the *Philobiblon* and its prologue, so that he apparently made two books out of one treatise. It is possible that the *Orationes* may represent a letter book of Richard de Bury's, entitled *Liber Epistolaris quondam domini Ricardi de Bury, Episcopi Dunelmensis*, now in the possession of Lord Harlech. This MS., the contents of which are fully catalogued in the Fourth Report (1874) of the Historical MSS. Commission (Appendix, pp. 379-397), contains numerous letters from various popes, from the king, a correspondence dealing with the affairs of the university of Oxford, another with the province of Gascony, beside some harangues and letters evidently kept as models to be used on various occasions.

It has often been asserted that the *Philobiblon* itself was not written by Richard de Bury at all, but by Robert Holkot. This assertion is supported by the fact that in seven of the extant MSS. of *Philobiblon* it is ascribed to Holkot in an introductory note, in these or slightly varying terms: *Incipit prologus in philobiblon ricardi dunelmensis episcopi quē librū composuit Robertus holcote de ordine predicatorum sub nomine dicti episcopi.* The Paris MS. has simply *Philobiblon olchoti anglici*, and does not contain the usual concluding note of the date when the book was completed by Richard. As a great part of the charm of the book lies in the unconscious record of the collector's own character, the establishment of Holkot's authorship would materially alter its value. A notice of Richard de Bury by his contemporary Adam Murimuth (*Continuatio Chronicarum*, Rolls Series, 1889, p. 171) gives a less favourable account of him than does William de Chambre, asserting that he was only moderately learned, but desired to be regarded as a great scholar.

The original Latin text was printed at Cologne (1473), Spires (1483), Paris (1500), Oxford (1598 and 1599), &c. It was first translated into English by J. B. Inglis in 1832, and into French by Hippolyte Cocheris in 1856. The best translation is that by Mr E. C. Thomas, accompanying the Latin text, with full biographical and bibliographical introductions (1888). Other editions are in the *King's Classics* (1902) and for the Grolier Club (New York, 1889, ed. A. W. West).

AUNT SALLY, the English name for a game popular at fairs, race-courses and summer resorts. It consists in throwing hard balls, of wood or leather-covered yarn, at puppets dressed to represent different characters, originally a grotesque female figure called "Aunt Sally," with the object of smashing a clay pipe which is inserted either in the mouth or forehead of the puppet. In France the game is popular under the name *jeu de massacre*. In a variation of the pastime the mark consists of a living person's head thrust through a hole in a sheet of canvas. In case of a hit a second shy is allowed, or a small prize is given.

AURA (from the Gr. for "breath" or "breeze"), a term used in old days to denote a supposed ethereal emanation from a volatile substance; applied later to the "electrical aura," or air-current caused by electrical discharge; in epilepsy (*q.v.*) to one of its premonitory symptoms; and in spiritualism to a mysterious light associated with the presence of spirit-forms. See also AUREOLA.

AURANGABAD, or AURUNGABAD, a city of India, in the dominions of the nizam of Hyderabad, north-west division, situated 138 m. from Poona, 207 from Bombay via Poona, and 270 from Hyderabad on the river Kaum. It gives its name to a district. It was founded in 1610, under the name of Fatchnagar, by Malik Ambar, an Abyssinian, who had risen from the condition of a slave to great influence. Subsequently it became the capital of the Mogul conquests in the south of India. Aurangzeb, who erected here a mausoleum to his wife which has been compared to the Taj at Agra, made the city the seat of his government during his viceroyalty of the Deccan, and gave it the name of Aurangabad. It thus grew into the principal city of an extensive province of the same name, stretching westward to the sea, and comprehending nearly the whole of the territory now comprised within the northern division of the presidency of Bombay. Aurangabad long continued to be the capital of the succession of potentates bearing the modern title of nizam, after those chiefs became independent of Delhi. They abandoned it subsequently, and transferred their capital to Hyderabad, when the town at once began to decline. Aurangabad is a railway station on the Hyderabad-Godavari line, 435 m. from Bombay. In 1901 the population, with military cantonments, was 36,837, showing an increase of 8% in the decade. It has a cotton mill.

The district of Aurangabad has an area of 6172 sq. m. The population in 1901 was 721,407. It contains the famous caves of Ajanta, and also the battlefield of Assaye.

AURANGZEB (1618–1707), one of the greatest of the Mogul emperors of Hindustan, was the third son of Shah Jahan, and was born in November 1618. His original name, Mahommed, was changed by his father, with whom he was a favourite, into Aurangzeb, meaning ornament of the throne, and at a later time he assumed the additional titles of Mohi-eddin, reviver of religion, and Alam-gir, conqueror of the world. At a very early age, and throughout his whole life, he manifested profound religious feeling, perhaps instilled into him in the course of his education under some of the strictest Mahommedan doctors.

[1] *Script. Ill. Maj. Brit.* cent. v. No. 69.

[2] *De Ill. Angl. Script.* (1619, p. 468).

He was employed, while very young, in some of his father's expeditions into the country beyond the Indus, gave promise of considerable military talents, and was appointed to the command of an army directed against the Uzbegs. In this campaign he was not completely successful, and soon after was transferred to the army engaged in the Deccan. Here he gained several victories, and in conjunction with the famous general, Mir Jumla, who had deserted from the king of Golconda, he seized and plundered the town of Hyderabad, which belonged to that monarch. His father's express orders prevented Aurangzeb from following up this success, and, not long after, the sudden and alarming illness of Shah Jahan turned his thoughts in another direction. Of Shah Jahan's four sons, the eldest, Dara, a brave and honourable prince, but disliked by the Mussulmans on account of his liberality of thought, had a natural right to the throne. Accordingly, on the illness of his father, he at once seized the reins of government and established himself at Delhi. The second son, Shuja, governor of Bengal, a dissolute and sensual prince, was dissatisfied, and raised an army to dispute the throne with Dara. The keen eye of Aurangzeb saw in this conjuncture of events a favourable opportunity for realising his own ambitious schemes. His religious exercises and temperate habits gave him, in popular estimation, a great superiority over his brothers, but he was too politic to put forward his claims openly. He made overtures to his younger brother Murad, governor of Gujarat, representing that neither of their elder brothers was worthy of the kingdom, that he himself had no temporal ambition, and desired only to place a fit monarch on the throne, and then to devote himself to religious exercises and make the pilgrimage to Mecca. He therefore proposed to unite his forces to those of Murad, who would thus have no difficulty in making himself master of the empire while the two elder brothers were divided by their own strife. Murad was completely deceived by these crafty representations, and at once accepted the offer. Their united armies then moved northward. Meanwhile Shah Jahan had recovered, and though Dara resigned the crown he had seized, the other brothers professed not to believe in their father's recovery, and still pressed on. Shuja was defeated by Dara's son, but the imperial forces under Jaswant Singh were completely routed by the united armies of Aurangzeb and Murad. Dara in person took the field against his brothers, but was defeated and compelled to fly. Aurangzeb then, by a clever stroke of policy, seized the person of his father, and threw him into confinement, in which he was kept for the remaining eight years of his life. Murad was soon removed by assassination, and the way being thus cleared, Aurangzeb, with affected reluctance, ascended the throne in August 1658. He quickly freed himself from all other competitors for the imperial power. Dara, who again invaded Gujarat, was defeated and closely pursued, and was given up by the native chief with whom he had taken refuge. He was brought up to Delhi, exhibited to the people, and assassinated. Shuja, who had been a second time defeated near Allahabad, was attacked by the imperial forces under Mir Jumla and Mahommed, Aurangzeb's eldest son, who, however, deserted and joined his uncle. Shuja was defeated and fled to Arakan, where he perished; Mahommed was captured, thrown into the fortress of Gwalior, and died after seven years' confinement. No similar contest disturbed Aurangzeb's long reign of forty-six years, which has been celebrated, though with doubtful justice, as the most brilliant period of the history of Hindustan. The empire certainly was wealthy and of enormous extent, for there were successively added to it the rich kingdoms of Bijapur and Golconda, but it was internally decaying and ready to crumble away before the first vigorous assault. Two causes principally had tended to weaken the Mogul power. The one was the intense bigotry and intolerant policy of Aurangzeb, which had alienated the Hindus and roused the fierce animosity of the haughty Rajputs. The other was the rise and rapid growth of the Mahratta power. Under their able leader, Sivaji, these daring freebooters plundered in every direction, nor could all Aurangzeb's efforts avail to subdue them. For the last twenty-six years of his life Aurangzeb was engaged in wars in the Deccan, and never set foot in his own capital. At the close of the long contest the Mogul power was weaker, the Mahratta stronger than at first. Still the personal ability and influence of the emperor were sufficient to keep his realms intact during his own life. His last years were embittered by remorse, by gloomy forebodings, and by constant suspicion, for he had always been in the habit of employing a system of espionage, and only then experienced its evil effects. He died on the 3rd of March 1707 at Ahmadnagar, while engaged on an extensive but unfortunate expedition against the Mahrattas.

See Lane-Poole, *Aurangzib*, "Rulers of India" series (1893).

AURAY, a town of France near the mouth of the Auray river, in the department of Morbihan, 12 m. W. of Vannes on the railway between that town and Lorient. Pop. (1906) 5241. Its port, which is formed by the channel of the river and divides the town into two parts, is frequented by coasting and fishing vessels. The principal buildings are the church of St Esprit (13th century) now secularized; the Renaissance church of St Gildas; the town-hall (18th century); and, at a short distance from the town, the Carthusian monastery, now a deaf and dumb institute, on the site of the battle of 1364, at which Charles of Blois was defeated by John of Montfort (see BRITTANY: *History*). Adjoining the Chartreuse is a small chapel in which are preserved the bones of the Royalists captured by the Republicans in a battle fought near the spot in 1795. In the neighbourhood is the church of Sainte Anne d'Auray, one of the principal places of pilgrimage in Brittany. Auray is one of the chief centres in France for oyster-breeding, and carries on boat-building and sardine-fishing.

AURELIA, VIA, an ancient highroad of Italy, the date of the construction of which is unknown. It ran from Rome to Alsium, where it reached the sea, and thence along the south-west coast of Italy, perhaps originally only as far as Cosa, and was later extended to Vada Volaterrana, and in 109 B.C. to Genua and Dertona by means of the Via Aemilia, though a coast road as far as Genua at least must have existed long before. The name is applied in the Antonine Itinerary to these extensions, and even to the prolongation to Arles. Its line is in the main closely followed by the modern coast highroad; cf., however, for the section between Cosa and Populonia, O. Cuntz in *Jahreshefte des Österr. arch. Instituts*, vii. (1904), 54. (T. As.)

AURELIAN [LUCIUS DOMITIUS AURELIANUS], one of the greatest of the Roman soldier emperors, was born at Sirmium in Pannonia between A.D. 212–214. He was of humble origin, but nothing definite is known of his family. He had always shown great enthusiasm for a military career, and so distinguished himself in the campaigns in which he took part that on one occasion he received a public vote of thanks. At the same time he was proclaimed consul elect, and adopted by Ulpius Crinitus, military governor of Illyria and Thrace. On the death of the emperor Claudius II. Gothicus (270), Aurelian was proclaimed his successor with the universal approval of the soldiers. His first task was to continue the war which had been begun by Claudius against the Goths. He drove them out of Moesia across the Danube, where he left them in possession of Dacia, which he did not think himself able to retain; the name was transferred to Moesia, which was then called Dacia Aureliani. The chronology, however, of Aurelian's reign is very confused, and the abandonment of Dacia is placed by some authorities towards its close. He next entered upon campaigns against the Juthungi, Alamanni, and other Germanic tribes, over whom, after a severe defeat which was said to have imperilled the very existence of the empire, he at length obtained a complete victory. Having thus secured the Rhine and Danube frontiers, he turned his energies towards the east, and in 271 set out on his expedition against Zenobia, queen of Palmyra (*q.v.*). At the same time he crushed two pretenders to the throne—Firmus and Tetricus. Firmus, a wealthy merchant of Seleucia, had proclaimed himself emperor of Egypt. Aurelian, who was at the time in Mesopotamia, hastened thither, and ordered him to be seized and put to death. Tetricus, who had been proclaimed emperor in the west after the death of Gallienus, and left undisturbed by Claudius II., still ruled over Gaul, Spain and Britain. A decisive battle was fought near the modern Châlons, in which Tetricus was defeated. The restoration of the unity of the empire was thus complete. In 274 a brilliant triumph, adorned by the persons of Zenobia and Tetricus, was celebrated at Rome.

Aurelian now turned his attention to the internal affairs of the empire. He introduced sumptuary laws; relieved the poor by distributions of bread and meat, proceeded with great severity against informers and embezzlers; began the construction of various public works and buildings; and proclaimed a general amnesty for political crimes. The restoration and enlargement of the walls of Rome, commenced by him, was not completed till the reign of Probus. An attempt to restore the standard of the coinage is said to have caused a revolt of the workmen and officials connected with the mint, which was only put down with the loss of 7000 soldiers. It has been suggested that this was really an attempt at revolution incited by the senate and praetorian guards, the opportunity being found in disturbances resulting from opposition to the attempted reform, which by themselves could hardly have assumed such serious proportions. Aurelian's restless spirit was not long able to endure a life of inaction in the city. Towards the end of 274, he started on an expedition against the Persians, halting in Thrace by the way. While on the march between Heracleia and Byzantium, at the beginning of the following year, he was assassinated through the treachery of his secretary Eros, who, in order to escape the discovery of his own irregularities, incited certain officers against the emperor by showing them a forged list, on which their names appeared as marked out for death.

Aurelian well deserved the title of restorer of the empire, and it must be remembered that he lived in an age when severity was absolutely necessary. He was a great soldier and a rigid but just disciplinarian. In more favourable circumstances he would have been a great administrator. He displayed a fondness for pomp and show on public occasions; he was the first Roman emperor to wear the diadem, and assumed the title of Lord and God on medals.

The chief authority for the events of Aurelian's reign is his life by Vopiscus, one of the writers of the "Augustan History"; it is founded on Greek memoirs and certain journals deposited in the Ulpian library at Rome. See L. Homo, *Le Règne de l'empereur Aurélien* (1904), and Groag's art. in Pauly-Wissowa, *Realencyclopädie*, v. 1347 foll.

AURELIANUS, CAELIUS, a physician of Sicca in Numidia, who probably flourished in the 5th century A.D., although some place him two or even three centuries earlier. In favour of the later date is the nature of his Latin, which shows a strong tendency to the Romance, and the similarity of his language to that of Cassius Felix, also an African medical writer, who about 450 wrote a short treatise, chiefly based on Galen. We possess a translation by Aurelianus of two works of Soranus of Ephesus (2nd century), the chief of the "methodist" school of medicine, on chronic and acute maladies—*Tardae* or *Chronicae Passiones*, in five, and *Celeres* or *Acutae Passiones* in three books. The translation, which is especially valuable since the original has been lost, shows that Soranus possessed considerable practical skill in the diagnosis of ordinary and even of exceptional diseases. It is also important as containing numerous references to the methods of earlier medical authorities. We also possess considerable fragments of his *Medicinales Responsiones*, also adapted from Soranus, a general treatise on medicine in the form of question and answer; it deals with rules of health (*salutaria praecepta*) and the pathology of internal diseases (ed. Rose, *Anecdota Graeca et Latina*, ii., 1870). Where it is possible to compare Aurelianus's translation with the original—as in a fragment of his Gynaecia with Soranus's *Περὶ γυναικείων Παθῶν*—it is found that it is literal, but abridged. There is apparently no MS. of the treatises in existence. (Editions: Amman, 1709; Haller, 1774.)

AURELLE DE PALADINES, LOUIS JEAN BAPTISTE D' (1804–1877), French general, was born at Malzieu, Lozère, on the 9th of January 1804. He was educated at St Cyr, and entered the army as sub-lieutenant of foot in 1824. He served with distinction in Algeria between 1841 and 1848, becoming lieut.-colonel and an officer of the Legion of Honour; took part in the Roman campaigns of 1848 and 1849, and was made colonel. He served as general of brigade throughout the Crimean War of 1854–56, being promoted general of division and commander of the Legion of Honour. During the campaign in Lombardy in 1859 he commanded at Marseilles, and superintended the despatch of men and stores to the seat of war, and for his services he was made a grand officer of the Legion of Honour. Placed on the reserve list in 1869, he was recalled to the Marseilles command on the outbreak of the Franco-German War of 1870–71. After the first capture of Orleans by the Germans, he was appointed by the Government of National Defence, in November 1870, to the command of the Army of the Loire. He was at first very successful against von der Tann-Rathsamhausen, winning the battle of Coulmiers and compelling the Germans to evacuate Orleans, but the capitulation of Metz had set free additional German troops to oppose him, and, after his defeat at Beaune la Rolande and subsequent unsuccessful fighting near Orleans, resulting in its recapture by the Germans in December, Aurelle retreated into the Sologne and was superseded. After the armistice he was elected to the National Assembly by the departments both of Allier and Gironde. He sat for Allier and was one of the fifteen officers chosen to assist in the peace negotiations. He was decorated with the grand cross of the Legion of Honour, and was given the command at Bordeaux, but retired in 1872. Elected a life senator in 1875, he supported the monarchical majority of 1876. He died at Versailles on the 17th of December 1877. He was the author of *La Première Armée de la Loire*, published in 1872.

AUREOLA, AUREOLE (diminutive of Lat. *aura*, air), the radiance of luminous cloud which, in paintings of sacred personages, is represented as surrounding the whole figure. In the earliest periods of Christian art this splendour was confined to the figures of the persons of the Godhead, but it was afterwards extended to the Virgin Mary and to several of the saints. The aureola, when enveloping the whole body, is generally oval or elliptical in form, but is occasionally circular or quatrefoil. When it is merely a luminous disk round the head, it is called specifically a *nimbus*, while the combination of nimbus and aureole is called a *glory*. The strict distinction between nimbus and aureole is not commonly maintained, and the latter term is most frequently used to denote the radiance round the heads of saints, angels or persons of the Godhead. The *nimbus* in Christian art appeared first in the 5th century, but practically the same device was known still earlier, though its history is obscure, in non-Christian art. Thus (though earlier Indian and Bactrian coins do not show it) it is found with the gods on some of the coins of the Indian kings Kanishka, Huvishka and Vasudeva, 58 B.C. to A.D. 41 (Gardner's *Cat. of Coins of Greek and Scythic Kings of Bactria and India*, Brit. Mus. 1886, plates 26-29). And its use has been traced through the Egyptians to the Greeks and Romans, representations of Trajan (arch of Constantine) and Antoninus Pius (reverse of a medal) being found with it. In the circular form it constitutes a natural and even primitive use of the idea of a crown, modified by an equally simple idea of the emanation of light from the head of a superior being, or by the meteorological phenomenon of a halo. The probability is that all later associations with the symbol refer back to an early astrological origin (cf. MITHRAS), the person so glorified being identified with the sun and represented in the sun's image; so the aureole is the *Hvarenō* of Mazdaism. From this early astrological use the form of "glory" or "nimbus" has been adapted or inherited under new beliefs.

AURICH, a town of Germany, in the Prussian province of Hanover, chief town of the district of East Friesland, on the Ems-Jade canal, 18 m. N.W. from Emden by rail. Pop. (1900) 6013. It is built in the Dutch style, and lies in a sandy but fertile plain, surrounded by pleasant promenades which have taken the place of the old fortifications. It has a palace, formerly the residence of the counts of East Friesland and now used as government offices, a Roman Catholic and two Protestant churches, a gymnasium, and four libraries. There are breweries and small manufactories of paper and tobacco. Close by is the *Upstallsboom*, the hill of oath and liberty, where every year at Whitsuntide representatives of the seven Frisian coast lands assembled to deliberate.

See Wiarda, *Bruchstücke zur Geschichte der Stadt Aurich* (Emden, 1835).

AURICLE (from Lat. diminutive of *auris*, ear), the external ear in animals, or an analogous part in plants, &c. From a supposed resemblance to the ear of a dog, the term was applied to the upper cavities of the heart. The adjective "auricular" is more specially used in the phrase "auricular confession" (see CONFESSION), *i.e.* private.

AURICULA (*Primula auricula*), an Alpine plant, which has been an inmate of British gardens for about three hundred years, and is still prized by florists as a favourite spring flower. It loves a cool soil and shady situation. The florists' varieties are grown in rich composts, for the preparation of which numberless receipts have been given; but many of the old nostrums are now exploded, and a more rational treatment has taken their place. Thus Mr Douglas writes (*Hardy Florists' Flowers*):—

> "There is no mystery, as some suppose, about the potting, any more than there is about the potting material. The compost should consist of turfy loam four parts, leaf-mould one part, sharp river or silver sand one part, and a few bits of broken charcoal mixed with it. The pots to be used should be from 3 to 4½ in. in diameter, inside measure; about 1 in. of potsherds should be placed in the bottom of each pot, and over this some fibrous turf, from which the fine particles of earth have been removed. The old soil should be shaken from the roots of the plants to be potted; and before potting cut off, if necessary, a portion of the main root. In potting press the soil rather firmly around the roots."

Auriculas are best grown in a cold frame mounted on legs about 2 ft. from the ground, and provided with hinged sashes. A graduated stage formed of wood battens 6 in. broad, with a rise of 2 in., should be fixed so as to take each one row of pots, with the plants standing at about 15 in. from the glass; the spaces between the shelves should be closed, while the top board of the back and the front should be hinged so as to be let down when desired for ventilation, the sashes, too, being movable for the same purpose, and also to afford facilities for examining and attending to the plants. This frame should face the north from May to October, and south in winter. No protection will be needed except in very severe frosts, when two or three thicknesses of garden mats may be thrown over the glass, and allowed to remain on until the soil is thawed, should it become frozen.

Auriculas may be propagated from seed, which is to be sown as soon as ripe, in July or August, in boxes, kept under cover, and exposed only to the rays of the morning sun. When seed has been saved from the finer sorts, the operation is one of considerable nicety, as it not unfrequently happens that the best seedlings are at first exceedingly weak. They generally flower in the second or third year, a few good sorts being all that can be expected from a large sowing. The established varieties are increased by taking off the offshoots, an operation performed at the time of potting in July or the beginning of August. But some varieties are very shy in producing offsets.

The original of the auricula is a hardy perennial herb, of dwarf habit, bearing dull yellowish blossoms. This and the commoner forms raised from seed, as well as one or two double forms, are interesting hardy border flowers. The choice florists' varieties are divided into five classes:—the *green-edged*, with the margins of the flowers green; the *grey-edged*, with the green margins powdered with meal so as to appear to be coloured grey; the *white-edged*, with the mealy powder so dense as to cover the green; the *selfs*, which have none of the green variegation of margin seen in the foregoing, but are of some distinct colour, as purple, maroon, &c., but have, like the preceding, a white paste surrounding the eye; and the *alpines*, which resemble the selfs in not having any green marginal variegation, but differ in having a yellow centre more or less dense. The individual flowers of the first three groups of florists' auriculas show four distinct circles:—first the eye or tube, which should have the stamens lying in it, but sometimes has the pin-headed stigma instead, which is a defect; second, the paste or circle of pure white surrounding the eye; third, the body colour, a circle of some dark tint, as maroon or violet, which feathers out more or less towards the edge, but is the more perfect the less it is so feathered, and is quite faulty if it breaks through to the outer circle; fourth, the margin, which is green or grey or white. These circles should be about equal in width and clearly defined, and the nearer they are to this standard the more perfect is the flower. In the group of selfs the conditions are the same, except that there is no margin, and consequently the body colour, which should be uniform in tone, extends to the edge. In the alpines there should be no paste or white surrounding the eye, but this space should be either golden-yellow or creamy-yellow, which makes two subdivisions in this group; and the body colour is more or less distinctly shaded, the edges being of a paler hue. There is besides a group of laced alpines, in which a distinct and regular border of colour surrounds each of the marginal lobes.

The following is a selection of the best varieties cultivated in 1909:—

Green-edged.—Abbé Liszt, Abraham Barker, Shirley Hibberd, Prince Charming, Mrs Henwood.

Grey-edged.—Amy Robsart, George Lightbody, Marmion, Olympus, George Rudd, Richard Headly.

White-edged.—Acme, Conservative, Heather Bell, Mrs Dodson, Rachel, Smiling Beauty.

Selfs.—Andrew Miller, Gerald, Mikado, Mrs Phillips, Mrs Potts, Harrison Weir.

Alpines.—Argus, Dean Hole, Duke of York, Firefly, Flora McIvor, Mrs Douglas, Mrs Markham, Perfection, Phyllis, Rosy Morn, The Bride, Teviotdale.

AURIFABER (the latinized form of Goldschmidt), a surname borne by three prominent men of the Reformation period in Germany.

1. ANDREAS (1514–1559) was a physician of some repute, but through his influence with Albert of Brandenburg, last grand-master of the Teutonic order, and first Protestant duke of Prussia, became an outstanding figure in the controversy associated with Andreas Osiander (*q.v.*) whose daughter he had married.

2. JOANNES (Vratislaviensis; 1517–1568), the younger brother of Andreas, was born at Breslau on the 30th of January 1517, and educated at Wittenberg, where he formed a close and lasting friendship with Melanchthon. After graduating in 1538 he spent twelve years as *docent* at the university, and having then received his doctorate of divinity, was appointed professor of divinity and pastor of the church of St Nicholas at Rostock. He distinguished himself by his conciliatory disposition, earned the special confidence of Duke John Albert of Mecklenburg, and took a leading part in 1552 in drawing up the constitution of the Mecklenburg church. He also settled some religious disputes in the town of Lübeck. In 1553 Duke Albert of Prussia, anxious to heal the differences in the Prussian church caused by the discussion of Osiander's doctrines, invited him to Königsberg, and in the following year appointed him professor of divinity and president of the Samland diocese. Joannes, however, found it impossible to conciliate all parties, and in 1565 returned to Breslau, where, in 1567, he became pastor in the church of St Elizabeth and inspector of the Lutheran churches and schools. He died on the 19th of October 1568.

3. JOANNES (Vinariensis; 1519–1575), was born in the county of Mansfeldt in 1519. He studied at Wittenberg where he heard the lectures of Luther, and afterwards became tutor to Count Mansfeldt. In the war of 1544–45 he accompanied the army as field-preacher, and then lived with Luther as his *famulus* or private secretary, being present at his death in 1546. In the following year he spent six months in prison with John Frederick, elector of Saxony, who had been captured by the emperor, Charles V. He held for some years the office of court-preacher at Weimar, but owing to theological disputes was compelled to resign this office in 1561. In 1566 he was appointed to the Lutheran church at Erfurt, and there remained till his death

in November 1575. Besides taking a share in the first collected or Jena edition of Luther's works (1556), Aurifaber sought out and published at Eisleben in 1564–1565 several writings not included in that edition. He also published Luther's *Letters* (1556, 1565), and *Table Talk* (1566). This popular work, which has given him most of his fame, is unfortunately but a second or third hand compilation.

See G. Kawerau's art. in Herzog-Hauck's *Realencyk. für prot. Theologie*, and the literature there cited.

AURIGA (the "charioteer" or "waggoner"), in astronomy, a constellation of the northern hemisphere, found in the catalogues of Eudoxus (4th century B.C.) and Aratus (3rd century B.C.). It was symbolized by the Greeks as an old man in a more or less sitting posture, with a goat and her kids in his left hand, and a bridle in his right. The ancient Greeks associated this constellation with many myths. Some assume it to be Erichthonius, son of Athena and Hephaestus, who was translated to the skies by Zeus on account of his invention of chariots or coaches. Others assume it to be Myrtilus, a son of Hermes and Clytie, and charioteer to Oenomaus, who was placed in the heavens by Hermes. Another myth has it to be Olenus, a son of Hephaestus, and father of Aega and Helice, two nymphs who nursed Zeus. Ptolemy catalogued fourteen stars, Tycho Brahe twenty-seven, and Hevelius forty in this constellation. Interesting stars are: α *Aurigae* or *Capella* (the goat), one of the brightest stars in the heavens, determined by Newall and Campbell to be a spectroscopic binary; β *Aurigae*, a star of the second magnitude also a spectroscopic binary; ε *Aurigae*, an irregularly variable star; and *Nova Aurigae*, a "new" star discovered by Anderson in 1892, and afterwards found on a photographic plate exposed at Harvard in December 1891. Several fine star clusters also appear in this constellation.

AURILLAC, a town of central France, capital of the department of Cantal, 140 m. N.N.E. of Toulouse, on the Orléans railway between Figeac and Murat. Pop. (1906) 14,097. Aurillac stands on the right bank of the Jordanne, and is dominated from the north-west by the Roc Castanet, crowned by the castle of St Etienne, the keep of which dates from the 11th century. Its streets are narrow and uninteresting, with the exception of one which contains, among other old houses, that known as the Maison des Consuls, a Gothic building of the 16th century, decorated with sculptured stone-work. Aurillac owes its origin to an abbey founded in the 9th century by St Géraud, and the abbey-church, rebuilt in the 17th century in the Gothic style, is the chief building in the town. The former college, which dates from the 17th century, is now occupied by a museum and a library. There is a statue of Pope Silvester II., born near Aurillac in 930 and educated in the abbey, which soon afterwards became one of the most famous schools of France. Aurillac is the seat of a prefect, and its public institutions include tribunals of first instance and of commerce, a chamber of commerce, a lycée, training-colleges and a branch of the Bank of France. The chief manufactures are wooden shoes and umbrellas, and there is trade in cheese and in the cattle and horses reared in the neighbourhood.

AURISPA, GIOVANNI (*c.* 1370–1459), one of the learned Italians of the 15th century, who did so much to promote the revival of the study of Greek in Italy, was born at Noto in Sicily. In 1418 he visited Constantinople, where he remained for some years, perfecting his knowledge of Greek and searching for ancient MSS. His efforts were rewarded by the acquisition of some 250 MSS., with which he returned to Venice. Here he is said to have been obliged to pawn his treasures for 50 gold florins to provide for his immediate wants. Cosimo de' Medici, hearing of his embarrassment, redeemed the MSS. and summoned the owner to Florence. In 1438, at the council of Basel, Aurispa attracted the attention of Pope Eugenius IV., who made him his secretary; he held a similar position under Nicholas V., who presented him to two lucrative abbacies. He died at Ferrara. Considering his long life and reputation Aurispa produced little: Latin translations of the commentary of Hierocles on the golden verses of Pythagoras (1474) and of *Philisci Consolatoria ad Ciceronem* from Dio Cassius (not published till 1510); and, according to Gesner, a translation of the works of Archimedes. Aurispa's reputation rests upon the extensive collection of MSS. copied and distributed by him, and his persistent efforts to revive and promote the study of ancient literature.

AUROCHS (from Lat. *urus*, the wild ox, and "ox") or URUS, the name of the extinct wild ox of Europe (*Bos taurus primigenius*), which after the disappearance of that animal became transferred to the bison. According to the German Freiherr von Herberstein (1486–1566), in his *Moscovia*, of which an Italian translation was published at Venice in 1550, the aurochs survived in Poland (and probably also in Hungary) during the latter middle ages. In this work appear woodcuts—rude but characteristic and unmistakable—of two distinct types of European wild cattle; one the aurochs, or ur, and the other the bison. As Herberstein had travelled in Poland, it is probable that he had seen both species alive, and the drawings were most likely executed under his own direction. It has indeed been suggested that the figure of the aurochs was taken from a domesticated ox, but this is a mistaken idea. Not the least important feature of the work of Herberstein is the application of the name aurochs to the wild ox, as distinct from the bison. The locality where aurochs survived in Herberstein's time was the forest of Jaktozowka, situated about 55 kilometres west-south-west of Warsaw, in the provinces of Bolemow and Sochaczew. From other evidence it appears that the last aurochs was killed in this forest in the year 1627. Herberstein describes the colour of the aurochs as black, and this is confirmed by another old picture of the animal. Gesner's figure of the aurochs, or as he calls it "thur," given in the *Icones* to his *History of Animals*, was probably adapted from Herberstein's. It may be added that an ancient gold goblet depicts the hunting and taming of the wild aurochs.

As a wild animal, then, the aurochs appears to have ceased to exist in the early part of the 17th century; but as a species it survives, for the majority of the domesticated breeds of European cattle are its descendants, all diminished in point of size, and some departing more widely from the original type than others. Aurochs' calves were in all probability captured by the early inhabitants of Britain and the continent and tamed; and from these, with perhaps an occasional blending of wild blood, are descended most European breeds of cattle.

Much misconception, however, has prevailed as to which breeds are the nearest to the ancestral wild stock. At one time this position was supposed to be occupied by the white half-wild cattle of Chillingham and other British parks. These white breeds are, however, partial albinos; and such semi-albinos are always the result of domestication and could not have arisen in the wild state. Moreover, park-cattle display evidence of their descent from dark-coloured breeds by the retention of red or black ears and brown or black muzzles. In the Chillingham cattle the ears are generally red, although sometimes black, and the muzzle is brown; while in the breed at Cadzow Chase, Lanarkshire, both ears and muzzle are black, and there are usually flecks of black on the head and forequarters. It is further significant that, in the Chillingham herd, dark-coloured calves, which are weeded out, make their appearance from time to time.

A very ancient British breed is the black Pembroke; and when this breed tends to albinism, the ears and muzzle, and more rarely the fetlocks, remain completely black, or very dark grey, although the colour elsewhere is whitish, more or less flecked and blotched with pale grey. In the shape and curvature of the horns, which at first incline outwards and forwards, and then bend somewhat upwards and inwards, this breed of cattle resembles the aurochs and the (by comparison) dwarfed park-breeds. Moreover, in both the Pembroke and the park-breeds the horns are light-coloured with black tips.

Evidence as to the affinity between these breeds is afforded by the fact that a breed of cattle very similar to that at Chillingham was found in Wales in the 10th century; these cattle being white with red ears. Individuals of this race survived till at least 1850 in Pembroke, where they were at one time kept perfectly pure as a part of the regular farm-stock. Until a period comparatively recent, they were relatively numerous, and were driven in droves to the pasturages of the Severn and the neighbouring markets. Their whole essential characters are the same as those of the cattle at Chillingham. Their horns are white, tipped with black, and extended and turned upwards in the manner distinctive of the park-breed. The inside of the ears and the muzzle are black, and the feet are black to the fetlock joint. The skin is unctuous and of a deep-toned yellow colour. Individuals of the race were sometimes born entirely black, and then were not to be distinguished from the common Pembroke cattle of the mountains.

It is thus evident that park-cattle are an albino offshoot from the ancient Pembroke black breed, which, from their soft and well-oiled skins, are evidently natives of a humid climate, such as that of the forests in which dwelt the wild aurochs. This disposes of a theory that they are descendants of a white sacrificial breed introduced into Britain by the ancient Romans.

The Pembroke and park-cattle are, however, by no means the sole descendants of the aurochs, the black Spanish fighting-bulls claiming a similar descent. This breed shows a light-coloured line along the spine, which was characteristic of the aurochs. It has also been suggested that the Swiss Siemental cattle are nearly related to the aurochs. The latter was a gigantic animal, especially during the Pleistocene period; the skulls and limb-bones discovered in the brick-earths and gravels of the Thames valley and many other parts of England having belonged to animals that probably stood six feet at the shoulder. (R. L.*)

AURORA (perhaps through a form *ausosa* from Sansk. *ush*, to burn; the common idea of "brightness" suggests a connexion with *aurum*, gold), the Roman goddess of the dawn, corresponding to the Greek goddess Eos. According to Hesiod (*Theog.* 271) she was the daughter of the Titan Hyperion and Thea (or Euryphassa), and sister of Helios and Selene. By the Titan Astraeus, she was the mother of the winds Zephyrus, Notus and Boreas, of Hesperus and the stars. Homer represents her as rising every morning from the couch of Tithonus (by whom she was the mother of Emathion and Memnon), and drawn out of the east in a chariot by the horses Lampus and Phaëthon to carry light to gods and men (*Odyssey*, xxiii. 253); in Homer, she abandons her course when the sun is fully risen (or at the latest at mid-day, *Iliad*, ix. 66), but in later literature she accompanies the sun all day and thus becomes the goddess of the daylight. From the roseate shafts of light which herald the dawn, she bears in Homer the epithet "rosy-fingered." The conception of a dawn-goddess is common in primitive religions, especially in the Vedic mythology, where the deity Usás is closely parallel to the Greco-Roman; see Paul Regnaud, *Le Rig-Vêda* in *Annales du musée Guimet*, vol. i. c. 6 (Paris, 1892). She is also represented as the lover of the hunter Orion (*Odyssey*, v. 121), the representative of the constellation that disappears at the flush of dawn, and the youthful hunter Cephalus, by whom she was the mother of Phaëthon (Apollodorus iii. 14. 3). In works of art, Eos is represented as a young woman, fully clothed, walking fast with a youth in her arms; or rising from the sea in a chariot drawn by winged horses; sometimes, as the goddess who dispenses the dews of the morning, she has a pitcher in each hand. In the fresco-painting by Guido Reni in the Rospigliosi palace at Rome, Aurora is represented strewing flowers before the chariot of the sun. Metaphorically the word Aurora was used (*e.g.* Virg. *Aen.* viii. 686, vii. 606) for the East generally.

AURORA, a city of Kane county, Illinois, U.S.A., in the N.E. part of the state, on the Fox river, about 37 m. W. of Chicago. Pop. (1890) 19,688; (1900) 24,147, of whom 5075 were foreign-born; (1910) 29,807. Aurora is served by the Chicago, Burlington & Quincy, the Chicago & North-Western, the Elgin, Joliet & Eastern, and the Illinois, Iowa and Minnesota railways, and is connected with Chicago by an electric line. The city has a soldiers' memorial hall, erected by popular subscription, and a Carnegie library. Aurora is an important manufacturing centre; among its manufactures are railway cars—the shops of the Chicago, Burlington & Quincy railway being here—flour and cotton, carriages, hardware specialties, corsets, suspenders, stoves and silver-plate. In 1905 the city's factory products were valued at $7,329,028, an increase of 30% in 5 years. The municipality owns and operates the water-works and electric-lighting plants. The first settlement in the vicinity of Aurora was made in 1834. In 1845 the village of East Aurora was incorporated, and West Aurora was incorporated nine years later. In 1853 the two villages were united under a city charter, which was superseded by a revised charter in 1887.

AURORA, a city of Lawrence county, Missouri, U.S.A., 275 m. S.W. of St Louis, on the St Louis & San Francisco, and the St Louis, Iron Mountain & Southern railways. Pop. (1890) 3482; (1900) 6191; (1910) 4148. It is situated near a lead and zinc mining region, where surface lead was discovered in 1873 and systematic mining began in 1887; among the cities of the state it is second to Joplin in mineral importance, and has large ironworks and flour-mills; mining machinery also is manufactured. Farming and fruit-growing are carried on in the surrounding country, and Aurora is the place from which the products are shipped. Aurora was platted in 1870 and was chartered as a city in 1886.

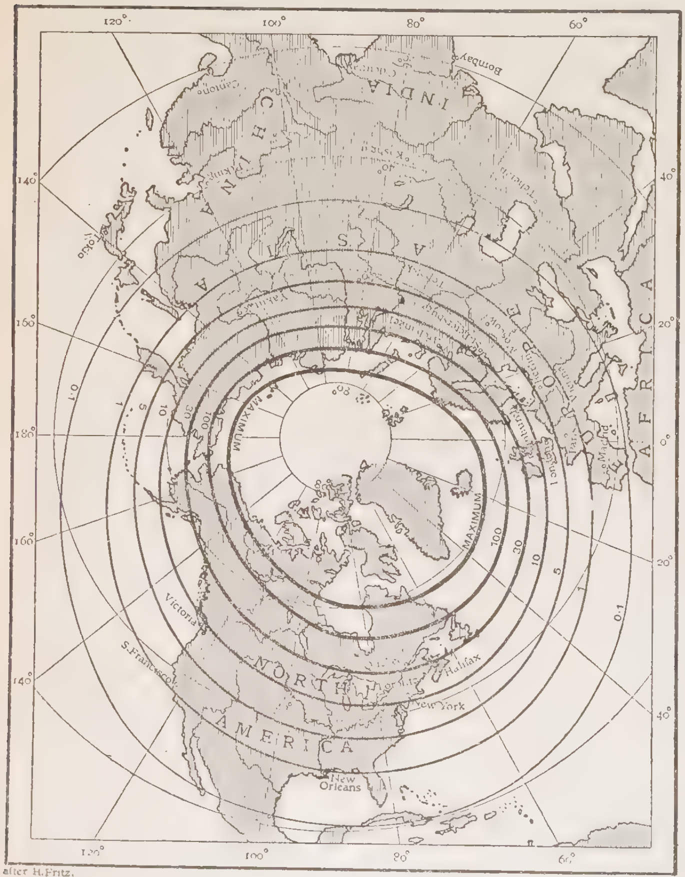
AURORA, a village of Cayuga county, New York, U.S.A., on Cayuga Lake, 16 m. S.W. of Auburn. Pop. (1905) 623; (1910) 493. It is served by the Lehigh Valley railway. Aurora is a beautiful place and a popular summer resort, but it is best known as the seat of Wells College, a non-sectarian college for women, founded in 1868 by Henry Wells (1805–1878), of the Wells Fargo Express Company, and liberally endowed by Edwin B. Morgan (1806–1881), also connected with the same company, and by others. At Aurora are also the Somes school (a preparatory school for boys), founded in 1798 and until 1904 known as the Cayuga Lake Academy, and the Wells school (a preparatory school for girls). The village has a public library. Aurora was settled in 1789 chiefly by residents of New England, and was incorporated in 1905.

AURORA POLARIS (*Aurora Borealis* and *Australis*, Polar Light, Northern Lights), a natural phenomenon which occurs in many forms, some of great beauty.

1. *Forms.*—Various schemes of classification have been proposed, but none has met with universal acceptance; the following are at least the principal types. (1) *Arcs.* These most commonly resemble segments of circles, but are not infrequently elliptical or irregular in outline. The ends of arcs frequently extend to the horizon, but often one or both ends stop short of this. Several arcs may be visible at the same time. Usually the under or concave edge of the arc is the more clearly defined, and adjacent to it the sky often seems darker than elsewhere. It is rather a disputed point whether this dark segment—through which starlight has been seen to pass—represents a real atmospheric condition or is merely a contrast effect. (2) *Bands.* These may be nearly straight and regular in outline, as if broken portions of arcs; frequently they are ribbon-like serpentine forms showing numerous sinuosities. (3) *Rays.* Frequently an arc or band is visibly composed of innumerable short rays separated by distinctly less luminous intervals. These rays are more or less perpendicular to the arc or band; sometimes they are very approximately parallel to one another, on other occasions they converge towards a point. Longer rays often show an independent existence. Not infrequently rays extend from the upper edge of an arc towards the zenith. Combinations of rays sometimes resemble a luminous fan, or a series of fans, or part of a hollow luminous cylinder. Rays often alter suddenly in length, seeming to stretch down towards the horizon or mount towards the zenith. This accounts for the description of aurora as "Merry Dancers." (4) *Curtains or Draperies.* This form is rare except in Arctic regions, where it is sometimes fairly frequent. It is one of the most imposing forms. As a rule the higher portion is visibly made up of rays, the light tending to become more continuous towards the lower edge; the combination suggests a connected whole, like a curtain whose alternate portions are in light and shade. The curtain often shows several conspicuous folds, and the lower

edge often resembles frilled drapery. At several stations in Greenland auroral curtains have been observed when passing right overhead to narrow to a thin luminous streak, exactly as a vertical sheet of light would seem to do to one passing underneath it. (5) *Corona.* A fully developed corona is perhaps the finest form of aurora. As the name implies, there is a sort of crown of light surrounding a comparatively or wholly dark centre. Farther from the centre the ray structure is usually prominent. The rays may lie very close together, or may be widely separated from one another. (6) *Patches.* During some displays, auroral light appears in irregular areas or patches, which sometimes bear a very close resemblance to illuminated detached clouds. (7) *Diffused Aurora.* Sometimes a large part of the sky shows a diffuse illumination, which, though brighter in some parts than others, possesses no definite outlines. How far the different forms indicate real difference in the nature of the phenomenon, and how far they are determined by the position of the observer, it is difficult to say. Not infrequently several different forms are visible at the same time.

2. *Isochasms.*—Aurora is seldom observed in low latitudes. In the southern hemisphere there is comparatively little inhabited land in high latitudes and observational data are few; thus little is known as to how the frequency varies with latitude and longitude. Even in the northern hemisphere there are large areas in the Arctic about which little is known. H. Fritz (2) has, however, drawn a series of curves which are believed to give a good general idea of the relative frequency of aurora throughout the northern hemisphere. Fritz' curves, shown in the illustration, are termed isochasms, from the Greek word employed by Aristotle to denote aurora. Points on the same curve are supposed to have the same average number of auroras in the year, and this average number is shown adjacent to the curve. Starting from the equator and travelling northwards we find in the extreme south of Spain an average of only one aurora in ten years. In the north of France the average rises to five a year; in the north of Ireland to thirty a year; a little to the north of the Shetlands to one hundred a year. Between the Shetlands and Iceland we cross the curve of maximum frequency, and farther north the frequency diminishes. The curve of maximum frequency forms a slightly irregular oval, whose centre, the auroral pole, is according to Fritz at about 81° N. lat., 70° W. long. Isochasms reach a good deal farther south in America than in Europe. In other words, auroras are much more numerous in the southern parts of Canada and in the United States than in the same latitudes of Europe.



after H.Fritz.

Emery Walker sc.

3. *Annual Variation.*—Table I. shows the annual variation observed in the frequency of aurora. It has been compiled from several authorities, especially Joseph Lovering (**4**) and Sophus Tromholt (**5**). The monthly figures denote the percentages of the total number seen in the year. The stations are arranged in order of latitude. Individual places are first considered, then a few large areas.

The Godthaab data in Table I. are essentially those given by Prof. A. Paulsen (**6**) as observed by Kleinschmidt in the winters of 1865 to 1882, supplemented by Lovering's data for summer. Starting at the extreme north, we have a simple period with a well-marked maximum at midwinter, and no auroras during several months at midsummer. This applies to Hammerfest, Jakobshavn, Godthaab and the most northern division of Scandinavia. The next division of Scandinavia shows a transition stage. To the south of this in Europe the single maximum at mid-winter is replaced by two maxima, somewhere about the equinoxes.

4. In considering what is the real significance of the great difference apparent in Table I. between higher and middle latitudes, a primary consideration is that aurora is seldom seen until the sun is some degrees below the horizon. There is no reason to suppose that the physical causes whose effects we see as aurora are in existence only when aurora is visible. Until means are devised for detecting aurora during bright sunshine, our knowledge as to the hour at which these causes are most frequently or most powerfully in operation must remain incomplete. But it can hardly be doubted that the differences apparent in Table I. are largely due to the influence of sunlight. In high latitudes for several months in summer it is never dark, and consequently a total absence of visible aurora is practically inevitable. Some idea of this influence can be derived from figures obtained by the Swedish International Expedition of 1882–1883 at Cape Thorsden, Spitsbergen, lat. 78° 28′ N. (**7**). The original gives the relative frequency of aurora for each degree of depression of the sun below the horizon, assuming the effect of twilight to be nil (*i.e.* the relative frequency to be 100) when the depression is 18·5° or more. The following are a selection of the figures:—

Angle of depression . .	4·5°	7·5°	10·5°	12·5°	15·5°.
Relative frequency . .	0·3	9·3	44·9	74·5	95·9.

These figures are not wholly free from uncertainties, arising from true diurnal and annual variations in the frequency, but they give a good general idea of the influence of twilight.

If sunlight and twilight were the sole cause of the apparent annual variation, the frequency would have a simple period, with a maximum at midwinter and a minimum at midsummer. This is what is actually shown by the most northern stations and districts in Table I. When we come, however, below 65° lat. in Europe the frequency near the equinoxes rises above that at midwinter, and we have a distinct double period, with a principal minimum at midsummer and a secondary minimum at midwinter. In southern Europe—where, however, auroras are too few to give smooth results in a limited number of years—in southern Canada, and in the United States, the difference between the winter and summer months is much reduced. Whether there is any real difference between high and mean latitudes in the annual frequency of the causes rendered visible by aurora, it is difficult to say. The Scandinavian data, from the wealth of observations, are probably the most representative, and even in the most northern district of Scandinavia the smallness of the excess of the frequencies in December and January over those in March and October suggests that some influence tending to create maxima at the equinoxes has largely counterbalanced the influence of sunlight and twilight in reducing the frequency at these seasons.

5. *Fourier Analysis.*—With a view to more minute examination, the annual frequency can be expressed in Fourier series, whose terms represent waves, whose periods are 12, 6, 4, 3, &c. months. This has been done by Lovering (**4**) for thirty-five stations. The nature of the results will best be explained by reference to the formula given by Lovering as a mean from all the stations considered, viz.:—

$$8{\cdot}33+3{\cdot}03\sin(30t+100^\circ 52')+2{\cdot}53\sin(60t+309^\circ 5')+0{\cdot}16\sin(90t+213^\circ 31')+0{\cdot}56\sin(120t+162^\circ 45')+0{\cdot}27\sin(150t+32^\circ 38').$$

The total number of auroras in the year is taken as 100, and t denotes the time, in months, that has elapsed since the middle of January

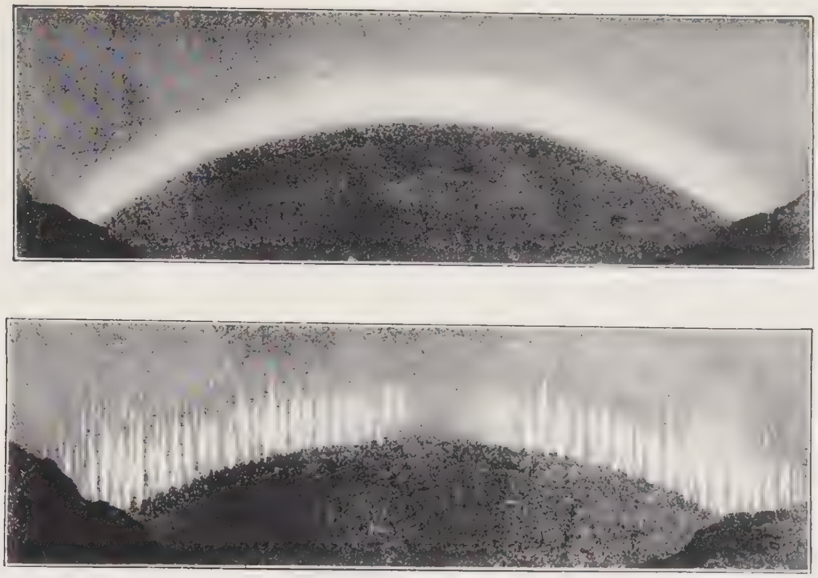


FIG. 1.—TWO TYPES OF AURORAL ARCS.

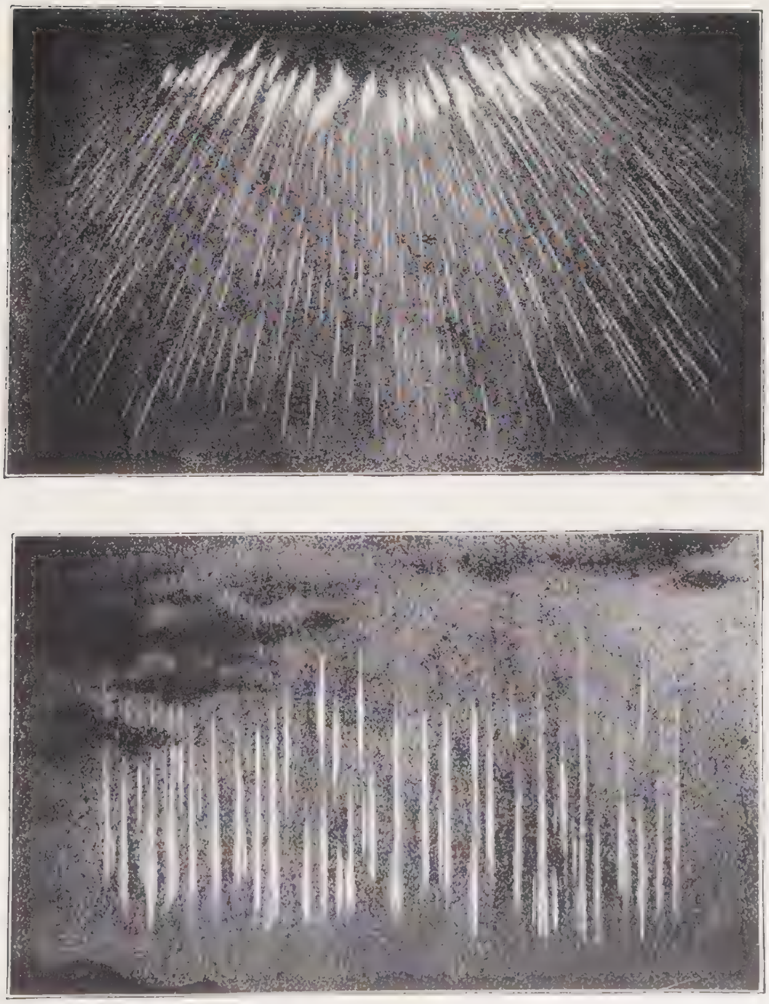


FIG. 2.—TWO TYPES OF AURORAL RAYS.

(From the *Internationale Polarforschung*, 1882–1883, by permission of the *Kaiserlichen Akademie der Wissenschaften*, Vienna.)

AURORA

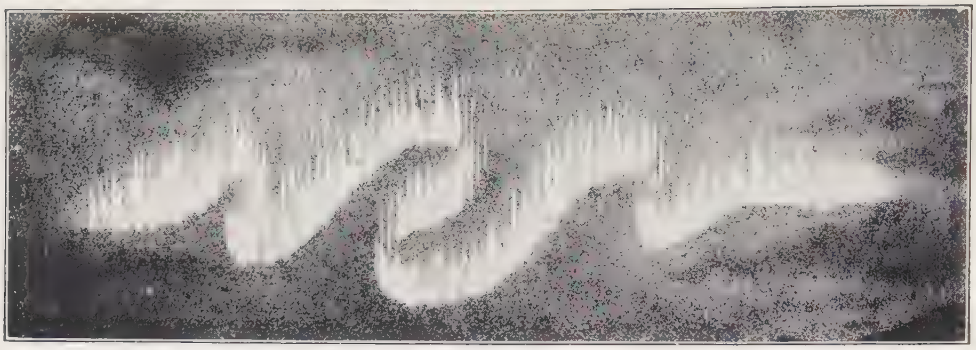


FIG. 3.—AURORAL BANDS.

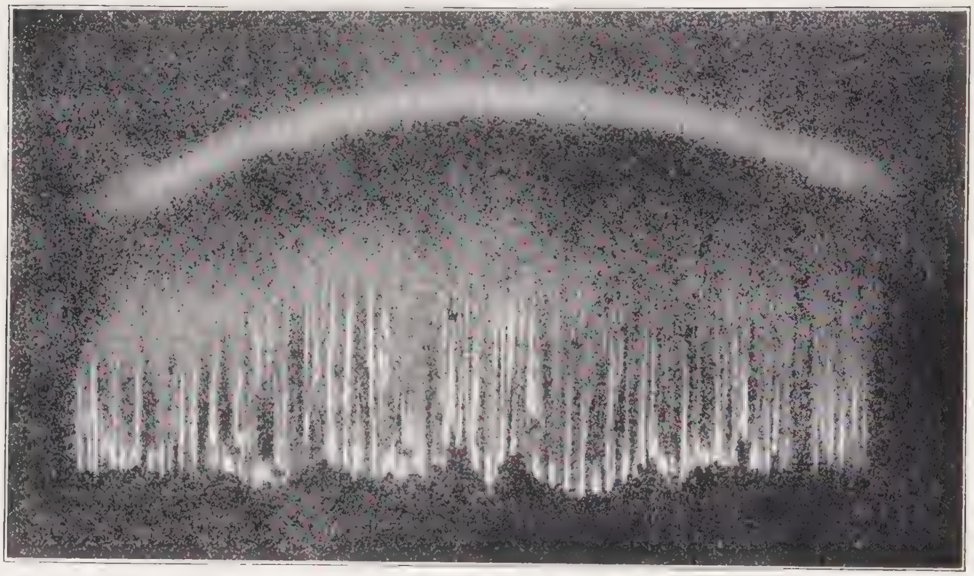


FIG. 4.—AURORAL CURTAIN BELOW AN ARC.

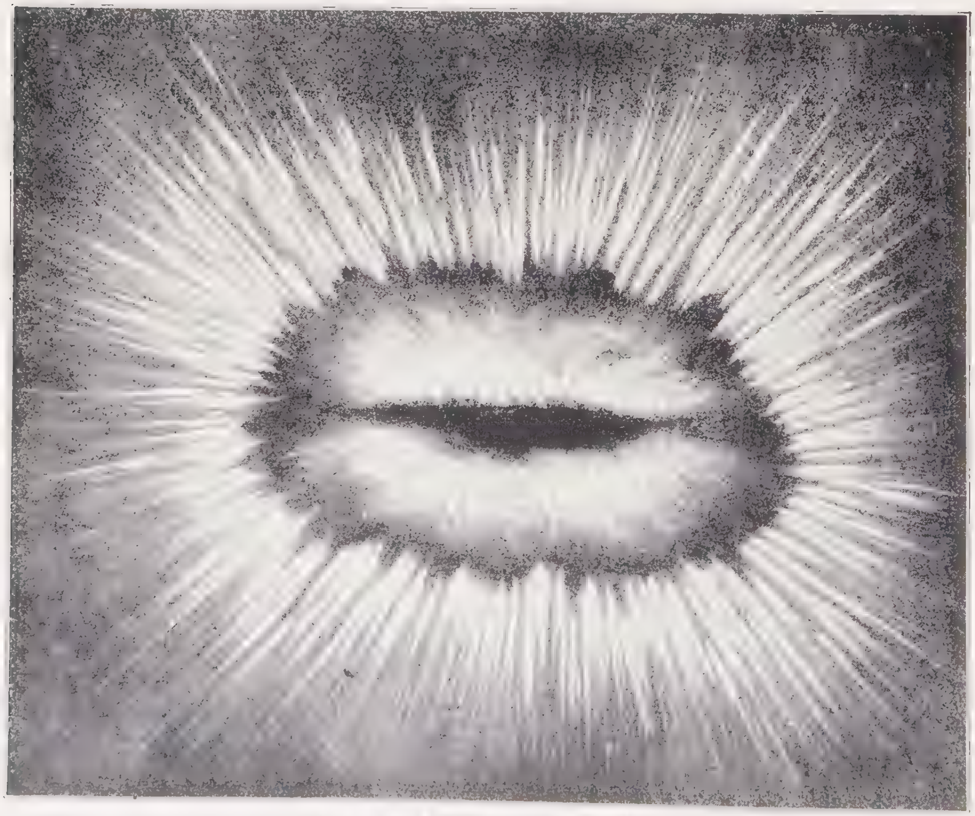


FIG. 5.—AURORAL CORONA.

Table I.—*Annual Frequency (Relative).*

Place.	Latitude.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	°												
Hammerfest	70½	20·9	17·6	8·8	0	0	0	0	0	4·4	9·9	17·6	20·9
Jakobshavn	69	14·6	13·0	9·2	0·5	0	0	0	0	9·2	15·1	18·4	20·0
Godthaab	64	15·5	12·4	9·7	4·9	0	0	0	1·2	8·7	13·3	17·0	17·4
St Petersburg	60	6·5	9·1	16·8	13·8	3·5	1·2	1·4	5·9	13·8	13·1	7·6	7·3
Christiania	60	8·6	11·4	14·0	11·2	0·6	0	0·2	6·5	14·6	12·2	10·3	10·3
Upsala	60	8·4	12·9	14·9	7·4	0·7	0·2	0·4	7·1	12·4	14·3	10·7	10·7
Stockholm	59	7·9	10·0	14·7	16·4	3·8	0·0	0·0	5·6	12·9	11·4	10·0	7·3
Edinburgh	56	9·5	12·6	14·0	9·5	3·4	0·0	1·7	6·0	12·6	13·5	11·8	5·2
Berlin	52½	7·0	10·8	16·4	15·5	11·4	0·6	2·9	2·9	6·5	13·2	8·5	4·1
London	51½	8·6	10·5	10·2	10·7	4·0	1·1	1·9	5·6	14·5	16·9	9·6	6·4
Quebec	47	3·6	14·8	8·3	14·2	4·1	5·9	7·7	5·9	11·2	12·4	7·7	4·1
Toronto	43½	5·4	9·5	8·7	11·8	9·0	6·2	8·0	6·4	8·5	11·1	8·7	6·7
Cambridge, Mass.	42½	5·1	8·2	11·8	10·2	6·4	5·1	10·3	8·5	13·3	9·2	6·8	5·1
New Haven, Conn.	41½	7·7	7·3	8·9	8·2	7·6	5·7	8·9	8·1	11·9	7·6	10·6	7·5
Scandinavia	N. of 68½°	16·4	13·8	14·8	1·6	0·0	0·0	0·0	0·4	7·8	15·1	14·4	15·7
,,	68½° to 65°	15·3	14·6	13·7	2·9	0·0	0·0	0·0	1·1	9·7	14·6	14·0	14·1
,,	65° to 61½°	13·2	12·3	14·5	5·4	0·2	0·0	0·0	2·8	13·1	14·2	12·8	11·5
,,	61½° to 58°	9·5	11·2	13·5	10·9	1·3	0·1	0·4	5·7	13·6	13·8	10·4	9·6
,,	S. of 58°	8·2	11·9	12·6	13·3	1·5	0·1	0·6	4·9	14·9	13·5	10·3	8·2
New York State	45° to 40½°	6·3	7·4	9·1	11·0	7·4	6·6	8·8	10·4	11·7	9·7	6·2	5·4

Putting $t=0, 1$, &c., in succession, we get the percentages of the total number of auroras which occur in January, February, and so on. The first periodic term has a period of twelve, the second of six months, and similarly for the others. The first periodic term is largest when $t\times30^\circ+100^\circ\ 52'=450^\circ$. This makes $t=11\cdot6$ months after the middle of January, otherwise the 3rd of January, approximately. The 6-month term has the earliest of its two equal maxima about the 26th of March. These two are much the most important of the periodic terms. The angles 100° 52′, 309° 5′, &c., are known as the phase angles of the respective periodic terms, while 3·03, 2·53, &c., are the corresponding amplitudes. Table II. gives a selection of Lovering's results. The stations are arranged according to latitude.

Table II.

Station.	Annual Term.		6-Month Term.		4-Month Term.	
	Amp.	Phase.	Amp.	Phase.	Amp.	Phase.
		°		°		°
Jakobshavn	10·40	123	1·13	206	1·41	333
Godthaab	8·21	111	1·54	316	0·64	335
St Petersburg	2·81	96	5·99	309	0·57	208
Christiania	4·83	116	4·99	317	0·76	189
Upsala	5·41	119	4·57	322	0·86	296
Stockholm	3·68	91	5·80	303	1·31	180
Makerstown (Scotland)	5·79	102	4·47	310	2·00	342
Great Britain	3·87	126	4·24	287	0·40	73
Toronto	0·18	12	2·13	260	0·52	305
Cambridge, Mass.	1·02	262	2·84	339	1·28	253
New Haven, Conn.	0·99	183	1·02	313	0·57	197
New York State.	1·34	264	2·29	325	0·54	157

Speaking generally, the annual term diminishes in importance as we travel south. North of 55° in Europe its phase angle seems fairly constant, not differing very much from the value 110° in Lovering's general formula. The 6-month term is small, in the two most northern stations, but south of 60° N. lat. it is on the whole the most important term. Excluding Jakobshavn, the phase angles in the 6-month term vary wonderfully little, and approach the value 309° in Lovering's general formula. North of lat. 50° the 4-month term is, as a rule, comparatively unimportant, but in the American stations its relative importance is increased. The phase angle, however, varies so much as to suggest that the term mainly represents local causes or observational uncertainties. Lovering's general formula suggests that the 4-month term is really less important than the 3-month term, but he gives no data for the latter at individual stations.

6. Sunlight is not the only disturbing cause in estimates of auroral frequency. An idea of the disturbing influence of cloud may be derived from some interesting results from the Cape Thorsden (7) observations. These show how the frequency of visible auroras diminished as cloud increased from 0 (sky quite clear) to 10 (sky wholly overcast).

Grouping the results, we have:

Amount of cloud	0	1 to 3	4 to 6	7 to 9	10
Relative frequency	100	82	57	46	8

Out of a total of 1714 hours during which the sky was wholly overcast the Swedish expedition saw auroras on 17, occurring on 14 separate days, whereas 226 hours of aurora would have occurred out of an equal number of hours with the sky quite clear. The figures being based on only one season's observations are somewhat irregular. Smoothing them, Carlheim-Gyllensköld gives $f=100'-7\cdot3c$ as the most probable linear relation between c, the amount of cloud, and f, the frequency, assuming the latter to be 100 when there is no cloud.

7. *Diurnal Variation.*—The apparent daily period at most stations is largely determined by the influence of daylight on the visibility. It is only during winter and in high latitudes that we can hope to ascertain anything directly as to the real diurnal variation of the causes whose influence is visible at night as aurora. Table III. gives particulars of the number of occasions when aurora was seen at each hour of the twenty-four during three expeditions in high latitudes when a special outlook was kept.

The data under A refer to Cape Thorsden (78° 28′ N. lat., 15° 42′ E. long.); those under B to Jan Mayen (8) (71° 0′ N. lat., 8° 28′ W. long.), both for the winter of 1882–1883. The data under C are given by H. Arctowski (9) for the "Belgica" Expedition in 1898. They may be regarded as applying approximately to the mean position of the "Belgica," or 70½° S. lat., 86½° W. long. The method of counting frequencies was fairly alike, at least in the case of A and B, but in comparing the different stations the data should be regarded as relative rather than absolute. The Jan Mayen data refer really to Göttingen mean time, but this was only twenty-three minutes late on local time. In calculating the percentages of forenoon and afternoon occurrences half the entries under noon and midnight were assigned to each half of the day. Even at Cape Thorsden, the sun at midwinter is only 11° below the horizon at noon, and its effect on the visibility is thus not wholly negligible. The influence of daylight is presumably the principal cause of the difference between the phenomena during November, December and January at Cape Thorsden and Jan Mayen, for in the equinoctial months the results from these two stations are closely similar. Whilst daylight is the principal cause of the diurnal inequality, it is not the only cause, otherwise there would be as many auroras in the morning (forenoon) as in the evening (afternoon). The number seen in the evening is, however, according to Table III., considerably in excess at all seasons. Taking the whole winter, the percentage seen in the evening was the same for the "Belgica" as for Jan Mayen, *i.e.* for practically the same latitudes South and North. At Cape Thorsden from November to January there seems a distinct double period, with minima near noon and midnight. The other months at Cape Thorsden show a single maximum and minimum, the former before midnight.

The same phenomenon appears at Jan Mayen especially in November, December and January, and it is the normal state of matters in temperate latitudes, where the frequency is usually greatest between 8 and 10 P.M. An excess of evening over morning occurrences is also the rule, and it is not infrequently more pronounced than in Table III. Thus at Tasiusak (65° 37′ N. lat., 37° 33′ W. long.) the Danish Arctic Expedition (**10**) of 1904 found seventy-five out of every hundred occurrences to take place before midnight.

TABLE III.—*Diurnal Variation.*

Hour.	Dec.		Nov. and Jan.		Feb., March, Sept. and Oct.		Sept. to March (N. Lat.). March to Sept. (S. Lat.).		
	A	B	A	B	A	B	A	B	C
1	14	7	14	8	27	23	55	38	24
2	10	6	15	6	20	25	45	37	23
3	9	4	15	5	15	21	39	30	10
4	10	5	21	7	14	18	45	30	4
5	13	5	20	3	10	10	43	18	2
6	11	3	15	4	2	3	28	10	1
7	9	2	13	3	1	2	23	7	0
8	5	1	6	1	0	0	11	2	0
9	7	2	9	0	0	0	16	2	0
10	10	0	5	0	0	0	15	0	0
11	9	0	6	0	0	0	15	0	0
Noon	10	0	4	0	0	0	14	0	0
1	10	0	6	0	0	0	16	0	0
2	14	0	10	0	0	0	24	0	0
3	18	1	20	3	0	0	38	4	0
4	16	7	19	7	1	1	36	15	0
5	12	11	22	10	5	2	39	23	3
6	14	10	21	16	8	5	43	31	3
7	16	13	23	16	20	9	59	38	14
8	15	12	22	18	24	24	61	54	25
9	14	15	18	17	27	28	59	60	31
10	12	15	19	15	31	25	62	55	29
11	10	12	18	17	33	26	61	55	26
Midnight	9	9	13	11	28	22	50	42	26
Totals . .	277	140	354	167	266	244	897	551	221
Percentages—									
Forenoon .	42	28	42	25	39	46	41	35	35
Afternoon .	58	72	58	75	61	54	59	65	65

8. The preceding remarks relate to auroras as a whole; the different forms differ considerably in their diurnal variation. Arcs, bands and, generally speaking, the more regular and persistent forms, show their greatest frequencies earlier in the night than rays or patches. Table IV. shows the percentages of e. (evening) and m. (morning) occurrences of the principal forms as recorded by the Arctic observers at Cape Thorsden, Jan Mayen and Tasiusak.

TABLE IV.

	Arcs.		Bands.		Rays.		Patches.	
	e.	m.	e.	m.	e.	m.	e.	m.
Cape Thorsden .	76	24	66	34	52	48	51	49
Jan Mayen . .	78	22	68	32	60	40	60	40
Tasiusak . .	85	15	85	15	65	35	62	38

At Cape Thorsden diffused auroral light had percentages e. 65, m. 35, practically identical with those for bands. At Tasiusak, 8 P.M. was the hour of most frequent occurrence for arcs and bands, whereas patches had their maximum frequency at 11 P.M. and rays at midnight.

9. *Lunar and other Periods.*—The action of moonlight necessarily gives rise to a true lunar period in the visibility of aurora. The extent to which it renders aurora invisible depends, however, so much on the natural brightness of the aurora—which depends on the time and the place—and on the sharpness of the outlook kept, that it is difficult to gauge it. Ekholm and Arrhenius (**11**) claim to have established the existence of a true tropical lunar period of 27·32 days, and also of a 26-day period, or, as they make it, a 25·929-day period. A 26-day period has also been derived by J. Liznar (**12**), after an elaborate allowance for the disturbing effects of moonlight from the observations in 1882–1883 at Bossekop, Fort Rae and Jan Mayen. Neither of these periods is universally conceded. The connexion between aurora and earth magnetic disturbances renders it practically certain that if a 26-day or similar period exists in the one phenomenon it exists also in the other, and of the two terrestrial magnetism (*q.v.*) is probably the element least affected by external complications, such as the action of moonlight.

10. *Sun-spot Connexion.*—The frequency of auroral displays is much greater in some years than others. At most places the variation in the frequency has shown a general similarity to that of sun-spots. Table V. gives contemporaneous data for the frequency of sun-spots and of auroras seen in Scandinavia. The sun-spot data prior to 1902 are from A. Wolfer's table in the *Met. Zeitschrift* for 1902, p. 195; the more recent data are from his quarterly lists. All are observed frequencies, derived after Wolf's method; maxima and minima are in heavy type.

The auroral data are from Table E of Tromholt's catalogue (**5**), with certain modifications. In Tromholt's yearly data the year commences with July. This being inconvenient for comparison with sun-spots, use was made of his monthly values to obtain corresponding data for years commencing with January. The Tromholt-Schroeter data for Scandinavia as a whole commenced with 1761; the figures for earlier years were obtained by multiplying the data for Sweden by 1·356, the factor being derived by comparing the figures for Sweden alone and for the whole of Scandinavia from July 1761 to June 1783.

In a general way Table V. warrants the conclusion that years of many sun-spots are years of many auroras, and years of few sun-spots years of few auroras; but it does not disclose any very definite relationship between the two frequencies. The maxima and minima in the two phenomena in a good many cases are not found in the same years. On the other hand, there is absolute coincidence in a number of cases, some of them very striking, as for instance the remarkably low minima of 1810 and 1823.

11. During the period 1764 to 1872 there have been ten years of maximum, and ten of minimum, in sun-spot frequency. Taking the three years of greatest frequency at each maximum, and the three years of least frequency at each minimum, we get thirty years of many and thirty of few sun-spots. Also we can split the period into an earlier half, 1764 to 1817; and a later half, 1818 to 1872, containing respectively the earlier five and the later five of the above groups of sun-spot maximum and minimum years. The annual means derived from the whole group, and the two sub-groups, of years of many and few sun-spots are as follows:—

Years of	1764–1872.		1764–1817.		1818–1872.	
	Spots.	Auroras.	Spots.	Auroras.	Spots.	Auroras.
Many sun-spots .	93·4	99·9	86·7	70·7	100·1	129·1
Few ,, .	13·4	61·5	13·6	51·6	13·1	71·3

In each case the excess of auroras in the group of years of many sun-spots is decided, but the results from the two sub-periods do not harmonize closely. The mean sun-spot frequency for the group of years of few sun-spots is almost exactly the same for the two sub-periods, but the auroral frequency for the later group is nearly 40% in excess of that for the earlier, and even exceeds the auroral frequency in the years of many sun-spots in the earlier sub-period. This inconsistency, though startling at first sight, is probably more apparent than real. It is almost certainly due in large measure to a progressive change in one or both of the units of frequency. In the case of sun-spots, A. Schuster (**13**) has compared J. R. Wolf and A. Wolfer's frequencies with data obtained by other observers for areas of sun-spots, and his figures show unquestionably that the unit in one or other set of data must have varied appreciably from time to time. Wolf and Wolfer have, however, aimed persistently at securing a definite standard, and there are several reasons for believing that the change of unit has been in the auroral rather than the sun-spot frequency. R. Rubenson (**14**), from whom Tromholt derives his data for Sweden, seems to accept this view, assigning the apparent increase in auroral frequency since 1860 to the institution by the state of meteorological stations in 1859, and to the increased interest taken in the subject since 1865 by the university of Upsala. The figures themselves in Table V. certainly point to this conclusion, unless we are prepared to believe that auroras have increased enormously in number. If, for instance, we compare the first and the last three 11-year cycles for which Table V. gives complete data, we obtain as yearly means:—

1749–1781 . . Sun-spots 56·4 Auroras 77·5
1844–1876 . . „ 55·8 „ 112·2

The mean sun-spot frequencies in the two periods differ by only 1 %, but the auroral frequency in the later period is 45 % in excess of that in the earlier.

The above figures would be almost conclusive if it were not for the conspicuous differences that exist between the mean sun-spot frequencies for different 11-year periods. Schuster, who has considered the matter very fully, has found evidence of the existence of other periods—notably 8·4 and 4·8 years—in addition to the recognized period of 11·125 years, and he regards the difference between the maxima in successive 11-year periods as due at least partly to an overlapping of maxima from the several periodic terms. This cannot, however, account for all the fluctuations observed in sun-spot frequencies, unless other considerably longer periods exist. There has been at least one 33-year period during which the mean value of sun-spot frequency has been exceptionally low, and, as we shall see, there was a corresponding remarkable scarcity of auroras. The period in question may be regarded as extending from 1794 to 1826 inclusive. Comparing it with the two adjacent periods of thirty-three years, we obtain the following for the mean annual frequencies:—

33-Year Period.	Sun-spots.	Auroras.
1761–1793	65·6	76·1
1794–1826	20·3	39·5
1827–1859	56·1	84·4

12. The association of high auroral and sun-spot frequencies shown in Table V. is not peculiar to Scandinavia. It is shown, for instance, in Loomis's auroral data, which are based on observations at a variety of European and American stations (*Ency. Brit.* 9th ed. art. METEOROLOGY, Table XXVIII.). It does not seem, however, to apply universally. Thus at Godthaab we have, according to Adam Paulsen (**15**), comparing 3-year periods of few and many sun-spots:—

3-Year Period.	Total Sun-spot Frequency.	Total Nights of Aurora.
1865–1868	48	274
1869–1872	339	138
1876–1879	23	273

The years start in the autumn, and 1865–1868 includes the three winters of 1865 to '66, '66 to '67, and '67 to '68. Paulsen also gives data from two other stations in Greenland, viz. Ivigtut (1869 to 1879) and Jakobshavn (1873 to 1879), which show the same phenomenon as at Godthaab in a prominent fashion. Greenland lies to the north of Fritz's curve of maximum auroral frequency, and the suggestion has been made that the zone of maximum frequency expands to the south as sun-spots increase, and contracts again as they diminish, the number of auroras at a given station increasing or diminishing as the zone of maximum frequency approaches to or recedes from it. This theory, however, does not seem to fit all the facts and stands in want of confirmation.

13. *Auroral Meridian.*—It is a common belief that the summit of an auroral arc is to be looked for in the observer's magnetic meridian. On any theory it would be rather extraordinary if this were invariably true. In temperate latitudes auroral arcs are seldom near the zenith, and there is reason to believe them at very great heights. In high latitudes the average height is probably less, but the direction in which the magnetic needle

TABLE V.

Year.	Frequency.		Year.	Frequency.		Year.	Frequency.		Year.	Frequency.	
	Sun-spot.	Auroral.		Sun-spot.	Auroral.		Sun-spot.	Auroral.		Sun-spot.	Auroral.
1749	80·9	103	1789	118·1	89	1829	67·0	93	1869	73·9	160
1750	**83·4**	134	1790	89·9	90	1830	**71·0**	132	1870	**139·1**	195
1751	47·7	53	1791	66·6	54	1831	47·8	89	1871	111·2	185
1752	47·8	111	1792	60·0	64	1832	27·5	54	1872	101·7	200
1753	30·7	96	1793	46·9	29	1833	**8·5**	79	1873	66·3	189
1754	12·2	65	1794	41·0	37	1834	13·2	81	1874	44·7	158
1755	**9·6**	34	1795	21·3	34	1835	56·9	58	1875	17·1	133
1756	10·2	60	1796	16·0	37	1836	121·5	98	1876	11·3	137
1757	32·4	83	1797	6·4	61	1837	**138·3**	137	1877	12·3	126
1758	47·6	80	1798	**4·1**	35	1838	103·2	159	1878	**3·4**	. .
1759	54·0	113	1799	6·8	28	1839	85·8	165	1879	6·0	. .
1760	62·9	86	1800	14·5	30	1840	63·2	82	1880	32·3	. .
1761	**85·9**	124	1801	34·0	34	1841	36·8	75	1881	54·3	. .
1762	61·2	114	1802	45·0	65	1842	24·2	91	1882	59·7	. .
1763	45·1	89	1803	43·1	73	1843	**10·7**	66	1883	**63·7**	. .
1764	36·4	107	1804	**47·5**	101	1844	15·0	81	1884	63·5	. .
1765	20·9	76	1805	42·2	85	1845	40·1	26	1885	52·2	. .
1766	**11·4**	51	1806	28·1	62	1846	61·5	50	1886	25·4	. .
1767	37·8	68	1807	10·1	42	1847	98·5	63	1887	13·1	. .
1768	69·8	80	1808	8·1	20	1848	**124·3**	107	1888	6·8	. .
1769	**106·1**	89	1809	2·5	20	1849	95·9	131	1889	**6·3**	. .
1770	100·8	83	1810	**0·0**	4	1850	66·5	95	1890	7·1	. .
1771	81·6	62	1811	1·4	13	1851	64·5	60	1891	35·6	. .
1772	66·5	38	1812	5·0	11	1852	54·2	92	1892	73·0	. .
1773	34·8	58	1813	12·2	18	1853	39·0	65	1893	**84·9**	. .
1774	30·6	98	1814	13·9	17	1854	20·6	64	1894	78·0	. .
1775	**7·0**	33	1815	35·4	10	1855	6·7	49	1895	64·0	. .
1776	19·8	17	1816	**45·8**	33	1856	**4·3**	46	1896	41·8	. .
1777	92·5	64	1817	41·1	60	1857	22·8	38	1897	26·2	. .
1778	**154·4**	59	1818	30·4	74	1858	54·8	88	1898	26·7	. .
1779	125·9	60	1819	23·9	43	1859	93·8	131	1899	12·1	. .
1780	84·8	67	1820	15·7	62	1860	**95·7**	119	1900	9·5	. .
1781	68·1	103	1821	6·6	37	1861	77·2	127	1901	**2·7**	. .
1782	38·5	67	1822	4·0	33	1862	59·1	135	1902	5·0	. .
1783	22·8	70	1823	**1·8**	13	1863	44·0	135	1903	24·4	. .
1784	**10·2**	78	1824	8·5	14	1864	47·0	124	1904	42·0	. .
1785	24·1	83	1825	16·6	40	1865	30·5	119	1905	62·8	. .
1786	82·9	136	1826	36·3	58	1866	16·3	130	1906	53·8	. .
1787	**132·0**	115	1827	49·7	79	1867	**7·3**	127	1907	62·0	. .
1788	130·9	97	1828	62·5	60	1868	37·3	144	1908	48·5	. .

points changes rapidly with change of latitude and longitude, and has a large diurnal variation. Thus there must in general be a difference between the observer's magnetic meridian—answering to the mean position of the magnetic needle at his station—and the direction the needle would have at a given hour, if undisturbed by the aurora, at any spot where the phenomena which the observer sees as aurora exist.

Very elaborate observations have been made during several Arctic expeditions of the azimuths of the summits of auroral arcs. At Cape Thorsden (7) in 1882–1883 the mean azimuth derived from 371 arcs was 24° 12′ W., or 11° 27′ to the W. of the magnetic meridian. As to the azimuths in individual cases, 130 differed from the mean by less than 10°, 118 by from 10° to 20°, 82 by from 20° to 30°, 21 by from 30° to 40°, 14 by from 40° to 50°; in six cases the departure exceeded 50°, and in one case it exceeded 70°. Also, whilst the mean azimuths deduced from the observations between 6 A.M. and noon, between noon and 6 P.M., and between 6 P.M. and midnight, were closely alike, their united mean being 22·4° W. of N. (or E. of S.), the mean derived from the 113 arcs observed between midnight and 6 A.M. was 47·8° W. At Jan Mayen (8) in 1882–1883 the mean azimuth of the summit of the arcs was 28·8° W. of N., thus approaching much more closely to the magnetic meridian 29·9° W. As to individual azimuths, 113 lay within 10° of the mean, 37 differed by from 10° to 20°, 18 by from 20° to 30°, 6 by from 30° to 40°, whilst 6 differed by over 40°. Azimuths were also measured at Jan Mayen for 338 auroral bands, the mean being 22·0° W., or 7·9° to the east of the magnetic meridian. Combining the results from arcs and bands, Carlheim-Gyllensköld gives the "anomaly" of the auroral meridian at Jan Mayen as 5·7° E. At the British Polar station of 1882, Fort Rae (62° 23′ N. lat., 115° 44′ W. long.), he makes it 15·7° W. At Godthaab in 1882–1883 the auroral anomaly was, according to Paulsen, 15·5° E., the magnetic meridian lying 57·6° W. of the astronomical.

14. *Auroral Zenith.*—Another auroral direction having apparently a close relation to terrestrial magnetism is the imaginary line drawn to the eye of an observer from the centre of the corona—*i.e.* the point to which the auroral rays converge. This seems in general to be nearly coincident with the direction of the dipping needle.

Thus at Cape Thorsden (7) in 1882–1883 the mean of a considerable number of observations made the angle between the two directions only 1° 7′, the magnetic inclination being 80° 35′, whilst the coronal centre had an altitude of 79° 55′ and lay somewhat to the west of the magnetic meridian. Even smaller mean values have been found for the angle between the auroral and magnetic "zeniths"—as the two directions have been called—*e.g.* 0° 50′ at Bossekop (16) in 1838–1839, and 0° 7′ at Treurenberg (17) (79° 55′ N. lat., 16° 51′ E. long.) in 1899–1900.

15. *Relations to Magnetic Storms.*—That there is an intimate connexion between aurora when visible in temperate latitudes and terrestrial magnetism is hardly open to doubt. A bright aurora visible over a large part of Europe seems always accompanied by a magnetic storm and earth currents, and the largest magnetic storms and the most conspicuous auroral displays have occurred simultaneously. Noteworthy examples are afforded by the auroras and magnetic storms of August 28-29 and September 1-2, 1859; February 4, 1872; February 13-14 and August 12, 1892; September 9, 1898; and October 31, 1903. On some of these occasions aurora was brilliant in both the northern and southern hemispheres, whilst magnetic disturbances were experienced the whole world over. In high latitudes, however, where both auroras and magnetic storms are most numerous, the connexion between them is much less uniform. Arctic observers, both Danish and British, have repeatedly reported displays of aurora unaccompanied by any special magnetic disturbance. This has been more especially the case when the auroral light has been of a diffused character, showing only minor variability. When there has been much apparent movement, and brilliant changes of colour in the aurora, magnetic disturbance has nearly always accompanied it. In the Arctic, auroral displays seem sometimes to be very local, and this may be the explanation. On the other hand, Arctic observers have reported an apparent connexion of a particularly definite character. According to Paulsen (18), during the Ryder expedition in 1891–1892, the following phenomenon was seen at least twenty times by Lieut. Vedel at Scoresby Sound (70° 27′ N. lat., 26° 10′ W. long.). An auroral curtain travelling with considerable velocity would approach from the south, pass right overhead and retire to the north. As the curtain approached, the compass needle always deviated to the west, oscillated as the curtain passed the zenith, and then deviated to the east. The behaviour of the needle, as Paulsen points out, is exactly what it should be if the space occupied by the auroral curtain were traversed by electric currents directed upwards from the ground. The Danish observers at Tasiusak (10) in 1898–1899 observed this phenomenon occasionally in a slightly altered form. At Tasiusak the auroral curtain after reaching the zenith usually retired in the direction from which it had come. The direction in which the compass needle deviated was west or east, according as the curtain approached from the south or the north; as the curtain retired the deviation eventually diminished.

Kr. Birkeland (19), who has made a special study of magnetic disturbances in the Arctic, proceeding on the hypothesis that they arise from electric currents in the atmosphere, and who has thence attempted to deduce the position and intensity of these currents, asserts that whilst in the case of many storms the data were insufficient, when it was possible to fix the position of the mean line of flow of the hypothetical current relatively to an auroral arc, he invariably found the directions coincident or nearly so.

16. In the northern hemisphere to the south of the zone of greatest frequency, the part of the sky in which aurora most generally appears is the magnetic north. In higher latitudes auroras are most often seen in the south. The relative frequency in the two positions seems to vary with the hour, the type of aurora, probably with the season of the year, and possibly with the position of the year in the sun-spot cycle.

At Jan Mayen (8) in 1882–1883, out of 177 arcs whose position was accurately determined, 44 were seen in the north, their summits averaging 38·5° above the northern horizon; 88 were seen in the south, their average altitude above the southern horizon being 33·5°; while 45 were in the zenith. At Tasiusak (10) in 1898–1899 the magnetic directions of the principal types were noted separately. The results are given in Table VI.

TABLE VI.

Direction.	Absolute Number for each Type.					Percentage from all Types.
	Arcs.	Bands.	Curtains.	Rays.	Patches.	
N.	9	16	5	15	4	10
N.E.	9	13	2	20	4	9
E.	3	11	2	26	3	9
S.E.	5	6	1	10	7	6
S.	45	43	1	16	15	24
S.W.	9	9	2	12	13	9
W.	3	11	2	22	6	9
N.W.	2	8	2	8	5	5

Table VI. accounts for only 81 % of the total displays; of the remainder 15 % appeared in the zenith, while 4 % covered the whole sky. Auroral displays generally cover a considerable area, and are constantly changing, so the figures are necessarily somewhat rough. But clearly, whilst the arcs and bands, and to a lesser extent the patches, showed a marked preference for the magnetic meridian, the rays showed no such preference.

At Cape Thorsden (7) in 1882–1883 auroras as a whole were divided into those seen in the north and those seen in the south. The variation throughout the twenty-four hours in the percentage seen in the south was as follows:—

Hour.	0–3.	3–6.	6–9.	9–12.
A.M.	69	55	44	35
P.M.	55	70	65	65

The mean from the whole twenty-four hours is sixty-three. Between 3 A.M. and 3 P.M. the percentage of auroras seen in the south thus appears decidedly below the mean.

17. The following data for the apparent angular width of arcs were obtained at Cape Thorsden, the arcs being grouped according to the height of the lower edge above the horizon. Group I. contained thirty arcs whose altitudes did not exceed 11° 45′; Group II. thirty arcs whose altitudes lay between 12° and 35°; and Group III. thirty arcs whose altitudes lay between 36° and 80°.

Group.	I.	II.	III.
Greatest width . . .	11·5°	12·0°	21·0°
Least ,, . . .	1·0°	0·75°	2·0°
Mean ,, . . .	3·45°	4·6°	6·9°

There is here a distinct tendency for the width to increase with the altitude. At the same time, arcs near the horizon often appeared wider than others near the zenith. Furthermore, Gyllensköld says that when arcs mounted, as they not infrequently did, from the horizon, their apparent width might go on increasing right up to the zenith, or it might increase until an altitude of about 45° was reached and then diminish, appearing much reduced when the zenith was reached. Of course the phenomenon might be due to actual change in the arc, but it is at least consistent with the view that arcs are of two kinds, one form constituting a layer of no great vertical depth but considerable real horizontal width, the other form having little horizontal width but considerable vertical depth, and resembling to some extent an auroral curtain.

18. According to numerous observations made at Cape Thorsden, the apparent angular velocity of arcs increases on the average with their altitude. Dividing the whole number of arcs, 156, whose angular velocities were measured into three numerically equal groups, according to their altitude, the following were the results in minutes of arc per second of time (or degrees per minute of time):—

Group.	I.	II.	III.	All.
Mean altitude	10·5°	34·6°	72·3°	..
Greatest velocity	4·81	15·12	109·09	..
Mean velocity	0·48	2·42	8·67	3·86

Each group contained auroras which appeared stationary. The intervals to which the velocities referred were usually from five to ten minutes, but varied widely. The velocity 109·09 was much the largest observed, the next being 52·38; both were from observations lasting under half a minute.

19. In 1882–1883 the direction of motion of arcs was from north to south in 62% of the cases at Jan Mayen, and in 58% of the cases at Cape Thorsden. This seems the more common direction in the northern hemisphere, at least for stations to the south of the zone of maximum frequency, but a considerable preponderance of movements towards the north was observed in Franz Joseph Land by the Austrian Expedition of 1872–1874. The apparent motion of arcs is sometimes of a complicated character. One end only, for example, may appear to move, as if rotating round the other; or the two ends may move in opposite directions, as if the arc were rotating about a vertical axis through its summit.

20. *Height.*—If an auroral arc represented a definite self-luminous portion of space of small transverse dimensions at a uniform height above the ground, its height could be accurately determined by observations made with theodolites at the two ends of a measured base, provided the base were not too short compared to the height. If a very long base is taken, it becomes increasingly open to doubt whether the portions of space emitting auroral light to the observers at the two ends are the same. There is also difficulty in ensuring that the observations shall be simultaneous, an important matter especially when the apparent velocity is considerable. If the base is short, definite results can hardly be hoped for unless the height is very moderate. Amongst the best-known theodolite determinations of height are those made at Bossekop in Norway by the French Expedition of 1838–1839 (**16**) and the Norwegian Expedition of 1882–1883, and those made in the latter year by the Swedes at Cape Thorsden and the Danes at Godthaab. At Bossekop and Cape Thorsden there were a considerable proportion of negative or impossible parallaxes. Much the most consistent results were those obtained at Godthaab by Paulsen (**15**). The base was 5·8 km. (about 3½ miles) long, the ends being in the same magnetic meridian, on opposite sides of a fiord, and observations were confined to this meridian, strict simultaneity being secured by signals. Heights were calculated only when the observed parallax exceeded 1°, but this happened in three-fourths of the cases. The calculated heights—all referring to the lowest border of the aurora—varied from 0·6 to 67·8 km. (about 0·4 to 42 m.), the average being about 20 km. (12 m.). Regular arcs were selected in most cases, but the lowest height obtained was for a collection of rays forming a curtain which was actually situated between the two stations.

In 1885 Messrs Garde and Eherlin made similar observations at Nanortalik near Cape Farewell in Greenland, but using a base of only 1250 metres (about ¾ m.). Their results were very similar to Paulsen's. On one occasion twelve observations, extending over half an hour, were made on a single arc, the calculated heights varying in a fairly regular fashion from 1·6 to 12·9 km. (about 1 to 8 m.). The calculated horizontal distances of this arc varied between 5 and 24 km. (about 3 and 15 m.), the motion being sometimes towards, sometimes away from the observers, but not apparently exceeding 3 km. (nearly 2 m.) per minute. Heights of arcs have often been calculated from the apparent altitudes at stations widely apart in Europe or America. The heights calculated in this way for the under surface of the arc, have usually exceeded 100 m.; some have been much in excess of this figure. None of the results so obtained can be accepted without reserve, but there are several reasons for believing that the average height in Greenland is much below that in lower latitudes. Heights have been calculated in various less direct ways, by observing for instance the angular altitude of the summit of an arc and the angular interval between its extremities, and then making some assumption such as that the portion visible to an observer may be treated as a circle whose centre lies over the so-called auroral pole. The mean height calculated at Arctic stations, where careful observations have been made, in this or analogous ways, has varied from 58 km. (about 36 m.) at Cape Thorsden (Gyllensköld) to 227 km. (about 141 m.) at Bossekop (Bravais). The height has also been calculated on the hypothesis that auroral light has its source where the atmospheric pressure is similar to that at which most brilliancy is observed when electric discharges pass in vacuum tubes. Estimates on this basis have suggested heights of the order of 50 km. (about 31 m.). There are, of course, many uncertainties, as the conditions of discharge in the free atmosphere may differ widely from those in glass vessels. If the Godthaab observations can be trusted, auroral discharges must often occur within a few miles of the earth's surface in Arctic regions. In confirmation of this view reference may be made to a number of instances where observers—*e.g.* General Sabine, Sir John Franklin, Prof. Selim Lemström, Dr David Walker (at Fort Kennedy in 1858–1859), Captain Parry (Fort Bowen, 1825) and others—have seen aurora below the clouds or between themselves and mountains. One or two instances of this kind have even been described in Scotland. Prof. Cleveland Abbe (**20**) has given a full historical account of the subject to which reference may be made for further details.

21. *Brightness.*—In auroral displays the brightness often varies greatly over the illuminated area and changes rapidly. Estimates of the intensity of the light have been based on various arbitrary scales, such for instance as the size of type which the observer can read at a given distance. The estimate depends in the case of reading type on the general illumination. In other cases scales have been employed which make the result mainly depend on the brightest part of the display. At Jan Mayen (**8**) in 1882–1883 a scale was employed running from 1, taken as corresponding to the brightness of the milky way, to 4, corresponding to full moonlight. The following is an analysis of the results obtained, showing the number of times the different grades were reached:—

Scale of Intensity.	1.	2.	3.	4.	Mean Intensity.
Arcs	27	53	13	1	1·87
Bands	46	83	49	22	2·24
Rays	30	116	138	28	2·21
Corona	3	14	12	12	2·81

On one or two occasions at Jan Mayen auroral light is described as making the full moon look like an ordinary gas jet in presence of electric light, whilst rays could be seen crossing and brighter than the moon's disk. Such extremely bright auroras seem very rare, however, even in the Arctic. There is a general tendency for both bands and rays to appear brightest at their lowest parts; arcs seldom appear as bright at their summits as nearer the horizon. It is not unusual for arcs and bands to look as if pulses or waves of light were travelling along them; also the direction in which these pulses travel does not seem to be wholly arbitrary. Movements to the east were twice as numerous at Jan Mayen and thrice as numerous at Traurenberg as movements to the west. In some cases changes of intensity take place round the auroral zenith, simulating the effect that would be produced by a cyclonic rotation of luminous matter. In the case of isolated patches the intensity often waxes and wanes as if a search-light were being thrown on and turned off.

22. *Colour.*—The ordinary colour of aurora is white, usually with a distinct yellow tint in the brighter forms, but silvery white when the light is faint. When the light is intense and changing rapidly, red is not infrequently present, especially towards the lower edge. Under these circumstances, green is also sometimes visible, especially towards the zenith. Thus a bright auroral ray may seem red towards the foot and green at its summit, with yellow intervening. In some cases the green may be only a contrast effect. Other colours, *e.g.* violet, have occasionally been noticed but are unusual.

23. *Spectrum.*—The spectrum of aurora consists of a number of lines. Numerous measurements have been made of the wave-lengths of the brightest. One line, in the yellow green, is so dominant optically as often to be described as the auroral line. Its wave-length is probably very near 5571 tenth-metres, and it is very close to, if not absolutely coincident with, a prominent line in the spectrum of krypton. This line is so characteristic that its presence or absence is the usual criterion for deciding

whether an atmospheric light is aurora. The Swedish Expedition (**17**) of 1899–1902, engaged in measuring an arc of the meridian in Spitsbergen, were unusually well provided spectrographically, and succeeded in taking photographs of aurora in conjunction with artificial lines—chiefly of hydrogen—which led to results claiming exceptional accuracy. In the spectrograms three auroral rays—including the principal one mentioned above—were pre-eminent. For the two shorter wave-lengths, for whose measurement he claims the highest precision, the observer, J. Westman, gives the values 4276·4 and 3913·5. In addition, he assigns wave-lengths for 156 other auroral lines between wave-lengths 5205 and 3513. The following table gives the wave-lengths of the photographically brightest of these, retaining four significant figures in place of Westman's five.

TABLE VII.

4830	4489	4329	3997	3861
4709	4420	4242	3986	3804
4699	4371	4230	3947	3793
4661	4356	4225	3937	3704
4560	4344	4078	3880	3607
4550	4337	4067	3876	3589

There are a number of optically bright lines of longer wave-length. For the principal of these Angot (**1**) gives the following wave-lengths (unit 1 $\mu\mu$ or 1×10^{-9} metre):—630, 578, 566, 535, 523, 500.

Out of a total of 146 auroral lines, with wave-lengths longer than 3684 tenth-metres, Westman identifies 82 with oxygen or nitrogen lines at the negative pole in vacuum discharges. Amongst the lines thus identified are the two principal auroral lines having wave-lengths 4276·4 and 3913·5. The interval considered by Westman contains at least 300 oxygen and nitrogen lines, so that approximate coincidence with a number of auroral lines was almost inevitable, and an appreciable number of the coincidences may be accidental. E. C. C. Baly (**21**), making use of the observations of the Russian expedition in Spitsbergen in 1899, accepts as the wave-lengths of the three principal auroral lines 5570, 4276 and 3912; and he identifies all three and ten other auroral lines ranging between 5570 and 3707 with krypton lines measured by himself. In addition to these, he mentions other auroral lines as very probably krypton lines, but in their case the wave-lengths which he quotes from Paulsen (**22**) are given to only three significant figures, so that the identification is more uncertain. The majority of the krypton lines which Baly identifies with auroral lines require for their production a Leyden jar and spark gap.

If, as is now generally believed, aurora represents some form of electrical discharge, it is only reasonable to suppose that the auroral lines arise from atmospheric gases. The conditions, however, as regards pressure and temperature under which the hypothetical discharges take place must vary greatly in different auroras, or even sometimes in different parts of the same aurora. Further, auroras are often possessed of rapid motion, so that conceivably spectral lines may receive small displacements in accordance with Doppler's principle. Thus the differences in the wave-lengths of presumably the same lines as measured by different Arctic observers may be only partly due to unfavourable observational conditions. Many of the auroral lines seen in any single aurora are exceedingly faint, so that even their relative positions are difficult to settle with high precision.

24. Whether or not auroral displays are ever accompanied by a characteristic sound is a disputed question. If sound waves originate at the seat of auroral displays they seem hardly likely to be audible on the earth, unless the aurora comes very low and great stillness prevails. It is thus to the Arctic one looks for evidence. According to Captain H. P. Dawson (**26**), in charge of the British Polar Station at Fort Rae in 1882–1883, "The Indians and *voyageurs* of the Hudson Bay Company, who often pass their nights in the open, say that it [sound] is not uncommon . . . there can be no doubt that distinct sound does occasionally accompany certain displays of aurora." On the one occasion when Captain Dawson says he heard it himself, "the sound was like the swishing of a whip or the noise produced by a sharp squall of wind in the upper rigging of a ship, and as the aurora brightened and faded so did the sound which accompanied it." If under these conditions the sound was really due to the aurora, the latter, as Captain Dawson himself remarks, must have been pretty close.

25. Usually the electric potential near the ground is positive compared to the earth and increases with the height (see ATMOSPHERIC ELECTRICITY). Several Arctic observers, however, especially Paulsen (**18**) have observed a diminution of positive potential, or even a change to negative, for which they could suggest no explanation except the presence of a bright aurora. Other Arctic observers have failed to find any trace of this phenomenon. If it exists, it is presumably confined to cases when the auroral discharge comes unusually low.

26. *Artificial Phenomena resembling Aurora.*—At Sodankylä, the station occupied by the Finnish Arctic Expedition of 1882–1883, Selim Lemström and Biese (**23**) described and gave drawings of optical phenomena which they believed to be artificially produced aurora. A number of metallic points, supported on insulators, were connected by wires enclosing several hundred square metres on the top of a hill. Sometimes a Holtz machine was employed, but even without it illumination resembling aurora was seen on several occasions, extending apparently to a considerable height. In the laboratory, Kr. Birkeland (**19**) has produced phenomena bearing a striking resemblance to several forms of aurora. His apparatus consists of a vacuum vessel containing a magnetic sphere—intended to represent the earth—and the phenomena are produced by sending electric discharges through the vessel.

27. *Theories.*—A great variety of theories have been advanced to account for aurora. All or nearly all the most recent regard it as some form of electrical discharge. Birkeland (**19**) supposes the ultimate cause to be cathode rays emanating from the sun; C. Nordmann (**24**) replaces the cathode rays by Hertzian waves; while Svante Arrhenius (**25**) believes that negatively charged particles are driven through the sun's atmosphere by the Maxwell-Bartoli repulsion of light and reach the earth's atmosphere. For the size and density of particles which he considers most likely, Arrhenius calculates the time required to travel from the sun as forty-six hours. By modifying the hypothesis as to the size and density, times appreciably longer or shorter than the above would be obtained. Cathode rays usually have a velocity about a tenth that of light, but in exceptional cases it may approach a third of that of light. Hertzian waves have the velocity of light itself. On either Birkeland's or Nordmann's theory, the electric impulse from the sun acts indirectly by creating secondary cathode rays in the earth's atmosphere, or ionizing it so that discharges due to natural differences of potential are immensely facilitated. The ionized condition must be supposed to last to a greater or less extent for a good many hours to account for aurora being seen throughout the whole night. The fact that at most places the morning shows a marked decay of auroral frequency and intensity as compared to the evening, the maximum preceding midnight by several hours, is certainly favourable to theories which postulate ionization of the atmosphere by some cause or other emanating from the sun.

AUTHORITIES.—The following works are numbered according to the references in the text:—(**1**) A. Angot, *Les Aurores polaires* (Paris, 1895); (**2**) H. Fritz, *Das Polarlicht* (Leipzig, 1881); (**3**) Svante August Arrhenius, *Lehrbuch der kosmischen Physik*; (**4**) Joseph Lovering, "On the Periodicity of the Aurora Borealis," *Mem. American Acad.* vol. x. (1868); (**5**) Sophus Tromholt, *Catalog der in Norwegen bis Juni 1878 beobachteten Nordlichter*; (**6**) *Observations internationales polaires* (1882–1883), *Expédition Danoise*, tome i. "Aurores boréales"; (**7**) Carlheim-Gyllensköld, "Aurores boréales" in *Observations faites au Cap Thorsden Spitzberg par l'expédition suédoise*, tome ii. 1; (**8**) "Die Österreichische Polar Station Jan Mayen" in *Die Internationale Polarforschung*, 1882–1883, Bd. ii. Abth. 1; (**9**) Henryk Arctowski, "Aurores australes" in *Expédition antarctique belge . . . Voyage du S. Y. "Belgica"*; (**10**) G. C. Amdrup, *Observations . . . faites par l'expédition danoise*; H. Ravn, *Observations de l'aurore boréale de Tasiusak*; (**11**) *K. Sven. Vet.-Akad. Hand.* Bd. 31, Nos. 2, 3, &c.; (**12**) *Sitz. d. k. Akad. d. Wiss.* (Vienna), Math. Naturw. Classe, Bd. xcvii. Abth. iia, 1888; (**13**) *Proc. Roy. Soc.*, 1906, lxxvii. A, 141; (**14**) *Kongl. Sven. Vet.-Akad. Hand.* Bd. 15, No. 5, Bd. 18, No. 1; (**15**) *Bull. Acad. Roy. Danoise*, 1889, p. 67; (**16**) *Voyages . . . pendant les années 1838, 1839 et 1840 sur . . . la Recherche*, "Aurores boréales," by MM. Lottin, Bravais, &c.; (**17**) *Missions scientifiques . . . au Spitzberg . . . en 1899–1902, Mission suédoise*, tome ii. VIII^{e} Section, C. "Aurores boréales"; (**18**) *Bull. Acad. R. des Sciences de Danemark*, 1894, p. 148; (**19**) Kr. Birkeland, *Expédition norvégienne 1899–1900 pour l'étude des aurores boréales* (Christiania, 1901); (**20**) *Terrestrial Magnetism*, vol. iii. (1898), pp. 5, 53, 149; (**21**) *Astrophysical Journal*, 1904, xix. p. 187; (**22**) *Rapports présentés au Conrgès International de Physique réuni à Paris*, 1900, iii. 438; (**23**) *Expédition polaire finlandaise* (1882–1884), tome iii.; (**24**) Charles Nordmann, *Thèses présentées à la Faculté des Sciences de Paris* (1903); (**25**) *Terrestrial Magnetism*, vol. 10, 1905, p. 1; (**26**) *Observations of the International Polar Expeditions 1882–1883 Fort Rae . . .* by Capt. H. P. Dawson, R.A.

(C. CH.)

AURUNCI, the name given by the Romans to a tribe which in historical times occupied only a strip of coast on either side of the Mons Massicus between the Volturnus and the Liris, although it must at an earlier period have extended over a considerably wider area. Their own name for themselves in the 4th century B.C. was *Ausŏnes*, and in Greek writers we find the name *Ausŏnia* applied to Latium and Campania (see Strabo v. p. 247; Aristotle, *Pol.* iv. (vii.) 10; Dion. Hal. i. 72), while in the Augustan poets (*e.g.* Virgil, *Aen.* vii. 795) it is used as one of many synonyms for Italy. In history the tribe appears only for a brief space, from 340 to 295 B.C. (Mommsen, *C.I.L.* x. pp. 451, 463, 465), and their struggle with the Romans ended in complete extermination; their territory was parcelled out between the Latin colonies of Cales (Livy viii. 16) and Suessa Aurunca (*id.* ix. 28) which took the place of an older town called *Ausona* (*id.* ix. 25; viii. 15), and the maritime colonies Sinuessa (the older *Vescia*) and Minturnae (both in 295 B.C., Livy x. 21). The coin formerly attributed to Suessa Aurunca on the strength of its supposed legend *Aurunkud* has now been certainly referred to Naples (see R. S. Conway, *Italic Dialects*, 145, and *Verner's law in Italy*, p. 78, where the change of *s* to *r* is explained as probably due to the Latin conquest). Seeing that the tribe was blotted out at the beginning of the 3rd century B.C., we can scarcely wonder that no record of its speech survives; but its geographical situation and the frequency of the *co*-suffix in that strip of coast (besides *Aurunci* itself we have the names *Vescia*, *Mons Massicus*, *Marica*, *Glanica* and *Caedicii*; see *Italic Dialects*, pp. 283 f.) rank them beyond doubt with their neighbours the Volsci (*q.v.*). (R. S. C.)

AUSCULTATION (from Lat. *auscultare*, to listen), a term in medicine, applied to the method employed by physicians for determining, by the sense of hearing, the condition of certain internal organs. The ancient physicians appear to have practised a kind of auscultation, by which they were able to detect the presence of air or fluids in the cavities of the chest and abdomen. Still no general application of this method of investigation was resorted to, or was indeed possible, till the advance of the study of anatomy led to correct ideas regarding the locality, structure and uses of the various organs of the body, and the alterations produced in them by disease. In 1761 Leopold Auenbrugger (1722–1809), a Viennese physician, published his *Inventum Novum*, describing the art of percussion in reference more especially to diseases of the chest. This consisted in tapping with the fingers the surface of the body, so as to elicit sounds by which the comparative resonance of the subjacent parts or organs might be estimated. Auenbrugger's method attracted but little attention till the French physician J. N. Corvisart (1755–1828) in 1808 demonstrated its great practical importance, and then its employment in the diagnosis of affections of the chest soon became general. Percussion was originally practised in the manner above mentioned (*immediate percussion*), but subsequently the method of *mediate percussion* was introduced by P. A. Piorry (1794–1879). It is accomplished by placing upon the spot to be examined some solid substance, upon which the percussion strokes are made with the fingers. For this purpose a thin oval piece of ivory (called a *pleximeter*, or stroke-measurer) may be used, with a small hammer; but one or more fingers of the left hand applied flat upon the part answer equally well, and this is the method which most physicians adopt. Percussion must be regarded as a necessary part of auscultation, particularly in relation to the examination of the chest; for the physician who has made himself acquainted with the normal condition of that part of the body in reference to percussion is thus able to recognize by the ear alterations of resonance produced by disease. But percussion alone, however important in diagnosis, could manifestly convey only limited and imperfect information, for it could never indicate the nature or extent of functional disturbance.

In 1819 the distinguished French physician R. T. H. Laënnec (1781–1826) published his *Traité de l'auscultation médiate*, embodying the present methods of auscultatory examination, and venturing definite conclusions based on years of his own study. He also invented the stethoscope (στῆθος, the breast, and σκοπεῖν, to examine). Since then many men have widened the scope of auscultation, notably Skoda, Wintrich, A. Geigel, Th. Weber and Gerhardt. According to Laënnec the essential of a good stethoscope was its capability of intensifying the tone vibrations. But since his time the opinion of experts on this matter has somewhat changed, and there are now two definite schools. The first and older condemns the resonating stethoscope, maintaining that the tones are bound to be altered; the second and younger school warmly advocates its use. In America, more than elsewhere, there is a type of phonendoscope much used by the younger men, which has the advantage that it can be used when the older type of instrument fails, viz. when the patient is recumbent and too ill to be moved. By slipping it beneath the patient's back a fairly accurate idea of the breathing over the bases of the lungs behind can often be obtained.

Stethoscopes have been made of many forms and materials. They usually consist of a hollow stem of wood, hard rubber or metal, with an enlarged tip slightly funnel-shaped at one end, and an ear-plate with a hole in the middle, fastened perpendicularly to the other end. To enable the instrument to be more conveniently carried, the ear-plate can be unscrewed from the tube. The length of the stem of the instrument is of minor importance, but its bore should be as nearly as possible that of the entrance of the external ear. A flexible stethoscope in general use both in England and America transmits the sound from a funnel through tubes to the ears of the observer. This is the common form of a binaural resonating stethoscope. It is convenient and gives a loud tone, but is condemned by the older school, who say that the resonance is confusing, and that the slightest movement in handling gives rise to perplexing murmurs. Nevertheless, it is this form of instrument which has by far the greatest vogue. It is probable, however, that the most skilled physicians of all find a special use in each form, the monaural non-resonating type being more sensitive to high-pitched sounds, and of greater assistance in differentiating the sounds and murmurs of the heart, the ordinary binaural form being more useful in examining the lungs and other organs. In using the stethoscope, it must be applied very carefully, so that the edge of the funnel makes an air-tight connexion with the skin, and in the monaural form the ear must be but lightly applied to the ear-plate, not pressing heavily on the patient.

The numerous diseases affecting the lungs can now be recognized and discriminated from each other with a precision which, but for auscultation and the stethoscope, would have been altogether unattainable. The same holds good in the case of the heart, whose varied and often complex forms of disease can, by auscultation, be identified with striking accuracy. But in addition to these its main uses, auscultation is found to render great assistance in the investigation of many obscure internal affections, such as aneurysms and certain diseases of the oesophagus and stomach. To the accoucheur the stethoscope yields valuable aid in the detection of some forms of uterine tumours, and especially in the diagnosis of pregnancy—the only evidence now accepted as absolutely diagnostic of that condition being the hearing of the foetal heart sounds.

AUSONIUS, DECIMUS MAGNUS (*c.* 310–395), Roman poet and rhetorician, was born at Burdigala [*Bordeaux*]. He received an excellent education, especially in grammar and rhetoric, but confesses that his progress in Greek was unsatisfactory. Having completed his studies, he practised for some time as an advocate, but his inclination lay in the direction of teaching. He set up (in 334) a school of rhetoric in his native place, which was largely attended, his most famous pupil being Paulinus, afterwards bishop of Nola. After thirty years of this work, he was summoned by Valentinian to the imperial court, to undertake the education of Gratian, the heir-apparent. The prince always entertained the greatest regard for his tutor, and after his accession bestowed upon him the highest titles and honours, culminating in the consulship (379). After the murder of Gratian (383), Ausonius retired to his estates near Burdigala. He appears to have been a (not very enthusiastic) convert to Christianity. He died about 395.

His most important extant works are: in prose, *Gratiarum Actio*, an address of thanks to Gratian for his elevation to the consulship; *Periochae*, summaries of the books of the *Iliad* and *Odyssey*; and one or two *epistolae*; in verse, *Epigrammata*, including several free translations from the Greek Anthology;

Ephemeris, the occupations of a day; *Parentalia* and *Commemoratio Professorum Burdigalensium*, on deceased relatives and literary friends; *Epitaphia*, chiefly on the Trojan heroes; *Caesares*, memorial verses on the Roman emperors from Julius Caesar to Elagabalus; *Ordo Nobilium Urbium*, short poems on famous cities; *Ludus Septem Sapientum*, speeches delivered by the Seven Sages of Greece; *Idyllia*, of which the best-known are the *Mosella*, a descriptive poem on the Moselle, and the infamous *Cento Nuptialis*. We may also mention *Cupido Cruciatus*, Cupid on the cross; *Technopaegion*, a literary trifle consisting of a collection of verses ending in monosyllables; *Eclogarum Liber*, on astronomical and astrological subjects; *Epistolae*, including letters to Paulinus and Symmachus; lastly, *Praefatiunculae*, three poetical epistles, one to the emperor Theodosius. Ausonius was rather a man of letters than a poet; his wide reading supplied him with material for a great variety of subjects, but his works exhibit no traces of a true poetic spirit; even his versification, though ingenious, is frequently defective.

There are no MSS. containing the whole of Ausonius's works. Editio princeps, 1472; editions by Scaliger 1575, Souchay 1730, Schenkl 1883, Peiper 1886; cf. *Mosella*, Böcking 1845, de la Ville de Mirmont (critical edition with translation) 1889, and *De Ausonii Mosella*, 1892, Hosius 1894. See Deydou, *Un Poète bordelais* (1868); Everat, *De Ausonii Operibus* (1885); Jullian, *Ausone et Bordeaux* (1893); C. Verrier and R. de Gourmont, *Les Épigrammes d'Ausone* (translation with bibliography, 1905); R. Pichon, *Les Derniers Écrivains profanes* (1907).

AUSSIG (Czech *Ousti nad Labem*), a town of Bohemia, Austria, 68 m. N. of Prague by rail. Pop. (1900) 37,255, mostly German. It is situated in a mountainous district, at the confluence of the Biela and the Elbe, and, besides being an active river port, is an important junction of the northern Bohemian railways. Aussig has important industries in chemicals, textiles, glass and boat-building, and carries on an active trade in coal from the neighbouring mines, stone and stoneware, corn, fruit and wood. It was the birthplace of the painter, Raphael Mengs (1728–1779). Aussig is mentioned as a trading centre as early as 993. It was made a city by Ottokar II. in the latter part of the 13th century. In 1423 it was pledged by King Sigismund to the elector Frederick of Meissen, who occupied it with a Saxon garrison. In 1426 it was besieged by the Hussites, who on the 16th of June, though only 25,000 strong, defeated a German army of 70,000, which had been sent to its relief, with great slaughter. The town was stormed and sacked next day. After lying waste for three years, it was rebuilt in 1429. It suffered much during the Thirty Years' and Seven Years' Wars, and in 1830 it had only 1400 inhabitants. Not far from Aussig is the village of Kulm, where, on the 29th and 30th of August 1813, a battle took place between the French under Vandamme and an allied army of Austrians, Prussians and Russians. The French were defeated, and Vandamme surrendered with his army of 10,000 men.

AUSTEN, JANE (1775–1817), English novelist, was born on the 16th of December 1775 at the parsonage of Steventon, in Hampshire, a village of which her father, the Rev. George Austen, was rector. She was the youngest of seven children. Her mother was Cassandra Leigh, niece of Theophilus Leigh, a dry humorist, and for fifty years master of Balliol, Oxford. The life of no woman of genius could have been more uneventful than Miss Austen's. She did not marry, and she never left home except on short visits, chiefly to Bath. Her first sixteen years were spent in the rectory at Steventon, where she began early to trifle with her pen, always jestingly, for family entertainment. In 1801 the Austens moved to Bath, where Mr Austen died in 1805, leaving only Mrs Austen, Jane and her sister Cassandra, to whom she was always deeply attached, to keep up the home; his sons were out in the world, the two in the navy, Francis William and Charles, subsequently rising to admiral's rank. In 1805 the Austen ladies moved to Southampton, and in 1809 to Chawton, near Alton, in Hampshire, and there Jane Austen remained till 1817, the year of her death, which occurred at Winchester, on July 18th, as a memorial window in the cathedral testifies.

During her placid life Miss Austen never allowed her literary work to interfere with her domestic duties: sewing much and admirably, keeping house, writing many letters and reading aloud. Though, however, her days were quiet and her area circumscribed, she saw enough of middle-class provincial society to find a basis on which her dramatic and humorous faculties might build, and such was her power of searching observation and her sympathetic imagination that there are not in English fiction more faithful representations of the life she knew than we possess in her novels. She had no predecessors in this genre. Miss Austen's "little bit (two inches wide) of ivory" on which she worked "with so fine a brush"—her own phrases—was her own invention.

Her best-known, if not her best work, *Pride and Prejudice*, was also her first. It was written between October 1796 and August 1797, although, such was the blindness of publishers, not issued until 1813, two years after *Sense and Sensibility*, which was written, on an old scenario called "Eleanor and Marianne," in 1797 and 1798. Miss Austen's inability to find a publisher for these stories, and for *Northanger Abbey*, written in 1798 (although it is true that she sold that MS. in 1803 for £10 to a Bath bookseller, only, however, to see it locked away in a safe for some years, to be gladly resold to her later), seems to have damped her ardour; for there is no evidence that between 1798 and 1809 she wrote anything but the fragment called "The Watsons," after which year she began to revise her early work for the press. Her other three books belong to a later date—*Mansfield Park*, *Emma* and *Persuasion* being written between 1811 and 1816. The years of publication were *Sense and Sensibility*, 1811; *Pride and Prejudice*, 1813; *Mansfield Park*, 1814; and *Emma*, 1816—all in their author's lifetime. *Persuasion* and *Northanger Abbey* were published posthumously in 1818. All were anonymous, agreeably to their author's retiring disposition.

Although *Pride and Prejudice* is the novel which in the mind of the public is most intimately associated with Miss Austen's name, both *Mansfield Park* and *Emma* are finer achievements—at once riper and richer and more elaborate. But the fact that *Pride and Prejudice* is more single-minded, that the love story of Elizabeth Bennet and D'Arcy is not only *of* the book but *is* the book (whereas the love story of Emma and Mr Knightley and Fanny Price and Edmund Bertram have parallel streams), has given *Pride and Prejudice* its popularity above the others among readers who are more interested by the course of romance than by the exposition of character. Entirely satisfactory as is *Pride and Prejudice* so far as it goes, it is, however, thin beside the niceness of analysis of motives in *Emma* and the wonderful management of two housefuls of young lovers that is exhibited in *Mansfield Park*.

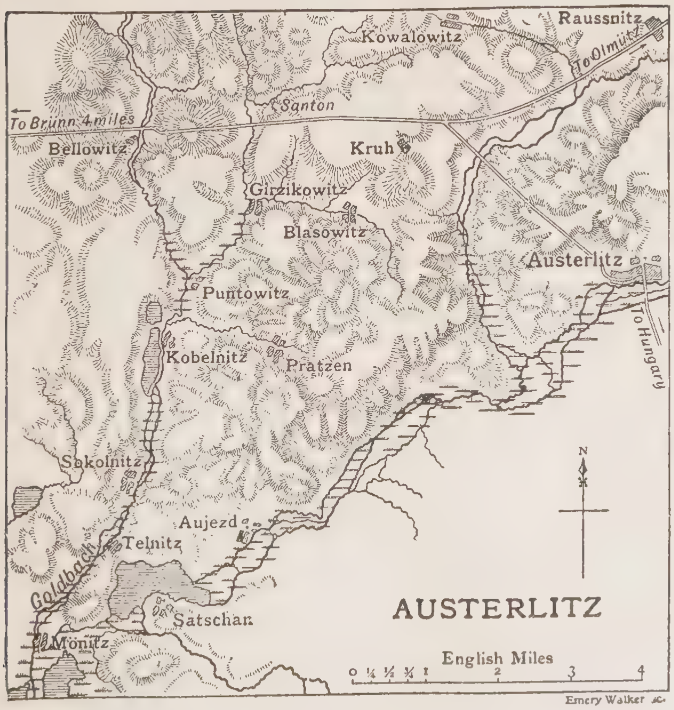
It has been generally agreed by the best critics that Miss Austen has never been approached in her own domain. No one indeed has attempted any close rivalry. No other novelist has so concerned herself or himself with the trivial daily comedy of small provincial family life, disdaining equally the assistance offered by passion, crime and religion. Whatever Miss Austen may have thought privately of these favourite ingredients of fiction, she disregarded all alike when she took her pen in hand. Her interest was in life's little perplexities of emotion and conduct; her gaze was steadily ironical. The most untoward event in any of her books is Louisa's fall from the Cobb at Lyme Regis, in *Persuasion*; the most abandoned, Maria's elopement with Crawford, in *Mansfield Park*. In pure ironical humour Miss Austen's only peer among novelists is George Meredith, and indeed *Emma* may be said to be her *Egoist*, or the *Egoist* his *Emma*. But irony and fidelity to the fact alone would not have carried her down the ages. To these gifts she allied a perfect sense of dramatic progression and an admirably lucid and flowing prose style which makes her stories the easiest reading.

Recognition came to Miss Austen slowly. It was not until quite recent times that to read her became a necessity of culture. But she is now firmly established as an English classic, standing far above Miss Burney (Madame d'Arblay) and Miss Edgeworth, who in her day were the popular women novelists of real life, while Mrs Radcliffe and "Monk" Lewis, whose supernatural fancies *Northanger Abbey* was written in part to ridicule, are no longer anything but names. Although, however, she has become only lately a household word, Miss Austen had always her panegyrists among the best intellects—such as Coleridge, Tennyson, Macaulay, Scott, Sydney Smith, Disraeli and Archbishop Whately, the last of whom may be said to have been her discoverer. Macaulay, whose adoration of Miss Austen's genius was almost idolatrous, considered *Mansfield Park* her greatest feat; but many critics give the palm to *Emma*. Disraeli read *Pride and Prejudice* seventeen times. Scott's testimony is often quoted: "That young lady had a talent for describing the involvements, feelings and characters of ordinary life which is to me the most wonderful I have ever met with. The big bow-wow I can do myself like any one going; but the exquisite touch which renders commonplace things and characters interesting from the truth of the description and the sentiment is denied to me."

Many monographs on Miss Austen have been written, in addition to the authorized *Life* by her nephew J. E. Austen Leigh in 1870, and the collection of her *Letters* edited by Lord Brabourne in 1884. The chief books on her and around her are *Jane Austen*, by S. F. Malden (1889); *Jane Austen*, by Goldwin Smith (1890); *Jane Austen: Her Contemporaries and Herself*, by W. H. Pollock; *Jane Austen: Her Homes and Her Friends*, by Constance Hill (1902); *Jane Austen and Her Times*, by G. E. Mitton (1905); *Jane Austen's Sailor Brothers*, by J. H. and E. C. Hubback (1906); and the essay on her in Lady Richmond (Thackeray) Ritchie's *Book of Sibyls* (1883). (E. V. L.)

AUSTERLITZ (Czech *Slavkov*), a town of Austria, in Moravia, 15 m. E.S.E. of Brünn by rail. Pop. (1900) 3145, mostly Czech. It contains a magnificent palace belonging to the prince of Kaunitz-Rietberg, and a beautiful church.

The great battle in which the French under Napoleon I. defeated the Austrians and Russians on the 2nd of December 1805, was fought in the country to the west of Austerlitz, the position of Napoleon's left wing being almost equi-distant from Brünn and from Austerlitz. The wooded hills to the northward throw out to the south and south-west long spurs, between which are the low valleys of several rivers and brooks. The scene of the most important fighting was the Pratzen plateau. The famous "lakes" in the southern part of the field were artificial ponds, which have long since been drained. On the west or Brünn side of the Goldbach is another and lower ridge, which formed in the battle the first position of the French right and centre. On the other wing is the mass of hills from which the spurs and streams descend: here the Olmütz-Brünn road passes. The road from Brünn to Vienna, Napoleon's presumed line of retreat, runs in a southerly direction, and near the village of Raigern (3 m. west of Mönitz) is very close to the extreme right of the French position, a fact which had a great influence on the course of the battle. (The course of events which led to the action is described under NAPOLEONIC CAMPAIGNS.) Napoleon, falling back before the advance of the allied Austrians and Russians from Olmütz, bivouacked west of the Goldbach, whilst the allies, holding, near Austerlitz, the junction of the roads from Olmütz and from Hungary, formed up in the valleys east of the Pratzen heights. The cavalry of both sides remained inactive, Napoleon's by express order, the enemy's seemingly from mere negligence, since they had 177 squadrons at their disposal. Napoleon, having determined to fight, as usual called up every available battalion; the splendid III. corps of Davout only arrived upon the field after a heavy march, late on the night of December 1st. The plan of the allies was to attack Napoleon's right, and to cut him off from Vienna, and their advanced guard began, before dark on the 1st of December, to skirmish towards Telnitz. At that moment Napoleon was in the midst of his troops, thousands of whom had made their bivouac-straw into torches in his honour. The glare of these seemed to the allies to betoken the familiar device of lighting fires previous to a retreat, and thus confirmed them in the impression which Napoleon's calculated timidity had given. Thus encouraged, those who desired an immediate battle soon gained the upper hand in the councils of the tsar and the emperor Francis. The attack orders for the 2nd of December (drawn up by the Austrian general Weyrother, and explained by him to a council of superior officers, of whom some were hostile, the greater part indifferent, and the chief Russian member, General Kutusov, asleep) gave the five columns and the reserve, into which the Austro-Russian army was organized, the following tasks: the first and second (Russians) to move south-westward behind the Pratzen ridge towards Telnitz and Sokolnitz; the third (Russian) to cross the southern end of the plateau, and come into line on the right of the first two; the fourth (Austrians and Russians under Kolowrat) on the right of the third to advance towards Kobelnitz. An Austrian advanced guard preceded the 1st and 2nd columns. Farther still on the right the 5th column (cavalry under Prince John of Liechtenstein) was to hold the northern part of the plateau, south of the Brünn-Olmütz road; across the road itself was the corps of Prince Bagration, and in rear of Liechtenstein's corps was the reserve (Russians under the grand-duke Constantine). Thus, the farther the four main columns penetrated into the French right wing, the wider would the gap become between Bagration and Kolowrat, and Liechtenstein's squadrons could not form a serious obstacle to a heavy attack of Napoleon's centre. The whole plan was based upon defective information and preconceived ideas; it has gone down to history as a classical example of bad generalship, and its author Weyrother, who was perhaps nothing worse than a pedant, as a charlatan.



Napoleon, on the other hand, with the exact knowledge of the powers of his men, which was the secret of his generalship, entrusted nearly half of his line of battle to a division (Legrand's) of Soult's corps, which was to be supported by Davout, some of whose brigades had marched, from Vienna, 90 m. in forty-eight hours. But the ground which this thin line was to hold against three columns of the enemy was marshy and densely intersected by obstacles, and the III. corps was the best in the *Grande Armée*, while its leader was perhaps the ablest of all Napoleon's marshals. The rest of the army formed in the centre and left. "Whilst they march to turn my right," said Napoleon in the inspiriting proclamation which he issued on the eve of the battle, "they present me their flank," and the great counterstroke was to be delivered against the Pratzen heights by the French centre. This was composed of Soult's corps, with Bernadotte's in second line. On the left, around the hill called by the French the Santon (which was fortified) was Lannes' corps, supported by the cavalry reserve under Murat. The general reserve consisted of the Guard and Oudinot's grenadiers.

The attack of the allies was begun by the first three columns, which moved down from their bivouacs behind the Pratzen plateau before dawn on the 2nd, towards Telnitz and Sokolnitz. The Austrian advanced guard engaged at daybreak, and the French in Telnitz made a vigorous defence; both parties were reinforced, and Legrand drew upon himself, in fulfilling his mission, the whole weight of the allied attack. The contest was long and doubtful, but the Russians gradually drove back Legrand and a part of Davout's corps; numerous attacks both of infantry and cavalry were made, and by the successive arrival of reinforcements each side in turn received fresh impetus. Finally, at about 10 A.M., the allies were in possession of the villages on the Goldbach from Sokolnitz southwards, and Davout's line of battle had reformed more than a mile to rearward, still, however, maintaining touch with the French centre on the Goldbach at Kobelnitz. Between the two lines the fighting continued almost to the close of the battle. With 12,500 men of all arms the Marshal held in front of him over 40,000 of the enemy.

In the centre, the defective arrangements of the allied staff had delayed the 4th column (Kolowrat), the line of march of which was crossed by Liechtenstein's cavalry moving in the opposite direction. The objective of this column was Kobelnitz, and the two emperors and Kutusov accompanied it. The delay had, however, opened a gap between Kolowrat and the 3rd column on his left; and towards this gap, and the denuded Pratzen plateau, Napoleon sent forward St Hilaire's division of Soult's corps for the decisive attack. Kutusov was pursuing this march to the south-west when he was surprised by the swift advance of Soult's men on the plateau itself. Napoleon had here double the force of the allies; Kutusov, however, displayed great energy, changed front to his right and called up his reserves. The French did not win the plateau without a severe struggle. St Hilaire's (the right centre) division was fiercely engaged by Kolowrat's column, General Miloradovich opposed the left centre attack under Vandamme, but the French leaders were two of the best fighting generals in their army. The rearmost troops of the Russian 2nd column, not yet committed to the fight on the Goldbach, made a bold counter stroke against St Hilaire's right flank, but were repulsed, and Soult now turned to relieve the pressure on Davout by attacking Sokolnitz. The Russians in Sokolnitz surrendered, an opportune cavalry charge further discomfited the allied left, and the Pratzen plateau was now in full possession of the French. Even the Russian Guard failed to shake Vandamme's hold. In the meanwhile Lannes and Murat had been engaged in the defence of the Santon. Here the allied leaders displayed the greatest vigour, but they were unable to drive back the French. The cavalry charges in this quarter are celebrated in the history of the mounted arm; and Kellermann, the hero of Marengo, won fresh laurels against the cavalry of Liechtenstein's command. The French not only held their ground, but steadily advanced and eventually forced back the allies on Austerlitz, thereby barring their retreat on Olmütz. The last serious attempt of the allies in the centre led to some of the hardest fighting of the day; the Russian Imperial Guard under the grand-duke Constantine pressed closely upon St Hilaire and Vandamme on the plateau, and only gave way when the French Guard and the Grenadiers came into action. After the "Chevalier Guards" had been routed by Marshal Bessières and the Guard cavalry, the allies had no more hope of victory; orders had already been sent to Buxhöwden, who commanded the three columns engaged against Davout, to retreat on Austerlitz. No further attempt was made on the plateau, which was held by the French from Pratzen to the Olmütz road. The allied army was cut in two, and the last confused struggle of the three Russian columns on the Goldbach was one for liberty only. The fighting in Telnitz was perhaps the hardest of the whole battle, but the inevitable retreat, every part of which was now under the fire of the French on the plateau, was terribly costly. Soult now barred the way to Austerlitz, and the allies turned southward towards Satschan. As they retreated, the ice of the Satschan pond was broken up by the French artillery, and many of the fugitives were drowned. In the twelve hours from 7 A.M. to nightfall, the 65,000 French troops had lost 6800 men, or about 10%; the allies (82,500 engaged) had 12,200 killed and wounded, and left in the enemy's hands 15,000 prisoners (many wounded) and 133 guns.

AUSTIN, ALFRED (1835–), English poet-laureate, was born at Headingley, near Leeds, on the 30th of May 1835. His father, Joseph Austin, was a merchant of the city of Leeds; his mother, a sister of Joseph Locke, M.P. for Honiton. Mr Austin was educated at Stonyhurst, Oscott, and London University, where he graduated in 1853. He was called to the bar four years later, and practised as a barrister for a short time; but in 1861, after two comparatively false starts in poetry and fiction, he made his first noteworthy appearance as a writer with a satire called *The Season*, which contained incisive lines, and was marked by some promise both in wit and observation. In 1870 he published a volume of criticism, *The Poetry of the Period*, which was again conceived in a spirit of satirical invective, and attacked Tennyson, Browning, Matthew Arnold and Swinburne in no half-hearted fashion. The book aroused some discussion at the time, but its judgments were extremely uncritical. In 1881 Mr Austin returned to verse with a tragedy, *Savonarola*, to which he added *Soliloquies* in 1882, *Prince Lucifer* in 1887, *England's Darling* in 1896, *The Conversion of Winckelmann* in 1897, &c. A keen Conservative in politics, for several years he edited *The National Review*, and wrote leading articles for *The Standard*. On Tennyson's death in 1892 it was felt that none of the then living poets, except Swinburne or William Morris, who were outside consideration on other grounds, was of sufficient distinction to succeed to the laurel crown, and for several years no new poet-laureate was nominated. In the interval the claims of one writer and another were much canvassed, but eventually, in 1896, Mr Austin was appointed. As poet-laureate, his occasional verses did not escape adverse criticism; his hasty poem in praise of the Jameson Raid in 1896 being a notable instance. The most effective characteristic of Mr Austin's poetry, as of the best of his prose, is a genuine and intimate love of nature. His prose idylls, *The Garden that I love* and *In Veronica's Garden*, are full of a pleasant, open-air flavour, which is also the outstanding feature of his *English Lyrics*. His lyrical poems are wanting in spontaneity and individuality, but many of them possess a simple, orderly charm, as of an English country lane. He has, indeed, a true love of England, sometimes not without a suspicion of insularity, but always fresh and ingenuous. A drama by him, *Flodden Field*, was acted at His Majesty's theatre in 1903.

AUSTIN, JOHN (1790–1859), English jurist, was born on the 3rd of March 1790. His father was the owner of flour mills at Ipswich and in the neighbourhood, and was in good circumstances. John was the eldest of five brothers. One of his brothers, Charles (1799–1874), obtained great distinction at the bar. John Austin entered the army at a very early age; he is said to have been only sixteen. He served with his regiment under Lord William Bentinck in Malta and Sicily. He seems to have liked his profession, and to have joined in the amusements and even in the follies of his brother officers. Yet it appears from a journal kept by him at the time that he occupied himself with studies of a far more serious kind than is common amongst young officers in the army. He notes having read in the course of one year Dugald Stewart's *Philosophical Essays*, Drummond's *Academical Questions*, Enfield's *History of Philosophy*, and Mitford's *History of Greece*, and upon all of these he makes observations which disclose much thought and a capacity for criticism which must have come from extensive reading elsewhere. The prevailing note of this journal is one of bitter self-depreciation. He says in it that the retrospect of the past year (1811) "has hardly given rise to one single feeling of satisfaction," and farther on he says that "indolence, always the prominent vice of my character," has "assumed over me an empire I almost despair of shaking off." It is difficult to believe that a man only just of age, whose serious reading consisted of such books, and who (as appears from the same journal) was in the habit of turning to the classics as an alternative, could have deserved the reproach of indolence.

In 1812, he resigned his commission in the army, and returned home. He then began to read law in the chambers of a barrister. He was called to the bar in the year 1818, and joined the Norfolk circuit, but he never obtained any large practice, and he finally retired from the bar in 1825. In 1819 he married Sarah Taylor (see AUSTIN, SARAH).

Although Austin had failed to attain success at the bar it was not long before he had an opportunity of exercising his abilities and in a manner peculiarly suited to his particular turn of mind. In 1826 a number of eminent men were engaged in the foundation of University College, and it was determined to establish in it a chair of jurisprudence. This chair was offered to Austin and he agreed to accept it. As he was not called upon to begin his lectures immediately, he resolved to proceed to Germany in order to prepare himself for his duties by studying the method of legal teaching pursued at German universities. He resided first at Heidelberg, and afterwards at Bonn, where he lived on terms of intimacy with such distinguished lawyers as Savigny and K. J. A. Mittermaier, and such eminent men of letters as Niebuhr, Brandis, Schlegel and A. W. Heffter. He began lecturing in 1828, and at first was not without encouragement. His class was a peculiarly brilliant one. It included a number of men who afterwards became eminent in law, politics and philosophy—Sir George Cornewall Lewis, Charles Buller, Charles Villiers, Sir Samuel Romilly and his brother Lord Romilly, Edward Strutt afterwards Lord Belper, Sir William Erle and John Stuart Mill were all members of his class. All of these have left on record expressions of the profound admiration which the lectures excited in the minds of those who heard them. But the members of his class, though exceptional in quality, were few in number, and as there was no fixed salary attached to the professorship, Austin could not afford to remain in London, and in 1832 he resigned. In that year he published his *Province of Jurisprudence determined*, being the first ten of his delivered lectures compressed into six.

There is ample testimony that Austin's lectures were very highly appreciated by those who heard them. Their one fault was that they were over-elaborated. In his desire to avoid ambiguity, he repeats his explanations and qualifications to an extent which must have tired his hearers. Nevertheless the lectures excited an admiration which almost amounted to enthusiasm. Nor was Austin's influence confined to his lectures. Sir William Erle says in a letter written to him in 1844, "The interchange of mind with you in the days of Lincoln's Inn I regard as a deeply important event in my life, and I ever remember your friendship with thankfulness and affection." John Stuart Mill, whose views on political subjects were entirely opposed to those of Austin, spoke of him after his death as the man "to whom he (Mill) had been intellectually and morally most indebted," and he expressed the opinion "that few men had contributed more by their individual influence, and their conversation, to the formation and growth of the most active minds of the generation."

In 1833 a royal commission was issued to draw up a digest of criminal law and procedure. Of this commission Austin was a member. The first report was signed by all the commissioners, and was presented in June 1834. Nevertheless it appears from some notes made at the time that Austin, though he thought it his duty to sign the report, strongly objected to some passages which it contained. It is pretty obvious from the nature of these objections that nothing would have satisfied him short of a complete recasting of the criminal law, whereas what the commissioners were ordered to produce was not a code but a digest. Probably Austin felt, as Mr Justice Wills felt some years later, that the anomalies which a code would remove would "choke a digest."

In 1834 the benchers of the Inner Temple appointed Austin to give lectures on the "General Principles of Jurisprudence and International Law." He delivered a few lectures in the spring of that year, but in June the course was by order of the benchers suspended on account of the smallness of the attendance, and it was never resumed. He then went to live with his wife and only child Lucie (afterwards Lady Duff-Gordon) at Boulogne. Here he remained for about a year and a half. He then accepted an appointment offered him by Sir James Stephen to go as royal commissioner to Malta in conjunction with Mr (afterward Sir George) Cornewall Lewis, to inquire into the nature and extent of the grievances of which the natives of that island complained.

The Austins remained in Malta until July 1838. After their return they lived a good deal abroad, and in 1844 they settled in Paris, where they remained until driven out of France by the revolution of 1848. They then took a house at Weybridge, and there Austin remained until his death in December 1859. He was urged by his friends to publish a second edition of the *Province of Jurisprudence*, which was then out of print, and he went so far as to allow a prospectus to be issued by Mr Murray of an extended work on "The Principles and Relations of Jurisprudence and Ethics." But nothing came of it.

In 1842 Austin published in the *Edinburgh Review* an attack upon Friedrich List's system of trade protection (*Das nationale System der politischen Ökonomie*). And in 1859 he published a pamphlet entitled "A Plea for the Constitution." This was occasioned by the publication of Lord Grey's essay on "Parliamentary Government." Its main object was to show that the consequences to be anticipated from Parliamentary Reform were all of them either impossible of realization or mischievous. He thought any attempt on the part of the poorer classes to improve their position was barred by the inexorable laws of political economy; and that if they obtained power they would only use it to plunder the rich; whilst, on the other hand, he seems not to have had any suspicion that the "proprietary class" were likely to disregard the interests of the poor. He thinks that political power is safest in the hands of those possessed of hereditary or acquired property; and that without property even intelligence and knowledge afford no presumption of political capacity. Undoubtedly Austin was a utilitarian in the Benthamite sense, and remained so to the end of his life. It must be remembered that Bentham's sole and immutable test of human action was the greatest happiness of the greatest number. This is a principle which an aristocrat may adopt if he chooses, no less than a democrat; an individualist no less than a socialist; and there is nothing in the "Plea for the Constitution" which contravenes this. But Austin thought, and in this no doubt he differed from Bentham, that the mass of the people did not know their own interests so well as "an aristocracy of independent gentlemen" who might be trusted to provide for the wants of all classes alike.

Austin's position as a jurist is much more difficult to estimate. Twice his influence appeared likely to produce some impression upon English law, but upon both occasions it lasted only a short time, and never extended very far. The men whom he influenced were very eminent, but in numbers they were few. As a rule, students for the bar never at any time paid any attention to his teaching. The first published lectures were almost forgotten when Mr (afterwards Sir Henry) Maine was appointed to lecture on jurisprudence at the Inner Temple. Both in his private and public lectures Maine constantly urged upon his hearers the importance of Austin's analytical inquiries into the meaning of legal terms. He used to say that it was Austin's inquiries which had made a philosophy of law possible. Undoubtedly Maine's influence revived for a short time the interest in Austin's teaching. Maine was lecturing about the time of Austin's death, and in 1861 Mrs Austin published a second edition of the *Province of Jurisprudence*, and this was followed soon after by two volumes which contained in addition in a fragmentary form the remaining lectures delivered at University College and other notes (*Lectures on Jurisprudence; or The Philosophy of Positive Law*).

It cannot be said that Austin's views of jurisprudence have had, as yet, any visible influence whatever on the study of English law. But if we consider what it was that Austin endeavoured to teach, it can hardly be said that the subject is one which a lawyer can with impunity neglect. He proposes to distinguish law from morals; to explain the notions which have been entertained of duty, right, liberty, injury, punishment and redress; and their connexion with, and relations to, sovereignty; to examine the distinction between rights *in rem* and rights *in personam*, and between rights *ex contractu* and rights *ex delicto*; and further to determine the meaning of such terms as right, obligation, injury, sanction, person, thing, act and forbearance. These are some of the terms, notions and distinctions which Austin endeavoured to explain. They are daily in the mouth of every practising lawyer. The only portion of Austin's work which has attracted much attention of recent years is his conception of sovereignty, and his dictum that all laws properly so called must be considered as sanctioned expressly or tacitly by the sovereign. This has been indignantly denied. It has been considered enough to justify this denial to point out that there are in existence states where the seat of sovereignty, and the ultimate source of law, cannot be accurately indicated. But this criticism is entirely misplaced; for as pointed out by Maine (*Early History of Institutions*, Lecture xii.), in an elaborate discussion of Austin's views, which in the main he accepts, what Austin was engaged upon was not an inquiry into the nature of sovereignty as it is found to exist, but an inquiry into what was the connexion between the various forms of political superiority. And this inquiry was undertaken in order to enable him to distinguish the province of jurisprudence properly so called from the province of morality; an inquiry which was hopeless unless the connexion just stated was clearly conceived. Austin's views of sovereignty, therefore, was an abstraction, useless it is true for some purposes, but by no means useless for others. "There is," as Maine says, "not the smallest necessity for accepting all the conclusions of these great writers (*i.e.* Bentham and Austin) with implicit deference, but there is the strongest necessity for knowing what these conclusions are. They are indispensable, if for no other object, for the purpose of clearing the head." These last words exactly express the work which Austin set himself to do. It was to clear his own head, and the heads of his hearers, that he laboured so hard. As Austin once said of himself, his special vocation was that of untying intellectual knots. The disentangling of classifications and distinctions, the separation of real from accidental distinctions, the analysis of ideas confusedly apprehended, these (as has been truly said) were the characteristics of Austin's work which specially distinguished him. Austin thought that this somewhat irksome task was a necessary preliminary both to the study of law as a science, and to the production of a code. It is a curious reflection that whilst the lectures in which these inquiries were begun (though not completed) excited the admiration of his contemporaries, hardly any one now thinks such inquiries worth pursuing.

The *Lectures on Jurisprudence* were reviewed by J. S. Mill in the *Edinburgh Review* of October 1863, and this review is republished in Mill's *Dissertations and Discussions*, vol. 3, p. 206. Professor Jethro Brown has published (1906) an edition of Austin's earlier lectures, in which they are stated in an abbreviated form. There is a sketch of his life by his widow in the preface to the *Lectures on Jurisprudence*, which she published after his death. (W. Ma.)

AUSTIN, SARAH (1793–1867), English author, was born in 1793, the daughter of John Taylor (d. 1826), a wool-stapler and a member of the well-known Taylor family of Norwich. Her great grandfather, Dr John Taylor (1694–1761), had been pastor of the Presbyterian church there, and wrote a once famous polemical work on *The Scripture Doctrine of Original Sin* (1738), which called forth celebrated treatises by Jonathan Edwards on *Original Sin*. Her mother, Susannah Cook, was an exceedingly clever woman who transmitted both her beauty and her talent to her daughter. Their friends included Dr Alderson and his daughter Mrs Opie, Henry Crabbe Robinson, the Gurneys and Sir James Mackintosh. Sarah Taylor married in 1820 John Austin (*q.v.*). They lived in Queen Square, Westminster, where Mrs. Austin, whose tastes, unlike her husband's, were extremely sociable, gathered round her a large circle, Jeremy Bentham, James Mill and the Grotes being especially intimate. She received many Italian exiles, who found a real friend in her. In 1821 was born her only child, Lucie, afterwards Lady Duff-Gordon. Mrs. Austin never attempted any considerable original work, contenting herself chiefly with translations, of which the most important are the *History of the Reformation in Germany* and the *History of the Popes* (1840), from the German of Leopold von Ranke, *Report on the State of Public Instruction in Prussia* (1834) from the French of V. Cousin, and F. W. Carove's *The Story without an End* (1864). After her husband's death in 1859 she edited his *Lectures on Jurisprudence*. She also edited the *Memoirs of Sydney Smith* (1855) and Lady Duff-Gordon's *Letters from Egypt* (1865). She died at Weybridge on the 8th of August 1867.

See *Three Generations of Englishwomen* (1888), by her granddaughter, Mrs Janet Ross.

AUSTIN, STEPHEN FULLER (1793–1836), American pioneer, was born in Austinville, Wythe county, Virginia, on the 3rd of November 1793. He was the son of Moses Austin (1767–1821), a native of Durham, Connecticut, who in 1820 obtained from Mexico a grant of land for an American colony in Texas, but died before he could carry out his project. The son was educated in New London, Connecticut, and at Transylvania University, Lexington, Kentucky, and settled in Missouri, where he was a member of the territorial legislature from 1813 to 1819. In 1819 he removed to Arkansas Territory, where he was appointed a circuit judge. After his father's death he obtained a confirmation of the Texas grants from the newly established Mexican government, and in 1821–1823 he established a colony of several hundred American families on the Brazos river, the principal town being named, in his honour, San Felipe de Austin. He was a firm defender of the rights of the Americans in Texas, and in 1833 he was sent to the city of Mexico to present a petition from a convention in Texas praying for the erection of a separate state government. While there, despairing of success for his petition, he wrote home recommending the organization of a state without waiting for the consent of the Mexican congress. This letter falling into the hands of the Mexican government, Austin, while returning home, was arrested at Saltillo, carried as a prisoner back to Mexico, and imprisoned for a year without trial. Returning to Texas in 1835, he found the Texans in armed revolt against Mexican rule, and was chosen commander-in-chief of the revolutionary forces, but after failing to take San Antonio he resigned the command, for which he had never considered himself fitted, and in November 1835 went to the United States as a commissioner to secure loans and supplies, and to learn the position the United States authorities would be likely to take in the event of a declaration of Texan independence. He succeeded in raising large sums, and received assurances that satisfied him that Americans would look with great favour on an independent Texas. Returning to Texas in the summer of 1836, he became a candidate, rather reluctantly, for the presidency of the newly established republic of Texas, but was defeated by Samuel Houston, under whom he was secretary of state until his sudden death on the 7th of December 1836.

See *A Comprehensive History of Texas*, edited by D. G. Wooten (2 vols., Dallas, 1898).

AUSTIN, a city and the county-seat of Mower county, Minnesota, U.S.A., on the Red Cedar river and Turtle creek, (by rail) 105 m. S. of Minneapolis and 100 m. from St Paul. Pop. (1900) 5474; (1905, state census) 6489 (913 foreign-born); (1910, U.S. census) 6960. It is served by the Chicago Great Western and the Chicago, Milwaukee & St Paul railways. Austin is the seat of the Southern Minnesota Normal College and Austin School of Commerce (1896), and has a Carnegie library, court house and city hall. It is a market for live-stock, and for dairy and farm products, and has slaughtering and packing establishments, flour mills, creameries and cheese factories, canning and preserving factories, carriage works, a flax fibre mill and grain elevators. Brick, tile, sewer-pipe, and hydraulic cement are manufactured, and there are railway repair shops. A valuable water-power is utilized for manufacturing purposes. Fresh-water pearls of considerable value and beauty are found in the Red Cedar river. The city owns and operates its own water-supply system and electric-lighting plant. Austin was settled in 1855, was incorporated as a village in 1868, and was chartered as a city in 1873.

AUSTIN, the capital of Texas, U.S.A., and the county-seat of Travis county, on the N. bank of the Colorado river, near the centre of the state and about 145 m. W.N.W. of Houston. Pop. (1890) 14,575; (1900) 22,258, of whom 5822 were negroes; (1910 census) 29,860. Austin is served by the Houston & Texas Central, the International & Great Northern, and the Missouri, Kansas & Texas railways. The city is built on high bluffs 40-120 ft. above the river, which is spanned here by a bridge, built in 1874. The Texas State Capitol, a handsome building of red Texas granite, with a dome 318 ft. high, cost more than $3,500,000, and stands in a square in the centre of the city. It was built (1881–1888) by Chicago capitalists in exchange for a land grant of 3,000,000 acres. It is in the form of a Greek cross, with an extreme length of 556·5 ft. and an extreme width of 288·8 ft. Next to the National Capitol at Washington, it is the largest capitol building in the United States, and it is said to be one of the ten largest buildings in the world. Austin is the seat of the University of Texas (opened in 1883; co-educational); the medical department of the state university is at Galveston, and the departments in Austin are the college of arts, department of education, department of engineering, department of law, school of pharmacy, and school of nursing. The government of the university is vested in a board of eight regents nominated by the governor and appointed with the advice and consent of the state senate. At Austin are also state institutions and asylums for the insane, the blind, the coloured deaf and blind; the state school for the deaf and dumb; the state Confederate home; the Confederate woman's home (1907; for wives and widows of Confederate soldiers and sailors), maintained by the Daughters of the Confederacy; St Mary's Academy (Roman Catholic, under the supervision of the Sisters of the Holy Cross, founded 1875, chartered 1886); St Edward's College (Roman Catholic, chartered 1885); the Austin Presbyterian Theological Seminary (Presbyterian Church, South), opened in 1902 by the Synod of Texas, and after 1905 partly controlled by the Synod of Arkansas; Tillotson College (a negro school under Congregational control, founded by the American Missionary Association, chartered in 1877, and opened in 1881); and Samuel Huston College (for negroes; Methodist Episcopal; opened in 1900 and named in honour of an Iowan benefactor). The principal newspapers of Austin are the *Statesman* (Democratic, established in 1871), a morning paper, and the *Tribune* (Democratic, established in 1891), an evening paper. The *Quarterly of the Texas State Historical Society* is published here. Austin is the principal trade and jobbing centre for central and western Texas, is an important market for live-stock, cotton, grain and wool, and has extensive manufactories of flour, cotton-seed oil, leather goods, lumber and wooden ware; the value of the factory product in 1905 was $1,569,353, being 105·2 % more than in 1900. The city owns and operates its water-supply system. In 1890–1893 one of the largest dams in the world, an immense structure of granite masonry, 1200 ft. long, 60-70 ft. high, and 18 to 66 ft. thick, was constructed across the Colorado river 2 m. above the city for the purpose of supplying water and power, creating a reservoir (Lake M'Donald) about 30 m. long. Freshets in the spring of 1900, however, undermined the wall, and on the 7th of April the dam broke with a resulting loss of several lives and about $1,000,000 worth of property. The rebuilding of the dam was projected in 1907. Austin was first settled in 1838 and was named Waterloo, but in 1839, when it was chosen as the site of the capital of the Republic of Texas, it was renamed in honour of Stephen F. Austin, one of its founders. Under the influence of General Sam Houston the capital was for a time in 1842–1845 removed from Austin to Houston, but in 1845 an ordinance was passed making Austin the capital, and it remained the state capital after Texas entered the Union, although Huntsville and Tehuacana Springs in 1850 and Houston in 1872 attempted in popular elections to be chosen in its place. The first Anglo-American settlement in Texas, established on the Brazos river in 1823 by members of the Austin colony, was San Felipe de Austin now San Felipe. In 1909 Austin adopted a commission form of government.

AUSTRALASIA, a term used by English geographers in a sense nearly synonymous with the Oceania of continental writers. It thus comprises all the insular groups which extend almost continuously from the south-eastern extremity of Asia to more than half-way across the Pacific. Its chief divisions are Malaysia with the Philippines; Australia with Tasmania and New Zealand; Melanesia, that is, New Guinea, New Britain, New Ireland, Admiralty, the Solomons, New Hebrides, Santa Cruz, Fiji, Loyalties and New Caledonia; Micronesia, that is, the Ladrones, Pelew and Carolines, with the Marshall and Gilbert groups; lastly, Polynesia, that is, Samoa, Tonga, Cook, Tahiti, the Marquesas, Ellice, Hawaii and all intervening clusters. The term is so far justified in that it harmonizes better than Oceania did with the names of the other continents, and also embodies the two essential facts that it is a south-eastern extension of Asia, and that its central and most important division is the great island-continent of Australia. In a more restricted sense the term Australasia corresponds to the large division including Australia, Tasmania and New Zealand.

See *Australasia*, 2 vols. Stanford Compendium Series, new issue (London, 1907–1908).

AUSTRALIA, the only continent entirely in the southern hemisphere. It lies between 10° 39′ and 39° 11½′ S., and between 113° 5′ and 153° 16′ E. Its greatest length is 2400 m. from east to west, and the greatest breadth 1971 m. from north to south. The area is, approximately, 2,946,691 sq. m., with a coast line measuring about 8850 m. This is equal to 1 m. to each 333 sq. m. of land, the smallest proportion of coast shown by any of the continents.

PHYSICAL GEOGRAPHY

General character.

Physiography.—The salient features of the Australian continent are its compact outline, the absence of navigable rivers communicating with the interior, the absence of active volcanoes or snow-capped mountains, its isolation from other lands, and its antiquity. Some of the most profound changes that have taken place on this globe occurred in Mesozoic times, and a great portion of Australia was already dry land when vast tracts of Europe and Asia were submerged; in this sense, therefore, Australia has been rightly referred to as one of the oldest existing land surfaces. It has been described as at once the largest island and the smallest continent on the globe. The general contours exemplify the law of geographers in regard to continents, viz. as to their having a high border around a depressed interior, and the highest mountains on the side of the greatest ocean. On the N. Australia is bounded by the Timor Sea, the Arafura Sea and Torres Strait; on the E. by the Pacific Ocean; on the S. by Bass Strait and the Southern Ocean; and on the W. by the Indian Ocean. It stands up from the ocean depths in three fairly well-marked terraces. The basal plain of these terraces is the bed of the ocean, which on the Pacific side has an average depth of 15,000 ft. From this profound foundation rise Australia, New Guinea and Melanesia, in varying slopes. The first ledge rising from the ocean floor has a depth averaging 8000 ft. below sea-level. The outer edge of this ledge is roughly parallel to the coast of Western Australia, and more than 150 m. from the land. Round the Australian Bight it continues parallel to the coast, until south of Spencer Gulf (the basal ledge still averaging 8000 ft. in depth) it sweeps southwards to lat. 55°, and forms a submarine promontory 1000 m. long. The edge of the abysmal area comes close to the eastern coasts of Tasmania and New South Wales, approaching to within 60 m. of Cape Howe. The terrace closest to the land, known as the continental shelf, has an average depth of 600 ft., and connects Australia, New Guinea, and Tasmania in one unbroken sweep. Compared with other continents, the Australian continental shelf is extremely narrow, and there are points on the eastern coast where the land plunges down to oceanic depths with an abruptness rarely paralleled. Off the Queensland coast the shelf broadens, its outer edge being lined by the seaward face of the Great Barrier Reef. From Torres Strait to Dampier Land the shelf spreads out, and connects Australia with New Guinea and the Malay Archipelago. An elongation of the shelf to the south joins Tasmania with the mainland. The vertical relief of the land above the ocean is a very important factor in determining the climate as well as the distribution of the fauna and flora of a continent.

The land mass of Australia rises to a mean height much less than that of any other continent; and the chief mountain systems are parallel to, and not far from, the coast-line. Thus, taking the continent as a whole, it may be described as a plateau, fringed by a low-lying well-watered coast, with a depressed, and for the most part arid, interior. A great plain, covering quite 500,000 sq. m., occupies a position a little to the east of a meridional line bisecting the continent, and south of the 22nd degree, but portions of it stretch upwards to the low-lying country south of the Gulf of Carpentaria. The contour of the continent in latitude 30° 5′ is as follows:—a short strip of coastal plain; then a sharp incline rising to a mountain range 4000 ft. above sea-level, at a distance of 40 m. from the coast. From this a gently-sloping plateau extends to almost due north of Spencer Gulf, at which point its height has fallen almost to sea-level. Then there is a gentle rise to the low steppes, 500 to 1000 ft. above sea-level. A further gentle rise in the high steppes leads to the mountains of the West Australian coast, and another strip of low-lying coastal land to the sea.

With a circumference of 8000 m. Australia presents a contour wonderfully devoid of inlets from the sea except on its northern shores, where the coast-line is largely indented. The Gulf of Carpentaria, situated in the north, is enclosed on the east by the projection of Cape York, and on the west by Arnheim Land, and forms the principal bay on the whole coast, measuring about 6° of long. by 6° of lat. Farther to the west, Van Diemen's Gulf, though much smaller, forms a better-protected bay, having Melville Island between it and the ocean; while beyond this, Queen's Channel and Cambridge Gulf form inlets about 14° 50′ S. On the north-west of the continent the coast-line is much broken, the chief indentations being Admiralty Gulf, Collier Bay and King Sound, on the shores of Tasman Land. Western Australia, again, is not favoured with many inlets, Exmouth Gulf and Shark's Bay being the only bays of any size. The same remark may be made of the rest of the sea-board; for, with the exception of Spencer Gulf, the Gulf of St Vincent and Port Phillip on the south, and Moreton Bay, Hervey Bay and Broad Sound on the east, the coast-line is singularly uniform. There are, however, numerous spacious harbours, especially on the eastern coast, which are referred to in the detailed articles dealing with the different states. The Great Barrier Reef forms the prominent feature off the north-east coast of Australia; its extent from north to south is 1200 m., and it is therefore the greatest of all coral reefs. The channel between the reef and the coast is in places 70 m. wide and 400 ft. deep. There are a few clear openings in the outer rampart which the reef presents to the ocean. These are opposite to the large estuaries of the Queensland rivers, and might be thought to have been caused by fresh water from the land. The breaks are, however, some 30 to 90 m. away from land and more probably were caused by subsidence; the old river-channels known to exist below sea-level, as well as the former land connexion with New Guinea, seem to point to the conditions assumed in Darwin's well-known subsidence theory, and any facts that appear to be inconsistent with the theory of a steady and prolonged subsidence are explainable by the assumption of a slight upheaval.

With the exception of Tasmania there are no important islands belonging geographically to Australia, for New Guinea, Timor and other islands of the East Indian archipelago, though not removed any great distance from the continent, do not belong to its system. On the east coast there are a few small and unimportant islands. In Bass Strait are Flinders Island, about 800 sq. m. in area, Clarke Island, and a few other small islands. Kangaroo Island, at the entrance of St Vincent Gulf, is one of the largest islands on the Australian coast, measuring 80 m. from east to west with an average width of 20 m. Numerous small islands lie off the western coast, but none has any commercial importance. On the north coast are Melville and Bathurst Islands; the former, which is 75 m. long and 38 m. broad, is fertile and well watered. These islands are opposite Port Darwin, and to the westward of the large inlet known as Van Diemen's Gulf. In the Gulf of Carpentaria are numerous islands, the largest bearing the Dutch name of Groote Eylandt.

Mountains. Along the full length of the eastern coast extends a succession of mountain chains. The vast cordillera of the Great Dividing Range originates in the south-eastern corner of the continent, and runs parallel with and close to the eastern shore, through the states of Victoria and New South Wales, right up to the far-distant York Peninsula in Queensland. In Victoria the greatest elevation is reached in the peaks of Mount Bogong (6508 ft.) and Mount Feathertop (6303 ft.), both of which lie north of the Dividing Range; in the main range Mount Hotham (6100 ft.) and Mount Cobberas (6025 ft.) are the highest summits. In New South Wales, but close to the Victorian border, are found the loftiest peaks of Australia, Mount Kosciusco and Mount Townsend, rising to heights of 7328 and 7260 ft. respectively. The range is here called the Muniong, but farther north it receives the name of Monaro Range; the latter has a much reduced altitude, its average being only about 2000 ft. As the tableland runs northward it decreases both in height and width, until it narrows to a few miles only, with an elevation of scarcely 1500 ft.; under the name of the Blue Mountains the plateau widens again and increases in altitude, the chief peaks being Mount Clarence (4000 ft.), Mount Victoria (3525 ft.), and Mount Hay (3270 ft.). The Dividing Range decreases north of the Blue Mountains, until as a mere ridge it divides the waters of the coastal rivers from those flowing to the Darling. The mass widens out once more in the Liverpool Range, where the highest peak, Mount Oxley, reaches 4500 ft., and farther north, in the New England Range, Ben Lomond reaches an elevation of 5000 ft. Near the Queensland border, Mount Lindsay, in the Macpherson Range, rises to a height of 5500 ft. In the latitude of Brisbane the chain swerves inland; no other peak north of this reaches higher than Mount Bartle Frere in the Bellenden Ker Range (5438 ft.). The Southern Ocean system of the Victorian Dividing Range hardly attains to the dignity of high mountains. An eastern system in South Australia touches at a few points a height of 3000 ft.; and the Stirling Range, belonging to the south-western system of South Australia, reaches to 2340 ft. There are no mountains behind the Great Australian Bight. On the west the Darling Range faces the Indian Ocean, and extends from Point D'Entrecasteaux to the Murchison river. North of the Murchison, Mount Augustus and Mount Bruce, with their connecting highlands, cut off the coastal drainage from the interior; but no point on the north-west coast reaches a greater altitude than 4000 ft. Several minor ranges, the topography of which is little known, extend from Cambridge Gulf, behind a very much broken coast-line, to Limmen Bight on the Gulf of Carpentaria. Nothing is more remarkable than the contrast between the aspect of the coastal ranges on the north-east and on the south-east of the continent. The higher Australian peaks in the south-east look just what they are, the worn and denuded stumps of mountains, standing for untold ages above the sea. Their shoulders are lifted high above the tree-line. Their summits stand out gaunt and lonely in an unbroken solitude. Having left the tree-line far behind him, nothing is visible to the traveller for miles around but barren peaks and torn crags in indescribable confusion. A verdure of herbage clothes the valleys that have been scooped from the summits downwards. But there are no perpetual snow-fields, no glaciers creep down these valleys, and no alpine hamlets ever appear to break the monotony. The mountains of the north-east, on the contrary, are clothed to their summits with a rich and varied flora. Naked crags, when they do appear, lift themselves from a sea of green, and a tropical vegetation, quite Malaysian in character, covers everything.

The absence of active volcanoes in Australia is a state of things, in a geological sense, quite new to the continent. Some of the volcanoes of the western districts of Victoria have been in eruption probably subsequent to the advent of the black-fellow. In some instances the cones are quite intact, and the beds of ash and scoriae are as yet almost unaffected by denuding agencies. Late in the Tertiary period vast sheets of lava poured from many points of the Great Dividing Range of eastern Australia. But it is notable that all recent volcanic action was confined to a wide belt parallel to the coast. No evidences of recent lava flows can be found in the interior over the great alluvial plain, the Lower, or the Higher Steppes. Nor has the continent, as a whole, in recent times been subjected to any violent earth tremors; though in 1873, to the north of Lake Amadeus, in central Australia, Ernest Giles records the occurrence of earthquake shocks violent enough to dislodge considerable rock masses.

Australia possesses one mountain which, though not a volcano, is a "burning mountain." This is Mount Wingen, situated in a spur of the Liverpool Range and close to the town of Scone. Its fires are not volcanic, but result from the combustion of coal some distance underground, giving off much smoke and steam; geologists estimate that the burning has been going on for at least 800 years.

Rivers. The coastal belt of Australia is everywhere well watered, with the exception of the country around the Great Australian Bight and Spencer Gulf. Flowing into the Pacific Ocean on the east coast there are some fine rivers, but the majority have short and rapid courses. In Queensland a succession of rivers falls into the Pacific from Cape York to the southern boundary of the state. The Burdekin is the finest of these, draining an area of 53,500 sq. m., and emptying into Upstart Bay; it receives numerous tributaries in its course, and carries a large body of fresh water even in the driest seasons. The Fitzroy river is the second in point of size; it drains an area of 55,600 sq. m., and receives several tributary streams during its course to Keppel Bay. The Brisbane river, falling into Moreton Bay, is important chiefly from the fact that the city of Brisbane is situated on its banks. In New South Wales there are several important rivers, the largest of which is the Hunter, draining 11,000 sq. m., and having a course of 200 m. Taking them from north to south, the principal rivers are the Richmond, Clarence, Macleay, Hastings, Manning, Hunter, Hawkesbury and Shoalhaven. The Snowy river has the greater part of its course in New South Wales, but its mouth and the last 120 m. are in Victoria. The other rivers worth mentioning are the Yarra, entering the sea at Port Phillip, Hopkins and Glenelg. The Murray (*q.v.*), the greatest river of Australia, debouches into Lake Alexandrina, and thence into the sea at Encounter Bay in South Australia. There are no other rivers of importance in South Australia, but the Torrens and the Gawler may be mentioned. Westward of South Australia, on the shores of the Australian Bight, there is a stretch of country 300 m. in length unpierced by any streams, large or small, but west of the bight, towards Cape Leeuwin, some small rivers enter the sea. The south-west coast is watered by a few streams, but none of any size; amongst these is the Swan, upon which Perth, the capital of Western Australia, is built. Between the Swan and North-West Cape the principal rivers are the Greenough, Murchison and Gascoyne; on the north-west coast, the Ashburton, Fortescue and De Grey; and in the Kimberley district, the Fitzroy, Panton, Prince Regent and the Ord. In the Northern Territory are several fine rivers. The Victoria river is navigable for large vessels for a distance of about 43 m. from the sea, and small vessels may ascend for another 80 m. The Fitzmaurice, discharging into the estuary of the Victoria, is also a large stream. The Daly, which in its upper course is called the Katherine, is navigable for a considerable distance, and small vessels are able to ascend over 100 m. The Adelaide, discharging into Adam Bay, has been navigated by large vessels for about 38 m., and small vessels ascend still farther. The South Alligator river, flowing into Van Diemen's Gulf, is also a fine stream, navigable for over 30 m. by large vessels; the East Alligator river, falling into the same gulf, has been navigated for 40 m. Besides those mentioned, there are a number of smaller rivers discharging on the north coast, and on the west shore of the Gulf of Carpentaria the Roper river discharges itself into Limmen Bight. The Roper is a magnificent stream, navigable for about 75 or 80 m. by vessels of the largest tonnage, and light draught vessels can ascend 20 m. farther. Along the portion of the south shore of the Gulf of Carpentaria which belongs to Queensland and the east coast, many large rivers discharge their waters, amongst them the Norman, Flinders, Leichhardt, Albert and Gregory on the southern shore, and the Batavia, Archer, Coleman, Mitchell, Staaten and Gilbert on the eastern shore. The rivers flowing into the Gulf of Carpentaria, as well as those in the Northern Territory, drain country which is subject to regular monsoonal rains, and have the general characteristics of sub-tropical rivers.

The network of streams forming the tributaries of the Darling and Murray system give an idea of a well-watered country. The so-called rivers have a strong flow only after heavy rains, and some of them do not ever reach the main drainage line. Flood waters disappear often within a distance of a few miles, being absorbed by porous soil, stretches of sand, and sometimes by the underlying bed-rocks. In many cases the rivers as they approach the main stream break up into numerous branches, or spread their waters over vast flats. This is especially the case with the tributaries of the Darling on its left bank, where in seasons of great rains these rivers overspread their banks and flood the flat country for miles around and thus reach the main stream. Lieutenant John Oxley went down the Lachlan (1817) during one of these periods of flood, and the great plains appeared to him to be the fringe of a vast inland sea. As a matter of fact, they are an alluvial deposit spread out by the same flood waters. The great rivers of Australia, draining inland, carve out valleys, dissolve limestone, and spread out their deposit over the plains when the waters become too sluggish to bear their burden farther. From a geological standpoint, the Great Australian Plain and the fertile valley of the Nile have had a similar origin. Taking the Lachlan as one type of Australian river, we find it takes its rise amongst the precipitous and almost unexplored valleys of the Great Dividing Range. With the help of its tributaries it acts as a denuding agent for 14,000 sq. m. of country, and carries its burden of sediment westwards. A point is reached about 200 m. from the Dividing Range, where the river ceases to act as a denuding agent, and the area of deposition begins, at a level of 250 ft. above the sea, but before the waters can reach the ocean they have still to travel about 1000 m.

The Darling is reckoned amongst the longest rivers in the world, for it is navigable, part of the year, from Walgett to its confluence with the Murray, 1758 m., and then to the sea, a further distance of 587 m.—making in all 2345 m. of navigable water. But this gives no correct idea of the true character of the Darling, for it can hardly be said to drain its own watershed. From the sources of its various tributaries to the town of Bourke, the river may be described as draining a watershed. But from Bourke to the sea, 550 m. in a direct line, the river gives rather than receives water from the country it flows through.

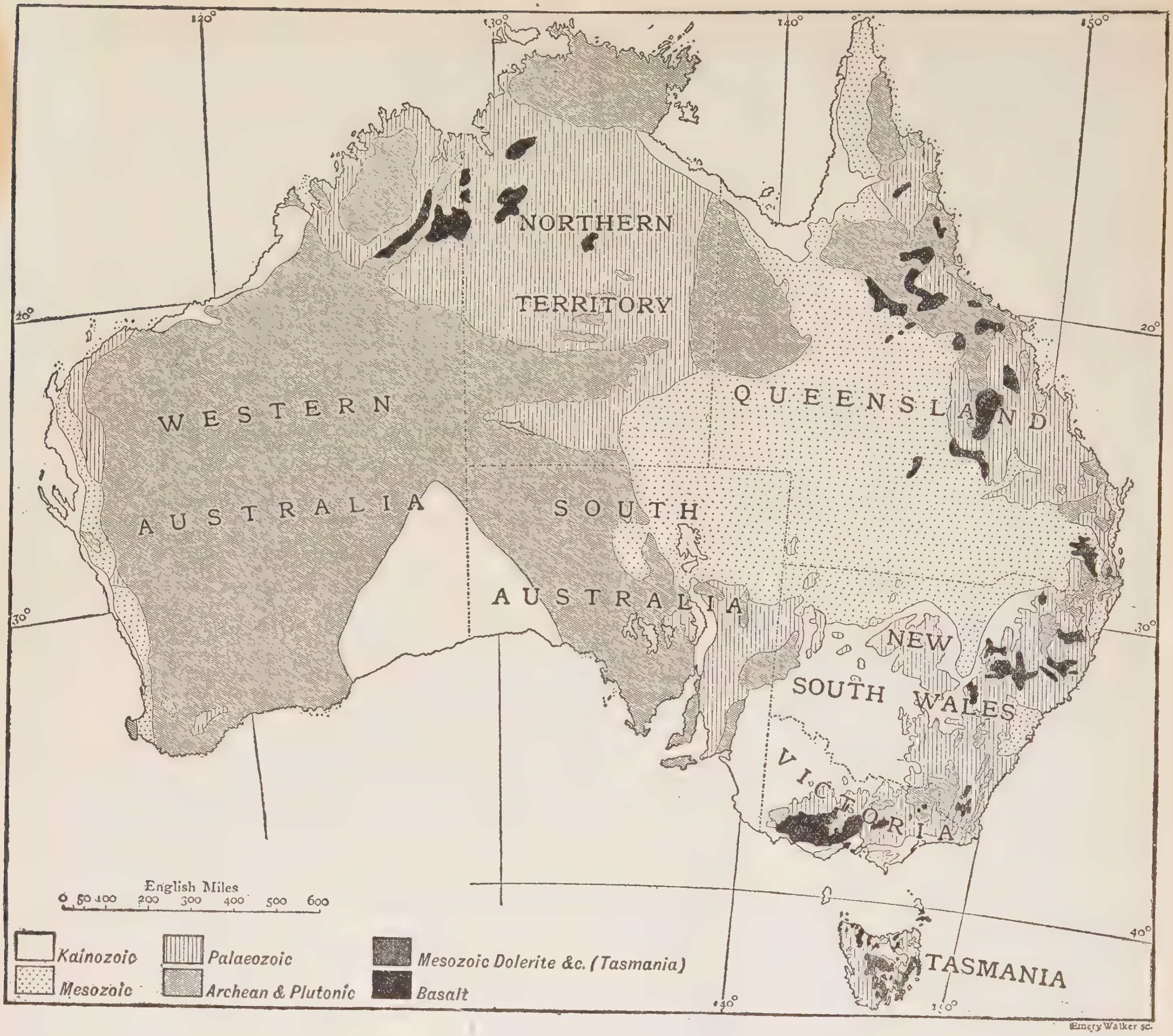
The annual rainfall and the area of the catchment afford no measure whatever as to the size of a river in the interior of Australia. The discharge of the Darling river at Bourke does not amount to more than 10 % of the rainfall over the country which it drains. It was this remarkable fact which first led to the idea that, as the rainfall could not be accounted for either by evaporation or by the river discharge, much of the 90 % unaccounted for must sink into the ground, and in part be absorbed by some underlying bed-rock. All Australian rivers, except the Murray and the Murrumbidgee, depend entirely and directly on the rainfall. They are flooded after rain, and in seasons of drought many of them, especially the tributaries of the Darling, become chains of ponds. Springs which would equalize the discharge of rivers by continuing to pour water into their beds after the rainy season has passed seem entirely absent in the interior. Nor are there any snowfields to feed rivers, as in the other continents. More remarkable still, over large tracts of country the water seems disposed to flow away from, rather than to, the river-beds. As the low-lying plains are altogether an alluvial deposit, the coarser sediments accumulate in the regions where the river first overflows its banks to spread out over the plains. The country nearest the river receiving the heaviest deposit becomes in this way the highest ground, and so continues until a "break-away" occurs, when a new river-bed is formed, and the same process of deposition and accumulation is repeated. As the general level of the country is raised by successive alluvial deposits, the more ancient river-beds become buried, but being still connected with the newer rivers at some point or other, they continue to absorb water. This underground network of old river-beds underlying the great alluvial plains must be filled to repletion before flood waters will flow over the surface. It is not surprising, therefore, that comparatively little of the rainfall over the vast extent of the great central plain ever reaches the sea by way of the river systems; indeed these systems as usually shown on the maps leave a false impression as to the actual condition of things.

Steppes.

Lakes.

The great alluvial plain is one of Australia's most notable inland features; its extent is upwards of 500,000 sq. m., lying east of 135° W. and extending right across the continent from the Gulf of Carpentaria to the Murray river. The interior of the continent west of 135° and north of the Musgrave ranges is usually termed by geographers the Australian Steppes. It is entirely different in all essential features from the great alluvial plains. Its prevailing aspect is characterized by flat and terraced hills, capped by desert sandstone, with stone-covered flats stretching over long distances. The country round Lake Eyre, where some of the land is actually below sea-level, comes under this heading. The higher steppes, as far as they are known, consist of Ordovician and Cambrian rocks, with an average elevation of 1500 to 3000 ft. above sea-level. Over this country water-courses are shown on maps. These run in wet seasons, but in every instance for a short distance only, and sooner or later they are lost in sand-hills, where their waters disappear and a line of stunted gum-trees (*Eucalyptus rostrata*) is all that is present to indicate that there may be even a soakage to mark the abandoned course. The steppes cover a surface of 400,000 sq. m., and from this vast expanse not a drop of the scanty rainfall reaches the sea; there is no leading drainage system and there are no rivers. Another notable feature of the interior is the so-called lake area, a district stretching to the north of Spencer Gulf. These lakes are expanses of brackish waters that spread or contract as the season is one of drought or rain. In seasons of drought they are hardly more than swamps and mud flats, which for a time may become a grassy plain, or desolate coast encrusted with salt. The country around is the dreariest imaginable, the surface is a dead level, there is no heavy timber and practically no settlement. Lake Torrens, the largest of these depressions, sometimes forms a sheet of water 100 m. in length. To the north again stretches Lake Eyre, and to the west Lake Gairdner. Some of these lake-beds are at or slightly below sea-level, so that a very slight depression of the land to the south of them would connect much of the interior with the Southern Ocean. (T. A. C.)

Geology.—The states of Australia are divided by natural boundaries, which separate geographical areas having different characters, owing, mainly, to their different geological structures. Hence the general stratigraphical geology can be most conveniently summarized for each state separately, dealing here with the geological history of Australia as a whole. Australia is essentially the fragment of a great plateau land of Archean rocks. It consists in the main of an Archean block or "coign," which still occupies nearly the whole of the western half of the continent, outcrops in north-eastern Queensland, forms the foundation of southern New South Wales and eastern Victoria, and is exposed in western Victoria, in Tasmania, and in the western flank of the Southern Alps of New Zealand. These areas of Archean rocks were doubtless once continuous. But they have been separated by the foundering of the Coral Sea and the Tasman Sea, which divided the continent of Australia from the islands of the Australasian festoon; and the foundering of the band across Australia, from the Gulf of Carpentaria, through western Queensland and western New South Wales, to the lower basin of the Murray, has separated the Archean areas of eastern and western Australia. The breaking up of the old Archean foundation block began in Cambrian and Ordovician times. A narrow Cambrian sea must have extended across central Australia from the Kimberley Goldfield in the north-west, through Tempe Downs and the Macdonnell chain in central Australia, to the South Australian highlands, central Victoria at Mansfield, and northern Tasmania. Cambrian rocks occur in each of these districts, and they are best developed in the South Australian highlands, where they include a long belt of contemporary glacial deposits. Marine Ordovician rocks were deposited along the same general course. They are best developed in the Macdonnell chain in



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central Australia and in Victoria, where the fullest sequence is known; while they also extended north-eastward from Victoria into New South Wales, where, as yet, no Cambrian rocks have been found. The Silurian system was marked by the retreat of the sea from central Australia; but the sea still covered a band across Victoria, from the coast to the Murray basin, passing to the east of Melbourne. This Silurian sea was less extensive than the Ordovician in Victoria; but it appears to have been wider in New South Wales and in Queensland. The best Silurian sequence is in New South Wales. Silurian rocks are well developed in western Tasmania, and the Silurian sea must have washed the south-western corner of the continent, if the rocks of the Stirling Range be rightly identified as of this age.

The Devonian system includes a complex series of deposits, which are of most interest in eastern Australia. This period was marked by intense earth movements, which affected the whole of the east Australian highlands. The Lower Devonian beds are in the main terrestrial, or coarse littoral deposits, and volcanic rocks. The Middle Devonian was marked by the same great transgression as in Europe and America; it produced inland seas, extending into Victoria, New South Wales and Queensland, in which were deposited limestones with a rich coral fauna. The Upper Devonian was a period of marine retreat; the crustal disturbances of the Lower Devonian were renewed and great quartz-pebble beaches were formed on the rising shore lines, producing the West Coast Range conglomerates of Tasmania, and the similar rocks to the south-east of Mansfield in Victoria. Intrusions of granitic *massifs* in the Devonian period formed the primitive mountain axis of Victoria, which extends east and west across the state and forms the nucleus of the Victorian highlands. Similar granitic intrusions occurred in New South Wales and Queensland, and built up a mountain chain, which ran north and south across the continent; its worn-down stumps now form the east Australian highlands.

The Carboniferous period began with a marine transgression, enabling limestones to form in Tasmania and New South Wales; and at the same time the sea first got in along the western edge of the western plateau, depositing the Carboniferous rocks of the Gascoyne basin and the coastal plain of north-western Australia. The Upper Carboniferous period was in the main terrestrial, and during it were laid down the coal-seams of New South Wales; they are best developed in the basin of the Hunter river, and they extend southward, covered by Mesozoic deposits, beyond Sydney. The Coal Measures become narrower in the south, until, owing to the eastward projection of the highlands, the Lower Palaeozoic rocks reach the coast. The coal-seams must have been formed in well-watered, lowland forests, at the foot of a high mountain range, built up by the Devonian earth movements. The mountains both in Victoria and New South Wales were snow-capped, and glaciers flowed down their flanks and laid down Carboniferous glacial deposits, which are still preserved in basins that flank the mountain ranges, such as the famous conglomerates of Bacchus Marsh, Heathcote and the Loddon valley in Victoria, and of Branxton and other localities in New South Wales. The age of the glacial deposits is later than the *Glossopteris* flora and occurs early in the time of the *Gangamopteris* flora. Kitson's work in Tasmania shows that there also the glacial beds may be correlated with the lower or Greta Coal Measures of New South Wales.

The Permian deposits are best developed in New South Wales and Tasmania, where their characters show the continuation of the Carboniferous conditions. The Mesozoic begins with a Triassic land period in the mainland of Australia; while the islands of the Australasian festoon contain the Triassic marine limestones, which fringe the whole of the Pacific. The Triassic beds are best known in New South Wales, where round Sydney they include a series of sandstones and shales. They also occur in northern Tasmania.

The Jurassic system is represented by two types. In Victoria, Tasmania, northern New South Wales and Queensland, there are Jurassic terrestrial deposits, containing the coal seams of Victoria, of the Clarence basin of north-eastern New South Wales, and of the Ipswich series in Queensland; the same beds range far inland on the western slopes of the east Australian highlands in New South Wales and Queensland and they occur, with coal-seams, at Leigh's Creek, at the northern foot of the South Australian highlands. They are also preserved in basins on the western plateau, as shown by brown coal deposits passed through in the Lake Phillipson bore. The second and marine type of the Jurassics occurs in Western Australia, on the coastal plain skirting the western foot of the western plateau.

The Cretaceous period was initiated by the subsidence of a large area to the south of the Gulf of Carpentaria, whereby a Lower Cretaceous sea spread southward, across western Queensland, western New South Wales and the north-eastern districts of South Australia. In this sea were laid down the shales of the Rolling Downs formation. The sea does not appear to have extended completely across Australia, breaking it into halves, for a projection from the Archean plateau of Western Australia extended as far east as the South Australian highlands, and thence probably continued eastward, till it joined the Victorian highlands. The Cretaceous sea gradually receded and the plains of the Rolling Downs formation formed on its floor were covered by the sub-aerial and lacustrine deposits of the Desert Sandstone.

The Kainozoic period opened with fresh earth movements, the most striking evidence of which are the volcanic outbreaks all round the Australian coasts. These movements in the south-east formed the Great Valley of Victoria, which traverses nearly the whole of the state between the Victorian highlands to the north, and the Jurassic sandstones of the Otway Ranges and the hills of south Gippsland. In this valley were laid down, either in Eocene or Oligocene times, a great series of lake beds and thick accumulations of brown coal. Similar deposits, of approximately the same age, occur in Tasmania and New Zealand; and at about the same time there began the Kainozoic volcanic period of Australasia. The first eruptions piled up huge domes of lavas rich in soda, including the geburite-dacites and sölvsbergites of Mount Macedon in Victoria, and the kenyte and tephrite domes of Dunedin, in New Zealand. These rocks were followed by the outpouring of the extensive older basalts in the Great Valley of Victoria and on the highlands of eastern Victoria, and also in New South Wales and Queensland. Then followed a marine transgression along most of the southern coast of Australia. The sea encroached far on the land from the Great Australian Bight and there formed the limestones of the Nullarbor Plains. The sea extended up the Murray basin into the western plains of New South Wales. Farther east the sea was interrupted by the still existing land-connexion between Tasmania and Victoria; but beyond it, the marine deposits are found again, fringing the coasts of eastern Gippsland and Croajingolong. These marine deposits are not found anywhere along the eastern coast of Australia; but they occur, and reach about the same height above sea-level, in New Guinea, and are widely developed in New Zealand. No doubt eastern Australia then extended far out into the Tasman Sea. The great monoclinal fold which formed the eastern face of the east Australian highlands, west of Sydney, is of later age. After this marine period was brought to a close the sea retreated. Tasmania and Victoria were separated by the foundering of Bass Strait, and at the same time the formation of the rift valley of Spencer Gulf, and Lake Torrens, isolated the South Australian highlands from the Eyre Peninsula and the Westralian plateau. Earth movements are still taking place both along Bass Strait and the Great Valley of South Australia, and apparently along the whole length of the southern coast of Australia.

The Flowing Wells of Central Australia.—The clays of the Rolling Downs formation overlie a series of sands and drifts, saturated with water under high pressure, which discharges at the surface as a flowing well, when a borehole pierces the impermeable cover. The first of these wells was opened at Kallara in the west of New South Wales in 1880. In 1882, Dr W. L. Jack concluded that western Queensland might be a deep artesian basin. The Blackhall bore, put down at his advice from 1885 to 1888, reached a water-bearing layer at the depth of 1645 ft. and discharged 291,000 gallons a day. It was the first of the deep artesian wells of the continent. As the plains on the Rolling Downs formation are mostly waterless, the discovery of this deep reservoir of water has been of great aid in the development of central Australia. In Queensland to the 30th of June 1904, 973 wells had been sunk, of which 596 were flowing wells, and the total flow was 62,635,722 cub. ft. a day. The deepest well is that at Whitewood, 5046 ft. deep. In New South Wales by the 30th of June 1903, the government had put down 101 bores producing 66 flowing wells and 22 sub-artesian wells, with a total discharge of 54,000,000 gallons a day; and there were also 144 successful private wells. In South Australia there are 38 deep bores, from 20 of which there is a flow of 6,250,000 gallons a day.

The wells were first called artesian in the belief that the ascent of the water in them was due to the hydrostatic pressure of water at a higher level in the Queensland hills. The well-water was supposed to have percolated underground, through the Blythesdale Braystone, which outcrops in patches on the eastern edge of the Rolling Downs formation. But the Blythesdale Braystone is a small local formation, unable to supply all the wells that have been sunk; and many of the wells derive their water from the Jurassic shales and mudstones. The difference in level between the outcrop of the assumed eastern intake and of the wells is often so small, in comparison with their distance apart, that the friction would completely sop up the whole of the available hydrostatic head. Many of the well-waters contain gases; thus the town of Roma is lighted by natural gas which escapes from its well. The chemical characters of the well-waters, the irregular distribution of the water-pressure, the distribution of the underground thermal gradients, and the occurrence in some of the wells of a tidal rise and fall of a varying period, are facts which are not explained on the simple hydrostatic theory. J. W. Gregory has maintained (*Dead Heart of Australia*, 1906, pp. 273-341) that the ascent of water in these wells is due to the tension of the included gases and the pressure of overlying sheets of rocks, and that some of the water is of plutonic origin.[1] (J. W. G.)

Climate.—The Australian continent, extending over 28° of latitude, might be expected to show a considerable diversity of climate. In reality, however, it experiences fewer climatic variations than the other great continents, owing to its distance (28°) from the Antarctic circle and (11°) from the equator. There is, besides, a powerful determining cause in the uniform character and undivided extent of its dry interior. The plains and steppes already described lie either within or close to the tropics. They present to the fierce play of the sun almost a level surface, so that during the day that surface becomes intensely heated and at night gives off its heat by radiation. Ordinarily the alternate expansion and contraction of the atmosphere which takes place under such circumstances would draw in a supply of moisture from the ocean, but the heated interior, covering some 900,000 sq. m., is so immense, that the moist air from the ocean does not come in sufficient supply, nor are there mountain chains to intercept the clouds which from time to time are formed; so that two-fifths of Australia, comprising a region stretching from the Australian Bight to 20° S. and from 117° to 142° E., receives less than an average of 10 in. of rain throughout the year, and a considerable portion of this region has less than 5 in. No part of Victoria and very little of Queensland and New South Wales lie within this area. The rest of the continent may be considered as well watered. The north-west coast, particularly the portions north of Cambridge Gulf and the shores of the Gulf of Carpentaria, are favoured with an annual visitation of the monsoon from December to March, penetrating as far as 500 m. into the continent, and sweeping sometimes across western and southern Queensland to the northern interior of New South Wales. It is this tropical downpour that fills and floods the rivers flowing into Lake Eyre and those falling into the Darling on its right bank. The whole of the east coast of the continent is well watered. From Cape York almost to the tropic of Capricorn the rainfall exceeds 50 in. and ranges to over 70 in. At Brisbane the fall is 50 in., and portions of the New South Wales coast receive a like quantity, but speaking generally the fall is from 30 in. to 40 in. The southern shores of the continent receive much less rain. From Cape Howe to Melbourne the fall may be taken at from 30 in. to 40 in., Melbourne itself having an average of 25·6 in. West of Port Phillip the fall is less, averaging 20 in. to 30 in., diminishing greatly away from the coast. Along the shores of Encounter Bay and St Vincent and Spencer Gulfs, the precipitation ranges from 10 to 20 in., the yearly rainfall at Adelaide is a little less than 21 in., while the head of Spencer Gulf is within the 5 to 10 in. district. The rest of the southern coast west as far as 124° E., with the exception of the southern projection of Eyre Peninsula, which receives from 10 to 20 in., belongs to the district with from 5 to 10 in. annual rainfall. The south-western angle of the continent, bounded by a line drawn diagonally from Jurien river to Cape Riche, has an average of from 30 to 40 in. annual rainfall, diminishing to about 20 to 30 in. in the country along the diagonal line. The remainder of the south and west coast from 124° E. to York Sound in the Kimberley district for a distance of some 150 m. inland has a fall ranging from 10 to 20 in. The 10 to 20 in. rainfall band circles across the continent through the middle of the Northern Territory, embraces the entire centre and south-west of Queensland, with the exception of the extreme south-western angle of the state, and includes the whole of the interior of New South Wales to a line about 200 m. from the coast, as well as the western and northern portions of Victoria and South Australia south of the Murray.

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[1] The literature of the geology of Australia is enumerated, to 1884, in the bibliography by Etheridge and Jack. A general summary of the stratigraphical geology was given by R. Tate, *Rep. Austral. Assoc. Adv. Sci.* vol. v. (1893), pp. 1-69. References to the chief sources of information regarding the states is given under each of them. A geological map of the whole continent, on the scale of 50 m. to the inch, was compiled by A. Everett, and issued in 1887 in six sheets, by the Geological Survey of Victoria.

The area of Australia subject to a rainfall of from 10 to 20 in. is 843,000 sq. m. On the seaward side of this area in the north and east is the 20 to 30 in. annual rainfall area, and still nearer the sea are the exceptionally well-watered districts. The following table shows the area of the rainfall zones in square miles:—

Rainfall.	Rainfall Areas in sq. m.
Under 10 inches	1,219,600
10 to 20 ,,	843,100
20 to 30 ,,	399,900
30 to 40 ,,	225,700
40 to 50 ,,	140,300
50 to 60 ,,	47,900
60 to 70 ,,	56,100
Over 70 ,,	14,100
Total	2,946,700

The tropic of Capricorn divides Australia into two parts. Of these the northern or intertropical portion contains 1,145,000 sq. m., comprising half of Queensland, the Northern Territory, and the north-western divisions of Western Australia. The whole of New South Wales, Victoria and South Australia proper, half of Queensland, and more than half of Western Australia, comprising 1,801,700 sq. m., are without the tropics. In a region so extensive very great varieties of climate are naturally to be expected, but it may be stated as a general law that the climate of Australia is milder than that of corresponding lands in the northern hemisphere. During July, which is the coldest month in southern latitudes, one-half of Australia has a mean temperature ranging from 45° to 61°, and the other half from 62° to 80°. The following are the areas subject to the various average temperatures during the month referred to:—

Temperature Fahr.	Area in sq. m.
45°-50°	18,800
50°-55°	506,300
55°-60°	681,800
60°-65°	834,400
65°-70°	515,000
70°-75°	275,900
75°-80°	24,500

The temperature in December ranges from 60° to above 95° Fahr., half of Australia having a mean temperature below 84°. Dividing the land into zones of average summer temperature, the following are the areas which would fall to each:—

Temperature Fahr.	Area in sq. m.
60°-65°	67,800
65°-70°	63,700
70°-75°	352,300
75°-80°	439,200
80°-85°	733,600
85°-90°	570,600
90°-95°	584,100
95° and over	135,400

Judging from the figures just given, it must be conceded that a considerable area of the continent is not adapted for colonization by European races. The region with a mean summer temperature in excess of 95° Fahr. is the interior of the Northern Territory north of the 20th parallel; and the whole of the country, excepting the seaboard, lying between the meridians of 120° and 140°, and north of the 25th parallel, has a mean temperature in excess of 90° Fahr.

Queensland.

The area of Australia is so large that the characteristics of its climate will not be understood without reference to the individual states. About one-half of the colony of Queensland lies in the tropics, the remaining area lying between the tropic and 29° S. The temperature, however, has a daily range less than that of other countries under the same isothermal lines. This circumstance is due to the sea-breezes, which blow with great regularity, and temper what would otherwise be an excessive heat. The hot winds which prevail during the summer in some of the other colonies are unknown in Queensland. Of course, in a territory of such large extent there are many varieties of climate, and the heat is greater along the coast than on the elevated lands of the interior. In the northern parts of the colony the high temperature is very trying to persons of European descent. The mean temperature at Brisbane, during December, January and February, is about 76°, while during the months of June, July and August it averages about 60°. Brisbane, however, is situated near the extreme southern end of the colony, and its average temperature is considerably less than that of many of the towns farther north. Thus the winter in Rockhampton averages nearly 65°, while the summer heat rises almost to 85°; and at Townsville and Normanton the average temperature is still higher. The average rainfall along the coast is high, especially in the north, where it ranges from 60 to 70 in. per annum, and along a strip of country south from Cape Melville to Rockingham Bay the average rainfall exceeds 70 in. At Brisbane the rainfall is about 50 in., taking an average of forty years. A large area of the interior is watered to the extent of 20 to 30 in. per annum, but in the west and south, more remote than from 250 to 300 m., there is a rainfall of less than 20 in.

New South Wales.

Climatically, New South Wales is divided into three marked divisions. The coastal region has an average summer temperature ranging from 78° in the north to 67° in the south, with a winter temperature of from 59° to 52°. Taking the district generally, the difference between the mean summer and mean winter temperatures may be set down as averaging not more than 20°, a range smaller than is found in most other parts of the world. Sydney, situated in latitude 33°51′S., has a mean temperature of 62·9° Fahr., which corresponds with that of Barcelona in Spain and of Toulon in France, the former of these being in latitude 41° 22′ N. and the latter in 43°7′ N. At Sydney the mean summer temperature is 70·8° Fahr., and that of winter 53·9°. The range is thus 16·9° Fahr. At Naples, where the mean temperature for the year is about the same as at Sydney, the summer temperature reaches a mean of 74·4°, and the mean of winter is 47·6°, with a range 26·8°. The mean temperature of Sydney for a long series of years was spring 62°, summer 71°, autumn 64°, winter 54°.

Passing from the coast to the tableland, a distinct climatic region is entered. Cooma, with a mean summer temperature of 65·4°, and a mean winter temperature of 41·4°, may be taken as illustrative of the climate of the southern tableland, and Armidale of the northern. The yearly average temperature of the latter is scarcely 65·5°, while the summer only reaches 67·7°, and the winter falls to 44·4°.

The climatic conditions of the western districts of the state are entirely different from those of the other two regions. The summer is hot, but on the whole the climate is very healthy. The town of Bourke, lying on the upper Darling, may be taken as an example of many of the interior districts, and illustrates peculiarly well the defects as well as the excellencies of the climate of the whole region. Bourke has exactly the same latitude as Cairo, yet its mean summer temperature is 1·3° less, and its mean annual temperature 4° less than that of the Egyptian city. New Orleans, also on the same parallel is, 4° hotter in summer. As regards winter temperature Bourke leaves little to be desired. The mean winter reading of the thermometer is 54·7, and accompanied as this is by clear skies and an absence of snow, the season is both pleasant and invigorating. The rainfall of New South Wales ranges from an annual average of 64 in. at various points on the northern coast, and at Kiandra in the Monaro district, to 9 in. at Milparinka in the trans-Darling district. The coastal districts average about 42 in. per annum, the tablelands 32 in., and the western interior has an average as low as 20 in. At Sydney, the average rainfall, since observations were commenced, has been 50 in.

Victoria.

The climate of Victoria does not differ greatly from that of New South Wales. The heat, however, is generally less intense in summer, and the cold greater in winter. Melbourne, which stands in latitude 37° 50′ S., has a mean temperature of 57·3°, and therefore corresponds with Washington in the United States, Madrid, Lisbon and Messina. The difference between summer and winter is, however, less at Melbourne than at any of the places mentioned, the result of a long series of observations being spring 57°, summer 65·3°, autumn 58·7°, and winter 49·2°. The highest recorded temperature in the shade at Melbourne is 110·7°, and the lowest 27°, but it is rare for the summer heat to exceed 85°, or for the winter temperature in the daytime to fall below 40°. Ballarat, the second city of Victoria, lies above 100 m. west from Melbourne at a height of 1400 ft. above sea-level. It has a minimum temperature of 29°, and a maximum of 104·5°, the average yearly mean being 54·1°. The rainfall of Melbourne averages 25·58 in., the mean number of rainy days being 131.

South Australia.

South Australia proper extends over 26 degrees of latitude, and naturally presents considerable variations of climate. The coldest months are June, July and August, during which the temperature is very agreeable, averaging 53·6°, 51·7°, and 54° in those months respectively. On the plains slight frosts occur occasionally, and ice is sometimes seen on the highlands. In summer the sun has great power, and the temperature reaches 100° in the shade, with hot winds blowing from the interior. The weather on the whole is remarkably dry. At Adelaide there are on an average 120 rainy days per annum, with a mean rainfall of 20·88 in. The country is naturally very healthful, as evidence of which may be mentioned that no great epidemic has ever visited the state.

Western Australia.

Western Australia has practically only two seasons, the winter or wet season, which commences in April and ends in October, and the summer or dry season, which comprises the remainder of the year. During the wet season frequent and heavy rains fall, and thunderstorms, with sharp showers, occur in the summer, especially on the north-west coast, which is sometimes visited by hurricanes of great violence. In the southern and early-settled parts of the state the mean temperature is about 64°, but in the more northern portions the heat is excessive, though the dryness of the atmosphere makes it preferable to moist tropical climates. The average rainfall at Perth is 33 in. per annum.

The climate of the Northern Territory is extremely hot, except on the elevated tablelands; altogether, the temperature of this part of the continent is very similar to that of northern Queensland, and the climate is not favourable to Europeans. The rainfall in the extreme north, especially in January and February, is very heavy, and the annual average along the coast is about 63 in. The whole of the peninsula north of 15° S. has a rainfall considerably exceeding 40 in. This region is backed by a belt of about 100 m. wide, in which the rainfall is from 30 to 40 in., from which inwards the rainfall gradually declines until between Central Mount Stuart and Macdonnell ranges it falls to between 5 and 10 in.

Fauna and Flora.—The origin of the fauna and flora of Australia has attracted considerable attention. Much accumulated evidence, biological and geological, has pointed to a southern extension of India, an eastern extension of South Africa, and a western extension of Australia into the Indian Ocean. The comparative richness of proteaceous plants in Western Australia and South Africa first suggested a common source for these primitive types. Dr H. O. Forbes drew attention to a certain community amongst birds and other vertebrates, invertebrates, and amongst plants, on all the lands stretching towards the south pole. A theory was therefore propounded that these known types were all derived from a continent which has been named Antarctica. The supposed continent extended across the south pole, practically joining Australia and South America. Just as we have evidence of a former mild climate in the arctic regions, so a similar mild climate has been postulated for Antarctica. Modern naturalists consider that many of the problems of Australia's remarkable fauna and flora can be best explained by the following hypothesis:—The region now covered by the antarctic ice-cap was in early Tertiary times favoured by a mild climate; here lay an antarctic continent or archipelago. From an area corresponding to what is now South America there entered a fauna and flora, which, after undergoing modification, passed by way of Tasmania to Australia. These immigrants then developed, with some exceptions, into the present Australian flora and fauna. This theory has advanced from the position of a disparaged heresy to acceptance by leading thinkers. The discovery as fossil, in South America, of primitive or ancestral forms of marsupials has given it much support. One of these, *Prothylacinus*, is regarded as the forerunner of the marsupial wolf of Tasmania. An interesting link between divergent marsupial families, still living in Ecuador, the *Coenolestes*, is another discovery of recent years. On the Australian side the fact that Tasmania is richest in marsupial types indicates the gate by which they entered. It is not to be supposed that this antarctic element, to which Professor Tate has applied the name *Euronotian*, entered a desert barren of all life. Previous to its arrival Australia doubtless possessed considerable vegetation and a scanty fauna, chiefly invertebrate. At a comparatively recent date Australia received its third and newest constituent. The islands of Torres Strait have been shown to be the denuded remnant of a former extension of Cape York peninsula in North Queensland. Previous to the existence of the strait, and across its site, there poured into Australia a wealth of Papuan forms. Along the Pacific slope of the Queensland Cordillera these found in soil and climate a congenial home. Among the plants the wild banana, pepper, orange and mangosteen, rhododendron, epiphytic orchids and the palm; among mammals the bats and rats; among birds the cassowary and rifle birds; and among reptiles the crocodile and tree snakes, characterize this element. The numerous facts, geological, geographical and biological, which when linked together lend great support to this theory, have been well worked out in Australia by Mr Charles Hedley of the Australian Museum, Sydney.

Fauna.

The zoology of Australia and Tasmania presents a very conspicuous point of difference from that of other regions of the globe, in the prevalence of non-placental mammalia. The vast majority of the mammalia are provided with an organ in the uterus, by which, before the birth of their young, a vascular connexion is maintained between the embryo and the parent animal. There are two orders, the Marsupialia and the Monotremata, which do not possess this organ; both these are found in Australia, to which region indeed they are not absolutely confined.

The geographical limits of the marsupials are very interesting. The opossums of America are marsupials, though not showing anomalies as great as kangaroos and bandicoots (in their feet), and *Myrmecobius* (in the number of teeth). Except the opossums, no single living marsupial is known outside the Australian zoological region. The forms of life characteristic of India and the Malay peninsula come down to the island of Bali. Bali is separated from Lombok by a strait not more than 15 m. wide. Yet this narrow belt of water is the boundary line between the Australasian and the Indian regions. The zoological boundary passing through the Bali Strait is called "Wallace's line," after the eminent naturalist who was its discoverer. He showed that not only as regards beasts, but also as regards birds, these regions are thus sharply limited. Australia, he pointed out, has no woodpeckers and no pheasants, which are widely-spread Indian birds. Instead of these it has mound-making turkeys, honey-suckers, cockatoos and brush-tongued lories, all of which are found nowhere else in the world.

The marsupials constitute two-thirds of all the Australian species of mammals. It is the well-known peculiarity of this order that the female has a pouch or fold of skin upon her abdomen, in which she can place the young for suckling within reach of her teats. The opossum of America is the only species out of Australasia which is thus provided. Australia is inhabited by at least 110 different species of marsupials, which is about two-thirds of the known species; these have been arranged in five tribes, according to the food they eat, viz., the grass-eaters (kangaroos), the root-eaters (wombats), the insect-eaters (bandicoots), the flesh-eaters (native cats and rats), and the fruit-eaters (phalangers).

The kangaroo (*Macropus*) lives in droves in the open grassy plains. Several smaller forms of the same general appearance are known as wallabies, and are common everywhere. The kangaroo and most of its congeners show an extraordinary disproportion of the hind limbs to the fore part of the body. The rock wallabies again have short tarsi of the hind legs, with a long pliable tail for climbing, like that of the tree kangaroo of New Guinea, or that of the jerboa. Of the larger kangaroos, which attain a weight of 200 ℔ and more, eight species are named, only one of which is found in Western Australia. Fossil bones of extinct kangaroo species are met with; these kangaroos must have been of enormous size, twice or thrice that of any species now living.

There are some twenty smaller species in Australia and Tasmania, besides the rock wallabies and the hare kangaroos; these last are wonderfully swift, making clear jumps 8 or 10 ft. high. Other terrestrial marsupials are the wombat (*Phascolomys*), a large, clumsy, burrowing animal, not unlike a pig, which attains a weight of from 60 to 100 ℔; the bandicoot (*Perameles*), a rat-like creature whose depredations annoy the agriculturist; the native cat (*Dasyurus*), noted robber of the poultry yard; the Tasmanian wolf (*Thylacinus*), which preys on large game; and the recently discovered *Notoryctes*, a small animal which burrows like a mole in the desert of the interior. Arboreal species include the well-known opossums (*Phalanger*); the extraordinary tree-kangaroo of the Queensland tropics; the flying squirrel, which expands a membrane between the legs and arms, and by its aid makes long sailing jumps from tree to tree; and the native bear (*Phascolarctos*), an animal with no affinities to the bear, and having a long soft fur and no tail.

The *Myrmecobius* of Western Australia is a bushy-tailed ant-eater about the size of a squirrel, and from its lineage and structure of more than passing interest. It is, Mivart remarks, a survival of a very ancient state of things. It had ancestors in a flourishing condition during the Secondary epoch. Its congeners even then lived in England, as is proved by the fact that their relics have been found in the Stonesfield oolitic rocks, the deposition of which is separated from that which gave rise to the Paris Tertiary strata by an abyss of past time which we cannot venture to express even in thousands of years.

We pass on to the other curious order of non-placental mammals, that of the Monotremata, so called from the structure of their organs of evacuation with a single orifice, as in birds. Their abdominal bones are like those of the marsupials; and they are furnished with pouches for their young, but have no teats, the milk being distilled into their pouches from the mammary glands. Australia and Tasmania possess two animals of this order—the echidna, or spiny ant-eater (hairy in Tasmania), and the *Platypus anatinus*, the duck-billed water mole, otherwise named the *Ornithorhynchus paradoxus*. This odd animal is provided with a bill or beak, which is not, like that of a bird, affixed to the skeleton, but is merely attached to the skin and muscles.

Australia has no apes, monkeys or baboons, and no ruminant beasts. The comparatively few indigenous placental mammals, besides the dingo or wild dog—which, however, may have come from the islands north of this continent—are of the bat tribe and of the rodent or rat tribe. There are four species of large fruit-eating bats, called flying foxes, twenty of insect-eating bats, above twenty of land-rats, and five of water-rats. The sea produces three different seals, which often ascend rivers from the coast, and can live in lagoons of fresh water; many cetaceans, besides the "right whale" and sperm whale; and the dugong, found on the northern shores, which yields a valuable medicinal oil.

The birds of Australia in their number and variety of species may be deemed some compensation for its poverty of mammals; yet it will not stand comparison in this respect with regions of Africa and South America in the same latitudes. The black swan was thought remarkable when discovered, as belying an old Latin proverb. There is also a white eagle. The vulture is wanting. Sixty species of parrots, some of them very handsome, are found in Australia. The emu corresponds with the African and Arabian ostrich, the rhea of South America, and the cassowary of the Moluccas and New Guinea. In New Zealand this group is represented by the apteryx, as it formerly was by the gigantic moa, the remains of which have been found likewise in Queensland. The graceful *Menura superba*, or lyre-bird, with its tail feathers spread in the shape of a lyre, is a very characteristic form. The mound-raising megapodes, the bower-building satin-birds, and several others, display peculiar habits. The honey-eaters present a great diversity of plumage. There are also many kinds of game birds, pigeons, ducks, geese, plovers and quails. The ornithology of New South Wales and Queensland is more varied and interesting than that of the other provinces.

As for reptiles, Australia has a few tortoises, all of one family, and not of great size. The "leathery turtle," which is herbivorous, and yields abundance of oil, has been caught at sea off the Illawarra coast so large as 9 ft. in length. The saurians or lizards are numerous, chiefly on dry sandy or rocky ground in the tropical region. The great crocodile of Queensland has been known to attain a length of 30 ft.; there is a smaller one about 6 ft. in length to be met with in the shallow lagoons of the interior of the Northern Territory. Lizards occur in great profusion and variety. The monitor, or fork-tongued lizard, which burrows in the earth, climbs and swims, is said to grow to a length of 8 to 9 ft. This species and many others do not extend to Tasmania. The monitor is popularly known as the goanna, a name derived from the iguana, an entirely different animal. There are about twenty kinds of night-lizards, and many which hibernate. One species can utter a cry when pained or alarmed, and the tall-standing frilled lizard can lift its forelegs, and squat or hop like a kangaroo. There is also the *Moloch horridus* of South and Western Australia, covered with tubercles bearing large spines, which give it a very strange aspect. This and some other lizards have power to change their colour, not only from light to dark, but over some portions of their bodies, from yellow to grey or red. Frogs of many kinds are plentiful, the brilliant green frogs being especially conspicuous and noisy. Australia is rich in snakes, and has more than a hundred different kinds. Most of these are venomous, but all are not equally dreaded. Five rather common species are certainly deadly—the death adder, the brown, the black, the superb and the tiger snakes. During the colder months these reptiles remain in a torpid state. No certain cure has been or is likely to be discovered for their poison, but in less serious cases strychnine has been used with advantage. In tropical waters a sea snake is found, which, though very poisonous, rarely bites. Among the inoffensive species are counted the graceful green "tree snake," which pursues frogs, birds and lizards to the topmost branches of the forest; also several species of pythons, the commonest of which is known as the carpet snake. These great reptiles may attain a length of 10 ft.; they feed on small animals which they crush to death in their folds.

The Australian seas are inhabited by many fishes of the same genera as exist in the southern parts of Asia and Africa. Of those peculiar to Australian waters may be mentioned the arripis, represented by what is called among the colonists a salmon trout. A very fine fresh-water fish is the Murray cod, which sometimes weighs 100 ℔; and the golden perch, found in the same river, has rare beauty of colour. Among the sea fish, the schnapper is of great value as an article of food, and its weight comes up to 50 ℔. This is the *Pagrus unicolor*, of the family of *Sparidae*, which includes also the bream. Its colours are beautiful, pink and red with a silvery gloss; but the male as it grows old takes on a singular deformity of the head, with a swelling in the shape of a monstrous human-like nose. These fish frequent rocky shoals off the eastern coast and are caught in numbers outside Port Jackson for the Sydney market. Two species of mackerel, differing somewhat from the European species, are also caught on the coasts. The so-called red garnet, a pretty fish, with hues of carmine and blue stripes on its head, is much esteemed for the table. The *Trigla polyommata*, or flying garnet, is a greater beauty, with its body of crimson and silver, and its large pectoral fins, spread like wings, of a rich green, bordered with purple, and relieved by a black and white spot. Whiting, mullet, gar-fish, rock cod and many others known by local names, are in the lists of edible fishes belonging to New South Wales and Victoria. Oysters abound on the eastern coast, and on the shelving banks of a vast extent of the northern coast the pearl oyster is the source of a considerable industry.

Two existing fishes may be mentioned as ranking in interest with the *Myrmecobius* (ant-eater) in the eyes of the naturalist. These are the *Ceratodus Forsteri* and the Port Jackson shark. The "mud-fish" of Queensland (*Ceratodus Forsteri*) belongs to an ancient order of fishes—the Dipnoi, only a few species of which have survived from past geological periods. The Dipnoi show a distinct transition between fishes and amphibia. So far the mud-fish has been found only in the Mary and the Burnett rivers. Hardly of less scientific interest is the Port Jackson shark (*Heterodontus*). It is a harmless helmeted ground-shark, living on molluscs, and almost the sole survivor of a genus abundant in the Secondary rocks of Europe.

Flora.

The eastern parts of Australia are very much richer both in their botany and in their zoology than any of the other parts. This is due in part to the different physical conditions there prevailing and in part to the invasion of the north-eastern portion of the continent by a number of plants characteristically Melanesian. This element was introduced via Torrès Strait, and spread down the Queensland coast to portions of the New South Wales littoral, and also round the Gulf of Carpentaria, but has never been able to obtain a hold in the more arid interior. It has so completely obliterated the original flora, that a Queensland coast jungle is almost an exact replication of what may be seen on the opposite shores of the straits, in New Guinea. This wealth of plant life is confined to the littoral and the coastal valleys, but the central valleys and the plateaux have, if not a varied flora, a considerable wealth of timber trees in every way superior to the flora inland in the same latitudes. In the interior there is little change in the general aspect of the vegetation, from the Australian Bight to the region of Carpentaria, where the exotic element begins. Behind the luxuriant jungles of the sub-tropical coast, once over the main range, we find the purely Australian flora with its apparent sameness and sombre dulness. Physical surroundings rather than latitude determine the character of the flora. The contour lines showing the heights above sea-level are the directions along which species spread to form zones. Putting aside the exotic vegetation of the north and east coast-line, the Australian bush gains its peculiar character from the prevalence of the so-called gum-trees (*Eucalyptus*) and the acacias, of which last there are 300 species, but the eucalypts above all are everywhere. Dwarfed eucalypts fringe the tree-limit on Mount Kosciusco, and the soakages in the parched interior are indicated by a line of the same trees, stunted and straggling. Over the vast continent from Wilson's Promontory to Cape York, north, south, east and west—where anything can grow—there will be found a gum-tree. The eucalypts are remarkable for the oil secreted in their leaves, and the large quantity of astringent resin of their bark. This resinous exudation (Kino) somewhat resembles gum, hence the name "gum" tree. It will not dissolve in water as gums do, but it is soluble in alcohol, as resin usually is. Many of the gum-trees throw off their bark, so that it hangs in long dry strips from the trunk and branches, a feature familiar in "bush" pictures. The bark, resin and "oils" of the eucalyptus are well known as commercial products. As early as 1866, tannic acid, gallic acid, wood spirit, acetic acid, essential oil and eucalyptol were produced from various species of eucalyptus, and researches made by Australian chemists, notably by Messrs. Baker and Smith of the Sydney Technical College, have brought to light many other valuable products likely to prove of commercial value. The genus *Eucalyptus* numbers more than 150 species, and provides some of the most durable timbers known. The iron-bark of the eastern coast uplands is well known (*Eucalyptus sideroxylon*), and is so called from the hardness of the wood, the bark not being remarkable except for its rugged and blackened aspect. Samples of this timber have been studied after forty-three years' immersion in sea-water. Portions most liable to destruction, those parts between the tide marks, were found perfectly sound, and showed no signs of the ravages of marine organisms. Other valuable timber trees of the eastern portion of the continent are the blackbutt, tallow-wood, spotted gum, red gum, mahogany, and blue gum, eucalyptus; and the turpentine (*Syncarpia laurifolia*), which has proved to be more resistant to the attacks of teredo than any other timber and is largely used in wharf construction in infested waters. There are also several extremely valuable soft timbers, the principal being red cedar (*Cedrela Toona*), silky oak (*Grevillea robusta*), beech and a variety of teak, with several important species of pine. The red gum forests of the Murray valley and the pine forests bordering the Great Plains are important and valuable. In Western Australia there are extensive forests of hardwood, principally jarrah (*Eucalyptus marginata*), a very durable timber; 14,000 sq. m. of country are covered with this species. Jarrah timber is nearly impervious to the attacks of the teredo, and there is good evidence to show that, exposed to wear and weather, or placed under the soil, or used as submarine piles, the wood remained intact after nearly fifty years' trial. The following figures show the high density of Australian timber:—

Australian timber.	Specific gravity.
Jarrah	1·12
Grey iron-bark	1·18
Red iron-bark	1·22
Forest oak	1·21
Tallow wood	1·23
Mahogany	1·20
Grey gum	·917
Red gum	·995

European timber.	Specific gravity.
Ash	·753
Beech	·690
Chestnut	·535
British oak	·99

The resistance to breaking or rupture of Australian timber is very high; grey iron-bark with a specific gravity of 1·18 has a modulus of rupture of 17,900 ℔ per sq. in. compared with 11,800 ℔ for British oak with a specific gravity of ·69 to ·99. No Australian timber in the foregoing list has a less modulus than 13,100 ℔ per sq. in.

Various "scrubs" characterize the interior, differing very widely from the coastal scrubs. "Mallee" scrub occupies large tracts of South Australia and Victoria, covering probably an extent of 16,000 sq. m. The mallee is a species of eucalyptus growing 12 to 14 ft. high. The tree breaks into thin stems close to the ground, and these branch again and again, the leaves being developed umbrella-fashion on the outer branches. The mallee scrub appears like a forest of dried osier, growing so close that it is not always easy to ride through it. Hardly a leaf is visible to the height of one's head; but above, a crown of thick leather-like leaves shuts out the sunlight. The ground below is perfectly bare, and there is no water. Nothing could add to the sterility and the monotony of these mallee scrubs. "Mulga" scrub is a somewhat similar thicket, covering large areas. The tree in this instance is one of the acacias, a genus distributed through all parts of the continent. Some species have rather elegant blossoms, known to the settlers as "wattle." They serve admirably to break the sombre and monotonous aspect of the Australian vegetation. Two species of acacia are remarkable for the delicate and violet-like perfume of their wood—myall and yarran. The majority of the species of *Acacia* are edible and serve as reserve fodder for sheep and cattle. In the alluvial portions of the interior salsolaceous plants—saltbush, bluebush, cottonbush—are invaluable to the pastoralist, and to their presence the pre-eminence of Australia as a wool-producing country is largely due.

Grasses and herbage in great variety constitute the most valuable element of Australian flora from the commercial point of view. The herbage for the most part grows with marvellous rapidity after a spring or autumn shower and forms a natural shelter for the more stable growth of nutritious grasses.

Under the system of grazing practised throughout Australia it is customary to allow sheep, cattle and horses to run at large all the year round within enormous enclosures and to depend entirely upon the natural growth of grass for their subsistence. Proteaceous plants, although not exclusively Australian, are exceedingly characteristic of Australian scenery, and are counted amongst the oldest flowering plants of the world. The order is easily distinguished by the hard, dry, woody texture of the leaves and the dehiscent fruits. They are found in New Zealand and also in New Caledonia, their greatest developments being on the south-west of the Australian continent. Proteaceae are found also in Tierra del Fuego and Chile. They are also abundant in South Africa, where the order forms the most conspicuous feature of vegetation. The range in species is very limited, no one being common to eastern and western Australia. The chief genera are banksia (*honeysuckle*), and hakea (*needle bush*). The Moreton Bay pine (*Araucaria Cunninghamii*) is reckoned amongst the giants of the forest. The genus is associated with one long extinct in Europe. Moreton Bay pine is chiefly known by the utility of its wood. Another species, *A. Bidwillii*, or the bunya-bunya, afforded food in its nut-like seeds to the aborigines. A most remarkable form of vegetation in the north-west is the gouty-stemmed tree (*Adansonia Gregorii*), one of the Malvaceae. It is related closely to the famous baobab of tropical Africa. The "grass-tree" (*Xanthorrhoea*), of the uplands and coast regions, is peculiarly Australian in its aspect. It is seen as a clump of wire-like leaves, a few feet in diameter, surrounding a stem, hardly thicker than a walking-stick, rising to a height of 10 or 12 ft. This terminates in a long spike thickly studded with white blossoms. The grass-tree gives as distinct a character to an Australian picture as the agave and cactus do to the Mexican landscape. With these might be associated the gigantic lily of Queensland (*Nymphaea gigantea*), the leaves of which float on water, and are quite 18 in. across. There is also a gigantic lily (*Doryanthes excelsa*) which grows to a height of 15 feet. The "flame tree" is a most conspicuous feature of an Illawarra landscape, the largest racemes of crimson red suggesting the name. The waratah or native tulip, the magnificent flowering head of which, with the kangaroo, is symbolic of the country, is one of the Proteaceae. The natives were accustomed to suck its tubular flowers for the honey they contained. The "nardoo" seed, on which the aborigines sometimes contrived to exist, is a creeping plant, growing plentifully in swamps and shallow pools, and belongs to the natural order of Marsileaceae. The spore-cases remain after the plant is dried up and withered. These are collected by the natives, and are known over most of the continent as nardoo.

No speculation of hypothesis has been propounded to account satisfactorily for the origin of the Australian flora. As a step towards such hypothesis it has been noted that the Antarctic, the South African, and the Australian floras have many types in common. There is also to a limited extent a European element present. One thing is certain, that there is in Australia a flora that is a remnant of a vegetation once widely distributed. Heer has described such Australian genera as Banksia, Eucalyptus, *Grevillea* and *Hakea* from the Miocene of Switzerland. Another point agreed upon is that the Australian flora is one of vast antiquity. There are genera so far removed from every living genus that many connecting links must have become extinct. The region extending round the south-western extremity of the continent has a peculiarly characteristic assemblage of typical Australian forms, notably a great abundance of the Proteaceae. This flora, isolated by arid country from the rest of the continent, has evidently derived its plant life from an outside source, probably from lands no longer existing.

POLITICAL AND ECONOMIC CONDITIONS

Population.[1]—The Australian people are mainly of British origin, only $3\frac{1}{4}$ % of the population of European descent being of non-British race. It is certain that the aborigines (see the section on Aborigines below) are very much less numerous than when the country was first colonized, but their present numbers can be given for only a few of the states. At the census of 1901, 48,248 aborigines were enumerated, of whom 7434 were in New South Wales, 652 in Victoria, 27,123 in South Australia, and 6212 in Western Australia. The assertion by the Queensland authorities that there are 50,000 aborigines in that state is a crude estimate, and may be far wide of the truth. In South Australia and the Northern Territory a large number are outside the bounds of settlement, and it is probable that they are as numerous there as in Queensland. The census of Western Australia included only those aborigines in the employment of the colonists; and as a large part of this, the greatest of the Australian states, is as yet unexplored, it may be presumed that the aborigines enumerated were very far short of the whole number of persons of that race in the state. Taking all things into consideration, the aboriginal population of the continent may be set down at something like 180,000. Chinese, numbering about 30,000, are chiefly found in New South Wales, Queensland, Victoria, and the Northern Territory. Of Japanese there were 3500, of Hindu and Sinhalese 4600, according to recent computation, but the policy of the Commonwealth is adverse to further immigration of other than whites. South Sea Islanders and other coloured races, numbering probably about 15,000, were in 1906 to be found principally in Queensland, but further immigration of Pacific Islanders to Australia is now restricted, and the majority of those in the country in 1906 were deported by the middle of 1907.

At the close of 1906 the population of Australia was approximately 4,120,000, exclusive of aborigines. The increase of population since 1871 was as follows: 1871, 1,668,377; 1881, 2,252,617; 1891, 3,183,237; 1901, 3,773,248. The expansion has been due mainly to the natural increase; that is, by reason of excess of births over deaths. Immigration to Australia has been very slight since 1891, owing originally to the stoppage of progress consequent on the bank crisis of 1893, and, subsequently, to the disinclination of several of the state governments towards immigration and their failure to provide for the welfare of immigrants on their arrival. During 1906 a more rational view of the value of immigration was adopted by the various state governments and by the federal government, and immigration to Australia is now systematically encouraged. Australia's gain of population by immigration,—*i.e.* the excess of the inward over the outward movement of a population—since the discovery of gold in 1851, arranged in ten years periods, was

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[1] The statistical portion of this article includes Tasmania, which is a member of the Australian Commonwealth.

1852–1861	520,713
1862–1871	188,158
1872–1881	223,326
1882–1891	374,097
1892–1901	2,377

During the five years following the last year of the foregoing table, there was practically no increase in population by immigration.

The birth rate averages 26·28 per thousand of the population and the death rate 12·28, showing a net increase of 14 per thousand by reason of the excess of births over deaths. The marriage rate varies as in other countries from year to year according to the degree of prosperity prevailing. In the five years 1881–1888 the rate was 8·08 marriages (16·1 persons) per thousand of the population, declining to 6·51 in 1891–1895; in recent years there has been a considerable improvement, and the Australian marriage rate may be quoted as ranging between 6·75 and 7·25. The death rate of Australia is much below that of European countries and is steadily declining. During the twenty years preceding the census of 1901 there was a fall in the death rate of 3·4 per thousand, of which, however, 1 per thousand is attributable to the decline in the birth rate, the balance being attributable to improved sanitary conditions.

Territorial Divisions.—Australia is politically divided into five states, which with the island of Tasmania form the Commonwealth of Australia. The area of the various states is as follows:

	Sq. m.
New South Wales	310,700
Victoria	87,884
Queensland	668,497
South Australia	903,690
Western Australia	975,920
	2,946,691
Tasmania	26,215
Commonwealth	2,972,906

To the area of the Commonwealth shown in the table might be added that of New Guinea, 90,000 sq. m.; this would bring the area of the territory controlled by the Commonwealth to 3,062,906 sq. m. The distribution of population at the close of 1906 (4,118,000) was New South Wales 1,530,000, Victoria 1,223,000, Queensland 534,000, South Australia 381,000, Western Australia 270,000, Tasmania 180,000. The rate of increase since the previous census was 1·5% per annum, varying from 0·31 in Victoria to 2·06 in New South Wales and 6·9 in Western Australia.

Australia contains four cities whose population exceeds 100,000, and fifteen with over 10,000. The principal cities and towns are Sydney (pop. 530,000), Newcastle, Broken Hill, Parramatta, Goulburn, Maitland, Bathurst, Orange, Lithgow, Tamworth, Grafton, Wagga and Albury, in New South Wales; Melbourne (pop. 511,900), Ballarat, Bendigo, Geelong, Eaglehawk, Warrnambool, Castlemaine, and Stawell in Victoria; Brisbane (pop. 128,000), Rockhampton, Maryborough, Townsville, Gympie, Ipswich, and Toowoomba in Queensland; Adelaide (pop. about 175,000), Port Adelaide and Port Pirie in South Australia; Perth (pop. 56,000), Fremantle, and Kalgoorlie in Western Australia; and Hobart (pop. 35,500) and Launceston in Tasmania.

Defence.—Up to the end of the 19th century, little was thought of any locally-raised or locally-provided defensive forces, the mother-country being relied upon. But the Transvaal War of 1899–1902, to which Australia sent 6310 volunteers (principally mounted rifles), and the gradual increase of military sentiment, brought the question more to the front, and more and more attention was given to making Australian defence a matter of local concern. Naval defence in any case remained primarily a question for the Imperial navy, and by agreement (1903, for ten years) between the British government and the governments of the Commonwealth (contributing an annual subsidy of £200,000) and of New Zealand (£40,000), an efficient fleet patrolled the Australasian waters, Sydney, its headquarters, being ranked as a first-class naval station. Under the agreement a royal naval reserve was maintained, three of the Imperial vessels provided being utilized as drill ships for crews recruited from the Australian states. At the end of 1908 the strength of the naval forces under the Commonwealth defence department was: permanent, 217, naval militia, 1016; the estimated expenditure for 1908–1909 being £63,531. In 1908–1909 a movement began for the establishment by Australia of a local flotilla of torpedo-boat destroyers, to be controlled by the Commonwealth in peace time, but subject to the orders of the British admiralty in war time, though not to be removed from the Australian coast without the sanction of the Commonwealth; and by 1909 three such vessels had been ordered in England preparatory to building others in Australia. The military establishment at the beginning of 1909 was represented by a small permanent force of about 1400, a militia strength of about 17,000, and some 6000 volunteers, besides 50,000 members of rifle clubs and 30,000 cadets; the expenditure being (estimate, 1908–1909) £623,946. But a reorganization of the military forces, on the basis of obligatory national training, was already contemplated, though the first Bill introduced for this purpose by Mr Deakin's government (Sept. 1908) was dropped, and in 1909 the subject was still under discussion.

Religion.—There is no state church in Australia, nor is the teaching of religion in any way subsidized by the state. The Church of England claims as adherents 39% of the population, and the Roman Catholic Church 22%; next in numerical strength are the Wesleyans and other Methodists, numbering 12%, the various branches of the Presbyterians 11%, Congregationalists 2%, and Baptists 2%. These proportions varied very little between 1881 and 1906, and may be taken as accurately representing the present strength of the various Christian denominations. Churches of all denominations are liberally supported throughout the states, and the residents of every settlement, however small, have their places of worship erected and maintained by their own contributions.

Instruction.—Education is very widely distributed, and in every state it is compulsory for children of school ages to attend school. The statutory ages differ in the various states; in New South Wales and Western Australia it is from 6 to 13 years inclusive, in Victoria 6 to 12 years, in Queensland 6 to 11 years, and in South Australia 7 to 12 years inclusive. Religious instruction is not imparted by the state-paid teachers in any state, though in certain states persons duly authorized by the religious organizations are allowed to give religious instruction to children of their own denomination where the parents' consent has been obtained. According to the returns for 1905 there were 7292 state schools, with 15,628 teachers and 648,927 pupils, and the average attendance of scholars was 446,000. Besides state schools there were 2145 private schools, with 7825 teachers and 137,000 scholars, the average number of scholars in attendance being 120,000. The census of 1901 showed that about 83% of the whole population and more than 91% of the population over five years of age could read and write. There was, therefore, a residue of 9% of illiterates, most of whom were not born in Australia. The marriage registers furnish another test of education. In 1905 only ten persons in every thousand married were unable to sign their names, thus proving that the number of illiterate adults of Australian birth is very small.

Instruction at state schools is either free or at merely nominal cost, and high schools, technical colleges and agricultural colleges are maintained by appropriations from the general revenues of the states. There are also numerous grammar schools and other private schools. Universities have been established at Sydney, Melbourne, Adelaide and Hobart, and are well equipped and numerously attended; they are in part supported by grants from the public funds and in part by private endowments and the fees paid by students. The number of students attending lectures is about 2500 and the annual income a little over £100,000. The cost of public instruction in Australia averages about 11s. 4d. per inhabitant, and the cost per scholar in average attendance at state schools is £4 : 13 : 9.

Pastoral and Agricultural Industries.—The continent is essentially a pastoral one, and the products of the flocks and herds constitute the chief element in the wealth of Australia. Practically the whole of the territory between the 145° meridian and the Great Dividing Range, as well as extensive tracts in the south and west, are a natural sheep pasture with climatic conditions and indigenous vegetation pre-eminently adapted for the growth of wool of the highest quality. Numerically the flocks of Australia represent one-sixth of the world's sheep, and in just over half a century (1851–1905) the exports of Australian wool alone reached the value of £650,000,000. During the same period, owing to the efforts of pastoralists to improve their flocks, there was a gradual increase in the weight of wool produced per sheep from 3¼ lb to an average of over 7 lb. The cattle and horse-breeding industries are of minor importance as compared with wool-growing, but nevertheless represent a great source of wealth, with vast possibilities of expansion in the over-sea trade. The perfection of refrigeration in over-sea carriage, which has done so much to extend the markets for Australian beef and mutton, has also furthered the expansion of dairying, there being an annual output of over 160 million lb of butter, valued at £6,000,000; of this about 64 million lb, valued at £2,500,000, is exported annually to British markets.

Next to the pastoral industry, agriculture is the principal source of Australian wealth. At the close of 1905 the area devoted to tillage was 9,365,000 acres, the area utilized for the production of breadstuffs being 6,270,000 acres or over two-thirds of the whole extent of cultivation. At first wheat was cultivated solely in the coastal country, but experience has shown that the staple cereal can be most successfully grown over almost any portion of the arable lands within the 20 to 40 in. rainfall areas. The value of Australian wheat and flour exported in 1905 was £5,500,000.

Other important crops grown are—maize, 324,000 acres; oats, 493,000 acres; other grains, 160,000 acres; hay, 1,367,000 acres; potatoes, 119,000 acres; sugar-cane, 141,000 acres; vines, 65,000 acres; and other crops, 422,000 acres. The chief wheat lands are in Victoria, South Australia and New South Wales; the yield averages about 9 bushels to the acre; this low average is due to the endeavour of settlers on new lands to cultivate larger areas than their resources can effectively deal with; the introduction of scientific farming should almost double the yield. Maize and sugar-cane are grown in New South Wales and Queensland. The vine is cultivated in all the states, but chiefly in South Australia, Victoria and New South Wales. Australia produces abundant quantities and nearly all varieties of fruits; but the kinds exported are chiefly oranges, pineapples, bananas and apples. Tobacco thrives well in New South Wales and Victoria, but kinds suitable for exportation are not largely grown. Compared with the principal countries of the world, Australia does not take a high position in regard to the gross value of the produce of its tillage, the standard of cultivation being for the most part low and without regard to maximum returns, but in value per inhabitant it compares fairly well; indeed, some of the states show averages which surpass those of many of the leading agricultural countries. For 1905 the total value of agricultural produce estimated at the place of production was £18,750,000 sterling, or about £4 : 13 : 4 per inhabitant.

Timber Industry.—Although the timbers of commercial value are confined practically to the eastern and a portion of the western coastal belt and a few inland tracts of Australia, they constitute an important national asset. The early settlement of heavily timbered country was characterized by wanton destruction of vast quantities of magnificent timber; but this waste is a thing of the past, and under the pressure of a demand for sound timber both for local use and for exportation, the various governments are doing much to conserve the state forests. In Western Australia, New South Wales, Tasmania and Queensland there are many hundreds of well-equipped saw-mills affording employment to about 5000 men. The export of timber is in ordinary years valued at a million sterling and the total production at £2,250,000.

Fisheries.—Excellent fish of many varieties abound in the Australian seas and in many of the rivers. In several of the states, fish have been introduced successfully from other countries. Trout may now be taken in many of the mountain streams. At one time whaling was an important industry on the coasts of New South Wales and Tasmania, and afterwards on the Western Australian coasts. The industry gravitated to New Zealand, and finally died out, chiefly through the wasteful practice of killing the calves to secure the capture of the mothers. Of late years whaling has again attracted attention, and a small number of vessels prosecute the industry during the season. The only source of maritime wealth that is now being sufficiently exploited to be regarded as an industry is the gathering of pearl-oysters from the beds off the northern and north-western coasts of the continent. In Queensland waters there are about 300 vessels, and on the Western Australian coast about 450 licensed craft engaged in the industry, the annual value of pearl-shell and pearls raised being nearly half a million sterling. Owing to the depletion of some of the more accessible banks, and to difficulties in connexion with the employment of coloured crews, many of the vessels have now gone farther afield. As the pearl-oyster is remarkably prolific, it is considered by experts that within a few years of their abandonment by fishing fleets the denuded banks will become as abundantly stocked as ever.

Gold.

Mineral Production.—Australia is one of the great gold producers of the world, and its yield in 1905 was about £16,000,000 sterling, or one-fourth of the gold output of the world; and the total value of its mineral production was approximately £25,000,000. Gold is found throughout Australia, and the present prosperity of the states is largely due to the discoveries of this metal, the development of other industries being, in a country of varied resources, a natural sequence to the acquisition of mineral treasure. From the date of its first discovery, up to the close of 1905, gold to the value of £460,000,000 sterling has been obtained in Australia. Victoria, in a period of fifty-four years, contributed about £273,000,000 to this total, and is still a large producer, its annual yield being about 800,000 oz., 29,000 men being engaged in the search for the precious metal. Queensland's annual output is between 750,000 and 800,000 oz.; the number of men engaged in gold-mining is 10,000. In New South Wales the greatest production was in 1852, soon after the first discovery of the precious metal, when the output was valued at £2,660,946; the production in 1905 was about 270,000 oz., valued at £1,150,000. For many years Western Australia was considered to be destitute of mineral deposits of any value, but it is now known that a rich belt of mineral country extends from north to south. The first important discovery was made in 1882, when gold was found in the Kimberley district; but it was not until a few years later that this rich and extensive area was developed. In 1887 gold was found in Yilgarn, about 200 m. east of Perth. This was the first of the many rich discoveries in the same district which have made Western Australia the chief gold-producer of the Australian group. In 1907 there were eighteen goldfields in the state, and it was estimated that over 30,000 miners were actively engaged in the search for gold. In 1905 the production amounted to 1,983,000 oz., valued at £8,300,000. Tasmania is a gold producer to the extent of about 70,000 or 80,000 oz. a year, valued at £300,000; South Australia produces about 30,000 oz.

Gold is obtained chiefly from quartz reefs, but there are still some important alluvial deposits being worked. The greatest development of quartz reefing is found in Victoria, some of the mines being of great depth. There are eight mines in the Bendigo district over 3000 ft. deep, and fourteen over 2500 ft. deep. In the Victoria mine a depth of 3750 ft. has been reached, and in Lazarus mine 3424 ft. In the Ballarat district a depth of 2520 ft. has been reached in the South Star mine. In Queensland there is one mine 3156 ft. deep, and several others exceed 2000 ft. in depth. A considerable number of men are engaged in the various states on alluvial fields, in hydraulic sluicing, and dredging is now adopted for the winning of gold in river deposits. So far this form of winning is chiefly carried on in New South Wales, where there are about fifty gold-dredging plants in successful operation. Over 70,000 men are employed in the gold-mining industry, more than two-thirds of them being engaged in quartz mining.

Silver.

Silver has been discovered in all the states, either alone or in the form of sulphides, antimonial and arsenical ores, chloride, bromide, iodide and chloro-bromide of silver, and argentiferous lead ores, the largest deposits of the metal being found in the last-mentioned form. The leading silver mines are in New South Wales, the returns from the other states being comparatively insignificant. The fields of New South Wales have proved to be of immense value, the yield of silver and lead during 1905 being £2,500,000, and the total output to the end of the year named over £40,000,000. The Broken Hill field, which was discovered in 1883, extends over 2500 sq. m. of country, and has developed into one of the principal mining centres of the world. It is situated beyond the river Darling, and close to the boundary between New South Wales and South Australia. The lodes occur in Silurian metamorphic micaceous schists, intruded by granite, porphyry and diorite, and traversed by numerous quartz reefs, some of which are gold-bearing. The Broken Hill lode is the largest yet discovered. It varies in width from 10 ft. to 200 ft., and may be traced for several miles. Although indications of silver abound in all the other states, no fields of great importance have yet been discovered. Up to the end of 1904 Australia had produced silver to the value of £45,000,000. At Broken Hill mines about 11,000 miners are employed.

Copper.

Copper is known to exist in all the states, and has been mined extensively in South Australia, New South Wales, Queensland and Tasmania. The low quotations which ruled for a number of years had a depressing effect upon the industry, and many mines once profitably worked were temporarily closed, but in 1906 there was a general revival. The discovery of copper had a marked effect on the fortunes of South Australia at a time when the young colony was surrounded by difficulties. The first important mine, the Kapunda, was opened up in 1842. It is estimated that at one time 2000 tons were produced annually, but the mine was closed in 1879. In 1845 the celebrated Burra Burra mine was discovered. This mine proved to be very rich, and paid £800,000 in dividends to the original owners. For a number of years, however, the mine has been suffered to remain untouched, as the deposits originally worked were found to be depleted. For many years the average output was from 10,000 to 13,000 tons of ore, yielding from 22 to 23% of copper. For the period of thirty years during which the mine was worked the production of ore amounted to 234,648 tons, equal to 51,622 tons of copper, valued at £4,749,924. The Wallaroo and Moonta mines, discovered in 1860 and 1861, proved to be even more valuable than the Burra Burra, the Moonta mines employing at one time upwards of 1600 hands. The dividends paid by these mines amounted to about £1,750,000 sterling. The satisfactory price obtained during recent years has enabled renewed attention to be paid to copper mining in South Australia, and the production of the metal in 1905 was valued at £470,324. The principal deposits of copper in New South Wales are found in the central part of the state between the Macquarie, Darling and Bogan rivers. Deposits have also been found in the New England and southern districts, as well as at Broken Hill, showing that the mineral is widely distributed throughout the state. The more important mines are those of Cobar, where the Great Cobar mine produces annually nearly 4000 tons of refined copper. In northern Queensland copper is found throughout the Cloncurry district, in the upper basin of the Star river, and the Herberton district. The returns from the copper fields in the state are at present a little over half a million sterling per annum, and would be still greater if it were not for the lack of suitable fuel for smelting purposes, which renders the economical treatment of the ore difficult; the development of the mines is also retarded by the want of easy and cheaper communication with the coast. In Western Australia copper deposits have been worked for some years. Very rich lodes of the metal have been found in the Northampton, Murchison and Champion Bay districts, and also in the country to the south of these districts on the Irwin river. Tasmania is now the largest copper-producing state of the Commonwealth; in 1905 the output was over £672,010 and in earlier years even larger. The chief mines belong to the Mount Lyell Mining & Railway Co., and are situated on the west side of the island with an outlet by rail to Strahan on the west coast. The total value of copper produced in Australia up to the end of 1905 was £42,500,000 sterling, £24,500,000 having been obtained in South Australia, £7,500,000 in New South Wales, £6,400,000 in Tasmania and over £3,500,000 in Queensland.

Tin.

Tin was known to exist in Australia from the first years of colonization. The wealth of Queensland and the Northern Territory in this mineral, according to the reports of Dr Jack, late Government geologist of the former state, and the late Rev. J. E. Tenison-Woods, appears to be very great. The most important tin-mines in Queensland are in the Herberton district, south-west of Cairns; at Cooktown, on the Annan and Bloomfield rivers; and at Stanthorpe, on the border of New South Wales. Herberton and Stanthorpe have produced more than three-fourths of the total production of the state. Towards the close of the 19th century the production greatly decreased in consequence of the low price of the metal, but in 1899 a stimulus was given to the industry, and since then the production has increased very considerably, the output for 1905 being valued at £989,627. In New South Wales lode tin occurs principally in the granite and stream tin under the basaltic country in the extreme north of the state, at Tenterfield, Emmaville, Tingha, and in other districts of New England. The metal has also been discovered in the Barrier ranges, and many other places. The value of the output in 1905 was £226,110. The yield of tin in Victoria is very small, and until lately no fields of importance have been discovered; but towards the latter end of 1899 extensive deposits were reported to exist in the Gippsland district—at Omeo and Tarwin. In South Australia tin-mining is unimportant. In Western Australia the production from the tin-fields at Greenbushes and elsewhere was valued at £87,000. Tasmania during the last few years has attained the foremost position in the production of tin, the annual output now being about £363,000. The total value of tin produced in Australia is nearly a million sterling per annum, and the total production to the end of 1905 was £22,500,000, of which Tasmania produced about 40%, New South Wales one-third, Queensland a little more than a fourth.

Iron.

Iron is distributed throughout Australia, but for want of capital for developing the fields this industry has not progressed. In New South Wales there are, together with coal and limestone in unlimited supply, important deposits of rich iron ores suitable for smelting purposes; and for the manufacture of steel of certain descriptions abundance of manganese, chrome and tungsten ores are available. The most extensive fields are in the Mittagong, Wallerawang and Rylstone districts, which are roughly estimated to contain in the aggregate 12,944,000 tons of ore, containing 5,853,000 tons of metallic iron. Extensive deposits, which are being developed successfully, occur in Tasmania, it being estimated that there are, within easy shipping facilities, 17,000,000 tons of ore. Magnetite, or magnetic iron, the richest of all iron ores, is found in abundance near Wallerawang in New South Wales. The proximity of coal-beds now being worked should accelerate the development of the iron deposits, which, on an average, contain 41% of metal. Magnetite occurs in great abundance in Western Australia, together with haematite, which would be of enormous value if cheap labour were available. Goethite, limonite and haematite are found in New South Wales, at the junction of the Hawkesbury sandstone formation and the Wianamatta shale, near Nattai, and are enhanced in their value by their proximity to coal-beds. Near Lithgow extensive deposits of limonite, or clay-band ore, are interbedded with coal. Some samples of ore, coal and limestone, obtained in the Mittagong district, with pig-iron and castings manufactured therefrom, were exhibited at the Mining Exhibition in London and obtained a first award.

Other minerals.

Antimony is widely diffused throughout Australia, and is sometimes found associated with gold. In New South Wales the principal centre of this industry is Hillgrove, near Armidale, where the Eleanora Mine, one of the richest in the state, is situated. The ore is also worked for gold. In Victoria the production of antimony gave employment in 1890 to 238 miners, but owing to the low price of the metal, production has almost ceased. In Queensland the fields were all showing development in 1891, when the output exhibited a very large increase compared with that of former years; but, as in the case of Victoria, the production of the metal seems to have ceased. Good lodes of stibnite (sulphide of antimony) have been found near Roebourne in Western Australia, but no attempt has yet been made to work them.

Bismuth is known to exist in all the Australian states, but up to the present time it has been mined for only in three states, viz. New South Wales, Queensland, South Australia and Tasmania. It is usually found in association with tin and other minerals. The principal mine in New South Wales is situated at Kingsgate, in the New England district, where the mineral is generally associated with molybdenum and gold.

Manganese probably exists in all the states, deposits having been found in New South Wales, Victoria, Queensland and Western Australia, the richest specimens being found in New South Wales. Little, however, has been done to utilize the deposits, the demands of the colonial markets being extremely limited. The ore generally occurs in the form of oxides, manganite and pyrolusite, and contains a high percentage of sesquioxide of manganese.

Platinum and the allied compound metal iridosmine have been found in New South Wales, but so far in inconsiderable quantities. Iridosmine occurs commonly with gold or tin in alluvial drifts.

The rare element tellurium has been discovered in New South Wales at Bingara and other parts of the northern districts, as well as at Tarana, on the western line, though at present in such minute quantities as would not repay the cost of working. At many of the mines at Kalgoorlie, Western Australia, large quantities of ores of telluride of gold have been found in the lode formations.

Lead is found in all the Australian states, but is worked only when associated with silver. In Western Australia the lead occurs in the form of sulphides and carbonates of great richness, but the quantity of silver mixed with it is very small. The lodes are most frequently of great size, containing huge masses of galena, and so little gangue that the ore can very easily be dressed to 83 or 84%. The association of this metal with silver in the Broken Hill mines of New South Wales adds very greatly to the value of the product.

Mercury is found in New South Wales and Queensland. In New

South Wales, in the form of cinnabar, it has been discovered on the Cudgegong river, near Rylstone, and it also occurs at Bingara, Solferino, Yulgilbar and Cooma. In the last-named place the assays of ore yielded 22 % of mercury.

Titanium, in the minerals known as octahedrite and brookite, is found in alluvial deposits in New South Wales, in conjunction with diamonds.

Wolfram (tungstate of iron and manganese) occurs in some of the states, notably in New South Wales, Victoria, Tasmania and Queensland. Scheelite, another mineral of tungsten, is also found in Queensland. Molybdenum, in the form of molybdenite (sulphide of molybdenum), is found in Queensland, New South Wales and Victoria, associated in the parent state with tin and bismuth in quartz reefs.

Zinc ores, in the several varieties of carbonates, silicates, oxide, sulphide and sulphate of zinc, have been found in several of the Australian states, but have attracted little attention except in New South Wales, where special efforts are being made successfully to produce a high-grade zinc concentrate from the sulphide ores. Several companies are devoting all their energies to zinc extraction, and the output is now equal to about 5% of the world's production.

Nickel, so abundant in the island of New Caledonia, has up to the present been found in none of the Australian states except Queensland and Tasmania. Few attempts, however, have been made to prospect systematically for this valuable mineral.

Cobalt occurs in New South Wales, Victoria and South Australia, and efforts have been made in the former state to treat the ore, the metal having a high commercial value; but the market is small, and no attempt has been made up to 1907 to produce it on any large scale. The manganese ores of the Bathurst district of New South Wales often contain a small percentage of cobalt—sufficient, indeed, to warrant further attempts to work them. In New South Wales chromium is found in the northern portion of the state, in the Clarence and Tamworth districts and also near Gundagai. It is usually associated with serpentine. In the Gundagai district the industry was rapidly becoming a valuable one, but the low price of chrome has greatly restricted the output. Chromium has been discovered in Tasmania also.

Arsenic, in its well-known and beautiful forms, orpiment and realgar, is found in New South Wales and Victoria. It usually occurs in association with other minerals in veins.

Fuel.

The Australian states have been bountifully supplied with mineral fuel. Five distinct varieties of black coal, of well-characterized types, may be distinguished, and these, with the two extremes of brown coal or lignite and anthracite, form a perfectly continuous series. Brown coal, or lignite, occurs principally in Victoria. Attempts have frequently been made to use the mineral for ordinary fuel purposes, but its inferior quality has prevented its general use. Black coal forms one of the principal resources of New South Wales; and in the other states the deposits of this valuable mineral are being rapidly developed. Coal of a very fair description was discovered in the basin of the Irwin river, in Western Australia, as far back as the year 1846. It has been ascertained from recent explorations that the area of carboniferous formation in that state extends from the Irwin northwards to the Gascoyne river, about 300 m., and probably all the way to the Kimberley district. The most important discovery of coal in the state, so far, is that made in the bed of the Collie river, near Bunbury, to the south of Perth. The coal has been treated and found to be of good quality, and there are grounds for supposing that there are 250,000,000 tons in the field. Dr Jack, late government geologist of Queensland, considers the extent of the coal-fields of that state to be practically unlimited, and is of opinion that the carboniferous formations extend to a considerable distance under the Great Western Plains. It is roughly estimated that the Coal Measures at present practically explored extend over an area of about 24,000 sq. m. Coal-mining is an established industry in Queensland, and is progressing satisfactorily. The mines, however, are situated too far from the coast to permit of serious competition with Newcastle in an export trade, and the output is practically restricted to supplying local requirements. The coal-fields of New South Wales are situated in three distinct regions—the northern, southern and western districts. The first of these comprises chiefly the mines of the Hunter river districts; the second includes the Illawarra district, and, generally, the coastal regions to the south of Sydney, together with Berrima, on the tableland; and the third consists of the mountainous regions on the Great Western railway and extends as far as Dubbo. The total area of the Carboniferous strata of New South Wales is estimated at 23,950 sq. m. The seams vary in thickness. One of the richest has been found at Greta in the Hunter river district; it contains an average thickness of 41 ft. of clean coal, and the quantity underlying each acre of ground has been computed to be 63,700 tons. The coal mines of New South Wales give employment to 14,000 persons, and the annual production is over 6,600,000 tons. Black coal has been discovered in Victoria, and about 250,000 tons are now being raised. The principal collieries in the state are the Outtrim Howitt, the Coal Creek Proprietary and the Jumbunna. In South Australia, at Leigh's Creek, north of Port Augusta, coal-beds have been discovered. The quantity of coal extracted annually in Australia had in 1906 reached 7,497,000 tons.

Kerosene shale (torbanite) is found in several parts of New South Wales. It is a species of cannel coal, somewhat similar to the Boghead mineral of Scotland, but yielding a much larger percentage of volatile hydro-carbon than the Scottish mineral. The richest quality yields about 100 to 130 gallons of crude oil per ton, or 17,000 to 18,000 cub. ft. of gas, with an illuminating power of 35 to 40 sperm candles, when gas only is extracted from the shale.

Large deposits of alum occur close to the village of Bulladelah, 30 m. from Port Stephens, New South Wales. It is said to yield well, and a quantity of the manufactured alum is sent to Sydney for local consumption. Marble is found in many parts of New South Wales and South Australia. Kaolin, fire-clays and brick-clays are common to all the states. Except in the vicinity of cities and townships, however, little use has been made of the abundant deposits of clay. Kaolin, or porcelain clay, although capable of application to commercial purposes, has not as yet been utilized to any extent, although found in several places in New South Wales and in Western Australia.

Asbestos has been found in New South Wales in the Gundagai Bathurst and Broken Hill districts—in the last-mentioned district in considerable quantities. Several specimens of very fair quality have also been met with in Western Australia.

Gems.

Many descriptions of gems and gem stones have been discovered in various parts of the Australian states, but systematic search has been made principally for the diamond and the noble opal. Diamonds are found in all the states; but only in New South Wales have any attempts been made to work the diamond drifts. The best of the New South Wales diamonds are harder and much whiter than the South African diamonds, and are classified as on a par with the best Brazilian gems, but no large specimens have yet been found. The finest opal known is obtained in the Upper Cretaceous formation at White Cliffs, near Wilcannia, New South Wales, and at these mines about 700 men find constant employment. Other precious stones, including the sapphire, emerald, oriental emerald, ruby, opal, amethyst, garnet, chrysolite, topaz, cairngorm, onyx, zircon, &c., have been found in the gold and tin bearing drifts and river gravels in numerous localities throughout the states. The sapphire is found in all the states, principally in the neighbourhood of Beechworth, Victoria. The oriental topaz has been found in New South Wales. Oriental amethysts also have been found in that state, and the ruby has been found in Queensland, as well as in New South Wales. Turquoises have been found near Wangaratta, in Victoria, and mining operations are being carried on in that state. Chrysoberyls have been found in New South Wales; spinel rubies in New South Wales and Victoria; and white topaz in all the states. Chalcedony, carnelian, onyx and cat's eyes are found in New South Wales; and it is probable that they are also to be met with in the other states, particularly in Queensland. Zircon, tourmaline, garnet and other precious stones of little commercial value are found throughout Australia.

Commerce.—The number of vessels engaged in the over-sea trade of Australia in 1905 was 2112, viz. 1050 steamers, with a tonnage of 2,629,000, and 1062 sailers, tonnage 1,090,000; the total of both classes was 3,719,000 tons. The nationality of the tonnage was, British 2,771,000, including Australian 288,000, and foreign 948,000. The destination of the shipping was, to British ports 2,360,000 tons, and to foreign ports 1,350,000 tons. The value of the external trade was £95,188,000, viz. £38,347,000 imports, and £56,841,000 exports. The imports represent £9:11:6 per inhabitant and the exports £14:4:2, with a total trade of £23:15:8. The import trade is divided between the United Kingdom and possessions and foreign countries as follows:—United Kingdom £23,074,000, British possessions £5,384,000, and foreign states £9,889,000, while the destination of the exports is, United Kingdom £26,703,000, British possessions £12,519,000, and foreign countries £17,619,000. The United Kingdom in 1905 sent 60 % of the imports taken by Australia, compared with 26 % from foreign countries, and 14 % from British possessions; of Australian imports the United Kingdom takes 47 %, foreign countries 31 % and British possessions 22 %. In normal years (that is to say, when there is no large movement of capital) the exports of Australia exceed the imports by some £15,300,000. This sum represents the interest payable on government loans placed outside Australia, mainly in England, and the income from British and other capital invested in the country; the former may be estimated at £7,300,000 and the latter £8,000,000 per annum. The principal items of export are wool, skins, tallow, frozen mutton, chilled beef, preserved meats, butter and other articles of pastoral produce, timber, wheat, flour and fruits, gold, silver, lead, copper, tin and other metals. In 1905 the value of the wool export regained the £20,000,000 level, and with the rapid recovery of the numerical strength of the flocks, great improvements in the quality and weight of fleeces, this item is likely to show permanent advancement. The exports of breadstuffs—chiefly to the United Kingdom—exceed six millions per annum, butter two and a half millions, and minerals of all kinds, except gold, six millions. Gold is exported in large quantities from Australia. The total gold production of the country is from £14,500,000 to £16,000,000, and as not more than three-quarters of a million are required to strengthen existing local stocks, the balance is usually available for export, and the average export of the precious metal during the ten years, 1896–1905, was £12,500,000 per annum. The chief articles of import are apparel and textiles, machinery and hardware, stimulants, narcotics, explosives, bags and sacks, books and paper, oils and tea.

Lines of steamers connect Australia with London and other British ports, with Germany, Belgium, France, Italy, Japan, China, India, San Francisco, Vancouver, New York and Montevideo, several important lines being subsidized by the countries to which they belong, notably Germany, France and Japan.

Railways.—Almost the whole of the railway lines in Australia are the property of the state governments, and have been constructed and equipped wholly by borrowed capital. There were on the 30th of June 1905, 15,000 m. open for traffic, upon which nearly £135,000,000 had been expended.

The railways are of different gauges, the standard narrow gauge of 4 ft. 8½ in. prevailing only in New South Wales; in Victoria the gauge is 5 ft. 3 in., in South Australia 5 ft. 3 in. and 3 ft. 6 in., and in the other states 3 ft. 6 in. Taking the year 1905, the gross earnings amounted to £11,892,262; the working expenses, exclusive of interest, £7,443,546; and the net earnings £4,448,716; the latter figure represents 3·31% upon the capital expended upon construction and equipment; in the subsequent year still better results were obtained. In several of the states, New South Wales and South Australia proper, the railways yield more than the interest paid by the government on the money borrowed for their construction. The earnings per train-mile vary greatly; but for all the lines the average is 7s. 1d., and the working expenses about 4s. 5d., making the net earnings 2s. 8d. per train-mile. The ratio of receipts from coaching traffic to total receipts is about 41%, which is somewhat less than in the United Kingdom; but the proportion varies greatly amongst the states themselves, the more densely populated states approaching most nearly to the British standard. The tonnage of goods carried amounts to about 16,000,000 tons, or 4 tons per inhabitant, which must be considered fairly large, especially as no great proportion of the tonnage consists of minerals on which there is usually a low freightage. Excluding coal lines and other lines not open to general traffic, the length of railways in private hands is only 382 m. or about 2½% of the total mileage open. Of this length, 277 m. are in Western Australia. The divergence of policy of that state from that pursued by the other states was caused by the inability of the government to construct lines, when the extension of the railway system was urgently needed in the interests of settlement. Private enterprise was, therefore, encouraged by liberal grants of land to undertake the work of construction; but the changed conditions of the state have now altered the state policy, and the government have already acquired one of the two trunk lines constructed by private enterprise, and it is not likely that any further concessions in regard to railway construction will be granted to private persons.

Posts and Telegraphs.—The postal and telegraphic facilities offered by the various states are very considerable. There are some 6686 post-offices throughout the Commonwealth, or about one office to every 600 persons. The letters carried amount to about 80 per head, the newspapers to 32 per head and the packets to 15 per head. The length of telegraph lines in use is 46,300 m., and the length of wire nearly three times that distance. In 1905 there were about 11,000,000 telegraphic messages sent, which gives an average of 2·7 messages per inhabitant. The postal services and the telegraphs are administered by the federal government.

Banking.—Depositors in savings banks represent about twenty-nine in every hundred persons, and in 1906 the sum deposited amounted to £37,205,000 in the names of 1,152,000 persons. In ordinary banks the deposits amounted to £106,625,000, so that the total deposits stood at £143,830,000, equivalent to the very large sum of £34, 18s. per inhabitant. The coin and bullion held by the banks varies between 20 and 24 millions sterling and the note circulation is almost stationary at about 3¼ millions.

Public Finance.—Australian public finance requires to be treated under the separate headings of Commonwealth and states finance. Under the Constitution Act the Commonwealth is given the control of the postal and telegraph departments, public defence and several other services, as well as the power of levying customs and excise duties; its powers of taxation are unrestricted, but so far no taxes have been imposed other than those just mentioned. The Commonwealth is empowered to retain one-fourth of the net revenue from customs and excise, the balance must be handed back to the states. This arrangement was to last until 1910. Including the total receipts derived from the customs, the Commonwealth revenue, during the year 1906, was made up as follows:—

Customs and excise	£8,999,485
Posts, telegraphs, &c.	2,824,182
Other revenue	55,676
	£11,879,343

The return made to the states was £7,385,731, so that the actual revenue disposed of by the Commonwealth was less by that amount, or £4,493,612. The expenditure was distributed as follows:—

Customs collection	£261,864
Posts, telegraphs, &c.	2,774,804
Defence	949,286
Other expenditure	508,887
Total	£4,494,841

The states have the same powers of taxation as the Commonwealth except in regard to customs and excise, over which the Commonwealth has exclusive power, but the states are the owners of the crown lands, and the revenues derived from this source form an important part of their income. The states have a total revenue, from sources apart from the Commonwealth, of £23,820,439, and if to this be added the return of customs duties made by the federal government, the total revenue is £31,206,170. Although the financial operations of the Commonwealth and the states are quite distinct, a statement of the total revenue of the Australian Commonwealth and states is not without interest as showing the weight of taxation and the different sources from which revenue is obtained. For 1906 the respective revenues were:—

Commonwealth	£11,879,343
States	23,820,439
	£35,699,782
Direct taxation	£3,200,000
Indirect taxation; customs and excise	8,999,485
Land revenue	3,500,000
Post-office and telegraphs	2,824,182
Railways, &c.	13,650,000
Other service	3,526,115

The revenue from direct taxation is equal to 15s. 10d. per inhabitant, from indirect taxation £2: 4: 6, and the total revenue from all sources £35,699,782, equal to £8 : 16 : 2 per inhabitant. The federal government has no public debt, but each of the six states has contracted debts which aggregate £237,000,000, equal to about £58, 8s. per inhabitant. The bulk of this indebtedness has been contracted for the purpose of constructing railways, tramways, water-supplies, and other revenue-producing works and services, and it is estimated that only 8% of the total indebtedness can be set down for unproductive services.

Information regarding Australian state finance will be found under the heading of each state. (T. A. C.)

ABORIGINES

The origin of the natives of Australia presents a difficult problem. The chief difficulty in deciding their ethnical relations is their remarkable physical difference from the neighbouring peoples. And if one turns from physical criteria to their manners and customs it is only to find fresh evidence of their isolation. While their neighbours, the Malays, Papuans and Polynesians, all cultivate the soil, and build substantial huts and houses, the Australian natives do neither. Pottery, common to Malays and Papuans, the bows and arrows of the latter, and the elaborate canoes of all three races, are unknown to the Australians. They then must be considered as representing an extremely primitive type of mankind, and it is necessary to look far afield for their prehistoric home.

Origin.

Wherever they came from, there is abundant evidence that their first occupation of the Australian continent must have been at a time so remote as to permit of no traditions. No record, no folk tales, as in the case of the Maoris of New Zealand, of their migration, are preserved by the Australians. True, there are legends and tales of tribal migrations and early tribal history, but nothing, as A. W. Howitt points out, which can be twisted into referring even indirectly to their first arrival. It is almost incredible there should be none, if the date of their arrival is to be reckoned as only dating back some centuries. Again, while they differ physically from neighbouring races, while there is practically nothing in common between them and the Malays, the Polynesians, or the Papuan Melanesians, they agree in type so closely among themselves that they must be regarded as forming one race. Yet it is noteworthy that the languages of their several tribes are different. The occurrence of a large number of common roots proves them to be derived from one source, but the great variety of dialects—sometimes unintelligible between tribes separated by only a few miles—cannot be explained except by supposing a vast period to have elapsed since their first settlement. There is evidence in the languages, too, which supports the physical separation from their New Zealand neighbours and, therefore, from the Polynesian family of races. The numerals in use were limited. In some tribes there were only three in use, in most four. For the number "five" a word meaning "many" was employed. This linguistic poverty proves that the Australian tongue has no affinity to the Polynesian group of languages, where denary enumeration prevails: the nearest Polynesians, the Maoris, counting in thousands. Further evidence of the antiquity of Australian man is to be found in the strict observance of tribal boundaries, which would seem to show that the tribes must have been settled a long time in one place.

A further difficulty is created by a consideration of the Tasmanian people, extinct since 1876. For the Tasmanians in many ways closely approximated to the Papuan type. They had coarse, short, woolly hair and Papuan features. They clearly had no racial affinities with the Australians. They did not possess the boomerang or woomerah, and they had no boats. When they were discovered, a mere raft of reeds in which they could scarcely venture a mile from shore was their only means of navigation. Yet while the Tasmanians are so distinctly separated in physique and customs from the Australians, the fauna and flora of Tasmania and Australia prove that at one time the two formed one continent, and it would take an enormous time for the formation of Bass Strait. How did the Tasmanians with their Papuan affinities get so far south on a continent inhabited by a race so differing from Papuans? Did they get to Tasmania before or after its separation from the main continent? If before, why were they only found in the south? It would have been reasonable to expect to find them sporadically all over Australia. If after, how did they get there at all? For it is impossible to accept the theory of one writer that they sailed or rowed round the continent—a journey requiring enormous maritime skill, which, according to the theory, they must have promptly lost.

Four points are clear: (1) the Australians represent a distinct race; (2) they have no kinsfolk among the neighbouring races; (3) they have occupied the continent for a very long period; (4) it would seem that the Tasmanians must represent a still earlier occupation of Australia, perhaps before the Bass Strait existed.

Several theories have been propounded by ethnologists. An attempt has been made to show that the Australians have close affinities with the African negro peoples, and certain resemblances in language and in customs have been relied on. Sorcery, the scars raised on the body, the knocking out of teeth, circumcision and rules as to marriage have been quoted; but many such customs are found among savage peoples far distant from each other and entirely unrelated. The alleged language similarities have broken down on close examination. A. R. Wallace is of the opinion that the Australians "are really of Caucasian type and are more nearly allied to ourselves than to the civilized Japanese or the brave and intelligent Zulus." He finds near kinsmen for them in the Ainus of Japan, the Khmers and Chams of Cambodia and among some of the Micronesian islanders who, in spite of much crossing, still exhibit marked Caucasic types. He regards the Australians as representing the lowest and most primitive examples of this primitive Caucasic type, and he urges that they must have arrived in Australia at a time when their ancestors had no pottery, knew no agriculture, domesticated no animals, had no houses and used no bows and arrows. This theory has been supported by the investigations of Dr Klaatsch, of the university of Heidelberg, who would, however, date Australian ancestry still farther back, for his studies on the spot have convinced him that the Australians are "a generalized, not a specialized, type of humanity—that is to say, they are a very primitive people, with more of the common undeveloped characteristics of man, and less of the qualities of the specialized races of civilization." Dr Klaatsch's view is that they are survivals of a primitive race which inhabited a vast Antarctic continent of which South America, South Africa and Australia once formed a part, as evidenced by the identity of many species of birds and fish. He urges that the similarities of some of the primitive races of India and Africa to the aborigines of Australia are indications that they were peopled from one common stock. This theory, plausible and attractive as it is, and fitting in, as it does, with the acknowledged primitive character of the Australian blackfellow, overlooks, nevertheless, the Tasmanian difficulty. Why should a Papuan type be found in what was certainly once a portion of the Australian continent? The theory which meets this difficulty is that which has in its favour the greatest weight of evidence, viz. that the continent was first inhabited by a Papuan type of man who made his way thither from Flores and Timor, New Guinea and the Coral Sea. That in days so remote as to be undateable, a Dravidian people driven from their primitive home in the hills of the Indian Deccan made their way south via Ceylon (where they may to-day be regarded as represented by the Veddahs) and eventually sailed and drifted in their bark boats to the western and north-western shores of Australia. It is difficult to believe that they at first arrived in such numbers as at once to overwhelm the Papuan population. There were probably several migrations. What seems certain, if this theory is adopted, is that they did at last accumulate to an extent which permitted of their mastering the former occupiers of the soil, who were probably in very scattered and defenceless communities.

In the slow process of time they drove them into the most southerly corner of Australia, just as the Saxons drove the Celts into Cornwall and the Welsh hills. Even if this Dravidian invasion is put subsequent to the Bass Strait forming, even if one allows the probability of much crossing between the two races at first, in time the hostilities would be renewed. With their earliest settlements on the north-north-west coasts, the Dravidians would probably tend to spread out north, north-east and east, and a southerly line of retreat would be the most natural one for the Papuans.[1] When at last they were driven to the Strait they would drift over on rafts or in clumsy shallops; being thereafter left in peace to concentrate their race, then possibly only in an approximately pure state, in the island to which the Dravidians would not take the trouble to follow them, and where they would have centuries in which once more to fix their racial type and emphasize over again those differences, perhaps temporarily marred by crossing, which were found to exist on the arrival of the Whites.

This Indo-Aryan origin for the Australian blackfellows is borne out by their physique. In spite of their savagery they are admitted by those who have studied them to be far removed from the low or Simian type of man. Dr Charles Pickering (1805–1878), who studied the Australians on the spot, writes:

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[1] In his *Discoveries in Central Australia*, E. T. Eyre has ingeniously attempted to reconstruct the routes taken by the Australians in their advance across the continent. He has relied, however, in his efforts to link the tribes together, too much on the prevalence or absence of such customs as circumcision—always very treacherous evidences—to allow of his hypothetical distribution being regarded very seriously. The migrations must have always been dependent upon physical difficulties, such as waterless tracts or mountain barriers. They were probably not definite massed movements, such as would permit of the survival of distinctive lines of custom between tribe and tribe; but rather spasmodic movements, sometimes of tribes or of groups, sometimes only of families or even couples, the first caused by tribal wars, the second to escape punishment for some offence against tribal law, such as the defiance of the rules as to clan-marriages.

"Strange as it may appear, I would refer to an Australian as the finest model of the human proportions I have ever met; in muscular development combining perfect symmetry, activity and strength, while his head might have compared with the antique bust of a philosopher." Huxley concluded, from descriptions, that "the Deccan tribes are indistinguishable from the Australian races." Sir W. W. Hunter states that the Dravidian tribes were driven southwards in Hindustan, and that the grammatical relations of their dialects are "expressed by suffixes," which is true as to the Australian languages. He states that Bishop Caldwell,[1] whom he calls "the great missionary scholar of the Dravidian tongue," showed that the south and western Australian tribes use almost the same words for "I, thou, he, we, you, as the Dravidian fishermen on the Madras coast." When in addition to all this it is found that physically the Dravidians resemble the Australians; that the boomerang is known among the wild tribes of the Deccan alone (with the doubtful exception of ancient Egypt) of all parts of the world except Australia, and that the Australian canoes are like those of the Dravidian coast tribes, it seems reasonable enough to assume that the Australian natives are Dravidians, exiled in remote times from Hindustan, though when their migration took place and how they traversed the Indian Ocean must remain questions to which, by their very nature, there can be no satisfactory answer.

The low stage of culture of the Australians when they reached their new home is thus accounted for, but their stagnation is remarkable, because they must have been frequently in contact with more civilized peoples. In the north of Australia there are traces of Malay and Papuan blood. That a far more advanced race had at one time a settlement on the north-west coast is indicated by the cave-paintings and sculptures discovered by Sir George Grey. In caves of the valley of the Glenelg river, north-west Australia, about 60 m. inland and 20 m. south of Prince Regent's river, are representations of human heads and bodies, apparently of females clothed to the armpits, but all the faces are without any indication of mouths. The heads are surrounded with a kind of head-dress or halo and one wears a necklace. They are drawn in red, blue and yellow. The figures are almost life-size. Rough sculptures, too, were found, and two large square mounds formed of loose stones, and yet perfect parallelograms in outline, placed due east and west. In the same district Sir George Grey noticed among the blackfellows people he describes as "almost white." On the Gascoyne river, too, were seen natives of an olive colour, quite good-looking; and in the neighbourhood of Sydney rock-carvings have been also found. All this points to a temporary occupation by a race at a far higher stage of culture than any known Australians, who were certainly never capable of executing even the crude works of art described.

Physique.

Physically the typical Australian is the equal of the average European in height, but is inferior in muscular development, the legs and arms being of a leanness which is often emphasized by an abnormal corpulence. The bones are delicately formed, and there is the lack of calf usual in black races. The skull is abnormally thick and the cerebral capacity small. The head is long and somewhat narrow, the forehead broad and receding, with overhanging brows, the eyes sunken, large and black, the nose thick and very broad at the nostrils. The mouth is large and the lips thick but not protuberant. The teeth are large, white and strong. In old age they appear much ground down; particularly is this the case with women, who chew the different kinds of fibres, of which they make nets and bags. The lower jaw is heavy; the cheekbones somewhat high, and the chin small and receding. The neck is thicker and shorter than that of most Europeans. The colour of the skin is a deep copper or chocolate, never sooty black. When born, the Australian baby is of a much lighter colour than its parents and remains so for about a week. The hair is long, black or very dark auburn, wavy and sometimes curly, but never woolly, and the men have luxuriant beards and whiskers, often of an auburn tint, while the whole body inclines to hairiness. On the Balonne river, Queensland, Baron Mikluho Maclay found a group of hairless natives. The head hair is usually matted with grease and dirt, but when clean is fine and glossy. The skin gives out an objectionable odour, owing to the habit of anointing the body with fish-oils, but the true fetor of the negro is lacking in the Australian. The voices of the blackfellows are musical. Their mental faculties, though inferior to those of the Polynesian race, are not contemptible. They have much acuteness of perception for the relations of individual objects, but little power of generalization. No word exists in their language for such general terms as tree, bird or fish; yet they have invented a name for every species of vegetable and animal they know. The grammatical structure of some north Australian languages has a considerable degree of refinement. The verb presents a variety of conjugations, expressing nearly all the moods and tenses of the Greek. There is a dual, as well as a plural form in the declension of verbs, nouns, pronouns and adjectives. The distinction of genders is not marked, except in proper names of men and women. All parts of speech, except adverbs, are declined by terminational inflections. There are words for the elementary numbers, one, two, three; but "four" is usually expressed by "two-two." They have no idea of decimals. The number and diversity of separate languages is bewildering.

Character.

In disposition the Australians are a bright, laughter-loving folk, but they are treacherous, untruthful and hold human life cheaply. They have no great physical courage. They are mentally in the condition of children. None of them has an idea of what the West calls morality, except the simple one of right or wrong arising out of property. A wife will be beaten without mercy for unfaithfulness to her husband, but the same wife will have had to submit to the first-night promiscuity, a widespread revel which Roth shows is a regular custom in north-west-central Queensland. A husband claims his wife as his absolute property, but he has no scruple in handing her over for a time to another man. There is, however, no proof that anything like community of women or unlimited promiscuity exists anywhere. It would be wrong, however, to conclude that moral considerations have led up to this state of things. Of sexual morality, in the everyday sense of the word, there is none. In his treatment of women the aboriginal may be ranked lower than even the Fuegians. Yet the Australian is capable of strong affections, and the blind (of whom there have always been a great number) are cared for, and are often the best fed in a tribe.

Manners.

The Australians when first discovered were found to be living in almost a prehistoric simplicity. Their food was the meat they killed in the chase, or seeds and roots, grubs or reptiles. They never, in any situation, cultivated the soil for any kind of food-crop. They never reared any kind of cattle, or kept any domesticated animal except the dog, which probably came over with them in their canoes. They nowhere built permanent dwellings, but contented themselves with mere hovels for temporary shelter. They neither manufactured nor possessed any chattels beyond such articles of clothing, weapons, ornaments and utensils as they might carry on their persons, or in the family store-bag for daily use. In most districts both sexes are entirely nude. Sometimes in the south during the cold season they wear a cloak of skin or matting, fastened with a skewer, but open on the right-hand side.

When going through the bush they sometimes wear an apron of skins, for protection merely. No headgear is worn, except sometimes a net to confine the hair, a bunch of feathers, or the tails of small animals. The breast or back, of both sexes, is usually tattooed, or rather, scored with rows of hideous raised scars, produced by deep gashes made at puberty. Their dwellings for the most part are either bowers, formed of the branches of trees, or hovels of piled logs, loosely covered with grass or bark, which they can erect in an hour, wherever they encamp. But some huts of a more substantial form were seen by Captain Matthew Flinders on the south-east coast in 1799, and by Captain King and Sir T. Mitchell on the north-east, where they no longer appear. The ingenuity of the race is mostly exhibited in the manufacture of their weapons of warfare and the chase. While the use of the bow and arrow does not seem to have occurred to them, the spear and axe are in general use, commonly made of hard-wood; the hatchets of stone, and the javelins pointed with stone or bone. The characteristic weapon of the Australian is the boomerang (*q.v.*). Their nets, made by women, either of the tendons of animals or the fibres of plants, will catch and hold the kangaroo or the emu, or the very large fish of Australian rivers. Canoes of bent bark, for the inland waters, are hastily prepared at need; but the inlets and straits of the north-eastern sea-coast are navigated by larger canoes and rafts of a better construction. As to food, they are omnivorous. In central Queensland and elsewhere, snakes, both venomous and harmless, are eaten, the head being first carefully smashed to pulp with a stone.

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[1] *The Languages of India* (1875).

Tribal organization.

The tribal organization of the Australians was based on that of the family. There were no hereditary or formally elected chiefs, nor was there any vestige of monarchy. The affairs of a tribe were ruled by a council of men past middle age. Each tribe occupied a recognized territory, averaging perhaps a dozen square miles, and used a common dialect. This district was subdivided between the chief heads of families. Each family, or family group, had a dual organization which has been termed (1) the Social, (2) the Local. The first was matriarchal, inheritance being reckoned through the mother. No territorial association was needed. All belonged to the same totem or totemic class, and might be scattered throughout the tribe, though subject to the same marriage laws. The second was patriarchal and of a strictly territorial nature. A family or group of families had the same hunting-ground, which was seldom changed, and descended through the males. Thus, the sons inherited their fathers' hunting-ground, but bore their mothers' name and therewith the right to certain women for wives. The Social or matriarchal took precedence of the Local or patriarchal organization. In many cases it arranged the assemblies and ceremonial of the tribe; it regulated marriage, descent and relationship; it ordered blood feuds, it prescribed the rites of hospitality and so on. Nevertheless the Local side of tribal life in time tended to overwhelm the Social and to organize the tribe irrespective of matriarchy, and inclined towards hereditary chieftainship.

The most intricate and stringent rules existed as to marriage within and without the totemic inter-marrying classes. There is said to be but one exception to the rule that marriage must be contracted outside the totem name. This exception was discovered by Messrs Spencer and Gillen among the Arunta of central Australia, some allied septs, and their nearest neighbours to the north, the Kaitish. This tribe may legally marry within the totem, but always avoids such unions. Even in casual amours these class laws were invariably observed, and the young man or woman who defied them was punished, he with death, she with spearing or beating. At the death of a man, his widows passed to his brother of the same totem class. Such a system gave to the elder men of a tribe a predominant position, and generally respect was shown to the aged. Laws and penalties in protection of property were enforced by the tribe. Thus, among some tribes of Western Australia the penalty for abducting another's wife was to stand with leg extended while each male of the tribe stuck his spear into it. Laws, however, did not protect the women, who were the mere chattels of their lords. Stringent rules, too, governed the food of women and the youth of both sexes, and it was only after initiation that boys were allowed to eat of all the game the forest provided. In every case of death from disease or unknown causes sorcery was suspected and an inquest held, at which the corpse was asked by each relative in succession the name of the murderer. This formality having been gone through, the flight of the first bird which passed over the body was watched, the direction being regarded as that in which the sorcerer must be sought. Sometimes the nearest relative sleeps with his head on the corpse, in the belief that he will dream of the murderer. The most sacred duty an Australian had to perform was the avenging of the death of a kinsman, and he was the object of constant taunts and insults till he had done so. Cannibalism was almost universal, either in the case of enemies killed in battle or when animal food was scarce. In the Luritcha tribe it was customary when a child was in weak health to kill a younger and healthy one and feed the weakling on its flesh. Cannibalism seems also to have sometimes been in the nature of a funeral observance, in honour of the deceased, of whom the relatives reverently ate portions.

Religion.

They had no special forms of religious worship, and no idols. The evidence on the question of whether they believed in a Supreme Being is very contradictory. Messrs Spencer and Gillen appear to think that such rudimentary idea of an All-Father as has, it is thought, been detected among the blackfellows is an exotic growth fostered by contact with missionaries. A. W. Howitt and Dr Roth appear to have satisfied themselves of a belief, common to most tribes, in a mythic being (he has different names in different tribes) having some of the attributes of a Supreme Deity. But Mr Howitt finds in this being "no trace of a divine nature, though under favourable conditions the beliefs might have developed into an actual religion." Other authorities suggest that it is going much too far to deny the existence of religion altogether, and instance as proof of the divinity of the supra-normal anthropomorphic beings of the Baiame class, the fact that the Yuin and cognate tribes dance around the image of Daramulun (their equivalent of Baiame) and the medicine men "invocate his name." A good deal perhaps depends on each observer's view of what religion really is. The Australians believed in spirits, generally of an evil nature, and had vague notions of an after-life. The only idea of a god known to be entertained by them seems to be that of the Euahlayi and Kamilaori tribe, Baiame, a gigantic old man lying asleep for ages, with his head resting on his arm, which is deep in the sand. He is expected one day to awake and eat up the world. Researches go to show that Baiame has his counterpart in other tribes, the myth varying greatly in detail. But the Australians are distinguished by possessing elaborate initiatory ceremonies. Circumcision of one or two kinds was usual in the north and south, but not in Western Australia or on the Murray river. In South Australia boys had to undergo three stages of initiation in a place which women were forbidden to approach. At about ten they were covered with blood from head to foot, several elder men bleeding themselves for the purpose. At about twelve or fourteen circumcision took place and (or sometimes as an alternative on the east coast) a front tooth was knocked out, to the accompaniment of the booming of the bullroarer (*q.v.*). At the age of puberty the lad was tattooed or scarred with gashes cut in back, shoulders, arms and chest, and the septum of the nose was pierced. The gashes varied in patterns for the different tribes. Girls, too, were scarred at puberty and had teeth knocked out, &c. The ceremonies—known to the Whites under the native generic term for initiatory rites, *Bora*—were much the same throughout Australia. Polygamy was rare, due possibly to the scarcity of women.[1] Infanticide was universally recognized. The mode of disposing of the dead varied. Among some tribes a circular grave was dug and the body placed in it with its face towards the east, and a high mound covered with bark or thatch raised over it. In New South Wales the body is often burned and the ashes buried. On the Lower Murray the body is placed on a platform of sticks and left to decay. Young children are often not buried for months, but are carried about by their mothers. At the funeral of men there is much mourning, the female relatives cutting or tearing their hair off and plastering their faces with clay, but for women no public ceremonies took place.

The numbers of the native Australians are steadily diminishing. It was estimated that when first visited by Europeans the native population did not much exceed 200,000. A remnant of the race exists in each of the provinces, while a few tribes still wander over the interior.

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[1] The existence of "Group Marriage" is a much-controverted point. This custom, which has been defined as the invasion of actual marriage by allotting permanent paramours, is confined to a special set of tribes.

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HISTORY

1. *The Discovery of Australia.*

It is impossible to say who were the first discoverers of Australia, although there is evidence that the Chinese had some knowledge of the continent so far back as the 13th century. The Malays, also, would seem to have been acquainted with the northern coast; while Marco Polo, who visited the East at the close of the 13th century, makes reference to the reputed existence of a great southern continent. There is in existence a map, dedicated to Henry VIII. of England, on which a large southern land is shown, and the tradition of a Terra Australis appears to have been current for a long period before it enters into authentic history.

In 1503 a French navigator named Binot Paulmyer, sieur de Gonneville, was blown out of his course, and landed on a large island, which was claimed to be the great southern land of tradition, although Flinders and other authorities are inclined to think that it must have been Madagascar. Some French authorities confidently put forward a claim that Guillaume le Testu, of Provence, sighted the continent in 1531. The Portuguese also advance claims to be the first discoverers of Australia, but so far the evidence cannot be said to establish their pretensions. As early as 1597 the Dutch historian, Wytfliet, describes the Australis Terra as the most southern of all lands, and proceeds to give some circumstantial particulars respecting its geographical relation to New Guinea, venturing the opinion that, were it thoroughly explored, it would be regarded as a fifth part of the world.

De Torres.

Early in the 17th century Philip III. of Spain sent out an expedition from Callao, in Peru, for the purpose of searching for a southern continent. The little fleet comprised three vessels, with the Portuguese pilot, De Quiros, as navigator, and De Torres as admiral or military commander. They left Callao on the 21st of December 1605, and in the following year discovered the island now known as Espiritu Santo, one of the New Hebrides group, which De Quiros, under the impression that it was indeed the land of which he was in search, named *La Austrialia del Espiritu Santo*. Sickness and discontent led to a mutiny on De Quiros' vessel, and the crew, overpowering their officers during the night, forced the captain to navigate his ship to Mexico. Thus, abandoned by his consort, De Torres, compelled to bear up for the Philippines to refit, discovered and sailed through the strait that bears his name, and may even have caught a glimpse of the northern coast of the Australian continent. His discovery was not, however, made known until 1792, when Dalrymple rescued his name from oblivion, bestowing it upon the passage which separates New Guinea from Australia. De Quiros returned to Spain to re-engage in the work of petitioning the king to despatch an expedition for the purpose of prosecuting the discovery of the Terra Australis. He was finally successful in his petitions, but died before accomplishing his work, and was buried in an unknown grave in Panama, never being privileged to set his foot upon the continent the discovery of which was the inspiration of his life.

Dutch discoverers.

During the same year in which De Torres sailed through the strait destined to make him famous, a little Dutch vessel called the "Duyfken," or "Dove," set sail from Bantam, in Java, on a voyage of discovery. This ship entered the Gulf of Carpentaria, and sailed south as far as Cape Keerweer, or Turn-again. Here some of the crew landed, but, being attacked by natives, made no attempt to explore the country. In 1616 Dirk Hartog discovered the island bearing his name. In 1622 the "Leeuwin," or "Lioness," made some discoveries on the south-west coast; and during the following year the yachts "Pera" and "Arnheim" explored the shores of the Gulf of Carpentaria. Arnheim Land, a portion of the Northern Territory, still appears on many maps as a memento of this voyage. Among other early Dutch discoverers were Edel; Pool, in 1629, in the Gulf of Carpentaria; Nuyts, in the "Gulde Zeepaard," along the southern coast, which he called, after himself, Nuyts Land; De Witt; and Pelsaert, in the "Batavia." Pelsaert was wrecked on Houtman's Abrolhos; his crew mutinied, and he and his party suffered greatly from want of water. The record of his voyage is interesting from the fact that he was the first to carry back to Europe an authentic account of the western coast of Australia, which he described in any but favourable terms. It is to Dutch navigators in the early portion of the 17th century that we owe the first really authentic accounts of the western coast and adjacent islands, and in many instances the names given by these mariners to prominent physical features are still retained. By 1665 the Dutch possessed rough charts of almost the whole of the western littoral, while to the mainland itself they had given the name of New Holland. Of the Dutch discoverers, Pelsaert was the only one who made any detailed observations of the character of the country inland, and it may here be remarked that his journal contains the first notice and description of the kangaroo that has come down to us.

In 1642 Abel Janszoon Tasman sailed on a voyage of discovery from Batavia, the headquarters of the governor and council of the Dutch East Indies, under whose auspices the expedition was undertaken. He was furnished with a yacht, the "Heemskirk," and a fly-boat, the "Zeehaen" (or "Sea Hen"), under the command of Captain Jerrit Jansen. He left Batavia on what has been designated by Dutch historians the "Happy Voyage," on the 14th of August 1642. After a visit to the Mauritius, then a Dutch possession, Tasman bore away to the south-east, and on the 24th of November sighted the western coast of the land which he named Van Diemen's Land, in honour of the governor under whose directions he was acting. The honour was later transferred to the discoverer himself, and the island is now known as Tasmania. Tasman doubled the southern extremity of Van Diemen's Land and explored the east coast for some distance. The ceremony of hoisting a flag and taking possession of the country in the name of the government of the Netherlands was actually performed, but the description of the wildness of the country, and of the fabulous giants by which Tasman's sailors believed it to be inhabited, deterred the Dutch from occupying the island, and by the international principle of "non-user" it passed from their hands. Resuming his voyage in an easterly direction, Tasman sighted the west coast of the South Island of New Zealand on the 13th of December of the same year, and describes the coast-line as consisting of "high mountainous country."

Dampier.

The first English navigator to sight the Australian continent was William Dampier, who made a visit to these shores in 1688, as supercargo of the "Cygnet," a trader whose crew had turned buccaneers. On his return to England he published an account of his voyage, which resulted in his being sent out in the "Roebuck" in 1699 to prosecute his discoveries further. To him we owe the exploration of the coast for about 900 m.—from Shark's Bay to Dampier's Archipelago, and thence to Roebuck Bay. He appears to have landed in several places in search of water. His account of the country was quite as unfavourable as Pelsaert's. He described it as barren and sterile, and almost devoid of animals, the only one of any importance somewhat resembling a raccoon—a strange creature, which advanced by great bounds or leaps instead of walking, using only its hind legs, and covering 12 or 15 ft. at a time. The reference is, of course, to the kangaroo, which Pelsaert had also remarked and quaintly described some sixty years previously.

During the interval elapsing between Dampier's two voyages, an accident led to the closer examination of the coasts of Western Australia by the Dutch. In 1684 a vessel had sailed from Holland for the Dutch possessions in the East Indies, and after rounding the Cape of Good Hope, she was never again heard of. Some twelve years afterwards the East India Company fitted out an expedition under the leadership of Commander William de Vlamingh, with the object of searching for any traces of the lost vessel on the western shores of New Holland. Towards the close of the year 1696 this expedition reached the island of Rottnest, which was thoroughly explored, and early the following year a landing party discovered and named the Swan river. The vessels then proceeded northward without finding any traces of the object of their search, but, at the same time, making fairly accurate charts of the coast-line.

Cook.

The great voyage of Captain James Cook, in 1769–1770, was primarily undertaken for the purposes of observing the transit of Venus, but he was also expressly commissioned to ascertain "whether the unexplored part of the southern hemisphere be only an immense mass of water, or contain another continent." H.M.S. "Endeavour," the vessel fitted out for the voyage, was a small craft of 370 tons, carrying twenty-two guns, and built originally for a collier, with a view rather to strength than to speed. Chosen by Cook himself, she was renamed the "Endeavour," in allusion to the great work which her commander was setting out to achieve. Mr Charles Green was commissioned to conduct the astronomical observations, and Sir Joseph Banks and Dr Solander were appointed botanists to the expedition. After successfully observing the transit from the island of Tahiti, or Otaheite, as Cook wrote it, the "Endeavour's" head was turned south, and then north-west, beating about the Pacific in search of the eastern coast of the great continent whose western shores had been so long known to the Dutch. On the 6th of October 1769 the coast of New Zealand was sighted, and two days later Cook cast anchor in Poverty Bay, so named from the inhospitality and hostility of the natives.

After voyaging westward for nearly three weeks, Cook, on the 19th of April 1770, sighted the eastern coast of Australia at a point which he named after his lieutenant, who discovered it, Point Hicks, and which modern geographers identify with Cape Everard.

The "Endeavour" then coasted northward, and after passing and naming Mount Dromedary, the Pigeon House, Point Upright, Cape St George and Red Point, Botany Bay was discovered on the 28th of April 1770, and as it appeared to offer a suitable anchorage, the "Endeavour" entered the bay and dropped anchor. The ship brought-to opposite a group of natives, who were cooking over a fire. The great navigator and his crew, unacquainted with the character of the Australian aborigines, were not a little astonished that these natives took no notice of them or their proceedings. Even the splash of the anchor in the water, and the noise of the cable running out through the hawse-hole, in no way disturbed them at their occupation, or caused them to evince the slightest curiosity. But as the captain of the "Endeavour" ordered out the pinnace and prepared to land, the natives threw off their nonchalance; for on the boat approaching the shore, two men, each armed with a bundle of spears, presented themselves on a projecting rock and made threatening signs to the strangers. It is interesting to note that the ingenious *wommera*, or throw-stick, which is peculiar to Australia, was first observed on this occasion. As the men were evidently determined to oppose any attempt at landing, a musket was discharged between them, in the hope that they would be frightened by the noise, but it produced no effect beyond causing one of them to drop his bundle of spears, of which, however, he immediately repossessed himself, and with his comrade resumed the same menacing attitude. At last one cast a stone towards the boat, which earned him a charge of small shot in the leg. Nothing daunted, the two ran back into the bush, and presently returned furnished with shields made of bark, with which to protect themselves from the firearms of the crew. Such intrepidity is certainly worthy of passing notice. Unlike the American Indians, who supposed Columbus and his crew to be supernatural beings, and their ships in some way endowed with life, and were thrown into convulsions of terror by the first discharge of firearms which they witnessed, these Australians were neither excited to wonder by the ship nor overawed by the superior number and unknown weapons of the strangers. Cook examined the bay in the pinnace, and landed several times; but by no endeavour could he induce the natives to hold any friendly communication with him. The well-known circumstance of the great variety of new plants here obtained, from which Botany Bay derives its name, should not be passed over. Before quitting the bay the ceremony was performed of hoisting the Union Jack, first on the south shore, and then near the north head, formal possession of the territory being thus taken for the British crown. During the sojourn in Botany Bay the crew had to perform the painful duty of burying a comrade—a seaman named Forby Sutherland, who was in all probability the first British subject whose body was committed to Australian soil.

After leaving Botany Bay, Cook sailed northward. He saw and named Port Jackson, but forbore to enter the finest natural harbour in Australia. Broken Bay and other inlets, and several headlands, were also seen and named, but the vessel did not come to an anchor till Moreton Bay was reached, although the wind prevented Cook from entering this harbour. Still sailing northward, taking notes as he proceeded for a rough chart of the coast, and landing at Bustard and Keppel Bays and the Bay of Inlets, Cook passed over 1300 m. without the occurrence of any event worthy of being chronicled, till suddenly one night at ten o'clock the water was found to shoal, without any sign of breakers or land. While Cook was speculating on the cause of this phenomenon, and was in the act of ordering out the boats to take soundings, the "Endeavour" struck heavily, and fell over so much that the guns, spare cables, and other heavy gear had at once to be thrown overboard to lighten the ship. As day broke, attempts were made to float the vessel off with the morning tide; but these were unsuccessful. The water was rising so rapidly in the hold that with four pumps constantly going the crew could hardly keep it in check. At length one of the midshipmen suggested the device of "fothering," which he had seen practised in the West Indies. This consists of passing a sail, attached to cords, and charged with oakum, wool, and other materials, under the vessel's keel, in such a manner that the suction of the leak may draw the canvas into the aperture, and thus partially stop the vent. This was performed with great success, and the vessel was floated off with the evening tide. The land was soon after made near the mouth of a small stream, which Cook called, after the ship, the Endeavour river. A headland close by he named Cape Tribulation. The ship was steered into the river, and there careened and thoroughly repaired. Cook having completed the survey of the east coast, to which he gave the name of New South Wales, sighted and named Cape York, the northernmost point of Australia, and took final possession of his discoveries northward from 38° S. to $10\frac{1}{2}$° S., on a spot which he named Possession Island, thence returning to England by way of Torres Straits and the Indian Ocean.

The great navigator's second voyage, undertaken in 1772, with the "Resolution" and the "Adventure," is of less importance. The vessels became separated, and both at different times visited New Zealand. Captain Tobias Furneaux, in the "Adventure," also found his way to Storm Bay in Tasmania. In 1777, while on his way to search for a north-east passage between the Atlantic and Pacific oceans, Cook again touched at the coast of Tasmania and New Zealand.

On his first voyage, in 1770, Cook had some grounds for the belief that Van Diemen's Land, as Tasmania was then called, was a separate island. The observations of Captain Furneaux, however, did not strengthen this belief, and when making his final voyage, the great navigator appears to have definitely concluded that it was part of the mainland of Australia. This continued to be the opinion of geographers until 1798, when Bass discovered the strait which bears his name. The next recorded expedition is a memorable one in the annals of Australian history—the despatch of a British colony to the shores of Botany Bay. The fleet sailed in May 1787, and arrived off the Australian coast early in the following January.

2. *Inland Exploration.*

For a period of twenty-five years after the first establishment of a British settlement in Australia, the colonists were only acquainted with the country along the coast extending northwards about 70 m. from Sydney and about a like distance to the south and shut in to the west by the Blue Mountain range, forming a narrow strip not more than 50 m. wide at its broadest part.

Oxley.

The Blue Mountains attain a height of between 3000 and 4000 ft. only, but they are intersected with precipitous ravines 1500 ft. deep, which baffled every effort to reach the interior until in 1813, when a summer of severe drought had made it of vital importance to find new pastures, three of the colonists, Messrs Blaxland, Lawson and Wentworth, more fortunate than their predecessors in exploration, after crossing the Nepean river at Emu Plains and ascending the Dividing Range, were able to reach a position enabling them to obtain a view of the grassy valley of the Fish river, which lies on the farther side of the Dividing Range. The western descent of the mountains appeared to the explorers comparatively easy, and they returned to report their discovery. A line of road was constructed across the mountains as far as the Macquarie river by the surveyor, Mr Evans, and the town of Bathurst laid out. This marks the beginning of the occupation of the interior of the continent. Some small expeditions were made from Bathurst, resulting in the discovery of the Lachlan, and in 1816 the first of the great exploration expeditions of Australia was fitted out under Lieutenant Oxley, R.N. Oxley was accompanied by Mr Evans and Mr Allan Cunningham the botanist, and the object of his expedition was to trace the course of the Lachlan in a westerly direction. Oxley traced the river until it lost itself in the swamps east of 147° E., then crossing the river he traversed the country between the Lachlan and Murrumbidgee as far as 34° S. and 144° 30′ E. On his return journey Oxley again crossed the Lachlan about 160 m., measured along the river, below the point where he left it on his journey south. Continuing in a north-easterly direction Oxley struck the Macquarie river at a place he called Wellington, and from this place in the following year he organized a second expedition in hopes of discovering an inland sea. He was, however, disappointed in this, as after descending the course of the Macquarie below Mount Harris, he found that the river ended in an immense swamp overgrown with reeds. Oxley now turned aside—led by Mr Evans's report of the country eastward—crossed the Arbuthnot range, and traversing the Liverpool Plains, and ascending the Peel and Cockburn rivers to the Blue Mountains, gained sight of the open sea, which he reached at Port Macquarie. A valuable extension of geographical knowledge had been gained by this circuitous journey of more than 800 m. Yet its result was a disappointment to those who had looked for means of inland navigation by the Macquarie river, and by its supposed issue in a mediterranean sea.

During the next two or three years public attention was occupied with Captain King's maritime explorations of the north-west coast in three successive voyages, and by explorations of Western Australia in 1821. These steps were followed by the foundation of a settlement on Melville Island, in the extreme north, which, however, was soon abandoned. In 1823 Lieutenant Oxley proceeded to Moreton Bay and Port Curtis, the first place 500 m., the other 690 m. north of Sydney, to choose the site of a new penal establishment. From a shipwrecked English sailor he met with, who had lived with the savages, he heard of the river Brisbane. About the same time, in the opposite direction, south-west of Sydney, a large extent of the interior was revealed. Messrs Hamilton Hume and Hovell set out from Lake George, crossed the Murrumbidgee, and, after following the river for a short distance, struck south, skirting the foothills of what are now known as the Australian Alps until they reached a fine river, which was called the Hume after the leader's father. Crossing the Murray at Albury, the explorers, bearing to the south-west, skirted the western shore of Port Philip and reached the sea-coast near where the town of Geelong now stands. In 1827 and the two following years, Cunningham prosecuted instructive explorations on both sides of the Liverpool range, between the upper waters of the Hunter and those of the Peel and other tributaries of the Brisbane north of New South Wales. Some of his discoveries, including those of Pandora's Pass and the Darling Downs, were of great practical utility.

Darling.

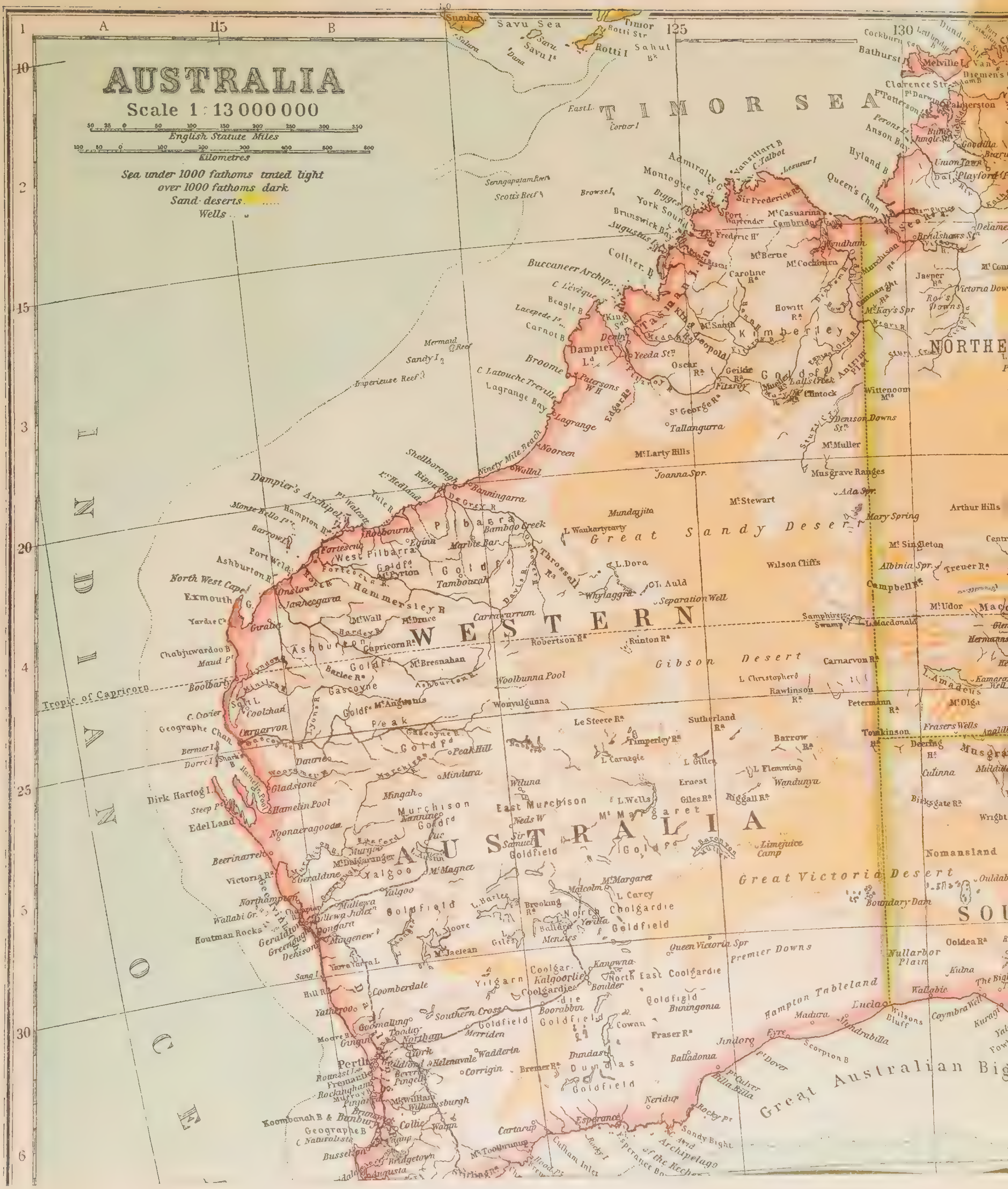
By this time much had thus been done to obtain an acquaintance with the eastern parts of the Australian continent, although the problem of what could become of the large rivers flowing north-west and south-west into the interior was still unsolved. With a view to determine this question, Governor Sir Ralph Darling, in the year 1828, sent out the expedition under Captain Charles Sturt, who, proceeding first to the marshes at the end of the Macquarie river, found his progress checked by the dense mass of reeds in that quarter. He therefore turned westward, and struck a large river, with many affluents, to which he gave the name of the Darling. This river, flowing from north-east to south-west, drains the marshes in which the Macquarie and other streams from the south appeared to be lost. The course of the Murrumbidgee, a deep and rapid river, was followed by the same eminent explorer in his second expedition in 1831 with a more satisfactory result. He travelled on this occasion nearly 2000 m., and discovered that both the Murrumbidgee, carrying with it the waters of the Lachlan morass, and likewise the Darling, from a more northerly region, finally joined another and larger river. This stream, the Murray, in the upper part of its course runs in a north-westerly direction, but afterwards turning southwards, almost at a right angle, expands into Lake Alexandrina on the south coast, about 60 m. south-east of the town of Adelaide, and finally enters the sea at Encounter Bay in E. long. 139°.

Mitchell.

After gaining a practical solution of the problem of the destination of the westward-flowing rivers, Sir Thomas Mitchell, in 1833, led an expedition northward to the upper branches of the Darling; the party met with a sad disaster in the death of Richard Cunningham, brother of the eminent botanist, who was murdered by the blacks near the Bogan river. The expedition reached the Darling on the 25th of May 1833, and after establishing a depot at Fort Bourke, Mitchell traced the Darling southwards for 300 m. until he was certain the river was identical with that reported by Sturt as joining the Murray about 142° E.

Eyre.

Meantime, from the new colony of Adelaide, South Australia, on the shores of Gulf St Vincent, a series of adventurous journeys to the north and to the west was begun by Mr Eyre, who explored a country very difficult of access. In 1840 he performed a feat of extraordinary personal daring, travelling all the way along the barren sea-coast of the Great Australian Bight, from Spencer Gulf to King George Sound. Eyre also explored the interior north of the head of Spencer Gulf, where he was misled, however, by appearances to form an erroneous theory about the water-surfaces named Lake Torrens. It was left to the veteran explorer, Sturt, to achieve the arduous enterprise of penetrating from the Darling northward to the very centre of the continent. This was in 1845, the route lying for the most part over a stony desert, where the heat (reaching 131° Fahr.), with scorching winds, caused much suffering to the party. The most northerly point reached by Sturt on this occasion was about S. lat. 24° 25′.


AUSTRALIA
Scale 1: 13 000 000
English Statute Miles
Kilometres
Sea under 1000 fathoms tinted light
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Sand-deserts
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Savu Sea
Timor
Rotti I
Sahul Bk
TIMOR SEA
INDIAN OCEAN
Tropic of Capricorn
Cockburn
Bathurst I
Melville I
Clarence Str.
Pt Darwin
Palmerston
Anson B
Queen's Chan
Admiralty G
Montague Sd
York Sound
Brunswick Bay
Collier B
Buccaneer Archip
C Leveque
Beagle B
Lacepede Is
Carnot B
Sandy I
Broome
Dampier Ld
Derby
King Sd
Tasman Ld
King Leopold Ra
Kimberley
Wyndham
Cambridge G
Mt Cockburn
Carolyne Ra
Mt Bertie
Howitt Ra
Yeeda Str
Oscar Ra
Geikie Ra
Fitzroy
Gold Fd
Denison Downs
St George Ra
Tallangurra
Mueller Ra
Mc Clintock
Wittenoom Mts
C Latouche Treville
Lagrange Bay
Lagrange
Ninety Mile Beach
Nooreen
Mt Larty Hills
Joanna Spr
Mt Muller
Musgrave Ranges
Mt Stewart
Ada Spr
Mary Spring
Arthur Hills
Great Sandy Desert
Mundagjita
L Dora
Mt Auld
Separation Well
Whylaggra
Wilson Cliffs
Mt Singleton
Albinia Spr
Treuer Ra
Campbell Ra
Mt Udor
Samphire Swamp
L Macdonald
Dampier's Archipelago
Monte Bello Is
Barrow I
Shellborough
Ripon
Pt Hedland
Condon
De Grey R
Yule R
Roebourne
Pilbarra
Bamboo Creek
Throssell Ra
Marble Bar
Nullagine
West Pilbarra
Tambourah
Ashburton R
North West Cape
Exmouth G
Onslow
Hammersley R
Mt Wall
Mt Bruce
Carrawarrum
WESTERN AUSTRALIA
Robertson Ra
Runton Ra
Gibson Desert
Carnarvon Ra
L Christopherd
Rawlinson Ra
Petermann Ra
L Amadeus
Mt Olga
Capricorn Ra
Mt Bresnahan
Barlee Ra
Gascoyne R
Woolbunna Pool
Wonyulgunna
Mt Augustus
Peak Hill
Carnarvon
Geographe Chan
Bernier I
Dorre I
Shark's B
Dirk Hartog I
Steep Pt
Edel Land
Hamelin Pool
Gladstone
Le Steere Ra
Timperley Ra
L Carnegie
L Gillen
Sutherland Ra
Barrow Ra
L Flemming
Wandunya
Ernest Giles Ra
Riggall Ra
Tomkinson Ra
Deering Hs
Cutinna
Birksgate Ra
Wright
Frasers Wells
Musgrave
Wiluna
East Murchison
L Wells
Mt Margaret
Limejuice Camp
Nomansland
Great Victoria Desert
Boundary Dam
Mingah
Murchison
Nannine
Sir Samuel
Goldfield
Mt Magnet
Yalgoo
Noonaeragooda
Beerinarreit
Victoria Ra
Geraldine
Northampton
Mullewa
Wallabi Gr
Houtman Rocks
Geraldton
Greenough
Mingenew
Dongara
Malcolm
L Carey
North Coolgardie
Menzies
Yerilla
L Barlee
Brooking Ra
L Moore
Mt Jackson
Queen Victoria Spr
Premier Downs
Nullarbor Plain
Ooldea Ra
Kulna
Wallabie
Eucla
Hampton Tableland
Madura
Wilsons Bluff
Coymbra Well
Yilgarn
Coolgardie
Kalgoorlie
Kanowna
Boulder
North East Coolgardie
Burngonia
Cowan
Fraser Ra
Balladonia
Southern Cross
Boorabbin
Goomalling
Toodyay
Northam
York
Merriden
Wadderin
Corrigin
Dundas
Eyre
Israelite B
Mundrabilla
Scorpion B
Pt Dover
Pt Culver
Great Australian Bight
Yathroo
Moore R
Coomberdale
Sand I
Hill R
Perth
Guildford
Rottnest I
Fremantle
Rockingham
Mundijong
Pinjarra
Beverley
Pingelly
Williamsburgh
Koombanah B & Bunbury
Collie
Wagin
Geographe B
C Naturaliste
Busselton
Bridgetown
Augusta
Cartarup
Esperance
Mt Toolbrunup
Sandy Bight
Archipelago of the Recherche
Culham Inlet
NORTHERN TERRITORY
SOUTH AUSTRALIA

Leichhardt.

A military station having been fixed by the British government at Port Victoria, on the coast of Arnheim Land, for the protection of shipwrecked mariners on the north coast, it was thought desirable to find an overland route between this settlement and Moreton Bay, in what then was the northern portion of New South Wales, now called Queensland. This was the object of Dr Leichhardt's expedition in 1844, which proceeded first along the banks of the Dawson and the Mackenzie, tributaries of the Fitzroy river, in Queensland. It thence passed farther north to the Burdekin, ascending to the source of that river, and turned westward across a table-land, from which there was an easy descent to the Gulf of Carpentaria. Skirting the low shores of this gulf, all the way round its upper half to the Roper, Leichhardt crossed Arnheim Land to the Alligator river, which he descended to the western shore of the peninsula, and arrived at Port Victoria, otherwise Port Essington, after a journey of 3000 m., performed within a year and three months. In 1847 Leichhardt undertook a much more formidable task, that of crossing the entire continent from east to west. His starting-point was on the Fitzroy Downs, north of the river Condamine, in Queensland, between the 26th and 27th degrees of S. latitude. But this eminent explorer had not proceeded far into the interior before he met his death, his last despatch dating from the Cogoon, 3rd of April 1848. In the same region, from 1845 to 1847, Sir Thomas Mitchell and Mr E. B. Kennedy explored the northern tributaries of the Darling, and a river in S. lat. 24°, named the Barcoo or Victoria, which flows to the south-west. This river was more thoroughly examined by Mr A. C. Gregory in 1858. Mr Kennedy lost his life in 1848, being killed by the natives while attempting to explore the peninsula of Cape York, from Rockingham Bay to Weymouth Bay.

Among the performances of less renown, but of much practical utility in surveying and opening new paths through the country, we may mention that of Captain Banister, showing the way across the southern part of Western Australia, from Swan river to King George Sound, and that of Messrs Robinson and G. H. Haydon in 1844, making good the route from Port Phillip to Gipps' Land with loaded drays, through a dense tangled scrub, which had been described by Strzelecki as his worst obstacle. Again, in Western Australia there were the explorations of the Arrowsmith, the Murchison, the Gascoyne, and the Ashburton rivers, by Captain Grey, Mr Roe, Governor Fitzgerald, Mr R. Austin, and the brothers Gregory, whose discoveries have great importance from a geographical point of view.

Stuart.

These local researches, and the more comprehensive attempts of Leichhardt and Mitchell to solve the chief problems of Australian geography, must yield in importance to the grand achievement of Mr Stuart in 1862. The first of his tours independently performed, in 1858 and 1859, were around the South Australian lakes, namely, Lake Torrens, Lake Eyre and Lake Gairdner. These waters had been erroneously taken for parts of one vast horseshoe or sickle shaped lake, only some 20 m. broad, believed to encircle a large portion of the inland country, with drainage at one end by a marsh into Spencer Gulf. The mistake, shown in all the old maps of Australia, had originated in a curious optical illusion. When Mr Eyre viewed the country from Mount Deception in 1840, looking between Lake Torrens and the lake which now bears his own name, the refraction of light from the glittering crust of salt that covers a large space of stony or sandy ground produced an appearance of water. The error was discovered, after eighteen years, by the explorations of Mr Babbage and Major Warburton in 1858, while Mr Stuart, about the same time, gained a more complete knowledge of the same district.

A reward of £10,000 having been offered by the legislature of South Australia to the first man who should traverse the whole continent from south to north, starting from the city of Adelaide, Mr Stuart resolved to make the attempt. He started in March 1860, passing Lake Torrens and Lake Eyre, beyond which he found a pleasant, fertile country till he crossed the Macdonnell range of mountains, just under the line of the tropic of Capricorn. On the 23rd of April he reached a mountain in S. lat. nearly 22°, and E. long. nearly 134°, which is the most central marked point of the Australian continent, and has been named Central Mount Stuart. Mr Stuart did not finish his task on this occasion, on account of indisposition and other causes. But the 18th degree of latitude had been reached, where the watershed divided the rivers of the Gulf of Carpentaria from the Victoria river, flowing towards the north-west coast. He had also proved that the interior of Australia was not a stony desert, like the region visited by Sturt in 1845. On the first day of the next year, 1861, Mr Stuart again started for a second attempt to cross the continent, which occupied him eight months. He failed, however, to advance farther than one geographical degree north of the point reached in 1860, his progress being arrested by dense scrubs and the want of water.

Burke and Wills.

Meanwhile, in the province of Victoria, by means of a fund subscribed among the colonists and a grant by the legislature, the ill-fated expedition of Messrs Burke and Wills was started. It made for the Barcoo (Cooper's Creek), with a view to reach the Gulf of Carpentaria by a northerly course midway between Sturt's track to the west and Leichhardt's to the east. The leading men of the party were Mr Robert O'Hara Burke, an officer of police, and Mr William John Wills, of the Melbourne observatory. Leaving the main body of his party at Menindie on the Darling under a man named Wright, Burke, with seven men, five horses and sixteen camels, pushed on for Cooper's Creek, the understanding being that Wright should follow him in easy stages to the depot proposed to be there established. Wright frittered away his time in the district beyond the Darling and did not attempt to follow the party to Cooper's Creek, and Burke, tired of waiting, determined to push on. Accordingly, dividing his party, leaving at the depot four men and taking with him Wills and two men, King and Gray, with a horse and six camels, he left Cooper's Creek on the 16th of December and crossed the desert traversed by Sturt fifteen years before. They got on in spite of great difficulties, past the McKinlay range of mountains, S. lat. 21° and 22°, and then reached the Flinders river, which flows into the head of the Gulf of Carpentaria. Here, without actually standing on the sea-beach of the northern shore, they met the tidal waters of the sea. On the 23rd of February 1861 they commenced the return journey, having in effect accomplished the feat of crossing the Australian continent. Gray, who had fallen ill, died on the 16th of April. Five days later, Burke, Wills and King had repassed the desert to the place on Cooper's Creek (the Barcoo, S. lat. 27° 40′, E. long. 140° 30′), where they had left the depot, with the rest of the expedition. Here they experienced a cruel disappointment. The depot was abandoned; the men in charge had quitted the place the same day, believing that Burke and those with him were lost. The men who had thus abandoned the depot rejoined the main body of the expedition under Wright, who at length moved to Cooper's Creek, and, incredible to relate, neglected to search for the missing explorers. Burke, Wills and King, when they found themselves so fearfully left alone and unprovided in the wilderness, wandered about in that district till near the end of June. They subsisted miserably on the bounty of some natives, and partly by feeding on the seeds of a plant called nardoo. At last both Wills and Burke died of starvation. King, the sole survivor, was saved by meeting the friendly blacks, and was found alive in September by Mr A. W. Howitt's party, sent on purpose to find and relieve that of Burke.

Four other parties, besides Howitt's, were sent out that year from different Australian provinces. Three of them, respectively commanded by Mr Walker, Mr Landsborough, and Mr Norman, sailed to the north, where the latter two landed on the shores of the Gulf of Carpentaria, while Mr Walker marched inland from Rockhampton. The fourth party, under Mr J. McKinlay, from Adelaide, made for the Barcoo by way of Lake Torrens. By these means, the unknown region of Mid Australia was simultaneously entered from the north, south, east and west, and important additions were made to geographical knowledge. Landsborough crossed the entire continent from north to south.

between February and June 1862; and McKinlay, from south to north, before the end of August in that year. The interior of New South Wales and Queensland, all that lies east of the 140th degree of longitude, was examined. The Barcoo or Cooper's Creek and its tributary streams were traced from the Queensland mountains, holding a south-westerly course to Lake Eyre in South Australia; the Flinders, the Gilbert, the Gregory, and other northern rivers watering the country towards the Gulf of Carpentaria were also explored. These valuable additions to Australian geography were gained through humane efforts to relieve the lost explorers. The bodies of Burke and Wills were recovered and brought to Melbourne for a solemn public funeral, and a noble monument has been erected to their honour.

Mr Stuart, in 1862, made his third and final attempt to traverse the continent from Adelaide along a central line, which, inclining a little westward, reaches the north coast of Arnheim Land, opposite Melville Island. He started in January, and on the 7th of April reached the farthest northern point, near S. lat. 17°, where he had turned back in May of the preceding year. He then pushed on, through a very thick forest, with scarcely any water, till he came to the streams which supply the Roper, a river flowing into the western part of the Gulf of Carpentaria. Having crossed a table-land of sandstone which divides these streams from those running to the western shores of Arnheim Land, Mr Stuart, in the month of July, passed down what is called the Adelaide river of north Australia. Thus he came at length to stand on the verge of the Indian Ocean; "gazing upon it," a writer has said, "with as much delight as Balboa, when he crossed the Isthmus of Darien from the Atlantic to the Pacific." The line crossing Australia which was thus explored has since been occupied by the electric telegraph connecting Adelaide, Melbourne, Sydney, and other Australian cities with London.

Gosse.

A third part, at least, of the interior of the whole continent, between the central line of Stuart and the known parts of Western Australia, from about 120° to 134° E. long., an extent of half a million square miles, still remained a blank in the map. But the two expeditions of 1873, conducted by William Christie Gosse (1842–1881), afterwards deputy surveyor-general for South Australia, and Colonel (then Major) Egerton Warburton, made a beginning in the exploration of this *terra incognita* west of the central telegraph route. That line of more than 1800 m., having its southern extremity at the head of Spencer Gulf, its northern at Port Darwin, in Arnheim Land, passes Central Mount Stuart, in the middle of the continent, S. lat. 22°, E. long. 134°. Mr Gosse, with men and horses provided by the South Australian government, started on the 21st of April from the telegraph station 50 m. south of Central Mount Stuart, to strike into Western Australia. He passed the Reynolds range and Lake Amadeus in that direction, but was compelled to turn south, where he found a tract of well-watered grassy land. A singular rock of conglomerate, 2 m. long, 1 m. wide, and 1100 ft. high, with a spring of water in its centre, struck his attention. The country was mostly poor and barren, sandy hillocks, with scanty growth of spinifex. Mr Gosse, having travelled above 600 m., and getting to 26° 32′ S. and 127° E., two degrees within the Western Australian boundary, was forced to return. Meantime a more successful attempt to reach the western coast from the centre of Australia was made by Major Warburton, with thirty camels, provided by Mr (afterwards Sir) T. Elder, of South Australia. Leaving the telegraph line at Alice Springs (23° 40′ S., 133° 14′ E.), 1120 m. north of Adelaide city, Warburton succeeded in making his way to the De Grey river, Western Australia. Overland routes had now been found possible, though scarcely convenient for traffic, between all the widely separated Australian provinces. In northern Queensland, also, there were several explorations about this period, with results of some interest. That performed by Mr W. Hann, with Messrs Warner, Tate and Taylor, in 1873, related to the country north of the Kirchner range, watered by the Lynd, the Mitchell, the Walsh and the Palmer rivers, on the east side of the Gulf of Carpentaria. The coasting expedition of Mr G. Elphinstone Dalrymple, with Messrs Hill and Johnstone, finishing in December 1873, effected a valuable survey of the inlets and navigable rivers in the Cape York Peninsula.

Warburton.

Forrest.

Of the several attempts to cross Western Australia, even Major Warburton's expedition, the most successful, had failed in the important particular of determining the nature of the country through which it passed. Major Warburton had virtually raced across from the Macdonnell range in South Australia to the headwaters of the Oakover river on the north-west coast, without allowing himself sufficient time to note the characteristics of the country. The next important expedition was differently conducted. John (afterwards Sir John) Forrest was despatched by the Perth government with general instructions to obtain information regarding the immense tract of country out of which flow the rivers falling into the sea on the northern and western shores of Western Australia. Leaving Yewin, a small settlement about lat. 28° S., long. 116° E., Forrest travelled north-east to the Murchison river, and followed the course of that river to the Robinson ranges; thence his course lay generally eastward along the 26th parallel. Forrest and his party safely crossed the entire extent of Western Australia, and entering South Australia struck the overland telegraph line at Peake station, and, after resting, journeyed south to Adelaide. Forrest traversed seventeen degrees of desert in five months, a very wonderful achievement, more especially as he was able to give a full report of the country through which he passed. His report destroyed all hope that pastoral settlement would extend to the spinifex region; and the main object of subsequent explorers was to determine the extent of the desert in the direction of north and south. Ernest Giles made several attempts to cross the Central Australian Desert, but it was not until his third attempt that he was successful. His journey ranks almost with Forrest's in the importance of its results and the success with which the appalling difficulties of the journey were overcome. Through the generosity of Sir Thomas Elder, of Adelaide, Giles's expedition was equipped with camels. It started on the 23rd of May 1875 from Port Augusta. Working westerly along the line of the 30th parallel, Giles reached Perth in about five months. After resting in Perth for a short time, he commenced the return journey, which was made for the most part between the 24th and 25th parallels, and again successfully traversed the desert, reaching the overland telegraph line in about seven months. Giles's journeys added greatly to our knowledge of the characteristics of Western and South Australia, and he was able to bear out the common opinion that the interior of Australia west of 132° E. long. is a sandy and waterless waste, entirely unfit for settlement.

Giles.

Recent explorers.

The list of explorers since 1875 is a long one; but after Forrest's and Giles's expeditions the main object ceased to be the discovery of pastoral country: a new zest had been added to the cause of exploration, and most of the smaller expeditions concerned themselves with the search for gold. Amongst the more important explorations may be ranked those of Tietkins in 1889, of Lindsay in 1891, of Wells in 1896, of Hübbe in 1896, and of the Hon. David Carnegie in 1896–97. Lindsay's expedition, which was fitted out by Sir Thomas Elder, the generous patron of Australian exploration, entered Western Australia about the 26th parallel south lat., on the line of route taken by Forrest in 1874. From this point the explorer worked in a south-westerly direction to Queen Victoria Springs, where he struck the track of Giles's expedition of 1875. From the Springs the expedition went north-west and made a useful examination of the country lying between 119° and 115° meridians and between 26° and 28° S. lat. Wells's expedition started from a base about 122° 20′ E. and 25° 54′ S., and worked northward to the Joanna Springs, situated on the tropic of Capricorn and near the 124th meridian. From the springs the journey was continued along the same meridian to the Fitzroy river. The country passed through was mostly of a forbidding character, except where the Kimberley district was entered, and the expedition suffered even more than the usual hardships. The establishment of the gold-fields, with their large population, caused great interest to be taken in the discovery of practicable stock routes, especially from South Australia in the east, and from Kimberley district in the north. Alive to the importance of the trade, the South Australian government despatched Hübbe from Oodnadatta to Coolgardie. He successfully accomplished his journey, but had to report that there was no practicable route for cattle between the two districts.

One of the most successful expeditions which traversed Western Australia was that led and equipped by the Hon. David Carnegie, which started in July 1896, and travelled north-easterly until it reached Alexander Spring; then turning northward, it traversed the country between Wells's track of 1896 and the South Australian border. The expedition encountered very many hardships, but successfully reached Hall Creek in the Kimberley district. After a few months' rest it started on the return journey, following Sturt Creek until its termination in Gregory's Salt Sea, and then keeping parallel with the South Australian border as far as Lake Macdonald. Rounding that lake the expedition moved south-west and reached the settled districts in August 1897. The distance travelled was 5000 m., and the actual time employed was eight months. This expedition put an end to the hope, so long entertained, that it was possible to obtain a direct and practicable route for stock between Kimberley and Coolgardie gold-fields; and it also proved that, with the possible exception of small isolated patches, the desert traversed contained no auriferous country.

It may be said that exploration on a large scale is now at an end; there remain only the spaces, nowhere very extensive, between the tracks of the old explorers yet to be examined, and these are chiefly in the Northern Territory and in Western Australia north of the tropic of Capricorn. The search for gold and the quest for unoccupied pasturage daily diminish the extent of these areas.

3. *Political History.*

Early colonization.

Of the six Australian states, New South Wales is the oldest. It was in 1788, eighteen years after Captain Cook explored the east coast, that Port Jackson was founded as a penal station for criminals from England; and the settlement retained that character, more or less, during the subsequent fifty years, transportation being virtually suspended in 1839. The colony, however, from 1821 had made a fair start in free industrial progress. By this time, too, several of the other provinces had come into existence. Van Diemen's Land, now called Tasmania, had been occupied as early as 1803. It was an auxiliary penal station under New South Wales till in 1825 it became a separate government. From this island, ten years later, parties crossed Bass Strait to Port Phillip, where a new settlement was shortly established, forming till 1851 a part of New South Wales, but now the state of Victoria. In 1827 and 1829, an English company endeavoured to plant a settlement at the Swan river, and this, added to a small military station established in 1825 at King George Sound, constituted Western Australia. On the shores of the Gulf St Vincent, again, from 1835 to 1837, South Australia was created by another joint-stock company, as an experiment in the Wakefield scheme of colonization. Such were the political component parts of British Australia up to 1839. The early history, therefore, of New South Wales is peculiar to itself. Unlike the other mainland provinces, it was at first held and used chiefly for the reception of British convicts. When that system was abolished, the social conditions of New South Wales, Victoria, and South Australia became more equal. Previous to the gold discoveries of 1851 they may be included, from 1839, in a general summary view.

Rise of New South Wales.

The first British governors at Sydney, from 1788, ruled with despotic power. They were naval or military officers in command of the garrison, the convicts and the few free settlers. The duty was performed by such men as Captain Arthur Phillip, Captain Hunter, and others. In the twelve years' rule of General Macquarie, closing with 1821, the colony made a substantial advance. By means of bond labour roads and bridges were constructed, and a route opened into the interior beyond the Blue Mountains. A population of 30,000, three-fourths of them convicts, formed the infant commonwealth, whose attention was soon directed to the profitable trade of rearing fine wool sheep, first commenced by Captain John McArthur in 1803. During the next ten years, 1821–1831, Sir Thomas Brisbane and Sir Ralph Darling, two generals of the army, being successively governors, the colony increased, and eventually succeeded in obtaining the advantages of a representative institution, by means of a legislative council. Then came General Sir Richard Bourke, whose wise and liberal administration proved most beneficial. New South Wales became prosperous and attractive to emigrants with capital. Its enterprising ambition was encouraged by taking fresh country north and south. In the latter direction, explored by Mitchell in 1834 and 1836, lay Australia Felix, now Victoria, including the well-watered, thickly-wooded country of Gipps' Land.

Growth of Victoria.

This district, then called Port Phillip, in the time of Governor Sir George Gipps, 1838–1846, was growing fast into a position claiming independence. Melbourne, which began with a few huts on the banks of the Yarra-Yarra in 1835, was in 1840 a busy town of 6000 inhabitants, the population of the whole district, with the towns of Geelong and Portland, reaching 12,850; while its import trade amounted to £204,000, and its exports to £138,000. Such was the growth of infant Victoria in five years; that of Adelaide or South Australia, in the same period, was nearly equal to it. At Melbourne there was a deputy governor, Mr Latrobe, under Sir George Gipps at Sydney. Adelaide had its own governors, first Captain Hindmarsh, next Colonel Gawler, and then Captain George Grey. Western Australia progressed but slowly, with less than 4000 inhabitants altogether, under Governors Stirling and Hutt.

Discovery of gold.

The general advancement of Australia, to the era of the gold-mining, had been satisfactory, in spite of a severe commercial crisis, from 1841 to 1843, caused by extravagant land speculations and inflated prices. Victoria produced already more wool than New South Wales, the aggregate produce of Australia in 1852 being 45,000,000 ℔; and South Australia, between 1842 and this date, had opened most valuable mines of copper. The population of New South Wales in 1851 was 190,000; that of Victoria, 77,000; and that of South Australia about the same. At Summerhill Creek, 20 m. north of Bathurst, in the Macquarie plains, gold was discovered, in February 1851, by Mr E. Hargraves, a gold-miner from California. The intelligence was made known in April or May; and then began a rush of thousands,—men leaving their former employments in the bush or in the towns to search for the ore so greatly coveted in all ages. In August it was found at Anderson's Creek, near Melbourne; a few weeks later the great Ballarat gold-field, 80 m. west of that city, was opened; and after that, Bendigo to the north. Not only in these lucky provinces, New South Wales and Victoria, where the auriferous deposits were revealed, but in every British colony of Australasia, all ordinary industry was left for the one exciting pursuit. The copper mines of South Australia were for the time deserted, while Tasmania and New Zealand lost many inhabitants, who emigrated to the more promising country. The disturbance of social, industrial and commercial affairs, during the first two or three years of the gold era, was very great. Immigrants from Europe, and to some extent from North America and China, poured into Melbourne, where the arrivals in 1852 averaged 2000 persons in a week. The population of Victoria was doubled in the first twelvemonth of the gold fever, and the value of imports and exports was multiplied tenfold between 1851 and 1853. The colony of Victoria was constituted a separate province in July 1851, Mr Latrobe being appointed governor, followed by Sir Charles Hotham and Sir Henry Barkly in succession.

The separation of the northern part of eastern Australia, *Responsible government.*

under the name of Queensland, from the original province of New South Wales, took place in 1859. At that time the district contained about 25,000 inhabitants; and in the first six years its population was quadrupled and its trade trebled. At the beginning of 1860, when the excitement of the gold discoveries was wearing off, five of the states had received from the home government the boon of responsible government, and were in a position to work out the problem of their position without external interference; it was not, however, until 1890 that Western Australia was placed in a similar position. After the establishment of responsible government the main questions at issue were the secular as opposed to the religious system of public instruction, protection as opposed to a revenue tariff, vote by ballot, adult suffrage, abolition of transportation and assignment of convicts, and free selection of lands before survey; these, and indeed all the great questions upon which the country was divided, were settled within twenty years of the granting of self-government.[1] With the disposal of these important problems, politics in Australia became a struggle for office between men whose political principles were very much alike, and the tenure of power enjoyed by the various governments did not depend upon the principles of administration so much as upon the personal fitness of the head of the ministry, and the acceptability of his ministry to the members of the more popular branch of the legislature.

General Australian problems.

The two most striking political events in the modern history of Australia, as a whole, apart from the readiness it has shown to remain a part of the British empire (*q.v.*), and to develop along Imperial lines, are the advent of the Labour party and the establishment of federation. As regards the last mentioned it may be said that it was accomplished from within, there being no real external necessity for the union of the states. Leading politicians have in all the states felt the cramping effects of mere domestic legislation, albeit on the proper direction of such legislation depends the well-being of the people; and to this sense of the limitations of local politics was due, as much as to anything else, the movement towards federation.

Agrarian legislation.

Before coming, however, to the history of federation, and the evolution of the Labour party, we must refer briefly to some other questions which have been of general interest in Australia. Taking the states as a whole, agrarian legislation has been the most important subject that has engrossed the attention of their parliaments, and every state has been more or less engaged in tinkering with its land laws. The main object of all such legislation is to secure the residence of the owners on the land. The object of settlers, however, in a great many, perhaps in the majority of instances, is to dispose of their holdings as soon as possible after the requirements of the law have been complied with, and to avoid permanent settlement. This has greatly facilitated the formation of large estates devoted chiefly to grazing purposes, contrary to the policy of the legislature, which has everywhere sought to encourage tillage, or tillage joined to stock-rearing, and to discourage large holdings. The importance of the land question is so great that it is hardly an exaggeration to say that it is usual for every parliament of Australia to have before it a proposal to alter or amend its land laws. Since 1870 there have been five radical changes made in New South Wales. In Victoria the law has been altered five times, and in Queensland and South Australia seven times.

Immigration question.

The prevention or regulation of the immigration of coloured races has also claimed a great share of parliamentary attention. The agitation against the influx of Chinese commenced very soon after the gold discoveries, the European miners objecting strongly to the presence of these aliens upon the diggings. The allegations made concerning the Chinese really amounted to a charge of undue industry. The Chinese were hard-working and had the usual fortune attending those who work hard. They spent little on drink or with the storekeepers, and were, therefore, by no means popular. As early as 1860 there had been disturbances of a serious character, and the Chinese were chased off the goldfields of New South Wales, serious riots occurring at Lambing Flat, on the Burrangong goldfield. The Chinese difficulty, so far as the mining population was concerned, was solved by the exhaustion of the extensive alluvial deposits; the miners' prejudice against the race, however, still exists, though they are no longer serious competitors, and the laws of some of the states forbid any Chinese to engage in mining without the express authority in writing of the minister of mines. The nearness of China to Australia has always appeared to the Australian democracy as a menace to the integrity of the white settlements; and at the many conferences of representatives from the various states, called to discuss matters of general concern, the Chinese question has always held a prominent place, but the absence of any federal authority had made common action difficult. In 1888 the last important conference on the Chinese question was held in Sydney and attended by delegates from all the states. Previously to the meeting of the conference there had been a great deal of discussion in regard to the influx of Chinese, and such influx was on all sides agreed to be a growing danger. The conference, therefore, merely expressed the public sentiment when it resolved that, although it was not advisable to prohibit altogether this class of immigration, it was necessary in the public interests that the number of Chinese privileged to land should be so limited as to prevent the people of that race from ever becoming an important element in the community. In conformity with this determination the various state legislatures enacted new laws or amended the existing laws to cope with the difficulty; these remained until they were in effect superseded by Commonwealth legislation. The objection to admitting immigrants was not only to the Chinese, but extended to all Asiatics; but as a large proportion of the persons whose entrance into the colonies it was desired to stop were British subjects, and the Imperial government refused to sanction any measure directly prohibiting in plain terms the movement of British subjects from one part of the empire to another, resort was made to indirect legislation; this was the more advisable, as the rise of the Japanese power in the East and the alliance of that country with Great Britain rendered it necessary to pay attention to the susceptibilities of a powerful nation whose subjects might be affected by restrictive laws. Eventually the difficulty was overcome by the device of an educational test based on the provisions of an act in operation in Natal. It was provided that a person was to be prohibited from landing in Australia who failed to write in any prescribed language fifty words dictated to him by the commonwealth officer supervising immigration. The efficacy of this legislation is in its administration, the language in which coloured aliens are usually tested being European. The agitation against the Chinese covered a space of over fifty years, a long period in the history of a young country, and was promoted and kept alive almost entirely by the trades unions, and the restriction acts were the first legislative triumph of the Labour party, albeit that party was not at the time directly represented in parliament.

Bank crisis of 1893.

One of the most notable events in the modern history of Australia occurred shortly after the great strike of 1890. This was what is ordinarily termed the bank crisis of 1893. Although this crisis followed on the great strike, the two things had no real connexion, the crisis being the natural result of events long anterior to 1890. The effects of the crisis were mainly felt in the three eastern states, Queensland, New South Wales and Victoria, Tasmania and South Australia being affected chiefly by reason of the fact of their intimate financial connexion with the eastern states. The approach of the crisis was heralded by many signs. Deposits were shifted from bank to bank, there were small runs on several of the savings banks guaranteed by the government, mortgagees required additional security from their debtors, bankruptcies became frequent, and some of the banks began to accumulate gold against the evil day. The building societies and financial institutions in receipt of deposits, or so many of them as were on an unsound footing, failed at an early period of the depression, so also did the weaker banks. There was distrust in the minds of the depositors, especially those whose holdings were small, and most of the banks were, at a very early period, subjected to the strain of repaying a large proportion of their deposits as they fell due. For a time the money so withdrawn was hoarded, but after a while it found its way back again into the banks. The crisis was by no means a sudden crash, and even when the failures began to take place they were spread over a period of sixteen weeks.

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[1] Australia, it may be noted, has woman's suffrage in all the states (Victoria, the last, adopting it in November 1908), and for the federal assembly.

The first noticeable effect of the crisis was a great scarcity of employment. Much capital was locked up in the failed banks, and was therefore not available for distribution amongst wage-earners. Wages fell precipitately, as also did rents. There was an almost entire cessation of building, and a large number of houses in the chief cities remained untenanted, the occupants moving to lodgings and more than one family living in a single house. Credit became greatly restricted, and all descriptions of speculative enterprise came to an end. The consuming power of the population was greatly diminished, and in the year following the crisis the imports into Australia from abroad diminished by four and three-quarter millions. In fact, everywhere the demand for goods, especially of those for domestic consumption, fell away; and there was a reduction in the average number of persons employed in the manufacturing industries to the extent of more than 20%. The lack of employment in factories naturally affected the coal mining industry, and indeed every industry in the states, except those connected with the export trade, was severely affected. During the crisis banks having a paid-up capital and reserves of £5,000,000 and deposits of £53,000,000 closed their doors. Most of these, however, reopened for business before many weeks. The crisis was felt in the large cities more keenly than in the country districts, and in Melbourne more severely than in any other capital. The change of fortune proved disastrous to many families, previously to all appearances in opulent circumstances, but by all classes alike their reverses were borne with the greatest bravery. In its ultimate effects the crisis was by no means evil. Its true meaning was not lost upon a business community that had had twenty years of almost unchecked prosperity. It required the chastening of adversity to teach it a salutary lesson, and a few years after, when the first effects of the crisis had passed away, business was on a much sounder footing than had been the case for very many years. One of the first results was to put trade on a sound basis and to abolish most of the abuses of the credit system, but the most striking effect of the crisis was the attention which was almost immediately directed to productive pursuits. Agriculture everywhere expanded, the mining industry revived, and, if it had not been for the low prices of staple products, the visible effects of the crisis would have passed away within a very few years.

Drought of 1902.

Another matter which deserves attention was the great drought which culminated in the year 1902. For some years previously the pastoral industry had been declining and the number of sheep and cattle in Australia had greatly diminished, but the year 1902 was one of veritable drought. The failure of the crops was almost universal and large numbers of sheep and cattle perished for want of food. The truth is, pastoralists for the most part carried on their industry trusting very greatly to luck, not making any special provisions against the vicissitudes of the seasons. Enormous quantities of natural hay were allowed every year to rot or be destroyed by bush fires, and the bountiful provision made by nature to carry them over the seasons of dry weather absolutely neglected; so that when the destructive season of 1902 fell upon them, over a large area of territory there was no food for the stock. The year 1903 proved most bountiful, and in a few years all trace of the disastrous drought of 1902 passed away. But beyond this the pastoralist learnt most effectually the lesson that, in a country like Australia, provision must be made for the occasional season when the rainfall is entirely inadequate to the wants of the farmer and the pastoralist.

Federation.

The question of federation was not lost sight of by the framers of the original constitution which was bestowed upon New South Wales. In the report of the committee of the legislative council appointed in 1852 to prepare a constitution for that colony, the following passage occurs:—"One of the most prominent legislative measures required by the colony, and the colonies of the Australian group generally, is the establishment at once of a general assembly, to make laws in relation to those intercolonial questions that have arisen or may hereafter arise among them. The questions which would claim the exercise of such a jurisdiction appear to be (1) intercolonial tariffs and the coasting trade; (2) railways, roads, canals, and other such works running through any two of the colonies; (3) beacons and lighthouses on the coast; (4) intercolonial gold regulations; (5) postage between the said colonies; (6) a general court of appeal from the courts of such colonies; (7) a power to legislate on all other subjects which may be submitted to them by addresses from the legislative councils and assemblies of the colonies, and to appropriate to any of the above-mentioned objects the necessary sums of money, to be raised by a percentage on the revenues of all the colonies interested." This wise recommendation received very scant attention, and it was not until the necessities of the colonies forced them to it that an attempt was made to do what the framers of the original constitution suggested. Federation at no time actually dropped out of sight, but it was not until thirty-five years later that any practical steps were taken towards its accomplishment. Meanwhile a sort of makeshift was devised, and the Imperial parliament passed a measure permitting the formation of a federal council, to which any colony that felt inclined to join could send delegates. Of the seven colonies New South Wales and New Zealand stood aloof from the council, and from the beginning it was therefore shorn of a large share of the prestige that would have attached to a body speaking and acting on behalf of a united Australia. The council had also a fatal defect in its constitution. It was merely a deliberative body, having no executive functions and possessing no control of funds or other means to put its legislation in force. Its existence was well-nigh forgotten by the people of Australia until the occurrence of its biennial meetings, and even then but slight interest was taken in its proceedings. The council held eight meetings, at which many matters of intercolonial interest were discussed. The last occasion of its being called together was in 1899, when the council met in Melbourne. In 1889 an important step towards federation was taken by Sir Henry Parkes. The occasion was the report of Major-General Edwards on the defences of Australia, and Sir Henry addressed the other premiers on the desirability of a federal union for purposes of defence. The immediate result was a conference at Parliament House, Melbourne, of representatives from each of the seven colonies. This conference adopted an address to the queen expressing its loyalty and attachment, and submitting certain resolutions which affirmed the desirability of an early union, under the crown, of the Australasian colonies, on principles just to all, and provided that the remoter Australasian colonies should be entitled to admission upon terms to be afterwards agreed upon, and that steps should be taken for the appointment of delegates to a national Australasian convention, to consider and report upon an adequate scheme for a federal convention. In accordance with the understanding arrived at, the various Australasian parliaments appointed delegates to attend a national convention to be held in Sydney, and on the 2nd March 1891 the convention held its first meeting. Sir Henry Parkes was elected president, and he moved a series of resolutions embodying the principles necessary to establish, on an enduring foundation, the structure of a federal government. These resolutions were slightly altered by the conference, and were adopted in the following form:—

1. The powers and rights of existing colonies to remain intact, except as regards such powers as it may be necessary to hand over to the Federal government.
2. No alteration to be made in states without the consent of the legislatures of such states, as well as of the federal parliament.
3. Trade between the federated colonies to be absolutely free.
4. Power to impose customs and excise duties to be in the Federal government and parliament.
5. Military and naval defence forces to be under one command.
6. The federal constitution to make provision to enable each state to make amendments in the constitution if necessary for the purposes of federation.

Other formal resolutions were also agreed to, and on the 31st of March Sir Samuel Griffith, as chairman of the committee on constitutional machinery, brought up a draft Constitution Bill, which was carefully considered by the convention in committee of the whole and adopted on the 9th of April, when the convention was formally dissolved. The bill, however, fell absolutely dead, not because it was not a good bill, but because the movement out of which it arose had not popular initiative, and therefore failed to reach the popular imagination.

Although the bill drawn up by the convention of 1891 was not received by the people with any show of interest, the federation movement did not die out; on the contrary, it had many enthusiastic advocates, especially in the colony of Victoria. In 1894 an unofficial convention was held at Corowa, at which the cause of federation was strenuously advocated, but it was not until 1895 that the movement obtained new life, by reason of the proposals adopted at a meeting of premiers convened by Mr G. H. Reid of New South Wales. At this meeting all the colonies except New Zealand were represented, and it was agreed that the parliament of each colony should be asked to pass a bill enabling the people to choose ten persons to represent the colony on a federal convention; the work of such convention being the framing of a federal constitution to be submitted to the people for approval by means of the referendum. During the year 1896 Enabling Acts were passed by New South Wales, Victoria, Tasmania, South Australia and Western Australia, and delegates were elected by popular vote in all the colonies named except Western Australia, where the delegates were chosen by parliament. The convention met in Adelaide on the 22nd of March 1897, and, after drafting a bill for the consideration of the various parliaments, adjourned until the 2nd of September. On that date the delegates reassembled in Sydney, and debated the bill in the light of the suggestions made by the legislatures of the federating colonies. In the course of the proceedings it was announced that Queensland desired to come within the proposed union; and in view of this development, and in order to give further opportunity for the consideration of the bill, the convention again adjourned. The third and final session was opened in Melbourne on the 20th of January 1898, but Queensland was still unrepresented; and, after further consideration, the draft bill was finally adopted on the 16th of March and remitted to the various colonies for submission to the people.

The constitution was accepted by Victoria, South Australia and Tasmania by popular acclamation, but in New South Wales very great opposition was shown, the main points of objection being the financial provisions, equal representation in the Senate, and the difficulty in the way of the larger states securing an amendment of the constitution in the event of a conflict with the smaller states. As far as the other colonies were concerned, it was evident that the bill was safe, and public attention throughout Australia was fixed on New South Wales, where a fierce political contest was raging, which it was recognized would decide the fate of the measure for the time being. The fear was as to whether the statutory number of 80,000 votes necessary for the acceptance of the bill would be reached. This fear proved to be well founded, for the result of the referendum in New South Wales showed 71,595 votes in favour of the bill and 66,228 against it, and it was accordingly lost. In Victoria, Tasmania and South Australia, on the other hand, the bill was accepted by triumphant majorities. Western Australia did not put it to the vote, as the Enabling Act of that colony only provided for joining a federation of which New South Wales should form a part. The existence of such a strong opposition to the bill in the mother colony convinced even its most zealous advocates that some changes would have to be made in the constitution before it could be accepted by the people; consequently, although the general election in New South Wales, held six or seven weeks later, was fought on the federal issue, yet the opposing parties seemed to occupy somewhat the same ground, and the question narrowed itself down to one as to which party should be entrusted with the negotiations to be conducted on behalf of the colony, with a view to securing a modification of the objectionable features of the bill. The new parliament decided to adopt the procedure of again sending the premier, Mr Reid, into conference, armed with a series of resolutions affirming its desire to bring about the completion of federal union, but asking the other colonies to agree to the reconsideration of the provisions which were most generally objected to in New South Wales. The other colonies interested were anxious to bring the matter to a speedy termination, and readily agreed to this course of procedure. Accordingly a premiers' conference was held in Melbourne at the end of January 1899, at which Queensland was for the first time represented. At this conference a compromise was effected, something was conceded to the claims of New South Wales, but the main principles of the bill remained intact. The bill as amended was submitted to the electors of each colony and again triumphantly carried in Victoria, South Australia and Tasmania. In New South Wales and Queensland there were still a large number of persons opposed to the measure, which was nevertheless carried in both colonies. New South Wales having decided in favour of federation, the way was clear for a decision on the part of Western Australia. The Enabling Bill passed the various stages in the parliament of that colony, and the question was then adopted by referendum.

In accordance with this general verdict of all the states, the colonial draft bill was submitted to the imperial government for legislation as an imperial act; and six delegates were sent to England to explain the measure and to pilot it through the cabinet and parliament. A bill was presented to the British parliament which embodied and established, with such variations as had been accepted on behalf of Australia by the delegates, the constitution agreed to at the premiers' conference of 1899 and speedily became law. Under this act, which was dated the 9th of July 1900, a proclamation was issued on the 17th of September of the same year, declaring that, on and after the 1st of January 1901, the people of New South Wales, Victoria, South Australia, Queensland, Tasmania and Western Australia should be united in a federal commonwealth under the name of the Commonwealth of Australia.

Provisions of the Act of 1900.

The six colonies entering the Commonwealth were denominated original states, and new states might be admitted, or might be formed by separation from or union of two or more states or parts of states; and territories (as distinguished from states) might be taken over and governed under the legislative power of the Commonwealth. The legislative power is vested in a federal parliament, consisting of the sovereign, a senate, and a house of representatives, the sovereign being represented by a governor-general. The Senate was to consist of the same number of members (not less than six) for each state, the term of service being six years, but subject to an arrangement that half the number would retire every three years. The House of Representatives was to consist of members chosen in the different states in numbers proportioned to their population, but never fewer than five. The first House of Representatives was to contain seventy-five members. For elections to the Senate the governors of states, and for general elections of the House of Representatives the governor-general, would cause writs to be issued. The Senate would choose its own president, and the House of Representatives its speaker; each house would make its own rules of procedure; in each, one-third of the number of members would form a quorum; the members of each must take oath, or make affirmation of allegiance; and all alike would receive an allowance of £400 a year. The legislative powers of the parliament have a wide range, many matters being transferred to it from the colonial parliaments. The more important subjects with which it deals are trade, shipping and railways; taxation, bounties, the borrowing of money on the credit of the Commonwealth; the postal and telegraphic services; defence, census and statistics; currency, coinage, banking, bankruptcy; weights and measures; copyright, patents and trade marks; marriage and divorce; immigration and emigration; conciliation and arbitration in industrial disputes. Bills imposing taxation or appropriating revenue must not originate in the Senate, and neither taxation bills nor bills appropriating revenue for the annual service of the government may be amended in the Senate, but the Senate may return such bills to the House of Representatives with a request for their amendment. Appropriation laws must not deal with other matters. Taxation laws must deal with only one subject of taxation; but customs and excise duties may, respectively, be dealt with together. Votes for the appropriation of the revenue shall not pass unless recommended by the governor-general. The constitution provides means for the settlement of disputes between the houses, and requires the assent of the sovereign to all laws. The executive power is vested in the governor-general, assisted by an executive council appointed by himself. He has command of the army and navy, and appoints federal ministers and judges. The ministers are members of the executive council, and must be, or within three months of their appointment must become, members of the parliament. The judicial powers are vested in a high court and other federal courts, and the federal judges hold office for life or during good behaviour. The High Court has appellate jurisdiction in cases from other federal courts and from the supreme courts of the states, and it has original jurisdiction in matters arising under laws made by the federal parliament, in disputes between states, or residents in different states, and in matters affecting the representatives of foreign powers. Special provisions were made respecting appeals from the High Court to the sovereign in council. The constitution set forth elaborate arrangements for the administration of finance and trade during the transition period following the transference of departments to the Commonwealth. Within two years uniform customs duties were to be imposed; thereafter the parliament of the Commonwealth had exclusive power to impose customs and excise duties, or to grant bounties; and trade within the Commonwealth was to be absolutely free. Exceptions were made permitting the states to grant bounties on mining and (with the consent of the parliament) on exports of produce or manufactures —Western Australia being for a time partially exempted from the prohibition to impose import duties.

The constitution, parliament and laws of each state, subject to the federal constitution, retained their authority; state rights were carefully safeguarded, and an inter-state commission was given powers of adjudication and of administration of the laws relating to trade, transport and other matters. Provision was made for necessary alteration of the constitution of the Commonwealth, but so that no alteration could be effected unless the question had been directly submitted to, and the change accepted by the electorate in the states. The seat of government was to be within New South Wales, not less than 100 m. distant from Sydney, and of an area not less than 100 sq. m. Until other provision was made, the governor-general was to have a salary of £10,000, paid by the Commonwealth. Respecting the salaries of the governors of states, the constitution made no provision.

The choice of governor-general of the new Commonwealth fell upon Lord Hopetoun (afterwards Lord Linlithgow), who had won golden opinions as governor of Victoria a few years before; Mr (afterwards Sir Edmund) Barton, who had taken the lead among the Australian delegates, became first prime minister; and the Commonwealth was inaugurated at the opening of 1901. The first parliament under the constitution was elected on the 29th and 30th of March 1901, and was opened by the prince of Wales on the 9th of May following. In October 1908 the Yass-Canberra district, near the town of Yass, N.S.W., was at length selected by both federal houses to contain the future federal capital.

Labour movement.

The Labour movement in Australia may be traced back to the early days when transportation was in vogue, and the free immigrant and the time-expired convict objected to the competition of the bond labourer. The great object of these early struggles being attained, Labour directed its attention mainly to securing shorter hours. It was aided very materially by the dearth of workers consequent on the gold discoveries, when every man could command his own price. When the excitement consequent on the gold finds had subsided, there was a considerable reaction against the claims of Labour, and this was greatly helped by the congested state of the labour market; but the principle of an eight-hours day made progress, and was conceded in several trades. In the early years of the 'seventies the colonies entered upon an era of well-being, and for about twelve years every man, willing to work and capable of exerting himself, readily found employment. The Labour unions were able to secure in these years many concessions both as to hours and wages. In 1873 there was an important rise in wages, in the following year there was a further advance, and another in 1876; but in 1877 wages fell back a little, though not below the rate of 1874. In 1882 there was a very important advance in wages; carpenters received 11s. a day, bricklayers 12s. 6d., stone-masons 11s. 6d., plasterers 12s., painters 11s., blacksmiths 10s., and navvies and general labourers 8s., and work was very plentiful. For five years these high wages ruled; but in 1886 there was a sharp fall, though wages still remained very good. In 1888 there was an advance, and again in 1889. In 1890 matters were on the eve of a great change and wages fell, in most cases to a point 20% below the rates of 1885. During the whole period from 1873 onwards, prices, other than of labour, were steadily tending downwards, so that the cost of living in 1890 was much below that of 1873. Taking everything into consideration the reduction was, perhaps, not less than 20%, so that, though the nominal or money wages in 1873 and 1890 were the same, the actual wages were much higher in the latter year. Much of the improvement in the lot of the wage-earners has been due to the Labour organizations, yet so late as 1881 these organizations were of so little account, politically, that when the law relating to trades unions was passed in New South Wales, the English law was followed, and it was simply enacted that the purposes of any trades union shall not be deemed unlawful (so as to render a member liable to criminal prosecution for conspiracy or otherwise) merely by reason that they are in restraint of trade. After the year 1884 Labour troubles became very frequent, the New South Wales coal miners in particular being at war with the colliery owners during the greater part of the six years intervening between then and what is called the Great Strike. The strong downward tendency of prices made a reduction of wages imperative; but the labouring classes failed to recognize any such necessity, and strongly resented any reductions proposed by employers. It was hard indeed for a carter drawing coal to a gasworks to recognize the necessity which compelled a reduction in his wages because wool had fallen 20%. Nor were other labourers, more nearly connected with the producing interests, satisfied with a reduction of wages because produce had fallen in price all round. Up to 1889 wages held their ground, although work had become more difficult to obtain, and some industries were being carried on without any profit. ***The Great Strike of 1890.*** It was at such an inopportune time that the most extensive combination of Labour yet brought into action against capital formulated its demands. It is possible that the London dockers' strike was not without its influence on the minds of the Australian Labour leaders. That strike had been liberally helped by the Australian unions, and it was confidently predicted that, as the Australian workers were more effectively organized than the English unions, a corresponding success would result from their course of action. A strike of the Newcastle miners, after lasting twenty-nine weeks, came to an end in January 1890, and throughout the rest of the year there was great unrest in Labour circles. On the 6th of September the silver mines closed down, and a week later a conference of employers issued a manifesto which was met next day by a counter-manifesto of the Intercolonial Labour Conference, and almost immediately afterwards by the calling out of 40,000 men. The time chosen for the strike was the height of the wool season, when a cessation of work would be attended with the maximum of inconvenience. Sydney was the centre of the disturbance, and the city was in a state of industrial siege, feeling running to dangerous extremes. Riotous scenes occurred both in Sydney and on the coal-fields, and a large number of special constables were sworn in by the government. Towards the end of October 20,000 shearers were called out, and many other trades, principally concerned with the handling or shipping of wool, joined the ranks of the strikers, with the result that the maritime and pastoral industries throughout the whole of Australia were most injuriously disturbed. The Great Strike terminated early in November 1890, the employers gaining a decisive victory. The colonies were, however, to have other and bitter experiences of strikes before Labour recognized that of all means for settling industrial disputes strikes are, on the whole, the most disastrous that it can adopt. The strikes of the years 1890 and 1892 are just as important on account of their political consequences as from the direct gains or losses involved.

Political consequences.

As one result of the strike of 1890 a movement was set afoot by a number of enthusiasts, more visionary than practical, that has resulted in a measure of more or less disaster. This was the planting of a colony of communistic Australians in South America. After much negotiation the leader, Mr William Lane, a Brisbane journalist, decided on Paraguay, and he tramped across the continent, preaching a new crusade, and gathering in funds and recruits in his progress. On the 16th of July 1893 the first little army of “New Australians” left Sydney in the “Royal Tar,” which arrived at Montevideo on the 31st of August. Other consignments of intending settlers in “New Australia” followed; but though the settlement is still in existence it has completely failed to realize the impracticable ideals of its original members. The Queensland government assisted some of the disillusioned to escape from the paradise which proved a prison; some managed to get away on their own account; and those that have remained have split into as many settlements almost as there are settlers. Another effect of the Great Strike was in a more practical direction. New South Wales was the first country which endeavoured to settle its labour grievances through the ballot-box and to send a great party to parliament as the direct representation of Labour, pledged to obtain through legislation what it was unable to obtain by strikes and physical force. The principle of one-man one-vote had been persistently advocated without arousing any special parliamentary or public enthusiasm until the meeting of the Federal Convention in 1891. The convention was attended by Sir George Grey, who was publicly welcomed to the colony by New Zealanders resident in Sydney, and by other admirers, and his reception was an absolute ovation. He eloquently and persistently advocated the principle of one-man one-vote as the bed-rock of all democratic reform. This subsequently formed the first plank of the Labour platform. Several attempts had been made by individuals belonging to the Labour party to enter the New South Wales parliament, but it was not until 1891 that the occurrence of a general election gave the party the looked-for opportunity for concerted action. The results of the election came as a complete surprise to the majority of the community. The Labour party captured 35 seats out of a House of 125 members; and as the old parties almost equally divided the remaining seats, and a fusion was impossible, the Labour representatives dominated the situation. It was not long, however, before the party itself became divided on the fiscal question; and a Protectionist government coming into power, about half the Labour members gave it consistent support and enabled it to maintain office for about three years, the party as a political unit being thus destroyed. The events of these three years taught the Labour leaders that a parliamentary party was of little practical influence unless it was able to cast on all important occasions a solid vote, and to meet the case a new method was devised. The party therefore determined that they would refuse to support any person standing in the Labour interests who refused to pledge himself to vote on all occasions in such way as the majority of the party might decide to be expedient. This was called the “solidarity pledge,” and, united under its sanction, what was left of the Labour party contested the general election of 1894. The result was a defeat, their numbers being reduced from 35 to 19; but a signal triumph was won for solidarity. Very few of the members who refused to take the pledge were returned and the adherents of the united party were able to accomplish more with their reduced number than under the old conditions.

The two features of the Labour party in New South Wales are its detachment from other parties and the control of the caucus. The caucus, which is the natural corollary of the detachment, determines by majority the vote of the whole of the members of the party, independence of action being allowed on minor questions only. So far the party has refrained from formal alliance with the other great parties of the state. It supports the government as the power alone capable of promoting legislation, but its support is given only so long as the measures of the government are consistent with the Labour policy. This position the Labour party has been able to maintain with great success, owing to the circumstance that the other parties have been almost equally balanced.

Parliamentary Labour party.

The movement towards forming a parliamentary Labour party was not confined to New South Wales; on the contrary, it was common to all the states, having its origin in the failure of the Great Strike of 1890. The experience of the party was also much the same as in New South Wales, but its greatest triumphs were achieved in South Australia. The Labour party has been in power in Queensland, Western Australia and South Australia, and has, on many occasions, decided the fate of the government on a critical division in all the states except Tasmania and Victoria. Different ideals dominate the party in the different states. The one ideal which has just been described represents the Labour party from the New South Wales standpoint. The only qualification worth mentioning is the signing of the pledge of solidarity. The other ideal, typified by the South Australian party, differs from this in one important respect. To the Labour party in that state are admitted only persons who have worked for their living at manual labour, and this qualification of being an actual worker is one that was strongly insisted upon at the formation of the party and strictly adhered to, although the temptation to break away from it and accept as candidates persons of superior education and position has been very great. On the formation of the Commonwealth a Labour party was established in the federal houses. It comprises one-third of the representation in the House of Representatives, and perhaps a still larger proportion in the Senate. The party is, however, formed on a broader basis than the state parties, the solidarity pledge extends only to votes upon which the fate of a government depends. Naturally, however, as the ideals of the members of the party are the same, the members of the Labour party will be generally found voting together on all important divisions, the chief exception being with regard to free trade or protection. The Labour party held power in the Commonwealth for a short period, and has had the balance of power in its hands ever since the formation of the Commonwealth. (T. A. C.)

Recent legislation.

Australian legislation in the closing years of the 19th century and the first decade of the 20th bore the most evident traces of the Labour party's influence. In all the colonies a complete departure from principles laid down by the leading political economists of the 19th century was made when acts were passed subjecting every branch of domestic industry to the control of specially constituted tribunals, which were empowered among other important functions to fix the minimum rate of wages to be paid to all grades of workmen. (See also the articles ARBITRATION AND CONCILIATION; TRADE UNIONS; LABOUR LEGISLATION.)

Victoria.

Victoria was the pioneer in factory legislation, the first Victorian act of that character dating from 1873. In 1884 a royal commission, appointed two years earlier to inquire into the conditions of employment in the colony and certain allegations of “sweating” that had then recently been made, reported that:—“The most effective mode of bringing about industrial co-operation and mutual sympathy between employers and employed, and thus obviating labour conflicts in the future, is by the establishment of courts of conciliation in Victoria, whose procedure and awards shall have the sanction and authority of law.” This report led to the passing of a number of acts which, proving ineffectual, were followed by the Factories and Shops Act of 1896, passed by the ministry of Mr (afterwards Sir Alexander) Peacock. This measure, together with several subsequent amending acts, of which the most important became law in 1903, 1905 and 1907, forms a complete industrial code in which the principle of state regulation of wages is recognized and established. Its central enactment was to bring into existence (1) “Special Boards,” consisting of an equal number of representatives of employers and workmen respectively in any trade, under the presidency of an independent chairman, and (2) a Court of Industrial Appeals. A special board may be formed at the request of any union of employers or of workmen, or on the initiative of the Labour department. After hearing evidence, which may be given on oath, the special board issues a “determination,” fixing the minimum rate of wages to be paid to various classes of workers of both sexes and different ages in the trade covered by the determination, including apprentices; and specifying the number of hours per week for which such wages are payable, with the rates for overtime when those hours are exceeded. The determination is then gazetted, and it becomes operative over a specified area, which varies in different cases, on a date fixed by the board. Either party, or the minister for Labour, may refer a determination to the court of industrial appeals, and the court, in the event of a special board failing to make a determination, may itself be called upon to frame one. The general administration of the Factories and Shops Acts, to which the special boards owe their being, is vested in a chief inspector of factories, subject to the control of the minister of Labour in matters of policy. Before the end of 1906 fifty-two separate trades in Victoria had obtained special boards, by whose determinations their operations were controlled.

South Australia. A similar system was introduced into South Australia by an act passed in 1900 amending the Factory Act of 1894, which was the first legislation of the sort passed in that state.

Queensland. In Queensland, where the earliest factory legislation dates from 1896, keen parliamentary conflict raged round the proposal in 1907 to introduce the special boards system for fixing wages. More than one change of government occurred before the bill became law in April 1908.

New South Wales. In New South Wales, whose example was followed by Western Australia, the machinery adopted for fixing the statutory rate of wages was of a somewhat different type. The model followed in these two states was not Victoria but New Zealand, where an Industrial Conciliation and Arbitration Act was passed in 1894. A similar measure, under the guidance of the attorney-general, the Hon. B. R. Wise, was carried after much opposition in New South Wales in 1901, to remain in force till the 30th of June 1908. By it an arbitration court was instituted, consisting of a president and assessors representing the employers' unions and the workers' unions respectively; in any trade in which a dispute occurs, any union of workmen or employers registered under the act was given the right to bring the matter before the arbitration court, and if the court makes an award, an application may be made to it to make the award a "common rule," which thereupon becomes binding over the trade affected, wherever the act applies. The award of the court is thus the equivalent of the determination of a special board in Victoria, and deals with the same questions, the most important of which are the minimum rates of wages and the number of working hours per week. The act contained stringent provisions forbidding strikes; but in this respect it failed to effect its purpose, several strikes occurring in the years following its enactment, in which there were direct refusals to obey awards.

Western Australia. In the years 1900 and 1902 acts were passed in Western Australia still more closely modelled on the New Zealand act than was the above-mentioned statute in New South Wales. Unlike the latter, they reproduced the institution of district conciliation boards in addition to the arbitration court; but these boards were a failure here as they were in New Zealand, and after 1903 they fell into disuse. In Western Australia, too, the act failed to prevent strikes taking place. In 1907 a serious strike occurred in the timber trade, attended by all the usual accompaniments, except actual disorder, of an industrial conflict.

Federal Arbitration Act 1904. In all this legislation one of the most hotly contested points was whether the arbitration court should be given power to lay it down that workers who were members of a trade union should be employed in preference to non-unionists. This power was given to the tribunal in New South Wales, but was withheld in Western Australia. It was the same question that formed the chief subject of debate over the Federal Conciliation and Arbitration Act, which, after causing the defeat of more than one ministry, passed through the Commonwealth parliament in 1904. It was eventually compromised by giving the power, but only with safeguarding conditions, to the Federal arbitration court. This tribunal differs from similar courts in the states inasmuch as it consists of a single member, called the "president," an officer appointed by the governor-general from among the justices of the High Court of Australia. The president has the power to appoint assessors to advise him on technical points; and considerable powers of devolution of authority for the purpose of inquiry and report are conferred upon the court, the main object of which is to secure settlement by conciliatory methods. The distinctive object of the Federal Act, as defined in the measure itself, is to provide machinery for dealing with industrial disputes extending beyond any one state, examples of which were furnished by the first two important cases submitted to the court—the one concerning the merchant marine of Australia, and the other the sheep shearers, both of which were heard in 1907. An additional duty was thrown on the Federal arbitration court by the Customs and Excise Tariff Acts of 1906, in which were embodied the principles known as the "New Protection." By the Customs Act the duty was raised on imported agricultural implements, while as a safeguard to the consumer the maximum prices for the retail of the goods were fixed. In order to provide a similar protection for the artisans employed in the protected industries, an excise duty was imposed on the home-produced articles, which was to be remitted in favour of manufacturers who could show that they paid "fair and reasonable" wages, and complied with certain other conditions for the benefit of their workmen. The chief authority for determining whether these conditions are satisfied or not is the Federal arbitration court.

Old age pensions. The same period that saw this legislation adopted was also marked by the establishment of old age pensions in the three eastern states, and also in the Commonwealth. By the Federal Act, passed in the session of 1908, a pension of ten shillings a week was granted to persons of either sex over sixty-five years of age, or to persons over sixty who are incapacitated from earning a living. The Commonwealth legislation thus made provision for the aged poor in the three states which up to 1908 had not accepted the principle of old age pensions, and also for those who, owing to their having resided in more than one state, were debarred from receiving pension in any.

Tariff. An important work of the Commonwealth parliament was the passing of a uniform tariff to supersede the six separate tariffs in force at the establishment of the Commonwealth, but many other important measures were considered and some passed into law. During the first six years of federation there were five ministries; the tenure of office under the three-yearly system was naturally uncertain, and this uncertainty was reflected in the proposals of whatever ministry was in office. The great task of adjusting the financial business of the Commonwealth on a permanent basis was one of very great difficulty, as the apparent interests of the states and of the Commonwealth were opposed. Up till 1908 it had been generally assumed that the constitution required the treasurer of the Commonwealth to hand over to the states month by month whatever surplus funds remained in his hands. But in July 1908 a Surplus Revenue Act was passed which was based on a different interpretation of the constitution. Under this act the appropriation of these surplus funds to certain trust purposes in the Federal treasury is held to be equivalent to payment to the states. The money thus obtained was appropriated in part to naval defence and harbours, and in part to the provision of old age pensions under the Federal Old Age Pension Act of 1908. The act was strongly opposed by the government of Queensland, and the question was raised as to whether it was based on a true interpretation of the constitution. The chief external interest, however, of the new financial policy of the Commonwealth lay in its relation towards the empire as a whole. At the Imperial Conference in London in 1907 Mr Deakin, the Commonwealth premier, was the leading advocate of colonial preference with a view to imperial commercial union; and though no reciprocal arrangement was favoured by the Liberal cabinet, who temporarily spoke for the United Kingdom, the colonial representatives were all agreed in urging such a policy, and found the Opposition (the Unionist party) in England prepared to adopt it as part of Mr Chamberlain's tariff reform movement. In spite of the official rebuff received from the mother-country, the Australian ministry, in drawing up the new Federal tariff, gave a substantial preference to British imports, and thus showed their willingness to go farther. (See the article BRITISH EMPIRE.) (R. J. M.)

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AUSTRASIA. The word *Austria* signifies the realm of the east (Ger. *Ost Reich*). In Gregory of Tours this word is still used vaguely, but the sense of it is gradually defined, and finally the name of *Austria* or *Austrasia* was given to the easternmost part of the Frankish kingdom. It usually had Metz for its capital, and the inhabitants of the kingdom were known as the *Austrasii*. Retrospectively, later historians have given this name to the kingdom of Theuderich I. (511–534), of his son Theudebert (534–548), and of his grandson Theudebald (548–555); then, after the death of Clotaire I., to the kingdom of Sigebert (561–575), and of his son Childebert (575–597). They have even tried to interpret the long struggle between Fredegond and Brunhilda as a rivalry between the two kings of Neustria and Austrasia. When these two words are at last found in the texts in their precise signification, Austrasia is applied to that part of the Frankish kingdom which Clotaire II. entrusted to his son Dagobert, subject to the guardianship of Pippin and Arnulf (623–629), and which Dagobert in his turn handed on to his son Sigebert (634–639), under the guardianship of Cunibert, bishop of Cologne, and Ansegisel, mayor of the palace. After the death of Dagobert, Austrasia and Neustria almost always had separate kings, with their own mayors of the palace, and then there arose a real rivalry between these two provinces, which ended in the triumph of Austrasia. The Austrasian mayors of the palace succeeded in enforcing their authority in the western as well as in the eastern part, and in re-establishing to their own advantage the unity of the Frankish kingdom. The mayor Pippin the Short was even powerful enough to take the title of king over the whole.

At the time of Charlemagne, the word Austrasia underwent a change of meaning and became synonymous with *Francia orientalis*, and was applied to the Frankish dominions beyond the Rhine (Franconia). This Franconia was in 843 included in the kingdom of Louis the German, and was then increased by the addition of the territories of Mainz, Spires and Worms, on the right bank of the river.

See A. Huguenin, *Histoire du royaume mérovingien d'Austrasie* (Paris, 1857); Aug. Digot, *Histoire du royaume d'Austrasie*, 4 vols. (Nancy, 1863); L. Drapeyron, *Essai sur l'origine, le développement et les résultats de la lutte entre la Neustrie et l'Austrasie* (Paris, 1867); Auguste Longnon, *Atlas historique*, 1st and 2nd parts. (C. Pf.)

AUSTRIA. (Ger. *Österreich*), a country of central Europe, bounded E. by Russia and Rumania, S. by Hungary, the Adriatic Sea and Italy, W. by Switzerland, Liechtenstein and the German empire (Bavaria), and N. by the German empire (Saxony and Prussia) and Russia. It has an area of 115,533 sq. m., or about twice the size of England and Wales together. Austria is one of the states which constitute the Austro-Hungarian (Habsburg) monarchy (see AUSTRIA-HUNGARY: *History*), and is also called Cisleithania, from the fact that it contains the portion of that monarchy which lies to the west of the river Leitha. Austria does not form a geographical unity, and the constituent parts of this empire belong to different geographical regions. Thus, Tirol, Styria and Carinthia belong, like Switzerland, to the system of the Alps, but these provinces together with those lying in the basin of the Danube form, nevertheless, a compact stretch of country. On the other hand Galicia, extending on the eastern side of the Carpathians, belongs to the great plain of Russia; Bohemia stretches far into the body of Germany; while Dalmatia, which is quite separated from the other provinces, belongs to the Balkan Peninsula.

Coasts.—Austria has amongst all the great European countries the most continental character, in so far as its frontiers are mostly land-frontiers, only about one-tenth of them being coast-land. The Adriatic coast, which stretches for a distance of about 1000 m., is greatly indented. The Gulf of Trieste on the west, and the Gulf of Fiume or Quarnero on the east, include between them the peninsula of Istria, which has many sheltered bays. In the Gulf of Quarnero are the Quarnero islands, of which the most important are Cherso, Veglia and Lussin. The coast west of the mouth of the Isonzo is fringed by lagoons, and has the same character as the Venetian coast, while the Gulf of Trieste and the Istrian peninsula have a steep coast with many bays and safe harbours. The principal ports are Trieste, Capodistria, Pirano, Parenzo, Rovigno and Pola, the great naval harbour and arsenal of Austria. The coast of Dalmatia also possesses many safe bays, the principal being those of Zara, Cattaro and Ragusa, but in some places it is very steep and inaccessible. On the other hand a string of islands extends along this coast, which offer many safe and easily accessible places of anchorage to ships during the fierce winter gales which rage in the Adriatic. The principal are Pago, Pasman, Isola Lunga and Isola Incoronata, Brazza, Lesina, Curzola and Meleda.

The political divisions of Austria correspond, for the most part, so closely to natural physical divisions that the detailed account of the physical features, natural resources and the movement of the population has been given under those separate headings. In this general article the geography of Austria—physical, economical and political—has been treated in its broad aspects, and those points insisted upon which give an adequate idea of the country as a whole.

Mountains.—Austria is the most mountainous country of Europe after Switzerland, and about four-fifths of its entire area is more than 600 ft. above the level of the sea. The mountains of Austria belong to three different mountain systems, namely, the Alps (*q.v.*), the Carpathians (*q.v.*), and the Bohemian-Moravian Mountains. The Danube, which is the principal river of Austria, divides the Alpine region, which occupies the whole country lying at its south, from the Bohemian-Moravian Mountains and their offshoots lying at its north; while the valleys of the March and the Oder separate the last-named mountains from the Carpathians. Of the three principal divisions of the Alps—the western, the central and the eastern Alps—Austria is traversed by several groups of the central Alps, while the eastern Alps lie entirely within its territory. The eastern Alps are continued by the Karst mountains, which in their turn are continued by the Dinaric Alps, which stretch through Croatia and Dalmatia. The second great mountain-system of Austria, the Carpathians, occupy its eastern and north-eastern portions, and stretch in the form of an arch through Moravia, Silesia, Galicia and Bukovina, forming the frontier towards Hungary, within which territory they principally extend. Finally, the Bohemian-Moravian Mountains, which enclose Bohemia and Moravia, and form the so-called quadrilateral of Bohemia, constitute the link of the Austrian mountain-system with the hilly region (the *Mittelgebirge*) of central Europe. Only a little over 25 % of the area of Austria is occupied by plains. The largest is the plain of Galicia, which is part of the extensive Sarmatic plain; while in the south, along the Isonzo, Austria comprises a small part of the Lombardo-Venetian plain. Several smaller plains are found along the Danube, as the Tulner Becken in Lower Austria, and the Wiener Becken, the plain on which the capital is situated; to the north of the Danube this plain is called the Marchfeld, and is continued under the name of the Marchebene into Moravia as far north as Olmütz. Along the other principal rivers there are also plains of more or less magnitude, some of them possessing tracts of very fertile soil.

Rivers.—Austria possesses a fairly great number of rivers, pretty equally distributed amongst its crown lands, with the exception of Istria and the Karst region, where there is a great scarcity of even the smallest rivers. The principal rivers are: the Danube, the Dniester, the Vistula, the Oder, the Elbe, the Rhine and the Adige or Etsch. As the highlands of Austria form part of the great watershed of Europe, which divides the waters flowing northward into the North Sea or the Baltic from those flowing southward or eastward into the Mediterranean or the Black Sea, its rivers flow in three different directions—northward, southward and eastward. With the exception of the small streams belonging to it which fall into the Adriatic, all its rivers have their mouths in other countries, and its principal river, the Danube, has also its source in another country. When it enters Austria at the gorge of Passau, where it receives the Inn, a river which has as large a body of water as itself, the Danube is already navigable. Till it leaves the country at Hainburg, just before Pressburg, its banks are pretty closely hemmed by the Alps, and the river passes through a succession of narrow defiles. But the finest part of its whole course, as regards the picturesqueness of the scenery on its banks, is between Linz and Vienna. Where it enters Austria the Danube is 898 ft. above the level of the sea, and where it leaves it is only 400 ft.; it has thus a fall within the country of 498 ft., and is at first a very rapid stream, becoming latterly much slower. The Danube has in Austria a course of 234 m., and it drains an area of 50,377 sq.m. Its principal affluents in Austria, besides the Inn, are the Traun, the Enns and the March. The Dniester, which, like the Danube, flows into the Black Sea, has its source in the Carpathians in Eastern Galicia, and pursues a very winding course towards the south-east, passing into Russia. It has in Austria a course of 370 m. of which 300 are navigable, and drains an area of 12,000 sq. m. The Vistula and the Oder both fall into the Baltic. The former rises in Moravia, flows first north through Austrian Silesia, then takes an easterly direction along the borders of Prussian Silesia, and afterwards a north-easterly, separating Galicia from Russian Poland, and leaving Austria not far from Sandomir. Its course in Austria is 240 m., draining an area of 15,500 sq. m. It is navigable for nearly 200 m., and its principal affluents are the Dunajec, the San and the Bug. The Oder has also its source in Moravia, flows first east and then north-east through Austrian Silesia into Prussia. Its length within the Austrian territory is only about 55 m., no part of which is navigable. The only river of this country which flows into the North Sea is the Elbe. It has its source in the Riesengebirge, not far from the Schneekoppe, flows first south, then west, and afterwards north-west through Bohemia, and then enters Saxony. Its principal affluents are the Adler, Iser and Eger, and, most important of all, the Moldau. The Elbe has a course within the Austrian dominions of 185 m., for about 65 of which it is navigable. It drains an area of upwards of 21,000 sq. m. The Rhine, though scarcely to be reckoned a river of the country, flows for about 25 m. of its course between it and Switzerland. The principal river of Austria which falls into the Adriatic is the Adige or Etsch. It rises in the mountains of Tirol, flows south, then east, and afterwards south, into the plains of Lombardy. It has in Austria a course of 138 m., and drains an area of 4266 sq. m. Its principal affluent is the Eisak. Of the streams which have their course entirely within the country, and fall into the Adriatic, the principal is the Isonzo, 75 m. in length, but navigable only for a short distance from its mouth.

Lakes.—Austria does not possess any great lakes; but has numerous small mountain lakes situated in the Alpine region, the most renowned for the beauty of their situation being found in Salzburg, Salzkammergut, Tirol and Carinthia. There should also be mentioned the periodical lakes situated in the Karst region, the largest of them being the Lake of Zirknitz. The numerous and large marshes, found now mostly in Galicia and Dalmatia, have been greatly reduced in the other provinces through the canalization of the rivers, and other works of sanitation.

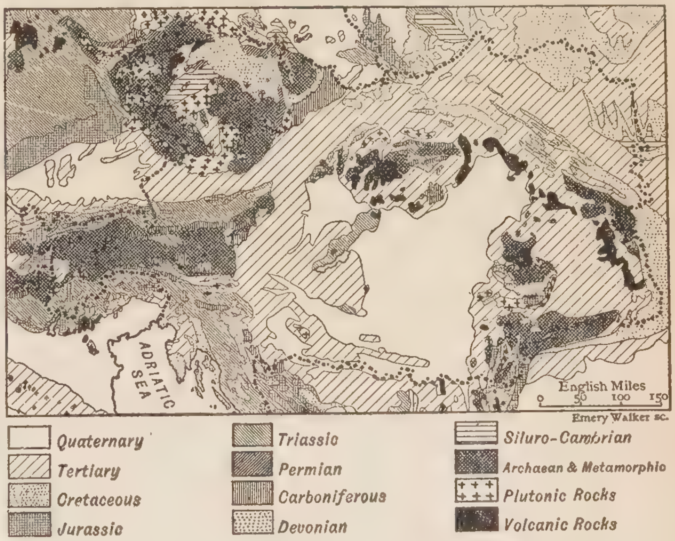
Mineral Springs.—No other European country equals Austria in the number and value of its mineral springs. They are mostly to be found in Bohemia, and are amongst the most frequented watering-places in the world. The most important are, the alkaline springs of Carlsbad, Marienbad, Franzensbad and Bilin; the alkaline acidulated waters of Giesshübel, largely used as table waters; the iron springs of Marienbad, Franzensbad and of Pyrawarth in Lower Austria; the bitter waters of Püllna, Saidschitz and Sedlitz; the saline waters of Ischl and of Aussee in Styria; the iodine waters of Hall in Upper Austria; the different waters of Gastein; and lastly the thermal waters of Teplitz-Schönau, Johannisbad, and of Römerbad in Styria. Altogether there are reckoned to exist over 1500 mineral springs, of which many are not used. (O. Br.)

Geology.—The Austro-Hungarian Monarchy is traversed by the great belt of folded beds which constitutes the Alps and the Carpathians; a secondary branch proceeding from the main belt runs along the Adriatic coast and forms the Julian and Dinaric Alps. In the space which is thus enclosed, lies the Tertiary basin of the Hungarian plain; and outside the belt, on the northern side, is a region which, geologically, is composite, but has uniformly resisted the Carpathian folding. In the neighbourhood of Vienna a gap in the folded belt—the gap between the Alps and the Carpathians—has formed a connexion between these two regions since the early part of the Miocene period. On its outer or convex side the folded belt is clearly defined by a depression which is generally filled by modern deposits. Beyond this, in Russia and Galicia, lies an extensive plateau, much of which is covered by flat-lying Miocene and Pliocene beds; but in the deep valleys of the Dniester and its tributaries the ancient rocks which form the foundation of the plateau are laid bare. Archaean granite is thus exposed at Yampol and other places in Russia, and this is followed towards the west by Silurian and Devonian beds in regular succession—the Devonian being of the Old Red Sandstone type characteristic of the British Isles and of Northern Russia. Throughout, the dip is very low and the beds are unaffected by the Carpathian folds, the strike being nearly from north to south. After Devonian times the region seems to have been dry land until the commencement of the Upper Cretaceous period, when it was overspread by the Cenomanian sea, and the deposits of that sea lie flat upon the older sediments.

Some 25 or 30 m. of undulating country separate the Dniester from the margin of the Carpathian chain, and in this space the Palaeozoic floor sinks far beneath the surface, so that not even the deep-cut valley of the Pruth exposes any beds of older date than Miocene. Towards the north-west, also, the Palaeozoic foundation falls beneath an increasing thickness of Cretaceous beds and lies buried far below the surface. At Lemberg a boring 1650 ft. in depth did not reach the base of the Senonian. West of Cracow the Cretaceous beds are underlaid by Jurassic and Triassic deposits, the general dip being eastward. It is not till Silesia that the Palaeozoic formations again rise to the surface. Here is the margin, often concealed by very modern deposits, of the great mass of Archaean and Palaeozoic rocks which forms nearly the whole of Bohemia and Moravia. The Palaeozoic beds no longer lie flat and undisturbed, as in the Polish plain. They are faulted and folded. But the folds are altogether independent of those of the Carpathians; they are of much earlier date, and are commonly different in direction. The principal folding took place towards the close of the Carboniferous period, and the *massif* is a fragment of an ancient mountain chain, the *Variscische Gebirge* of E. Suess, which in Permian and Triassic times stretched across the European area from west to east.

In Bohemia and Moravia the whole of the beds from the Cambrian to the Lower Carboniferous are of marine origin; but after the Carboniferous period the area appears to have been dry land until the beginning of the Upper Cretaceous period, when the sea again spread over it. The deposits of this sea are now visible in the large basin of Upper Cretaceous beds which stretches from Dresden south-eastward through Bohemia. Since the close of the Cretaceous period the Bohemian *massif* has remained above the sea; but the depression which lies immediately outside the Carpathian chain has at times been covered by an arm of the sea and at other times has been occupied by a chain of salt lakes, to which the salt deposits of Wieliczka and numerous brine springs owe their origin.

The large area which is enclosed within the curve of the Carpathians is for the most part covered by loess, alluvium and other modern deposits, but Miocene and Pliocene beds appear around its borders. In the hilly region of western Transylvania a large mass of more ancient rocks is exposed; the Carboniferous system and all the Mesozoic systems have been recognized here, and granite and volcanic rocks occur. In the middle of Hungary a line of hills rises above the plain, striking from the Platten See towards the north-east, where it merges into the inner girdle of the Carpathian chain. These hills are largely formed of volcanic rocks of late Tertiary age; but near the Platten See Triassic beds of Alpine type are well developed. The Tertiary eruptions were not confined to this line of hills. They were most extensive along the inner border of the Carpathians, and they occurred also in the north of Bohemia. Most of the eruptions took place during the Miocene and Pliocene periods.



Geological Map of Austria-Hungary.

The mineral wealth of Austria is very great. The older rocks are in many places peculiarly rich in metalliferous ores of all kinds. Amongst them may be mentioned the silver-bearing lead ores of Erzgebirge and of Přibram in Bohemia; the iron ores of Styria and Bukovina; and the iron, copper, cobalt and nickel of the districts of Zips and Gömör. The famous cinnabar and mercury mines of Idria in Carniola are in Triassic beds; and the gold and silver of northern Hungary and of Transylvania are associated with the Tertiary volcanic rocks. The Carboniferous coal-fields of Silesia and Bohemia are of the greatest importance; while Jurassic coal is worked at Steyerdorf and Fünfkirchen in Hungary, and lignite at many places in the Tertiary beds. The great salt mines of Galicia are in Miocene deposits; but salt is also worked largely in the Trias of the Alps. (See also Alps; Carpathians; Hungary and Tirol.) (P. La.)

Climate.—The climate of Austria, in consequence of its great extent, and the great differences in the elevation of its surface, is very various. It is usual to divide it into three distinct zones. The most southern extends to 46° N. lat., and includes Dalmatia and the country along the coast, together with the southern portions of Tirol and Carinthia. Here the seasons are mild and equable, the winters are short (snow seldom falling), and the summers last for five months. The vine and maize are everywhere cultivated, as well as olives and other southern products. In the south of Dalmatia tropical plants flourish in the open air. The central zone lies between 46° and 49° N. lat., and includes Lower and Upper Austria, Salzburg, Styria, Carinthia, Carniola, Central and Northern Tirol, Southern Moravia and a part of Bohemia. The seasons are more marked here than in the preceding. The winters are longer and more severe, and the summers are hotter. The vine and maize are cultivated in favourable situations, and wheat and other kinds of grain are generally grown. The northern zone embraces the territory lying north of 49° N. lat., comprising Bohemia, Northern Moravia, Silesia and Galicia. The winters are here long and cold; the vine and maize are no longer cultivated, the principal crops being wheat, barley, oats, rye, hemp and flax. The mean annual temperature ranges from about 59° in the south to 48° in the north. In some parts of the country, however, it is as low as 46° 40′ and even 36°. In Vienna the average annual temperature is 50°, the highest temperature being 94°, the lowest 2° Fahr. In general the eastern part of the country receives less rain than the western. In the south the rains prevail chiefly in spring and autumn, and in the north and central parts during summer. Storms are frequent in the region of the south Alps and along the coast. In some parts in the vicinity of the Alps the rainfall is excessive, sometimes exceeding 60 in. It is less among the Carpathians, where it usually varies from 30 to 40 in. In other parts the rainfall usually averages from 20 to 24 in.

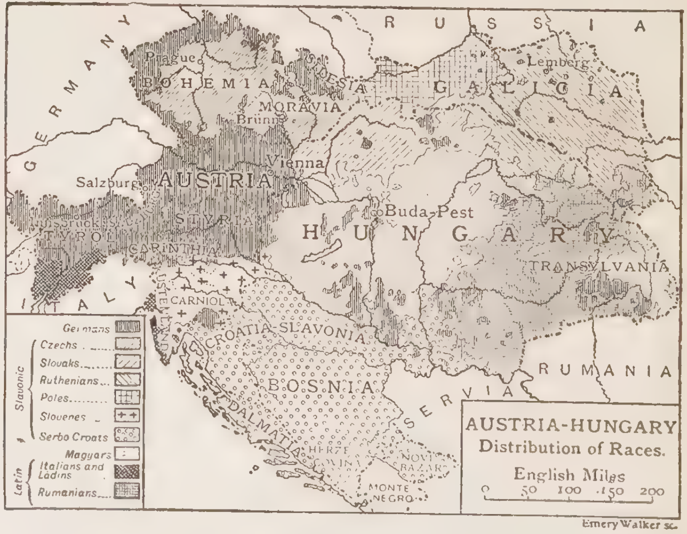
Flora.—From the varied character of its climate and soil the vegetable productions of Austria are very diverse. It has floras of the plains, the hills and the mountains; an alpine flora, and an arctic flora; a flora of marshes, and a flora of steppes; floras peculiar to the clay, the chalk, the sandstone and the slate formations. The number of different species is estimated at 12,000, of which one-third are phanerogamous, or flowering plants, and two-thirds cryptogamous, or flowerless. The crown land of Lower Austria far surpasses in this respect the other divisions of the country, having about four-ninths of the whole, and not less than 1700 species of flowering plants. As stated above, Austria is a very mountainous country and the mountains are frequently covered with vegetation to a great elevation. At the base are found vines and maize; on the lower slopes are green pastures, or wheat, barley and other kinds of corn; above are often forests of oak, ash, elm, &c.; and still higher the yew and the fir may be seen braving the climatic conditions. Corn grows to between 3400 and 4500 ft. above the level of the sea, the forests extend to 5600 or 6400 ft., and the line of perpetual snow is from 7800 to 8200 ft.

Fauna.—The animal kingdom embraces, besides the usual domestic animals (as horses, cattle, sheep, swine, goats, asses, &c.), wild boars, deer, wild goats, hares, &c.; also bears, wolves, lynxes, foxes, wild cats, jackals, otters, beavers, polecats, martens, weasels and the like. Eagles and hawks are common, and many kinds of singing birds. The rivers and lakes abound in different kinds of fish, which are also plentiful on the sea-coast. Among the insects the bee and the silkworm are the most useful. The leech forms an article of trade. In all there are 90 different species of mammals, 248 species of birds, 377 of fishes and more than 13,000 of insects.

Divisions.—Austria is composed of seventeen "lands," called also "crown lands." Of these, three—namely, Bohemia, Galicia and Lodomeria, and Dalmatia—are kingdoms; two—Lower and Upper Austria—archduchies; six—Salzburg, Styria, Carinthia, Carniola, Silesia and Bukovina—duchies; two—Görz-Gradisca and Tirol—countships of princely rank (*gefürstete Grafschaften*); two—Moravia and Istria—margraviates (march counties). Vorarlberg bears the title simply of "land." Trieste, with its district, is a town treated as a special crown land. For administrative purposes Trieste, with Görz-Gradisca and Istria, constituting the Küstenland (the Coast land) and Tirol and Vorarlberg, are each comprehended as one administrative territory. The remaining lands constitute each an administrative territory by itself.

Population.—Austria had in 1900 a population of 26,107,304 inhabitants,[1] which is equivalent to 226 inhabitants per sq. m. As seen from the above table the density of the population is unequal in the various crown lands. The most thickly populated province is Lower Austria; the Alpine provinces are sparsely populated, while Salzburg is the most thinly populated crown land of Austria. As regards sex, for every 1000 men there were 1035 women, the female element being the most numerous in every crown land, except the Küstenland, Bukovina and Dalmatia. Compared with the census returns of 1890, the population shows an increase of 2,211,891, or 9·3% of the total population. The increase between the preceding census returns of 1880 and 1890 was of 1,750,093 inhabitants, or 7·9% of the total population. A very important factor in the movement of the population is the large over-sea emigration, mostly to the United States of America, which has grown very much during the last quarter of the 19th century, and which shows a tendency to become still larger. Between 1891 and 1900 the number of over-sea emigrants was 387,770 persons. The movement of the population shown in the other vital statistics—births, marriages, deaths—are mostly satisfactory, and show a steady and normal progress. The annual rate per thousand of population in 1900 was: births, 37·0; still-births, 1·1; deaths, 25·2; marriages, 8·2. The only unsatisfactory points are the great number of illegitimate births, and the high infant mortality. Of the total population of Austria 14,009,233 were scattered in 26,321 rural communities with less than 2000 inhabitants; while the remainder was distributed in 1742 communities with a population of 2000–5000; in 260 communities with a population of 5000–10,000; in 96 towns with a population of 10,000–20,000; in 41 towns with a population of 20,000–50,000; in 6 towns with a population of 50,000–100,000; and in 6 towns with a population of over 100,000 inhabitants. The principal towns of Austria are Vienna (1,662,269), Prague (460,849), Trieste (132,879), Lemberg (159,618), Graz (138,370), Brünn (108,944), Cracow (91,310), Czernowitz (67,622), Pilsen (68,292) and Linz (58,778).

Administrative Territories.	Areas in Square Miles.	Population.		Density of Population per sq. m. in 1900.
		1890.	1900.	
AUSTRIA—				
Lower Austria	7,654	2,661,799	3,100,493	405
Upper Austria	4,617	785,831	809,918	175
Salzburg	2,757	173,510	193,247	69
Styria	8,642	1,282,708	1,356,058	156
Carinthia	3,992	361,008	367,344	91
Carniola	3,844	498,958	508,348	132
Küstenland	3,974	695,384	755,183	245
Tirol and Vorarlberg	11,287	928,769	979,878	86
Bohemia	19,997	5,843,094	6,318,280	315
Moravia	8,555	2,276,870	2,435,081	284
Silesia	1,981	605,649	680,529	342
Galicia	30,212	6,607,816	7,295,538	241
Bukovina	4,022	646,591	729,921	181
Dalmatia	4,923	527,426	591,597	120
Total	115,533	23,895,413	26,107,304	226



Emery Walker sc.

Races.—From an ethnographical point of view Austria contains a diversity of races; in fact no other European state contains within its borders so many nationalities as the Austrian empire. The three principal races of Europe—the Latin, the Teutonic and the Slavonic—are all represented in Austria. The Slavonic race, numbering 15,690,000, is numerically the principal race in Austria, but as it is divided into a number of peoples, differing from one another in language, religion, culture, customs and historical traditions, it does not possess a national unity. Besides, these various nationalities are geographically separated from one another by other races, and are divided into two groups. The northern group includes the Czechs, the Moravians, the Slovaks, the Ruthenians and the Poles; while the southern group contains the Slovenes, the Servians and the Croats. Just as their historical traditions are different, so are also the aspirations of these various peoples of the Slavonic race different, and the rivalries between them, as for instance between the Poles and the Ruthenians, have prevented them from enjoying the full political advantage due to their number. The Germans, numbering 9,171,614, constitute the most numerous nationality in Austria, and have played and still play the principal rôle in the political life of the country. The Germans are in a relative majority over the other peoples in the empire, their language is the vehicle of communication between all the other peoples both in official life and in the press; they are in a relatively more advanced state of culture, and they are spread over every part of the empire. Historically they have contributed most to the foundation and to the development of the Austrian monarchy, and think that for all the above-mentioned reasons they are entitled to the principal position amongst the various nationalities of Austria. The Latin race is represented by the Italians, Ladini and Rumanians.

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[1] The census returns of 1857, and of 1869, which were the first systematic censuses taken, gave the population of Austria as 18,224,500 and 20,394,980 respectively. It must be noticed that between these two dates Austria lost its Lombardo-Venetian territories, with a population of about 5,000,000 inhabitants.

The following table gives the numbers of different nationalities, as determined by the languages spoken by them in 1900:—

Germans	9,171,614
Czechs and Slovaks	5,955,397
Poles	4,252,483
Ruthenians	3,381,570
Slovenes	1,192,780
Italians and Ladini	727,102
Servians and Croats	711,380
Rumanians	230,963
Magyars	9,516

The Germans occupy exclusively Upper Austria, Salzburg, Vorarlberg, and, to a large extent, Lower Austria; then the north and central part of Styria, the north and western part of Carinthia, and the north and central part of Tirol. In Bohemia they are concentrated round the borders, in the vicinity of the mountains, and they form nearly half the population of Silesia; besides they are found in every part of the monarchy. The Czechs occupy the central and eastern parts of Bohemia, the greatest part of Moravia and a part of Silesia. The Poles are concentrated in western Galicia, and in a part of Silesia; the Ruthenians in eastern Galicia and a part of Bukovina; the Slovenes in Carniola, Görz and Gradisca, Istria, the south of Styria, and the Trieste territory. The Servians and Croats are found in Istria and Dalmatia; the Italians and Ladini in southern Tirol, Görz and Gradisca, Trieste, the coast of Istria, and in the towns of Dalmatia; while the Rumanians live mostly in Bukovina.

Agriculture.—Notwithstanding the great industrial progress made by Austria during the last quarter of the 19th century, agriculture still forms the most important source of revenue of its inhabitants. In 1900 over 50 % of the total population of Austria derived their income from agricultural pursuits. The soil is generally fertile, although there is a great difference in the productivity of the various crown-lands owing to their geographical situation. The productive land of Austria covers 69,519,953 acres, or 93·8 % of the total area, which is 74,102,001 acres; to this must be added 0·4 of lakes and fish-ponds, making a total of 94·2 % of productive area. The remainder is unproductive, or used for other, not agricultural purposes. The area of the productive land has been steadily increasing—it was estimated to cover about 89 % in 1875,—and great improvements in the agricultural methods have also been introduced. Of the whole productive area of Austria, 37·6 % is laid out in arable land; 34·6 % in woods; 25·2 % in pastures and meadows; 1·3 % in gardens, 0·9 % in vineyards; and 0·4 % in lakes, marshes and ponds. The provinces having the largest proportion of arable land are Bohemia, Galicia, Moravia and Lower Austria. The principal products are wheat, rye, barley, oats, maize, potatoes, sugar beet, and cattle turnip. The produce of the ploughed land does not, on the whole, suffice for the home requirements. Large quantities in particular of wheat and maize are imported from Hungary for home consumption. Only barley and oats are usually reaped in quantity for export. The provinces which have the lowest proportion of arable land are Tirol and Salzburg. Besides these principal crops, other crops of considerable magnitude are: buckwheat in Styria, Galicia, Carniola and Carinthia; rape and rape-seed in Bohemia and Galicia, poppy in Moravia and Silesia; flax in Bohemia, Moravia, Styria and Galicia; hemp in Galicia, chicory in Bohemia; tobacco, which is a state monopoly, in Galicia, Bukovina, Dalmatia and Tirol; fuller's thistle in Upper Austria and Styria; hops in Bohemia, including the celebrated hops round Saaz, in Galicia and Moravia; rice in the Küstenland; and cabbage in Bohemia, Galicia, Lower Austria and Styria. The principal garden products are kitchen vegetables and fruit, of which large quantities are exported. The best fruit districts are in Bohemia, Moravia, Upper Austria and Styria. Certain districts are distinguished for particular kinds of fruit, as Tirol for apples, Bohemia for plums, Dalmatia for figs, pomegranates and olives. The chestnut, olive and mulberry trees are common in the south—chiefly in Dalmatia, the Küstenland and Tirol; while in the south of Dalmatia the palm grows in the open air, but bears no fruit.

The vineyards of Austria covered in 1901 an area of 626,044 acres, the provinces with the largest proportion of vineyards being Dalmatia, the Küstenland, Lower Austria, Styria and Moravia. The wines of Dalmatia are mostly sweet wines, and not suitable to be kept for long periods, while those of the other provinces are not so sweet, but improve with age.

Forests.—The forests occupy just a little over one-third of the whole productive area of Austria, and cover 24,157,709 acres. In the forests tall timber predominates to the extent of 85 %, and consists of conifers much more than of green or leaved trees, in the proportion of seventy against fifteen out of the 85 % of the total forests laid out in tall timber. Exceptions are the forest lands of the Karst region, where medium-sized trees and underwood occupy 80 %, and of Dalmatia, where underwood occupies 92·6 % of the whole forest land. The Alpine region is well wooded, and amongst the other provinces Bukovina is the most densely wooded, having 43·2 % of its area under forests, while Galicia with 25·9 % is the most thinly-wooded crown-land of Austria. The forests are chiefly composed of oak, pine, beech, ash, elm, and the like, and constitute one of the great sources of wealth of the country. Forestry is carried on in a thoroughly scientific manner. Large works of afforestation have been undertaken in Carinthia, Carniola and Tirol with a view of checking the periodical inundations, while similar works have been successfully carried out in the Karst region.

Landed Property.—Of the whole territory of the state, 74,102,001 acres, about 29 %, is appropriated to large landed estates; 71 % is disposed of in medium and smaller properties. Large landed property is most strongly represented in Bukovina, where it absorbs 46 % of the whole territory, and in Salzburg, Galicia, Silesia and Bohemia. To the state belongs 4½ % of the total territory. The Church, the communities, and the corporations are also in possession of large areas of land; 4 % (speaking roundly) of the territory of Austria is held on the tenure of *fidei-commissum.* Of the entire property in large landed estates, 59 % is laid out in woods; of the property in *fidei-commissum*, 66 % is woodland; of the entire forest land, about 10 % is the property of the state; 14·5 % is communal property; and 3·8 % is the property of the Church. The whole of the territory in large landed estates includes 52 % of the entire forest land. The forest land held under *fidei-commissum* amounts to over 9 % of the entire forest land.

Live Stock.—Although richly endowed by nature, Austria cannot be said to be remarkable as a cattle-rearing country. Indeed, except in certain districts of the Alpine region, where this branch of human activity is carried on under excellent conditions, there is much room for improvement. The amount of live stock is registered every ten years along with the census of the population.

	1880.	1890.	1900.
Horses	1,463,282	1,548,197	1,711,077
Mules and asses	49,618	57,952	66,638
Cattle	8,584,077	8,643,936	9,506,626
Goats	1,006,675	1,035,832	1,015,682
Sheep	3,841,340	3,186,787	2,621,026
Pigs	2,721,541	3,549,700	4,682,734
Beehives	926,312	920,640	996,139

Austria is distinguished for the number and superiority of its horses, for the improvements of which numerous studs exist all over the country. All kinds of horses are represented from the heaviest to the lightest, from the largest to the smallest. The most beautiful horses are found in Bukovina, the largest and strongest in Salzburg; those of Styria, Carinthia, Northern Tirol and Upper Austria are also famous. In Dalmatia, the Küstenland and Southern Tirol, horses are less numerous, and mules and asses in a great measure take their place. The finest cattle are to be found in the Alpine region; of the Austrian provinces, Salzburg and Upper Austria contain the largest proportion of cattle. The number of sheep has greatly diminished, but much has been done in the way of improving the breeds, more particularly in Bohemia, Moravia, Silesia and Upper and Lower Austria. The main object has been the improvement of the wool, and with this object the merino and other fine-woolled breeds have been introduced. Goats abound mostly in Dalmatia, Bohemia and Tirol. The rearing of pigs is carried on most largely in Styria, Bohemia, Galicia and Upper and Lower Austria. Bees are extensively kept in Carinthia, Carniola, Lower Austria and Galicia. The silk-worm is reared more particularly in Southern Tirol and in the Küstenland, and the average annual yield is 5,000,000 lb of cocoons. In the Alpine region dairy-farming has attained a great degree of development, and large quantities of butter and cheese are annually produced. Altogether, the rearing of cattle, with all its actual shortcomings, constitutes a great source of revenue, and yields a certain amount for export.

Fisheries.—The fisheries of Austria are very extensive, and are divided into river, lake and sea fisheries. The numerous rivers of Austria swarm with a great variety of fishes. The lake fisheries are mostly pursued in Bohemia, where pisciculture is an art of old standing, and largely developed. The sea fisheries on the coast of Dalmatia and of the Küstenland constitute an important source of wealth to the inhabitants of these provinces. About 4000 vessels, with a number of over 16,000 fishermen are employed, and the average annual catch realizes £240,000.

In the mountainous regions of Austria game is plentiful, and constitutes a large source of income.

Minerals.—In the extent and variety of its mineral resources Austria ranks among the first countries of Europe. With the exception of platinum, it possesses every useful metal; thus, besides the noble metals, gold and silver, it abounds in ores of more or less richness in iron, copper, lead and tin. Rich deposits of coal, both pit coal and brown coal are to be found, as well as extensive basins of petroleum, and large deposits of salt. In smaller quantities are found zinc, antimony, arsenic, cobalt, nickel, manganese, bismuth, chromium, uranium, tellurium, sulphur, graphite and asphalt. There are also marble, roofing-slate, gypsum, porcelain-earth, potter's clay, and precious stones. It is therefore natural that mining operations should have been carried out in Austria from the earliest times, as, for instance, the salt mines of Hallstatt in Upper Austria, which had already been worked during the Celtic and Romanic period. Famous through the middle ages were also the works, especially for the extraction of gold and silver, carried out in Bohemia and Moravia, whose early mining regulations, for instance those of Iglau, were adopted in other countries. But the great industrial development of the 19th century, with its growing necessity for fuel, has brought about the exploitation of the rich coal-fields of the country, and to-day the coal mines yield the heaviest output of any mineral products. To instance the rapid growth in the extraction of coal, it is worth mentioning that in 1825 its output was about 150,000 tons; in 1875, or only after half a century, the output has become 100 times greater, namely, over 15,000,000 tons; while in 1900 it was 32,500,000 tons. Coal is found in nearly every province of Austria, with the exception of Salzburg and Bukovina, but the richest coal-fields are in Bohemia, Silesia, Styria, Moravia and Carniola in the order named. Iron ores are found more or less in all the crown-lands except Upper Austria, the Küstenland and Dalmatia, but it is most plentiful in Styria, Carinthia, Bohemia and Moravia. Gold and silver ores are found in Bohemia, Salzburg and Tirol. Quicksilver is found at Idria in Carniola, which after Almaden in Spain is the richest mine in Europe. Lead is extracted in Carinthia and Bohemia, while the only mines for tin in the whole of Austria are in Bohemia. Zinc is mostly found in Galicia, Tirol and Bohemia, and copper is extracted in Tirol, Moravia and Salzburg. Petroleum is found in Galicia, where ozocerite is also raised. Rock-salt is extracted in Galicia, while brine-salt is produced in Salzburg, Salzkammergut and Tirol. Graphite is extracted in Bohemia, Moravia, Styria and Lower Austria. Uranium, bismuth and antimony are dug out in Bohemia, while procelain earth is found in Bohemia and Moravia. White, red, black and variously-coloured marbles exist in the Alps, particularly in Tirol and Salzburg; quartz, felspar, heavy spar, rock-crystal, and asbestos are found in various parts; and among precious stones may be specially mentioned the Bohemian garnets. The total value of the mines and foundry products throughout Austria in 1875 was £5,000,000. The number of persons employed in the mines and in the smelting and casting works in the same year was 94,019. The total value of the mining products throughout Austria in 1902 was £10,500,000, and the value of the product of the foundries was £3,795,000. Of this amount £3,150,000 represents the value of the iron: raw steel and pig iron. The increase in the value of the mining products during the period 1892–1902 was 40 %; and the increase in the product of the furnaces in the same period was 35 %. The number of persons employed in 1902 in mining was 140,890; in smelting works 7148; and in the extraction of salt, 7963. The value of the chief mining products of Austria in 1903 was: Brown coal (21,808,583 tons), £4,182,516; coal (12,145,000 tons), £4,059,807; iron ores (1,688,960 tons), £615,273; lead ores, £135,965; silver ores, £119,637; quicksilver ores, £92,049; graphite, £78,437; tin ores, £78,275; copper ores, £22,119; manganese ores, £5368; gold ores, £4407; asphalt, £2250; alum and vitriol slate, £992. The production of petroleum was 660,000 tons, and of salt 340,000 tons. The value of the principal products of the smelting furnaces in 1903 was: Iron (955,543 tons), £2,970,866; coke, £862,137; zinc (metallic), £174,344; silver, £141,594; copper, £57,542; sulphuric acid, £8488; copper vitriol, £5710; mineral colours, £5565; lead, £5067; tin, £4566; gold, £878; iron vitriol, £603; litharge, £384; quicksilver, £218; coal briquettes, £92,000.

Industry.—The manufactures of Austria were much developed during the last quarter of the 19th century, although Austria as a whole cannot be said to be an industrial country. Austria possesses many favourable conditions for a great industrial activity. It possesses an abundance of raw materials, of fuel—both mineral and wood,—of metals and minerals, in fact all the necessaries for a great and flourishing industry; and the rivers can easily be utilized as producers of motive power. It is besides densely populated, and has an adequate supply of cheap labour, while the undeveloped industries of the Balkan states also offer a ready market for its products. The glass manufacture in Bohemia is very old, and has kept up its leading position in the markets of the world up to the present day. Industrial activity is greatly developed in Bohemia, Lower Austria, Silesia, Moravia and Vorarlberg, while in Dalmatia and Bukovina it is almost non-existent. The principal branches of manufactures are, the textile industry, the metallurgic industries; brewing and distilling; leather, paper and sugar; glass, porcelain and earthenware; chemicals; and scientific and musical instruments.

The textile industry in all its branches—cotton, woollen, linen, silk, flax and hemp—is mostly concentrated in Bohemia, Moravia, Silesia and Lower Austria. It is an old industry, and one which has made great progress since 1875. Thus the number of mechanical looms increased more than threefold during this period, and numbered in 1902 about 120,000. In the same year the number of spindles at work was about 3,100,000. Austria had in 1902, 21,837 textile factories with 337,514 workmen. The principal seat of the manufacture of cotton goods is in northern Bohemia, from the Eger to Reichenberg, which can be considered as the Lancashire of Austria, Lower Austria between the Wiener Wald and the Leitha, and in Vorarlberg. Woollen goods are manufactured in the above places, and besides in Moravia, at Brünn and at Iglau; in Silesia; and at Biala in Galicia. Vienna is also distinguished for its manufacture of shawls. The coarser kind of woollen goods are manufactured all over the country, principally in the people's houses as a home industry. The most important places for the linen industry are in Bohemia at Trautenau; in Moravia and Silesia, while the commoner kinds of linen are mostly produced as a home industry by the peasants in the above-mentioned crown-lands. The manufacture of ribbons, embroidery and lace, the two latter being carried on principally as a house industry in Vorarlberg and in the Bohemian Erzgebirge, also thrives. The industry in stitched stuffs is especially developed in northern Bohemia. Ready-made men's clothes and oriental caps (fezes) are produced on a large scale in Bohemia and Moravia. The manufacture of silk goods is mainly carried on in Vienna, while the spinning of silk has its principal seat in southern Tirol, and to a smaller extent in the Küstenland.

The metallurgic industry forms one of the most important branches of industry, because iron ore of excellent quality is extracted annually in great quantities. The principal seats of the iron and steel manufactures are in Bohemia, Moravia, Silesia, Upper and Lower Austria, Styria and Carinthia, which contain extensive iron-works. The most important manufactured products are cutlery, firearms, files, wire, nails, tin-plates, scythes, sickles, steel pens, needles, rails, iron furniture, drains, and kitchen utensils. A famous place for its iron manufacture is Steyr in Upper Austria. The manufacture of machinery, for industrial and agricultural purposes, and of railway engines is mainly concentrated in Vienna, Wiener-Neustadt, Prague, Brünn and Trieste; while the production of rolling stock for railways is carried on in Vienna, Prague and Graz. Ship-building yards for sea-vessels are at Trieste and Pola; while for river-vessels the largest yards are at Linz. Among other metal manufactures, the principal are copper works at Brixlegg and other places in Tirol, and in Galicia, tin and lead in Bohemia, and metallic alloys, especially *Packfong* or German silver, an alloy of nickel and copper, at Berndorf in Lower Austria. The precious metals, gold and silver, are principally worked in the larger towns, particularly at Vienna and Prague. Vienna is also the principal seat for scientific and surgical instruments. In the manufacture of musical instruments Austria takes a leading part amongst European states, the principal places of production being Vienna, Prague, Königgrätz, Graslitz and Schönbach.

The glass manufacture is one of the oldest industries in Austria, and is mainly concentrated in Bohemia. Its products are of the best quality, and rule the markets of the world. In the manufacture of earthenwares Austria plays also a leading part, and the porcelain industry round Carlsbad and in the Eger district in Bohemia has a world-wide reputation. The leather industry is widely extended, and is principally carried on in Lower Austria, Bohemia and Moravia. Vienna and Prague are great centres for the boot and shoe trade, and the gloves manufactured in these towns enjoy a great reputation. The manufacture of wooden articles is widespread over the country, and is very varied. In Vienna and other large towns the production of ornamental furniture has attained a great development. The industry in paper has also assumed great proportions, its principal seats being in Bohemia, Moravia, Upper and Lower Austria. Of food-stuffs, besides milling, and other flour products, the principal industry is the manufacture of sugar from beet-root. The sugar industry is almost exclusively carried on in Bohemia, Moravia, Silesia and Galicia. It has attained such large proportions that large districts in those provinces have been converted from wheat-growing districts into fields for the cultivation of beet-root. Brewing is extensively carried on, and the beer produced is of a good quality. The largest brewing establishment is at Schwechat near Vienna, and large breweries are also found at Pilsen and Budweiss in Bohemia, whose products enjoy a great reputation abroad. There were in Austria 1341 breweries, which produced 422,993,120 gallons of beer, in 1902–1903. Distilling is carried on on a large scale in Galicia, Bukovina, Bohemia, Moravia and Lower Austria; the number of distilleries being 1257, which produced 30,435,812 gallons of spirit. Rosoglio, maraschino, and other liqueurs are made in Dalmatia and Moravia. The manufacture as well as the growth of tobacco is a government monopoly, which has 30 tobacco factories with over 40,000 work-people, the largest establishment being at Hainburg in Lower Austria. Other important branches of industry are the manufacture of chemicals, in Vienna and in Bohemia; petroleum refineries in Galicia, and the extraction of various petroleum products; the manufacture of buttons; printing, lithographing, engraving, and map-making, especially in Vienna, &c.

In 1900 the various manufacturing industries employed in Austria 3,138,800 persons, of whom 2,264,871 were workmen and 103,854 were labourers. Including families and domestic servants, a little over 7,000,000 were dependent on industry for their livelihood.

Commerce.—Austria forms together with Hungary one customs and commercial territory, and the statistics for the foreign trade are given under AUSTRIA-HUNGARY. Owing to its situation, the bulk of the Austrian trade is carried on the railways and on the inland navigable rivers. Only a small portion is sea-borne trade, while the commercial interchange between the provinces lying on the Adriatic coast is very small.

Commercial Navy.—The commercial sea navy of Austria, excluding small coasting vessels and fishing-boats, consisted in 1900 of 154 vessels, with a tonnage of 198,322 tons, of which 123 vessels with a tonnage of 183,949 were steamers. The greatest navigation company is the Austrian Lloyd in Trieste, which in 1900 employed 70 steamers of 165,430 tons. During 1900 the total tonnage of vessels engaged in the foreign trade, which entered all the Austrian ports, was 1,448,764 tons under the Austro-Hungarian flag, and 888,707 under foreign flags; the total tonnage of vessels cleared during the same period was 1,503,532 tons under the Austro-Hungarian flag, and 866,591 under foreign flags.

Government.—Austria is a parliamentary or constitutional (limited) monarchy, its monarch bearing the title of emperor. The succession to the throne is hereditary, in the order of primogeniture, in the male line of the house of Habsburg-Lothringen; and failing this, in the female line. The monarch must be a member of the Roman Catholic Church. The emperor of Austria is also king of Hungary, but except for having the same monarch and a few common affairs (see AUSTRIA-HUNGARY), the two states are quite independent of one another. The emperor has the supreme command over the armed forces of the country, has the right to confer degrees of nobility, and has the prerogatives of pardon for criminals. He is the head of the executive power, and shares the legislative power with the Reichsrat; and justice is administered in his name. The constitution of Austria is based upon the following statutes:—(1) the Pragmatic Sanction of the emperor Charles VI., first promulgated on the 19th of April 1713, which regulated the succession to the throne; (2) the Pragmatic Patent of the emperor Francis II. of the 1st of August 1804, by which he took the title of Emperor of Austria; (3) the Diploma of the emperor Francis Joseph I. of the 20th of October 1860, by which the constitutional form of government was introduced; (4) the Diploma of the emperor Francis Joseph I. of the 26th of February 1861, by which the provincial diets were created; (5) the six fundamental laws of the 21st of December 1867, which contain the exposition and guarantee of the civil and political rights of the citizen, the organization of justice, the organization and method of election for the Reichsrat, &c.

The executive power is vested in the council of ministers, at whose head is the minister-president. There are eight ministries, namely, the ministry of the interior, of national defence, of worship and instruction, of finance, of commerce, of agriculture, of justice, and of railways. There are, further, two ministries without portfolio, for Galicia and Bohemia. The civil administration in the different provinces is carried out by governors or stadtholders (*Statthalter*), to whom are subordinate the heads of the 347 districts in which Austria was divided in 1900, and of the 33 towns with special statute, *i.e.* of the towns which have also the management of the civil administration. Local self-government of the provinces, districts and communities is also granted, and is exercised by various elective bodies. Thus, the autonomous provincial administration is discharged by the provincial committees elected by the local diets; and the affairs of the communities are discharged by an elected communal council.

The leg[illegible] power for all the kingdoms and lands which constitute Au[illegible] vested in the Reichsrat. It consists of two Houses: an Up[illegible] House (the *Herrenhaus*), and a Lower House (the *Abgeordnete*[illegible]). The Upper House is composed of (1) princes of the imperia[illegible] who are of age (14 in 1907); (2) of the members of the large [illegible]nded nobility, to which the emperor had conferred this right, [illegible] which is hereditary in their family (78 in 1907); (3) of 9 archbishops and 8 prince-bishops; and (4) of life members nominated by the emperor for distinguished services (170 in 1907). The Lower House has undergone considerable changes since its creation in 1861, by the various modifications of the electoral laws passed in 1867, 1873, 1892, 1896 and 1907. The general spirit of those modifications was to broaden the electoral basis, and to extend the franchise to a larger number of citizens. The law of the 26th of January 1907 granted universal franchise to Austrian male citizens over twenty-four years of age, who have resided for a year in the place of election. The Lower House consists of 516 members, elected for a period of six years. The members receive payment for their services, as well as an indemnity for travelling expenses. A bill to become law must pass through both Houses, and must receive the sanction of the emperor. The emperor is bound to summon the Reichsrat annually.

According to the imperial Diploma of the 26th February 1861, local diets have been created for the legislation of matters of local interest. These provincial parliaments are 17 in number, and their membership varies from 22 members, which compose the diet of Görz and Gradisca, to the 242 members which constitute that of Bohemia. They assemble annually and are composed of members elected for a period of six years, and of members *ex-officio*, namely, the archbishops and bishops of the respective provinces, and the rector of the local university.

Religion.—Religious toleration was secured throughout the Habsburg dominions by the patent of the 13th of October 1781, but Protestants were not given full civil rights until the issue of the *Protestantenpatent* of the 8th of April 1861, after the promulgation of the imperial constitution of the 26th of February. The principle underlying this and all subsequent acts is the guarantee to all religious bodies *recognized by law* of freedom of worship, the management of their own affairs, and the undisturbed possession and disposal of their property. Though all the churches are, in a sense, "established," the Roman Catholic Church, to which the sovereign must belong, is the state religion. The reigning house, however, though strongly attached to the Roman faith, has always resisted the extreme claims of the papacy, an attitude which in Joseph II.'s time resulted, under the influence of Febronianism (*q.v.*), in what was practically a national schism. Thus the emperor retains the right to tax church property, to nominate bishops, and to prohibit the circulation of papal bulls without his permission. By the concordat of August 18, 1855, this traditional attitude was to some extent reversed; but this agreement soon became a dead letter and was formally denounced by the Austrian government after the promulgation of the dogma of papal infallibility.

Of the population of Austria in 1900, 23,796,814 (91%) were Roman Catholics, including 3,134,439 uniate Greeks and 2096 uniate Armenians. There were 12,937 Old Catholics, in scattered communities, 606,764 members of the Eastern Orthodox Church, mainly in Bukovina and Dalmatia, and 698 Armenians, also mainly in Bukovina. The Protestants, who in the 16th century comprised 90% of the population, are now only 1·9%. In 1900, 365,505 of them were returned as belonging to the Augsburg Confession (Lutheran), 128,557 to the Helvetic (Reformed). Other Christian Confessions in Austria are Herrnhuters (Moravian Brethren) in Bohemia, Mennonites in Galicia, Lippovanians (akin to the Russian Skoptsi) in Bukovina, and Anglicans. The Jews compose 4·7% of the population, and are strongest in Galicia, Lower Austria, Bohemia, Moravia and Bukovina. The Roman Catholic Church is divided into eight provinces, seven of the Latin rite—Vienna, Prague, Lemberg, Salzburg, Olmütz, Görz and Zara—with 23 bishoprics, and one of the Greek rite (Lemberg), with two bishoprics. The Armenian bishopric of Lemberg and the Austrian part of the archdiocese of Breslau are under the immediate jurisdiction of the Holy See. The Greek Orthodox Church has one archbishopric (at Czernowitz) and two bishoprics. There are 559 communities of the Jewish religion (253 in Galicia, and 255 in Bohemia). In 1900 there were, belonging to the Roman Catholic Church, 541 monasteries with 7775 monks, and 877 convents with 19,194 nuns; while the Greek Orthodox Church had 14 monasteries with 85 members. The Evangelical Church, according to the constitution granted by imperial decree on the 9th of April 1861 (modified by those of January 6, 1866 and December 9, 1891) is organized on a territorial basis, being administered by 10 superintendents, who are, in thei , subject to the Supreme Church Council (*K.K. Oberkirc* at Vienna, the emperor as sovereign being technically of the Church. The small Anglican community at Triest der the jurisdiction of the Evangelical superintendent of V

Education.—The system of elemen schools dates from the time of Maria Theresa; the present ization was introduced by the education law of May 14, (amended in 1883). By this law the control of the school hitherto in the hands of the Church, was assumed by the state every local community being bound to erect and maintain public elementary schools. These are divided into *Volksschulen* (national or primary schools) and *Bürgerschulen* (higher elementary schools) Attendance is obligatory on all from the age of six to fourteen (in some provinces six to twelve). Religious instruction is given by the parish priest, but in large schools a special grant is made or a teacher *ad hoc* appointed in the higher classes (law of June 17, 1888). Private schools are also allowed which, if fulfilling the legal requirements, may be accorded the validity of public primary schools. The language of instruction is that of the nationality prevalent in the district. In about 40 % of the schools the instruction is given in German; in 26 % in Czech; in 28 % in other Slavonic languages, and in the remainder in Italian, Rumanian or Magyar. In 1903 there were in Austria 20,268 elementary schools with 78,025 teachers, frequented by 3,618,837 pupils, which compares favourably with the figures of the year 1875, when there were 14,257 elementary schools with 27,677 teachers, frequented by 2,050,808 pupils. About 88 % of the children who are of school age actually attend school, but in some provinces like Upper Austria and Salzburg nearly the full 100 attend, while in the eastern parts of the monarchy the percentage is much lower. In 1900 62 % of the total population of Austria could read and write, and 2·9 % could only read. In the number of illiterates are included children under seven years of age. For the training of teachers of elementary schools there were in 1900 54 institutions for masters and 38 for mistresses. In these training colleges, as also in the secondary or "middle" schools (*Mittelschulen*), religious instruction is also in the hands of the Roman Catholic Church; but, by the law of June 20, 1870, the state must provide for such teaching in the event of the Protestant pupils numbering 20 or upwards (the school authorities usually refuse to take more than 19 Protestants in consequence).

Besides the elementary schools three other groups of educational establishments exist in Austria: "middle" schools (*Mittelschulen*); "high" schools (*Hochschulen*); professional and technical schools (*Fachlehranstalten* and *Gewerbeschulen*). The "middle" schools include the classical schools (*Gymnasien*), "modern" schools with some Latin teaching (*Realgymnasien*), and modern schools simply (*Realschulen*). In 1903 there were 202 *Gymnasien*, 19 *Realgymnasien* and 117 *Realschulen*, with 7121 teachers and 111,012 scholars. The "high" schools include the universities and the technical high schools (*Technische Hochschulen*). Of state universities there are eight:—Vienna, Gratz, Innsbruck, Prague (German), and Czernowitz, in which German is the language of instruction; Prague (Bohemian) with Czech; and Cracow and Lemberg with Polish as the language of instruction. Each university has four faculties—theology, law and political science, medicine, and philosophy. In Czernowitz, however, the faculty of medicine is wanting. Since 1905 an Italian faculty of law has been added to the university of Innsbruck. The theological faculties are all Roman Catholic, except Czernowitz, where the theological faculty is Orthodox Eastern. All the universities are maintained by the state. The number of professors and lecturers was about 1596 in 1903; while the number of students was 17,498.

Justice.—The judicial authorities in Austria are:—(1) the county courts, 963 in number; (2) the provincial and district courts, 74 in number, to which are attached the jury courts,—both these courts are courts of first instance; (3) the higher provincial courts, 9 in number, namely, at Vienna, Graz, Trieste, Innsbruck, Zara, Prague, Brünn, Cracow and Lemberg; these are courts of appeal from the lower courts, and have the supervision of the criminal courts in their jurisdiction; (4) the supreme court of justice and court of cassation in Vienna. The judicial organization is independent of the executive power. There are also special courts for commercial, industrial, shipping, military and other matters. There is also the court of the Empire at Vienna, which has the power to decide in case of conflict between different authorities.

Finance.—The growth of the Austrian budget is shown by the following figures:—

	1885	1895	1900	1905
Expenditure	£44,121,600	£55,396,916	£66,003,494	£74,013,000
Revenue . .	£43,714,666	£57,446,091	£66,020,475	£74,079,000

The chief sources of revenue are direct taxes, indirect taxes, customs duties, post and telegraph and post-office savings banks receipts, railway receipts, and profits or royalties on forests, domains and mining. The direct taxes are divided into two groups, real and personal; the former include the land tax and house-rent tax, and the latter the personal income tax, tax on salaries, tax on commercial and industrial establishments, tax on all business with properly audited accounts (like the limited liability companies), and tax on investments. The principal indirect taxes are the tobacco monopoly, stamps and fees, excise duties on sugar, alcohol and beer, the salt monopoly, excise duty on mineral oil, and excise duty on meat and cattle for slaughtering.

The national debt of Austria is divided into two groups, a general national debt, incurred jointly by the two halves of the Austro-Hungarian monarchy for common affairs, and is therefore jointly borne by both parts, and a separate debt owed only by Austria alone. The following table shows the growth of the Austrian debt in millions sterling:—

1885	1890	1895	1900	1905
45·	88·23	119·60	140·68	167·91

At the close of 1903 the debt of Austria was £156,724,000, an increase since 1900 of £16,044,000. This large increase is due to the great expenditure on public works, as railways, navigable canals, harbour works, &c., started by the Austrian government since 1900.

Railways.—As regards internal communications, Austria is provided with an extensive network of railways, the industrial provinces being specially favoured. This has been accomplished in spite of the engineering difficulties owing to the mountainous nature of the country and of the great financial expenses resulting therefrom. The construction of the Semmering railway, opened in 1854, for instance, was the first mountain railway built in the European continent, and marked an epoch in railway engineering. The first railway laid down in Austria was in 1824 between Budweis and Kerschbaum, over a distance of 40 m., and was at first used for horse tramway. The first steam railway was opened in 1837 over a distance of about 10 m. between Floridsdorf (near Vienna) and Wagram. From the first, the policy of the Austrian government was to construct and to work the railways itself; and in granting concessions to private companies it stipulated among its conditions the reversionary right of the state, whereby the line becomes the property of the state without compensation after the lapse of the period of concession. With various modifications, according to its financial means, it vigorously pursued its policy, by both building railways itself, and encouraging private companies to build. In 1905 the total length of railways in Austria was 13,590 m., of which 5017 m. belonged to and were worked by the state, and 3359 m. belonged to private companies, but were worked by the state.

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